

**2012 ENGINE****Engine Mechanical (Service Information) - tC****ENGINE****ON-VEHICLE INSPECTION****ON-VEHICLE INSPECTION****HINT:**

The type of ignition switch used on this model differs according to the specifications of the vehicle. For the expressions listed in this information, refer to the "Ignition Switch Expressions" precaution. Refer to **PRECAUTION**.

**1. INSPECT VALVE LASH ADJUSTER ASSEMBLY NOISE**

- a. Rev up the engine several times. Check that the engine does not emit unusual noises.

If unusual noises occur, warm up the engine and idle it for over 30 minutes. Then perform the inspection above again.

If any defects or problems are found during the inspection above, perform a lash adjuster inspection See step 2.

**2. INSPECT IGNITION TIMING**

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

Standard ignition timing

5 to 15° BTDC @ idle

**HINT:**

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

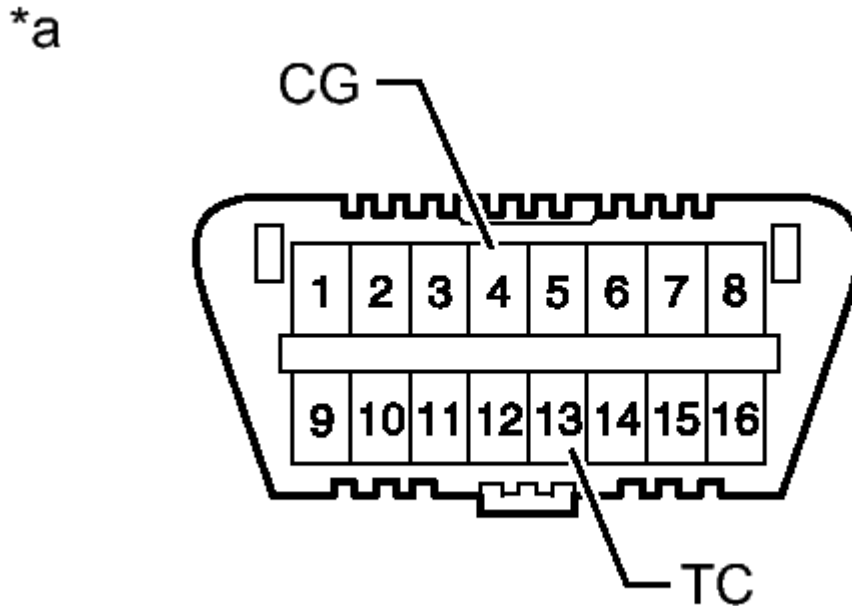
If the ignition timing is not as specified, check the valve timing.

- c. When not using the Techstream:

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.



**Fig. 1: Identifying DLC3 Terminal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09843-18040

**TEXT IN ILLUSTRATION**

*a	Front view of DLC3
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**NOTE:**

- Confirm the terminal numbers before connecting them. Connecting the wrong terminals can damage the engine.
- When checking the ignition timing, the transmission should be in neutral.

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

Standard ignition timing

8 to 12° BTDC @ idle

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

Standard ignition timing

5 to 15° BTDC @ idle

If the ignition timing is not as specified, check the valve timing.

6. Check that the ignition timing advances immediately when the engine speed is increased.
7. Disconnect the timing light from the engine.

### 3. INSPECT ENGINE IDLE SPEED

- a. Warm up and stop the engine.
- 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 on.
4. Enter the following menus: Powertrain / Engine and ECT / Data List / Primary / Engine Speed.

Standard idle speed

600 to 700 RPM

**HINT:**

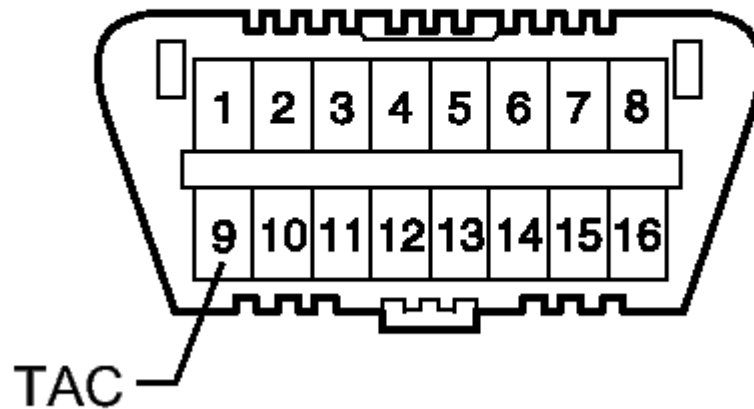
Refer to the Techstream operator's manual for further details.

**NOTE:**        **When checking the idle speed, the transmission should be in neutral.**

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

\*a

**Fig. 2: Identifying DLC3 Terminals**

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

- SST: 09843-18030

**TEXT IN ILLUSTRATION**

*a	Front view of DLC3
----	-----------------------

**NOTE:** Confirm the terminal number before connecting the probe.  
Connecting the wrong terminals can damage the engine.

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

Standard idle speed (Transmission in neutral)

600 to 700 RPM

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

- Disconnect the tachometer probe from the DLC3.

**4. INSPECT COMPRESSION**

- Warm up and stop the engine.
- Check for DTCs. Refer to **DTC CHECK / CLEAR**.



- c. Remove the 4 spark plugs. Refer to **REMOVAL** .
- d. Disconnect the 4 fuel injector connectors.
- e. Insert a compression gauge into the spark plug hole.
- f. Fully open the throttle.
- g. While cranking the engine, measure the compression pressure.

Standard compression pressure

1450 kPa (14.7 kgf/cm<sup>2</sup> , 210 psi) or higher

Minimum pressure

980 kPa (9.9 kgf/cm<sup>2</sup> , 142 psi)

Difference between each cylinder

200 kPa (2.0 kgf/cm<sup>2</sup> , 29 psi) or less

**HINT:**

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

- h. 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 is worn or damaged.
- If the pressure stays low, a valve may be stuck or seated improperly, or there may be leakage from the gasket.
- i. Connect the 4 fuel injector connectors.
- j. Install the 4 spark plugs. Refer to **INSTALLATION** .
- k. Clear the DTCs. Refer to **DTC CHECK / CLEAR** .

**5. INSPECT CO/HC**

**HINT:**

This check determines 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 a CO/HC meter testing probe at least 40 cm (1.31 ft.) into the tailpipe during idling.

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

**HINT:**

- When performing the 2-mode (2500 RPM and idle) test, follow the measurement order prescribed by the applicable local regulations.
  - If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
1. Check the air fuel ratio sensor. Refer to **INSPECTION** and heated oxygen sensor. Refer to **INSPECTION** operation.
  2. See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

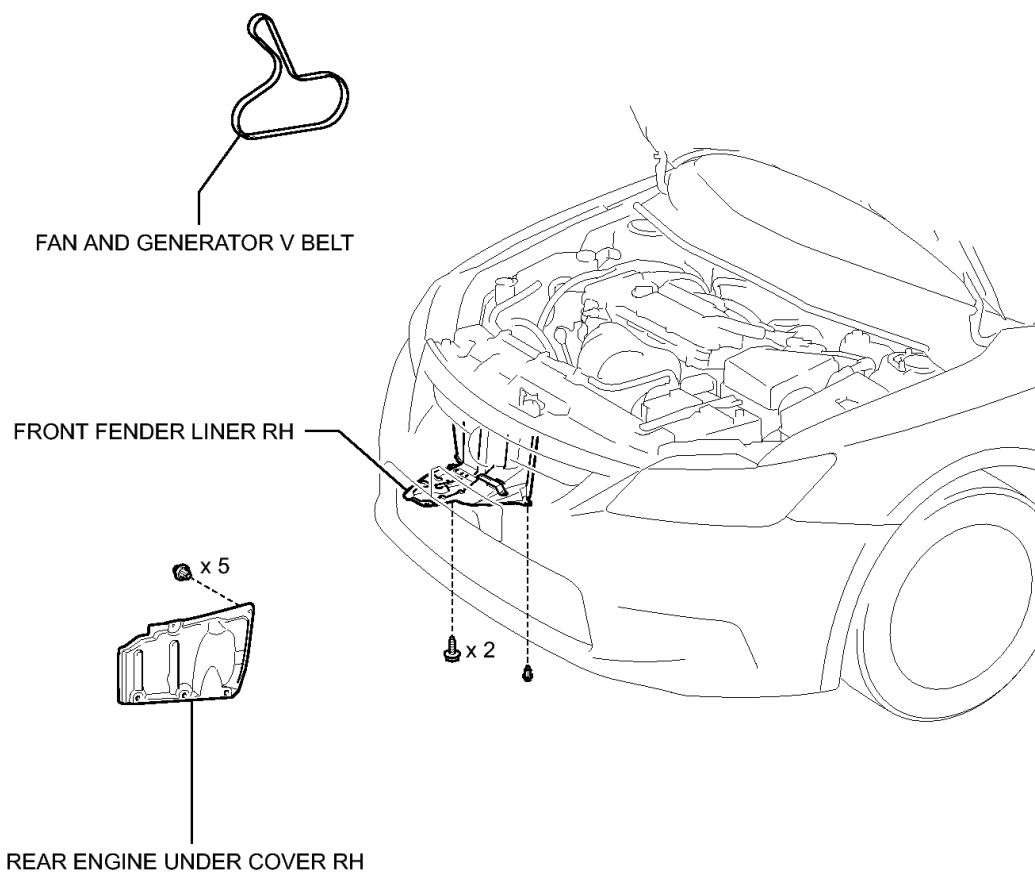
CO	HC	Symptom	Causes
Normal	High	Rough idle	1. Faulty ignition <ul style="list-style-type: none"> <li>• Incorrect timing</li> <li>• Plugs are contaminated or shorted, or gaps are defective</li> </ul> 2. Leaky intake and exhaust valves 3. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. 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> 2. Lean mixture causing misfire
			1. Restricted air filter 2. Faulty SFI system <ul style="list-style-type: none"> <li>• Faulty pressure</li> <li>• Defective</li> </ul>

High	High	Rough idle (Black smoke from exhaust)	engine coolant temperature sensor <ul style="list-style-type: none"><li>• Faulty ECM</li><li>• Faulty injector</li><li>• Faulty throttle position sensor</li><li>• Faulty mass air flow meter sensor</li></ul>
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## DRIVE BELT

### COMPONENTS

### ILLUSTRATION



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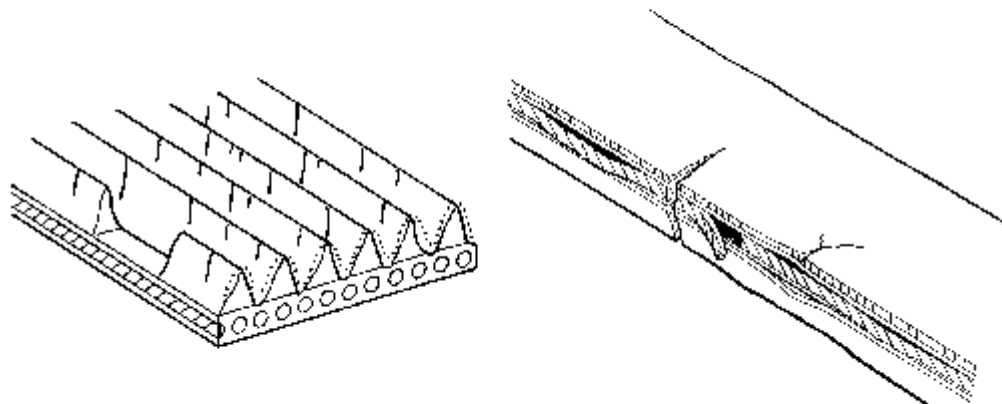
**Fig. 3: Identifying Drive Belt Replacement Components**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 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.

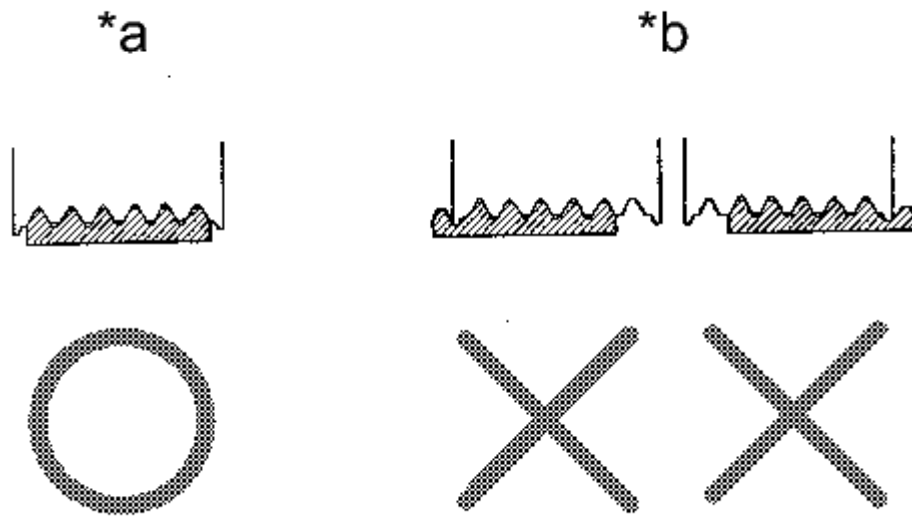


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**Fig. 4: Inspecting Fan And Generator V Belt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.



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**Fig. 5: Illustration Of Correct Belt Alignment**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*a	CORRECT
*b	INCORRECT

**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 a malfunction exists, replace the V-ribbed belt tensioner.

**REMOVAL**

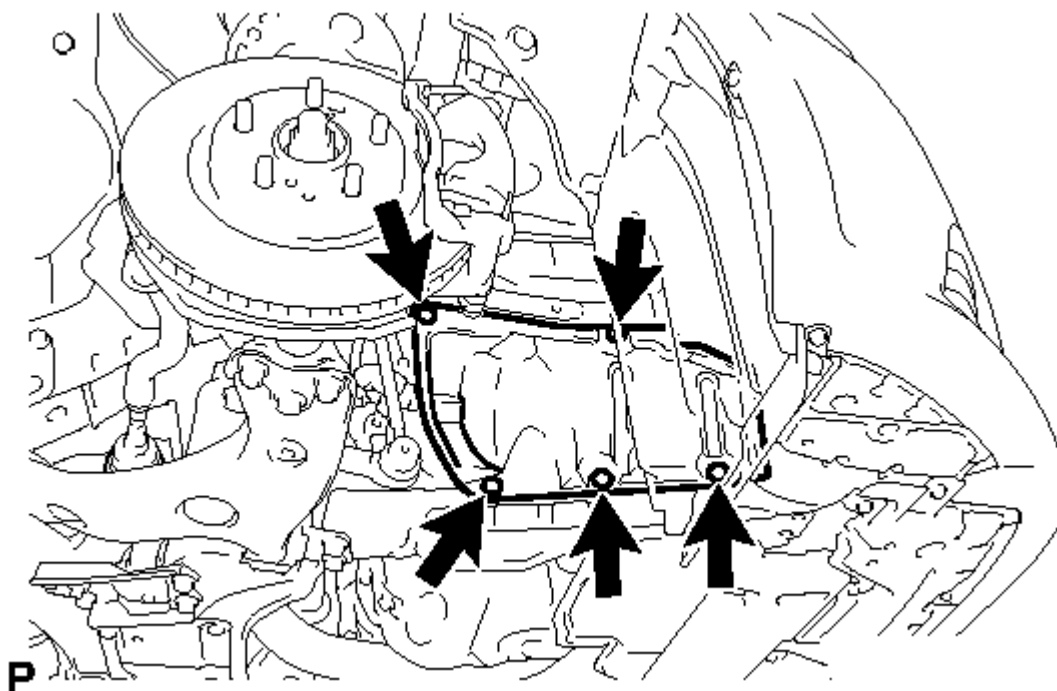
**REMOVAL**

**1. DISCONNECT FRONT FENDER LINER RH**

- a. Remove the 2 screws and clip and disconnect the front fender liner.

**2. REMOVE REAR ENGINE UNDER COVER RH**

- a. Remove the 5 clips and rear engine under cover RH.

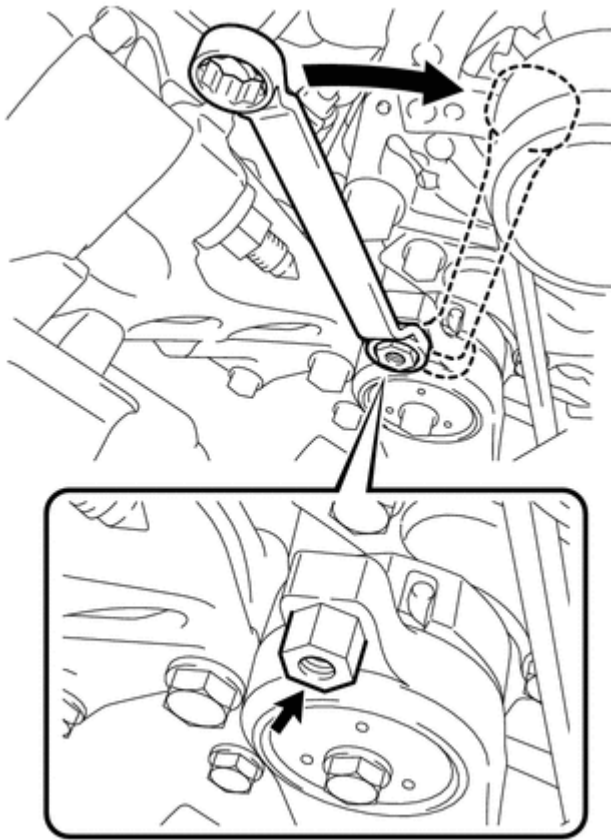


**Fig. 6: Identifying Rear Engine Under Cover Clips (RH)**

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

### 3. REMOVE FAN AND GENERATOR V BELT

- a. Attach a wrench to the hexagonal portion of the belt tensioner as shown in the illustration, rotate the belt tensioner clockwise, and remove the V belt.



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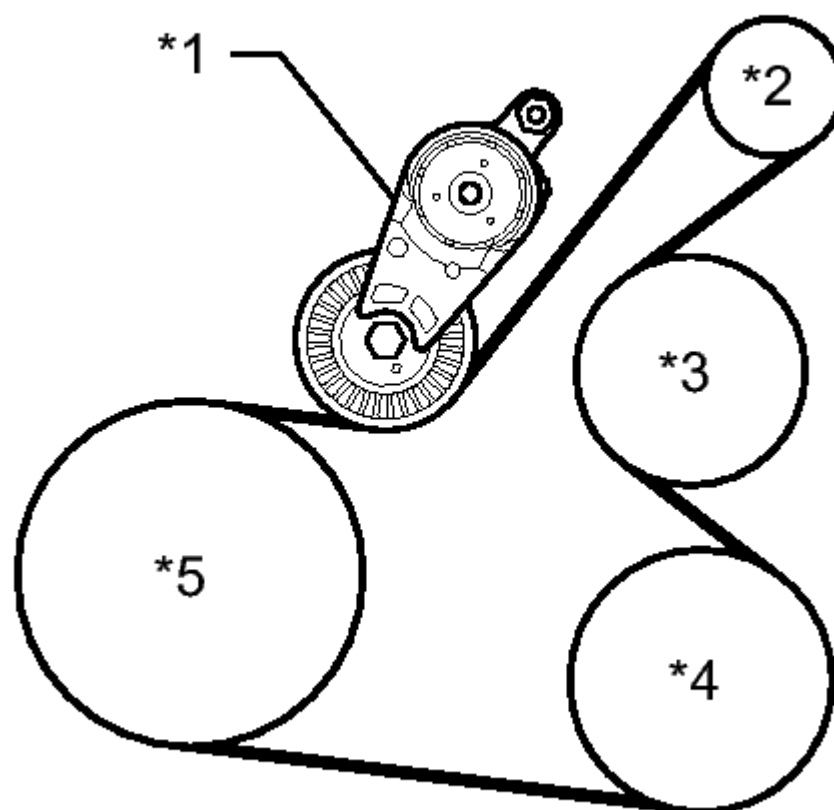
**Fig. 7: Removing V-Ribbed Belt Using Wrench**

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

**INSTALLATION****INSTALLATION****1. INSTALL FAN AND GENERATOR V BELT**

- a. Set the V belt onto each part as shown in the illustration, except the water pump pulley.



**P****Fig. 8: V Belt Pulley & Belt Routing**

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

**TEXT IN ILLUSTRATION**

*1	Belt Tensioner
*2	Generator
*3	Water Pump
*4	Cooler Compressor
*5	Crankshaft

- b. Loosen the V belt by turning the belt tensioner clockwise.
- c. Set the V belt onto the water pump pulley.

**NOTE:** Make sure that the belt is attached to each pulley. In particular, make

**sure that the belt is securely fitted into the grooves of the crankshaft pulley.**

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

- a. Install the under cover RH with the 5 clips.

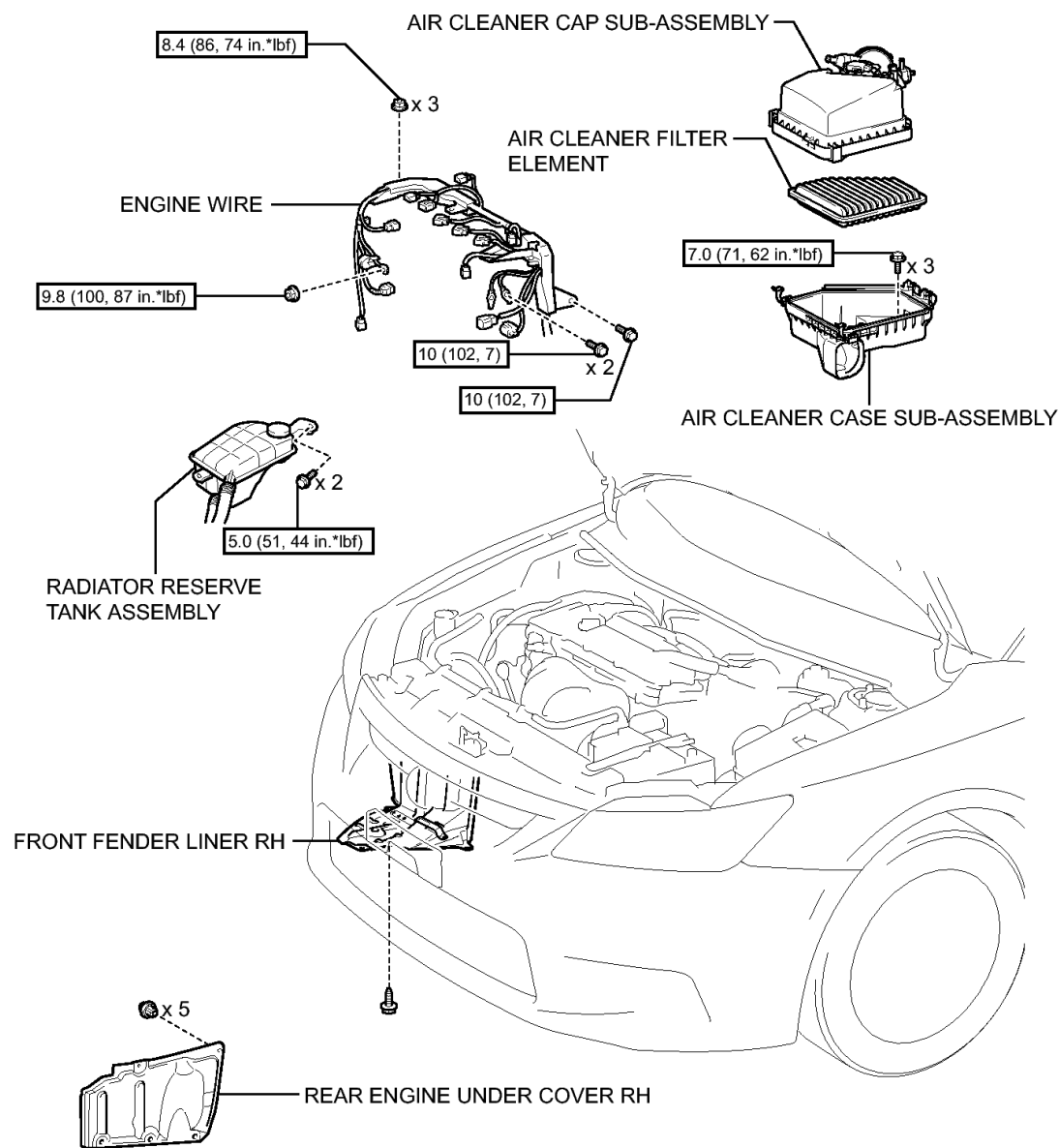
**3. CONNECT FRONT FENDER LINER RH**

- a. Connect the front fender liner with the 2 screws and clip.

## **CAMSHAFT**

### **COMPONENTS**

### **ILLUSTRATION**

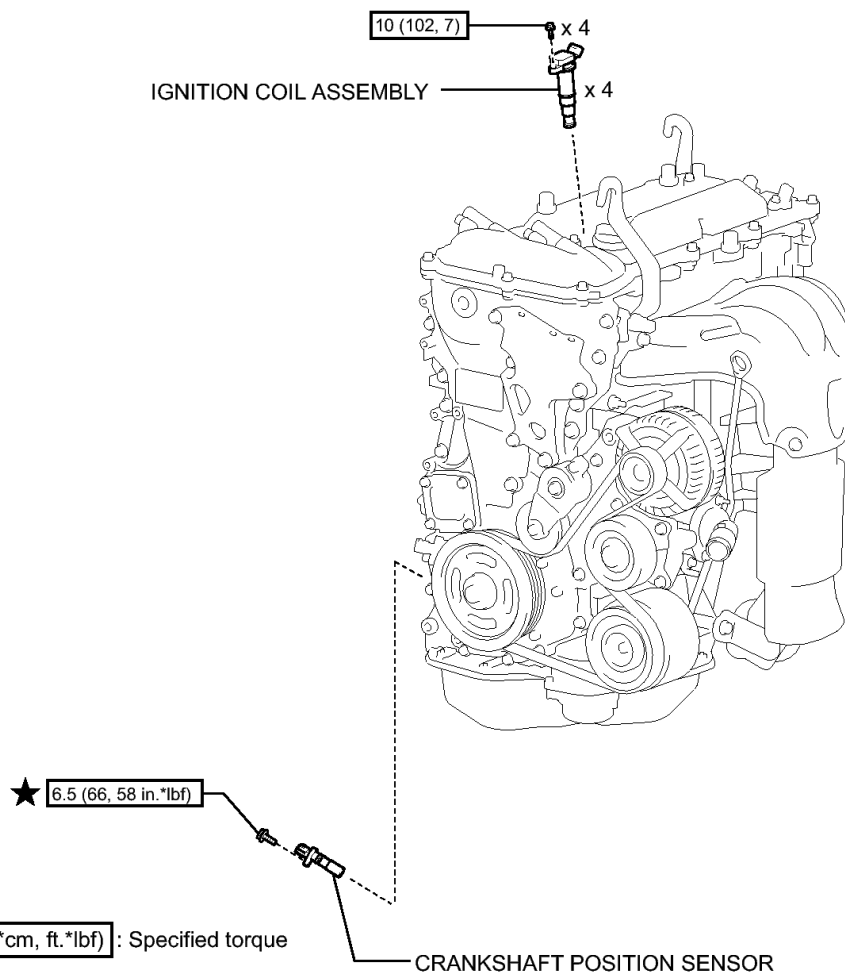


[N\*m (kgf\*cm, ft.\*lbf)]: Specified torque

c

**Fig. 9: Identifying Camshaft Replacement Components With Torque Specifications (1 Of 3)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

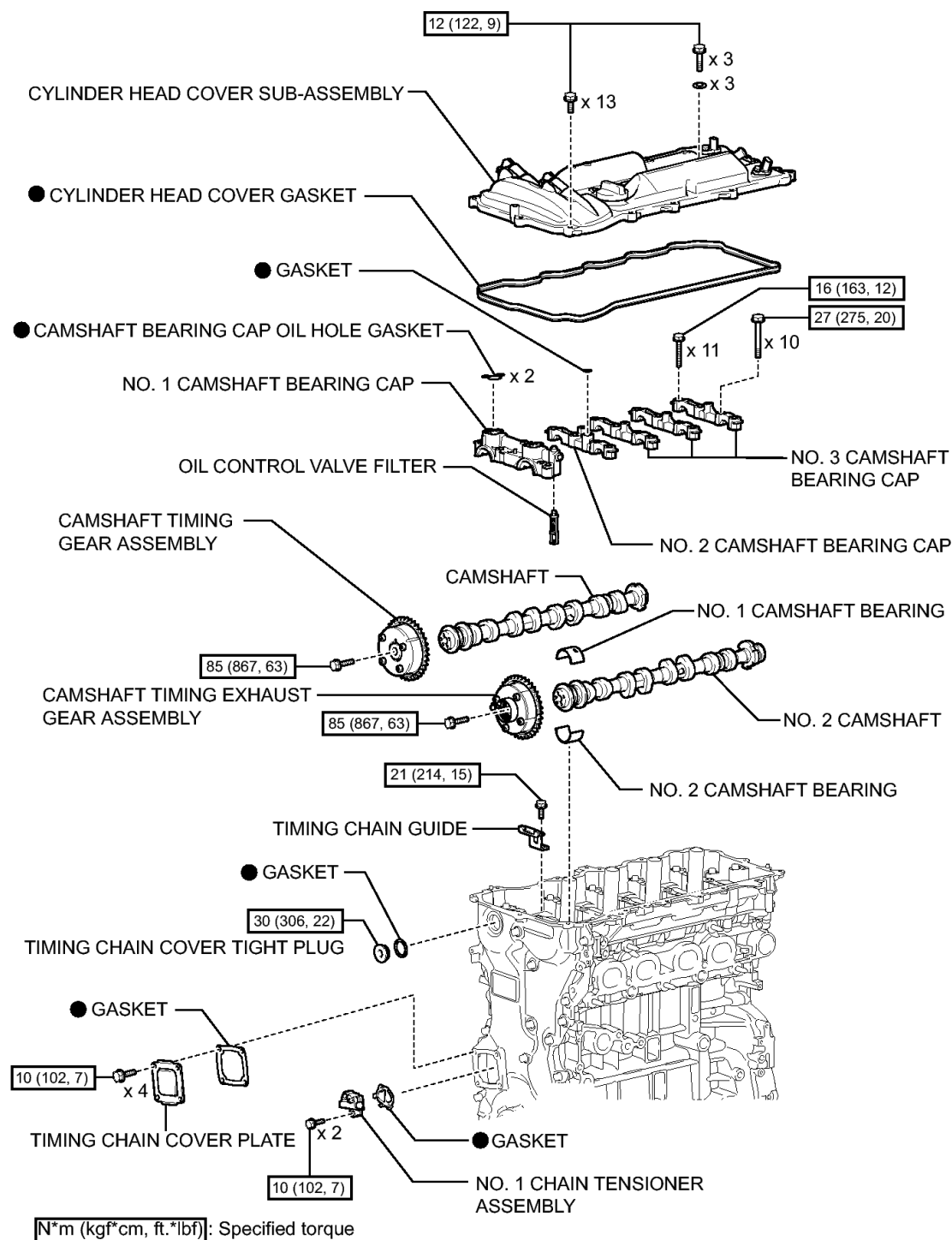
ILLUSTRATION



★ Precoated part

**Fig. 10: Identifying Camshaft Replacement Components With Torque Specifications (2 Of 3)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



c

**Fig. 11: Identifying Camshaft Replacement Components With Torque Specifications (3 Of 3)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

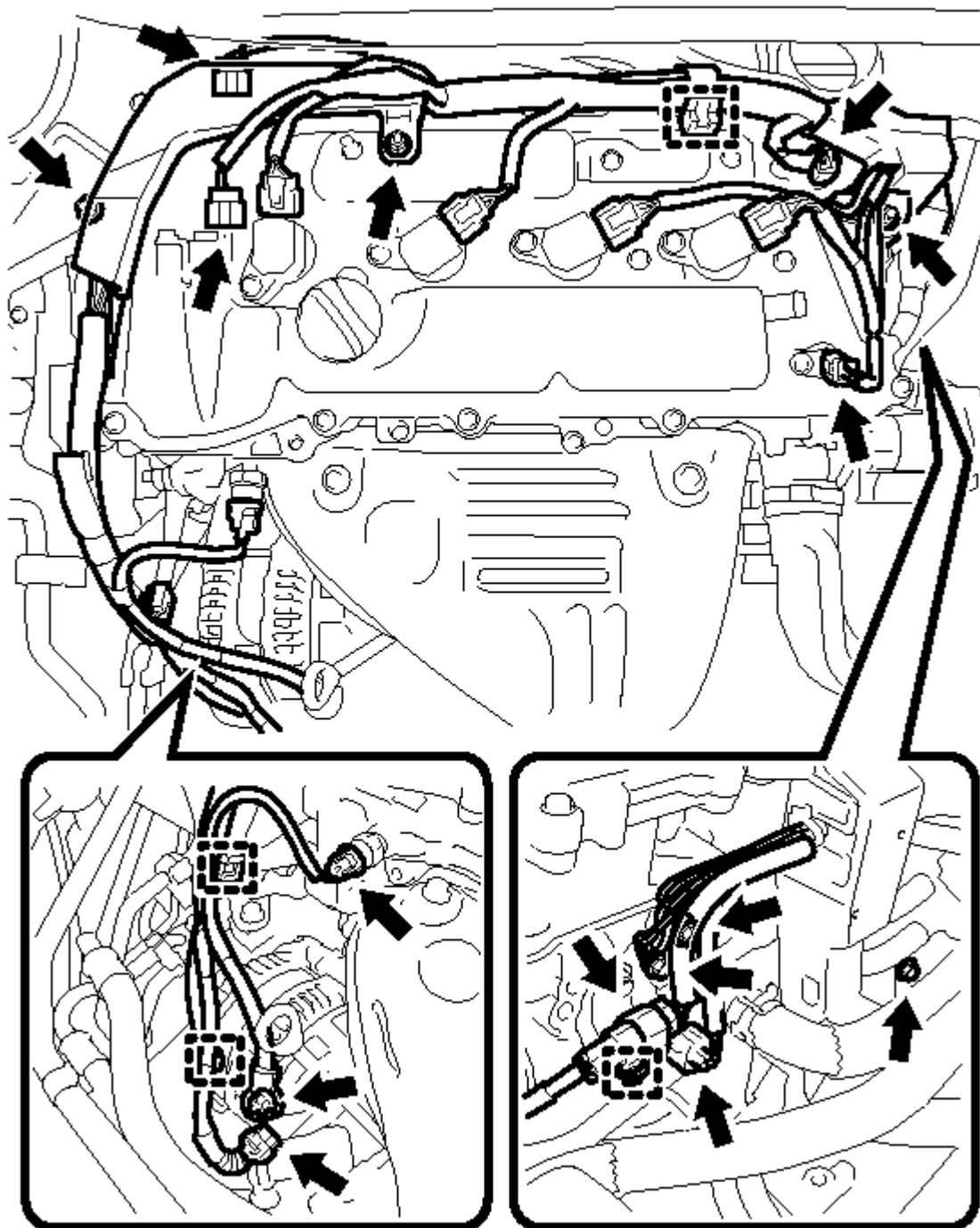
## REMOVAL

**REMOVAL****1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

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

**2. REMOVE FRONT WHEEL RH****3. DISCONNECT FRONT FENDER LINER RH** See step 8**4. REMOVE REAR ENGINE UNDER COVER RH** See step 2**5. REMOVE AIR CLEANER CAP SUB-ASSEMBLY** . Refer to REMOVAL - Step 2**6. REMOVE AIR CLEANER CASE SUB-ASSEMBLY** . Refer to REMOVAL - Step 3**7. DISCONNECT ENGINE WIRE**

- a. Disconnect the connectors and clamps, remove the bolts and nuts and disconnect the engine wire from the engine.

**C****Fig. 12: Engine Wiring Harness**

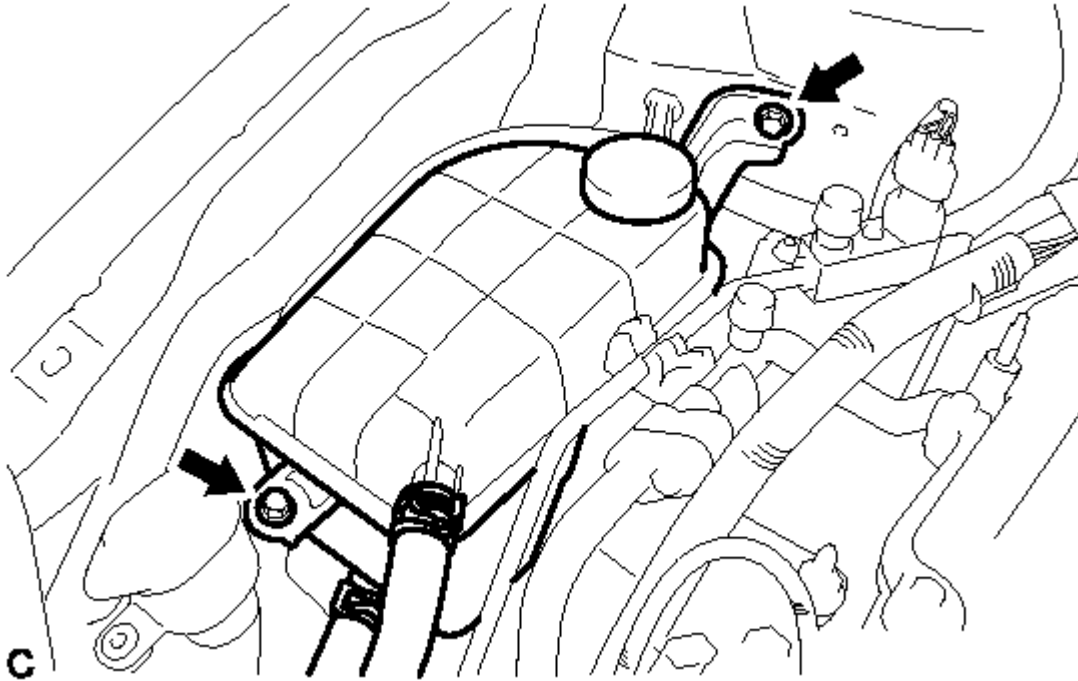
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE IGNITION COIL ASSEMBLY** . Refer to **REMOVAL - Step 1**
9. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** . Refer to **REMOVAL - Step 4**

10. **REMOVE CRANKSHAFT POSITION SENSOR** . Refer to **REMOVAL - Step 2**

11. **SEPARATE RADIATOR RESERVE TANK ASSEMBLY**

- a. Remove the 2 bolts and separate the radiator reserve tank assembly.



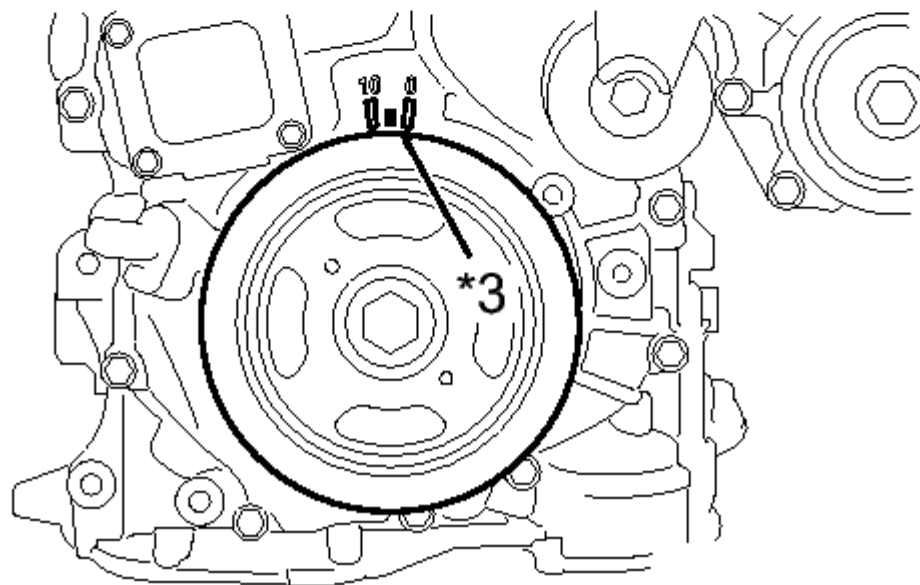
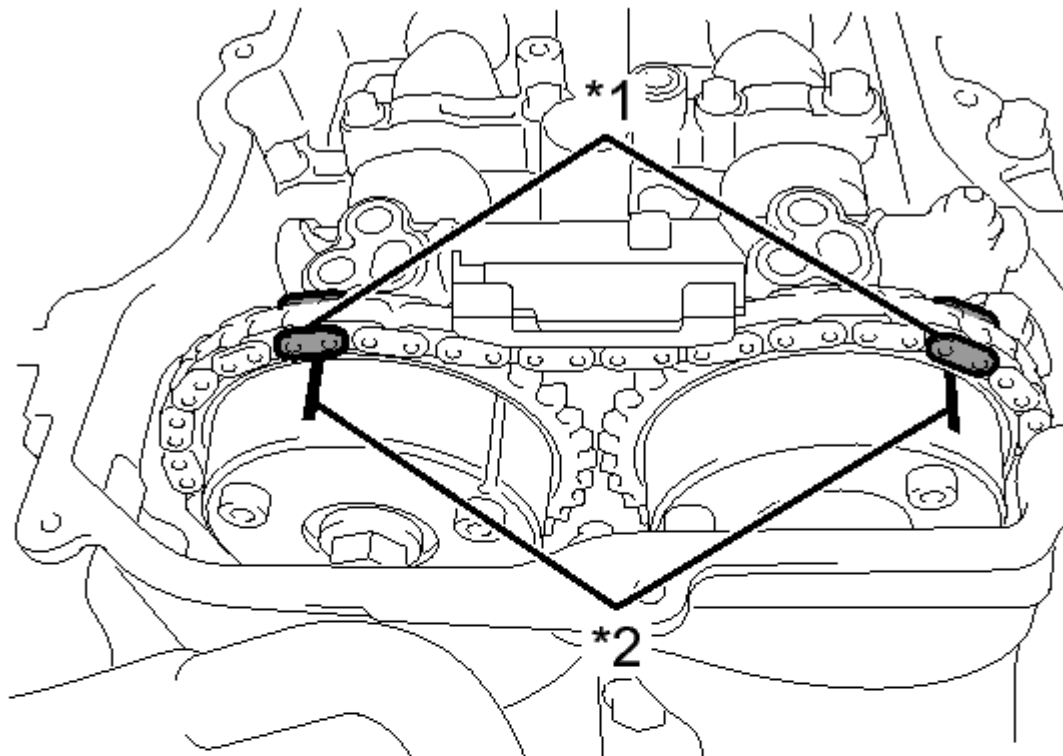
**Fig. 13: Radiator Reserve Tanks Assembly**

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

12. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**

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



**C**

**Fig. 14: Aligning Timing Notch (Groove) And Timing Mark "0"**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

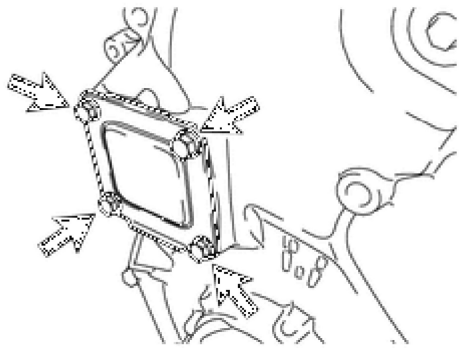
\*1 Paint Mark

*2	Matchmark
*3	Timing Notch

- b. Check that each matchmark of the camshaft timing gear and camshaft timing exhaust gear are aligned with each matchmark located as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.
- c. Place paint marks on the chain in alignment with the timing marks on the camshaft timing gear and camshaft timing exhaust gear.

### 13. REMOVE TIMING CHAIN COVER PLATE

- a. Remove the 4 bolts, timing chain cover plate and gasket.

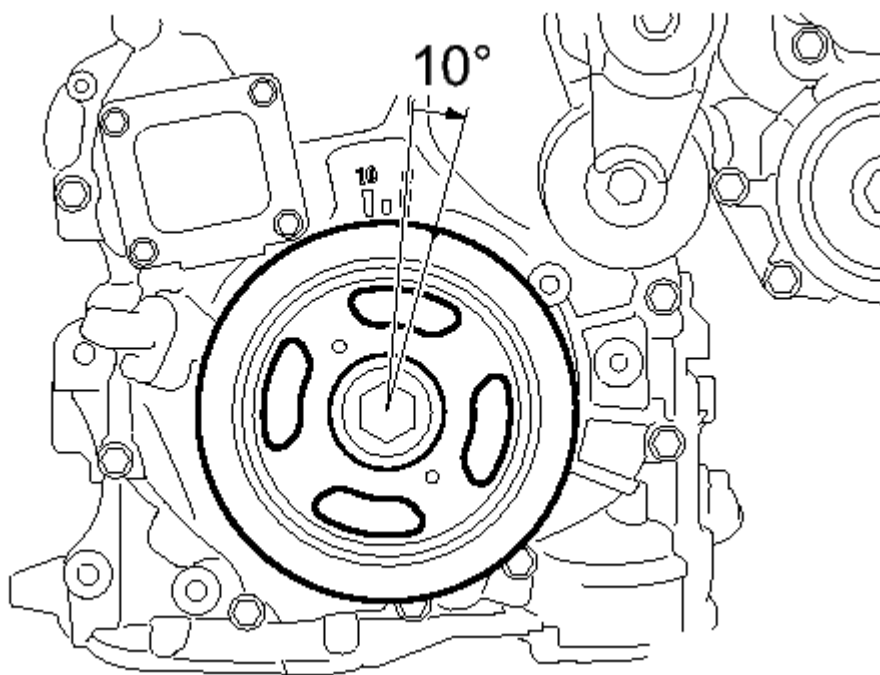


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**Fig. 15: Location of Timing Chain Cover Plate Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

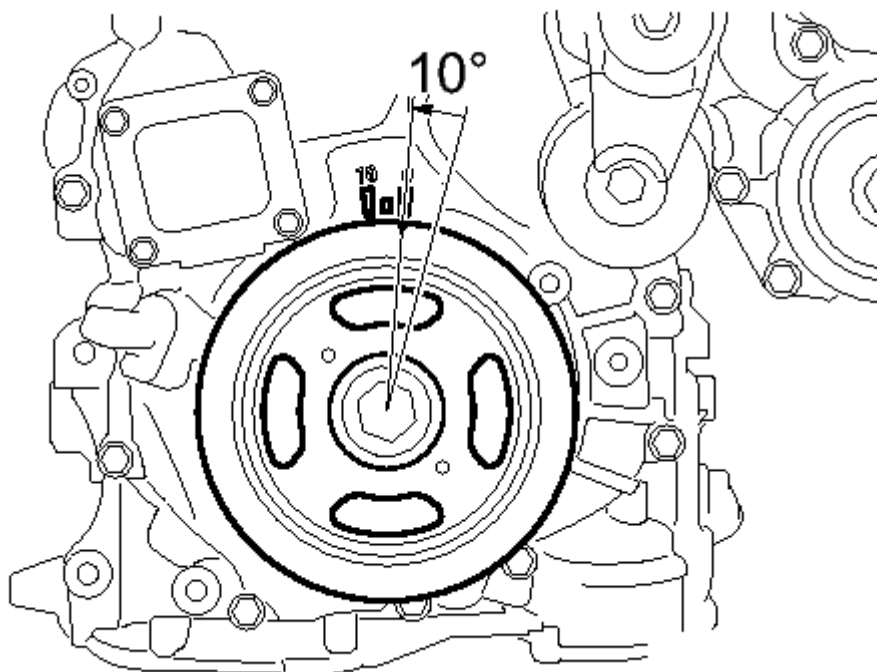
### 14. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Turn the crankshaft approximately 10° clockwise.

**C**

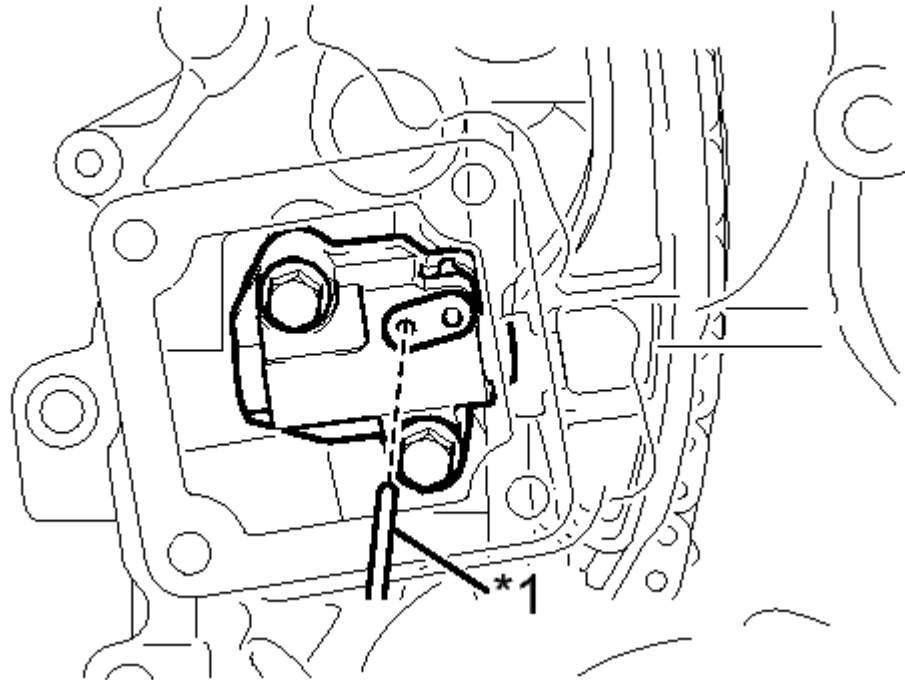
**Fig. 16: View Of Turning Crankshaft 10Degrees Clockwise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Turn the crankshaft approximately 10° counterclockwise.

**C**

**Fig. 17: Turning Crankshaft Approximately 10Degrees Counterclockwise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Align the holes of the stopper plate and tensioner, and insert a pin into the stopper plate hole to lock the tensioner.

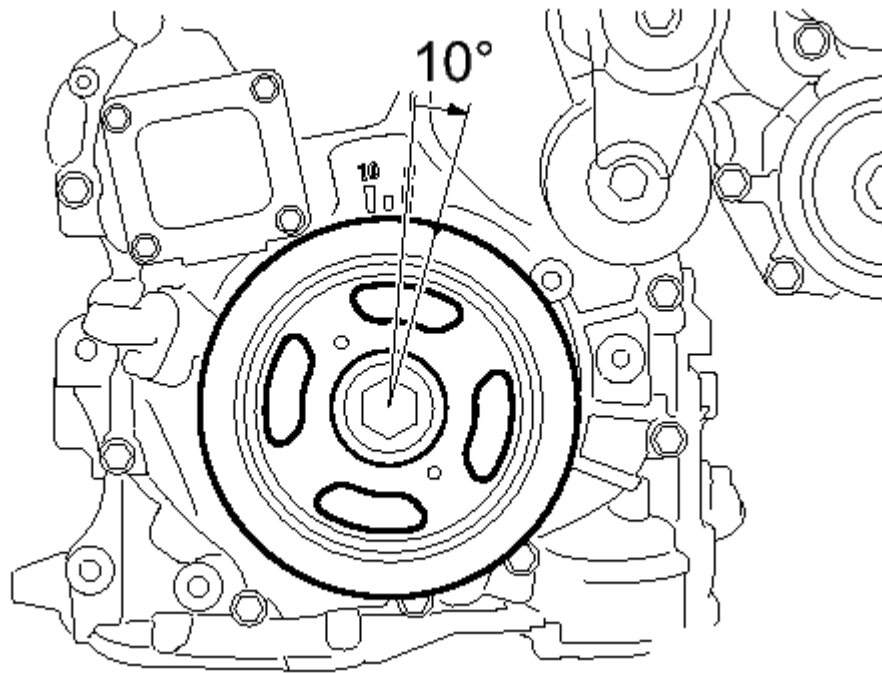


**Fig. 18: Aligning Holes Of Stopper Plate & Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

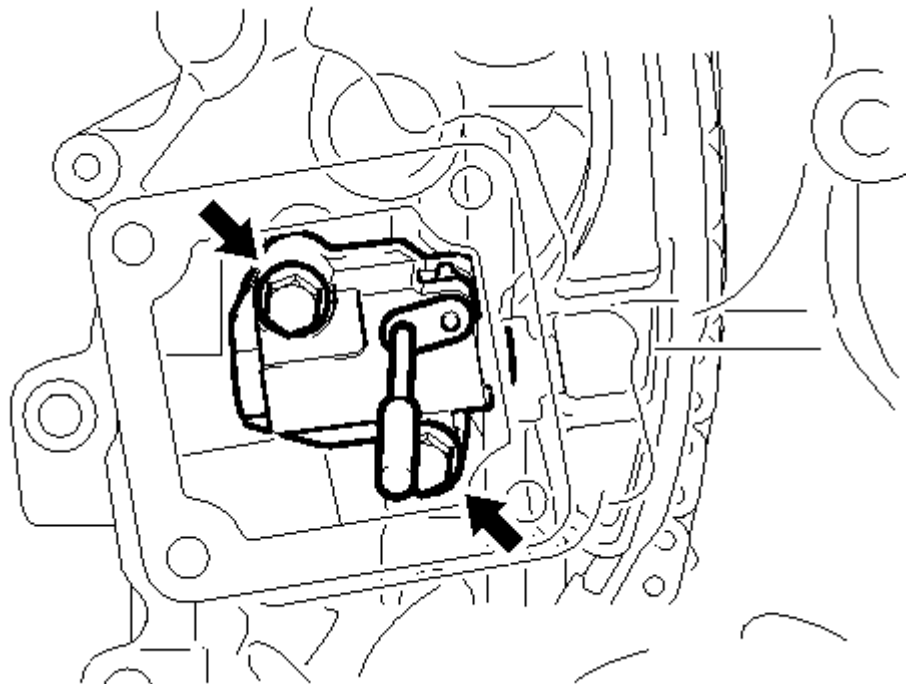
\*1 Pin

- d. Turn the crankshaft approximately 10° clockwise.

**C**

**Fig. 19: View Of Turning Crankshaft 10Degrees Clockwise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

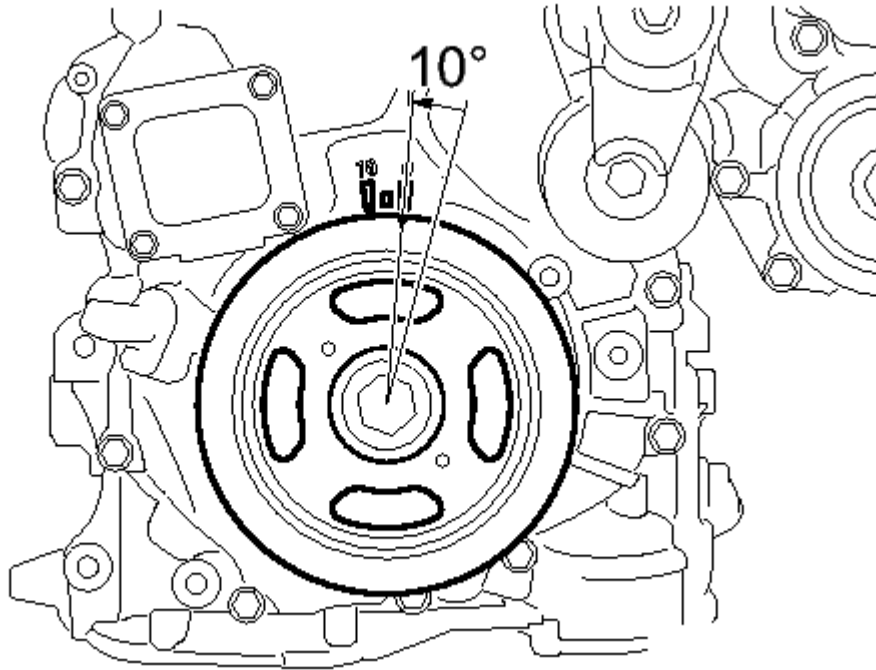
- e. Remove the 2 bolts, chain tensioner and gasket.

**C**

**Fig. 20: No. 1 Chain Tensioner Assembly Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

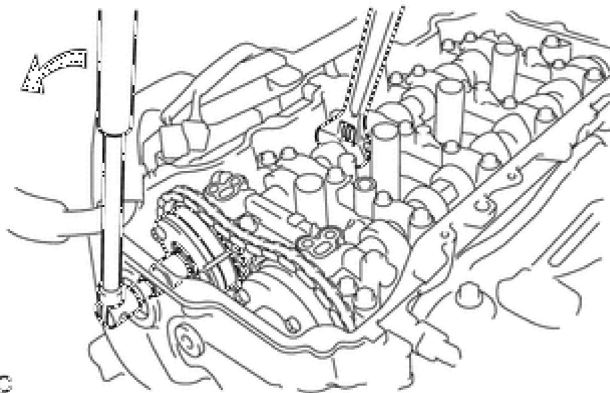
**NOTE:** Make sure not to drop the gasket inside the timing chain cover.

- f. Turn the crankshaft approximately 10° counterclockwise.



**Fig. 21: Turning Crankshaft Approximately 10Degrees Counterclockwise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

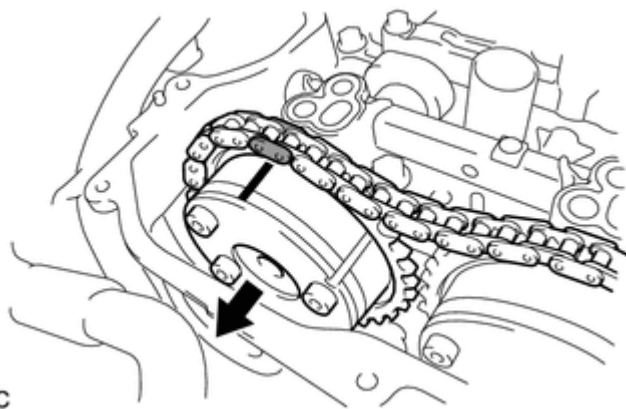
15. **REMOVE TIMING CHAIN GUIDE** See step 12
16. **REMOVE TIMING CHAIN COVER TIGHT PLUG** See step 23
17. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY**
  - a. Hold the hexagonal portion of the camshaft with a wrench and remove the bolt from the camshaft.



**Fig. 22: Removing Bolt From The Camshaft Using A Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

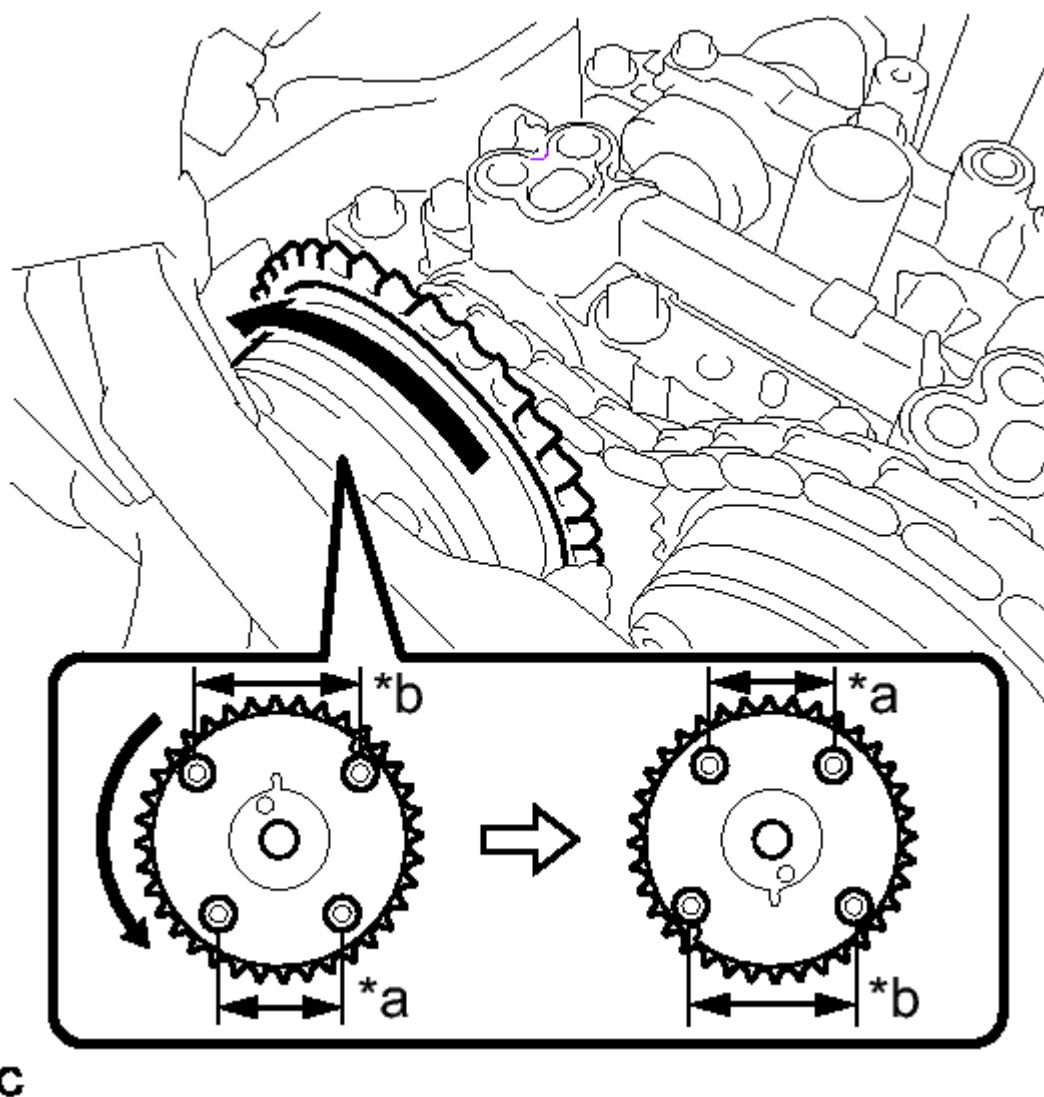
**NOTE:** Be careful not to damage the cylinder head or spark plug tube with the wrench.

- b. Separate the camshaft timing gear assembly from the camshaft.



**Fig. 23: Identifying Camshaft Timing Gear Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the timing chain from the camshaft timing gear assembly, and turn the camshaft timing gear assembly approximately 180°.



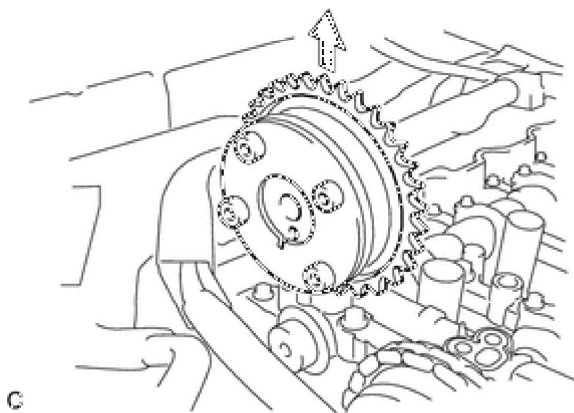
**Fig. 24: Removing Timing Chain From The Camshaft Timing Gear Assembly & Turn The Camshaft Timing Gear Assembly Approximately 180Degrees**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*a	Narrow
*b	Wide

- d. Remove the camshaft timing gear assembly.



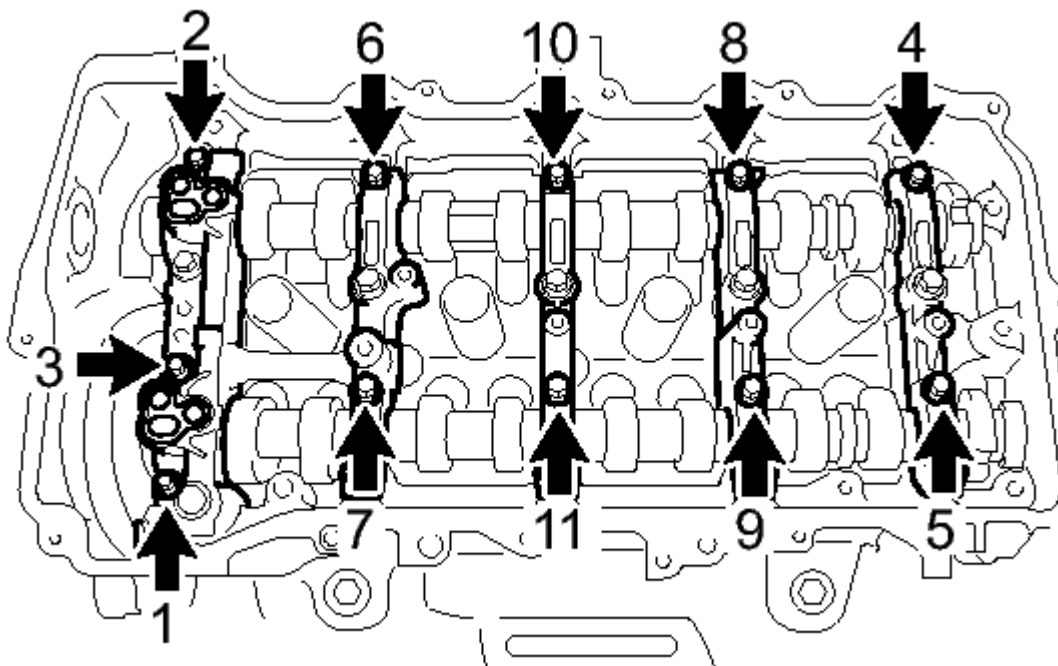


**Fig. 25: Identifying Camshaft Timing Gear Assembly**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not disassemble the camshaft timing gear.

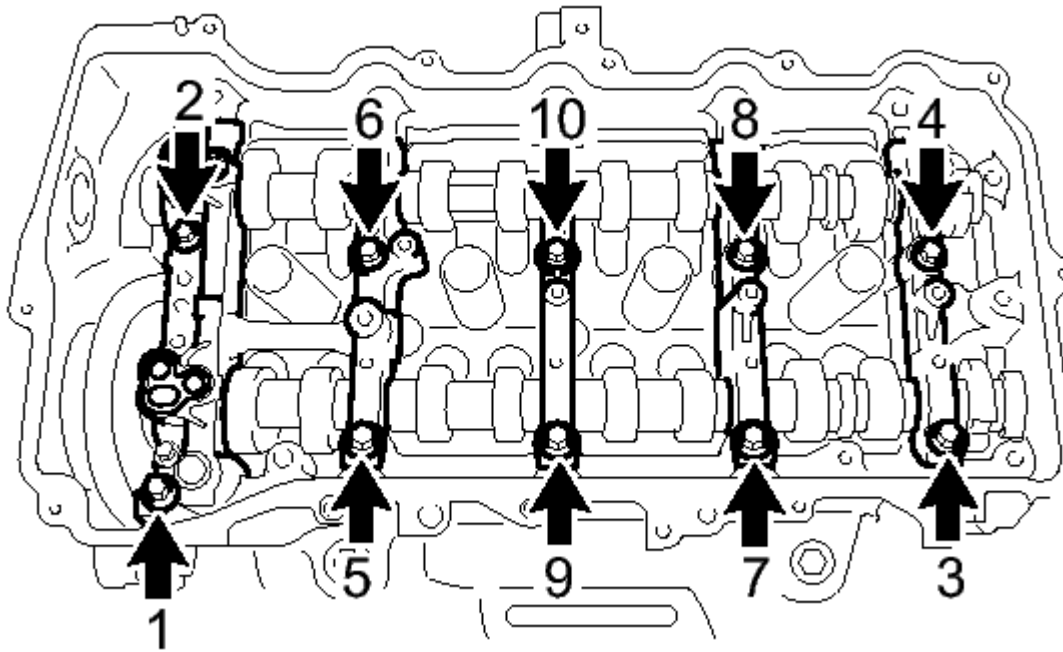
#### 18. REMOVE CAMSHAFT BEARING CAP

- a. Using several steps, remove the 11 bearing cap bolts in the sequence shown in the illustration.



**Fig. 26: Identifying 11 Bearing Cap Bolts with Loosening Sequence**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using several steps, remove the 10 bearing cap bolts in the sequence shown in the illustration.



**Fig. 27: Identifying 10 Bearing Cap Bolt Loosening Sequence (Second Step)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

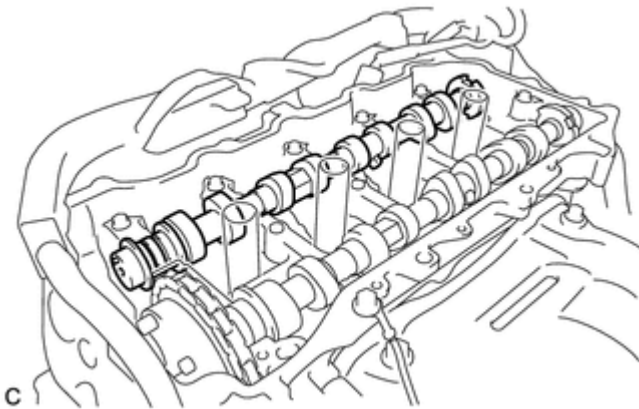
- c. Remove the 5 bearing caps.

**HINT:**

Arrange the removed parts in the correct order.

**19. REMOVE CAMSHAFT**

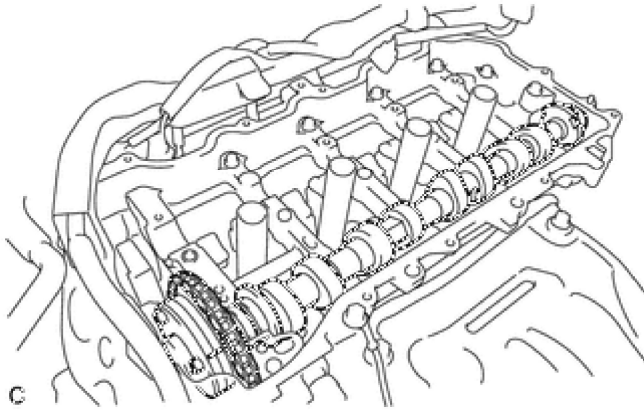
- a. Remove the camshaft from the camshaft housing.



**Fig. 28: Removing Camshaft From Camshaft Housing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

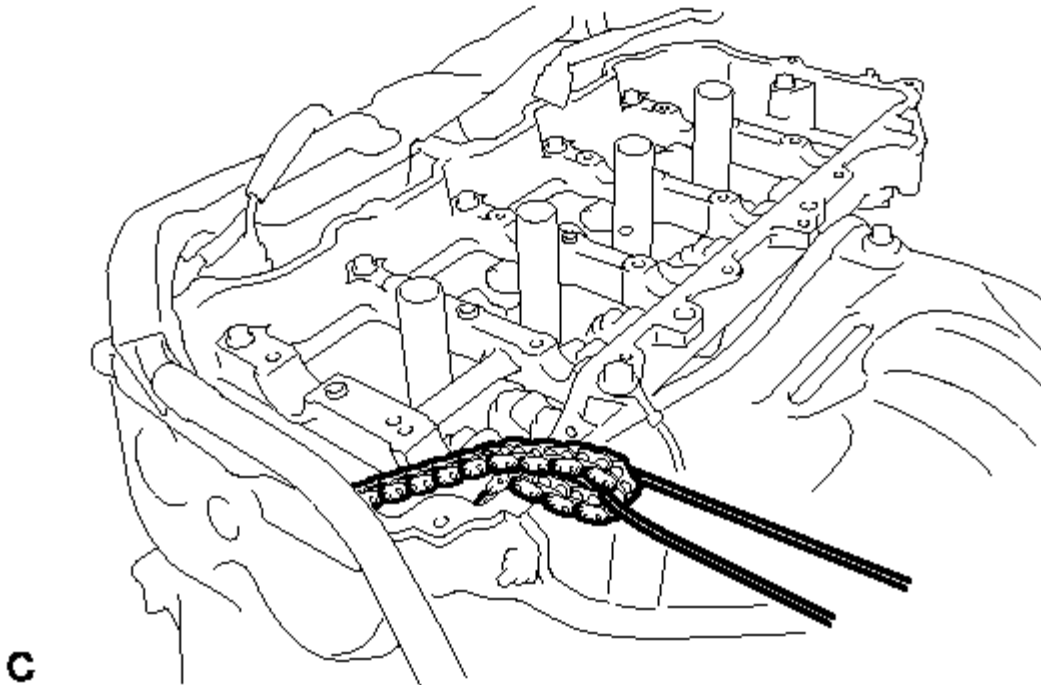
**20. REMOVE NO. 2 CAMSHAFT**

- a. Hold the chain and remove the No. 2 camshaft from the camshaft housing.



**Fig. 29: Removing No. 2 Camshaft From The Camshaft Housing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Suspend the chain with a string or equivalent as shown in the illustration.

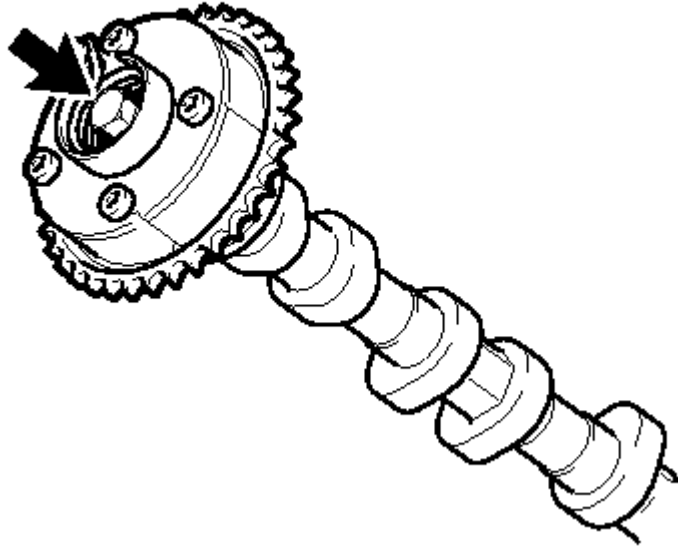


**Fig. 30: Suspending Chain With A String Or Equivalent**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to drop the chain inside the timing chain cover.

**21. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

- a. Remove the flange bolt and camshaft timing exhaust gear assembly.



**Fig. 31: Location of Camshaft Timing Exhaust Gear Flange Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

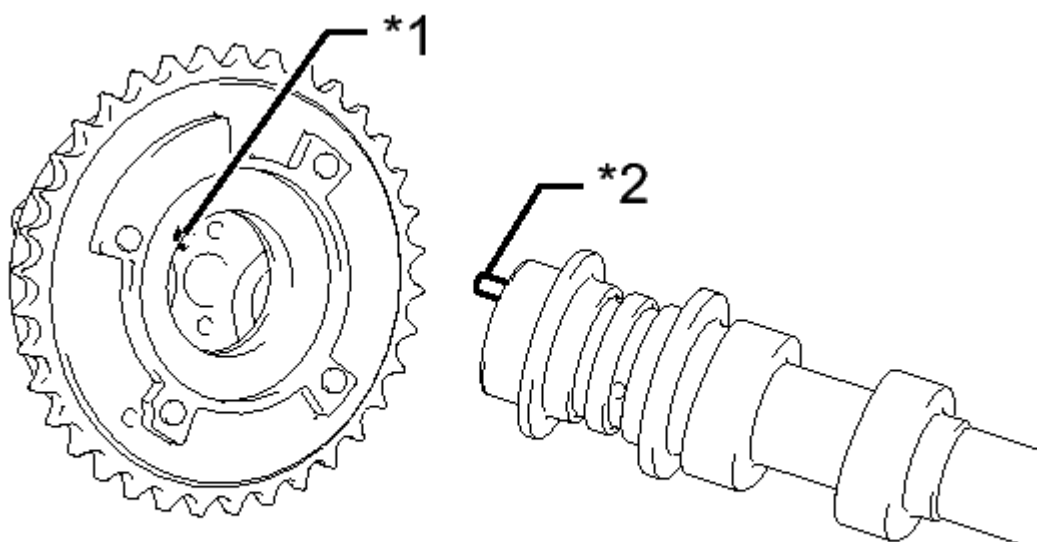
**NOTE:** Do not disassemble the camshaft timing exhaust gear.

22. **REMOVE OIL CONTROL VALVE FILTER** See step 37
23. **REMOVE NO. 1 CAMSHAFT BEARING** See step 39
24. **REMOVE NO. 2 CAMSHAFT BEARING** See step 40

## INSTALLATION

### INSTALLATION

1. **INSTALL NO. 2 CAMSHAFT BEARING** See step 18
2. **INSTALL NO. 1 CAMSHAFT BEARING** See step 17
3. **INSTALL OIL CONTROL VALVE FILTER** See step 19
4. **INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
  - a. Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear assembly.

**P****Fig. 32: Identifying Pin Hole And Knock Pin**

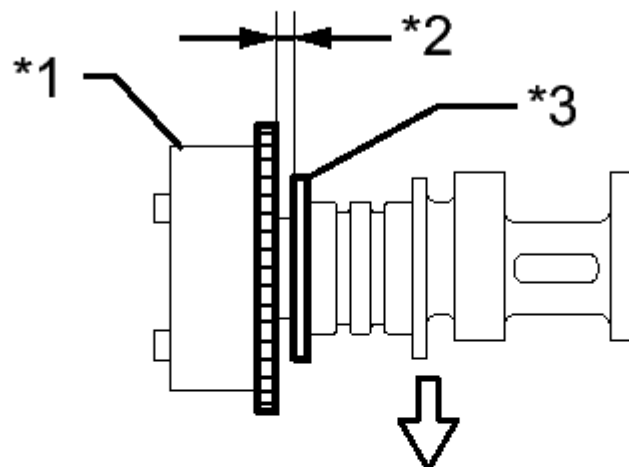
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

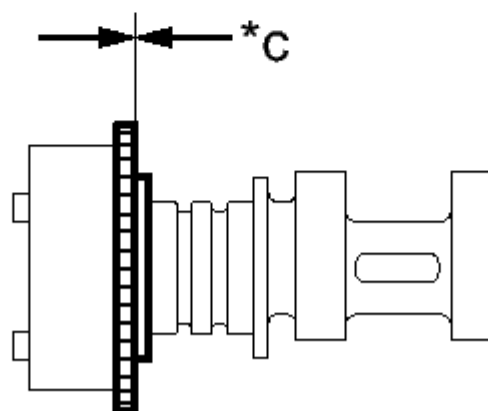
*1	Knock Pin Hole
*2	Knock Pin

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

\*a



\*b

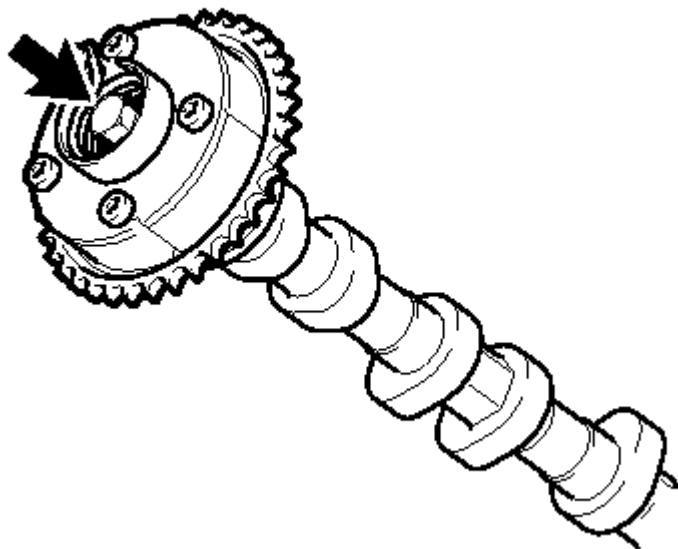
**P**

**Fig. 33: Checking Clearance Between Camshaft Timing Gear And Camshaft Flange**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### TEXT IN ILLUSTRATION

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

- c. Fix the camshaft timing exhaust gear assembly with the bolt.



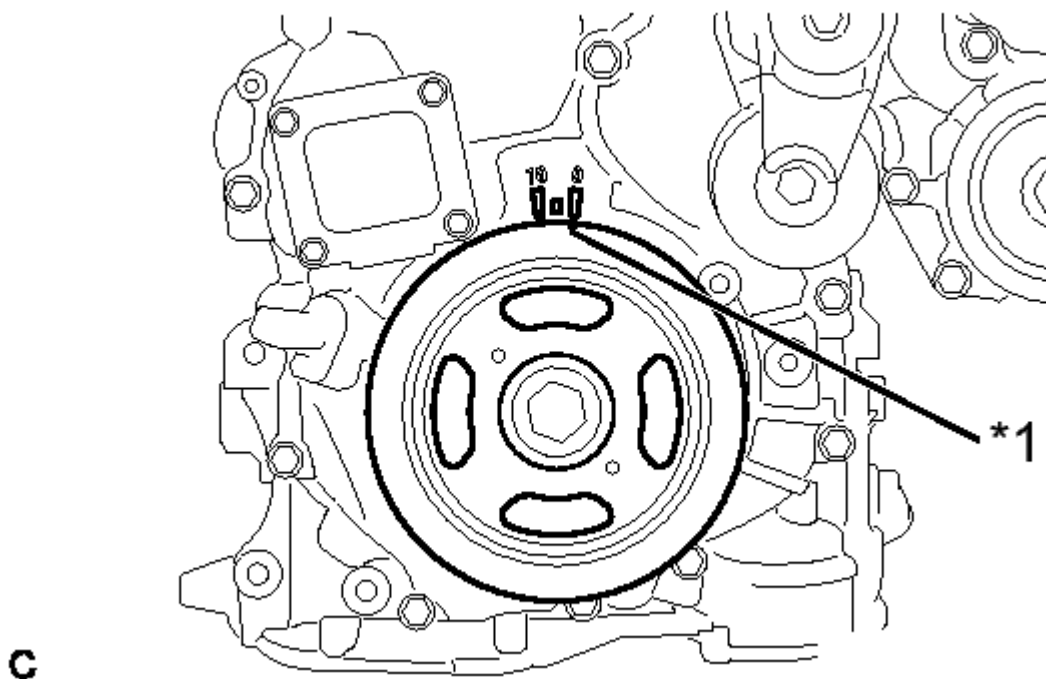
**Fig. 34: Location of Camshaft Timing Exhaust Gear Flange Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 85 N\*m (867 kgf\*cm, 63 ft.\*lbf)**

**NOTE: Do not disassemble the camshaft timing exhaust gear.**

**5. SET NO. 1 CYLINDER TO TDC/COMPRESSION**

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



**Fig. 35: Aligning Crankshaft Pulley Timing Notch (Groove) And The Timing Mark "0" Of The Timing Chain Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

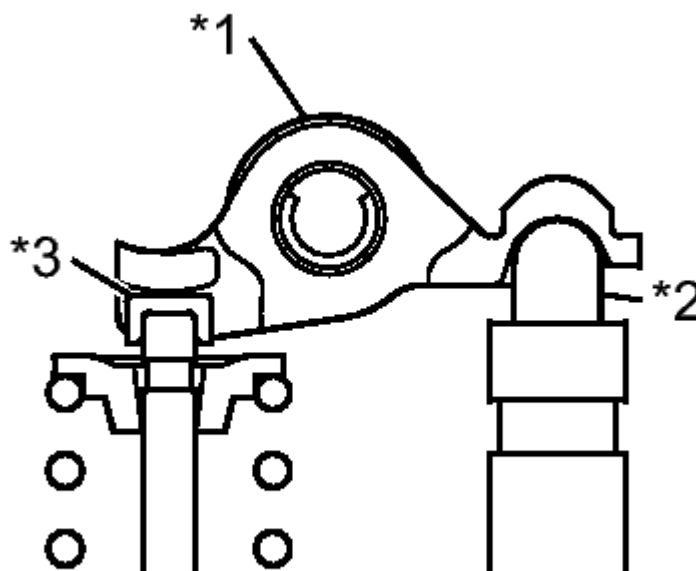
**TEXT IN ILLUSTRATION**

\*1 Timing Notch

**6. INSTALL NO. 2 CAMSHAFT**

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



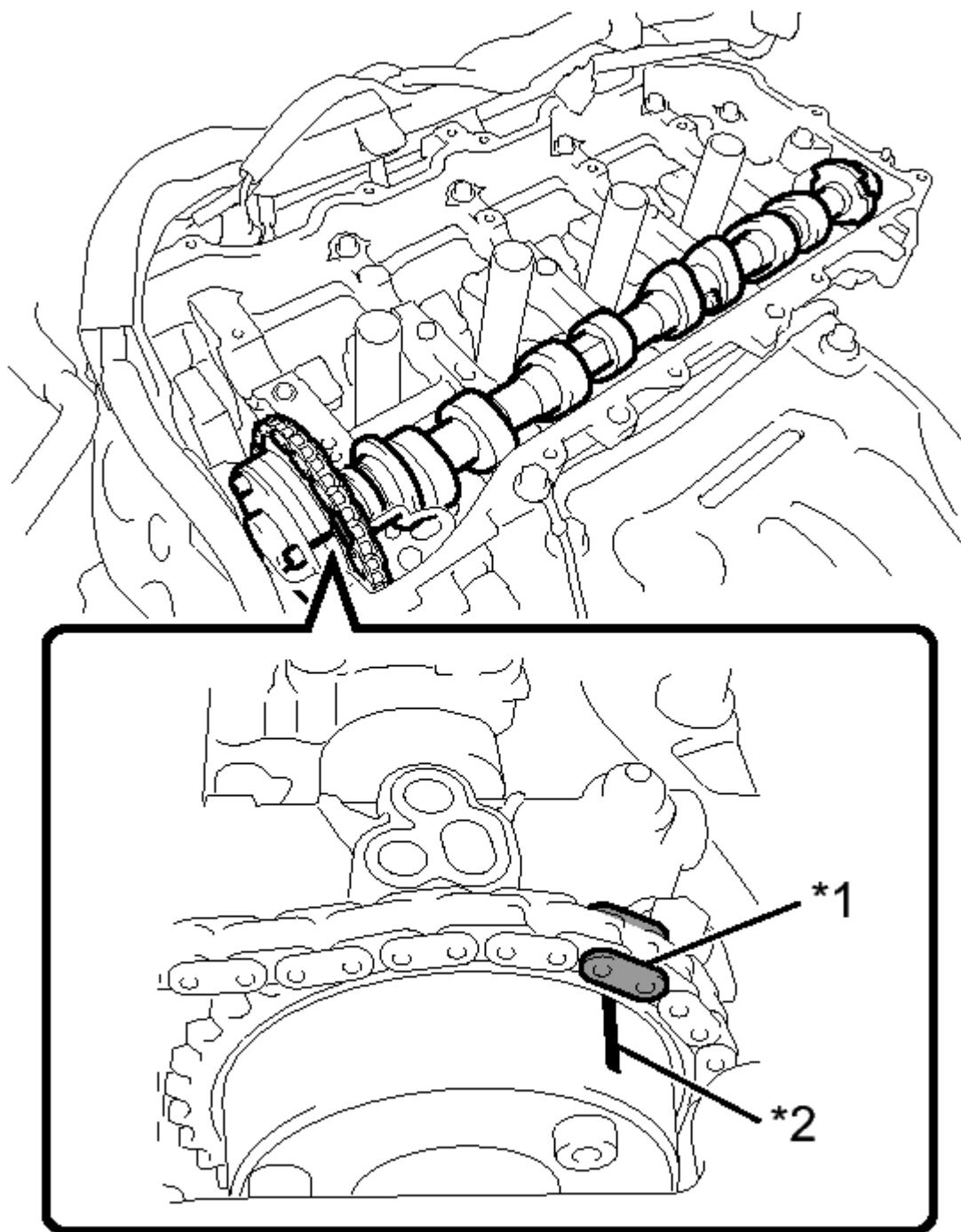
**P****Fig. 36: Identifying Valve Rocker Arms**

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

**TEXT IN ILLUSTRATION**

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

- Clean the camshaft journals.
- Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.
- Hold up the chain and align the matchmark and the paint mark and install the camshaft.



**Fig. 37: Identifying Camshaft Journals**

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

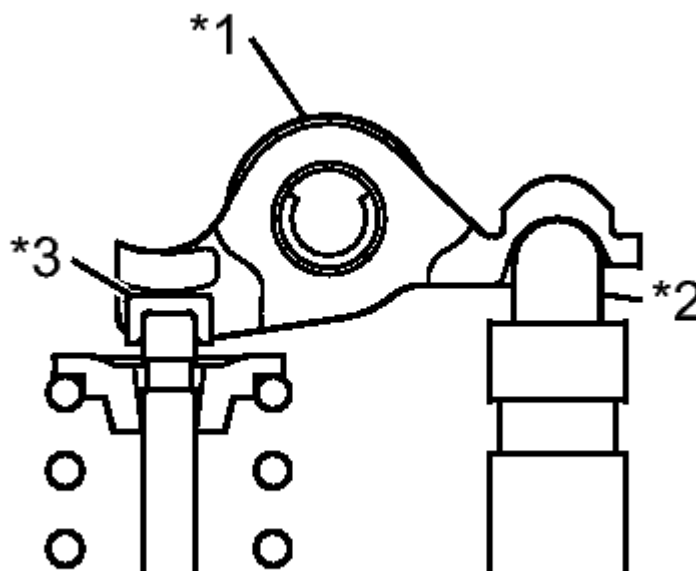
**TEXT IN ILLUSTRATION**

\*1 Paint Mark

*2	Matchmark
----	-----------

## 7. INSTALL CAMSHAFT

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



**P**

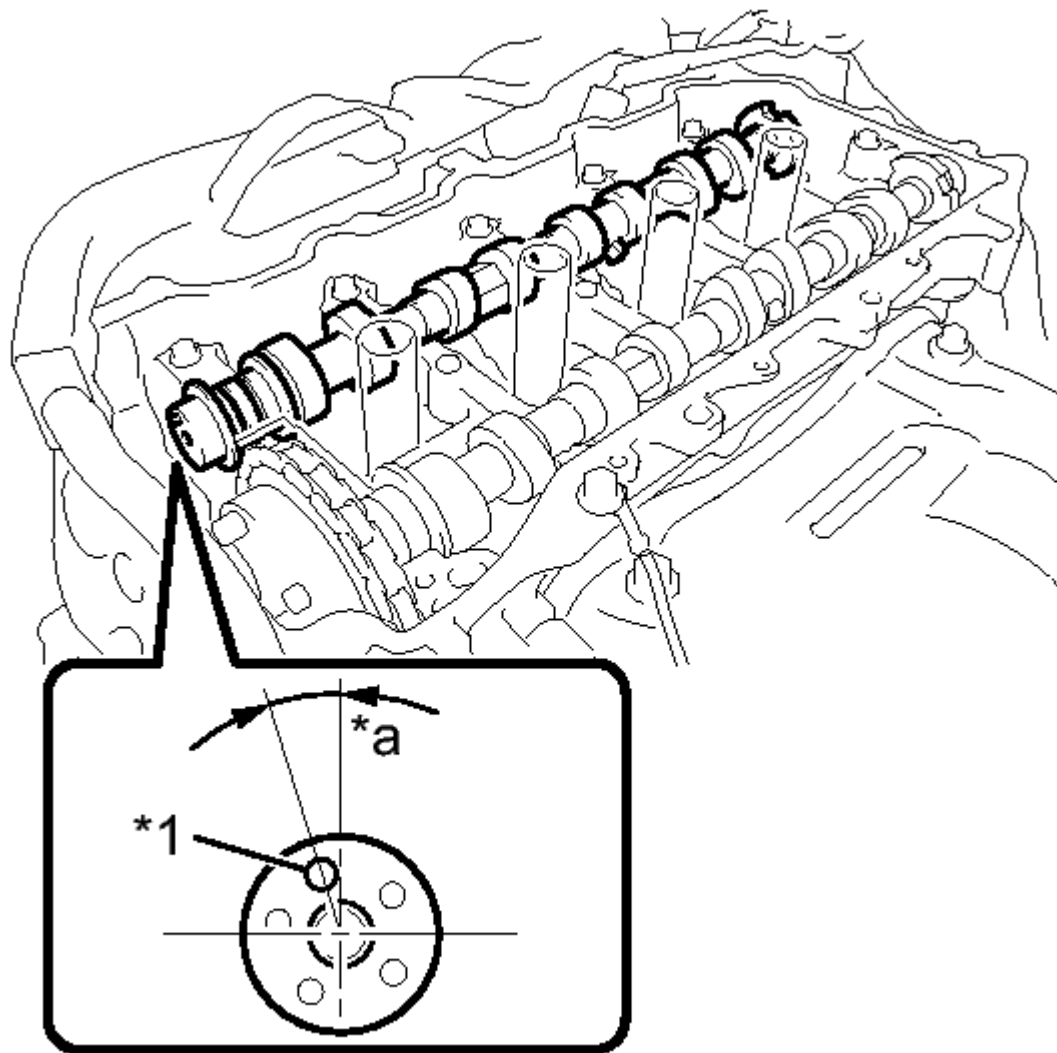
**Fig. 38: Identifying Valve Rocker Arms**

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

### TEXT IN ILLUSTRATION

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

- b. Clean the camshaft journals.
- c. Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.
- d. Install the camshaft to the camshaft housing as shown in the illustration.



**Fig. 39: Identifying Camshaft Housing**

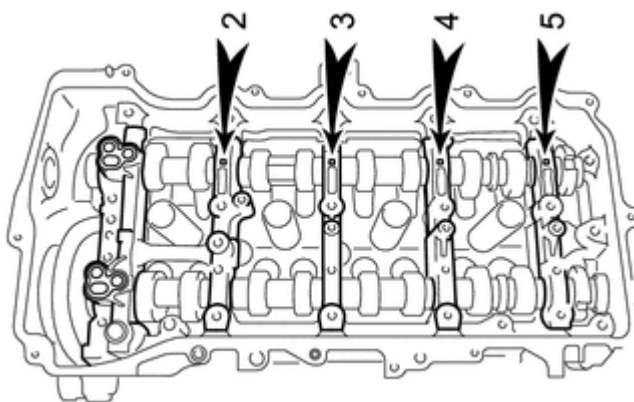
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Knock Pin
*a	Approximately 17°

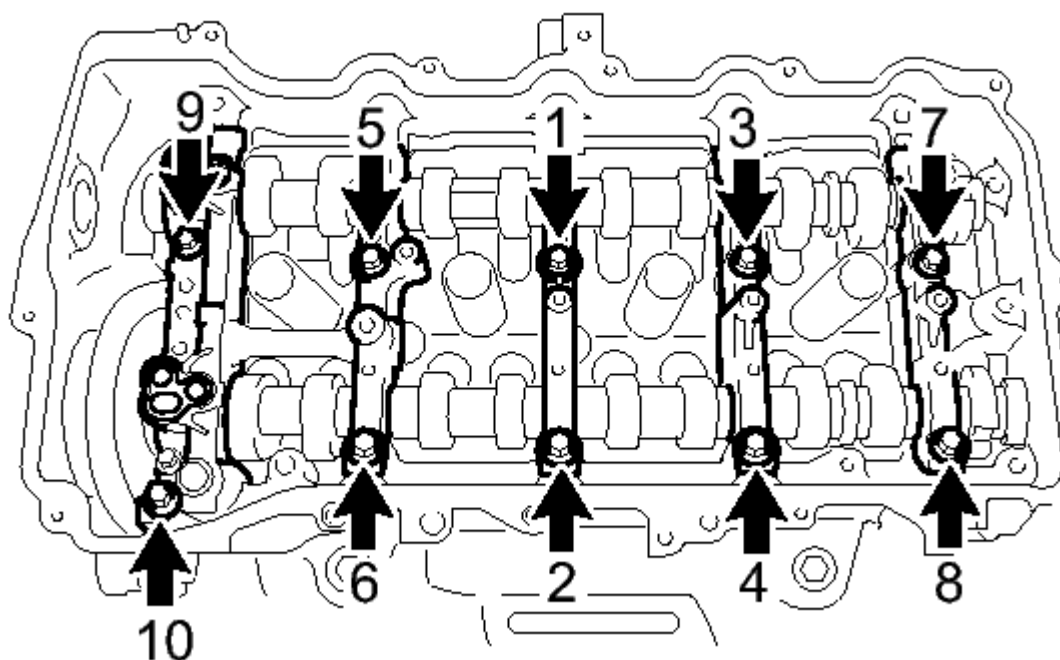
**8. INSTALL CAMSHAFT BEARING CAP**

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



**Fig. 40: Identifying Marks And Numbers Camshaft Bearing Caps**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

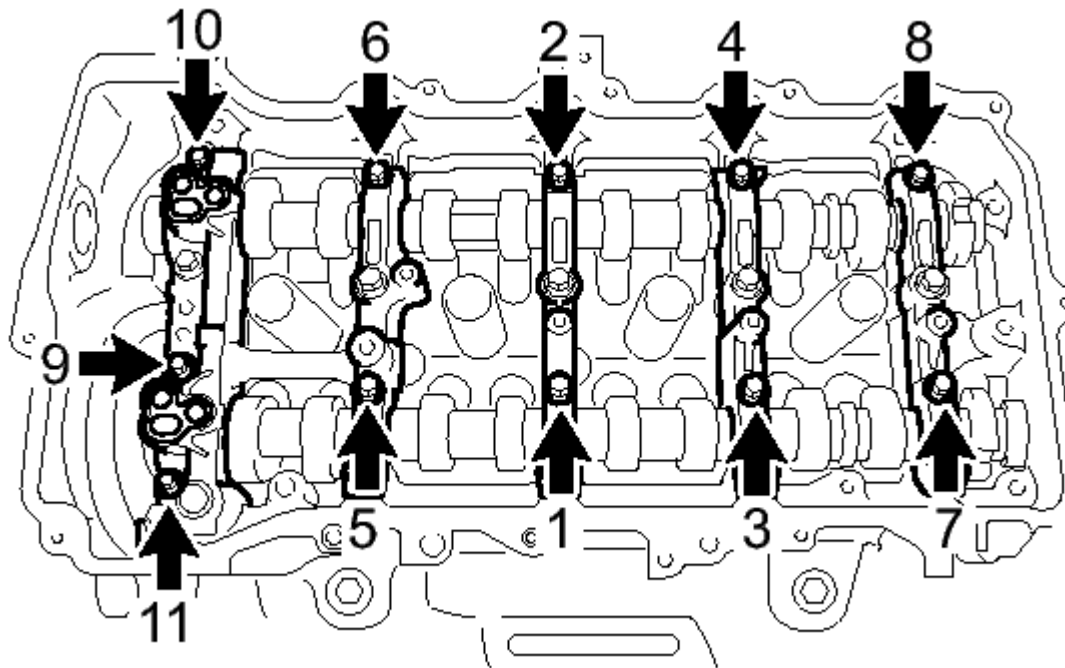
- b. Using several steps, uniformly tighten the 10 bolts in the sequence shown in the illustration.



**Fig. 41: Tightening 10 Bolts In The Sequence**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 27 N\*m (275 kgf\*cm, 20 ft.\*lbf)**

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

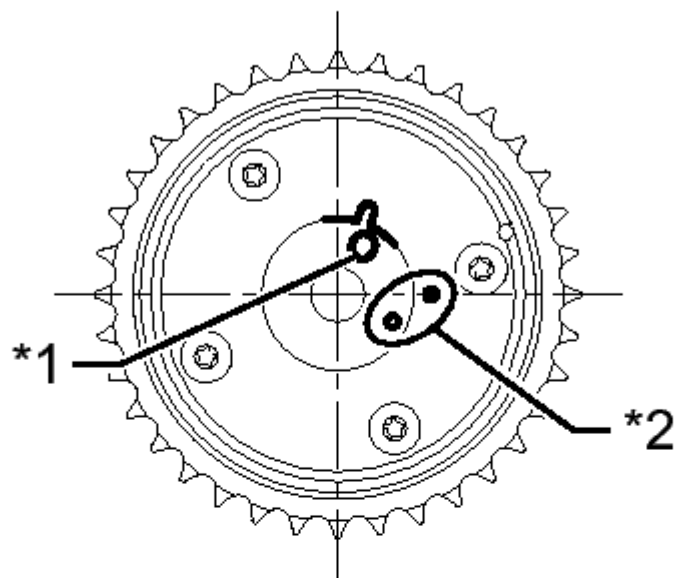
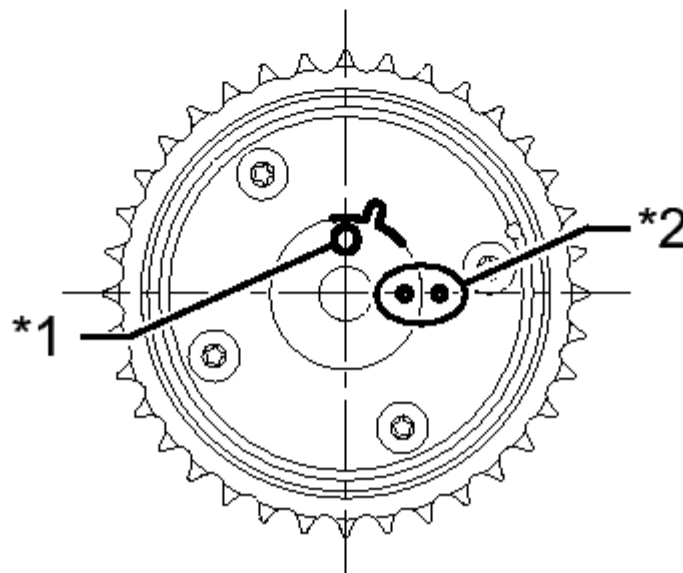


**Fig. 42: Tightening 11 Bolts In The Sequence**

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

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

- d. Check the torque of each bolt again.
- 9. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY**
  - a. Check the camshaft timing gear position.

**\*a****\*b****P**

**Fig. 43: Identifying Camshaft Timing Gear Position**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

Knock Pin
-----------

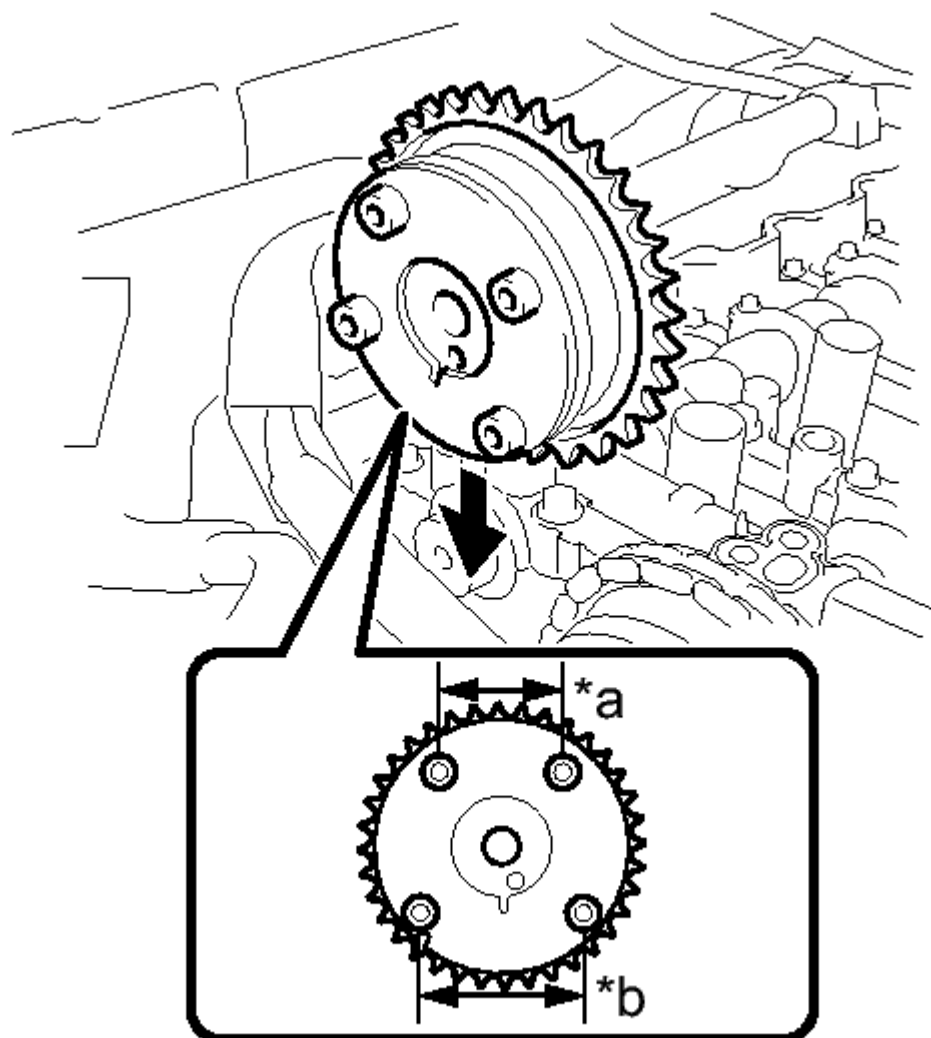
*1	Hole
*2	Alignment Mark
*a	Advanced Position
*b	Retarded Position

**NOTE:**

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

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



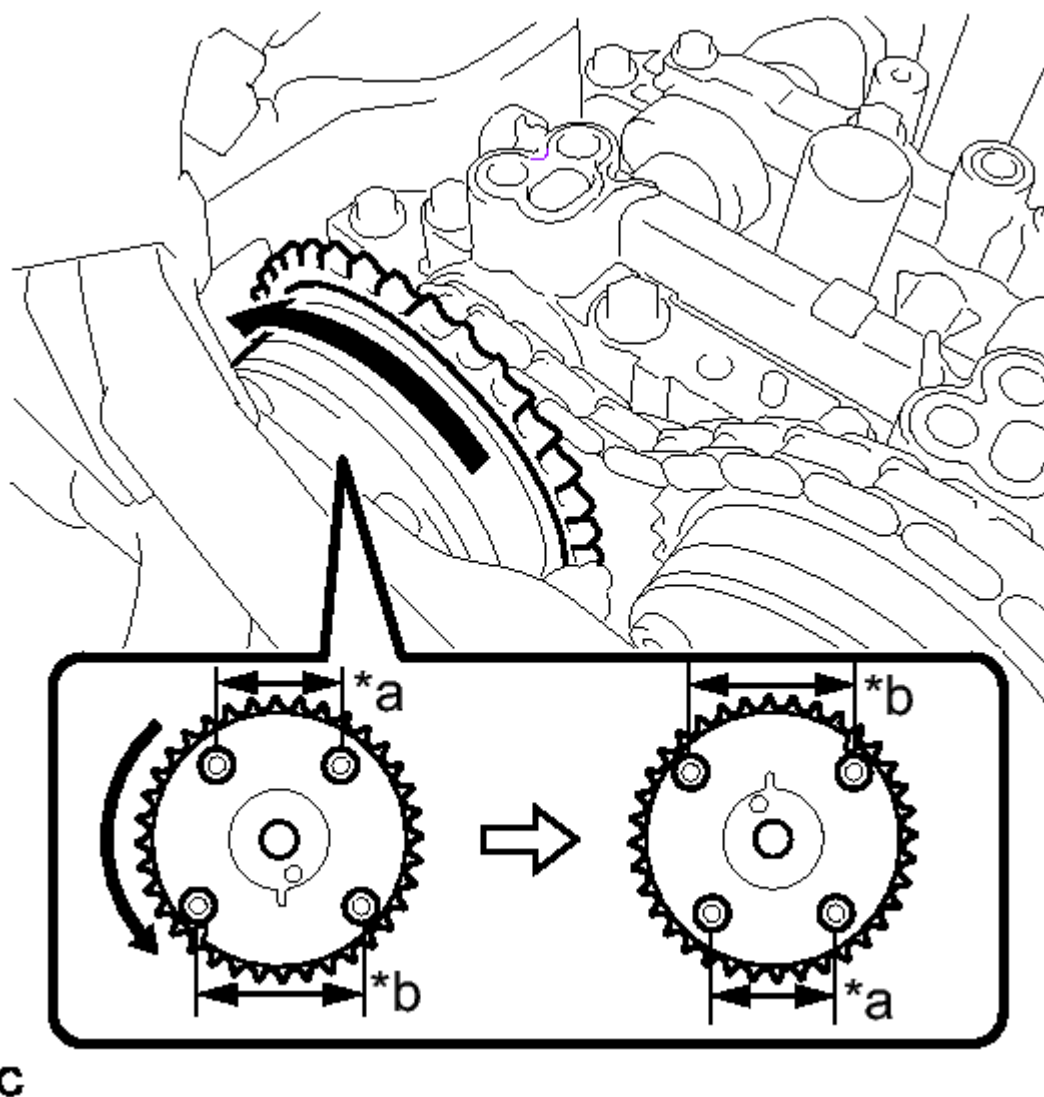


**Fig. 44: Installing Camshaft Timing Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*a	Narrow
*b	Wide

- c. Turn the camshaft timing gear approximately 180° counterclockwise.

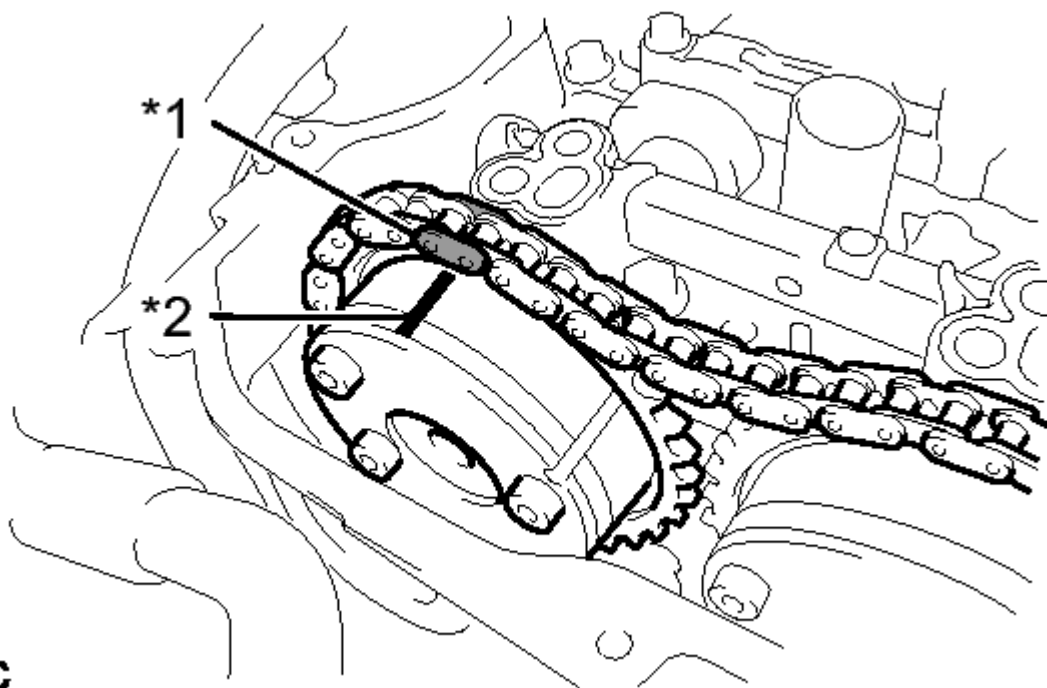


**Fig. 45: Turning Camshaft Timing Gear Approximately 180 Degrees Counterclockwise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*a	Narrow
*b	Wide

- d. Align the paint mark with the matchmark to install the chain.

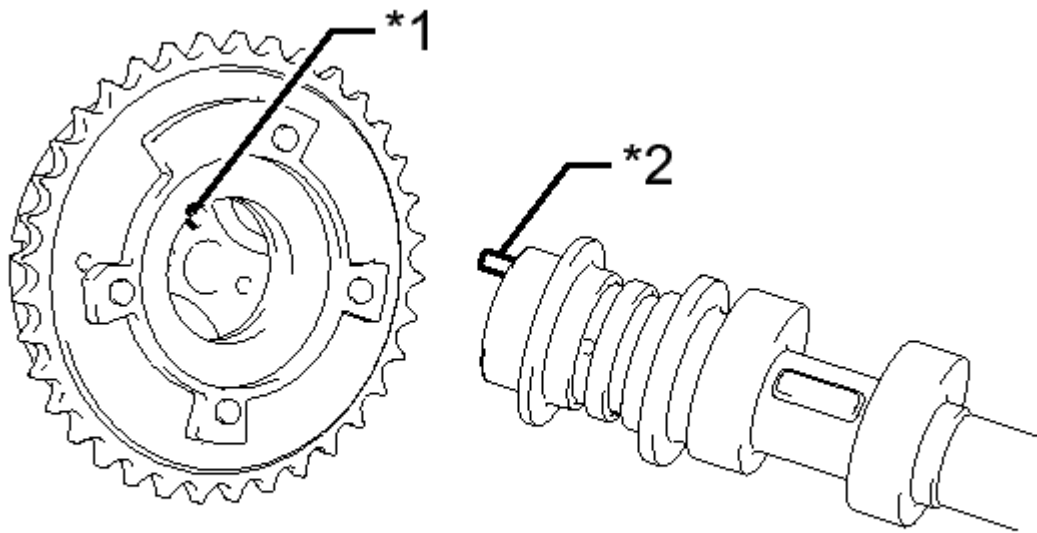


**C**  
**Fig. 46: Aligning Paint Mark With Matchmark To Install Chain**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Paint Mark
*2	Matchmark

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

**P****Fig. 47: Identifying Pin Hole And Knock Pin**

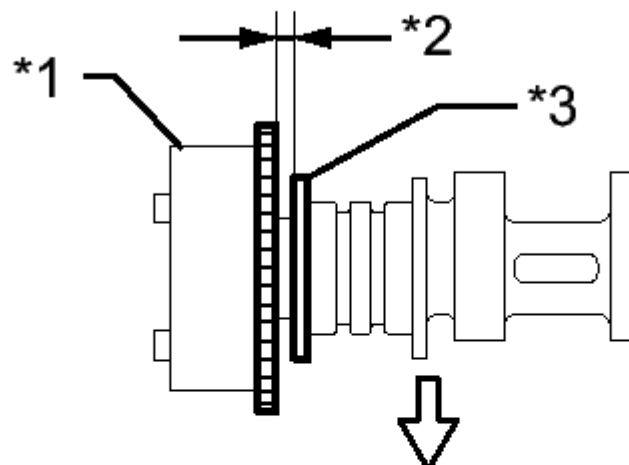
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

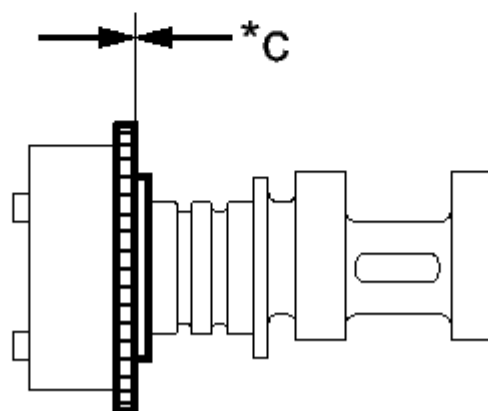
*1	Knock Pin Hole
*2	Knock Pin

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

\*a



\*b

**P**

**Fig. 48: Checking Clearance Between Camshaft Timing Gear And Camshaft Flange**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

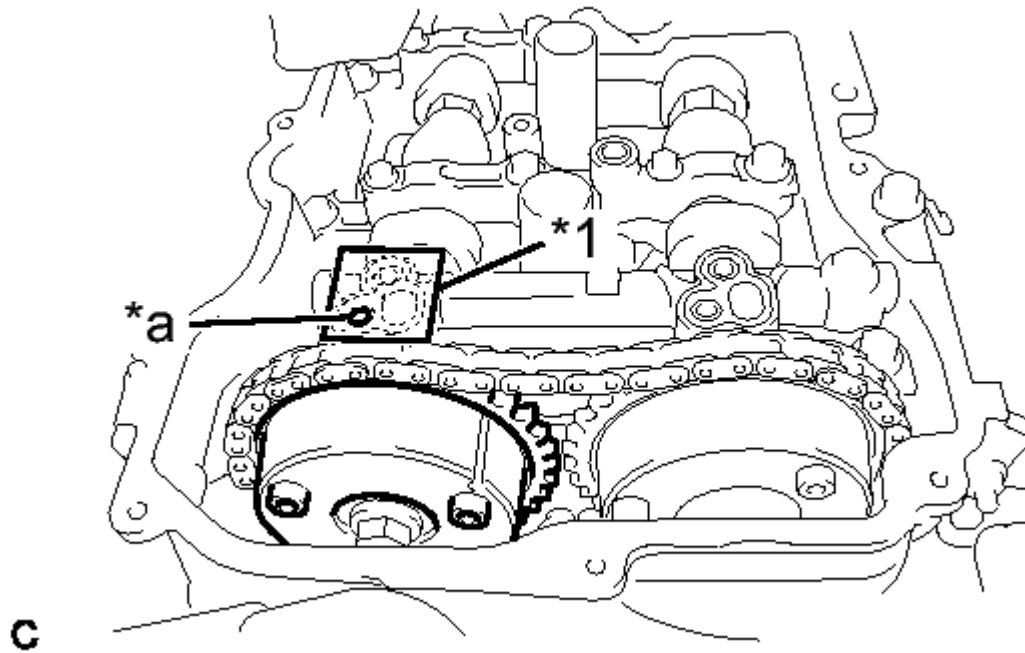
**TEXT IN ILLUSTRATION**

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

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

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

- h. If the lock pin has not been released, release it.
1. After cleaning and degreasing the intake side VVT oil hole on the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.



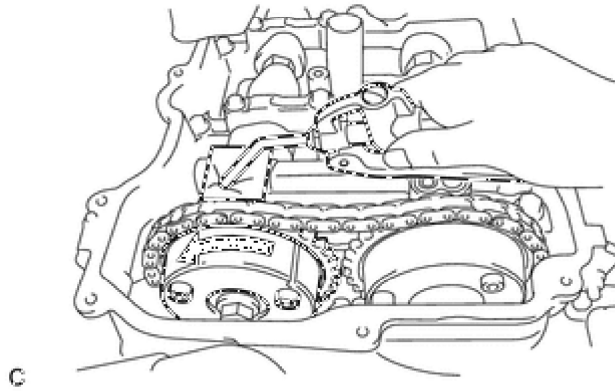
**Fig. 49: Identifying VVT Oil Hole On No. 1 Camshaft Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Adhesive Tape Sealing Area
*a	Make a Hole

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

2. Make a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure A)
3. Apply approximately 200 kPa (2.0 kgf/cm<sup>2</sup>, 29 psi) of air pressure to the hole made in procedure A to release the lock pin.



**Fig. 50: Applying Air Pressure To Hole To Release Lock Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

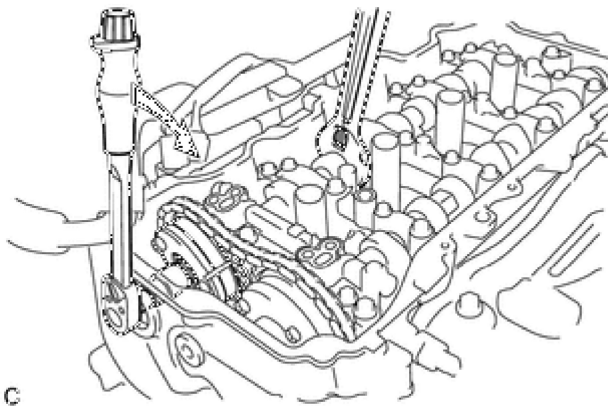
- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.

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

**HINT:**

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

5. Remove the adhesive tape from the No. 1 camshaft bearing cap.
  - i. Using a wrench to hold the hexagonal portion of the No. 1 camshaft, install the bolt.

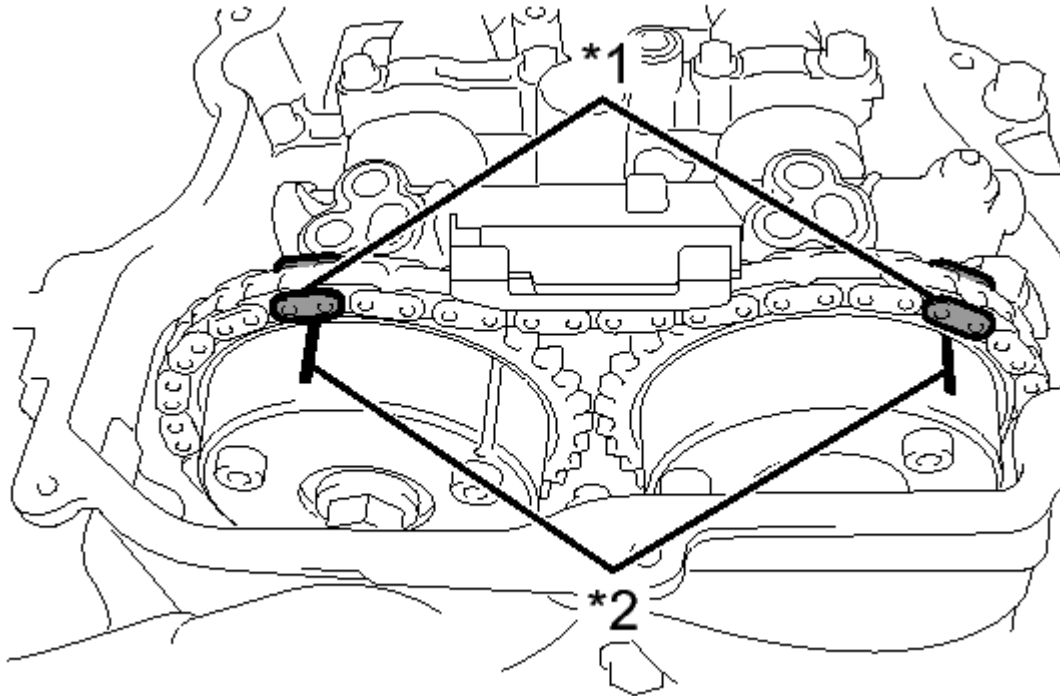


**Fig. 51: Installing No. 1 Camshaft Bolt Using A Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 85 N\*m (867 kgf\*cm, 63 ft.\*lbf)**

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

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



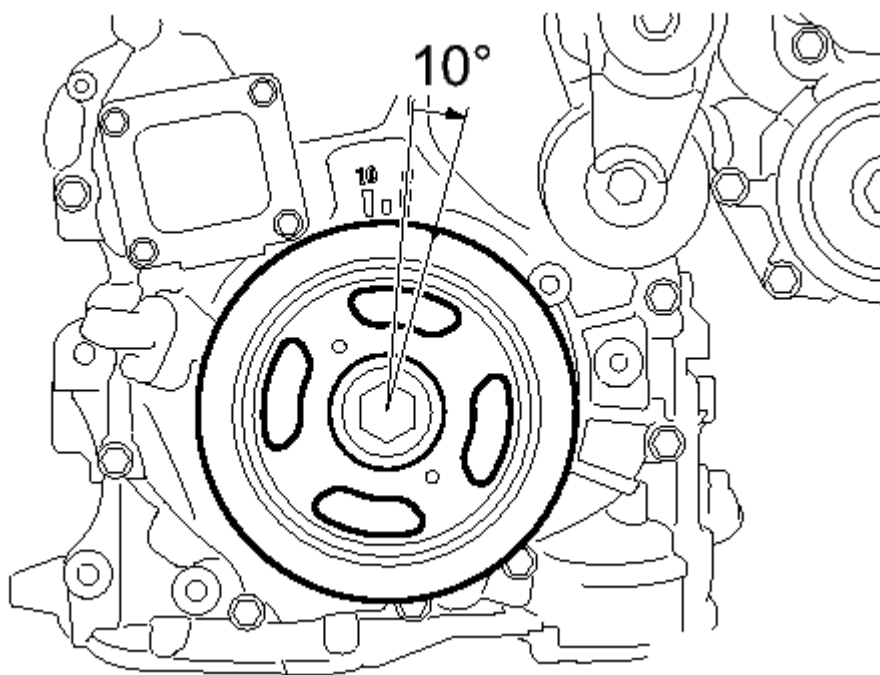
**Fig. 52: Aligning Camshaft Timing Gear Matchmarks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Paint Mark
*2	Matchmark

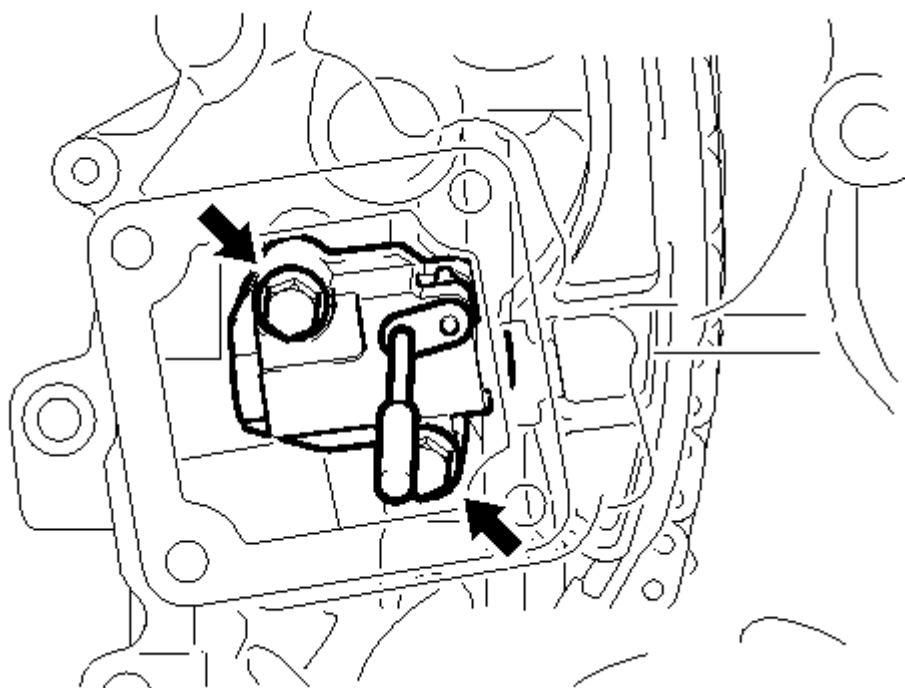
10. **ADD ENGINE OIL** See step 15
11. **INSTALL TIMING CHAIN GUIDE** See step 21
12. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY**
  - a. Turn the crankshaft approximately 10° clockwise.



**C**

**Fig. 53: View Of Turning Crankshaft 10 Degrees Clockwise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**C**

**Fig. 54: No. 1 Chain Tensioner Assembly Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

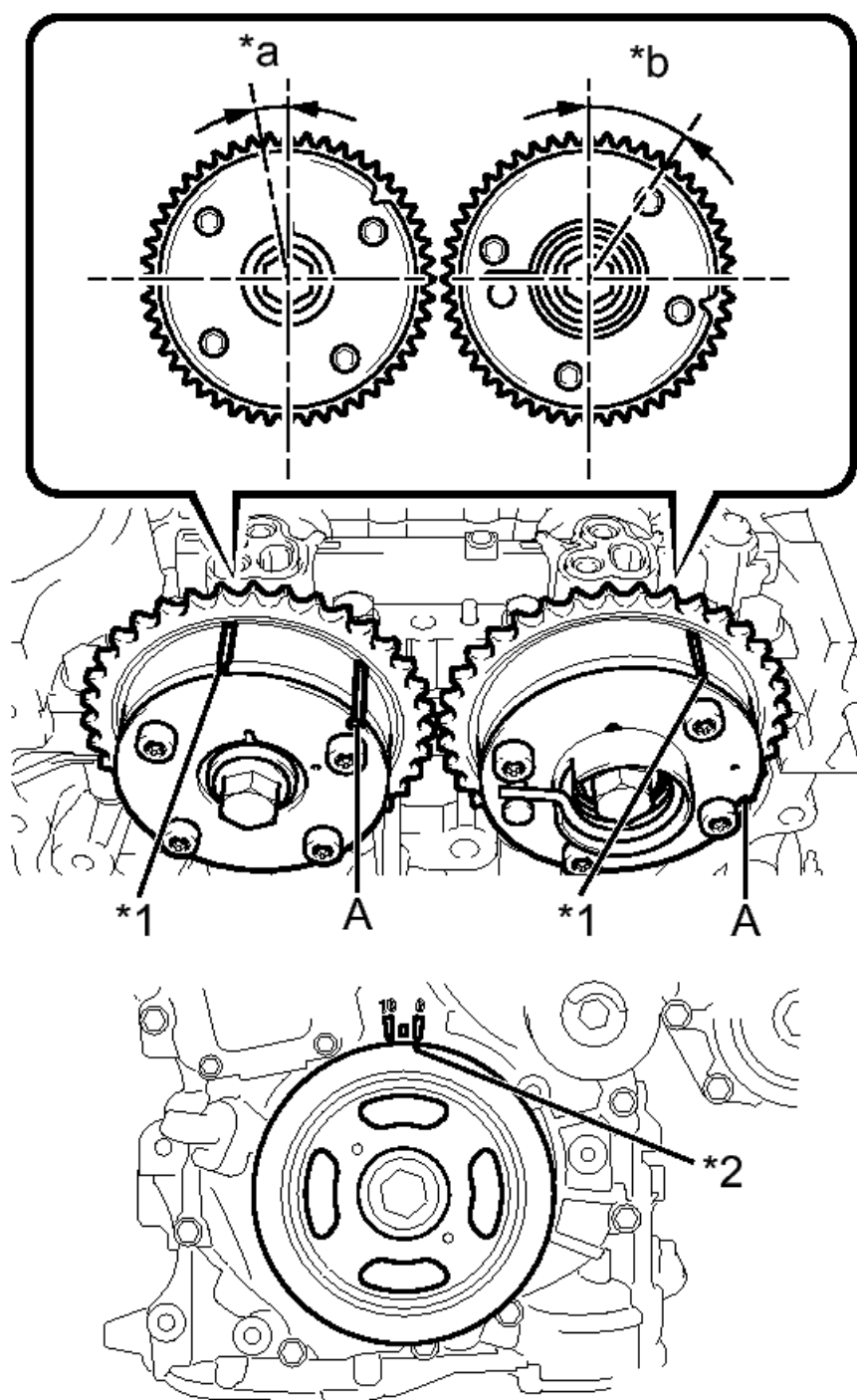
**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

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

- c. Remove the pin from the stopper plate.

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

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



**Fig. 55: Aligning Camshaft Timing Gears & Crankshaft Timing Marks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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

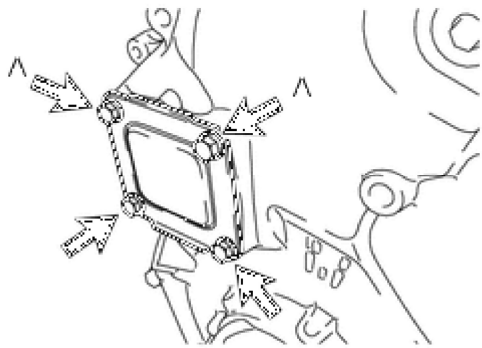
- b. Check that the timing marks of the camshaft timing gears are as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

### HINT:

"A" is not a timing mark.

## 14. INSTALL TIMING CHAIN COVER PLATE

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



P

**Fig. 56: Timing Chain Cover Plate Bolts**

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

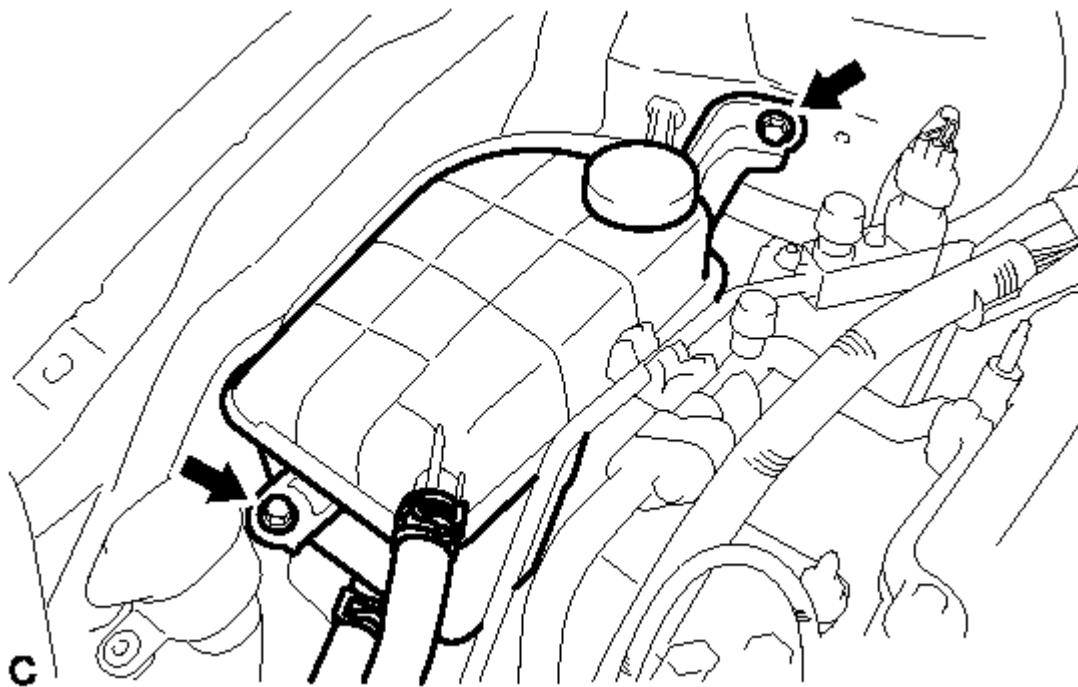
**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**NOTE:** Using a 10 mm union nut wrench, tighten the A bolts. Use the torque value compensation formula to calculate the torque value for use when a torque wrench is combined with a tool such as a union nut wrench. Refer to **PRECAUTION** .

## 15. INSTALL TIMING CHAIN COVER TIGHT PLUG See step 38

## 16. INSTALL RADIATOR RESERVE TANK ASSEMBLY

- a. Install the radiator reserve tank assembly with the 2 bolts.

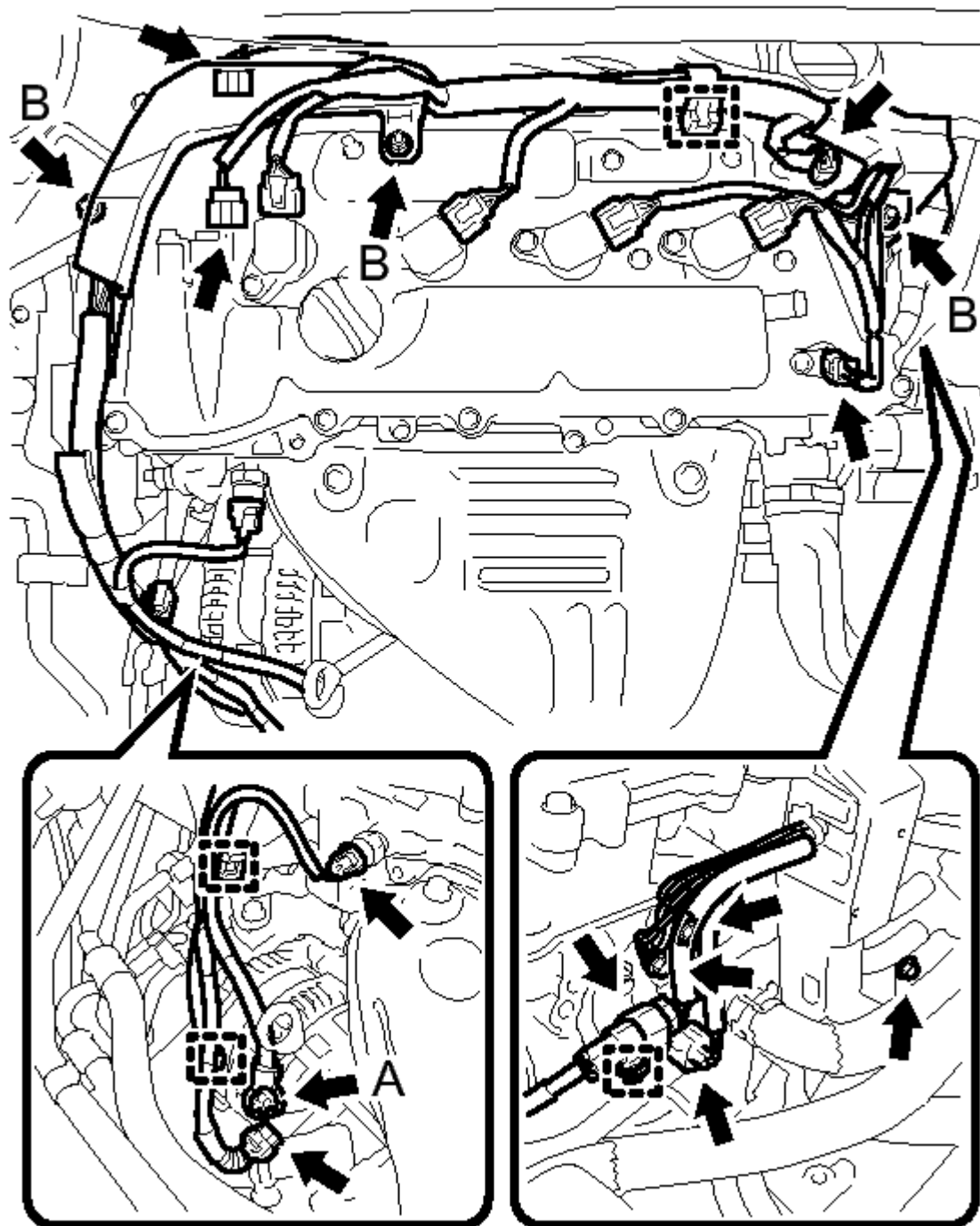


**Fig. 57: Radiator Reserve Tanks Assembly**

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

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

17. **INSTALL CRANKSHAFT POSITION SENSOR** . Refer to **INSTALLATION - Step 1**
18. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 8**
19. **INSTALL IGNITION COIL ASSEMBLY** . Refer to **INSTALLATION - Step 2**
20. **INSTALL ENGINE WIRE**
  - a. Connect the connectors and clamps, and install the engine wire to the engine with the bolts and nuts.



**Fig. 58: Engine Wiring Harness**

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

Nut A

**Torque: 9.8 N\*m (100 kgf\*cm, 87 in.\*lbf)**

**Nut B**

**Torque: 8.4 N\*m (86 kgf\*cm, 74 in.\*lbf)**

**Bolt**

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

21. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 3**
22. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 4**
23. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

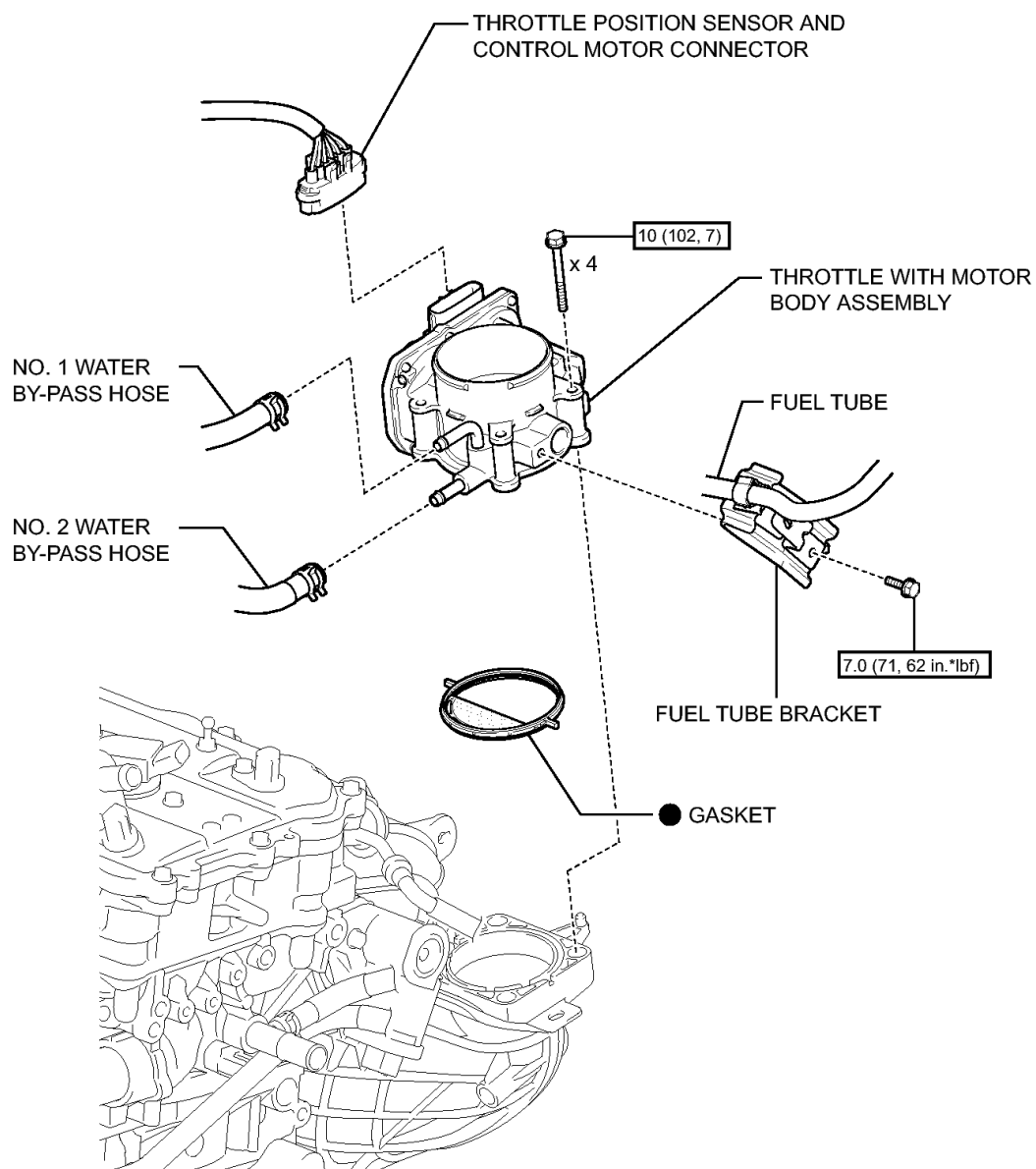
**NOTE:** When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to **INITIALIZATION** .

24. **INSPECT FOR OIL LEAK**
25. **INSTALL REAR ENGINE UNDER COVER RH** See step 2
26. **CONNECT FRONT FENDER LINER RH** See step 81
27. **INSTALL FRONT WHEEL RH**

## **CYLINDER HEAD GASKET**

### **COMPONENTS**

### **ILLUSTRATION**



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

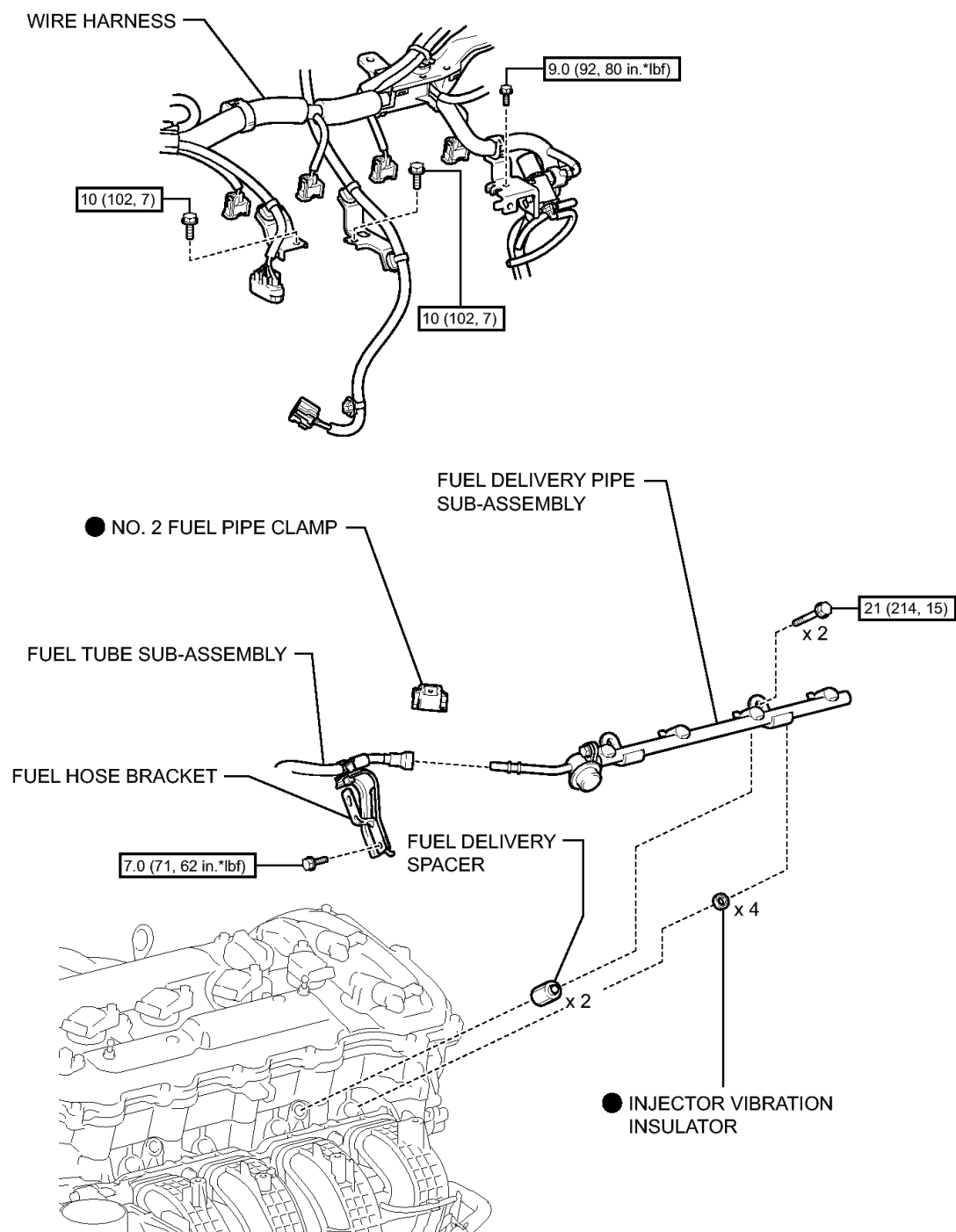
● Non-reusable part

P

**Fig. 59: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (1 Of 5)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION





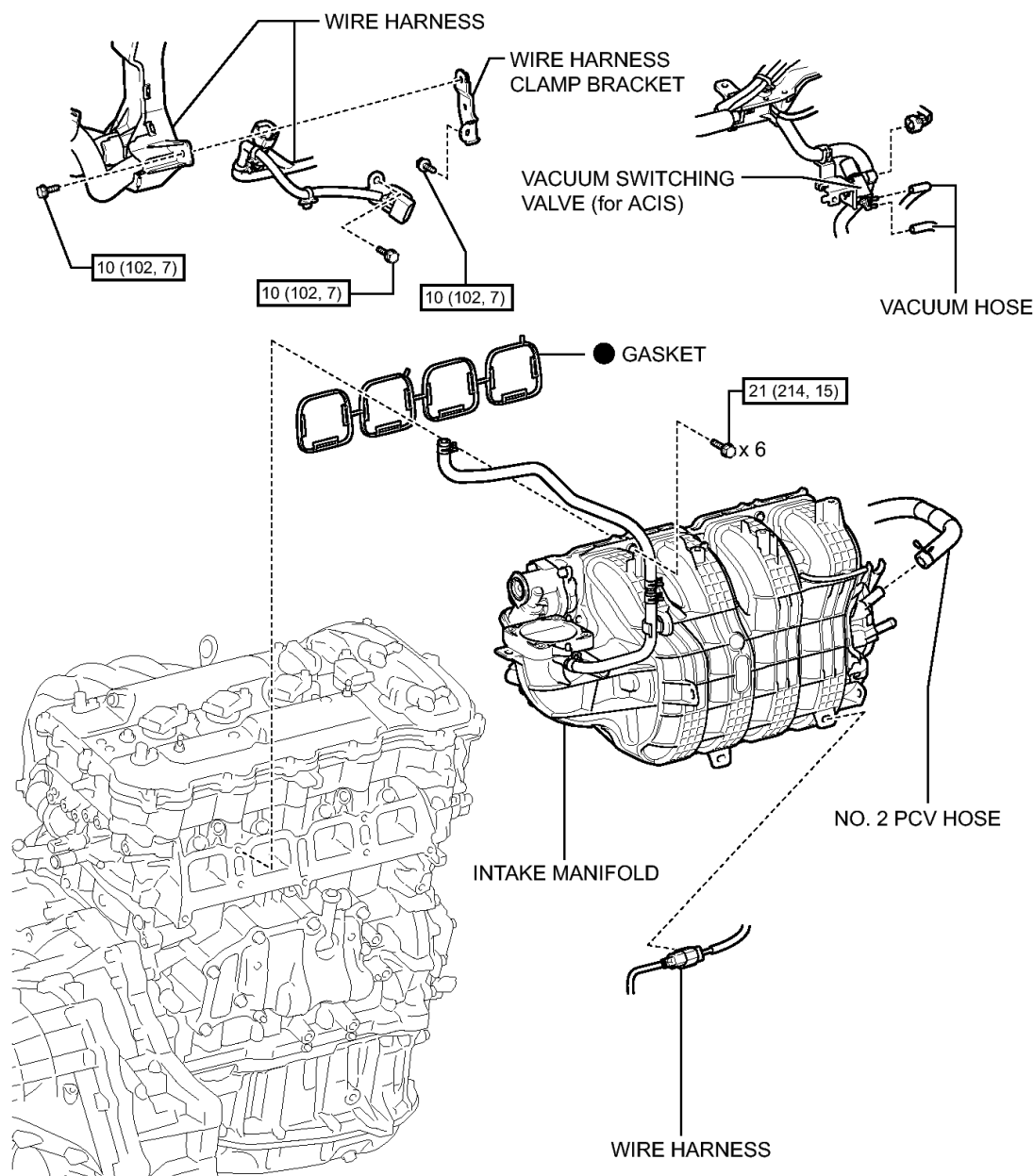
N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

P

**Fig. 60: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (2 Of 5)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ILLUSTRATION



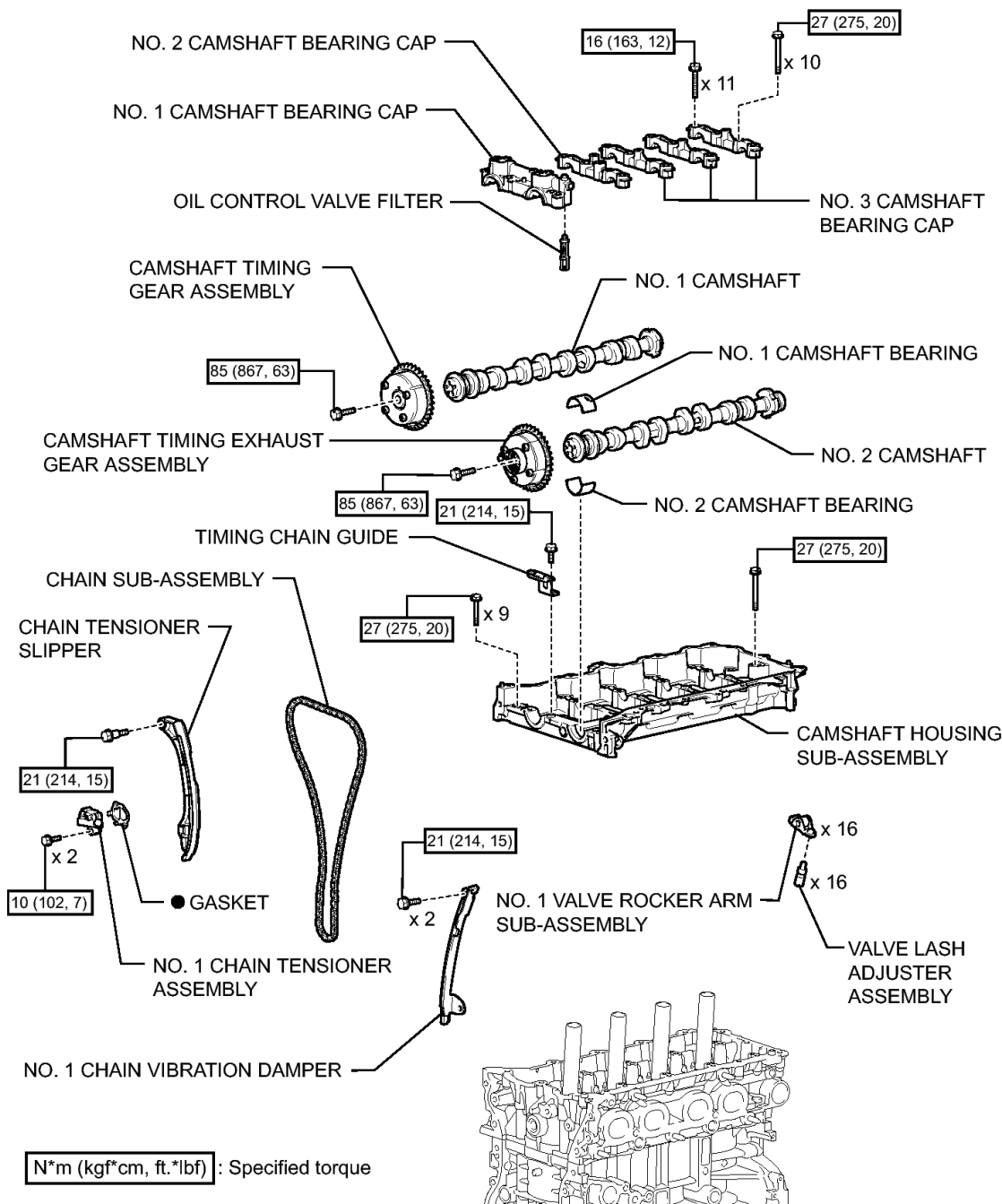
**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

● Non-reusable part

P

**Fig. 61: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (3 Of 5)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

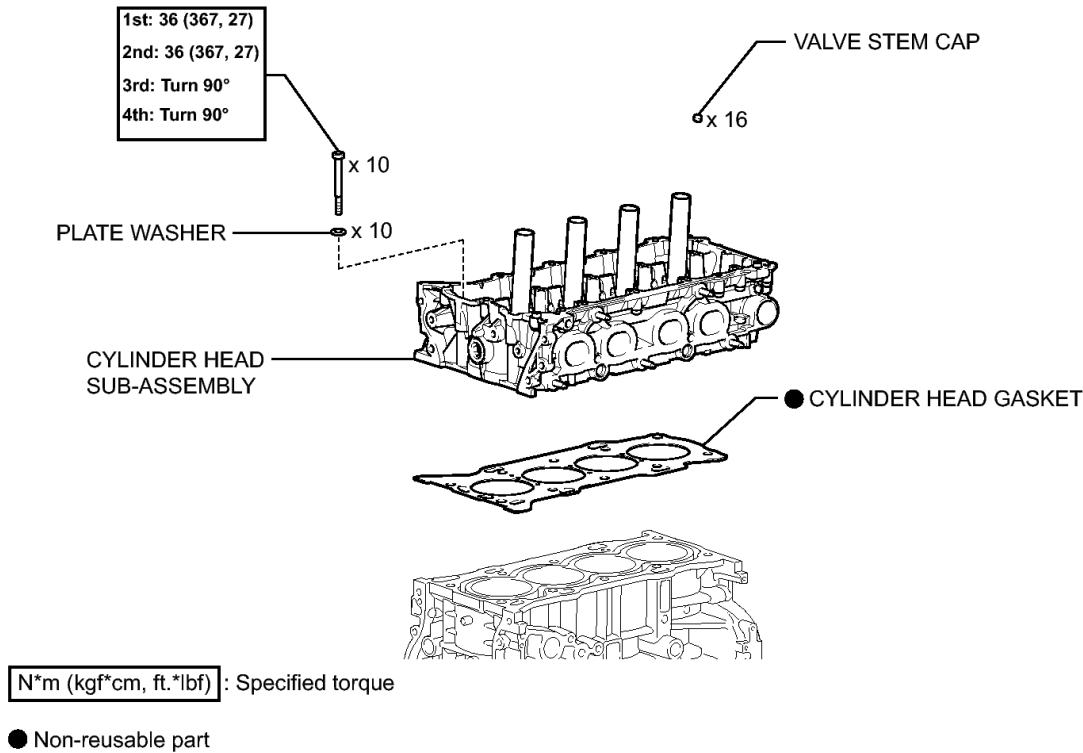
## ILLUSTRATION



P

**Fig. 62: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (4 Of 5)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## ILLUSTRATION



**Fig. 63: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (5 Of 5)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### REMOVAL

#### 1. REMOVE ENGINE AND TRANSAXLE

Refer to REMOVAL

#### 2. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

Refer to REMOVAL

#### 3. REMOVE THROTTLE WITH MOTOR BODY ASSEMBLY . Refer to REMOVAL - Step 4

#### 4. DISCONNECT FUEL TUBE SUB-ASSEMBLY . Refer to REMOVAL - Step 7

#### 5. DISCONNECT WIRE HARNESS . Refer to REMOVAL - Step 8

#### 6. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY . Refer to REMOVAL - Step 9

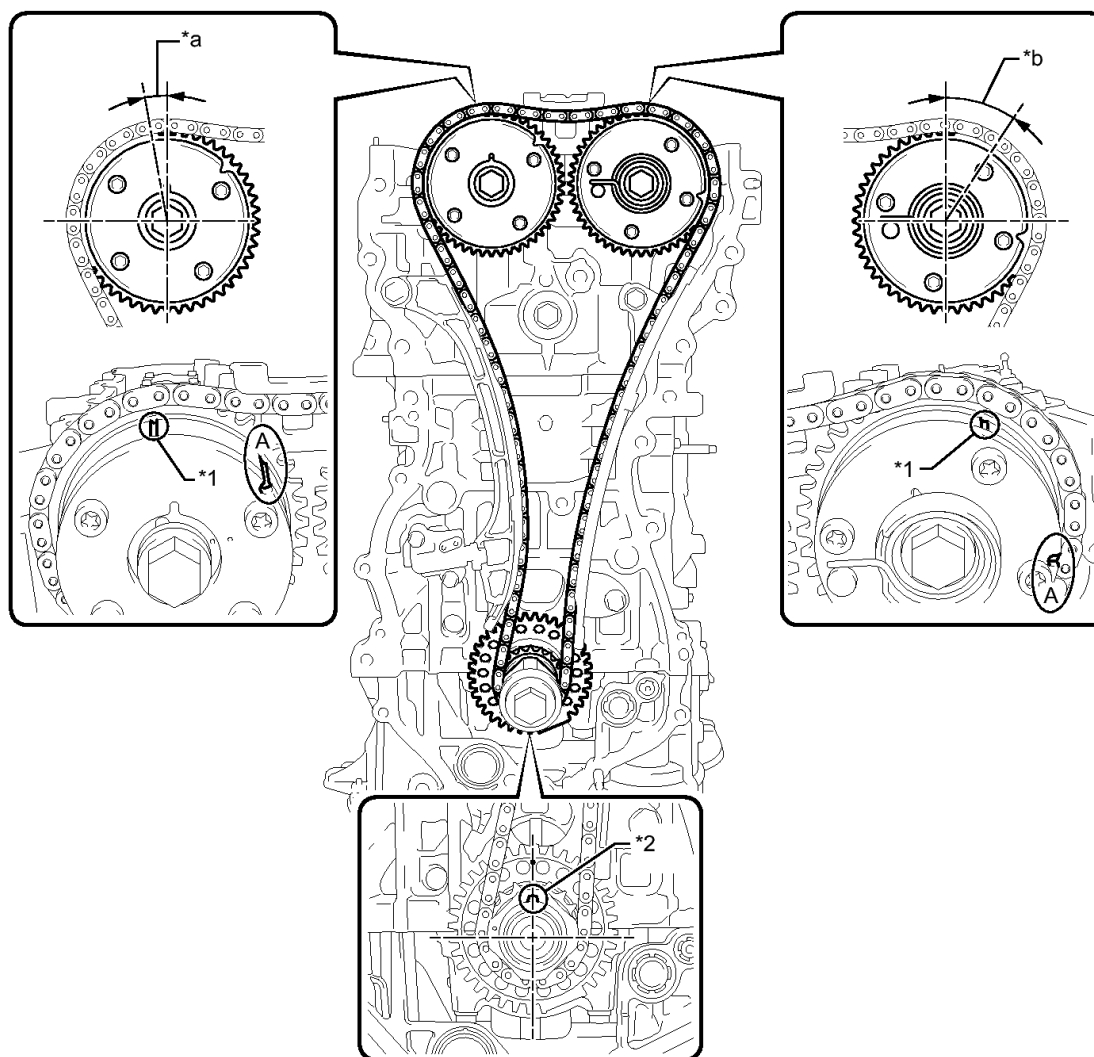
#### 7. REMOVE WIRE HARNESS . Refer to REMOVAL - Step 7

8. **DISCONNECT NO. 2 PCV HOSE** . Refer to **REMOVAL - Step 8**
9. **REMOVE INTAKE MANIFOLD** . Refer to **REMOVAL - Step 9**
10. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY**

Refer to **REMOVAL**

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

- a. Temporarily install the crankshaft pulley bolt.



P

**Fig. 64: Crankshaft Sprocket Marks & Camshaft Gear Marks For No. 1 Cylinder TDC**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## TEXT IN ILLUSTRATION

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

**HINT:**

"A" is not a timing mark.

- 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.

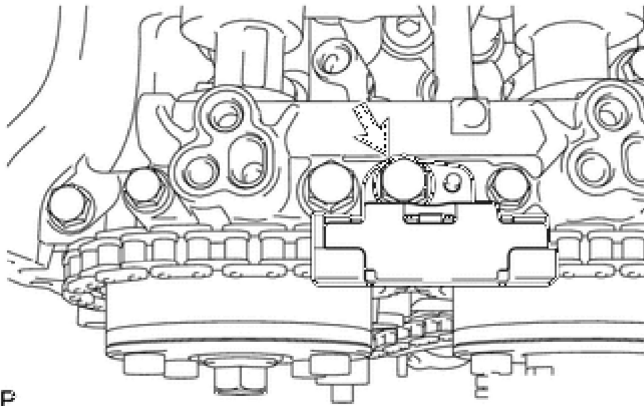
**HINT:**

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

- c. Remove the crankshaft pulley bolt.

**12. REMOVE TIMING CHAIN GUIDE**

- a. Remove the bolt and timing chain guide.

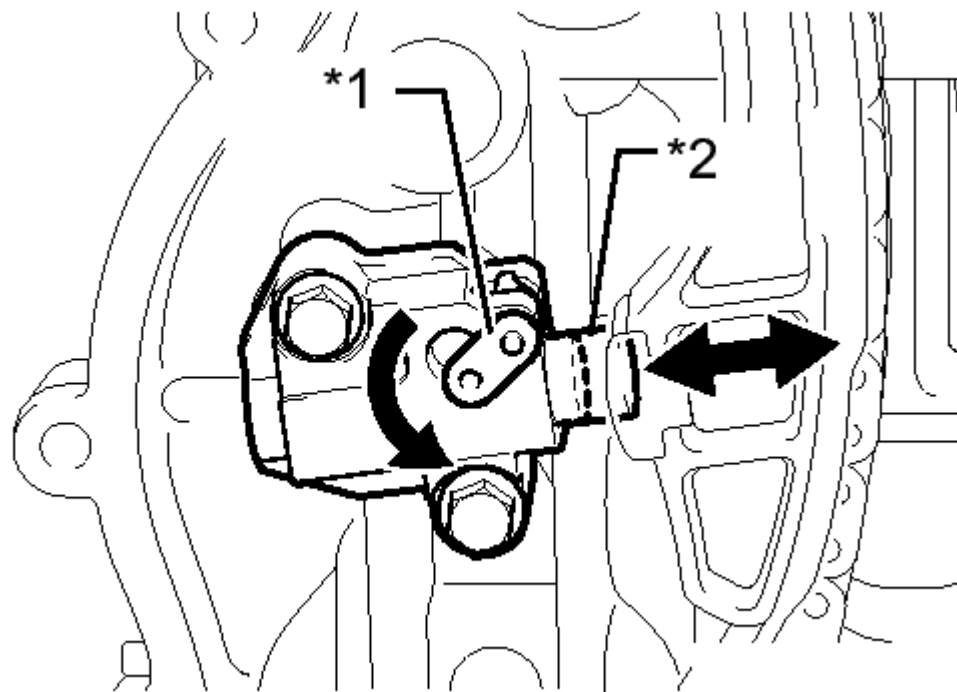


**Fig. 65: Location of Timing Chain Guide Bolt**

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

**13. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY**

- a. Allow the plunger to extend slightly, and then rotate the stopper plate counterclockwise to release the lock. Once the lock is released, push the plunger into the tensioner.

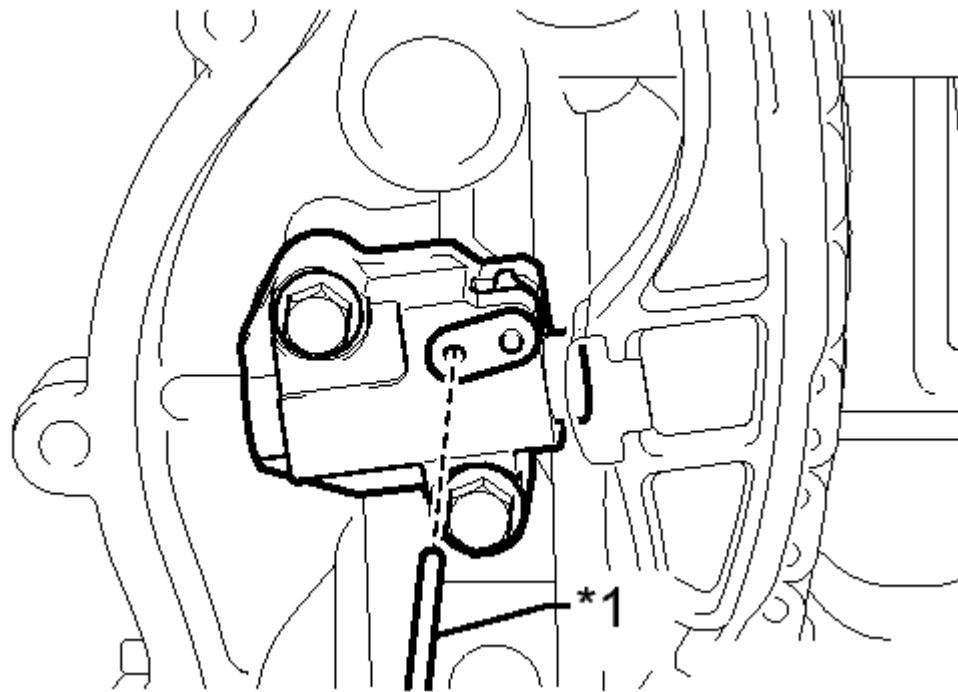
**P**

**Fig. 66: Removing No. 1 Timing Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Stopper Plate
*2	Plunger

- b. Move the stopper plate clockwise to set the lock, and then insert a pin into the stopper plate hole.

**P**

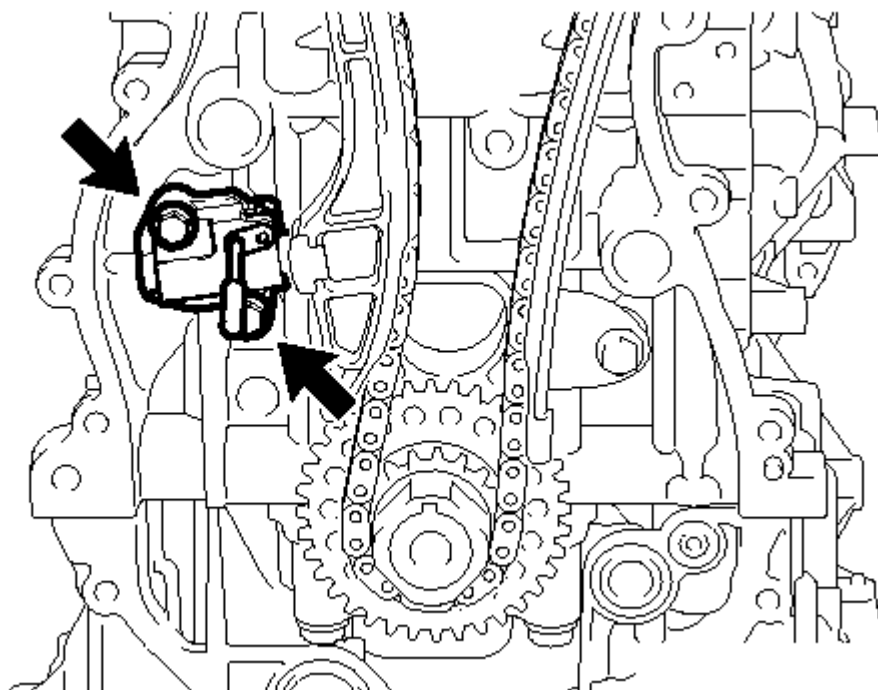
**Fig. 67: Timing Chain Tensioner Stopper Plate & Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Pin
----	-----

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

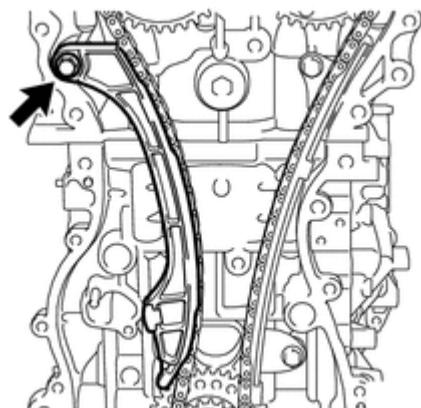


**P****Fig. 68: Location of Chain Tensioner Bolts**

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

**14. REMOVE CHAIN TENSIONER SLIPPER**

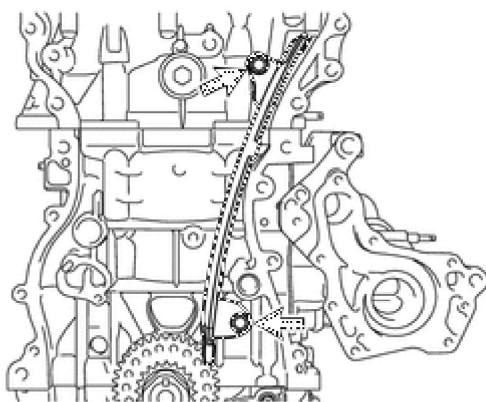
- a. Remove the bolt and chain tensioner slipper.

**P****Fig. 69: Location of Bolt And Chain Tensioner Slipper**

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

**15. REMOVE CHAIN SUB-ASSEMBLY****16. REMOVE NO. 1 CHAIN VIBRATION DAMPER**

- a. Remove the 2 bolts and chain vibration damper.

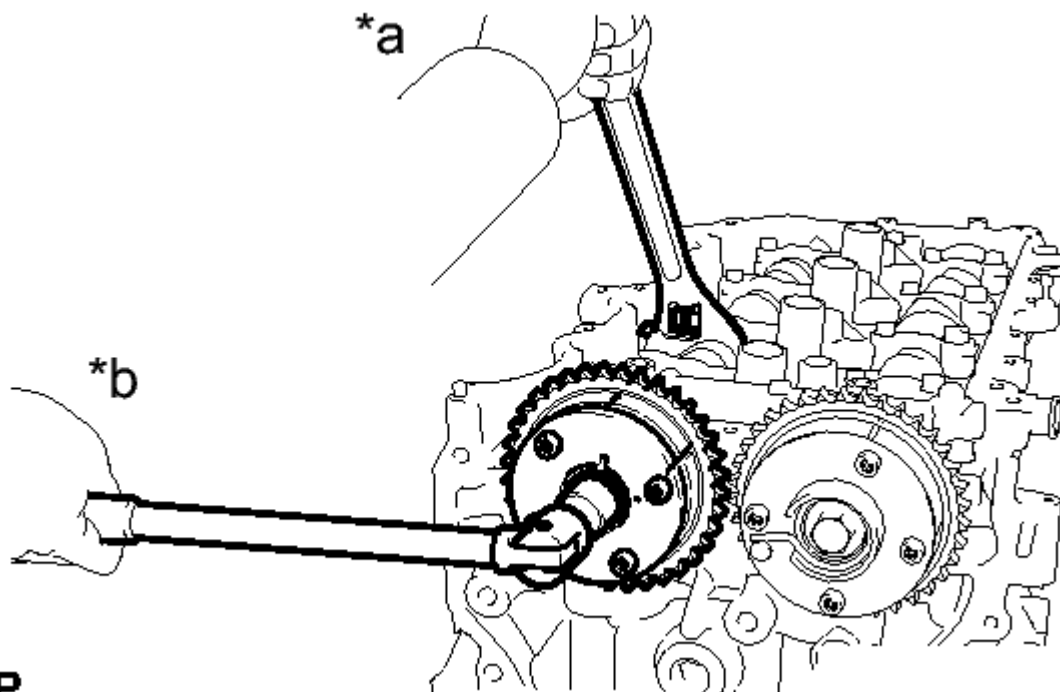


P

**Fig. 70: Location of Chain Vibration Damper Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 17. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

- a. Hold the hexagonal portion of the camshaft with a wrench and remove the bolt and camshaft timing gear.



P

**Fig. 71: Removing Camshaft Timing Gear Assembly Using A Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### TEXT IN ILLUSTRATION

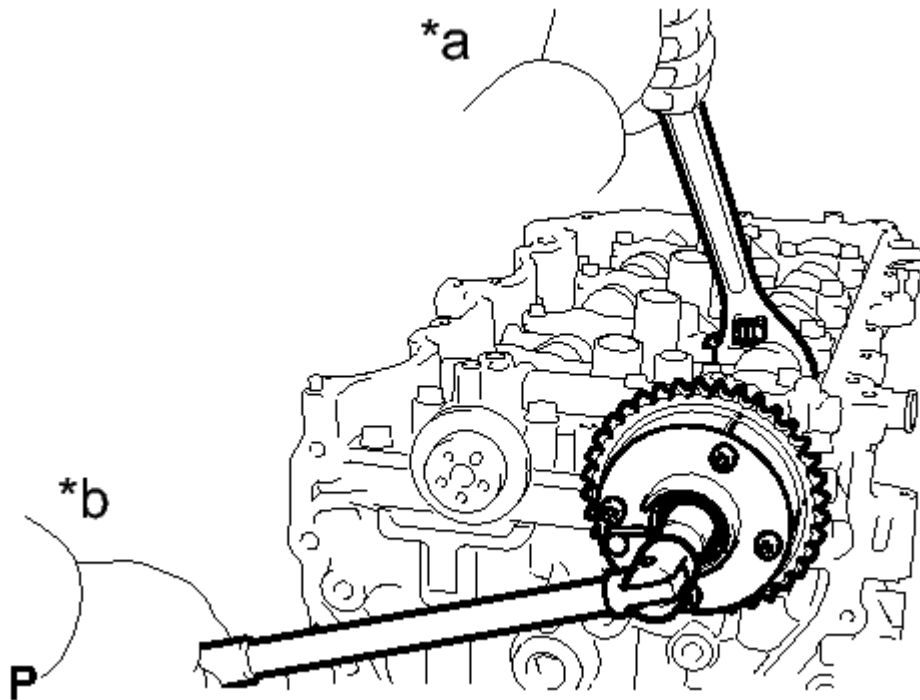
*a	Hold
*b	Turn

**NOTE:**

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

**18. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

- a. Hold the hexagonal portion of the camshaft with a wrench and remove the bolt and camshaft timing exhaust gear.



**Fig. 72: Removing Camshaft Timing Exhaust Gear Assembly Using A Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

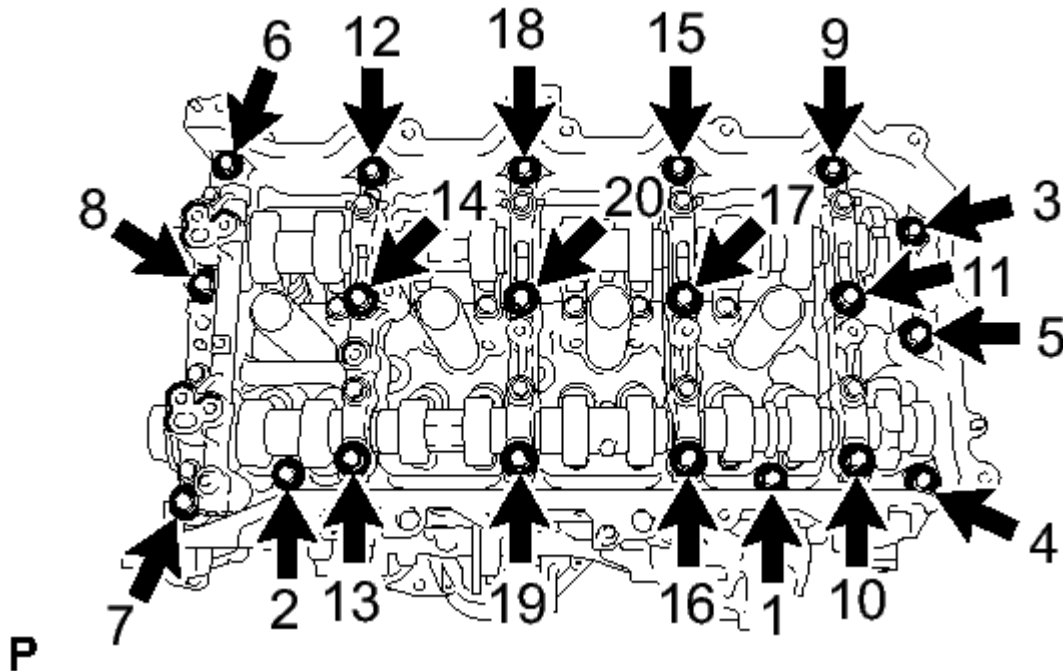
*a	Hold
*b	Turn

**NOTE:**

- Be careful not to damage the cylinder head or spark plug tube with the wrench.
- Do not disassemble the camshaft timing exhaust gear.

**19. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY**

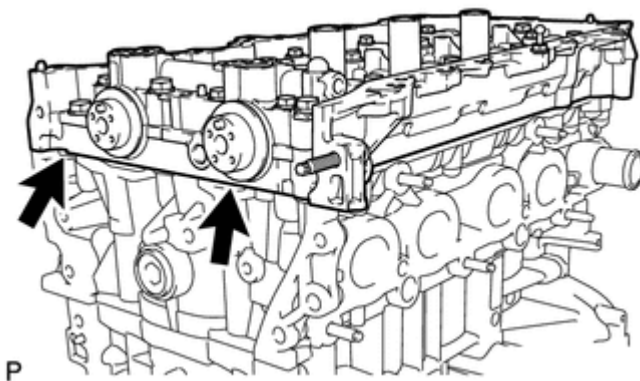
- a. Uniformly loosen and remove the 20 bearing cap bolts in the sequence shown in the illustration.



**Fig. 73: Identifying Bearing Cap Bolts Loosening Sequence**

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

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



**Fig. 74: Location of Contact Surfaces Of Cylinder Head And Camshaft Housing**

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

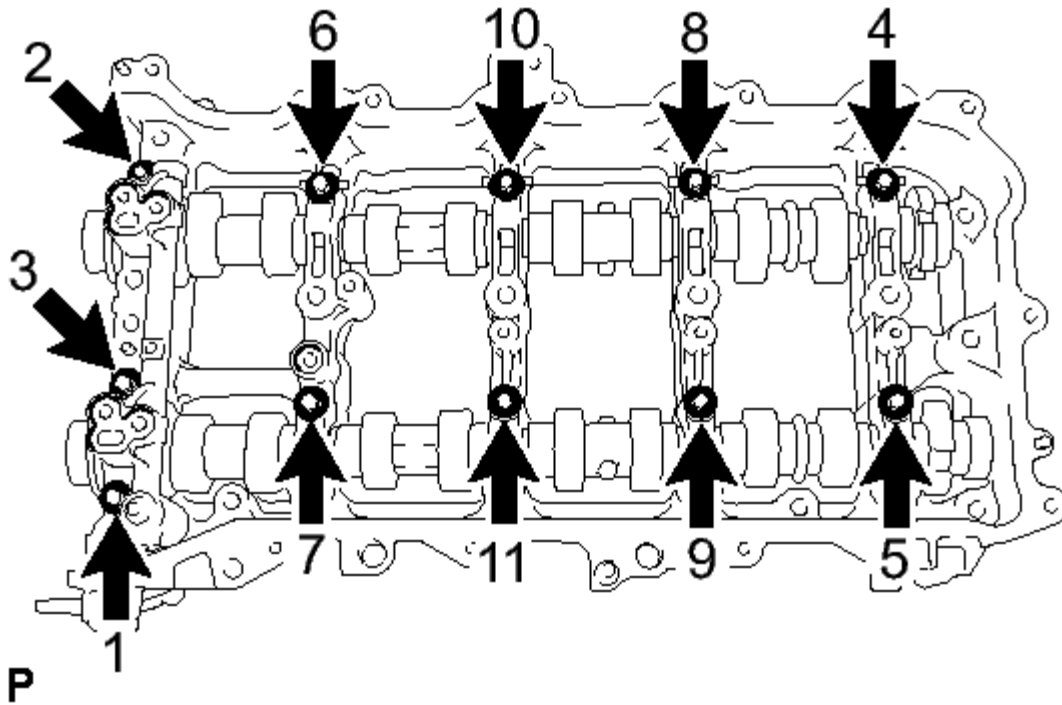
**HINT:**

Tape the screwdriver tip before use.

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

**20. REMOVE CAMSHAFT BEARING CAP**

- a. Remove the 11 bearing cap bolts in the sequence shown in the illustration.



**Fig. 75: Identifying Bearing Cap Bolts Loosening Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 5 bearing caps.

**HINT:**

Arrange the removed parts in the correct order.

**21. REMOVE OIL CONTROL VALVE FILTER** See step 37**22. REMOVE NO. 1 CAMSHAFT BEARING** See step 39**23. REMOVE CAMSHAFT**

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

**24. REMOVE NO. 2 CAMSHAFT BEARING** See step 40**25. 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.

**26. 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.

**27. REMOVE VALVE STEM CAP**

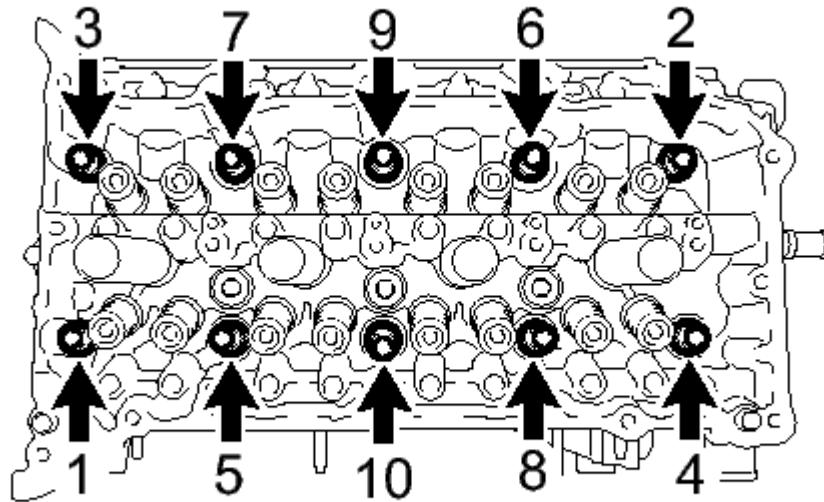
- a. Remove the 16 valve stem caps from the cylinder head.

**HINT:**

Arrange the removed parts in the correct order.

**28. REMOVE CYLINDER HEAD SUB-ASSEMBLY**

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

**P**

**Fig. 76: Identifying Bolts Loosening Sequence**

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

**HINT:**

Be sure to keep the removed parts separate for each installation position.

**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. Remove the cylinder head.

**29. REMOVE CYLINDER HEAD GASKET**

- a. Remove the cylinder head gasket from the cylinder block.

**30. INSPECT CYLINDER HEAD BOLT** See step 17

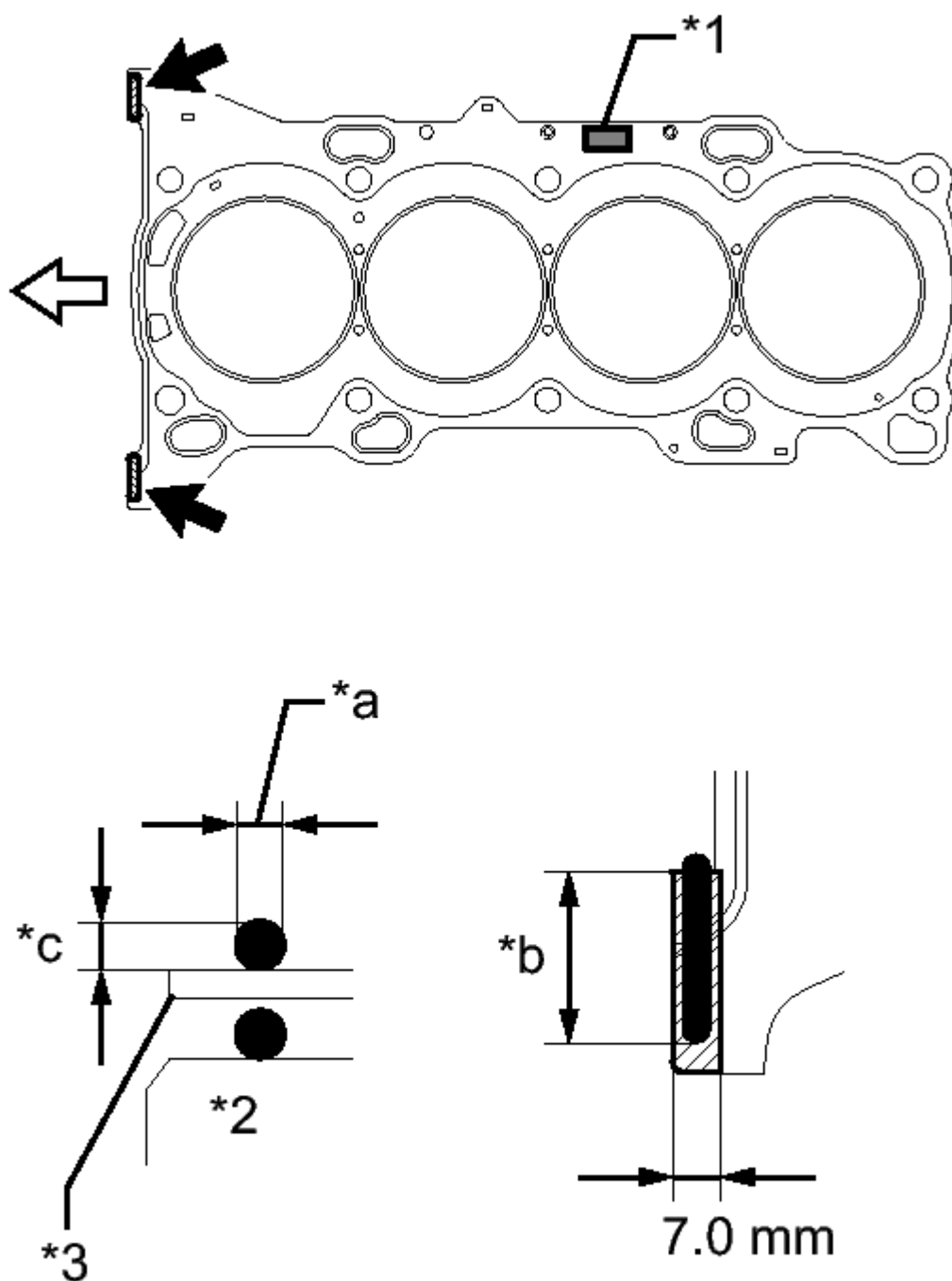
**31. INSPECT CYLINDER HEAD SUB-ASSEMBLY** See step 1

**INSTALLATION**

**INSTALLATION**

**1. INSTALL CYLINDER HEAD GASKET**

- a. Clean the cylinder block and cylinder head with solvent.
- b. Apply a continuous line of seal packing to a new cylinder head gasket as shown in the illustration.





**P**

**Fig. 77: Seal Packing Areas For New Cylinder Head Gasket**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Lot No.
----	---------



*2	Cylinder Block
*3	Cylinder Head Gasket
*a	3.0 to 7.0 mm (0.118 to 0.276 in.)
*b	20 mm (0.787 in.) or more
*c	3.0 mm (0.118 in.) or more
	Seal Packing
	Front

### Seal packing

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

### Standard seal dimension

3.0 to 7.0 mm (0.118 to 0.276 in.) wide and 3.0 mm (0.118 in.) thick

### HINT:

Apply at least 20 mm (0.787 in.) of seal packing from the inside edge of the protrusion of the cylinder block.

### NOTE:

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

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

### NOTE:

**Pay attention to the installation direction.**

## 2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

### HINT:

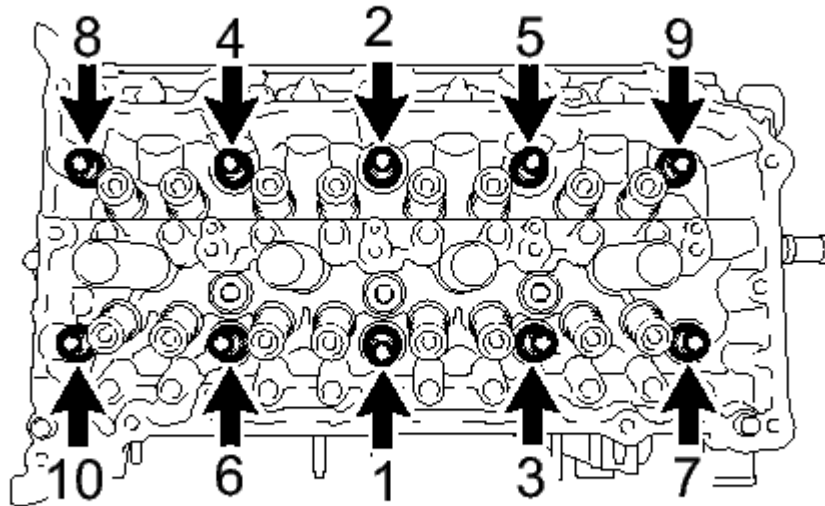
The cylinder head bolts are tightened in 4 progressive steps.

- Place the cylinder head on the cylinder block.

**NOTE:**

- Make sure that no oil is on the mounting surface of the cylinder head.
- Place the cylinder head on the cylinder block gently in order not to damage the gasket with the bottom part of the head.

- b. Install the plate washers to the cylinder head bolts.
- c. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- d. Step 1:
  1. Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 10 cylinder head bolts in several steps in the sequence shown in the illustration.

**P**

**Fig. 78: Identifying Cylinder Head Bolts Tightening Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**NOTE:**

**Do not drop the plate washer for the cylinder head bolt into the cylinder head.**

- e. Step 2:

1. Tighten the cylinder head bolts again in the sequence shown in the illustration to make sure that they are tightened to the specified torque.

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

## f. Step 3:

1. Mark the front side of each cylinder head bolt head with paint.
2. Tighten the cylinder head bolts 90° in the sequence shown in step 1.

## g. Step 4:

1. Tighten the cylinder head bolts another 90° in the sequence shown in step 1.
2. Check that the paint marks are now at a 180° angle to the front.

**NOTE:**

- **Do not apply oil for at least 4 hours after the installation.**
- **Do not start the engine for at least 4 hours after installation.**
- **After installation, if the seal packing has seeped out, wipe it off.**

**3. INSTALL VALVE STEM CAP**

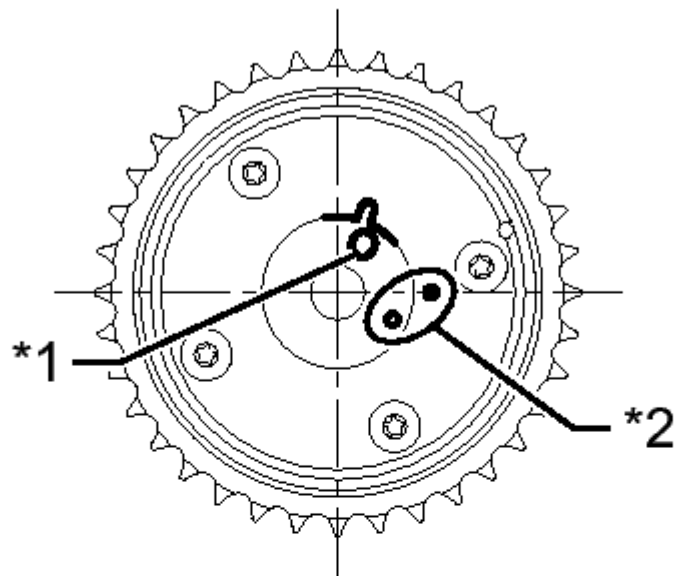
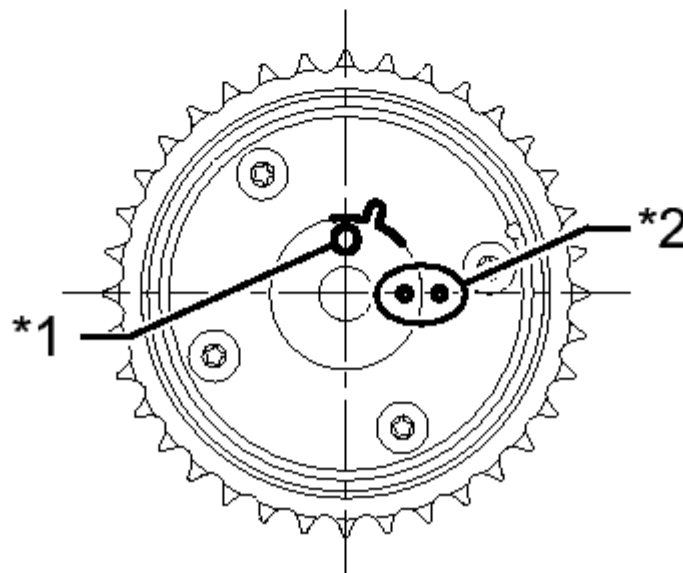
- a. Apply a light coat of engine oil to the valve stem ends.
- b. Install the 16 valve stem caps to the cylinder head.

**NOTE:**

**Do not drop the valve stem caps into the cylinder head.**

**4. SET CAMSHAFT TIMING GEAR ASSEMBLY****HINT:**

- When reusing the camshaft timing gear, release the lock pin and set the camshaft timing gear to the advanced position before installation.
  - If the camshaft timing gear is new or has already been set to the advanced position, install the camshaft timing gear after the camshafts have been installed to the engine.
- a. Check the camshaft timing gear position.

**\*a****\*b****P**

**Fig. 79: Identifying Camshaft Timing Gear Position**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

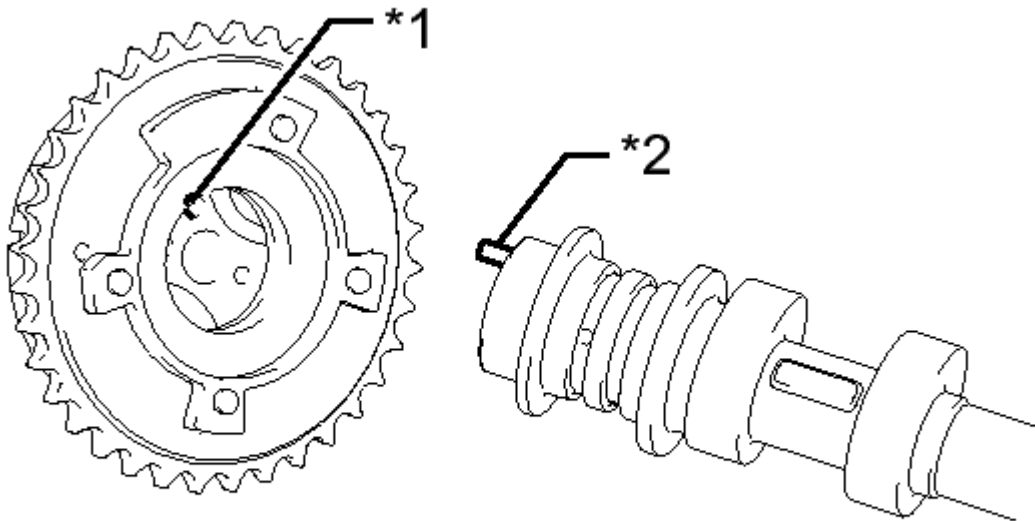
Knock Pin
-----------

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

**NOTE:** If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during installation.

If the camshaft timing gear rotates to the retarded position, release the lock pin and set the camshaft timing gear to the advanced position.

- b. Align the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear and attach the gear to the camshaft.



## P

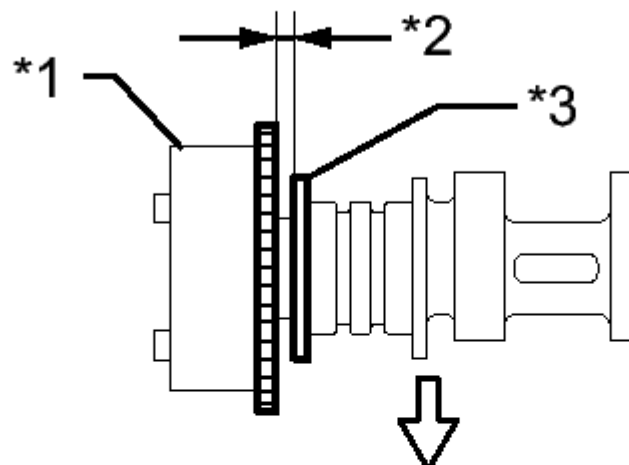
**Fig. 80: Aligning No. 1 Camshaft Knock Pin & Timing Gear Pin Hole**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### TEXT IN ILLUSTRATION

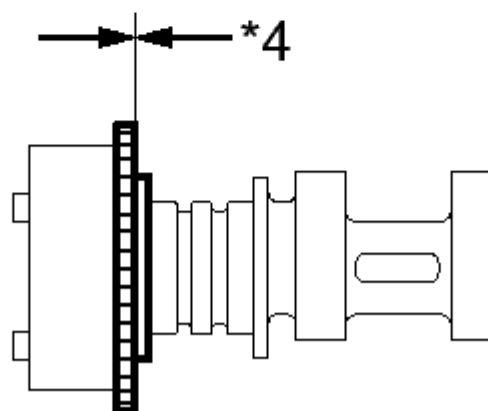
*1	Pin Hole
*2	Knock Pin

- c. Check that there is no clearance between the camshaft timing gear and camshaft flange.

\*a



\*b

**P**

**Fig. 81: Checking Clearance Between Camshaft Timing Gear & Flange**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

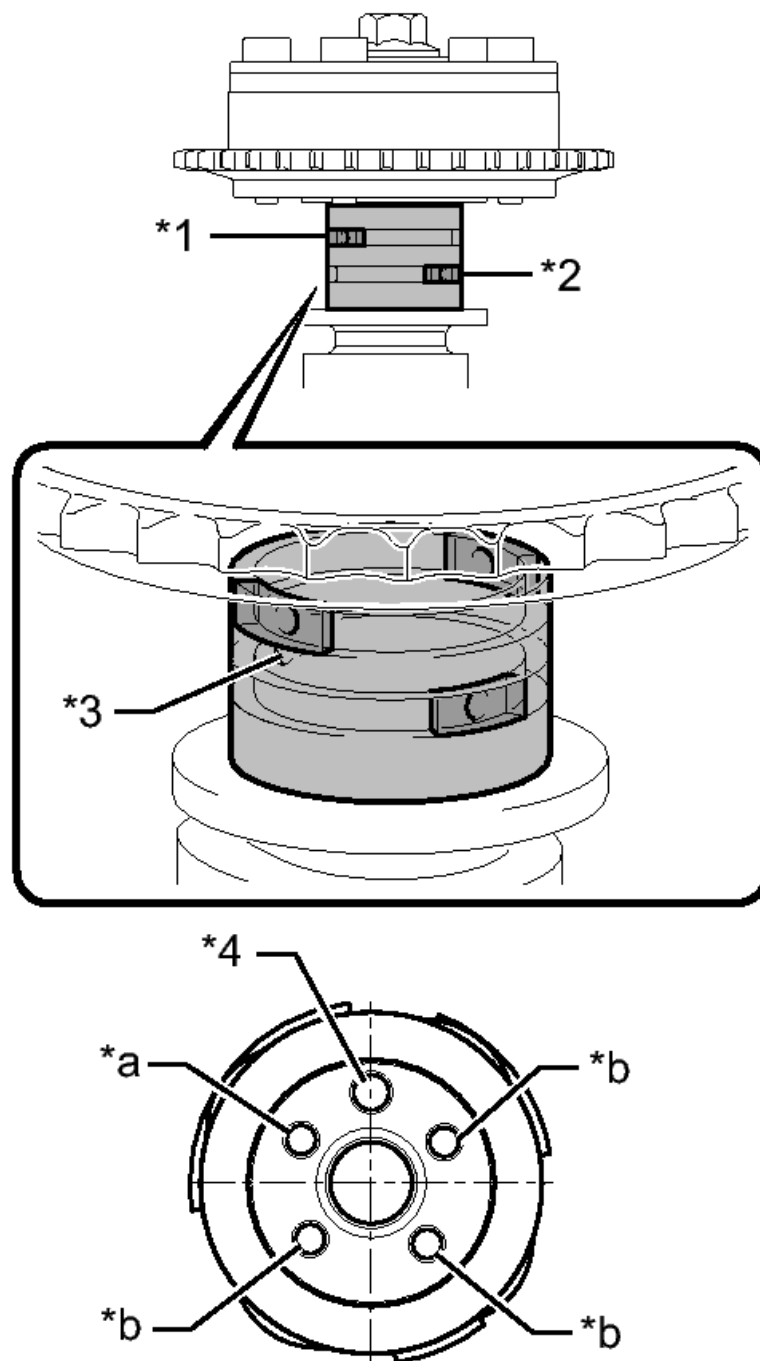
**TEXT IN ILLUSTRATION**

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

- d. Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

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



- e. Release the lock pin.
  - 1. Clean the camshaft journal with non-residue solvent.
  - 2. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

**P****Fig. 82: Camshaft Journal Oil Paths**

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

**TEXT IN ILLUSTRATION**

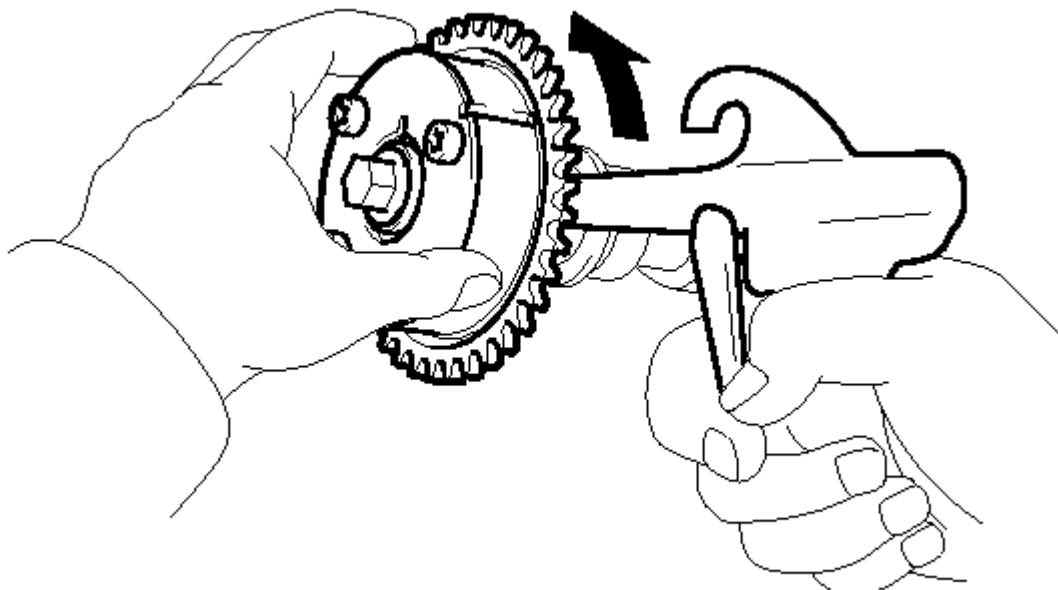


*1	Retard Side Path
*2	Advance Side Path
*3	Port A
*4	Knock Pin
*a	Open
*b	Closed
	Rubber
	Vinyl Tape

**HINT:**

There are 4 oil paths in the grooves of the camshaft. Plug three of the paths with pieces of rubber.

3. Open a hole at port A shown in the illustration.
4. While applying compressed air at approximately 200 kPa (2.0 kgf/cm<sup>2</sup>, 29 psi) to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).

**P**

**Fig. 83: Turning Camshaft Timing Gear Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**WARNING:** Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

**NOTE:** Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

**HINT:**

- The camshaft timing gear assembly may be turned in the advance direction without applying any force.
  - If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.
5. Remove the vinyl tape and pieces of rubber from the camshaft.
  - f. Remove the bolt and camshaft timing gear.

**NOTE:** Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

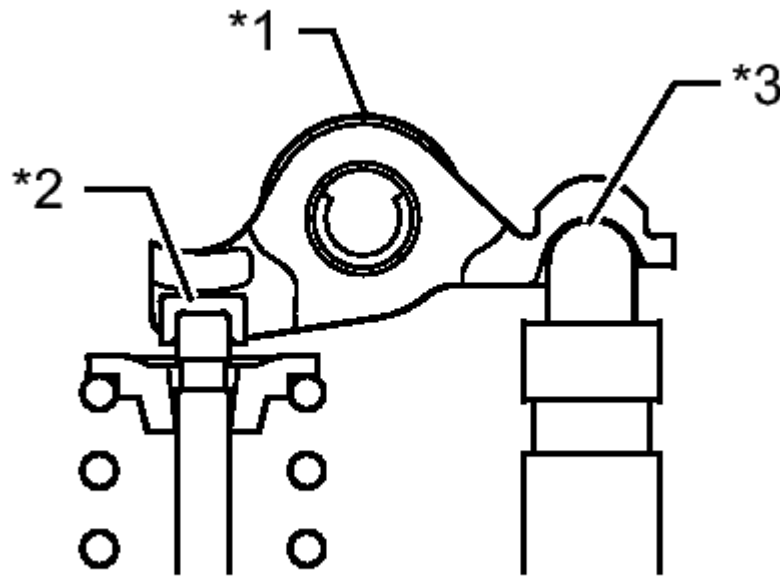
**5. INSTALL VALVE LASH ADJUSTER ASSEMBLY**

- a. Inspect the valve lash adjuster before installing it See step 2.
- b. Install the 16 lash adjusters to the cylinder head.

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

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

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

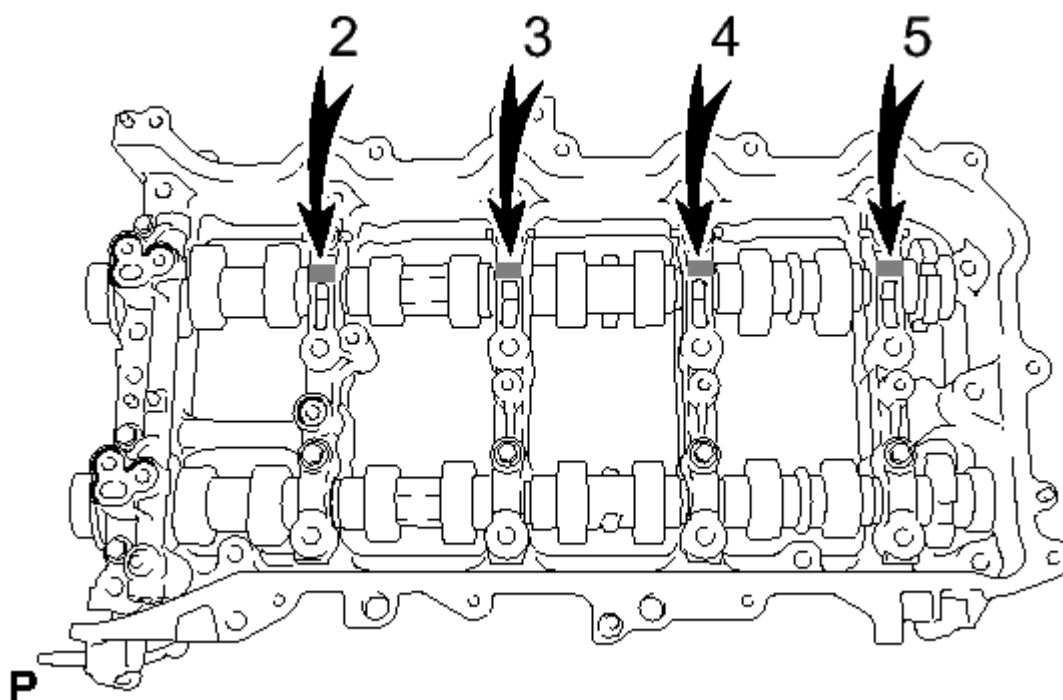
**P****Fig. 84: No. 1 Valve Rocker Arm Assembly**

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

**TEXT IN ILLUSTRATION**

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

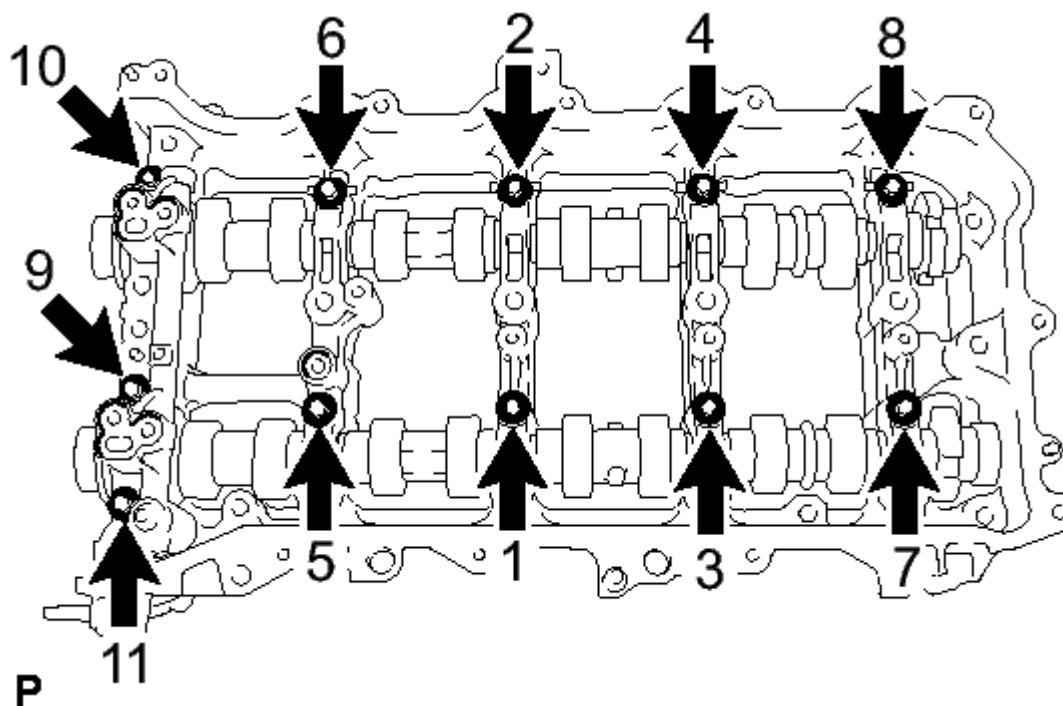
- b. Install the 16 valve rocker arms as shown in the illustration.
7. **INSTALL NO. 2 CAMSHAFT BEARING** See step 18
8. **INSTALL NO. 1 CAMSHAFT BEARING** See step 17
9. **INSTALL OIL CONTROL VALVE FILTER** See step 19
10. **INSTALL CAMSHAFT**
  - a. Clean the camshaft journals, camshaft housing and bearing caps.
  - b. Apply a light coat of engine oil to the camshaft journal, camshaft housing and bearing caps.
  - c. Install the No. 1 and No. 2 camshafts to the camshaft housing.
11. **INSTALL CAMSHAFT BEARING CAP**
  - a. Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.



**Fig. 85: Camshaft Bearing Cap Marks & Numbers**

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

- b. Install the 11 bolts in the order shown in the illustration.



**Fig. 86: Identifying Camshaft Bearing Caps Bolts Tightening Sequence**

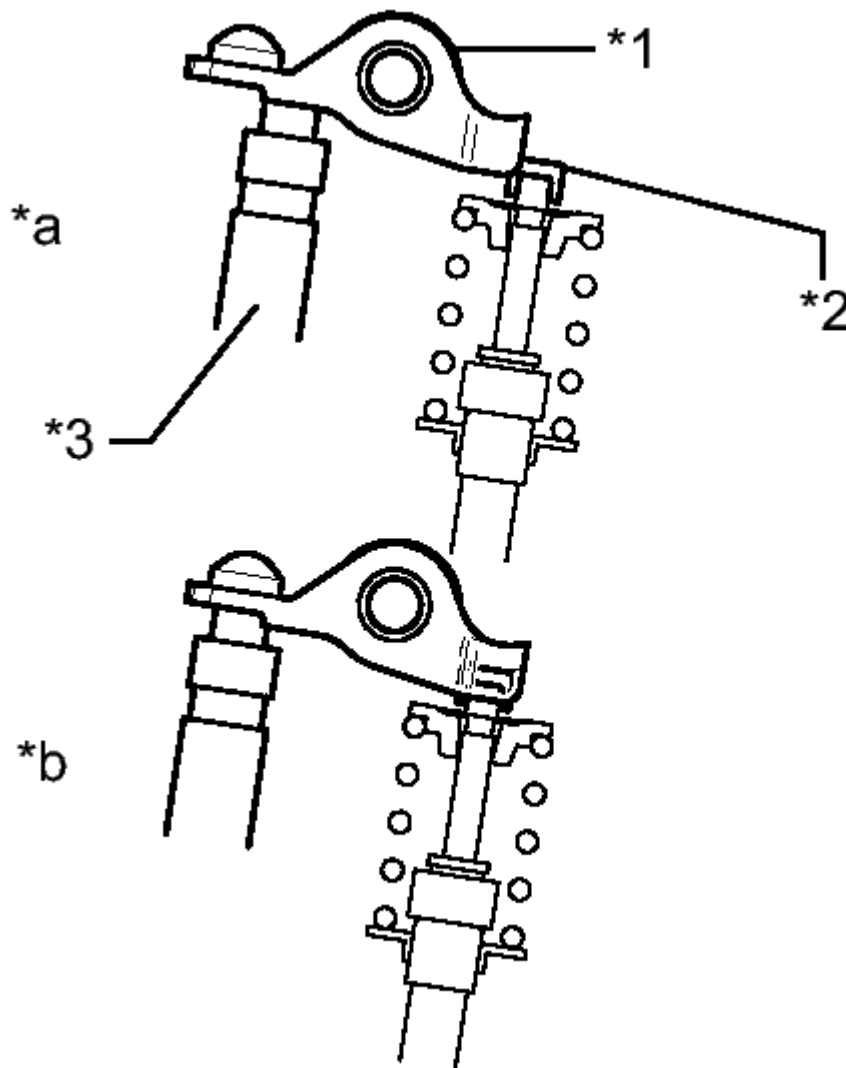
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**NOTE:** Make sure that the camshaft rotates smoothly after installing the bearing caps.

## 12. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY

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



**P**

**Fig. 87: Correct Valve Rocker Arm Installation**

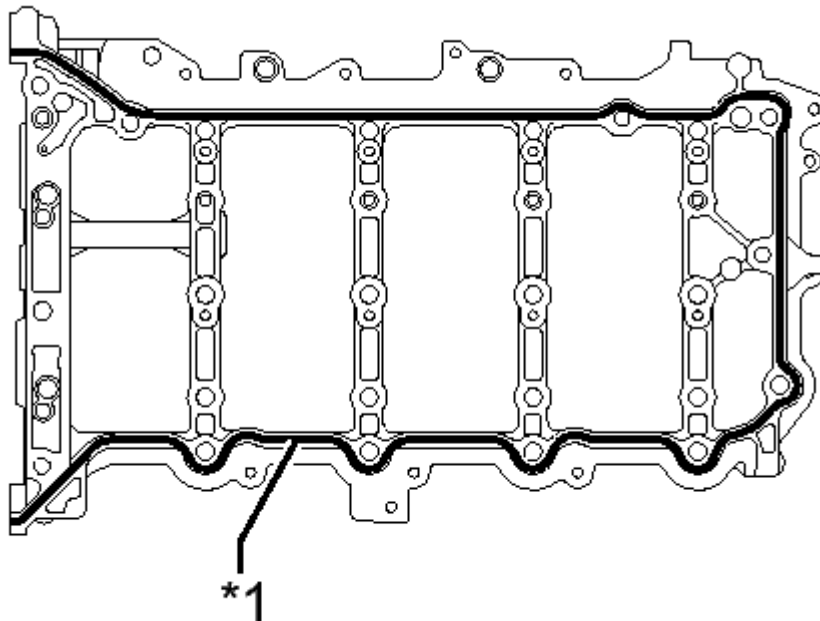
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### TEXT IN ILLUSTRATION

*1	Valve Rocker Arm
*2	Valve Stem

	Cap
*3	Valve Lash Adjuster
*a	INCORRECT
*b	CORRECT

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



**P**

**Fig. 88: Seal Packing**

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

**TEXT IN ILLUSTRATION**

\*1 Seal Packing

Seal packing

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

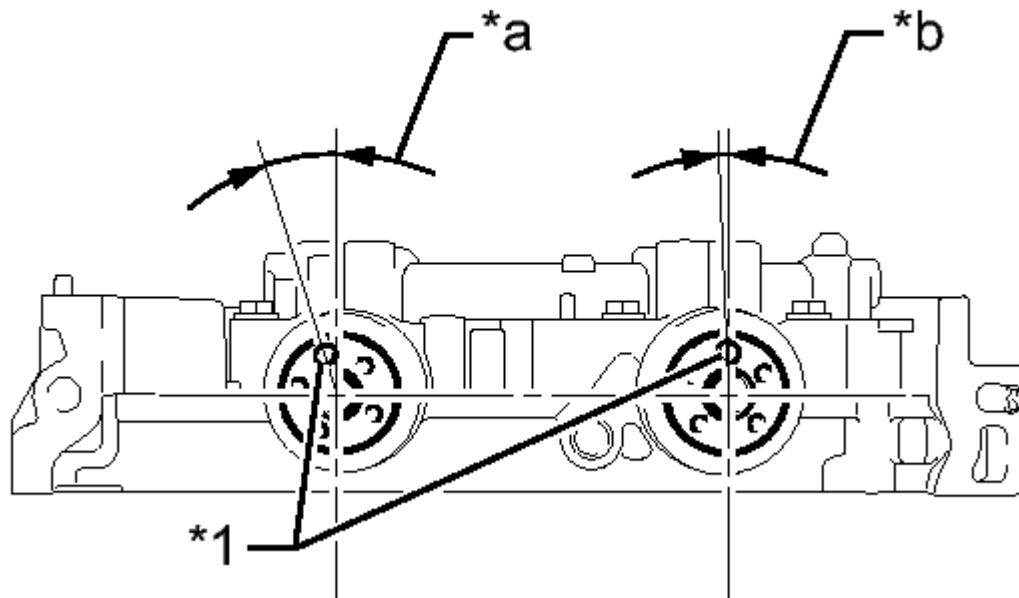
Standard seal diameter

3.0 to 4.0 mm (0.118 to 0.157 in.)

**NOTE:**

- Remove any oil from the contact surface.
- Install the camshaft housing within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.

- c. Position the knock pin of the No. 1 and No. 2 camshafts as shown in the illustration.



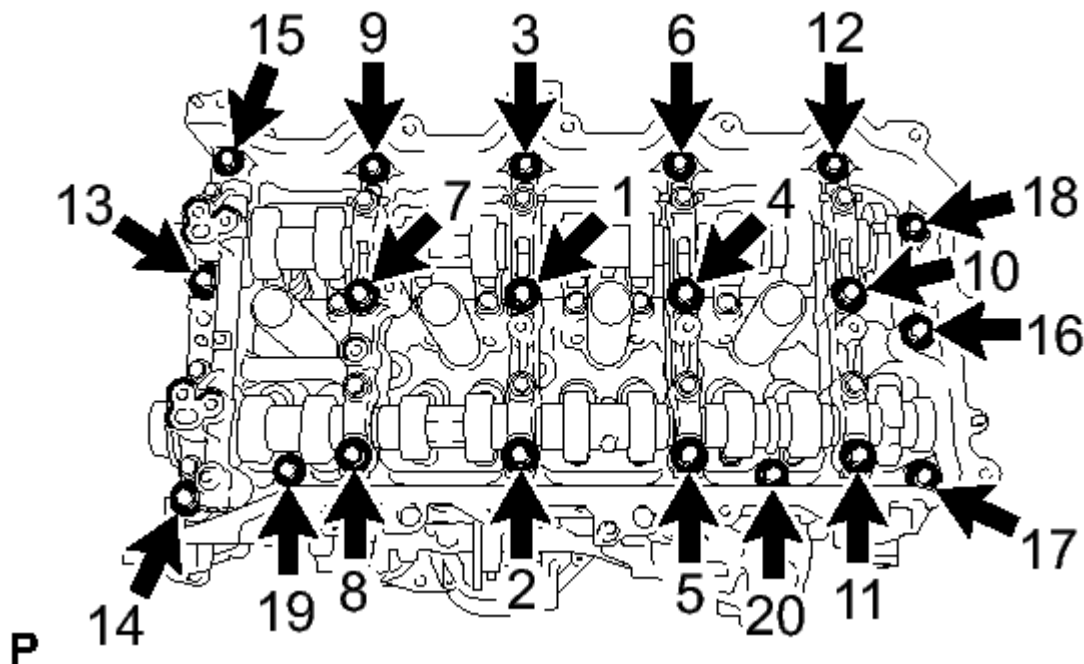
**P**

**Fig. 89: Correct Position Of No. 1 & No. 2 Camshaft Knock Pins**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Knock Pin
*a	Approximately 17°
*b	Approximately 2°

- d. Install the camshaft housing, and then install the 20 bolts in the order shown in the illustration.



**Fig. 90: Identifying Camshaft Housing Bolts Tightening Sequence**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 27 N\*m (275 kgf\*cm, 20 ft.\*lbf)**

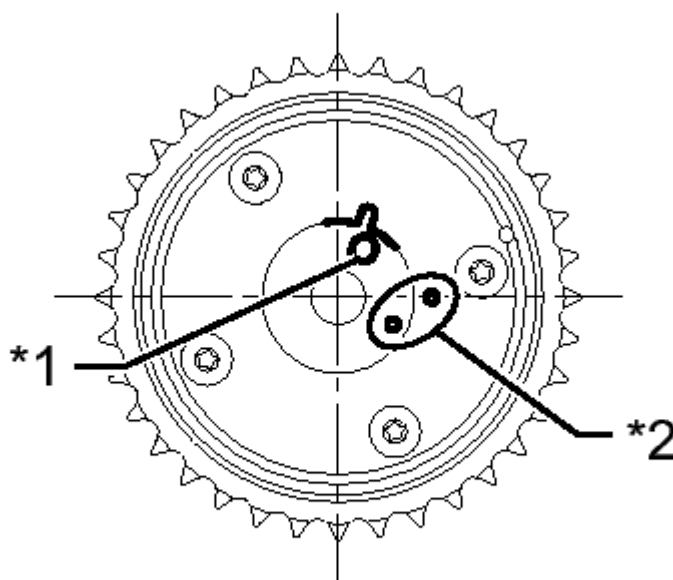
**NOTE:**

- Do not apply oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.
- Thoroughly wipe clean any seal packing.

### 13. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- a. Check the camshaft timing gear position.





**Fig. 91: Camshaft Timing Gear Position**

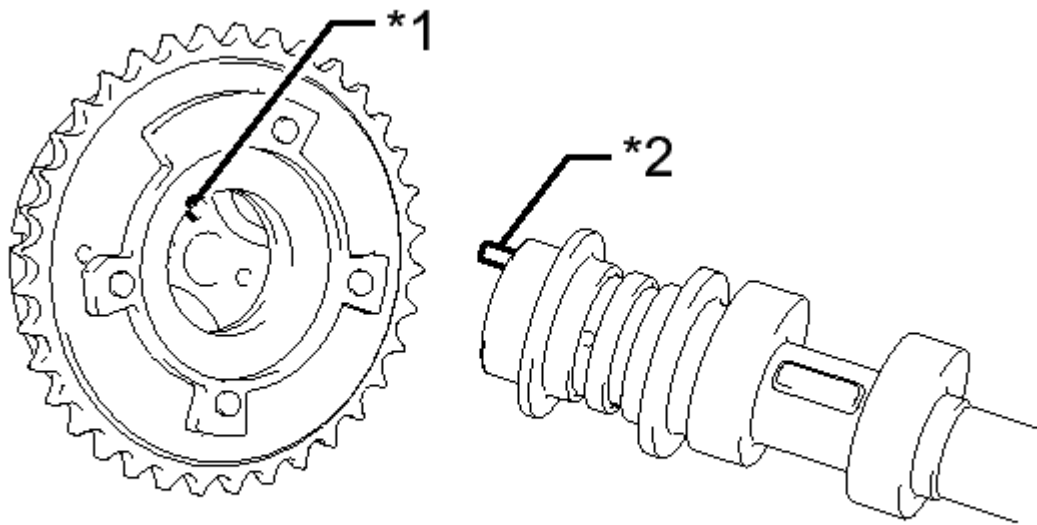
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Knock Pin Hole
*2	Alignment Mark

If the camshaft timing gear is not set to the advanced position, release the lock pin and reset the camshaft timing gear (Refer to the Set Camshaft Timing Gear Assembly procedures 4).

- b. Align the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear and attach the gear to the camshaft.

**P**

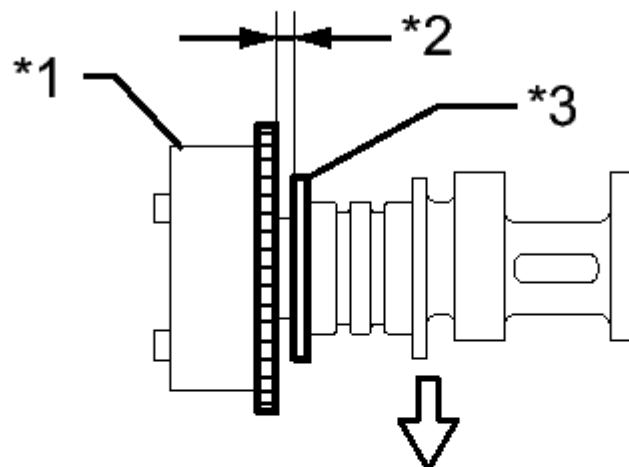
**Fig. 92: Aligning No. 1 Camshaft Knock Pin & Timing Gear Pin Hole**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

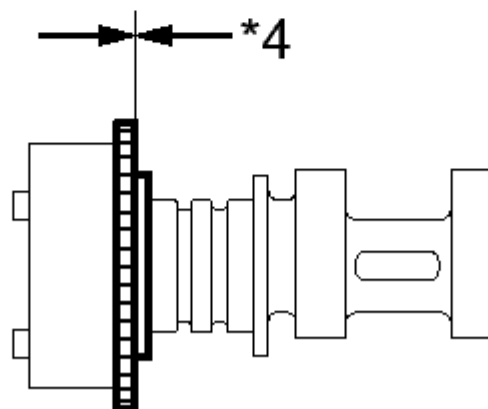
*1	Pin Hole
*2	Knock Pin

- c. Check that there is no clearance between the camshaft timing gear and camshaft flange.

\*a



\*b

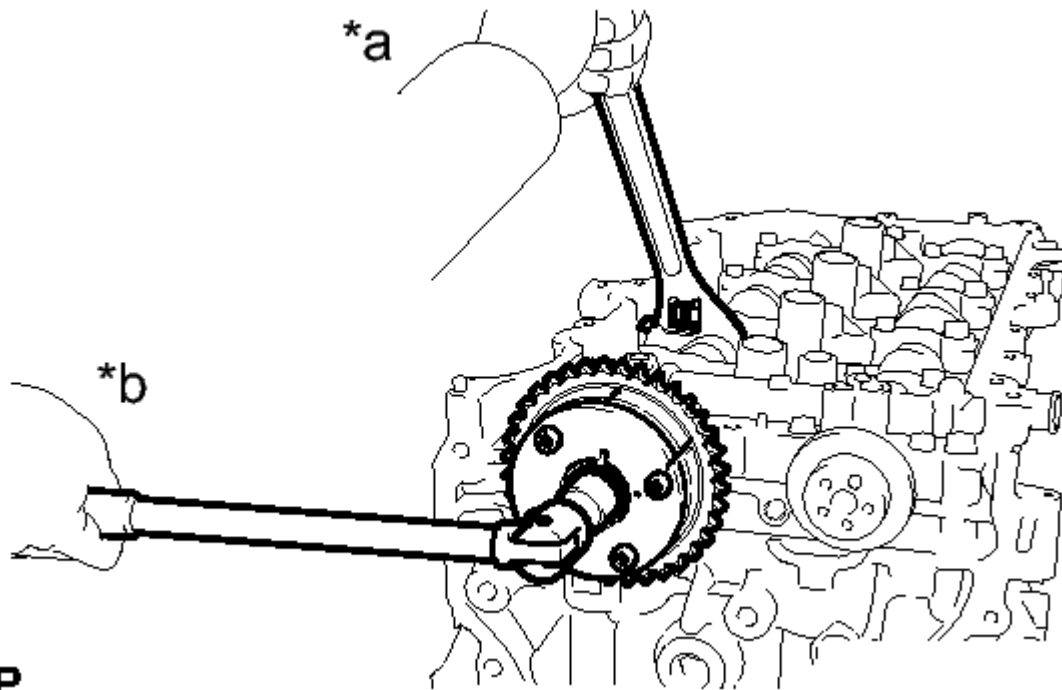
**P**

**Fig. 93: Checking Clearance Between Camshaft Timing Gear & Flange**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

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

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

**P****Fig. 94: Installing No. 1 Camshaft Bolt Using A Wrench**

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

**Torque: 85 N\*m (867 kgf\*cm, 63 ft.\*lbf)****TEXT IN ILLUSTRATION**

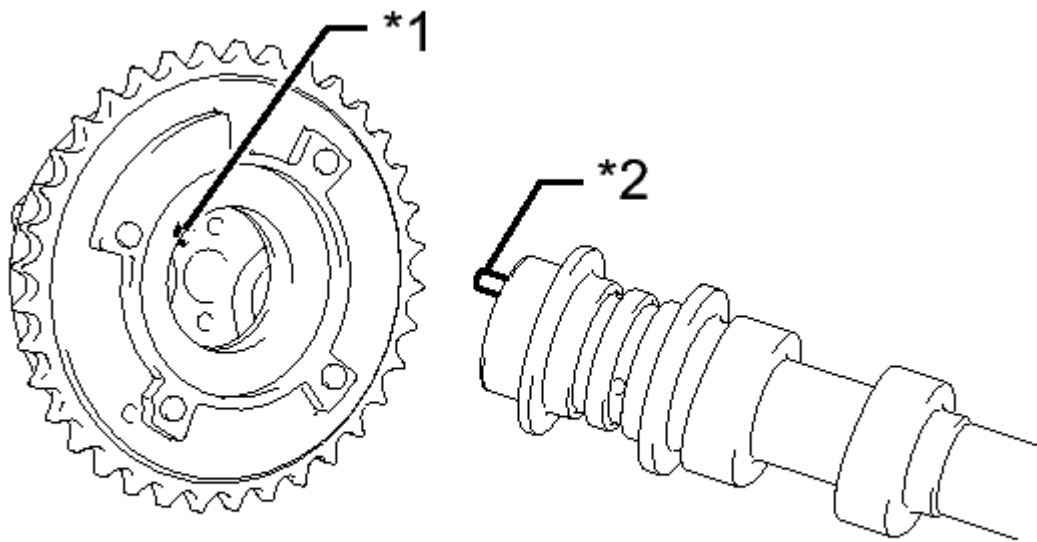
*a	Hold
*b	Turn

**NOTE:**

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

**14. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

- a. Align the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear and attach the gear to the camshaft.

**P**

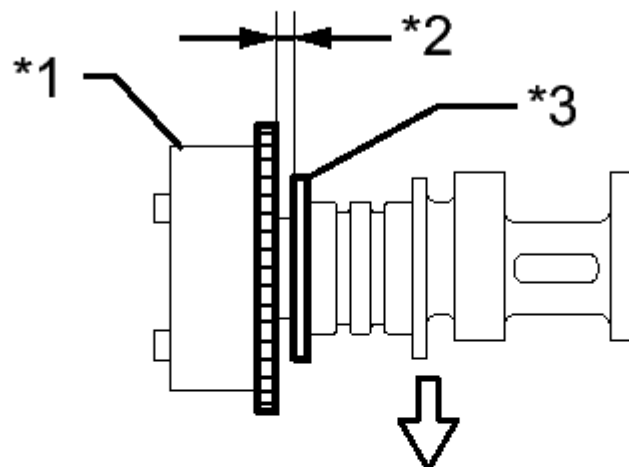
**Fig. 95: Aligning No. 2 Camshaft Knock Pin & Timing Gear Pin Hole**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

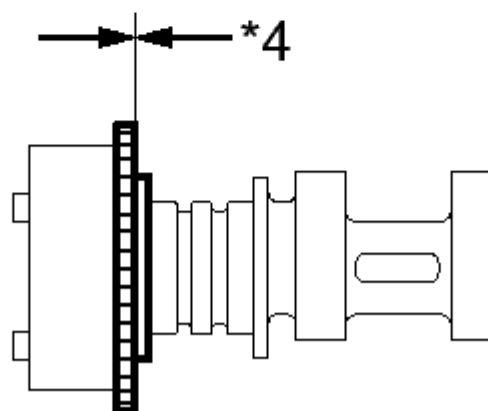
*1	Pin Hole
*2	Knock Pin

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

\*a



\*b

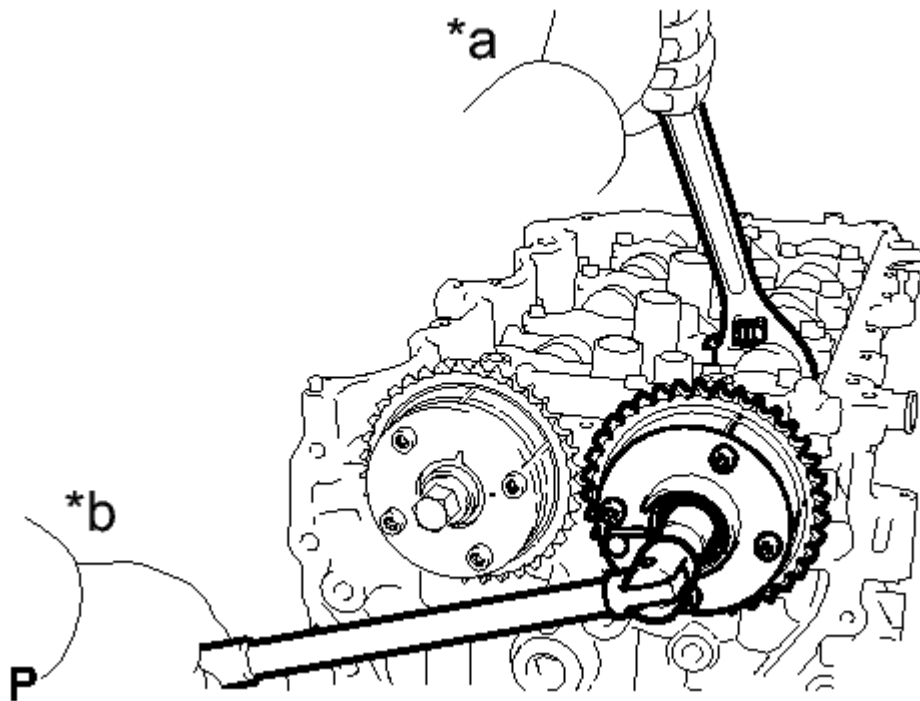
**P**

**Fig. 96: Checking Clearance Between Camshaft Timing Gear & Flange**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

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

- c. Using a wrench to hold the hexagonal portion of the No. 2 camshaft, install the bolt.



**Fig. 97: Installing No. 2 Camshaft Bolt Using A Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 85 N\*m (867 kgf\*cm, 63 ft.\*lbf)**

**TEXT IN ILLUSTRATION**

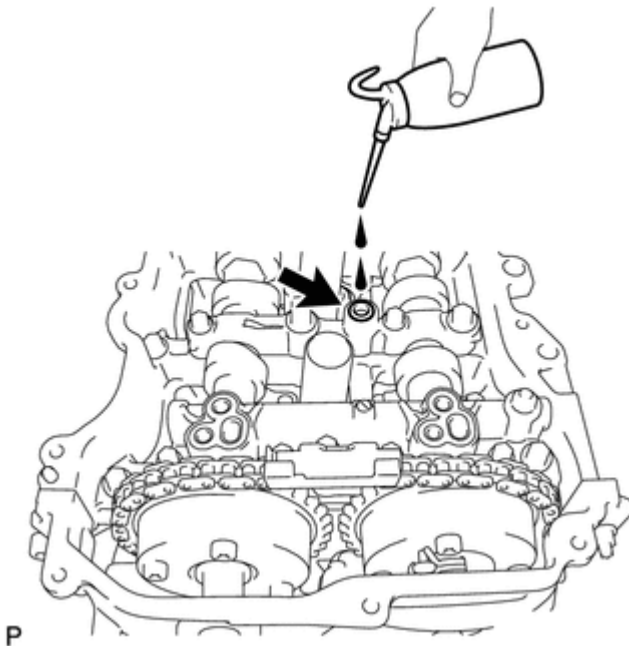
*a	Hold
*b	Turn

**NOTE:**

- Be careful not to damage the cylinder head or spark plug tube with the wrench.
- Do not disassemble the camshaft timing exhaust gear.

**15. ADD ENGINE OIL**

- a. Add 50 cc (3.1 cu. in.) of engine oil into the oil hole shown in the illustration.



**Fig. 98: Adding Engine Oil Into Oil Hole**

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

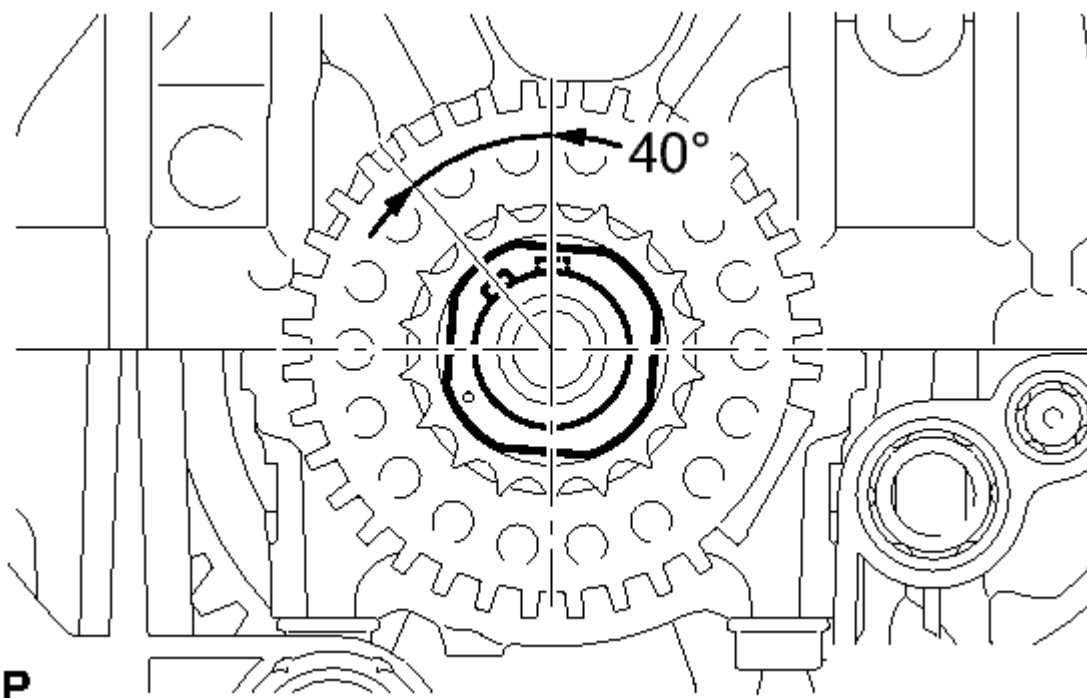
**NOTE:**

- Oil must be added if the lash adjusters were removed.
- Make sure that the low pressure chamber and oil paths of the lash adjusters are full of engine oil.

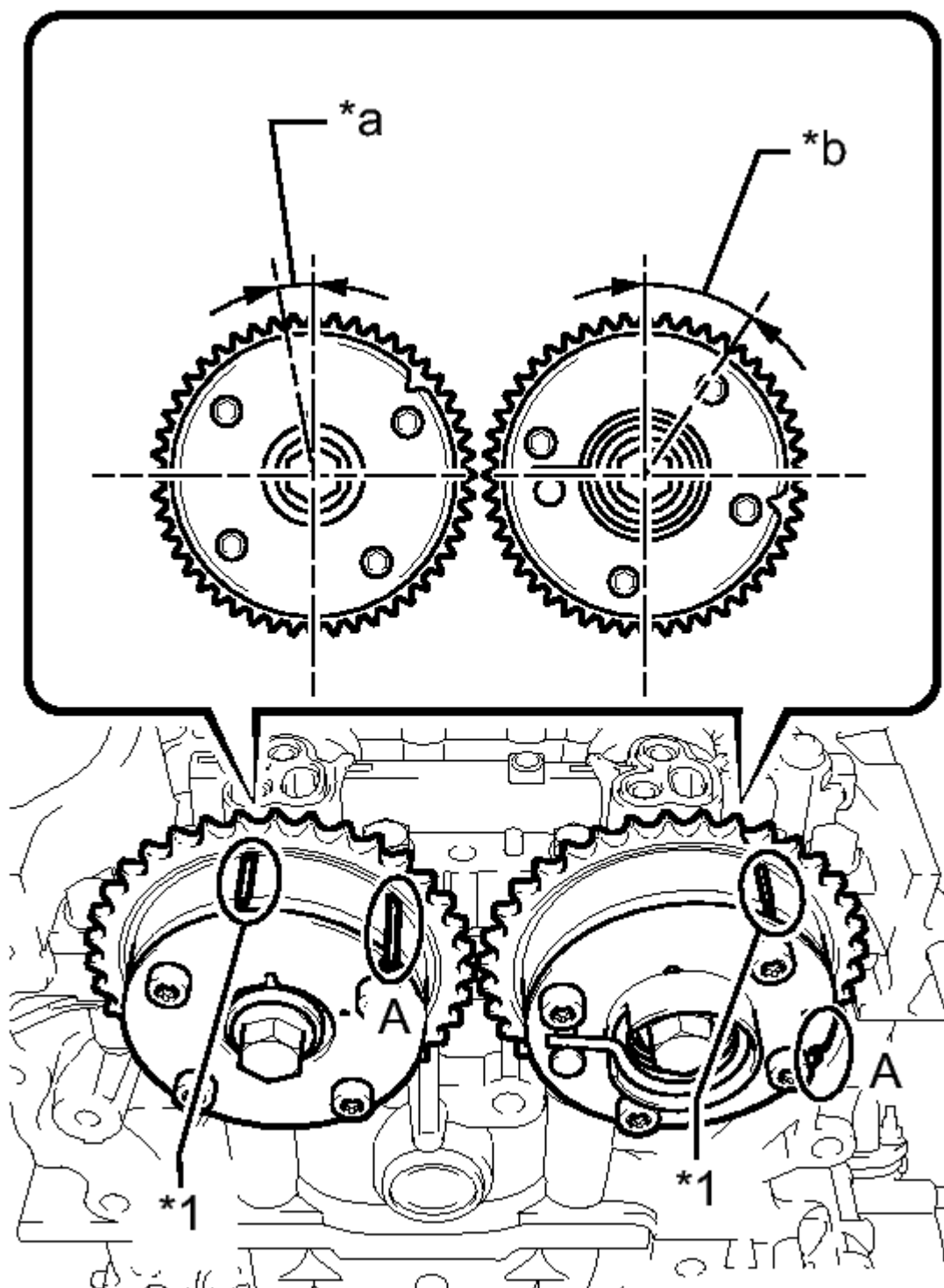
**16. SET NO. 1 CYLINDER TO TDC/COMPRESSION**

- a. Temporarily install the crankshaft pulley bolt.



**P****Fig. 99: Identifying Crankshaft Pulley Key Position****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Rotate the crankshaft 40° counterclockwise to position the crankshaft pulley key as shown in the illustration.
- c. Check that the timing marks of the camshaft timing gears are as shown in the illustration.

**P****Fig. 100: Camshaft Timing Gear Marks**

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

**TEXT IN ILLUSTRATION****\*1** Timing Mark

*a	Approximately 7°
*b	Approximately 32°

**HINT:**

"A" is not a timing mark.

- d. Remove the crankshaft pulley bolt.

**17. INSTALL NO. 1 CHAIN VIBRATION DAMPER**

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

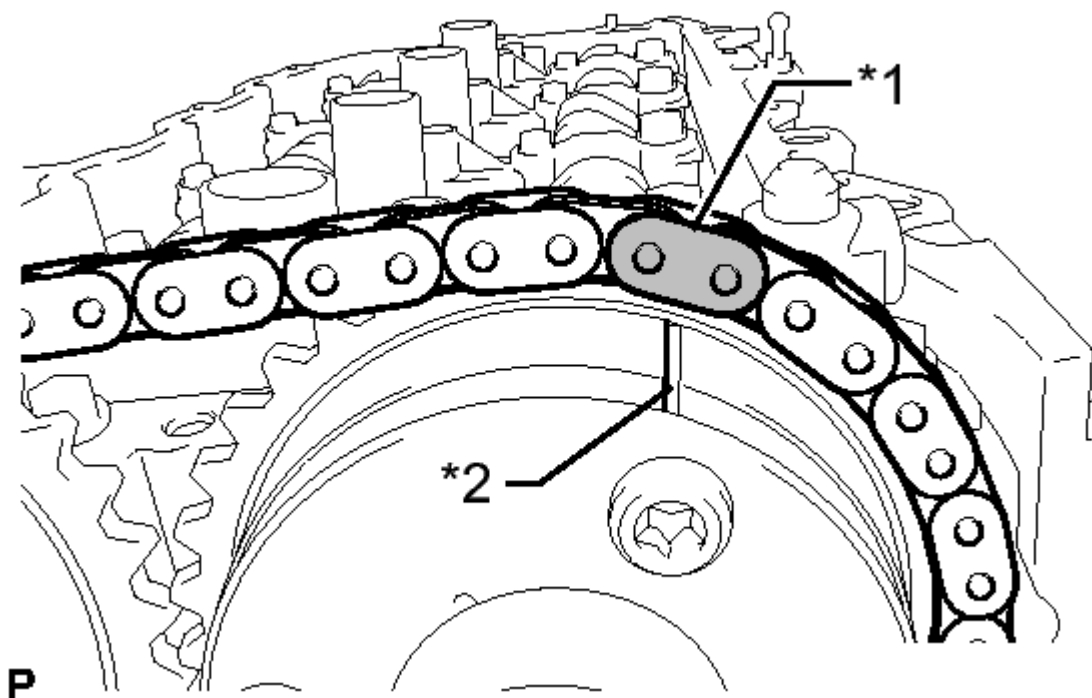
**Torque: 21 N\*m (214 kgf\*cm, 15 ft.\*lbf)**

**18. INSTALL CHAIN SUB-ASSEMBLY**

- a. Place the chain onto the camshaft timing gears and crankshaft timing sprocket.

**HINT:**

- Make sure the mark plate of the chain faces away from the engine.
  - It is not necessary to install the chain to the teeth of the gears and sprocket.
- b. Align the mark plate (yellow) of the chain with the timing mark of the camshaft timing exhaust gear and install the chain to the camshaft timing exhaust gear.



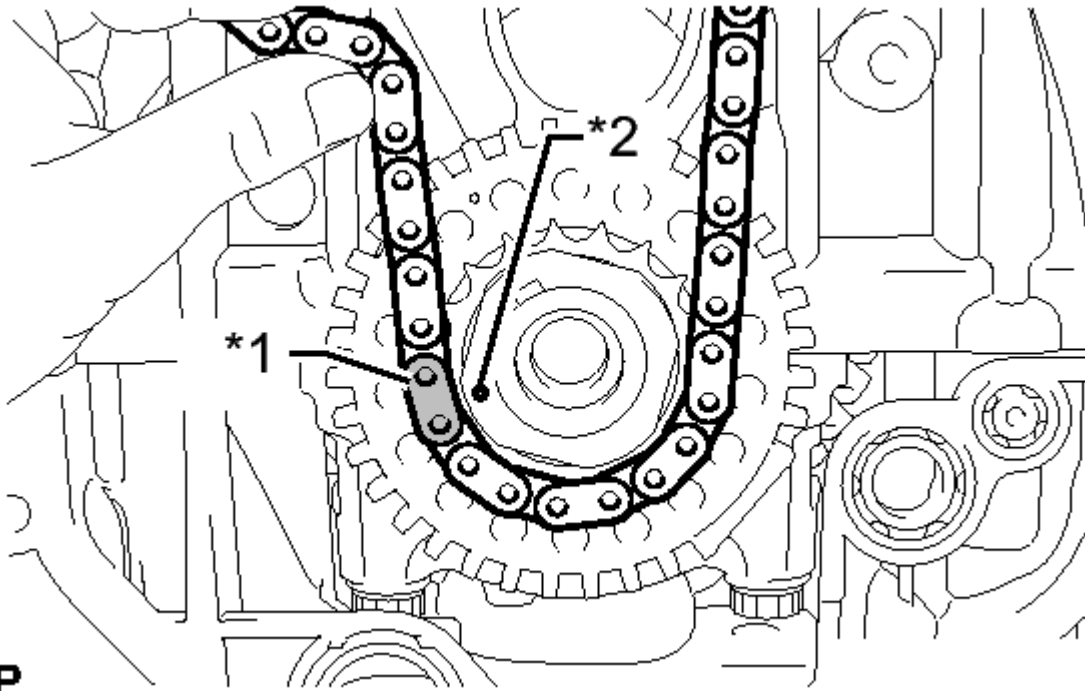
**Fig. 101: Aligning Timing Chain Mark Plate (Yellow) & Timing Exhaust Gear Mark**

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

**TEXT IN ILLUSTRATION**

*1	Mark Plate
*2	Timing Mark

- c. Align the mark plate (pink) of the chain with the timing mark of the crankshaft timing sprocket and install the chain to the crankshaft timing sprocket.



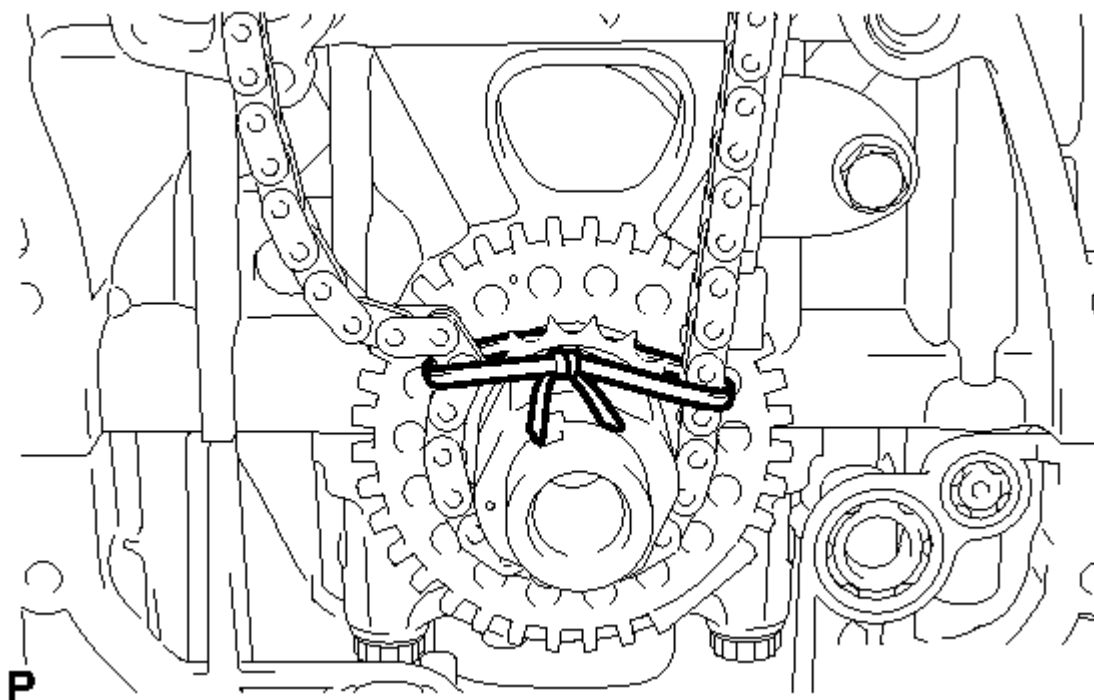
**P**

**Fig. 102: Aligning Timing Chain Mark Plate (Pink) & Crankshaft Timing Sprocket Mark**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Mark Plate
*2	Timing Mark

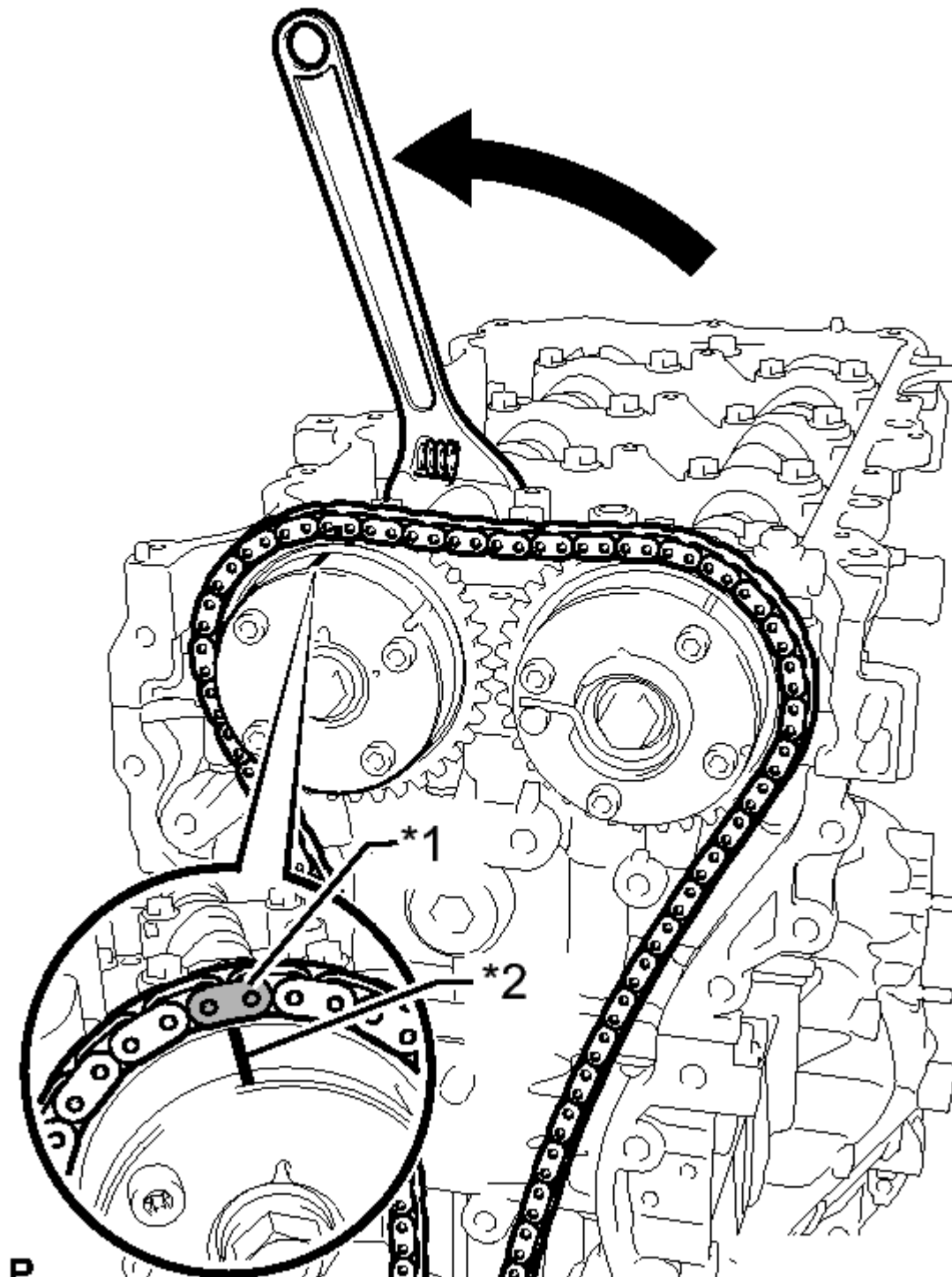
- d. Tie a string above the crankshaft timing sprocket so that the chain is secure.



**Fig. 103: Tying String Above Crankshaft Timing Sprocket**

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

- e. Using the hexagonal portion of the intake camshaft, rotate the intake camshaft counterclockwise with a wrench, align the timing mark of the camshaft timing gear with the mark plate (yellow) of the chain and install the chain to the camshaft timing gear.



**Fig. 104: Aligning Camshaft Timing Gear Mark & Timing Chain Mark Plate (Yellow)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

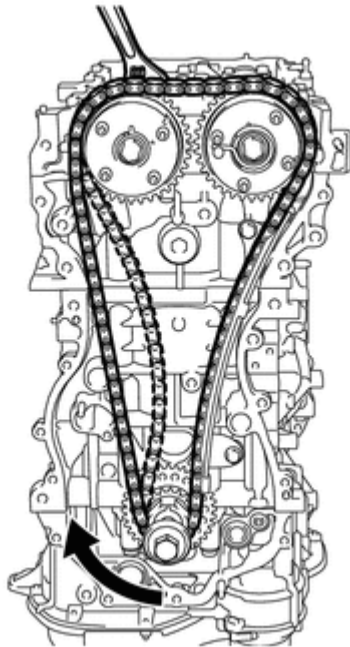
\*1 Mark Plate

*2	Timing Mark
----	-------------

**HINT:**

Hold the intake camshaft in place with a wrench until the chain tensioner is installed.

- f. Remove the string above the crankshaft timing sprocket, rotate the crankshaft clockwise, and loosen the chain so that the chain tensioner slipper can be installed.



P

**Fig. 105: Rotating Crankshaft**

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

**NOTE:**        **Make sure the chain is secure.**

**19. INSTALL CHAIN TENSIONER SLIPPER**

- a. Install the chain tensioner slipper with the bolt.

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

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

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

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

- b. Remove the pin from the stopper plate.

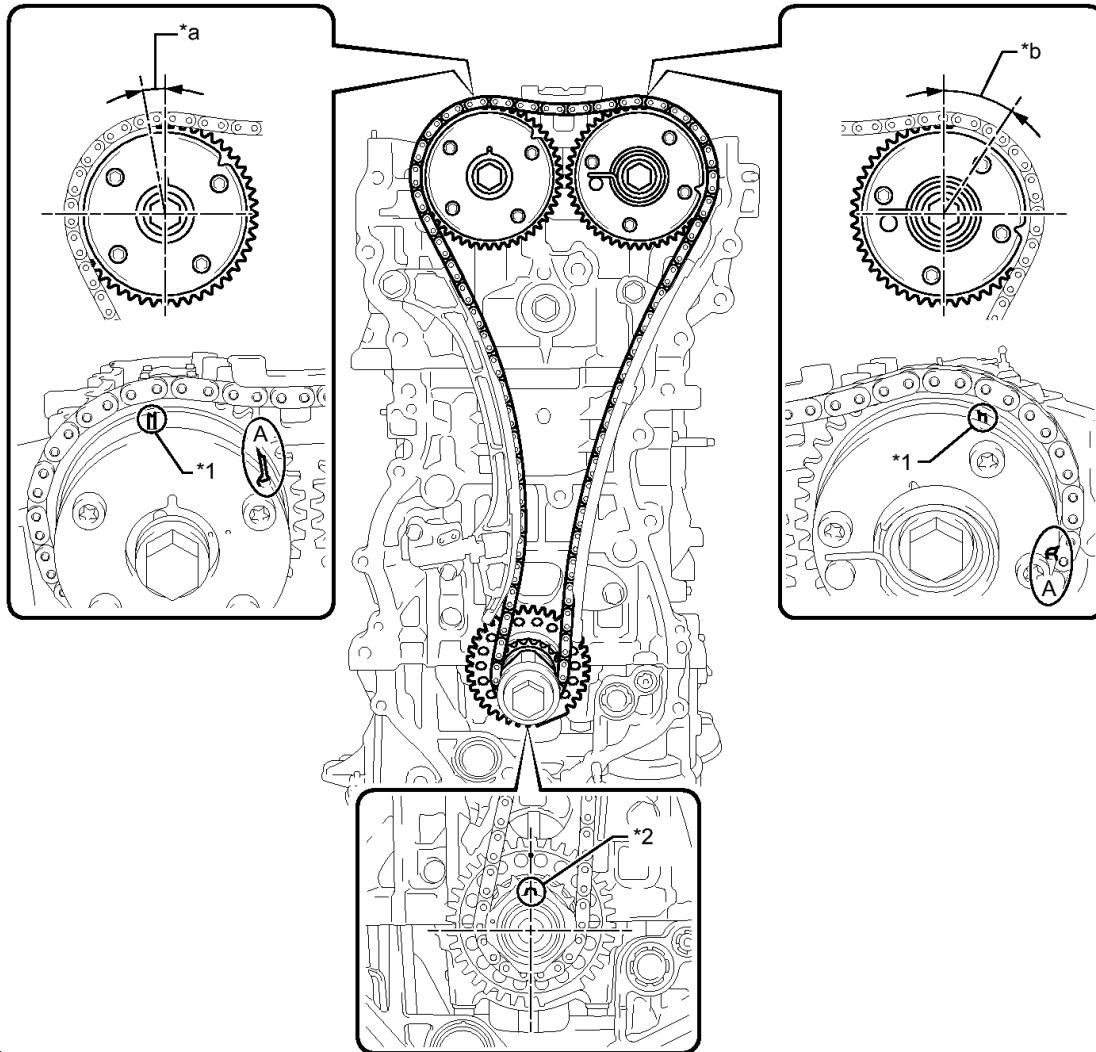
**21. INSTALL TIMING CHAIN GUIDE**

- a. Install the timing chain guide with the bolt

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

## 22. CHECK NO. 1 CYLINDER TO TDC/COMPRESSION

- a. Temporarily install the crankshaft pulley bolt.



P

**Fig. 106: Crankshaft Sprocket Marks & Camshaft Gear Marks For No. 1 Cylinder TDC**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### TEXT IN ILLUSTRATION

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

- b. Rotate the crankshaft clockwise, and check that the timing marks on the crankshaft timing sprocket and camshaft timing gears are as shown in the illustration.

### HINT:



"A" is not a timing mark.

c. Remove the crankshaft pulley bolt.

### **23. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY**

Refer to **INSTALLATION**

24. **INSTALL INTAKE MANIFOLD** . Refer to **INSTALLATION - Step 4**

25. **CONNECT NO. 2 PCV HOSE** . Refer to **INSTALLATION - Step 5**

26. **CONNECT WIRE HARNESS** . Refer to **INSTALLATION - Step 6**

27. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 2**

28. **CONNECT WIRE HARNESS** . Refer to **INSTALLATION - Step 3**

29. **CONNECT FUEL TUBE SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 4**

30. **INSTALL THROTTLE WITH MOTOR BODY ASSEMBLY** . Refer to **INSTALLATION - Step 1**

31. **INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**

Refer to **INSTALLATION**

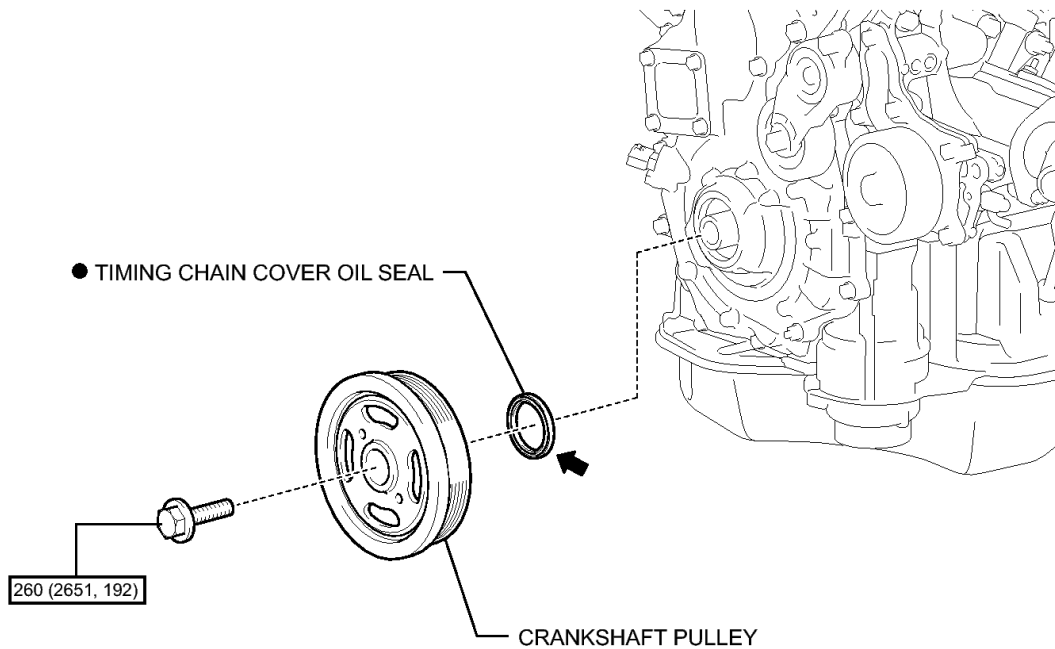
### **32. INSTALL ENGINE AND TRANSAXLE**

Refer to **INSTALLATION**

## **FRONT CRANKSHAFT OIL SEAL**

### **COMPONENTS**

### **ILLUSTRATION**



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

● Non-reusable part

➡ MP grease

P

**Fig. 107: Identifying Front Crankshaft Oil Seal Replacement Components With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### REMOVAL

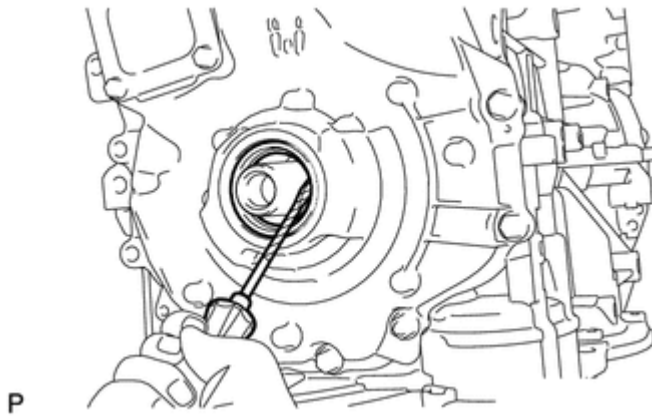
#### 1. REMOVE FAN AND GENERATOR V BELT

Refer to **REMOVAL**

#### 2. REMOVE CRANKSHAFT PULLEY See step 18

#### 3. REMOVE TIMING CHAIN COVER OIL SEAL

- Using a screwdriver, pry out the oil seal.



**Fig. 108: Prying Out Oil Seal**

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

**HINT:**

Tape the screwdriver tip before use.

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

**INSTALLATION**

**INSTALLATION**

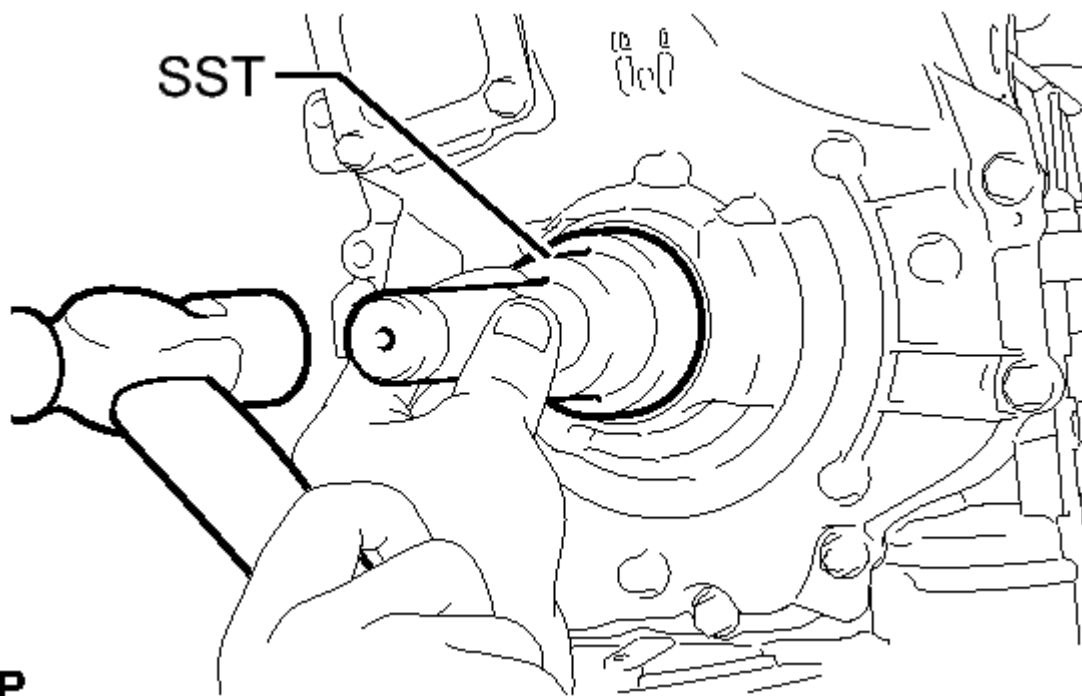
**1. INSTALL TIMING CHAIN COVER OIL SEAL**

- a. Apply MP grease to the lip of a new oil seal.

**NOTE:**

- Do not allow foreign matter to contact the lip of the oil seal.
- Do not allow MP grease to contact the dust seal.

- b. Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.

**P****Fig. 109: Installing Oil Seal**

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

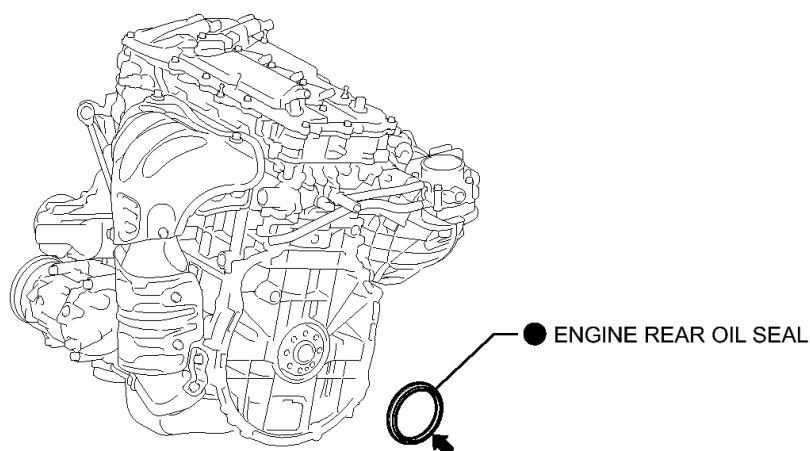
- SST: 09223-22010

**NOTE:**

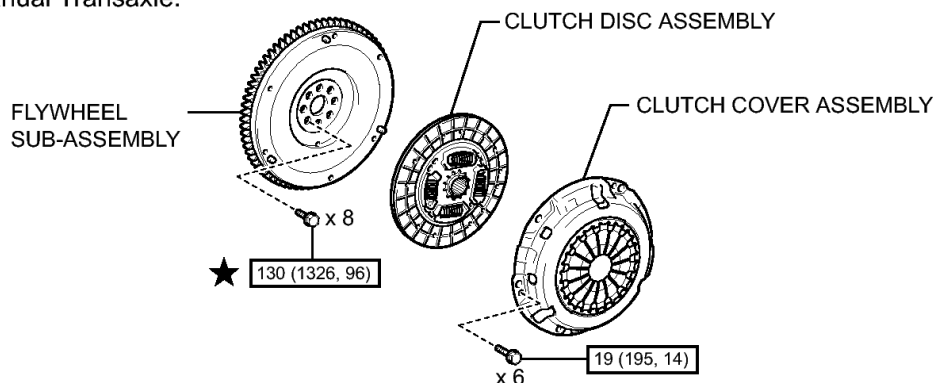
- Keep the lip of the oil seal free from foreign matter.
- Do not tap in the oil seal at an angle.

2. **INSTALL CRANKSHAFT PULLEY** See step 44
3. **INSTALL FAN AND GENERATOR V BELT**

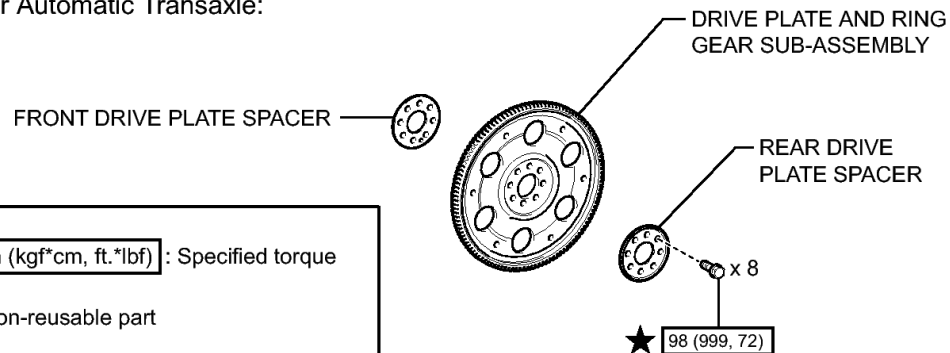
Refer to **INSTALLATION****REAR CRANKSHAFT OIL SEAL****COMPONENTS****ILLUSTRATION**



for Manual Transaxle:



for Automatic Transaxle:



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

● Non-reusable part

★ Precoated part

← MP grease

P

**Fig. 110: Identifying Rear Crankshaft Oil Seal Replacement Components With Torque Specifications**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

### REMOVAL

#### 1. REMOVE ENGINE AND TRANSAXLE

Refer to **REMOVAL**

2. **REMOVE MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)**

Refer to **REMOVAL**

3. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)**

Refer to **REMOVAL**

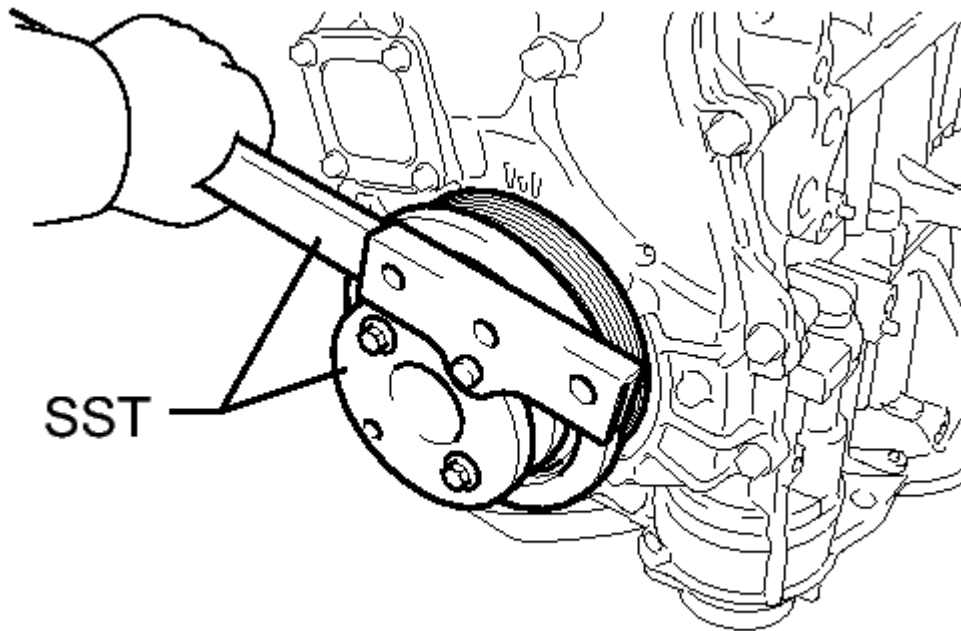
4. **FIX ENGINE ASSEMBLY** See step 66

5. **REMOVE CLUTCH COVER ASSEMBLY (for Manual Transaxle)** . Refer to **REMOVAL - Step 6**

6. **REMOVE CLUTCH DISC ASSEMBLY (for Manual Transaxle)**

7. **REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)**

- a. Using SST, hold the crankshaft pulley.



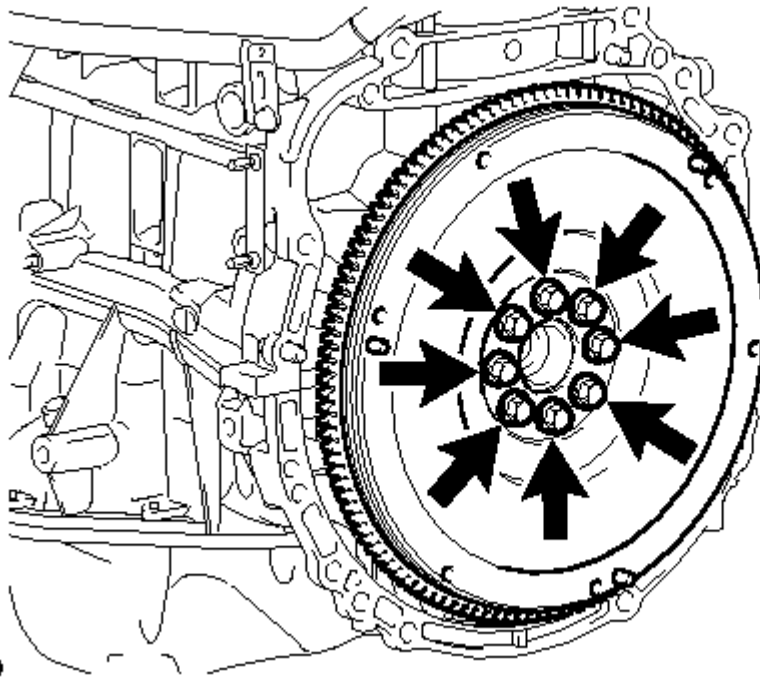
**P**

**Fig. 111: Holding Crankshaft Pulley Using SST**

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

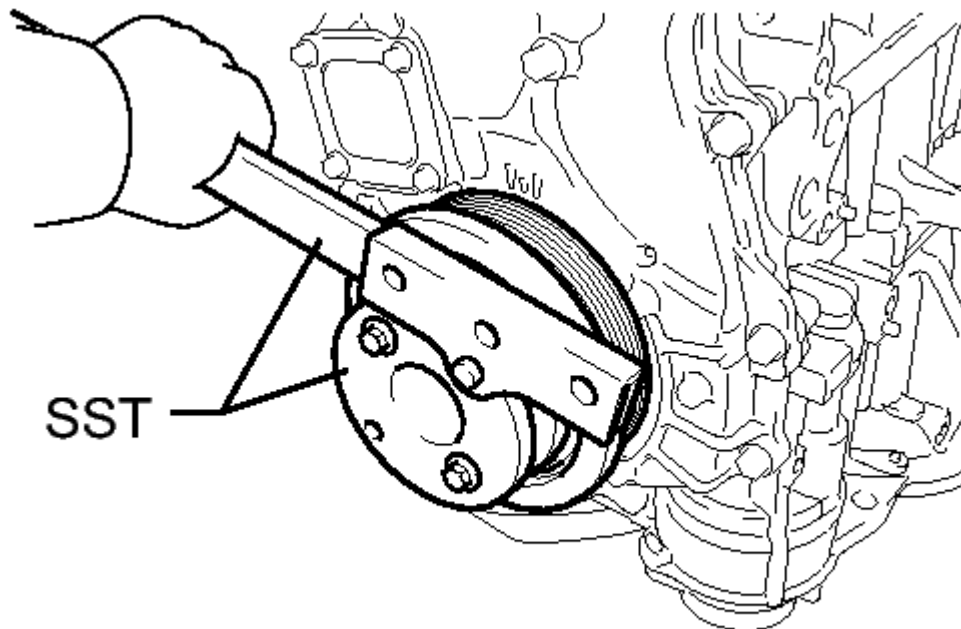
- SST: 09213-54015
- SST: 91551-80650
- SST: 09330-00021

- b. Remove the 8 bolts and flywheel.

**P****Fig. 112: Flywheel Bolts**

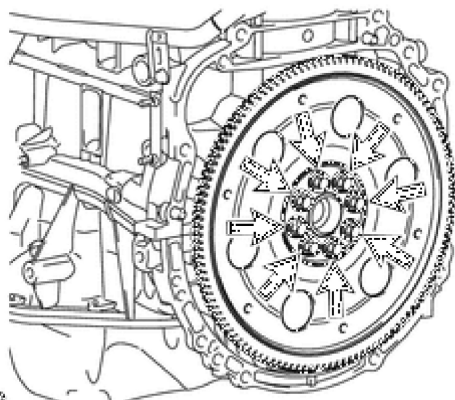
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)**
  - a. Using SST, hold the crankshaft pulley.

**P****Fig. 113: Holding Crankshaft Pulley Using SST**

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

- SST: 09213-54015
  - SST: 91551-80650
  - SST: 09330-00021
- b. Remove the 8 bolts, front drive plate spacer, drive plate and ring gear sub-assembly and rear drive plate spacer.



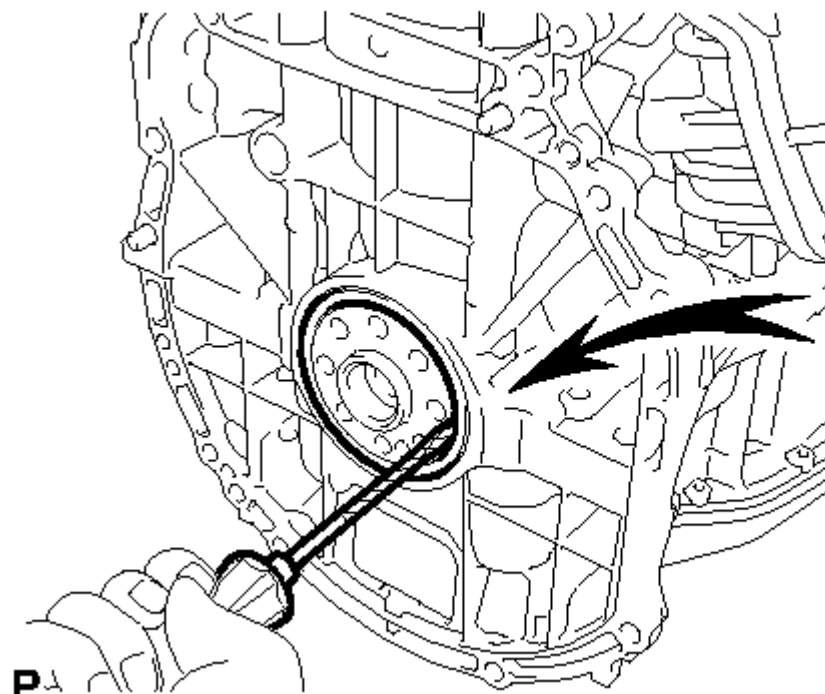
P

**Fig. 114: Front Drive Plate Assembly Bolts**

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

## 9. REMOVE REAR ENGINE OIL SEAL

- a. Using a knife, cut off the lip of the oil seal.



P





**Fig. 115: Removing Rear Engine Oil Seal**

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

**TEXT IN ILLUSTRATION**

*1	Cut Position
----	--------------

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

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

**HINT:**

Tape the screwdriver tip before use.

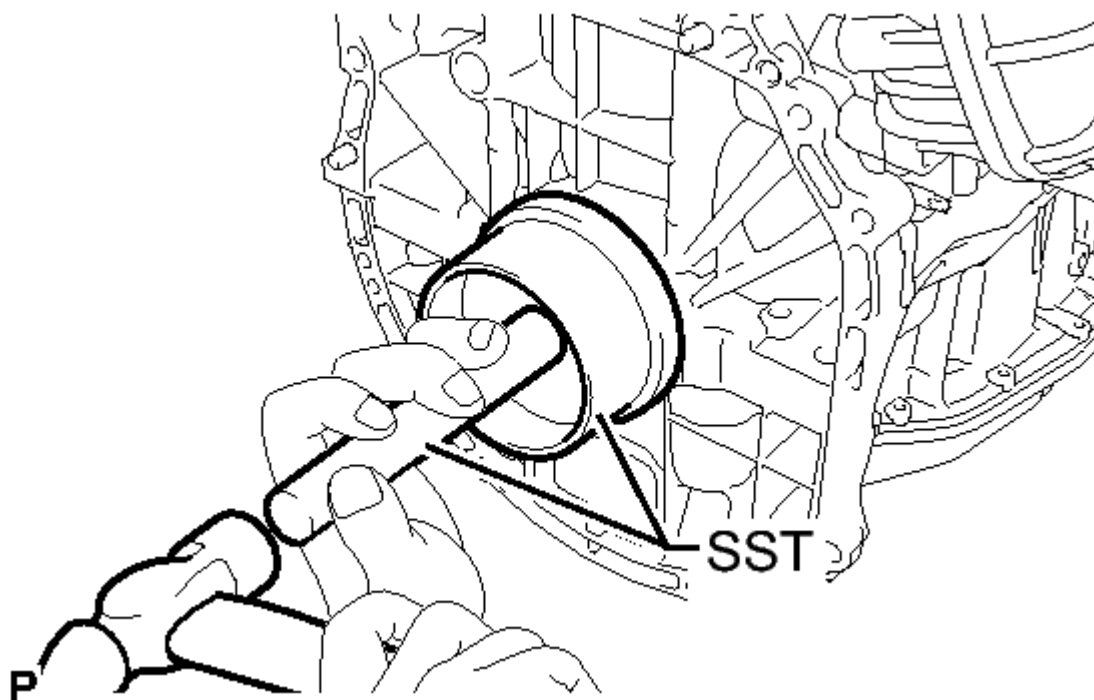
**INSTALLATION****INSTALLATION****1. INSTALL REAR ENGINE OIL SEAL**

- a. Apply MP grease to the lip of a new oil seal.

**NOTE:**

- **Do not allow foreign matter to contact the lip of the oil seal.**
- **Do not allow MP grease to contact the dust seal.**

- b. Using SST and a hammer, tap in the oil seal until its surface is flush with the edges of the cylinder block and crankcase.



**Fig. 116: Installing Rear Engine Oil Seal**

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

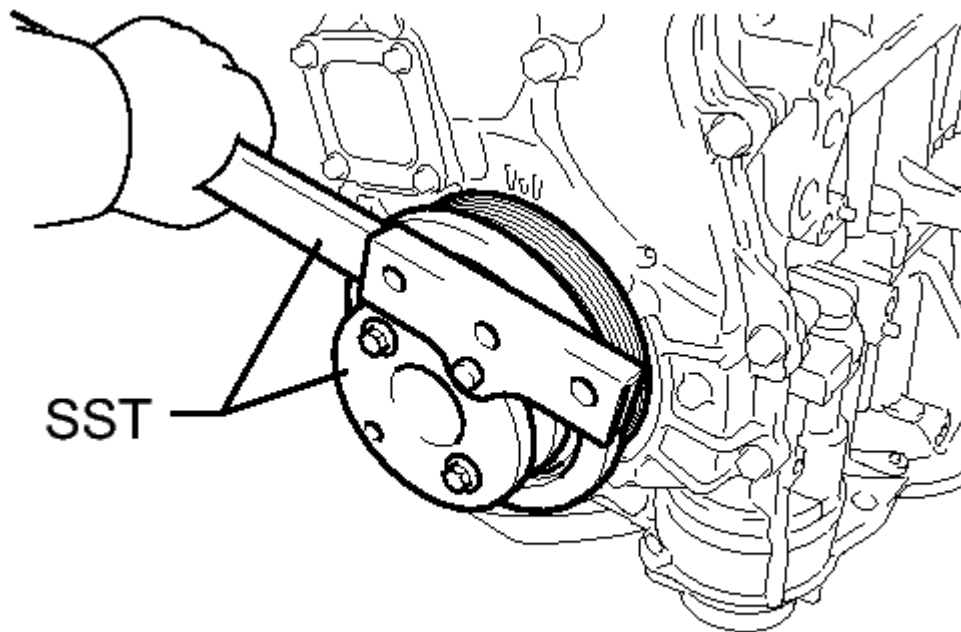
- SST: 09223-15030
- SST: 09950-70010  
09951-07150

**NOTE:**

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

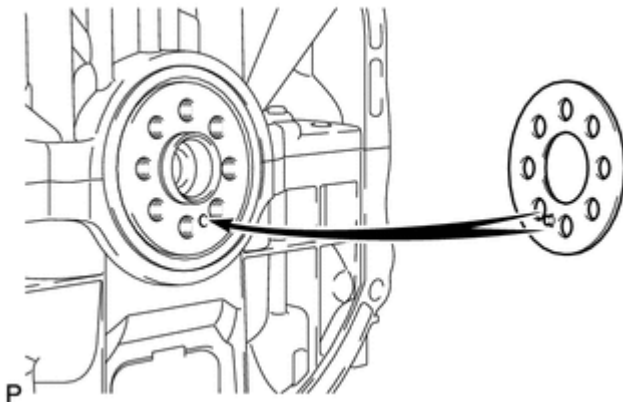
**2. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)**

- a. Using SST, hold the crankshaft.

**P****Fig. 117: Holding Crankshaft Pulley Using SST**

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

- SST: 09213-54015
  - SST: 91551-80650
  - SST: 09330-00021
- b. Clean the bolts and their installation holes.
- c. Install the front drive plate spacer.

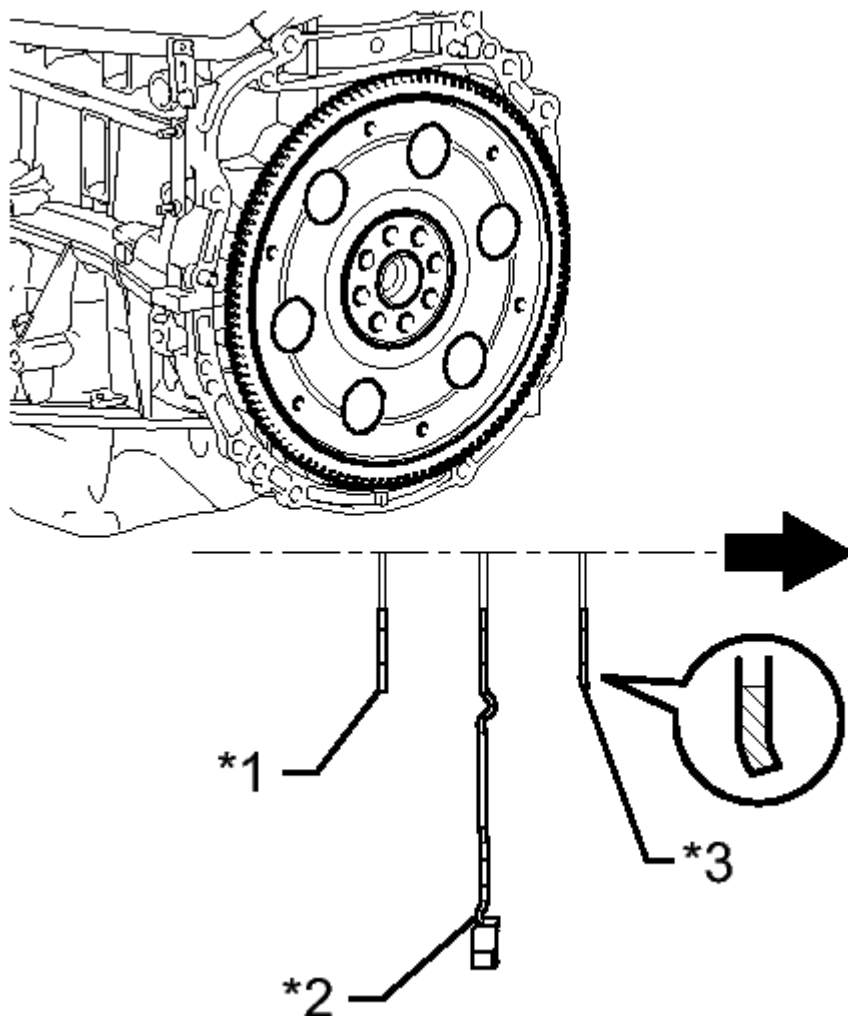
**Fig. 118: Aligning Pin Of Front Drive Plate Spacer With Pin Hole Of Crankshaft**

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

**HINT:**

Align the pin of the front drive plate spacer with the pin hole of the crankshaft.


- d. Install the drive plate and ring gear sub-assembly and rear drive plate spacer to the crankshaft.



**P**

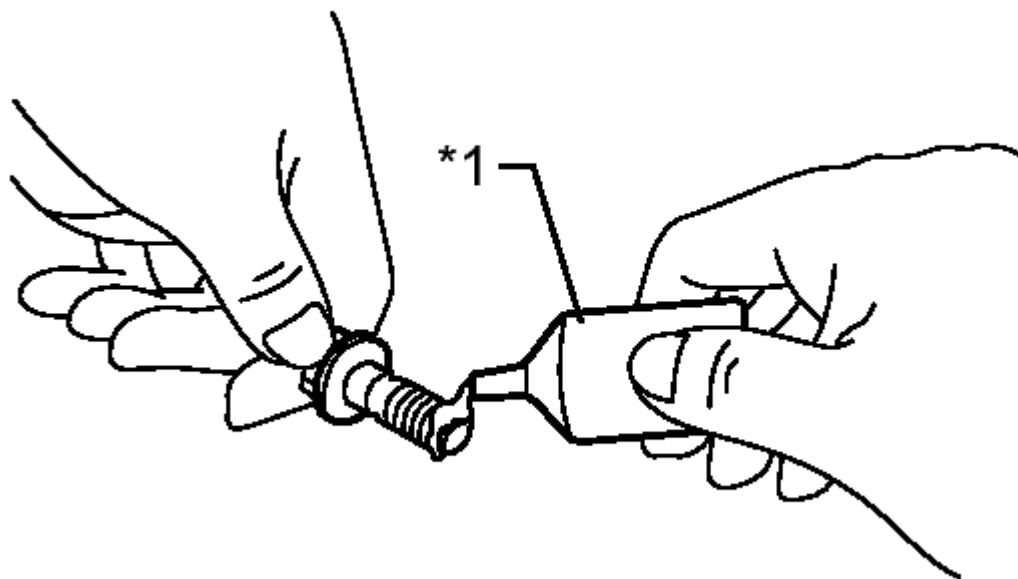
**Fig. 119: Crankshaft Drive Plate & Ring Gear Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Front Drive Plate Spacer
*2	Drive Plate and Ring Gear
*3	Rear Drive Plate Spacer
	Transaxle Side

**HINT:**

- The front drive plate spacer is reversible.
  - As the rear drive plate spacer and the drive plate and ring gear are not reversible, be sure to install them so that they are facing in the direction shown in the illustration.
- e. Apply a few drops of adhesive to 2 or 3 threads at the end of the bolt.



**Fig. 120: Apply Adhesive To End Threads Of Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

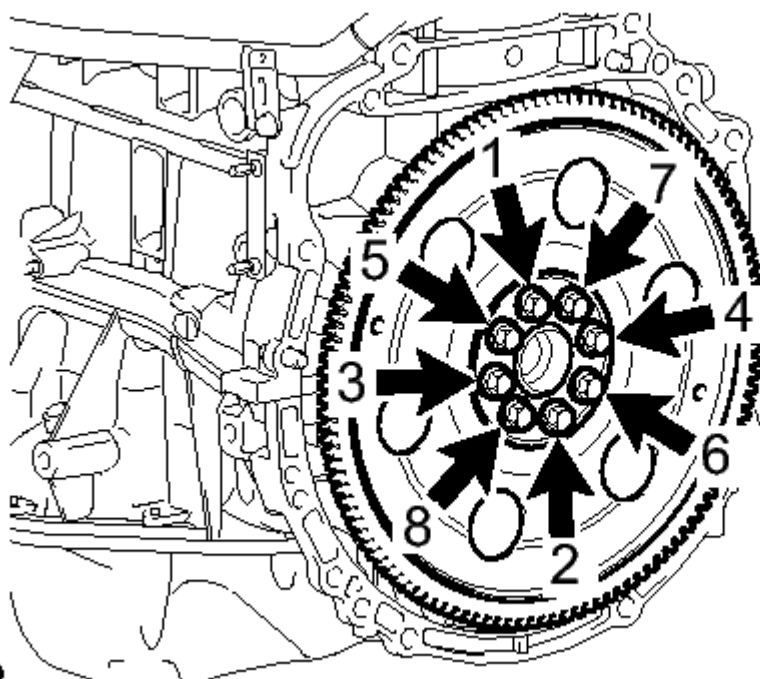
Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

**TEXT IN ILLUSTRATION**

\*1 Adhesive

- f. Install and uniformly tighten the 8 bolts in the sequence shown in the illustration.

**P****Fig. 121: Flywheel Bolt Tightening Sequence**

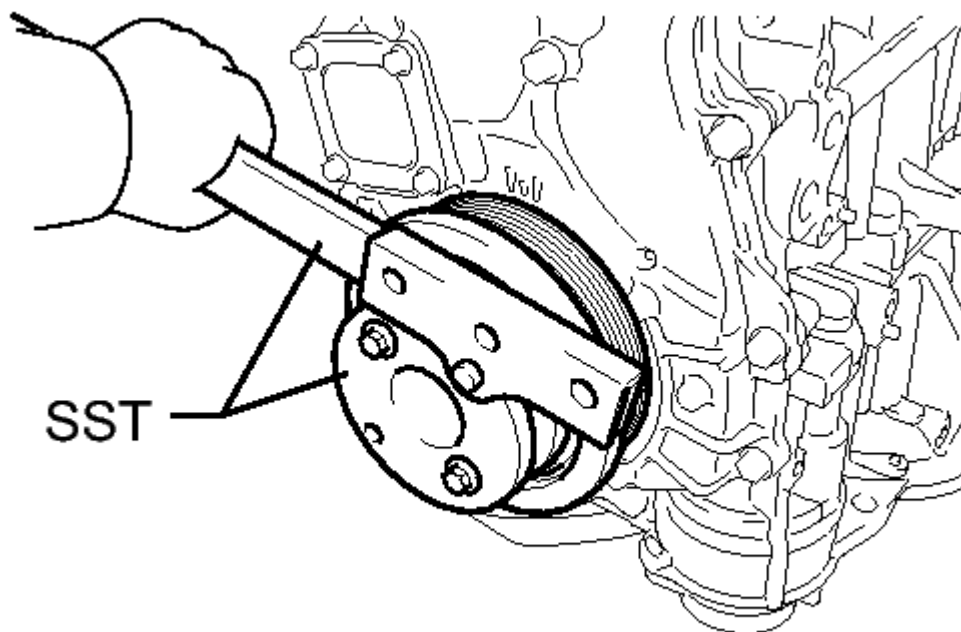
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 98 N\*m (999 kgf\*cm, 72 ft.\*lbf)

**NOTE:** Do not start the engine for at least an hour after installing the drive plate.

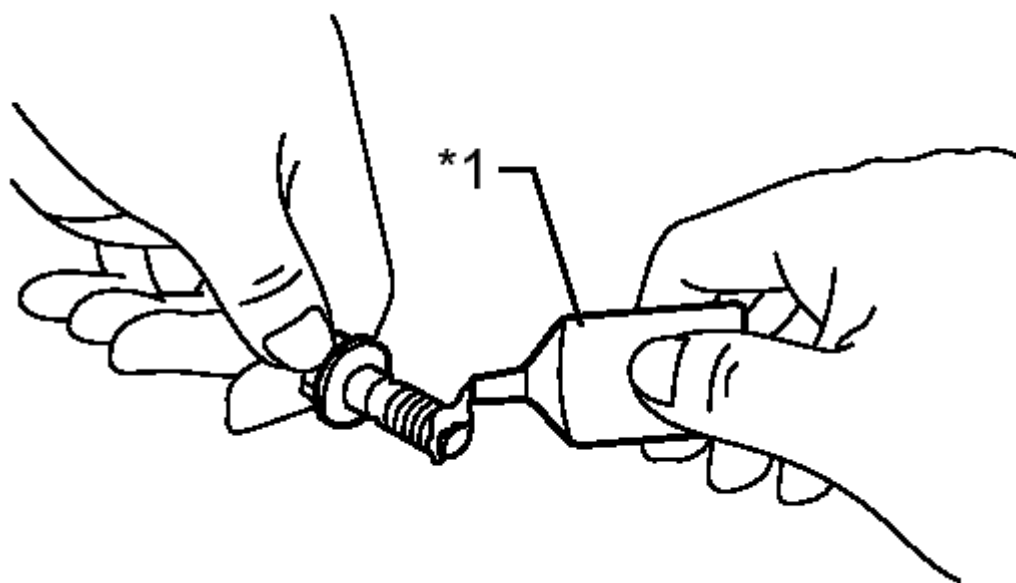
### 3. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)

- a. Using SST, hold the crankshaft.

**P****Fig. 122: Holding Crankshaft Pulley Using SST**

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

- b. Clean the bolts and bolt holes.

**Fig. 123: Apply Adhesive To End Threads Of Bolts**

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

- c. Apply adhesive to 2 or 3 threads at the end of each of the 8 bolts.

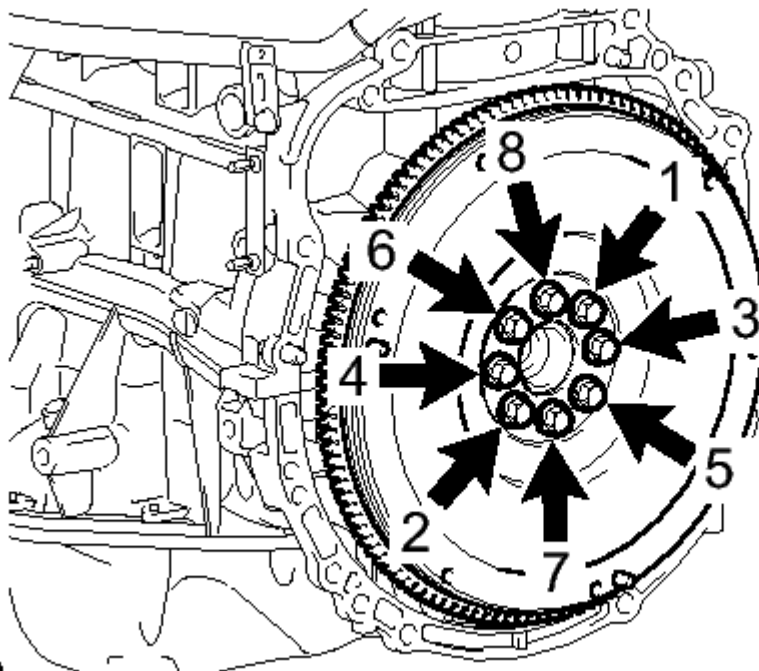
Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

**TEXT IN ILLUSTRATION**

\*1 Adhesive

- d. Install the flywheel with the 8 bolts. Uniformly tighten the 8 bolts in the sequence shown in the illustration.



**P**

**Fig. 124: Flywheel Bolt Tightening Sequence**

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

**Torque: 130 N\*m (1326 kgf\*cm, 96 ft.\*lbf)**

4. **INSTALL CLUTCH DISC ASSEMBLY (for Manual Transaxle)** . Refer to **INSTALLATION - Step 1**
5. **INSTALL CLUTCH COVER ASSEMBLY (for Manual Transaxle)** . Refer to **INSTALLATION - Step 2**
6. **FIX ENGINE ASSEMBLY** See step 66
7. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)**

Refer to **INSTALLATION**



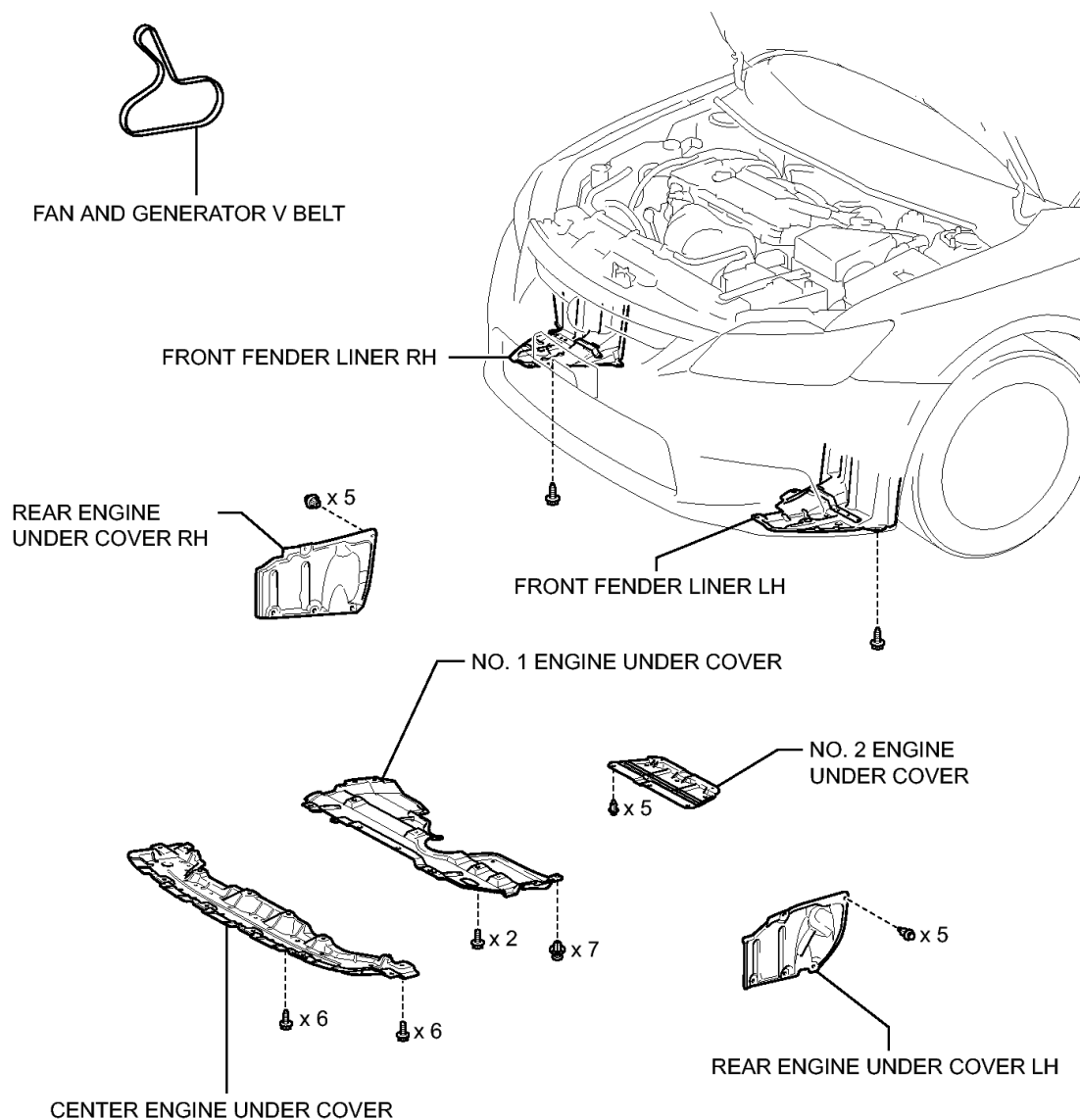
**8. INSTALL MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)**

Refer to **INSTALLATION**

**9. INSTALL ENGINE AND TRANSAXLE**

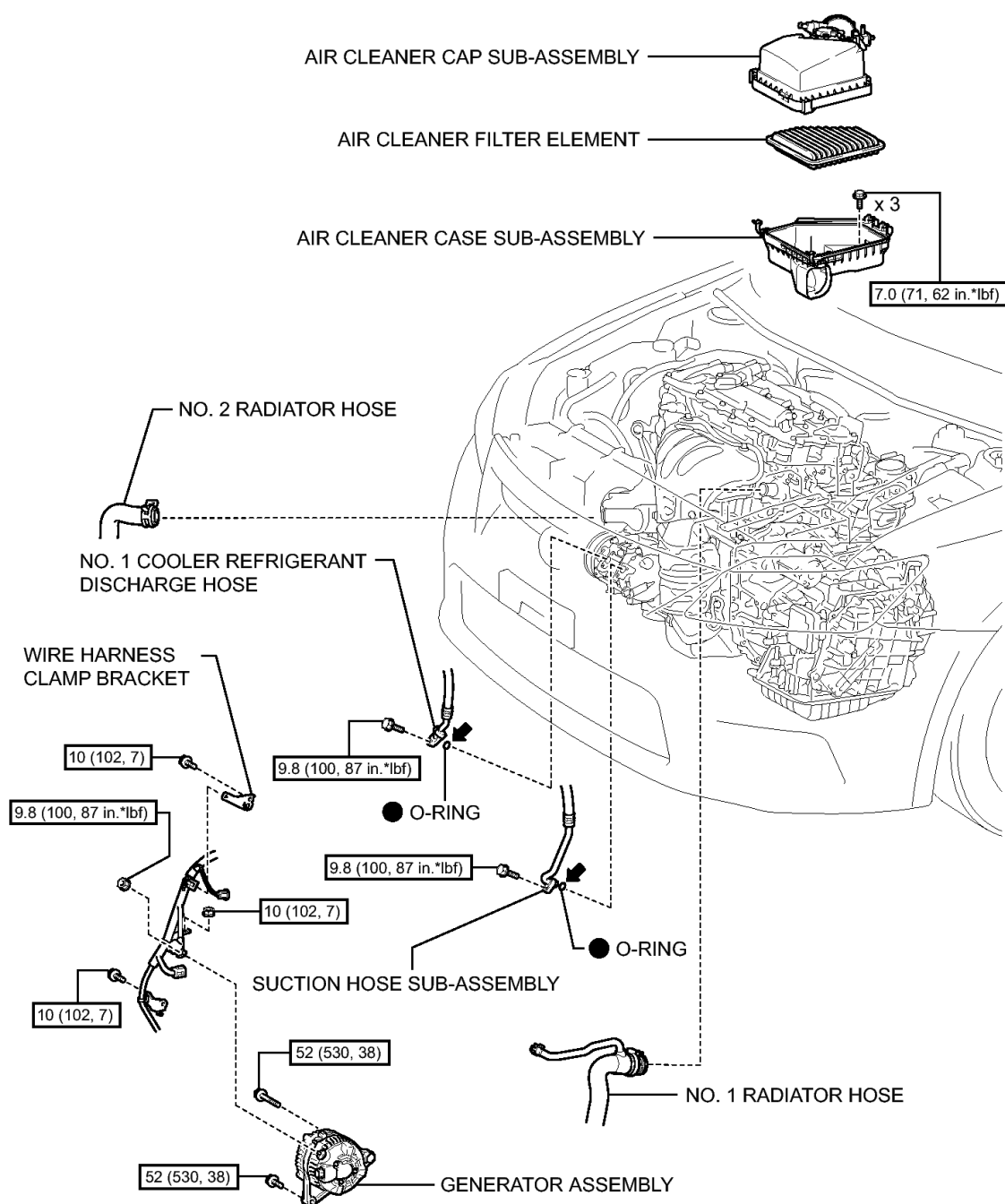
Refer to **INSTALLATION**

**ENGINE ASSEMBLY****COMPONENTS****ILLUSTRATION**



P  
**Fig. 125: Identifying Engine Assembly Replacement Components (1 Of 9)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



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

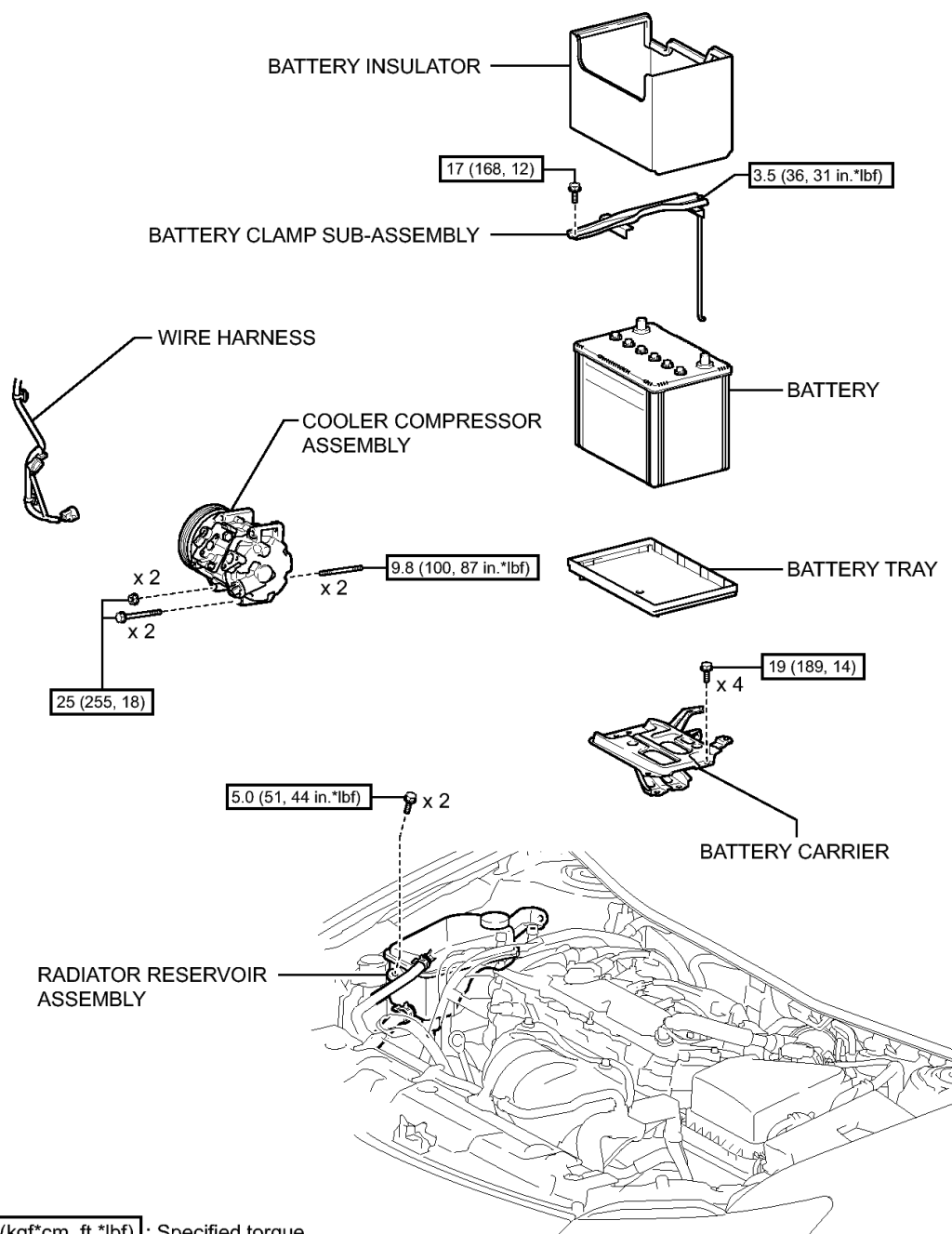
● Non-reusable part

◀ Compressor oil ND-OIL 8 or equivalent

P

**Fig. 126: Identifying Engine Assembly Replacement Components With Torque Specifications (2 Of 9)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ILLUSTRATION

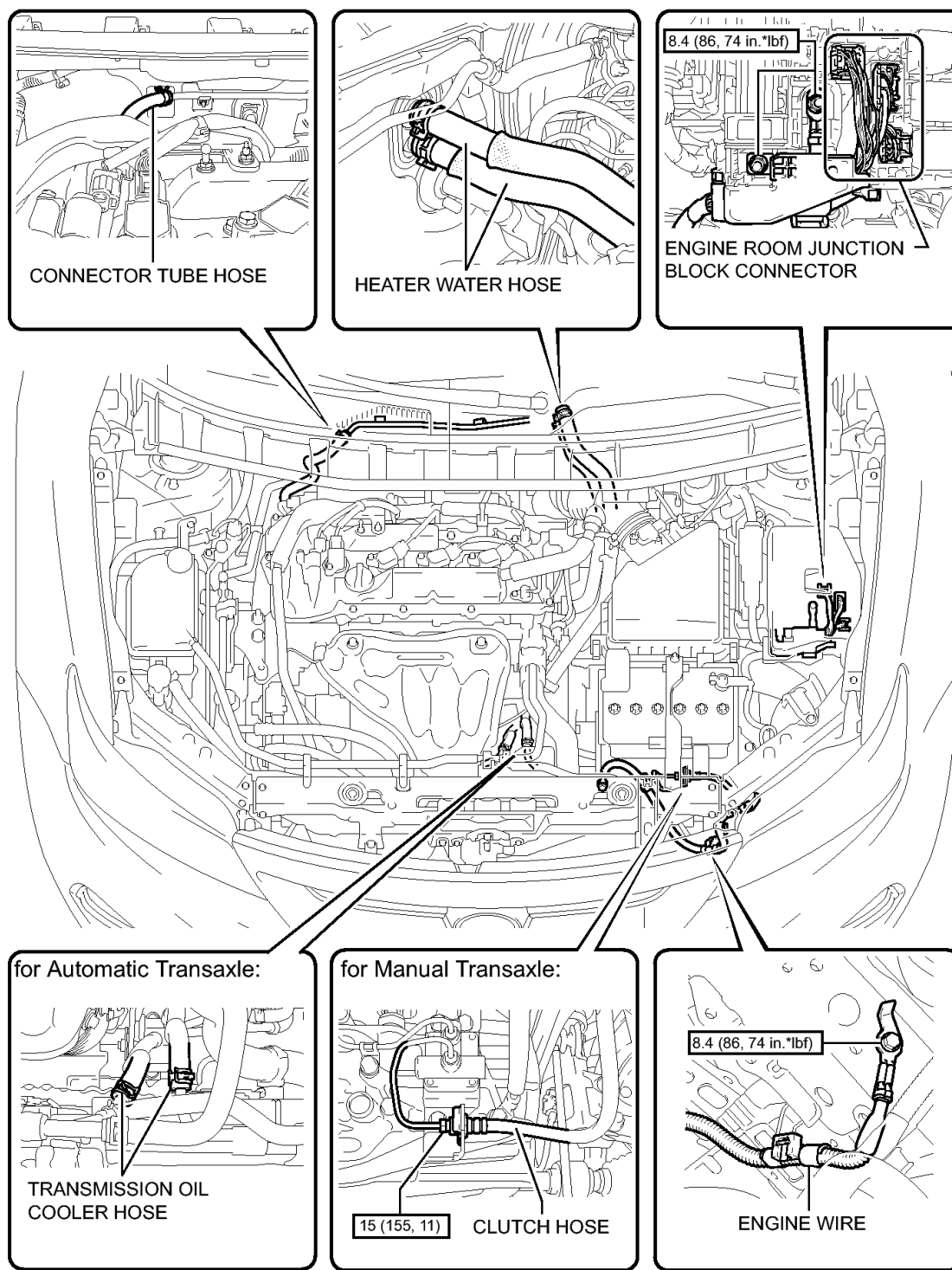


N\*m (kgf\*cm, ft.\*lbf) : Specified torque

P

**Fig. 127: Identifying Engine Assembly Replacement Components With Torque Specifications (3 Of 9)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ILLUSTRATION

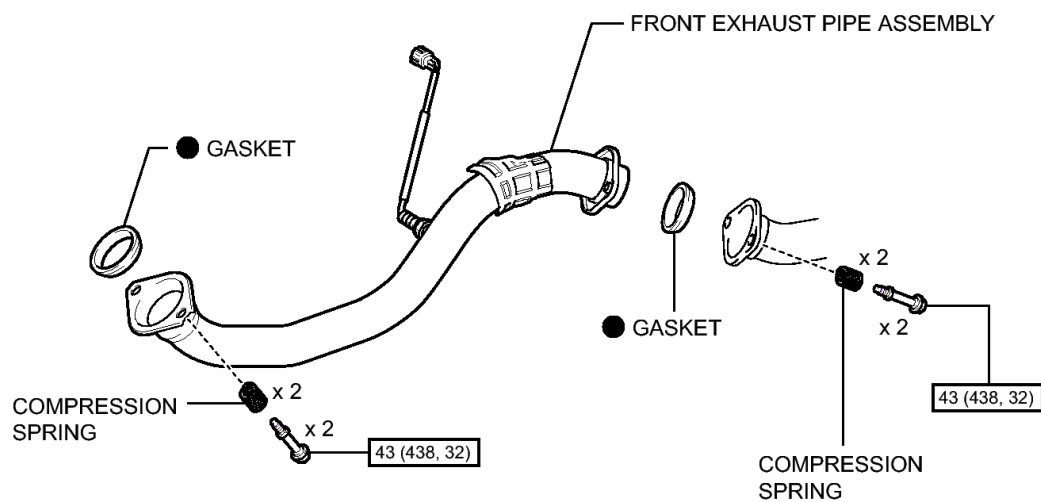
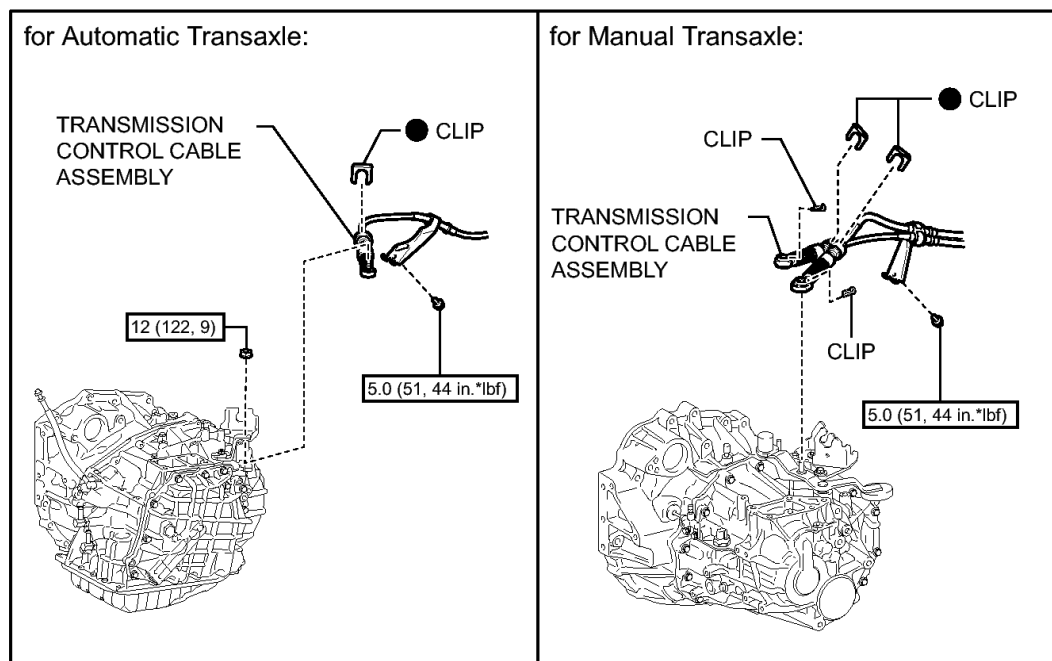


N\*m (kgf\*cm, ft.\*lbf) : Specified torque

P

**Fig. 128: Identifying Engine Assembly Replacement Components With Torque Specifications (4 Of 9)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ILLUSTRATION



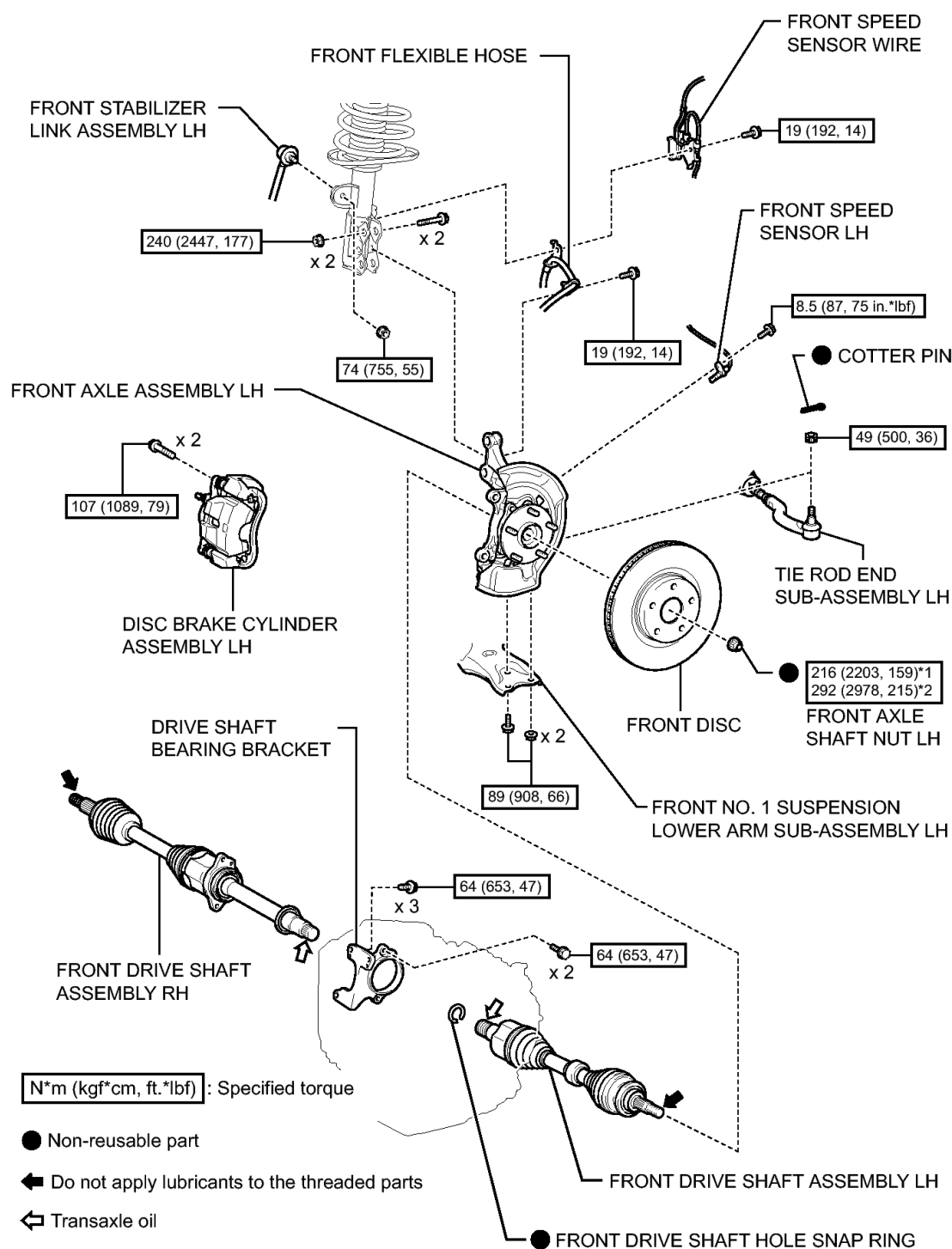
N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

P

**Fig. 129: Identifying Engine Assembly Replacement Components With Torque Specifications (5 Of 9)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

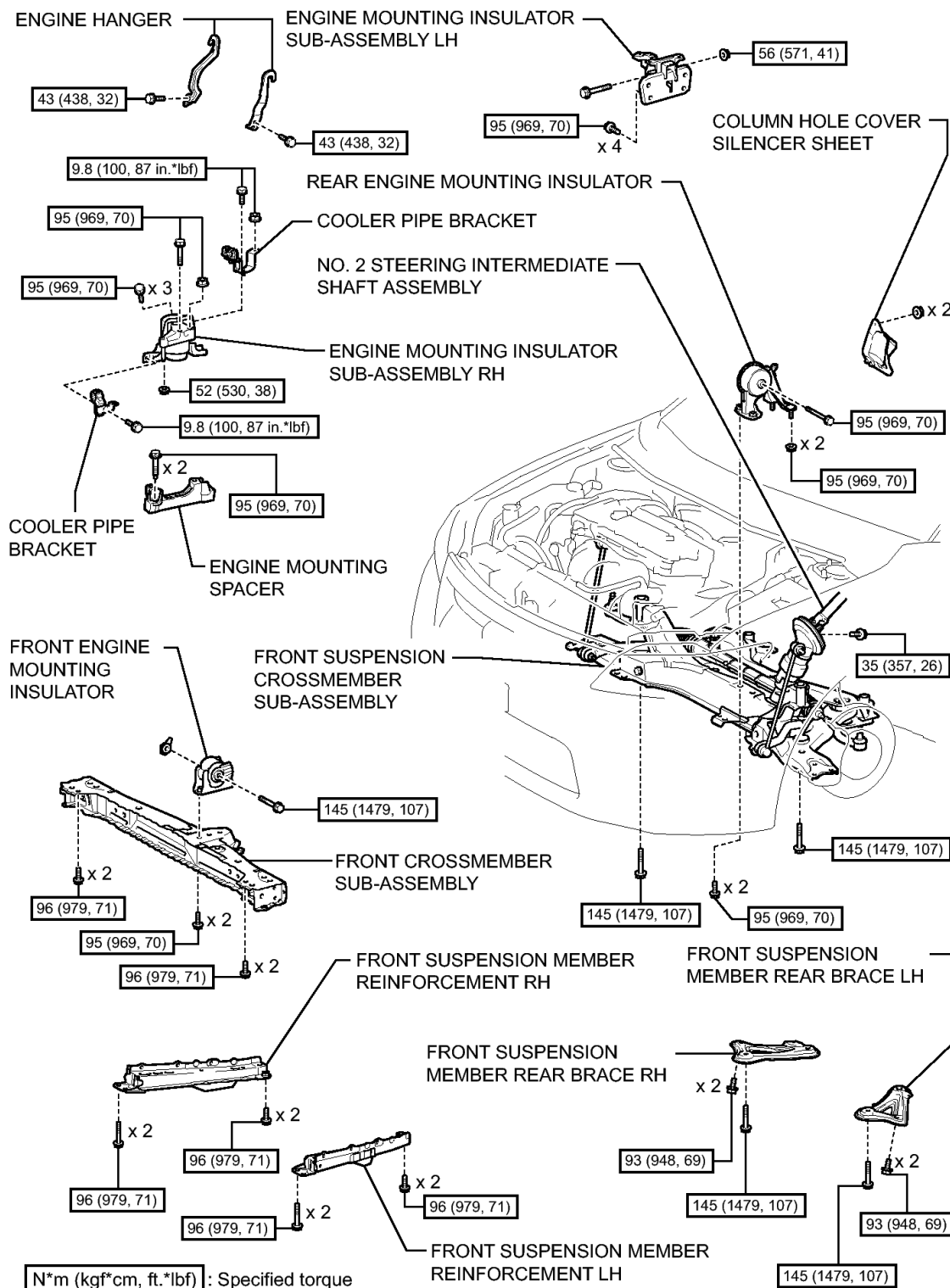
ILLUSTRATION



P

**Fig. 130: Identifying Engine Assembly Replacement Components With Torque Specifications (6 Of 9)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ILLUSTRATION



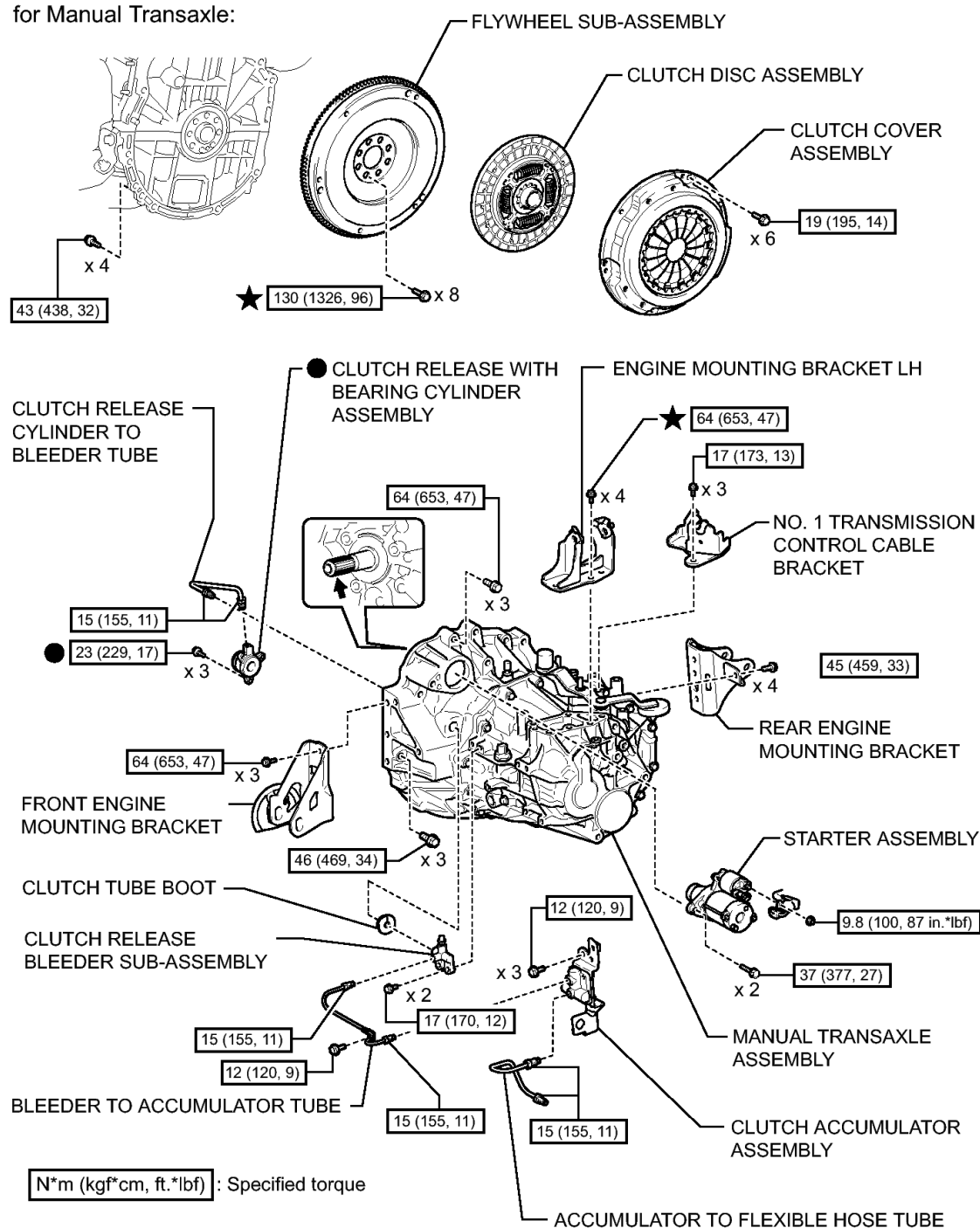
P

**Fig. 131: Identifying Engine Assembly Replacement Components With Torque Specifications (7 Of 9)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## ILLUSTRATION



for Manual Transaxle:



P

**Fig. 132: Identifying Engine Assembly Replacement Components With Torque Specifications (8 Of 9)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

★ Precoated part

**REMOVAL**

**WARNING:** As the engine assembly with transaxle is extremely heavy, the engine lifter may suddenly drop if the instructions listed in the repair information are not followed. Therefore, always follow the instructions listed in the repair information when performing this procedure.

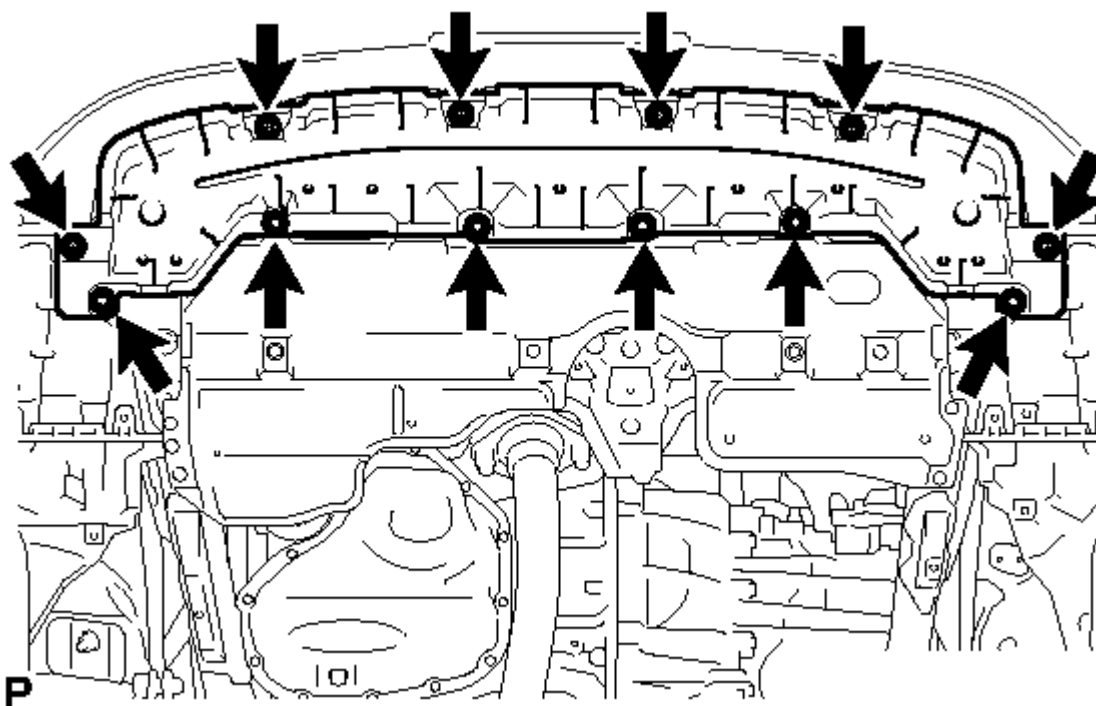
**NOTE:** for Manual Transaxle:

When the transaxle is removed, be sure to use a new clutch release with bearing cylinder and new installation bolts. Removal of the transaxle allows the compressed clutch release with bearing cylinder to return to its original position, and dust could damage the seal of the clutch release with bearing cylinder, possibly causing clutch fluid leaks.

1. **RECOVER REFRIGERANT FROM REFRIGERATION SYSTEM** . Refer to **REPLACEMENT - Step 1**
2. **DISCHARGE FUEL SYSTEM PRESSURE** . Refer to **REMOVAL - Step 1**
3. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

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

4. **ALIGN FRONT WHEELS FACING STRAIGHT AHEAD**
5. **REMOVE FRONT WHEEL**
6. **REMOVE CENTER ENGINE UNDER COVER**
  - a. Remove the 6 screws, 6 bolts and center engine under cover.

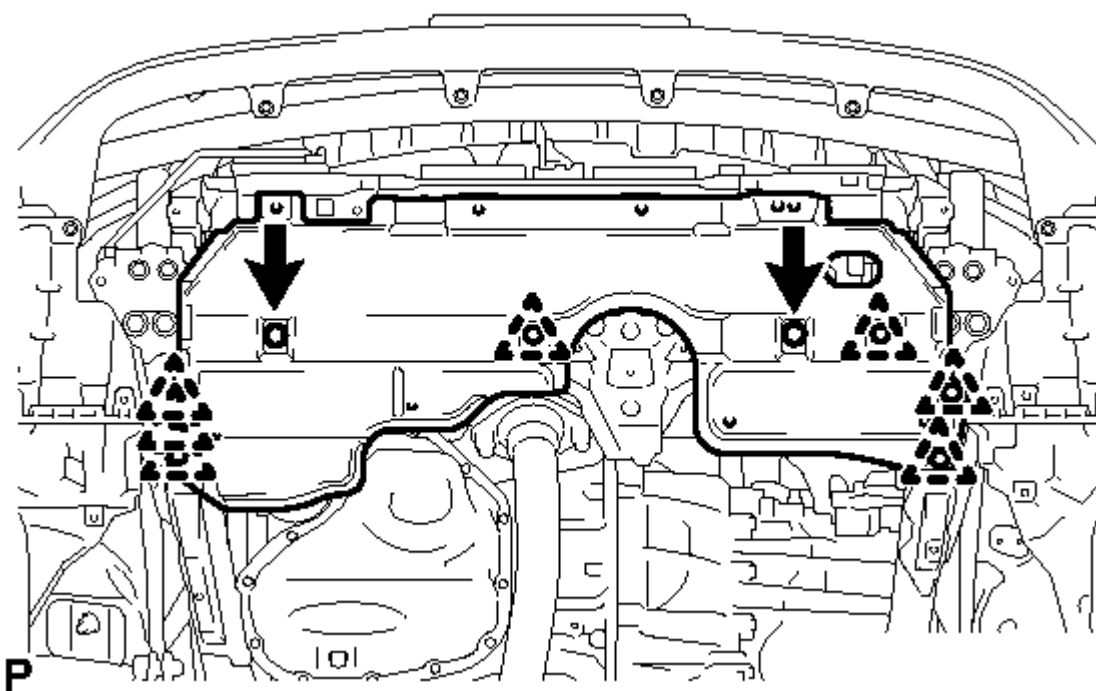


**Fig. 134: Center Engine Under Cover**

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

**7. REMOVE NO. 1 ENGINE UNDER COVER**

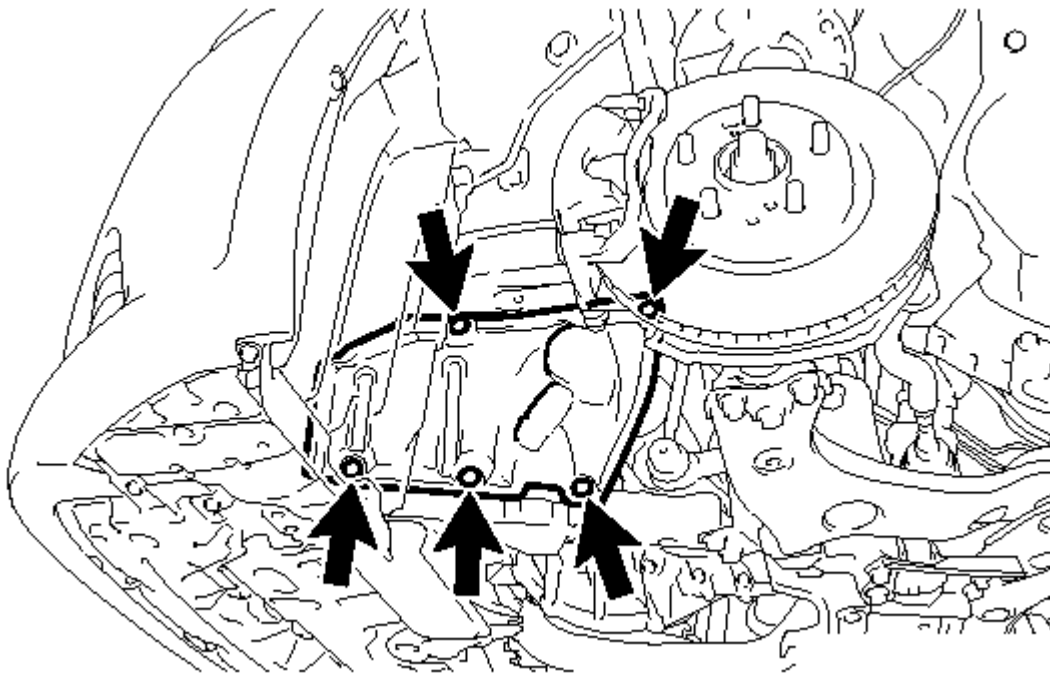
- a. Remove the 2 bolts, 7 clips and under cover.



**Fig. 135: No. 1 Engine Under Cover**

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

8. **DISCONNECT FRONT FENDER LINER RH**
  - a. Remove the screw and disconnect the front fender liner.
9. **DISCONNECT FRONT FENDER LINER LH**
  - a. Remove the screw and disconnect the front fender liner.
10. **REMOVE REAR ENGINE UNDER COVER RH** See step 2
11. **REMOVE REAR ENGINE UNDER COVER LH**

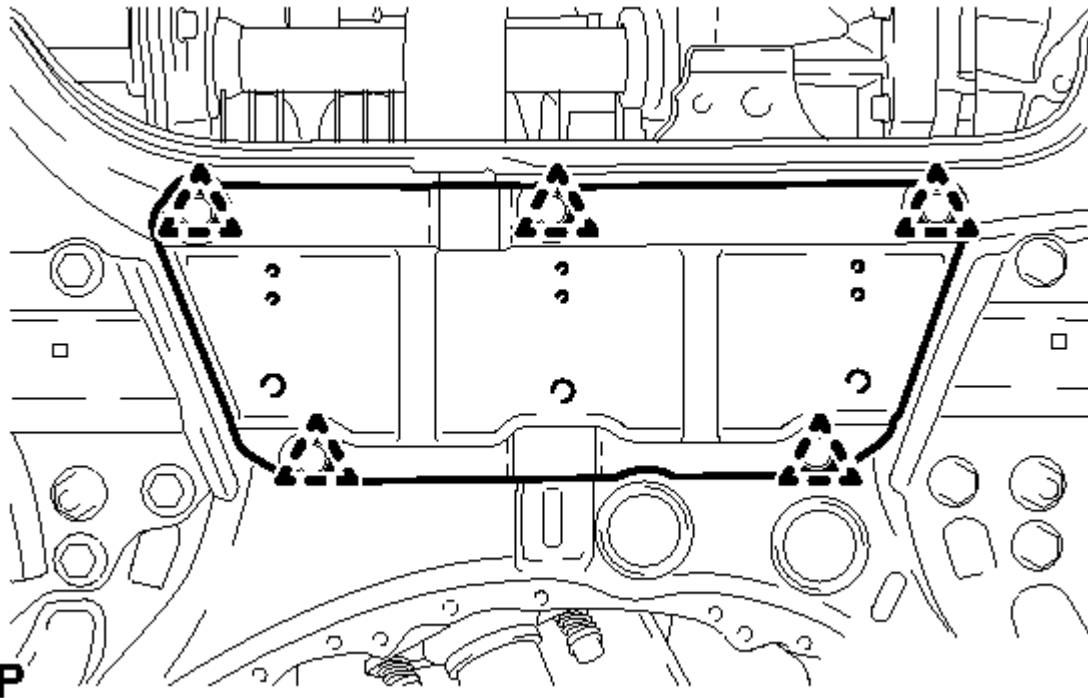


**P**

**Fig. 136: Rear Engine Under Cover (LH)**

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

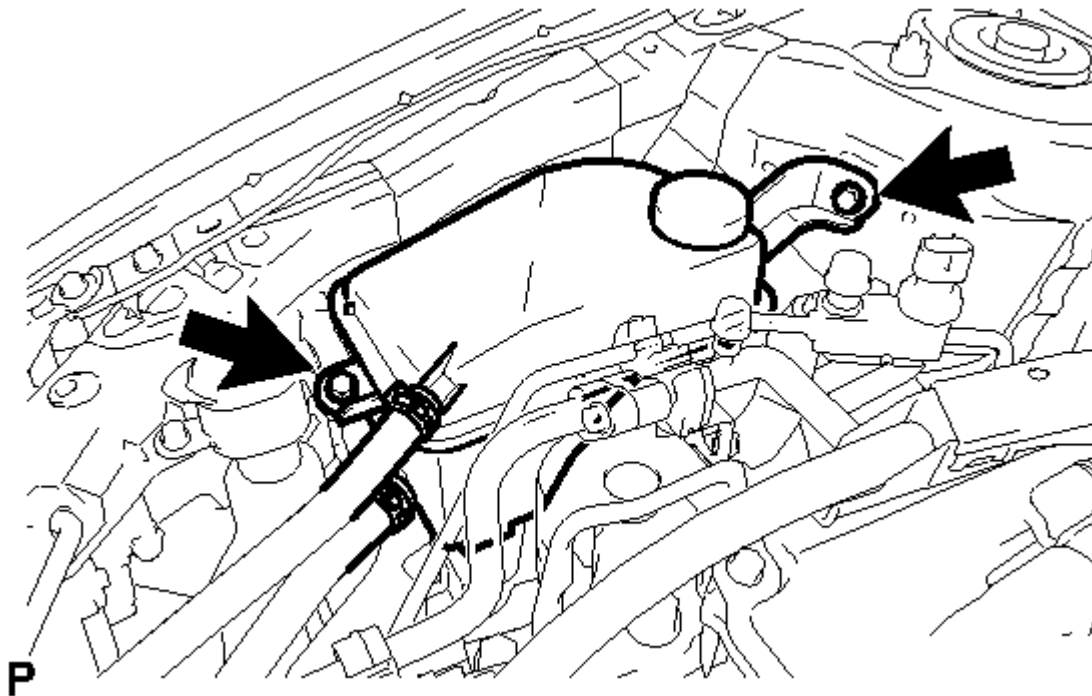
- a. Remove the 5 clips and under cover.
12. **REMOVE NO. 2 ENGINE UNDER COVER**
  - a. Remove the 5 clips and under cover.



**Fig. 137: No. 2 Engine Under Cover**

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

13. **DRAIN ENGINE COOLANT** . Refer to **REPLACEMENT - Step 3**
14. **DRAIN ENGINE OIL** . Refer to **REPLACEMENT - Step 1**
15. **DRAIN MANUAL TRANSAXLE OIL (for Manual Transaxle)** . Refer to **REPLACEMENT - Step 1**
16. **DRAIN AUTOMATIC TRANSAXLE FLUID (for Automatic Transaxle)** . Refer to **REPLACEMENT - Step 1**
17. **DISCONNECT RADIATOR RESERVOIR ASSEMBLY**
  - a. Remove the 2 bolts and disconnect the radiator reservoir.



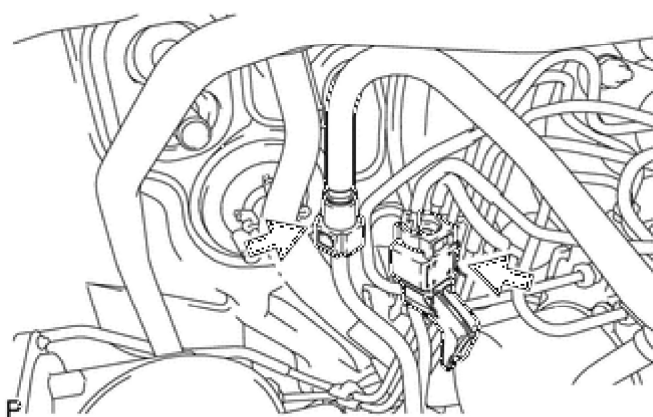
**Fig. 138: Radiator Reservoir Assembly**

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

b. Remove the grommet from the radiator reservoir.

18. **REMOVE FAN AND GENERATOR V BELT** See step 3
19. **REMOVE GENERATOR ASSEMBLY** . Refer to **REMOVAL - Step 4**
20. **DISCONNECT NO. 2 RADIATOR HOSE** . Refer to **REMOVAL - Step 12**
21. **DISCONNECT NO. 1 COOLER REFRIGERANT DISCHARGE HOSE** . Refer to **REMOVAL - Step 8**
22. **DISCONNECT SUCTION HOSE SUB-ASSEMBLY** . Refer to **REMOVAL - Step 9**
23. **REMOVE COOLER COMPRESSOR ASSEMBLY** . Refer to **REMOVAL - Step 10**
24. **REMOVE RADIATOR HOSE CLAMP** . Refer to **REMOVAL - Step 10**
25. **DISCONNECT NO. 1 RADIATOR HOSE** . Refer to **REMOVAL - Step 11**
26. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **REMOVAL - Step 2**
27. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY** . Refer to **REMOVAL - Step 3**
28. **REMOVE BATTERY CLAMP SUB-ASSEMBLY** . Refer to **REMOVAL - Step 3**
29. **REMOVE BATTERY INSULATOR**
30. **REMOVE BATTERY**
31. **REMOVE BATTERY TRAY**
32. **REMOVE BATTERY CARRIER** . Refer to **REMOVAL - Step 7**
33. **DISCONNECT FUEL TUBE SUB-ASSEMBLY**

a. Remove the No. 1 fuel pipe clamp.



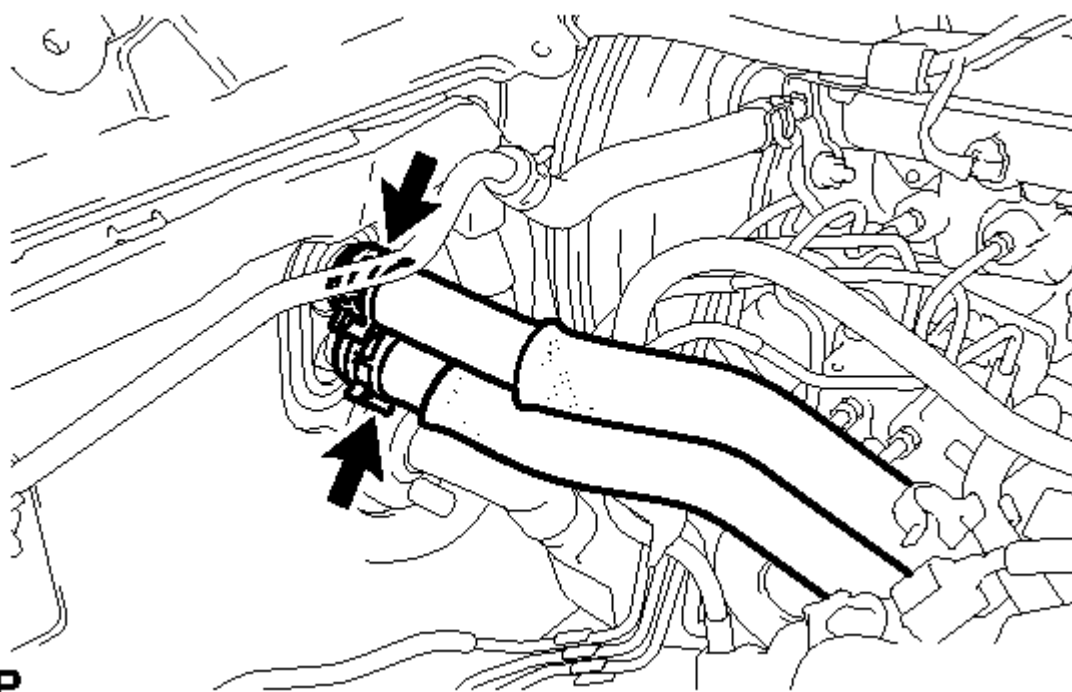
**Fig. 139: Fuel Tube Connector**

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

- b. Disconnect the fuel tube connector. Refer to **PRECAUTION** .

**34. DISCONNECT HEATER WATER HOSE**

- a. Disconnect the 2 heater water hoses.



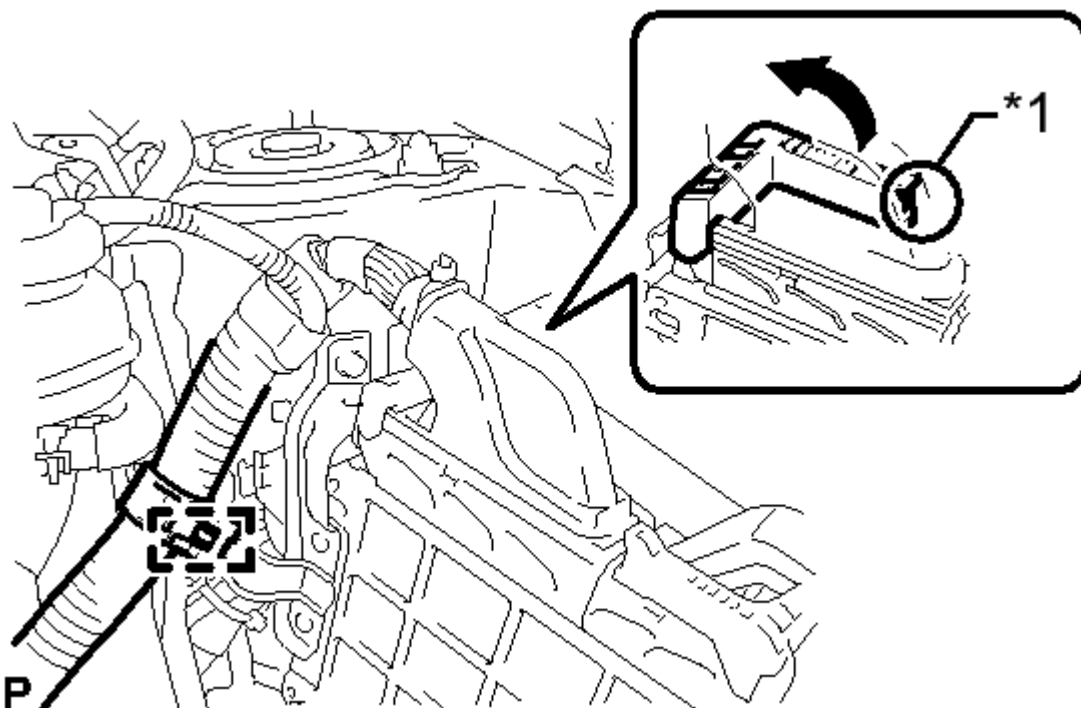
**Fig. 140: Water Hoses**

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

**35. DISCONNECT WIRE HARNESS AND HOSE**

- a. Detach the clamp and disconnect the ECM connector.
  - 1. Raise the lever while pushing the lock on the lever and disconnect the ECM connector.





**Fig. 141: Disconnecting The ECM Connector**

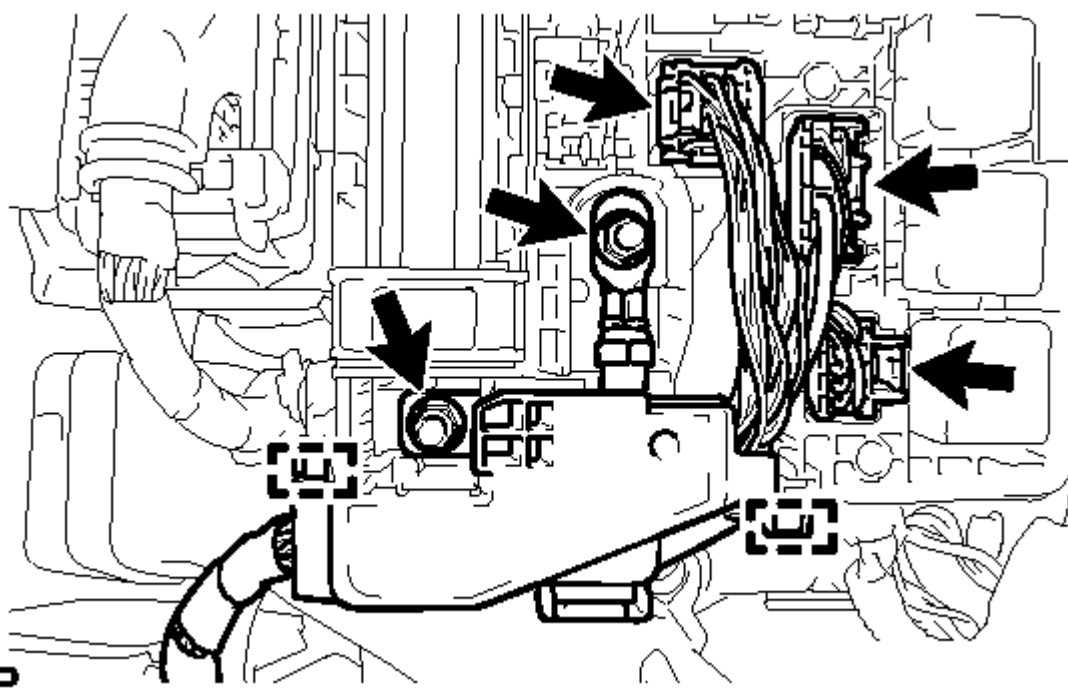
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

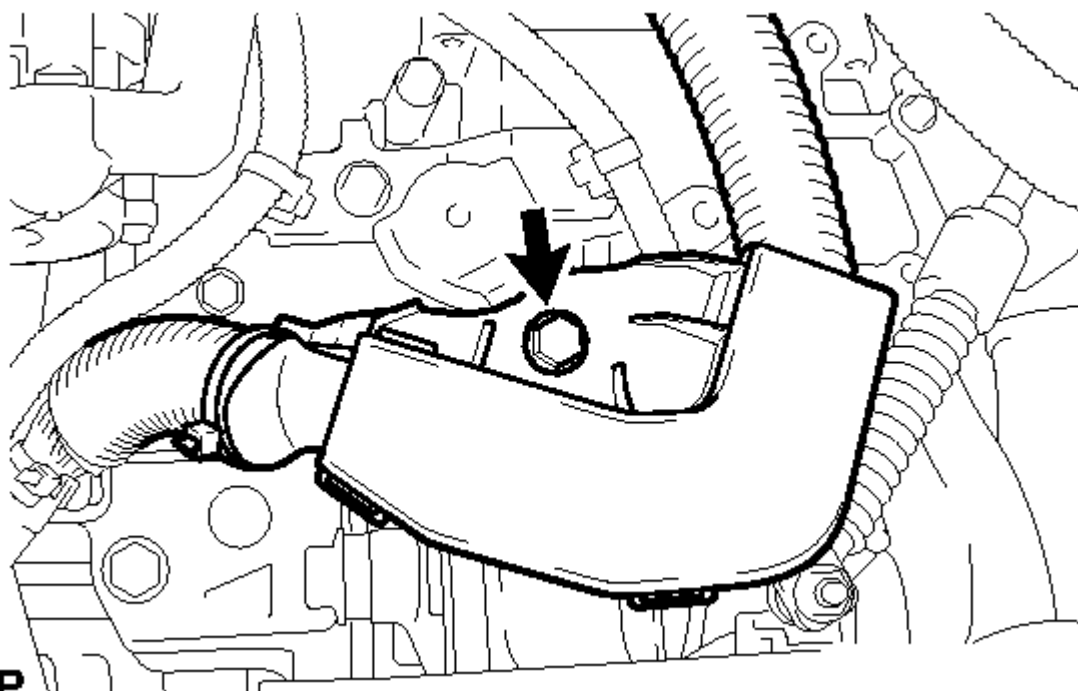
\*1 Lock

**NOTE:** After disconnecting the connector, make sure that dirt, water or other foreign matter does not contact the connecting parts of the connector.

- b. Remove the 2 nuts from the engine room No. 1 relay block.

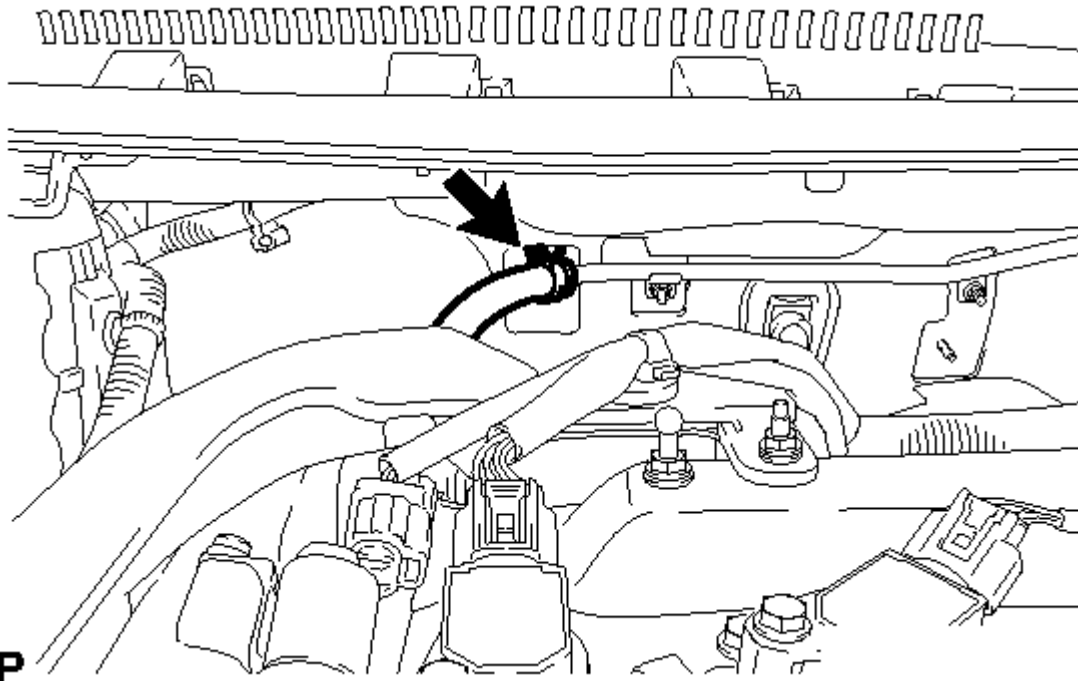
**P****Fig. 142: Disconnecting Wiring Harness****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- c. Disconnect the 3 connectors, detach the 2 clamps from the engine room No. 1 relay block and disconnect the wire harness.

**P****Fig. 143: Disconnecting Wiring Harness**

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

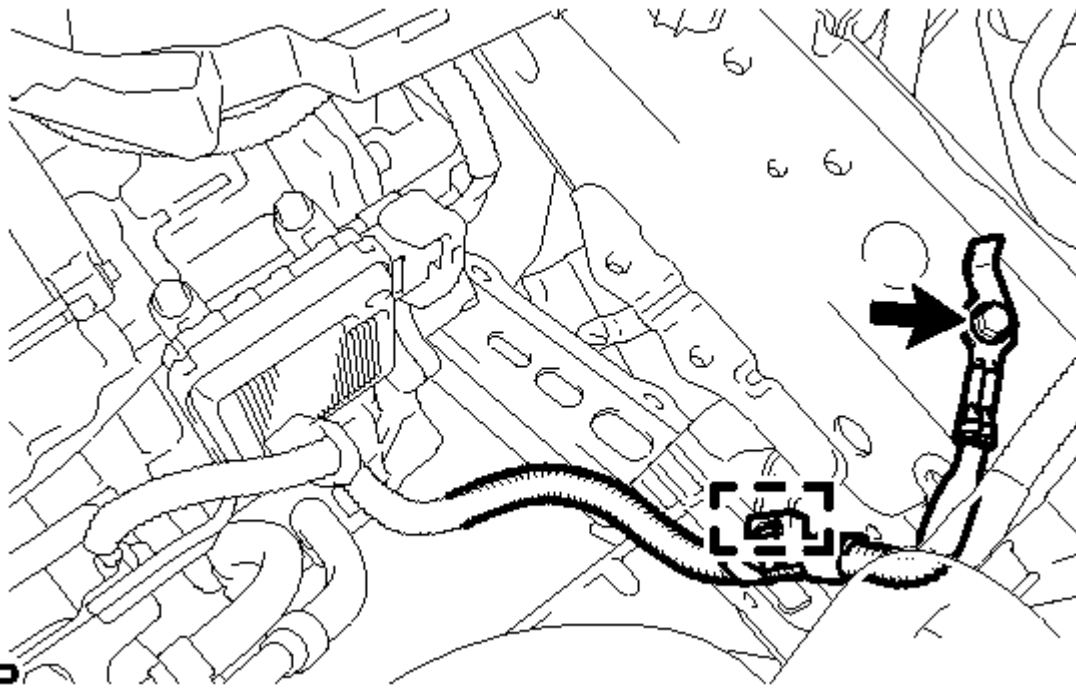
- d. Remove the bolt and disconnect the wire harness.
- e. Disconnect the vacuum hose.



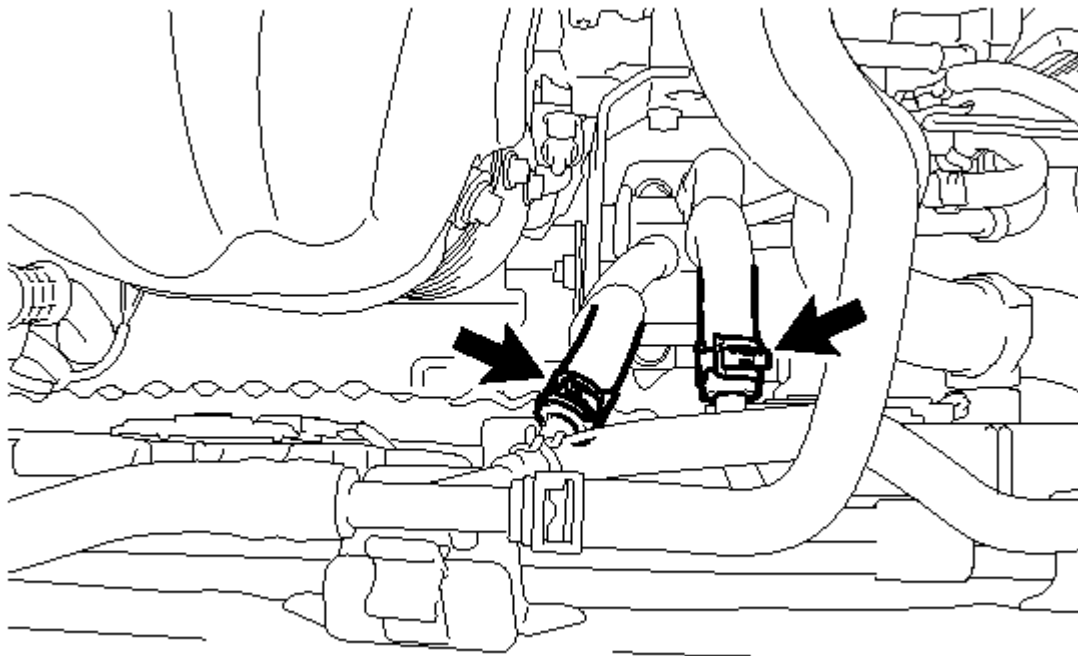
**Fig. 144: Vacuum Hose**

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

- f. Detach the clamp.

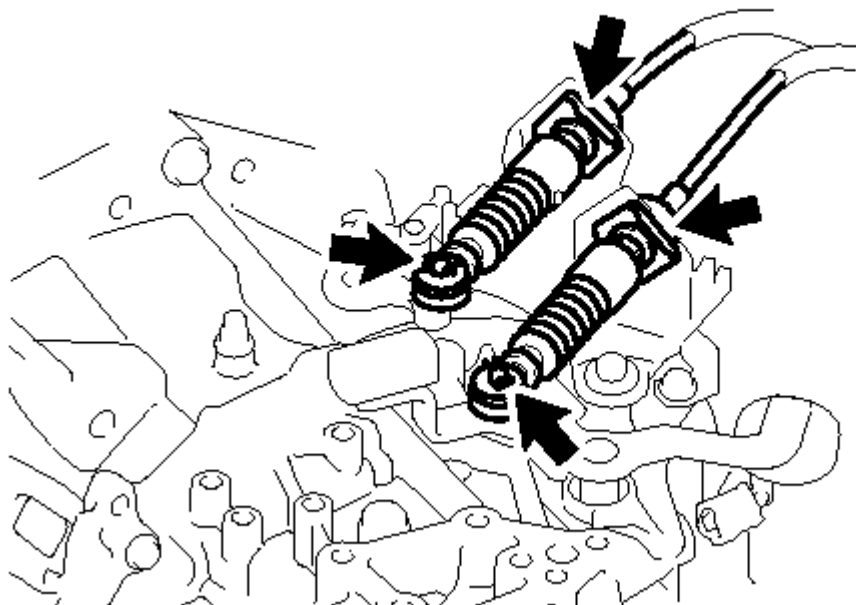
**P****Fig. 145: Transmission Wire****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- g. Remove the bolt and disconnect the transmission wire.
- h. for Automatic Transaxle:

**P****Fig. 146: Oil Cooler Hoses**

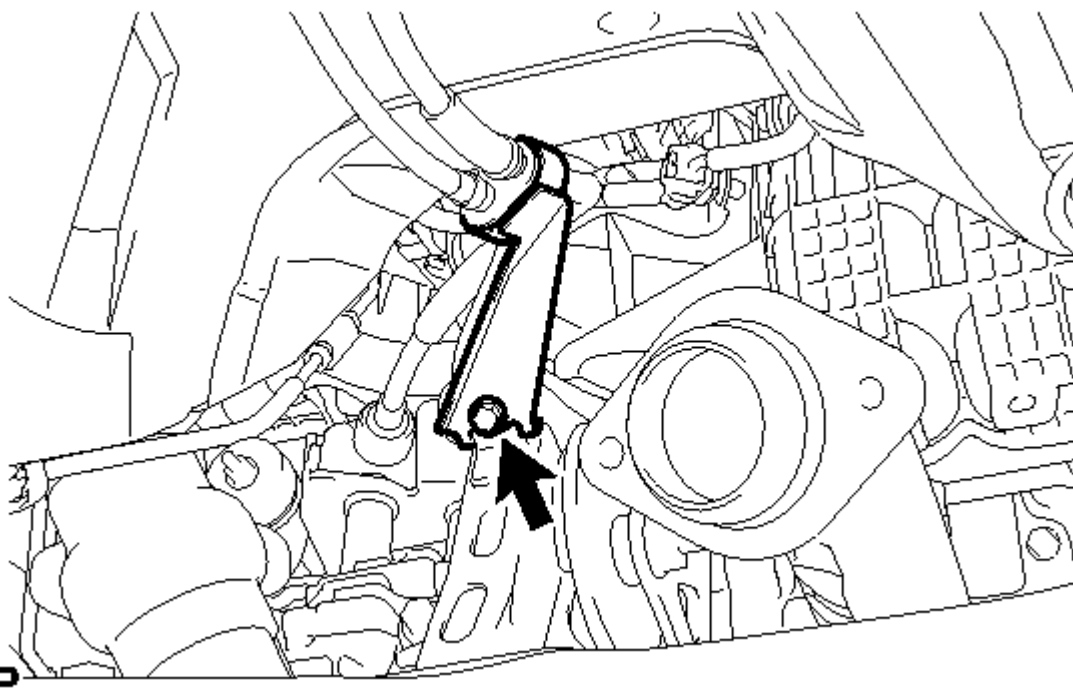
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Disconnect the 2 oil cooler hoses from the oil cooler tube.
36. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle)**
- a. Remove the 4 clips and disconnect the 2 transmission control cables.



**Fig. 147: Transmission Control Cable Assembly Clips**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt and disconnect the control cable support from the rear engine mounting insulator.

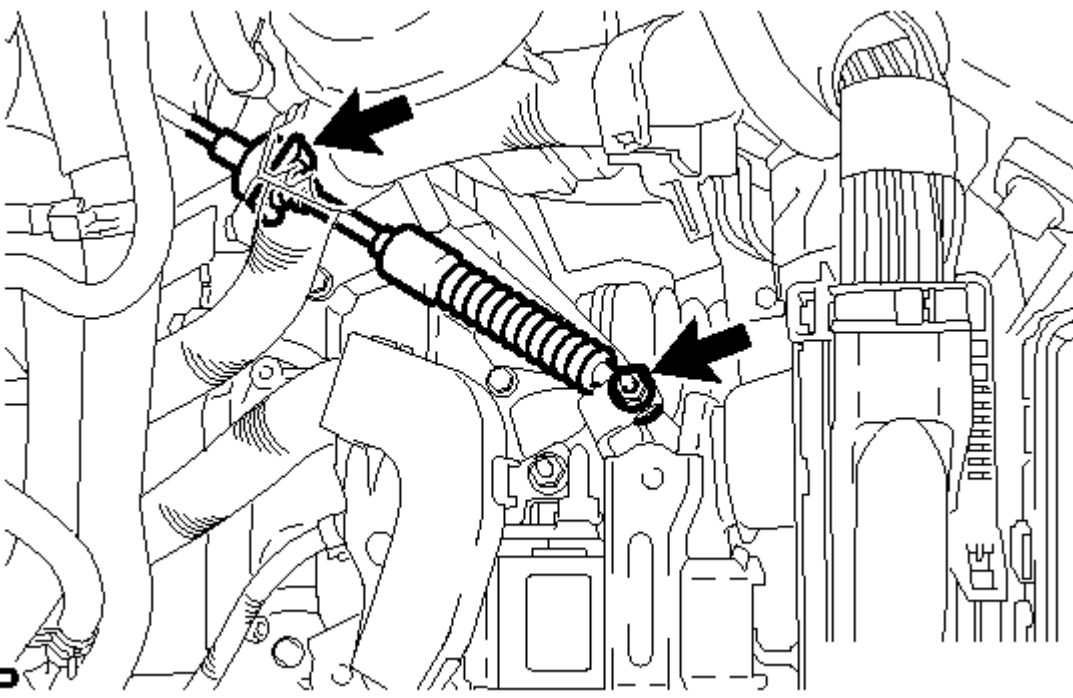


**Fig. 148: Transmission Control Cable Support**

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

**37. DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle)**

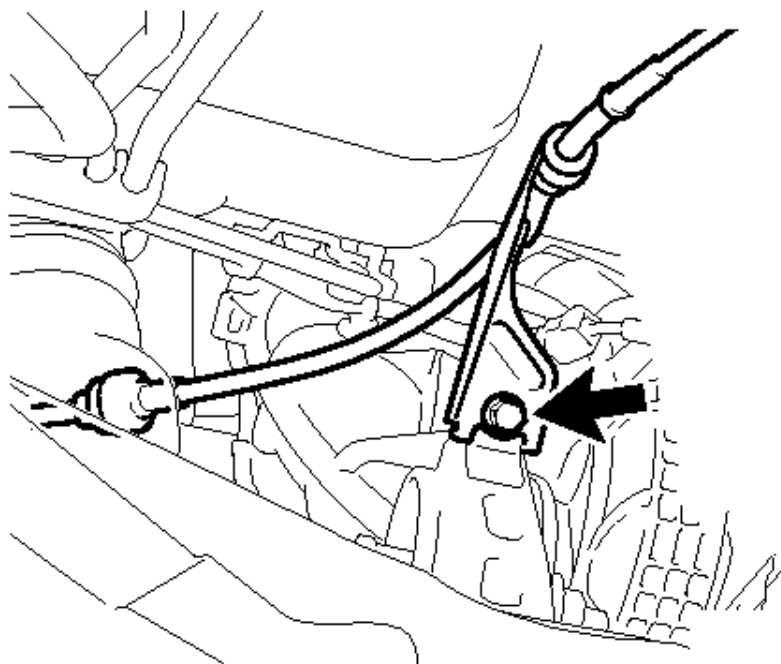
- a. Remove the nut and disconnect the control cable from the control shaft lever.



**Fig. 149: Transmission Control Cable Assembly**

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

- b. Remove the clip and disconnect the transmission control cable from the control cable bracket.
- c. Remove the bolt and disconnect the control cable support from the rear engine mounting insulator.



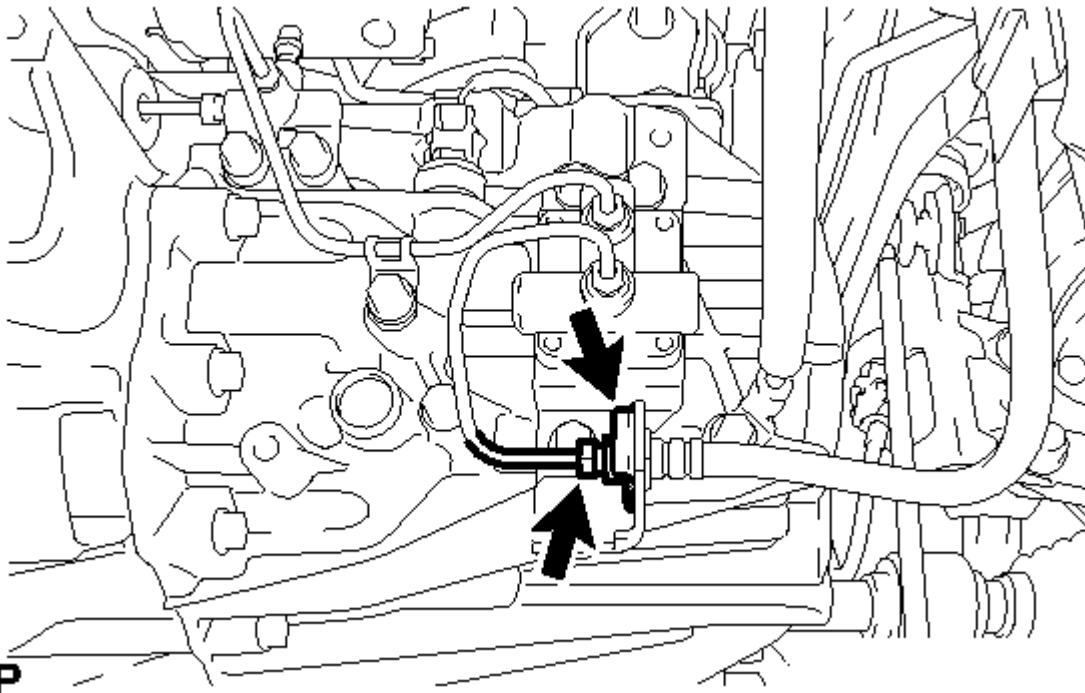
**P**

**Fig. 150: Transmission Control Cable Support**

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

**38. DISCONNECT CLUTCH HOSE (for Manual Transaxle)**

- a. Using a 10 mm union nut wrench, disconnect the clutch hose from the flexible hose tube.



**Fig. 151: Clutch Hose**

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

b. Remove the clip and disconnect the clutch hose.

39. **SECURE STEERING WHEEL ASSEMBLY** . Refer to **REMOVAL - Step 2**
40. **REMOVE COLUMN HOLE COVER SILENCER SHEET** . Refer to **REMOVAL - Step 6**
41. **DISCONNECT NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY** . Refer to **REMOVAL - Step 7**
42. **DISCONNECT NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY** . Refer to **REMOVAL - Step 5**
43. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** . Refer to **REMOVAL - Step 2**
44. **REMOVE FRONT AXLE SHAFT NUT LH** . Refer to **REMOVAL - Step 4**
45. **REMOVE FRONT AXLE SHAFT NUT RH**

**HINT:**

Use the same procedure described for the LH side.

46. **DISCONNECT FRONT STABILIZER LINK ASSEMBLY LH** . Refer to **REMOVAL - Step 5**
47. **DISCONNECT FRONT STABILIZER LINK ASSEMBLY RH**

**HINT:**

Use the same procedure described for the LH side.



**48. REMOVE FRONT AXLE ASSEMBLY LH**

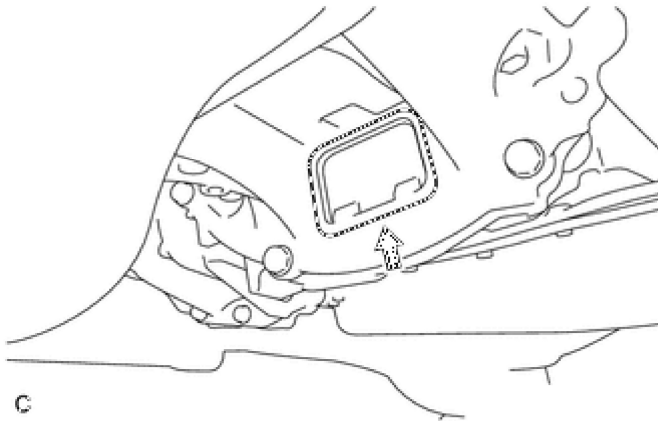
Refer to **REMOVAL**

**49. REMOVE FRONT AXLE ASSEMBLY RH****HINT:**

Use the same procedure described for the LH side.

**50. REMOVE FRONT DRIVE SHAFT ASSEMBLY LH . Refer to **REMOVAL - Step 10******51. REMOVE FRONT DRIVE SHAFT HOLE SNAP RING . Refer to **DISASSEMBLY - Step 9******52. REMOVE FRONT DRIVE SHAFT ASSEMBLY RH . Refer to **REMOVAL - Step 11******53. REMOVE DRIVE SHAFT BEARING BRACKET**

- a. Remove the 3 bolts and bracket.

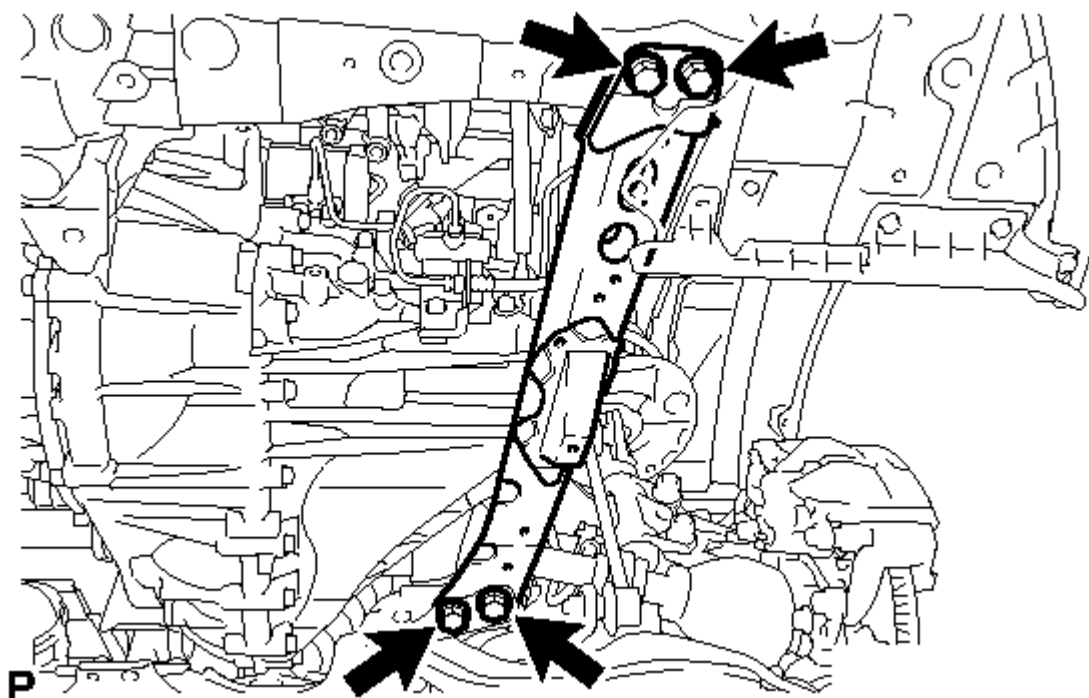
**54. REMOVE FLYWHEEL HOUSING UNDER COVER**

**Fig. 152: Location of Flywheel Housing Under Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the flywheel housing under cover.

**55. REMOVE DRIVE PLATE AND TORQUE CONVERTER SETTING BOLT (for Automatic Transaxle) . Refer to **REMOVAL - Step 1******56. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT LH**

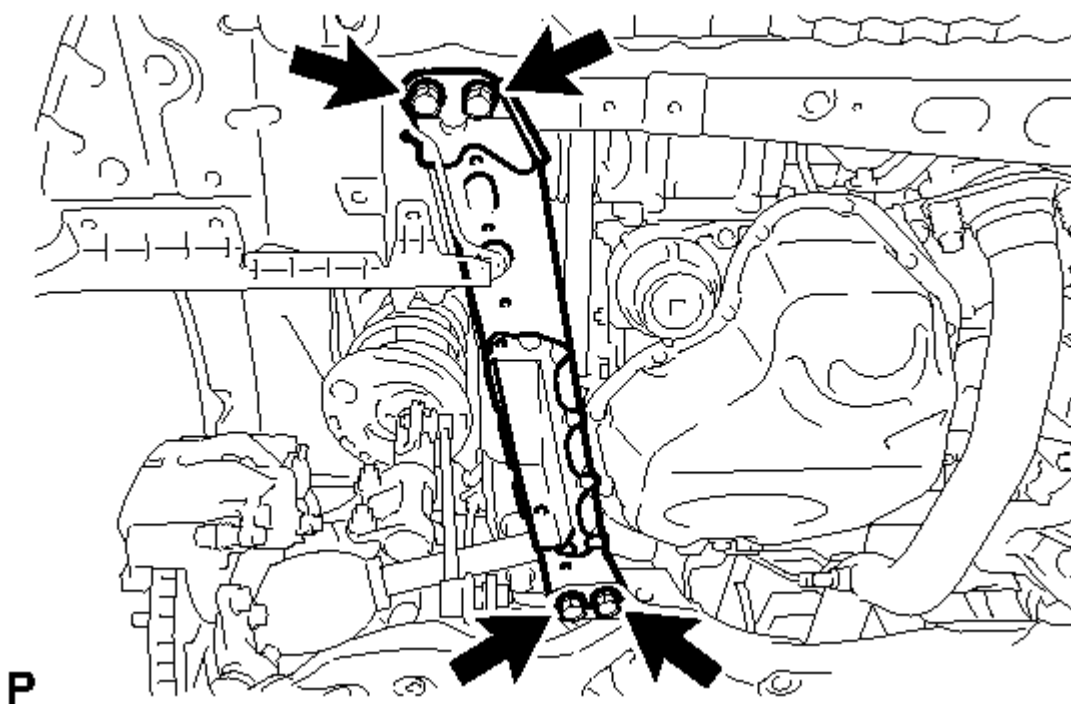
- a. Remove the 4 bolts and front suspension member reinforcement LH.



**Fig. 153: Identifying Front Suspension Member Reinforcement LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**57. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH**

- a. Remove the 4 bolts and front suspension member reinforcement RH.

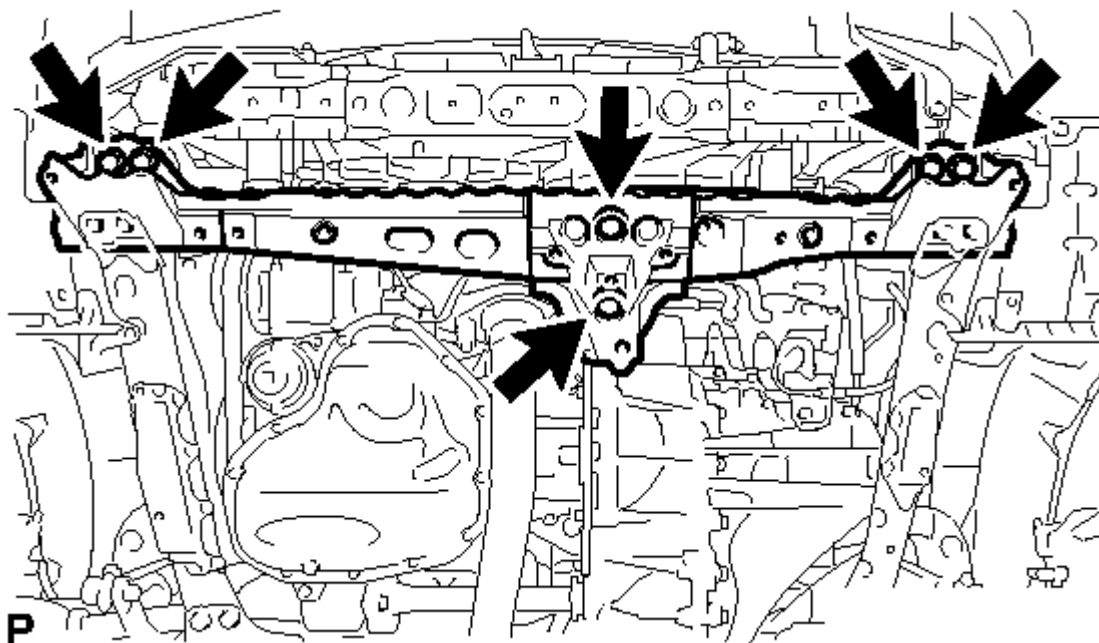


**Fig. 154: Front Suspension Member Reinforcement (LH)**

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

**58. REMOVE FRONT CROSSMEMBER SUB-ASSEMBLY**

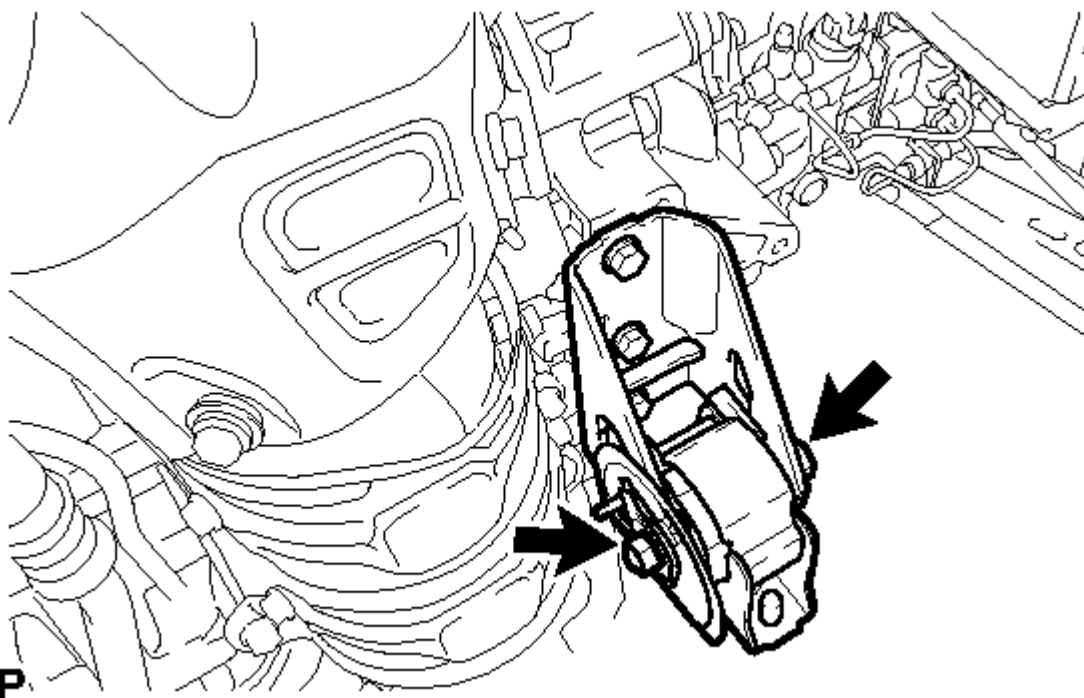
- a. Remove the 6 bolts and front crossmember.



**Fig. 155: Front Crossmember**

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

**59. REMOVE FRONT ENGINE MOUNTING INSULATOR**



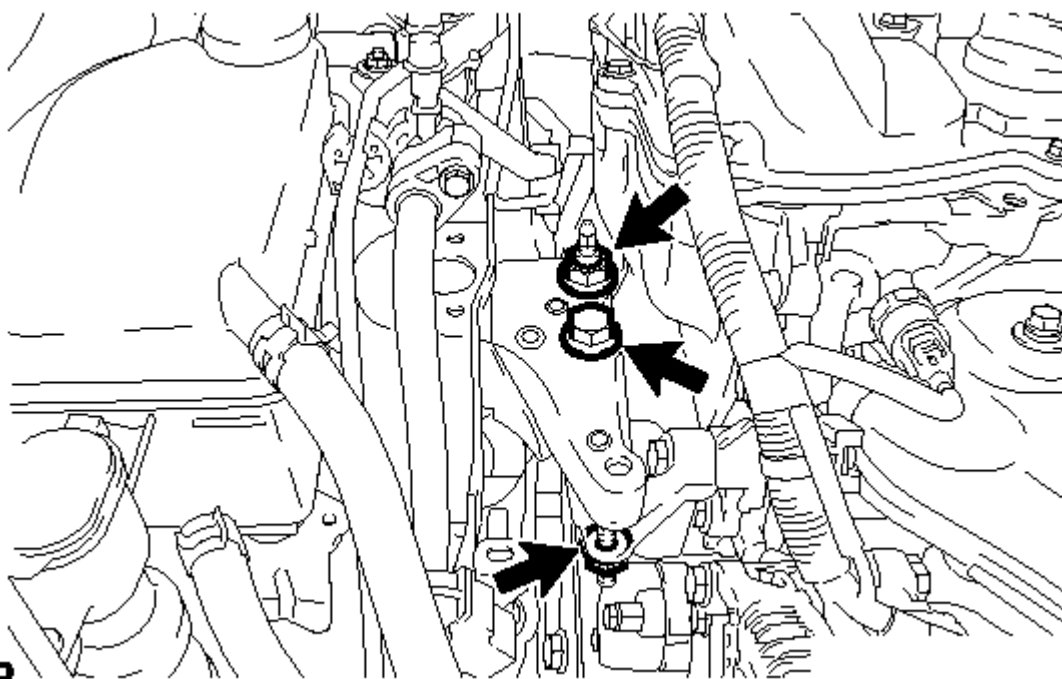
**Fig. 156: Engine Mounting Insulator**

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

- a. Remove the bolt, nut and engine mounting insulator.
60. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**
- a. Set an engine lifter underneath the engine.

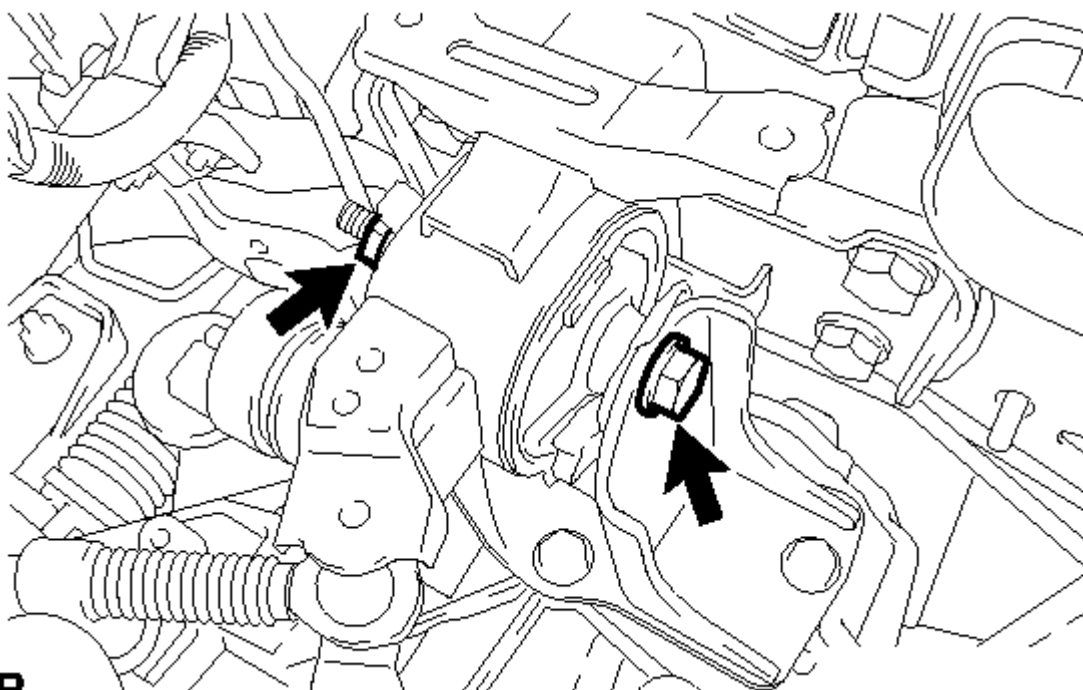
**NOTE:** Place the engine on wooden blocks or equivalent so that the engine is level.

- b. Remove the bolt and 2 nuts and disconnect the engine mounting insulator RH.

**P****Fig. 157: Engine Mounting Insulator (RH)**

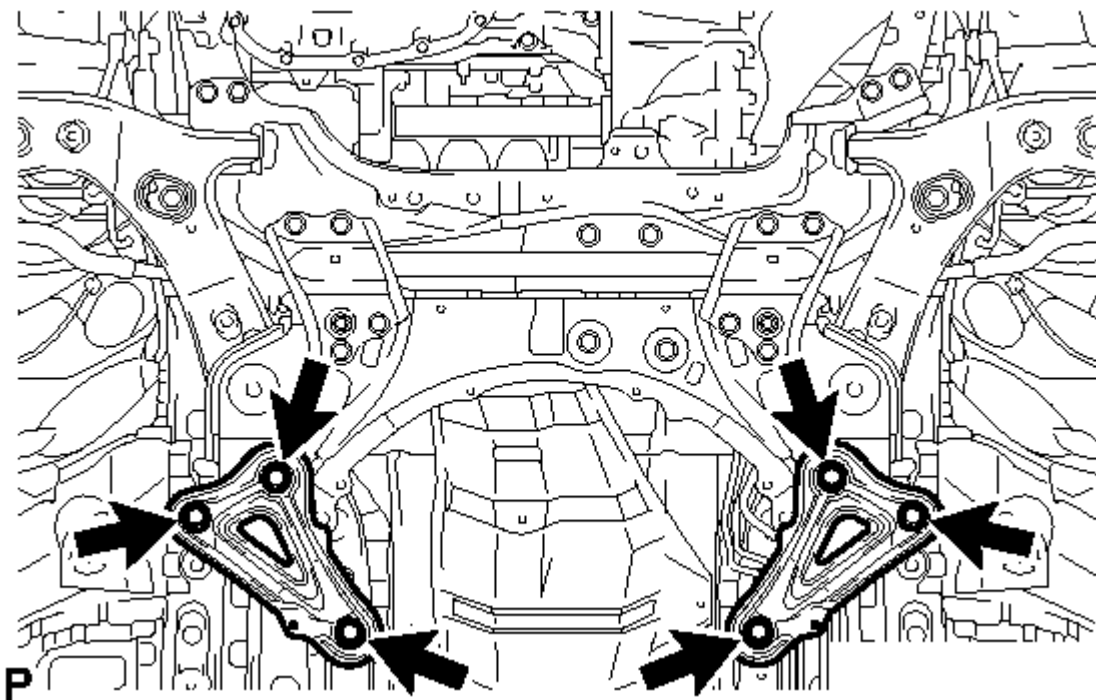
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the bolt and nut and disconnect the engine mounting insulator LH.

**P****Fig. 158: Engine Mounting Insulator (LH)**

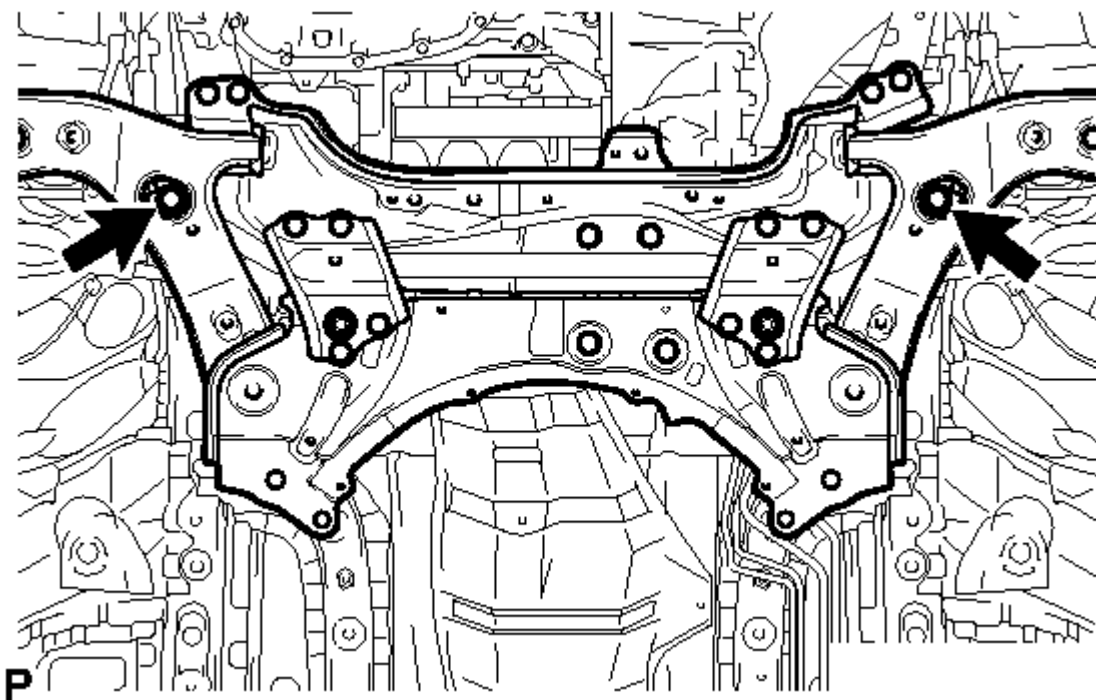
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the 6 bolts and front suspension member rear brace RH and LH.



**Fig. 159: Front Suspension Member Rear Brace**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the 2 bolts and front suspension crossmember.



**Fig. 160: Identifying Front Suspension Crossmember Sub-Assembly And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

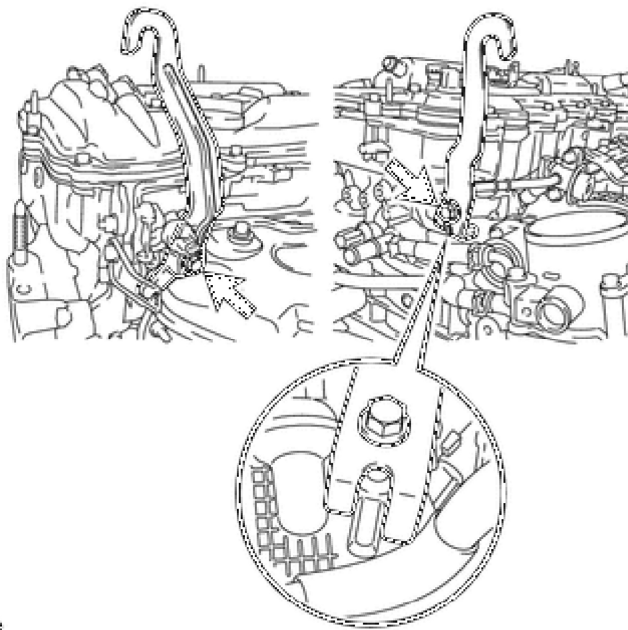
- f. Operate the engine lifter and slowly remove the engine from the vehicle.

**NOTE:**

- Make sure that the engine is clear of all wiring and hoses.
- While lowering the engine from the vehicle, do not allow it to contact the vehicle.

**61. INSTALL ENGINE HANGER**

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



P

**Fig. 161: Engine Hangers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**TEXT IN ILLUSTRATION**

*1	No. 1 Engine Hanger
*2	No. 2 Engine Hanger

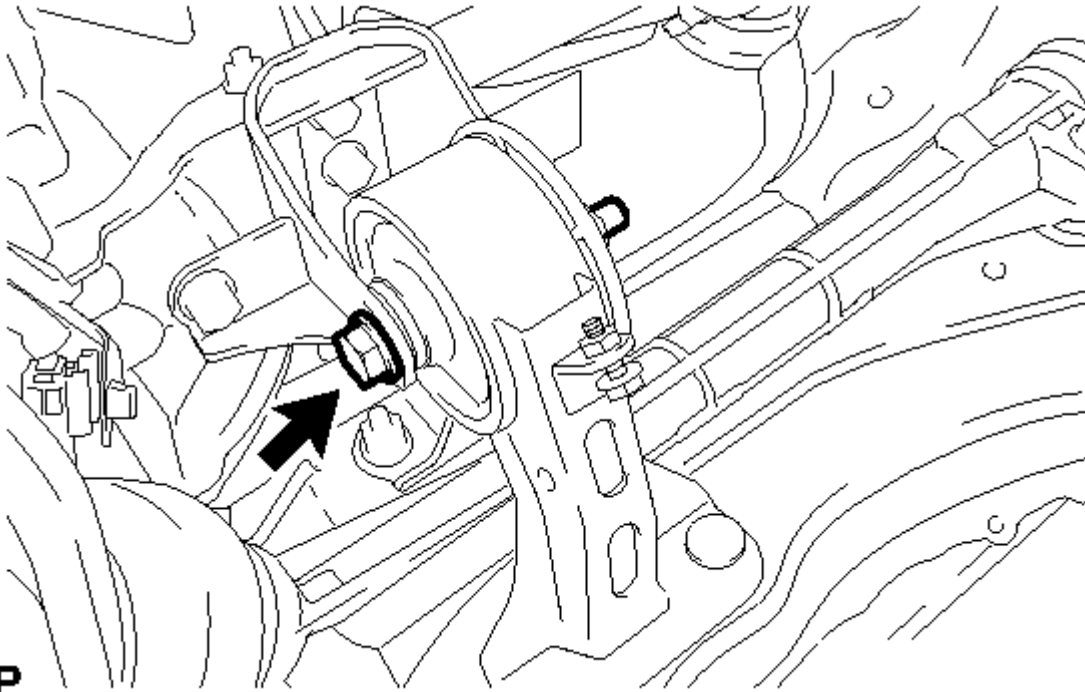
**HINT:**

No. 1 Engine Hanger	12281-36020
---------------------	-------------

No. 2 Engine Hanger	12282-36020
Bolt	91552-81025 91552-81040

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

**62. REMOVE FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY**



**Fig. 162: Front Suspension Crossmember**

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

**NOTE:** Do not damage any engine or transaxle components.

- a. Remove the bolt and front suspension crossmember from the engine with transaxle.

**HINT:**

Raise the engine with transaxle assembly while keeping it level.

**63. REMOVE STARTER ASSEMBLY . Refer to REMOVAL - Step 8**

**64. REMOVE MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)**

Refer to REMOVAL

**65. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)**



Refer to **REMOVAL - Step 6**

**66. FIX ENGINE ASSEMBLY**

- a. Using wooden blocks or plate lift attachments, set the engine on a flat surface.

**NOTE:**

- Place wooden blocks or plate lift attachments so that the engine is level.
- Never install attachments to the oil pan of the engine assembly or transmission as doing so may deform the oil pan.
- Perform this step while supporting the engine assembly using a sling device and chain block.

**67. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transaxle)** . Refer to **REMOVAL - Step 6**

**68. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transaxle)**

**69. REMOVE CLUTCH RELEASE WITH BEARING CYLINDER ASSEMBLY (for Manual Transaxle)**

Refer to **REMOVAL**

**70. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)** See step 7

**71. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)** See step 8

**72. REMOVE ENGINE WIRE**

- a. Remove the engine wire from the engine.

**73. INSTALL ENGINE TO ENGINE STAND**

**NOTE:**

- Pay attention to the angle of the sling device as the engine assembly or engine hangers may be damaged or deformed if the angle is incorrect.
- With the exception of installing the engine assembly to an engine stand or removing the engine assembly from an engine stand, do not perform any work on the engine while it is suspended, as doing so is dangerous.

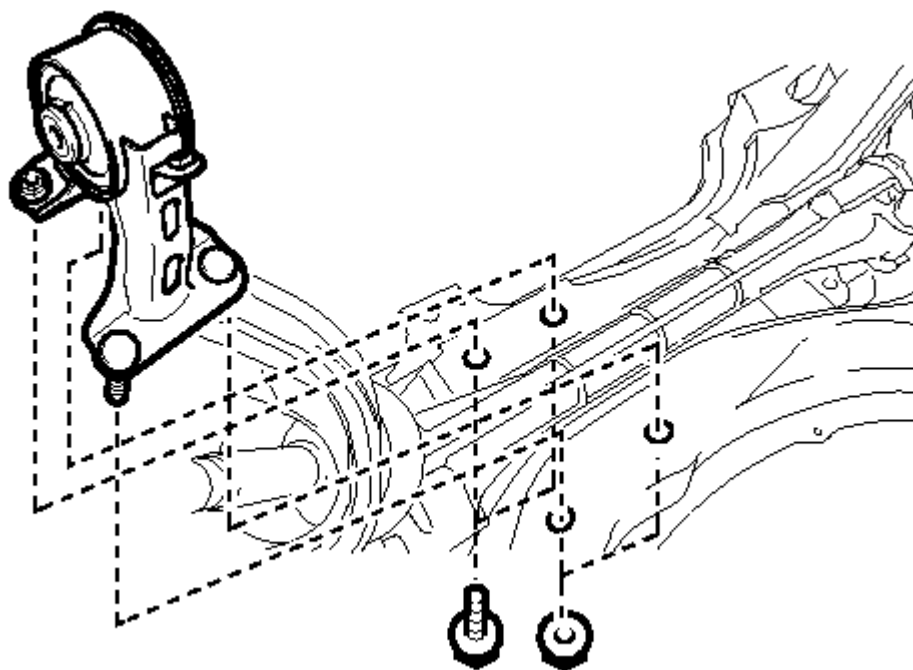
- a. Install the engine to an engine stand with the bolts.

- b. Remove the 2 bolts and 2 engine hangers.

**74. REMOVE REAR ENGINE MOUNTING INSULATOR**

**HINT:**

Perform this procedure only when replacement of the engine mounting insulator is necessary.

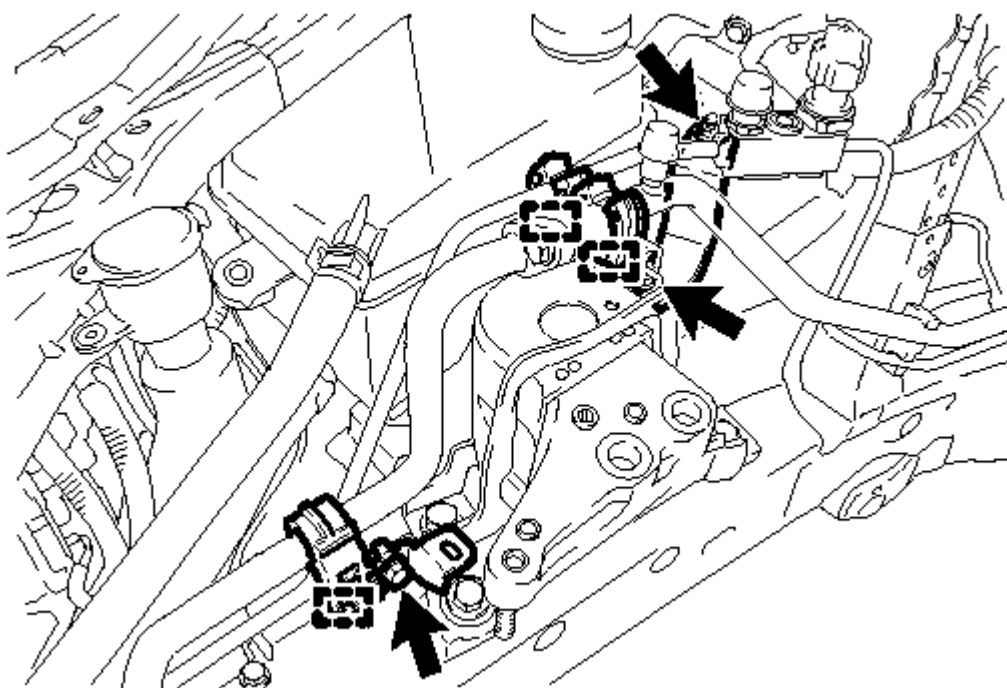
**P****Fig. 163: Removing Engine Mounting Insulator**

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

- a. Remove the 2 bolts, 2 nuts and engine mounting insulator.

**75. REMOVE ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH****HINT:**

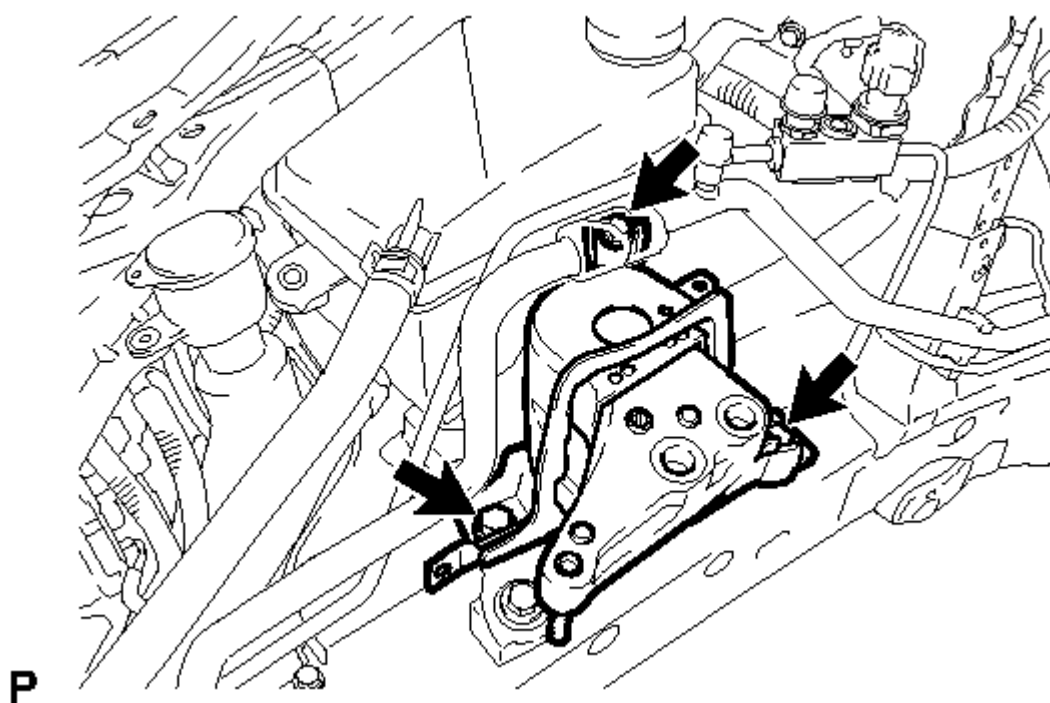
Perform this procedure only when replacement of the engine mounting insulator is necessary.



**Fig. 164: Cooler Pipe**

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

- a. Detach the 3 cooler pipe clamps.
- b. Remove the 2 bolts, nut and 2 cooler pipe brackets.
- c. Remove the 3 bolts and engine mounting insulator.

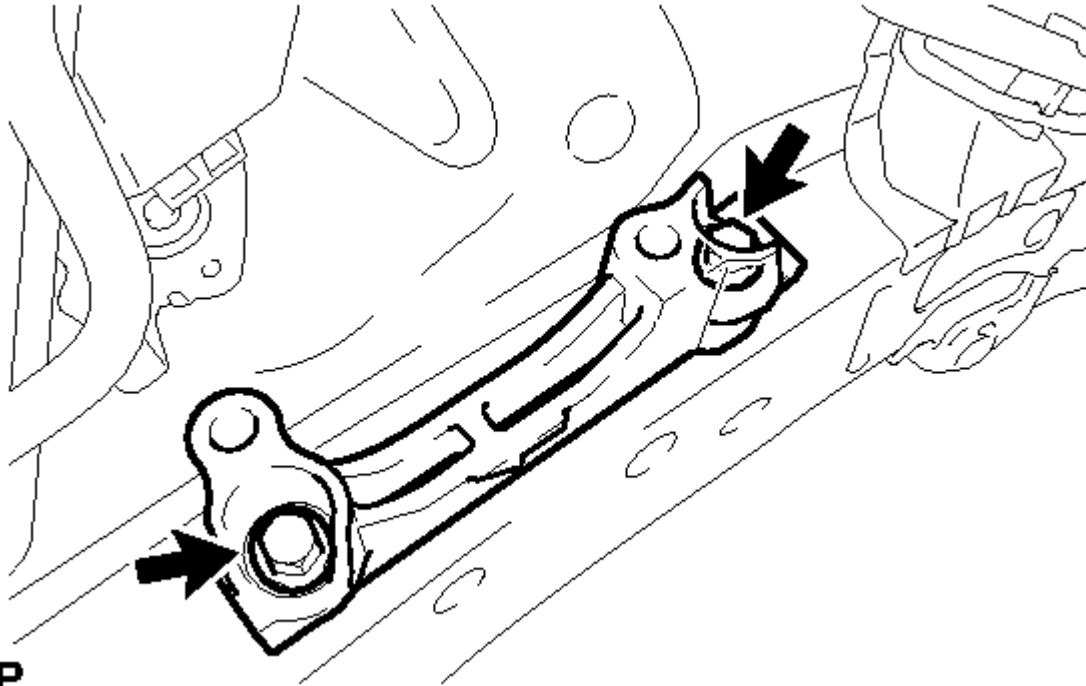


**Fig. 165: Engine Mounting Insulator**

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

**76. REMOVE ENGINE MOUNTING SPACER****HINT:**

Perform this procedure only when replacement of the engine mounting spacer is necessary.

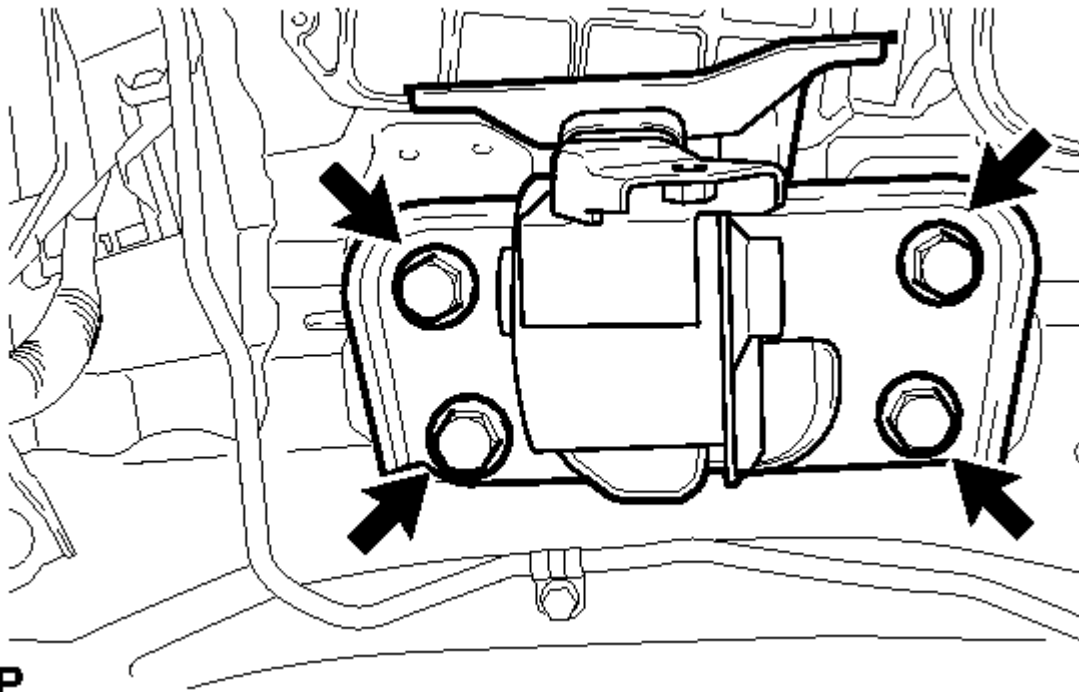
**Fig. 166: Engine Mounting Spacer**

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

- a. Remove the 2 bolts and engine mounting spacer.

**77. REMOVE ENGINE MOUNTING INSULATOR SUB-ASSEMBLY LH****HINT:**

Perform this procedure only when replacement of the engine mounting insulator is necessary.

**P****Fig. 167: Engine Mounting Insulator**

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

- a. Remove the 4 bolts and engine mounting insulator.

## INSTALLATION

### INSTALLATION

**WARNING:** As the engine assembly with transaxle is extremely heavy, the engine lifter may suddenly drop if the instructions listed in the repair information are not followed. Therefore, always follow the instructions listed in the repair information when performing this procedure.

**NOTE:** for Manual Transaxle:

When the transaxle is removed, be sure to use a new clutch release with bearing cylinder and new installation bolts. Removal of the transaxle allows the compressed clutch release with bearing cylinder to return to its original position, and dust could damage the seal of the clutch release with bearing cylinder, possibly causing clutch fluid leaks.

### 1. INSTALL ENGINE MOUNTING INSULATOR SUB-ASSEMBLY LH

#### **HINT:**

Perform this procedure only when replacement of the engine mounting insulator is necessary.

- a. Install the engine mounting insulator with the 4 bolts.

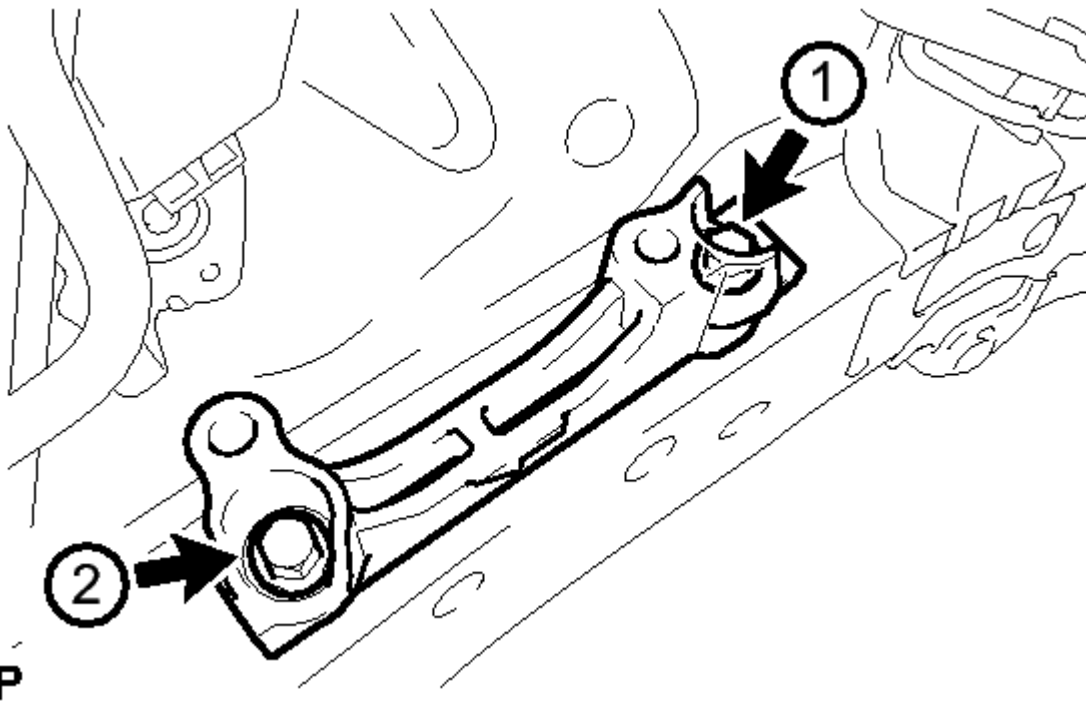
**Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)**

## 2. INSTALL ENGINE MOUNTING SPACER

### HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

- a. Temporarily install the engine mounting spacer with the 2 bolts.



**Fig. 168: Engine Mounting Spacer Tighten Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Tighten the 2 bolts in the sequence shown in the illustration.

**Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)**

## 3. INSTALL ENGINE MOUNTING INSULATOR SUB-ASSEMBLY RH

### HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

- a. Install the engine mounting insulator with the 3 bolts.

**Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)**

- b. Install the 2 cooler pipe brackets with the 2 bolts and nut.

**Torque: 9.8 N\*m (100 kgf\*cm, 87 in.\*lbf)**

- c. Attach the 3 cooler pipe clamps.

#### **4. INSTALL REAR ENGINE MOUNTING INSULATOR**

**HINT:**

Perform this procedure only when replacement of the engine mounting insulator is necessary.

- a. Install the engine mounting insulator with the 2 bolts and 2 nuts.

**Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)**

#### **5. INSTALL FRONT ENGINE MOUNTING INSULATOR**

**HINT:**

Perform this procedure only when replacement of the engine mounting insulator is necessary.

- a. Install the engine mounting insulator with the 2 bolts.

**Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)**

#### **6. INSTALL ENGINE HANGER** See step 61

#### **7. REMOVE ENGINE FROM ENGINE STAND**

**NOTE:**

- Pay attention to the angle of the sling device as the engine assembly or engine hangers may be damaged or deformed if the angle is incorrect.
- With the exception of installing the engine assembly to an engine stand or removing the engine assembly from an engine stand, do not perform any work on the engine while it is suspended, as doing so is dangerous.

- a. Attach a sling device and hang the engine with a chain block.
- b. Lift the engine and remove it from the engine stand.

#### **8. FIX ENGINE ASSEMBLY** See step 66

#### **9. INSTALL ENGINE WIRE**

- a. Install the engine wire to the engine.

#### **10. INSTALL CLUTCH RELEASE WITH BEARING CYLINDER ASSEMBLY (for Manual Transaxle)**

Refer to INSTALLATION

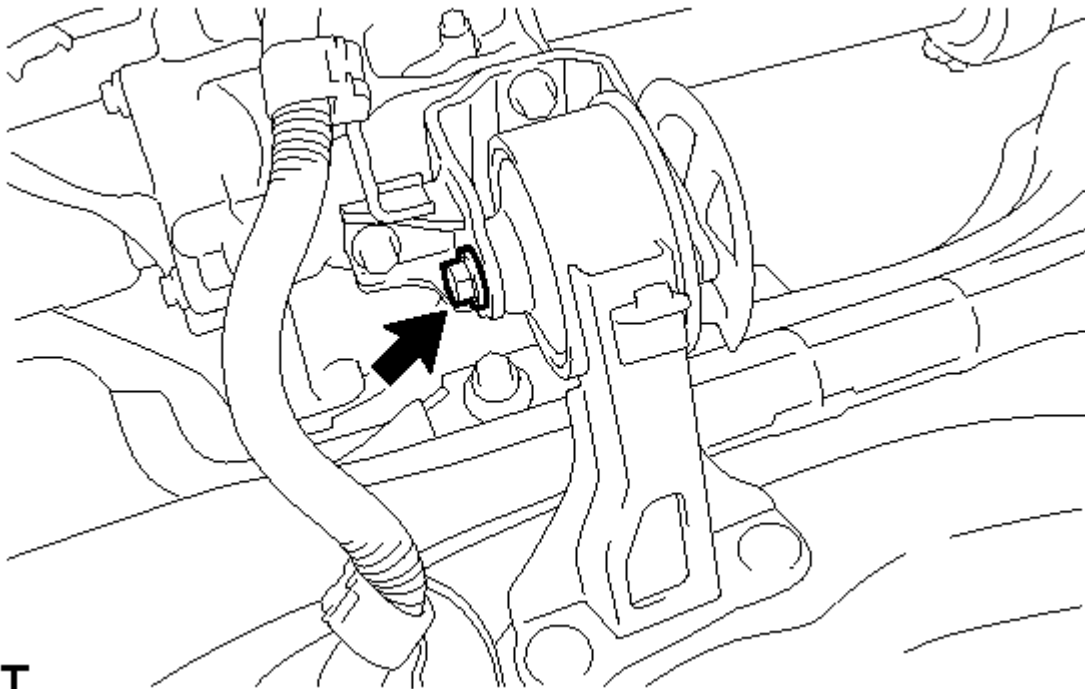
11. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)** See step 2
12. **INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)** See step 3
13. **INSTALL CLUTCH DISC ASSEMBLY (for Manual Transaxle)** . Refer to INSTALLATION - Step 1
14. **INSTALL CLUTCH COVER ASSEMBLY (for Manual Transaxle)** . Refer to INSTALLATION - Step 2
15. **INSPECT AND ADJUST CLUTCH COVER ASSEMBLY (for Manual Transaxle)** . Refer to INSTALLATION - Step 3
16. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)**

Refer to INSTALLATION

17. **INSTALL MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)**

Refer to INSTALLATION

18. **INSTALL STARTER ASSEMBLY** . Refer to INSTALLATION - Step 1
19. **TEMPORARILY INSTALL FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY**
  - a. Temporarily install the rear engine mounting insulator to the engine mounting bracket with the through bolt.



**T**

**Fig. 169: Rear Engine Mounting Insulator & Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**20. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**

- a. Place the engine on an engine lifter.

**HINT:**

Place the engine on wooden blocks or equivalent so that the engine is level.

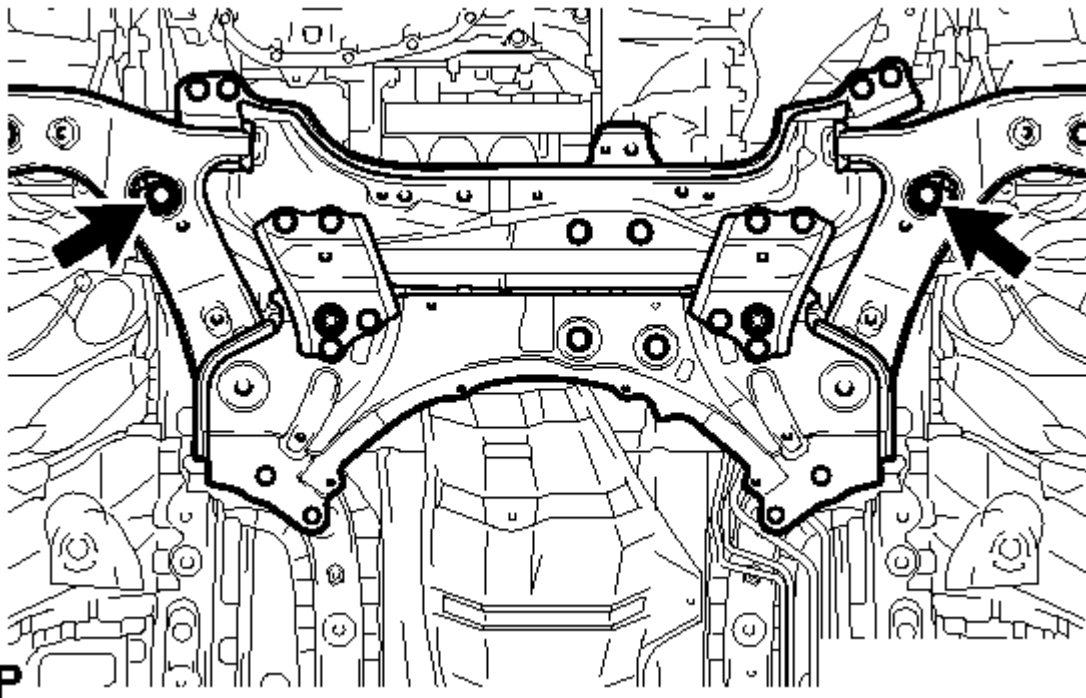
- b. Operate the engine lifter and install the engine to the vehicle.

**WARNING:** Do not raise the engine more than necessary. If the engine is raised excessively, the vehicle may also be lifted up.

**NOTE:**

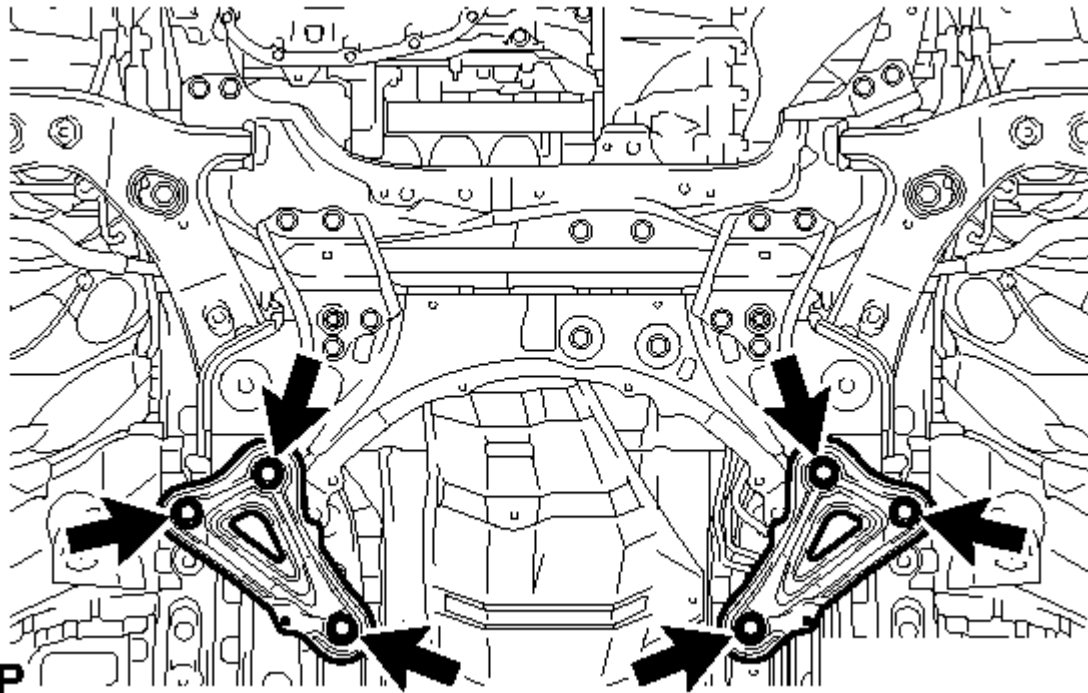
- Make sure that the engine is clear of all wiring and hoses.
- While raising the engine into the vehicle, do not allow it to contact the vehicle.

- c. Temporarily install the front suspension crossmember with the 2 bolts.



**Fig. 170: Identifying Front Suspension Crossmember Sub-Assembly And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Temporarily install the member rear brace RH and LH with the 6 bolts.



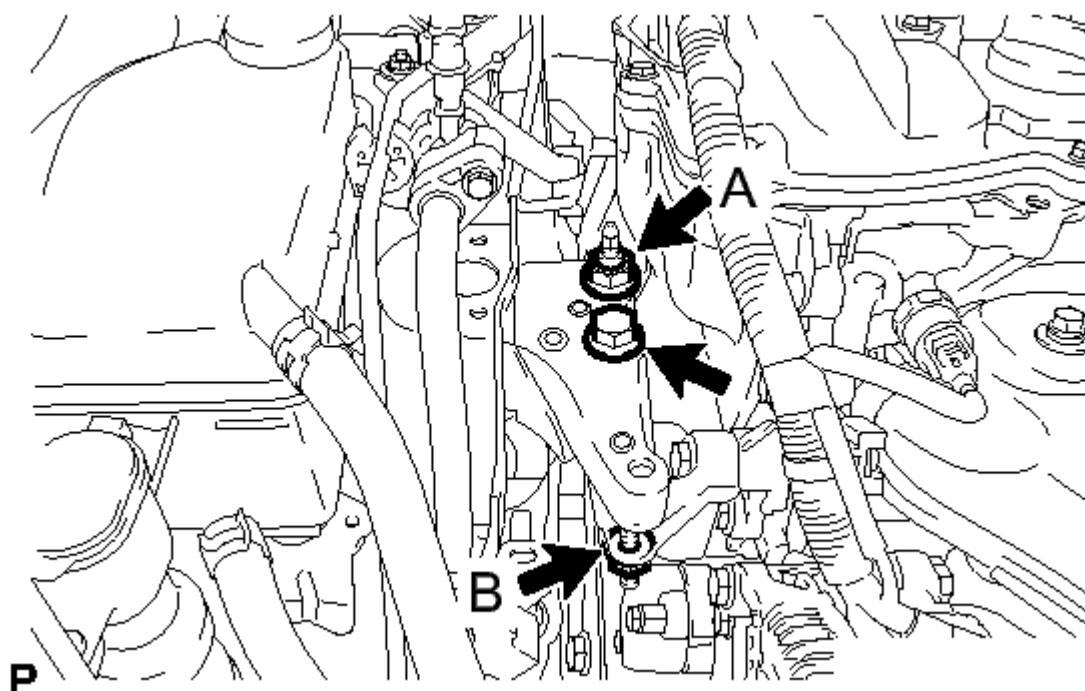
**Fig. 171: Front Suspension Member Rear Brace**

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

- e. Install the engine mounting insulator LH with the through bolt and nut.

**Torque: 56 N\*m (571 kgf\*cm, 41 ft.\*lbf)**

- f. Install the engine mounting insulator RH with the bolt and 2 nuts.



**Fig. 172: Engine Mounting Insulator (RH)**

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

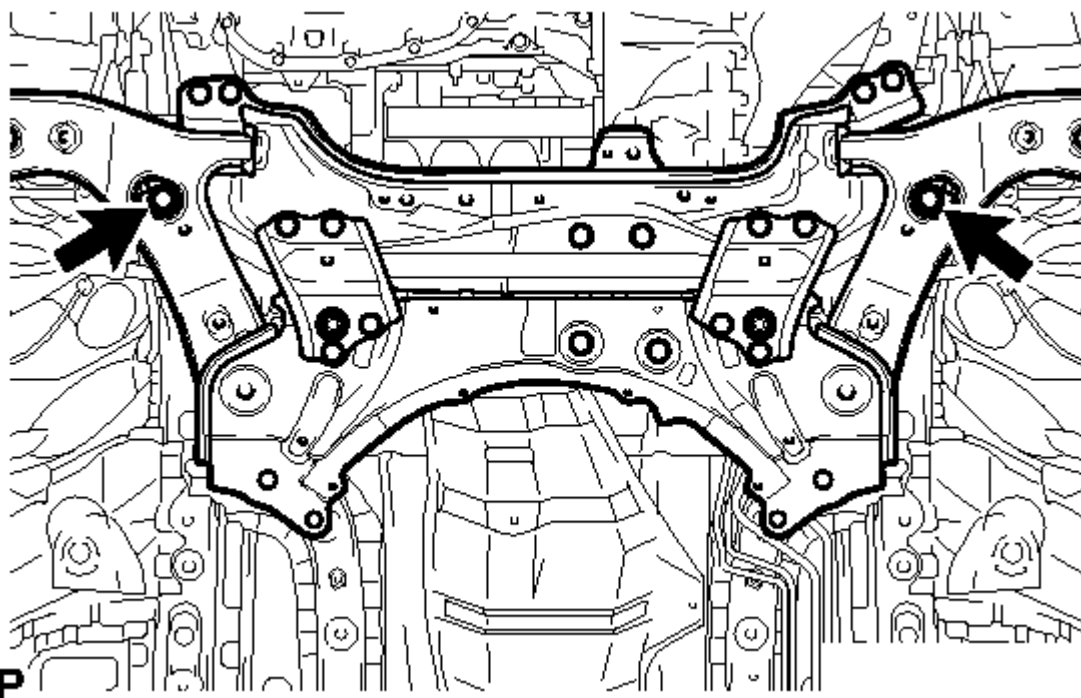
**for bolt and nut A**

**Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)**

**for nut B**

**Torque: 52 N\*m (530 kgf\*cm, 38 ft.\*lbf)**

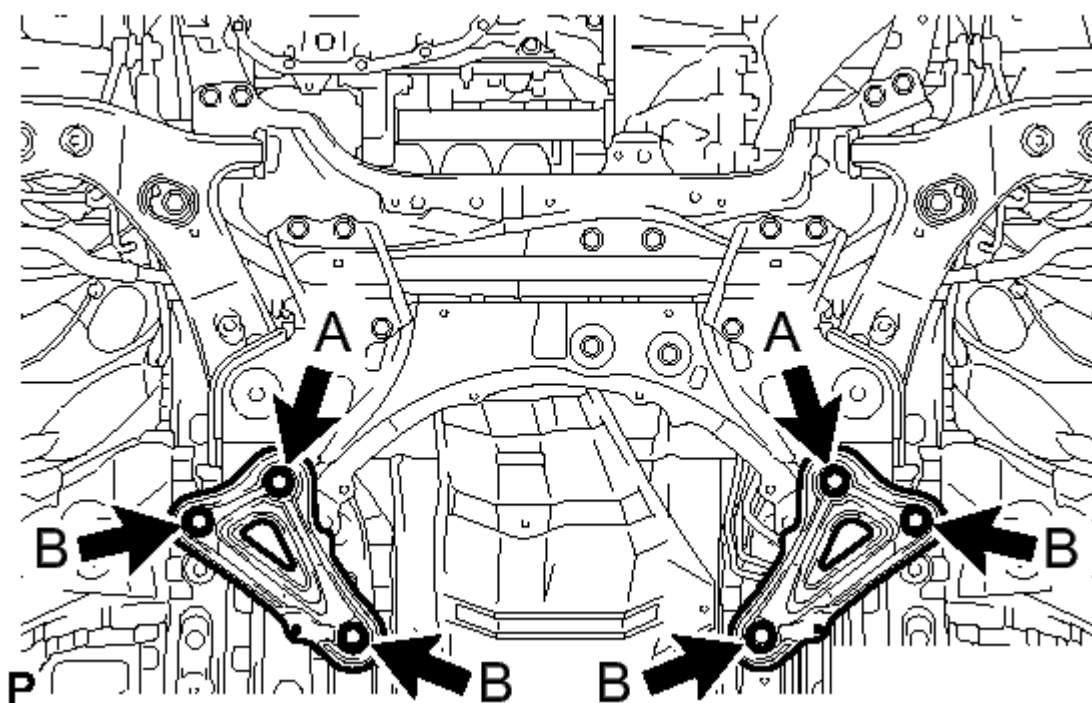
- g. Tighten the 2 front suspension member bolts.



**Fig. 173: Identifying Front Suspension Crossmember Sub-Assembly And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 145 N\*m (1479 kgf\*cm, 107 ft.\*lbf)**

- h. Tighten the 6 member rear brace bolts.



**Fig. 174: Crossmember Rear Brace**

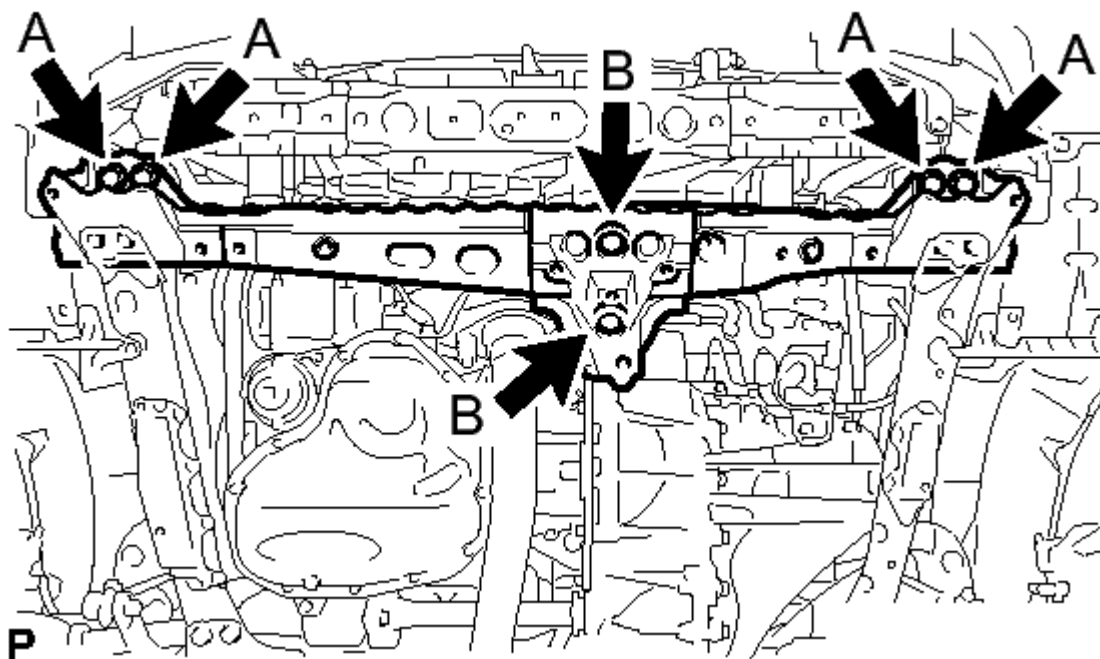
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for bolt A

Torque: 145 N\*m (1479 kgf\*cm, 107 ft.\*lbf)

for bolt B

Torque: 93 N\*m (948 kgf\*cm, 69 ft.\*lbf)

**21. INSTALL FRONT CROSSMEMBER SUB-ASSEMBLY****Fig. 175: Front Crossmember**

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

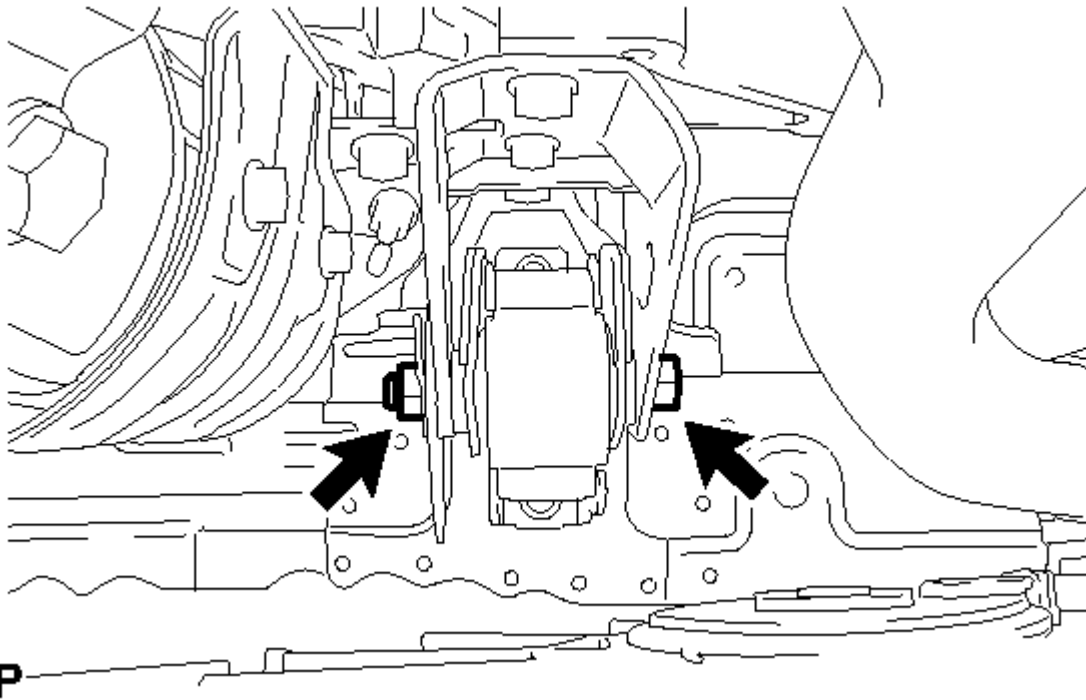
- a. Install the front crossmember with the 6 bolts.

for bolt A

Torque: 96 N\*m (979 kgf\*cm, 71 ft.\*lbf)

for bolt B

Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)



**Fig. 176: Front Engine Mounting Insulator Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Tighten the bolt and nut holding the front engine mounting insulator.

**Torque: 145 N\*m (1479 kgf\*cm, 107 ft.\*lbf)**

## 22. TIGHTEN FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY

- a. Tighten the rear engine mounting insulator bolt.

**Torque: 95 N\*m (969 kgf\*cm, 70 ft.\*lbf)**

## 23. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT LH

- a. Install the reinforcement with the 4 bolts.

**Torque: 96 N\*m (979 kgf\*cm, 71 ft.\*lbf)**

## 24. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH

- a. Install the reinforcement with the 4 bolts.

**Torque: 96 N\*m (979 kgf\*cm, 71 ft.\*lbf)**

## 25. INSTALL DRIVE PLATE AND TORQUE CONVERTER SETTING BOLT (for Automatic Transaxle) . Refer to INSTALLATION - Step 19

## 26. INSTALL FLYWHEEL HOUSING UNDER COVER

- a. Install the flywheel housing under cover.

**27. INSTALL DRIVE SHAFT BEARING BRACKET**

- a. Install the bracket with the 3 bolts.

**Torque: 64 N\*m (653 kgf\*cm, 47 ft.\*lbf)**

**28. INSTALL FRONT DRIVE SHAFT HOLE SNAP RING . Refer to REASSEMBLY - Step 7****29. INSTALL FRONT DRIVE SHAFT ASSEMBLY LH . Refer to INSTALLATION - Step 1****30. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH . Refer to INSTALLATION - Step 2****31. INSTALL FRONT AXLE ASSEMBLY LH**

Refer to INSTALLATION - Step 2

**32. INSTALL FRONT AXLE ASSEMBLY RH****HINT:**

Use the same procedure described for the LH side.

**33. CONNECT FRONT STABILIZER LINK ASSEMBLY LH . Refer to INSTALLATION - Step 5****34. CONNECT FRONT STABILIZER LINK ASSEMBLY RH****HINT:**

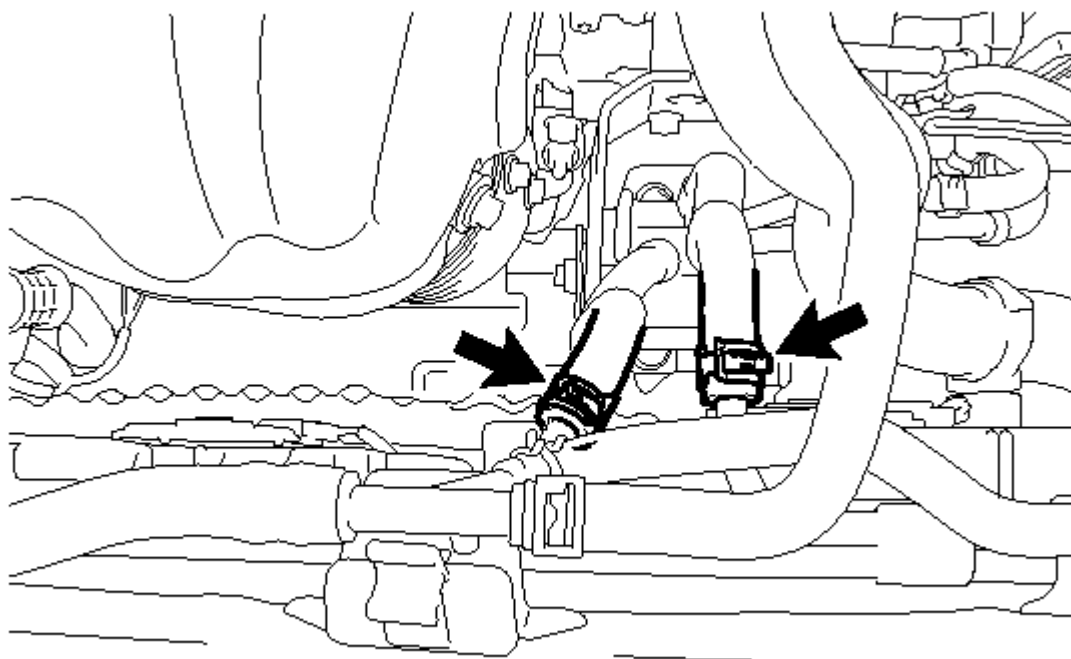
Use the same procedure described for the LH side.

**35. INSTALL FRONT AXLE SHAFT NUT LH . Refer to INSTALLATION - Step 8****36. INSTALL FRONT AXLE SHAFT NUT RH****HINT:**

Use the same procedure described for the LH side.

**37. INSTALL FRONT EXHAUST PIPE ASSEMBLY . Refer to INSTALLATION - Step 11****38. CONNECT NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY . Refer to INSTALLATION - Step 23****39. CONNECT NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY . Refer to INSTALLATION - Step 5****40. INSTALL COLUMN HOLE COVER SILENCER SHEET . Refer to INSTALLATION - Step 10****41. CONNECT WIRE HARNESS AND HOSE**

- a. for Automatic Transaxle:

**P****Fig. 177: Oil Cooler Hoses****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

1. Connect the 2 oil cooler hoses to the oil cooler tube.
- b. Connect the transmission wire with the bolt.

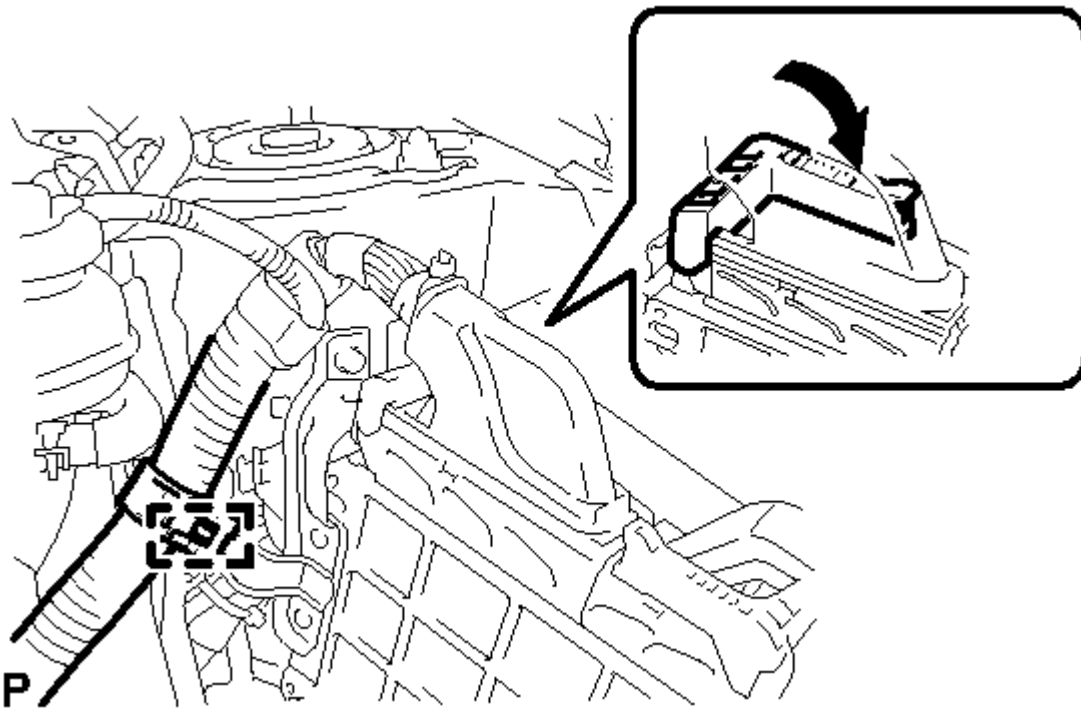
**Torque: 8.4 N\*m (86 kgf\*cm, 74 in.\*lbf)**

- c. Attach the clamp.
- d. Connect the vacuum hose.
- e. Attach the 2 clamps to install the wire harness, and then install the 2 nuts.

**Torque: 8.4 N\*m (86 kgf\*cm, 74 in.\*lbf)**

- f. Connect the 3 wire harness connectors to the engine room No. 1 junction block.
- g. Connect the ECM connector and lower the lever.





**Fig. 178: Connecting ECM Connector**

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

**NOTE:**

- When connecting the connector, make sure that dirt, water or other foreign matter does not get caught between the connector and other parts.
- Make sure that the lever is securely lowered.

h. Attach the wire harness clamp.

**42. CONNECT HEATER WATER HOSE**

a. Connect the 2 heater water hoses.

**43. CONNECT FUEL TUBE SUB-ASSEMBLY**

a. Connect the fuel tube connector. Refer to **PRECAUTION** .

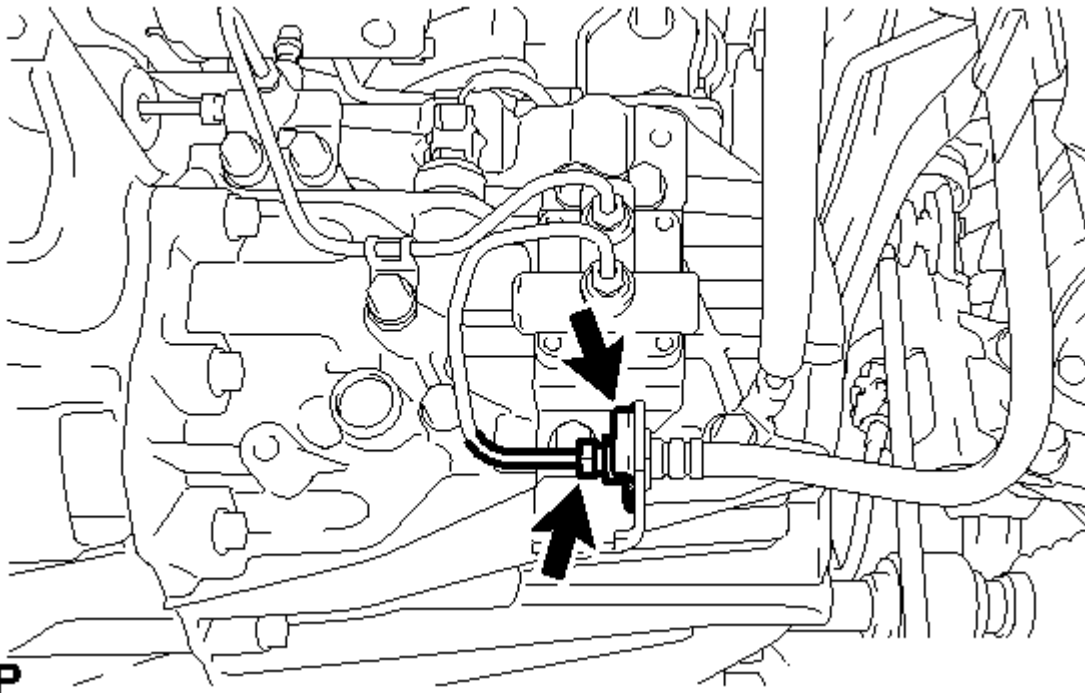
b. Install the No. 1 fuel pipe clamp.

**44. CONNECT NO. 1 RADIATOR HOSE** . Refer to **INSTALLATION - Step 11**

**45. INSTALL RADIATOR HOSE CLAMP** . Refer to **INSTALLATION - Step 12**

**46. CONNECT CLUTCH HOSE (for Manual Transaxle)**

a. Temporarily install the clutch line.



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**Fig. 179: Clutch Hose**

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

- b. Install the clutch hose with a new clip.
- c. Using a union nut wrench, tighten the 2 clutch lines to the clutch accumulator assembly.

**Torque: 15 N\*m (155 kgf\*cm, 11 ft.\*lbf)**

**NOTE:** Use the formula to calculate special torque values for situations where a union nut wrench is combined with a torque wrench. Refer to **PRECAUTION** .

**47. CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle)**

- a. Connect the control cable support to the rear engine mounting insulator with the bolt.

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

- b. Connect the 2 transmission control cables with 2 new clips.
- c. Install the 2 clips.

**48. CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle)**

- a. Connect the control cable support to the rear engine mounting insulator with the bolt.

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

- b. Connect the transmission control cable to the control cable bracket with a new clip.

- c. Connect the transmission control cable to the control shaft lever with the nut.

**Torque: 12 N\*m (122 kgf\*cm, 9 ft.\*lbf)**

- 49. **INSTALL BATTERY CARRIER** . Refer to INSTALLATION - Step 2
- 50. **INSTALL BATTERY TRAY**
- 51. **INSTALL BATTERY**
- 52. **INSTALL BATTERY INSULATOR**
- 53. **INSTALL BATTERY CLAMP SUB-ASSEMBLY** . Refer to INSTALLATION - Step 6
- 54. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY** . Refer to INSTALLATION - Step 3
- 55. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** . Refer to INSTALLATION - Step 4
- 56. **INSTALL COOLER COMPRESSOR ASSEMBLY** . Refer to INSTALLATION - Step 2
- 57. **CONNECT SUCTION HOSE SUB-ASSEMBLY** . Refer to INSTALLATION - Step 3
- 58. **CONNECT NO. 1 COOLER REFRIGERANT DISCHARGE HOSE** . Refer to INSTALLATION - Step 4
- 59. **CONNECT NO. 2 RADIATOR HOSE** . Refer to INSTALLATION - Step 10
- 60. **INSTALL GENERATOR ASSEMBLY** . Refer to INSTALLATION - Step 1
- 61. **INSTALL FAN AND GENERATOR V BELT** See step 1
- 62. **CONNECT RADIATOR RESERVOIR ASSEMBLY**
  - a. Install the grommet to the radiator reservoir.
  - b. Connect the radiator reservoir with the 2 bolts.

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

63. **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 .

- 64. **ADD MANUAL TRANSAXLE OIL (for Manual Transaxle)** . Refer to REPLACEMENT - Step 2
- 65. **INSPECT MANUAL TRANSAXLE OIL (for Manual Transaxle)** . Refer to ON-VEHICLE INSPECTION - Step 1
- 66. **ADD AUTOMATIC TRANSAXLE FLUID (for Automatic Transaxle)**
- 67. **ADD ENGINE COOLANT** . Refer to REPLACEMENT - Step 4
- 68. **ADD ENGINE OIL** . Refer to REPLACEMENT - Step 5
- 69. **INSPECT FOR FUEL LEAK** . Refer to INSTALLATION - Step 10
- 70. **INSPECT FOR COOLANT LEAK** . Refer to ON-VEHICLE INSPECTION - Step 1
- 71. **INSPECT FOR OIL LEAK** . Refer to REPLACEMENT - Step 6
- 72. **INSPECT FOR EXHAUST GAS LEAK** . Refer to INSTALLATION - Step 7
- 73. **INSPECT IGNITION TIMING** See step 2

74. **INSPECT ENGINE IDLE SPEED** See step 3

75. **INSPECT CO/HC** See step 5

76. **INSTALL FRONT WHEEL**

**Torque: 103 N\*m (1050 kgf\*cm, 76 ft.\*lbf)**

77. **ADJUST FRONT WHEEL ALIGNMENT**

Refer to **ADJUSTMENT**

78. **INSTALL NO. 2 ENGINE UNDER COVER**

a. Install the under cover with the 5 clips.

79. **INSTALL REAR ENGINE UNDER COVER RH** See step 2

80. **INSTALL REAR ENGINE UNDER COVER LH**

a. Install the under cover with the 5 clips.

81. **CONNECT FRONT FENDER LINER RH**

a. Connect the front fender liner with the screw.

82. **CONNECT FRONT FENDER LINER LH**

a. Connect the front fender liner with the screw.

83. **INSTALL NO. 1 ENGINE UNDER COVER**

a. Install the under cover with the 2 bolts and 7 clips.

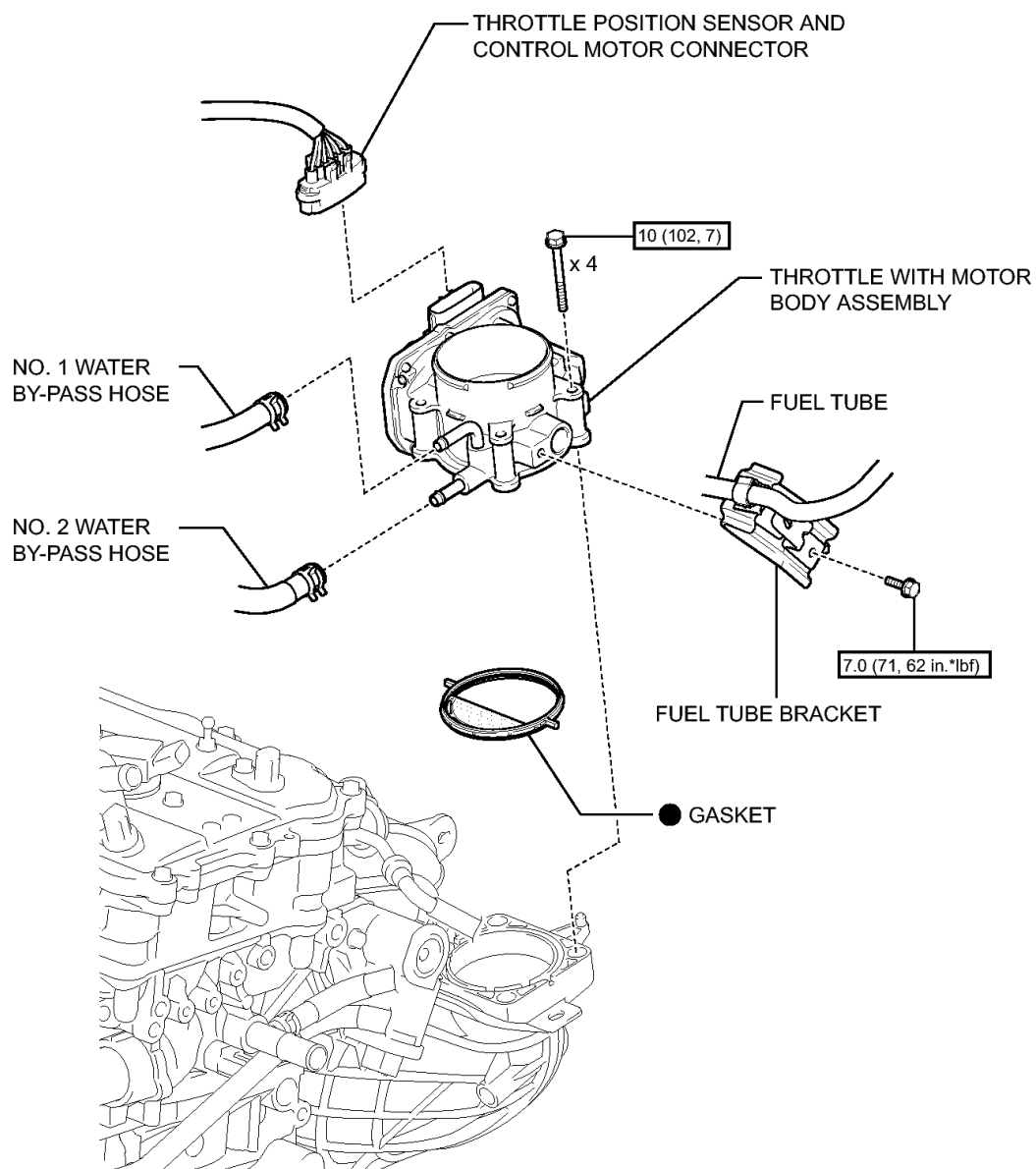
84. **INSTALL CENTER ENGINE UNDER COVER**

a. Install the center engine under cover with the 6 screws and 6 bolts.

## **ENGINE UNIT**

### **COMPONENTS**

### **ILLUSTRATION**



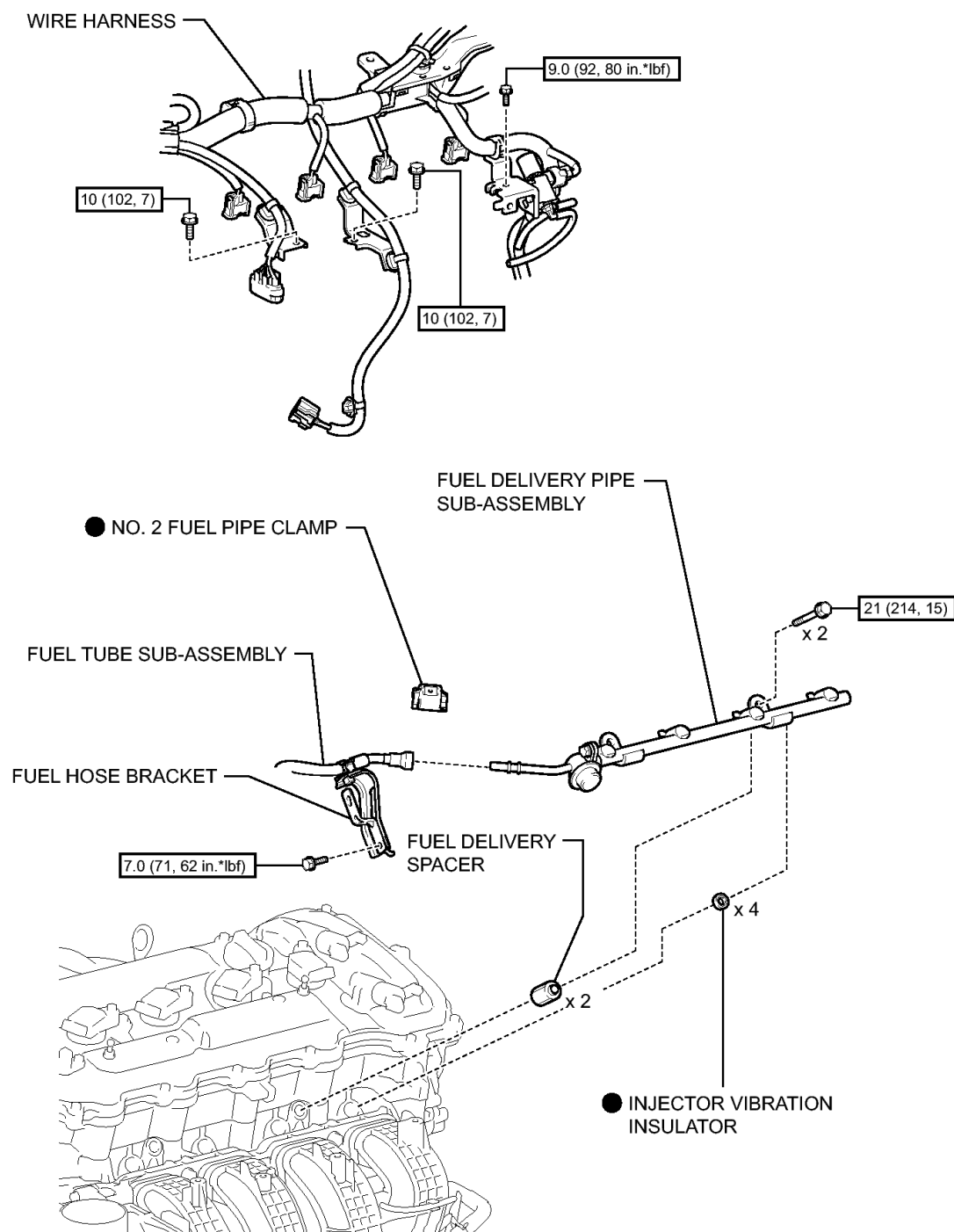
N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

P

**Fig. 180: Identifying Engine Unit Replacement Components With Torque Specifications (1 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## ILLUSTRATION



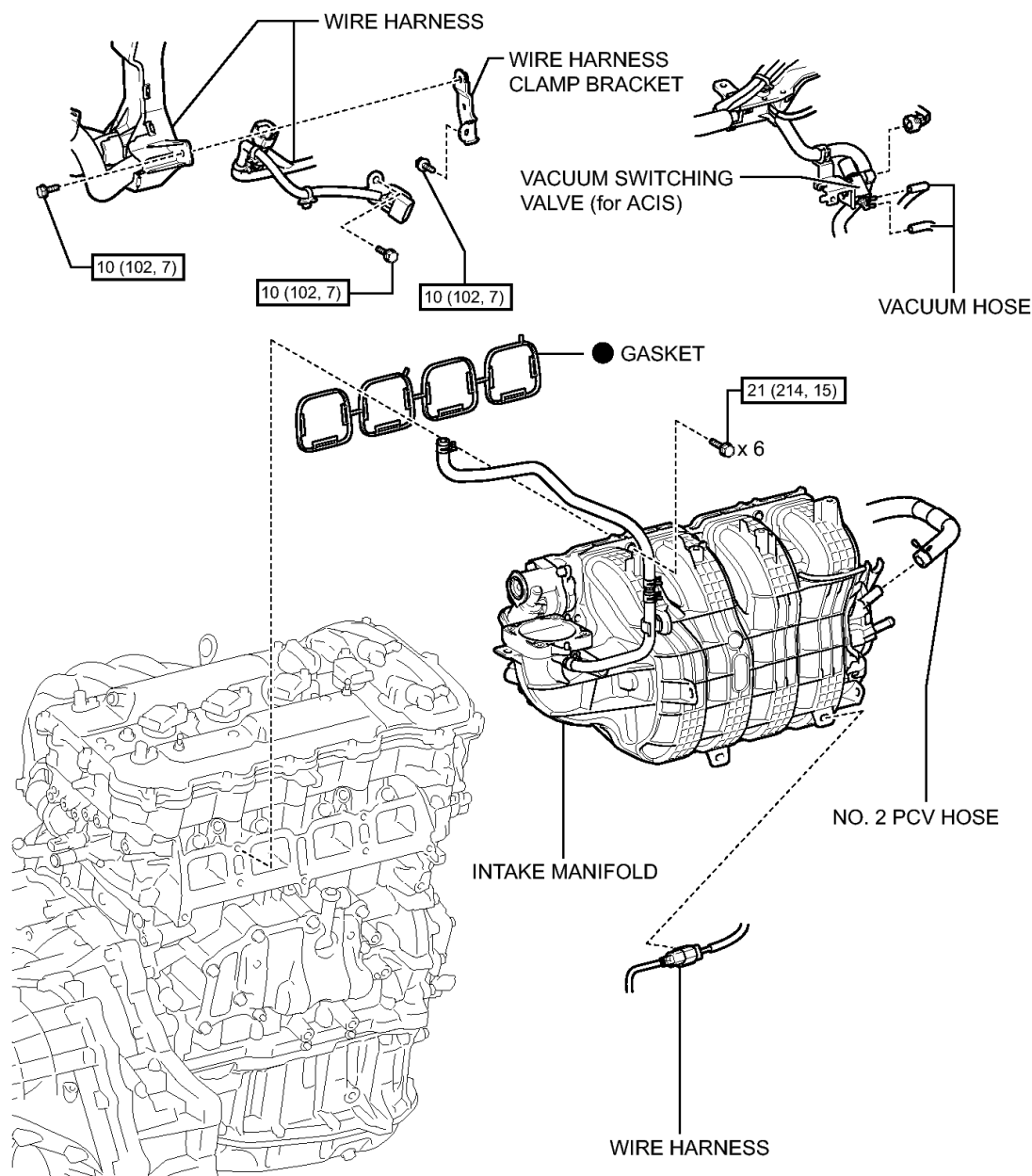
N\*m (kgf\*cm, ft.\*lbf) : Specified torque

● Non-reusable part

P

**Fig. 181: Identifying Engine Unit Replacement Components With Torque Specifications (2 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ILLUSTRATION



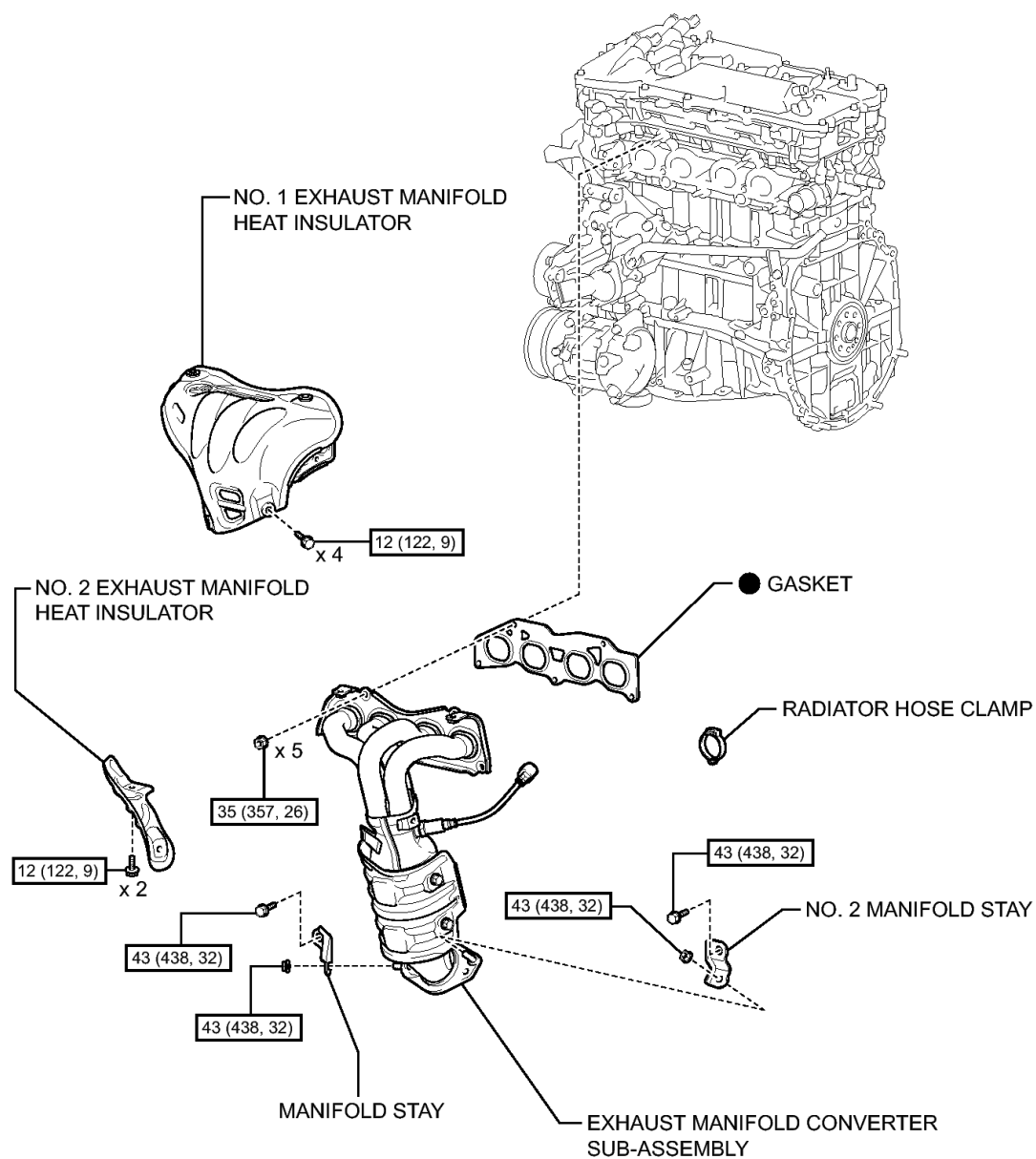
**N\*m (kgf\*cm, ft.\*lbf)** : Specified torque

● Non-reusable part

P

**Fig. 182: Identifying Engine Unit Replacement Components With Torque Specifications (3 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## ILLUSTRATION



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

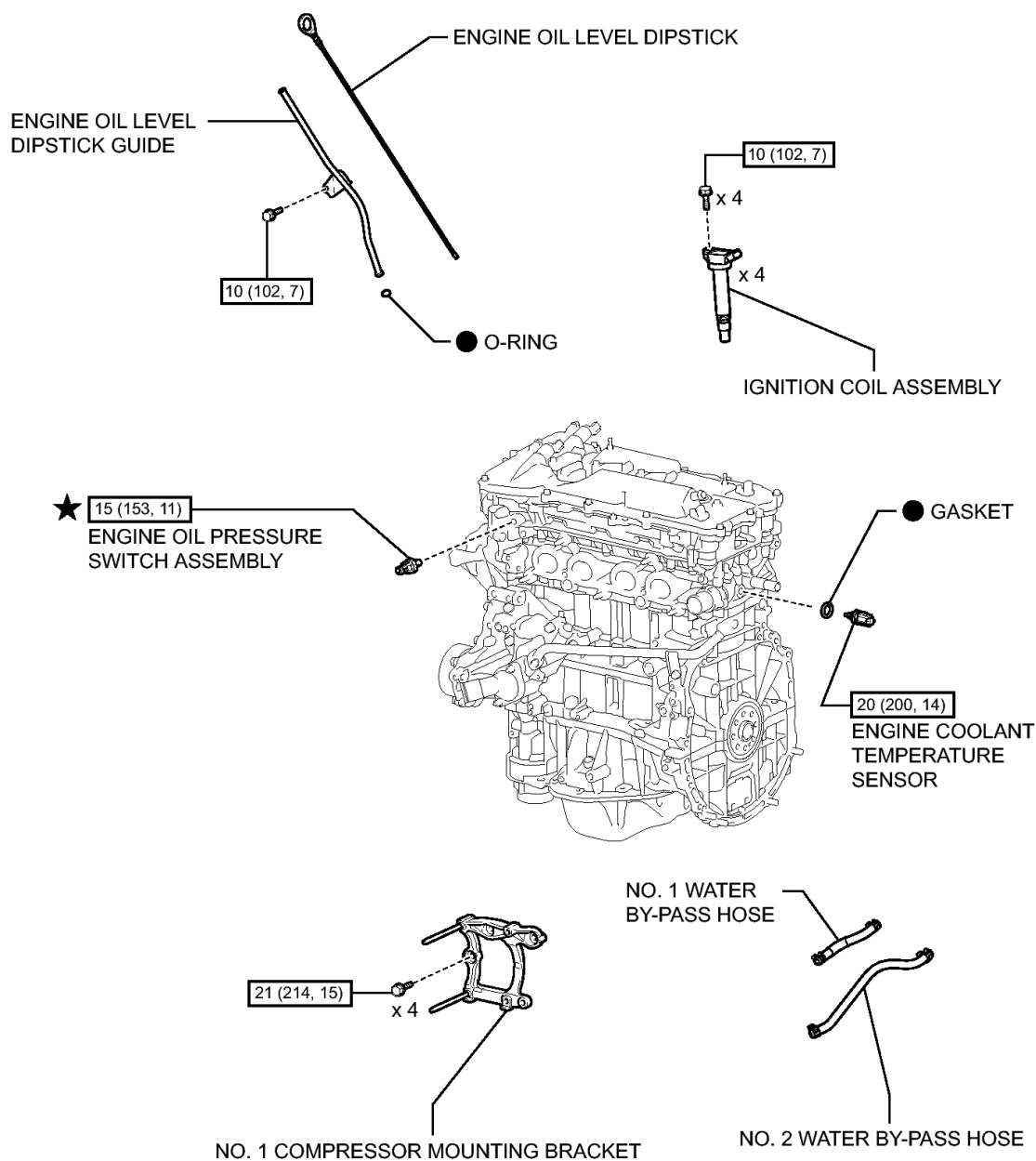
● Non-reusable part

P

**Fig. 183: Identifying Engine Unit Replacement Components With Torque Specifications (4 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION





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

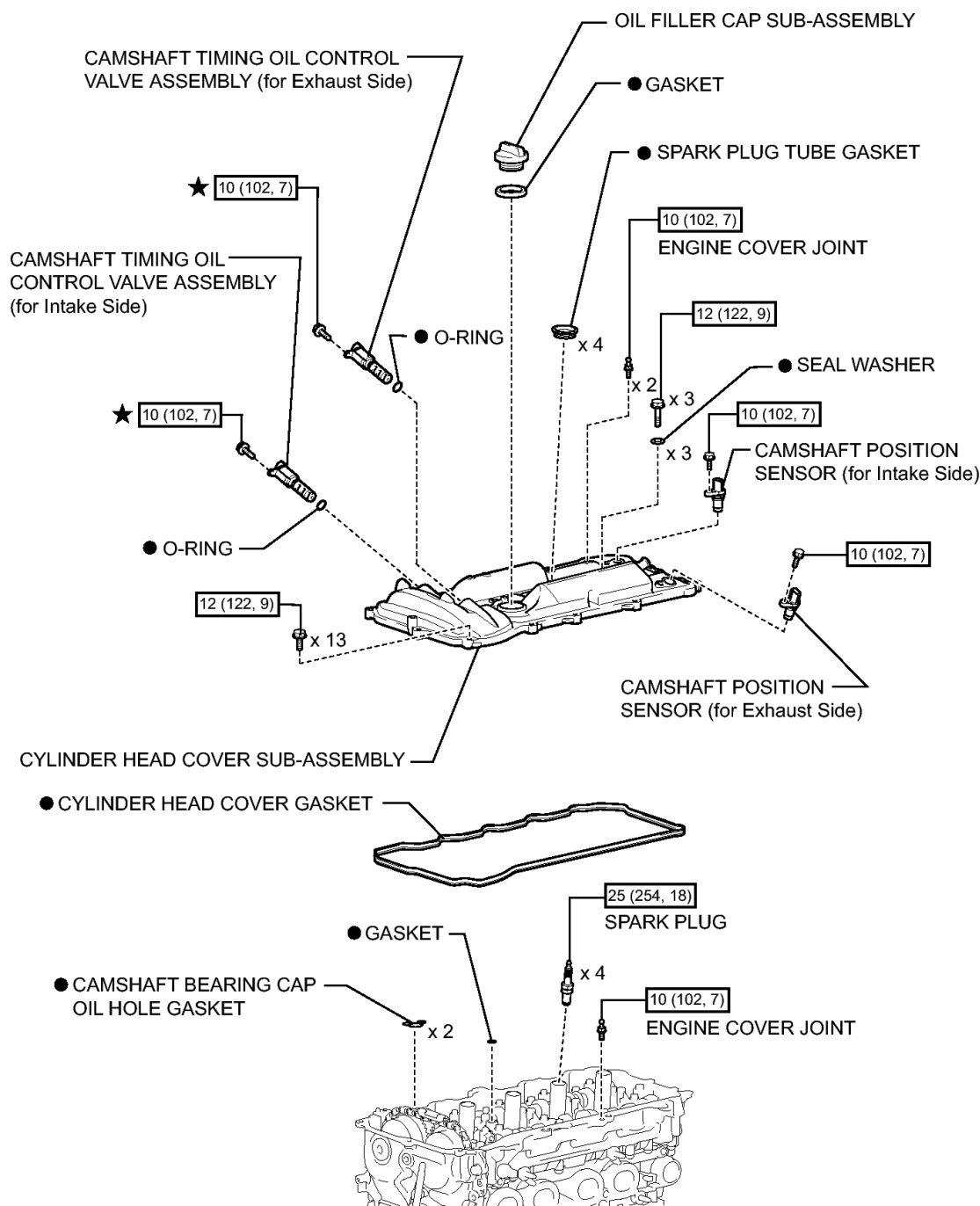
● Non-reusable part

★ Precoated part

P

**Fig. 184: Identifying Engine Unit Replacement Components With Torque Specifications (5 Of 10)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## ILLUSTRATION



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

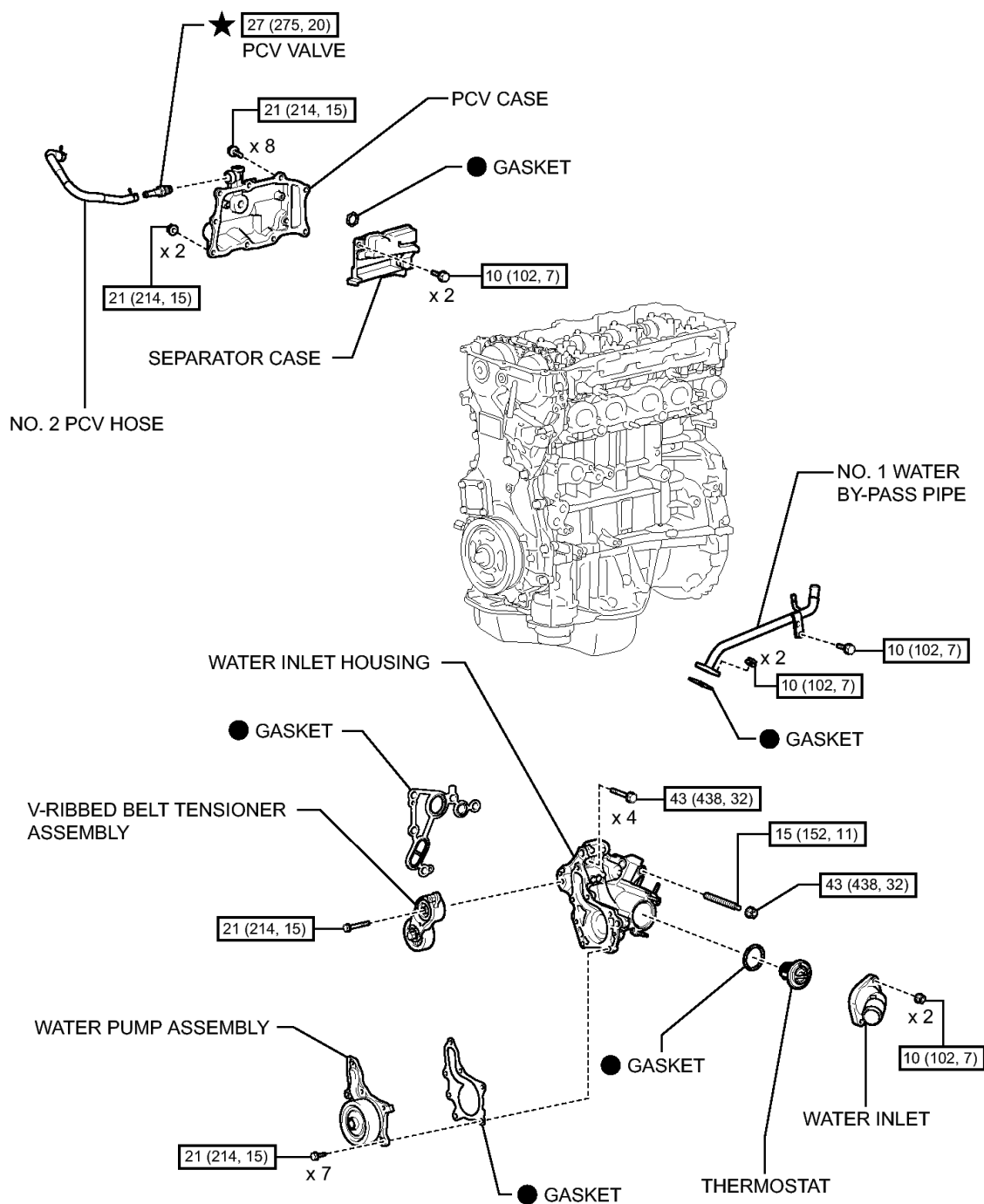
● Non-reusable part

★ Precoated part

P

**Fig. 185: Identifying Engine Unit Replacement Components With Torque Specifications (6 Of 10)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION



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

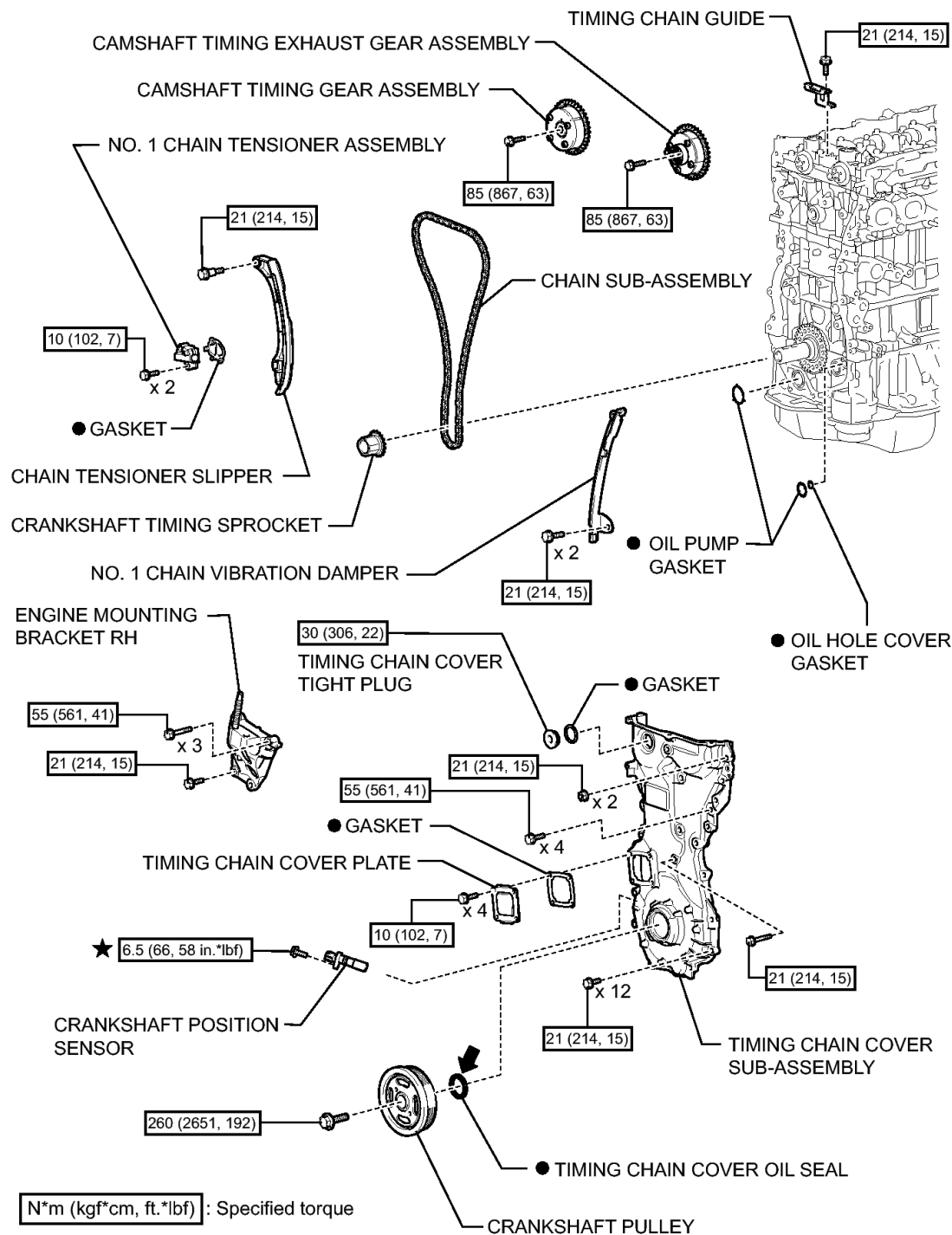
● Non-reusable part

★ Precoated part

P

**Fig. 186: Identifying Engine Unit Replacement Components With Torque Specifications (7 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

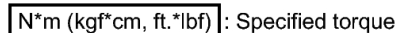
ILLUSTRATION



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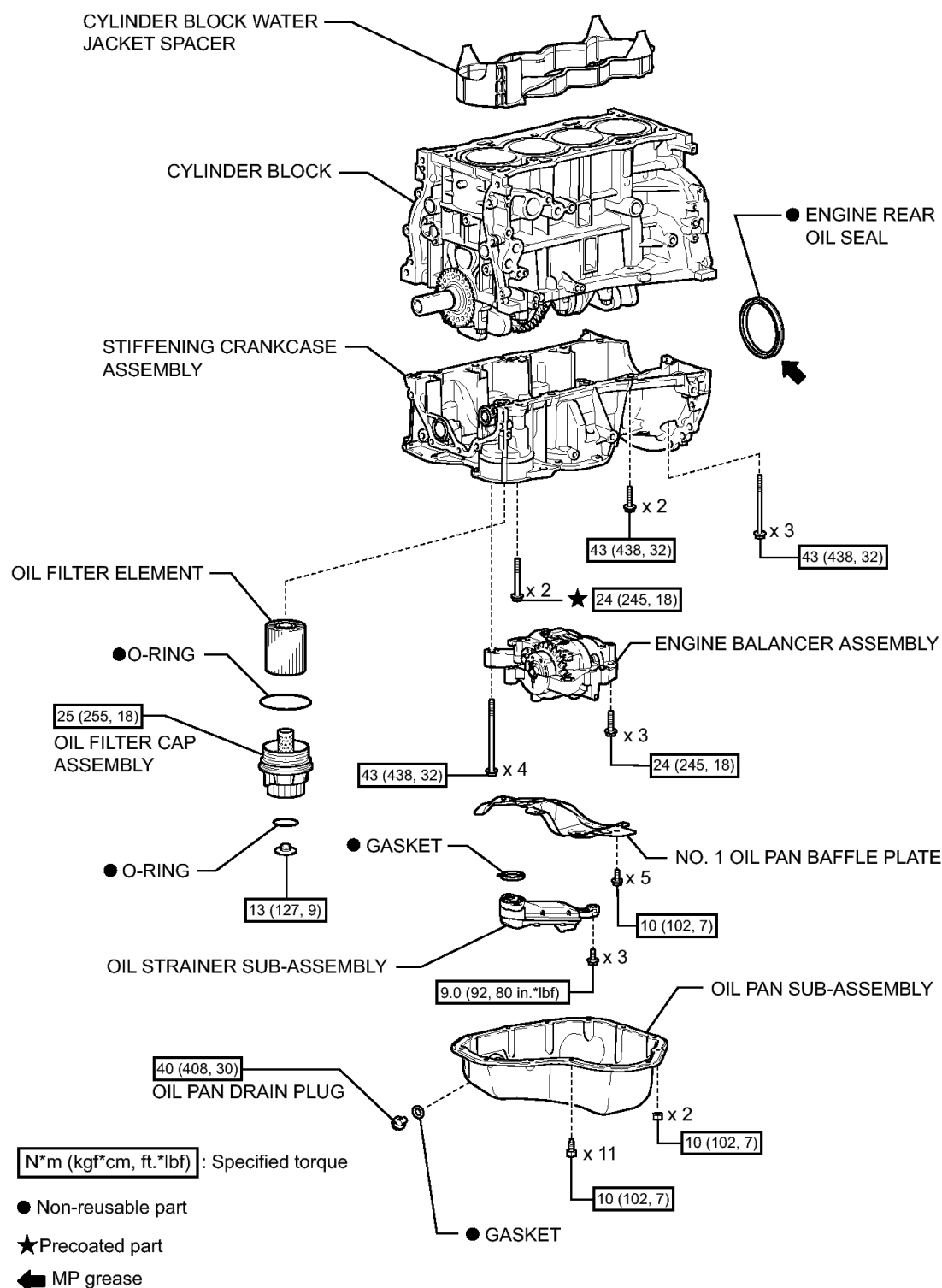
**Fig. 187: Identifying Engine Unit Replacement Components With Torque Specifications (8 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ILLUSTRATION



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## ILLUSTRATION



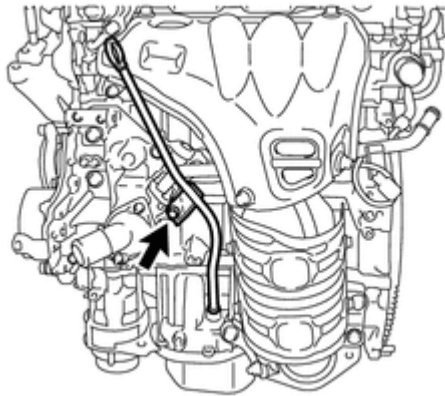
P

**Fig. 189: Identifying Engine Unit Replacement Components With Torque Specifications (10 Of 10)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL

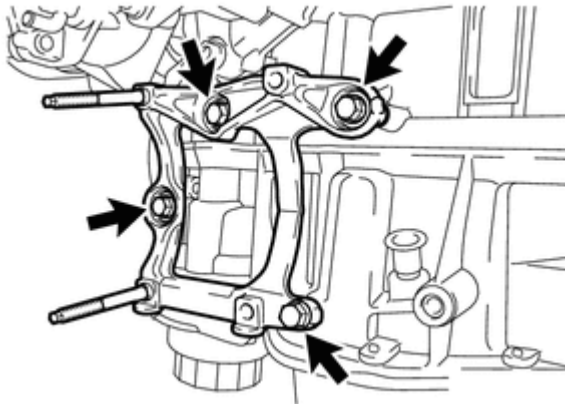
**REMOVAL**

1. **REMOVE THROTTLE BODY ASSEMBLY** . Refer to **REMOVAL - Step 4**
2. **DISCONNECT FUEL TUBE SUB-ASSEMBLY** . Refer to **REMOVAL - Step 7**
3. **REMOVE WIRE HARNESS** . Refer to **REMOVAL - Step 8**
4. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** . Refer to **REMOVAL - Step 9**
5. **DISCONNECT WIRE HARNESS** . Refer to **REMOVAL - Step 7**
6. **DISCONNECT NO. 2 PCV HOSE** . Refer to **REMOVAL - Step 8**
7. **REMOVE INTAKE MANIFOLD** . Refer to **REMOVAL - Step 9**
8. **REMOVE ENGINE OIL LEVEL DIPSTICK GUIDE**
  - a. Remove the engine oil level dipstick.

**P****Fig. 190: Location of Dipstick Guide Bolt**

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

- b. Remove the bolt and dipstick guide.
  - c. Remove the O-ring from the dipstick guide.
9. **REMOVE MANIFOLD STAY** . Refer to **REMOVAL - Step 7**
10. **REMOVE NO. 2 MANIFOLD STAY** . Refer to **REMOVAL - Step 8**
11. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to **REMOVAL - Step 9**
12. **REMOVE NO. 2 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to **REMOVAL - Step 10**
13. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** . Refer to **REMOVAL - Step 11**
14. **REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET**
  - a. Remove the 4 bolts and bracket.

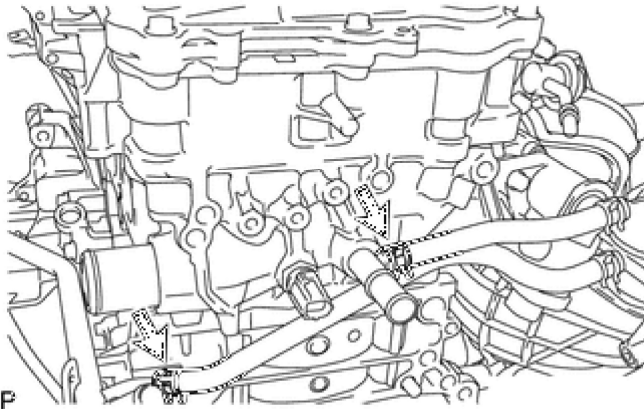


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**Fig. 191: Location of No. 1 Compressor Mounting Bracket Bolts**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE WATER BY-PASS HOSE**

- a. Remove the No. 1 and No. 2 water by-pass hoses.



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**Fig. 192: Location of No. 1 And No. 2 Water By-Pass Hoses**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY** . Refer to **REMOVAL - Step 1**
17. **REMOVE ENGINE COOLANT TEMPERATURE SENSOR** . Refer to **REMOVAL - Step 3**
18. **REMOVE IGNITION COIL ASSEMBLY** . Refer to **REMOVAL - Step 1**

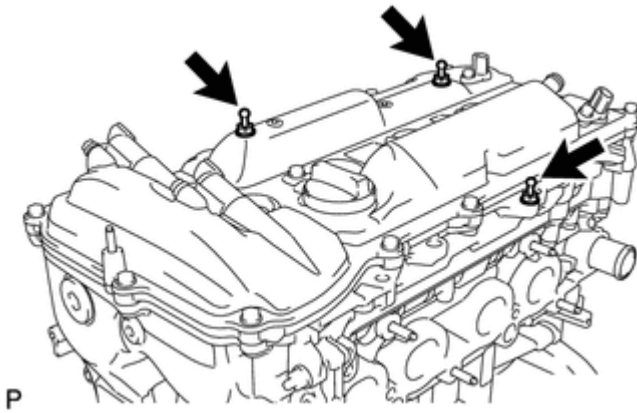
**DISASSEMBLY**

**DISASSEMBLY**

**1. REMOVE ENGINE COVER JOINT**

- a. Remove the 3 joints.

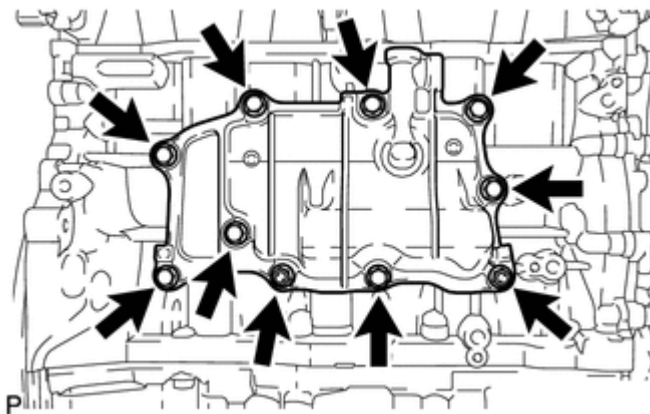




**Fig. 193: Location of Engine Cover Joint**

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

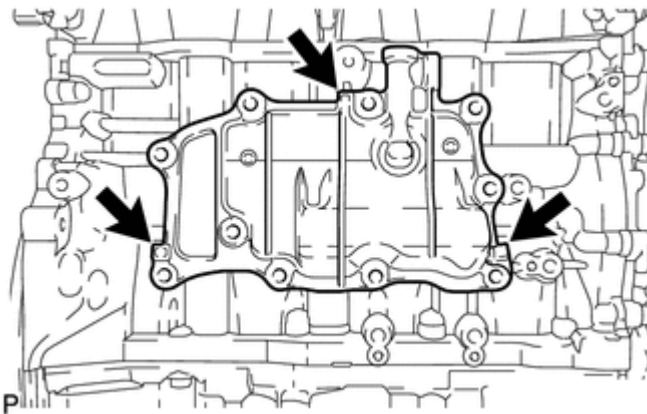
2. **REMOVE SPARK PLUG** . Refer to **REMOVAL - Step 2**
3. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)** . Refer to **REMOVAL - Step 2**
4. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)** . Refer to **REMOVAL - Step 1**
5. **REMOVE CAMSHAFT POSITION SENSOR (for Intake Side)** . Refer to **REMOVAL - Step 2**
6. **REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side)** . Refer to **REMOVAL - Step 1**
7. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
  - a. Remove the oil filler cap from the cylinder head.
  - b. Remove the gasket from the oil filler cap.
8. **REMOVE CRANKSHAFT POSITION SENSOR** . Refer to **REMOVAL - Step 2**
9. **REMOVE PCV VALVE** . Refer to **REMOVAL - Step 2**
10. **REMOVE PCV CASE**
  - a. Remove the 8 bolts and 2 nuts.



**Fig. 194: Location of Ventilation Case Sub-Assembly Bolts And Nuts**

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

- b. Remove the PCV case by prying between the PCV case and cylinder block with a screwdriver.



**Fig. 195: Location of Ventilation Case**

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

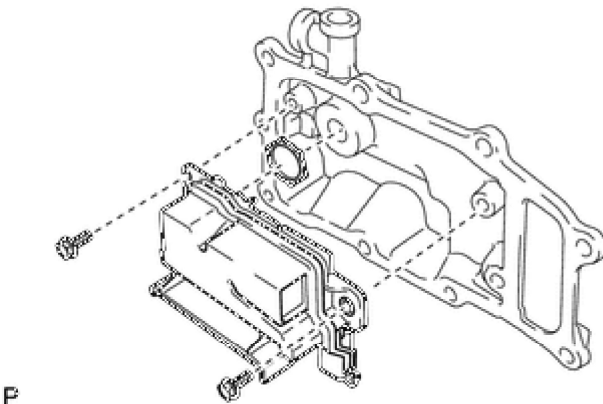
**NOTE:** Be careful not to damage the contact surfaces of the cylinder block and PCV case.

**HINT:**

Tape the screwdriver tip before use.

## 11. REMOVE SEPARATOR CASE

- a. Remove the 2 bolts, separator case and gasket.

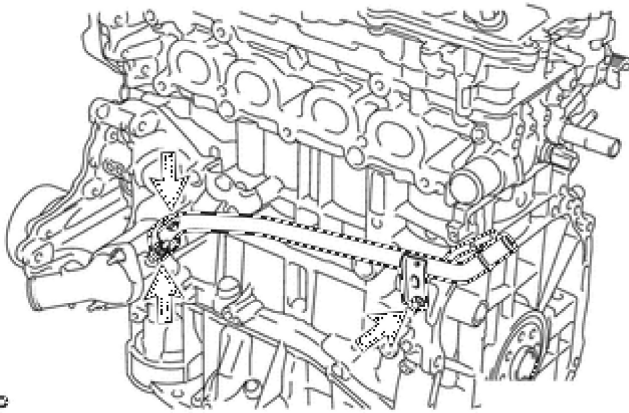


**Fig. 196: Identifying Separator Case With Bolts**

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

## 12. REMOVE NO. 1 WATER BY-PASS PIPE

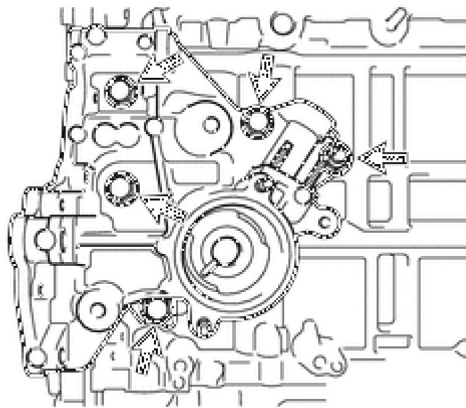
- a. Remove the bolt, 2 nuts, water by-pass pipe and gasket.



P

**Fig. 197: Location of Water By-Pass Pipe And Gasket Bolt And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

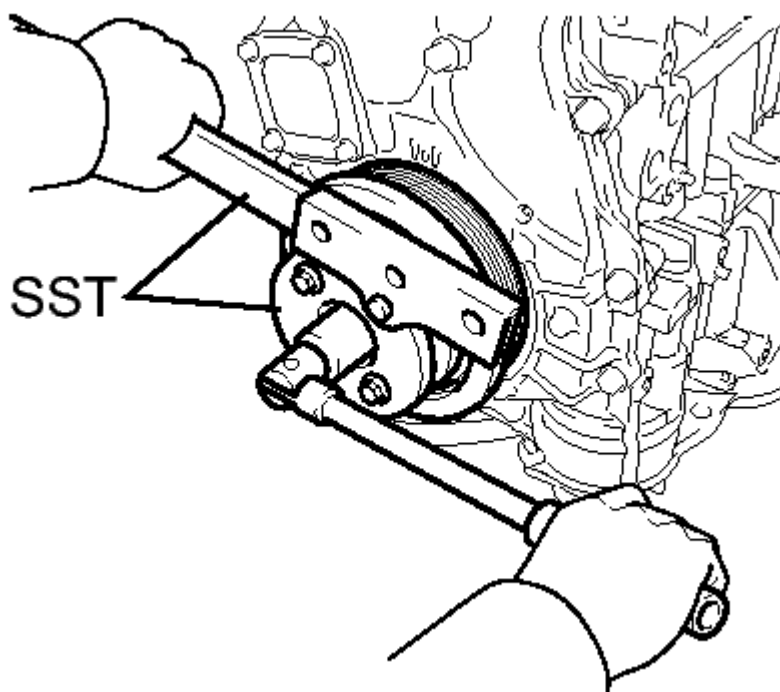
13. **REMOVE WATER INLET** . Refer to **REMOVAL - Step 6**
14. **REMOVE THERMOSTAT** . Refer to **REMOVAL - Step 7**
15. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY** . Refer to **REMOVAL - Step 8**
16. **REMOVE WATER PUMP ASSEMBLY** . Refer to **REMOVAL - Step 9**
17. **REMOVE WATER INLET HOUSING**
  - a. Remove the 4 bolts, nut, water inlet housing and gasket.



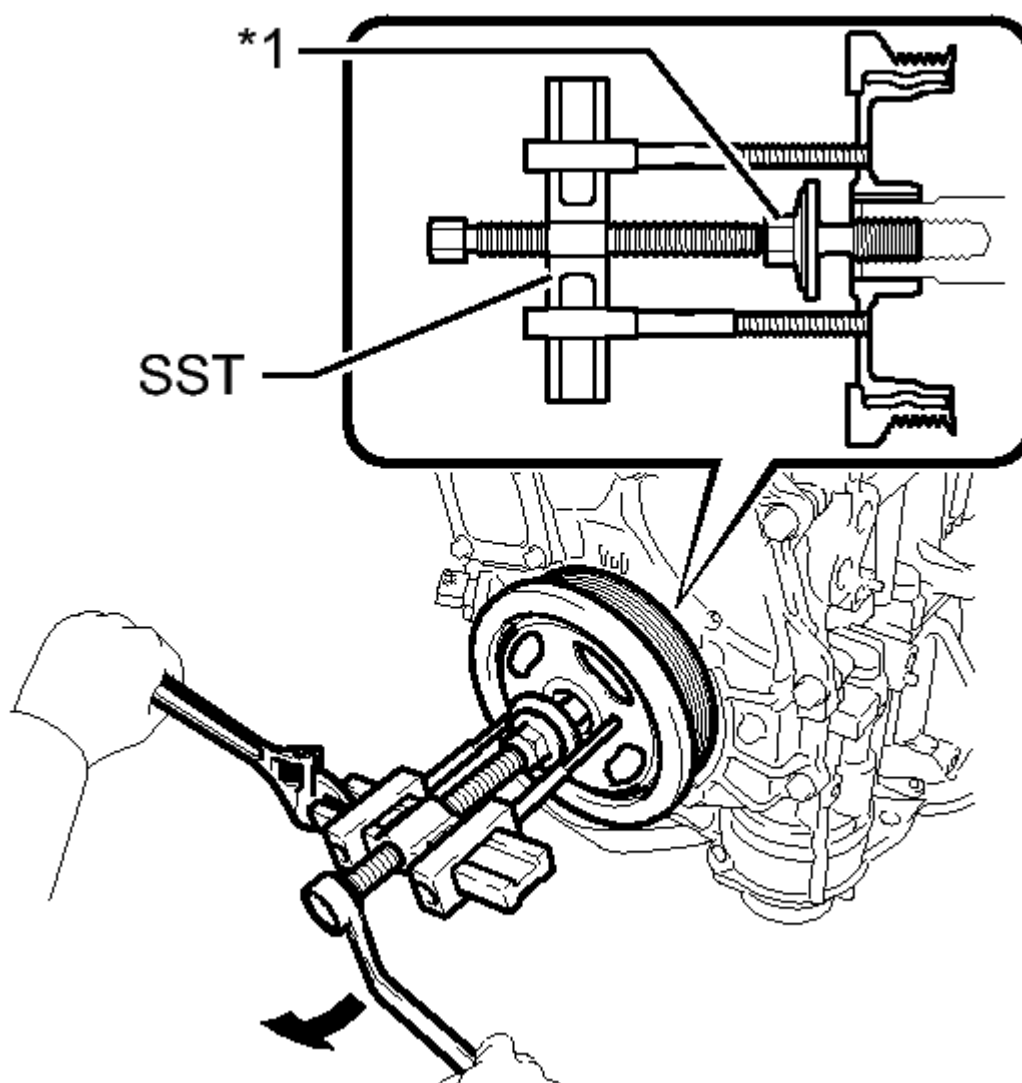
P

**Fig. 198: Location of Inlet Water Housing And Gasket Bolts And Nut**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE CRANKSHAFT PULLEY**
  - a. Using SST, hold the crankshaft pulley and loosen the pulley bolt until 2 or 3 threads are screwed into the crankshaft.

**P****Fig. 199: Holding Crankshaft Pulley****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- SST: 09213-54015
  - SST: 91551-80650
  - SST: 09330-00021
- b. Using SST and the pulley bolt, remove the crankshaft pulley.

**P**

**Fig. 200: Removing Crankshaft Pulley Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09950-50013  
09954-05011  
09951-05010  
09952-05010  
09953-05020

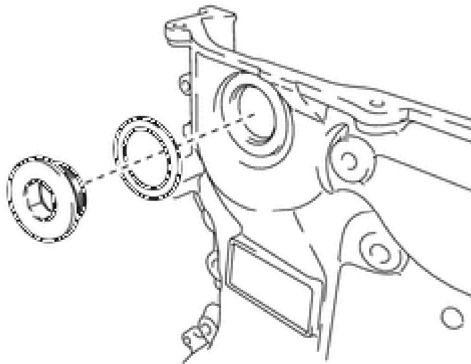
**TEXT IN ILLUSTRATION**

*1	Pulley Bolt
----	-------------

**HINT:**

Apply lubricant to the threads and end of SST.

19. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** . Refer to **REMOVAL - Step 4**
20. **REMOVE SPARK PLUG TUBE GASKET** . Refer to **REMOVAL - Step 5**
21. **REMOVE ENGINE MOUNTING BRACKET RH** . Refer to **REMOVAL - Step 8**
22. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY** . Refer to **REMOVAL - Step 10**
23. **REMOVE TIMING CHAIN COVER TIGHT PLUG**
  - a. Using a 14 mm hexagon wrench, remove the plug and gasket.

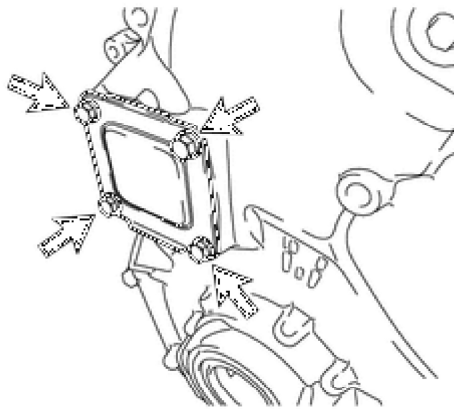


P

**Fig. 201: Identifying Plug And Gasket**

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

24. **REMOVE TIMING CHAIN COVER PLATE**
  - a. Remove the 4 bolts, timing chain cover plate and gasket.



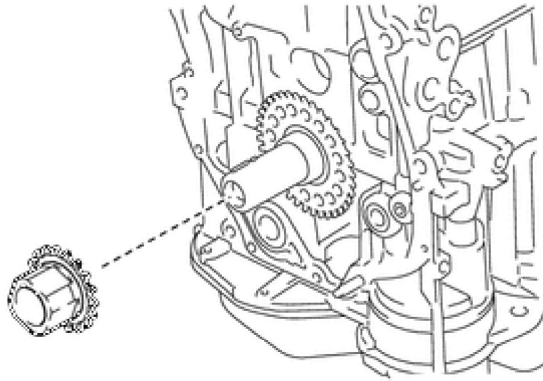
P

**Fig. 202: Location of Timing Chain Cover Plate Bolts**

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

25. **REMOVE TIMING CHAIN COVER OIL SEAL** . Refer to **REMOVAL - Step 11**
26. **SET NO. 1 CYLINDER TO TDC/COMPRESSION** See step 11
27. **REMOVE TIMING CHAIN GUIDE** See step 12
28. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY** See step 13
29. **REMOVE CHAIN TENSIONER SLIPPER** See step 14

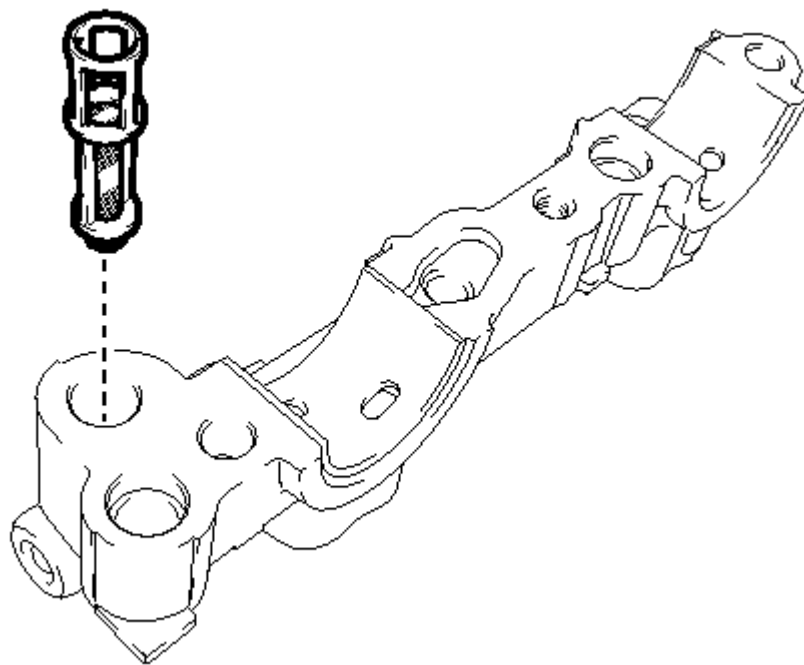
- 30. **REMOVE CHAIN SUB-ASSEMBLY**
- 31. **REMOVE NO. 1 CHAIN VIBRATION DAMPER** See step 16
- 32. **REMOVE CRANKSHAFT TIMING SPROCKET**
  - a. Remove the crankshaft timing sprocket from the crankshaft.



F

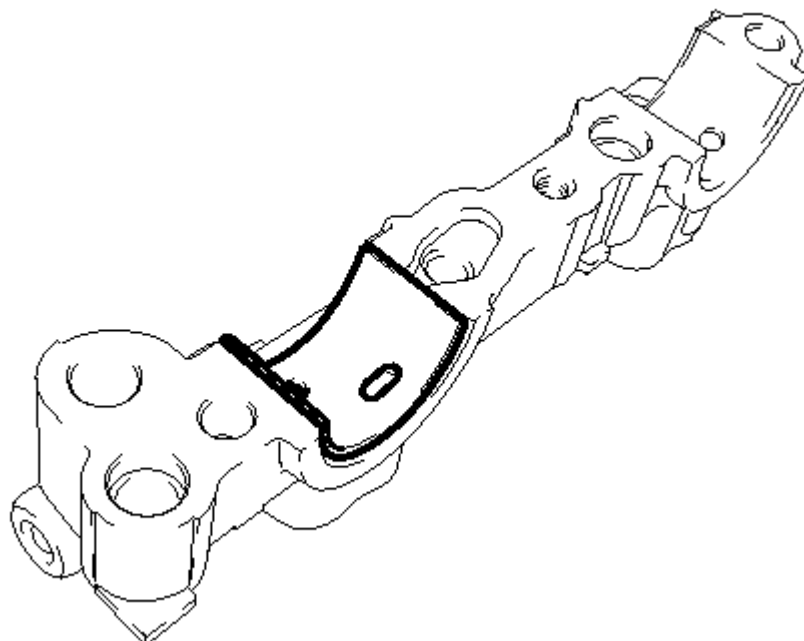
**Fig. 203: Identifying Crankshaft Timing Sprocket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 33. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY** See step 17
- 34. **REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY** See step 18
- 35. **REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY** See step 19
- 36. **REMOVE CAMSHAFT BEARING CAP** See step 20
- 37. **REMOVE OIL CONTROL VALVE FILTER**
  - a. Remove the oil control valve filter from the No. 1 camshaft bearing cap.

**P****Fig. 204: Identifying Oil Control Valve Filter**

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

- 38. **REMOVE CAMSHAFT** See step 23
- 39. **REMOVE NO. 1 CAMSHAFT BEARING**
  - a. Remove the No. 1 camshaft bearing.

**P**

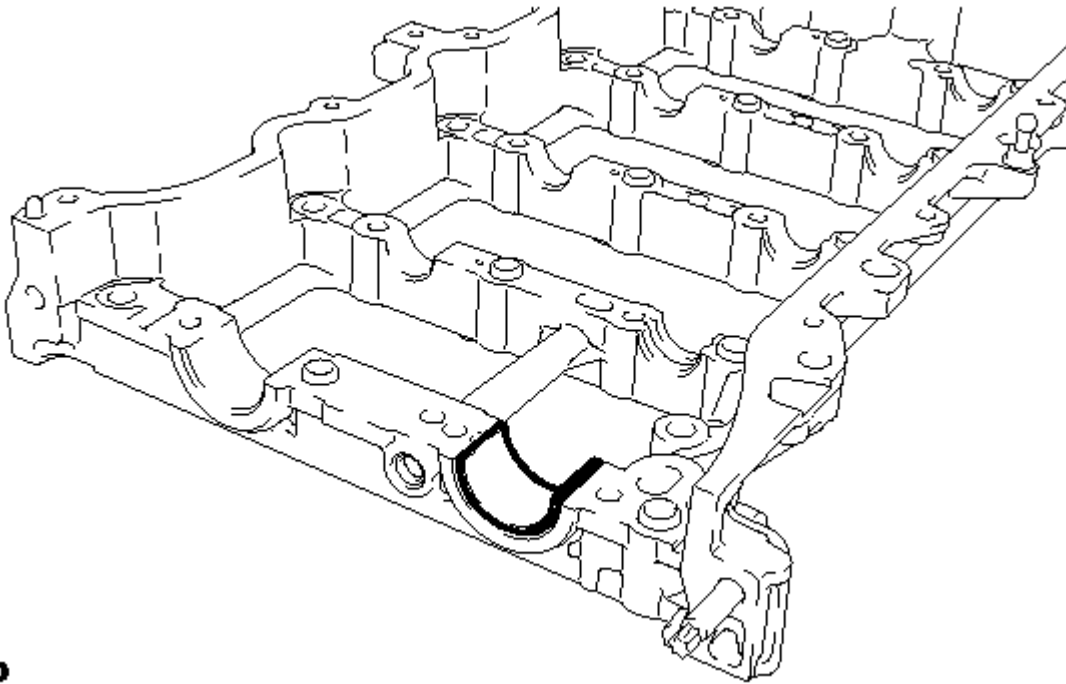


**Fig. 205: Identifying No. 1 Camshaft Bearing**

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

**40. REMOVE NO. 2 CAMSHAFT BEARING**

- a. Remove the No. 2 camshaft bearing.

**P****Fig. 206: Identifying No. 2 Camshaft Bearing**

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

**41. REMOVE CAMSHAFT HOUSING STUD BOLT**

**NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

**42. REMOVE CAMSHAFT BEARING CAP SETTING RING PIN**

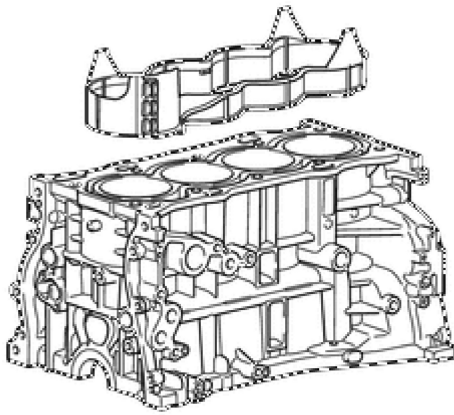
**NOTE:** It is not necessary to remove the ring pin unless it is being replaced.

**43. REMOVE CAMSHAFT HOUSING STRAIGHT PIN**

**NOTE:** It is not necessary to remove the straight pin unless it is being replaced.

**44. REMOVE VALVE ROCKER ARM SUB-ASSEMBLY** See step 25**45. REMOVE VALVE LASH ADJUSTER ASSEMBLY** See step 26**46. REMOVE VALVE STEM CAP** See step 27**47. REMOVE CYLINDER HEAD SUB-ASSEMBLY** See step 28

48. **REMOVE CYLINDER HEAD GASKET** See step 29
49. **REMOVE CYLINDER BLOCK WATER JACKET SPACER**
- Remove the cylinder block water jacket spacer from the cylinder block.

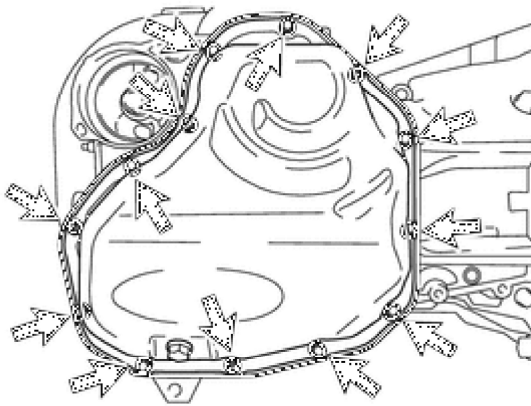


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**Fig. 207: Identifying Cylinder Block Water Jacket Spacer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

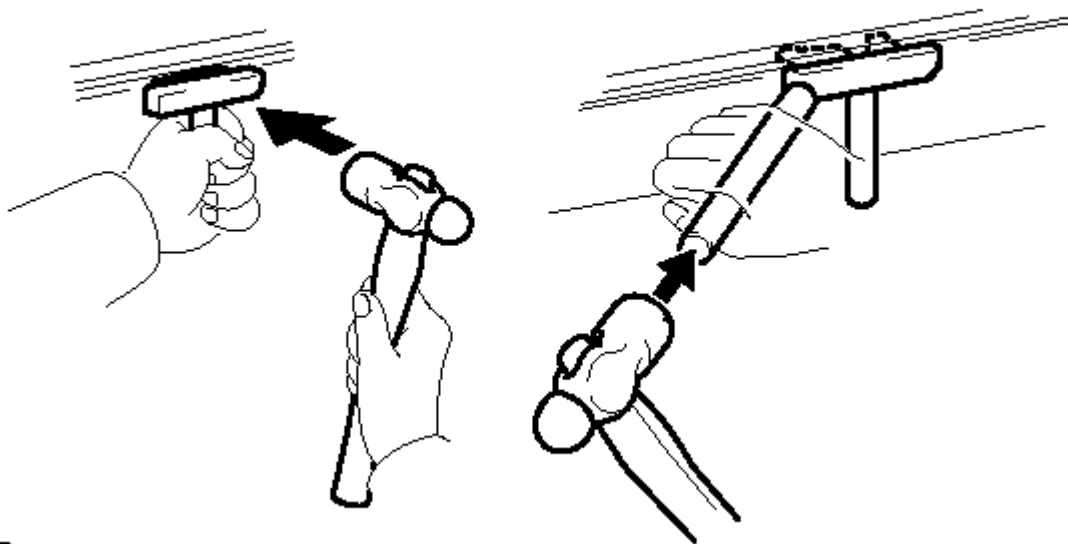
50. **REMOVE OIL FILTER ELEMENT** . Refer to REPLACEMENT - Step 3
51. **REMOVE OIL PAN SUB-ASSEMBLY**
- Remove the 11 bolts and 2 nuts.



P

**Fig. 208: Location of Oil Pan Sub-Assembly Bolts And Nuts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Insert the blade of an oil pan seal cutter between the oil pan and stiffening crankcase, cut off the applied sealer and remove the oil pan.

**P**

**Fig. 209: Inserting Blade Of SST Between No. 1 & No. 2 Oil Pans**

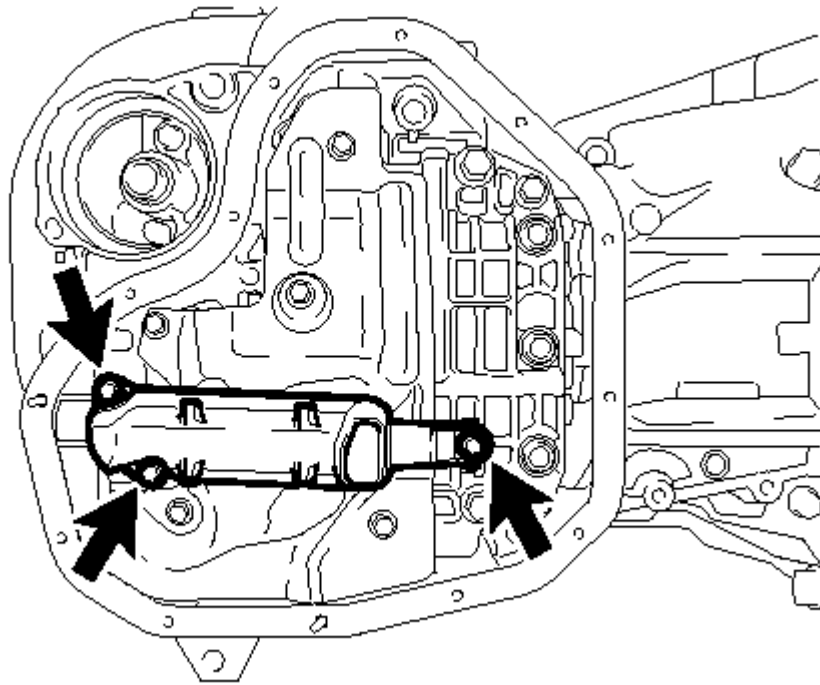
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- Be careful not to damage the contact surfaces of the stiffening crankcase and oil pan.
- Be careful not to damage the stiffening crankcase flange.

**52. REMOVE OIL STRAINER SUB-ASSEMBLY**

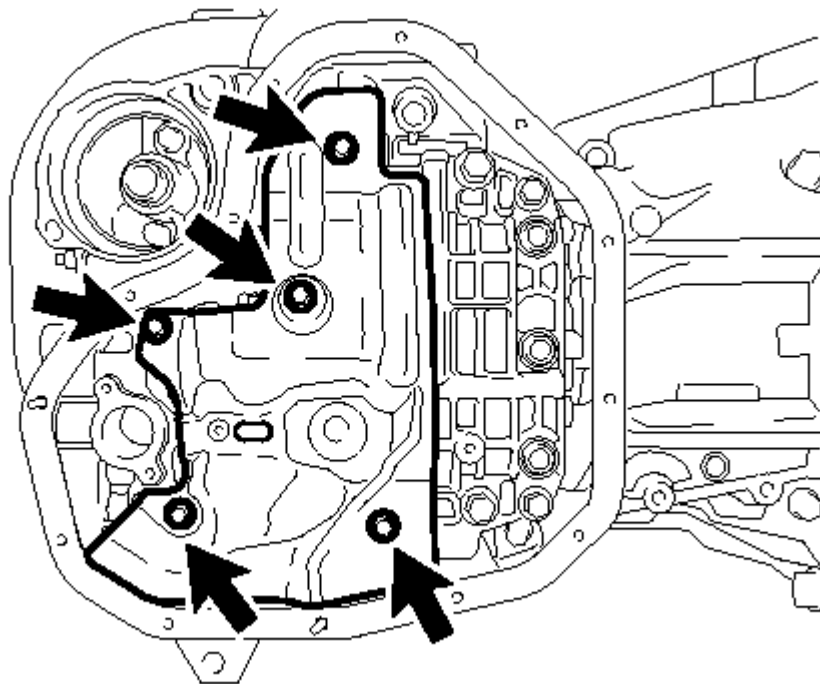
- a. Remove the 3 bolts, oil strainer and gasket.

**P**

**Fig. 210: Location of Oil Strainer And Gasket Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**53. REMOVE NO. 1 OIL PAN BAFFLE PLATE**

- a. Remove the 5 bolts and oil pan baffle plate.

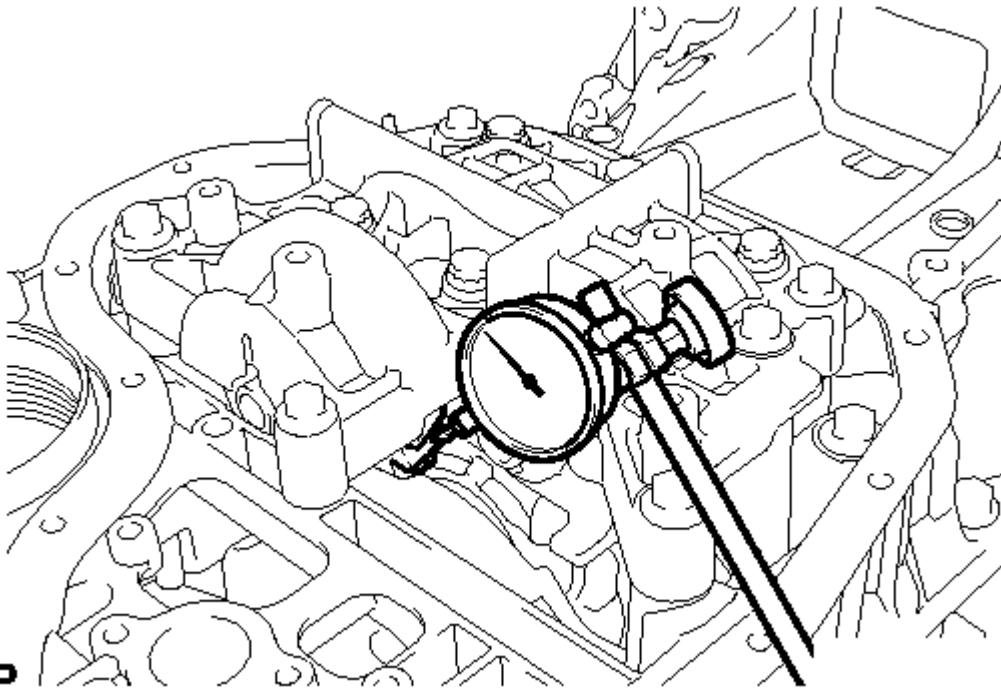
**P**

**Fig. 211: Location of Oil Pan Baffle Plate Bolts**

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

#### 54. INSPECT CRANKSHAFT BACKLASH

- a. Using a dial indicator, measure the backlash of the crankshaft and balance shaft as shown in the illustration.



**P**

**Fig. 212: Measuring Backlash Of Crankshaft And Balance Shaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard backlash

0.005 to 0.020 mm (0.000197 to 0.000787 in.)

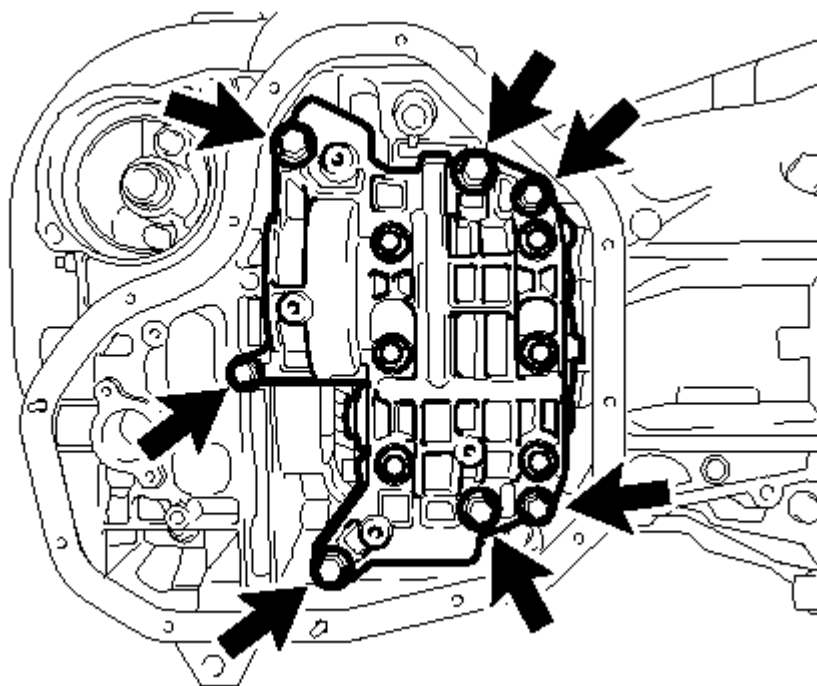
Maximum backlash

0.020 mm (0.000787 in.)

If the backlash is more than the maximum, replace the engine balancer assembly.

#### 55. REMOVE ENGINE BALANCER ASSEMBLY

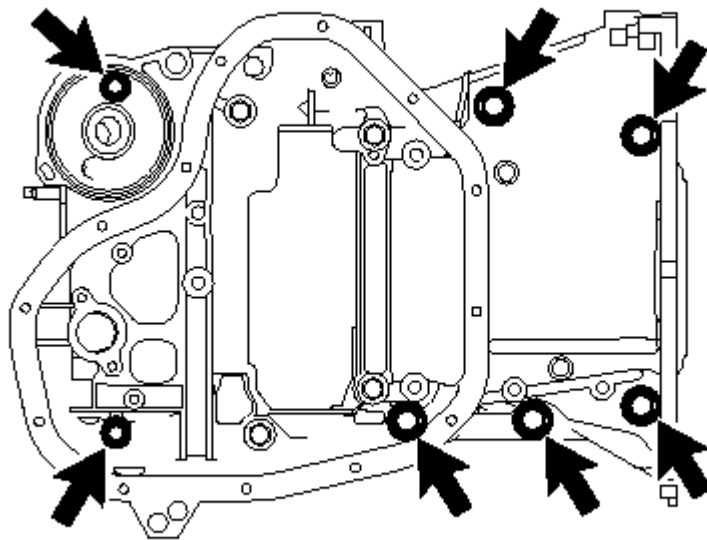
- a. Remove the 7 bolts and engine balancer.

**P****Fig. 213: Location of Engine Balancer Bolts**

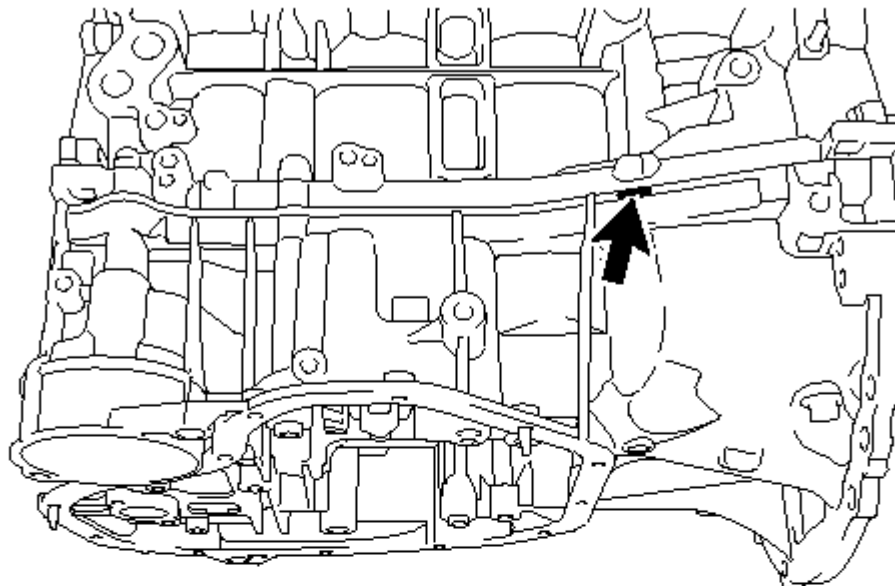
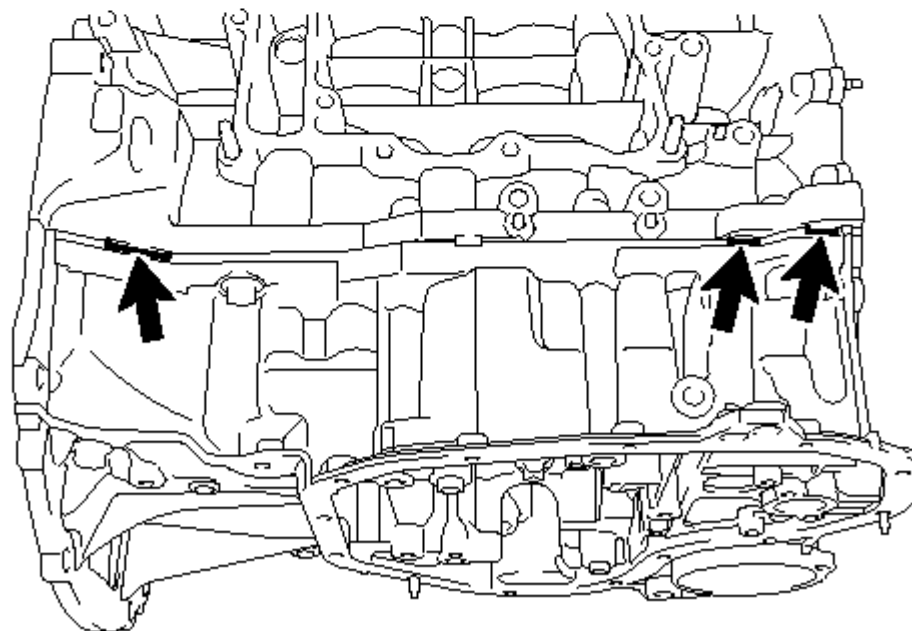
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE: Do not disassemble the engine balancer.**

56. **INSPECT BALANCE SHAFT THRUST CLEARANCE** See step 14
57. **REMOVE STIFFENING CRANKCASE ASSEMBLY**
  - a. Remove the 7 bolts.

**P****Fig. 214: Location of Stiffening Crankcase Assembly Bolts****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Using a screwdriver, remove the stiffening crankcase by prying between the stiffening crankcase and cylinder block at the places shown in the illustration.

**\*A****\*B****P**

**Fig. 215: Prying Surfaces For Removing Stiffening Crankcase**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*A	LH Side
----	---------



*B RH Side
------------

**HINT:**

Tape the screwdriver tip before use.

**NOTE:** Be careful not to damage the contact surfaces of the cylinder block and stiffening crankcase.

**58. REMOVE STIFFENING CRANKCASE STUD BOLT**

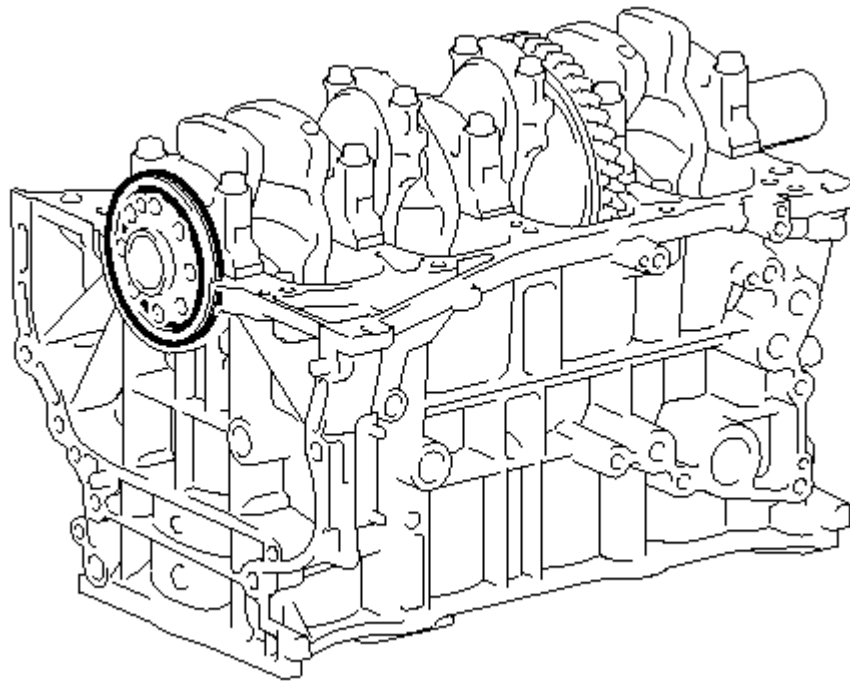
**NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

**59. REMOVE STIFFENING CRANKCASE RING PIN**

**NOTE:** It is not necessary to remove the ring pin unless it is being replaced.

**60. REMOVE ENGINE REAR OIL SEAL**

- a. Remove the engine rear oil seal from the cylinder block.

**P**

**Fig. 216: Identifying Rear Engine Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**INSPECTION****INSPECTION**

**1. INSPECT NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**

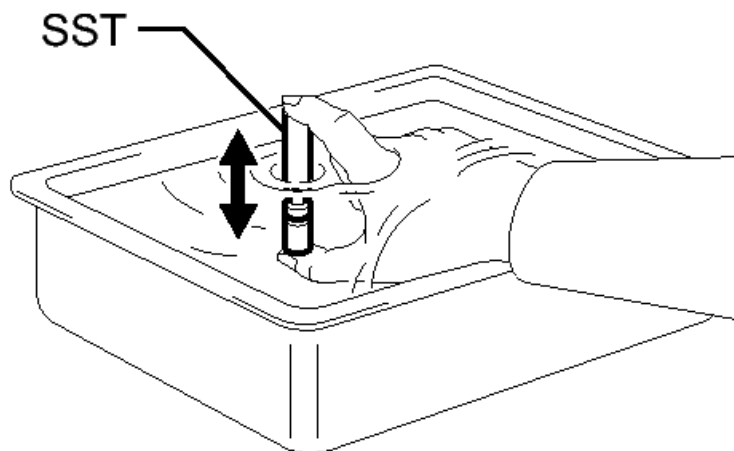
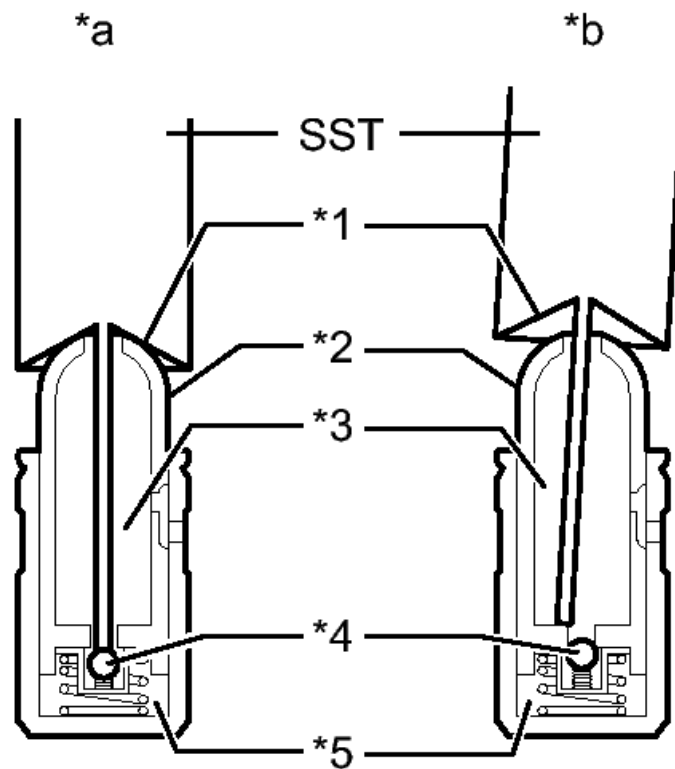
- a. Turn the roller by hand and check that it turns smoothly.

If the roller does not turn smoothly, replace the valve rocker arm sub-assembly.

**2. INSPECT VALVE LASH ADJUSTER ASSEMBLY****NOTE:**

- **Keep the adjuster free from dirt and foreign matter.**
- **Use only clean engine oil.**

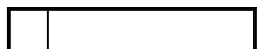
- a. Place the lash adjuster into a container full of new engine oil.



**P**

**Fig. 217: Inspecting Valve Lash Adjuster Assembly Using SST**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**



*1	Taper Part
*2	Plunger
*3	Low Pressure Chamber
*4	Check Ball
*5	High Pressure Chamber
*a	CORRECT
*b	INCORRECT

- b. Insert the tip of SST into the lash adjuster plunger and use the tip to press down on the check ball inside the plunger.
  - **SST: 09276-75010**
- c. Squeeze SST and the lash adjuster together to move the plunger up and down 5 to 6 times.
- d. 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.

- e. After bleeding the air, remove SST. Then try to quickly and firmly press the plunger with your fingers.

OK

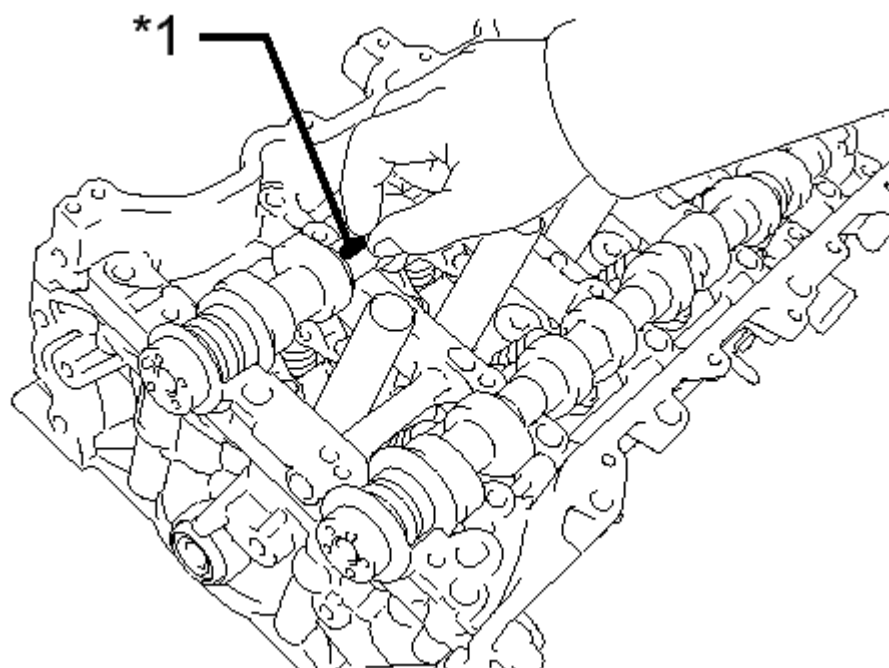
Plunger can be pressed 3 times.

If the plunger can still be compressed after pressing it 3 times, replace the valve lash adjuster with a new one.

### 3. INSPECT CAMSHAFT OIL CLEARANCE

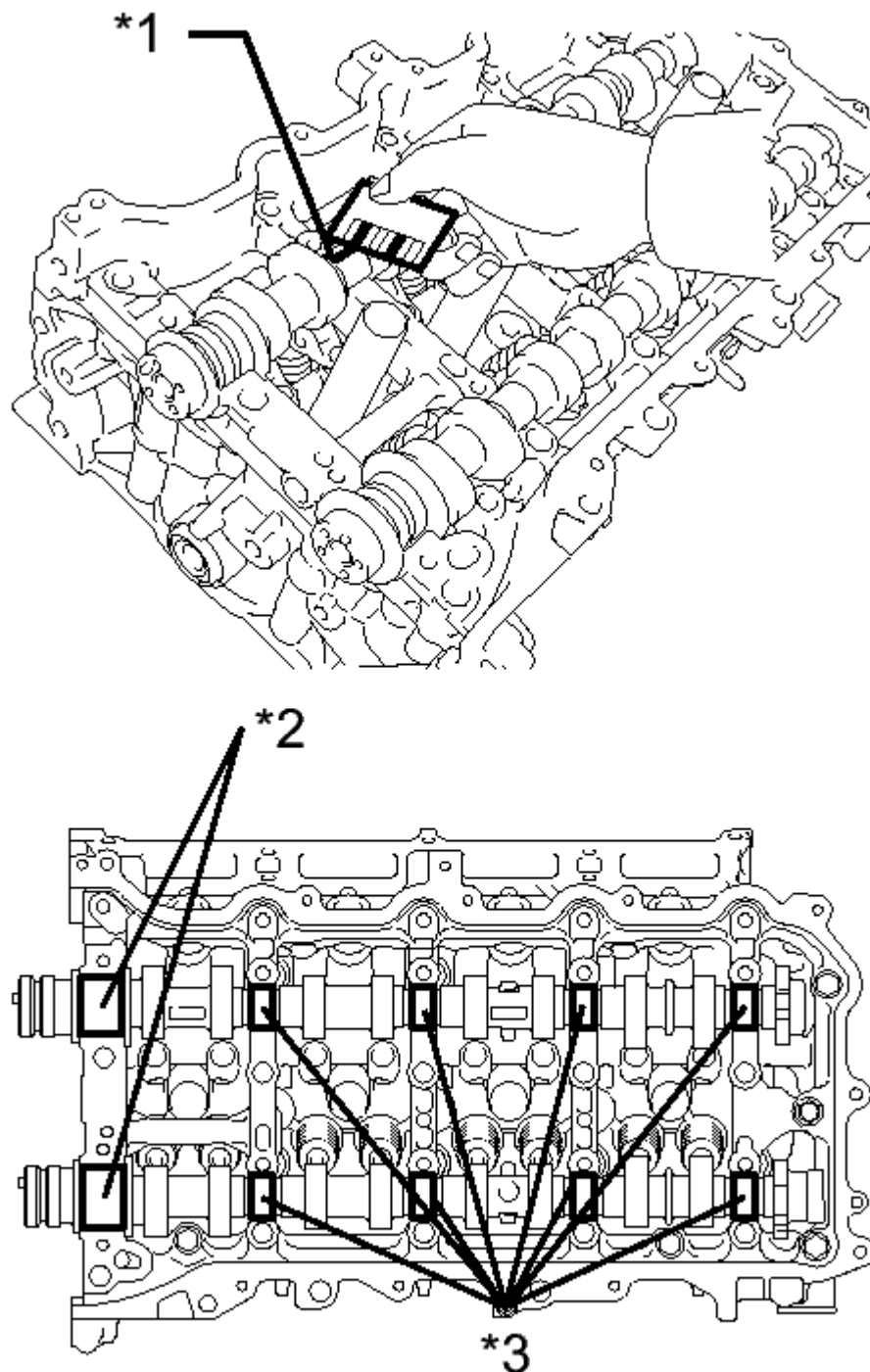
**NOTE:** Do not turn the camshafts.

- a. Clean the bearing caps, camshaft housing and camshaft journals.
- b. Place the camshafts on the camshaft housing.
- c. Lay a strip of Plastigage across each of the camshaft journals.

**P****Fig. 218: Inspecting Camshaft Oil Clearance****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****TEXT IN ILLUSTRATION**

*1	Plastigage
----	------------

- d. Install the camshaft bearing caps See step 11.
- e. Install the camshaft housing sub-assembly See step 12.
- f. Remove the camshaft bearing caps See step 20.
- g. Measure the Plastigage at its widest point.

**P****Fig. 219: Measuring The Plastigage**

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

Standard Oil Clearance



Item	Specified Condition
Intake No. 1 journal	0.035 to 0.072 mm (0.00137 to 0.00283 in.)
Exhaust No. 1 journal	0.049 to 0.086 mm (0.00193 to 0.00339 in.)
Other journals	0.025 to 0.062 mm (0.00098 to 0.00244 in.)

## Maximum Oil Clearance

Item	Specified Condition
Intake No. 1 journal	0.085 mm (0.00335 in.)
Exhaust No. 1 journal	0.095 mm (0.00374 in.)
Other journals	0.085 mm (0.00335 in.)

## TEXT IN ILLUSTRATION

*1	Plastigage
*2	No. 1 Journal
*3	Other Journals

If the oil clearance is more than the maximum, replace the camshaft. If necessary, replace the camshaft housing.

4. **INSPECT CAMSHAFT THRUST CLEARANCE** See step 85. **INSPECT CAMSHAFT**

- a. Inspect the camshaft runout.
  1. Place the camshaft on V-blocks.
  2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout

0.03 mm (0.00118 in.)

If the circle runout is more than the maximum, replace the camshaft sub-assembly.

**HINT:**

Check the oil clearance after replacing the camshaft.

b. Inspect the cam lobes.

1. Using a micrometer, measure the cam lobe height.

Standard Cam Lobe Height

Item	Specified Condition
Intake	44.163 to 44.305 mm (1.739 to 1.744 in.)
Exhaust	44.144 to 44.286 mm (1.738 to 1.744 in.)

Minimum Cam Lobe Height

Item	Specified Condition
Intake	44.013 mm (1.733 in.)
Exhaust	43.996 mm (1.732 in.)

If the cam lobe height is less than the minimum, replace the camshaft sub-assembly.

c. Inspect the camshaft journals.

1. Using a micrometer, measure the journal diameter.

Standard Journal Diameter

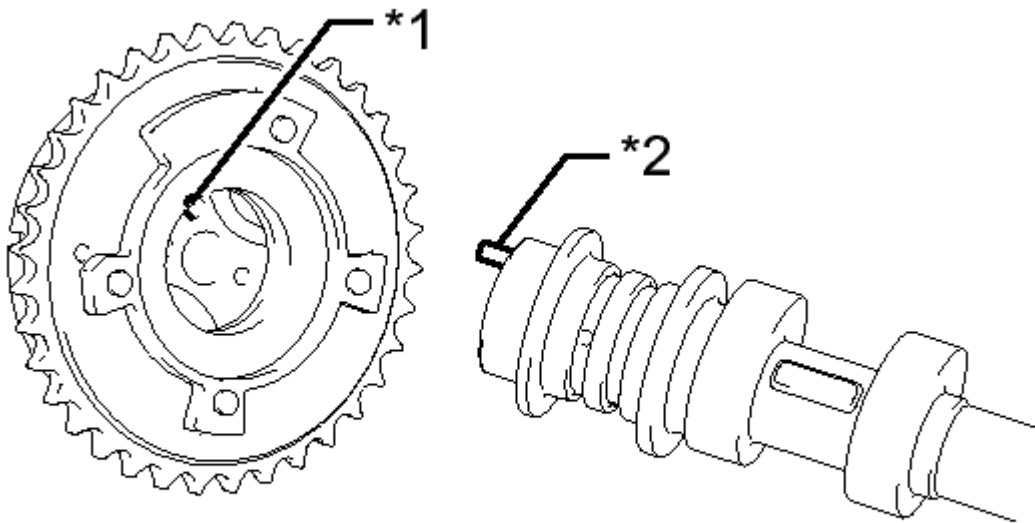
Item	Specified Condition
No. 1 journal	34.449 to 34.465 mm (1.356 to 1.357 in.)
Other journals	22.959 to 22.975 mm (0.904 to 0.905 in.)



If the journal diameter is not as specified, check the oil clearance.

## 6. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Align the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear and attach the gear to the camshaft.



**P**

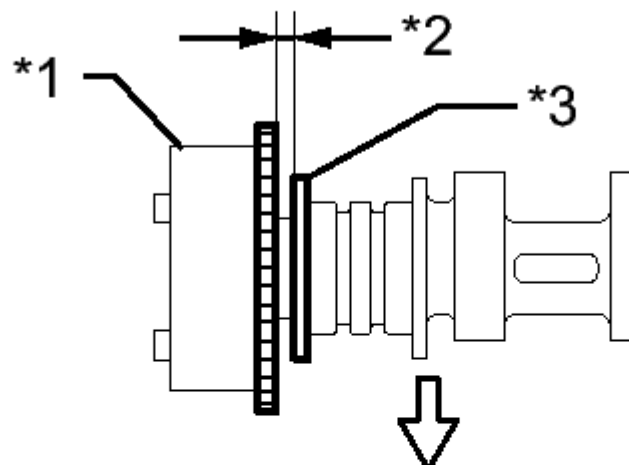
**Fig. 220: Aligning No. 1 Camshaft Knock Pin & Timing Gear Pin Hole**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### TEXT IN ILLUSTRATION

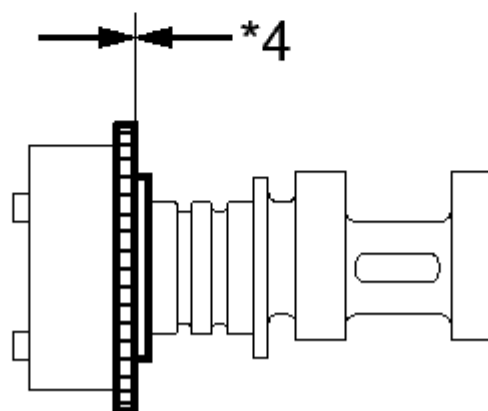
*1	Pin Hole
*2	Knock Pin

- b. Check that there is no clearance between the camshaft timing gear and camshaft flange.

\*a



\*b

**P**

**Fig. 221: Checking Clearance Between Camshaft Timing Gear & Flange**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

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

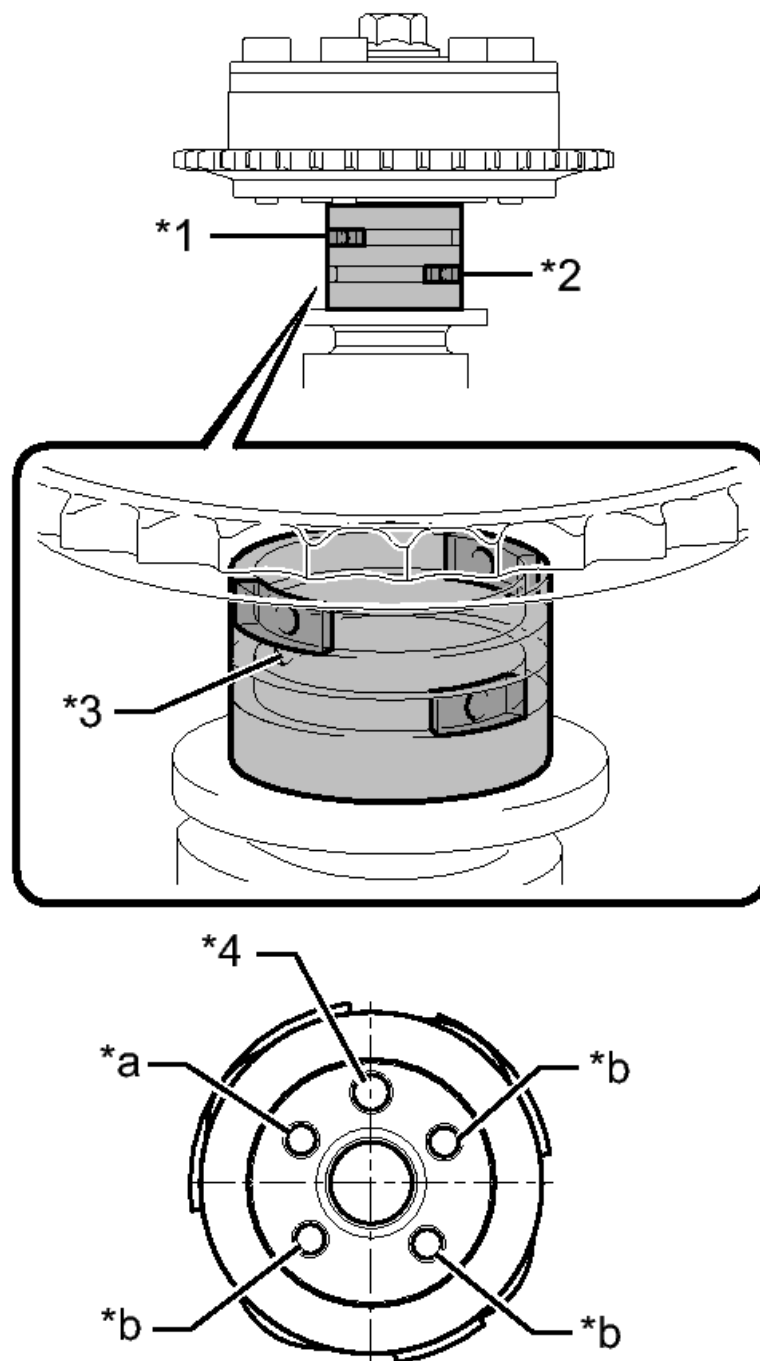
- c. Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

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

- d. Check the lock of the camshaft timing gear.
  - 1. Make sure that the camshaft timing gear is locked.



**NOTE:**        **Be careful not to damage the camshaft.**

- e. Release the lock pin.
  - 1. Clean the camshaft journal with non-residue solvent.
  - 2. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

**P****Fig. 222: Camshaft Journal Oil Paths**

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

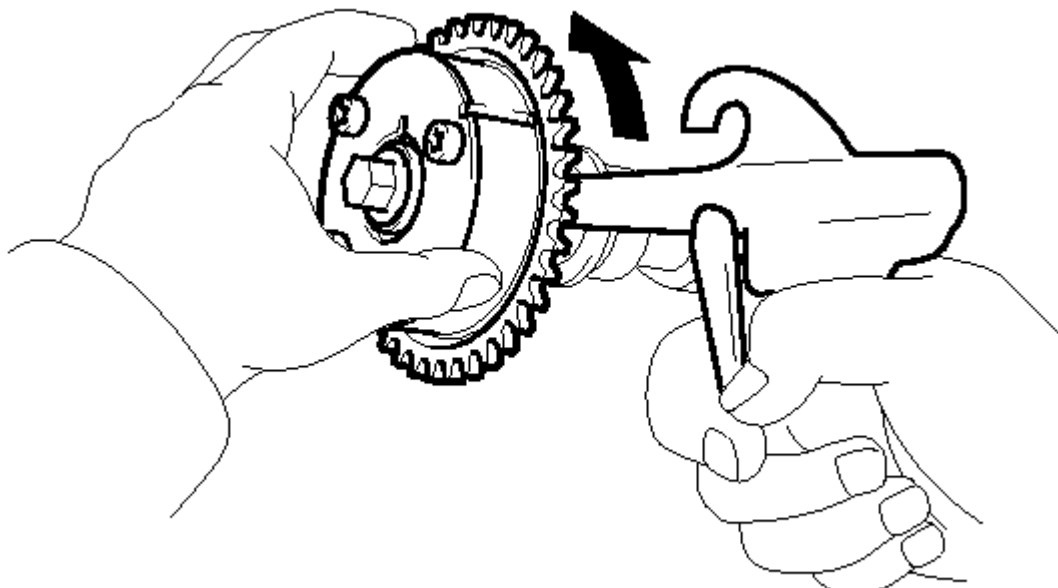
**TEXT IN ILLUSTRATION**

*1	Retard Side Path
*2	Advance Side Path
*3	Port A
*4	Knock Pin
*a	Open
*b	Closed
	Rubber
	Vinyl Tape

**HINT:**

There are 4 oil paths in the grooves of the camshaft. Plug three of the paths with pieces of rubber.

3. Open a hole at port A shown in the illustration.
4. While applying compressed air at approximately 200 kPa (2.0 kgf/cm<sup>2</sup>, 29 psi) to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).

**P**

**Fig. 223: Turning Camshaft Timing Gear Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**WARNING:** Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

**NOTE:** Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

**HINT:**

- The camshaft timing gear assembly may be turned in the advance direction without applying any force.
  - If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.
- f. Check for smooth rotation.
1. Turn the camshaft timing gear within its movable range (26.5 to 28.5°) 2 or 3 times, but do not turn it to the most retarded position. Make sure that the gear turns smoothly.

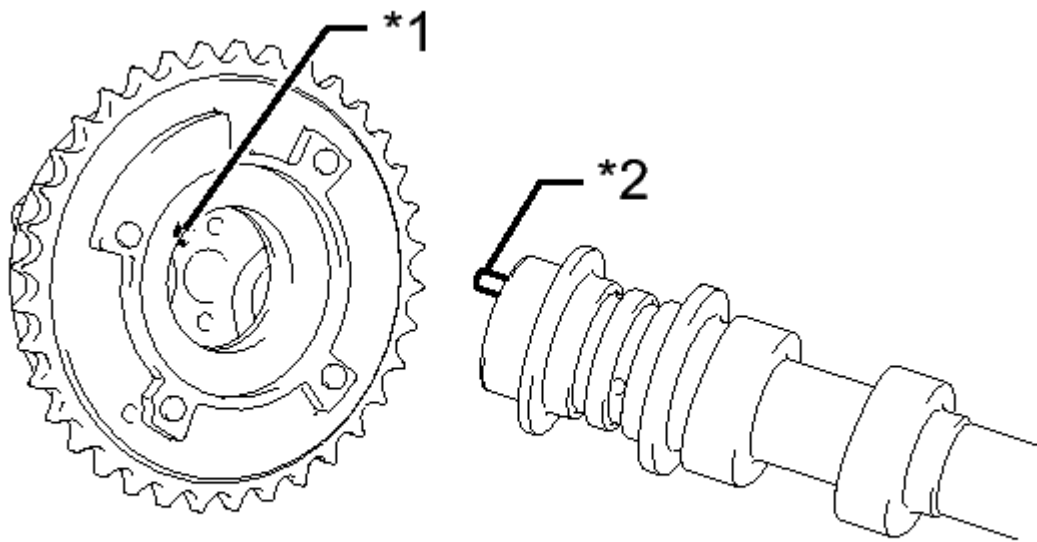
**NOTE:** Do not allow the camshaft timing gear assembly to lock.

**If it locks, release the lock pin again.**

- g. Remove the vinyl tape and pieces of rubber from the camshaft.
- h. Remove the bolt and camshaft timing gear.

**7. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

- a. Align the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear and attach the gear to the camshaft.

**P**

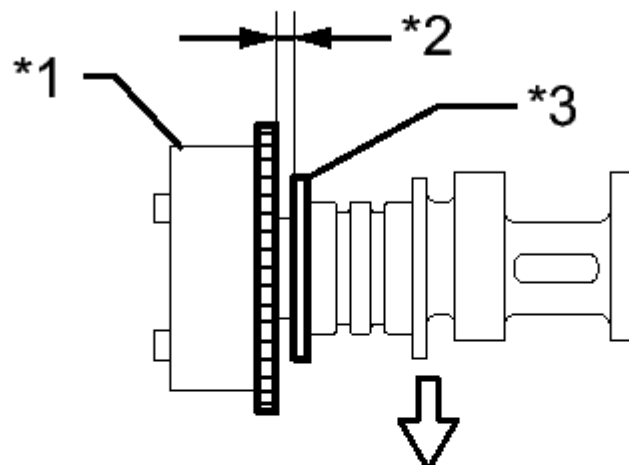
**Fig. 224: Aligning No. 2 Camshaft Knock Pin & Timing Gear Pin Hole**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

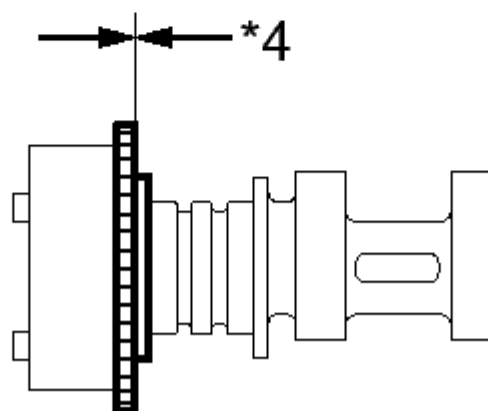
*1	Pin Hole
*2	Knock Pin

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

\*a



\*b

**P**

**Fig. 225: Checking Clearance Between Camshaft Timing Gear & Flange**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

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

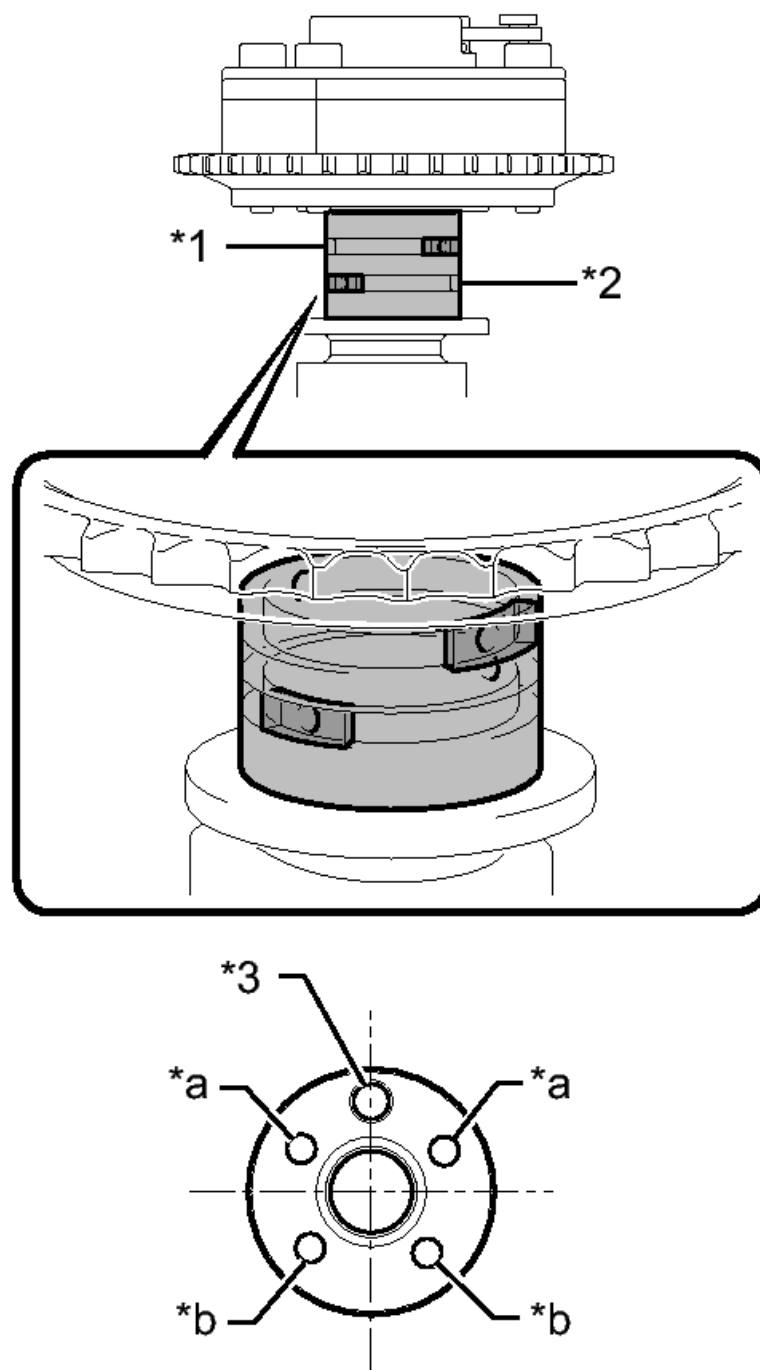
- c. Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing exhaust gear by hand.



- d. Check the lock of the camshaft timing exhaust gear.
  - 1. Make sure that the camshaft timing exhaust gear is locked.



**NOTE:**        **Be careful not to damage the camshaft.**

- e. Release the lock pin.
  - 1. Clean the camshaft journal with non-residue solvent.
  - 2. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

**P****Fig. 226: Camshaft Journal Oil Paths**

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

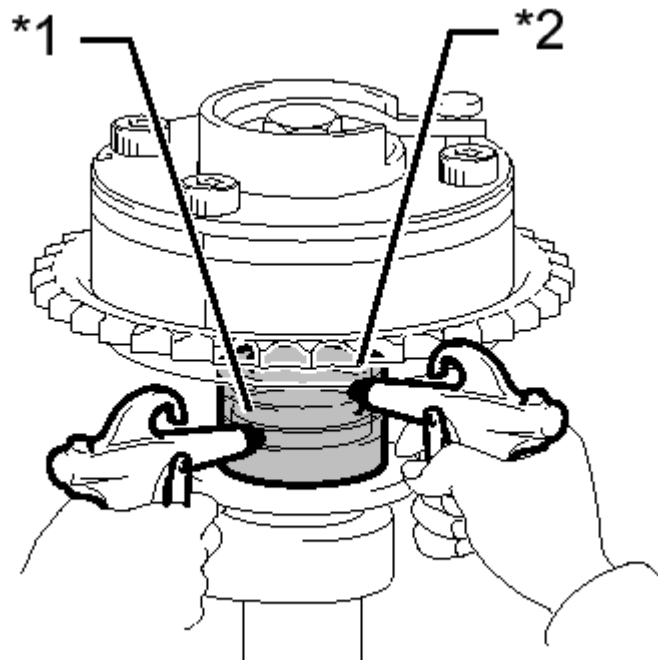
**TEXT IN ILLUSTRATION**

*1	Advance Side Path
*2	Retard Side Path
*3	Knock Pin
*a	Open
*b	Closed
	Rubber
	Vinyl Tape

**HINT:**

There are 4 oil paths in the grooves of the camshaft. Plug 2 paths with pieces of rubber.

3. Prick a hole in the tape placed on the advance side path. Prick a hole in the tape placed on the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.
4. Apply compressed air at approximately 200 kPa (2.0 kgf/cm<sup>2</sup>, 29 psi) to the two open paths (the advance side path and retard side path).



**P**

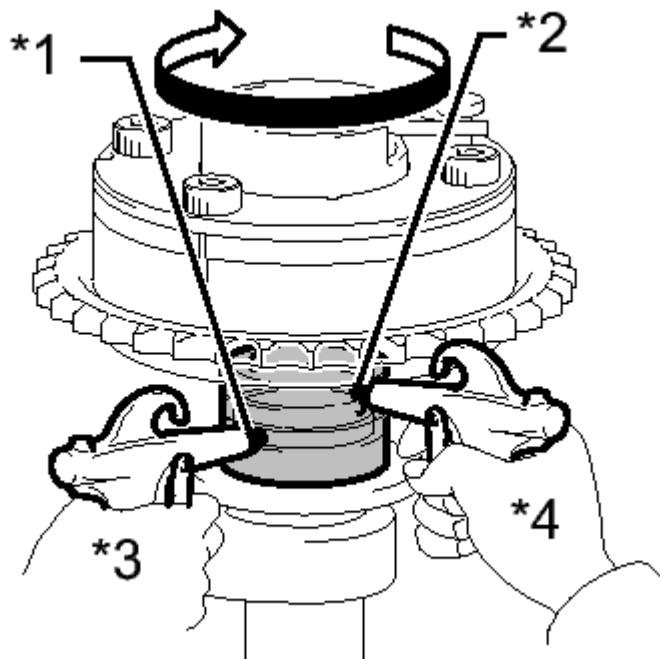
**Fig. 227: Applying Compressed Air To Camshaft Journal Oil Paths**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Retard Side Path
*2	Advance Side Path

**NOTE:** Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

5. Check that the camshaft timing exhaust gear turns in the retard direction when reducing the air pressure applied to the advance side path.

**P**

**Fig. 228: Checking Camshaft Timing Exhaust Gear Turns In Retard Direction**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

*1	Retard Side Path
*2	Advance Side Path
*3	Hold Pressure
*4	Decompress

**HINT:**

The lock pin is released and the camshaft timing exhaust gear turns in the retard direction.

6. 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.

- f. Check for smooth rotation.

1. Turn the camshaft timing exhaust gear within its movable range (21.5 to 23.5°) 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.

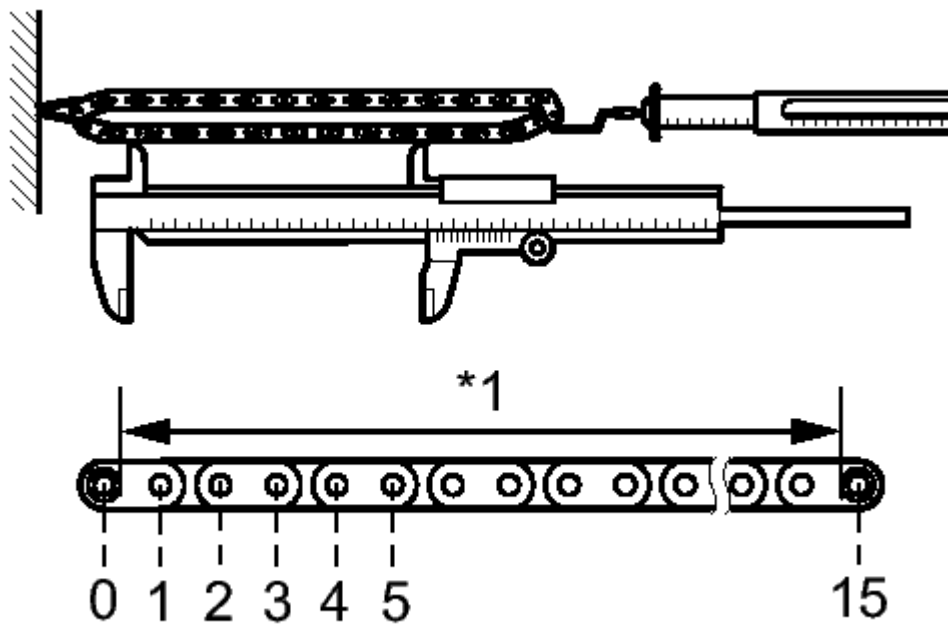
- g. Check the lock at the most advanced position.

1. Make sure that the camshaft timing exhaust gear locks at the most advanced position.

- h. Remove the vinyl tape and pieces of rubber from the camshaft.

- i. Remove the bolt and camshaft timing gear.

## 8. INSPECT CHAIN SUB-ASSEMBLY



## P

**Fig. 229: Pulling Chain Using Spring Scale**

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

- Using a spring scale, pull the chain with a force of 147 N (15 kgf, 33.0 lbf) as shown in the illustration.
- Using a vernier caliper, measure the length of 15 pins.

Maximum chain elongation

137.7 mm (5.42 in.)

### TEXT IN ILLUSTRATION

*1	Measuring Area
----	----------------

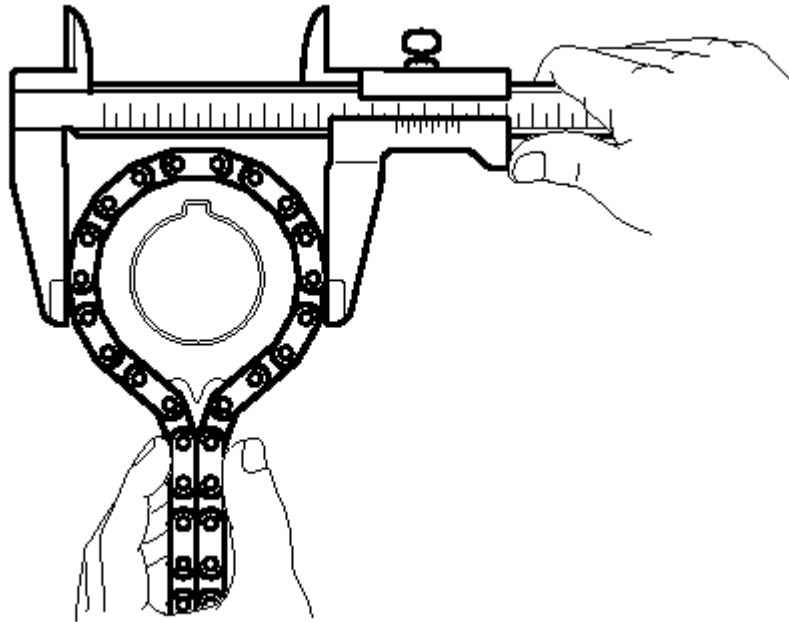
### HINT:

Perform the measurement at 3 random places.

If the elongation is more than the maximum, replace the chain sub-assembly.

## 9. INSPECT CRANKSHAFT TIMING SPROCKET

- Wrap the chain around the sprocket.

**P**

**Fig. 230: Measuring Sprocket Diameter With Chain**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a vernier caliper, measure the sprocket diameter together with the chain.

Minimum sprocket diameter (with chain)

59.94 mm (2.36 in.)

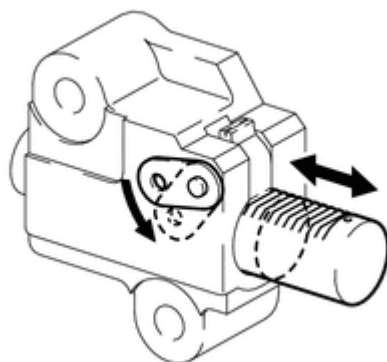
If the diameter is less than the minimum, replace the chain and crankshaft timing sprocket.

**HINT:**

The vernier caliper must contact the chain rollers for the measurement.

**10. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY**

- a. Move the stopper plate counterclockwise to release the lock. Push the plunger and check that it moves smoothly.

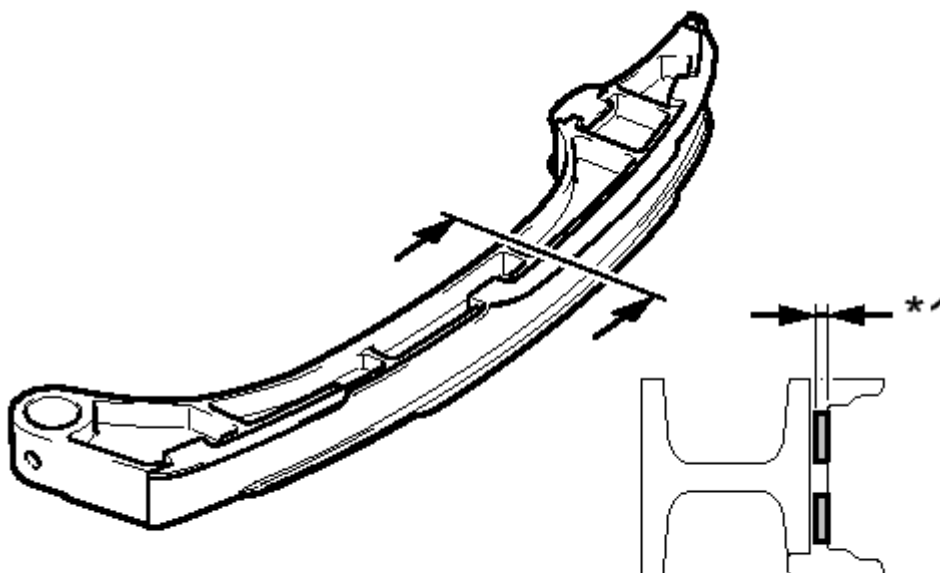
**P**

**Fig. 231: Inspecting No. 1 Chain Tensioner Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If necessary, replace the No. 1 chain tensioner assembly.

## 11. INSPECT CHAIN TENSIONER SLIPPER

- a. Measure the depth of wear of the chain tensioner slipper.

**P**

**Fig. 232: Measuring Chain Tensioner Slipper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum depth

1.0 mm (0.0394 in.)



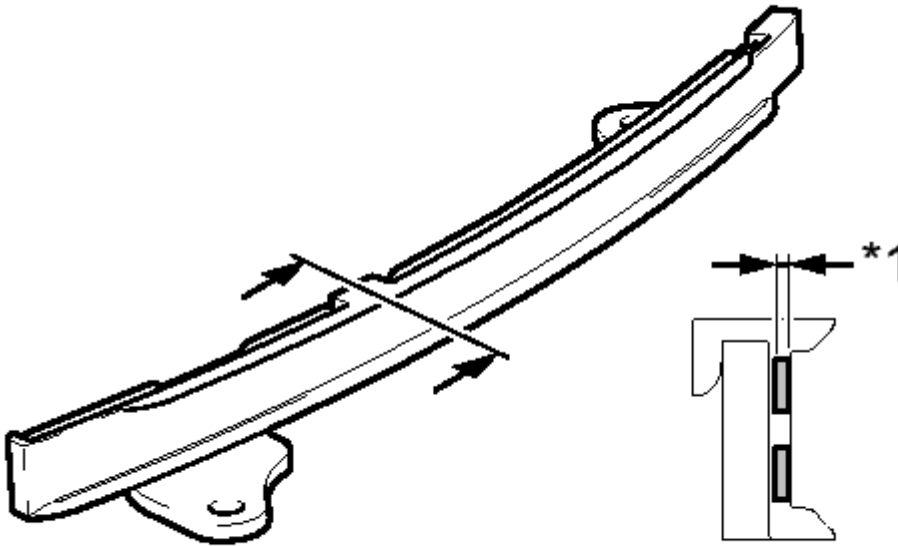
**TEXT IN ILLUSTRATION**

*1	Depth
----	-------

If the depth is more than the maximum, replace the chain tensioner slipper.

**12. INSPECT NO. 1 CHAIN VIBRATION DAMPER**

- a. Measure the depth of wear of the chain vibration damper.

**P**

**Fig. 233: Measuring Chain Vibration Damper**

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

Maximum depth

1.0 mm (0.0394 in.)

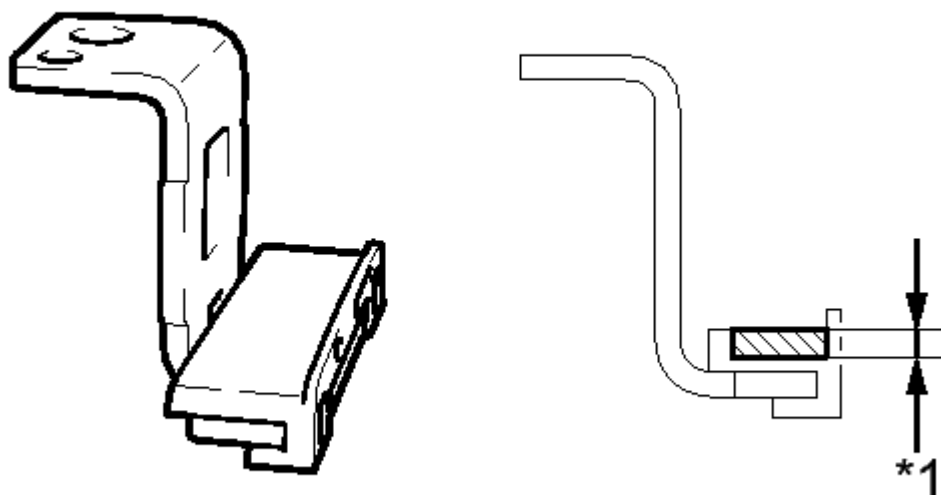
**TEXT IN ILLUSTRATION**

*1	Depth
----	-------

If the depth is more than the maximum, replace the No. 1 chain vibration damper.

**13. INSPECT TIMING CHAIN GUIDE**

- a. Measure the depth of wear of the timing chain guide.

**P****Fig. 234: Measuring Timing Chain Guide****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Maximum depth

1.0 mm (0.0394 in.)

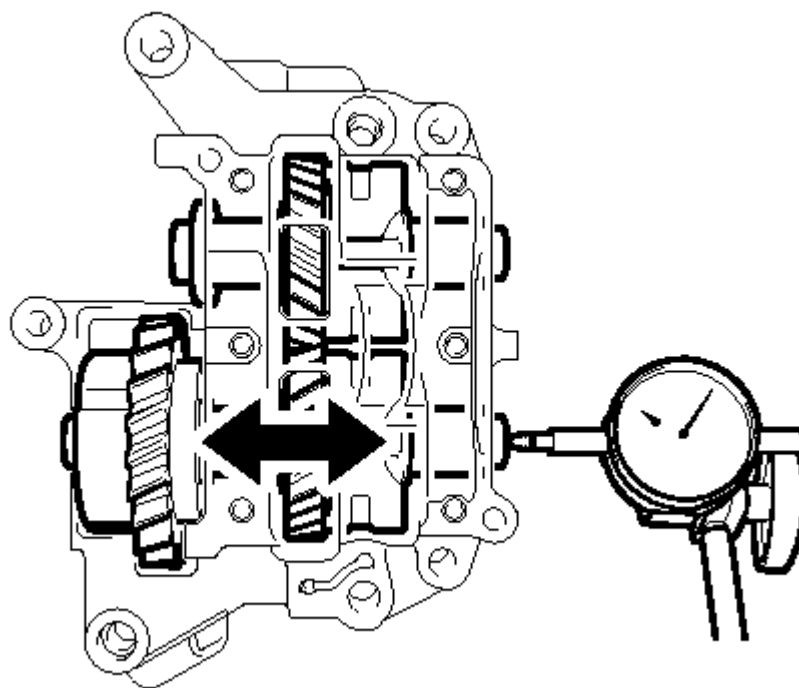
**TEXT IN ILLUSTRATION**

*1	Depth
----	-------

If the depth is more than the maximum, replace the timing chain guide.

**14. INSPECT NO. 1 BALANCE SHAFT THRUST CLEARANCE**

- a. Using a dial indicator, measure the thrust clearance while moving the No. 1 balance shaft back and forth.

**P**

**Fig. 235: Inspecting No. 1 Balance Shaft Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.05 to 0.09 mm (0.00197 to 0.00354 in.)

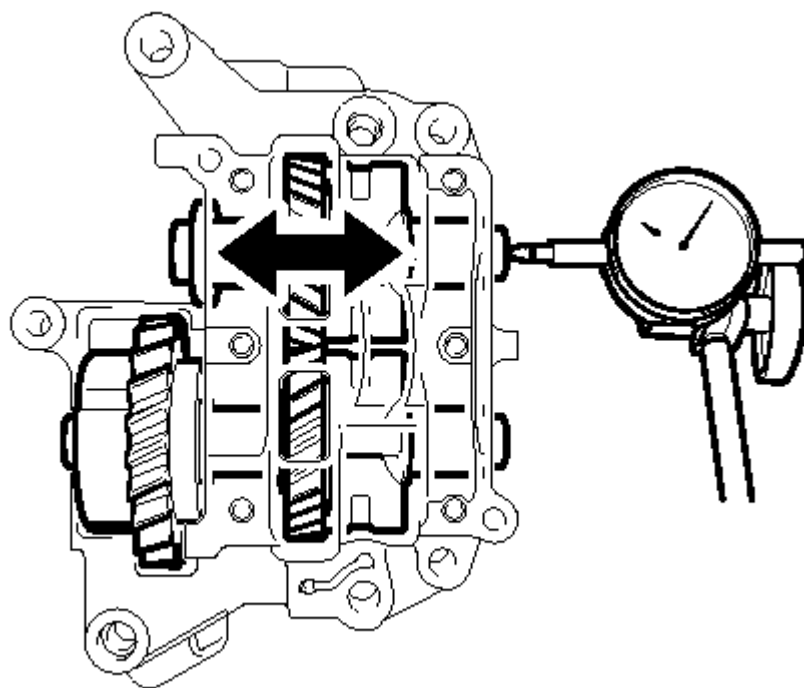
Maximum thrust clearance

0.09 mm (0.00354 in.)

If the thrust clearance is more than the maximum, replace the engine balancer assembly.

#### 15. INSPECT NO. 2 BALANCE SHAFT THRUST CLEARANCE

- a. Using a dial indicator, measure the thrust clearance while moving the No. 2 balance shaft back and forth.

**P**

**Fig. 236: Inspecting No. 2 Balance Shaft Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.05 to 0.09 mm (0.00197 to 0.00354 in.)

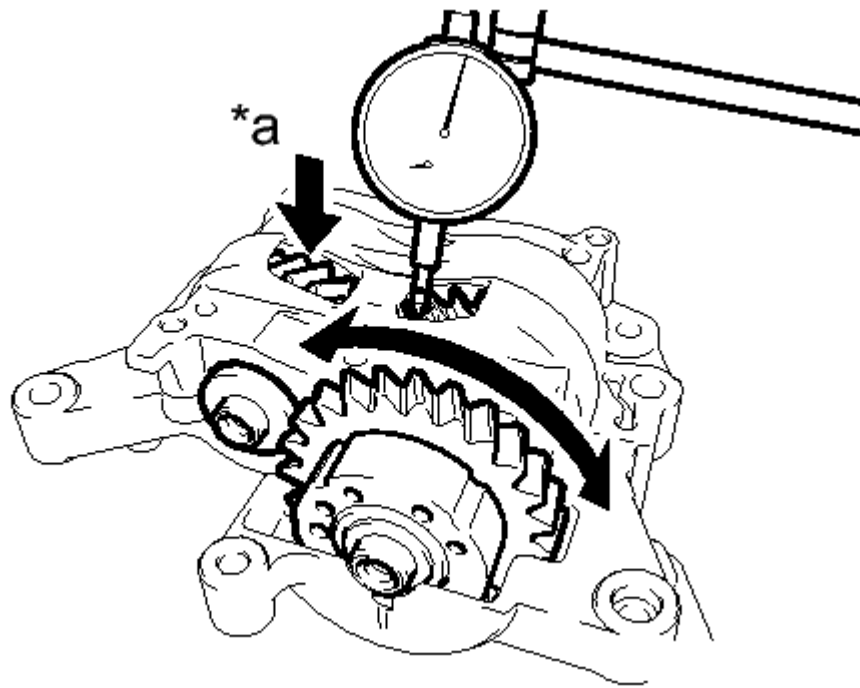
Maximum thrust clearance

0.09 mm (0.00354 in.)

If the thrust clearance is more than the maximum, replace the engine balancer assembly.

## 16. INSPECT BALANCE SHAFT BACKLASH

- a. Fix the No. 2 balance shaft in place, and then, using a dial indicator, measure the backlash of the No. 1 and No. 2 balance shafts as shown in the illustration.

**P**

**Fig. 237: Measuring No. 1 And No. 2 Balance Shafts Backlash**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard backlash

0.04 to 0.17 mm (0.00154 to 0.00669 in.)

Maximum backlash

0.17 mm (0.00669 in.)

**TEXT IN ILLUSTRATION**

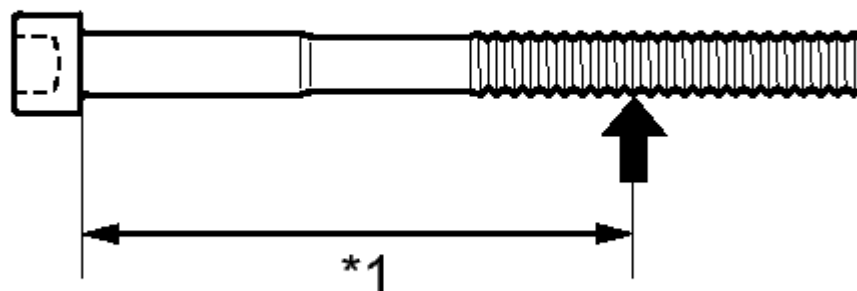
\*a Fix in place

**NOTE:**        **Measure at 3 or more areas around the circumference of the No. 1 and No. 2 balance shafts.**

If the backlash is more than the maximum, replace the engine balancer assembly.

**17. INSPECT CYLINDER HEAD BOLT**

- a. Using a vernier caliper, measure the diameter of the elongated thread at the measuring point.

**P****Fig. 238: Measuring Cylinder Head Bolt****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Measuring point

106 mm (4.17 in.)

Standard diameter

10.85 to 11.00 mm (0.427 to 0.433 in.)

Minimum diameter

10.6 mm (0.417 in.)

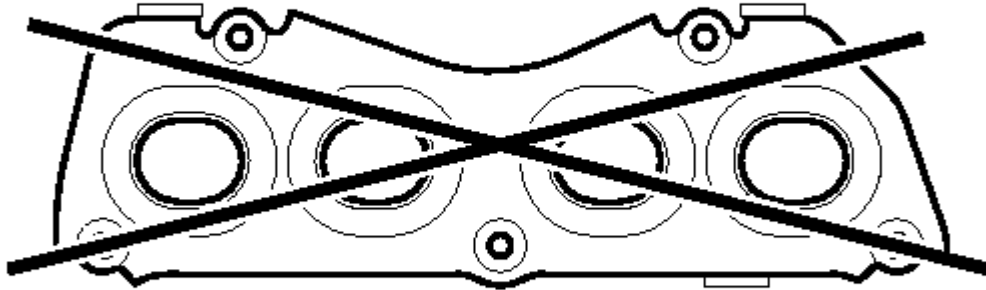
**TEXT IN ILLUSTRATION**

*1	Measuring Point
----	--------------------

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 (see illustration **Fig. 238**) and find the area that has the smallest diameter.**18. INSPECT EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**

- a. Using a precision straightedge and feeler gauge, measure the warpage of the surface that contacts the cylinder head.

**P**

**Fig. 239: Checking Exhaust Manifold Converter Sub-Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

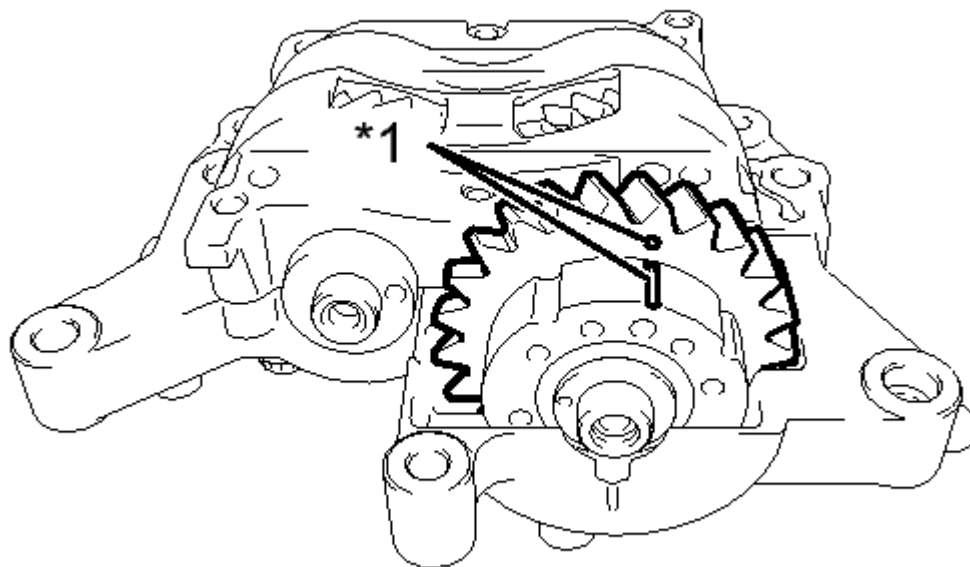
Maximum warpage

0.7 mm (0.0276 in.)

If the warpage is more than the maximum, replace the exhaust manifold.

**REASSEMBLY****REASSEMBLY****1. INSTALL ENGINE BALANCER ASSEMBLY**

- a. Check that the alignment marks of the balance shaft damper cover and balance shaft driven gear are aligned.

**P**

**Fig. 240: Aligning Balance Shaft Damper Cover Mark & Balance Shaft Driven Gear Mark**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

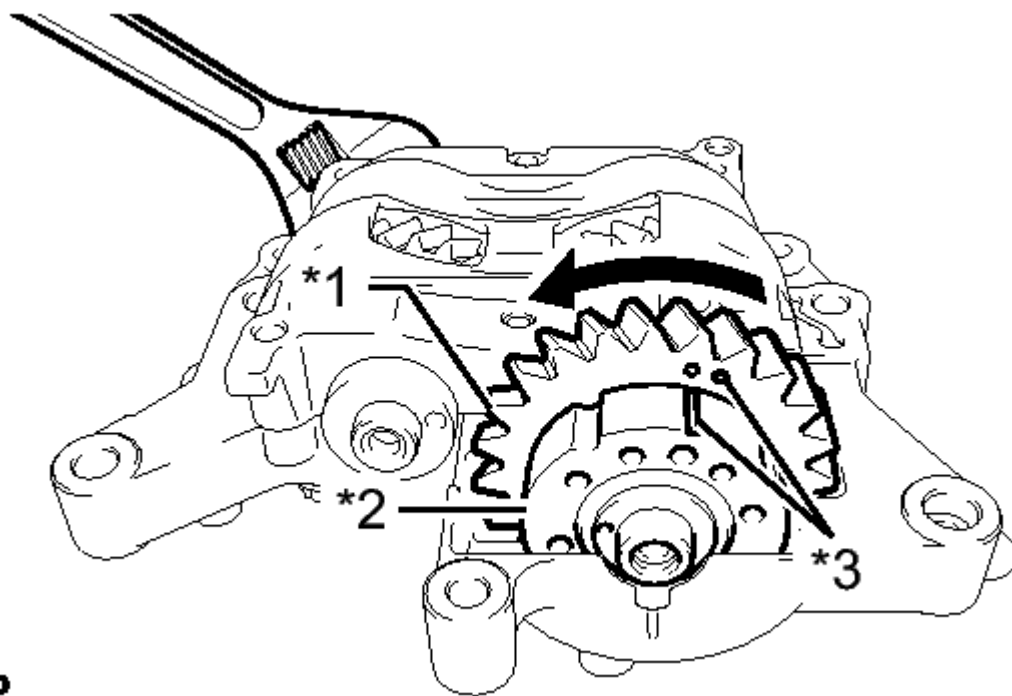
**TEXT IN ILLUSTRATION**

*1	Alignment Mark
----	-------------------

If the alignment marks are not aligned, realign them.

1. Place a wrench on the rear cutout part of the No. 2 balance shaft and fix the shaft in place.



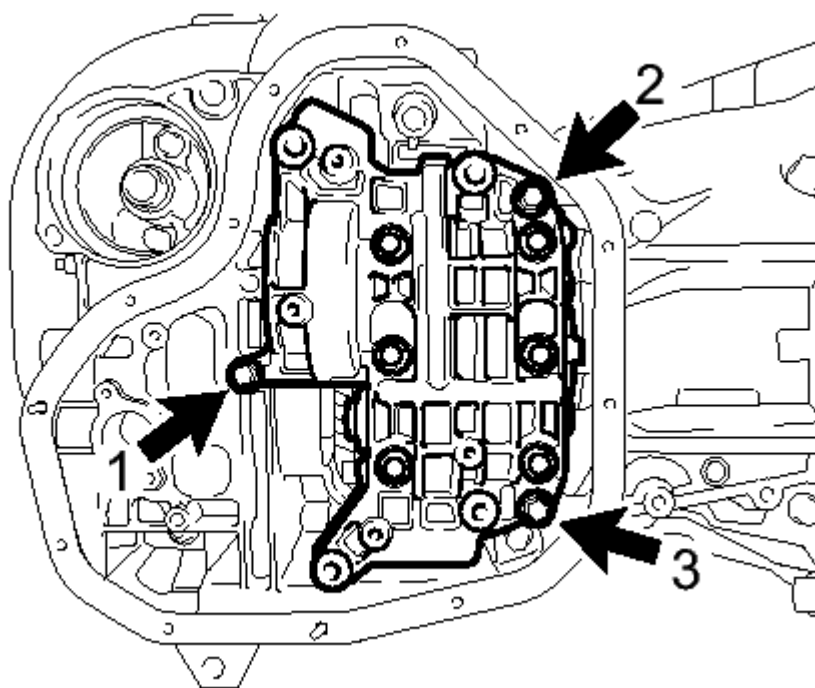
**P****Fig. 241: Rotating Balance Shaft Driven Gear**

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

**TEXT IN ILLUSTRATION**

*1	Driven Gear
*2	Damper Cover
*3	Alignment Mark

2. Rotate the balance shaft driven gear of the No. 1 balance shaft counterclockwise to align the alignment mark of the balance shaft driven gear with the alignment mark of the balance shaft damper cover.
- b. Install the engine balancer to the stiffening crankcase with the 3 bolts and tighten the bolts in the sequence shown in the illustration.



P

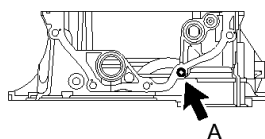
**Fig. 242: Identifying Engine Balancer Bolts Tightening Sequence**

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

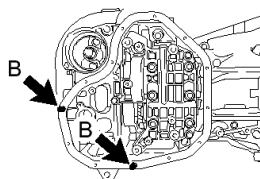
Torque: 24 N\*m (245 kgf\*cm, 18 ft.\*lbf)

**2. INSTALL STIFFENING CRANKCASE STUD BOLT****NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

\*A



\*B



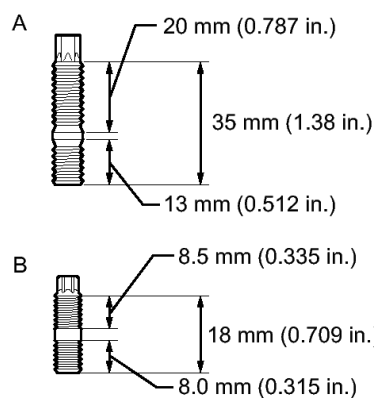
P

**Fig. 243: Stiffening Crankcase Stud Bolts**

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

**TEXT IN ILLUSTRATION**

*A	Front Side	*B	Lower Side
----	------------	----	------------



- a. Using an E5 and E8 "TORX" socket wrench, install the stud bolts.

**for stud bolt A**

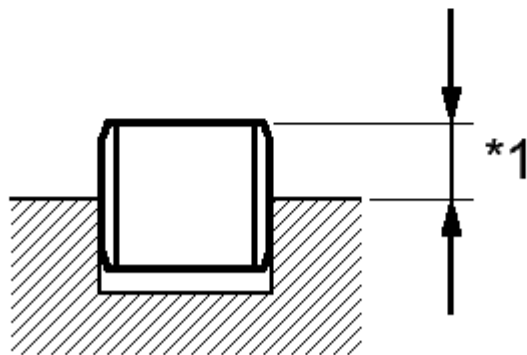
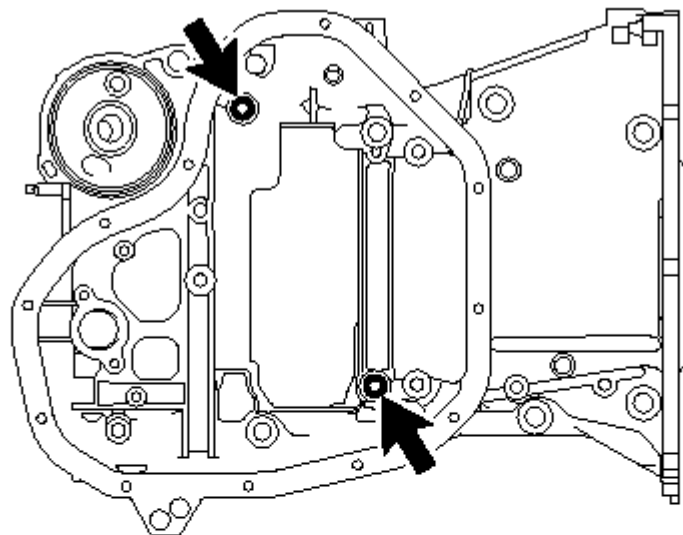
**Torque: 5.0 N\*m (51 kgf\*cm, 44 in.\*lbf)**

**for stud bolt B**

**Torque: 9.5 N\*m (97 kgf\*cm, 84 in.\*lbf)**

### 3. INSTALL STIFFENING CRANKCASE RING PIN

**NOTE:** It is not necessary to remove the ring pin unless it is being replaced.



**P**

**Fig. 244: Stiffening Crankcase Ring Pin**

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

- a. Using a plastic-faced hammer, tap in 2 new ring pins until they stop.

Standard protrusion height

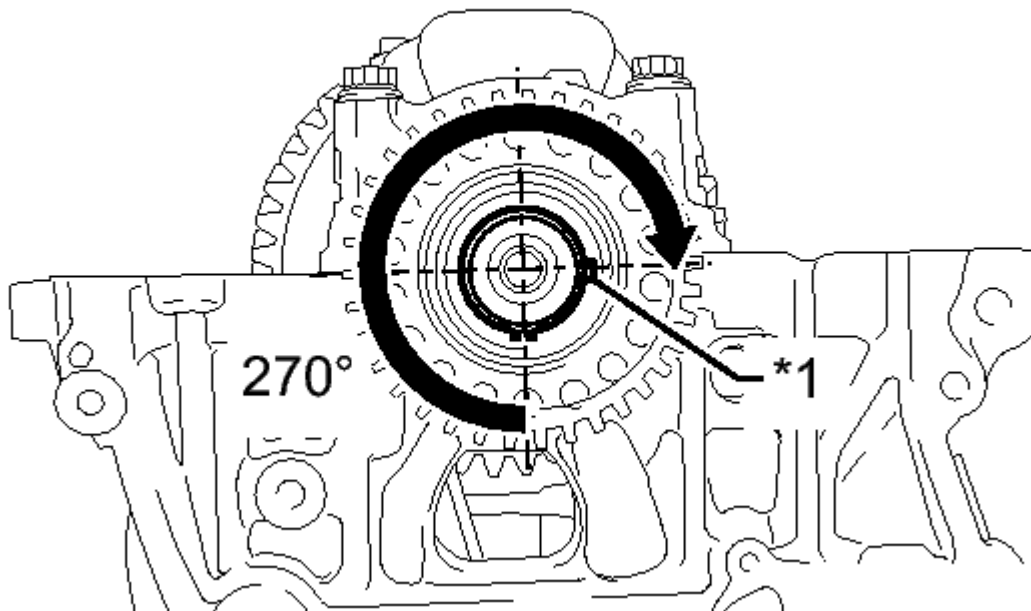
4.3 to 5.3 mm (0.169 to 0.209 in.)

**TEXT IN ILLUSTRATION**

*1	Protrusion Height
----	----------------------

**4. INSTALL STIFFENING CRANKCASE ASSEMBLY**

- a. Rotate the crankshaft clockwise so that the crankshaft key is at the position 270° from the bottom as shown in the illustration.



**P**

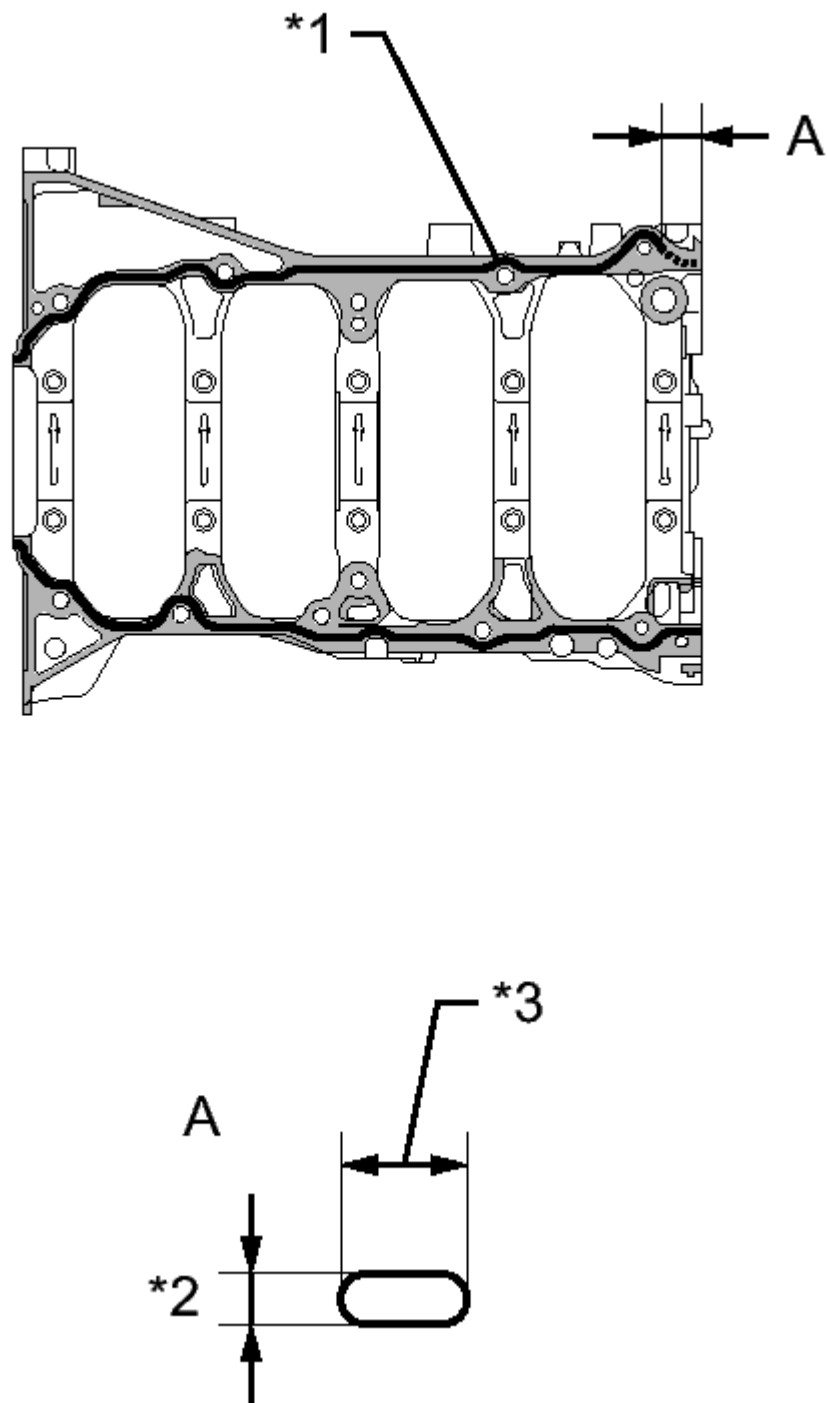
**Fig. 245: Rotating Crankshaft**

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

**TEXT IN ILLUSTRATION**

*1	Key
----	-----

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

**P****Fig. 246: Applying Seal Packing**

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

Seal packing

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



Standard Seal Dimension

Area	Specified Condition
Continuous Line	2.5 to 3.5 mm (0.0984 to 0.138 in.)
Dashed Line	7.0 to 9.0 mm (0.276 to 0.354 in.) wide and 2.5 to 3.5 mm (0.0984 to 0.138 in.) thick

Application length A

28 mm (1.10 in.)

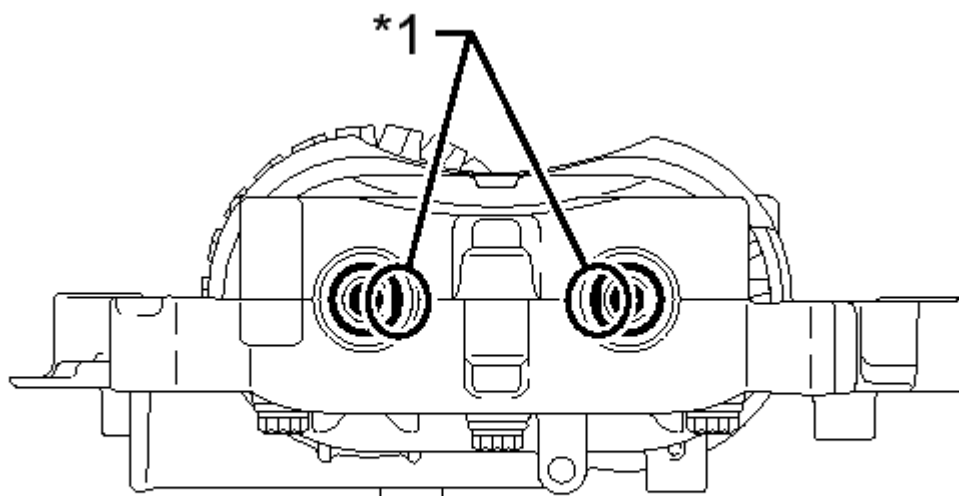
#### TEXT IN ILLUSTRATION

*1	Seal Packing
*2	Continuous Line
*3	Dashed Line
	Stiffening Crankcase
	Cylinder Block

#### 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.
- Do not apply oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.

c. Check that the rear cutouts are as shown in the illustration.

**P****Fig. 247: Checking Rear Cutouts****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****TEXT IN ILLUSTRATION**

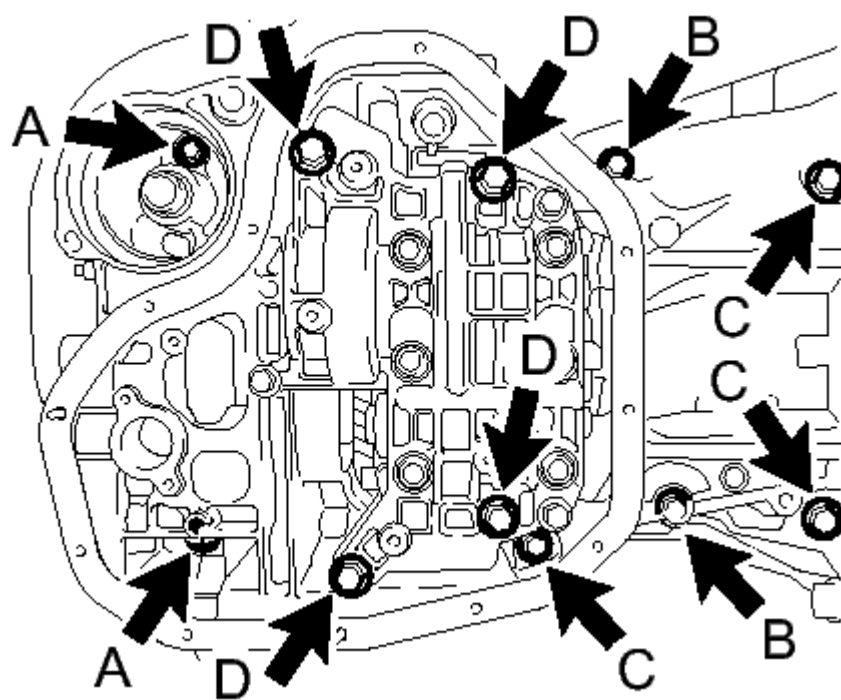
*1	Cutout
----	--------

- d. Clean the bolts and their installation holes.
- e. Apply adhesive to 3 threads or more at the end of bolt A.

Adhesive

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

- f. Temporarily install the stiffening crankcase with the 11 bolts.



**P**

**Fig. 248: Identifying Stiffening Crankcase Bolts Tightening Sequence**

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

Bolt Length

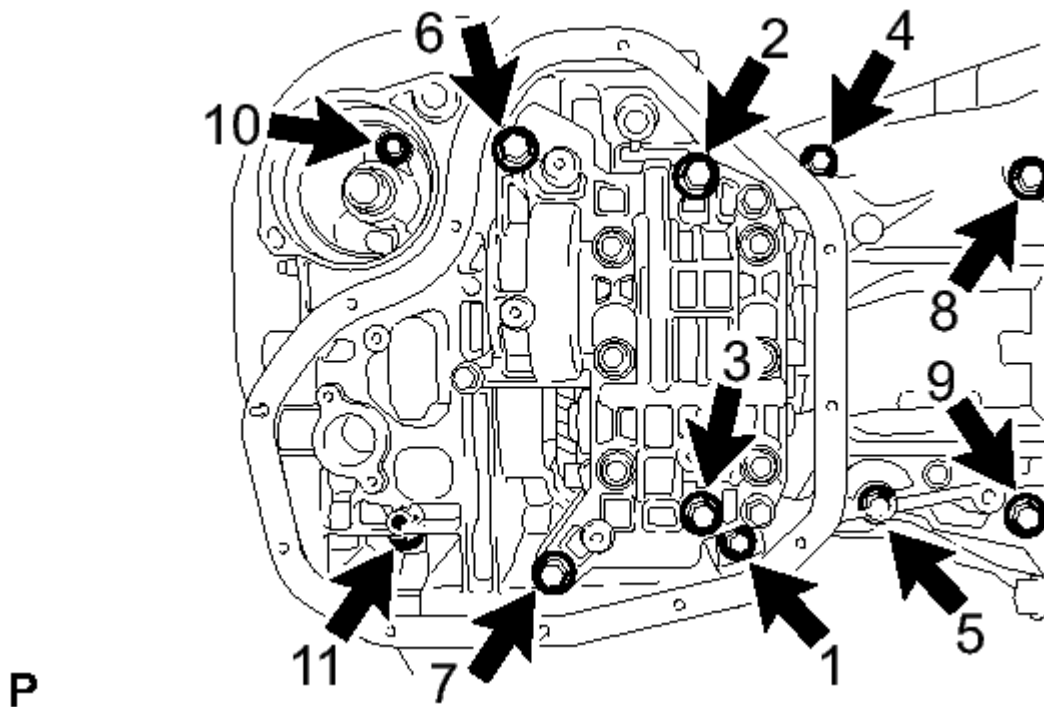
Item	Length
Bolt A	65 mm (2.56 in.)
Bolt B	35 mm (1.38 in.)
Bolt C	125 mm (4.92 in.)
Bolt D	165 mm (6.50 in.)

**HINT:**

Apply adhesive to bolt A before installing it

- g. Tighten the 11 bolts in the sequence shown in the illustration to install the stiffening crankcase.





**Fig. 249: Identifying Stiffening Crankcase Bolts Tightening Sequence**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for bolt A

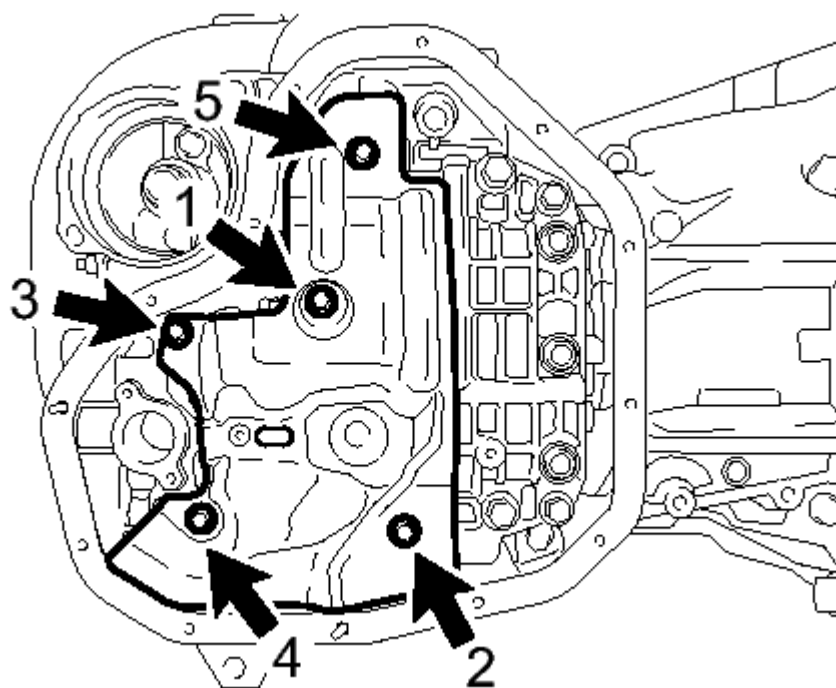
**Torque: 24 N\*m (245 kgf\*cm, 18 ft.\*lbf)**

except bolt A

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

##### 5. INSTALL NO. 1 OIL PAN BAFFLE PLATE

- a. Install the oil pan baffle plate and uniformly tighten the 5 bolts in several steps in the sequence shown in the illustration.

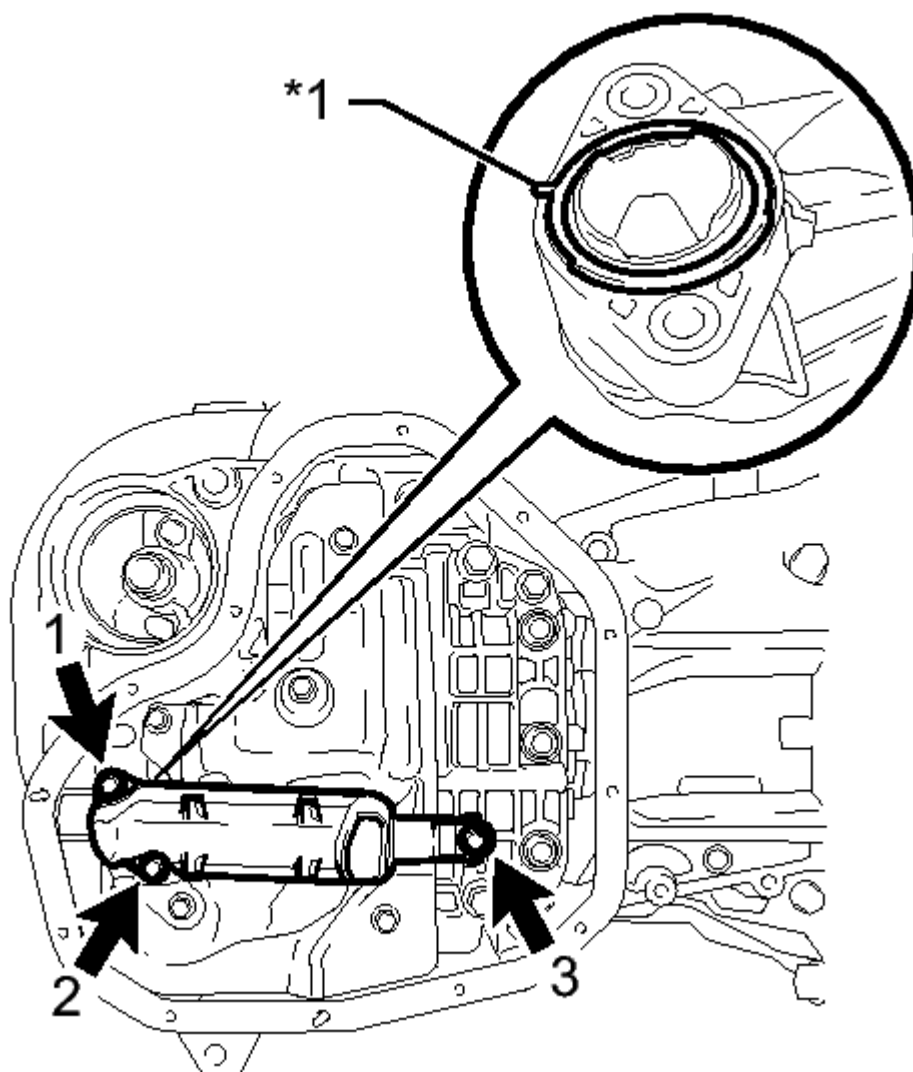
**P**

**Fig. 250: Identifying No. 1 Oil Pan Baffle Plate Bolts Tightening Sequence**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

#### **6. INSTALL OIL STRAINER SUB-ASSEMBLY**

- a. Apply a light coat of engine oil to a new gasket.

**P****Fig. 251: Aligning Oil Strainer Gasket**

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

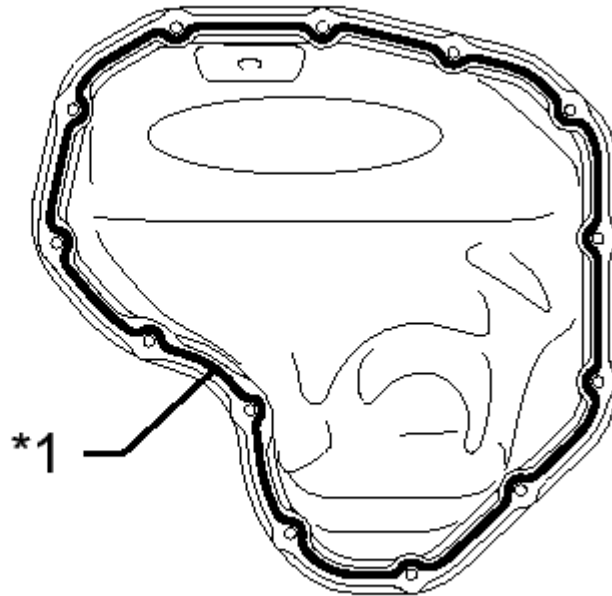
**TEXT IN ILLUSTRATION**

*1	Protrusion
----	------------

- b. Align the protrusion of the gasket with the cutout of the oil strainer and install the gasket to the oil strainer.
- c. Install the oil strainer with the 3 bolts in several steps in the sequence shown in the illustration.

**Torque: 9.0 N\*m (92 kgf\*cm, 80 in.\*lbf)****7. INSTALL OIL PAN SUB-ASSEMBLY**

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

**P****Fig. 252: Applying Packing Seal**

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

Seal packing

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

Standard seal diameter

2.5 to 3.5 mm (0.0984 to 0.138 in.)

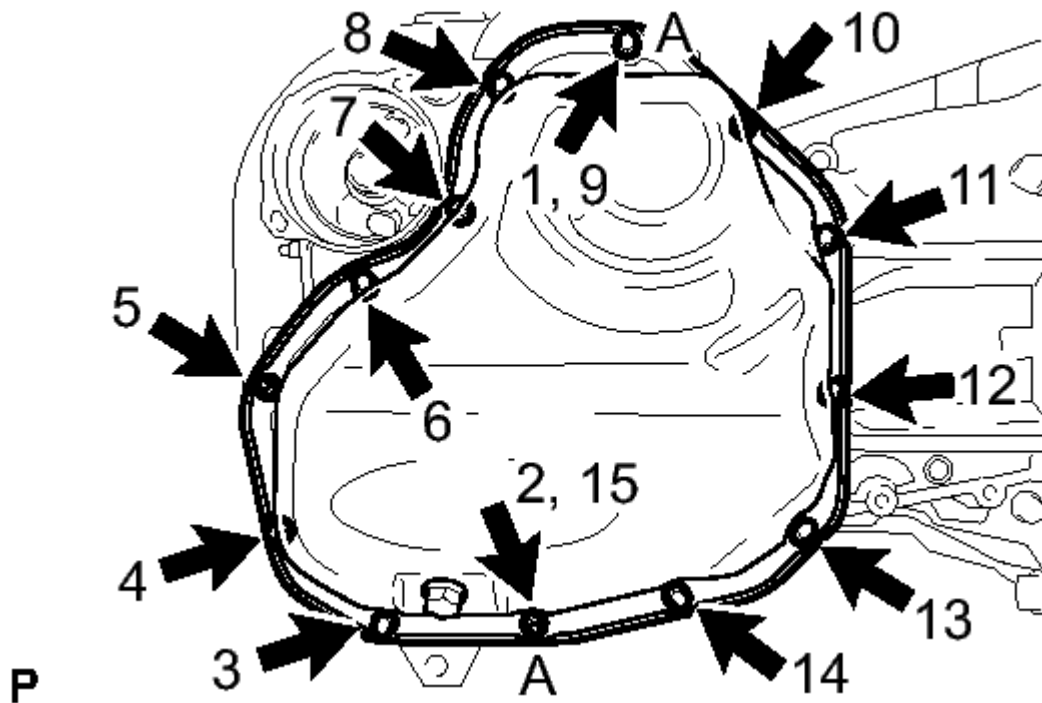
**TEXT IN ILLUSTRATION**

*1	Seal Packing
----	--------------

**NOTE:**

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes and tighten the bolts and nuts within 10 minutes after applying seal packing.
- Do not apply oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.

- b. Install the oil pan with the 11 bolts and 2 nuts in several steps in the sequence shown in the illustration.



**Fig. 253: Identifying Oil Pan Bolts And Nuts Tightening Sequence**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

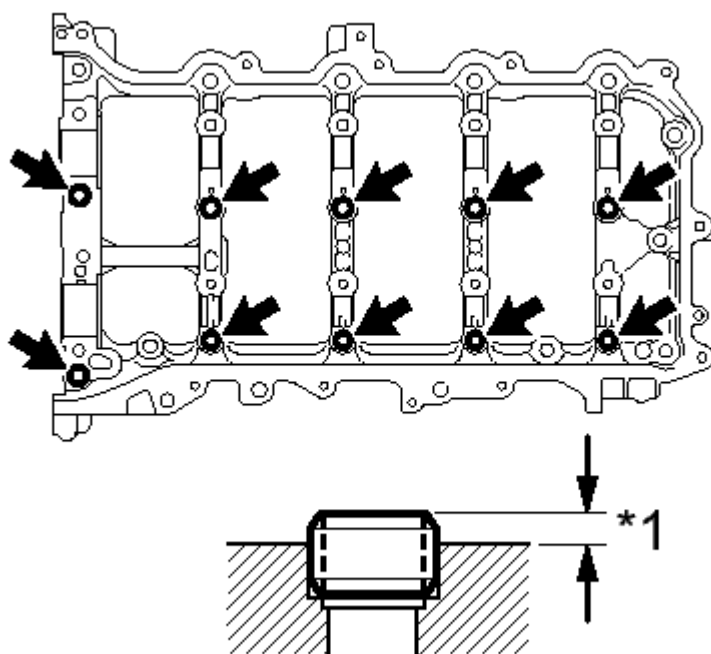
**Torque: 10 N\*m (102 kgf\*cm, 7 ft.\*lbf)**

**HINT:**

Bolt A and nut A are tightened twice.

8. **INSTALL OIL FILTER ELEMENT** . Refer to **REPLACEMENT - Step 4**
9. **INSTALL ENGINE REAR OIL SEAL** See step 1
10. **INSTALL CYLINDER BLOCK WATER JACKET SPACER**
  - a. Install the water jacket spacer to the cylinder block.
11. **INSTALL CYLINDER HEAD GASKET** See step 1
12. **INSTALL CYLINDER HEAD SUB-ASSEMBLY** See step 2
13. **SET CAMSHAFT TIMING GEAR ASSEMBLY** See step 4
14. **INSTALL CAMSHAFT BEARING CAP SETTING RING PIN**

**NOTE:** It is not necessary to remove the ring pin unless it is being replaced.

**P****Fig. 254: Camshaft Housing Ring Pins**

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

- a. Using a plastic-faced hammer, tap in 10 new ring pins to the camshaft housing.

Standard protrusion height

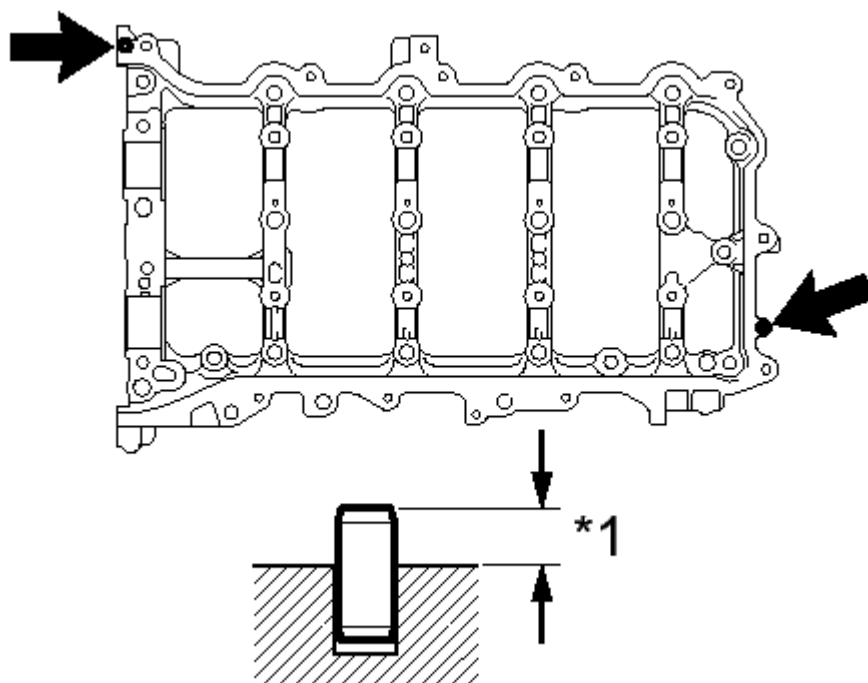
2.7 to 3.3 mm (0.106 to 0.130 in.)

**TEXT IN ILLUSTRATION**

*1	Protrusion Height
----	----------------------

**15. INSTALL CAMSHAFT HOUSING STRAIGHT PIN**

**NOTE:** It is not necessary to remove the straight pin unless it is being replaced.

**P****Fig. 255: Camshaft Housing Strait Pins**

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

- a. Using a plastic-faced hammer, tap in 2 new straight pins to the camshaft housing.

Standard protrusion height

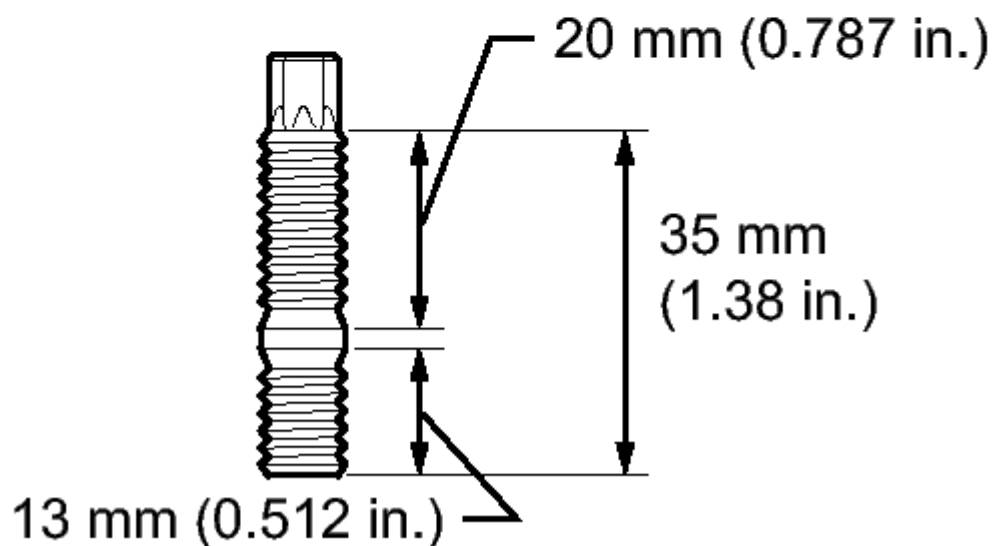
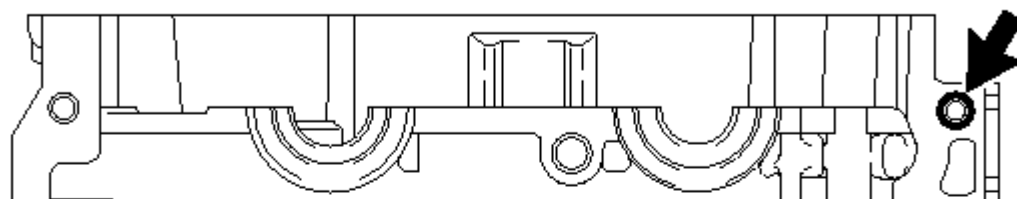
5.0 to 7.0 mm (0.197 to 0.276 in.)

**TEXT IN ILLUSTRATION**

*1	Protrusion Height
----	----------------------

**16. INSTALL CAMSHAFT HOUSING STUD BOLT**

**NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

**P**

**Fig. 256: Identifying Camshaft Housing Stud Bolt Dimensions**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

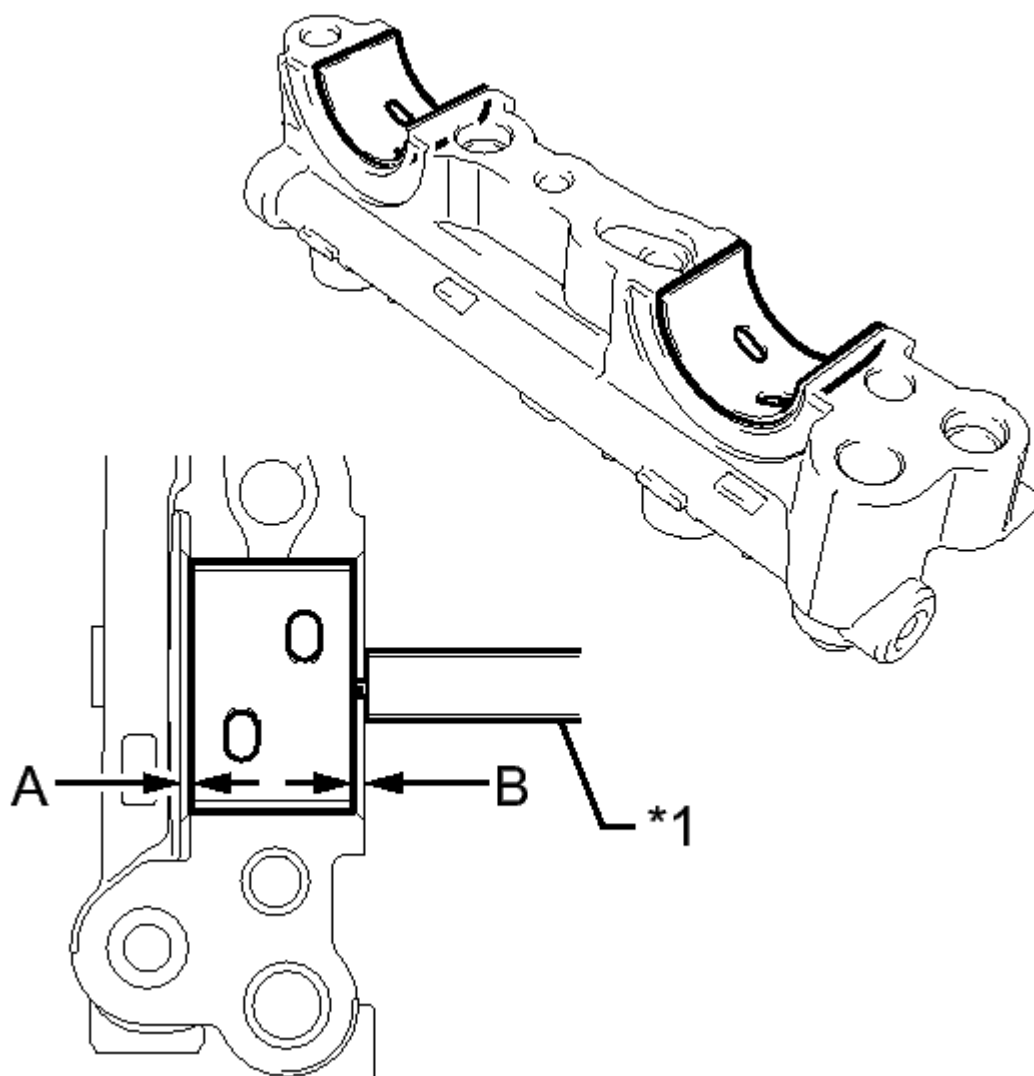
- a. Using an E8 "TORX" socket wrench, install the stud bolt.

**Torque: 9.5 N\*m (97 kgf\*cm, 84 in.\*lbf)**

#### **17. INSTALL NO. 1 CAMSHAFT BEARING**

- a. Clean the No. 1 camshaft bearing.



**P****Fig. 257: Measuring No. 1 Camshaft Bearing****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****TEXT IN ILLUSTRATION****\*1 Vernier Caliper**

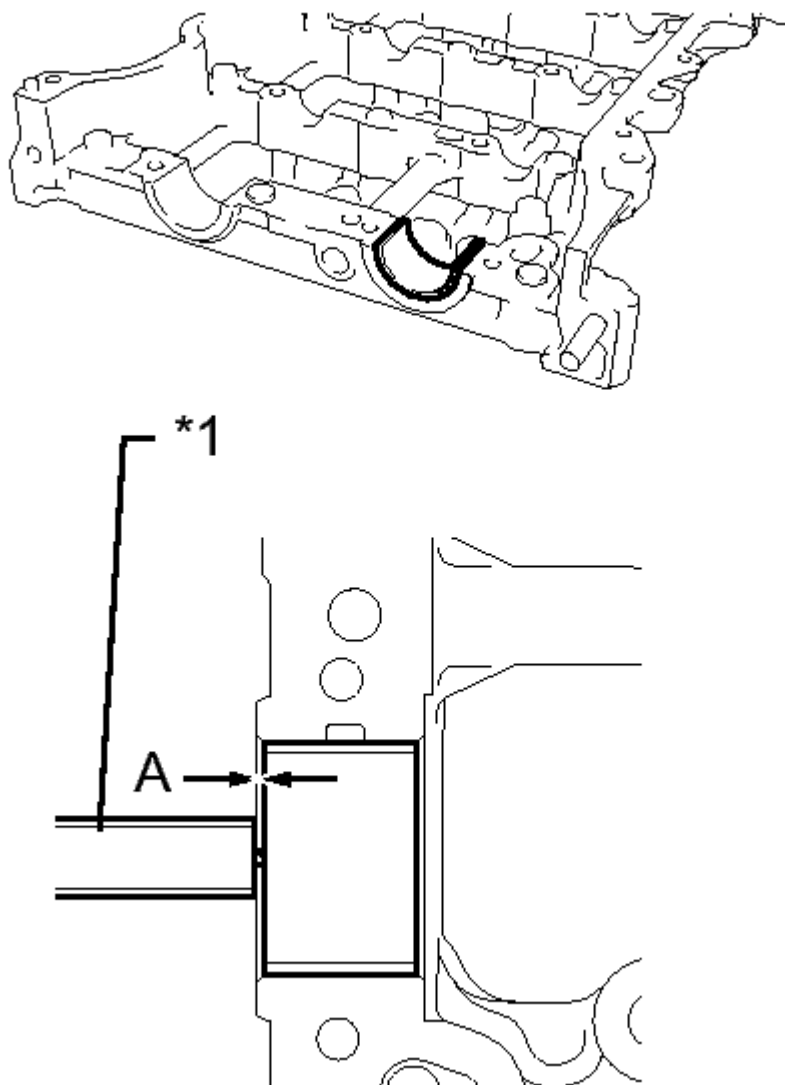
- b. Install the camshaft bearing to the No. 1 camshaft bearing cap.
- c. Using a vernier caliper, measure the distance between the camshaft bearing cap edge and the camshaft bearing edge.

Dimension A - B or B - A

0 to 0.7 mm (0 to 0.0276 in.)

**18. INSTALL NO. 2 CAMSHAFT BEARING**

- a. Clean the No. 2 camshaft bearing.



**P**

**Fig. 258: Measuring No. 2 Camshaft Bearing**

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

**TEXT IN ILLUSTRATION**

**\*1** Vernier Caliper

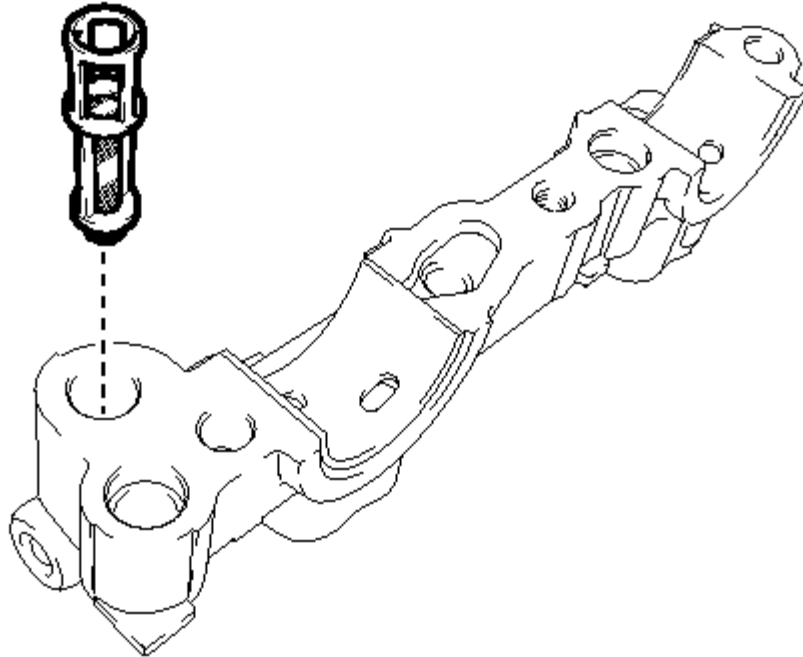
- b. Install the camshaft bearing to the camshaft housing.
- c. Using a vernier caliper, measure the distance between the camshaft housing edge and the camshaft bearing edge.

Standard distance

1.15 to 1.85 mm (0.0453 to 0.0728 in.)

**19. INSTALL OIL CONTROL VALVE FILTER**

- a. Install the oil control valve filter to the No. 1 camshaft bearing cap.

**P****Fig. 259: Identifying Oil Control Valve Filter****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

20. **INSTALL CAMSHAFT** See step 10
21. **INSTALL CAMSHAFT BEARING CAP** See step 11
22. **INSTALL VALVE STEM CAP** See step 3
23. **INSTALL VALVE LASH ADJUSTER ASSEMBLY** See step 5
24. **INSTALL VALVE ROCKER ARM SUB-ASSEMBLY** See step 6
25. **INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY** See step 12
26. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY** See step 13
27. **INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY** See step 14
28. **INSTALL CRANKSHAFT TIMING SPROCKET**
  - a. Install the crankshaft timing sprocket to the crankshaft.
29. **ADD ENGINE OIL** See step 15
30. **SET NO. 1 CYLINDER TO TDC/COMPRESSION** See step 16
31. **INSTALL NO. 1 CHAIN VIBRATION DAMPER** See step 17
32. **INSTALL CHAIN SUB-ASSEMBLY** See step 18
33. **INSTALL CHAIN TENSIONER SLIPPER** See step 19
34. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY** See step 20
35. **INSTALL TIMING CHAIN GUIDE** See step 21

36. **CHECK NO. 1 CYLINDER TO TDC/COMPRESSION** See step 22

37. **INSTALL TIMING CHAIN COVER PLATE**

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

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

38. **INSTALL TIMING CHAIN COVER TIGHT PLUG**

- a. Using a 14 mm hexagon wrench, install a new gasket and plug.

**Torque: 30 N\*m (306 kgf\*cm, 20 ft.\*lbf)**

39. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 1**

40. **INSTALL ENGINE MOUNTING BRACKET RH** . Refer to **INSTALLATION - Step 2**

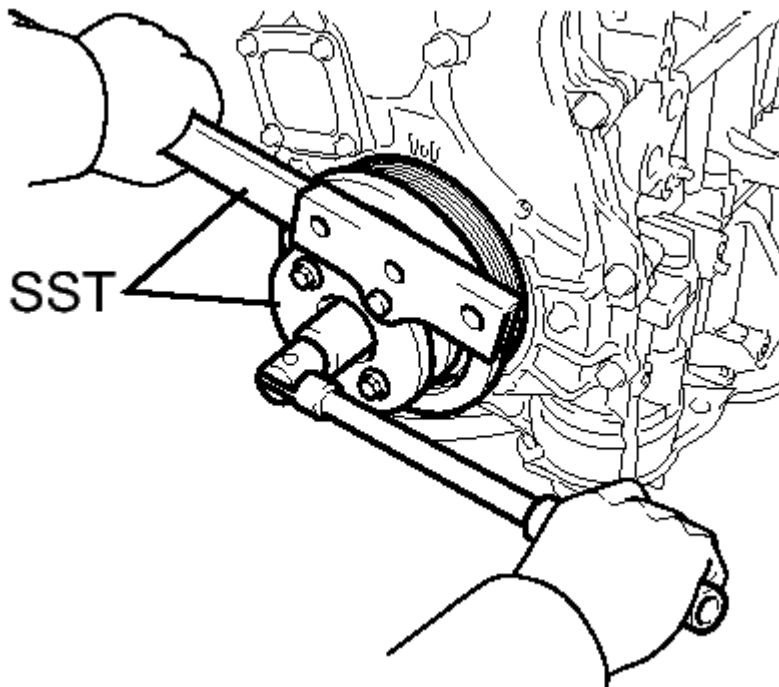
41. **INSTALL TIMING CHAIN COVER OIL SEAL** See step 1

42. **INSTALL SPARK PLUG TUBE GASKET** . Refer to **INSTALLATION - Step 7**

43. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 8**

44. **INSTALL CRANKSHAFT PULLEY**

- a. Align the pulley set key with the key groove of the crankshaft pulley.



**P**

**Fig. 260: Holding Crankshaft Pulley**

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

- b. Using SST, hold the crankshaft pulley and install the pulley bolt.

- **SST: 09213-54015**

- SST: 91551-80650
- SST: 09330-00021

**Torque: 260 N\*m (2651 kgf\*cm, 192 ft.\*lbf)**

45. **INSTALL CRANKSHAFT POSITION SENSOR** . Refer to **INSTALLATION - Step 1**

46. **INSTALL WATER INLET HOUSING**

- a. Install a new gasket and the water inlet housing with the 4 bolts and nut.

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

47. **INSTALL WATER PUMP ASSEMBLY** . Refer to **INSTALLATION - Step 1**

48. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY** . Refer to **INSTALLATION - Step 2**

49. **INSTALL THERMOSTAT** . Refer to **INSTALLATION - Step 1**

50. **INSTALL WATER INLET** . Refer to **INSTALLATION - Step 2**

51. **INSTALL NO. 1 WATER BY-PASS PIPE**

- a. Install a new gasket and the water by-pass pipe with the 2 nuts and bolt.

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

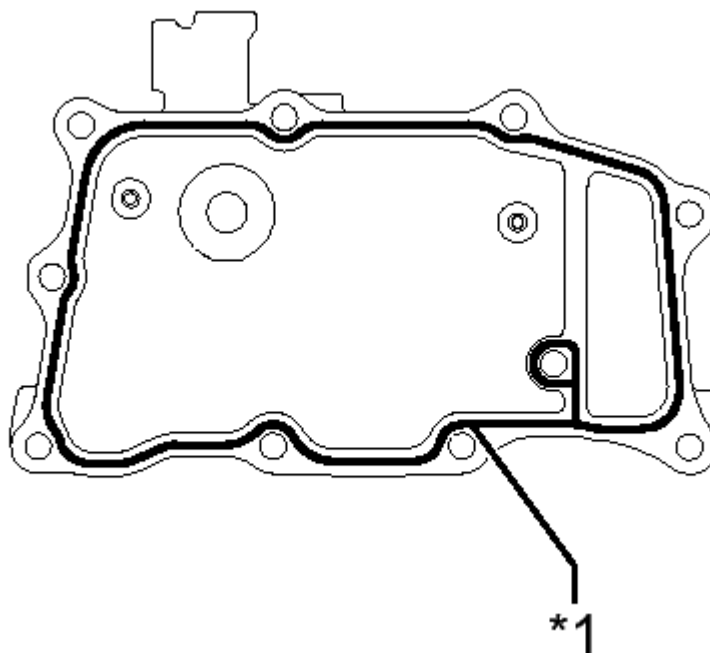
52. **INSTALL SEPARATOR CASE**

- a. Apply a light coat of engine oil to a new gasket.
- b. Install the gasket to the separator case.
- c. Install the separator case with the 2 bolts.

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

53. **INSTALL PCV CASE**

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

**P****Fig. 261: Applying Packing Seal****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Seal packing

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

Standard seal diameter

2.5 to 3.5 mm (0.0984 to 0.138 in.)

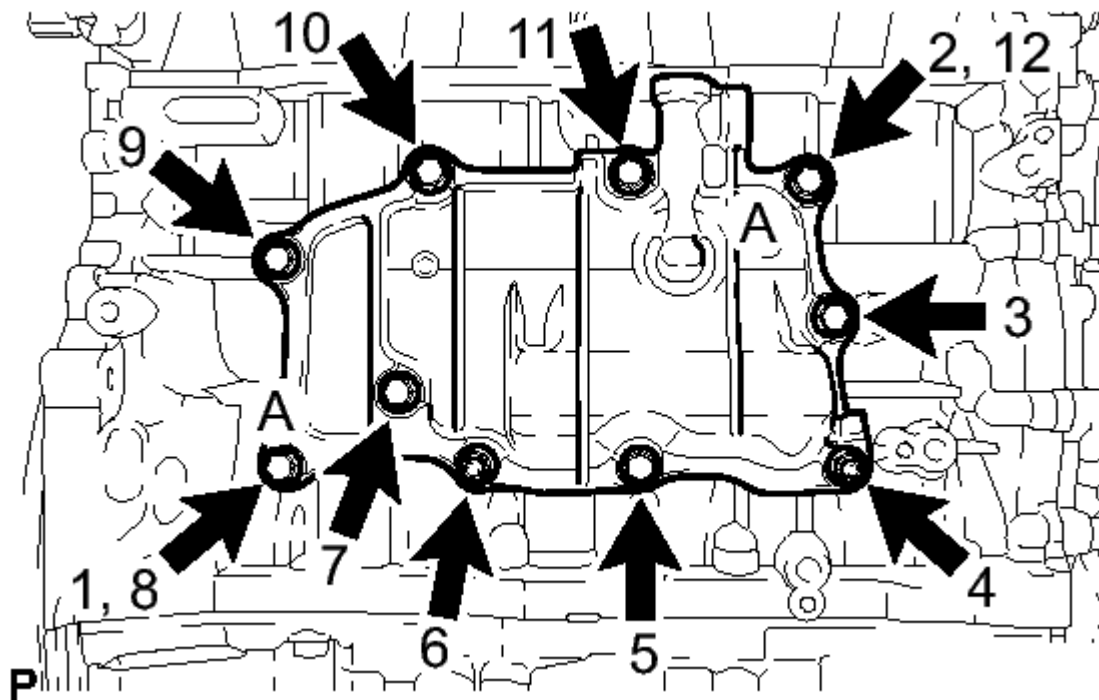
**TEXT IN ILLUSTRATION**

*1	Seal Packing
----	--------------

**NOTE:**

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

- b. Install the PCV case, and then install the 8 bolts and 2 nuts in the order shown in the illustration.



**Fig. 262: Identifying Ventilation Case Bolts And Nuts Tightening Sequence**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

**HINT:**

Bolt A is tightened twice.

54. **INSTALL PCV VALVE** . Refer to **INSTALLATION - Step 1**
55. **INSTALL CAMSHAFT POSITION SENSOR (for Intake Side)** . Refer to **INSTALLATION - Step 2**
56. **INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side)** . Refer to **INSTALLATION - Step 1**
57. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)** . Refer to **INSTALLATION - Step 2**
58. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)** . Refer to **INSTALLATION - Step 1**
59. **INSTALL OIL FILLER CAP SUB-ASSEMBLY**
  - a. Install a new gasket to the oil filler cap.
  - b. Install the oil filler cap to the cylinder head.
60. **INSTALL SPARK PLUG** . Refer to **INSTALLATION - Step 1**
61. **INSTALL ENGINE COVER JOINT**
  - a. Install the 3 joints.

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

## INSTALLATION

### INSTALLATION

1. **INSTALL IGNITION COIL ASSEMBLY** . Refer to **INSTALLATION - Step 2**
2. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR** . Refer to **INSTALLATION - Step 1**
3. **INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY** . Refer to **INSTALLATION - Step 1**
4. **INSTALL WATER BY-PASS HOSE**
  - a. Install the No. 1 and No. 2 water by-pass hoses.
5. **INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET**
  - a. Install the bracket with the 4 bolts.

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

6. **INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 2**
7. **INSTALL NO. 2 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to **INSTALLATION - Step 3**
8. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** . Refer to **INSTALLATION - Step 4**
9. **INSTALL NO. 2 MANIFOLD STAY** . Refer to **INSTALLATION - Step 5**
10. **INSTALL MANIFOLD STAY** . Refer to **INSTALLATION - Step 6**
11. **INSTALL ENGINE OIL LEVEL DIPSTICK GUIDE**
  - a. Apply a light coat of engine oil to a new O-ring.
  - b. Install the O-ring to the dipstick guide.
  - c. Install the dipstick guide with the bolt.

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

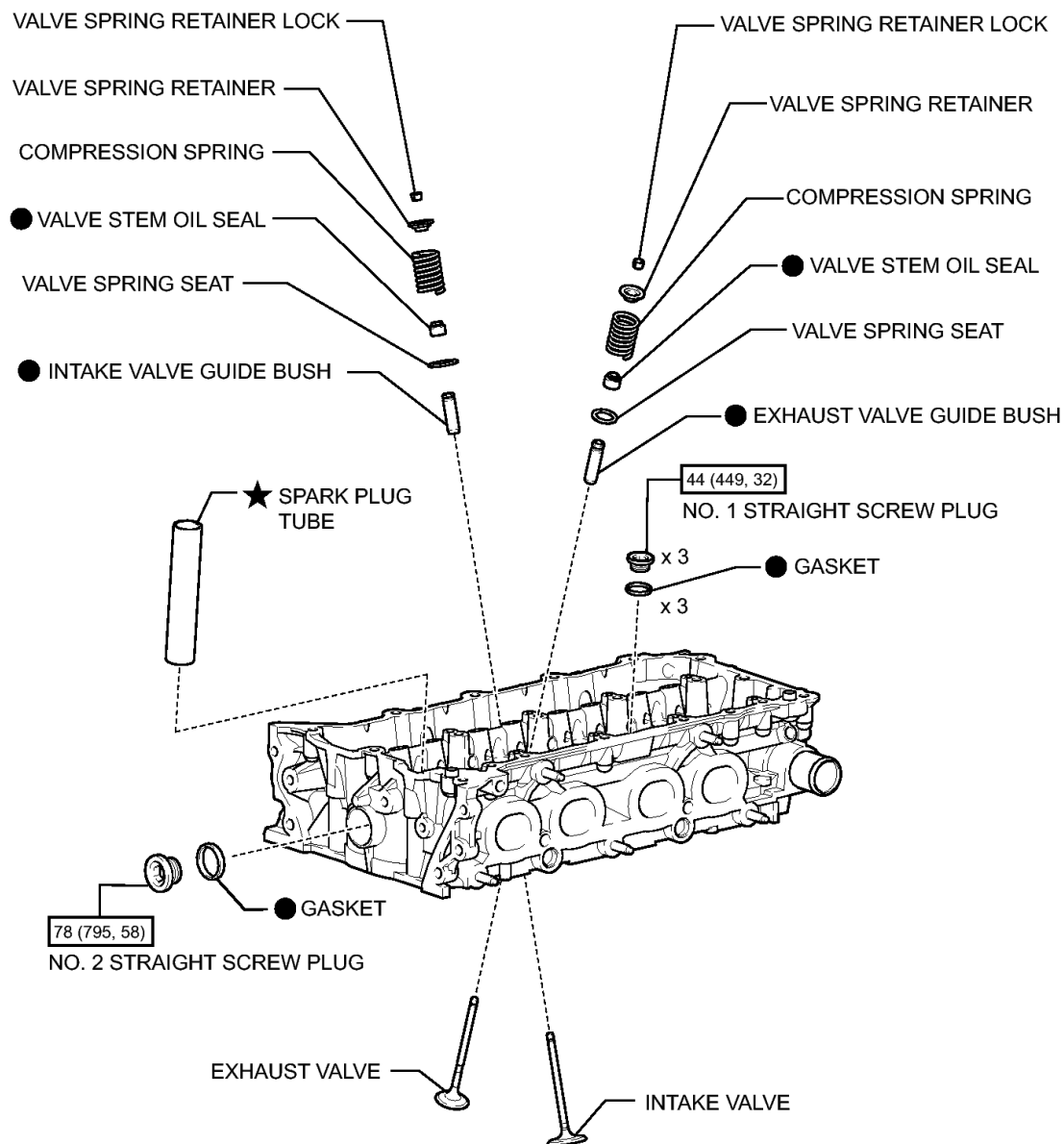
- d. Install the engine oil dipstick.
12. **INSTALL INTAKE MANIFOLD** . Refer to **INSTALLATION - Step 4**
13. **CONNECT NO. 2 PCV HOSE** . Refer to **INSTALLATION - Step 5**
14. **CONNECT WIRE HARNESS** . Refer to **INSTALLATION - Step 6**
15. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 2**
16. **CONNECT WIRE HARNESS** . Refer to **INSTALLATION - Step 3**
17. **CONNECT FUEL TUBE SUB-ASSEMBLY** . Refer to **INSTALLATION - Step 4**
18. **INSTALL THROTTLE BODY ASSEMBLY** . Refer to **INSTALLATION - Step 1**

## CYLINDER HEAD

### COMPONENTS



## ILLUSTRATION



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

● Non-reusable part

★ Precoated part

P

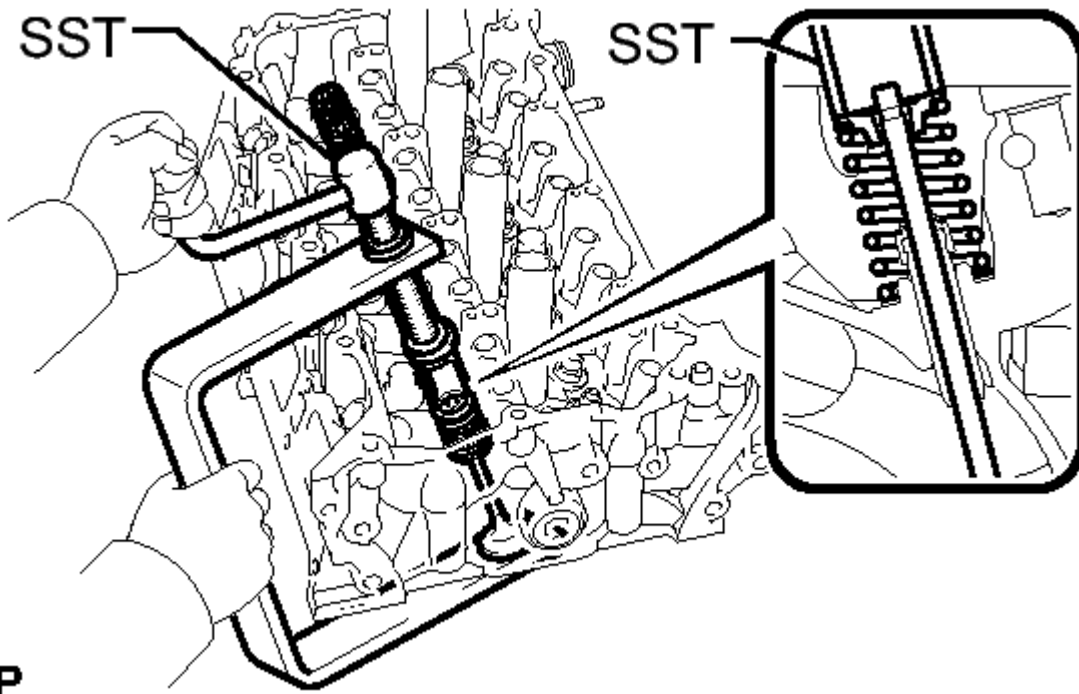
**Fig. 263: Identifying Cylinder Head Replacement Components With Torque Specifications**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## DISASSEMBLY

## DISASSEMBLY

## 1. REMOVE INTAKE VALVE

- a. Using SST and wooden blocks, compress the compression spring and remove the valve spring retainer locks.



**P**

**Fig. 264: Compressing Spring**

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

- SST: 09202-70020  
09202-00010

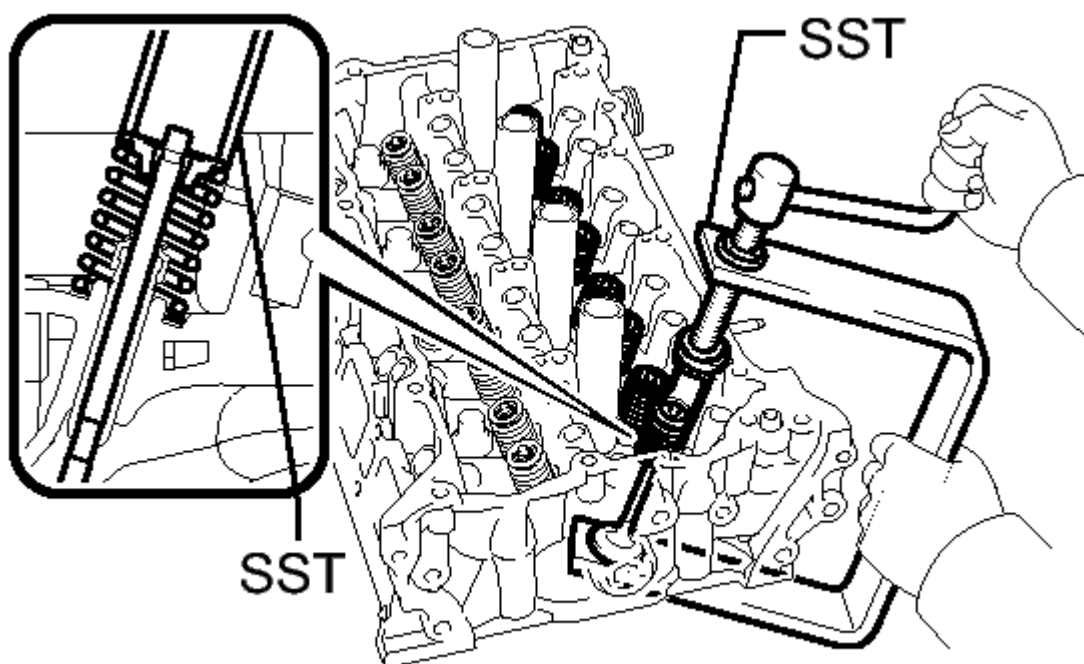
- b. Remove the retainer, compression spring and valve.

### 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 spring retainer locks.

**P****Fig. 265: Compressing Spring****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- SST: 09202-70020  
09202-00010

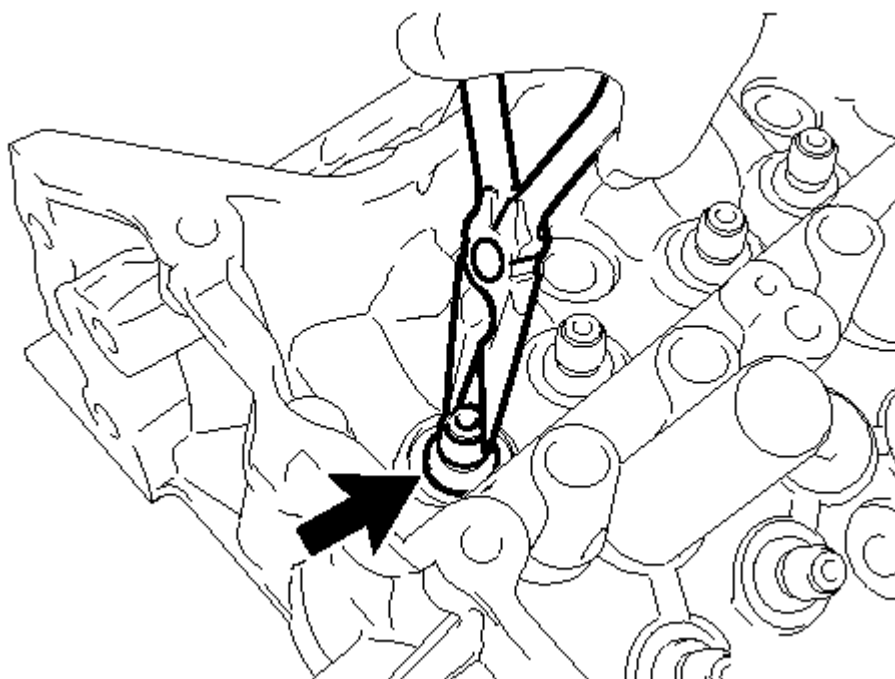
- b. Remove the retainer, compression spring and valve.

**HINT:**

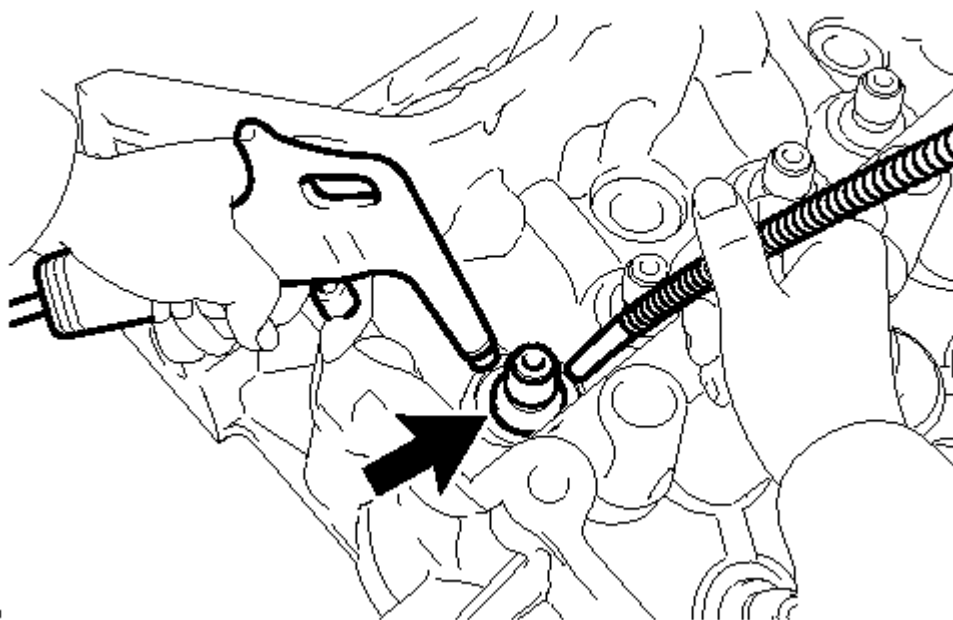
Arrange the removed parts in the correct order.

**3. REMOVE VALVE STEM OIL SEAL**

- a. Using needle-nose pliers, remove the oil seals.

**P****Fig. 266: Removing Oil Seals****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****4. REMOVE VALVE SPRING SEAT**

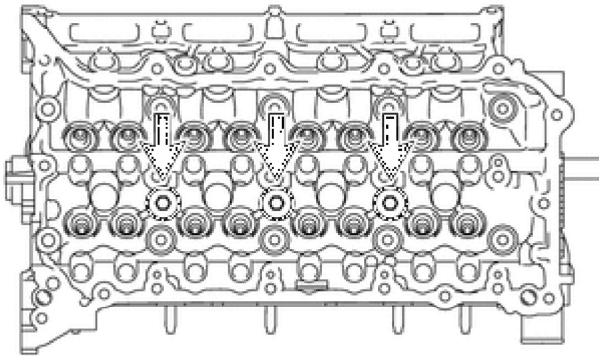
- a. Using compressed air and a magnet hand, remove the valve spring seat by blowing air onto it.

**P****Fig. 267: Removing Valve Spring Seat**

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

## 5. REMOVE NO. 1 STRAIGHT SCREW PLUG

**NOTE:** If coolant leaks from a No. 1 screw plug or a plug is corroded, replace it.



P

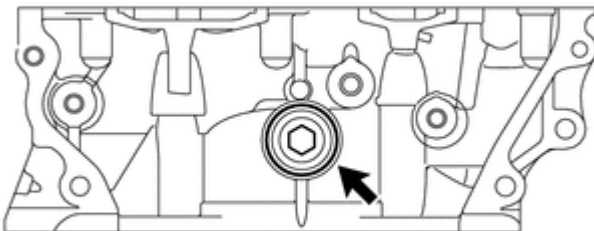
**Fig. 268: Location of No. 1 Straight Screw Plugs**

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

- a. Using a 10 mm hexagon wrench, remove the 3 screw plugs and 3 gaskets.

## 6. REMOVE NO. 2 STRAIGHT SCREW PLUG

**NOTE:** If coolant leaks from the No. 2 screw plug or the plug is corroded, replace it.



P

**Fig. 269: Location of No. 2 Straight Screw Plug**

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

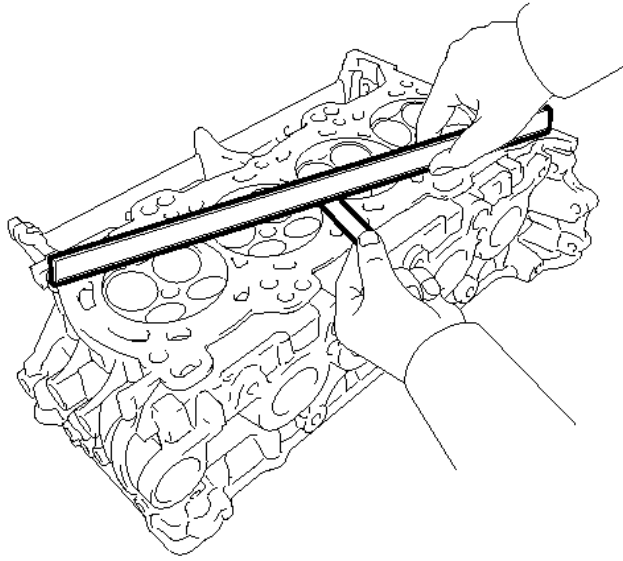
- a. Using a 14 mm hexagon wrench, remove the screw plug and gasket.

## 7. REMOVE STUD BOLT

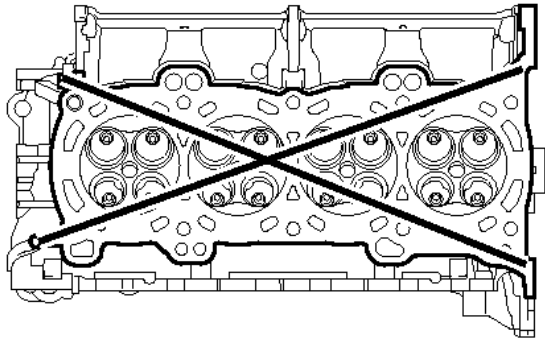
**NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

**INSPECTION****INSPECTION****1. INSPECT CYLINDER HEAD SUB-ASSEMBLY**

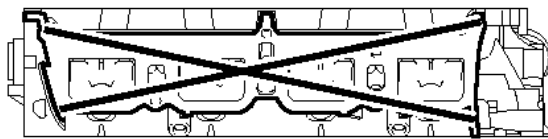
- a. Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces where the cylinder head contacts the cylinder block and manifold.



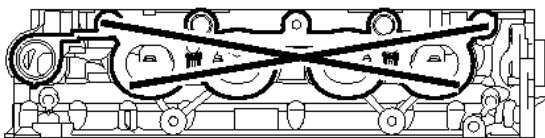
\*A



\*B



\*C



P

**Fig. 270: Measuring Cylinder Head For Warpage**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum Warpage



Item	Specified Condition
Cylinder head lower side	0.05 mm (0.00197 in.)
Intake manifold side	0.10 mm (0.0394 in.)
Exhaust manifold side	0.10 mm (0.0394 in.)

**TEXT IN ILLUSTRATION**

*A	Cylinder Head Lower Side
*B	Intake Manifold Side
*C	Exhaust Manifold Side

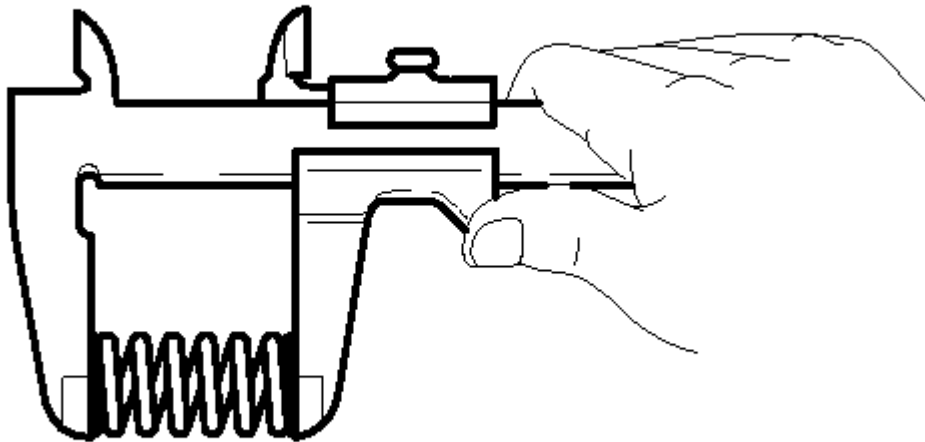
If the warpage is more than the maximum, replace the cylinder head.

- b. Using a dye penetrant, check the intake ports, exhaust ports and cylinder surface for cracks.

If cracked, replace the cylinder head.

**2. INSPECT COMPRESSION SPRING**

- a. Using a vernier caliper, measure the free length of the inner compression spring.

**P**



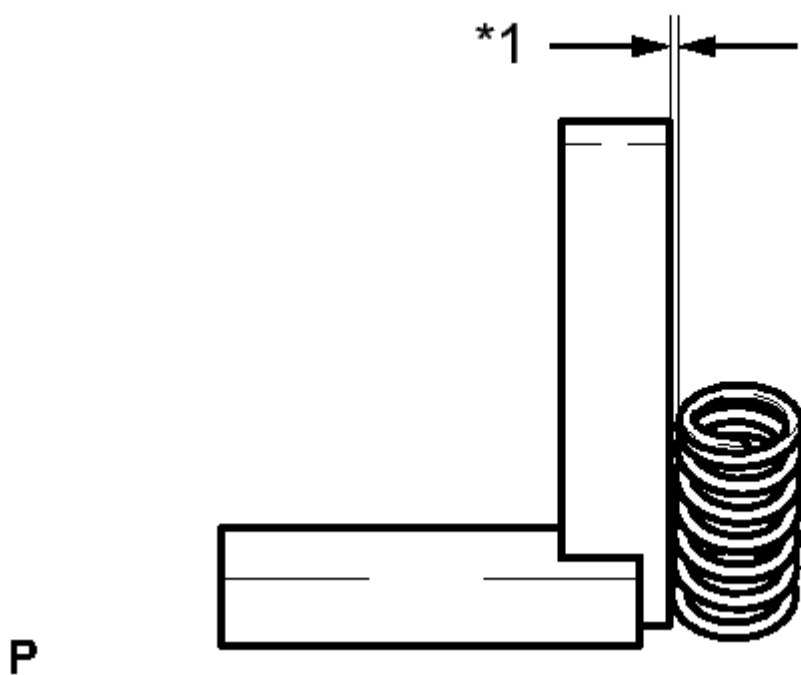
**Fig. 271: Measuring Free Length Of Inner Compression Spring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard free length

50.0 mm (1.97 in.)

If the free length is not as specified, replace the spring.

- b. Using a steel square, measure the deviation of the inner compression spring.



**P**

**Fig. 272: Measuring Deviation Of Inner Compression Spring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum deviation

1.0 mm (0.0394 in.)

Maximum angle

2°

**TEXT IN ILLUSTRATION**

\*1 Deviation

If the deviation is more than the maximum, replace the spring.

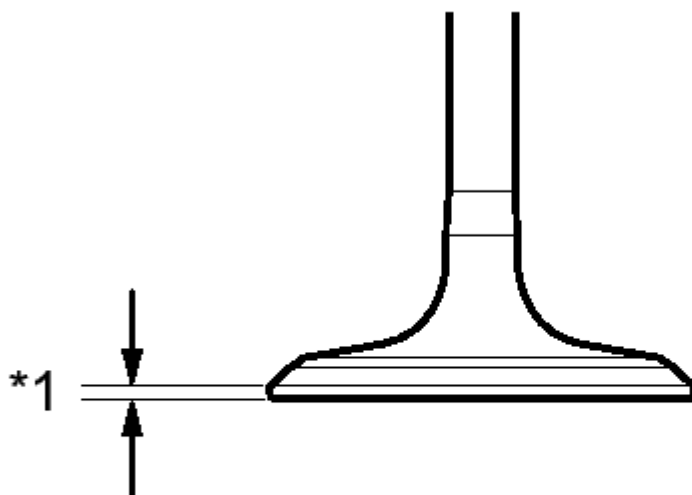
### 3. INSPECT INTAKE VALVE

- a. Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter

5.470 mm to 5.485 mm (0.2151 to 0.2157 in.)

- b. Using a vernier caliper, measure the valve head margin thickness.



## P

**Fig. 273: Measuring Valve Head Margin Thickness**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard margin thickness

1.0 mm (0.0394 in.)

Minimum margin thickness

0.50 mm (0.0197 in.)

### TEXT IN ILLUSTRATION

*1	Margin Thickness
----	---------------------

If the margin thickness is less than the minimum, replace the valve.

- c. Using a vernier caliper, measure the overall length of the valve.

Standard overall length

103.92 mm (4.09 in.)

Minimum overall length

103.42 mm (4.07 in.)

If the overall length is less than the minimum, replace the intake valve.

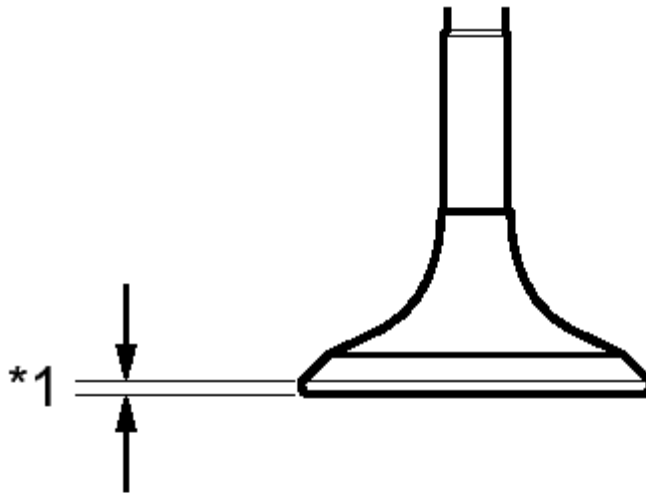
#### 4. INSPECT EXHAUST VALVE

- a. Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter

5.465 mm to 5.480 mm (0.2153 to 0.2159 in.)

- b. Using a vernier caliper, measure the valve head margin thickness.



**P**

**Fig. 274: Measuring Valve Head Margin Thickness**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard margin thickness

1.0 mm (0.0394 in.)

Minimum margin thickness

0.50 mm (0.0197 in.)

**TEXT IN ILLUSTRATION**

*1	Margin Thickness
----	---------------------

If the margin thickness is less than the minimum, replace the exhaust valve.

- c. Using a vernier caliper, measure the overall length of the valve.

Standard overall length

112.91 mm (4.44 in.)

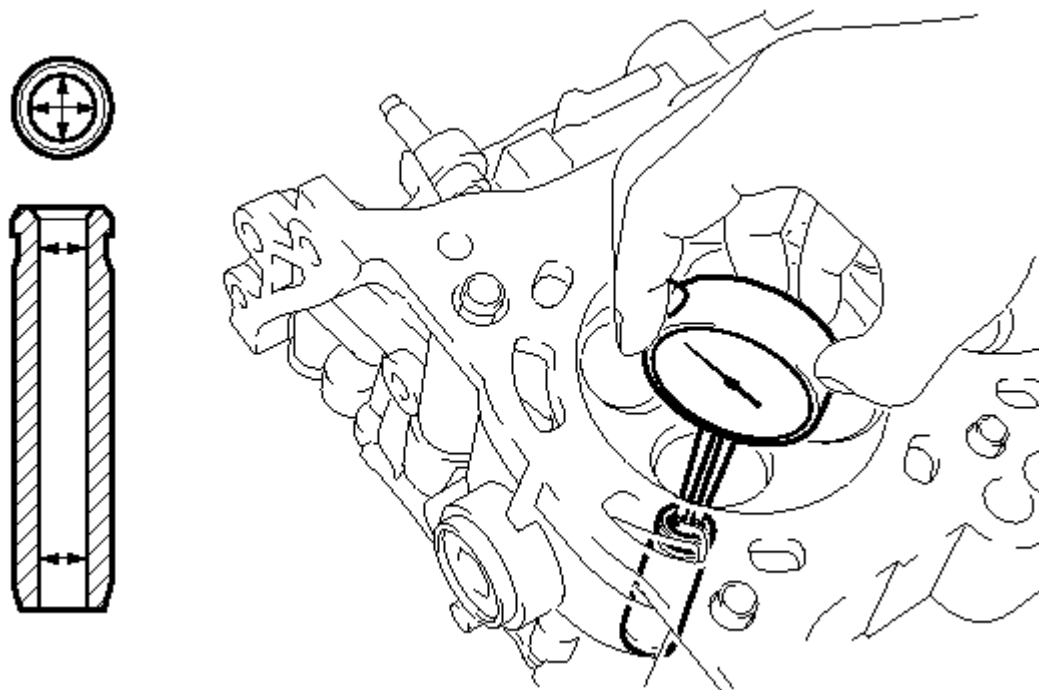
Minimum overall length

112.41 mm (4.43 in.)

If the overall length is less than the minimum, replace the exhaust valve.

**5. INSPECT VALVE GUIDE BUSH OIL CLEARANCE**

- a. Using a caliper gauge, measure the inside diameter of the guide bush.



**P**

**Fig. 275: Measuring Inside Diameter Of Guide Bush**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard bush inside diameter

5.510 to 5.530 mm (0.2169 to 0.2177 in.)

- b. 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 (0.00098 to 0.00236 in.)
Exhaust	0.030 to 0.065 mm (0.00118 to 0.00256 in.)

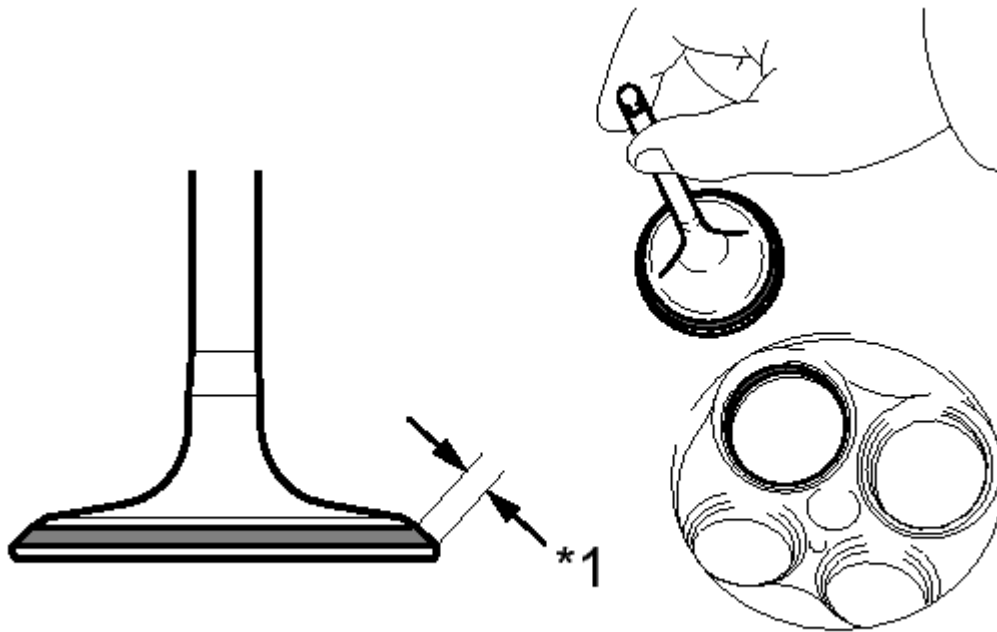
Maximum Oil Clearance

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.

## 6. INSPECT INTAKE VALVE SEAT

- a. Apply a light coat of Prussian blue to the valve face.
- b. Lightly press the valve face against the valve seat.

**P****Fig. 276: Pressing Valve Face Against Valve Seat**

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

**TEXT IN ILLUSTRATION**

\*1 Width

**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 and 1.5 mm (0.0433 and 0.0591 in.).

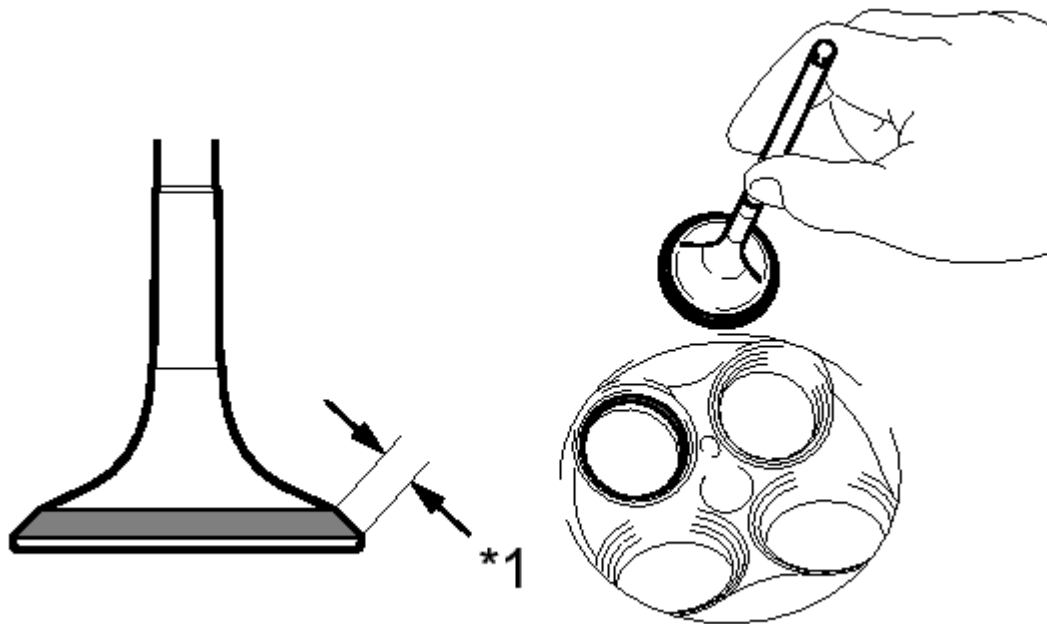
If not, correct the valve seat.

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.

**7. INSPECT EXHAUST VALVE SEAT**

- a. Apply a light coat of Prussian blue to the valve face.
- b. Lightly press the valve face against the valve seat.

**P****Fig. 277: Pressing Valve Face Against Valve Seat**

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

**TEXT IN ILLUSTRATION**

*1	Width
----	-------

**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 and 1.5 mm (0.0433 and 0.0591 in.).

If not, correct the valve seat.

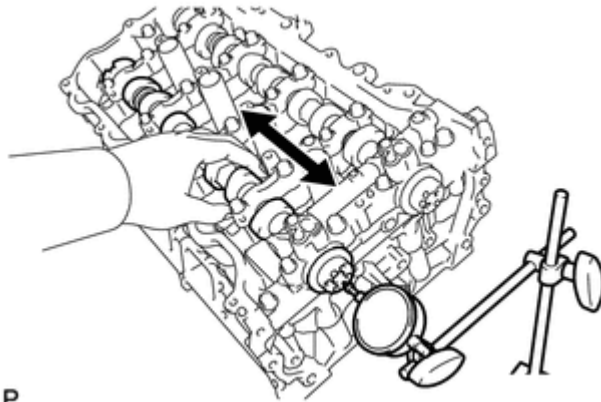
2. Check that the contact surfaces of the valve seat and valve face are even around the entire valve seat.

If not, correct the valve seat.

**8. INSPECT CAMSHAFT THRUST CLEARANCE**

a. Inspect the intake and exhaust camshafts.

1. Install the intake and exhaust camshafts.
2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.



P

**Fig. 278: Measuring Camshaft Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Thrust Clearance

0.060 to 0.155 mm (0.00236 to 0.00610 in.)

Maximum Thrust Clearance

0.170 mm (0.00669 in.)

If the thrust clearance is more than the maximum, replace the camshaft housing. If the thrust surface is damaged, replace the camshaft.

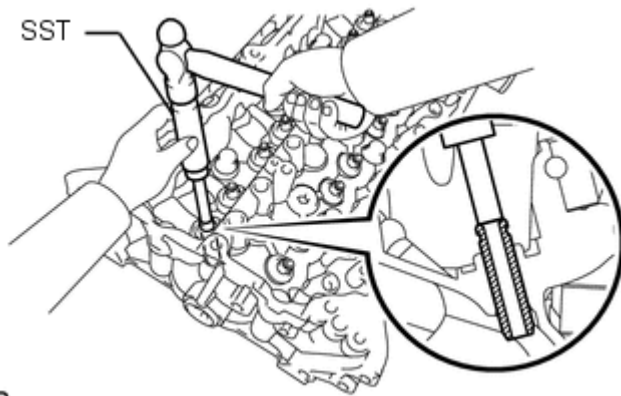
## REPLACEMENT

### REPLACEMENT

#### 1. REPLACE INTAKE VALVE GUIDE BUSH

- Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
- Place the cylinder head on wooden blocks.
- Using SST and a hammer, tap out the valve guide bush.
  - **SST: 09201-01055**
  - **SST: 09950-70010**  
09951-07100





P

**Fig. 279: Tapping Out Valve Guide Bush**

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

- d. Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard bush bore diameter

10.285 to 10.306 mm (0.405 to 0.406 in.)

If the bush bore diameter of the cylinder head is between 10.285 and 10.306 mm (0.405 and 0.406 in.), proceed to the next step.

If the bush bore diameter of the cylinder head is 10.356 mm (0.408 in.) or more, replace the cylinder head

- e. Select a new guide bush (STD or O/S 0.05) and measure its diameter.  
f. Machine the bush bore of the cylinder head to the diameter of the selected guide bush.

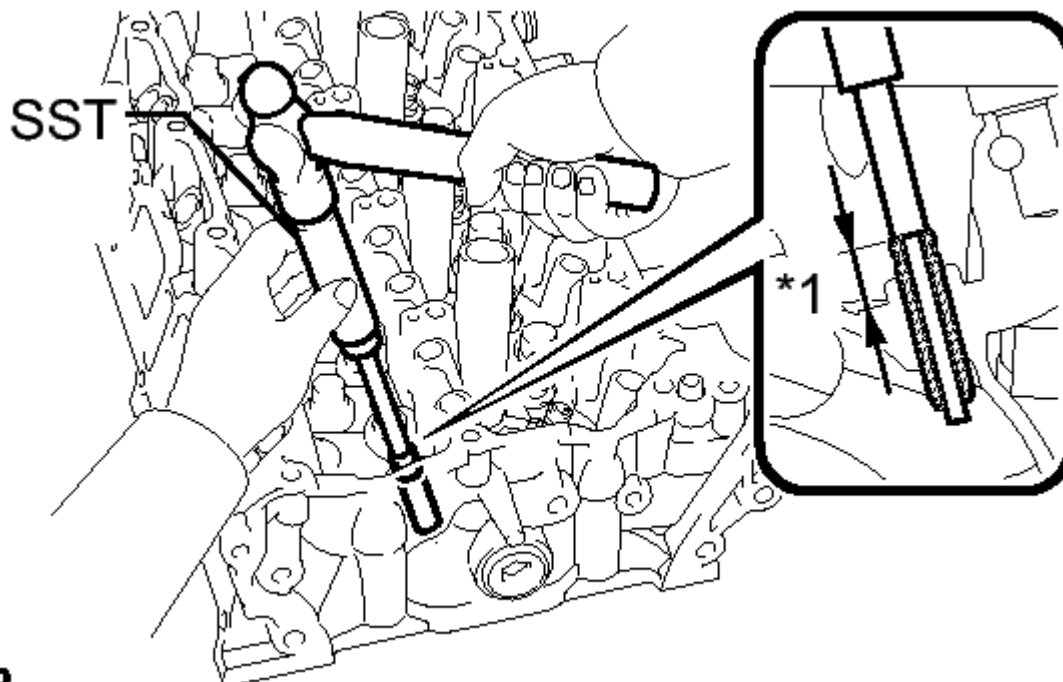
Bush Bore Diameter

Bush Size	Specified Condition
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.)

Standard bush length

41.3 to 41.7 mm (1.626 to 1.642 in.)

- g. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
- h. Using SST and a hammer, tap in the selected guide bush to the standard protrusion height.
  - SST: 09201-10000  
09201-01050
  - SST: 09950-70010  
09951-07100

**P**

**Fig. 280: Tapping in Guide Bush Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

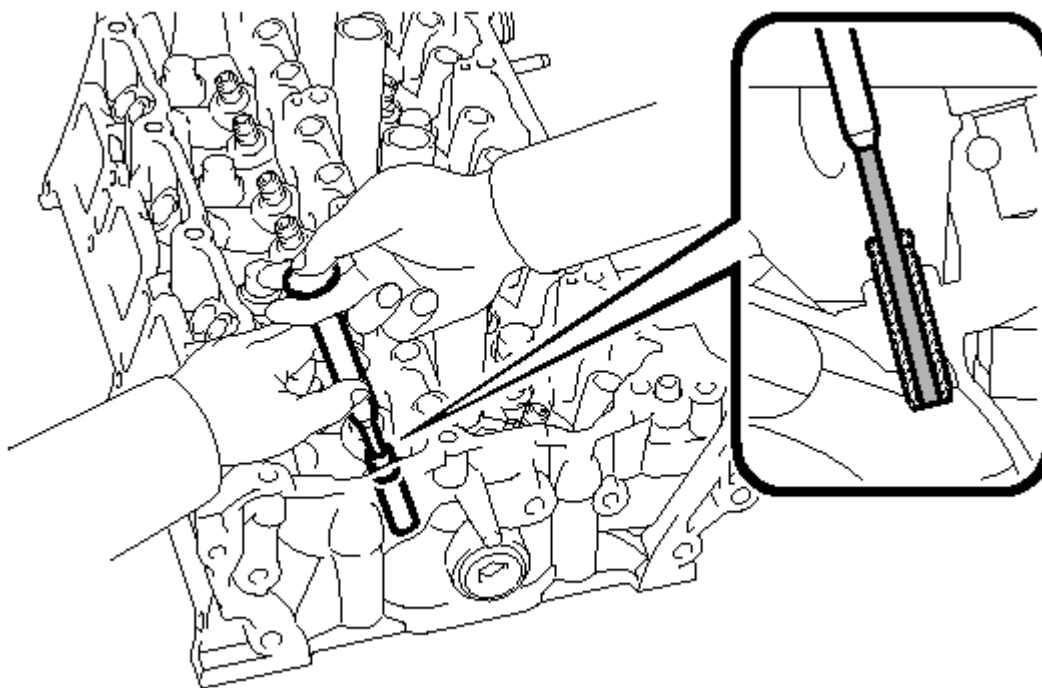
Standard protrusion height

14.8 to 15.2 mm (0.582 to 0.598 in.)

**TEXT IN ILLUSTRATION**

*1	Protrusion Height
----	----------------------

- i. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard oil clearance between the guide bush and valve stem.

**P****Fig. 281: Reaming Guide Bush****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Standard oil clearance

0.025 to 0.060 mm (0.00098 to 0.00236 in.)

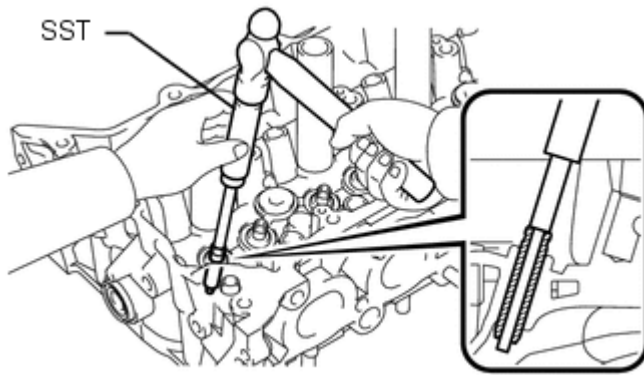
## **2. REPLACE EXHAUST VALVE GUIDE BUSH**

- 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.

- **SST: 09201-01055**

- **SST: 09950-70010**

09951-07100



P

**Fig. 282: Tapping Out Valve Guide Bush Using SST**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard bush bore diameter

10.285 to 10.306 mm (0.405 to 0.406 in.)

If the bush bore diameter of the cylinder head is between 10.285 and 10.306 mm (0.405 and 0.406 in.), proceed to the next step.

If the bush bore diameter of the cylinder head is 10.356 mm (0.408 in.) or more, replace the cylinder head.

- e. Select a new guide bush (STD or O/S 0.05) and measure its diameter.  
 f. Machine the bush bore of the cylinder head to the diameter of the selected guide bush.

Bush Bore Diameter

Bush Size	Specified Condition
STD	10.333 to 10.344 mm (0.4068 in to 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

Standard bush length

46.8 to 47.2 mm (1.843 to 1.858 in.)

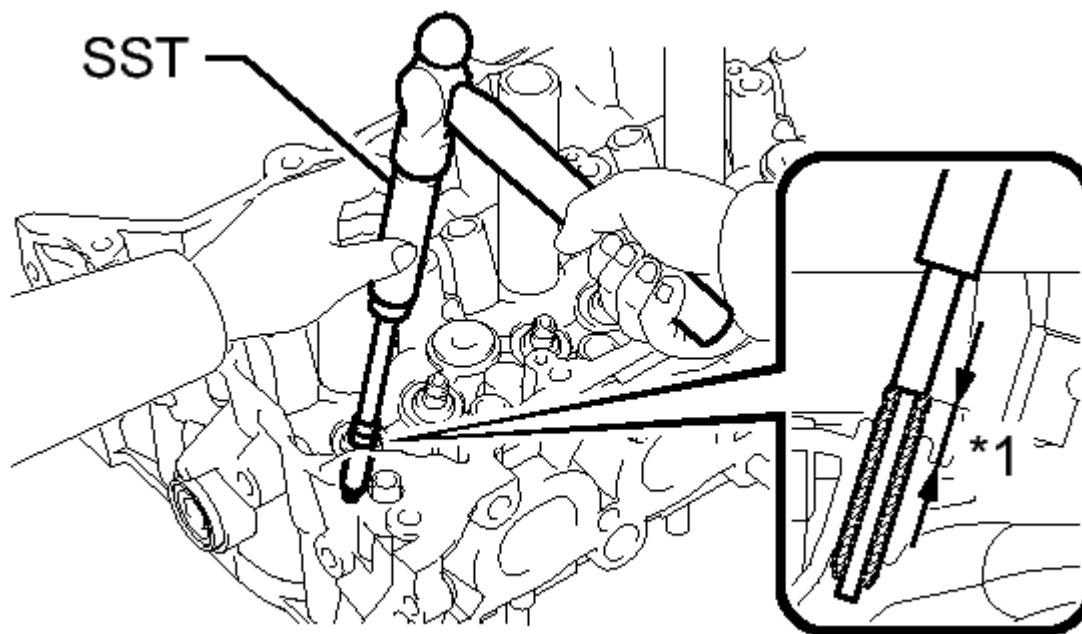
- g. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
- h. Using SST and a hammer, tap in the selected guide bush to the standard protrusion height.

- SST: 09201-10000

09201-01050

- SST: 09950-70010

09951-07100



## P

**Fig. 283: Tapping In Guide Bush Using SST**

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

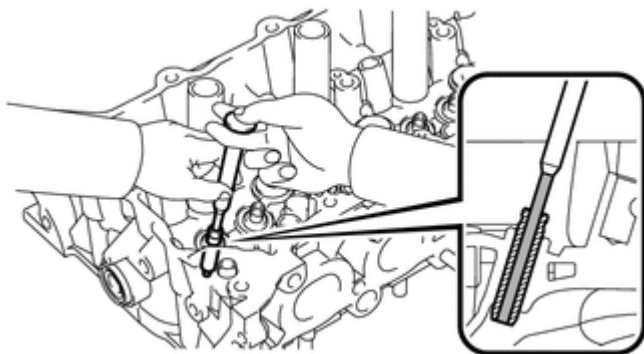
Standard protrusion height

14.2 to 14.6 mm (0.559 to 0.575 in.)

### TEXT IN ILLUSTRATION

*1	Protrusion Height
----	----------------------

- i. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard oil clearance between the guide bush and valve stem.



P

**Fig. 284: Reaming The Guide Bush**

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

Standard oil clearance

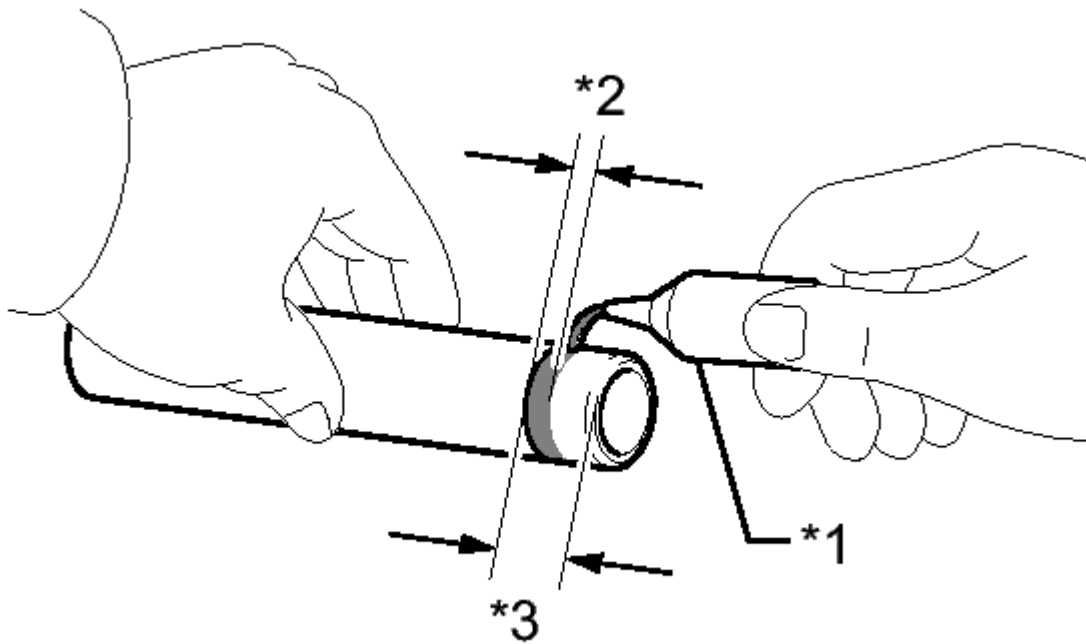
0.030 to 0.065 mm (0.00118 to 0.00256 in.)

### 3. REPLACE SPARK PLUG TUBE

**HINT:**

When using a new cylinder head, the spark plug tubes must be replaced.

- a. Remove the spark plug tube.
- b. Apply adhesive onto the shaded area of a new spark plug tube.

**P****Fig. 285: Applying Adhesive To Spark Plug Tube**

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

Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent.

Standard application width

2.0 mm (0.0787 in.)

Distance

6.0 mm (0.236 in.)

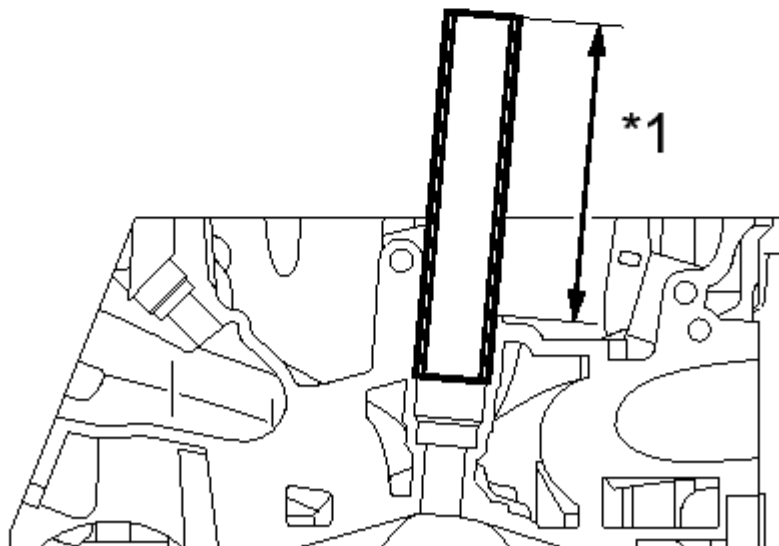
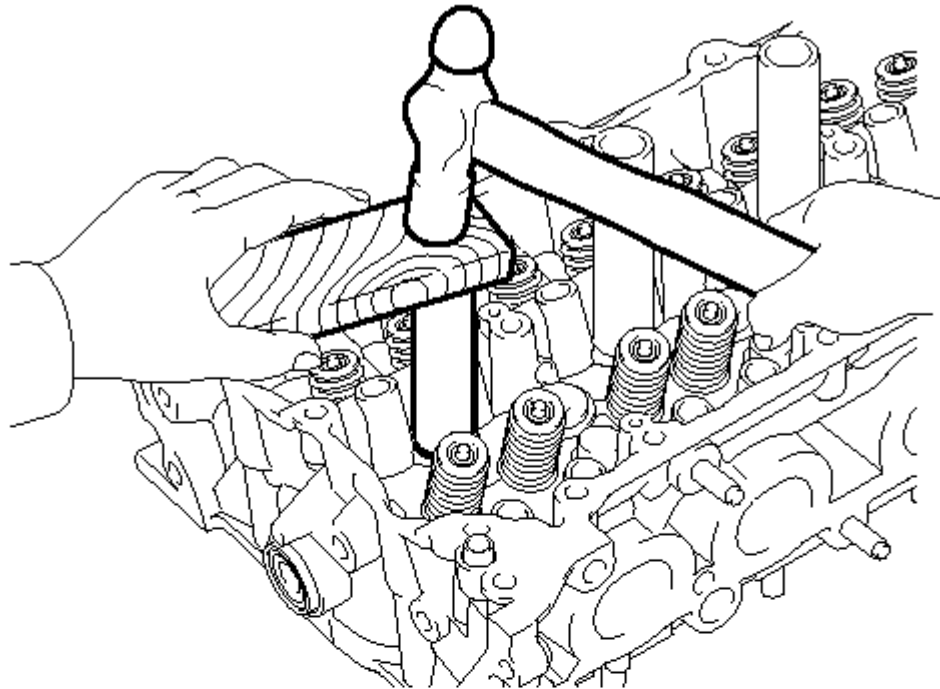
**TEXT IN ILLUSTRATION**

*1	Adhesive
*2	Application Width
*3	Distance

**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.

- c. Using a wooden block and hammer, tap in the spark plug tube to the specified protrusion height.



**P**

**Fig. 286: Tapping In Spark Plug Tube**

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



Standard protrusion height

112 mm (4.41 in.)

**TEXT IN ILLUSTRATION**

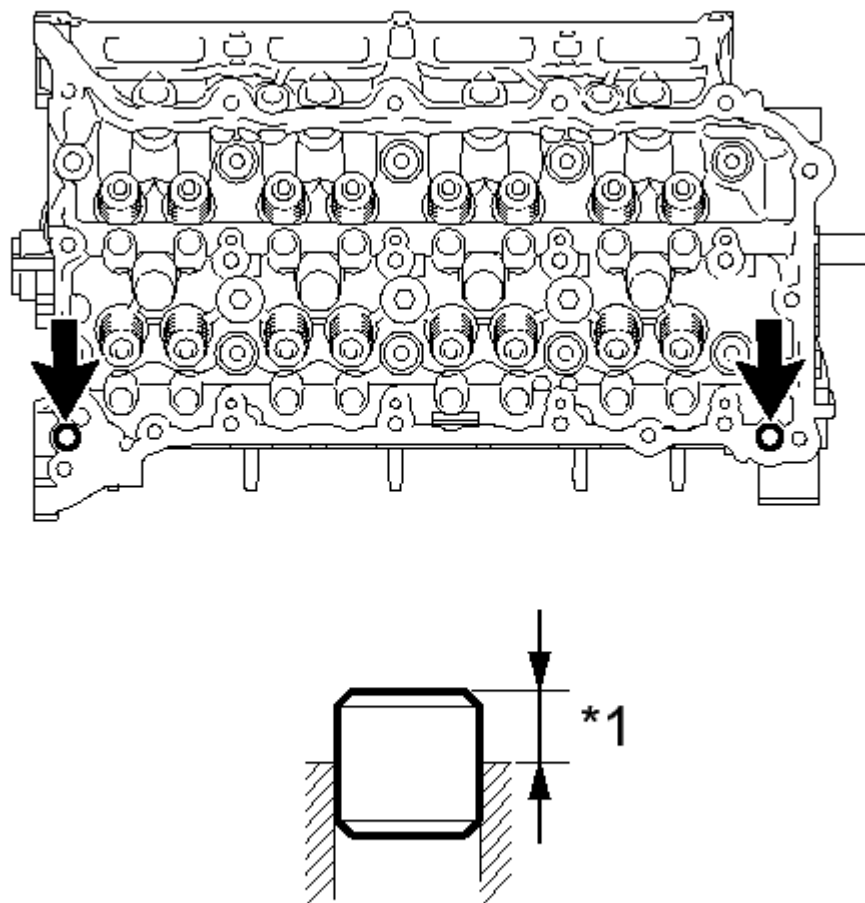
*1	Protrusion Height
----	----------------------

**NOTE:** To avoid tapping in the spark plug tube too far, measure the protrusion height while tapping it.

**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.

**P****Fig. 287: Cylinder Head Ring Pins****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Standard protrusion height

6.5 to 7.5 mm (0.256 to 0.295 in.)

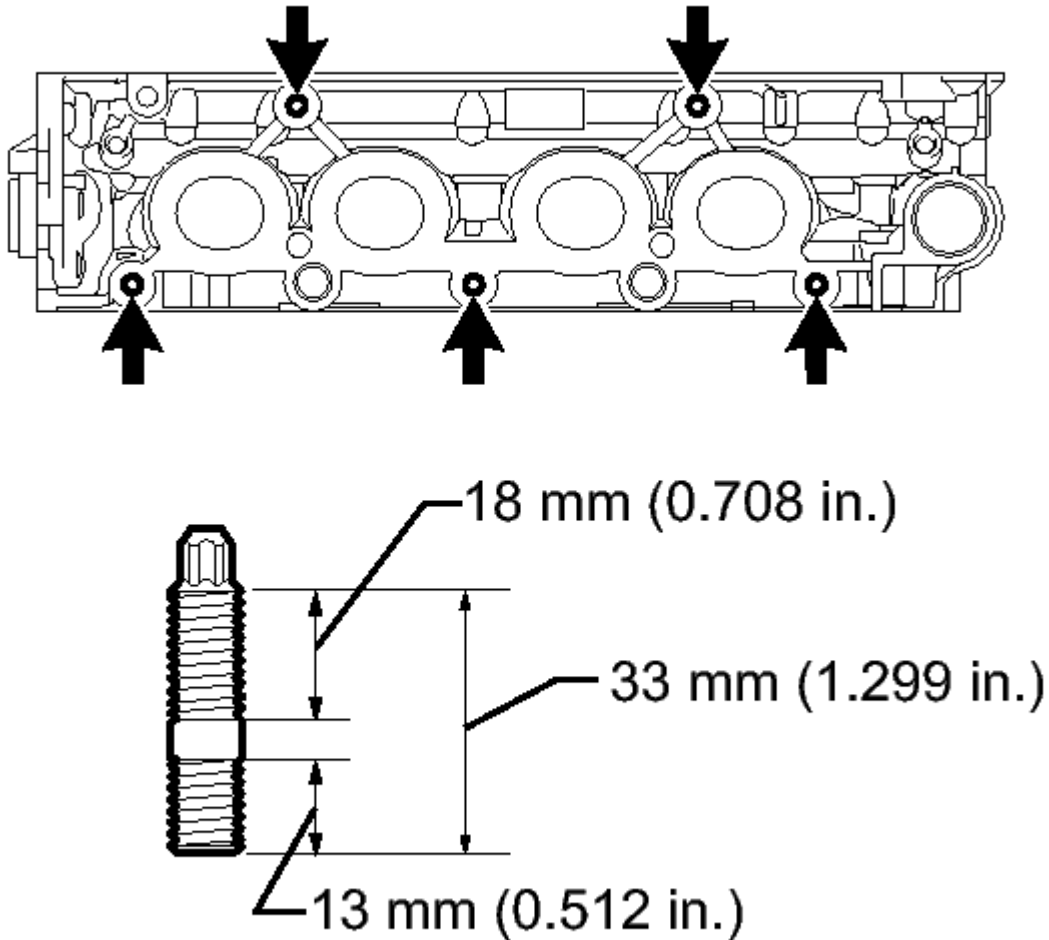
**TEXT IN ILLUSTRATION**

*1	Protrusion Height
----	----------------------

**REASSEMBLY****REASSEMBLY****1. INSTALL CYLINDER HEAD STUD BOLT**

**NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

- a. Using an E7 "TORX" socket wrench, install the cylinder head stud bolts.



**P**

**Fig. 288: Identifying Cylinder Head Stud Bolt Dimensions**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 9.5 N\*m (97 kgf\*cm, 84 in.\*lbf)**

## 2. INSTALL NO. 1 STRAIGHT SCREW PLUG

**NOTE:** If coolant leaks from a straight screw plug or a plug is corroded, replace it.

- a. Using a 10 mm hexagon wrench, install 3 new gaskets and the 3 straight screw plugs.

**Torque: 44 N\*m (449 kgf\*cm, 32 ft.\*lbf)**

### 3. INSTALL NO. 2 STRAIGHT SCREW PLUG

**NOTE:** If coolant leaks from a straight screw plug or a plug is corroded, replace it.

- a. Using a 14 mm hexagon wrench, install a new gasket and the straight screw plug.

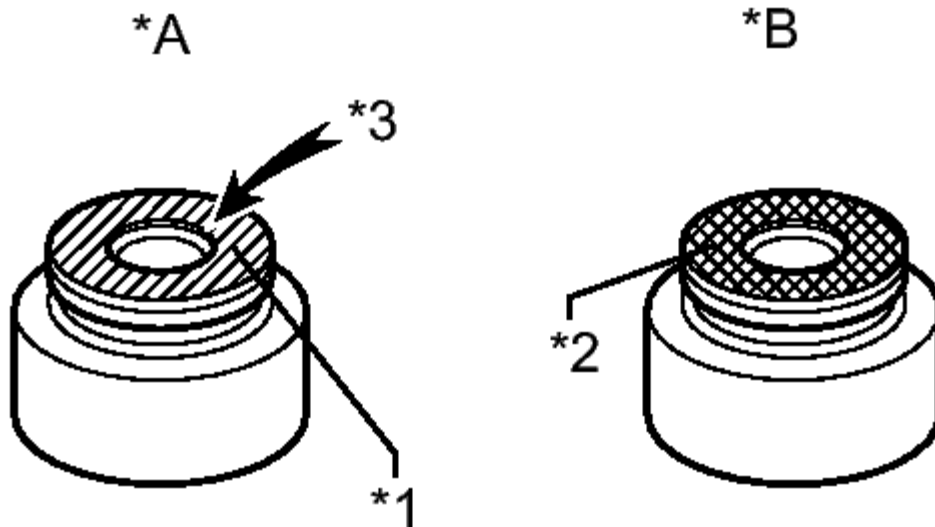
**Torque: 78 N\*m (795 kgf\*cm, 58 ft.\*lbf)**

### 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.



**H**

**Fig. 289: Valve Stem Oil Seal**

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

#### TEXT IN ILLUSTRATION

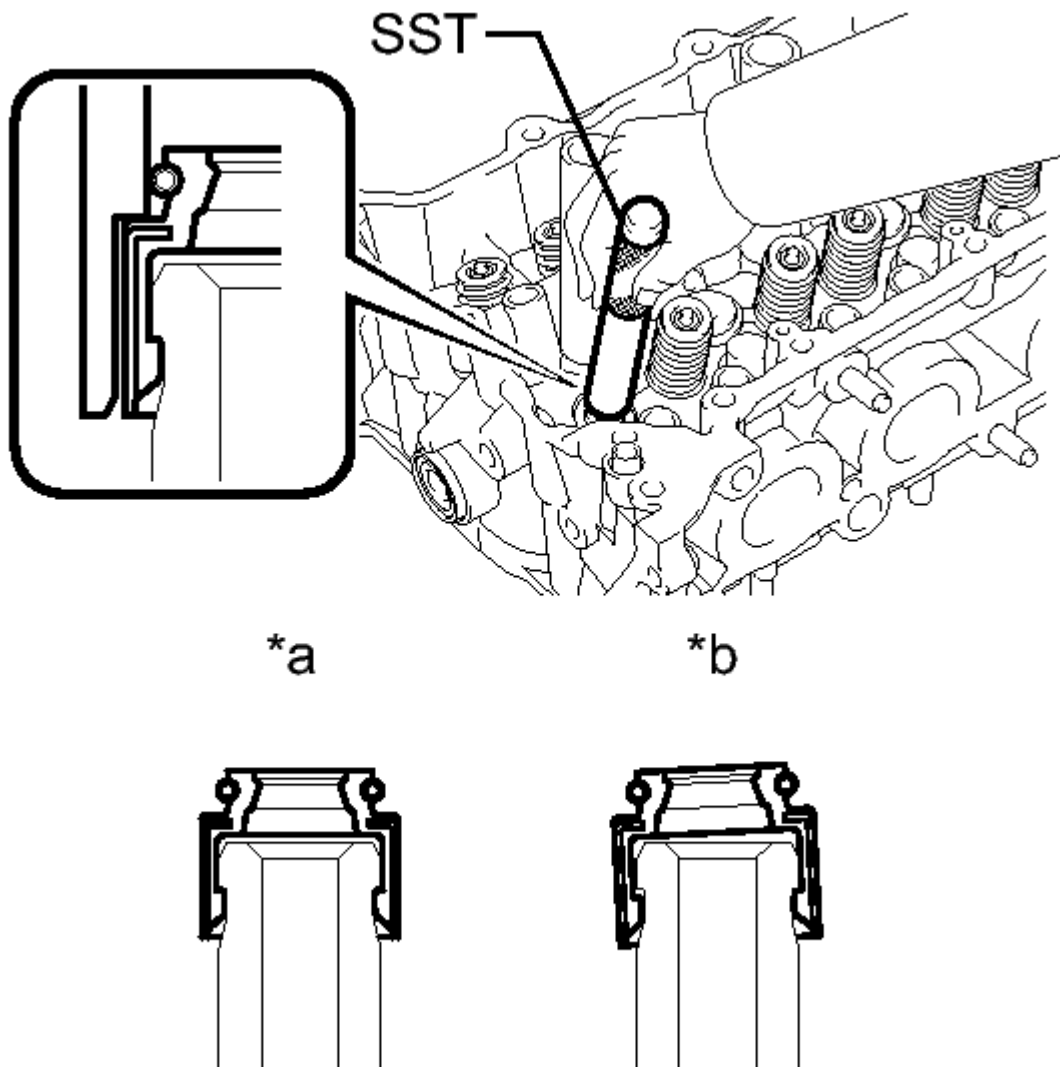
*A	Intake Side
*B	Exhaust Side
*1	Gray
*2	Black
*3	Mark "NOK"

**NOTE:** Pay attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal onto the exhaust side or installing the exhaust oil seal onto the intake side can cause installation problems later.

**HINT:**

The intake valve oil seals are gray and the exhaust valve oil seals are black.

- b. Using SST, push in the intake and exhaust valve oil seals.



**P**

**Fig. 290: Installing Valve Oil Seals using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- SST: 09201-41020

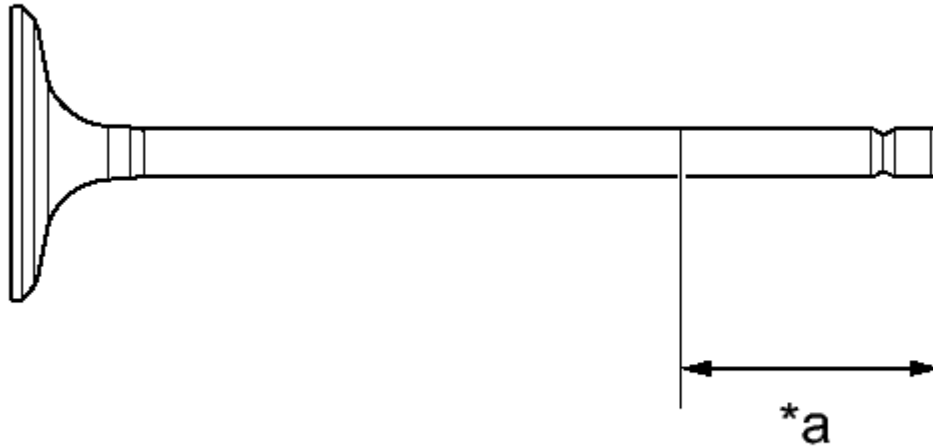
**TEXT IN ILLUSTRATION**

*a	CORRECT
*b	INCORRECT

**NOTE:** Failure to use SST will cause the seal to be damaged or improperly seated.

**6. INSTALL INTAKE VALVE**

- a. Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.

**T**

**Fig. 291: Intake Valve Oil Application Area**

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

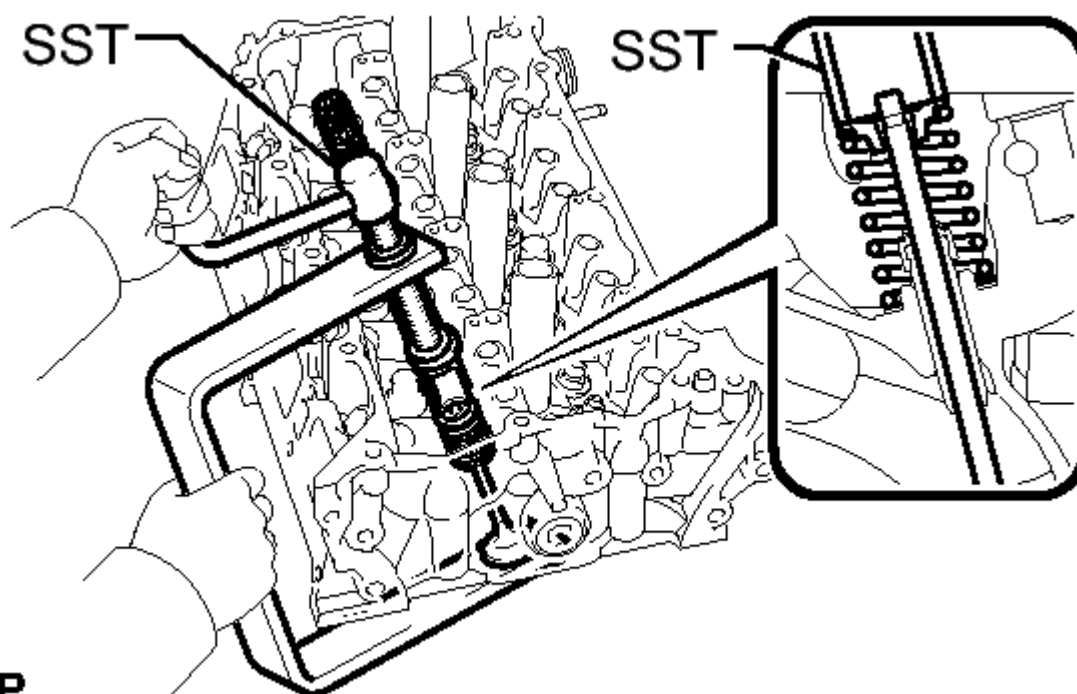
**TEXT IN ILLUSTRATION**

*a	30 mm (1.18 in.) or more
----	--------------------------

- 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.

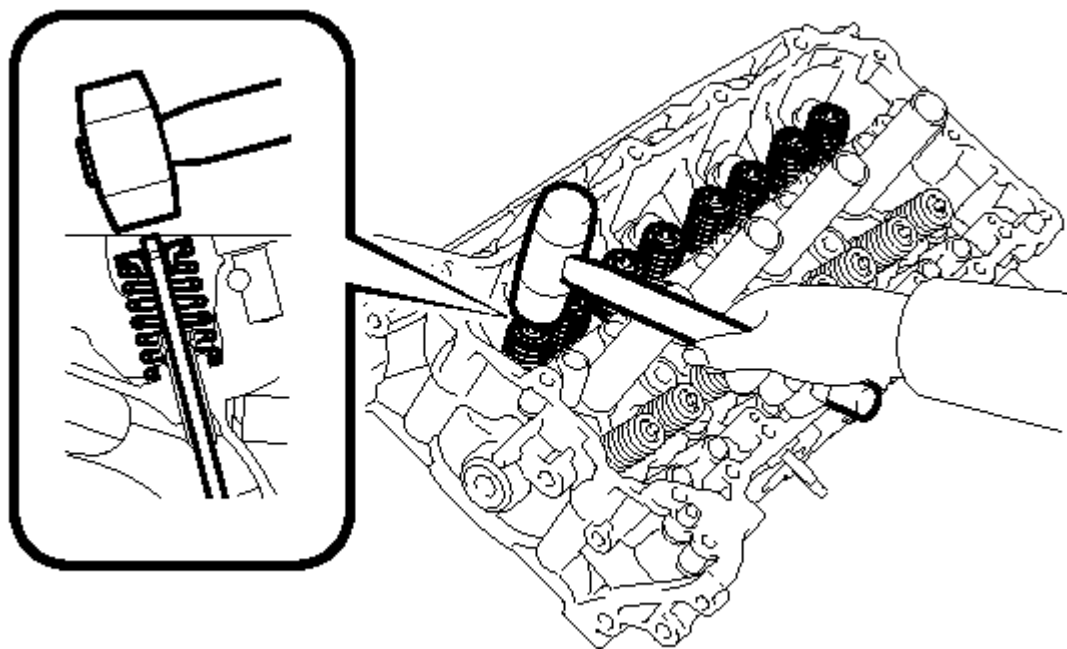
- c. Using SST and wooden blocks, compress the spring and install the retainer locks.

**P****Fig. 292: Compressing Spring**

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.

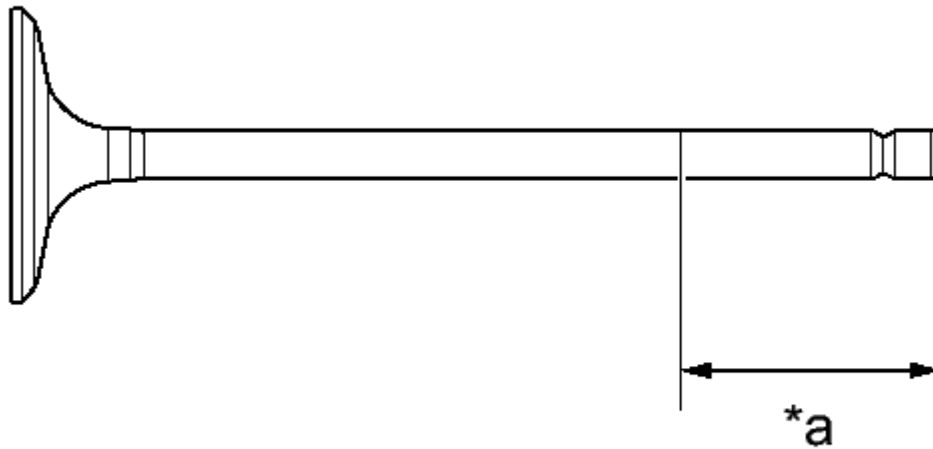
**P**

**Fig. 293: 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. 294: Intake Valve Oil Application Area**

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

**TEXT IN ILLUSTRATION**

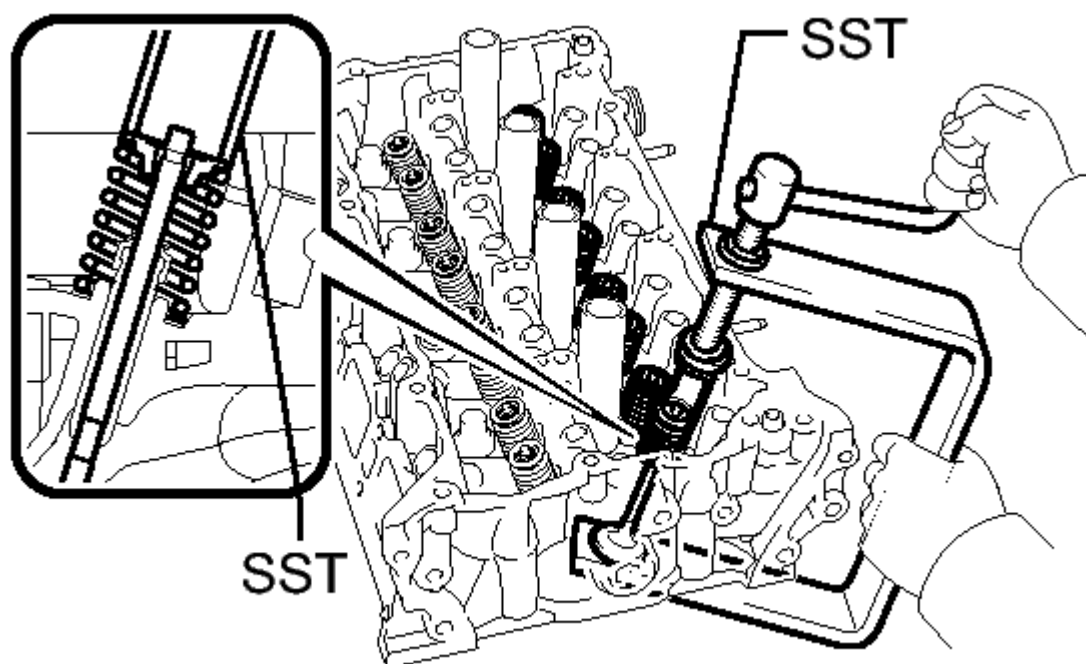
*a	30 mm (1.18 in.) or more
----	--------------------------

- 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.





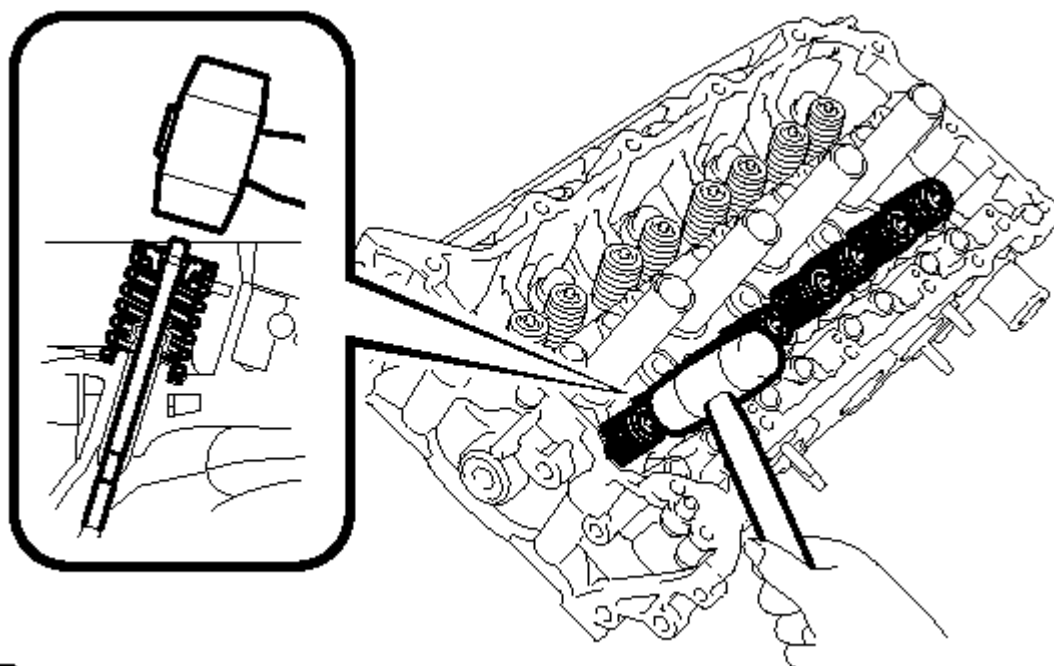
P

**Fig. 295: Compressing Spring**

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.



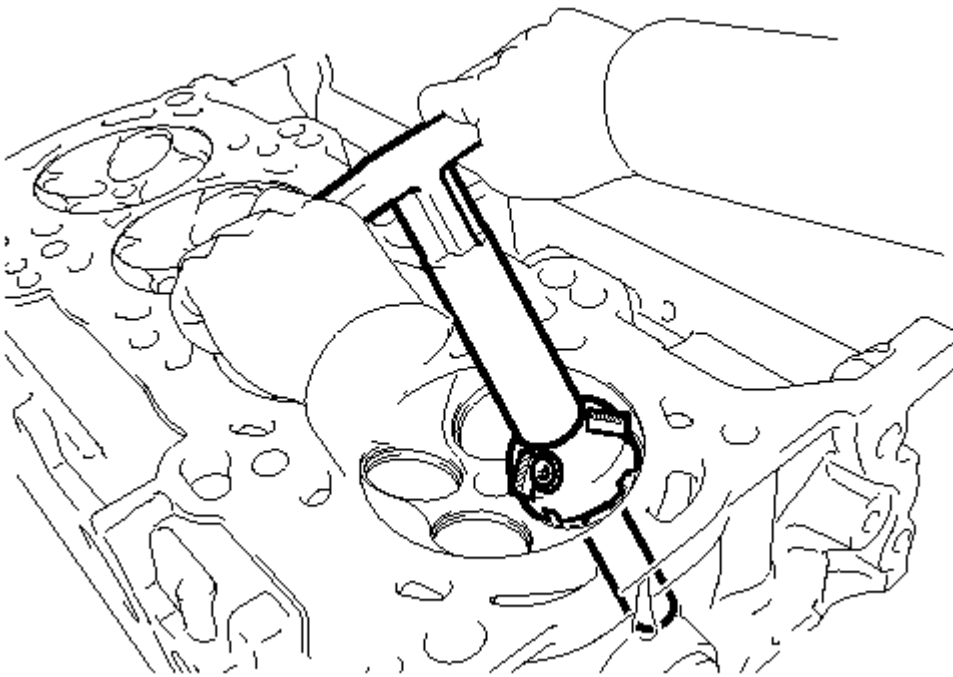
P

**Fig. 296: Tapping Valve Stem Tip**

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

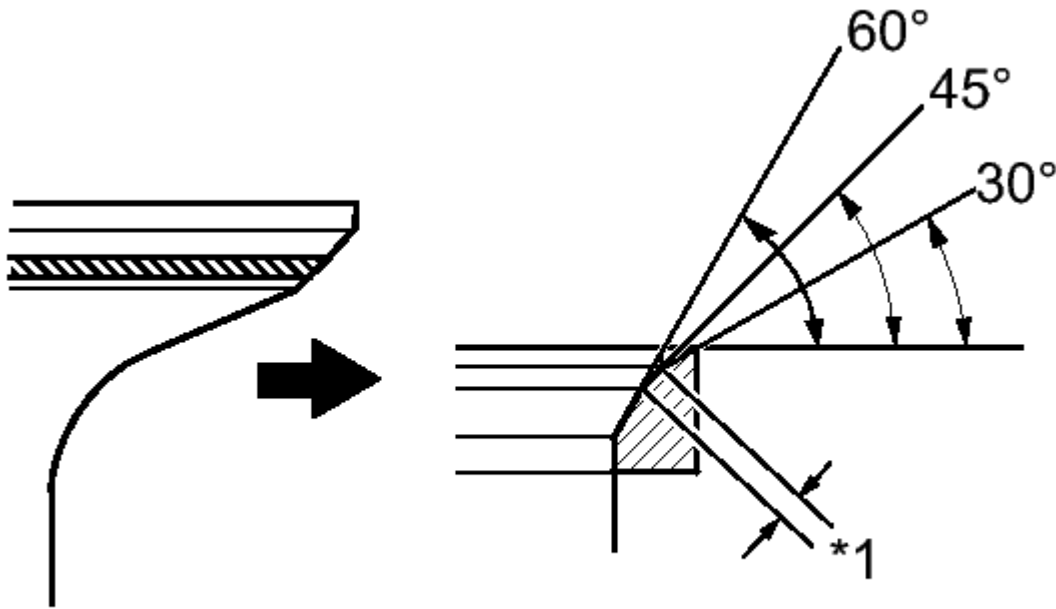
**NOTE:** Be careful not to damage the retainer.**REPAIR****REPAIR****1. REPAIR INTAKE VALVE SEAT****NOTE:**

- Repair the seat while checking the seating position.
  - Keep the lip free of foreign matter.
  - Take off the 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.

**P****Fig. 297: Cutting Intake 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. 298: Valve Seat Positioning**

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

Standard width

1.0 to 1.4 mm (0.0394 to 0.0551 in.)

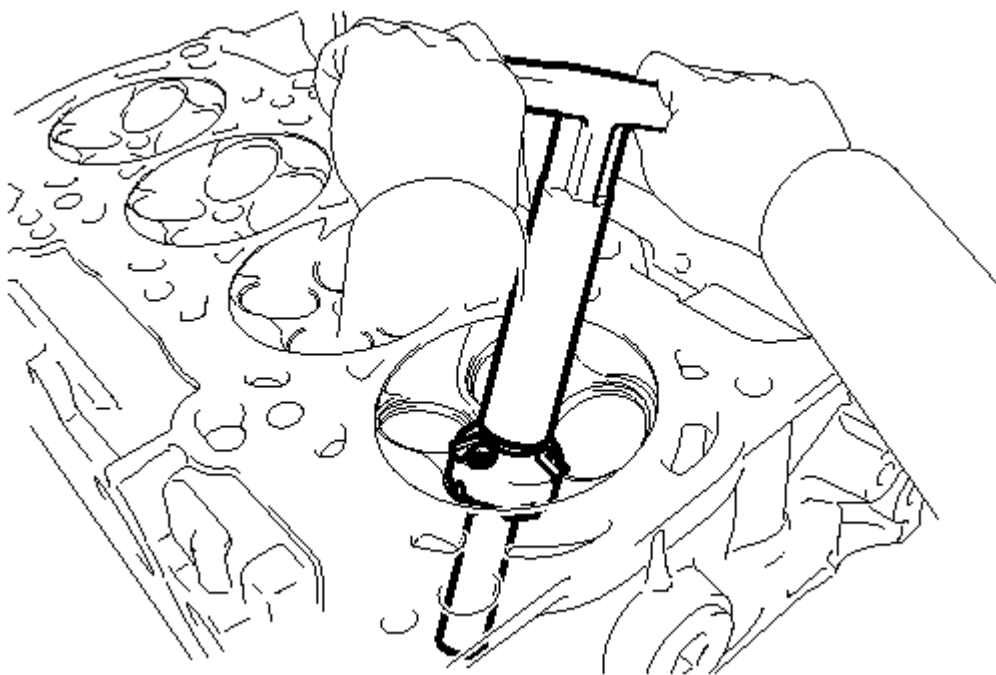
**TEXT IN ILLUSTRATION**

\*1 Width

- 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 the 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.

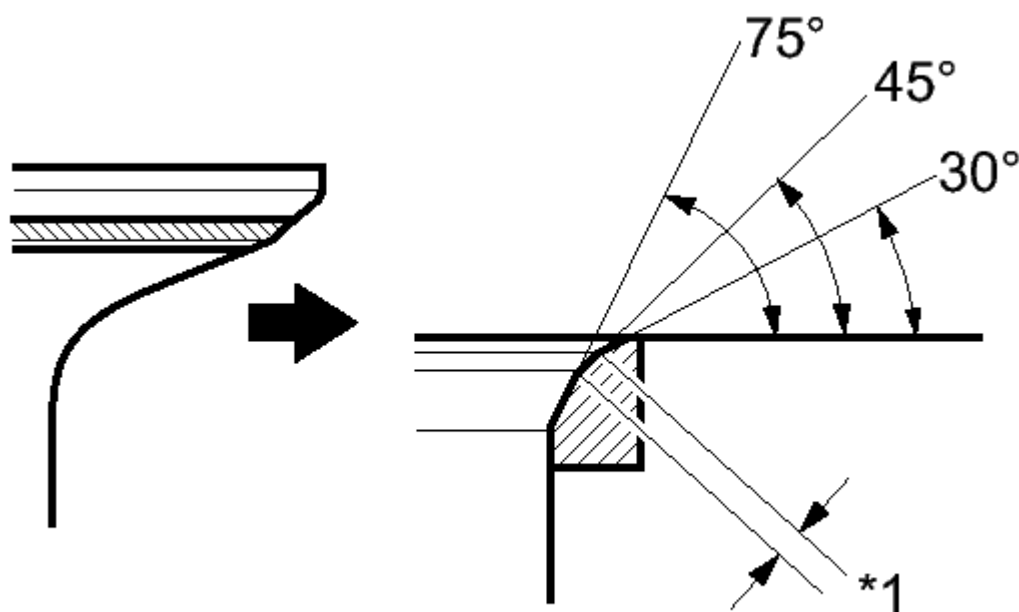


P

**Fig. 299: Cutting Exhaust Valve Seat**

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

- b. Using 30° and 75° 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. 300: Valve Seat Positioning****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Standard width

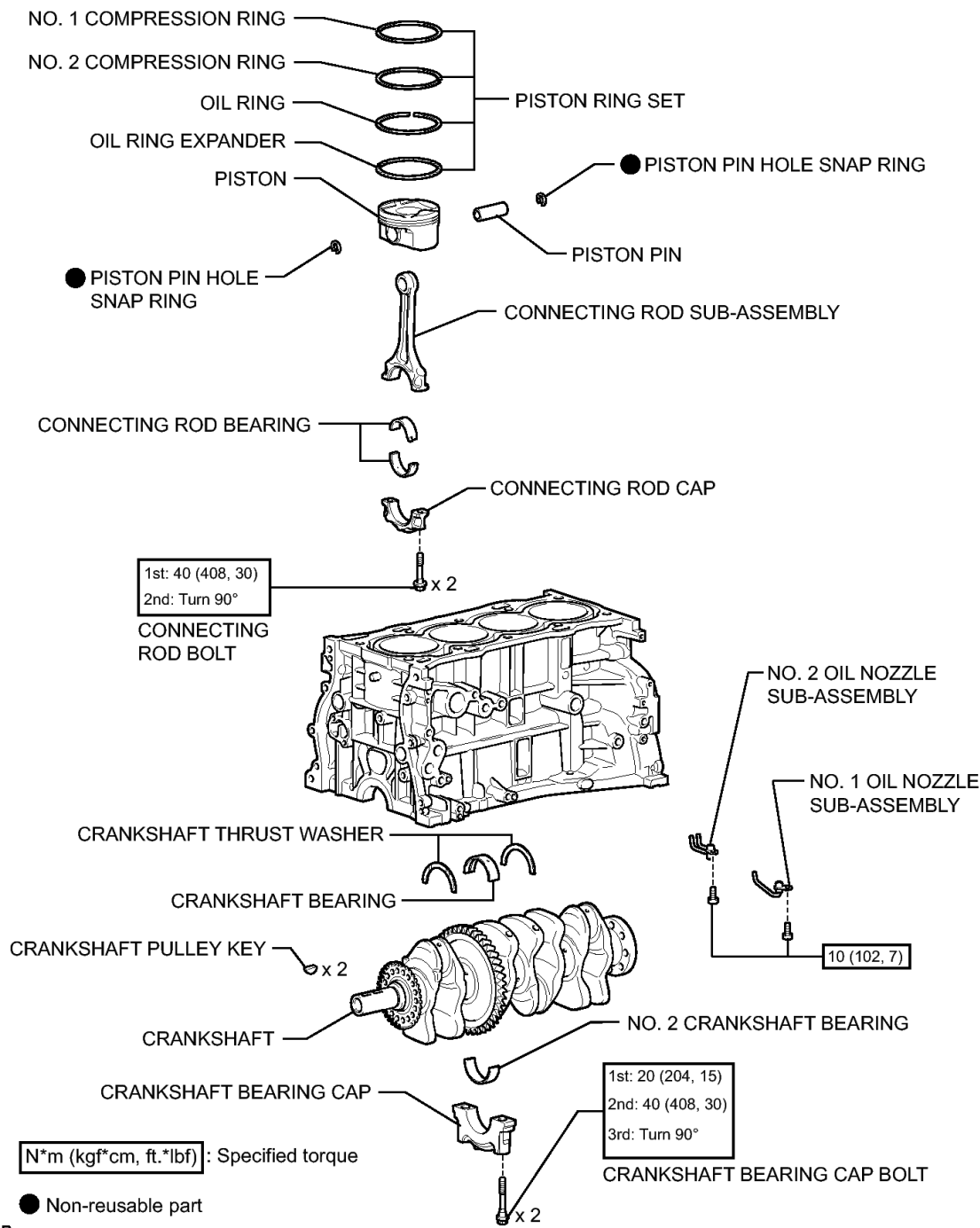
1.2 to 1.6 mm (0.0472 to 0.0630 in.)

**TEXT IN ILLUSTRATION**

*1	Width
----	-------

- c. Hand-lap the valve and valve seat with an abrasive compound.
- d. Check the valve seating position.

**CYLINDER BLOCK****COMPONENTS****ILLUSTRATION**



**Fig. 301: 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. 302: Measuring Connecting Rod Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.160 to 0.512 mm (0.00630 to 0.00202 in.)

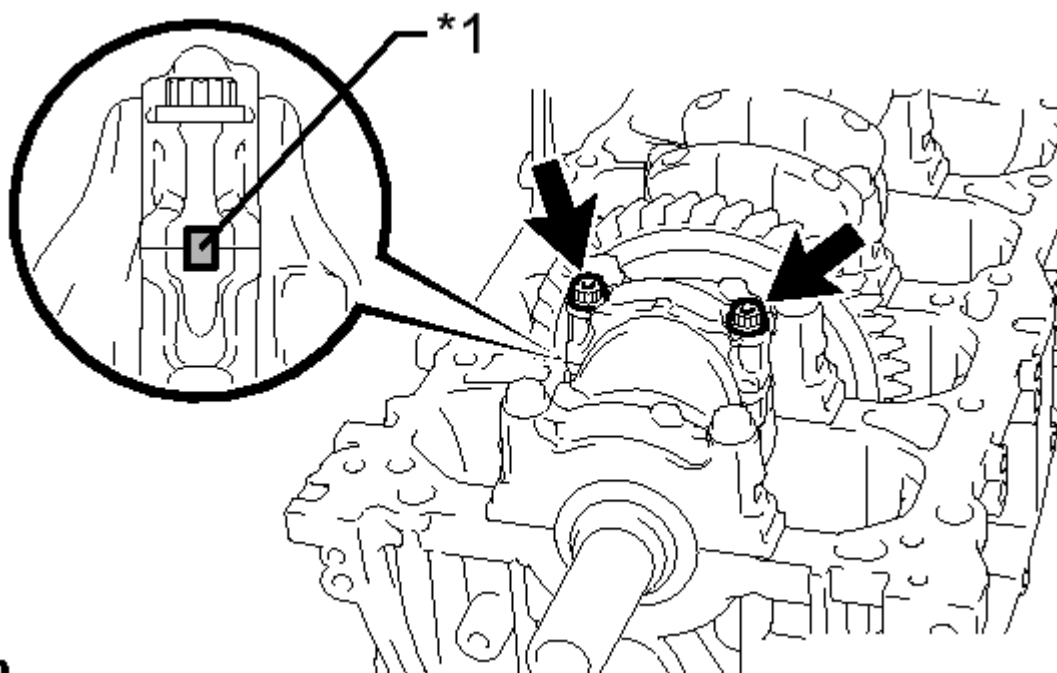
Maximum thrust clearance

0.512 mm (0.00202 in.)

If the thrust clearance is more than the maximum, replace the connecting rod. If necessary, replace the crankshaft.

## 2. INSPECT CONNECTING ROD OIL CLEARANCE

- a. Check the alignment marks on the connecting rod and cap to ensure correct reassembly.

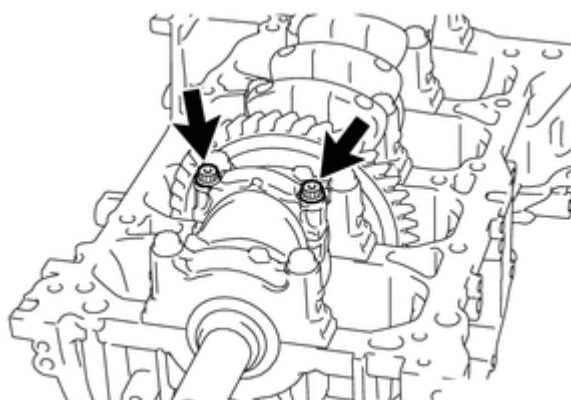
**P****Fig. 303: Connecting Rod Alignment Marks**

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

**TEXT IN ILLUSTRATION**

*1	Alignment Mark
----	-------------------

- b. Remove the 2 bolts and connecting rod cap.

**P****Fig. 304: Location of Connecting Rod Cap Bolts**

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

**HINT:**

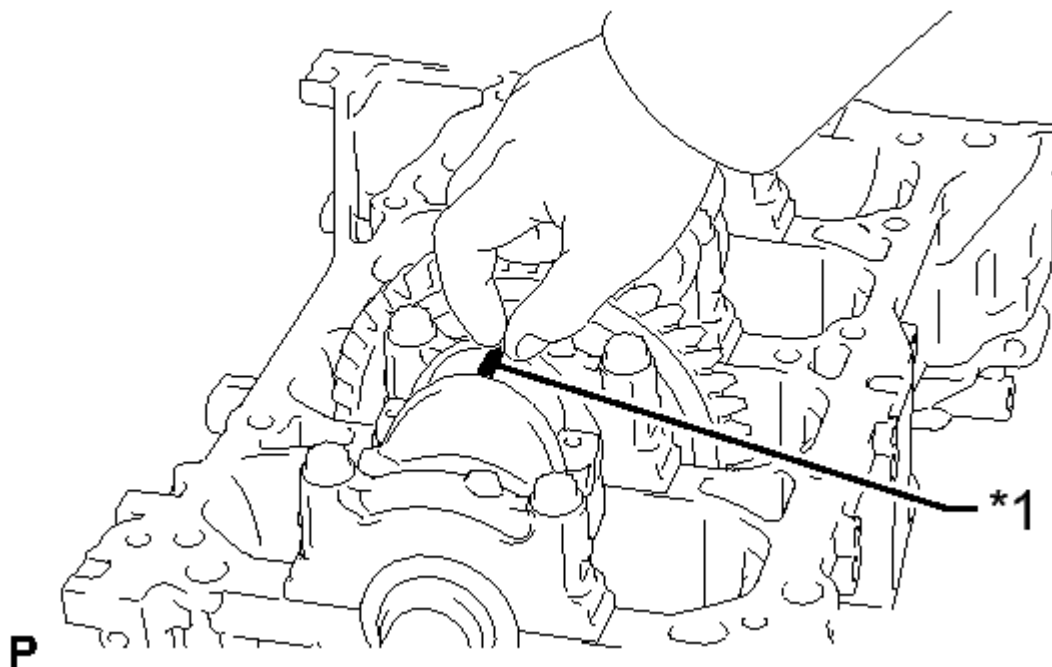
Keep the lower bearing and connecting rod cap together.



- c. Clean the crank pin and bearing.
- d. 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.

- e. Lay a strip of Plastigage on the crank pin.



**Fig. 305: Applying Plastigage To Crank Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**TEXT IN ILLUSTRATION**

\*1 Plastigage

- f. Install the connecting rod cap See step 11.

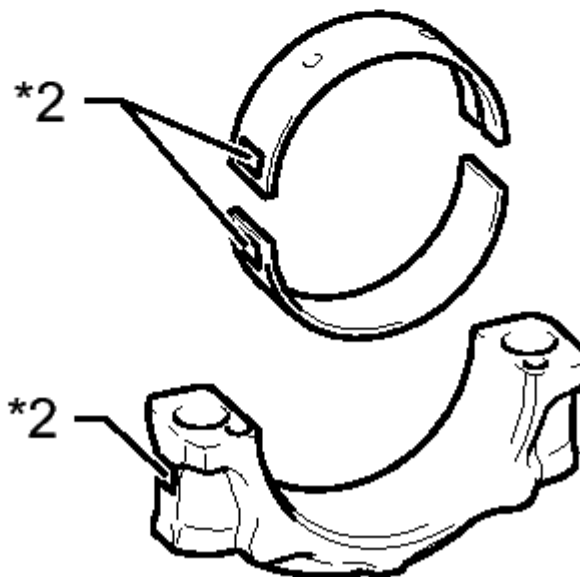
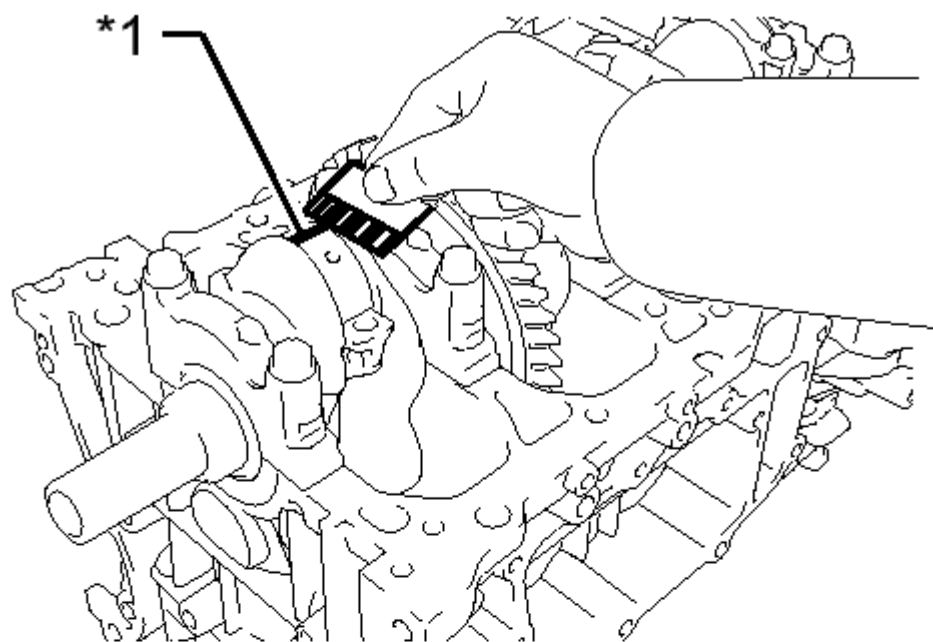
**NOTE:** Do not turn the crankshaft.

- g. Remove the 2 bolts and connecting rod cap.

**HINT:**

Keep the lower bearing and connecting rod cap together.

- h. Measure the Plastigage at its widest point.

**P****Fig. 306: Measuring Crank Pin Oil Clearance****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Standard oil clearance

0.030 to 0.063 mm (0.00118 to 0.00248 in.)

Maximum oil clearance

0.07 mm (0.00276 in.)

#### TEXT IN ILLUSTRATION

*1	Plastigage
*2	Number Mark

**NOTE:** Remove the Plastigage completely after the measurement.

If the oil clearance is more than the maximum, replace the connecting rod bearing. If necessary, grind or replace the crankshaft.

#### HINT:

If replacing a bearing, select a new one with the same number as that which is marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Standard crank pin diameter

51.492 to 51.500 mm (2.0272 to 2.0276 in.)

Standard Connecting Rod Big End Inside Diameter

Item	Specified Condition
Mark 1	54.500 to 54.508 mm (2.1457 to 2.1460 in.)
Mark 2	54.509 to 54.516 mm (2.1460 to 2.1463 in.)
Mark 3	54.517 to 54.524 mm (2.1463 to 2.1466 in.)

Standard Size Bearing Center Wall Thickness

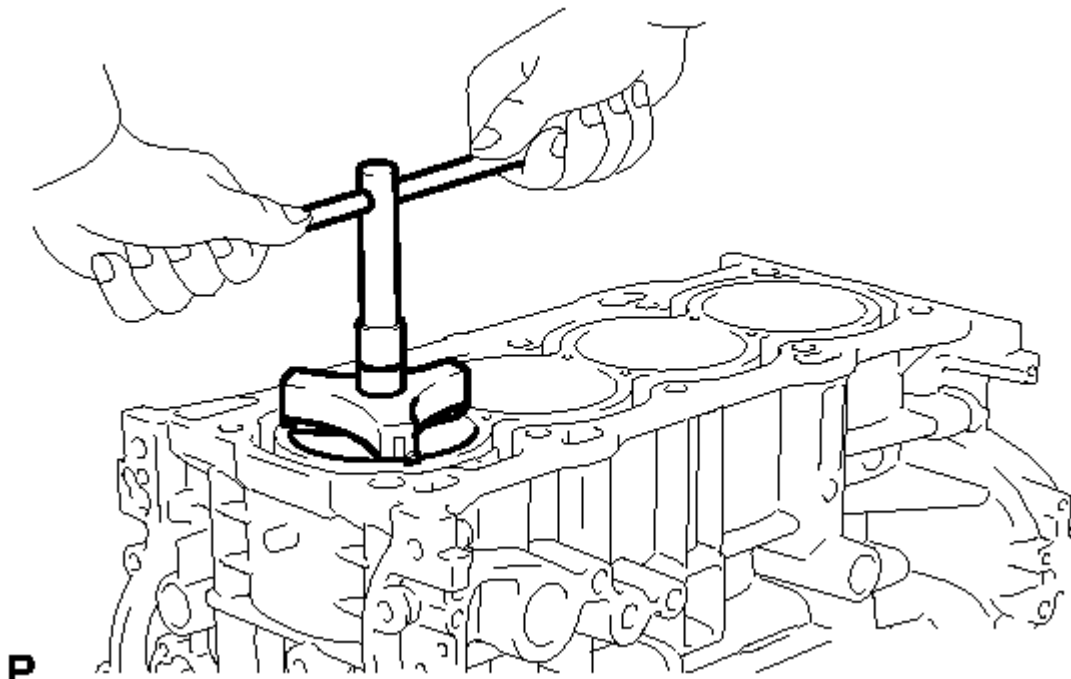
Item	Specified Condition

Mark 1	1.483 to 1.487 mm (0.0584 to 0.0585 in.)
Mark 2	1.488 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.492 to 1.495 mm (0.0587 to 0.0589 in.)

- i. Perform the inspection above for each cylinder.

### 3. REMOVE PISTON WITH CONNECTING ROD

- a. Using a ridge reamer, remove all the carbon from the top of the cylinder.



**P**

**Fig. 307: Removing Carbon From Top Of Cylinder**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 8 bolts, 4 connecting rod caps and 4 lower bearings.  
c. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

#### **HINT:**

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.
- Be sure to arrange the removed piston and connecting rod assemblies in such a way that they can be reinstalled exactly as before.

#### 4. REMOVE CONNECTING ROD BEARING

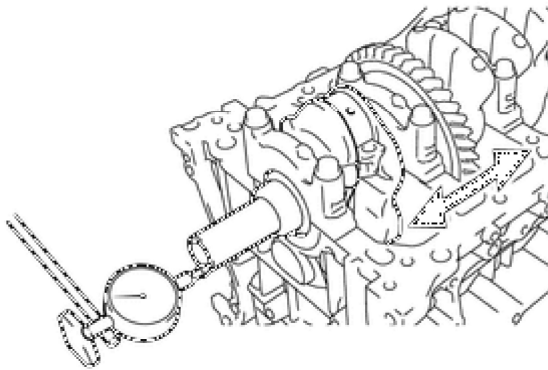
- a. Remove the connecting rod bearings from the connecting rods and connecting rod caps.

##### **HINT:**

Arrange the removed parts in the correct order.

#### 5. INSPECT CRANKSHAFT THRUST CLEARANCE

- a. Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.



F

**Fig. 308: Measuring Crankshaft Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.04 to 0.24 mm (0.00157 to 0.00945 in.)

Maximum thrust clearance

0.30 mm (0.0118 in.)

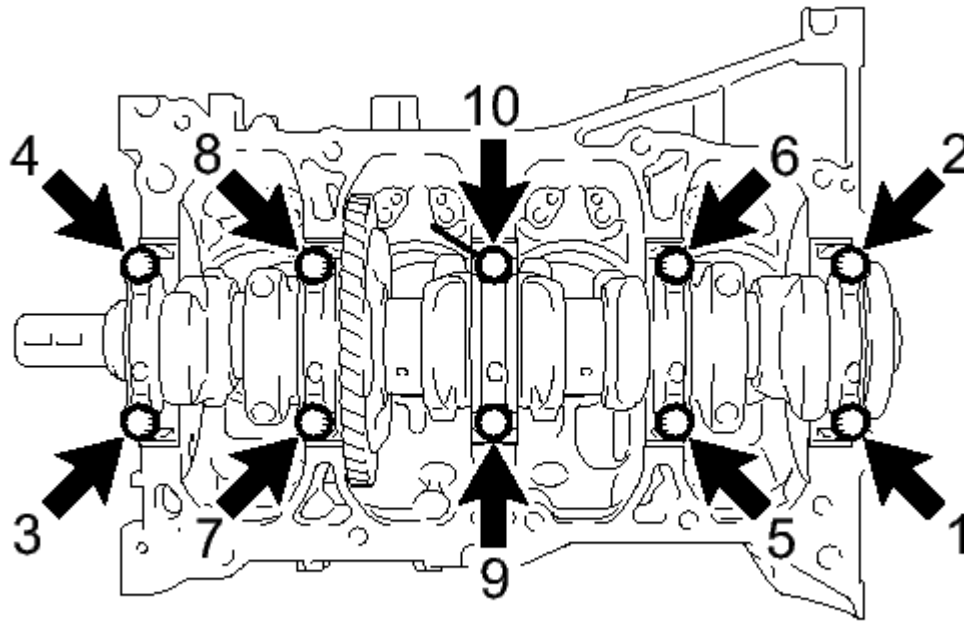
If the thrust clearance is more than the maximum, replace the thrust washers as a set. If necessary, replace the crankshaft.

Standard thrust washer thickness

1.93 to 1.98 mm (0.0760 to 0.0780 in.)

#### 6. REMOVE CRANKSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

**P****Fig. 309: Identifying Bearing Cap Bolts Loosening Sequence**

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

- b. Remove the 5 bearing caps from the cylinder block.

**HINT:**

- Keep the No. 2 crankshaft bearings and crankshaft bearing caps together.
- Arrange the bearing caps in the correct order.

- c. Remove the crankshaft from the cylinder block.

**HINT:**

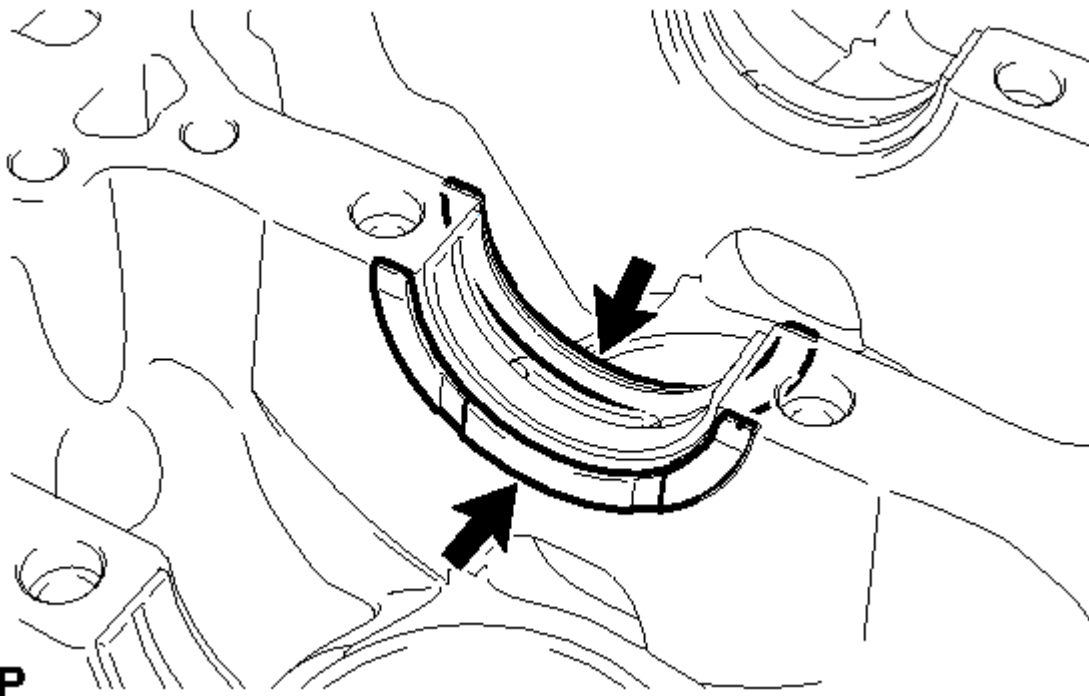
Keep the crankshaft bearings and crankshaft thrust washers together with the cylinder block.

- d. Check each crankshaft journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

**7. REMOVE CRANKSHAFT THRUST WASHER**

- a. Remove the thrust washers from the cylinder block.

**P****Fig. 310: Location of Crankshaft Bearing**

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

**8. REMOVE CRANKSHAFT BEARING**

- a. Remove the crankshaft bearings from the cylinder block and bearing caps.

**HINT:**

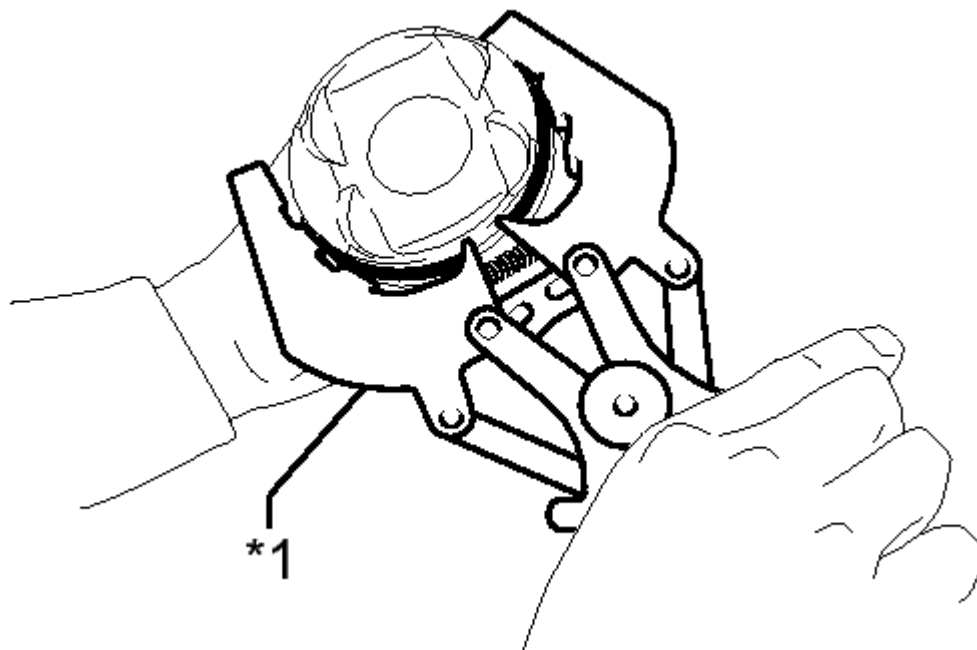
Arrange the bearings in the correct order.

**9. REMOVE CRANKSHAFT PULLEY KEY**

- a. Using a screwdriver, remove the 2 pulley keys from the crankshaft.

**10. REMOVE PISTON RING SET**

- a. Using a piston ring expander, remove the 2 compression rings.

**P****Fig. 311: Removing Piston Compression Rings**

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

**TEXT IN ILLUSTRATION**

*1	Piston Ring Expander
----	-------------------------

- b. Remove the oil ring and expander by hand.

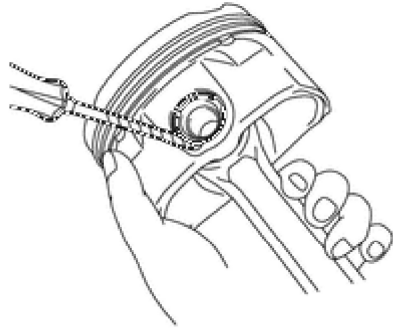
**HINT:**

Arrange the removed parts in the correct order.

**11. REMOVE PISTON PIN HOLE SNAP RING**

- a. Insert a small screwdriver into the service hole and pry out the snap ring on the front side.



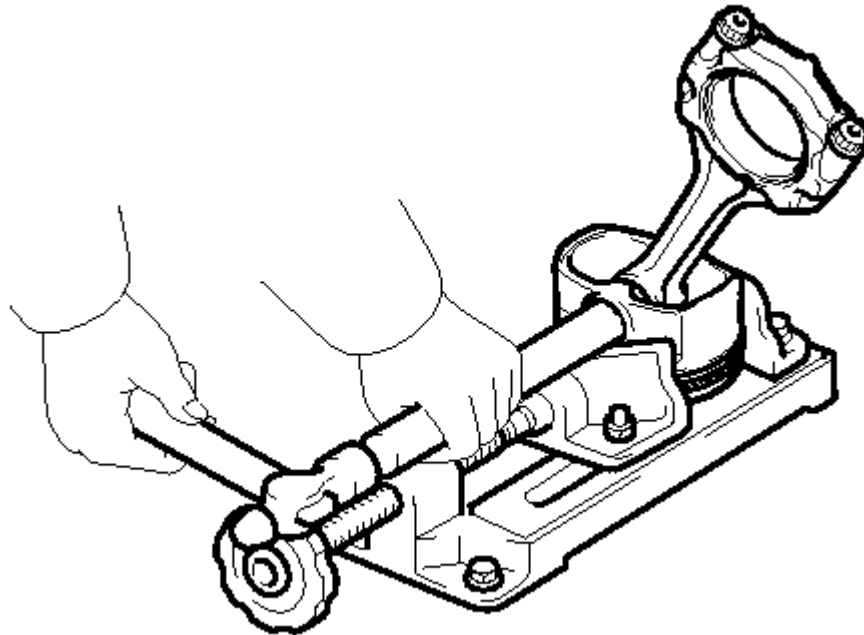
**P****Fig. 312: Removing Piston Pin Hole Snap Ring**

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

**NOTE:** Do not remove the snap ring on the rear side unless it is necessary. When the snap ring needs to be removed, be careful not to damage the piston.

## 12. REMOVE PISTON

- Gradually heat the piston up to 80 to 90°C (176 to 194°F).
- Using a plastic-faced hammer and brass bar, lightly tap out the piston pin. Then remove the connecting rod.

**P****Fig. 313: Tapping Out Piston Pin**

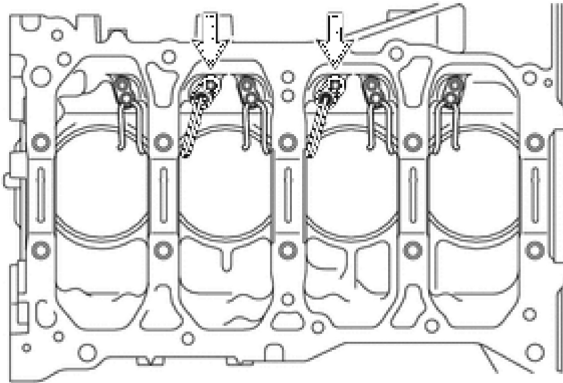
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

- The piston and pin are a matched set.
- Be sure to arrange the removed pistons, pins, rings, connecting rods and bearings in such a way that the parts can be reinstalled exactly as before.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

**13. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY**

- Using a 5 mm hexagon wrench, remove the 2 bolts and 2 oil nozzles.



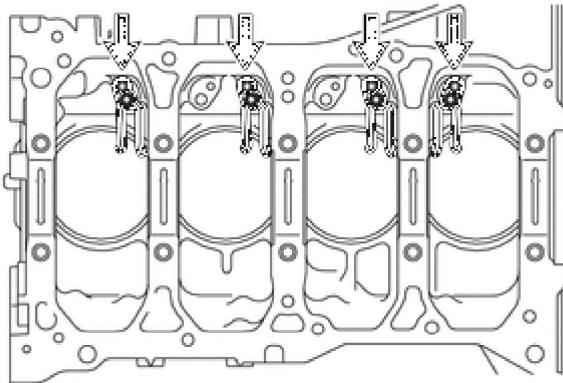
P

**Fig. 314: Location of NO. 1 Oil Nozzles Bolts**

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

**14. REMOVE NO. 2 OIL NOZZLE SUB-ASSEMBLY**

- Using a 5 mm hexagon wrench, remove the 4 bolts and 4 oil nozzles.



P

**Fig. 315: Location of NO. 2 Oil Nozzles Bolts**

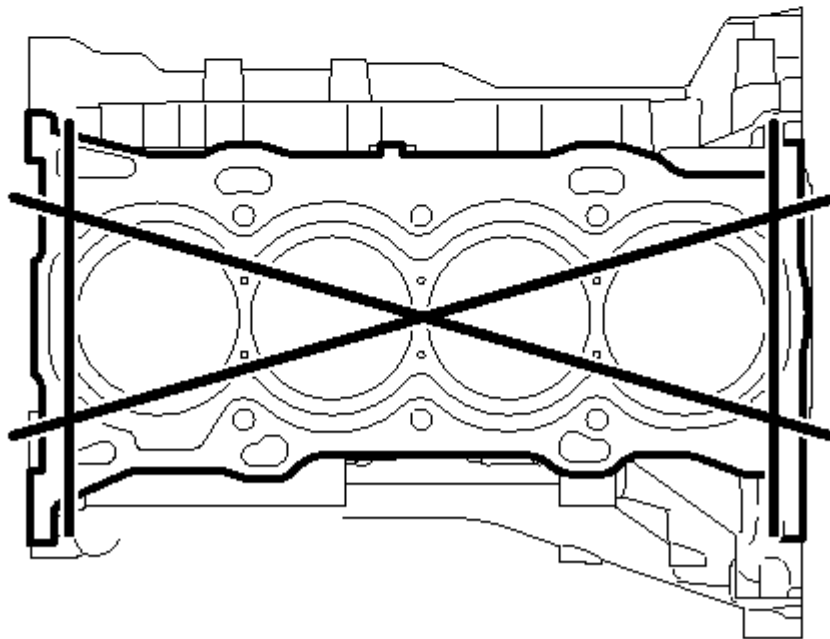
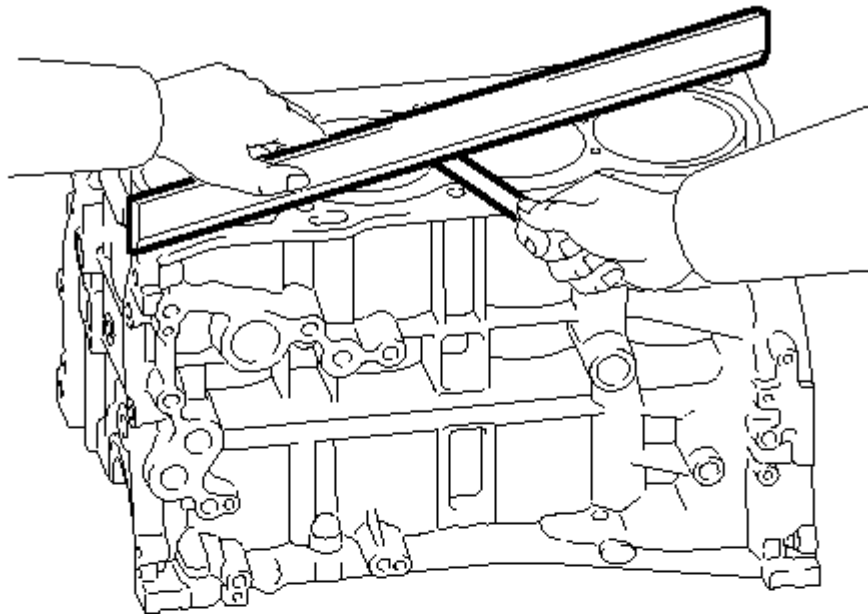
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE STUD BOLT**

**NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

**INSPECTION****INSPECTION****1. INSPECT CYLINDER BLOCK FOR WARPAGE**

- a. Using a precision straightedge and feeler gauge, measure the warpage of the surface that contacts the cylinder head gasket.

**P**

**Fig. 316: Inspecting Cylinder Block For Warpage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

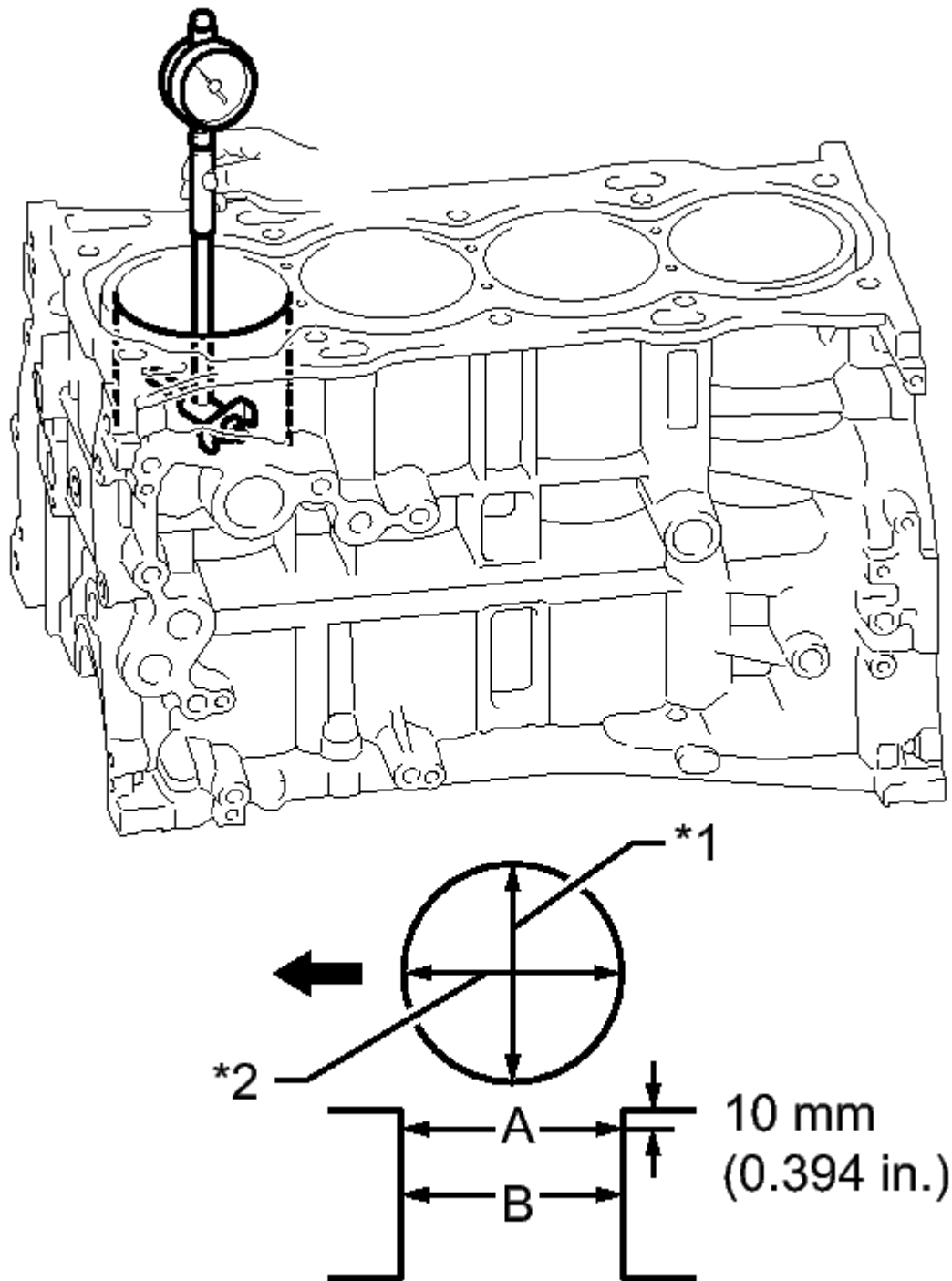
Maximum warpage

0.05 mm (0.00197 in.)

If the warpage is more than the maximum, replace the cylinder block.

## **2. INSPECT CYLINDER BORE**

- a. Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

**P****Fig. 317: Measuring Cylinder Bore Diameter****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**


Standard diameter

90.000 to 90.013 mm (3.543 to 3.544 in.)

Maximum diameter

90.133 mm (3.549 in.)

#### TEXT IN ILLUSTRATION

*1	Thrust Direction
*2	Axial Direction
	Front

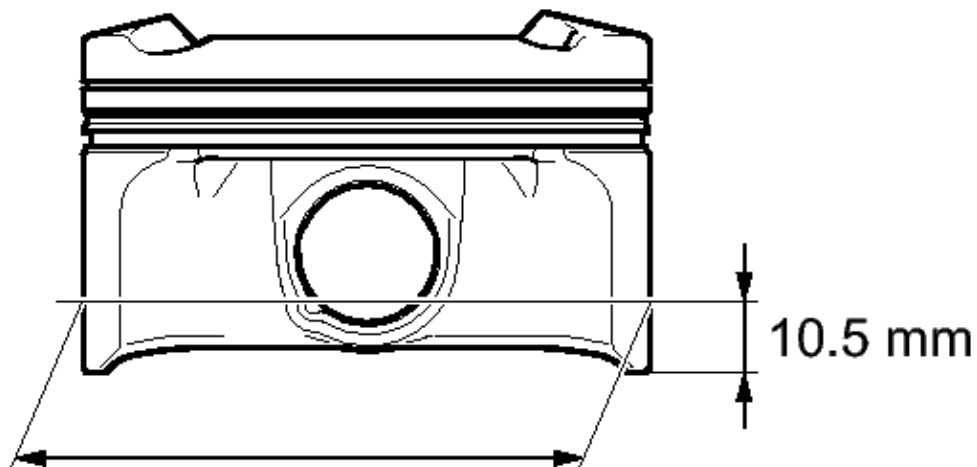
If the average diameter of the 4 positions is more than the maximum, replace the cylinder block.

### 3. INSPECT PISTON

- Using a gasket scraper, remove the carbon from the piston top.
- Using a groove cleaning tool or a broken ring, clean the piston ring grooves.
- Using a brush and solvent, thoroughly clean the piston.

**NOTE:** Do not use a wire brush.

- Using a micrometer, measure the piston diameter at a position that is 10.5 mm (0.413 in.) from the bottom of the piston (refer to the illustration below).



**P**

**Fig. 318: Identifying Piston Diameter**

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

Standard piston diameter

89.970 to 89.996 mm (3.542 to 3.543 in.)

If the diameter is less than the minimum, replace the piston with pin.

#### 4. 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

0.004 to 0.043 mm (0.000157 to 0.00169 in.)

Maximum oil clearance

0.10 mm (0.00394 in.)

If the oil clearance is more than the maximum, replace all the pistons. If necessary, replace the cylinder block.

#### 5. INSPECT RING GROOVE CLEARANCE

- 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 ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)
No. 2 ring	0.020 to 0.060 mm (0.000787 to 0.00236 in.)
Oil ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)

If the groove clearance is not as specified, replace the piston with pin.

#### 6. INSPECT PISTON RING END GAP

- a. Insert the piston ring into the cylinder bore.
- b. Using a piston, push the piston ring a little beyond the bottom of the ring travel, 120 mm (4.72 in.) from the top of the cylinder block.



- c. Using a feeler gauge, measure the end gap.

#### Standard End Gap

Item	Specified Condition
No. 1 ring	0.22 to 0.27 mm (0.00866 to 0.0106 in.)
No. 2 ring	0.37 to 0.42 mm (0.0146 to 0.0165 in.)
Oil ring	0.10 to 0.20 mm (0.00394 to 0.00787 in.)

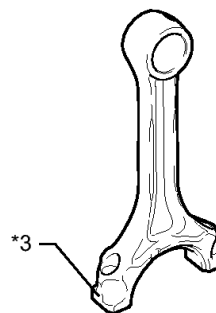
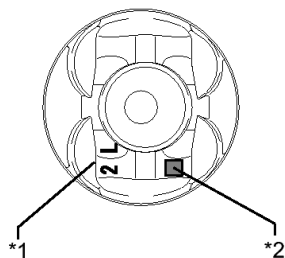
#### Maximum End Gap

Item	Specified Condition
No. 1 ring	0.87 mm (0.0342 in.)
No. 2 ring	1.02 mm (0.0402 in.)
Oil ring	0.80 mm (0.0315 in.)

If the end gap is more than the maximum, replace the piston ring. If the end gap is more than the maximum even with a new piston ring, replace the cylinder block.

## 7. INSPECT PISTON PIN OIL CLEARANCE

- a. Check each mark on the piston, piston pin and connecting rod.



P

**Fig. 319: Checking Piston, Pin & Connecting Rod Marks**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

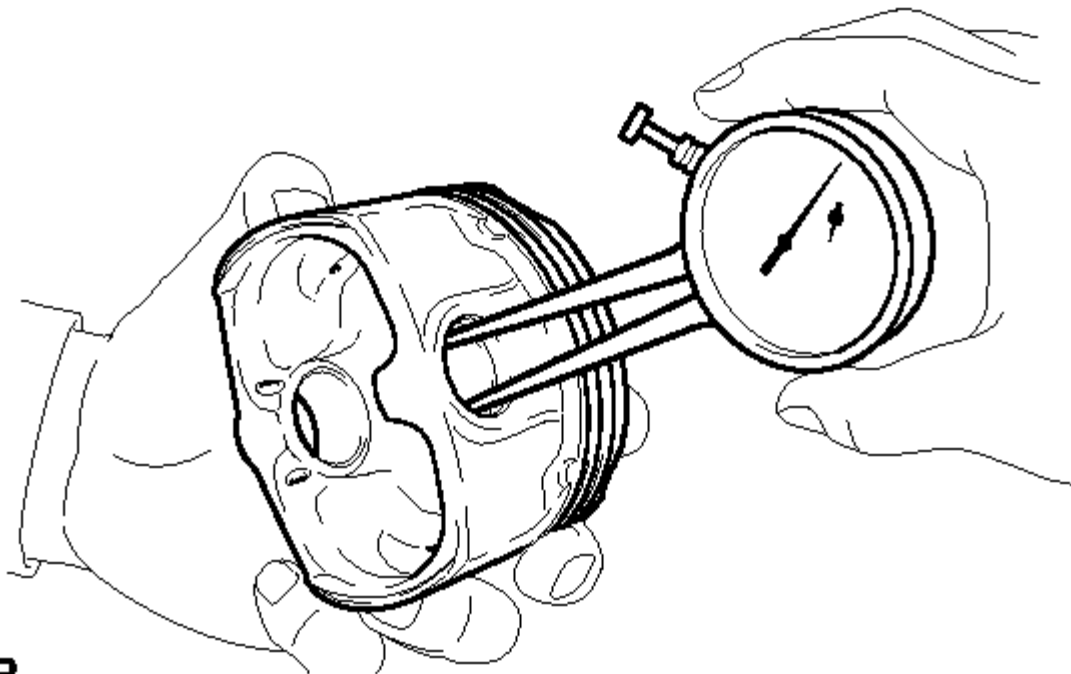
**TEXT IN ILLUSTRATION**

*1	Front Mark	*2	Position Pin Hole Inside Diameter Mark
*3	Connecting Rod Small End Bush Inside Diameter Mark	-	-

**HINT:**

The front mark is "2L" printed in raised letters.

- b. Using a caliper gauge, measure the inside diameter of the piston pin hole.



**P**

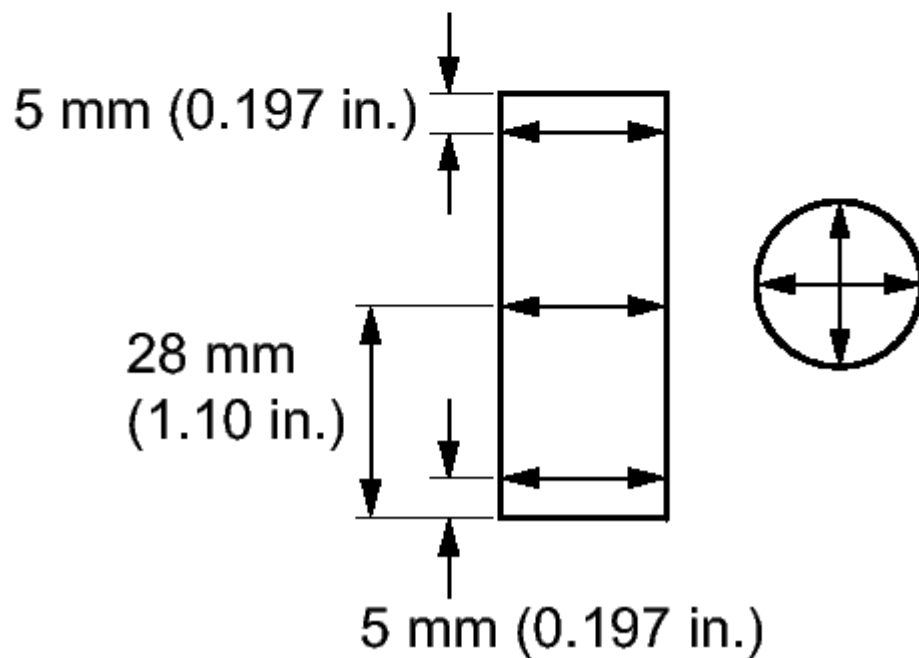
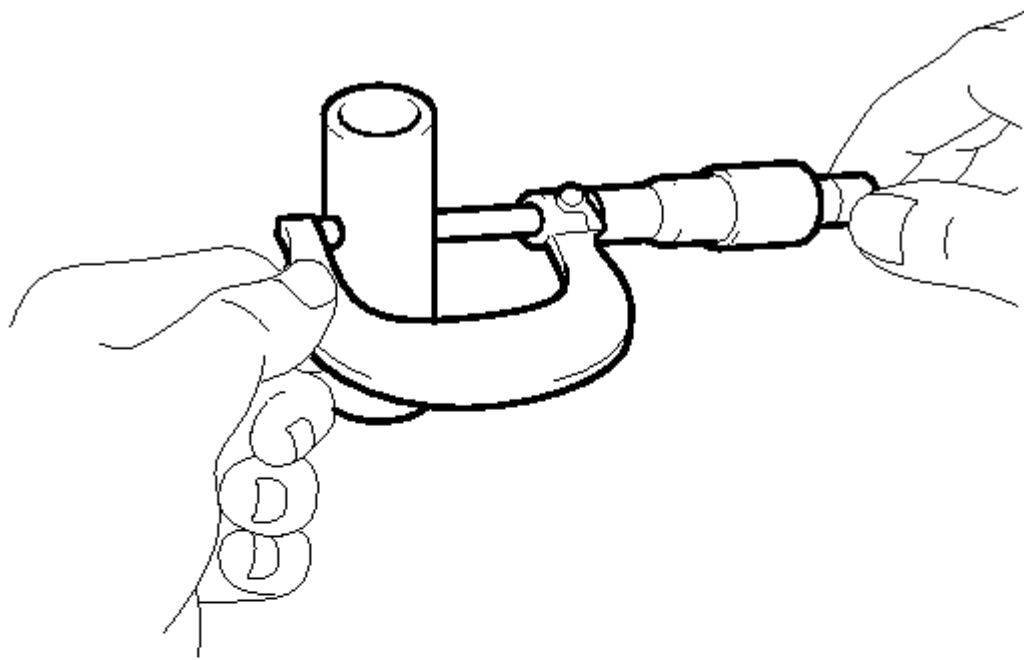
**Fig. 320: Measuring Inside Diameter Of Piston Pin Hole**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Piston Pin Hole Inside Diameter

Item	Specified Condition
	22.001 to 22.004 mm

Mark A	(0.86618 to 0.86630 in.)
Mark B	22.005 to 22.007 mm (0.86634 to 0.86642 in.)
Mark C	22.008 to 22.010 mm (0.86645 to 0.86653 in.)

- c. Using a micrometer, measure the piston pin diameter.

**P****Fig. 321: Measuring Piston Pin Diameter**

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

Standard Piston Pin Diameter



Item	Specified Condition
Mark A	21.997 to 22.000 mm (0.86602 to 0.86614 in.)
Mark B	22.001 to 22.003 mm (0.86617 to 0.86626 in.)
Mark C	22.004 to 22.006 mm (0.86630 to 0.86638 in.)

If the diameter is not as specified, replace the piston pin.

- d. Using a caliper gauge, measure the connecting rod small end bush inside diameter.

Standard Connecting Rod Small End Bush Inside Diameter

Item	Specified Condition
Mark A	22.005 to 22.008 mm (0.86634 to 0.86645 in.)
Mark B	22.009 to 22.011 mm (0.86649 to 0.86657 in.)
Mark C	22.012 to 22.014 mm (0.86661 to 0.86669 in.)

If the diameter is not as specified, replace the connecting rod.

- e. Subtract the piston pin diameter measurement from the piston pin hole inside diameter measurement.

Standard oil clearance

0.001 to 0.007 mm (0.0000394 to 0.000276 in.)

Maximum oil clearance

0.013 mm (0.000512 in.)

If the oil clearance is more than the maximum, replace the piston and piston pin as a set.

- f. Subtract the piston pin diameter measurement from the connecting rod small end bush inside diameter measurement.

Standard oil clearance

0.005 to 0.011 mm (0.000197 to 0.000433 in.)

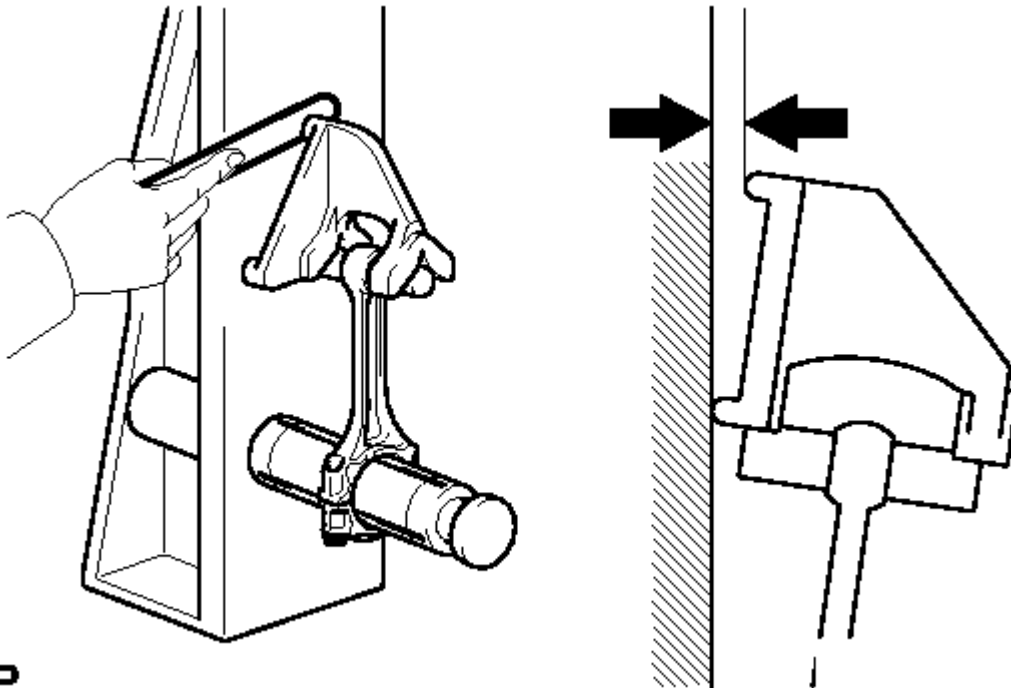
Maximum oil clearance

0.017 mm (0.000669 in.)

If the oil clearance is more than the maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.

## 8. INSPECT CONNECTING ROD SUB-ASSEMBLY

- a. Using a connecting rod aligner and feeler gauge, check the connecting rod alignment.



**P**

**Fig. 322: Checking Connecting Rod Alignment (For Band)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

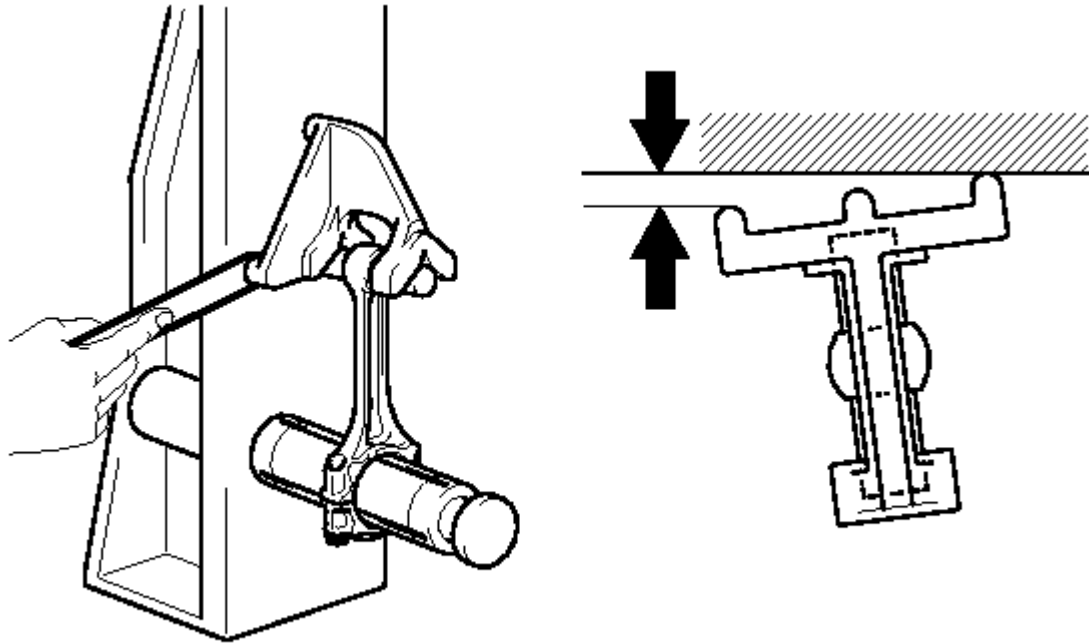
1. Check for bend.

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.

2. Check for twist.



**P**

**Fig. 323: Checking Connecting Rod Alignment (For Twist)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

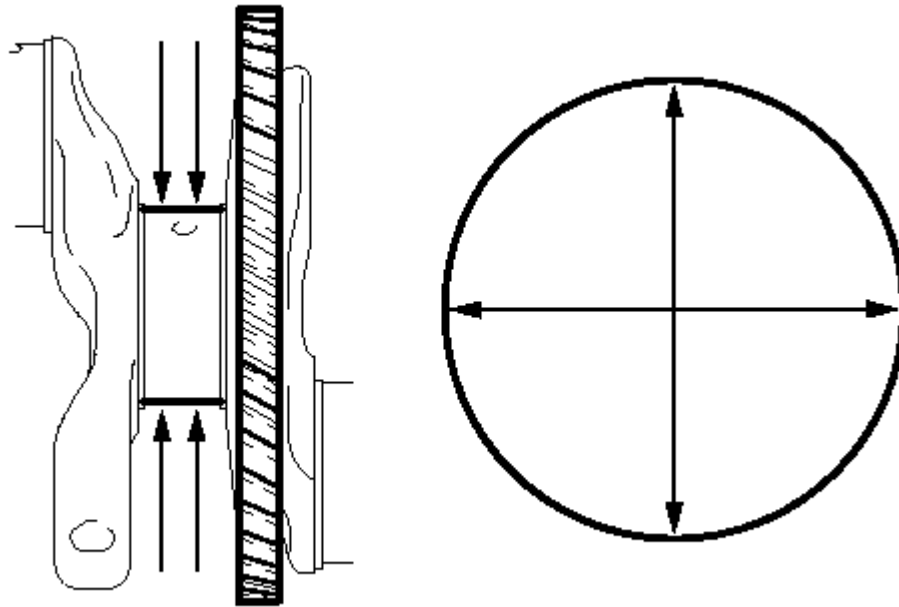
- a. Inspect for circle runout.
  1. Using a dial indicator and V-blocks, measure the circle runout.

Maximum circle runout

0.003 mm (0.000118 in.)

If the circle runout is more than the maximum, replace the crankshaft.

- b. Inspect the main journals.

**P****Fig. 324: Checking Crankshaft Main Journal**

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

1. Using a micrometer, measure the diameter of each main journal.

Standard main journal diameter

54.988 to 55.000 mm (2.1649 to 2.1654 in.)

If the diameter is not as specified, check the crankshaft oil clearance. If necessary, replace the crankshaft.

2. Check each main journal for taper and out-of-round as shown in the illustration.

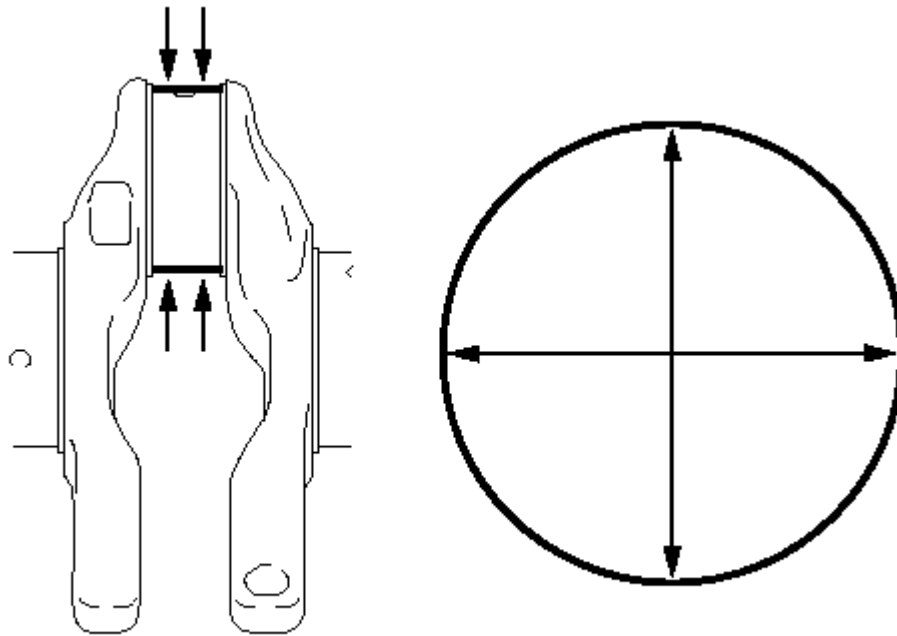
Maximum taper and out-of-round

0.003 mm (0.000118 in.)

If the taper and out-of-round are more than the maximum, replace the crankshaft.

- c. Inspect the crank pin.



**P****Fig. 325: Measuring Diameter Of Crank Pin**

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

1. Using a micrometer, measure the diameter of each crank pin.

Standard crank pin diameter

51.492 to 51.500 mm (2.027 to 2.028 in.)

If the diameter is not as specified, check the connecting rod oil clearance. If necessary, replace the crankshaft.

2. Inspect each crank pin for taper and out-of-round as shown in the illustration.

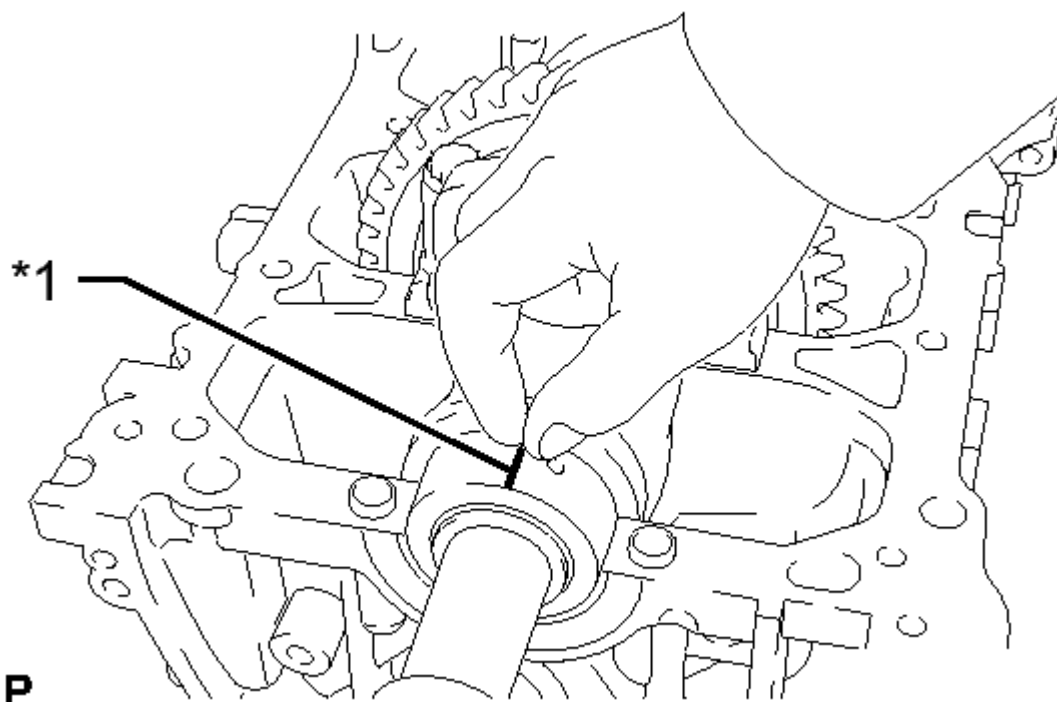
Maximum taper and out-of-round

0.003 mm (0.000118 in.)

If the taper and out-of-round are more than the maximum, replace the crankshaft.

**10. INSPECT CRANKSHAFT OIL CLEARANCE**

- a. Install the crankshaft bearings See step 7.
- b. Install the crankshaft thrust washers See step 8.
- c. Clean each main journal and bearing.

**P**

**Fig. 326: Applying Plastigage To Crankshaft Journal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Place the crankshaft onto the cylinder block.
- e. Lay a strip of Plastigage across each journal.

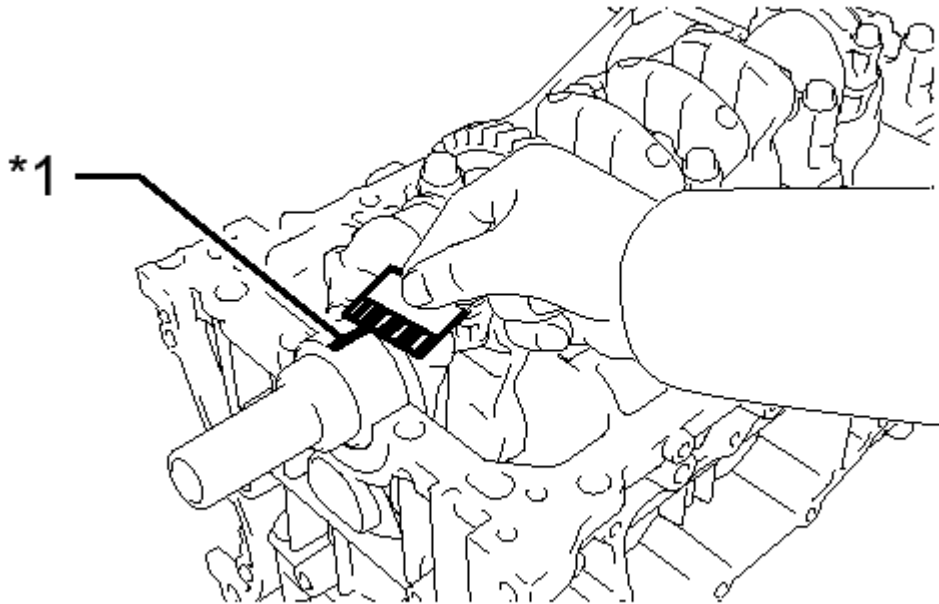
**TEXT IN ILLUSTRATION**

*1	Plastigage
----	------------

- f. Install the crankshaft bearing caps See step 9.

**NOTE:**        **Do not turn the crankshaft.**

- g. Remove the crankshaft bearing caps See step 6.
- h. Measure the Plastigage at its widest point.

**P****Fig. 327: Measuring Crankshaft Journal Oil Clearance****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Standard oil clearance

0.016 to 0.039 mm (0.000630 to 0.00154 in.)

Maximum oil clearance

0.05 mm (0.00197 in.)

**TEXT IN ILLUSTRATION**

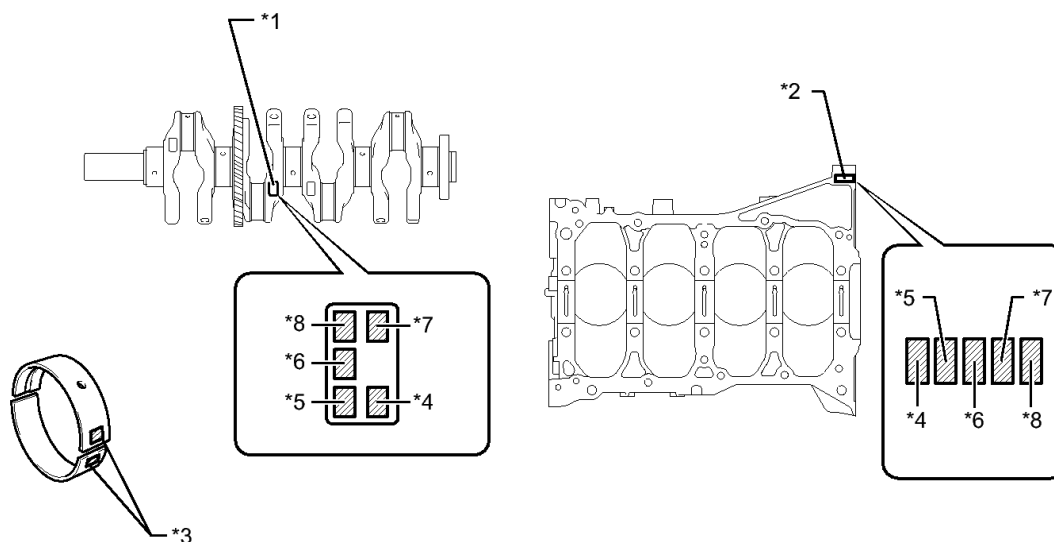
*1	Plastigage
----	------------

**NOTE:** Remove the Plastigage completely after the measurement.

If the oil clearance is more than the maximum, replace the crankshaft bearing. If necessary, replace the crankshaft.

**HINT:**

If replacing a bearing, select a new one with the same number. If the number of the bearing cannot be determined, calculate the correct bearing number by adding together the numbers imprinted on the cylinder block and crankshaft. Then select a new bearing with the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.



P

**Fig. 328: Crankshaft And Cylinder Block Number Marks**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### TEXT IN ILLUSTRATION

*1	Crankshaft Number Mark (B)	*2	Cylinder Block Number Mark (A)
*3	Diameter Mark	*4	No. 1
*5	No. 2	*6	No. 3
*7	No. 4	*8	No. 5

#### EXAMPLE

Cylinder block (A) "3" + Crankshaft (B) "4" = Total "7"

Select the bearing marked "3".

#### Bearing Chart

(A) + (B)	Bearing to be Used
0 to 2	1
3 to 5	2
6 to 8	3
9 to 11	4

Standard Cylinder Block Journal Inside Diameter (A)

--	--

Item	Specified Condition
Mark 0	59.000 to 59.002 mm (2.32283 to 2.32291 in.)
Mark 1	59.003 to 59.004 mm (2.32295 to 2.32299 in.)
Mark 2	59.005 to 59.006 mm (2.32303 to 2.32307 in.)
Mark 3	59.007 to 59.009 mm (2.32311 to 2.32318 in.)
Mark 4	59.010 to 59.011 mm (2.32322 to 2.32326 in.)
Mark 5	59.012 to 59.013 mm (2.32330 to 2.32334 in.)
Mark 6	59.014 to 59.016 mm (2.32338 to 2.32346 in.)

Standard Crankshaft Main Journal Diameter (B)

Item	Specified Condition
Mark 0	54.999 to 55.000 mm (2.16531 to 2.16535 in.)
Mark 1	54.997 to 54.998 mm (2.16523 to 2.16527 in.)
Mark 2	54.995 to 54.996 mm (2.16515 to 2.16519 in.)

	2.16519 in.)
Mark 3	54.993 to 54.994 mm (2.16507 to 2.16511 in.)
Mark 4	54.991 to 54.992 mm (2.16500 to 2.16504 in.)
Mark 5	54.988 to 54.990 mm (2.16488 to 2.16496 in.)

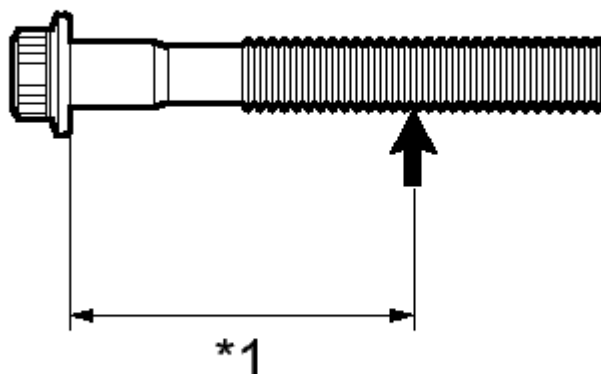
## Standard Bearing Center Wall Thickness

Item	Specified Condition
Mark 1	1.991 to 1.994 mm (0.07839 to 0.07850 in.)
Mark 2	1.995 to 1.997 mm (0.07854 to 0.07862 in.)
Mark 3	1.998 to 2.000 mm (0.07866 to 0.07874 in.)
Mark 4	2.001 to 2.003 mm (0.07878 to 0.07886 in.)

- i. Perform the inspection above for each journal.

## 11. INSPECT CRANKSHAFT BEARING CAP BOLT

- a. Using a vernier caliper, measure the diameter of the tension portion of the bolts.

**T****Fig. 329: Measuring Crankshaft Bearing Cap Bolt Diameter****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Measuring point

58.5 mm (2.30 in.)

Standard diameter

9.77 to 9.96 mm (0.385 to 0.392 in.)

Minimum diameter

9.1 mm (0.358 in.)

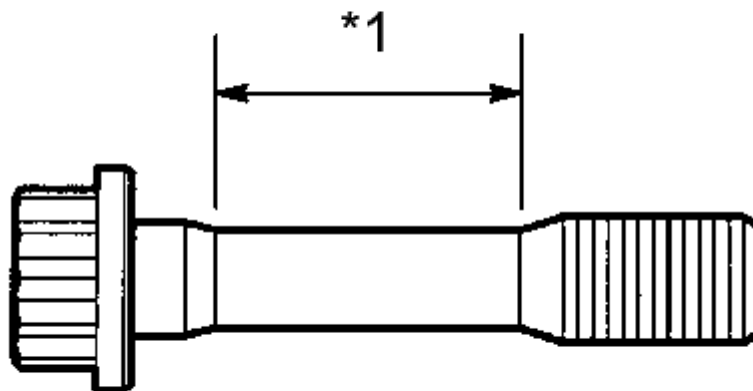
**TEXT IN ILLUSTRATION**

*1	Measuring Point
----	--------------------

If the diameter is less than the minimum, replace the crankshaft bearing cap bolt.

**12. INSPECT CONNECTING ROD BOLT**

- a. Using a vernier caliper, measure the diameter of the tension portion of the bolt.



**Fig. 330: Measuring Connecting Rod Bolt Diameter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard diameter

8.5 to 8.6 mm (0.335 to 0.339 in.)

Minimum diameter

8.3 mm (0.327 in.)

**TEXT IN ILLUSTRATION**

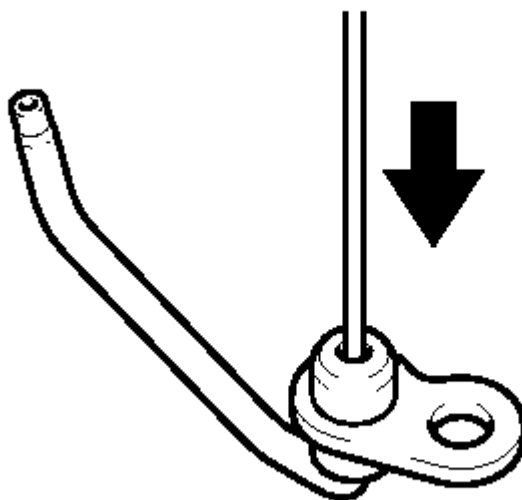
*1	Tension Portion
----	--------------------

If the diameter is less than the minimum, replace the connecting rod bolt.

**13. INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY**

- a. Push the check valve with a pin to check if it is stuck.



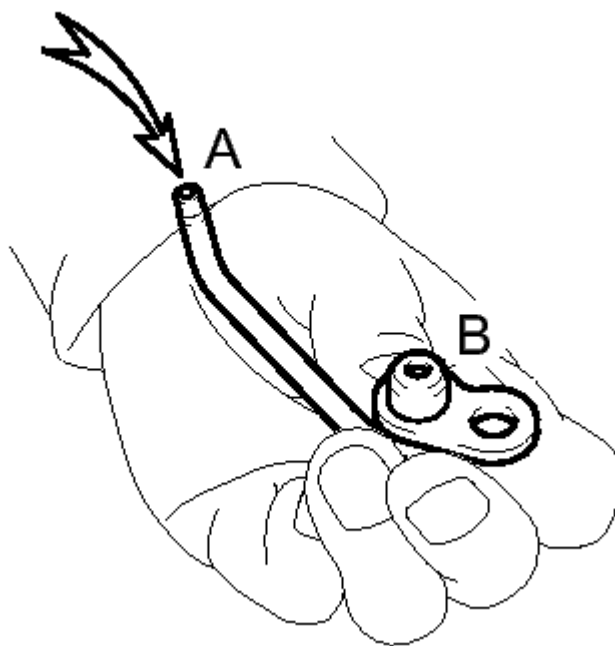
**P****Fig. 331: Pushing Check Valve With Pin****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

If stuck, replace the No. 1 oil nozzle.

- b. Push the check valve with a pin to check if it moves smoothly.

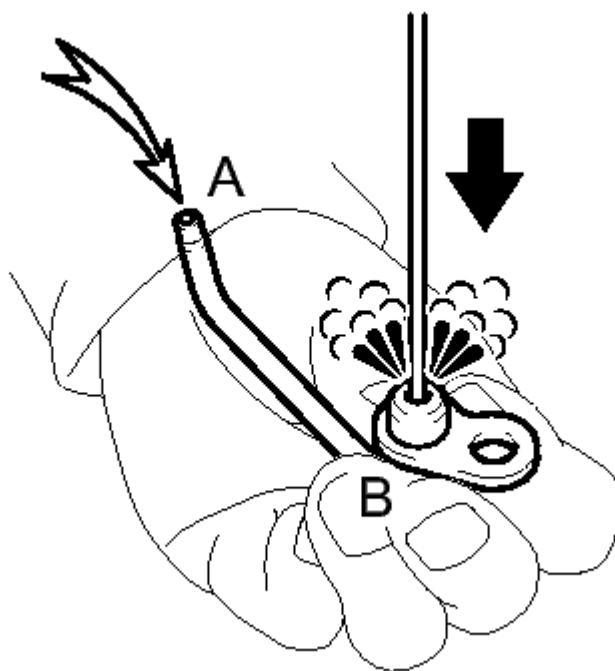
If the valve does not move smoothly, clean or replace the No. 1 oil nozzle.

- c. Apply air into A. Check that air does not leak through B.

**P****Fig. 332: Checking Air Leak Through B****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

If air leaks, clean or replace the No. 1 oil nozzle.

- d. Push the check valve while applying air into A. Check that air passes through B.

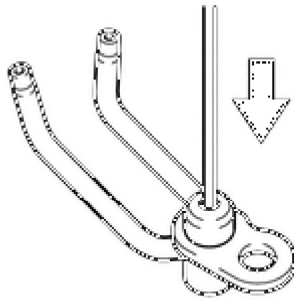
**P**

**Fig. 333: Pushing Check Valve****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

If air does not pass through B, clean or replace the No. 1 oil nozzle.

**14. INSPECT NO. 2 OIL NOZZLE SUB-ASSEMBLY**

- a. Push the check valve with a pin to check if it is stuck.

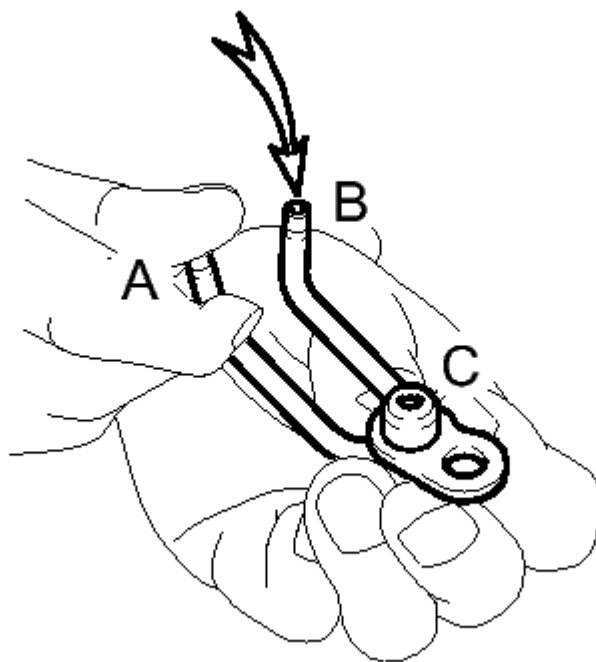
**P****Fig. 334: Pushing Check Valve With Pin****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

If stuck, replace the No. 2 oil nozzle.

- b. Push the check valve with a pin to check if it moves smoothly.

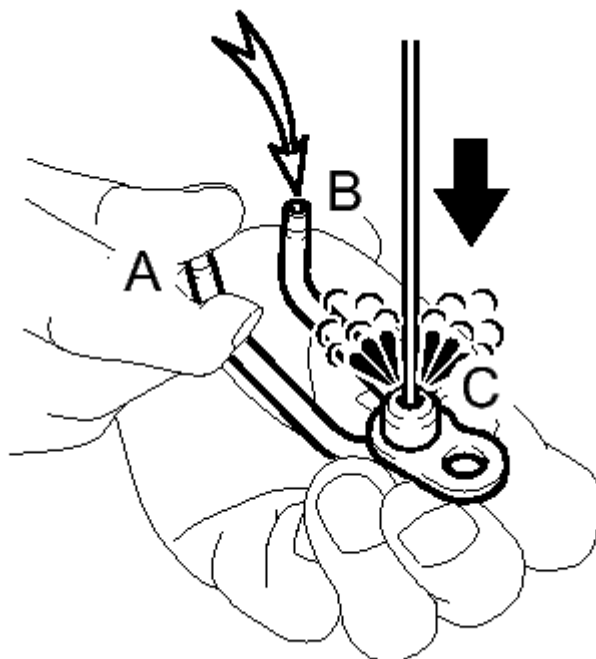
If the valve does not move smoothly, clean or replace the No. 2 oil nozzle.

- 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.

**P****Fig. 335: Checking Air Leak****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

If air leaks, clean or replace the No. 2 oil nozzle.

- 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.

**P**

**Fig. 336: Location of Ring Pin**

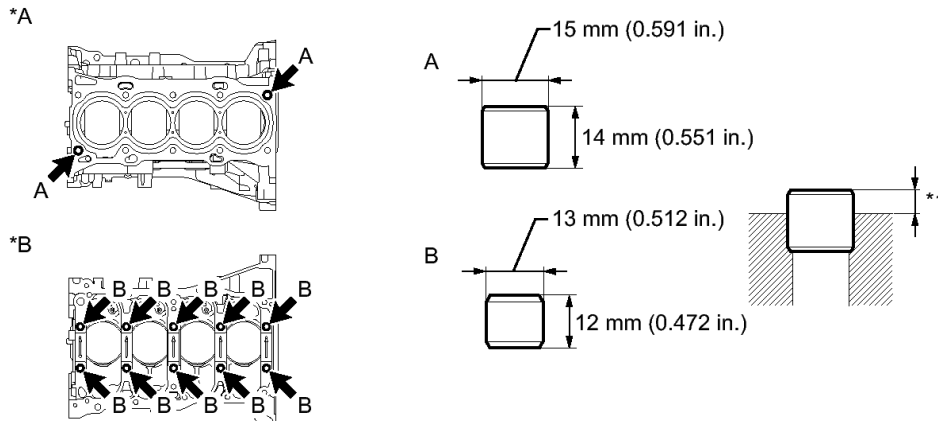
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If air does not pass through C, clean or replace the No. 2 oil nozzle.

**REPLACEMENT****REPLACEMENT****1. REPLACE RING PIN**

**NOTE:** It is not necessary to remove the ring pin unless it is being replaced.

- a. Remove the 12 ring pins.
- b. Using a plastic-faced hammer, install 12 new ring pins.



P

**Fig. 337: Ring Pins**

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

**TEXT IN ILLUSTRATION**

*A	Upper Side	*B	Lower Side
*1	Protrusion Height	-	-

**Standard Protrusion Height**

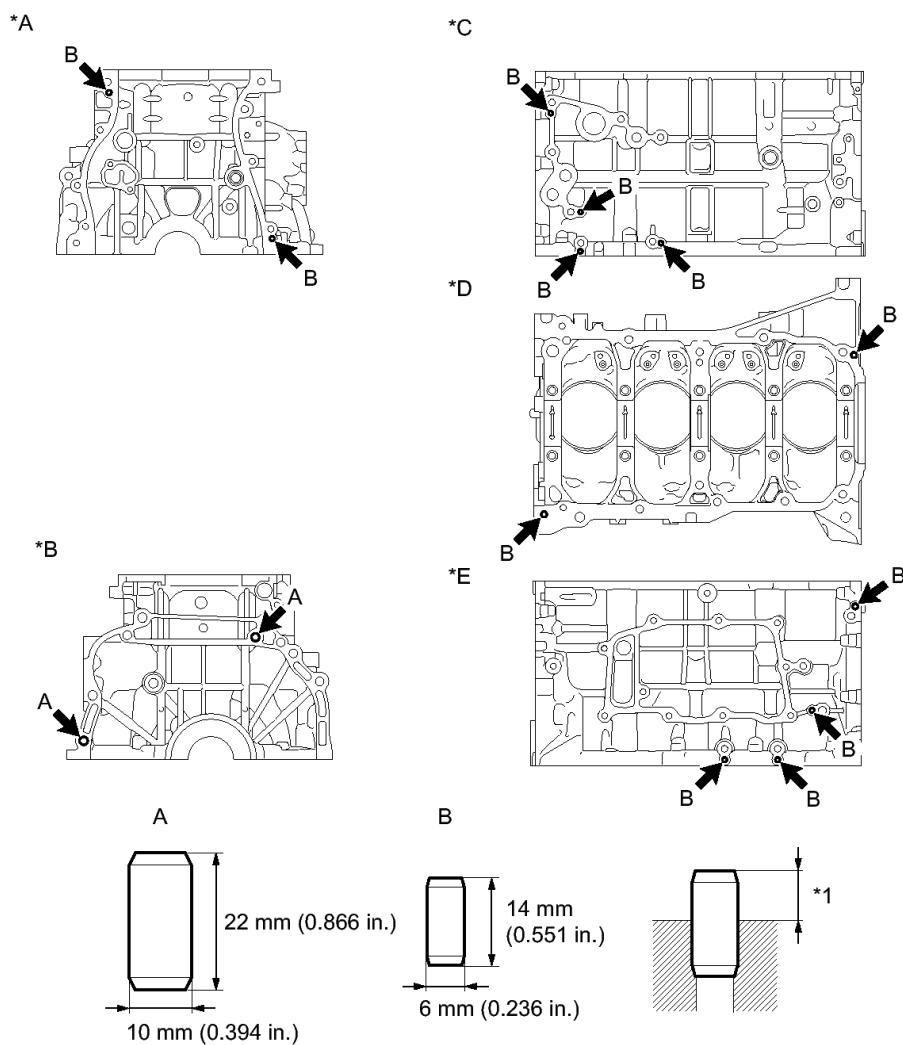
Item	Specified Condition
A	5.0 to 7.0 mm (0.197 to 0.276 in.)
B	4.0 to 7.0 mm (0.157 to 0.276 in.)



## 2. REPLACE STRAIGHT PIN

**NOTE:** It is not necessary to remove the straight pin unless it is being replaced.

- Remove the 14 straight pins.
- Using a plastic-faced hammer, install 14 new straight pins.



P

**Fig. 338: Straight Pins**

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

### TEXT IN ILLUSTRATION

*A	Front Side	*B	Rear Side
*C	LH Side	*D	Lower Side
*E	RH Side	-	-

*1	Protrusion Height	-	-
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## Standard Protrusion Height

Item	Specified Condition
A	11.0 to 13.0 mm (0.433 to 0.512 in.)
B	5.0 to 7.0 mm (0.197 to 0.276 in.)

## REASSEMBLY

## REASSEMBLY

## 1. INSTALL STUD BOLT

**NOTE:** If a stud bolt is deformed or its threads are damaged, replace it.

- a. Using an E8 and E10 "TORX" socket wrench, install the stud bolts.

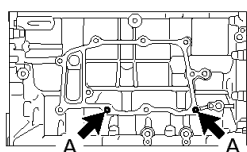
for stud bolt A

Torque: 9.5 N\*m (97 kgf\*cm, 84 in.\*lbf)

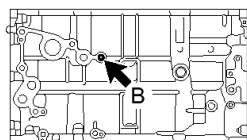
for stud bolt B

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

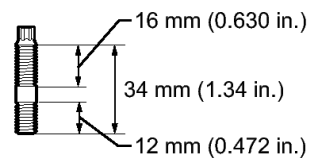
\*A



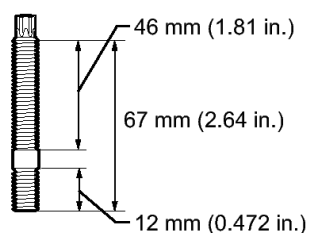
\*B



A



B



P

**Fig. 339: Stud Bolts**

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

**TEXT IN ILLUSTRATION**

*A	RH Side	*B	LH Side
----	---------	----	---------

**2. INSTALL NO. 2 OIL NOZZLE SUB-ASSEMBLY**

- a. Using a 5 mm hexagon wrench, install the 4 oil nozzles with the 4 bolts.

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

**3. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY**

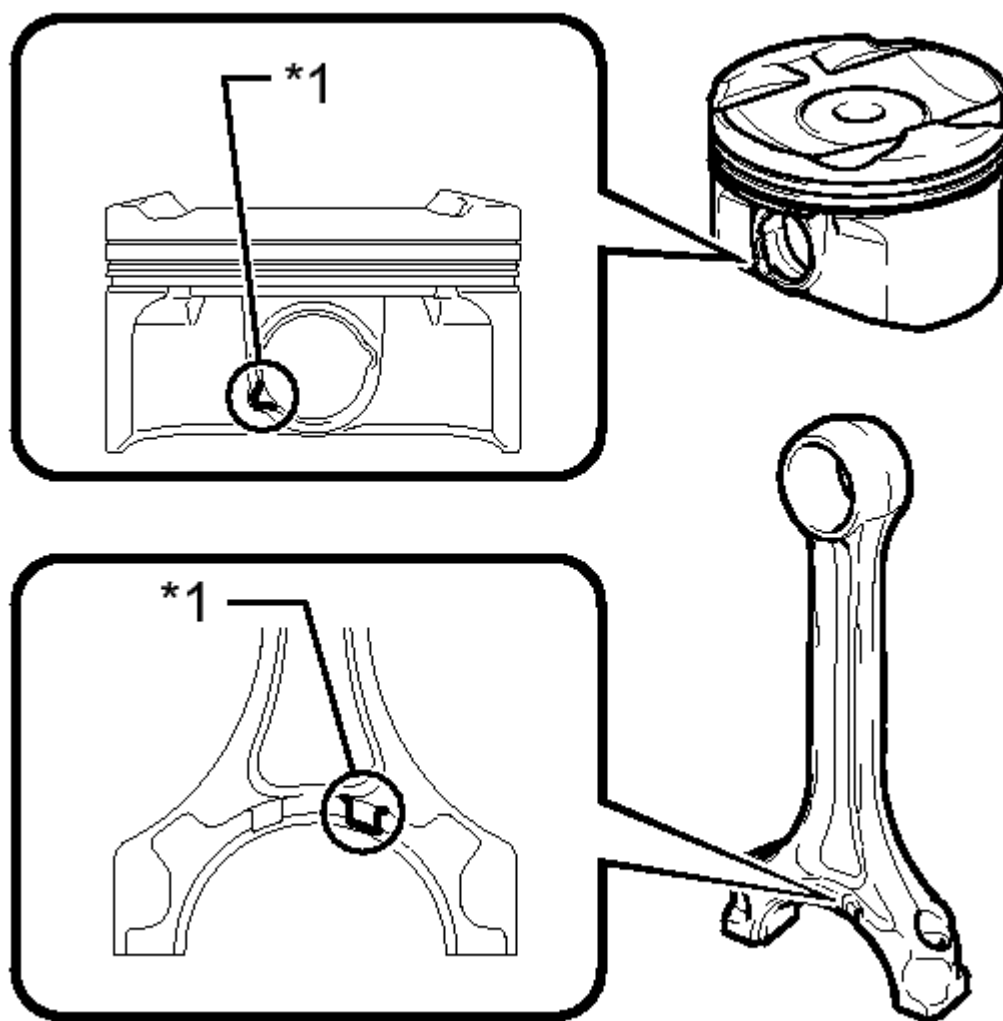
- a. Using a 5 mm hexagon wrench, install the 2 oil nozzles with the 2 bolts.

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

**4. INSTALL PISTON**

- a. Using a small screwdriver, install a new snap ring at one end of the piston pin hole.
- b. Gradually heat the piston up to 80 to 90°C (176 to 194°F).
- c. Coat the piston, piston pin and connecting rod with engine oil.
- d. Align the front marks of the piston and connecting rod, insert the connecting rod into the piston, and then push in the piston pin with your thumb until the pin comes into contact with the snap ring.



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**Fig. 340: Aligning Piston And Connecting Rod Marks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

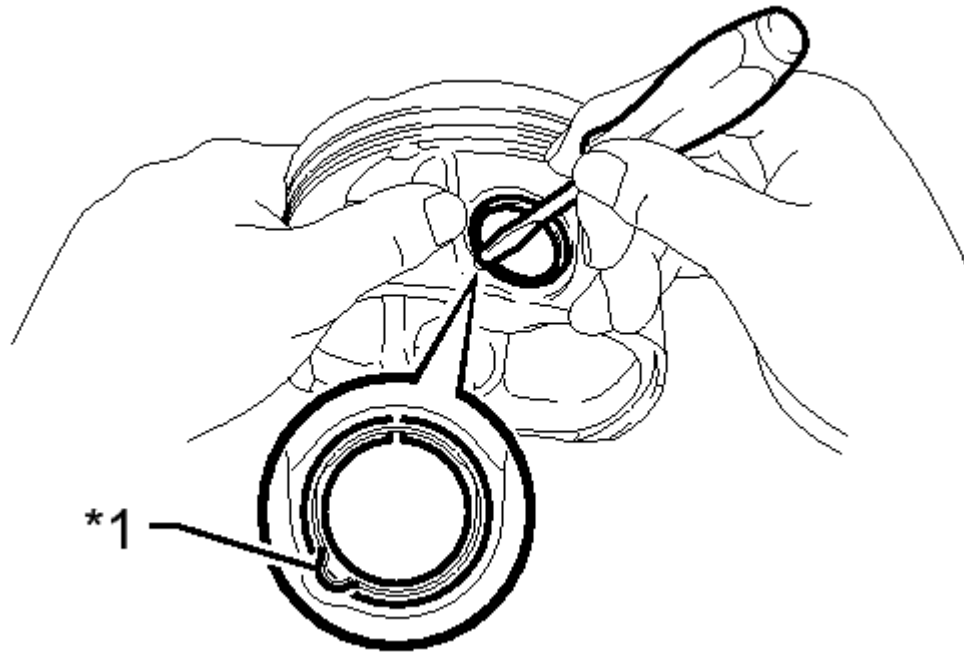
**TEXT IN ILLUSTRATION**

\*1 Front Mark

**HINT:**

The piston and pin are a matched set.

- e. Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.

**P****Fig. 341: Installing New Snap Ring**

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

**TEXT IN ILLUSTRATION**

*1	Service Hole Cutout Portion
----	--------------------------------

**HINT:**

Be sure that the end gap of the snap ring is not aligned with the service hole cutout portion of the piston.

- f. Check the fitting condition between the piston and piston pin.
  1. Move the connecting rod back and forth on the piston pin. Check the fitting condition.

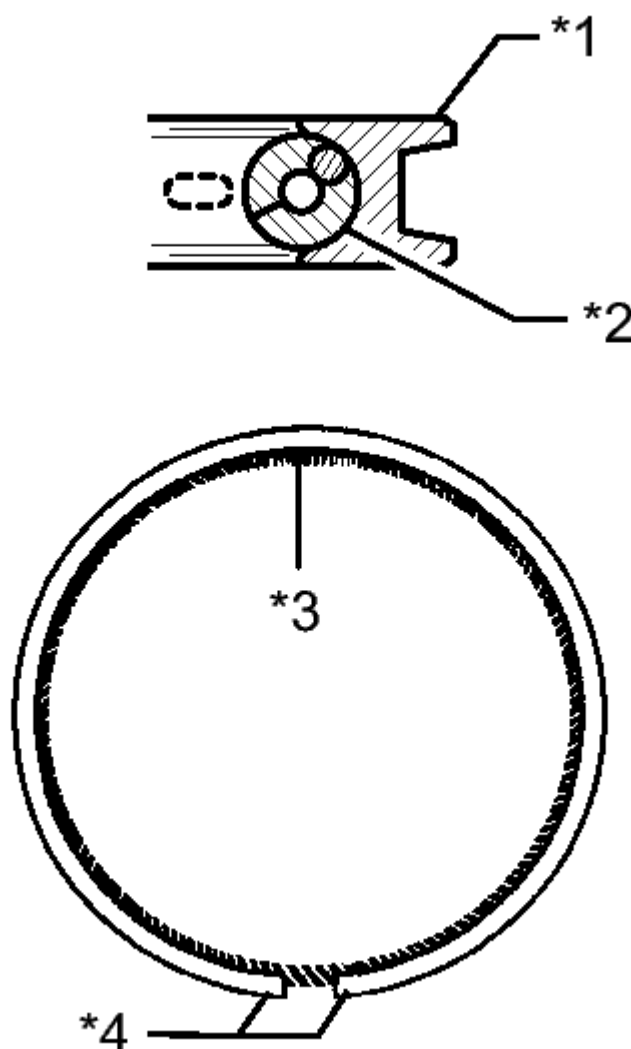
If abnormal movement is felt, replace the piston and pin as a set.

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.

**5. INSTALL PISTON RING SET**

- a. Install the oil ring expander and oil ring by hand.

**Fig. 342: Piston Ring Set**

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

**TEXT IN ILLUSTRATION**

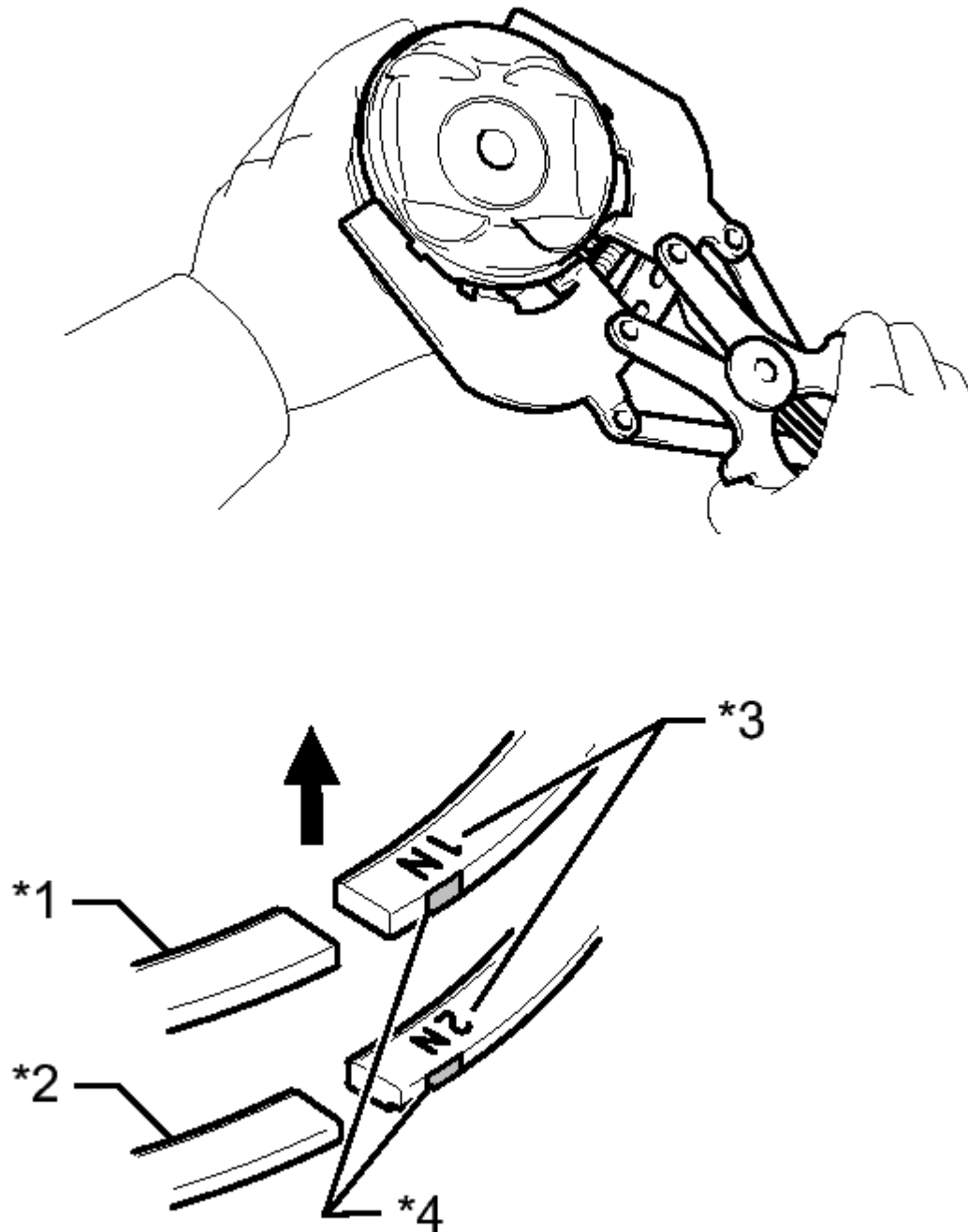
*1	Oil Ring
*2	Oil Ring Expander
*3	Coil Joint
*4	Oil Ring End

**HINT:**

Arrange the oil ring ends and coil joint as shown in the illustration.

- b. Using a piston ring expander, install the 2 compression rings with the code mark positioned as

shown in the illustration.



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**Fig. 343: Installing Compression Rings**

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

## Piston Ring Mark

Item	Code Mark	Paint Mark
No. 1	1N	Blue
No. 2	2N	Orange

## TEXT IN ILLUSTRATION

*1	No. 1 Compression Ring
*2	No. 2 Compression Ring
*3	Code Mark
*4	Paint Mark
	Upward

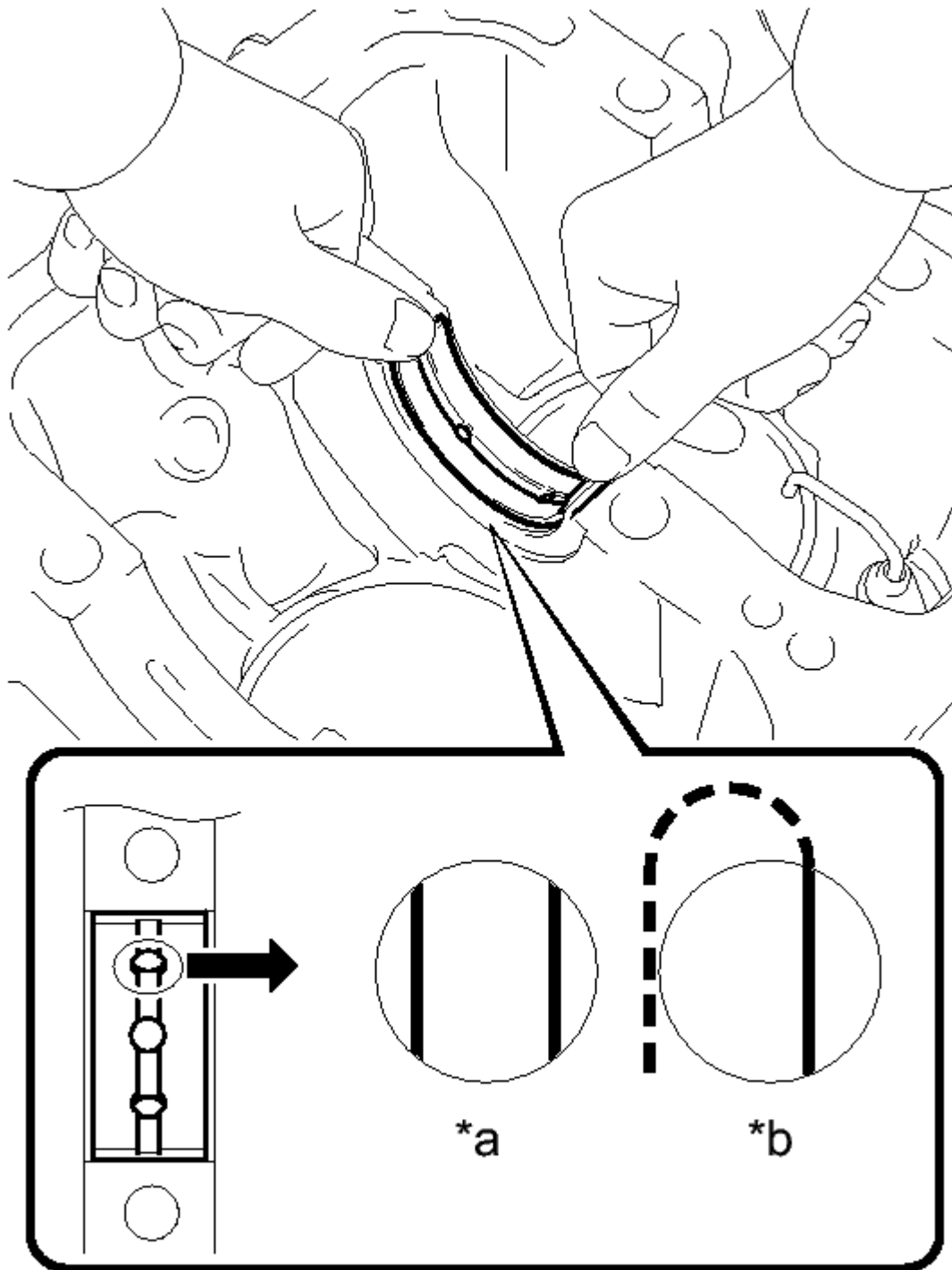
**NOTE:** Install the compression ring with the code mark facing upward.

**6. INSTALL CRANKSHAFT PULLEY KEY**

- Install the 2 crankshaft pulley keys to the crankshaft.

**7. INSTALL CRANKSHAFT BEARING**

- Clean the main journal and both surfaces of the bearing.

**P****Fig. 344: Installing Upper Crankshaft Bearing**

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

- b. Install the upper bearing to the cylinder block as shown in the illustration.

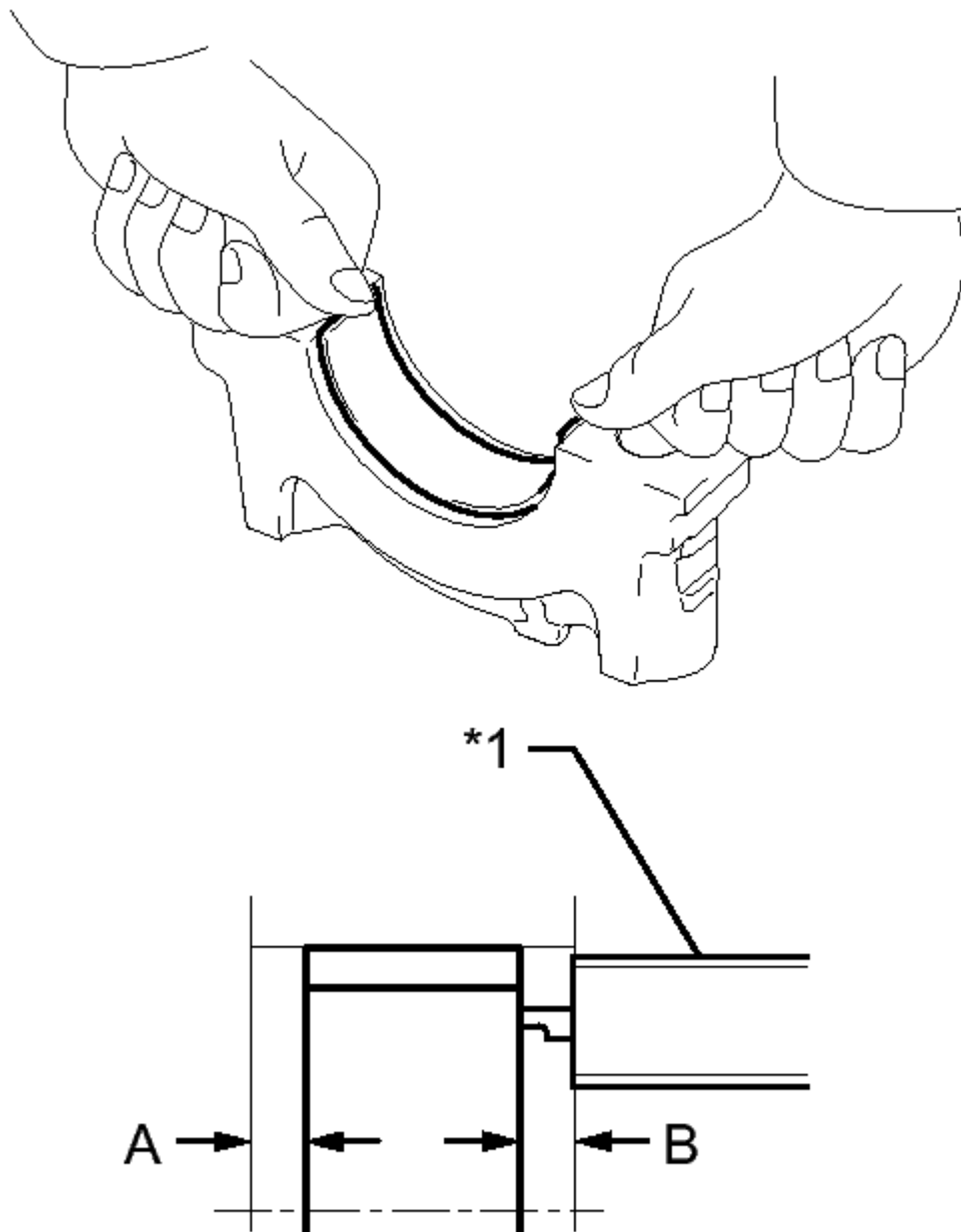
**TEXT IN ILLUSTRATION**

*a	CORRECT
*b	INCORRECT

**NOTE:**

- Do not apply engine oil to the bearings or their 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 to the bearing cap.

**P****Fig. 345: Lower Bearing Cap****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- d. Using a vernier caliper, measure the distance between the edges of the crankshaft bearing cap and lower bearing.



Dimension A - B or B - A

0 to 0.7 mm (0 to 0.0276 in.)

**TEXT IN ILLUSTRATION**

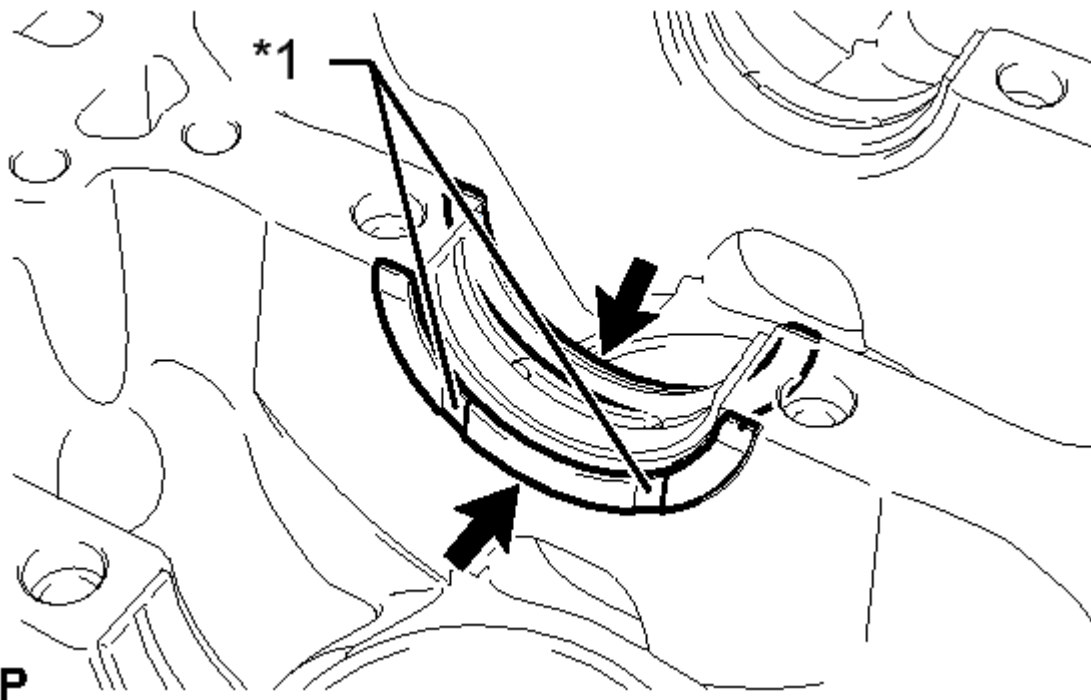
\*1 Vernier Caliper

**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.

**8. INSTALL CRANKSHAFT THRUST WASHER**

- a. Apply engine oil to the thrust washers.



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**Fig. 346: Thrust Washer Oil Grooves**

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

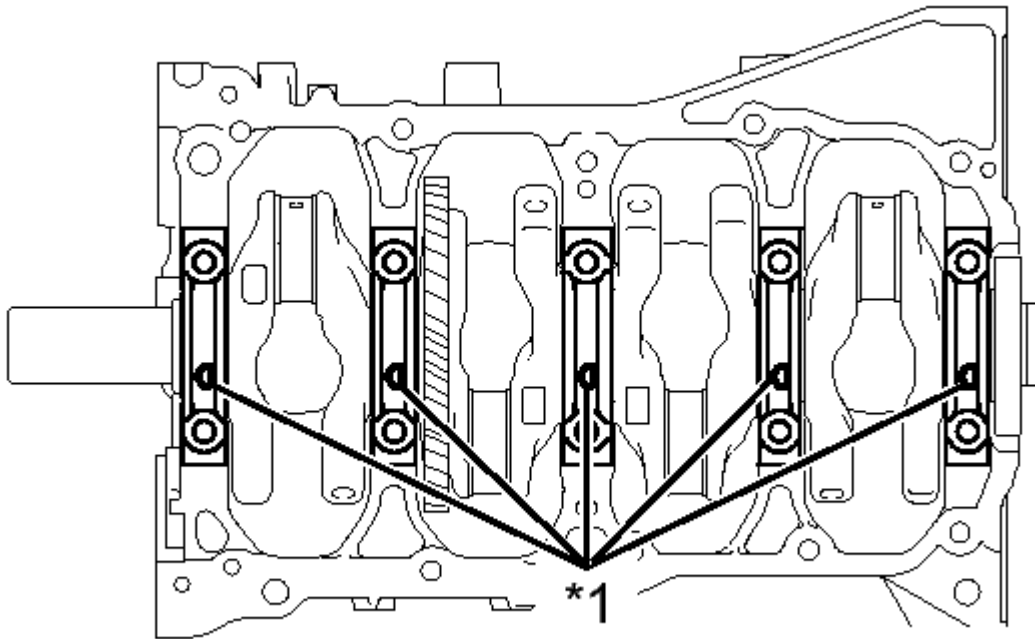
- b. Install the 2 thrust washers to the No. 3 journal position of the cylinder block with the oil grooves facing outward.

**TEXT IN ILLUSTRATION**

\*1 Oil Groove

**9. INSTALL CRANKSHAFT**

- a. Apply engine oil to the upper bearing, and then install the crankshaft to the cylinder block.



**P**

**Fig. 347: Crankshaft Front Marks & Numbers**

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

- b. Examine the front marks and numbers, and then install the bearing caps to the cylinder block with the front marks as shown in the illustration.

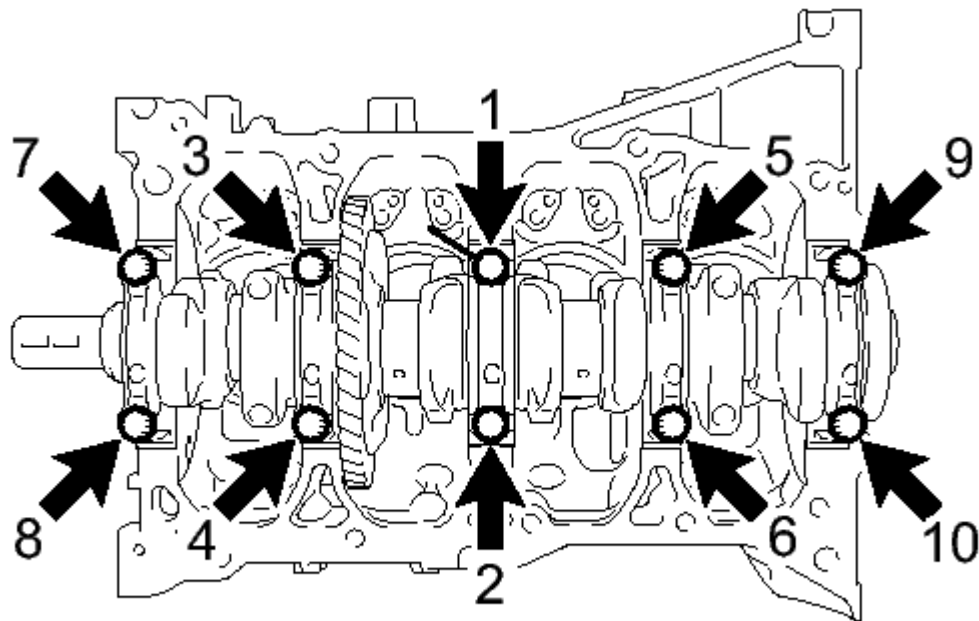
**TEXT IN ILLUSTRATION**

\*1 Front Mark

- c. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.  
d. Tighten the crankshaft bearing cap bolts.

**HINT:**

The cap bolts are tightened in 3 progressive steps.



## P

**Fig. 348: Identifying Bearing Cap Bolts Tightening Sequence**

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

1. Step 1:

Using several steps, install and uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

**Torque: 20 N\*m (204 kgf\*cm, 15 ft.\*lbf)**

2. Step 2:

Tighten the 10 bearing cap bolts again in the sequence shown in the illustration.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**

If a crankshaft bearing cap bolt does not meet the specified torque, replace it.

3. Mark the front side of each crankshaft bearing cap bolt with paint.

4. Step 3:

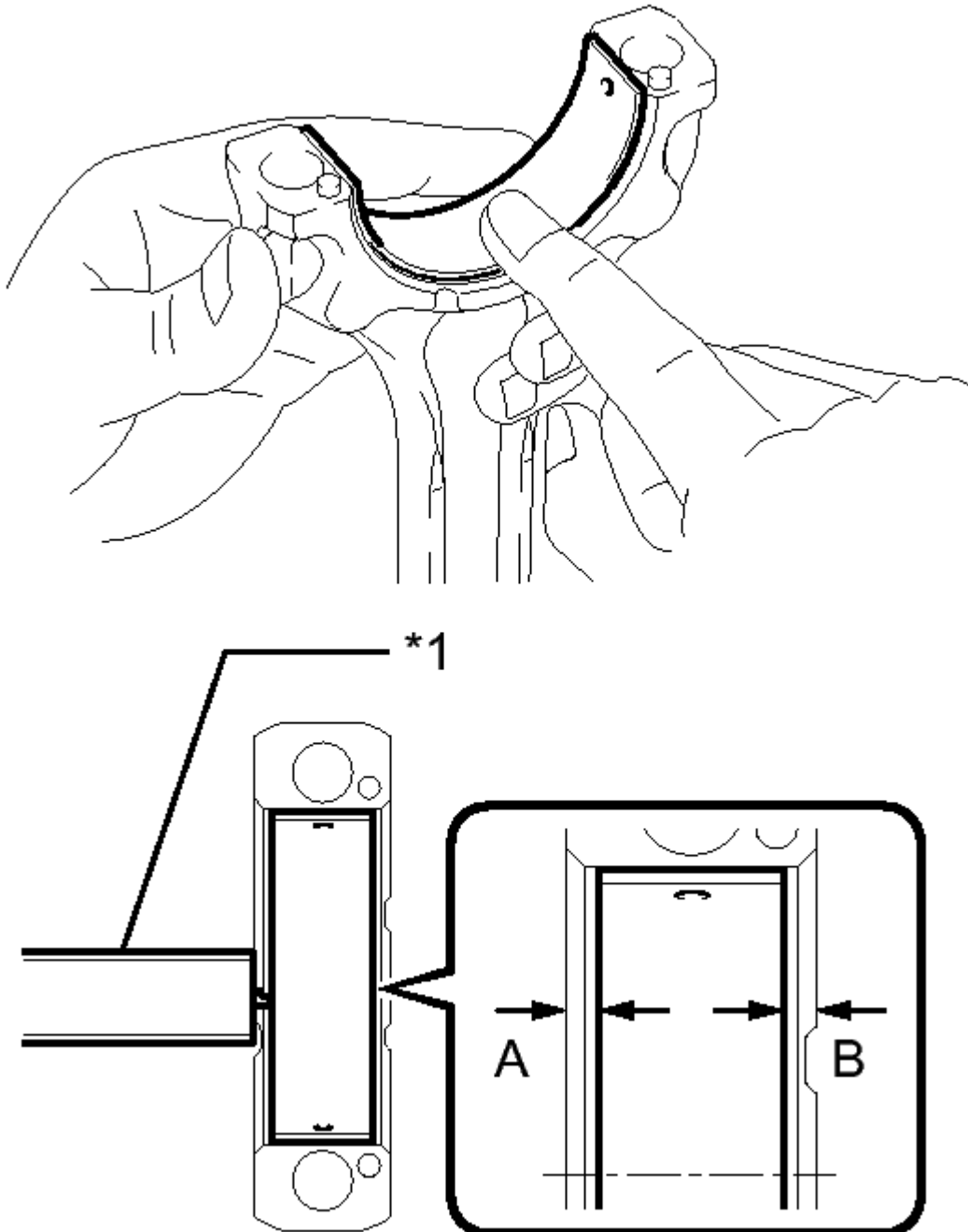
Tighten the 10 bearing cap bolts 90° in the order shown in step 1.

5. Check that the paint marks are now at a 90° angle to the front.

e. Check that the crankshaft turns smoothly.

## 10. INSTALL CONNECTING ROD BEARING

- a. Clean the bearing contact surface of the connecting rod and cap, and both surfaces of both bearings.



**P**

**Fig. 349: Connecting Rod Bearing Surface**

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

- b. Install the connecting rod bearings to the connecting rods and connecting rod caps.
- c. Using a vernier caliper, measure the distance between the edges of the connecting rod and connecting rod bearing, and the edges of the bearing cap and connecting rod bearing.

Dimension A - B or B - A

0 to 0.7 mm (0 to 0.0276 in.)

**TEXT IN ILLUSTRATION**

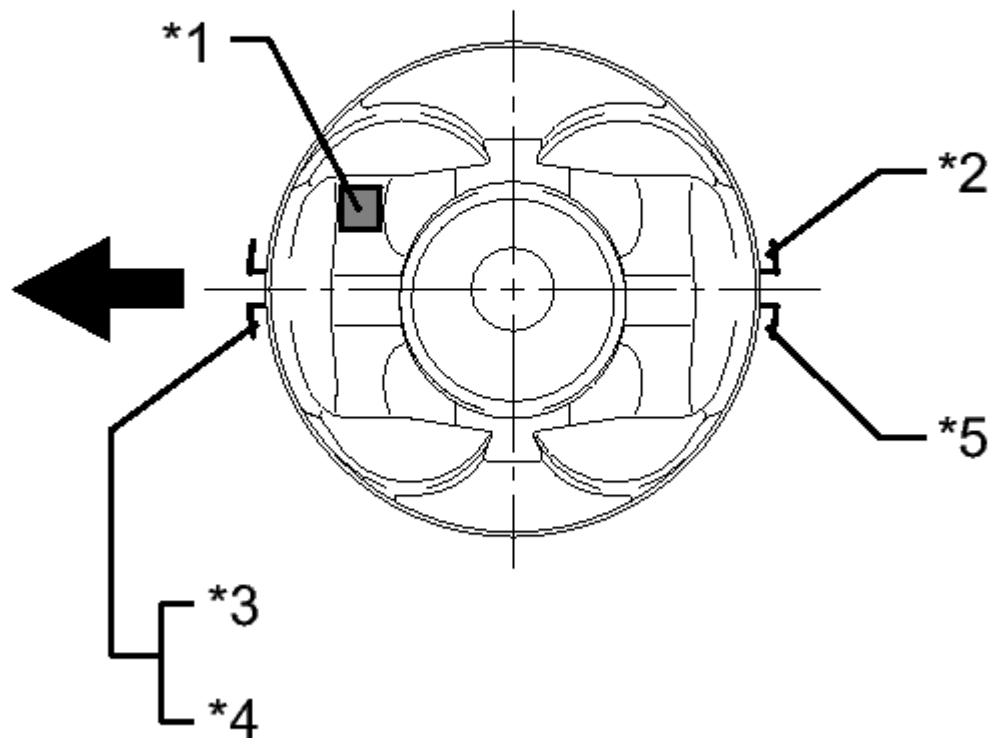
\*1 Vernier Caliper

**NOTE:**

- Do not apply engine oil to the bearings or 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.

**11. INSTALL PISTON WITH CONNECTING ROD**

- a. Apply engine oil to the cylinder walls, pistons, and surfaces of the connecting rod bearings.
- b. Position the piston rings so that the ring ends are as shown in the illustration.




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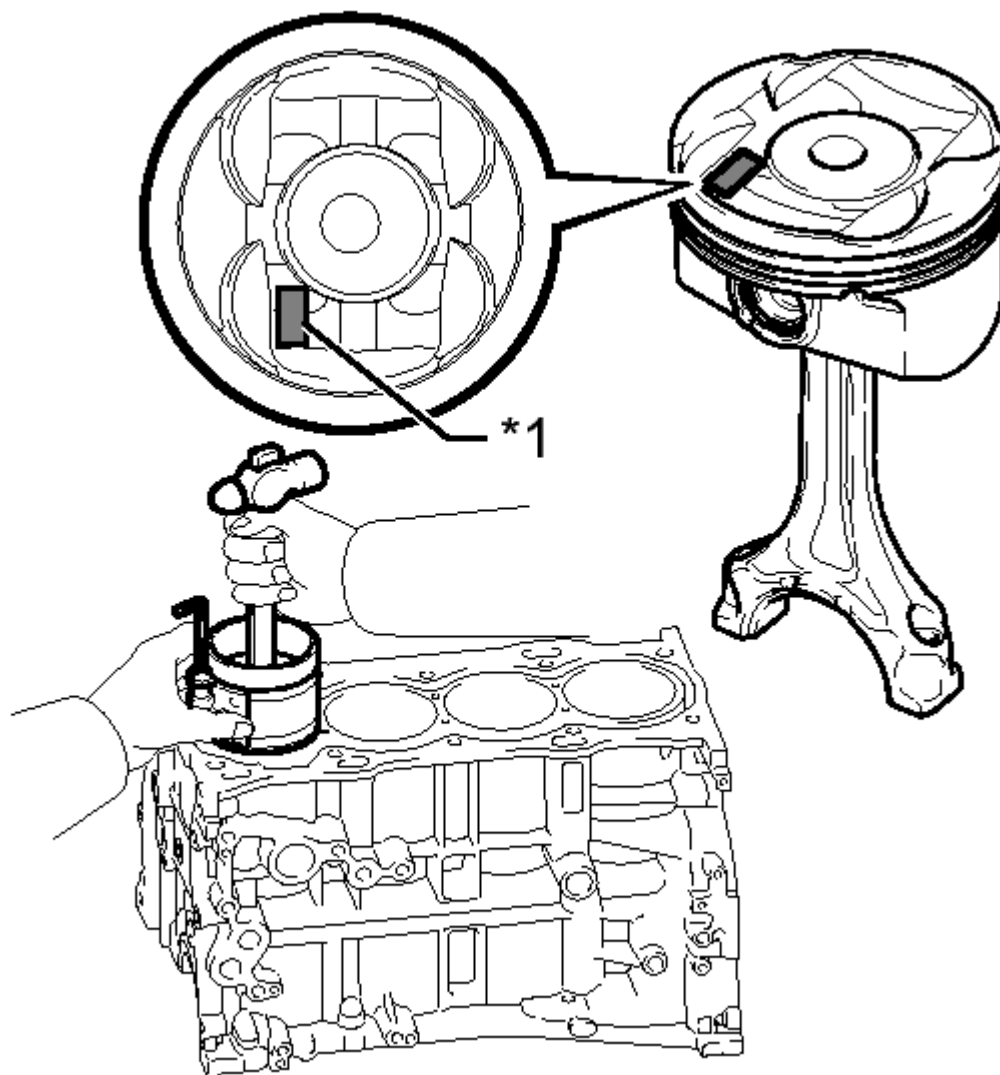
**Fig. 350: Piston Ring Position**

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

**TEXT IN ILLUSTRATION**

*1	Front Mark
*2	No. 2 Compression Ring
*3	No. 1 Compression Ring
*4	Oil Ring
*5	Oil Ring (Expander)
	Front

- c. Using a hammer handle and piston ring compressor, press a piston with connecting rod into each cylinder with the front mark of the piston facing forward.

**P****Fig. 351: Installing Pistons**

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

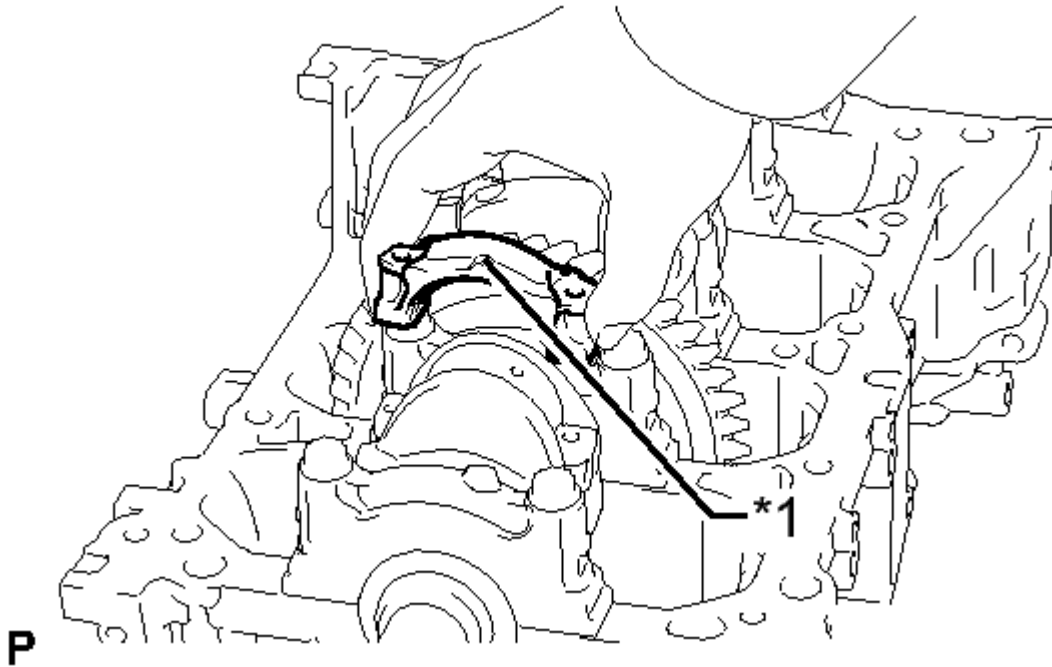
**TEXT IN ILLUSTRATION****\*1** Front Mark

**NOTE:** When inserting the piston with connecting rod into the cylinder block, make sure the oil nozzle does not interfere with the connecting rod.

**HINT:**

The front mark is "2L" printed in raised letters.

- d. Check that the front mark of the connecting rod cap is facing in the correct direction.



**Fig. 352: Checking Connecting Rod Cap Mark**

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

**TEXT IN ILLUSTRATION**

\*1 Front Mark

**NOTE:** Match the numbered connecting rod cap with the correct connecting rod.

- e. Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
- f. Install the connecting rod bolts.

**HINT:**

The connecting rod bolts are tightened in 2 progressive steps.

- 1. Step 1:

Install and alternately tighten the connecting rod bolts of each connecting rod cap in several steps.

**Torque: 40 N\*m (408 kgf\*cm, 30 ft.\*lbf)**



2. Mark the front side of each connecting rod cap bolt with paint.

3. Step 2:

Tighten the cap bolts 90°.

4. Check that the paint marks are now at a 90° angle to the front.

g. Check that the crankshaft turns smoothly.