

**2012 ENGINE****Engine Mechanical (1UR-FE) (Service Information) - Sequoia****ENGINE****ON-VEHICLE INSPECTION****ON-VEHICLE INSPECTION****1. INSPECT IGNITION TIMING**

- a. Warm up and stop the engine.
  1. Allow the engine to warm up to a normal operating temperature.
- b. When using the Techstream:
  1. Connect the Techstream to the DLC3.
  2. Start the engine and idle it.
  3. Turn the Techstream main switch ON.
  4. Enter the following menus: Powertrain / Engine and ECT / Data List / Primary / IGN Advance.

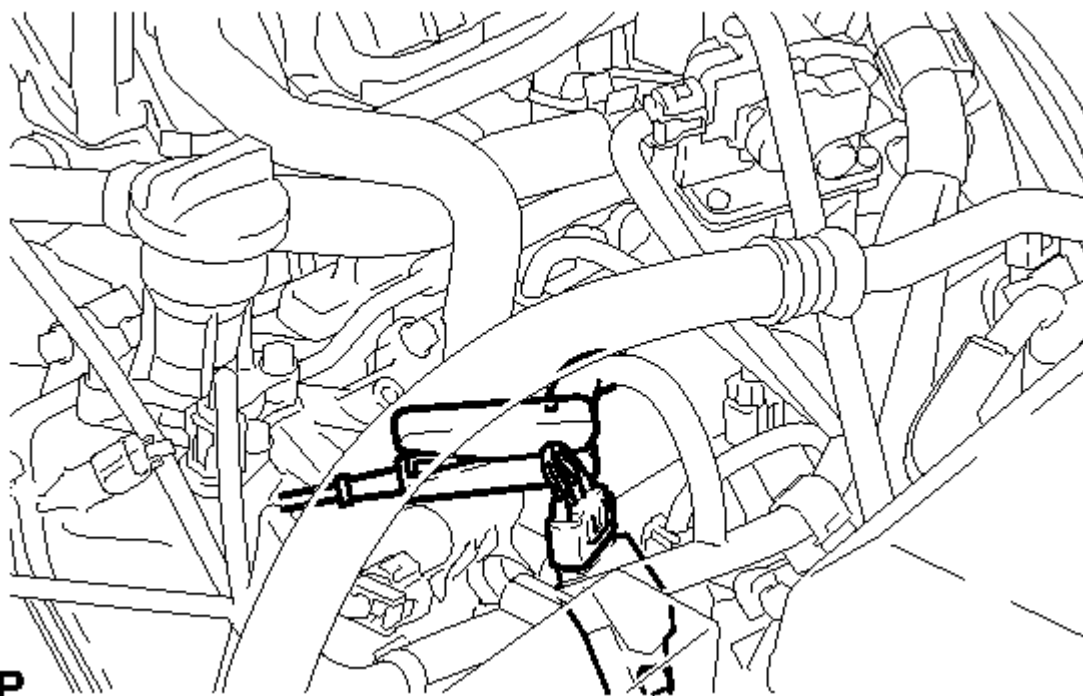
**HINT:**

Refer to the Techstream operator's manual for further details.

Standard ignition timing

7 to 24° BTDC @ idle (transmission in neutral and A/C switch OFF)

5. Disconnect the Techstream from the DLC3.
- c. When not using the Techstream:



**Fig. 1: Identifying Timing Light Tester Probe & Ignition Wire**

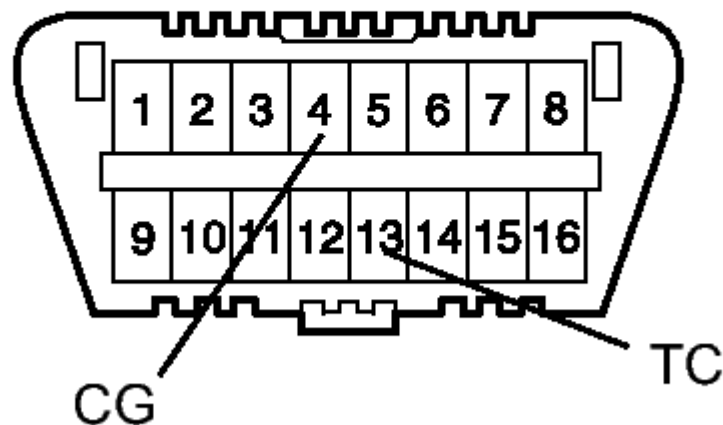
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Connect the tester probe of a timing light to the wire of the ignition coil connector for the No. 1 cylinder.

**NOTE:** Use a timing light that detects primary signals.

2. Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.

## Front view of DLC3:



**T**

**Fig. 2: Identifying DLC3 Connector Terminals**

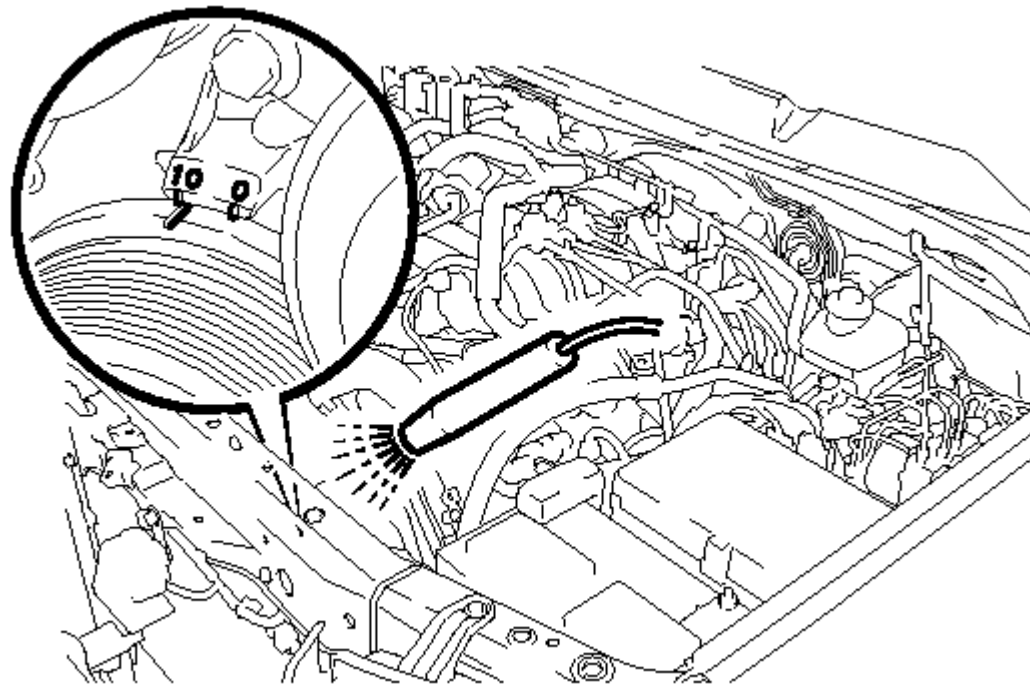
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09843-18040

**NOTE:**

- Confirm the terminal numbers before connecting them. Connecting the wrong terminals can damage the engine.
- Switch off all accessories and the A/C before connecting the terminals.

3. Using the timing light, check the ignition timing.



**P**

**Fig. 3: Identifying Ignition Timing Light Tester**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard ignition timing

8 to 12° BTDC @ idle (transmission in neutral and A/C switch OFF)

4. Remove SST from the DLC3.
5. Check the ignition timing.

Standard ignition timing

7 to 24° BTDC @ idle (transmission in neutral and A/C switch OFF)

6. Disconnect the timing light from the engine.

## 2. INSPECT ENGINE IDLE SPEED

- a. Warm up and stop the engine.
  1. Allow the engine to warm up to a normal operating temperature.
- b. When using the Techstream:
  1. Connect the Techstream to the DLC3.

**NOTE:**      **Switch off all accessories and the A/C before connecting the Techstream.**

2. Race the engine at 2500 RPM for approximately 90 seconds.



3. Turn the Techstream main switch ON.
4. Enter the following menus: Powertrain / Engine and ECT / Data List / Primary / Engine Speed.

Standard idle speed

650 to 750 RPM (transmission in neutral and A/C switch OFF)

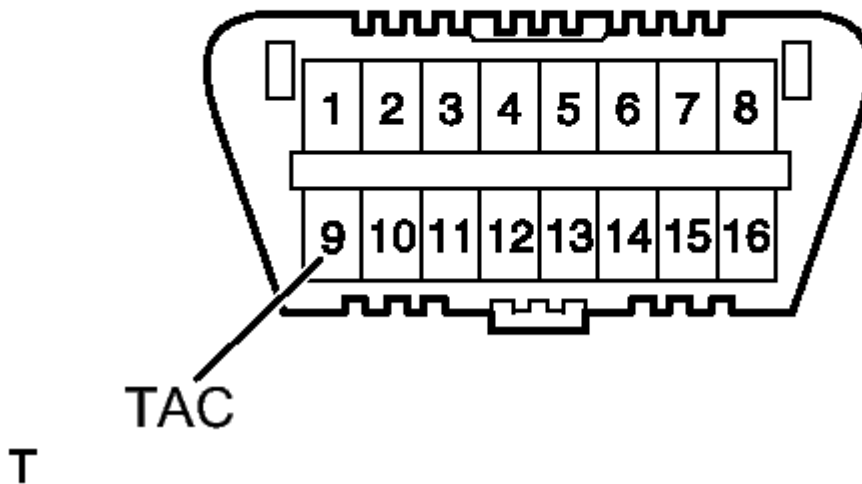
**HINT:**

Refer to the Techstream operator's manual for further details.

If the idle speed is not as specified, check the air intake system.

5. Disconnect the Techstream from the DLC3.
- c. When not using the Techstream:

## Front view of DLC3:



**Fig. 4: Identifying DLC3 Connector Terminals**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Using SST, connect the tachometer probe to terminal 9 (TAC) of the DLC3.
  - SST: 09843-18030

**NOTE:**

- Confirm the terminal number before connecting the probe. Connecting the probe to the wrong terminal can damage the engine.

- **Switch off all accessories and the A/C before connecting the probe.**

2. Race the engine at 2500 RPM for approximately 90 seconds.
3. Check the idle speed.

Standard idle speed

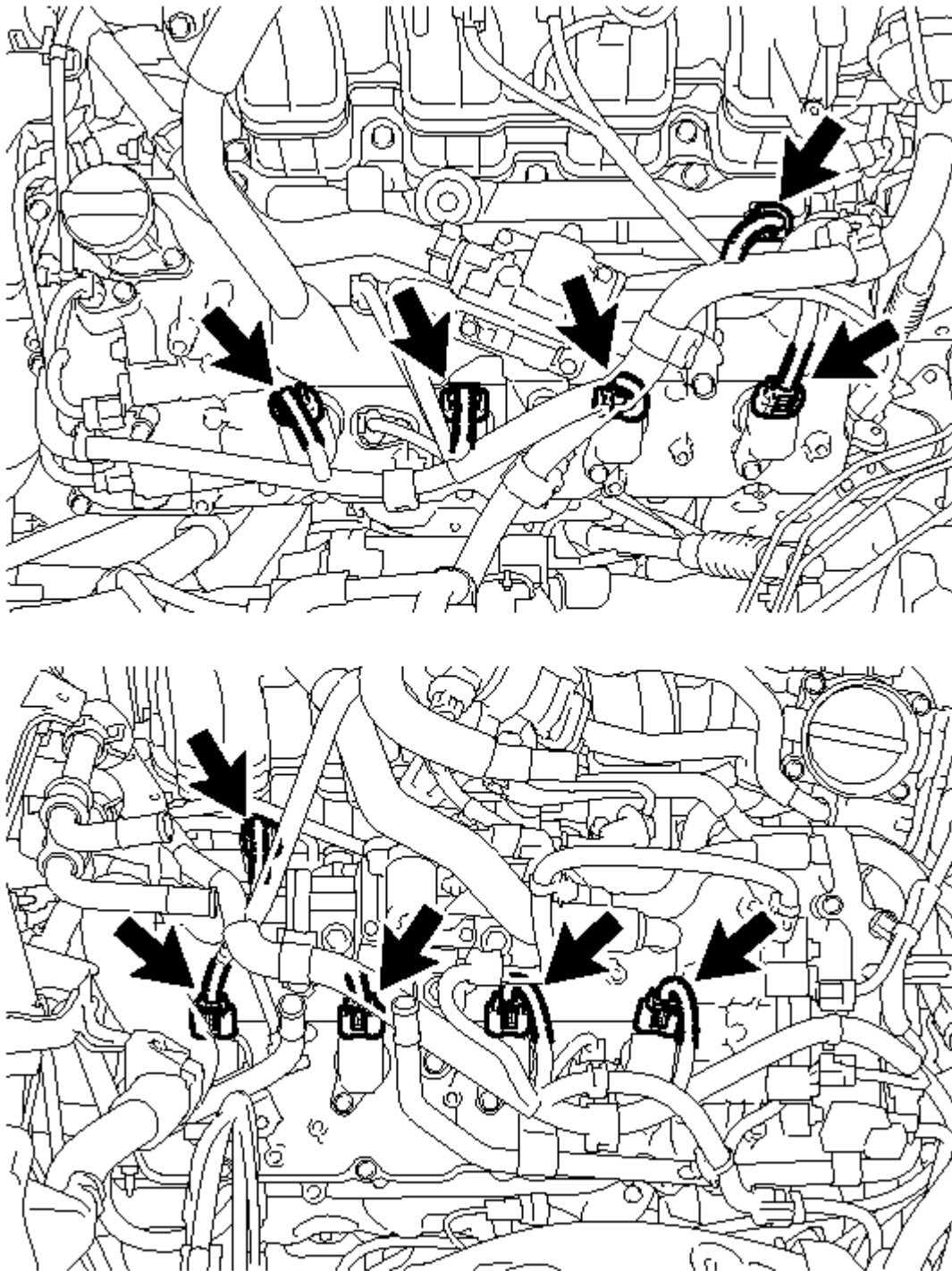
650 to 750 RPM (transmission in neutral and A/C switch OFF)

If the idle speed is not as specified, check the air intake system.

4. Disconnect the tachometer probe from the DLC3.

### **3. INSPECT COMPRESSION**

- a. Warm up and stop the engine.
  1. Allow the engine to warm up to a normal operating temperature.
- b. Remove the V-bank cover.
- c. Remove the air cleaner hose assembly.
- d. Remove the air cleaner cap.
- e. Disconnect the 2 injector connectors and 8 ignition coil connectors.



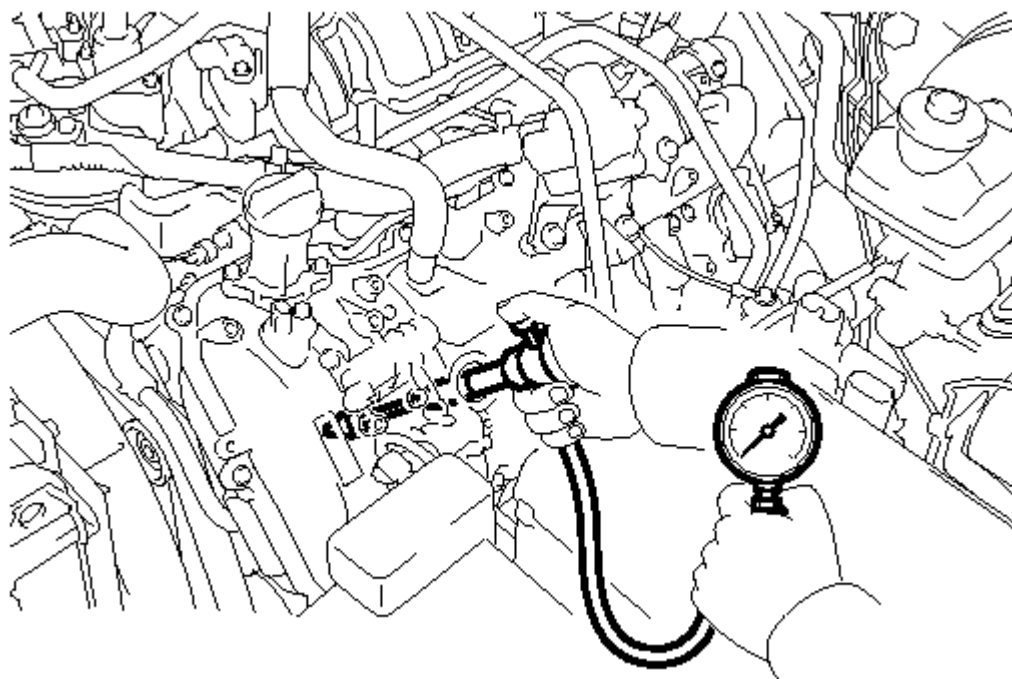
**P**

**Fig. 5: 8 Bolts, 8 Ignition Coils & 8 Spark Plugs**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- f. Remove the 8 bolts and 8 ignition coils.
- g. Remove the 8 spark plugs.

- h. Check the cylinder compression pressure.

**P**

**Fig. 6: Checking Cylinder Compression Pressure**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Check each cylinder's compression pressure in the same way.

1. Insert a compression gauge into the spark plug hole.
2. Fully open the throttle.
3. While cranking the engine, measure the compression pressure.

Standard compression pressure

1300 kPa (13.3 kgf/cm<sup>2</sup> , 189 psi) or higher

Minimum pressure

1000 kPa (10.2 kgf/cm<sup>2</sup> , 145 psi)

Difference between each cylinder

100 kPa (1.0 kgf/cm<sup>2</sup> , 15 psi) or less

**NOTE:**

- Always use a fully charged battery to obtain an engine speed of 250 RPM or more.

- **This measurement must be done as quickly as possible.**

4. If the cylinder compression is low in one or more cylinders, pour a small amount of engine oil into the cylinder with low compression through its spark plug hole. Then inspect the cylinder compression pressure again.

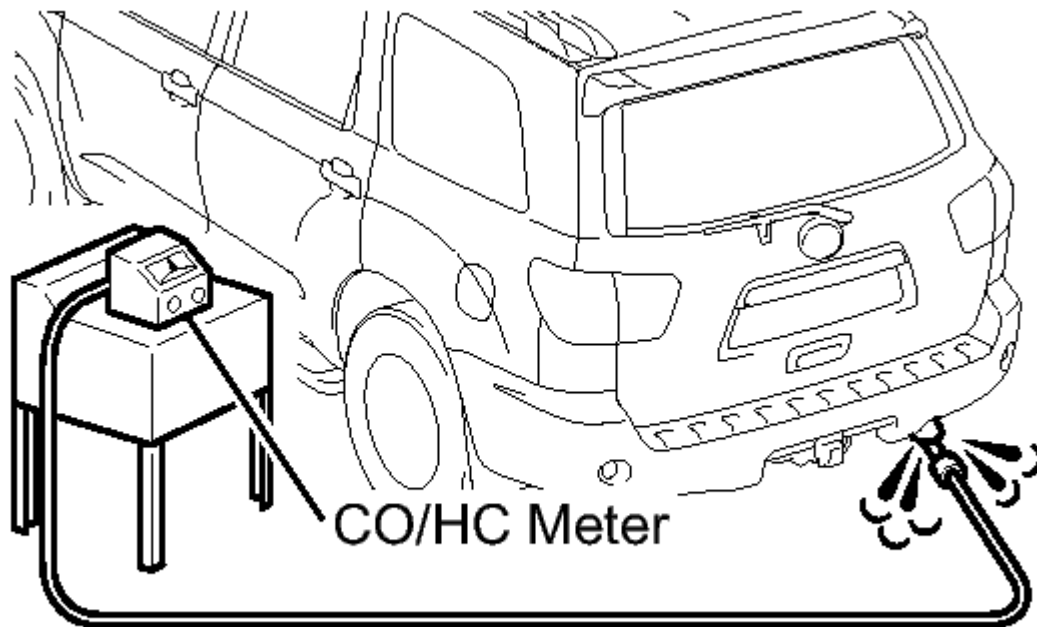
**HINT:**

- If adding oil helps boost the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
  - If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage in the gasket.
- i. Install the 8 spark plugs.
  - j. Install the 8 ignition coils with the 8 bolts.
  - k. Connect the 2 injector connectors and 8 ignition coil connectors.
  - l. Install the air cleaner cap.
  - m. Install the air cleaner hose.
  - n. Install the V-bank cover.

**4. INSPECT CO/HC****HINT:**

This check is used only to determine whether or not the idle CO/ HC complies with regulations.

- a. Start the engine.
- b. Keep the engine speed at 2500 RPM for approximately 180 seconds.
- c. Insert the CO/HC meter testing probe at least 40 cm (1.31 ft.) into the tailpipe during idling.



**P**

**Fig. 7: Identifying CO/HC Meter Testing Probe At Least**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Immediately check CO/HC concentration at idle and/or 2500 RPM.

**HINT:**

When performing the 2 mode (2500 RPM and idle) test, follow the measurement order prescribed by the applicable local regulations.

- e. If the CO/HC concentration does not comply with the regulations, troubleshoot in the order given below.
  1. Check the A/F sensor operation. Refer to **ON-VEHICLE INSPECTION** and heated oxygen sensor operation. Refer to **ON-VEHICLE INSPECTION**.
  2. See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

CO	HC	Symptom	Cause
Normal	High	Rough idle	a. Faulty ignitions: <ul style="list-style-type: none"> <li>• Incorrect timing</li> <li>• Plugs (contaminated, shorted or gaps are defective)</li> </ul>

## 2012 Toyota Sequoia Limited

2012 ENGINE Engine Mechanical (1UR-FE) (Service Information) - Sequoia

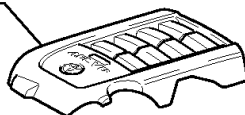
			<ul style="list-style-type: none"><li>b. Incorrect valve clearance</li><li>c. Leaky intake and exhaust valves</li><li>d. Leaky cylinder</li></ul>
Low	High	Rough idle (Fluctuating HC reading)	<ul style="list-style-type: none"><li>a. Vacuum leaks:<ul style="list-style-type: none"><li>• PCV hose</li><li>• Intake manifold</li><li>• Throttle body</li><li>• Brake booster line</li></ul></li><li>b. Lean mixture causing misfire</li></ul>
High	High	Rough idle (Black smoke from exhaust)	<ul style="list-style-type: none"><li>a. Restricted air filter</li><li>b. Faulty SFI system:<ul style="list-style-type: none"><li>• Faulty pressure regulator</li><li>• Defective ECT sensor</li><li>• Faulty ECM</li><li>• Faulty injectors</li><li>• Faulty throttle position sensor</li><li>• Faulty MAF meter</li></ul></li></ul>

### DRIVE BELT

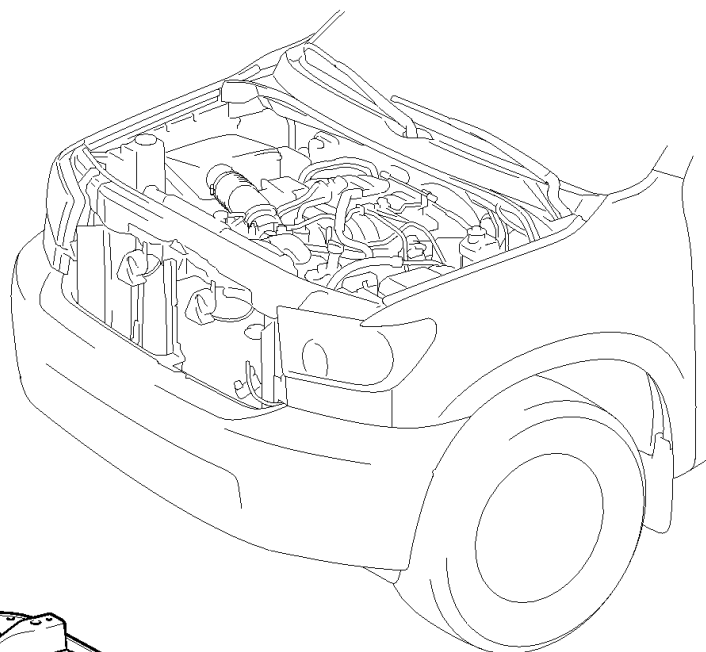
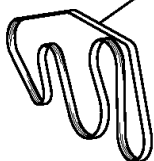
### COMPONENTS

### ILLUSTRATION

V-BANK COVER SUB-ASSEMBLY



FAN AND GENERATOR V BELT



3.0 (31, 27 in.\*lbf)

x 3

x 5

29 (296, 21)

NO. 1 ENGINE UNDER COVER

N\*m (kgf\*cm, ft.\*lbf) : Specified torque

P

**Fig. 8: Identifying Drive Belt Replacement Components With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

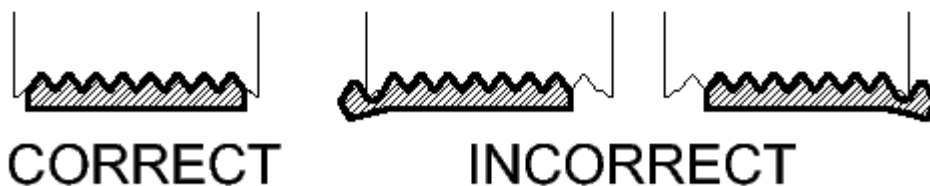
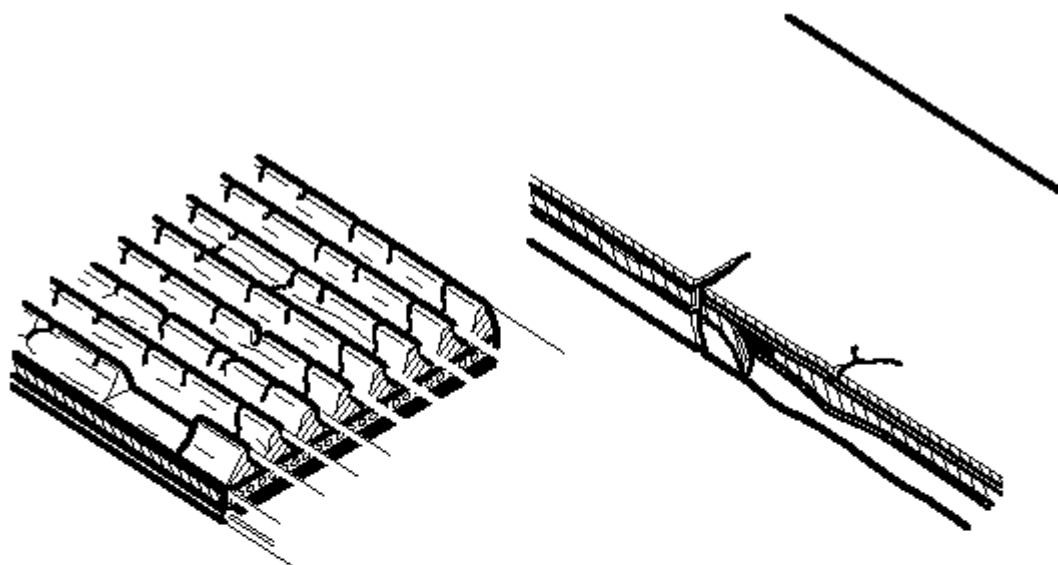
## ON-VEHICLE INSPECTION

### ON-VEHICLE INSPECTION

#### 1. INSPECT FAN AND GENERATOR V BELT



- a. Check the belt for wear, cracks or other signs of damage.



## P

**Fig. 9: Identifying Correct And Incorrect Position Of Fan And Generator V Belt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If any of the following defects is found, replace the fan and generator V belt.

- The belt is cracked.
  - The belt is worn out to the extent that the cords are exposed.
  - The belt has chunks missing from the ribs.
- b. Check that the belt fits properly in the ribbed grooves.

### HINT:

Check with your hand to confirm that the belt has not slipped out of the grooves on the bottom of

the pulley. If it has slipped out, replace the fan and generator V belt. Install a new fan and generator V belt correctly.

## **2. INSPECT V-RIBBED BELT TENSIONER ASSEMBLY**

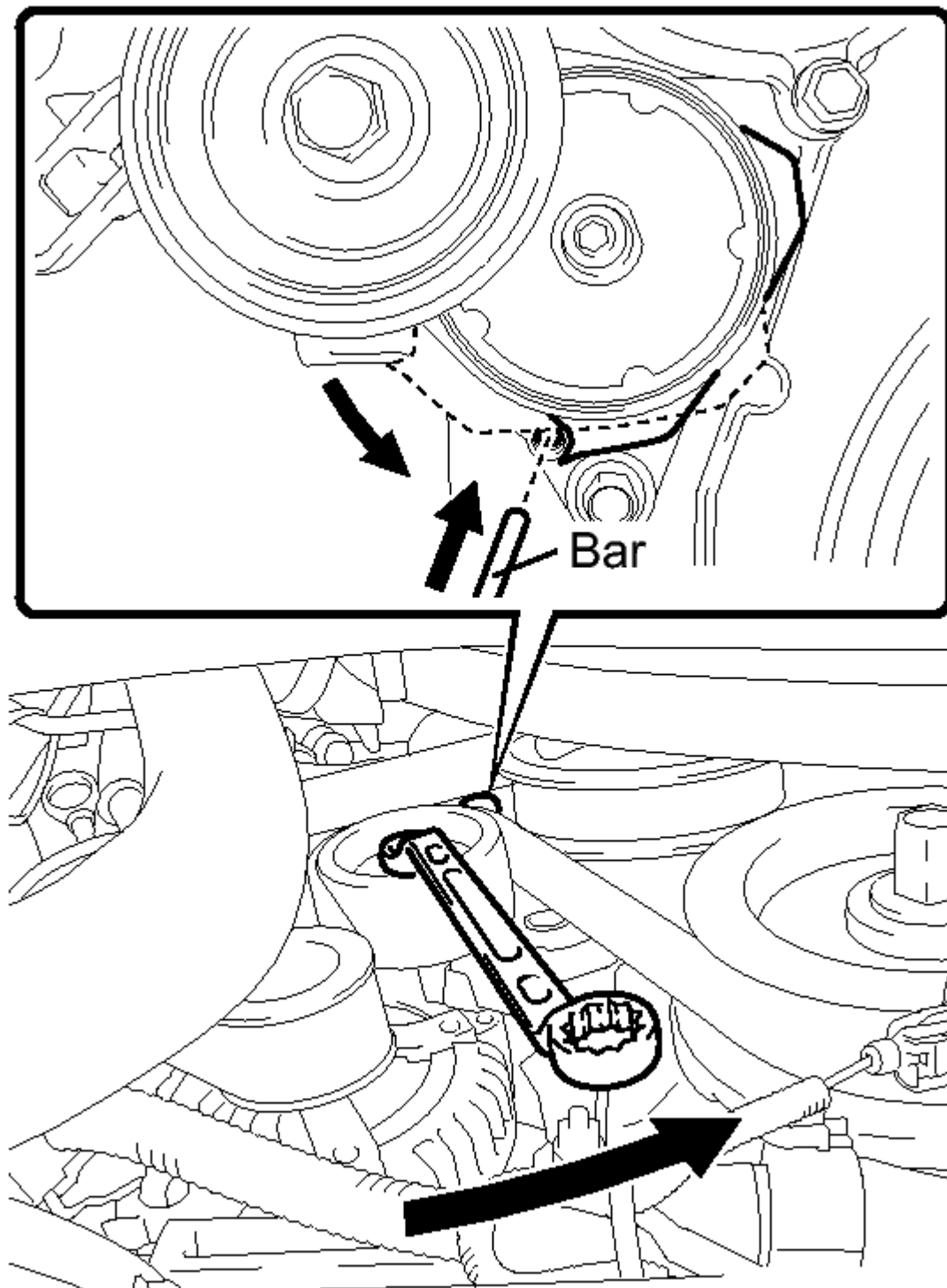
- a. Check that nothing gets caught in the tensioner by turning it clockwise and counterclockwise.

If the result is not as specified, replace the tensioner.

## **REMOVAL**

### **REMOVAL**

1. **REMOVE V-BANK COVER SUB-ASSEMBLY** See step 9
2. **REMOVE NO. 1 ENGINE UNDER COVER** . Refer to **REPLACEMENT - Step 2**
3. **REMOVE FAN AND GENERATOR V BELT**
  - a. While turning the belt tensioner counterclockwise, align the service hole for the belt tensioner and the belt tensioner fixing position, and then insert a bar of 5 mm (0.197 in.) into the service hole to fix the belt tensioner in place.



**P**

**Fig. 10: Removing Fan And Generator V Belt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

The pulley bolt for the belt tensioner has a left-hand thread.

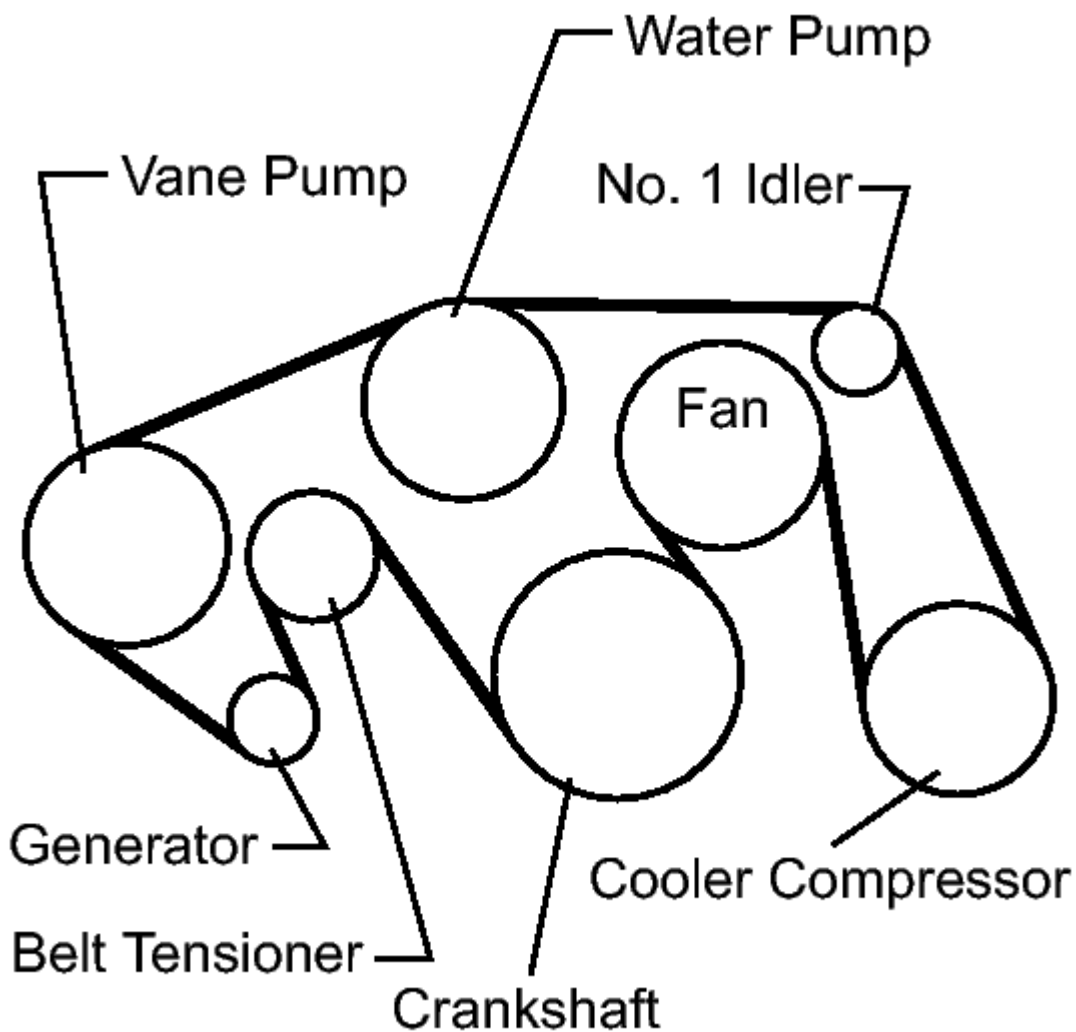
- b. Remove the V belt.

## INSTALLATION

### INSTALLATION

#### 1. INSTALL FAN AND GENERATOR V BELT

- a. Set the V belt onto every part.



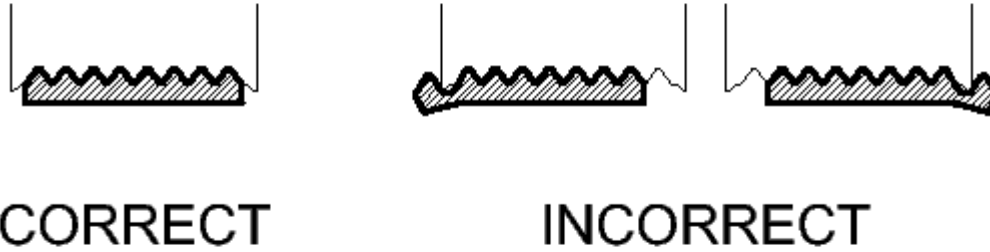
**P**

**Fig. 11: Identifying Fan And Generator V Belt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. While turning the belt tensioner counterclockwise, remove the pin.

**NOTE:** Make sure that the V belt is properly set to each pulley.



## P

**Fig. 12: Identifying Correct And Incorrect Position Of Drive Belt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. After installing the belt, check that it fits properly in the ribbed grooves.

### HINT:

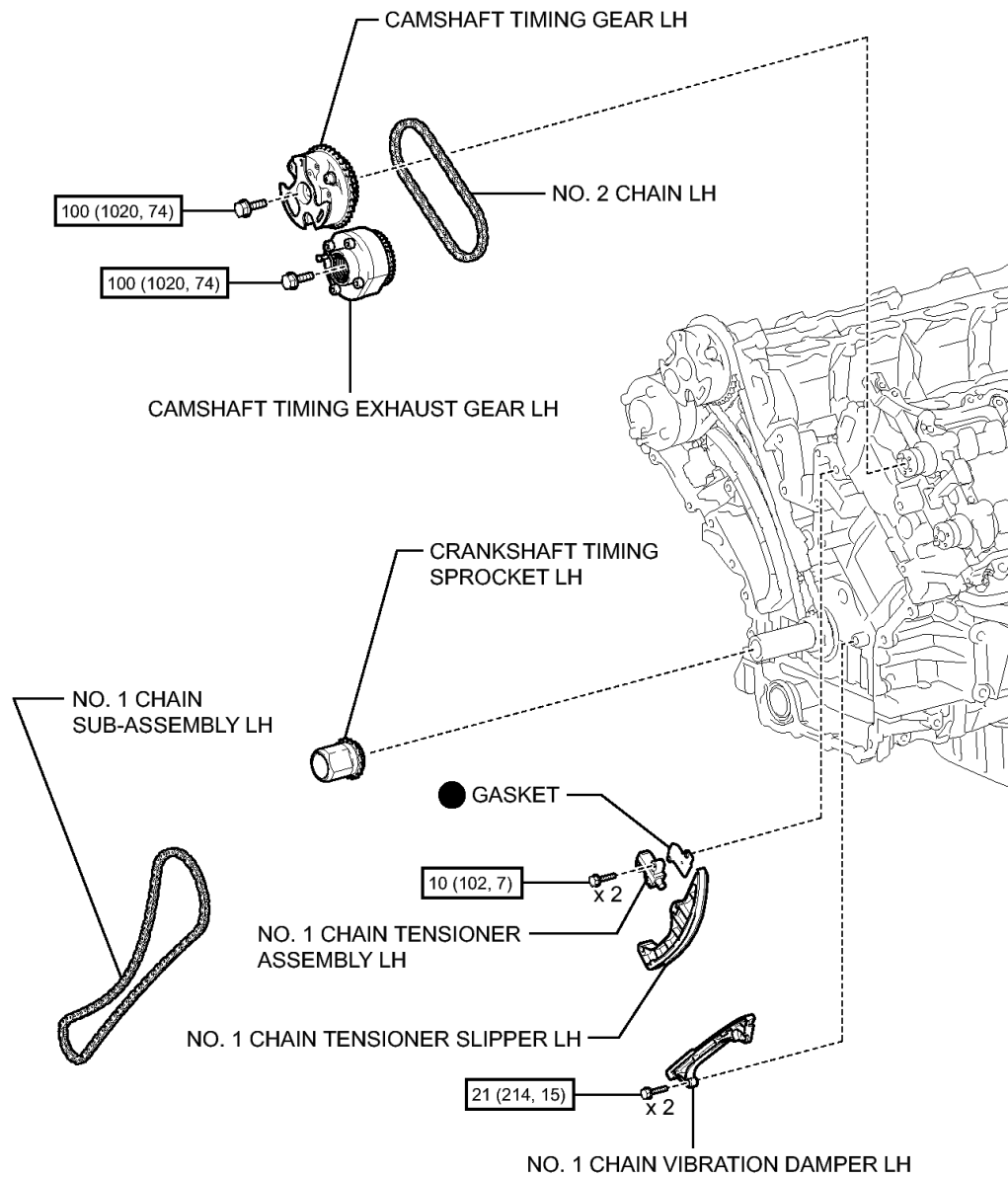
Make sure to check by hand that the belt has not slipped out of the grooves on the bottom of the pulley.

- 2. **INSTALL NO. 1 ENGINE UNDER COVER** . Refer to **REPLACEMENT - Step 8**
- 3. **INSTALL V-BANK COVER SUB-ASSEMBLY** See step 57

## CAMSHAFT (FOR BANK 1)

### COMPONENTS

### ILLUSTRATION



[N\*m (kgf\*cm, ft.\*lbf)] : Specified torque

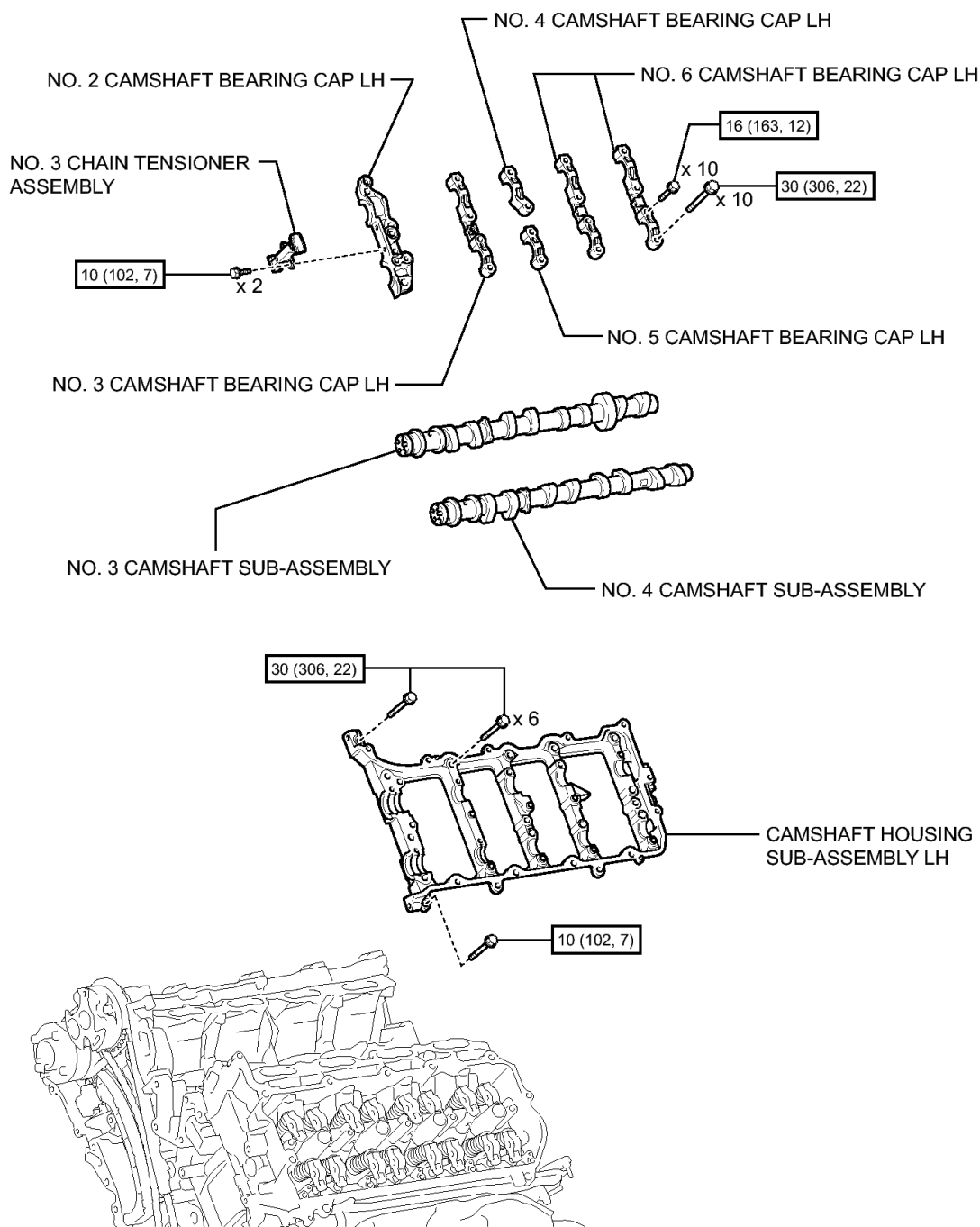
● Non-reusable part

P

**Fig. 13: Identifying Camshaft (For Bank 1) Replacement Components With Torque Specifications (1 Of 2)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

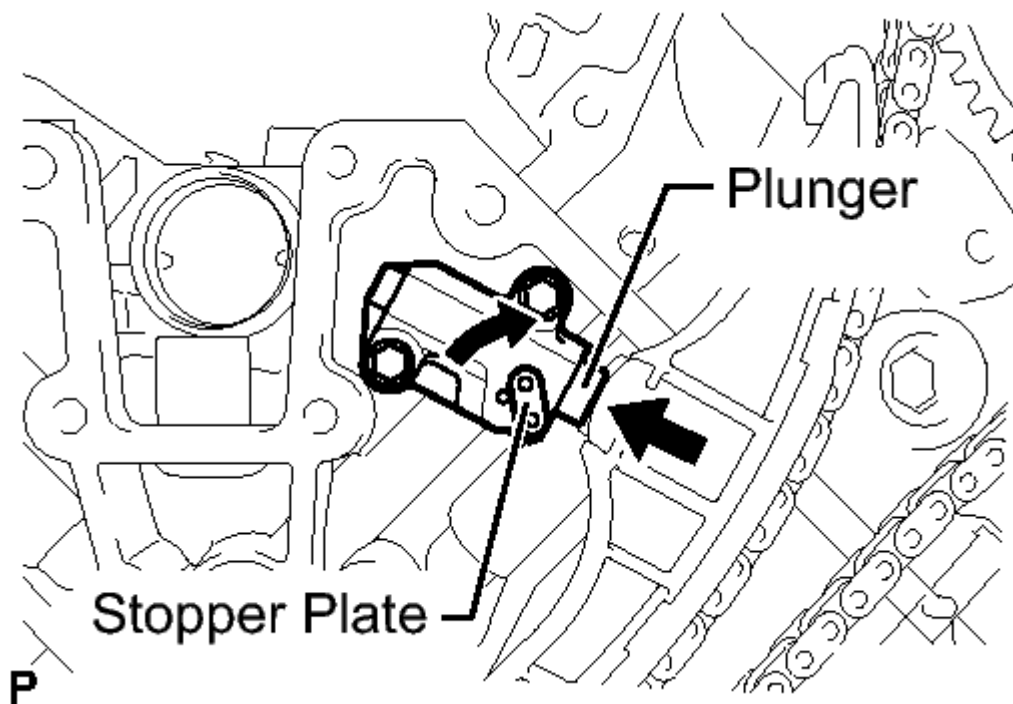
P

**Fig. 14: Identifying Camshaft (For Bank 1) Replacement Components With Torque Specifications (2 Of 2)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**REMOVAL****REMOVAL**

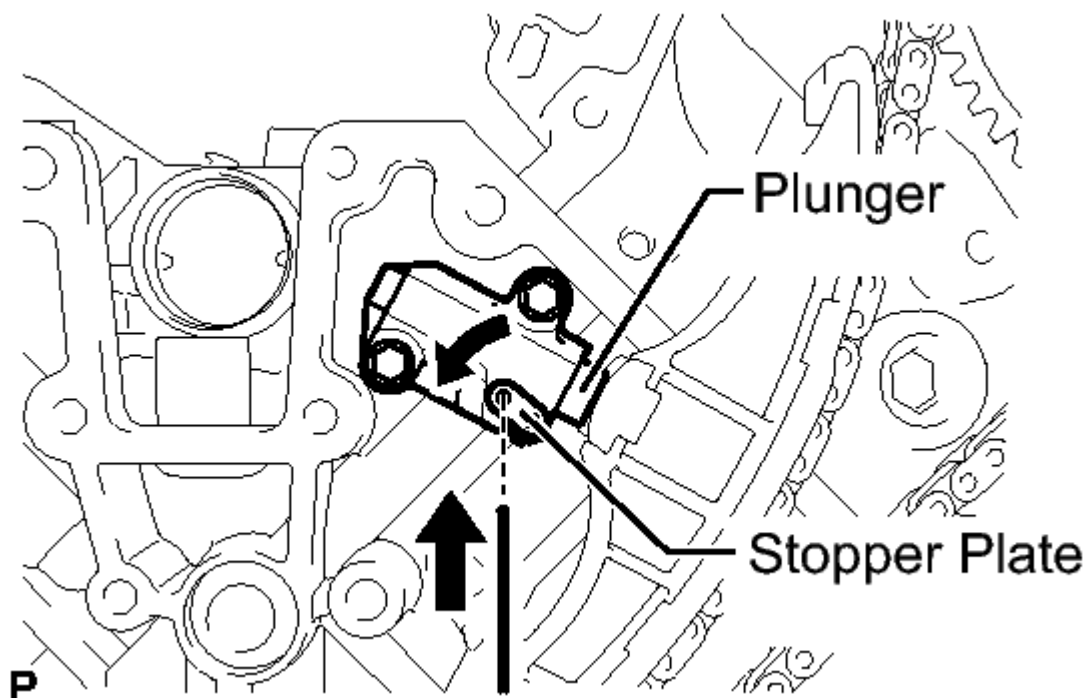
1. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY**
  - a. Remove the timing chain cover. Refer to **REMOVAL** .
2. **SET NO. 1 CYLINDER TO TDC / COMPRESSION** See step 21
3. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY LH**



**Fig. 15: Identifying Chain Tensioner Stopper Plate & Plunger**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.

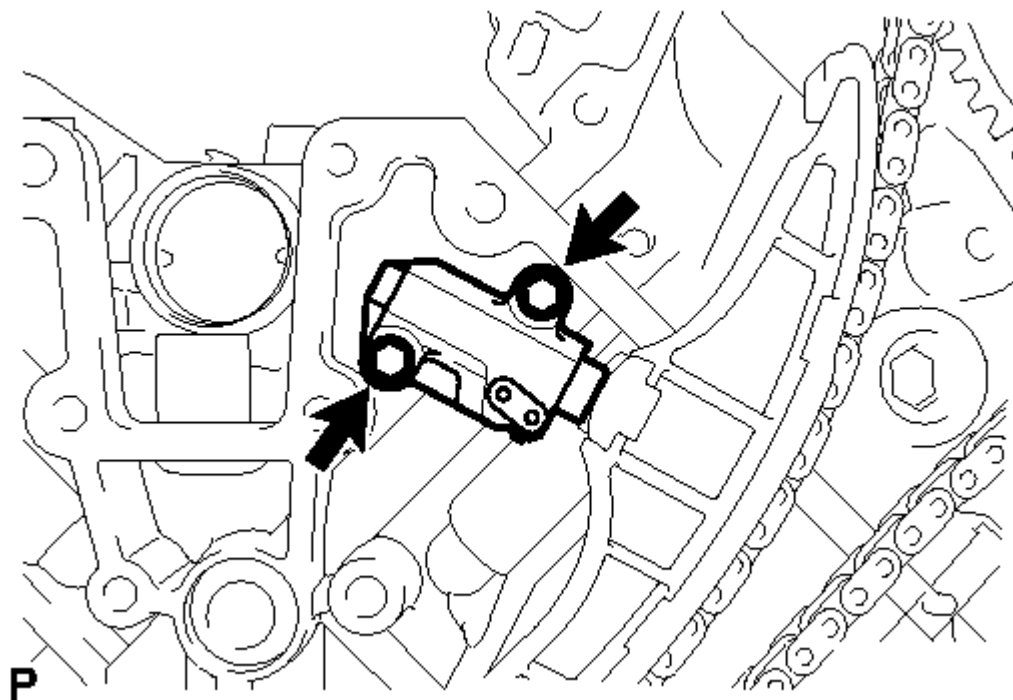




**Fig. 16: Identifying Chain Tensioner Stopper Plate & Plunger**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Move the stopper plate downward to set the lock, and insert a hexagon wrench into the stopper plate hole.

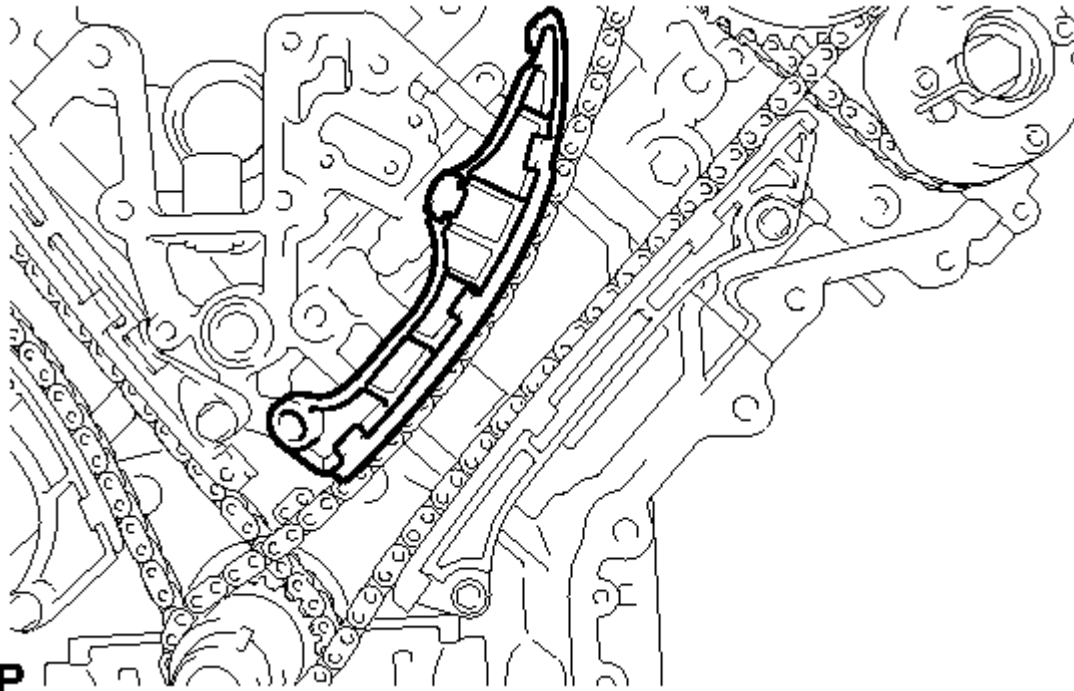


**Fig. 17: Identifying No. 1 Chain Tensioner Assembly LH & Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 2 bolts, chain tensioner and gasket.

**4. REMOVE NO. 1 CHAIN TENSIONER SLIPPER LH**

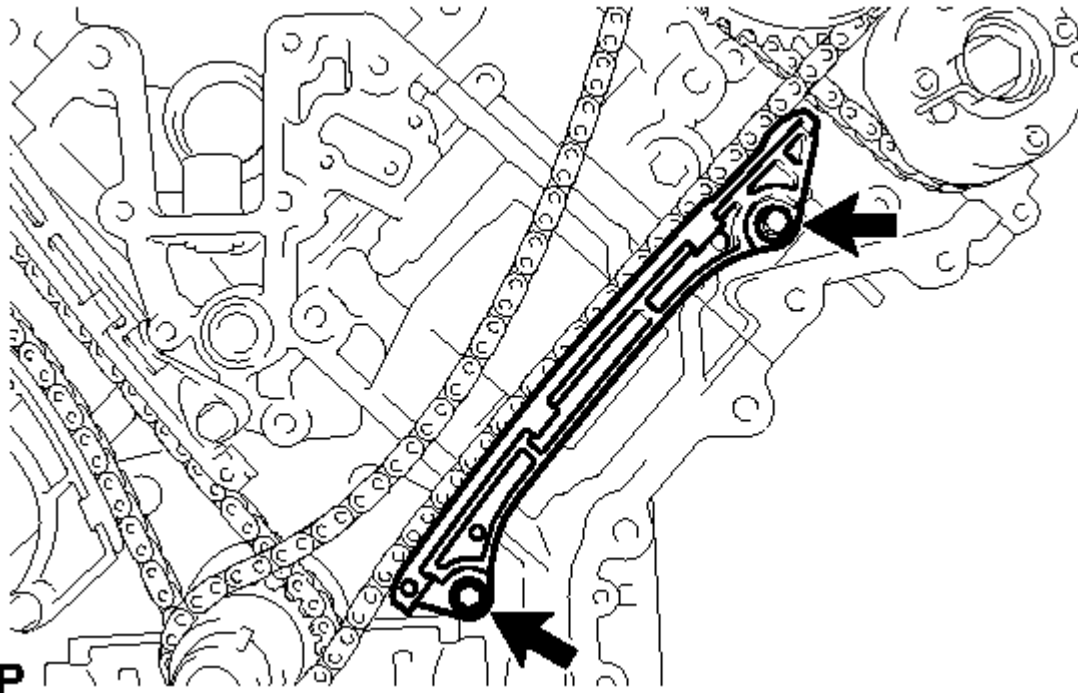


**P**

**Fig. 18: Identifying Chain Tensioner Slipper**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

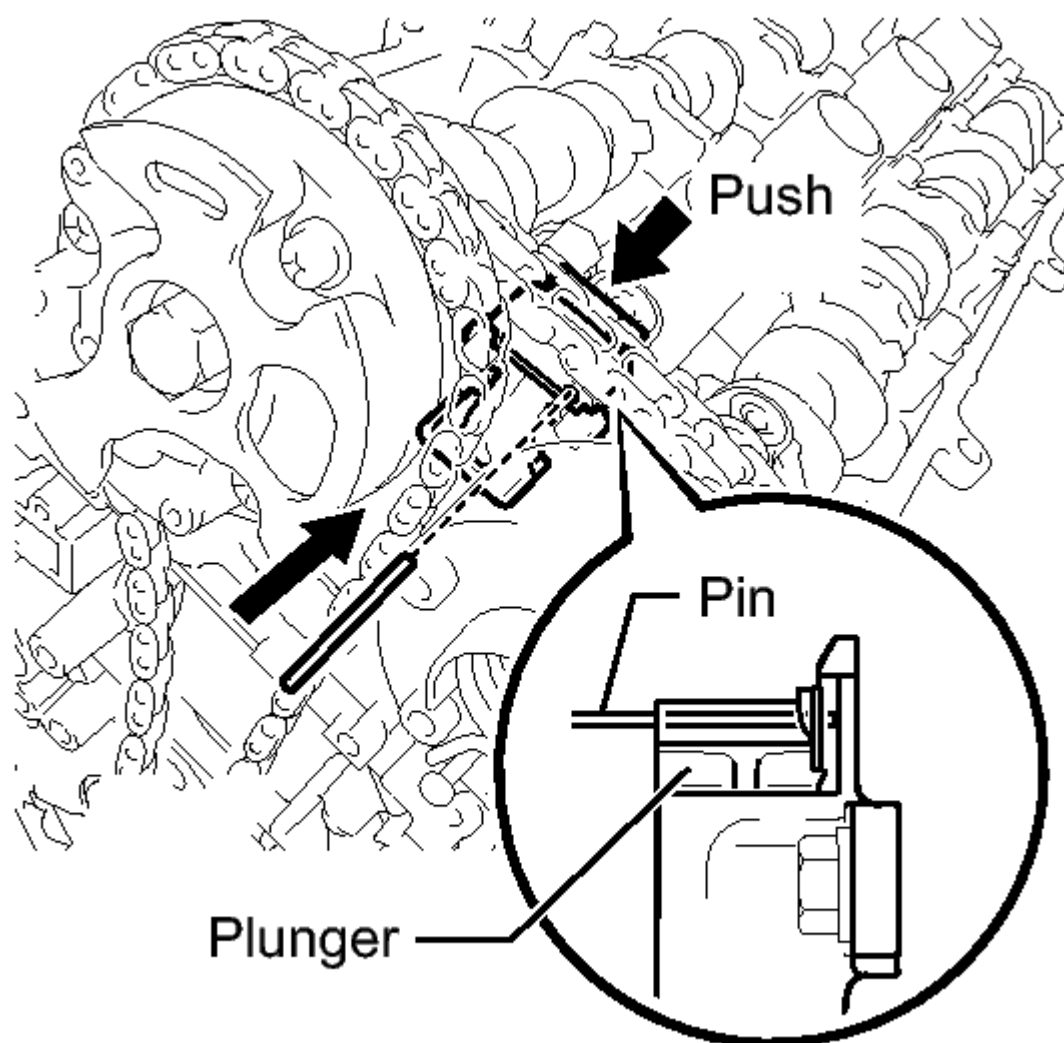
**5. REMOVE NO. 1 CHAIN VIBRATION DAMPER LH**



**Fig. 19: 2 Bolts And Chain Vibration Damper**

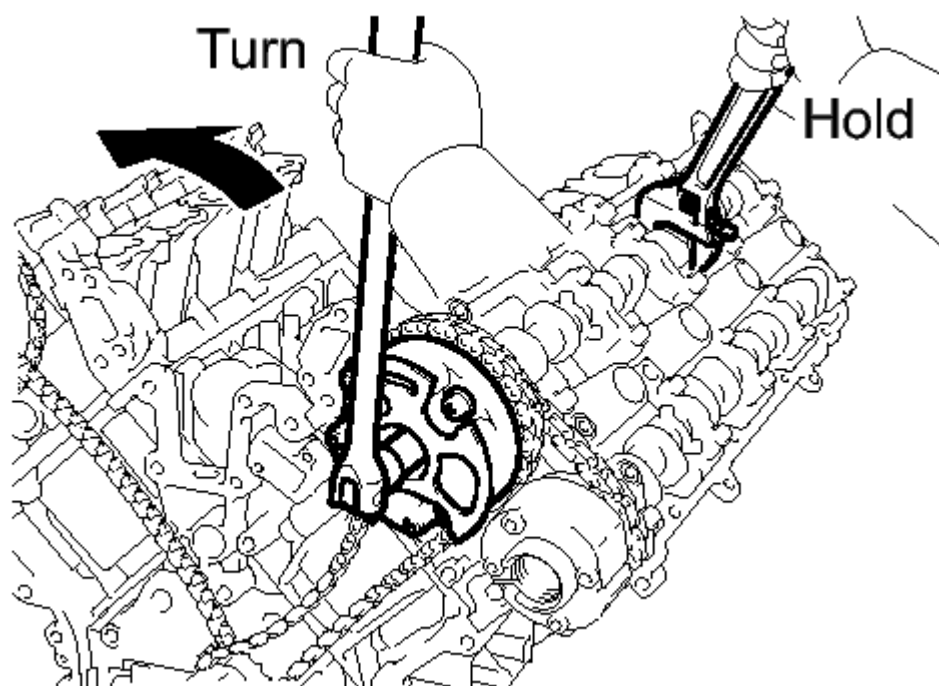
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 bolts and chain vibration damper.
6. **REMOVE NO. 1 CHAIN SUB-ASSEMBLY LH**

**P****Fig. 20: Identifying Chain Tensioner Stopper Plunger & Pin**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. While pushing down the No. 3 chain tensioner, insert a pin of 1.0 mm (0.0394 in.) into the hole to fix it in place.



**P**

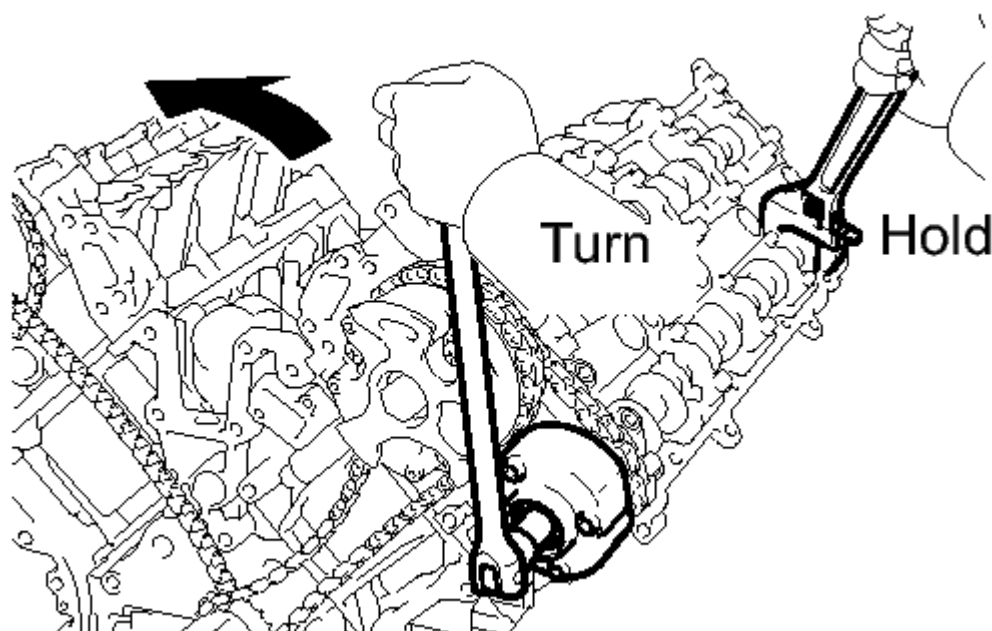
**Fig. 21: Holding Hexagonal Camshaft With Wrench To Loosen Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Be careful not to damage the cylinder head with the wrench.
- Do not disassemble the camshaft timing gear.

- b. Hold the hexagonal portion of the camshaft with a wrench and loosen the bolt.



**P**

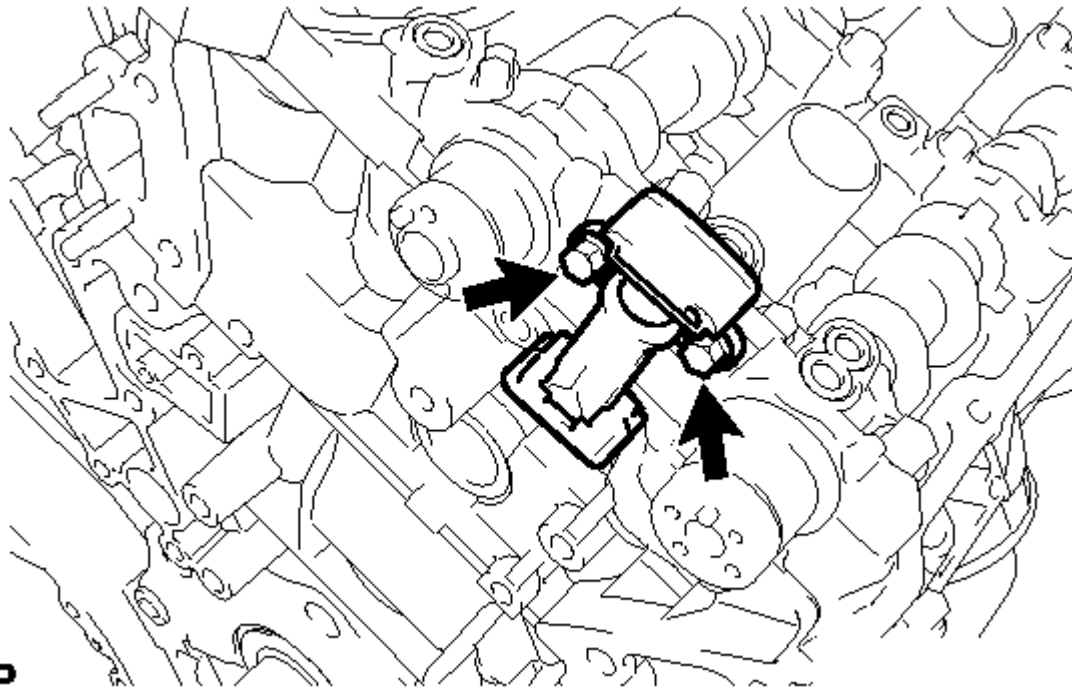
**Fig. 22: Holding Hexagonal Camshaft With Wrench To Loosen Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to damage the cylinder head with the wrench.

- c. Hold the hexagonal portion of the camshaft with a wrench and loosen the bolt.
- d. Remove the 2 bolts. Then with the No. 1 and No. 2 chains still connected to the gears, remove the camshaft timing gear, camshaft timing exhaust gear and crankshaft timing sprocket LH.
- e. Remove the No. 1 and No. 2 chains from the gears.

#### **7. REMOVE NO. 3 CHAIN TENSIONER ASSEMBLY**



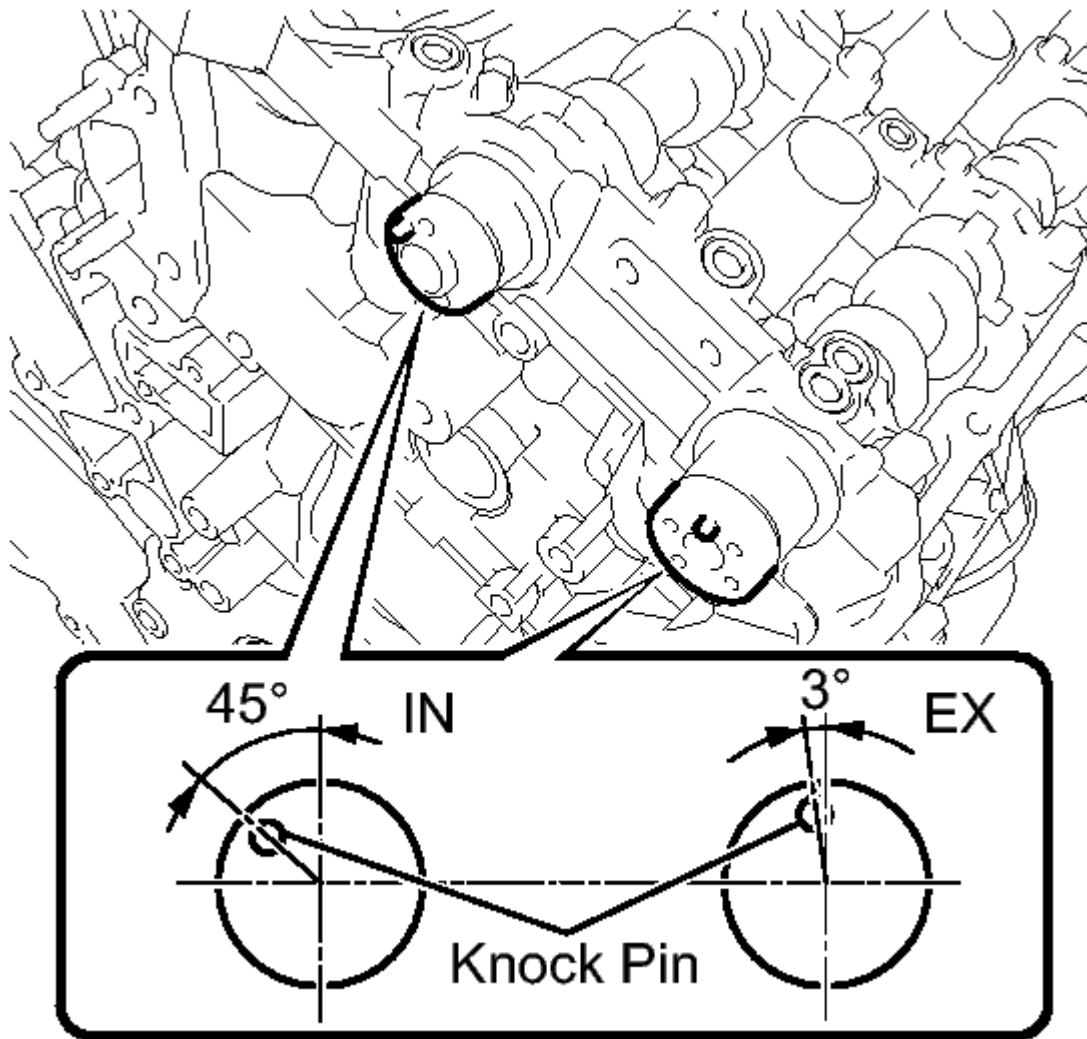
**P**

**Fig. 23: Locating Chain Tensioner Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 bolts and chain tensioner.

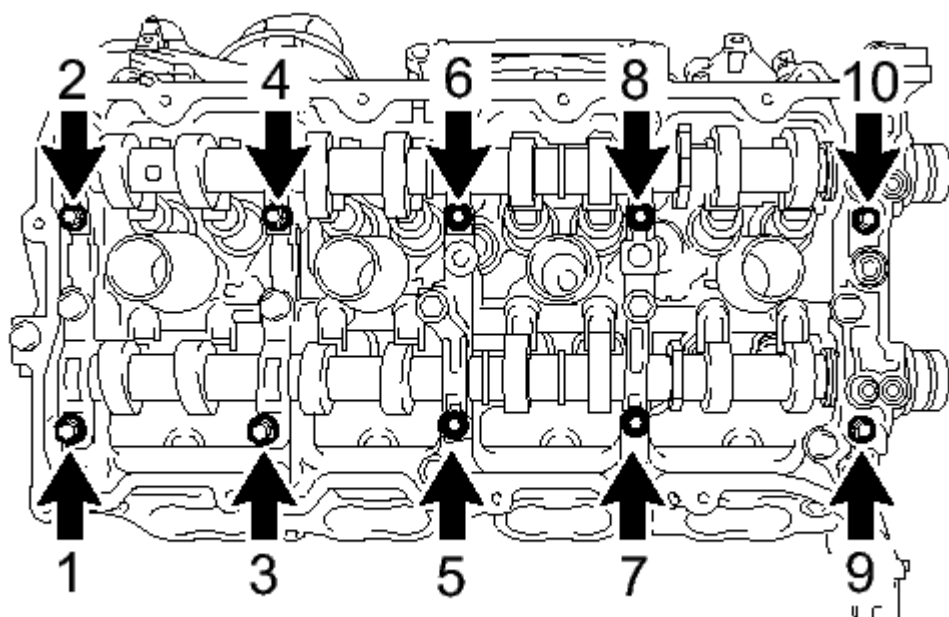
**8. REMOVE CAMSHAFT BEARING CAP LH**

**P****Fig. 24: Identifying Camshaft Bearing Caps**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Make sure that the knock pin of the camshaft is positioned as shown in the illustration.



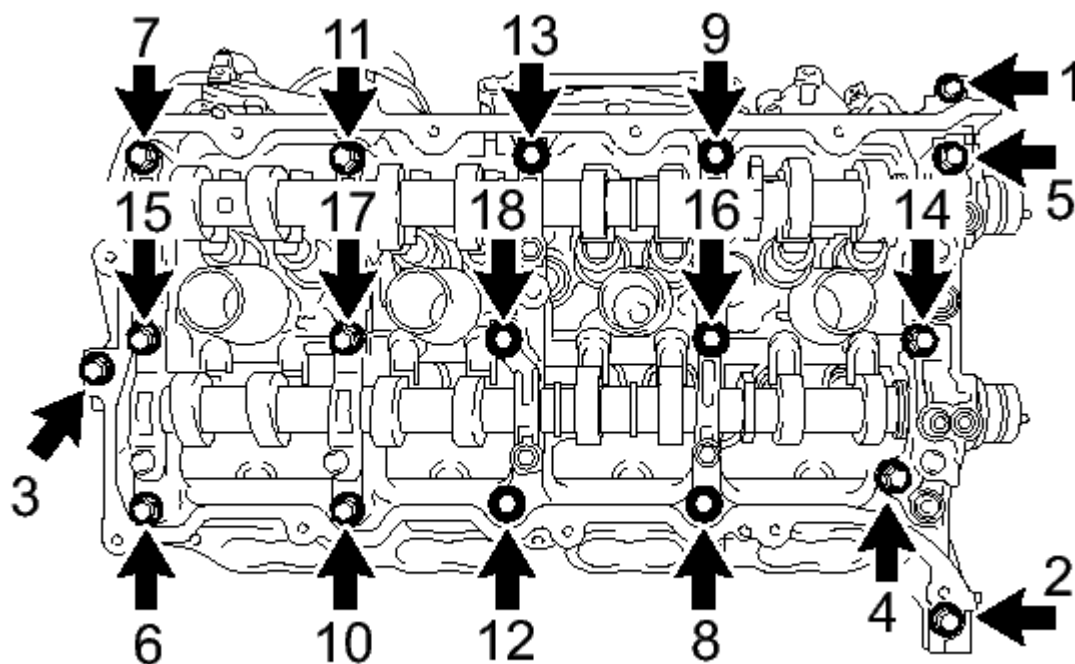


P

**Fig. 25: Locating Bearing Cap Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.



P

**Fig. 26: Identifying Bearing Cap Bolts Loosening Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Uniformly loosen the bolts while keeping the camshaft level.

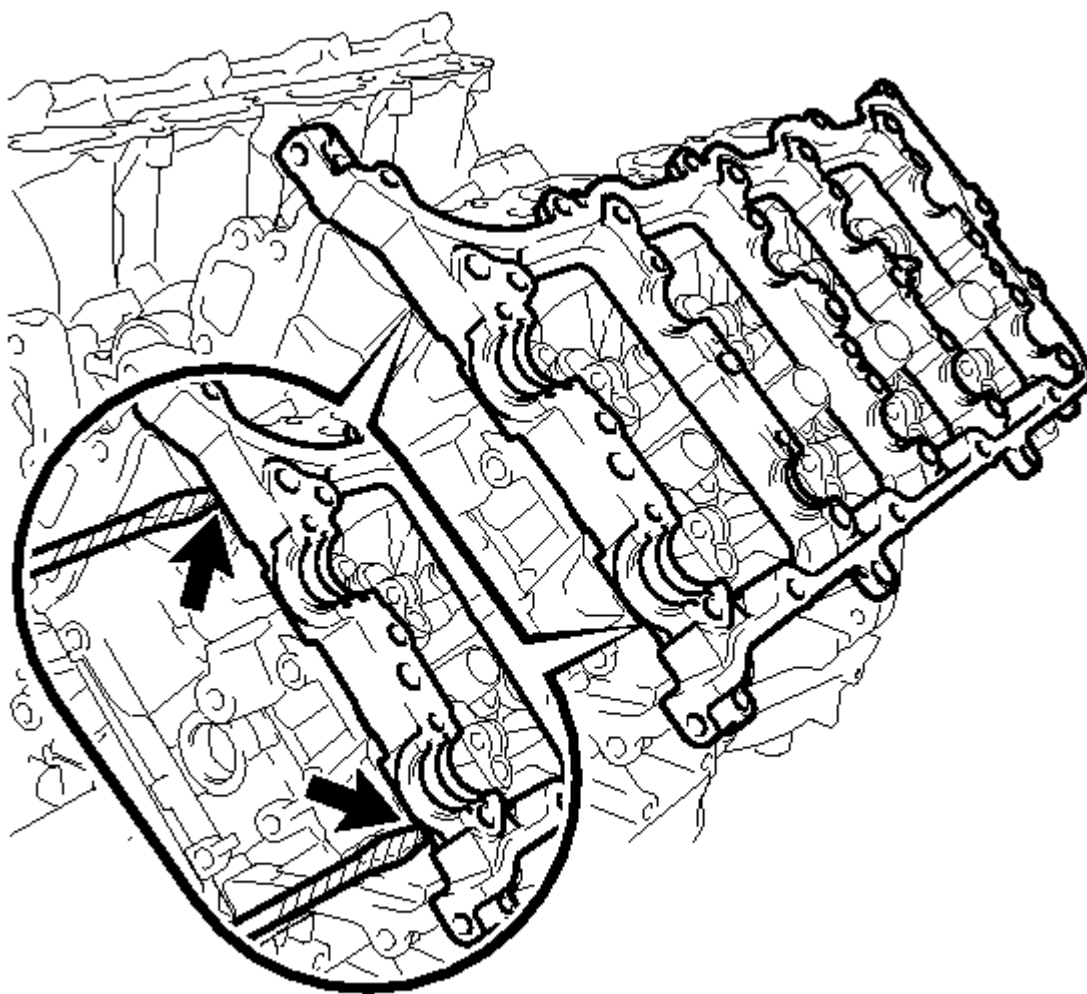
- c. Uniformly loosen and remove the 18 bearing cap bolts in the sequence shown in the illustration.
- d. Remove the 6 bearing caps.

**HINT:**

Arrange the removed parts in the correct order.

- e. Remove the No. 3 and No. 4 camshafts.

**9. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY LH**



**P**

**Fig. 27: Identifying Pry Points For Camshaft Housing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to damage the contact surfaces of the cylinder head and camshaft housing.

- a. Remove the camshaft housing by prying between the cylinder head and camshaft housing with a screwdriver.

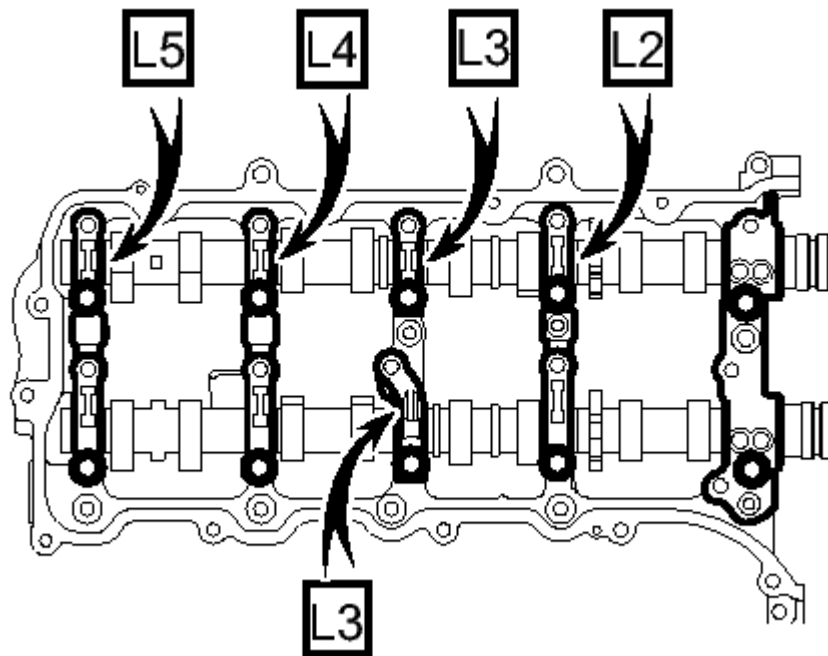
**HINT:**

Tape the screwdriver tip before use.

## INSTALLATION

### INSTALLATION

#### 1. INSTALL CAMSHAFT BEARING CAP LH

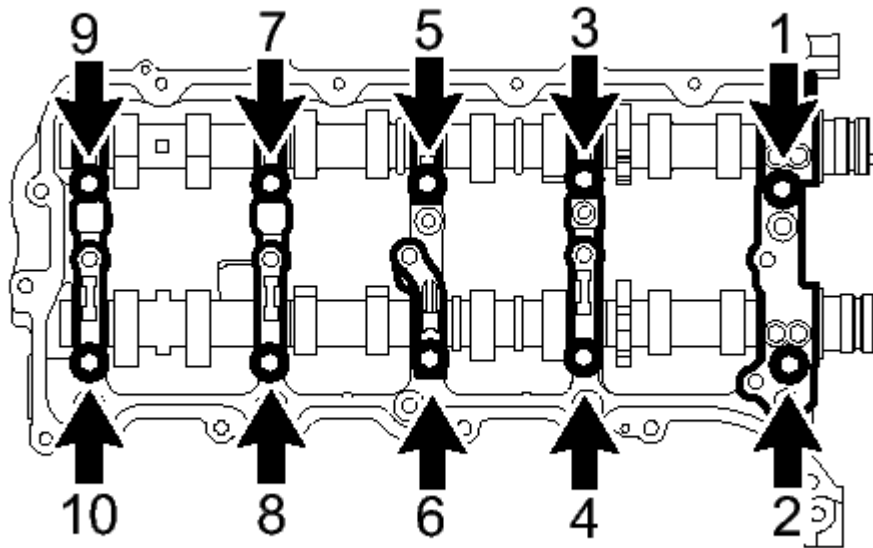


**P**

**Fig. 28: Applying A Light Coat Of Engine Oil**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.
- b. Install the No. 3 and No. 4 camshafts to the camshaft housing.
- c. Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.



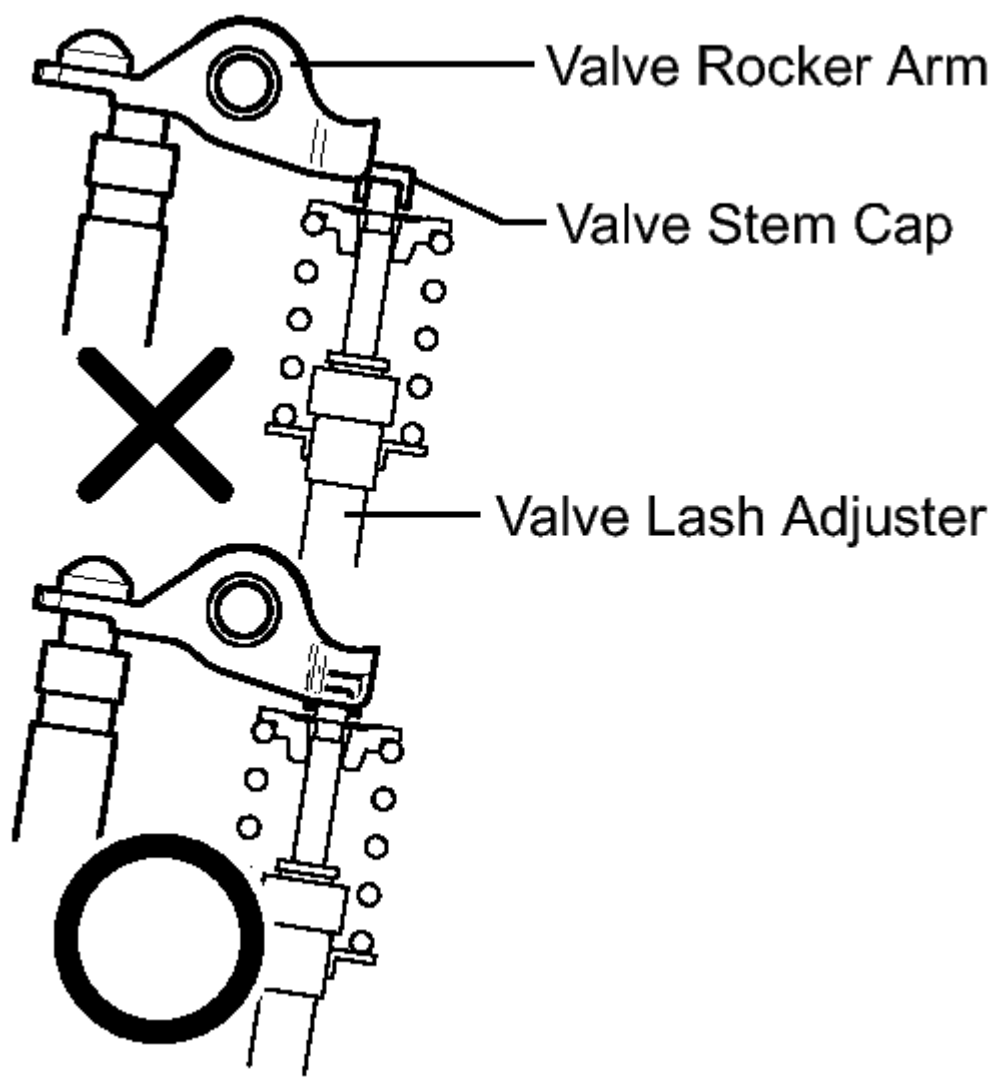
**P**

**Fig. 29: Identifying Camshaft Bearing Cap Bolts Tightening Order**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Temporarily install the 10 bolts in the order shown in the illustration.

## 2. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY LH

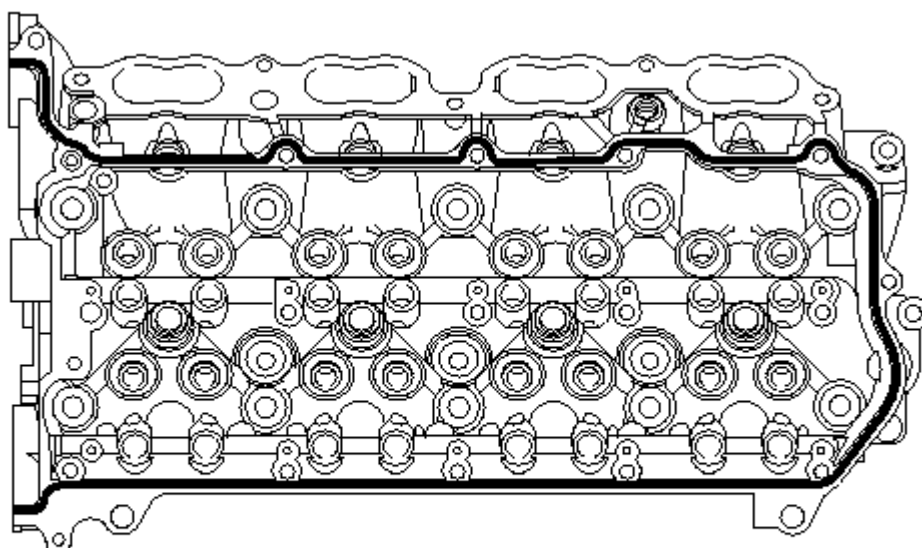


**P**

**Fig. 30: Identifying Valve Rocker Arms**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the valve rocker arms as shown in the illustration.



Seal diameter: 3.5 to 4.0 mm

**T**

**Fig. 31: Applying Seal Packing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Remove any oil from the contact surface.
- Install the camshaft housing within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.

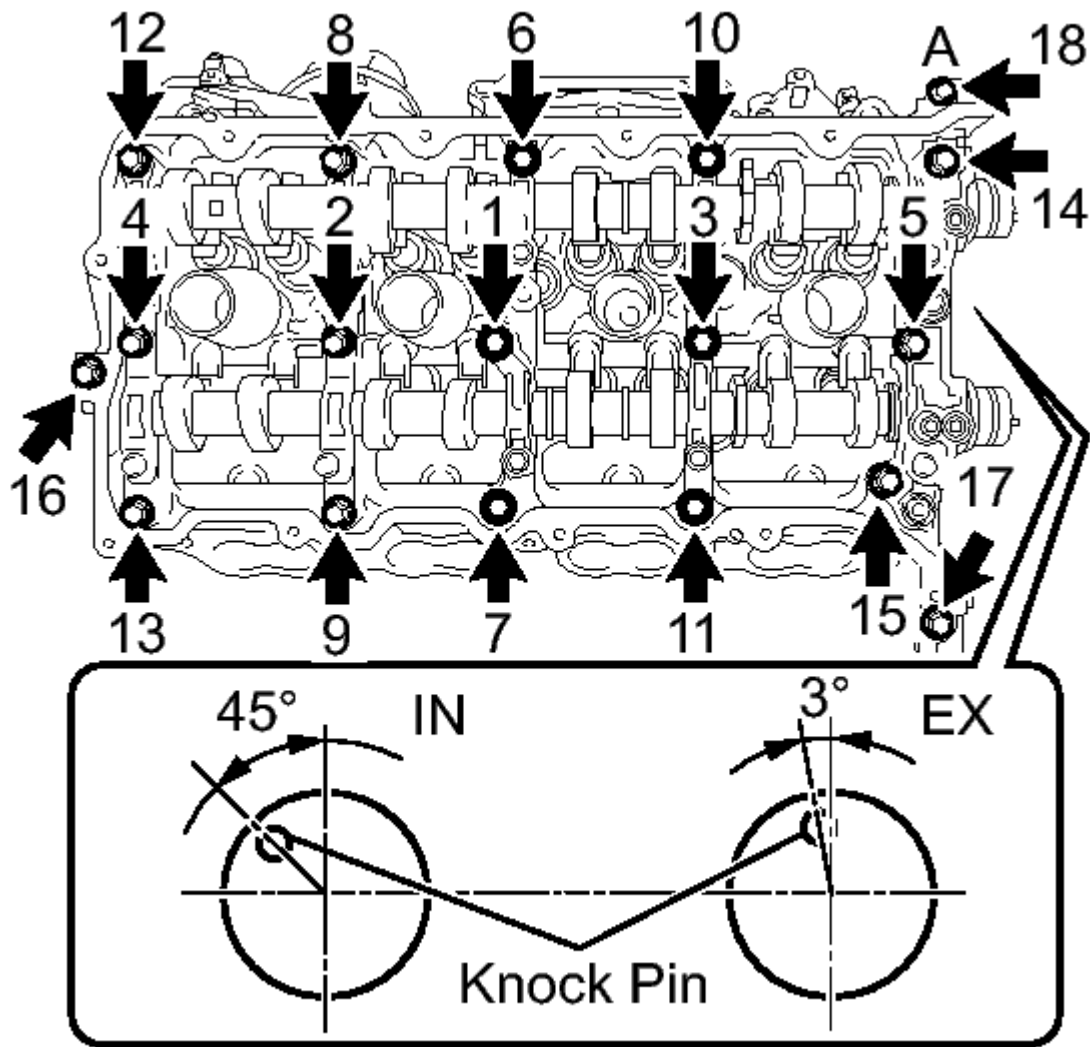
- b. Apply seal packing in a continuous line as shown in the illustration.

Seal packing

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Standard seal diameter

3.5 to 4.0 mm (0.138 to 0.157 in.)



**P**

**Fig. 32: Identifying Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Do not start the engine for at least 2 hours after the installation.
- Make sure that the knock pin of the camshaft is positioned as shown in the illustration before installing the camshaft housing.

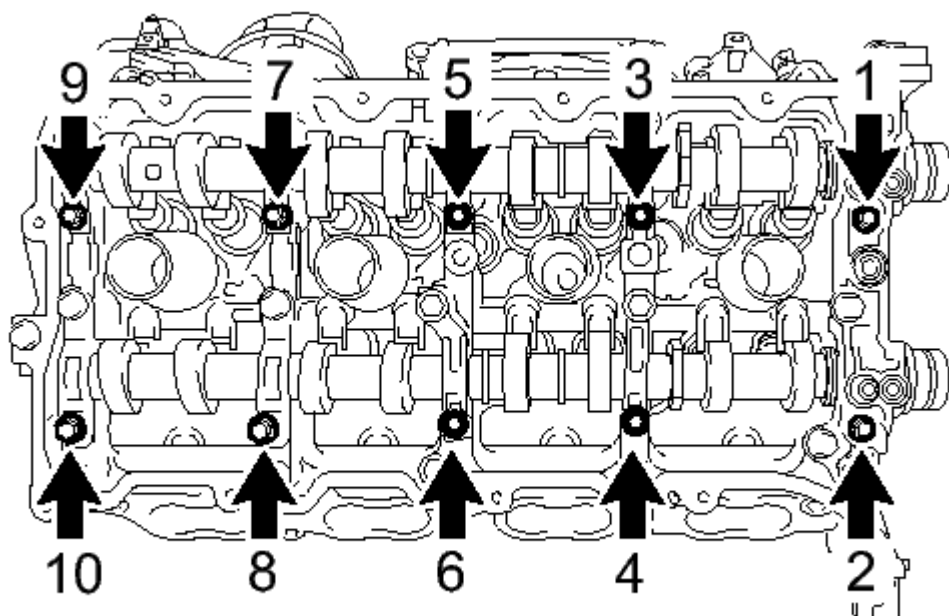
c. Install the camshaft housing, and install the 18 bolts in the order shown in the illustration.

for bolt A

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

except bolt A

**Torque: 30 N\*m (306 kgf\*cm, 22 ft.\*lbf)**



**P**

**Fig. 33: Identifying Bearing Caps Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

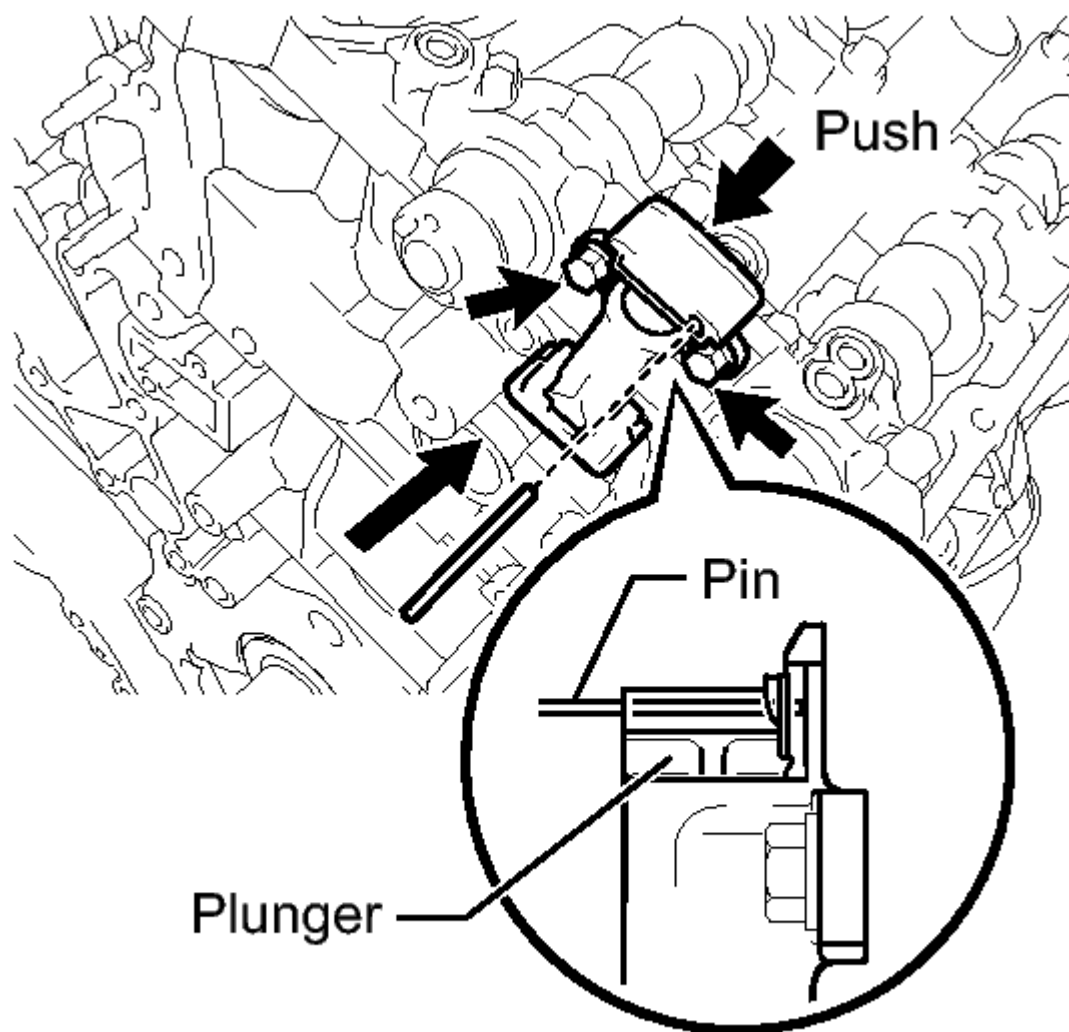
**NOTE:** Thoroughly wipe clean any seal packing.

- d. Tighten the 10 bolts in the order shown in the illustration.

**Torque: 16 N\*m (163 kgf\*cm, 12 ft.\*lbf)**

### 3. INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY



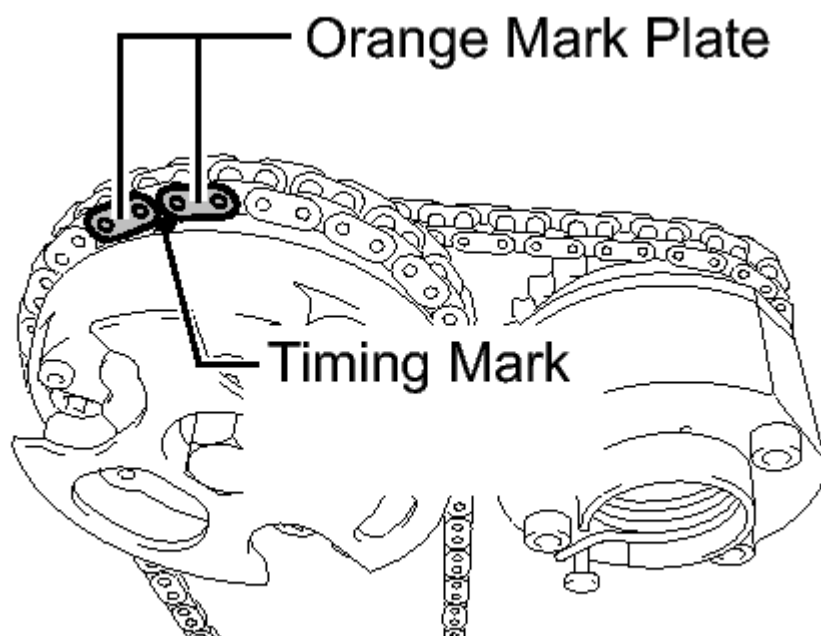
**P****Fig. 34: Identifying Chain Tensioner Pin & Hole****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. Install the chain tensioner with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

- b. While pushing down the No. 2 chain tensioner, insert a pin of 1.0 mm (0.0394 in.) into the hole to fix it in place.

**4. INSTALL NO. 1 CHAIN SUB-ASSEMBLY LH**

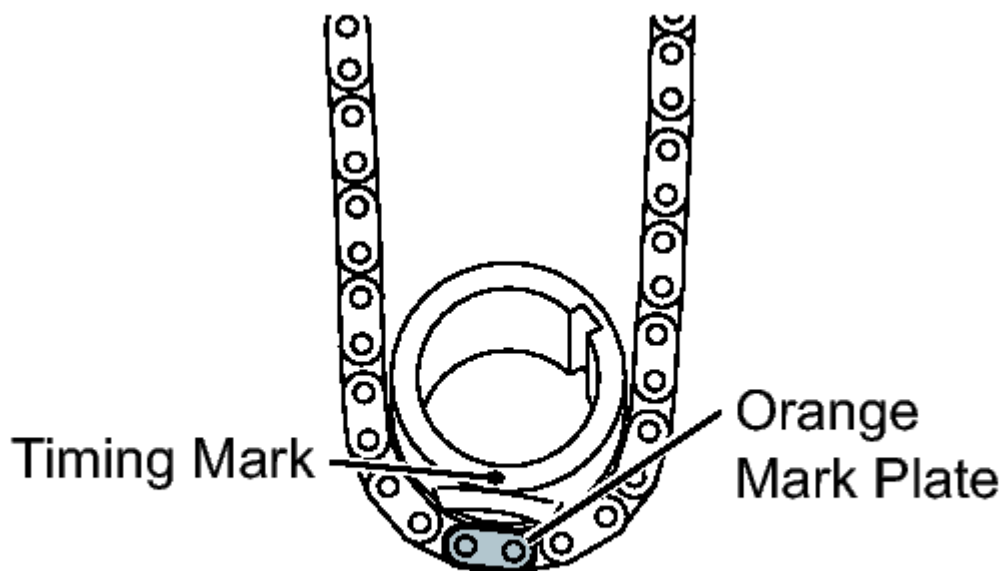


**P**

**Fig. 35: Aligning the No. 1 Chain's Orange Mark Plates**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Align the No. 1 chains orange mark plates with the camshaft timing gear's timing mark, and attach the chain to the gear as shown in the illustration.

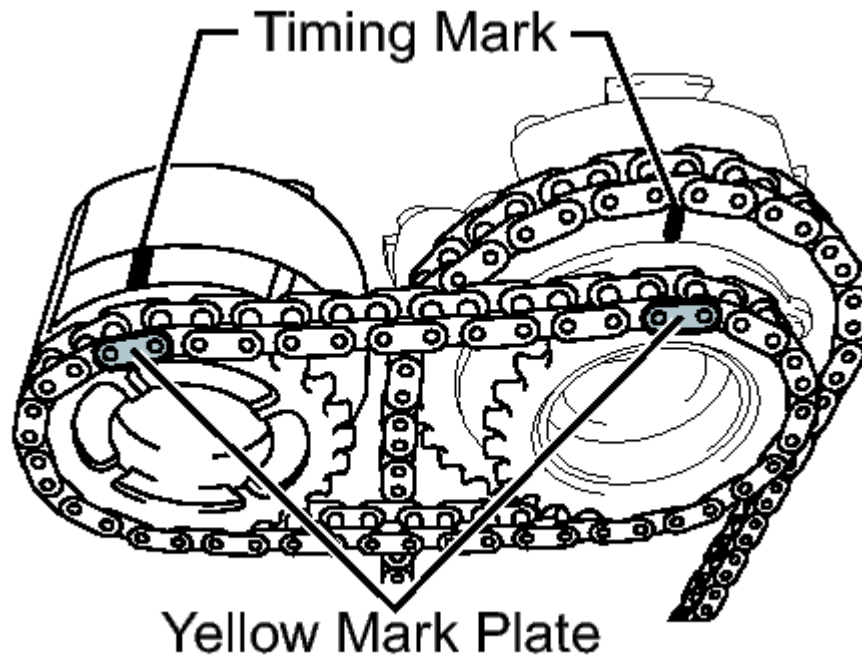


**O**

**Fig. 36: Aligning the No. 1 Chain's Orange Mark Plates**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the No. 1 chain's orange mark plate with the crankshaft timing gear's timing mark, and attach the chain to the gear as shown in the illustration.



**P**

**Fig. 37: Aligning the No. 2 Chain's Yellow Mark Plates**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Align the No. 2 chain's yellow mark plates with the timing marks of the camshaft timing gear and camshaft timing exhaust gear, and attach the No. 2 chain to the gears as shown in the illustration.

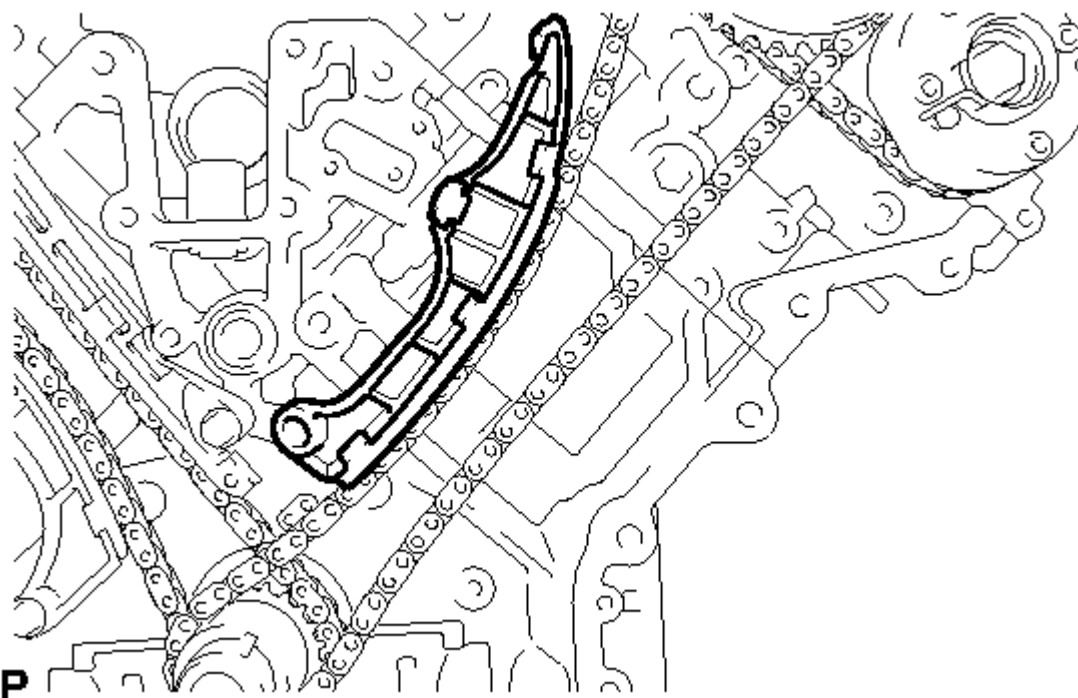
**HINT:**

The crankshaft timing gear and camshaft exhaust gear will be installed with the No. 1 and No. 2 chains connected to the gears.

- d. Install the crankshaft timing sprocket to the crankshaft.
- e. Align and attach the knock pin of the No. 3 camshaft with the pin hole of the camshaft timing gear.
- f. Using the hexagonal portion of the No. 4 camshaft, align and attach the knock pin of the No. 4 camshaft with the pin hole of the camshaft timing exhaust gear.

**NOTE:** Because the gears' timing mark positions may shift due to looseness of the No. 1 chain, use the hexagonal portion of the camshaft to hold the No. 3 camshaft in place until the No. 1 chain tensioner is installed.

- g. Remove the pin from the No. 2 chain tensioner.

**5. INSTALL NO. 1 CHAIN TENSIONER SLIPPER LH**

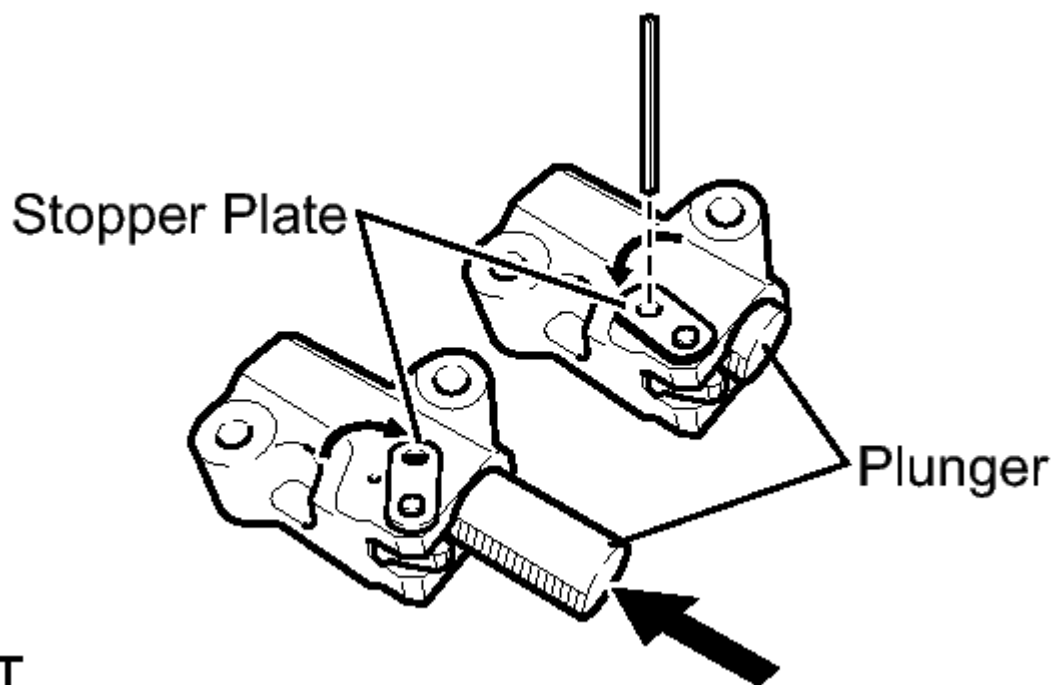
**Fig. 38: Identifying Chain Tensioner Slipper**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

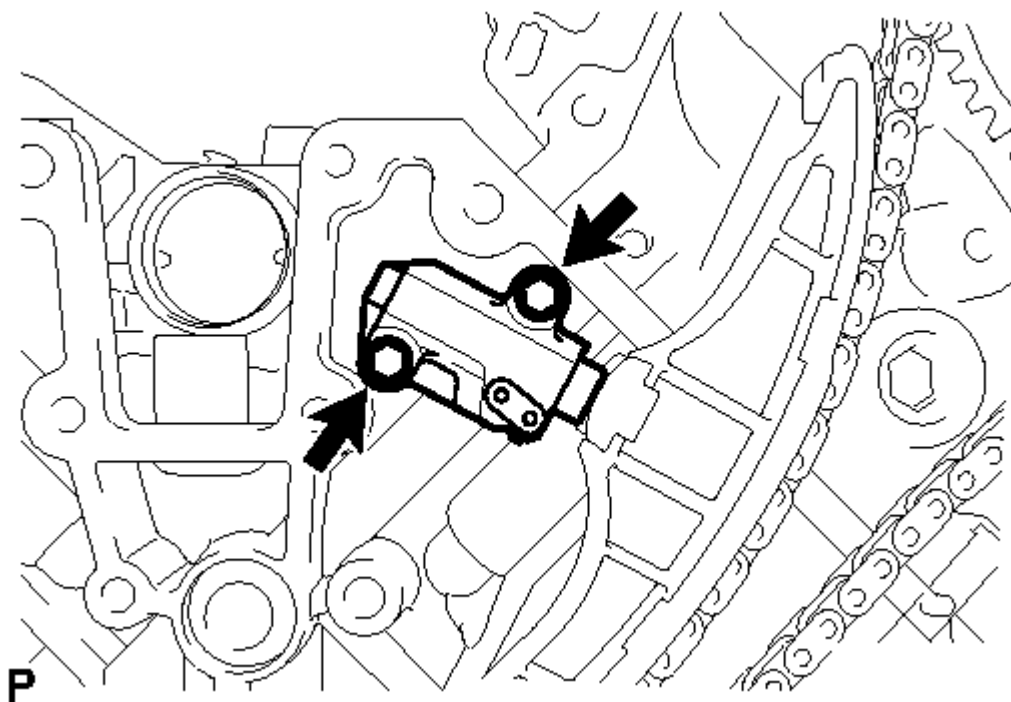
**HINT:**

If you cannot install the chain tensioner slipper due to the tension of the chain, use the hexagonal portion of the camshaft to loosen the chain and install the chain tensioner.

**6. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY LH**

**T****Fig. 39: Pushing Plunger Deep Into Tensioner****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.
- Move the stopper plate downward to set the lock, and insert a hexagon wrench into the hole of the stopper plate.

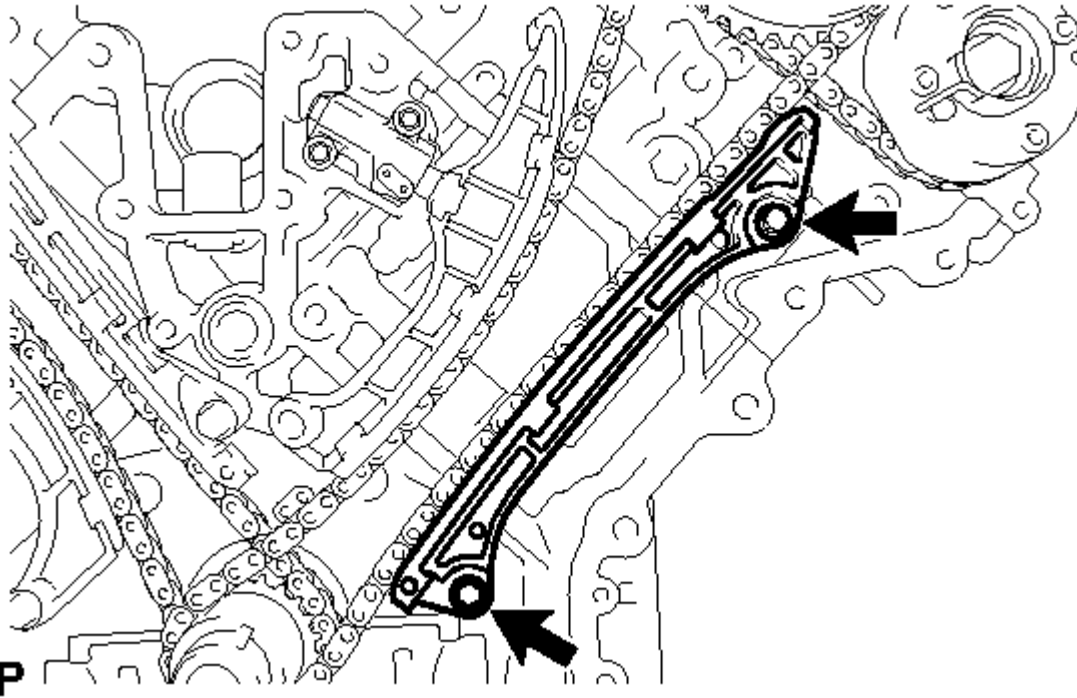


**Fig. 40: Identifying No. 1 Chain Tensioner Assembly LH & Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install a new gasket and the chain tensioner with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

## 7. INSTALL NO. 1 CHAIN VIBRATION DAMPER LH



**Fig. 41: Installing The Vibration Damper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

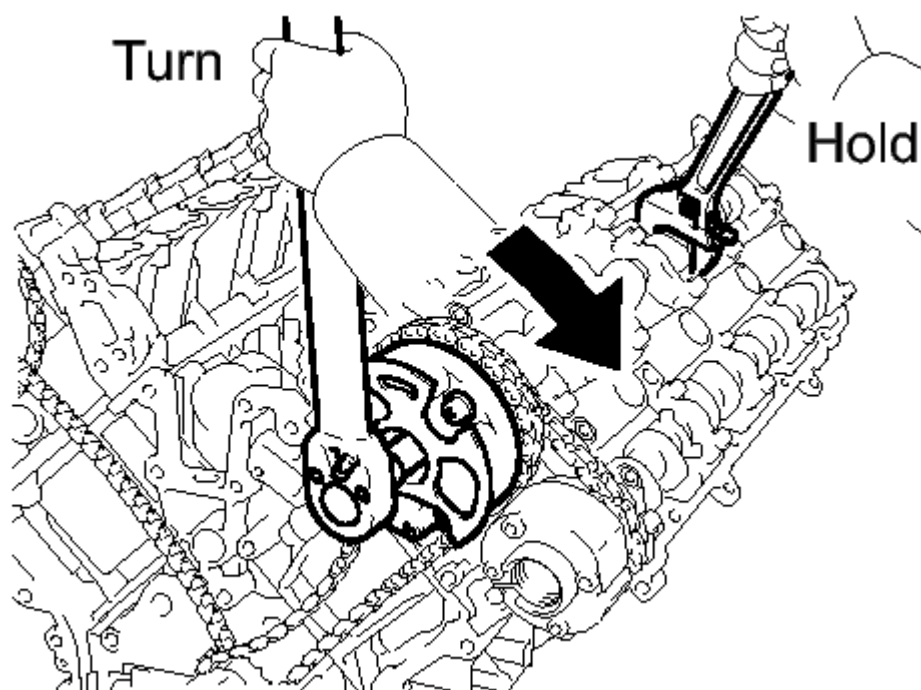
- a. Install the vibration damper with the 2 bolts.

**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

- b. Remove the hexagon wrench from the No. 1 chain tensioner.

## 8. TIGHTEN CAMSHAFT TIMING GEAR LH

- a. Using a wrench to hold the hexagonal portion of the No. 3 camshaft, tighten the camshaft timing gear with the bolt.

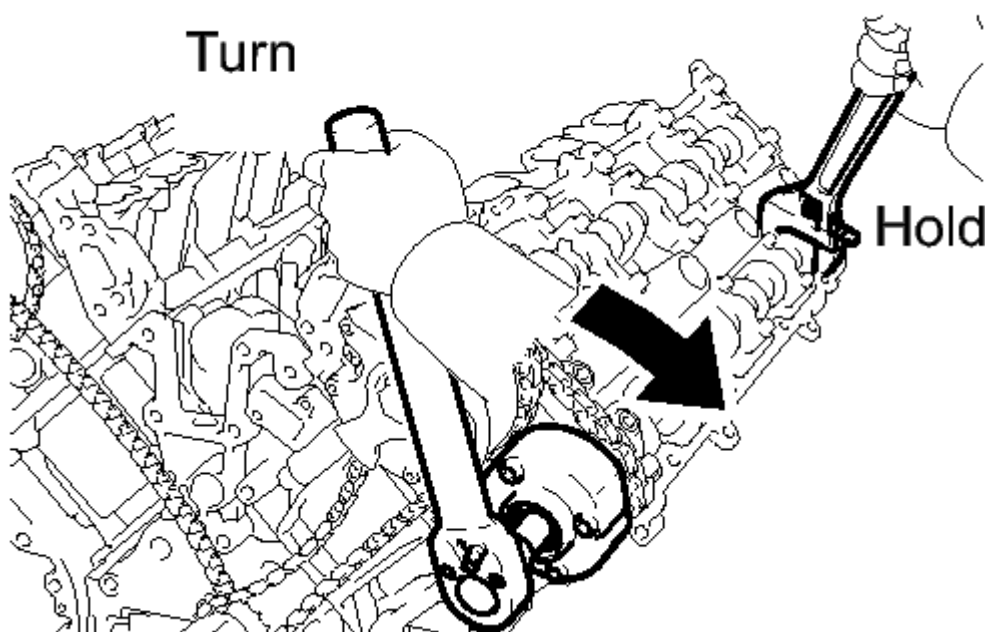


P

**Fig. 42: Tightening The Camshaft Timing Gear With The Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**

- b. Using a wrench to hold the hexagonal portion of the No. 4 camshaft, tighten the camshaft timing exhaust gear with the bolt.



P

**Fig. 43: Tightening The Camshaft Timing Exhaust Gear With The Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**

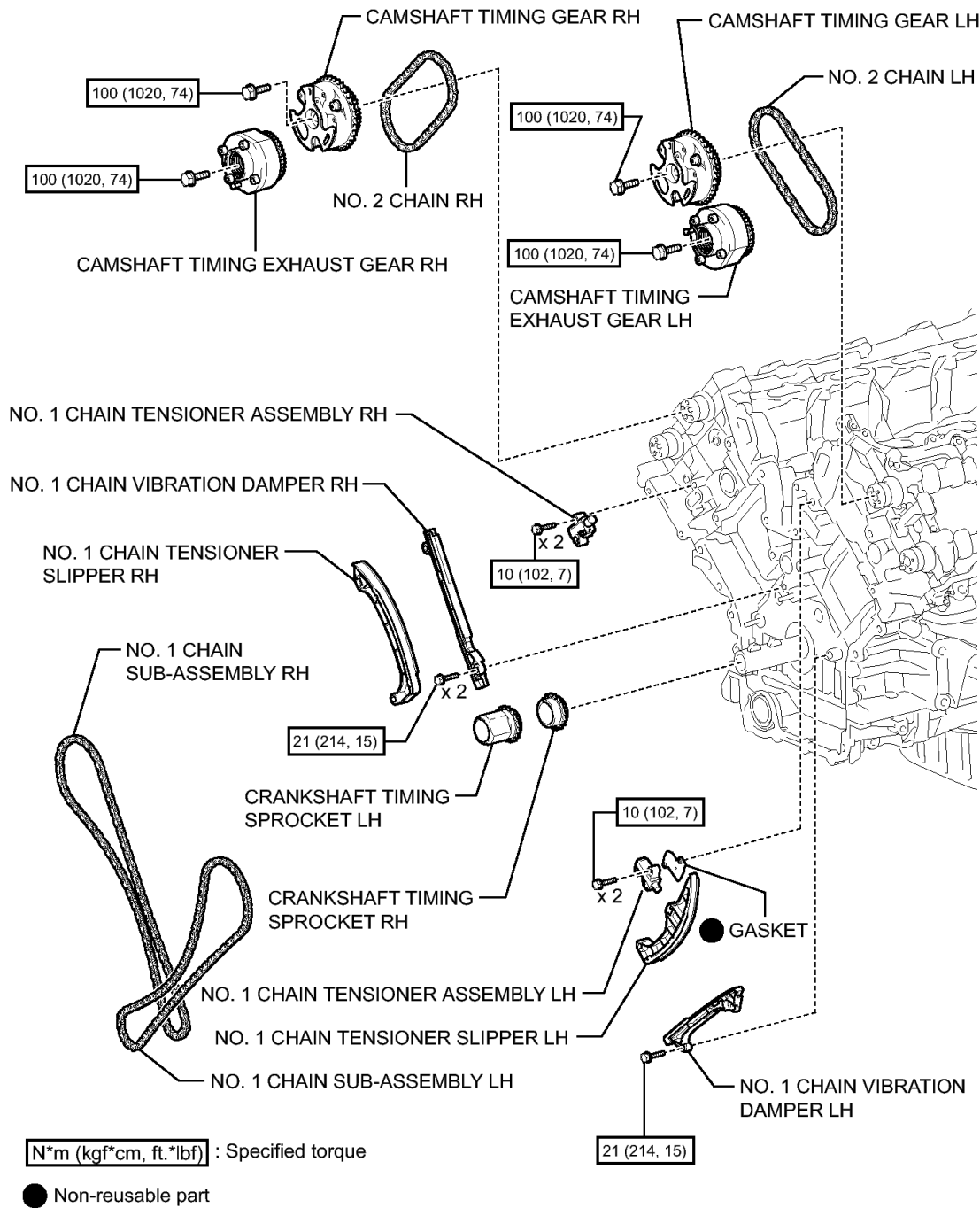
9. **CHECK NO. 1 CYLINDER TO TDC / COMPRESSION** See step 37
10. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY**
  - a. Install the timing chain cover. Refer to **INSTALLATION** .
11. **INSPECT IGNITION TIMING** See step 1
12. **INSPECT ENGINE IDLE SPEED** See step 2

## **CAMSHAFT (FOR BANK 2)**

### **COMPONENTS**

### **ILLUSTRATION**



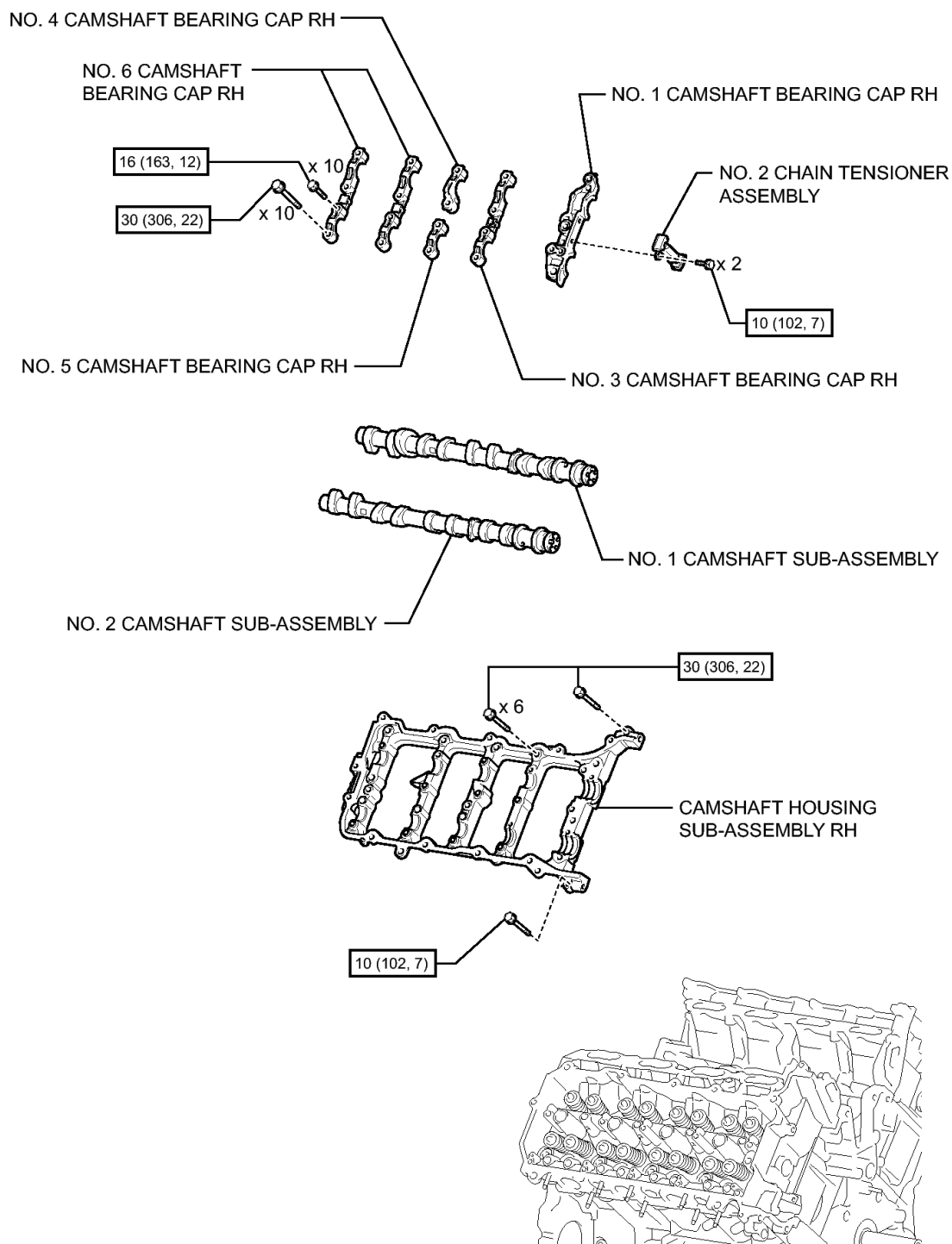


P

**Fig. 44: Identifying Camshaft (For Bank 2) Replacement Components With Torque Specifications (1 Of 2)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

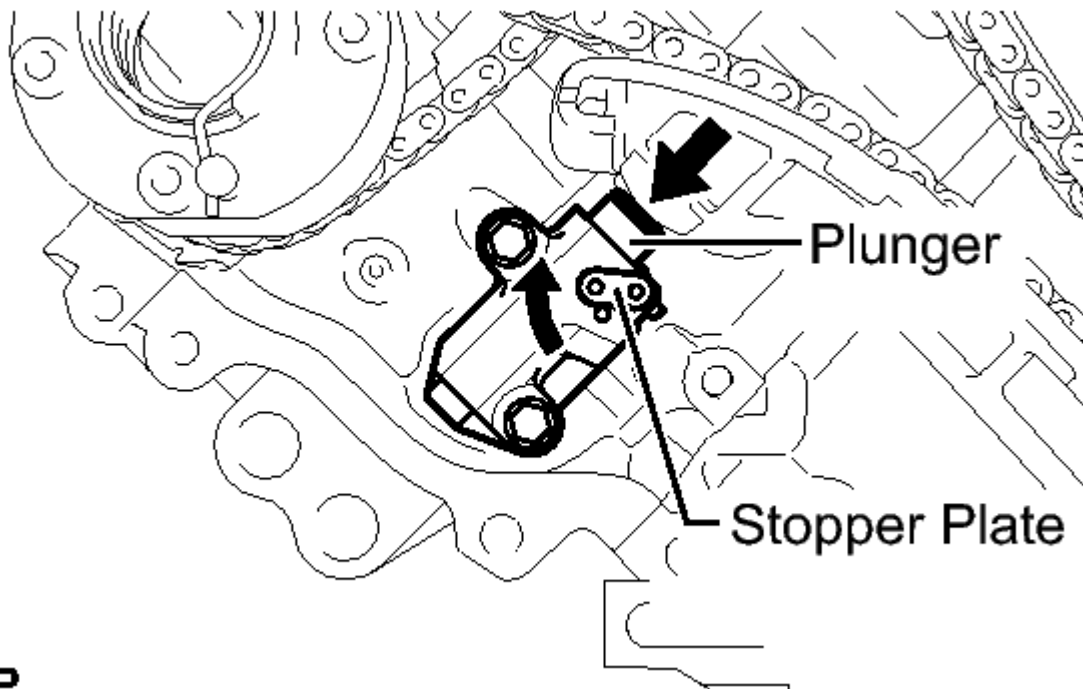
P

**Fig. 45: Identifying Camshaft (For Bank 2) Replacement Components With Torque Specifications (2 Of 2)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

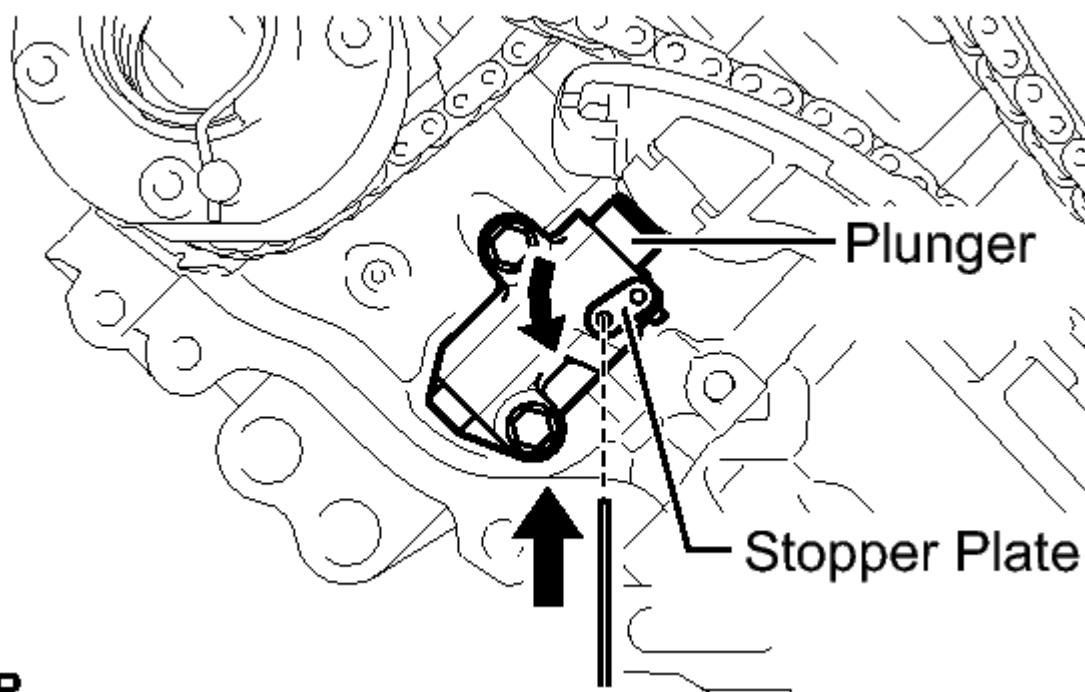
**REMOVAL****REMOVAL**

1. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY**
  - a. Remove the timing chain cover. Refer to **REMOVAL** .
2. **SET NO. 1 CYLINDER TO TDC / COMPRESSION** See step 21
3. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY LH** See step 3
4. **REMOVE NO. 1 CHAIN TENSIONER SLIPPER LH** See step 4
5. **REMOVE NO. 1 CHAIN VIBRATION DAMPER LH** See step 5
6. **REMOVE NO. 1 CHAIN SUB-ASSEMBLY LH** See step 6
7. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY RH**

**P**

**Fig. 46: Identifying Stopper Plate & Plunger**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.

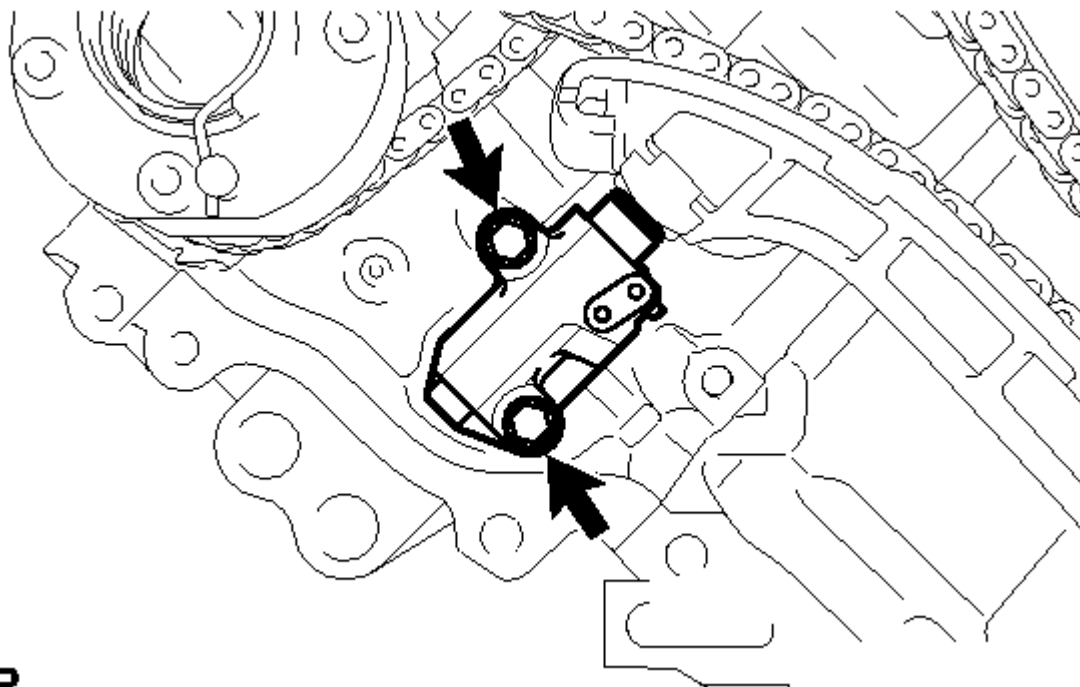


**P**

**Fig. 47: Identifying Stopper Plate & Plunger**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Move the stopper plate downward to set the lock, and insert a hexagon wrench into the stopper plate hole.



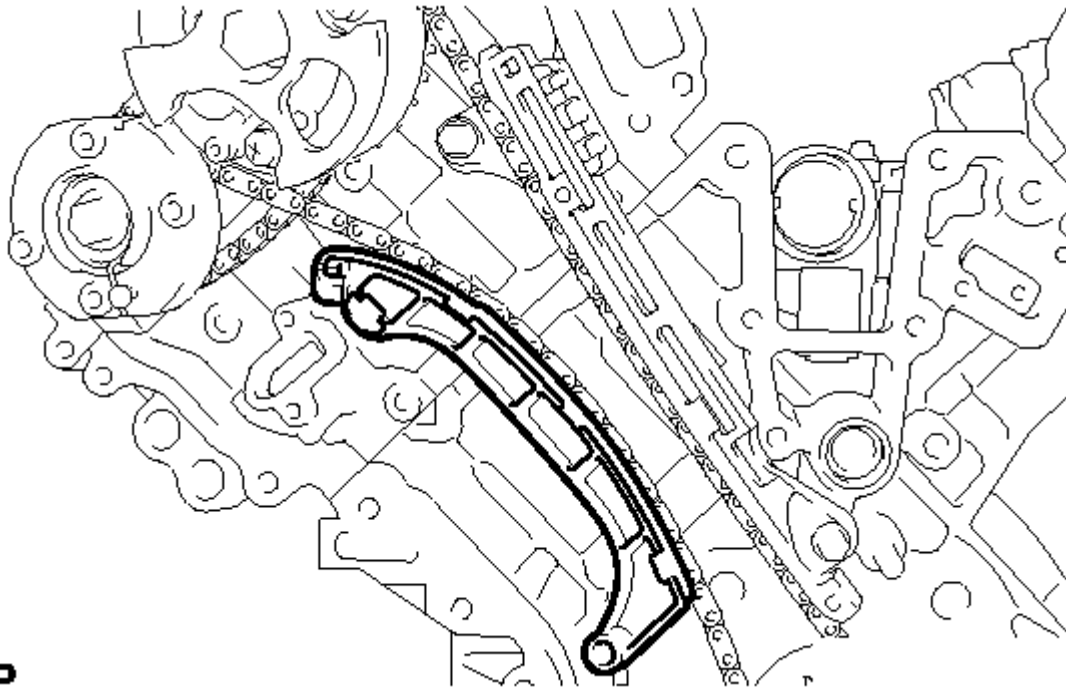
**P**

**Fig. 48: Identifying No. 1 Chain Tensioner Assembly RH & Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 2 bolts and chain tensioner.

**8. REMOVE NO. 1 CHAIN TENSIONER SLIPPER RH**

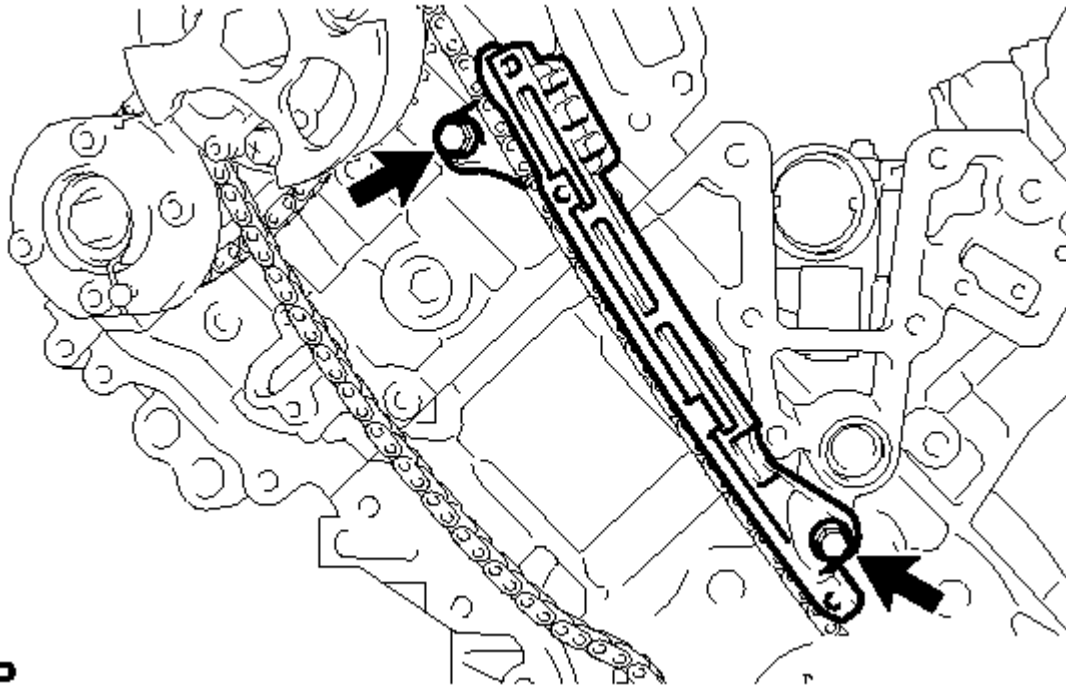


**P**

**Fig. 49: Identifying Chain Tensioner Slipper RH**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**9. REMOVE NO. 1 CHAIN VIBRATION DAMPER RH**



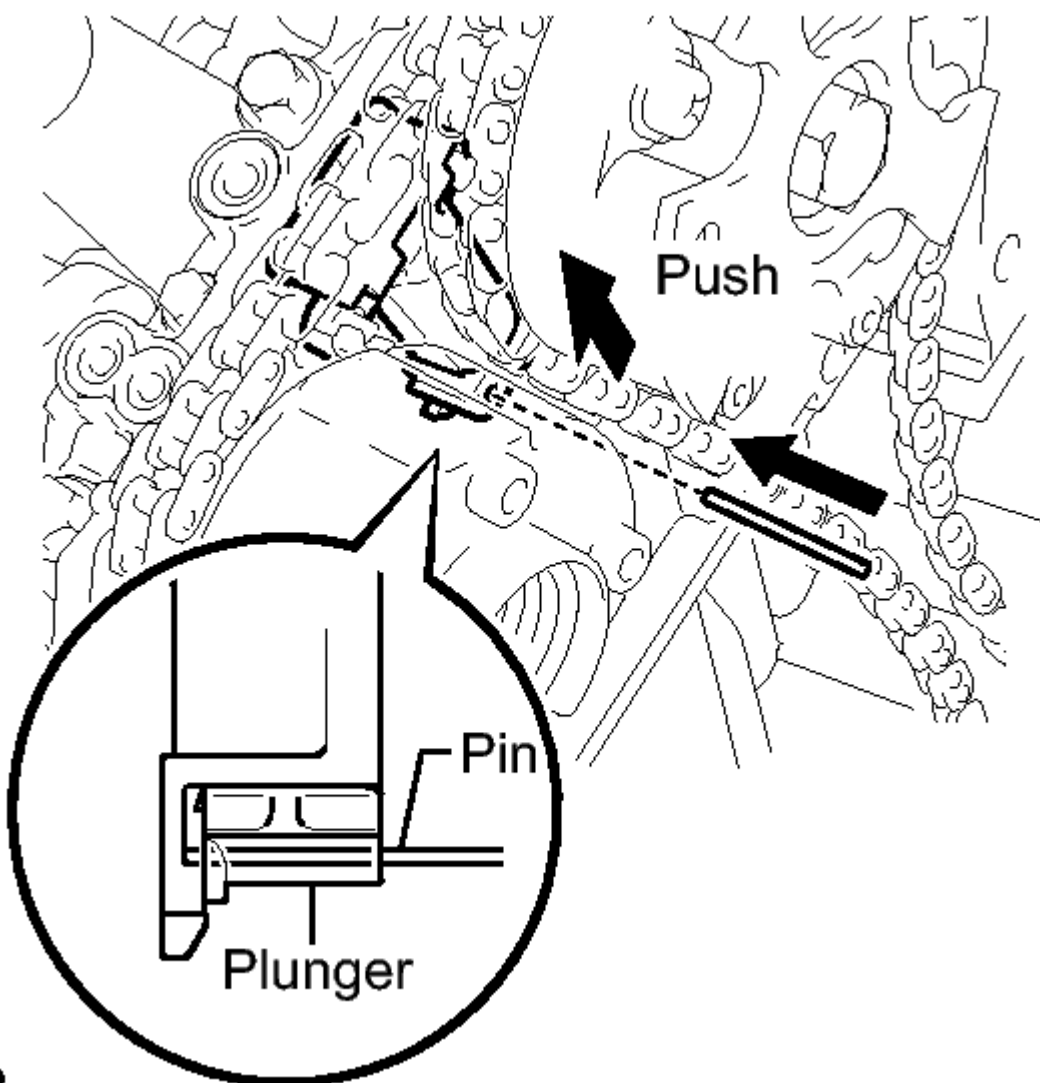
**P**

**Fig. 50: Identifying No. 1 Chain Vibration Damper RH**

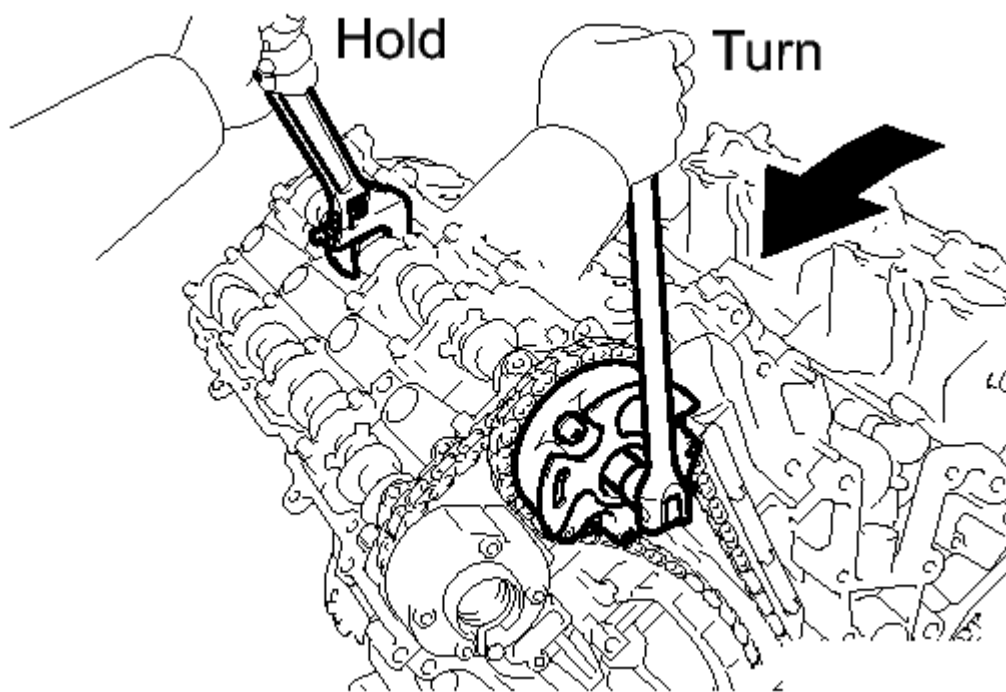
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 bolts and vibration damper.

**10. REMOVE NO. 1 CHAIN SUB-ASSEMBLY RH**

**P****Fig. 51: Identifying Chain Tensioner Pin & Hole****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. While raising up the No. 2 chain tensioner, insert a pin of 1.0 mm (0.0394 in.) into the hole to fix it in place.



**P**

**Fig. 52: Holding Hexagonal Portion Of Camshaft**

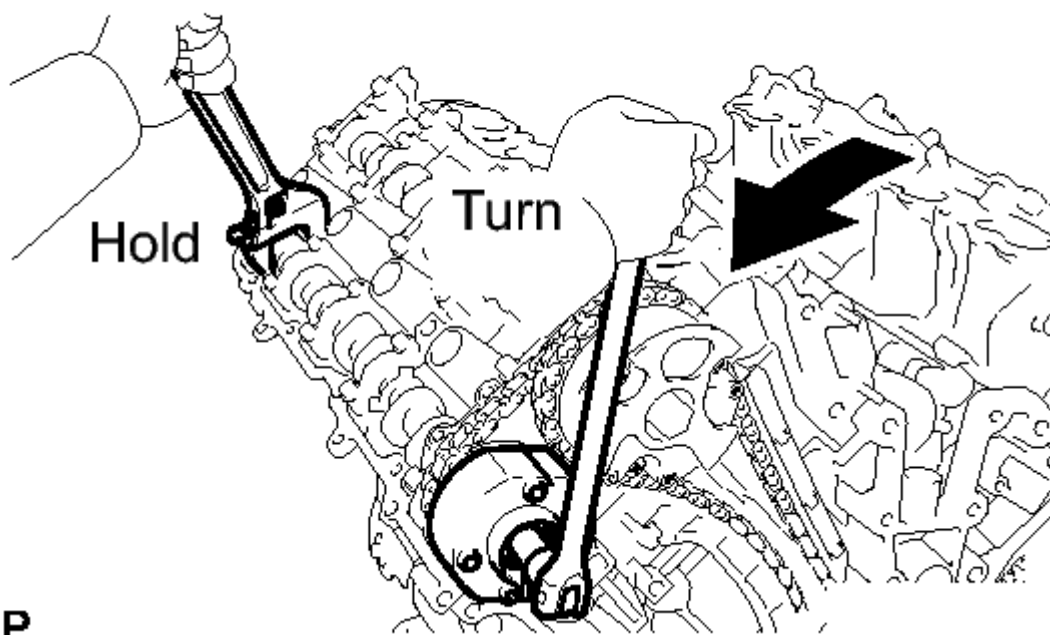
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Be careful not to damage the cylinder head with the wrench.
- Do not disassemble the camshaft timing gear.

- b. Hold the hexagonal portion of the camshaft with a wrench and loosen the bolt.





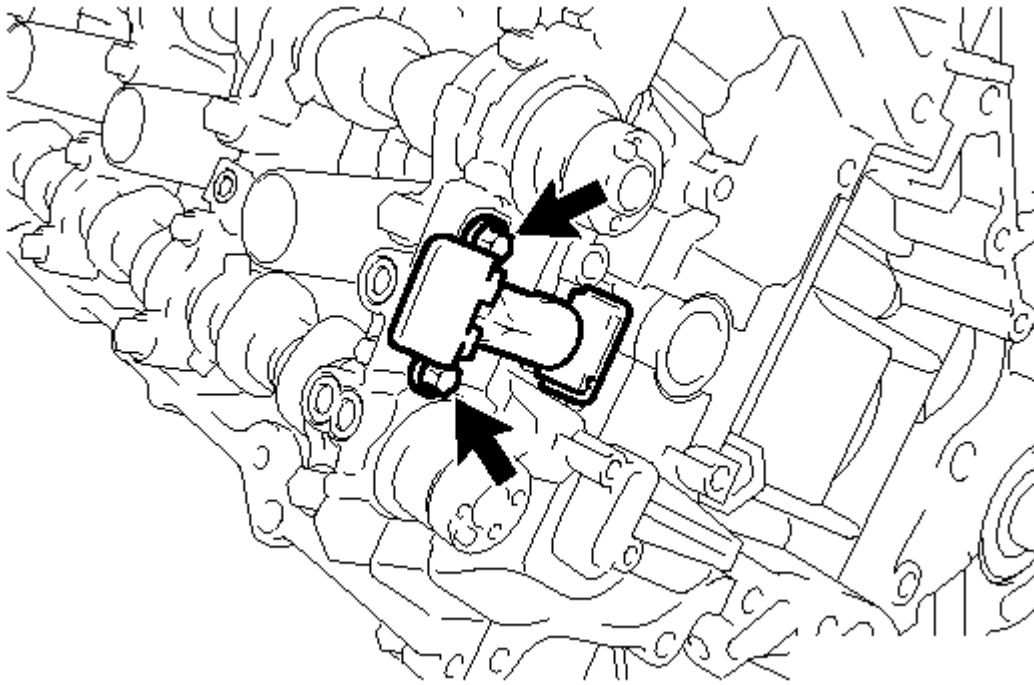
P

**Fig. 53: Holding Hexagonal Portion Of Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to damage the cylinder head with the wrench.

- c. Hold the hexagonal portion of the camshaft with a wrench and loosen the bolt.
- d. Remove the 2 bolts. Then with the No. 1 and No. 2 chains still connected to the gears, remove the camshaft timing gear, camshaft timing exhaust gear and crankshaft timing sprocket RH.
- e. Remove the No. 1 and No. 2 chains from the gears.

#### 11. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY



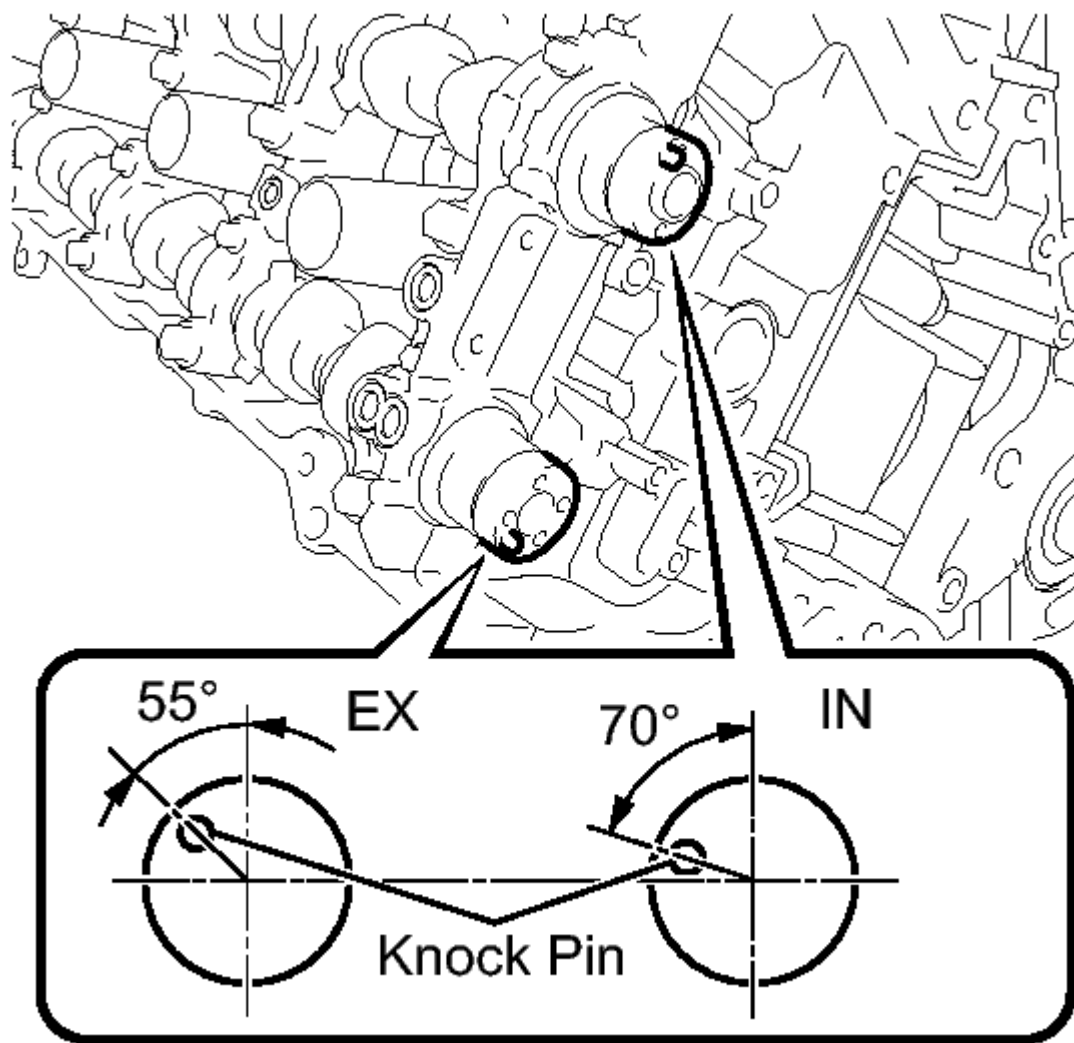
**P**

**Fig. 54: Locating No. 2 Chain Tensioner Assembly Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

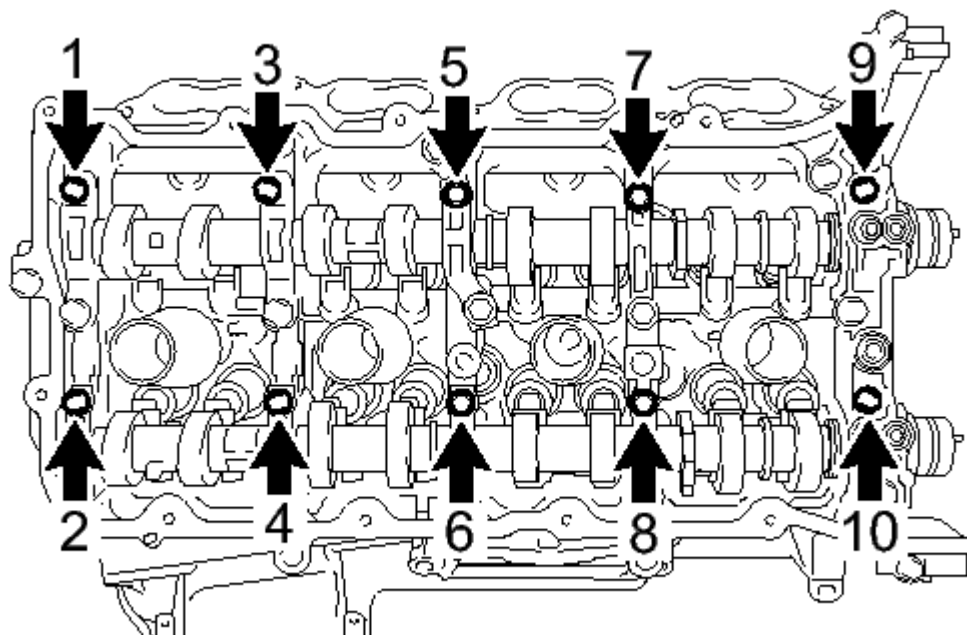
- a. Remove the 2 bolts and chain tensioner.

**12. REMOVE CAMSHAFT BEARING CAP RH**

**P****Fig. 55: Identifying Knock Pin Angle**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Make sure that the knock pin of the camshaft is positioned as shown in the illustration.

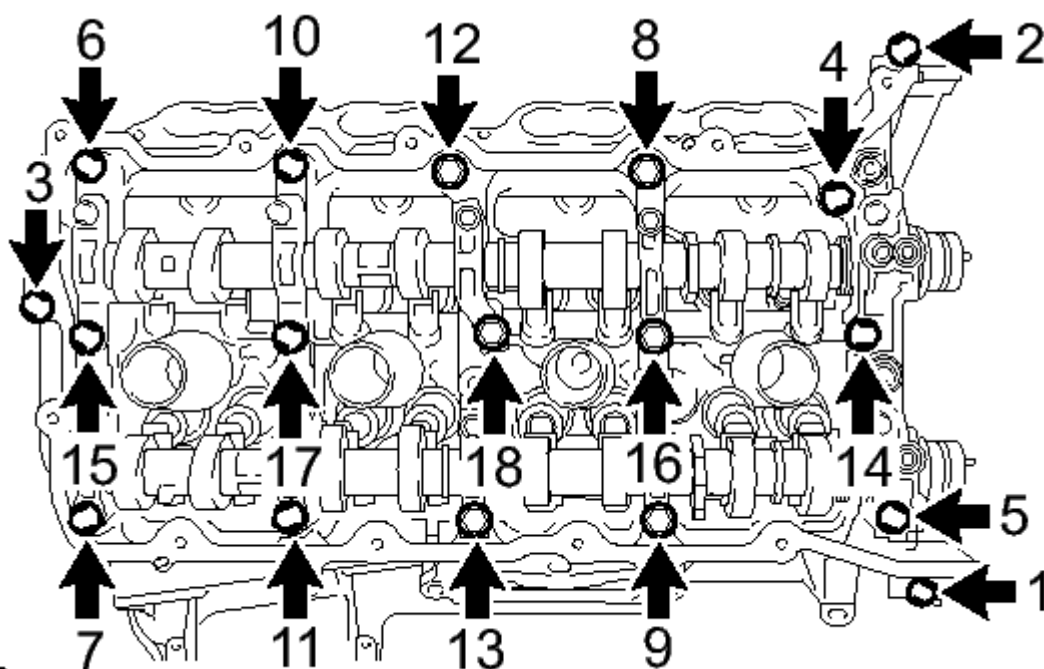


P

**Fig. 56: Identifying Bearing Cap Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.



P

**Fig. 57: Identifying Bearing Cap Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Uniformly loosen the bolts while keeping the camshaft level.

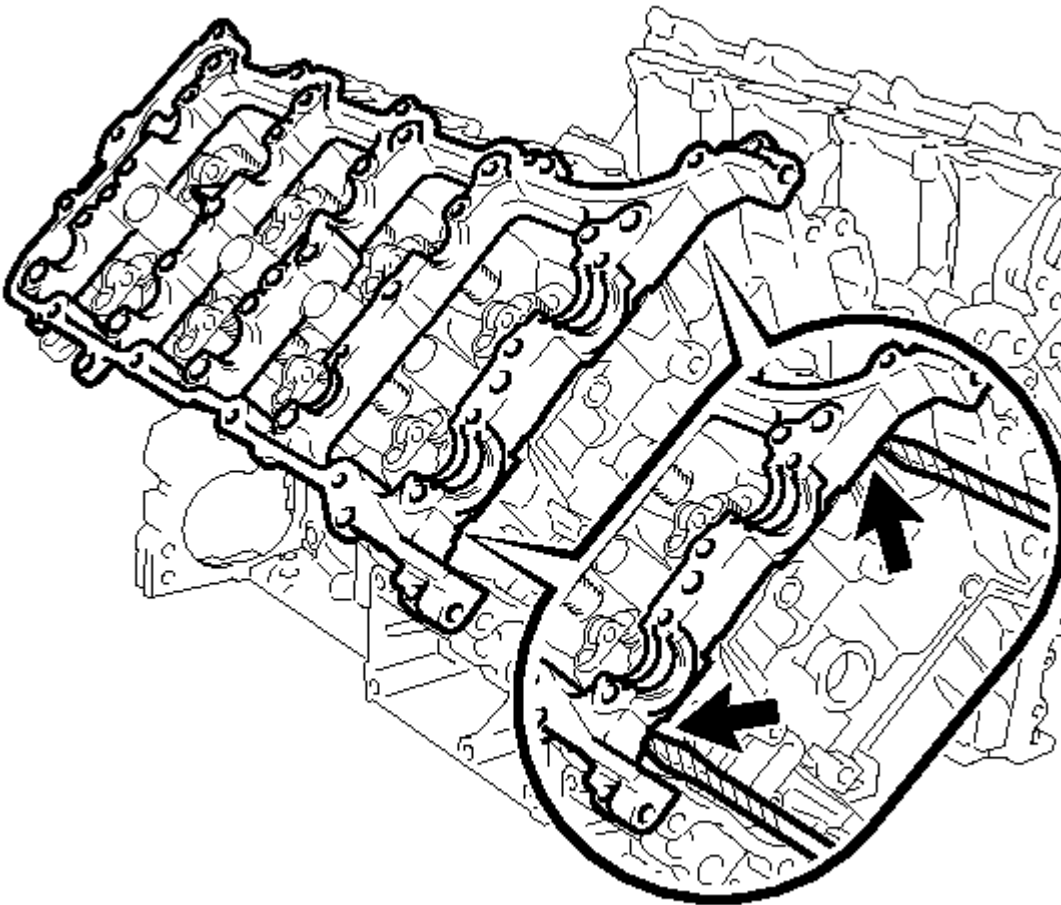
- c. Uniformly loosen and remove the 18 bearing cap bolts in the sequence shown in the illustration.
- d. Remove the 6 bearing caps.

**HINT:**

Arrange the removed parts in the correct order.

- e. Remove the No. 1 and No. 2 camshafts.

### 13. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY RH



**P**

**Fig. 58: Identifying Cylinder Head Pry Points, Camshaft Housing & Screwdriver**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the camshaft housing by prying between the cylinder head and camshaft housing with a screwdriver.

**HINT:**

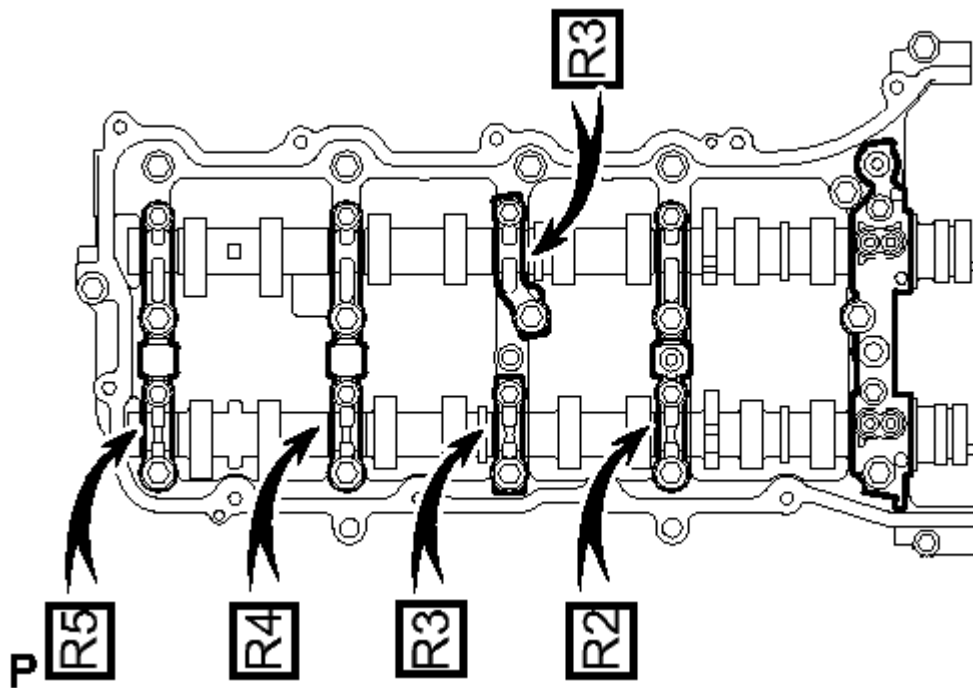
Tape the screwdriver tip before use.

**NOTE:** Be careful not to damage the contact surfaces of the cylinder head and camshaft housing.

**INSTALLATION**

**INSTALLATION**

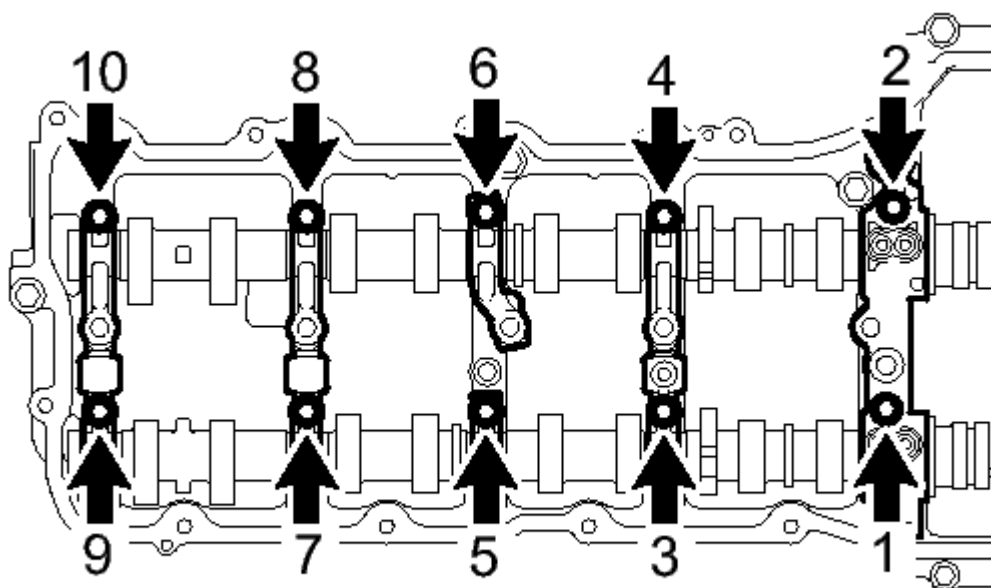
**1. INSTALL CAMSHAFT BEARING CAP RH**



**Fig. 59: Identifying Bearing Caps**

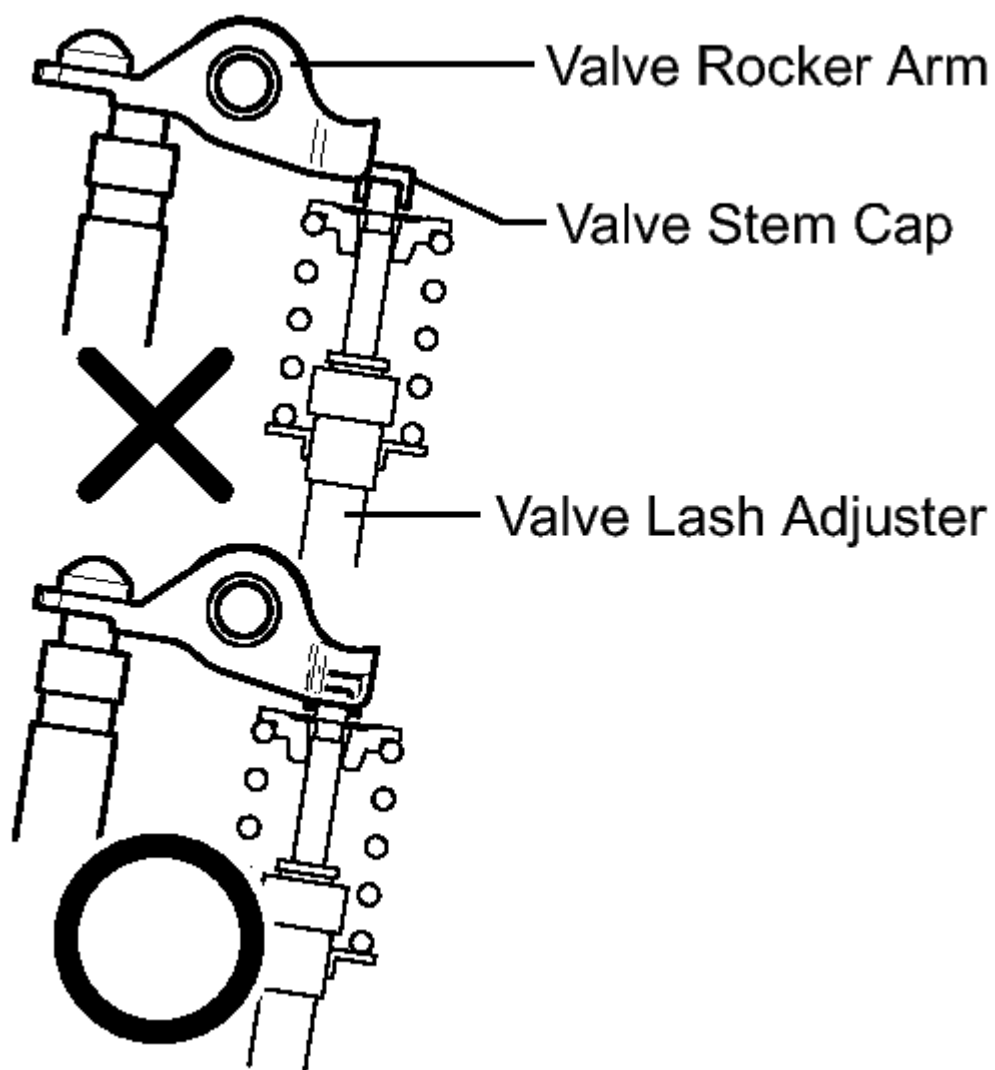
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.
- b. Install the No. 1 and No. 2 camshafts to the camshaft housing.
- c. Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.

**P****Fig. 60: Identifying Camshaft Bearing Cap Bolts Tightening Order****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- d. Temporarily install the 10 bolts in the order shown in the illustration.

**2. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY RH**



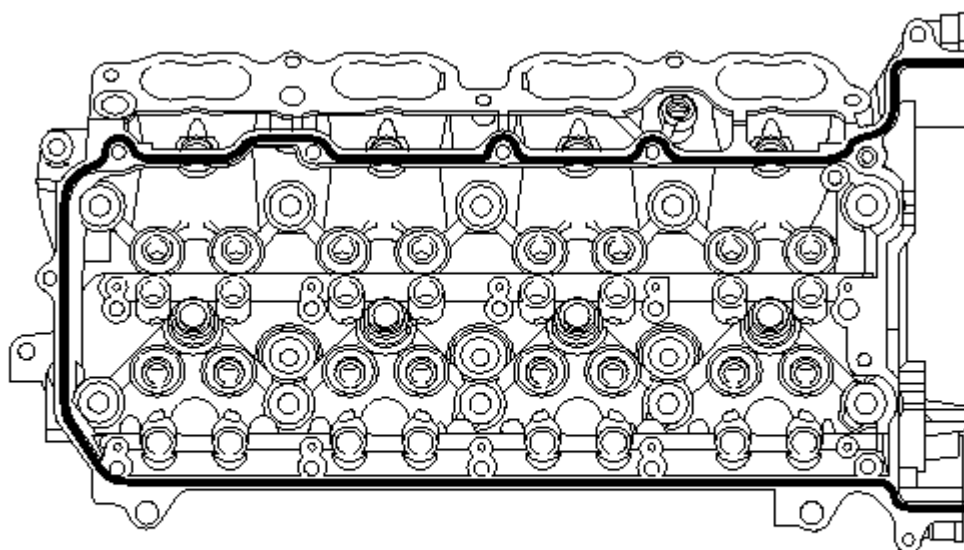
**P**

**Fig. 61: Identifying Valve Rocker Arms**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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





Seal diameter: 3.5 to 4.0 mm

T

**Fig. 62: Applying Seal Packing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Remove any oil from the contact surface.
- Install the camshaft housing within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.

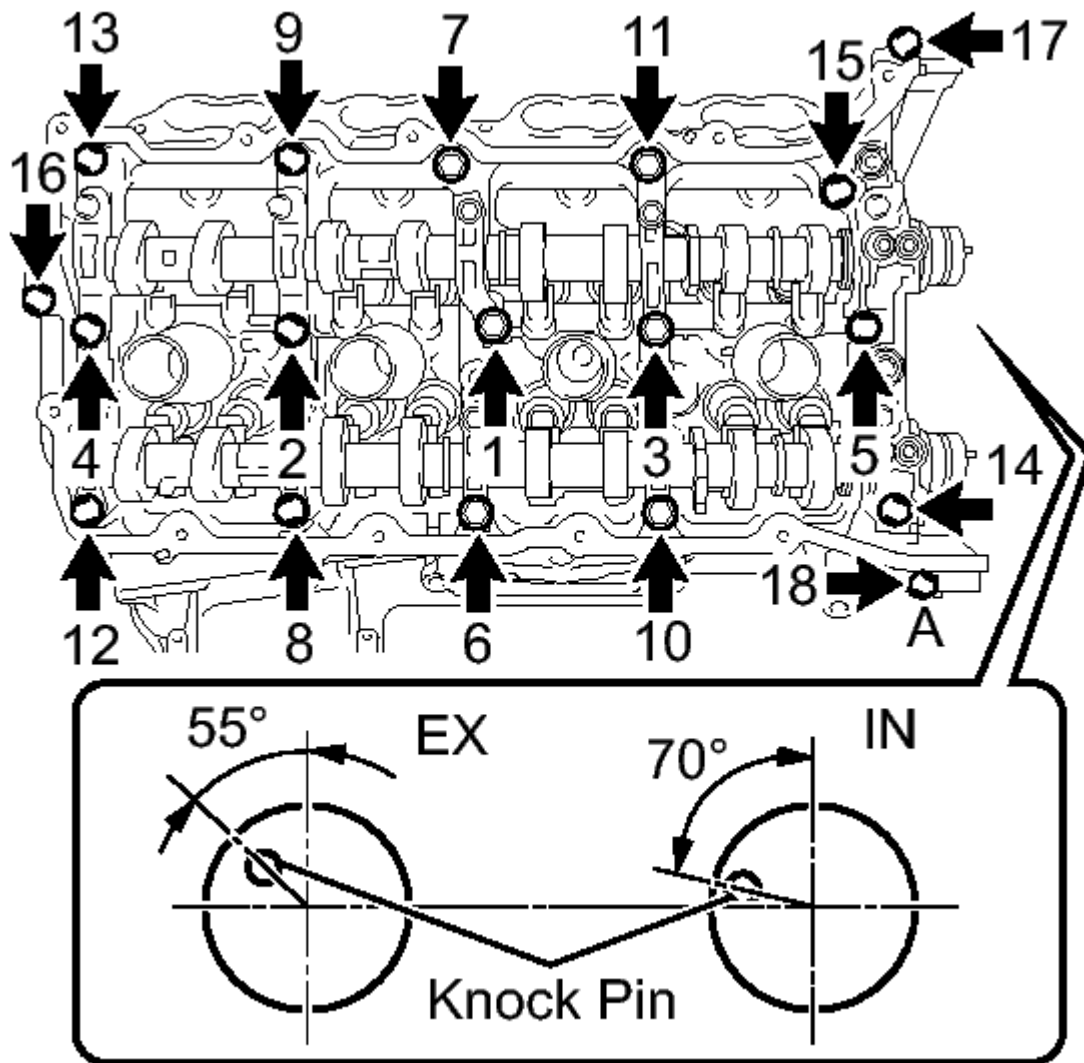
- b. Apply seal packing in a continuous line as shown in the illustration.

Seal packing

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Standard seal diameter

3.5 to 4.0 mm (0.138 to 0.157 in.)



**T**

**Fig. 63: Identifying Bolt In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Do not start the engine for at least 2 hours after the installation.
- Make sure that the knock pin of the camshaft is positioned as shown in the illustration before installing the camshaft housing.

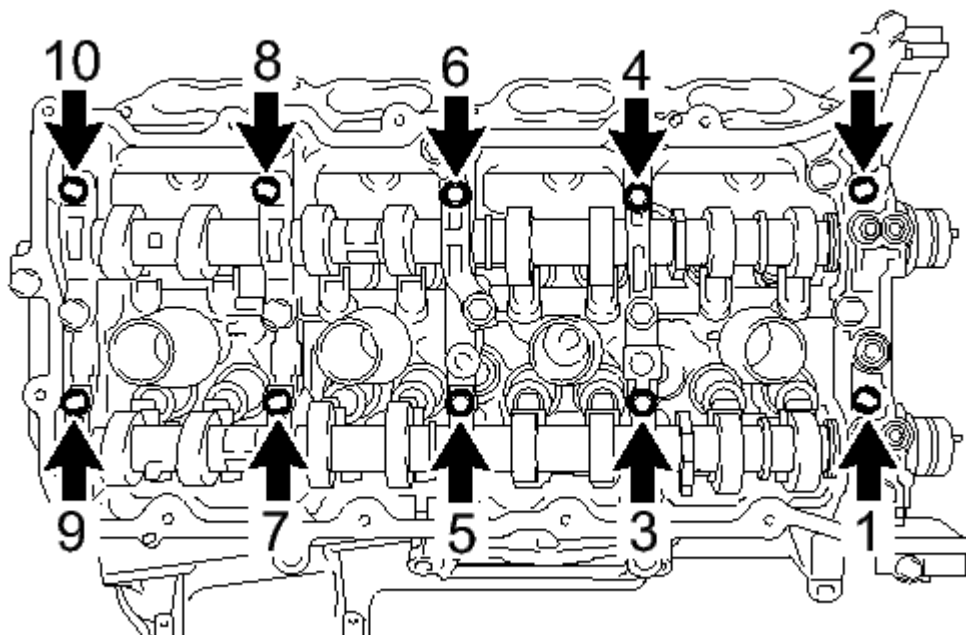
c. Install the camshaft housing, and install the 18 bolts in the order shown in the illustration.

for bolt A

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

except bolt A

**Torque: 30 N\*m (306 kgf\*cm, 22 ft.\*lbf)**



**P**

**Fig. 64: Identifying Bolt In Sequence**

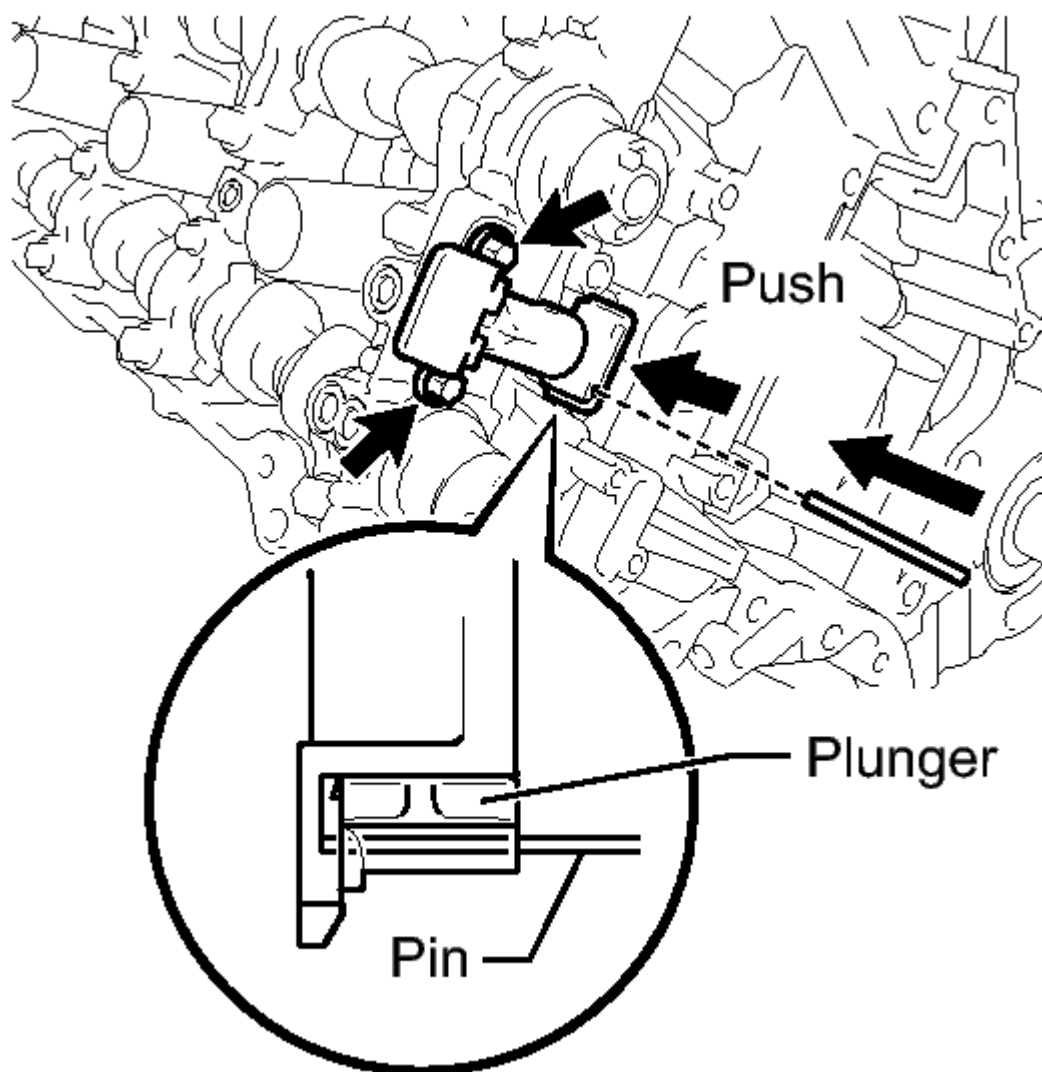
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Thoroughly wipe clean any seal packing.

- d. Tighten the 10 bolts in the order shown in the illustration.

**Torque: 16 N\*m (163 kgf\*cm, 12 ft.\*lbf)**

### 3. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

**P****Fig. 65: Identifying Chain Tensioner**

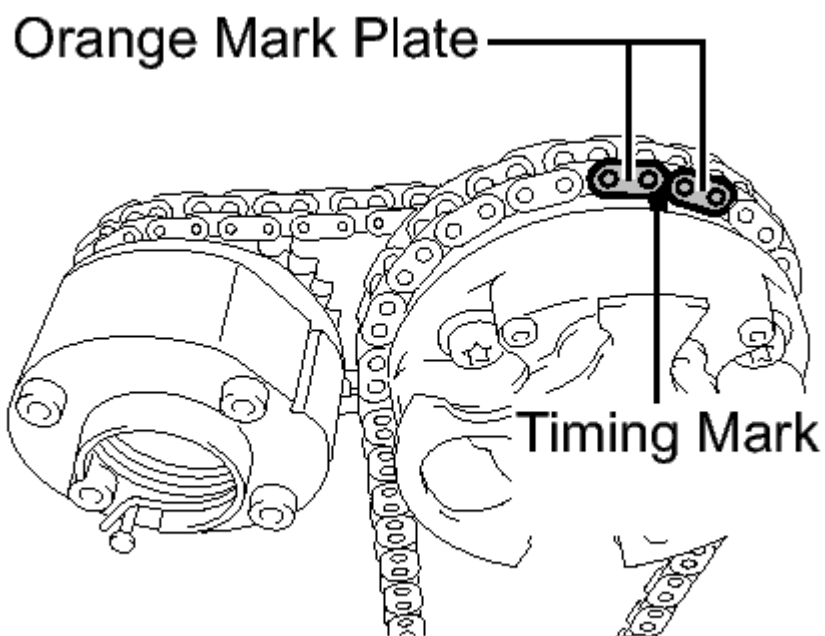
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the chain tensioner with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

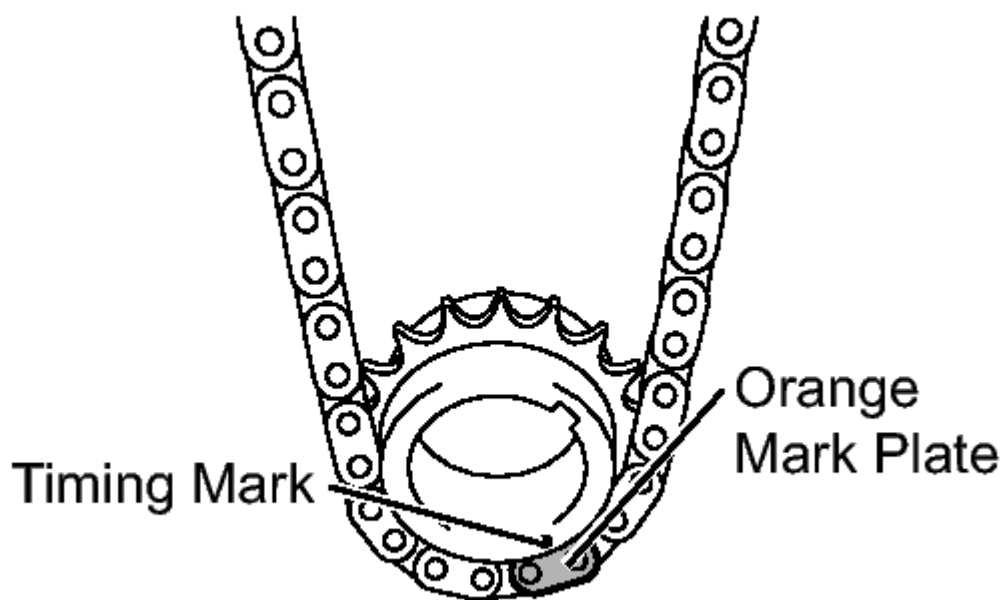
- b. While raising up the No. 2 chain tensioner, insert a pin of 1.0 mm (0.0394 in.) into the hole to fix it in place.

**4. INSTALL NO. 1 CHAIN SUB-ASSEMBLY RH**

**P****Fig. 66: Aligning The No. 1 Chain's Orange Mark Plates**

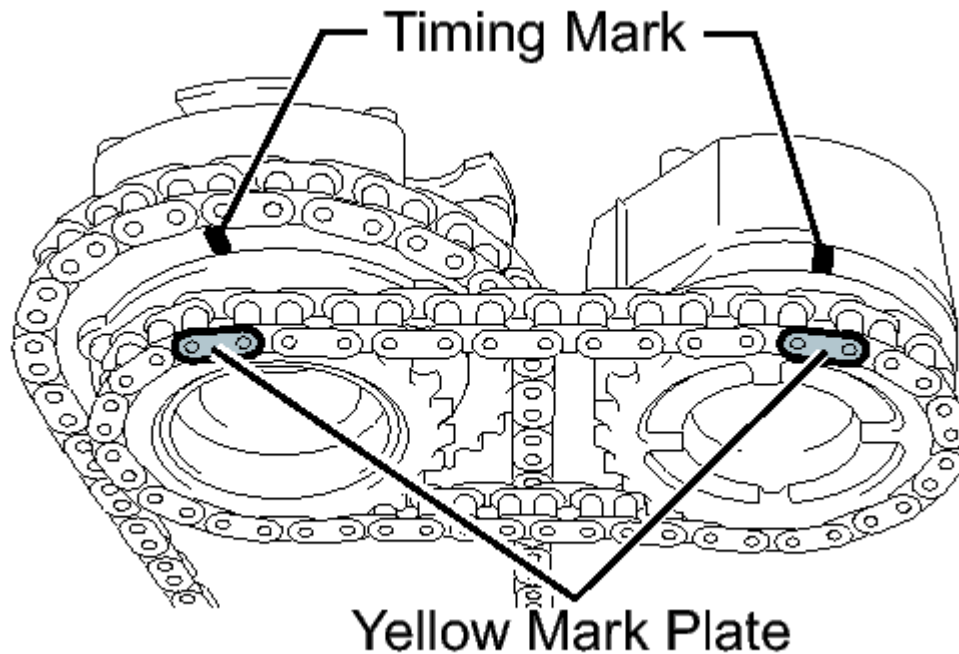
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Align the No. 1 chains orange mark plates with the camshaft timing gear's timing mark, and attach the chain to the gear as shown in the illustration.

**O****Fig. 67: Aligning the No. 1 Chain's Orange Mark Plates**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the No. 1 chain's orange mark plate with the crankshaft timing gear's timing mark, and attach the chain to the gear as shown in the illustration.



**P**

**Fig. 68: Aligning The No. 2 Chain's Yellow Mark Plates**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

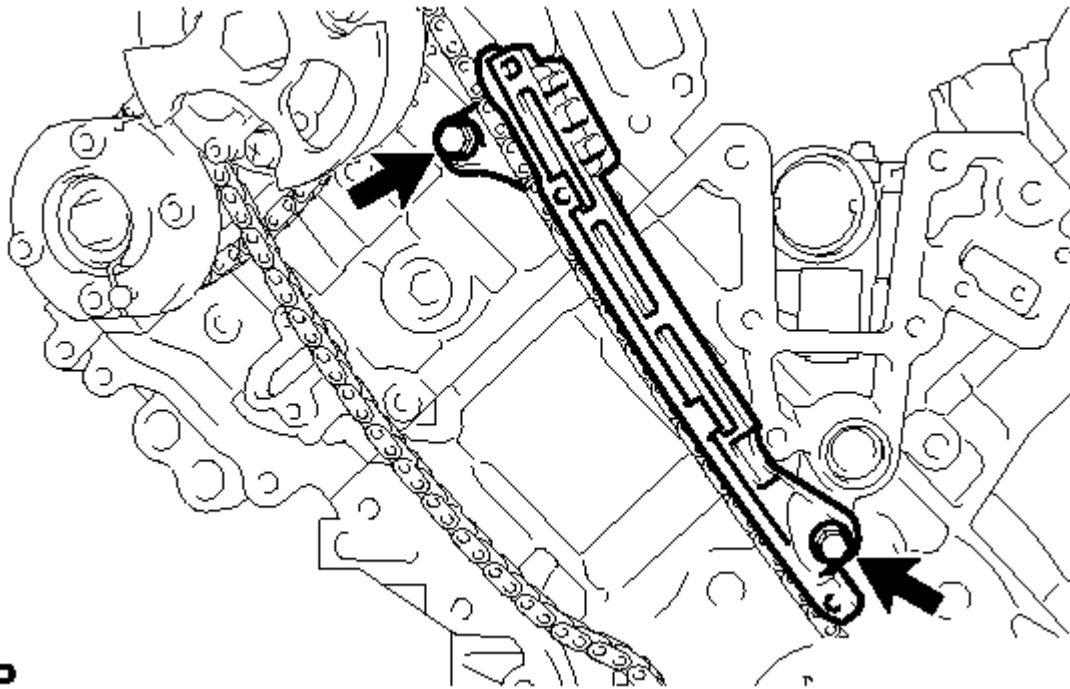
- c. Align the No. 2 chain's yellow mark plates with the timing marks of the camshaft timing gear and camshaft timing exhaust gear, and attach the No. 2 chain to the gears as shown in the illustration.

**HINT:**

The crankshaft timing gear and camshaft exhaust gear will be installed with the No. 1 and No. 2 chains connected to the gears.

- d. Install the crankshaft timing sprocket to the crankshaft.
- e. Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.
- f. Using the hexagonal portion of the No. 2 camshaft, align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear.
- g. Remove the pin from the No. 2 chain tensioner.

**5. INSTALL NO. 1 CHAIN VIBRATION DAMPER RH**



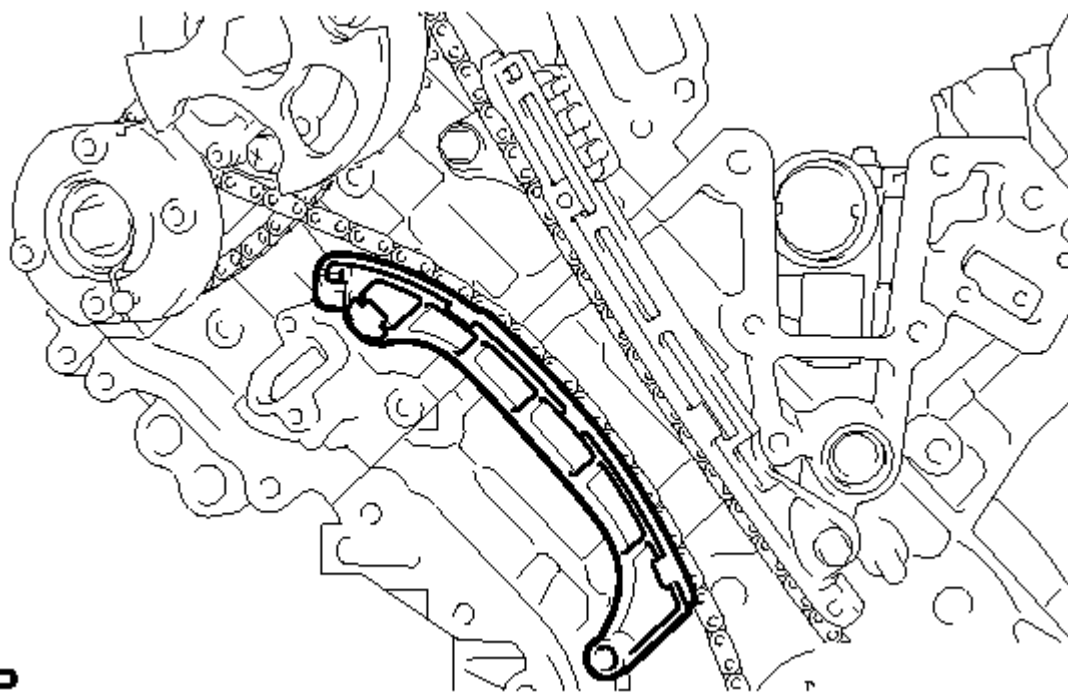
**P**

**Fig. 69: Identifying No. 1 Chain Vibration Damper RH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the vibration damper with the 2 bolts.

**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

## **6. INSTALL NO. 1 CHAIN TENSIONER SLIPPER RH**

**P****Fig. 70: Identifying Chain Tensioner Slipper RH**

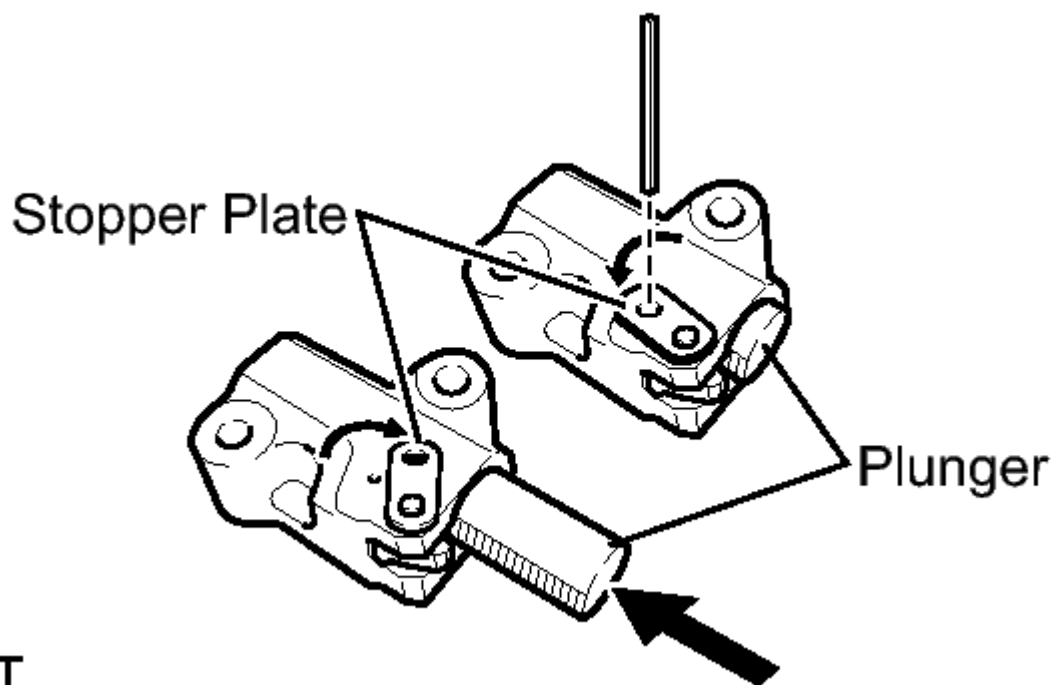
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

If you cannot install the chain tensioner slipper due to the tension of the chain, use the hexagonal portion of the camshaft to loosen the chain, and then install the chain tensioner slipper.

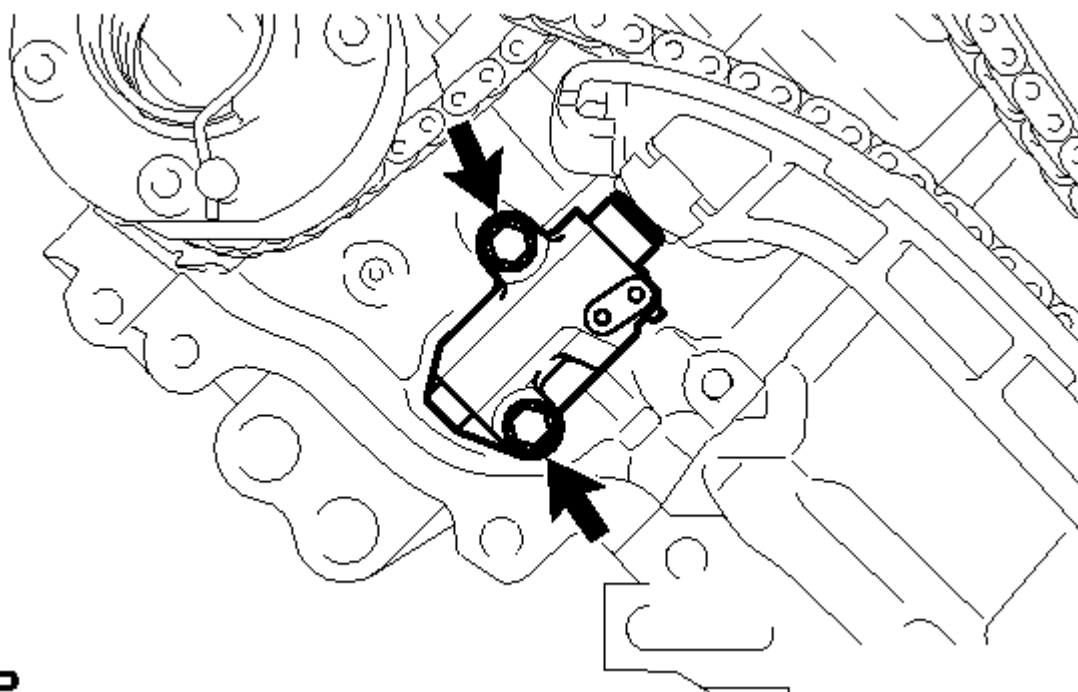
**7. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY RH**



**T****Fig. 71: Pushing Plunger Deep Into Tensioner**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.
- Move the stopper plate downward to set the lock, and insert a hexagon wrench into the hole of the stopper plate.



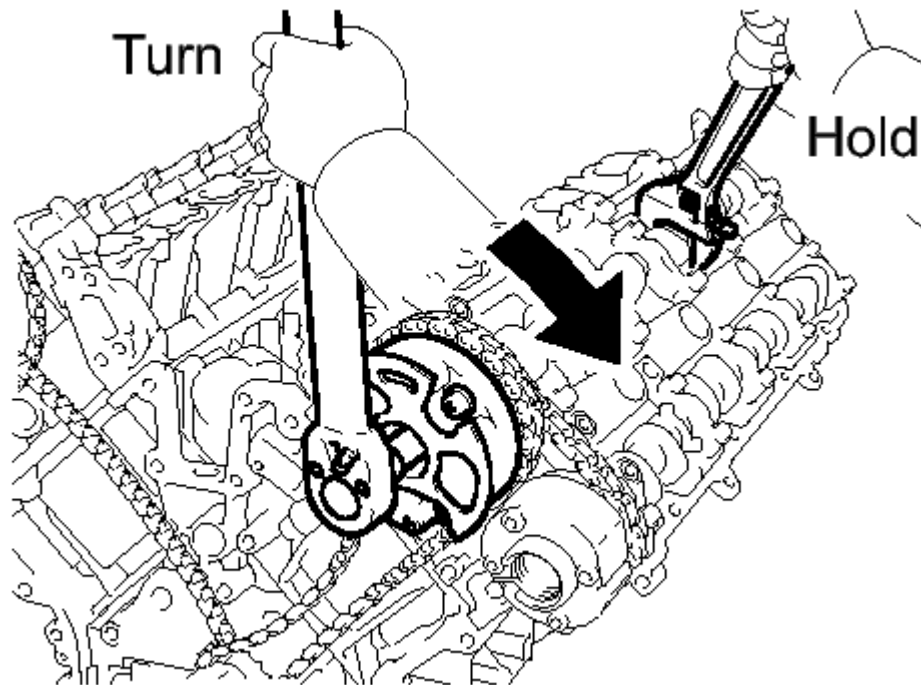
**Fig. 72: Identifying No. 1 Chain Tensioner Assembly RH & Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the chain tensioner with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

- d. Remove the hexagon wrench from the chain tensioner.

8. **INSTALL NO. 1 CHAIN SUB-ASSEMBLY LH** See step 4
9. **INSTALL NO. 1 CHAIN TENSIONER SLIPPER LH** See step 5
10. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY LH** See step 6
11. **INSTALL NO. 1 CHAIN VIBRATION DAMPER LH** See step 7
12. **TIGHTEN CAMSHAFT TIMING GEAR**

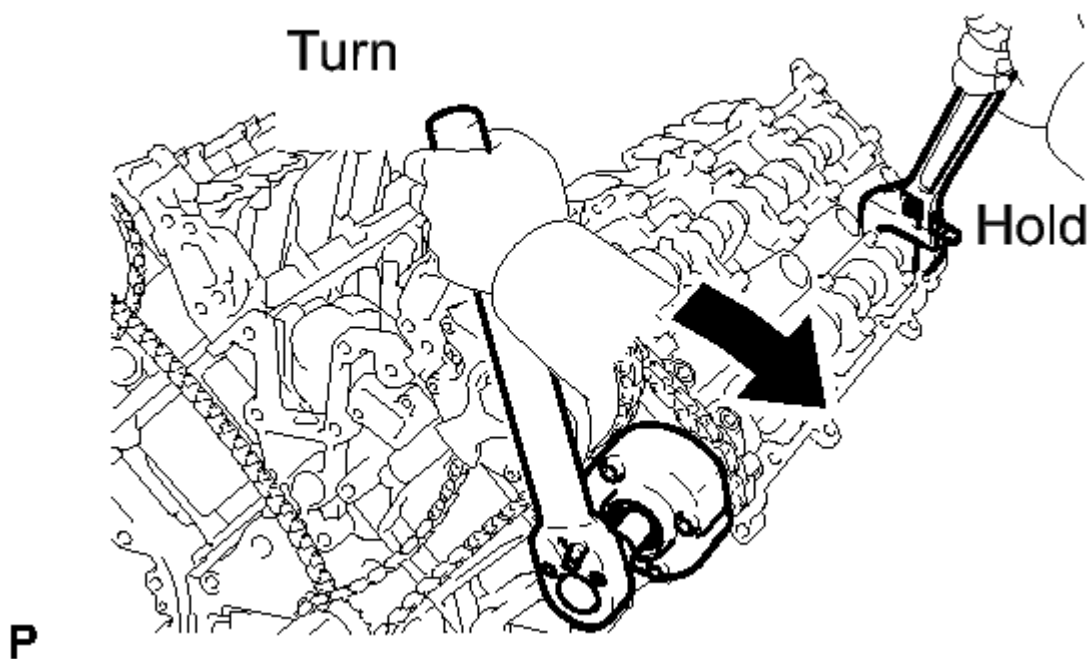


**P**

**Fig. 73: Tightening The Camshaft Timing Gear With The Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. LH:
  1. Using a wrench to hold the hexagonal portion of the No. 3 camshaft, tighten the camshaft timing gear with the bolt.

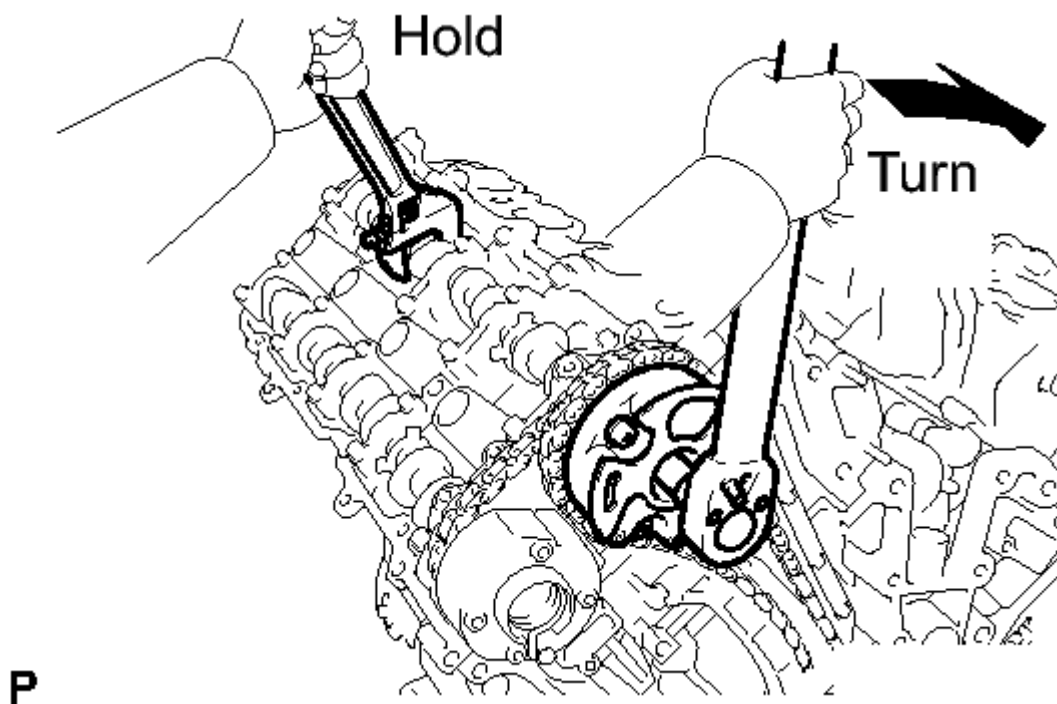
**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**



**Fig. 74: Tightening The Camshaft Timing Exhaust Gear With The Bolt**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a wrench to hold the hexagonal portion of the No. 4 camshaft, tighten the camshaft timing exhaust gear with the bolt.

**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**

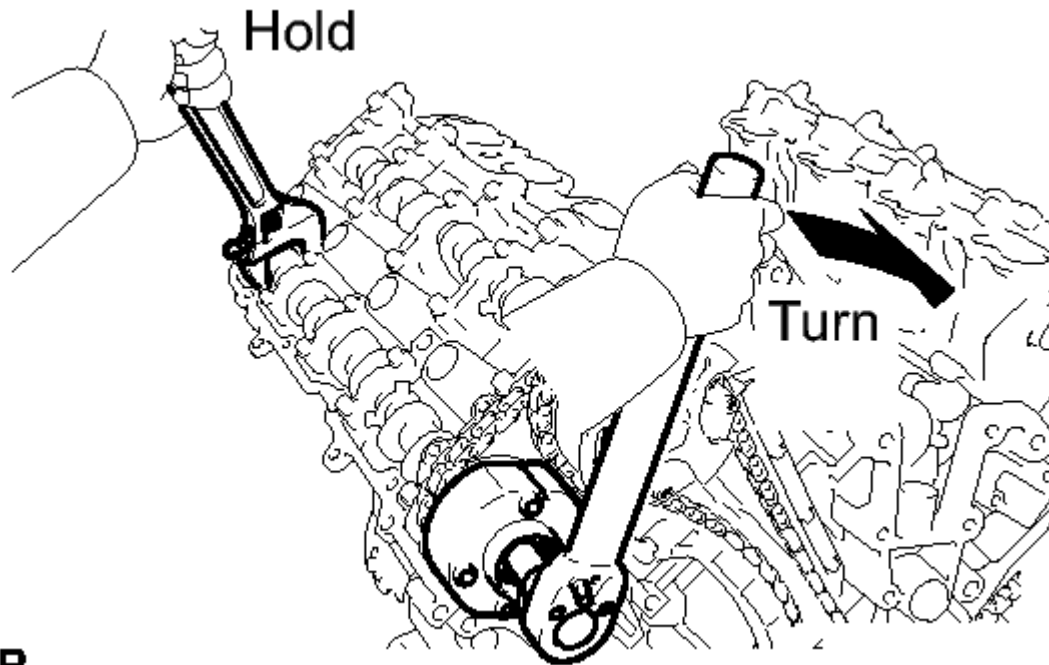


**Fig. 75: Holding Hexagonal Portion Of No. 1 Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. RH:

1. Using a wrench to hold the hexagonal portion of the No. 1 camshaft, tighten the camshaft timing gear with the bolt.

**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**



**P**

**Fig. 76: Holding Hexagonal Portion Of No. 2 Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a wrench to hold the hexagonal portion of the No. 2 camshaft, tighten the camshaft timing exhaust gear with the bolt.

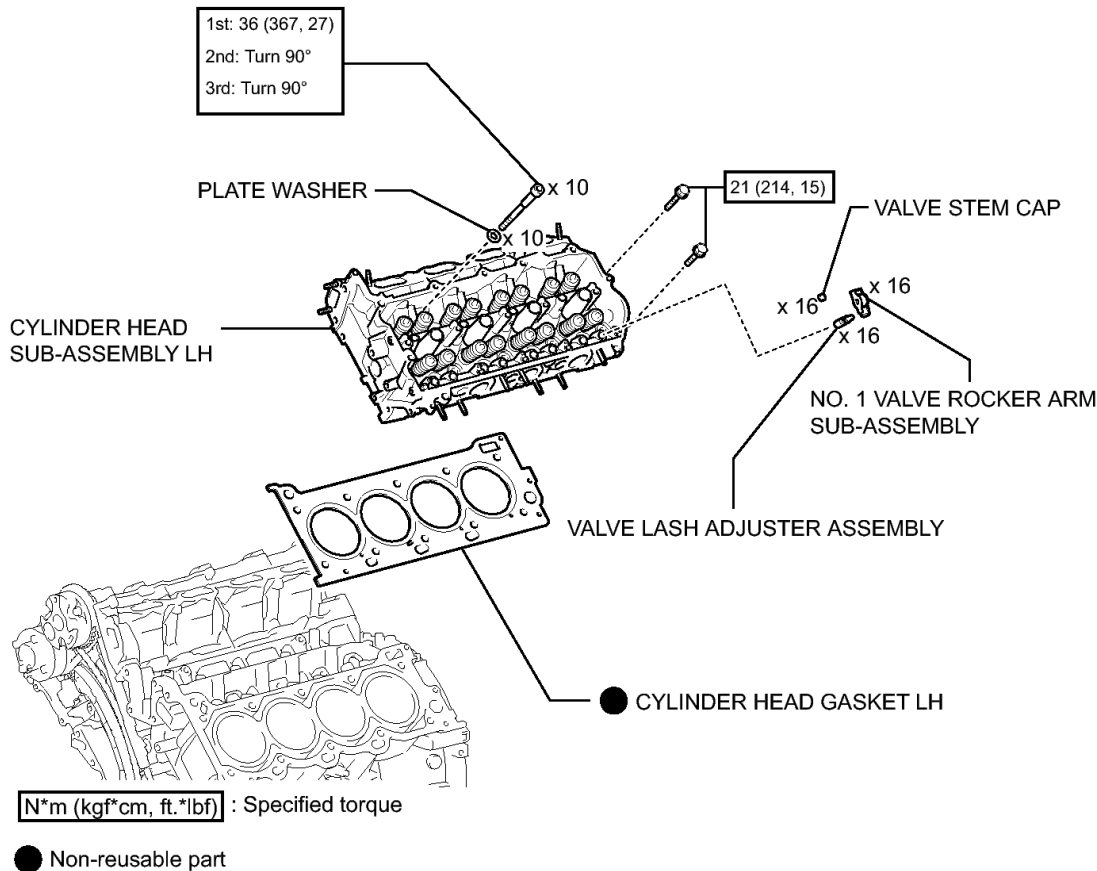
**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**

13. **CHECK NO. 1 CYLINDER TO TDC / COMPRESSION** See step 37
14. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY**
  - a. Install the timing chain cover. Refer to **INSTALLATION**.
15. **INSPECT IGNITION TIMING** See step 1
16. **INSPECT ENGINE IDLE SPEED** See step 2

## CYLINDER HEAD GASKET (FOR BANK 1)

### COMPONENTS

## ILLUSTRATION



**Fig. 77: Identifying Cylinder Head Gasket (For Bank 1) Replacement Components With Torque Specifications**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### REMOVAL

1. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH**
  - a. Remove the exhaust manifold LH. Refer to **REMOVAL**.
2. **REMOVE CAMSHAFTS (for Bank 1)**
  - a. Remove the camshafts. Refer to **REMOVAL**.
3. **REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
  - a. Remove the 16 valve rocker arms from the cylinder head.

### HINT:

Arrange the removed parts in the correct order.

**4. REMOVE VALVE LASH ADJUSTER ASSEMBLY**

- a. Remove the 16 valve lash adjusters from the cylinder head.

**HINT:**

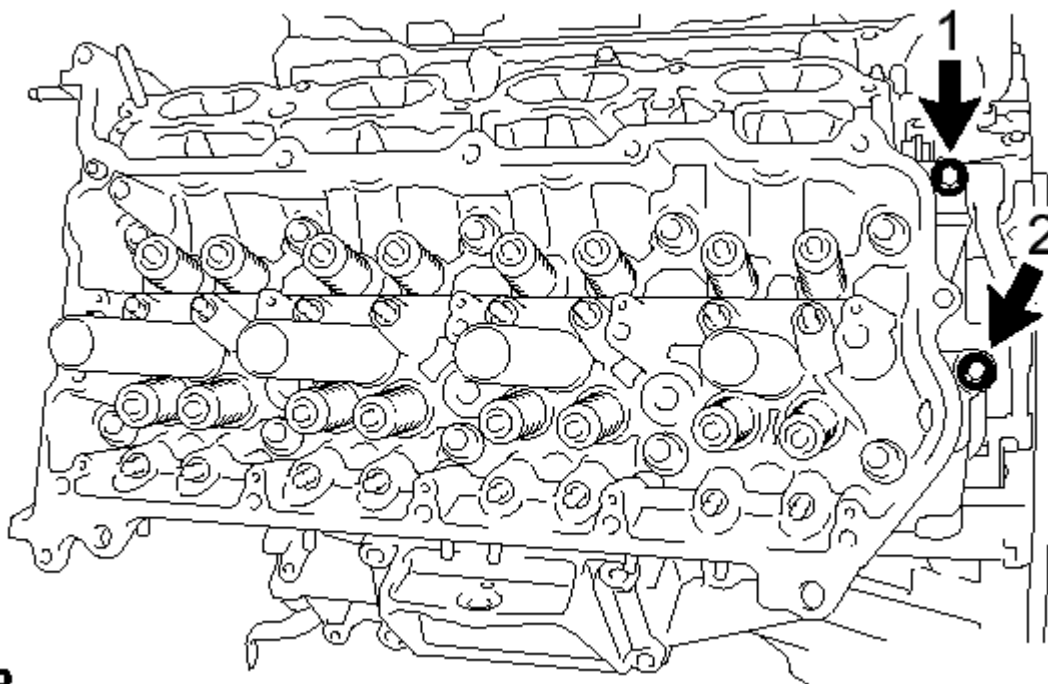
Arrange the removed parts in the correct order.

**5. REMOVE VALVE STEM CAP**

- a. Remove the 16 valve stem caps from the cylinder head.

**HINT:**

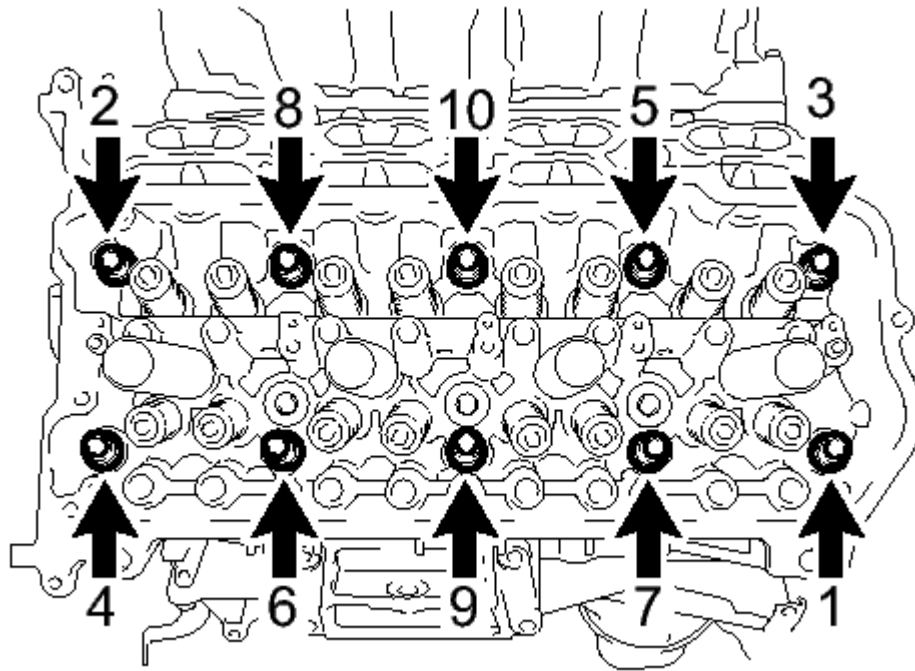
Arrange the removed parts in the correct order.

**6. REMOVE CYLINDER HEAD SUB-ASSEMBLY LH****P**

**Fig. 78: Identifying Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Uniformly loosen and remove the 2 bolts in the sequence shown in the illustration.



**P**

**Fig. 79: Identifying Cylinder Head Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Be careful not to drop washers into the cylinder head.
- Head warpage or cracking could result from removing bolts in an incorrect order.

- b. Using a 10 mm bi-hexagon wrench, uniformly loosen the 10 cylinder head bolts in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

**HINT:**

Be sure to arrange the removed parts for each installation position separately.

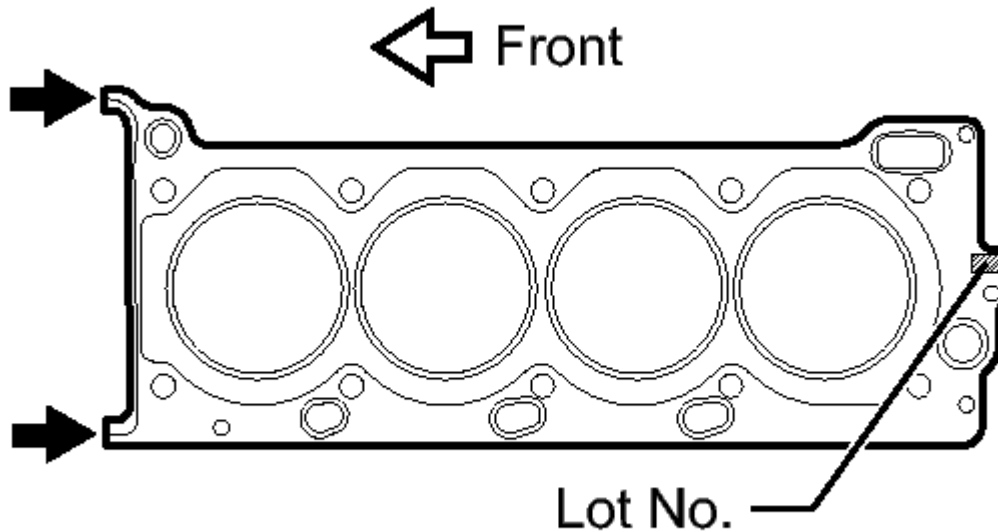
**7. REMOVE CYLINDER HEAD GASKET LH**

**INSTALLATION**

**INSTALLATION**

1. **INSPECT CYLINDER HEAD SET BOLT** See step 1
2. **INSPECT CYLINDER HEAD SUB-ASSEMBLY LH** See step 9
3. **INSTALL CYLINDER HEAD GASKET LH**
  - a. Check the piston protrusions for each cylinder.
    1. Clean the cylinder block with solvent.

2. Set the piston of the cylinder to be measured to slightly ATDC.



**T**

**Fig. 80: Identifying Cylinder Head Gasket Lot No. Stamp**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Be careful of the installation direction.
- Make sure that no oil is on the front end (indicated by the arrows) of the cylinder head gasket.

- b. Place the cylinder head gasket on the cylinder block surface with the front face of the Lot No. stamp upward.

**4. INSTALL CYLINDER HEAD SUB-ASSEMBLY LH**

- a. Place the cylinder head on the cylinder block.

**NOTE:**

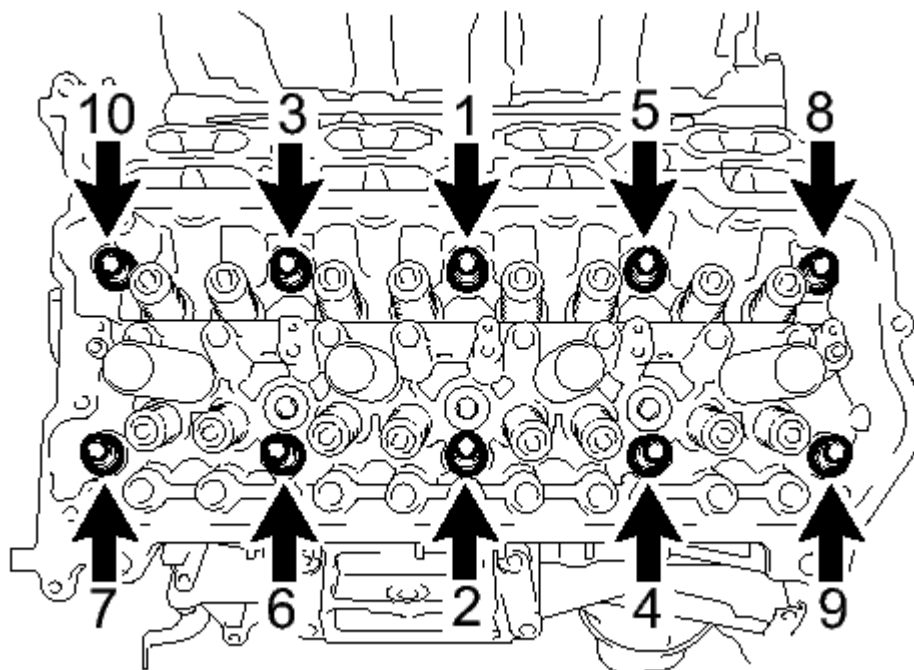
- Ensure that no oil is on the mounting surface of the cylinder head.
- Gently place the cylinder head in order not to damage the gasket with the bottom part of the head.

**HINT:**

The cylinder head bolts are tightened in 3 progressive steps.

- b. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.





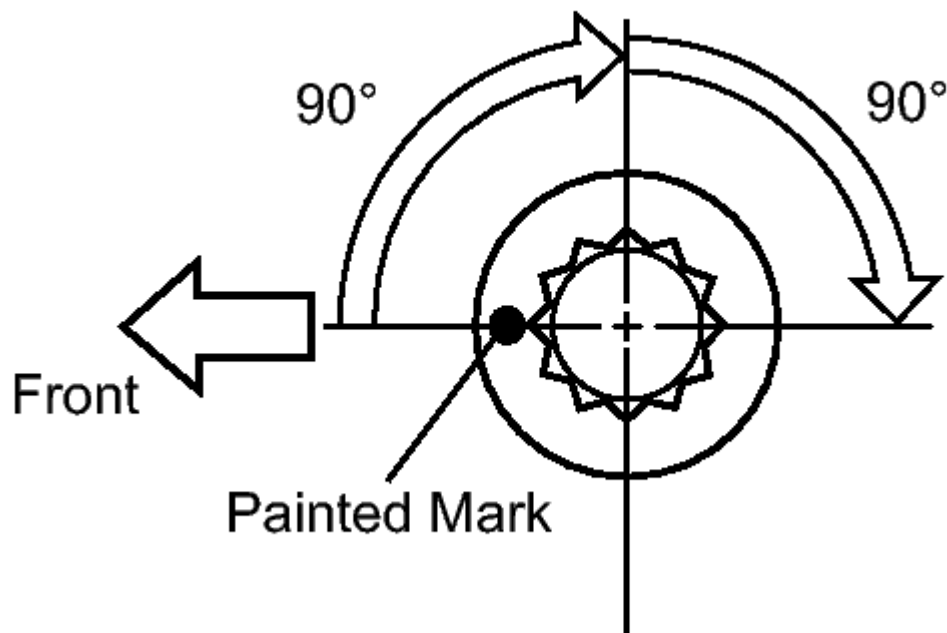
**P**

**Fig. 81: Identifying Cylinder Head Bolt In Sequence**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Step 1:

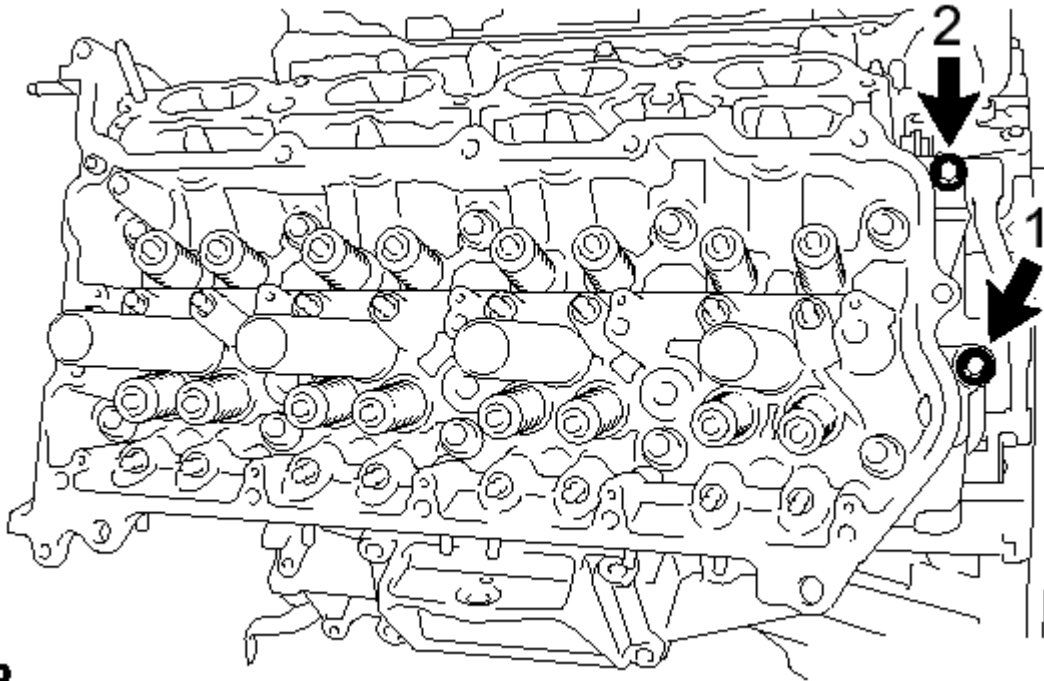
1. Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 10 cylinder head bolts with the plate washers in several steps, in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**



**Fig. 82: Checking Painted Mark On Cylinder Head Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Step 2:
  - 1. Mark each cylinder head bolt head with paint as shown in the illustration.
  - 2. Tighten the cylinder head bolts another 90° in the sequence shown in step 1.
- e. Step 3:
  - 1. Tighten the cylinder head bolts an additional 90° in the sequence shown in step 1.
  - 2. Check that the painted marks are now facing rearward.



**P**

**Fig. 83: Identifying Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Install and uniformly tighten the 2 bolts in the sequence shown in the illustration.

**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

#### 5. INSTALL VALVE STEM CAP

- a. Apply a light coat of engine oil to the valve stem caps.
- b. Install the 16 valve stem caps to the cylinder head.

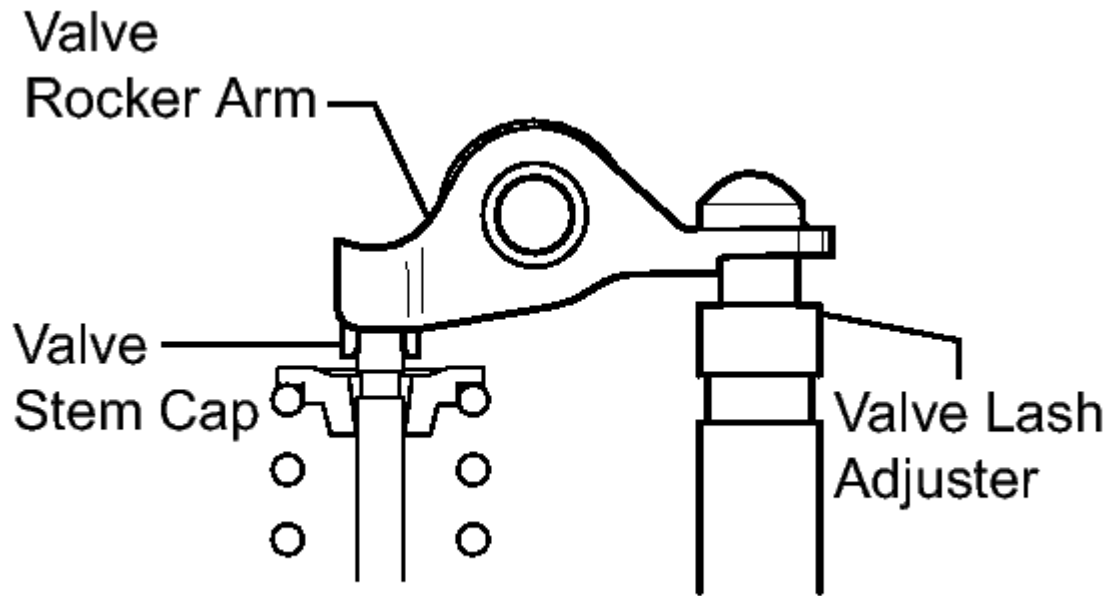
#### 6. INSTALL VALVE LASH ADJUSTER ASSEMBLY

- a. Inspect the valve lash adjuster See step 3.
- b. Install the 16 lash adjusters to the cylinder head.

**NOTE:**        **Install the lash adjuster at the same place it was removed from.**

#### 7. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

- a. Apply engine oil to the lash adjuster tips and valve stem cap ends.

**P**

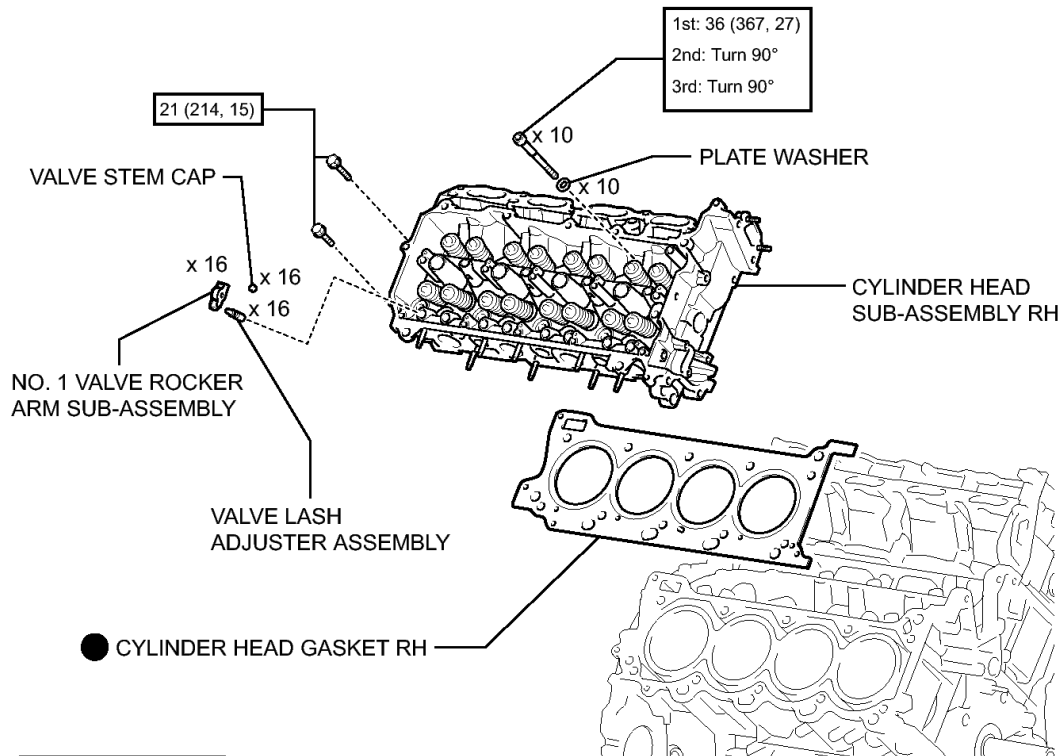
**Fig. 84: Identifying Valve Rocker Arm And Valve Stem Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 16 valve rocker arms as shown in the illustration.
- 8. **INSTALL CAMSHAFTS (for Bank 1)**
  - a. Install the camshafts. Refer to **INSTALLATION**.
- 9. **INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH**
  - a. Install the exhaust manifold LH. Refer to **INSTALLATION**.

## **CYLINDER HEAD GASKET (FOR BANK 2)**

### **COMPONENTS**

### **ILLUSTRATION**



[N\*m (kgf\*cm, ft.\*lbf)] : Specified torque

● Non-reusable part

P

**Fig. 85: Identifying Cylinder Head Gasket (For Bank 2) Replacement Components With Torque Specifications**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### REMOVAL

1. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH**
  - a. Remove the exhaust manifold RH. Refer to **REMOVAL**.
2. **REMOVE CAMSHAFTS (for Bank 2)**
  - a. Remove the camshafts. Refer to **REMOVAL**.
3. **REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
  - a. Remove the 16 valve rocker arms from the cylinder head.

### HINT:

Arrange the removed parts in the correct order.

4. **REMOVE VALVE LASH ADJUSTER ASSEMBLY**

- a. Remove the 16 valve lash adjusters from the cylinder head.

**HINT:**

Arrange the removed parts in the correct order.

**5. REMOVE VALVE STEM CAP**

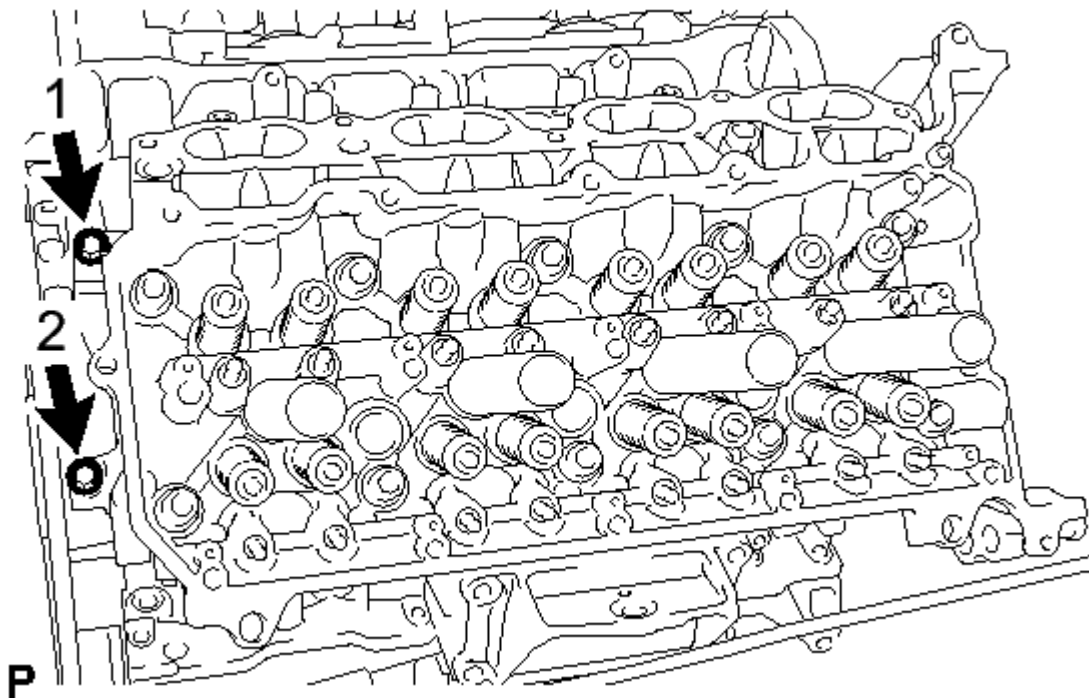
- a. Remove the 16 valve stem caps from the cylinder head.

**HINT:**

Arrange the removed parts in the correct order.

**6. REMOVE CYLINDER HEAD SUB-ASSEMBLY RH**

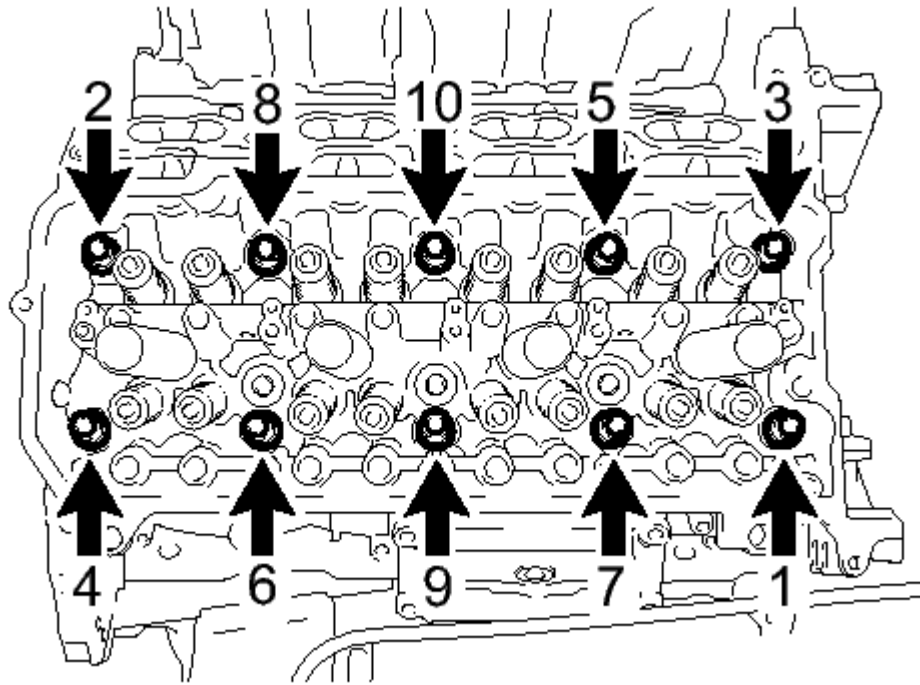
- a. Uniformly loosen and remove the 2 bolts in the sequence shown in the illustration.



**Fig. 86: Identifying Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 10 mm bi-hexagon wrench, uniformly loosen the 10 cylinder head bolts in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.



**P**

**Fig. 87: Identifying Cylinder Head Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Be sure to arrange the removed parts for each installation position separately.

**NOTE:**

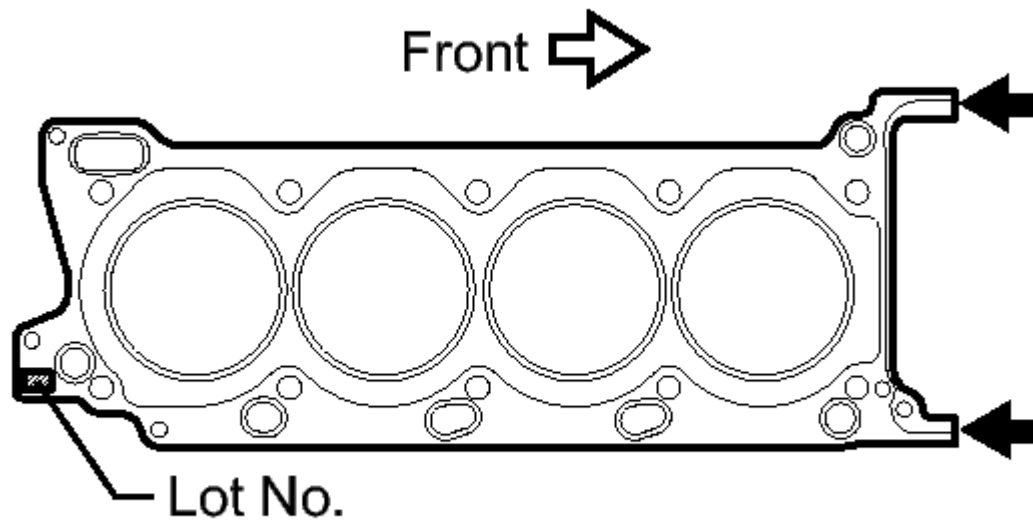
- Be careful not to drop washers into the cylinder head.
- Head warpage or cracking could result from removing bolts in an incorrect order.

**7. REMOVE CYLINDER HEAD GASKET RH**

**INSTALLATION**

**INSTALLATION**

1. **INSPECT CYLINDER HEAD SET BOLT** See step 1
2. **INSPECT CYLINDER HEAD SUB-ASSEMBLY RH** See step 9
3. **INSTALL CYLINDER HEAD GASKET RH**
  - a. Check the piston protrusions for each cylinder.
    1. Clean the cylinder block with solvent.
    2. Set the piston of the cylinder to be measured to slightly ATDC.
  - b. Place the cylinder head gasket on the cylinder block surface with the front face of the Lot No. stamp upward.

**T**

**Fig. 88: Identifying Cylinder Head Gasket Lot No. Stamp**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Be careful of the installation direction.
- Make sure that no oil is on the front end (indicated by the arrows) of the cylinder head gasket.

**4. INSTALL CYLINDER HEAD SUB-ASSEMBLY RH**

- a. Place the cylinder head on the cylinder block.

**NOTE:**

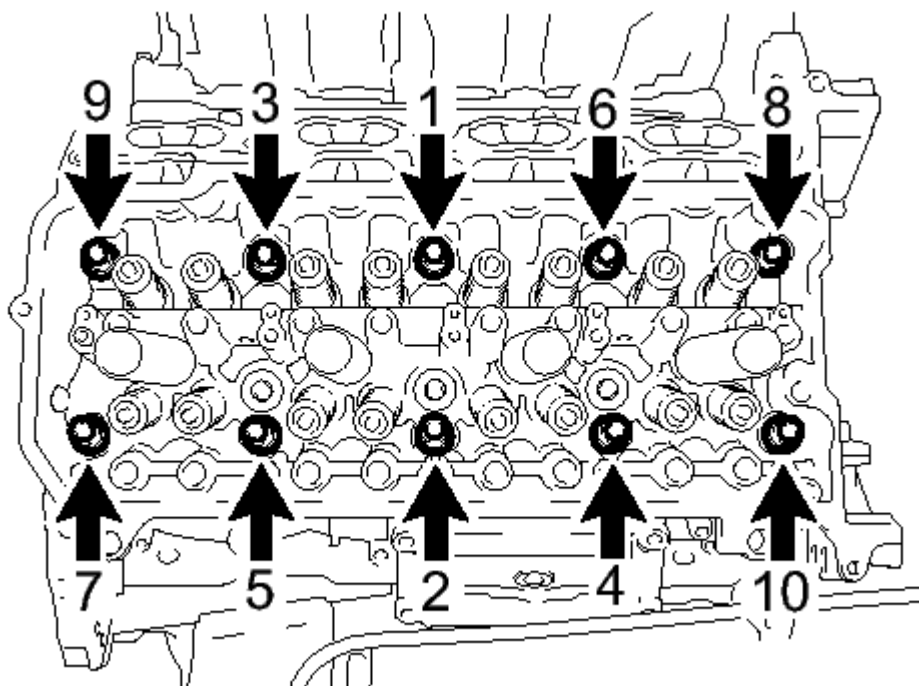
- Gently place the cylinder head in order not to damage the gasket with the bottom part of the head.
- Ensure that no oil is on the mounting surface of the cylinder head.

**HINT:**

The cylinder head bolts are tightened in 3 progressive steps.

- b. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- c. Step 1:





**P**

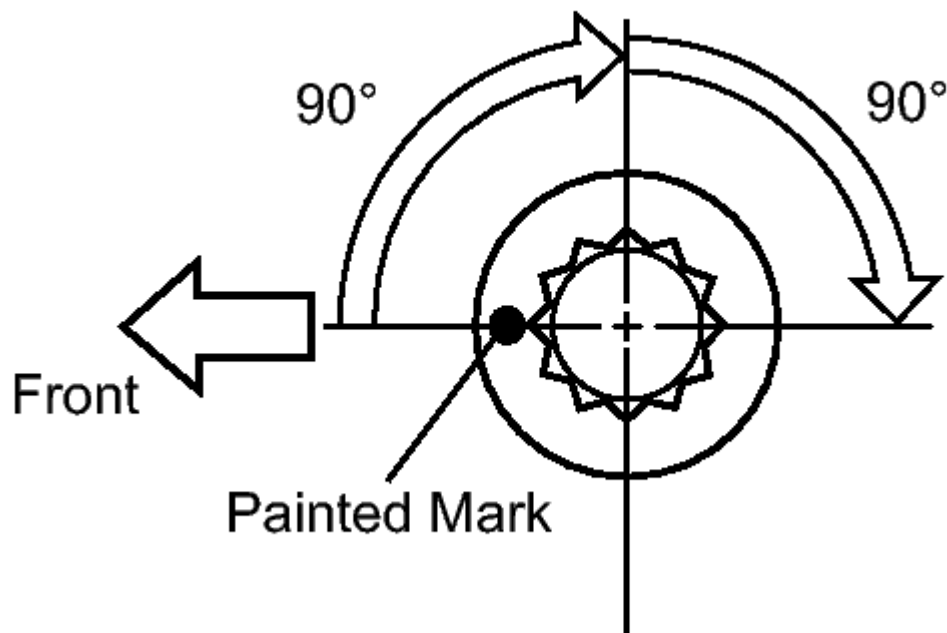
**Fig. 89: Identifying Cylinder Head Bolts In Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 10 cylinder head bolts with the plate washers in several steps, in the sequence shown in the illustration.

**Torque: 36 N\*m (367 kgf\*cm, 27 ft.\*lbf)**

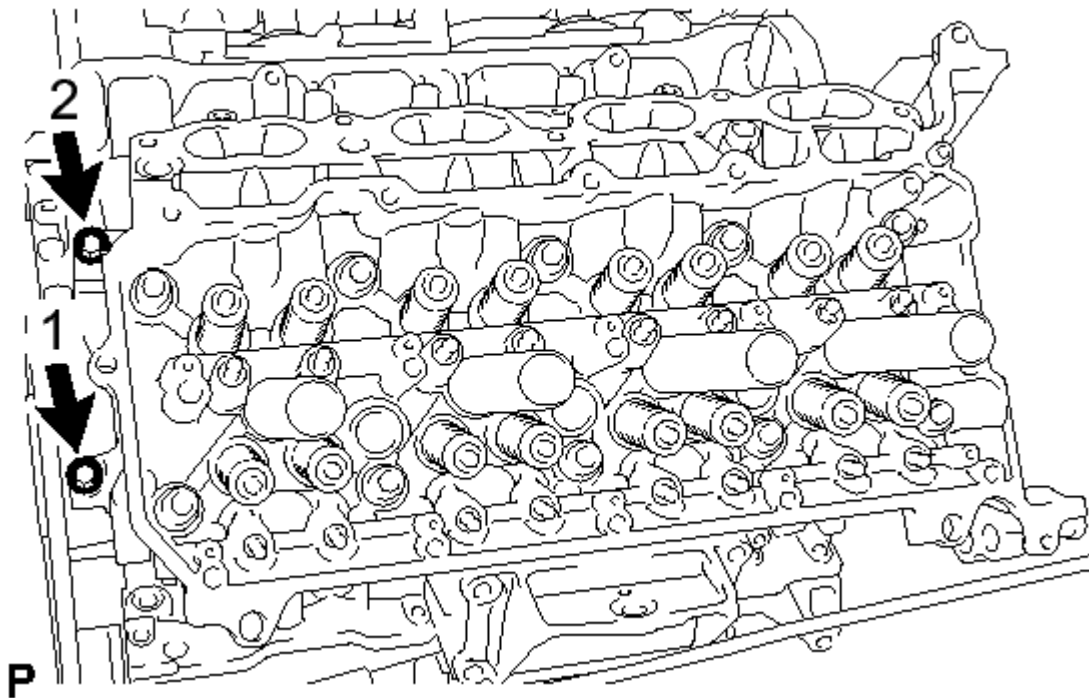
d. Step 2:



**Fig. 90: Checking Painted Mark On Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Mark each cylinder head bolt head with paint as shown in the illustration.
  2. Tighten the cylinder head bolts another 90° in the sequence shown in step 1.
- e. Step 3:
1. Tighten the cylinder head bolts an additional 90° in the sequence shown in step 1.
  2. Check that the painting marks are now facing rearward.
- f. Install and uniformly tighten the 2 bolts in the sequence shown in the illustration.



**Fig. 91: Identifying Cylinder Head Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

**5. INSTALL VALVE STEM CAP**

- a. Apply a light coat of engine oil to the valve stem caps.
- b. Install the 16 valve stem caps to the cylinder head.

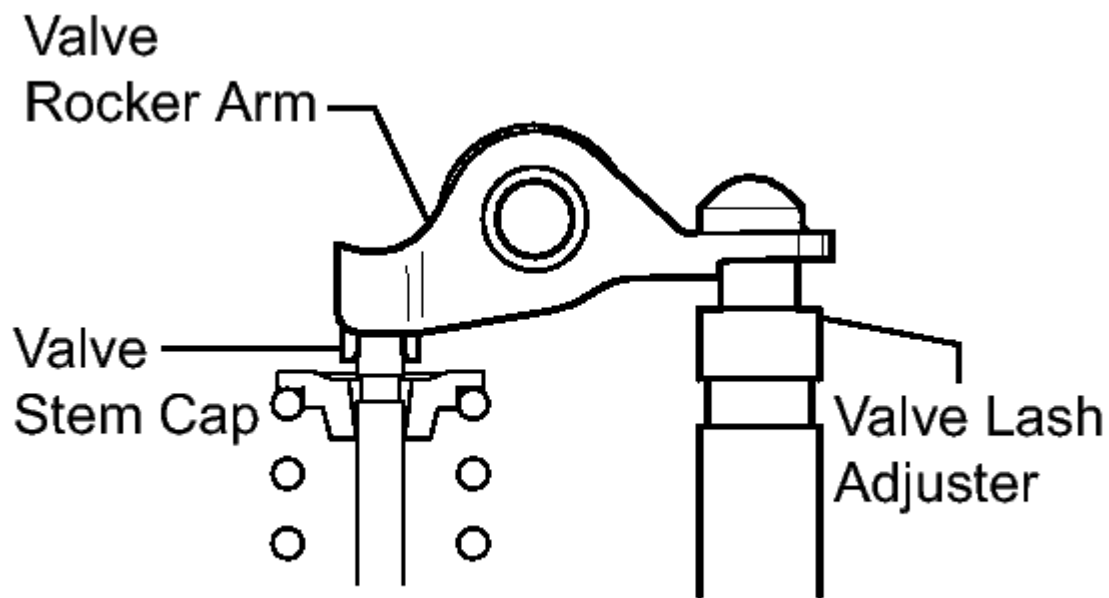
**6. INSTALL VALVE LASH ADJUSTER ASSEMBLY**

- a. Inspect the valve lash adjuster See step 3.
- b. Install the 16 valve lash adjusters to the cylinder head.

**NOTE:**        **Install the lash adjuster at the same place it was removed from.**

**7. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**

- a. Apply engine oil to the lash adjuster tips and valve stem cap ends.
- b. Install the valve rocker arms as shown in the illustration.

**P**

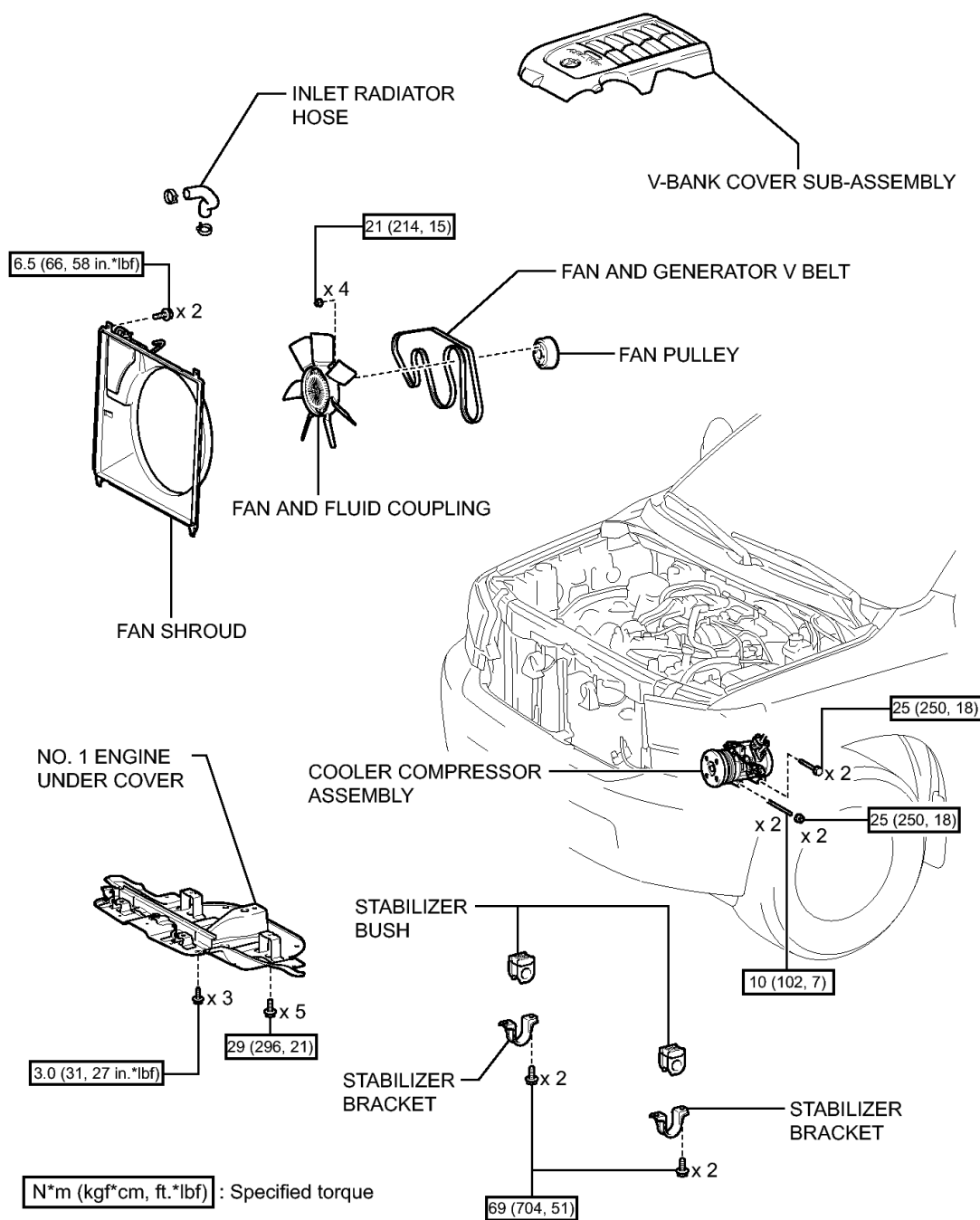
**Fig. 92: Identifying Valve Rocker Arm And Valve Stem Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSTALL CAMSHAFTS (for Bank 2)**
  - a. Install the camshafts. Refer to **INSTALLATION**.
9. **INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH**
  - a. Install the exhaust manifold RH. Refer to **INSTALLATION**.

## FRONT CRANKSHAFT OIL SEAL

### COMPONENTS

### ILLUSTRATION

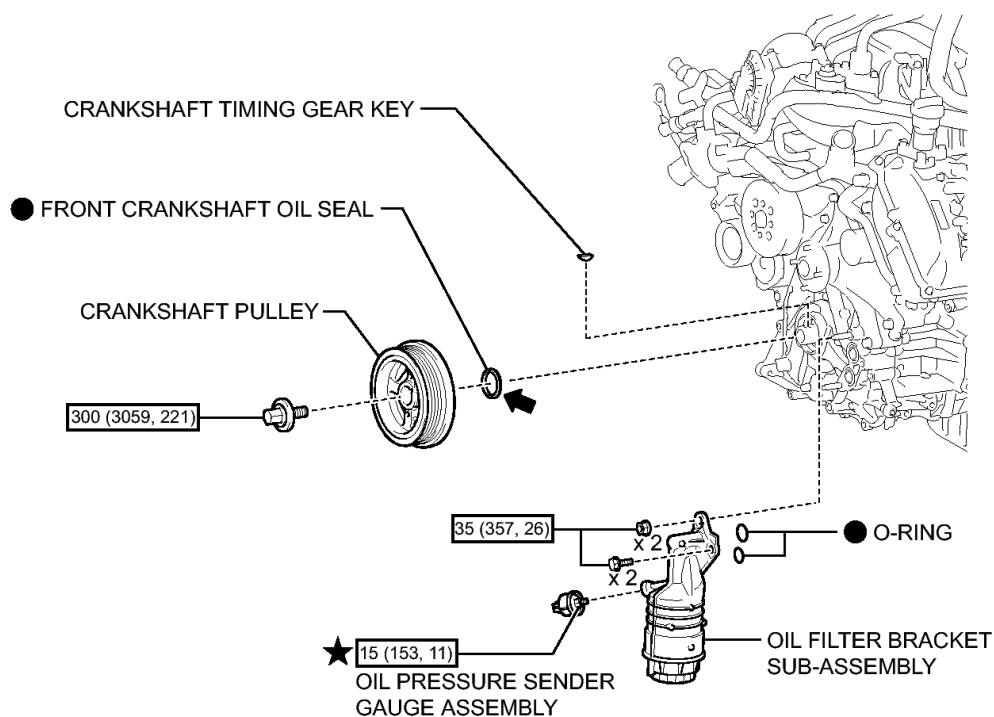


P

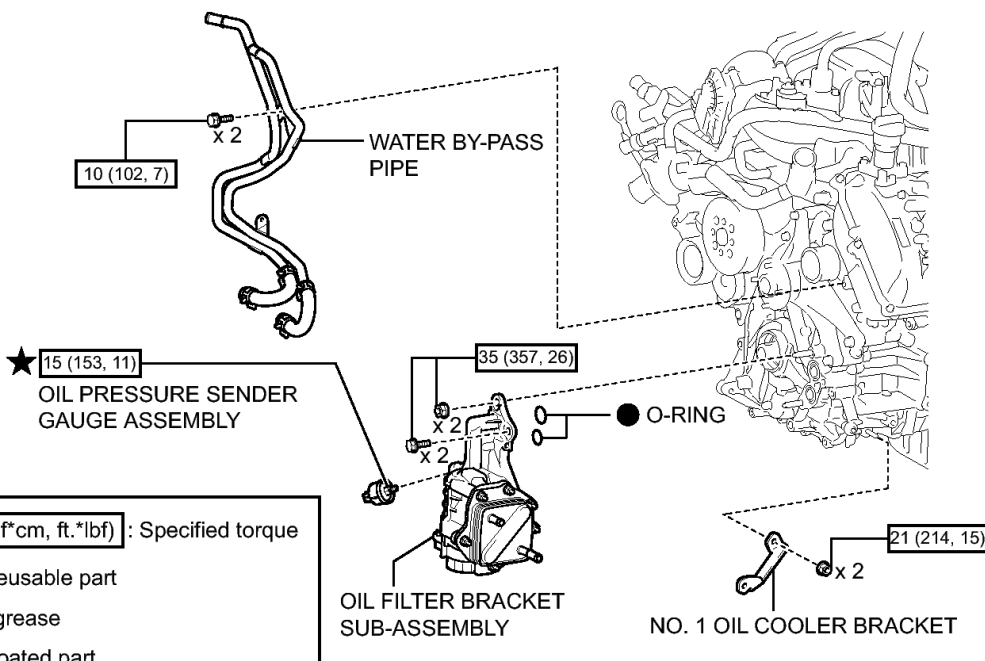
**Fig. 93: Identifying Front Crankshaft Oil Seal Replacement Components (1 of 2) With Torque Specifications**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



w/ Oil Cooler:



N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

← MP grease

★ Precoated part

P

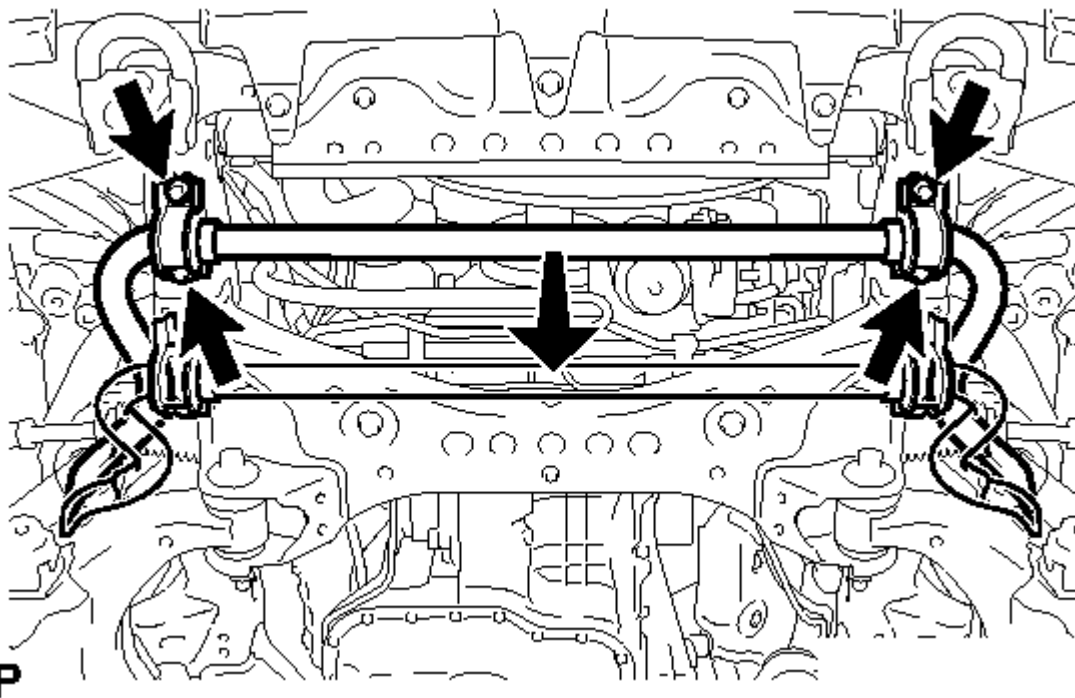
**Fig. 94: Identifying Front Crankshaft Oil Seal Replacement Components (2 of 2) With Torque Specifications**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

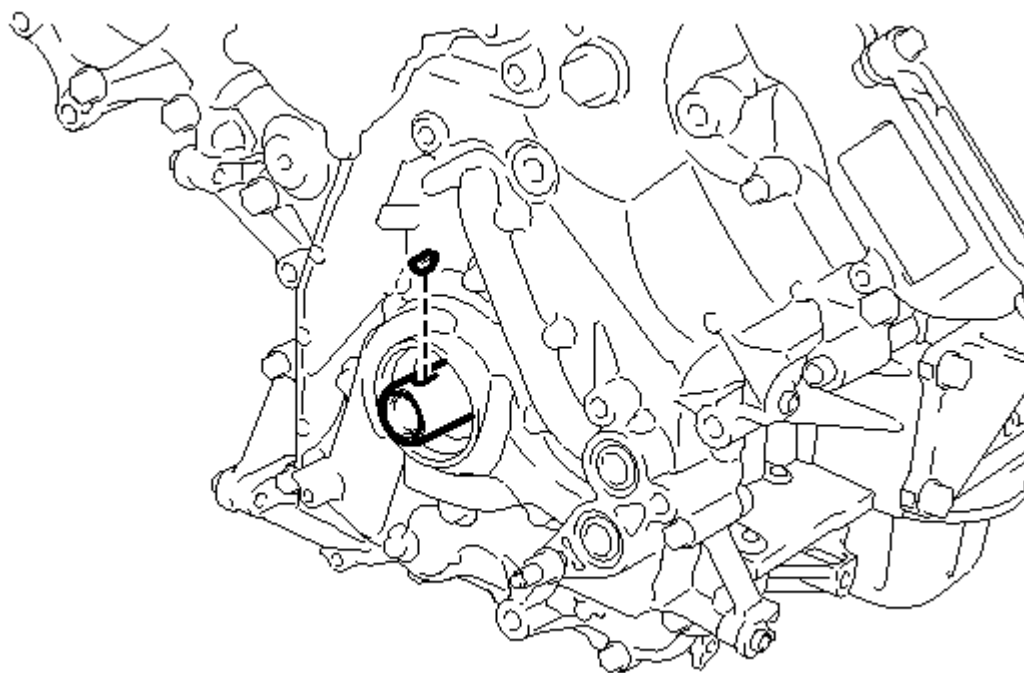
### REMOVAL

1. **REMOVE V-BANK COVER SUB-ASSEMBLY** See step 9
2. **REMOVE NO. 1 ENGINE UNDER COVER** . Refer to **REPLACEMENT - Step 2**
3. **DRAIN ENGINE COOLANT** . Refer to **REPLACEMENT - Step 2**
4. **REMOVE INLET RADIATOR HOSE** . Refer to **REMOVAL - Step 6**
5. **REMOVE FAN AND GENERATOR V BELT** See step 3
6. **REMOVE FAN SHROUD** . Refer to **REMOVAL - Step 7**
7. **DISCONNECT FRONT STABILIZER BAR**
  - a. Remove the 4 bolts, 2 stabilizer brackets and 2 stabilizer bushes. Then disconnect the stabilizer bar.



**P**  
**Fig. 95: Identifying Bolts, Stabilizer Brackets And Stabilizer Bushes**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **DISCONNECT COOLER COMPRESSOR ASSEMBLY** . Refer to **REMOVAL - Step 14**
9. **REMOVE OIL PRESSURE SENDER GAUGE ASSEMBLY** . Refer to **REPLACEMENT - Step 2**
10. **REMOVE WATER BY-PASS PIPE (w/ Oil Cooler)** . Refer to **REMOVAL - Step 6**
11. **REMOVE NO. 1 OIL COOLER BRACKET (w/ Oil Cooler)** . Refer to **REMOVAL - Step 11**
12. **REMOVE OIL FILTER BRACKET SUB-ASSEMBLY** . Refer to **REMOVAL - Step 12**
13. **REMOVE CRANKSHAFT PULLEY** . Refer to **REMOVAL - Step 41**
14. **REMOVE CRANKSHAFT TIMING GEAR KEY**
  - a. Remove the crankshaft timing gear key from the crankshaft.

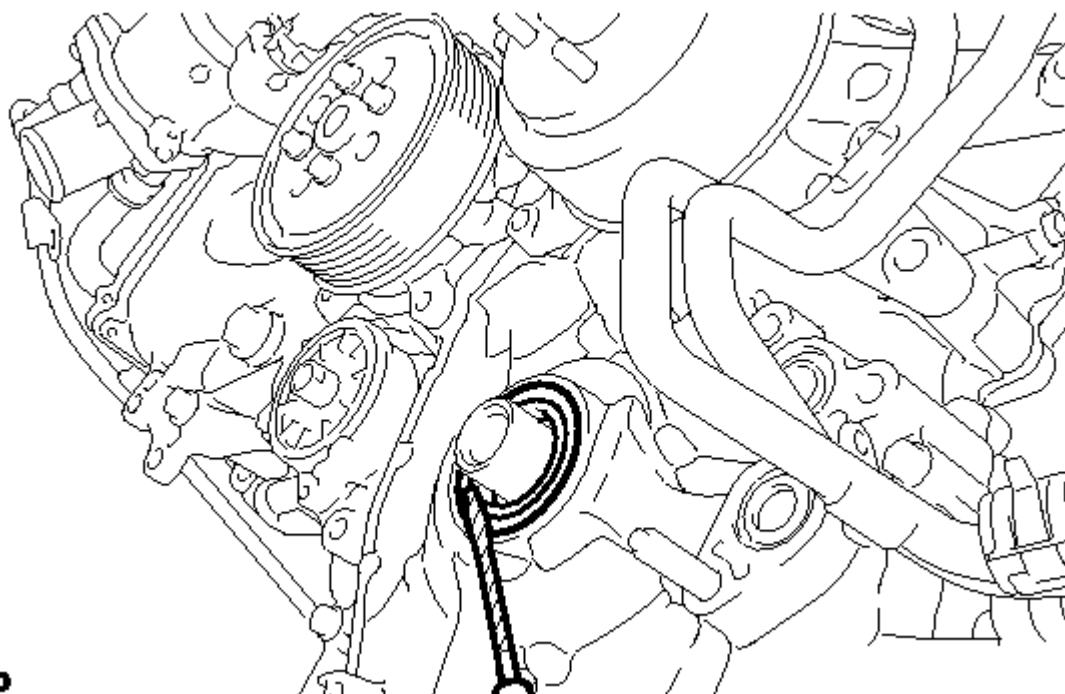


**P**

**Fig. 96: Removing The Crankshaft Timing Gear Key**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE FRONT CRANKSHAFT OIL SEAL**

- a. Using a screwdriver, pry out the oil seal.



**P**

**Fig. 97: Identifying Oil Seal**



Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not damage the surface of the oil seal press fit hole and crankshaft.

**HINT:**

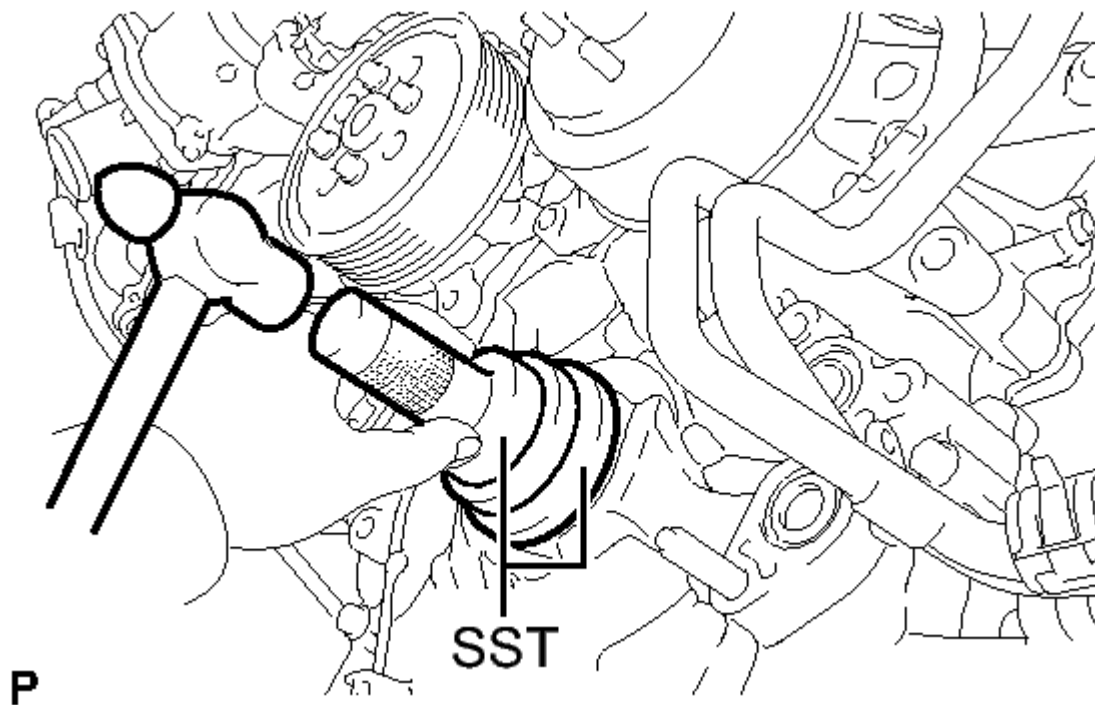
Tape the screwdriver tip before use.

## INSTALLATION

### INSTALLATION

#### 1. INSTALL FRONT CRANKSHAFT OIL SEAL

- Apply MP grease to the lip of a new oil seal.
- Using SST and a hammer, tap in the oil seal to a depth between 0 to 1.0 mm (0 to 0.0394 in.) from the timing chain cover edge.



**Fig. 98: Tapping In Front Crankshaft Oil Seal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

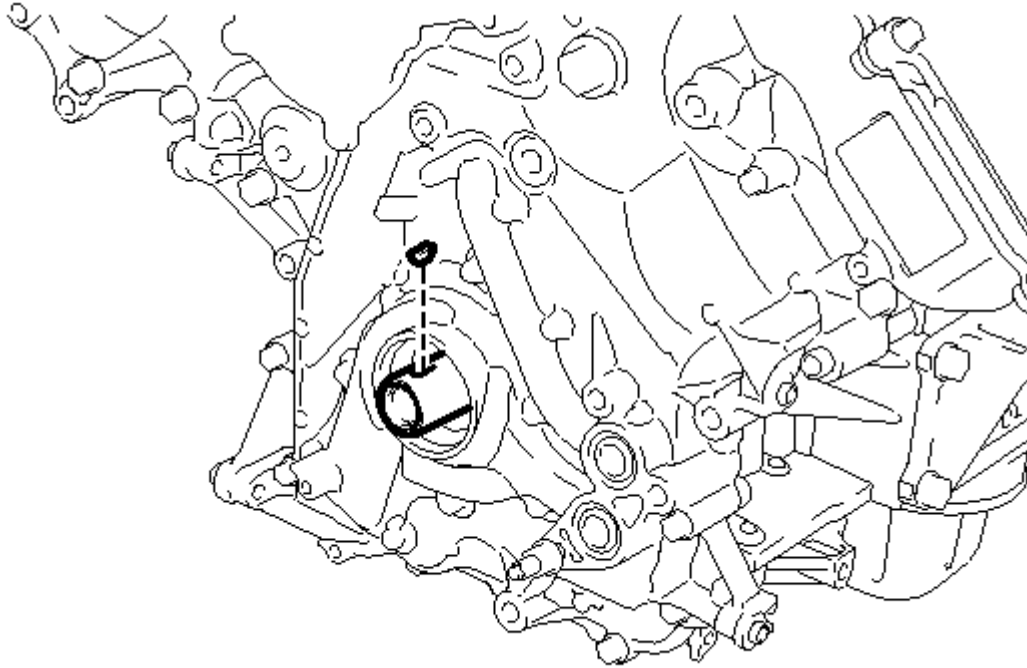
- SST: 09223-22010
- SST: 09506-35010

**NOTE:** • Keep the lip free from foreign matter.

- **Do not tap the oil seal at an angle.**

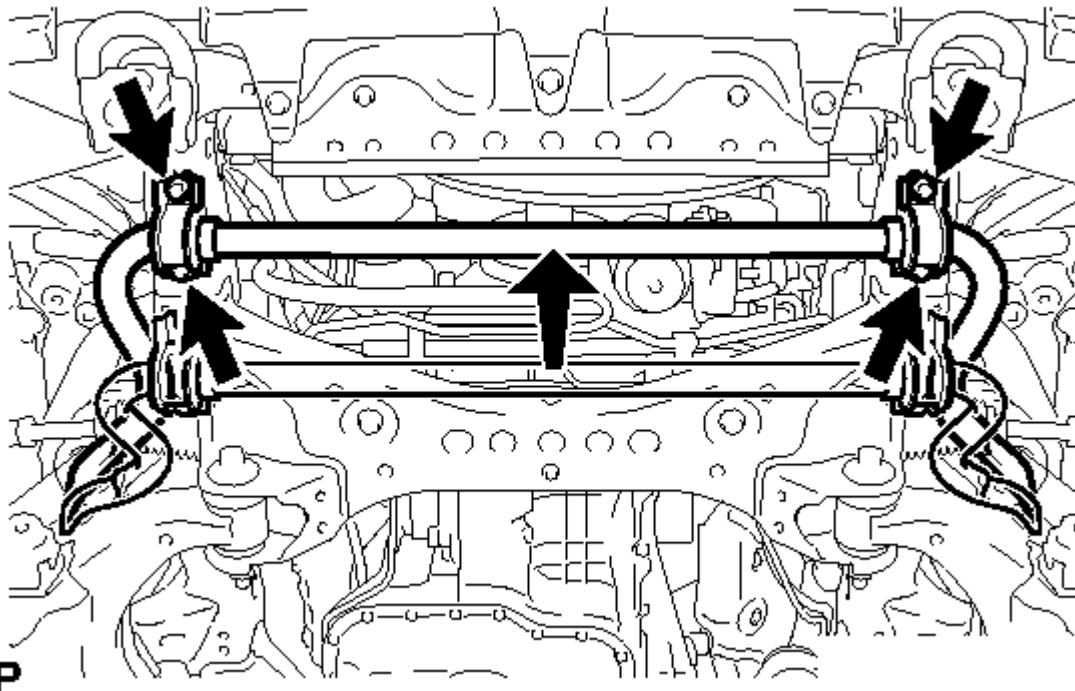
**2. INSTALL CRANKSHAFT TIMING GEAR KEY**

- a. Install the crankshaft timing gear key.

**P**

**Fig. 99: Removing The Crankshaft Timing Gear Key**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL CRANKSHAFT PULLEY** . Refer to **INSTALLATION - Step 9**
4. **INSTALL OIL FILTER BRACKET SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 3**
5. **INSTALL NO. 1 OIL COOLER BRACKET (w/ Oil Cooler)** . Refer to **INSTALLATION - Step 4**
6. **INSTALL WATER BY-PASS PIPE (w/ Oil Cooler)** . Refer to **INSTALLATION - Step 7**
7. **INSTALL OIL PRESSURE SENDER GAUGE ASSEMBLY** . Refer to **INSTALLATION - Step 1**
8. **CONNECT COOLER COMPRESSOR ASSEMBLY** . Refer to **INSTALLATION - Step 29**
9. **CONNECT FRONT STABILIZER BAR**
  - a. Connect the stabilizer bar and install the 2 stabilizer bushes and 2 stabilizer brackets with the 4 bolts.



P

**Fig. 100: Locating Front Stabilizer Bar Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

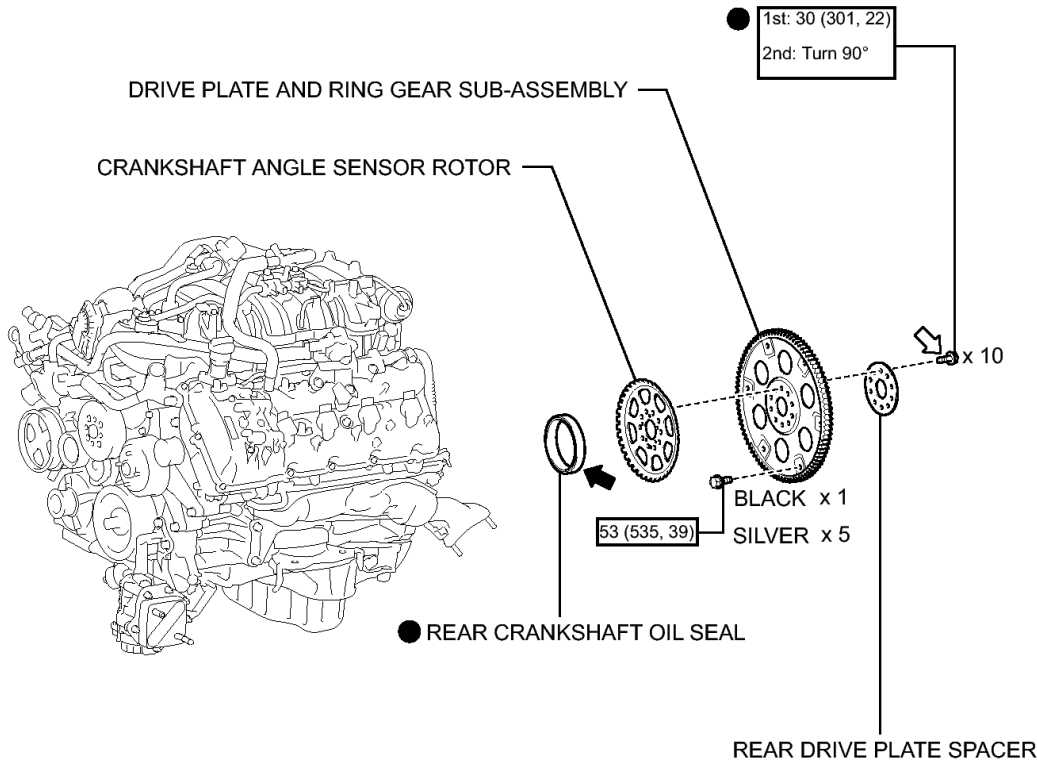
**Torque: 69 N\*m (704 kgf\*cm, 51 ft.\*lbf)**

10. **INSTALL FAN SHROUD** . Refer to **INSTALLATION - Step 7**
11. **INSTALL FAN AND GENERATOR V BELT** See step 1
12. **INSTALL INLET RADIATOR HOSE** . Refer to **INSTALLATION - Step 8**
13. **ADD ENGINE COOLANT** . Refer to **REPLACEMENT - Step 3**
14. **INSPECT FOR COOLANT LEAK** . Refer to **ON-VEHICLE INSPECTION - Step 1**
15. **INSPECT FOR OIL LEAK** . Refer to **REPLACEMENT - Step 6**
16. **CHECK ENGINE OIL LEVEL** . Refer to **ON-VEHICLE INSPECTION - Step 2**
17. **INSTALL NO. 1 ENGINE UNDER COVER** . Refer to **REPLACEMENT - Step 8**
18. **INSTALL V-BANK COVER SUB-ASSEMBLY** See step 57

## REAR CRANKSHAFT OIL SEAL

### COMPONENTS

### ILLUSTRATION



**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

● Non-reusable part

← MP grease

⇐ Adhesive 1324

P

**Fig. 101: Identifying Rear Crankshaft Oil Seal Replacement Components With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### REMOVAL

#### 1. PRECAUTION

**NOTE:** After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work. Refer to PRECAUTION .

#### 2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

**WARNING:** Wait at least 90 seconds after disconnecting the cable from the

negative (-) battery terminal to disable the SRS system.

**NOTE:** When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION .

### 3. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY

- a. for 2WD:

Refer to the following procedures. Refer to REMOVAL .

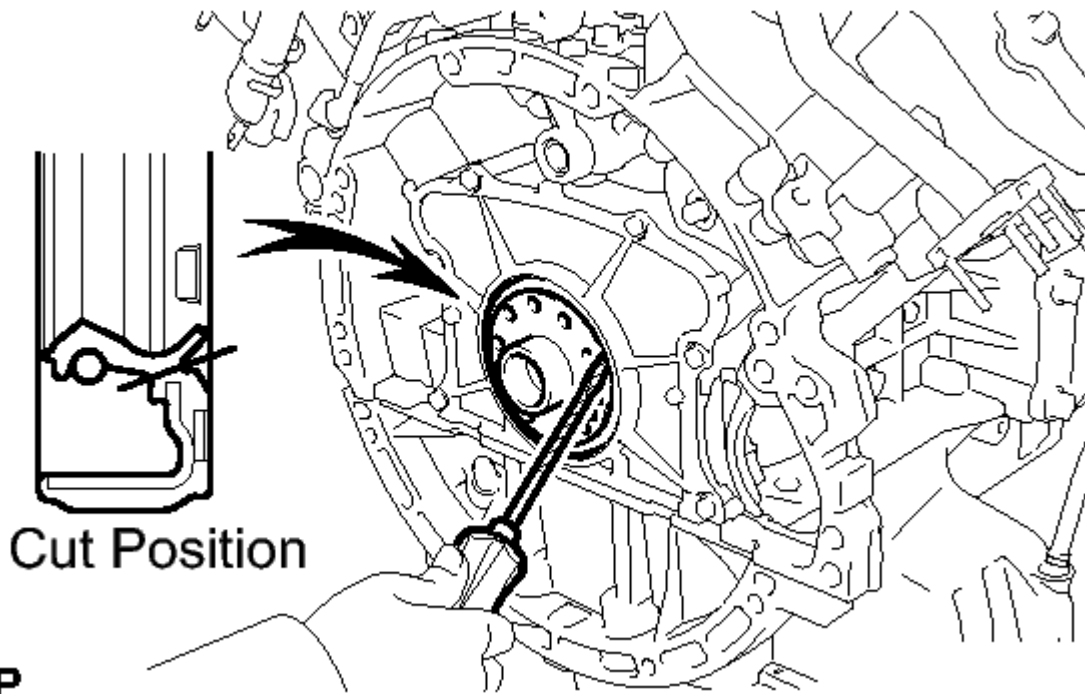
- b. for 4WD:

Refer to the following procedures. Refer to REMOVAL .

### 4. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY See step 55

### 5. REMOVE REAR CRANKSHAFT OIL SEAL

- a. Using a knife, cut off the lip of the oil seal.
- b. Using a screwdriver, pry out the oil seal.



**P**

**Fig. 102: Prying Out Oil Seal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

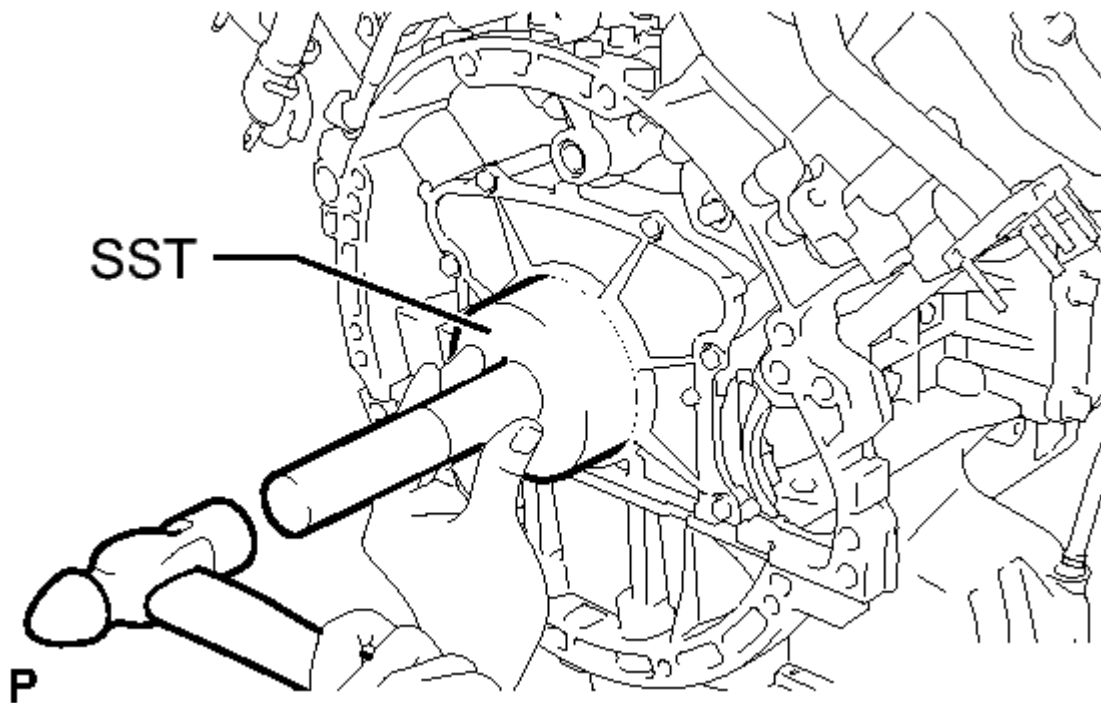
**NOTE:** Do not damage the surface of the oil seal press fit hole and crankshaft.

**HINT:**

Tape the screwdriver tip before use.

**INSTALLATION****INSTALLATION****1. INSTALL REAR CRANKSHAFT OIL SEAL**

- a. Apply MP grease to the lip of a new oil seal.
- b. Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



**Fig. 103: Tapping In Oil Seal Using SST**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09223-56010

**NOTE:**

- Keep the lip free from foreign matter.
- Do not tap on the oil seal at an angle.

**2. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** See step 3**3. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY**

- a. for 2WD:

Refer to the following procedures. Refer to **INSTALLATION** .

b. for 4WD:

Refer to the following procedures. Refer to **INSTALLATION** .

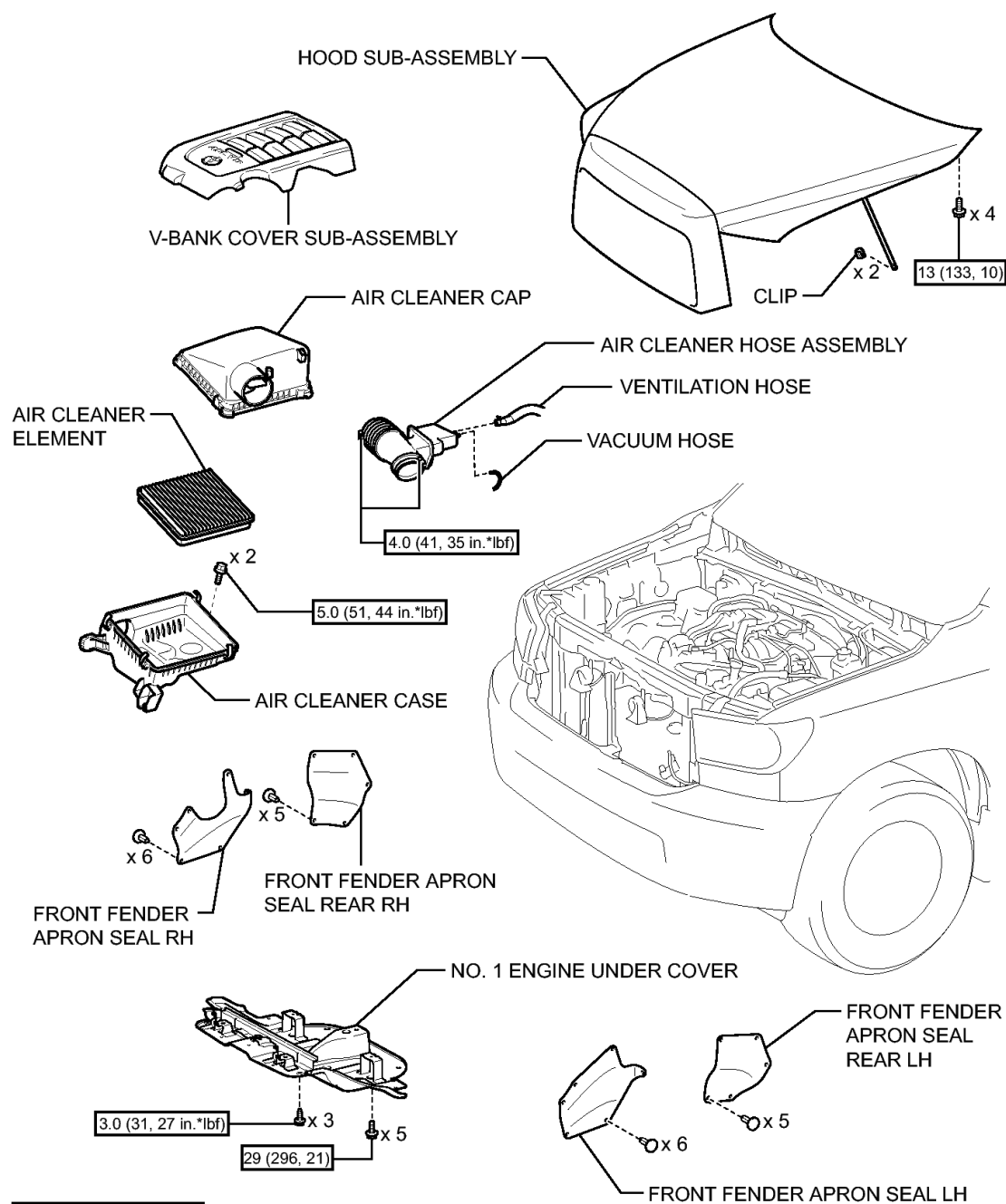
#### **4. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

**NOTE:** When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to **INITIALIZATION** .

## **ENGINE ASSEMBLY**

### **COMPONENTS**

### **ILLUSTRATION**



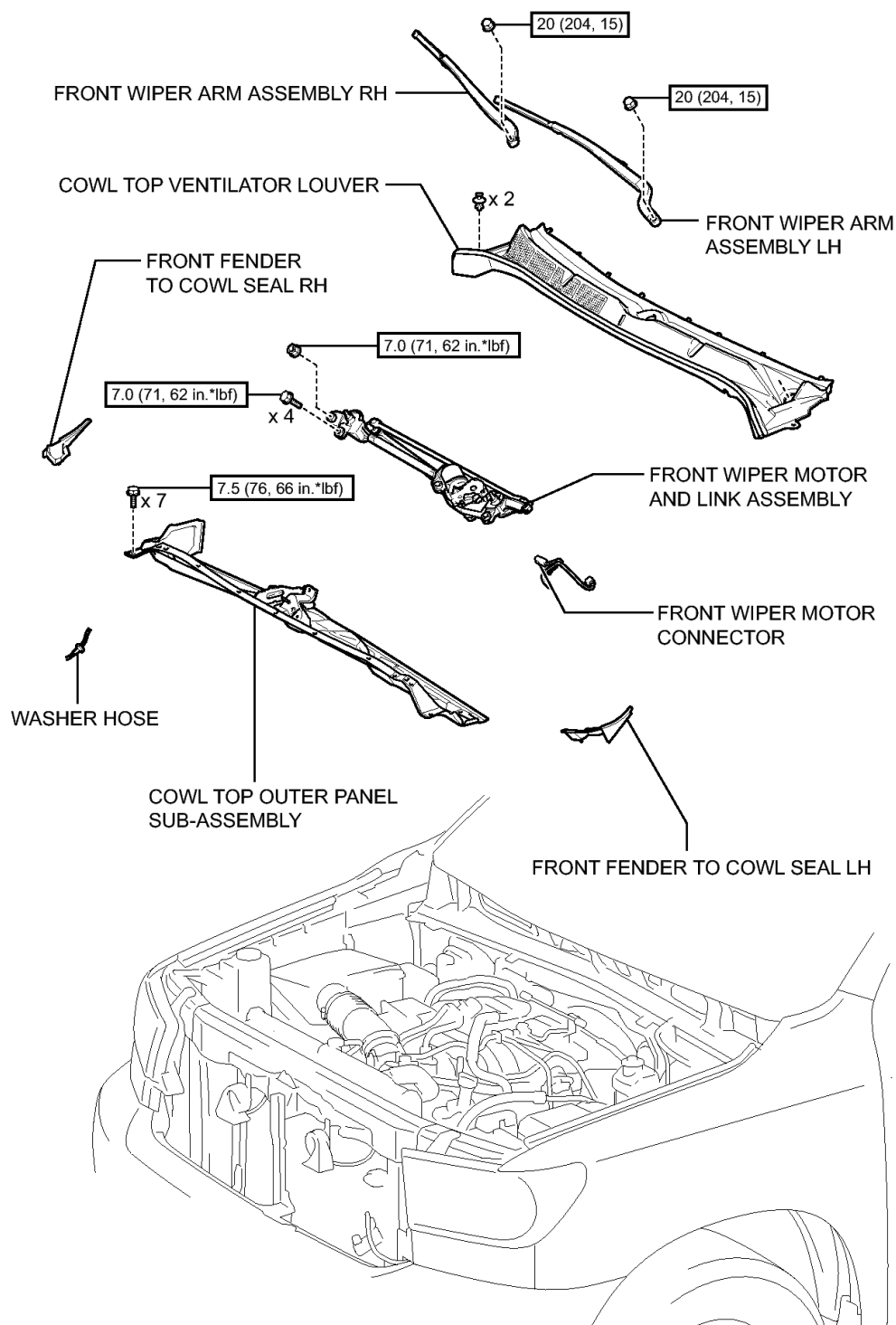
N\*m (kgf\*cm, ft.\*lbf) : Specified torque

P

**Fig. 104: Identifying Engine Assembly Replacement Components (1 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION





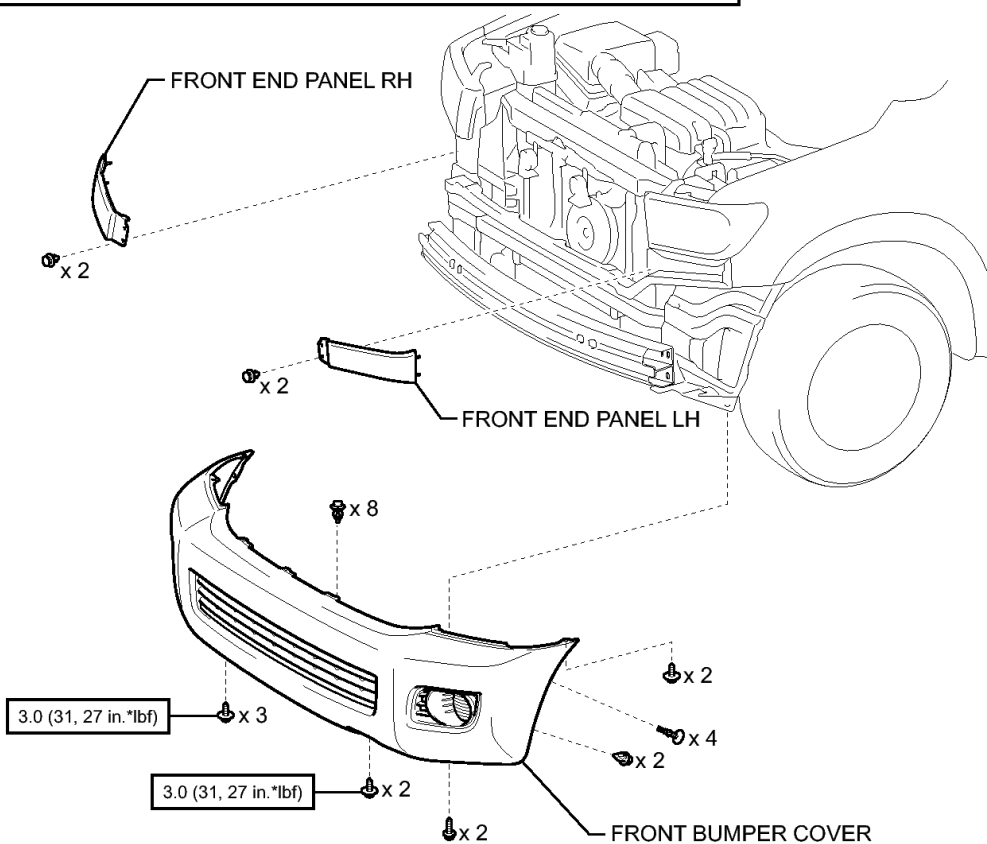
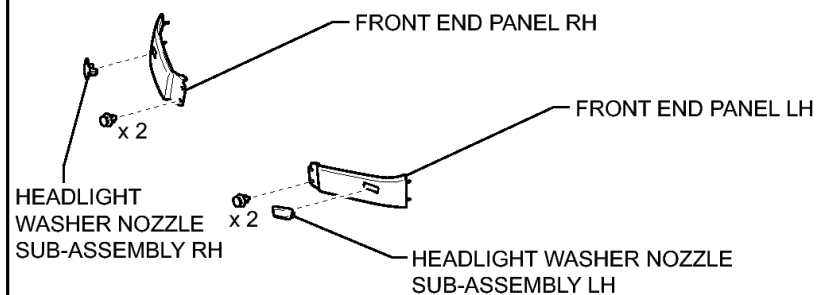
N\*m (kgf\*cm, ft.\*lbf) : Specified torque

P

**Fig. 105: Identifying Engine Assembly Replacement Components (2 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

w/ Headlight Cleaner:

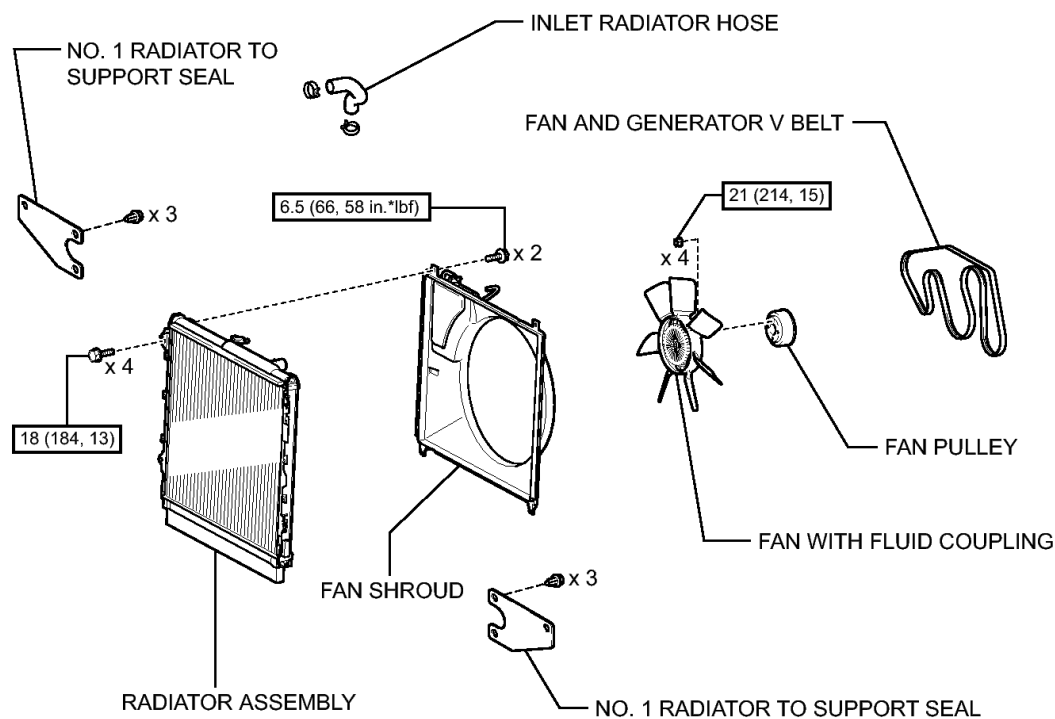


N\*m (kgf\*cm, ft.\*lbf) : Specified torque

T

**Fig. 106: Identifying Engine Assembly Replacement Components (3 Of 16) With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



OUTLET RADIATOR HOSE

RADIATOR SIDE DEFLECTOR RH

x 6

x 6

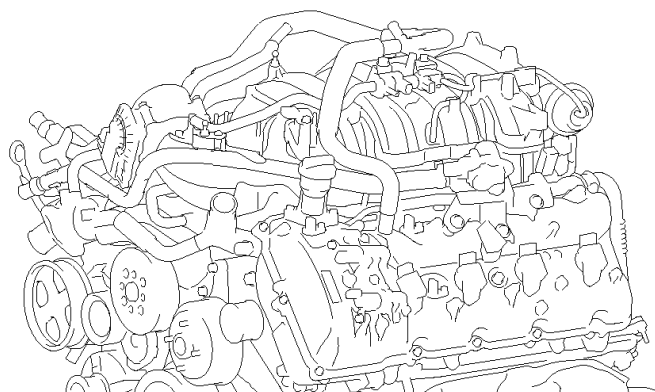
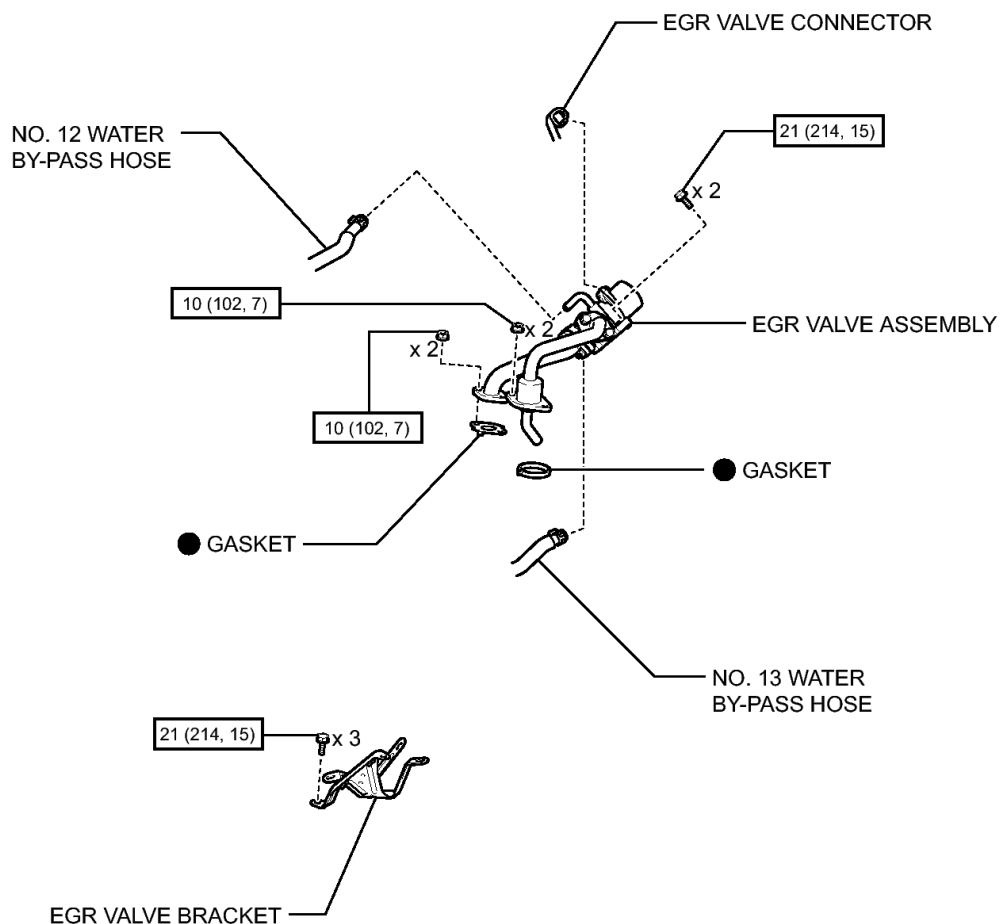
RADIATOR SIDE DEFLECTOR LH

[N\*m (kgf\*cm, ft.\*lbf)]: Specified torque

P

**Fig. 107: Identifying Engine Assembly Replacement Components (4 Of 16) With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



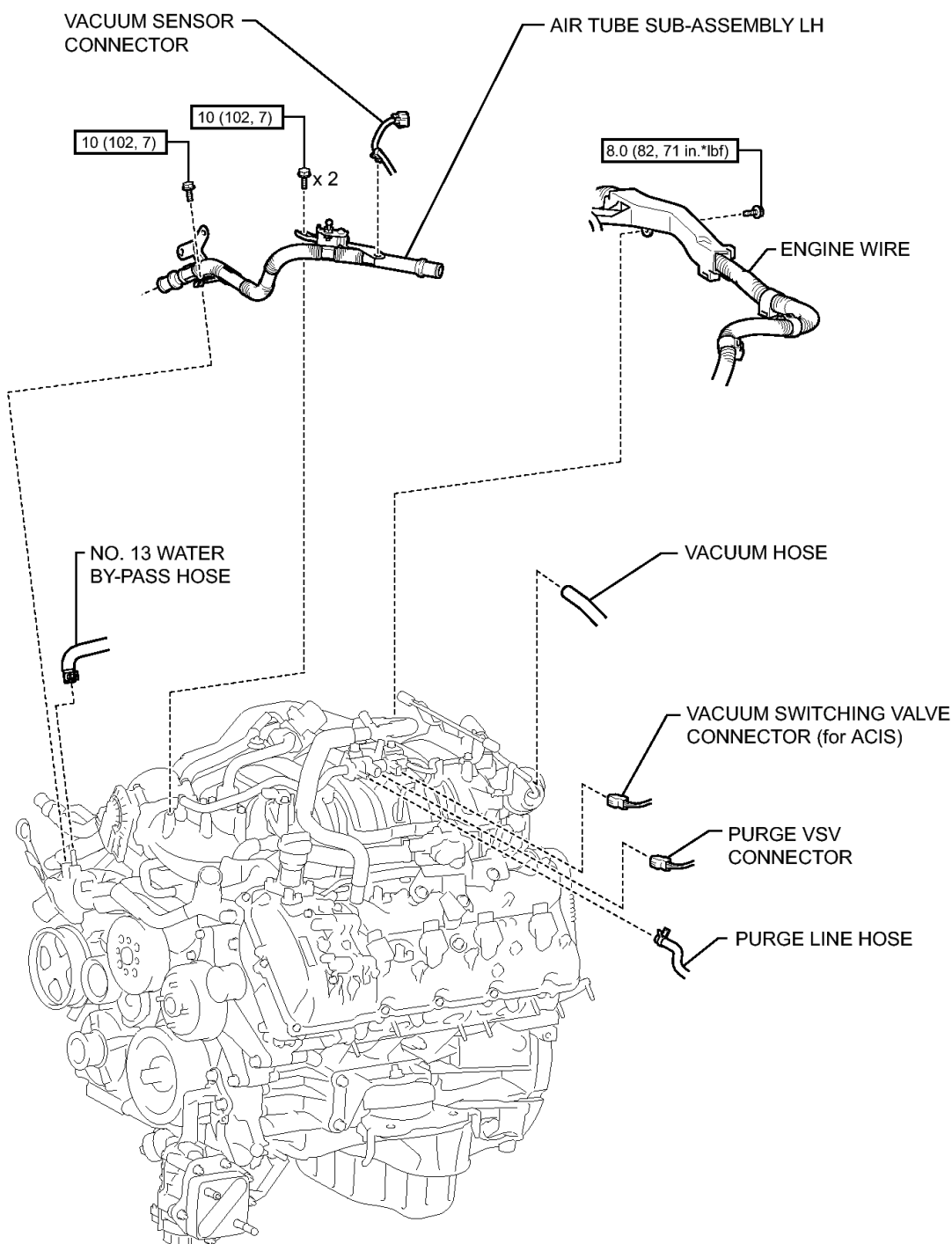
**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

● Non-reusable part

P

**Fig. 108: Identifying Engine Assembly Replacement Components (5 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

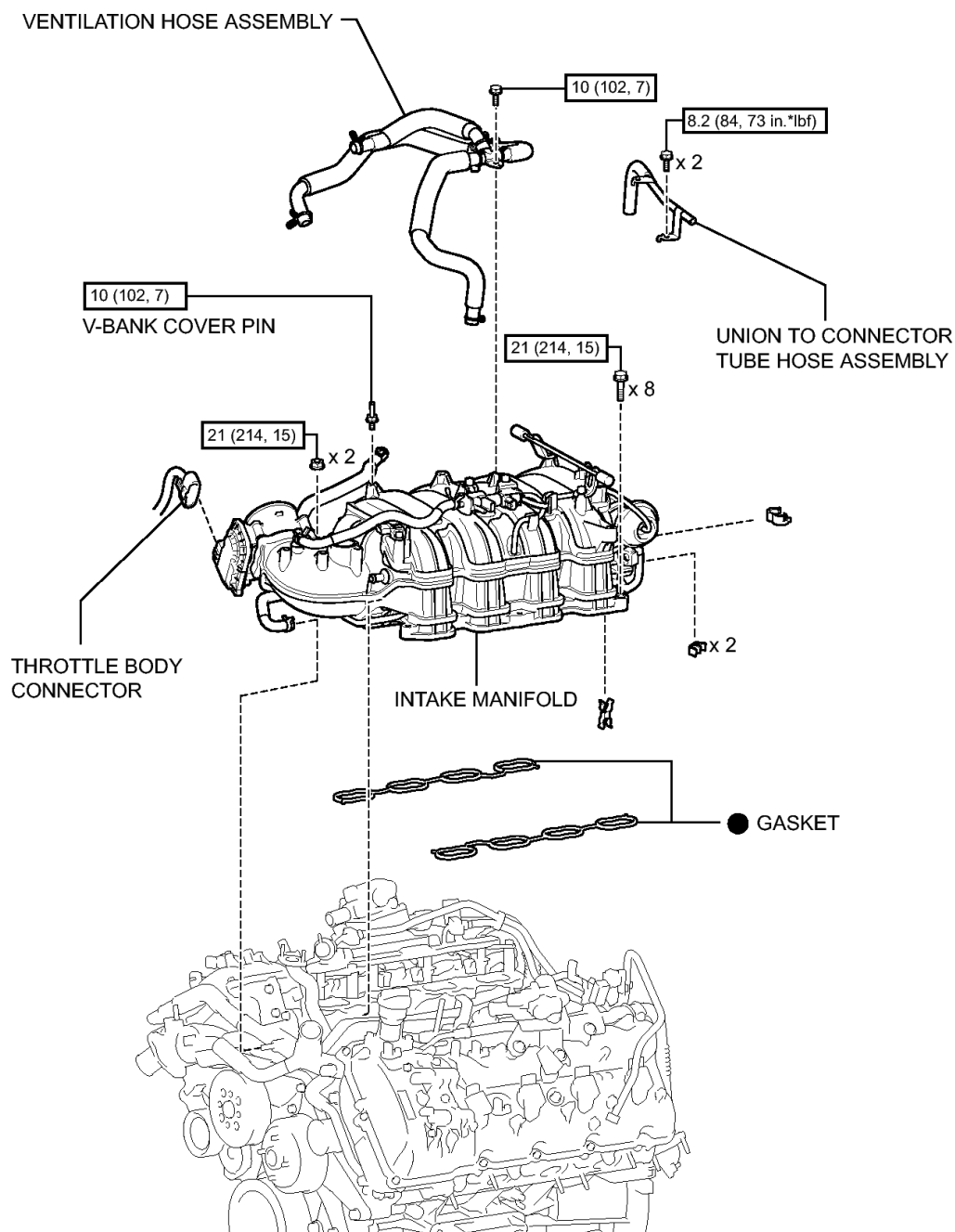


N\*m (kgf\*cm, ft.\*lbf): Specified torque

P

**Fig. 109: Identifying Engine Assembly Replacement Components (6 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



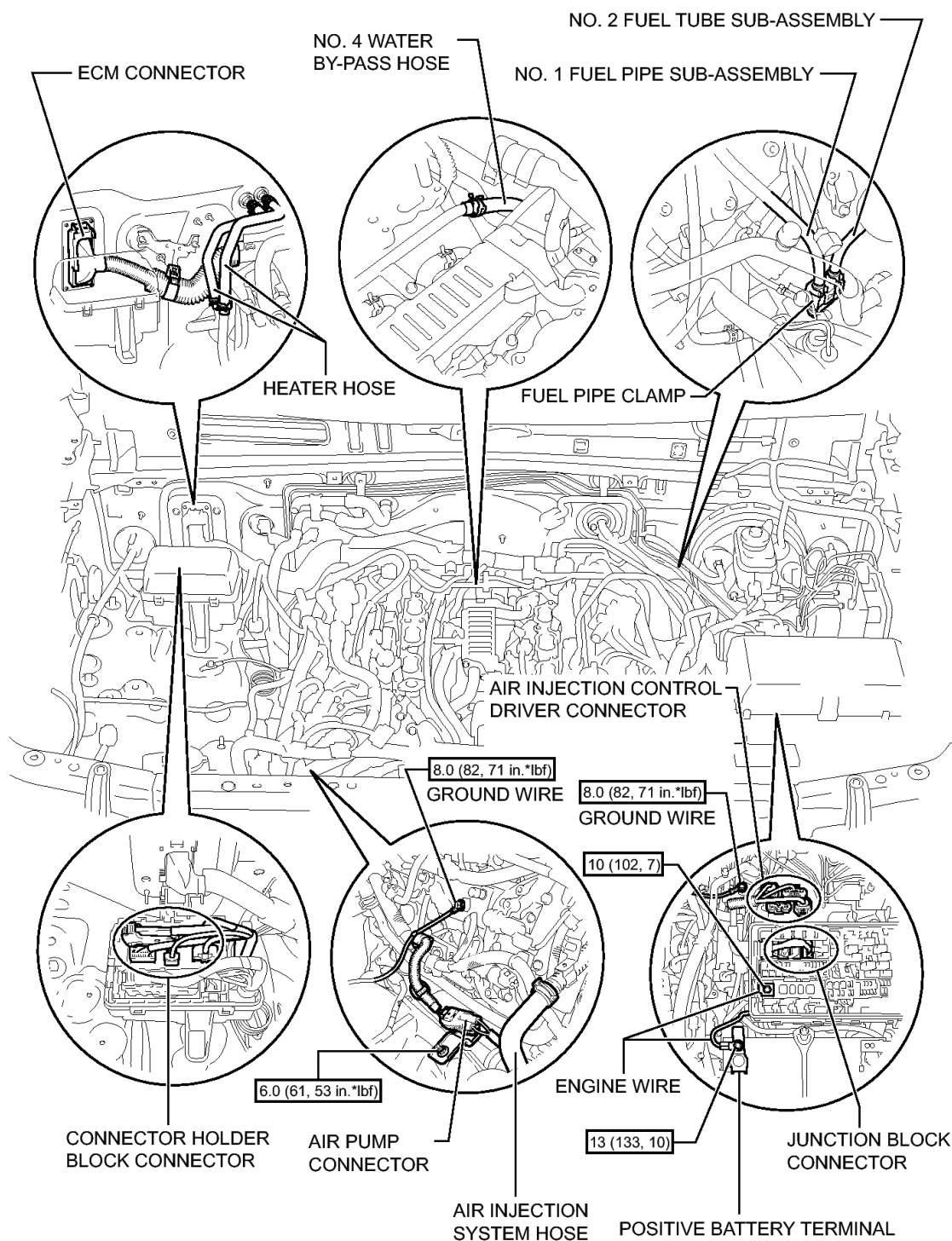
**N\*m (kgf\*cm, ft.\*lbf) : Specified torque**

● Non-reusable part

T

**Fig. 110: Identifying Engine Assembly Replacement Components (7 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

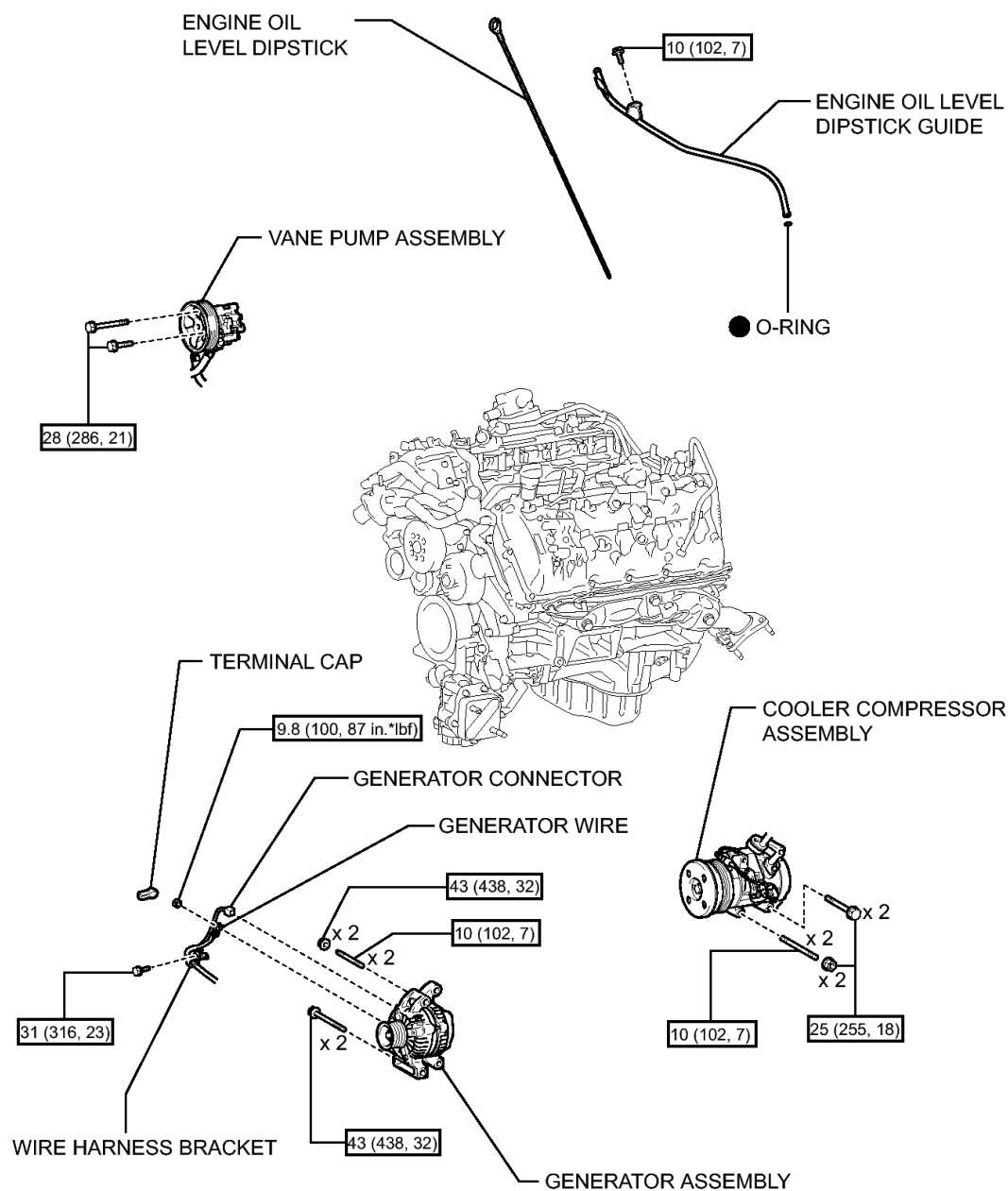


N\*m (kgf\*cm, ft.\*lbf) : Specified torque

T

**Fig. 111: Identifying Engine Assembly Replacement Components (8 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## ILLUSTRATION



N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

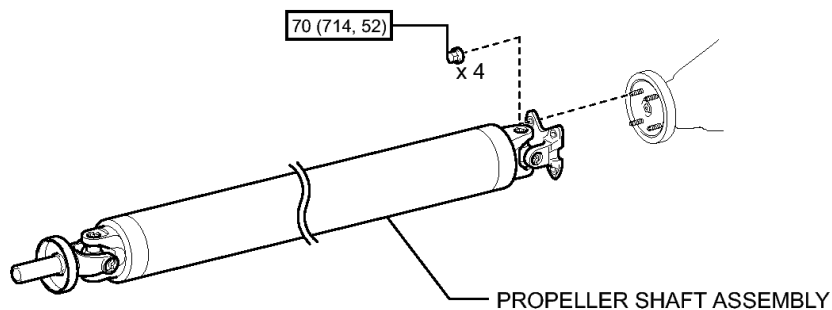
P

**Fig. 112: Identifying Engine Assembly Replacement Components (9 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

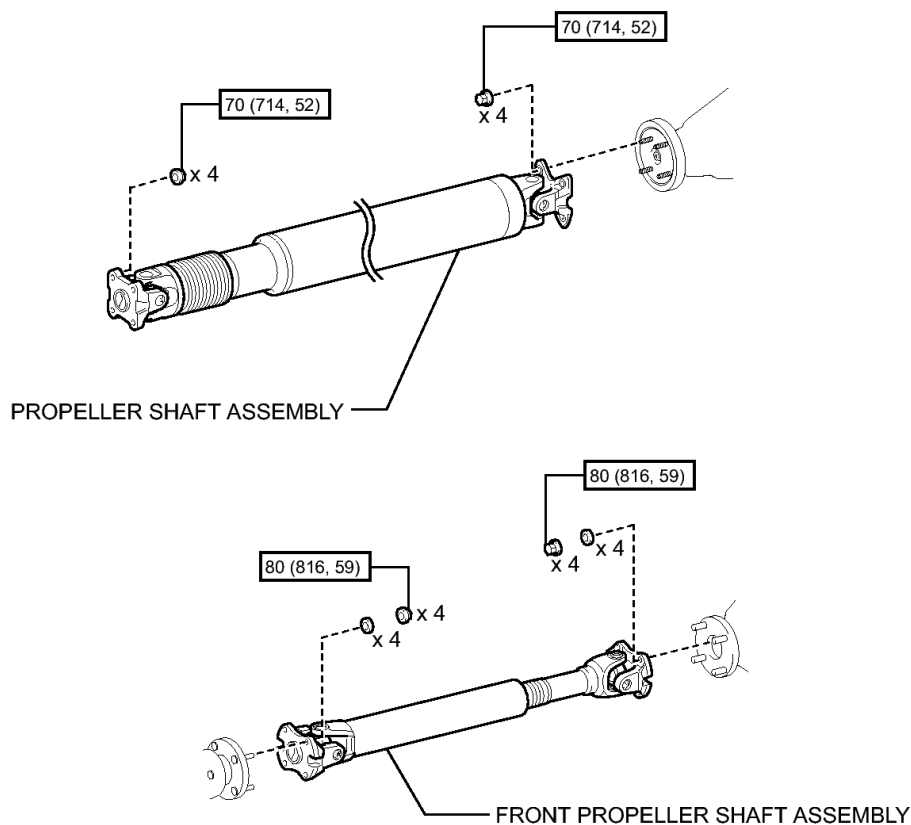
ILLUSTRATION



for 2WD:



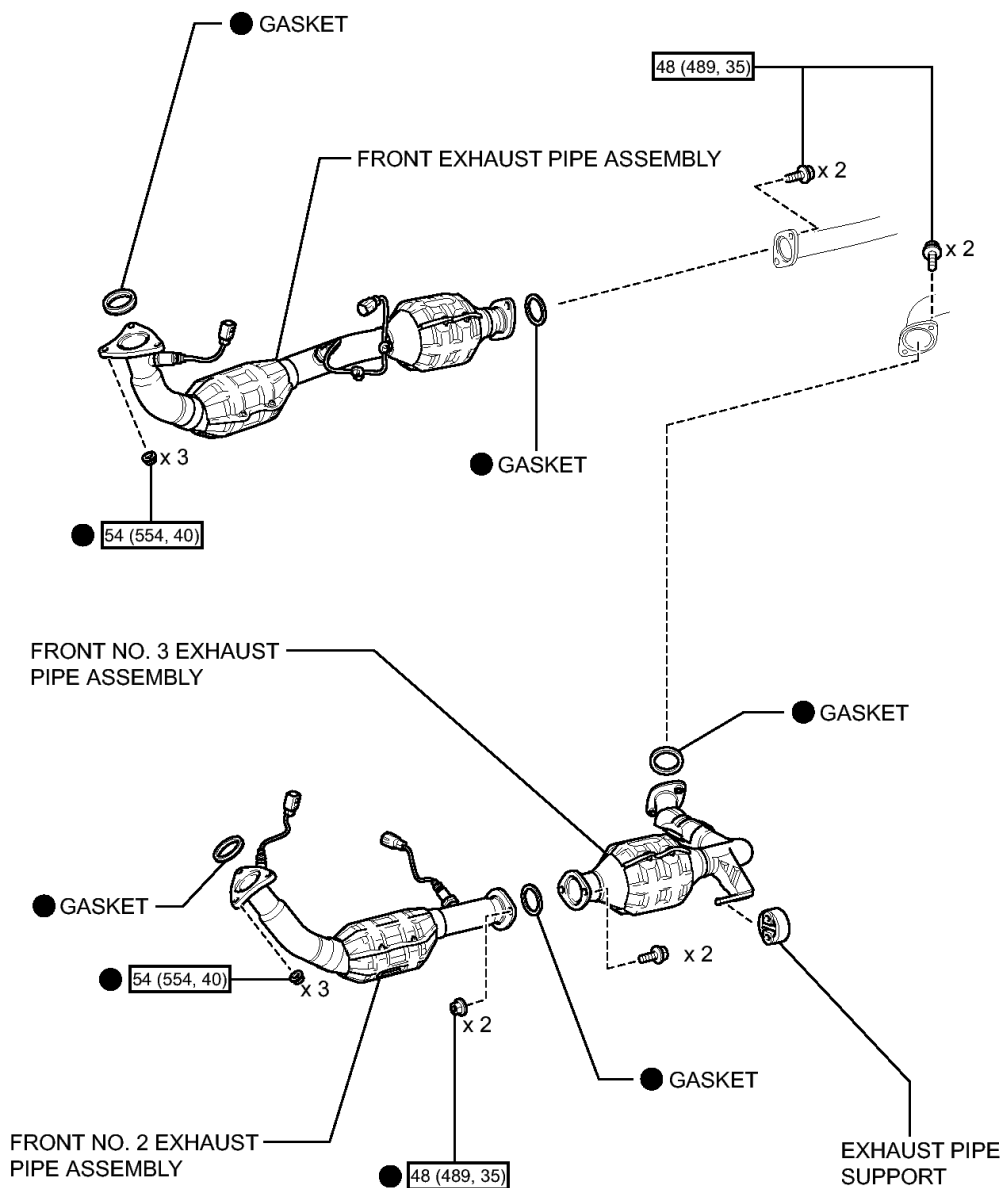
for 4WD:



**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

**Fig. 113: Identifying Engine Assembly Replacement Components (10 Of 16) With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



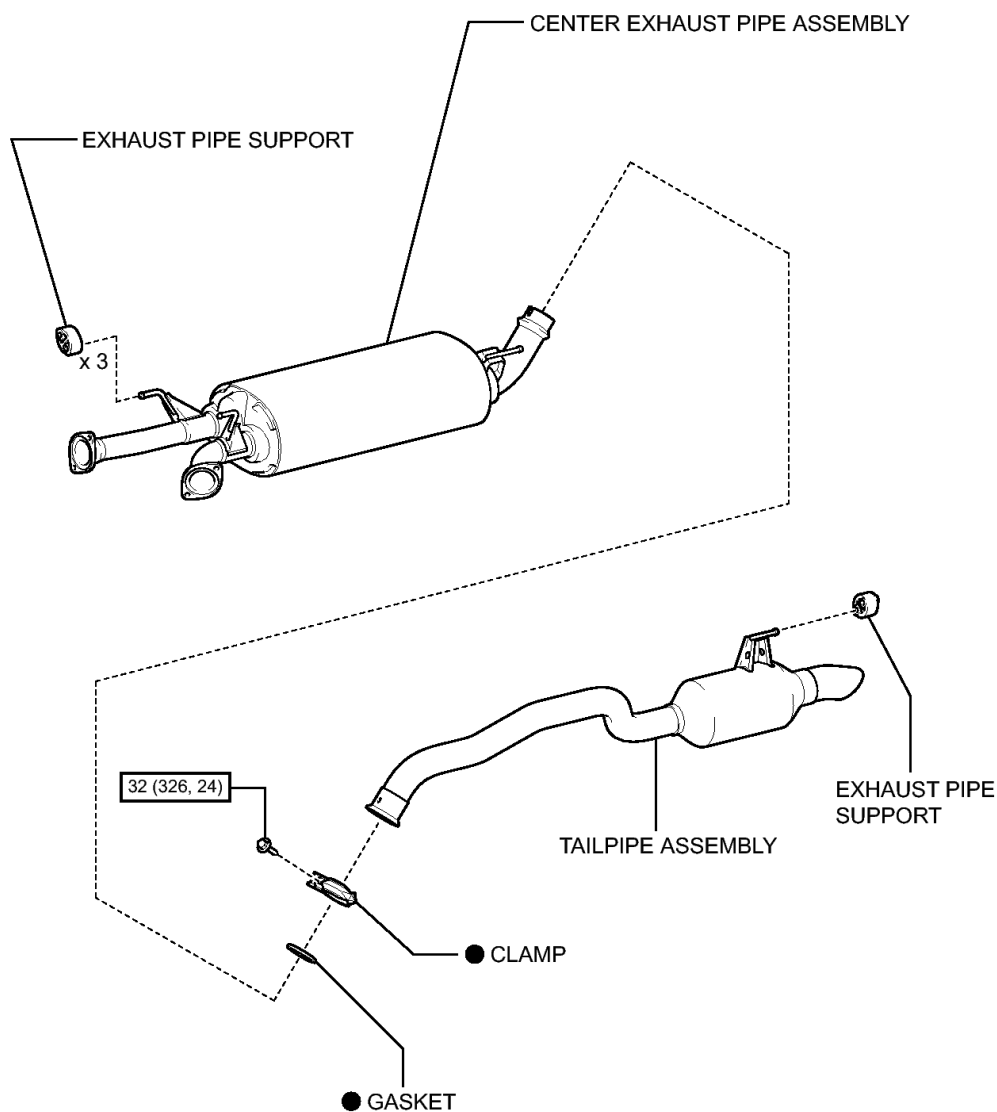
N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

P

**Fig. 114: Identifying Engine Assembly Replacement Components (11 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### ILLUSTRATION



**32 (326, 24)**: Specified torque

● Non-reusable part

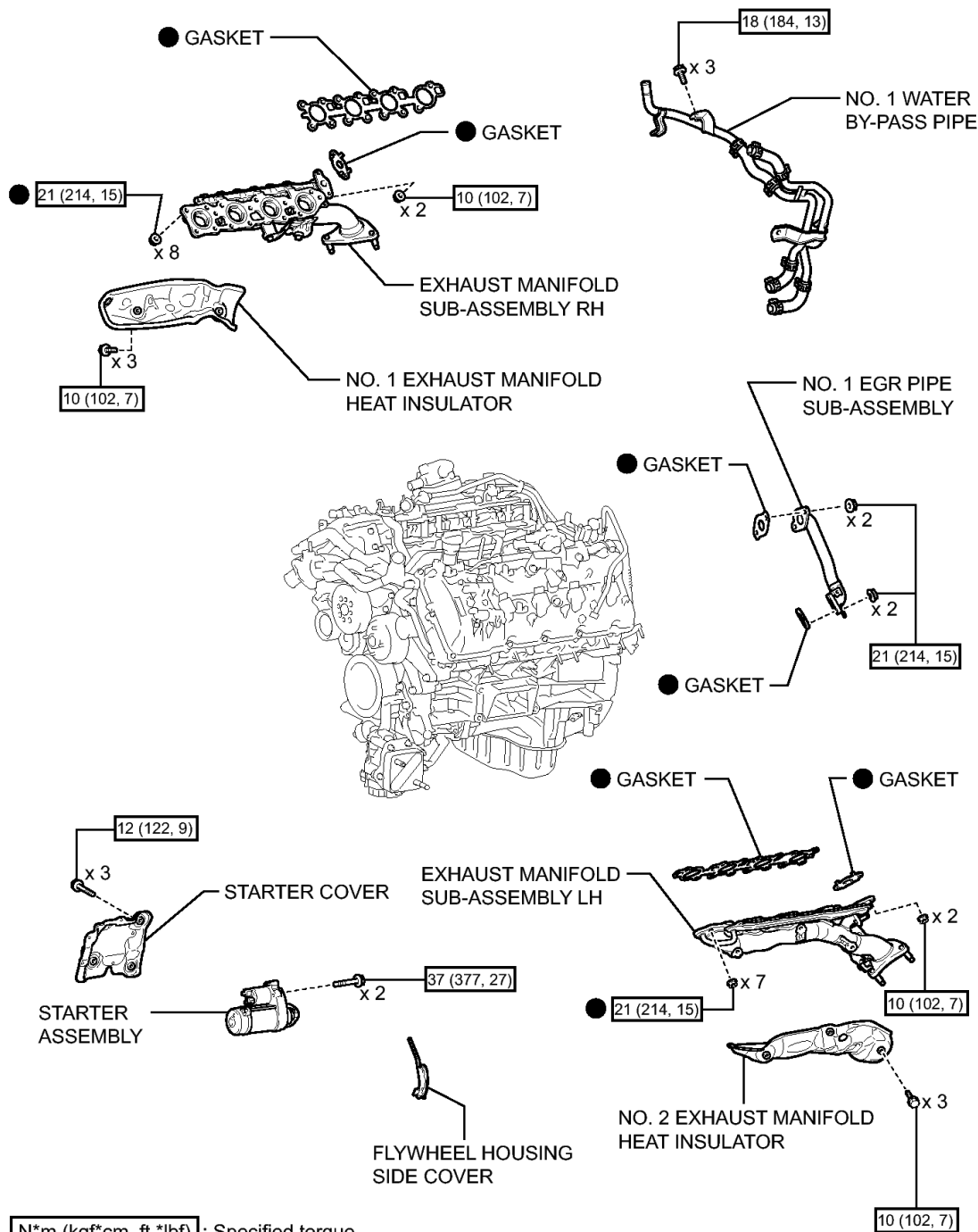
P

**Fig. 115: Identifying Engine Assembly Replacement Components (12 Of 16) With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

## 2012 Toyota Sequoia Limited

2012 ENGINE Engine Mechanical (1UR-FE) (Service Information) - Sequoia



N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

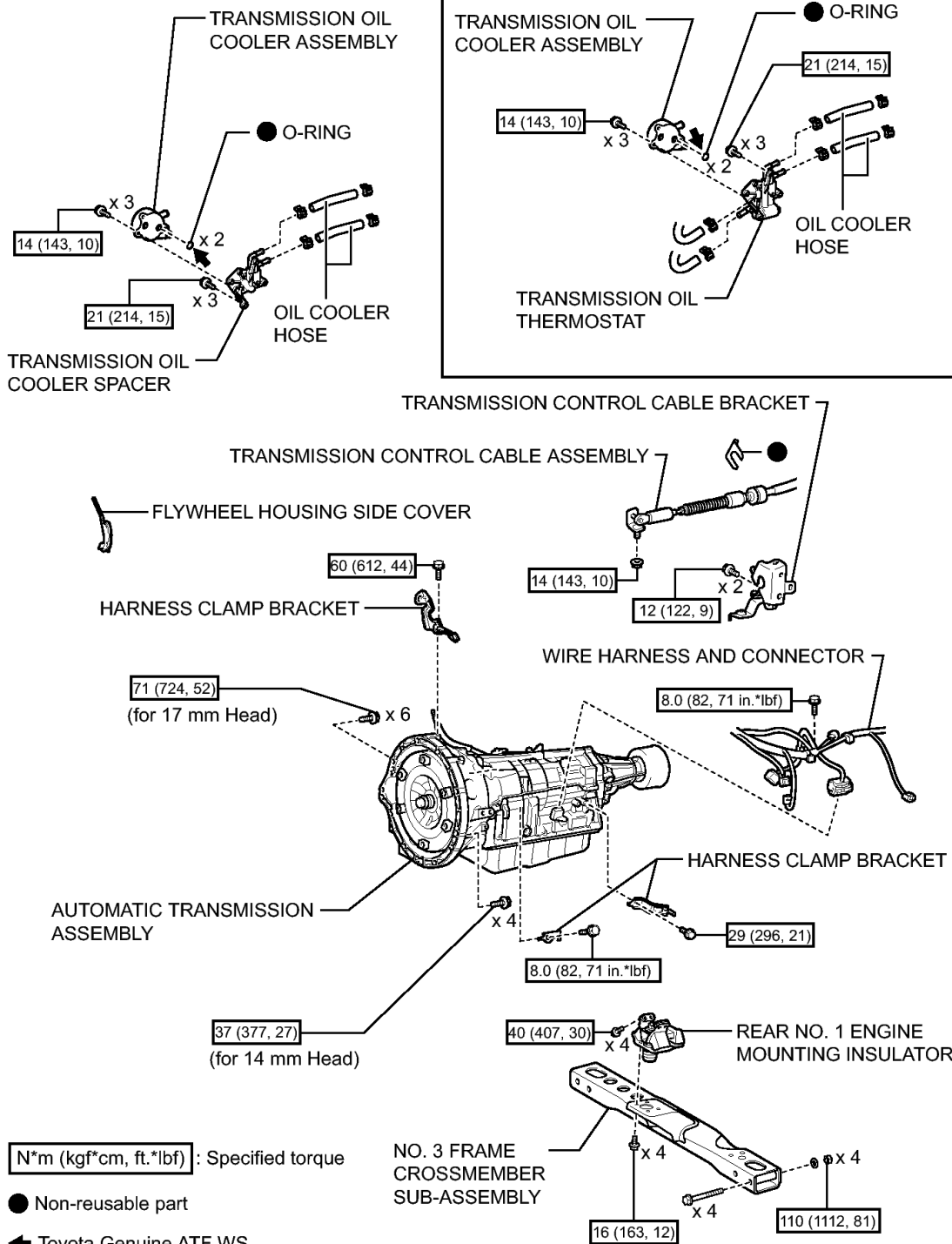
P

**Fig. 116: Identifying Engine Assembly Replacement Components (13 Of 16) With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

for 2WD:

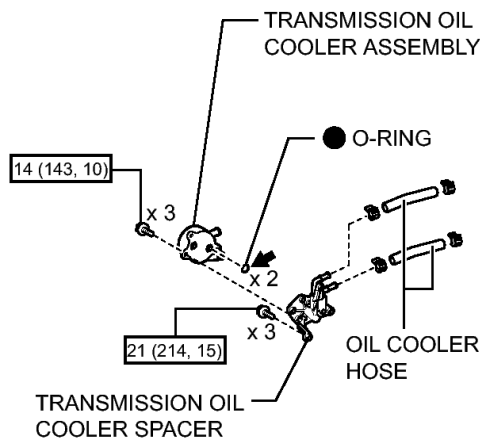
w/ Trailer Towing System:



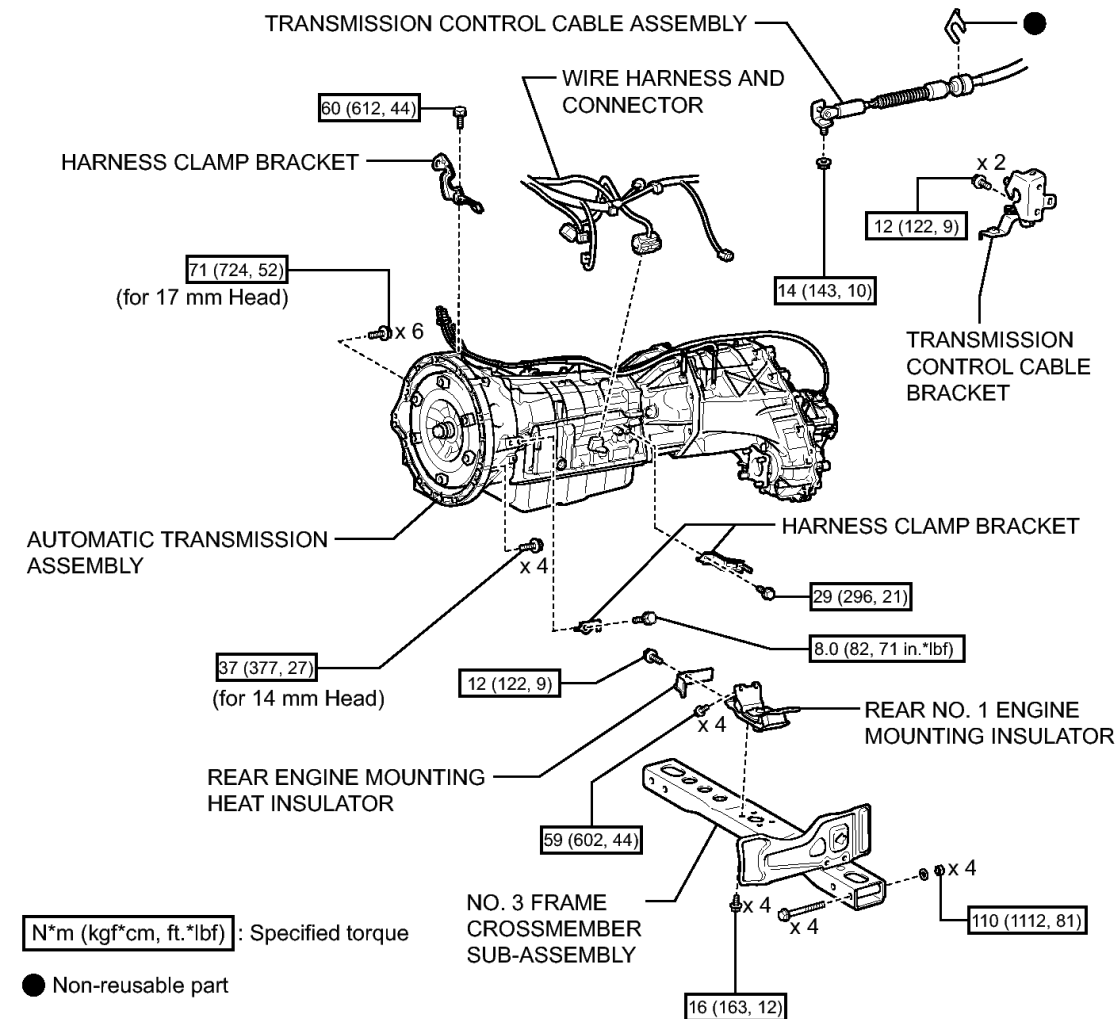
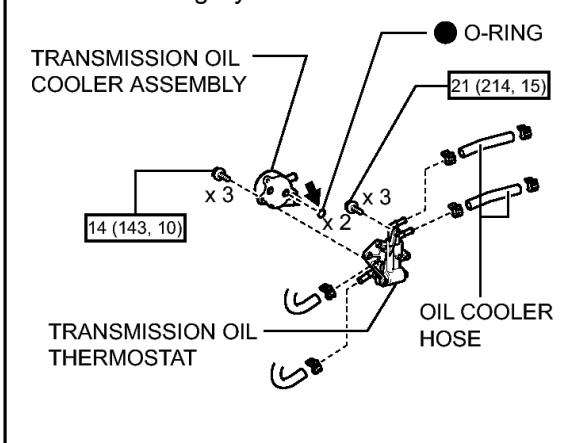
**Fig. 117: Identifying Engine Assembly Replacement Components (14 Of 16) With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

for 4WD:



w/ Trailer Towing System:



N\*m (kgf\*cm, ft.\*lbf) : Specified torque

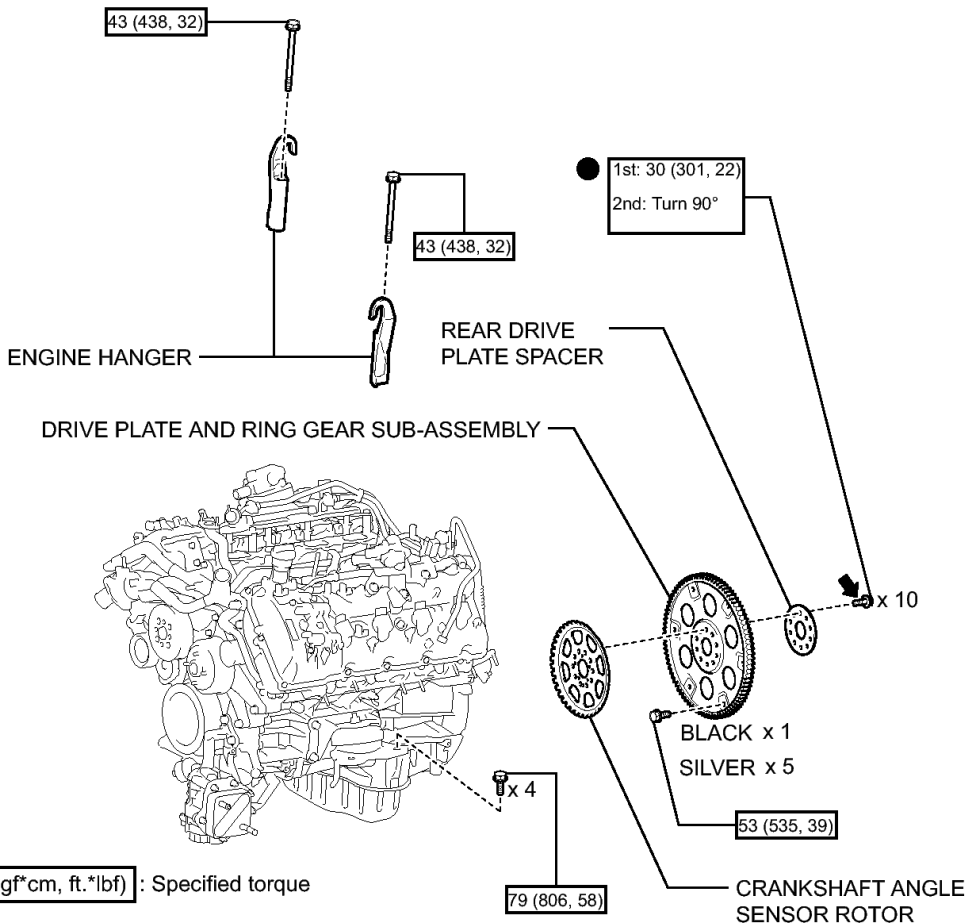
● Non-reusable part

◀ Toyota Genuine ATF WS

P

**Fig. 118: Identifying Engine Assembly Replacement Components (15 Of 16) With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



**Fig. 119: Identifying Engine Assembly Replacement Components (16 Of 16) With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

## REMOVAL

### 1. PRECAUTION

**NOTE:** After turning the ignition switch off, waiting time may be required before disconnecting the cable from the battery terminal. Therefore, make sure to read the disconnecting the cable from the battery terminal notice before proceeding with work. Refer to PRECAUTION.

2. **DISCHARGE FUEL SYSTEM PRESSURE**. Refer to REMOVAL - Step 2

3. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

**WARNING:** Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to disable the SRS system.

**NOTE:** When disconnecting the cable some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION .

4. **REMOVE FRONT WIPER MOTOR AND LINK ASSEMBLY**

- a. Remove the front wiper motor and link. Refer to REMOVAL .

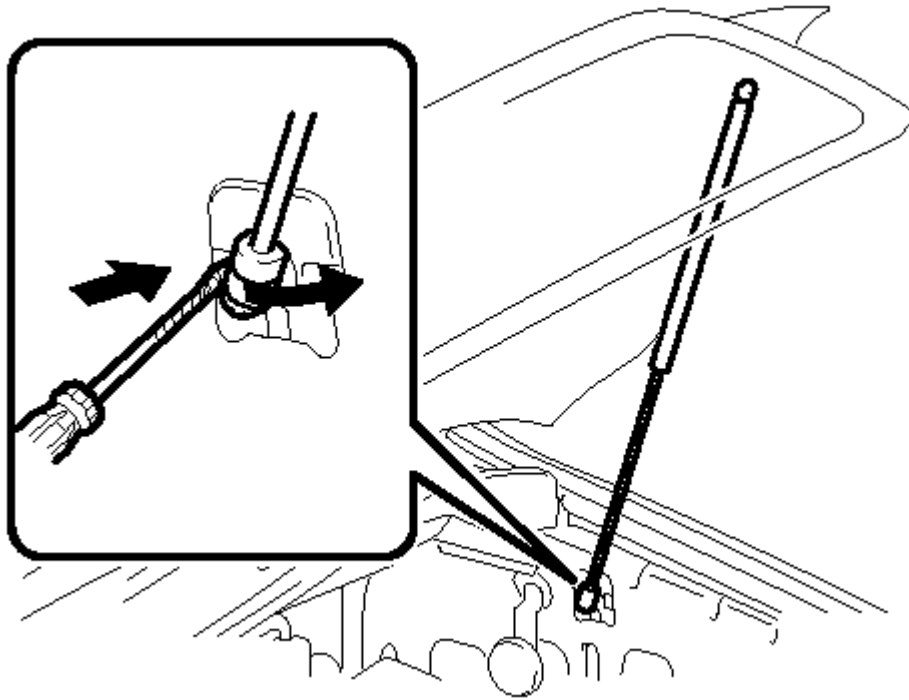
5. **REMOVE NO. 1 ENGINE UNDER COVER** . Refer to REPLACEMENT - Step 2

6. **DRAIN ENGINE OIL** . Refer to REPLACEMENT - Step 1

7. **DRAIN ENGINE COOLANT** . Refer to REPLACEMENT - Step 2

8. **REMOVE HOOD SUB-ASSEMBLY**

- a. Using a screwdriver, release the 2 clips and remove the 2 hood supports assembly.



**T**

**Fig. 120: Release The 2 Clips And Remove The 2 Hood Supports Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Tape the screwdriver tip before use.

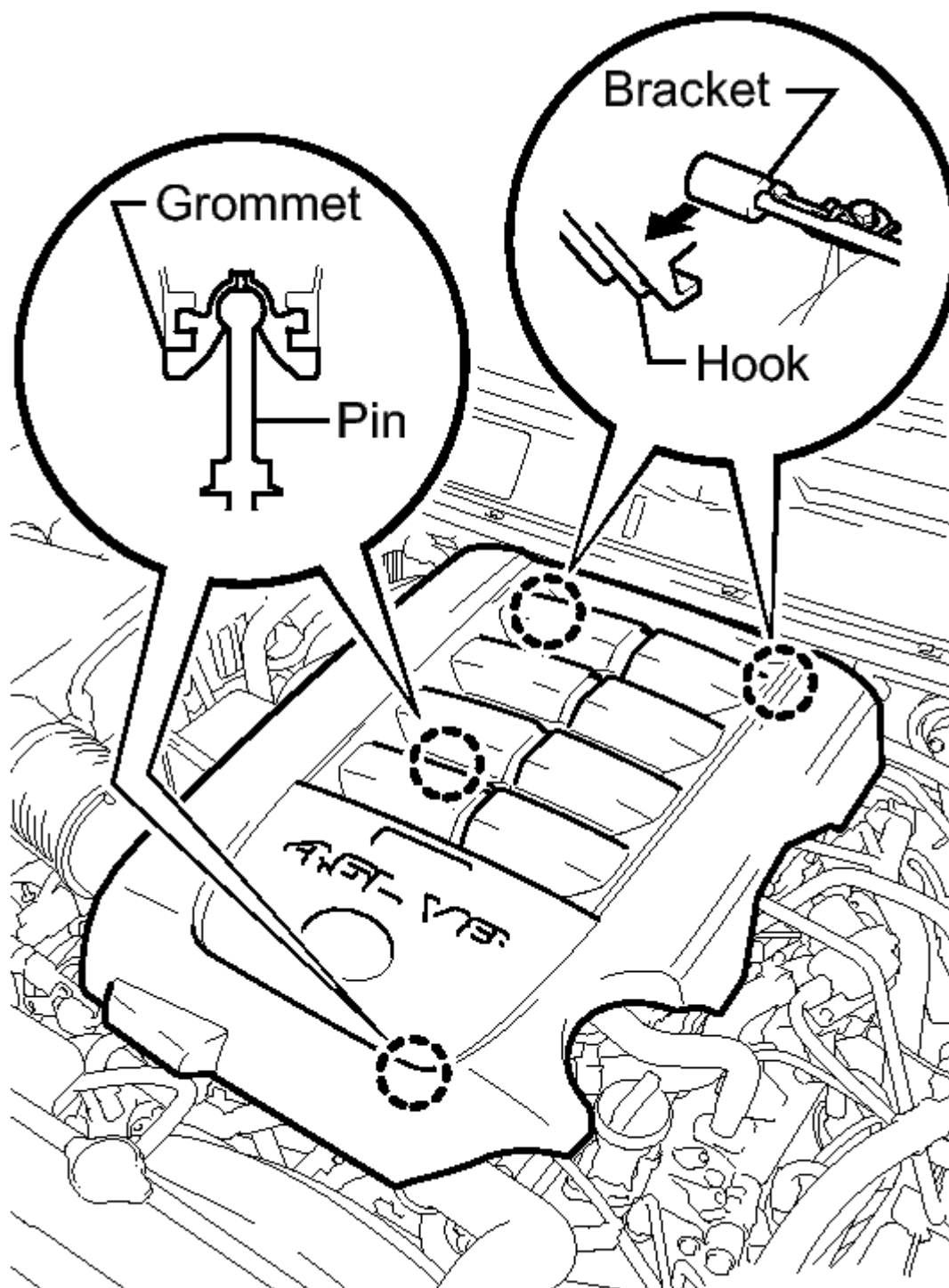
**WARNING:** Remove the hood support assembly while supporting the hood by hand.



- b. Remove the 4 bolts and hood.

**9. REMOVE V-BANK COVER SUB-ASSEMBLY**

- a. Raise the front of the V-bank cover to detach the 2 pins. Then remove the 2 V-bank cover hooks from the bracket, and remove the V-bank cover.



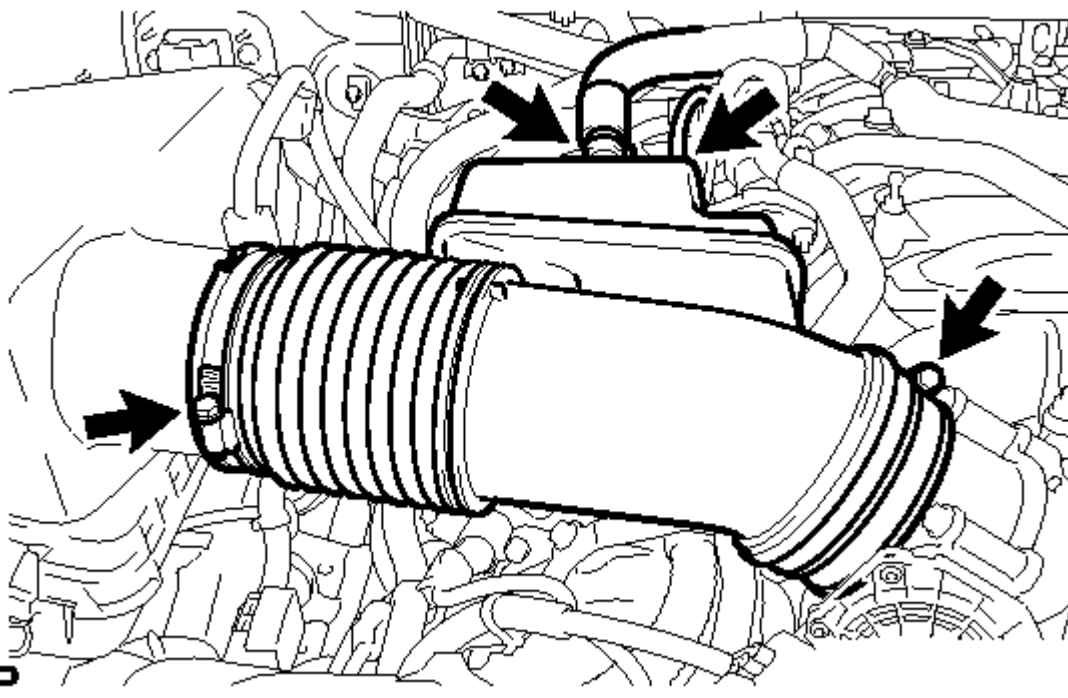
**P**

**Fig. 121: Detach The 2 Pins**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**10. REMOVE AIR CLEANER HOSE ASSEMBLY**

- a. Disconnect the vacuum sensing hose and ventilation hose.

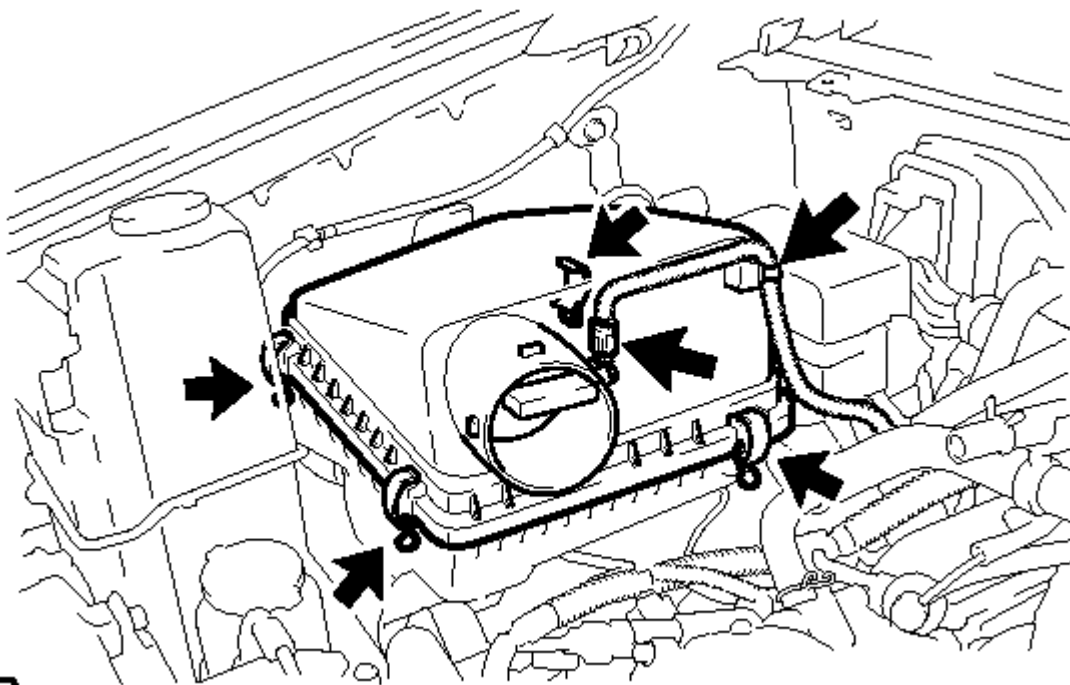
**Fig. 122: Installing The Air Cleaner Hose With The 2 Clamps**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

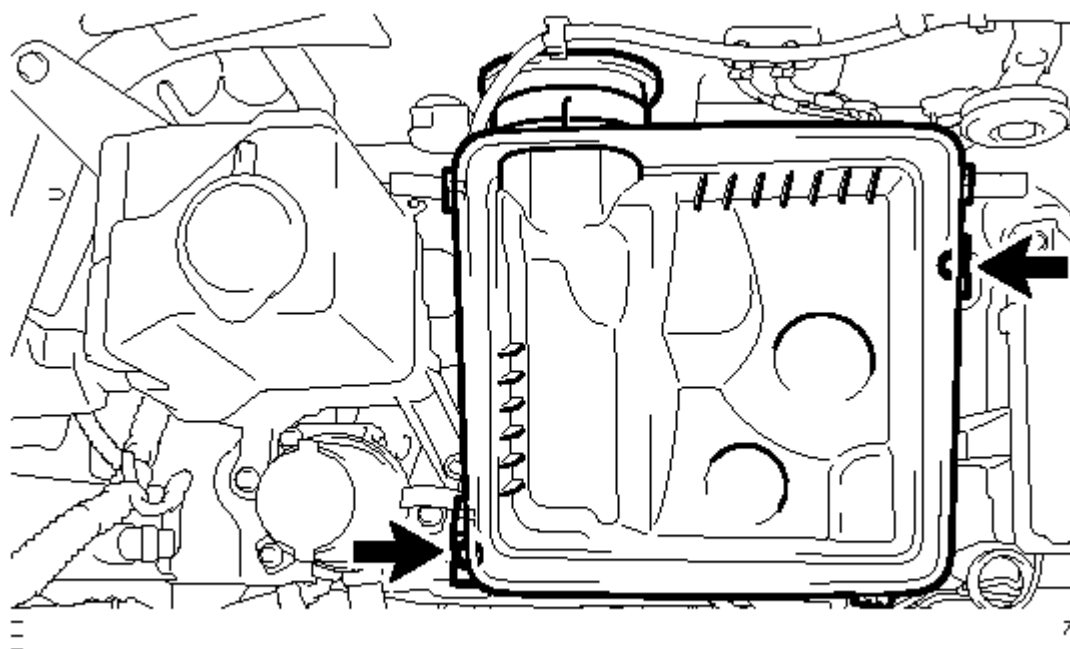
- b. Loosen the 2 clamps.
- c. Remove the air cleaner hose.

**11. REMOVE AIR CLEANER ASSEMBLY**

- a. Remove the air cleaner cap.

**P****Fig. 123: Identifying Air Cleaner Assembly****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

1. Disconnect the MAF meter connector.
  2. Using a clip remover, detach the wire harness clamp.
  3. Unfasten the 4 hook clamps and then remove the air cleaner cap.
- b. Remove the air cleaner element.
- c. Remove the 2 bolts and air cleaner case.



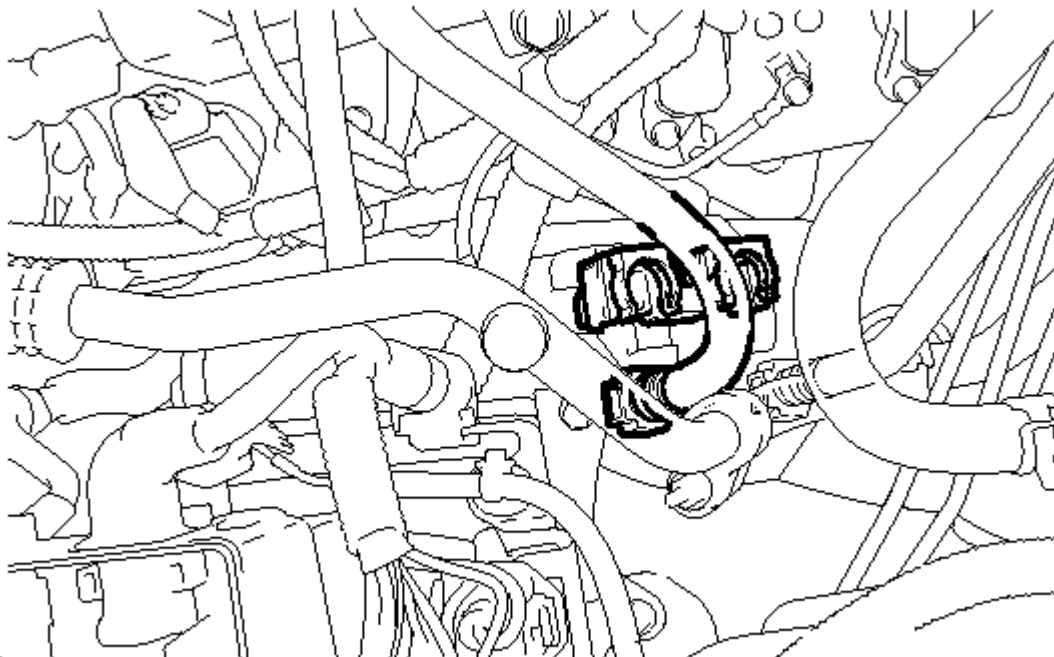
P

**Fig. 124: Identifying Air Cleaner Case With Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **REMOVE COWL TOP OUTER PANEL SUB-ASSEMBLY** . Refer to **REMOVAL - Step 4**
13. **REMOVE FRONT FENDER APRON SEAL RH** . Refer to **REMOVAL - Step 1**
14. **REMOVE FRONT FENDER APRON SEAL REAR RH** . Refer to **REMOVAL - Step 2**
15. **REMOVE FRONT FENDER APRON SEAL LH** . Refer to **REMOVAL - Step 3**
16. **REMOVE FRONT FENDER APRON SEAL REAR LH** . Refer to **REMOVAL - Step 4**
17. **REMOVE FRONT BUMPER COVER**
  - a. Remove the front bumper cover. Refer to **REMOVAL** .
18. **REMOVE INLET RADIATOR HOSE** . Refer to **REMOVAL - Step 6**
19. **DISCONNECT OUTLET RADIATOR HOSE** . Refer to **REMOVAL - Step 6**
20. **REMOVE RADIATOR SIDE DEFLECTOR RH** . Refer to **REMOVAL - Step 9**
21. **REMOVE RADIATOR SIDE DEFLECTOR LH** . Refer to **REMOVAL - Step 10**
22. **REMOVE FAN AND GENERATOR V BELT** See step 3
23. **REMOVE FAN SHROUD** . Refer to **REMOVAL - Step 7**
24. **REMOVE NO. 1 RADIATOR TO SUPPORT SEAL (for LH Side)** . Refer to **REMOVAL - Step 11**
25. **REMOVE NO. 1 RADIATOR TO SUPPORT SEAL (for RH Side)** . Refer to **REMOVAL - Step 12**
26. **REMOVE RADIATOR ASSEMBLY** . Refer to **REMOVAL - Step 13**
27. **DISCONNECT NO. 12 WATER BY-PASS HOSE** . Refer to **REMOVAL - Step 4**
28. **DISCONNECT NO. 13 WATER BY-PASS HOSE** . Refer to **REMOVAL - Step 5**
29. **REMOVE EGR VALVE ASSEMBLY** . Refer to **REMOVAL - Step 6**

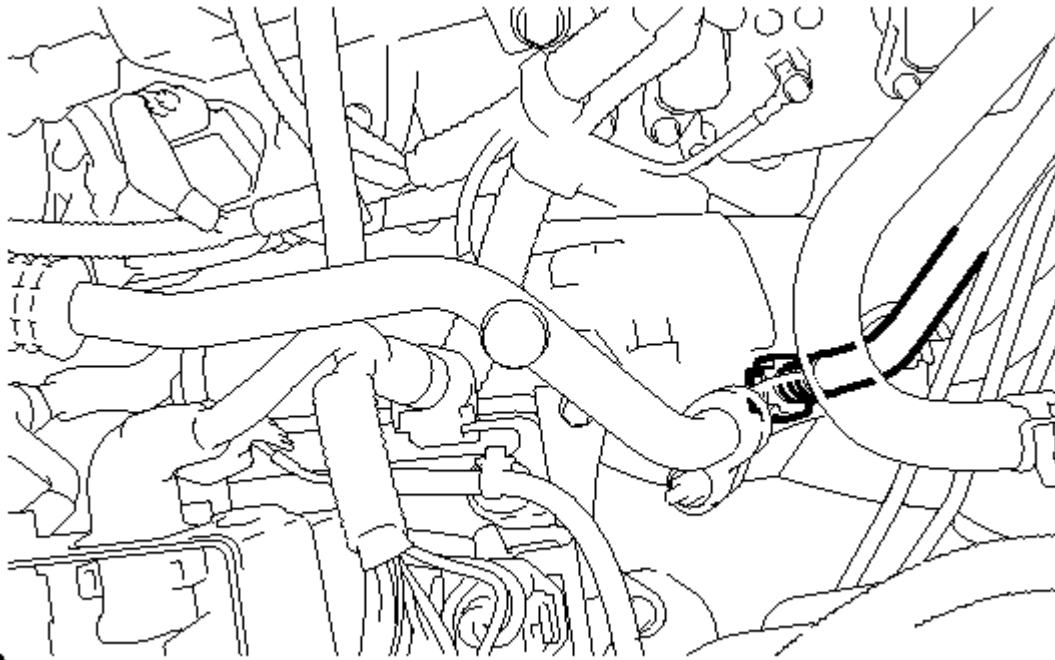
- 30. **REMOVE EGR VALVE BRACKET** . Refer to **REMOVAL - Step 9**
- 31. **REMOVE VENTILATION HOSE ASSEMBLY** . Refer to **REMOVAL - Step 5**
- 32. **REMOVE AIR TUBE SUB-ASSEMBLY LH** . Refer to **REMOVAL - Step 5**
- 33. **REMOVE INTAKE MANIFOLD** . Refer to **REMOVAL - Step 7**
- 34. **DISCONNECT NO. 1 FUEL PIPE SUB-ASSEMBLY**
  - a. Remove the fuel pipe clamp.

**P**

**Fig. 125: Removing The Fuel Pipe Clamp**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Disconnect the No. 1 fuel pipe. Refer to **PRECAUTION** .
- 35. **DISCONNECT NO. 2 FUEL TUBE SUB-ASSEMBLY**



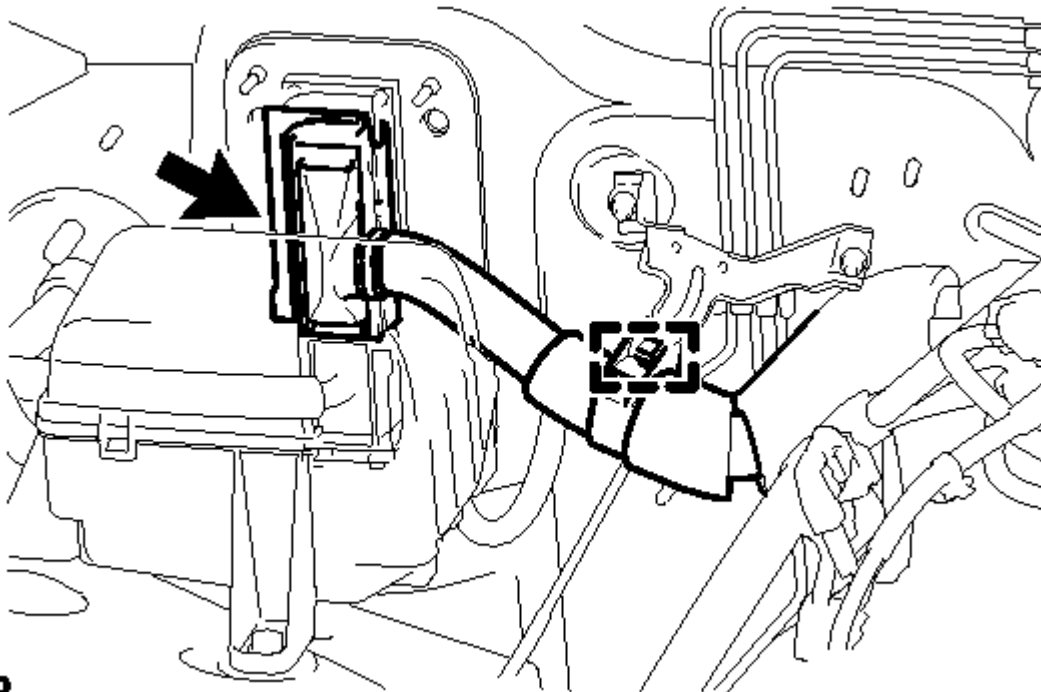
**P**

**Fig. 126: Identifying No. 2 Fuel Tube & Connector**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Disconnect the No. 2 fuel tube. Refer to **PRECAUTION**.

**36. DISCONNECT WIRE HARNESS AND HOSE**



**P**

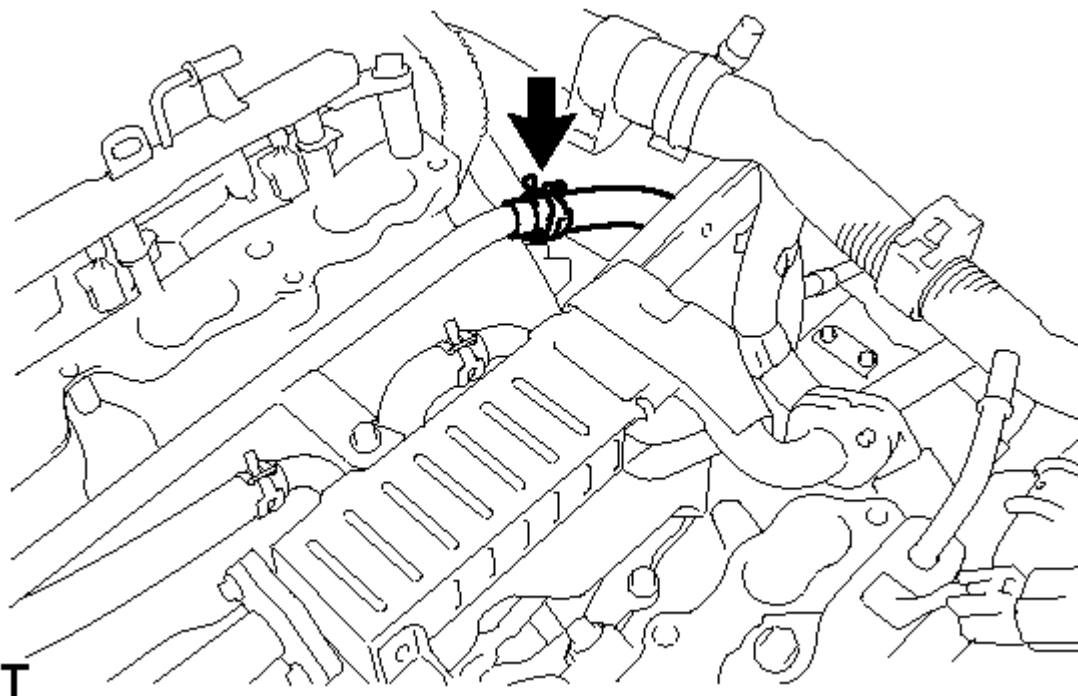
**Fig. 127: Identifying ECM Connector & Clamp**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Disconnect the clamp and ECM connector.

**HINT:**

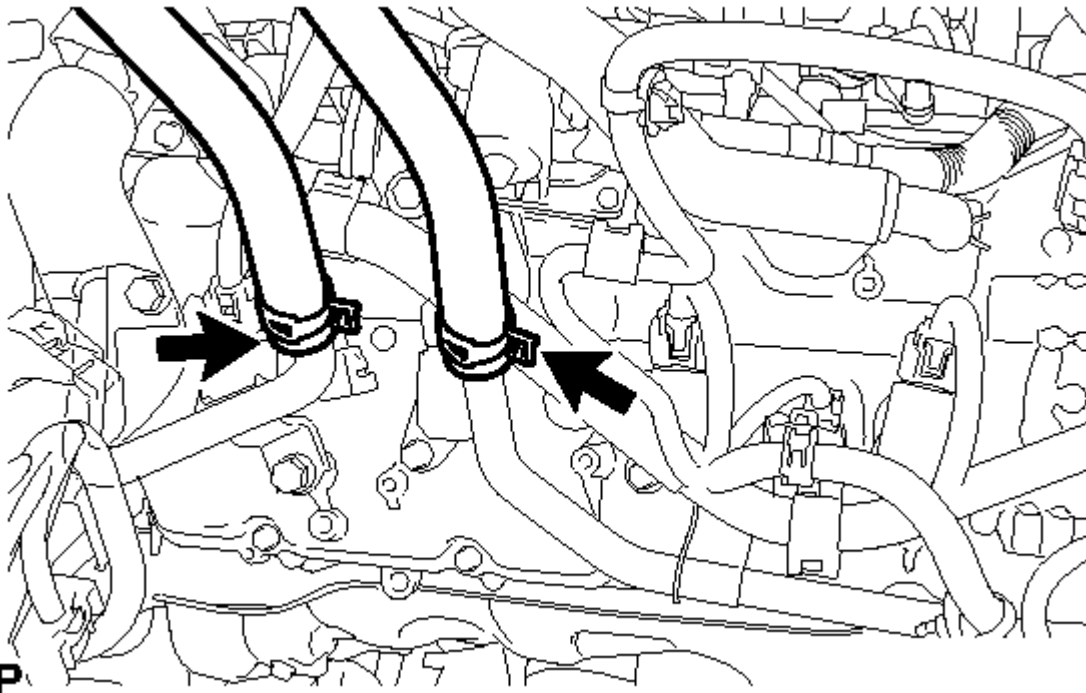
Refer to the following procedures to disconnect the ECM connector. Refer to **REMOVAL - Step 5**.



**Fig. 128: Identifying Water By-Pass Hose**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

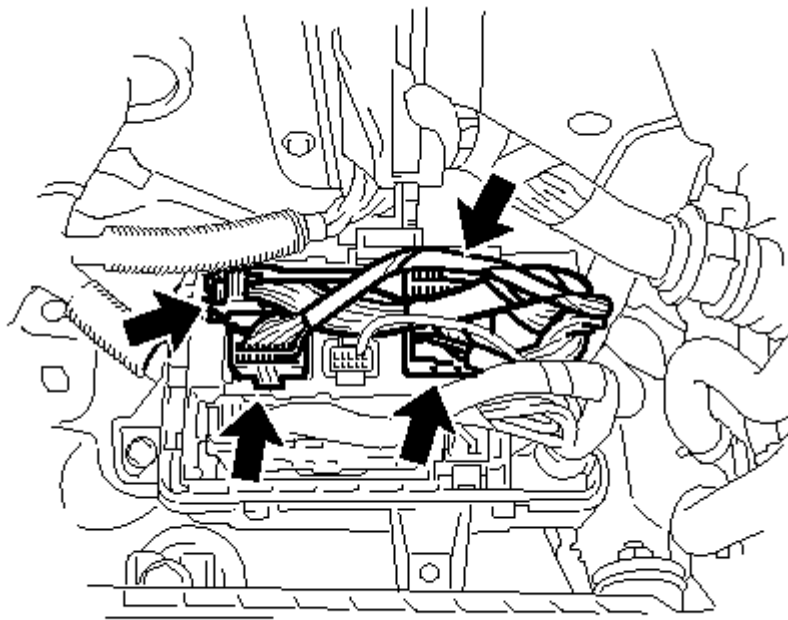
- b. Disconnect the No. 4 water by-pass hose.
- c. Disconnect the 2 heater hoses.



P

**Fig. 129: Identifying Heater Hoses**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



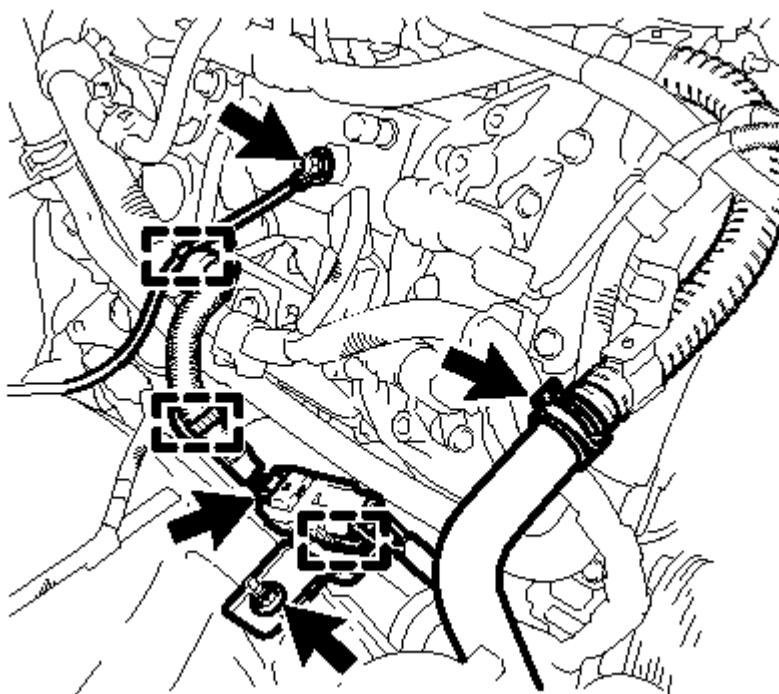
P

**Fig. 130: Locating Connector Holder Block Connectors**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Disconnect the 4 connectors from the connector holder block.

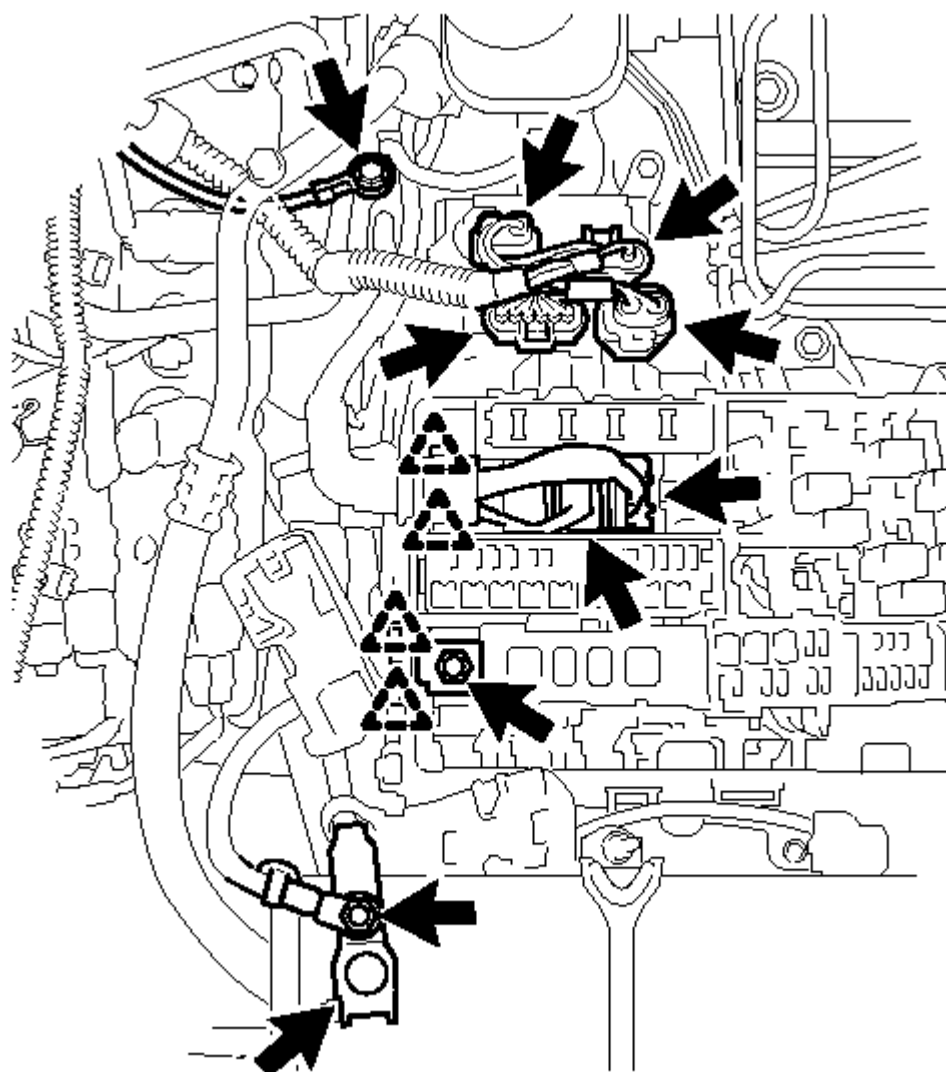




**P**

**Fig. 131: Removing The Bolt And Disconnect The Clamp And Ground Wire**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the bolt and disconnect the clamp and ground wire.
- f. Disconnect the air pump connector and 2 clamps.
- g. Remove the nut and connector bracket.
- h. Disconnect the air injection system hose.
- i. Remove the nut and disconnect the wire from the positive (+) battery cable.



P

**Fig. 132: Locating Air Injection Control Driver Connectors**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Disconnect the cable from the positive (+) battery terminal.
- k. Remove the bolt and disconnect the ground wire.
- l. Disconnect the 4 air injection control driver connectors.
- m. Remove the nut and disconnect the wire and 2 clips from the engine room junction block.
- n. Disconnect the 2 connectors and 2 clips from the engine room junction block.
- 37. **DISCONNECT COOLER COMPRESSOR ASSEMBLY** . Refer to **REMOVAL - Step 14**
- 38. **DISCONNECT VANE PUMP ASSEMBLY** . Refer to **REMOVAL - Step 21**
- 39. **REMOVE GENERATOR ASSEMBLY** . Refer to **REMOVAL - Step 9**
- 40. **REMOVE PROPELLER SHAFT ASSEMBLY**
  - a. for 2WD:

Refer to the following procedures. Refer to **REMOVAL** .

b. for 4WD:

Refer to the following procedures. Refer to **REMOVAL** .

**41. REMOVE FRONT PROPELLER SHAFT ASSEMBLY (for 4WD)**

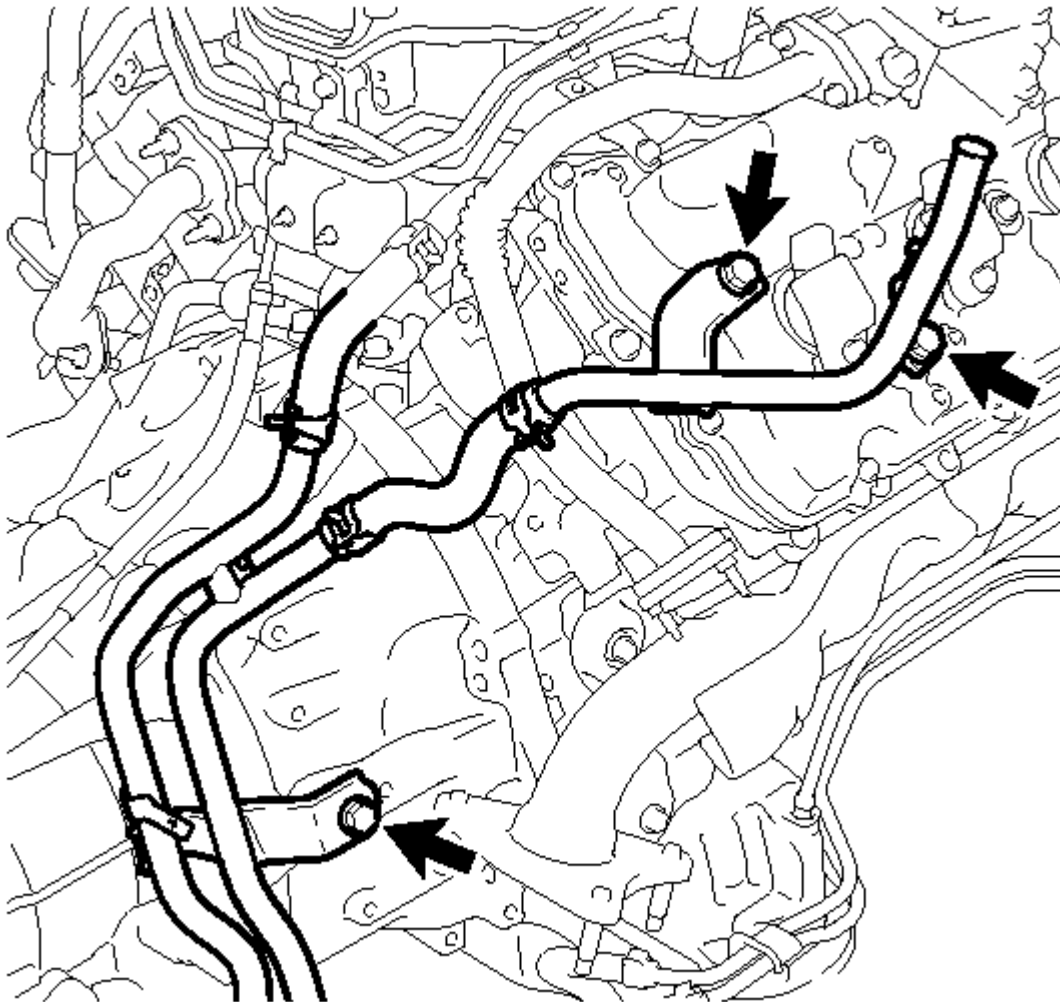
a. Remove the front propeller shaft. Refer to **REMOVAL** .

**42. REMOVE EXHAUST PIPE ASSEMBLY**

a. Remove the exhaust pipe. Refer to **REMOVAL** .

**43. DISCONNECT NO. 1 WATER BY-PASS PIPE**

a. Remove the 3 bolts and disconnect the No. 1 water by-pass pipe.



**P**

**Fig. 133: Removing The 3 Bolts And Disconnect The No. 1 Water By-Pass Pipe**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 44. **REMOVE ENGINE OIL LEVEL DIPSTICK GUIDE** . Refer to **REMOVAL - Step 8**
- 45. **REMOVE NO. 1 EGR PIPE SUB-ASSEMBLY** . Refer to **REMOVAL - Step 13**
- 46. **REMOVE NO. 2 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to **REMOVAL - Step 14**
- 47. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH** . Refer to **REMOVAL - Step 15**
- 48. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to **REMOVAL - Step 16**
- 49. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH** . Refer to **REMOVAL - Step 17**
- 50. **REMOVE STARTER COVER** . Refer to **REMOVAL - Step 4**
- 51. **REMOVE STARTER ASSEMBLY** . Refer to **REMOVAL - Step 5**
- 52. **REMOVE AUTOMATIC TRANSMISSION ASSEMBLY**

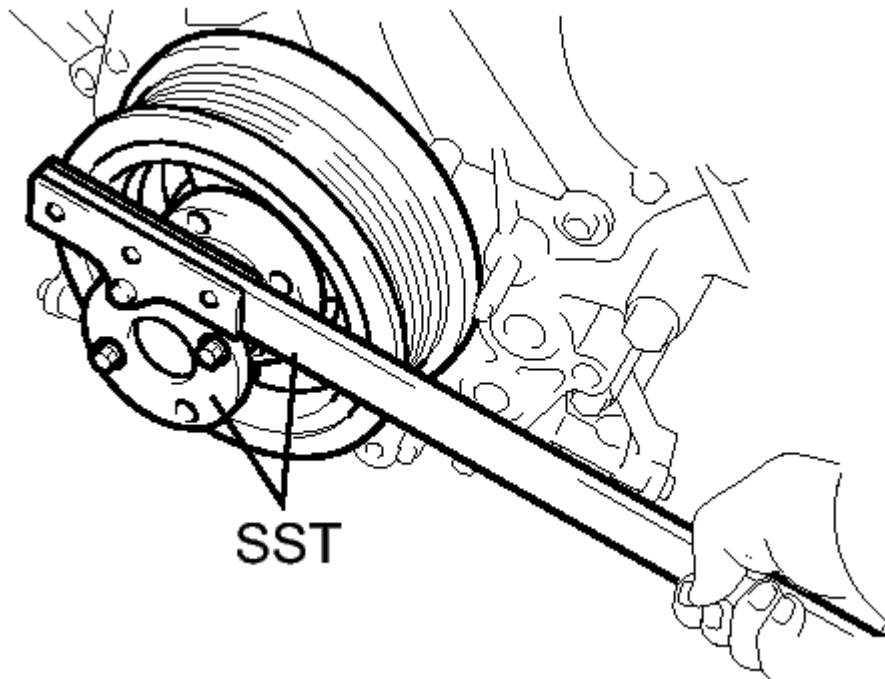
- a. for 2WD:

Refer to the following procedures. Refer to **REMOVAL** .

- b. for 4WD:

Refer to the following procedures. Refer to **REMOVAL** .

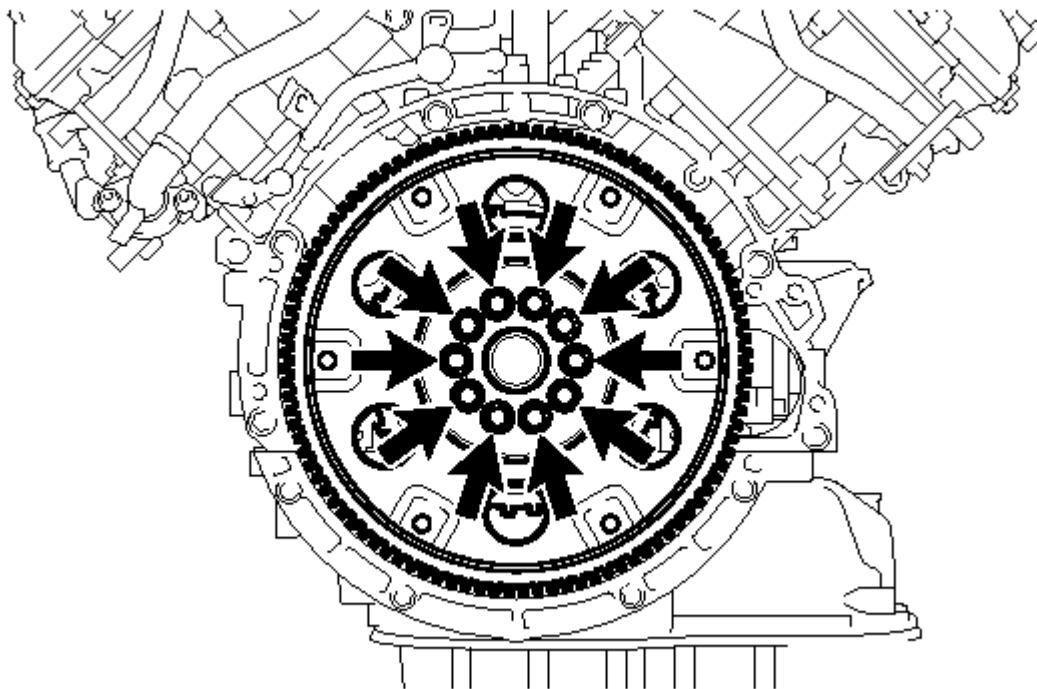
- 53. **REMOVE REAR NO. 1 ENGINE MOUNTING INSULATOR (for 2WD)**
- 54. **REMOVE REAR NO. 1 ENGINE MOUNTING INSULATOR (for 4WD)**
- 55. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY**
  - a. Using SST, hold the crankshaft.



**P**

**Fig. 134: Holding Crankshaft Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09213-70011
  - SST: 09330-00021
- b. Remove the 10 bolts, rear drive plate spacer, drive plate and crankshaft angle sensor rotor.

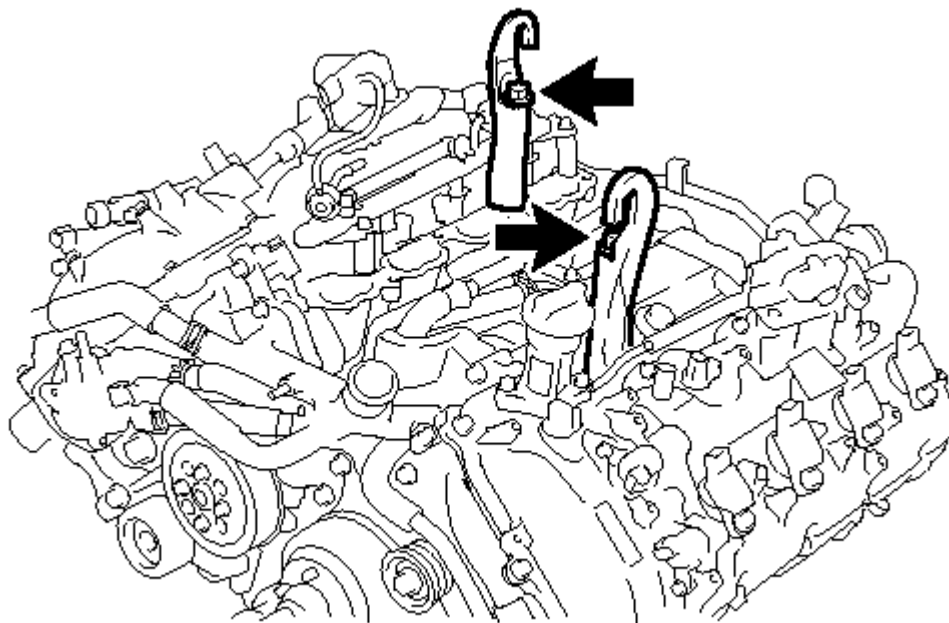
**P**

**Fig. 135: Identifying Bolts On Drive Plate**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 56. REMOVE ENGINE ASSEMBLY

- a. Install 2 engine hangers with 2 bolts as shown in the illustration.



**T**

**Fig. 136: Identifying Engine Hangers & Bolts**

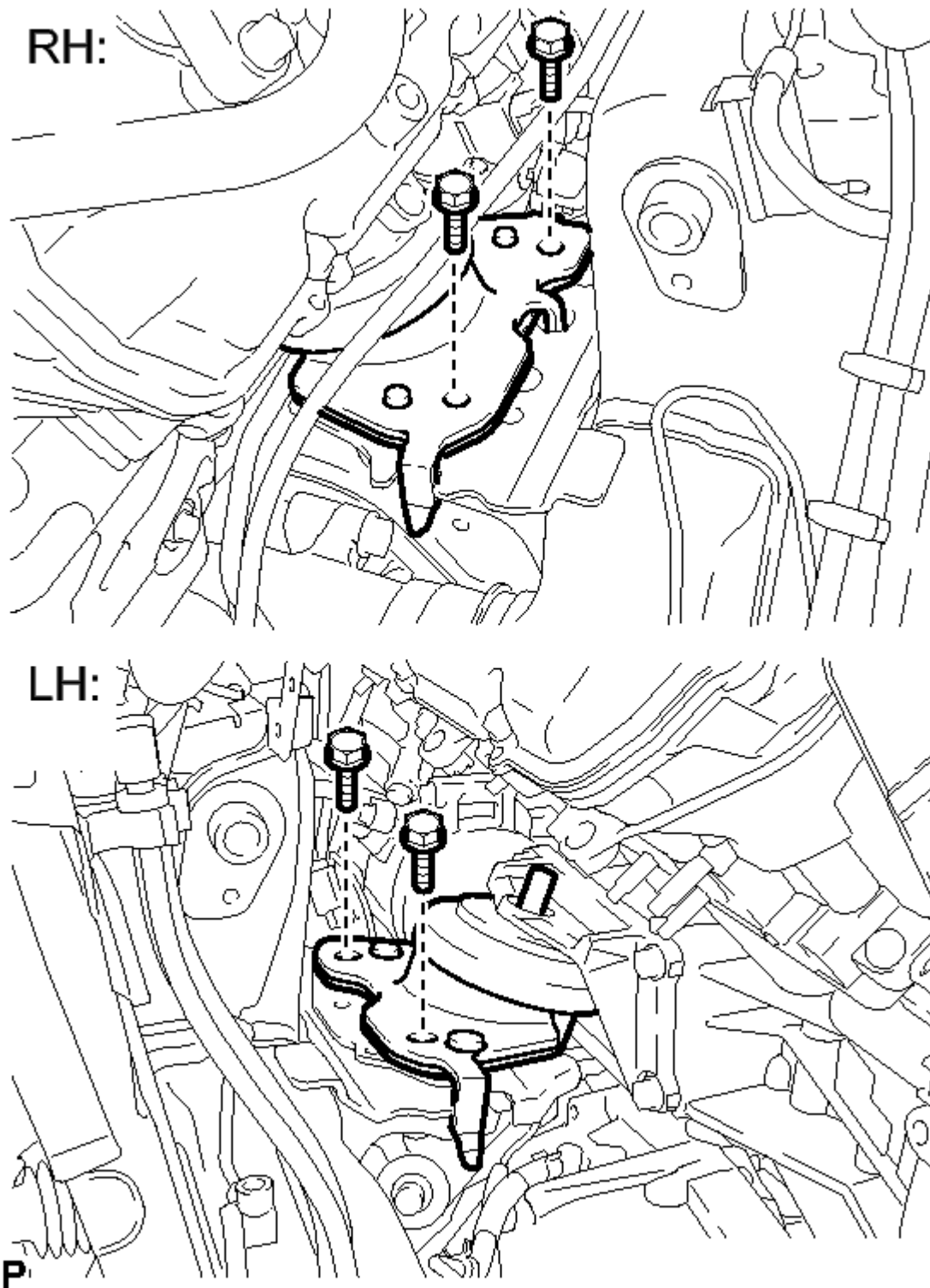
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 43 N\*m (438 kgf\*cm, 32 ft.\*lbf)**

**HINT:**

Engine hanger	12281-38150
Bolt	90119-A0166

- b. Attach an engine sling device and hang the engine with a chain block.
- c. Remove the 4 engine mounting insulator bolts.



**Fig. 137: Removing the 4 Engine Mounting Insulator Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Lift the engine out from the vehicle slowly and carefully.

**NOTE:** Make sure the engine is clear of all wiring, hoses and cables.

### 57. INSTALL ENGINE TO ENGINE STAND

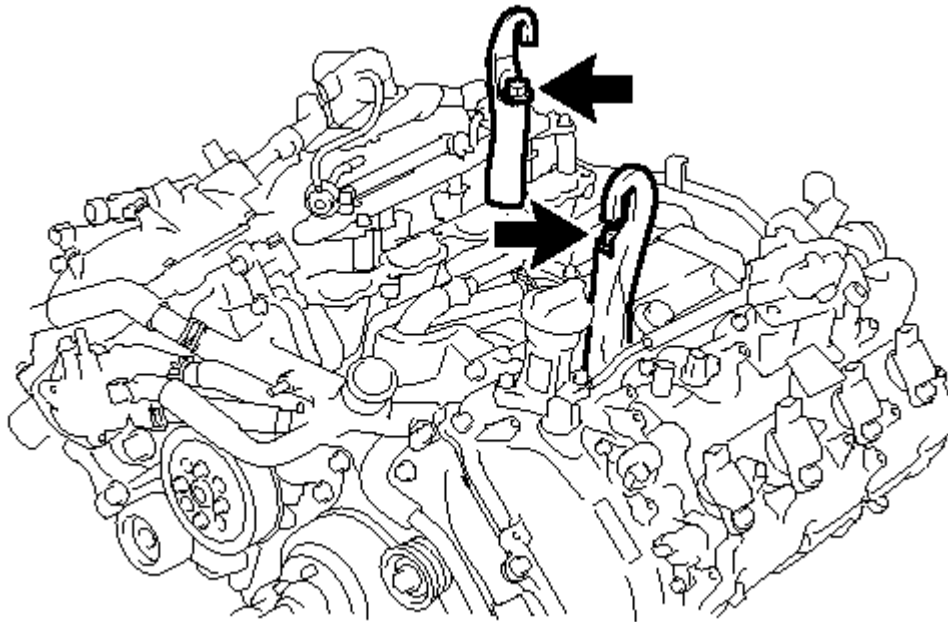
- Install the engine to an engine stand with the bolts.
- Remove the 2 bolts and 2 engine hangers.

## INSTALLATION

### INSTALLATION

#### 1. REMOVE ENGINE FROM ENGINE STAND

- Install the 2 engine hangers with the 2 bolts as shown in the illustration.



**T**

**Fig. 138: Identifying Engine Hangers & Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque:** 43 N\*m (438 kgf\*cm, 32 ft.\*lbf)

#### **HINT:**

Engine hanger	12281-38150
Bolt	90119-A0166

- Attach an engine sling device and hang the engine with a chain block.



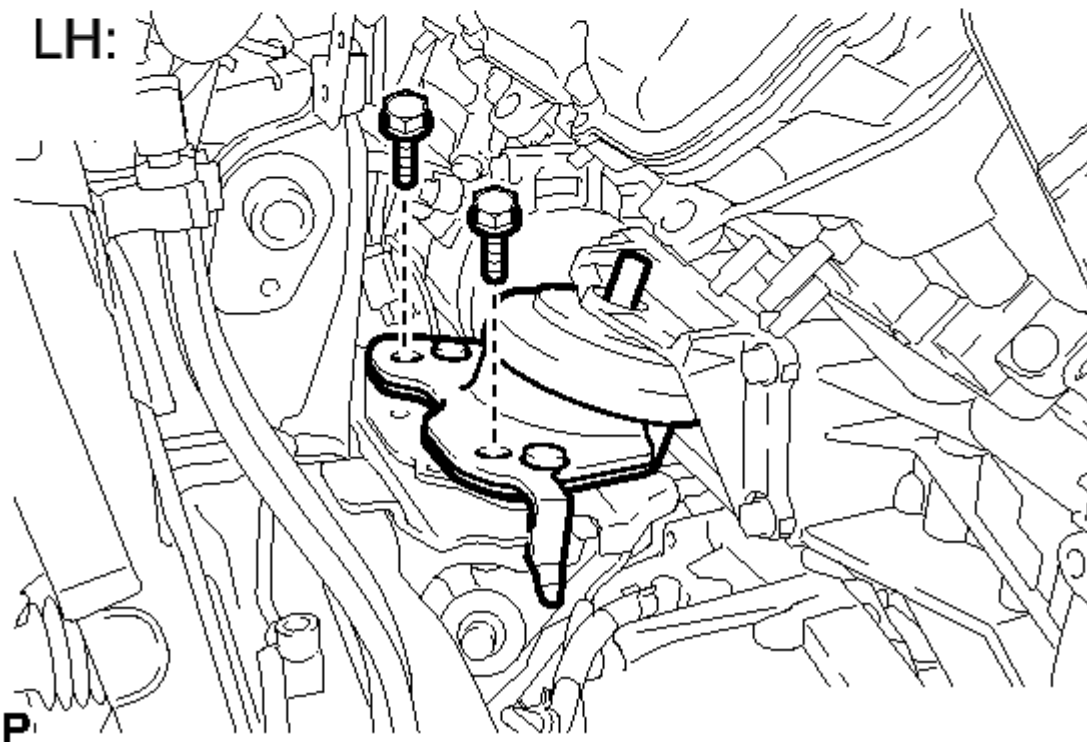
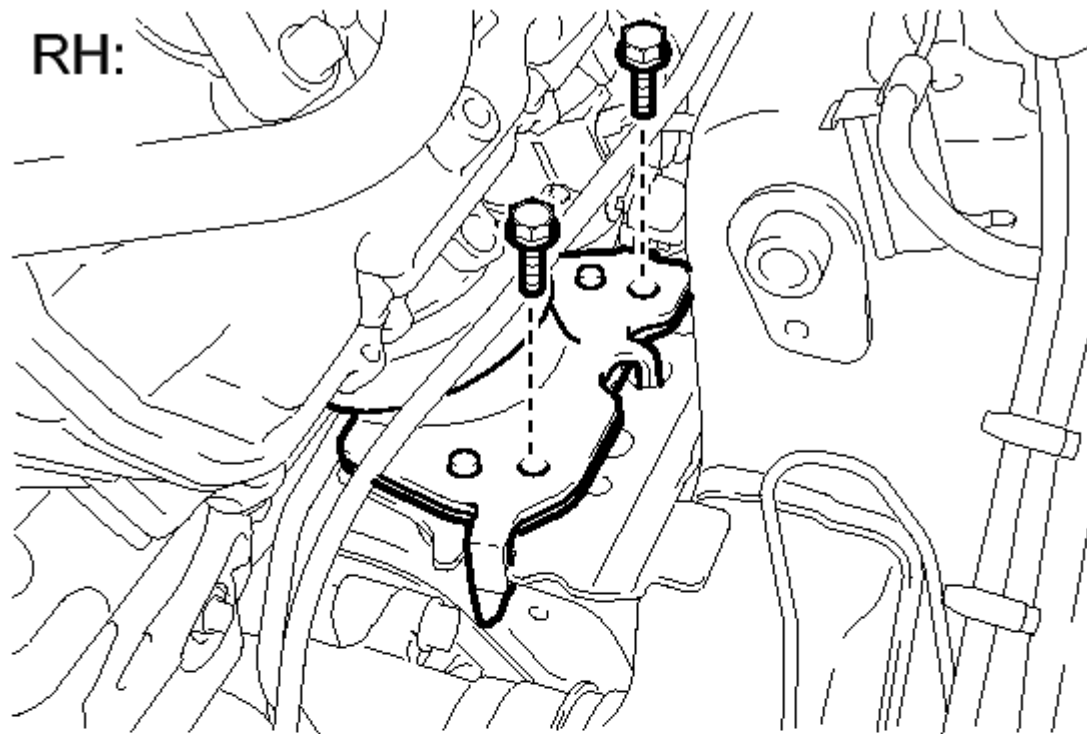
- c. Remove the bolts and engine assembly from the engine stand.

## **2. INSTALL ENGINE ASSEMBLY**

- a. Slowly lower the engine assembly into the engine compartment.

**NOTE:**        **Make sure that the engine is clear of all wiring and hoses.**

- b. Attach the engine mounting insulators to the vehicle.
- c. Install the 4 engine mounting insulator bolts.



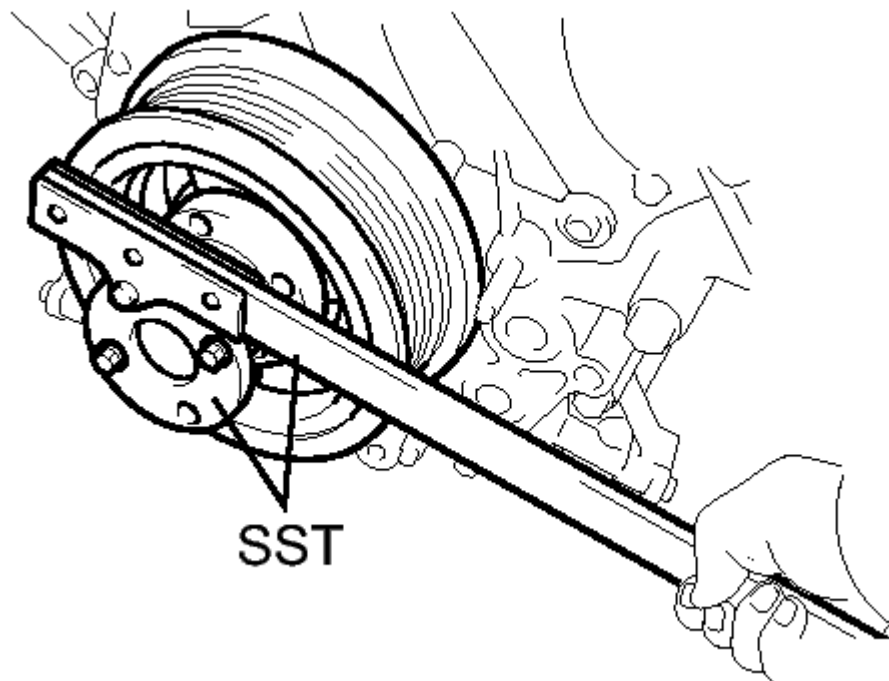
**Fig. 139: Removing the 4 Engine Mounting Insulator Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 79 N\*m (806 kgf\*cm, 58 ft.\*lbf)**

d. Remove the 2 bolts and 2 engine hangers.

**3. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY**

a. Using SST, hold the crankshaft.

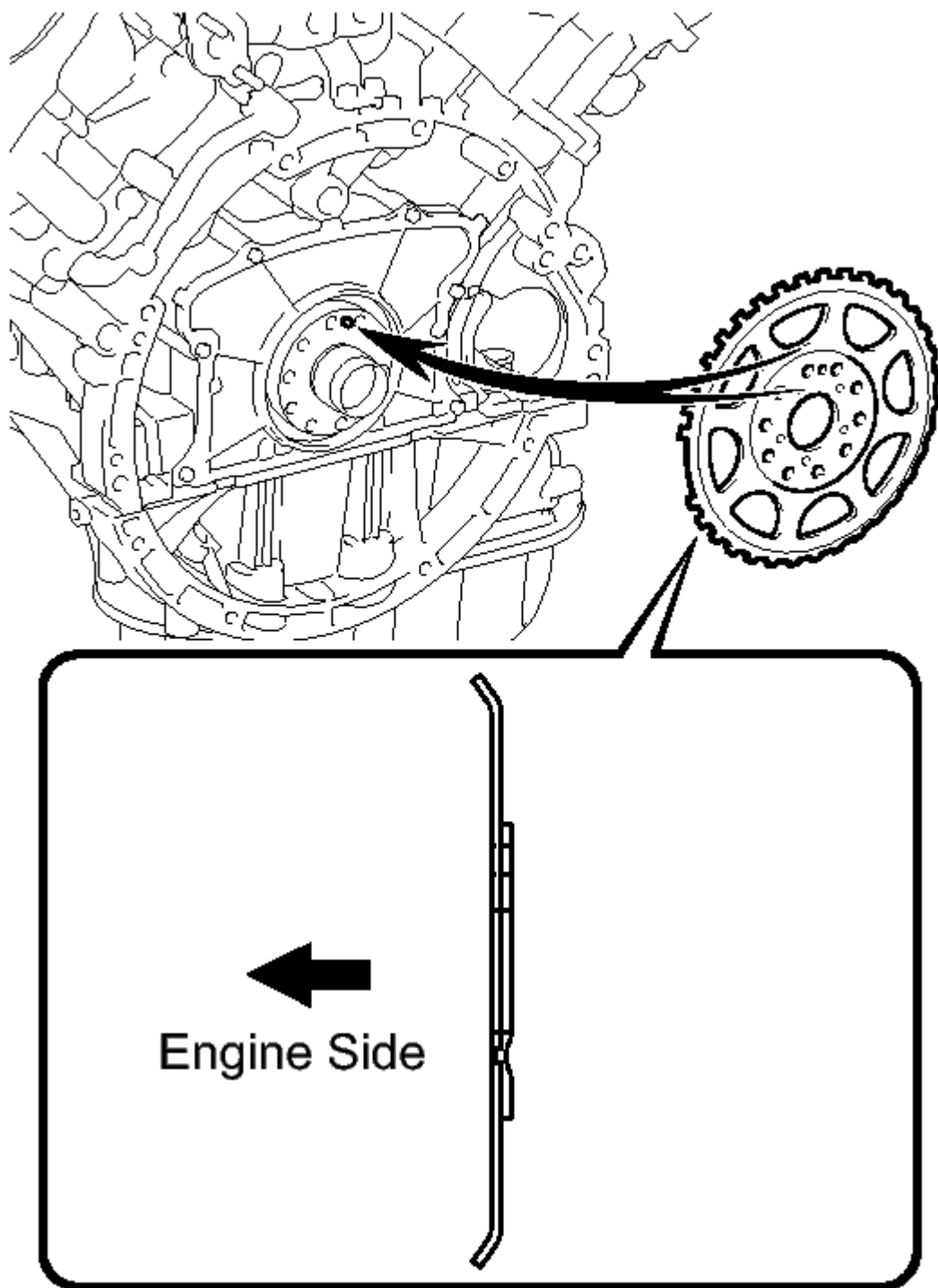


**P**

**Fig. 140: Holding Crankshaft Using SST**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09213-70011
- SST: 09330-00021



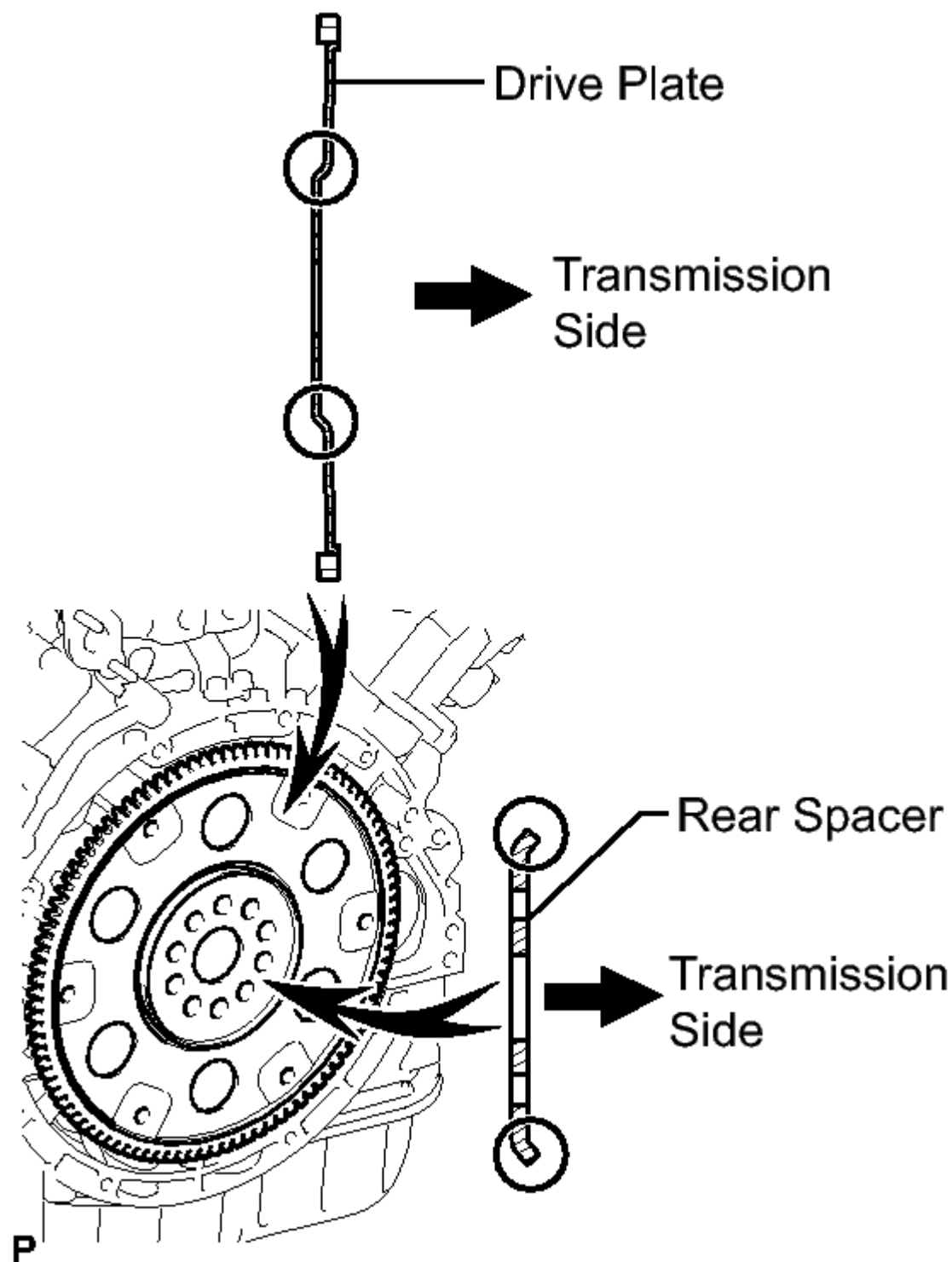
**P**

**Fig. 141: Identifying Pin Hole Of Angle Sensor Rotor & Crankshaft Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the crankshaft angle sensor rotor.

**HINT:**

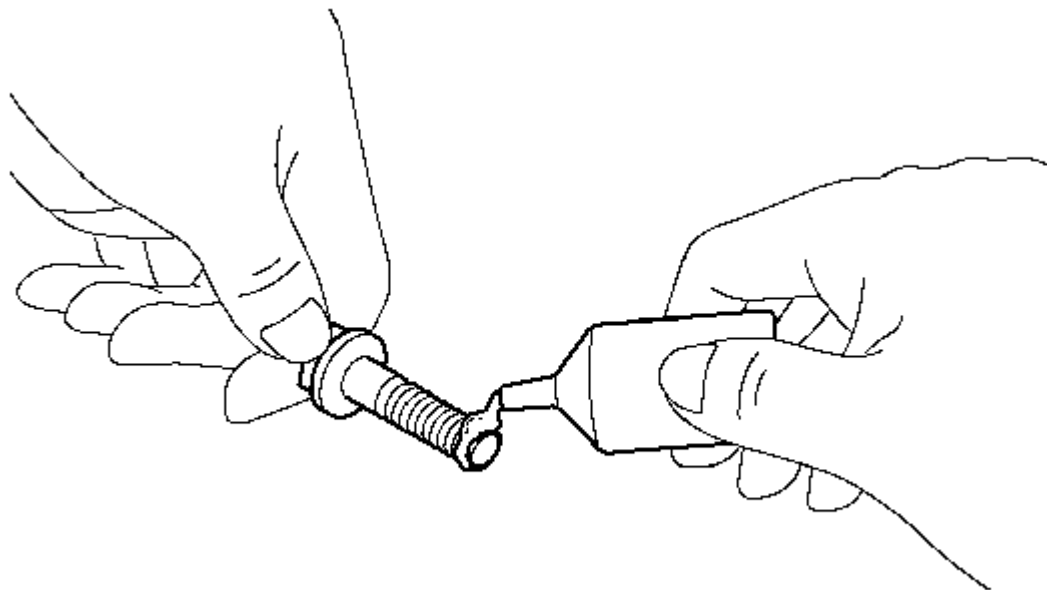
Align the pin hole of the crankshaft angle sensor rotor with the pin of the crankshaft.



**Fig. 142: Identifying Drive Plate & Rear Drive Plate Spacer**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the drive plate and rear drive plate spacer onto the crankshaft.



Y

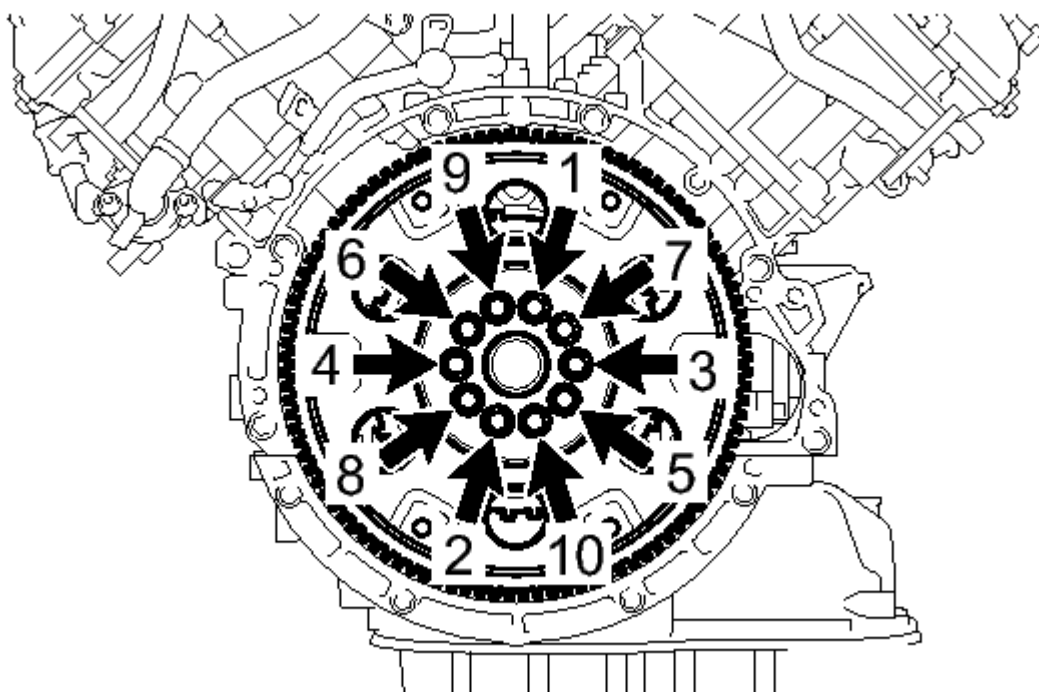
**Fig. 143: Applying Adhesive To 2 Or 3 Threads Of The 8 Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply adhesive to 2 or 3 threads of the 8 bolts.

Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- e. Install and uniformly tighten 10 new bolts in the sequence shown in the illustration.



**P**

**Fig. 144: Identifying Drive Plate Tightening Sequence**

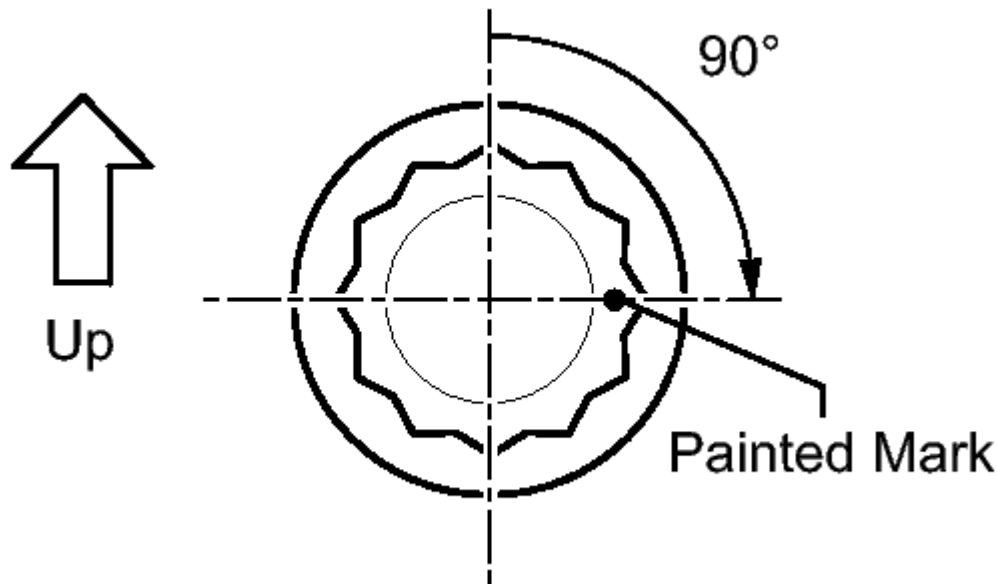
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 30 N\*m (301 kgf\*cm, 22 ft.\*lbf)**

**NOTE:**

- Do not reuse the drive plate installation bolts.
- Do not strike or damage the drive plate installation bolts. Be sure to handle them carefully.

f. Mark the top of each drive plate installation bolt with paint.



**P**

**Fig. 145: Retightening Drive Plate Installation Bolts By 90 Degrees**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Tighten the drive plate installation bolts 90° as shown in the illustration.
- h. Check that the painted marks are now at a 90° angle to the top.
- 4. **INSTALL REAR NO. 1 ENGINE MOUNTING INSULATOR (for 4WD)**
- 5. **INSTALL REAR NO. 1 ENGINE MOUNTING INSULATOR (for 2WD)**
- 6. **INSTALL AUTOMATIC TRANSMISSION ASSEMBLY**
  - a. for 2WD:

Refer to the following procedures. Refer to INSTALLATION .

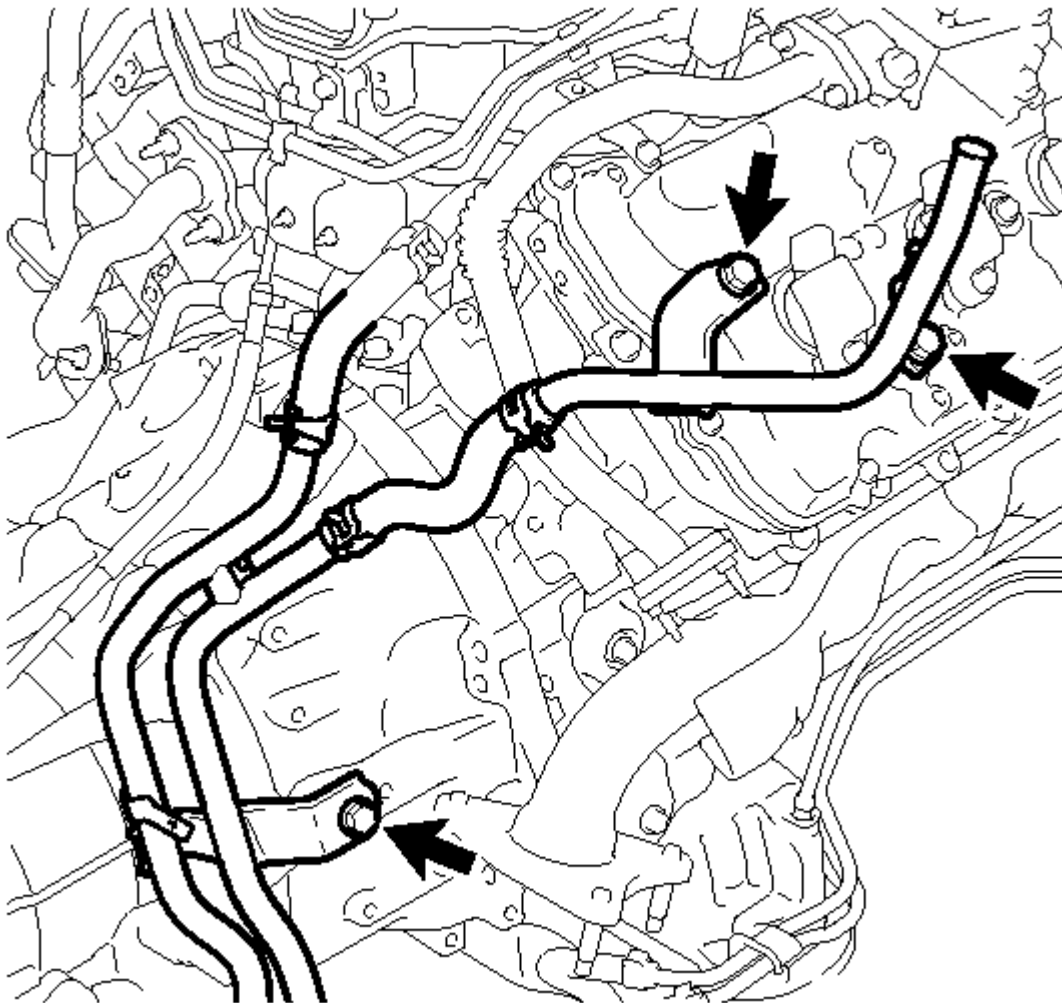
- b. for 4WD:

Refer to the following procedures. Refer to INSTALLATION .

- 7. **INSTALL STARTER ASSEMBLY** . Refer to INSTALLATION - Step 1
- 8. **INSTALL STARTER COVER** . Refer to INSTALLATION - Step 2
- 9. **INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH** . Refer to INSTALLATION - Step 1
- 10. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to INSTALLATION - Step 2
- 11. **INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH** . Refer to INSTALLATION - Step 3
- 12. **INSTALL NO. 2 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to INSTALLATION - Step 4
- 13. **INSTALL NO. 1 EGR PIPE SUB-ASSEMBLY** . Refer to INSTALLATION - Step 5



14. **INSTALL ENGINE OIL LEVEL DIPSTICK GUIDE** . Refer to **INSTALLATION - Step 12**
15. **CONNECT NO. 1 WATER BY-PASS PIPE**
  - a. Connect the No. 1 water by-pass pipe with the 3 bolts.



**P**

**Fig. 146: Removing The 3 Bolts And Disconnect The No. 1 Water By-Pass Pipe**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 18 N\*m (184 kgf\*cm, 13 ft.\*lbf)**

16. **INSTALL EXHAUST PIPE ASSEMBLY**
  - a. Install the exhaust pipe. Refer to **INSTALLATION** .
17. **INSTALL FRONT PROPELLER SHAFT ASSEMBLY (for 4WD)**
  - a. Install the front propeller shaft. Refer to **INSTALLATION** .
18. **INSTALL PROPELLER SHAFT ASSEMBLY**

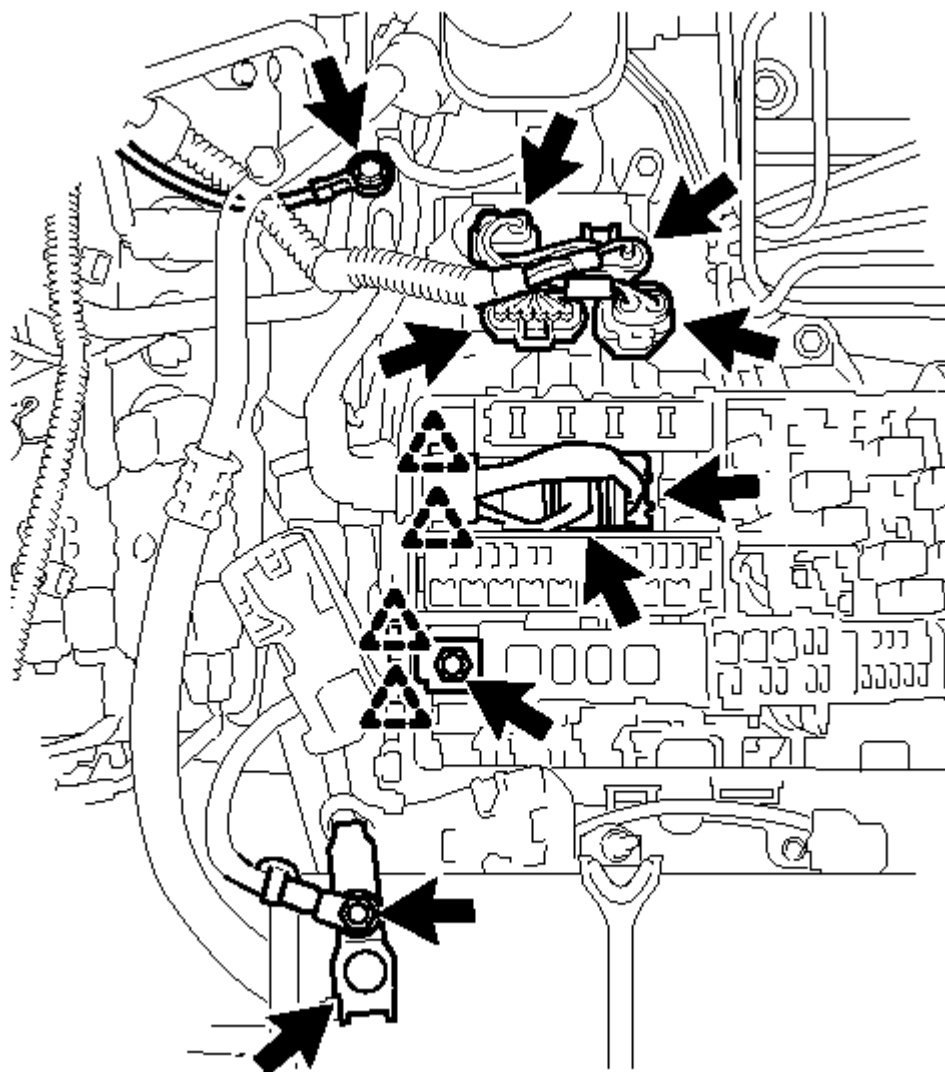
- a. for 2WD:

Refer to the following procedures. Refer to **INSTALLATION** .

- b. for 4WD:

Refer to the following procedures. Refer to **INSTALLATION** .

19. **INSTALL GENERATOR ASSEMBLY** . Refer to **INSTALLATION - Step 1**
20. **CONNECT VANE PUMP ASSEMBLY** . Refer to **INSTALLATION - Step 22**
21. **CONNECT COOLER COMPRESSOR ASSEMBLY** . Refer to **INSTALLATION - Step 29**
22. **CONNECT WIRE HARNESS AND HOSE**
  - a. Connect the 2 connectors and 2 clips to the engine room junction block.



**P**

**Fig. 147: Locating Air Injection Control Driver Connectors**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the engine wire with the nut. Then connect the 2 clips.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

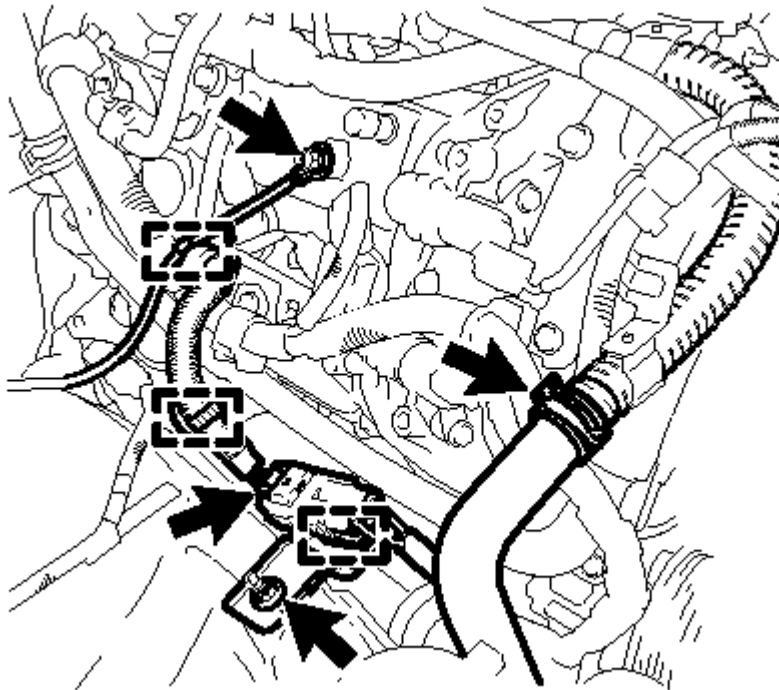
- c. Connect the 4 air injection control driver connectors.
- d. Install the ground wire with the bolt.

**Torque: 8.0 N\*m (82 kgf\*cm, 71 in.\*lbf)**

- e. Connect the cable to the positive (+) battery terminal.
- f. Install the wire to the positive (+) battery cable with the nut.

**Torque: 13 N\*m (133 kgf\*cm, 10 ft.\*lbf)**

- g. Connect the air injection system hose.



**P**

**Fig. 148: Removing The Bolt And Disconnect The Clamp And Ground Wire**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

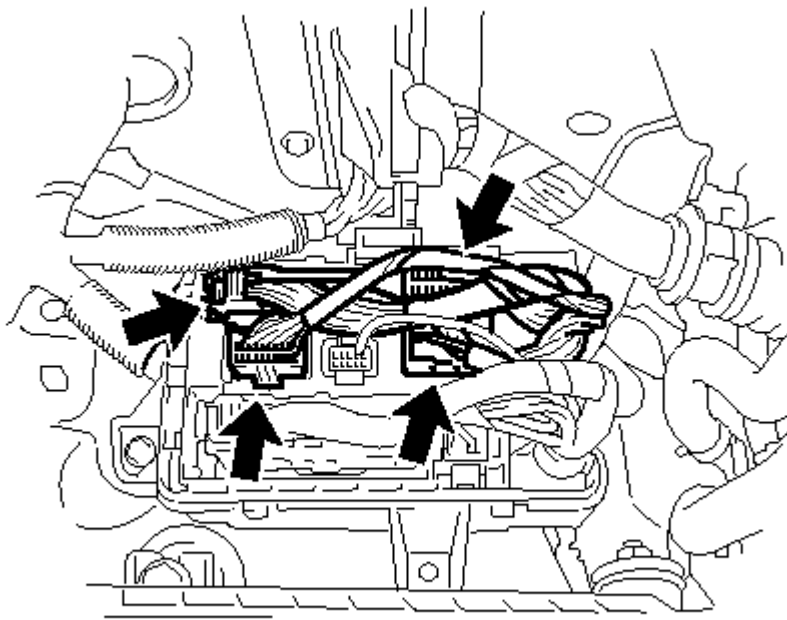
- h. Install the connector bracket with the nut.

**Torque: 6.0 N\*m (61 kgf\*cm, 53 in.\*lbf)**

- i. Connect the 2 clamps and air pump connector.

- j. Connect the clamp and ground wire with the bolt.

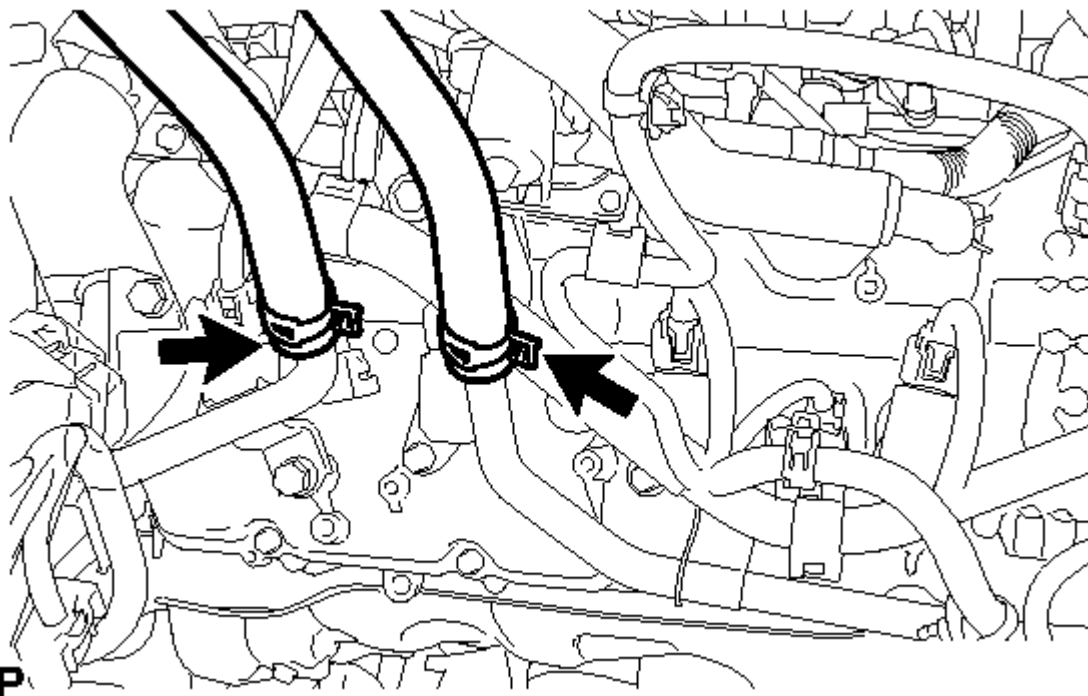
**Torque: 8.0 N\*m (82 kgf\*cm, 71 in.\*lbf)**



**P**

**Fig. 149: Locating Connector Holder Block Connectors**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

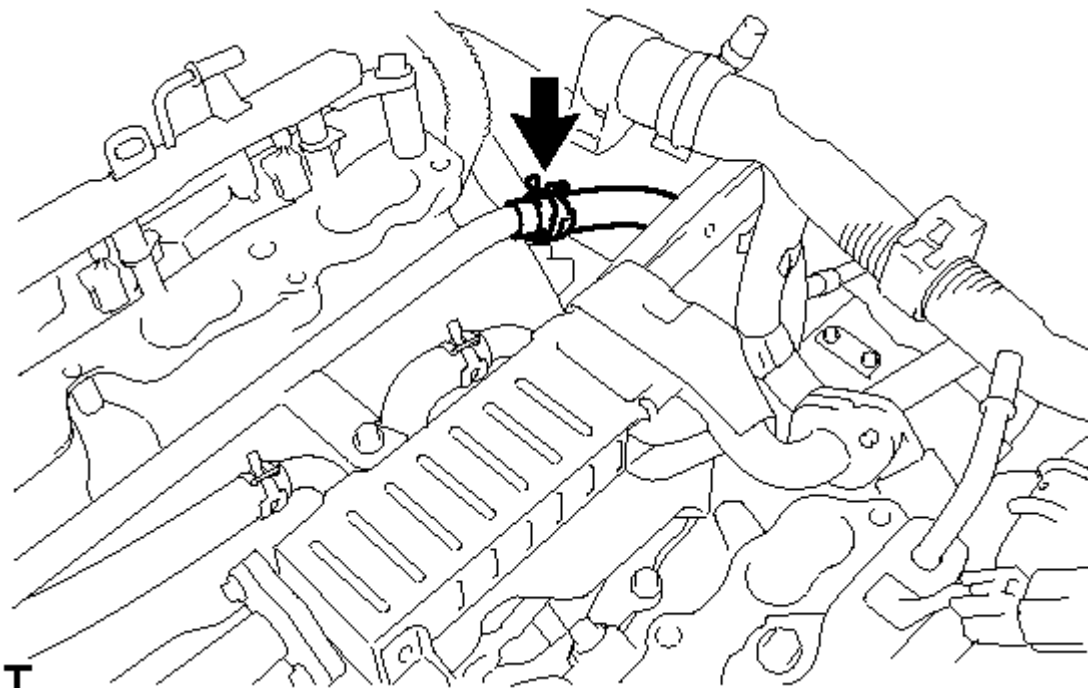
- k. Connect the 4 connectors to the connector holder block.
  - l. Connect the 2 heater hoses.



P

**Fig. 150: Identifying Heater Hoses**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

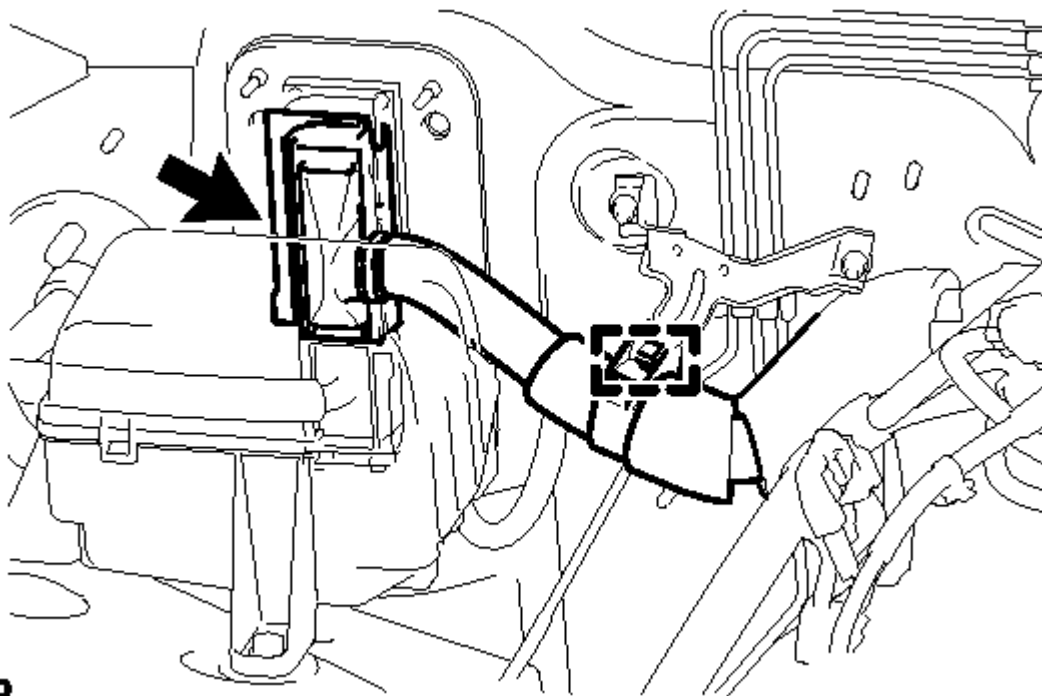


T

**Fig. 151: Identifying Water By-Pass Hose**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Connect the No. 4 water by-pass hose.



**P**

**Fig. 152: Identifying ECM Connector & Clamp**

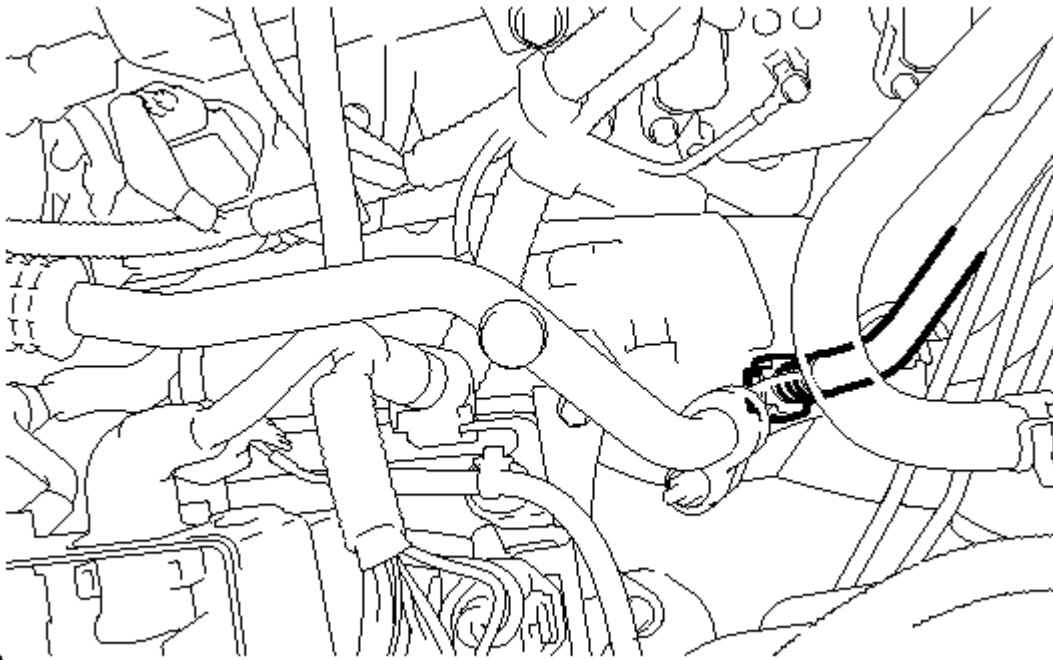
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- n. Connect the ECM connector and clamp.

**HINT:**

Refer to the following procedures to connect the ECM connector. Refer to **INSTALLATION - Step 2** .

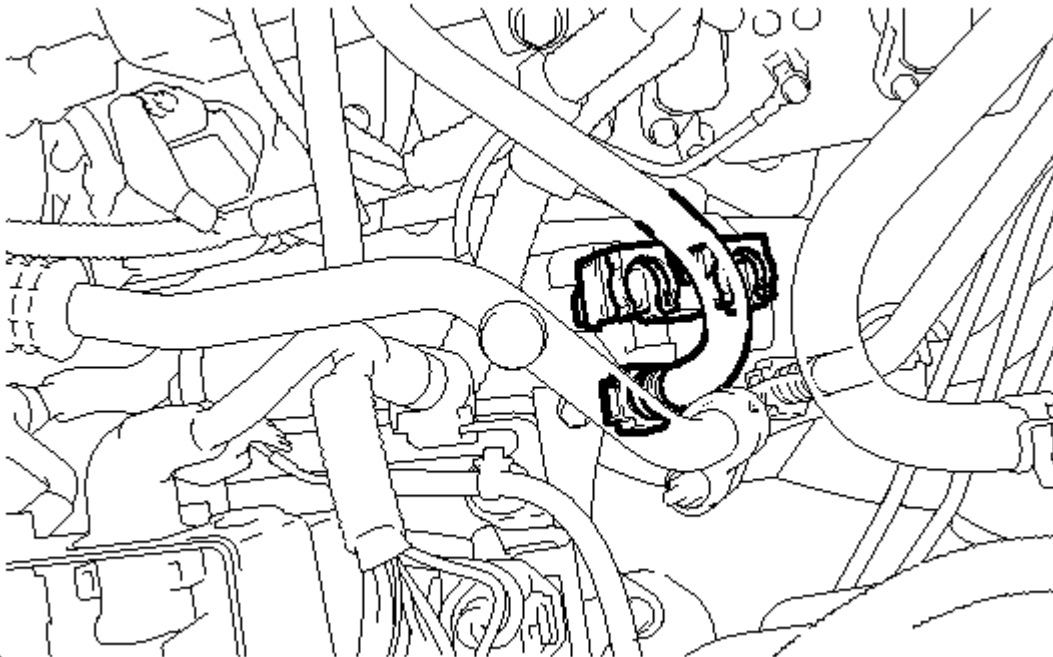
**23. CONNECT NO. 2 FUEL TUBE SUB-ASSEMBLY**



P

**Fig. 153: Identifying No. 2 Fuel Tube & Connector**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Connect the No. 2 fuel tube. Refer to **PRECAUTION** .
- 24. **CONNECT NO. 1 FUEL PIPE SUB-ASSEMBLY**
  - a. Connect the No. 1 fuel pipe. Refer to **PRECAUTION** .



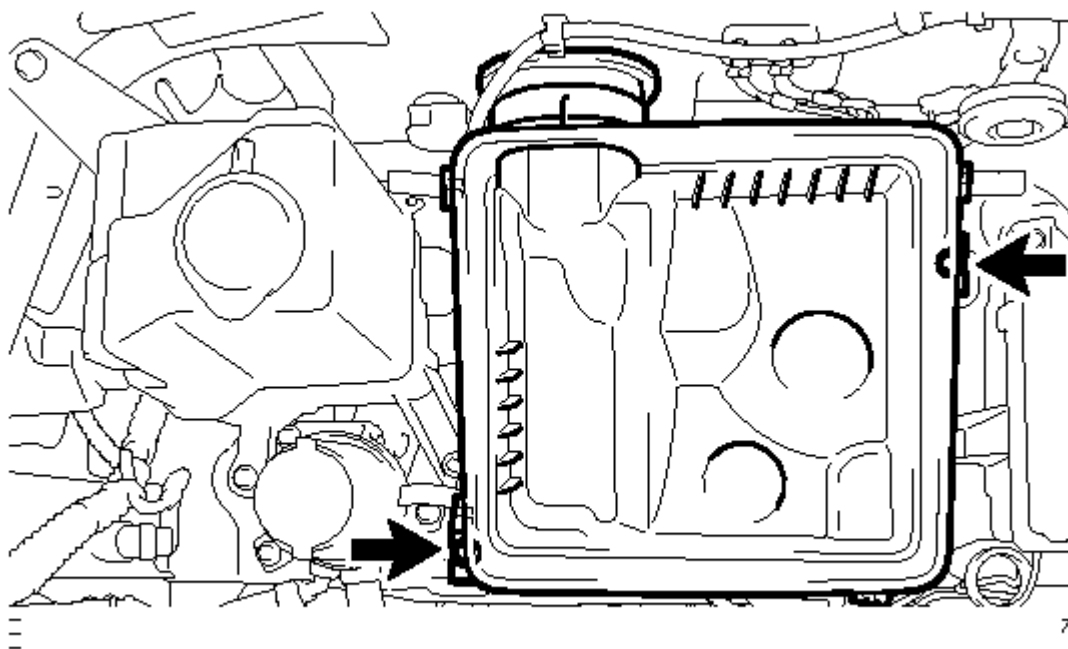
P

**Fig. 154: Removing The Fuel Pipe Clamp****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

b. Install the fuel pipe clamp.

25. **INSTALL INTAKE MANIFOLD** . Refer to **INSTALLATION - Step 10**
26. **INSTALL AIR TUBE SUB-ASSEMBLY LH** . Refer to **INSTALLATION - Step 3**
27. **INSTALL VENTILATION HOSE ASSEMBLY** . Refer to **INSTALLATION - Step 11**
28. **INSTALL EGR VALVE BRACKET** . Refer to **INSTALLATION - Step 1**
29. **INSTALL EGR VALVE ASSEMBLY** . Refer to **INSTALLATION - Step 4**
30. **CONNECT NO. 13 WATER BY-PASS HOSE** . Refer to **INSTALLATION - Step 5**
31. **CONNECT NO. 12 WATER BY-PASS HOSE** . Refer to **INSTALLATION - Step 6**
32. **INSTALL RADIATOR ASSEMBLY** . Refer to **INSTALLATION - Step 1**
33. **INSTALL NO. 1 RADIATOR TO SUPPORT SEAL (for RH Side)** . Refer to **INSTALLATION - Step 3**
34. **INSTALL NO. 1 RADIATOR TO SUPPORT SEAL (for LH Side)** . Refer to **INSTALLATION - Step 2**
35. **INSTALL FAN SHROUD** . Refer to **INSTALLATION - Step 7**
36. **INSTALL FAN AND GENERATOR V BELT** See step 1
37. **INSTALL RADIATOR SIDE DEFLECTOR LH** . Refer to **INSTALLATION - Step 4**
38. **INSTALL RADIATOR SIDE DEFLECTOR RH** . Refer to **INSTALLATION - Step 5**
39. **CONNECT OUTLET RADIATOR HOSE** . Refer to **INSTALLATION - Step 2**
40. **INSTALL INLET RADIATOR HOSE** . Refer to **INSTALLATION - Step 8**
41. **INSTALL FRONT BUMPER COVER**
  - a. Install the front bumper cover. Refer to **INSTALLATION** .
42. **INSTALL FRONT FENDER APRON SEAL REAR LH** . Refer to **INSTALLATION - Step 15**
43. **INSTALL FRONT FENDER APRON SEAL LH** . Refer to **INSTALLATION - Step 16**
44. **INSTALL FRONT FENDER APRON SEAL REAR RH** . Refer to **INSTALLATION - Step 17**
45. **INSTALL FRONT FENDER APRON SEAL RH** . Refer to **INSTALLATION - Step 18**
46. **INSTALL COWL TOP OUTER PANEL SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 13**
47. **INSTALL AIR CLEANER ASSEMBLY**
  - a. Install the air cleaner case with the 2 bolts.





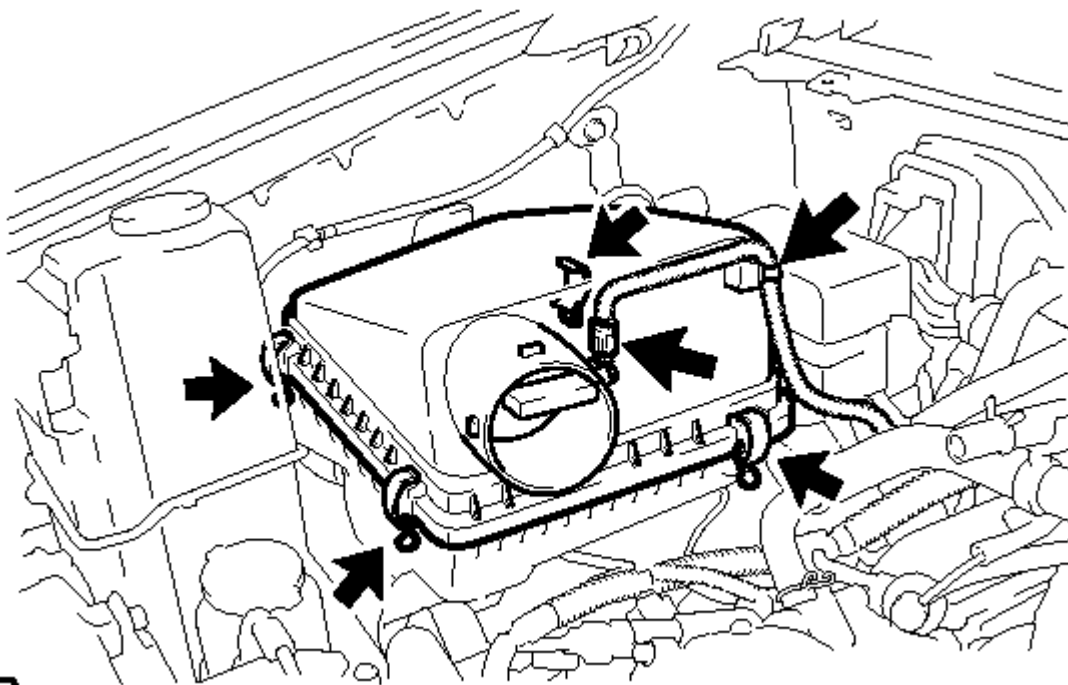
**P**

**Fig. 155: Identifying Air Cleaner Case With Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 5.0 N\*m (51 kgf\*cm, 44 in.\*lbf)**

- b. Install the air cleaner element to the air cleaner case.
- c. Install the air cleaner cap.



P

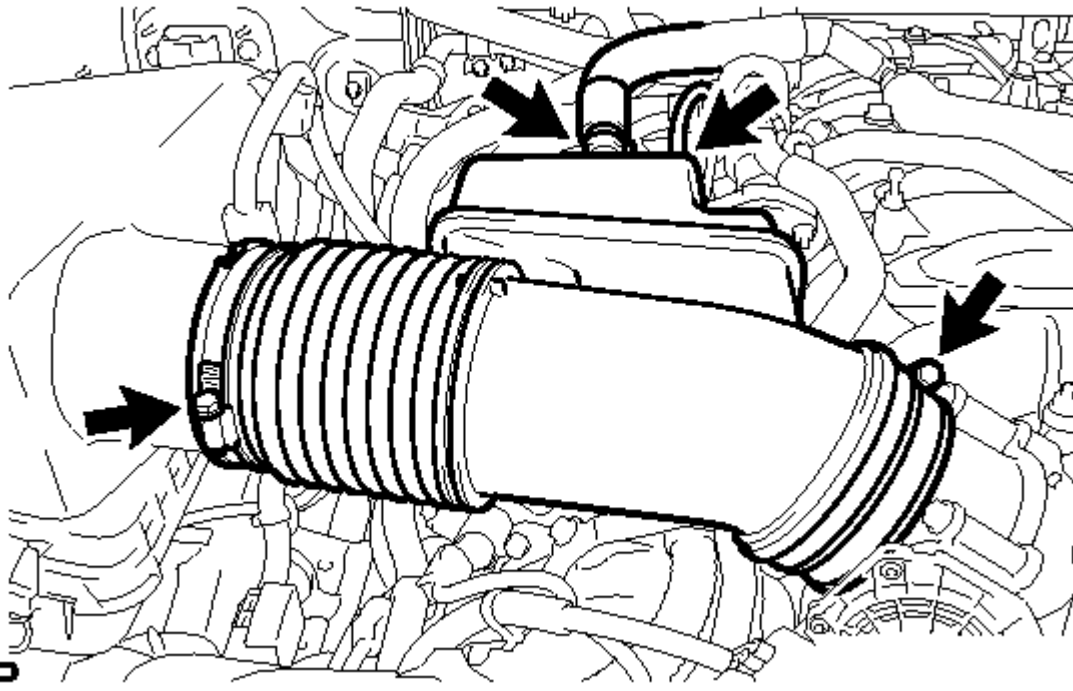
**Fig. 156: Identifying Air Cleaner Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Install the air cleaner cap and fasten the 4 hook clamps.
2. Connect the MAF meter connector.
3. Attach the wire harness clamp.

**48. INSTALL AIR CLEANER HOSE ASSEMBLY**

- a. Install the air cleaner hose with the 2 clamps.



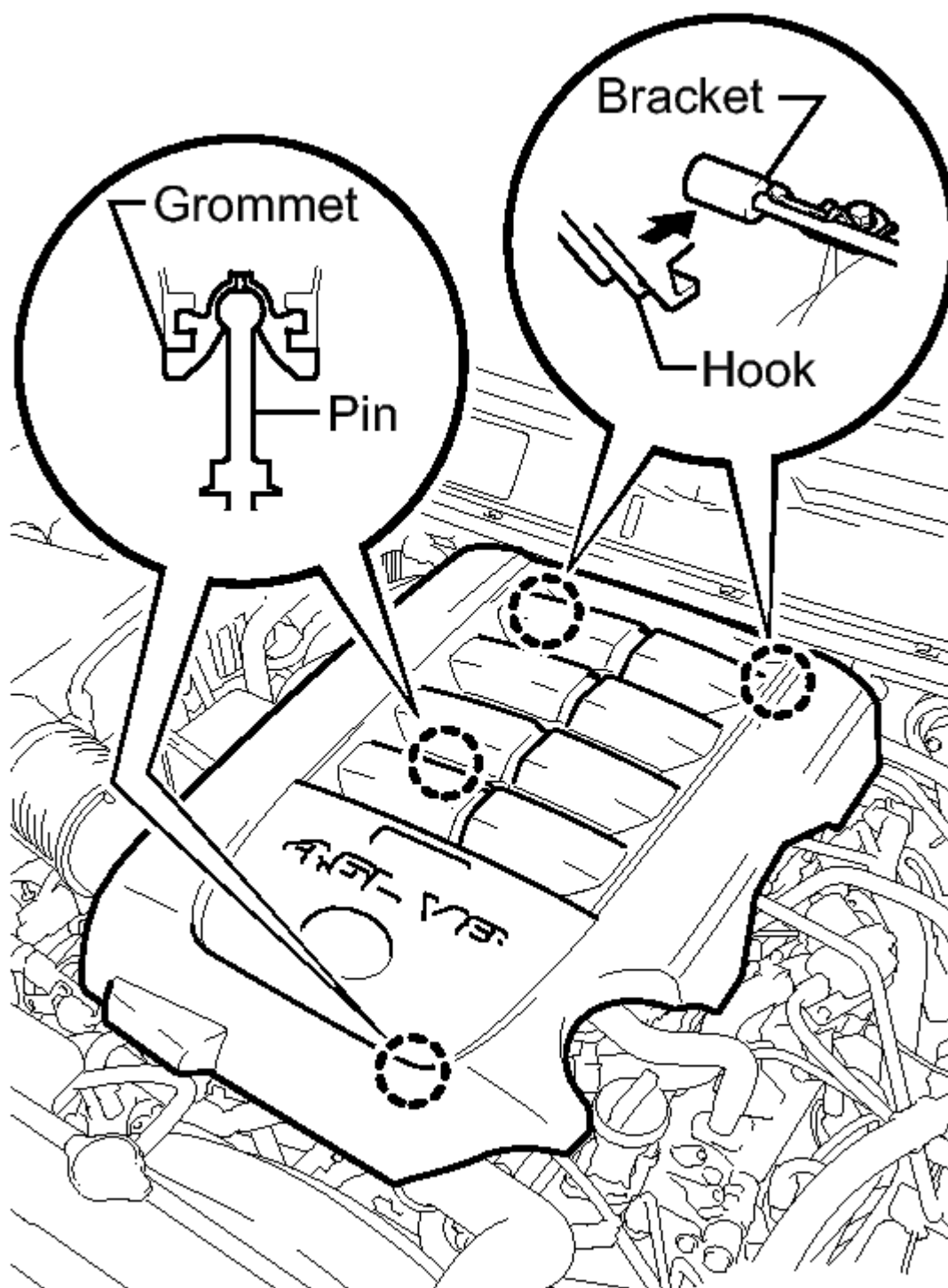
**Fig. 157: Installing The Air Cleaner Hose With The 2 Clamps**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 4.0 N\*m (41 kgf\*cm, 35 in.\*lbf)**

- b. Connect the ventilation hose and vacuum sensing hose.
- 49. **ADD ENGINE OIL** . Refer to **REPLACEMENT - Step 5**
- 50. **ADD ENGINE COOLANT** . Refer to **REPLACEMENT - Step 3**
- 51. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

**NOTE:** When disconnecting the cable some systems need to be initialized after the cable is reconnected. Refer to **INITIALIZATION** .

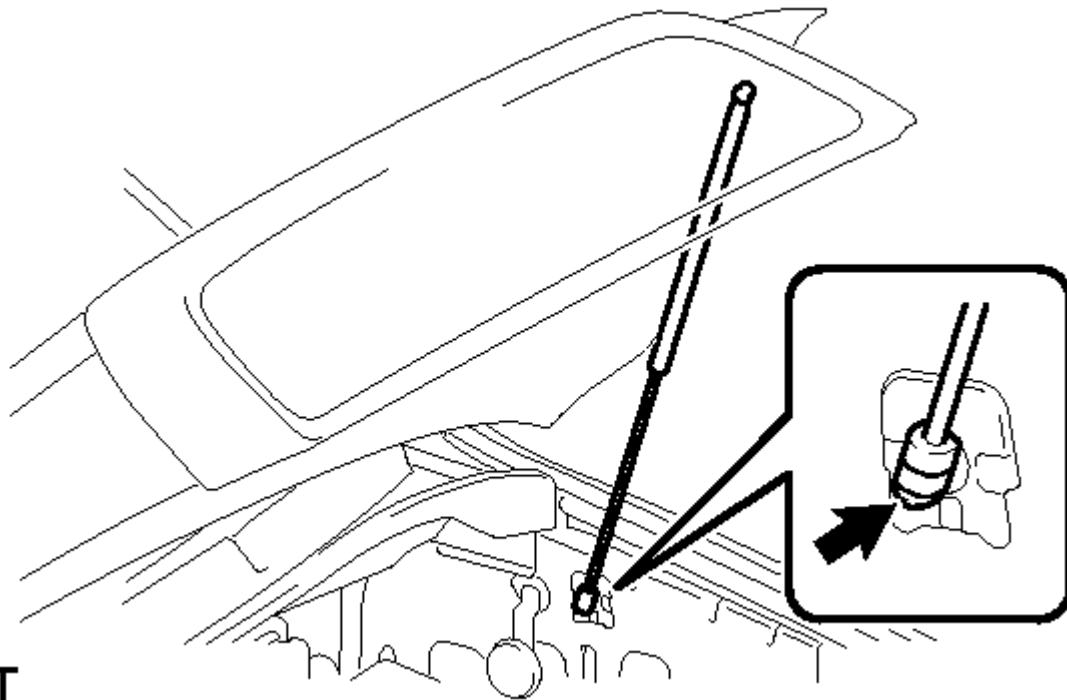
- 52. **INSPECT FOR OIL LEAK** . Refer to **REPLACEMENT - Step 6**
- 53. **INSPECT FOR COOLANT LEAK** . Refer to **ON-VEHICLE INSPECTION - Step 1**
- 54. **INSPECT FOR EXHAUST GAS LEAK** . Refer to **INSTALLATION - Step 14**
- 55. **INSPECT FOR FUEL LEAK** . Refer to **INSTALLATION - Step 9**
- 56. **INSPECT SHIFT LEVER POSITION**
  - a. Inspect the shift lever position. Refer to **ON-VEHICLE INSPECTION - Step 1** .
- 57. **INSTALL V-BANK COVER SUB-ASSEMBLY**
  - a. Attach the 2 V-bank cover hooks to the bracket. Then align the 2 V-bank cover grommets with the 2 pins, and press down on the V-bank cover to attach the pins.

**P**

**Fig. 158: Attaching The 2 V-Bank Cover Hooks To The Bracket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 58. INSTALL HOOD SUB-ASSEMBLY

- Install the hood with the 4 bolts.



**T**  
**Fig. 159: Installing The Hood With The 4 Bolts**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 13 N\*m (133 kgf\*cm, 10 ft.\*lbf)**

- b. Attach the lower part of the 2 hood supports to the hood support bolt ball joints.

**WARNING: Install the hood support while supporting the hood by hand.**

- c. Attach the hood support clips.

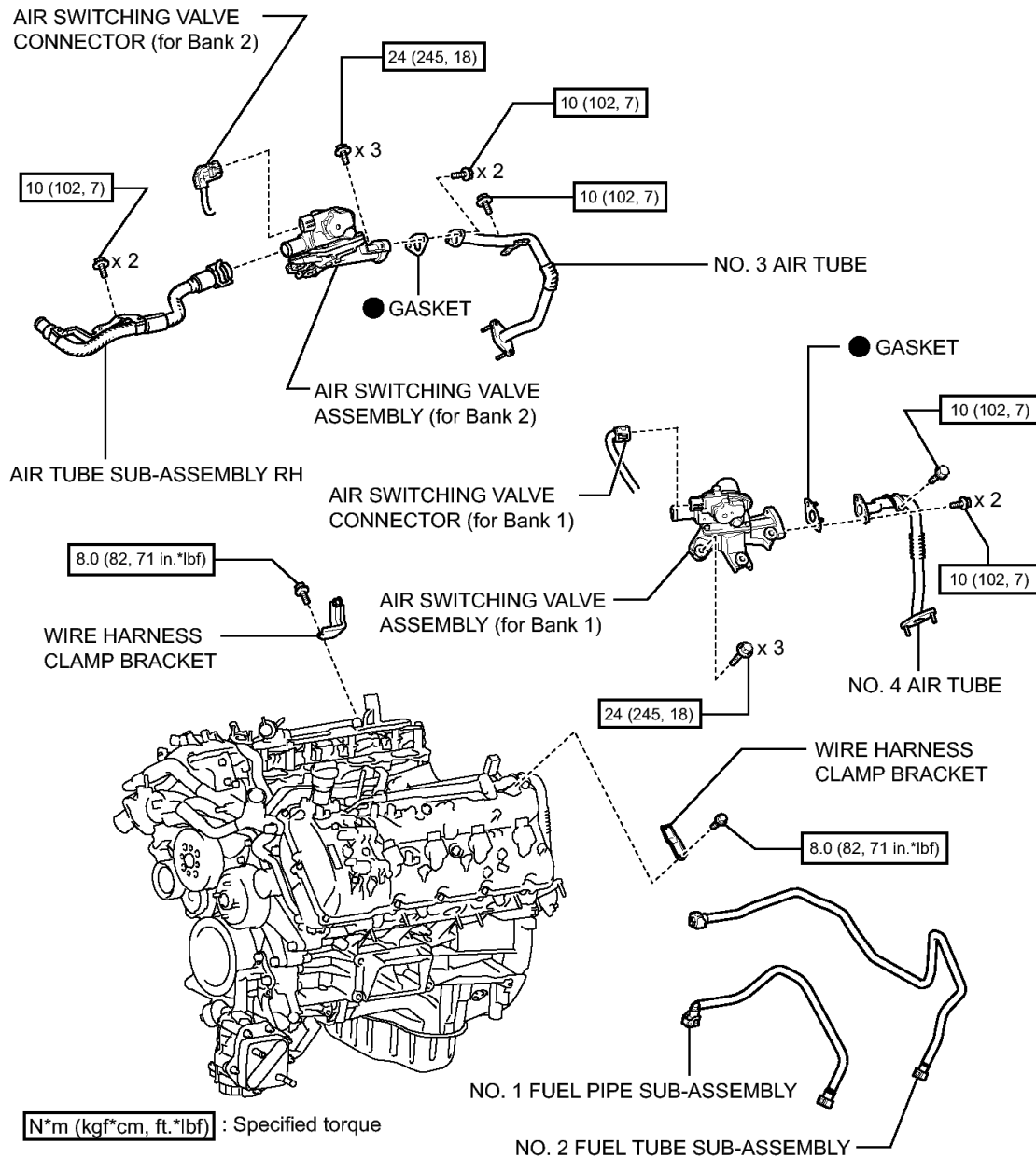
**NOTE:** Check that the hood support is engaged in the ball joint and that it cannot be pulled out.

59. **ADJUST HOOD SUB-ASSEMBLY** . Refer to ADJUSTMENT - Step 2
60. **INSTALL NO. 1 ENGINE UNDER COVER** . Refer to REPLACEMENT - Step 8
61. **INSTALL FRONT WIPER MOTOR AND LINK ASSEMBLY**
  - a. Install the front wiper motor and link. Refer to INSTALLATION .
62. **INSPECT IGNITION TIMING** See step 1
63. **INSPECT ENGINE IDLE SPEED** See step 2
64. **INSPECT CO/HC** See step 4
65. **CHECK ENGINE OIL LEVEL** . Refer to ON-VEHICLE INSPECTION - Step 2
66. **CHECK ENGINE COOLANT LEVEL** . Refer to ON-VEHICLE INSPECTION - Step 2

# ENGINE UNIT

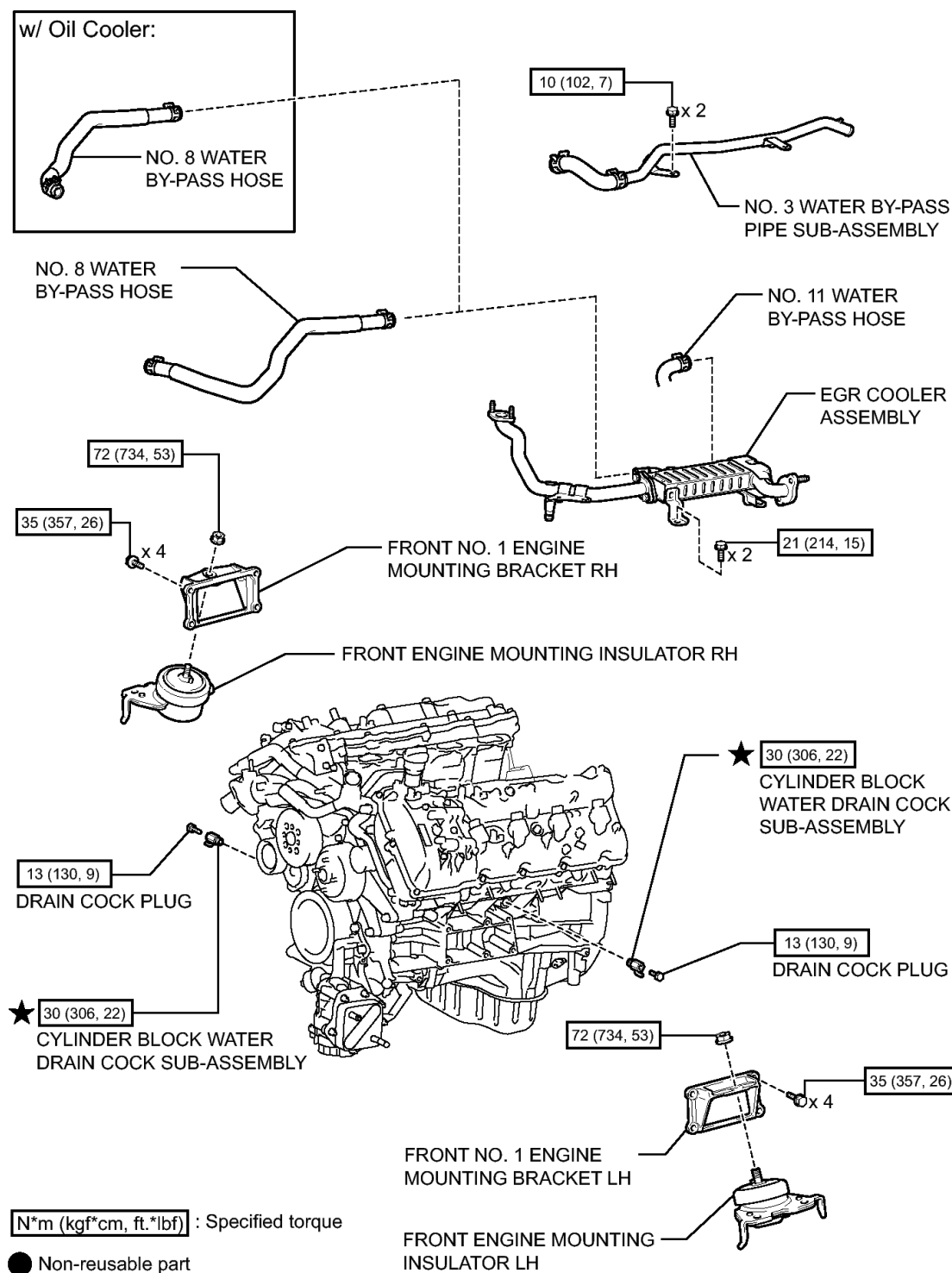
## COMPONENTS

## ILLUSTRATION



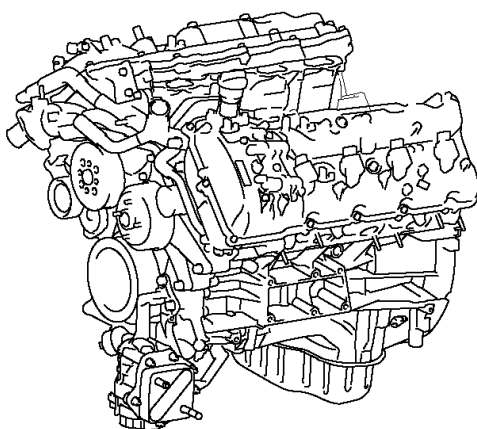
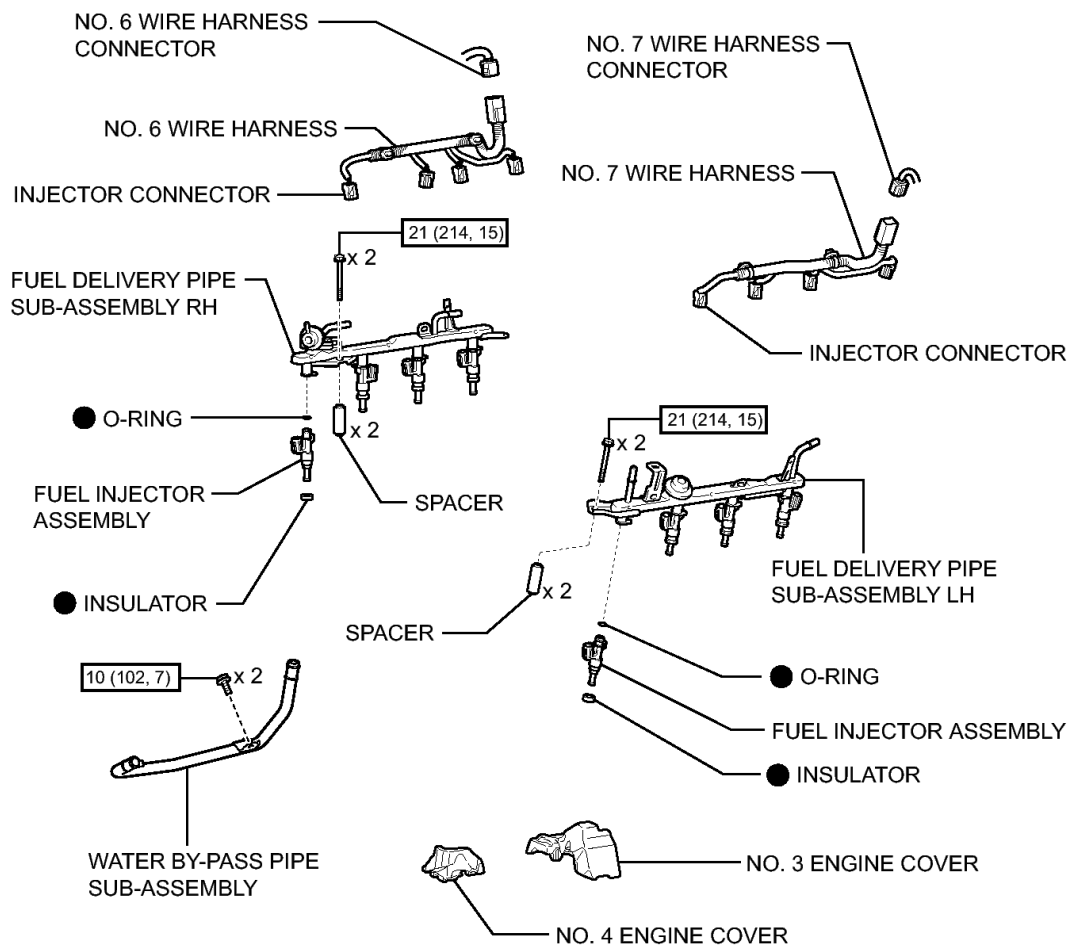
**Fig. 160: Exploded View Of Engine Unit Replacement Components With Torque Specifications (1 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### ILLUSTRATION



**Fig. 161: Exploded View Of Engine Unit Replacement Components With Torque Specifications (2 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

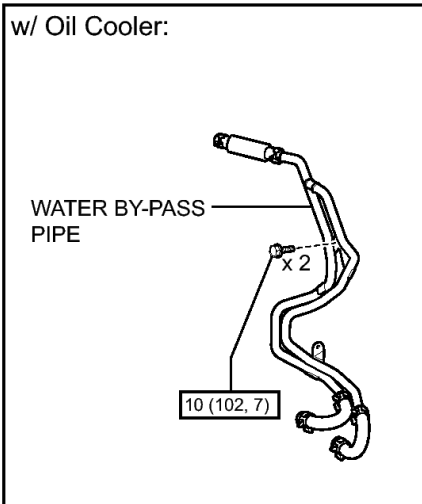
### ILLUSTRATION



N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

P



**Fig. 162: Exploded View Of Engine Unit Replacement Components With Torque Specifications (3 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Diagram illustrating the assembly of the engine cooling system components, showing the engine block and various hoses and covers.

Components and Torque Specifications:

- NO. 1 ENGINE COVER
- NO. 2 ENGINE COVER
- SEPARATOR CASE (Torque: 10 (102, 7))
- WATER INLET HOUSING (Torque: 21 (214, 15))
- GASKET
- ENGINE WIRE (Torque: 8.0 (82, 71 in.\*lbf))
- KNOCK SENSOR (Torque: 20 (204, 15))
- NO. 1 WATER BY-PASS HOSE
- FRONT WATER BY-PASS JOINT

Note: (ft.\*cm, ft.\*lbf) : Specified torque

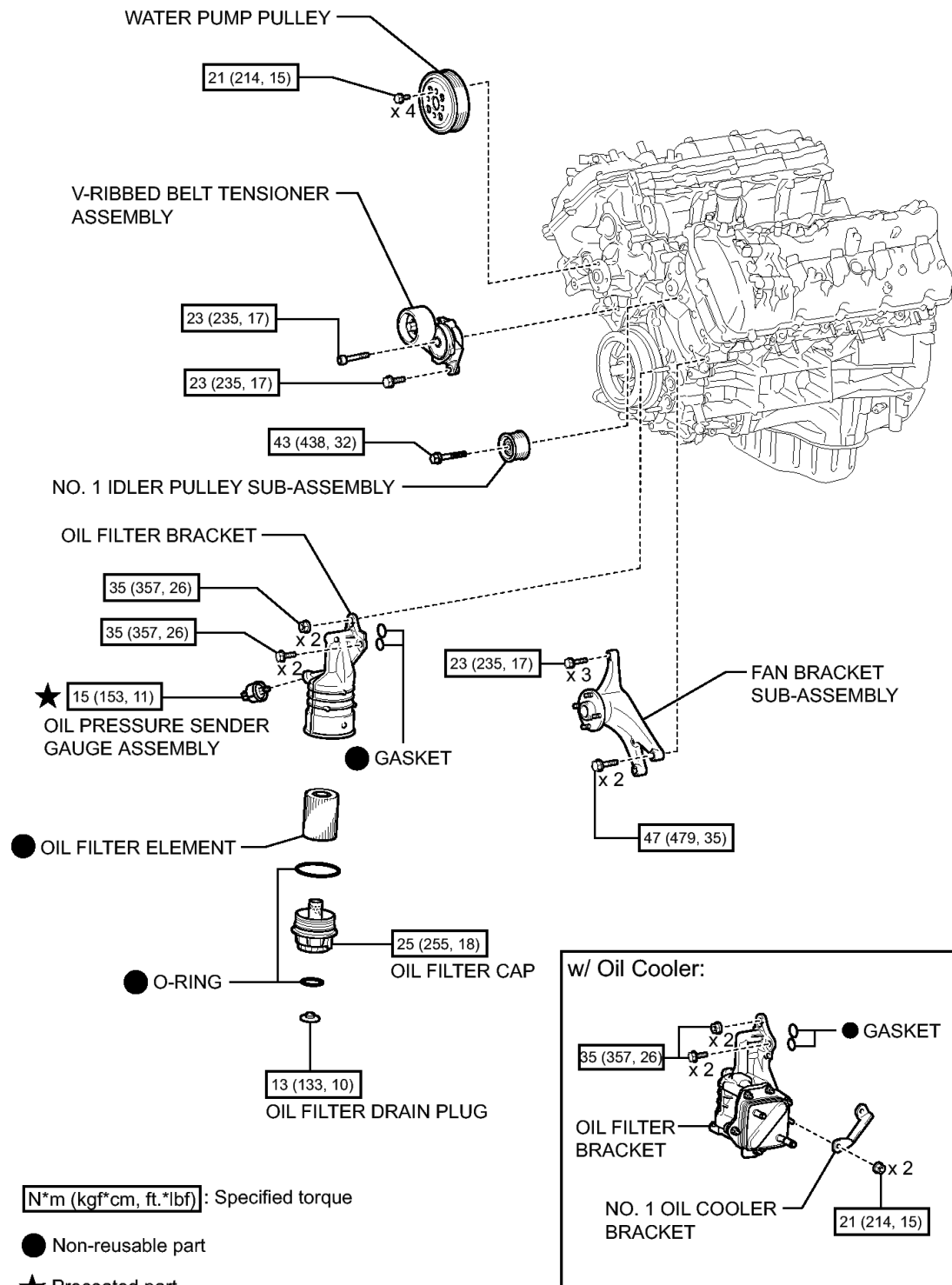
**[N\*m (kgf\*cm, ft.\*lbf)]** : Specified torque

● Non-reusable part

**P**

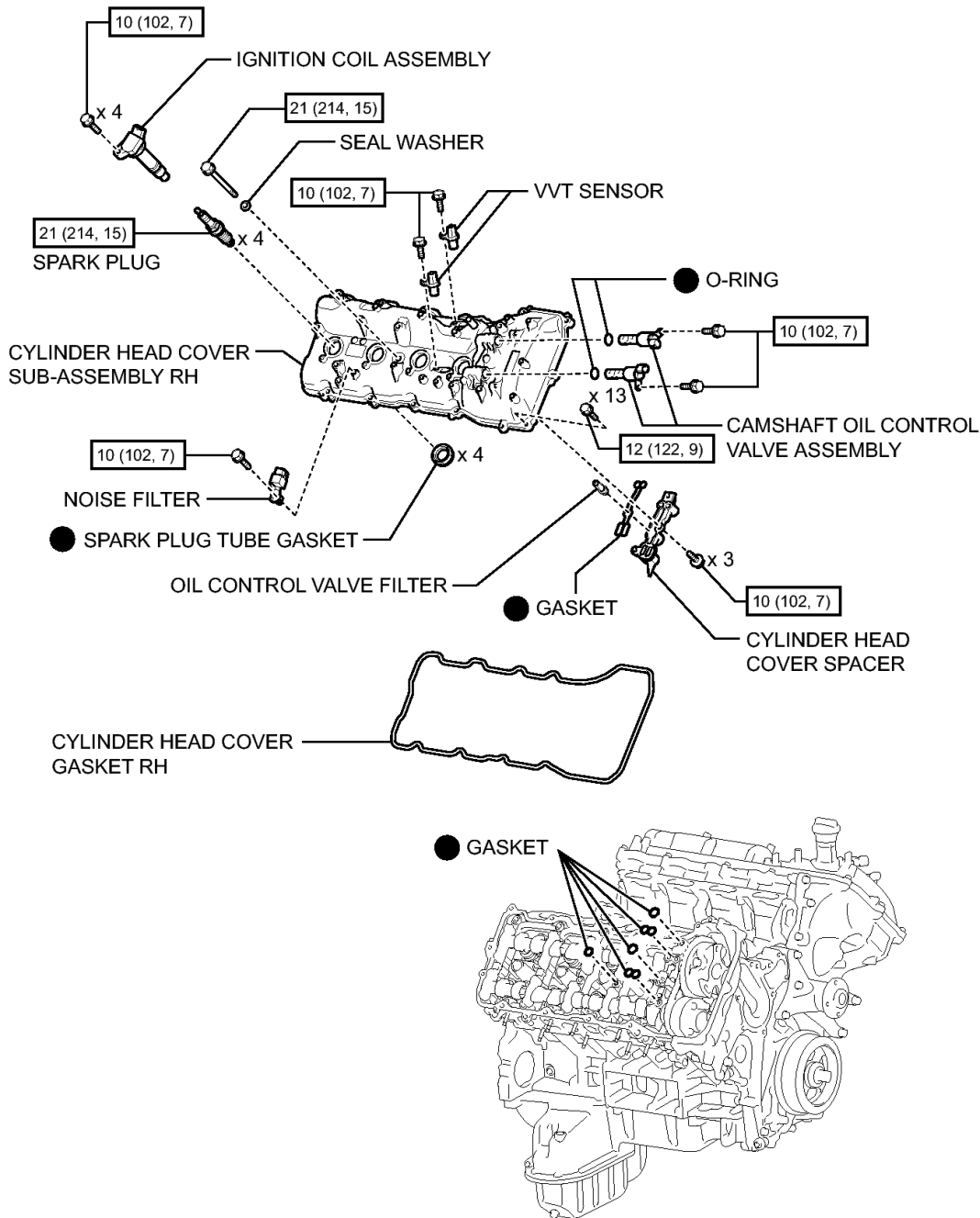
domingo, 3 de enero de 2021 07:37:30 p. m.

ILLUSTRATION



**Fig. 164: Exploded View Of Engine Unit Replacement Components With Torque Specifications (5 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### ILLUSTRATION



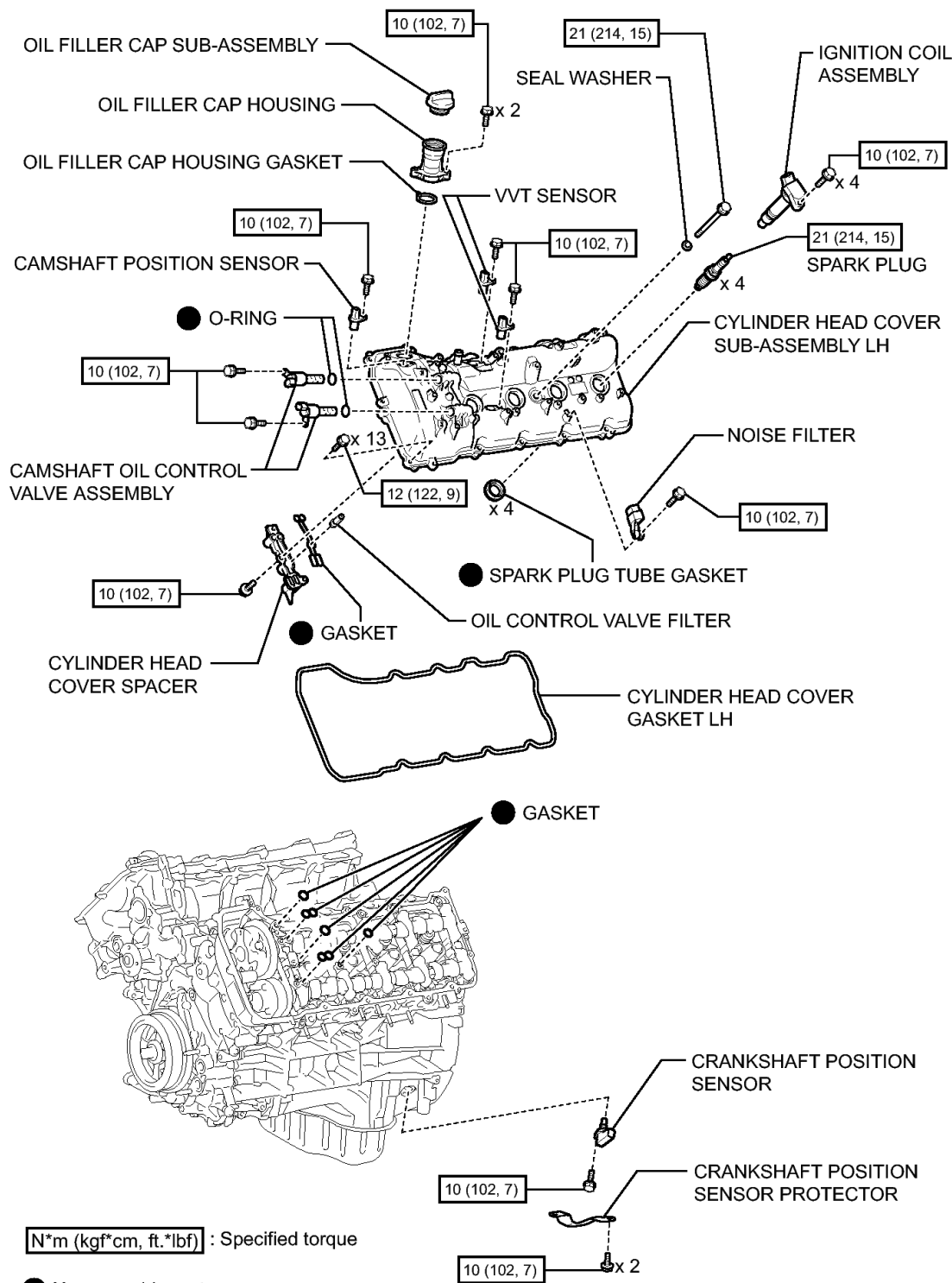
[N\*m (kgf\*cm, ft.\*lbf)] : Specified torque

● Non-reusable part

P

**Fig. 165: Exploded View Of Engine Unit Replacement Components With Torque Specifications (6 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

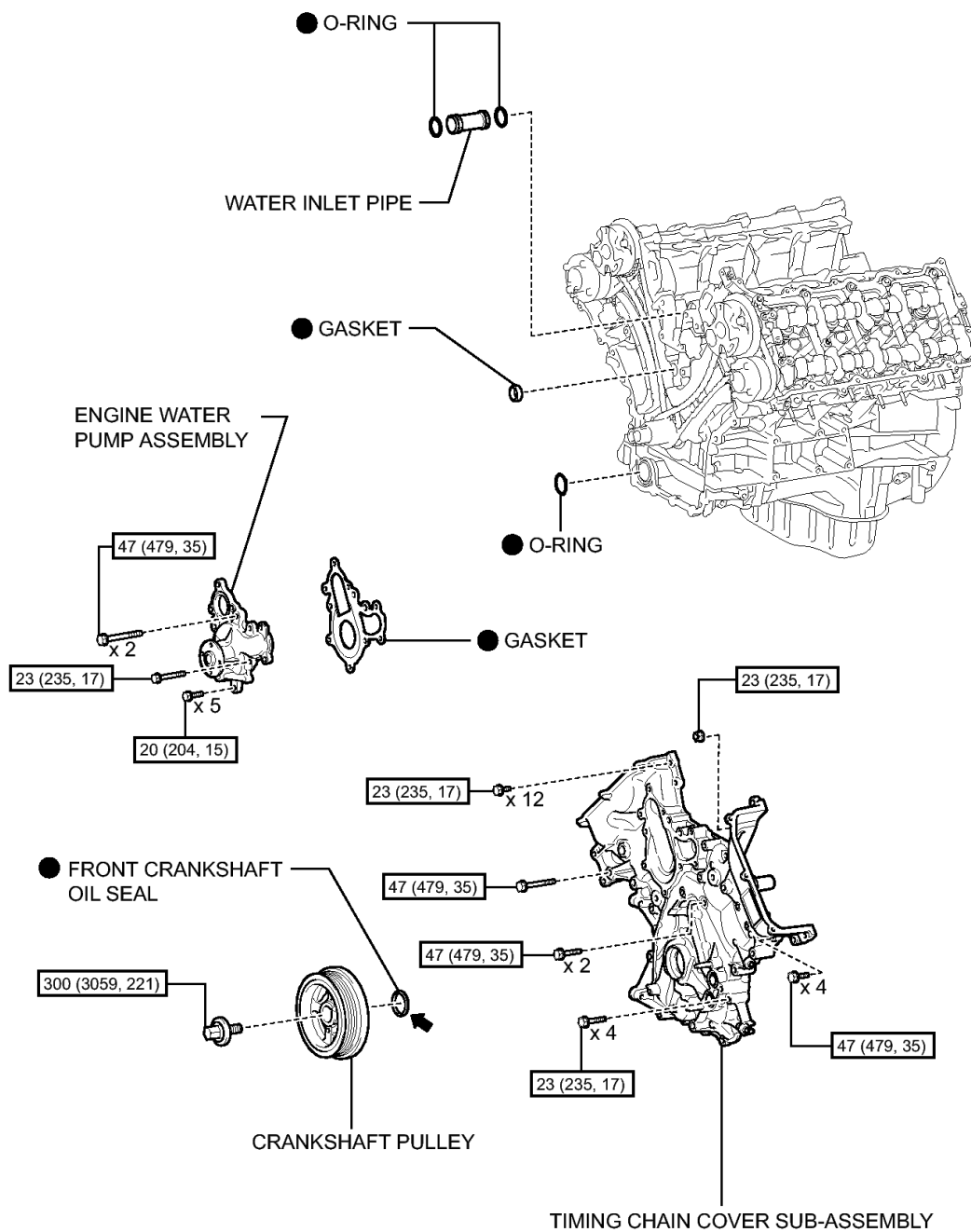
### ILLUSTRATION



P

**Fig. 166: Exploded View Of Engine Unit Replacement Components With Torque Specifications (7 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### ILLUSTRATION



N\*m (kgf\*cm, ft.\*lbf) : Specified torque

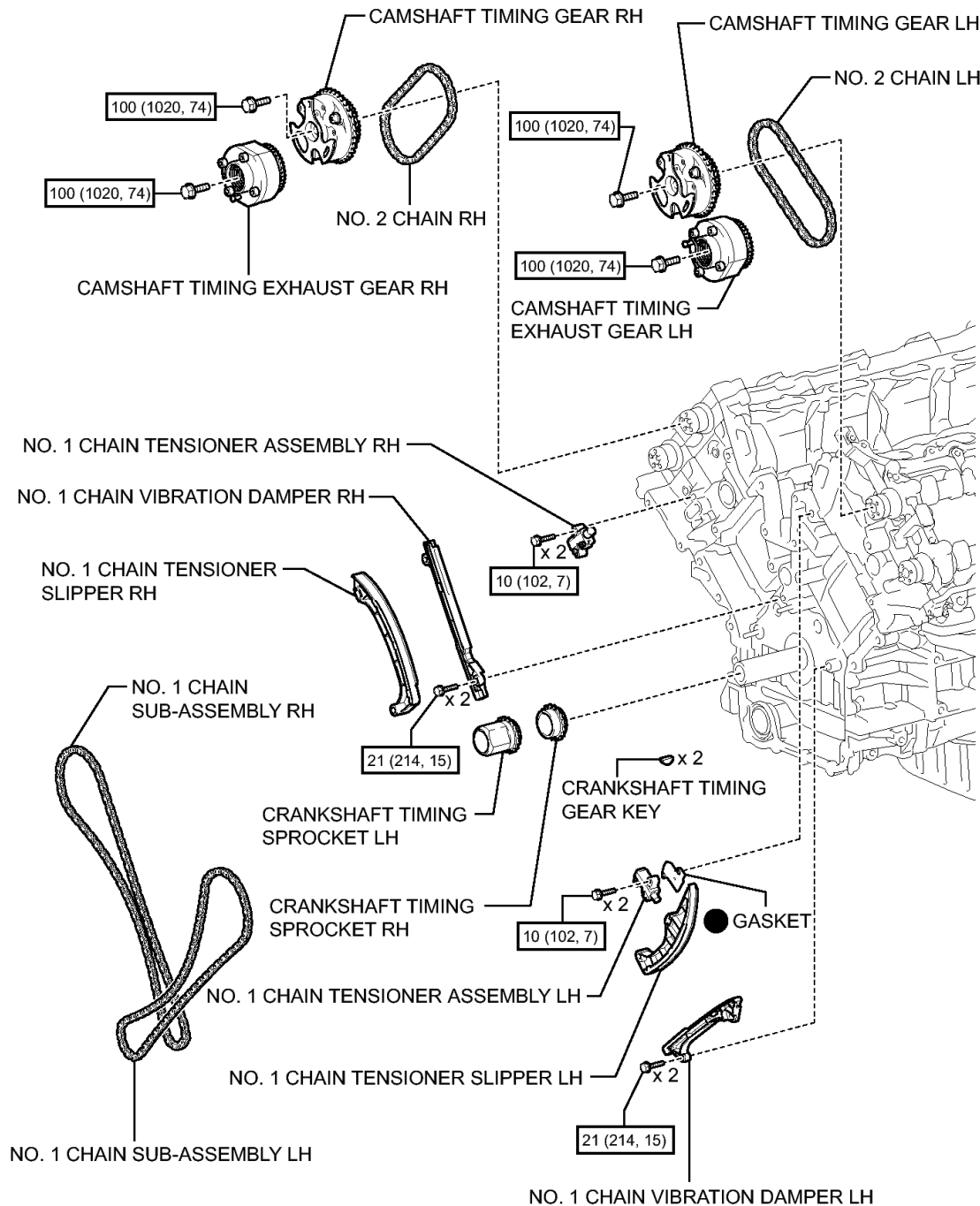
● Non-reusable part

← MP grease

P

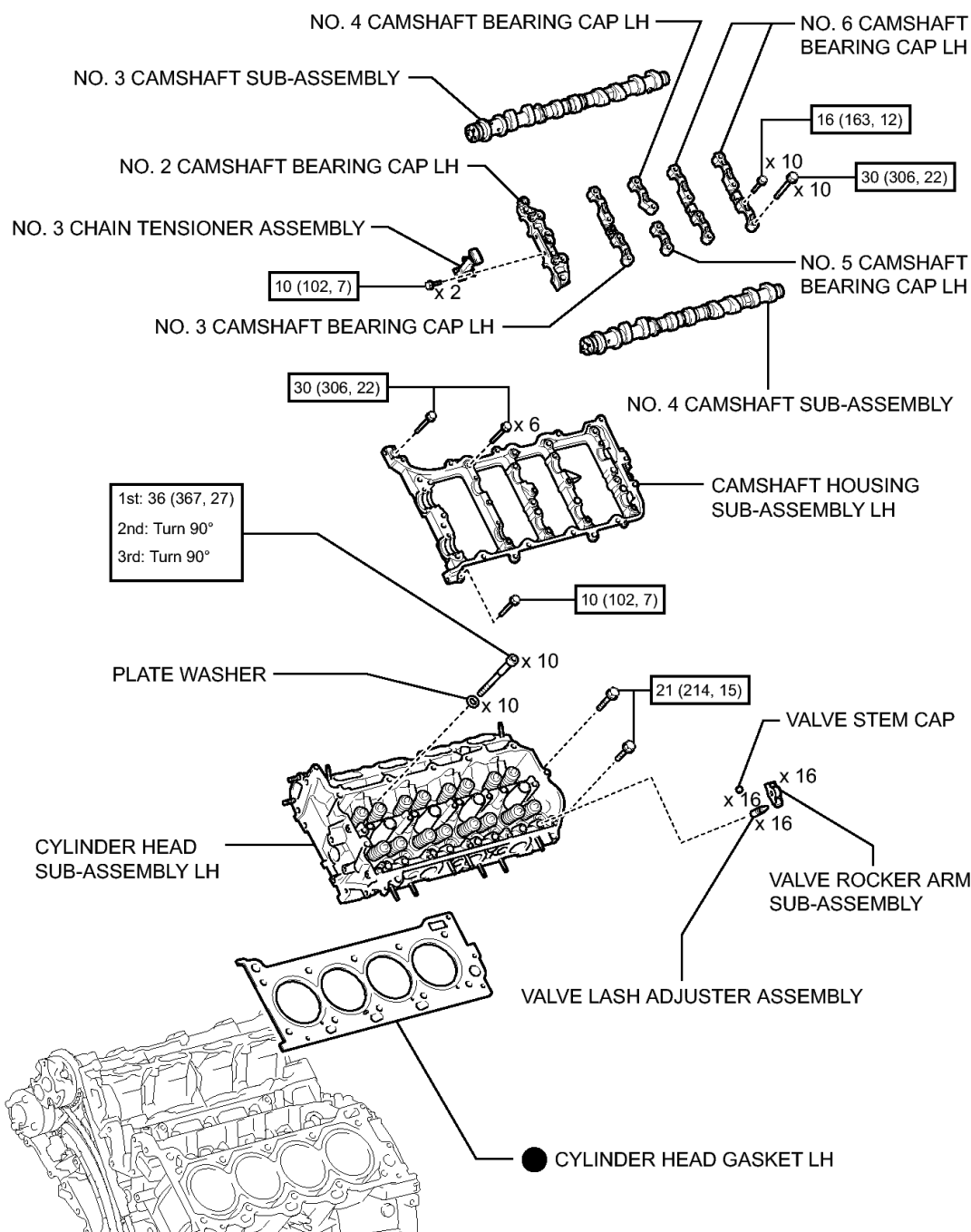
**Fig. 167: Identifying Engine Unit Replacement Components With Torque Specifications (8 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



**Fig. 168: Exploded View Of Engine Unit Replacement Components With Torque Specifications (9 Of 13)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### ILLUSTRATION



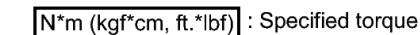
**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

● Non-reusable part

P

**Fig. 169: Exploded View Of Engine Unit Replacement Components With Torque Specifications (10 Of 13)**

## ILLUSTRATION



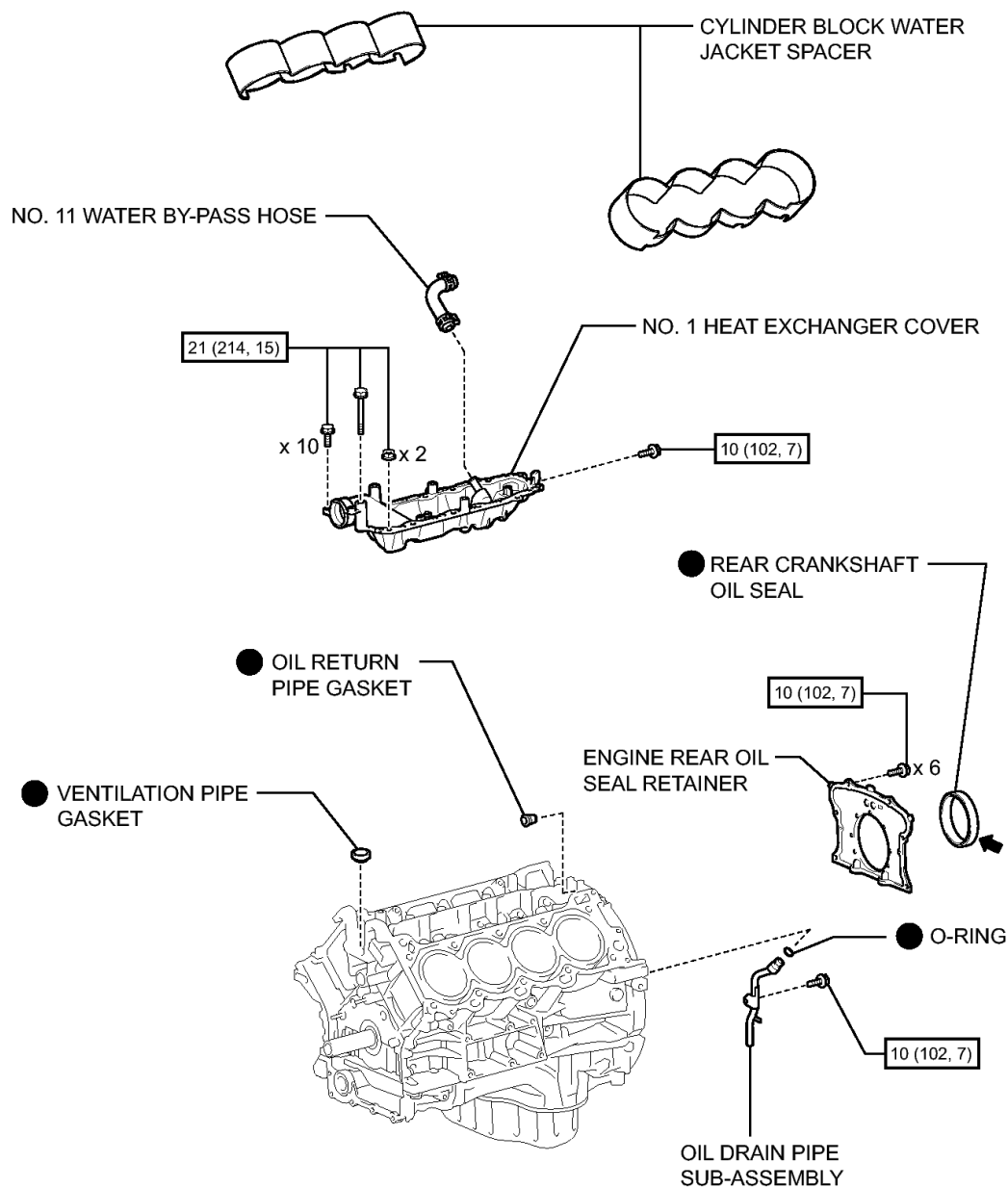
● Non-reusable part



**Fig. 170: Exploded View Of Engine Unit Replacement Components With Torque Specifications (11 Of 13)**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

**ILLUSTRATION**



[N\*m (kgf\*cm, ft.\*lbf)] : Specified torque

● Non-reusable part

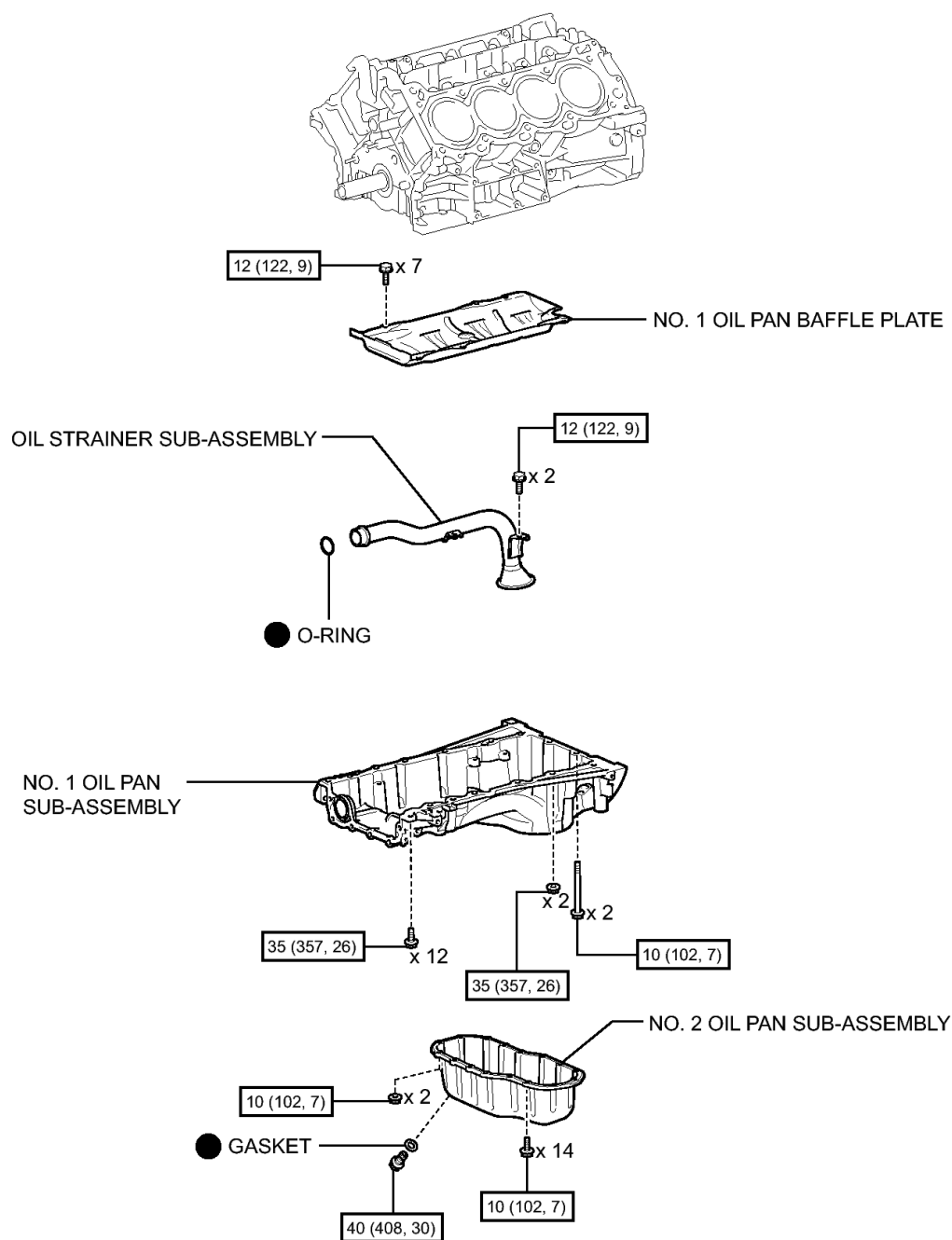
← MP grease

P

**Fig. 171: Exploded View Of Engine Unit Replacement Components With Torque Specifications (12 Of 13)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### ILLUSTRATION



[N\*m (kgf\*cm, ft.\*lbf)] : Specified torque

● Non-reusable part

P

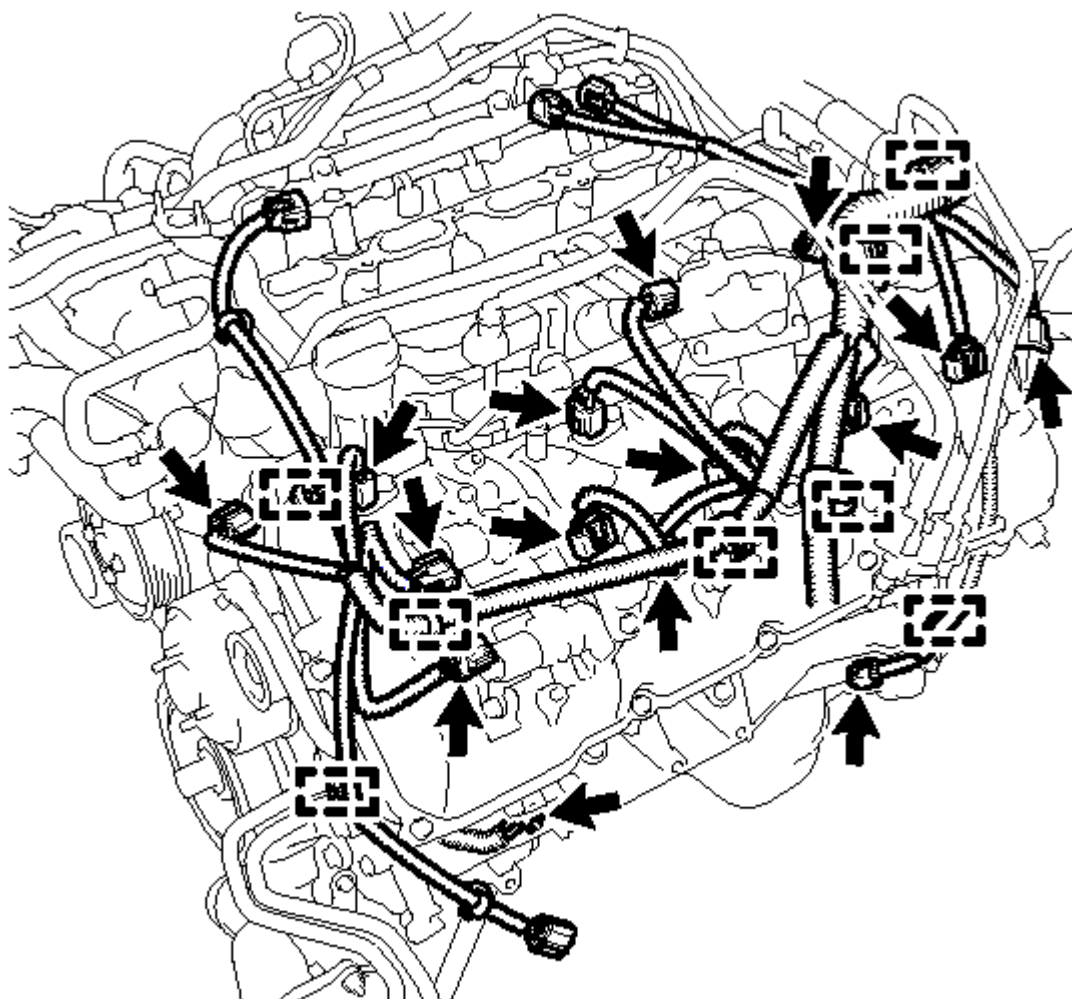
**Fig. 172: Exploded View Of Engine Unit Replacement Components With Torque Specifications (13 Of 13)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### REMOVAL

#### 1. REMOVE ENGINE WIRE



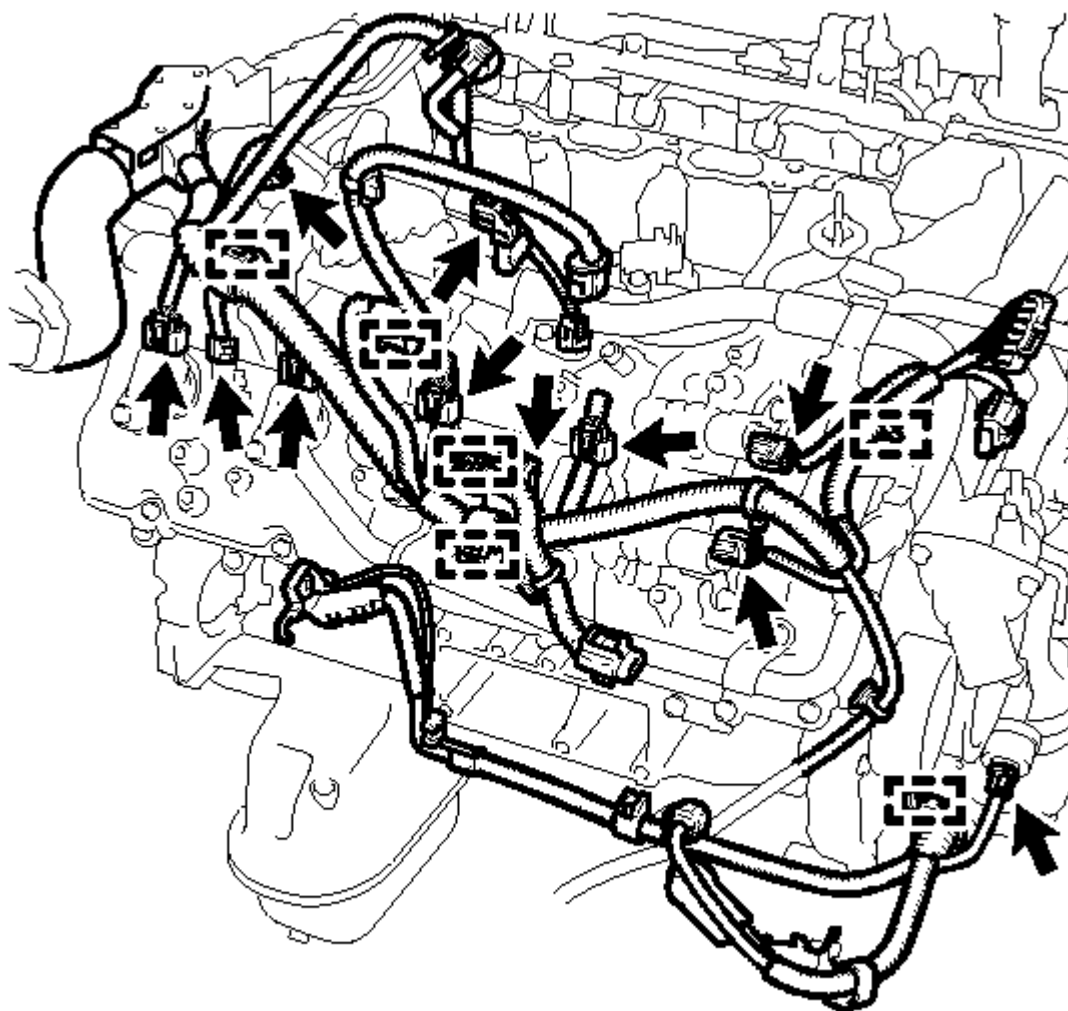
**P**

**Fig. 173: Identifying Engine Wires & Fasteners**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Engine LH Side:
  1. Disconnect the 2 camshaft timing control valve connectors.
  2. Disconnect the 4 ignition coil connectors.
  3. Disconnect the 2 VVT sensor connectors.

4. Disconnect the camshaft position sensor connector.
  5. Disconnect the crankshaft position sensor connector.
  6. Disconnect the air switching valve connector.
  7. Disconnect the engine coolant temperature sensor connector.
  8. Disconnect the fuel injector connector.
  9. Disconnect the noise filter connector.
  10. Remove the bolt and disconnect the 8 clamps.
- b. Engine RH Side:



**P**

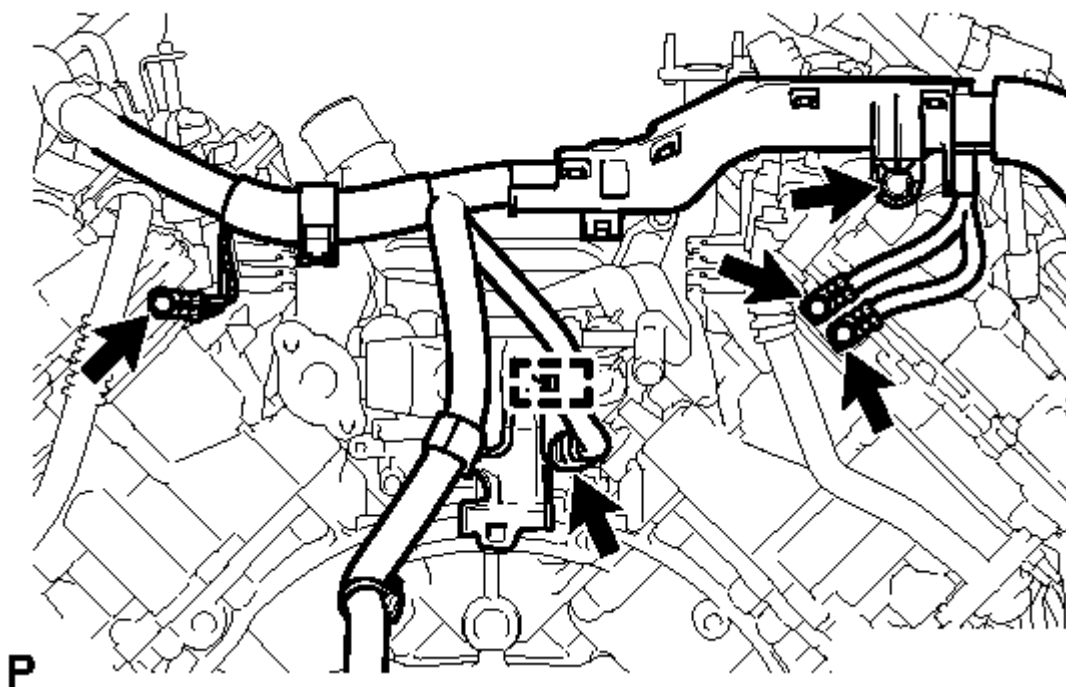
**Fig. 174: Identifying Engine Wires & Fasteners**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Disconnect the 2 camshaft timing control valve connectors.
2. Disconnect the 4 ignition coil connectors.

3. Disconnect the 2 VVT sensor connectors.
4. Disconnect the fuel injector connector.
5. Disconnect the noise filter connector.
6. Disconnect the air switching valve connector.
7. Disconnect the oil pressure sender gauge connector.
8. Disconnect the 6 clamps.

c. Engine Rear Side:

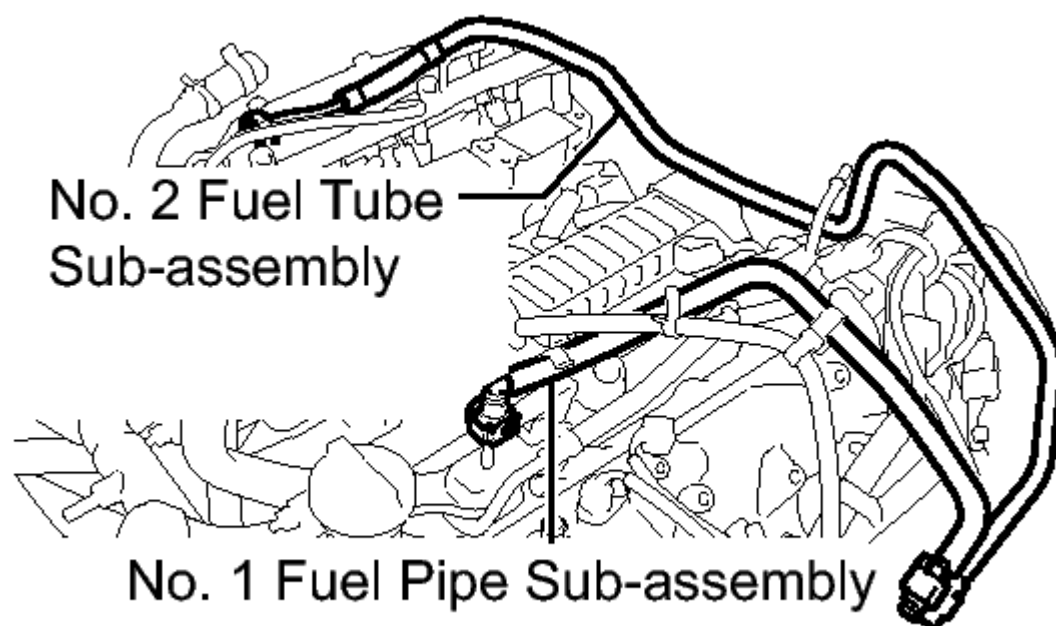


**Fig. 175: Disconnecting The Connector And Clamp, 4 Bolts & Engine Wire**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Disconnect the connector and clamp.
2. Remove the 4 bolts.

d. Remove the engine wire.

**2. REMOVE NO. 1 FUEL PIPE SUB-ASSEMBLY**

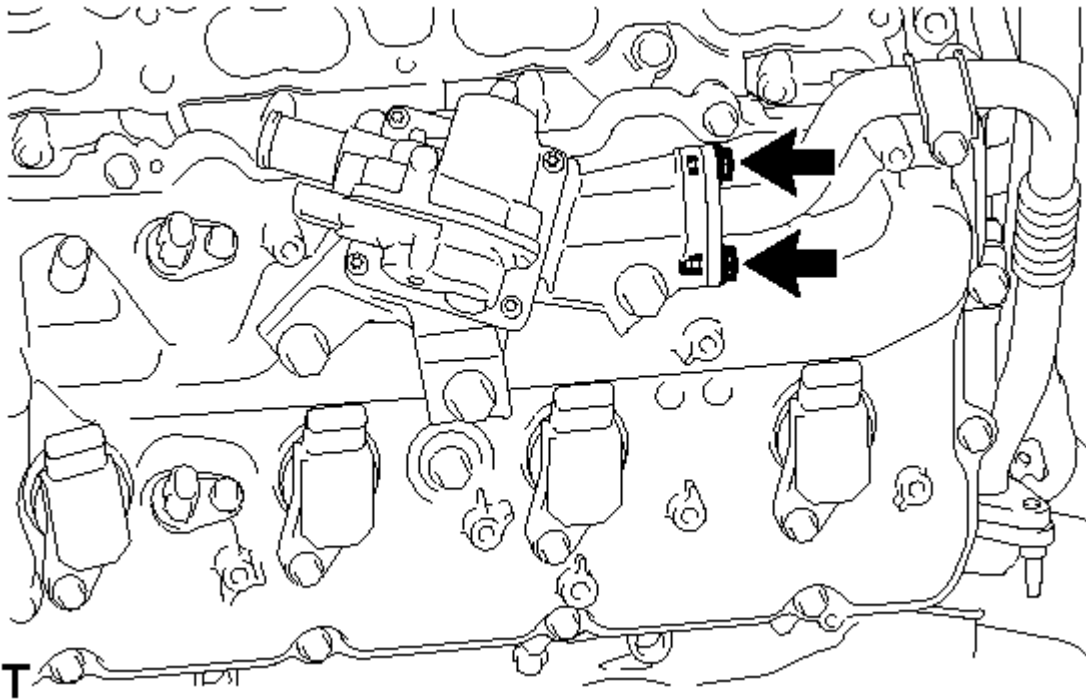


**F**

**Fig. 176: Removing No. 1 Fuel Pipe Sub-Assembly**

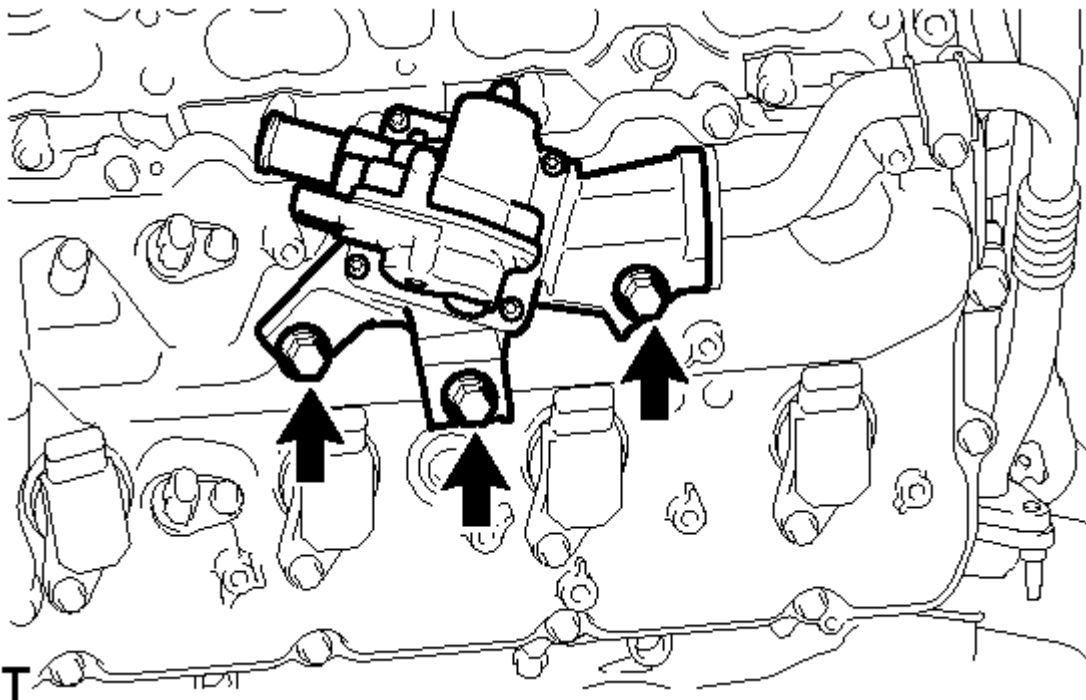
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the No. 1 fuel pipe. Refer to **PRECAUTION** .
3. **REMOVE NO. 2 FUEL TUBE SUB-ASSEMBLY**
  - a. Remove the No. 2 fuel tube. Refer to **PRECAUTION** .
4. **REMOVE AIR SWITCHING VALVE ASSEMBLY (for Bank 1)**



**Fig. 177: Identifying Air Switching Valve Hose Bolts (Bank 1)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 bolts.



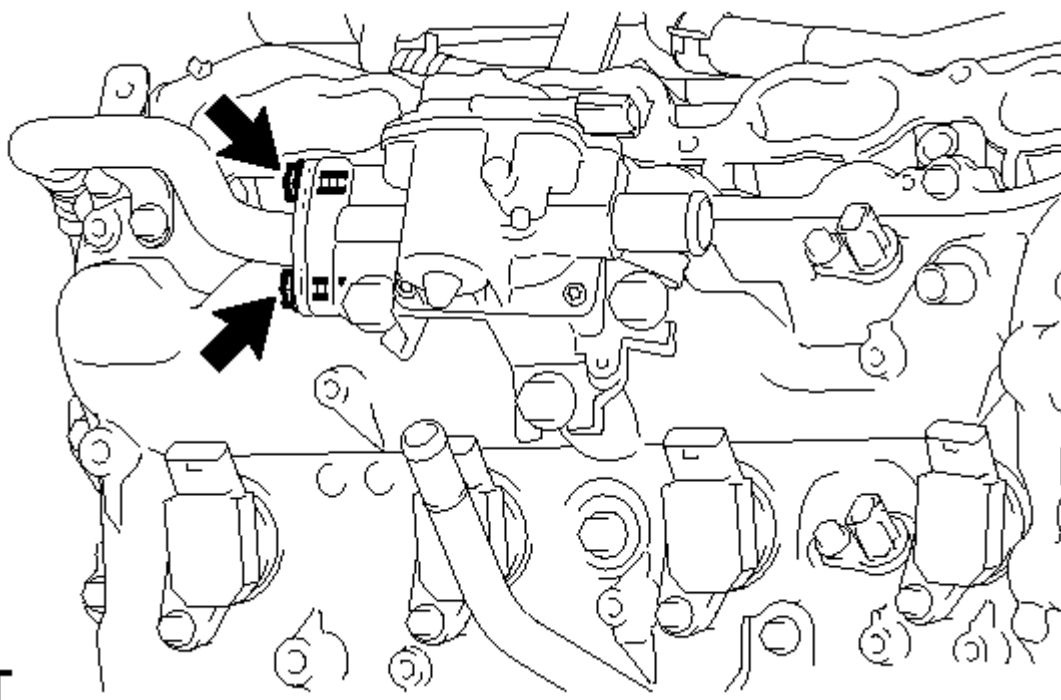
**Fig. 178: Identifying Air Switching Valve & Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**NOTE:** Be careful not to damage the installation surface of the gaskets.

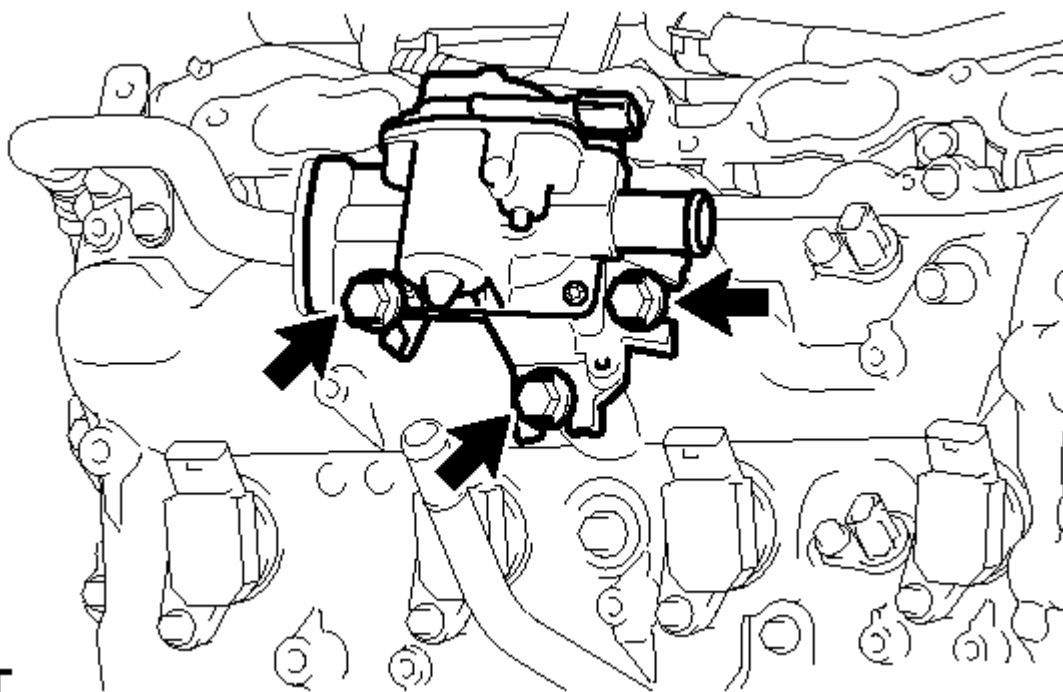
b. Remove the 3 bolts, air switching valve and gasket.

**5. REMOVE AIR SWITCHING VALVE ASSEMBLY (for Bank 2)**



**Fig. 179: Identifying Air Switching Valve Hose Bolts (Bank 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Remove the 2 bolts.



**T**

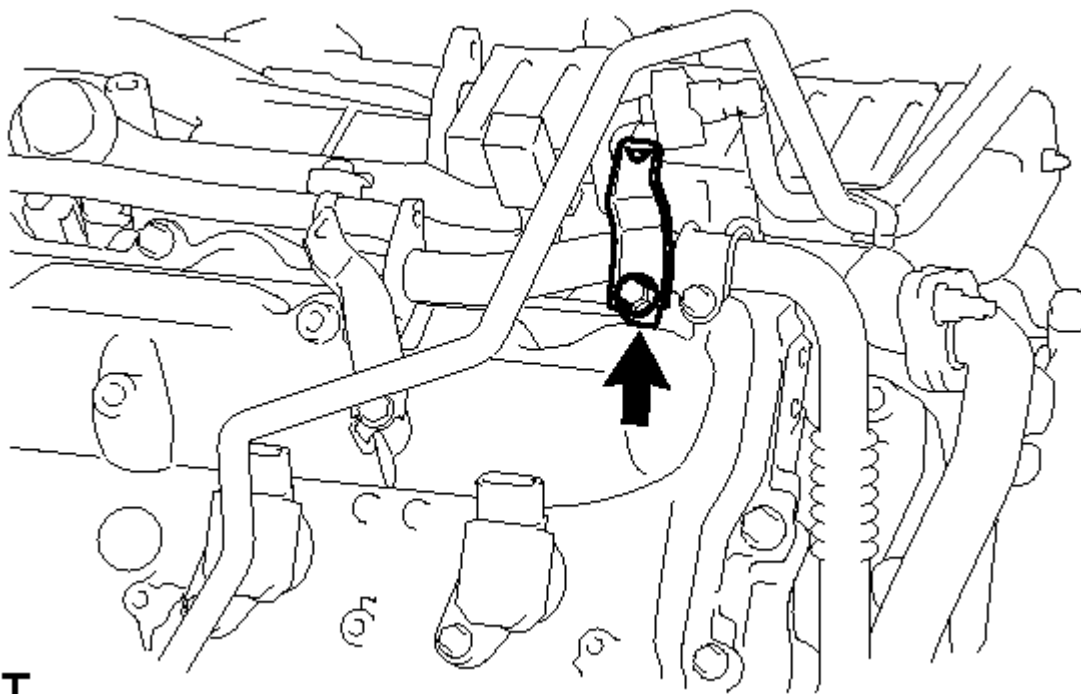
**Fig. 180: Identifying Air Switching Valve & Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to damage the installation surface of the gaskets.

- b. Remove the 3 bolts, air switching valve and gasket.

**6. REMOVE NO. 4 AIR TUBE**

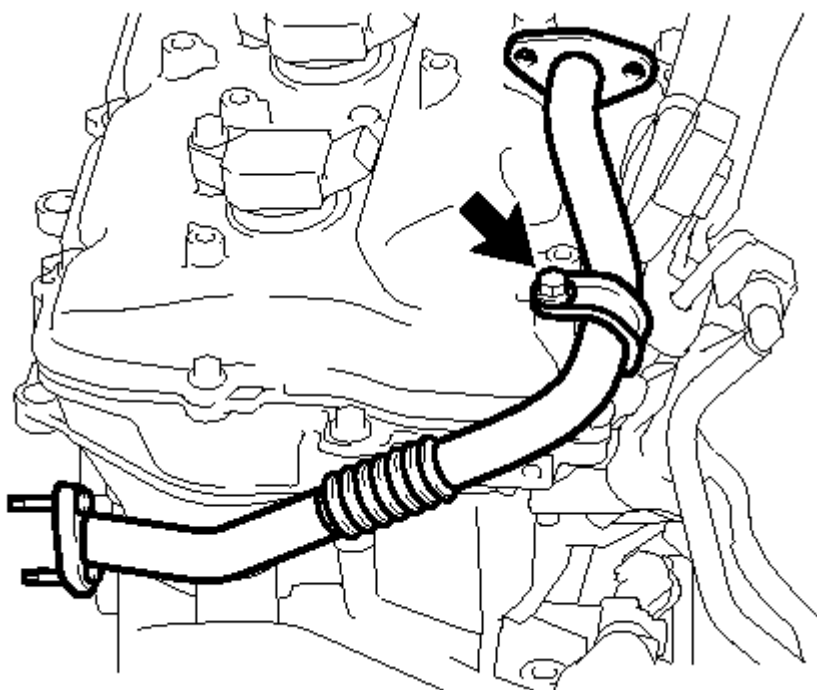


T

**Fig. 181: Removing The Bolt And Wire Harness Clamp Bracket**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the bolt and wire harness clamp bracket.



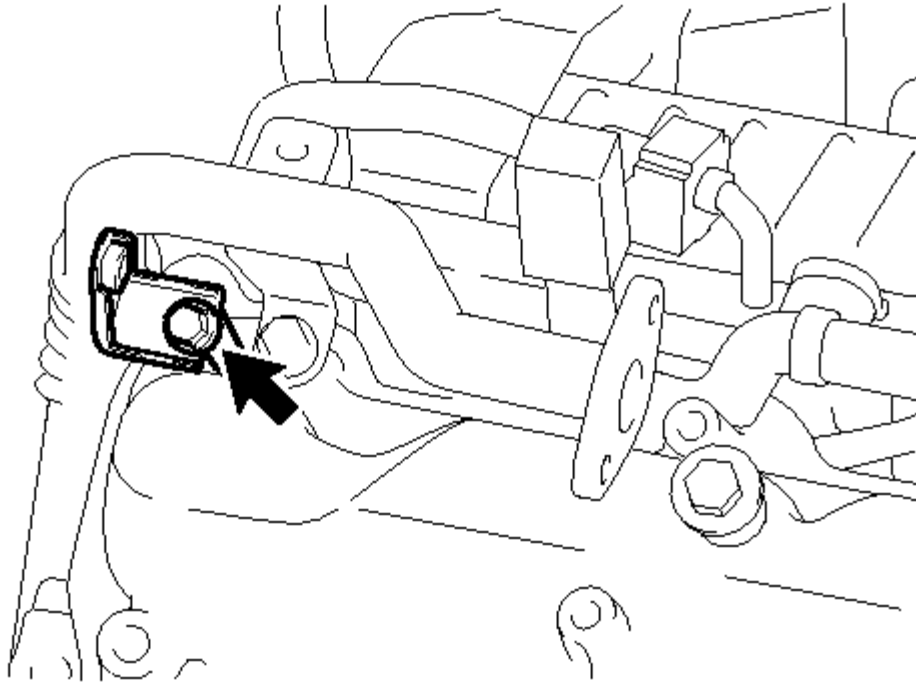
T

**Fig. 182: Identifying No. 4 Air Tube Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt and No. 4 air tube.

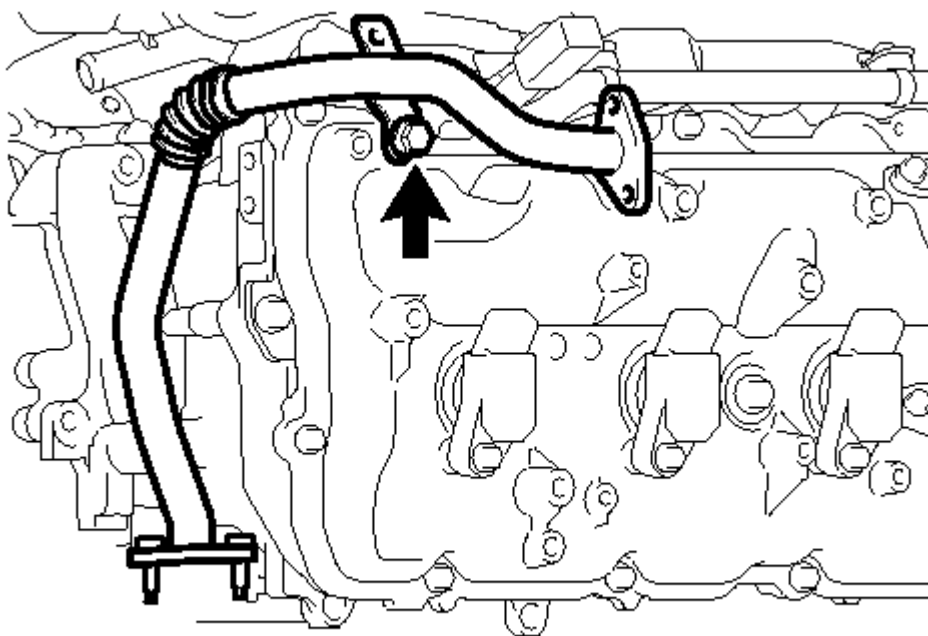
**7. REMOVE NO. 3 AIR TUBE**



**T**

**Fig. 183: Removing The Bolt And Wire Harness Clamp Bracket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the bolt and wire harness clamp bracket.



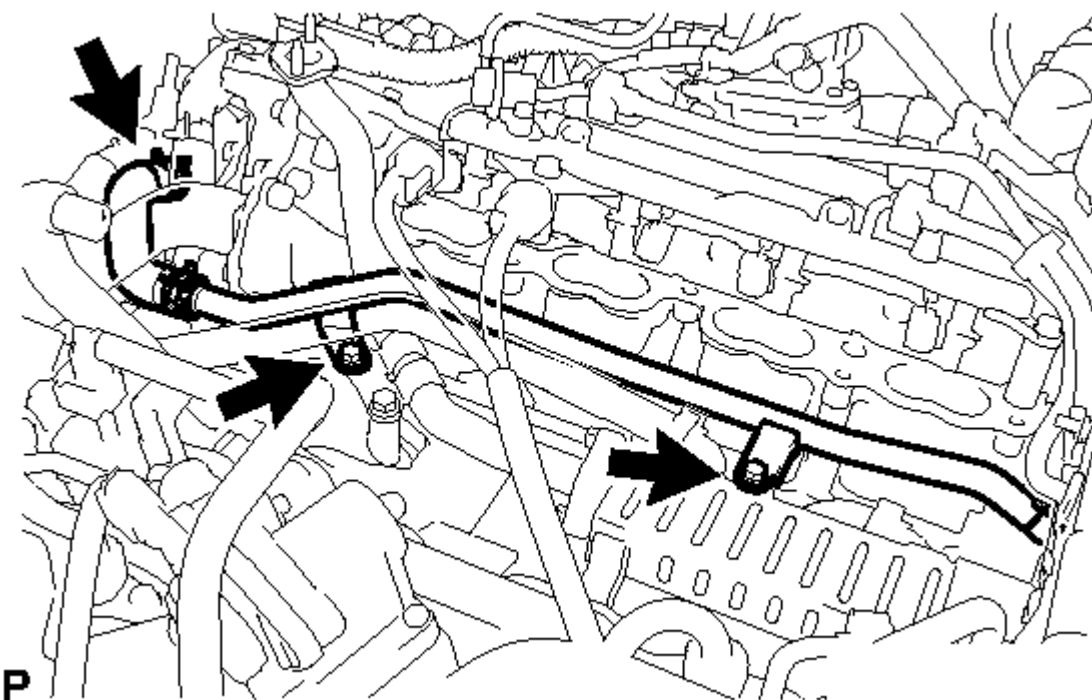
**T**

**Fig. 184: Identifying No. 3 Air Tube Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt and No. 3 air tube.

**8. REMOVE NO. 3 WATER BY-PASS PIPE SUB-ASSEMBLY**



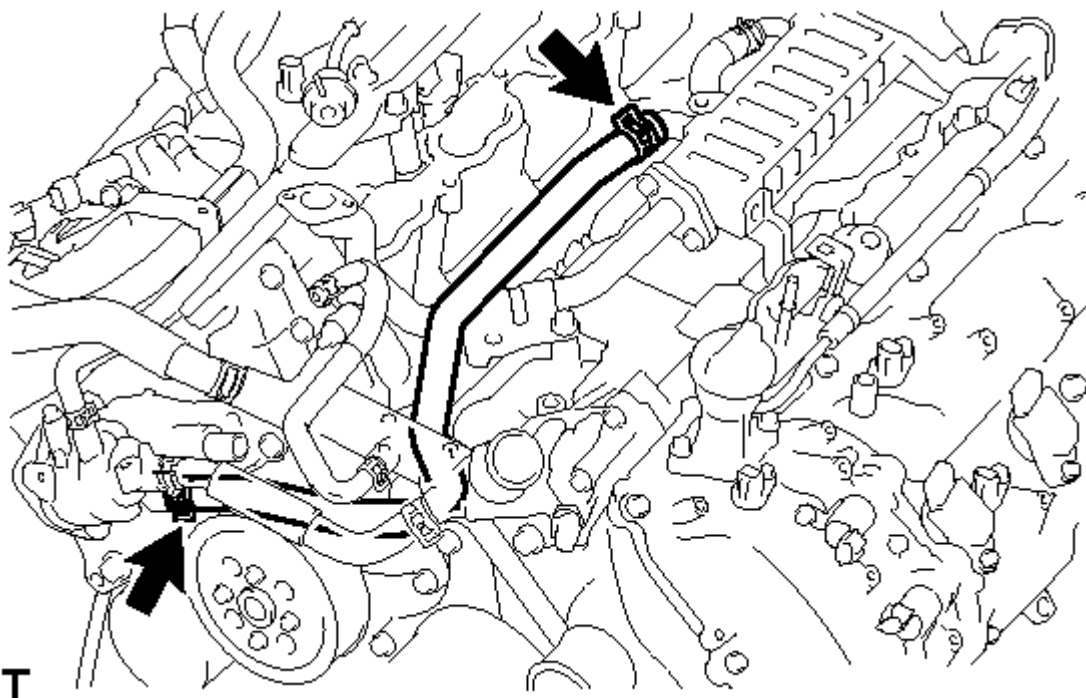
**P**

**Fig. 185: Disconnecting The Hose And Remove The 2 Bolts And No. 3 Water By-Pass Pipe**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Disconnect the hose and remove the 2 bolts and No. 3 water by-pass pipe.

**9. REMOVE NO. 8 WATER BY-PASS HOSE (w/o Oil Cooler)**

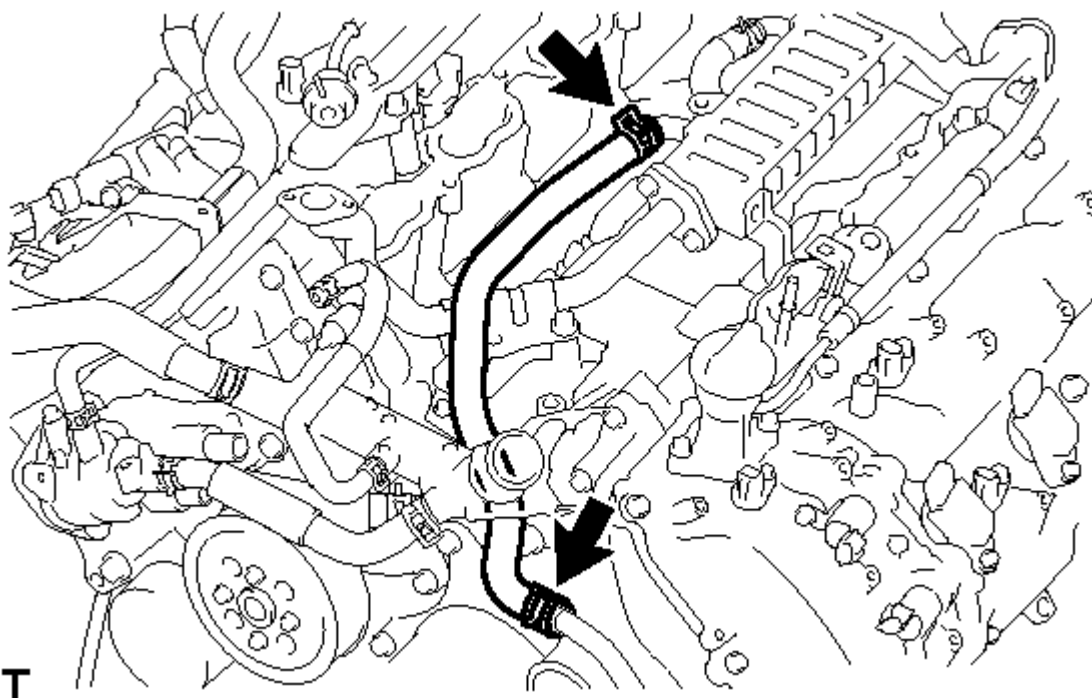


**Fig. 186: Identifying No. 8 Water By-Pass Hose**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the No. 8 water by-pass hose.

**10. REMOVE NO. 8 WATER BY-PASS HOSE (w/ Oil Cooler)**



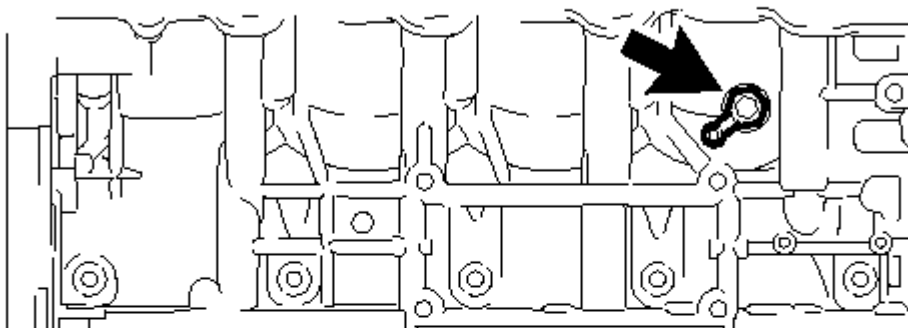
**T**

**Fig. 187: Identifying Water By-Pass Hose (W/ Oil Cooler)**

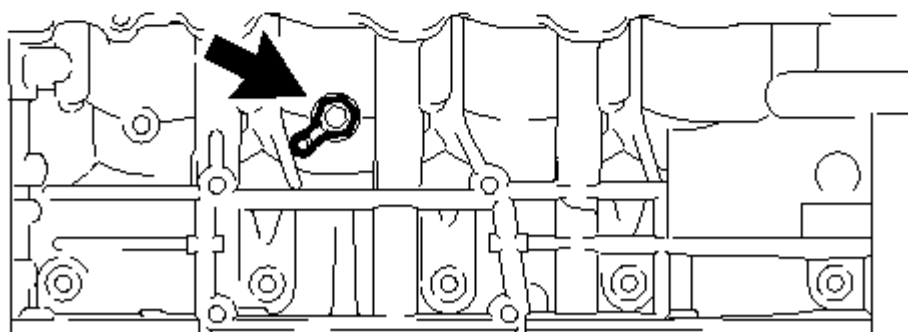
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the No. 8 water by-pass hose.
- 11. **DISCONNECT NO. 11 WATER BY-PASS HOSE** . Refer to **REMOVAL - Step 4**
- 12. **REMOVE EGR COOLER ASSEMBLY** . Refer to **REMOVAL - Step 6**
- 13. **REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY**

RH:



LH:



**P**

**Fig. 188: Identifying Cylinder Block Water Drain Cock Plug**

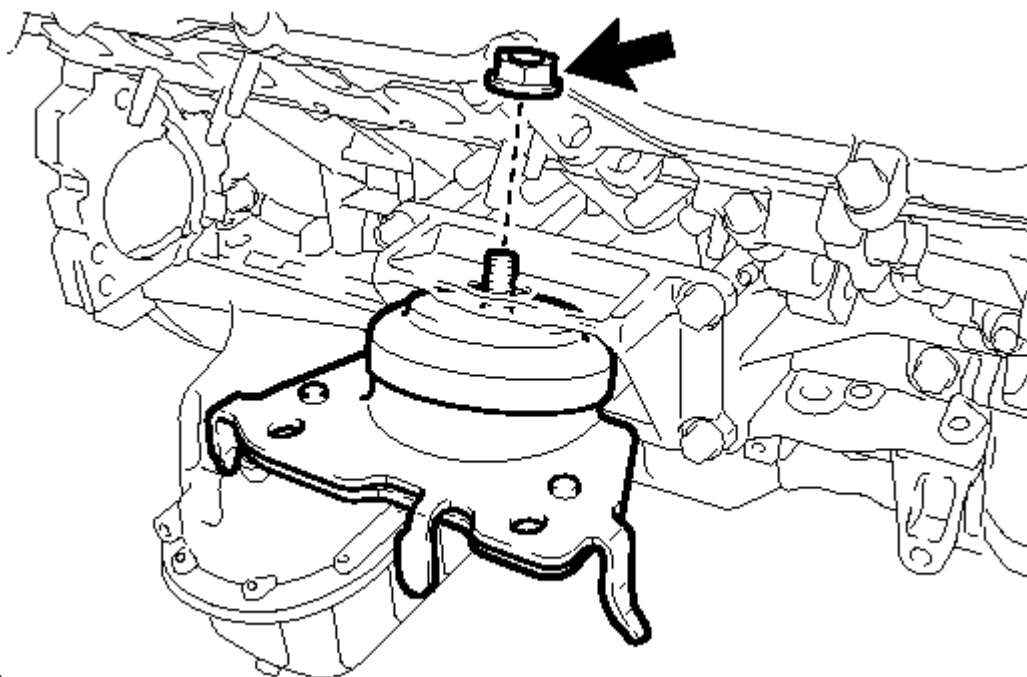
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 water drain cock plugs from the water drain cocks.
- b. Remove the 2 water drain cocks from the cylinder block.

**14. REMOVE FRONT ENGINE MOUNTING INSULATOR RH**

- a. Remove the nut and mounting insulator.



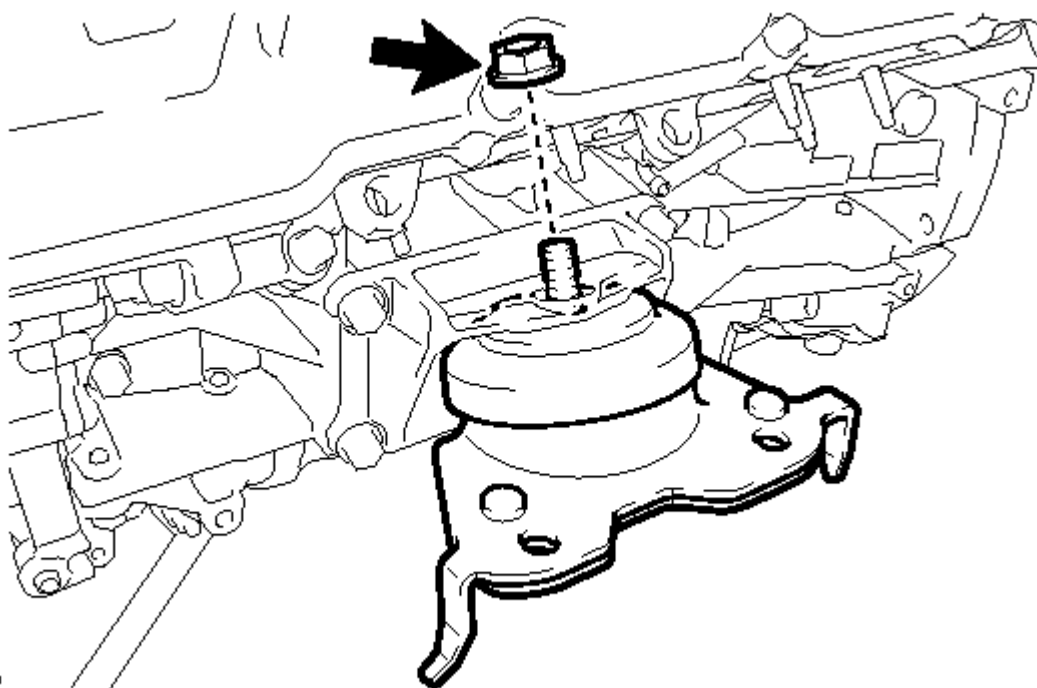


**P**

**Fig. 189: Removing The Nut And Mounting Insulator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE FRONT ENGINE MOUNTING INSULATOR LH**

- a. Remove the nut and mounting insulator.

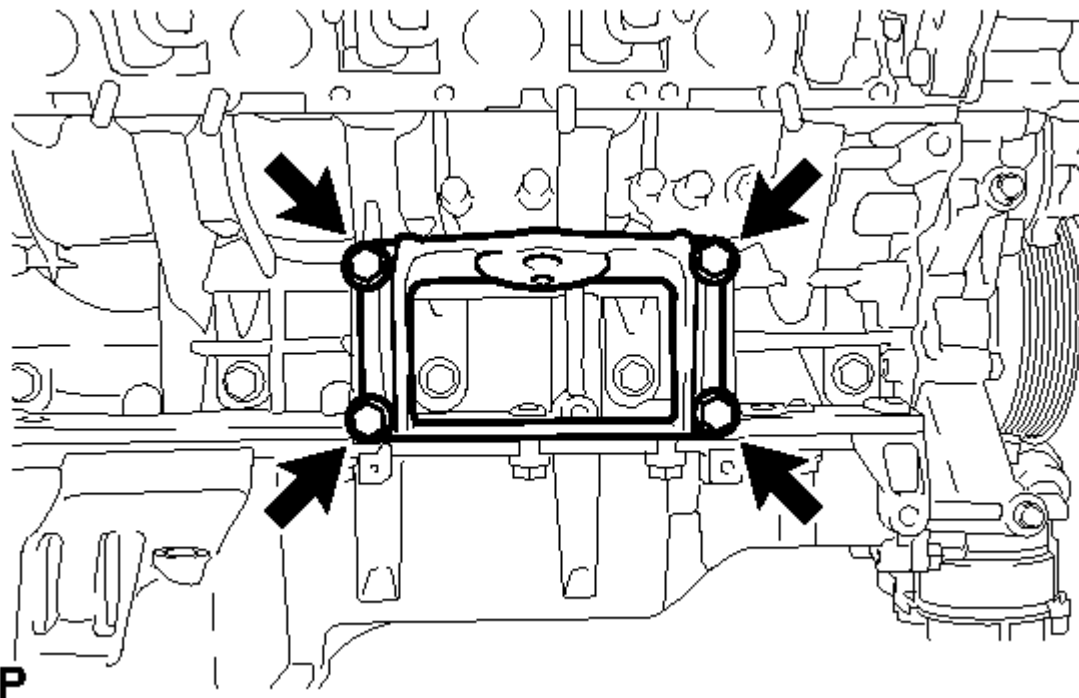


**P**

**Fig. 190: Removing The Nut And Mounting Insulator**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

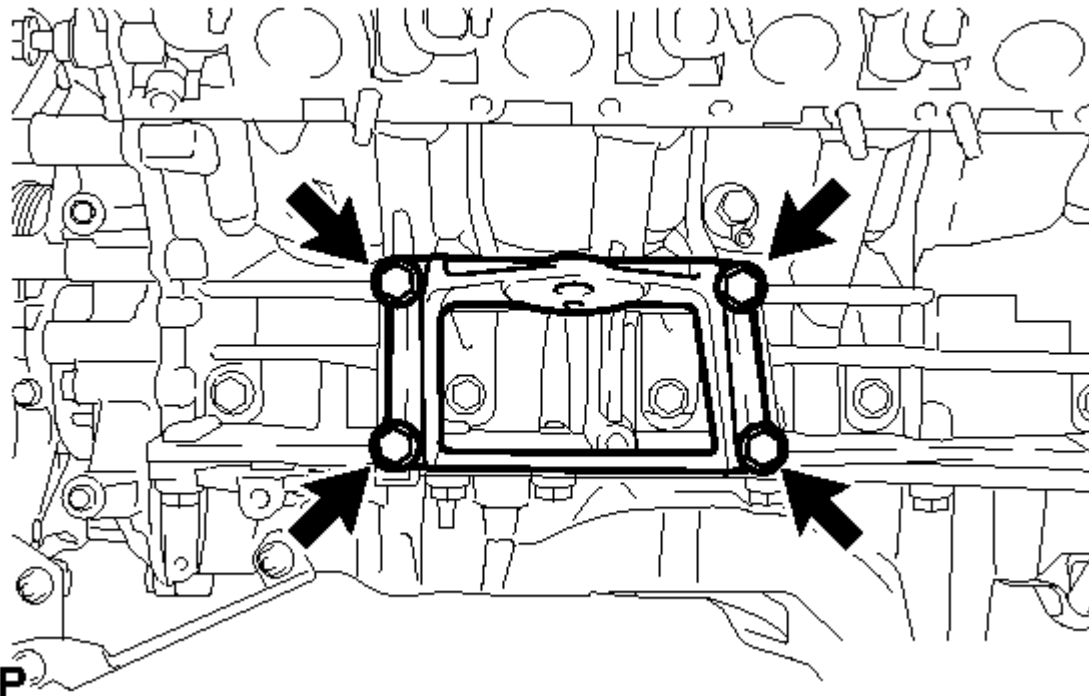
**16. REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET RH**



**Fig. 191: Removing The 4 Bolts And Mounting Bracket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 4 bolts and mounting bracket.

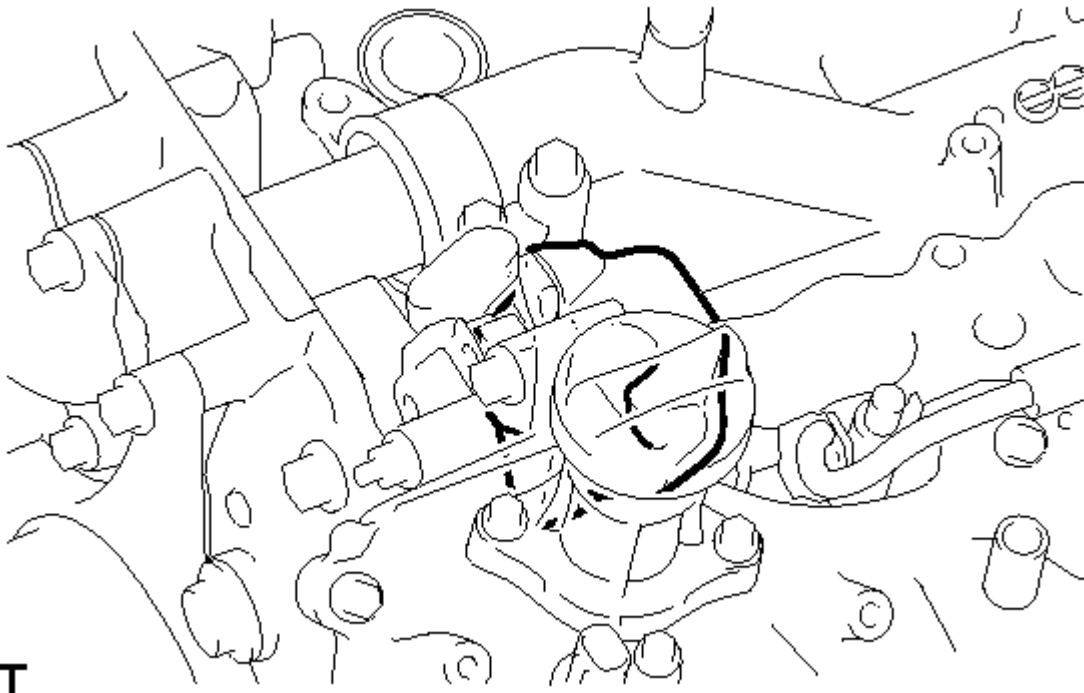
**17. REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET LH**



**Fig. 192: Removing The 4 Bolts And Mounting Bracket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Remove the 4 bolts and mounting bracket.

18. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY RH** . Refer to **REMOVAL - Step 8**
19. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY LH** . Refer to **REMOVAL - Step 9**
20. **REMOVE OIL PRESSURE SENDER GAUGE ASSEMBLY** . Refer to **REMOVAL - Step 2**
21. **REMOVE WATER BY-PASS PIPE (w/ Oil Cooler)** . Refer to **REMOVAL - Step 6**
22. **REMOVE NO. 4 ENGINE COVER** . Refer to **REMOVAL - Step 2**
23. **REMOVE NO. 3 ENGINE COVER** . Refer to **REMOVAL - Step 3**
24. **REMOVE NO. 1 WATER BY-PASS HOSE** . Refer to **REMOVAL - Step 7**
25. **REMOVE AIR TUBE SUB-ASSEMBLY RH** . Refer to **REMOVAL - Step 26**
26. **REMOVE WATER BY-PASS PIPE SUB-ASSEMBLY** . Refer to **REMOVAL - Step 27**
27. **REMOVE WATER INLET HOUSING** . Refer to **REMOVAL - Step 30**
28. **REMOVE FRONT WATER BY-PASS JOINT** . Refer to **REMOVAL - Step 31**
29. **REMOVE WATER PUMP PULLEY** . Refer to **REMOVAL - Step 11**
30. **REMOVE NO. 1 IDLER PULLEY SUB-ASSEMBLY** . Refer to **REMOVAL - Step 33**
31. **REMOVE FAN BRACKET SUB-ASSEMBLY** . Refer to **REMOVAL - Step 34**
32. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY** . Refer to **REMOVAL - Step 35**
33. **REMOVE SEPARATOR CASE** . Refer to **REMOVAL - Step 2**
34. **REMOVE NO. 2 ENGINE COVER**



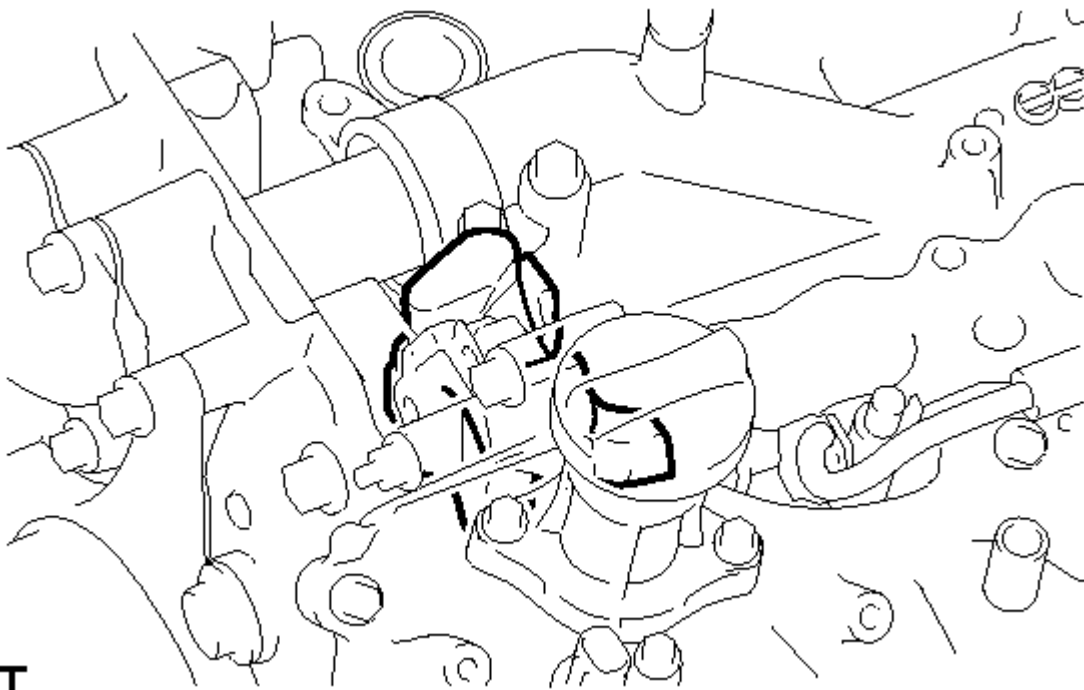
T

**Fig. 193: Identifying No. 2 Engine Cover**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the No. 2 engine cover.

**35. REMOVE NO. 1 ENGINE COVER**



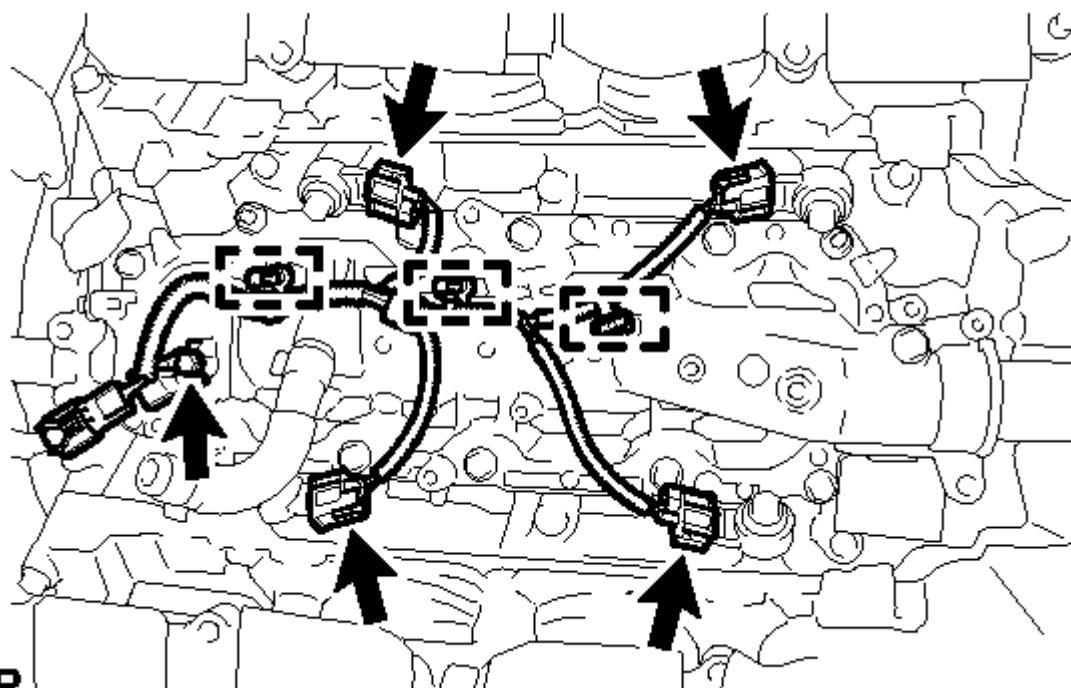
T

**Fig. 194: Identifying No. 1 Engine Cover**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the No. 1 engine cover.

### 36. REMOVE ENGINE WIRE



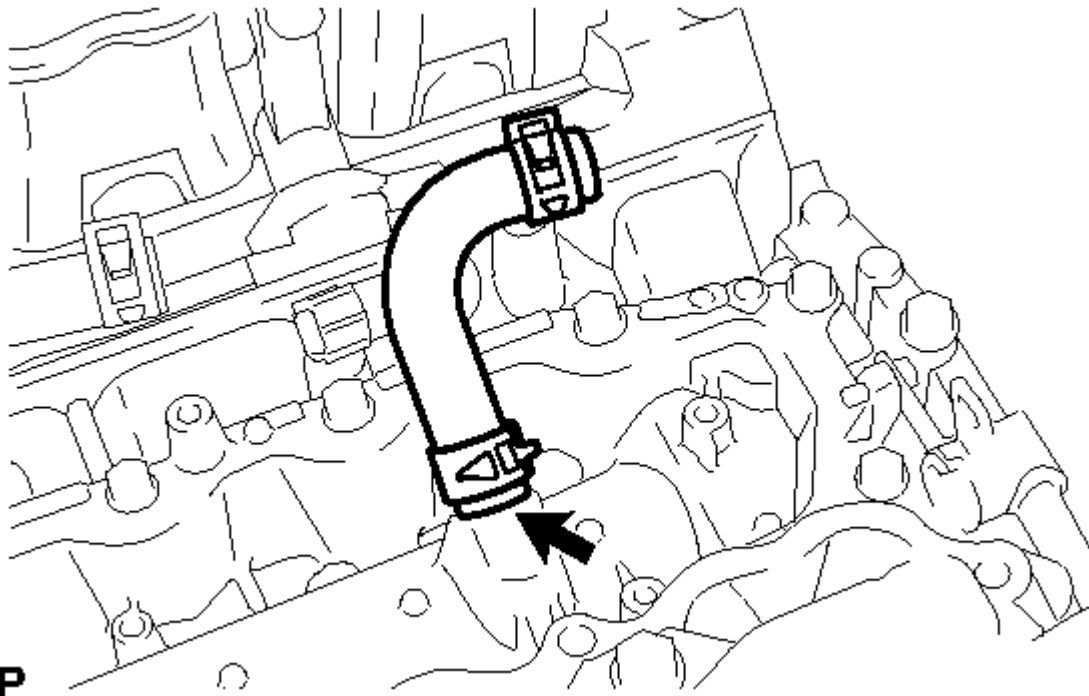
P

**Fig. 195: Identifying Knock Sensor Connectors**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Disconnect the 4 knock sensor connectors.
- b. Disconnect the 3 clamps. Then remove the engine wire.

### 37. REMOVE NO. 11 WATER BY-PASS HOSE



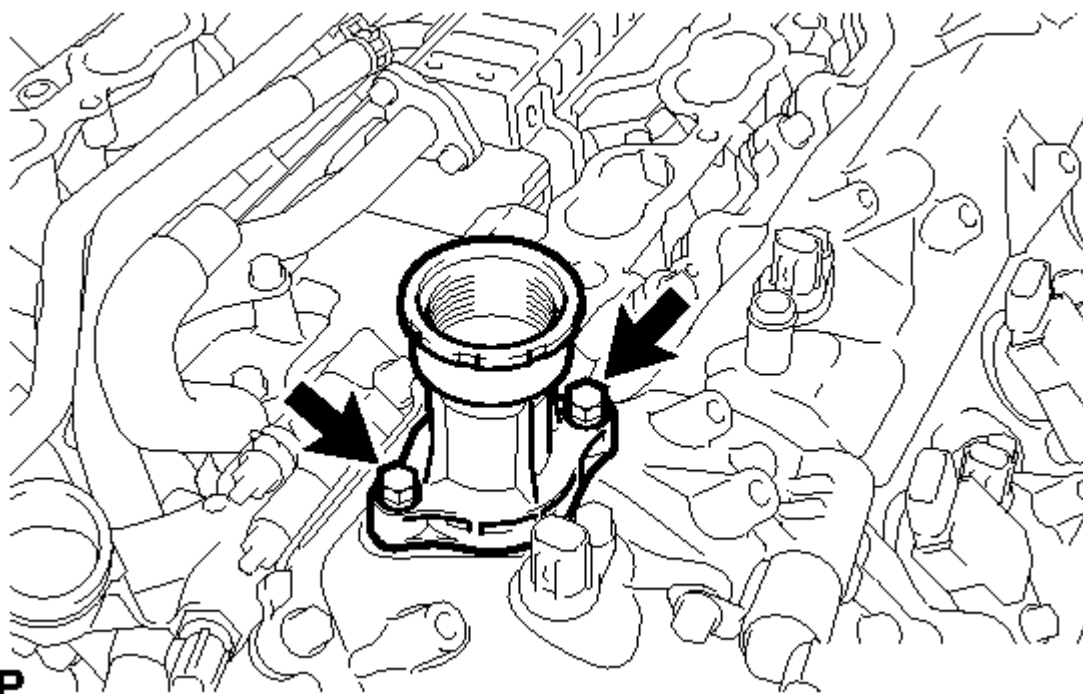
**Fig. 196: Identifying Water By-Pass Hose**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the No. 11 water by-pass hose.
- 38. **REMOVE KNOCK SENSOR** . Refer to **REMOVAL - Step 3**
- 39. **REMOVE IGNITION COIL ASSEMBLY**
  - a. Remove the 8 bolts and 8 ignition coils.
- 40. **REMOVE NOISE FILTER**
  - a. LH Side:  
  
Remove the bolt and noise filter from the cylinder head cover.
  - b. RH Side:  
  
Remove the bolt and noise filter from the cylinder head cover.

## DISASSEMBLY

### DISASSEMBLY

- 1. **REMOVE OIL FILTER ELEMENT** . Refer to **REPLACEMENT - Step 3**
- 2. **REMOVE NO. 1 OIL COOLER BRACKET (w/ Oil Cooler)** . Refer to **REMOVAL - Step 11**
- 3. **REMOVE OIL FILTER BRACKET** . Refer to **REMOVAL - Step 12**
- 4. **REMOVE CRANKSHAFT PULLEY** . Refer to **REMOVAL - Step 41**
- 5. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**

**6. REMOVE OIL FILLER CAP HOUSING****P**

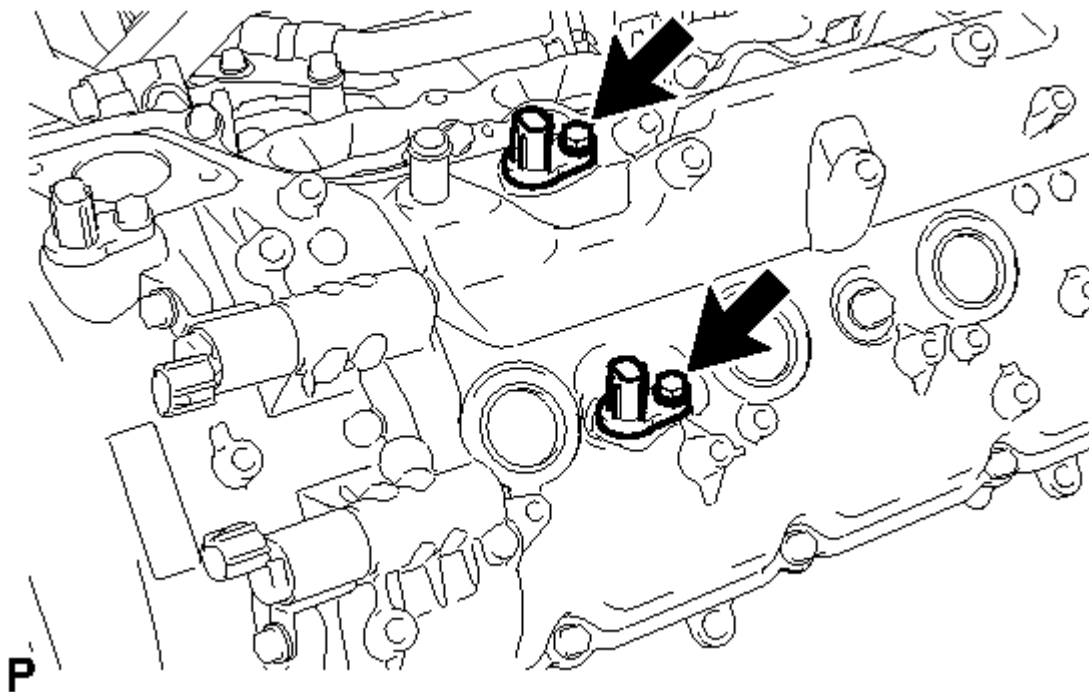
**Fig. 197: Removing The 2 Bolts, Filler Cap Housing And Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 bolts, filler cap housing and gasket.

**7. REMOVE SPARK PLUG**

- a. Using a 16 mm plug wrench, remove the 8 spark plugs.

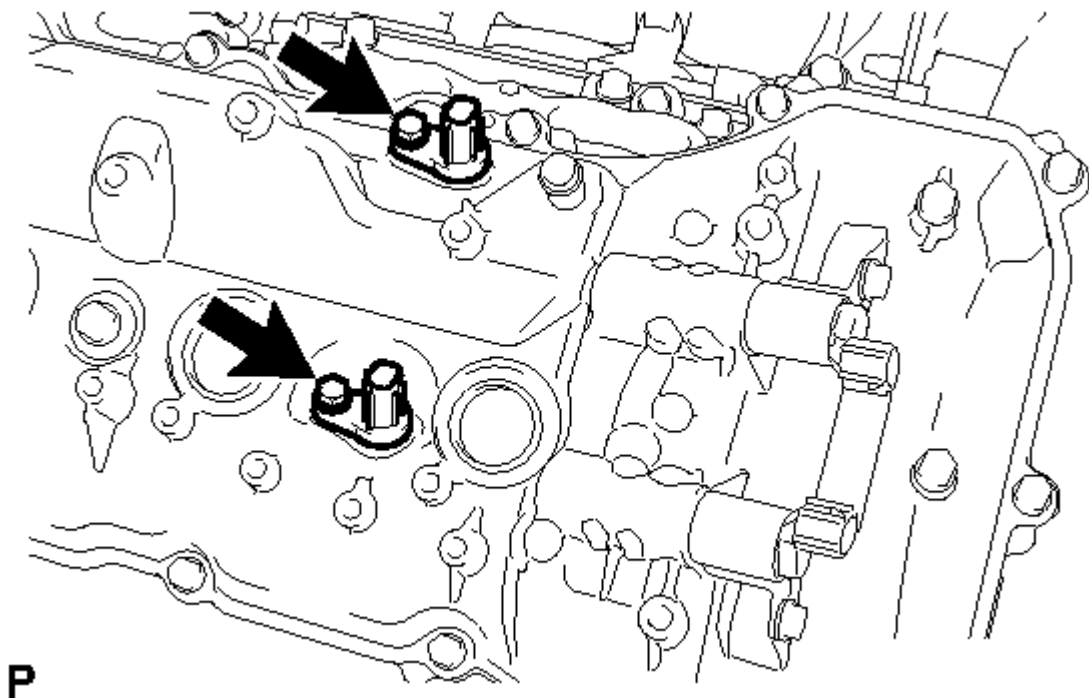
**8. REMOVE VVT SENSOR**



**Fig. 198: Removing The 2 Bolts And 2 Vvt Sensors**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. LH:

Remove the 2 bolts and 2 VVT sensors.



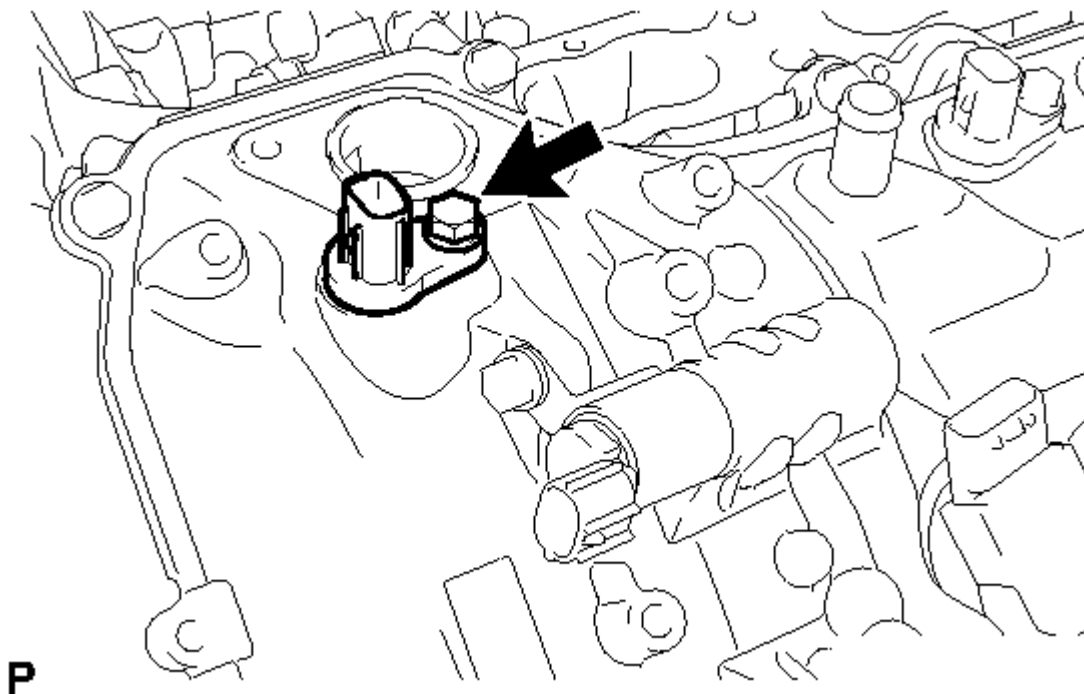


**Fig. 199: Removing The 2 Bolts And 2 Vvt Sensors**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. RH:

Remove the 2 bolts and 2 VVT sensors.

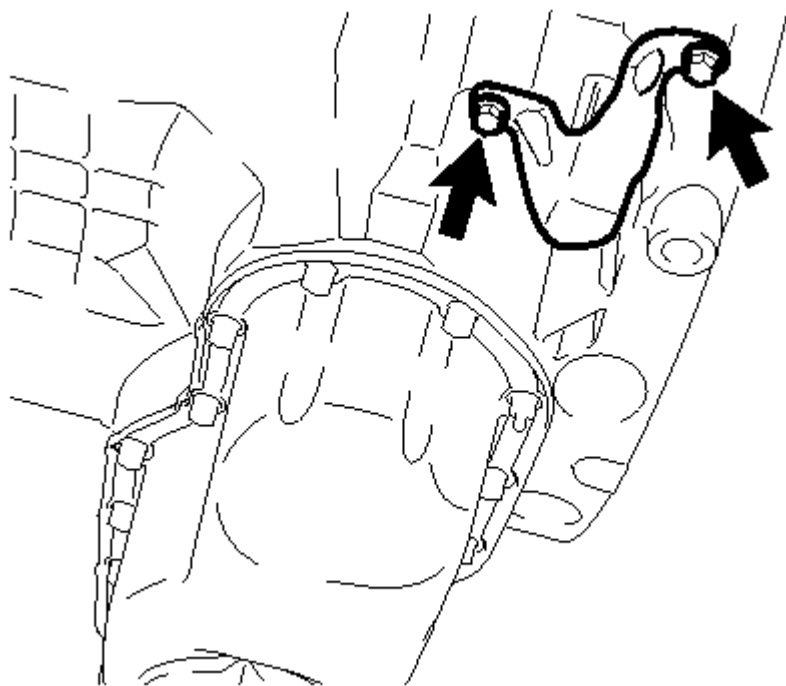
#### **9. REMOVE CAMSHAFT POSITION SENSOR**



**Fig. 200: Removing The Bolt And Camshaft Position Sensor**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Remove the bolt and camshaft position sensor.

#### **10. REMOVE CRANKSHAFT POSITION SENSOR PROTECTOR**



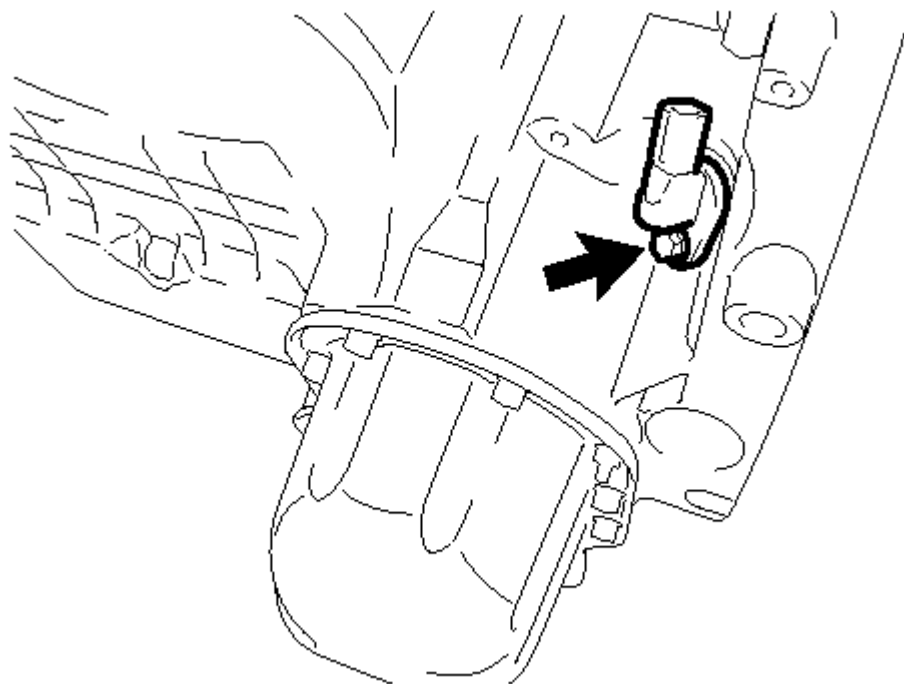
**P**

**Fig. 201: Locating Crank Position Sensor Protector Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 bolts and sensor protector.

#### **11. REMOVE CRANKSHAFT POSITION SENSOR**



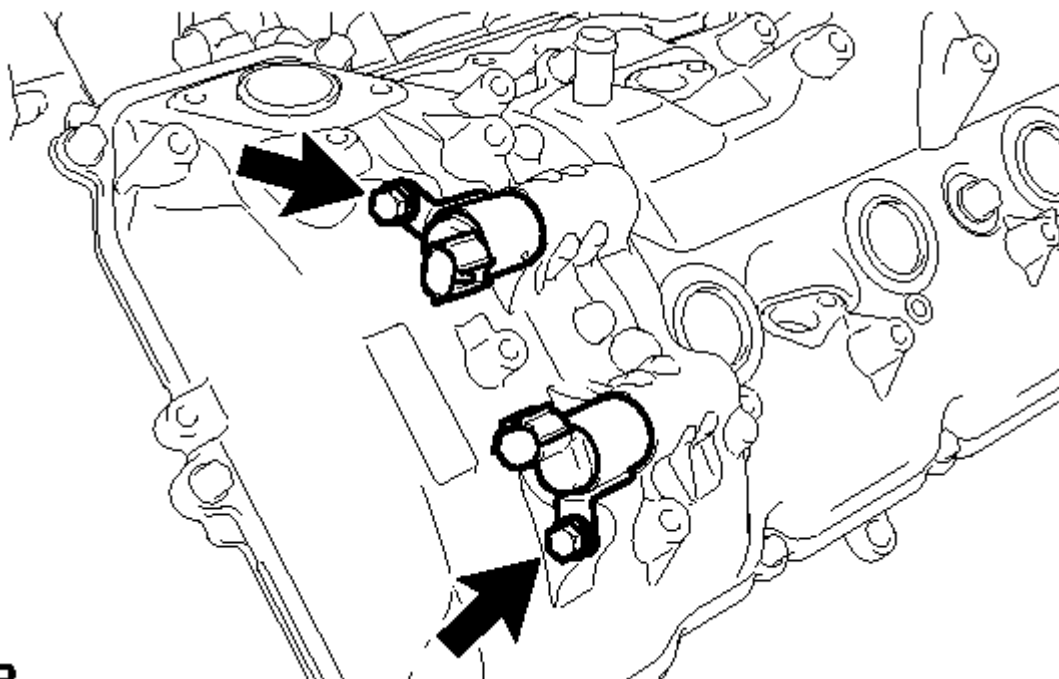
**P**

**Fig. 202: Locating Crankshaft Position Sensor Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the bolt and crankshaft position sensor.

**12. REMOVE CAMSHAFT OIL CONTROL VALVE ASSEMBLY**



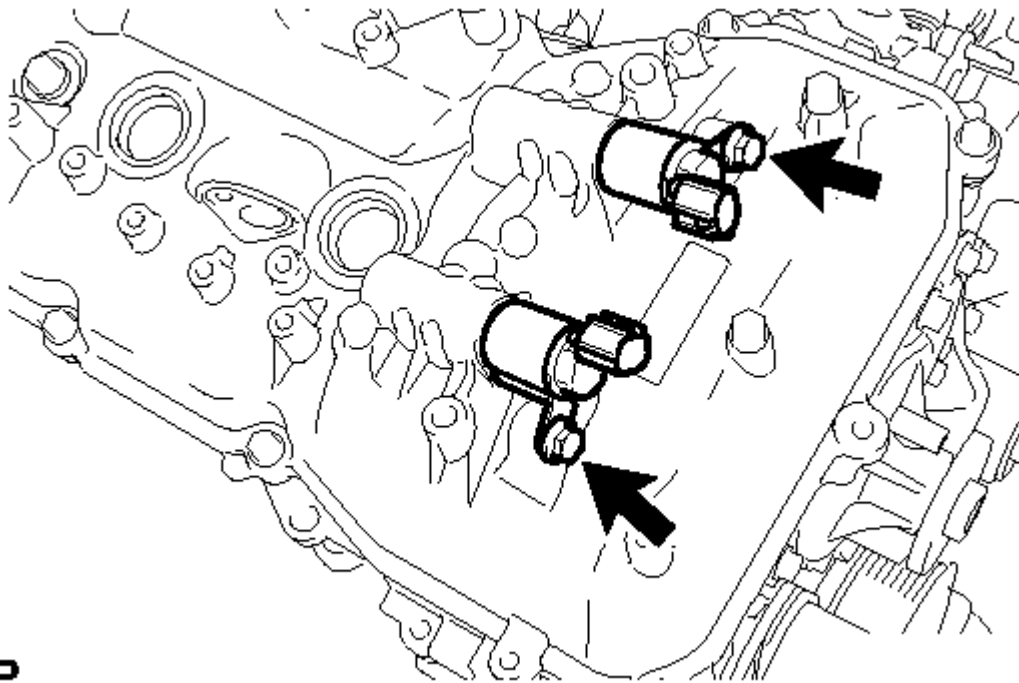
**P**

**Fig. 203: Removing The 2 Bolts And 2 Oil Control Valves**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. LH:

Remove the 2 bolts and 2 oil control valves.

**P****Fig. 204: Removing The 2 Bolts And 2 Oil Control Valves**

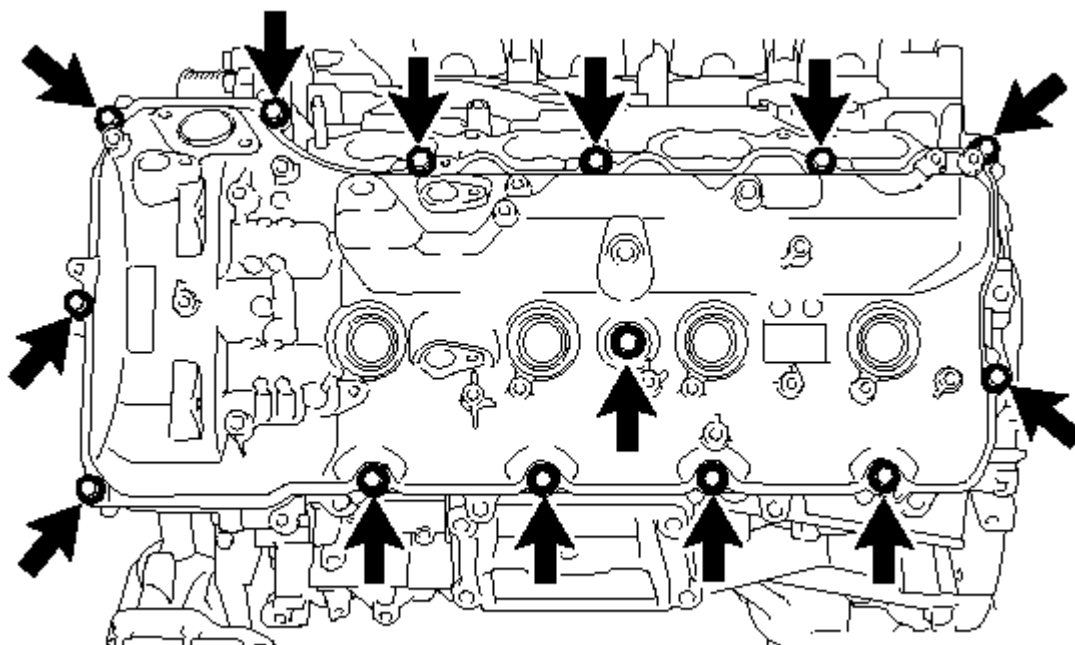
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. RH:

Remove the 2 bolts and 2 oil control valves.

**13. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH**

a. Remove the 14 bolts, seal washer, cylinder head cover and gasket.



**P**

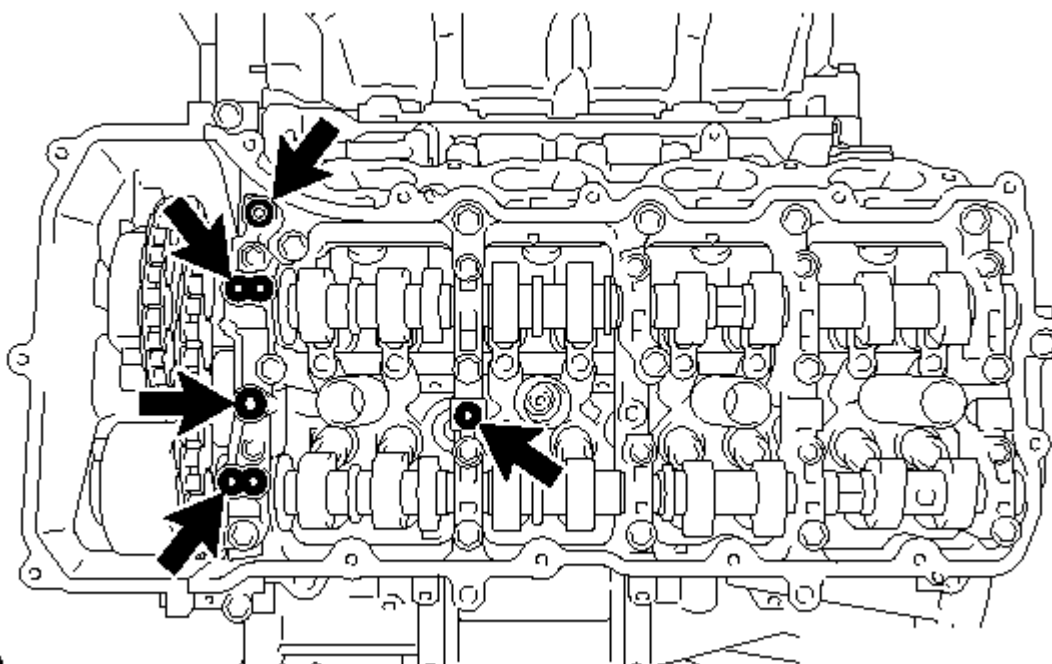
**Fig. 205: Locating Bolts, Seal Washer & Cylinder Head Cover**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Make sure the removed parts are returned to the same places they were removed from.

- b. Remove the 5 gaskets from the camshaft bearing caps (No. 2, No. 3).

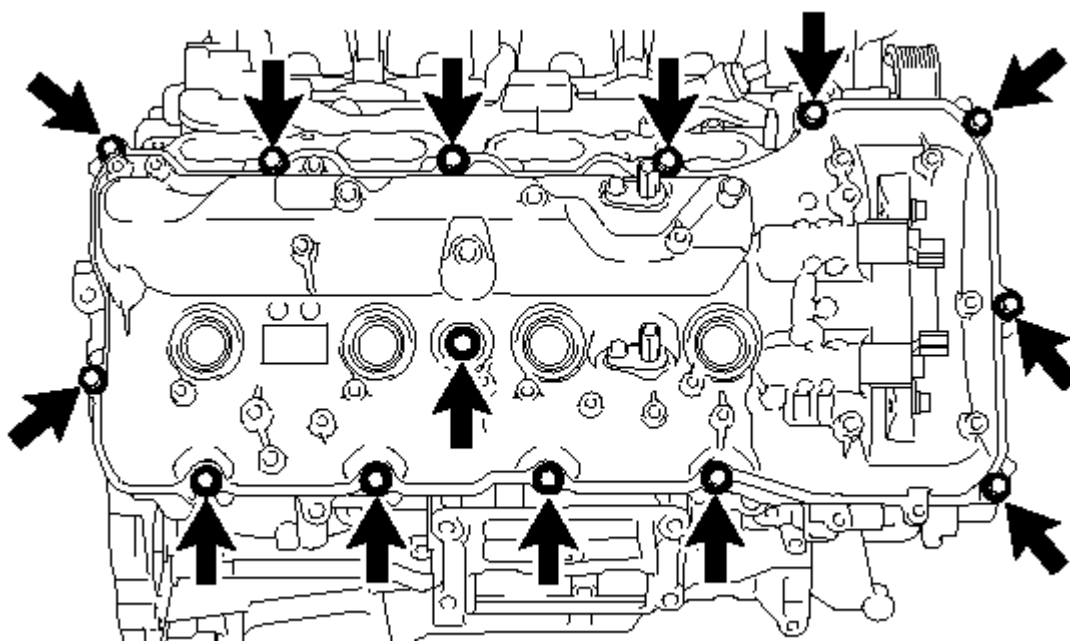


P

**Fig. 206: Identifying Camshaft Bearing Caps Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**14. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY RH**

- a. Remove the 14 bolts, seal washer, cylinder head cover and gasket.



P

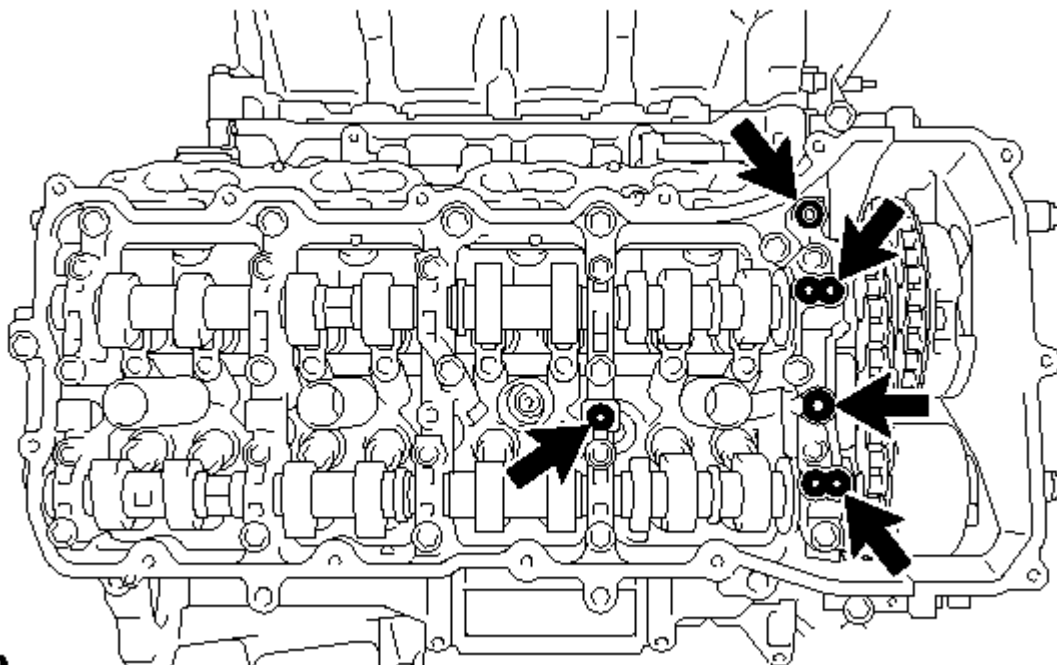
**Fig. 207: Identifying Remove Cylinder Head Cover And Bolts RH**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Make sure the removed parts are returned to the same places they were removed from.

- b. Remove the 5 gaskets from the camshaft bearing caps (No. 1, No. 3).

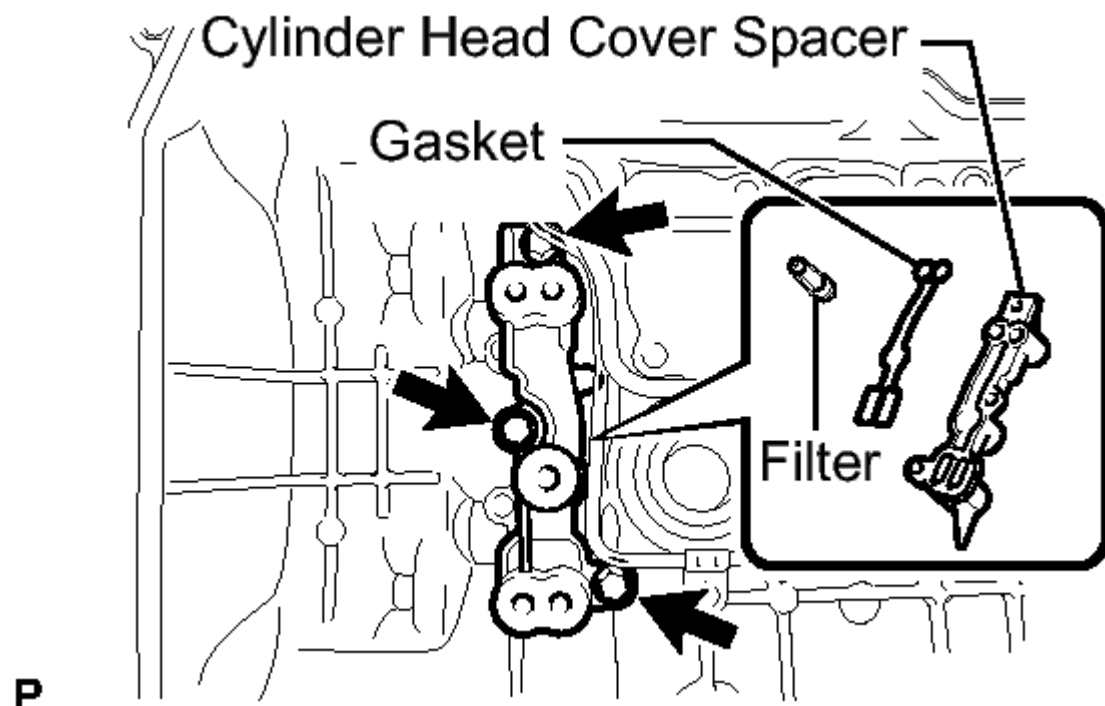


**P**

**Fig. 208: Identifying Camshaft Bearing Caps Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE OIL CONTROL VALVE FILTER**

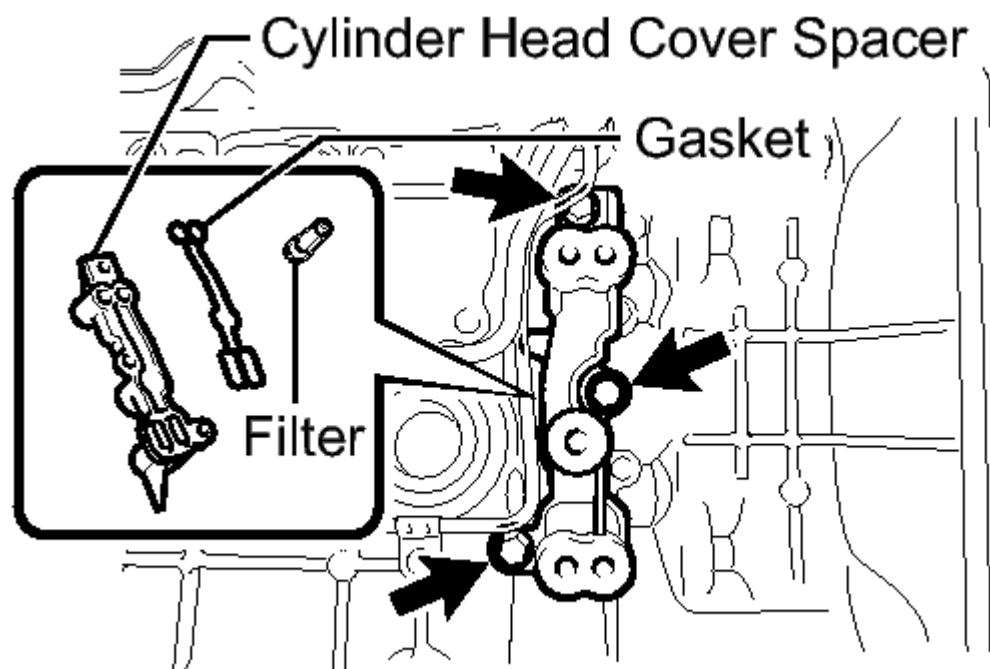


P

**Fig. 209: Identifying Bolts, Cylinder Head Cover Spacer, Gasket And Valve Filter**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. LH:

Remove the 3 bolts, cylinder head cover spacer, gasket and valve filter.



P

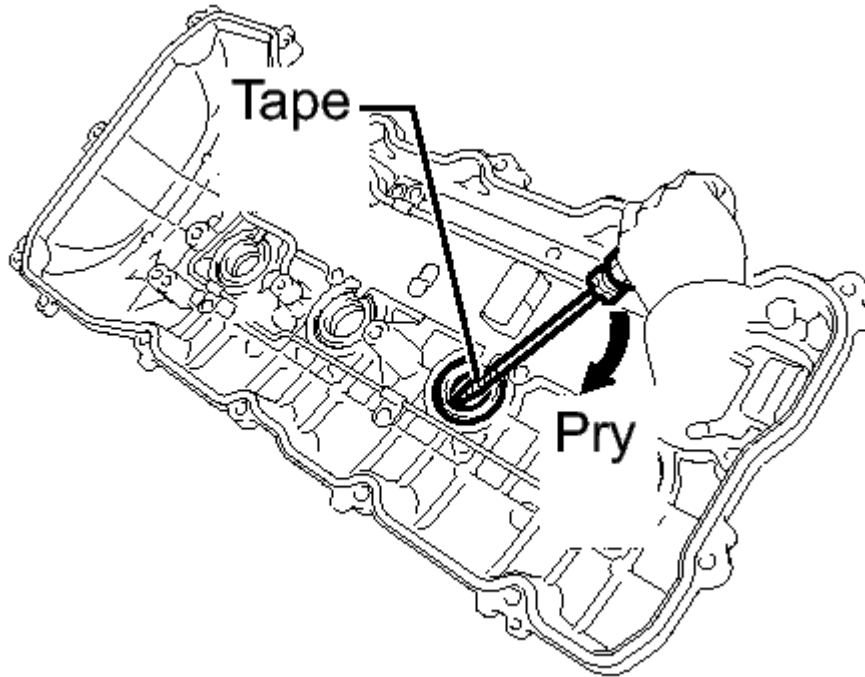


**Fig. 210: Identifying Oil Control Valve Filter, Gasket And Cylinder Head Cover Spacer (RH)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. RH:

Remove the 3 bolts, cylinder head cover spacer, gasket and valve filter.

## 16. REMOVE SPARK PLUG TUBE GASKET



**P**

**Fig. 211: Removing Spark Plug Tube Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Bend the 4 ventilation baffle plate claws on the cylinder head cover to an angle of 90° or more.
- Using a screwdriver, pry out the gaskets.

**NOTE:** Be careful not to damage the cylinder head cover.

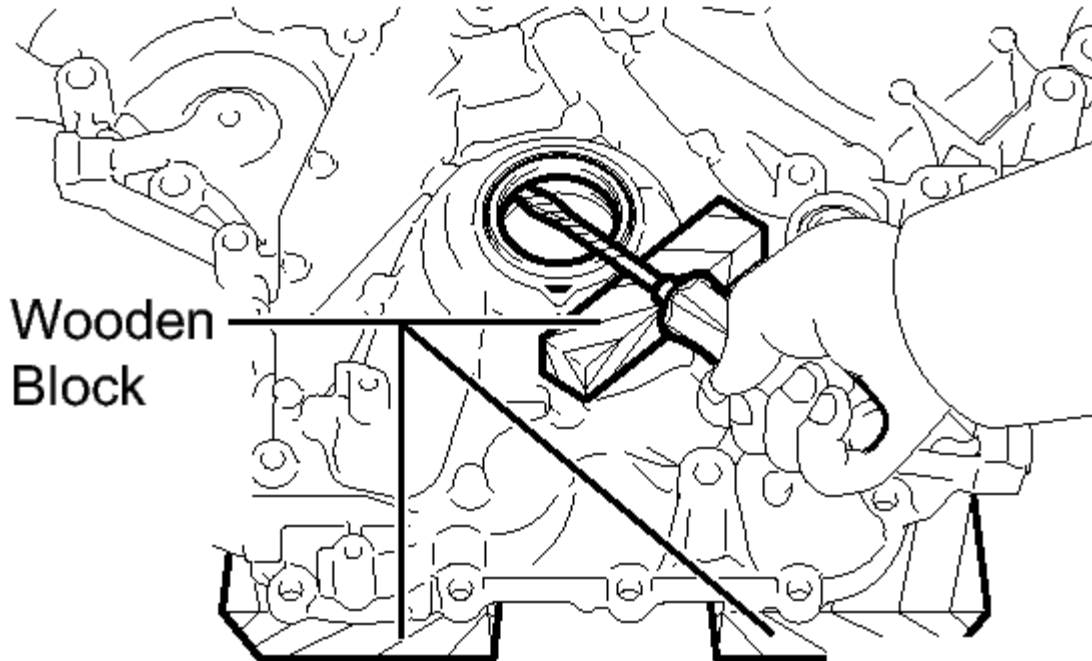
**HINT:**

- Be careful not to damage the gasket when removing it, as the removed gasket needs to be used when installing a new one.
- Tape the screwdriver tip before use.

- REMOVE ENGINE WATER PUMP ASSEMBLY** . Refer to **REMOVAL - Step 12**
- REMOVE TIMING CHAIN COVER SUB-ASSEMBLY** . Refer to **REMOVAL - Step 42**
- REMOVE WATER INLET PIPE** . Refer to **REMOVAL - Step 43**

## 20. REMOVE FRONT CRANKSHAFT OIL SEAL

- a. Place the timing chain cover on wooden blocks.



**P**

**Fig. 212: Placing The Oil Pump On A Wooden Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Place the oil pump on a wooden block.
- c. Using a screwdriver and wooden block, pry out the oil seal.

**NOTE:** Do not damage the surface of the oil seal press fit hole.

**HINT:**

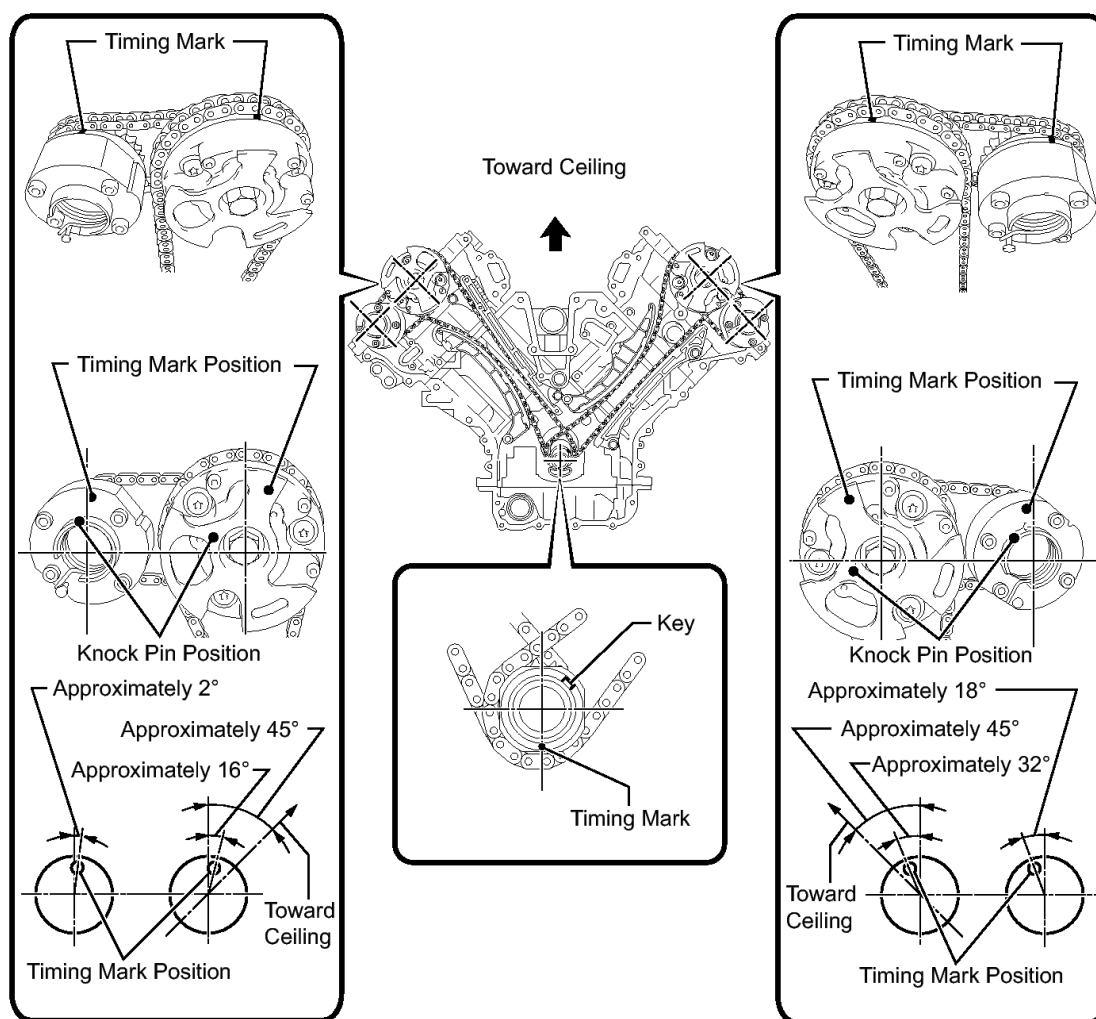
Tape the screwdriver tip before use.

## 21. SET NO. 1 CYLINDER TO TDC / COMPRESSION

- a. Temporarily install the pulley set bolt.
- b. Rotate the crankshaft clockwise so that the timing marks on the crankshaft timing gear and camshaft timing gears are as shown in the illustration.

**HINT:**

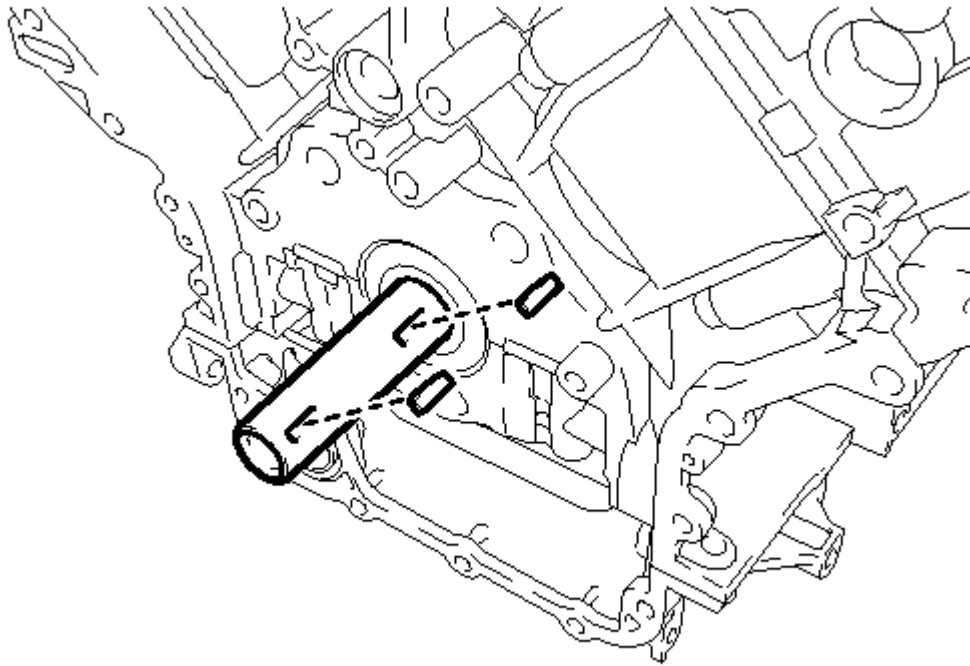
If the timing marks do not align, rotate the crankshaft clockwise again and align the timing marks.



P

**Fig. 213: Rotate The Crankshaft Clockwise Again And Align The Timing Marks**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY LH** See step 3
23. **REMOVE NO. 1 CHAIN TENSIONER SLIPPER LH** See step 4
24. **REMOVE NO. 1 CHAIN VIBRATION DAMPER LH** See step 5
25. **REMOVE NO. 1 CHAIN SUB-ASSEMBLY LH** See step 6
26. **REMOVE NO. 3 CHAIN TENSIONER ASSEMBLY** See step 7
27. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY RH** See step 7
28. **REMOVE NO. 1 CHAIN TENSIONER SLIPPER RH** See step 8
29. **REMOVE NO. 1 CHAIN VIBRATION DAMPER RH** See step 9
30. **REMOVE NO. 1 CHAIN SUB-ASSEMBLY RH** See step 10
31. **REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY** See step 11
32. **REMOVE CRANKSHAFT TIMING GEAR KEY**



**P**

**Fig. 214: Identifying Crankshaft Timing Gear Keys**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a screwdriver, remove the 2 timing gear keys from the crankshaft.
- 33. **REMOVE CAMSHAFT BEARING CAP LH** See step 8
- 34. **REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY LH** See step 9
- 35. **REMOVE CAMSHAFT BEARING CAP RH** See step 12
- 36. **REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY RH** See step 13
- 37. **REMOVE VALVE ROCKER ARM SUB-ASSEMBLY**
  - a. Remove the 32 valve rocker arms from the cylinder head.

**HINT:**

Arrange the removed parts in the correct order.

- 38. **REMOVE VALVE LASH ADJUSTER ASSEMBLY**
  - a. Remove the 32 valve lash adjusters from the cylinder head.

**HINT:**

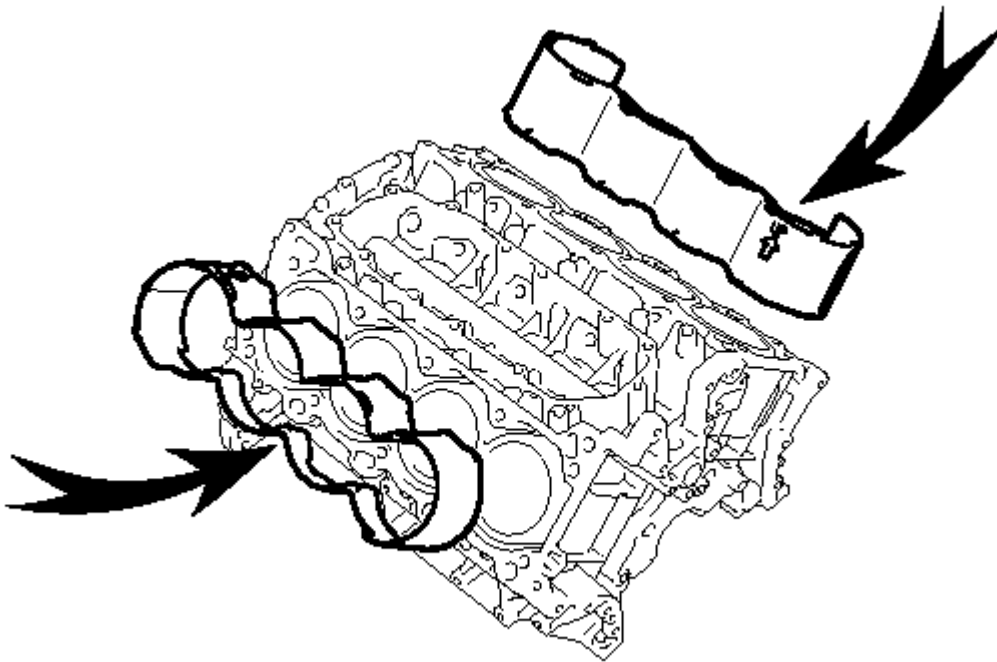
Arrange the removed parts in the correct order.

- 39. **REMOVE VALVE STEM CAP**
  - a. Remove the 32 valve stem caps from the cylinder head.

**HINT:**

Arrange the removed parts in the correct order.

- 40. **REMOVE CYLINDER HEAD SUB-ASSEMBLY LH** See step 6
- 41. **REMOVE CYLINDER HEAD SUB-ASSEMBLY RH** See step 6
- 42. **REMOVE CYLINDER HEAD GASKET LH**
- 43. **REMOVE CYLINDER HEAD GASKET RH**
- 44. **REMOVE CYLINDER BLOCK WATER JACKET SPACER**

**P**

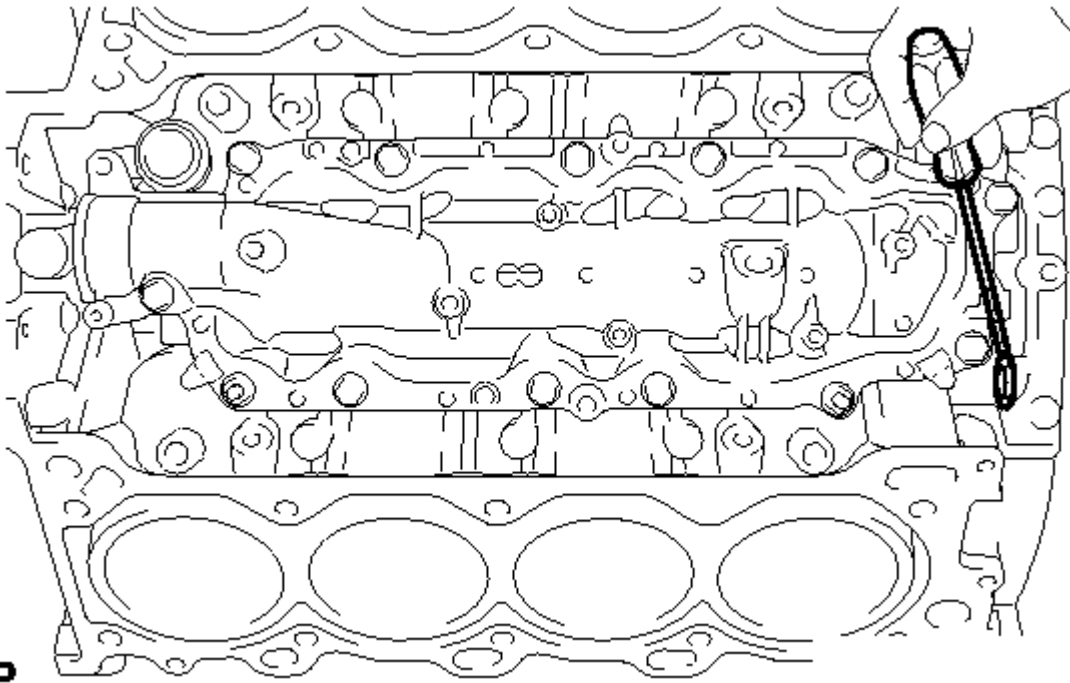
**Fig. 215: Identifying Cylinder Block Water Jacket Spacer**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 2 water jacket spacers from the cylinder head.

**NOTE:** Be sure to remove the water jacket spacers. If not, they may fall and become damaged when the cylinder block is inverted.

- 45. **REMOVE OIL RETURN PIPE GASKET**



**P**

**Fig. 216: Prying Oil Return Pipe Gasket**

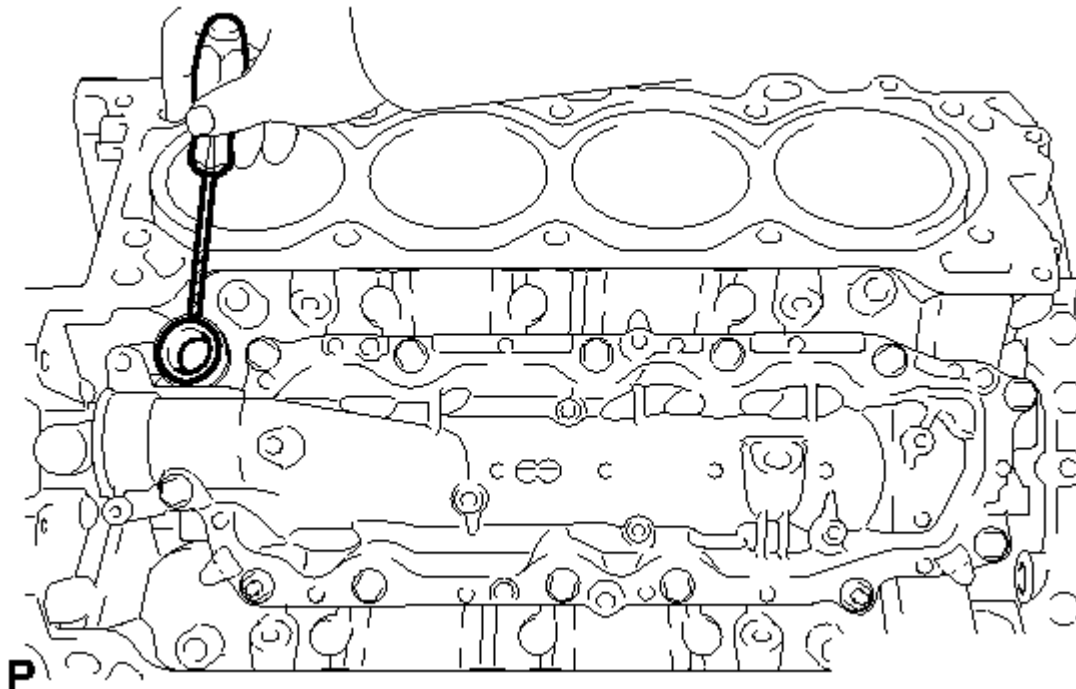
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a screwdriver, pry out the oil return pipe gasket.

**HINT:**

Tape the screwdriver tip before use.

**46. REMOVE VENTILATION PIPE GASKET**



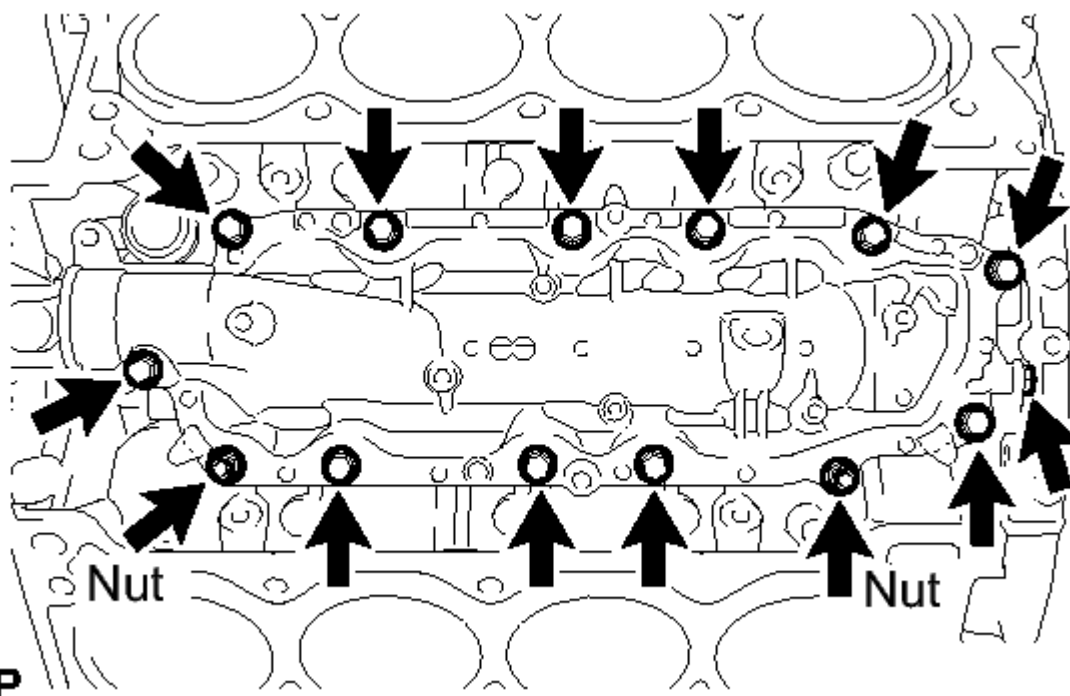
**Fig. 217: Prying Ventilation Pipe Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a screwdriver, pry out the ventilation pipe gasket.

**HINT:**

Tape the screwdriver tip before use.

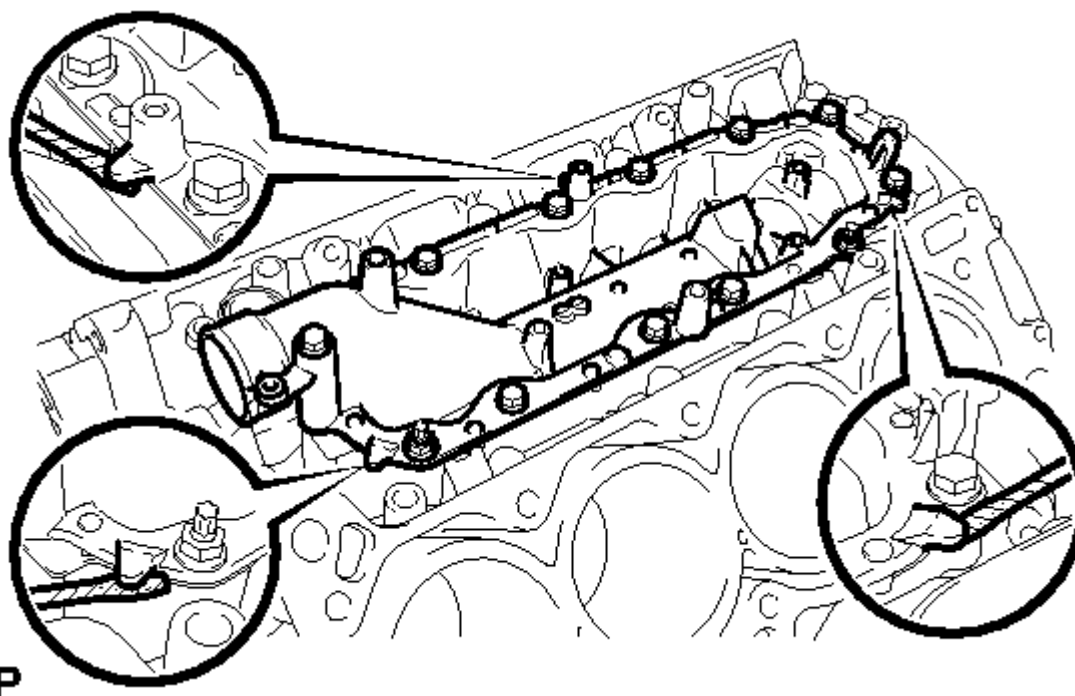
**47. REMOVE NO. 1 HEAT EXCHANGER COVER**



**Fig. 218: Locating Heat Exchanger Cover Bolts & Nuts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 12 bolts and 2 nuts.



**Fig. 219: Identifying Pry Points Between Heat Exchanger & Cylinder Block**

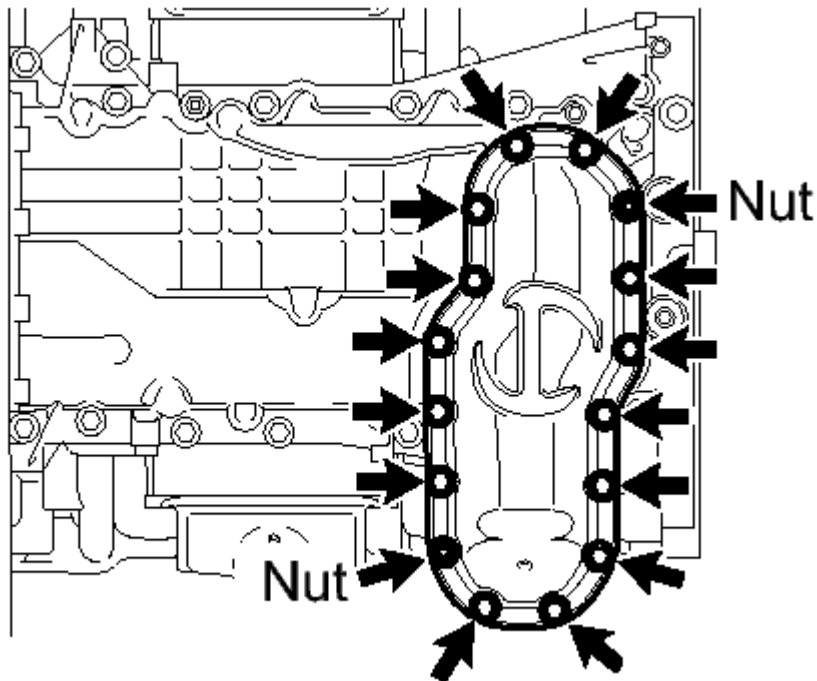
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



- b. Remove the heat exchanger by prying between the heat exchanger and cylinder block with a screwdriver.

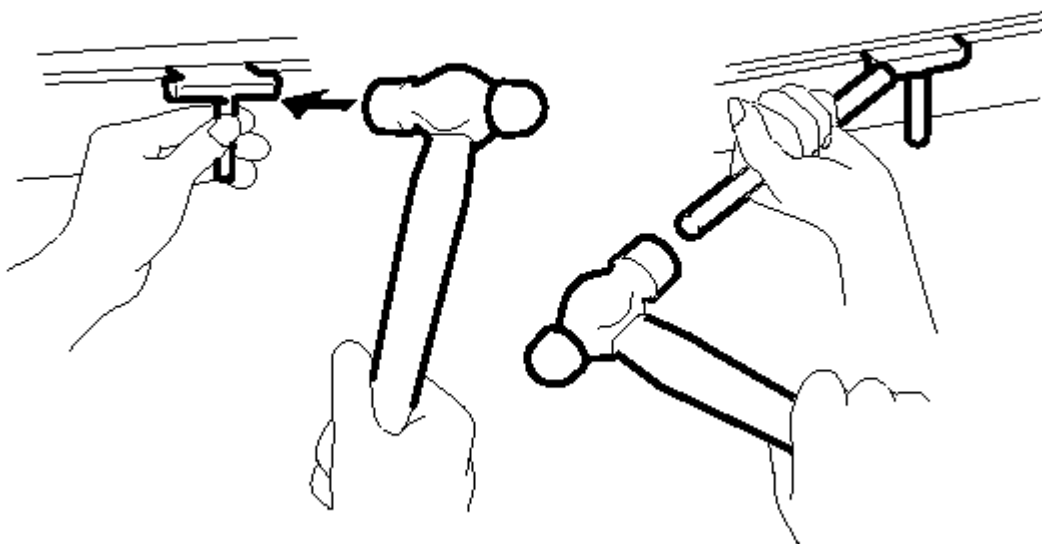
**HINT:**

Tape the screwdriver tip before use.

**48. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY****P**

**Fig. 220: Locating No. 2 Oil Pan Sub-Assembly Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 14 bolts and 2 nuts.

**T**

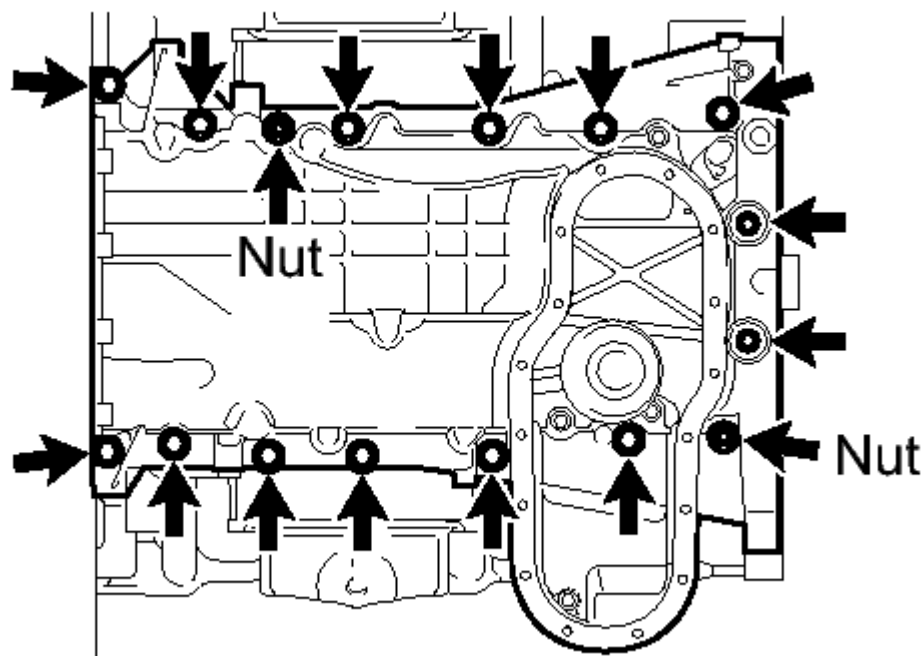
**Fig. 221: Inserting Blade Of Oil Pan Seal Cutter Between Oil Pans**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to damage the contact surfaces of the oil pans.

- b. Insert the blade of oil pan seal cutter between the oil pans. Cut through the applied sealer and remove the No. 2 oil pan.

**49. REMOVE NO. 1 OIL PAN SUB-ASSEMBLY**



P

**Fig. 222: Locating No. 1 Oil Pan Sub-Assembly Bolts And Nuts**

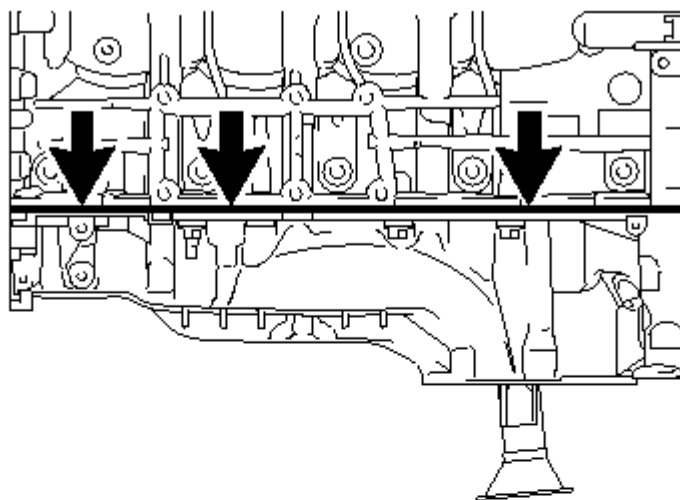
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 14 bolts and 2 nuts.

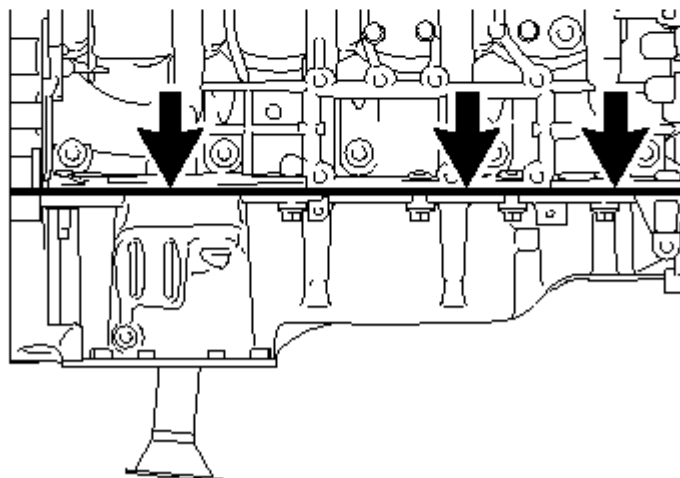
**HINT:**

Be sure to clean the bolts and stud bolts, and check the threads for cracks or other damage.

LH  
Side:



RH  
Side:



**P**

**Fig. 223: Locating Seam Between Oil Pan & Cylinder Block**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

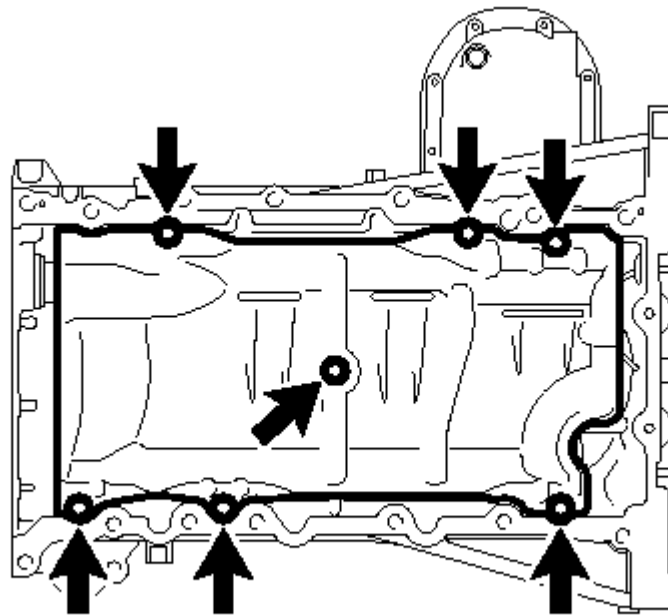
**NOTE:** Be careful not to damage the contact surfaces of the cylinder block and oil pan.

- b. Remove the oil pan by prying between the oil pan and cylinder block with a screwdriver.

**HINT:**

Tape the screwdriver tip before use.

#### 50. REMOVE NO. 1 OIL PAN BAFFLE PLATE



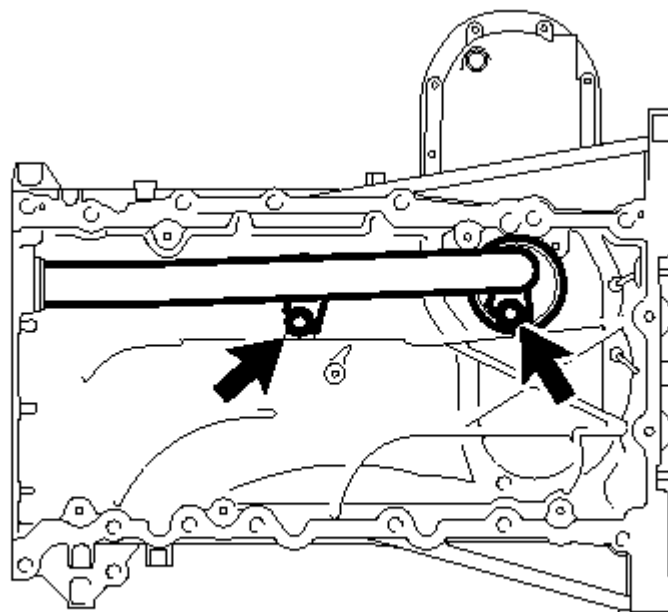
**P**

**Fig. 224: Locating No. 1 Oil Pan Baffle Plate Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 7 bolts and baffle plate.

#### 51. REMOVE OIL STRAINER SUB-ASSEMBLY



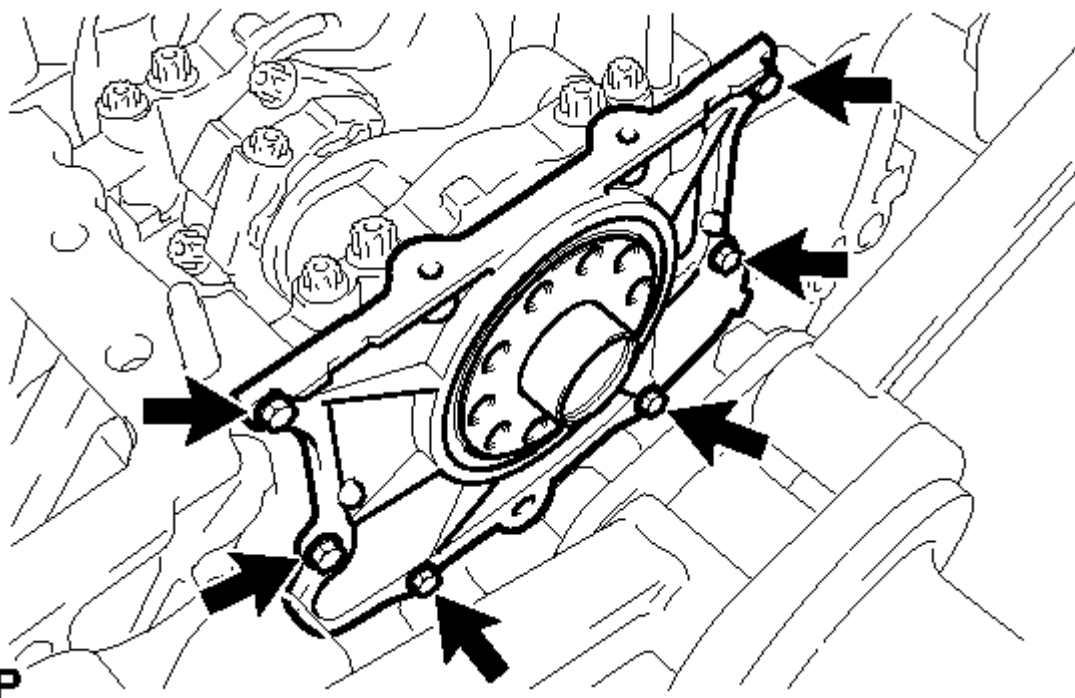
**P**

**Fig. 225: Locating Oil Strainer Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

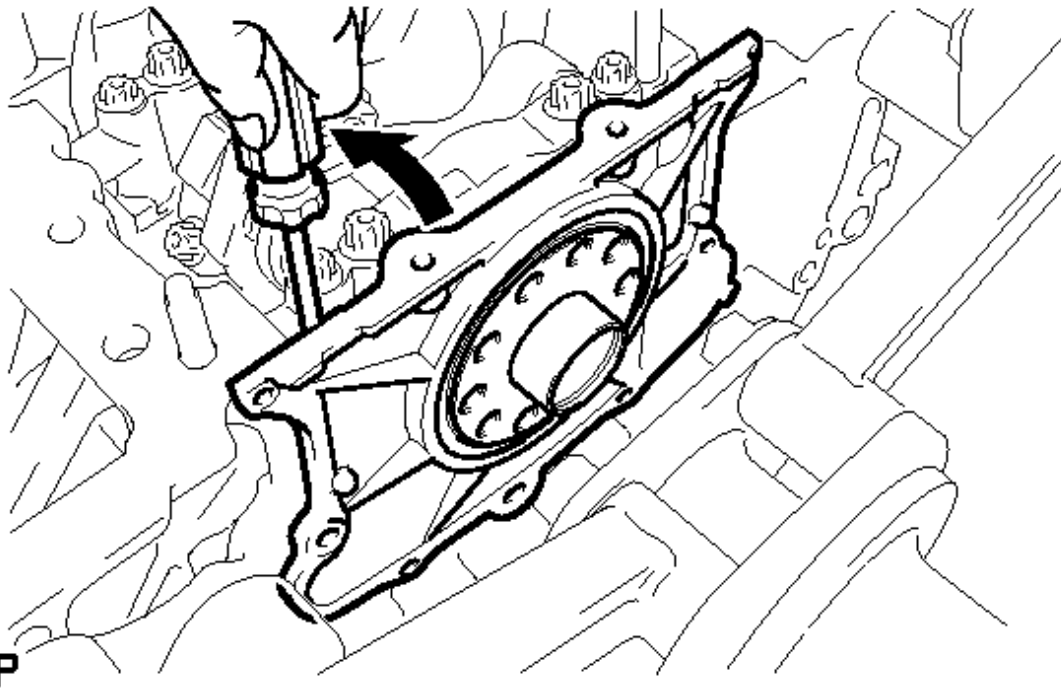
- a. Remove the 2 bolts, oil strainer and O-ring.

52. REMOVE ENGINE REAR OIL SEAL RETAINER



**Fig. 226: Locating Engine Rear Oil Seal Retainer Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the 6 bolts and oil seal retainer.



**Fig. 227: Prying Out Oil Seal Retainer**

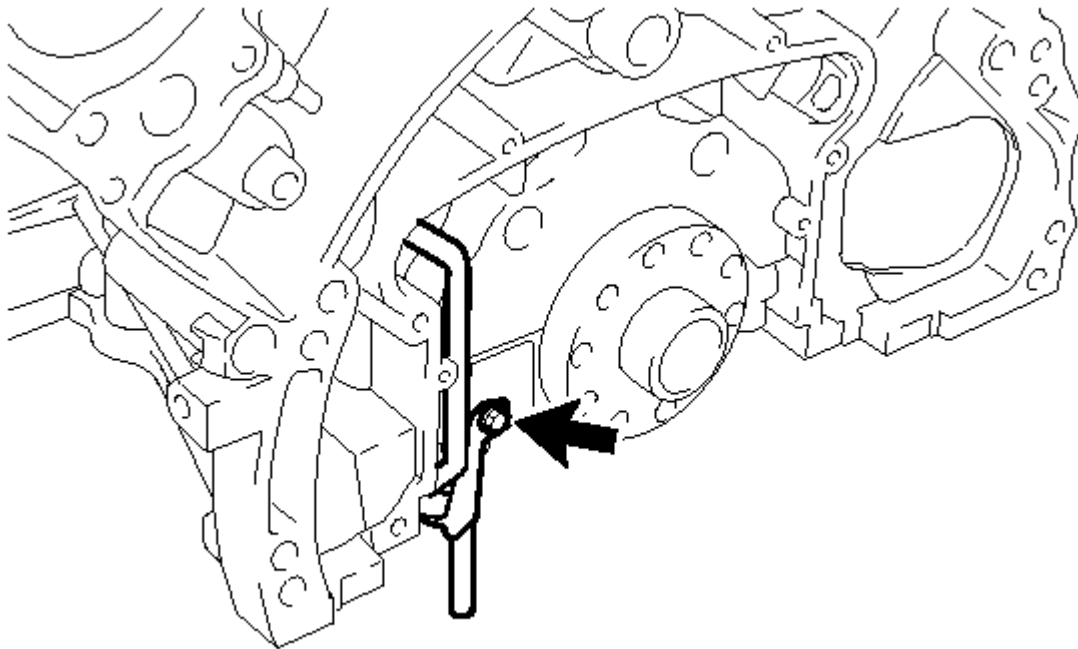
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver, pry out the oil seal retainer.

**HINT:**

Tape the screwdriver tip before use.

**53. REMOVE OIL DRAIN PIPE SUB-ASSEMBLY**



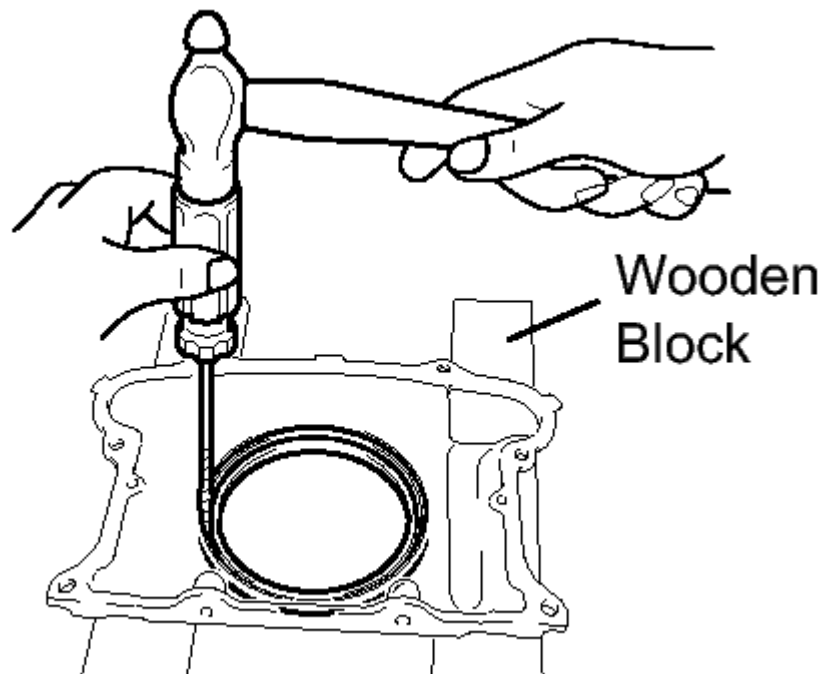
**P**

**Fig. 228: Locating Oil Drain Pipe Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the bolt and oil drain pipe.
- b. Remove the O-ring.

#### 54. REMOVE REAR CRANKSHAFT OIL SEAL



**P**



**Fig. 229: Removing Engine Rear Oil Seal**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. Place the oil seal retainer on wooden blocks.
- b. Using a screwdriver and hammer, tap out the oil seal.

**55. REMOVE RING PIN**

**NOTE:** It is not necessary to remove the ring pin unless it is being replaced.

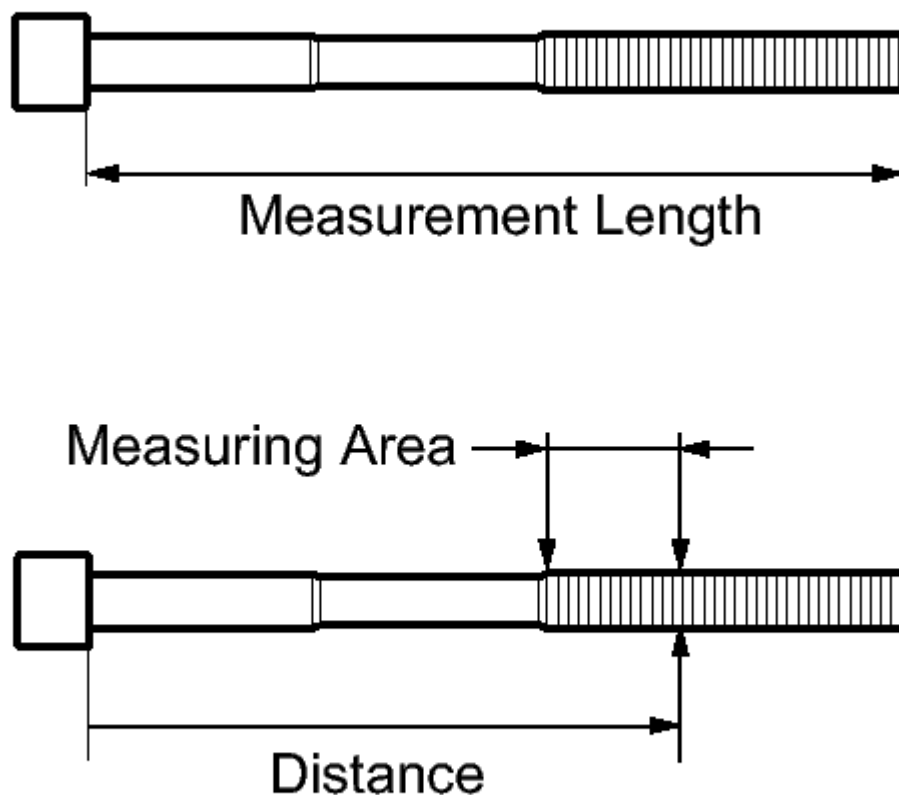
**56. REMOVE STUD BOLT**

**NOTE:** If the stud bolt is deformed or its threads are damaged, replace it.

**INSPECTION**

**INSPECTION**

**1. INSPECT CYLINDER HEAD SET BOLT**



**Fig. 230: Identifying Length Of Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a vernier caliper, measure the length of the cylinder head bolt from the seat to the end.

Standard length

141.3 to 142.7 mm (5.56 to 5.62 in.)

Maximum length

143.7 mm (5.66 in.)

If the length is more than the maximum, replace the cylinder head bolt.

- b. Using a vernier caliper, measure the diameter of the elongated thread at the measuring area.

Distance

103 mm (4.06 in.) for intake side bolt.

108 mm (4.25 in.) for exhaust side bolt.

Standard diameter

10.85 to 11.00 mm (0.427 to 0.433 in.)

Minimum diameter

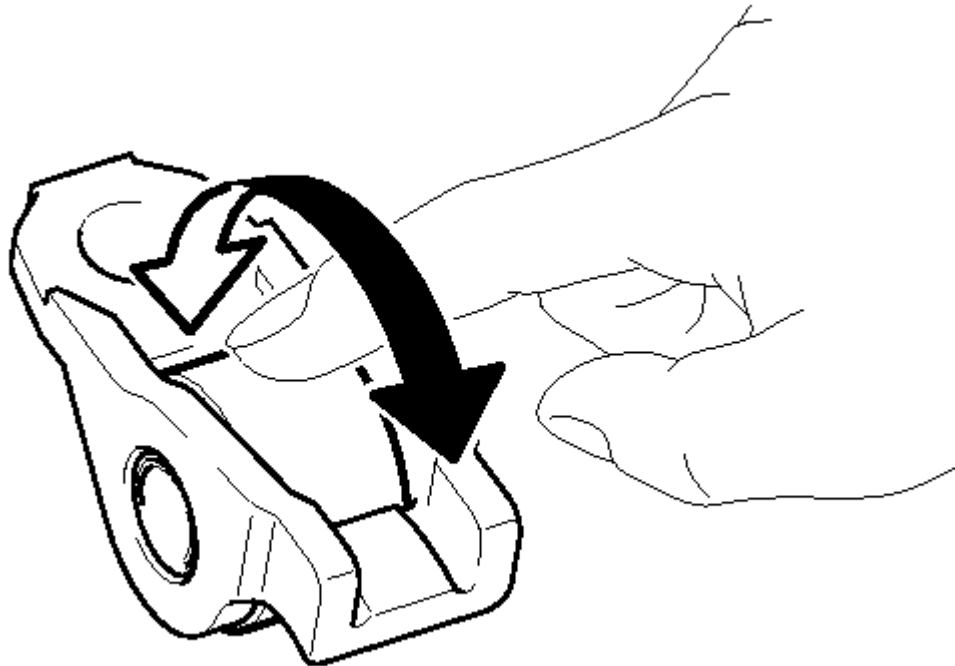
10.60 mm (0.417 in.)

If the diameter is less than the minimum, replace the cylinder head bolt.

**HINT:**

If a visual check reveals no excessively thin areas, check the center of the bolt (refer to illustration) and find the area that has the smallest diameter.

**2. INSPECT NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**



**P**

**Fig. 231: Inspecting No. 1 Valve Rocker Arm Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Turn the roller by hand to check that it turns smoothly.

If the roller does not turn smoothly, replace the valve rocker arm.

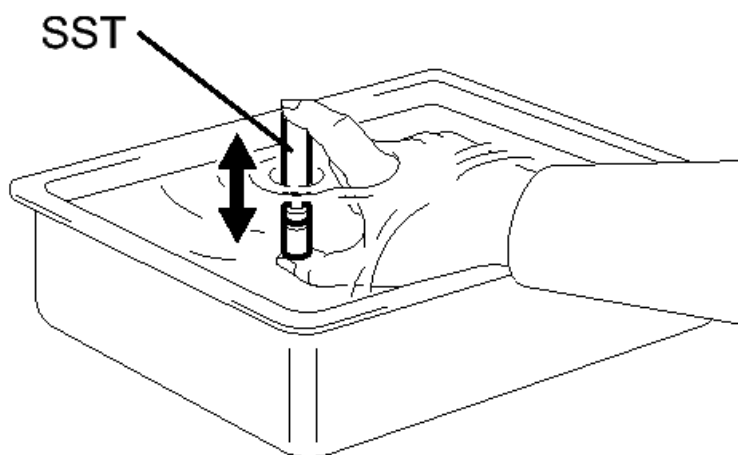
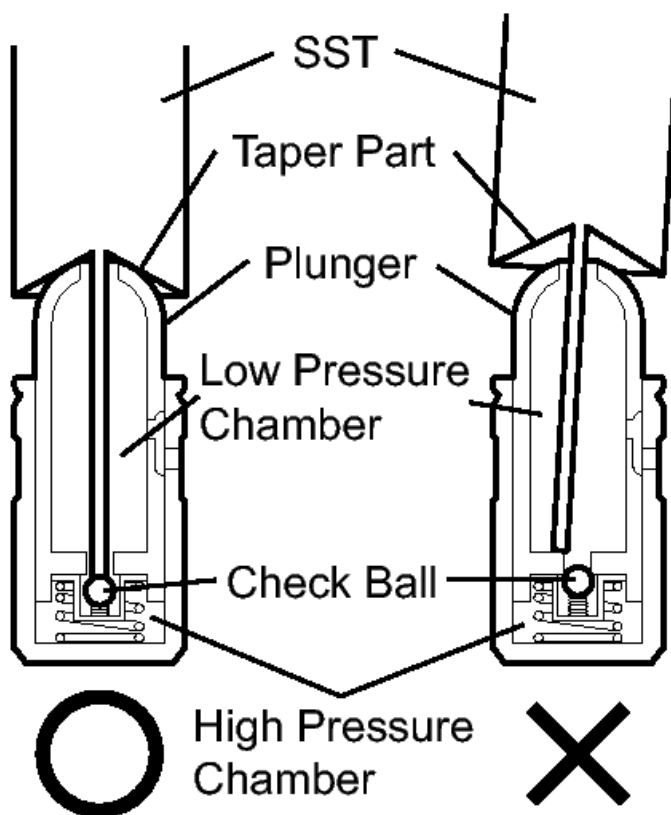
### 3. INSPECT VALVE LASH ADJUSTER ASSEMBLY

**NOTE:**

- **Keep the adjuster free from dirt and foreign objects.**
- **Use only clean engine oil.**

CORRECT

INCORRECT

**P****Fig. 232: Checking Movement Of Plunger**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Place the lash adjuster into a container full of new engine oil.
- Insert SST's tip into the lash adjuster's plunger and use the tip to press down on the check ball

inside the plunger.

- **SST: 09276-75010**

- Squeeze SST and the lash adjuster together to move the plunger up and down 5 to 6 times.
- Check the movement of the plunger and bleed air.

OK

Plunger moves up and down.

**NOTE:** When bleeding high-pressure air from the compression chamber, make sure that the tip of SST is actually pressing the check ball as shown in the illustration. If the check ball is not pressed, air will not bleed.

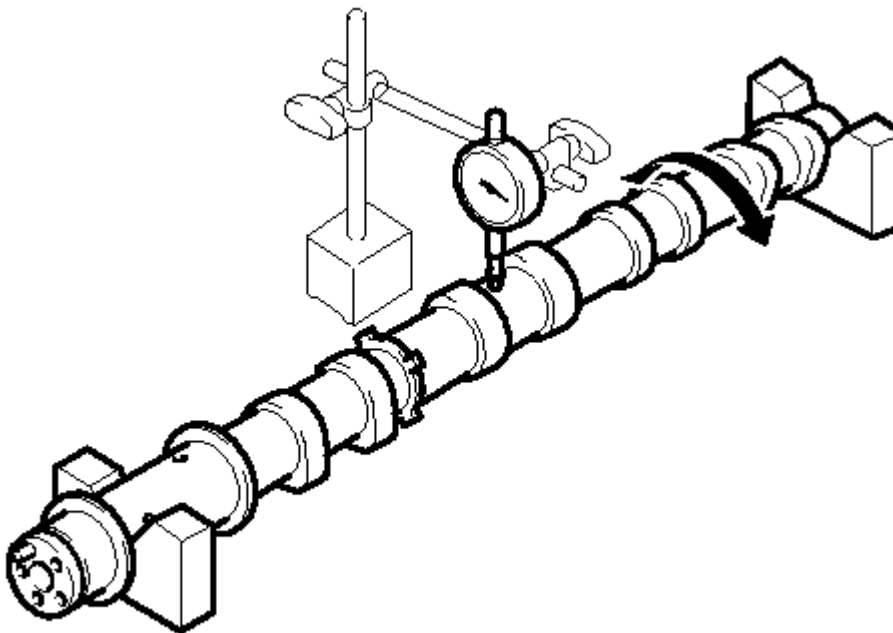
- After bleeding the air, remove SST. Then try to quickly and firmly press the plunger with your fingers.

OK

Plunger can be pressed 3 times.

If the plunger can still be compressed after pressing it 3 times, replace the lash adjuster with a new one.

#### 4. INSPECT CAMSHAFT SUB-ASSEMBLY



**T**

**Fig. 233: Measuring Circle Runout At Center Journal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Inspect the camshaft for runout.
  1. Place the camshaft on V-blocks.
  2. Using a dial indicator, measure the circle runout at the center journal.

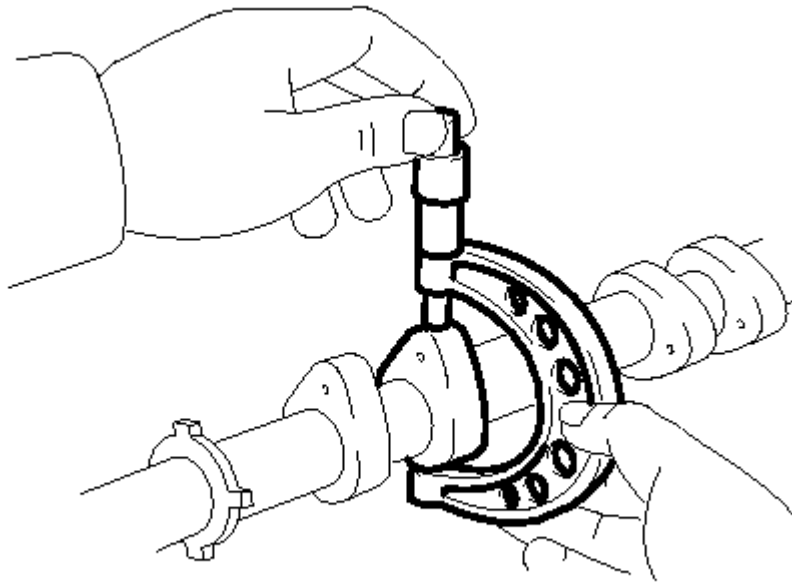
Maximum circle runout

0.04 mm (0.00157 in.)

If the circle runout is more than the maximum, replace the camshaft.

**HINT:**

Check the oil clearance after replacing the camshaft.



**T**

**Fig. 234: Measuring Cam Lobe Height**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the cam lobe height.

Standard Cam Lobe Height

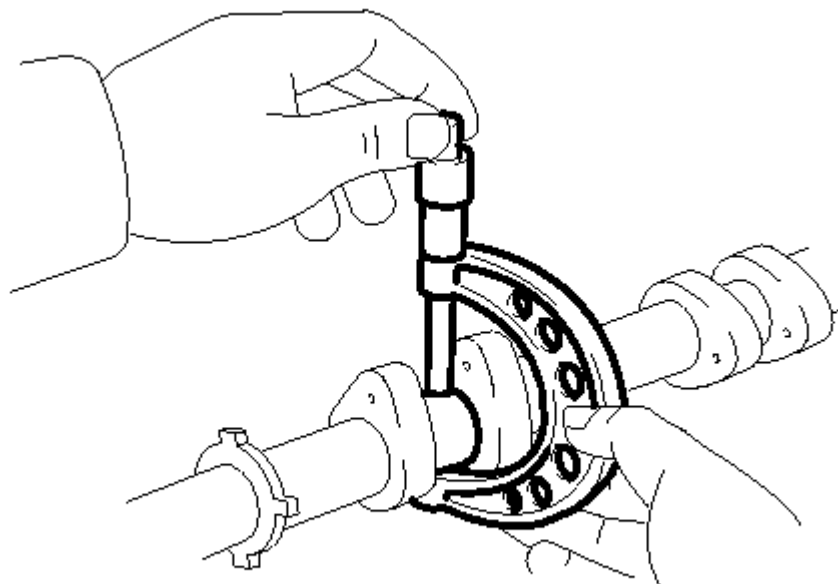
Item	Specified Condition

Intake	44.291 to 44.441 mm (1.744 to 1.750 in.)
Exhaust	44.196 to 44.346 mm (1.740 to 1.746 in.)

#### Minimum Cam Lobe Height

Item	Specified Condition
Intake	44.241 mm (1.742 in.)
Exhaust	44.146 mm (1.738 in.)

If the cam lobe height is less than the minimum, replace the camshaft.



**T**

**Fig. 235: Measuring Journal Diameter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



- c. Using a micrometer, measure the journal diameter.

Standard Journal Diameter

Item	Specified Condition
No. 1 journal	29.956 to 29.970 mm (1.1793 to 1.1799 in.)
Other journals	25.959 to 25.975 mm (1.0220 to 1.0226 in.)

If the journal diameter is not as specified, check the oil clearance.

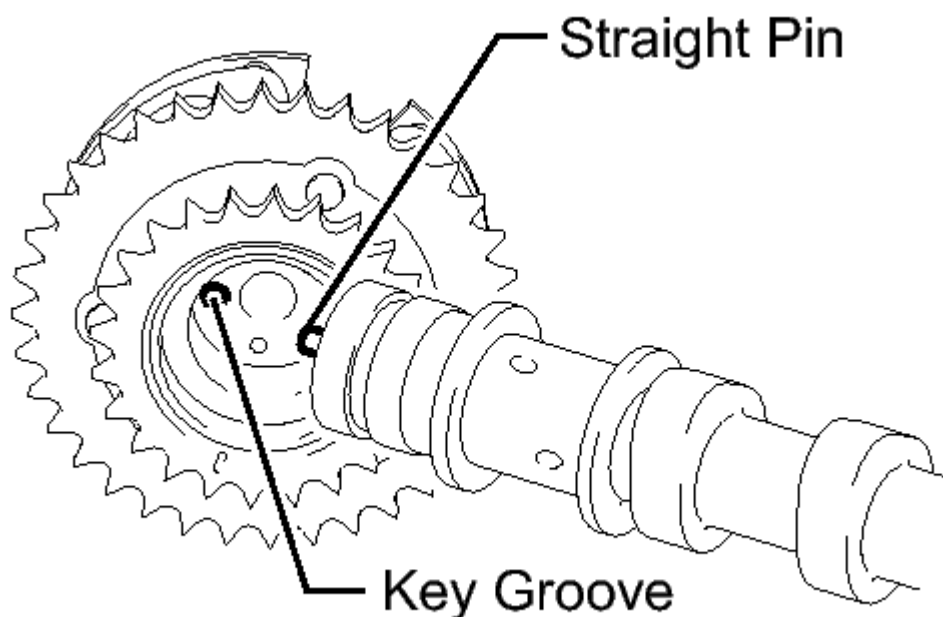
## 5. INSPECT CAMSHAFT TIMING GEAR

- a. Install the camshaft bearing cap See step 1.

**HINT:**

Only install the intake camshaft.

- b. Install the camshaft housing See step 2.  
c. Apply a light coat of engine oil on the camshaft and camshaft timing gear.



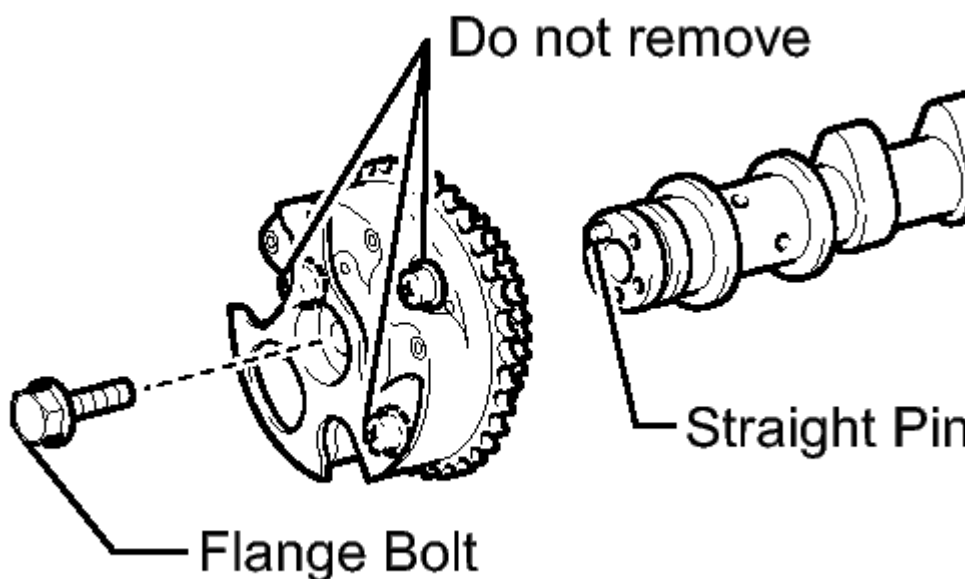
**P**

**Fig. 236: Identifying Key Groove And Straight Pin**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

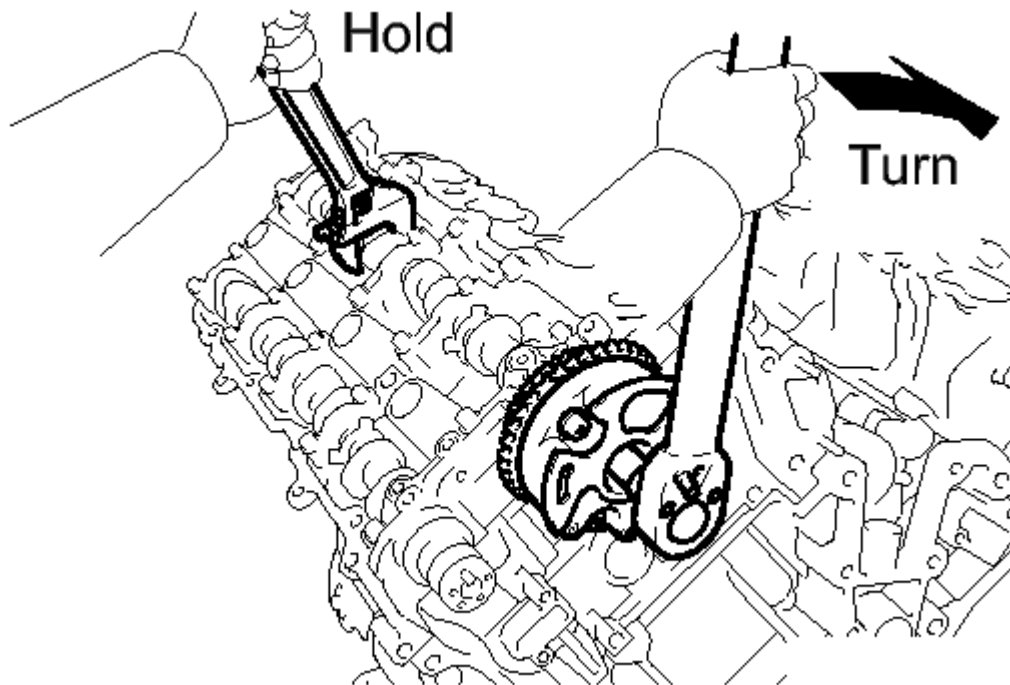
- Do not forcefully push in the camshaft timing gear. This may cause the camshaft knock pin tip to damage the installation surface of the camshaft timing gear.



**P**

**Fig. 237: Identifying Flange Bolt And Straight Pin**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Do not loosen or remove the 3 bolts shown in the illustration. If any of them are loosened or removed, the backlash of the gear in the timing tube will go out of adjustment. In this case, replace the camshaft timing gear assembly with a new one.
- d. Using the hexagonal portion of the camshaft, align and attach the knock pin of the camshaft with the pin hole of the camshaft timing gear.



**P**

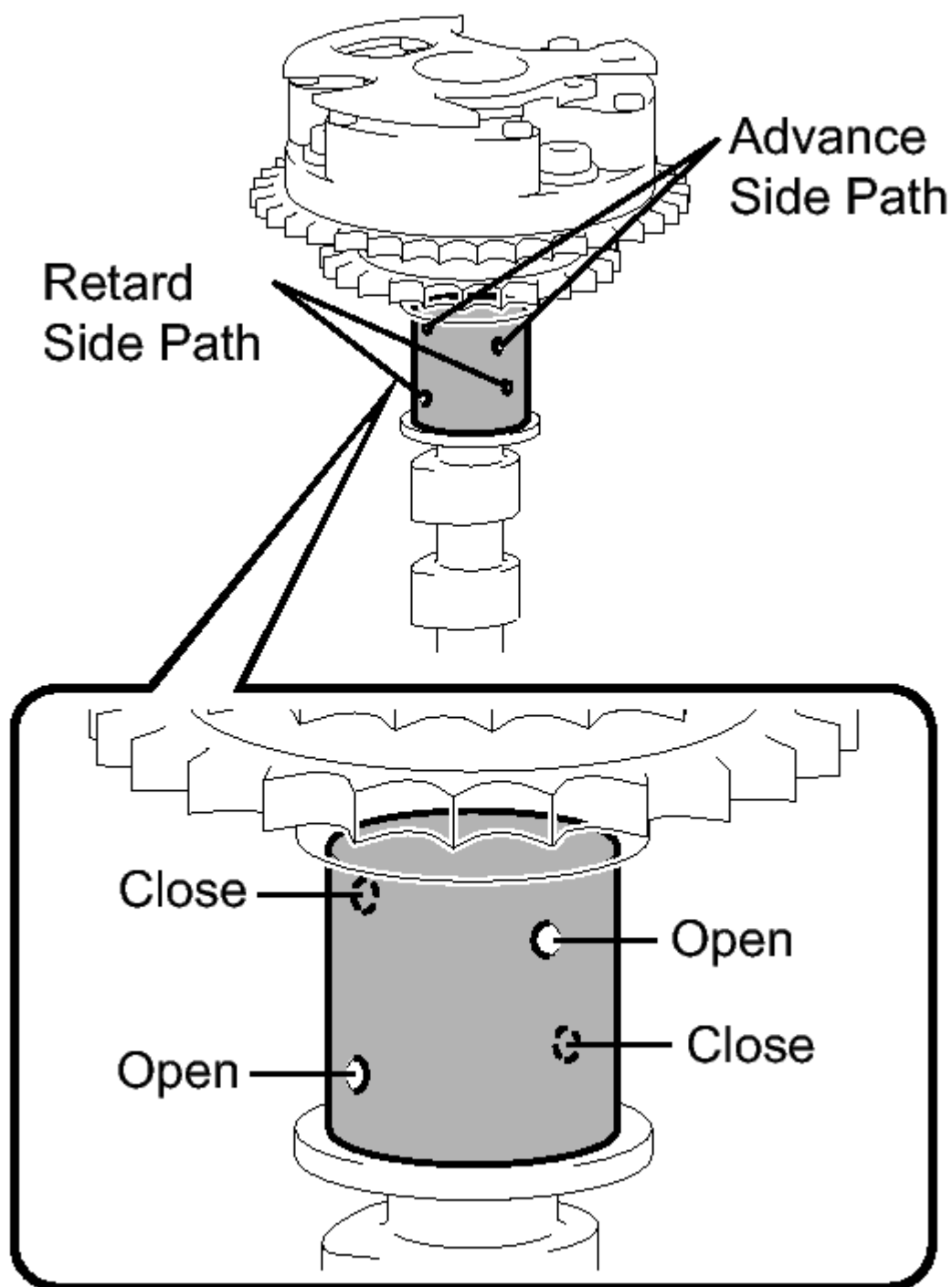
**Fig. 238: Engine Oil On The Threads And Under The Head Of The Bolt**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a light coat of engine oil on the threads and under the head of the bolt.
- f. Using a wrench to hold the hexagonal portion of the camshaft, install the camshaft timing gear with the bolt.

**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**

- g. Remove the camshaft bearing cap See step 12.
- h. Check the lock of the camshaft timing gear.
1. Clamp the camshaft in a vise, and confirm that the camshaft timing gear is locked.

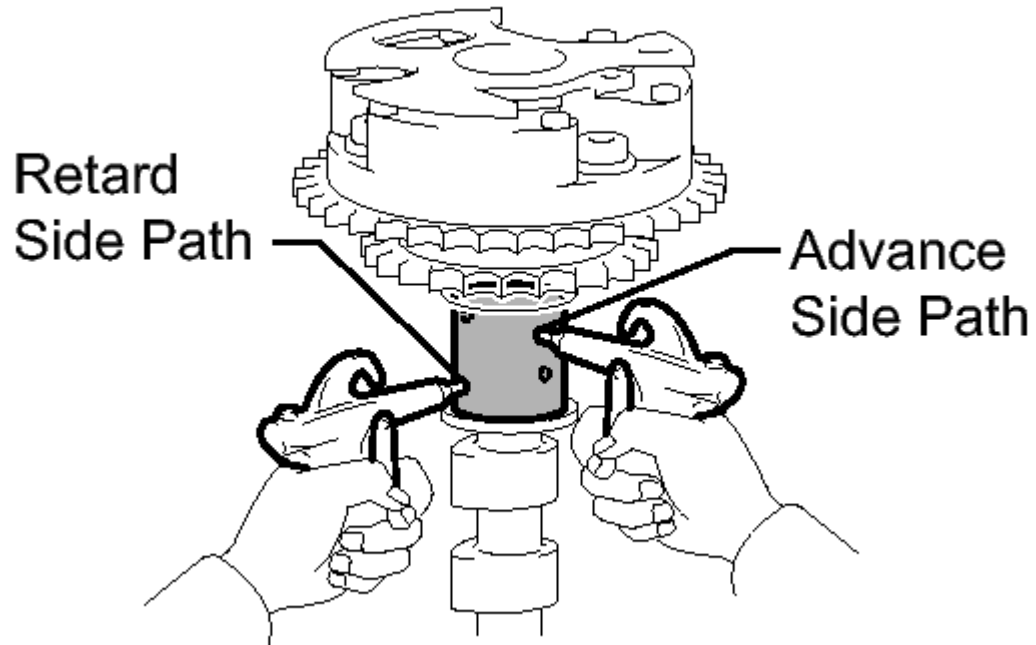
**NOTE: Be careful not to damage the camshaft.**

**P**

**Fig. 239: Identifying Retard And Advance Side Path**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Release the lock pin.
  1. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

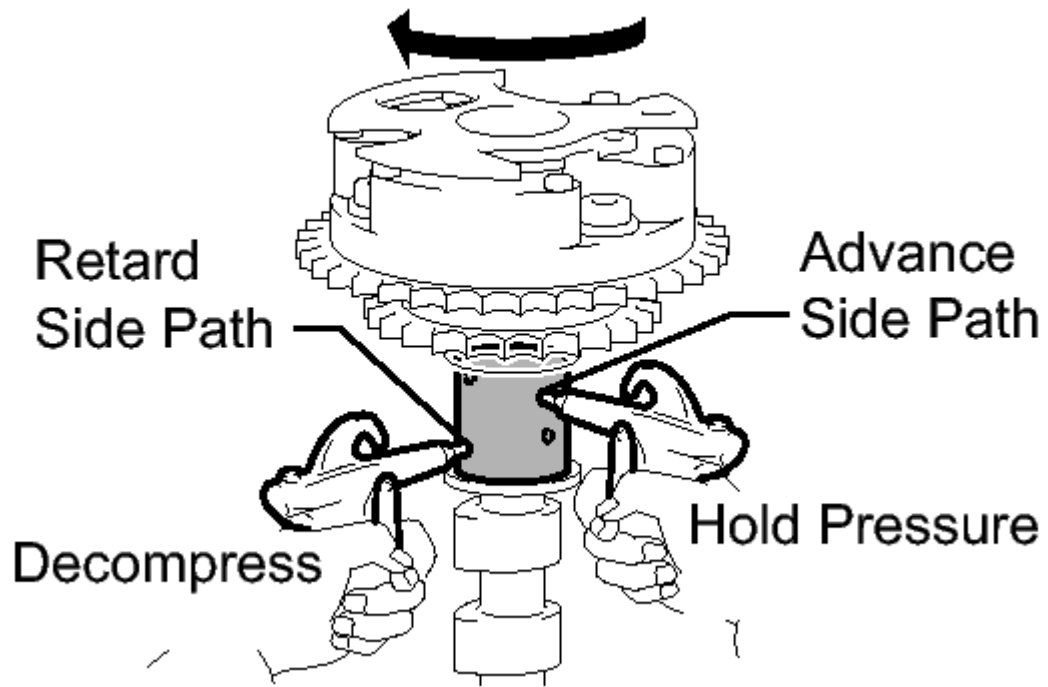
2. Break through the tape of the advance side path. Then break through the tape of the retard side path on the opposite side of the advanced side path, as shown in the illustration.

**P**

**Fig. 240: Applying Air Pressure To Two Broken Paths**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**        **Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.**

3. Apply approximately 200 kPa (2.0 kgf/cm<sup>2</sup> , 29 psi) of air pressure to the two broken paths.



**P**

**Fig. 241: Applying Air Pressure To Two Broken Paths**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Check that the camshaft timing gear revolves in the advance direction when reducing the air pressure applied to the retard side path.

**HINT:**

This operation releases the lock pin for the most retarded position.

5. When the camshaft timing gear reaches the most advanced position, release the air pressure from the retard side path and advance side path, in that order.

**NOTE:** Do not release the air pressure from the advance side path first. The gear may abruptly shift in the retard direction and break the lock pin.

- j. Check for smooth rotation.
  1. Turn the camshaft timing gear within its movable range (21°) 2 or 3 times, but do not turn it to the most retarded position. Make sure that the gear turns smoothly.

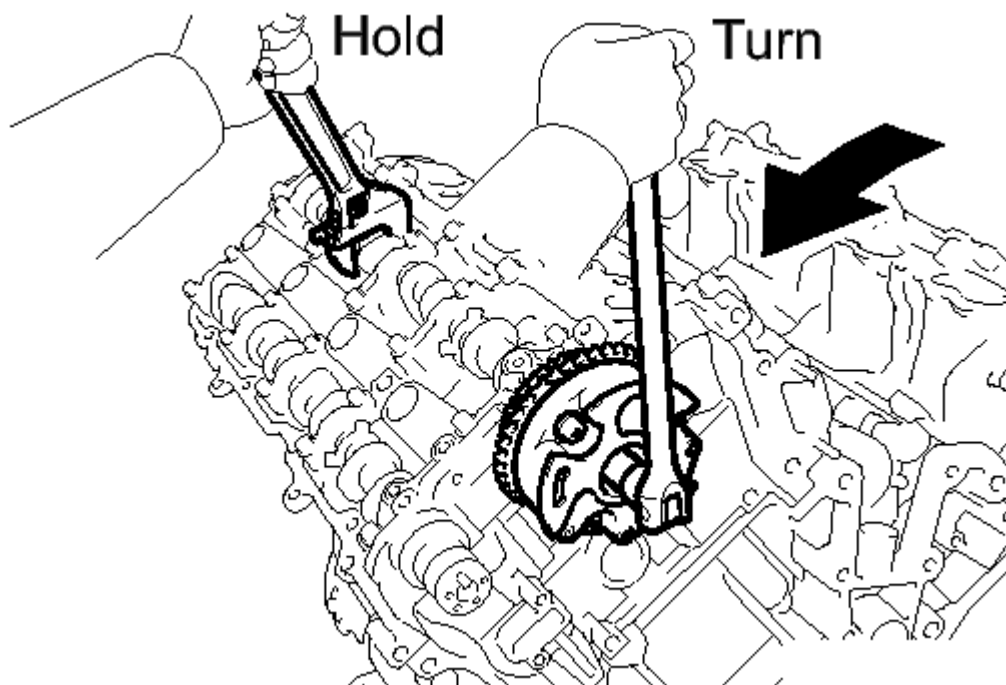
**NOTE:** Do not use air pressure to perform the smooth rotation check.

- k. Check the lock in the most retarded position.
  1. Confirm that the camshaft timing gear is locked at the most retarded position.
  1. Install the camshaft bearing cap See step 1.

**HINT:**

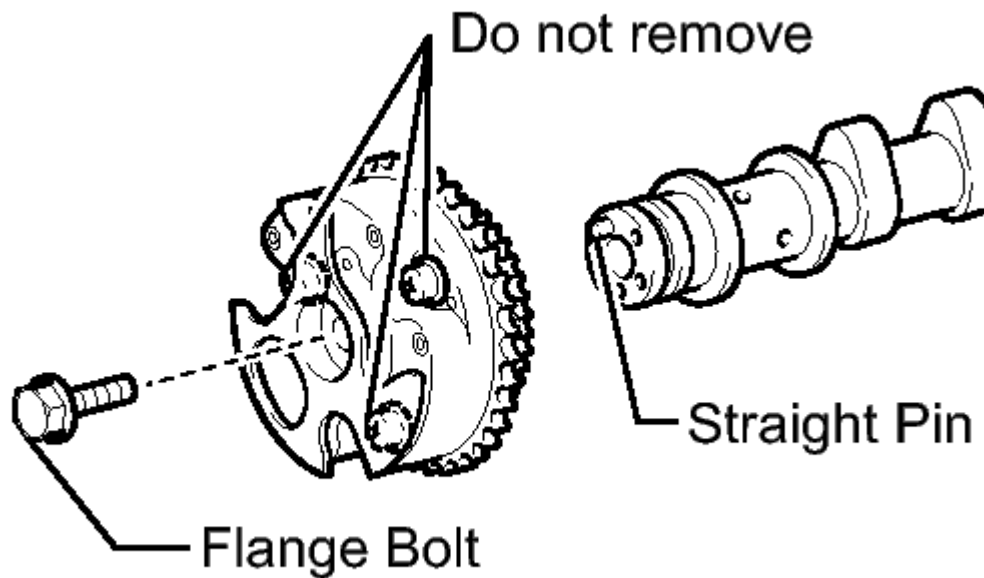
Only install the intake camshaft.

- m. Install the camshaft housing See step 2.

**P**

**Fig. 242: Hold The Hexagonal Portion Of The Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- n. Hold the hexagonal portion of the camshaft with a wrench and loosen the bolt.  
o. Remove the camshaft bearing cap See step 12.



**P**

**Fig. 243: Identifying Flange Bolt And Straight Pin**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- p. Remove the flange bolt and camshaft timing gear.

#### 6. INSPECT CAMSHAFT TIMING EXHAUST GEAR

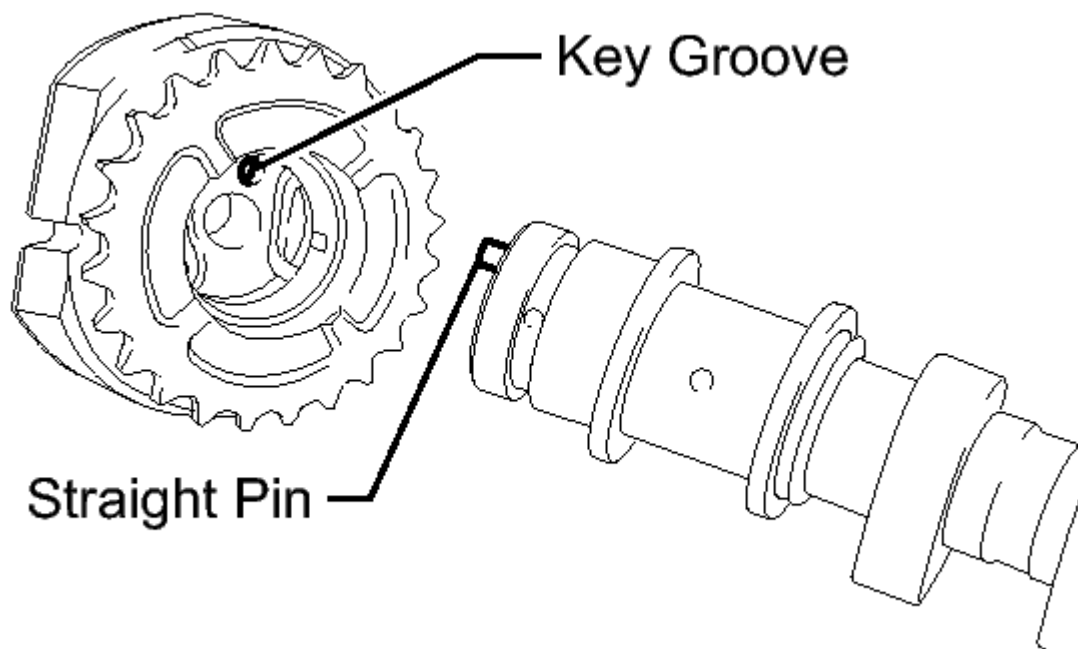
- a. Install the camshaft bearing cap See step 1.

#### HINT:

Only install the exhaust camshaft.

- b. Install the camshaft housing See step 2.
- c. Apply a light coat of engine oil on the camshaft and camshaft timing exhaust gear.





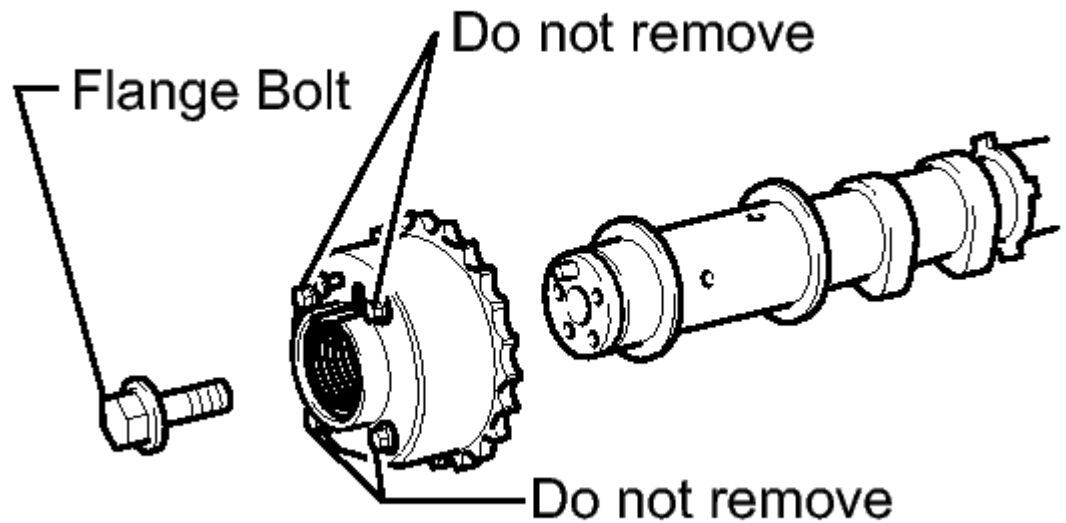
**T**

**Fig. 244: Identifying Knock Pin Of Camshaft With Pin Hole Of Camshaft Timing Exhaust Gear**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

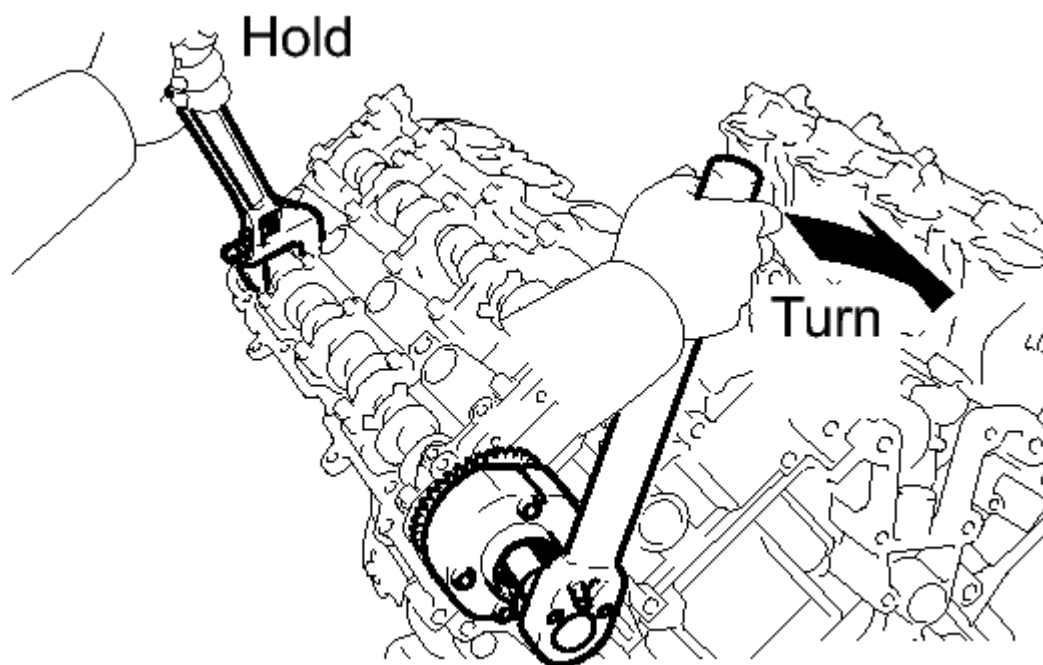
- Do not forcefully push in the camshaft timing exhaust gear. This may cause the camshaft knock pin tip to damage the installation surface of the camshaft timing exhaust gear.



**T**

**Fig. 245: Identifying Flange Bolt And Camshaft Timing Exhaust Gear**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Do not loosen or remove the 4 bolts shown in the illustration. If any of them are loosened or removed, the backlash of the gear in the timing tube will go out of adjustment. In this case, replace the camshaft timing exhaust gear assembly with a new one.
- d. Using the hexagonal portion of the camshaft, align and attach the knock pin of the camshaft with the pin hole of the camshaft timing exhaust gear.
  - e. Apply a light coat of engine oil on the threads and under the head of the bolt.



**P**

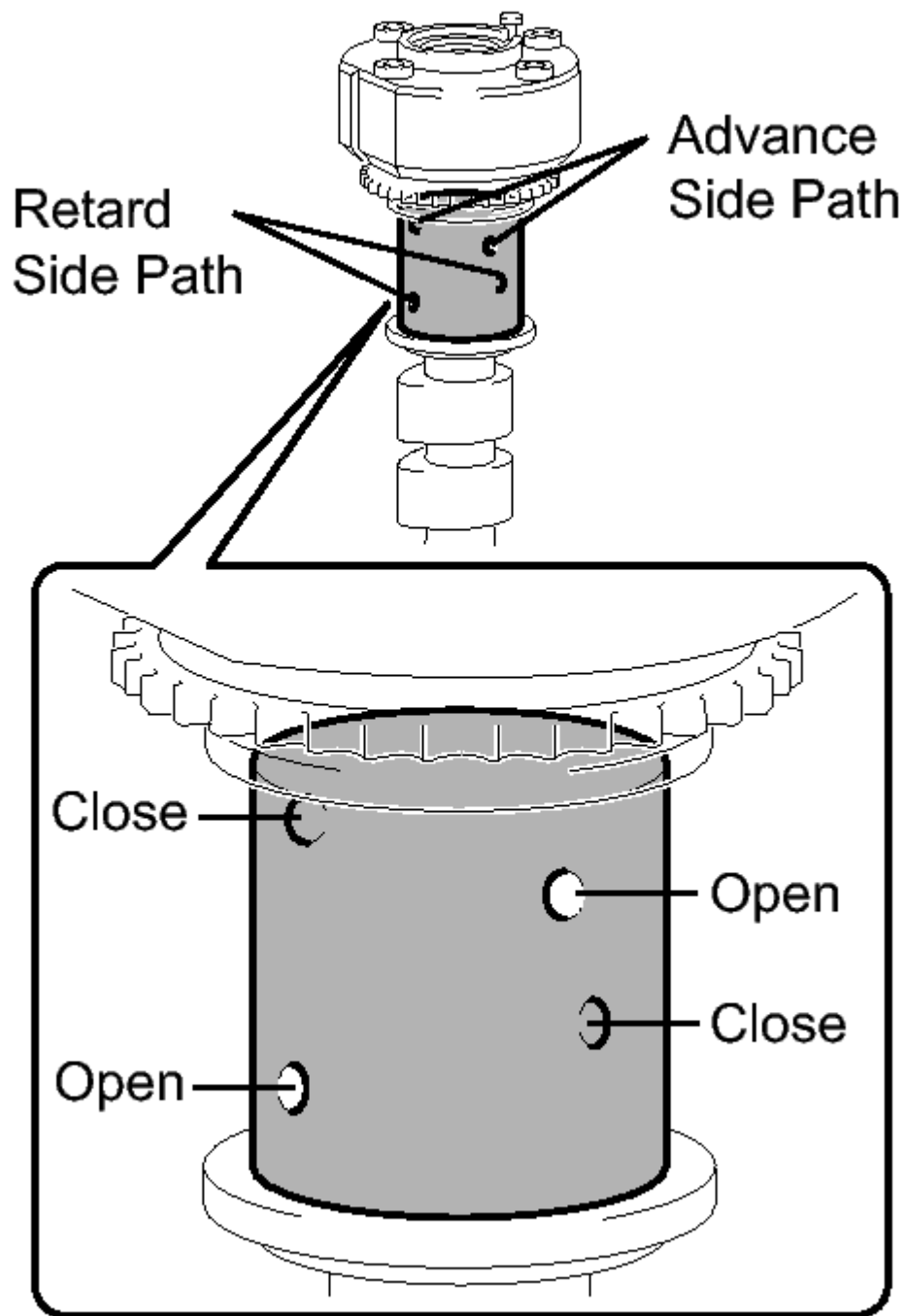
**Fig. 246: Hexagonal Portion Of The Camshaft**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using a wrench to hold the hexagonal portion of the camshaft, install the camshaft timing exhaust gear with the bolt.

**Torque: 100 N\*m (1020 kgf\*cm, 74 ft.\*lbf)**

- g. Remove the camshaft bearing cap See step 12.
- h. Check the camshaft timing exhaust gear lock.
  1. Make sure that the camshaft timing exhaust gear is locked.

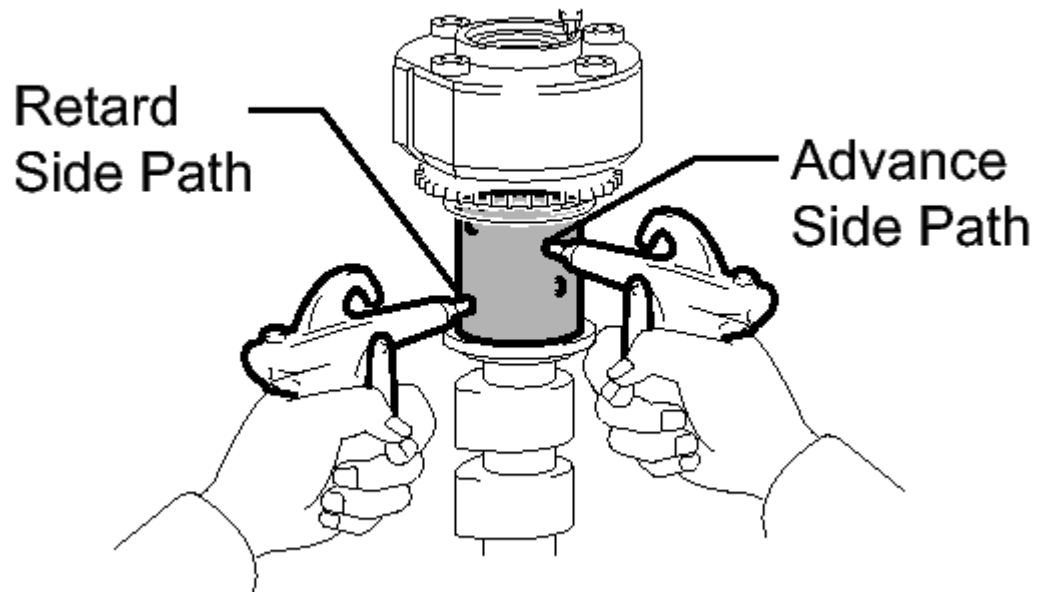


**T**

**Fig. 247: Identifying Advance And Retard Side Path**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Release the lock pin.
  1. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

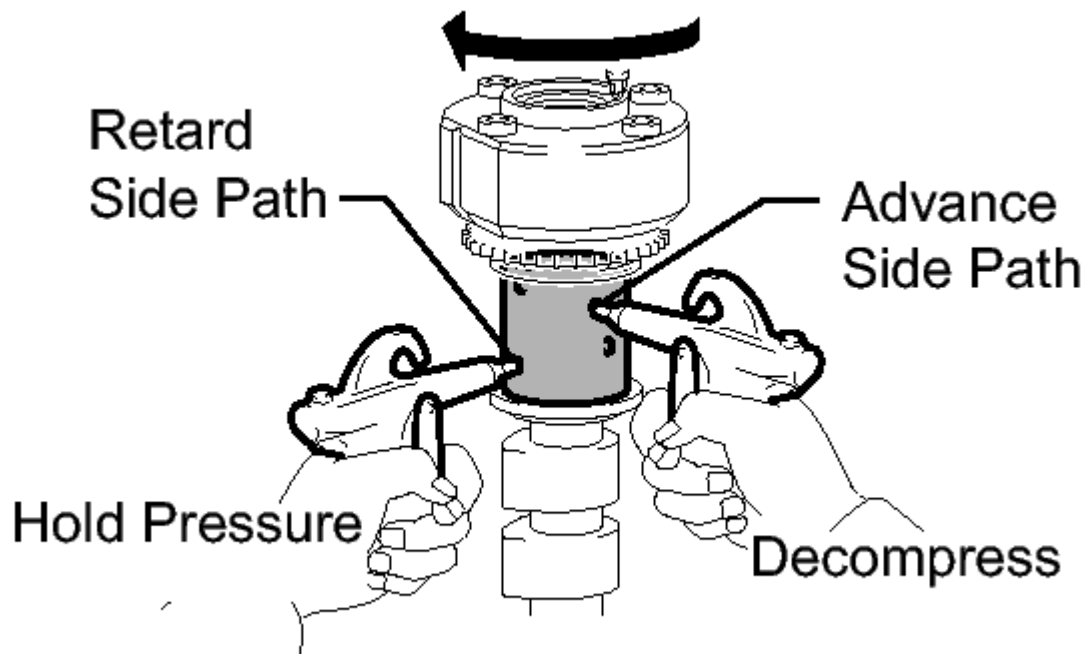
2. Break through the tape of the advance side path. Then break through the tape of the retard side path on the opposite side of the advanced side path, as shown in the illustration.

**T**

**Fig. 248: Applying Air Pressure To Two Broken Paths**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

3. Apply approximately 200 kPa (2.0 kgf/cm<sup>2</sup>, 29 psi) of air pressure to the two broken paths (the advance side path and the retard side path).



**T**

**Fig. 249: Checking Camshaft Timing Exhaust Gear Rotation**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Check that the camshaft timing exhaust gear turns in the retard direction when reducing the air pressure applied to the advance side path.

**HINT:**

The lock pin is released and the camshaft timing exhaust gear turns in the retard direction.

5. When the camshaft timing exhaust gear moves to the most retarded position, release the air pressure from the advance side path, and then release the air pressure from the retard side path.

**NOTE:**

**Be sure to release the air pressure from the advance side path first. If the air pressure of the retard side path is released first, the camshaft timing exhaust gear may abruptly shift in the advance direction and break the lock pin or other parts.**

- j. Check for smooth rotation.

1. Turn the camshaft timing exhaust gear within its movable range (18.5°) 2 or 3 times, but do not turn it to the most advanced position. Make sure that the gear turns smoothly.

**NOTE:**

**When the air pressure is released from the advance side path and then from the retard side path, the gear automatically returns to the most advanced position due to the advance assist**

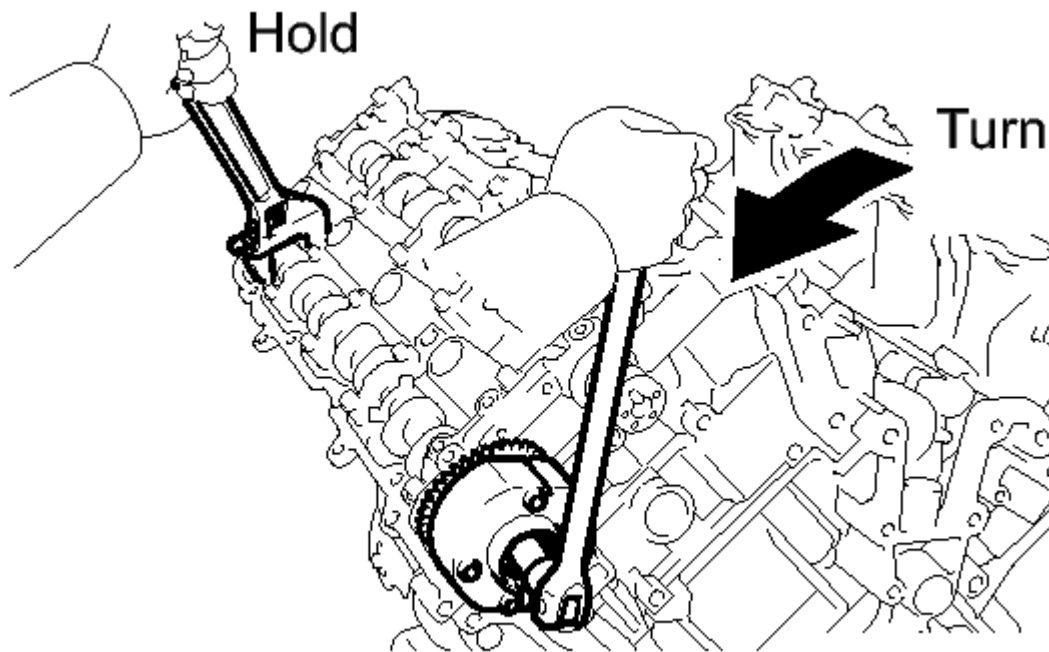
**spring operation, and locks. Gradually release the air pressure from the retard side path before performing the smooth rotation check.**

- k. Check the lock at the most advanced position.
  - 1. Make sure that the camshaft timing exhaust gear is locked at the most advanced position.
- l. Install the camshaft bearing cap See step 1.

**HINT:**

Only install the exhaust camshaft.

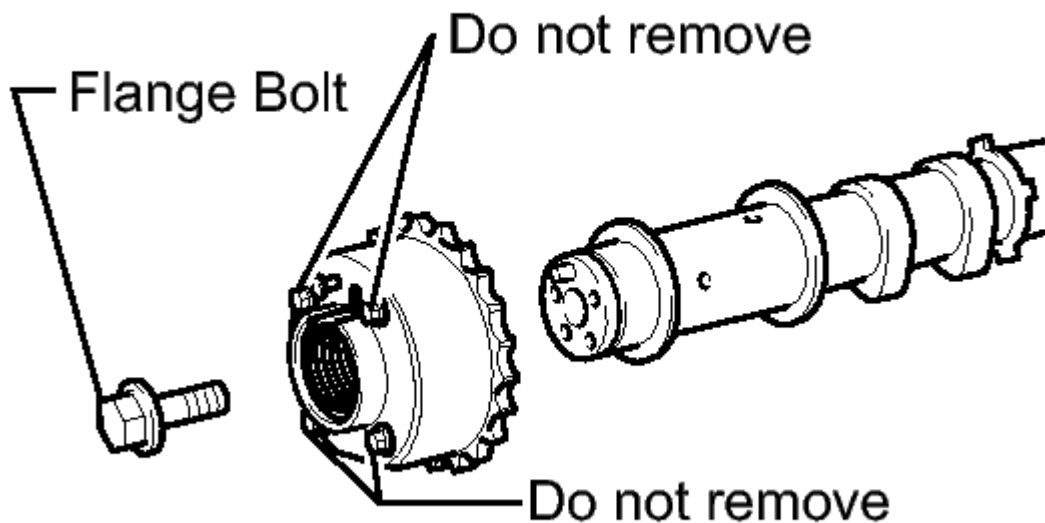
- m. Install the camshaft housing See step 2.



**P**

**Fig. 250: Hexagonal Portion Of The Camshaft**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- n. Hold the hexagonal portion of the camshaft with a wrench and loosen the bolt.
- o. Remove the camshaft bearing cap See step 12.

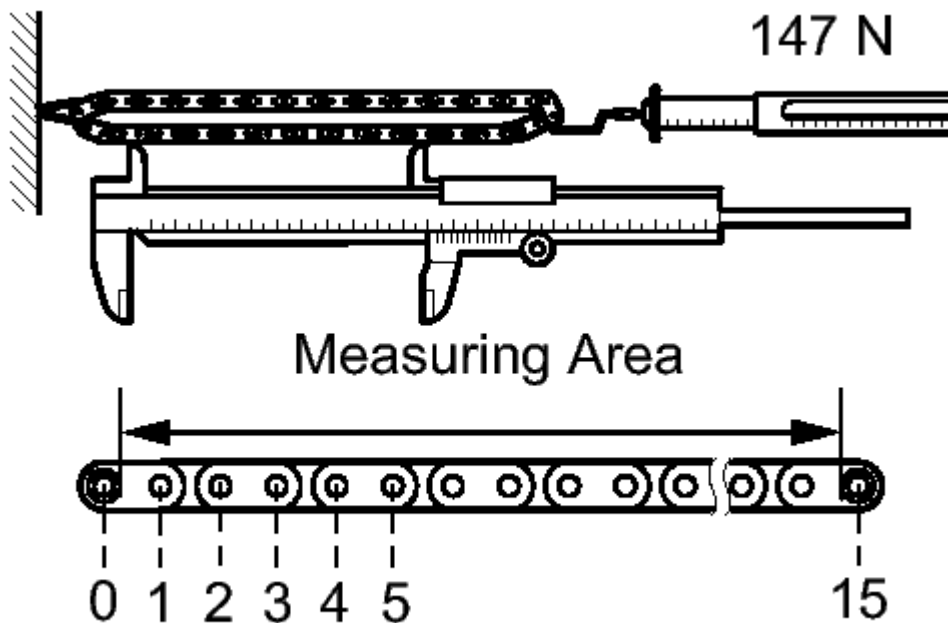


**T**

**Fig. 251: Identifying Flange Bolt And Camshaft Timing Exhaust Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- p. Remove the flange bolt and camshaft timing exhaust gear.

**7. INSPECT NO. 1 CHAIN SUB-ASSEMBLY**



**P**

**Fig. 252: Measuring Length Of Pins Using Vernier Caliper**



Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a spring scale, pull the chain with a force of 147 N (15 kgf, 33.1 lbf) as shown in the illustration.
- Using a vernier caliper, measure the length of 15 pins.

Maximum chain elongation

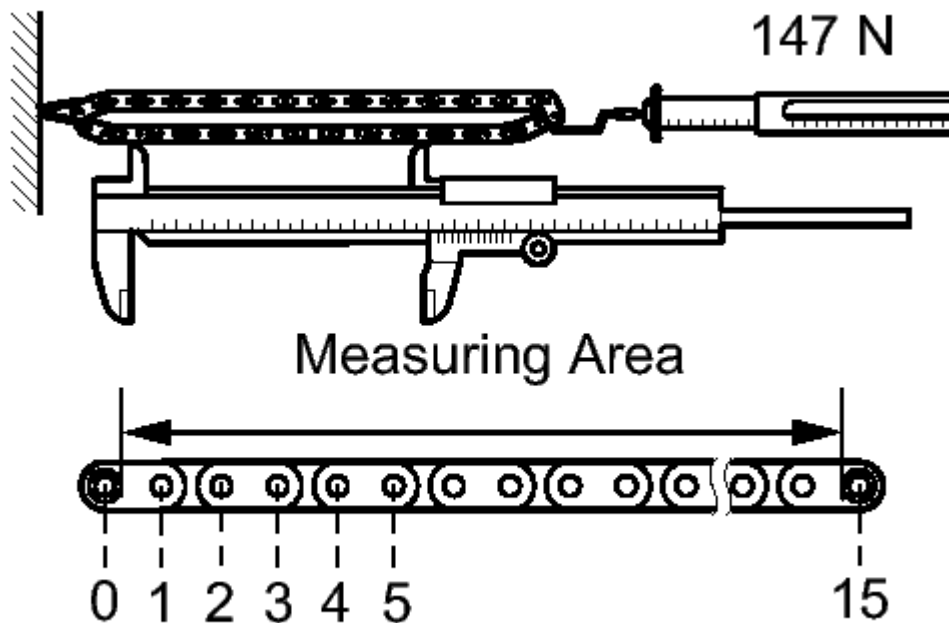
136.9 mm (5.39 in.)

**HINT:**

Perform the measurement at 3 random places.

If the elongation is more than the maximum, replace the chain.

**8. INSPECT NO. 2 CHAIN SUB-ASSEMBLY**



**P**

**Fig. 253: Measuring Length Of Pins Using Vernier Caliper**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a spring scale, pull the chain with a force of 147 N (15 kgf, 33.1 lbf) as shown in the illustration.
- Using a vernier caliper, measure the length of 15 pins.

Maximum chain elongation

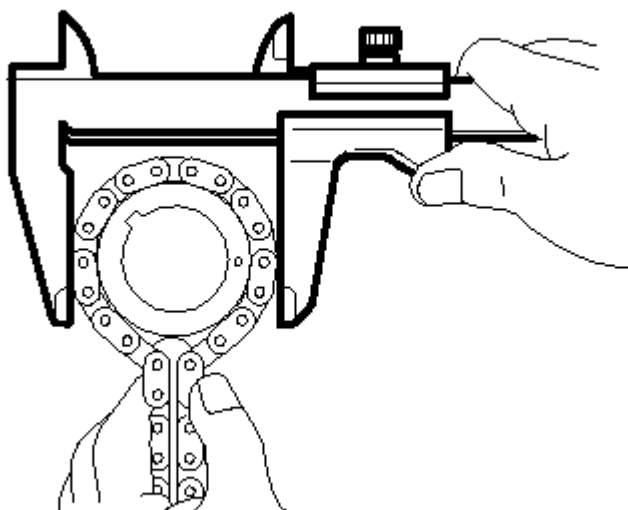
137.6 mm (5.42 in.)

**HINT:**

Perform the measurement at 3 random places.

If the elongation is more than the maximum, replace the chain.

**9. INSPECT CRANKSHAFT TIMING SPROCKET RH**



**T**

**Fig. 254: Measuring Sprocket Diameter With Chain**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Wrap the chain around the sprocket.
- b. Using a vernier caliper, measure the sprocket diameter with the chain.

Minimum sprocket diameter (with chain)

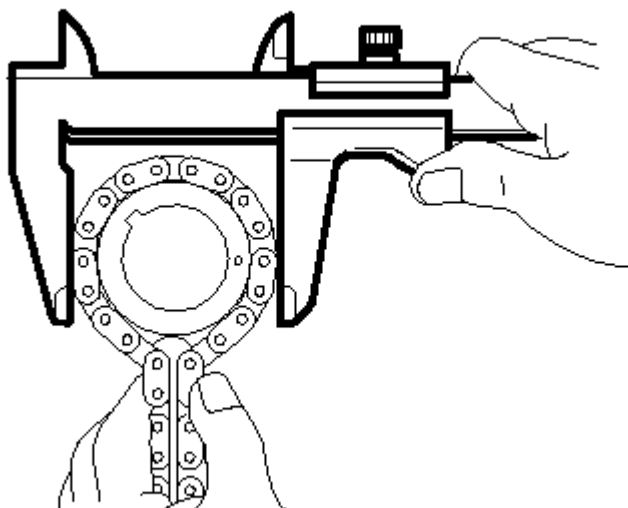
61.4 mm (2.42 in.)

**HINT:**

The vernier caliper must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the chain and sprocket.

**10. INSPECT CRANKSHAFT TIMING SPROCKET LH**

**T****Fig. 255: Measuring Sprocket Diameter With Chain****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. Wrap the chain around the sprocket.
- b. Using a vernier caliper, measure the sprocket diameter with the chain.

Minimum sprocket diameter (with chain)

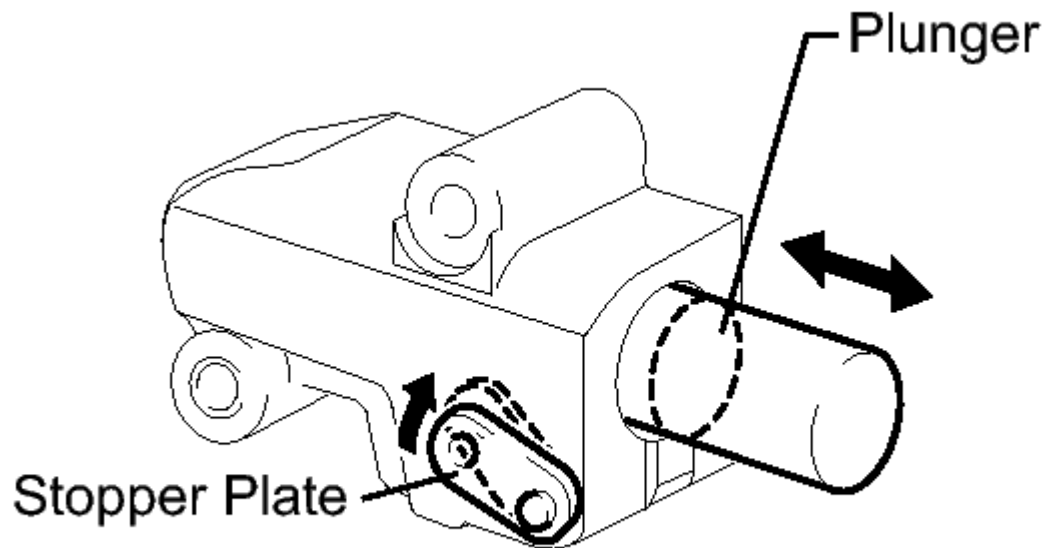
61.4 mm (2.42 in.)

**HINT:**

The vernier caliper must contact the chain rollers for the measurement.

If the diameter is less than the minimum, replace the chain and sprocket.

**11. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY**

**T**

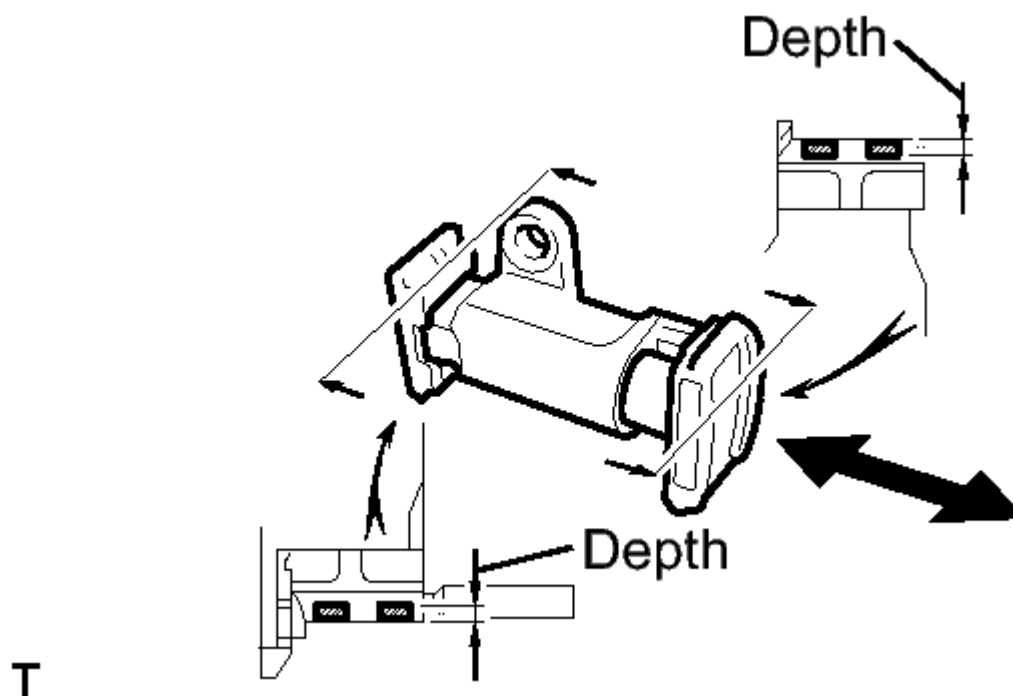
**Fig. 256: Inspecting No. 1 Chain Tensioner Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Move the stopper plate upward to release the lock. Push the plunger and check that it moves smoothly.

If necessary, replace the chain tensioner.

## 12. INSPECT NO. 2 CHAIN TENSIONER ASSEMBLY



**Fig. 257: Inspecting No. 2 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

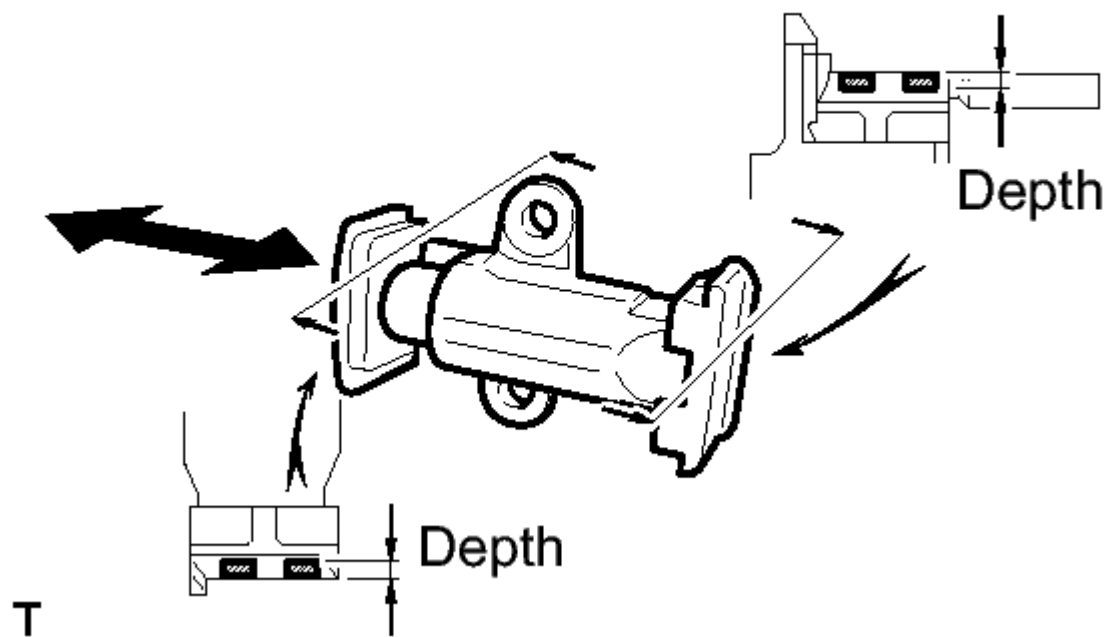
- a. Check that the plunger moves smoothly.
- b. Measure the worn depth of the chain tensioner.

Maximum depth

0.9 mm (0.0354 in.)

If the depth is more than the maximum, replace the chain tensioner.

### 13. INSPECT NO. 3 CHAIN TENSIONER ASSEMBLY



**Fig. 258: Inspecting No. 3 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

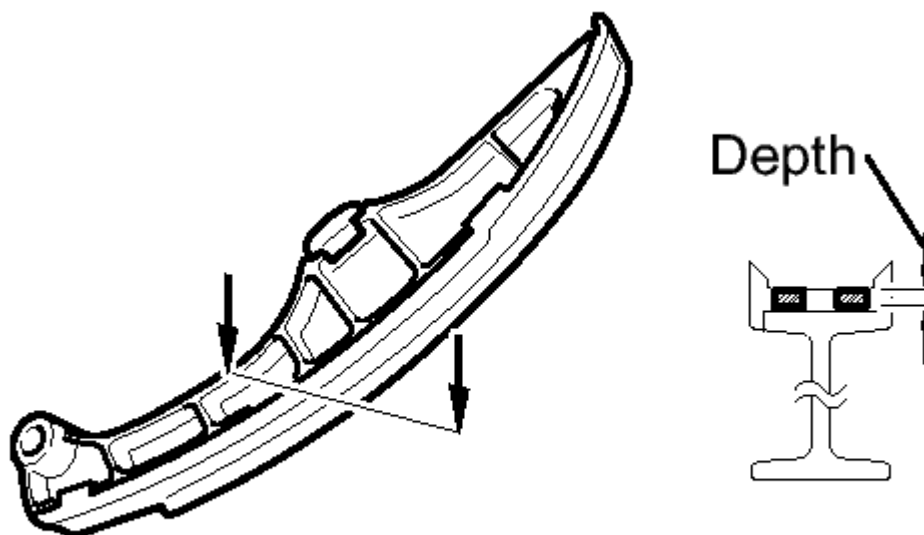
- a. Check that the plunger moves smoothly.
- b. Measure the worn depth of the chain tensioner.

Maximum depth

0.9 mm (0.0354 in.)

If the depth is more than the maximum, replace the chain tensioner.

#### 14. INSPECT NO. 1 CHAIN TENSIONER SLIPPER LH

**T**

**Fig. 259: Measuring Worn Depth Of Chain Tensioner Slipper (For Bank 1)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

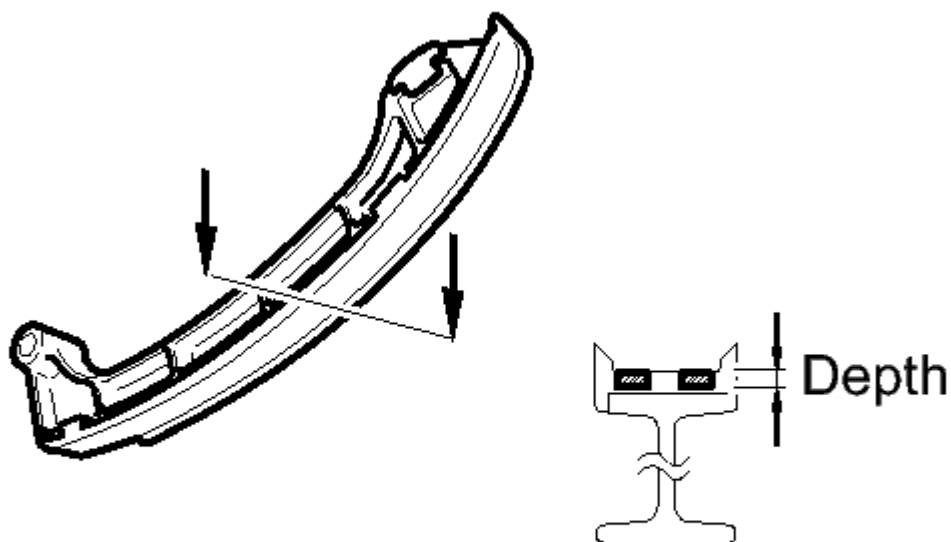
- a. Measure the worn depth of the chain tensioner slipper.

Maximum depth

1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the chain tensioner slipper.

#### 15. INSPECT NO. 1 CHAIN TENSIONER SLIPPER RH

**T**

**Fig. 260: Measuring Worn Depth Of Chain Tensioner Slipper (For Bank 2)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Measure the worn depth of the chain tensioner slipper.

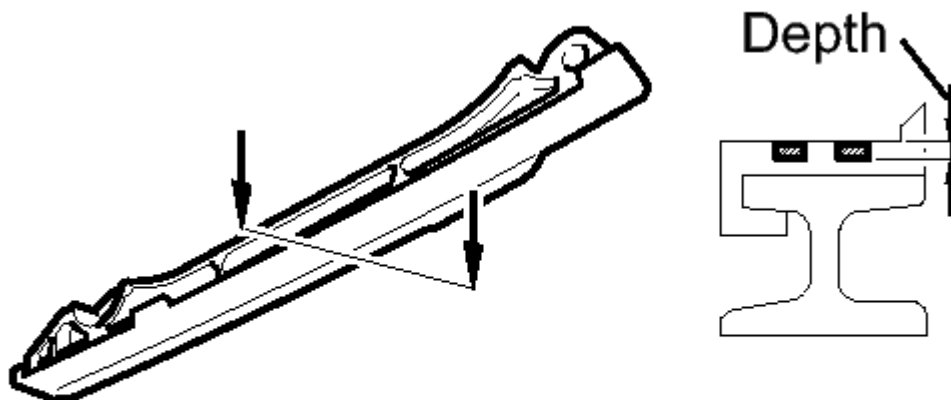
Maximum depth

1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the chain tensioner slipper.

## 16. INSPECT NO. 1 CHAIN VIBRATION DAMPER LH



**T**

**Fig. 261: Measuring Worn Depth Of Chain Vibration Damper**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

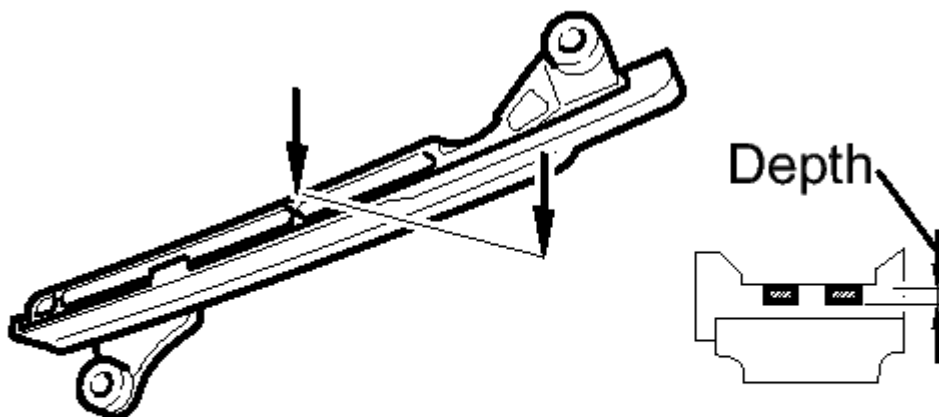
- a. Measure the worn depth of the chain vibration damper.

Maximum depth

1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the chain vibration damper.

#### **17. INSPECT NO. 1 CHAIN VIBRATION DAMPER RH**



**T**

**Fig. 262: Measuring Worn Depth Of Chain Vibration Damper**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

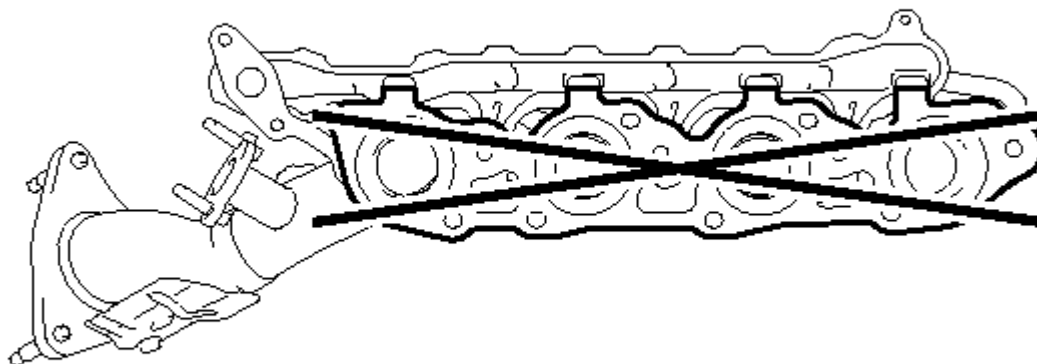
- a. Measure the worn depth of the chain vibration damper.

Maximum depth

1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the chain vibration damper.

## 18. INSPECT EXHAUST MANIFOLD SUB-ASSEMBLY LH

**P****Fig. 263: Identifying Warpage Of Contact Surface Of Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

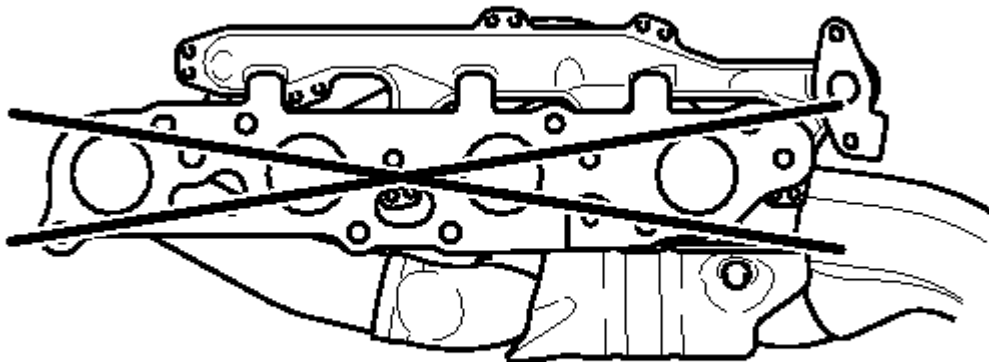
- a. Using a precision straightedge and feeler gauge, measure the warpage of the contact surface of the cylinder head.

Maximum warpage

0.7 mm (0.0276 in.)

If the warpage is more than the maximum, replace the exhaust manifold.

**19. INSPECT EXHAUST MANIFOLD SUB-ASSEMBLY RH**

**P****Fig. 264: Measuring Warpage Of Contact Surface Of Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

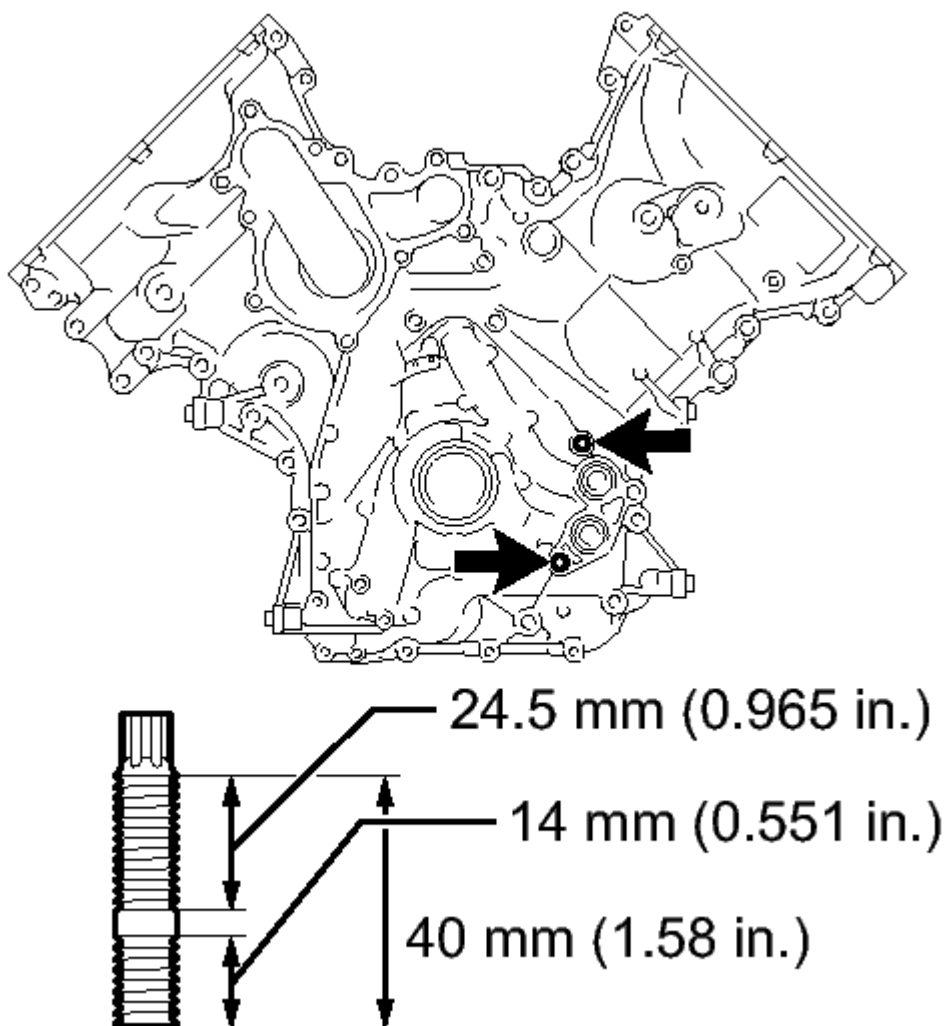
- a. Using a precision straightedge and feeler gauge, measure the warpage of the contact surface of the cylinder head.

Maximum warpage

0.7 mm (0.0276 in.)

If the warpage is more than the maximum, replace the exhaust manifold.

**REASSEMBLY****REASSEMBLY****1. INSTALL STUD BOLT**

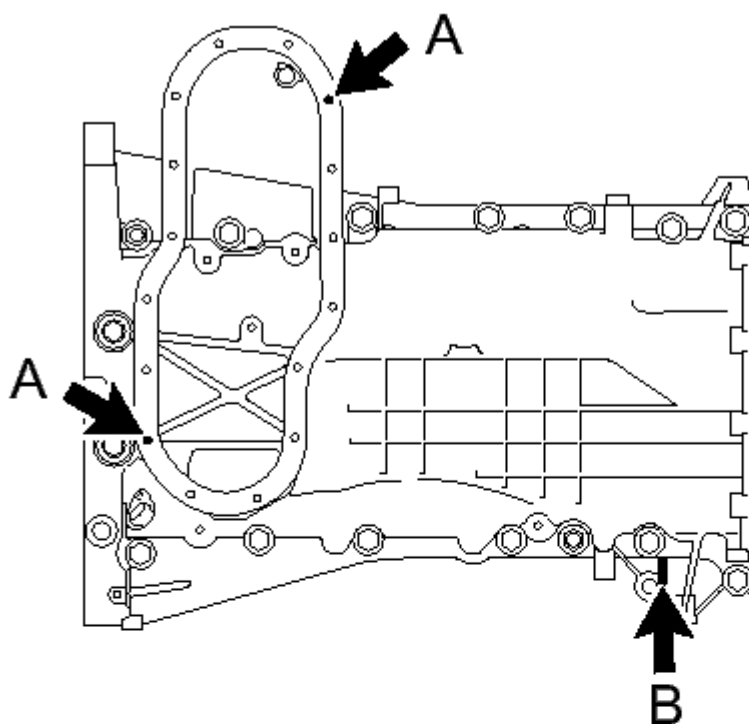


**P**

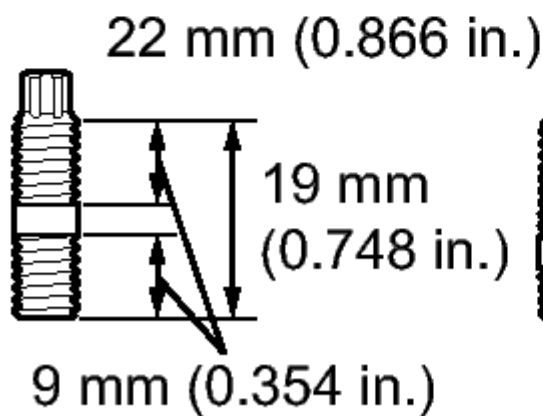
**Fig. 265: Identifying Timing Chain Cover Stud Bolt**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the timing chain cover stud bolt.
  1. Using an E10 "TORX" socket wrench, install the 2 stud bolts as shown in the illustration.

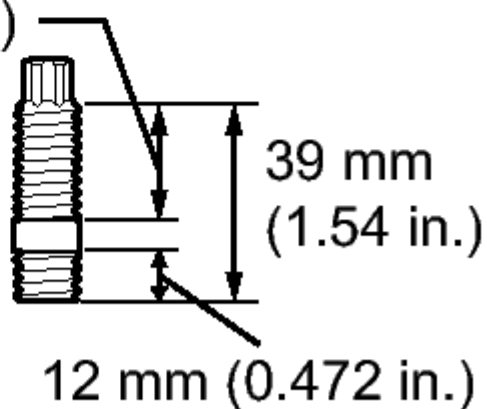
**Torque: 20 N\*m (204 kgf\*cm, 15 ft.\*lbf)**



A:



B:



**P**

**Fig. 266: Identifying Oil Pan Stud Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the oil pan stud bolt.

1. Using an E6 and E7 "TORX" socket wrench, install the 3 stud bolts as shown in the

illustration.

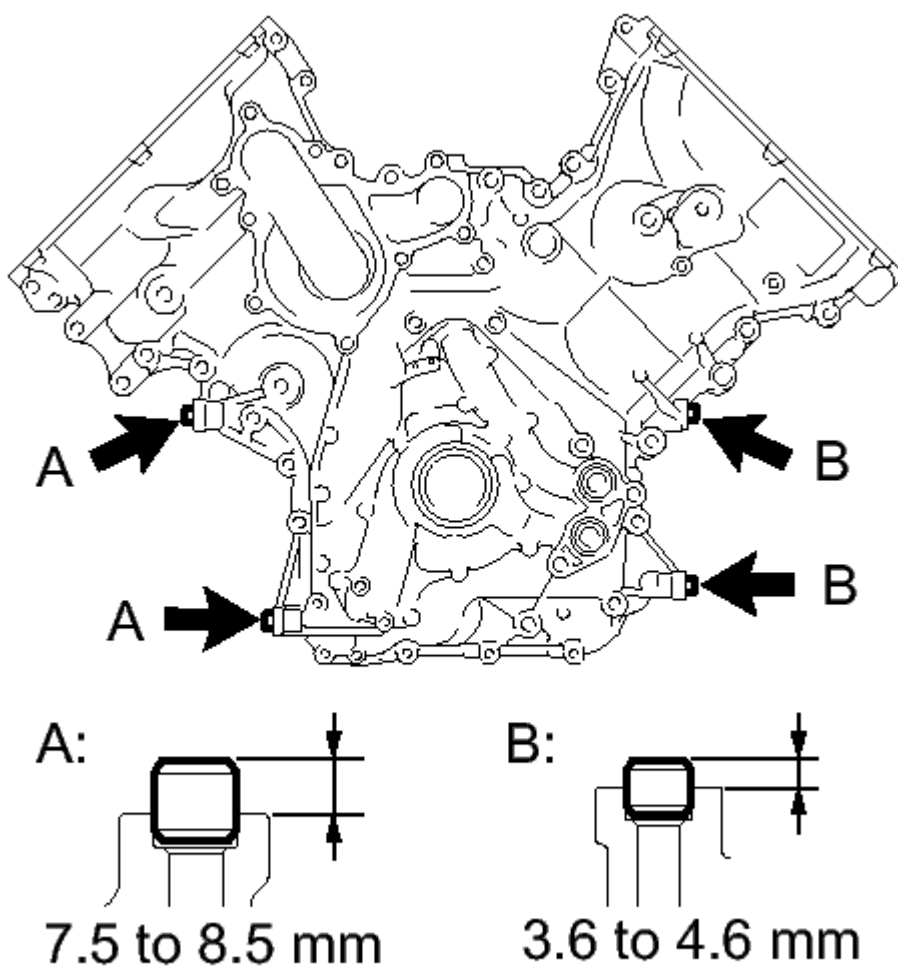
for stud bolt A

Torque: 5.0 N\*m (51 kgf\*cm, 44 in.\*lbf)

for stud bolt B

Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)

## 2. INSTALL RING PIN



**P**

**Fig. 267: Identifying Ring Pin**

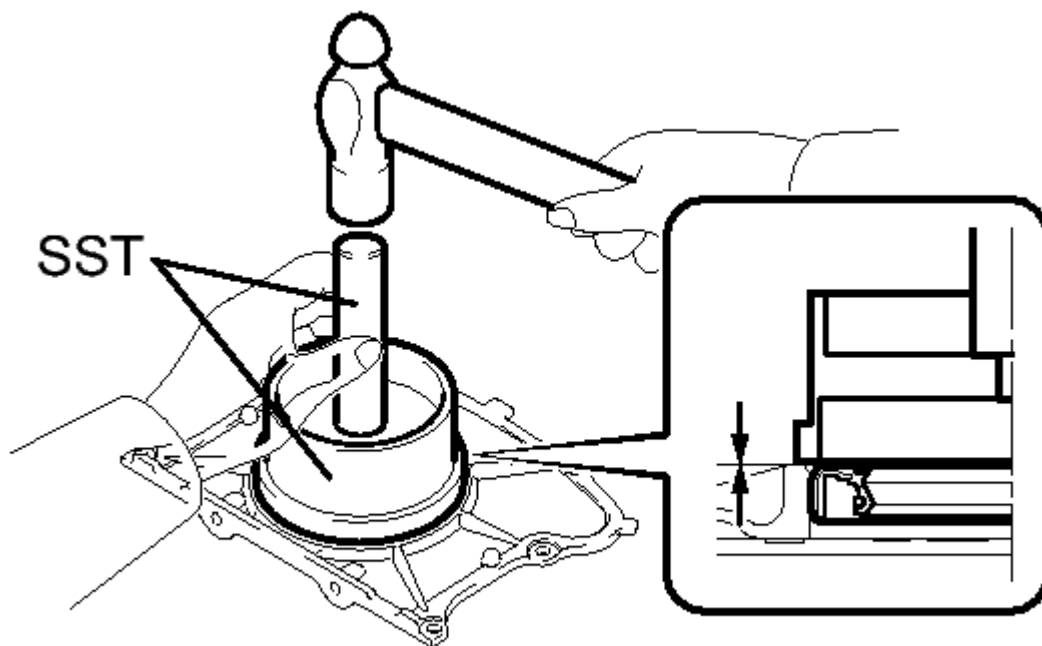
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a plastic-faced hammer, tap in new ring pins to the timing chain cover.

## Standard Protrusion

Item	Ring Pin Diameter	Specified Condition
Ring pin A	13 mm (0.512 in.)	7.5 to 8.5 mm (0.295 to 0.335 in.)
Ring pin B	11 mm (0.433 in.)	3.6 to 4.6 mm (0.142 to 0.181 in.)

## 3. INSTALL REAR CRANKSHAFT OIL SEAL

**P****Fig. 268: Installing Engine Rear Oil Seal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Keep the lip free from foreign matter.
- Do not tap on the oil seal at an angle.

a. Using SST, tap in a new oil seal until its surface is flush with the oil seal retainer edge.

- SST: 09223-15030

- SST: 09950-70010

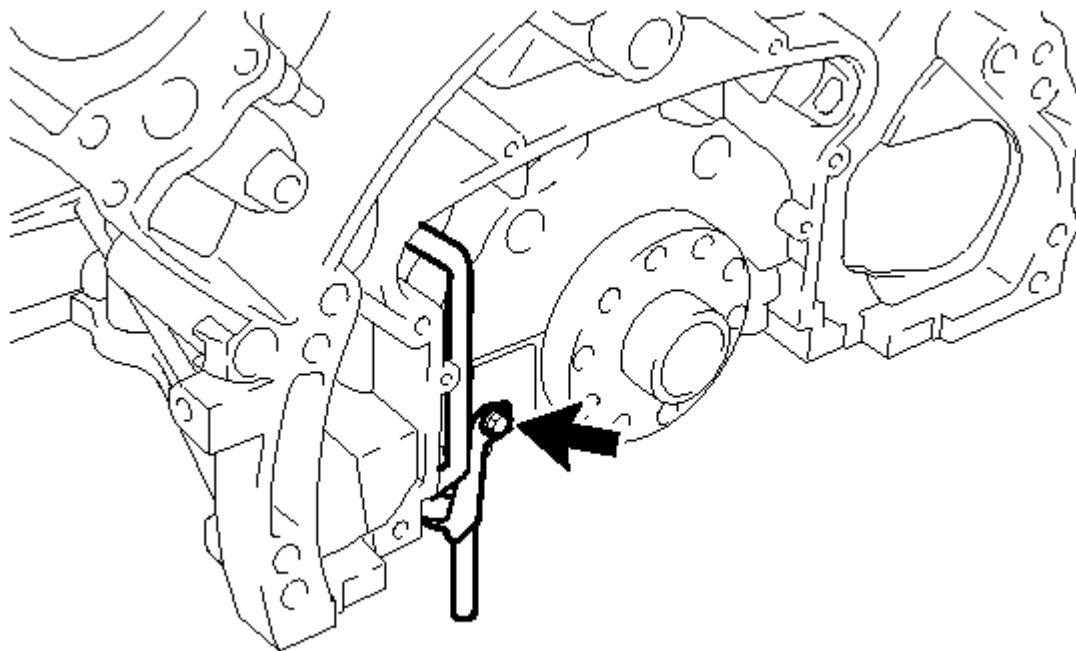
09951-07100



Standard depth

0 to 1.0 mm (0 to 0.0394 in.)

#### 4. INSTALL OIL DRAIN PIPE SUB-ASSEMBLY



**P**

**Fig. 269: Locating Oil Drain Pipe Bolt**

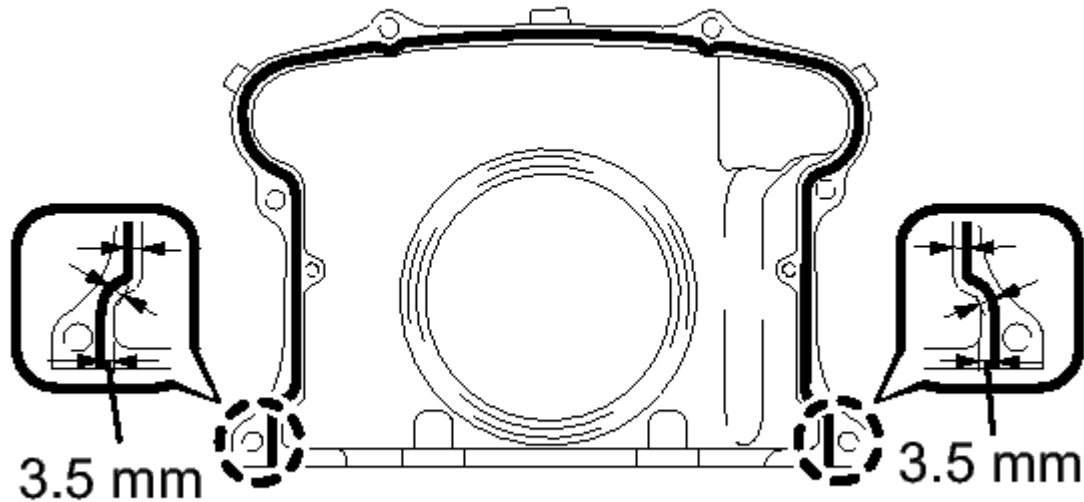
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Apply a light coat of engine oil to a new O-ring.
- Install the O-ring to the drain pipe.
- Install the oil drain pipe with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

#### 5. INSTALL ENGINE REAR OIL SEAL RETAINER

Seal diameter: 2.0 to 3.0 mm



**P**

**Fig. 270: Applying Seal Packing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply seal packing in a continuous line as shown in the illustration.

Seal packing

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Seal diameter

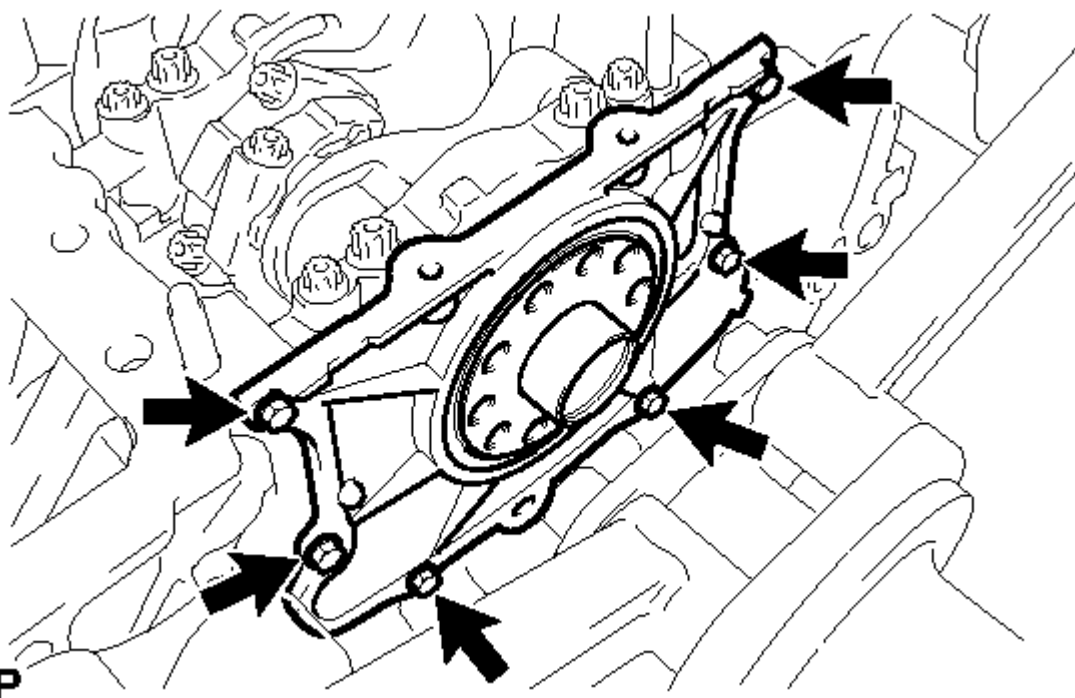
2.0 to 3.0 mm (0.0787 to 0.118 in.)

Application position from inside edge of retainer

3.5 mm (0.138 in.)

**NOTE:**

- Remove any oil from the contact surface.
- Install the engine rear oil seal retainer within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.



**Fig. 271: Locating Engine Rear Oil Seal Retainer Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

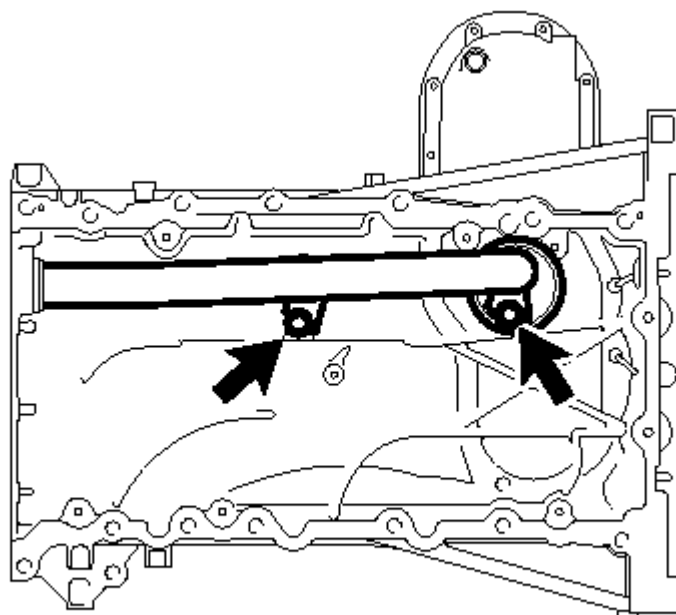
**NOTE:**

- Do not start the engine for at least 2 hours after installing.
- When installing the oil seal retainer, make sure the lip of the oil seal is not damaged.
- When installing the oil seal retainer, make sure the lip of the oil seal is not folded incorrectly.

- b. Install the oil seal retainer with the 6 bolts.

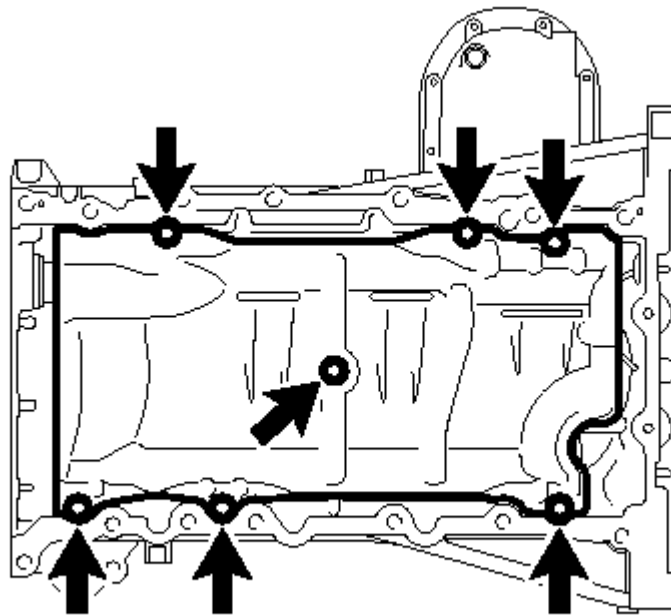
**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**6. INSTALL OIL STRAINER SUB-ASSEMBLY**

**P****Fig. 272: Locating Oil Strainer Bolts****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. Apply a light coat of engine oil to a new O-ring.
- b. Install the O-ring to the oil strainer.
- c. Install the oil strainer with the 2 bolts.

**Torque: 12 N\*m (122 kgf\*cm, 9 ft.\*lbf)****NOTE:        Make sure the O-ring is not twisted or damaged.****7. INSTALL NO. 1 OIL PAN BAFFLE PLATE**

**P**

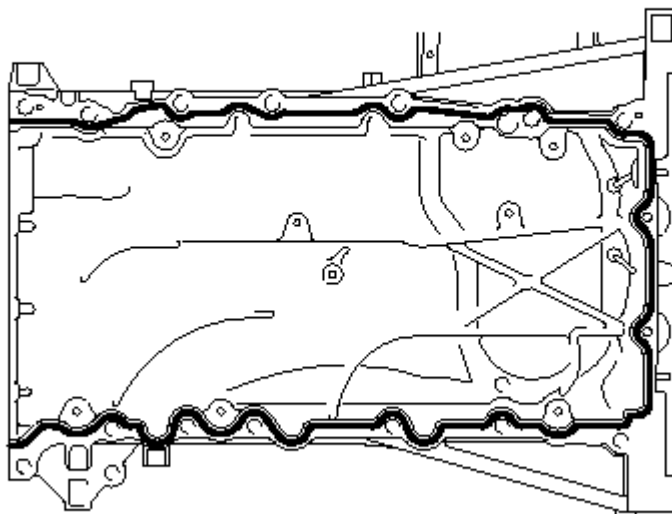
**Fig. 273: Locating No. 1 Oil Pan Baffle Plate Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the baffle plate with the 7 bolts.

**Torque: 12 N\*m (122 kgf\*cm, 9 ft.\*lbf)**

## **8. INSTALL NO. 1 OIL PAN SUB-ASSEMBLY**

Seal diameter: 3.0 to 4.0 mm



**P**

**Fig. 274: Applying Seal Packing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply seal packing in a continuous line as shown in the illustration.

Seal packing

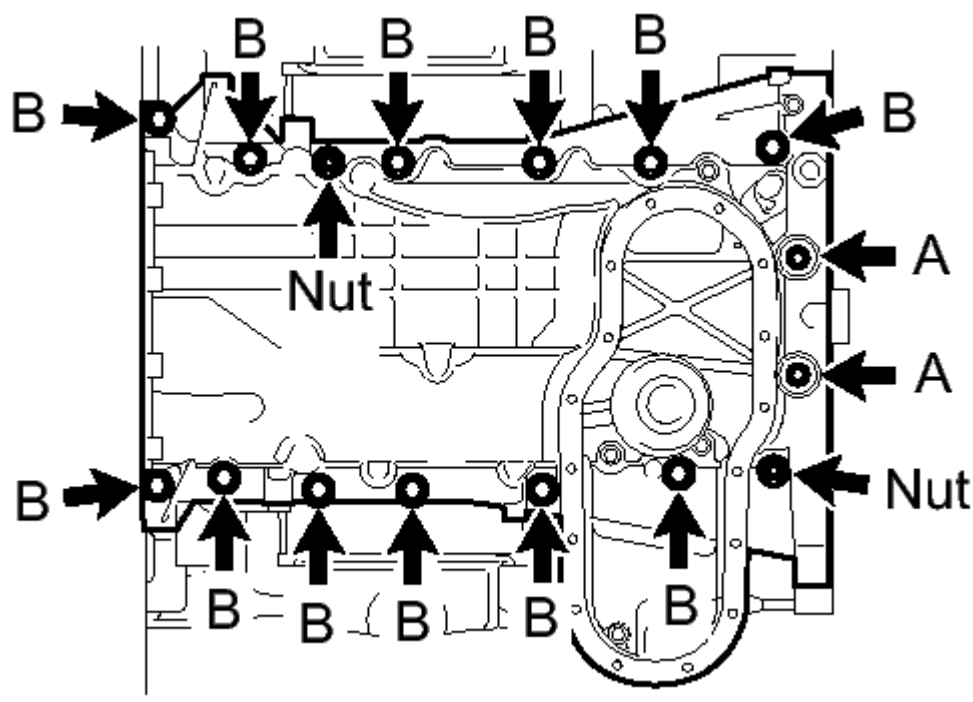
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Standard seal diameter

3.0 to 4.0 mm (0.118 to 0.157 in.)

**NOTE:**

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.



**Fig. 275: Locating Oil Pan Bolts And Nuts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not start the engine for at least 2 hours after installing.

- b. Install the oil pan with the 14 bolts and 2 nuts.

for bolt A

Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)

for bolt B

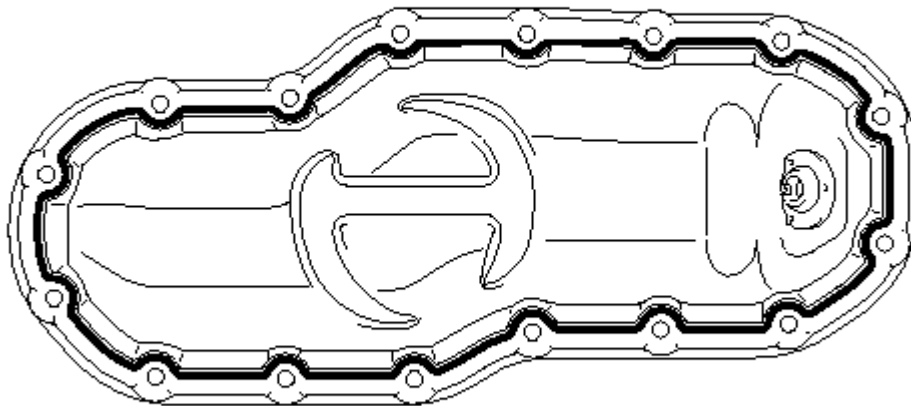
Torque: 35 N\*m (357 kgf\*cm, 26 ft.\*lbf)

for nut

Torque: 35 N\*m (357 kgf\*cm, 26 ft.\*lbf)

## 9. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY

Seal diameter: 3.0 to 4.0 mm



**P**

**Fig. 276: Applying Seal Packing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply seal packing in a continuous line as shown in the illustration.

Seal packing

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

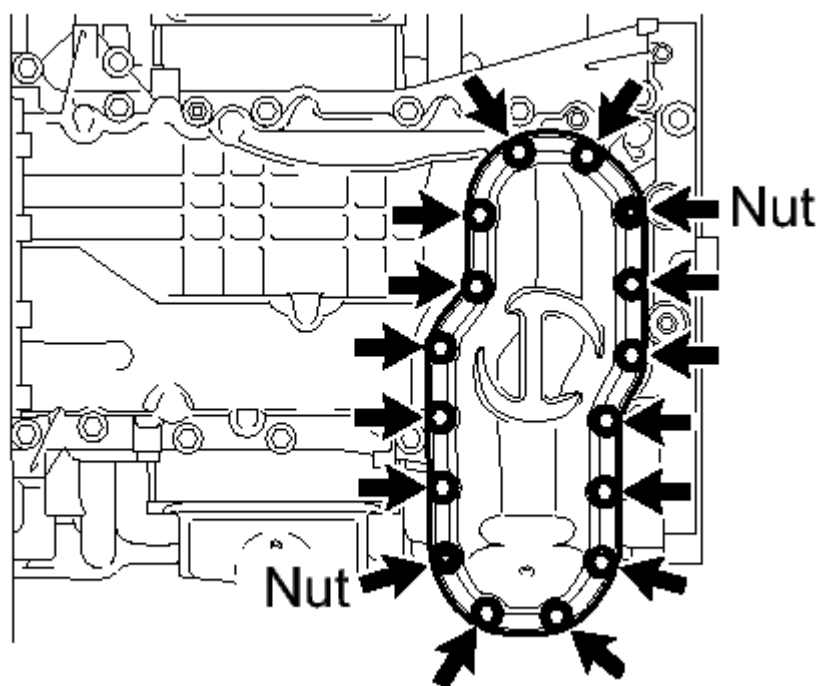
Standard seal diameter

3.0 to 4.0 mm (0.118 to 0.156 in.)

**NOTE:**

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.





**P**

**Fig. 277: Locating No. 2 Oil Pan Sub-Assembly Bolts And Nuts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

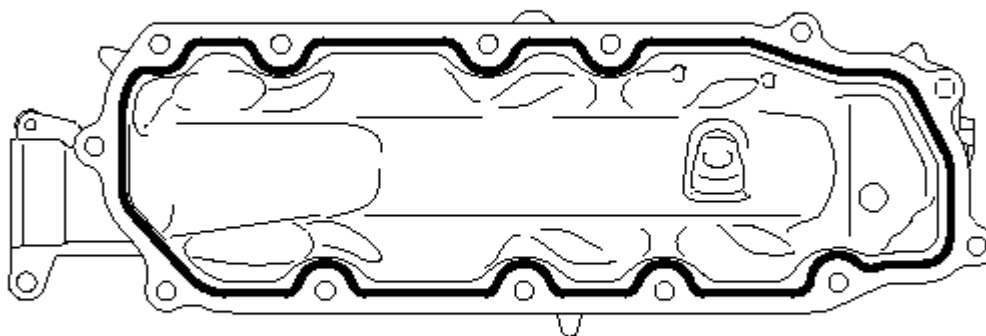
**NOTE:** Do not start the engine for at least 2 hours after installing.

- b. Install the oil pan with the 14 bolts and 2 nuts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

#### 10. INSTALL NO. 1 HEAT EXCHANGER COVER

Seal diameter: 3.0 to 4.0 mm



**P**

**Fig. 278: Applying Seal Packing In A Continuous Line**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply seal packing in a continuous line as shown in the illustration.

Seal packing

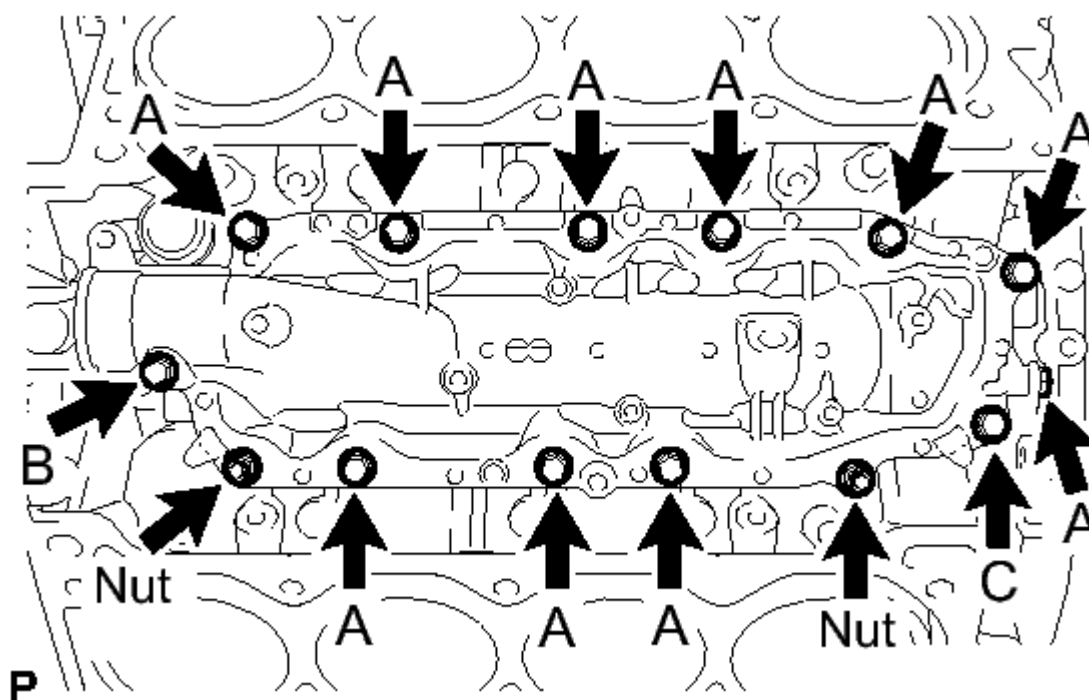
Toyota Genuine Seal Packing 1282B, Three Bond 1282B or equivalent

Standard seal diameter

3.0 to 4.0 mm (0.118 to 0.157 in.)

**NOTE:**

- Remove any oil from the contact surface.
- Install the No. 1 heat exchanger cover within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.



**Fig. 279: Installing The Heat Exchanger Cover**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not start the engine for at least 2 hours after installing.

- b. Install the heat exchanger cover with the 12 bolts and 2 nuts.

for bolt C

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

except bolt C

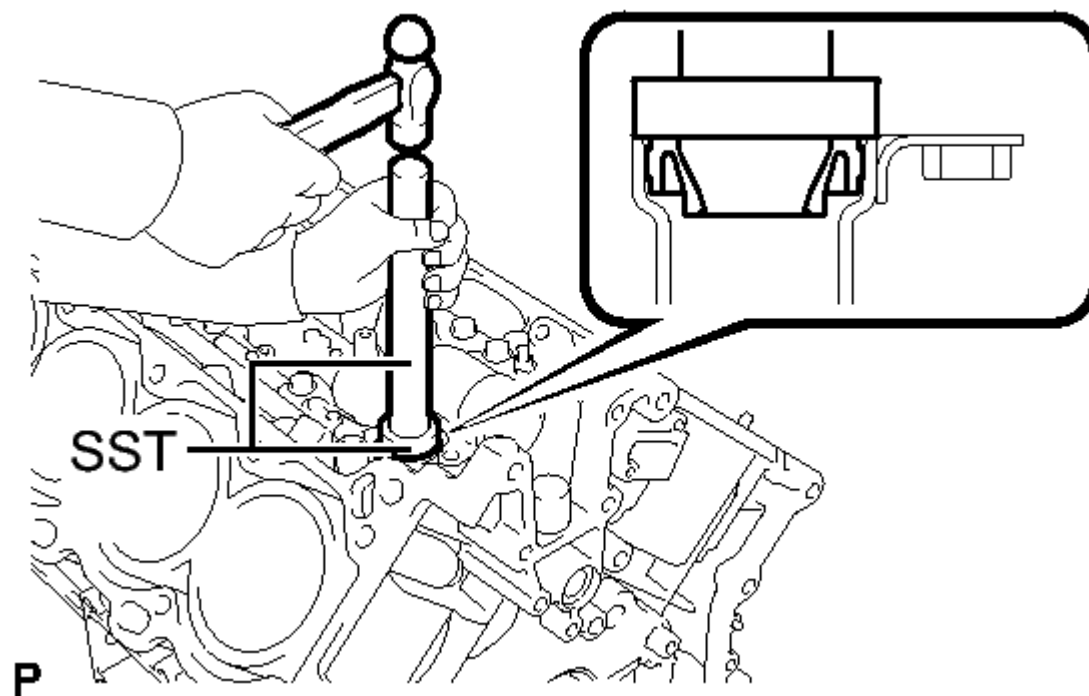
**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

Standard Bolt

Item	Length	Thread Diameter
Bolt A	20 mm (0.787 in.)	8 mm (0.315 in.)
Bolt B	70 mm (2.76 in.)	8 mm (0.315 in.)
Bolt	16 mm	6 mm

C	(0.630 in.)	(0.236 in.)
---	----------------	----------------

## 11. INSTALL VENTILATION PIPE GASKET



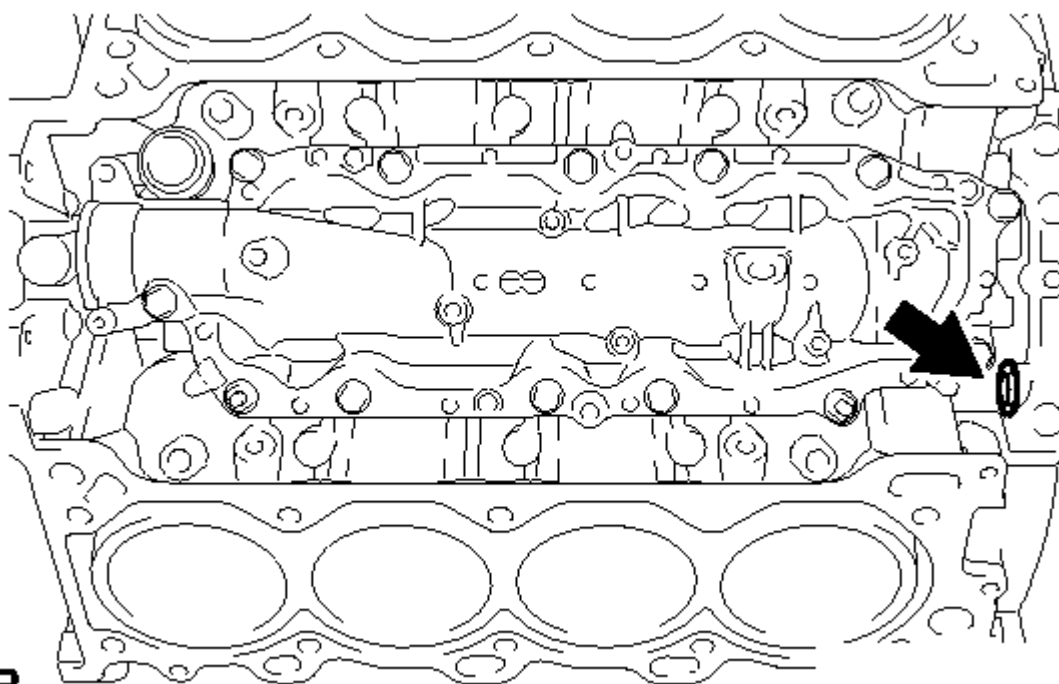
**Fig. 280: Evenly Tap In A New Ventilation Pipe Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using SST, evenly tap in a new ventilation pipe gasket until its surface is flush with the lip of the ventilation pipe.
  - SST: 09950-60010  
09951-00360
  - SST: 09950-70010  
09951-07100

**NOTE:**

- Do not tap the gasket at an angle.
- Do not tap the gasket excessively.

## 12. INSTALL OIL RETURN PIPE GASKET



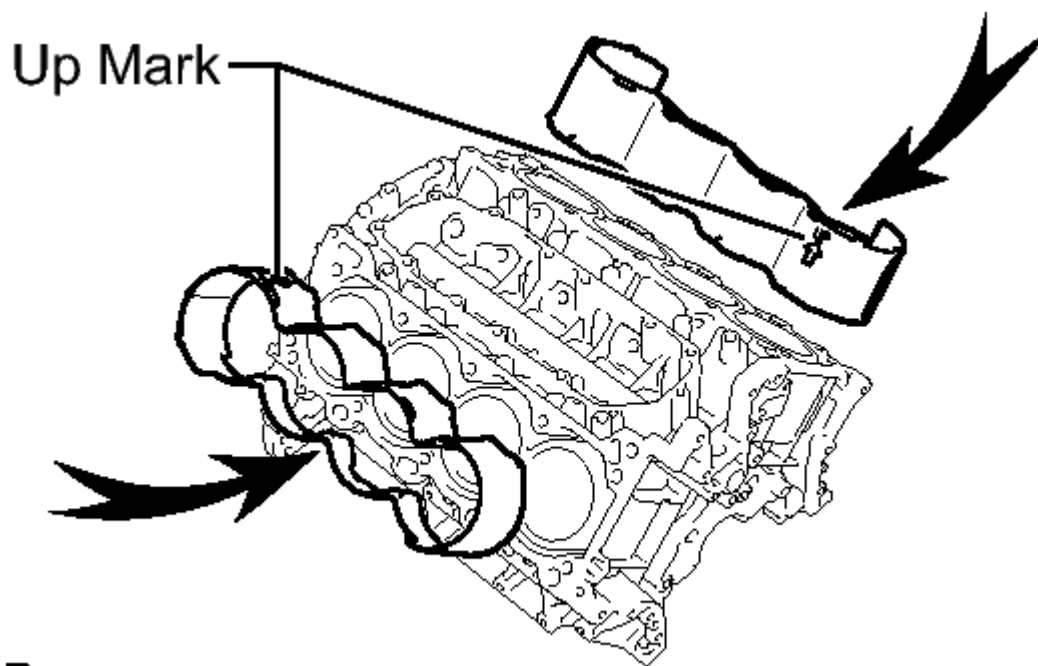
**P**

**Fig. 281: Identifying Oil Return Pipe Gasket**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install a new oil return pipe gasket.

**13. INSTALL CYLINDER BLOCK WATER JACKET SPACER**



**P**

**Fig. 282: Identifying Cylinder Block Water Jacket Spacer**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the 2 water jacket spacers as shown in the illustration.

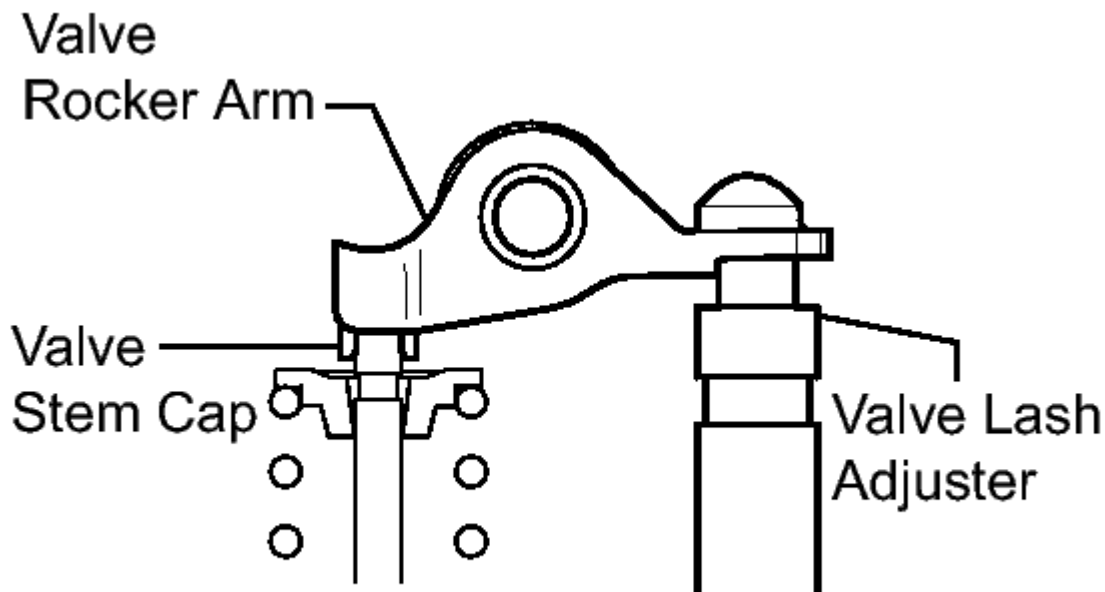
**NOTE:**

- Face the cutouts indicated by the arrows in illustration away from the engine.
- Face the "up mark" as shown in the illustration.

14. **INSTALL CYLINDER HEAD GASKET RH** See step 3
15. **INSTALL CYLINDER HEAD GASKET LH** See step 3
16. **INSTALL CYLINDER HEAD SUB-ASSEMBLY RH** See step 4
17. **INSTALL CYLINDER HEAD SUB-ASSEMBLY LH** See step 4
18. **INSTALL VALVE STEM CAP**
- a. Apply a light coat of engine oil to the valve stem caps.
- b. Install the 32 valve stem caps to the cylinder head.
19. **INSTALL VALVE LASH ADJUSTER ASSEMBLY**
- a. Inspect the valve lash adjuster See step 3.
- b. Install the 32 valve lash adjusters to the cylinder head.

**NOTE:** Install the lash adjuster at the same place it was removed from.

20. **INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
- a. Apply engine oil to the lash adjuster tips and valve stem cap ends.

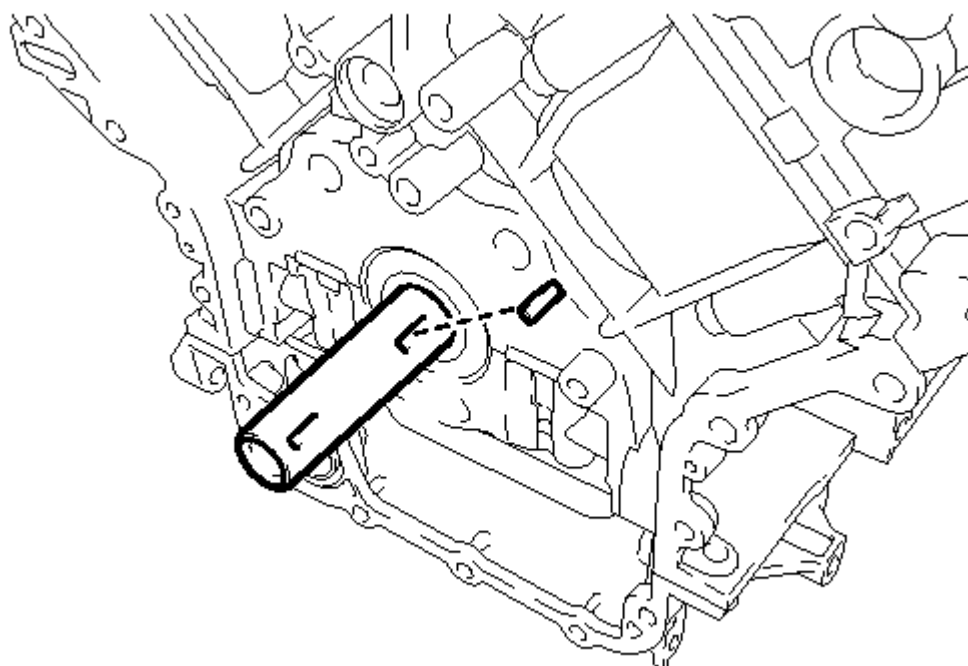


**P**

**Fig. 283: Identifying Valve Rocker Arm And Valve Stem Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the 32 valve rocker arms as shown in the illustration.

21. **INSTALL CAMSHAFT BEARING CAP RH** See step 1
22. **INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY RH** See step 2
23. **INSTALL CAMSHAFT BEARING CAP LH** See step 1
24. **INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY LH** See step 2
25. **INSTALL CRANKSHAFT TIMING GEAR KEY**



**P**

**Fig. 284: Identifying Timing Gear Key**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

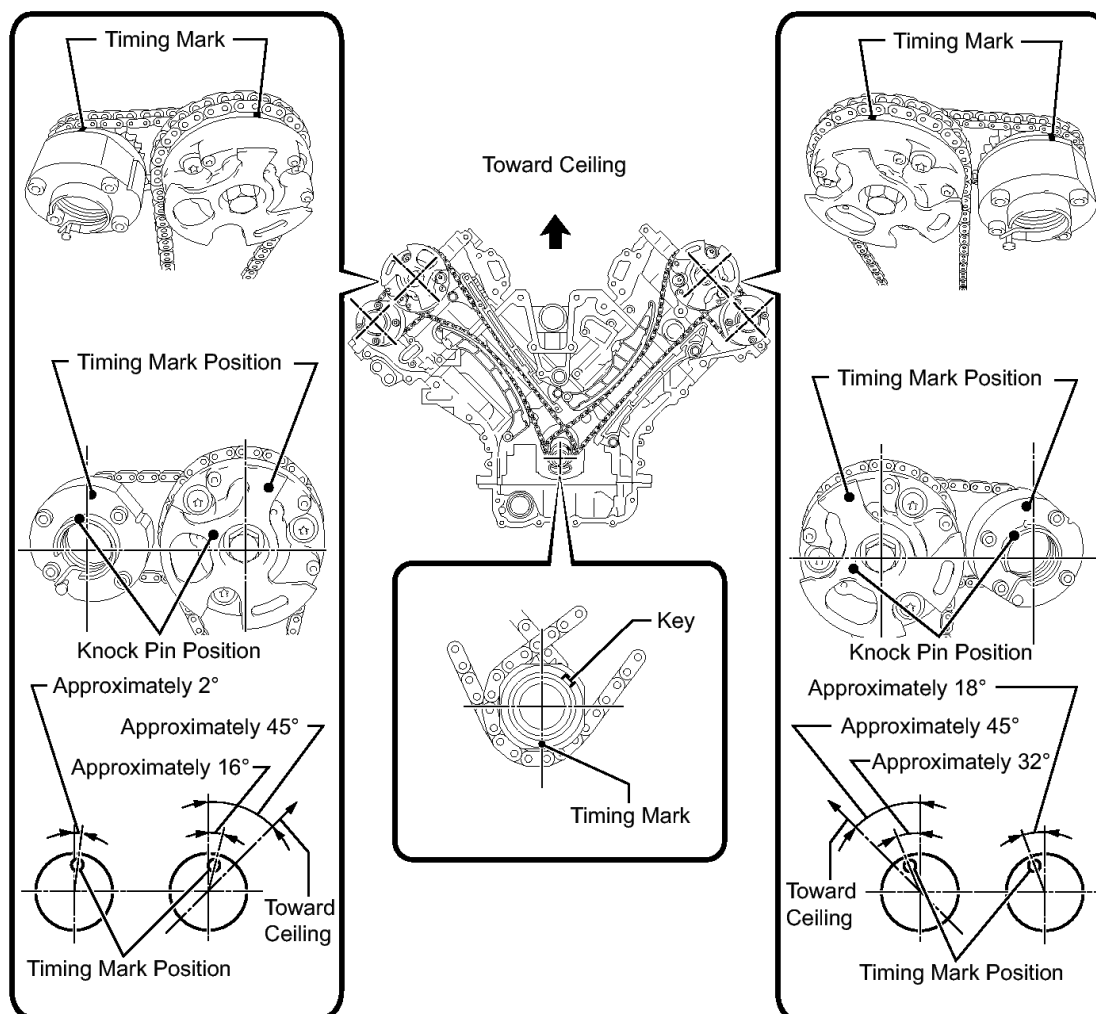
a. Install the timing gear key.

**HINT:**

The other timing gear key will be installed at a later step.

26. **INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY** See step 3
27. **INSTALL NO. 1 CHAIN SUB-ASSEMBLY RH** See step 4
28. **INSTALL NO. 1 CHAIN VIBRATION DAMPER RH** See step 5
29. **INSTALL NO. 1 CHAIN TENSIONER SLIPPER RH** See step 6
30. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY RH** See step 7
31. **INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY** See step 3

32. **INSTALL NO. 1 CHAIN SUB-ASSEMBLY LH** See step 4
33. **INSTALL NO. 1 CHAIN TENSIONER SLIPPER LH** See step 5
34. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY LH** See step 6
35. **INSTALL NO. 1 CHAIN VIBRATION DAMPER LH** See step 7
36. **TIGHTEN CAMSHAFT TIMING GEAR** See step 12
37. **CHECK NO. 1 CYLINDER TO TDC / COMPRESSION**
  - a. Temporarily install the pulley set bolt.
  - b. Rotate the crankshaft clockwise, and check that the timing marks on the crankshaft timing gear and camshaft timing gears are as shown in the illustration.
  - c. Remove the crankshaft pulley set bolt.



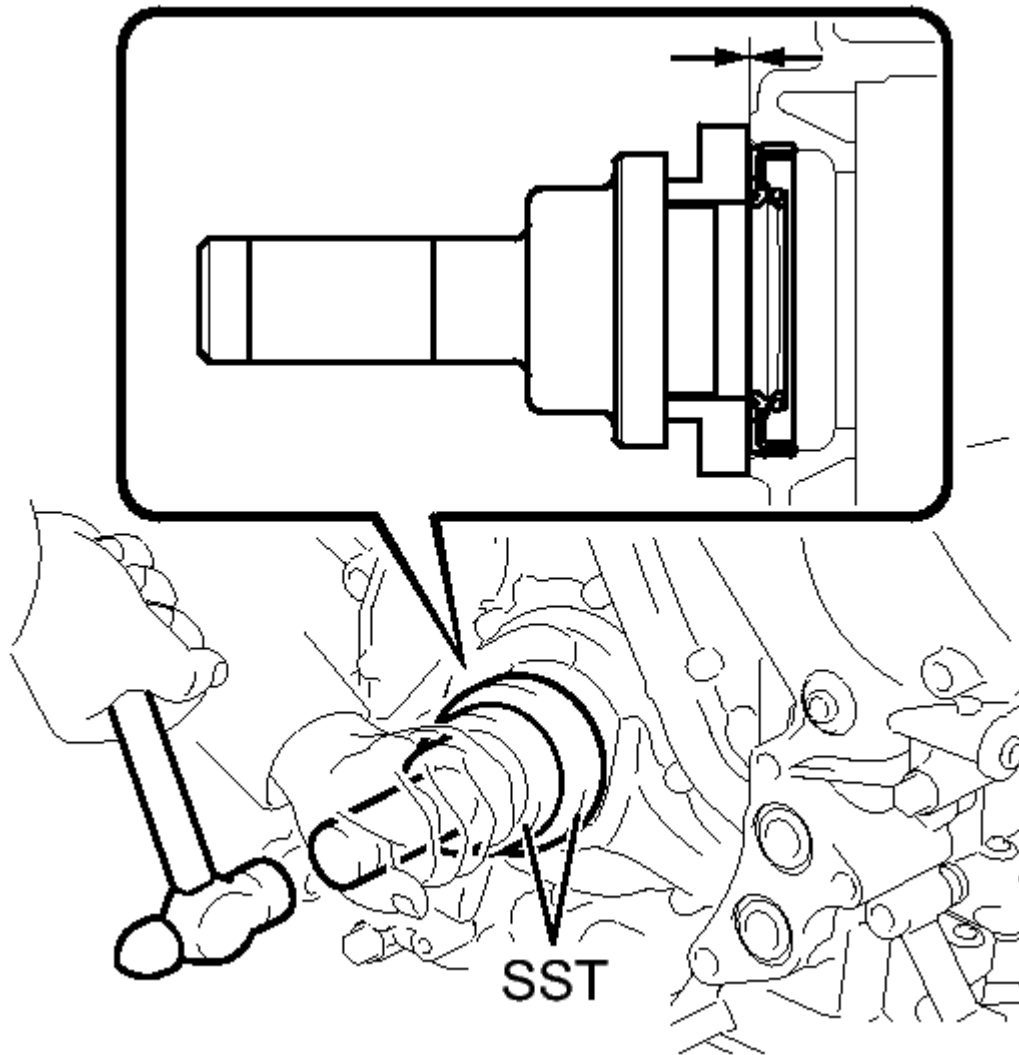
P

**Fig. 285: Rotate The Crankshaft Clockwise Again And Align The Timing Marks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. **INSTALL WATER INLET PIPE** . Refer to **INSTALLATION - Step 1**



39. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 2**
40. **INSTALL ENGINE WATER PUMP ASSEMBLY** . Refer to **INSTALLATION - Step 1**
41. **INSTALL FRONT CRANKSHAFT OIL SEAL**



**P**

**Fig. 286: Installing Front Crankshaft Oil Seal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

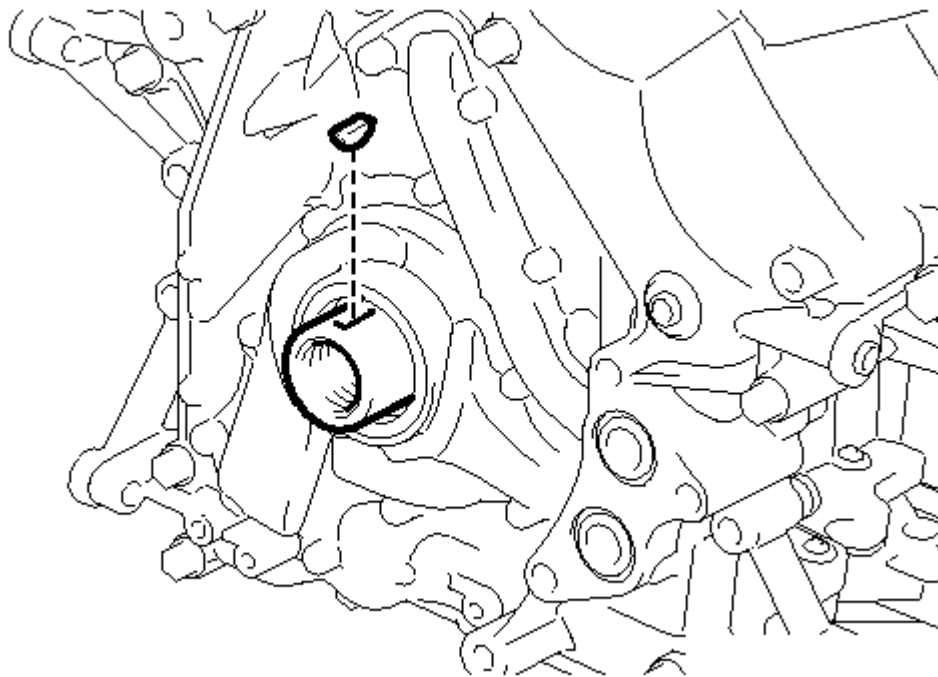
- a. Apply MP grease to the lip of a new oil seal.
- b. Using SST and a hammer, tap in the oil seal to a depth between 0 to 1.0 mm (0 to 0.0394 in.) from the timing chain cover edge.
  - SST: 09223-22010
  - SST: 09506-35010

**NOTE:**

- **Keep the lip free from foreign matter.**

- Do not tap oil seal at an angle.

**42. INSTALL CRANKSHAFT TIMING GEAR KEY**

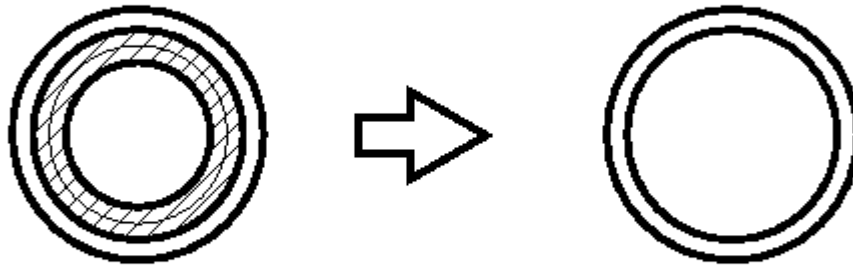



**P**

**Fig. 287: Identifying Crankshaft Timing Gear Key**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the crankshaft timing gear key to the crankshaft.

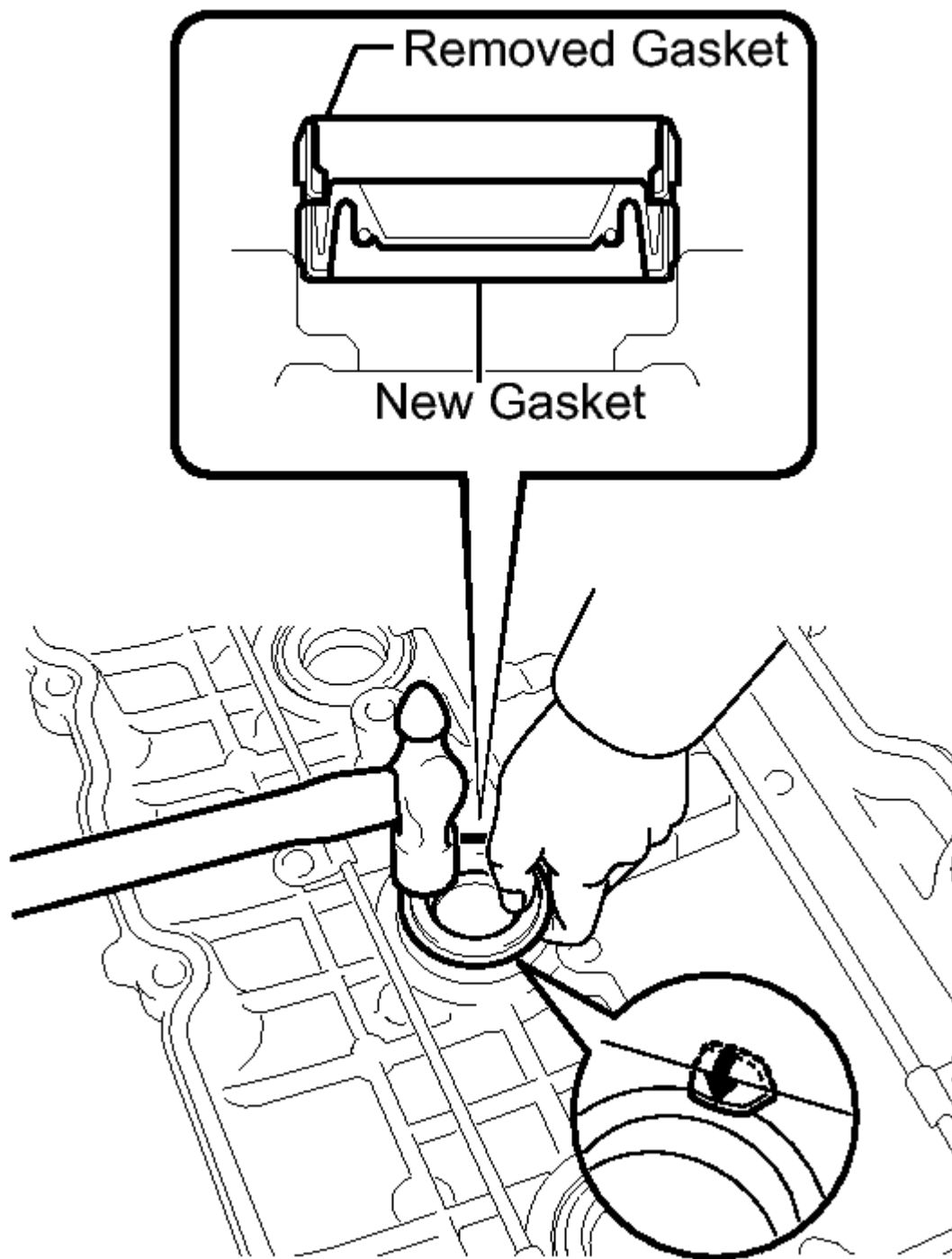
**43. INSTALL SPARK PLUG TUBE GASKET**



T  Area to cut off

**Fig. 288: Identifying Spark Plug Tube Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a cutter knife, cut off the seal part of the removed gasket.

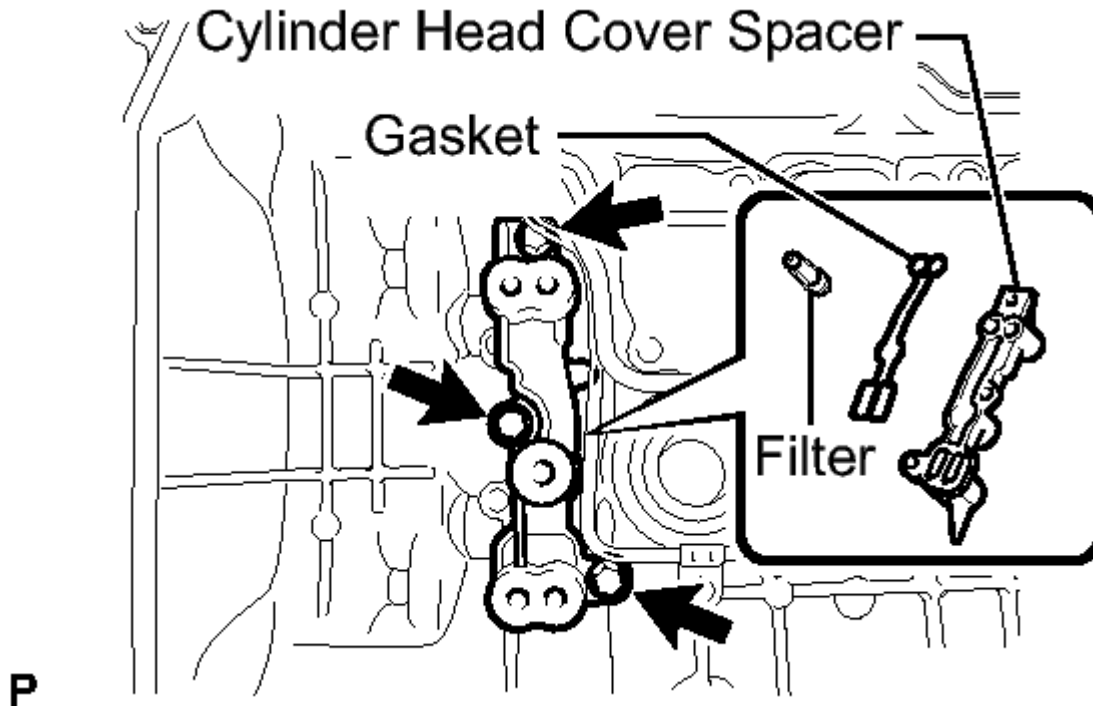
**P****Fig. 289: Installing Spark Plug Tube Gasket****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Using the removed gasket and a hammer, tap in a new gasket until it stops.

**HINT:**

If the removed gasket does not fit on the new one, correct the removed one with pliers.

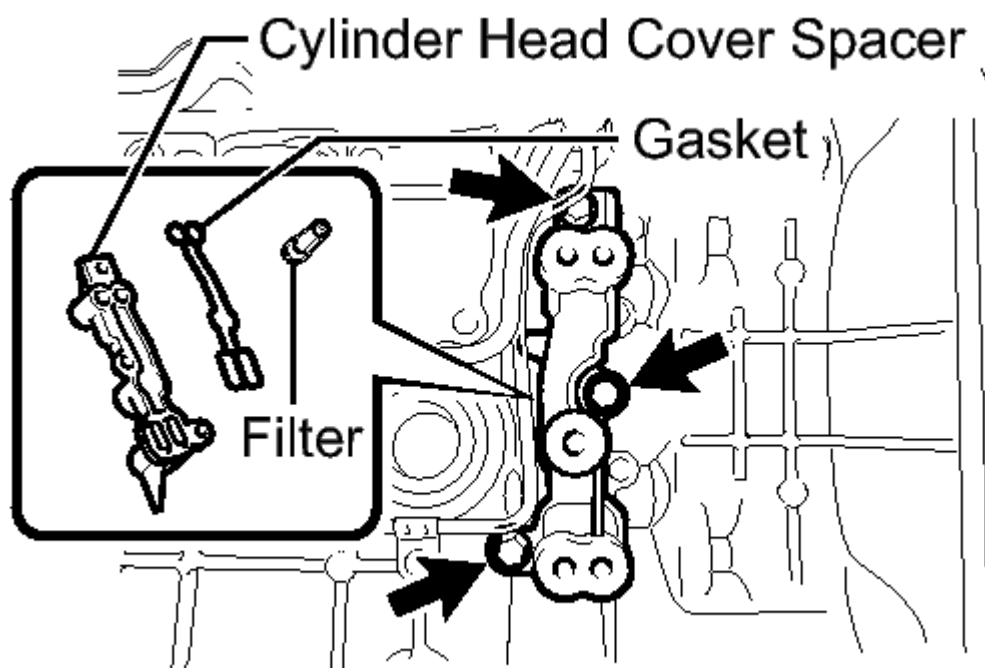
- c. Apply a light coat of MP grease to the gasket lip.
- d. Return the 4 ventilation baffle plate claws to the original positions.

**44. INSTALL OIL CONTROL VALVE FILTER****P**

**Fig. 290: Identifying Bolts, Cylinder Head Cover Spacer, Gasket And Valve Filter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. LH:
  - 1. Install the valve filter in the cylinder head cover.
  - 2. Install a new gasket and the cylinder head cover spacer with the 3 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**P**

**Fig. 291: Identifying Oil Control Valve Filter, Gasket And Cylinder Head Cover Spacer (RH)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

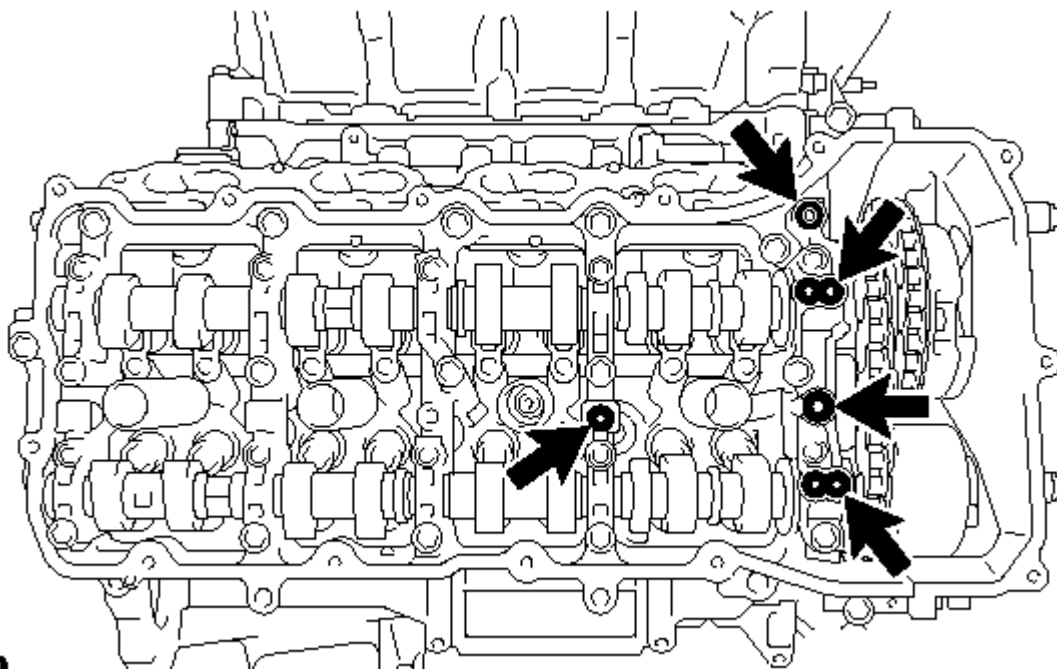
b. RH:

1. Install the valve filter in the cylinder head cover.
2. Install a new gasket and the cylinder head cover spacer with the 3 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

#### **45. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY RH**

- a. Install 5 new gaskets to the camshaft bearing caps. (No. 1, No. 3).



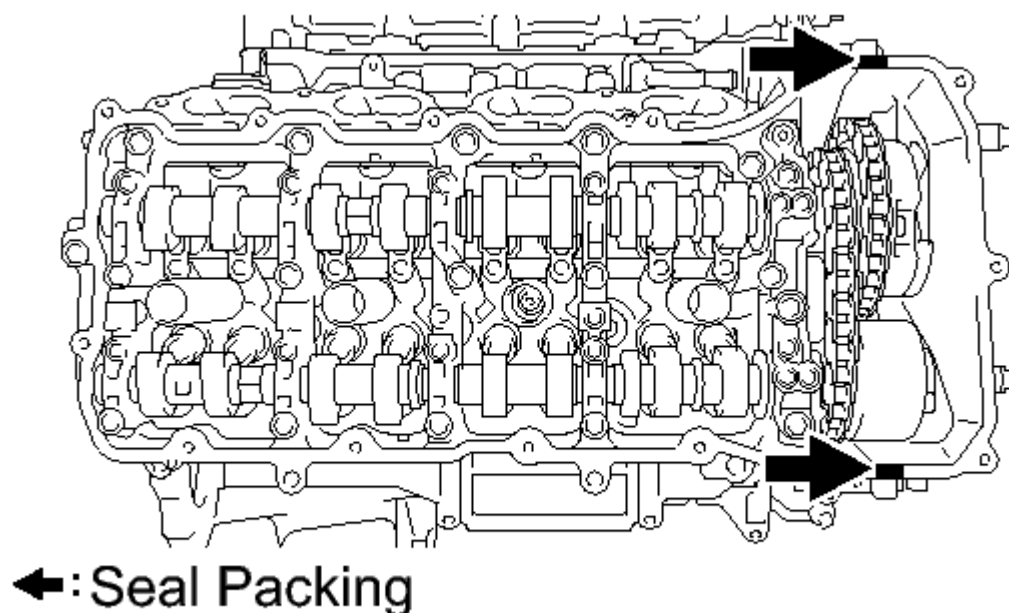
**P**

**Fig. 292: Identifying Camshaft Bearing Caps Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cover gasket to the cylinder head cover.

**NOTE:** Remove any oil from the contact surface.

- c. Apply seal packing as shown in the illustration.



**P**

**Fig. 293: Identifying Area For Applying Seal Packing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing

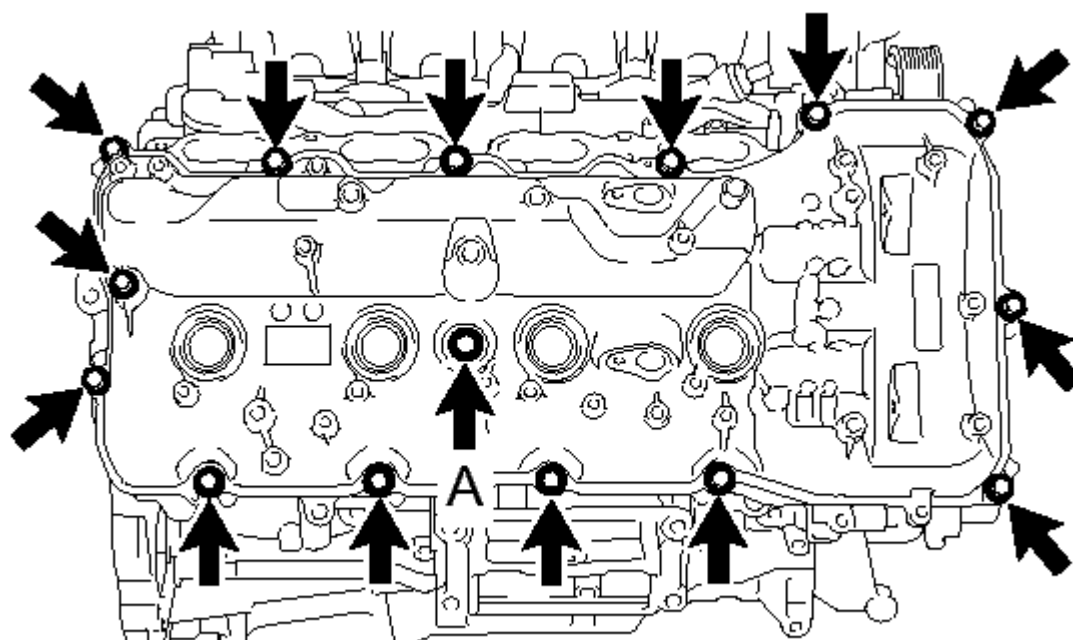
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

**NOTE:**

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.

- d. Install the cylinder head cover washer with a new seal and the 14 bolts.





**P**

**Fig. 294: Installing The Cylinder Head Cover Washer**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for bolt A

Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)

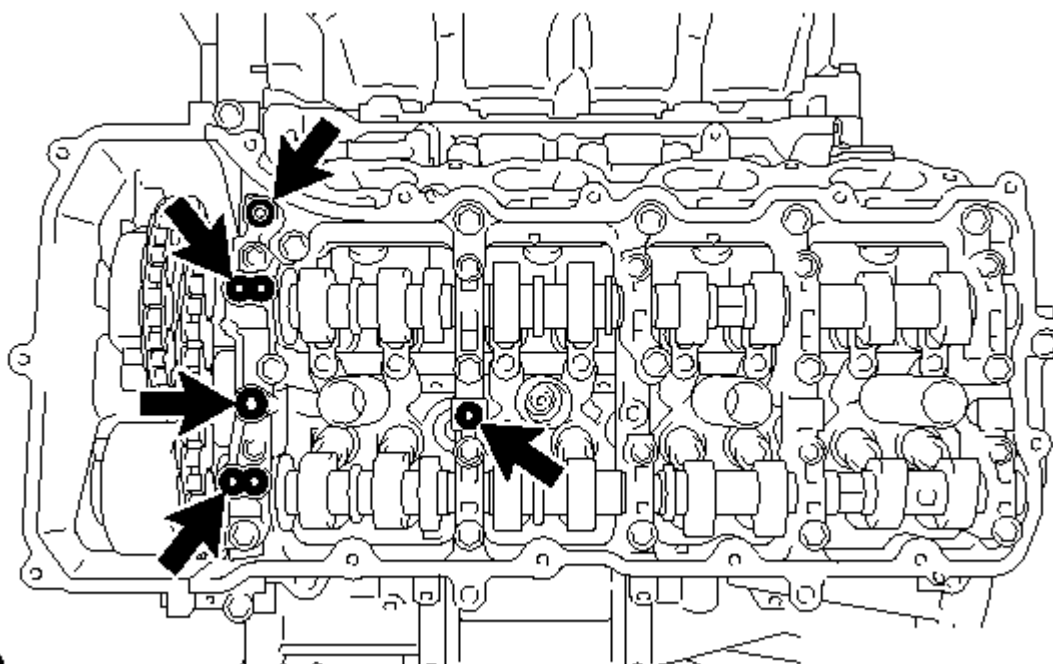
except bolt A

Torque: 12 N\*m (122 kgf\*cm, 9 ft.\*lbf)

**NOTE:** Do not start the engine for at least 2 hours after the installation.

#### 46. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH

- a. Install 5 new gaskets to the camshaft bearing caps (No. 2, No. 3).



**P**

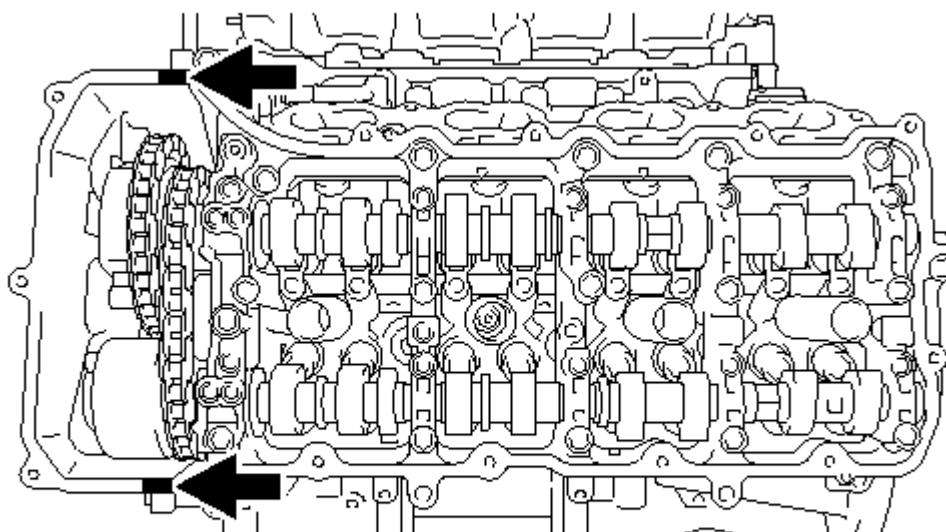
**Fig. 295: Identifying Camshaft Bearing Caps Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cover gasket to the cylinder head cover.

**NOTE:** Remove any oil from the contact surface.

- c. Apply seal packing as shown in the illustration.



←: Seal Packing

**P**

**Fig. 296: Identifying Seal Packing Applying Area To Cylinder Head Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

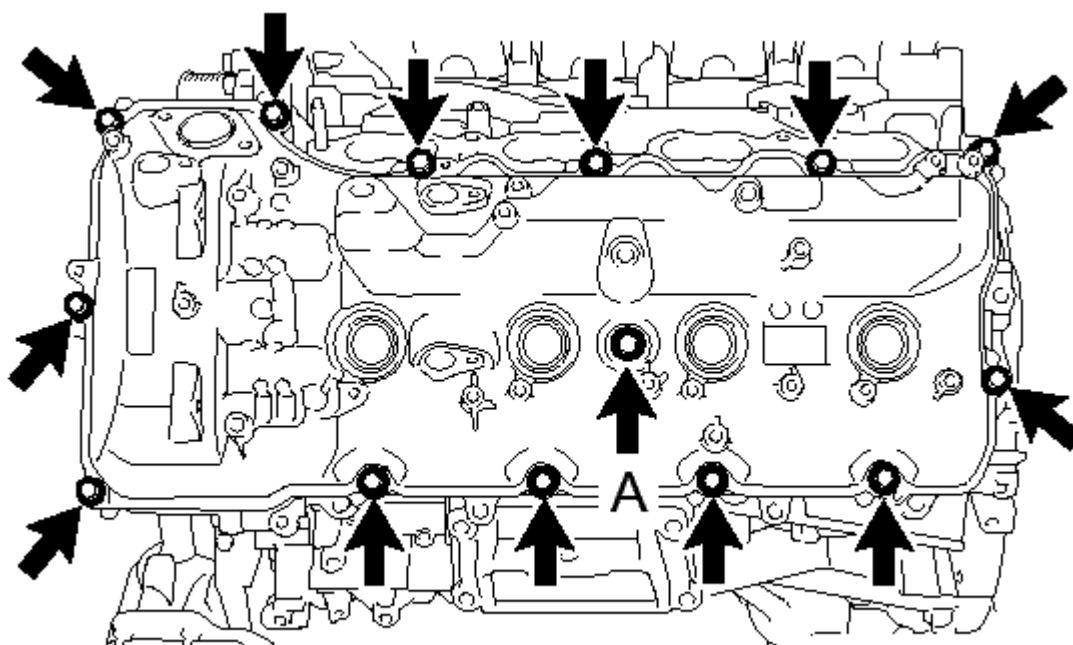
Seal packing

Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

**NOTE:**

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.

- d. Install the cylinder head cover washer with a new seal and the 14 bolts.



**P**

**Fig. 297: Installing The Cylinder Head Cover Washer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for bolt A

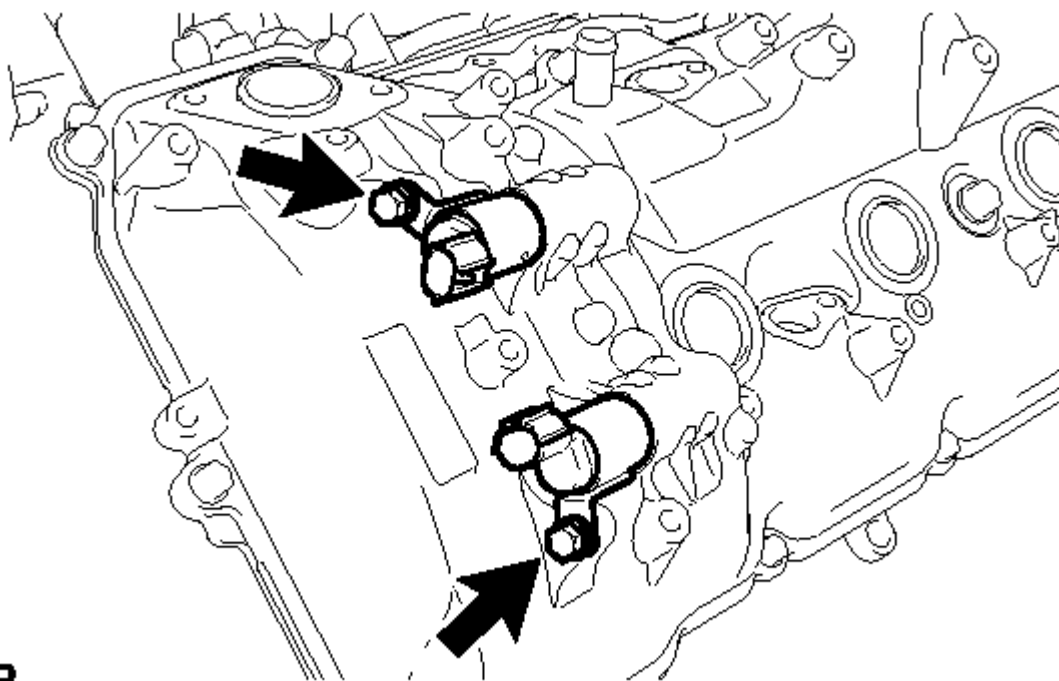
Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)

except bolt A

Torque: 12 N\*m (122 kgf\*cm, 9 ft.\*lbf)

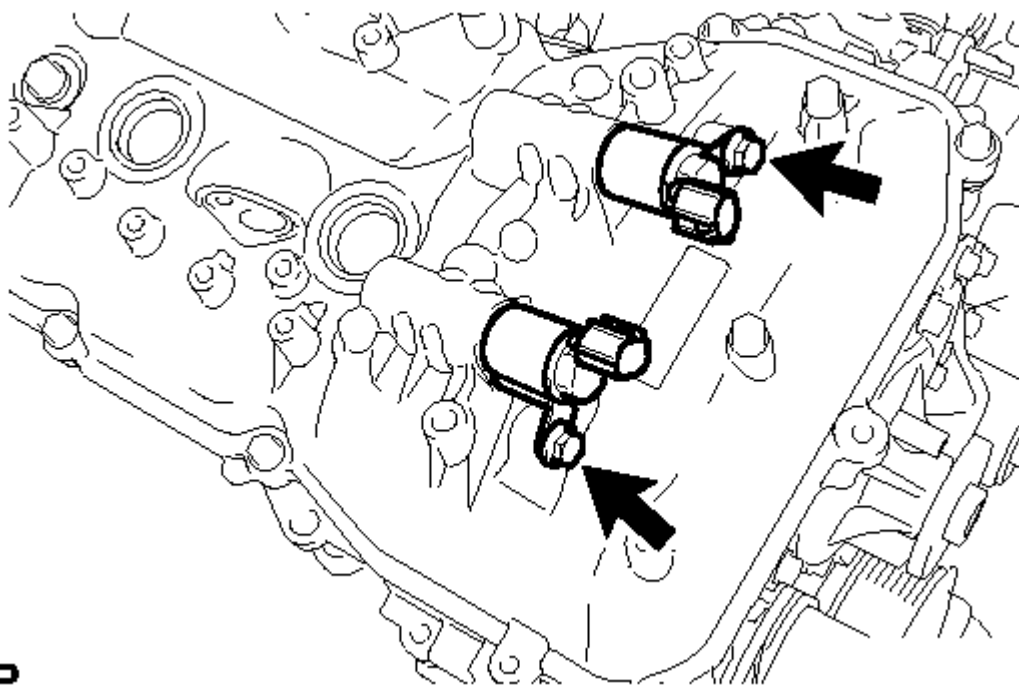
**NOTE:** Do not start the engine for at least 2 hours after the installation.

#### 47. INSTALL CAMSHAFT OIL CONTROL VALVE ASSEMBLY

**P****Fig. 298: Removing The 2 Bolts And 2 Oil Control Valves****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. LH:
1. Apply a light coat of engine oil to 2 new O-rings.
  2. Install the 2 O-rings to the 2 oil control valves.
  3. Install the 2 oil control valves with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**



**P**

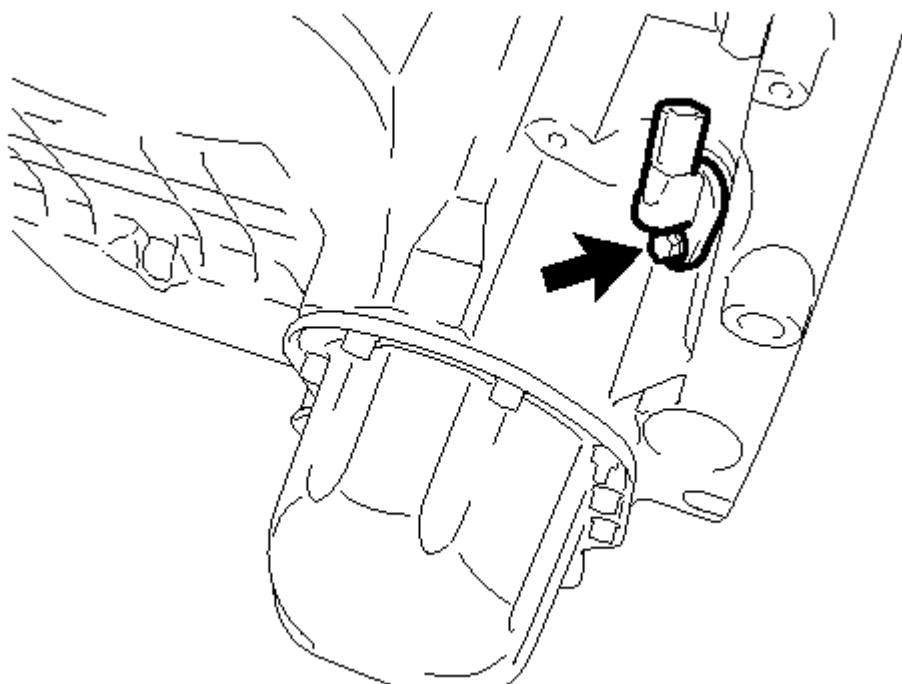
**Fig. 299: Removing The 2 Bolts And 2 Oil Control Valves**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. RH:

1. Apply a light coat of engine oil to 2 new O-rings.
2. Install the 2 O-rings to the 2 oil control valves.
3. Install the 2 oil control valves with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

#### **48. INSTALL CRANKSHAFT POSITION SENSOR**



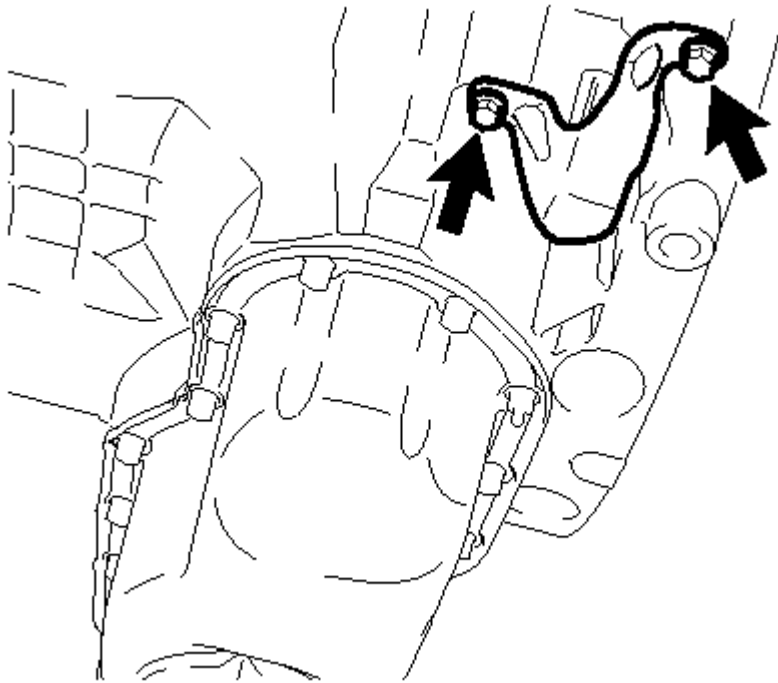
**P**

**Fig. 300: Locating Crankshaft Position Sensor Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the crankshaft position sensor with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**49. INSTALL CRANKSHAFT POSITION SENSOR PROTECTOR**



**P**

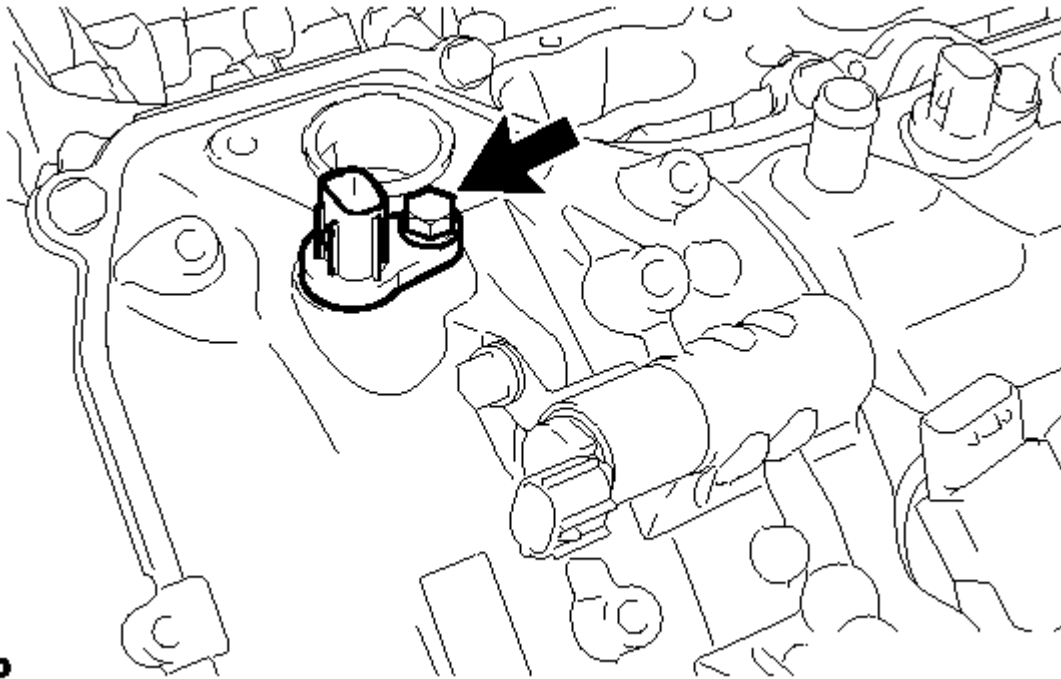
**Fig. 301: Locating Crank Position Sensor Protector Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the sensor protector with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

## **50. INSTALL CAMSHAFT POSITION SENSOR**





**P**

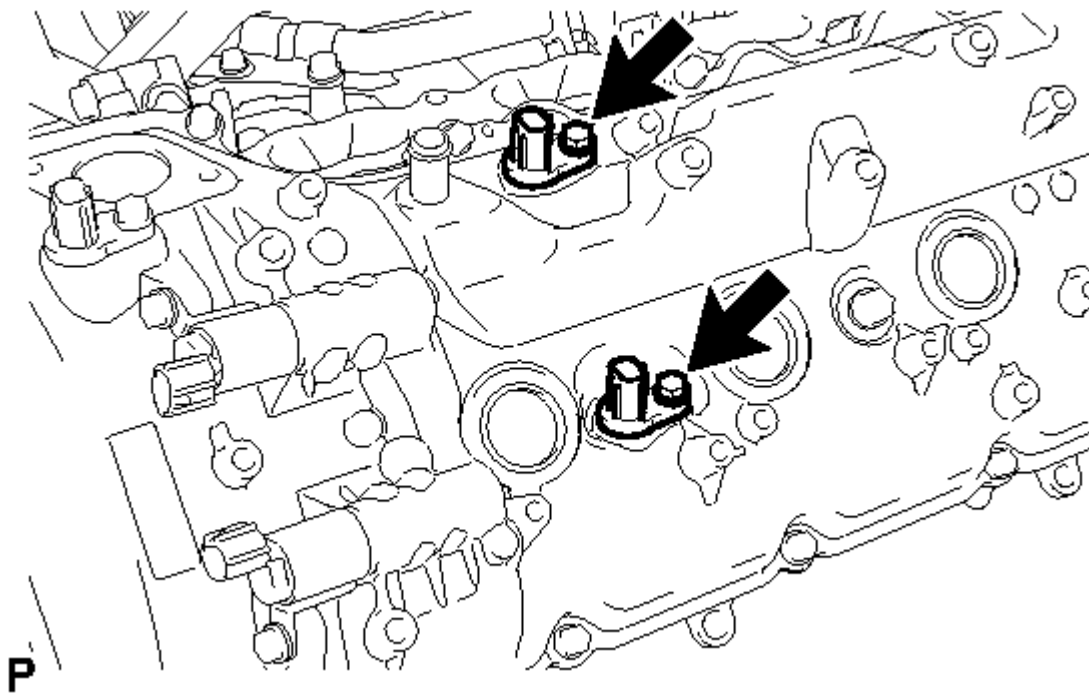
**Fig. 302: Removing The Bolt And Camshaft Position Sensor**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the camshaft position sensor with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

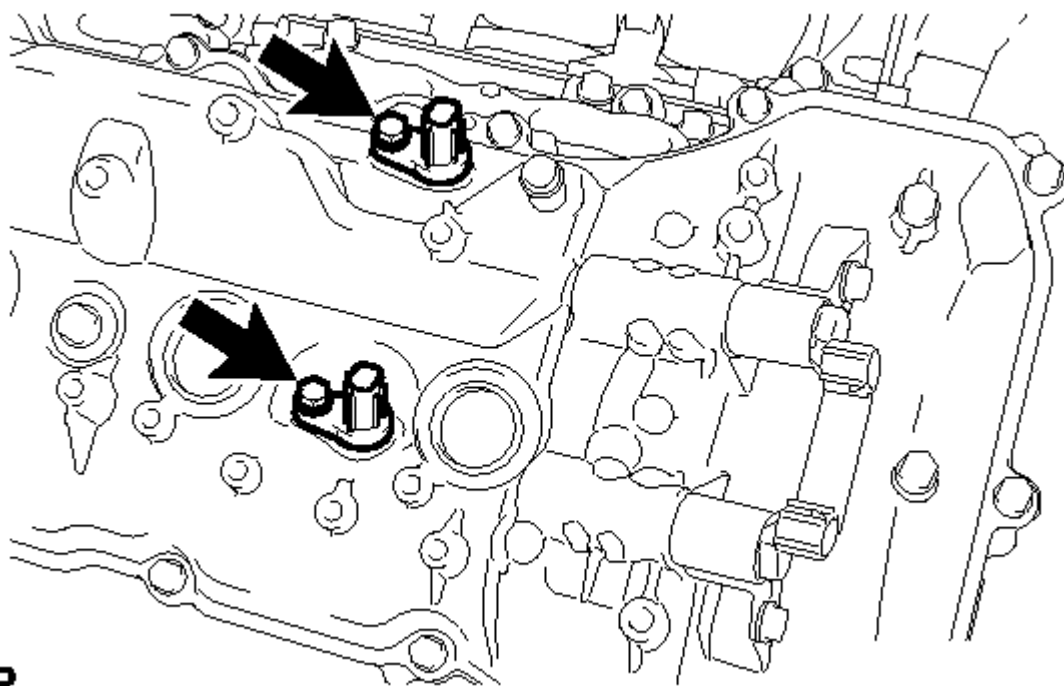
## **51. INSTALL VVT SENSOR**



**Fig. 303: Removing The 2 Bolts And 2 Vvt Sensors**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. LH:
  - 1. Install the 2 VVT sensors with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**



**P**

**Fig. 304: Removing The 2 Bolts And 2 Vvt Sensors**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. RH:
  - 1. Install the 2 VVT sensors with the 2 bolts.

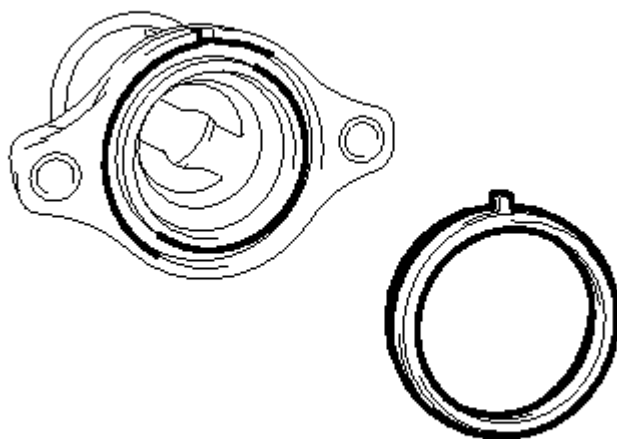
**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

## 52. INSTALL SPARK PLUG

- a. Using a 16 mm plug wrench, install the 8 spark plugs.

**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

## 53. INSTALL OIL FILLER CAP HOUSING

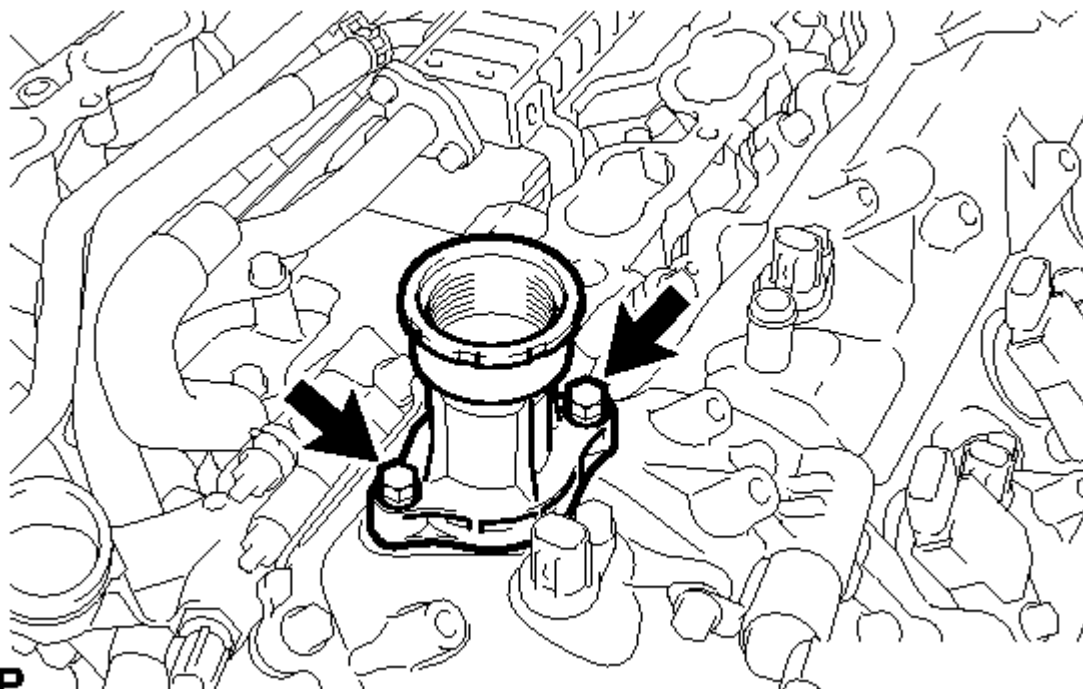


**P**

**Fig. 305: Identifying Oil Filler Cap Housing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Align the protrusion of a new gasket with the cutout of the oil filler cap housing, and install the gasket to the housing.



**P**

**Fig. 306: Removing The 2 Bolts, Filler Cap Housing And Gasket**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cap housing with the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**54. INSTALL OIL FILLER CAP SUB-ASSEMBLY**

**55. INSTALL CRANKSHAFT PULLEY** . Refer to **INSTALLATION - Step 9**

**56. INSTALL OIL FILTER BRACKET** . Refer to **INSTALLATION - Step 3**

**57. INSTALL NO. 1 OIL COOLER BRACKET (w/ Oil Cooler)** . Refer to **INSTALLATION - Step 4**

**58. INSTALL OIL FILTER ELEMENT** . Refer to **REPLACEMENT - Step 4**

**INSTALLATION**

**INSTALLATION**

**1. INSTALL NOISE FILTER**

- a. RH Side:

Install the noise filter to the cylinder head cover with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

- b. LH Side:

Install the noise filter to the cylinder head cover with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

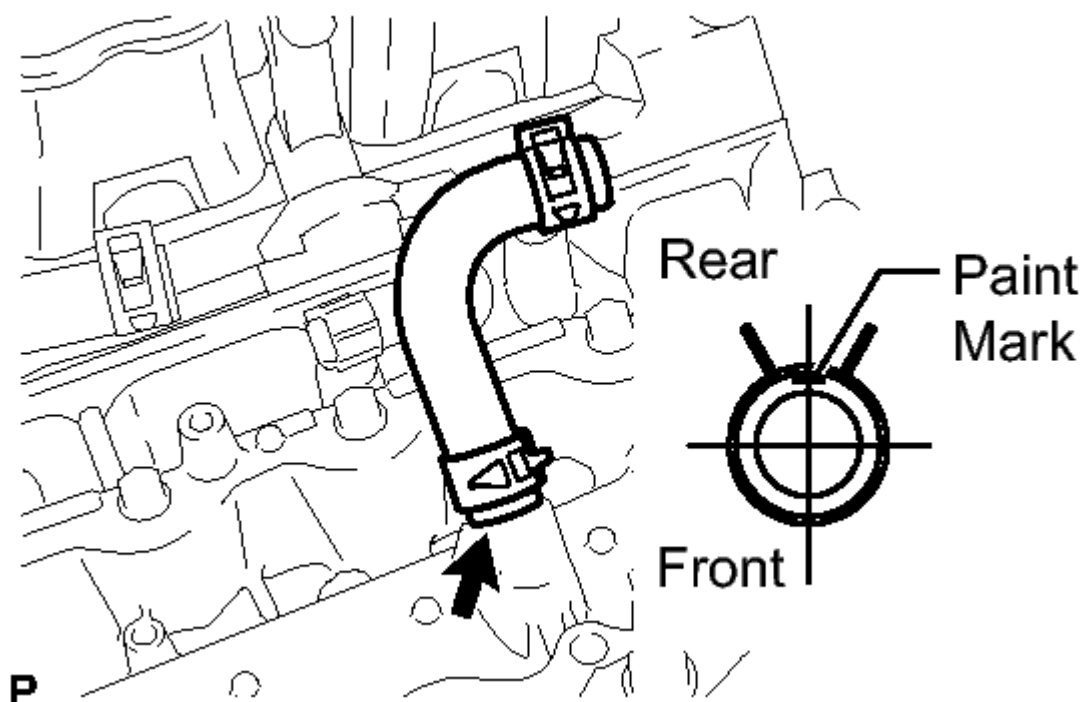
**2. INSTALL IGNITION COIL ASSEMBLY**

- a. Install the 8 ignition coils with the 8 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**3. INSTALL KNOCK SENSOR** . Refer to **INSTALLATION - Step 1**

**4. INSTALL NO. 11 WATER BY-PASS HOSE**



**P**

**Fig. 307: Identifying Water By-Pass Hose**

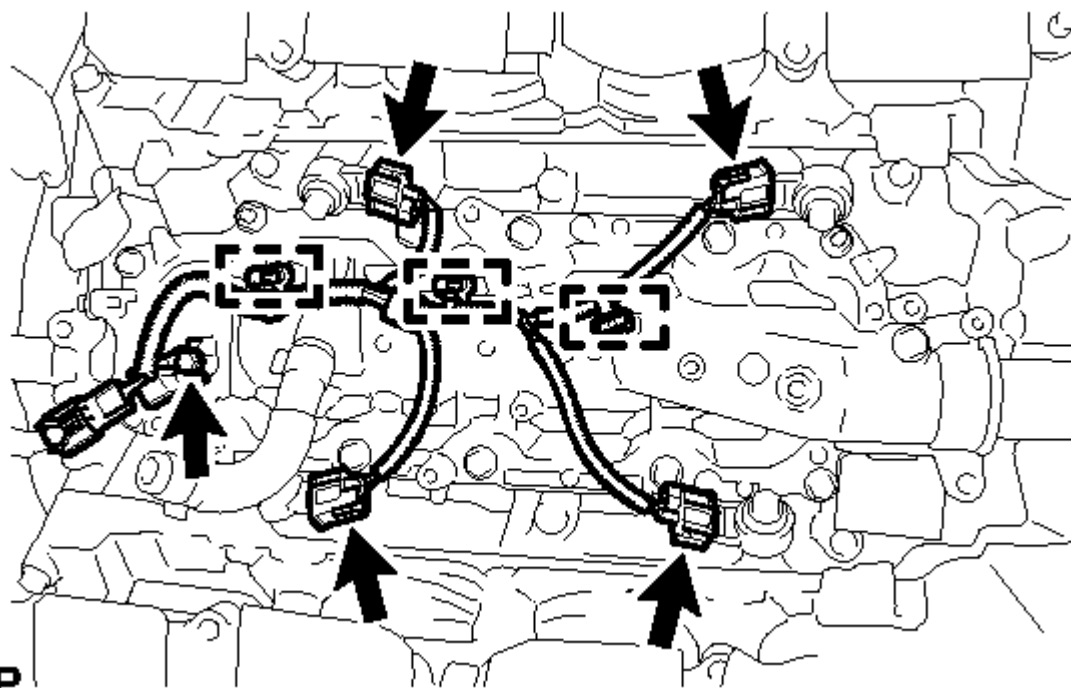
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the No. 11 water by-pass hose.

**HINT:**

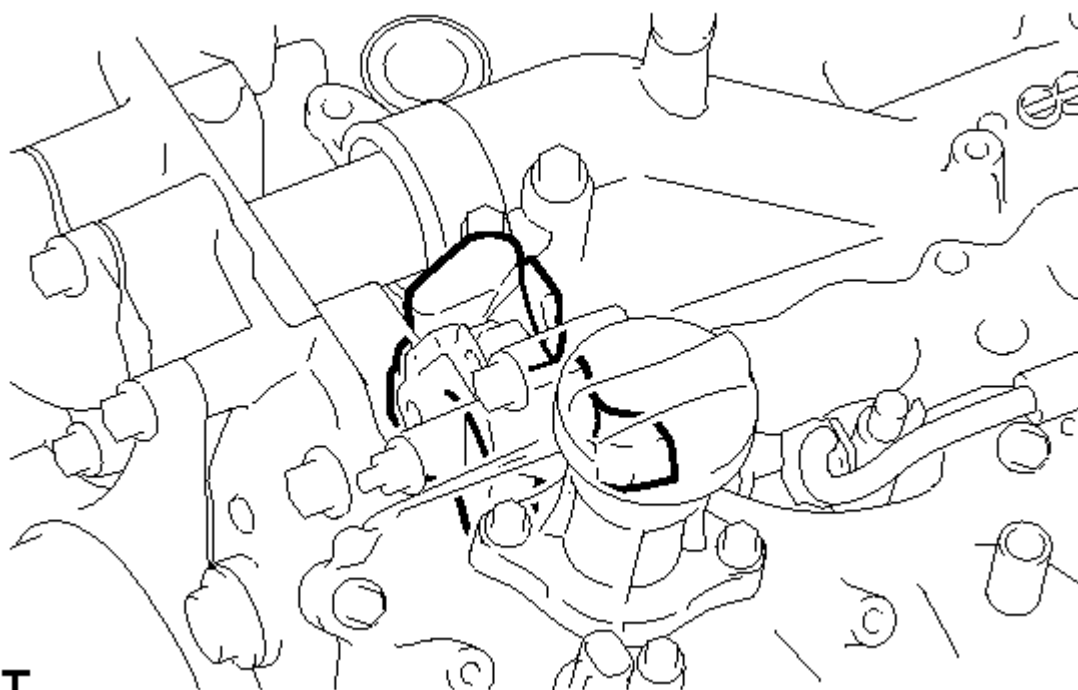
The direction of the hose clamp is indicated in the illustration.

**5. INSTALL ENGINE WIRE**

**P****Fig. 308: Identifying Knock Sensor Connectors**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

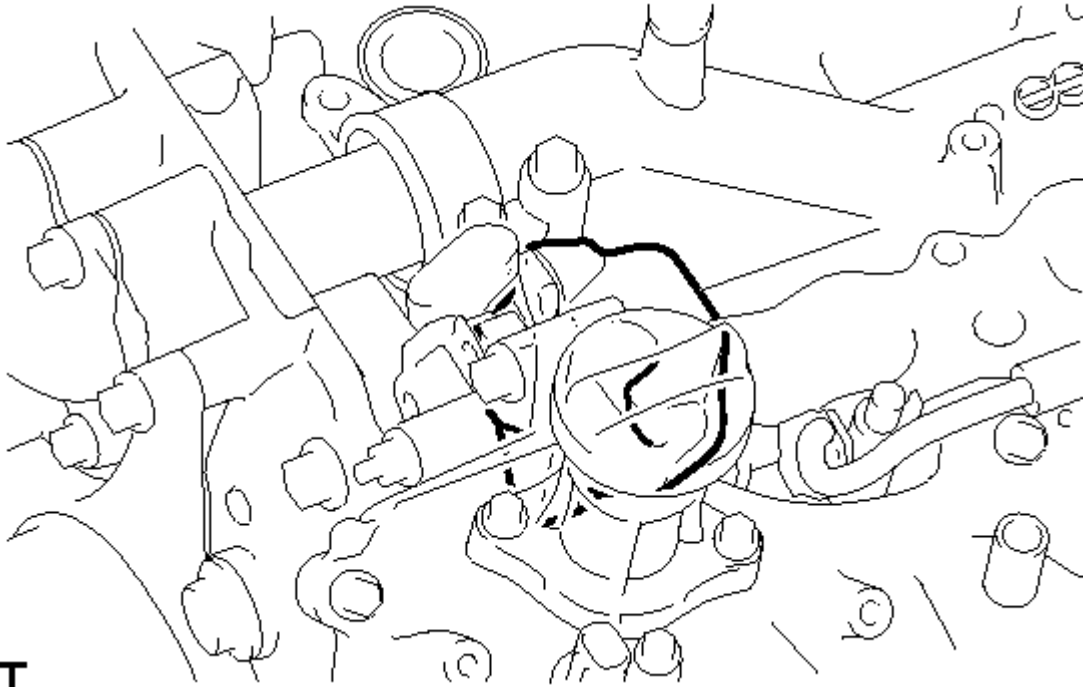
- a. Connect the 3 clamps and 4 knock sensor connectors to install the engine wire.

**6. INSTALL NO. 1 ENGINE COVER****T****Fig. 309: Identifying No. 1 Engine Cover**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the No. 1 engine cover.

**7. INSTALL NO. 2 ENGINE COVER**

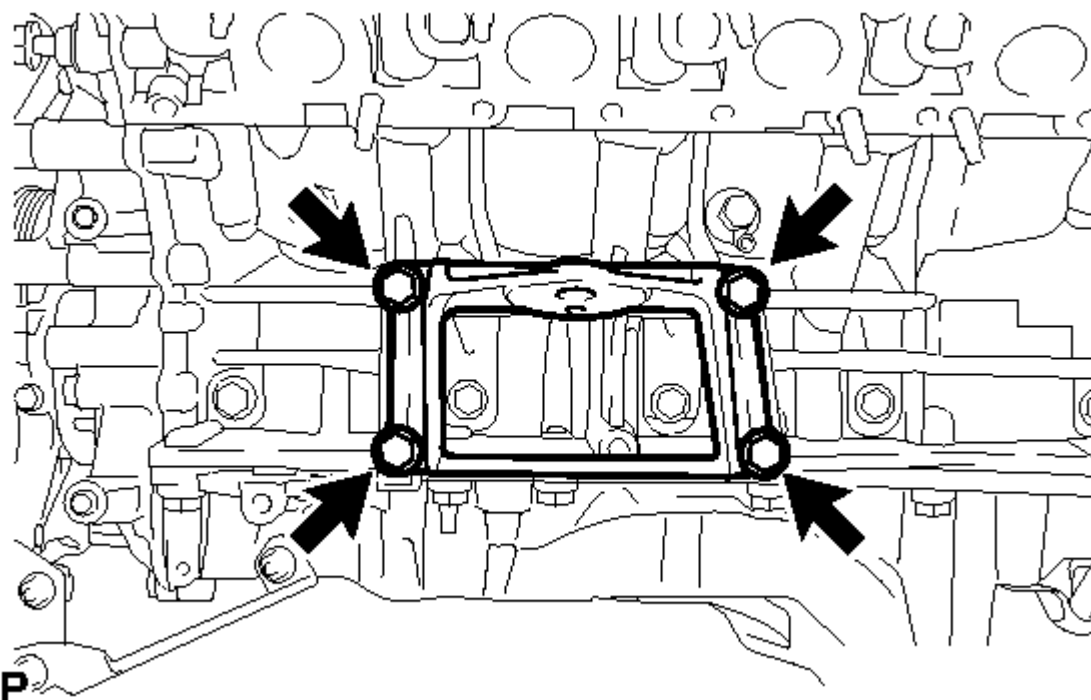


**Fig. 310: Identifying No. 2 Engine Cover**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the No. 2 engine cover.
8. **INSTALL SEPARATOR CASE** . Refer to **INSTALLATION - Step 2**
  9. **INSTALL NO. 1 IDLER PULLEY SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 10**
  10. **INSTALL WATER PUMP PULLEY** . Refer to **INSTALLATION - Step 2**
  11. **INSTALL FRONT WATER BY-PASS JOINT** . Refer to **INSTALLATION - Step 12**
  12. **INSTALL WATER INLET HOUSING** . Refer to **INSTALLATION - Step 13**
  13. **INSTALL WATER BY-PASS PIPE SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 16**
  14. **INSTALL AIR TUBE SUB-ASSEMBLY RH** . Refer to **INSTALLATION - Step 17**
  15. **INSTALL NO. 1 WATER BY-PASS HOSE** . Refer to **INSTALLATION - Step 6**
  16. **INSTALL NO. 3 ENGINE COVER** . Refer to **INSTALLATION - Step 3**
  17. **INSTALL NO. 4 ENGINE COVER** . Refer to **INSTALLATION - Step 4**
  18. **INSTALL WATER BY-PASS PIPE (w/ Oil Cooler)** . Refer to **INSTALLATION - Step 7**
  19. **INSTALL OIL PRESSURE SENDER GAUGE ASSEMBLY** . Refer to **INSTALLATION - Step 1**
  20. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY LH** . Refer to **INSTALLATION - Step 2**
  21. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY RH** . Refer to **INSTALLATION - Step 3**



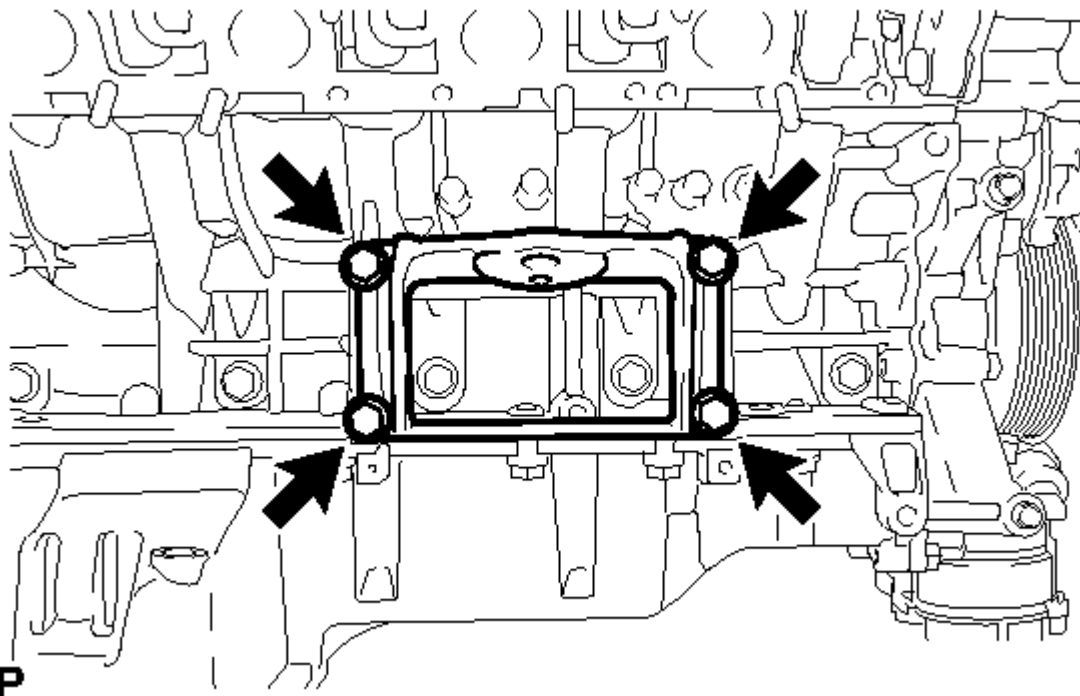
**22. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET LH**

**P**  
**Fig. 311: Removing The 4 Bolts And Mounting Bracket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the mounting bracket with the 4 bolts.

**Torque: 35 N\*m (357 kgf\*cm, 26 ft.\*lbf)**

**23. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET RH**



**P**

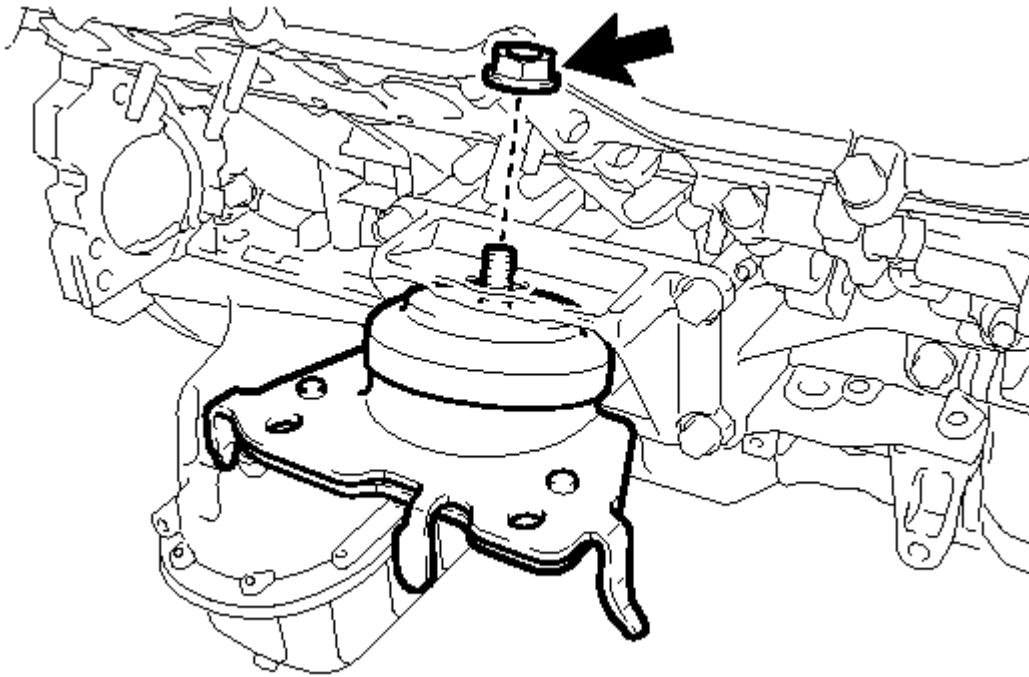
**Fig. 312: Removing The 4 Bolts And Mounting Bracket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the mounting bracket with the 4 bolts.

**Torque: 35 N\*m (357 kgf\*cm, 26 ft.\*lbf)**

#### **24. INSTALL FRONT ENGINE MOUNTING INSULATOR RH**

- a. Install the mounting insulator with the nut.



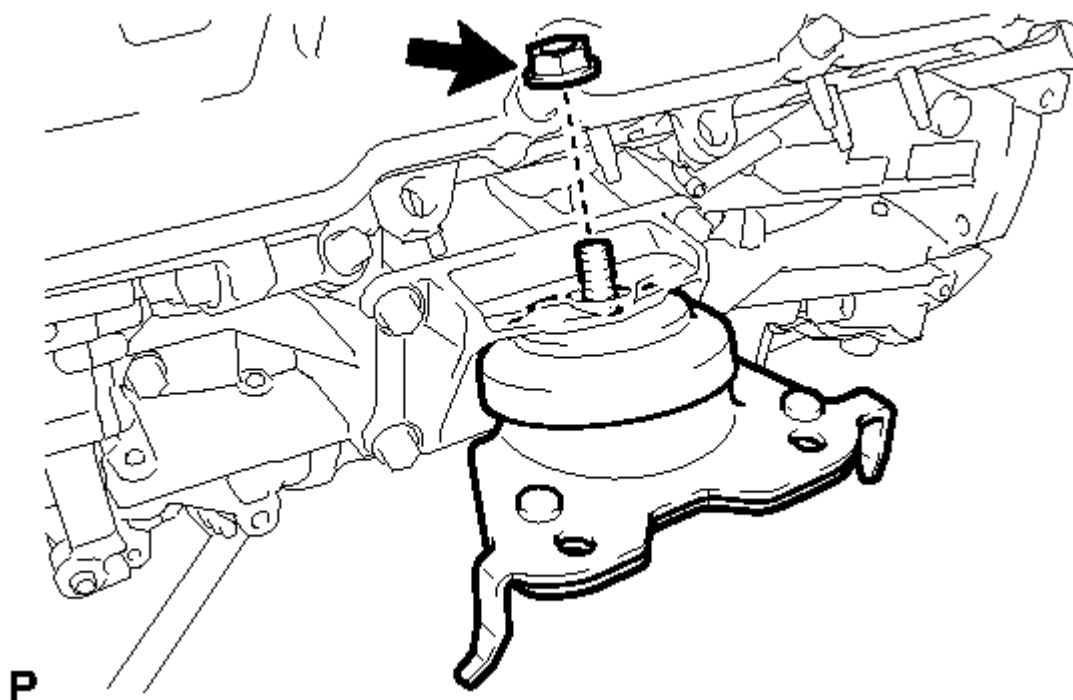
**P**

**Fig. 313: Removing The Nut And Mounting Insulator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 72 N\*m (734 kgf\*cm, 53 ft.\*lbf)**

**25. INSTALL FRONT ENGINE MOUNTING INSULATOR LH**

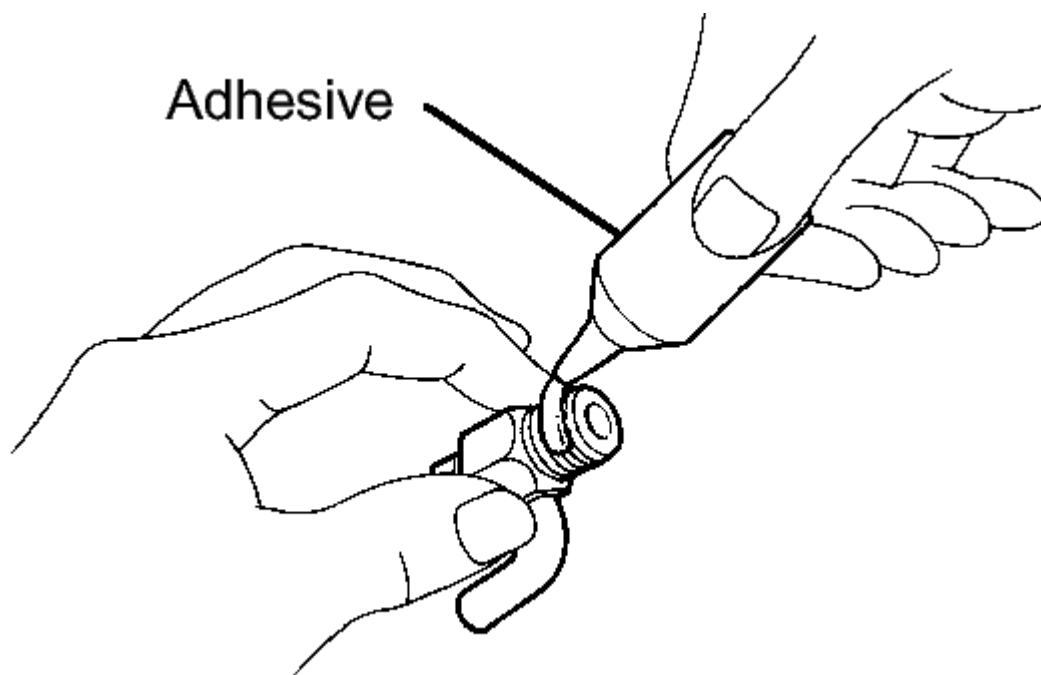
- a. Install the mounting insulator with the nut.



**Fig. 314: Removing The Nut And Mounting Insulator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 72 N\*m (734 kgf\*cm, 53 ft.\*lbf)

**26. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY**



**Fig. 315: Applying Adhesive Around Drain Cocks**

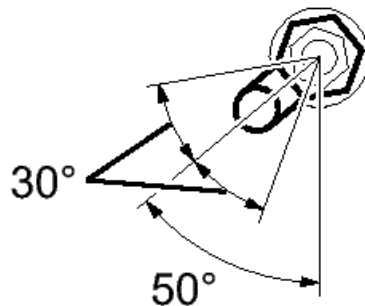
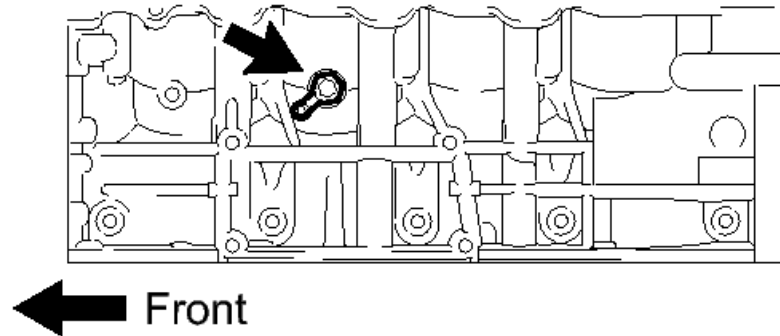
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- a. Apply adhesive to 2 or 3 threads of the drain cocks.

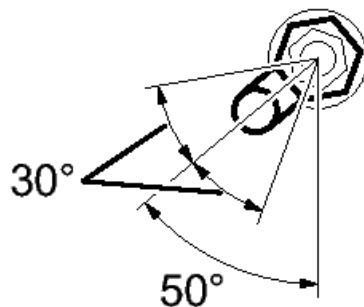
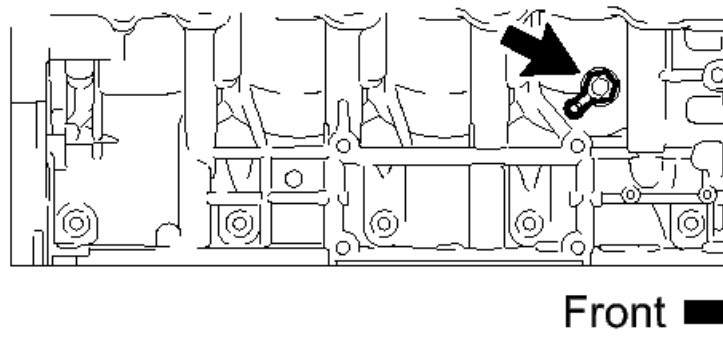
Adhesive

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

LH:



RH:



T

**Fig. 316: Locating Water Drain Cocks Angle**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the water drain cocks.

**Torque: 30 N\*m (306 kgf\*cm, 22 ft.\*lbf)**

- c. Tighten the drain cocks up to an additional 360° so that the drain cock pipes are within the range shown in the illustration.

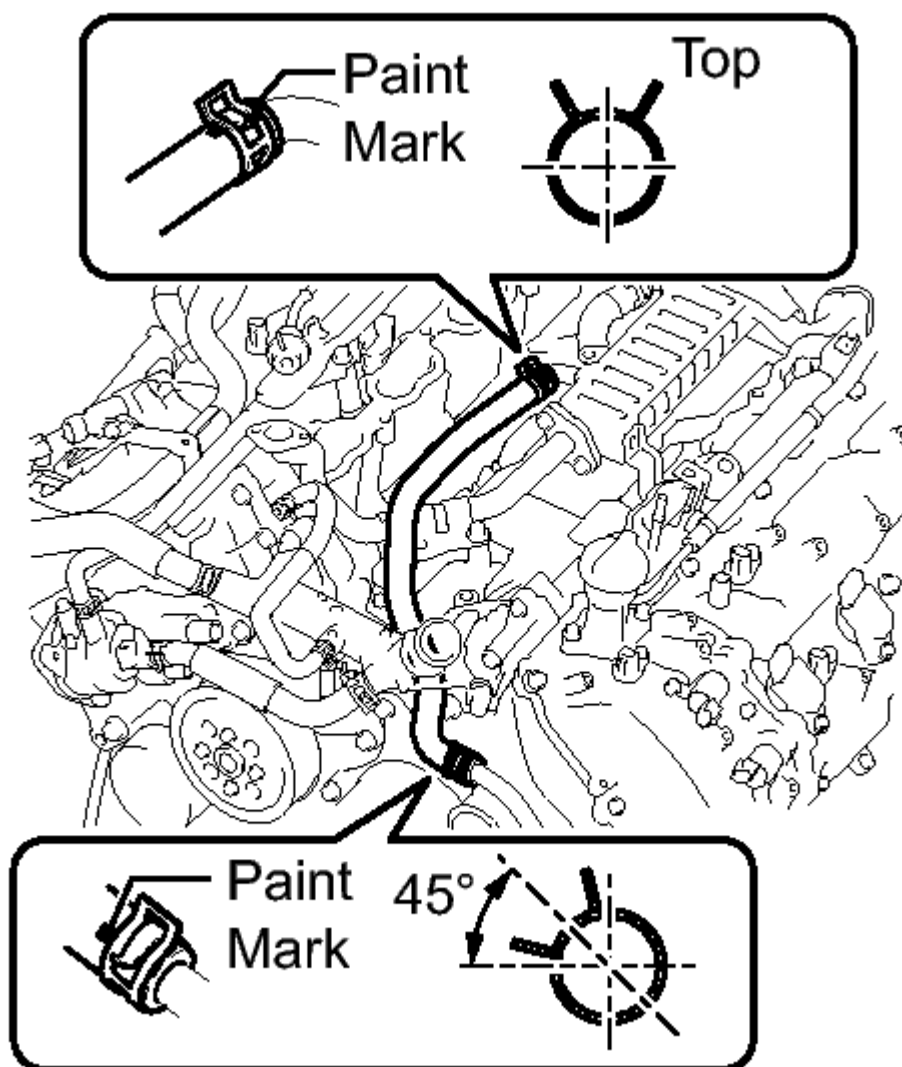
**NOTE:**

- **Do not rotate the drain cocks more than 1 revolution (360°) after tightening the drain cocks to the specified torque.**
- **Do not loosen the drain cocks to adjust them. If an adjustment is necessary, remove the drain cocks and reinstall them.**

- d. Install the water drain cock plugs to the water drain cocks.

**Torque: 13 N\*m (130 kgf\*cm, 9 ft.\*lbf)**

27. **INSTALL EGR COOLER ASSEMBLY** . Refer to **INSTALLATION - Step 2**
28. **CONNECT NO. 11 WATER BY-PASS HOSE** . Refer to **INSTALLATION - Step 4**
29. **INSTALL NO. 8 WATER BY-PASS HOSE (w/ Oil Cooler)**

**T**

**Fig. 317: Identifying Water By-Pass Hose (W/ Oil Cooler)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

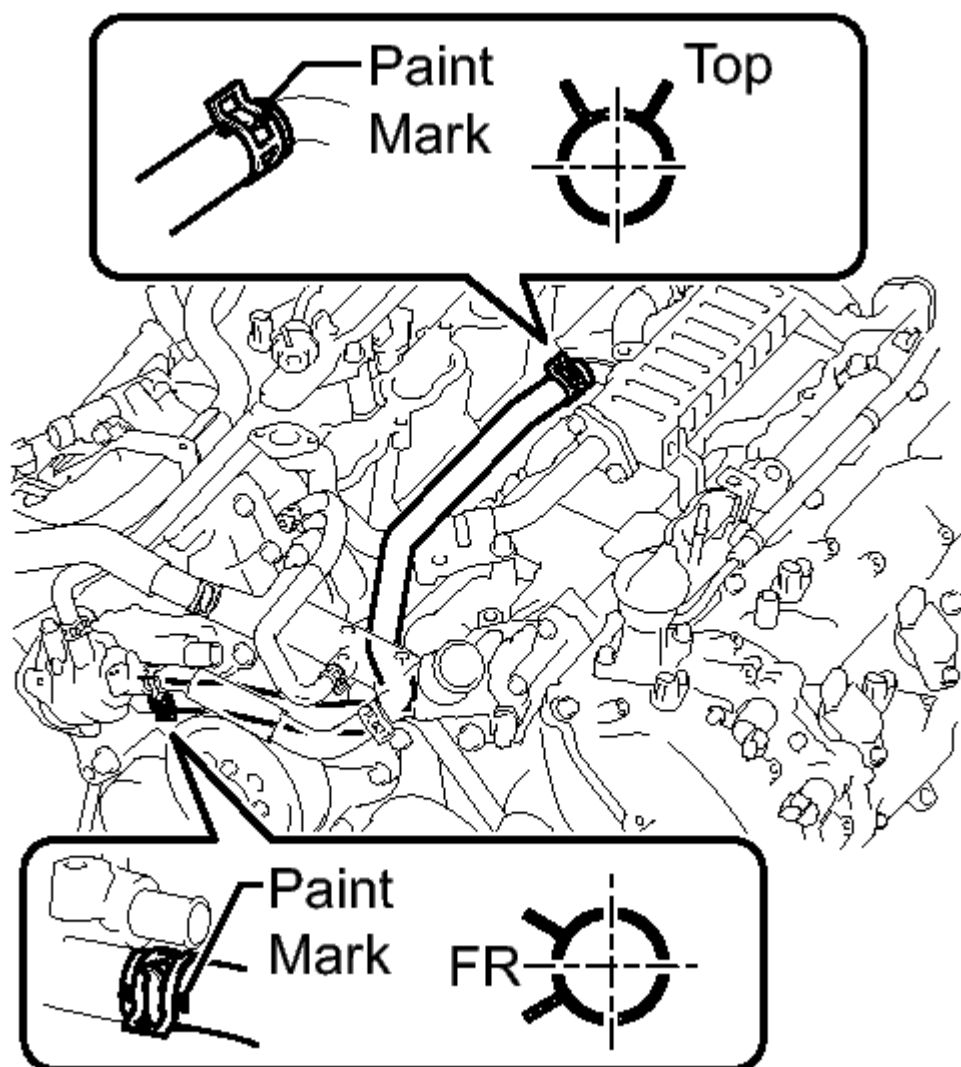
- a. Install the No. 8 water by-pass hose.

**HINT:**

The direction of the hose clamp is indicated in the illustration.

**30. INSTALL NO. 8 WATER BY-PASS HOSE (w/o Oil Cooler)**



**T**

**Fig. 318: Identifying Water By-Pass Hose (W/O Oil Cooler)**

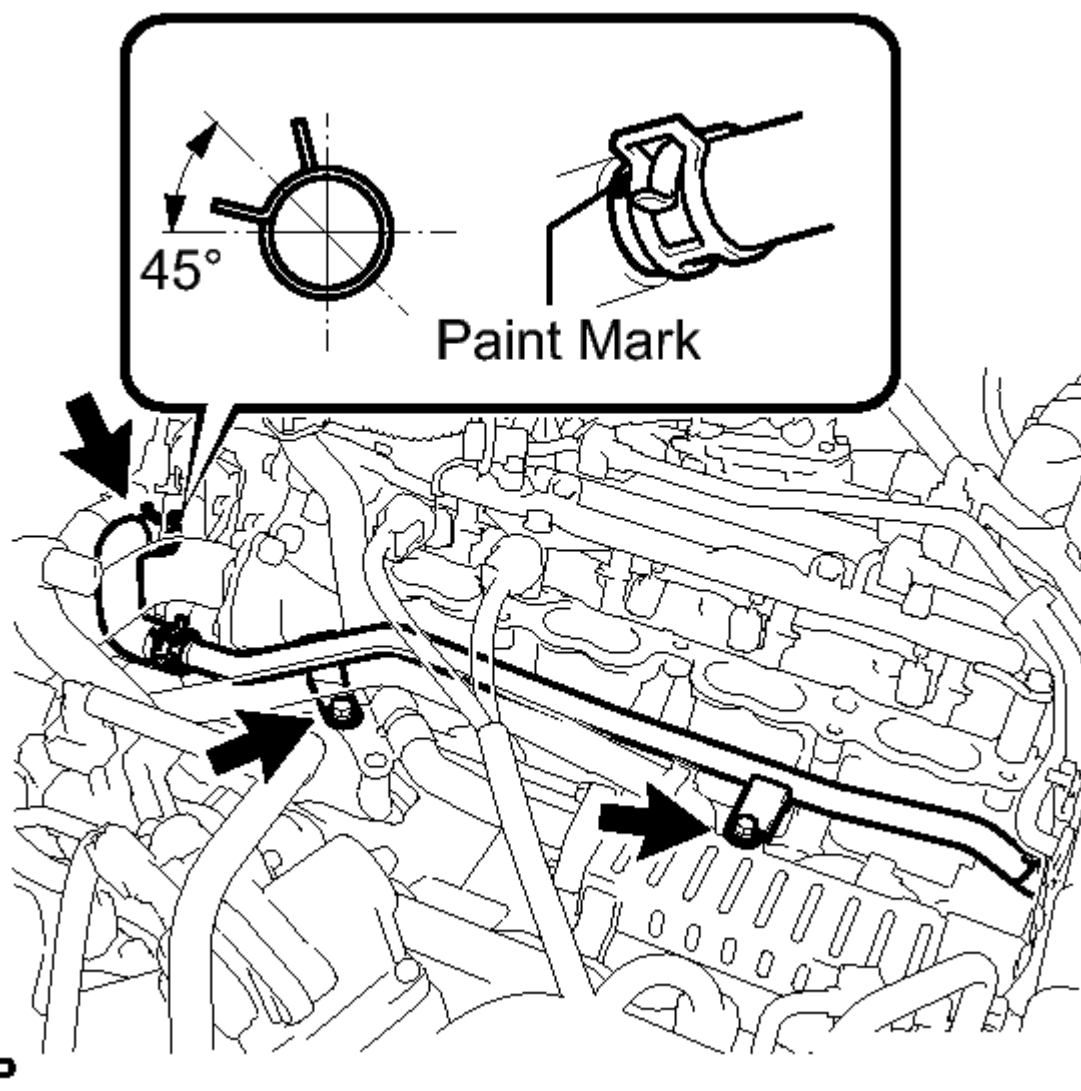
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the No. 8 water by-pass hose.

**HINT:**

The direction of the hose clamp is indicated in the illustration.

**31. INSTALL NO. 3 WATER BY-PASS PIPE SUB-ASSEMBLY**



**P**  
**Fig. 319: Identifying Water By-Pass Pipe & Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

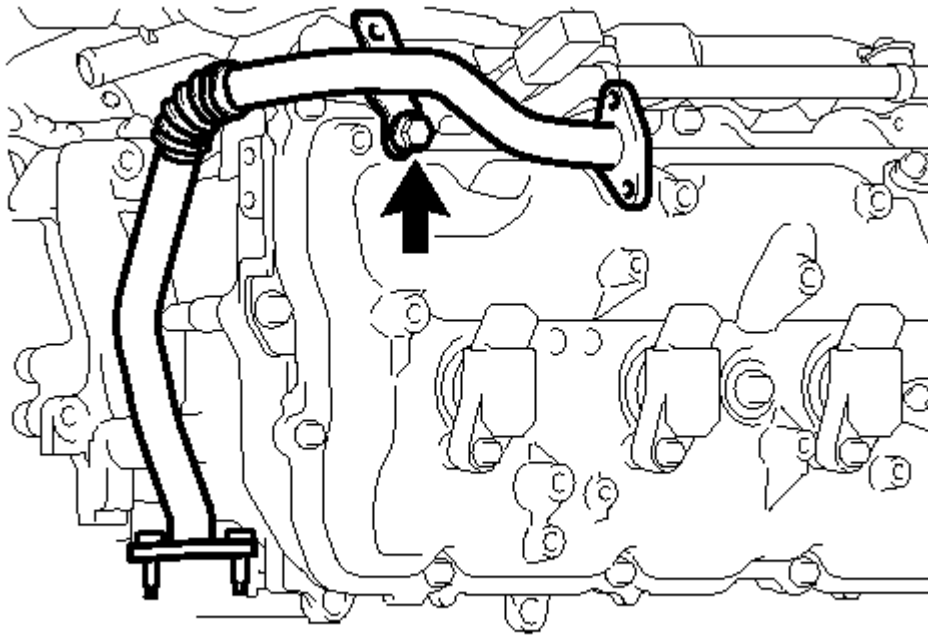
- a. Install the No. 3 water by-pass pipe with the 2 bolts and connect the hose.

**HINT:**

The direction of the hose clamp is indicated in the illustration.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**32. INSTALL NO. 3 AIR TUBE**



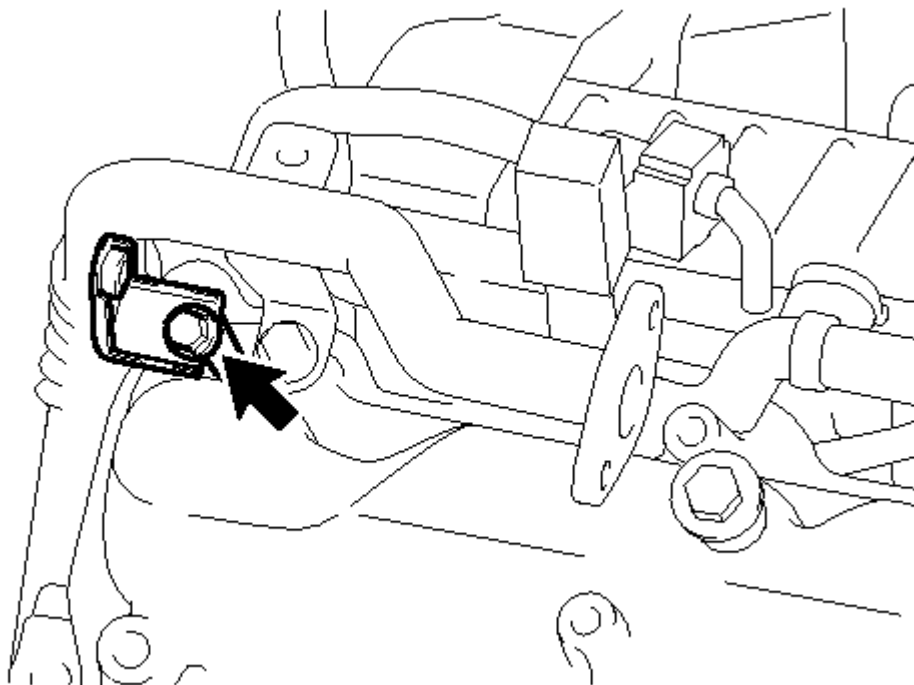
T

**Fig. 320: Identifying No. 3 Air Tube Bolt**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the No. 3 air tube with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**



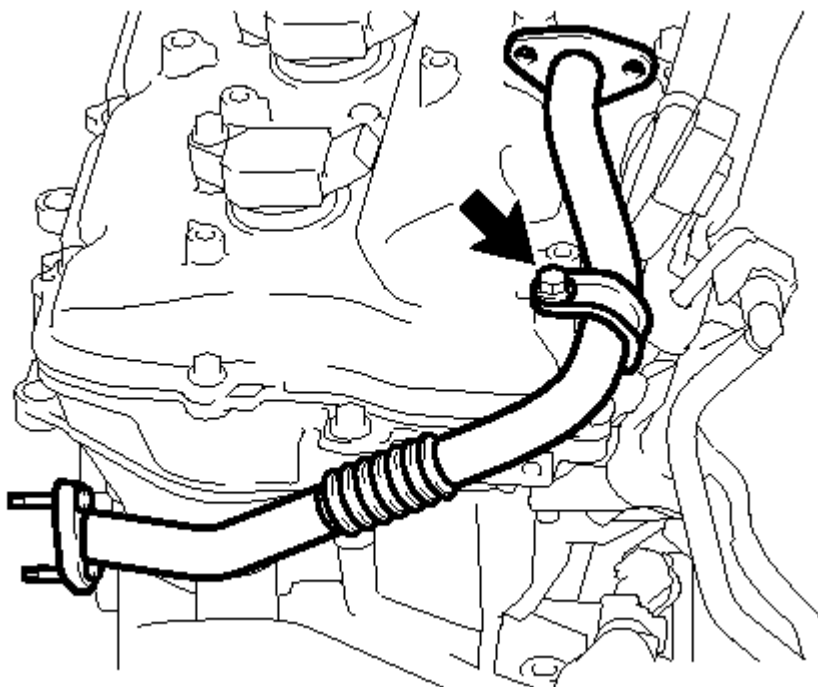
T

**Fig. 321: Removing The Bolt And Wire Harness Clamp Bracket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the wire harness clamp bracket with the bolt.

**Torque: 8.0 N\*m (82 kgf\*cm, 71 in.\*lbf)**

### 33. INSTALL NO. 4 AIR TUBE

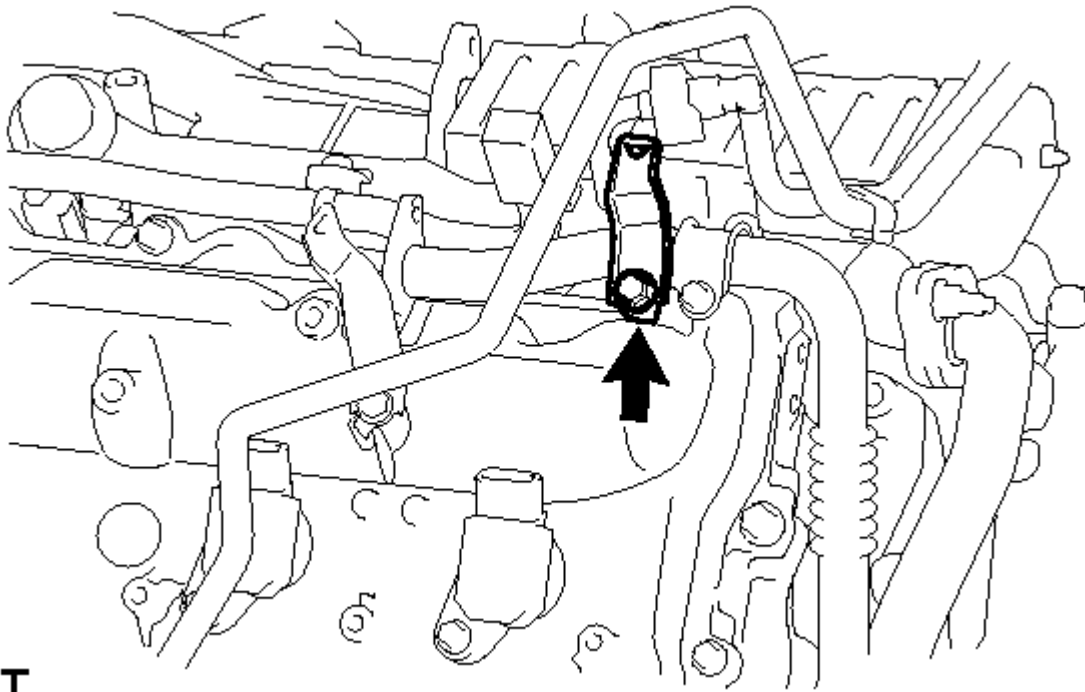


**T**

**Fig. 322: Identifying No. 4 Air Tube Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Install the No. 4 air tube with the bolt.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**



**T**

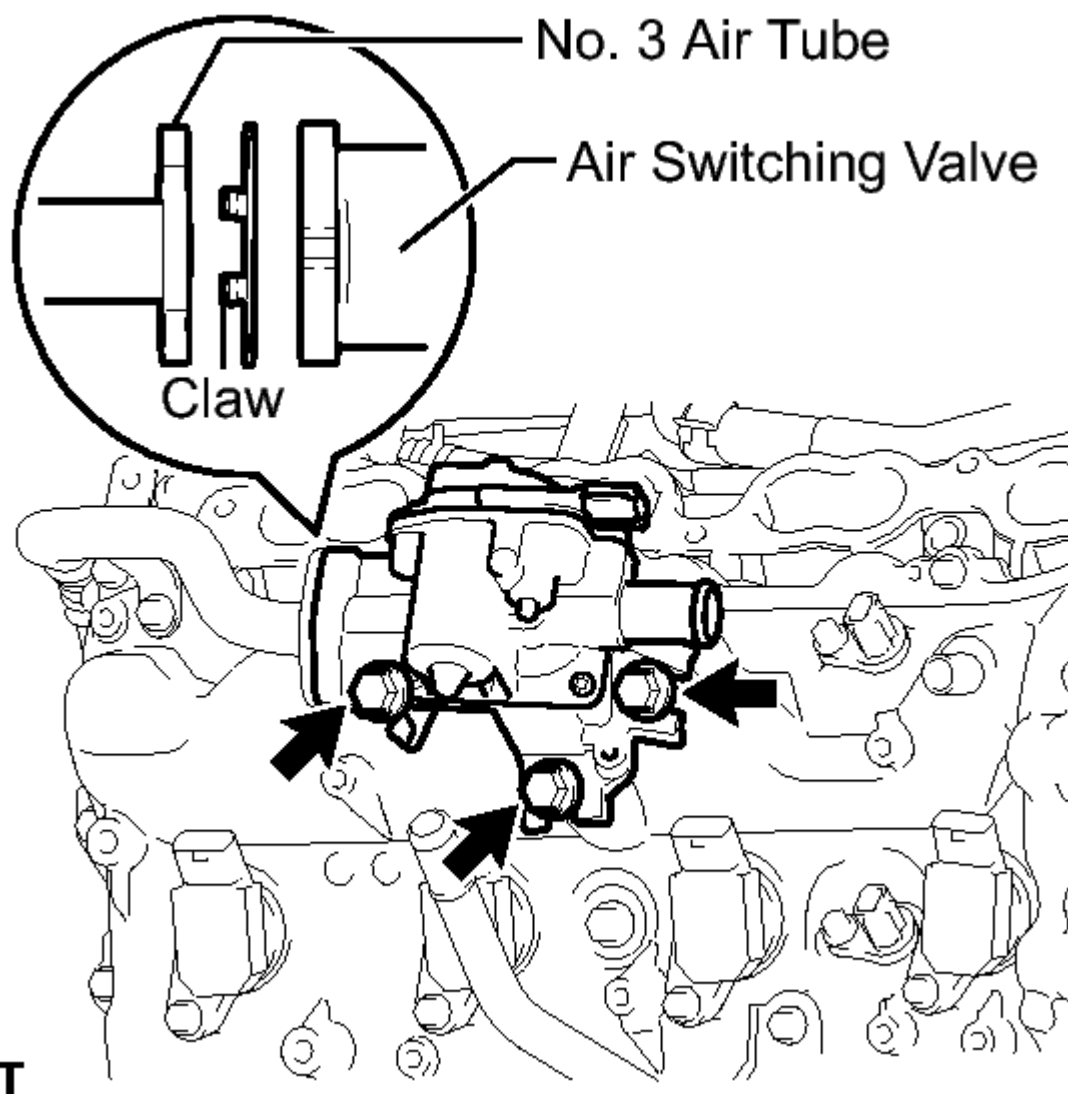
**Fig. 323: Removing The Bolt And Wire Harness Clamp Bracket**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the wire harness clamp bracket with the bolt.

**Torque: 8.0 N\*m (82 kgf\*cm, 71 in.\*lbf)**

**34. INSTALL AIR SWITCHING VALVE ASSEMBLY (for Bank 2)**

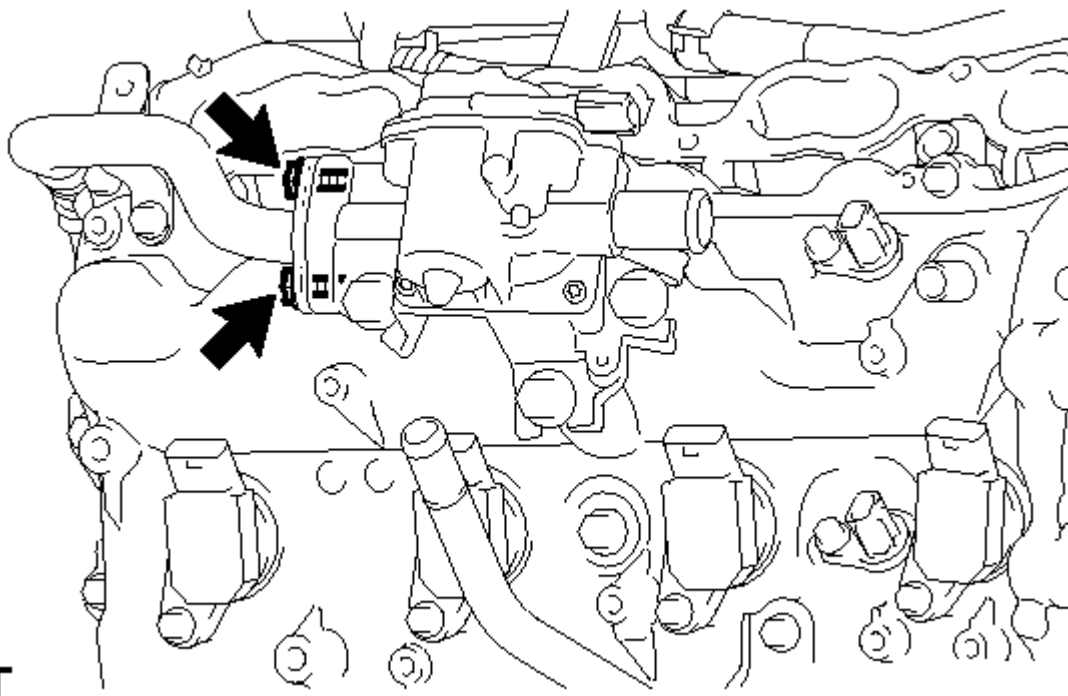
**T**

**Fig. 324: Identifying Air Switching Valve Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Make sure the gasket's claws are not caught between the air switching valve and No. 3 air tube.

- a. Install a new gasket and the air switching valve with the 3 bolts.

**Torque: 24 N\*m (245 kgf\*cm, 18 ft.\*lbf)**

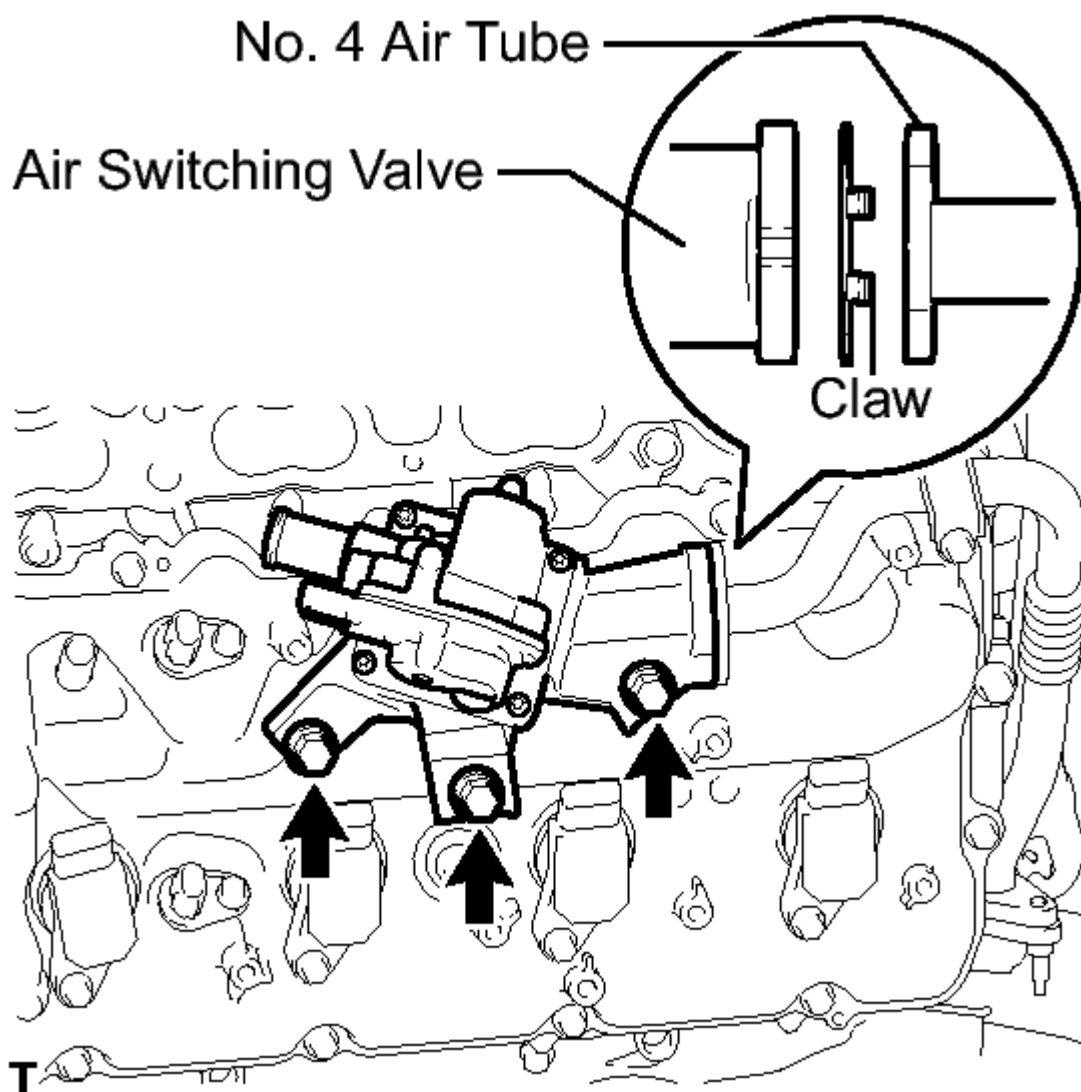


**Fig. 325: Identifying Air Switching Valve Hose Bolts (Bank 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**35. INSTALL AIR SWITCHING VALVE ASSEMBLY (for Bank 1)**



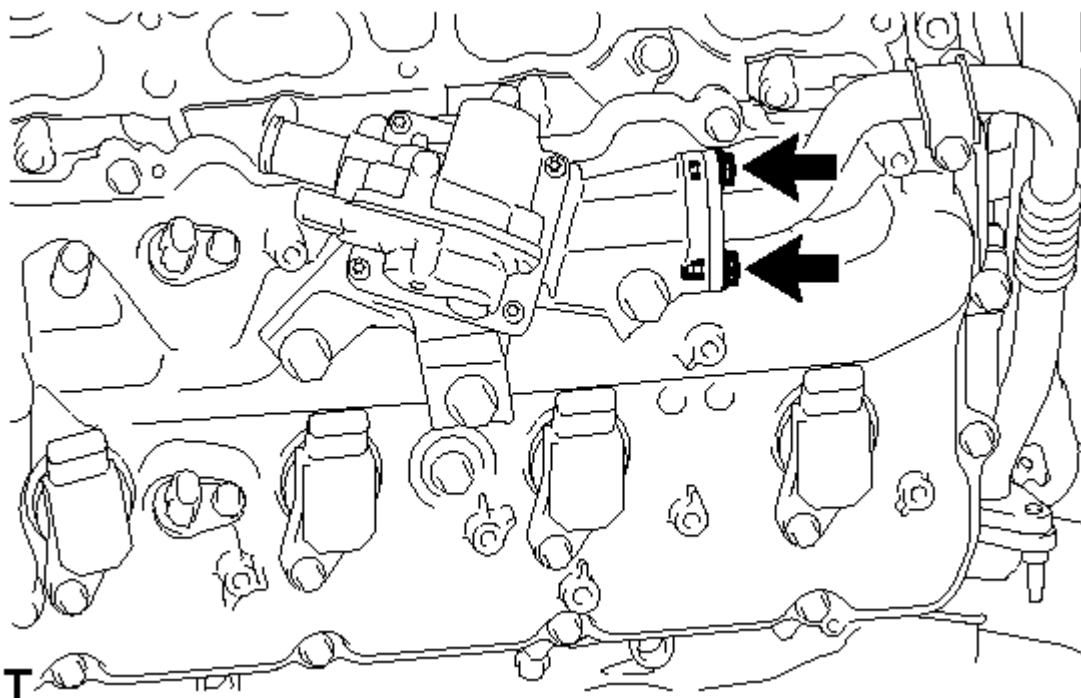
**Fig. 326: Identifying Air Switching Valve Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Make sure the gasket's claws are not caught between the air switching valve and No. 4 air tube.

- a. Install a new gasket and the air switching valve with the 3 bolts.

**Torque:** 24 N\*m (245 kgf\*cm, 18 ft.\*lbf)





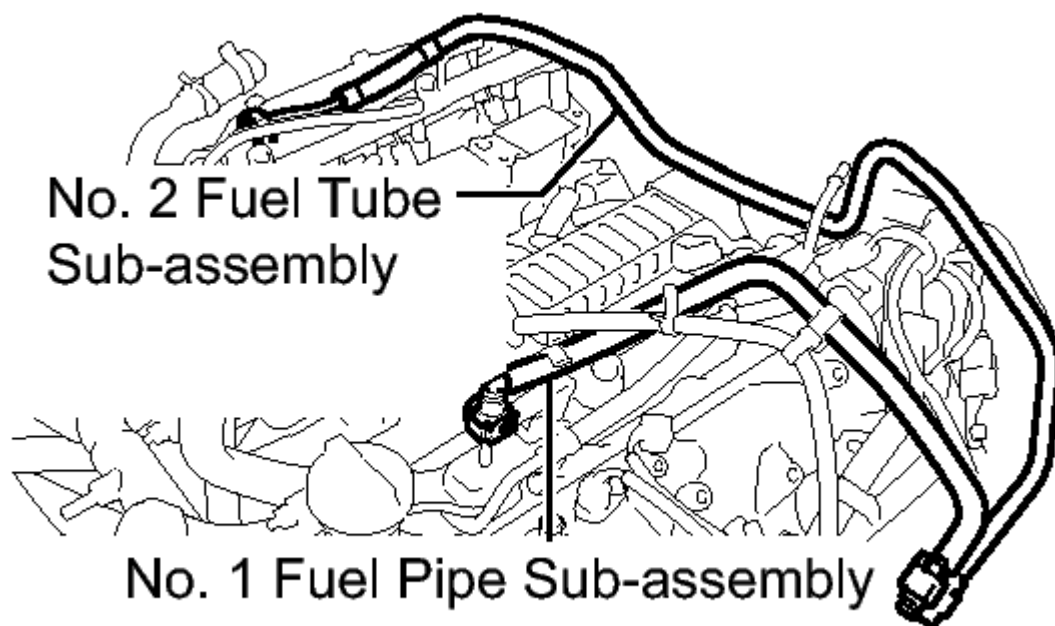
**Fig. 327: Identifying Air Switching Valve Hose Bolts (Bank 1)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 bolts.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

### **36. INSTALL NO. 2 FUEL TUBE SUB-ASSEMBLY**

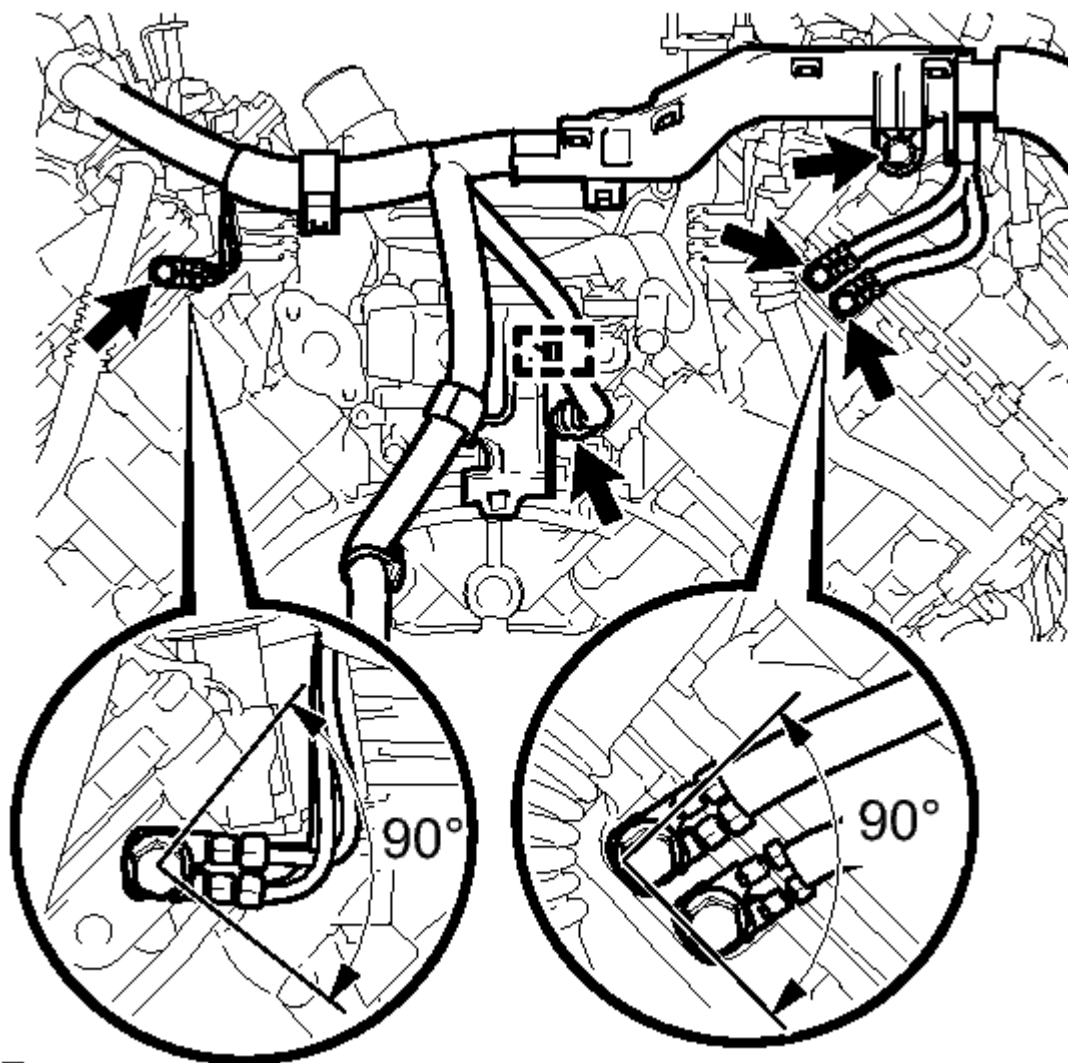


**F**

**Fig. 328: Removing No. 1 Fuel Pipe Sub-Assembly**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

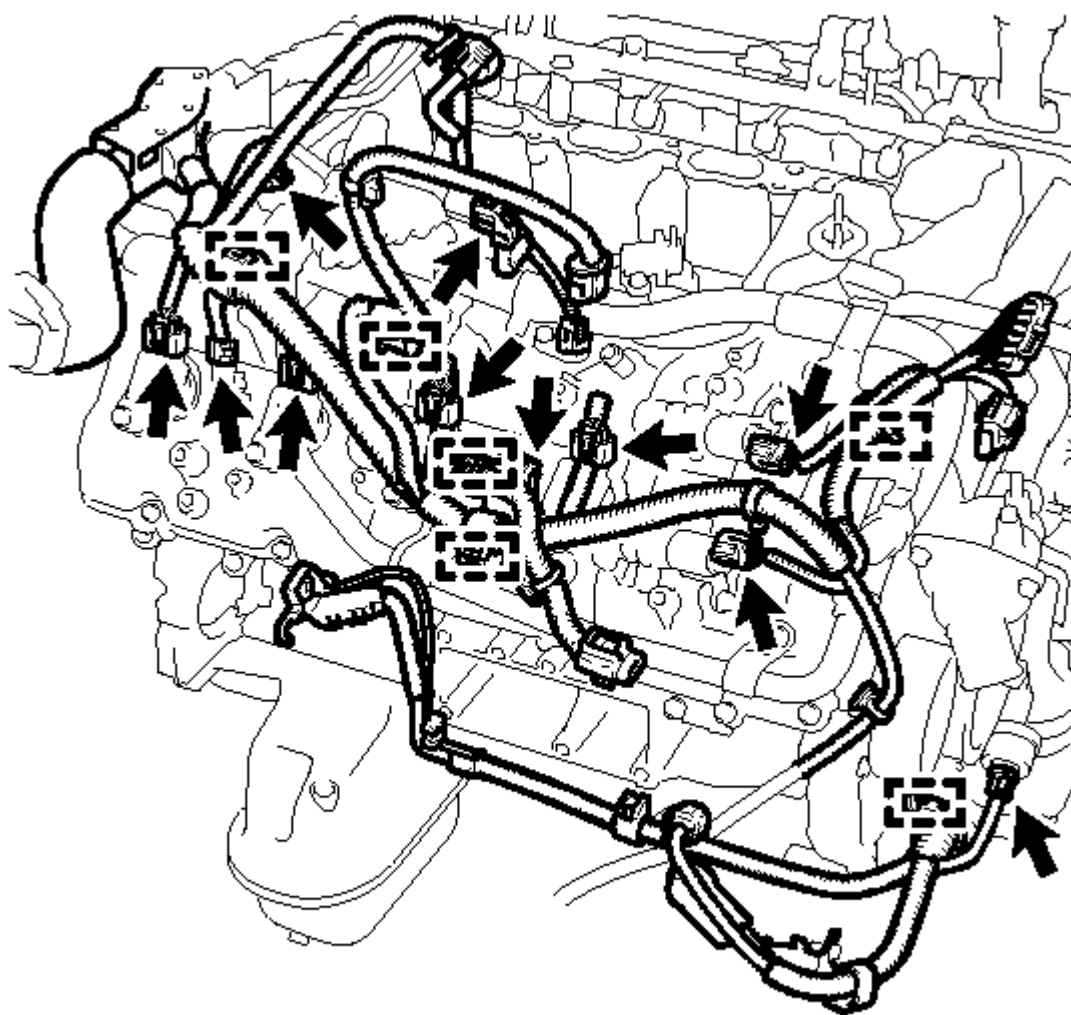
- a. Install the No. 2 fuel tube. Refer to **PRECAUTION** .
37. **INSTALL NO. 1 FUEL PIPE SUB-ASSEMBLY**
  - a. Install the No. 1 fuel pipe. Refer to **PRECAUTION** .
38. **INSTALL ENGINE WIRE**

**P****Fig. 329: Identifying Engine Wire****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****a. Engine Rear Side:**

1. Install the 4 bolts.

**Torque: 8.4 N\*m (86 kgf\*cm, 74 in.\*lbf)**

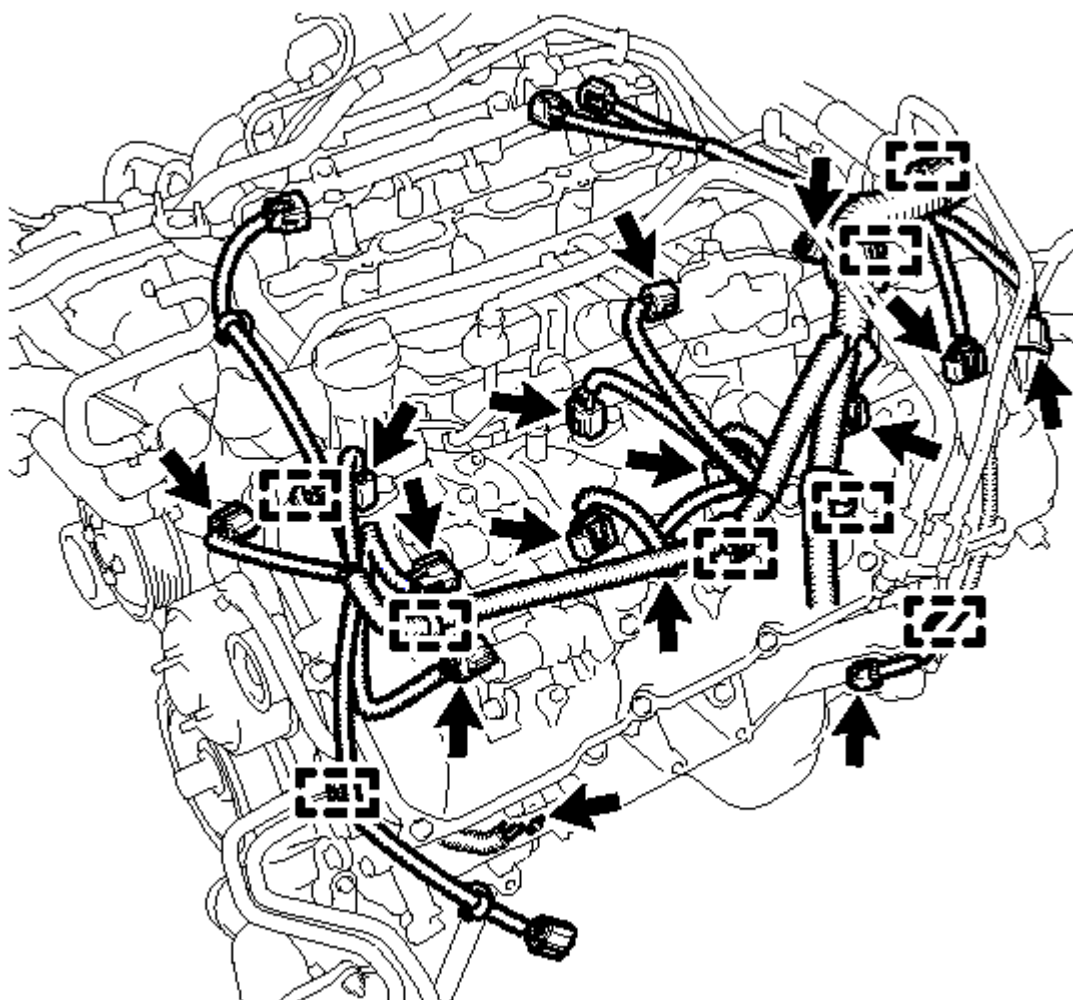
2. Connect the clamp and connector.

**P****Fig. 330: Identifying Engine Wires & Fasteners**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**b. Engine RH Side:**

1. Connect the 6 clamps.
2. Connect the oil pressure sender gauge connector.
3. Connect the air switching valve connector.
4. Connect the noise filter connector.
5. Connect the fuel injector connector.
6. Connect the 2 VVT sensor connectors.
7. Connect the 4 ignition coil connectors.
8. Connect the 2 camshaft timing control valve connectors.

**P****Fig. 331: Identifying Engine Wires & Fasteners****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****c. Engine LH Side:**

1. Connect the 8 clamps and install the engine wire with the bolt.

**Torque: 20 N\*m (204 kgf\*cm, 15 ft.\*lbf)**

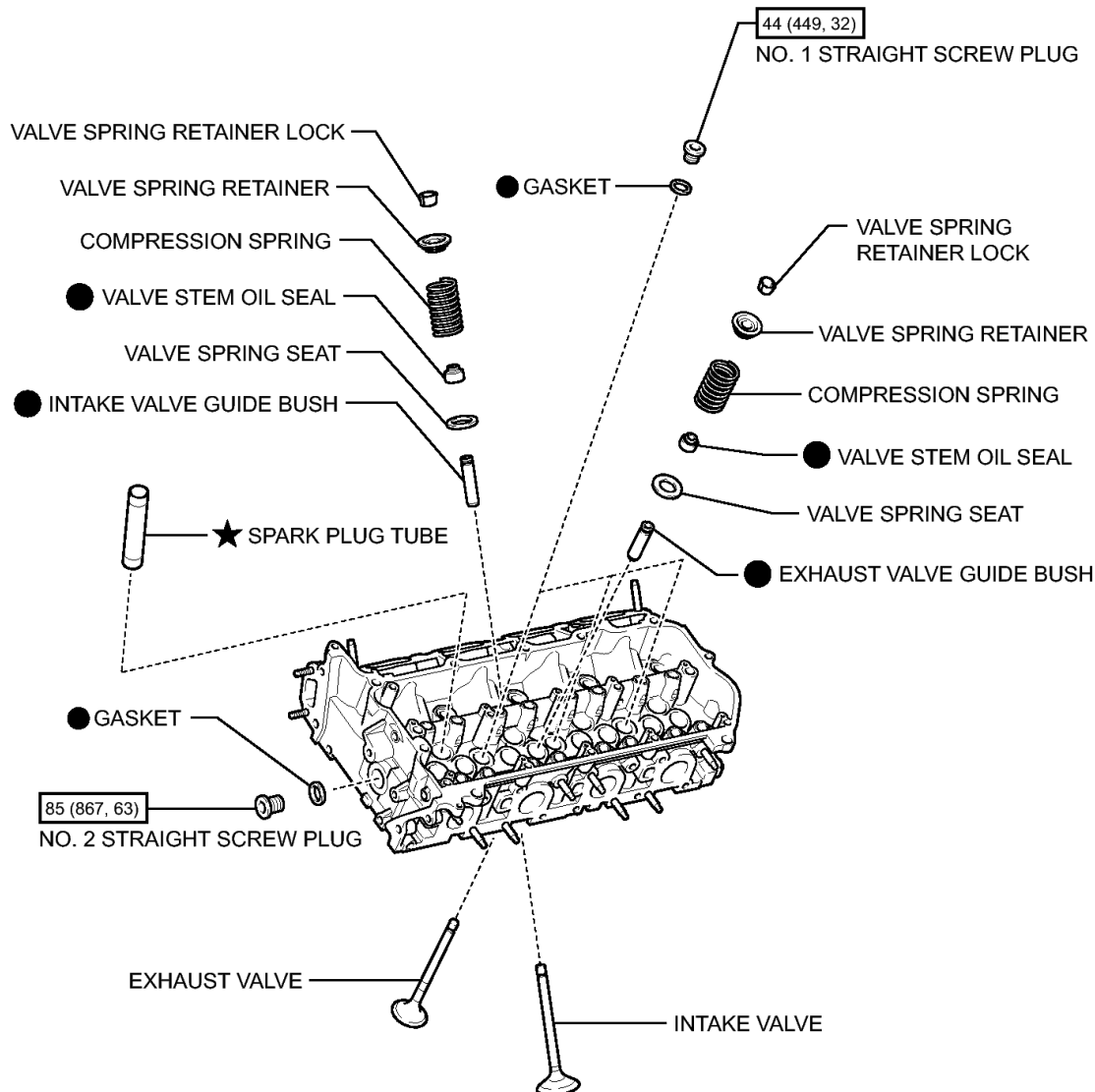
2. Connect the noise filter connector.
3. Connect the fuel injector connector.
4. Connect the engine coolant temperature sensor connector.
5. Connect the air switching valve connector.
6. Connect the crankshaft position sensor connector.
7. Connect the camshaft position sensor connector.

8. Connect the 2 VVT sensor connectors.
9. Connect the 4 ignition coil connectors.
10. Connect the 2 camshaft timing control valve connectors.

## **CYLINDER HEAD**

### **COMPONENTS**

### **ILLUSTRATION**



**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

● Non-reusable part

★ Precoated part

P

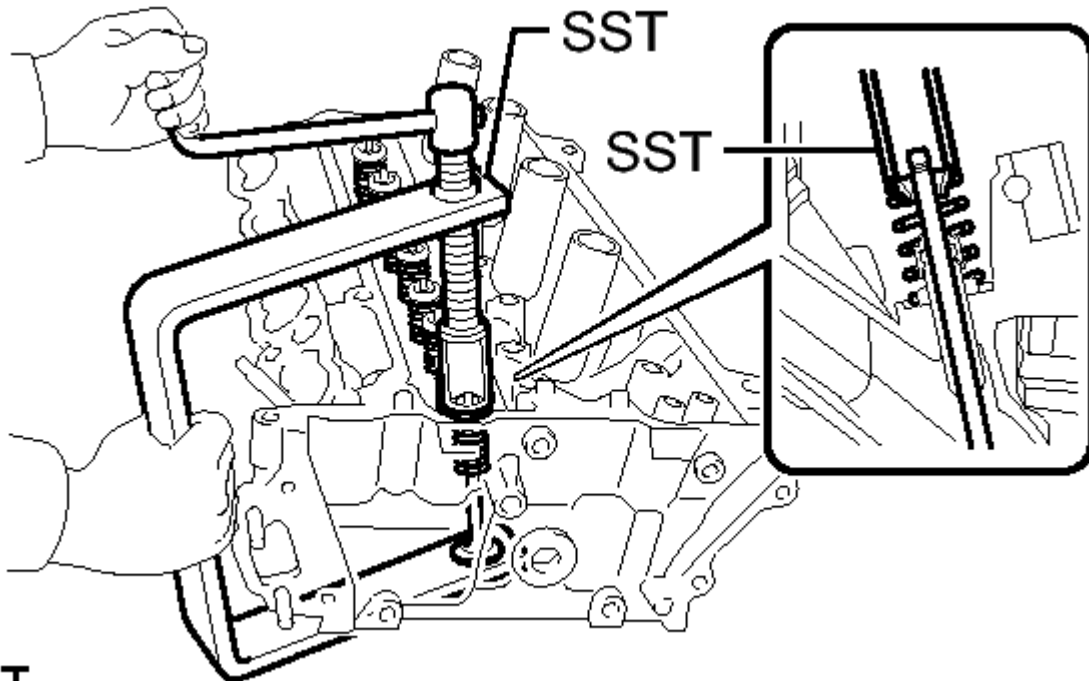
**Fig. 332: Identifying Cylinder Head Replacement Components With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## DISASSEMBLY

### DISASSEMBLY

#### 1. REMOVE INTAKE VALVE

- a. Using SST and wooden blocks, compress the compression spring and remove the valve retainer locks.



**T**

**Fig. 333: Compressing Spring And Retainer Locks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09202-70020  
09202-00010

- b. Remove the retainer, compression spring and valve.

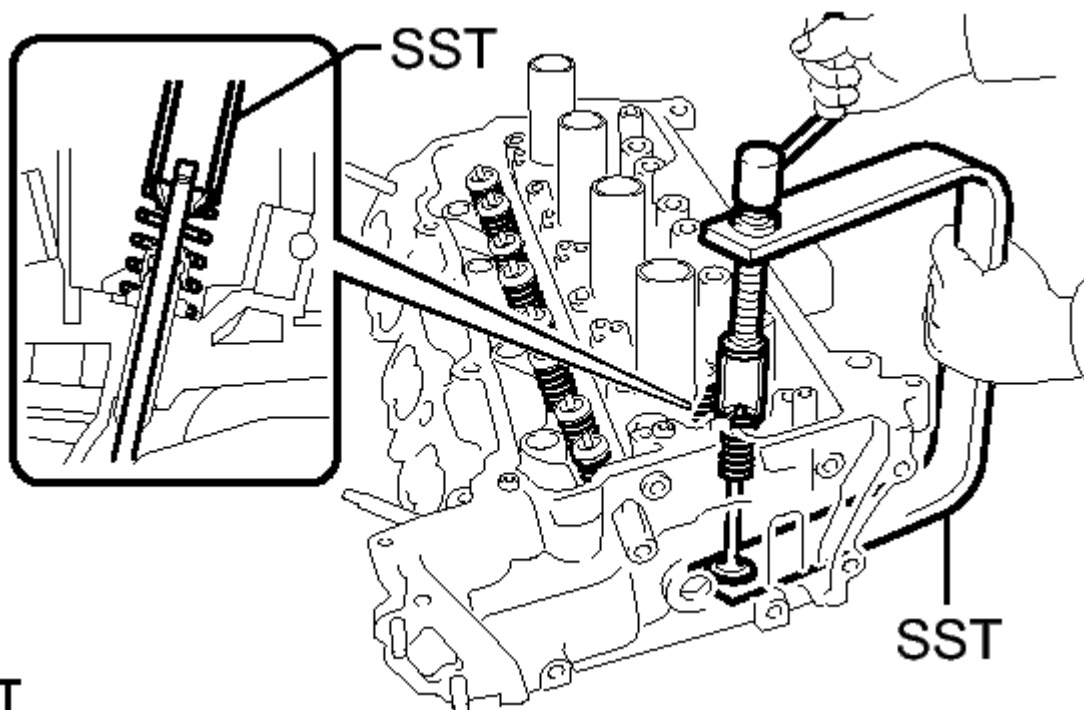
**HINT:**

Arrange the removed parts in the correct order.

**2. REMOVE EXHAUST VALVE**

- a. Using SST and wooden blocks, compress the compression spring and remove the valve retainer locks.





**T**

**Fig. 334: Compressing Compression Spring Using SST**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09202-70020  
09202-00010

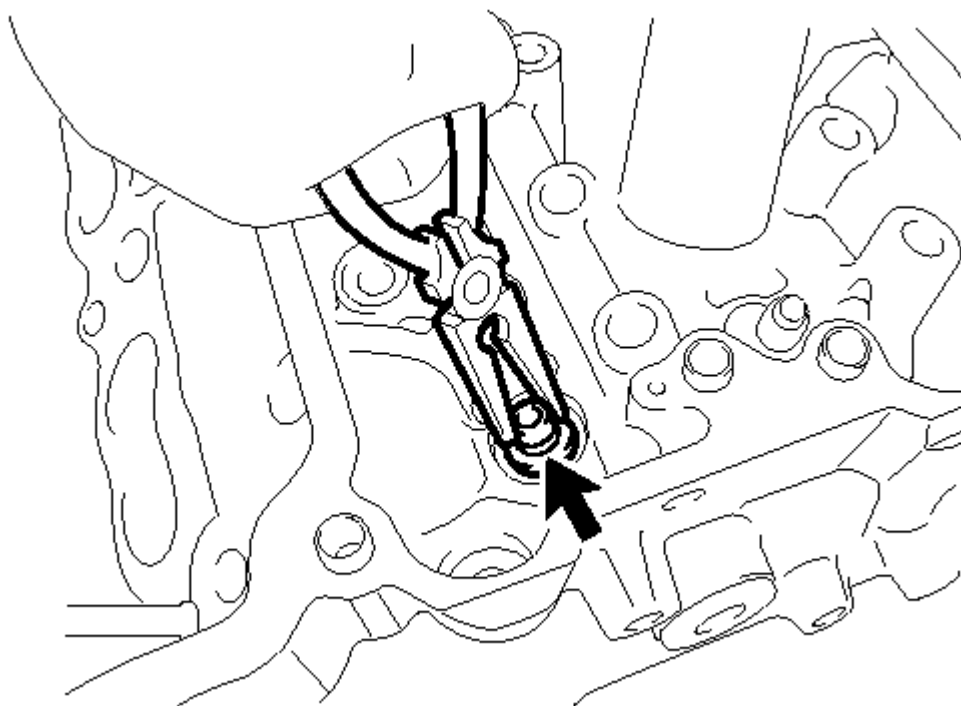
- b. Remove the retainer, compression spring and valve.

**HINT:**

Arrange the removed parts in the correct order.

**3. REMOVE VALVE STEM OIL SEAL**

- a. Using needle-nose pliers, remove the oil seals.



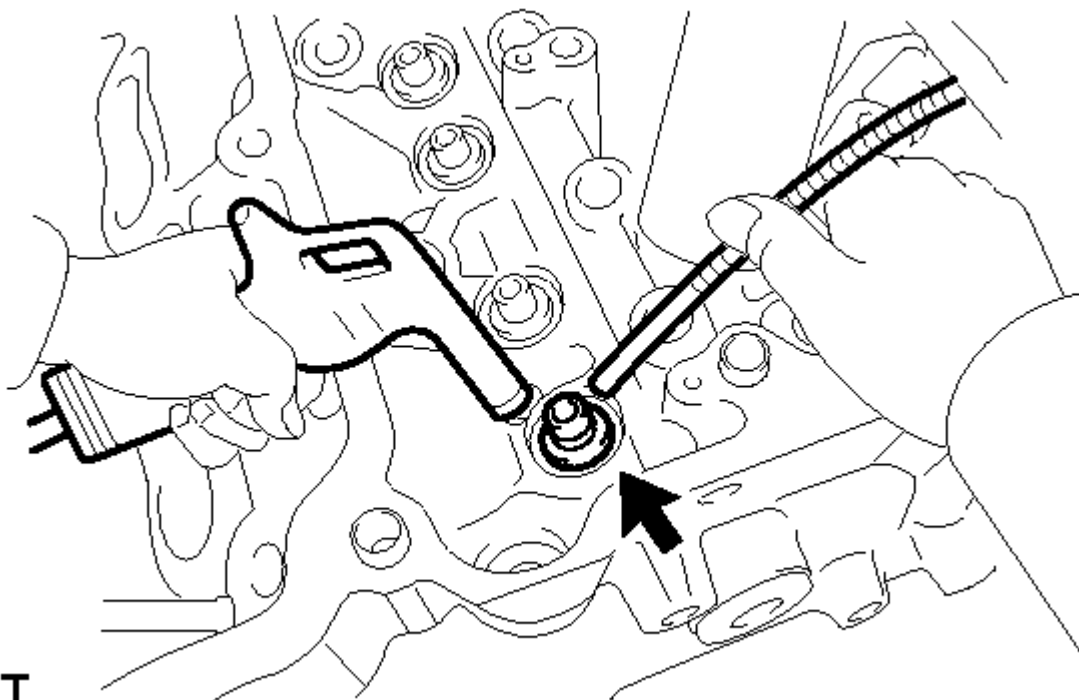
T

**Fig. 335: Removing Oil Seals**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 4. REMOVE VALVE SPRING SEAT

- a. Using compressed air and a magnetic finger, remove the valve spring seat by blowing air onto it.



T

**Fig. 336: Removing Valve Spring Seat**

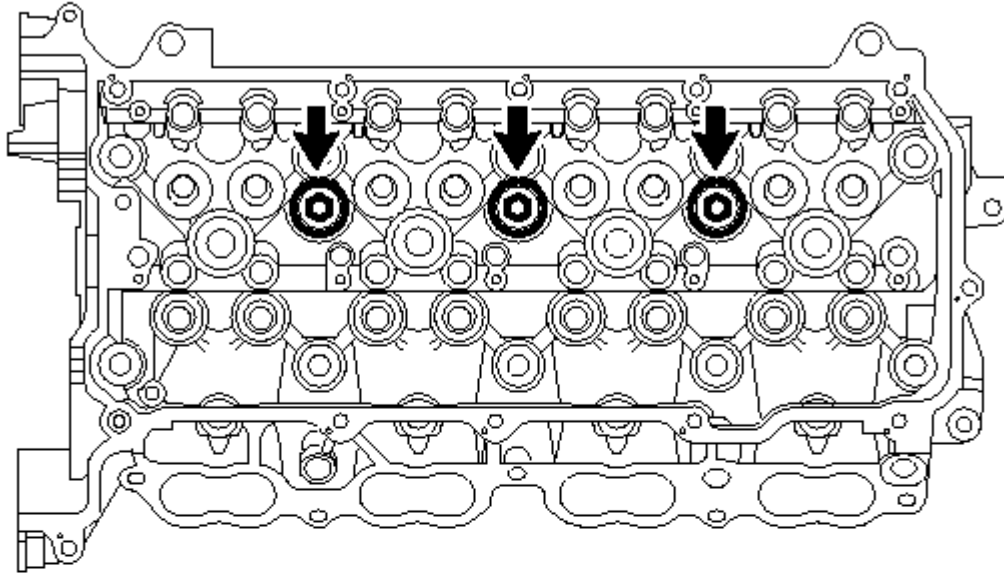
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

**5. REMOVE NO. 1 STRAIGHT SCREW PLUG**

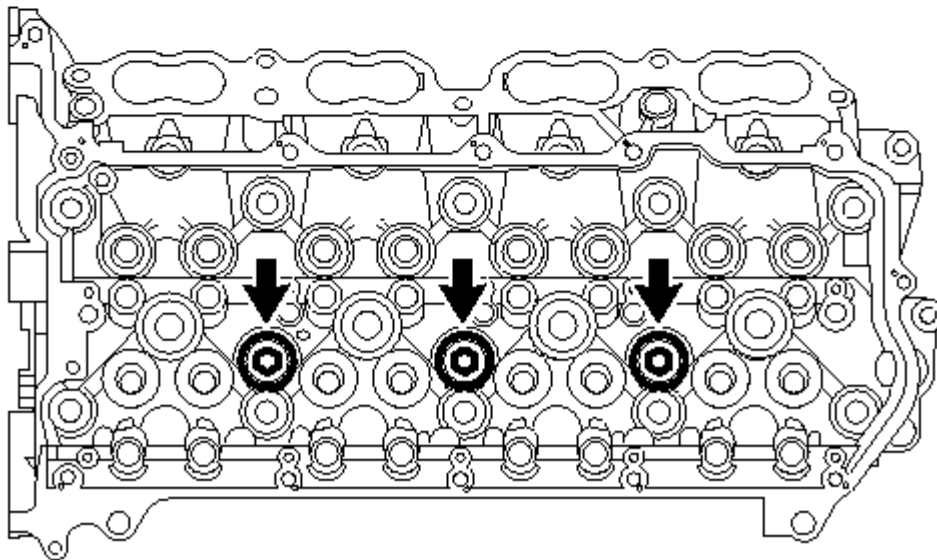
**NOTE:**        **If water leaks from the No. 1 screw plug or the plug is corroded, replace it.**

- a. Using a 10 mm hexagon wrench, remove the 6 screw plugs and 6 gaskets.

**RH:**



**LH:**



**T**

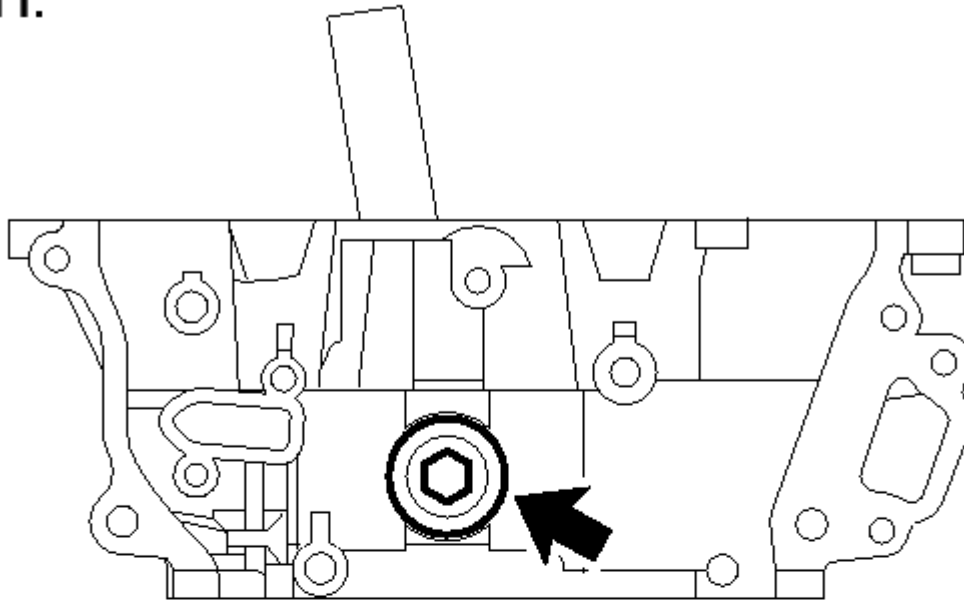
**Fig. 337: Identifying Screw Plugs**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

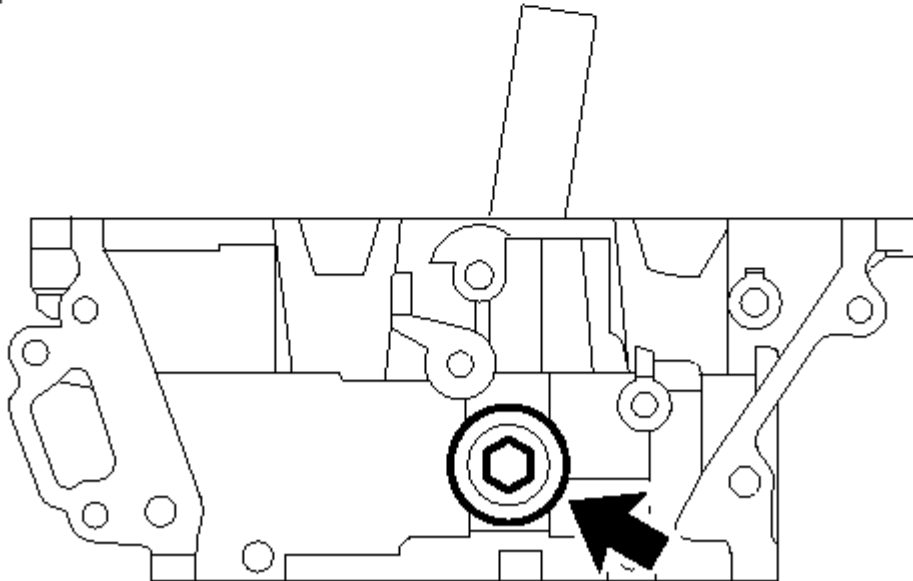
**6. REMOVE NO. 2 STRAIGHT SCREW PLUG**

- a. Using a 14 mm hexagon wrench, remove the 2 screw plugs and 2 gaskets.

RH:



LH:



T

**Fig. 338: Identifying Screw Plugs**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** If water leaks from the No. 2 screw plug or the plug is corroded, replace it.

## 7. REMOVE STUD BOLT

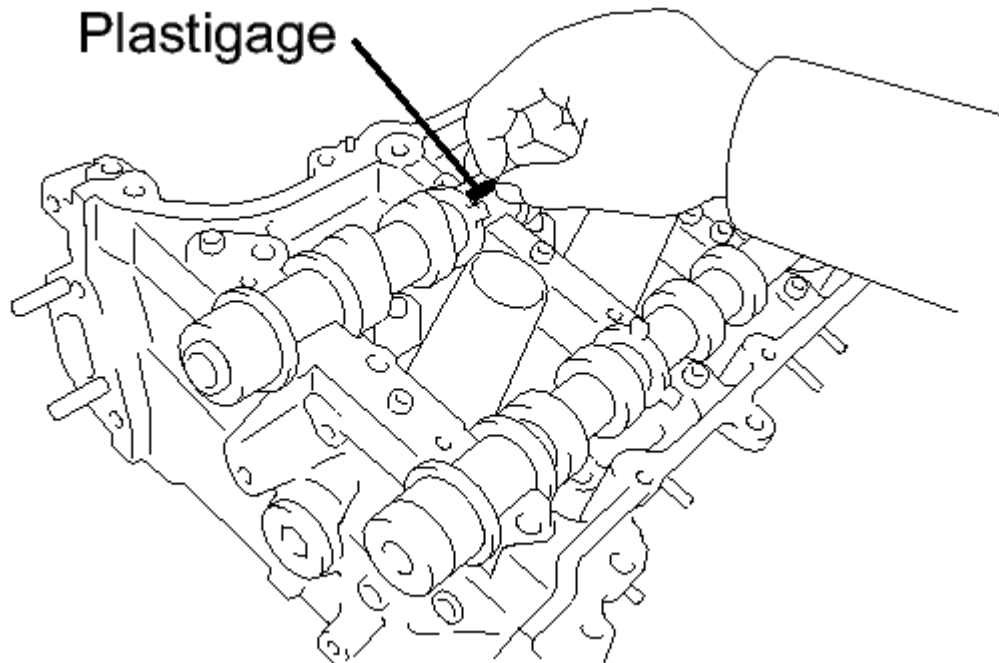
**NOTE:** If the stud bolt is deformed or its threads are damaged, replace it.

### INSPECTION

### INSPECTION

#### 1. INSPECT CAMSHAFT OIL CLEARANCE

- Clean the bearing caps, camshaft housing and camshaft journals.
- Place the camshafts on the camshaft housing.



**T**

**Fig. 339: Laying Strip Of Plastigage Across Camshaft Journals**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

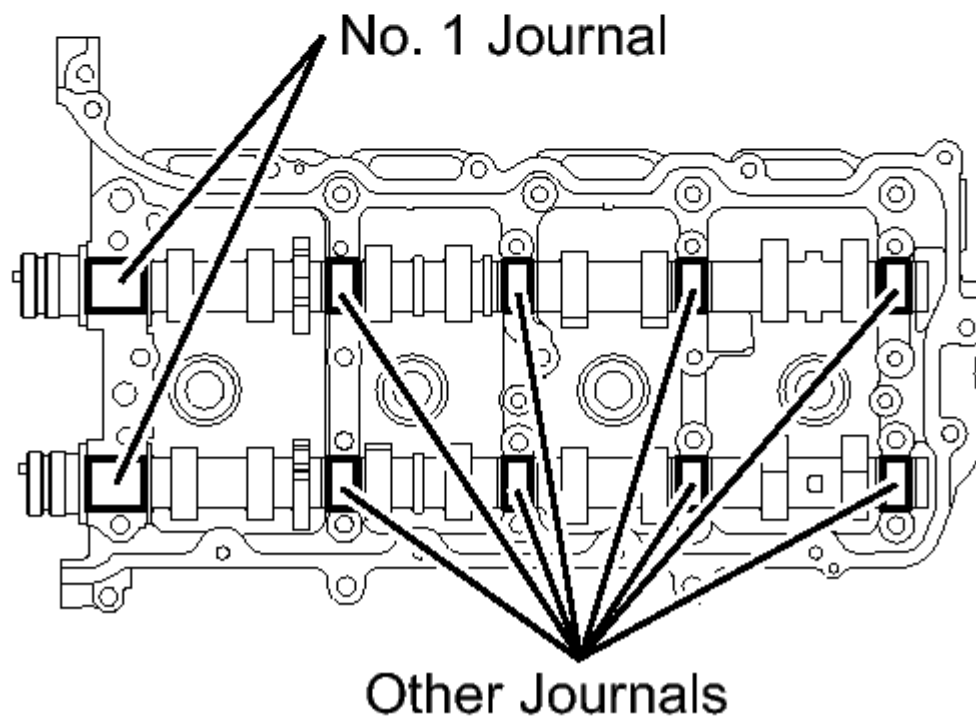
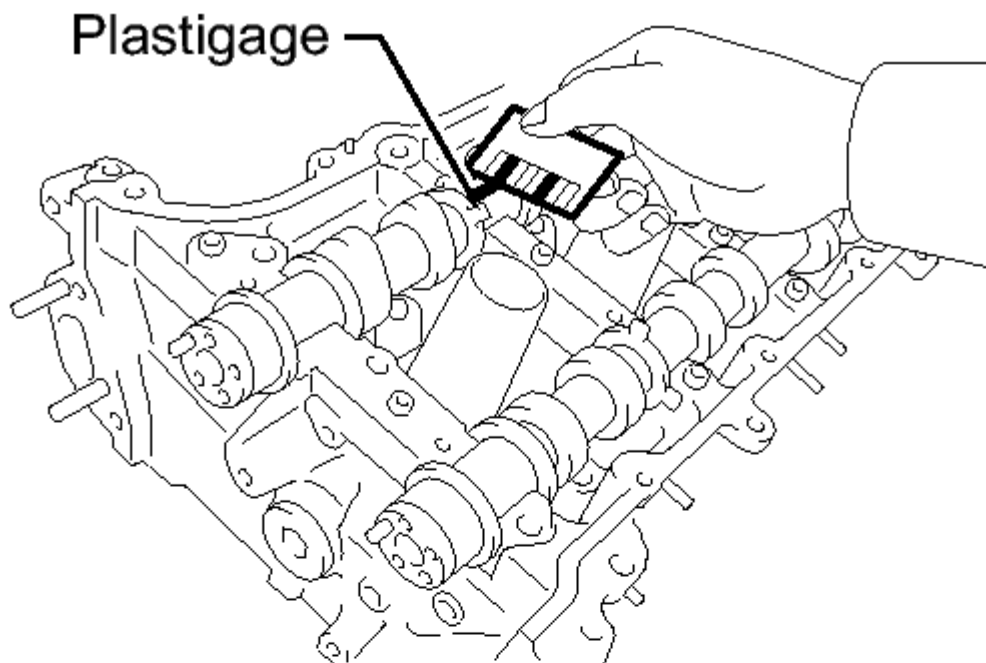
- Lay a strip of Plastigage across each of the camshaft journals.
- Install the camshaft bearing caps See step 1.

**NOTE:** Do not turn the camshaft.

- Install the camshaft housing See step 2.

**NOTE:** Do not turn the camshaft.

- Remove the camshaft bearing caps See step 8.



**P**

**Fig. 340: Measuring Plastigage At Widest Point**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Measure the Plastigage at its widest point.

## Standard Oil Clearance

Item	Specified Condition
No. 1 journal	0.030 to 0.065 mm (0.00118 to 0.00256 in.)
Other journals	0.025 to 0.062 mm (0.000984 to 0.00244 in.)

## Maximum Oil Clearance

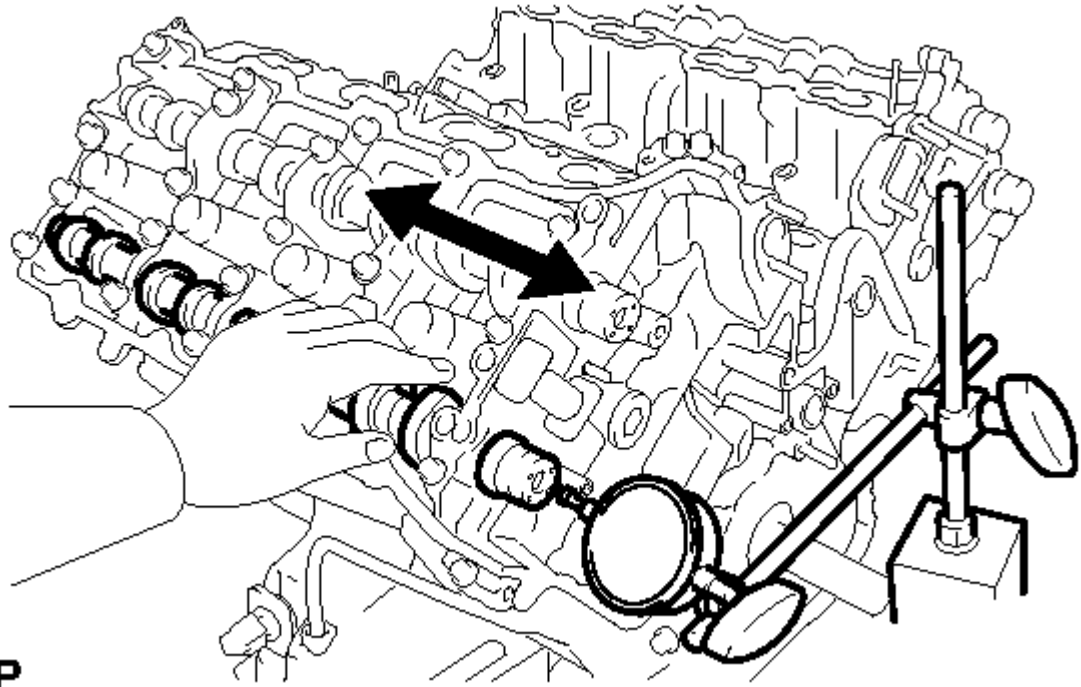
Item	Specified Condition
No. 1 journal	0.10 mm (0.00394 in.)
Other journals	0.09 mm (0.00354 in.)

If the oil clearance is more than the maximum, replace the camshaft. If necessary, replace the camshaft housing.

**2. INSPECT CAMSHAFT THRUST CLEARANCE**

- a. Inspect the LH side camshafts.
  1. Install the LH side camshafts.





**P**

**Fig. 341: Measuring Thrust Clearance**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance

0.08 to 0.135 mm (0.00315 to 0.00531 in.)

Maximum thrust clearance

0.15 mm (0.00591 in.)

If the thrust clearance is more than the maximum, replace the camshaft housing. If the thrust surface is damaged, replace the camshaft.

- b. Inspect the RH side camshafts.

1. Install the RH side camshafts.

2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance

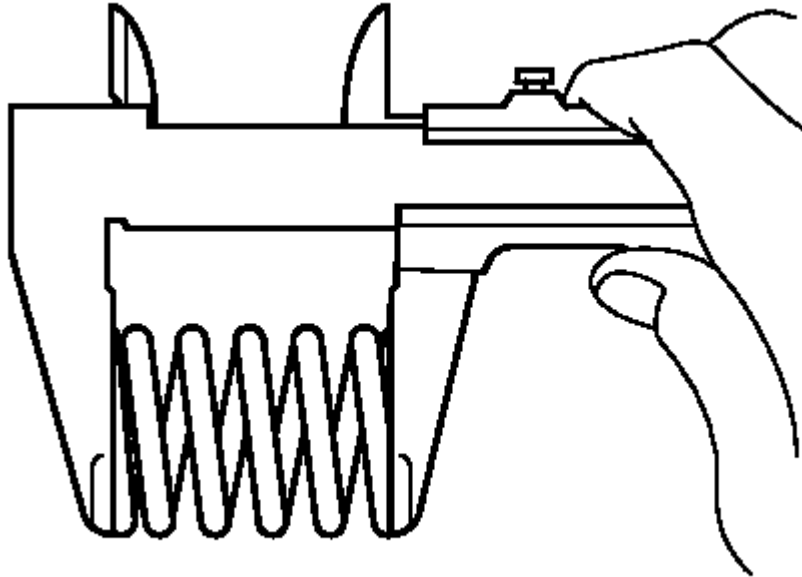
0.08 to 0.135 mm (0.00315 to 0.00531 in.)

Maximum thrust clearance

0.15 mm (0.00591 in.)

If the thrust clearance is more than the maximum, replace the camshaft housing. If the thrust surface is damaged, replace the camshaft.

### 3. INSPECT COMPRESSION SPRING



**T**

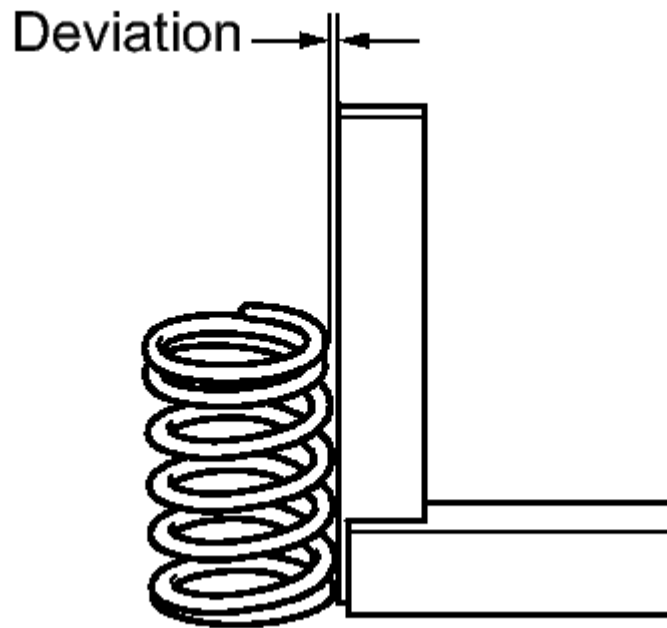
**Fig. 342: Measuring Free Length Of Inner Compression Spring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a vernier caliper, measure the free length of the inner compression spring.

Standard free length

51.59 mm (2.03 in.)

If the free length is not as specified, replace the spring.



**T**

**Fig. 343: Measuring Deviation Of Inner Compression Spring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a steel square, measure the deviation of the inner compression spring.

Maximum deviation

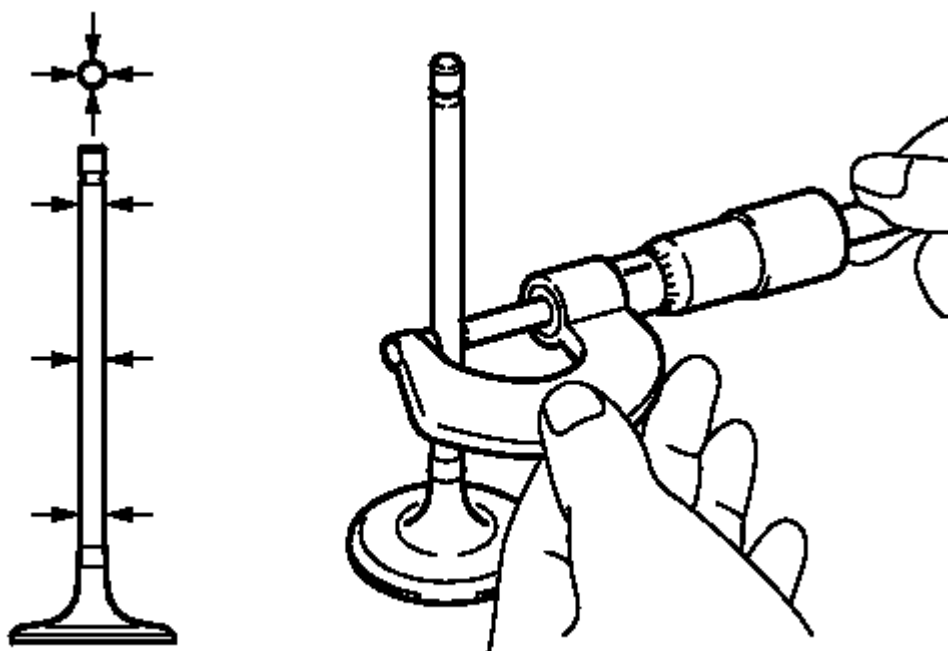
1.0 mm (0.0394 in.)

Maximum angle (reference)

2°

If the deviation is more than the maximum, replace the spring.

#### **4. INSPECT INTAKE VALVE**



T

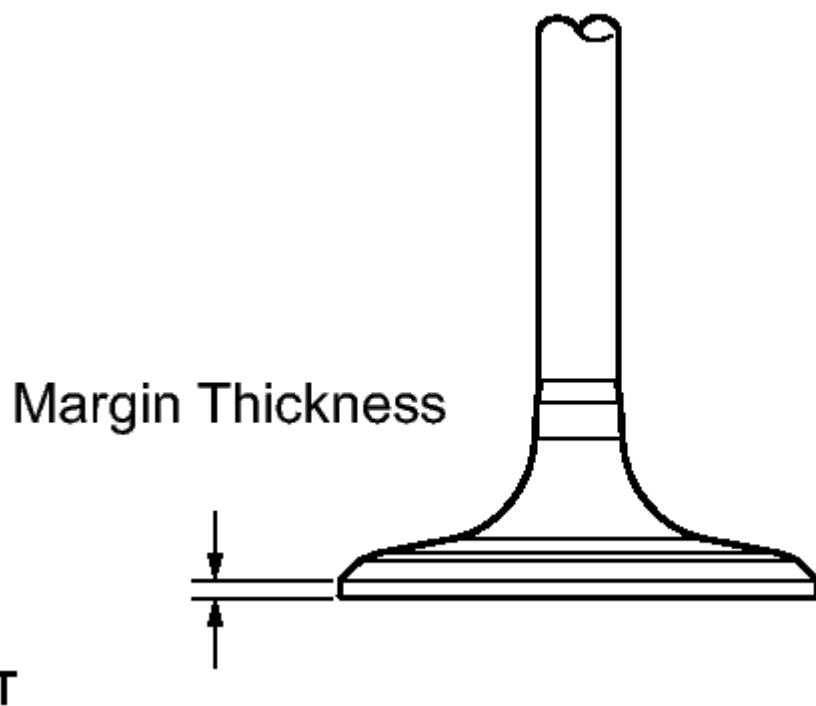
**Fig. 344: Measuring Diameter Of Valve Stem**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter

5.470 to 5.485 mm (0.215 to 0.216 in.)



**Fig. 345: Measuring Valve Head Margin Thickness**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a vernier caliper, measure the valve head margin thickness.

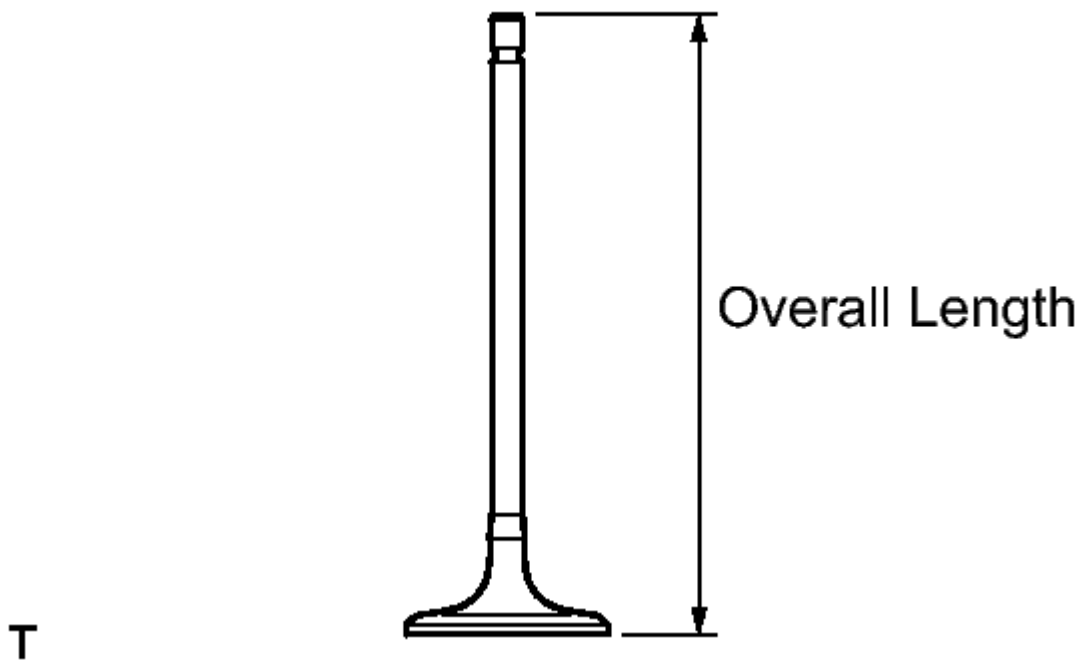
Standard margin thickness

1.25 mm (0.0492 in.)

Minimum margin thickness

0.50 mm (0.0197 in.)

If the margin thickness is less than the minimum, replace the intake valve.



**Fig. 346: Identifying Valve's Overall Length**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a vernier caliper, measure the valve overall length.

Standard overall length

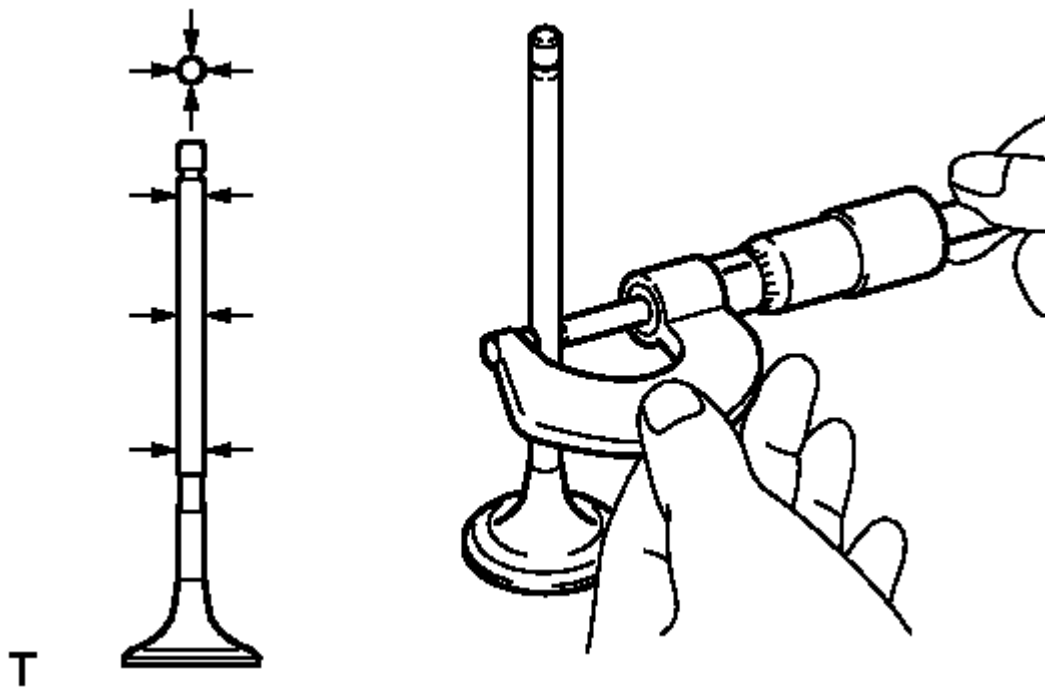
105.85 mm (4.17 in.)

Minimum overall length

105.35 mm (4.15 in.)

If the overall length is less than the minimum, replace the intake valve.

## 5. INSPECT EXHAUST VALVE

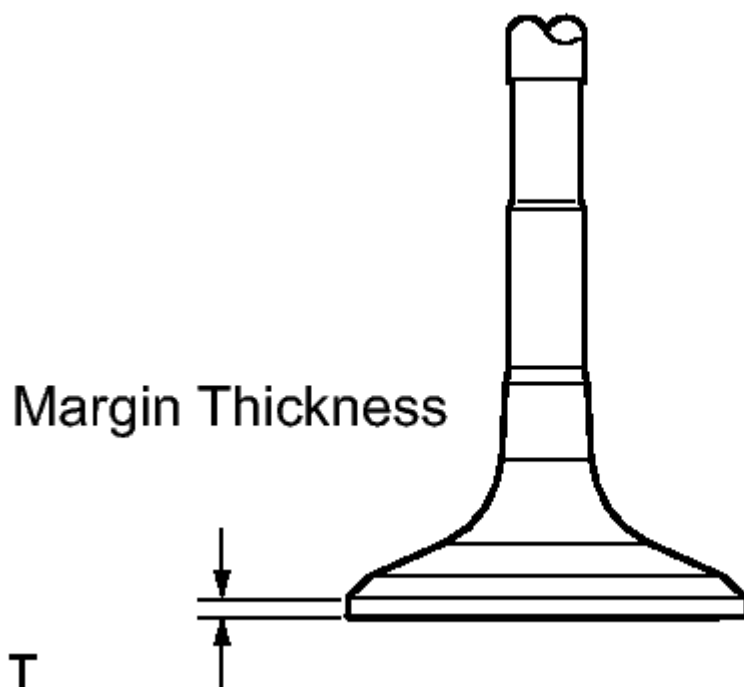


**Fig. 347: Measuring Diameter Of Valve Stem**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter

5.465 to 5.480 mm (0.215 to 0.216 in.)



**Fig. 348: Measuring Valve Head Margin Thickness**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a vernier caliper, measure the valve head margin thickness.

Standard margin thickness

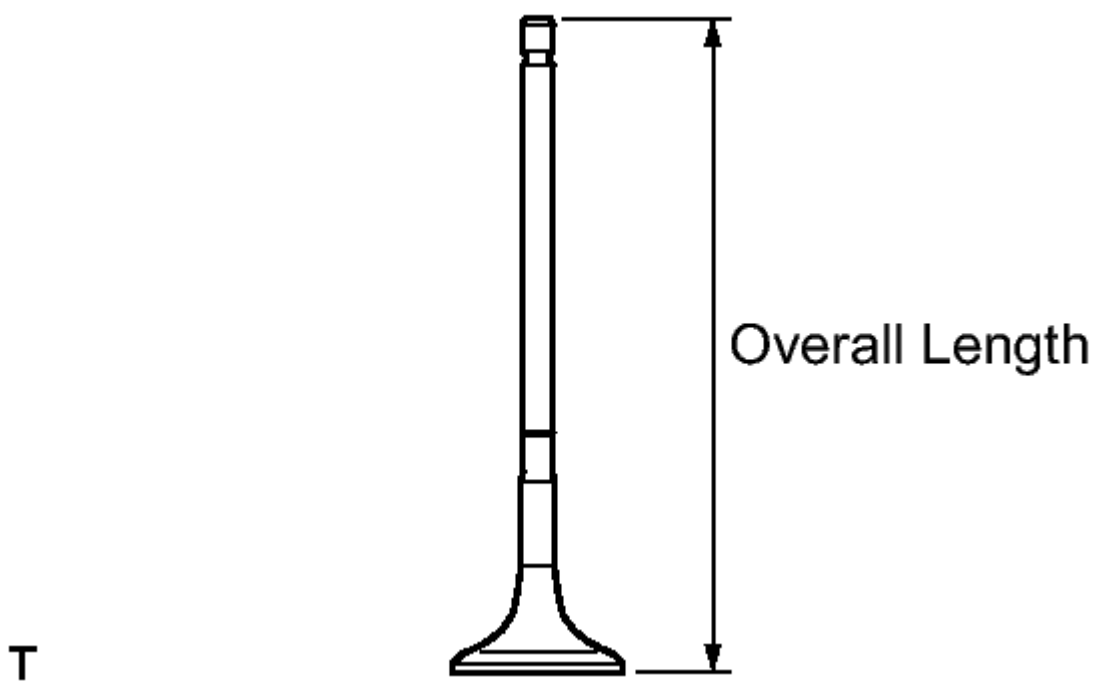
1.4 mm (0.0551 in.)

Minimum margin thickness

0.50 mm (0.0197 in.)

If the margin thickness is less than the minimum, replace the exhaust valve.





**Fig. 349: Measuring Valve's Overall Length**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a vernier caliper, measure the valve overall length.

Standard overall length

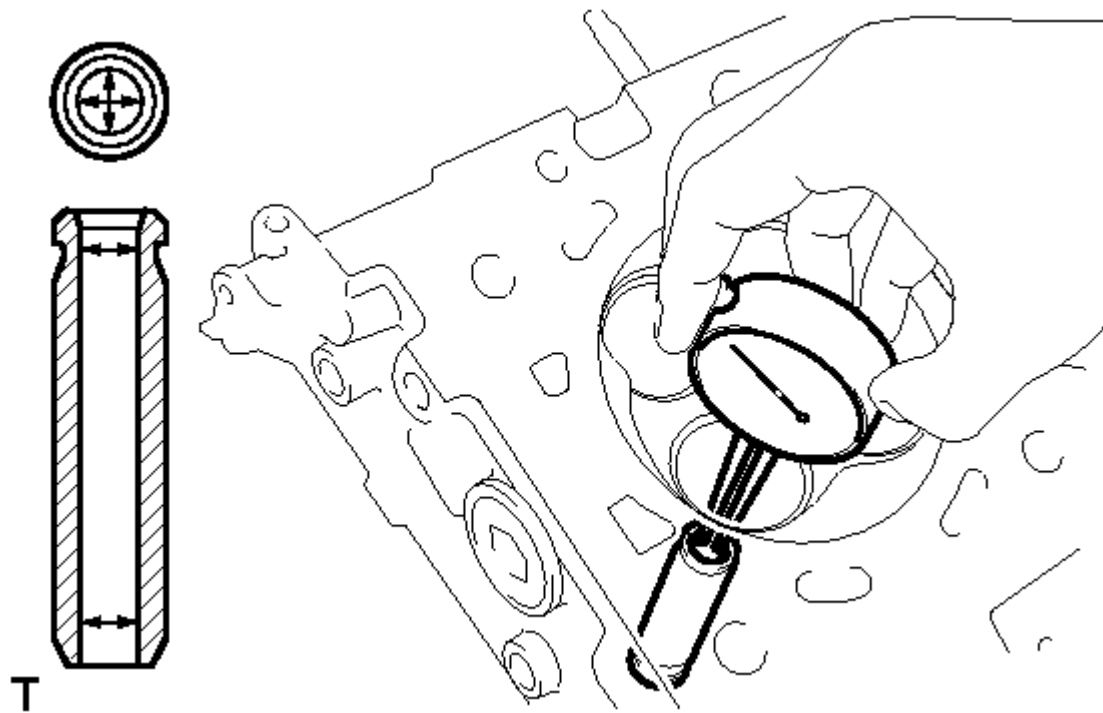
110.40 mm (4.35 in.)

Minimum overall length

109.90 mm (4.33 in.)

If the overall length is less than the minimum, replace the exhaust valve.

## 6. INSPECT VALVE GUIDE BUSH OIL CLEARANCE



**Fig. 350: Measuring Inside Diameter Of Guide Bush**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a caliper gauge, measure the inside diameter of the guide bush.

Standard bush inside diameter

5.51 to 5.53 mm (0.217 to 0.218 in.)

- Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

Standard Oil Clearance

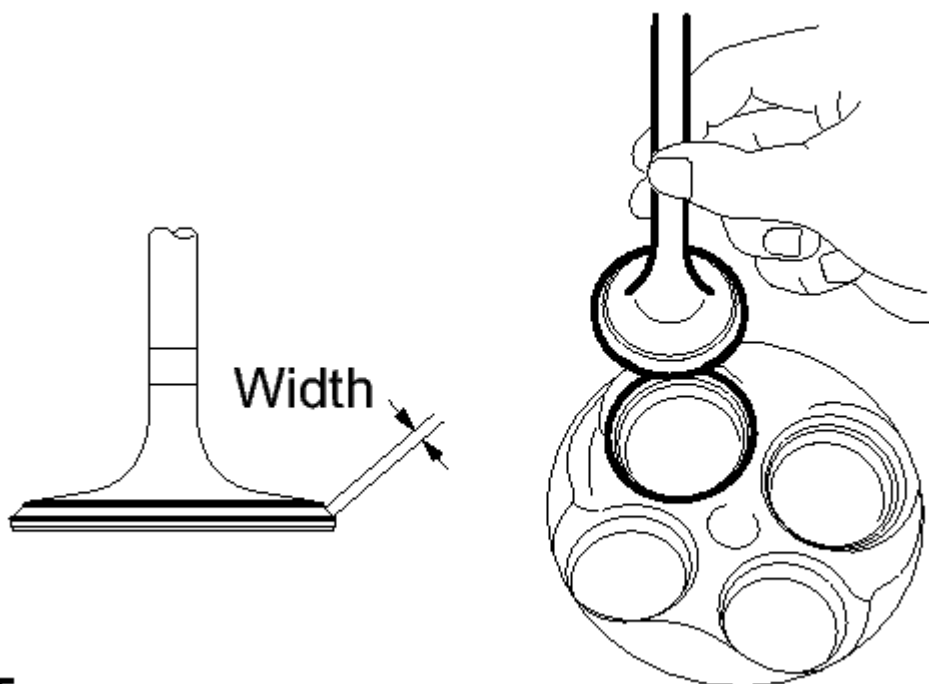
Item	Specified Condition
Intake	0.025 to 0.060 mm (0.000984 to 0.00236 in.)
Exhaust	0.030 to 0.065 mm (0.00118 to 0.00256 in.)

Maximum Oil Clearance

Item	Specified Condition
Intake	0.08 mm (0.00315 in.)
Exhaust	0.10 mm (0.00394 in.)

If the oil clearance is more than the maximum, replace the valve and guide bush.

## 7. INSPECT INTAKE VALVE SEAT



**T**

**Fig. 351: Inspecting Intake Valve Seat**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Apply a light coat of Prussian blue to the valve face.
- Lightly press the valve face against the valve seat.

### **HINT:**

Do not rotate the valve while pressing the valve.

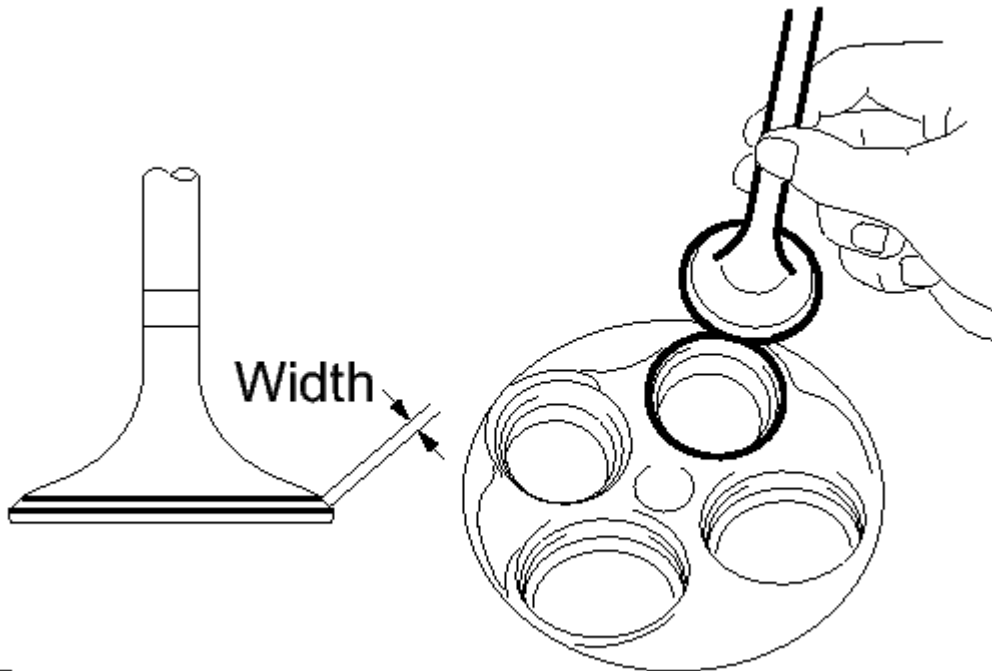
- Check the valve face and valve seat.
  - Check that the contact surfaces of the valve seat and valve face are in the middle area of their respective surfaces, with the width between 1.1 to 1.5 mm (0.0433 to 0.0591 in.).

If not, correct the valve seat.

2. Check that the contact surfaces of the valve seat and valve face are even around the entire valve seat.

If not, correct the valve seat.

## 8. INSPECT EXHAUST VALVE SEAT



**T**

**Fig. 352: Inspecting Exhaust Valve Seat**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply a light coat of Prussian blue to the valve face.
- b. Lightly press the valve face against the valve seat.

### **HINT:**

Do not rotate the valve while pressing the valve.

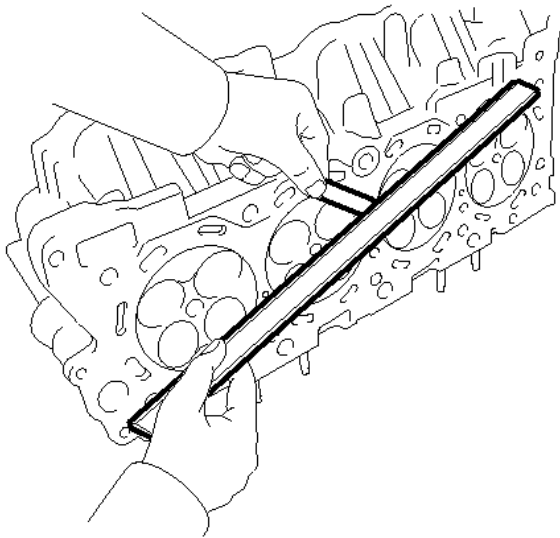
- c. Check the valve face and valve seat.
  1. Check that the contact surfaces of the valve seat and valve face are in the middle area of their respective surfaces, with the width between 1.1 to 1.5 mm (0.0433 to 0.0591 in.).

If not, correct the valve seat.

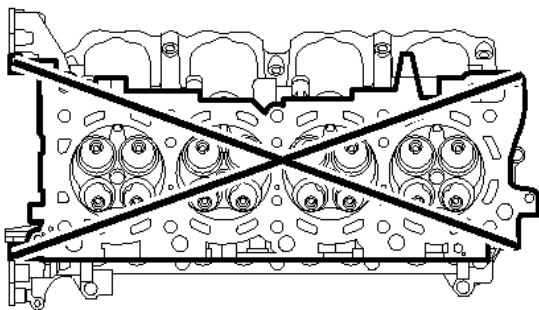
2. Check that the contact surfaces of the valve seat and valve face are even around the entire valve seat.

If not, correct the valve seat.

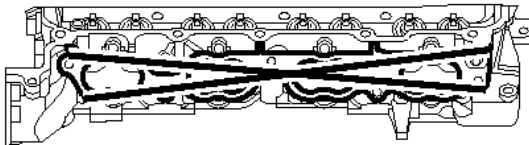
## 9. INSPECT CYLINDER HEAD SUB-ASSEMBLY



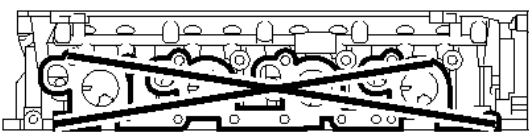
Cylinder Head Block Side:



Intake Manifold Side:



Exhaust Manifold Side:



P

**Fig. 353: Measure The Warpage Of The Contact Surfaces**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces of the cylinder block and manifold.

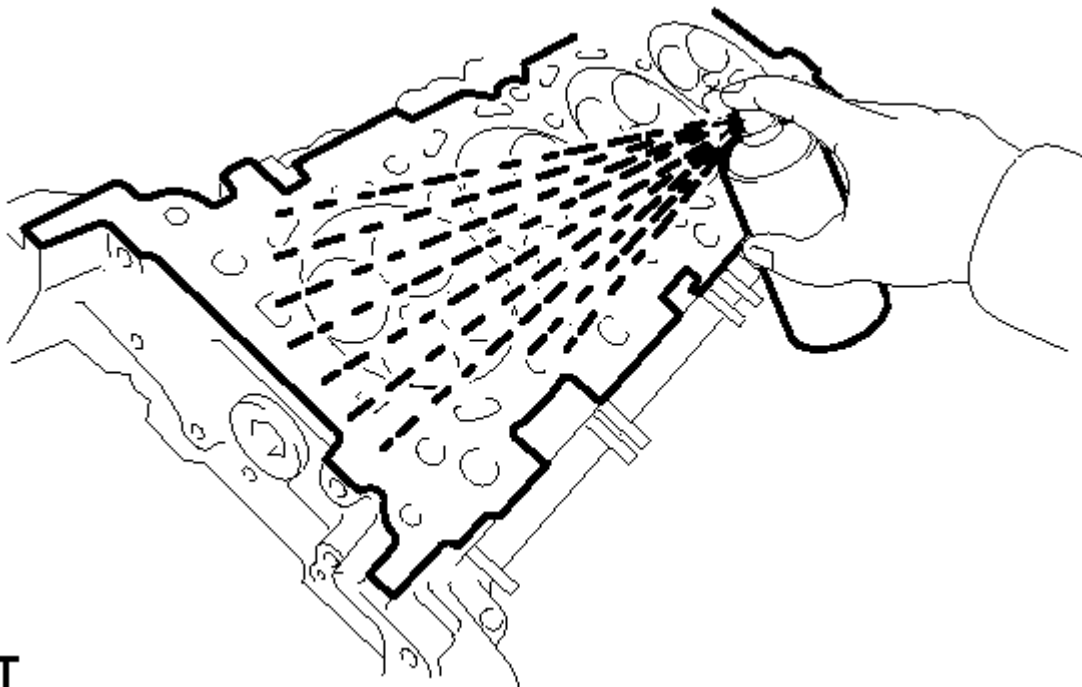
Standard Warpage

Item	Specified Condition
Cylinder head block side	0.05 mm (0.00197 in.)
Intake manifold side	0.08 mm (0.00315 in.)
Exhaust manifold side	0.05 mm (0.00197 in.)

Maximum warpage

0.10 mm (0.00394 in.)

If the warpage is more than the maximum, replace the cylinder head.



T

**Fig. 354: Checking Intake Ports, Exhaust Ports And Cylinder Surface For Cracks**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a dye penetrant, check the intake ports, exhaust ports and cylinder surface for cracks.

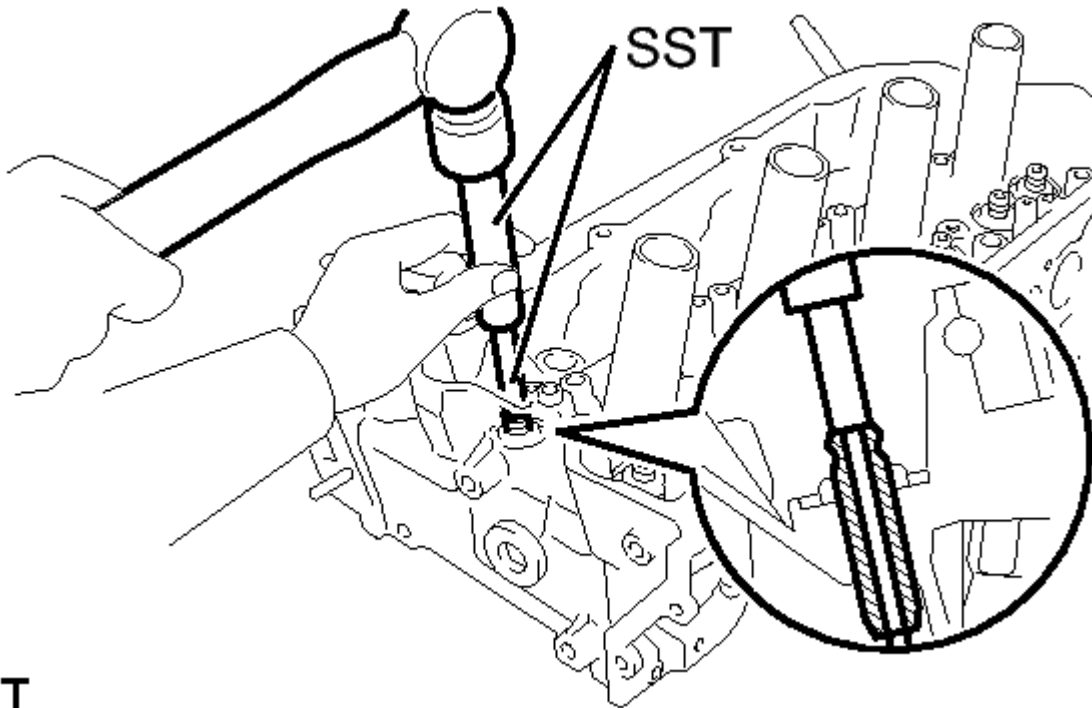
If cracked, replace the cylinder head.

## REPLACEMENT

### REPLACEMENT

#### 1. REPLACE INTAKE VALVE GUIDE BUSH

- a. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
- b. Place the cylinder head on wooden blocks.
- c. Using SST and a hammer, tap out the valve guide bush.



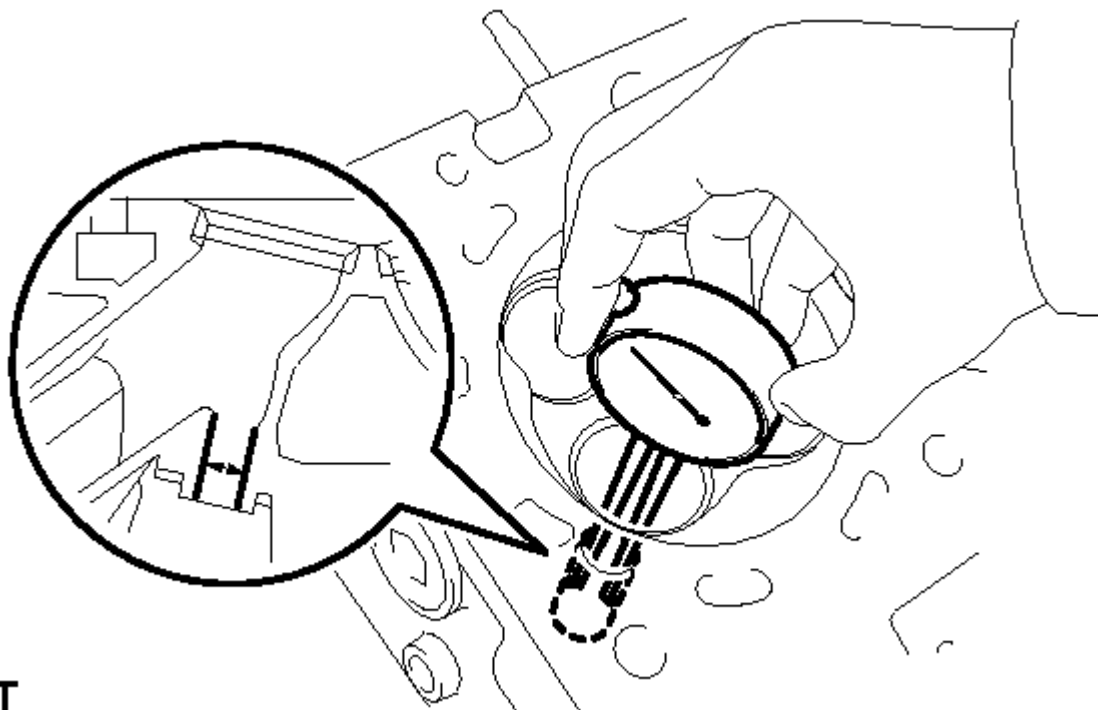
**T**

**Fig. 355: Tapping Out Valve Guide Bush**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09201-10000**  
09201-01050
- **SST: 09950-70010**  
09951-07100

- d. Using a caliper gauge, measure the bush bore diameter of the cylinder head.



T

**Fig. 356: Measuring Bush Bore Diameter Of Cylinder Head Side**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Cylinder Head Inside Diameter

Bush Size	Specified Condition
STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

- e. Select a new valve guide bush.

New Valve Guide Bush

Bush Size	Bush Diameter



STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

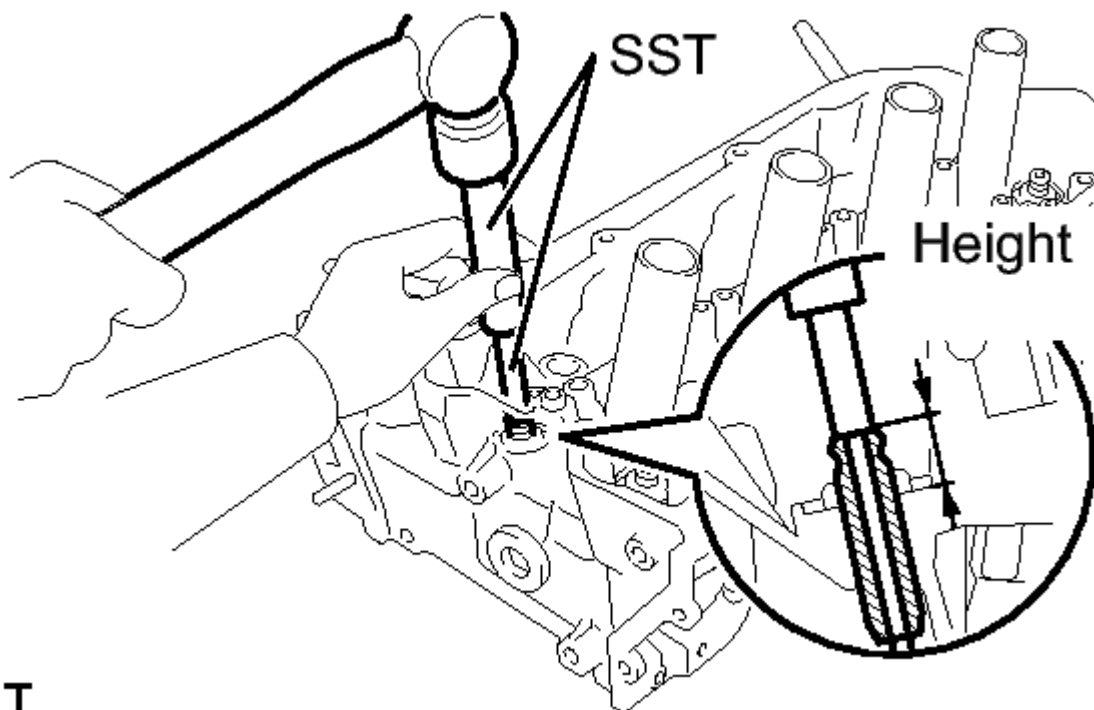
If the bush bore diameter of the cylinder head is more than 10.306 mm (0.406 in.), machine the bush bore diameter to between 10.335 and 10.356 mm (0.4069 and 0.4077 in.).

If the bush bore diameter of the cylinder head is more than 10.356 mm (0.408 in.), replace the cylinder head.

**HINT:**

Standard bush length: 41.3 to 41.7 mm (1.63 to 1.64 in.)

- f. Using SST and a hammer, tap in a new guide bush to the standard protrusion height.
  - **SST: 09201-10000**  
09201-01050
  - **SST: 09950-70010**  
09951-07100



**T**

**Fig. 357: Tapping Guide Bush To Standard Protrusion Height Using SST**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

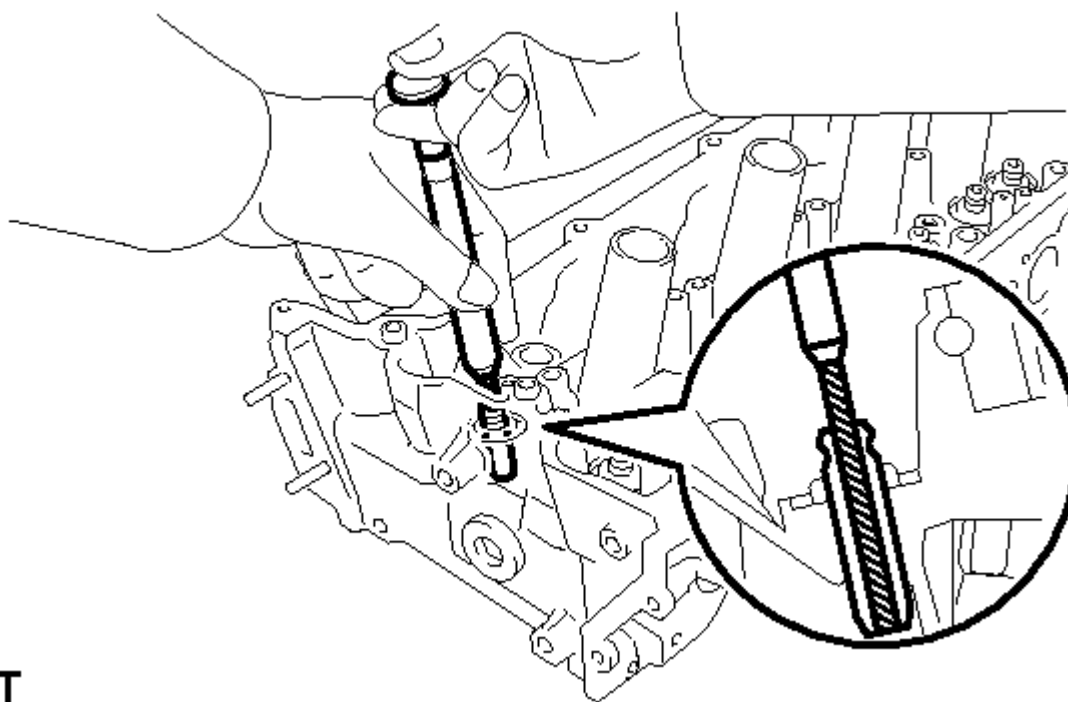
Standard protrusion height

14.3 to 14.7 mm (0.563 to 0.579 in.)

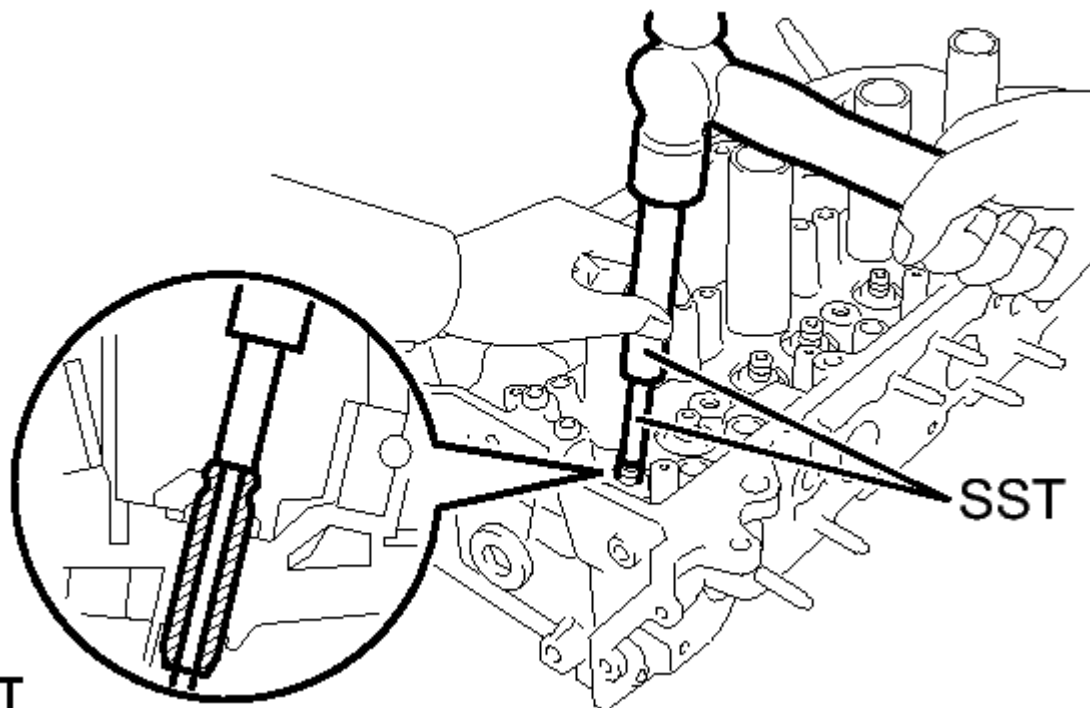
- g. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard oil clearance between the guide bush and valve stem.

Standard oil clearance

0.025 to 0.060 mm (0.000984 to 0.00236 in.)

**T****Fig. 358: Reaming Guide Bush****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****2. REPLACE EXHAUST VALVE GUIDE BUSH**

- a. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
- b. Place the cylinder head on wooden blocks.
- c. Using SST and a hammer, tap out the valve guide bush.



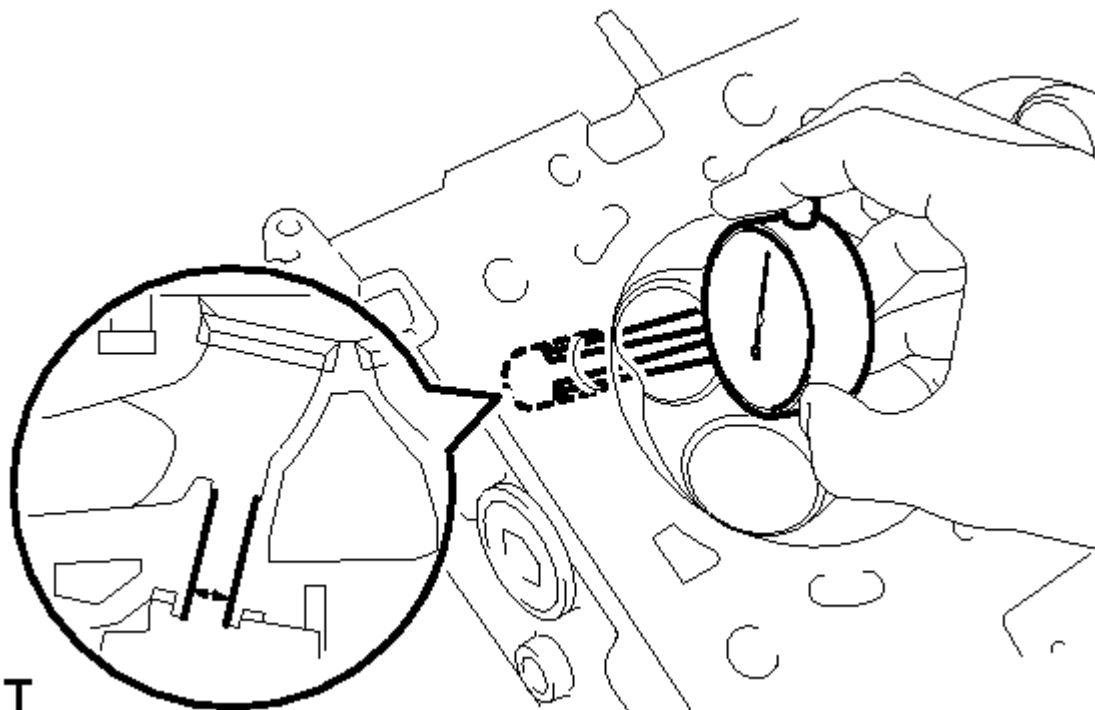
**T**

**Fig. 359: Tapping Out Valve Guide Bush**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09201-10000  
09201-01050
- SST: 09950-70010  
09951-07100

d. Using a caliper gauge, measure the bush bore diameter of the cylinder head.



T

**Fig. 360: Measuring Bush Bore Diameter Of Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Cylinder Head Inside Diameter

Bush Size	Specified Condition
STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

- e. Select a new valve guide bush.

New Valve Guide Bush

Bush Size	Bush Diameter

STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

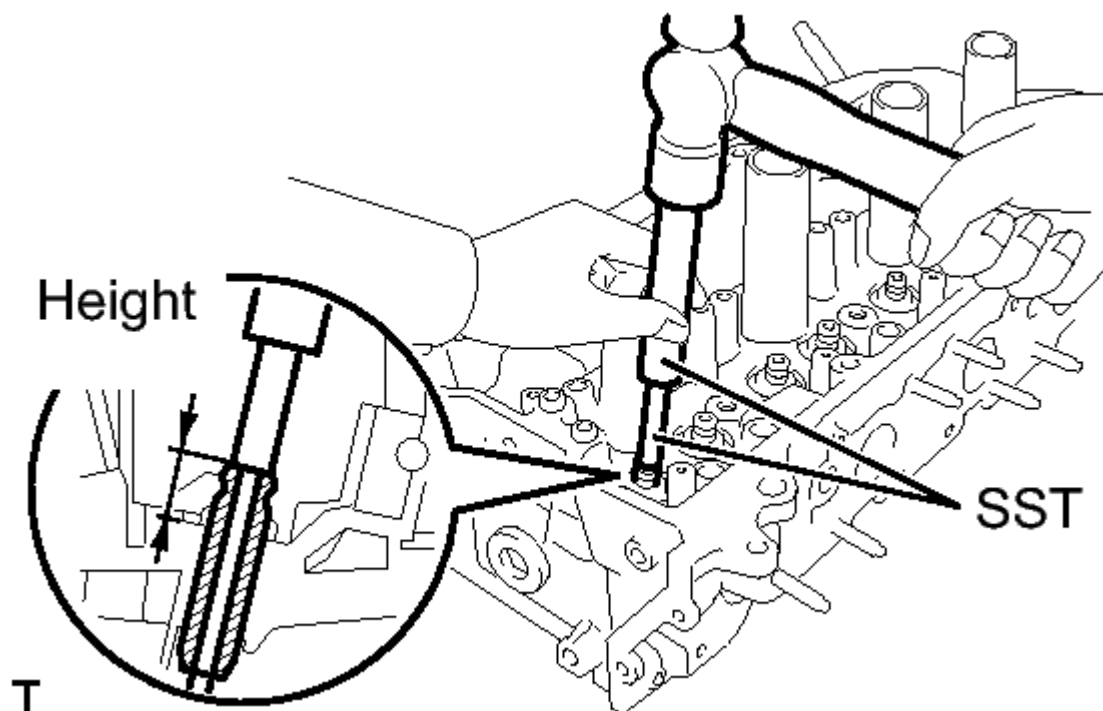
If the bush bore diameter of the cylinder head is more than 10.306 mm (0.406 in.), machine the bush bore diameter to between 10.335 and 10.356 mm (0.4069 and 0.4077 in.).

If the bush bore diameter of the cylinder head is more than 10.356 mm (0.408 in.), replace the cylinder head.

**HINT:**

Standard bush length: 46.8 to 47.2 mm (1.84 to 1.86 in.)

- f. Using SST and a hammer, tap in a new guide bush to the standard protrusion height.



**Fig. 361: Tapping Guide Bush To Standard Protrusion Height Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09201-10000**  
09201-01050
- **SST: 09950-70010**  
09951-07100

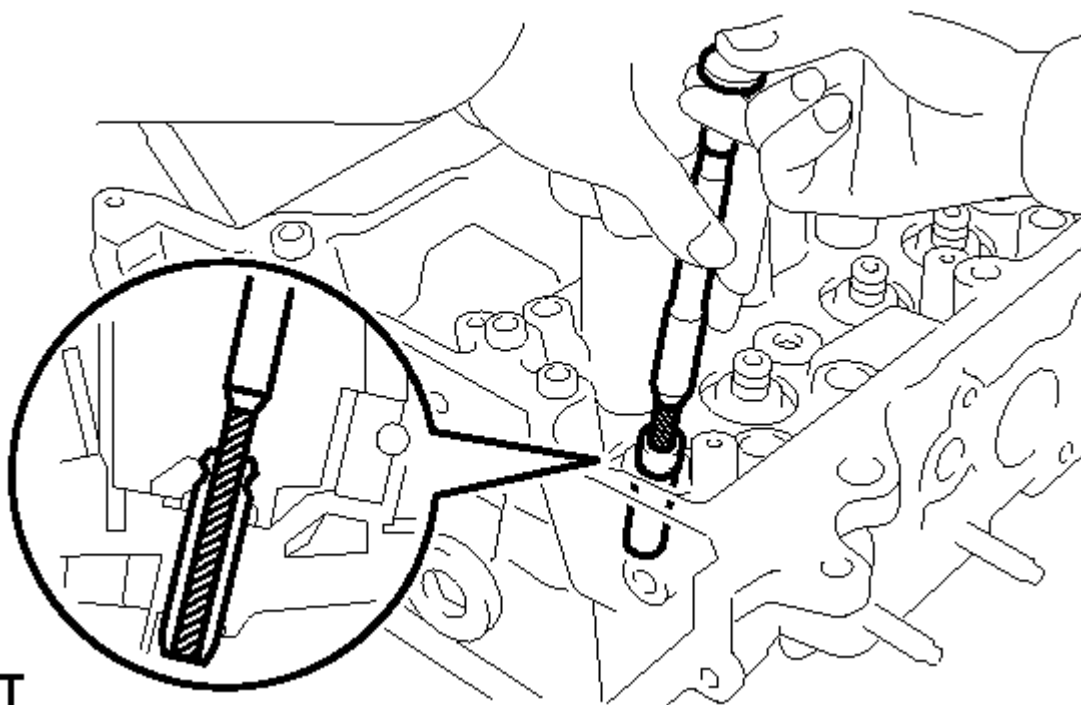
Standard protrusion height

14.3 to 14.7 mm (0.563 to 0.579 in.)

- g. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard oil clearance between the guide bush and valve stem.

Standard oil clearance

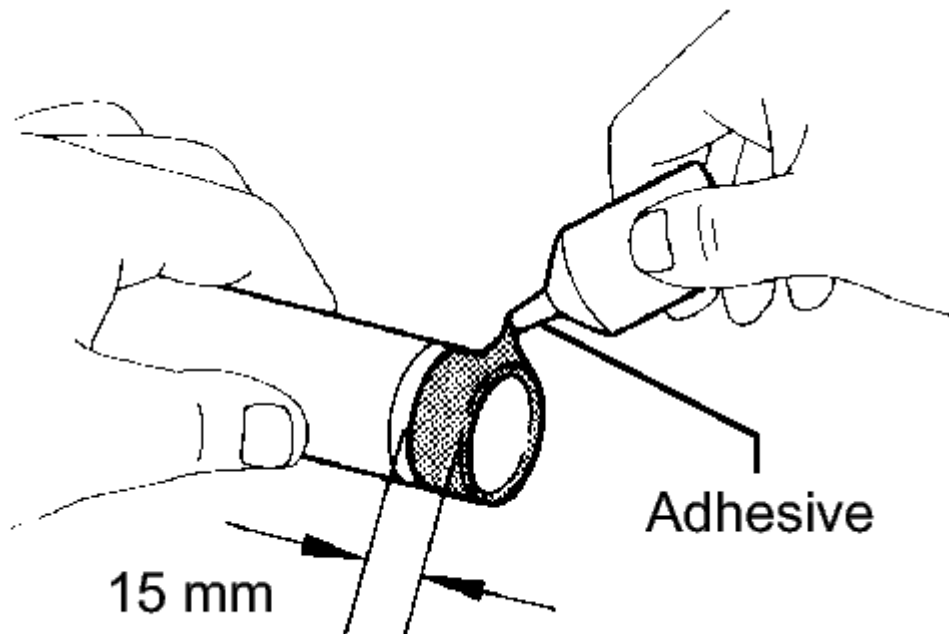
0.030 to 0.065 mm (0.00118 to 0.00256 in.)



**Fig. 362: Reaming Guide Bush**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 3. REPLACE SPARK PLUG TUBE



**Fig. 363: Applying Adhesive To End Of Spark Plug Tube**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

When using a new cylinder head, the spark plug tubes must be replaced.

- Remove the spark plug tube.
- Apply adhesive to the end of a new spark plug tube.

Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent.

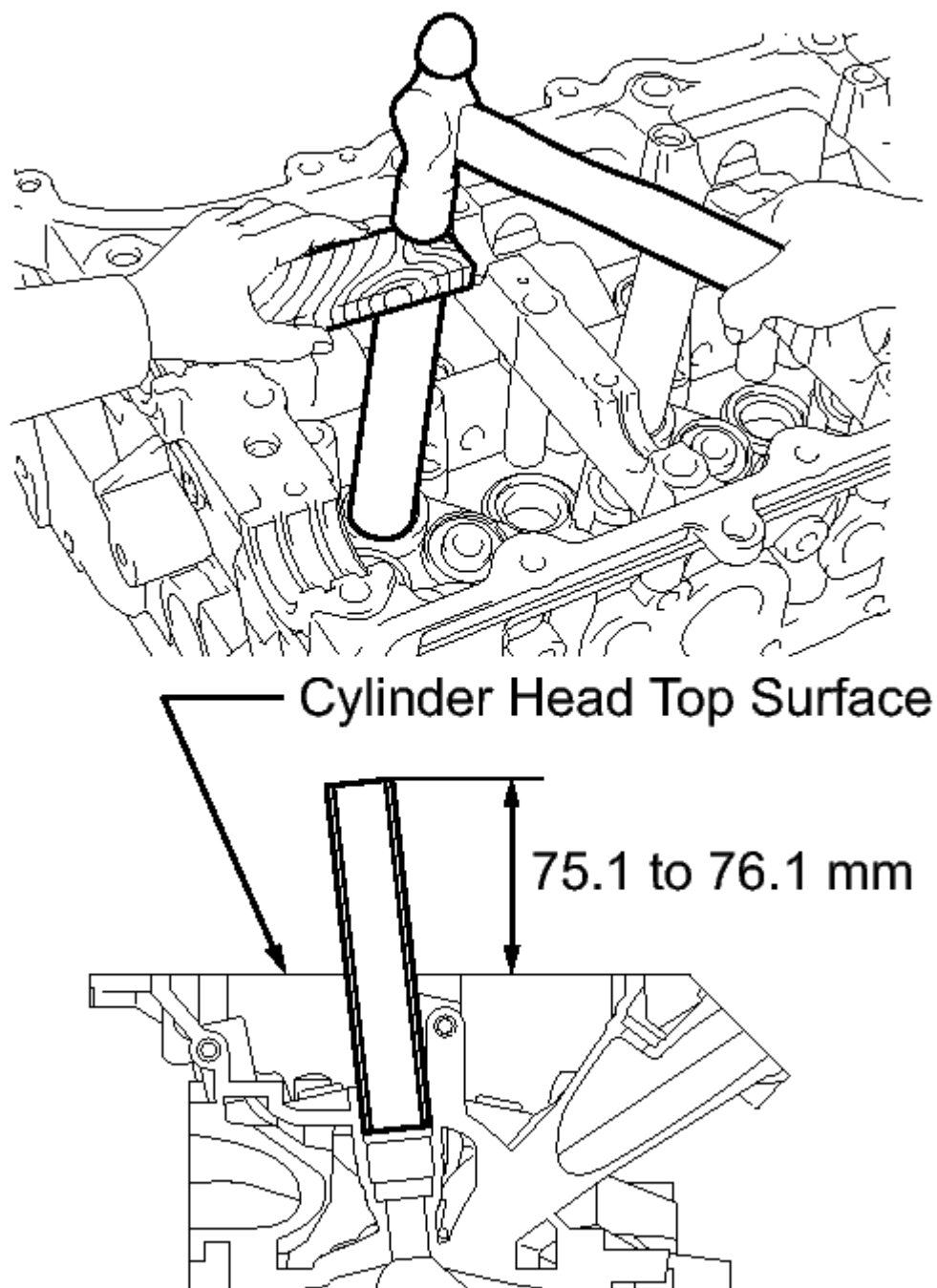
Standard seal diameter

15 mm (0.591 in.)

**NOTE:**

- Install the spark plug tube within 3 minutes after applying adhesive.
- Be careful not to deform the spark plug tube.
- Be careful not to expose the seal to coolant for at least 1 hour after installing it.





**P**

**Fig. 364: Tapping In Ring Pins To Cylinder Head**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** To avoid tapping in the spark plug tube too far, measure the protrusion height while tapping it.

- c. Using a wooden block and hammer, tap in the spark plug tube to the specified protrusion height.

Standard protrusion height

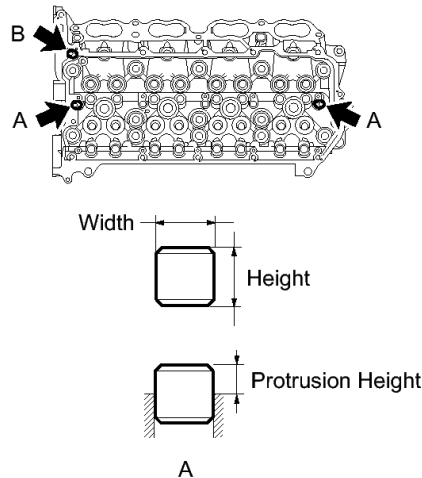
75.1 to 76.1 mm (2.96 to 3.00 in.)

#### 4. REPLACE RING PIN

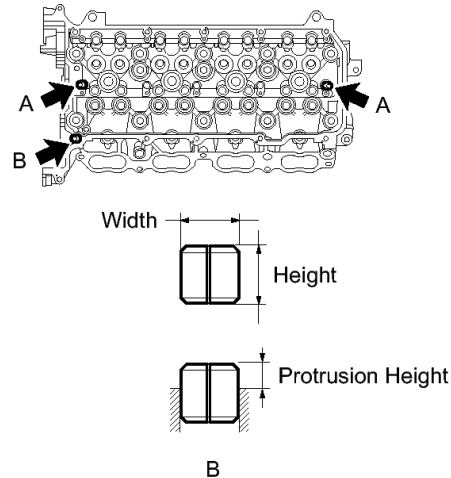
**NOTE:** It is not necessary to remove the ring pin unless it is being replaced.

- a. Remove the ring pins.
- b. Using a plastic-faced hammer, tap in new ring pins to the cylinder head.

LH:



RH:



T

**Fig. 365: Identifying Ring Pins**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Ring Pin

Item	Height	Width	Protrusion
Ring pin A	11 mm (0.433 in.)	11 mm (0.433 in.)	5.5 to 6.5 mm (0.217 to 0.256 in.)
Ring pin B	10 mm (0.394 in.)	11 mm (0.433 in.)	3.5 to 6.5 mm (0.138 to 0.256 in.)

#### REASSEMBLY

## REASSEMBLY

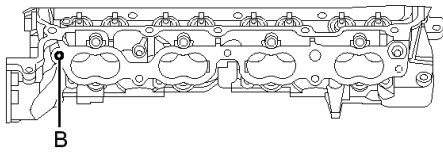
### 1. INSTALL STUD BOLT

- Using E7 and E8 "TORX" socket wrenches, install the stud bolts.

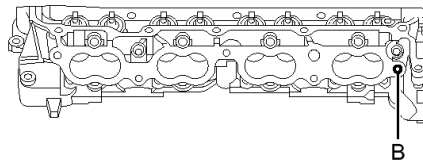
for stud bolts A, B, C, D

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

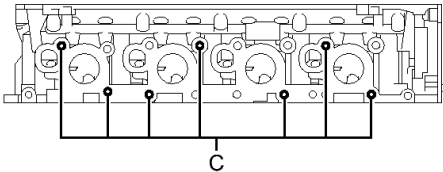
Intake Side of RH:



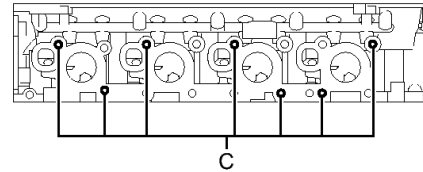
Intake Side of LH:



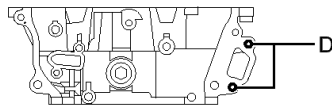
Exhaust Side of RH:



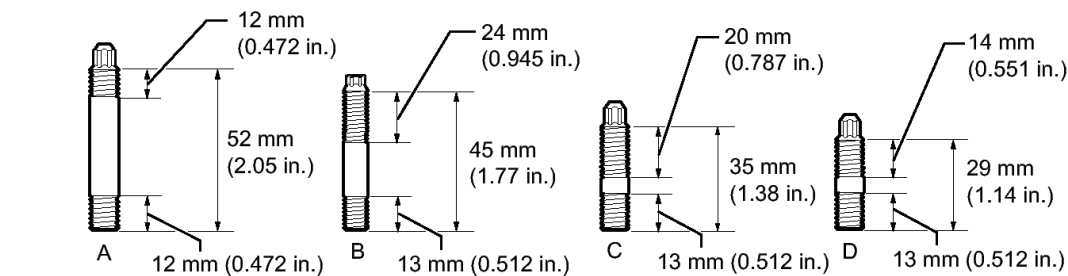
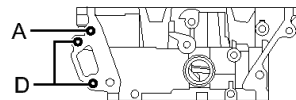
Exhaust Side of LH:



Front Side of RH:



Front Side of LH:



P

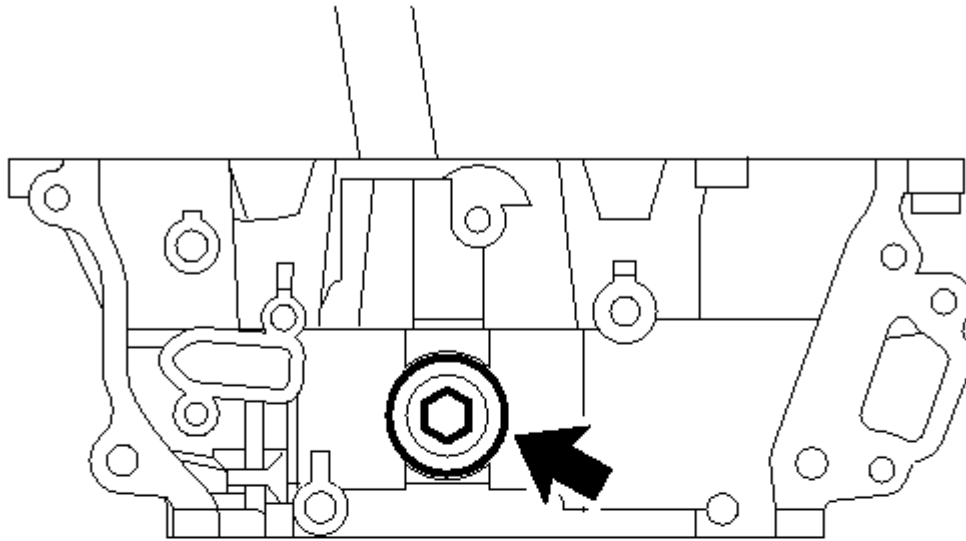
**Fig. 366: Identifying Stud Bolt Lengths**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

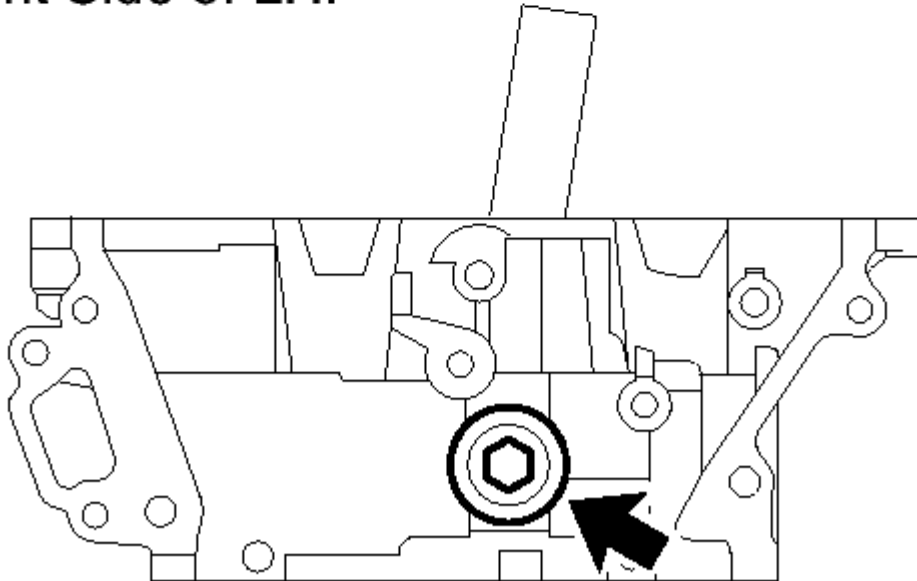
### 2. INSTALL NO. 2 STRAIGHT SCREW PLUG

- Using a 14 mm hexagon wrench, install 2 new gaskets and the 2 straight screw plugs.

## Front Side of RH:



## Front Side of LH:



**T**

**Fig. 367: Identifying Screw Plugs**

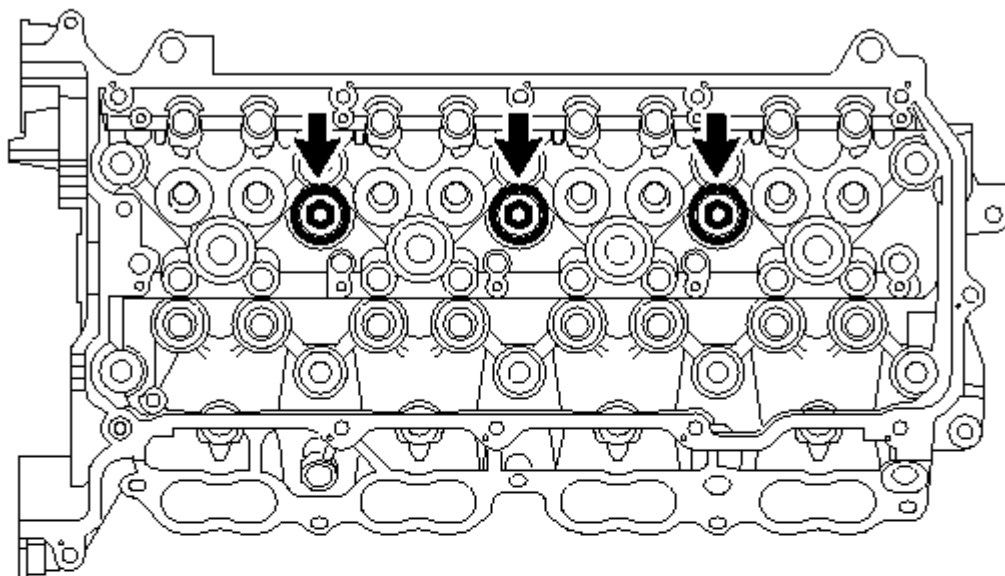
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 85 N\*m (867 kgf\*cm, 63 ft.\*lbf)**

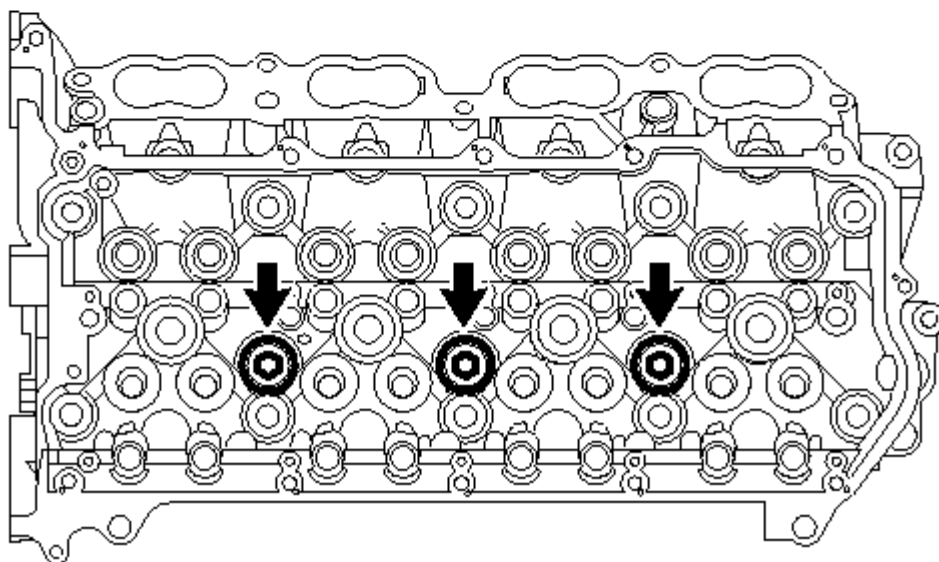
### 3. INSTALL NO. 1 STRAIGHT SCREW PLUG

- a. Using a 10 mm hexagon wrench, install 6 new gaskets and the 6 straight screw plugs.

**RH:**



**LH:**



**T**

**Fig. 368: Identifying Screw Plugs**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 44 N\*m (449 kgf\*cm, 32 ft.\*lbf)**

**4. INSTALL VALVE SPRING SEAT**

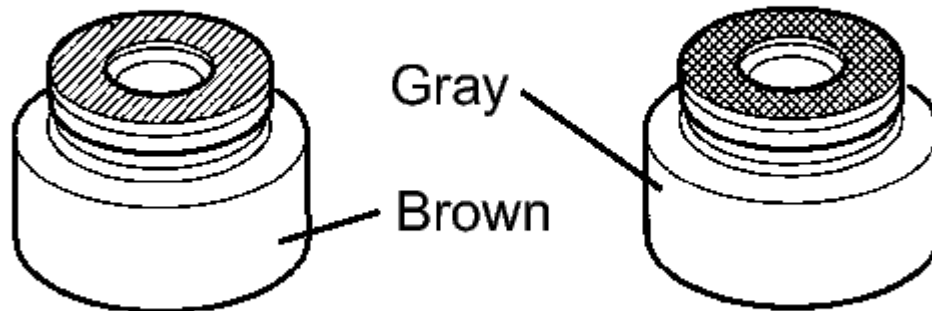
- a. Install the valve spring seats to the cylinder head.

**5. INSTALL VALVE STEM OIL SEAL**

- a. Apply a light coat of engine oil to new oil seals.

**Intake Side:**

**Exhaust Side:**



**Fig. 369: Identifying Valve Stem Oil Seal**

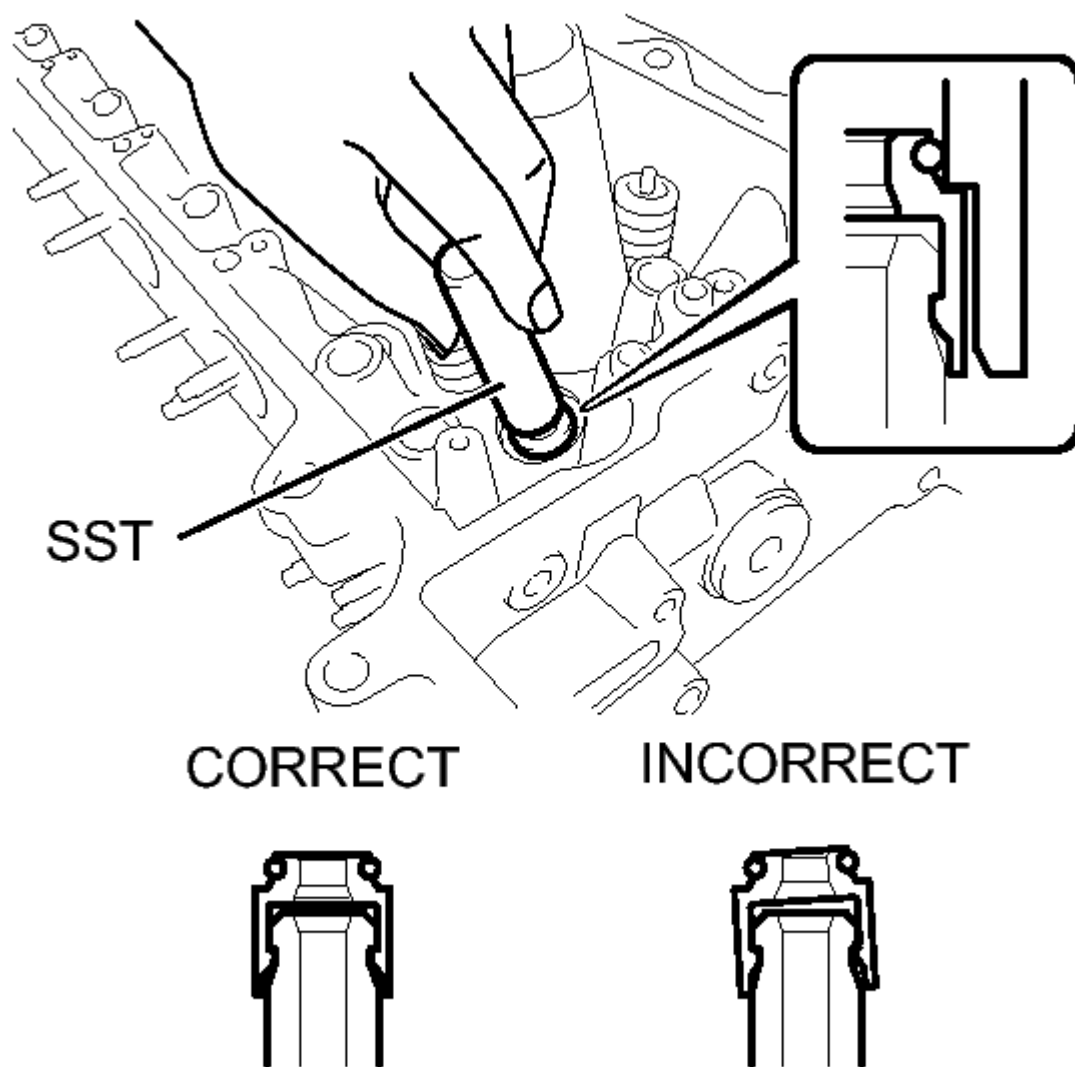
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Pay attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust side or installing the exhaust oil seal into the intake side can cause installation problems later.

**HINT:**

The intake valve oil seals are brown and the exhaust valve oil seals are gray.

- b. Using SST, push in the oil seals.



T

**Fig. 370: Pushing Oil Seals Using SST**

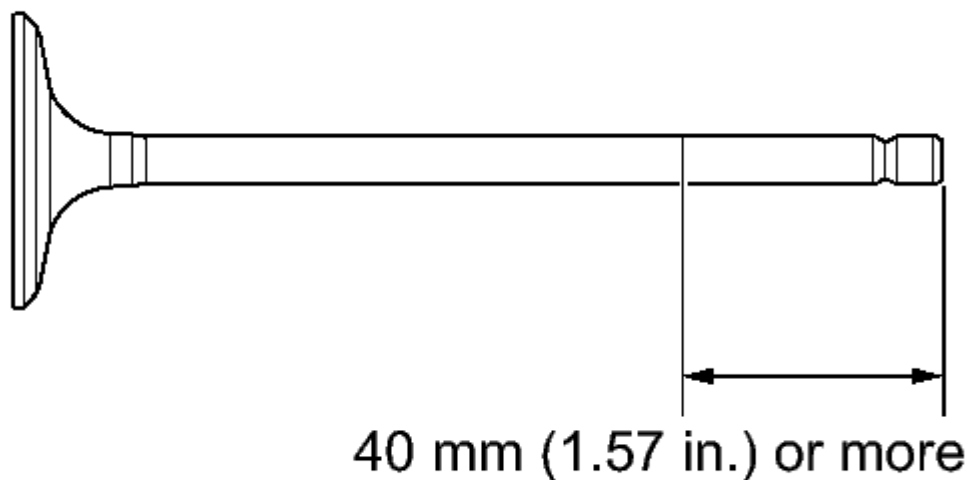
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09201-41020

**NOTE:** Failure to use SST will cause the seal to be damaged or improperly seated.

## 6. INSTALL INTAKE VALVE

- Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.



T

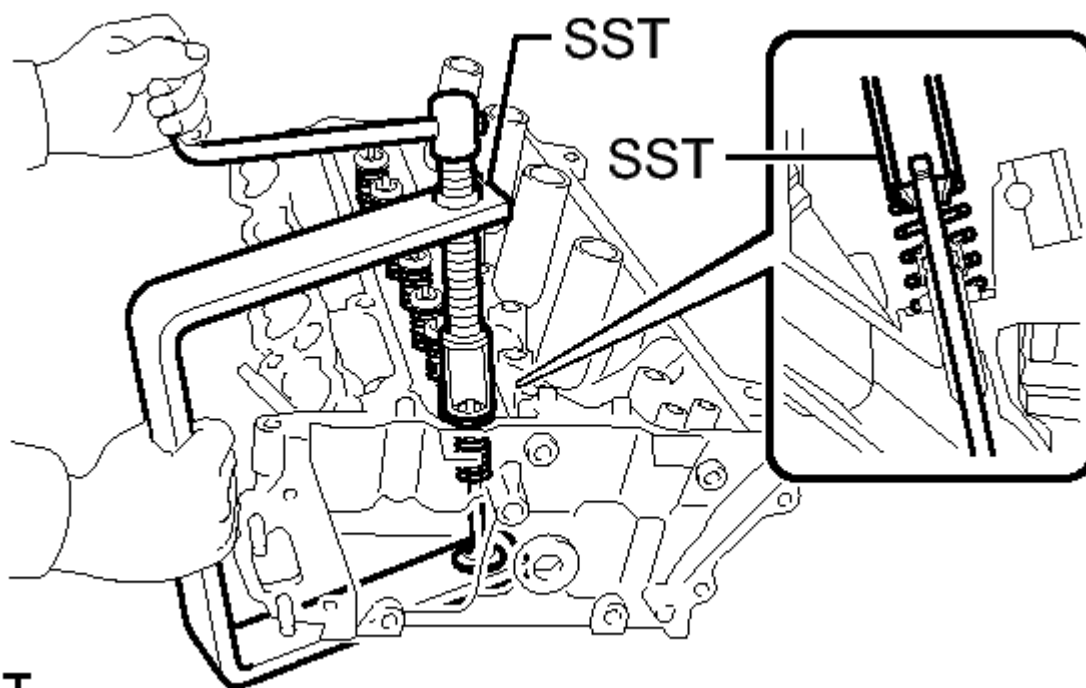
**Fig. 371: Apply Plenty Of Engine Oil To The Tip Area Of The Intake Valve**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the valve, compression spring and spring retainer to the cylinder head.

**NOTE:**        **Install the same parts in the same combination to their original locations.**

- c. Using SST and wooden blocks, compress the spring and install the retainer locks.





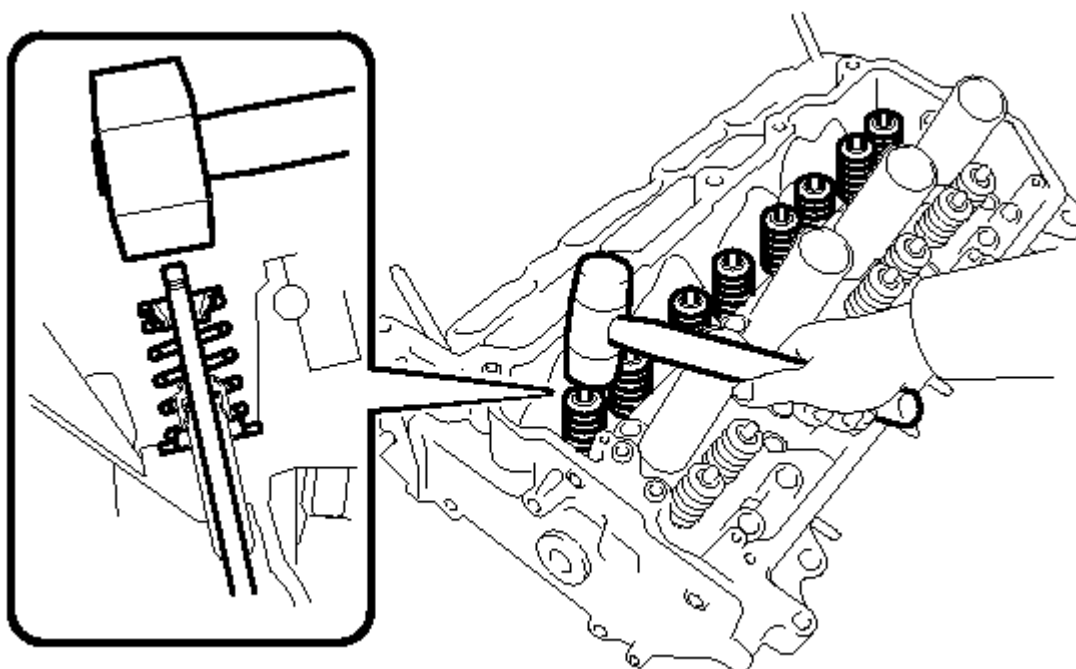
T

**Fig. 372: Compressing Spring And Retainer Locks**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09202-70020  
09202-00010

d. Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.



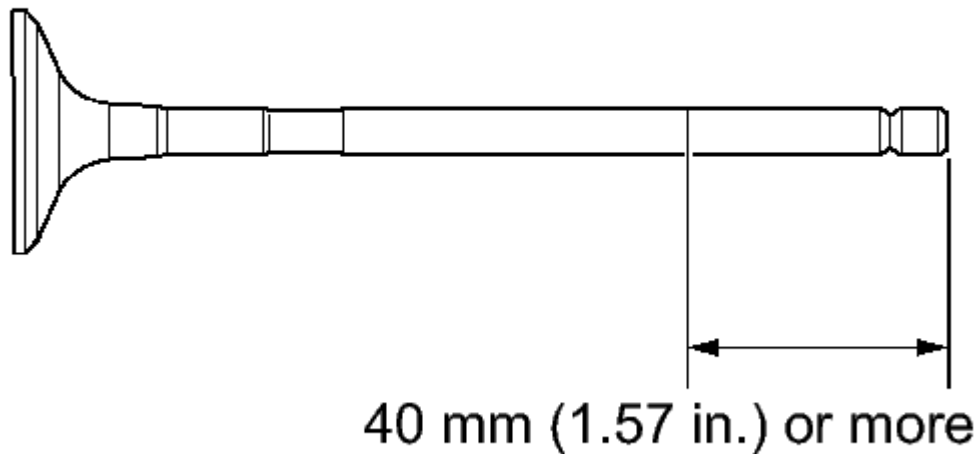
T

**Fig. 373: Tapping Valve Stem Tip**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to damage the retainer.**7. INSTALL EXHAUST VALVE**

- a. Apply plenty of engine oil to the tip area of the exhaust valve shown in the illustration.

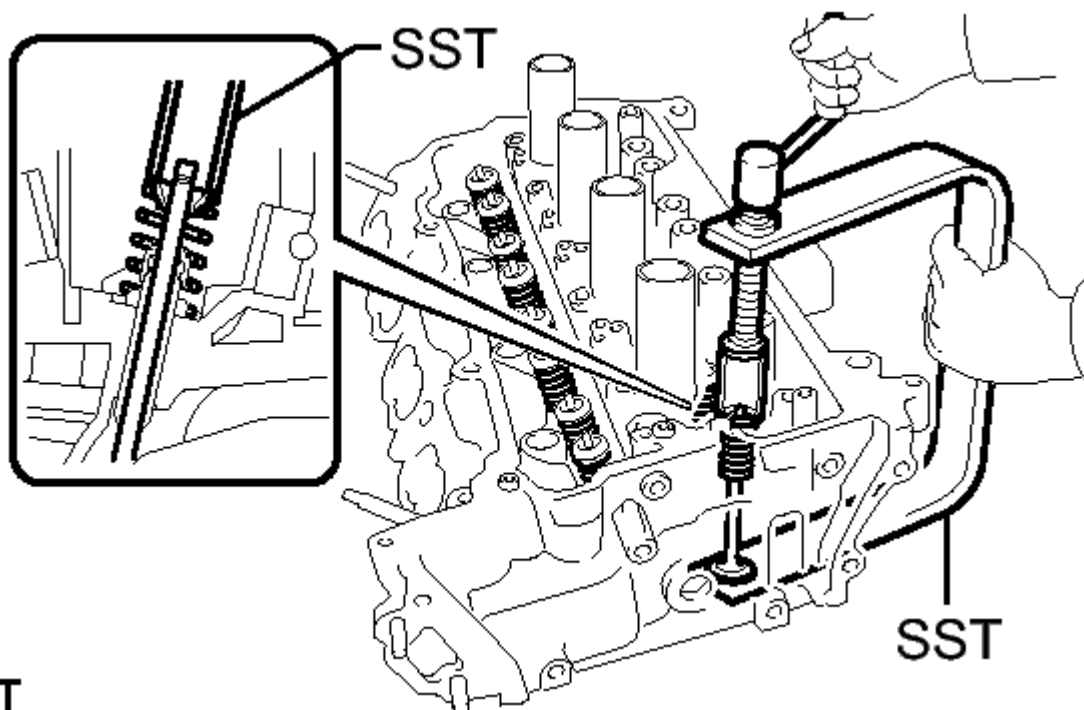
**T****Fig. 374: Apply Plenty Of Engine Oil To The Tip Area Of The Exhaust Valve**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the valve, compression spring and spring retainer to the cylinder head.

**NOTE:** Install the same parts in the same combination to their original locations.

- c. Using SST and wooden blocks, compress the spring and install the retainer locks.



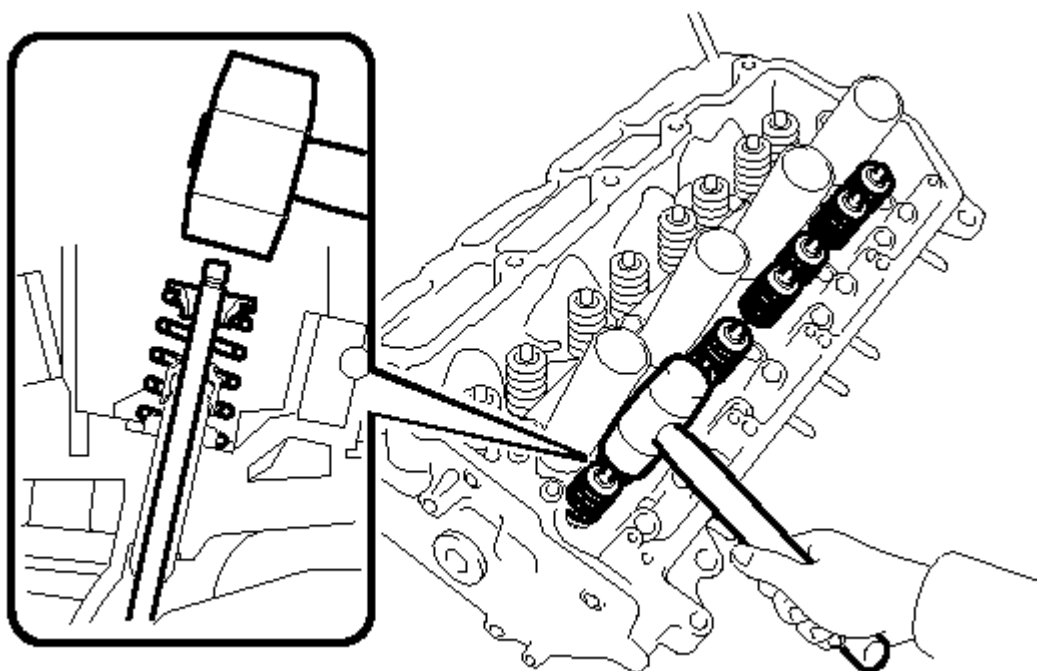
T

**Fig. 375: Compressing Compression Spring Using SST**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09202-70020  
09202-00010

d. Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.



T

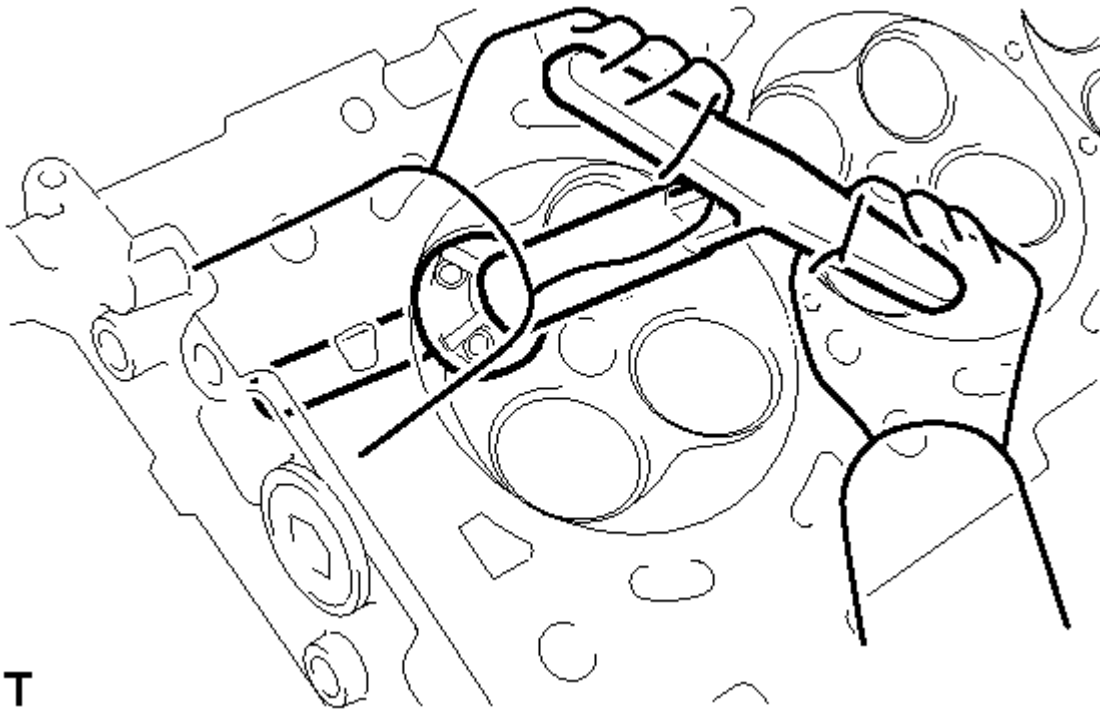
**Fig. 376: Tapping Valve Stem Tip**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to damage the retainer.**REPAIR****REPAIR****1. REPAIR INTAKE VALVE SEAT****NOTE:**

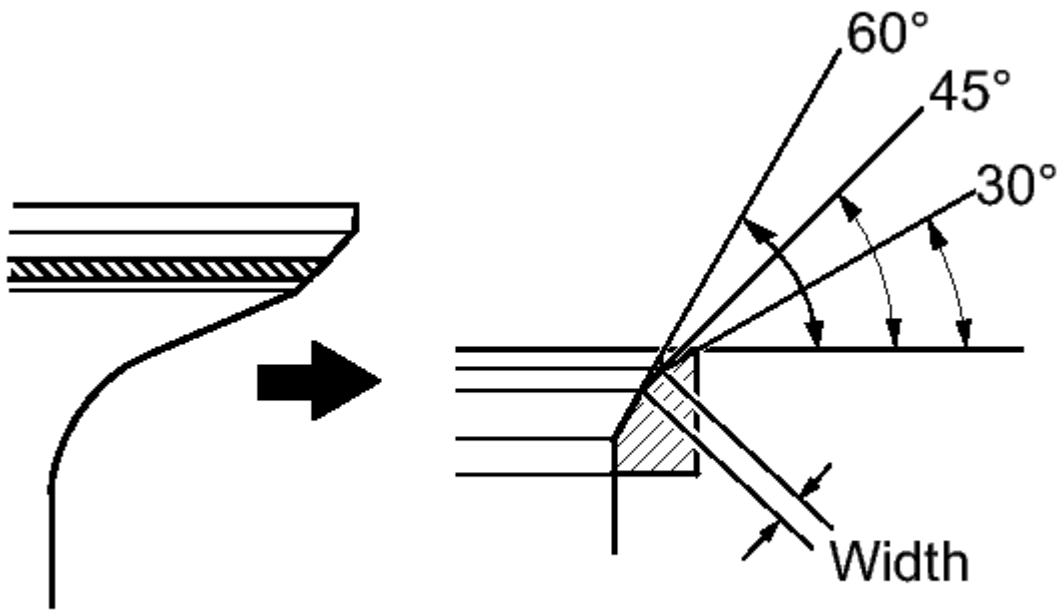
- Repair the seat while checking the seating position.
- Keep the lip free of foreign matter.
- Take off a cutter gradually to make the intake valve seat smooth.

- a. Using a 45° cutter, resurface the valve seat so that the valve seat width is more than the specification.

**T****Fig. 377: Resurfacing Valve Seat**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using 30° and 60° cutters, correct the valve seat so that the valve contacts the entire circumference of the seat. The contact should be in the center of the valve seat, and the valve seat width should be maintained within the specified range around the entire circumference of the seat.



**T**

**Fig. 378: Identifying Valve Seat Width**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard width

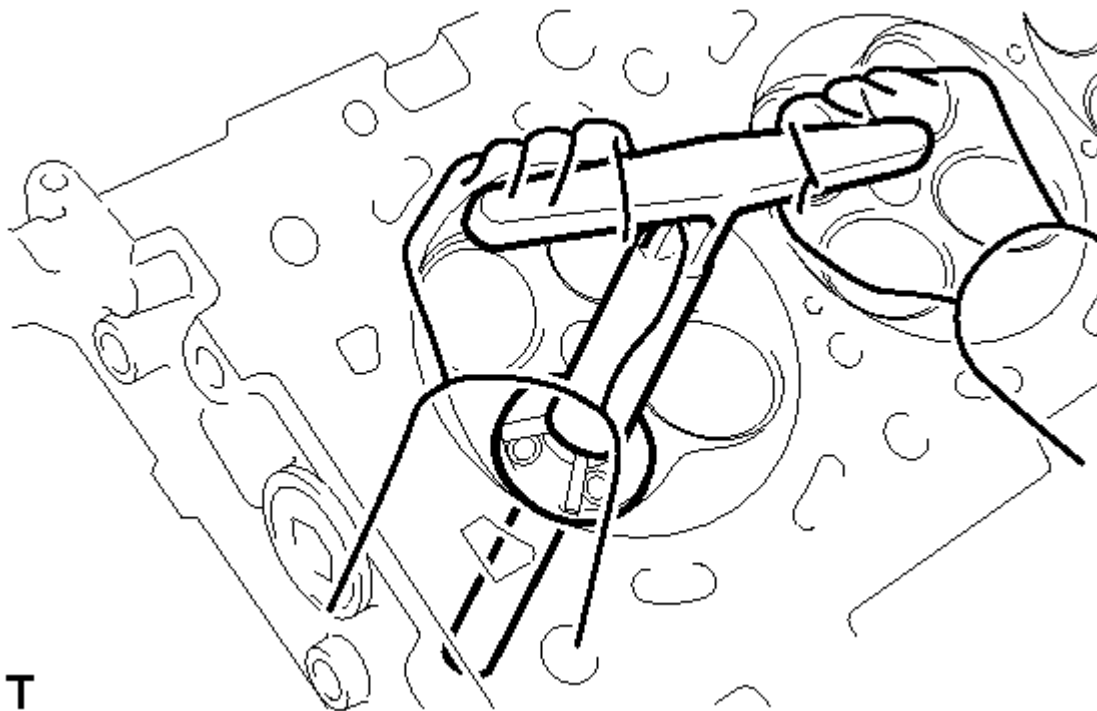
1.1 to 1.5 mm (0.0433 to 0.0591 in.)

- c. Hand-lap the valve and valve seat with an abrasive compound.
- d. Check the valve seating position.

## 2. REPAIR EXHAUST VALVE SEAT

### NOTE:

- Repair the seat while checking the seating position.
  - Keep the lip free of foreign matter.
  - Take off a cutter gradually to make the exhaust valve seat smooth.
- a. Using a 45° cutter, resurface the valve seat so that the valve seat width is more than the specification.

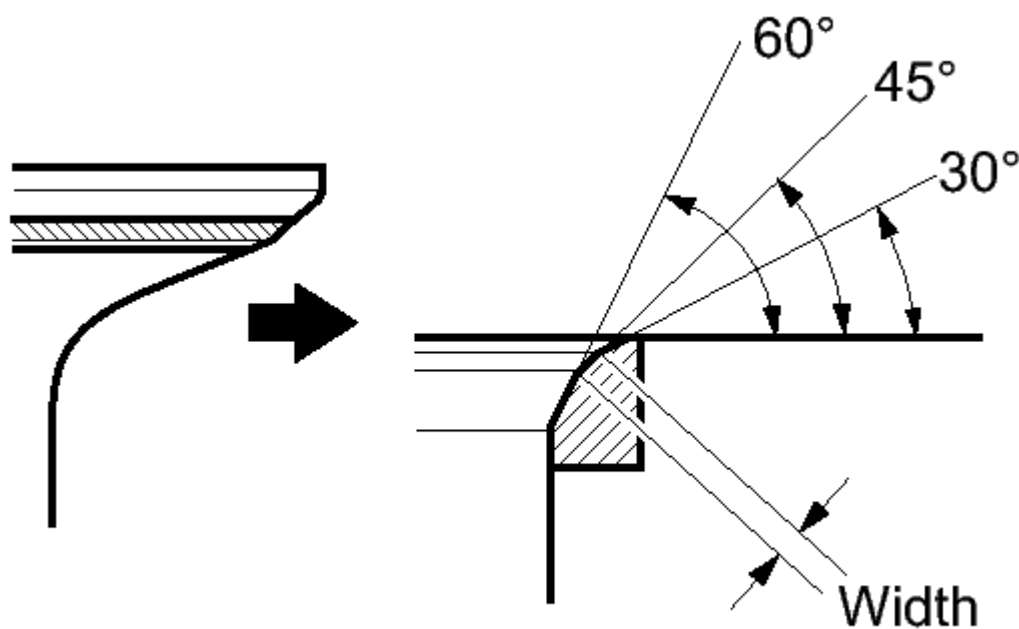


T

**Fig. 379: Resurfacing Valve Seat**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using 30° and 60° cutters, correct the valve seat so that the valve contacts the entire circumference of the seat. The contact should be in the center of the valve seat, and the valve seat width should be maintained within the specified range around the entire circumference of the seat.



T

**Fig. 380: Identifying Exhaust Valve Seat Width**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Standard width

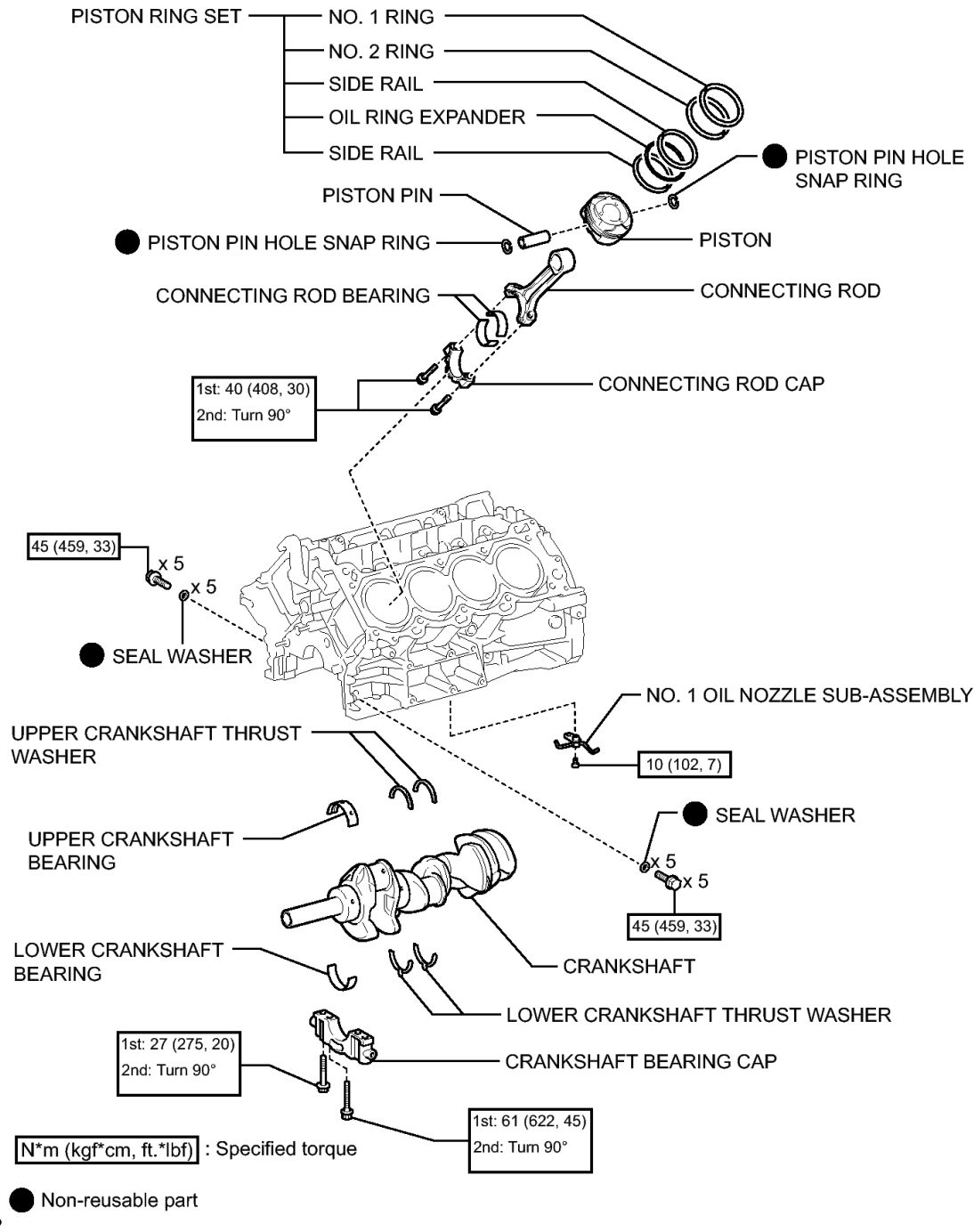
1.1 to 1.5 mm (0.0433 to 0.0591 in.)

- c. Hand-lap the valve and valve seat with an abrasive compound.
- d. Check the valve seating position.

## **CYLINDER BLOCK**

### **COMPONENTS**

### **ILLUSTRATION**



**Fig. 381: Identifying Cylinder Block Replacement Components With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

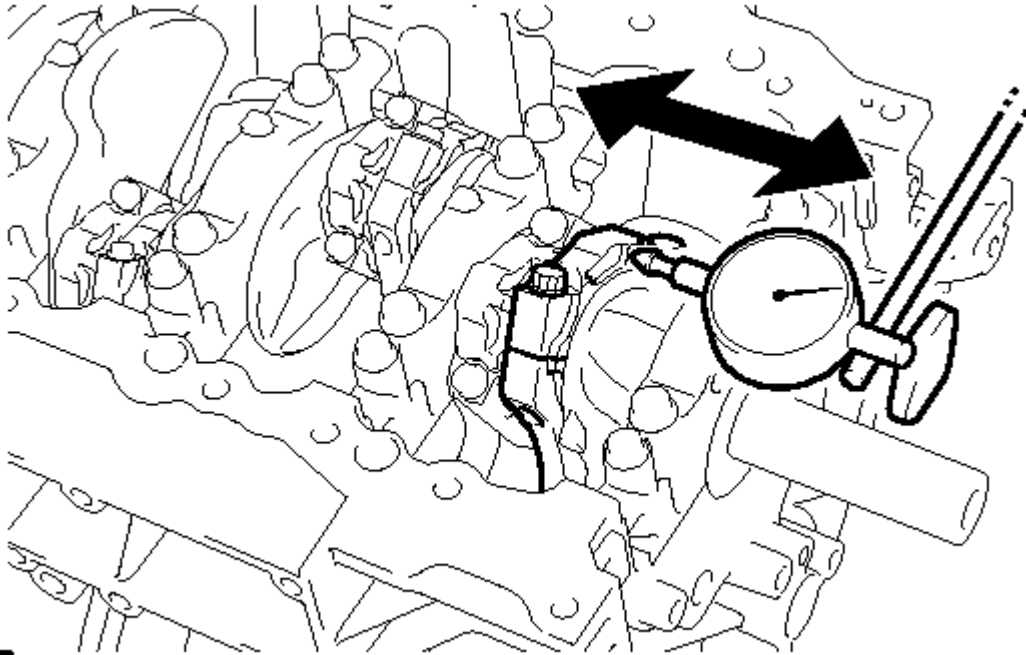
## DISASSEMBLY

### DISASSEMBLY

#### 1. INSPECT CONNECTING ROD THRUST CLEARANCE



- a. Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

**P****Fig. 382: Identifying Thrust Clearance****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Standard thrust clearance

0.15 to 0.55 mm (0.00591 to 0.0217 in.)

Maximum thrust clearance

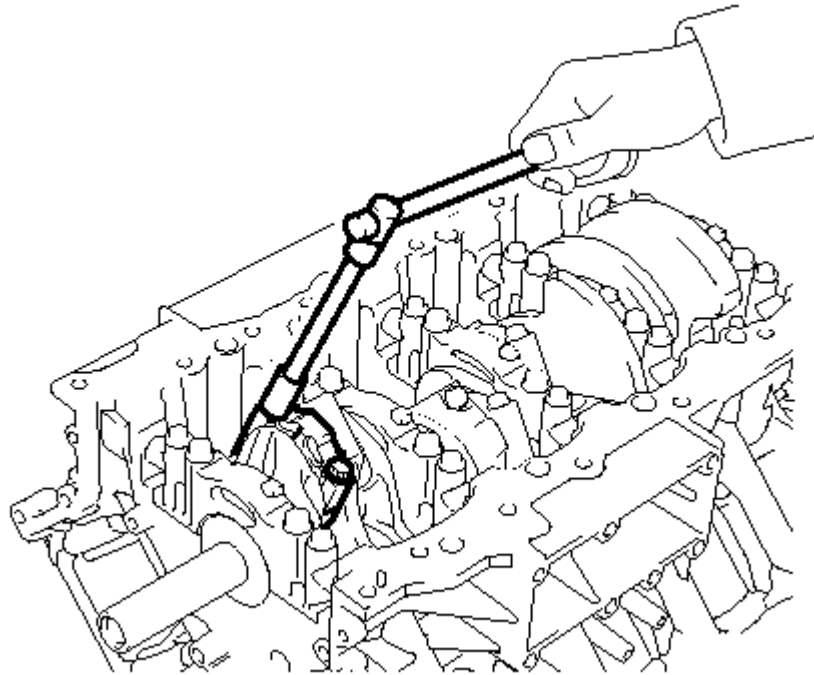
0.70 mm (0.0276 in.)

If the thrust clearance is more than the maximum, replace one or more connecting rods as necessary.

If necessary, replace the crankshaft.

## **2. INSPECT CONNECTING ROD OIL CLEARANCE**

- a. Check that the front mark on the connecting rod and cap are aligned to ensure correct reassembly.

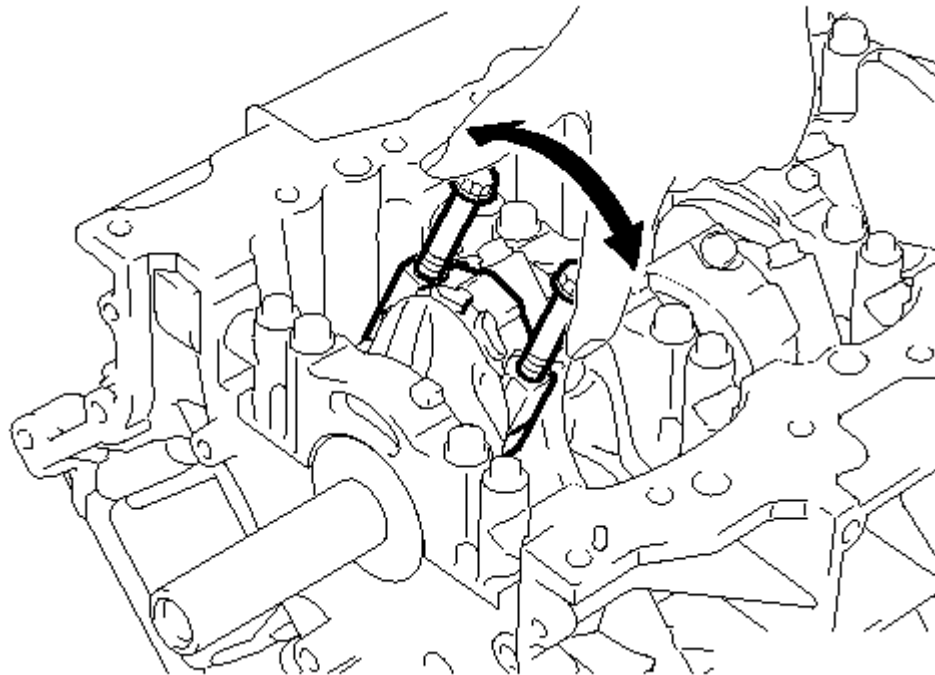


**P**

**Fig. 383: Removing Connecting Rod Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 2 connecting rod cap bolts.



**P**

**Fig. 384: Remove The Connecting Rod Cap And Lower Bearing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

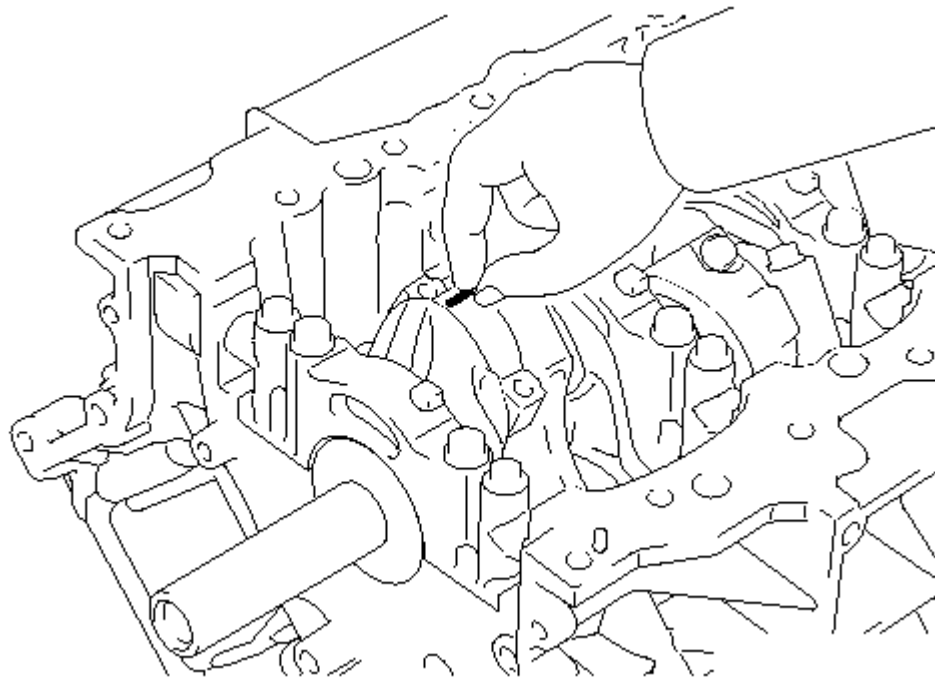
- c. Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

**HINT:**

Keep the lower bearing inserted to the connecting rod cap.

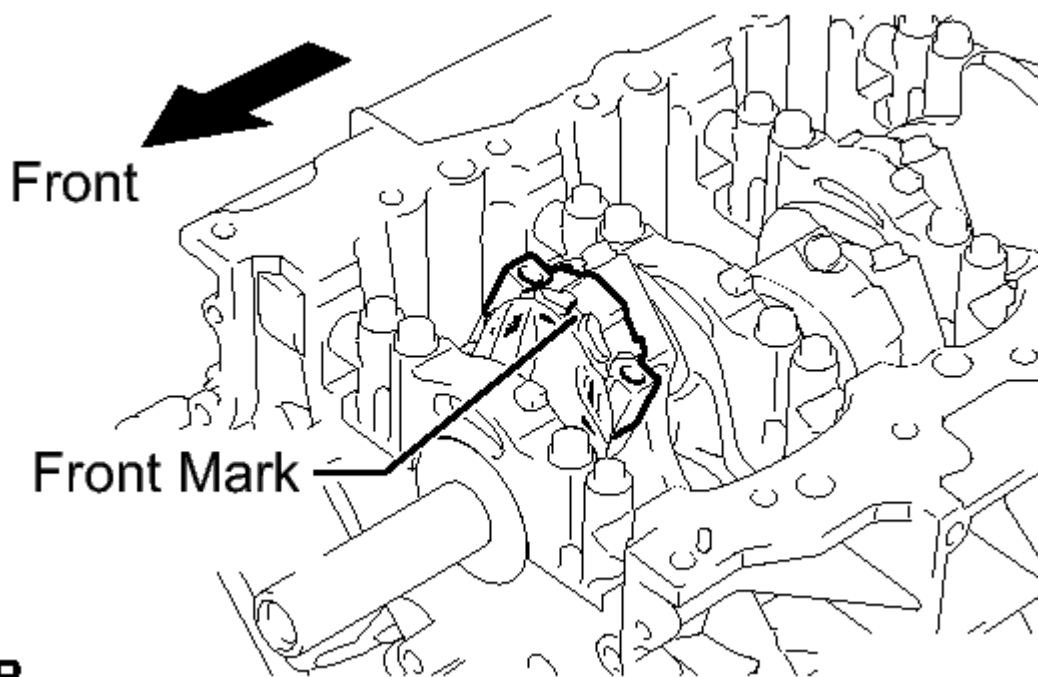
- d. Clean the crank pin and bearing.
- e. Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

**P**

**Fig. 385: Laying Strip Of Plastigage On Crank Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Lay a strip of Plastigage on the crank pin.

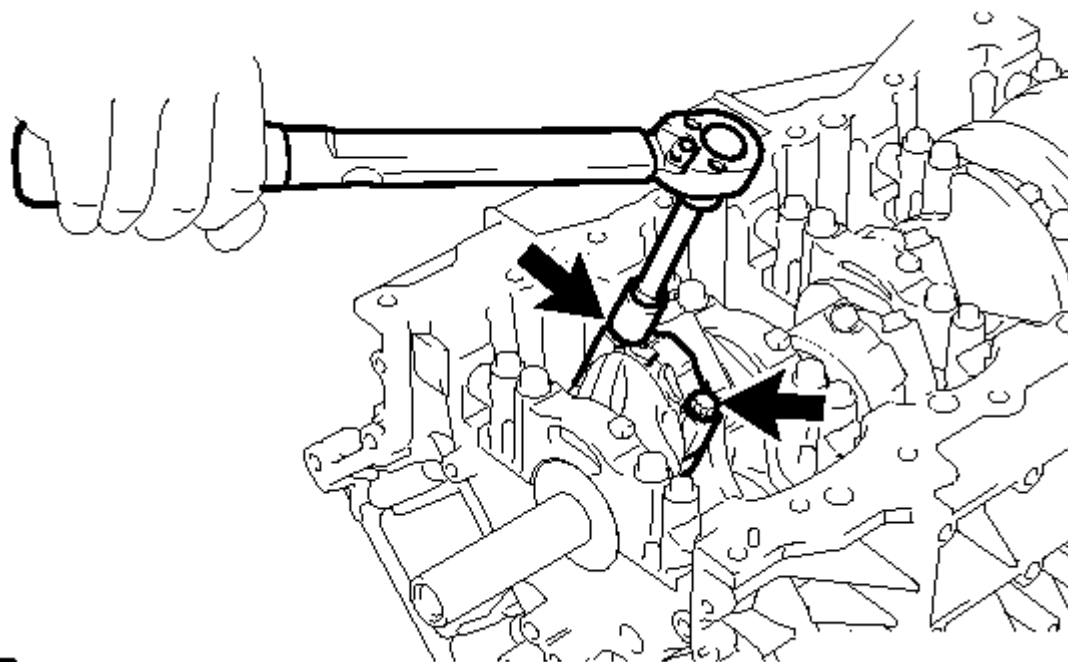


**P**

**Fig. 386: Place The Connecting Rod Cap**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Check that the front mark of the connecting rod cap is facing forward.



**P**

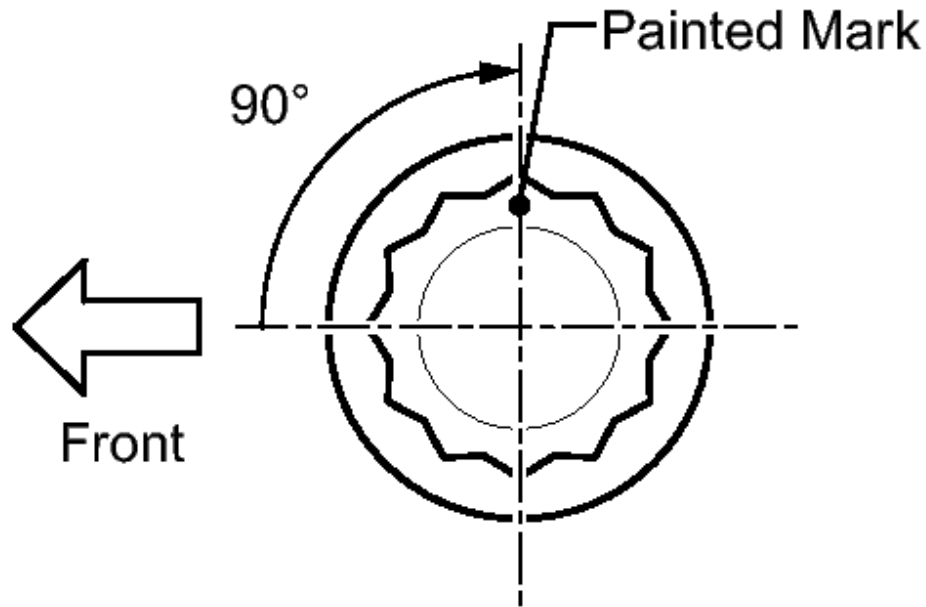
**Fig. 387: Tightening Connecting Rod Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE: Do not turn the crankshaft.**

- h. Install and alternately tighten the bolts of the connecting rod cap in several steps.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**



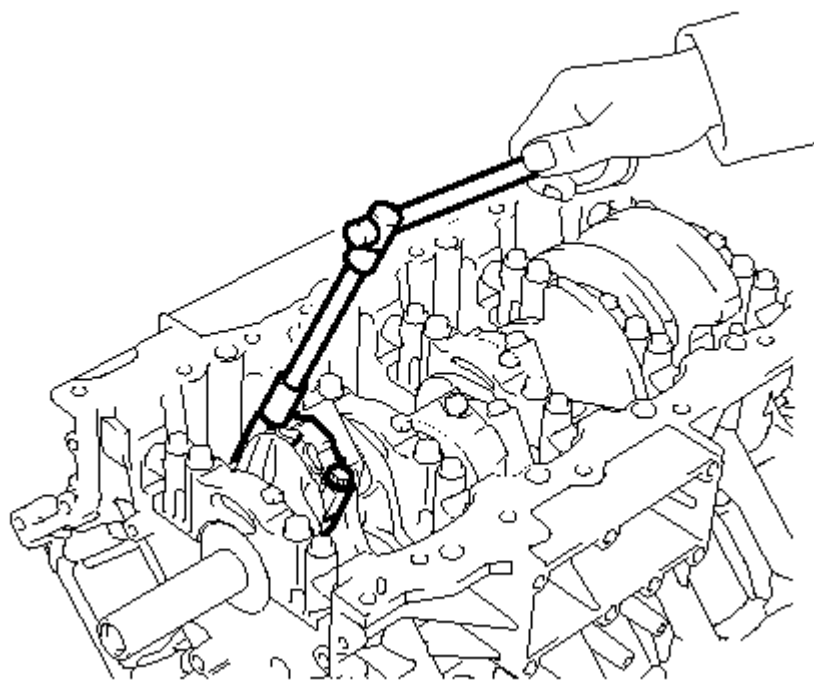
**P**

**Fig. 388: Checking Painted Mark On Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Mark the front side of each connecting rod cap bolt with paint.
- j. Tighten the cap bolts another 90° as shown in the illustration.
- k. Check that the painted marks are now at a 90° angle to the front.

**NOTE: Do not turn the crankshaft.**

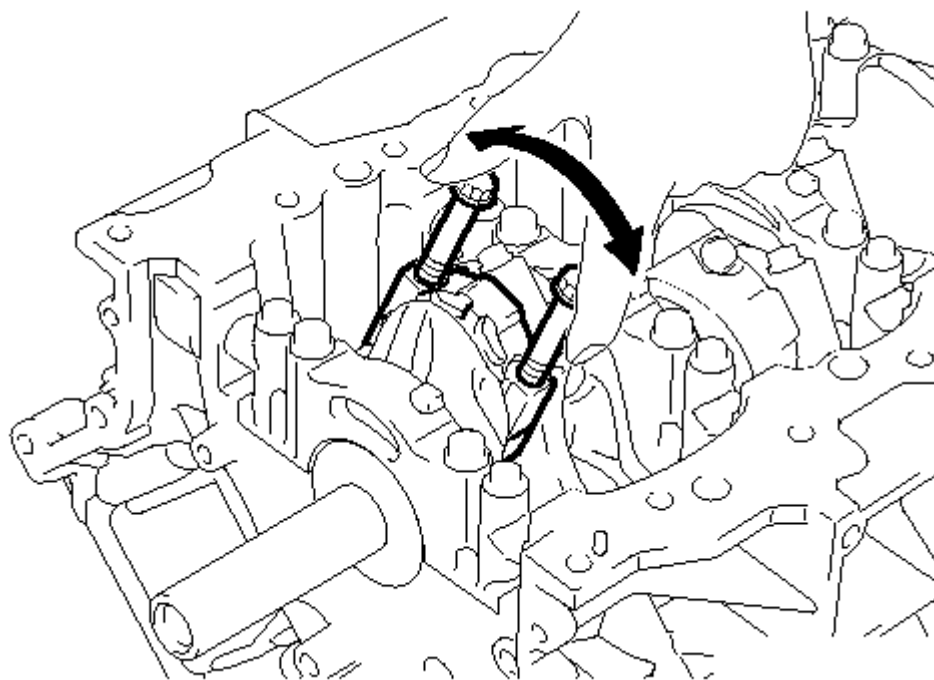


**P**

**Fig. 389: Removing Connecting Rod Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Remove the 2 connecting rod cap bolts.



**P**

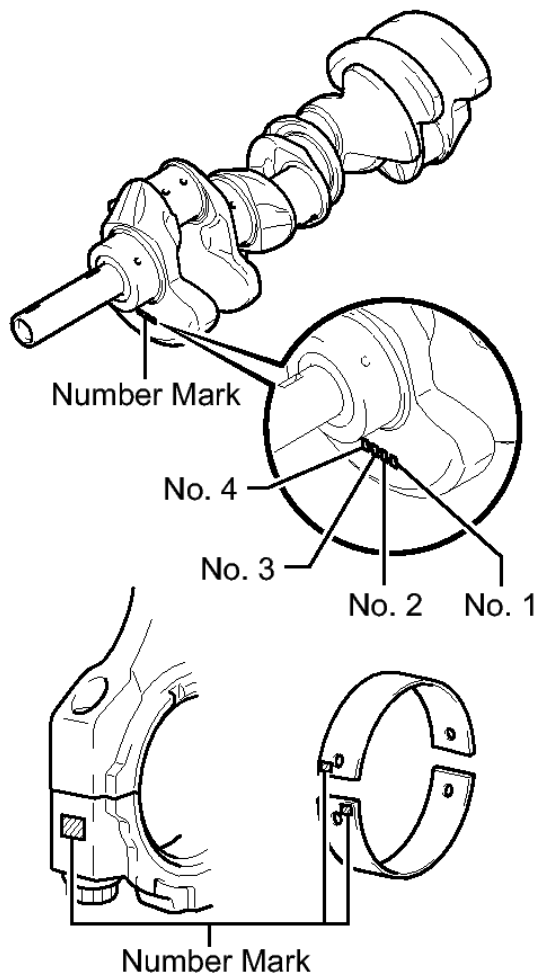
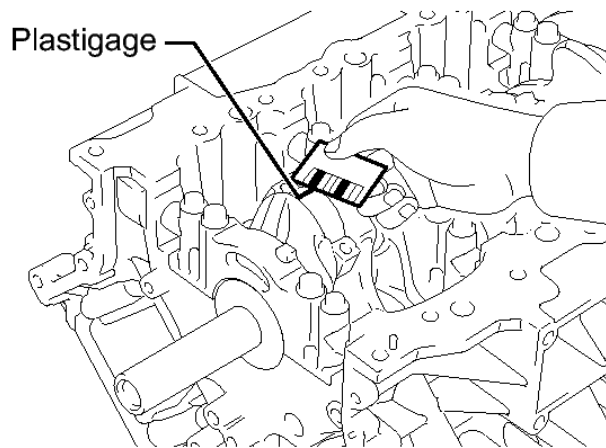
**Fig. 390: Remove The Connecting Rod Cap And Lower Bearing**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

**HINT:**

Keep the lower bearing inserted to the connecting rod cap.



P

**Fig. 391: Measure The Plastigage**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- n. Measure the Plastigage at its widest point.



Standard oil clearance

0.025 to 0.050 mm (0.000984 to 0.00197 in.)

Maximum oil clearance

0.070 mm (0.00276 in.)

If the oil clearance is more than the maximum, replace the bearings. If necessary, replace the crankshaft.

**HINT:**

- If replacing a bearing, replace it with one that has the same number as its respective connecting rod cap. Each bearing's standard thickness is indicated by a 1, 2, 3 or 4 mark on its surface.
- Select the correct bearing by adding together the number marks imprinted on the connecting rod big end and crankshaft.

Standard Bearing Chart

Item	Number Mark											
Connecting rod	1	2	1	2	3	2	3	4	3	4		
Crankshaft	1	2	1	3	2	1	3	2	1	3	2	3
Use bearing	2	3	4		5		6	7				

EXAMPLE:

Connecting rod "1" + Crankshaft "2" = 3 (Use bearing "3")

Standard Sized Bearing Center Wall Thickness

Number Mark	Specified Condition
2	1.489 to 1.492 mm (0.0586 to 0.0587 in.)
3	1.492 to 1.495 mm (0.0587 to 0.0589 in.)
	1.495 to 1.498 mm

**2012 Toyota Sequoia Limited**

## 2012 ENGINE Engine Mechanical (1UR-FE) (Service Information) - Sequoia

4	(0.0589 to 0.0590 in.)
5	1.498 to 1.501 mm (0.0590 to 0.0591 in.)
6	1.501 to 1.504 mm (0.0591 to 0.0592 in.)
7	1.504 to 1.507 mm (0.0592 to 0.0593 in.)

## Connecting Rod Big End Inside Diameter

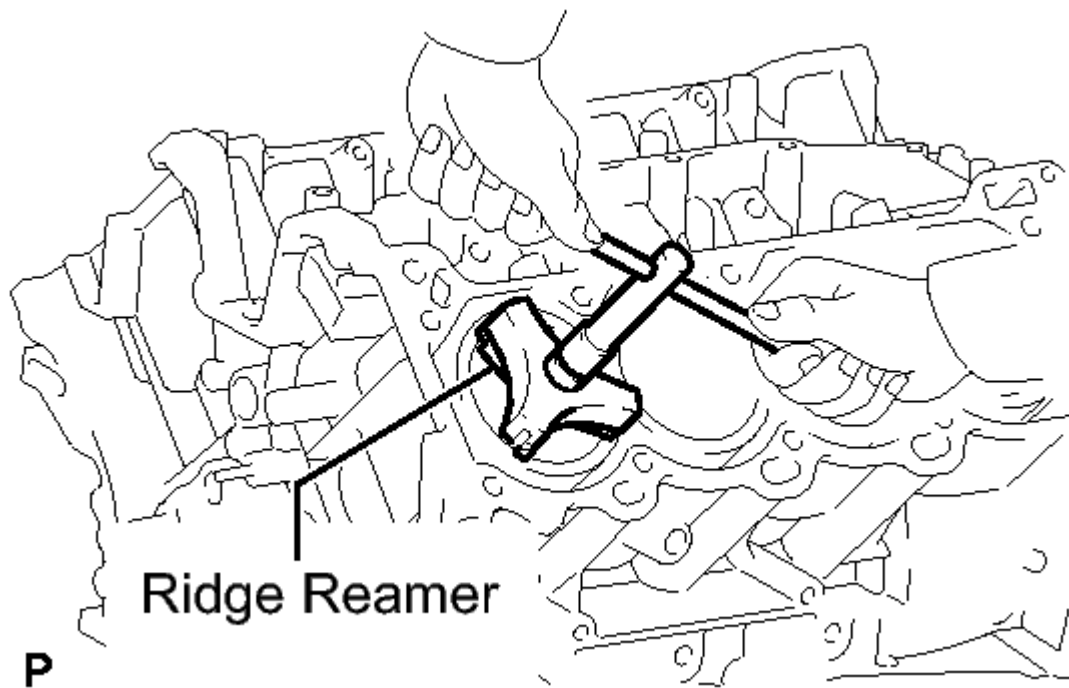
Number Mark	Specified Condition
1	56.000 to 56.006 mm (2.20472 to 2.20496 in.)
2	56.006 to 56.012 mm (2.20496 to 2.20519 in.)
3	56.012 to 56.018 mm (2.20519 to 2.20543 in.)
4	56.018 to 56.024 mm (2.20543 to 2.20566 in.)

in.)

## Crankshaft Pin Diameter

Number Mark	Specified Condition
1	52.994 to 53.000 mm (2.08637 to 2.08661 in.)
2	52.988 to 52.994 mm (2.08614 to 2.08637 in.)
3	52.982 to 52.988 mm (2.08590 to 2.08614 in.)

- o. Completely remove the Plastigage.
  - p. Perform the inspection above for each cylinder.
3. **REMOVE PISTON AND CONNECTING ROD**
- a. Using a ridge reamer, remove all the carbon from the top of the cylinder.



**Fig. 392: Removing Piston And Connecting Rod**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 16 cap bolts, 8 connecting rod caps and 8 lower bearings.
- c. Push the 8 pistons and 8 connecting rods through the top of the cylinder block.

**HINT:**

Arrange the piston and connecting rod in the correct order.

**4. REMOVE CONNECTING ROD BEARING**

- a. Remove the connecting rod bearings from the connecting rods and connecting rod caps.

**HINT:**

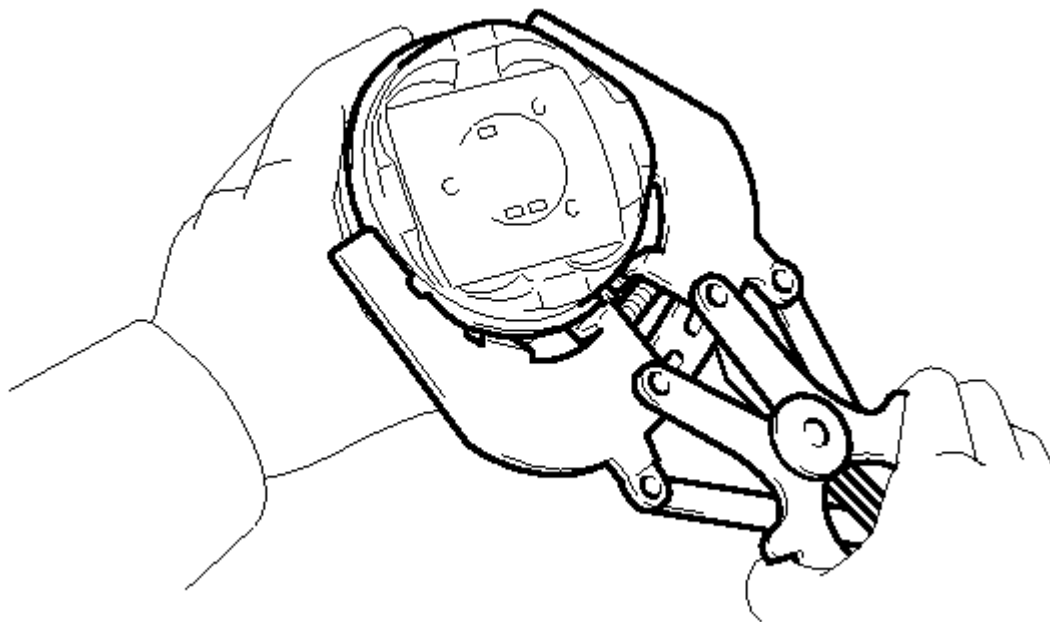
Arrange the removed parts in the correct order.

**5. REMOVE PISTON RING SET**

**HINT:**

Arrange the piston rings in the correct order.

- a. Using a piston ring expander, remove the 2 compression rings.



**P**

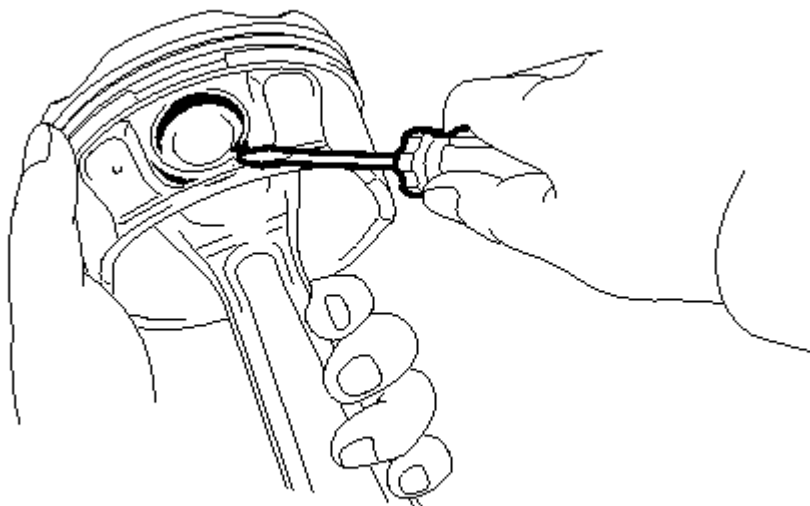
**Fig. 393: Remove The 2 Compression Rings**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 2 side rails and oil ring expander by hand.

**6. REMOVE PISTON WITH PIN SUB-ASSEMBLY**

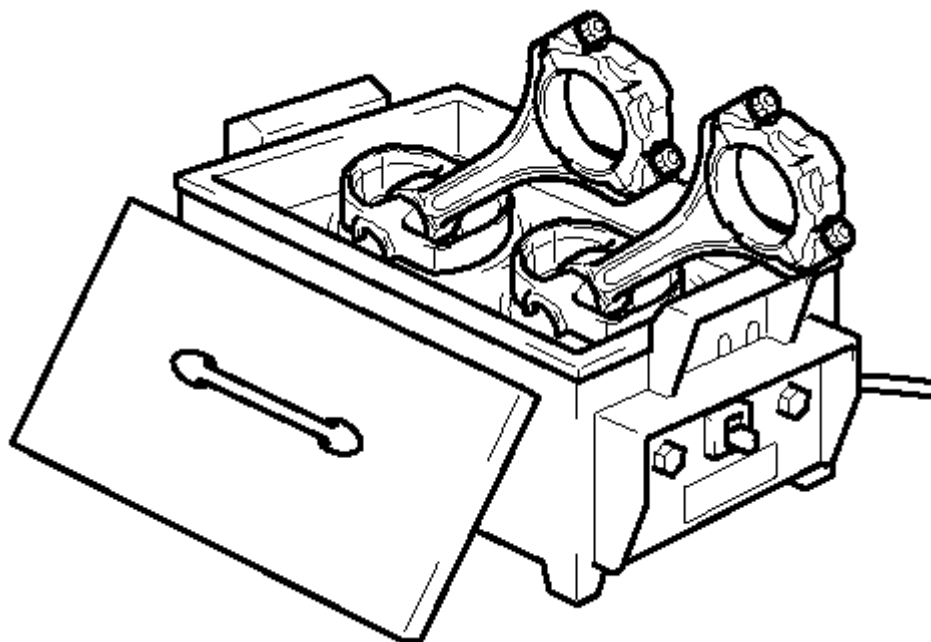
- a. Disconnect the connecting rod from the piston.
  - 1. Using a small screwdriver, pry off the 2 snap rings from the piston.



**P**

**Fig. 394: Pry Off The 2 Snap Rings From The Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

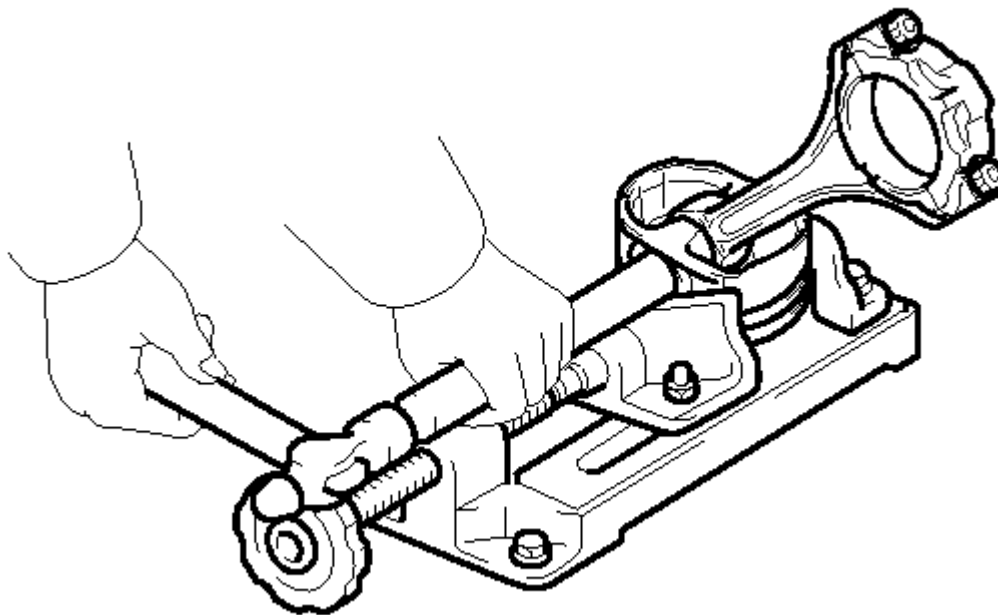
2. Gradually heat the piston to approximately 80°C (176°F).



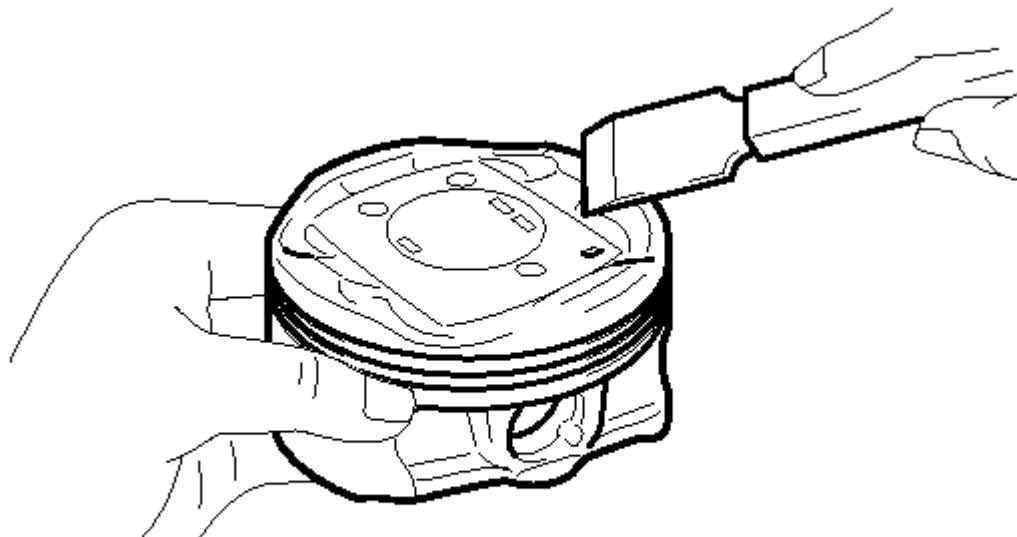
**P**

**Fig. 395: Heat The Piston To Approximately 80 Degrees C (176 Degrees F).**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Using a brass bar and plastic-faced hammer, lightly tap out the piston pin. Then remove the connecting rod.

**P****Fig. 396: Tapping Out Piston Pin****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****HINT:**

- The piston and pin are a matched set.
  - Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.
- b. Clean the piston.
    1. Using a gasket scraper, remove the carbon from the piston top.

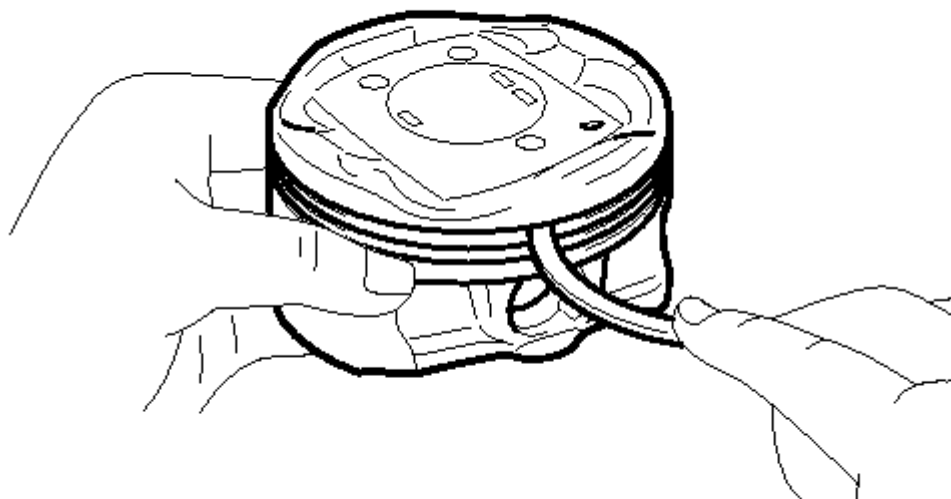


**P**

**Fig. 397: Cleaning Carbon From Piston Top**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.



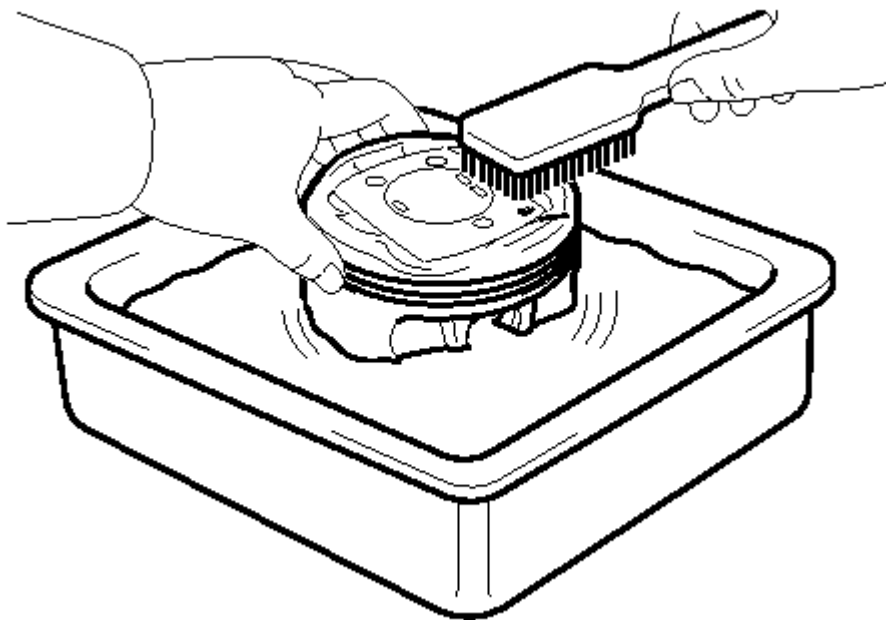
**P**

**Fig. 398: Cleaning Piston Ring Grooves**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



3. Using solvent and a brush, thoroughly clean the piston.



**P**

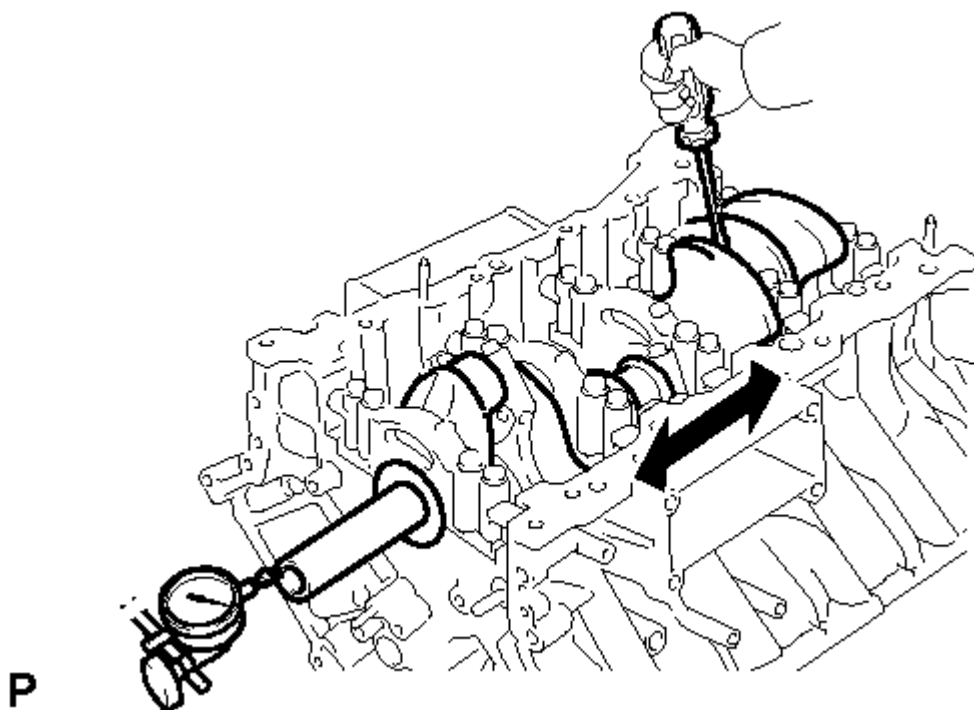
**Fig. 399: Cleaning Piston**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE: Do not use a wire brush.**

## **7. INSPECT CRANKSHAFT THRUST CLEARANCE**

- a. Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.



**Fig. 400: Measuring Thrust Clearance**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.020 to 0.220 mm (0.000787 to 0.00866 in.)

Maximum thrust clearance

0.30 mm (0.0118 in.)

If the thrust clearance is more than the maximum, replace the thrust washers as a set.

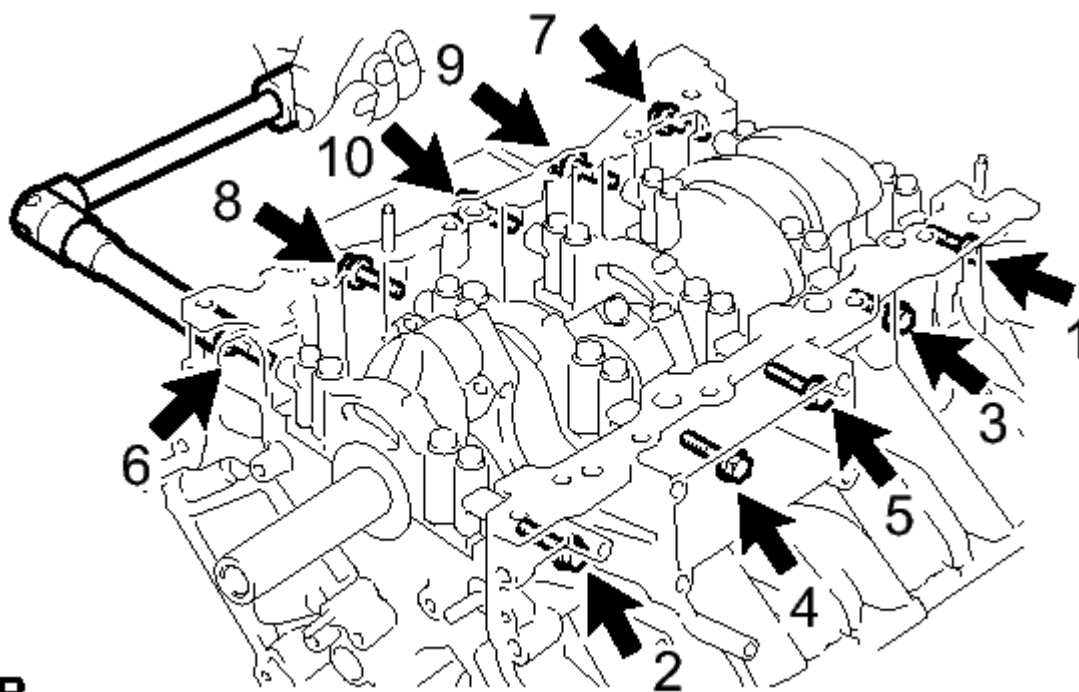
Standard thrust washer thickness

2.44 to 2.49 mm (0.0961 to 0.0980 in.)

If necessary, replace the crankshaft.

## 8. REMOVE CRANKSHAFT

- a. Uniformly loosen and remove the 10 bearing cap bolts and 10 seal washers in several steps, in the sequence shown in the illustration.

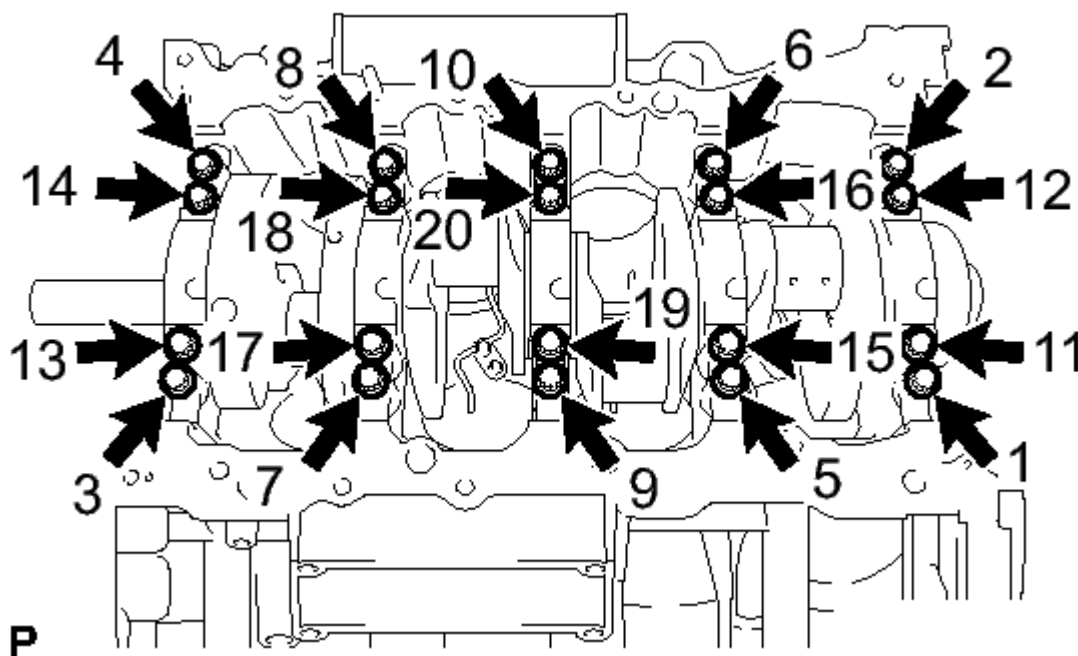


P

**Fig. 401: Removing Bearing Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Uniformly loosen and remove the 20 bearing cap bolts in several steps, in the sequence shown in the illustration.

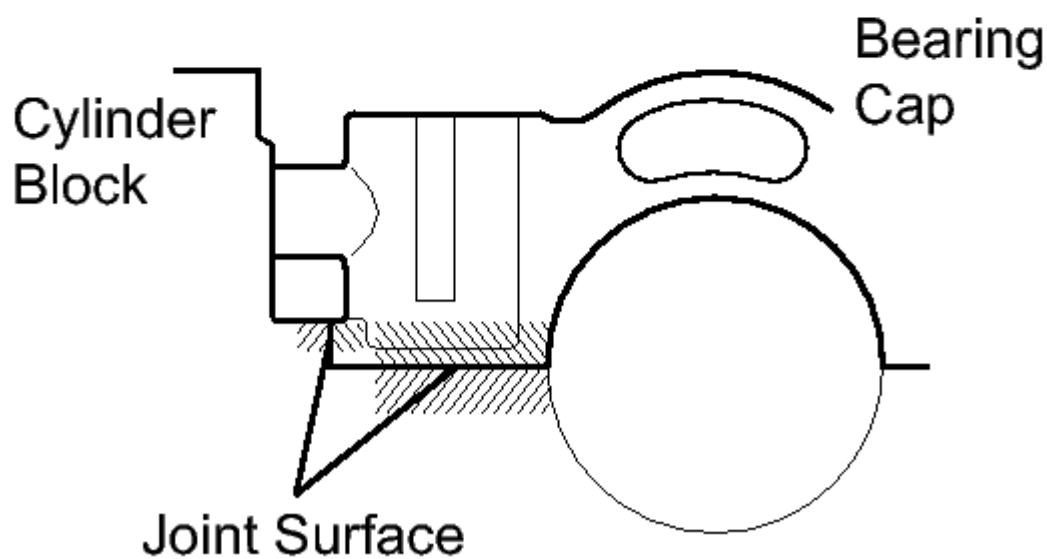
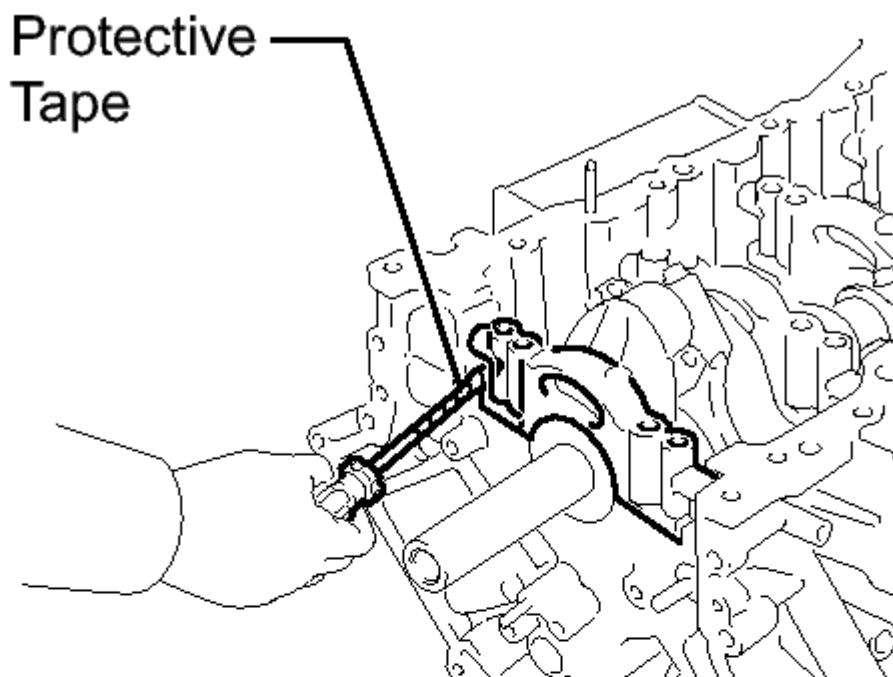


P

**Fig. 402: Identifying Bearing Cap Bolts Loosening Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a screwdriver, slightly pry up the 5 main bearing caps.



**P**

**Fig. 403: Prying Up Main Bearing Caps**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

- Tape the screwdriver tip before use.
- Keep the lower bearing and crankshaft bearing cap together.

**NOTE:**

- **Be careful not to damage the joint surface of the cylinder block and main bearing caps.**
  - **Pry up the left and right side of the cap little by little.**
- d. Using 2 inside position main bearing cap bolts, loosen each main bearing cap by moving it forward and backward, and remove the 5 main bearing caps and 2 lower thrust washers (No. 3 crankshaft bearing cap only).

**HINT:**

Arrange the removed parts in the correct order.

- e. Remove the crankshaft.

**9. REMOVE CRANKSHAFT BEARING**

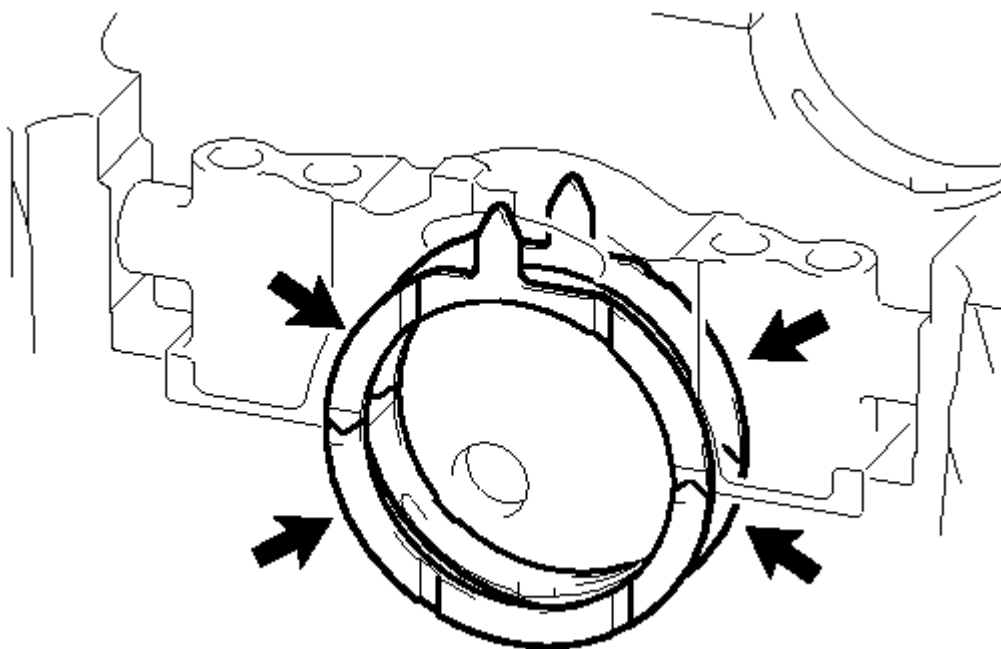
- a. Remove the crankshaft bearings from the bearing caps and cylinder block.

**HINT:**

Arrange the removed parts in the correct order.

**10. REMOVE CRANKSHAFT THRUST WASHER SET**

- a. Remove the thrust washer set from the cylinder block and No. 3 bearing cap.

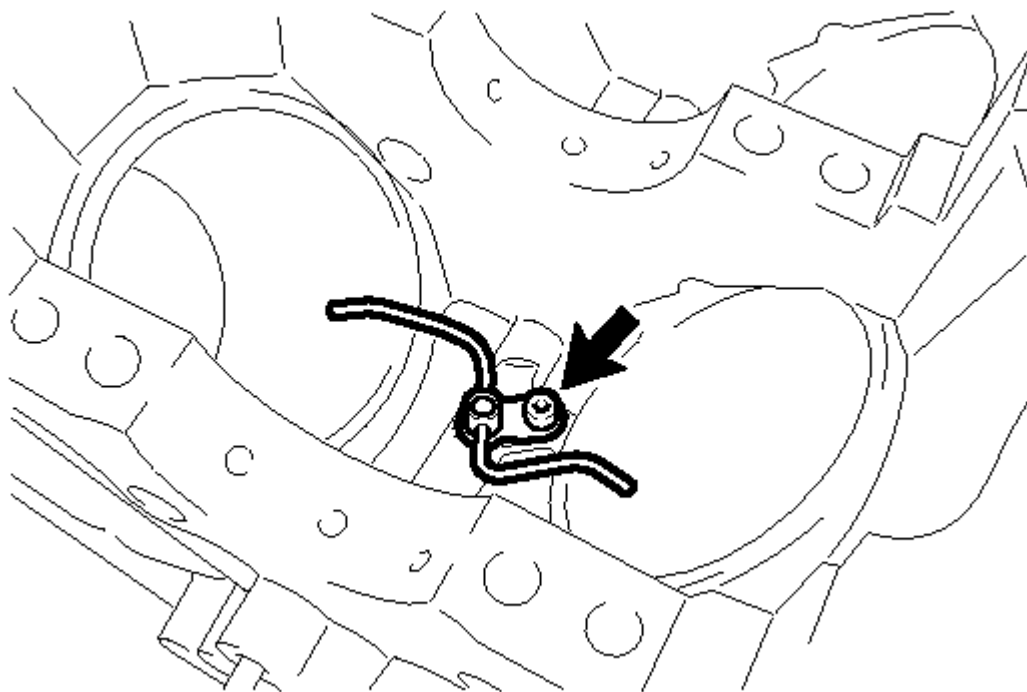


**P**

**Fig. 404: Locating Crankshaft Thrust Washer Set**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**11. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY**

- a. Using a 5 mm hexagon wrench, remove the 4 bolts and 4 oil nozzles.



**P**

**Fig. 405: Locating No. 1 Oil Nozzle Sub-Assembly**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

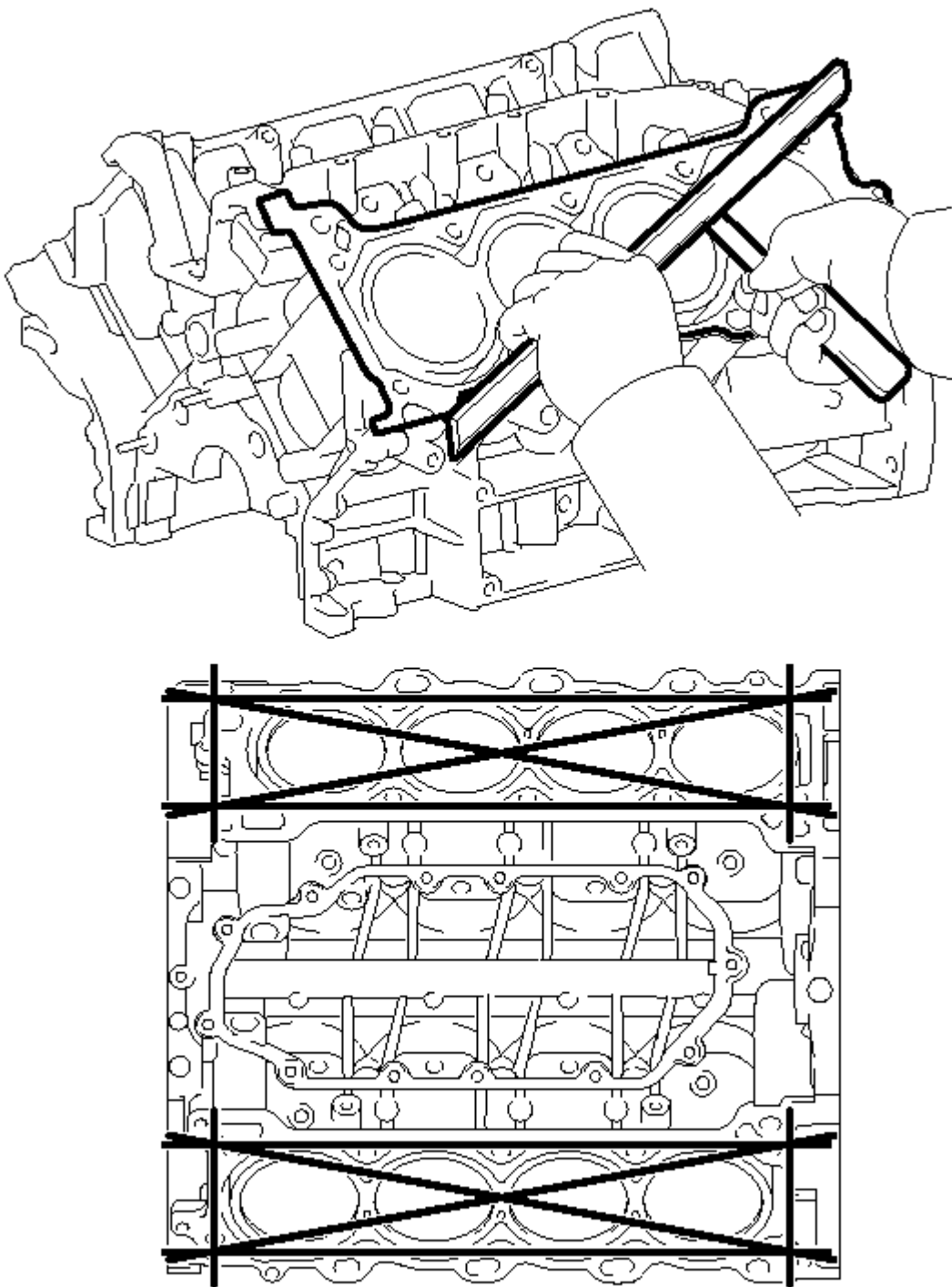
**12. REMOVE STUD BOLT**

**NOTE:** If the stud bolt is deformed or its threads are damaged, replace it.

**INSPECTION**

**INSPECTION**

**1. INSPECT CYLINDER BLOCK FOR WARPAGE**

**P**

**Fig. 406: Measuring Warpage Of Contact Surfaces Of Cylinder Head Gaskets**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

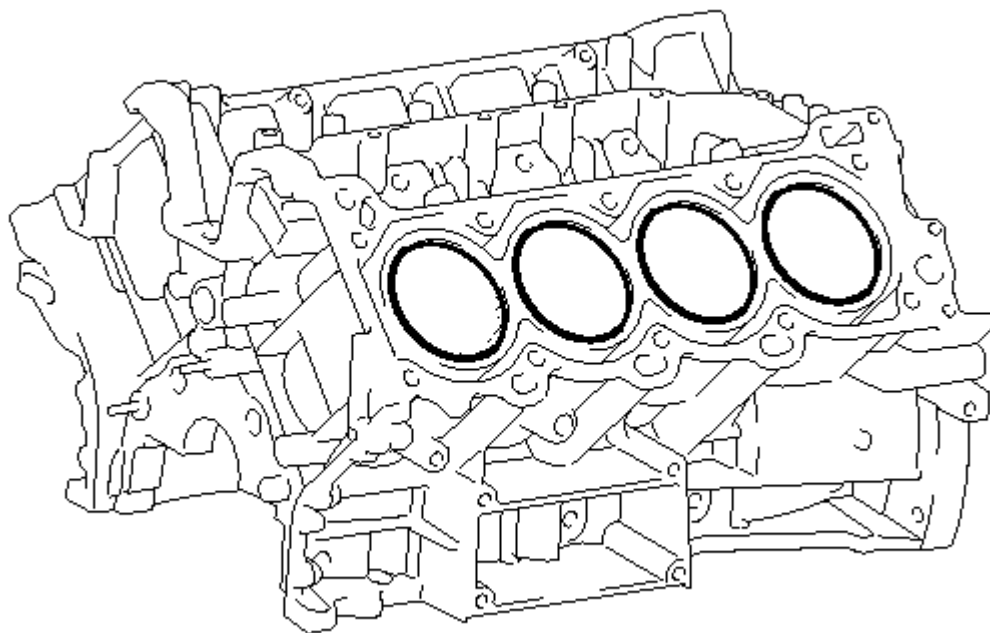
- a. Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces of the cylinder head gaskets.



Maximum warpage

0.07 mm (0.00276 in.)

If the warpage is more than the maximum, replace the cylinder block.



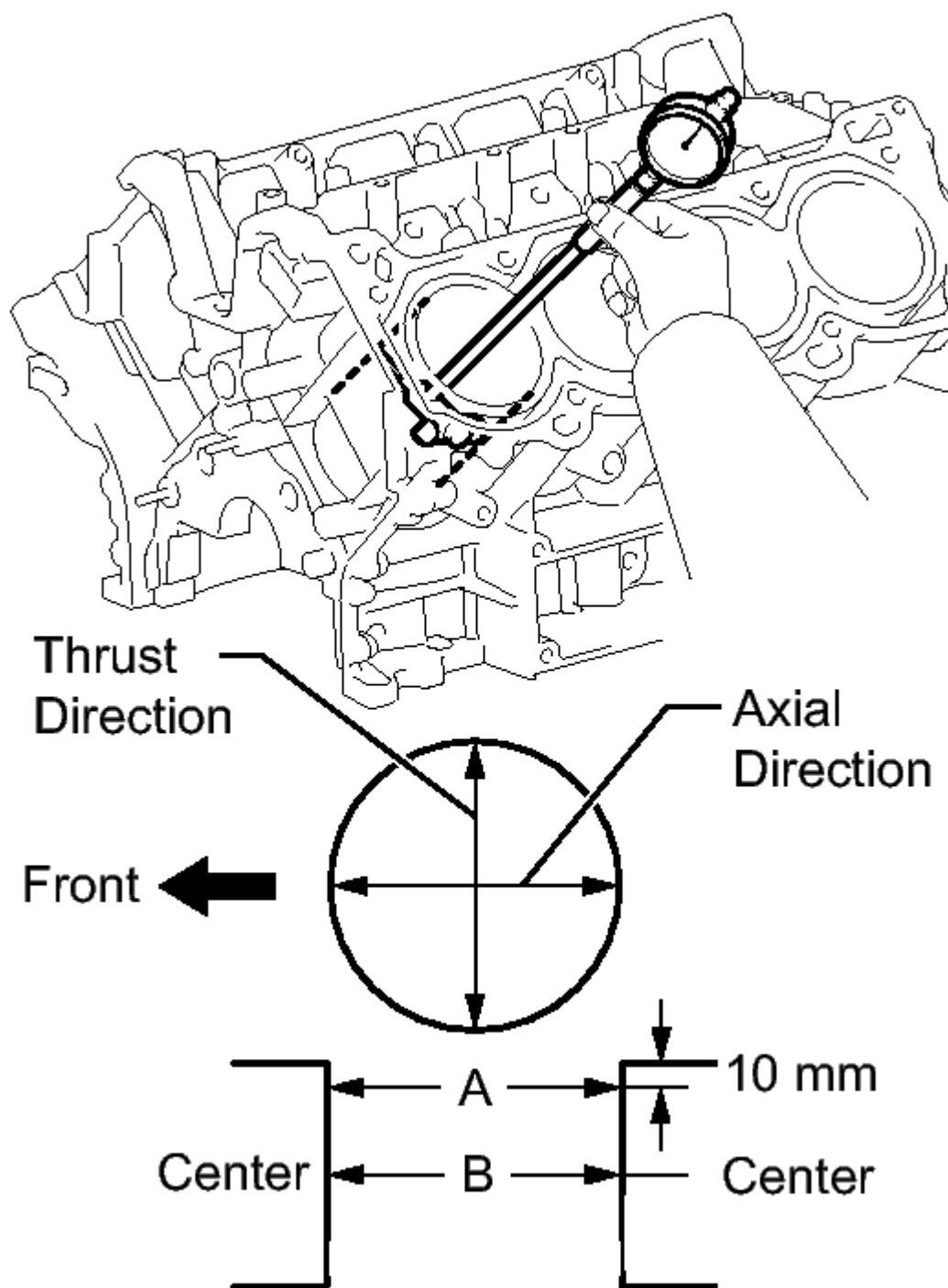
**P**

**Fig. 407: Identifying Cylinder Block**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Visually check the cylinder for vertical scratches. If deep scratches are present, rebore all 8 cylinders. If necessary, replace the cylinder block.

## **2. INSPECT CYLINDER BORE**

**P****Fig. 408: Measuring Cylinder Bore Diameter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

Standard diameter

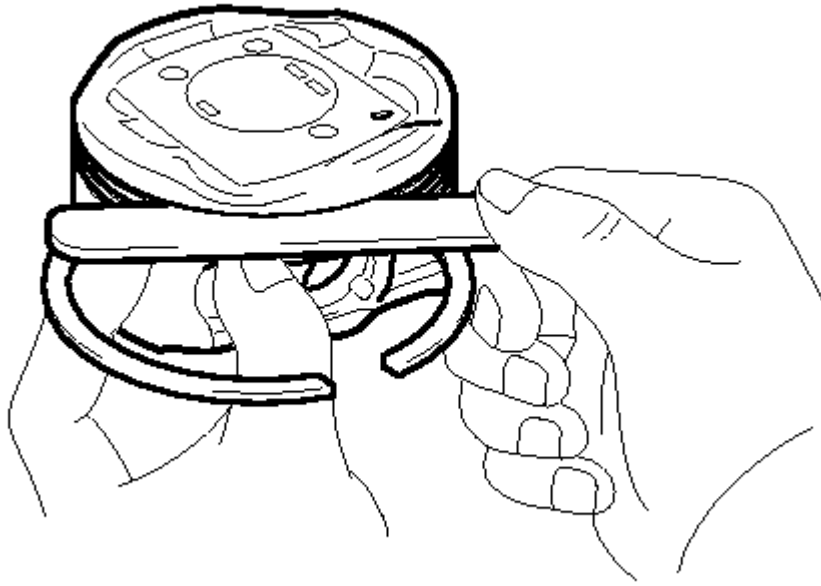
94.000 to 94.012 mm (3.700 to 3.701 in.)

Maximum diameter

94.200 mm (3.709 in.)

If the diameter is more than the maximum, replace the cylinder block.

### 3. INSPECT RING GROOVE CLEARANCE



**P**

**Fig. 409: Measure The Clearance Between A New Piston Ring And The Wall Of The Ring Groove**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a feeler gauge, measure the clearance between a new piston ring and the wall of the ring groove.

Standard Ring Groove Clearance

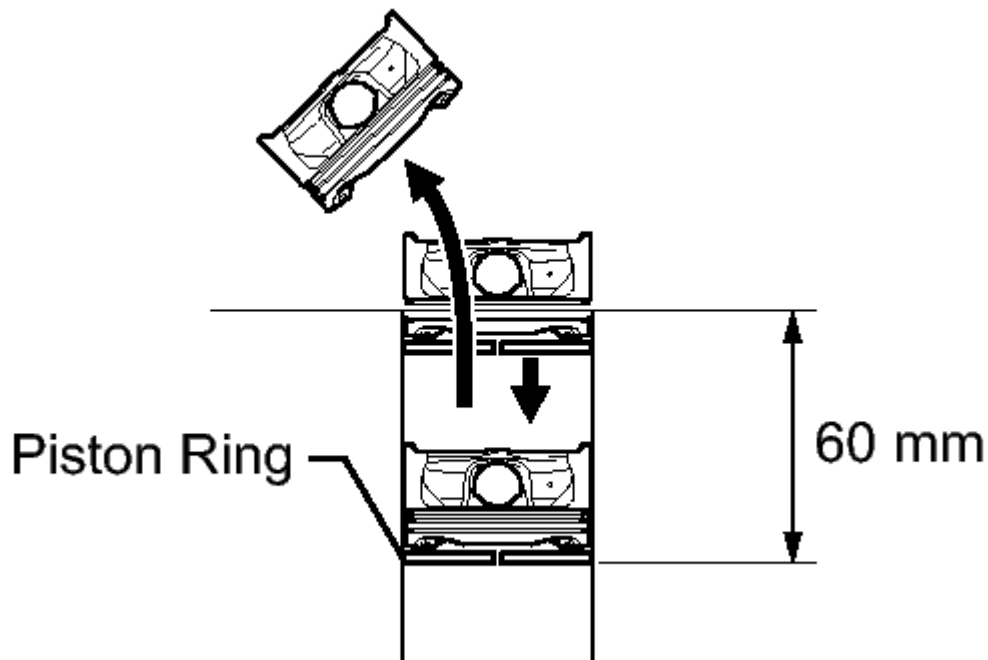
Item	Specified Condition
No. 1	0.020 to 0.070 mm (0.000787 to 0.00276)

	in.)
No. 2	0.020 to 0.060 mm (0.000787 to 0.00236 in.)
Oil	0.070 to 0.145 mm (0.00276 to 0.00571 in.)

If the clearance is not as specified, replace the piston.

#### 4. INSPECT PISTON RING END GAP

- Insert the piston ring into the cylinder bore.

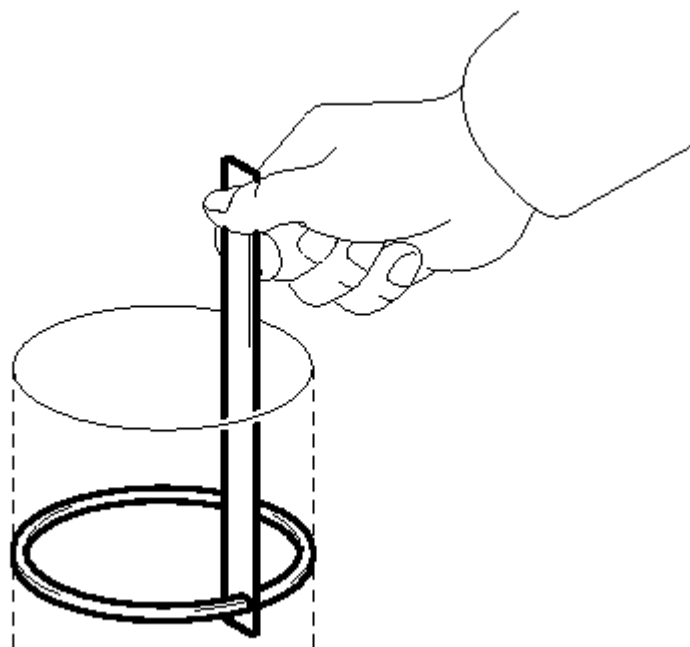


**P**

**Fig. 410: Identifying Piston Ring & Piston**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a piston, push the piston ring a little beyond the bottom of the ring travel, 60 mm (2.36 in.) from the top of the cylinder block.

**P****Fig. 411: Measuring End Gap****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- c. Using a feeler gauge, measure the end gap.

Standard End Gap

Item	Specified Condition
No. 1	0.23 to 0.33 mm (0.00906 to 0.0130 in.)
No. 2	0.40 to 0.50 mm (0.0157 to 0.0197 in.)
Oil	0.10 to 0.40 mm (0.00394 to 0.0157 in.)

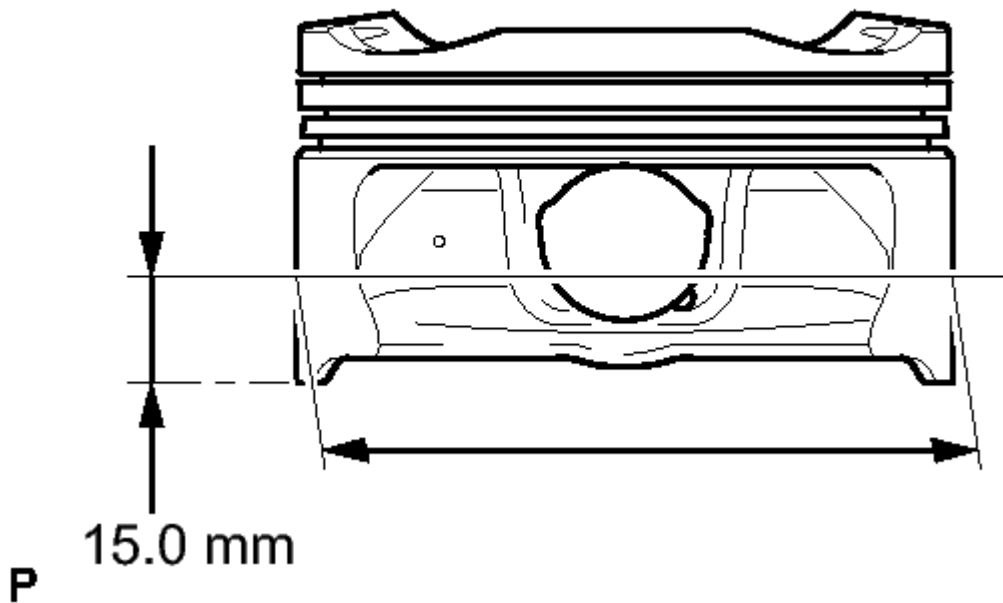
Maximum End Gap



Item	Specified Condition
No. 1	0.42 mm (0.0165 in.)
No. 2	0.55 mm (0.0217 in.)
Oil	0.45 mm (0.0177 in.)

If the end gap is more than the maximum, replace the piston ring. If the end gap is greater than the maximum even with a new piston ring, replace the cylinder block.

#### 5. INSPECT PISTON SUB-ASSEMBLY WITH PIN



**Fig. 412: Identifying Piston Diameter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a micrometer, measure the piston diameter at a position that is 15.0 mm (0.591 in.) from the bottom of the piston (refer to the illustration).

Standard diameter

93.980 to 93.990 mm (3.7000 to 3.7004 in.)

Minimum diameter

93.815 mm (3.6935 in.)

If the diameter is less than the minimum, replace the piston.

## **6. INSPECT PISTON OIL CLEARANCE**

- a. Measure the cylinder bore diameter in the thrust direction.
- b. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance

0.010 to 0.032 mm (0.000394 to 0.001260 in.)

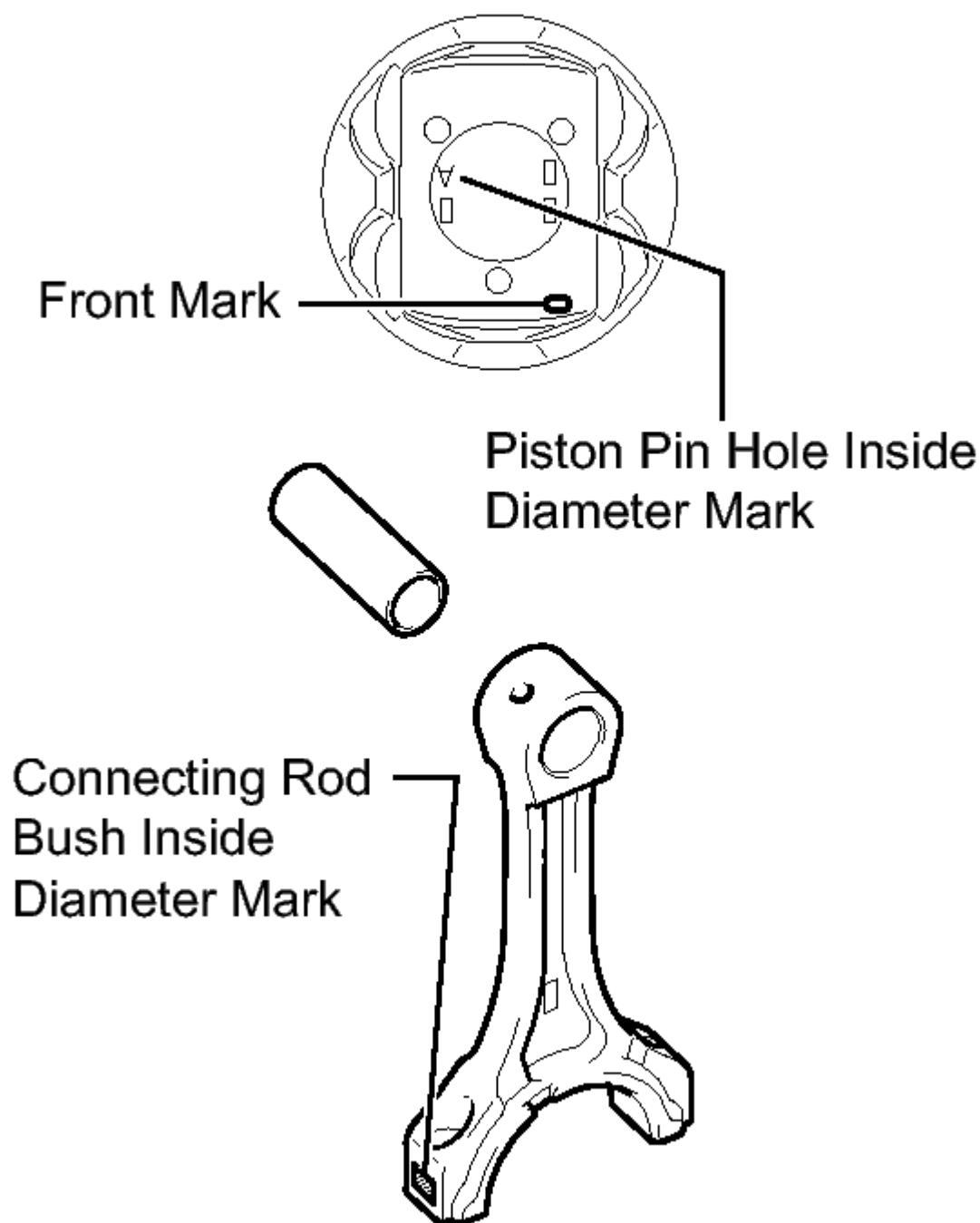
Maximum oil clearance

0.385 mm (0.0152 in.)

If the oil clearance is more than the maximum, replace all the pistons. If necessary, replace the cylinder block.

## **7. INSPECT PISTON PIN OIL CLEARANCE**

- a. Check each mark on the piston, piston pin and connecting rod.

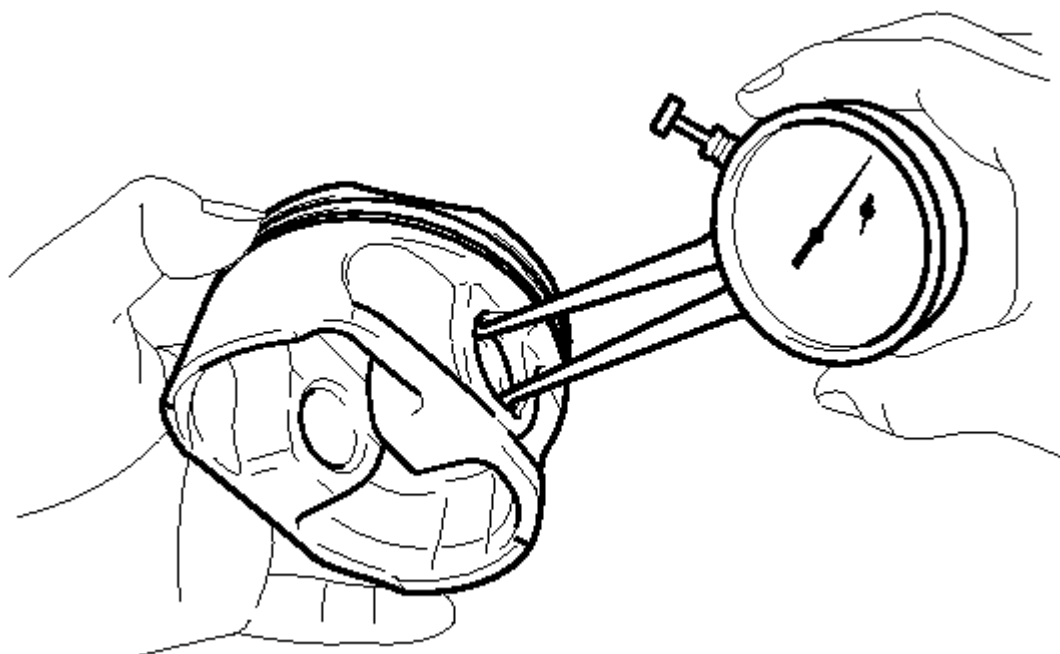


**P**

**Fig. 413: Identifying Piston, Piston Pin & Connecting Rod**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a caliper gauge, measure the inside diameter of the piston pin hole.



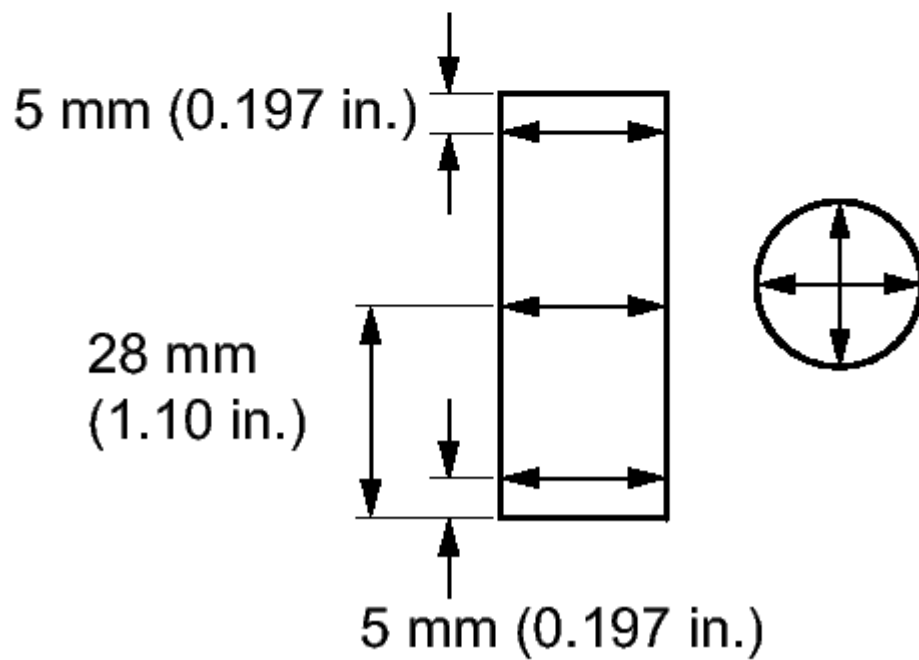
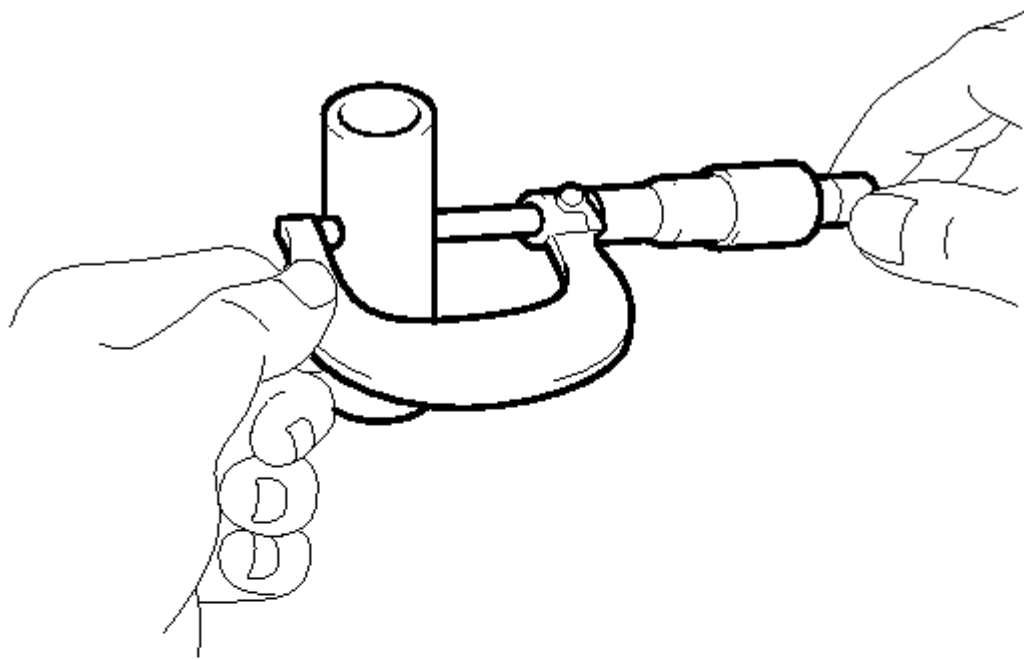
**P**

**Fig. 414: Measuring Inside Diameter Of Piston Pin Hole**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Piston Pin Hole Inside Diameter

Mark	Specified Condition
A	21.998 to 22.001 mm (0.86606 to 0.86618 in.)
B	22.001 to 22.004 mm (0.86618 to 0.86630 in.)
C	22.004 to 22.007 mm (0.86630 to 0.86642 in.)

- c. Using a micrometer, measure the piston pin diameter.



**P**

**Fig. 415: Measuring Piston Pin Diameter**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Piston Pin Diameter



Mark	Specified Condition
A	21.998 to 22.001 mm (0.86606 to 0.86618 in.)
B	22.001 to 22.004 mm (0.86618 to 0.86630 in.)
C	22.004 to 22.007 mm (0.86630 to 0.86642 in.)

- d. Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance

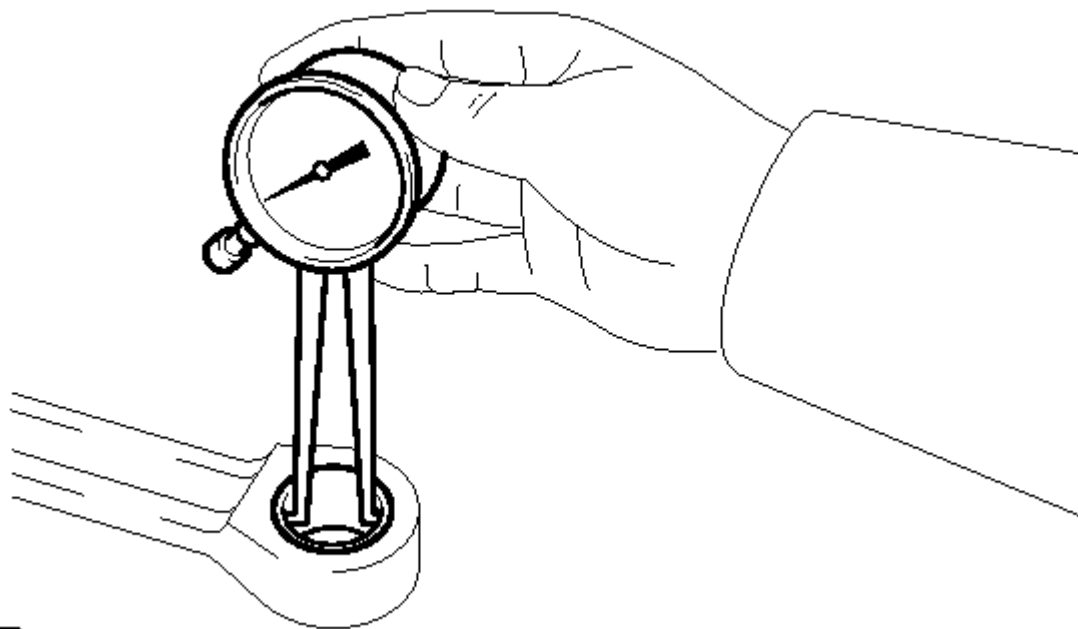
-0.002 to 0.004 mm (-0.0000787 to 0.000157 in.)

Maximum oil clearance

0.015 mm (0.000591 in.)

If the oil clearance is more than the maximum, replace the piston and piston pin as a set.

- e. Using a caliper gauge, measure the inside diameter of the connecting rod bush.

**P**

**Fig. 416: Measuring Inside Diameter Of Connecting Rod Bush**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Bush Inside Diameter

Mark	Specified Condition
A	22.005 to 22.008 mm (0.86634 to 0.86645 in.)
B	22.008 to 22.011 mm (0.86645 to 0.86657 in.)
C	22.011 to 22.014 mm (0.86657 to 0.86669 in.)

- f. Subtract the piston pin diameter measurement from the bush inside diameter measurement.

Standard oil clearance

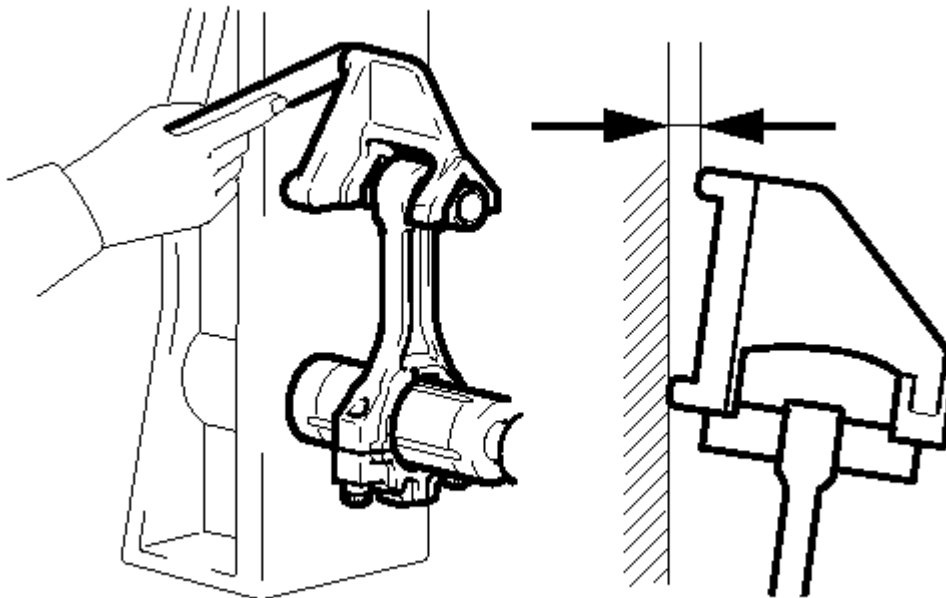
0.005 to 0.011 mm (0.000197 to 0.000433 in.)

Maximum oil clearance

0.03 mm (0.00118 in.)

If the oil clearance is more than the maximum, replace the connecting rod, and replace the piston and pin as a set.

## 8. INSPECT CONNECTING ROD SUB-ASSEMBLY



**P**

**Fig. 417: Checking Connecting Rod Alignment**

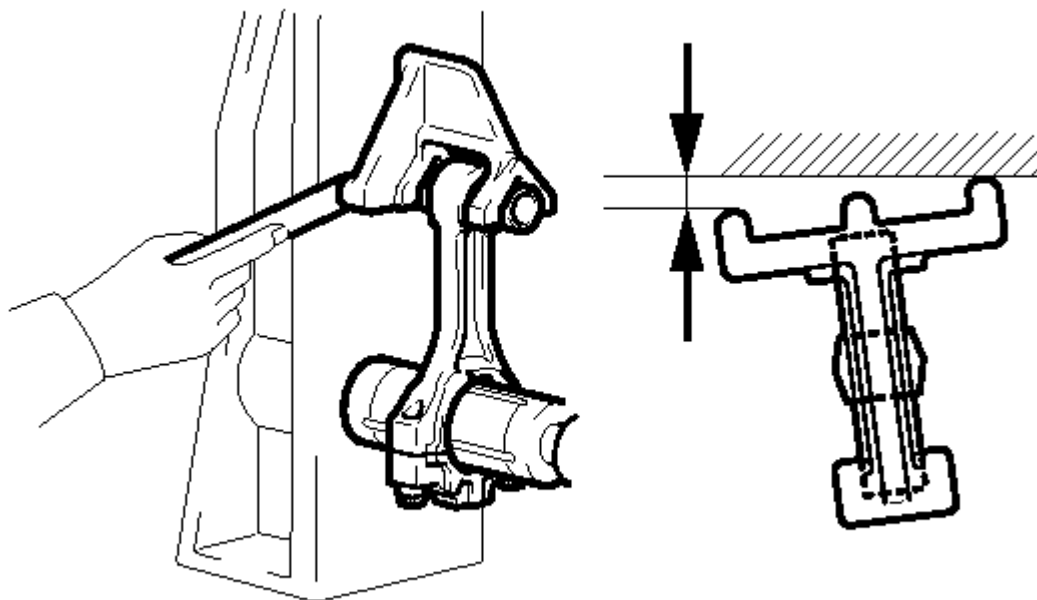
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a rod aligner and feeler gauge, check the connecting rod alignment.
  1. Check for bend.

Maximum bend

0.05 mm (0.00197 in.) per 100 mm (3.94 in.)

If the bend is more than the maximum, replace the connecting rod.



**P**

**Fig. 418: Checking Connecting Rod Alignment For Twist**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

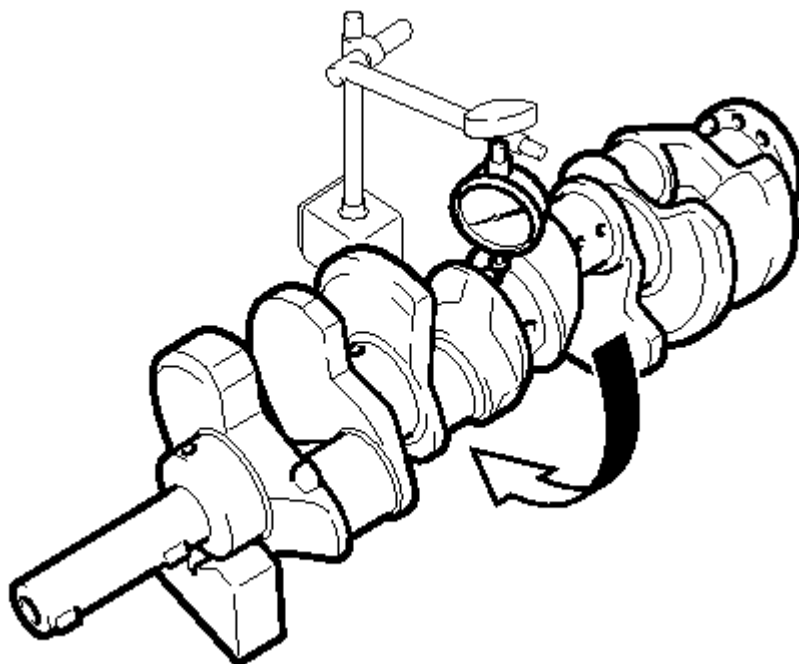
2. Check for twist.

Maximum twist

0.15 mm (0.00591 in.) per 100 mm (3.94 in.)

If the twist is more than the maximum, replace the connecting rod.

## 9. INSPECT CRANKSHAFT



**P**

**Fig. 419: Measuring Circle Runout At Center Journal**

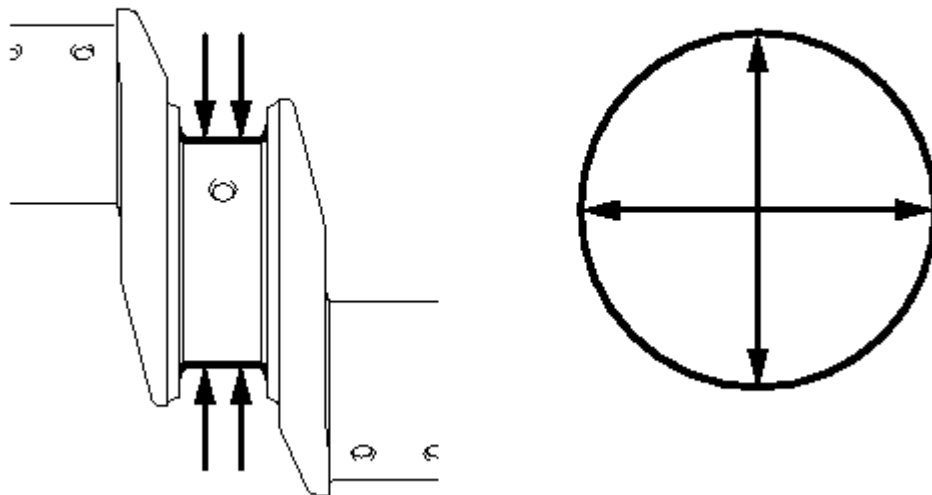
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Inspect for circle runout.
  1. Place the crankshaft on V-blocks.
  2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout

0.06 mm (0.00236 in.)

If the circle runout is more than the maximum, replace the crankshaft.



**P**

**Fig. 420: Identifying Diameter Of Main Journal**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Inspect the main journals.

1. Using a micrometer, measure the diameter of each main journal.

Standard journal diameter

66.988 to 67.000 mm (2.6373 to 2.6378 in.)

If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.

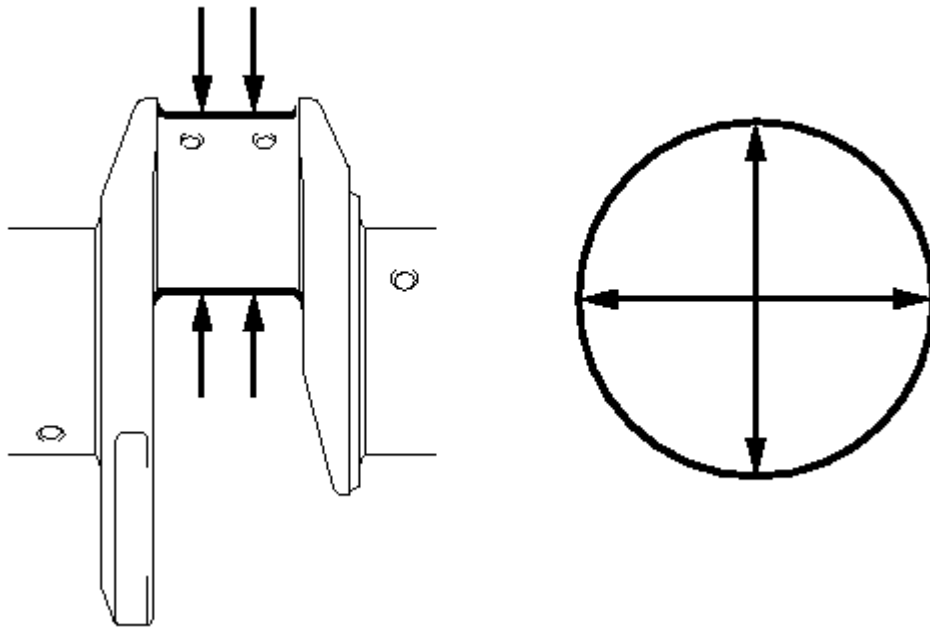
2. Check each main journal for taper and out-of-round as shown in the illustration.

Maximum taper and out-of-round

0.02 mm (0.000787 in.)

If the taper and out-of-round is more than the maximum, replace the crankshaft.





**P**

**Fig. 421: Identifying Diameter Of Crank Pin**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect the crank pins.
  1. Using a micrometer, measure the diameter of each crank pin.

Standard crank pin diameter

52.982 to 53.000 mm (2.0859 to 2.0866 in.)

If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.

2. Check each crank pin for taper and out-of-round as shown in the illustration.

Maximum taper and out-of-round

0.02 mm (0.000787 in.)

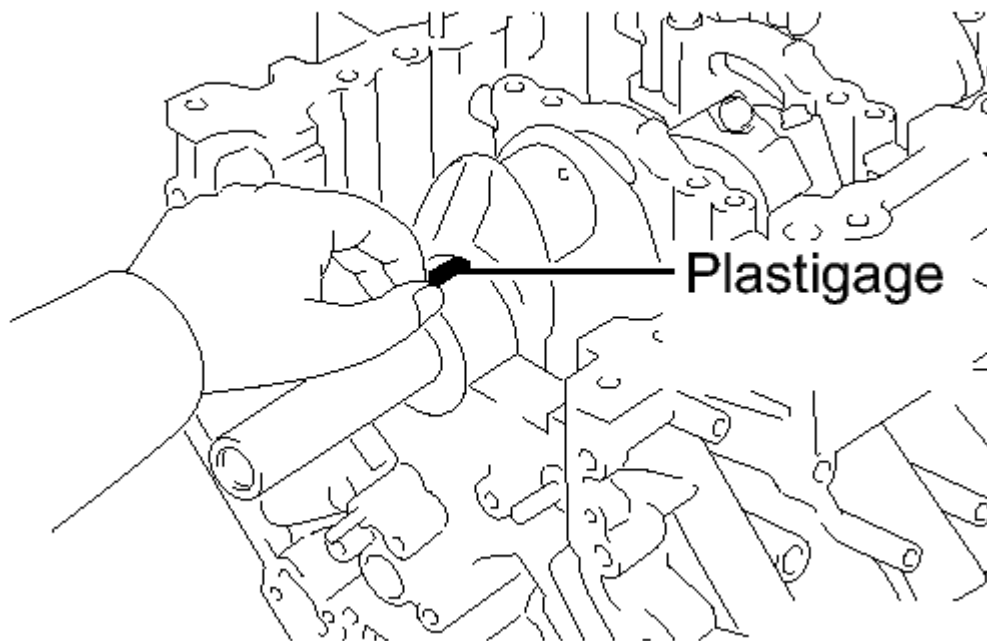
If the taper and out-of-round is more than the maximum, replace the crankshaft.

## 10. INSPECT CRANKSHAFT OIL CLEARANCE

- a. Clean each main journal and bearing.
- b. Check each main journal and bearing for pitting and scratches.

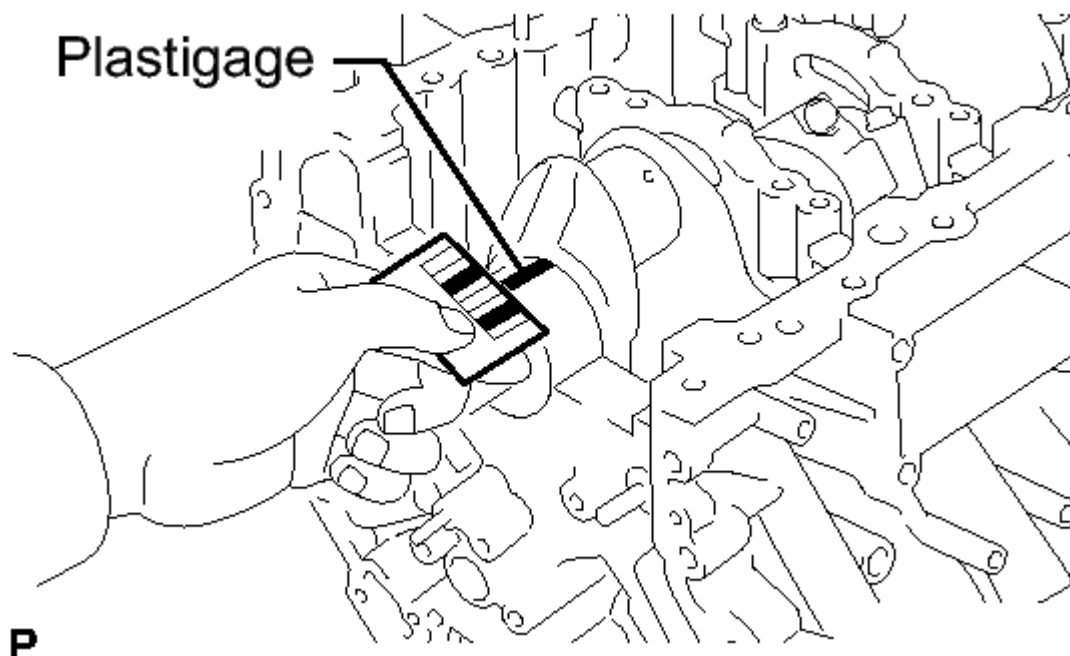
If the journal or bearing is damaged, replace the bearing.

- c. Place the crankshaft on the cylinder block.



**P**  
**Fig. 422: Laying Strip Of Plastigage Across Journal**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

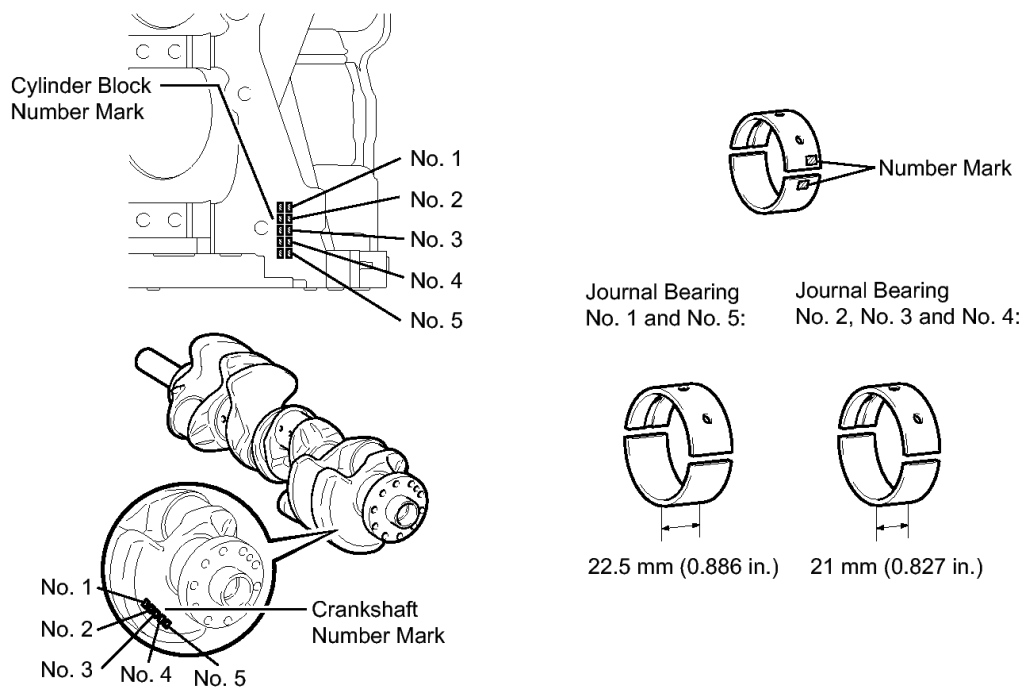
- d. Lay a strip of Plastigage across each journal.  
e. Install the crankshaft bearing caps See step 7.  
f. Remove the crankshaft bearing caps See step 8.



P

**Fig. 423: Measuring Plastigage At Widest Point**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



P

**Fig. 424: Identifying Cylinder Block Number Mark**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Measure the Plastigage at its widest point.

Standard Oil Clearance

Number Mark	Specified Condition
No. 1 and No. 5 journals	0.017 to 0.030 mm (0.000669 to 0.00118 in.)
Other journals	0.024 to 0.037 mm (0.000945 to 0.00146 in.)

Maximum Oil Clearance

Number Mark	Specified Condition
No. 1 and No. 5 journals	0.050 mm (0.00197 in.)
Other journals	0.060 mm (0.00236 in.)

If the oil clearance is more than the maximum, replace the bearings. If necessary, replace the crankshaft.

**HINT:**

If replacing a bearing, replace it with one that has the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft. Refer to the table below for the appropriate bearing number. There are 6 sizes of standard bearings. For the No. 1 and No. 5 position bearings, use bearings marked 4, 5, 6, 7, 8 and 9. For other bearings, use bearings marked 3, 4, 5, 6, 7 and 8.

A = Cylinder block number mark

B = Crankshaft number mark

**HINT:**

## 2012 Toyota Sequoia Limited

2012 ENGINE Engine Mechanical (1UR-FE) (Service Information) - Sequoia

(Cylinder block journal diameter - crankshaft journal diameter - 5) X 1000 = A + B

### Standard Bearing Chart

No. 1 and No. 5 Journals

Item		Number Mark (A) + (B)									
		00 to 02	03 to 05	06 to 08	09 to 11	12 to 14	15 to 17	18 to 20	21 to 23	24 to 26	27 to 28
Use bearing	Upper	4	5	5	6	6	7	7	8	8	9
	Lower	5	5	6	6	7	7	8	8	9	9

Other Journals

Item		Number Mark (A) + (B)									
		00 to 02	03 to 05	06 to 08	09 to 11	12 to 14	15 to 17	18 to 20	21 to 23	24 to 26	27 to 28
Use bearing	Upper	3	4	4	5	5	6	6	7	7	8
	Lower	4	4	5	5	6	6	7	7	8	8

EXAMPLE:

No. 1 and No. 5 journals

Cylinder block "7" + Crankshaft "6" = Total number 13 (Use upper bearing "6" and lower bearing "7")

Other journals

Cylinder block "7" + Crankshaft "6" = Total number 13 (Use upper bearing "5" and lower bearing "6")

### Standard Bearing Chart

Standard Cylinder Block Crankshaft Journal Bore Diameter (A)

Number Mark	Specified Condition
Mark 00	72.000 mm (2.83464 in.)
Mark 01	72.001 mm (2.83469 in.)

**2012 Toyota Sequoia Limited**

2012 ENGINE Engine Mechanical (1UR-FE) (Service Information) - Sequoia

	in.)
Mark 02	72.002 mm (2.83472 in.)
Mark 03	72.003 mm (2.83476 in.)
Mark 04	72.004 mm (2.83480 in.)
Mark 05	72.005 mm (2.83484 in.)
Mark 06	72.006 mm (2.83488 in.)
Mark 07	72.007 mm (2.83492 in.)
Mark 08	72.008 mm (2.83496 in.)
Mark 09	72.009 mm (2.83500 in.)
Mark 10	72.010 mm (2.83503 in.)
Mark 11	72.011 mm (2.83508 in.)
Mark 12	72.012 mm (2.83512 in.)
	72.013

**2012 Toyota Sequoia Limited**

## 2012 ENGINE Engine Mechanical (1UR-FE) (Service Information) - Sequoia

Mark 13	mm (2.83516 in.)
Mark 14	72.014 mm (2.83520 in.)
Mark 15	72.015 mm (2.83524 in.)
Mark 16	72.016 mm (2.83528 in.)

## Standard Crankshaft Journal Diameter (B)

Number Mark	Specified Condition
Mark 00	67.000 mm (2.63780 in.)
Mark 01	66.999 mm (2.63775 in.)
Mark 02	66.998 mm (2.63771 in.)
Mark 03	66.997 mm (2.63768 in.)
Mark 04	66.996 mm (2.63763 in.)
Mark 05	66.995 mm (2.63760 in.)
	66.994 mm

Mark 06	(2.63756 in.)
Mark 07	66.993 mm (2.63751 in.)
Mark 08	66.992 mm (2.63748 in.)
Mark 09	66.991 mm (2.63744 in.)
Mark 10	66.990 mm (2.63740 in.)
Mark 11	66.989 mm (2.63736 in.)
Mark 12	66.988 mm (2.63732 in.)

Standard Bearing Center Wall Thickness

#### NO. 1 AND NO. 5 JOURNALS

Upper Bearing		Lower Bearing	
Number Mark	Specified Condition	Number Mark	Specified Condition
4	2.501 to 2.504 (0.0985 to 0.0986 in.)	5	2.488 to 2.491 (0.0980 to 0.0981 in.)
5	2.504 to 2.507 (0.0986 to 0.0987 in.)	6	2.491 to 2.494 (0.0981 to 0.0982 in.)
6	2.507 to 2.510 (0.0987 to	7	2.494 to 2.497 (0.0982 to



## 2012 Toyota Sequoia Limited

2012 ENGINE Engine Mechanical (1UR-FE) (Service Information) - Sequoia

	0.0988 in.)		0.0983 in.)
7	2.510 to 2.513 (0.0988 to 0.0989 in.)	8	2.497 to 2.500 (0.0983 to 0.0984 in.)
8	2.513 to 2.516 (0.0989 to 0.0991 in.)	9	2.500 to 2.503 (0.0984 to 0.0985 in.)
9	2.516 to 2.519 (0.0991 to 0.0992 in.)	-	-

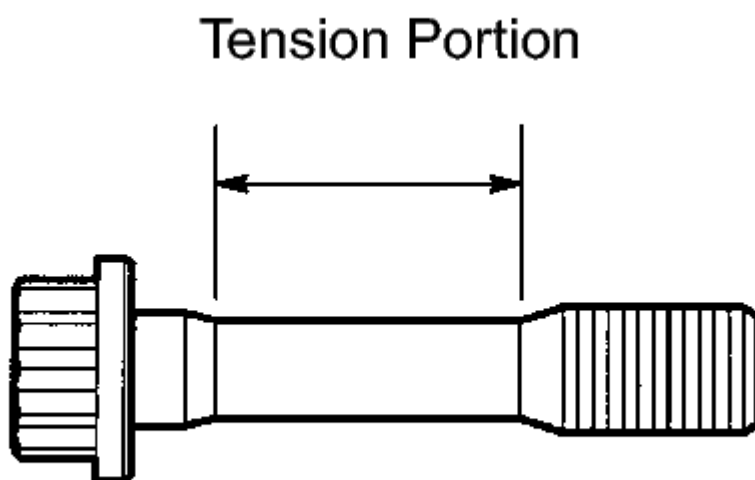
### Other Journals

Upper Bearing		Lower Bearing	
Number Mark	Specified Condition	Number Mark	Specified Condition
3	2.482 to 2.485 (0.0977 to 0.0978 in.)	4	2.501 to 2.504 (0.0985 to 0.0986 in.)
4	2.485 to 2.488 (0.0978 to 0.0980 in.)	5	2.504 to 2.507 (0.0986 to 0.0987 in.)
5	2.488 to 2.491 (0.0980 to 0.0981 in.)	6	2.507 to 2.510 (0.0987 to 0.0988 in.)
6	2.491 to 2.494 (0.0981 to 0.0982 in.)	7	2.510 to 2.513 (0.0988 to 0.0989 in.)
7	2.494 to 2.497 (0.0982 to	8	2.513 to 2.516 (0.0989 to

	0.0983 in.)		0.0991 in.)
8	2.497 to 2.500 (0.0983 to - 0.0984 in.)	-	-

h. Completely remove the Plastigage.

#### 11. INSPECT CONNECTING ROD BOLT



**Fig. 425: Identifying Connecting Rod Bolt Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Using a vernier caliper, measure the tension portion diameter of the bolt.

Standard diameter

8.5 to 8.6 mm (0.335 to 0.339 in.)

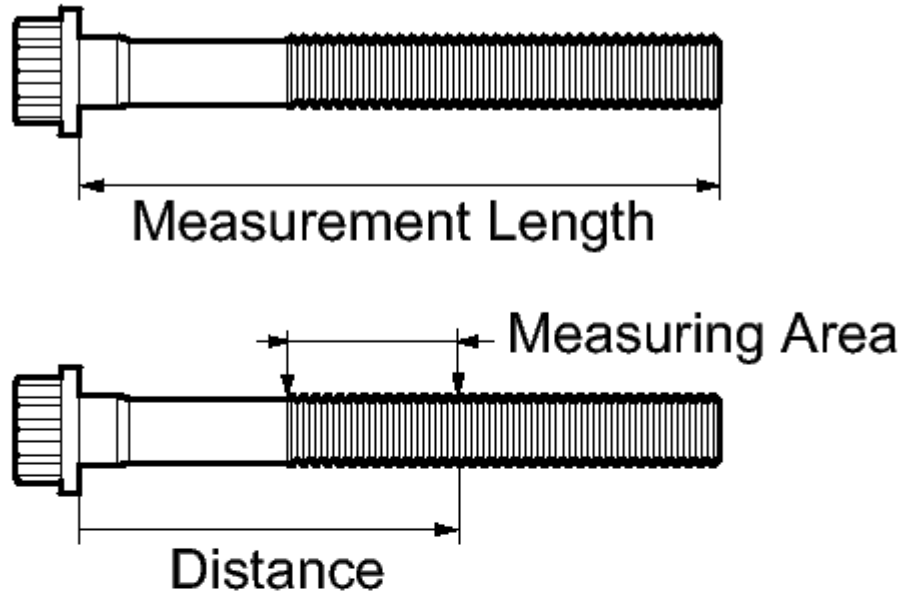
Minimum diameter

8.3 mm (0.327 in.)

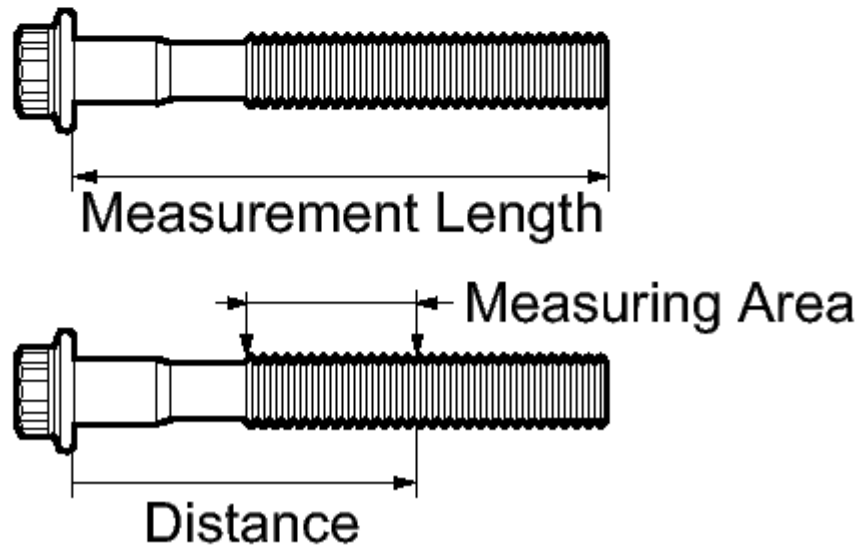
If the diameter is less than the minimum, replace the bolt.

#### 12. INSPECT CRANKSHAFT BEARING CAP SET BOLT

### Bolt A:



### Bolt B:



T

**Fig. 426: Identifying Crankshaft Bearing Cap Set Bolt Dimension**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Using a vernier caliper, measure the length of the crankshaft bearing cap bolt from the seat to end.

### Standard Bolt Length

Item	Specified Condition
Bolt A	90.3 to 91.7 mm (3.56 to 3.61 in.)
Bolt B	78.8 to 80.2 mm (3.10 to 3.16 in.)

### Maximum Bolt Length

Item	Specified Condition
Bolt A	92.7 mm (3.65 in.)
Bolt B	81.2 mm (3.20 in.)

If the length is more than the maximum, replace the crankshaft bearing cap bolt.

- b. Using a vernier caliper, measure the diameter of the elongated thread at the measuring area.

Distance

57.5 mm (2.26 in.)

Standard Diameter

Item	Specified Condition
Bolt A	10.5 to 11.0 mm (0.413 to 0.433 in.)
Bolt B	9.5 to 10.0 mm (0.374 to 0.394 in.)

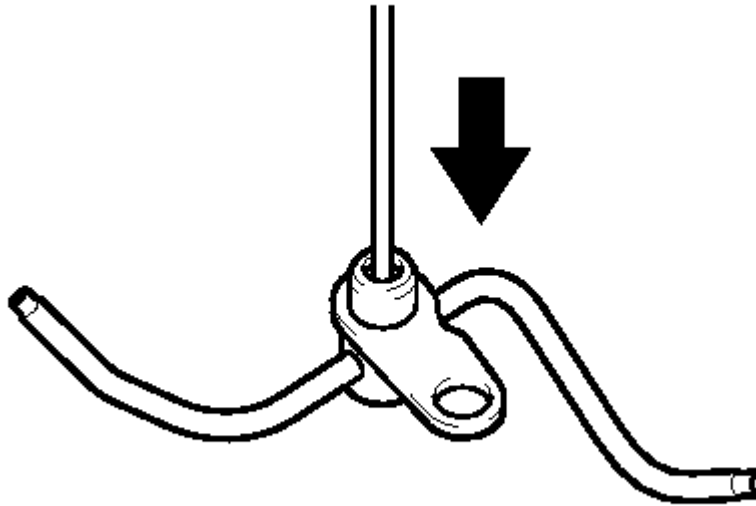
Minimum Diameter

--	--

Item	Specified Condition
Bolt A	10.4 mm (0.409 in.)
Bolt B	9.4 mm (0.370 in.)

If the diameter is less than the minimum, replace the crankshaft bearing cap bolt.

### 13. INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY



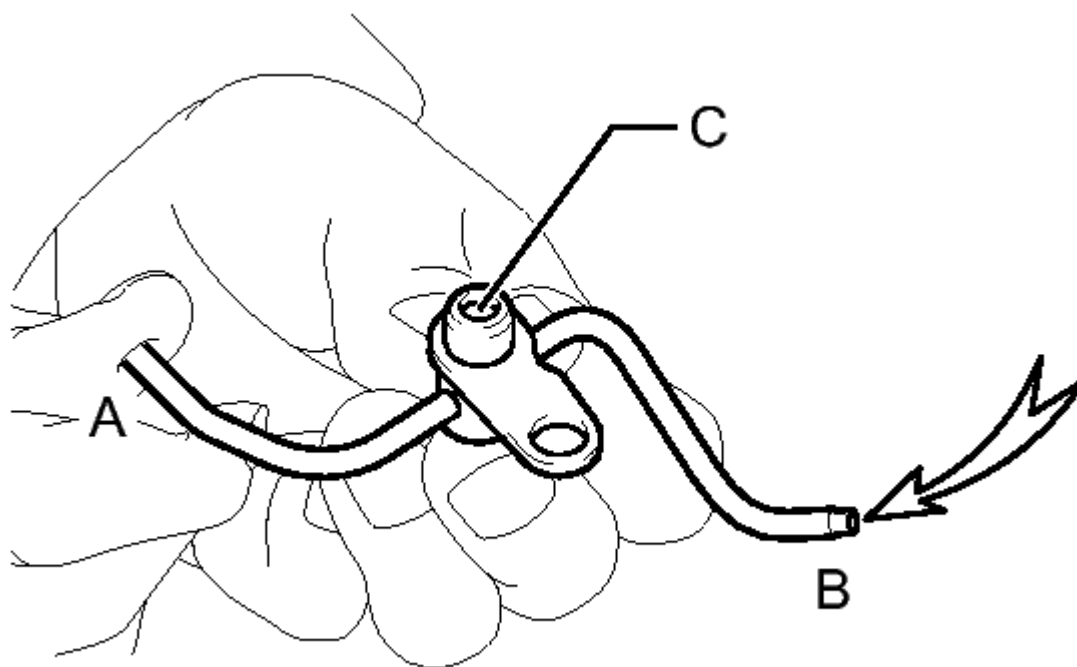
**P**

**Fig. 427: Pushing Check Valve With Pin**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

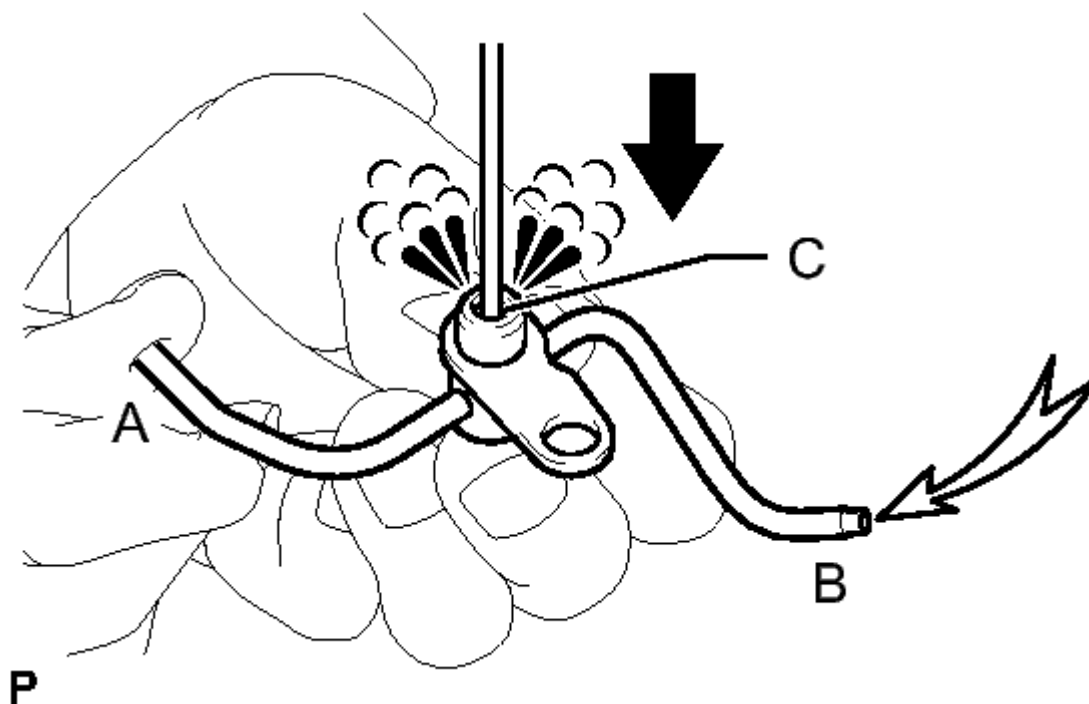
- Push the check valve with a pin to check if it is stuck. If stuck, replace the oil nozzle.
- Push the check valve with a pin to check if it moves smoothly.

If it does not move smoothly, clean or replace the oil nozzle.

**P****Fig. 428: Applying Air Into B****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- c. While covering A, apply air into B. Check that air does not leak through C. Perform the check again while covering B and applying air into A.

If air leaks, clean or replace the oil nozzle.

**P**

**Fig. 429: Checking Air Passes Through C****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- d. Push the check valve while covering A, and apply air into B. Check that air passes through C. Perform the check again while covering B, pushing the check valve and applying air into A.

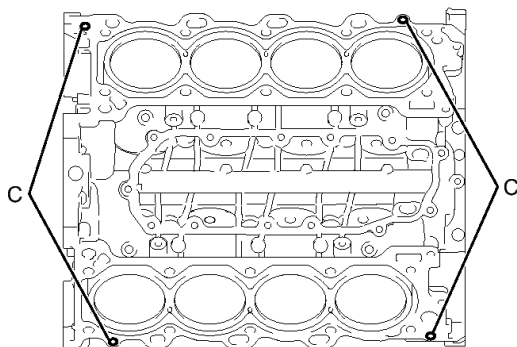
If air does not pass through C, clean or replace the oil nozzle.

**REPLACEMENT****REPLACEMENT****1. REPLACE STRAIGHT PIN**

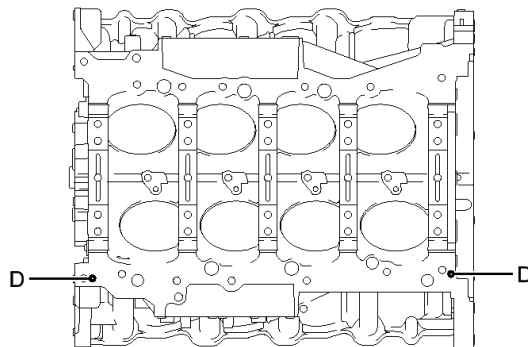
**NOTE:** It is not necessary to remove the straight pin unless it is being replaced.

- a. Remove the straight pins.
- b. Using a plastic-faced hammer, tap in new straight pins to the cylinder block.

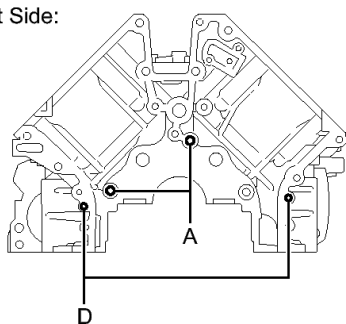
Upper Side:



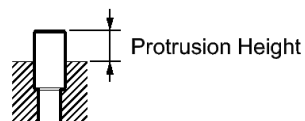
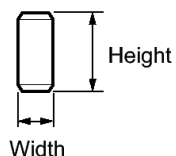
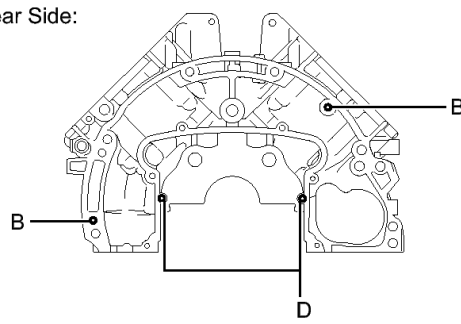
Lower Side:



Front Side:



Rear Side:



P

### Fig. 430: Identifying Straight Pin Height

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### Standard Straight Pin

Item	Height	Width	Protrusion
Pin A	36 mm (1.42 in.)	10 mm (0.394 in.)	22 to 24 mm (0.866 to 0.945 in.)
Pin B	22 mm (0.866 in.)	10 mm (0.394 in.)	10.5 to 11.5 mm (0.413 to 0.453 in.)
Pin C	20 mm (0.787 in.)	8 mm (0.315 in.)	8.0 to 10.0 mm (0.315 to 0.394 in.)



	in.)	in.)	in.)
Pin	12 mm	4 mm	5.0 to 7.0
D	(0.472	(0.157	mm (0.197
	in.)	in.)	to 0.276
			in.)

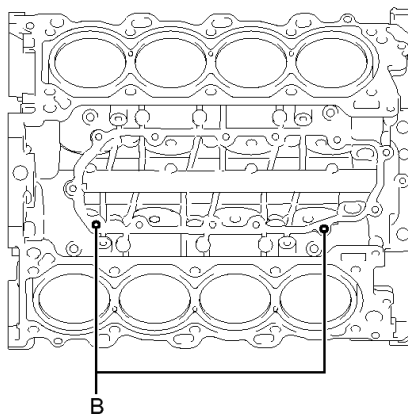
## REASSEMBLY

## REASSEMBLY

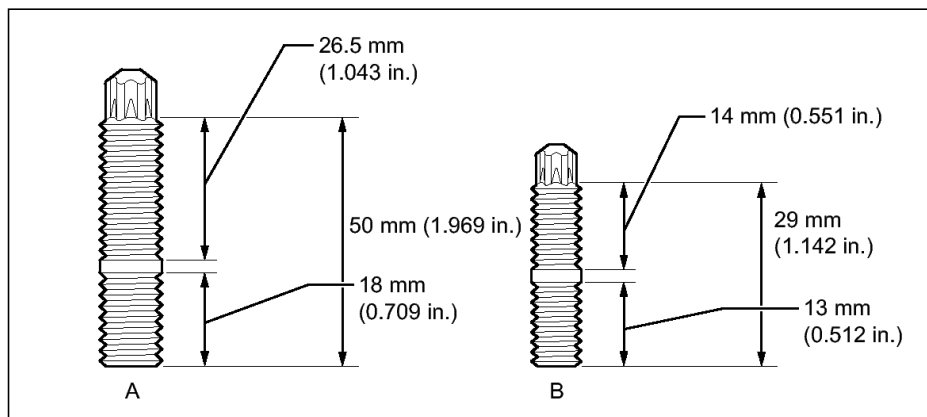
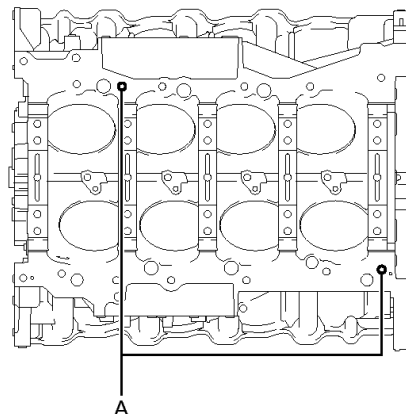
### 1. INSTALL STUD BOLT

- Using an E8 "TORX" socket wrench, install the stud bolts.

for Upper Side:



for Lower Side:



P

**Fig. 431: Identifying Stud Bolt Height**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for stud bolt A

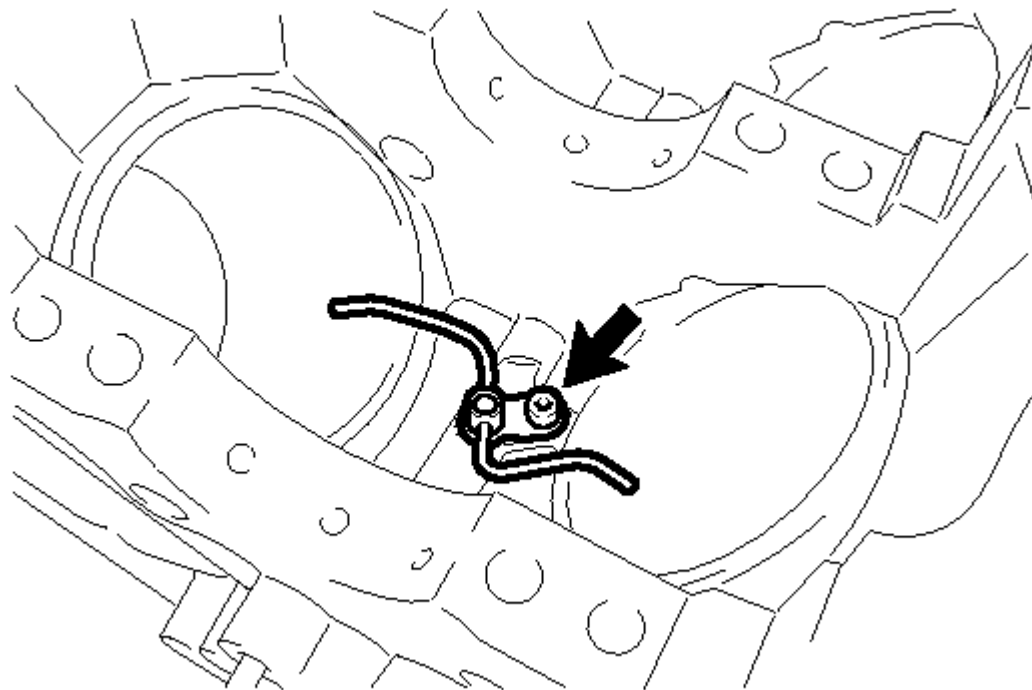
**Torque: 20 N\*m (204 kgf\*cm, 15 ft.\*lbf)**

**for stud bolt B**

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)**

## **2. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY**

- a. Using a 5 mm hexagon wrench, install the 4 oil nozzles with the 4 bolts.



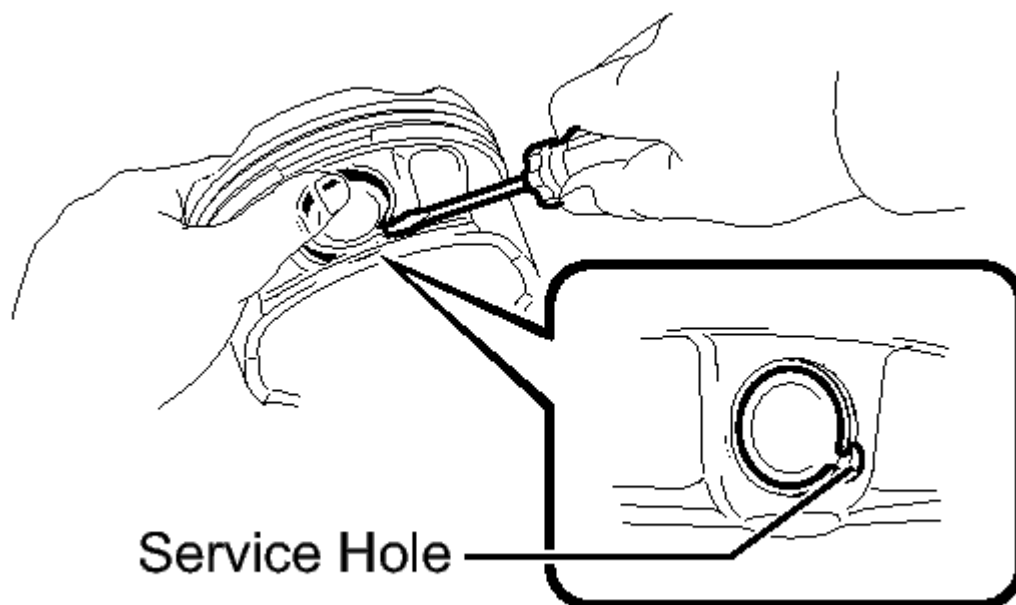
**P**

**Fig. 432: Locating No. 1 Oil Nozzle Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

## **3. INSTALL PISTON WITH PIN SUB-ASSEMBLY**

- a. Using a small screwdriver, install a new snap ring at one end of the piston pin hole.



**P**

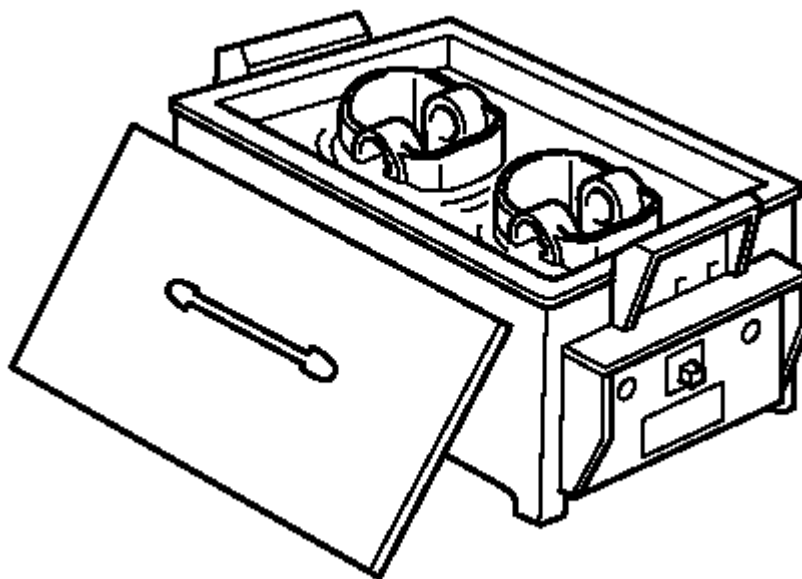
**Fig. 433: Identifying Snap Ring & Piston Pin Hole**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

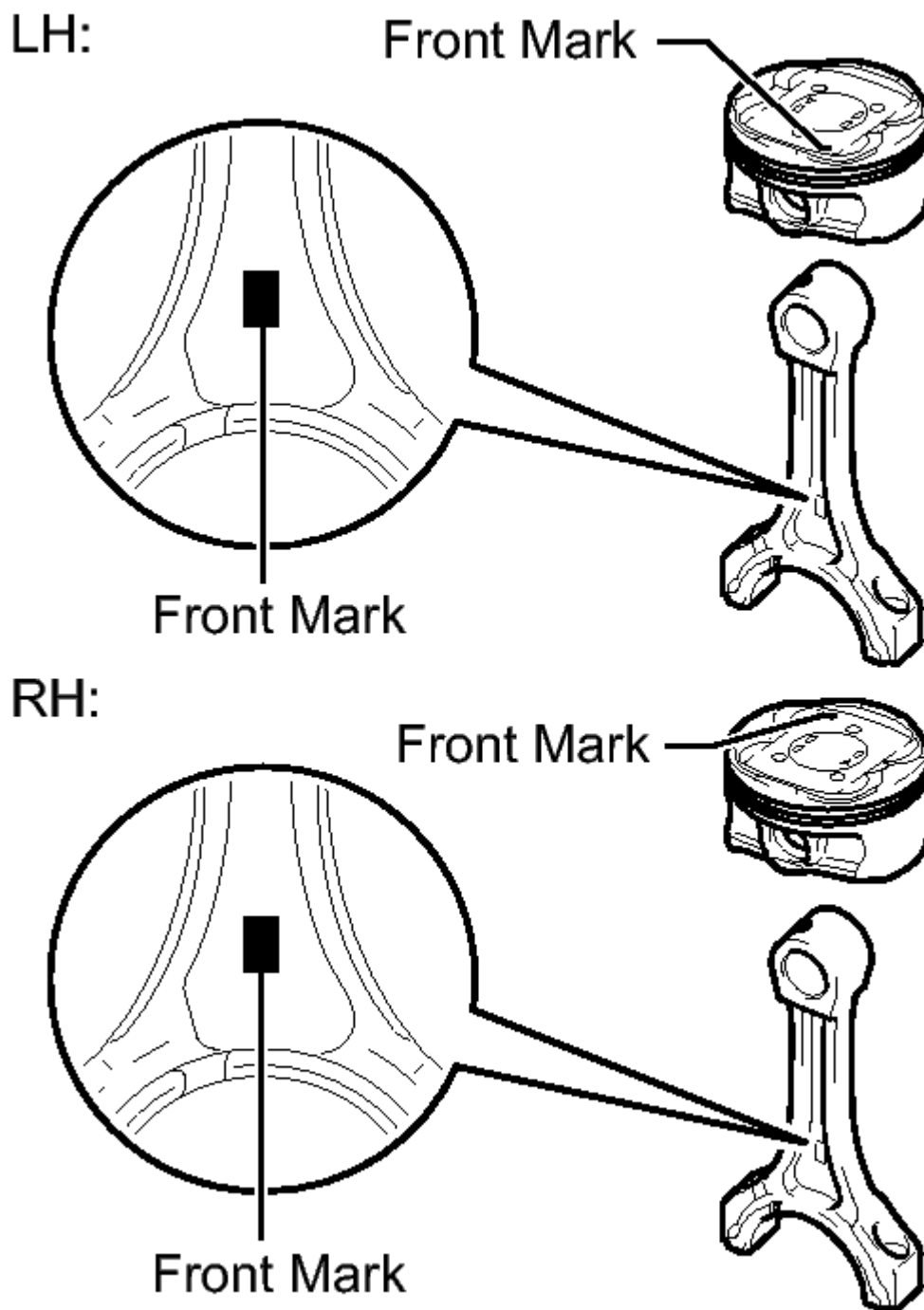
**HINT:**

Be sure that the end gap of the snap ring is not aligned with the service hole of the piston.

- b. Gradually heat the piston to approximately 80°C (176°F).

**Y****Fig. 434: Heating Piston****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- c. Coat the piston pin and connecting rod with engine oil.
- d. Align the front marks of the piston and connecting rod as shown in the illustration. Then push in the piston pin with your thumb until the piston pin contacts the snap ring.



**P**

**Fig. 435: Front Marks Of The Piston And Connecting Rod**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

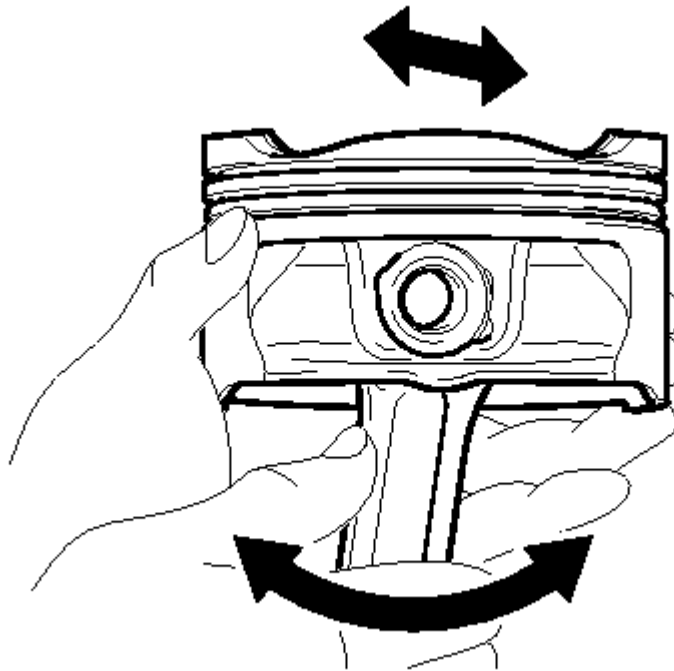
**NOTE:** For the LH side, perform the assembly so that the front marks of the piston and connecting rod are on the same side. For the RH side,

**perform the assembly so that the front marks of the piston and connecting rod are on opposite sides.**

**HINT:**

The piston and pin are a matched set.

- e. Check the fitting condition between the piston and piston pin.

**P****Fig. 436: Check The Fitting Condition**

**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

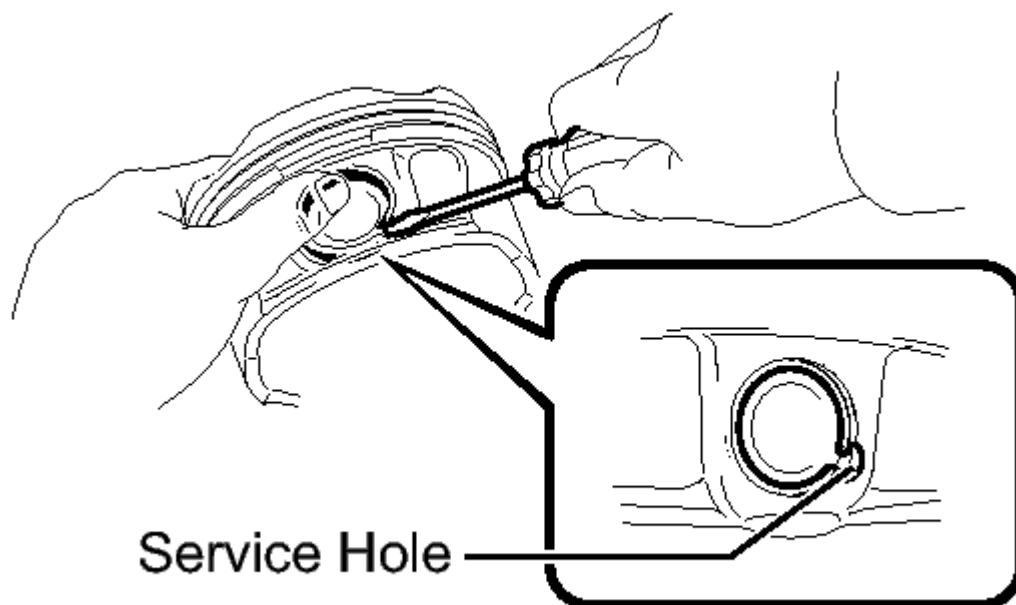
1. Move the connecting rod back and forth on the piston pin. Check the fitting condition.

If abnormal movement is felt, replace the piston and pin as a set.

2. Rotate the piston back and forth on the piston pin. Check the fitting condition.

If abnormal movement is felt, replace the piston and pin as a set.

- f. Using a small screwdriver, install a new snap ring at the other end of the piston pin hole.

**P****Fig. 437: Identifying Snap Ring & Piston Pin Hole**

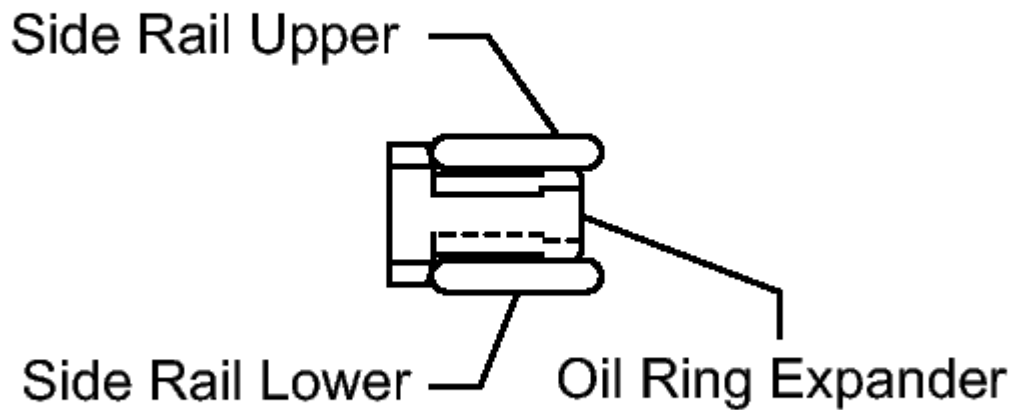
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

Be sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

**4. INSTALL PISTON RING SET**

- a. Install the oil ring expander and 2 side rails by hand.



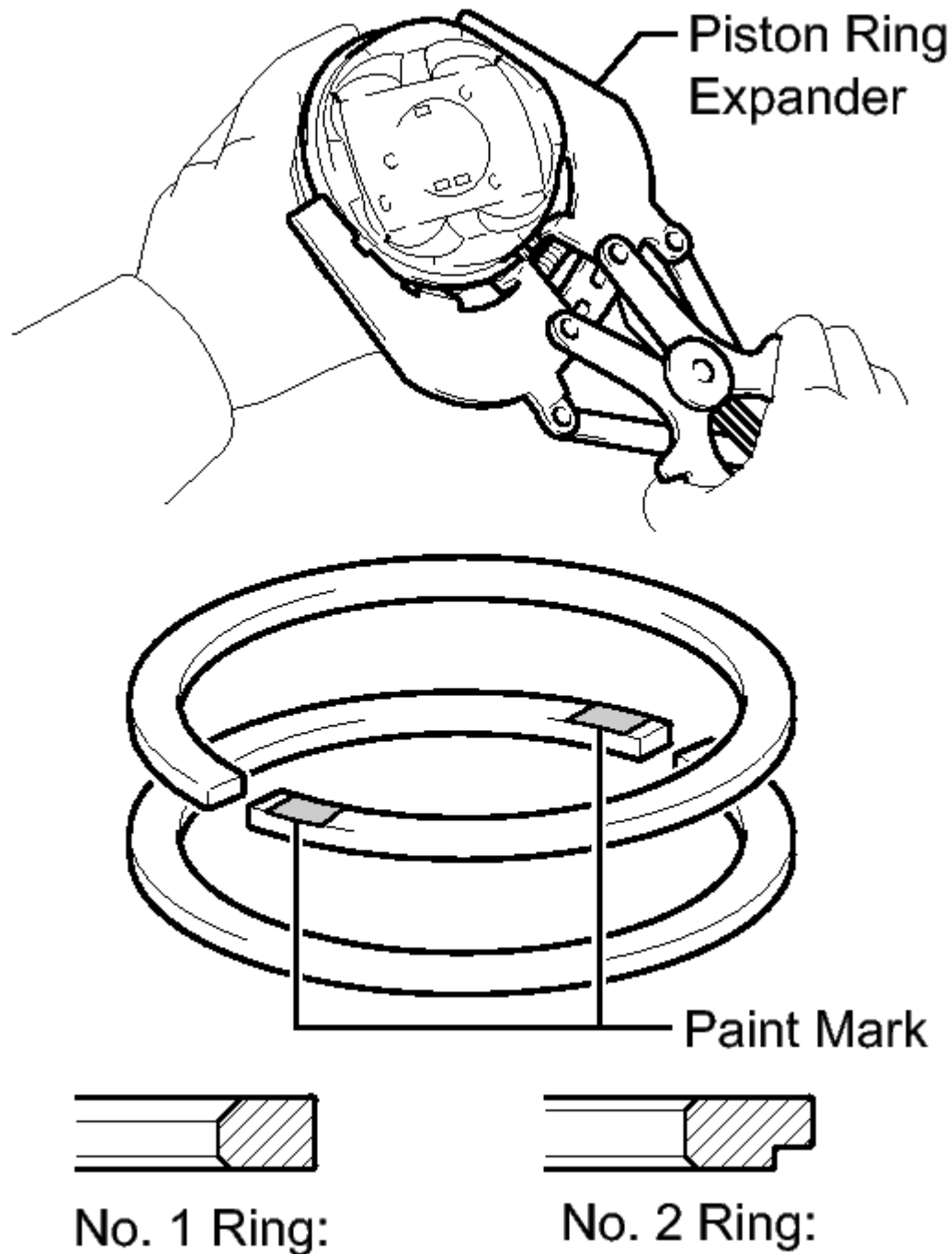
**Y**

**Fig. 438: Identifying Oil Ring Expander And Side Rails**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a piston ring expander, install the 2 compression rings so that the paint marks are positioned as shown in the illustration.





**P**

**Fig. 439: Identifying Piston Ring Expander & Paint Marks**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Paint Mark

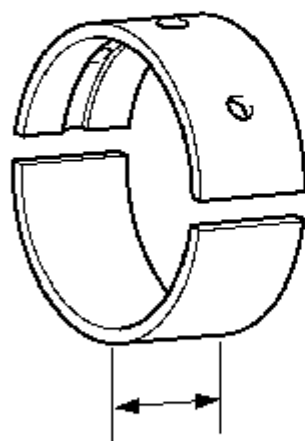


Item	Paint Mark
No. 1	Blue
No. 2	Orange

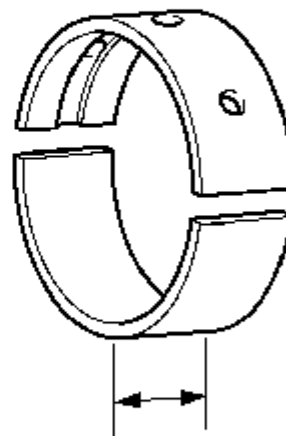
## 5. INSTALL CRANKSHAFT BEARING

- Clean the main journal and both surfaces of the bearing.

No. 1 and No. 5      No. 2, No. 3 and No. 4  
Journal Bearings:      Journal Bearings:



22.5 mm



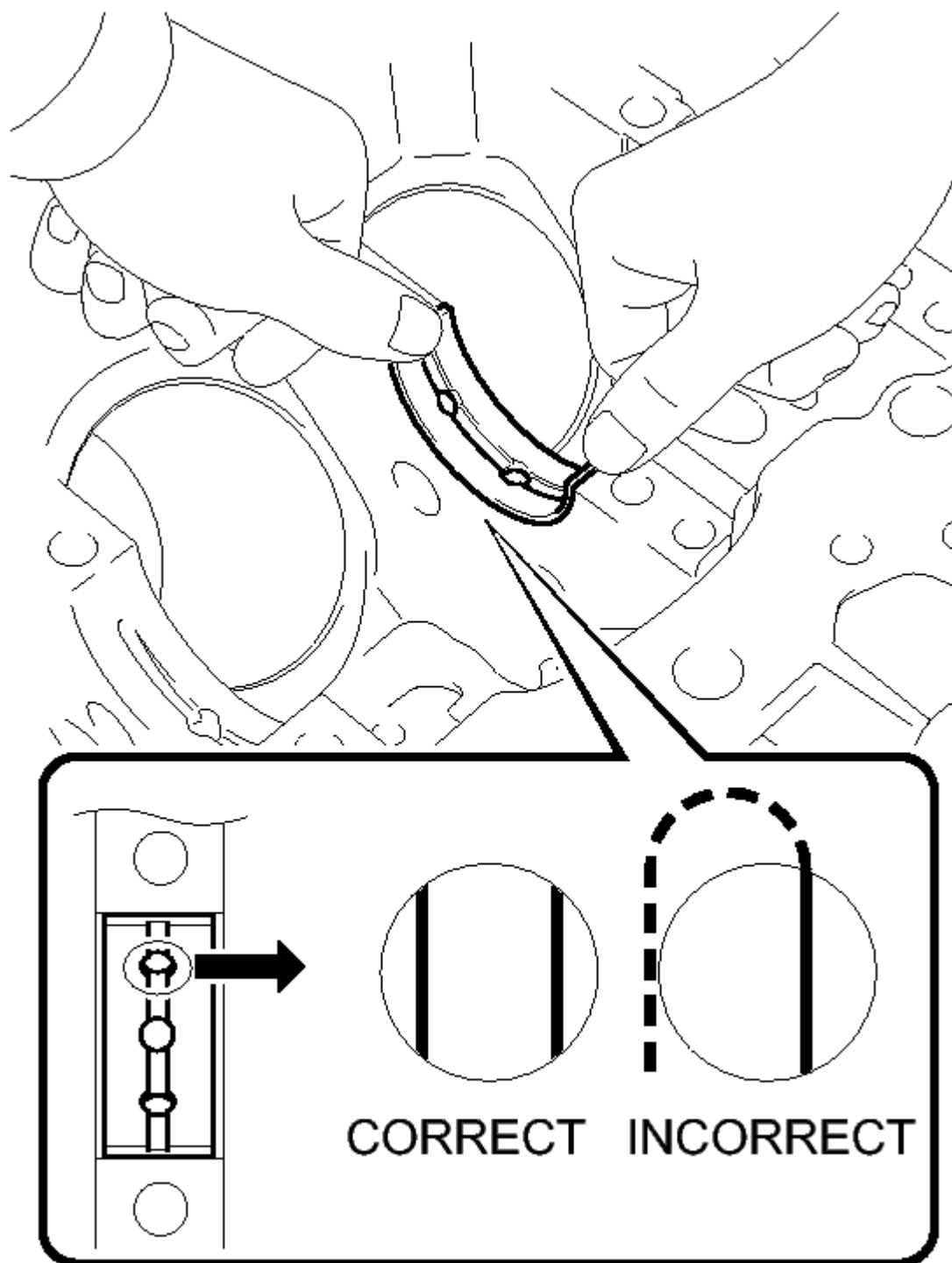
21 mm

**Fig. 440: Identifying Crankshaft Bearing Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Install the upper bearing.

**NOTE:** Main bearings come in widths of 21 mm (0.827 in.) and 22.5 mm (0.886 in.). Install the 22.5 mm (0.886 in.) bearings in the No. 1 and No. 5 cylinder block journal positions with the main bearing caps. Install the 21 mm (0.827 in.) bearings in the No. 2, No. 3 and No. 4 positions.

1. Install the upper bearing to the cylinder block as shown in the illustration.



**P**

**Fig. 441: Installing Upper Bearing To Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

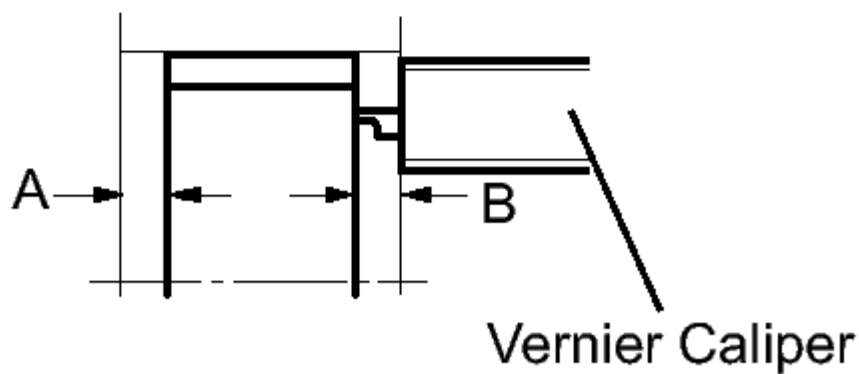
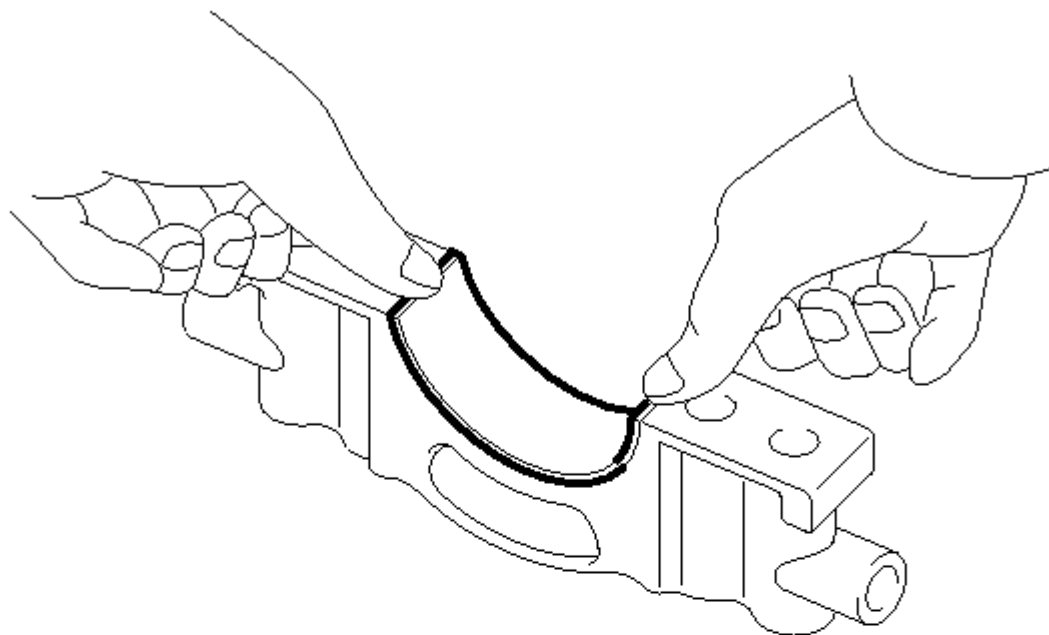
- Do not apply engine oil to the bearings and the contact surfaces.

- Both sides of the oil groove in the cylinder block should be visible through the oil feed holes in the bearing. The amount visible on each side of the holes should be equal.
- Do not allow coolant to come into contact with the bearing inner surface.
- If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.

c. Install the lower bearing.

**NOTE:**

- Be sure to install the selected bearing.
- Main bearings come in widths of 21 mm (0.827 in.) and 22.5 mm (0.886 in.). Install the 22.5 mm (0.886 in.) bearings in the No. 1 and No. 5 cylinder block journal positions with the main bearing caps. Install the 21 mm (0.827 in.) bearings in the No. 2, No. 3 and No. 4 positions.



**T**

**Fig. 442: Installing Lower Bearings To Bearing Caps**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Install the lower bearings to the bearing caps.
2. Using a vernier caliper, measure the distance between the bearing cap's edge and the lower

bearing's edge.

Dimension A - B or B - A

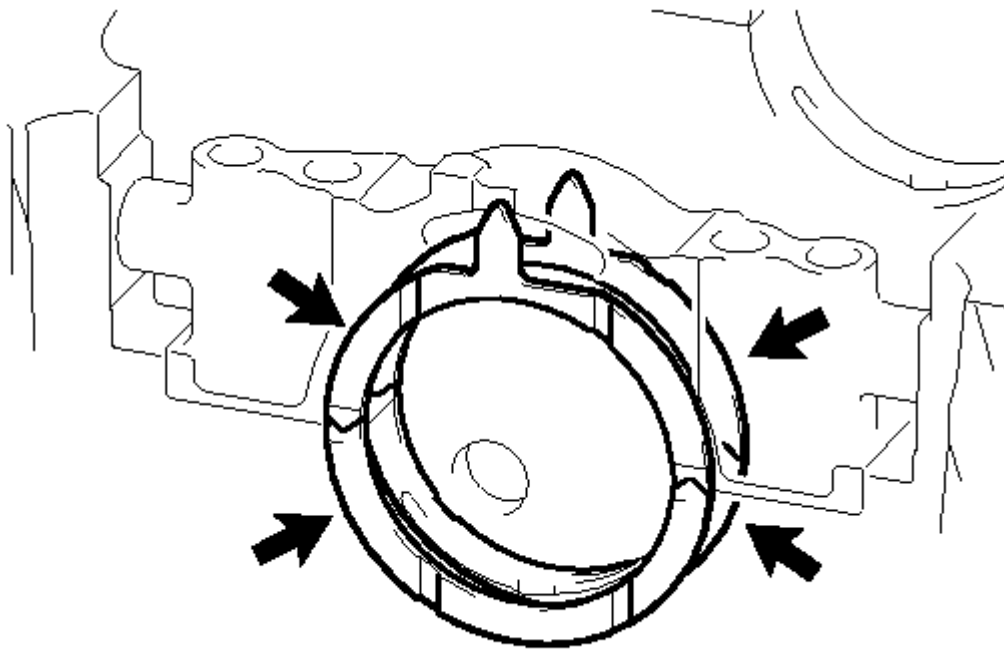
0 to 0.7 mm (0 to 0.0276 in.)

**NOTE:**

- Do not apply engine oil to the bearings and the contact surfaces.
- Do not allow coolant to come into contact with the bearing inner surface.
- If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.

**6. INSTALL CRANKSHAFT THRUST WASHER SET**

- a. Apply engine oil to the thrust washer set.

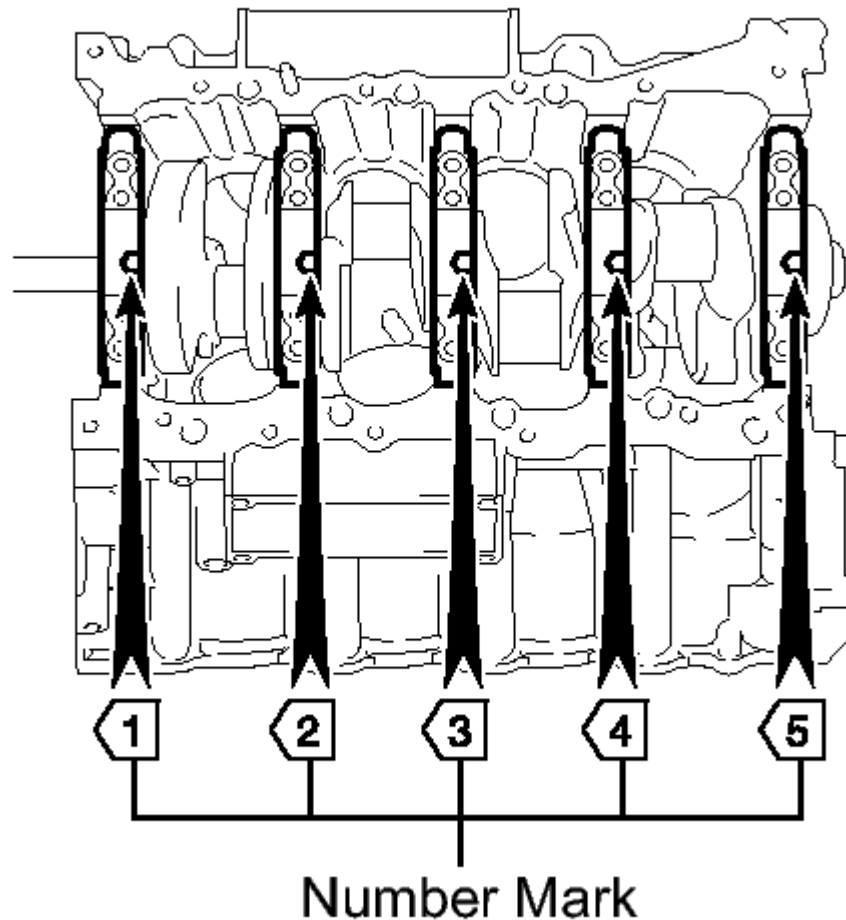


**P**

**Fig. 443: Locating Crankshaft Thrust Washer Set**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 4 thrust washers to the No. 3 journal position of the cylinder block and bearing cap with the oil grooves facing outward.

**7. INSTALL CRANKSHAFT**

**P****Fig. 444: Identifying Crankshaft Number Mark**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply engine oil to the upper bearing and lower bearing, then place the crankshaft on the cylinder block.
- b. Confirm the front marks and numbers of the main bearing caps, and install the bearing caps on the cylinder block.

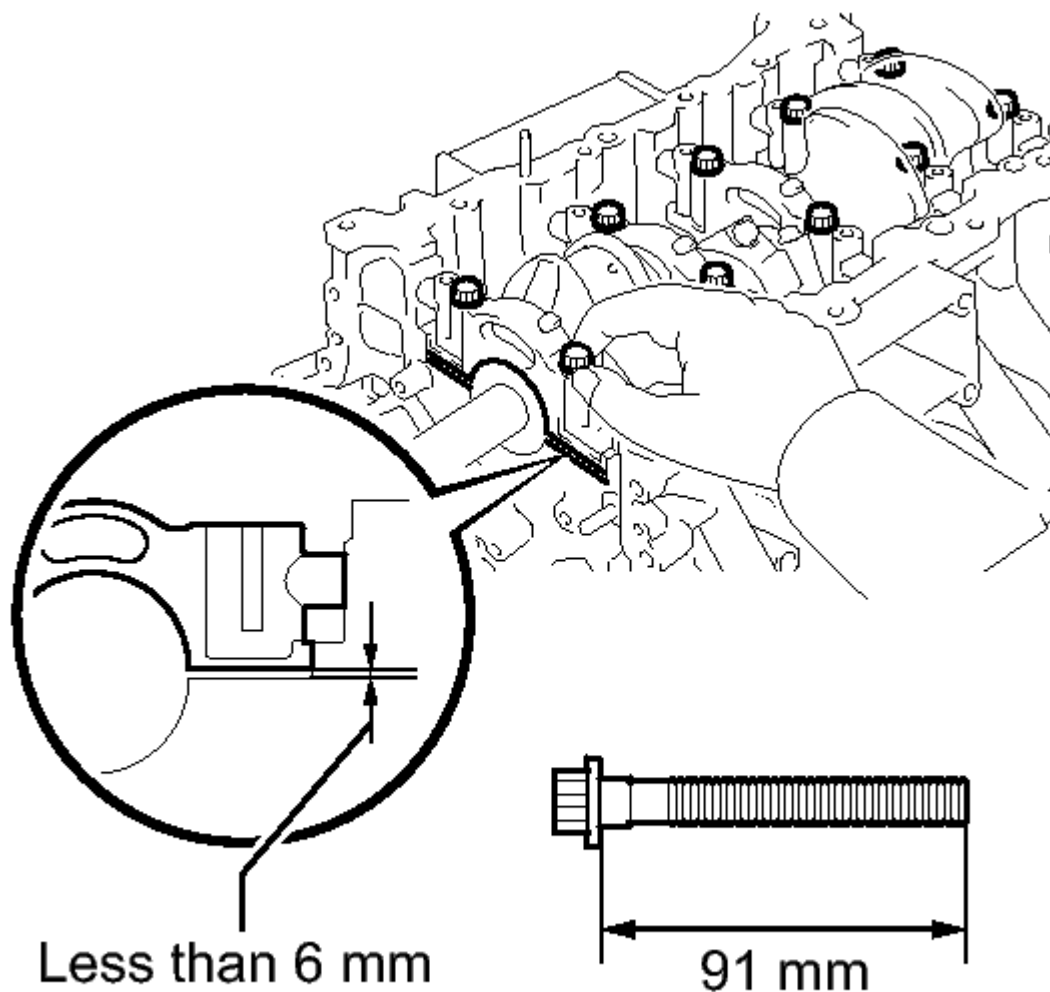
**HINT:**

A number is marked on each main bearing cap to indicate the installation position.

- c. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
- d. Temporarily install the 10 main bearing cap bolts to the inside positions.
- e. Insert the main bearing cap by hand until the clearance between the main bearing cap and cylinder



block is less than 6 mm (0.236 in.) by marking the 2 internal bearing cap bolts as a guide.

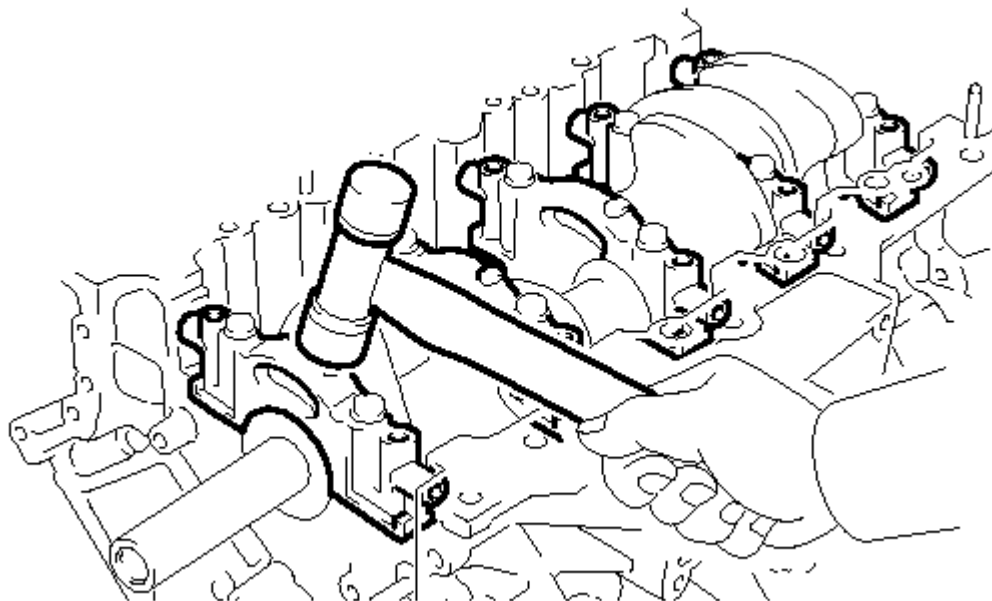
**P**

**Fig. 445: Identifying Clearance Between Main Bearing Cap And Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bolt length

91 mm (3.58 in.)

- f. Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.

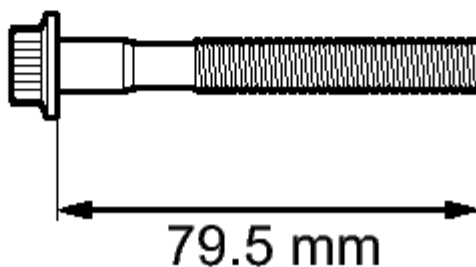
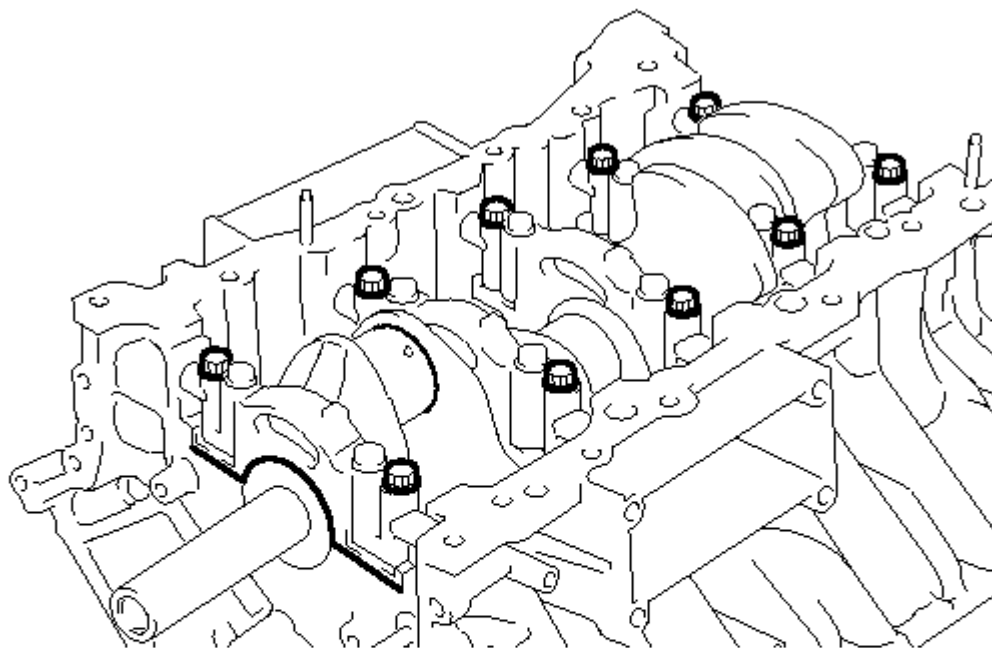


**P**

**Fig. 446: Tapping Bearing Cap**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Apply a light coat of engine oil to the threads and under the heads of the 10 main bearing cap bolts.
- h. Temporarily install the 10 main bearing cap bolts to the outside positions.

**P**

**Fig. 447: Identifying Main Bearing Cap Bolt Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bolt length

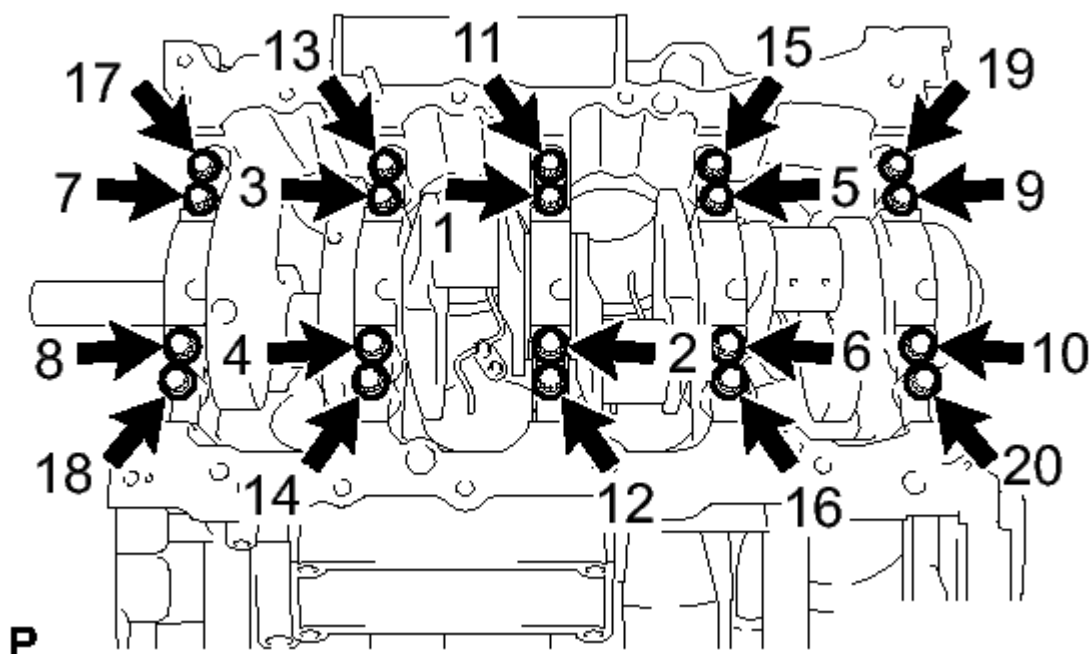
79.5 mm (3.13 in.)

**HINT:**

The main bearing cap bolts are tightened in 2 progressive steps.

i. Step 1:

1. Uniformly tighten the 20 main bearing cap bolts in the sequence shown in the illustration.



**Fig. 448: Identifying Crankshaft Bearing Cap Bolts Tightening Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for inside position

Torque: 61 N\*m (622 kgf\*cm, 45 ft.\*lbf)

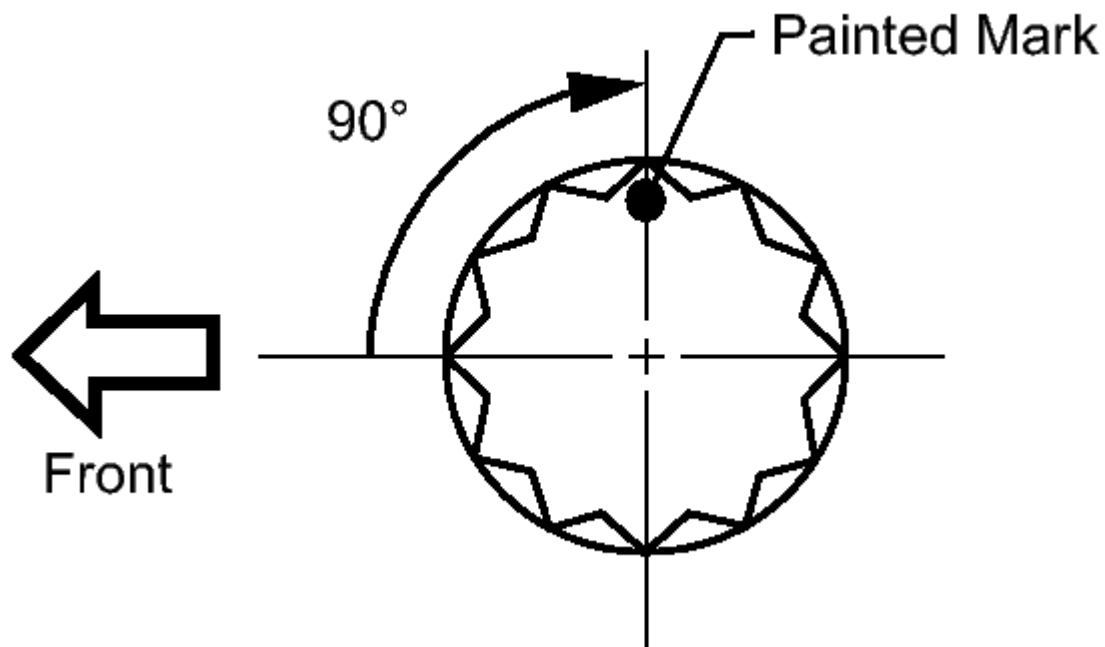
for outside position

Torque: 27 N\*m (275 kgf\*cm, 20 ft.\*lbf)

If any of the main bearing cap bolts do not meet the specified torque, replace it.

j. Step 2:

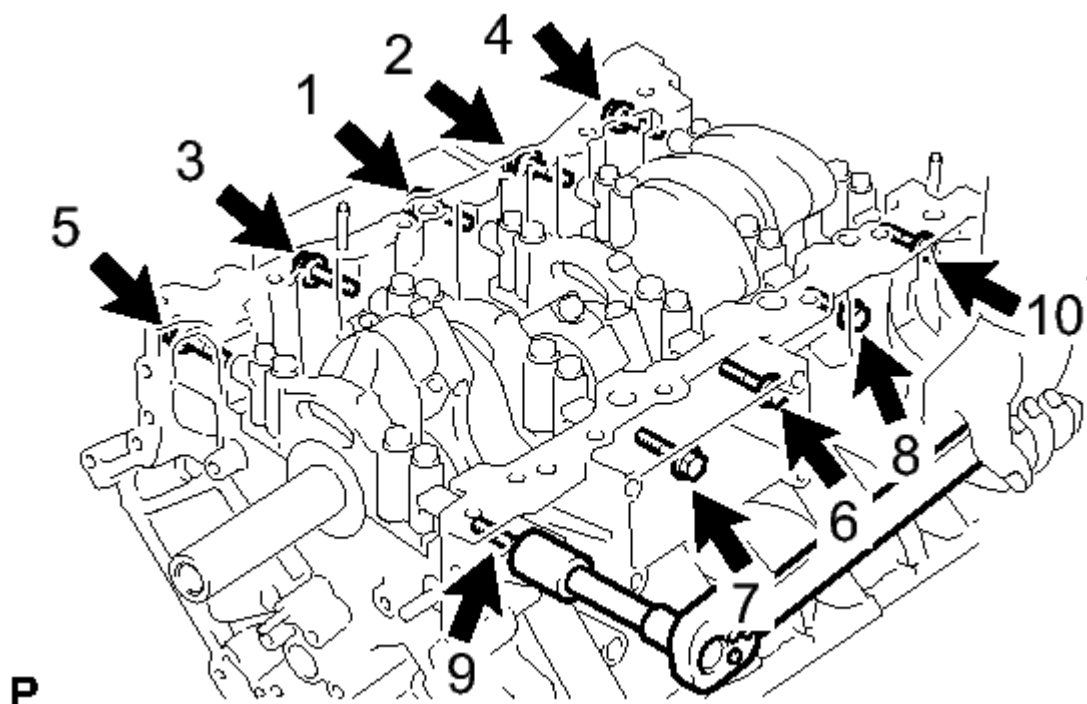
1. Mark the front of the bearing cap bolts with paint.



**Fig. 449: Checking Painted Mark On Bearing Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Tighten the bearing cap bolts another 90° in the order shown in step 1.
  3. Check that the painted marks are now at a 90° angle to the front.
- k. Check that the crankshaft turns smoothly.
1. Install and uniformly tighten the 10 main bearing cap bolts and 10 new seal washers in several steps, in the sequence shown in the illustration.



**P**

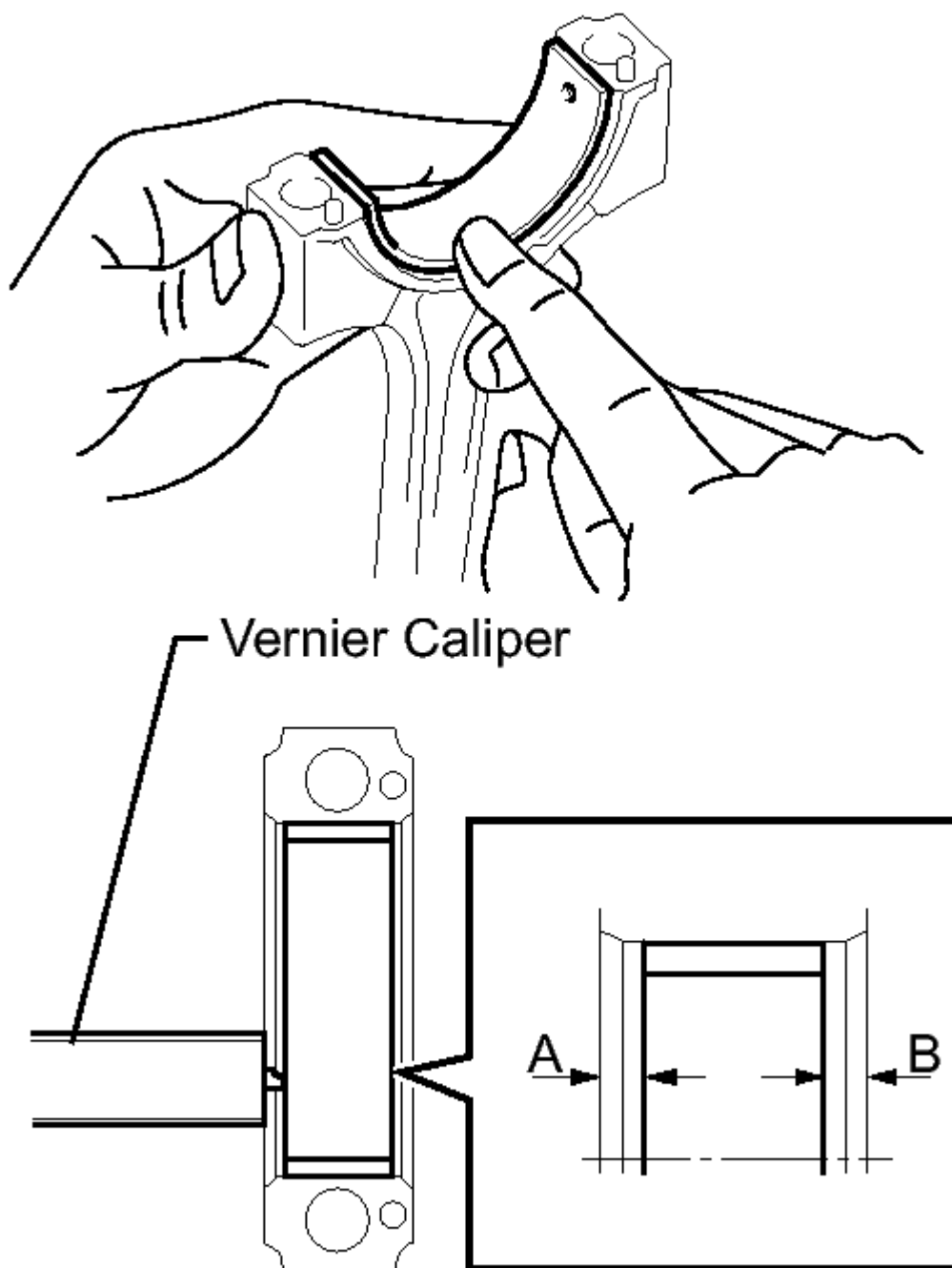
**Fig. 450: Identifying Crankshaft Bearing Cap Bolts Tighten Sequence**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 45 N\*m (459 kgf\*cm, 33 ft.\*lbf)**

m. Check that the crankshaft turns smoothly.

**8. INSTALL CONNECTING ROD BEARING**

**T**

**Fig. 451: Installing Connecting Rod Bearing To Connecting Rod And Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Clean the connecting rod's bearing contact surface, cap's bearing contact surface and both surfaces of both bearings.

- b. Install the connecting rod bearings to the connecting rods and bearing caps.
- c. Using a vernier caliper, measure the distance between the connecting rod's and bearing cap's edges, and each connecting rod bearing's edge.

Dimension A - B or B - A

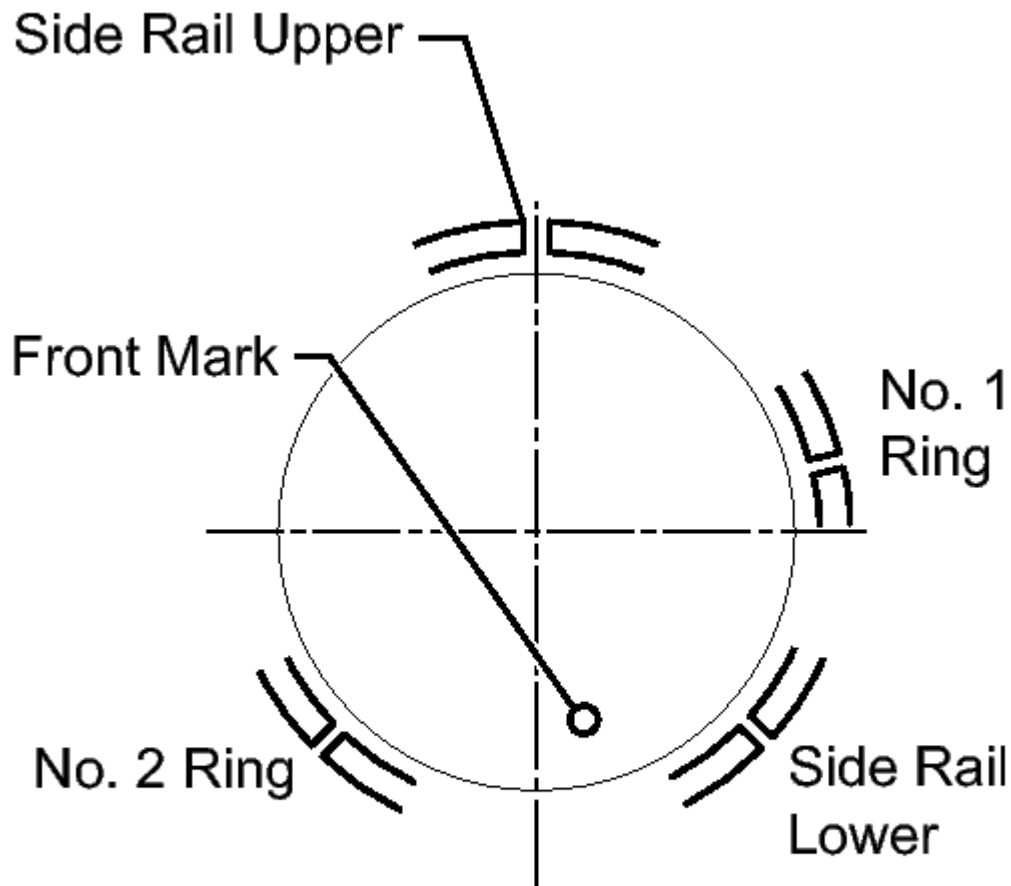
0 to 0.7 mm (0 to 0.0276 in.)

**NOTE:**

- **Do not apply engine oil to the bearings and the contact surfaces.**
- **Do not allow coolant to come into contact with the bearing inner surface.**
- **If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.**

## 9. INSTALL PISTON AND CONNECTING ROD



**P****Fig. 452: Positioning Piston Rings**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

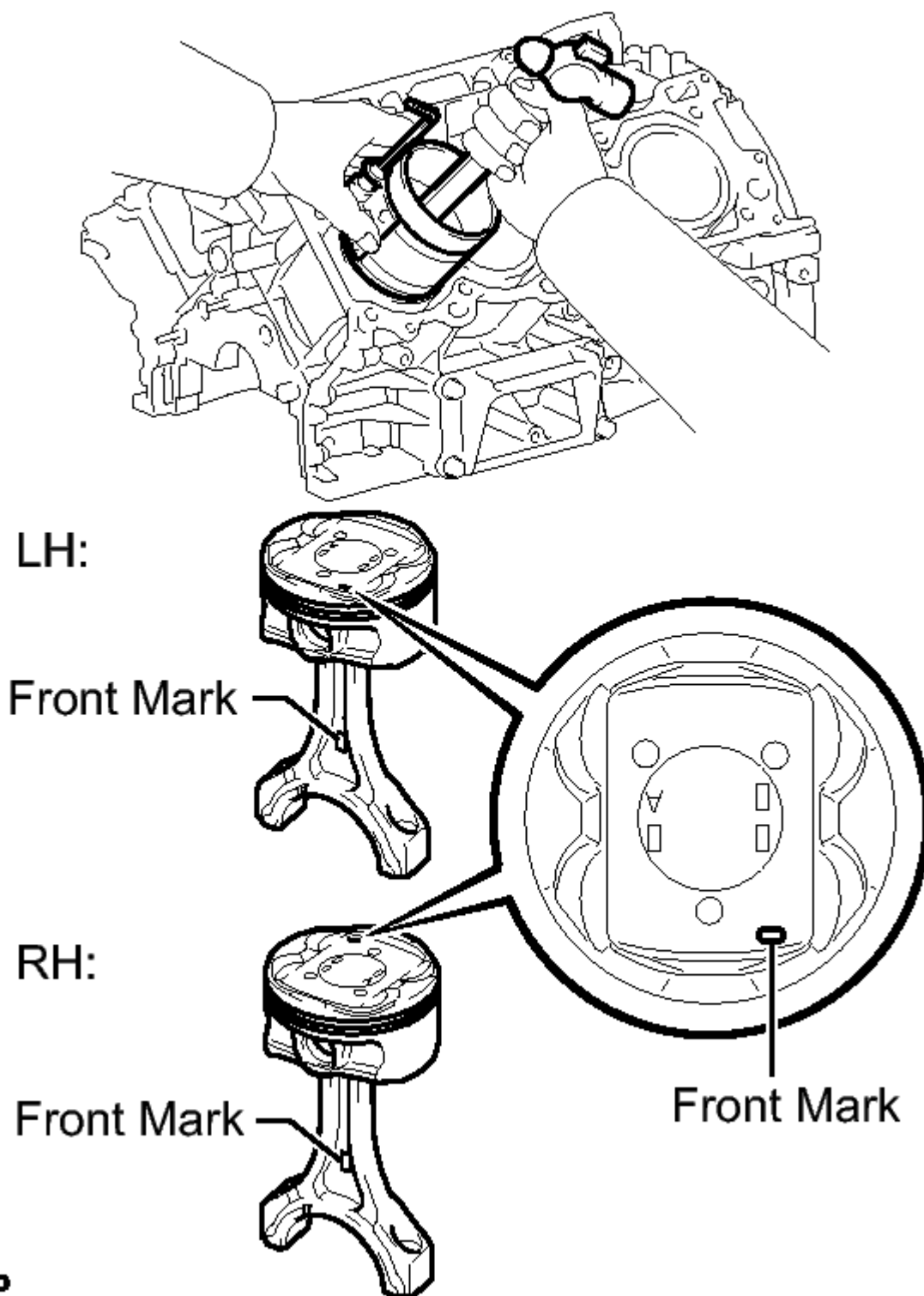
- Apply engine oil to the cylinder walls, the pistons, and the surfaces of the connecting rod bearings.
- Position the piston rings so that the ring ends are as shown in the illustration.

**HINT:**

The expander ends can be placed anywhere.

**NOTE:**        **Do not align the ring ends.**

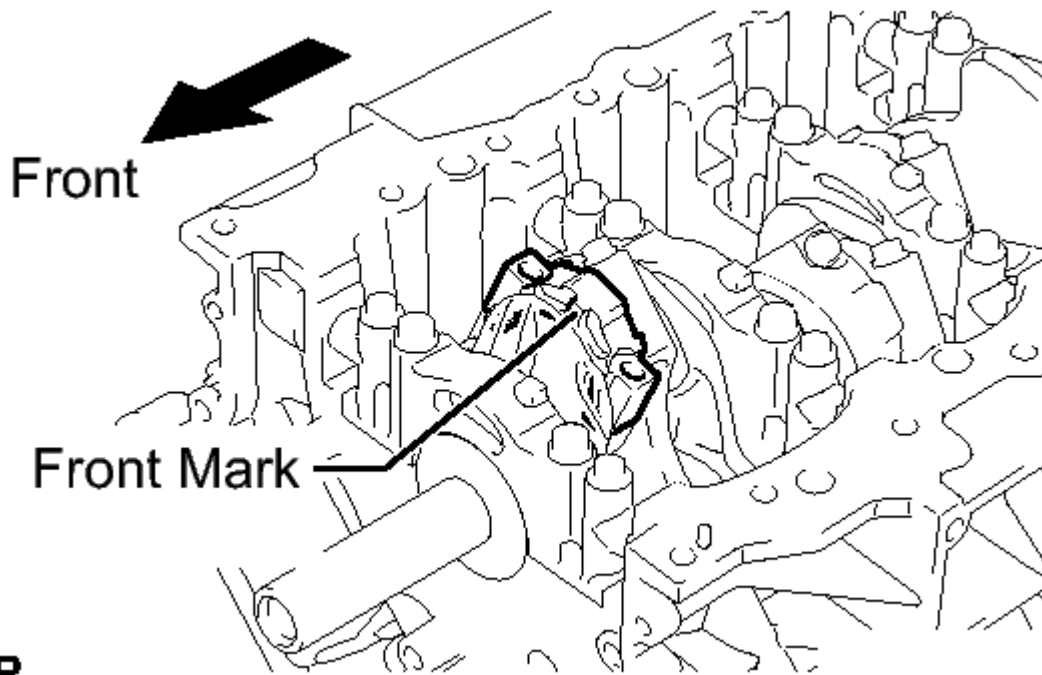
- Using a hammer handle and piston ring compressor, push the correctly numbered piston and connecting rod into the cylinder with the front mark of the piston facing forward.



**P**

**Fig. 453: Push The Correctly Numbered Piston And Connecting Rod**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Place the connecting rod cap on the connecting rod.

**P****Fig. 454: Place The Connecting Rod Cap**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Match the numbered connecting rod cap with the connecting rod.
2. Check that the front mark of the connecting rod cap is facing forward.

Front Mark

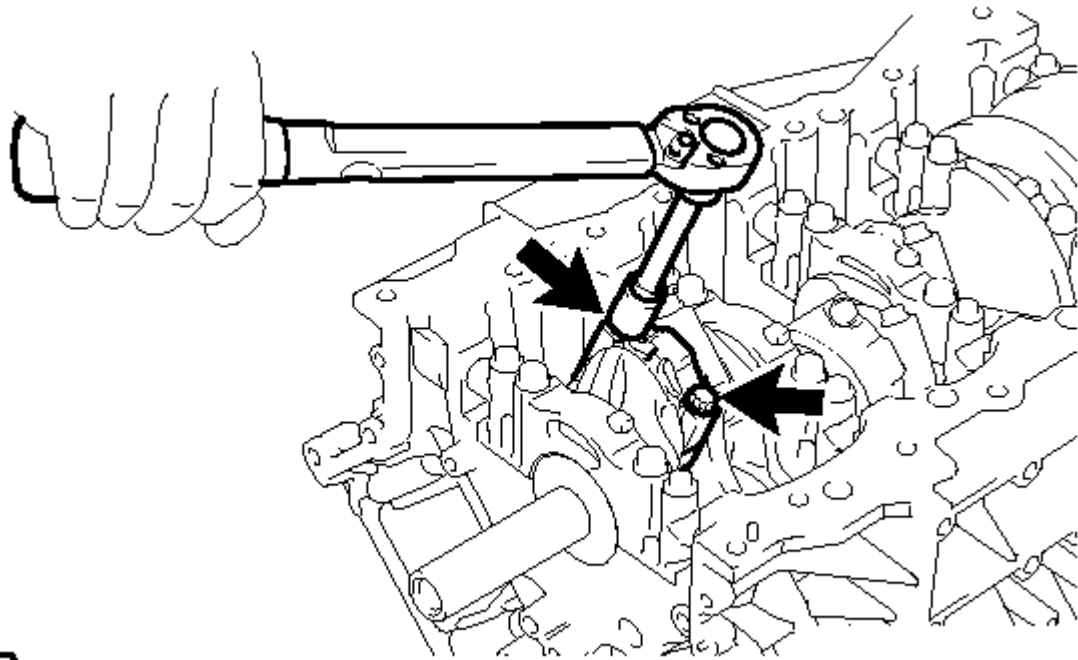
Item	Front Mark
LH	Front Side
RH	Rear Side

- e. Apply a light coat of engine oil to the threads and under the heads of the connecting rod cap bolts.
- f. Temporarily install the connecting rod cap bolts.

**HINT:**

The connecting rod cap bolts are tightened in 2 progressive steps.

- g. Step 1:
  1. Install and alternately tighten the bolts of the connecting rod cap in several steps.



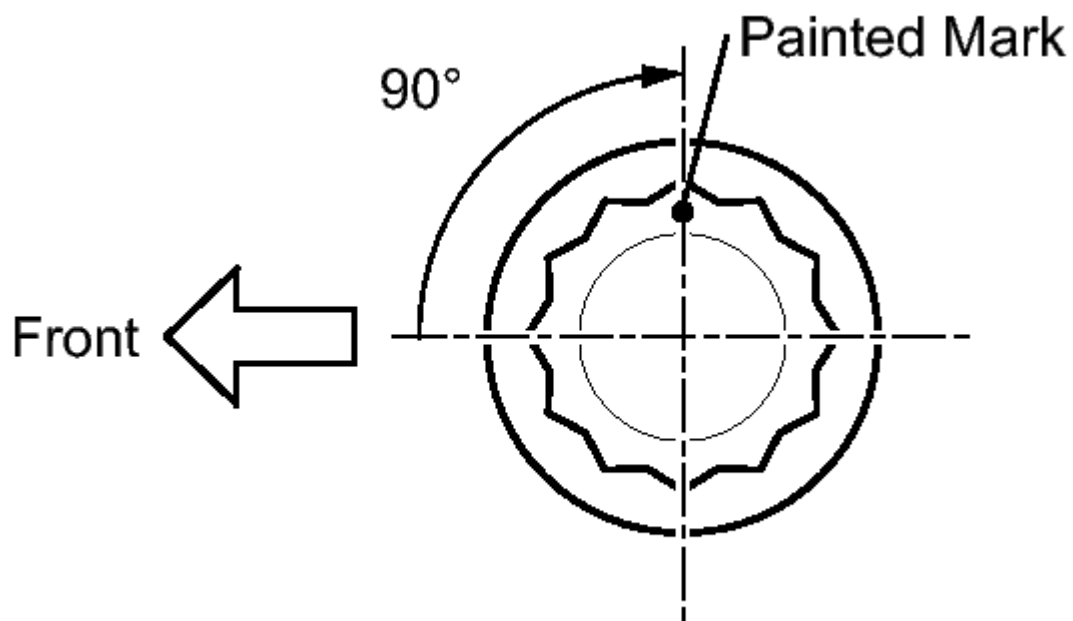
**P**

**Fig. 455: Tightening Connecting Rod Cap Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**

h. Step 2:



**P**

**Fig. 456: Checking Painted Mark On Connecting Cap Bolt**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

1. Mark the front side of each connecting rod cap bolt with paint.
  2. Tighten the cap bolts another 90° as shown in the illustration in the order in step 1.
  3. Check that the painted marks are now at a 90° angle to the front.
- i. Check that the crankshaft turns smoothly.