

## Engine Mechanical - LS430

# ENGINE

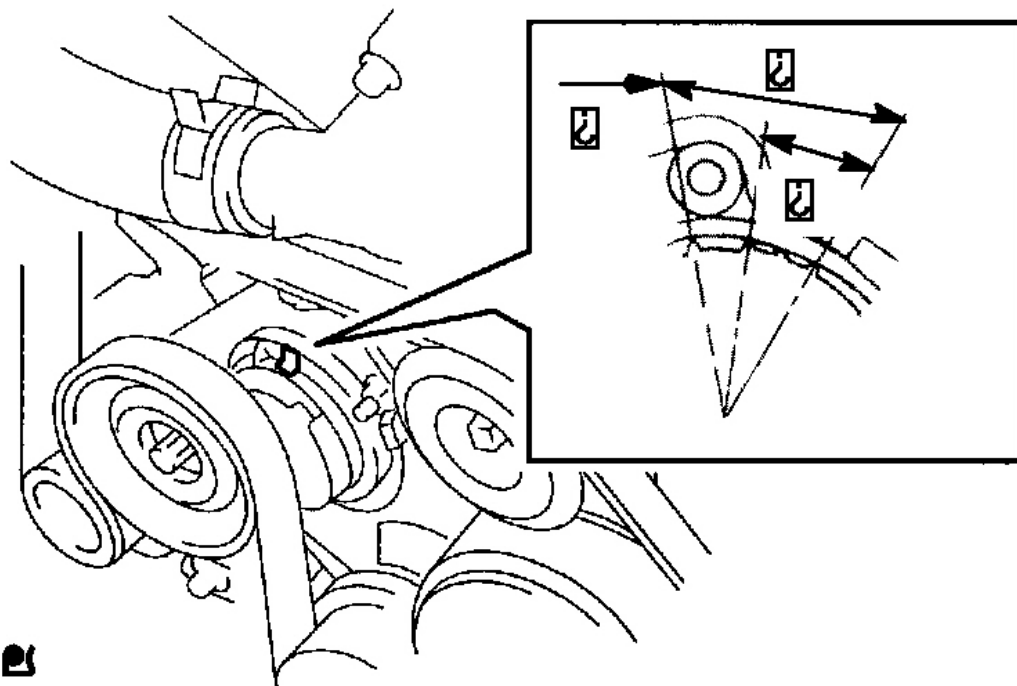
## INSPECTION

1. **INSPECT ENGINE COOLANT (See REPLACEMENT )**
2. **INSPECT ENGINE OIL (See ON-VEHICLE INSPECTION )**
3. **INSPECT BATTERY (See REPLACEMENT )**
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSY**
5. **INSPECT SPARK PLUG (See REPLACEMENT )**
6. **INSPECT FAN AND GENERATOR V BELT**

### HINT:

Use of the automatic tensioner has made tension and flexibility measurements unnecessary.

- a. Check that the indicator mark on the automatic tensioner is within range A as shown in the illustration.
- b. When the mark is out of the standard range, replace the V belt with a new one.



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

**HINT:**

- After installing the V belt, check that it fits properly in the ribbed grooves. Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the crank pulley.
- A "new belt" is a belt which has been used for less than 5 minutes on a running engine.
- A "used belt" is a belt which has been used on a running engine for 5 minutes or more.
- After installing a new belt, run the engine for approximately 5 minutes and then recheck the tension.



**CORRECT**

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**INCORRECT**

**Fig. 2: Identifying Proper Ribbed Grooves**

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

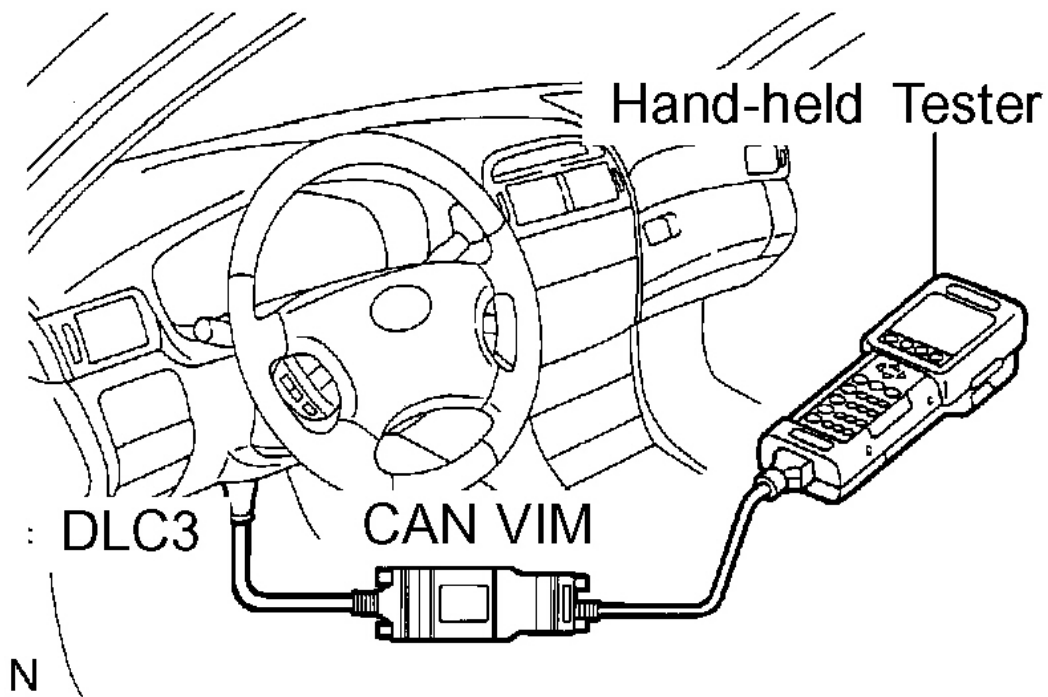
**7. INSPECT IGNITION TIMING**

- a. Warm up the engine.
- b. Check the ignition timing.
  1. Connect the hand-held tester (with CAN VIM) to the DLC3.
  2. Enter DATA LIST MODE on the hand-held tester.

**Ignition timing 8 to 12° BTDC @ idle**

**HINT:**

Please refer to the hand-held tester operator's manual for help on selecting the DATA LIST.



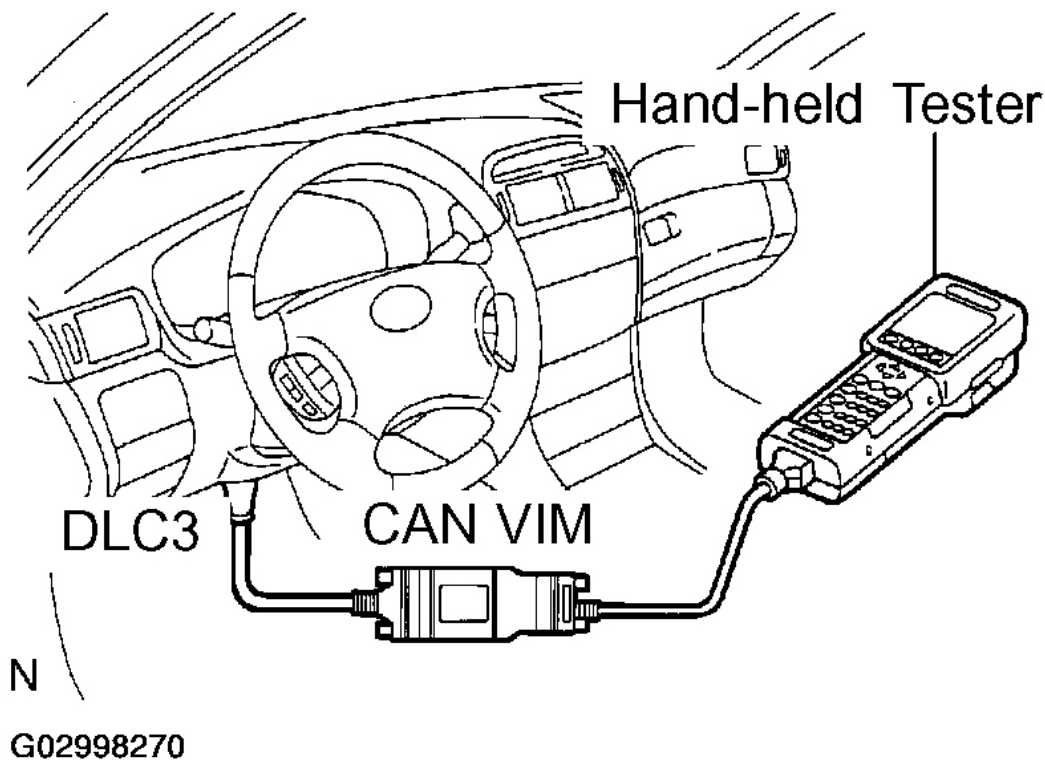
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**Fig. 3: Checking Ignition Timing Connecting Hand-Held Tester DLC3**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 8. INSPECT ENGINE IDLE SPEED

- a. Warm up the engine.
- b. Check the idle speed.
  1. Connect the hand-held tester (with CAN VIM) to the DLC3.
  2. Enter DATA LIST MODE on the hand-held tester.

**Idle speed: 700 to 800 rpm**



**Fig. 4: Checking Engine Idle Speed Connecting Hand-Held Tester DLC3**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:**

- When checking the idle speed, the transmission should be in the neutral position.
- Check the idle speed with the cooling fan off.
- Switch off all accessories and A/C before connecting the hand-held tester.

**HINT:**

Please refer to the hand-held tester operator's manual for further details.

**9. INSPECT COMPRESSION**

- a. Remove the V-bank cover.
- b. Remove the air cleaner inlet and intake air pipe.
- c. Disconnect the throttle control motor connector.
- d. Remove the oil level gauge guide.
- e. Remove the 8 ignition coils.

- f. Remove the spark plugs.
- g. Disconnect the 8 injector connectors.
- h. Check the cylinder compression pressure.

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

**Compression pressure:**

**1.2 MPa (12.5 kgf/cm<sup>2</sup> , 178 psi)**

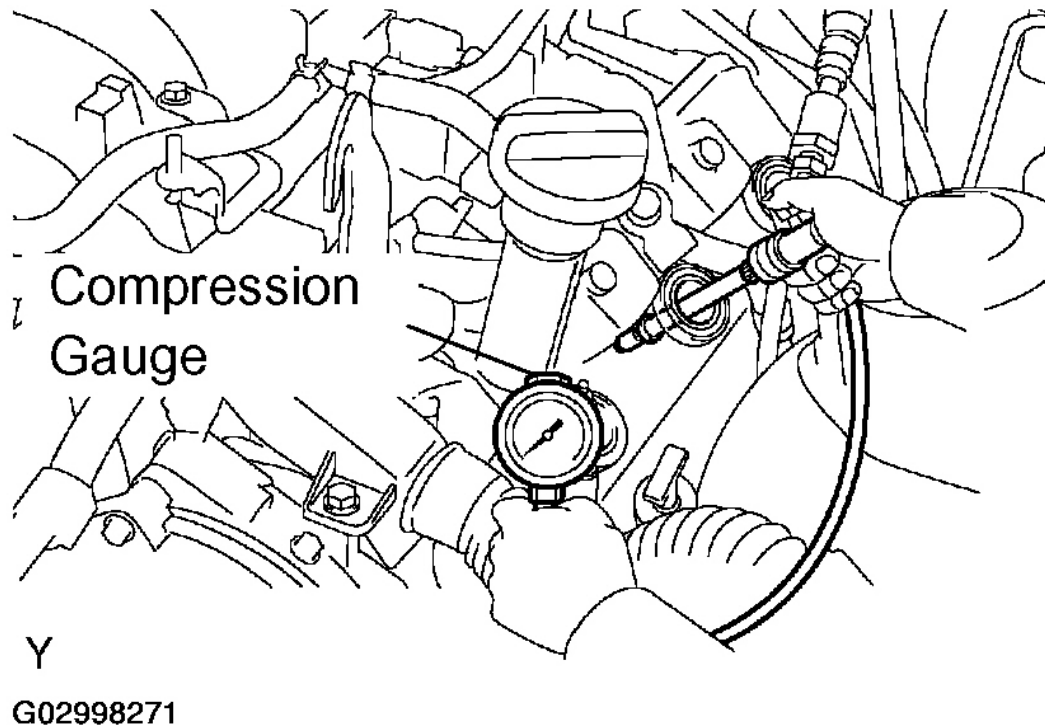
**Minimum pressure: 981 kPa (10.0 kgf/cm<sup>2</sup> , 142 psi)**

**Difference between each cylinder:**

**98 kPa (1.0 kgf/cm<sup>2</sup> , 14 psi)**

**NOTE:**

- **Always use a fully charged battery to obtain engine speed of 250 rpm or more.**
  - **Check other cylinder's compression pressure in the same way.**
  - **This measurement must be done as quickly as possible.**
4. If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and inspect again.



**Fig. 5: Checking Cylinder'S Compression Pressure**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- If adding oil increases the compression, the piston rings and/or cylinder bore may be worn or damaged.
  - If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage in the gasket.
- i. Connect the 8 injector connectors.
  - j. Install the spark plugs.
  - k. Install the 8 ignition coils.
  - l. Install the oil level gauge guide.
  - m. Connect the throttle control motor connector.
  - n. Install the air cleaner inlet and intake air pipe.
  - o. Install the V-bank cover.

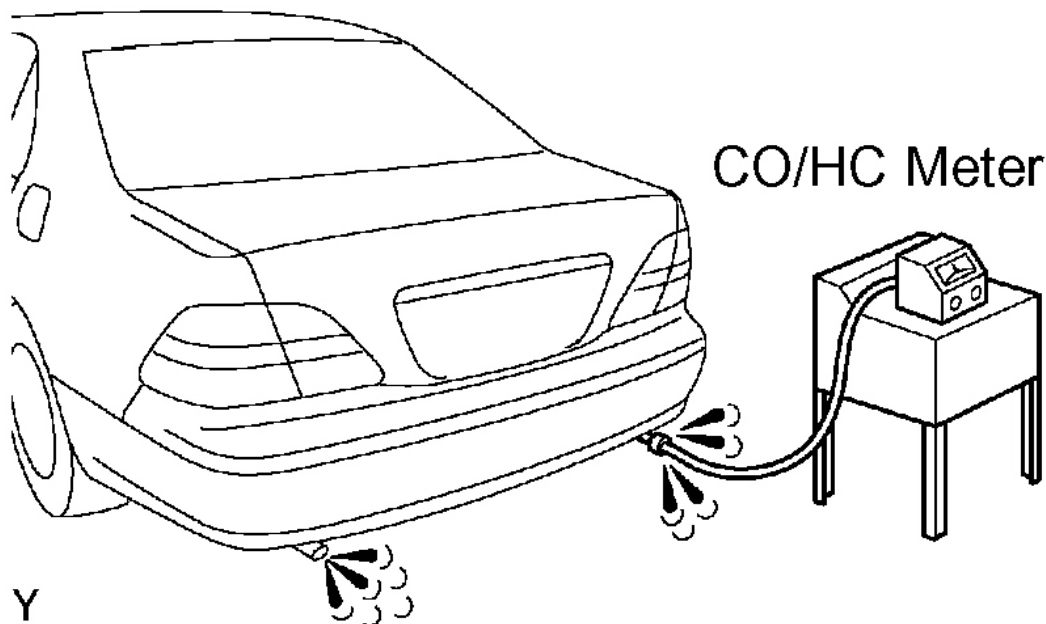
10. **INSPECT CO/HC**

- a. Start the engine.
- b. Rev the engine at 2,500 rpm for approximately 180 seconds.

- c. Insert CO/HC meter testing probe at least 40 cm (1.3 ft) into the tailpipe during idling.
- d. Check CO/HC concentration at idle and/or 2,500 rpm.

HINT:

- Complete the measuring within 3 minutes.
  - Check regulations and restrictions in your area when performing 2 mode CO/HC concentration testing (engine check at both idle speed and at 2,500 rpm).
- e. If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
    1. Check heated oxygen sensor operation (see **DTC P0130, P0150, P2195, P2196, P2197, P2198: OXYGEN SENSOR CIRCUIT (BANK 1 SENSOR 1), OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 2 SENSOR 1), OXYGEN SENSOR SIGNAL STUCK LEAN (BANK 1 SENSOR 1)/ (BANK 2 SENSOR 1), OXYGEN SENSOR SIGNAL STUCK RICH (BANK 1 SENSOR 1) and DTC P0133, P0153: OXYGEN SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)/ (BANK 2 SENSOR 1)** ).
    2. See the table on the next page for possible causes, and then inspect and repair.



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**Fig. 6: Checking CO/HC Concentration**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



CO	HC	Symptom	Causes
Normal	High	Rough idle	1. Faulty ignitions: <ul style="list-style-type: none"> <li>• Incorrect timing</li> <li>• Fouled, shorted or improperly gapped plugs</li> </ul> 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. 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> </ul> 2. Lean mixture causing misfire
High	High	Rough idle (black smoke from exhaust)	1. Restricted air filter 2. Faulty SFI system: <ul style="list-style-type: none"> <li>• Faulty pressure regulator</li> <li>• Defective ECT sensor</li> <li>• Faulty ECM</li> <li>• Faulty injector</li> <li>• Faulty throttle position sensor</li> <li>• MAF meter</li> </ul>

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**Fig. 7: CO/HC Symptom Reference Chart**

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

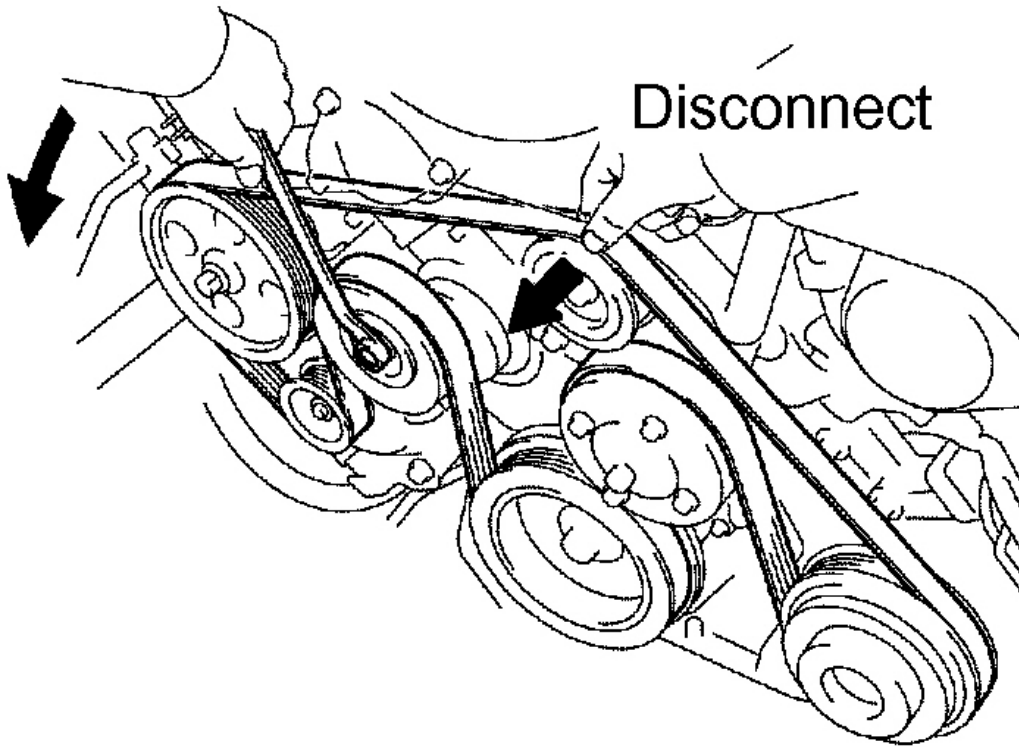
## **DRIVE BELT**

### **REPLACEMENT**

1. **REMOVE AIR CLEANER INLET NO.1**
2. **REMOVE FAN AND GENERATOR V BELT**
  - a. Loosen the belt tension by turning the belt tensioner counterclockwise, and remove the V belt.

**HINT:**

The tension pulley has a left-hand thread.

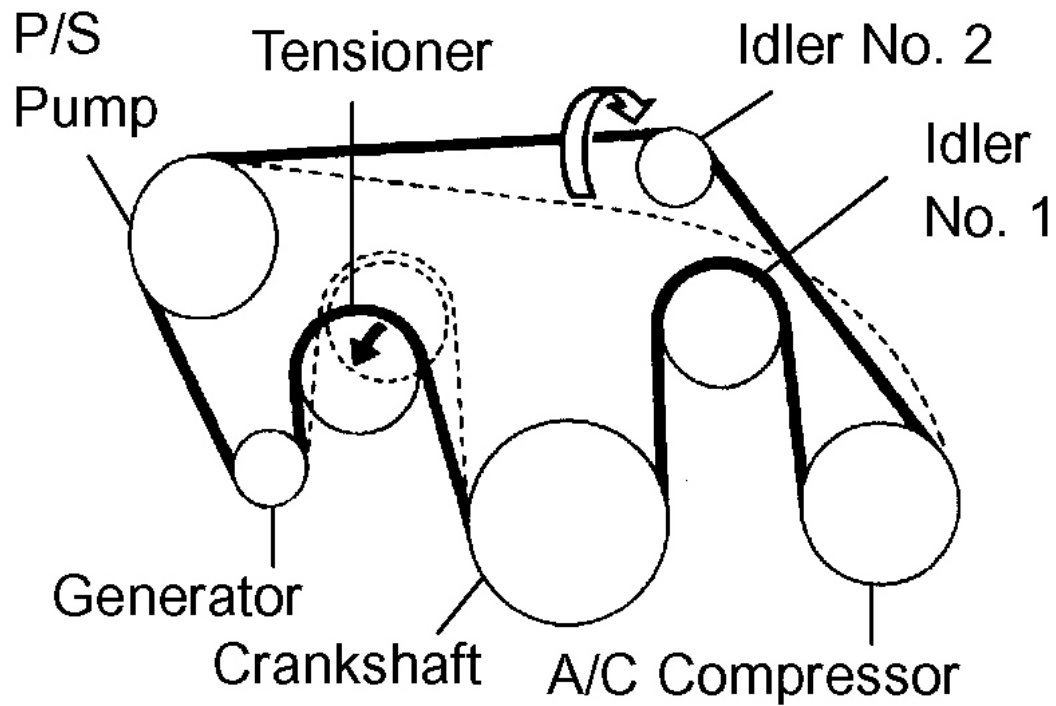


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**Fig. 8: Removing Fan And Generator V Belt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**3. INSTALL FAN AND GENERATOR V BELT**

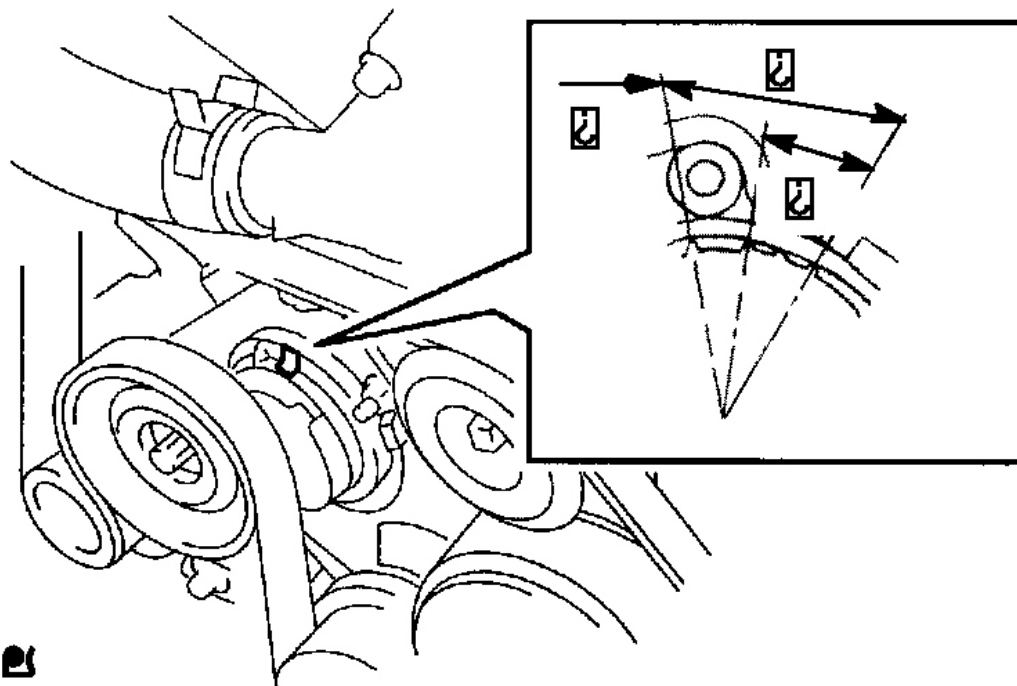
- a. Set the V belt to everything except the idler pulley No. 2, as shown in the illustration.
- b. Loosen the V belt by turning the belt tensioner counterclockwise.
- c. Then set the V belt to the idler pulley.



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**Fig. 9: Installing Fan And Generator V Belt**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. After a new belt has been installed, check that the mark is within range B as shown in the illustration.



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**Fig. 10: Locating Mark**

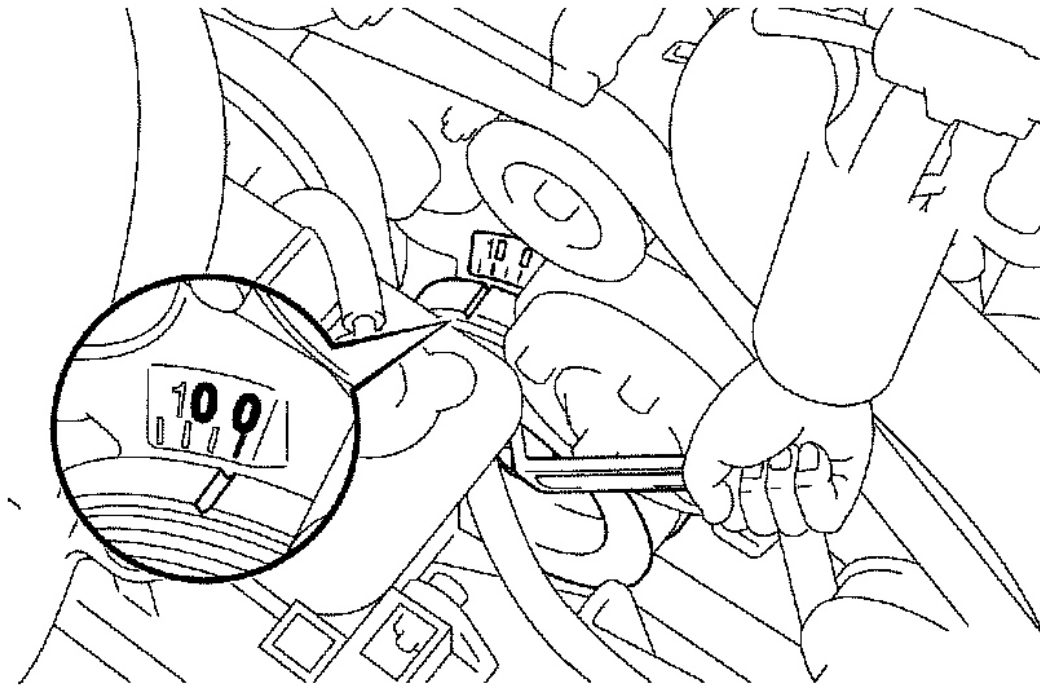
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL AIR CLEANER INLET NO.1

## VALVE CLEARANCE

### ADJUSTMENT

1. REMOVE V-BANK COVER
2. REMOVE CYLINDER HEAD COVER SUB-ASSY (See REPLACEMENT )
3. REMOVE CYLINDER HEAD COVER SUB-ASSY LH (See REPLACEMENT )
4. SET NO. 1 CYLINDER TO TDC/COMPRESSION
  - a. Turn the crankshaft damper, and align its groove with timing mark "0" of the timing belt No. 1 cover.

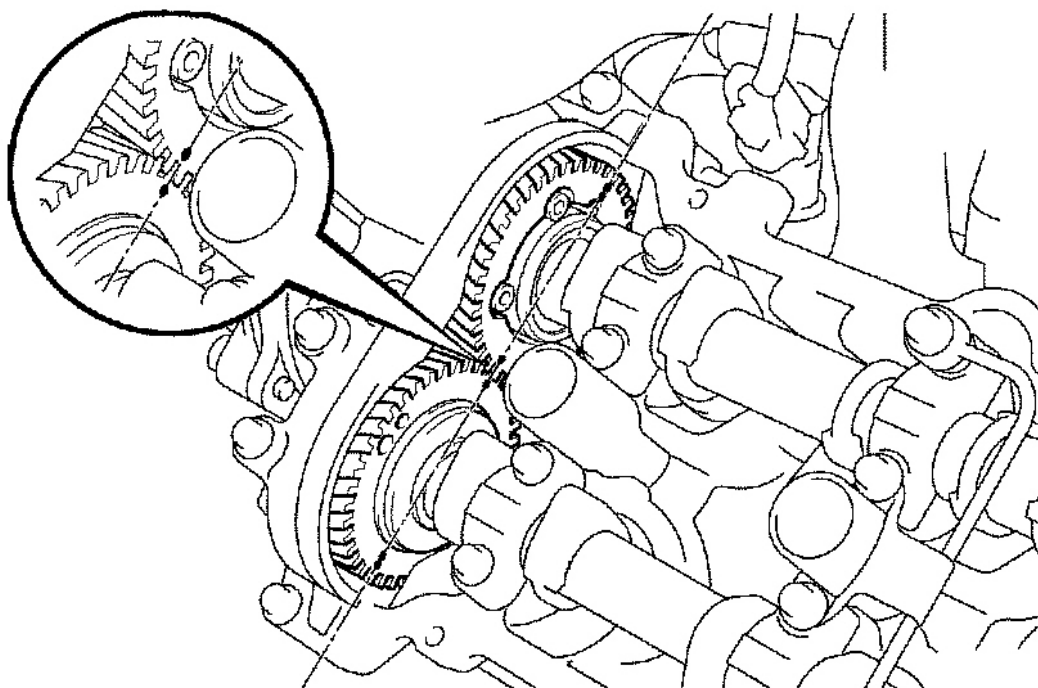


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**Fig. 11: Aligning Groove With Timing Mark**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the timing marks (1 dot mark) of the intake and exhaust camshaft gears on the LH bank are aligned.

If not, turn the crankshaft 1 revolution (360°) and align the mark as above.



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**Fig. 12: Aligning Mark Intake And Exhaust Camshaft Gears**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 5. INSPECT VALVE CLEARANCE

- a. Check only the valves indicated by diagonal lines in the illustration.
  1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

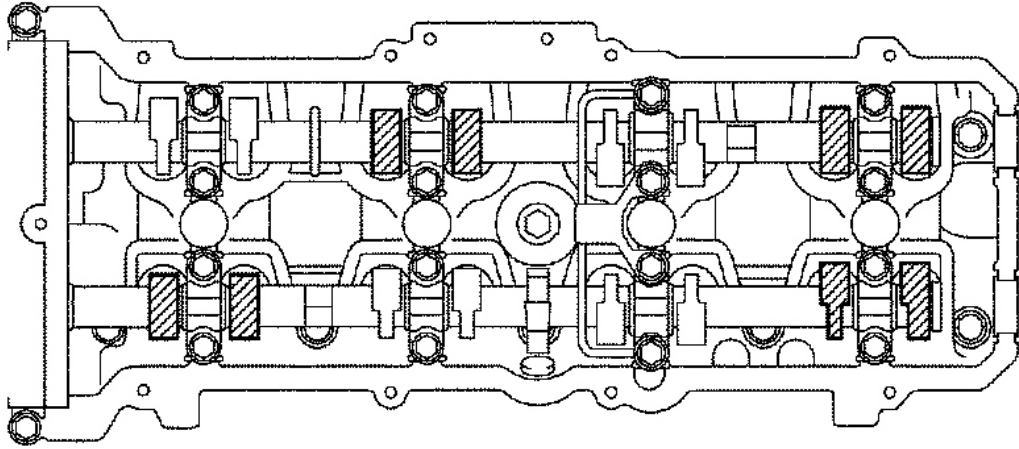
### VALVE CLEARANCE (COLD):

#### VALVE CLEARANCE SPECIFICATIONS

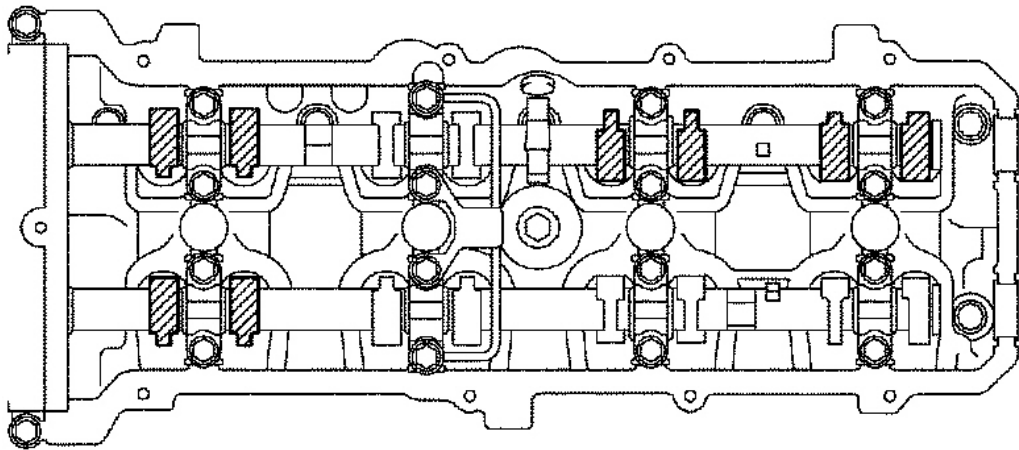
Intake	0.15 to 0.25 mm (0.006 to 0.010 in.)
Exhaust	0.25 to 0.35 mm (0.010 to 0.014 in.)

2. Record valve clearance measurements that are out of the specified range. These measurements will be used later to determine the size of the adjustment shim to be installed.

## RH Bank



## LH Bank



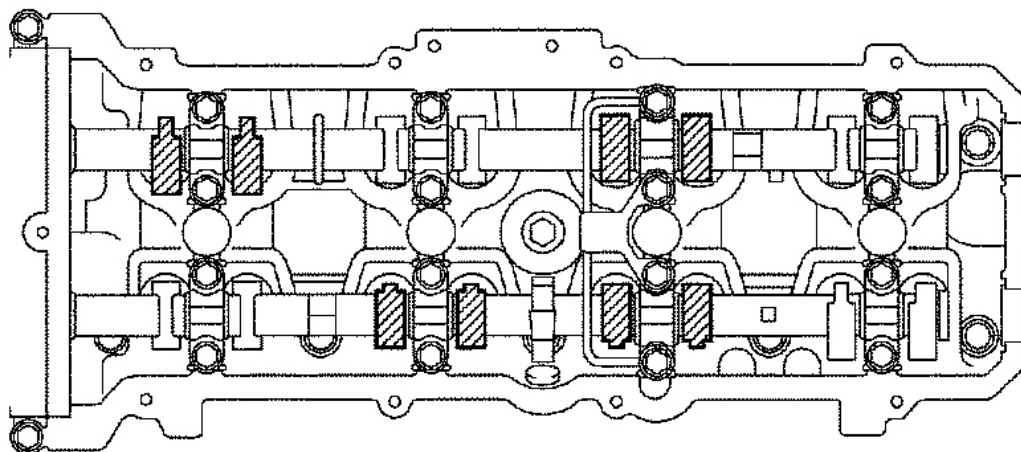
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**Fig. 13: Measuring Clearance Between Valve Lifter And Camshaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

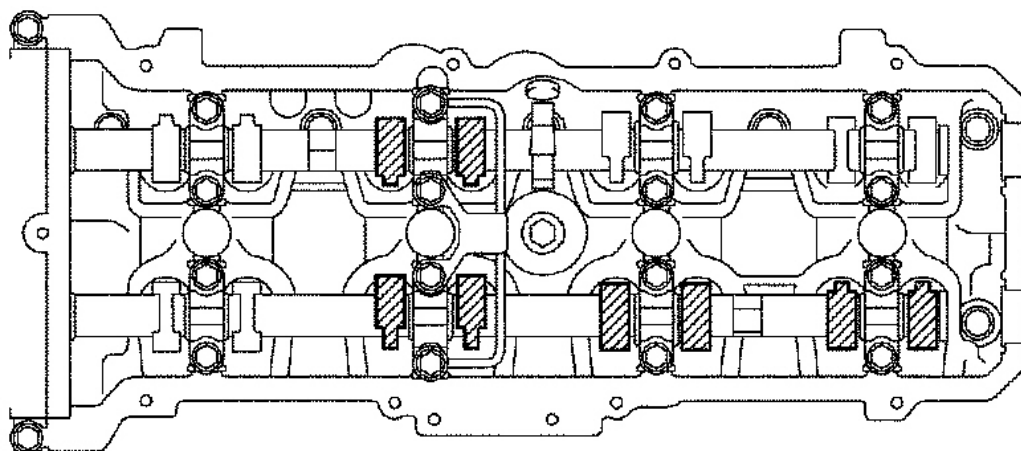
- b. Turn the crankshaft 1 revolution (360°) and align the marks of the intake and exhaust camshaft gears on the LH bank (see procedure in step 4).

- c. Check only the valves indicated by diagonal lines in the illustration. Measure the valve clearance (see procedure in step (a)).

## RH Bank



## LH Bank



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**Fig. 14: Measuring Valve Clearance**

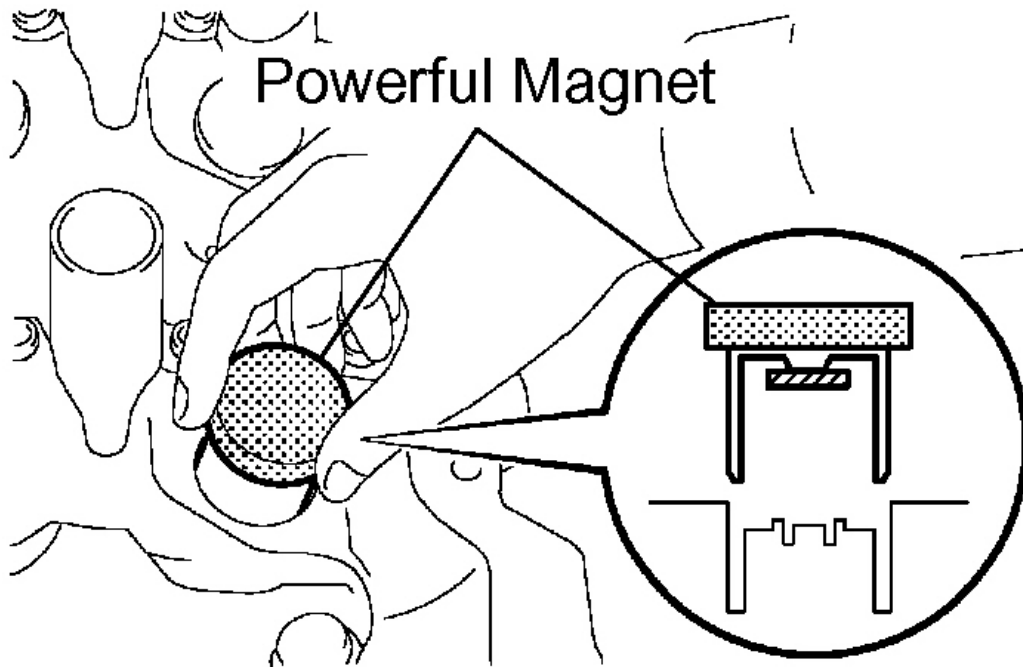


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6. REMOVE CAMSHAFT (See REPLACEMENT )
7. REMOVE NO.3 CAMSHAFT SUB-ASSY (See REPLACEMENT )
8. ADJUST VALVE CLEARANCE
  - a. Using a powerful magnet, remove the valve lifter and adjusting shim.

**NOTE:**

- Since shims might drop inside the cylinder head, the operation should be performed slowly.
- Shims should be classified by the installation.



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**Fig. 15: Identifying Powerful Magnet**

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

- b. Determine the replacement adjusting shim size according to these formulas and charts:
  1. Using a micrometer, measure the thickness of the removed shim.
  2. Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

T = Thickness of removed shim

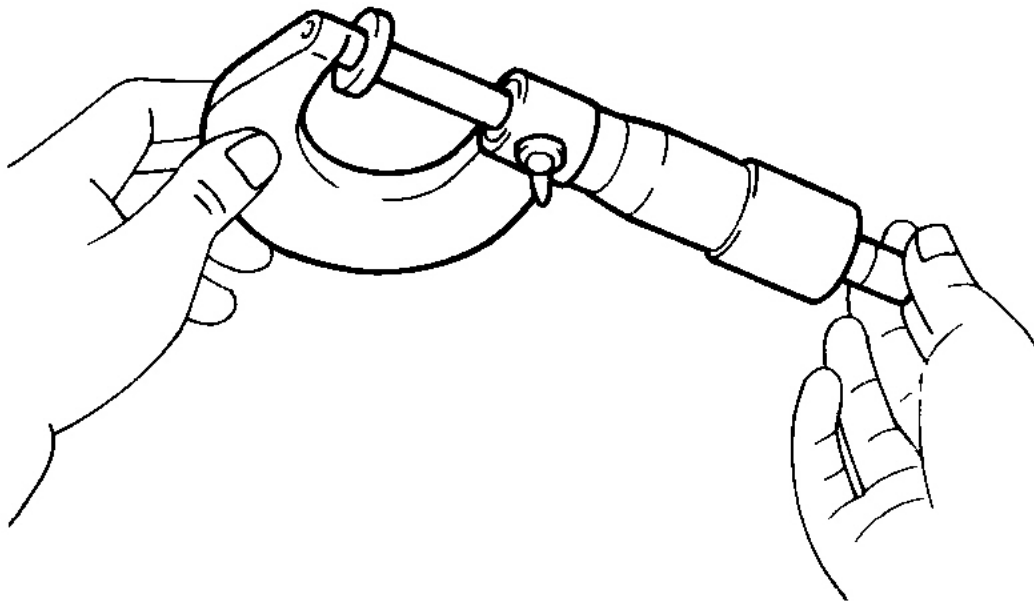
A = Measured valve clearance

N = Thickness of new shim

**SHIM THICKNESS REFERENCE**

Intake	$N = T + (A - 0.20 \text{ mm (0.008 in.)})$
Exhaust	$N = T + (A - 0.30 \text{ mm (0.012 in.)})$

- c. Select a new shim with a thickness as close as possible to the calculated value.



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**Fig. 16: Measuring Thickness Of Shim Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

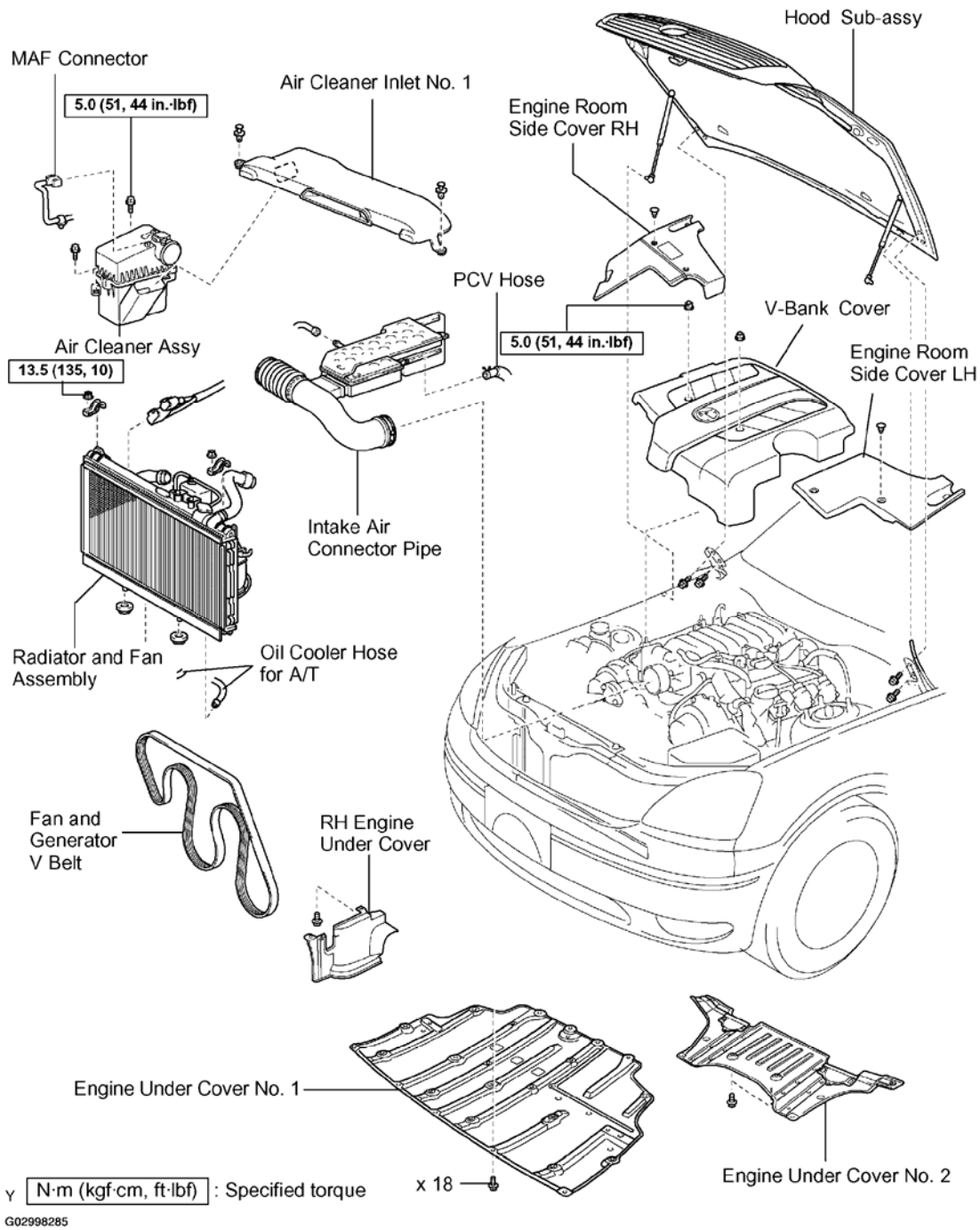
HINT:

Shims are available in 41 increments of 0.020 mm (0.0008 in.), from 2.00 mm (0.0787 in.) to 2.80 mm (0.1102).

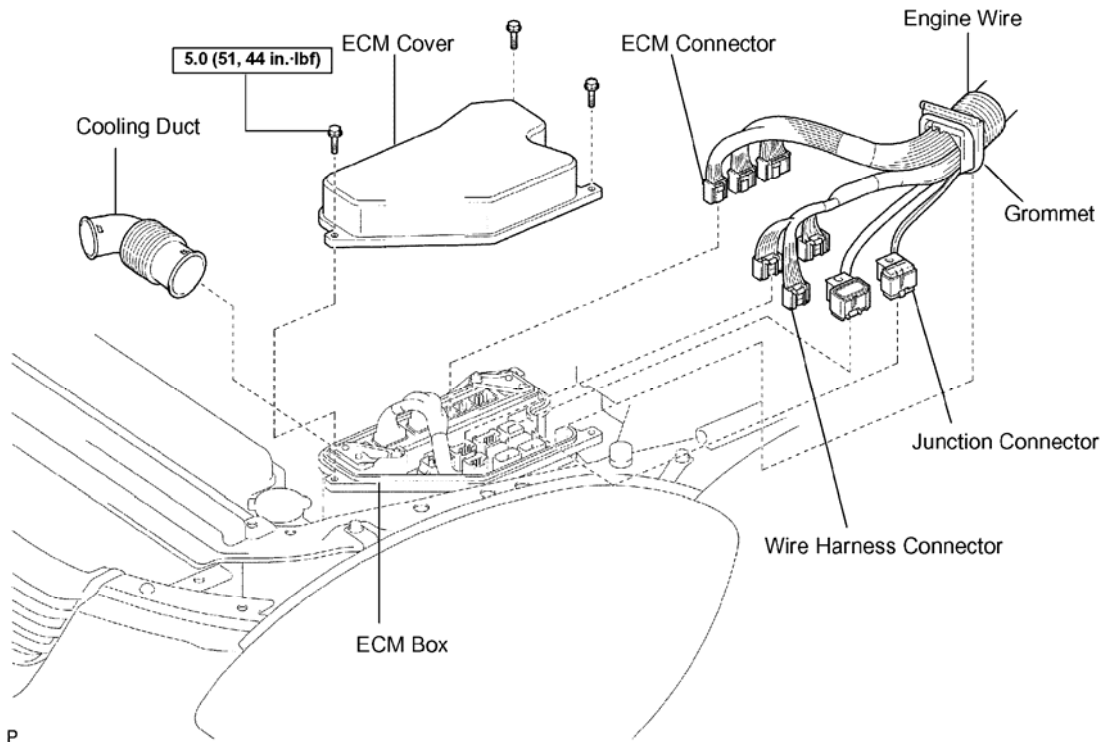
- d. Install a new adjusting shim to the spring retainer.
- e. Install the valve lifter.





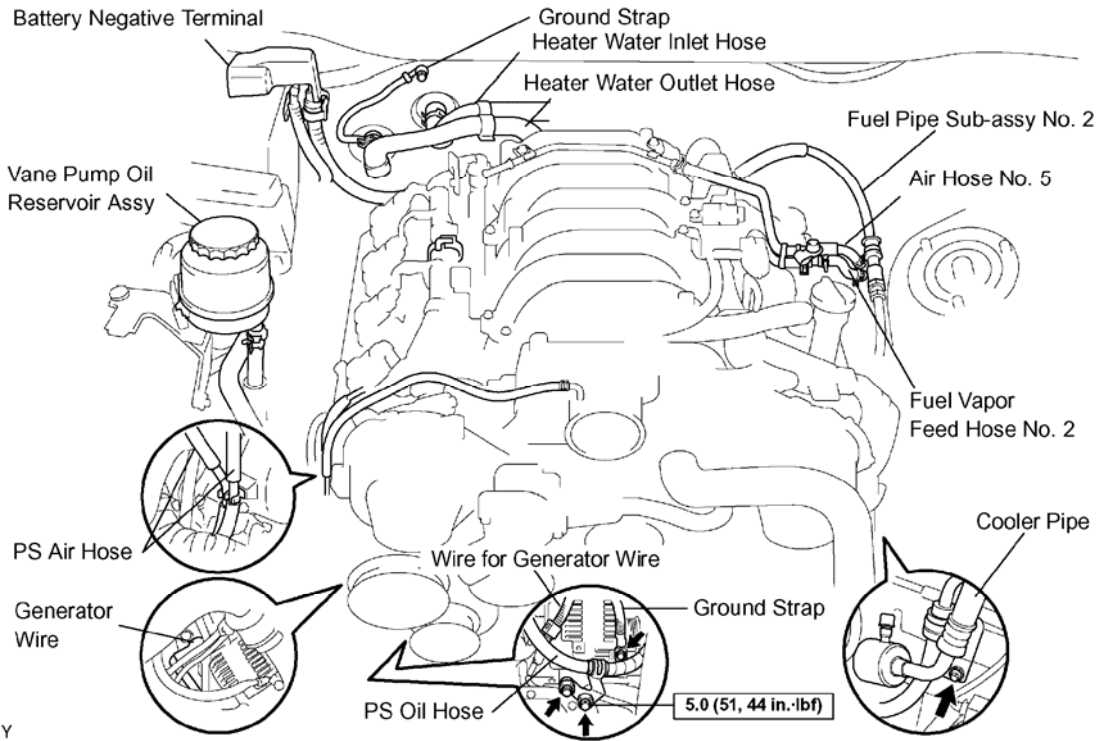


**Fig. 19: Exploded View Of Partial Engine Assy Components (1 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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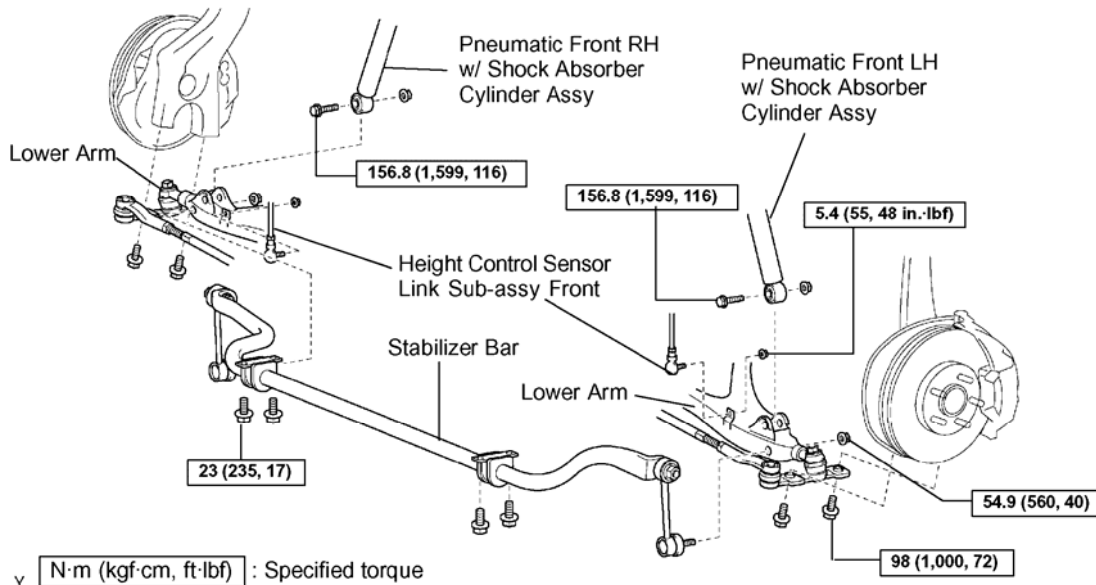
**Fig. 20: Exploded View Of Partial Engine Assy Components (2 Of 15)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



Y

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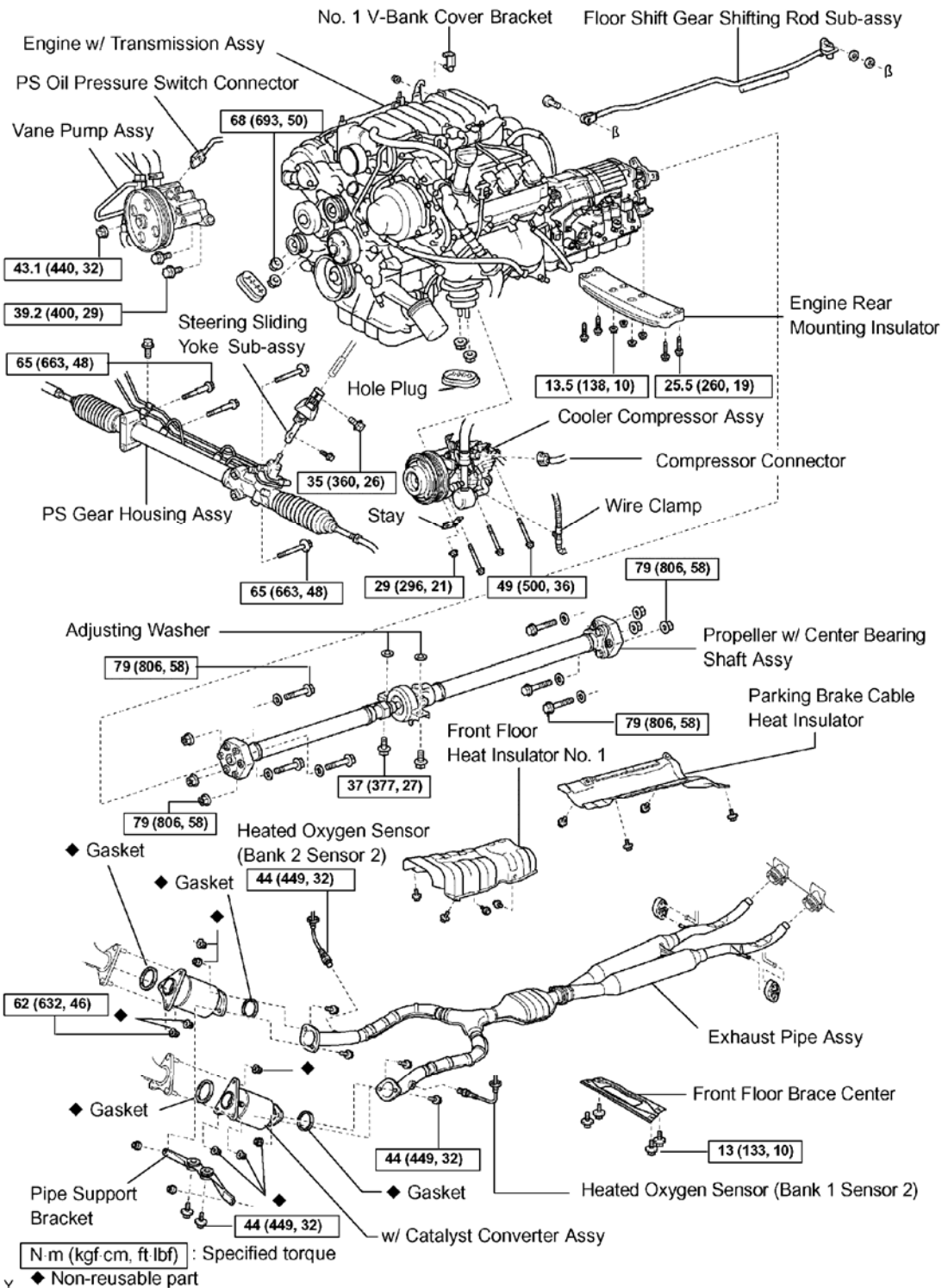
**Fig. 21: Exploded View Of Partial Engine Assy Components (3 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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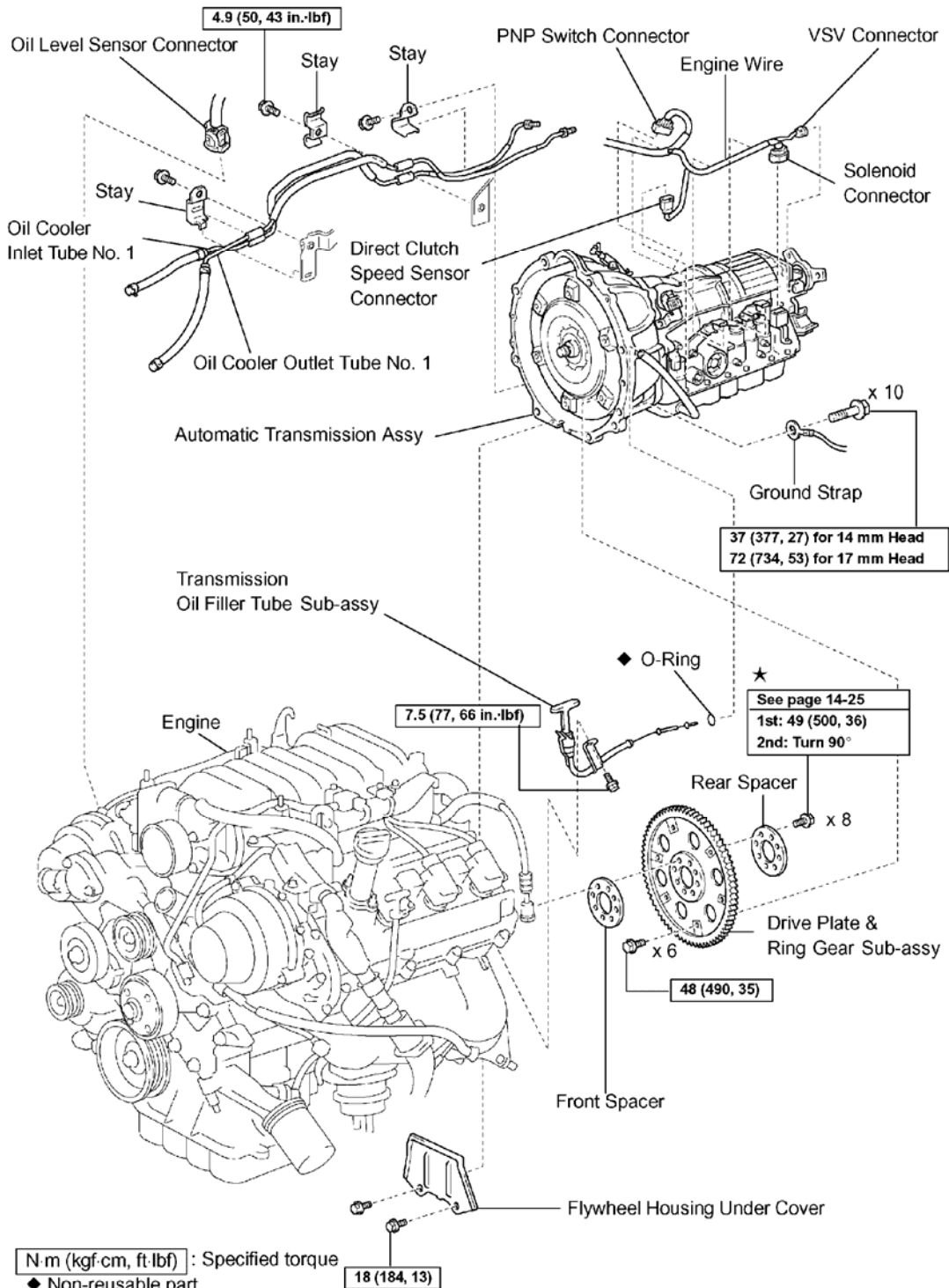
**Fig. 22: Exploded View Of Partial Engine Assy Components (4 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



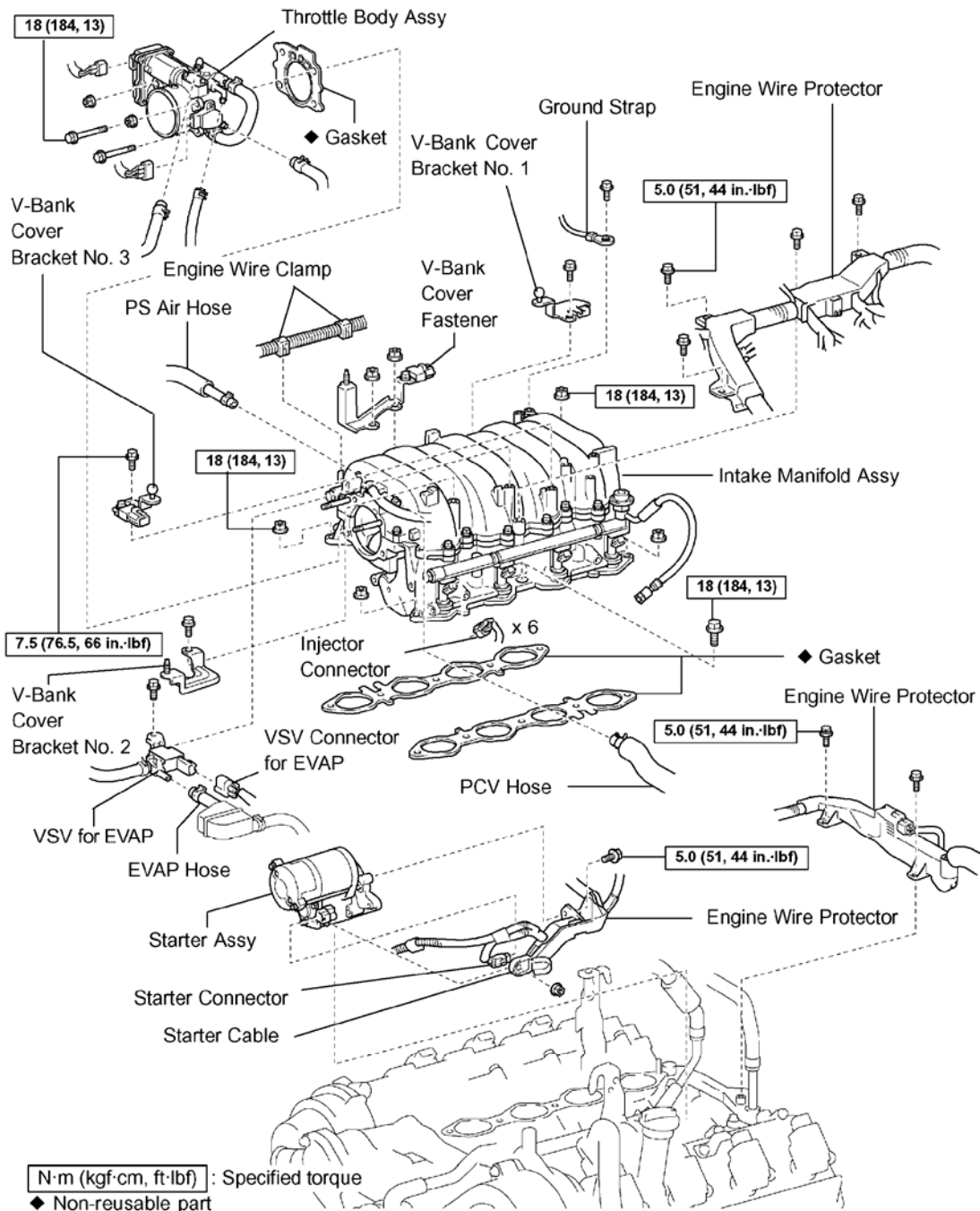
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**Fig. 23: Exploded View Of Partial Engine Assy Components (5 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



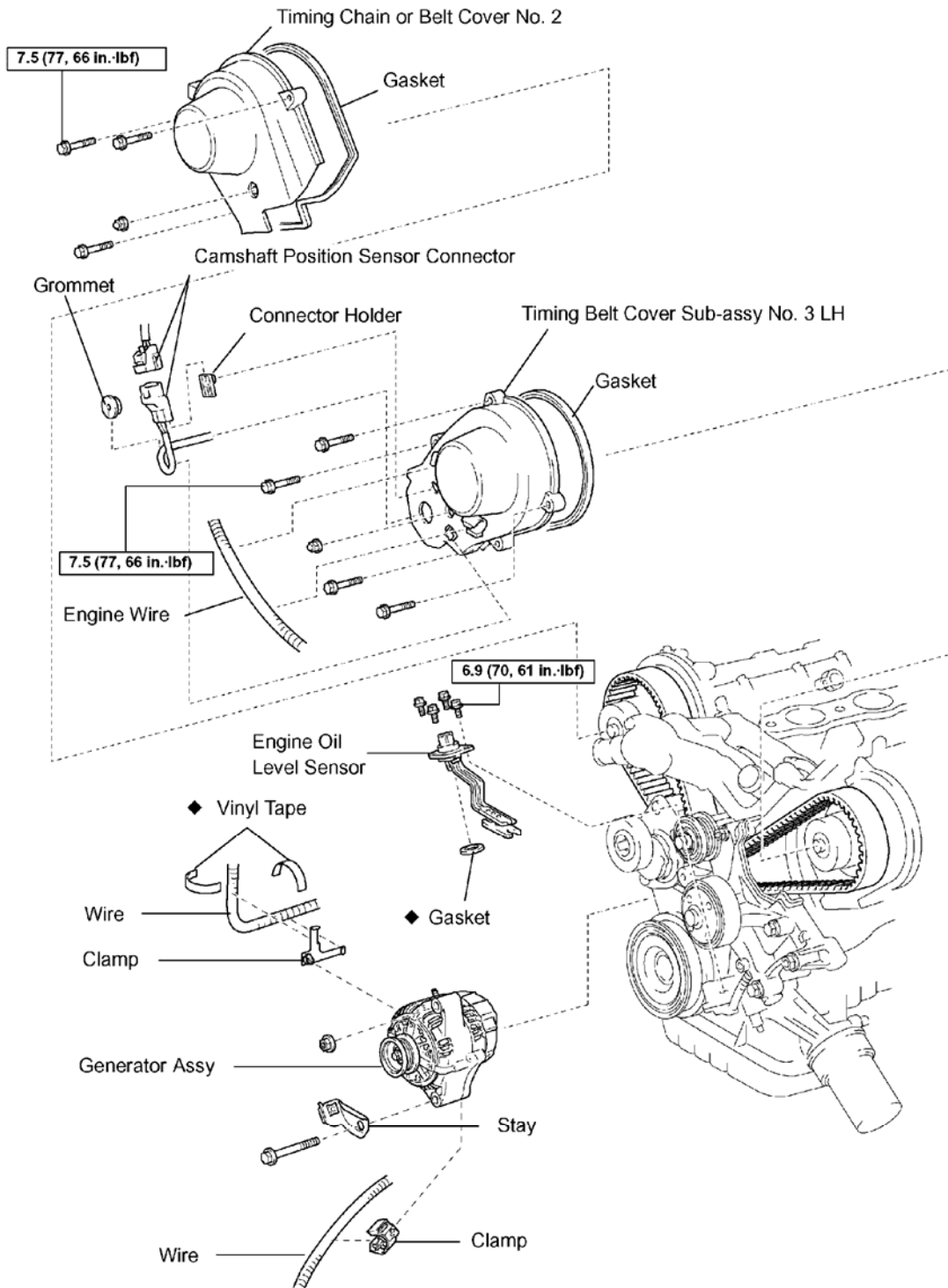


**Fig. 24: Exploded View Of Partial Engine Assy Components (6 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 25: Exploded View Of Partial Engine Assy Components (7 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

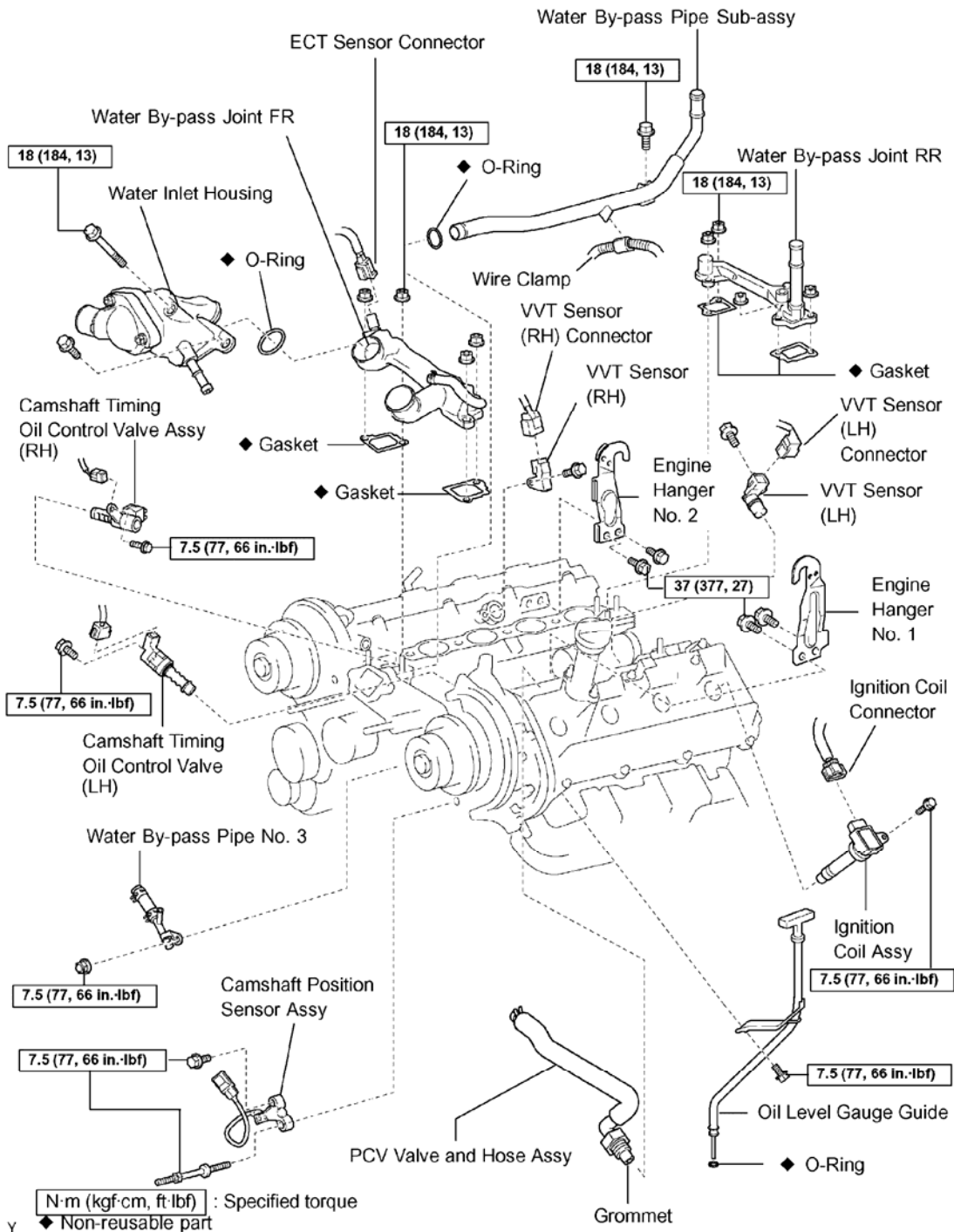


**N-m (kgf-cm, ft-lbf)** : Specified torque

◆ Non-reusable part

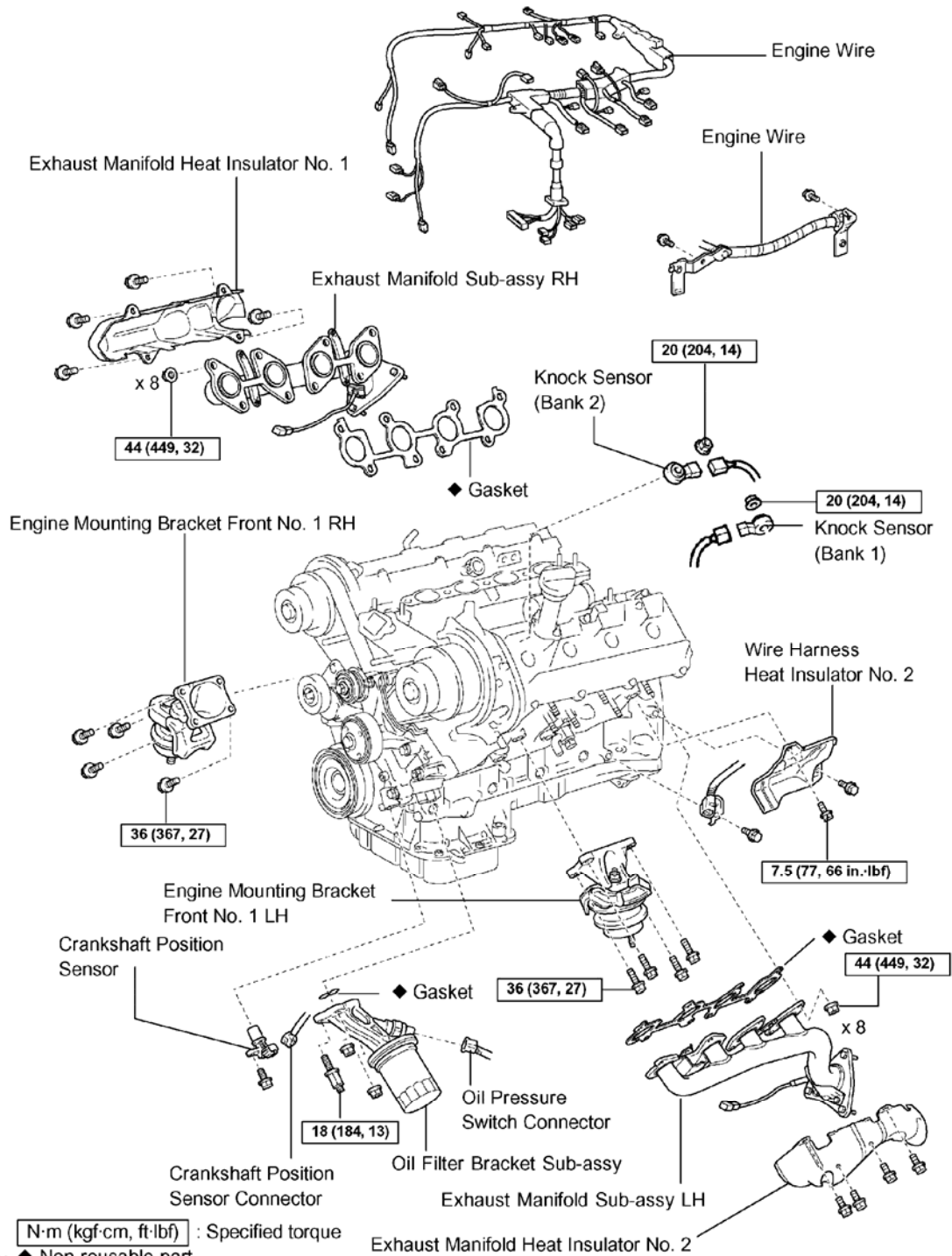
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**Fig. 26: Exploded View Of Partial Engine Assy Components (8 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

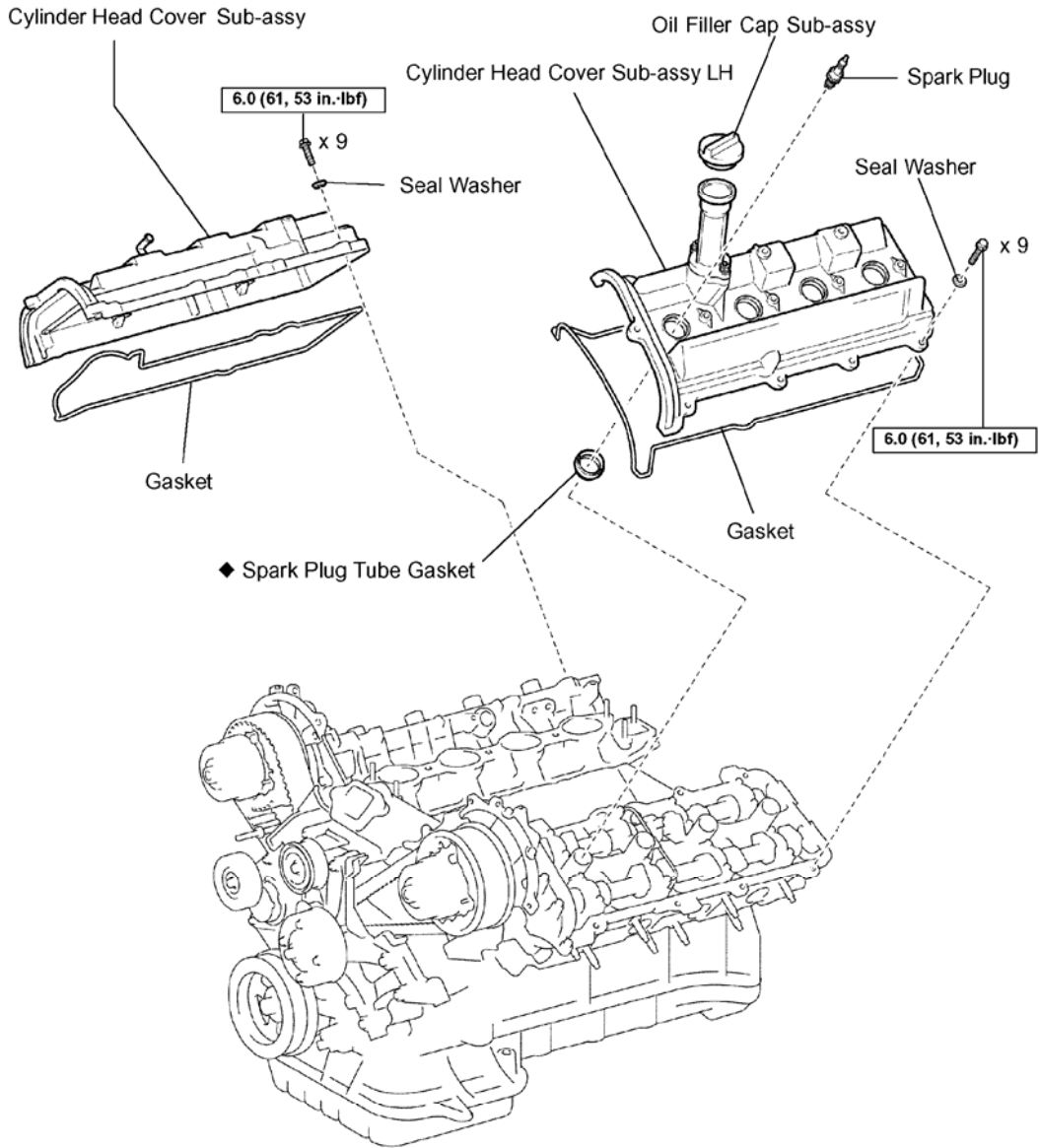


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**Fig. 27: Exploded View Of Partial Engine Assy Components (9 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 28: Exploded View Of Partial Engine Assy Components (10 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

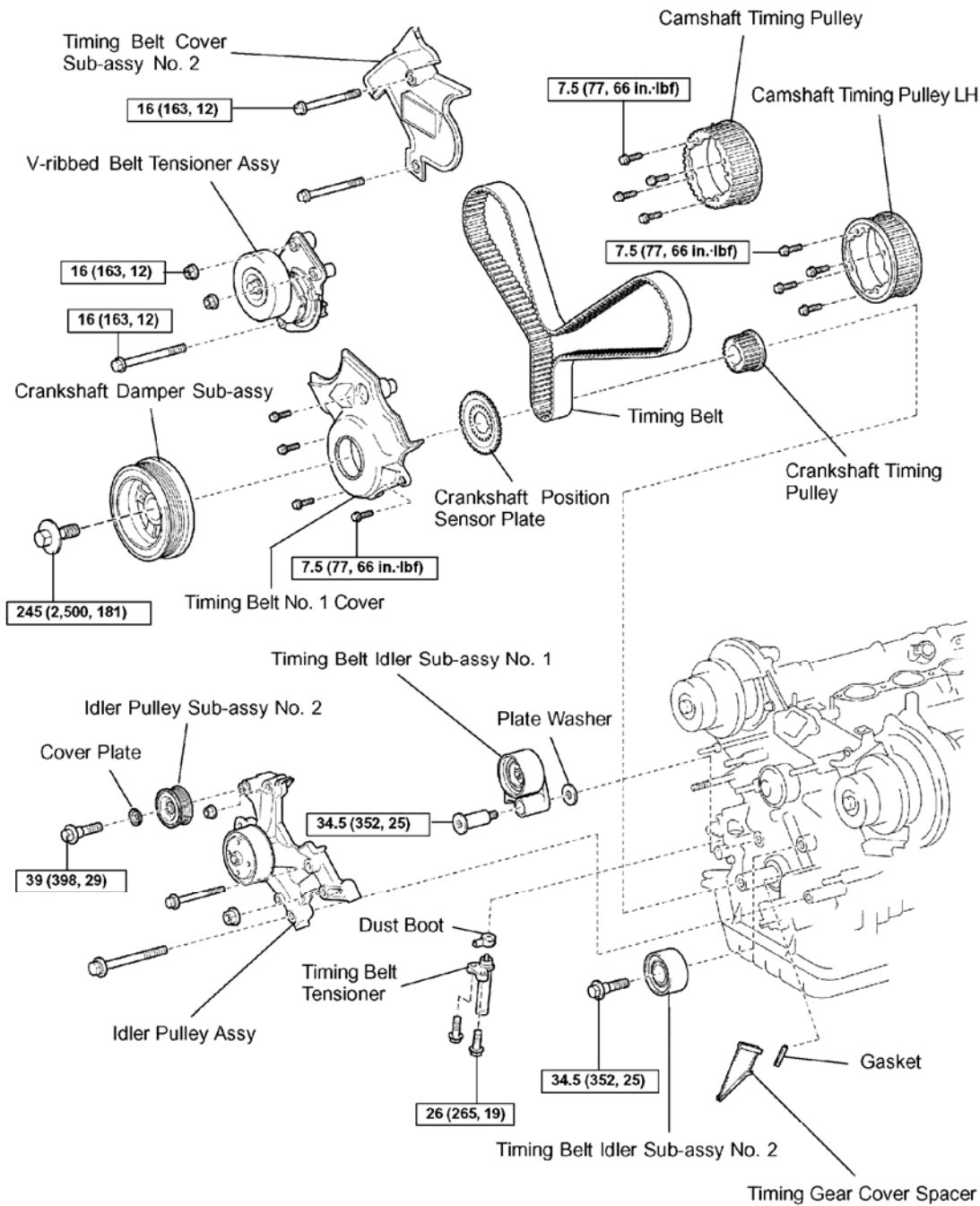


N·m (kgf·cm, ft·lbf) : Specified torque

P ◆ Non-reusable part

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**Fig. 29: Exploded View Of Partial Engine Assy Components (11 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

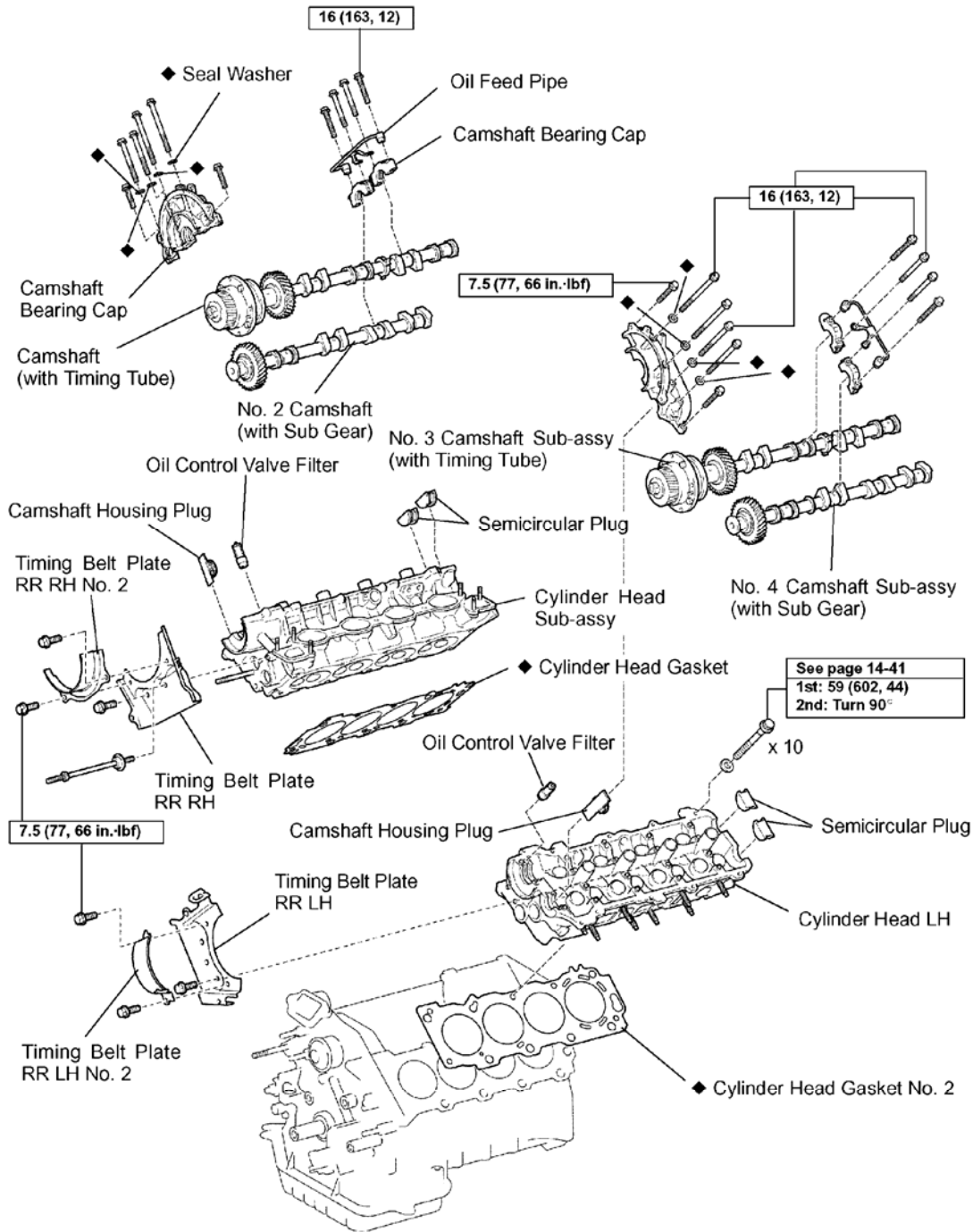


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

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**Fig. 30: Exploded View Of Partial Engine Assy Components (12 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



N·m (kgf-cm, ft-lbf) : Specified torque

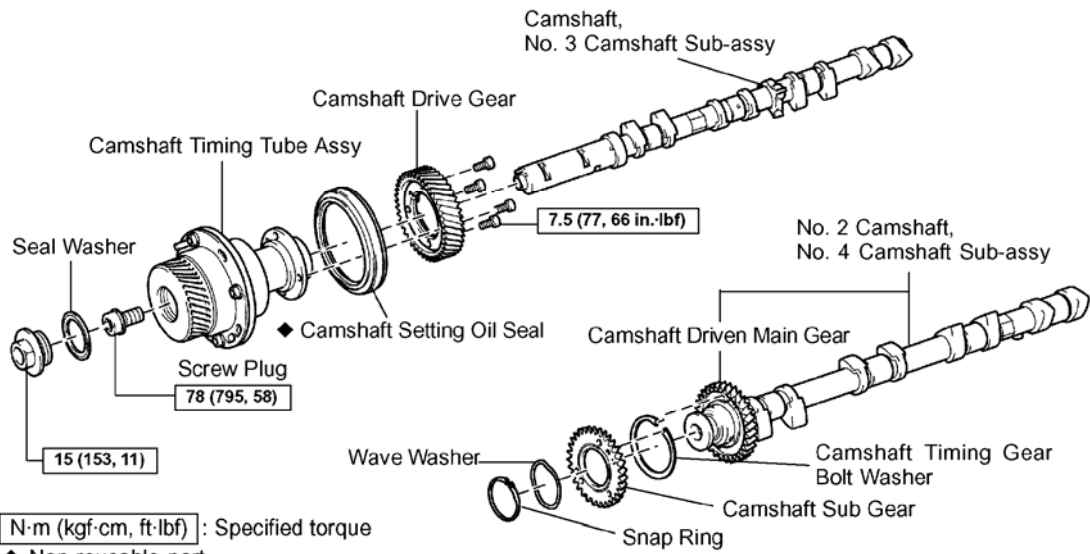
◆ Non-reusable part

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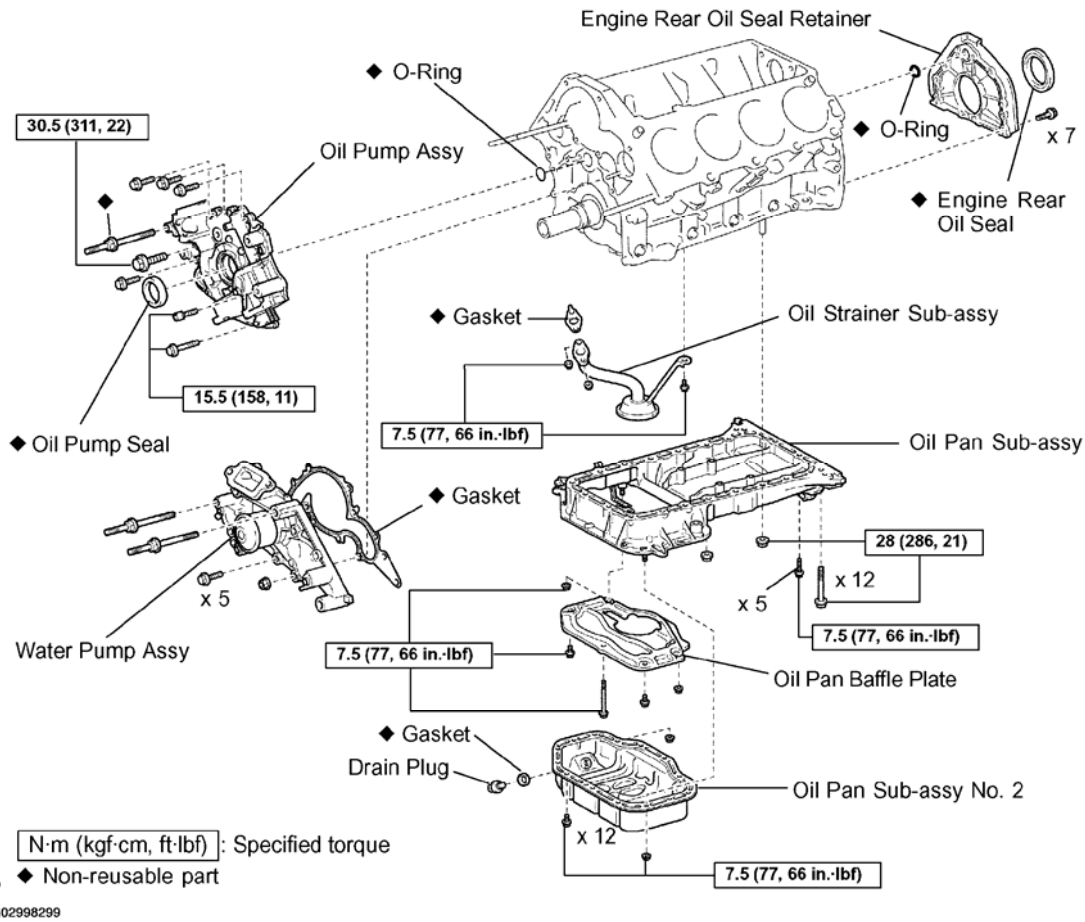
**Fig. 31: Exploded View Of Partial Engine Assy Components (13 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.





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**Fig. 32: Exploded View Of Partial Engine Assy Components (14 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



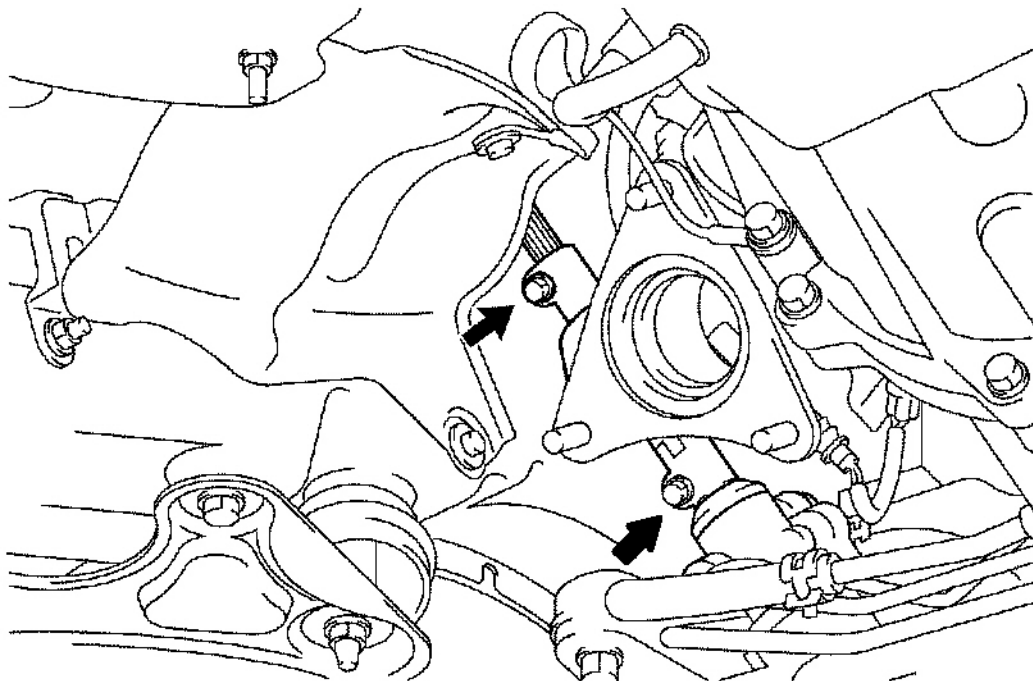
**Fig. 33: Exploded View Of Partial Assy Components (15 Of 15)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REPLACEMENT

1. **WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See PRECAUTION )**
2. **DISCONNECT BATTERY NEGATIVE TERMINAL**
3. **REMOVE HOOD SUB-ASSY (See OVERHAUL )**
4. **REMOVE V-BANK COVER**
5. **REMOVE AIR CLEANER INLET NO.1**
6. **REMOVE INTAKE AIR CONNECTOR PIPE**
7. **REMOVE AIR CLEANER ASSY**
8. **REMOVE FRONT WHEEL**
9. **REMOVE ENGINE UNDER COVER NO.1**
10. **REMOVE ENGINE UNDER COVER NO.2**
11. **DRAIN ENGINE OIL**
12. **DRAIN ENGINE COOLANT**

13. **DRAIN AUTOMATIC TRANSMISSION FLUID**
14. **REMOVE RADIATOR ASSY (See REPLACEMENT )**
15. **DISCONNECT FUEL PIPE SUB-ASSY NO.2 (See REPLACEMENT )**
16. **REMOVE FAN AND GENERATOR V BELT (See REPLACEMENT )**
17. **DISCONNECT ENGINE WIRE**
  - a. Disconnect the engine wire from the ECM box.
  - b. Remove the nut, and disconnect the generator wire from the generator.
  - c. Disconnect the wire for generator wire from the wire clamp on generator.
  - d. Remove the bolt, and disconnect the ground cable from the stay on the generator.
  - e. Remove the 2 bolts, and disconnect the PS oil hose from the No. 1 oil pan.
  - f. Remove the bolt, and disconnect the ground strap from the body.
18. **DISCONNECT AIR HOSE NO.5**
19. **DISCONNECT FUEL VAPOR FEED HOSE NO.2**
20. **DISCONNECT HEATER WATER INLET HOSE A**
21. **DISCONNECT HEATER WATER OUTLET HOSE A (FROM HEATER UNIT)**
22. **DISCONNECT VANE PUMP OIL RESERVOIR ASSY**
23. **DISCONNECT VANE PUMP ASSY**
  - a. Disconnect the 2 PS air hoses.
  - b. Remove the 2 screws and RH engine under cover.
  - c. Disconnect the PS oil pressure switch connector.
  - d. Remove the 2 bolts and nut, and disconnect the pump from the engine.
  - e. Support the pump securely.
24. **DISCONNECT COOLER COMPRESSOR ASSY**
  - a. Disconnect the compressor connector.
  - b. Disconnect the wire clamp from the wire bracket on the compressor.
  - c. Remove the bolt, nut and stay.
  - d. Remove the bolt, and disconnect the wire bracket from the compressor.
  - e. Remove the bolt, and disconnect the compressor from the engine.
  - f. Support the cooler compressor securely.
25. **REMOVE FRONT FLOOR BRACE CENTER**
  - a. Remove the 4 bolts and brace center.
26. **REMOVE EXHAUST PIPE ASSY (See REPLACEMENT )**
27. **REMOVE W/ CATALYST CONVERTER ASSY**
28. **REMOVE FRONT FLOOR HEAT INSULATOR NO.1**
29. **REMOVE PARKING BRAKE CABLE HEAT INSULATOR**
30. **REMOVE PROPELLER W/ CENTER BEARING SHAFT ASSY (See OVERHAUL )**
31. **REMOVE FLOOR SHIFT GEAR SHIFTING ROD SUB-ASSY**
32. **REMOVE STEERING SLIDING W/ SHAFT YOKE SUB-ASSY**

- a. Check the steering wheel at the straight-ahead position.
- b. Remove the 2 bolts and sliding yoke from the steering intermediate shaft.



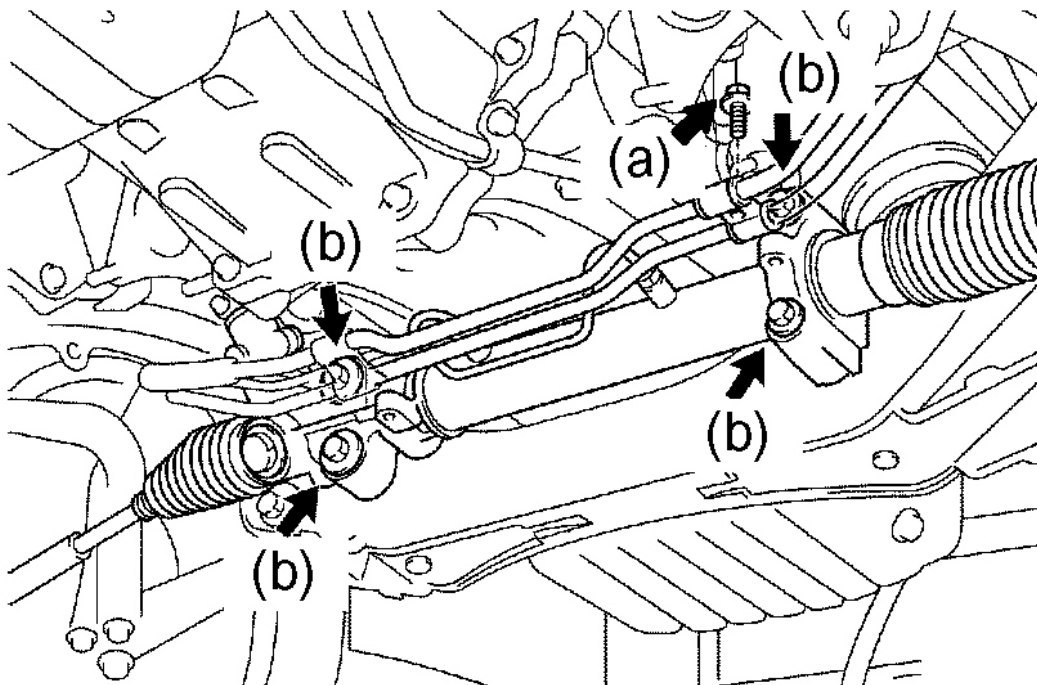
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**Fig. 34: Removing Bolts And Sliding Yoke**

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

33. **REMOVE FRONT DISC BRAKE CYLINDER ASSY RH (See OVERHAUL )**
34. **REMOVE DISC BRAKE CYLINDER ASSY LH (See OVERHAUL )**
35. **REMOVE FRONT SUSPENSION UPPER ARM ASSY RH (See REPLACEMENT )**
36. **REMOVE FRONT SUSPENSION UPPER ARM ASSY LH (See REPLACEMENT )**
37. **REMOVE PNEUMATIC FRONT RH W/ SHOCK ABSORBER CYLINDER ASSY (See REPLACEMENT )**
38. **REMOVE PNEUMATIC FRONT LH W/ SHOCK ABSORBER CYLINDER ASSY (See REPLACEMENT )**
39. **REMOVE HEIGHT CONTROL SENSOR LINK SUB-ASSY FRONT (See REPLACEMENT )**
40. **REMOVE STABILIZER BRACKET FRONT (See REPLACEMENT )**
41. **DISCONNECT POWER STEERING GEAR HOUSING ASSY**
  - a. Remove the bolt, and disconnect the 2 PS oil tubes from the front frame.
  - b. Remove the 4 bolts, and disconnect the PS gear housing from the front frame.

c. Suspend the PS gear housing securely.

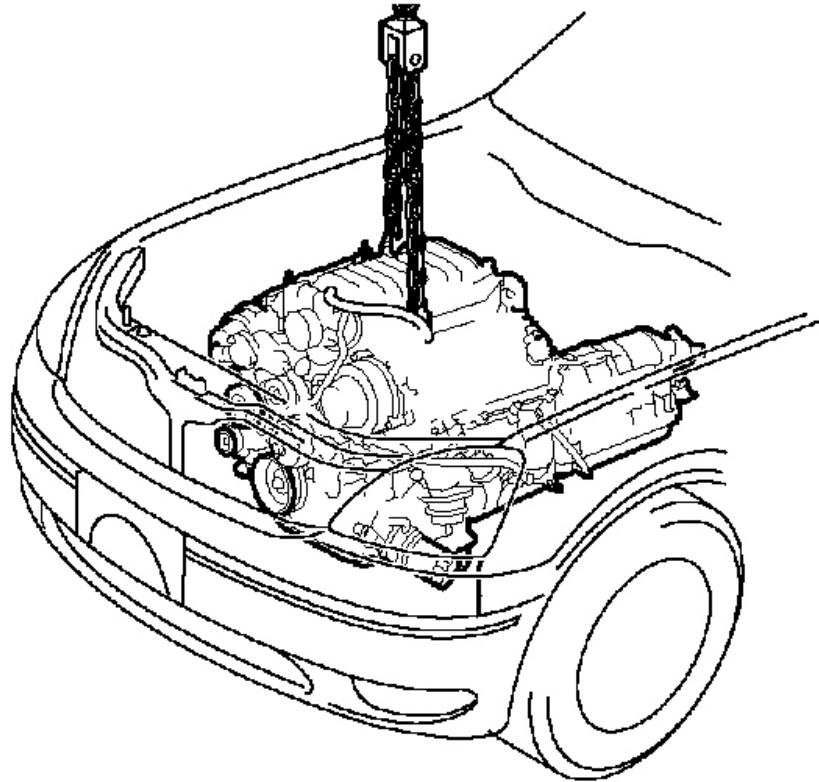


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**Fig. 35: Disconnecting PS Gear Housing From Front Frame**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**42. REMOVE ENGINE W/ TRANSMISSION ASSEMBLY**

- a. Remove the nut and No. 1 V-bank cover bracket from the No. 2 engine hanger.
- b. Attach the engine chain hoist to the engine hangers.

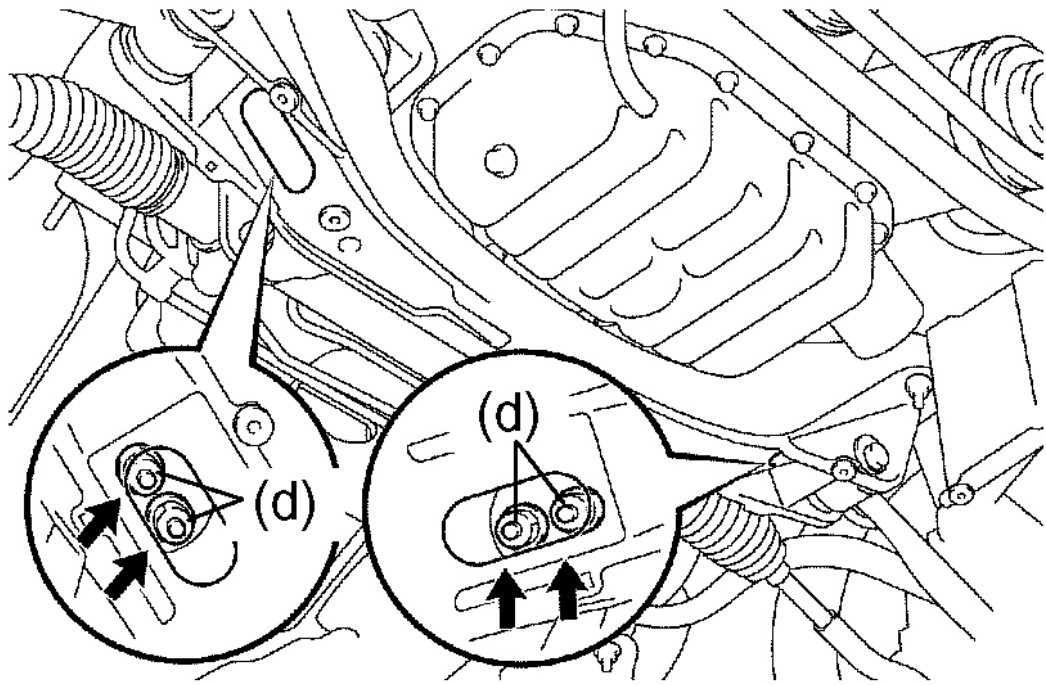


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**Fig. 36: Removing Engine W/ Transmission Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 2 hole plugs.
- d. Remove the 4 nuts holding the engine mounting insulator to the front suspension cross member.
- e. Remove the 4 bolts, 4 nuts and rear engine mounting member.



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**Fig. 37: Identifying Bolts**

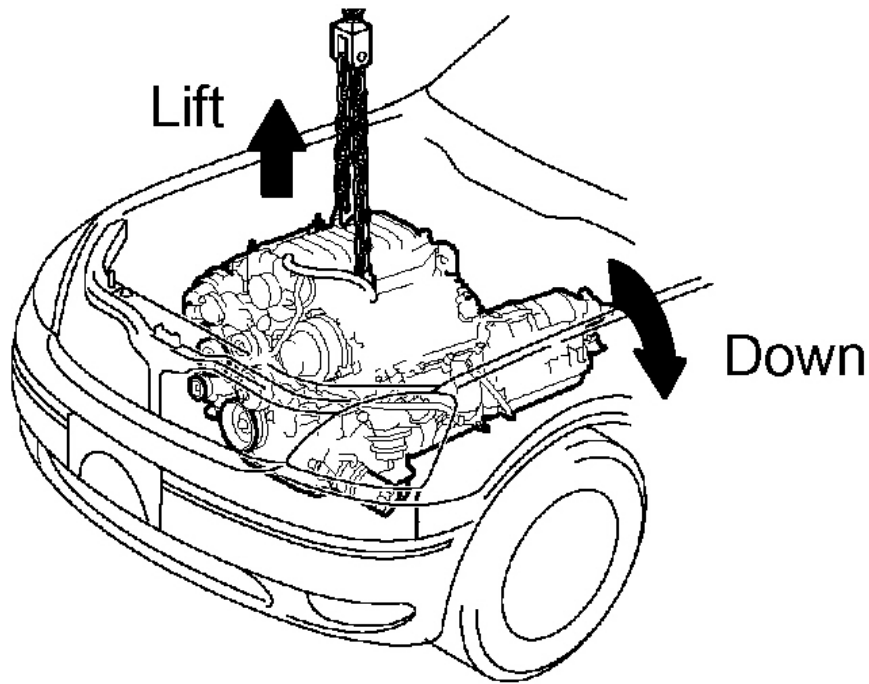
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Lift the engine out of the vehicle slowly and carefully.

HINT:

Make sure the engine is clear of all wiring, hose and cable.

- g. Place the engine and transmission assy onto the stand.



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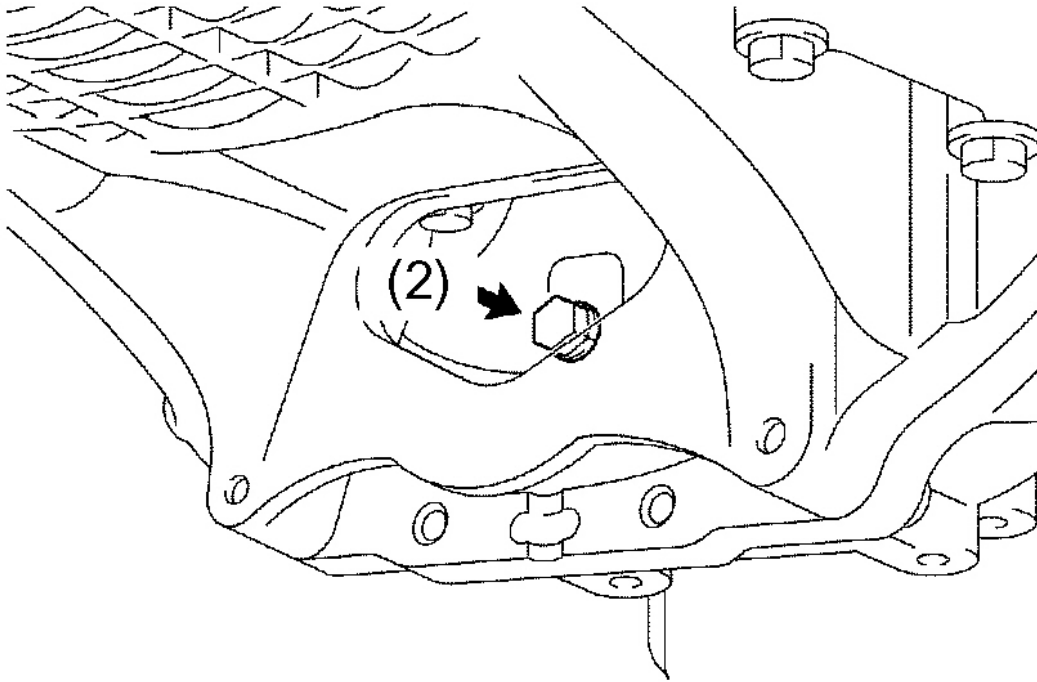
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**Fig. 38: Lifting Engine Out Of Vehicle**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **DISCONNECT ENGINE WIRE**
  - a. Disconnect the engine wire from the transmission.
    1. Disconnect the VSV connector.
    2. Disconnect the PNP switch connector.
    3. Disconnect the solenoid connector.
    4. Disconnect the direct clutch speed sensor connector.
    5. Disconnect the engine wire from the 3 wire clamps.
    6. Disconnect the oil level sensor connector.
44. **REMOVE TRANSMISSION OIL FILTER TUBE SUB-ASSY**
45. **REMOVE OIL COOLER OUTLET TUBE NO.1**
46. **REMOVE OIL COOLER INLET TUBE NO.1**
47. **REMOVE AUTOMATIC TRANSMISSION ASSY**
  - a. Remove the torque converter clutch bolts.
    1. Remove the 2 bolts and flywheel housing under cover.



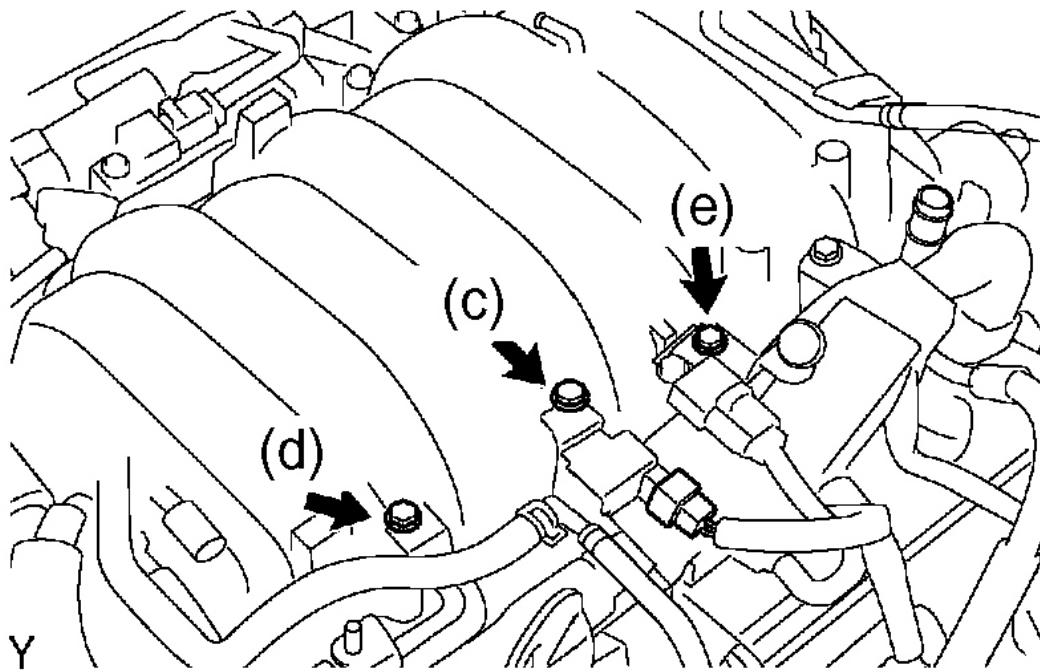
2. Turn the crankshaft damper bolt to gain access to each bolt.
  3. Hold the crankshaft damper bolt with a wrench, and remove the 6 bolts.
- b. Remove the 10 bolts and ground strap.
  - c. Remove the transmission together with the torque converter clutch from the engine.



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**Fig. 39: Removing Flywheel Housing Under Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

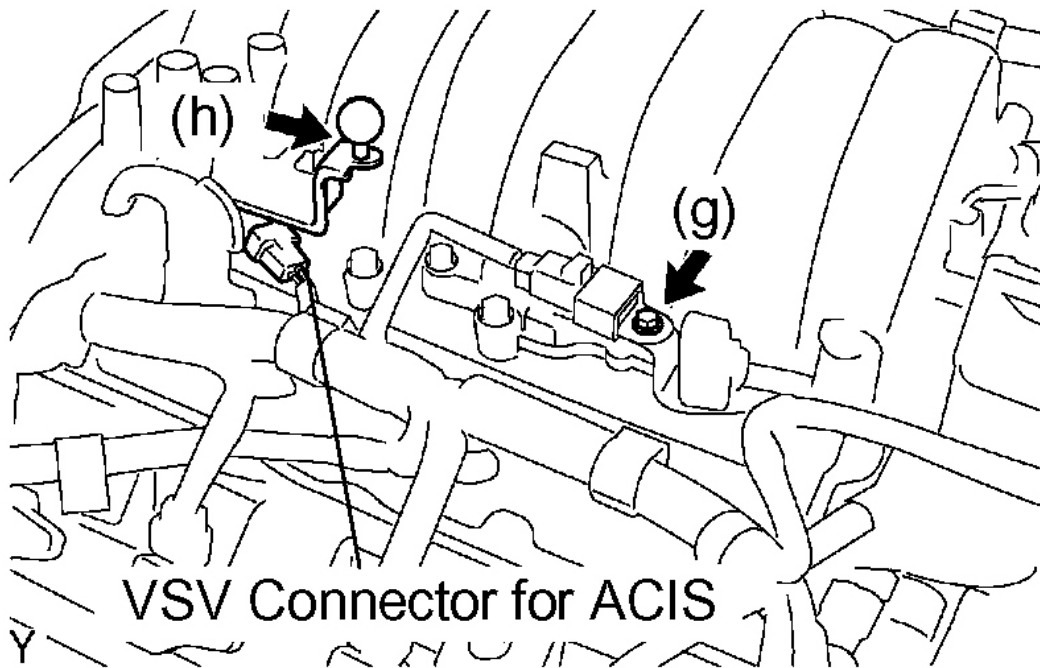
48. **REMOVE DRIVE PLATE & RING GEAR SUB-ASSY**
  - a. Remove the 8 bolts, rear spacer, ring gear and front spacer.
49. **INSTALL ENGINE STAND**
50. **REMOVE THROTTLE BODY ASSY (See REPLACEMENT )**
51. **REMOVE INTAKE MANIFOLD ASSY**
  - a. Disconnect the VSV connector for EVAP.
  - b. Disconnect the EVAP hose from the VSV for EVAP.
  - c. Remove the bolt, disconnect the VSV for EVAP from the upper intake manifold.
  - d. Remove the bolt and V-bank cover bracket No. 2.
  - e. Remove the bolt and V-bank cover bracket No. 3.



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**Fig. 40: Removing Intake Manifold Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

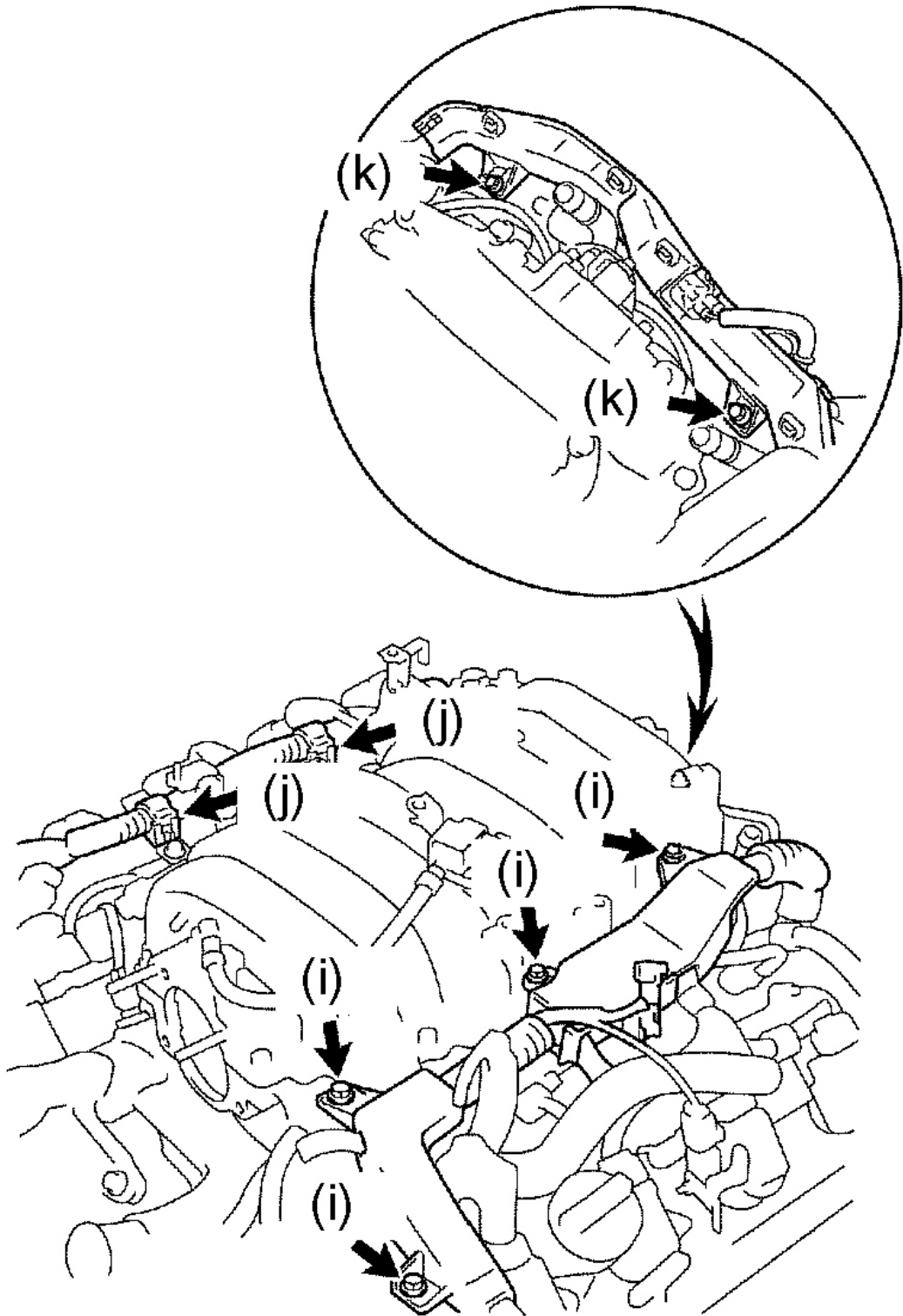
- f. Disconnect the VSV connector for ACIS.
- g. Remove the bolt and V-bank cover bracket No. 1.
- h. Remove the bolt and V-bank cover fastener.



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**Fig. 41: Identifying VSV Connector For ACIS**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

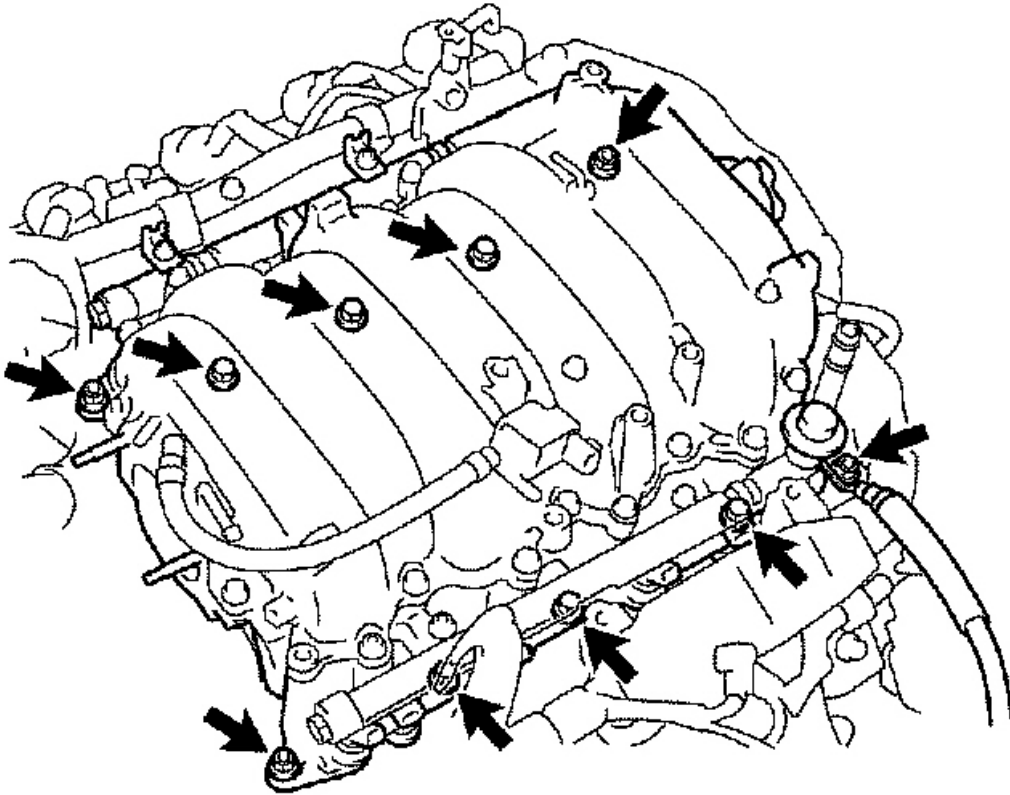
- i. Remove the 4 bolts, and disconnect the engine wire protector (LH side) from the upper intake manifold and camshaft bearing cap.
- j. Disconnect the 2 wire clamps on the engine wire (RH side) from the brackets on the RH delivery pipe.
- k. Remove the 2 bolts, and disconnect the engine wire protector (rear side) from the rear water bypass joint and RH cylinder head.



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**Fig. 42: Disconnecting Engine Wire Protector (LH Side) From Upper Intake Manifold**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Disconnect the 8 injector connectors.
- m. Remove the 6 bolts, 4 nuts, intake manifold assy and 2 gaskets.



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**Fig. 43: Identifying Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

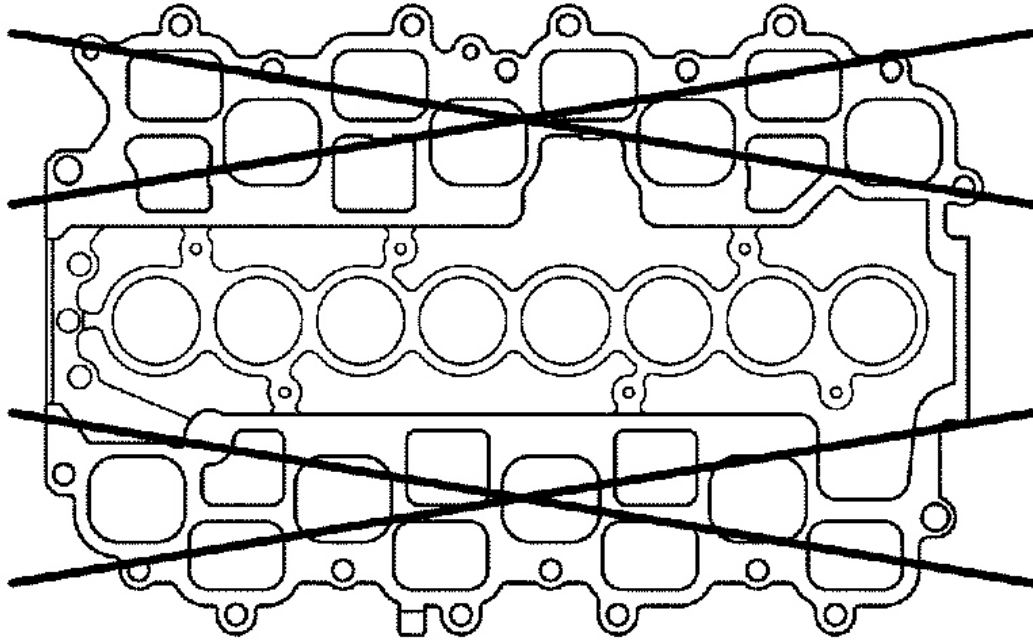
**52. INSPECT INTAKE MANIFOLD ASSY**

- a. Upper intake manifold:

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

**Maximum warpage: 0.15 mm (0.0059 in.)**

If the warpage is greater than the maximum, replace the manifold.



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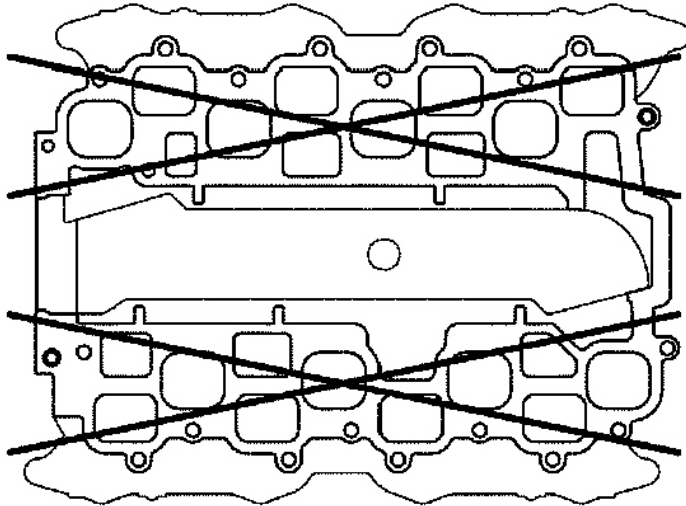
**Fig. 44: Measuring Surface Contacting Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Lower intake manifold Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

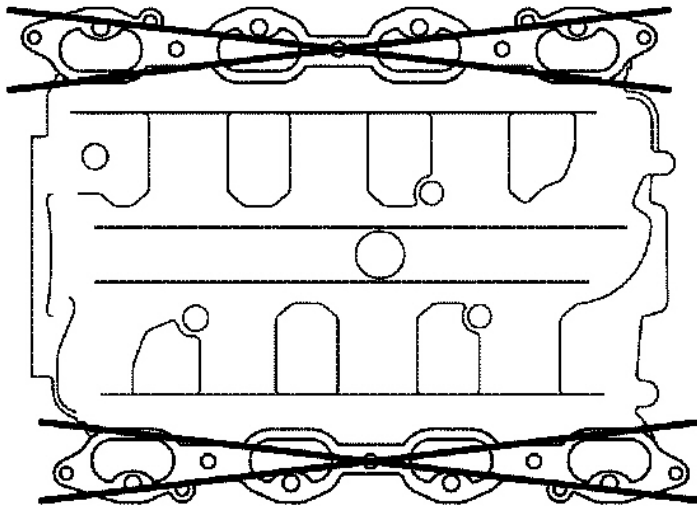
**Maximum warpage: 0.15 mm (0.0059 in.)**

If the warpage is greater than the maximum, replace the manifold.

## Upper Intake Manifold Side



## Cylinder Head Side



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**Fig. 45: Identifying Lower Intake Manifold**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. REMOVE STARTER ASSY (See REPLACEMENT )

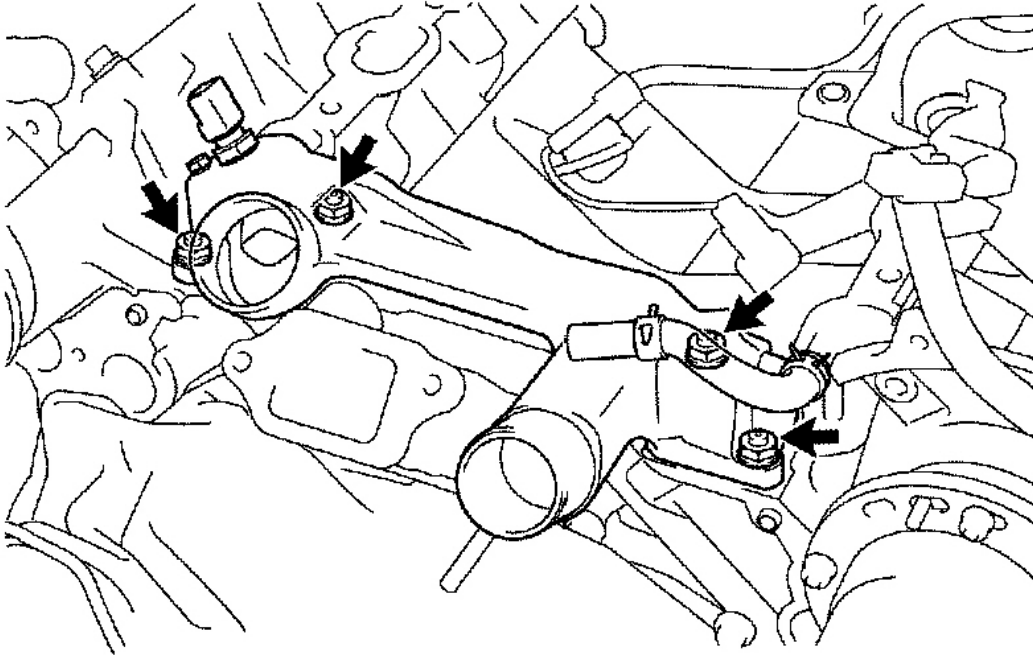
54. **REMOVE GENERATOR ASSY (See REPLACEMENT )**

55. **REMOVE WATER INLET HOUSING**

- a. Remove the 2 bolts and inlet housing.

56. **REMOVE WATER BYPASS JOINT FR**

- a. Disconnect the ECT sensor connector.
- b. Remove the 4 nuts, water bypass joint and 2 gaskets.



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**Fig. 46: Identifying Water By-Pass Joint FR**

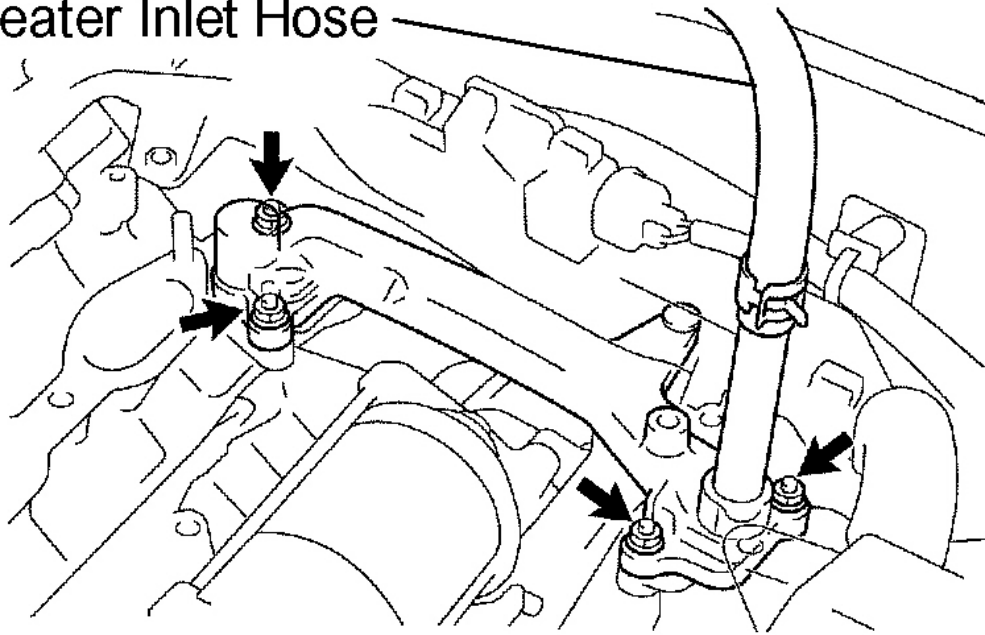
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **REMOVE WATER BYPASS JOINT RR**

- a. Disconnect the heater inlet hose from the water bypass joint.
- b. Remove the 4 nuts, water bypass joint and 2 gaskets.



Heater Inlet Hose



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**Fig. 47: Removing Water By-Pass Joint RR**

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

**58. REMOVE WATER BYPASS PIPE SUB-ASSY**

- a. Disconnect the heater outlet hose from the water bypass pipe.
- b. Disconnect the wire clamp (for knock sensor bank 1, 2) from the bracket of the water bypass pipe.
- c. Remove the bolt.
- d. Pull out the water bypass pipe from the water pump.
- e. Remove the O-ring from the water bypass pipe.

**59. REMOVE OIL LEVEL GAGE GUIDE**

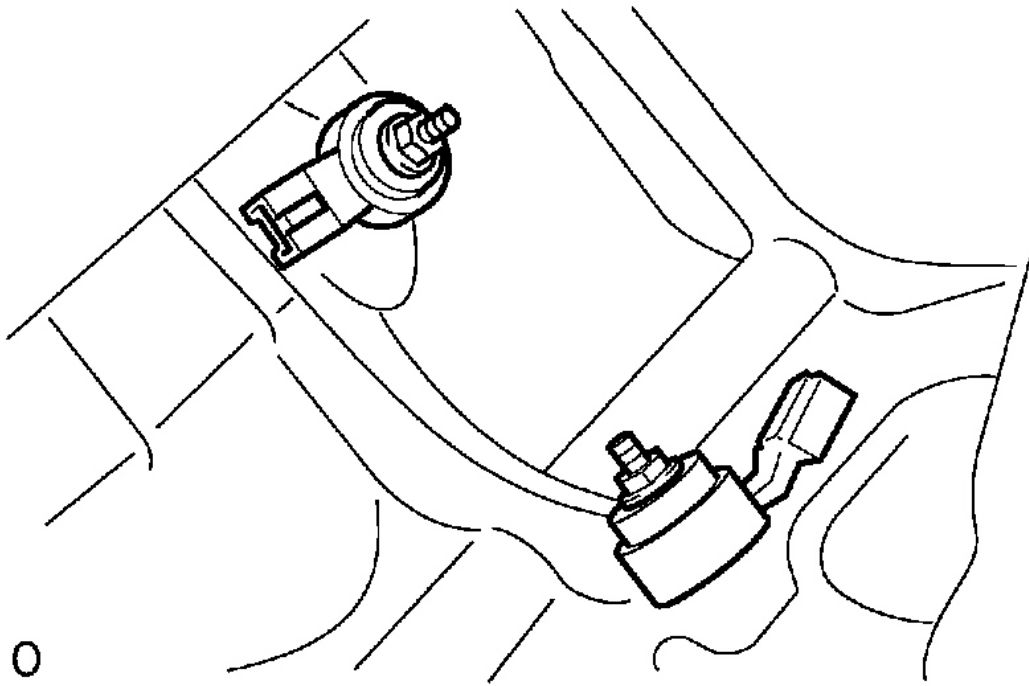
**60. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

**61. REMOVE CAMSHAFT POSITION SENSOR**

**62. REMOVE VVT SENSOR**

**63. REMOVE KNOCK SENSOR**

- a. Disconnect the 2 knock sensor connectors.
- b. Remove the 2 nuts and 2 knock sensors.

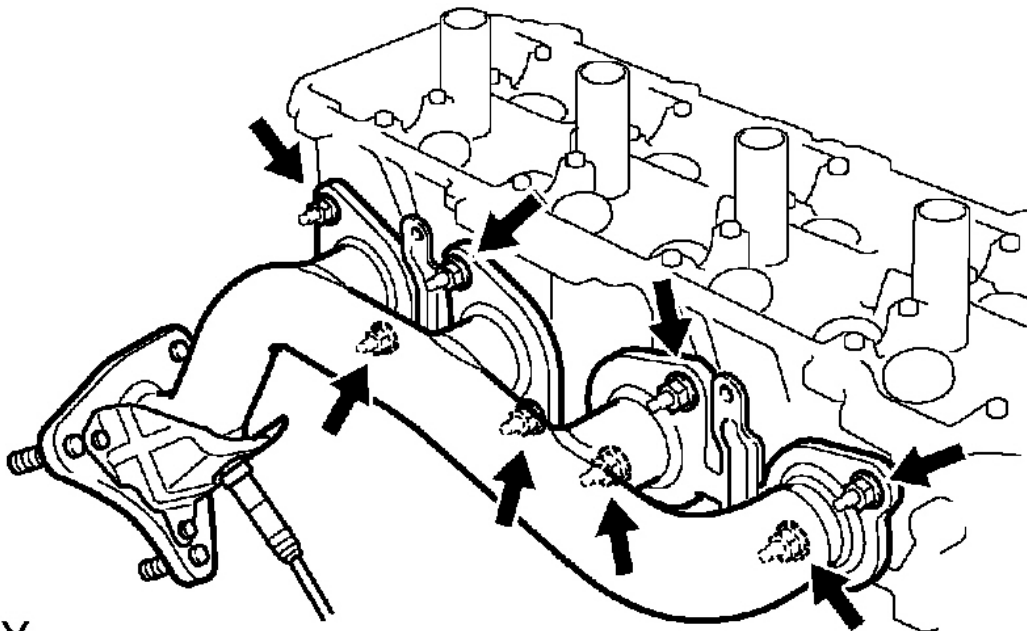


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**Fig. 48: Identifying Knock Sensor Connectors**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 64. **REMOVE ENGINE HANGER NO.1**
- 65. **REMOVE ENGINE HANGER NO.2**
- 66. **REMOVE IGNITION COIL ASSY**
- 67. **REMOVE OIL FILTER BRACKET SUB-ASSY**
  - a. Disconnect the oil pressure switch connector.
  - b. Remove the stud bolt, 2 nuts and oil filter bracket with gasket.
- 68. **REMOVE CRANKSHAFT POSITION SENSOR**
- 69. **REMOVE ENGINE OIL LEVEL SENSOR**
- 70. **REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO.1**
- 71. **REMOVE EXHAUST MANIFOLD SUB-ASSY RH**
  - a. Remove the 8 nuts, exhaust manifold and gasket.



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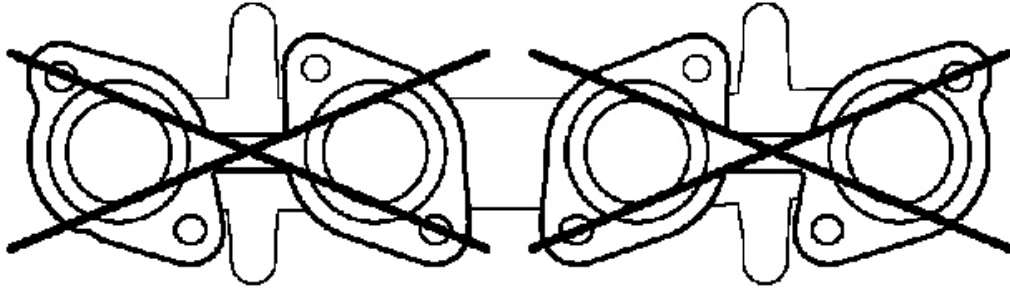
**Fig. 49: Identifying Exhaust Manifold Sub-Assy RH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**72. INSPECT EXHAUST MANIFOLD SUB-ASSY RH**

- a. Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

**Maximum warpage: 0.50 mm (0.0197 in.)**

If the warpage is greater than the maximum, replace the manifold.

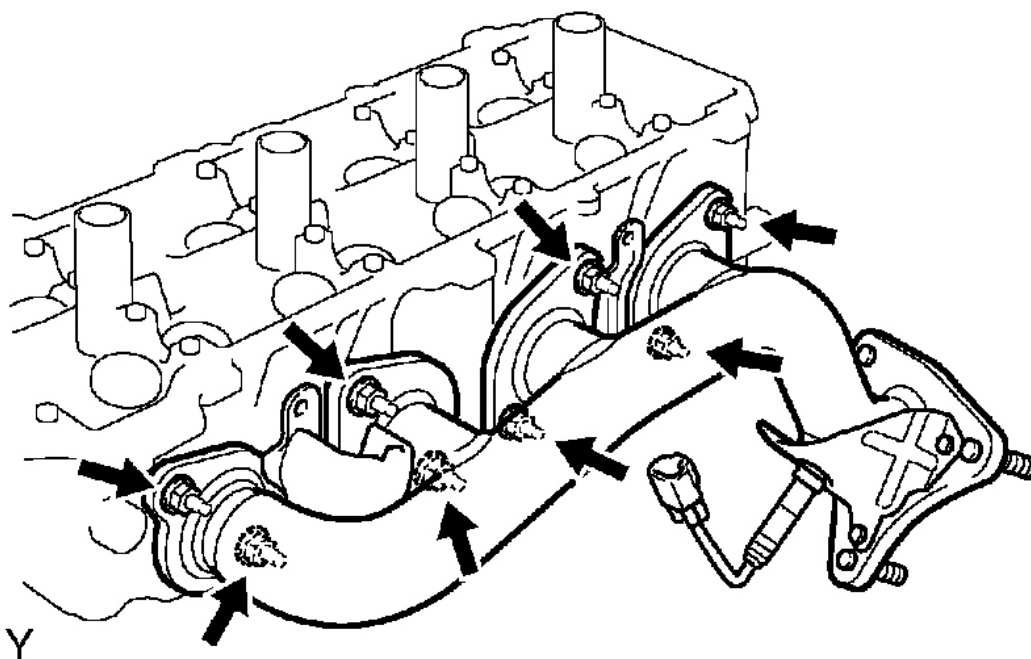


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**Fig. 50: Measuring Surface Cylinder Head**

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

- 73. REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO.2**
- 74. REMOVE EXHAUST MANIFOLD SUB-ASSY LH**
  - a. Remove the 8 nuts, exhaust manifold and gasket.



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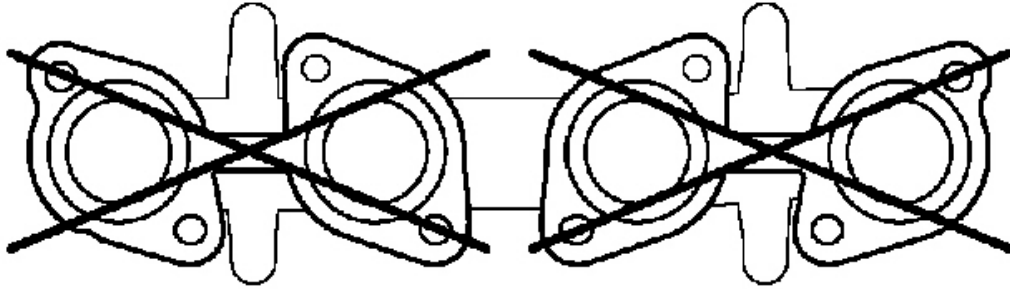
**Fig. 51: Removing Exhaust Manifold Sub-Assy LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**75. INSPECT EXHAUST MANIFOLD SUB-ASSY LH**

- a. Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

**Maximum warpage: 0.50 mm (0.0197 in.)**

If the warpage is greater than the maximum, replace the manifold.



**G02998318**

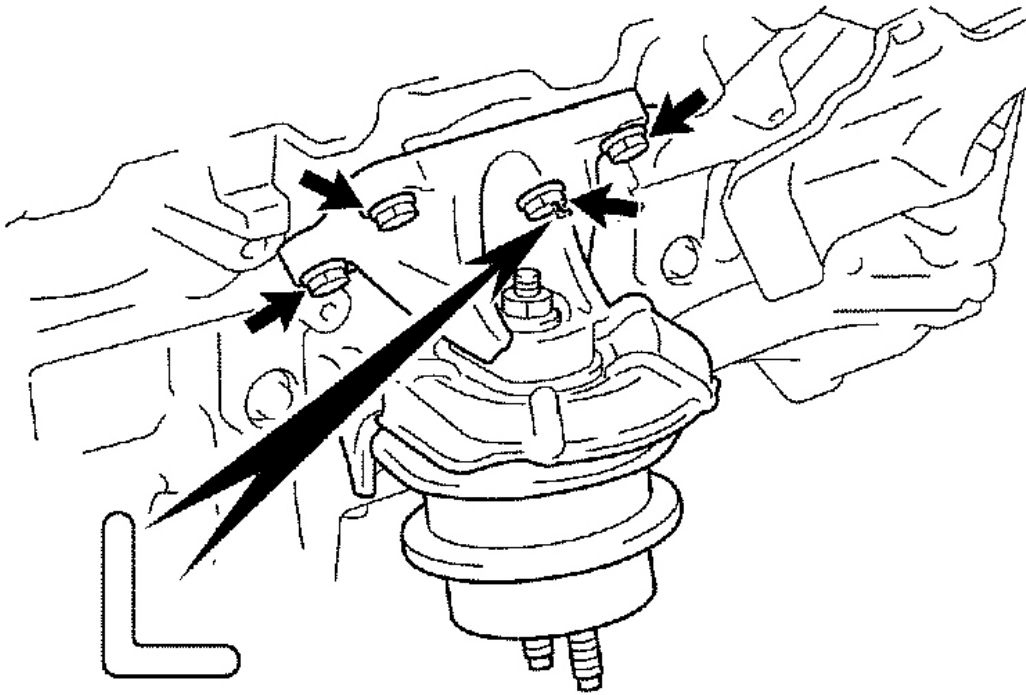
**Fig. 52: Measuring Surface**

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

- 76. REMOVE WIRING HARNESS HEAT INSULATOR NO.2**
- 77. REMOVE ENGINE MOUNTING BRACKET FRONT NO.1 RH**
- 78. REMOVE ENGINE MOUNTING BRACKET FRONT NO.1 LH**
- 79. INSTALL ENGINE MOUNTING BRACKET FRONT NO.1 LH**
  - a. Install the mounting bracket with the 4 bolts.**  
**Torque: 36 N.m (367 kgf.cm, 27 ft.lbf)**

**HINT:**

The LH mounting bracket is marked with "L".



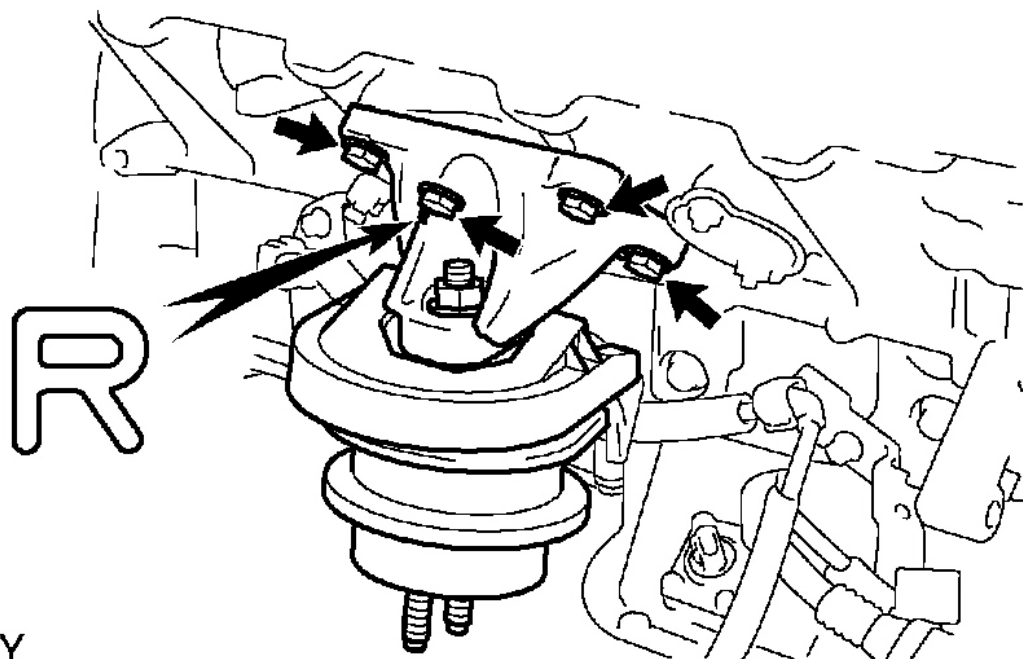
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**Fig. 53: Installing Engine Mounting Bracket Front No.1 LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

80. **INSTALL ENGINE MOUNTING BRACKET FRONT NO.1 RH**
- a. Install the mounting bracket with the 4 bolts.  
**Torque: 36 N.m (367 kgf.cm, 27 ft.lbf)**

HINT:

The RH mounting bracket is marked with "R".



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**Fig. 54: Installing Mounting Bracket And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

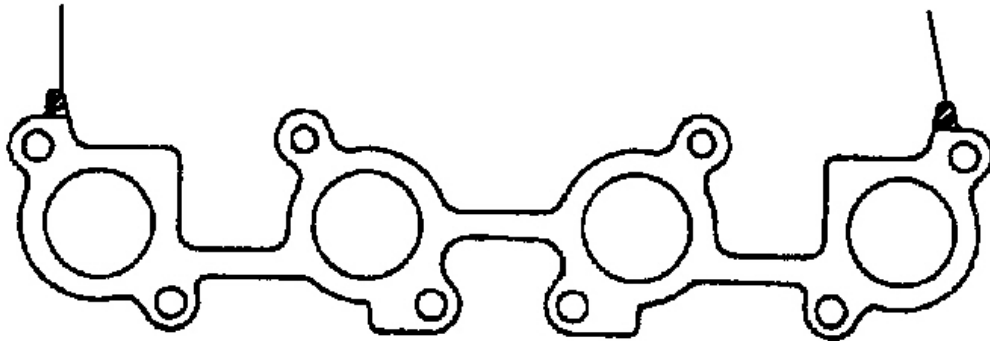
81. **INSTALL WIRING HARNESS HEAT INSULATOR NO.2**
82. **INSTALL EXHAUST MANIFOLD SUB-ASSY LH**
  - a. Place a new gasket on the cylinder head with the white mark facing the manifold side.

**NOTE: Be careful of the installation direction.**



White Mark

White Mark

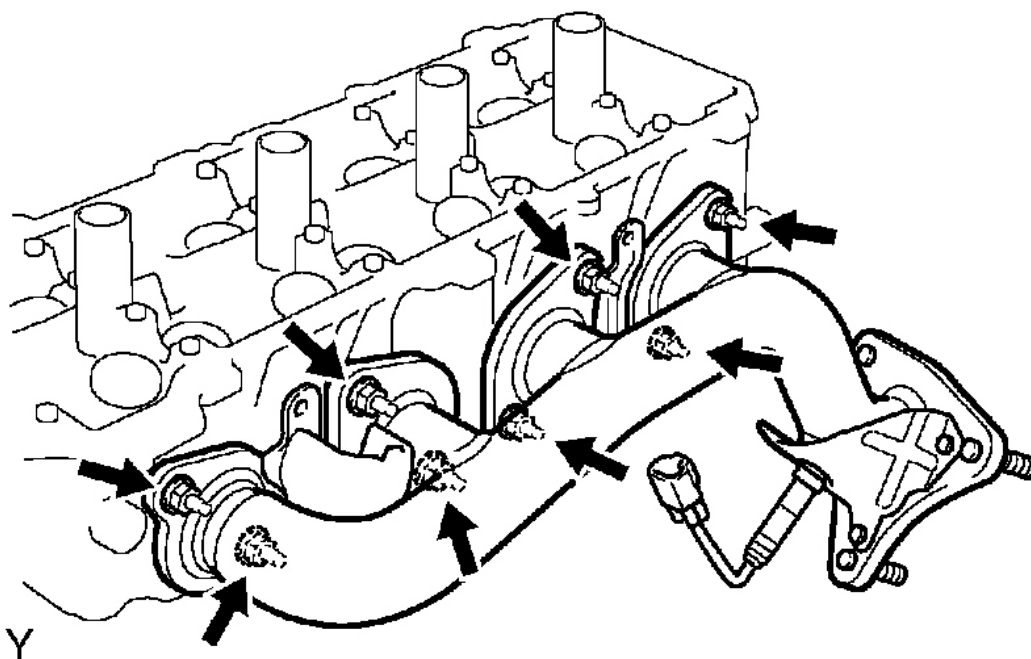


G02998321

**Fig. 55: Identifying White Mark**

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

- b. Install the exhaust manifold with 8 new nuts. Uniformly tighten the nuts in several passes.  
**Torque: 44 N.m (449 kgf.cm, 32 ft.lbf)**



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**Fig. 56: Installing Exhaust Manifold**

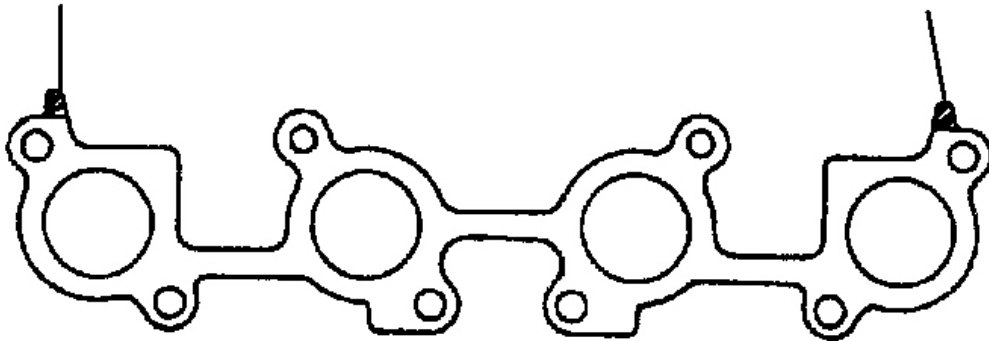
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

83. **INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.2**
84. **INSTALL EXHAUST MANIFOLD SUB-ASSY RH**
  - a. Place a new gasket on the cylinder head with the white mark facing the manifold side.

**NOTE: Be careful of the installation direction.**

White Mark

White Mark

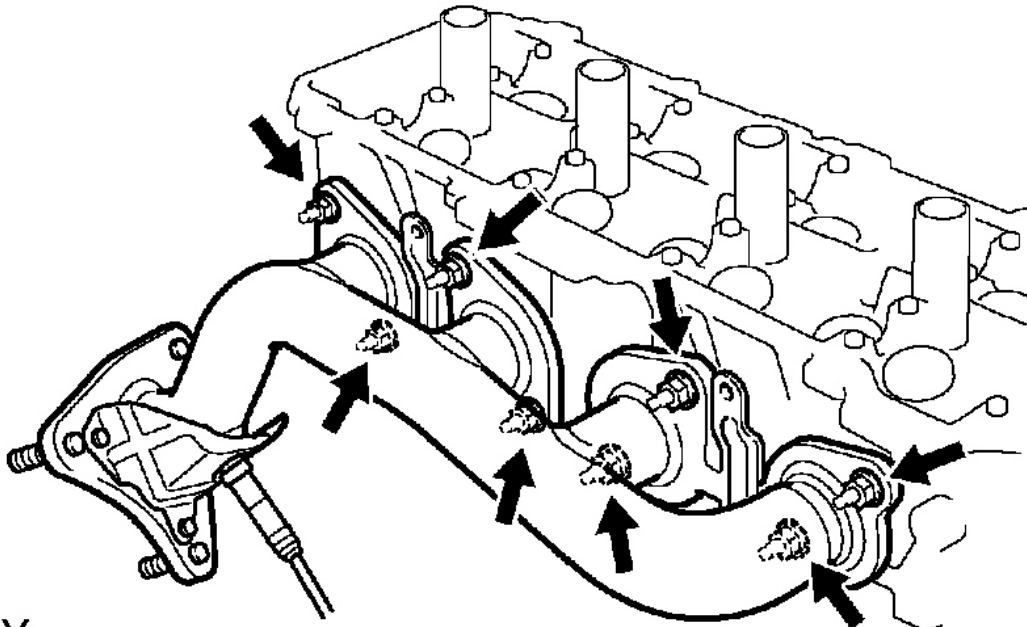


G02998323

**Fig. 57: Identifying White Mark**

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

- b. Install the exhaust manifold with 8 new nuts. Uniformly tighten the nuts in several passes.  
**Torque: 44 N.m (449 kgf.cm, 32 ft.lbf)**



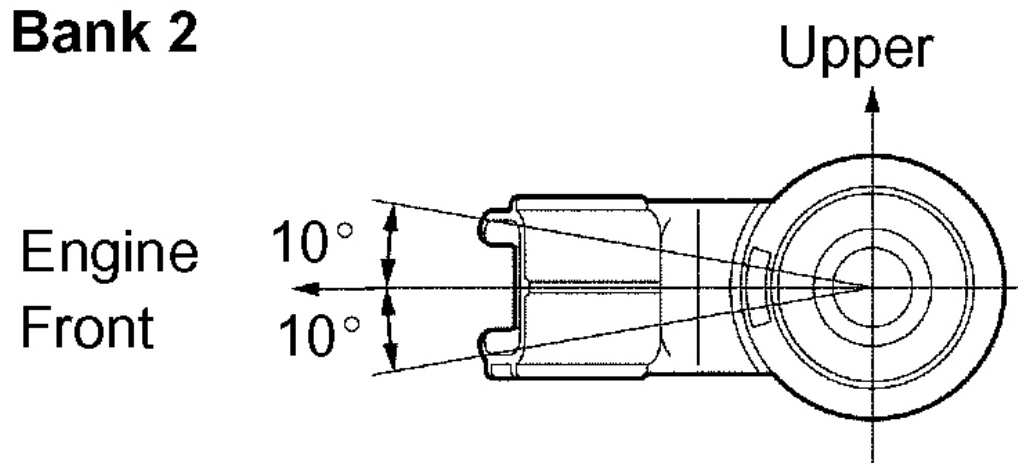
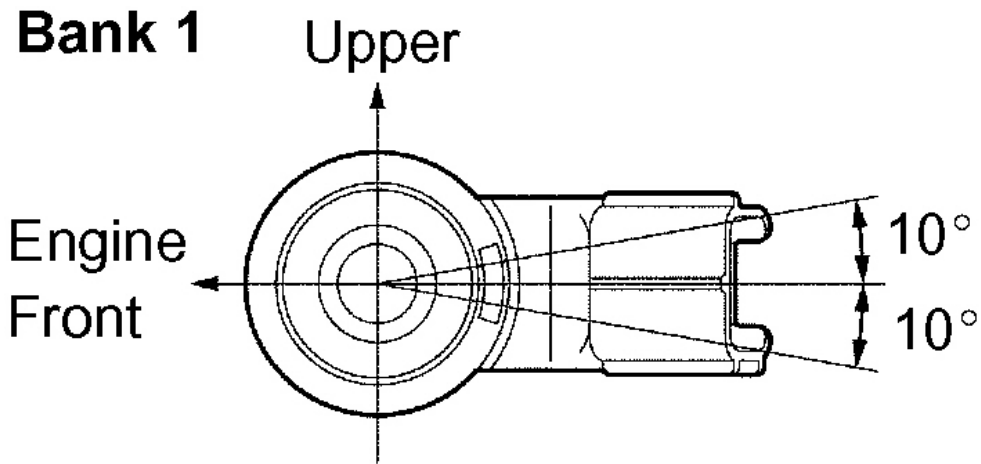
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**Fig. 58: Installing Exhaust Manifold**

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

85. **INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.1**
86. **INSTALL ENGINE OIL LEVEL SENSOR**
87. **INSTALL CRANKSHAFT POSITION SENSOR (See REPLACEMENT )**
88. **INSTALL OIL FILTER BRACKET SUB-ASSY**  
**Torque: 18 N.m (184 kgf.cm, 13 ft.lbf)**
89. **INSTALL IGNITION COIL ASSY**  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
90. **INSTALL ENGINE HANGER NO.2**  
**Torque: 37 N.m (377 kgf.cm, 27 ft.lbf)**
91. **INSTALL ENGINE HANGER NO. 1**  
**Torque: 37 N.m (377 kgf.cm, 27 ft.lbf)**
92. **INSTALL KNOCK SENSOR**
  - a. Install the 2 knock sensors with the 2 nuts, as shown in the illustration.  
**Torque: 20 N.m (204 kgf.cm, 15 ft.lbf)**
  - b. Connect the 2 knock sensor connectors.



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**Fig. 59: Identifying Knock Sensor**

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

93. **INSTALL VVT SENSOR**

94. **INSTALL CAMSHAFT POSITION SENSOR**

**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**

95. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY (See REPLACEMENT - RH and REPLACEMENT - LH )**

96. **INSTALL OIL LEVEL GAGE GUIDE**

**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**

97. **INSTALL WATER BYPASS PIPE SUB-ASSY**

a. Install a new O-ring to the water bypass pipe.

- b. Apply soapy water to the O-ring.
- c. Push in the water bypass pipe end into the pipe hole of the water pump.
- d. Install the water bypass pipe with the bolt.

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

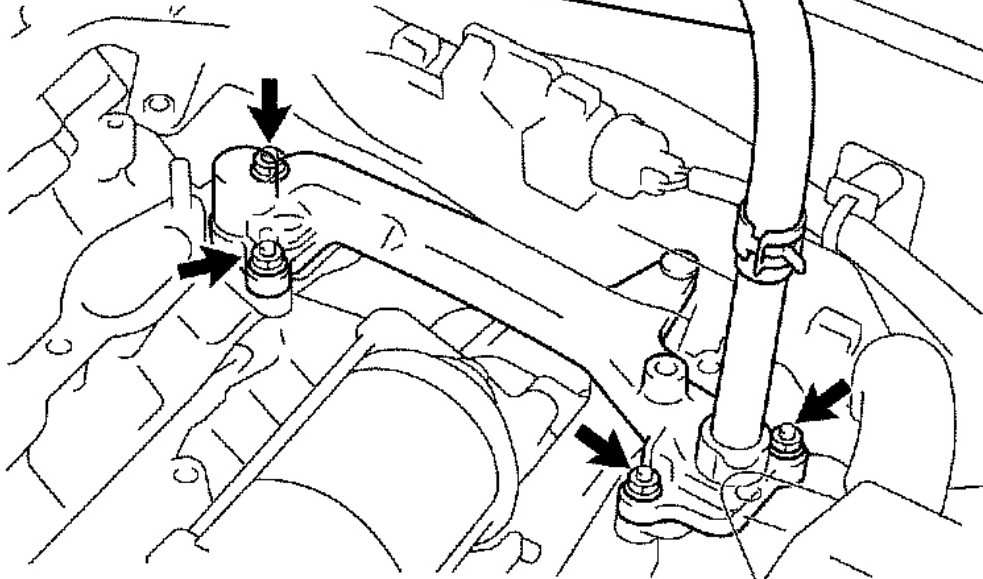
- e. Install the wire clamp to the bracket of the water bypass pipe.

98. **INSTALL WATER BYPASS JOINT RR**

- a. Install 2 new gaskets and the water bypass joint with the 4 nuts. Alternately tighten the nuts.

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

## Heater Inlet Hose



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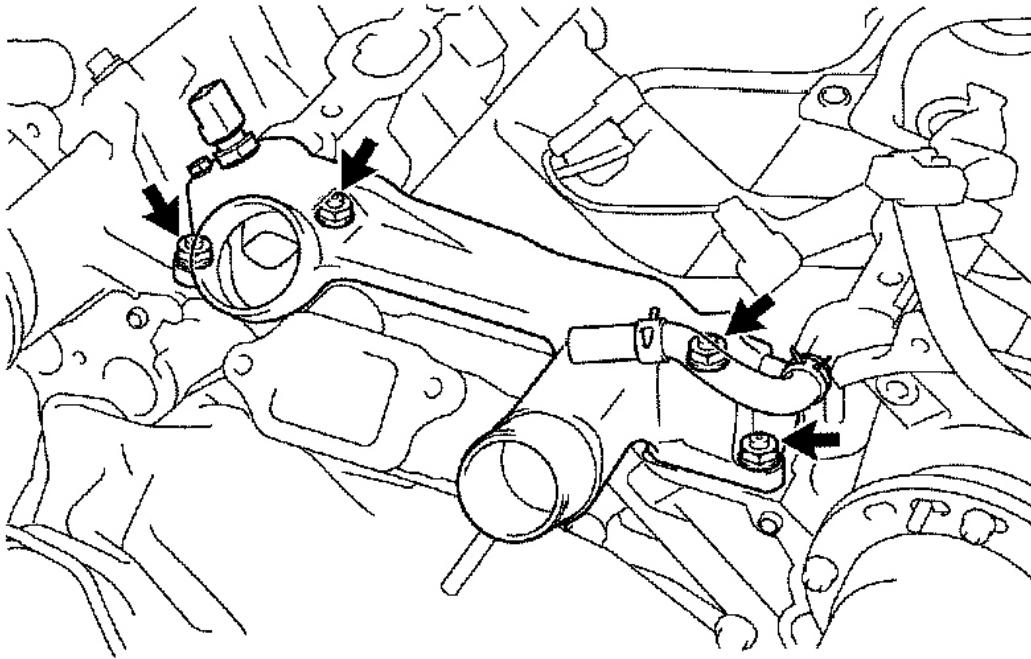
**Fig. 60: Installing Water By-Pass Joint RR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

99. **INSTALL WATER BYPASS JOINT FR**

- a. Install 2 new gaskets and the water bypass joint with the 4 nuts. Alternately tighten the nuts.

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

- b. Connect the ECT sensor connector.



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**Fig. 61: Installing Water By-Pass Joint FR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

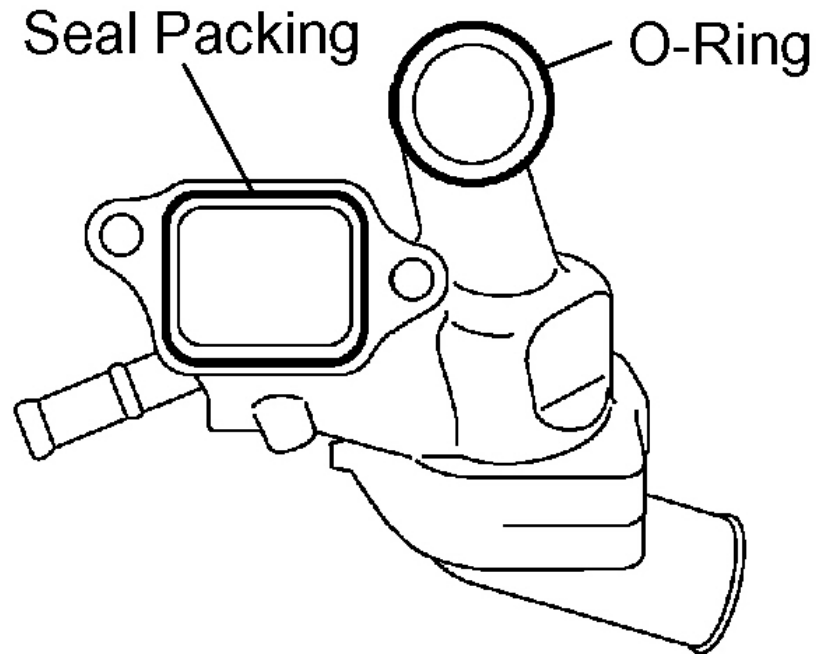
100. **INSTALL WATER INLET HOUSING**

- a. Install a new O-ring to the inlet housing.
- b. Apply soapy water on the O-ring.
- c. Apply seal packing to the sealing groove of the inlet housing as shown in the illustration.

**Seal packing: Part No. 08826-00100 or equivalent**

- Install a nozzle that has its opening cut to a 2 to 3 mm (0.08 to 0.12 in.).
  - Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- d. Install the water inlet and housing assy with the 2 bolts. Alternately tighten the bolts.

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



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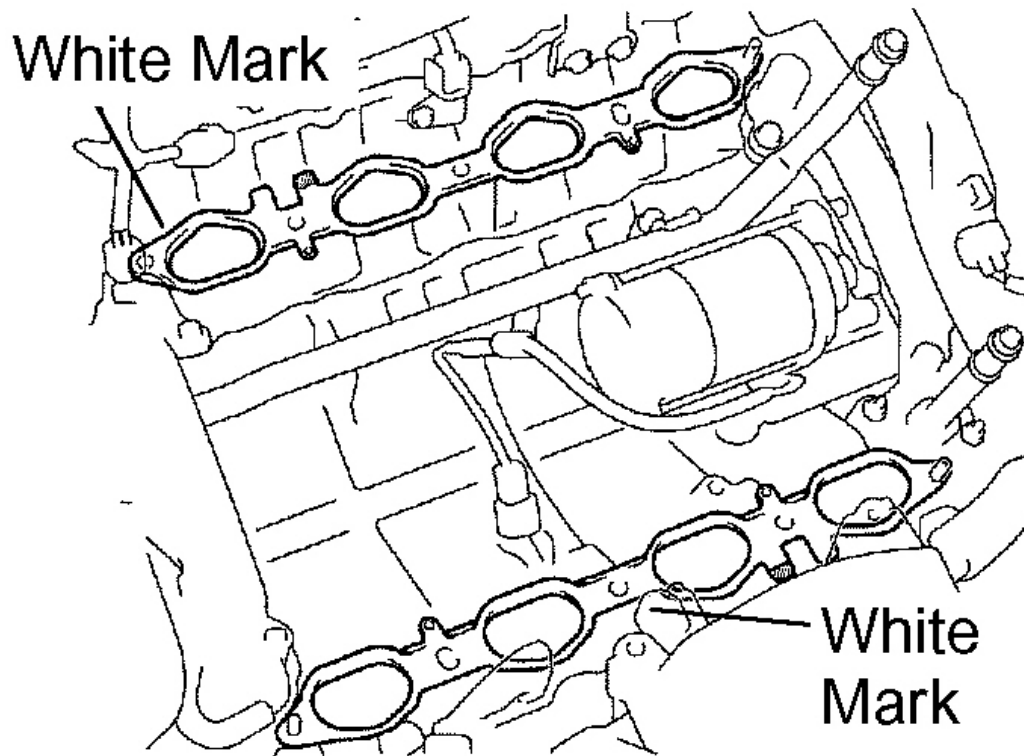
**Fig. 62: Identifying Seal Packing**

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

101. **INSTALL GENERATOR ASSY (See REPLACEMENT )**
102. **INSTALL STARTER ASSY (See REPLACEMENT )**
103. **INSTALL INTAKE MANIFOLD ASSY**
  - a. Place 2 new gaskets on the cylinder heads with the white mark facing outward.

**NOTE: Be careful of the installation direction.**





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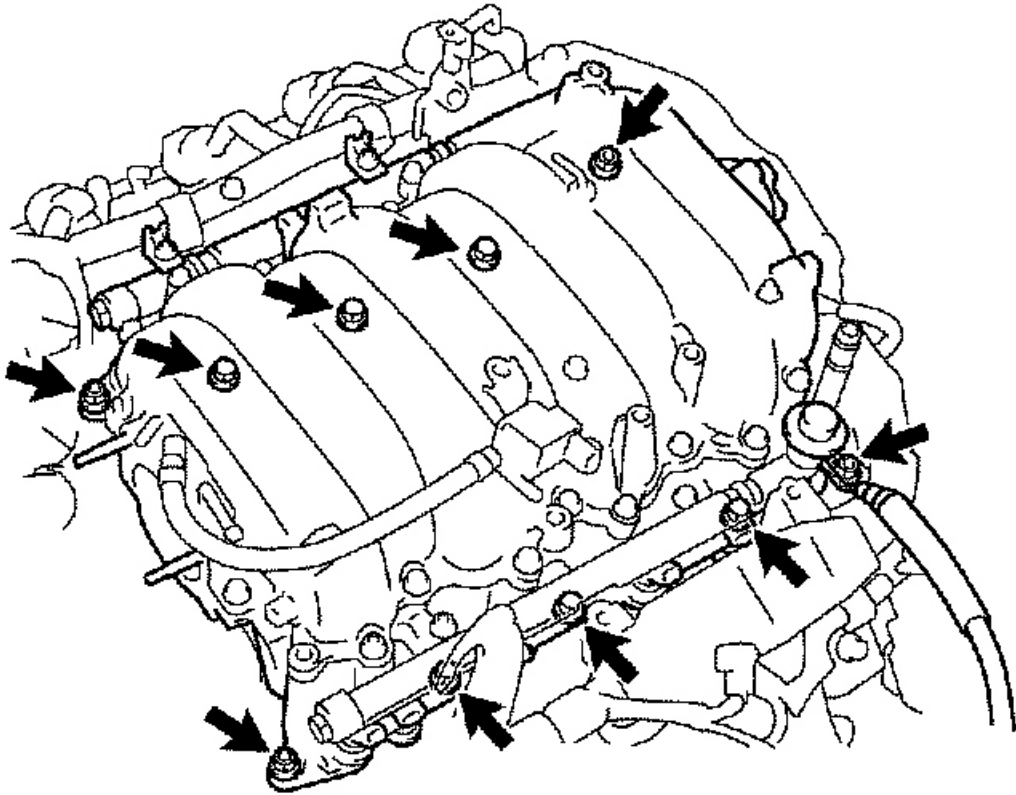
**Fig. 63: Installing Gaskets**

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

- b. Install the intake manifold assy with the 6 bolts and 4 nuts.

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

- c. Connect the 8 injector connectors.

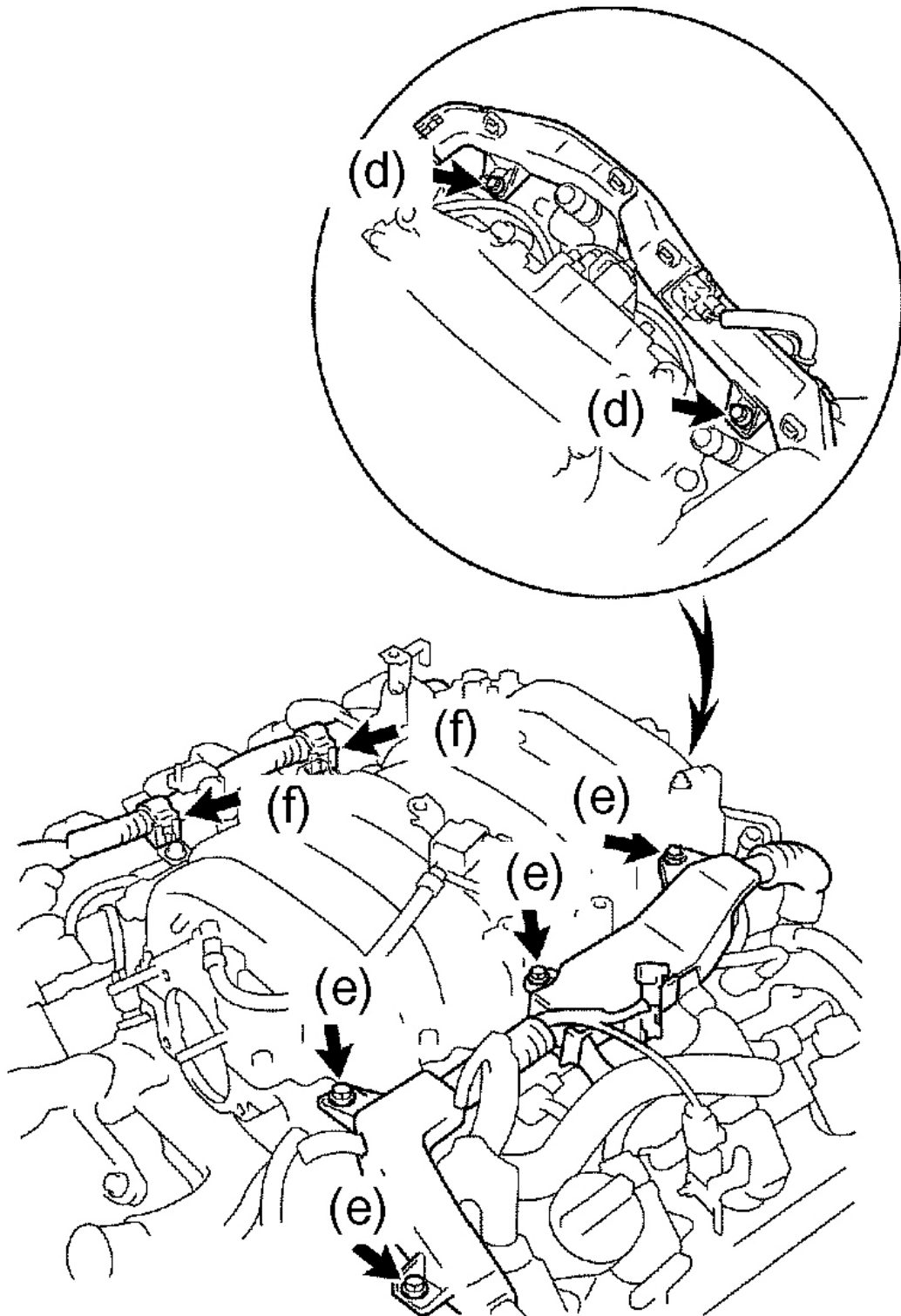


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**Fig. 64: Installing Intake Manifold Assy**

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

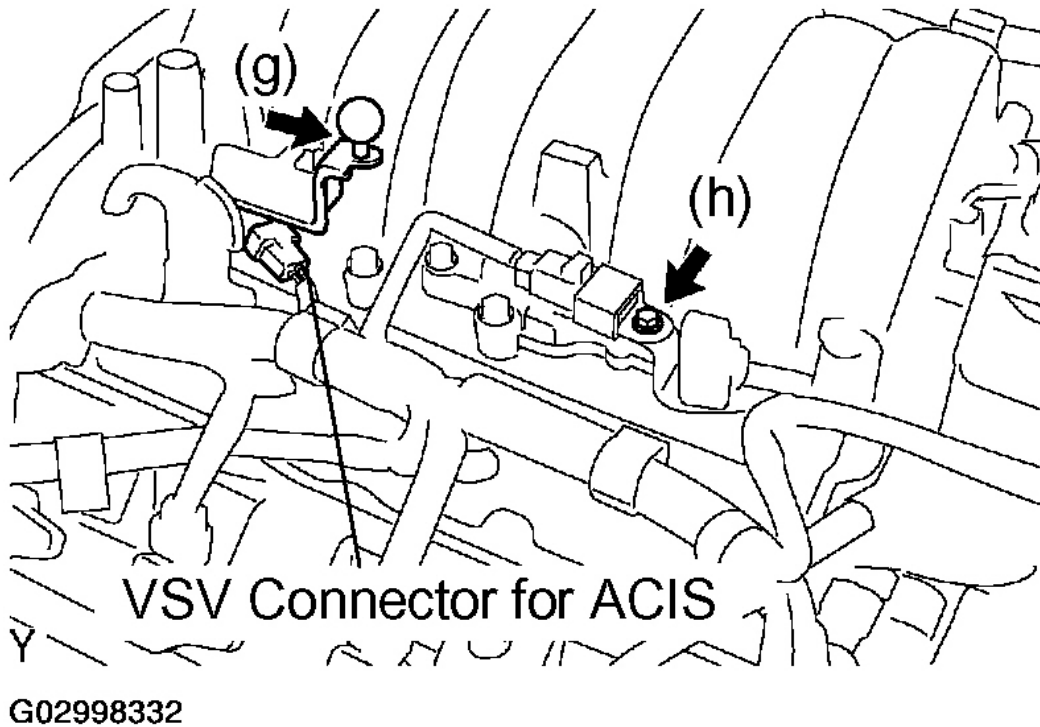
- d. Install the engine wire protector (rear side) with the 2 bolts.
- e. Install the engine wire protector (LH side) with the 4 bolts.
- f. Install the 2 wire clamps on the engine wire (RH side) to the brackets on the RH delivery pipe.



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**Fig. 65: Installing Engine Wire Protector (Rear Side)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

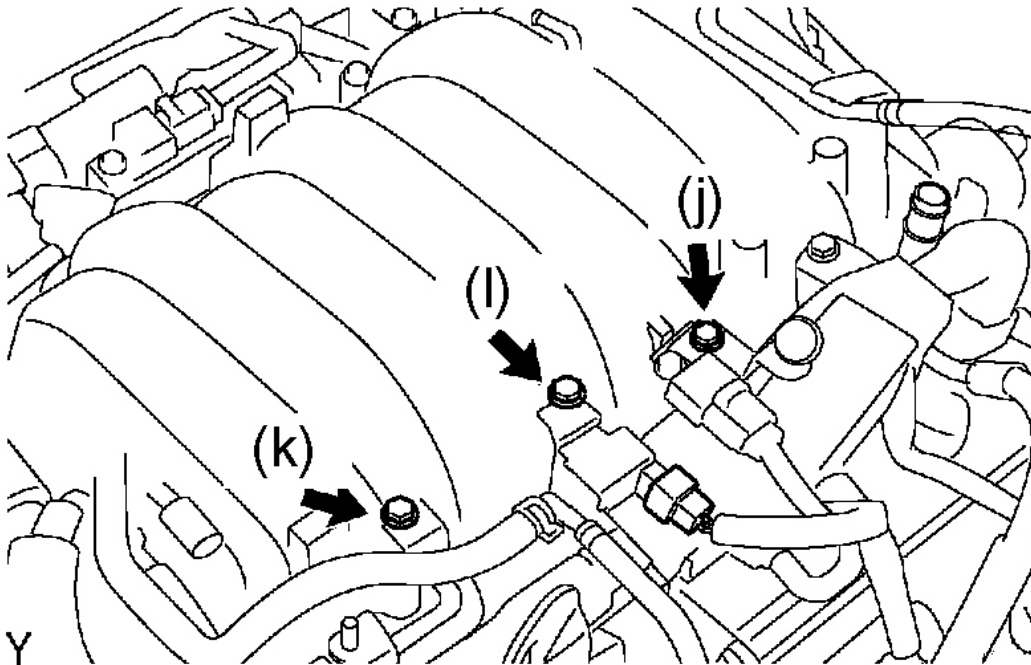
- g. Install the V-bank cover fastener with the bolt.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- h. Install the V-bank cover bracket No. 1 with the bolt.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- i. Connect the VSV connector for ACIS.



**Fig. 66: Connecting VSV Connector For ACIS**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Install the V-bank cover bracket No. 3 with the bolt.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- k. Install the V-bank cover bracket No. 2 with the bolt.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- l. Connect the VSV for EVAP to the intake manifold with the bolt.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- m. Connect the EVAP hose to the VSV for EVAP.

n. Connect the VSV connector for EVAP.



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**Fig. 67: Identifying VSV Connector For EVAP**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

104. **INSTALL THROTTLE BODY ASSY (See REPLACEMENT )**
105. **REMOVE ENGINE STAND**
106. **INSTALL DRIVE PLATE & RING GEAR SUB-ASSY**

HINT:

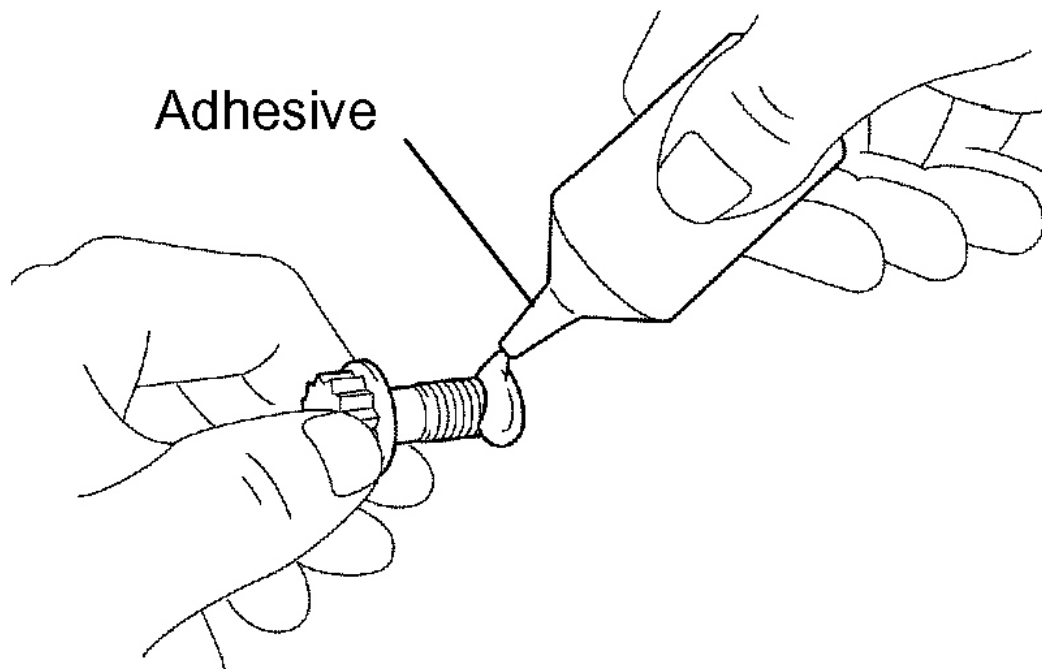
The mounting bolts are tightened in 2 progressive steps (step (c) and (e)).

If any one of the mounting bolts is broken or deformed, replace it.

- a. Apply adhesive to 2 or 3 threads of the mounting bolt end.

**Adhesive:**

**Part No. 08833-00070, THREE BOND 1324 or equivalent**



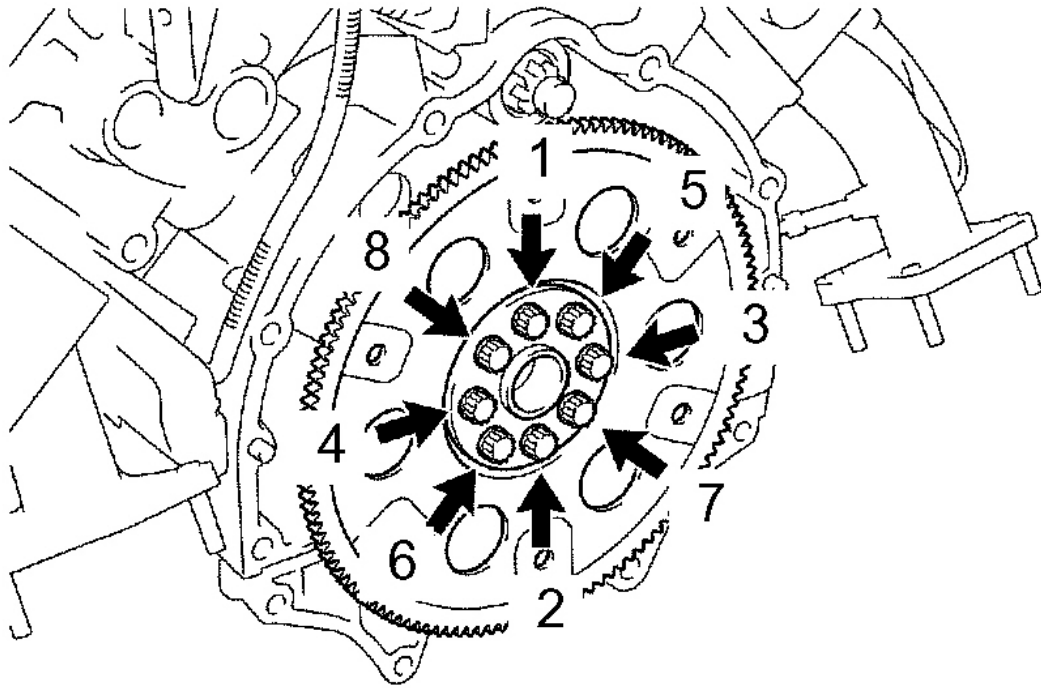
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**Fig. 68: Applying Adhesive To Threads Of Mounting Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the front spacer, drive plate and rear spacer on the crankshaft.
- c. Install and uniformly tighten the 8 mounting bolts in several passes in the sequence shown in the illustration.

**Torque: 49 N.m (500 kgf.cm, 36 ft.lbf)**

If any one of the mounting bolts does not meet the torque specification, replace the mounting bolt.

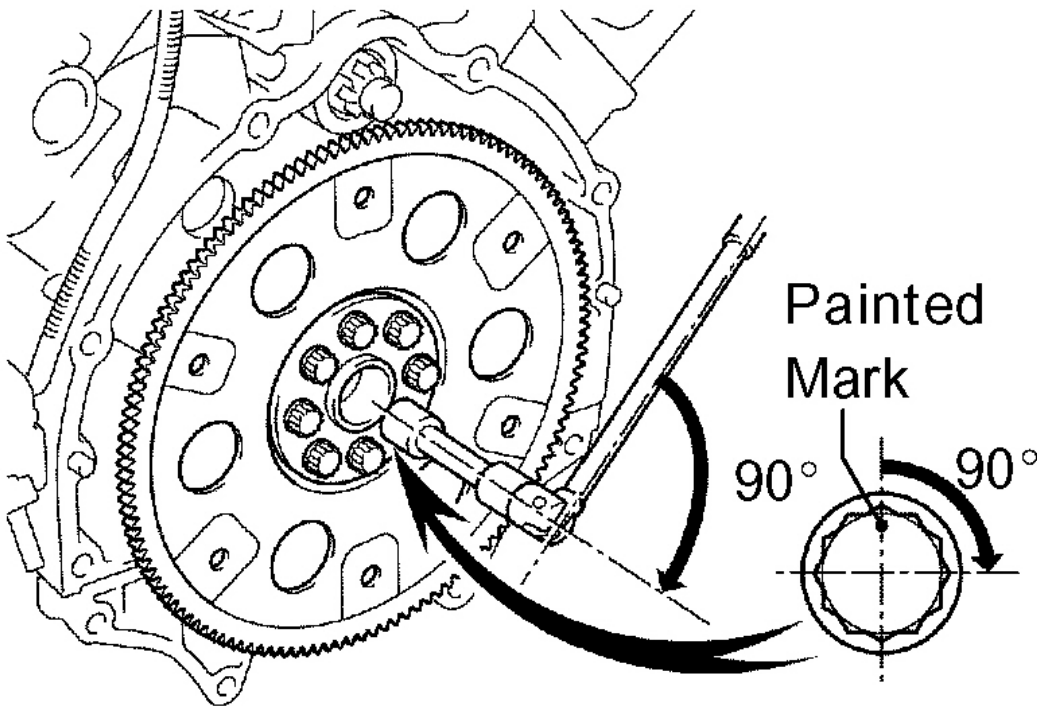


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**Fig. 69: Identifying Drive Plate Bolts**

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

- d. Mark the mounting bolt with paint.
- e. Retighten the mounting bolt by  $90^{\circ}$  in the numerical order shown.
- f. Check that the painted mark is now at a  $90^{\circ}$  angle to step (e).



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**Fig. 70: Identifying Painted Mark**

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

**107. INSTALL AUTOMATIC TRANSMISSION ASSY**

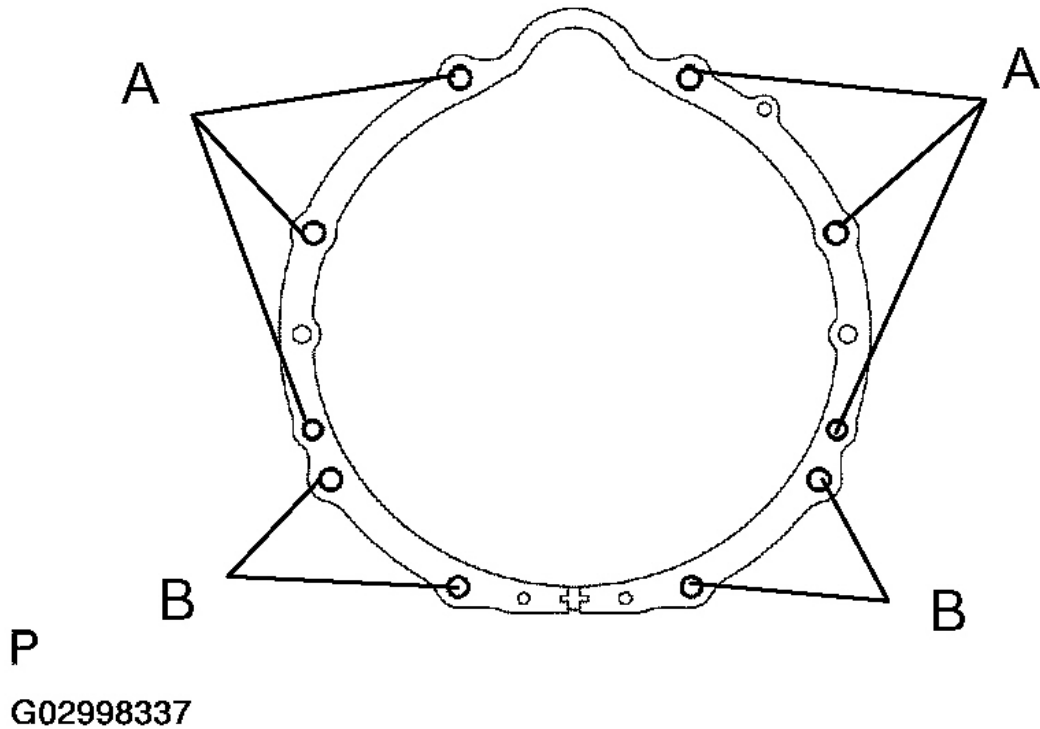
- a. Check the torque converter clutch installation (see **INSPECTION**).
- b. Attach the transmission to the engine.
- c. Install the ground strap and 10 bolts.

**Torque:**

**72 N.m (734 kgf.cm, 53 ft.lbf) for 17 mm head bolt A**

**37 N.m (377 kgf.cm, 27 ft.lbf) for 14 mm head bolt B**





**Fig. 71: Installing Automatic Transmission Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the torque converter clutch bolts.
  1. Apply adhesive to 2 or 3 threads of the bolt end.

**Adhesive:**

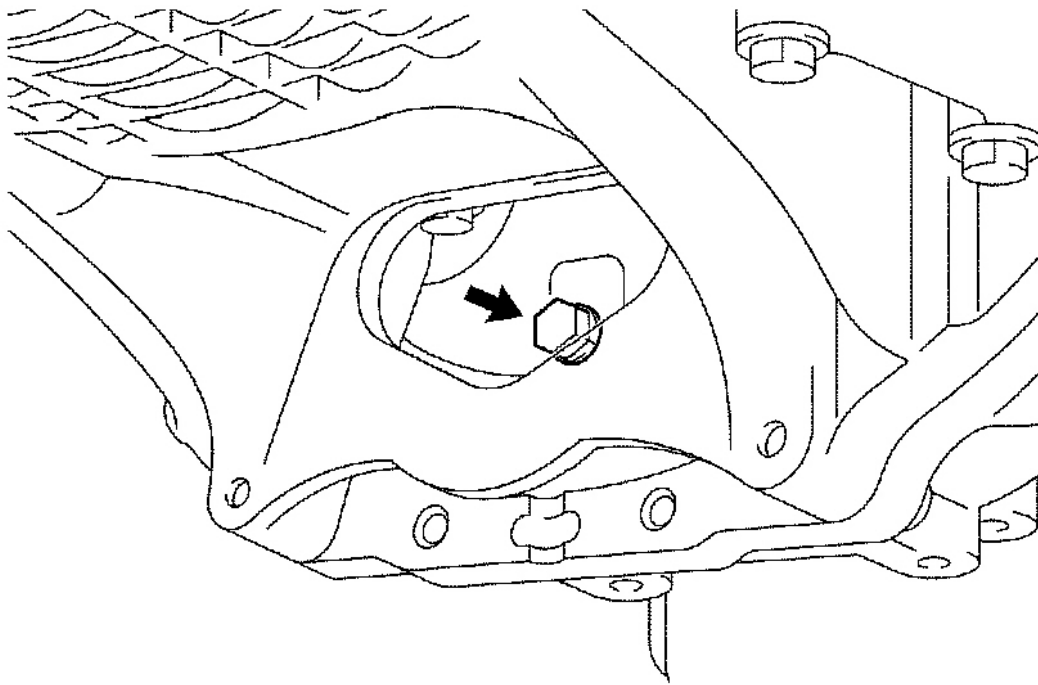
**Part No. 08833-00070, THREE BOND 1324 or equivalent**

2. Hold the crankshaft pulley bolt with a wrench, and install the 6 bolts evenly.  
**Torque: 48 N.m (490 kgf.cm, 35 ft.lbf)**

**HINT:**

First install the black colored bolt, and then install the other bolts.

3. Install the flywheel housing undercover with the 2 bolts.  
**Torque: 18 N.m (184 kgf.cm, 13 ft.lbf)**

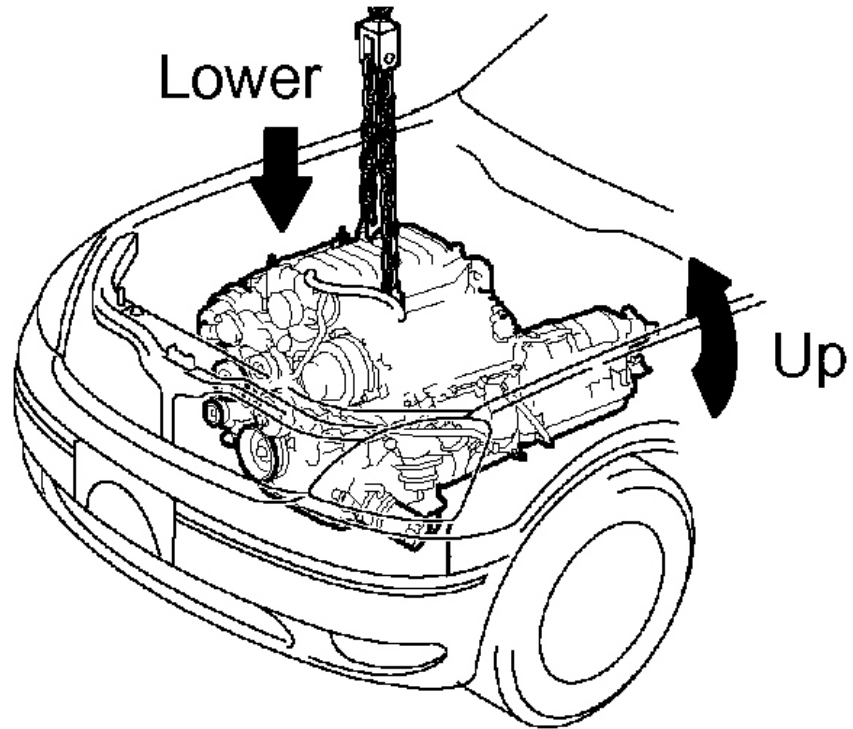


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**Fig. 72: Identifying Torque Converter Clutch Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

108. **INSTALL OIL COOLER INLET TUBE NO.1**
109. **INSTALL OIL COOLER OUTLET TUBE NO.1**
110. **INSTALL TRANSMISSION OIL FILTER TUBE SUB-ASSY**
111. **CONNECT ENGINE WIRE**
  - a. Connect the engine wire to the transmission.
    1. Connect the VSV connector.
    2. Connect the PNP switch connector.
    3. Connect the solenoid connector.
    4. Connect the direct clutch speed sensor connector.
    5. Connect the engine wire from the 3 wire clamps.
    6. Connect the oil level sensor connector.
112. **INSTALL ENGINE W/ TRANSMISSION ASSEMBLY**
  - a. Attach the engine chain hoist to the engine hangers.
  - b. Slowly lower the engine and transmission assembly into the engine compartment.
  - c. Insert the stud bolts of the front engine mounting brackets into the stud bolt holes of the front

suspension crossmember.

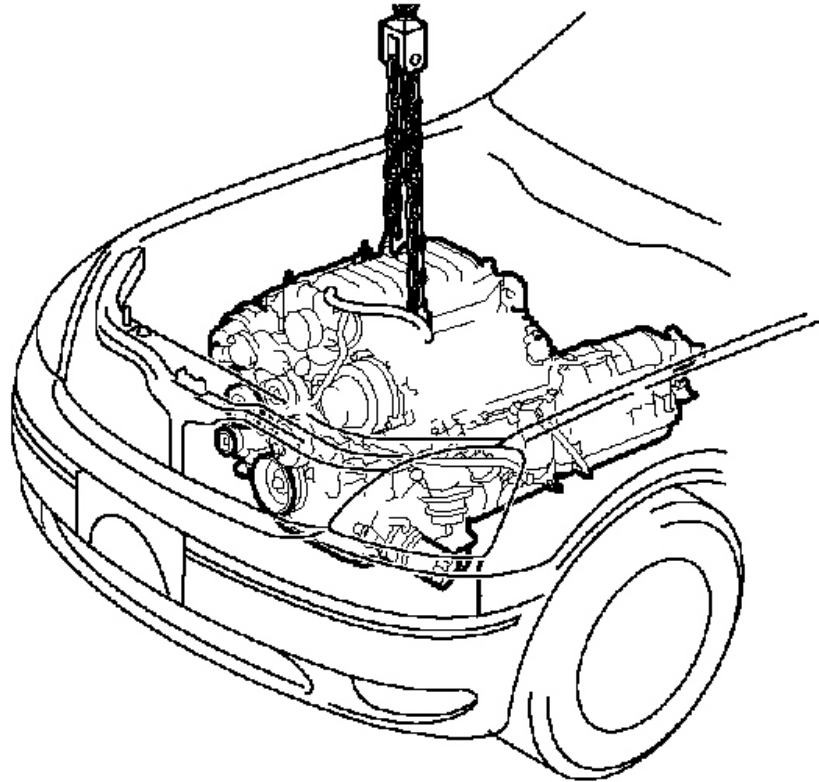


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**Fig. 73: Installing Engine W/ Transmission Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Keep the engine level.



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**Fig. 74: Keeping Engine Level**

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

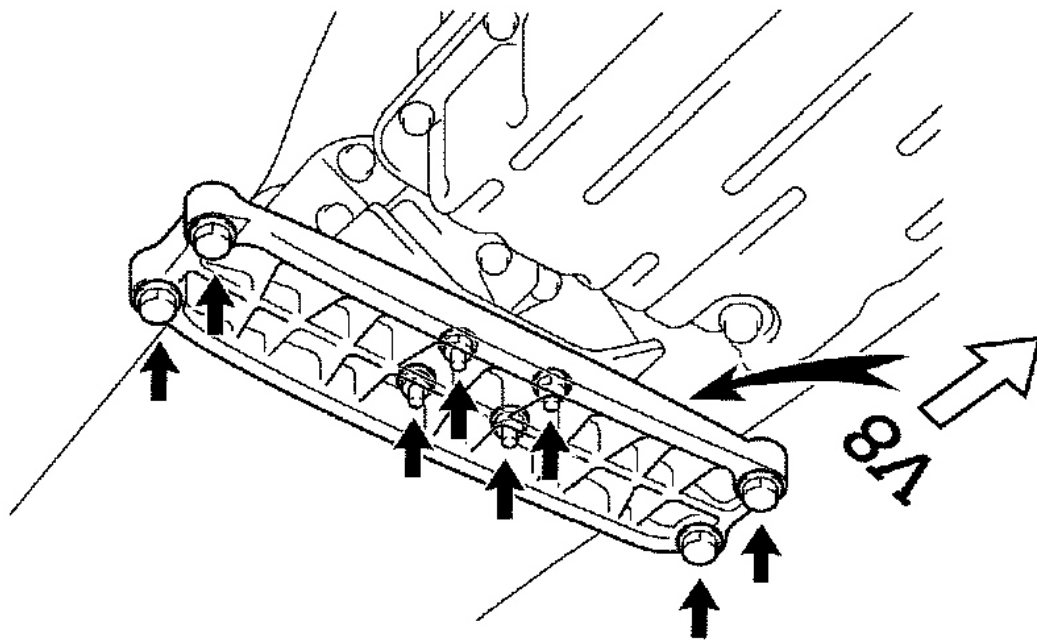
- e. Install the rear engine mounting member with the 4 bolts and 4 nuts.

**Torque:**

**25.5 N.m (260 kgf.cm, 19 ft.lbf) for bolt**

**13.5 N.m (138 kgf.cm, 10 ft.lbf) for nut**

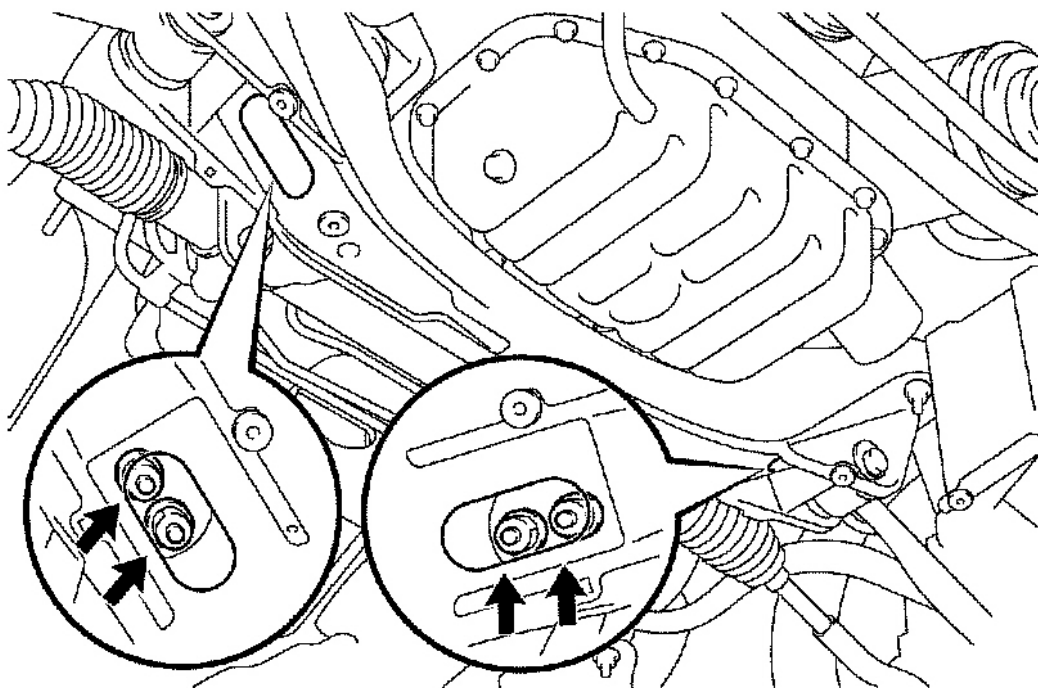
**NOTE: Be careful of installation direction.**



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**Fig. 75: Tightening Rear Engine Mounting Member And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Install the 4 nuts holding the engine mounting brackets to the front suspension crossmember.  
**Torque: 68 N.m (693 kgf.cm, 50 ft.lbf)**
- g. Install the 2 hole plugs.
- h. Remove the engine chain hoist.
- i. Install the V-bank cover bracket No. 1 to the engine hanger No. 2 with the nut.



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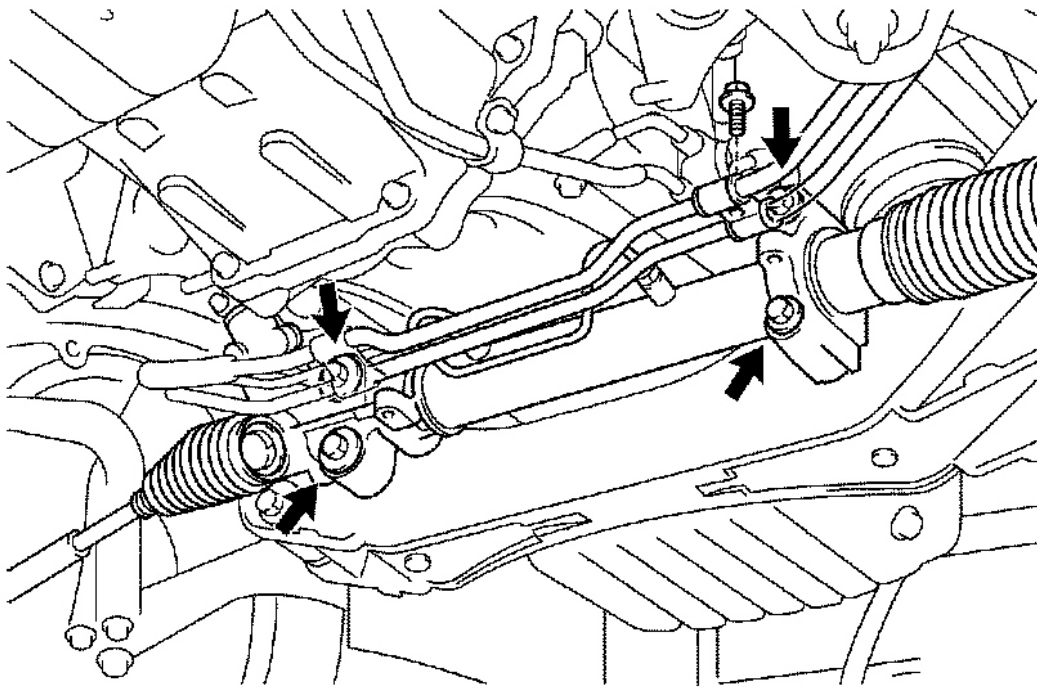
**Fig. 76: Identifying Engine Mounting Brackets**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**113. INSTALL POWER STEERING GEAR HOUSING ASSY**

- a. Connect the sliding yoke to the PS gear housing and intermediate shaft.
- b. Install the PS gear housing with the 4 bolts.

**Torque: 65 N.m (663 kgf.cm, 48 ft.lbf)**

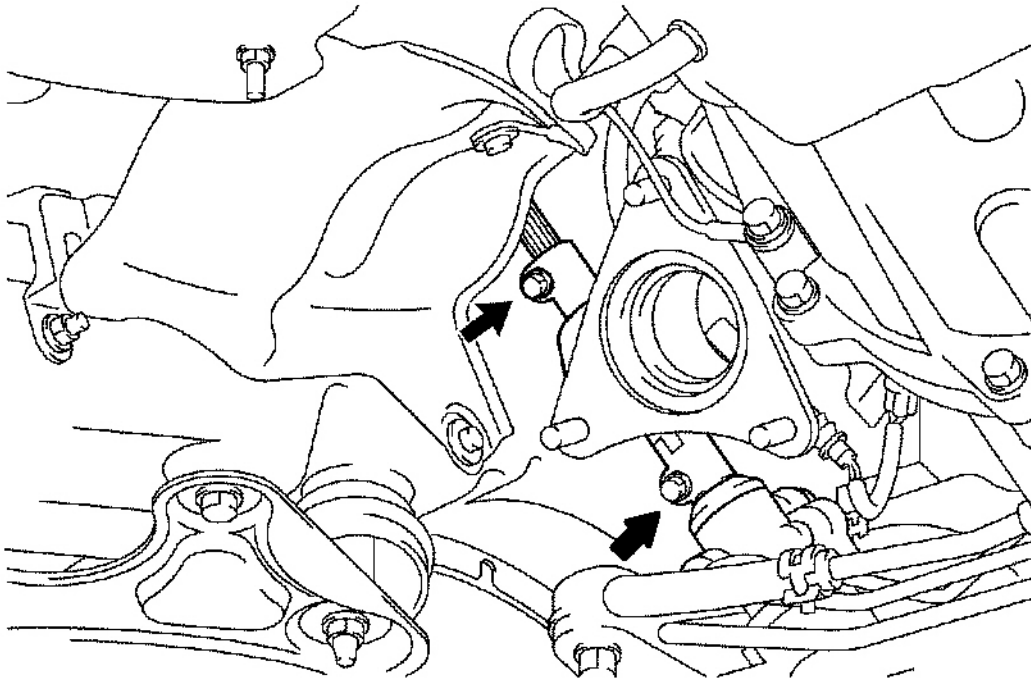
- c. Install the 2 PS oil tubes with the bolts.



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**Fig. 77: Installing Power Steering Gear Housing Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

114. **INSTALL HEIGHT CONTROL SENSOR LINK SUB-ASSY FRONT (See REPLACEMENT )**
115. **INSTALL PNEUMATIC FRONT RH W/SHOCK ABSORBER CYLINDER ASSY (See REPLACEMENT )**
116. **INSTALL PNEUMATIC FRONT LH W/SHOCK ABSORBER CYLINDER ASSY (See REPLACEMENT )**
117. **INSTALL FRONT SUSPENSION UPPER ARM ASSY RH (See REPLACEMENT )**
118. **INSTALL FRONT SUSPENSION UPPER ARM ASSY LH (See REPLACEMENT )**
119. **INSTALL FRONT DISC BRAKE CYLINDER ASSY RH (See OVERHAUL )**
120. **INSTALL DISC BRAKE CYLINDER ASSY LH (See OVERHAUL )**
121. **INSTALL STEERING SLIDING W/ SHAFT YOKE SUB-ASSY**
  - a. Tighten the 2 bolts for sliding yoke.  
**Torque: 35 N.m (357 kgf.cm, 26 ft.lbf)**

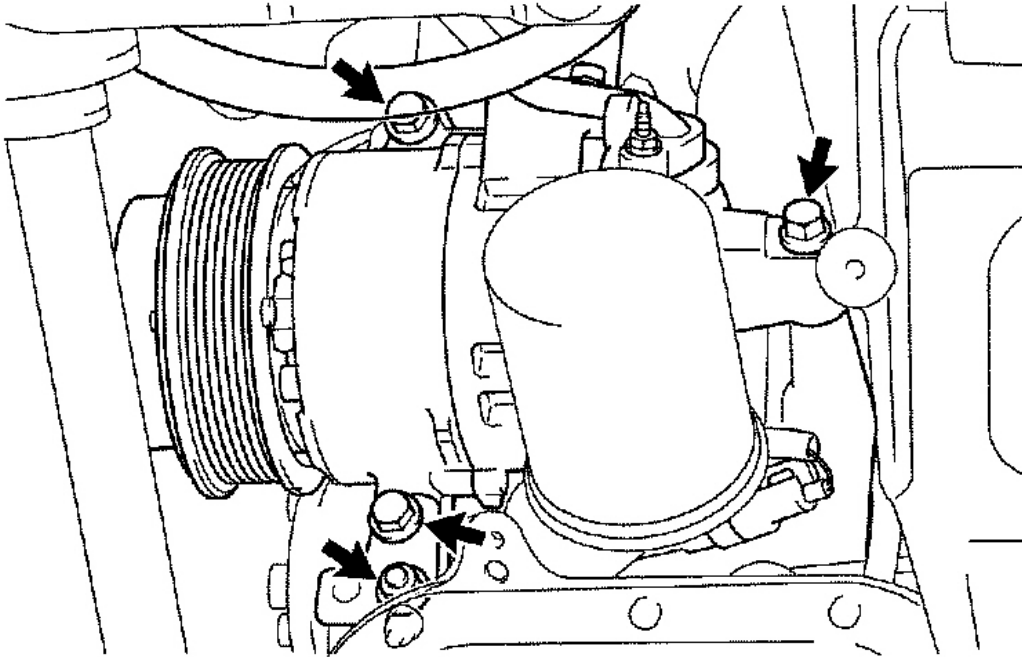


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**Fig. 78: Installing Steering Sliding W/ Shaft Yoke Sub-Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

122. **INSTALL FLOOR SHIFT GEAR SHIFTING ROD SUB-ASSY**
123. **INSTALL PROPELLER W/ CENTER BEARING SHAFT ASSY (See OVERHAUL )**
124. **INSTALL PARKING BRAKE CABLE HEAT INSULATOR**
125. **INSTALL FRONT FLOOR HEAT INSULATOR NO.1**
126. **INSTALL W/ CATALYST CONVERTER ASSY**
127. **INSTALL EXHAUST PIPE ASSY (See REPLACEMENT )**
128. **INSTALL FRONT FLOOR BRACE CENTER**
129. **INSTALL COOLER COMPRESSOR ASSY**
  - a. Install the cooler compressor, stay and wire bracket with the 3 bolts and nut.  
**Torque:**  
**49 N.m (500 kgf.cm, 36 ft.lbf) for bolt**  
**29 N.m (296 kgf.cm, 21 ft.lbf) for nut**
  - b. Connect the compressor connector.
  - c. Install the wire clamp.





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**Fig. 79: Installing Cooler Compressor**

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

130. **INSTALL VANE PUMP ASSY**

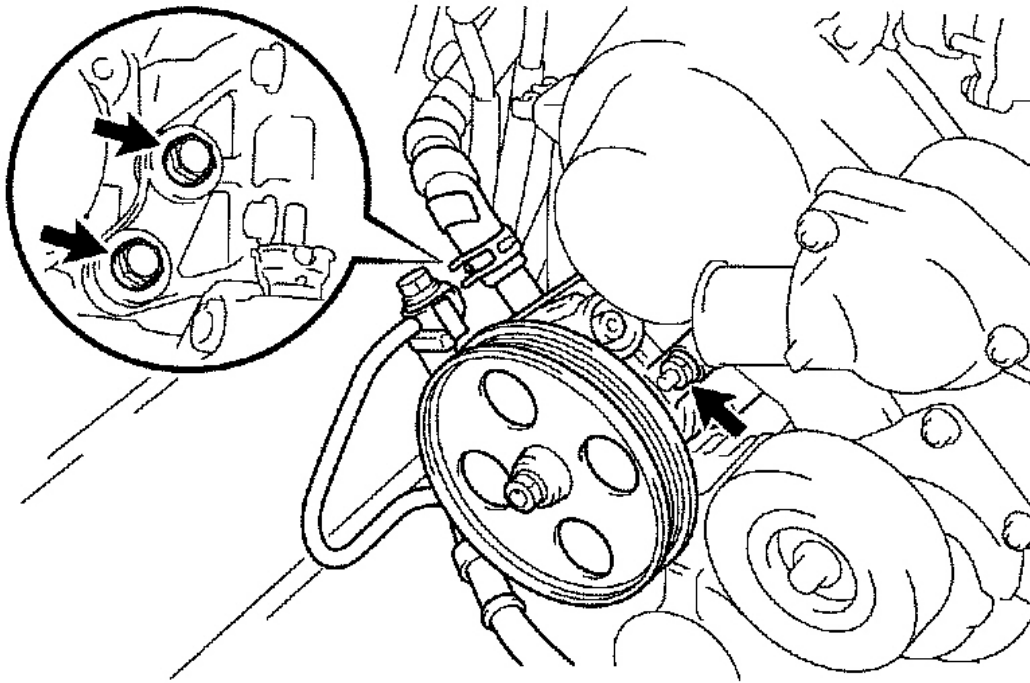
- a. Install the vane pump with the 2 bolts and nut. Alternately tighten the bolts and nut.

**Torque:**

**39.2 N.m (400 kgf.cm, 29 ft.lbf) for bolt**

**43.1 N.m (440 kgf.cm, 32 ft.lbf) for nut**

- b. Connect the PS oil pressure switch connector.
- c. Install the RH engine under cover with the 2 screws.
- d. Connect the 2 PS air hoses to the vane pump.



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**Fig. 80: Installing Vane Pump Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

131. **INSTALL VANE PUMP OIL RESERVOIR ASSY**
132. **CONNECT HEATER WATER OUTLET HOSE A (FROM HEATER UNIT)**
133. **CONNECT HEATER WATER INLET HOSE A**
134. **CONNECT FUEL VAPOR FEED HOSE NO.2**
135. **CONNECT AIR HOSE NO.5**
136. **CONNECT ENGINE WIRE**
  - a. Connect the engine wire from the ECM box.
  - b. Install the nut, and connect the generator wire to the generator.
  - c. Connect the wire for generator wire to the wire clamp on generator.
  - d. Connect the ground cable to the stay on generator with the bolt.
  - e. Connect the PS oil hose to the No. 1 oil pan with the 2 bolts.
  - f. Connect the ground strap to the body with the 2 bolts.
137. **INSTALL FAN AND GENERATOR V BELT (See REPLACEMENT )**
138. **CONNECT FUEL PIPE SUB-ASSY NO.2 (See REPLACEMENT )**
139. **INSTALL RADIATOR ASSY (See REPLACEMENT )**

140. **INSTALL ENGINE UNDER COVER NO.2**
141. **INSTALL ENGINE UNDER COVER NO.1**
142. **INSTALL FRONT WHEEL**
143. **INSTALL AIR CLEANER ASSY**
144. **INSTALL INTAKE AIR CONNECTOR PIPE**
145. **INSTALL AIR CLEANER INLET NO.1**
146. **INSTALL V-BANK COVER**
147. **INSTALL HOOD SUB-ASSY (See ADJUSTMENT and OVERHAUL )**
148. **CONNECT BATTERY NEGATIVE TERMINAL**

**NOTE:** When disconnecting the negative (-) battery terminal, initialize the following system (s) after the terminal is reconnected (see INITIALIZATION ).

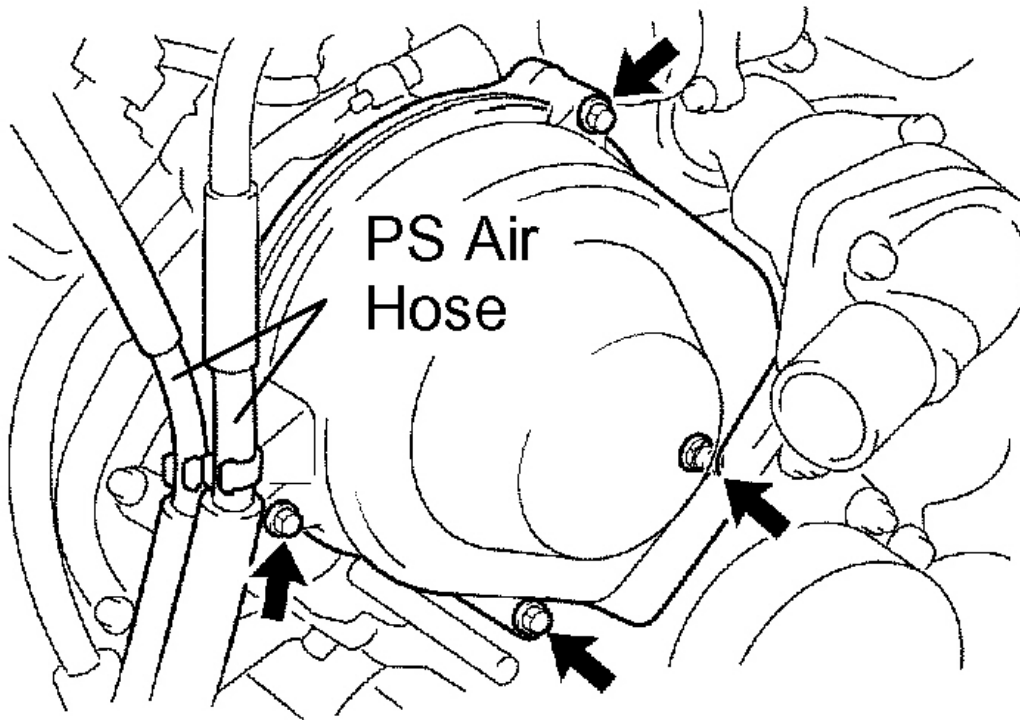
149. **ADD AUTOMATIC TRANSMISSION FLUID**
150. **ADD ENGINE COOLANT (See REPLACEMENT )**
151. **ADD ENGINE OIL (See ON-VEHICLE INSPECTION )**
152. **ADD POWER STEERING FLUID**
153. **BLEED POWER STEERING FLUID**
154. **INSPECT AUTOMATIC TRANSMISSION FLUID (See ADJUSTMENT )**
155. **INSPECT ENGINE OIL LEAKS**
156. **CHECK FOR ENGINE COOLANT LEAKS**
157. **INSPECT FOR FUEL LEAKS**
158. **CHECK FOR EXHAUST GAS LEAKS**
159. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT**
160. **INSPECT IGNITION TIMING**
161. **INSPECT ENGINE IDLE SPEED**
162. **INSPECT CO/HC**
163. **ADJUST ENGINE (See INSPECTION )**
164. **CHECK ABS SPEED SENSOR SIGNAL (See TEST MODE PROCEDURE )**

## **OVERHAUL**

1. **REMOVE SPARK PLUG**
2. **REMOVE OIL FILLER CAP SUB-ASSY**
3. **REMOVE CYLINDER HEAD COVER SUB-ASSY LH**
  - a. Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.
4. **REMOVE CYLINDER HEAD COVER SUB-ASSY**
  - a. Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.

5. **REMOVE TIMING CHAIN OR BELT COVER NO.2**

- a. Disconnect the 2 PS air hoses from the clamp on the cover.
- b. Remove the cap nut, 3 bolts, cover and gasket.

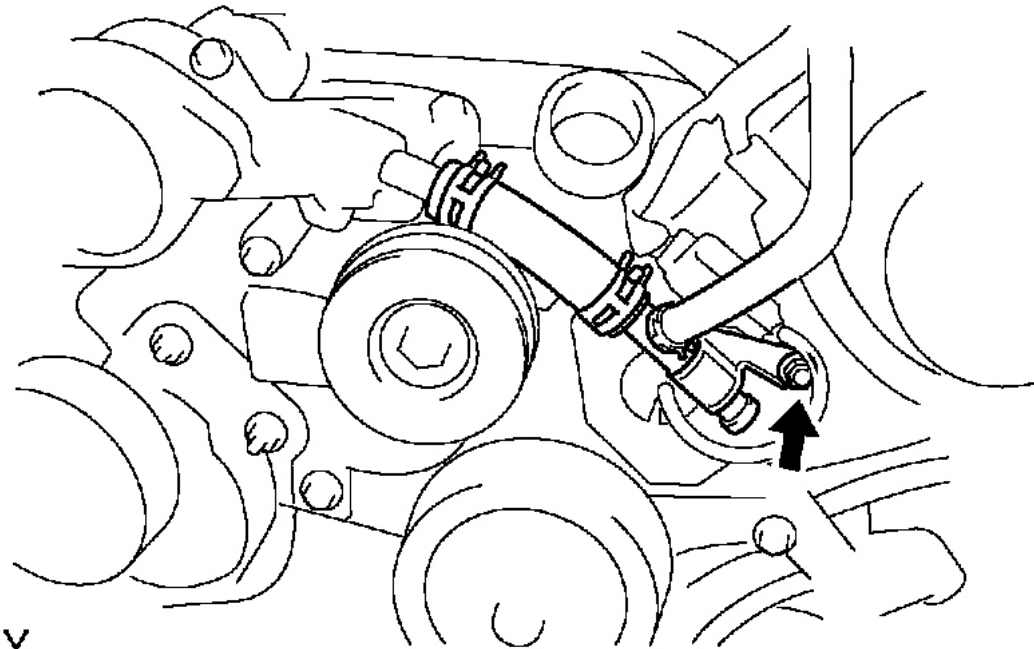


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**Fig. 81: Disconnecting PS Air Hoses From Clamp**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE TIMING BELT COVER SUB-ASSY NO.3 LH**

- a. Remove the cap nut, and disconnect the No. 3 water bypass pipe from the cover.
- b. Disconnect the 2 water bypass hoses as shown in the illustration.



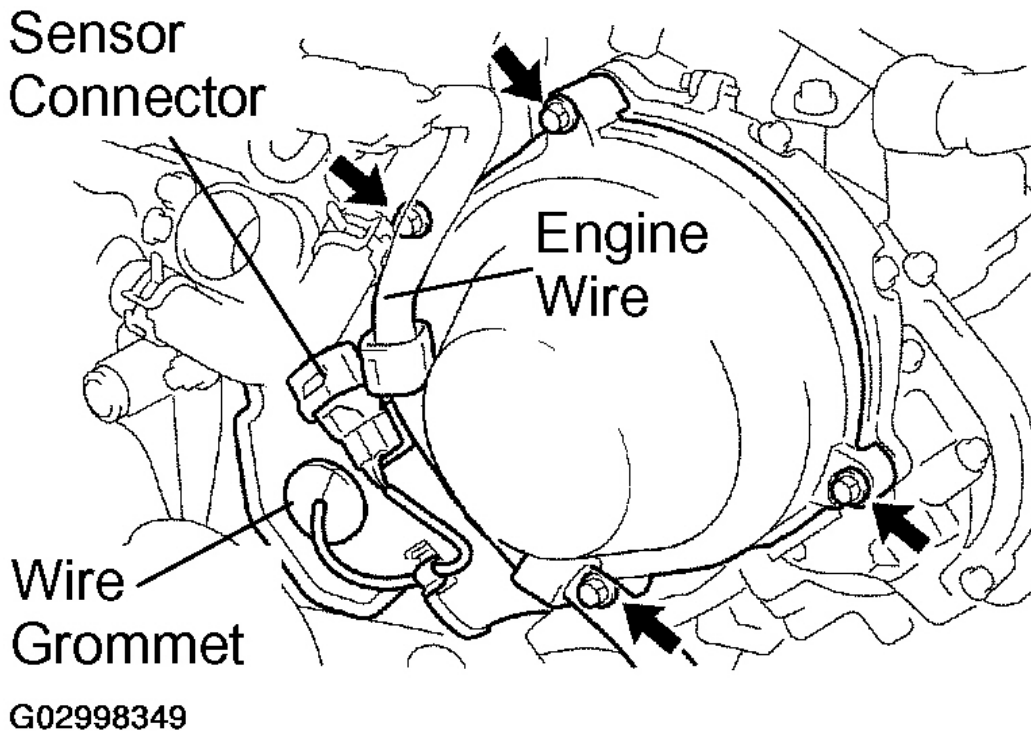
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**Fig. 82: Disconnecting Water By-Pass Hoses**

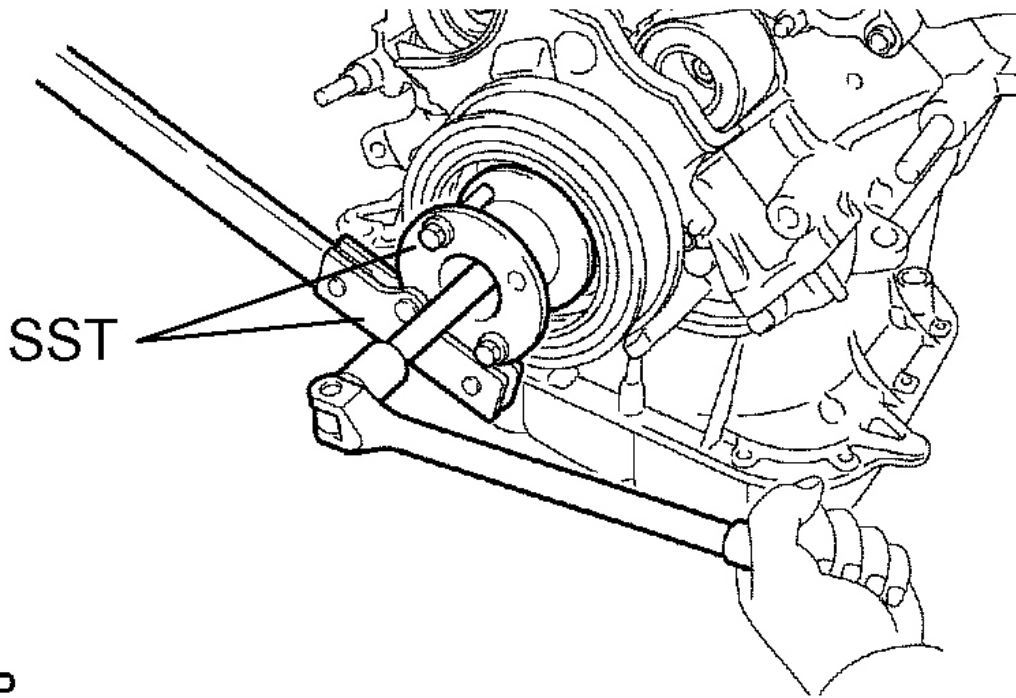
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Disconnect the engine wire from the 2 wire clamps.
- d. Disconnect the camshaft position sensor connector.
- e. Disconnect the camshaft position sensor wire from the wire clamp on the cover.
- f. Remove the wire grommet from the cover.
- g. Remove the 4 bolts.
- h. Disconnect the cover from the timing plate and camshaft bearing cap.
- i. Disconnect the wire clamp for the sensor from the cover.
- j. Remove the connector holder from the sensor connector.
- k. Remove the cover and gasket.



**Fig. 83: Removing Cover And Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **REMOVE IDLER PULLEY ASSY**
  - a. Remove the 2 bolts, 2 nuts and idler pulley.
8. **REMOVE TIMING BELT COVER SUB-ASSY NO.2**
  - a. Remove the 2 bolts and timing belt cover.
9. **REMOVE IDLER PULLEY SUB-ASSY NO.2**
  - a. Remove the pulley bolt, cover plate and idler pulley.
10. **REMOVE V-RIBBED BELT TENSIONER ASSY**
  - a. Remove the bolt, 2 nuts and belt tensioner.
11. **REMOVE CRANKSHAFT DAMPER SUB-ASSY**
  - a. Using SST, remove the damper bolt.  
SST 09213-70011, 09330-00021



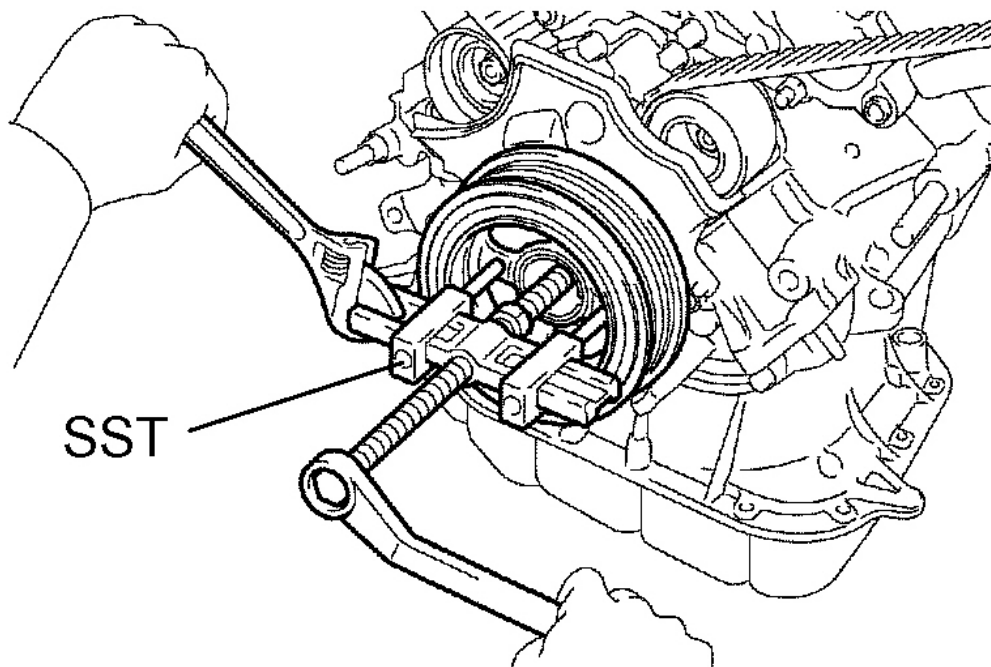
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**Fig. 84: Removing Damper Bolt Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, remove the damper.

SST 09950-50013 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05021)



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**Fig. 85: Removing Damper Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**12. REMOVE TIMING BELT NO.1 COVER**

- a. Remove the 4 bolts and cover.

**13. REMOVE TIMING GEAR COVER SPACER**

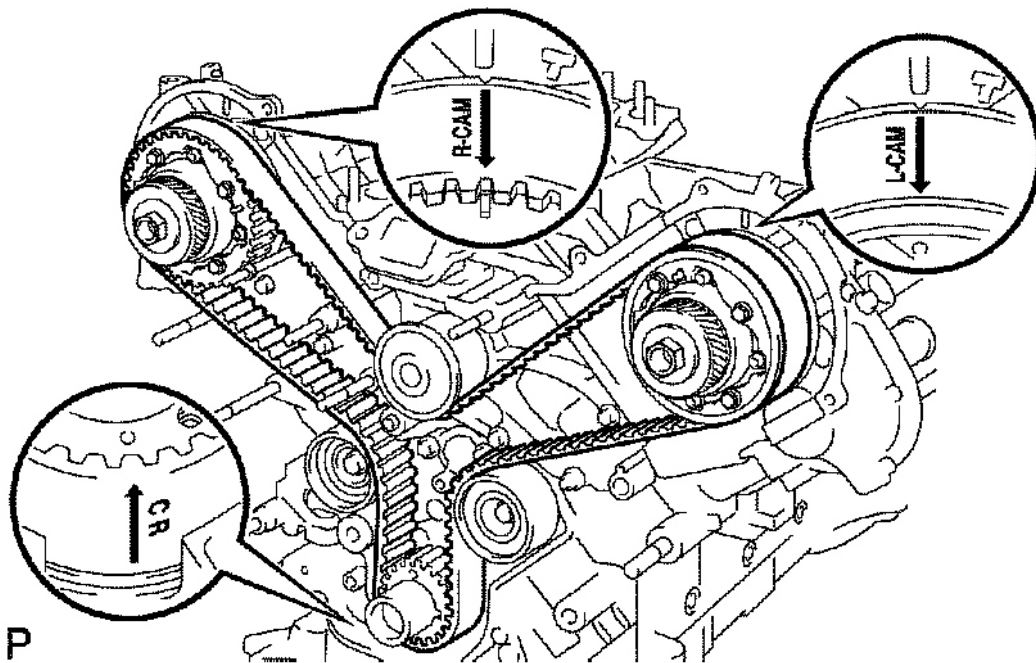
**14. REMOVE CRANKSHAFT POSITION SENSOR PLATE**

**15. REMOVE TIMING BELT**

- a. If planning to reuse the timing belt, check the installation marks on the belt.
  1. Check that there are 3 installation marks on the timing belt by turning the crankshaft as shown in the illustration.

If the installation marks have disappeared, place a new installation mark on the timing belt before removing each part.



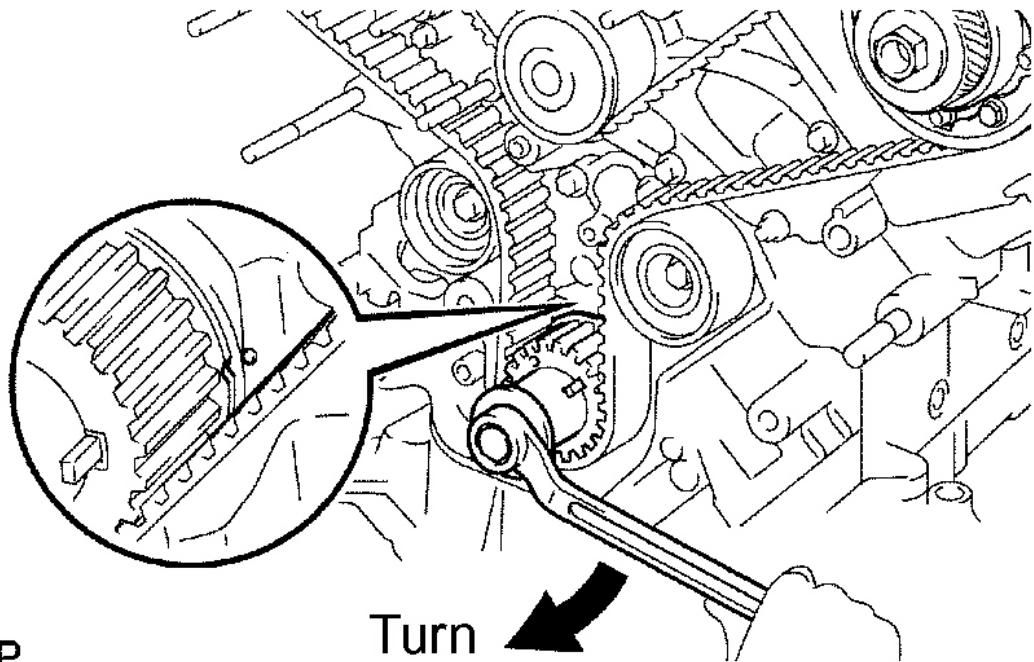


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**Fig. 86: Removing Timing Belt**

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

- b. Set the No. 1 cylinder to approximately 50° BTDC/compression.
  - 1. Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.



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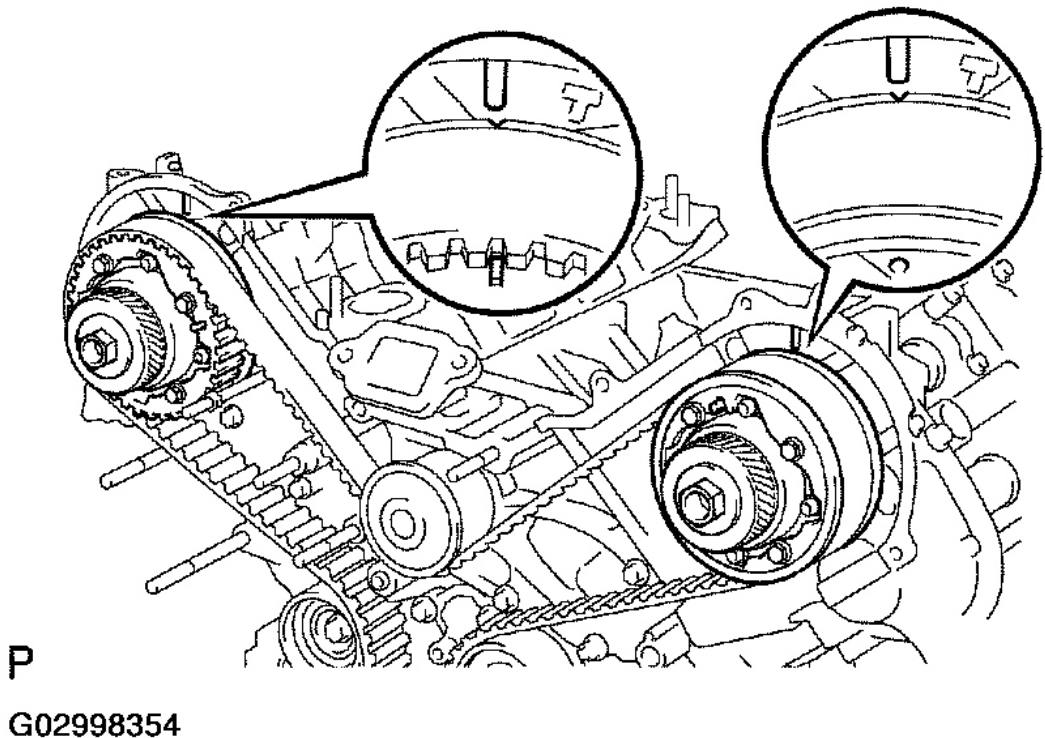
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**Fig. 87: Turning Crankshaft To Aligning Timing Marks Of Crankshaft Timing Pulley And Oil Pump Body**

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

2. Check that the timing marks of the camshaft timing pulleys and timing belt plates are aligned.

If not, turn the crankshaft 1 revolution (360°).



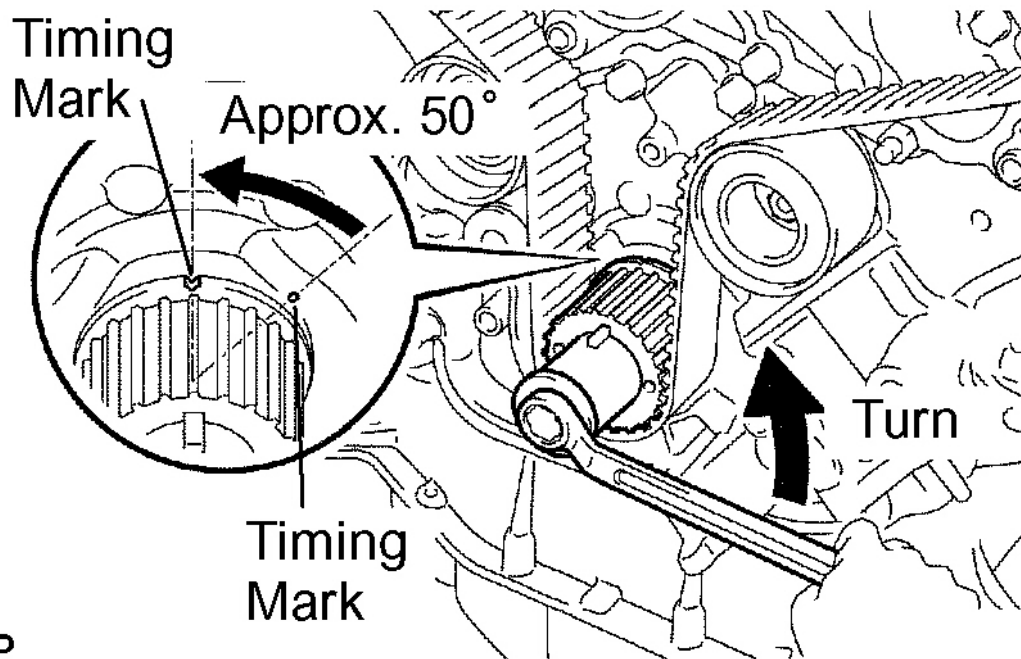
**Fig. 88: Checking Timing Marks**

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

3. Using the crankshaft damper bolt, turn the crankshaft counterclockwise by approximately 50°.

**NOTE:** With timing belt disengaged: The crankshaft damper must be at the correct angle to avoid damage in later steps. If the crankshaft pulley is at the wrong angle and then the camshaft timing pulley and the camshaft are removed, the piston head and valve head may come in contact and be damaged.

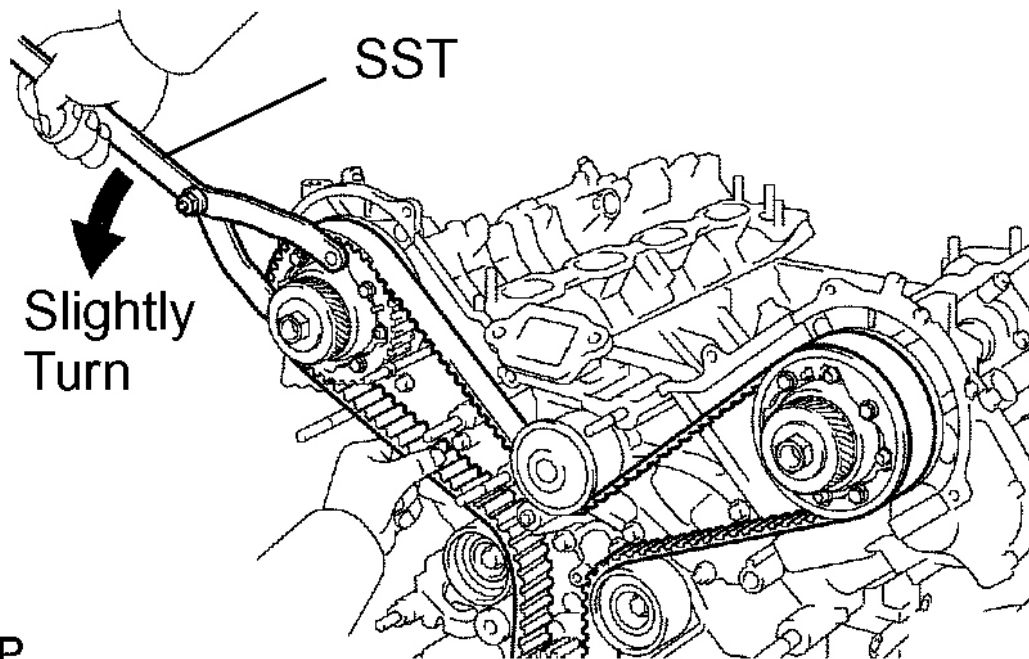
- c. Alternately loosen the 2 bolts, and remove them, the belt tensioner and dust boot.



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**Fig. 89: Turning Crankshaft Counterclockwise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using SST, loosen the tension between the camshaft timing pulley (RH bank) and crankshaft timing pulley by slightly turning the camshaft timing pulley counterclockwise.  
SST 09960-10010 (09962-01000, 09963-00350)
- e. Disconnect the belt from the timing belt idler No. 1, and remove the belt.



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**Fig. 90: Turning Camshaft Timing Pulley Counterclockwise Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

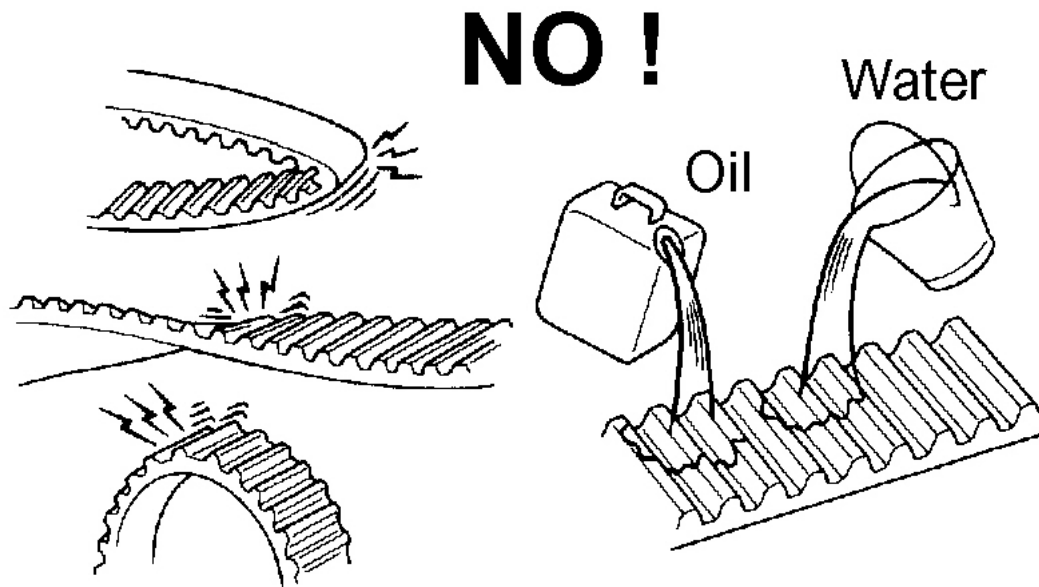
## 16. INSPECT TIMING BELT

### NOTE:

- Do not bend, twist or turn the timing belt inside out.
- Do not allow the timing belt to come into contact with oil, water or steam.
- Do not utilize timing belt tension when installing or removing the mount bolt of the camshaft timing pulley.

If there are any defects, as shown in the illustrations, check these points:

- a. Premature parting
  1. Check for proper installation.
  2. Check the timing cover gasket for damage and proper installation.
- b. If the belt teeth are cracked or damaged, check to see if either camshaft is locked.



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**Fig. 91: Checking Timing Belt**

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

- c. If there is noticeable wear or cracks on the belt face, check to see if there are nicks on the side of the idler pulley lock and water pump.
- d. If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.
- e. If there is noticeable wear on the belt teeth, check the timing cover for damage, check that the gasket has been installed correctly, and check for foreign material on the pulley teeth.

If necessary, replace the timing belt.

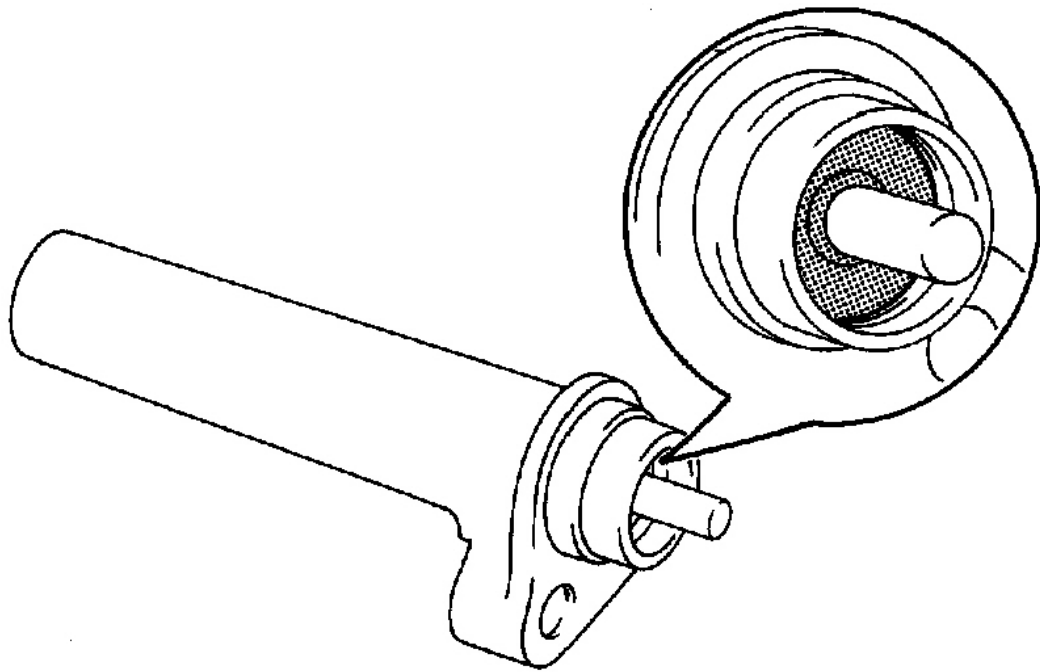
**17. INSPECT TIMING BELT TENSIONER**

- a. Visually check the seal portion of the tensioner for oil leakage.

HINT:

If there is only the faint trace of oil on the push rod, the tensioner does not need to be replaced.

If leakage is found, replace the tensioner.



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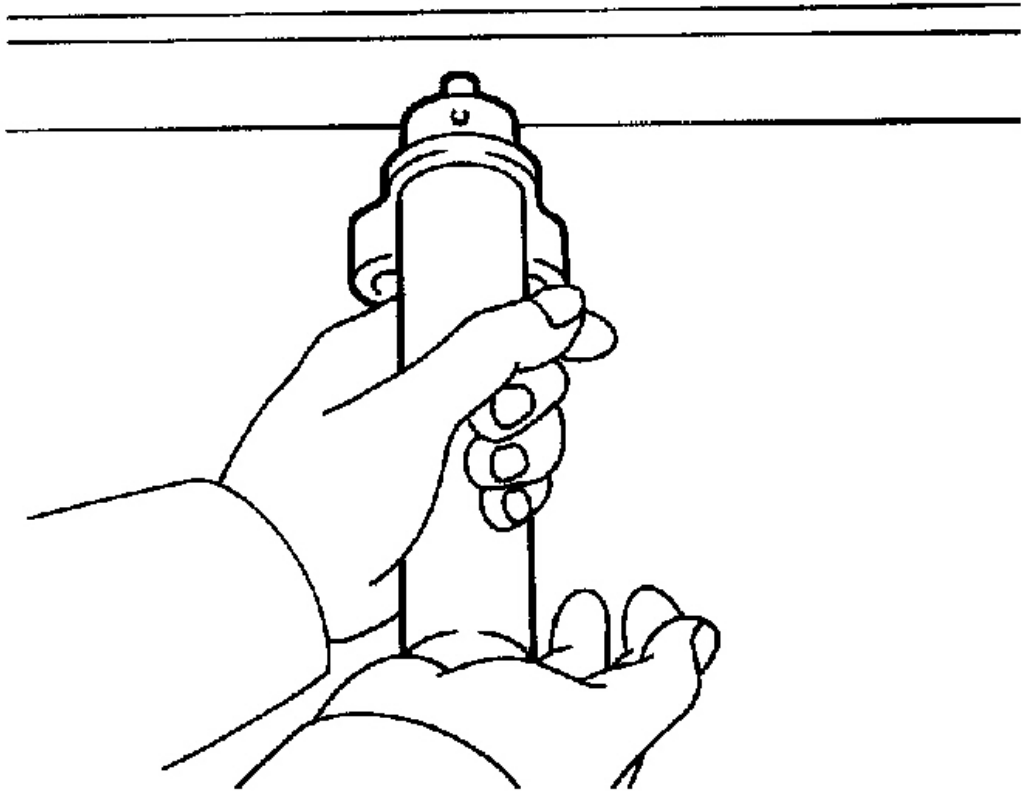
**Fig. 92: Identifying Seal Portion**

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

- b. Hold the tensioner with both hands and push the push rod strongly as shown to check that it does not move.

If the push rod moves, replace the tensioner.

**NOTE:**        **Never hold the tensioner push rod facing downward.**



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**Fig. 93: Pushing Push Rod**

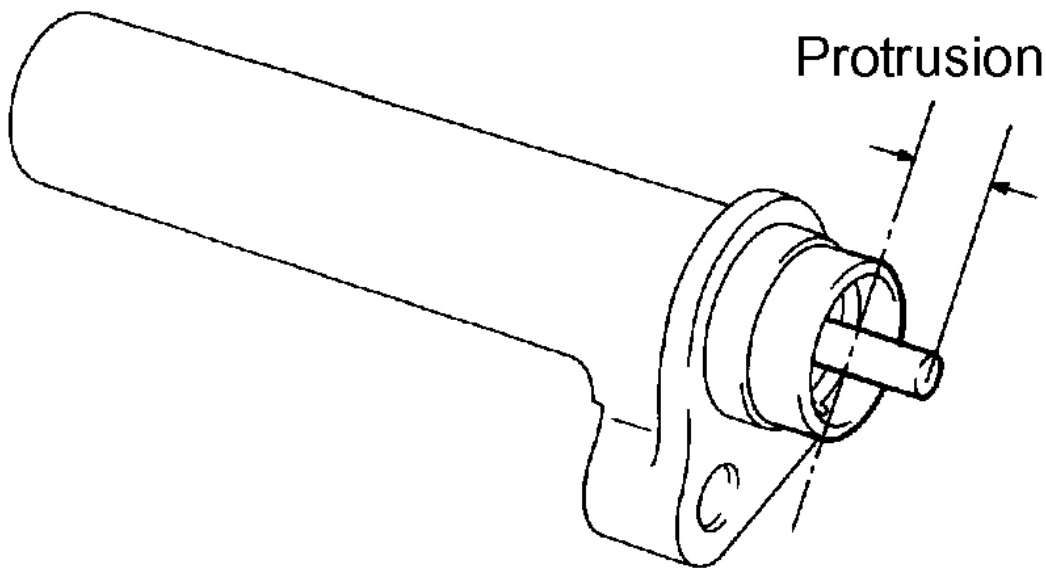
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Measure the protrusion of the push rod from the housing end.

**Protrusion: 9.5 to 10.5 mm (0.374 to 0.413 in.)**

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



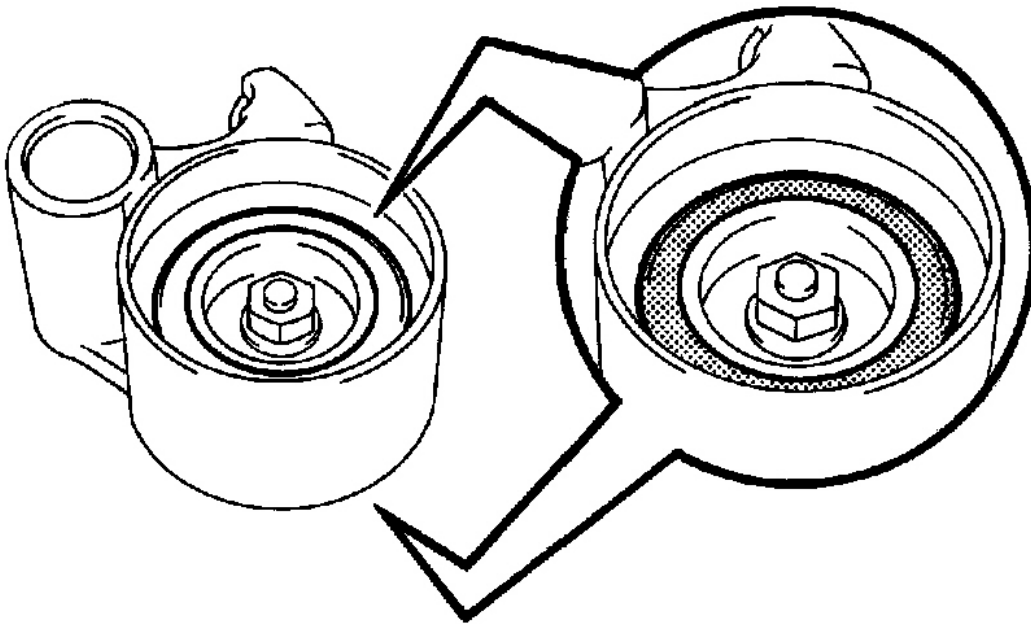


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**Fig. 94: Measuring Protrusion Of Push Rod From Housing End**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE TIMING BELT IDLER SUB-ASSY NO.1**
  - a. Using a 10 mm hexagon wrench, remove the bolt, idler and plate washer.
19. **REMOVE TIMING BELT IDLER SUB-ASSY NO.2**
  - a. Remove the bolt and idler.
20. **INSPECT TIMING BELT IDLER SUB-ASSY NO.1**
  - a. Visually check the seal portion of the idler for oil leakage.  
  
If leakage is found, replace the idler.
  - b. Check that the idler turns smoothly.

If necessary, replace the idler.



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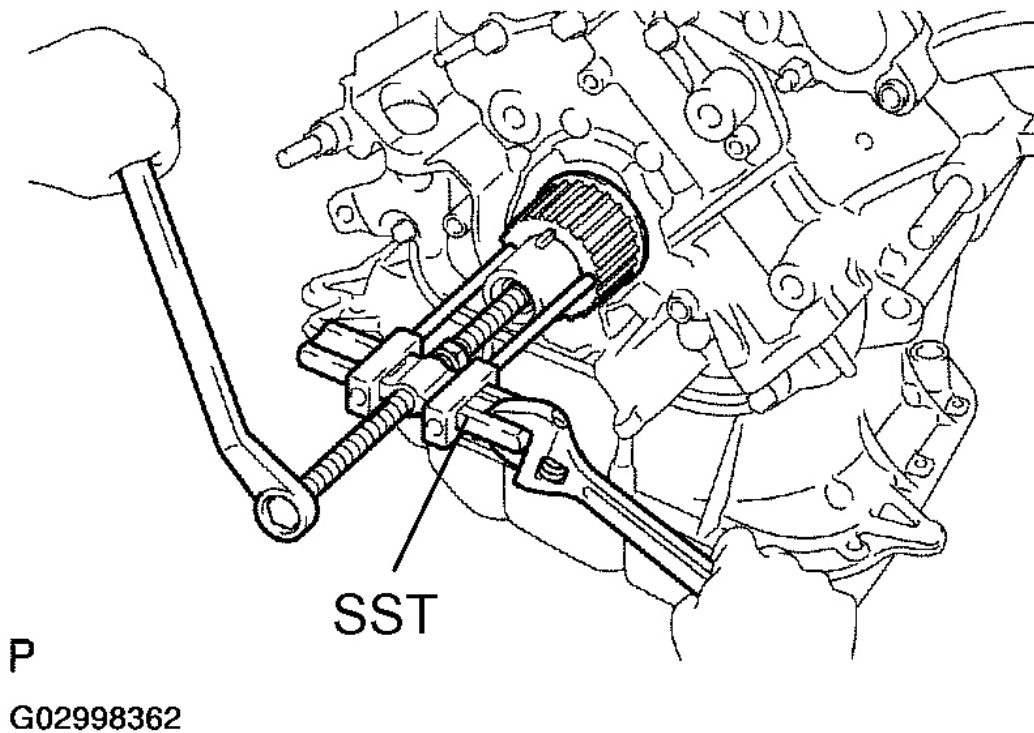
**Fig. 95: Checking Seal Portion Of Idler For Oil Leakage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**21. REMOVE CRANKSHAFT TIMING PULLEY**

- a. Using SST, remove the timing pulley.

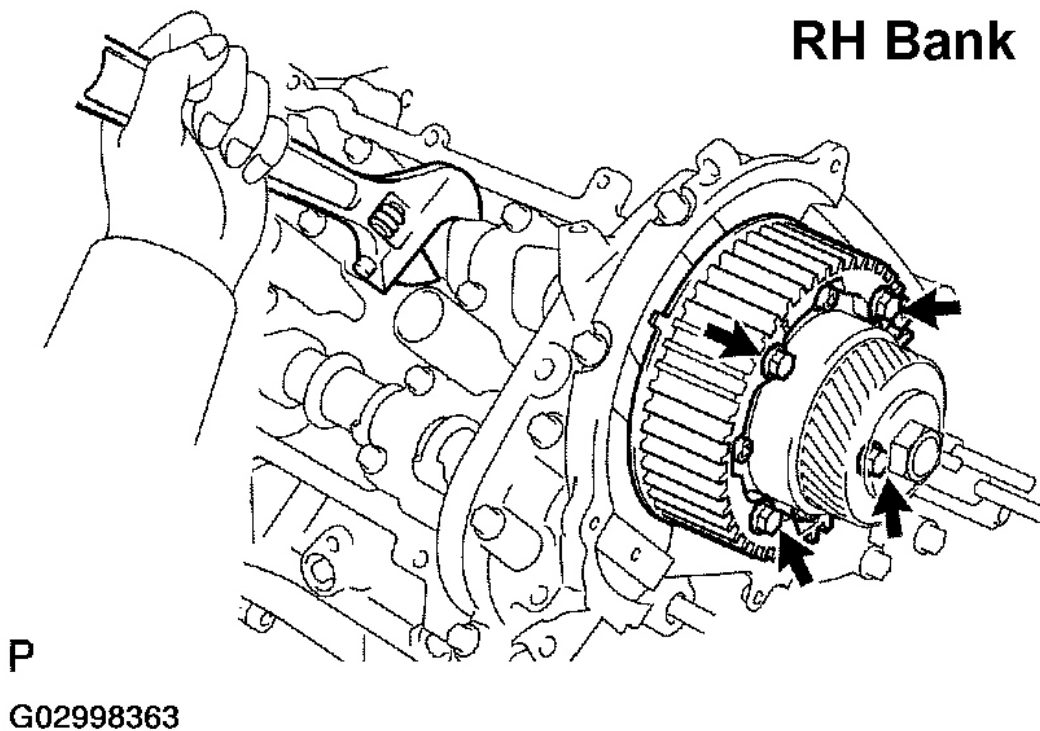
SST 09950-50013 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05010)

**NOTE:**        **Do not turn the timing pulley.**



**Fig. 96: Removing Crankshaft Timing Pulley Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **REMOVE CAMSHAFT TIMING PULLEY**
  - a. Remove the 4 bolts and timing pulley.

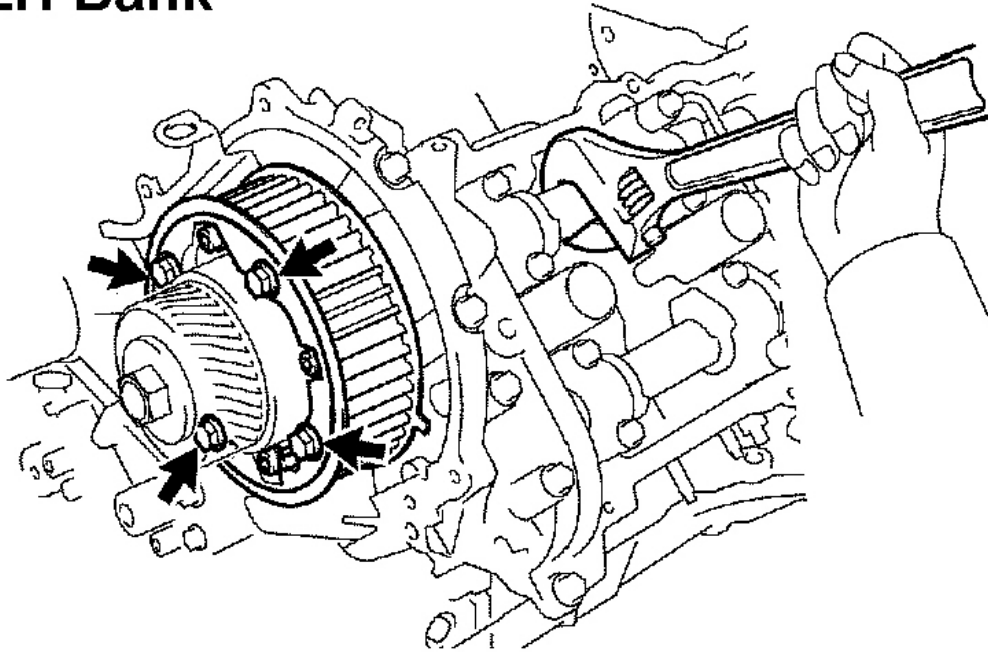


**Fig. 97: Removing Camshaft Timing Pulley Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. **REMOVE CAMSHAFT TIMING PULLEY SUB-ASSY LH**
  - a. Remove the 4 bolts and timing pulley.
24. **REMOVE CAMSHAFT**

**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

# LH Bank



**P**

**G02998364**

**Fig. 98: Removing Bolts And Timing Pulley**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Remove the camshafts of the RH bank.
  1. Bring the service bolt hole of the sub gear upward by turning the hexagon wrench head portion of the No. 2 camshaft with a wrench.
  2. Secure the sub gear to the main gear with a service bolt.

### **RECOMMENDED SERVICE BOLT:**

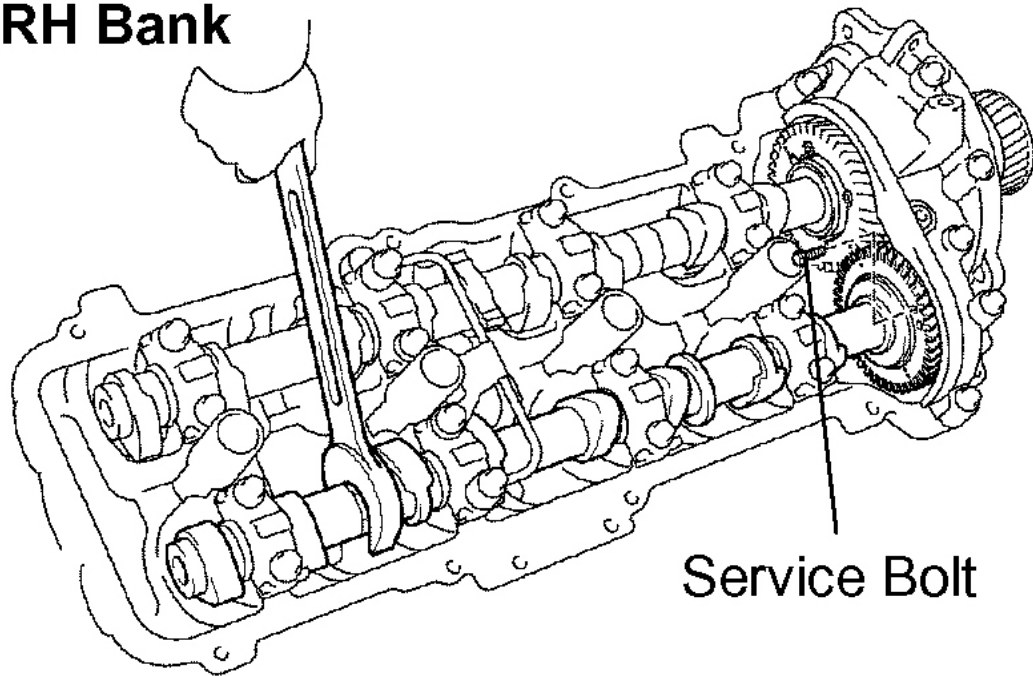
#### **RECOMMENDED SERVICE BOLT**

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 to 20 mm (0.63 to 0.79 in.)

#### **HINT:**

When removing the camshafts, make sure that the torsional spring force of the sub gear has been eliminated by the above operation.

**RH Bank**



**Service Bolt**

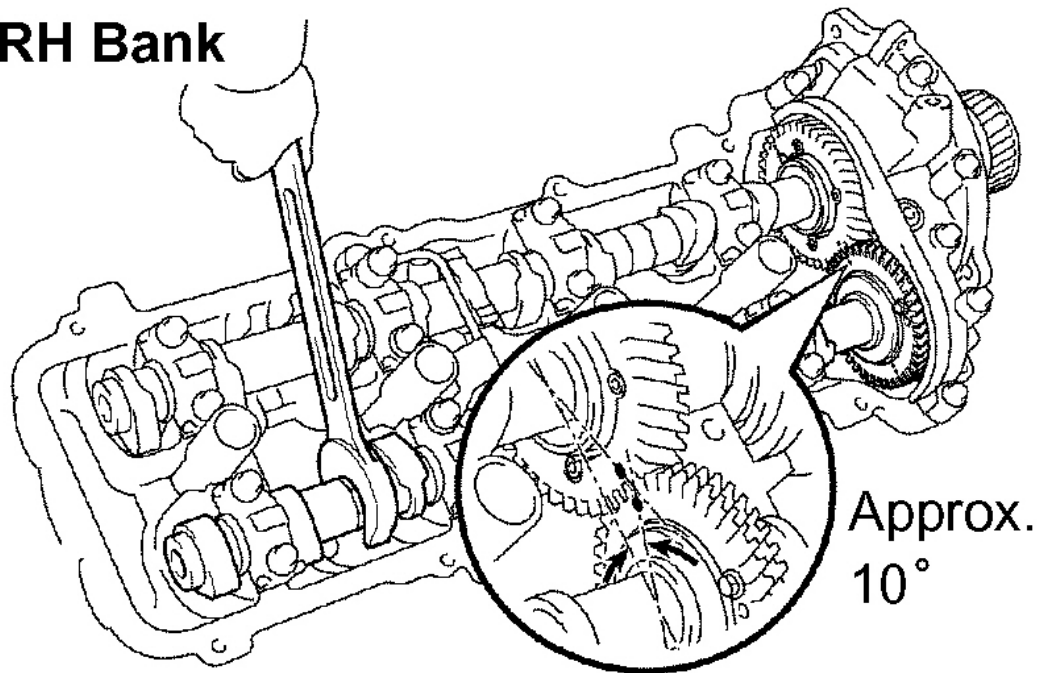
**G02998365**

**Fig. 99: Removing Camshafts Of RH Bank**

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

3. Set the timing mark (1 dot mark) of the camshaft main gear at approximately 10° angle by turning the hexagon wrench head portion of the No. 2 camshaft with a wrench.

**RH Bank**



**G02998366**

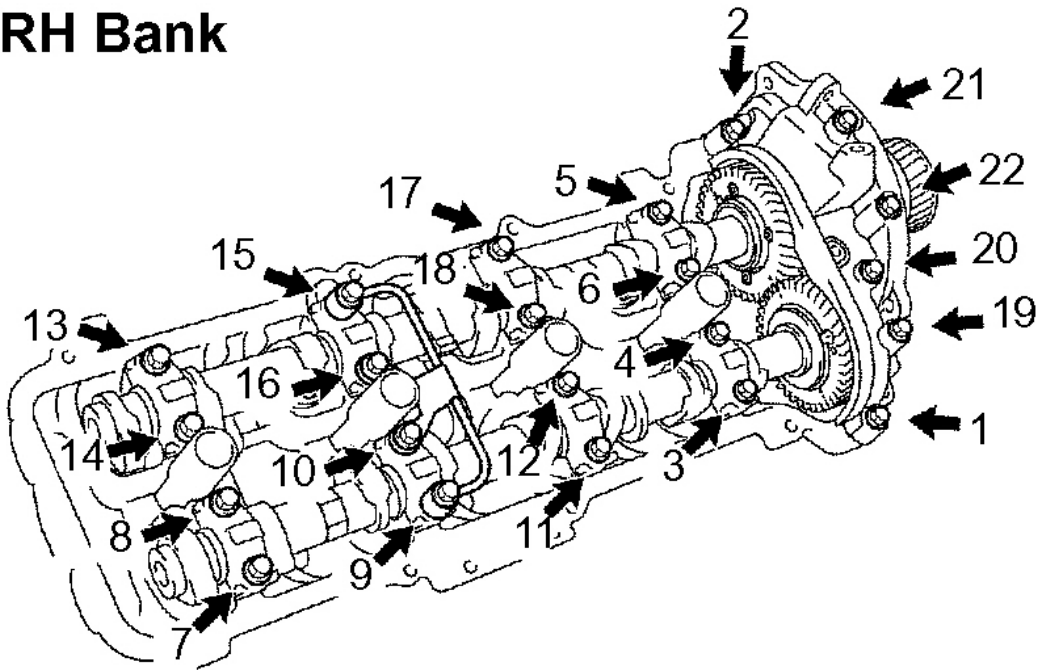
**Fig. 100: Setting Timing Mark Of Camshaft Main Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Uniformly loosen the 22 bearing cap bolts in several passes in the sequence shown in the illustration.
5. Remove the 22 bearing cap bolts, 4 seal washers, oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter and 2 camshafts.

**25. REMOVE NO.3 CAMSHAFT SUB-ASSY**

**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

## RH Bank



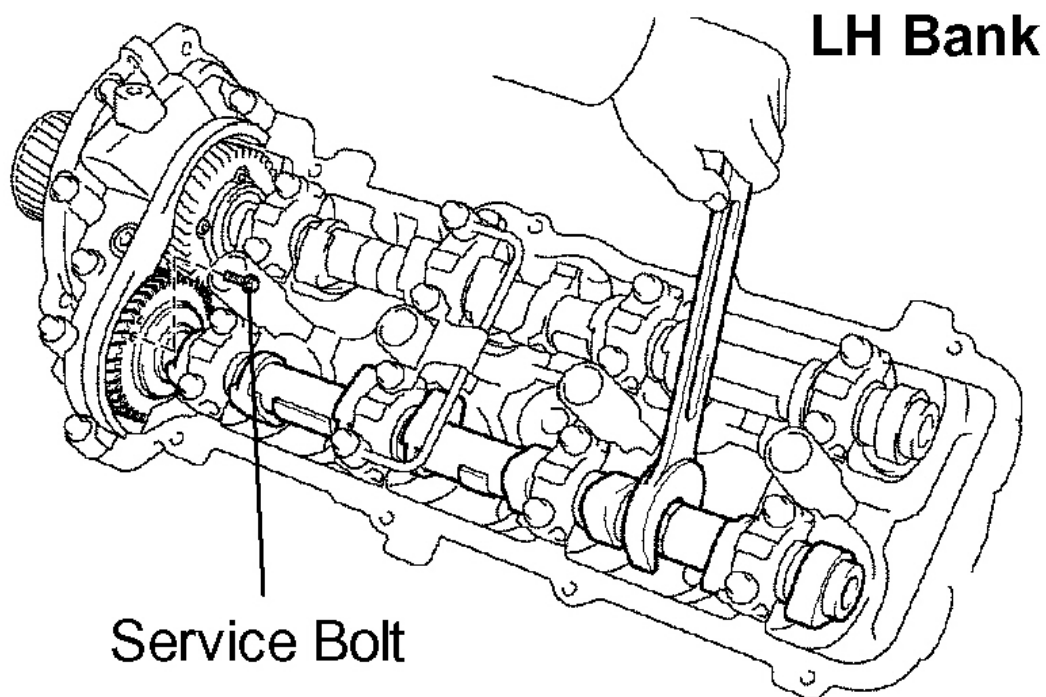
G02998367

### **Fig. 101: Removing Bearing Cap Bolts**

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

- a. Remove the camshafts of the LH bank.
1. Boring the service bolt hole of the sub gear upward by turning the hexagon wrench head portion of the No. 4 camshaft with a wrench.
2. Secure the sub gear to the main gear with a service bolt.





G02998368

**Fig. 102: Removing Camshafts Of LH Bank**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**RECOMMENDED SERVICE BOLT:**

**RECOMMENDED SERVICE BOLT**

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 to 20 mm (0.63 to 0.79 in.)

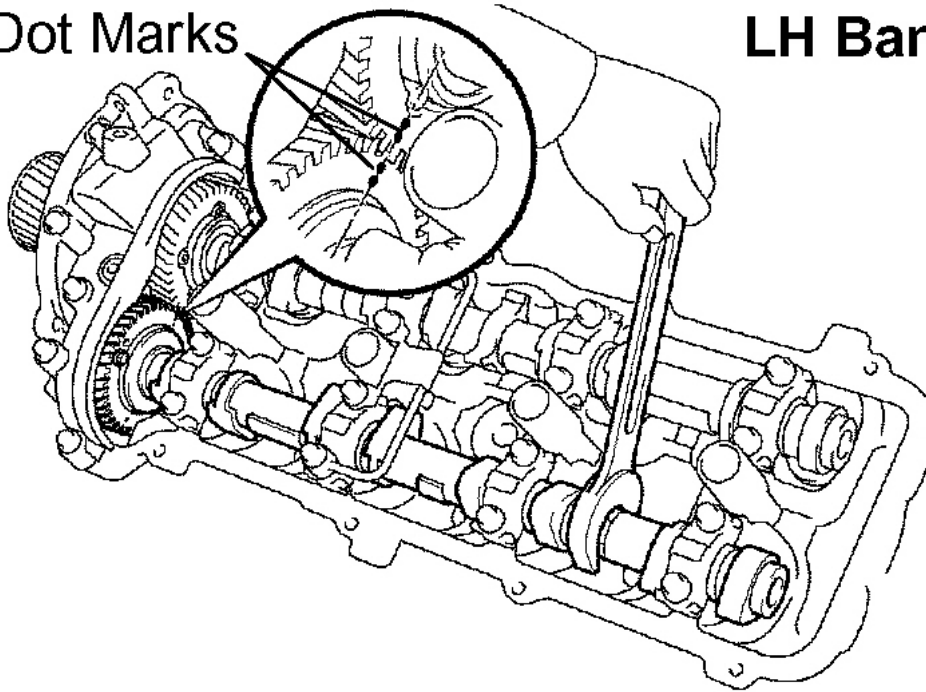
**HINT:**

When removing the camshaft, make sure that the torsional spring force of the sub gear has been eliminated by the above operation.

- Align the timing mark (2 dot marks) of the camshaft drive gear by turning the hexagon wrench head portion of the No. 4 camshaft with a wrench.

2 Dot Marks

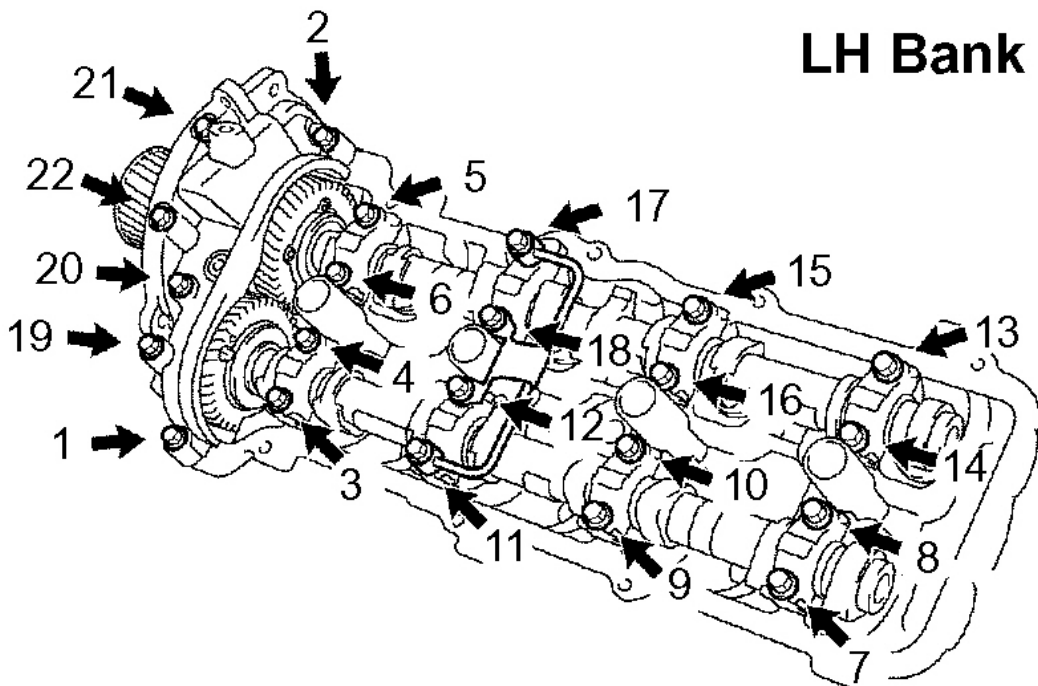
LH Bank



G02998369

**Fig. 103: Aligning Timing Mark Of Camshaft Drive Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Uniformly loosen the 22 bearing cap bolts in several passes in the sequence shown in the illustration.
5. Remove the 22 bearing cap bolts, 4 seal washers, oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter and 2 camshafts.

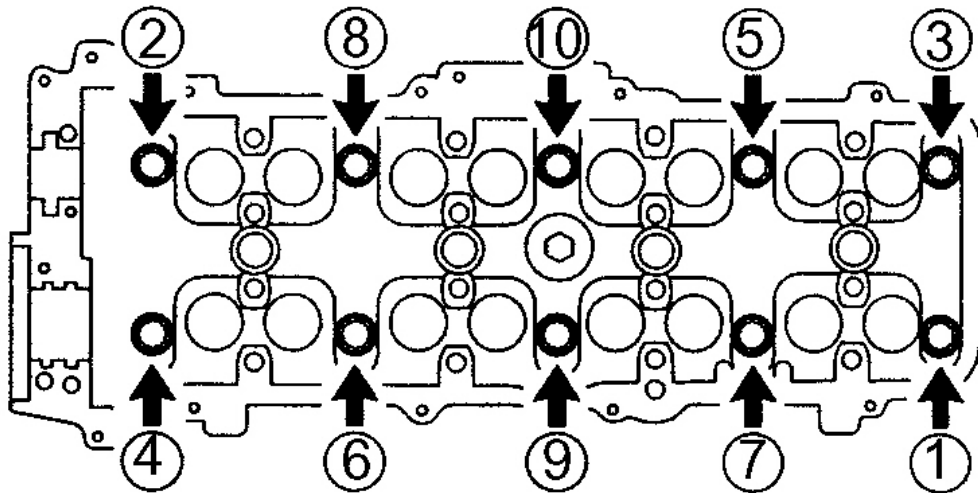


G02998370

**Fig. 104: Removing Bearing Cap Bolts**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. **REMOVE SEMICIRCULAR PLUG**
27. **REMOVE TIMING BELT PLATE RR RH NO.2**
  - a. Remove the 2 bolts and timing belt plate.
28. **REMOVE TIMING BELT PLATE RR RH**
  - a. Remove the bolt, stud bolt and timing belt plate.
29. **REMOVE TIMING BELT PLATE RR LH NO.2**
  - a. Remove the 2 bolts and timing belt plate.
30. **REMOVE TIMING BELT PLATE RR LH**
  - a. Remove the bolt and timing belt plate.
31. **REMOVE CYLINDER HEAD SUB-ASSY**
  - a. Uniformly loosen the 10 cylinder head bolts on one side of each cylinder head in several passes in the sequence shown in the illustration.

# RH Bank



G02998371

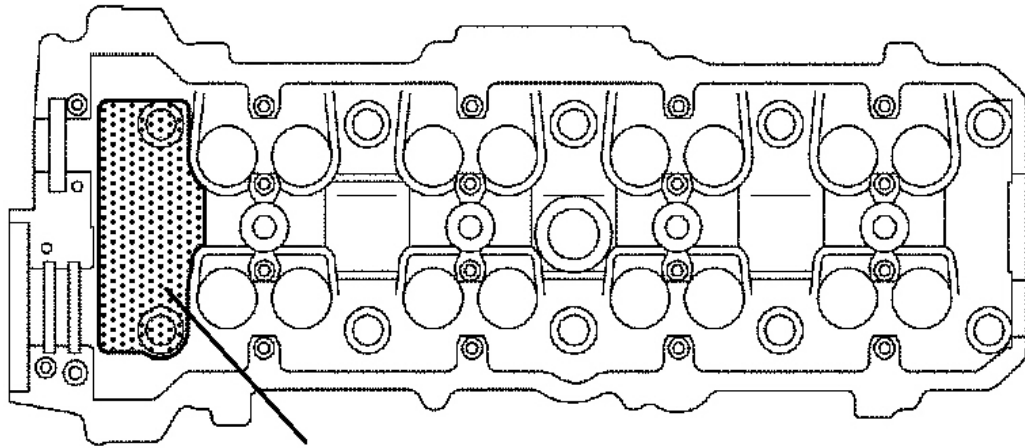
## Fig. 105: Removing Cylinder Head Bolts

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

### NOTE:

- Cylinder head warpage or cracking could result from removing bolts in incorrect order.
- Do not drop the plate washer for the cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.

# RH Bank



Portion A

G02998372

**Fig. 106: Identifying Cylinder Head Bolt Into Portion A**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

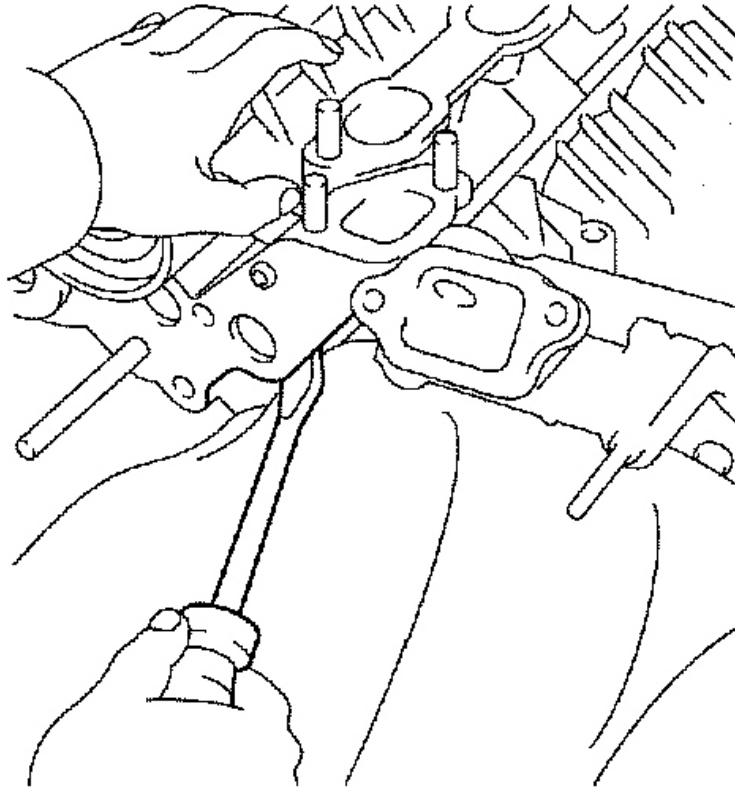
- b. Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

HINT:

If the cylinder head cannot be removed, pry between the cylinder head and cylinder block with a screwdriver.

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

## RH Bank



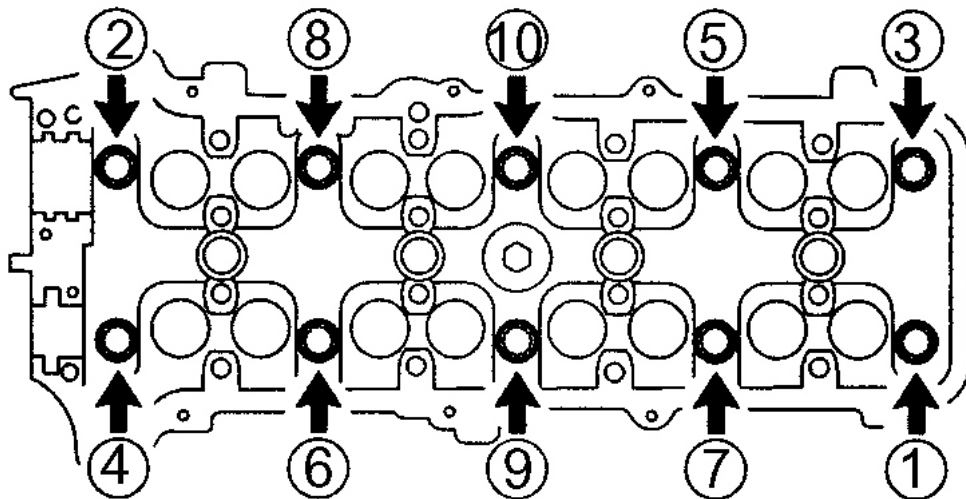
G02998373

**Fig. 107: Lifting Cylinder Head From Dowels**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 32. REMOVE CYLINDER HEAD LH

- a. Uniformly loosen the 10 cylinder head bolts on one side of each cylinder head in several passes in the sequence shown in the illustration.

# LH Bank



G02998374

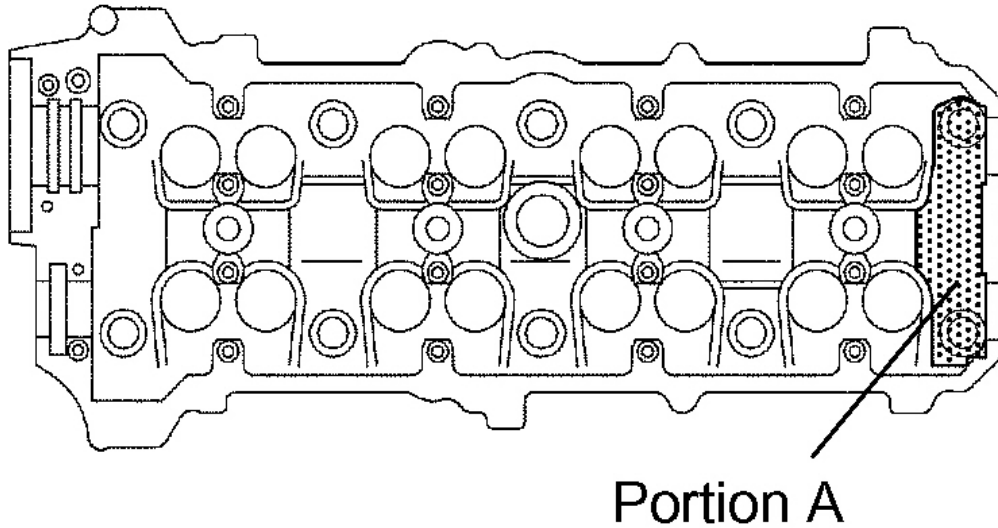
**Fig. 108: Identifying Cylinder Head LH**

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

**NOTE:**

- Cylinder head warpage or cracking could result from removing bolts in incorrect order.
- Do not drop the plate washer for the cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.

# LH Bank



G02998375

**Fig. 109: Identifying Cylinder Head Bolt Into Portion A**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Lift the cylinder head from the dowels on the cylinder block, and place the cylinder head on wooden blocks on a bench.

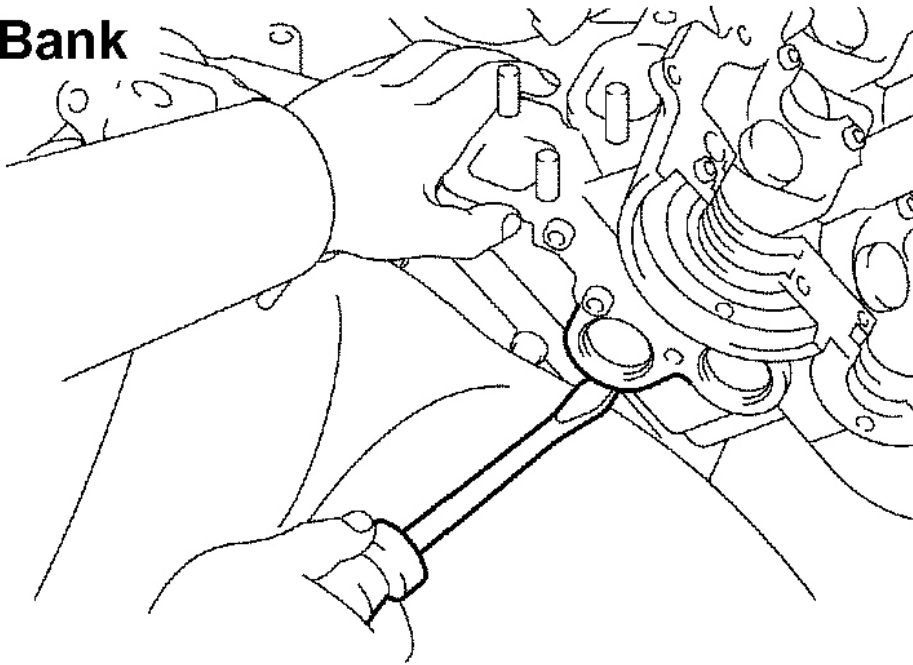
## HINT:

If the cylinder head cannot be removed, pry between the cylinder head and cylinder block with a screwdriver.

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



**LH Bank**

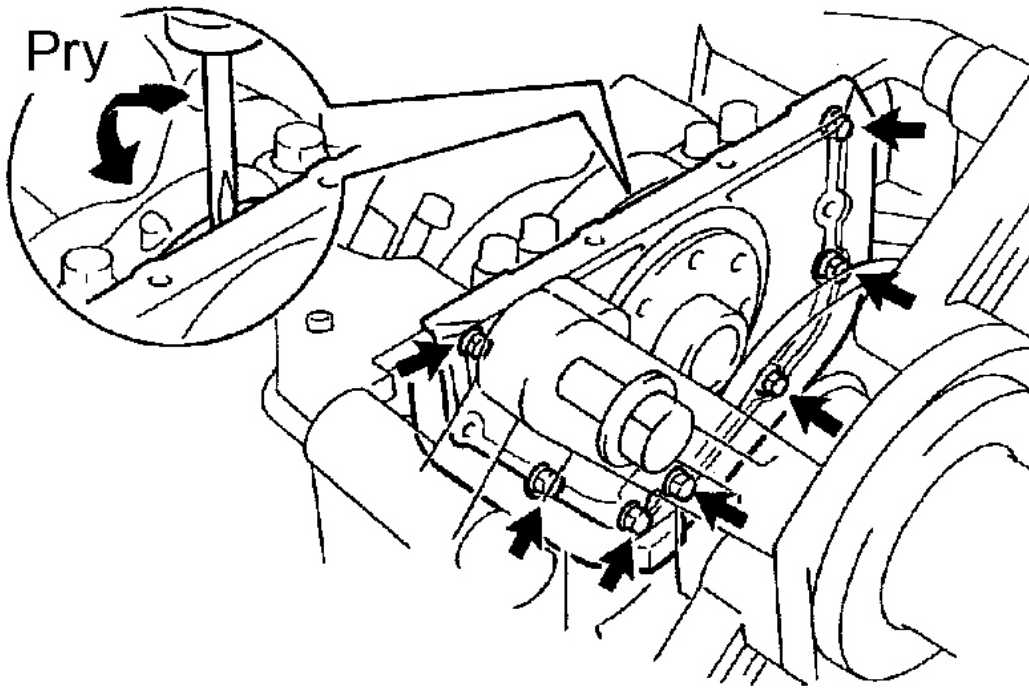


**P**

**G02998376**

**Fig. 110: Lifting Cylinder Head From Dowels**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **REMOVE WATER PUMP ASSY**
  - a. Remove the 5 bolts, 2 stud bolts and nut, water pump and gasket.
34. **REMOVE OIL PAN SUB-ASSY NO.2 (See REPLACEMENT )**
35. **REMOVE OIL PAN BAFFLE PLATE**
  - a. Remove the 3 bolts, 2 nuts and baffle plate.
36. **REMOVE OIL PAN SUB-ASSY (See REPLACEMENT )**
37. **REMOVE OIL STRAINER SUB-ASSY**
  - a. Remove the bolt, 2 nuts, oil strainer and gasket.
38. **REMOVE OIL PUMP ASSY (See REPLACEMENT )**
39. **REMOVE ENGINE REAR OIL SEAL RETAINER**
  - a. Remove the 7 bolts.
  - b. Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and crankshaft bearing cap.
  - c. Remove the O-ring.



G02998377

**Fig. 111: Removing Engine Rear Oil Seal Retainer Using Screwdriver**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

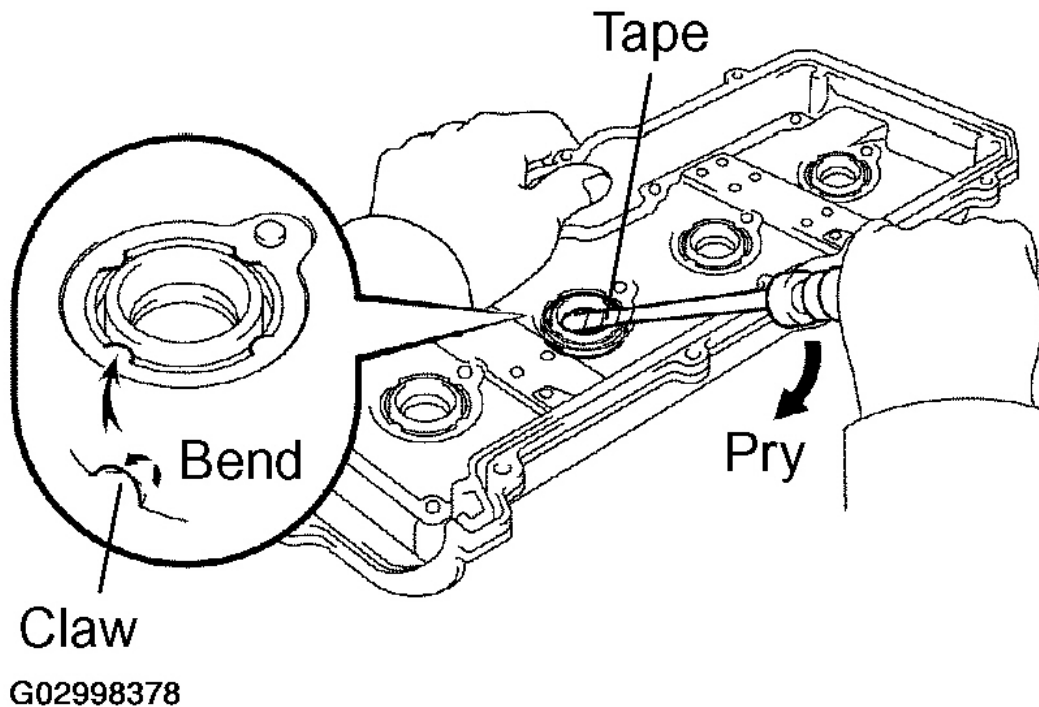
**40. REMOVE SPARK PLUG TUBE GASKET**

- a. Bend the 4 ventilation case claws installed on the cylinder head cover to an angle of 90° or more.
- b. Using a screwdriver, pry out the gasket.

**HINT:**

Tape the screwdriver tip before use.

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



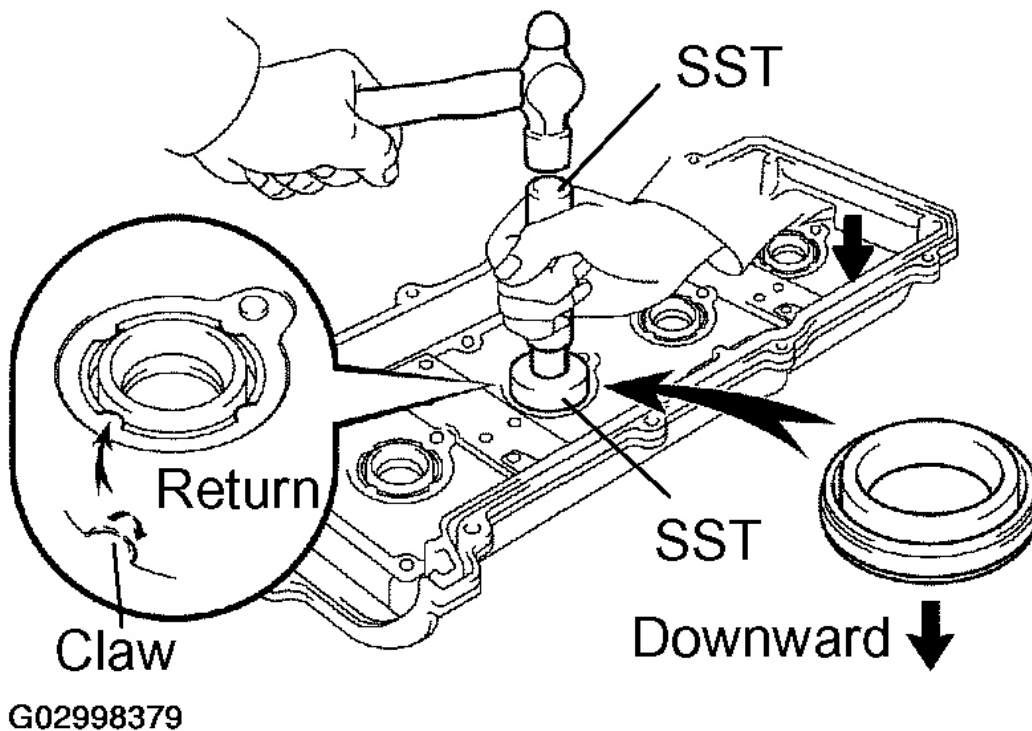
**Fig. 112: Prying Out Gasket Using Screwdriver**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 41. INSTALL SPARK PLUG TUBE GASKET

- a. Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.  
SST 09950-60010, 09950-70010 (09951-00240, 09951-00440, 09951-07100, 09952-06010)

**NOTE:** Be careful of the installation direction.

- b. Apply a light coat of MP grease to the gasket lip.
- c. Return the 4 ventilation case claws to its original position.



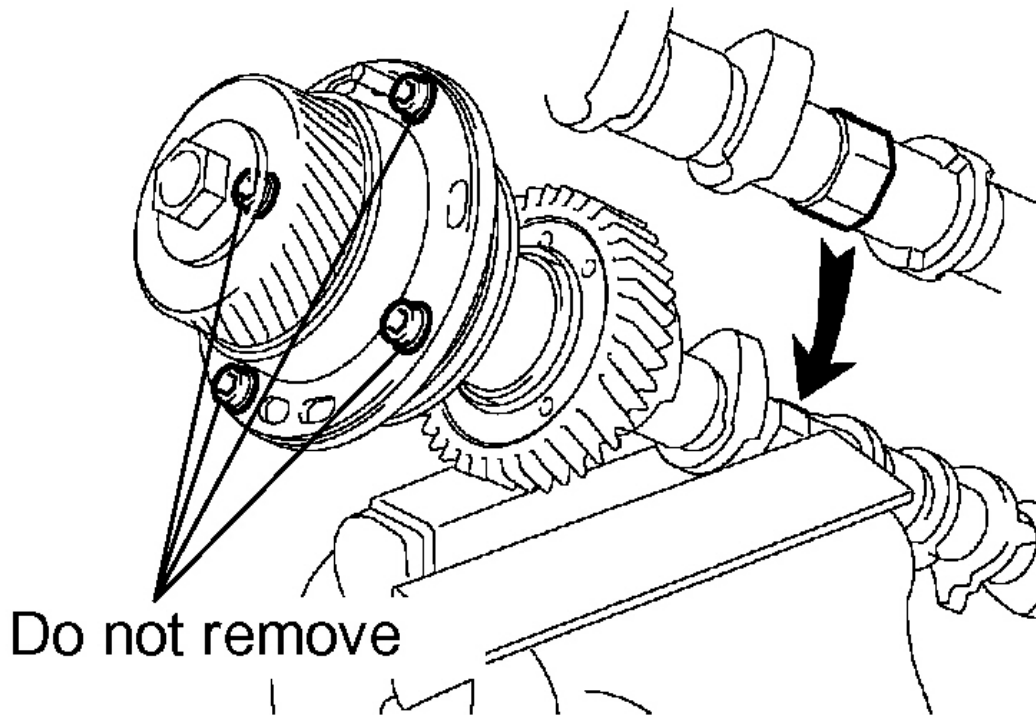
**Fig. 113: Installing Spark Plug Tube Gasket Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**42. REMOVE CAMSHAFT TIMING TUBE ASSY**

- a. Mount the hexagon wrench head portion of the camshaft in a vise.

**NOTE:**

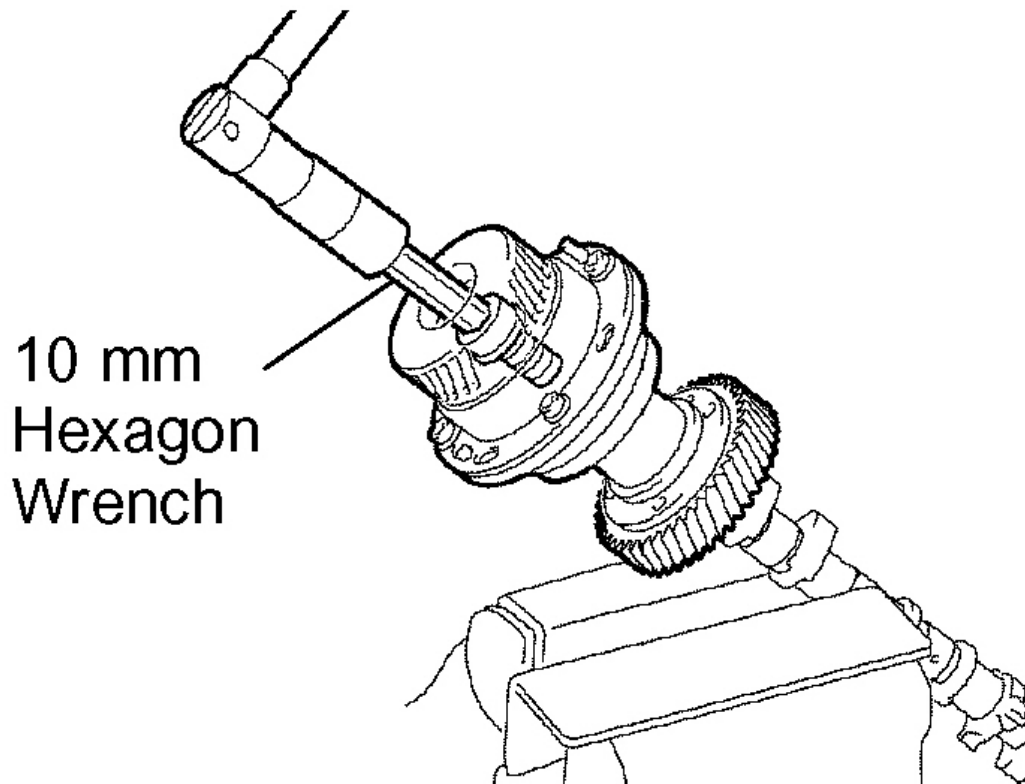
- Be careful not to damage the camshaft.
- Do not remove the 4 bolts shown in the illustration. The bolts determine the backlash of the gear in the timing tube. If any of the bolts are removed, install a new timing tube assembly.



G02998380

**Fig. 114: Removing Camshaft Timing Tube Assy Using Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the screw plug and seal washer.
- c. Using a 10 mm hexagon wrench, and remove the bolt.
- d. Pull out the timing tube and drive gear assembly from the camshaft.



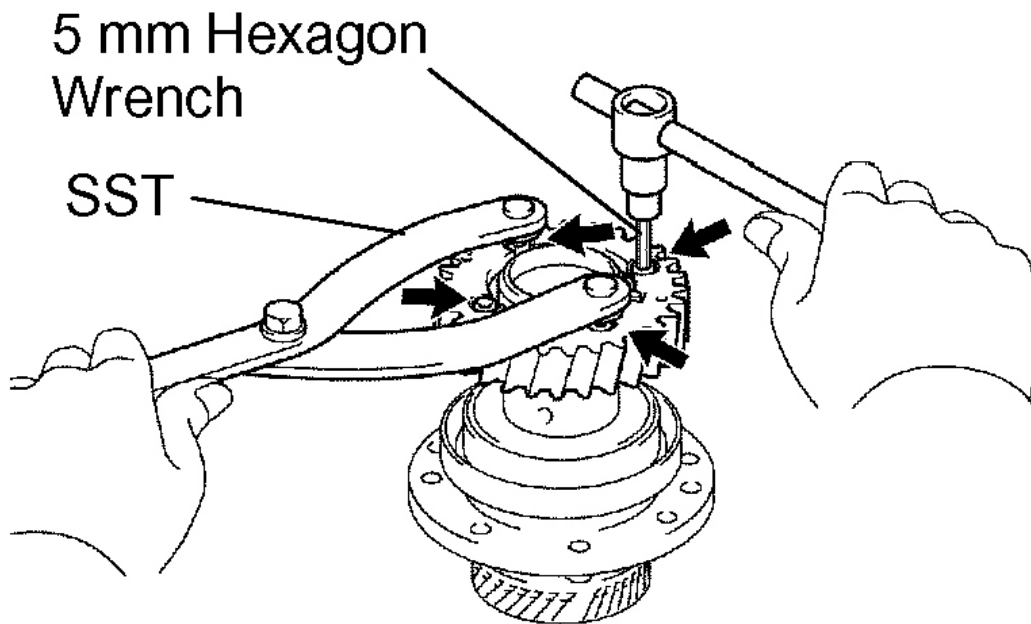
G02998381

**Fig. 115: Removing Bolts Using SST**

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

- e. Using SST and a 5 mm hexagon wrench, remove the 4 bolts, drive gear and oil seal.  
SST 09960-10010 (09962-01000, 09963-00500)

**NOTE:** Be careful not to damage the timing tube.

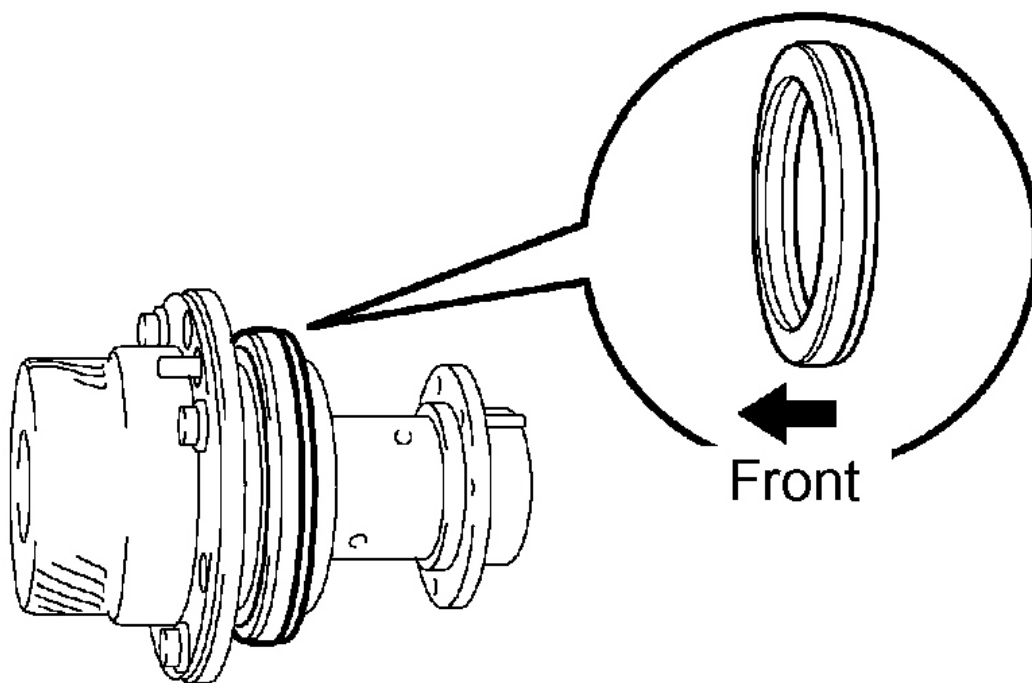


G02998382

**Fig. 116: Removing Bolts And Drive Gear And Oil Seal Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **INSTALL CAMSHAFT SETTING OIL SEAL**
  - a. Place a new oil seal onto the timing tube.

**NOTE:** Be careful of the installation direction.



**G02998383**

**Fig. 117: Placing Oil Seal Onto Timing Tube**

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

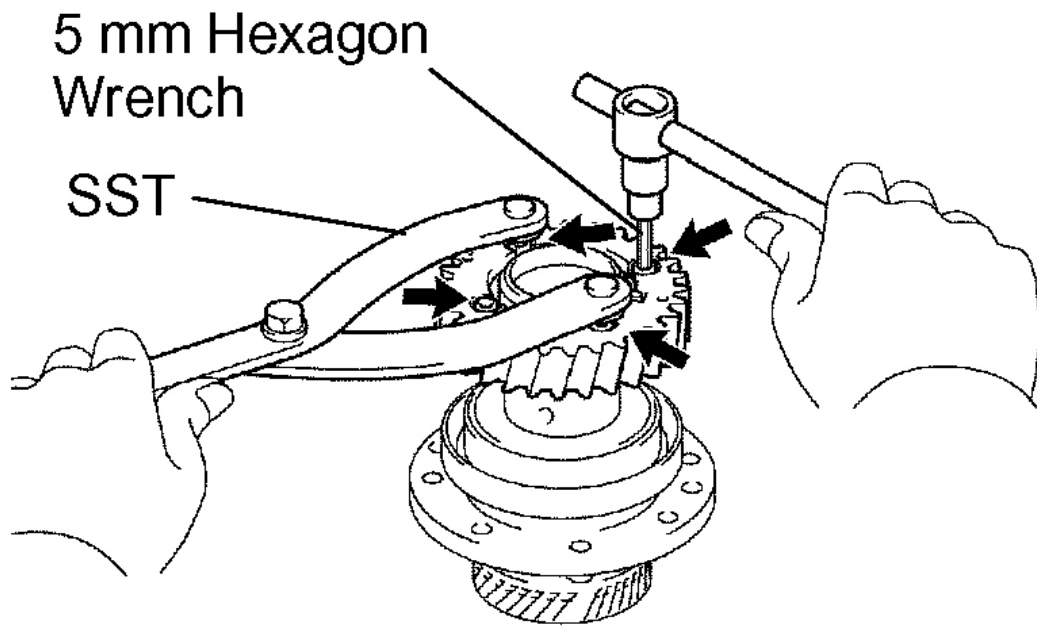
**44. INSTALL CAMSHAFT TIMING TUBE ASSY**

- a. Align the timing tube knock pin with the knock pin groove of the drive gear, and temporarily install the drive gear with the 4 bolts.
- b. Using SST and a 5 mm hexagon wrench, uniformly tighten the 4 bolts in several passes.  
SST 09960-10010 (09962-01000, 09963-00500)

**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**

**NOTE: Be careful not to damage the timing tube.**



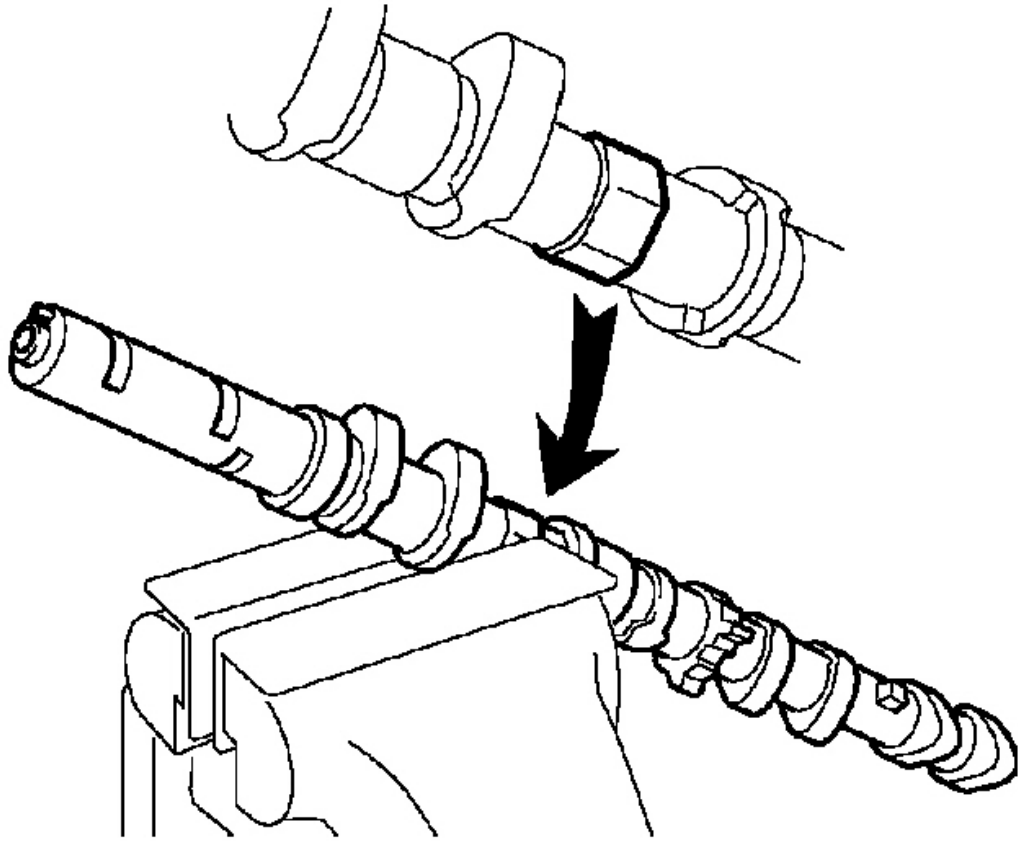


G02998384

**Fig. 118: Aligning Timing Tube Knock Pin Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mount the hexagon wrench head portion of the camshaft in a vise.

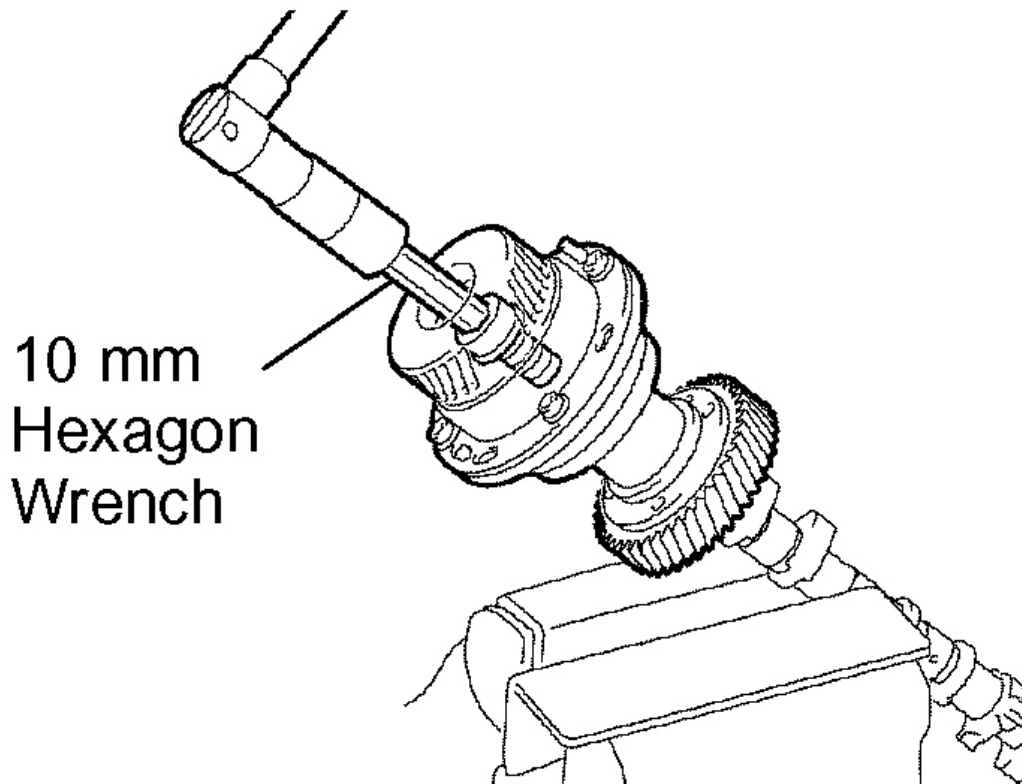
**NOTE:** Be careful not to damage the camshaft.



**G02998385**

**Fig. 119: Mounting Hexagon Wrench Head Portion Of Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the camshaft knock pin with the knock pin groove of the timing tube, and push the timing tube by hand until it touches the bottom.
- e. Using a 10 mm hexagon wrench, install the bolt.  
**Torque: 78 N.m (795 kgf.cm, 58 ft.lbf)**
- f. Install the seal washer and screw plug.  
**Torque: 15 N.m (153 kgf.cm, 11 ft.lbf)**



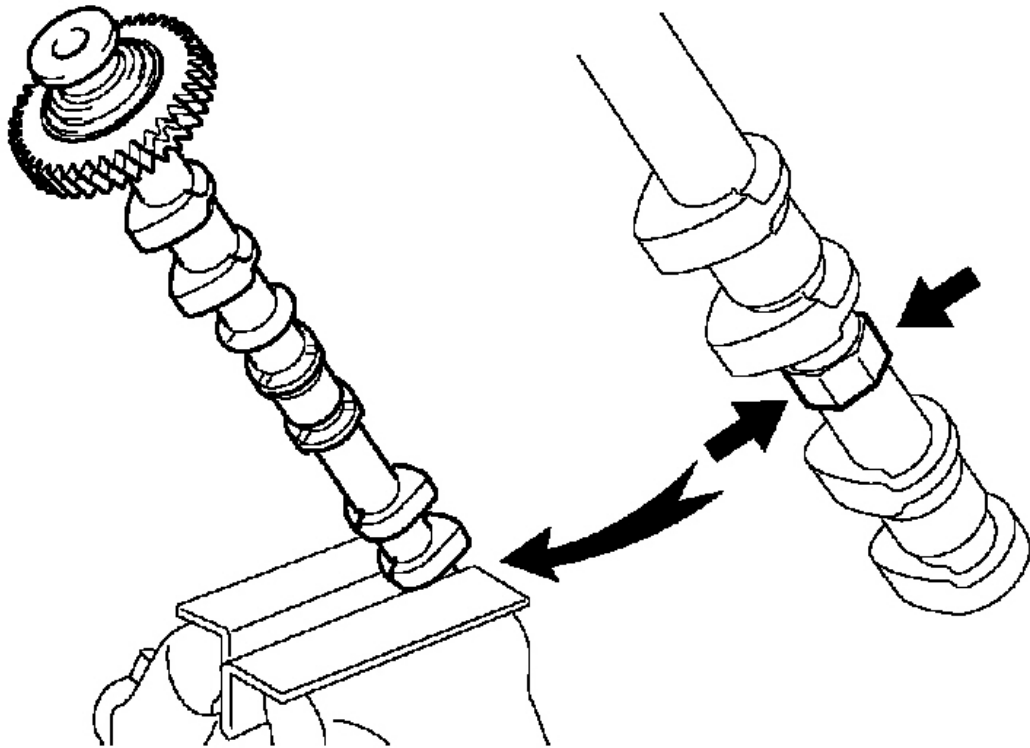
G02998386

**Fig. 120: Installing Bolts Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**45. REMOVE CAMSHAFT SUB GEAR**

- a. Mount the hexagon wrench head portion of the camshaft in a vise.

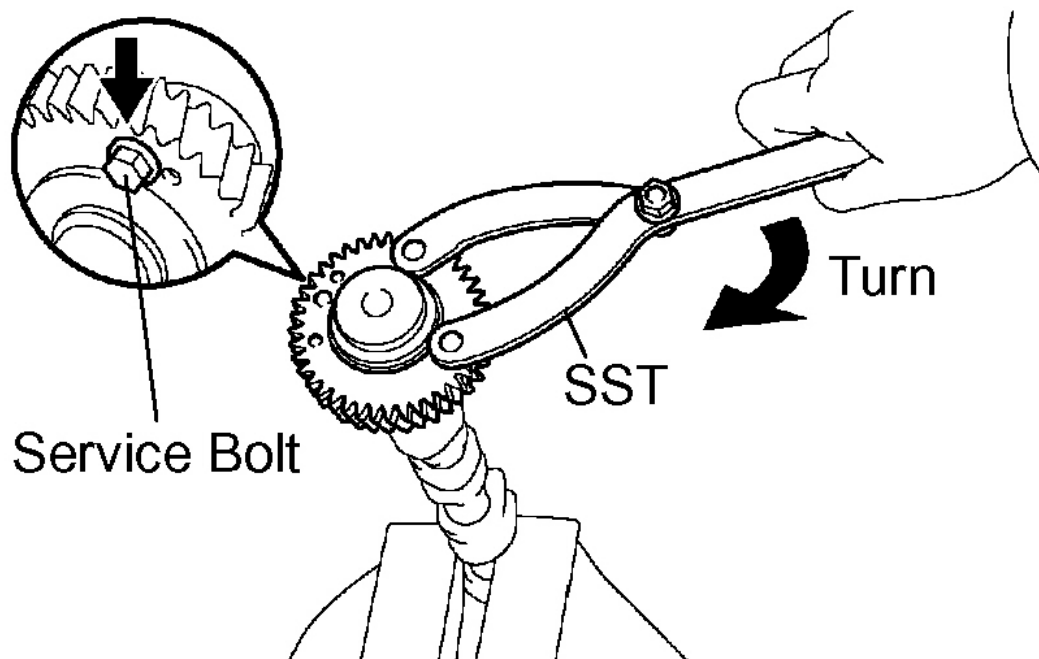
**NOTE:** Be careful not to damage the camshaft.



G02998387

**Fig. 121: Mounting Hexagon Wrench Head Portion Of Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, turn the sub gear clockwise and remove the service bolt.  
SST 09960-10010 (09962-01000, 09963-00500)



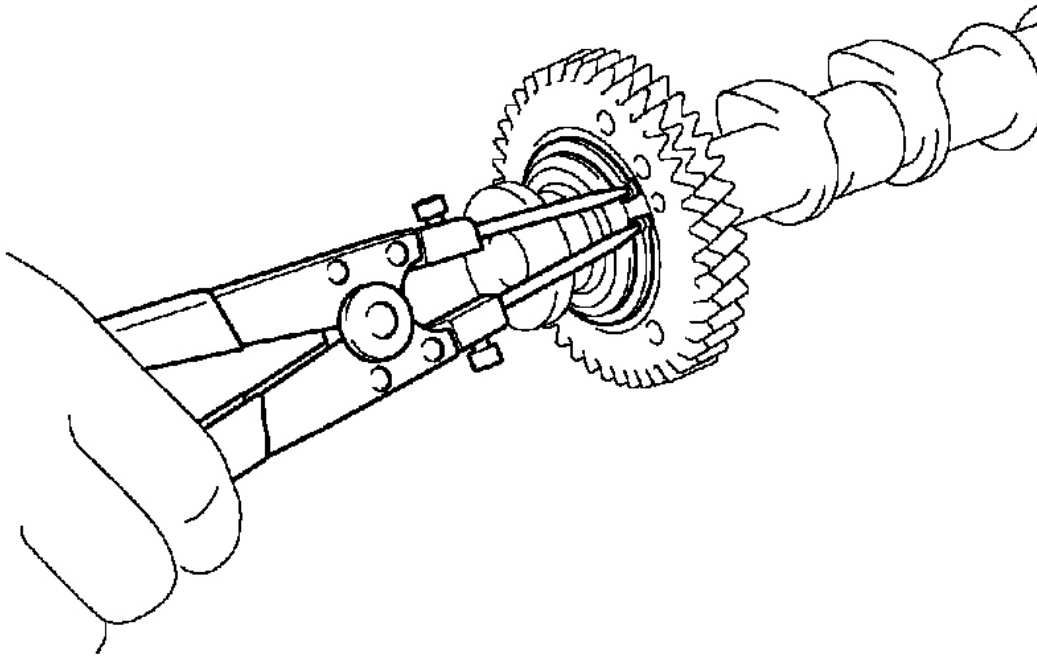
G02998388

**Fig. 122: Removing Service Bolt Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using snap ring plier, remove the snap ring.
- d. Remove the wave washer, sub gear and bolt washer.

HINT:

Arrange the driven sub gears and bolt washers (RH and LH sides).



**G02998389**

**Fig. 123: Removing Snap Ring Using Snap Ring Plier**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

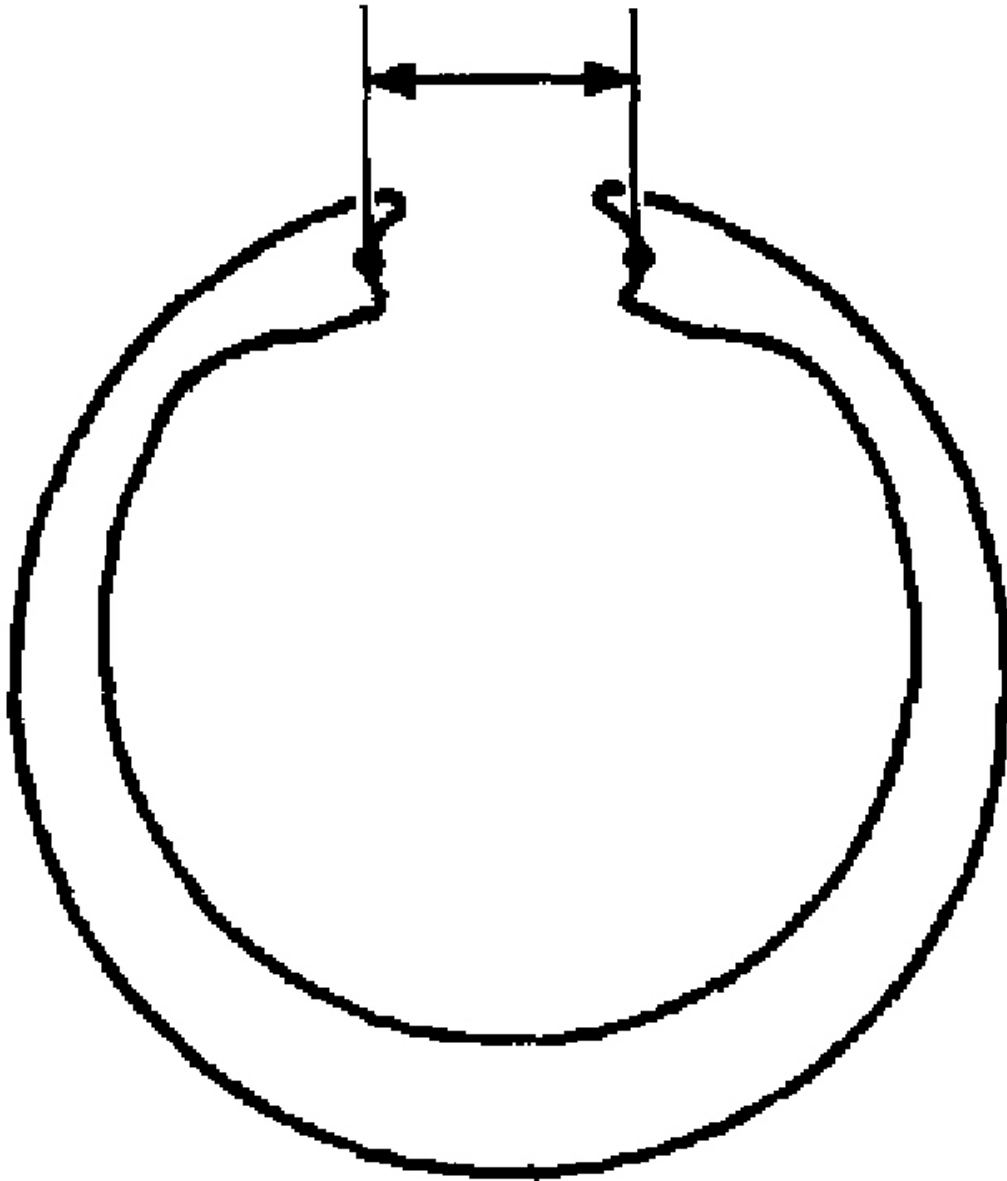
**46. INSPECT CAMSHAFT TIMING GEAR BOLT WASHER**

- a. Using a vernier caliper, measure the gap between the washer ends.

**Gap: 18.2 to 18.8 mm (0.712 to 0.740 in.)**

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

18.2 to 18.8 mm



G02998390

Fig. 124: Measuring Gap Between Washer Ends Using Vernier Caliper

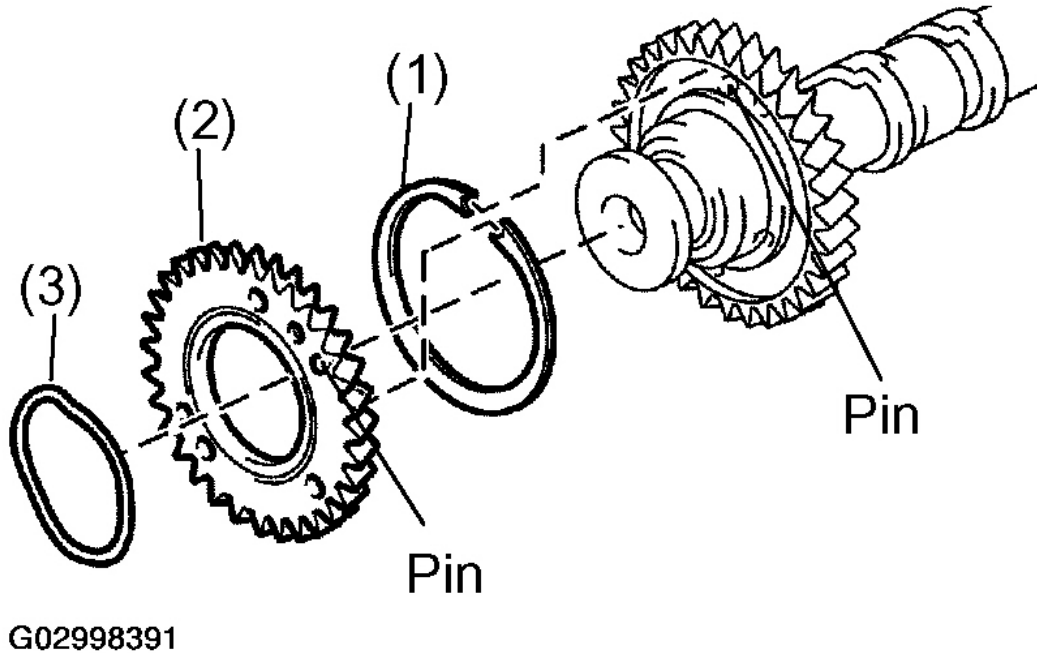
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. **INSTALL CAMSHAFT SUB GEAR**

- a. Install the bolt washer (1), sub gear (2) and wave washer (3).

HINT:

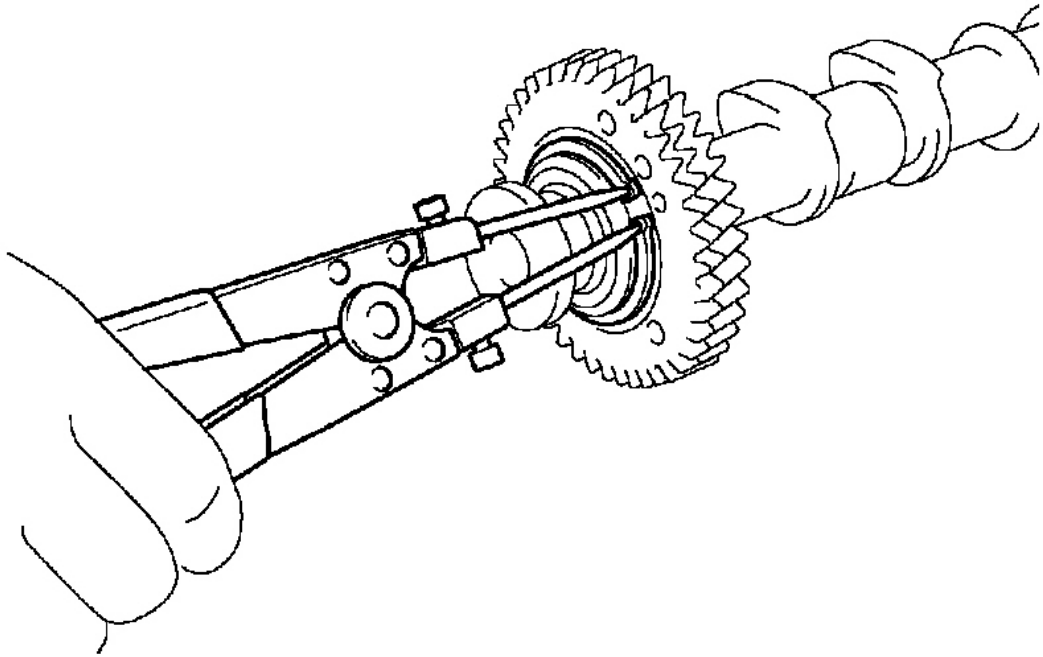
Attach the pins on the gears to the gear bolt washer ends.



**Fig. 125: Installing Camshaft Sub Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using snap ring pliers, install the snap ring.



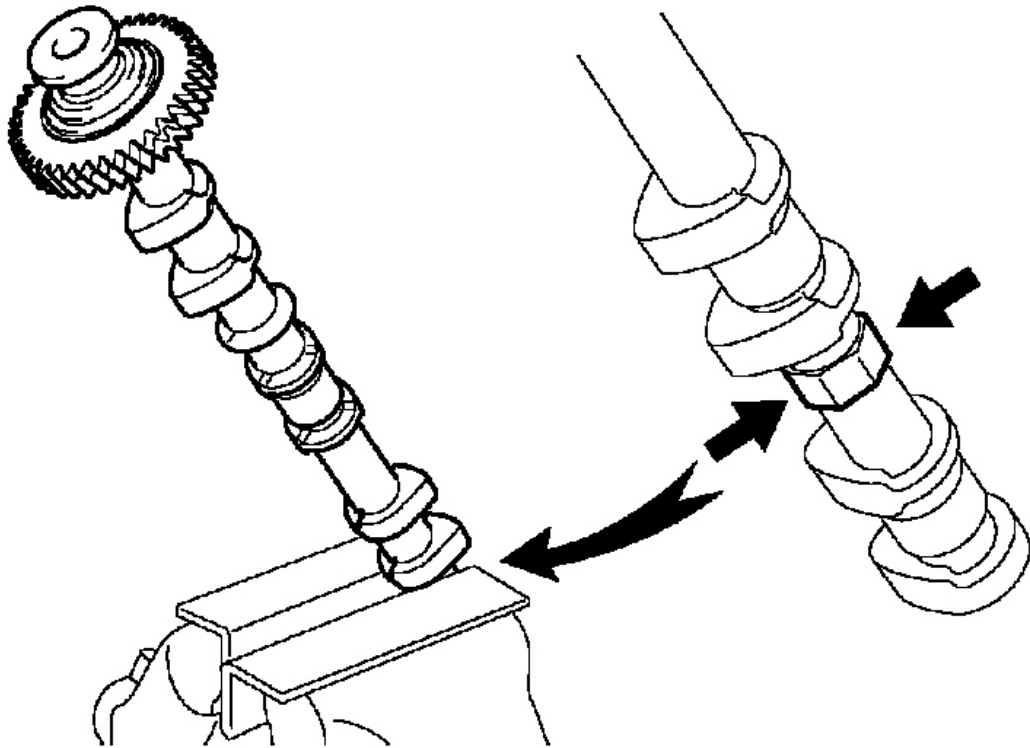


G02998392

**Fig. 126: Removing Snap Ring Using Snap Ring Pliers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mount the hexagon wrench head portion of the camshaft in a vise.

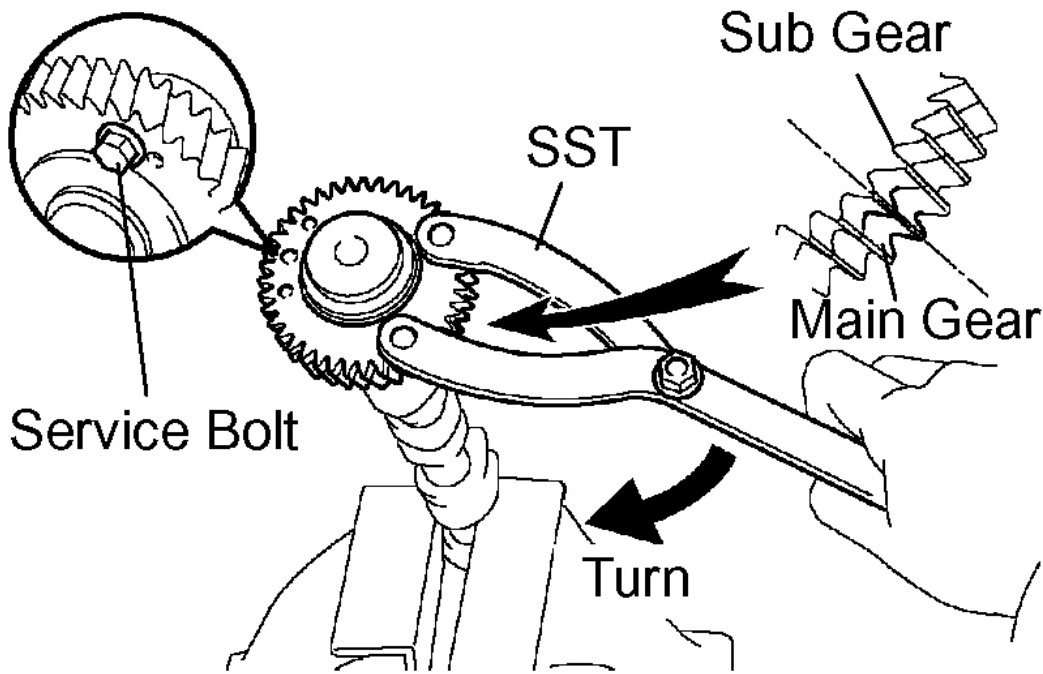
**NOTE:** Be careful not to damage the camshaft.



G02998393

**Fig. 127: Mounting Hexagon Wrench Head Portion Of Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise. Temporarily install a service bolt.  
SST 09960-10010 (09962-01000, 09963-00500)
- e. Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.



G02998394

**Fig. 128: Aligning Holes Of Driven Main Gear And Sub Gear Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

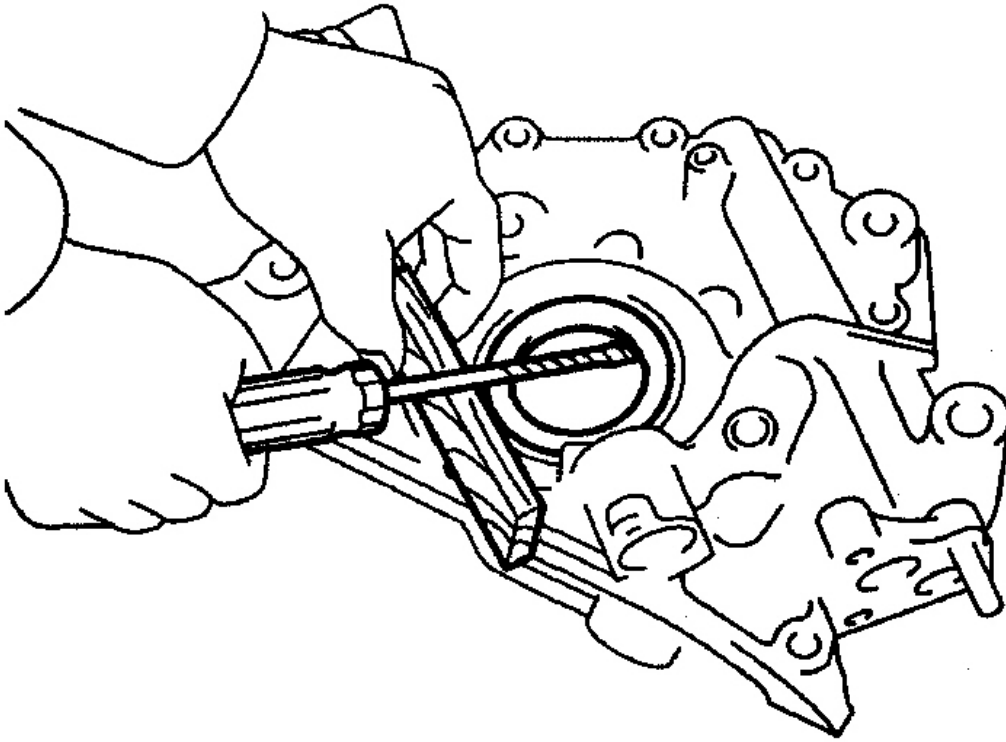
**48. REMOVE OIL PUMP SEAL**

- a. Using a screwdriver and wooden block, pry out the oil seal.

HINT:

Tape the screwdriver tip before use.

**NOTE:** Be careful not to damage the oil pump body.



G02998395

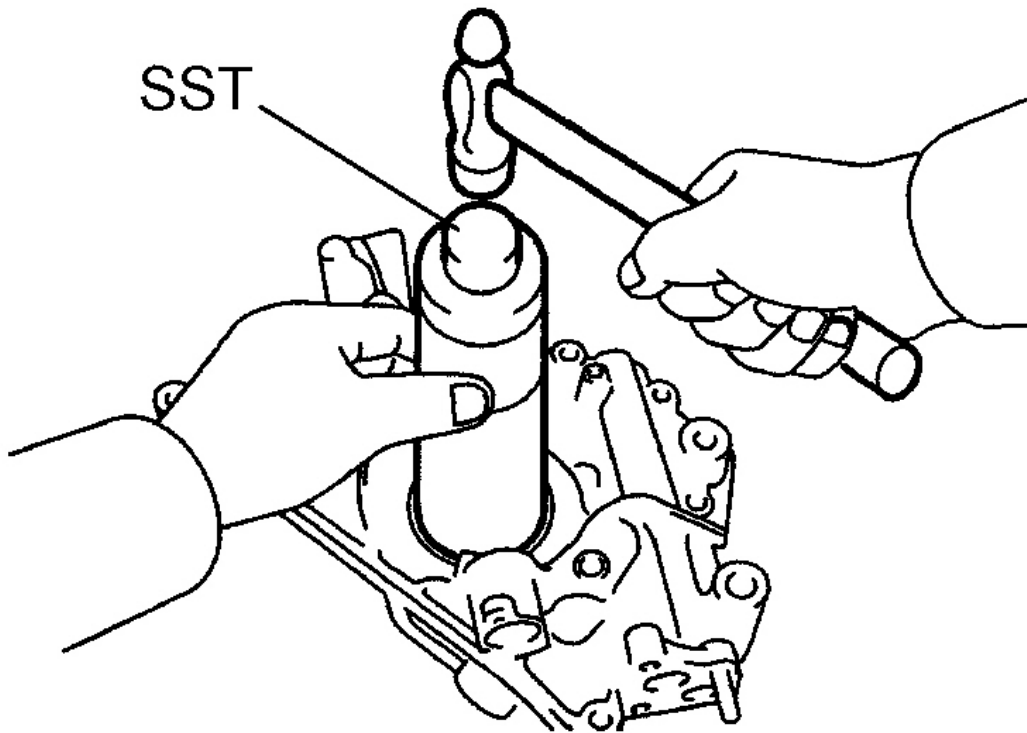
**Fig. 129: Prying Out Oil Seal Using Screwdriver**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**49. INSTALL OIL PUMP SEAL**

- a. Using SST and a hammer, tap in a new oil seal until its surface is flush with the oil pump body edge.

SST 09316-60011 (09316-00011)

- b. Apply MP grease to the oil seal lip.

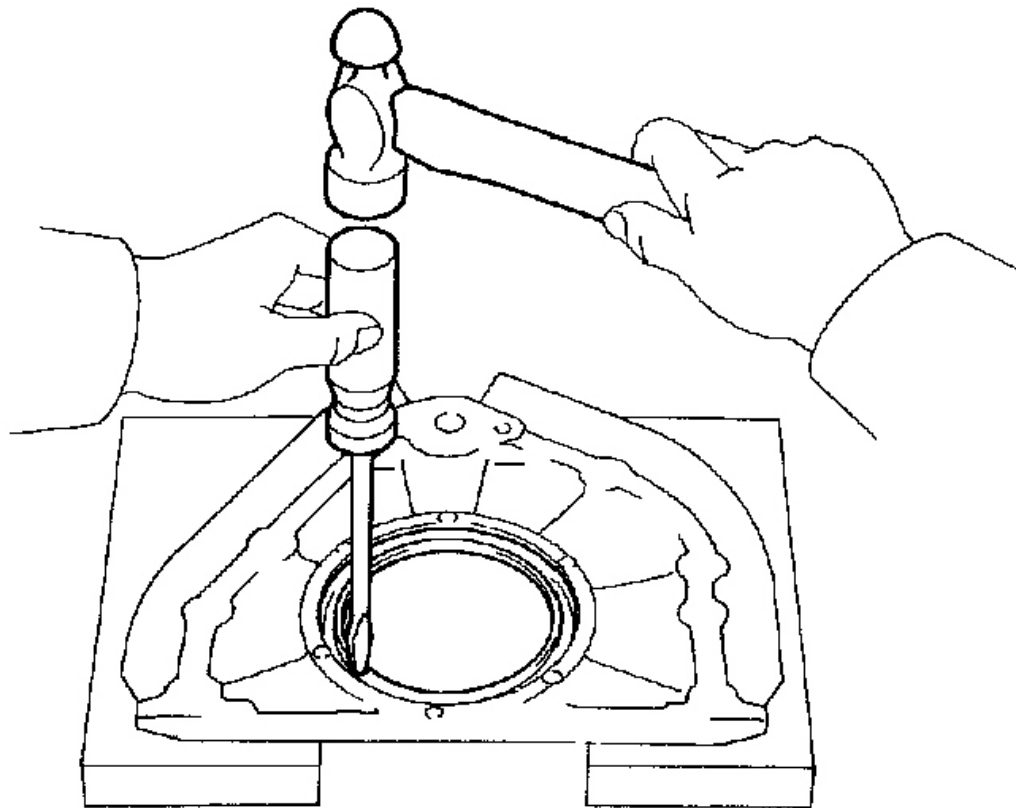


G02998396

**Fig. 130: Taping Oil Seal Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**50. REMOVE ENGINE REAR OIL SEAL**

- a. Using a screwdriver and hammer, tap out the oil seal.



G02998397

**Fig. 131: Taping Out Oil Seal Using Screwdriver And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**51. INSTALL ENGINE REAR OIL SEAL**

- a. Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.

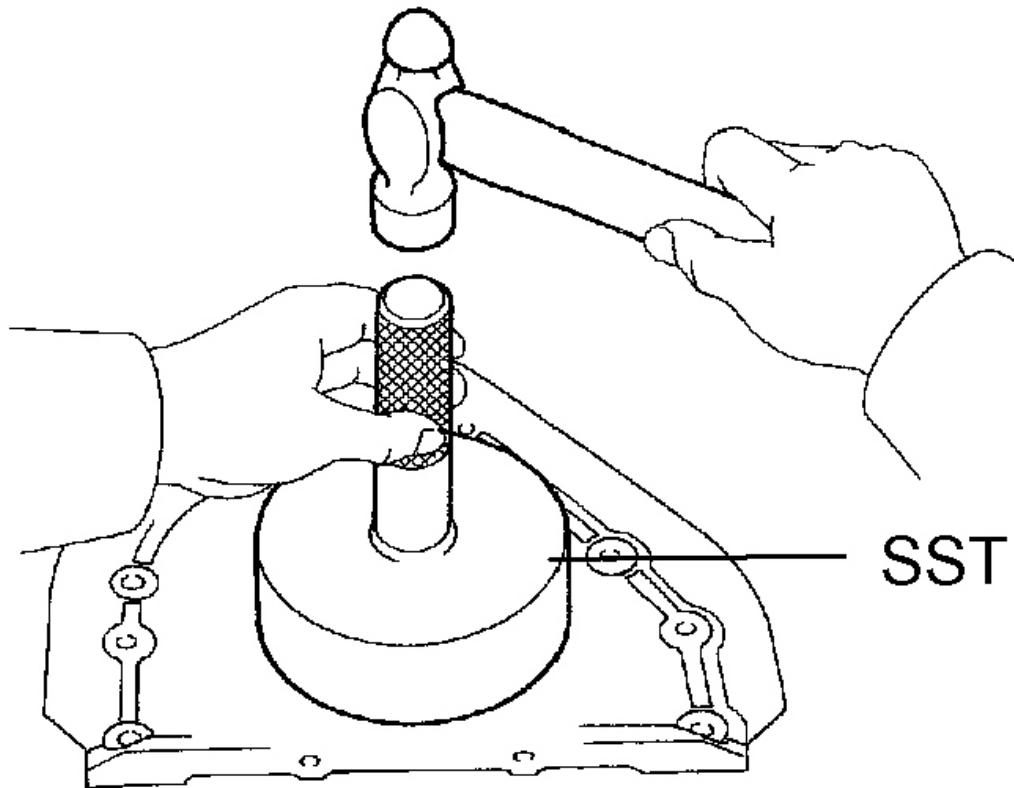
SST 09223-56010

- b. Apply MP grease to the oil seal lip.

**52. INSTALL ENGINE REAR OIL SEAL RETAINER**

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil seal retainer and cylinder block.
  1. Using a razor blade and gasket scraper, remove all the oil packing (FIPG) material from the gasket surfaces and sealing grooves.
  2. Thoroughly clean all components to remove all the loose material.

3. Using a non-residue solvent, clean both sealing surfaces.



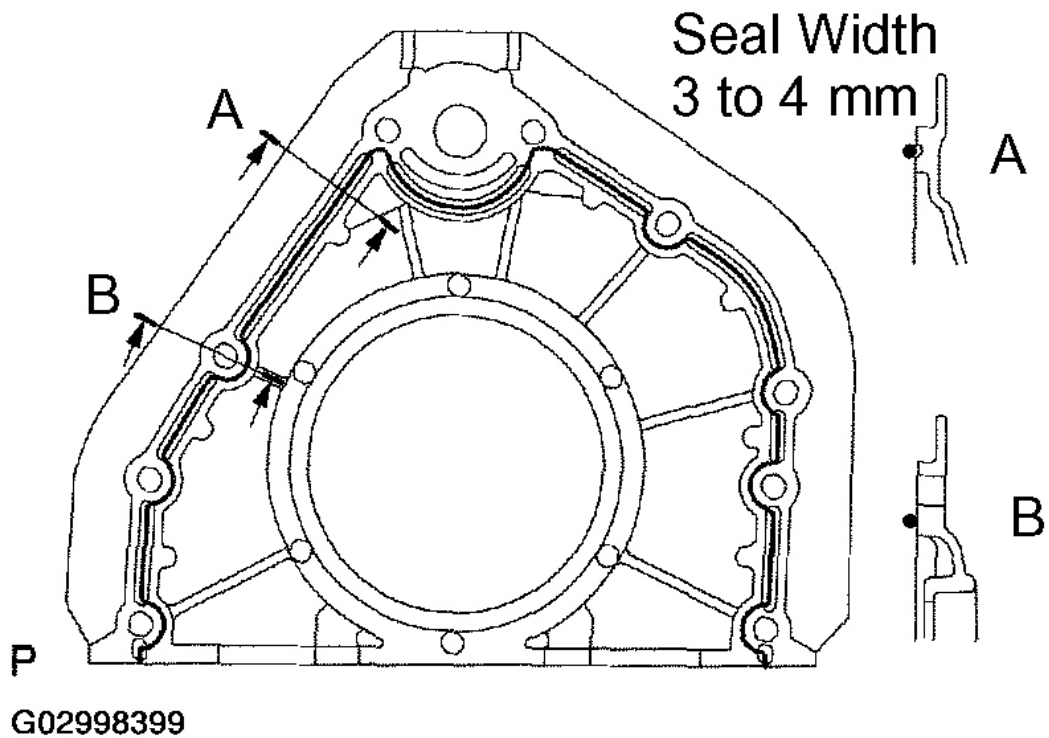
**G02998398**

**Fig. 132: Taping In Oil Seal Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply seal packing to the oil seal retainer as shown in the illustration.

**Seal packing: Part No. 08826-00080 or equivalent**

1. Install a nozzle that has its opening cut to 3 to 4 mm (0.12 to 0.16 in.).
2. Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
3. Immediately remove the nozzle from the tube and reinstall the cap.

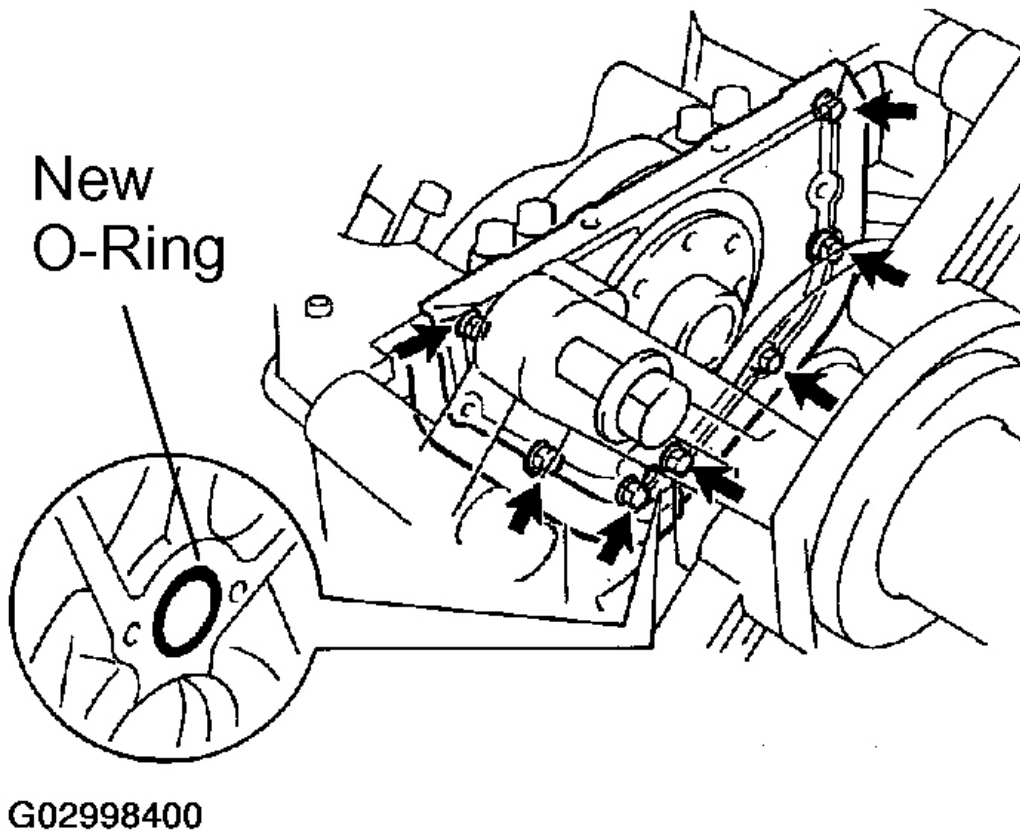


**Fig. 133: Applying Seal Packing To Oil Seal Retainer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install a new O-ring to the cylinder block.
- d. Install the oil seal retainer with the 7 bolts.

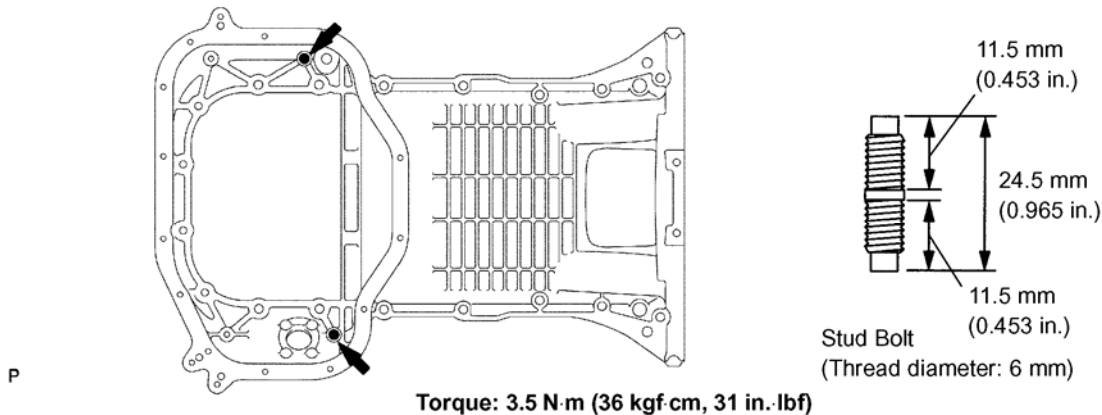
**Torque: 8.0 N.m (82 kgf.cm, 71 in.lbf)**





**Fig. 134: Installing O-Ring To Cylinder Block**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. **INSTALL OIL PUMP ASSY (See REPLACEMENT )**
54. **INSTALL OIL STRAINER SUB-ASSY (See REPLACEMENT )**
55. **INSTALL OIL PAN STUD BOLT**

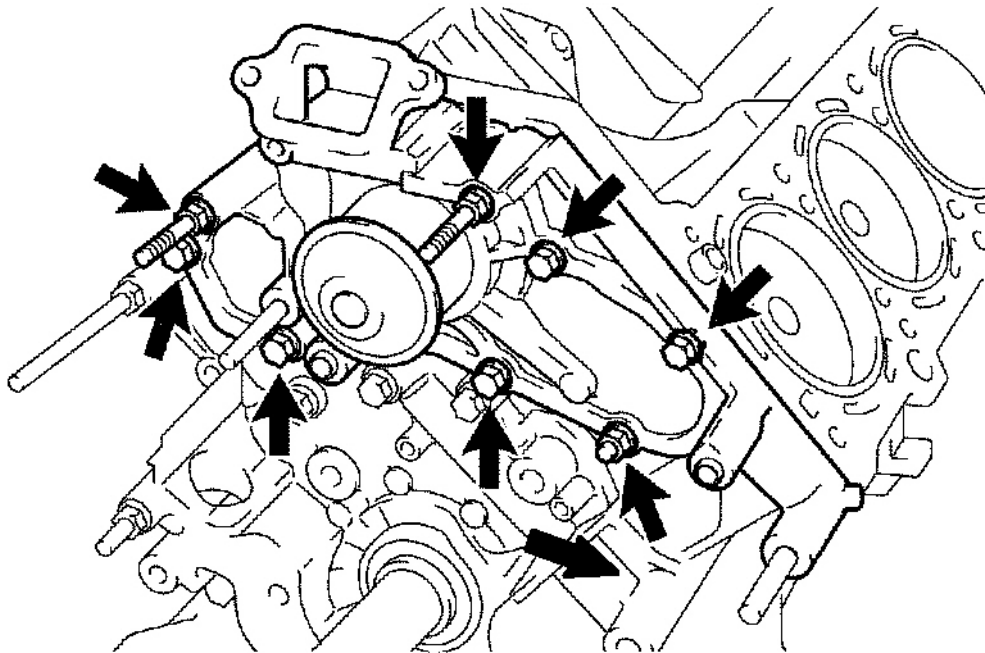


**Fig. 135: Identifying Oil Pan Stud Bolt Diameter**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. **INSTALL OIL PAN SUB-ASSY (See REPLACEMENT )**
  57. **INSTALL OIL PAN BAFFLE PLATE (See REPLACEMENT )**
  58. **INSTALL OIL PAN SUB-ASSY NO.2 (See REPLACEMENT )**
  59. **INSTALL WATER PUMP ASSY**
    - a. Install a new gasket and water pump with the 5 bolts, 2 stud bolts and nut. Uniformly tighten the bolts, stud bolts and nut in several passes.
- Torque:**
- 21 N.m (214 kgf.cm, 16 ft.lbf) for bolt**
- 18 N.m (184 kgf.cm, 13 ft.lbf) for stud bolt and nut**

**HINT:**

Use bolts that are 30 mm (1.18 in.) in length.



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**Fig. 136: Identifying Water Pump Assy Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**60. INSTALL CYLINDER HEAD SUB-ASSY**

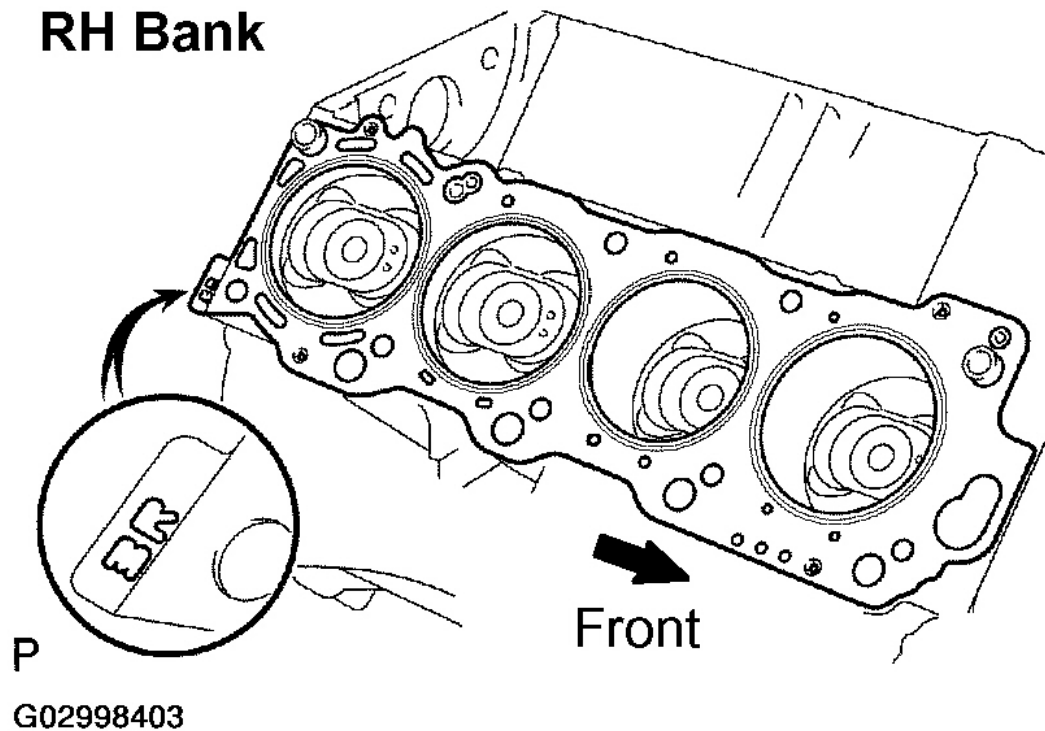
- a. Place a new cylinder head gasket on the cylinder block.

HINT:

The rear side of the cylinder head gasket has marks so that the RH and LH banks can be distinguished. A "3R" mark is on the RH bank's gasket.

**NOTE:**        **Be careful of the installation direction.**

- b. Place the cylinder head on the cylinder head gasket.



**Fig. 137: Placing Cylinder Head Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the cylinder head bolts.

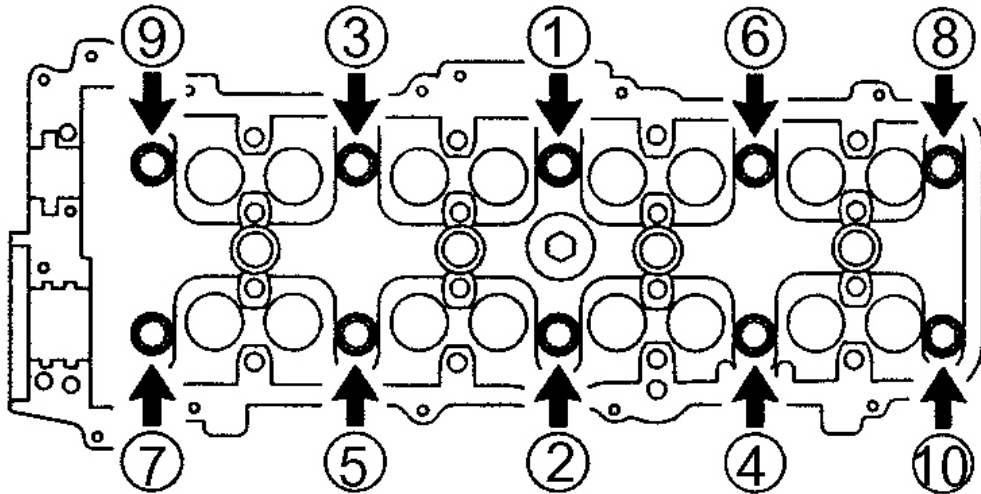
**HINT:**

- The cylinder head bolts are tightened in 2 progressive steps (steps (3) and (5)).
  - If any cylinder head bolt is broken or deformed, replace it.
1. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
  2. Install the plate washer to the cylinder head bolt.
  3. Install and uniformly tighten the 10 cylinder head bolts on one side of the cylinder head in several passes in the sequence shown in the illustration.

**Torque: 59 N.m (602 kgf.cm, 44 ft.lbf)**

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.

# RH Bank

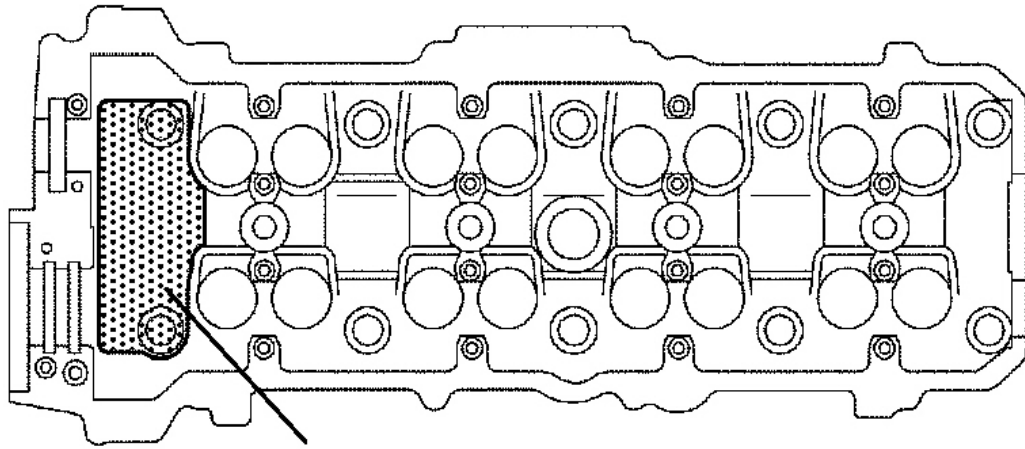


G02998404

**Fig. 138: Identifying Cylinder Head Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not drop the plate washer for the cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.

## RH Bank



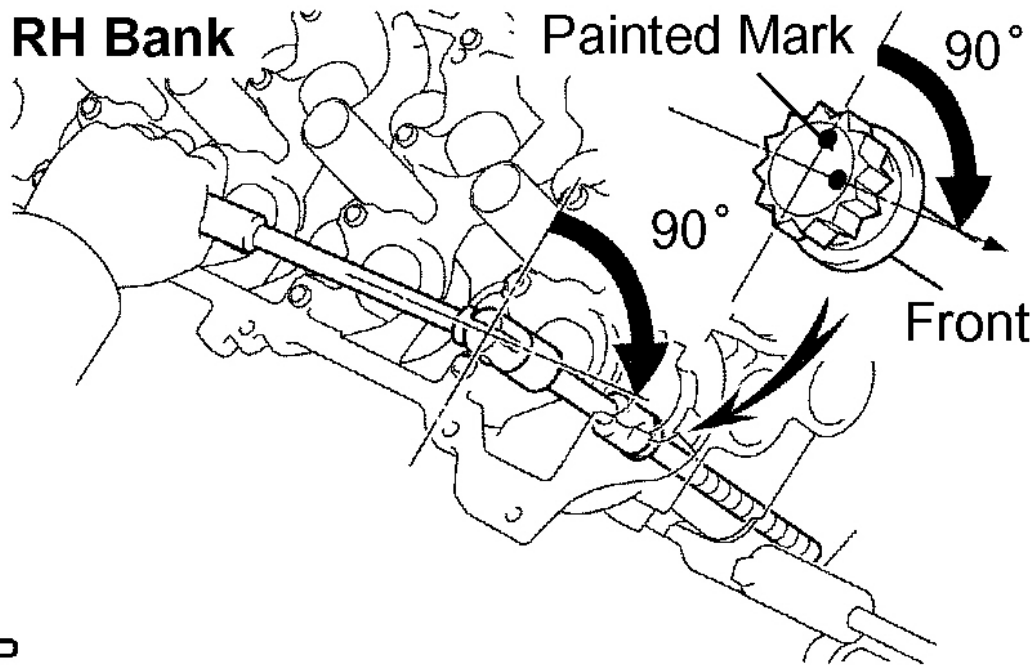
Portion A

G02998405

**Fig. 139: Locating Portion A**

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

4. Mark the front of the cylinder head bolt head with paint.
5. Retighten the cylinder head bolts by 90° in the sequence shown in the illustration.
6. Check that the painted mark is now at a 90° angle to front.



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**Fig. 140: Locating Painted Mark**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**61. INSTALL CYLINDER HEAD LH**

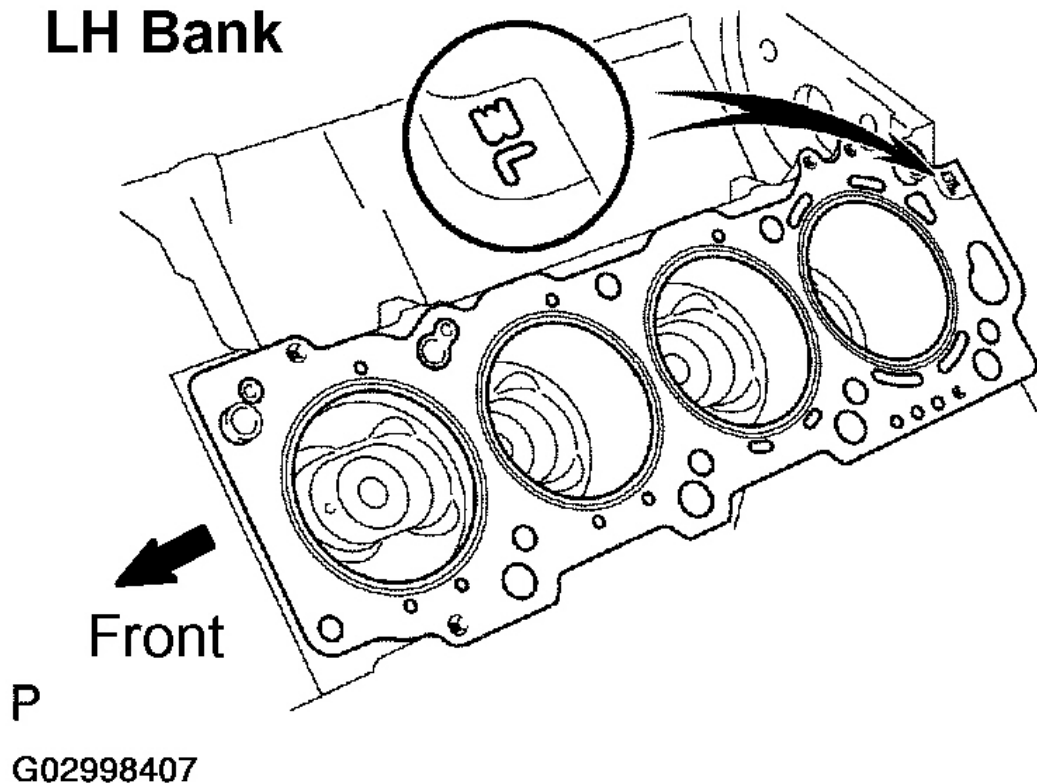
- a. Place a new cylinder head gasket on the cylinder block.

HINT:

The rear side of the cylinder head gasket has marks so that the RH and LH banks can be distinguished. A "3L" mark is on the LH bank's gasket.

**NOTE:** Be careful of the installation direction.

- b. Place the cylinder head on the cylinder head gasket.



**Fig. 141: Placing Cylinder Head On Cylinder Head Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the cylinder head bolts.

**HINT:**

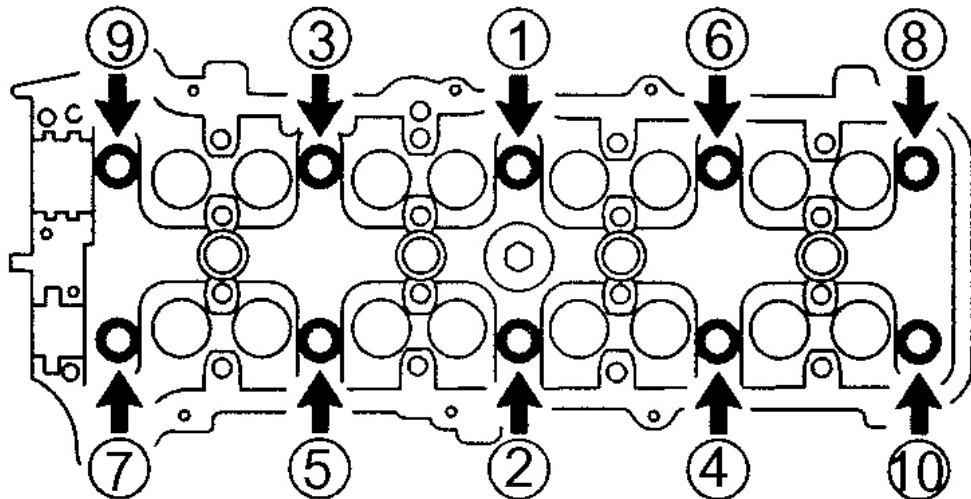
- The cylinder head bolts are tightened in 2 progressive steps (steps (3) and (5)).
  - If any cylinder head bolt is broken or deformed, replace it.
1. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
  2. Install the plate washer to the cylinder head bolt.
  3. Install and uniformly tighten the 10 cylinder head bolts on one side of the cylinder head in several passes in the sequence shown in the illustration.

**Torque: 59 N.m (602 kgf.cm, 44 ft.lbf)**

If any one of the cylinder head bolts does not meet the torque specification, replace the cylinder head bolt.



# LH Bank

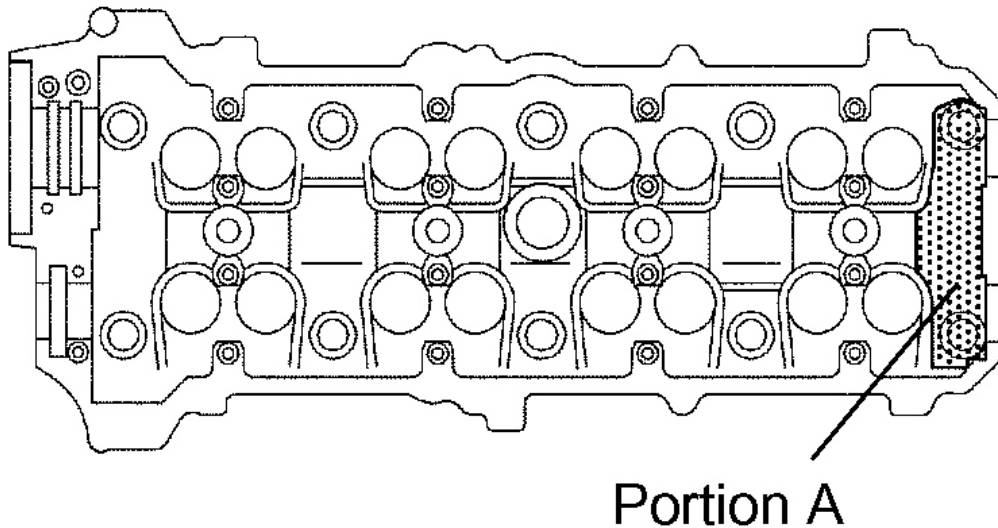


G02998408

**Fig. 142: Identifying Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not drop the plate washer for the cylinder head bolt into portion A of the cylinder head. If dropped into portion A, the plate washer will pass through the cylinder head and cylinder block into the oil pan.

# LH Bank



G02998409

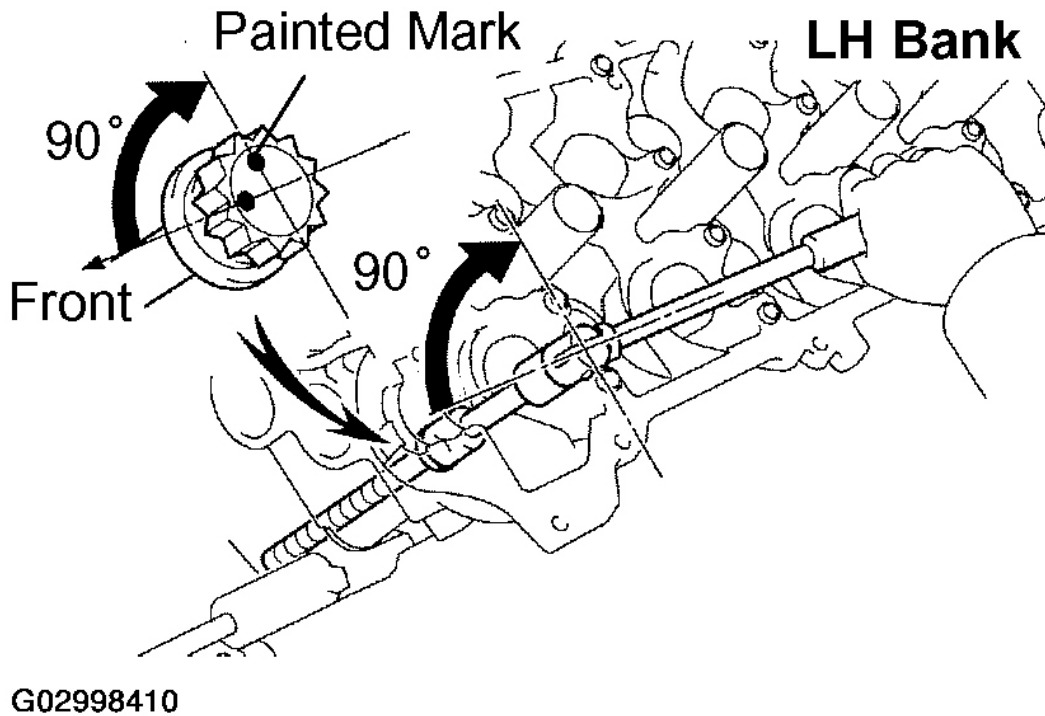
**Fig. 143: Locating Portion A**

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

4. Mark the front of the cylinder head bolt head with paint.
5. Retighten the cylinder head bolts by 90° in the sequence shown in the illustration.
6. Check that the painted mark is now at a 90° angle to front.

## 62. INSTALL CAMSHAFT

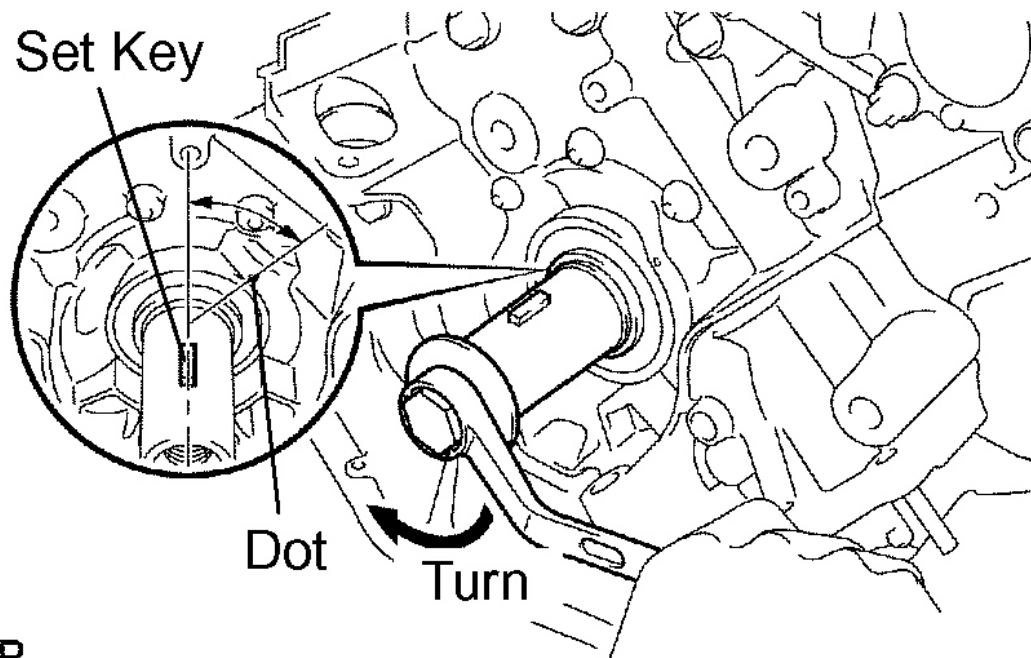
**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



**Fig. 144: Tightening Cylinder Head Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Set the crankshaft position.
  1. Using the crankshaft damper bolt, turn the crankshaft, and set the set key of the crankshaft to 90° counterclockwise from the timing mark (1 dot mark) of the oil pump body.

**NOTE:** The crankshaft must be at the correct angle to avoid damage in later steps. If the crankshaft is at the wrong angle and then the camshaft is installed, the piston head and valve head may come in contact and be damaged.

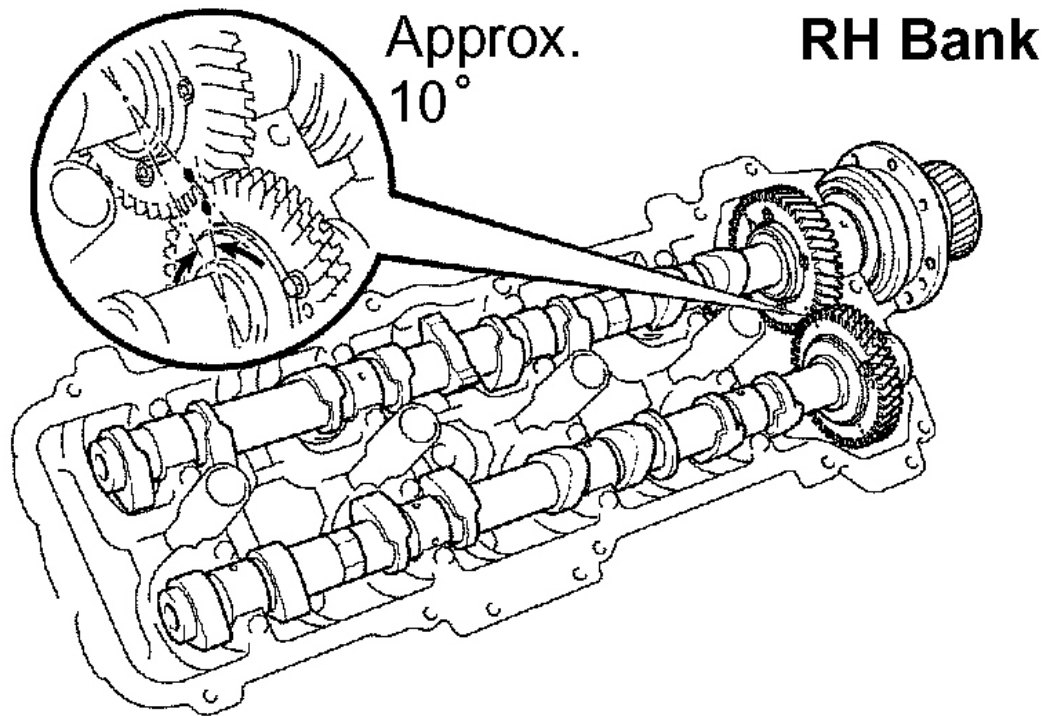


P

G02998411

**Fig. 145: Turning Crankshaft And Setting Set Key**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the camshafts of the RH bank.
  1. Apply MP grease to the thrust portion of the camshafts.
  2. Align the timing marks (1 dot mark) of the camshaft drive and driven main gears, and place the 2 camshafts.
  3. Set the timing mark (1 dot mark) of the camshaft drive and driven main gears at approximately 10° angle.

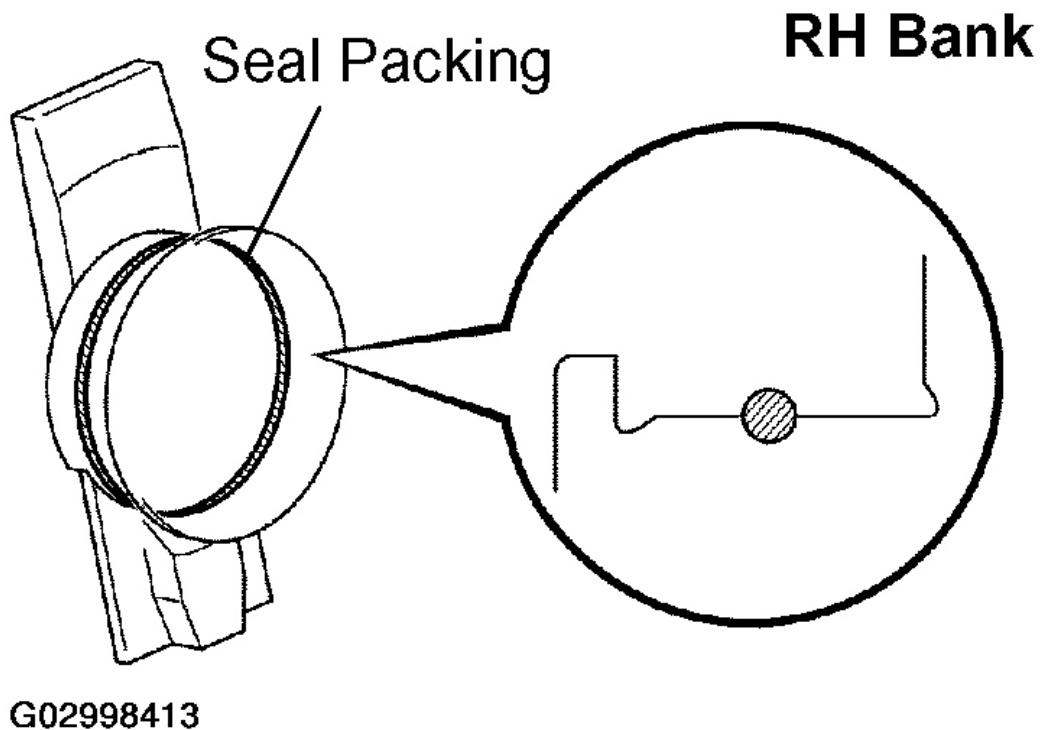


G02998412

**Fig. 146: Aligning Timing Marks Of Camshaft Drive And Driven Main Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Apply seal packing to the camshaft housing plug.
  - Remove the old packing (FIPG) material.
  - Apply seal packing to the housing plug.

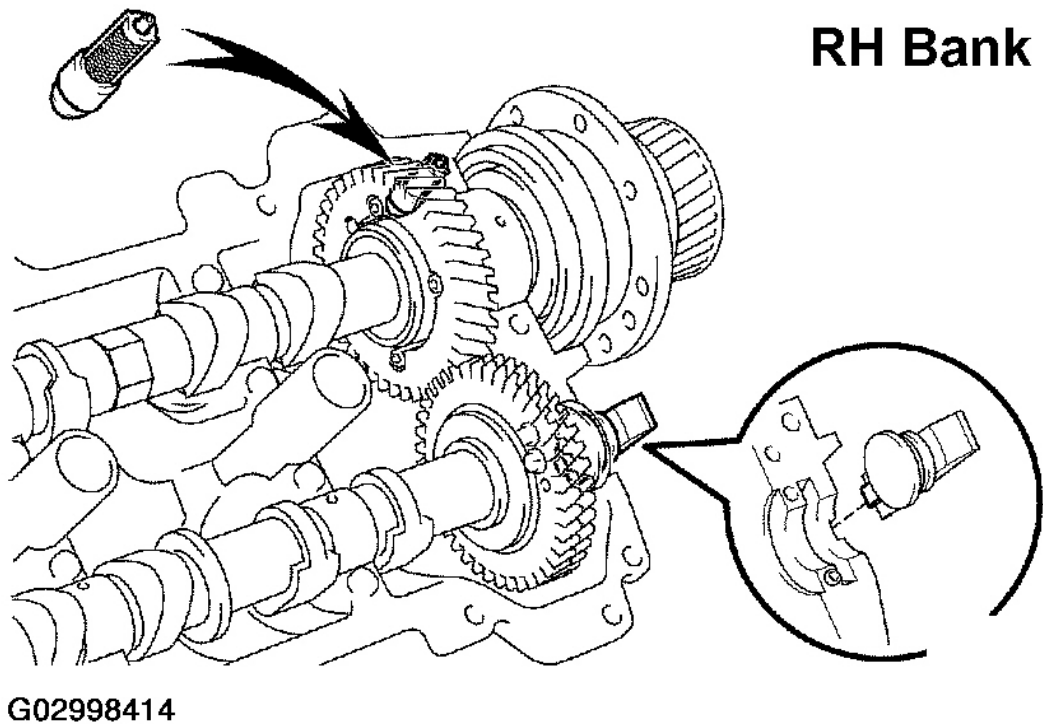
**Seal packing: Part No. 08826-00080 or equivalent**



**Fig. 147: Applying Seal Packing To Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

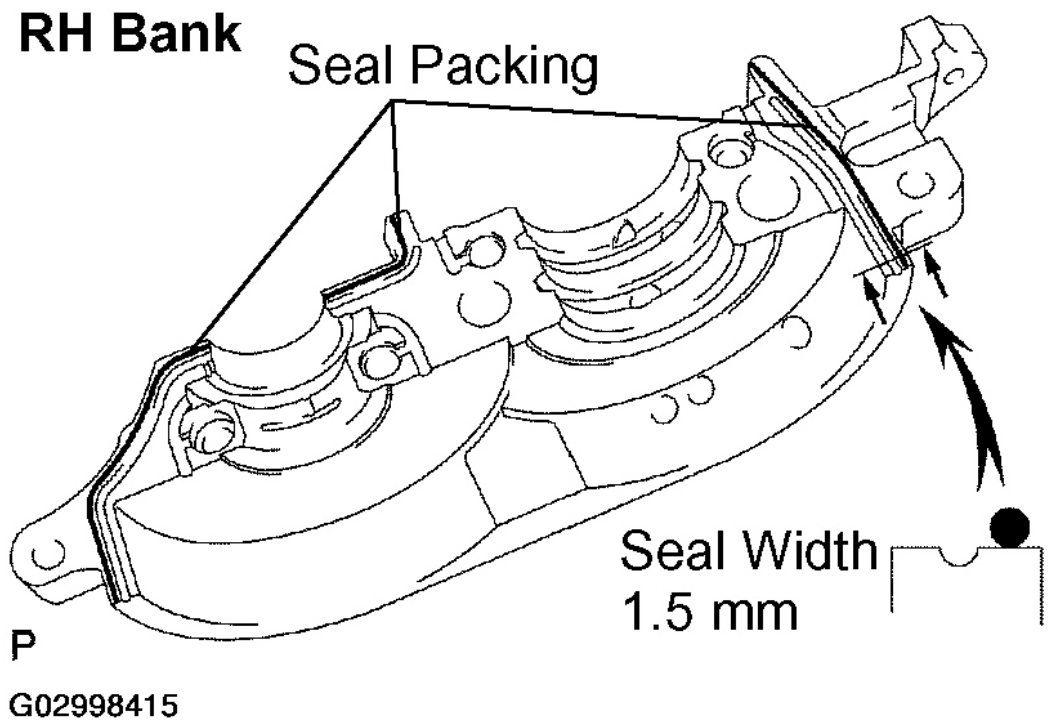
5. Install the camshaft housing plug to the cylinder head as shown in the illustration.
6. Install the oil control valve filter to the cylinder head.

**NOTE:** Be careful of the installation direction.



**Fig. 148: Installing Camshaft Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Apply seal packing to the front bearing cap.
  - Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.
  - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove.
  - Thoroughly clean all components to remove all loose material.



**Fig. 149: Applying Seal Packing To Front Bearing Cap**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a non-residue solvent, clean both sealing surfaces.
- Apply seal packing to the bearing cap as shown in the illustration.
- Install a nozzle that has been cut to a 1.5 to 2.0 mm (0.059 to 0.79 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise, the seal packing must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap.

**Seal packing: Part No. 08826-00080 or equivalent**

**NOTE:            Do not apply seal packing to the front bearing cap grooves.**

8. Install the front bearing cap.

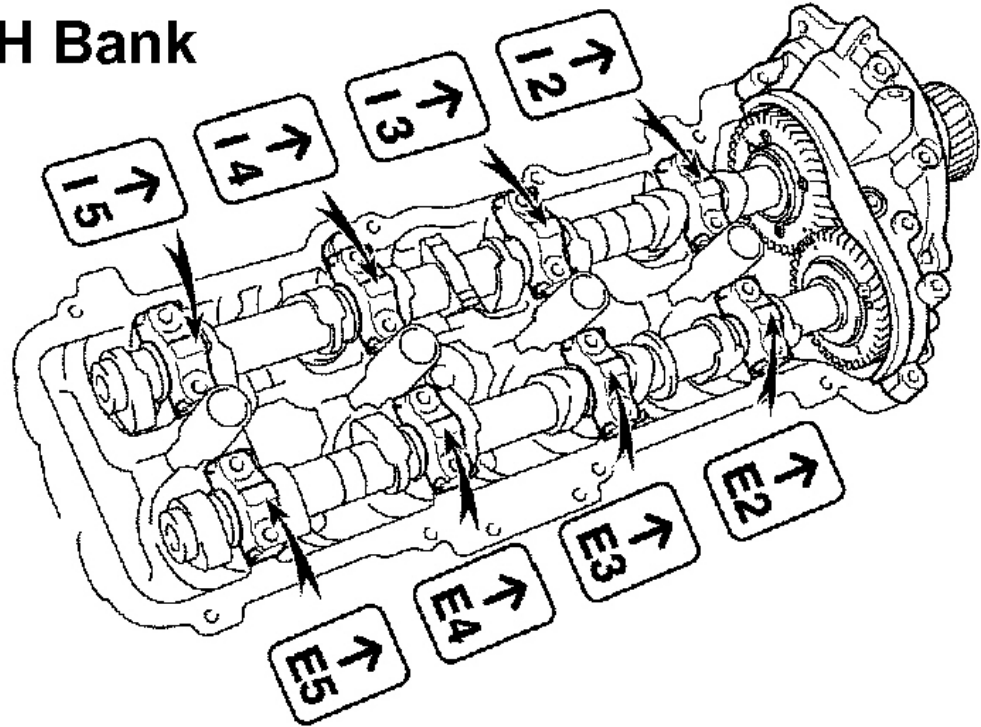
HINT:

Installing the front bearing cap will determine the thrust portion of the camshaft.

9. Install the other bearing caps in the sequence shown with the arrow mark facing forward.



## RH Bank

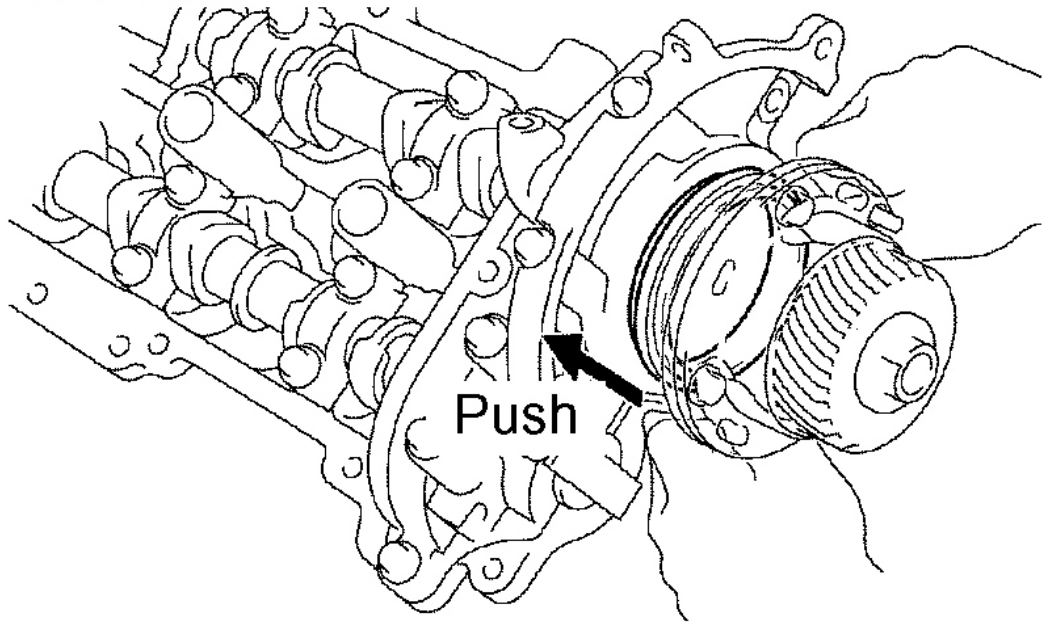


G02998416

**Fig. 150: Identifying Front Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. Push in the camshaft setting oil seal.

## RH Bank



G02998417

**Fig. 151: Pushing Camshaft Setting Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. Install a new seal washer to the bearing cap bolts (A and B).
12. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (D and E).

**NOTE:** Do not apply engine oil under the heads of the bearing cap bolts (A), (B) and (C).

### **Bolt length:**

**94 mm (3.70 in.) for A with seal washer**

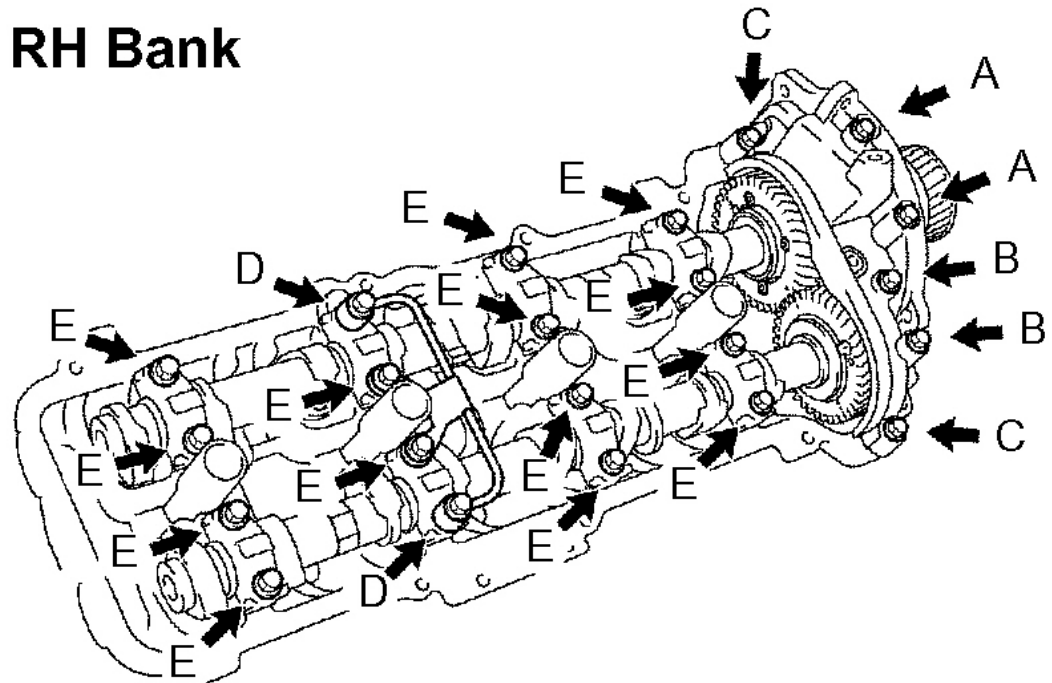
**72 mm (2.83 in.) for B with seal washer**

**25 mm (0.98 in.) for C**

**52 mm (2.05 in.) for D**

**38 mm (1.50 in.) for E**

13. Install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.



G02998418

**Fig. 152: Identifying Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

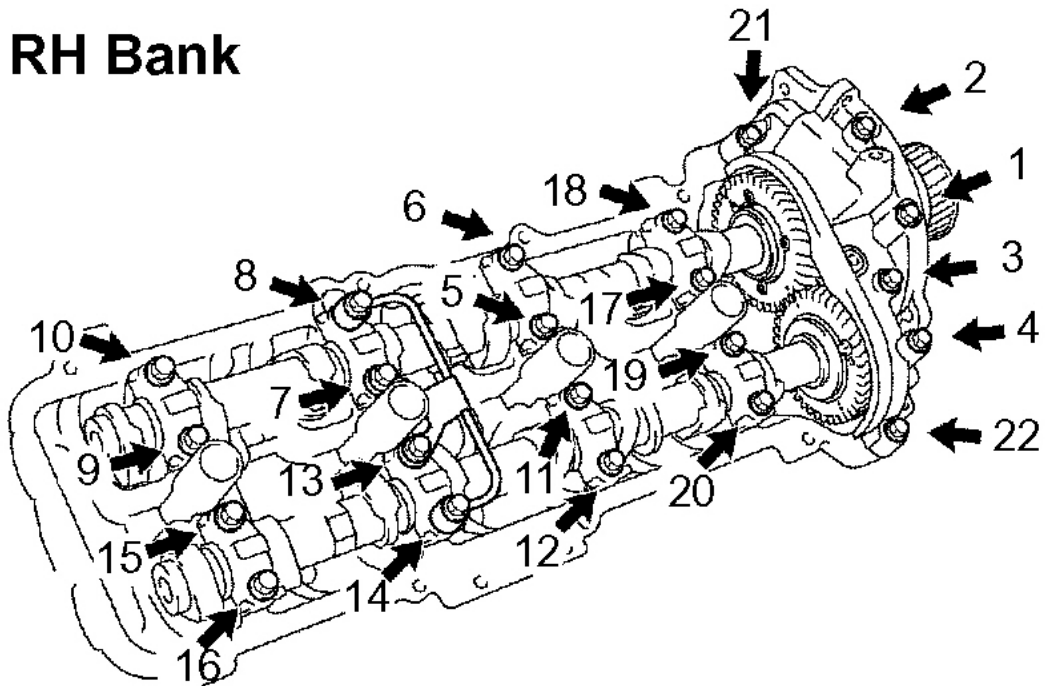
14. Uniformly tighten the 22 bearing cap bolts in several passes in the sequence shown in the illustration.

**Torque:**

**7.5 N.m (77 kgf.cm, 66 in.lbf) for bolt 21 and 22**

**16 N.m (163 kgf.cm, 12 ft.lbf) for others**

## RH Bank



G02998419

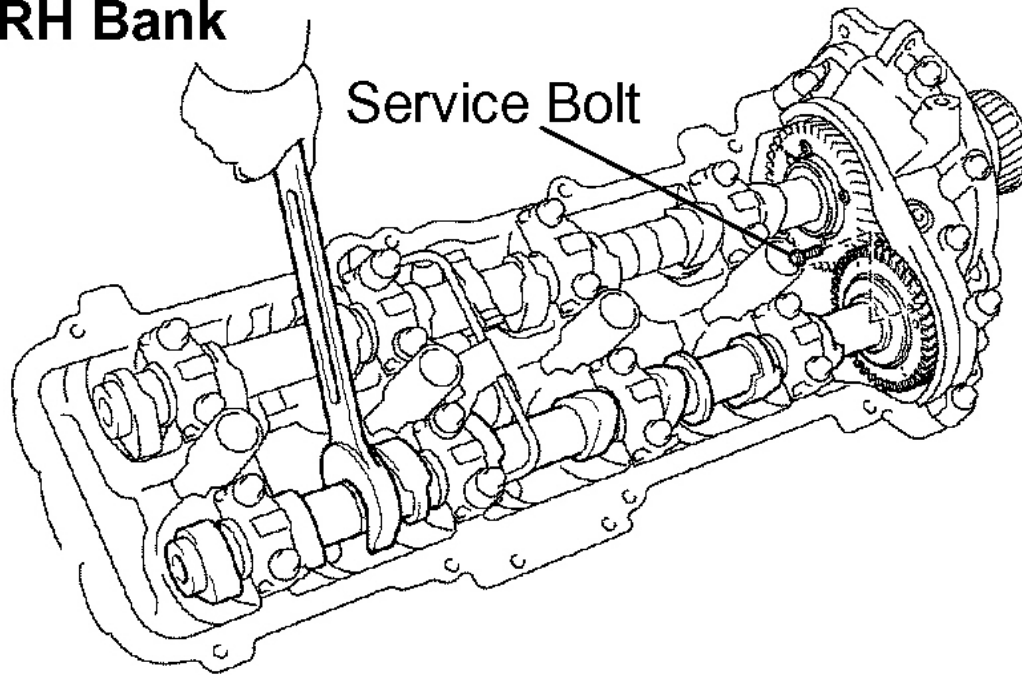
**Fig. 153: Tightening Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. Remove the service bolt.

### 63. INSTALL NO.3 CAMSHAFT SUB-ASSY

**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

**RH Bank**



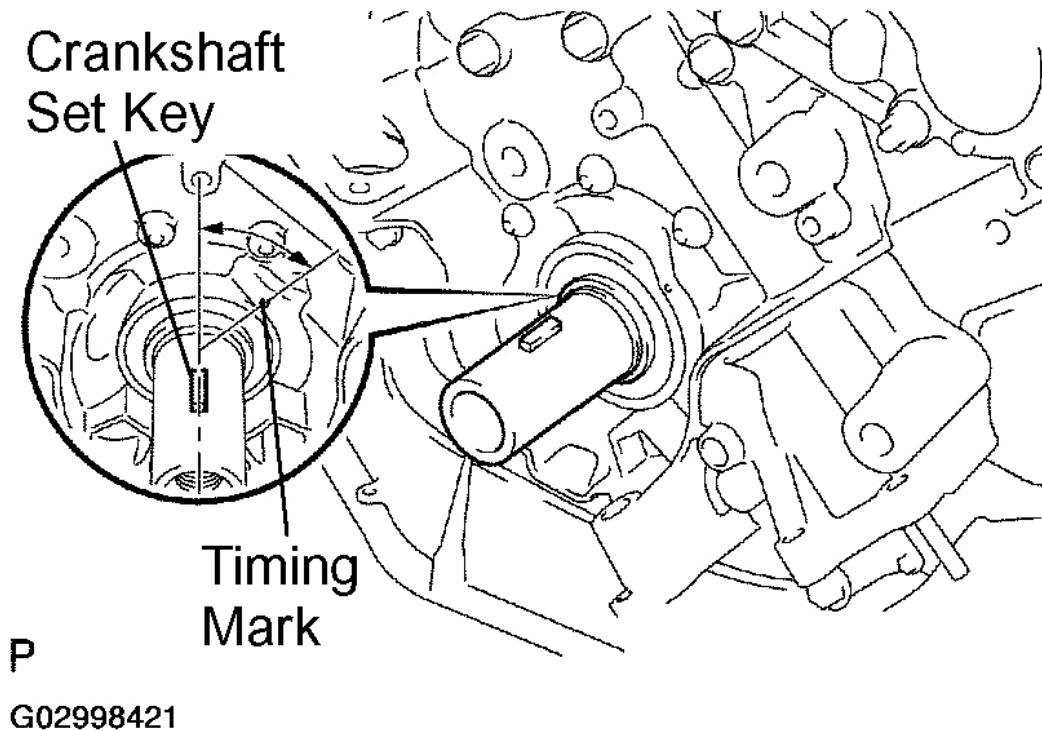
**G02998420**

**Fig. 154: Removing Service Bolt**

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

- a. Check the set key of the crankshaft is at the position of 90° counterclockwise from the timing mark (1 dot mark) of the oil pump body.

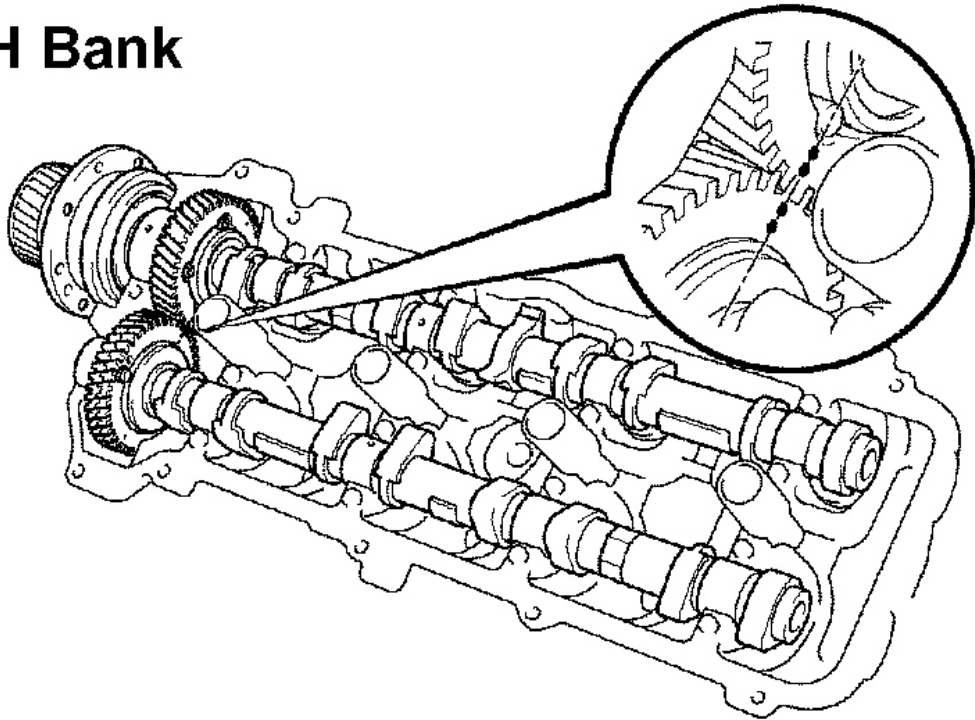
**NOTE:** The crankshaft must be at the correct angle to avoid damage in later steps. If the crankshaft is at the wrong angle and then the camshaft is installed, the piston head and valve head may come in contact and be damaged.



**Fig. 155: Identifying Crankshaft Position Checking Setting Key**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the camshafts of the LH bank.
  - 1. Apply MP grease to the thrust portion of the camshafts.
  - 2. Align the timing marks (2 dot marks each) of the camshaft drive and driven main gears, and place the 2 camshafts.

## LH Bank



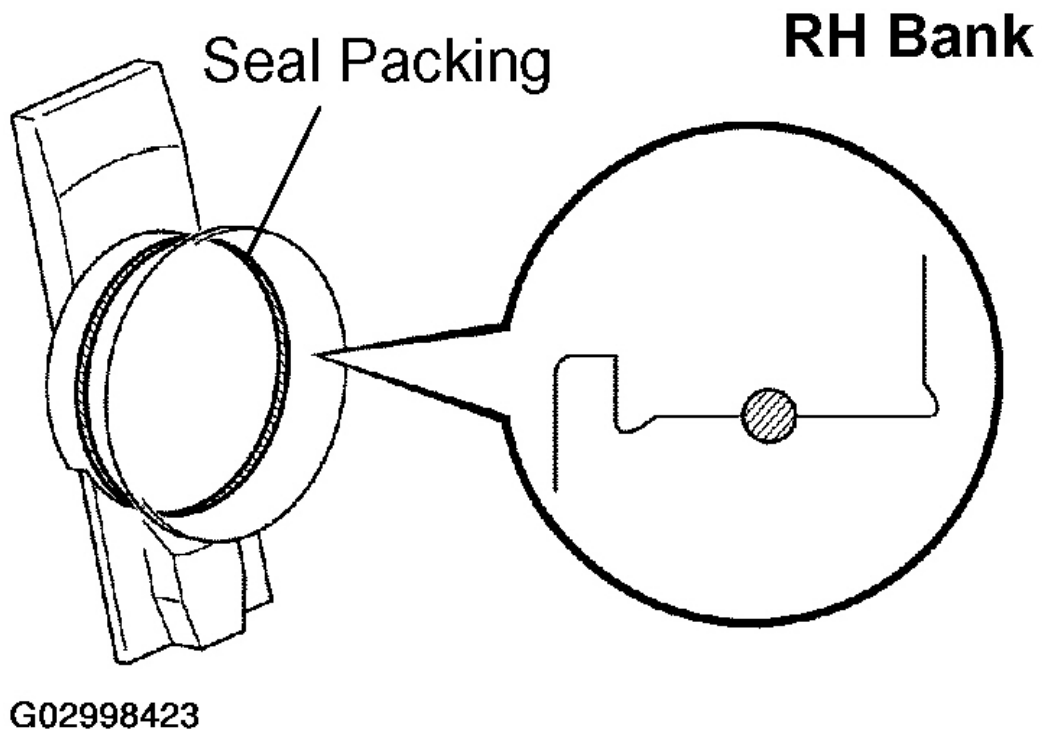
G02998422

**Fig. 156: Aligning Timing Marks**

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

3. Apply seal packing to the camshaft housing plug.
  - Remove the old packing (FIPG) material.
  - Apply seal packing to the housing plug.

**Seal packing: Part No. 08826-00080 or equivalent**



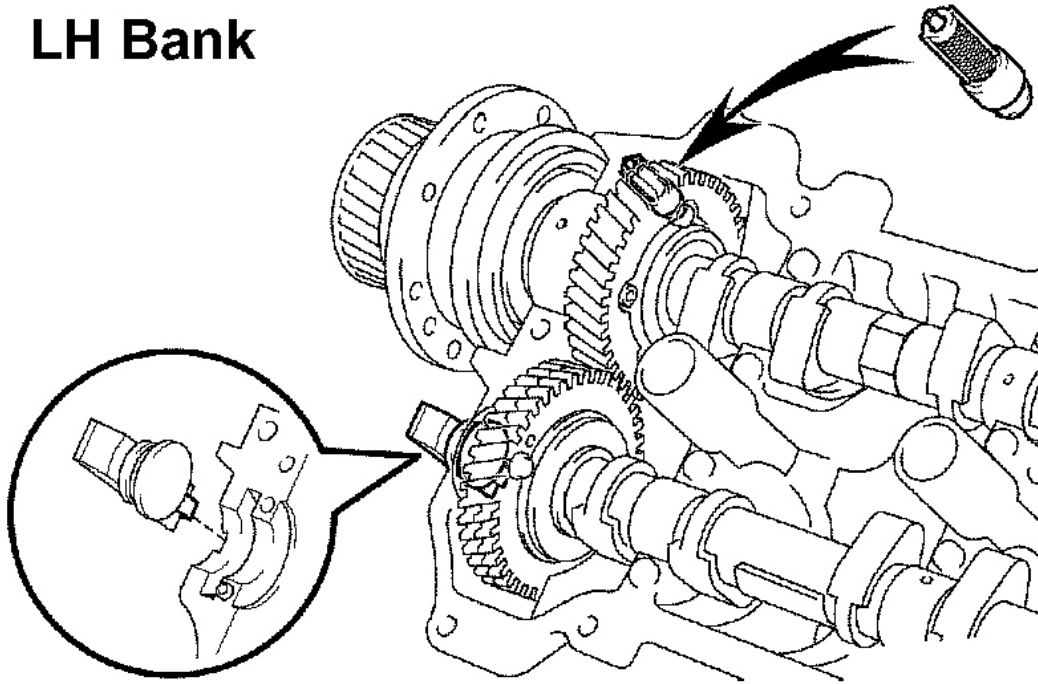
**Fig. 157: Applying Seal Packing To Camshaft Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Install the camshaft housing plug to the cylinder head as shown in the illustration.
5. Install the oil control valve filter to the cylinder head.

**NOTE:** Be careful of the installation direction.



## LH Bank



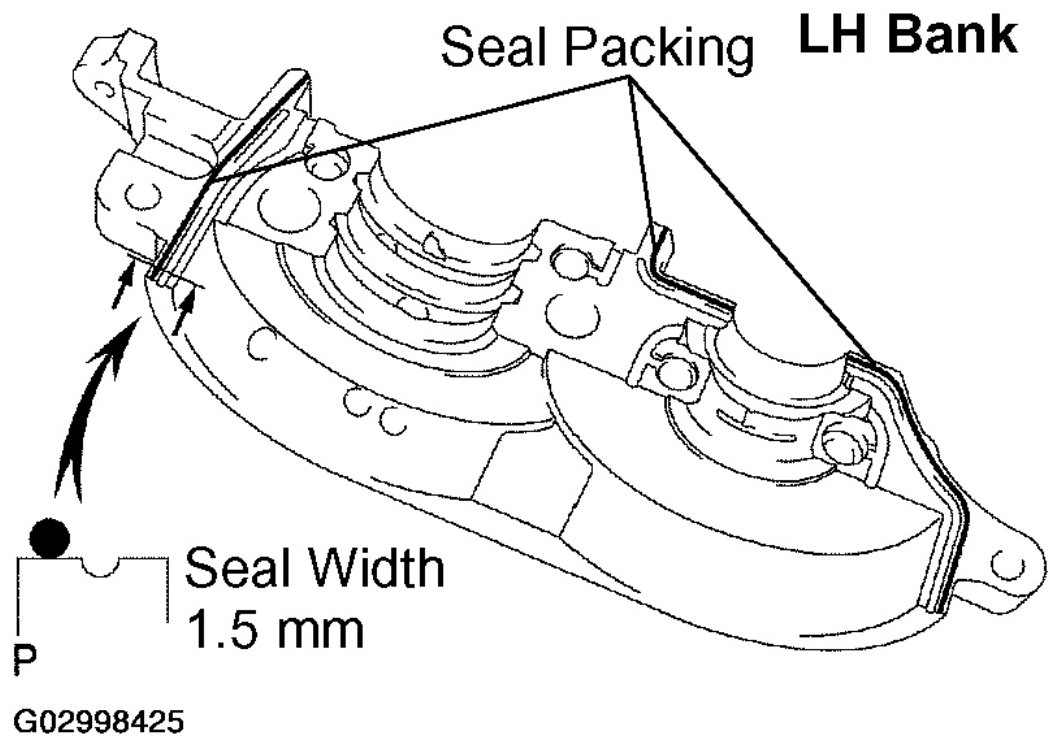
G02998424

**Fig. 158: Installing Camshaft Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Apply seal packing to the front bearing cap.
  - Remove any old packing (FIPG) material and be care not to drop any oil on the contact surfaces of the bearing cap and cylinder head.
  - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove.
  - Thoroughly clean all components to remove all loose material.
  - Using a non-residue solvent, clean both sealing surfaces.
  - Apply seal packing to the bearing cap as shown in the illustration.
  - Install a nozzle that has its opening cut to 1.5 to 2.0 mm (0.059 to 0.79 in.).
  - Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
  - Immediately remove the nozzle from the tube and reinstall the cap.

**Seal packing: Part No. 08826-00080 or equivalent**

**NOTE: Do not apply seal packing to the front bearing cap grooves.**



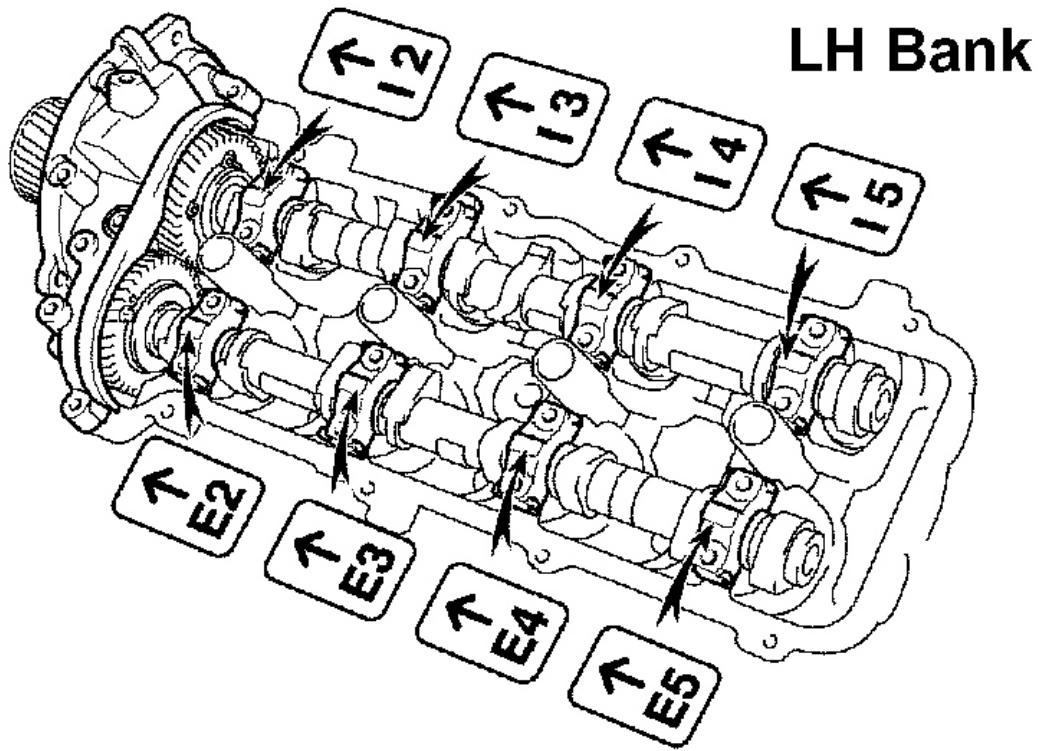
**Fig. 159: Applying Seal Packing To Front Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Install the front bearing cap.

HINT:

Installing the front bearing cap will determine the thrust portion of the camshaft.

8. Install the other bearing cap in the sequence shown with the arrow mark facing forward.

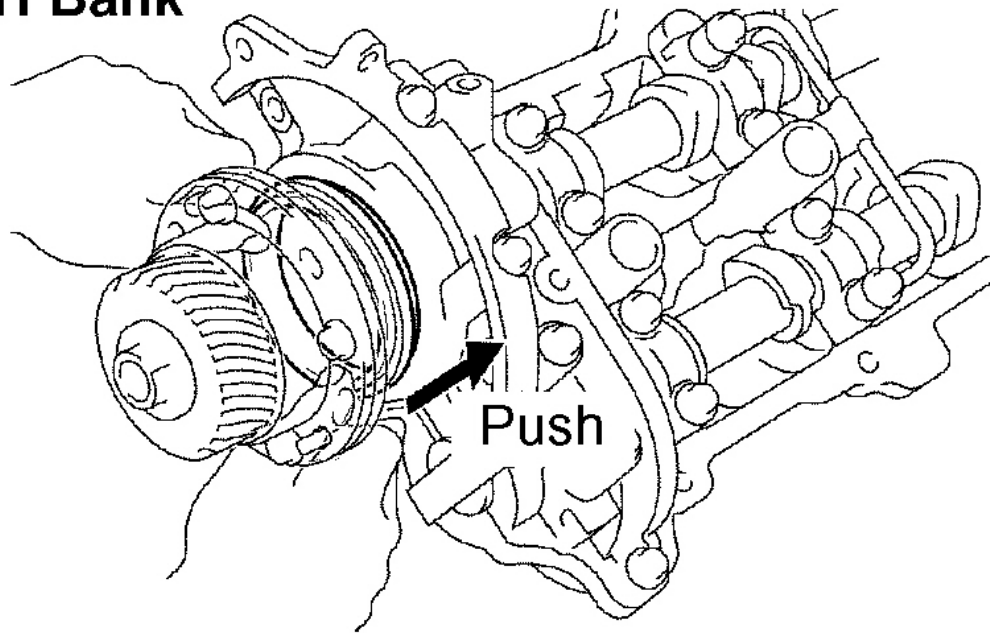


G02998426

**Fig. 160: Identifying Front Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. Push in the camshaft setting oil seal.

## LH Bank



G02998427

**Fig. 161: Pushing Camshaft Setting Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. Install a new seal washer to the bearing cap bolts (A and B).
11. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (D and E).

**NOTE:** Do not apply engine oil under the heads of the bearing cap bolt (A), (B) and (C).

### **Bolt length:**

**94 mm (3.70 in.) for A with seal washer**

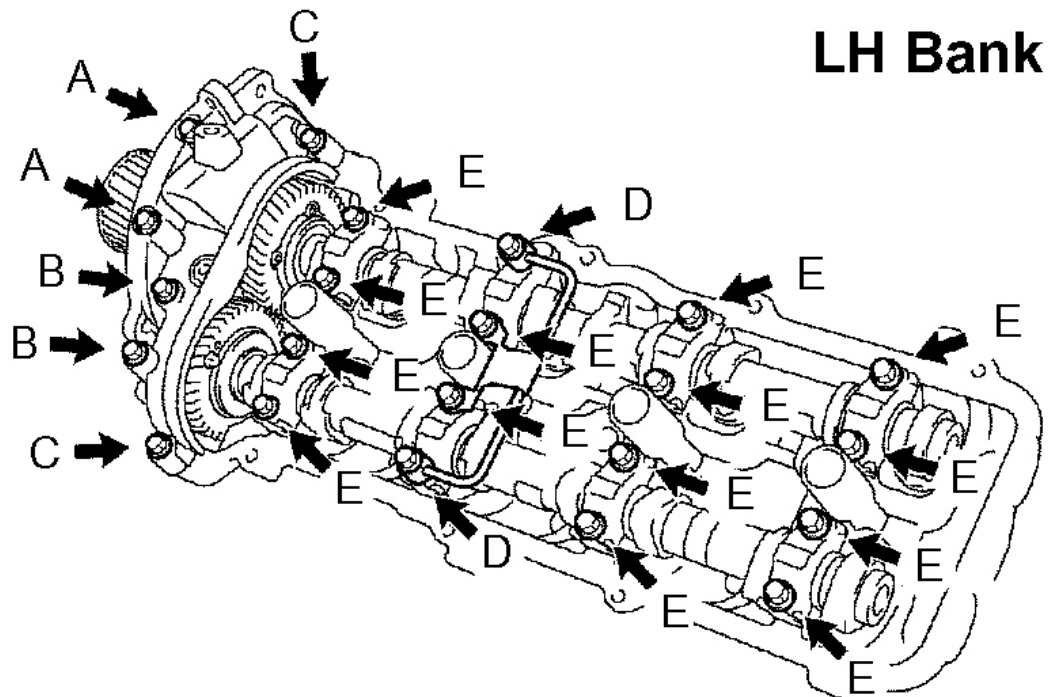
**72 mm (2.83 in.) for B with seal washer**

**25 mm (0.98 in.) for C**

**52 mm (2.05 in.) for D**

**38 mm (1.50 in.) for E**

12. Install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.



G02998428

**Fig. 162: Identifying Bearing Cap Bolts**

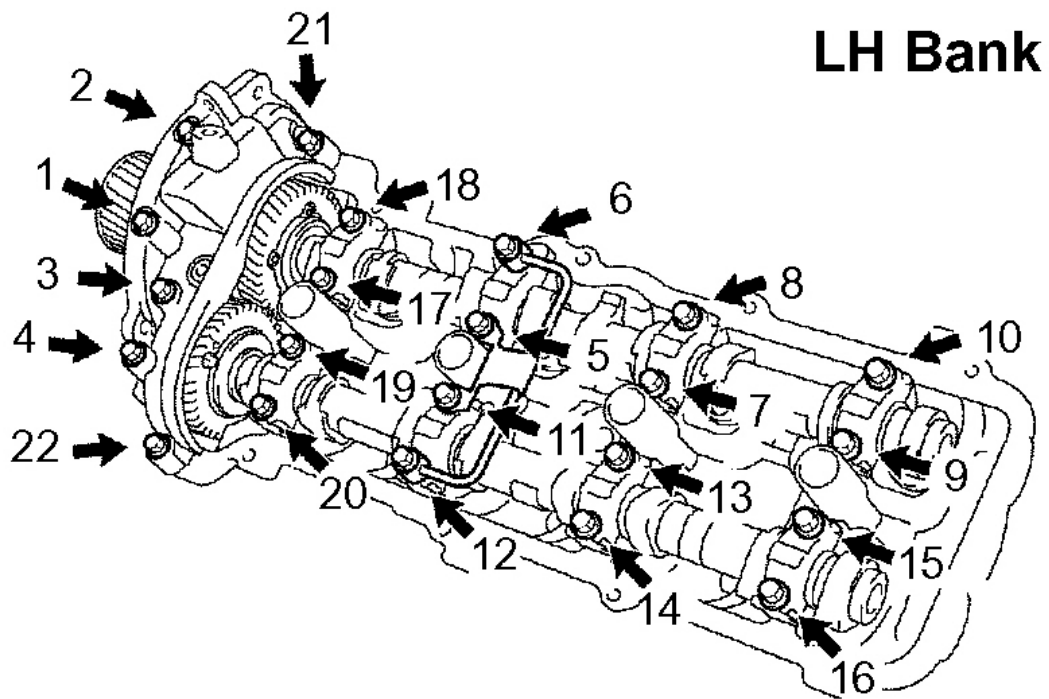
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. Uniformly tighten the 22 bearing cap bolts in several passes in the sequence shown in the illustration.

**Torque:**

**7.5 N.m (77 kgf.cm, 66 in.lbf) for bolt C**

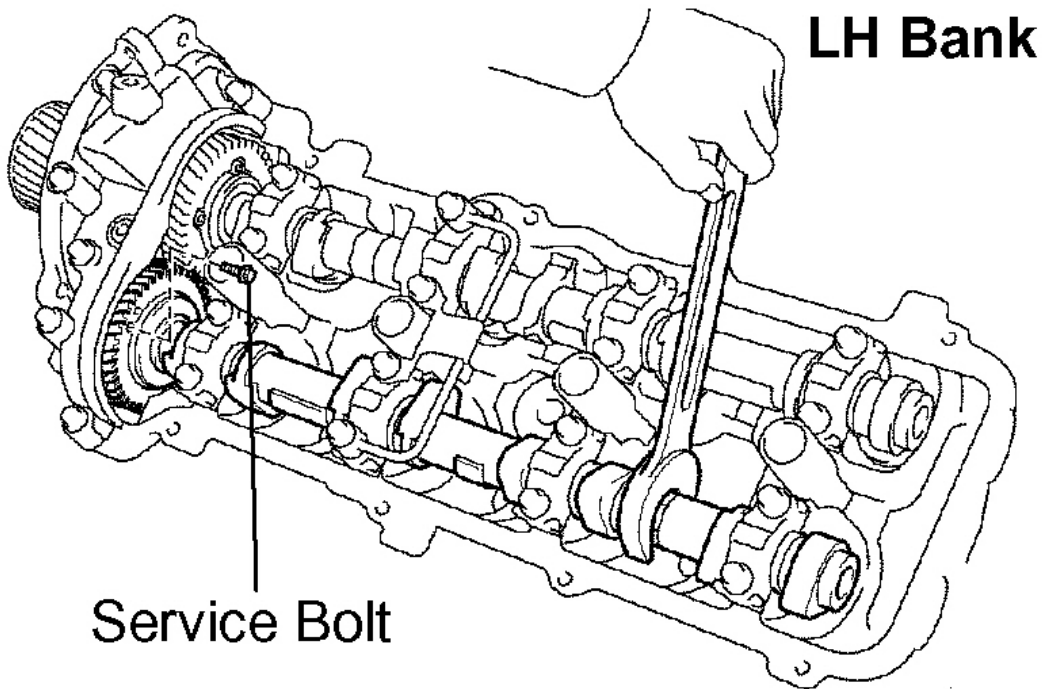
**16 N.m (163 kgf.cm, 12 ft.lbf) for others**



G02998429

**Fig. 163: Tightening Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. Remove the service bolt.



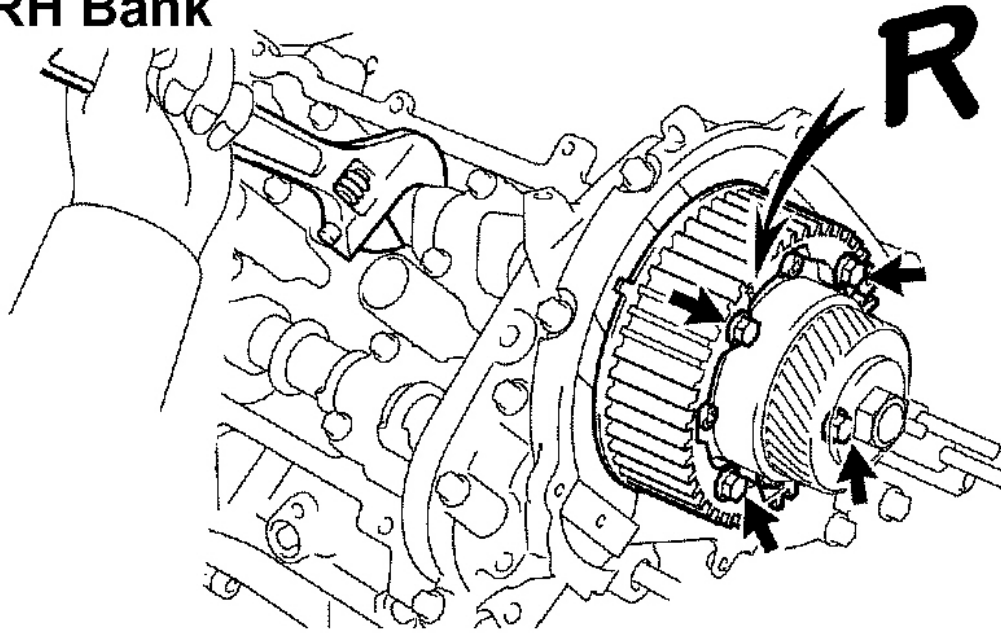
G02998430

**Fig. 164: Removing Service Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. **INSTALL TIMING BELT PLATE RR RH**
  - a. Install the timing belt plate with the bolt and stud bolt.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
65. **INSTALL TIMING BELT PLATE RR RH NO.2**
  - a. Install the timing belt plate with the 2 bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
66. **INSTALL TIMING BELT PLATE RR LH**
  - a. Install the timing belt plate with the bolt.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
67. **INSTALL TIMING BELT PLATE RR LH NO.2**
  - a. Install the timing belt plate with the 2 bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
68. **INSTALL CAMSHAFT TIMING PULLEY**
  - a. Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.

- b. Attach the timing pulley to the camshaft timing tube. Face the timing pulley's "R" mark forward.
- c. Hold the hexagon wrench head portion of the camshaft and install the 4 pulley bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**

**RH Bank**



**G02998431**

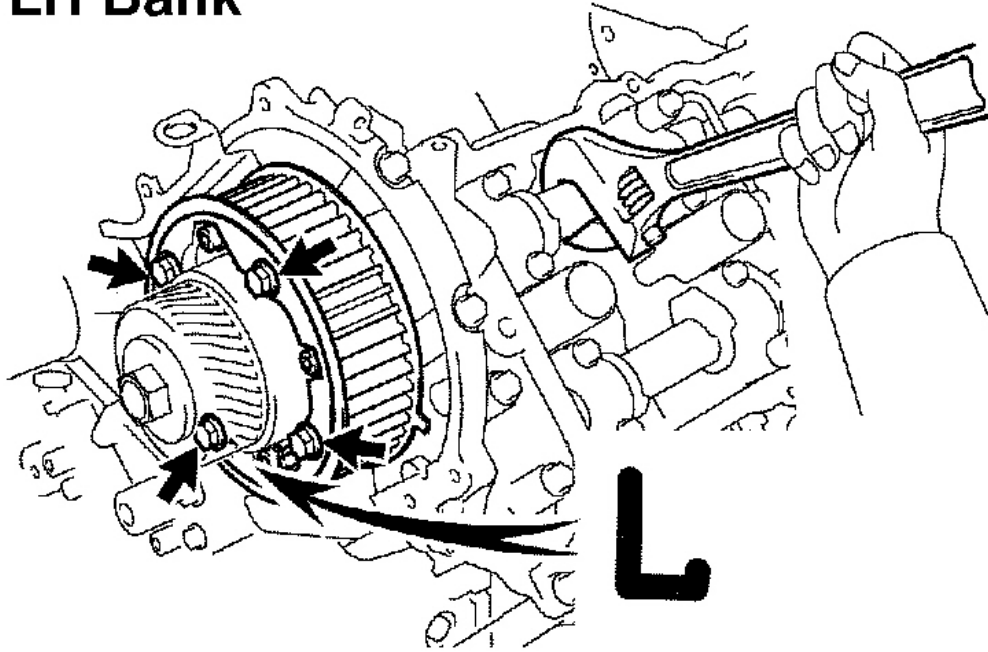
**Fig. 165: Installing Camshaft Timing Pulley**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**69. INSTALL CAMSHAFT TIMING PULLEY SUB-ASSY LH**

- a. Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.
- b. Attach the timing pulley to the camshaft timing tube. Face the timing pulley's "L" mark forward.
- c. Hold the hexagon wrench head portion of the camshaft and install the 4 pulley bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**



# LH Bank



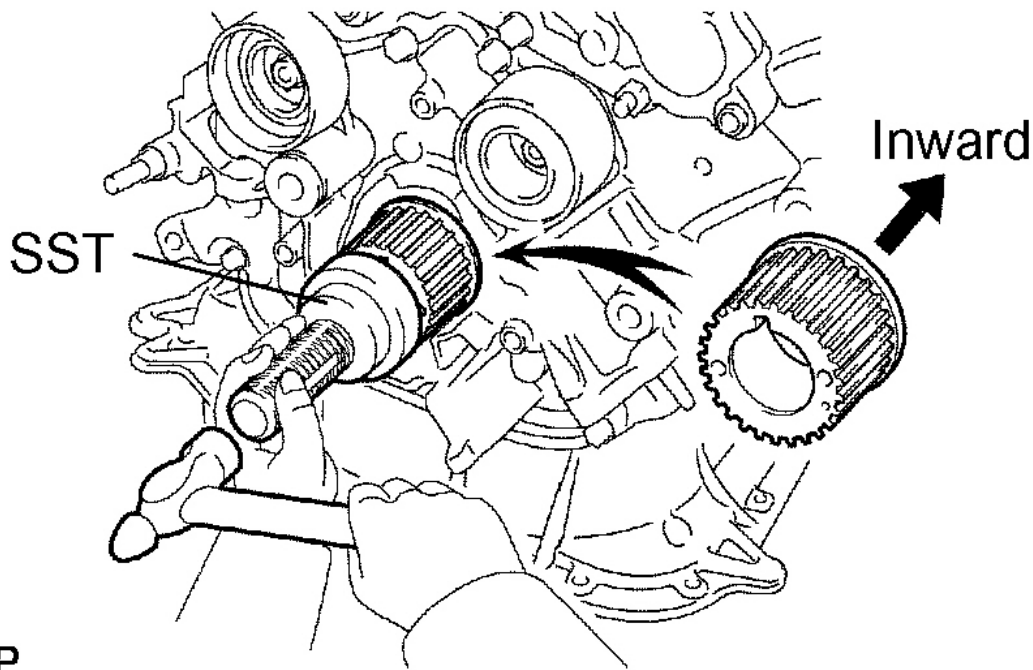
P

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**Fig. 166: Installing Camshaft Timing Pulley Sub-Assy LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 70. INSTALL CRANKSHAFT TIMING PULLEY

- a. Align the timing pulley set key with the key groove of the pulley.
- b. Using SST and a hammer, tap in the timing pulley. Face the flange side inward.  
SST 09223-46011



**P**

**G02998433**

**Fig. 167: Installing Crankshaft Timing Pulley**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**71. INSTALL TIMING BELT IDLER SUB-ASSY NO.2**

- a. Install the idler with the bolt.  
**Torque: 34.5 N.m (352 kgf.cm, 25 ft.lbf)**
- b. Check that the idler moves smoothly.

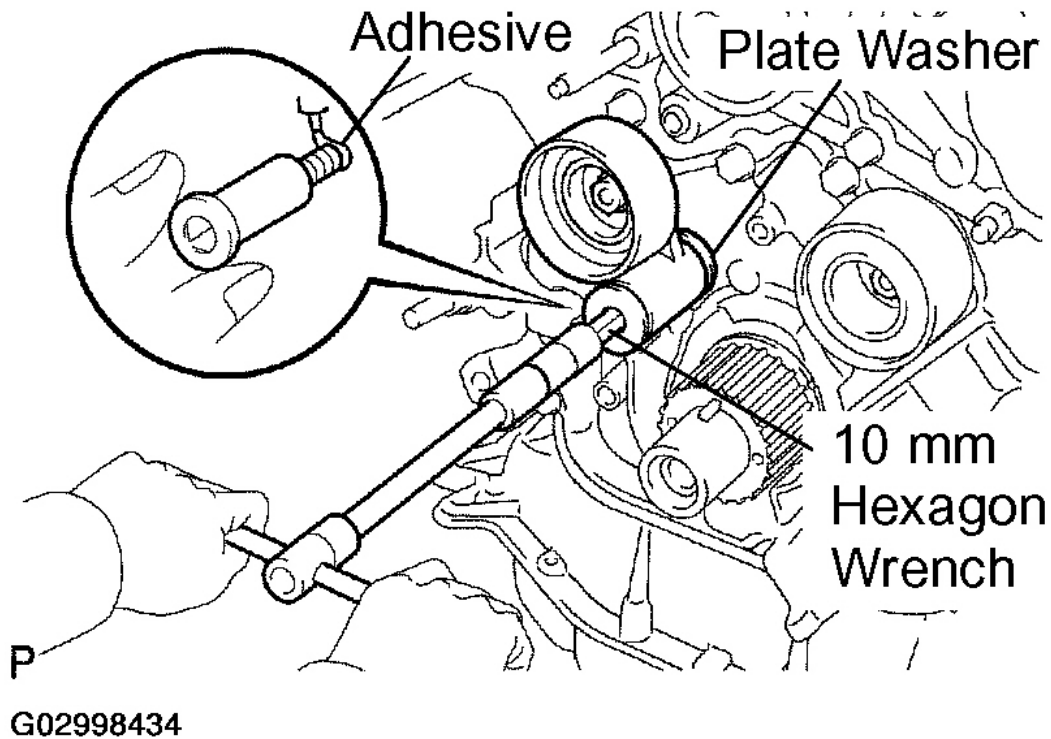
**72. INSTALL TIMING BELT IDLER SUB-ASSY NO.1**

- a. Apply adhesive to 2 or 3 threads of the pivot bolt.

**Adhesive:**

**Part No. 08833-00080, THREE BOND 1344, LOCTITE 242 or equivalent**

- b. Using a 10 mm hexagon wrench, install the plate washer and idler with the pivot bolt.  
**Torque: 34.5 N.m (352 kgf.cm, 25 ft.lbf)**
- c. Check that the idler bracket moves smoothly.

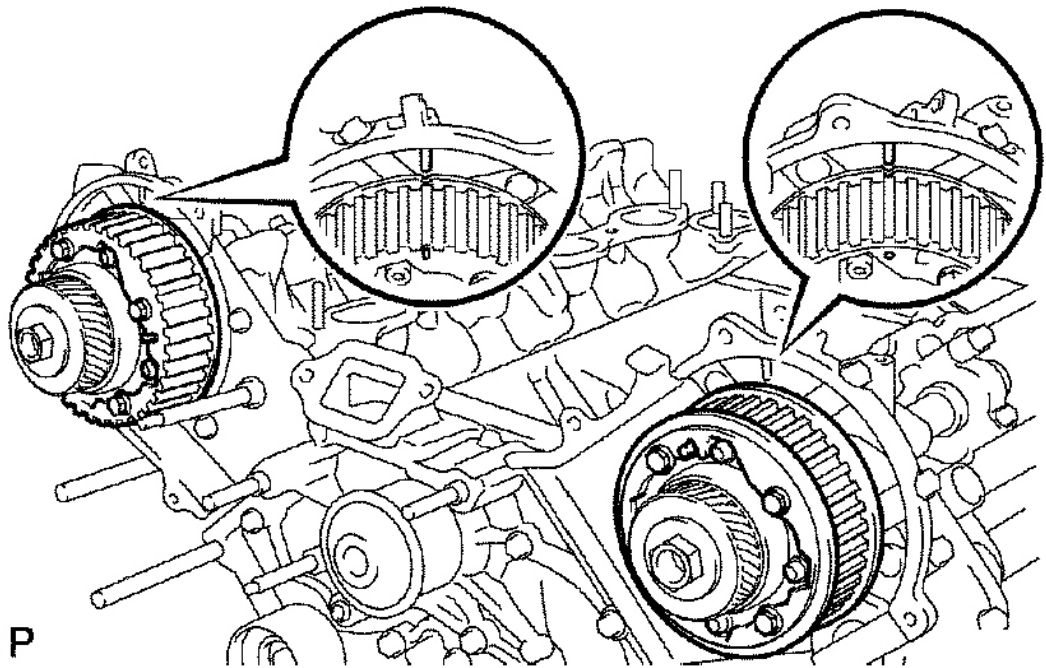


**Fig. 168: Installing Timing Belt Idler Sub-Assy No.1**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 73. INSTALL TIMING BELT

**NOTE:** The engine should be cold.

- a. Set the No. 1 cylinder to TDC/compression.
  1. Turn the hexagon wrench head portion of the camshaft to align the timing marks of the camshaft timing pulleys and timing belt plates.



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**Fig. 169: Aligning Timing Marks**

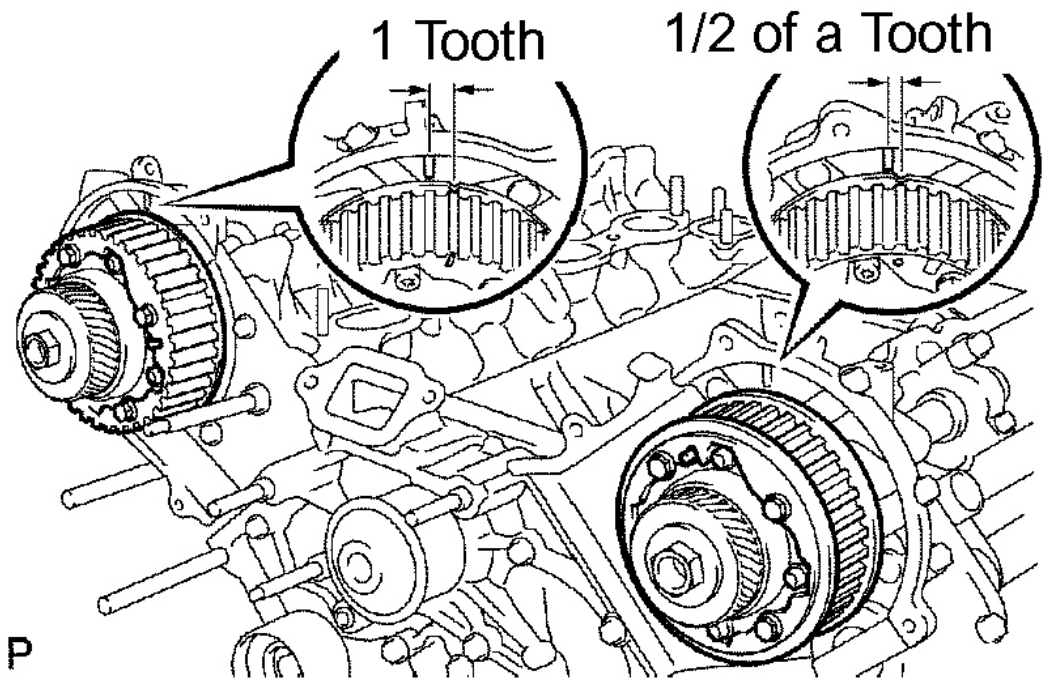
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

HINT:

Turn the camshaft timing pulleys slightly clockwise to make installation of the timing belt easier.

Camshaft timing pulley of LH bank: 1/2 of a tooth

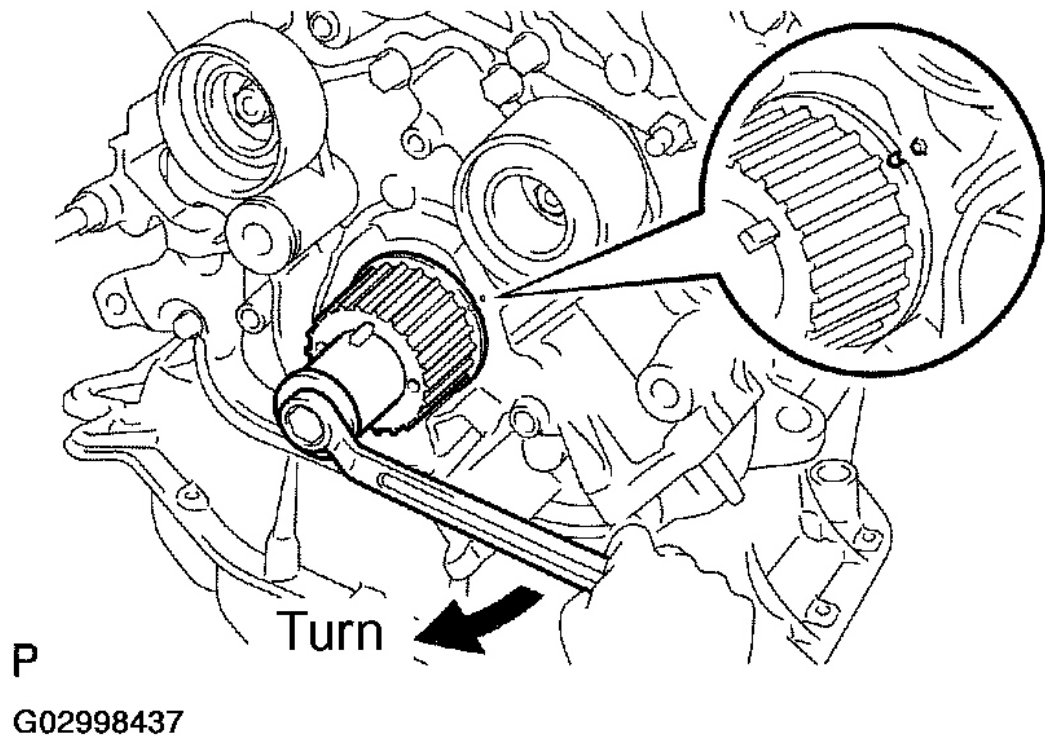
Camshaft timing pulley of RH bank: 1 tooth



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**Fig. 170: Turning Camshaft Timing Pulleys**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.

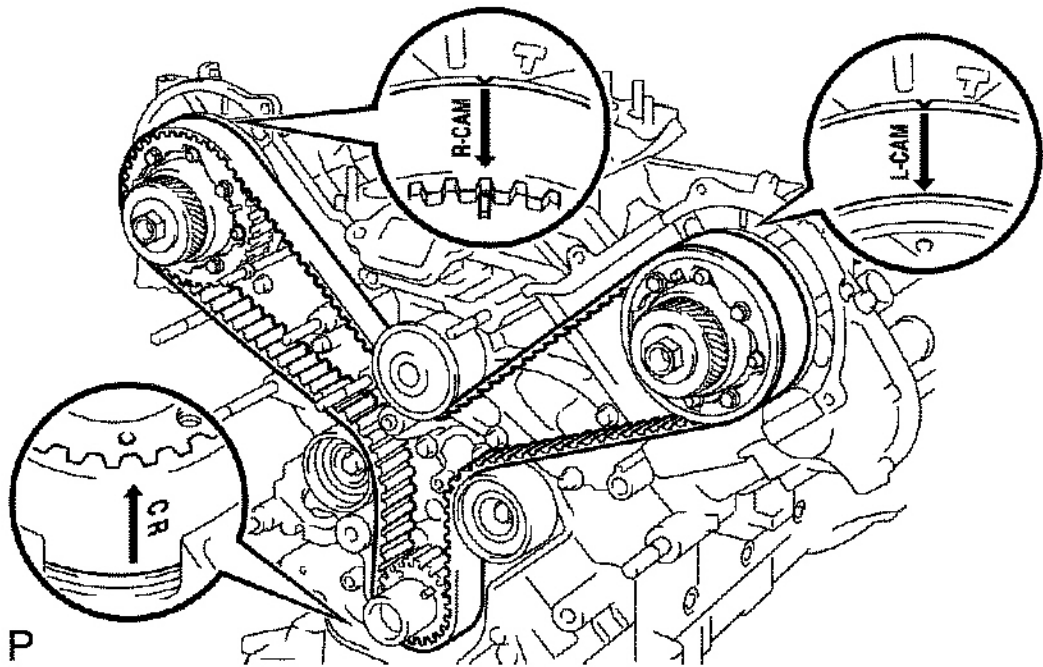


**Fig. 171: Turning Crankshaft To Aligning Timing Marks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the timing belt.
1. Remove any oil or water on each pulley, and keep them clean.

**NOTE:** Only wipe the pulleys. Do not use cleaning agents on the pulleys.

2. Face the front mark (arrow) on the timing belt forward.
3. Connect the timing belt to the crankshaft timing pulley.



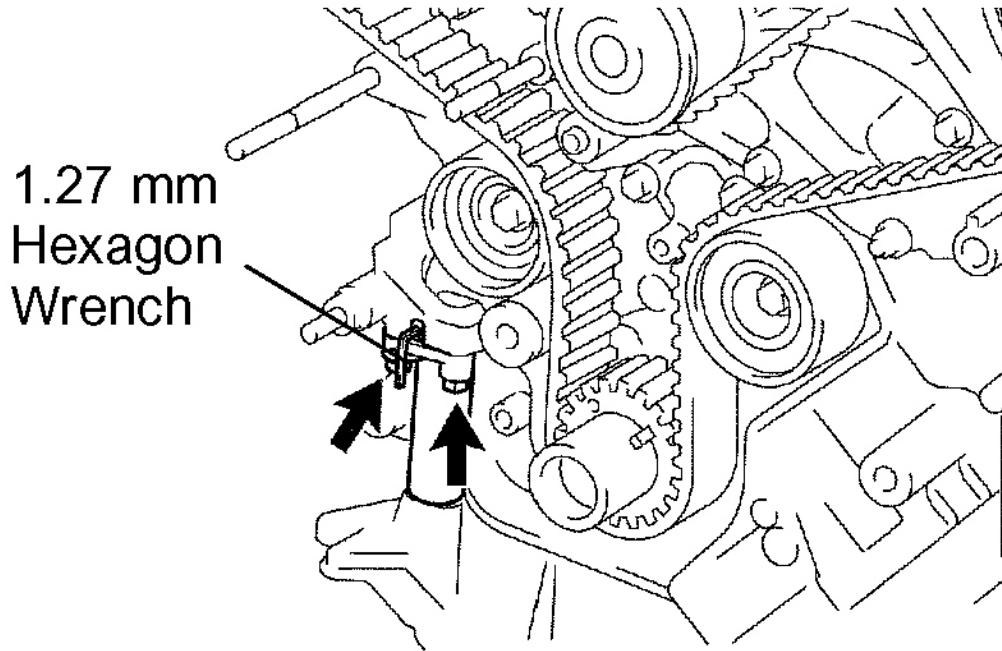
G02998438

**Fig. 172: Installing Timing Belt**

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

- Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.
4. Connect the timing belt to the idler No. 2.
  5. Connect the timing belt to the camshaft timing pulley LH.
    - Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.
  6. Connect the timing belt to the water pump pulley.
  7. Connect the timing belt to the camshaft timing pulley (RH bank).
    - Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.
  8. Connect the timing belt to the idler No. 1.
  9. Using a press, slowly press in the push rod using 981 to 9,807 N (100 to 1,000 kgf, 220 to 2,205 lbf) of pressure.
  10. Align the holes of the push rod and housing. Pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
  11. Release the press.

12. Install the dust boot to the belt tensioner.
- c. Install the belt tensioner.
1. Temporarily install the belt tensioner with the 2 bolts.
  2. Alternately tighten the 2 bolts.  
**Torque: 26 N.m (265 kgf.cm, 19 ft.lbf)**
  3. Using pliers, remove the 1.27 mm hexagon wrench from the belt tensioner.



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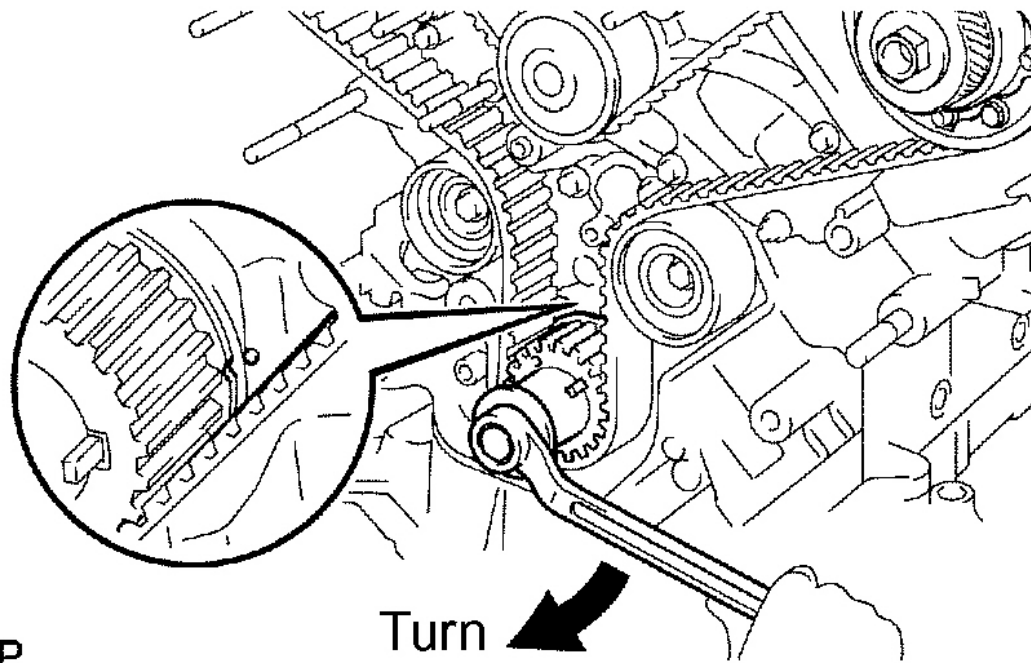
**Fig. 173: Installing Belt Tensioner**

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

- d. Check the valve timing.
1. Using the crankshaft damper bolt, slowly turn the crankshaft pulley 2 revolutions from TDC to TDC.

**NOTE:** Always turn the crankshaft pulley clockwise.





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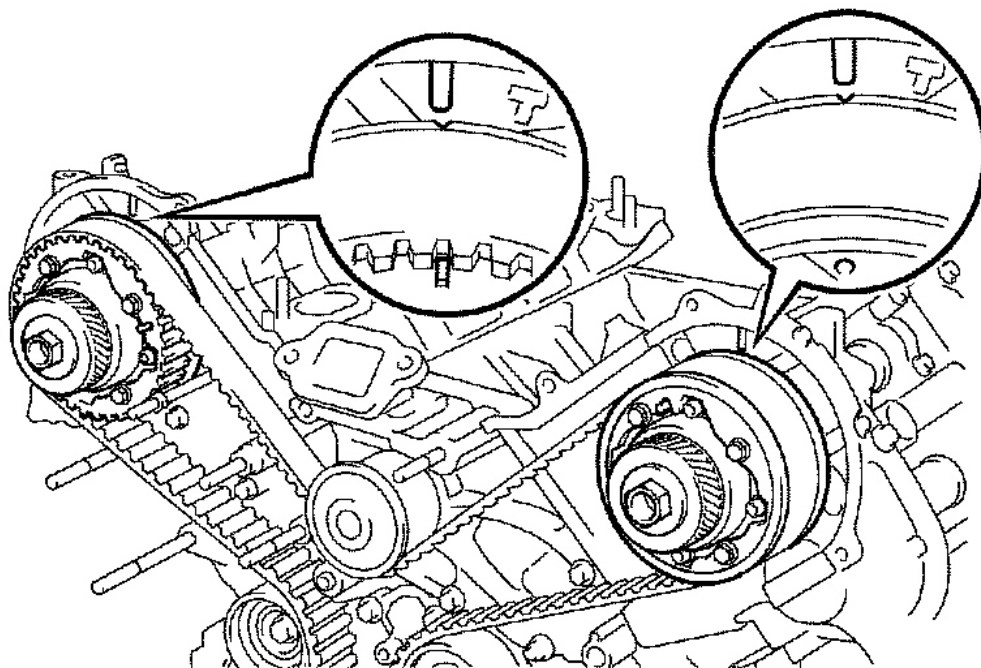
G02998440

**Fig. 174: Turning Crankshaft Pulley**

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

2. Check that each pulley aligns with the timing marks as shown in the illustration.

If the timing marks do not align, remove the timing belt and reinstall it.



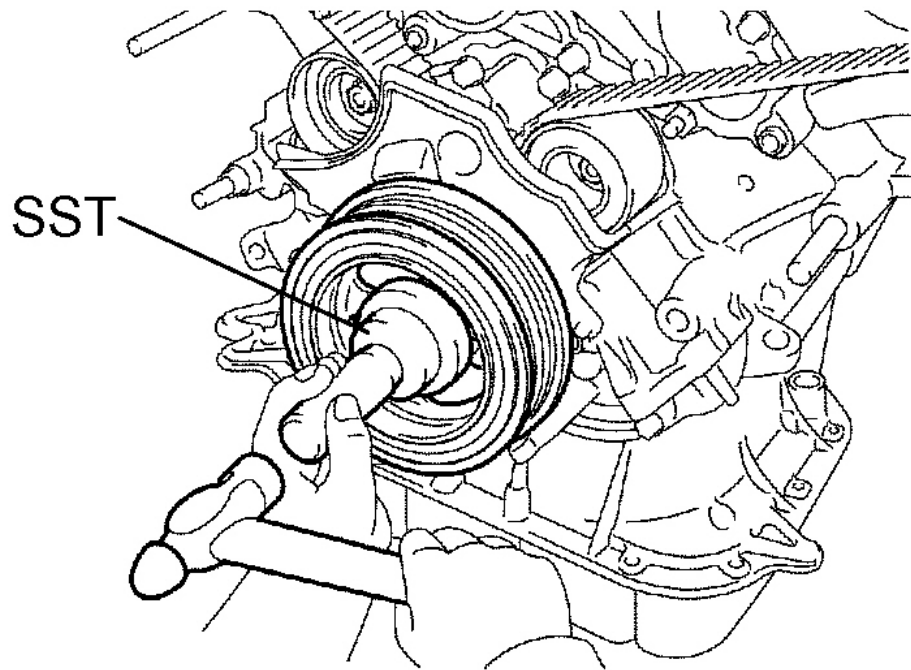
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**Fig. 175: Aligning Timing Marks**

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

74. **INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1**
  - a. Install the sensor plate. Face the cup side outward.
75. **INSTALL TIMING GEAR COVER SPACER**
  - a. Install the gasket to the cover spacer.
  - b. Install the cover spacer.
76. **INSTALL TIMING BELT NO.1 COVER**
  - a. Install the timing belt cover with the 4 bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
77. **INSTALL CRANKSHAFT DAMPER SUB-ASSY**
  - a. Using SST and a hammer, tap in the crankshaft damper.  
SST 09223-46011

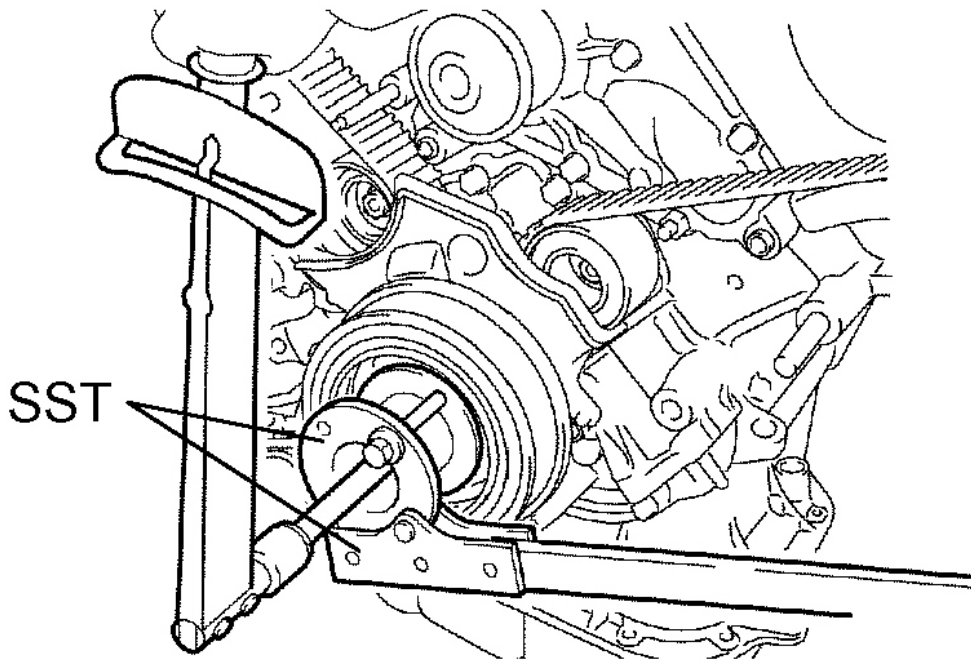


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**Fig. 176: Taping Crankshaft Damper Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, install the damper bolt.  
SST 09213-70010, 09330-00021  
**Torque: 245 N.m (2,500 kgf.cm, 181 ft.lbf)**
- c. Align the pulley set key with the key groove of the crankshaft damper.



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**Fig. 177: Installing Damper Bolt Using SST**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

78. **ADJUST VALVE CLEARANCE (See ADJUSTMENT )**
79. **INSTALL V-RIBBED BELT TENSIONER ASSY**
  - a. Install the belt tensioner with the bolt and 2 nuts.  
**Torque: 16 N.m (163 kgf.cm, 11 ft.lbf)**

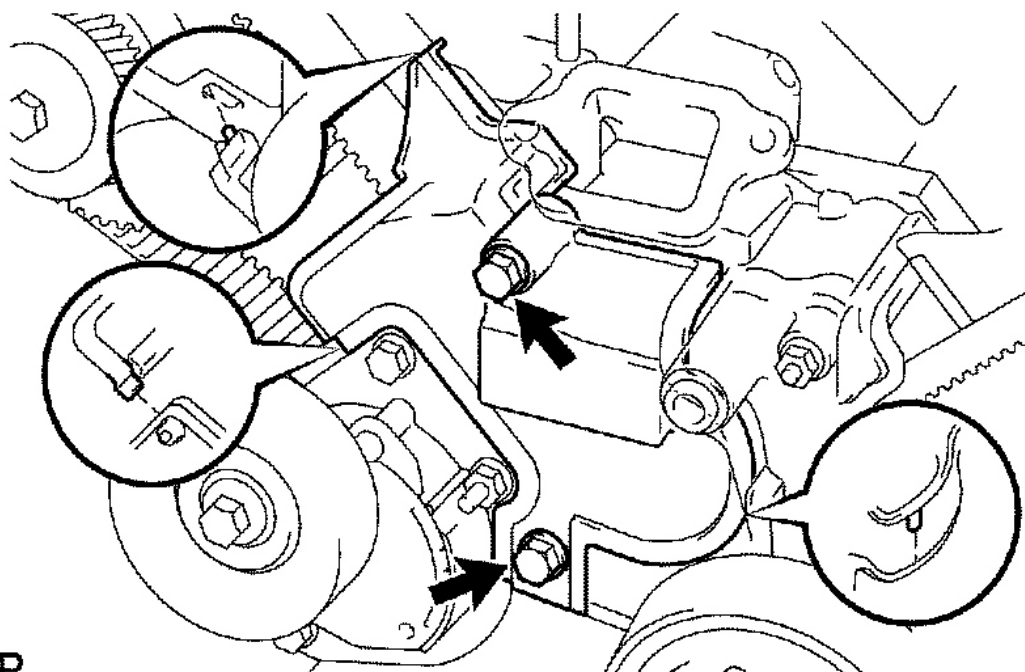
HINT:

Use a bolt that is 106 mm (4.18 in.) in length.

80. **INSTALL IDLER PULLEY SUB-ASSY NO.2**
  - a. Install the idler pulley and cover plate with the bolt.  
**Torque: 39 N.m (398 kgf.cm, 29 ft.lbf)**
81. **INSTALL TIMING BELT COVER SUB-ASSY NO.2**
  - a. Fit the timing belt cover, matching the claws and pin with each part.
  - b. Install the timing belt cover with the 2 bolts.  
**Torque: 16 N.m (163 kgf.cm, 12 ft.lbf)**

HINT:

Use bolts that are 106 mm (4.17 in.) in length.



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**Fig. 178: Installing Timing Belt Cover Sub-Assy No.2**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 82. INSTALL IDLER PULLEY ASSY

- a. Install the idler pulley with the 2 bolts and 2 nuts.

**Torque:**

**32 N.m (326 kgf.cm, 24 ft.lbf) for 14 mm head bolt A**

**16 N.m (163 kgf.cm, 12 ft.lbf) for 12 mm head bolt B**

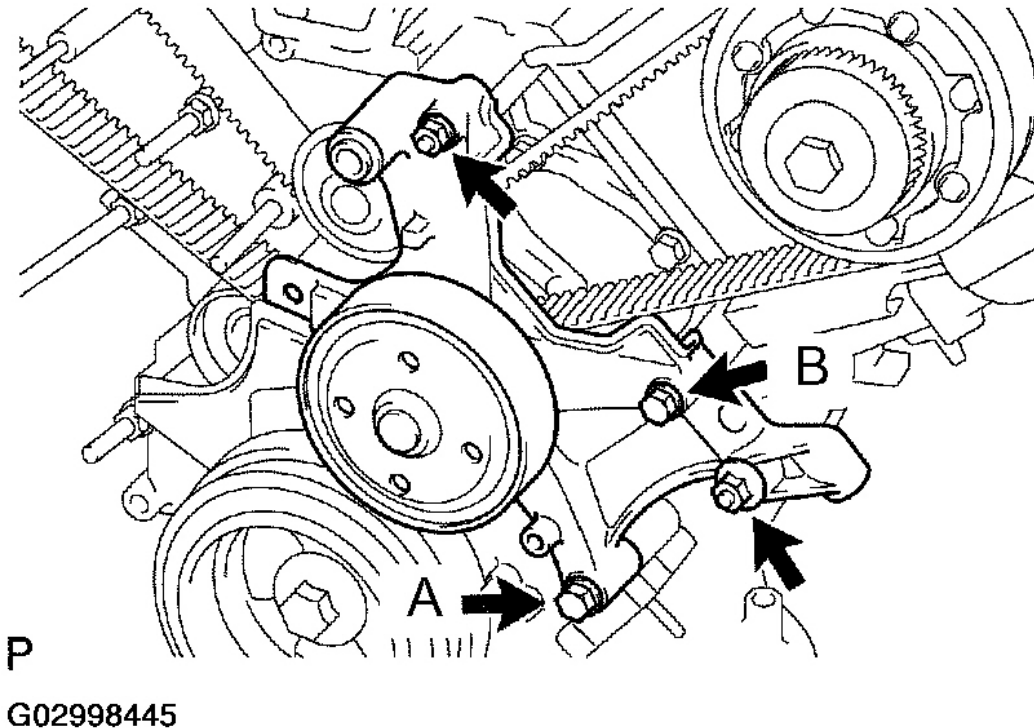
HINT:

Each bolt length is indicated below.

Bolt length:

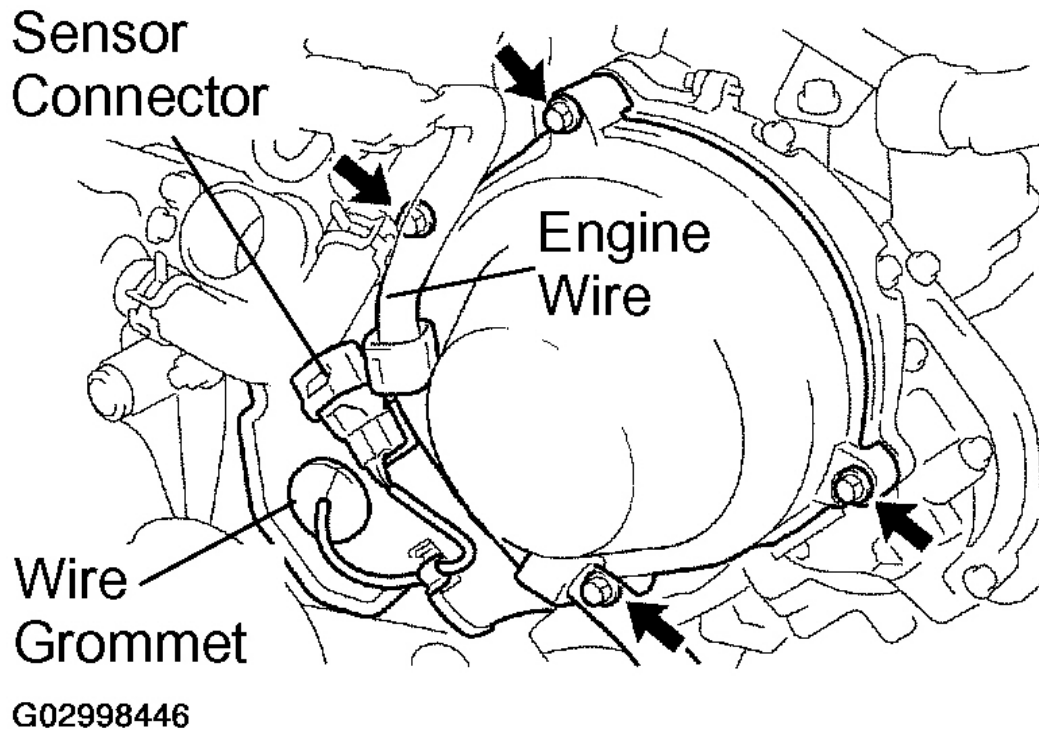
114 mm (4.49 in.) for 14 mm head (A)

106 mm (4.17 in.) for 12 mm head (B)



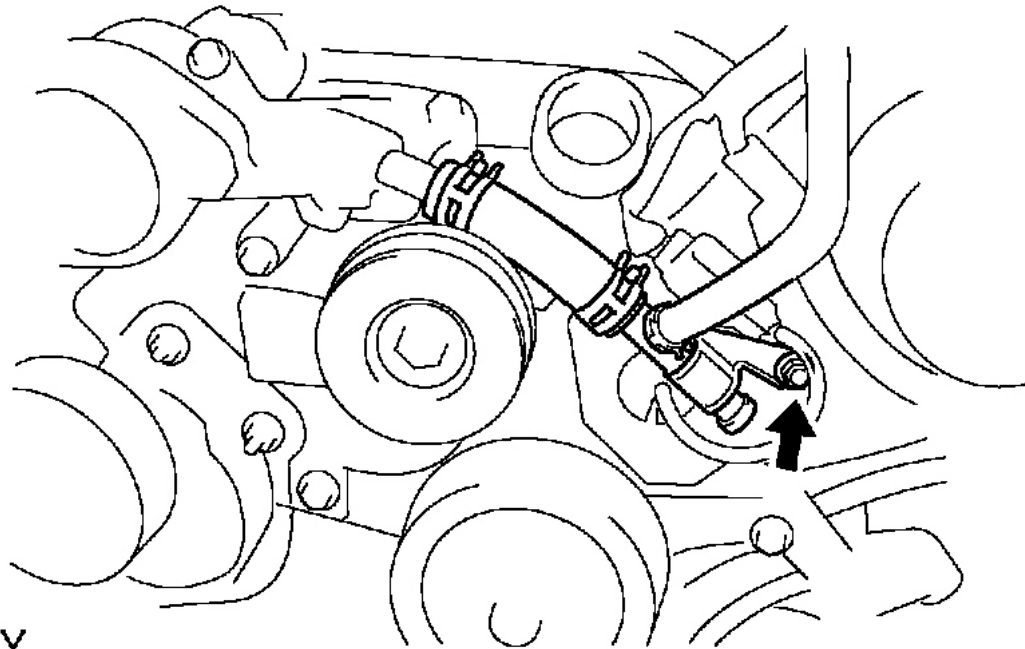
**Fig. 179: Installing Idler Pulley Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

83. **INSTALL TIMING BELT COVER SUB-ASSY NO.3 LH**
- Install the gasket to the cover.
  - Run the camshaft position sensor wire through the cover hole.
  - Install the cover with the 4 bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
  - Install the wire grommet to the cover.
  - Install the sensor connector to the sensor holder.
  - Connect the sensor connector.
  - Install the sensor wire to the wire clamp on the cover.
  - Install the engine wire to the 2 wire clamps on the cover.



**Fig. 180: Installing Timing Belt Cover Sub-Assy No.3 LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Connect the 2 water bypass hoses, as shown in the illustration.
- j. Install the No. 3 water bypass pipe to the cover with the cap nut.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- k. Install the engine wire to the 2 wire clamps on the cover.



Y

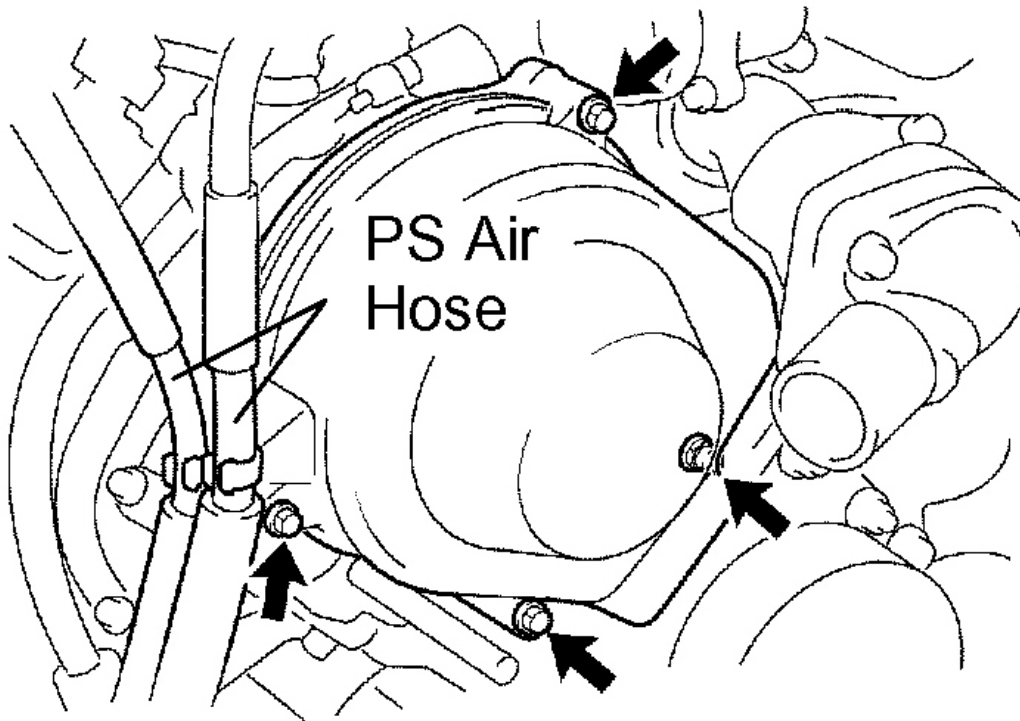
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**Fig. 181: Connecting Water By-Pass Hoses**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**84. INSTALL TIMING CHAIN OR BELT COVER NO.2**

- a. Install the gasket to the cover.
- b. Install the cover with the cap nut and 3 bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- c. Install the 2 PS air hoses to the clamp on the cover.





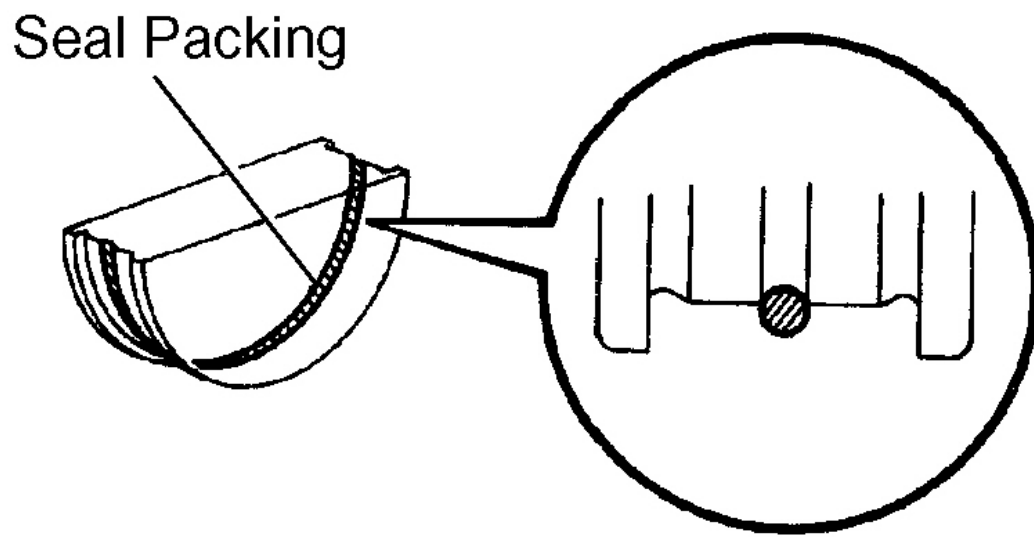
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**Fig. 182: Installing Cover With Cap Nut And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**85. INSTALL SEMICIRCULAR PLUG**

- a. Remove any old packing (FIPG) material.
- b. Apply seal packing to the semicircular plug grooves.

**Seal packing: Part No. 08826-00080 or equivalent**

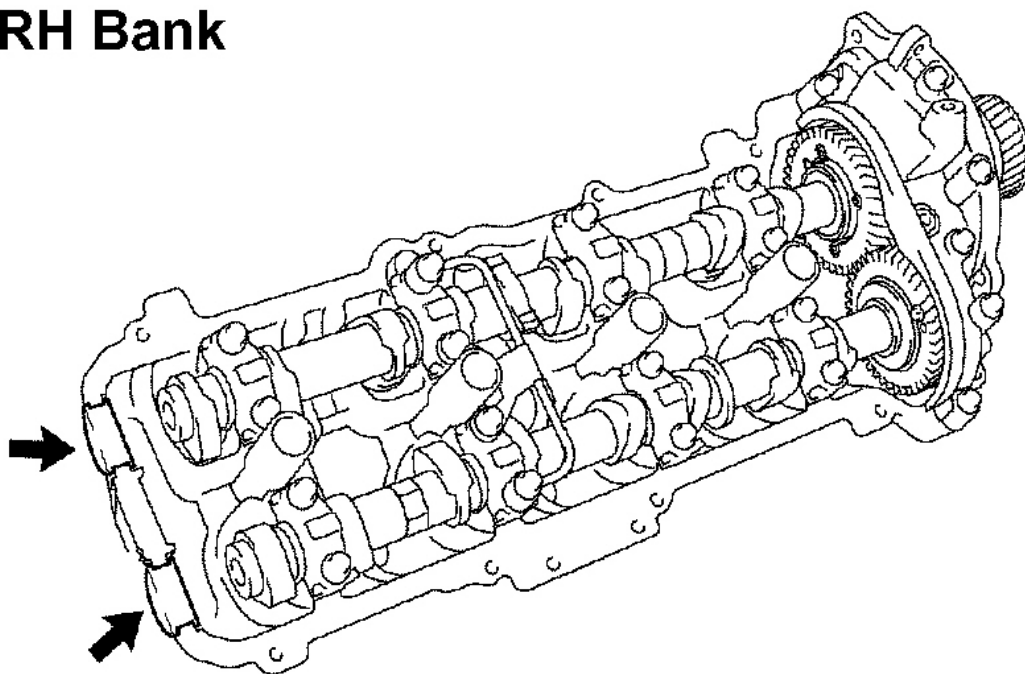


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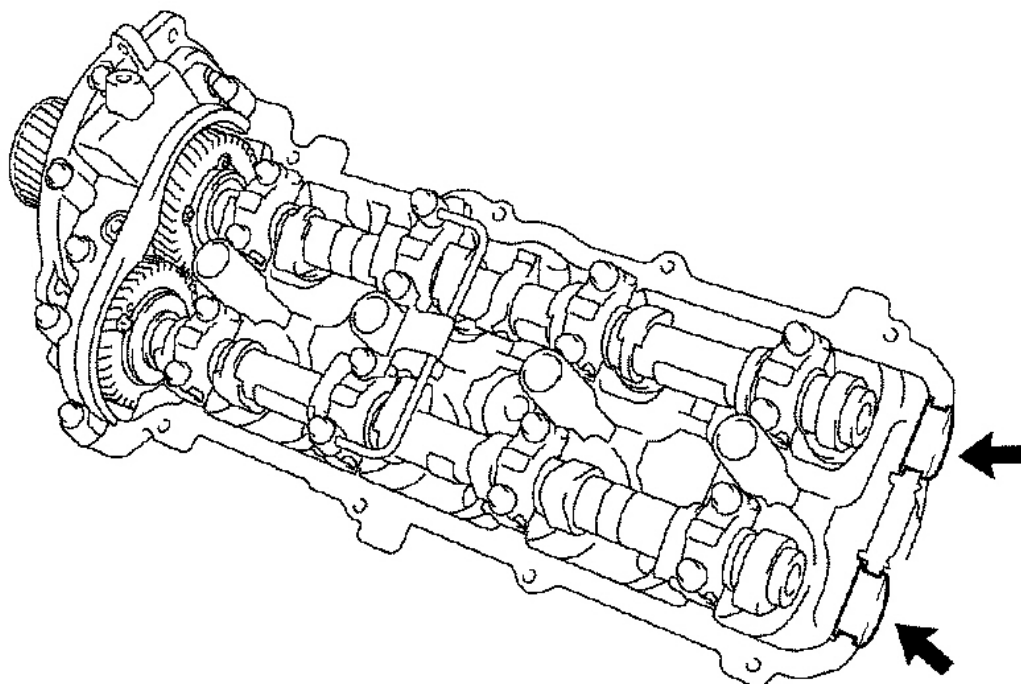
**Fig. 183: Identifying Applying Seal Packing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 4 semicircular plugs to the cylinder heads as shown in the illustration.

**RH Bank**



**LH Bank**



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**Fig. 184: Identifying Cylinder Heads**

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

86. **INSTALL CYLINDER HEAD COVER SUB-ASSY**

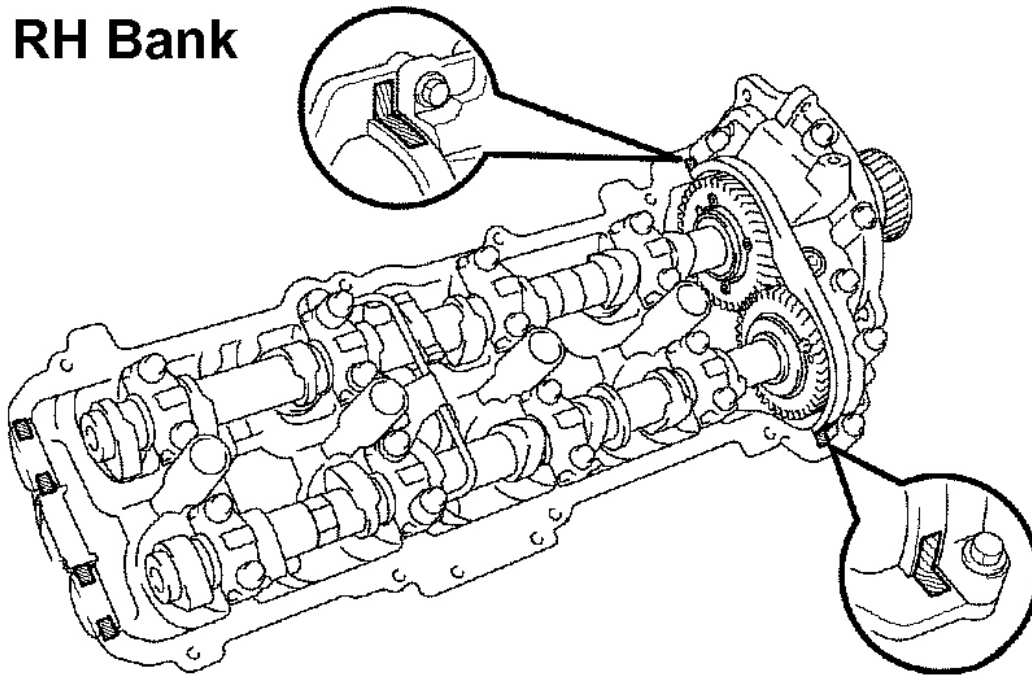
- a. Remove any old packing (FIPG) material.
- b. Apply seal packing to the cylinder heads as shown in the illustration.

**Seal packing: Part No. 08826-00080 or equivalent**

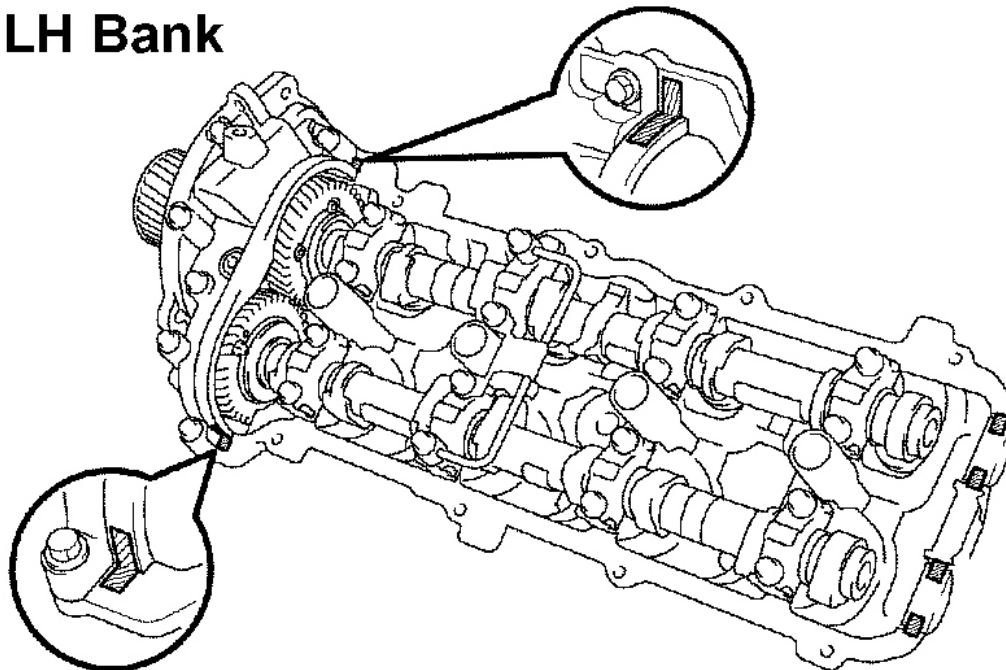
- c. Install the gasket to the cylinder head cover.
- d. Install the seal washer to the bolt.
- e. Install the cylinder head cover with the 9 bolts. Uniformly tighten the bolts in several passes.

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

**RH Bank**



**LH Bank**



 : Seal Packing

G02998451

**Fig. 185: Applying Seal Packing To Cylinder Heads**

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

87. **INSTALL OIL FILLER CAP SUB-ASSY**
88. **INSTALL SPARK PLUG**

## **TIMING BELT**

### **REPLACEMENT**

1. **DISCONNECT BATTERY NEGATIVE TERMINAL**
2. **REMOVE AIR CLEANER INLET NO.1**
3. **DRAIN ENGINE COOLANT**
4. **REMOVE V-BANK COVER**
5. **REMOVE INTAKE AIR CONNECTOR PIPE**
6. **REMOVE ENGINE UNDER COVER NO.1**
7. **DISCONNECT RADIATOR HOSE NO.1**
8. **DISCONNECT RADIATOR HOSE NO.2**
9. **DISCONNECT OIL COOLER INLET TUBE NO.1**
10. **DISCONNECT OIL COOLER OUTLET TUBE NO.1**
11. **REMOVE AIR CLEANER ASSY**
12. **REMOVE RADIATOR ASSY (See REPLACEMENT)**
13. **REMOVE FAN AND GENERATOR V BELT (See REPLACEMENT)**
14. **REMOVE VANE PUMP ASSY**
  - a. Remove the 2 bolts, nut and pump.

HINT:

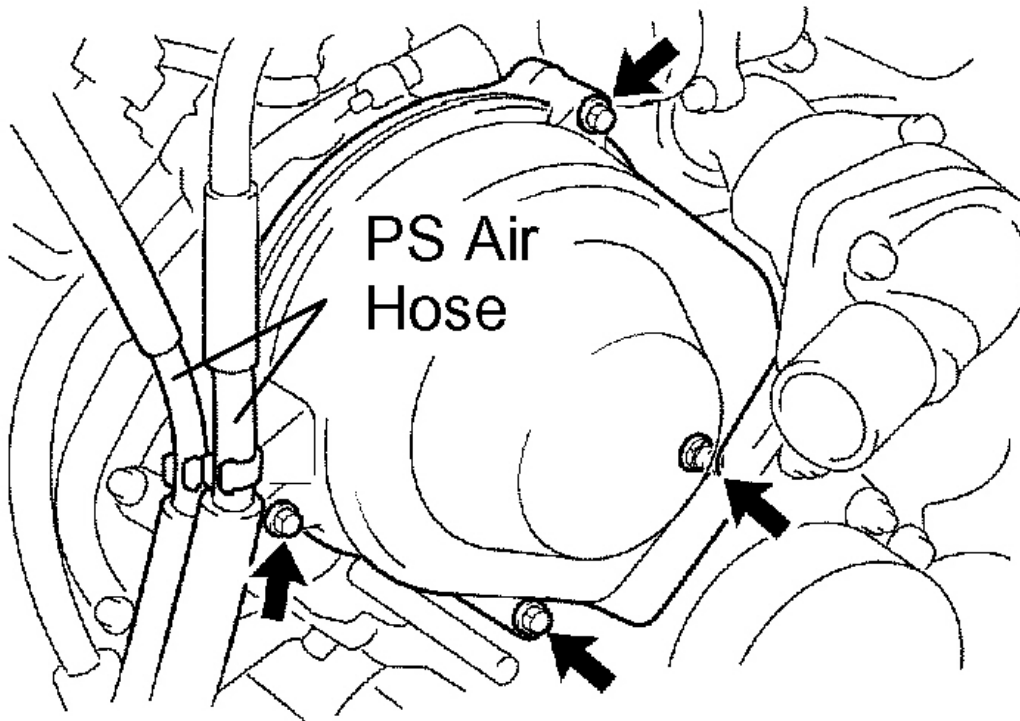
Pump should be removed with the hoses connected and then hang with a rope or wire on the body's side.

15. **REMOVE GENERATOR ASSY (See REPLACEMENT)**
16. **DISCONNECT COMPRESSOR AND MAGNETIC CLUTCH**

HINT:

The cooler compressor with the magnetic clutch should be removed with the low-pressure and high-pressure hoses connected and then hang with a rope or wire on the body's side.

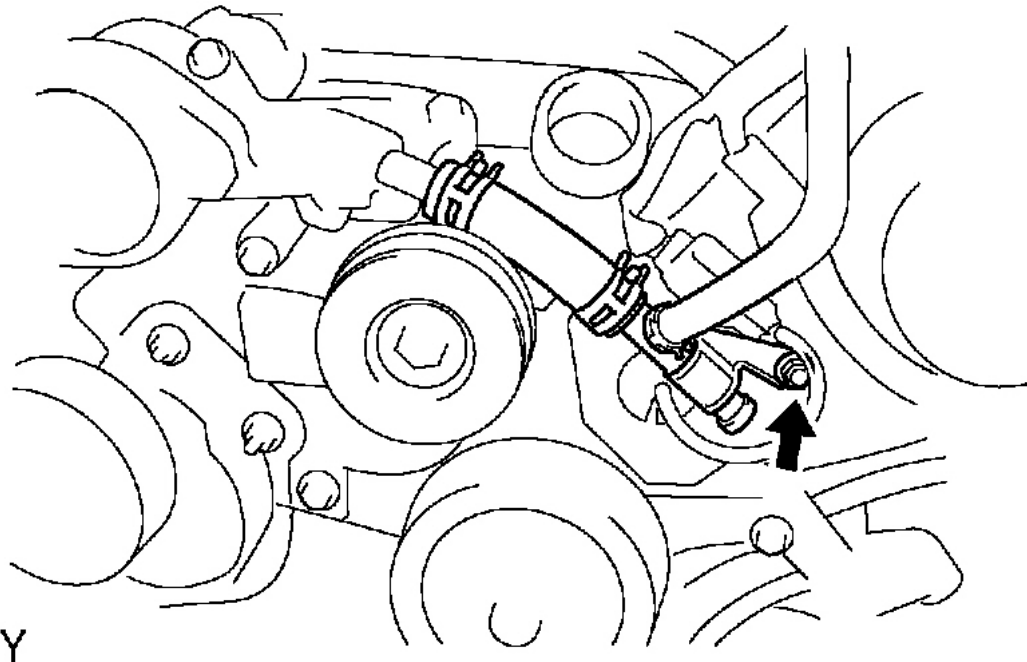
17. **REMOVE TIMING CHAIN OR BELT COVER NO.2**
  - a. Disconnect the 2 PS air hoses from the clamp on the cover.
  - b. Remove the cap nut, 3 bolts, cover and gasket.



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**Fig. 186: Removing Cap Nut And Bolts, Cover And Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE TIMING BELT COVER SUB-ASSY NO.3 LH**
  - a. Remove the cap nut, and disconnect the No.3 water bypass pipe from the cover.
  - b. Disconnect the 2 water bypass hoses as shown in the illustration.



Y

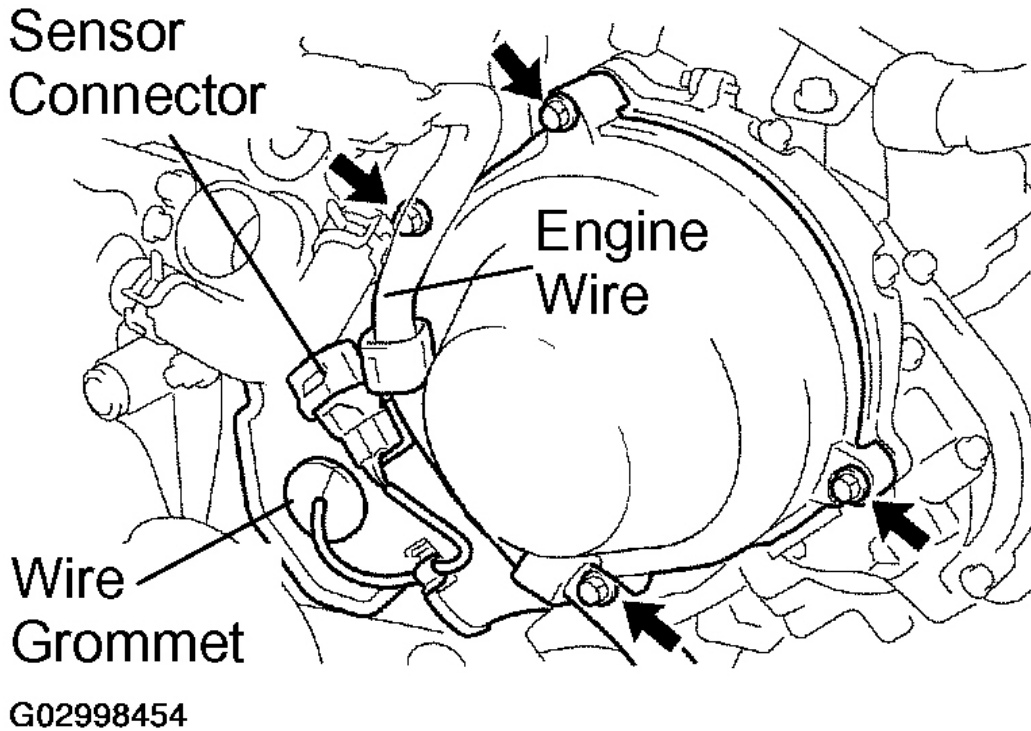
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**Fig. 187: Disconnecting Water By-Pass Hoses**

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

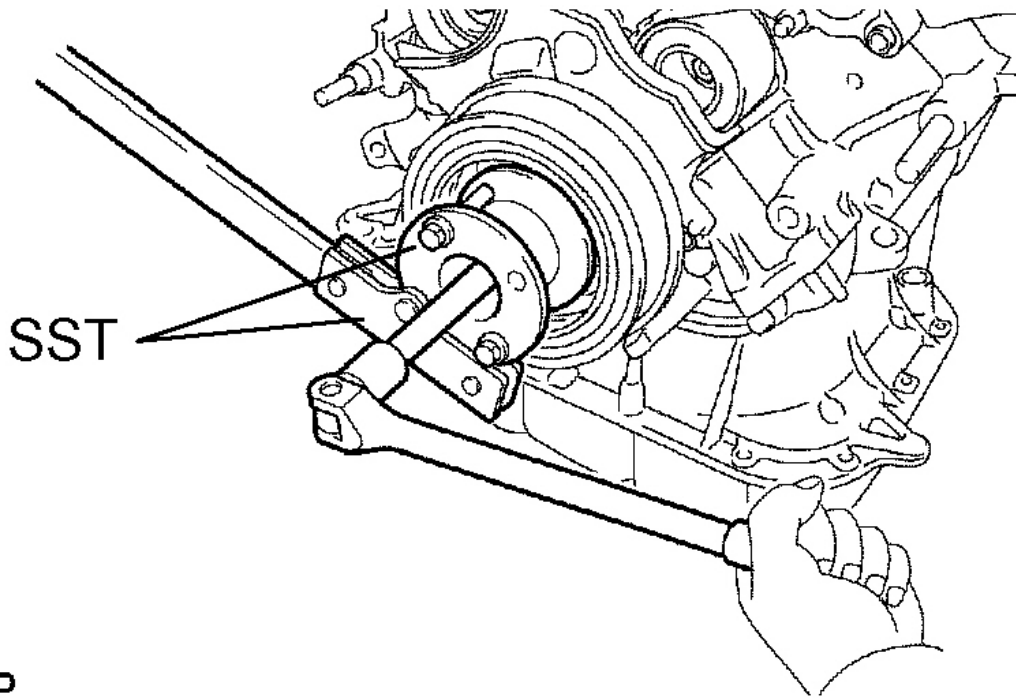
- c. Disconnect the engine wire from the 2 wire clamps.
  - d. Disconnect the camshaft position sensor connector.
  - e. Disconnect the camshaft position sensor wire from the wire clamp on the cover.
  - f. Remove the wire grommet from the cover.
  - g. Remove the 4 bolts.
  - h. Disconnect the cover from the timing plate and camshaft bearing cap.
  - i. Disconnect the wire clamp for the sensor from the cover.
  - j. Remove the connector holder from the sensor connector.
  - k. Remove the cover and gasket.
19. **REMOVE TIMING BELT COVER SUB-ASSY NO.2**
- a. Remove the 2 bolts and timing belt cover.
20. **REMOVE V-RIBBED BELT TENSIONER ASSY**
- a. Remove the bolt, 2 nuts and belt tensioner.





**Fig. 188: Disconnecting Wire Clamp For Sensor From Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. **REMOVE IDLER PULLEY ASSY**
  - a. Remove the 2 bolts, 2 nuts and idler pulley.
22. **REMOVE CRANKSHAFT DAMPER SUB-ASSY**
  - a. Using SST, remove the pulley bolt.  
SST 09213-7001 1, 09330-00021



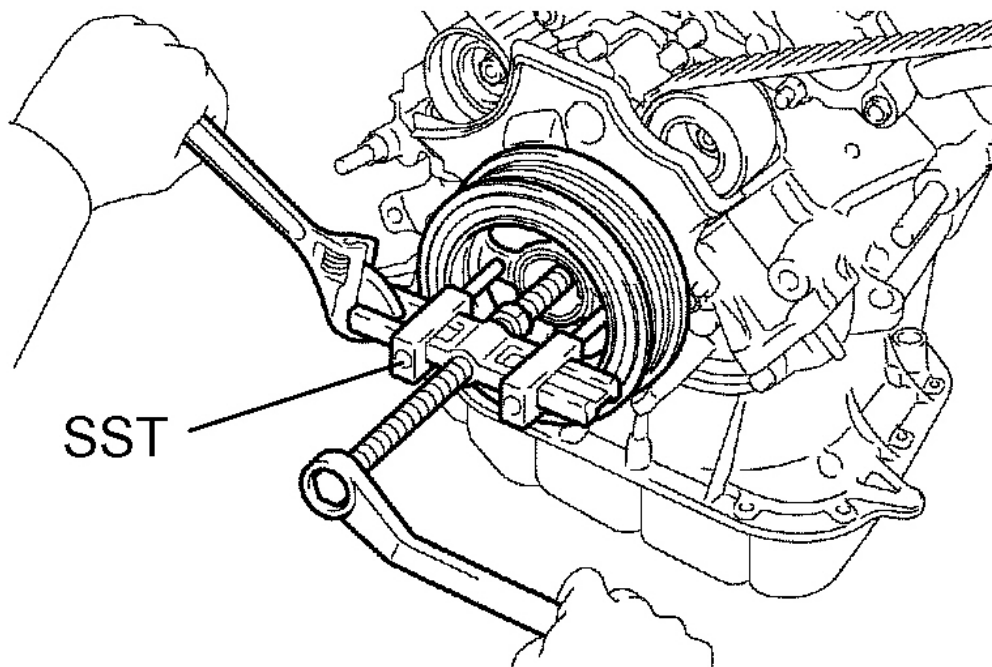
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**Fig. 189: Removing Pulley Bolt Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, remove the damper.

SST 09950-50013 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05021)



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**Fig. 190: Removing Damper Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**23. REMOVE TIMING BELT NO.1 COVER**

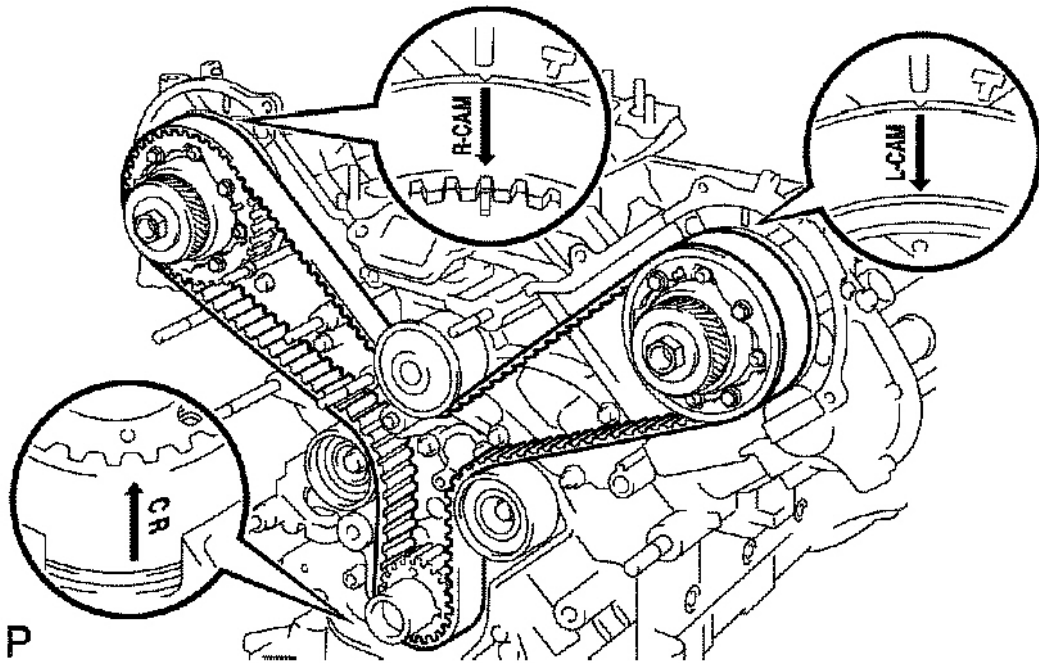
- a. Remove the 4 bolts and cover.

**24. REMOVE CRANKSHAFT POSITION SENSOR PLATE**

**25. REMOVE TIMING BELT**

- a. If planning to reuse the belt, check the installation marks on the belt.
  1. Check that there are 3 installation marks on the belt by turning the crankshaft as shown in the illustration.

If the installation marks have disappeared, place a new installation mark on the belt before removing each part.

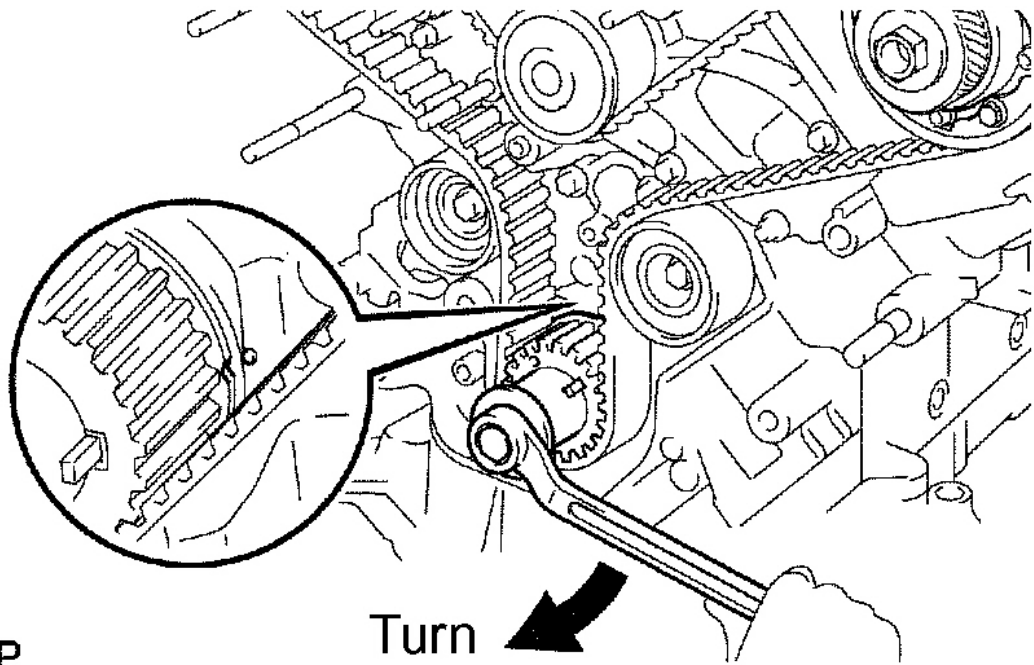


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**Fig. 191: Removing Timing Belt**

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

- b. Set the No. 1 cylinder to approximately 50° BTDC/compression.
  1. Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.



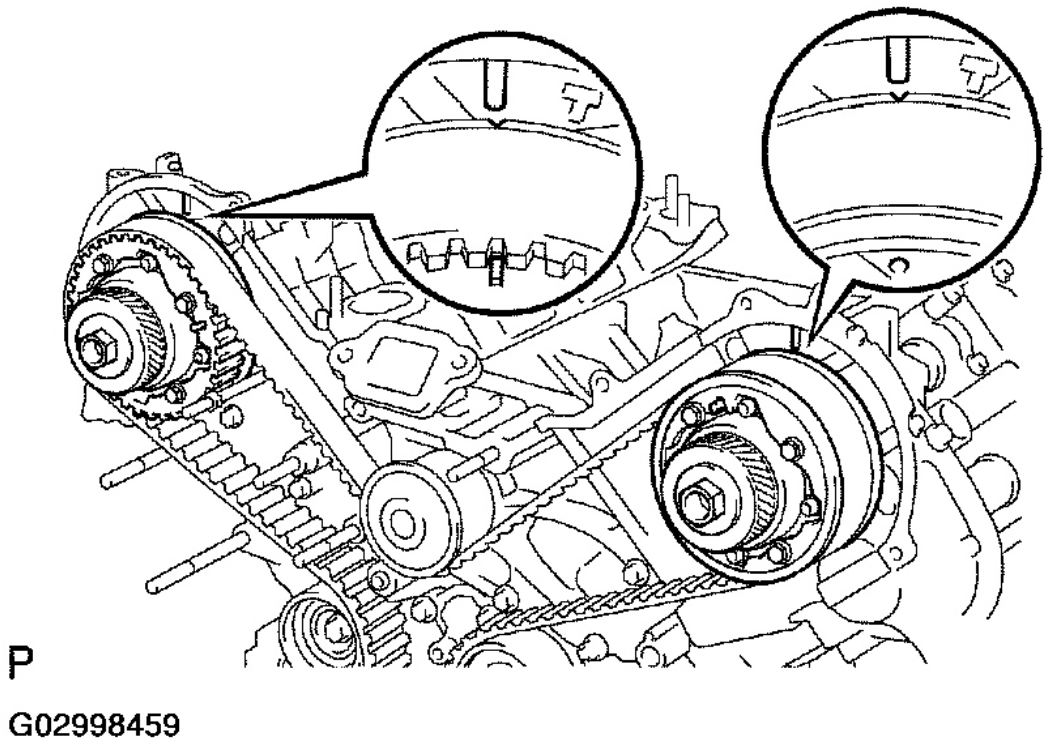
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**Fig. 192: Turning Crank-Shaft To Aligning Timing Marks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check that the timing marks of the camshaft timing pulleys and timing belt plates are aligned.

If not, turn the crankshaft 1 revolution (360°).



**Fig. 193: Checking Timing Marks**

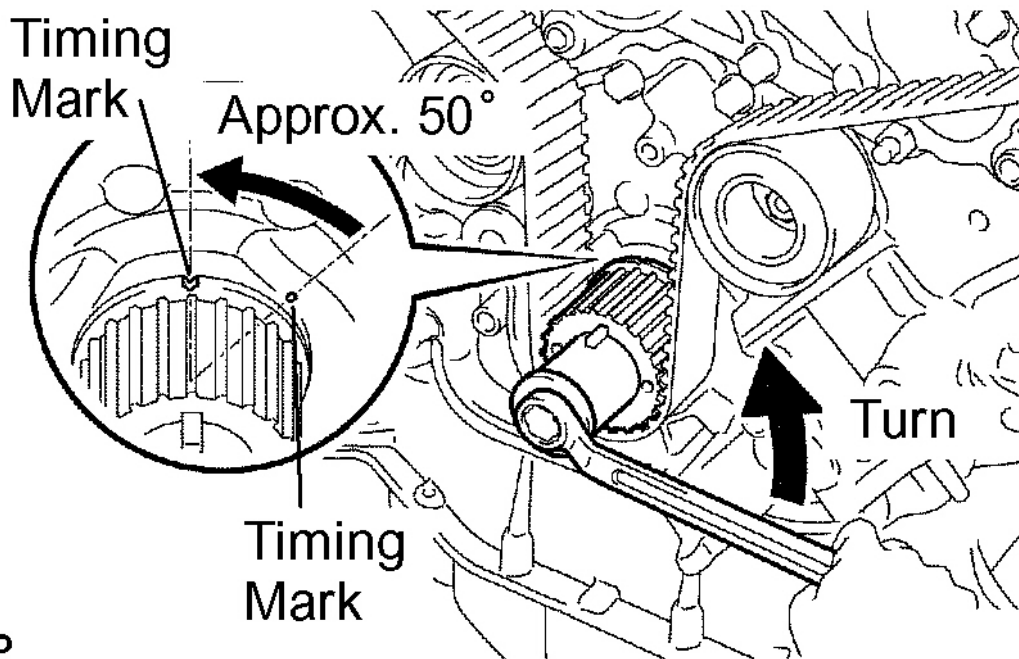
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Using the crankshaft damper bolt, turn the crankshaft counterclockwise by approximately 50°.

**With timing belt disengaged:**

**The crankshaft damper must be at the correct angle to avoid damage in later steps. If the crankshaft pulley is at the wrong angle and then the camshaft timing pulley and the camshaft are removed, the piston head and valve head may come in contact and be damaged.**

- c. Alternately loosen the 2 bolts, and remove them, the belt tensioner and dust boot.



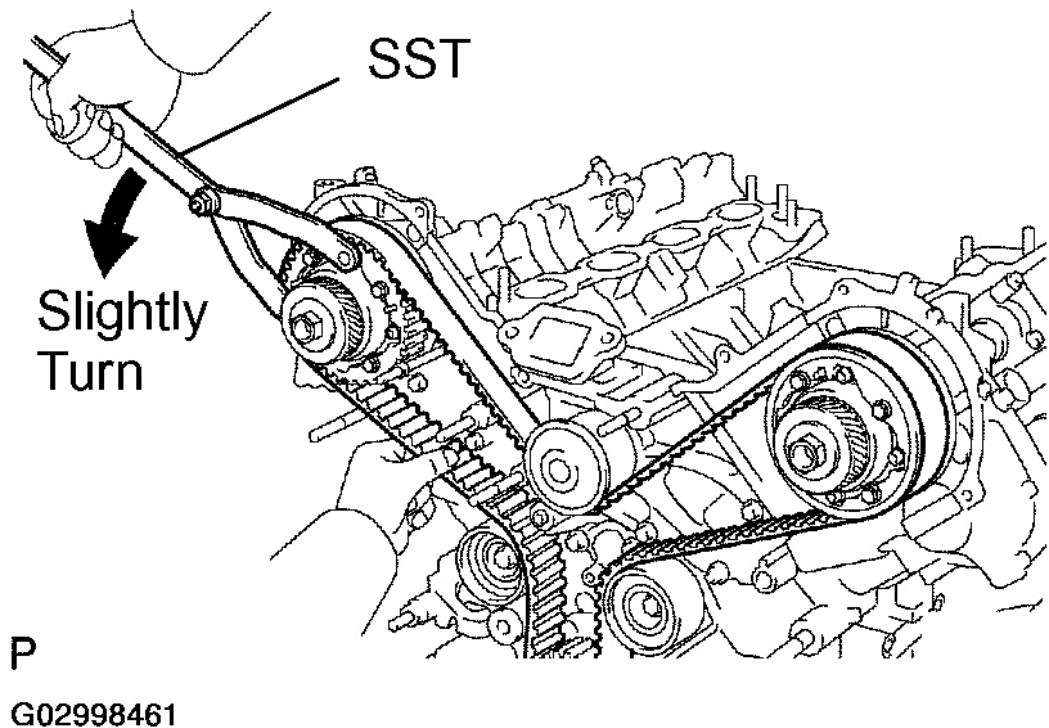
G02998460

**Fig. 194: Turning Crank-Shaft**

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

- d. Using SST, loosen the tension between the camshaft timing pulley (RH bank) and crankshaft timing pulley by slightly turning the camshaft timing pulley (RH bank) counterclockwise.

SST 09960-10010 (09962-01000, 09963-00350)



**Fig. 195: Turning Camshaft Timing Pulley (RH Bank) Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

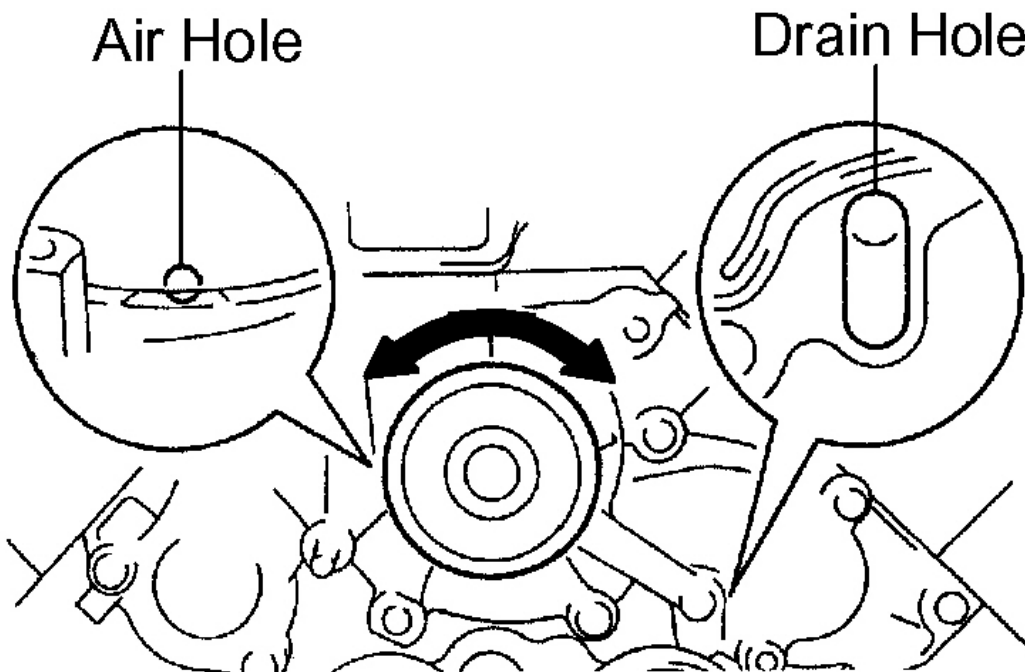
- e. Disconnect the belt from the timing belt idler No. 1, and remove the belt.
26. **INSTALL TIMING BELT**
- a. Check the belt idler No. 1 and No. 2.
    1. Visually check the seal portion of the idler pulley for oil leakage.  
  
If leakage is found, replace the idler.
    2. Check that the idler turns smoothly.  
  
If necessary, replace the idler.
  - b. Check the water pump.
    1. Visually check the air hole and water hole for coolant leakage.  
  
If leakage is found, replace the water pump and belt.
    2. Turn the pulley, and check that the water pump bearing moves smoothly and quietly.



If necessary, replace the water pump.

27. Remove any oil or water on the crankshaft damper, oil pump pulley, water pump pulley, idler No. 1 and idler No. 2. Keep them clean.

**NOTE:** Only wipe the pulleys. Do not use any cleaning agents on the pulleys.

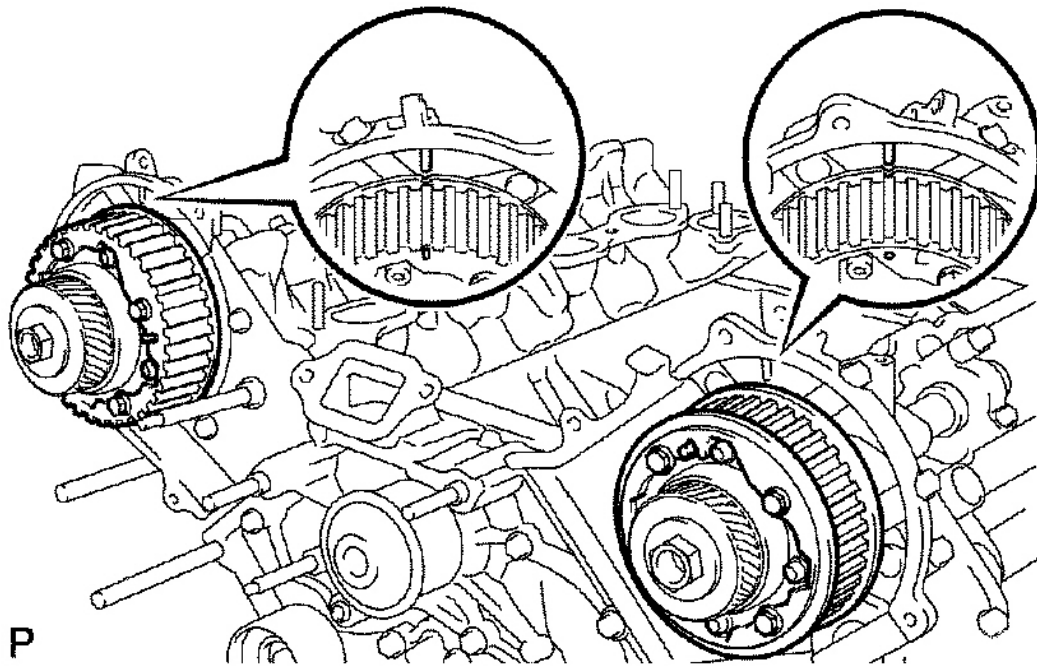


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**Fig. 196: Checking Water Pump**

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

28. Set the No. 1 cylinder to TDC/compression.
  1. Turn the hexagon wrench head portion of the camshaft to align the timing marks of the camshaft timing pulleys and timing belt plates.



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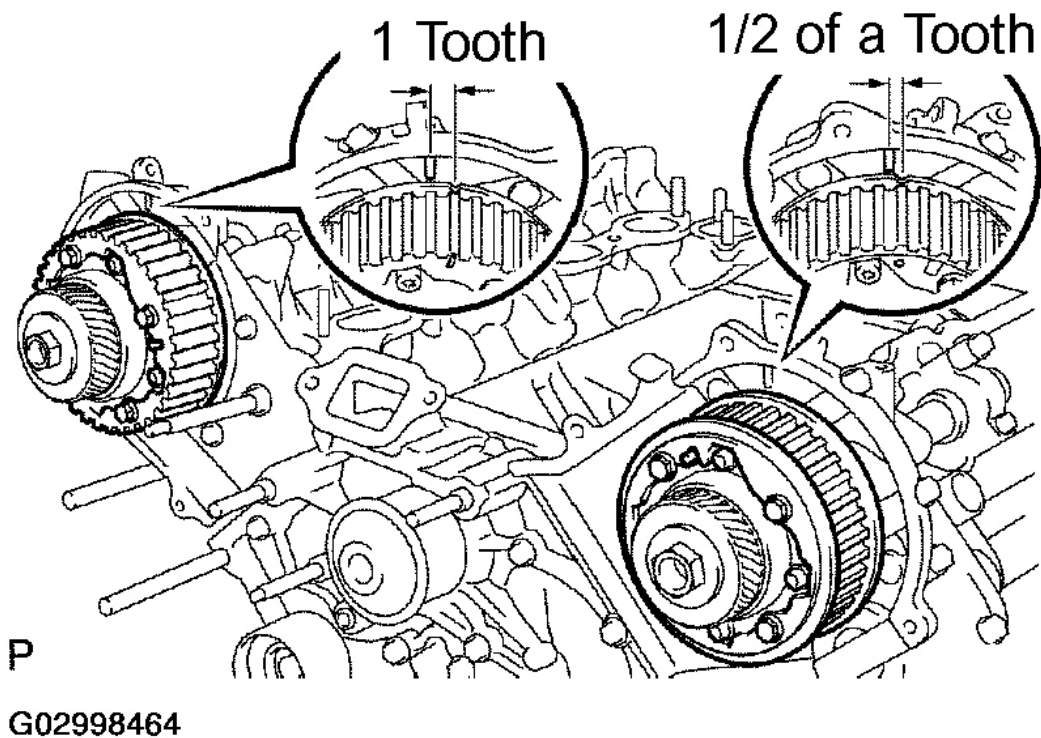
**Fig. 197: Aligning Timing Marks Of Camshaft Timing Pulleys And Timing Belt Plates**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Turn the camshaft timing pulleys slightly clockwise to make installation of the timing belt easier.

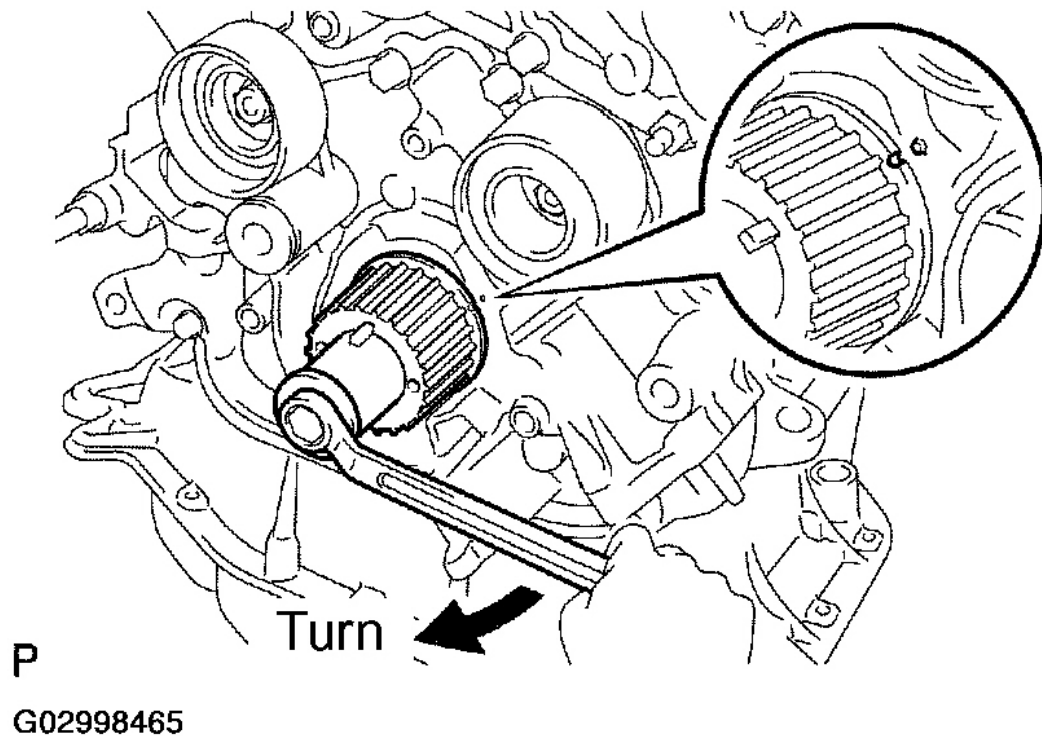
Camshaft timing pulley of LH bank: 1/2 of a tooth

Camshaft timing pulley of RH bank: 1 tooth



**Fig. 198: Turning Camshaft Timing Pulleys**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the crankshaft damper bolt, turn the crankshaft to align the timing marks of the crankshaft timing pulley and oil pump body.



**Fig. 199: Turning Crankshaft To Aligning Timing Marks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Remove any oil or water on each pulley. Keep them clean.

**NOTE:** Only wipe the pulleys. Do not use cleaning agents on the pulleys.

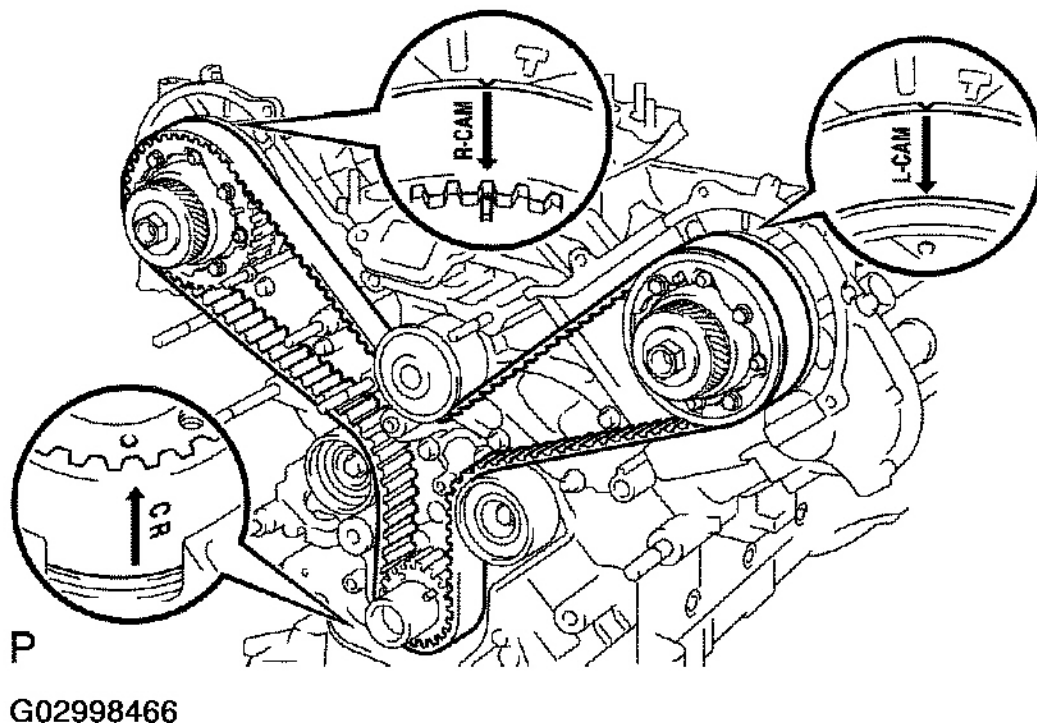
4. Face the front mark (arrow) on the belt forward.
5. Connect the belt to the crankshaft timing pulley. Align the installation mark on the belt with the timing mark of the crankshaft timing pulley.
6. Connect the belt to the idler No. 2.
7. Connect the belt to the camshaft timing pulley (LH bank).

Align the installation mark on the belt with the timing mark of the camshaft timing pulley.

8. Connect the belt to the water pump pulley.
9. Connect the belt to the camshaft timing pulley (RH bank).

Align the installation mark on the belt with the timing mark of the camshaft timing pulley.

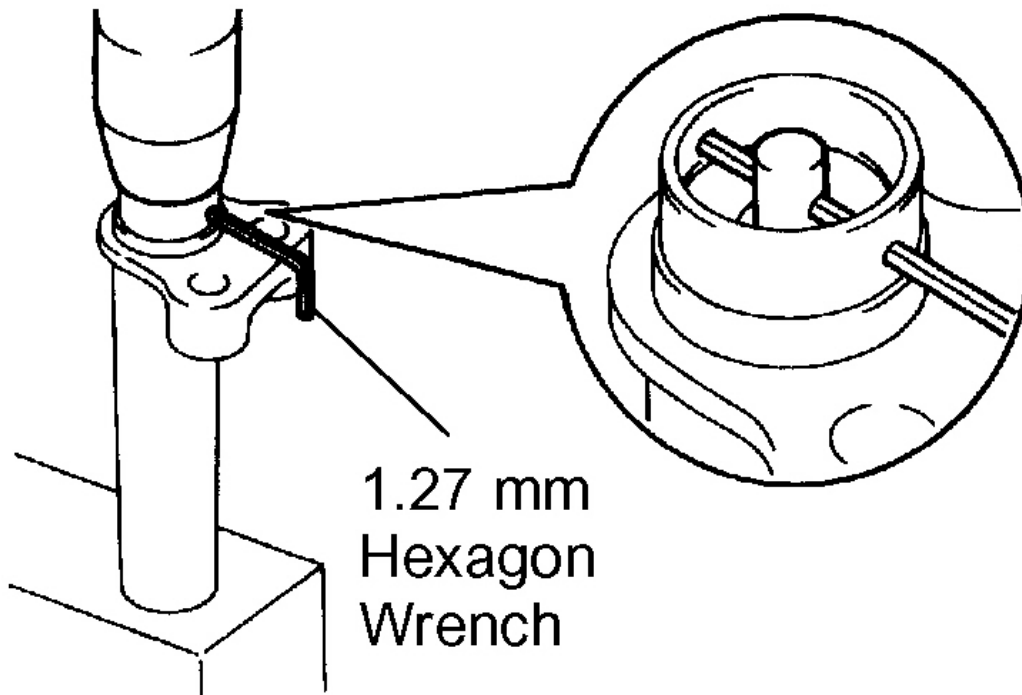
10. Connect the timing belt to the idler No.1.



**Fig. 200: Aligning Timing Marks Of Crankshaft Timing Pulley And Oil Pump Body**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. Set the belt tensioner.

1. Using a press, slowly press in the push rod using 981 to 9,807 N (100 to 1,000 kgf, 220 to 2,205 lbf) of pressure.
2. Align the holes of the push rod and housing. Pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.
3. Release the press.
4. Install the dust boot to the belt tensioner.



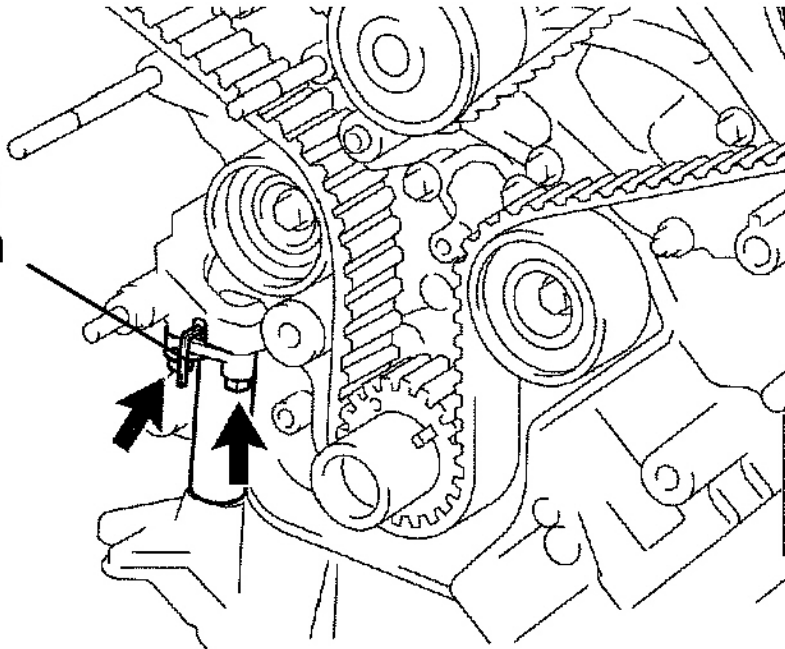
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**Fig. 201: Aligning Holes Of Using Hexagon Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. Install the belt tensioner.
  1. Temporarily install the belt tensioner with the 2 bolts.
  2. Alternately tighten the 2 bolts.

**Torque: 26 N.m (265 kgf.cm, 19 ft.lbf)**
  3. Using pliers, remove the 1.27 mm hexagon wrench from the belt tensioner.

1.27 mm  
Hexagon  
Wrench



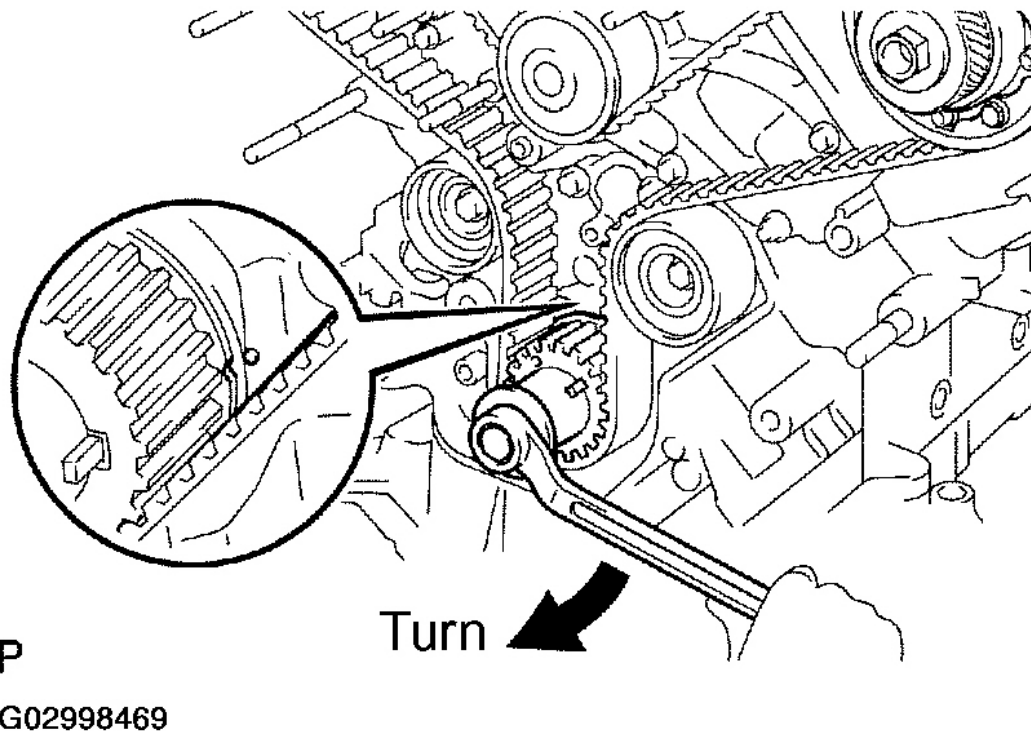
P

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**Fig. 202: Removing Hexagon Wrench From The Belt Tensioner**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. Check the valve timing.
  1. Using the crankshaft damper bolt, slowly turn the crankshaft timing pulley 2 revolutions from TDC to TDC.

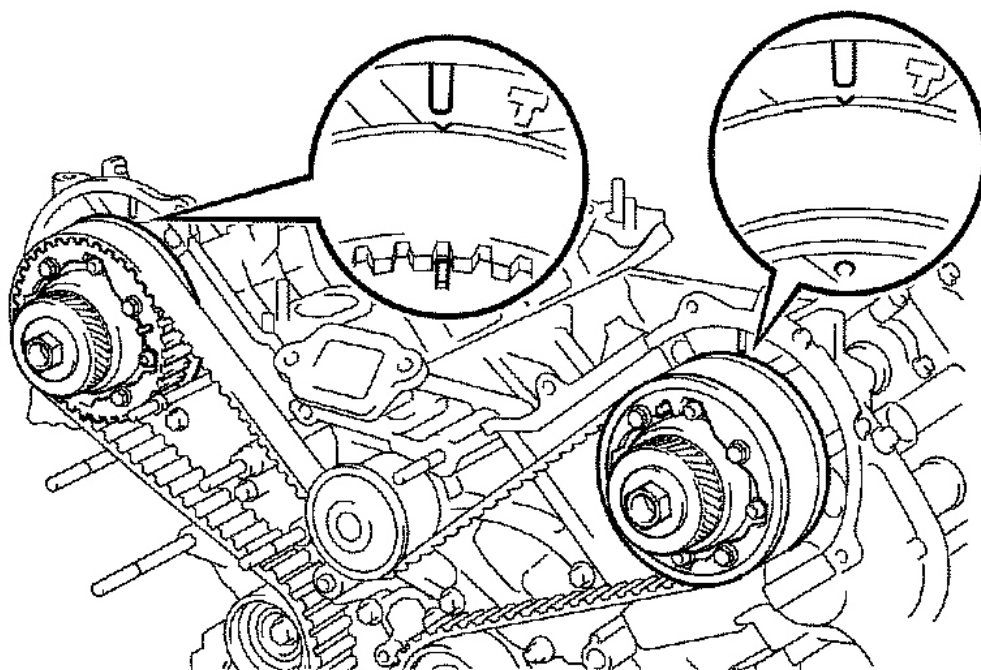
**NOTE:** Always turn the crankshaft pulley clockwise.



**Fig. 203: Turning Crankshaft Timing Pulley**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check that each pulley aligns with the timing marks as shown in the illustration.  
If the timing marks do not align, remove the belt and reinstall it.
3. Remove the crankshaft damper bolt.





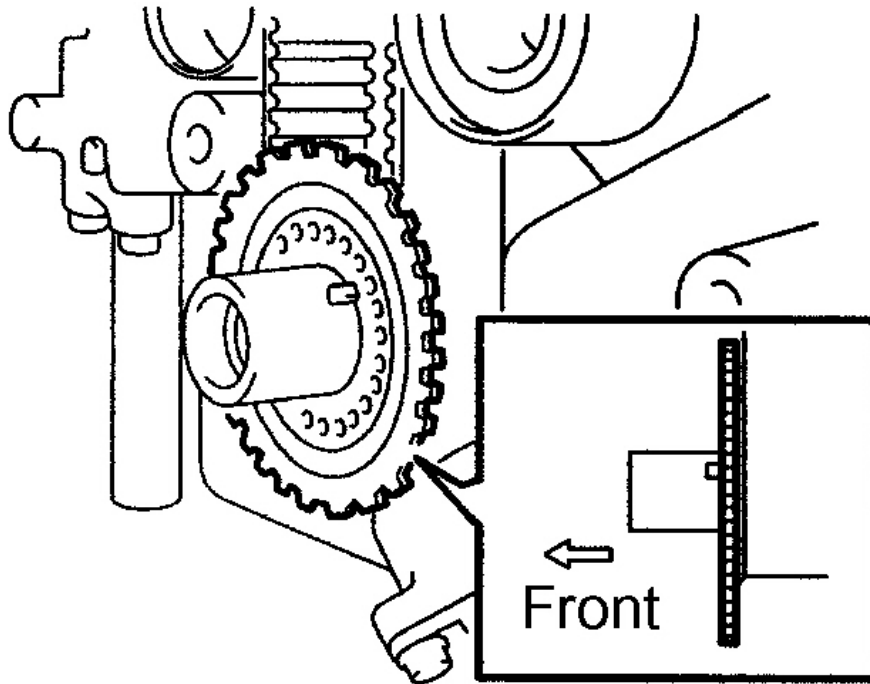
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**Fig. 204: Checking Pulley Aligning Timing Marks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. **INSTALL CRANKSHAFT POSITION SENSOR PLATE**
  - a. Install the crankshaft position sensor plate as shown in the illustration.

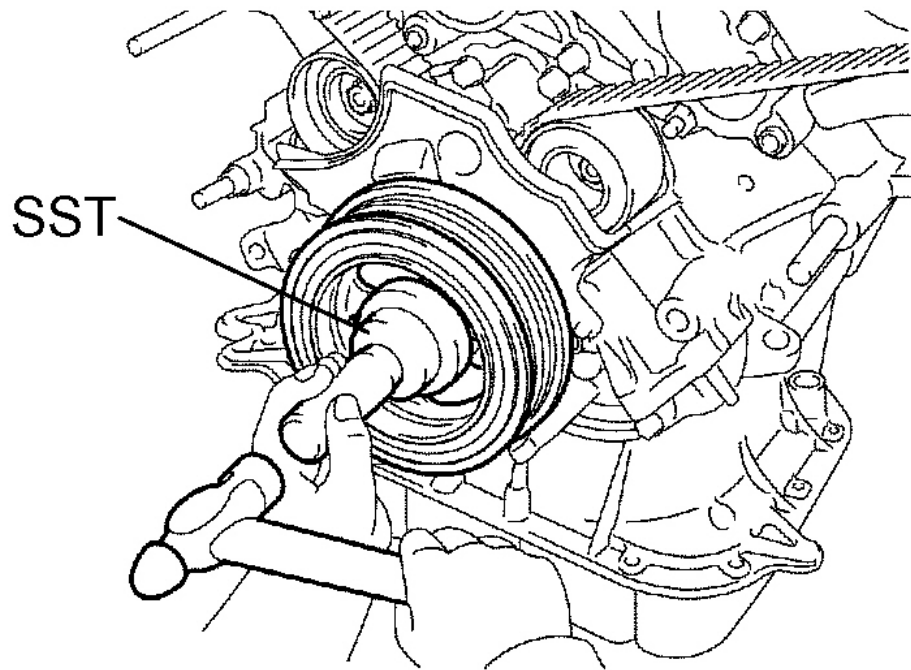
**NOTE:**        **Be careful of the installation direction.**



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**Fig. 205: Installing Crankshaft Position Sensor Plate**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **INSTALL TIMING BELT NO.1 COVER**
  - a. Install the timing belt cover with the 4 bolts.  
**Torque: 7.5 N.m (76.5 kgf.cm, 66 in..lbf)**
34. **INSTALL CRANKSHAFT DAMPER SUB-ASSY**
  - a. Using SST and a hammer, tap in the damper.  
SST 09223-4601 1

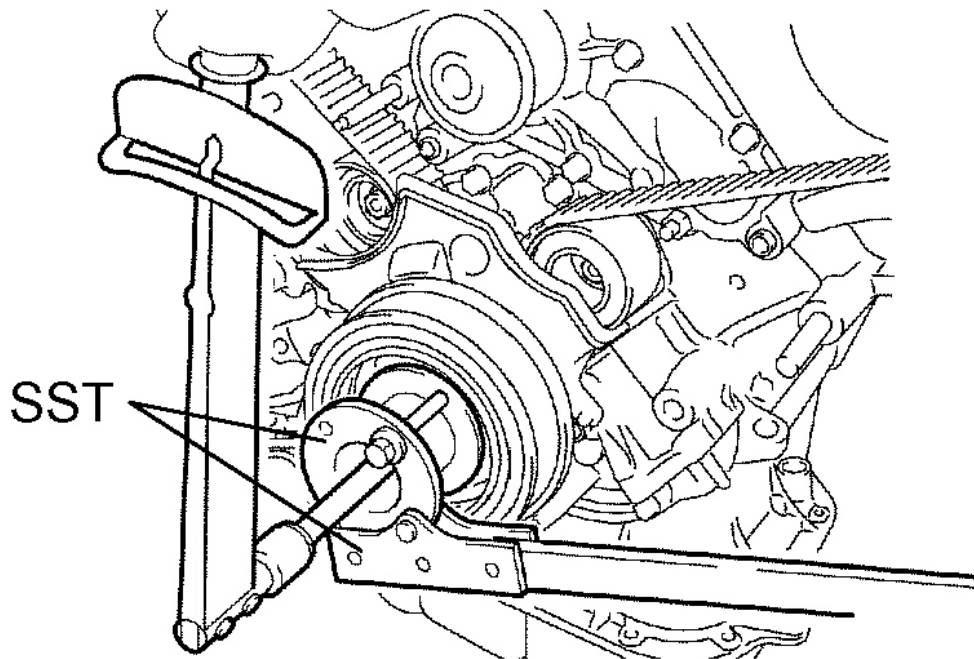


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**Fig. 206: Taping Damper Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, install the damper bolt.  
SST 09213-7001 1, 09330-00021  
**Torque: 245 N.m (2,500 kgf.cm, 181 ft.lbf)**
- c. Align the pulley set key with the key groove of the crankshaft damper.



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**Fig. 207: Installing Damper Bolt Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

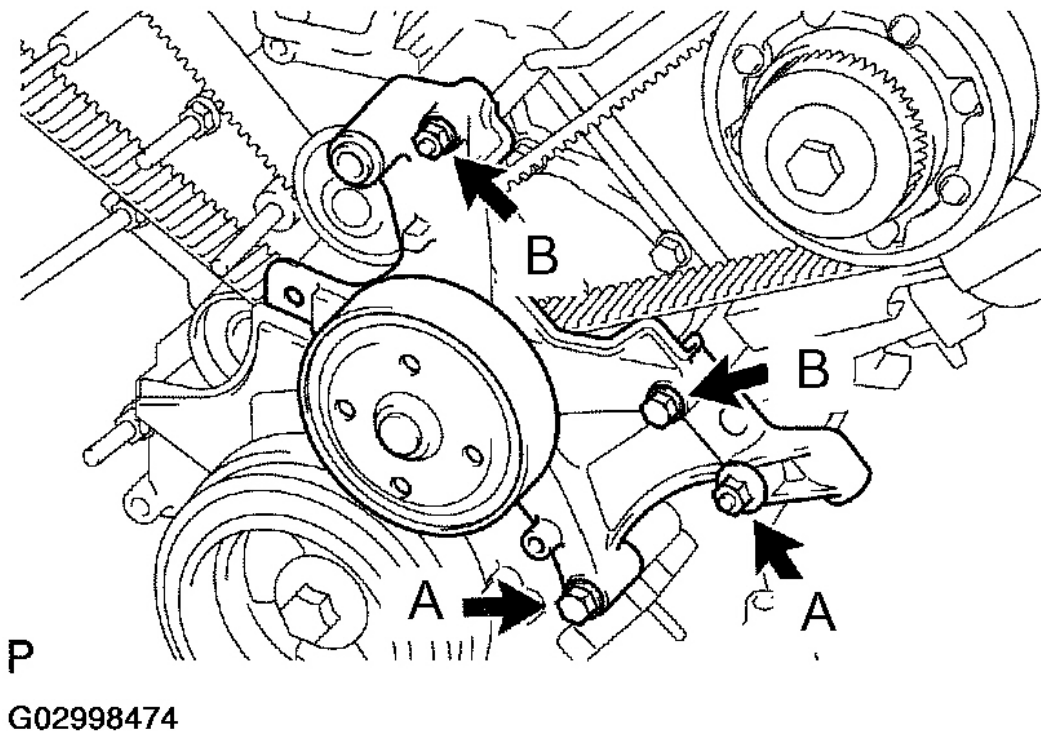
**35. INSTALL IDLER PULLEY ASSY**

- a. Install the idler with the 2 bolts and 2 nuts.

**Torque:**

**32 N.m (326 kgf.cm, 24 ft.lbf) for 14 mm head bolt A**

**16 N.m (163 kgf.cm, 12 ft.lbf) for 12 mm head bolt B**



**Fig. 208: Installing Idler Pulley And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Each bolt length is indicated below.

Bolt length:

114 mm (4.49 in.) for 14 mm head (A)

106 mm (4.17 in.) for 12 mm head (B)

36. **INSTALL V-RIBBED BELT TENSIONER ASSY**
- a. Install the belt tensioner with the bolt and 2 nuts.  
**Torque: 16 N.m (163 kgf.cm, 12 ft.lbf)**

HINT:

Use a bolt that is 106 mm (4.18 in.) in length.

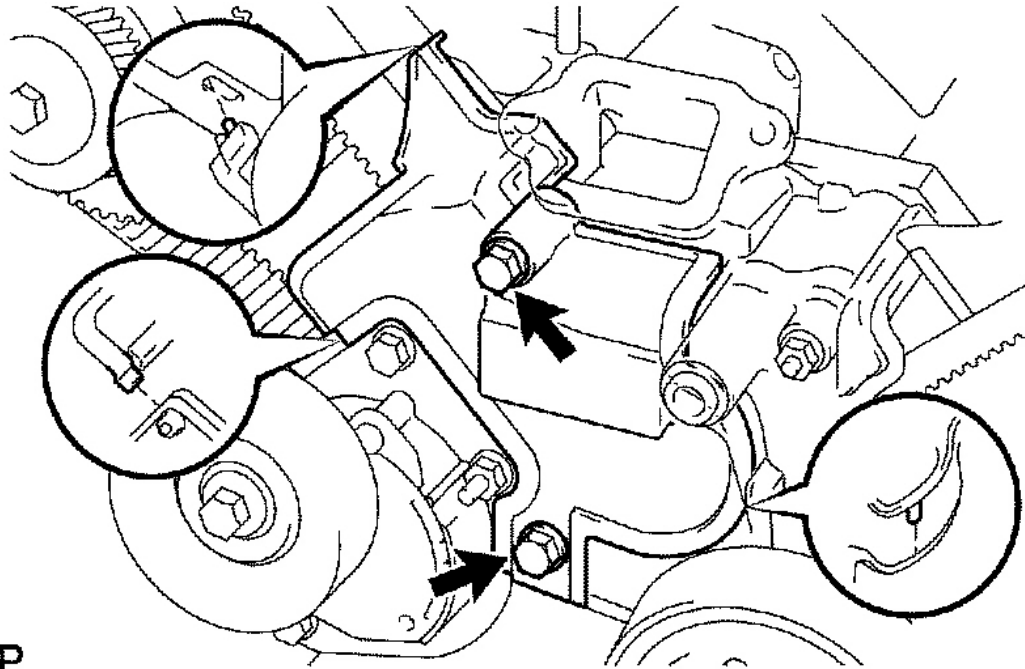
37. **INSTALL TIMING BELT COVER SUB-ASSY NO.2**

- a. Fit the cover No. 2, matching the claws and pin with each part.
- b. Install the timing belt cover with the 2 bolts.

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

HINT:

Use bolts that are 106 mm (4.17 in.) in length.



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**Fig. 209: Installing Timing Belt Cover With Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

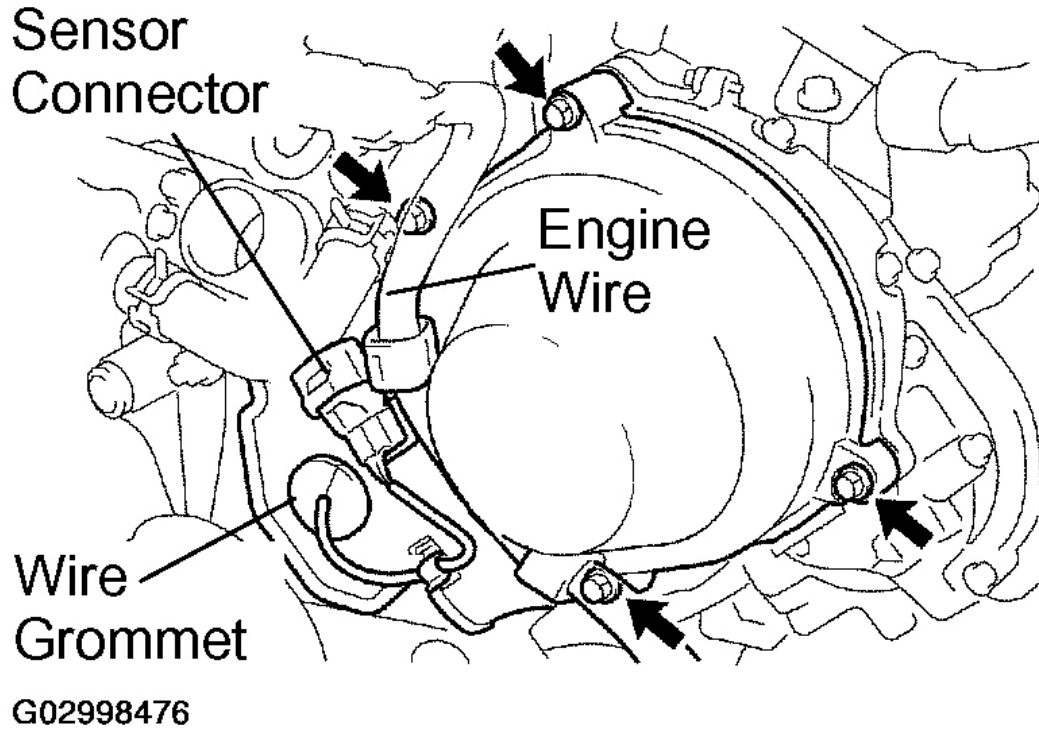
38. **INSTALL TIMING BELT COVER SUB-ASSY NO.3 LH**

- a. Install the gasket to the cover.
- b. Run the camshaft position sensor wire through the cover hole.
- c. Install the cover with the 4 bolts.

**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**

- d. Install the wire grommet to the cover.
- e. Install the sensor connector to the sensor holder.

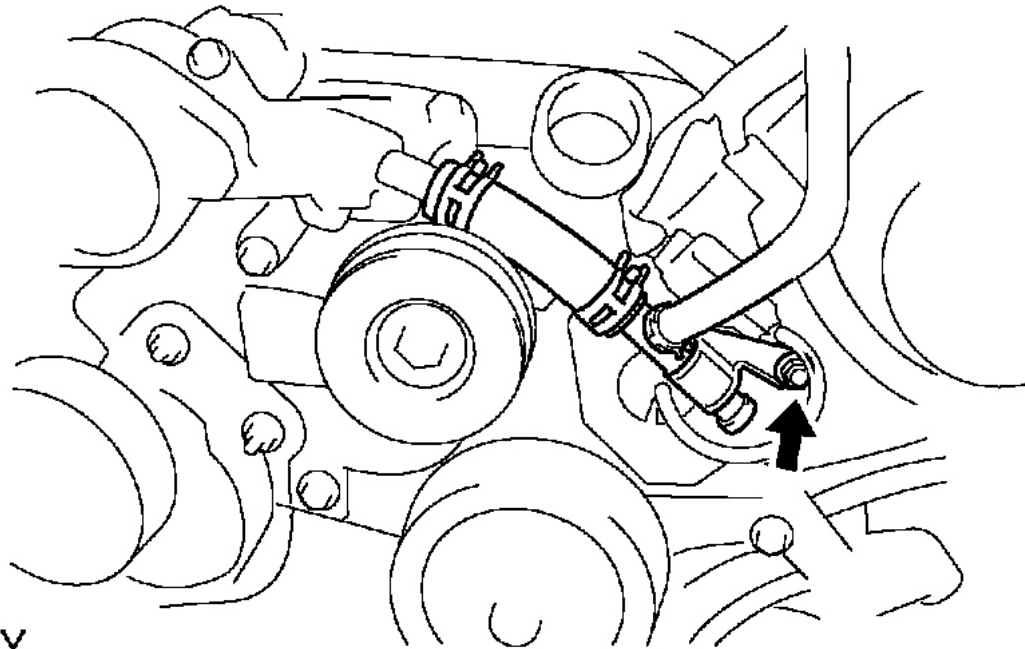
- f. Connect the sensor connector.
- g. Install the sensor wire to the wire clamp on the cover.
- h. Install the engine wire to the 2 wire clamps on the cover.



**Fig. 210: Installing Timing Belt Cover Sub-Assy No.3 LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Connect the 2 water bypass hoses, as shown in the illustration.
- j. Install the No. 3 water bypass pipe to the cover with the cap nut.

**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**



Y

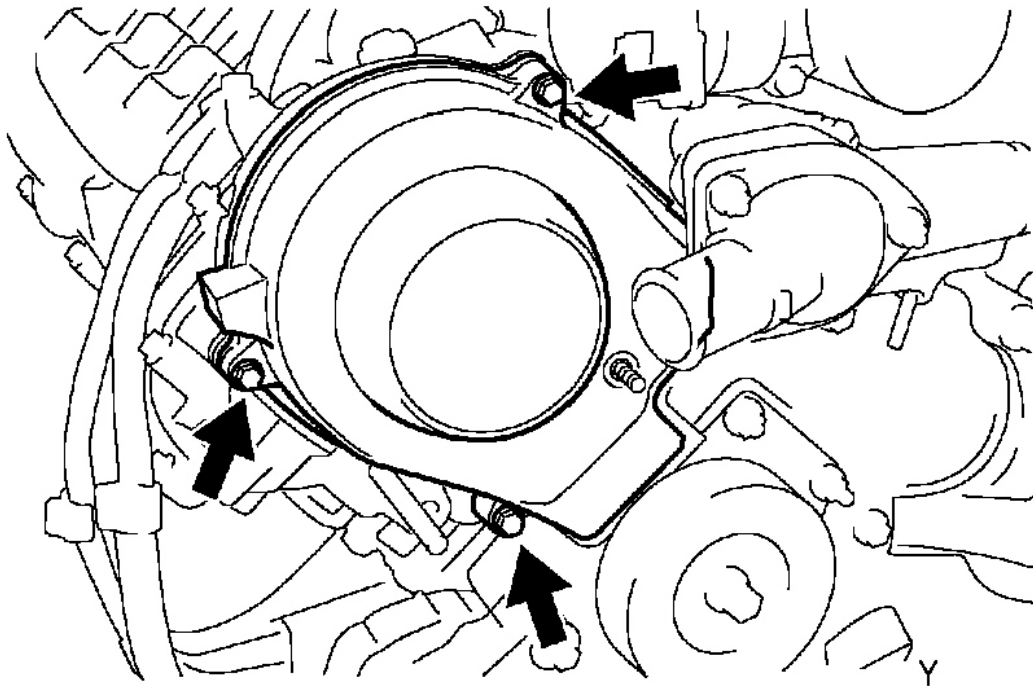
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**Fig. 211: Connecting Water By-Pass Hoses**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**39. INSTALL TIMING CHAIN OR BELT COVER NO.2**

- a. Install the gasket to the cover.
- b. Install the cover with the cap nut and 3 bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**
- c. Install the 2 PS air hoses to the clamp on the cover.





**G02998478**

**Fig. 212: Installing Cover With Cap Nut And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **INSTALL COMPRESSOR AND MAGNETIC CLUTCH**
  - a. Install the cooler compressor, stay and wire bracket with the 3 bolts and nut.  
**Torque:**  
**49 N.m (500 kgf.cm, 36ft.lbf) for bolt**  
**29 N.m (296 kgf.cm, 21 ft.lbf) for nut**
41. **INSTALL GENERATOR ASSY (See REPLACEMENT )**
42. **INSTALL VANE PUMP ASSY**
  - a. Install the pump with the 2 bolts and nut. Alternately tighten the bolts and nut.  
**Torque:**  
**39.2 N.m (400 kgf.cm, 29 ft.lbf) for bolt**  
**43.1 N.m (440 kgf.cm, 32 ft.lbf) for nut**
43. **INSTALL FAN AND GENERATOR V BELT (See REPLACEMENT )**
44. **INSTALL RADIATOR ASSY (See REPLACEMENT )**
45. **INSTALL AIR CLEANER ASSY**  
**Torque: 5.0 N.m (51 kgf.cm, 44 in.lbf)**

46. **INSTALL OIL COOLER OUTLET TUBE NO.1**
47. **INSTALL OIL COOLER INLET TUBE NO.**
48. **INSTALL AIR CLEANER INLET NO.1**  
Torque: 5.0 N.m (51 kgf.cm, 44 in.lbf)
49. **INSTALL INTAKE AIR CONNECTOR PIPE**  
Torque: 5.0 N.m (51 kgf.cm, 44 in.lbf)
50. **INSTALL V-BANK COVER**  
Torque: 5.0 N.m (51 kgf.cm, 44 in.lbf)
51. **REFILL ENGINE COOLANT (See REPLACEMENT )**
52. **CHECK FOR ENGINE COOLANT LEAKS (See ON-VEHICLE INSPECTION )**
53. **INSTALL ENGINE UNDER COVER NO.1**
54. **CONNECT BATTERY NEGATIVE TERMINAL**

**NOTE:** When disconnecting the negative (-) battery terminal, initialize the following systems (s) after the terminal is reconnected (see INITIALIZATION ).

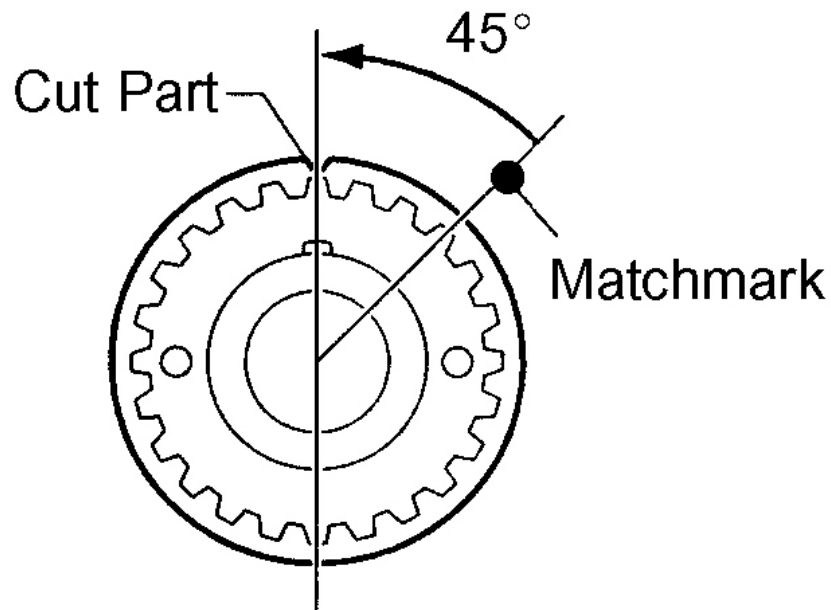
## **CAMSHAFT (RH BANK)**

### **REPLACEMENT**

1. **REMOVE TIMING BELT (See REPLACEMENT )**
2. **REMOVE CYLINDER HEAD COVER SUB-ASSY (See REPLACEMENT )**
3. **PISTON & VALVE BREAK PREVENT WORK**
  - a. Turn the crankshaft timing pulley counterclockwise by 45° and match the cut part with the illustrated position.

### **HINT:**

When the No. 1 cylinder is positioned at 45° BTDC, the valve and piston do not interfere with each other even when the valve is fully open.



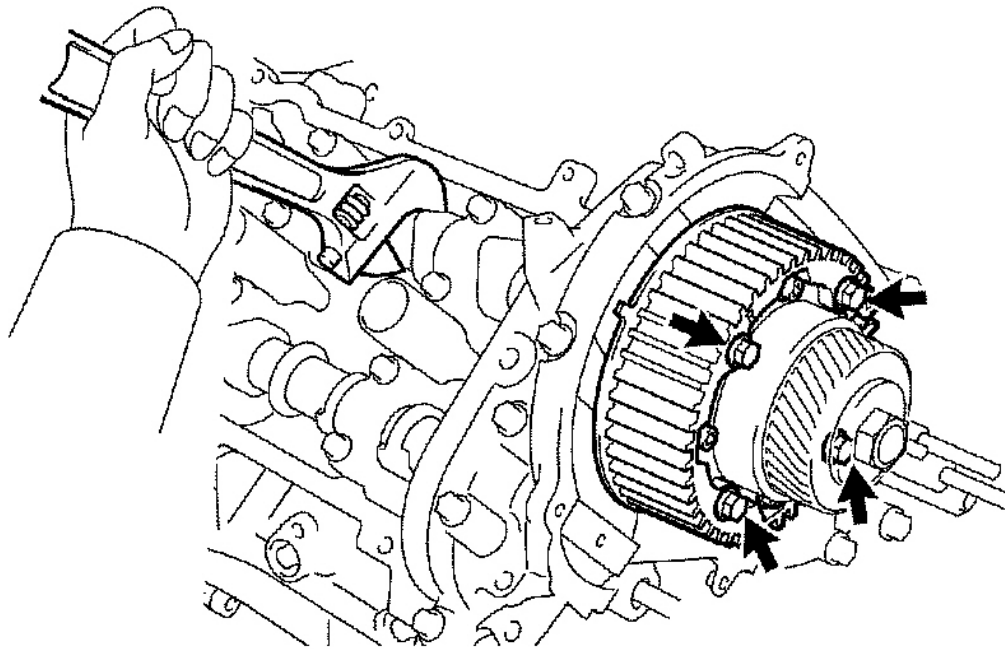
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**Fig. 213: Identifying Cylinder Valve And Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be sure to match the cut part by turning it counterclockwise.

**4. REMOVE CAMSHAFT TIMING PULLEY**

- a. Remove the 4 bolts and timing pulley.



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**Fig. 214: Removing Camshaft Timing Pulley**

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

5. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY
6. REMOVE CAMSHAFT

**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

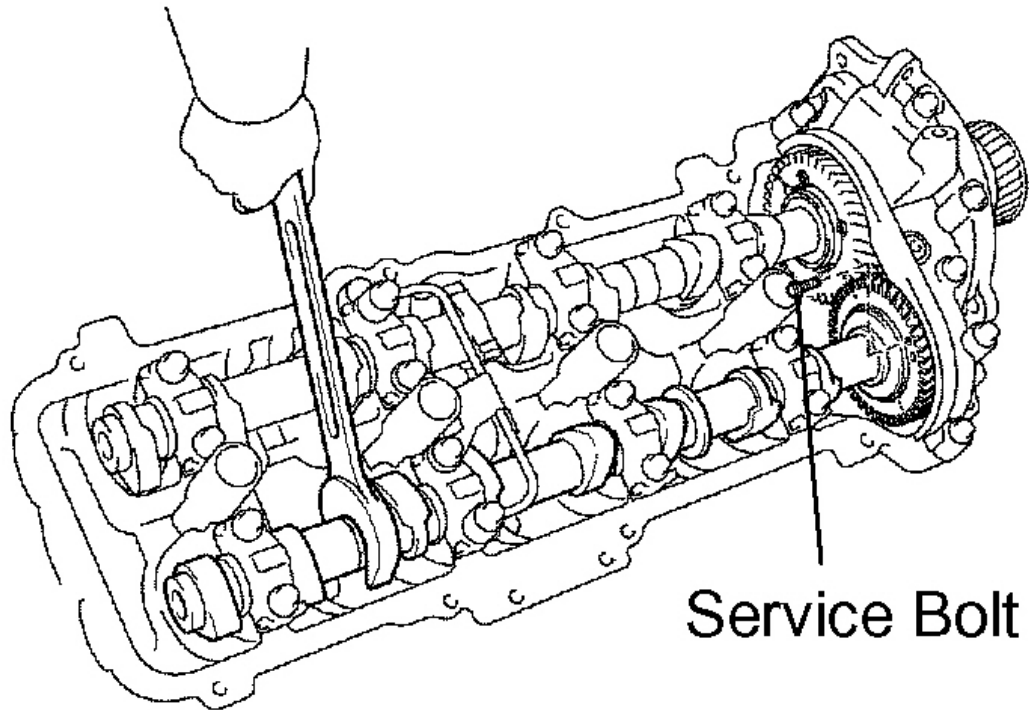
- a. Bring the service bolt hole of the sub gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
- b. Secure the sub gear to the main gear with a service bolt.

**RECOMMENDED SERVICE BOLT:**

**RECOMMENDED SERVICE BOLT**

Thread diameter	6 mm
Thread pitch	1.0 mm

Bolt length	16 to 20 mm (0.63 to 0.79 in.)
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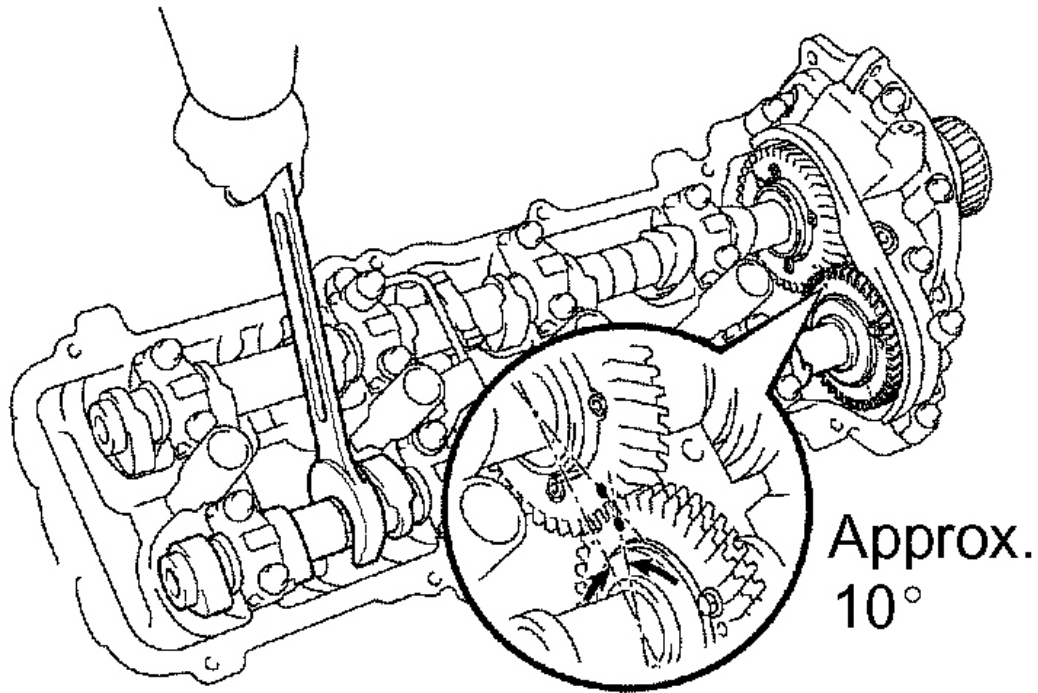
**Fig. 215: Removing Service Bolt**

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

HINT:

When removing the camshaft, make sure that the torsional spring force of the sub-gear has been eliminated by the above operation.

- c. Set the timing mark (1 dot mark) of the camshaft main gear at an angle of approximately 10° by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.



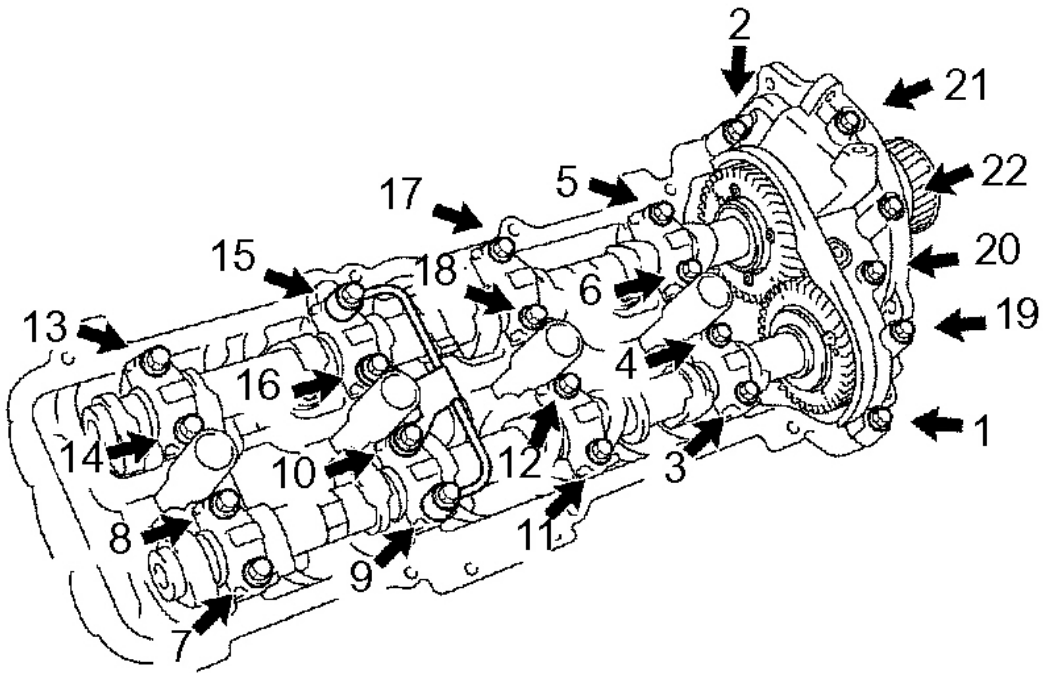
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**Fig. 216: Setting Timing Mark Of Camshaft Main Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Uniformly loosen the 22 bearing cap bolts in several passes in the sequence shown in the illustration.
- e. Remove the 22 bearing cap bolts, 4 seal washers, oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter and 2 camshafts.

**NOTE:**

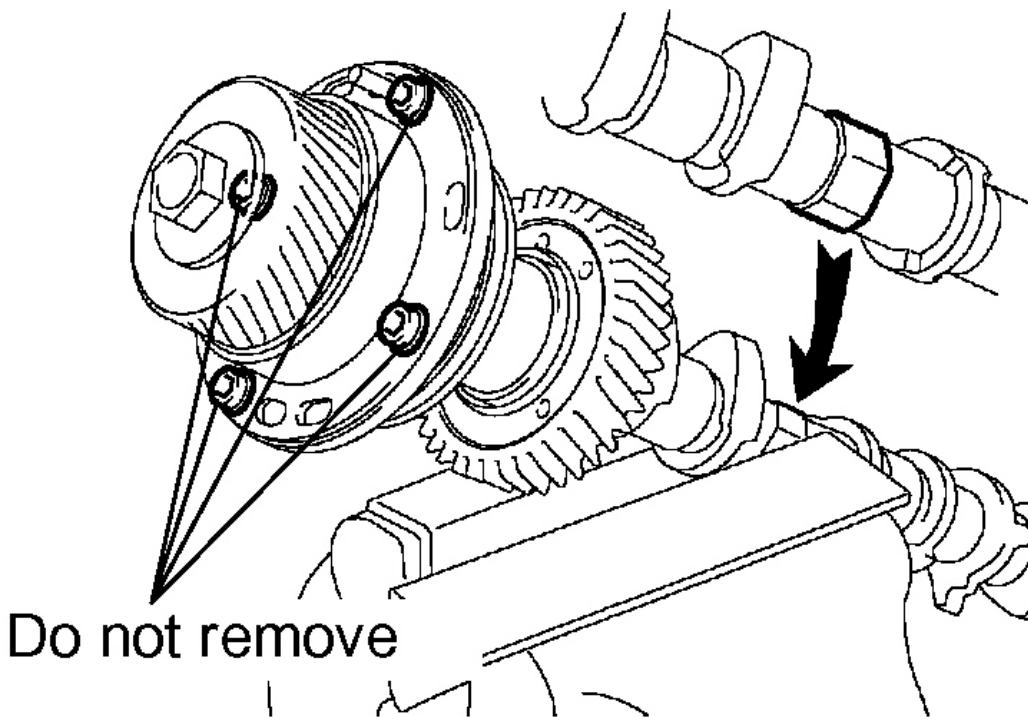
- Do not pry the camshaft with a tool by applying excessive force to it.
- Do not damage the reception part of the thrust on the cylinder head side.



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**Fig. 217: Identifying Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**7. REMOVE CAMSHAFT TIMING TUBE ASSY**



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**Fig. 218: Mounting Hexagon Wrench Head Portion Of Intake Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

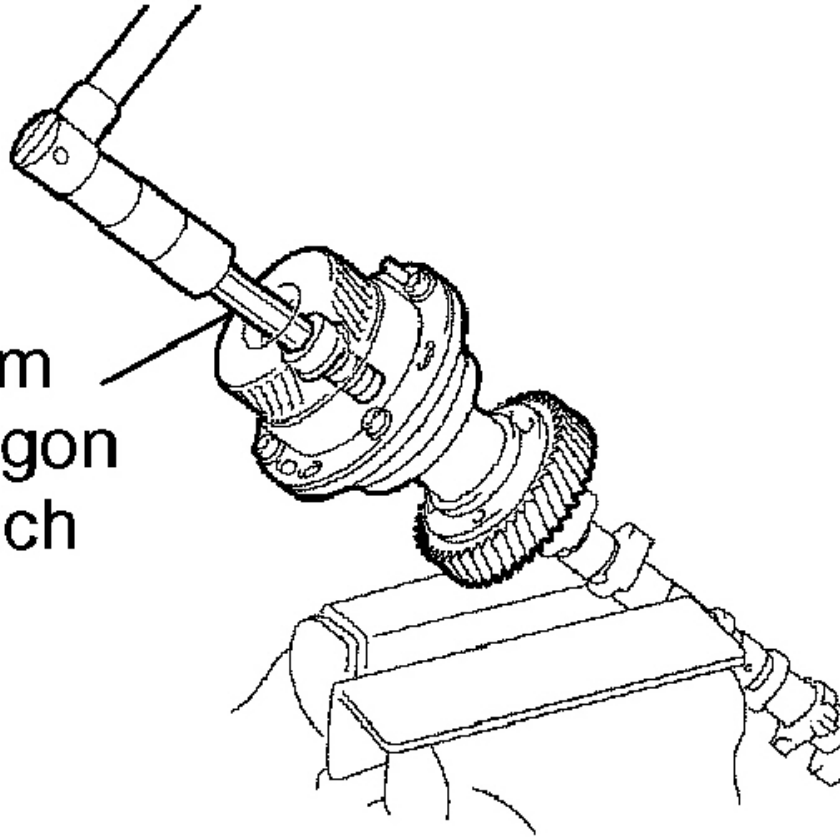
- a. Mount the hexagon wrench head portion of the intake camshaft in a vise.

**NOTE:**

- **Be careful not to damage the camshaft.**
  - **Do not remove the 4 bolts shown in the illustration. The bolts determine the backlash of the gear in the timing tube. If any of the bolts are removed, install a new timing tube assembly.**
- b. Remove the screw plug and seal washer.
  - c. Using a 10 mm hexagon wrench, remove the bolt.
  - d. Pull out the timing tube and drive gear assembly from the camshaft.



10 mm  
Hexagon  
Wrench

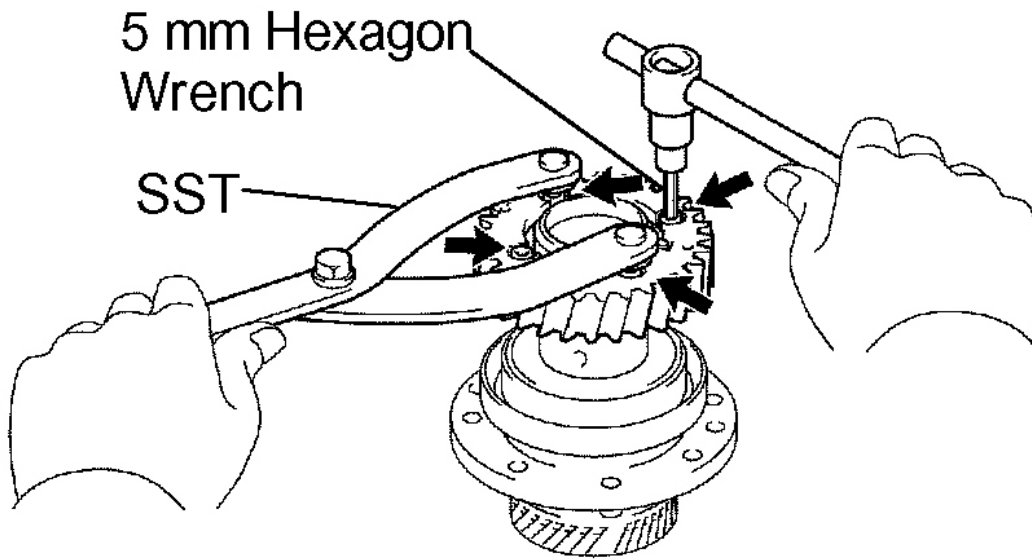


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**Fig. 219: Removing Bolts Using Hexagon Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using SST and a 5 mm hexagon wrench, remove the 4 bolts, drive gear and oil seal.  
SST 09960-10010 (09962-01000, 09963-00500)

**NOTE:**        **Be careful not to damage the timing tube.**



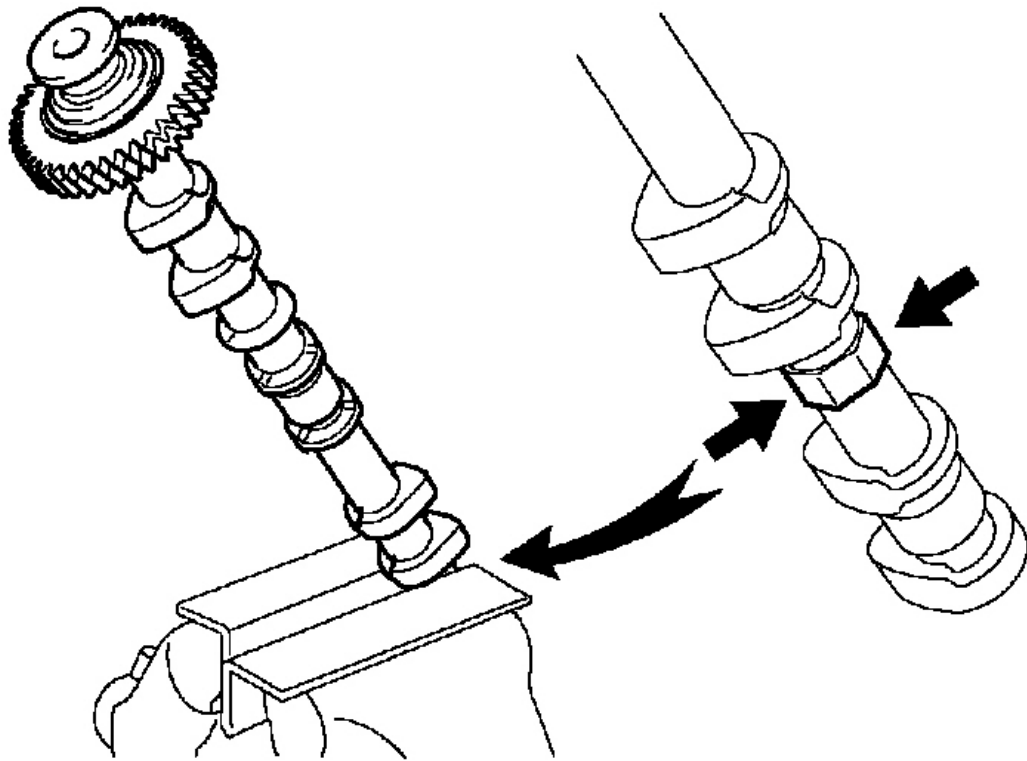
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**Fig. 220: Removing Bolts, Drive Gear And Oil Seal Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**8. REMOVE CAMSHAFT SUB GEAR**

- a. Mount the hexagon wrench head portion of the camshaft in a vise.

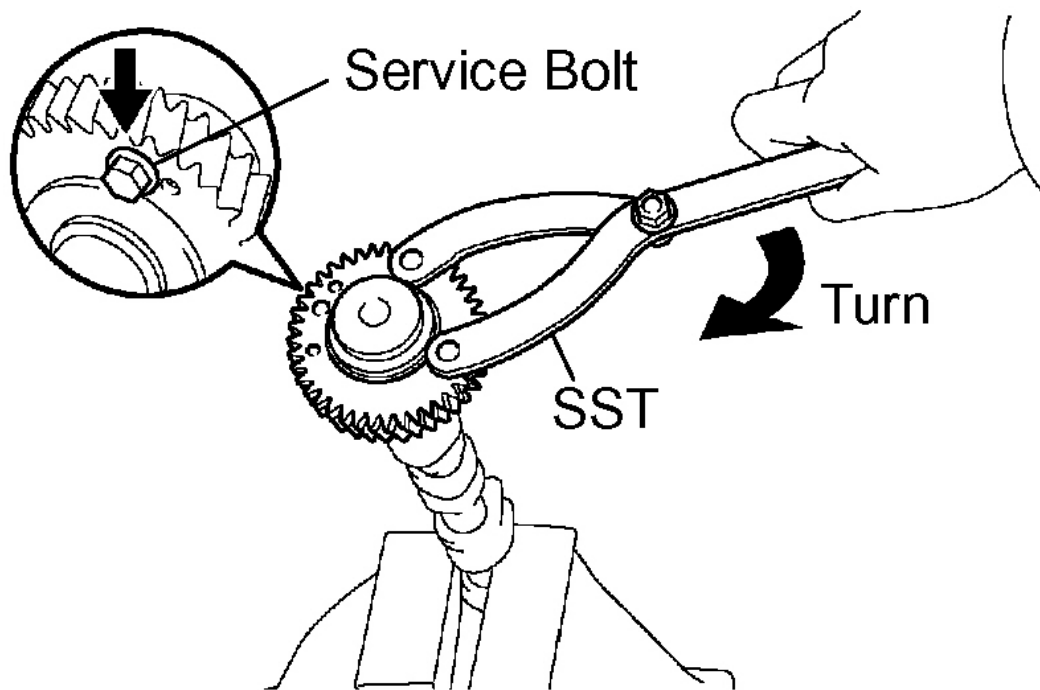
**NOTE: Be careful not to damage the camshaft.**



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**Fig. 221: Mounting Hexagon Wrench Head Portion Of Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, turn the sub gear clockwise and remove the service bolt.  
SST 09960-10010 (09962-01000, 09963-00500)



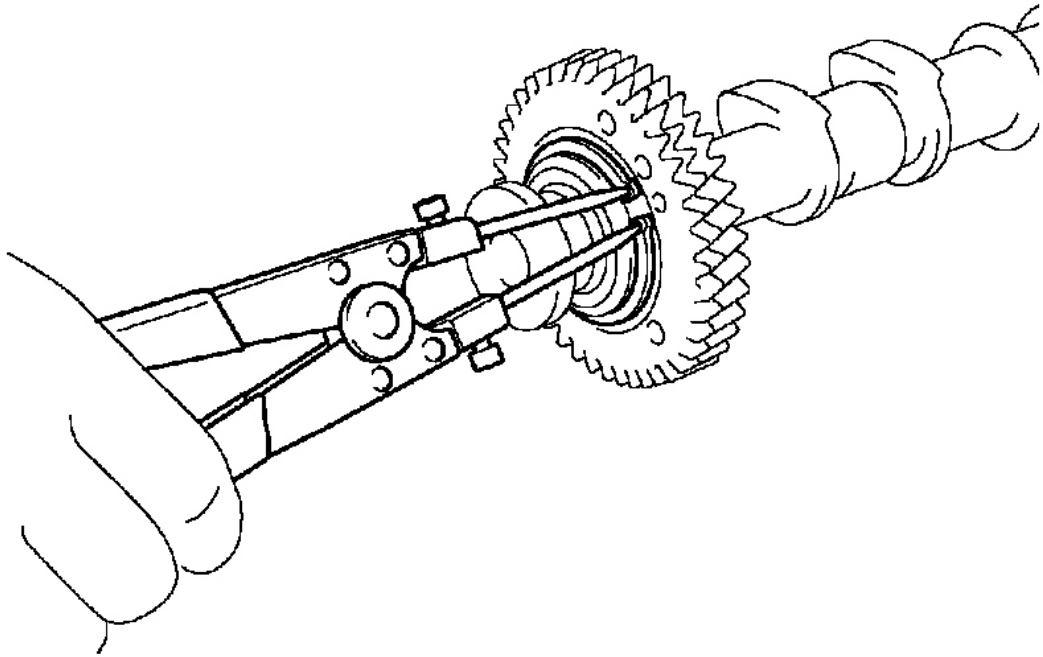
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**Fig. 222: Removing Service Bolt Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using snap ring pliers, remove the snap ring.
- d. Remove the wave washer, sub gear and bolt washer.

HINT:

Arrange the driven sub gears and bolt washers (RH and LH sides).



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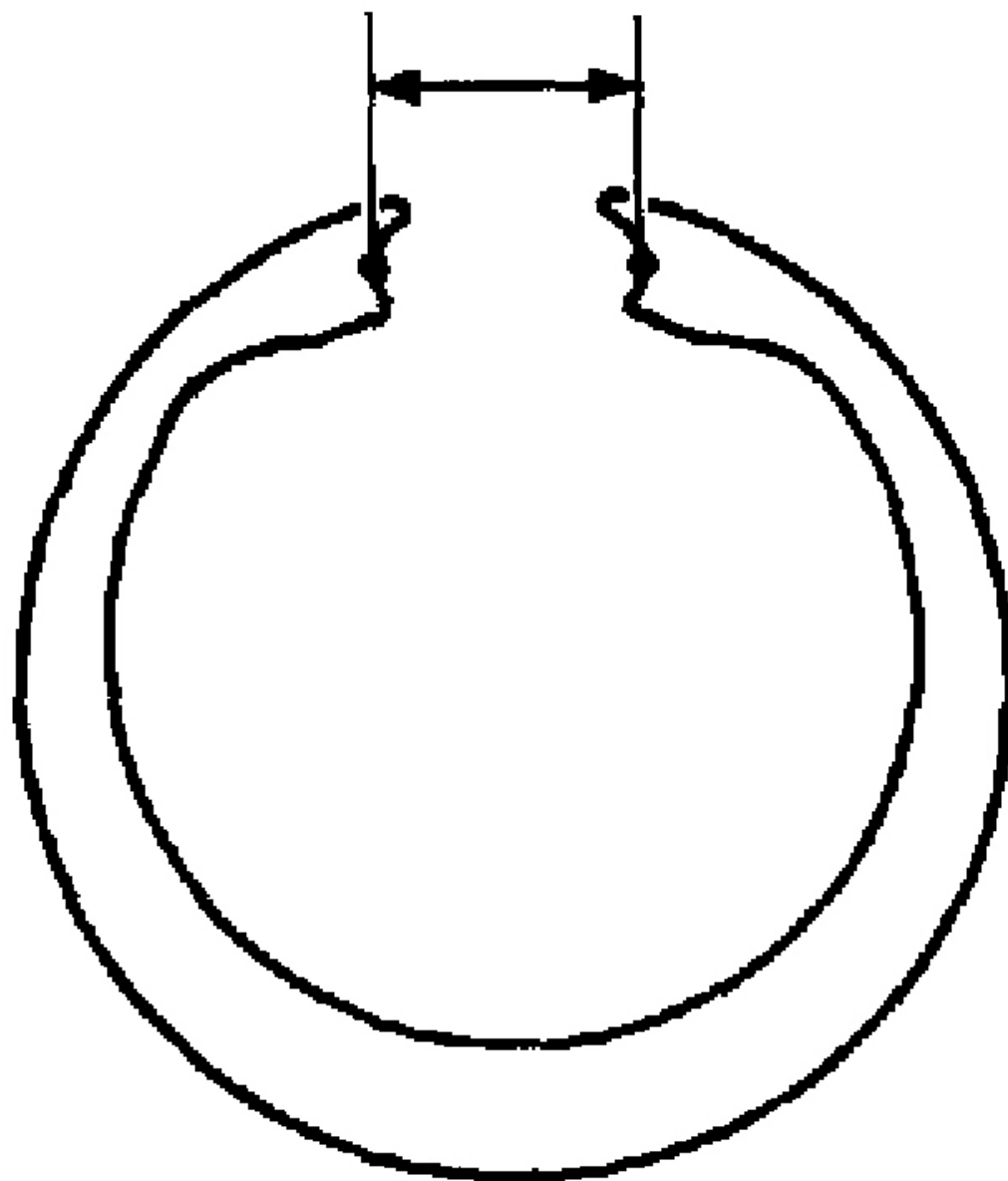
**Fig. 223: Removing Snap Ring Using Snap Ring Pliers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using a vernier caliper, measure the gap between the washer ends.

**Gap: 18.2 to 18.8 mm (0.712 to 0.740 in.)**

If the gap is not as specified, replace the bolt washer.

18.2 to 18.8 mm



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Fig. 224: Measuring Gap Between Washer Ends

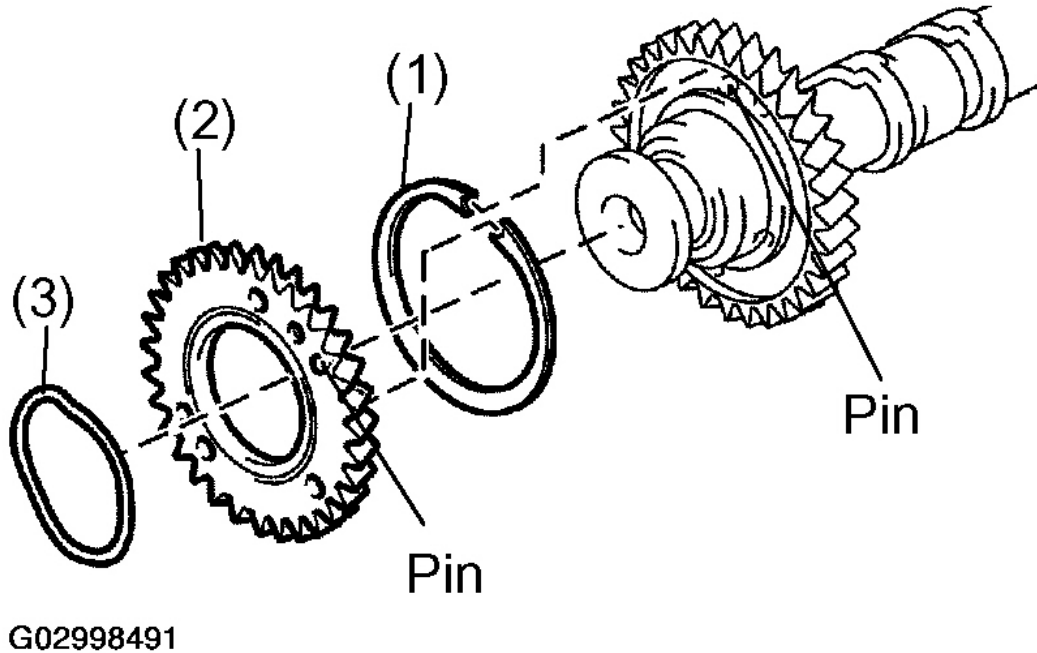
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL CAMSHAFT SUB GEAR**

- a. Install the bolt washer (1), sub gear (2) and wave washer (3).

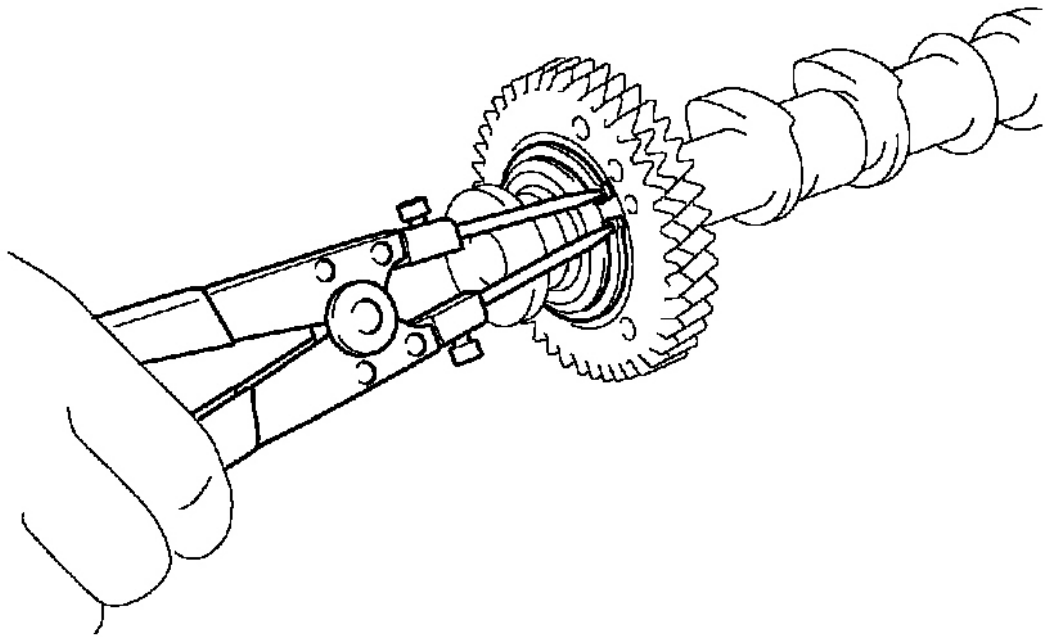
HINT:

Attach the pins on the gears to the gear bolt washer ends.



**Fig. 225: Installing Camshaft Sub Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using snap ring pliers, install the snap ring.



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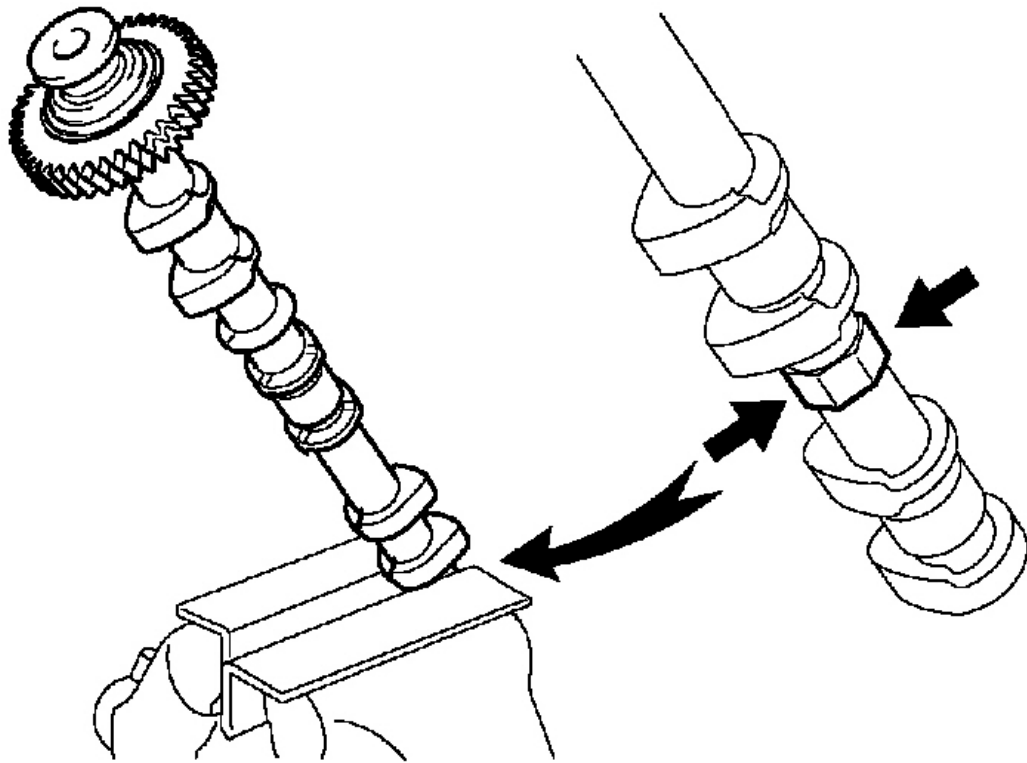
**Fig. 226: Identifying Snap Ring Using Snap Ring Pliers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mount the hexagon wrench head portion of the camshaft in a vise.

HINT:

**Be careful not to damage the camshaft.**

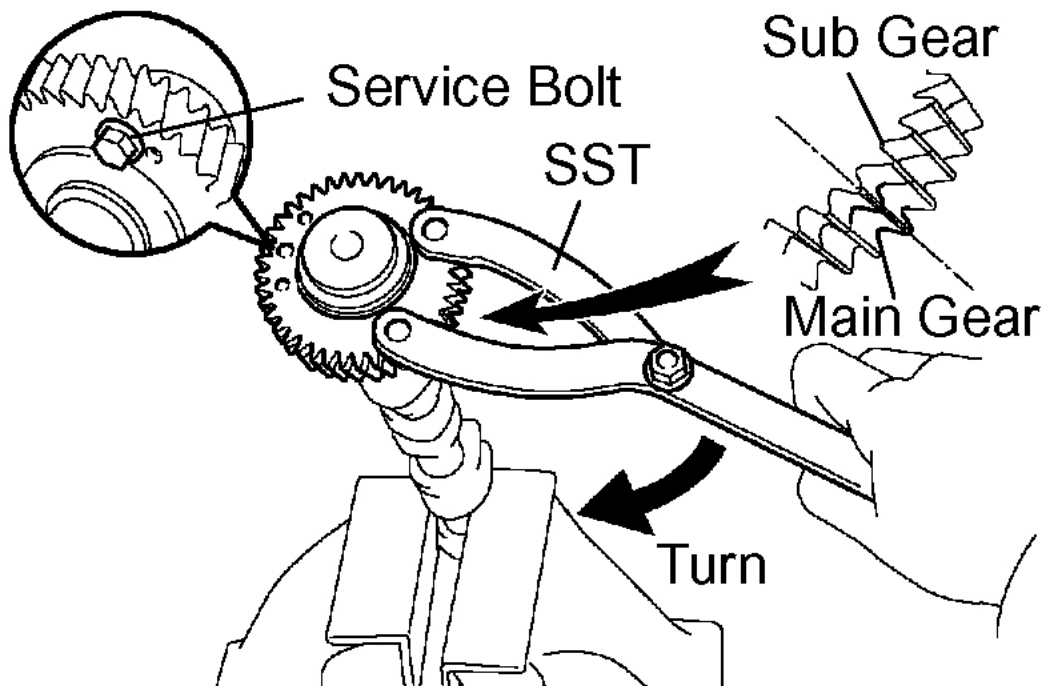




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**Fig. 227: Mounting Hexagon Wrench Head Portion Of Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise. Temporarily install a service bolt.  
SST 09960-10010 (09962-01000, 09963-00500)
- e. Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.



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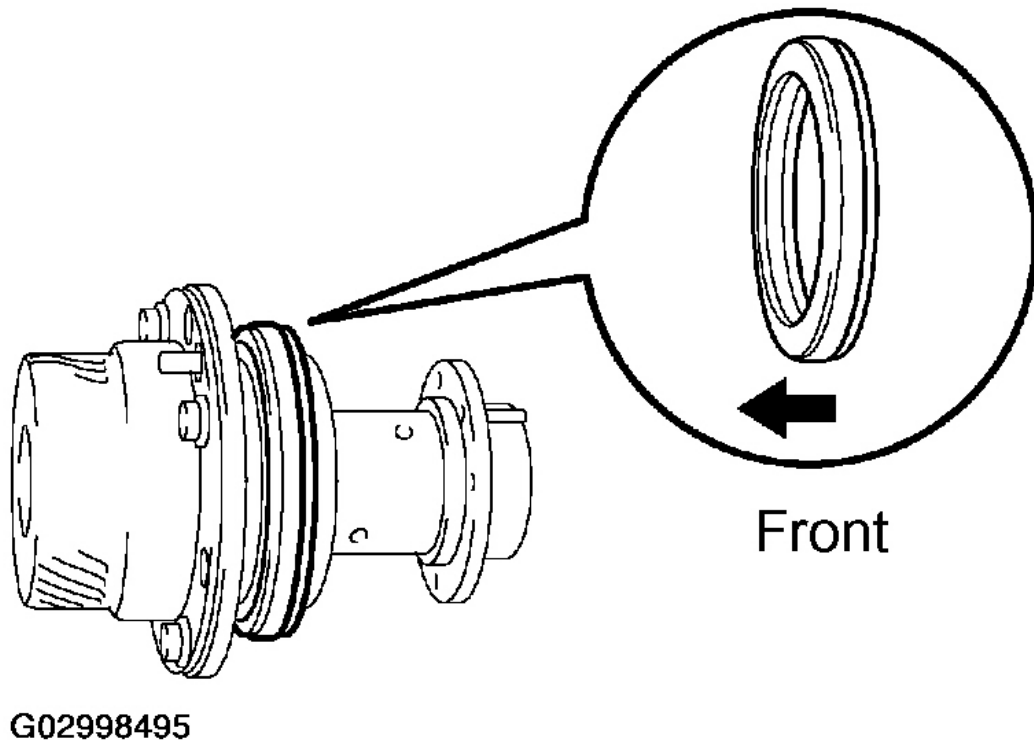
**Fig. 228: Aligning Gear Teeth Tightening Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**10. INSTALL CAMSHAFT TIMING TUBE ASSY**

- a. Insert a new oil seal into the camshaft timing tube until it reaches the stopper.

**NOTE:**

- Be careful of the installation direction.
- Do not turn over the oil seal lip.



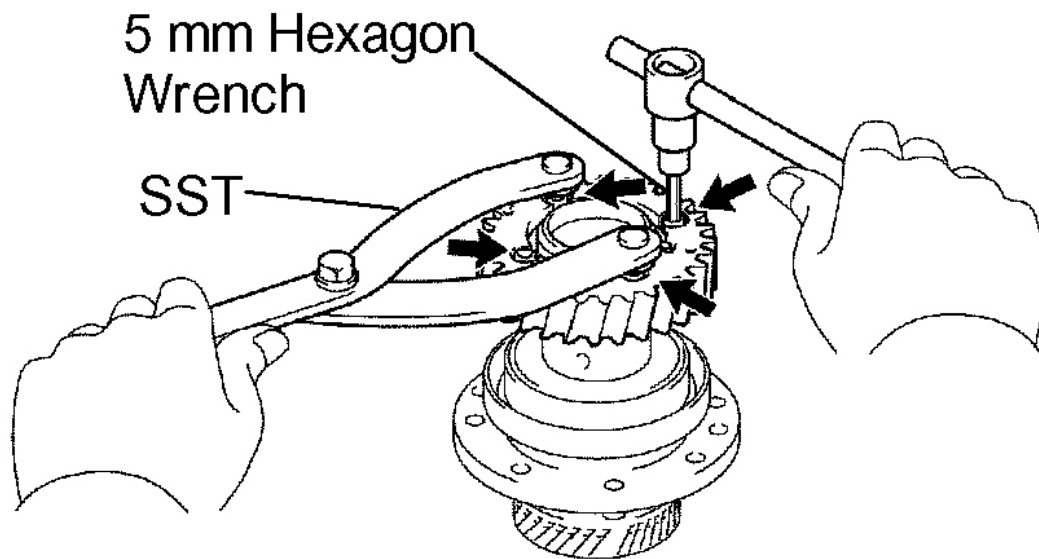
**Fig. 229: Installing Camshaft Timing Tube Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing tube knock pin with the knock pin groove of the drive gear, and temporarily install the drive gear with the 4 bolts.
- c. Using SST and a 5 mm hexagon wrench, uniformly tighten the 4 bolts in several passes.  
SST 09960-10010 (09962-01000, 09963-00500)  
**Torque: 7.5 N.m (77 kgf.cm, 66 in.lbf)**

**NOTE: Be careful not to damage the timing tube.**

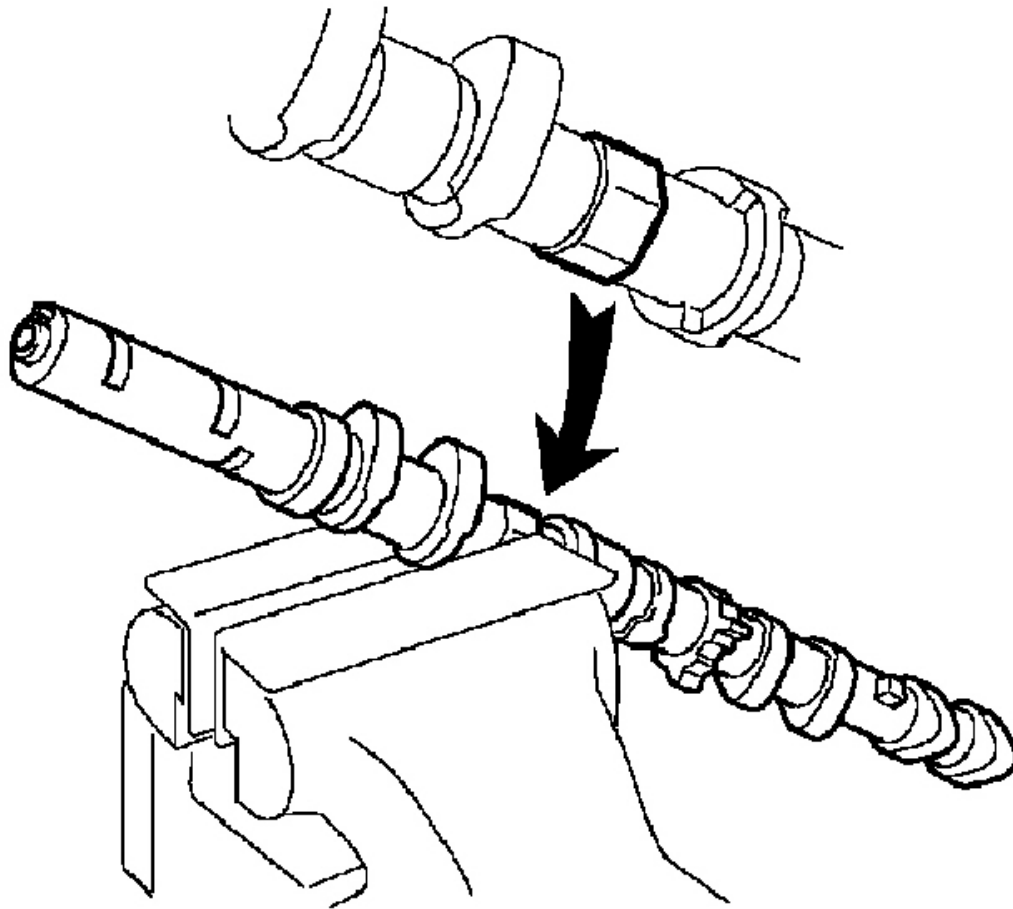
- d. Mount the hexagon wrench head portion of the camshaft in a vise.

**NOTE: Be careful not to damage the camshaft.**



G02998496

**Fig. 230: Aligning Timing Tube Knock Pin With Knock Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**G02998497**

**Fig. 231: Mounting Hexagon Wrench Head Portion Of Camshaft In Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Align the camshaft knock pin with the knock pin groove of the timing tube, and push the timing tube by hand until it touches the bottom.
- f. Using a 10 mm hexagon wrench, install the bolt.
- g. Install the seal washer and screw plug.

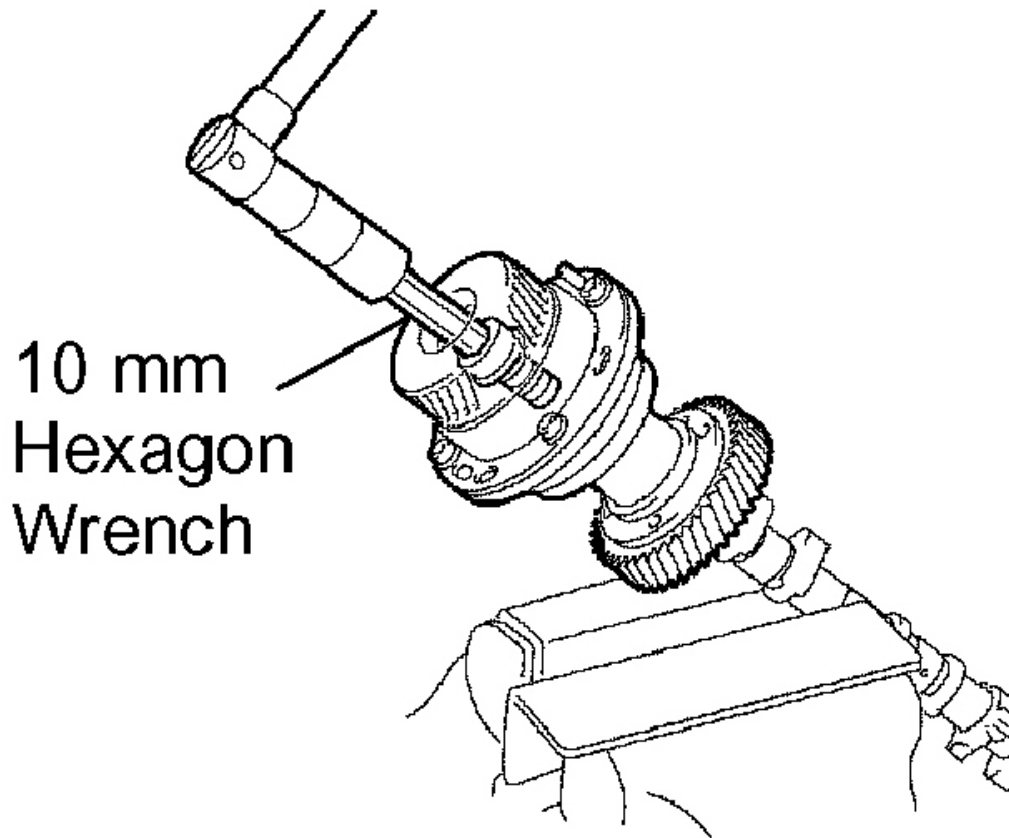
**Torque: 78 N.m (795 kgf.cm, 58 ft.lbf)**

**Torque: 15 N.m (153 kgf.cm, 11 ft.lbf)**

## 11. INSTALL CAMSHAFT

**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be

kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.

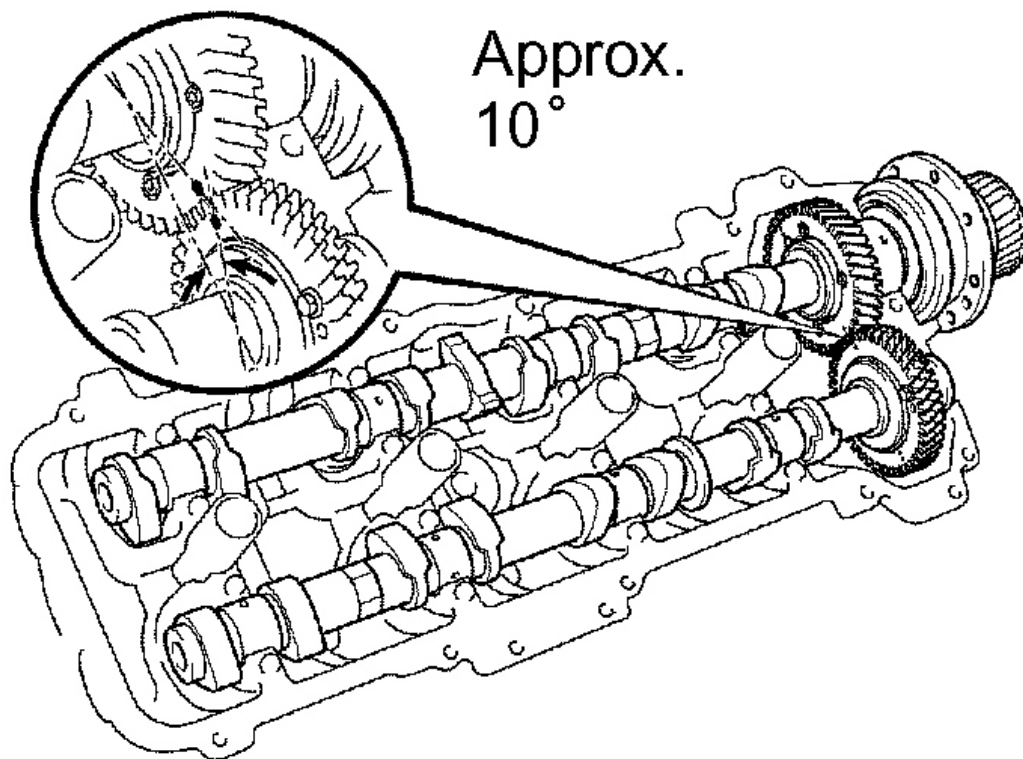


**G02998498**

**Fig. 232: Installing Bolts Using SST**

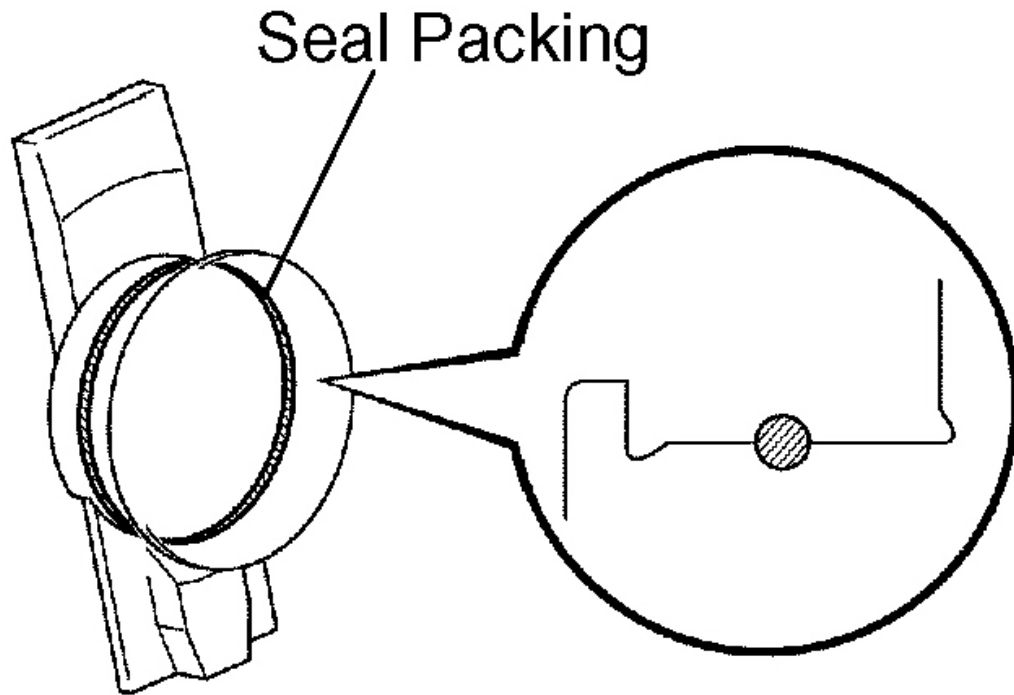
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Apply engine oil to the cam and gear of the camshaft and also the journal of the cylinder head.
2. Align the timing marks (1 dot mark each) of the camshaft drive and driven main gears, and place the intake and exhaust camshafts.
3. Set the timing mark (1 dot mark each) of the camshaft drive and driven main gears at an angle of approximately 10°.



G02998499

**Fig. 233: Aligning Timing Marks Of Camshaft Drive And Driven Main Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



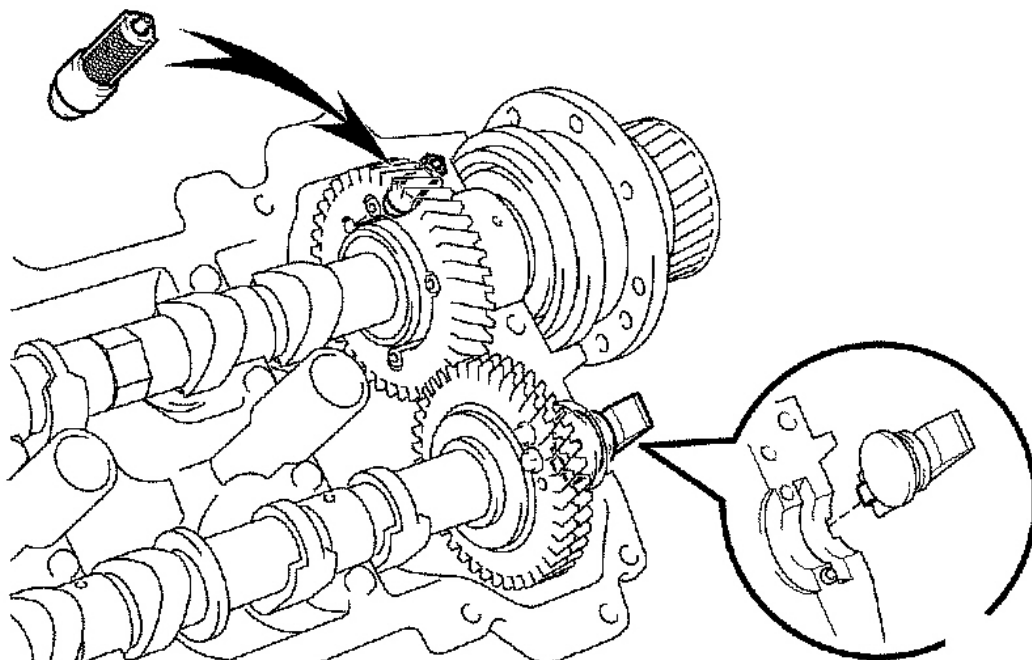
G02998500

**Fig. 234: >Applying Seal Packing To Camshaft Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Apply seal packing to the camshaft housing plug.
  - Remove the old packing (FIPG) material.
  - Apply seal packing to the housing plug.

**Seal packing: Part No. 08826-00080 or equivalent**



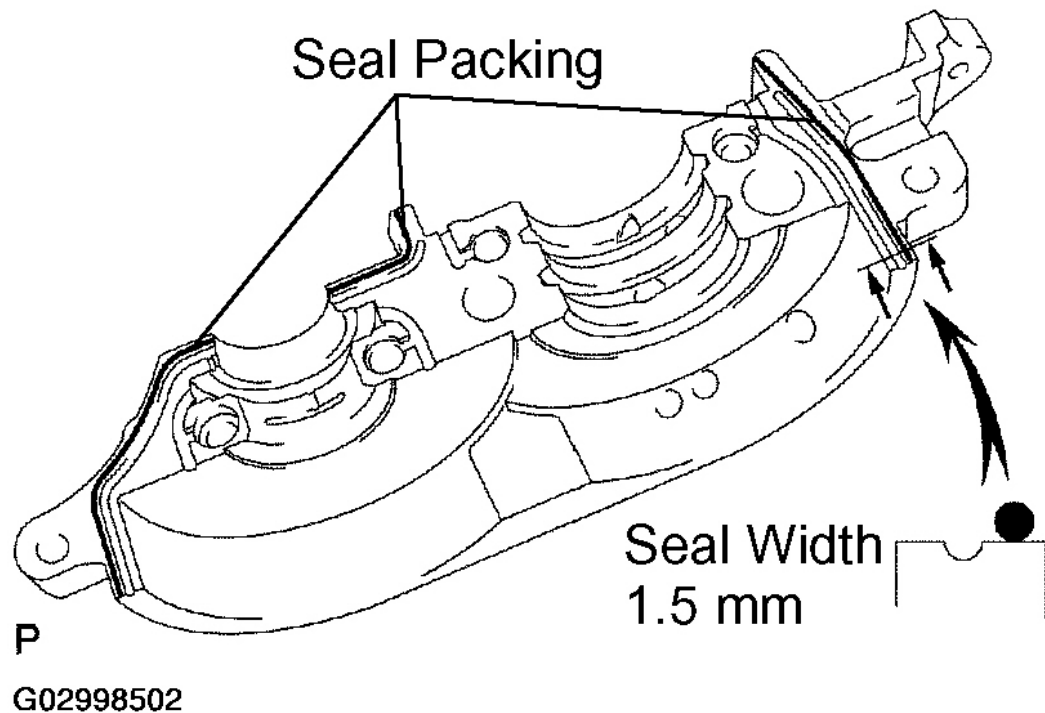


G02998501

**Fig. 235: Installing Camshaft Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Install the camshaft housing plug to the cylinder head as shown in the illustration.
6. Install the oil control valve filter to the cylinder head.

**NOTE:**        **Be careful of the installation direction.**

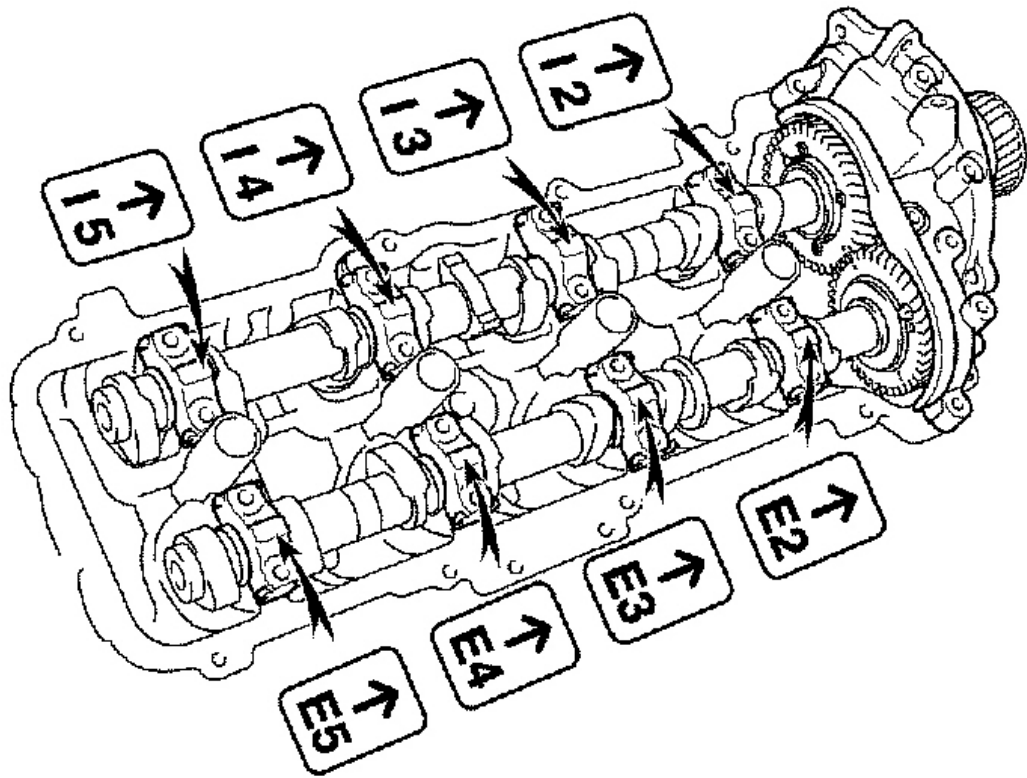


**Fig. 236: Applying Seal Packing To Front Bearing Cap**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Apply seal packing to the front bearing cap.
  - Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.
  - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove.
  - Thoroughly clean all components to remove all loose material.
  - Using a non-residue solvent, clean both sealing surfaces.
  - Apply seal packing to the bearing cap as shown in the illustration.
  - Install a nozzle that has been cut to a 1.5 mm (0.059 in.) opening.
  - Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
  - Immediately remove the nozzle from the tube and reinstall the cap.

**Seal packing: Part No. 08826-00080 or equivalent**

**NOTE: Do not apply seal packing to the front bearing cap grooves.**



G02998503

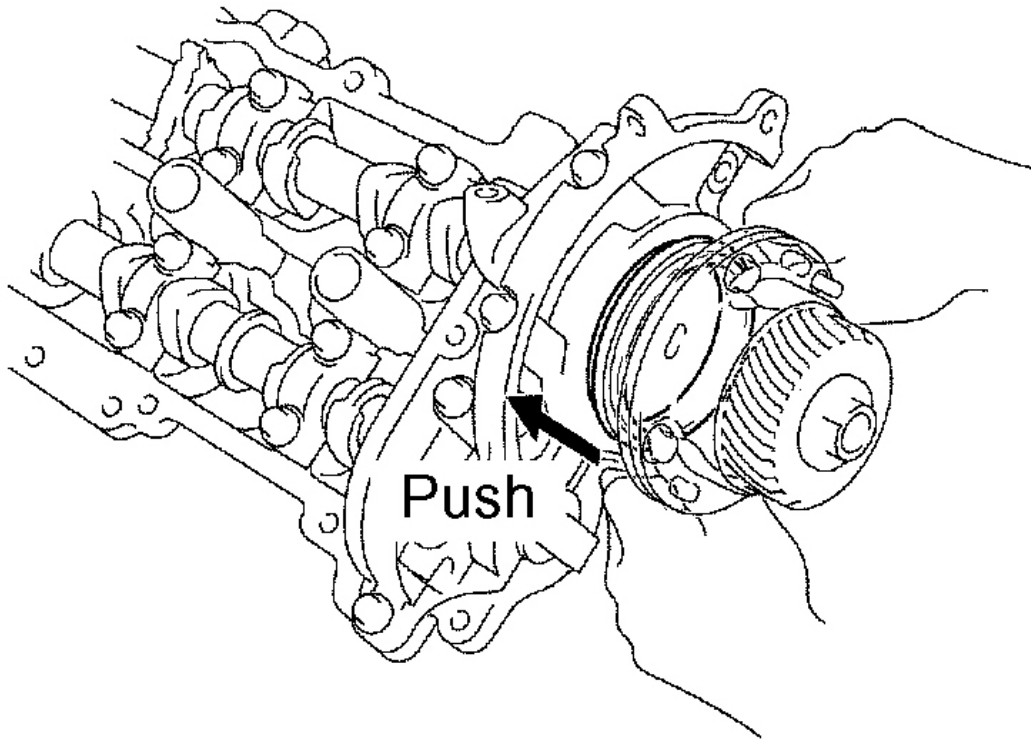
**Fig. 237: Installing Front Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. Install the front bearing cap.

HINT:

Installing the front bearing cap will determine the thrust portion of the camshaft.

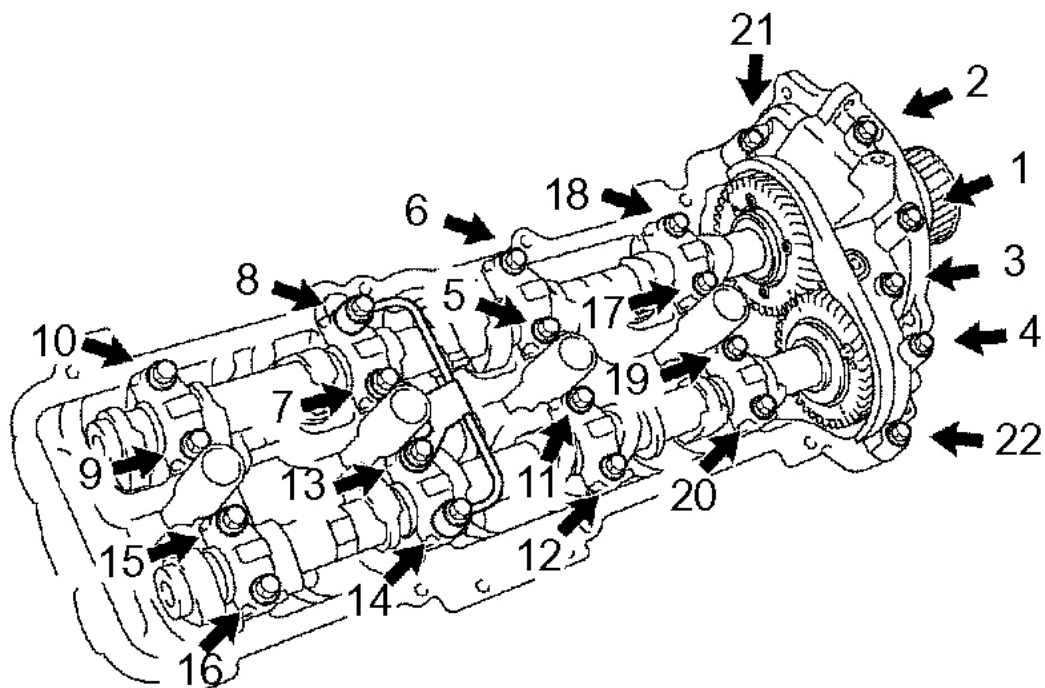
9. Install the other bearing caps in the sequence shown with the arrow mark facing forward.



**G02998504**

**Fig. 238: Pushing In Camshaft Oil Seal**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

10. Push in the camshaft oil seal.



G02998505

**Fig. 239: Identifying Bearing Cap Bolts**

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

11. Install 4 new seal washers to the bearing cap bolts (1 to 4).
12. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (5 to 22).

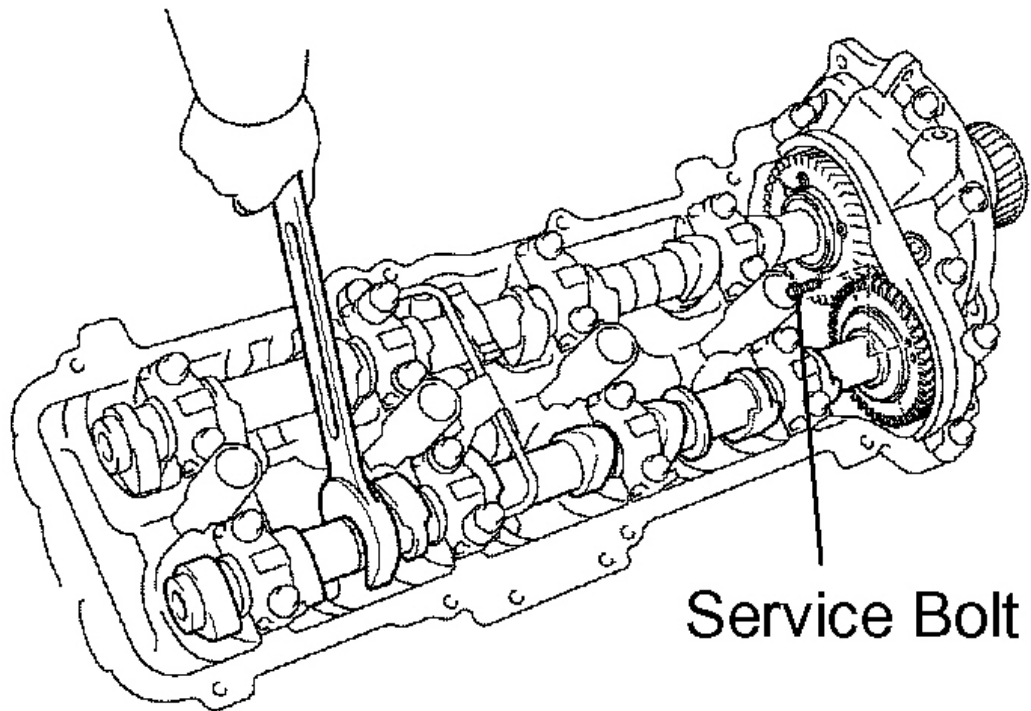
**NOTE:** Do not apply engine oil under the heads of the bearing cap bolts (1 to 4).

13. Install the oil feed pipe with the 22 bearing cap bolts.
14. Uniformly tighten the 22 bearing cap bolts in several passes in the sequence shown in the illustration.

**Torque:**

**7.5 N.m (77 kgf.cm, 66 in..lbf) for bolts 21 and 22**

**16 N.m (163 kgf.cm, 12 ft.lbf) for others**

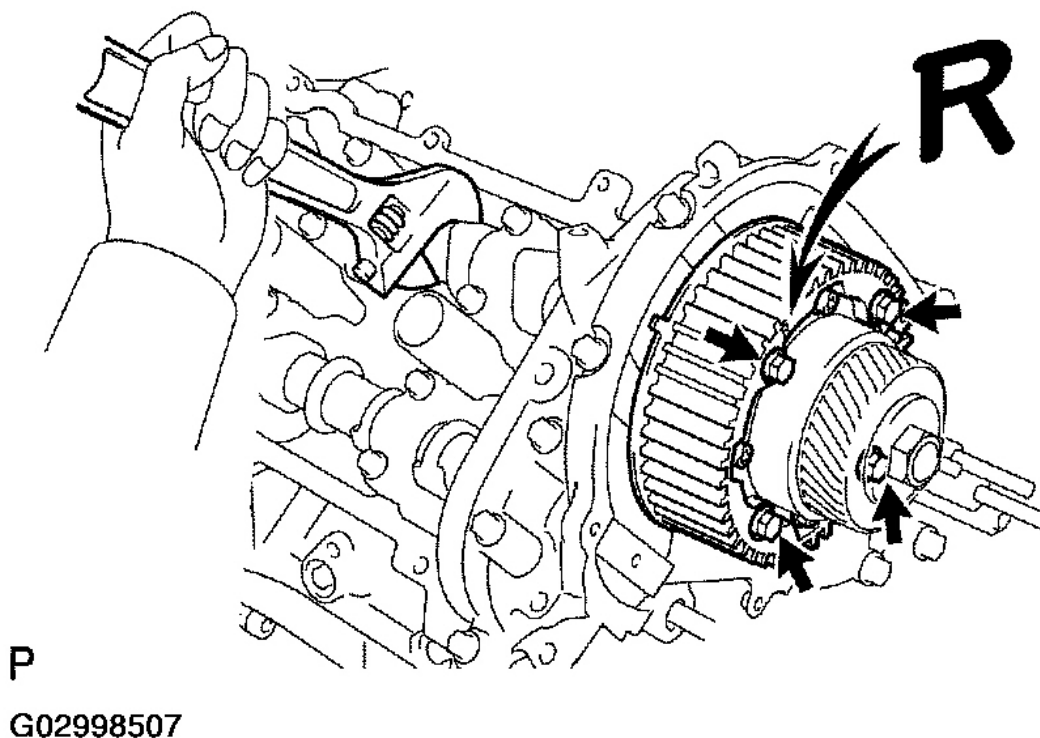


G02998506

**Fig. 240: Removing Service Bolt**

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

15. Remove the service bolt.
12. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY**



**Fig. 241: Installing Camshaft Timing Pulley**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**13. INSTALL CAMSHAFT TIMING PULLEY**

- a. Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.
- b. Attach the timing pulley to the camshaft timing tube. Face the timing pulley's "R" mark forward.
- c. Hold the hexagon wrench head portion of the camshaft, and install the 4 pulley bolts.

**Torque: 7.5 N.m (77 kgf.cm, 66 in..lbf)**

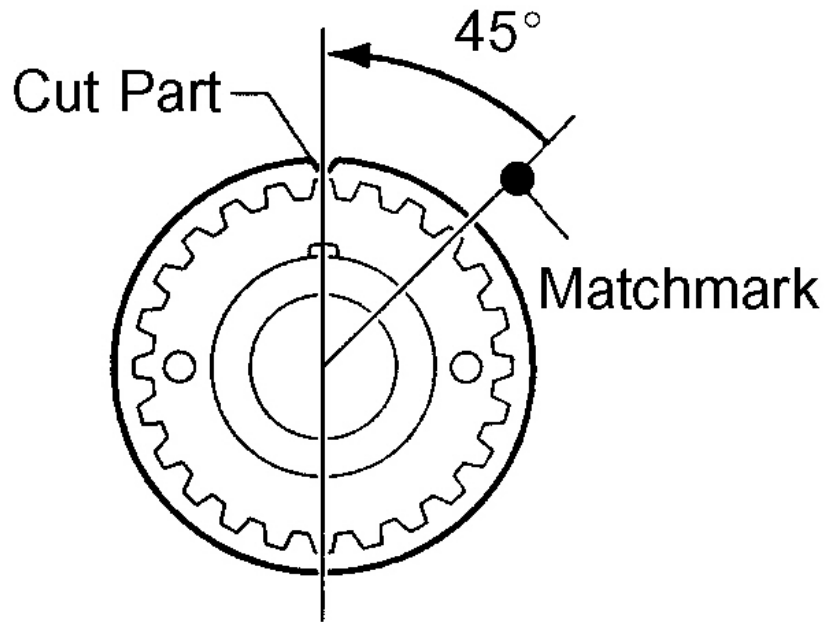
**14. INSTALL CYLINDER HEAD COVER SUB-ASSY (See REPLACEMENT )**

**15. INSTALL TIMING BELT (See REPLACEMENT )**

**CAMSHAFT (LH BANK)**

**REPLACEMENT**

1. **REMOVE TIMING BELT (See REPLACEMENT )**
2. **REMOVE CYLINDER HEAD COVER SUB-ASSY LH (See REPLACEMENT )**



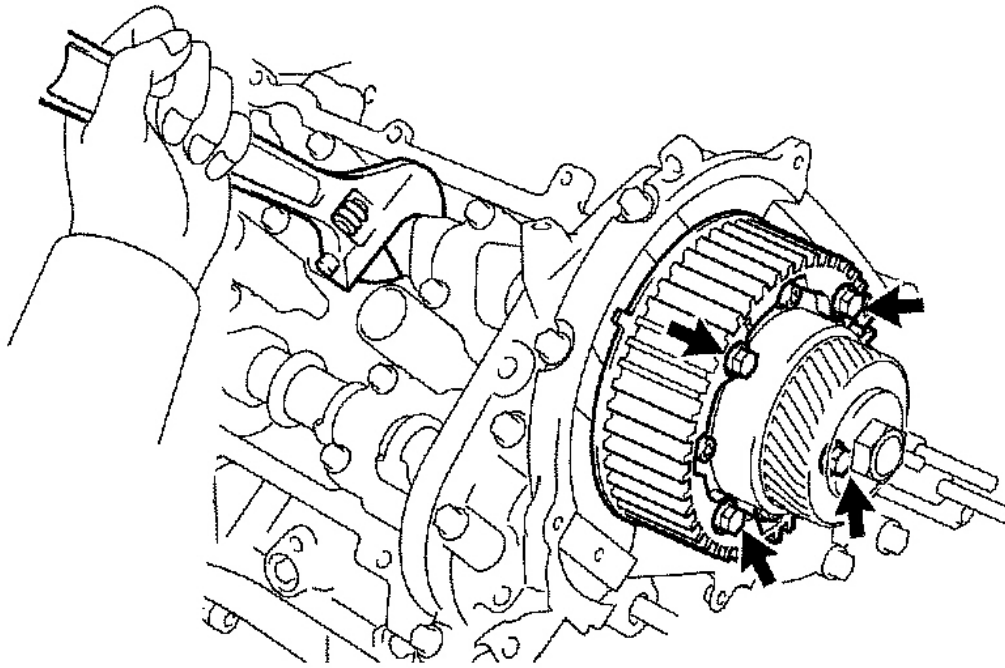
G02998508

**Fig. 242: Identifying Cylinder And Valve Piston Position**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**3. PISTON & VALVE BREAK PREVENT WORK**

- a. Turn the crankshaft timing pulley counterclockwise by 45° and match the cut part with the illustrated position.





P

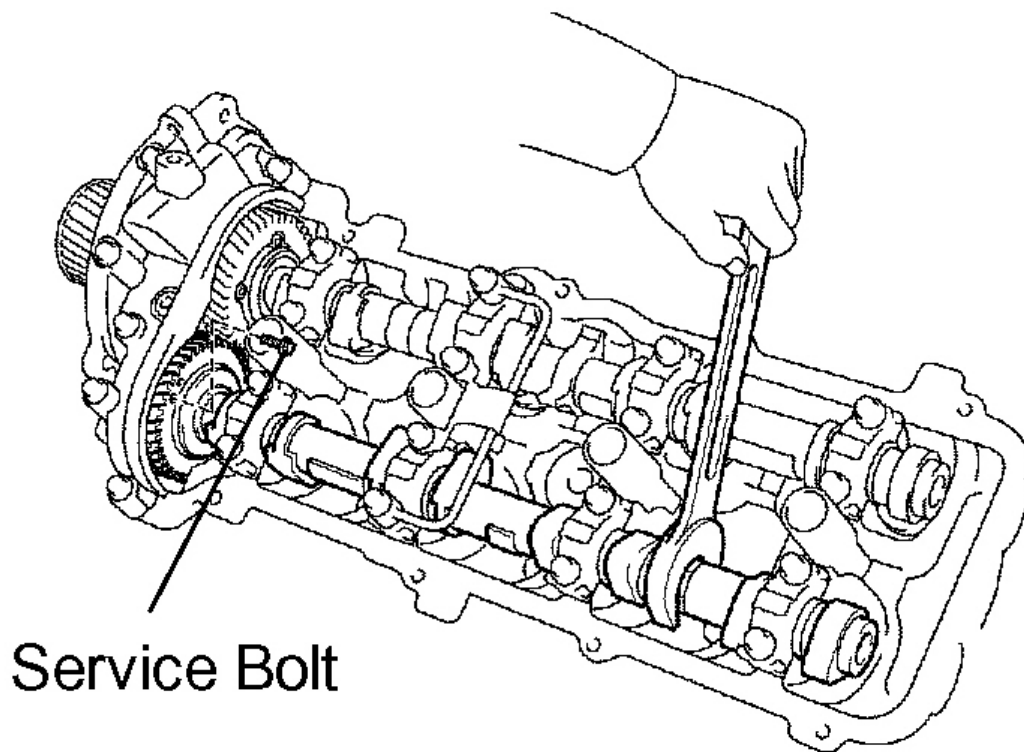
G02998509

**Fig. 243: Removing Camshaft Timing Pulley Sub-Assy LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

When the No. 1 cylinder is positioned at 45° BTDC, the valve and piston do not interfere with each other even when the valve is fully open.

**NOTE:** Be sure to match the cut part by turning it counterclockwise.



## Service Bolt

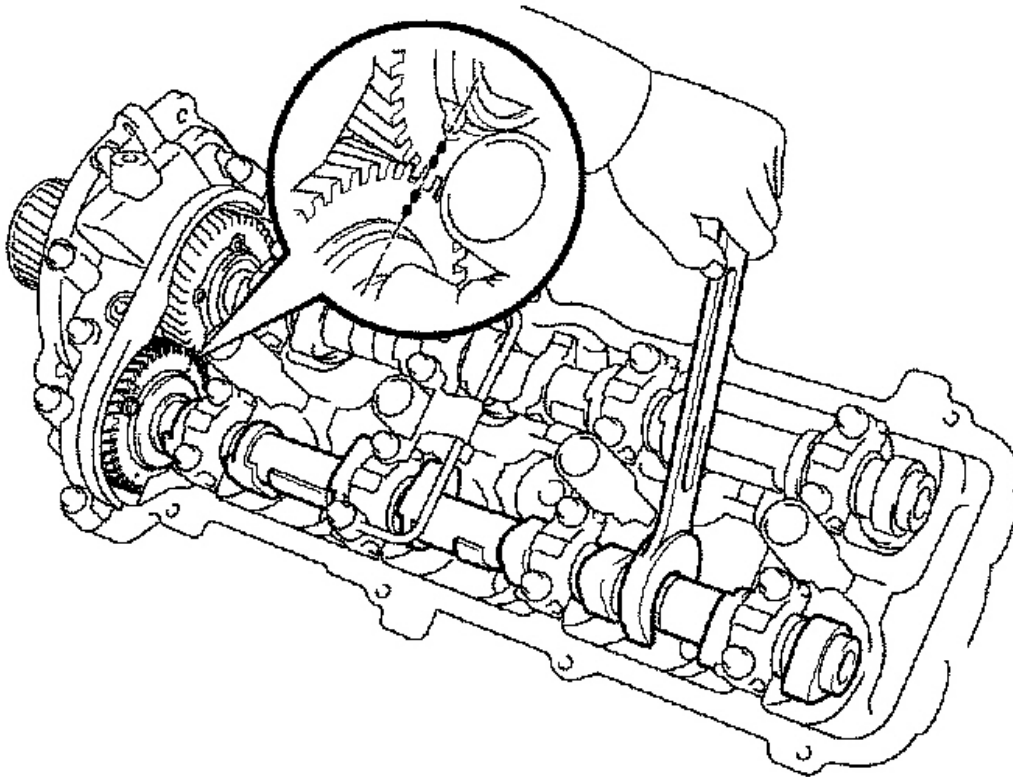
G02998510

**Fig. 244: Removing Service Bolt**

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

4. **REMOVE CAMSHAFT TIMING PULLEY SUB-ASSY LH**
  - a. Remove the 4 bolts and timing pulley.
5. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**
6. **REMOVE NO.3 CAMSHAFT SUB-ASSY**

**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



**G02998511**

**Fig. 245: Setting Timing Mark Of Camshaft Main Gear**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Bring the service bolt hole of the sub gear upward by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.
- b. Secure the sub gear to the main gear with a service bolt.

**RECOMMENDED SERVICE BOLT:**

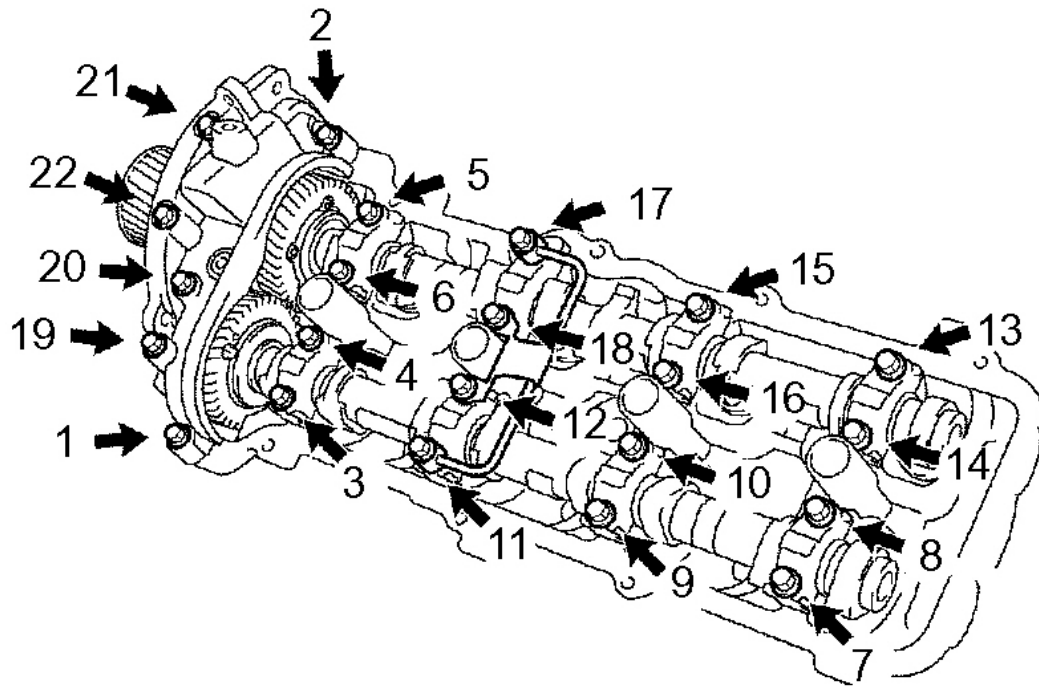
**RECOMMENDED SERVICE BOLT**

Thread diameter	6mm
Thread pitch	1.0 mm
Bolt length	16 to 20 mm (0.63 to 0.79 in.)

**HINT:**

When removing the camshaft, make sure that the torsional spring force of the sub gear has been

eliminated by the above operation.

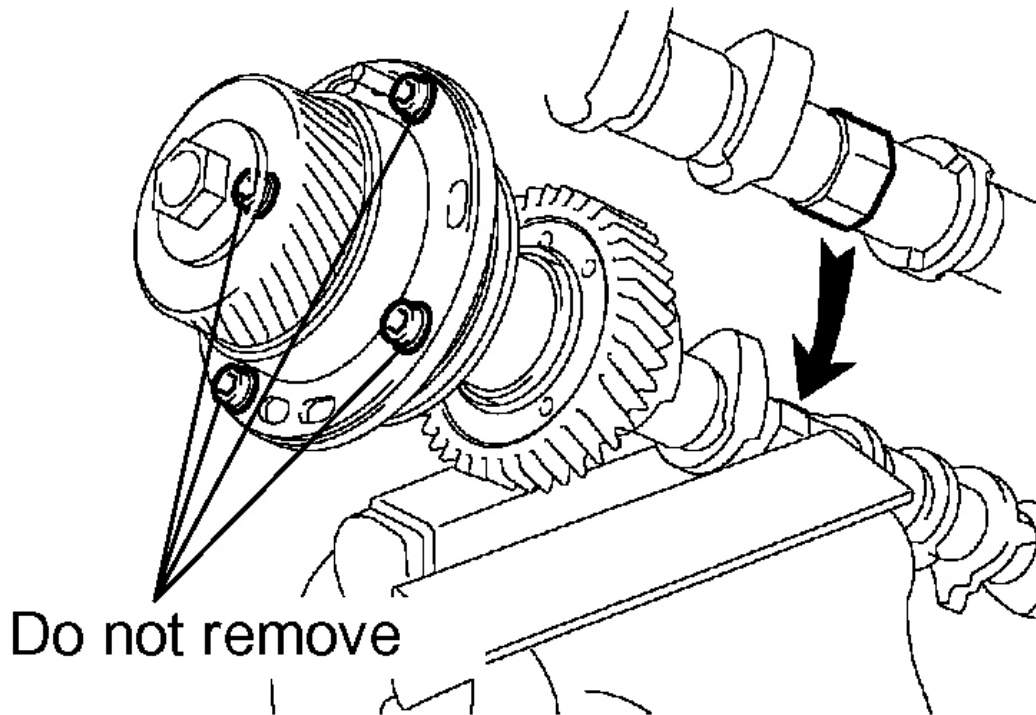


G02998512

**Fig. 246: Identifying Bearing Cap Bolts**

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

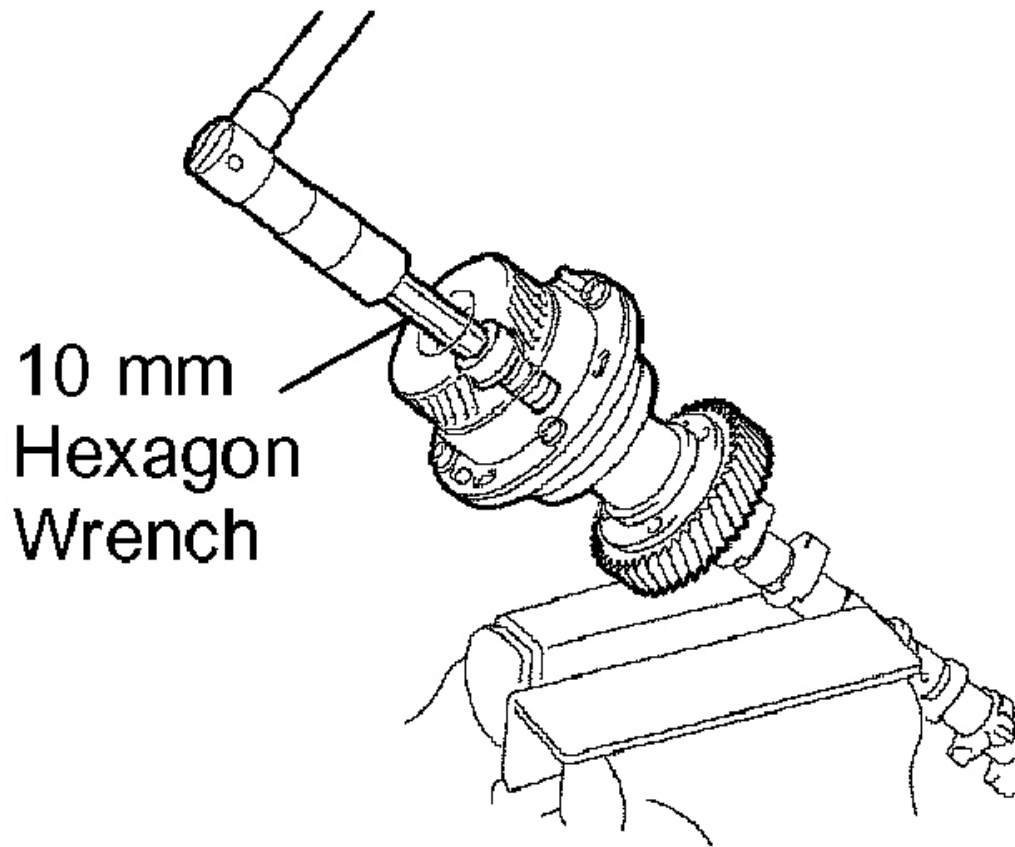
- c. Set the timing mark (2 dot marks) of the camshaft main gear at an angle of approximately 10° by turning the hexagon wrench head portion of the exhaust camshaft with a wrench.



G02998513

**Fig. 247: Mounting Hexagon Wrench Head Portion Of Intake Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Uniformly loosen the 22 bearing cap bolts in several passes in the sequence shown in the illustration.
- e. Remove the 22 bearing cap bolts, 4 seal washers, oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter and 2 camshafts.
- f. Do not pry the camshaft with a tool by applying excessive force to it.
- g. Do not damage the reception part of the thrust on the cylinder head side.



G02998514

**Fig. 248: Mounting Hexagon Wrench Head Portion Of Intake Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

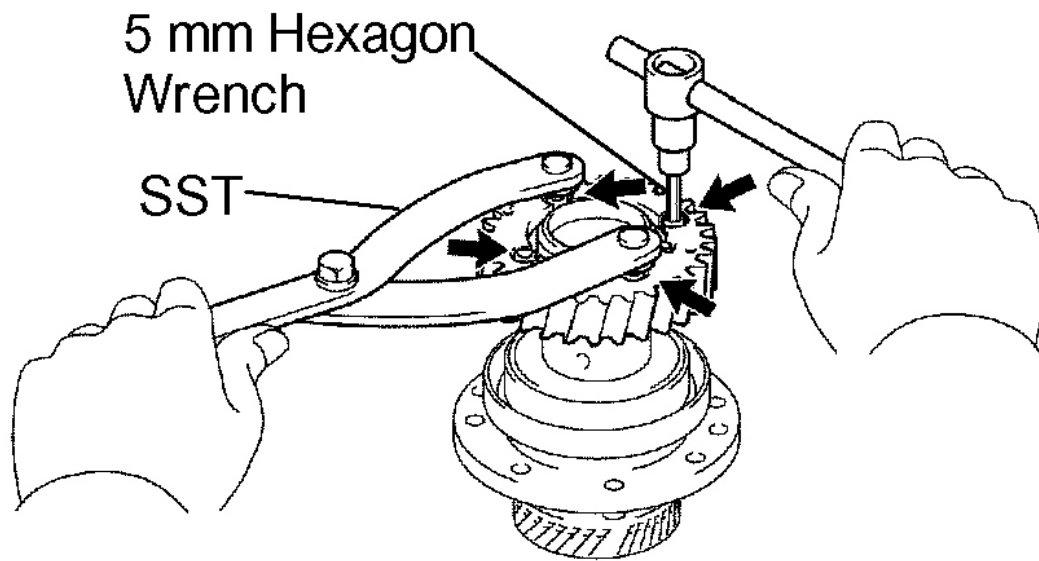
**7. REMOVE CAMSHAFT TIMING TUBE ASSY**

- a. Mount the hexagon wrench head portion of the intake camshaft in a vise.

**NOTE:**

- Be careful not to damage the camshaft.
- Do not remove the 4 bolts shown in the illustration. The bolts determine the backlash of the gear in the timing tube. If any of the bolts are removed, install a new timing tube assembly.

- b. Remove the screw plug and seal washer.

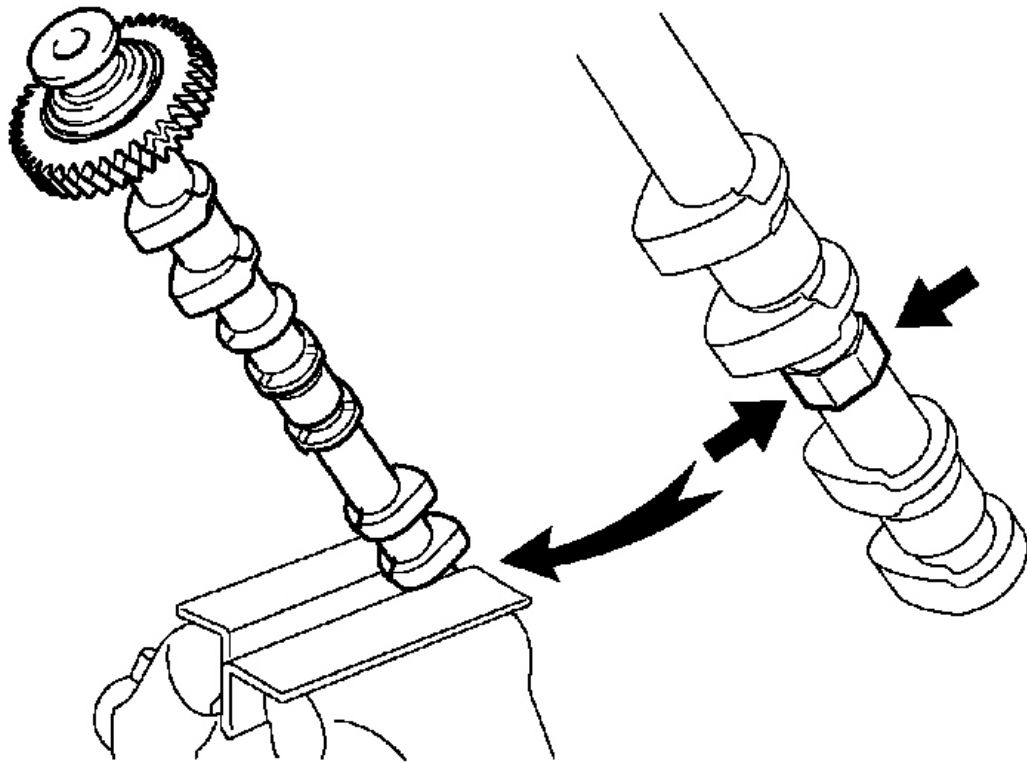


G02998515

**Fig. 249: Removing Bolts Using SST**

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

- c. Using a 10 mm hexagon wrench, remove the bolt.
- d. Pull out the timing tube and drive gear assembly from the camshaft.



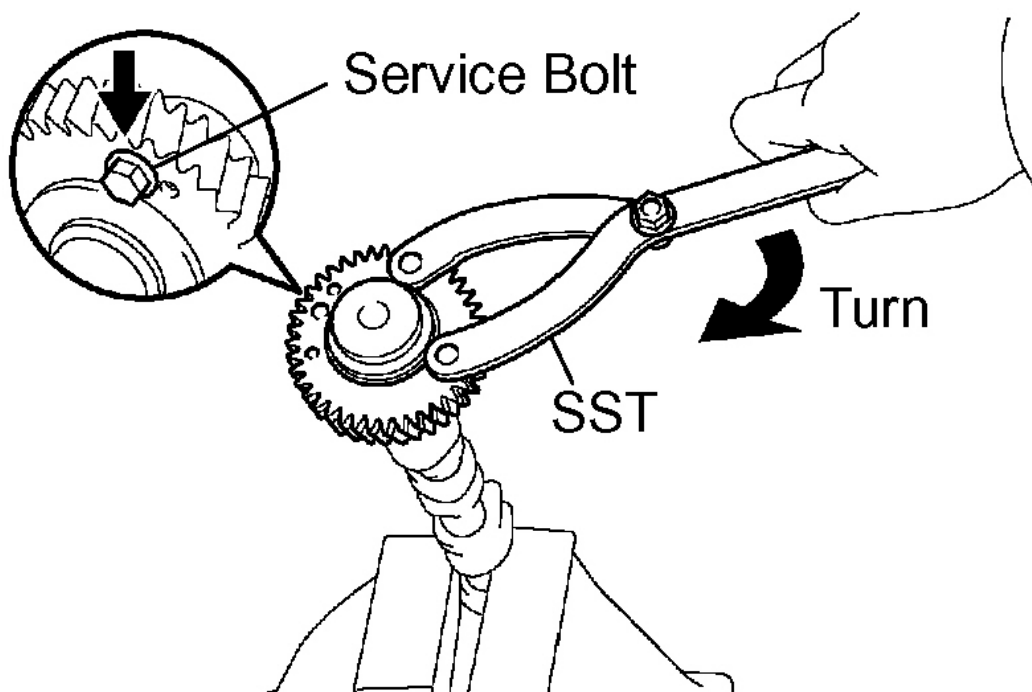
**G02998516**

**Fig. 250: Removing Bolts, Drive Gear And Oil Seal Using SST And Hexagon Wrench**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using SST and a 5 mm hexagon wrench, remove the 4 bolts, drive gear and oil seal.  
SST 09960-10010 (09962-01000, 09963-00500)

**NOTE:** Be careful not to damage the timing tube.





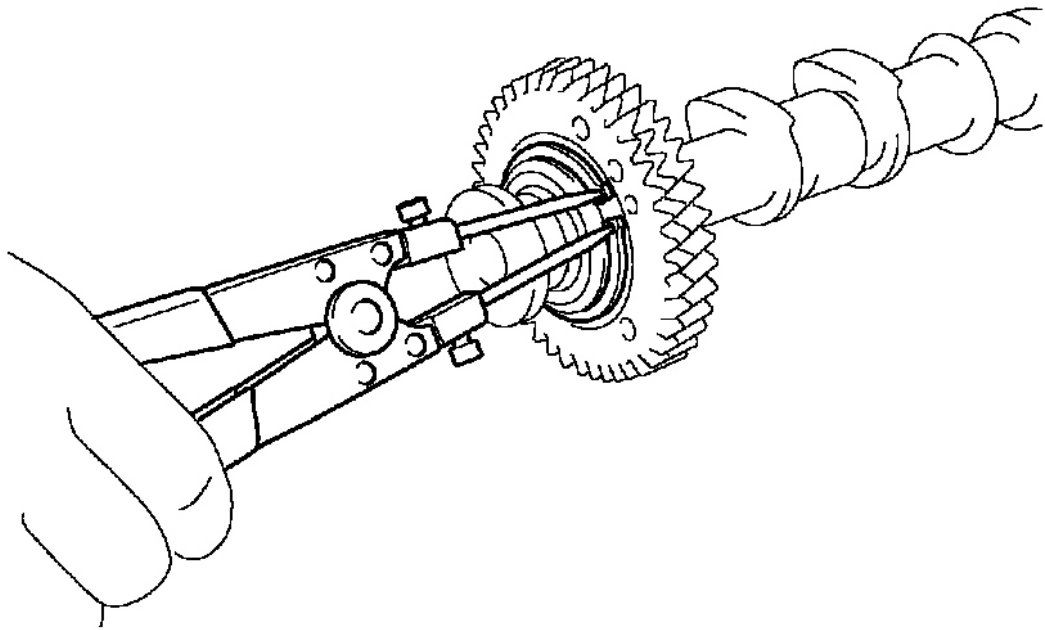
G02998517

**Fig. 251: Mounting Hexagon Wrench Head Portion Of Camshaft In A Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 8. REMOVE CAMSHAFT SUB GEAR

- Mount the hexagon wrench head portion of the camshaft in a vise.

**NOTE:** Be careful not to damage the camshaft.

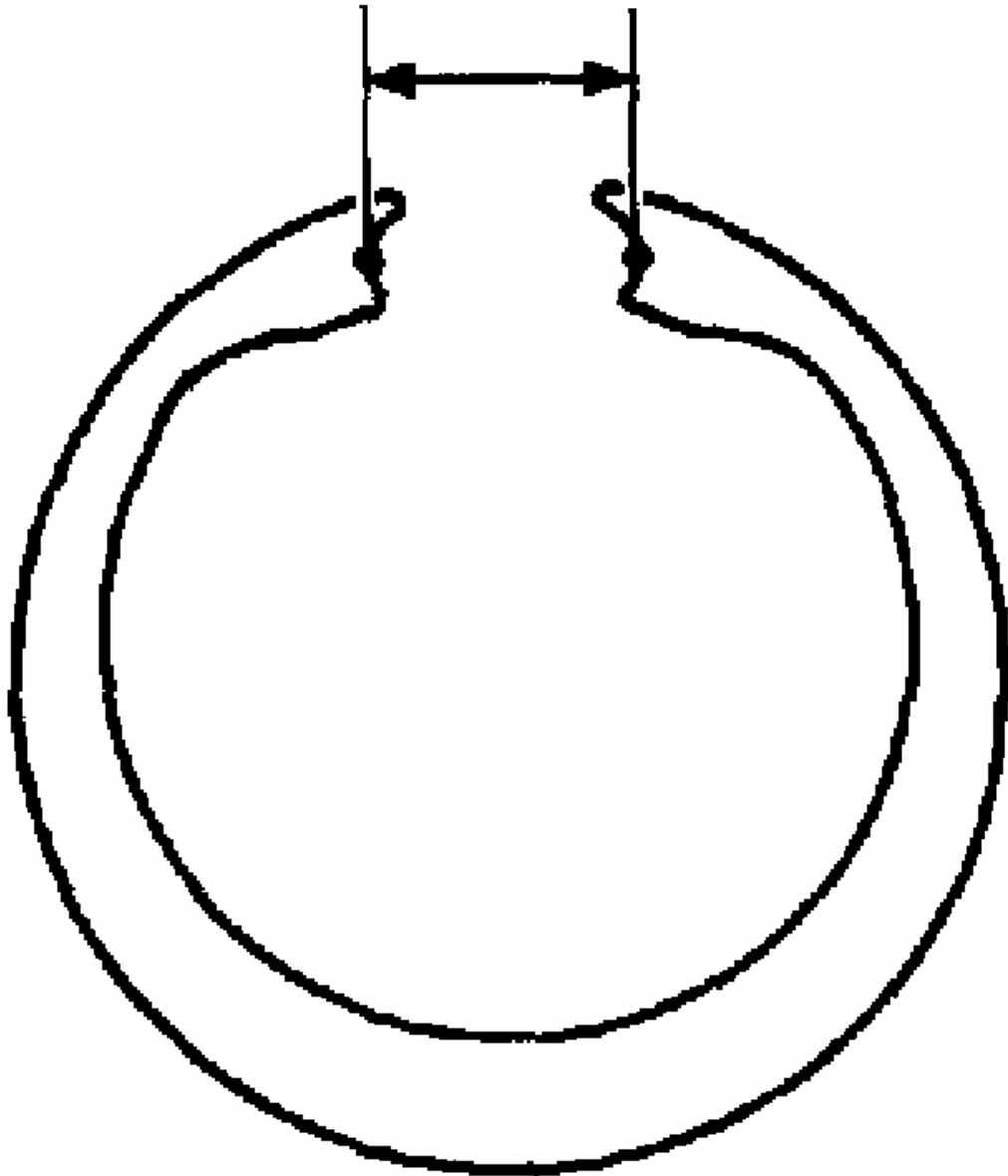


**G02998518**

**Fig. 252: Removing Service Bolt Using SST**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- Using SST, turn the sub gear clockwise and remove the service bolt.  
SST 09960-10010 (09962-01000, 09963-00500)

18.2 to 18.8 mm



G02998519

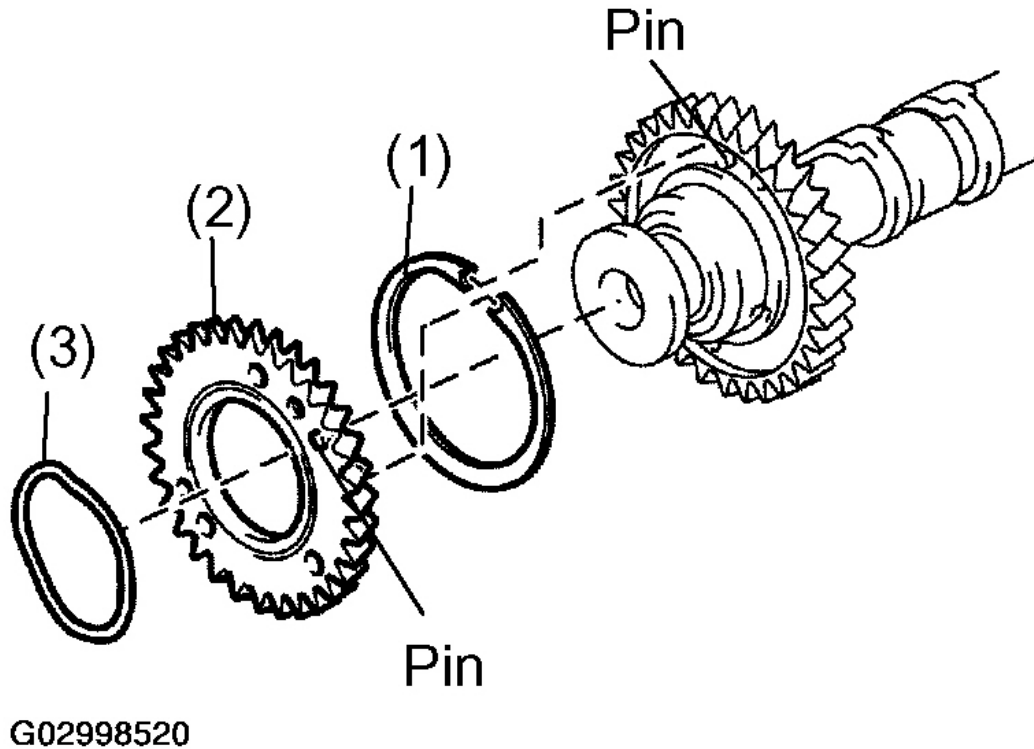
Fig. 253: Removing Snap Ring Using Snap Ring Pliers

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

- Using snap ring pliers, remove the snap ring.
- Remove the wave washer, sub gear and bolt washer.

HINT:

Arrange the driven sub gears and bolt washers (RH and LH sides).



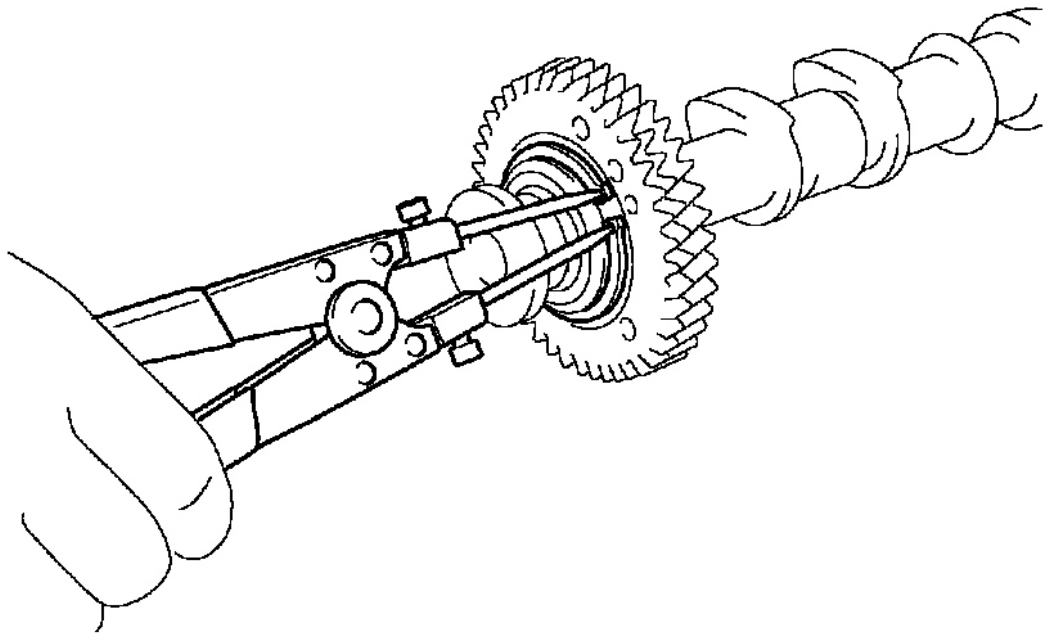
**Fig. 254: Installing Camshaft Sub Gear**

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

- Using a vernier caliper, measure the gap between the washer ends.

**Gap: 18.2 to 18.8 mm (0.712 to 0.740 in.)**

If the gap is not as specified, replace the bolt washer.



G02998521

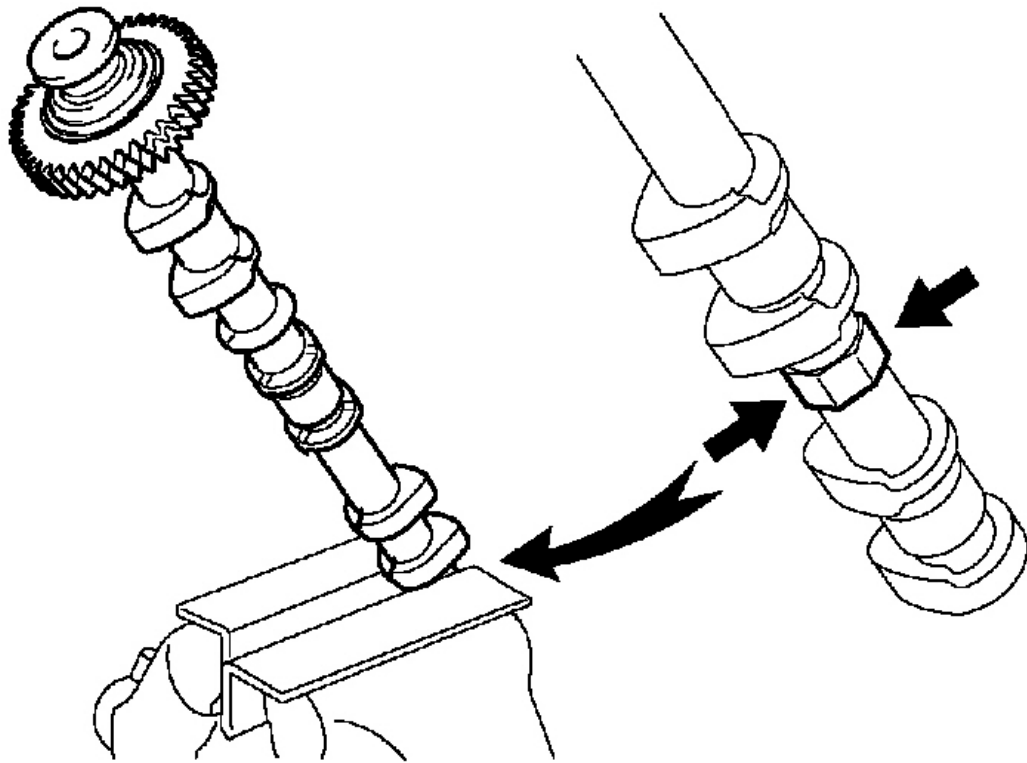
**Fig. 255: Removing Snap Ring Using Snap Ring Pliers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 9. INSTALL CAMSHAFT SUB GEAR

- a. Install the bolt washer (1), sub gear (2) and wave washer (3).

HINT:

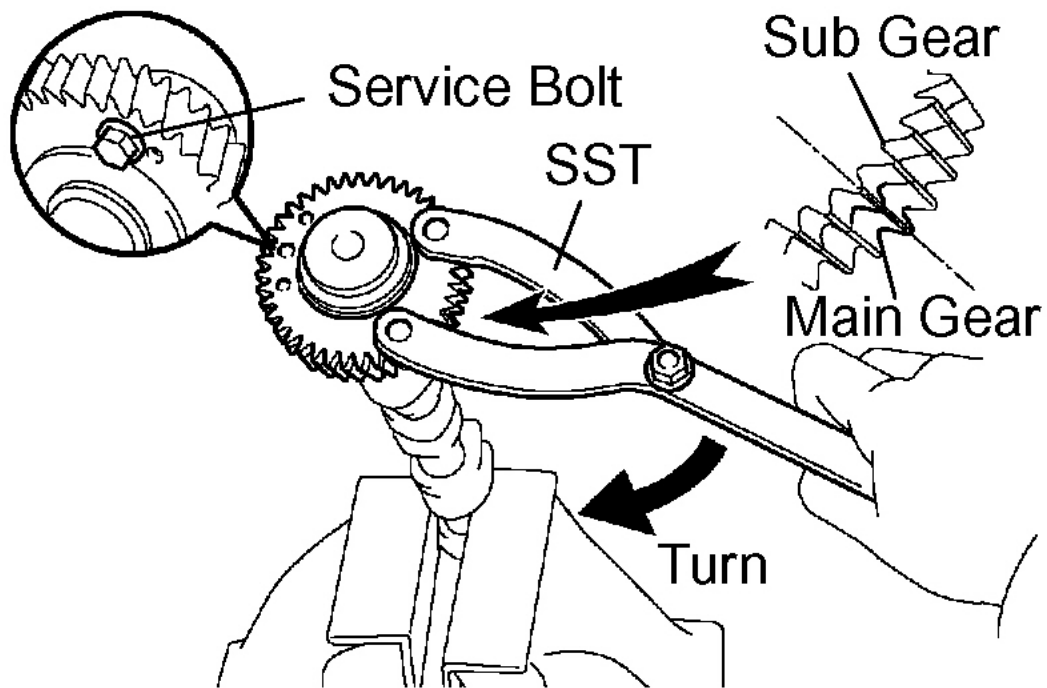
Attach the pins on the gears to the gear bolt washer ends.



G02998522

**Fig. 256: Mounting Hexagon Wrench Head Portion Of Camshaft In Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using snap ring pliers, install the snap ring.

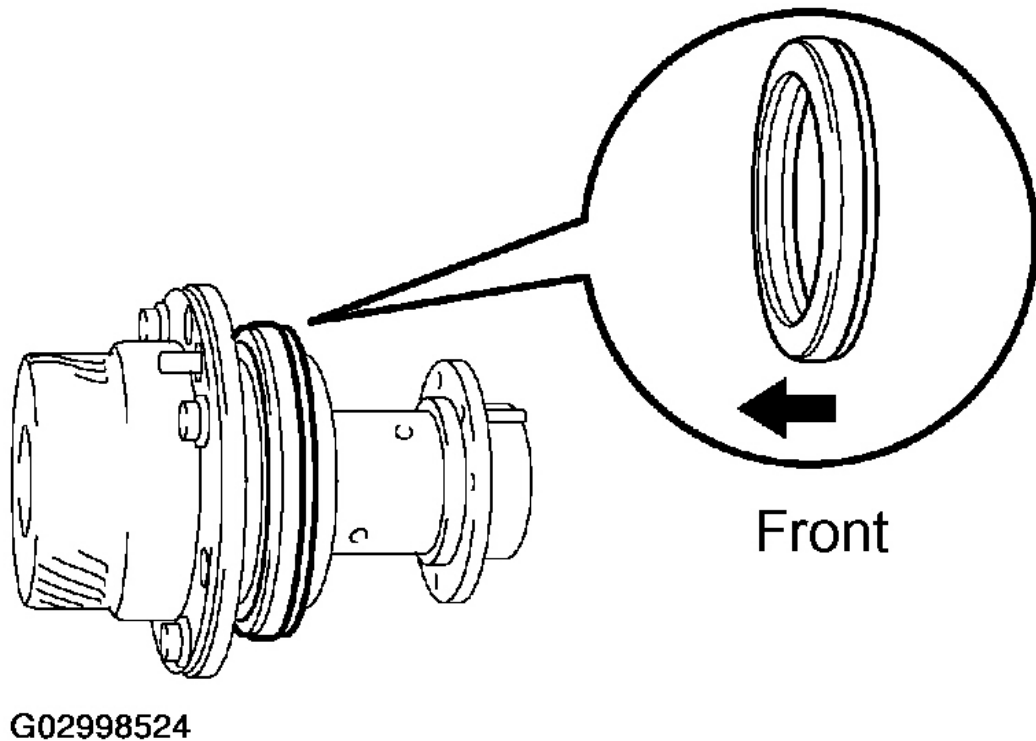


G02998523

**Fig. 257: Aligning Holes Of Driven Main Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mount the hexagon wrench head portion of the camshaft in a vise.

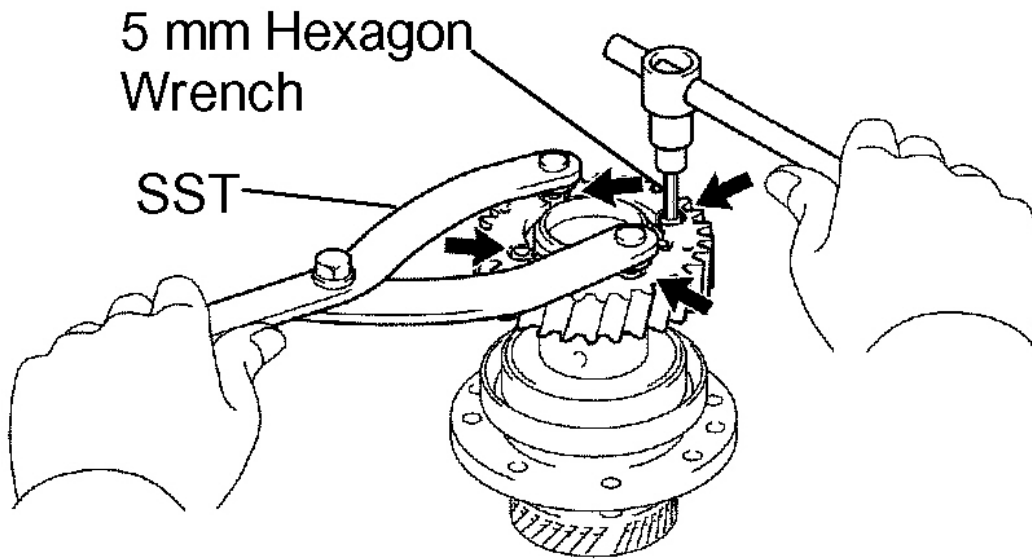
**NOTE:** Be careful not to damage the camshaft.



**Fig. 258: Inserting Oil Seal Into Camshaft Timing Tube**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise, and temporarily install a service bolt.  
SST 09960-10010 (09962-01000, 09963-00500)
- e. Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.





G02998525

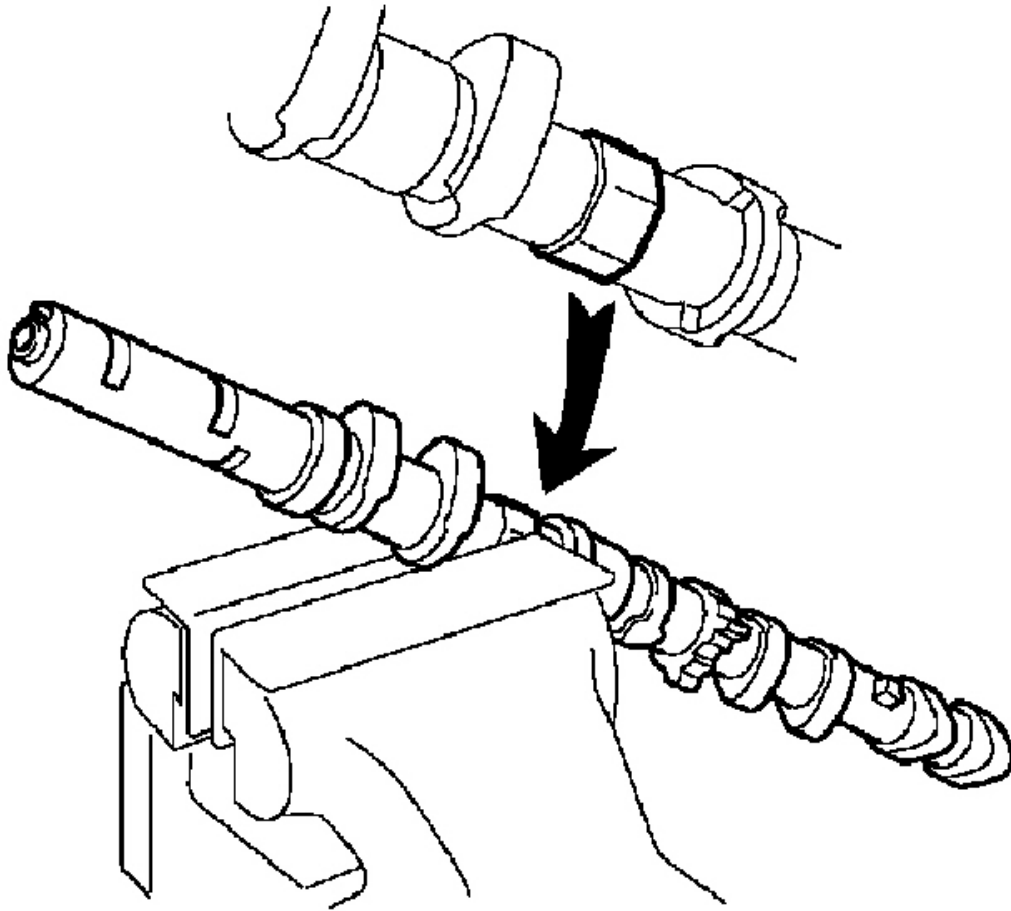
**Fig. 259: Installing Drive Gear And Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**10. INSTALL CAMSHAFT TIMING TUBE ASSY**

- a. Insert a new oil seal into the camshaft timing tube until it reaches the stopper.

**NOTE:**

- Be careful of the installation direction.
- Do not turn over the oil seal lip.



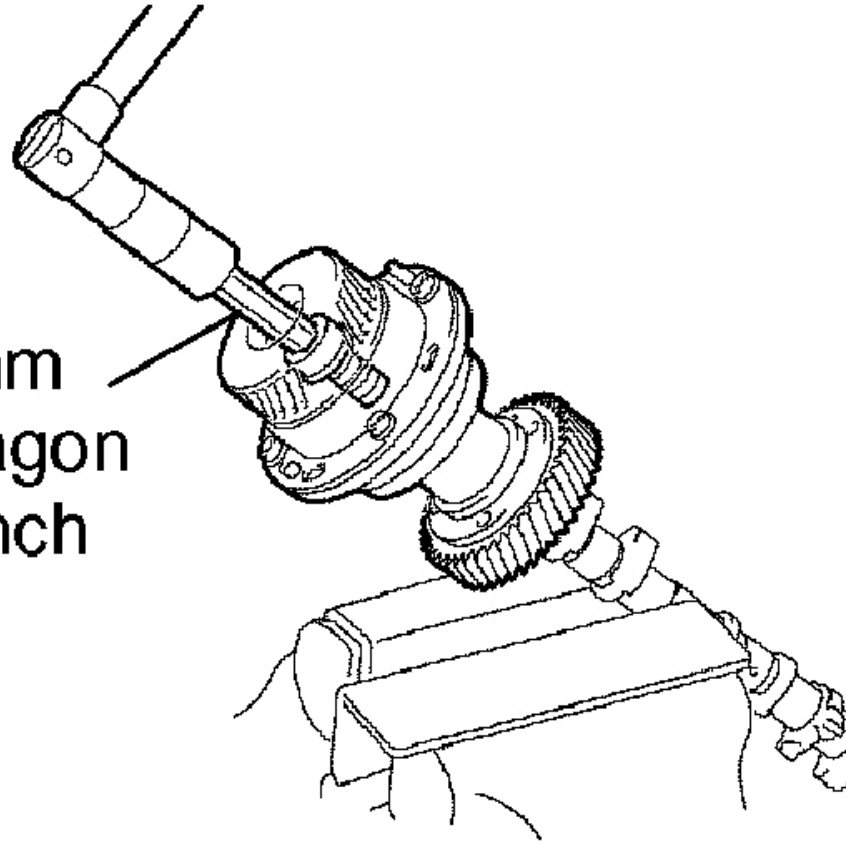
**G02998526**

**Fig. 260: Mounting Hexagon Wrench Head Portion Of Camshaft In Vise**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing tube knock pin with the knock pin groove of the drive gear, and temporarily install the drive gear with the 4 bolts.
- c. Using SST and a 5 mm hexagon wrench, uniformly tighten the 4 bolts in several passes.  
SST 09960-10010 (09962-01000, 09963-00500)  
**Torque: 7.5 N.m (77 kgf.cm, 66 in..lbf)**

**NOTE: Be careful not to damage the timing tube.**

10 mm  
Hexagon  
Wrench



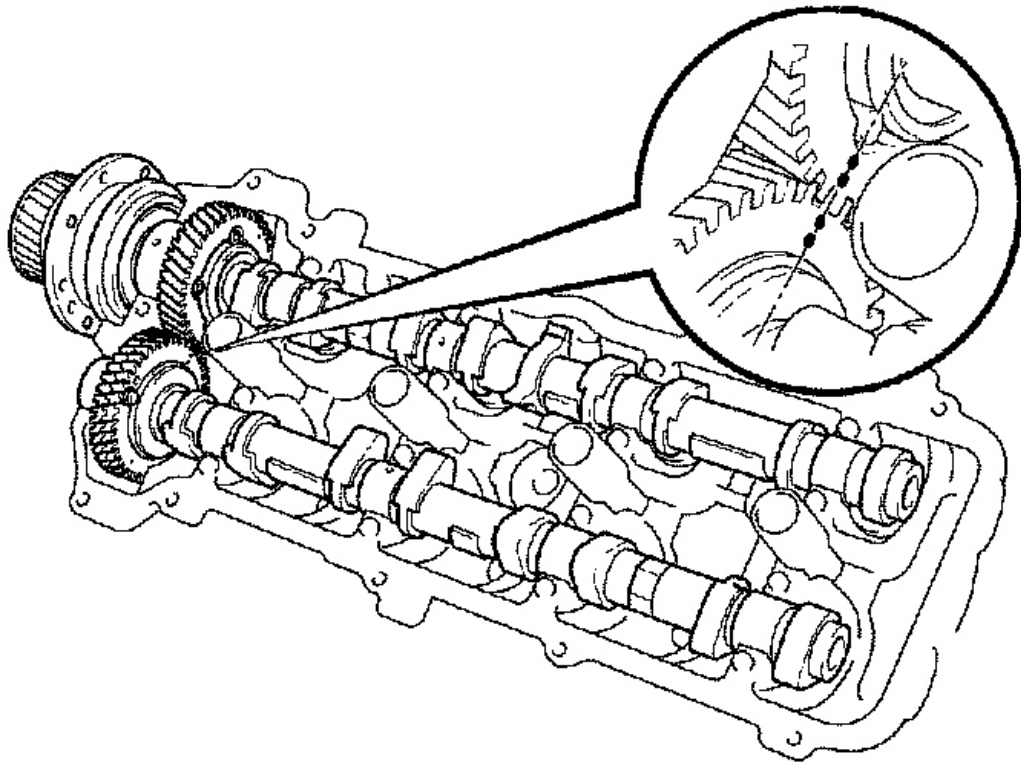
G02998527

**Fig. 261: Installing Bolts Using SST**

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

- d. Mount the hexagon wrench head portion of the camshaft in a vise.

**NOTE:** Be careful not to damage the camshaft.



**G02998528**

**Fig. 262: >Aligning Timing Marks Of Camshaft Drive And Driven Main Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

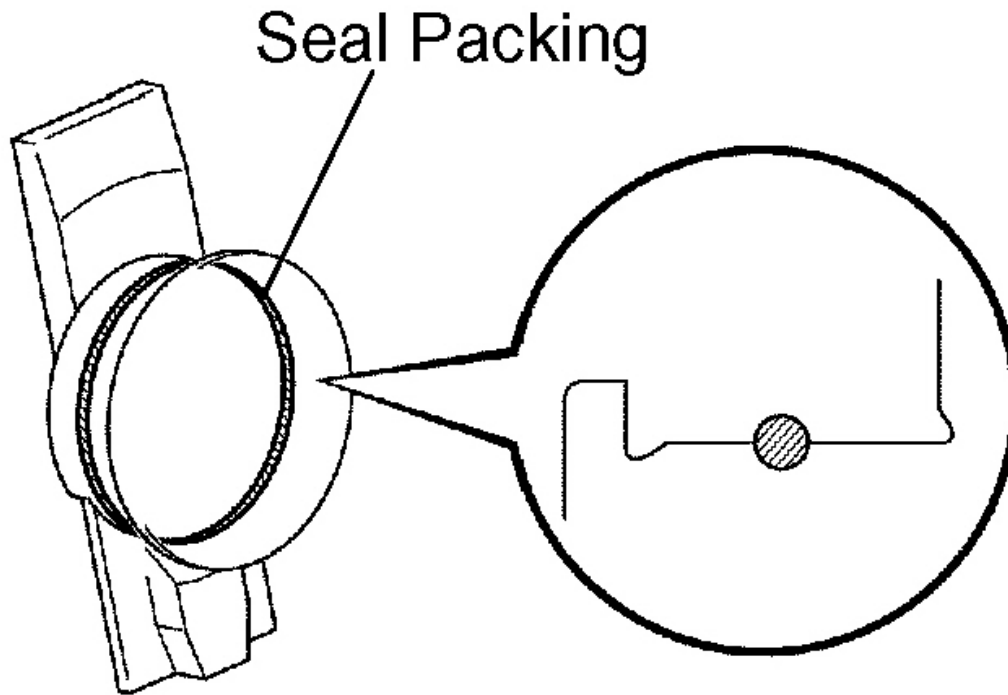
- e. Align the camshaft knock pin with the knock pin groove of the timing tube, and push the timing tube by hand until it touches the bottom.
- f. Using a 10 mm hexagon wrench, install the bolt.
- g. Install the seal washer and screw plug.

**Torque: 78 N.m (795 kgf.cm, 58 ft.lbf)**

**Torque: 15 N.m (153 kgf.cm, 11 ft.lbf)**

#### 11. INSTALL NO.3 CAMSHAFT SUB-ASSY

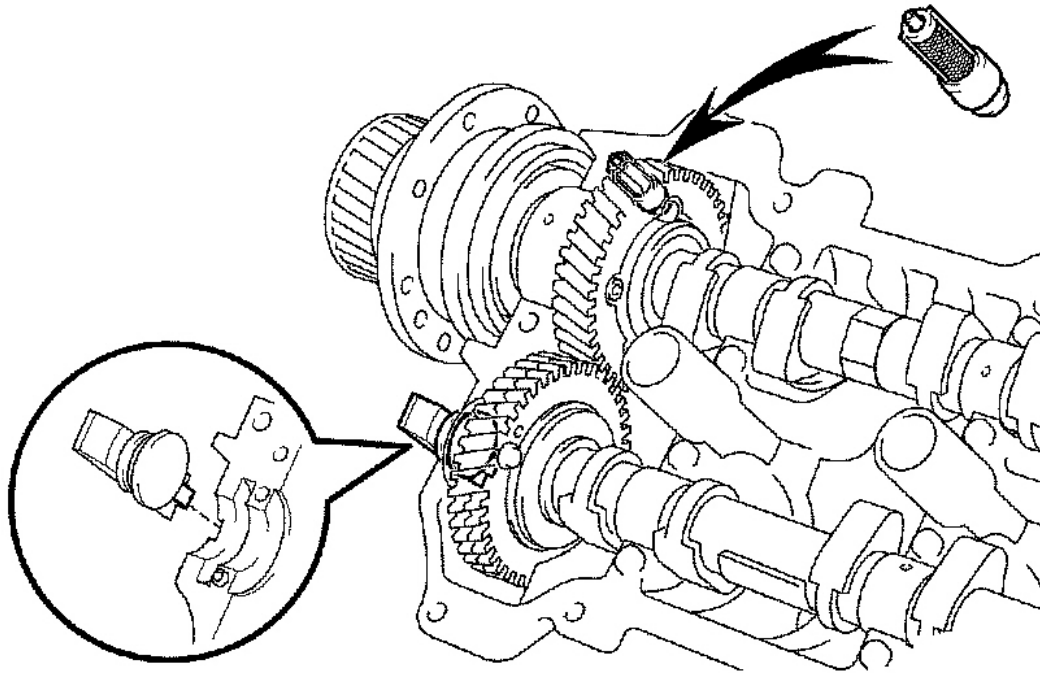
**NOTE:** Since the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head receiving the shaft thrust may crack or be damaged, causing the camshaft to seize or break. To avoid this, the following steps should be carried out.



G02998529

**Fig. 263: Applying Seal Packing To Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Apply engine oil to the cam and gear of the camshaft and also the journal of the cylinder head.
- b. Align the timing marks (2 dot marks each) of the camshaft drive and driven main gears, and place the intake and exhaust camshafts.
- c. Set the timing mark (2 dot marks each) of the camshaft drive and driven main gears at an angle of approximately 10°.

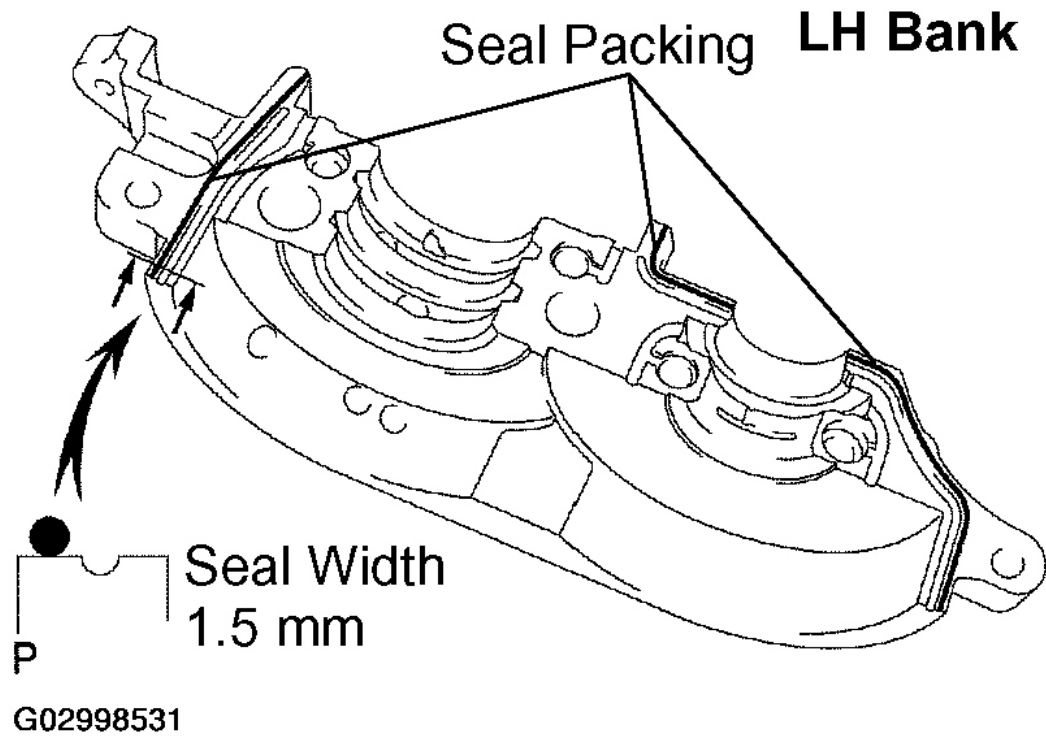


G02998530

**Fig. 264: Installing Camshaft Housing Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply seal packing to the camshaft housing plug.
- Remove the old packing (FIPG) material.
  - Apply seal packing to the housing plug.

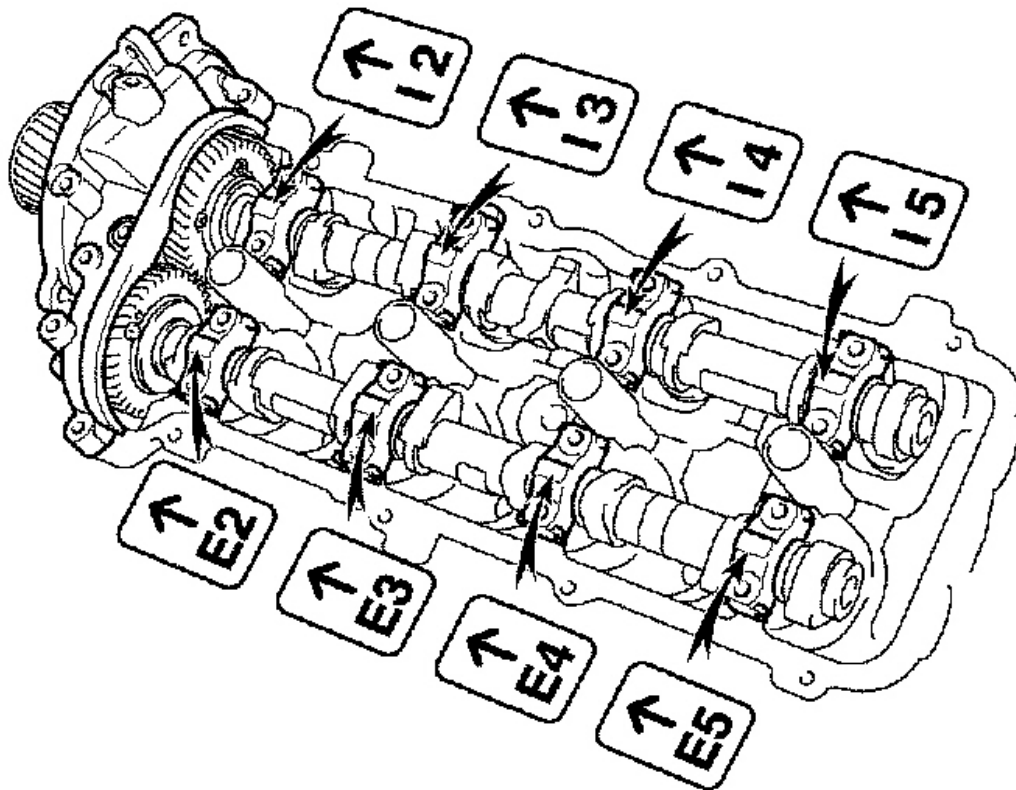
**Seal packing: Part No. 08826-00080 or equivalent**



**Fig. 265: Applying Seal Packing To Front Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the camshaft housing plug to the cylinder head as shown in the illustration.
- f. Install the oil control valve filter to the cylinder head.

**NOTE:** Be careful of the installation direction.



G02998532

**Fig. 266: Installing Front Bearing Cap**

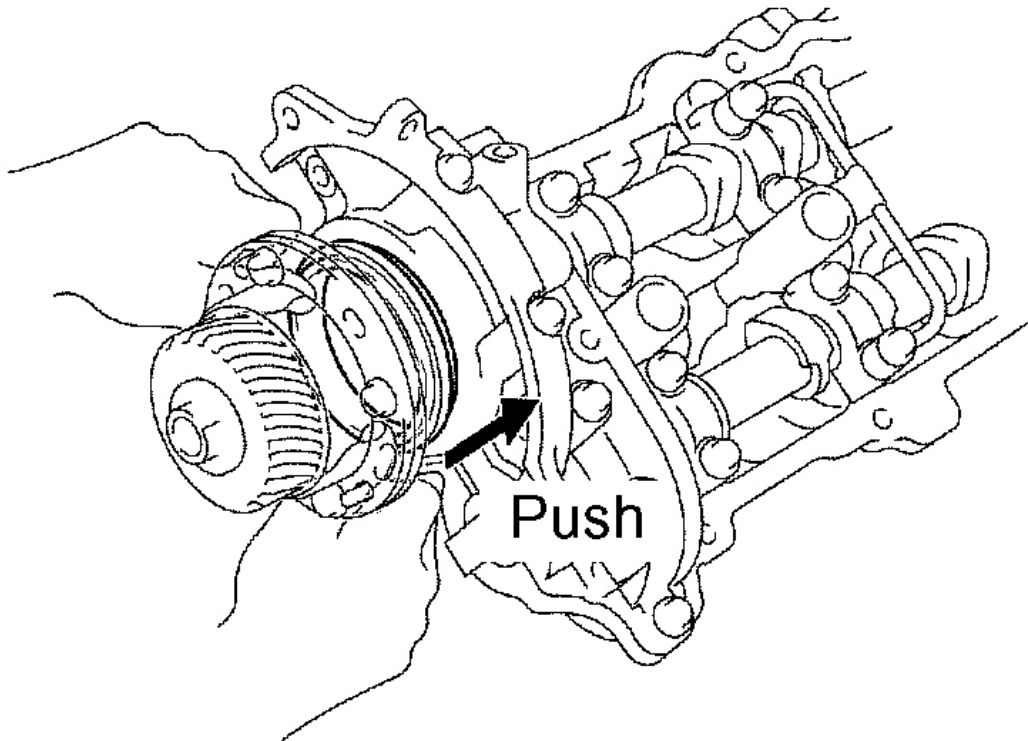
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Apply seal packing to the front bearing cap.
- Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.
  - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove.
  - Thoroughly clean all components to remove all loose material.
  - Using a non-residue solvent, clean both sealing surfaces.
  - Apply seal packing to the bearing cap as shown in the illustration.
  - Install a nozzle that has been cut to a 1.5 mm (0.059 in.) opening.
  - Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
  - Immediately remove the nozzle from the tube and reinstall the cap.



Seal packing: Part No. 08826-00080 or equivalent

**NOTE:** Do not apply seal packing to the front bearing cap grooves.



G02998533

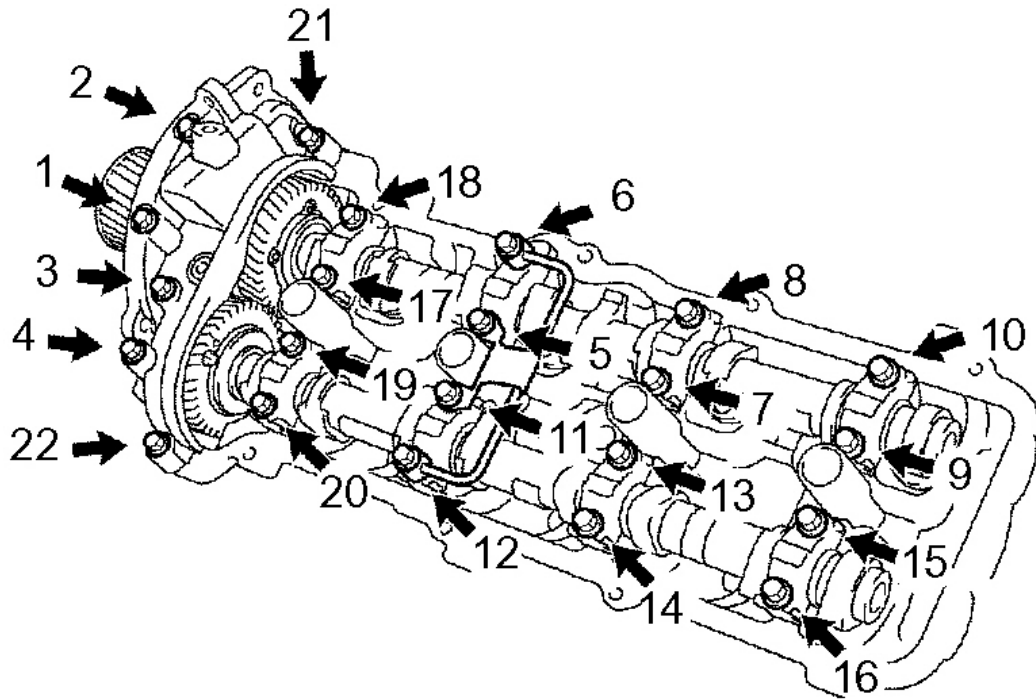
**Fig. 267: Pushing In Camshaft Oil Seal**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Install the front bearing cap.

HINT:

Installing the front bearing cap will determine the thrust portion of the camshaft.

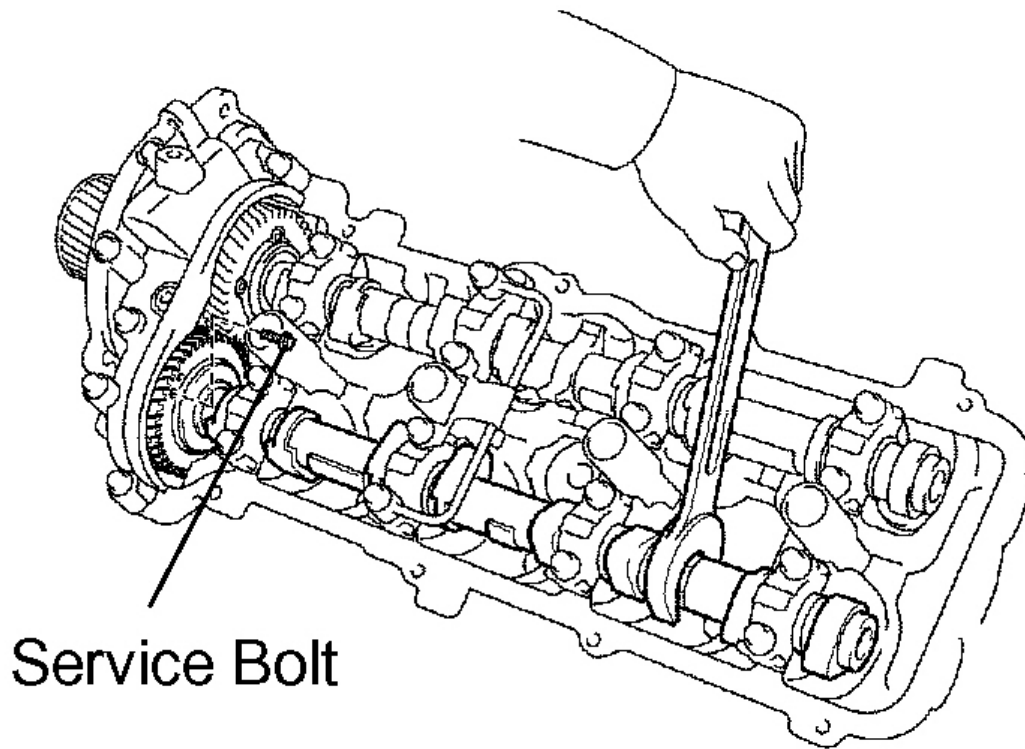
- i. Install the other bearing caps in the sequence shown with the arrow mark facing forward.



G02998534

**Fig. 268: Identifying Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Push in the camshaft oil seal.



## Service Bolt

G02998535

### **Fig. 269: Removing Service Bolt**

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

- k. Install 4 new seal washers to the bearing cap bolts (1 to 4).
- l. Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts (5 to 22).

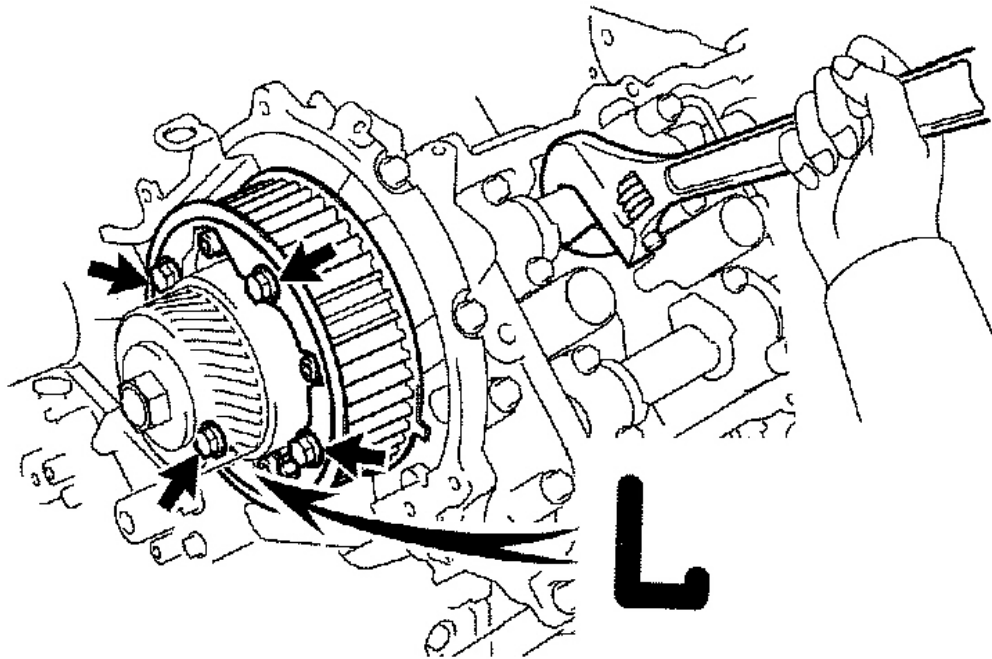
**NOTE:** Do not apply engine oil under the heads of the bearing cap bolts (1 to 4).

- m. Install the oil feed pipe and the 22 bearing cap bolts.
- n. Uniformly tighten the 22 bearing cap bolts in several passes in the sequence shown in the illustration.

#### **Torque:**

**7.5 N.m (77 kgf.cm, 66 in..lbf) for bolt (21 and 22)**

**16 N.m (163 kgf.cm, 12 ft.lbf) for others**

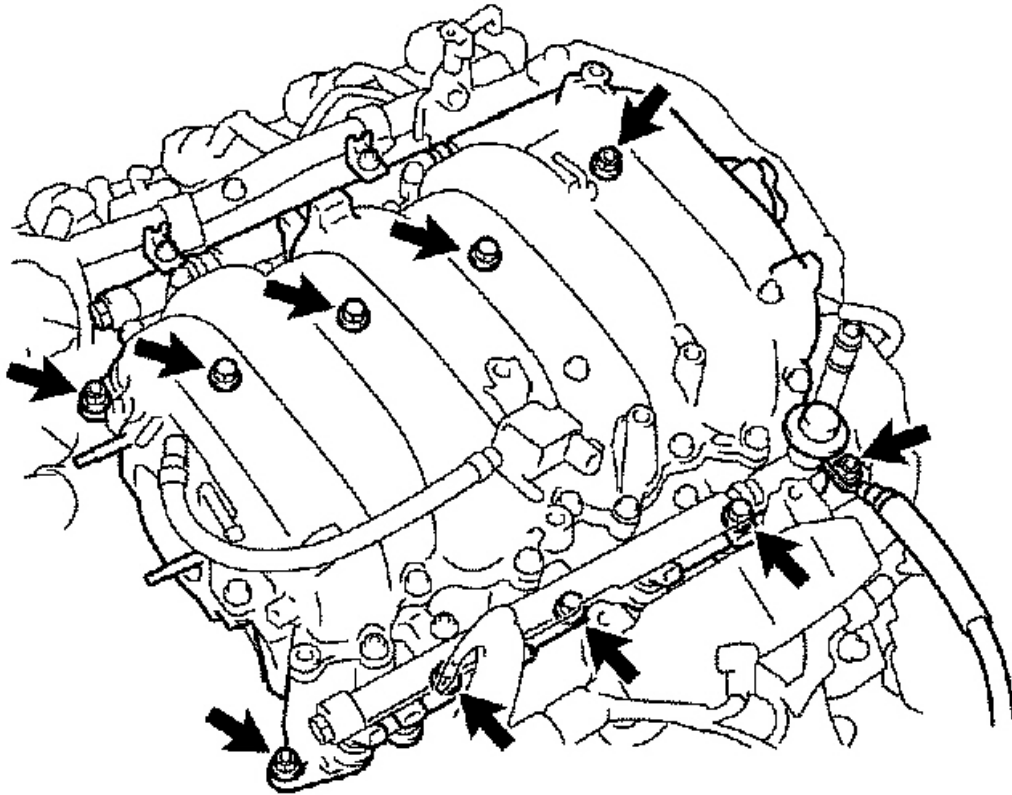


P

G02998536

**Fig. 270: Installing Camshaft Timing Pulley Sub-Assy LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- o. Remove the service bolt.
12. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY**



G02998537

**Fig. 271: Removing Upper And Lower Intake Manifold Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

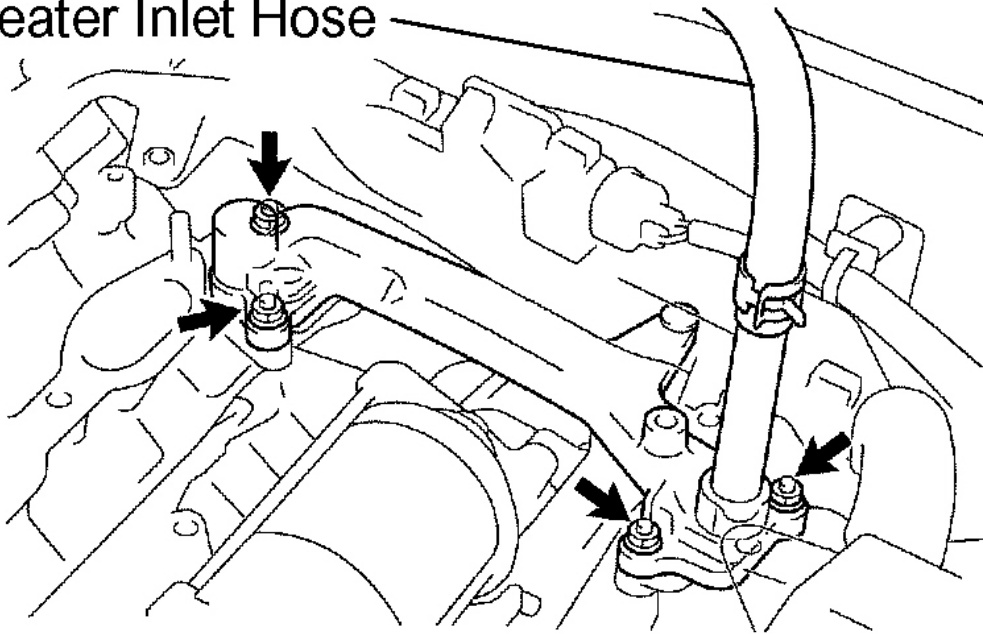
13. **INSTALL CAMSHAFT TIMING PULLEY SUB-ASSY LH**
  - a. Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.
  - b. Attach the timing pulley to the camshaft timing tube. Face the timing pulley's "L" mark forward.
  - c. Hold the hexagon wrench head portion of the camshaft, and install the 4 pulley bolts.  
**Torque: 7.5 N.m (77 kgf.cm, 66 in..lbf)**
14. **INSTALL CYLINDER HEAD COVER SUB-ASSY LH (See REPLACEMENT )**
15. **INSTALL TIMING BELT (See REPLACEMENT )**

## **CYLINDER HEAD GASKET**

### **REPLACEMENT**

1. **WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See PRECAUTION )**
2. **REMOVE CAMSHAFT (See REPLACEMENT )**
3. **REMOVE THROTTLE BODY ASSY (See REPLACEMENT )**
4. **REMOVE V-BANK COVER BRACKET NO.1**
5. **REMOVE V-BANK COVER BRACKET NO.2**
6. **REMOVE V-BANK COVER BRACKET NO.3**
7. **REMOVE V-VANK COVER BRACKET NO.4**
8. **REMOVE VACUUM SWITCHING VALVE ASSY**
9. **DISCONNECT FUEL PIPE SUB-ASSY NO.2 (See REPLACEMENT )**

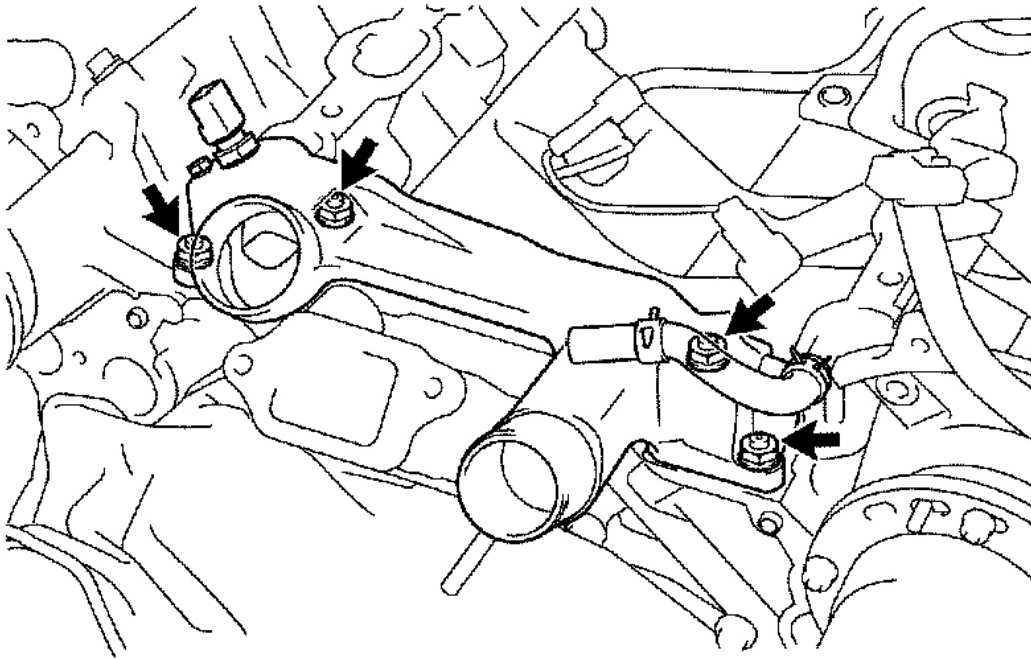
Heater Inlet Hose



G02998538

**Fig. 272: Disconnecting Heater Inlet Hose From Water By-Pass Joint**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

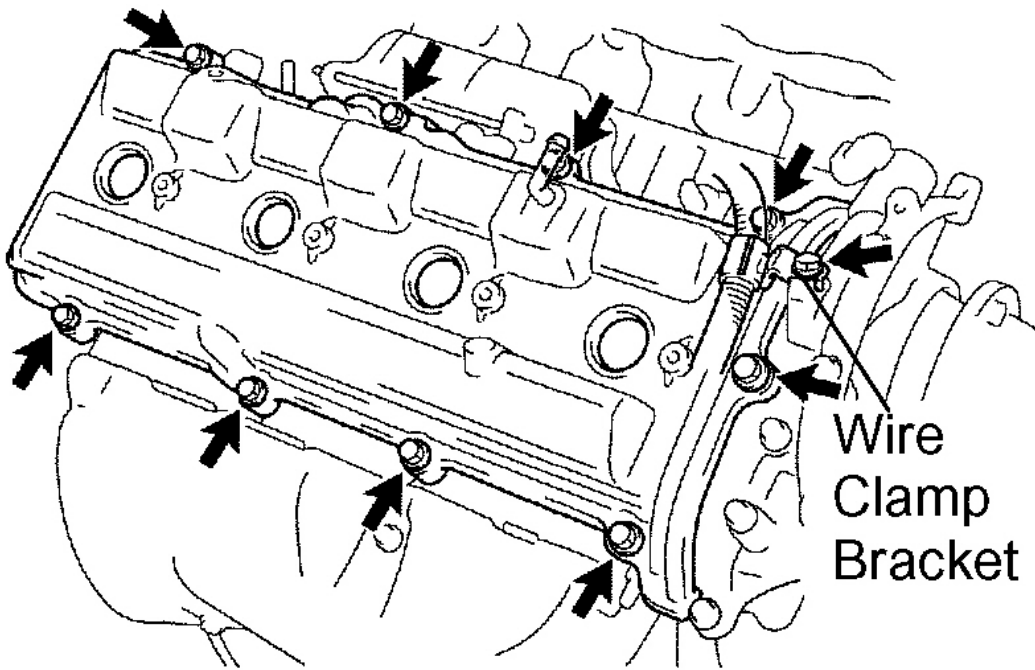
10. **REMOVE INTAKE MANIFOLD ASSY**
  - a. Remove the 6 bolts, 4 nuts, upper and lower intake manifold assembly and 2 gaskets.



G02998539

**Fig. 273: Removing Water By-Pass Joint RR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE WATER BYPASS JOINT RR**
  - a. Disconnect the heater inlet hose from the water bypass joint.
  - b. Remove the 4 nuts, water bypass joint and 2 gaskets.
12. **REMOVE WATER INLET HOUSING**
  - a. Remove the 2 bolts and inlet housing.

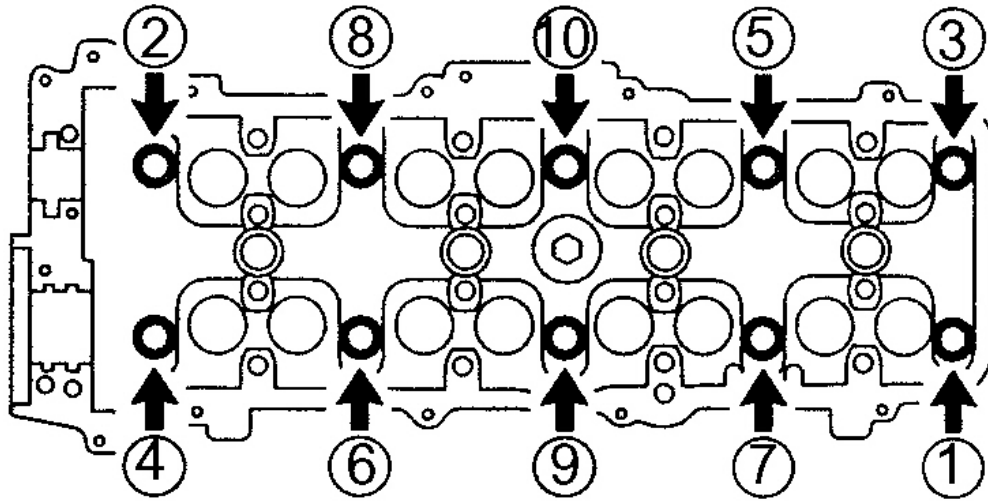


G02998540

**Fig. 274: Removing Cylinder Head Sub-Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **REMOVE WATER BYPASS JOINT FR**
  - a. Disconnect the ECT sensor connector.
  - b. Remove the 4 nuts, water bypass joint and 2 gaskets.
14. **REMOVE W/CATALYST CONVERTER ASSY**





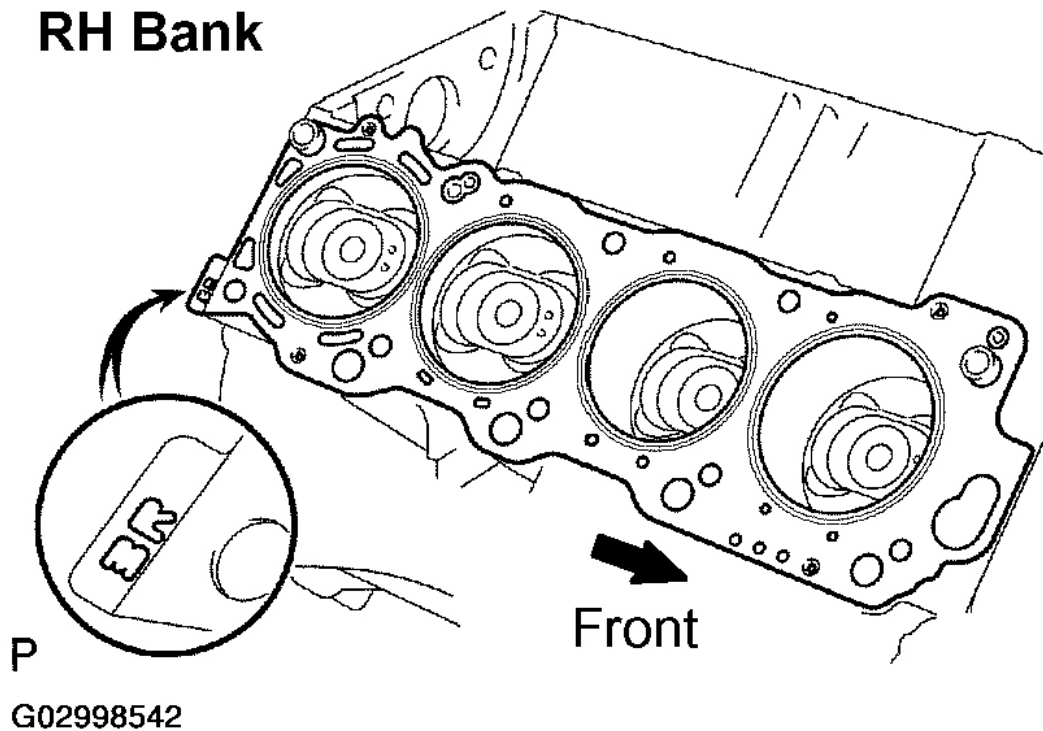
G02998541

**Fig. 275: Identifying Cylinder Head Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE CYLINDER HEAD SUB-ASSY**

- a. Remove the bolt, and disconnect the wire clamp bracket on the engine wire from the camshaft bearing cap.
- b. Remove the EVAP from the cylinder head cover sub-assy.
- c. Remove the 9 bolts, 9 seal washers, cylinder head cover sub-assy and gasket.

**RH Bank**



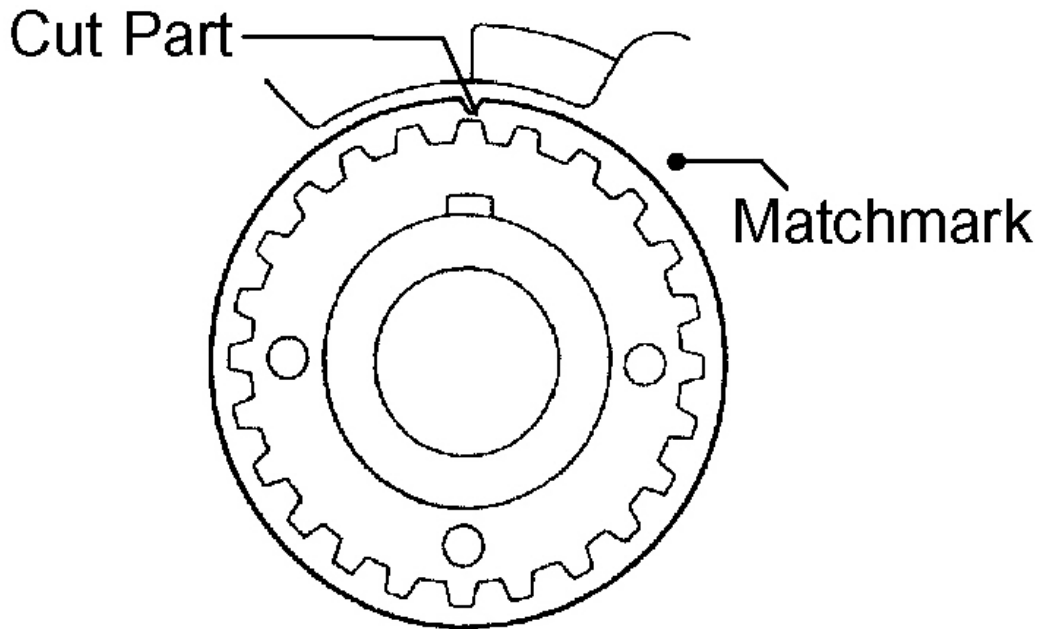
**Fig. 276: Removing Cylinder Head Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Uniformly loosen and remove the 10 cylinder head bolts and plate washers in the sequence shown in the illustration.

**NOTE:** Be careful not to drop washers into the cylinder head.

- e. Remove the cylinder head together with the RH manifold.

**16. REMOVE CYLINDER HEAD GASKET**



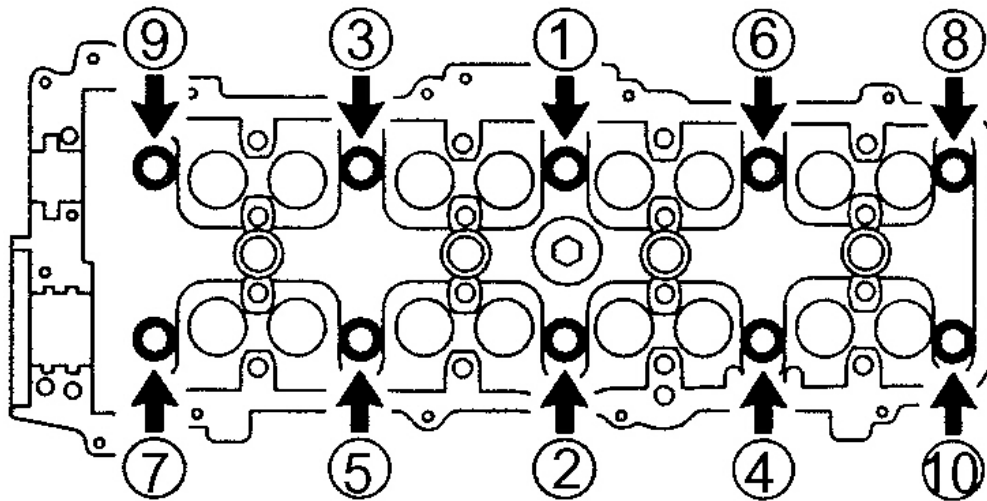
G02998543

**Fig. 277: Identifying Cylinder Head Sub-Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**17. INSTALL CYLINDER HEAD GASKET**

- a. **Place a new cylinder head gasket in position on the cylinder block.**
- b. The rear side of the cylinder head gasket has marks so that the RH and LH banks can be distinguished. A "3R" mark is on the RH bank's gasket.

**NOTE: Be careful of the installation direction.**



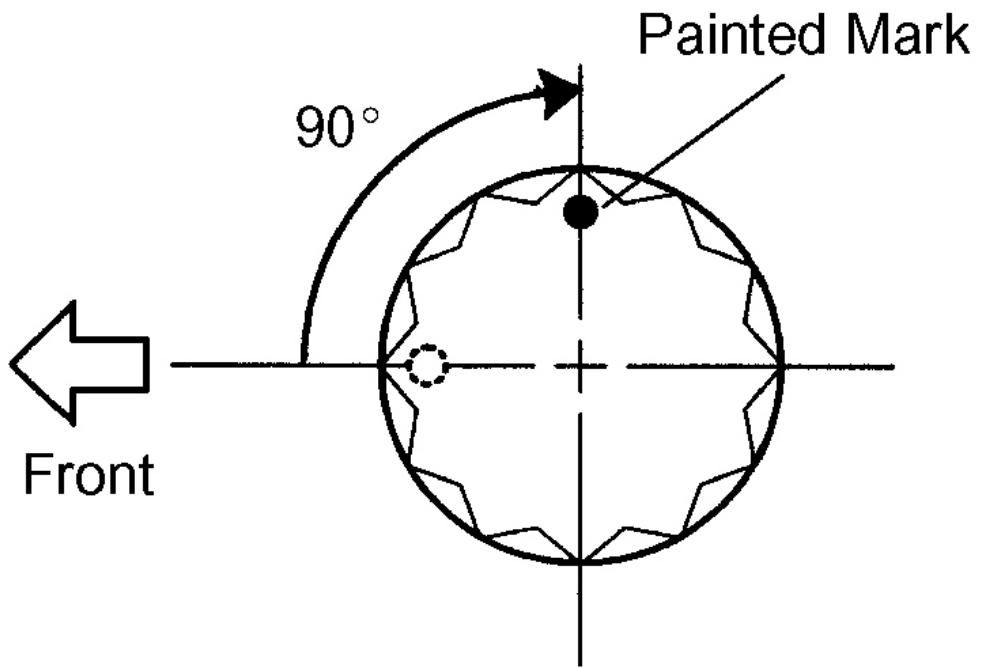
G02998544

**Fig. 278: Tightening Cylinder Head Bolts**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **INSTALL CYLINDER HEAD SUB-ASSY**

- a. Check that the cut part of the crankshaft timing pulley is in the position shown in the illustration, and that the piston is below the TDC of compression.
- b. Install the cylinder head together with the manifold RH to the cylinder block.
- c. Apply a light coat of engine oil on the threads and under the head of the cylinder head bolts.
- d. Put the washer on the bolt, and insert the bolt with washer into the cylinder head.

**NOTE:** Be careful not to drop washers into the cylinder head.



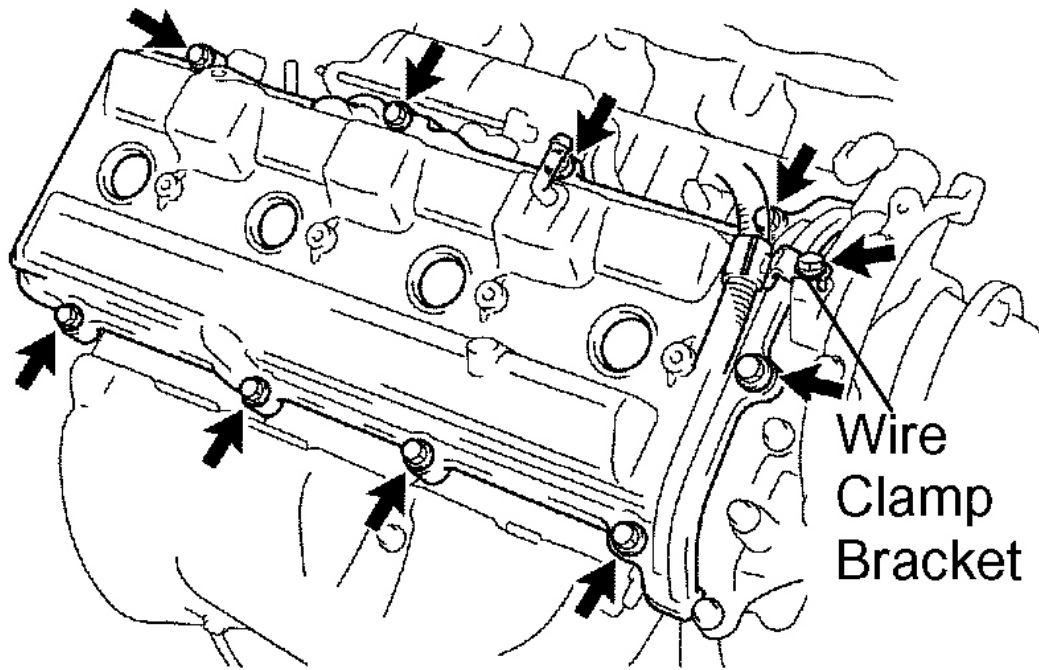
G02998545

**Fig. 279: Identifying Painted Mark**

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

- e. Install and uniformly tighten the 10 cylinder head bolts, and plate washers in the sequence shown in the illustration.

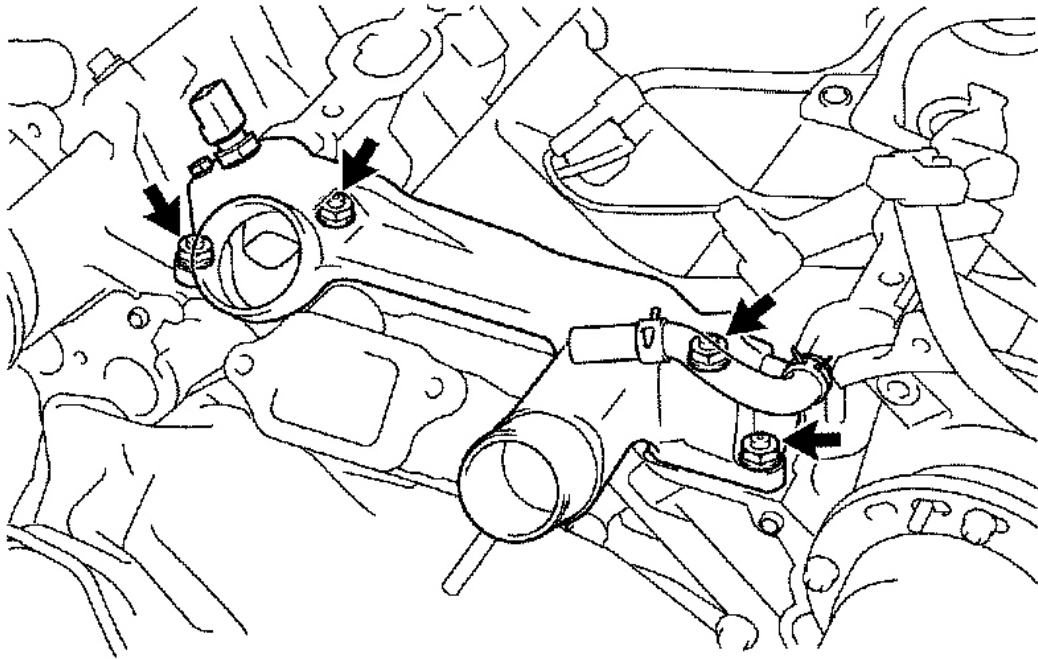
**Torque: 59 N.m (602 kgf.cm, 44 ft.lbf)**



G02998546

**Fig. 280: Installing Gasket To Cylinder Head Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Mark the front of the cylinder head bolt head with paint.
- g. Retighten the cylinder head bolts by  $90^\circ$  in the sequence shown.
- h. Check that the painted mark is now at a  $90^\circ$  angle to the front.



G02998547

**Fig. 281: Installing Water By-Pass Joint FR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Install the gasket to the cylinder head cover.
- j. Install the seal washer to the bolt.
- k. Install the cylinder head cover with the 9 bolts. Uniformly tighten the bolts in several passes. Install the 2 cylinder head covers.

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

- l. Install the wire clamp bracket on the engine wire to the camshaft bearing cap.

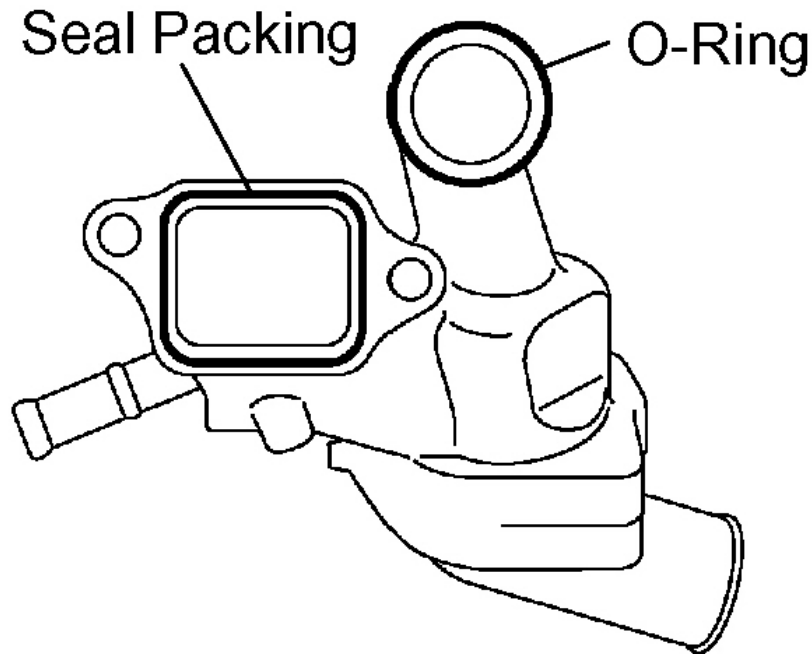
**19. INSTALL W/CATALYST CONVERTER ASSY**

**20. INSTALL WATER BYPASS JOINT FR**

- a. Install 2 new gaskets and the water bypass joint with the 4 nuts. Alternately tighten the nuts.

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

- b. Connect the ECT sensor connector.



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G02998548

**Fig. 282: Applying Seal Packing To Sealing Groove**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**21. INSTALL WATER INLET HOUSING**

- a. Install a new O-ring to the inlet housing.
- b. Apply soapy water to the O-ring.
- c. Apply seal packing to the sealing groove of the inlet housing as shown in the illustration.

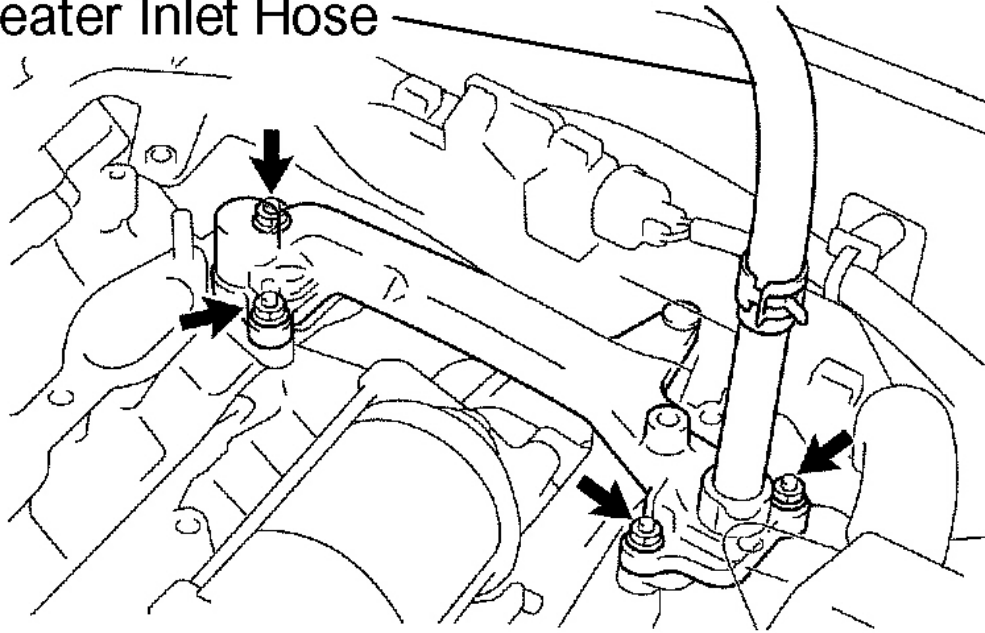
**Seal packing: Part No. 08826-00100 or equivalent**

- Install a nozzle that has been cut to a 2 to 3 mm (0.08 to 0.12 in.) opening.
  - Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- d. Install the water inlet and housing assy with the 2 bolts. Alternately tighten the bolts.

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



Heater Inlet Hose

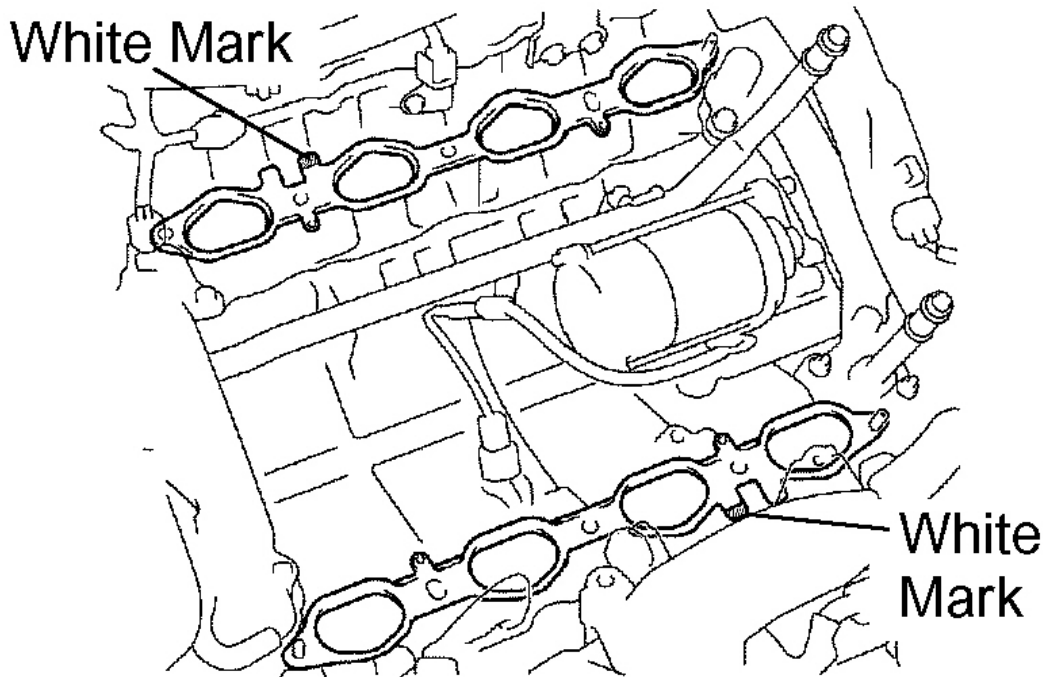


G02998549

**Fig. 283: Installing Water By-Pass Joint RR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**22. INSTALL WATER BYPASS JOINT RR**

- a. Install 2 new gaskets and the water bypass joint with the 4 nuts. Alternately tighten the nuts.  
**Torque: 18 N.m (184 kgf.cm, 13 ft.lbf)**



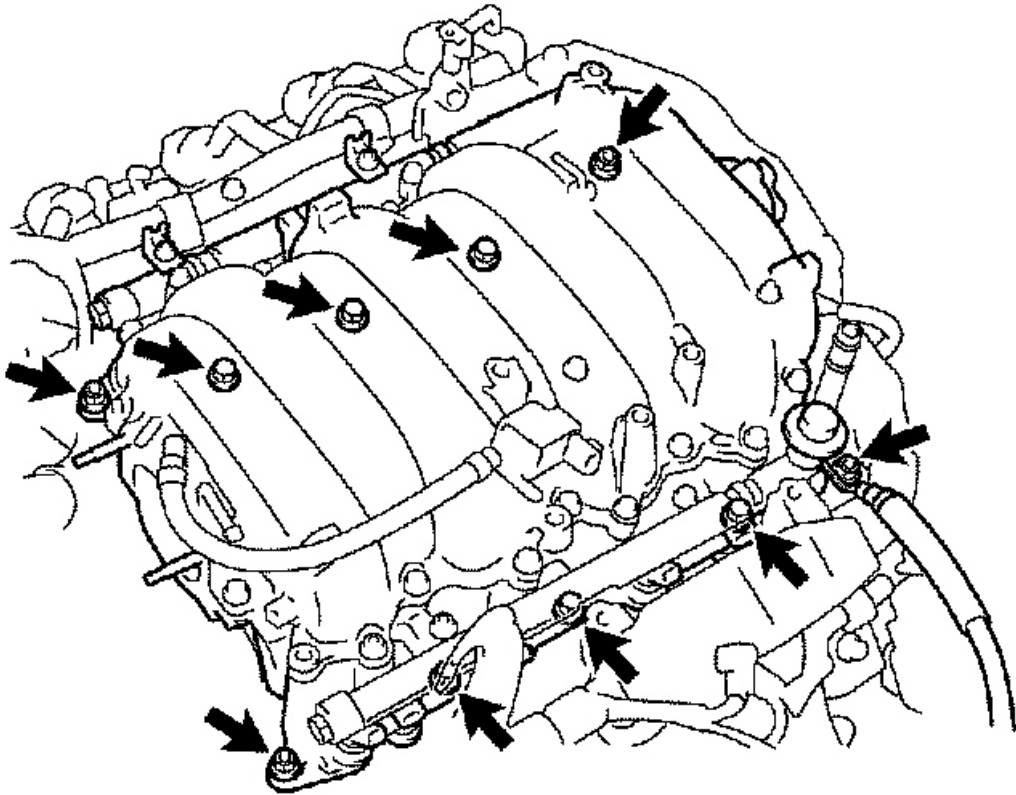
G02998550

**Fig. 284: Placing Gaskets On Cylinder Heads**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. **INSTALL INTAKE MANIFOLD ASSY**

- a. Place 2 new gaskets on the cylinder heads with the white mark facing outward.

**NOTE:** Be careful of the installation direction.



**G02998551**

**Fig. 285: Installing Upper And Lower Intake Manifolds Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the upper and lower intake manifolds assembly with the 6 bolts and 4 nuts.

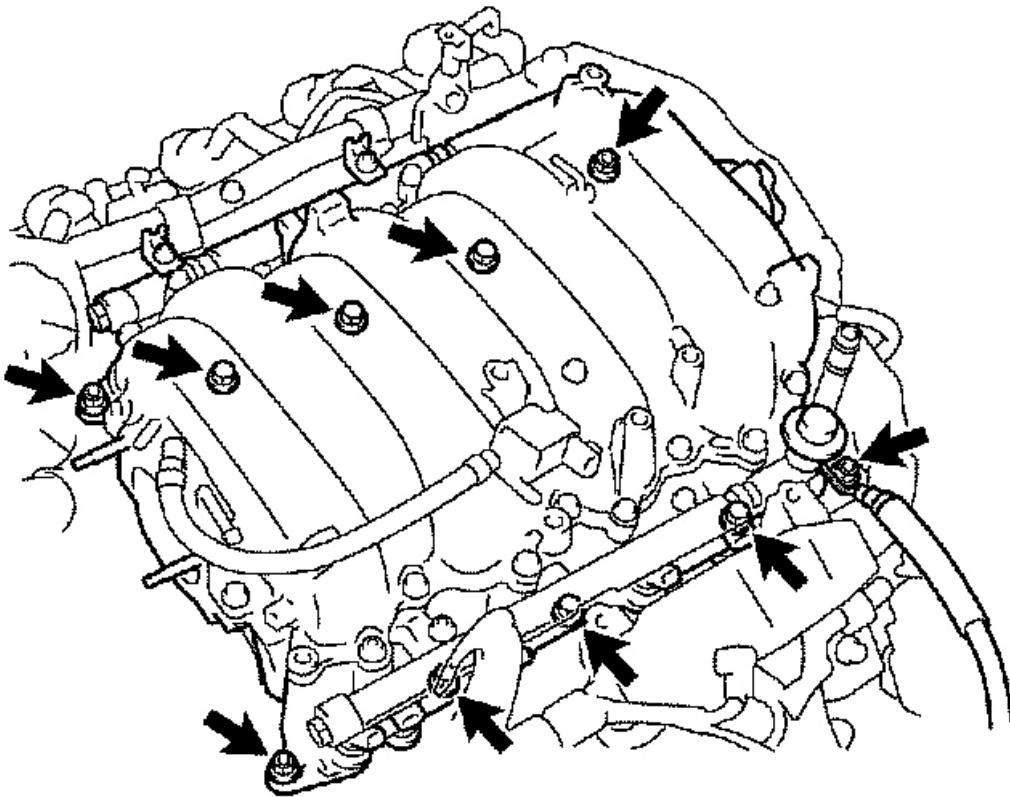
**Torque: 18 N.m (184 kgf.cm, 13 ft.lbf)**

24. **INSTALL FUEL PIPE SUB-ASSY NO.2 (See REPLACEMENT )**
25. **INSTALL VACUUM SWITCHING VALVE ASSY**
26. **INSTALL V-VANK COVER BRACKET NO.4**
27. **INSTALL V-BANK COVER BRACKET NO.3**
28. **INSTALL V-BANK COVER BRACKET NO.2**
29. **INSTALL V-BANK COVER BRACKET NO.1**
30. **INSTALL THROTTLE BODY ASSY (See REPLACEMENT )**
31. **INSTALL CAMSHAFT (See REPLACEMENT )**

## CYLINDER HEAD GASKET NO.2

### REPLACEMENT

1. WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See PRECAUTION )
2. REMOVE NO.3 CAMSHAFT SUB-ASSY (See REPLACEMENT )
3. REMOVE THROTTLE BODY ASSY (See REPLACEMENT )
4. REMOVE V-BANK COVER BRACKET NO.1
5. REMOVE V-BANK COVER BRACKET NO.2
6. REMOVE V-BANK COVER BRACKET NO.3
7. REMOVE V-VANK COVER BRACKET NO.4
8. REMOVE VACUUM SWITCHING VALVE ASSY
9. DISCONNECT FUEL PIPE SUB-ASSY NO.2 (See REPLACEMENT )



G02998552

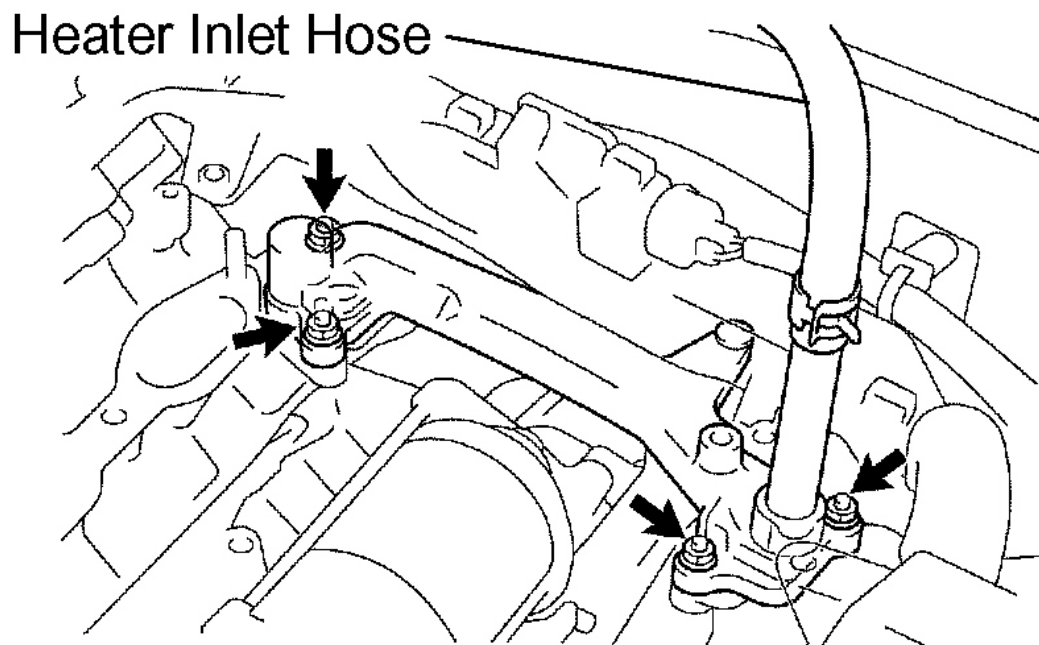
**Fig. 286: Removing Upper And Lower Intake Manifold Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**10. REMOVE INTAKE MANIFOLD ASSY**

- a. Remove the 6 bolts, 4 nuts, upper and lower intake manifold assembly and 2 gaskets.

**11. REMOVE WATER BYPASS JOINT RR**

- a. Disconnect the heater inlet hose from the water bypass joint.
- b. Remove the 4 nuts, water bypass joint and 2 gaskets.



G02998553

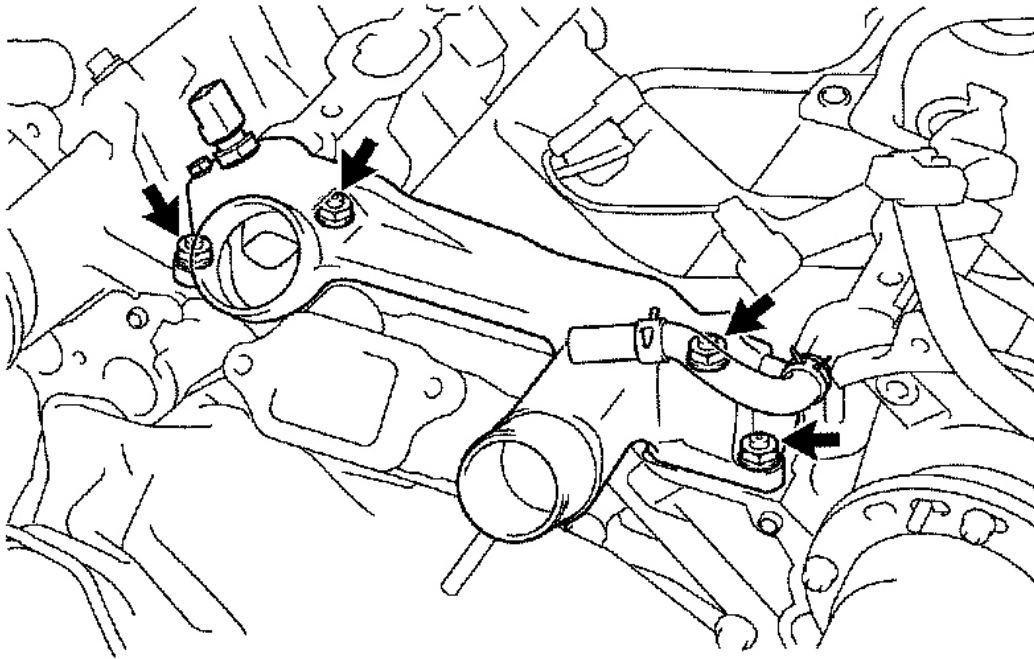
**Fig. 287: Disconnecting Heater Inlet Hose From Water By-Pass Joint**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**12. REMOVE WATER INLET HOUSING**

- a. Remove the 2 bolts and inlet housing.

**13. REMOVE WATER BYPASS JOINT FR**

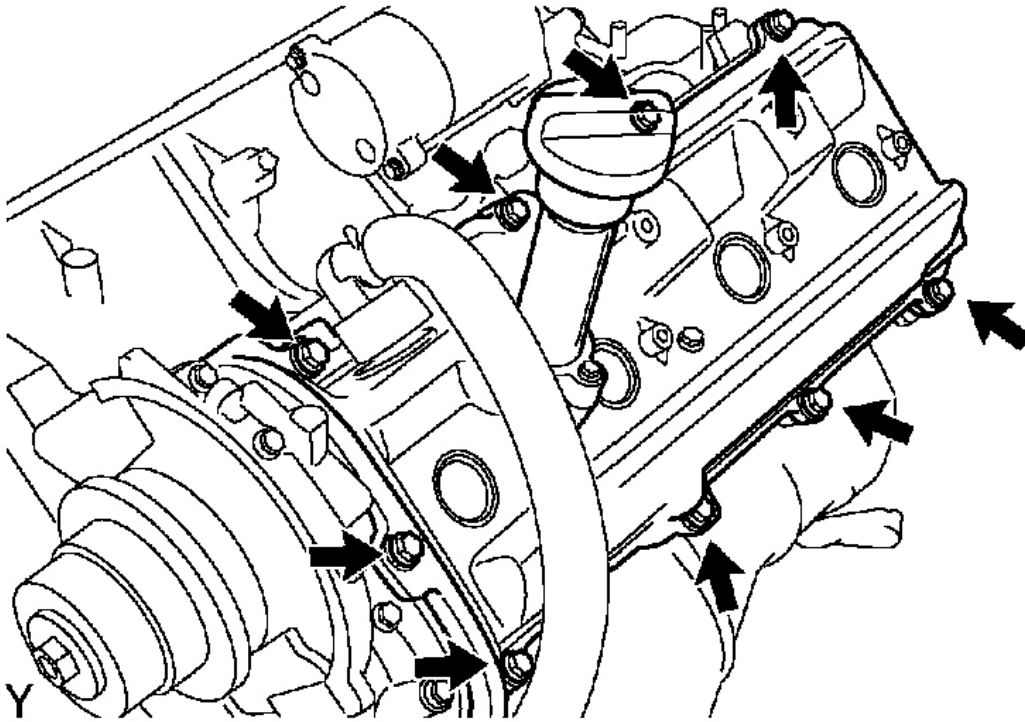
- a. Disconnect the ECT sensor connector.
- b. Remove the 4 nuts, water bypass joint and 2 gaskets.



G02998554

**Fig. 288: Removing Water By-Pass Joint FR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE W/CATALYST CONVERTER ASSY

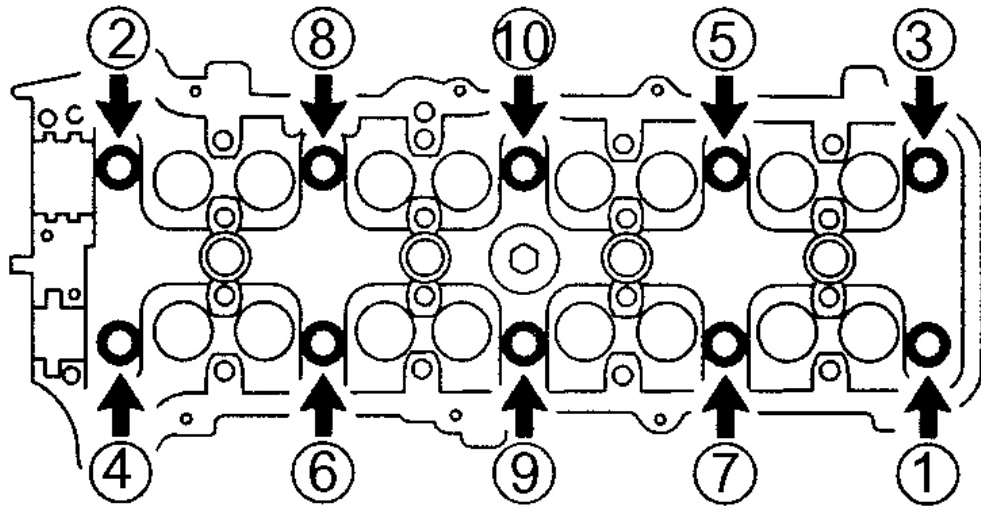


G02998555

**Fig. 289: Removing Cylinder Head LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. REMOVE CYLINDER HEAD LH**

- a. Disconnect the wire clamp from the wire bracket on the cylinder head cover.
- b. Remove the EVAP from the cylinder head cover.
- c. Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.



G02998556

**Fig. 290: Identifying Cylinder Head Bolts**

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

- d. Uniformly loosen and remove the 10 cylinder head bolts and plate washers in the sequence shown in the illustration.

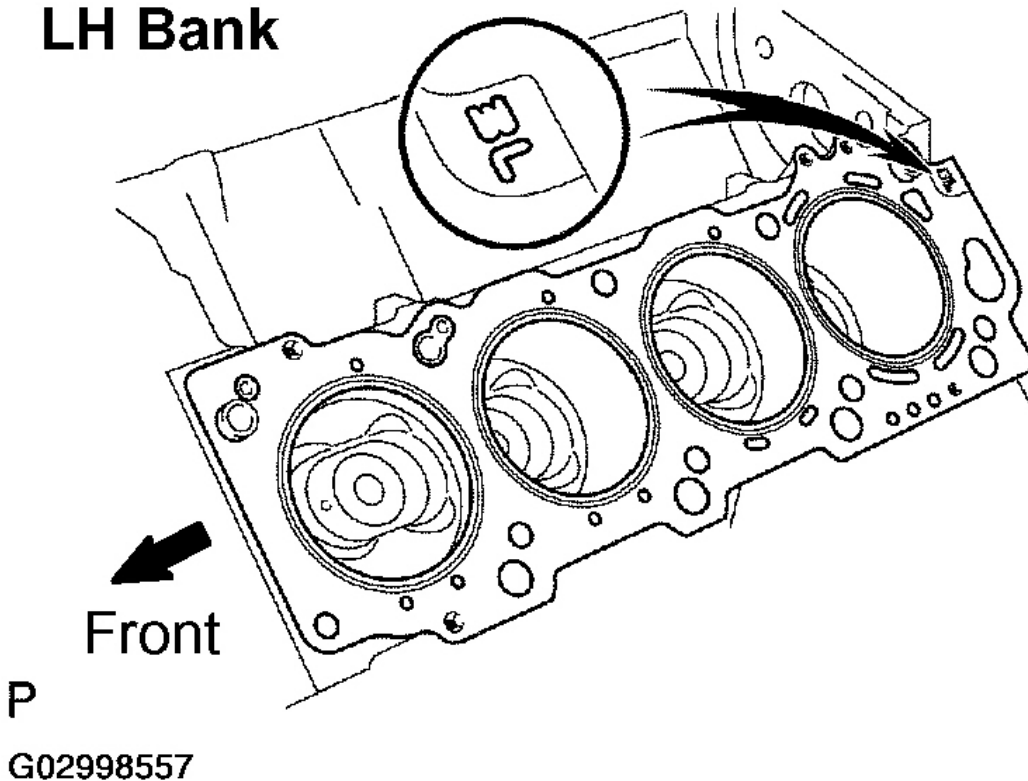
**NOTE:** Be careful not to drop washers into the cylinder head.

- e. Remove the cylinder head together with the LH manifold.

**16. REMOVE CYLINDER HEAD GASKET NO.2**



**LH Bank**



**Fig. 291: Removing Cylinder Head Gasket No.2**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

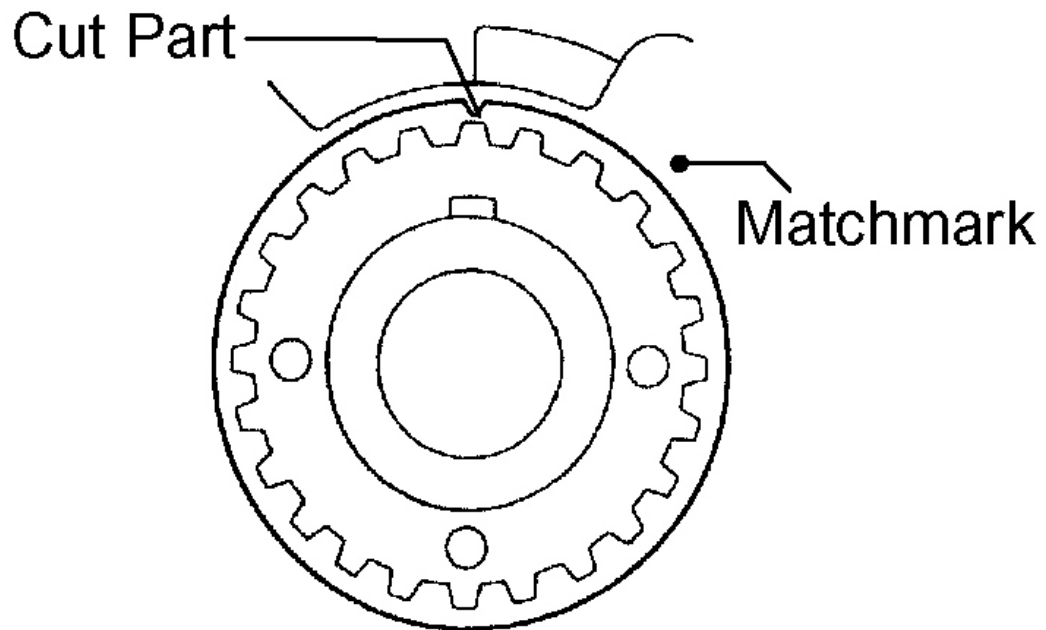
**17. INSTALL CYLINDER HEAD GASKET NO.2**

- a. Place a new cylinder head gasket in position on the cylinder block.
- b. The rear side of the cylinder head gasket has marks so that the RH and LH banks can be distinguished. A "3L" mark is on the LH bank's gasket.

**NOTE: Be careful of the installation direction.**

**18. INSTALL CYLINDER HEAD LH**

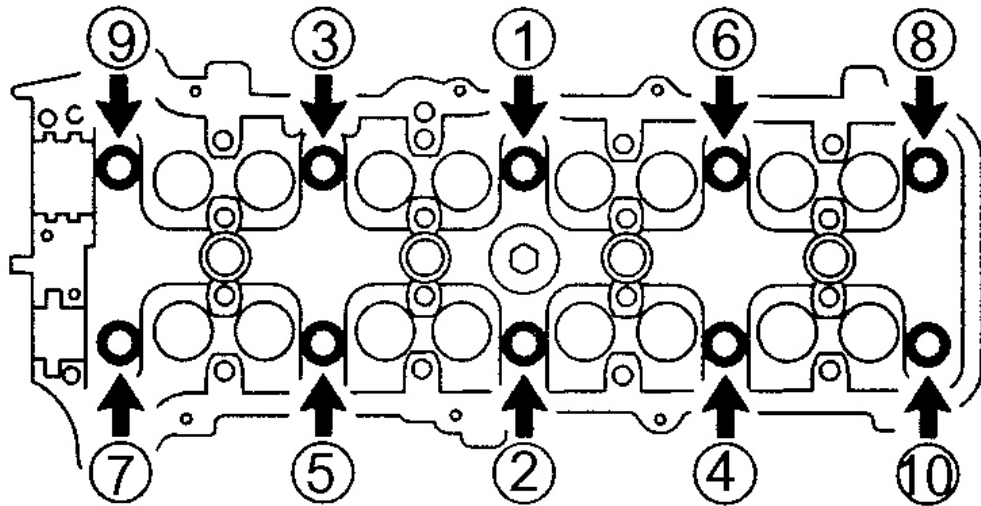
- a. Check that the cut part of the crankshaft timing pulley is in the position shown in the illustration, and that the piston is below the TDC of compression.
- b. Install the cylinder head together with the manifold RH to the cylinder block.
- c. Apply a light coat of engine oil on the threads and under the head of the cylinder head bolts.
- d. Put the washer on the bolt, and insert the bolt with washer into the cylinder head.



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**Fig. 292: Identifying Cylinder Head LH**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to drop washers into the cylinder head.



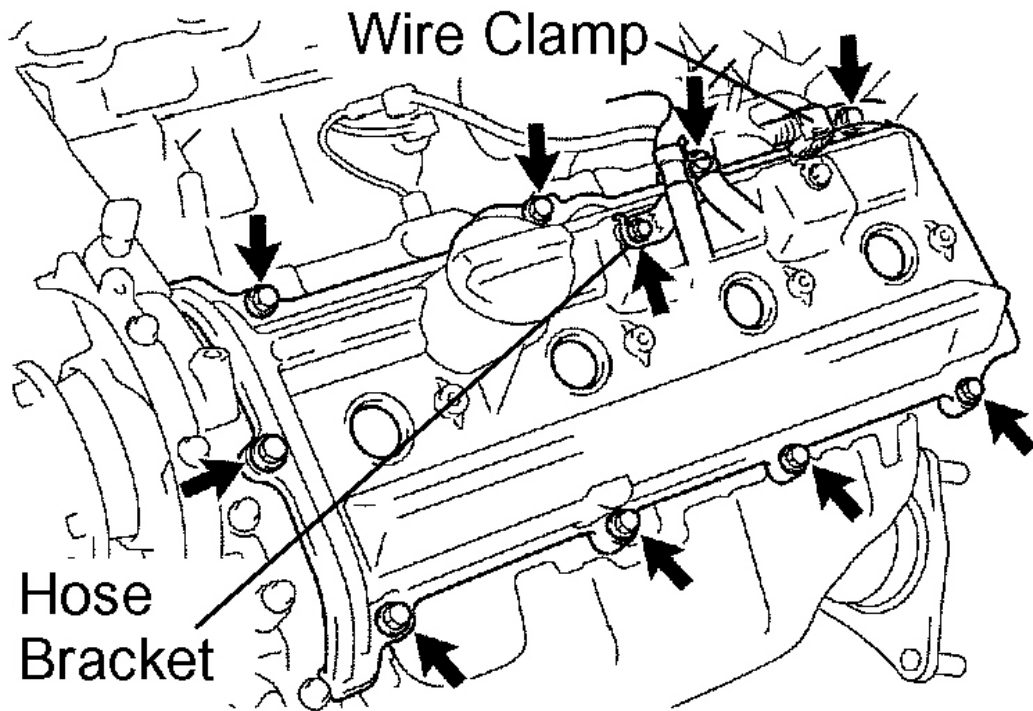
G02998559

**Fig. 293: Tightening Cylinder Head Bolts**

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

- e. Install and uniformly tighten the 10 cylinder head bolts, and plate washers in the sequence shown in the illustration.

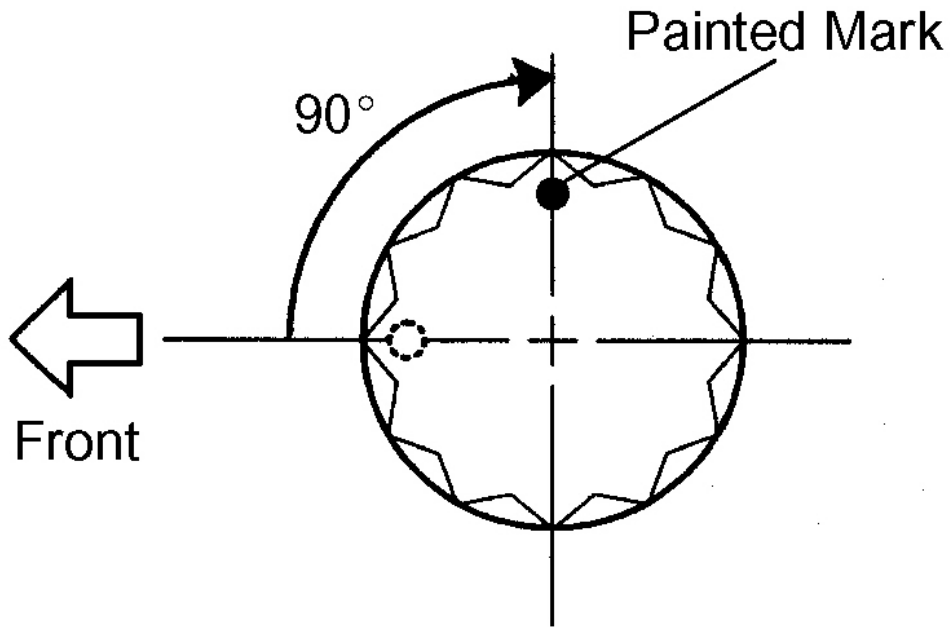
**Torque: 59 N.m (602 kgf.cm, 44 ft.lbf)**



G02998561

**Fig. 294: Installing Cylinder Head Cover**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Mark the front of the cylinder head bolt head with paint.
- g. Retighten the cylinder head bolts by  $90^\circ$  in the sequence shown in the illustration.
- h. Check that the painted mark is now at a  $90^\circ$  angle to the front.



G02998560

**Fig. 295: Identifying Painted Mark**

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

- i. Install the gasket to the cylinder head cover.
- j. Install the seal washer to the bolt.
- k. Install the cylinder head cover with the 9 bolts. Uniformly tighten the bolts in several passes.

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

- l. Install the hose bracket of the EVAP to the cylinder head cover.
- m. Install the wire clamp to the bracket on the cylinder head cover.

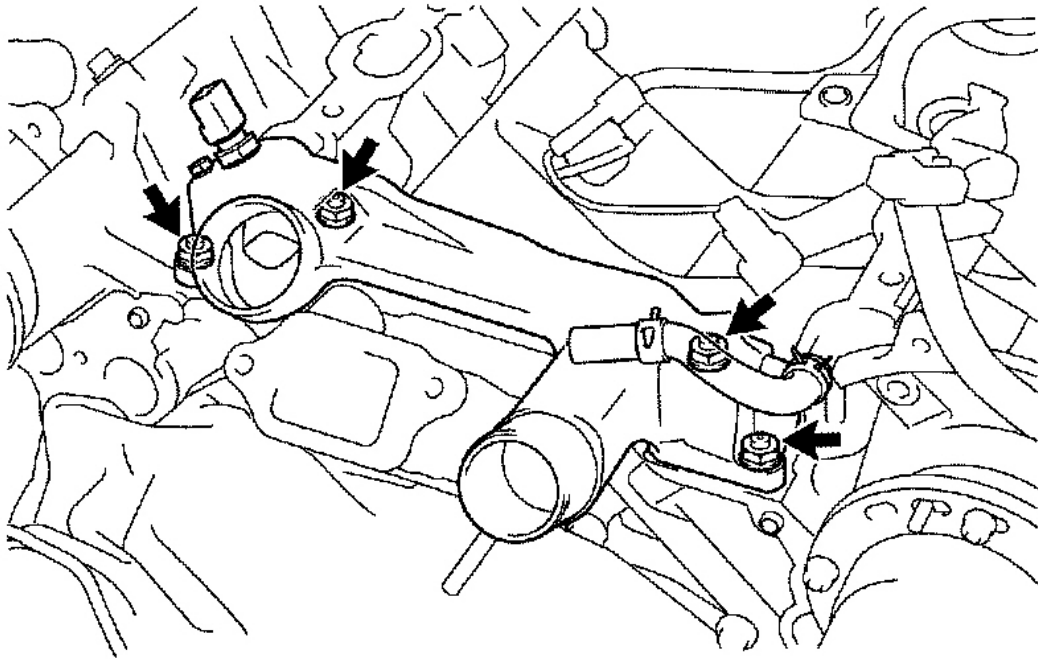
**19. INSTALL W/CATALYST CONVERTER ASSY**

**20. INSTALL WATER BYPASS JOINT FR**

- a. Install 2 new gaskets and the water bypass joint with the 4 nuts. Alternately tighten the nuts.

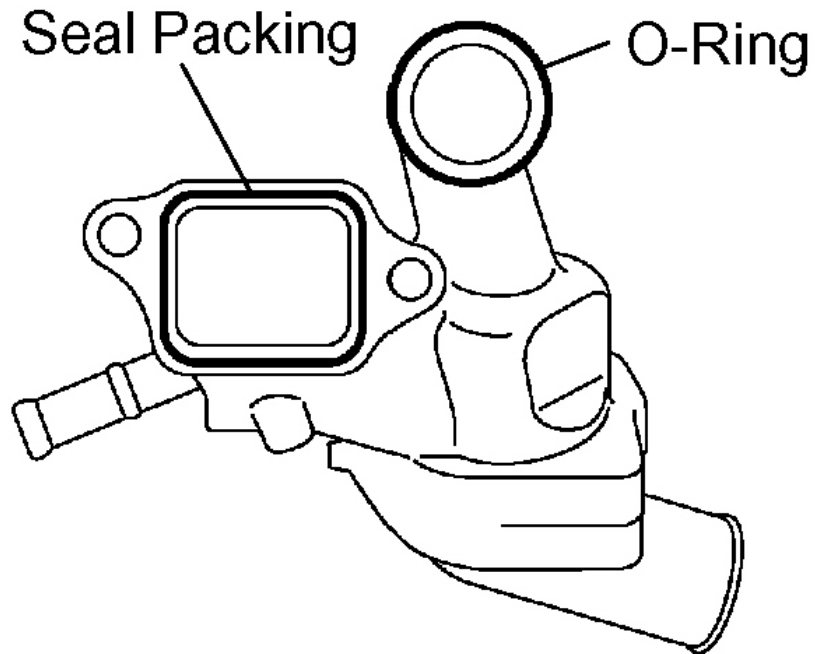
**Torque: 18 N.m (184 kgf.cm, 13 ft.lbf)**

- b. Connect the ECT connector.



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**Fig. 296: Installing Water By-Pass Joint FR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

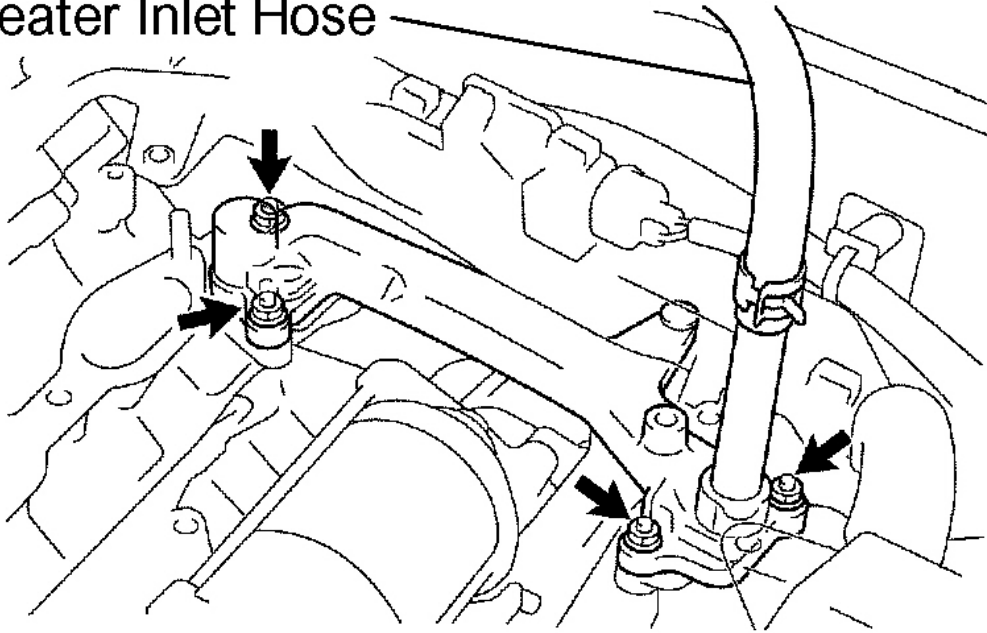


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G02998563

**Fig. 297: Applying Seal Packing To Sealing Groove**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## Heater Inlet Hose



G02998564

**Fig. 298: Installing Water By-Pass Joint RR**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 21. INSTALL WATER INLET HOUSING

- Install a new O-ring to the inlet housing.
- Apply soapy water to the O-ring.
- Apply seal packing to the sealing groove of the inlet housing as shown in the illustration.

**Seal packing: Part No. 08826-00100 or equivalent**

- Install a nozzle that has been cut to a 2 to 3 mm (0.08 to 0.12 in.) opening.
- Parts must be assembled within 3 minutes of application. Otherwise the material must be removed and reapplied.
- Install the water inlet and housing assembly with the 2 bolts. Alternately tighten the bolts.

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

### 22. INSTALL WATER BYPASS JOINT RR

- Install 2 new gaskets and the water bypass joint with the 4 nuts. Alternately tighten the nuts.

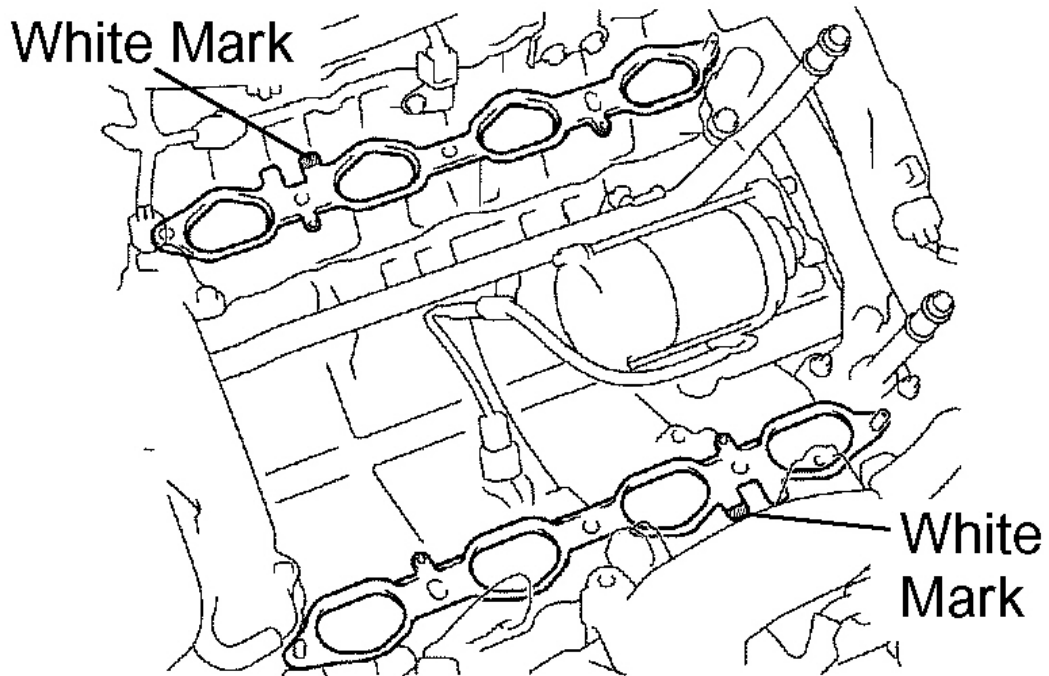
**Torque: 18 N.m (184 kgf.cm, 13 ft.lbf)**

### 23. INSTALL INTAKE MANIFOLD ASSY

- Place 2 new gaskets on the cylinder heads with the white mark facing outward.



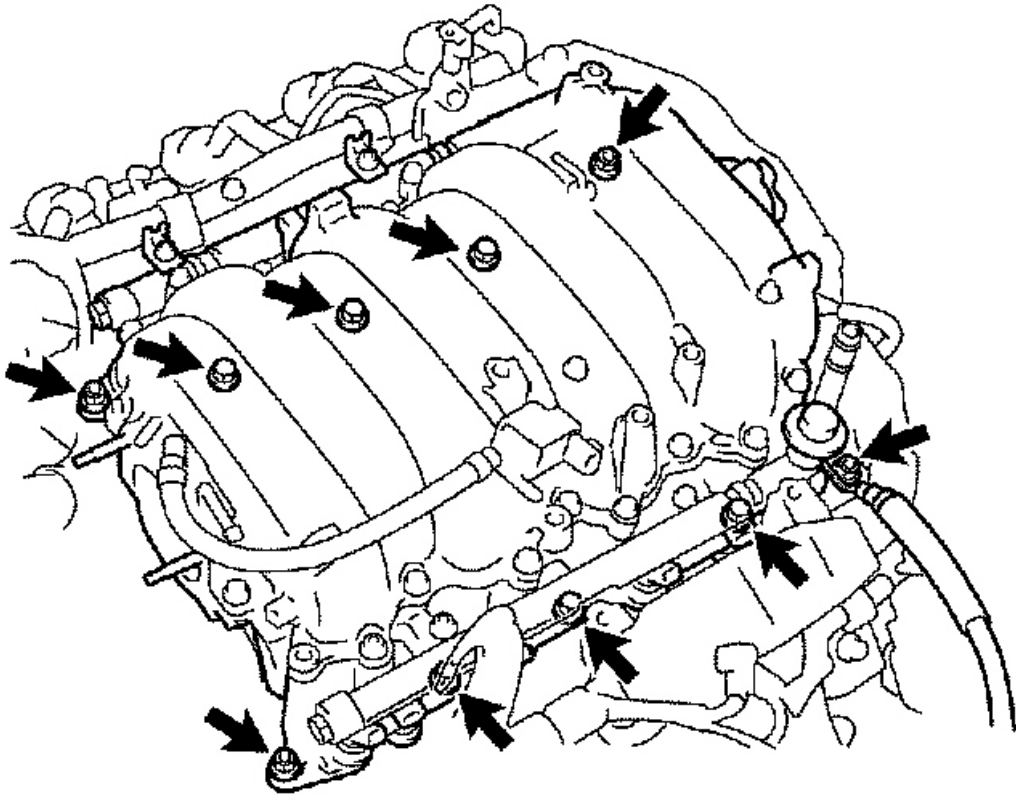
**NOTE:** Be careful of the installation direction.



**G02998565**

**Fig. 299: Placing Gaskets On Cylinder Heads**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the upper and lower intake manifold assembly with the 6 bolts and 4 nuts.  
**Torque: 18 N.m (184 kgf.cm, 13 ft.lbf)**



G02998566

**Fig. 300: Installing Upper And Lower Intake Manifold Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

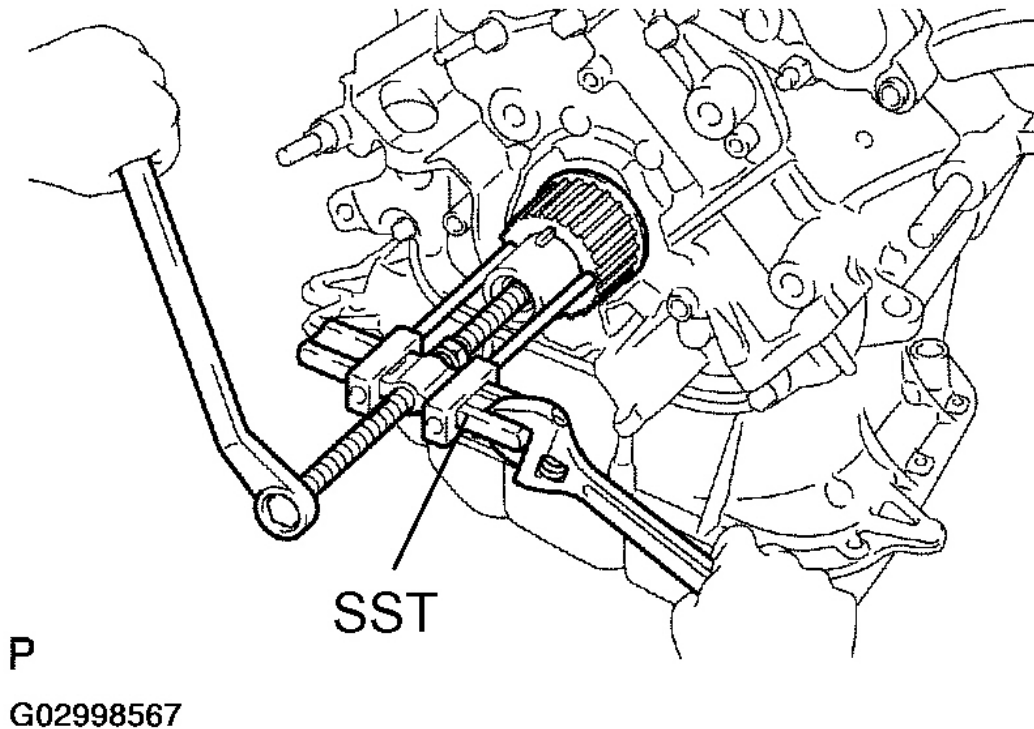
24. **INSTALL FUEL PIPE SUB-ASSY NO.2 (See REPLACEMENT )**
25. **INSTALL VACUUM SWITCHING VALVE ASSY**
26. **INSTALL V-VANK COVER BRACKET NO.4**
27. **INSTALL V-BANK COVER BRACKET NO.3**
28. **INSTALL V-BANK COVER BRACKET NO.2**
29. **INSTALL V-BANK COVER BRACKET NO.1**
30. **INSTALL THROTTLE BODY ASSY (See REPLACEMENT )**
31. **INSTALL NO.3 CAMSHAFT SUB-ASSY (See REPLACEMENT )**

## **OIL PUMP SEAL**

### **REPLACEMENT**

1. **REMOVE TIMING BELT (See REPLACEMENT )**
2. **REMOVE CRANKSHAFT TIMING PULLEY**
  - a. Using SST, remove the timing pulley.

**NOTE:**        **Do not turn the timing pulley.**

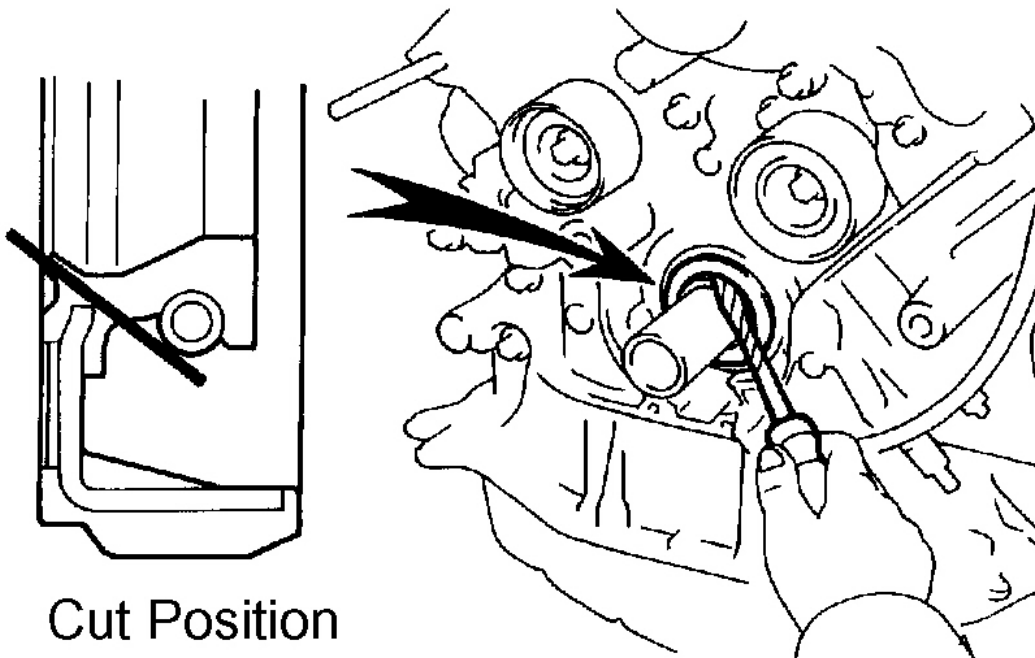


**Fig. 301: Removing Timing Pulley Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09950-50013 (09951-05010, 09952-05010, 09953-05010, 09953-05020, 09954-05021)

3. **REMOVE OIL PUMP SEAL**
  - a. Using a knife, cut the oil seal lip.
  - b. Using a screwdriver with its tip taped, pry out the oil seal.
  - c. After the removal, check if the crankshaft is not damaged.

**NOTE:**        **If it is damaged, smooth the surface with 400-grit sandpaper.**



Cut Position

G02998568

**Fig. 302: Removing Oil Pump Seal**

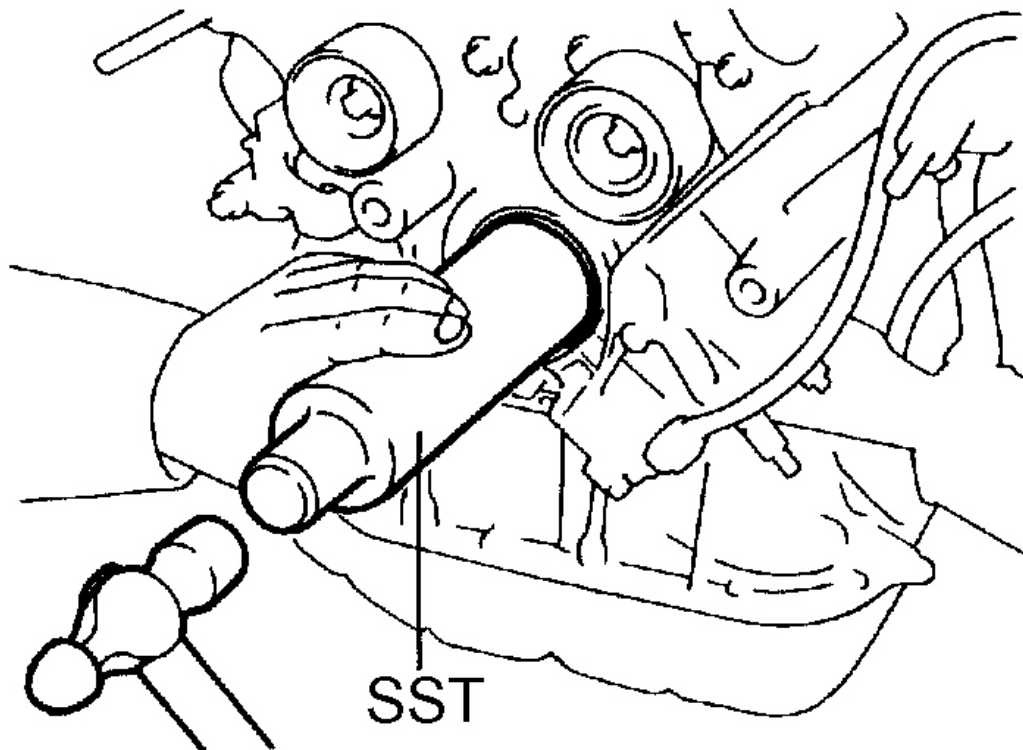
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**4. INSTALL OIL PUMP SEAL**

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

**NOTE: Keep the lip free from foreign materials.**

- b. Using SST and a hammer, tap in the oil seal until its surface is flush with the oil pump edge.  
SST 09316-6001 1 (09316-00011)



G02998569

**Fig. 303: Taping In Oil Seal Using SST And A Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

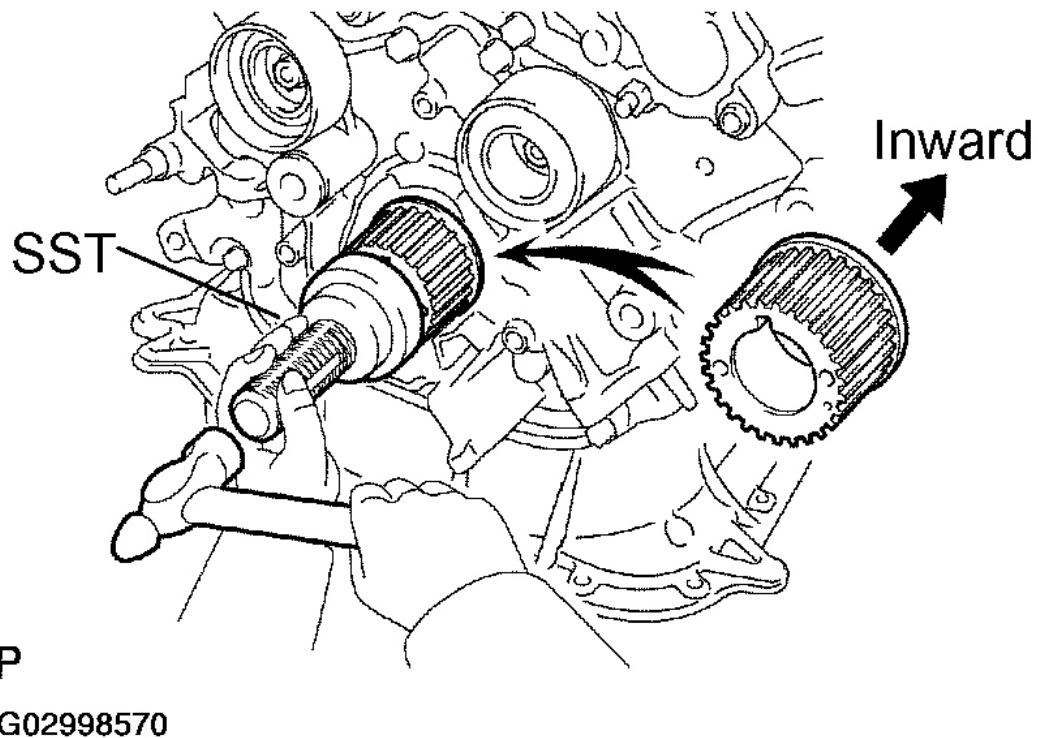
**NOTE:**

- Wipe off any extra grease on the crankshaft.
- Be careful not to tap the oil seal at an angle.

**5. INSTALL CRANKSHAFT TIMING PULLEY**

- a. Align the timing pulley set key with the key groove of the pulley.
- b. Face the timing pulley's flange side inward. Using SST and a hammer, tap in the timing pulley.

SST 09223-4601 1



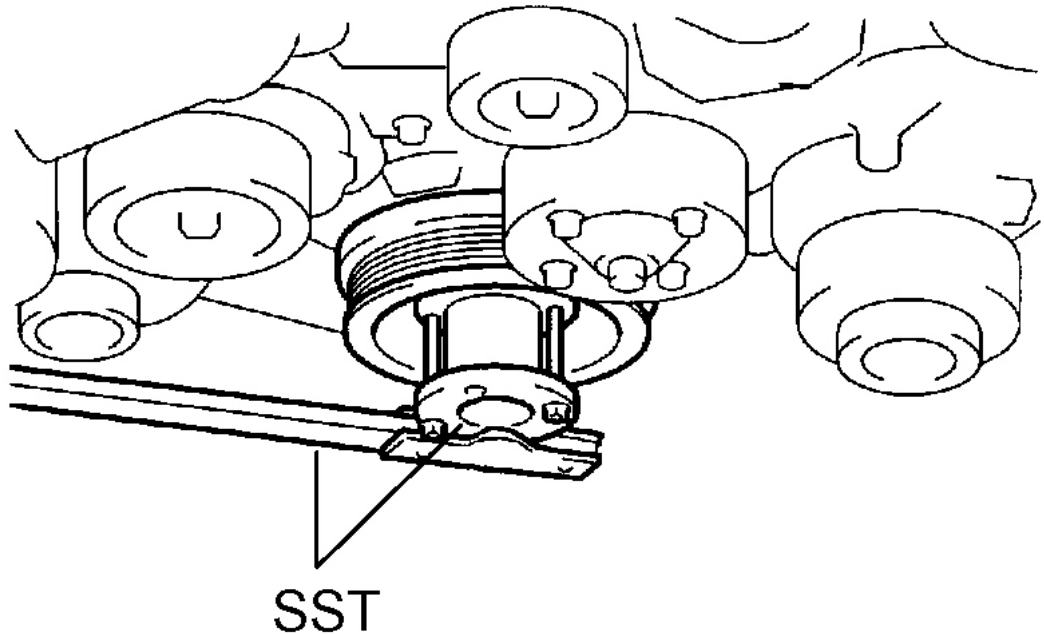
**Fig. 304: Aligning Timing Pulley Setting Key With Key Groove**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL TIMING BELT** (See REPLACEMENT )

## **ENGINE REAR OIL SEAL**

### **REPLACEMENT**

1. **REMOVE AUTOMATIC TRANSMISSION ASSY** (See REPLACEMENT )
2. **REMOVE DRIVE PLATE & RING GEAR SUB-ASSY**
  - a. Using SST, hold the crankshaft damper.  
SST 09213-7001 1, 09330-00021

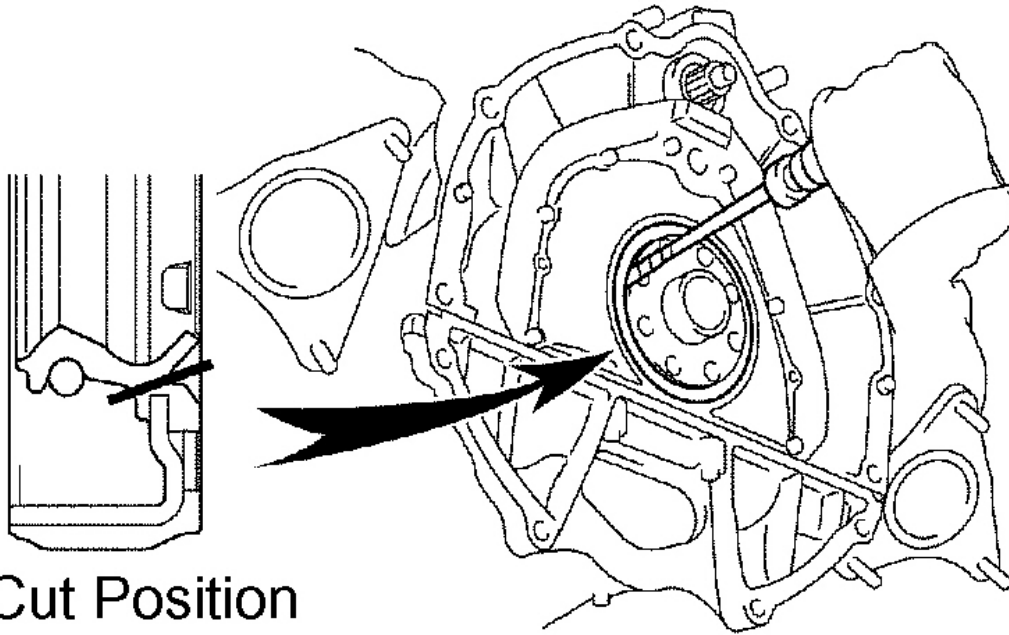


G02998571

**Fig. 305: Removing Drive Plate And Ring Gear And The Front Spacer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 8 mounting bolts, the rear spacer, the drive plate and ring gear and the front spacer.
3. **REMOVE ENGINE REAR OIL SEAL**
- a. Using a knife, cut the oil seal lip.
  - b. Using a screwdriver with its tip taped, pry out the oil seal.
  - c. After the removal, check if the crankshaft is not damaged.

**NOTE:** If it is damaged, smooth the surface with 400-grit sandpaper.



Cut Position

G02998572

**Fig. 306: Removing Rear Oil Seal Using Screwdriver**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 4. INSTALL ENGINE REAR OIL SEAL

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

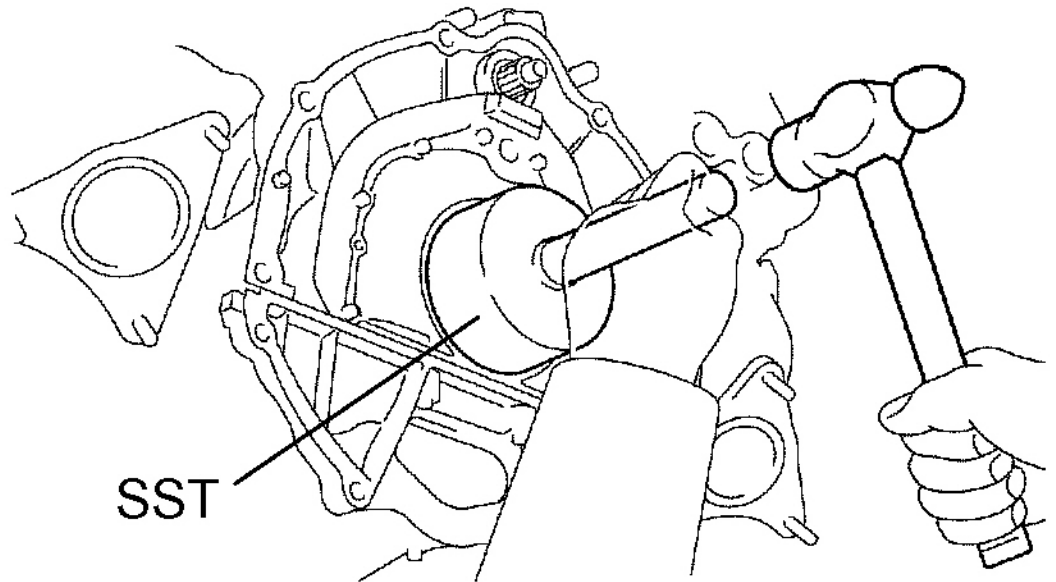
**NOTE:**            **Keep the lip free from foreign materials.**

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

**NOTE:**

- Be careful not to tap the oil seal at an angle.
- Wipe off any extra grease on the crankshaft.





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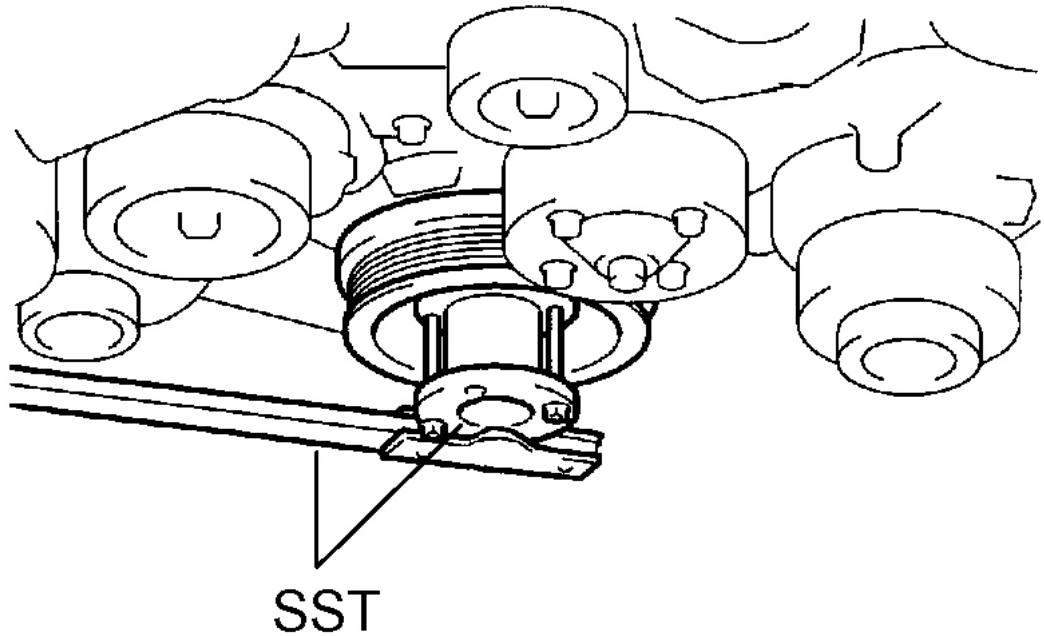
**Fig. 307: Taping In Oil Seal Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

SST 09223-56010

**5. INSTALL DRIVE PLATE & RING GEAR SUB-ASSY**

- a. Hold the crankshaft with SST.

SST 09213-7001 1, 09330-00021



G02998574

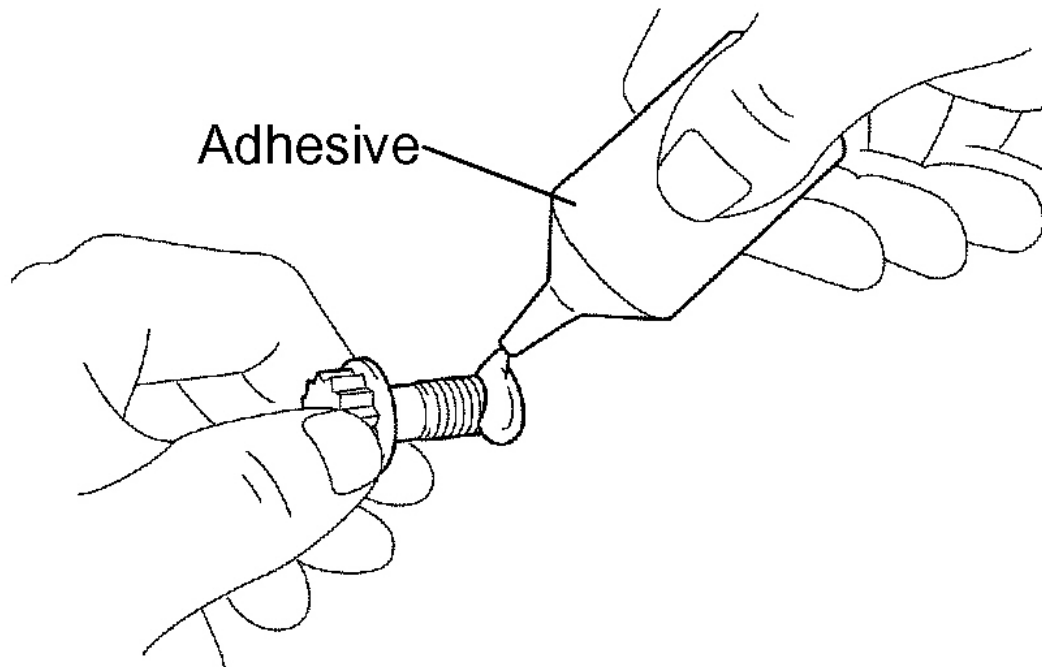
**Fig. 308: Holding Crankshaft Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**HINT:**

- The mounting bolts are tightened in 2 progressive steps (steps (c) and (e)).
  - If any one of the mounting bolts is broken or deformed, replace it.
- b. Apply adhesive to 2 or 3 threads of the mounting bolt end.

**Adhesive:**

**Part No. 08833-00070, THREE BOND 1324 or equivalent**

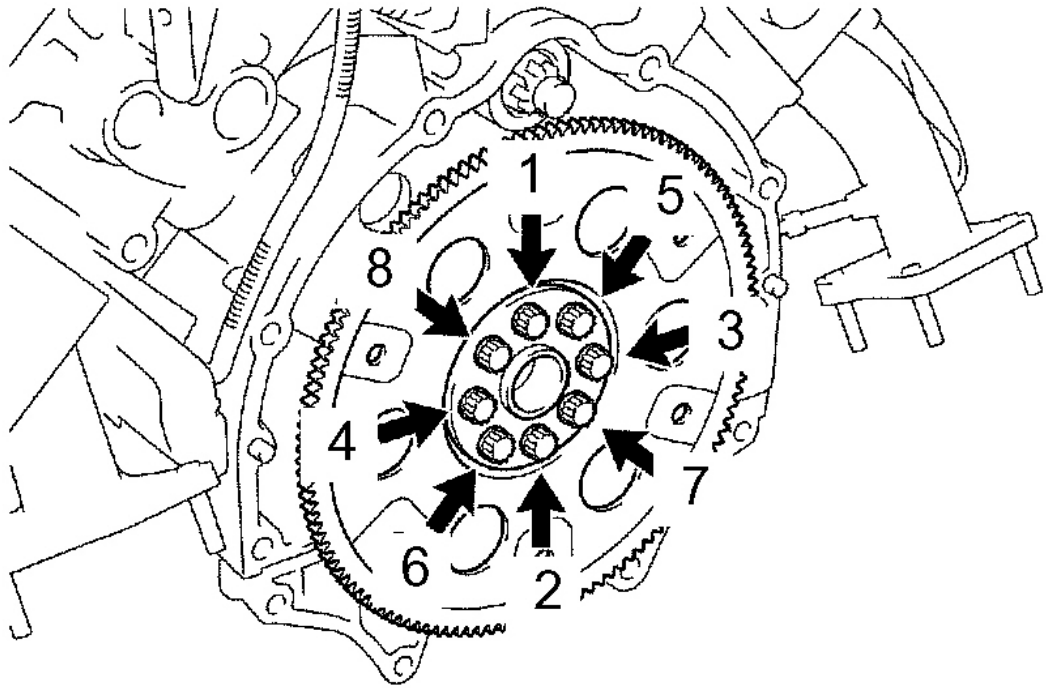


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**Fig. 309: Applying Adhesive To Threads Of Mounting Bolt**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the front spacer, drive plate and rear spacer on the crankshaft.
- d. Install and uniformly tighten the 8 mounting bolts in several passes in the sequence shown in the illustration.

**Torque: 49 N.m (500 kgf.cm, 36 ft.lbf)**



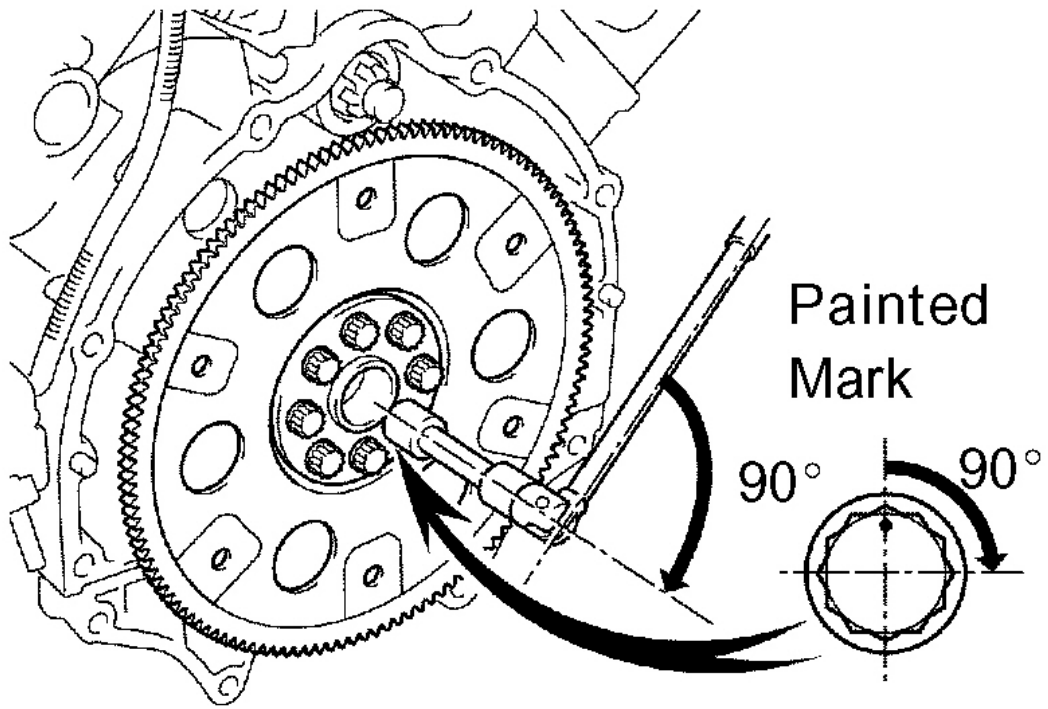
G02998576

**Fig. 310: Installing Mounting Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

If any one of the mounting bolts does not meet the torque specification, replace the mounting bolt.

- e. Mark the mounting bolt with paint.
- f. Retighten the mounting bolts by 90° in the sequence shown in the illustration.
- g. Check that the painted mark is now at a 90° angle to (e).



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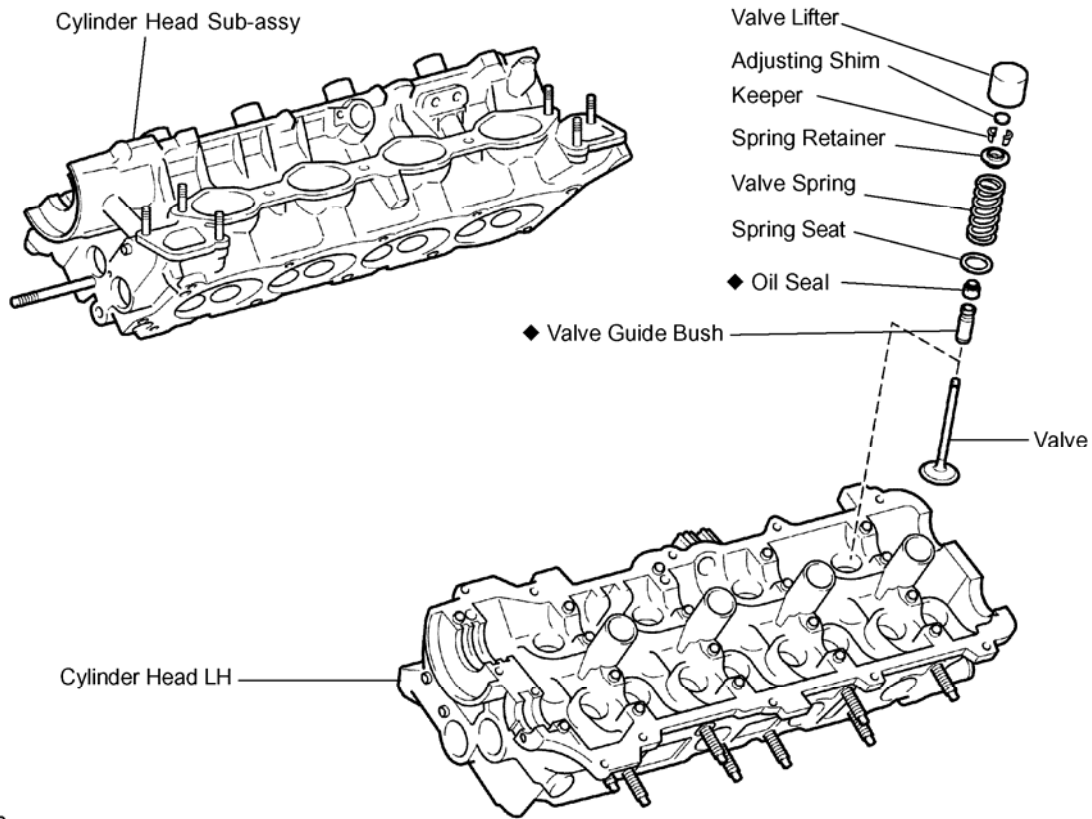
**Fig. 311: Locating Painted Mark**

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

6. INSTALL AUTOMATIC TRANSMISSION ASSY (See REPLACEMENT )

## **CYLINDER HEAD ASSY**

### **COMPONENTS**



P  
 ◆ Non-reusable part  
 G02998578

**Fig. 312: Identifying Cylinder Head Assy Components**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## OVERHAUL

### 1. REMOVE VALVE LIFTER

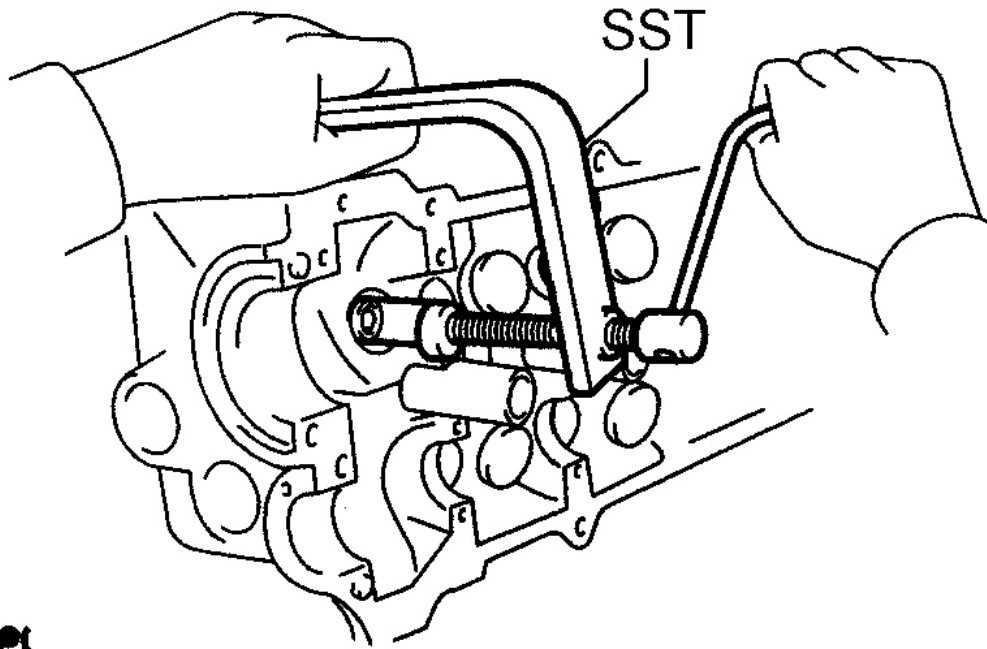
- a. Remove the valve lifter and adjusting shim.

HINT:

Arrange the valve lifters and shims in correct order.

### 2. REMOVE INTAKE VALVE

- a. Using SST, compress the compression spring and remove the 2 keepers.  
 SST 09202-70020 (09202-01010)
- b. Remove the spring retainer, compression spring, valve and spring seat.



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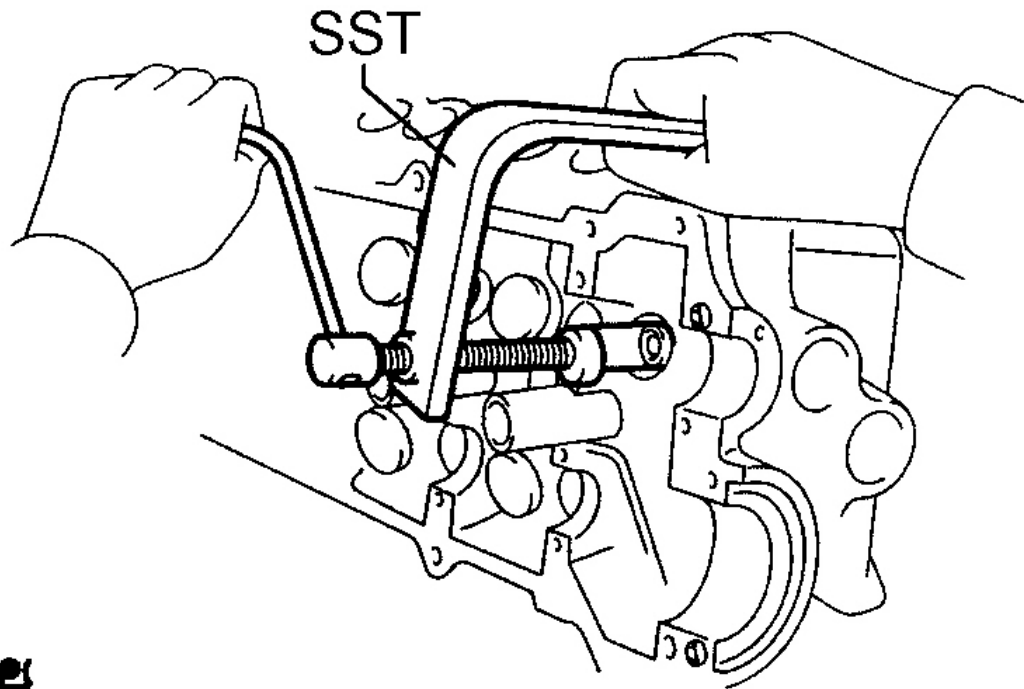
**Fig. 313: Removing Intake Valve Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Arrange the valves, compression springs, spring seats and spring retainers in the correct order.

**3. REMOVE EXHAUST VALVE**

- a. Using SST, compress the compression spring and remove the 2 keepers.  
SST 09202-70020 (09202-00010)



G02998580

**Fig. 314: Removing Compression Spring And Removing Keepers Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the spring retainer, compression spring, valve and spring seat.

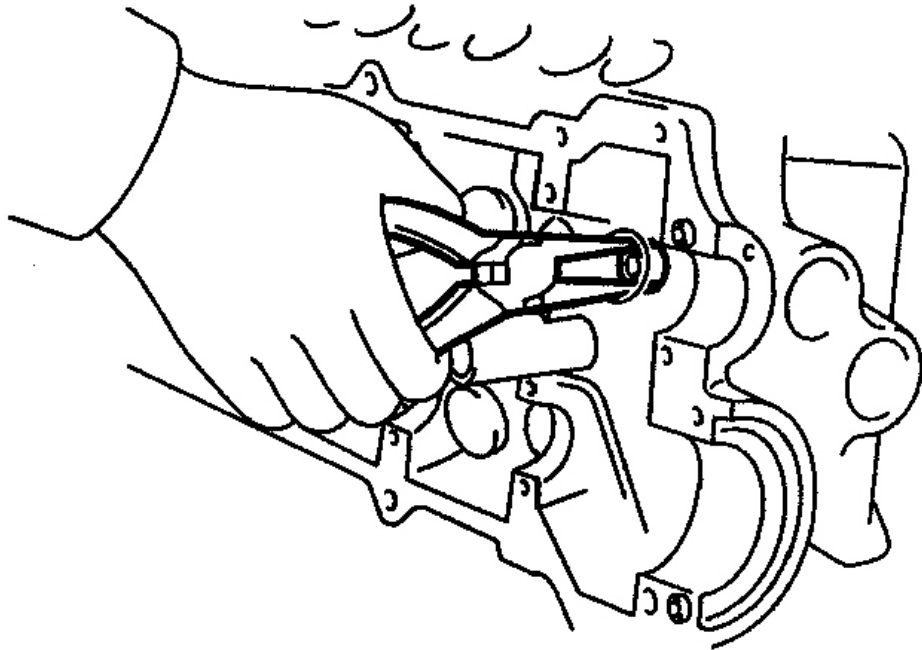
HINT:

Arrange the valves, compression springs, spring seats and spring retainers in the correct order.

#### 4. REMOVE VALVE STEM OIL O SEAL OR RING

- a. Using needle-nose pliers, remove the oil seal.



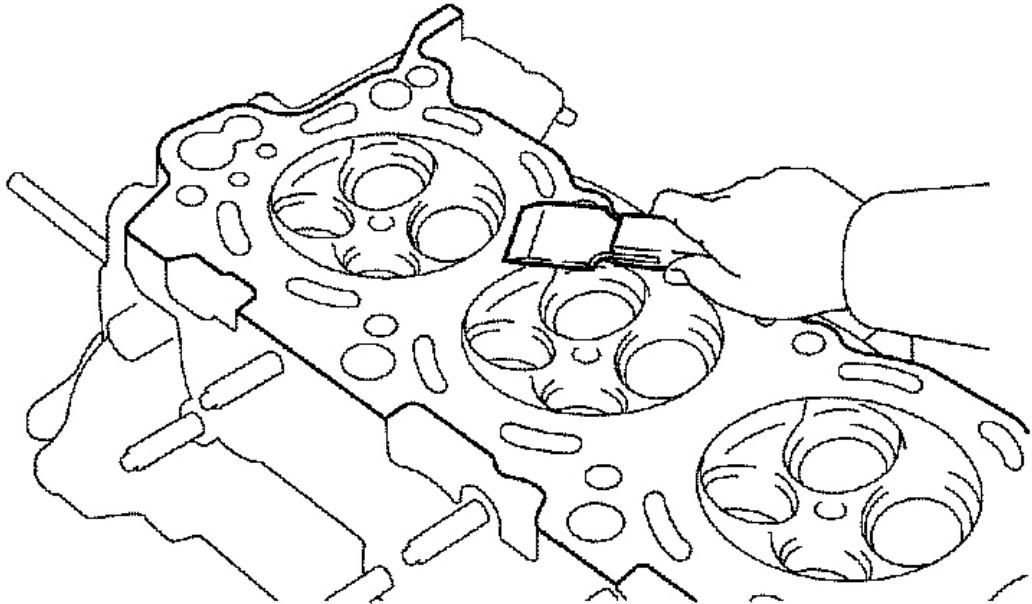


G02998581

**Fig. 315: Removing Oil Seal Using Needle-Nose Pliers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**5. INSPECT CYLINDER HEAD SUB-ASSY**

- a. Clean the cylinder head.
  1. Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

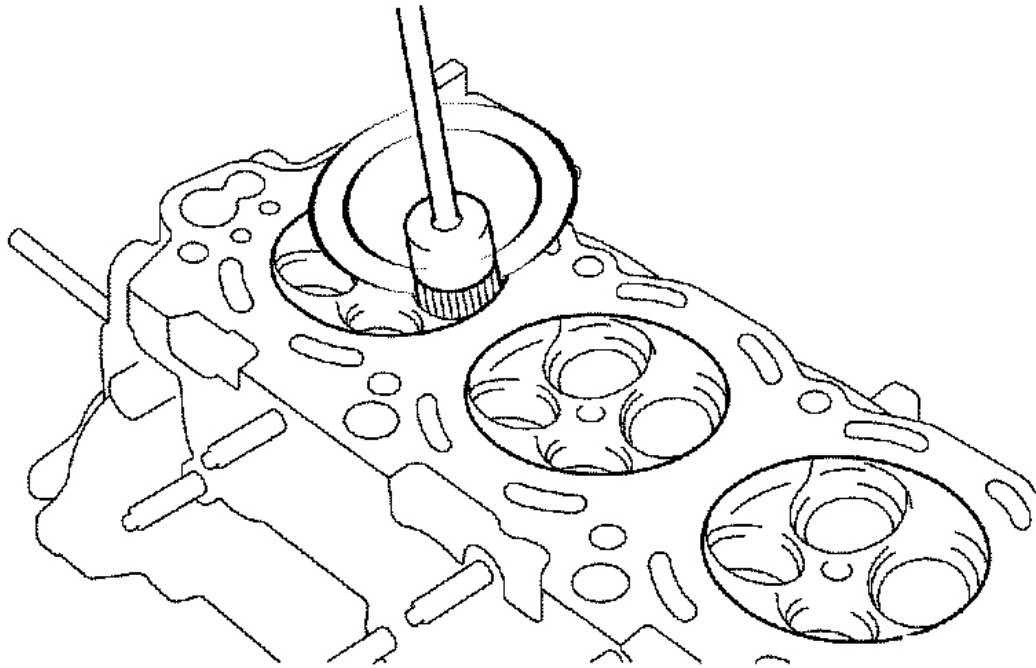


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**Fig. 316: Cleaning Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to scratch the cylinder block contact surface.

2. Using a wire brush, remove all the carbon from the combustion chambers.

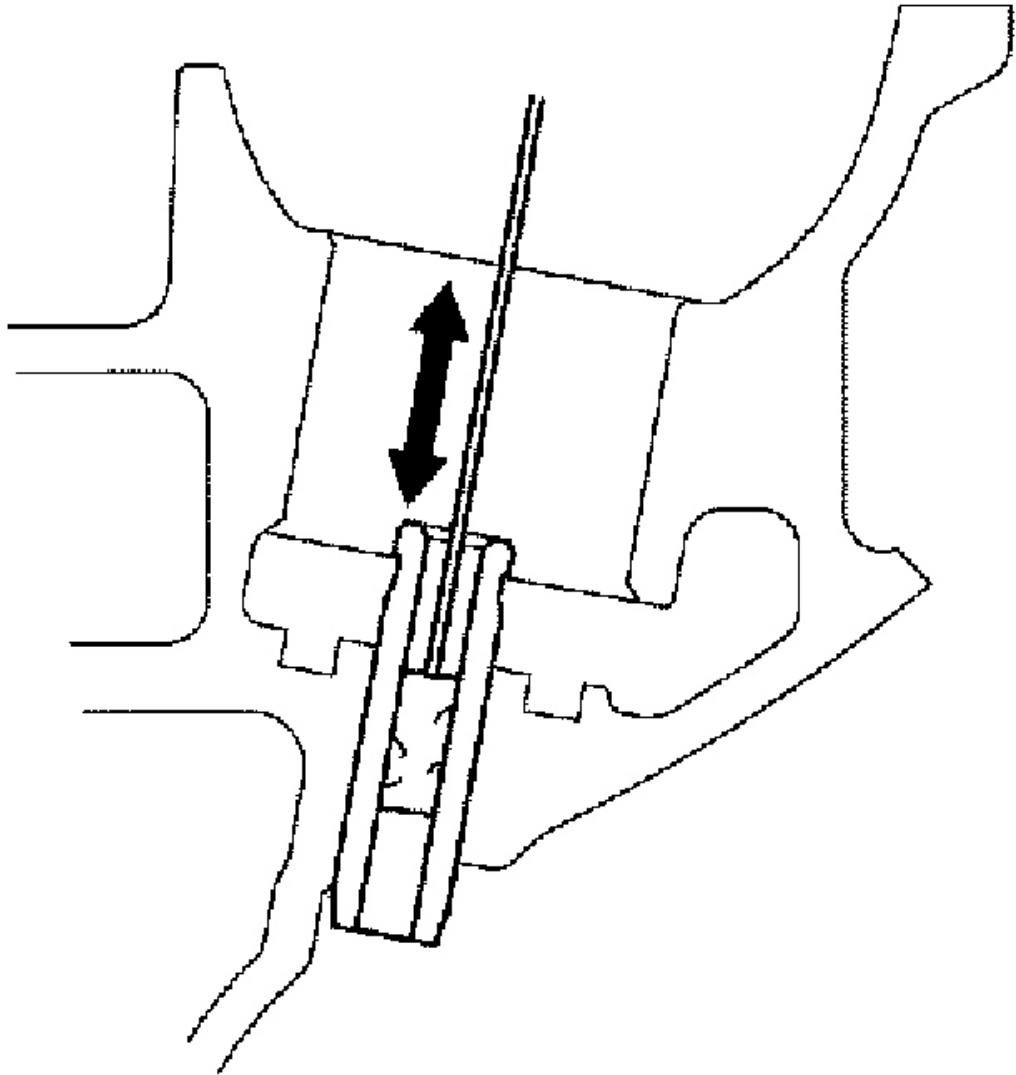


**G02998583**

**Fig. 317: Removing Carbon From Combustion Chambers**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Be careful not to scratch the cylinder block contact surface.

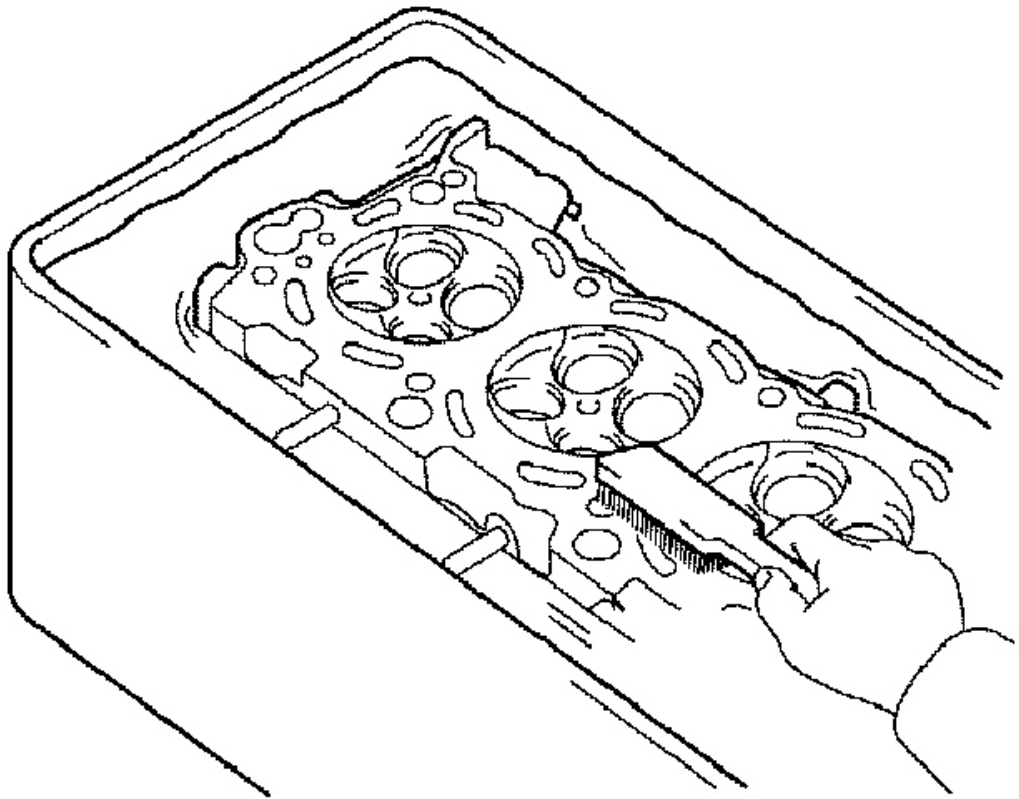
3. Using a valve guide bushing brush and solvent, clean all the guide bushes.



G02998584

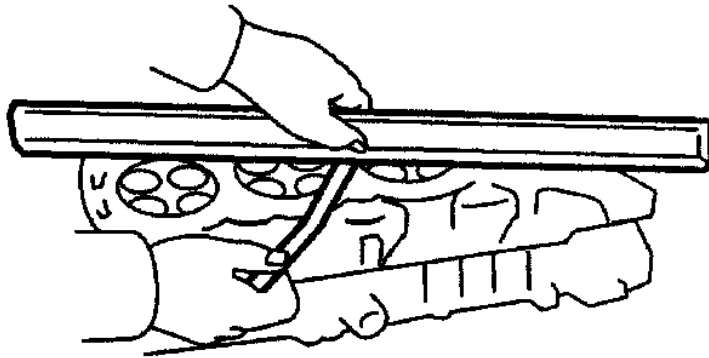
**Fig. 318: Cleaning All Guide Bushes**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Using a soft brush and solvent, thoroughly clean the cylinder head.

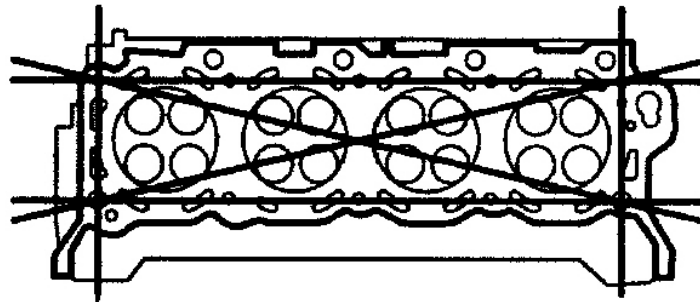


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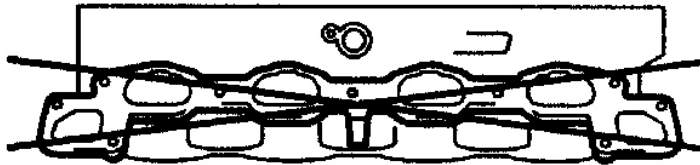
**Fig. 319: Cleaning Cylinder Head Using Soft Brush**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



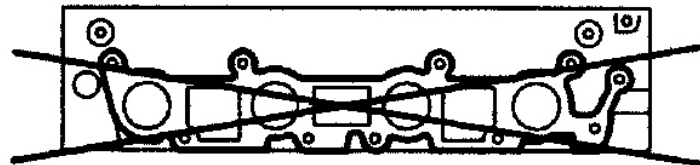
**Cylinder Block Side**



**Intake Manifold Side**



**Exhaust Manifold Side**



G02998586

**Fig. 320: Inspecting Cylinder Head Warpage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the cylinder head warpage.
  - 1. Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder

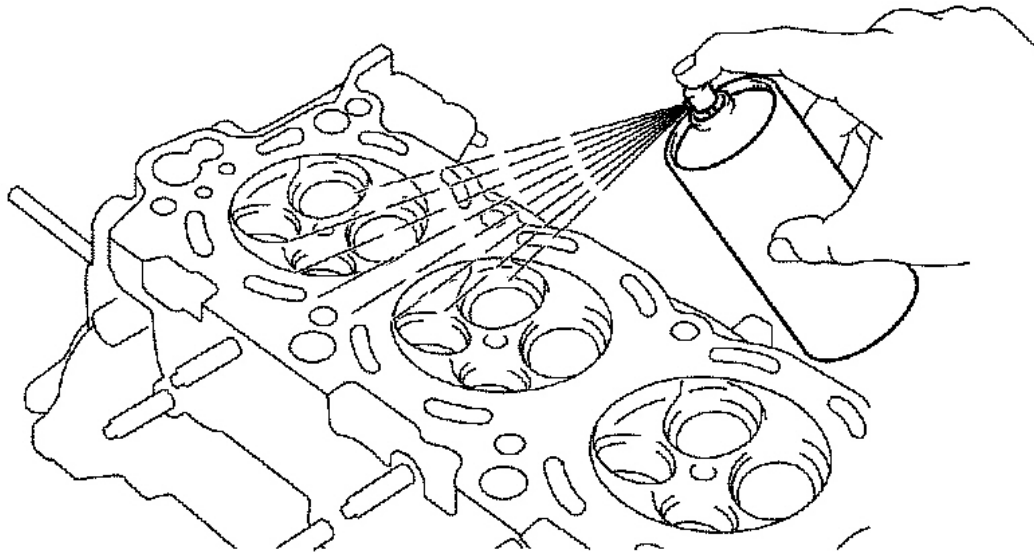
block and the manifolds for warpage.

## MAXIMUM WARPAGE:

### CYLINDER BLOCK CONTACTING SURFACE SPECIFICATIONS

Item	Specified Condition
Cylinder block surface	0.05 mm (0.0020 in.)
Intake manifold surface	0.10 mm (0.0039 in.)
Exhaust manifold surface	0.10 mm (0.0039 in.)

If the warpage is greater than the maximum, replace the cylinder head.

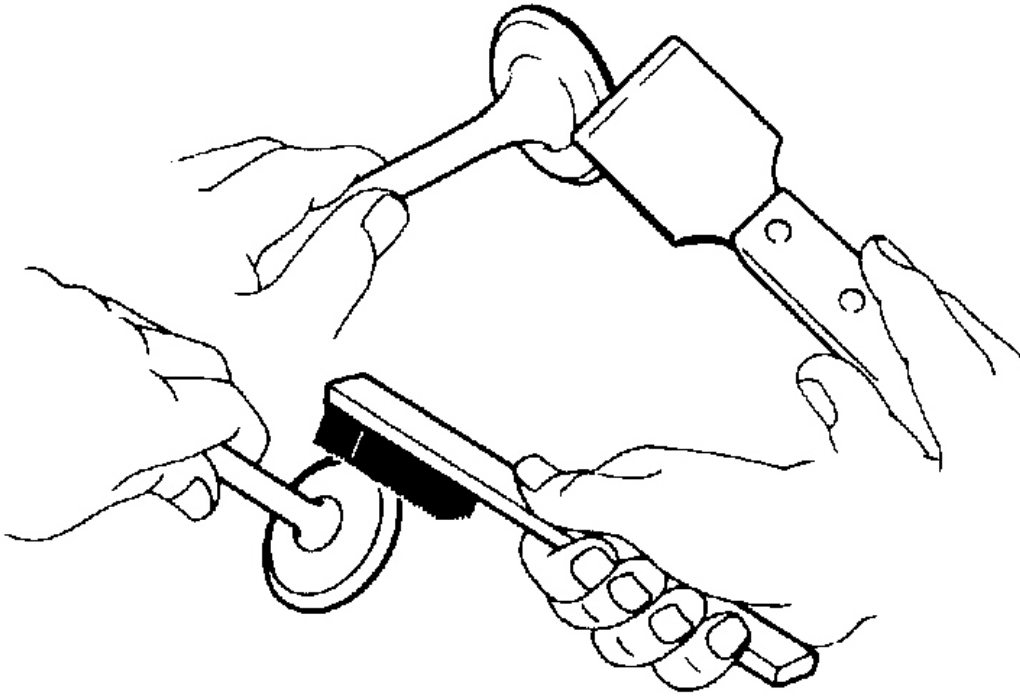


G02998587

**Fig. 321: Inspecting Cylinder Head For Cracks**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect the cylinder head for cracks.
  1. Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



**G02998588**

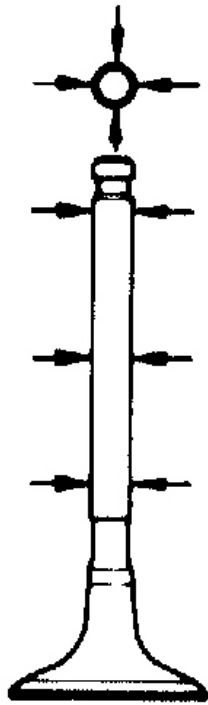
**Fig. 322: Cleaning Valves**

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

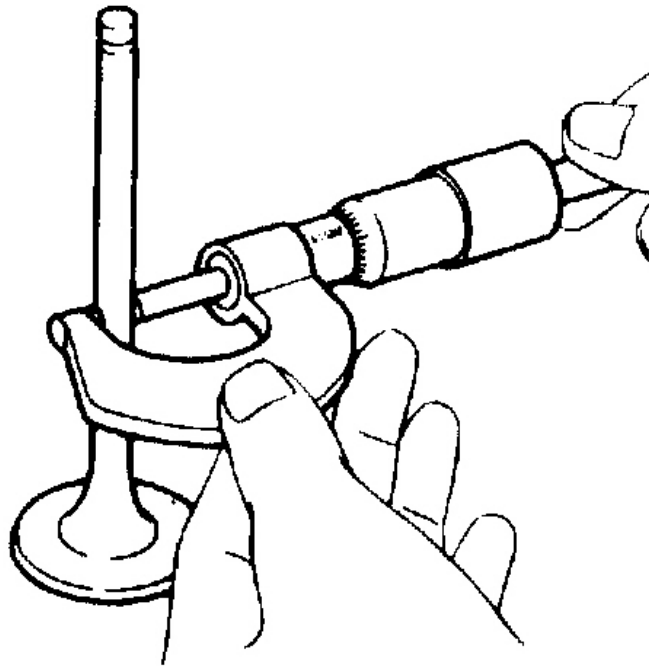
**6. INSPECT INTAKE VALVE**

- a. Clean the valves.
  1. Using a gasket scraper, chip off any carbon from the valve head.
  2. Using a wire brush, thoroughly clean the valve.





G02998589



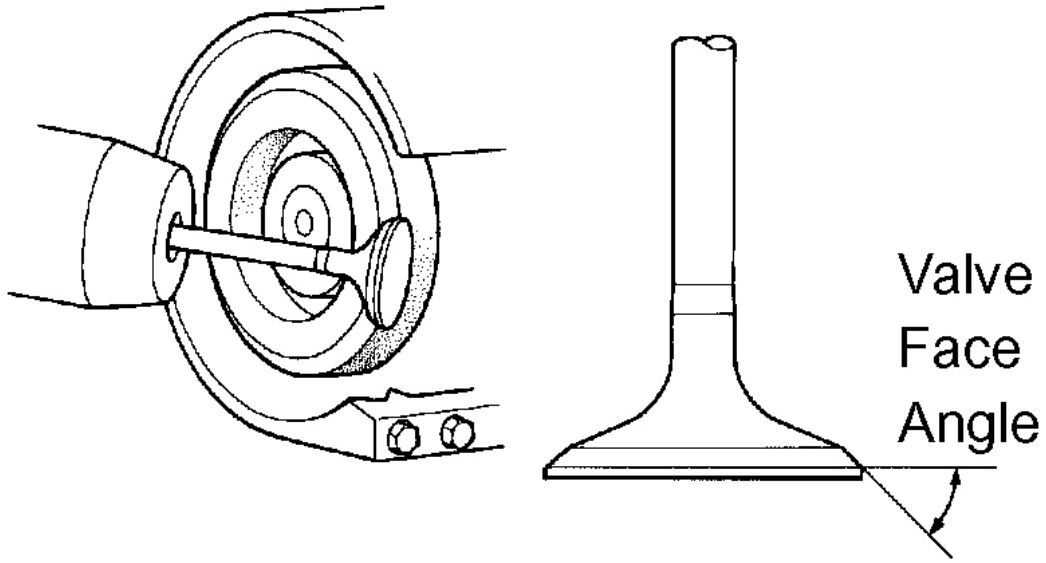
**Fig. 323: Measuring Diameter Of Valve Stem Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**5.470 to 5.485 mm (0.2154 to 2.2159 in.)**

If the diameter is greater than the maximum, replace the valve and guide bushing.



G02998590

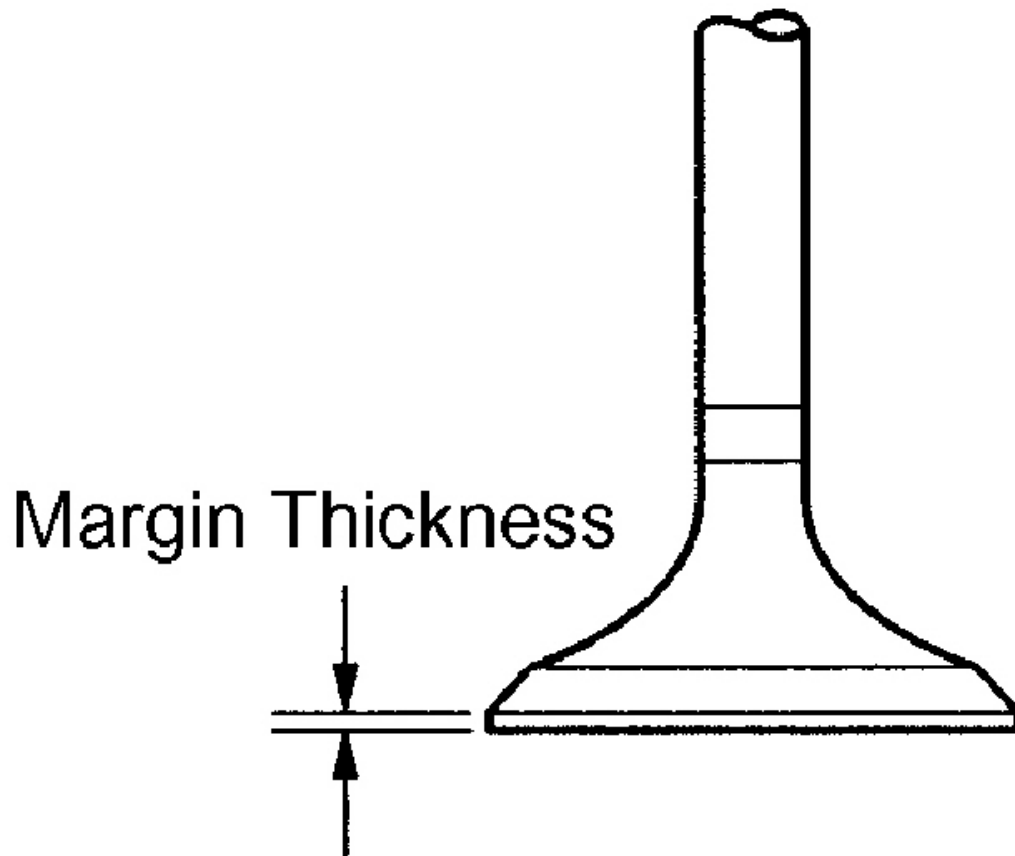
**Fig. 324: Checking Valve Face Angle**

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

- c. Check the valve face angle.
  - 1. Grind the valve enough to remove pits and carbon.
  - 2. Check that the valve is ground to the correct valve face angle.

**Valve face angle:  $44.5^\circ$**

If the valve face is worn, replace the valve.



G02998591

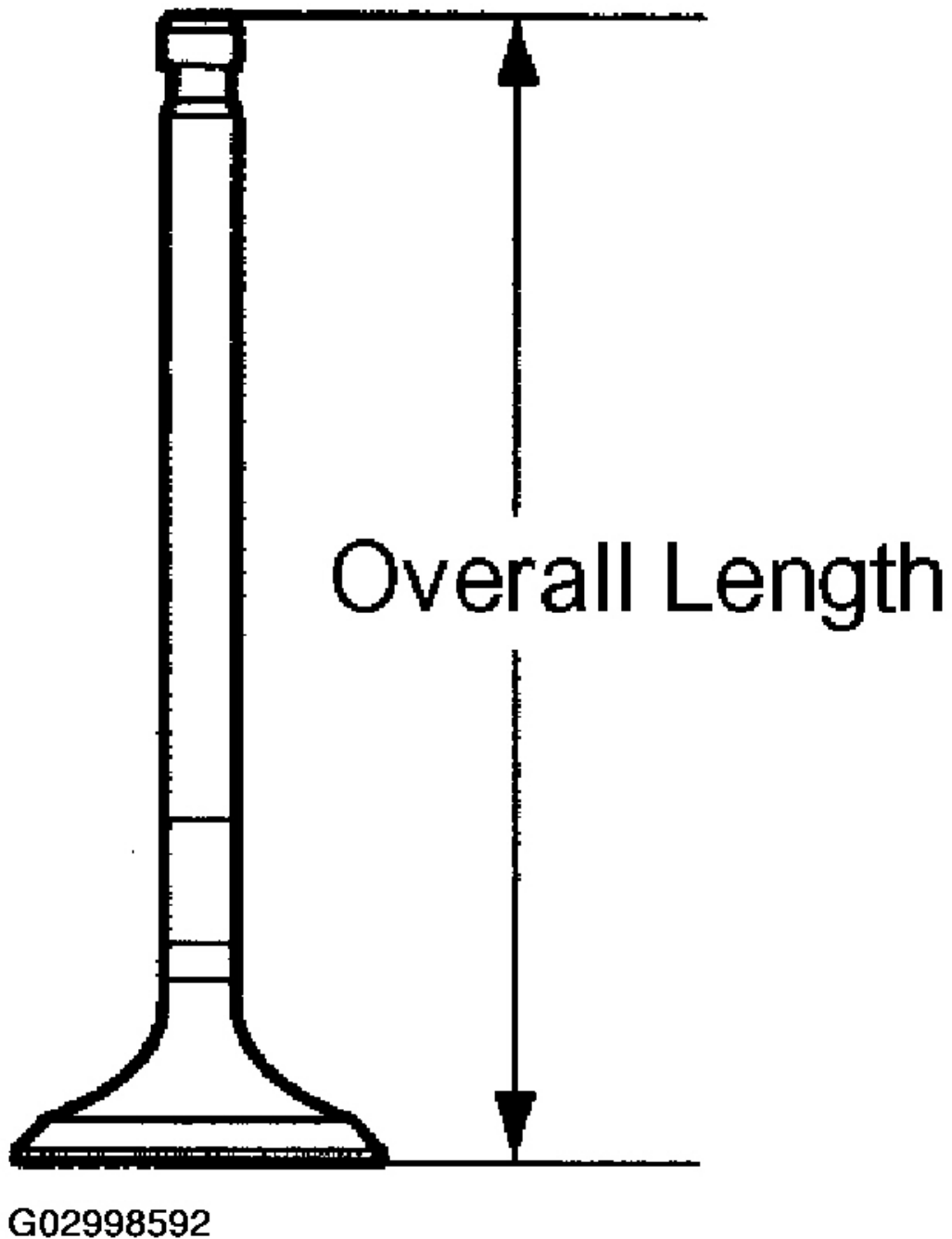
**Fig. 325: Checking Valve Head Margin Thickness**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check the valve head margin thickness.

**Standard margin thickness: 1.0 mm (0.039 in.)**

**Minimum margin thickness: 0.5 mm (0.020 in.)**

If the margin thickness is less than the minimum, replace the valve.



**Fig. 326: Checking Valve Overall Length**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

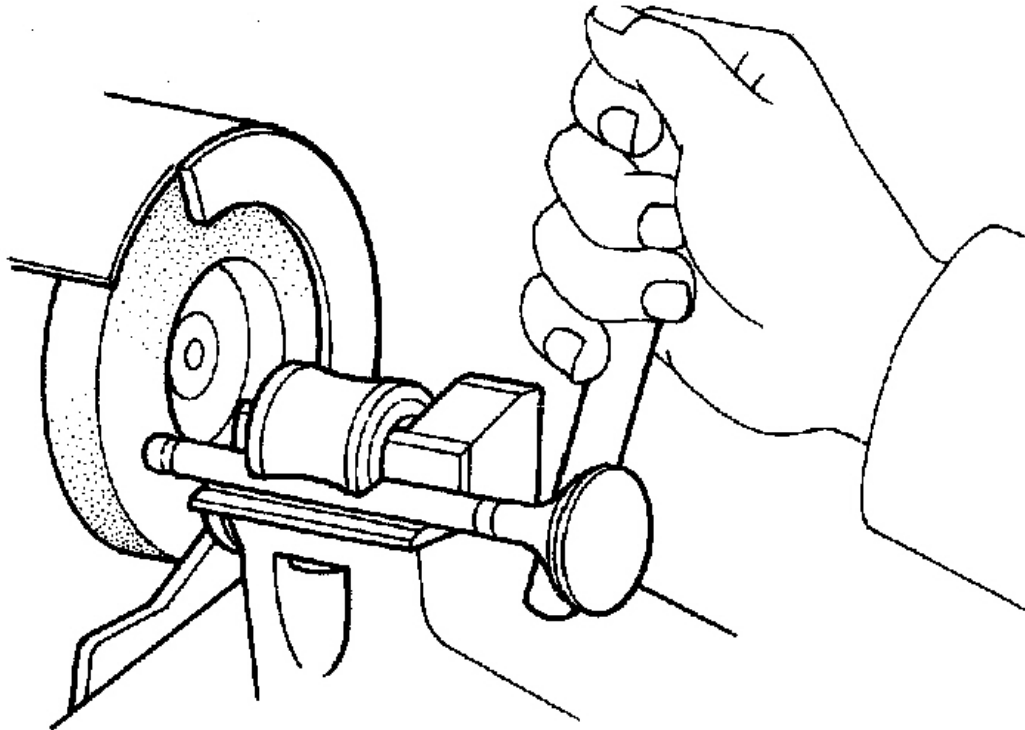
- e. Check the valve overall length.

**Standard overall length:**

**94.80 to 95.30 mm (3.7323 to 3.7520 in.)**

**Minimum overall length: 94.55 mm (3.7224 in.)**

If the overall length is less than the minimum, replace the valve.



**G02998593**

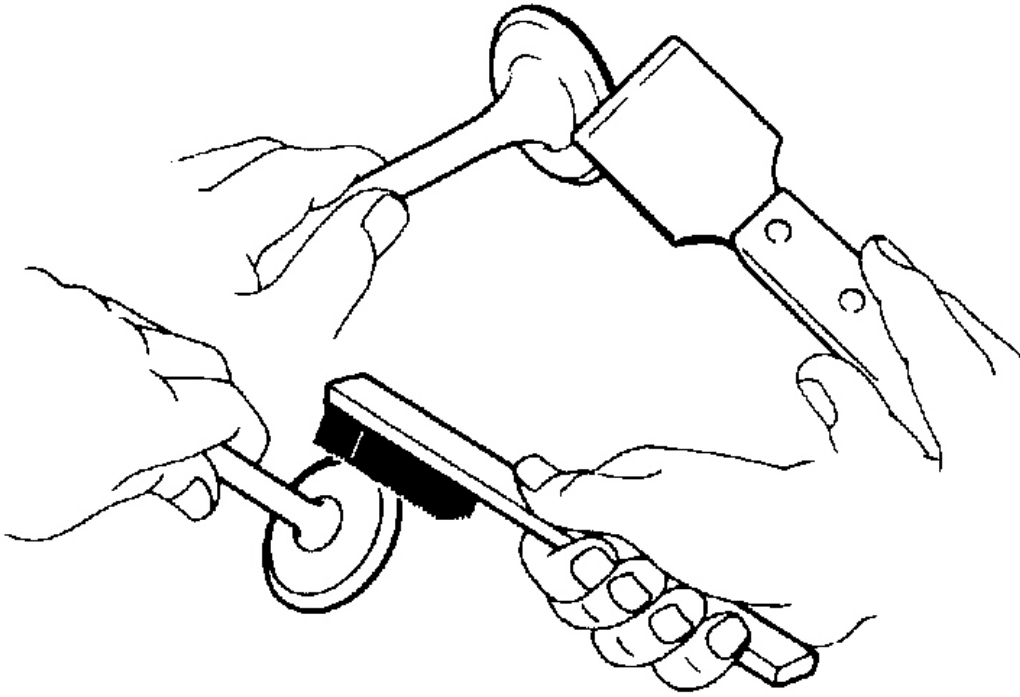
**Fig. 327: Checking Surface Of Valve Stem**

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

- f. Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

**NOTE: Do not grind off more than the minimum.**

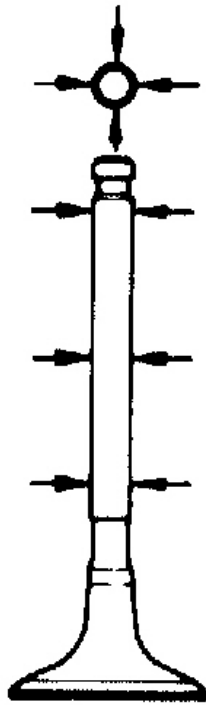


G02998594

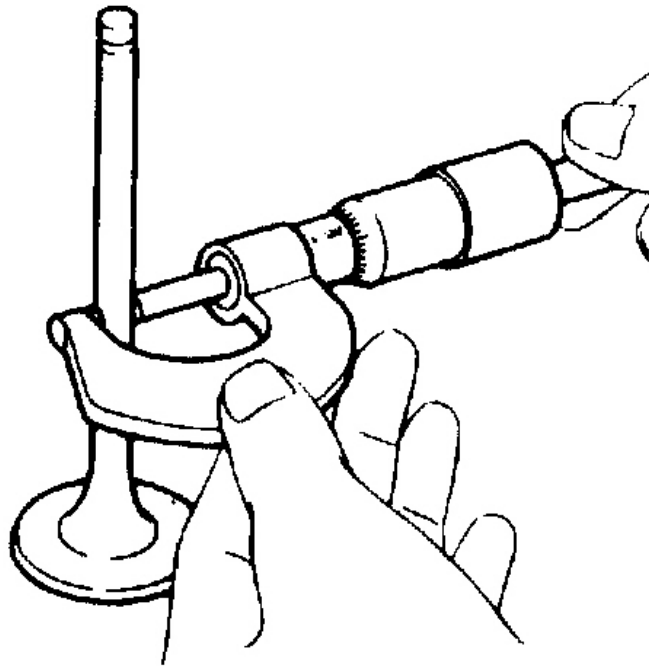
**Fig. 328: Checking Exhaust Valve**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 7. INSPECT EXHAUST VALVE

- a. Clean the valves.
  1. Using a gasket scraper, chip off any carbon from the valve head.
  2. Using a wire brush, thoroughly clean the valve.



G02998595



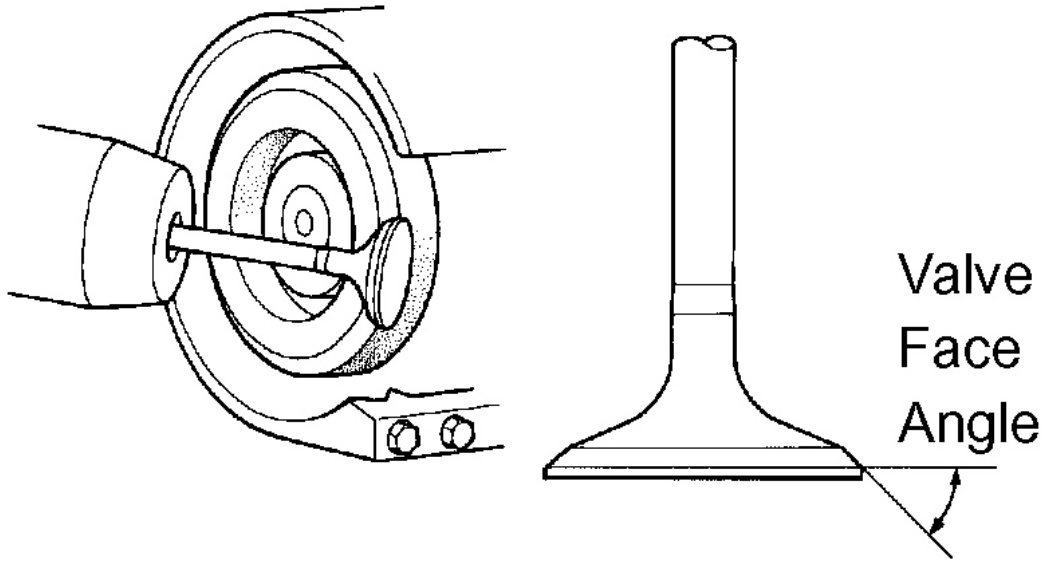
**Fig. 329: Measuring Diameter Of Valve Stem Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**5.465 to 5.480 mm (0.2152 to 2.2157 in.)**

If the clearance is greater than the maximum, replace the valve and guide bushing.



G02998596

**Fig. 330: Removing Pits And Carbon**

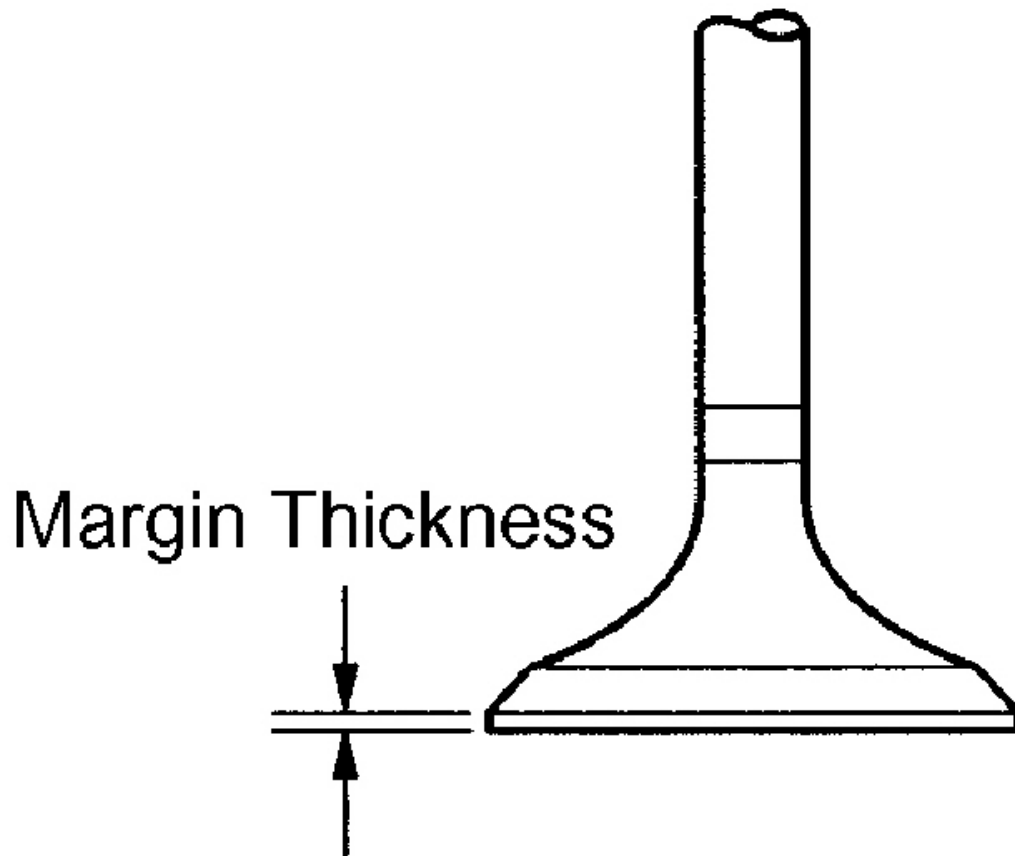
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check the valve face angle.
  1. Grind the valve enough to remove pits and carbon.
  2. Check that the valve is ground to the correct valve face angle.

**Valve face angle:  $44.5^\circ$**

If the valve face is worn, replace the valve.





G02998597

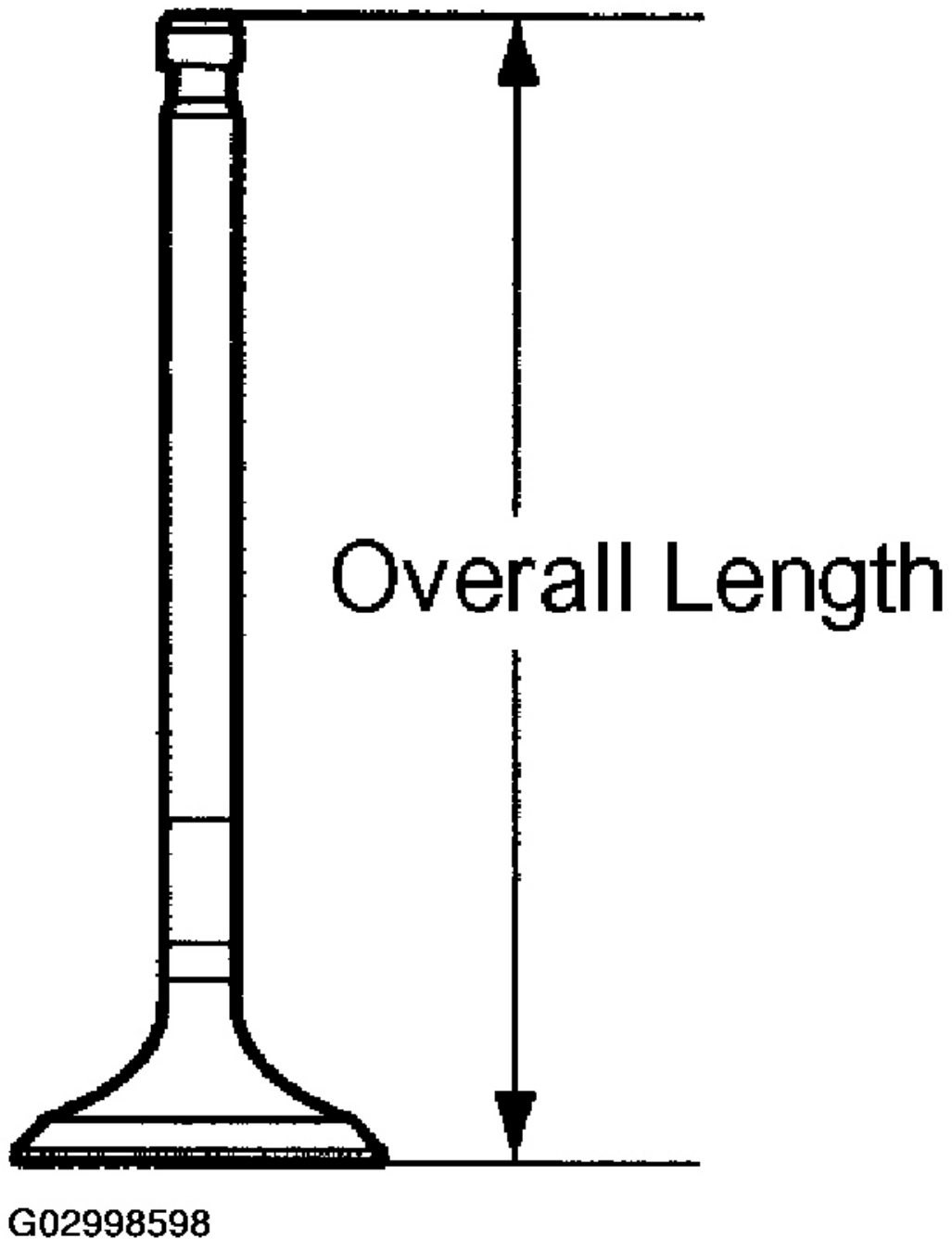
**Fig. 331: Measuring Valve Head Margin Thickness**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check the valve head margin thickness.

**Standard margin thickness: 1.0 mm (0.039 in.)**

**Minimum margin thickness: 0.5 mm (0.020 in.)**

If the margin thickness is less than the minimum, replace the valve.



**Fig. 332: Checking Valve Overall Length**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

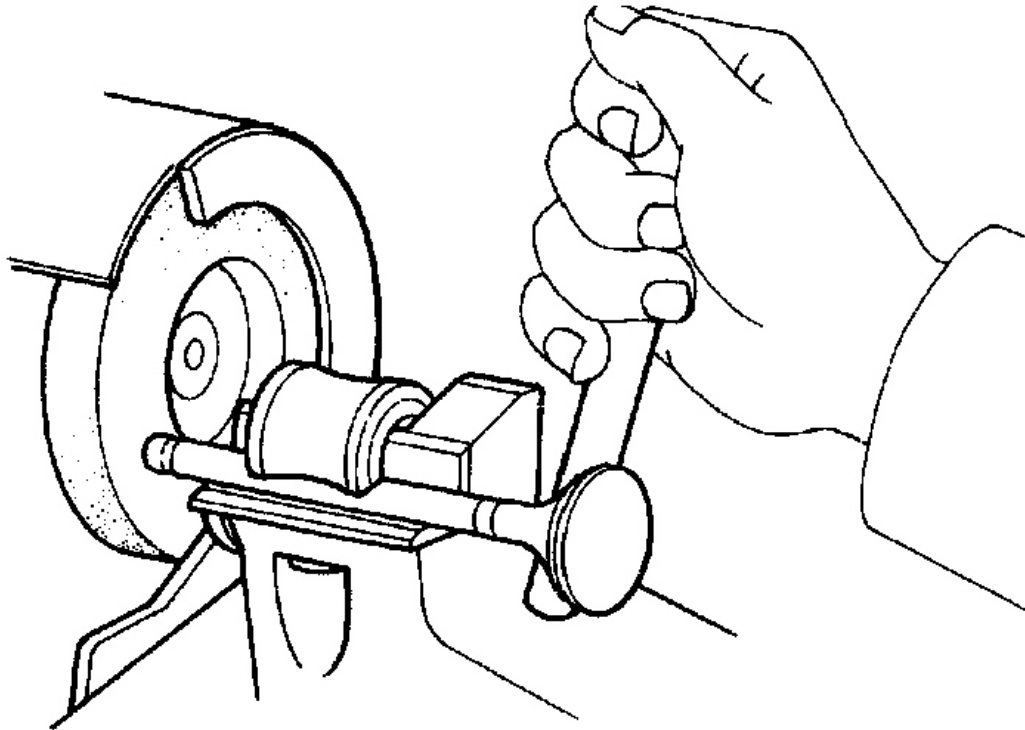
- e. Check the valve overall length.

**Standard overall length:**

**94.85 to 95.35 mm (3.7342 to 3.7539 in.)**

**Minimum overall length: 94.60 mm (3.7244 in.)**

If the overall length is less than the minimum, replace the valve.



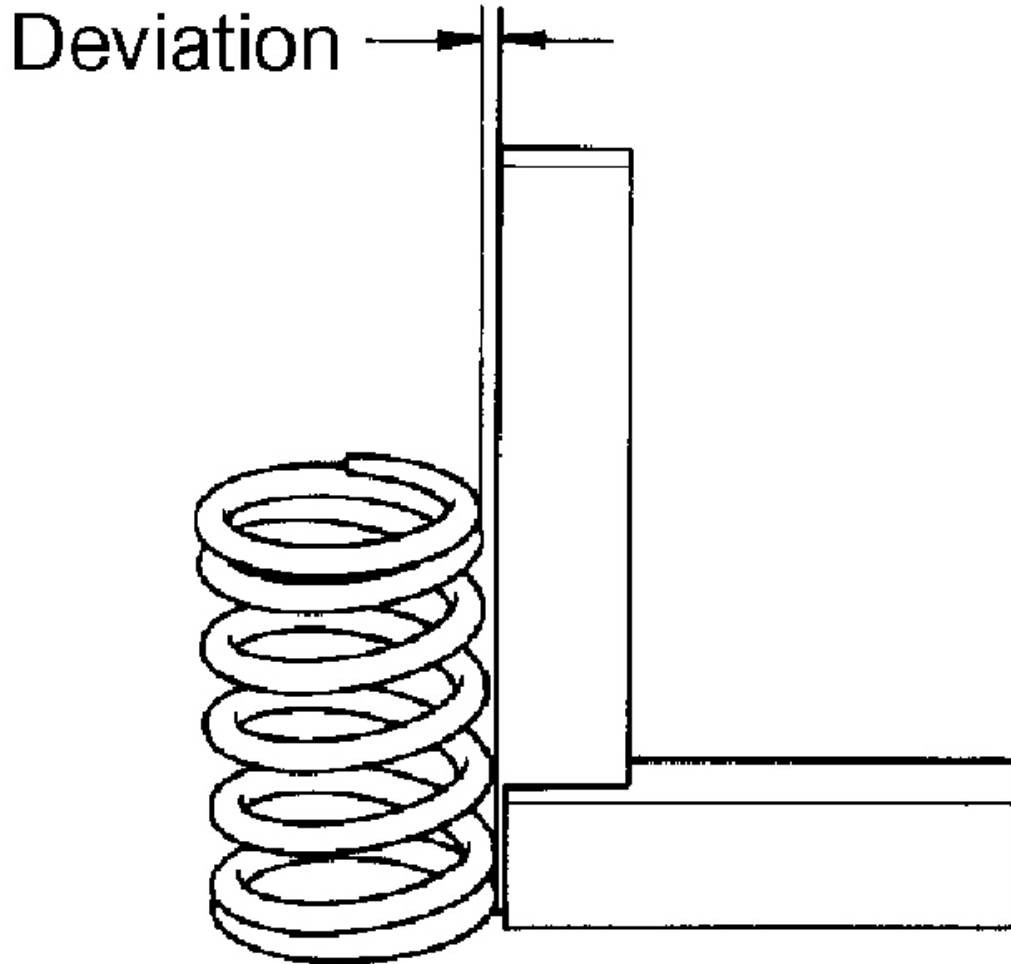
**G02998599**

**Fig. 333: Checking Surface Of Valve Stem Tip For Wear**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- f. Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

**NOTE: Do not grind off more than the minimum.**



G02998600

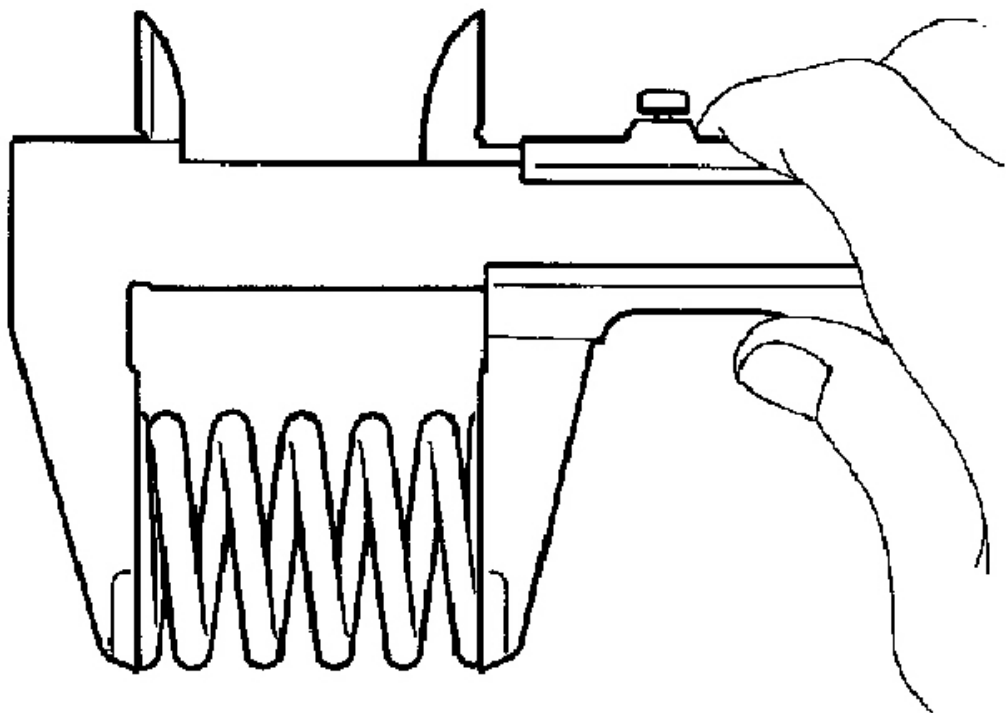
**Fig. 334: Measuring Deviation Of Spring Using Steel Squares**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**8. INSPECT INNER COMPRESSION SPRING**

- a. Using steel squares, measure the deviation of the spring.

**Maximum deviation: 2.0 mm (0.079 in.)**

If the deviation is greater than the maximum, replace the spring.



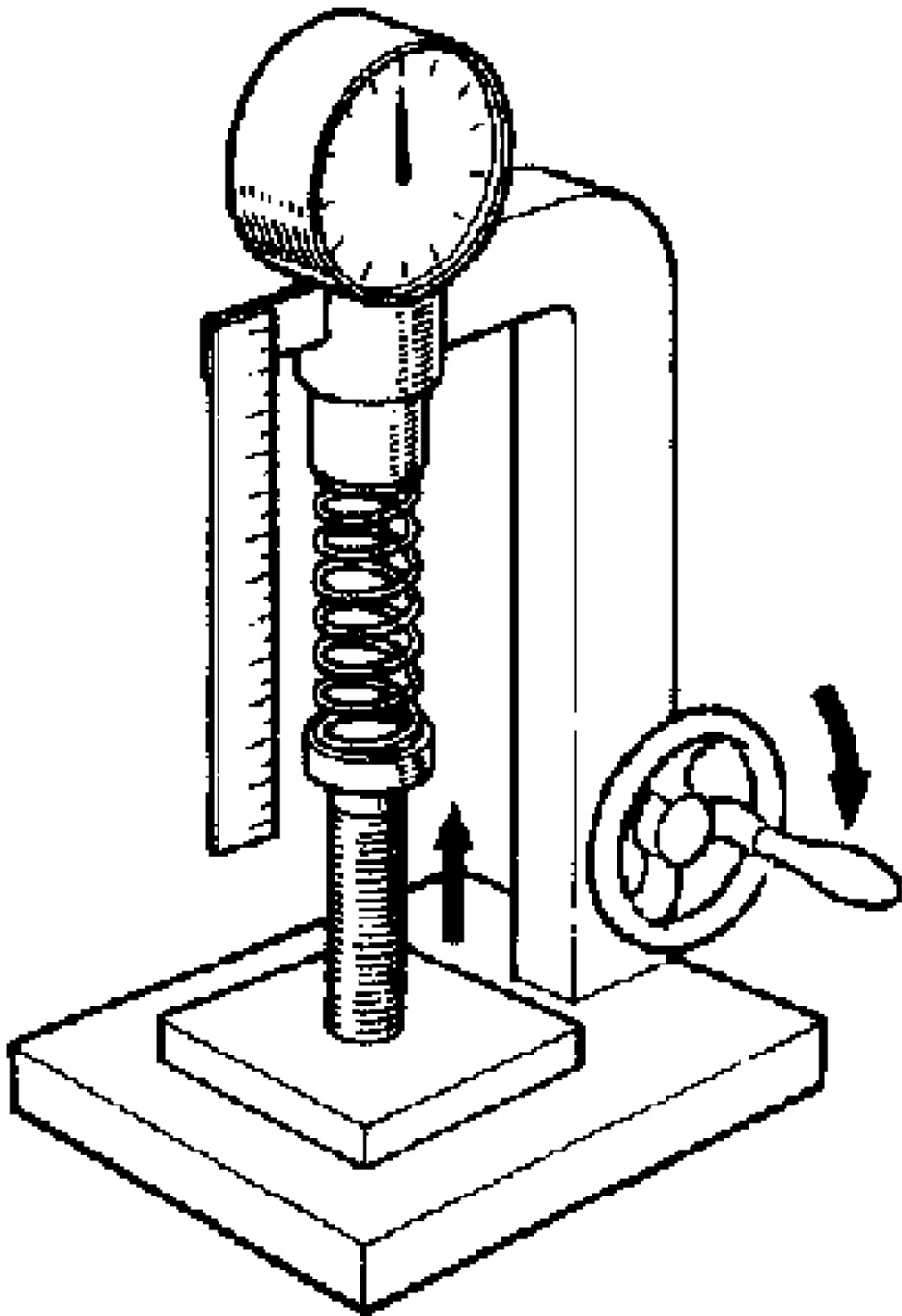
G02998601

**Fig. 335: Measuring Free Length Of Spring Using Vernier Caliper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a vernier caliper, measure the free length of the spring.

**Free length: 54.05 to 54.15 mm (2.1279 to 2.1319 in.)**

If the free length is not as specified, replace the spring.



G02998602

**Fig. 336: Measuring Tension Of Valve Spring Using Spring Tester**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

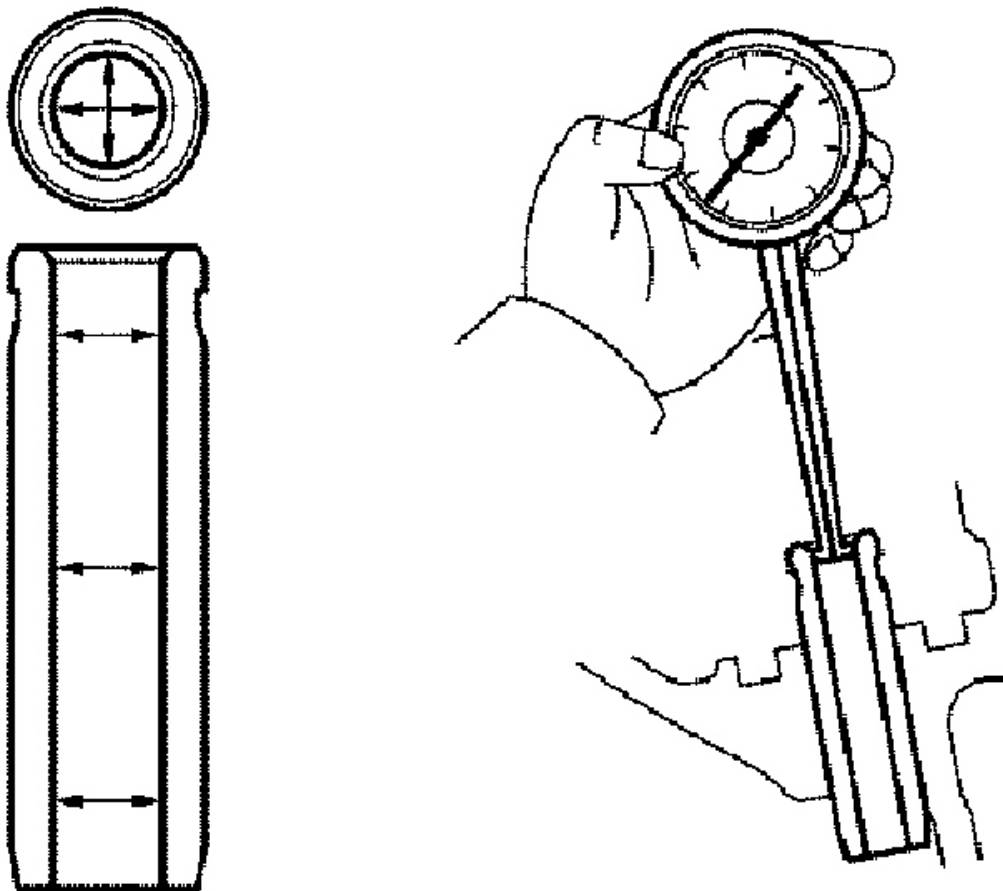
c. Using a spring tester, measure the tension of the valve spring at the specified installed length.

**Standard:**

**204 to 226 N (20.8 to 23.0 kgf, 45.9 to 50.7 lbf)**

**at 35.04 mm (1.3795 in.)**

If the tension is not as specified, replace the valve spring.



**G02998603**

**Fig. 337: Measuring Inside Diameter Of Guide Bush Using Caliper Gauge (Intake Valve Guide**

**Bush)**

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

9. **INSPECT INTAKE VALVE GUIDE BUSH**

- a. Using a caliper gauge, measure the inside diameter of the guide bush.

**Bush inside diameter:**

**5.510 to 5.530 mm (0.2169 to 0.2177 in.)**

If the journal diameter is not as specified, check the oil clearance.

- b. Subtract the valve stem diameter measurement (see step 6) from the guide bush inside diameter measurement.

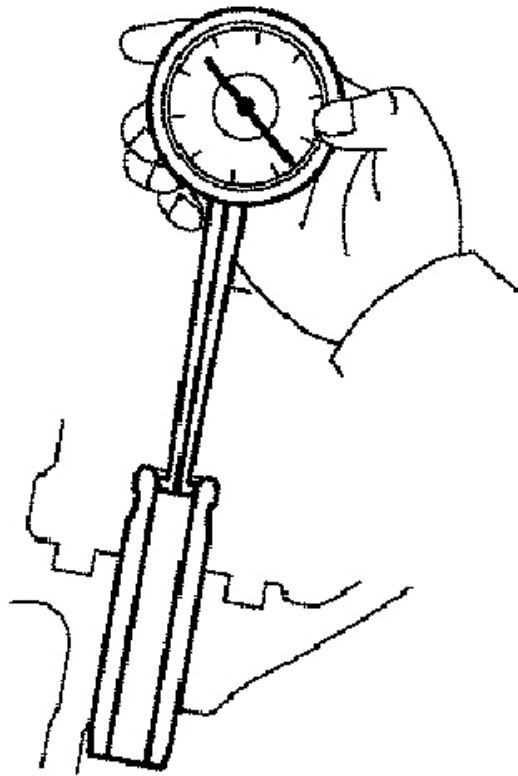
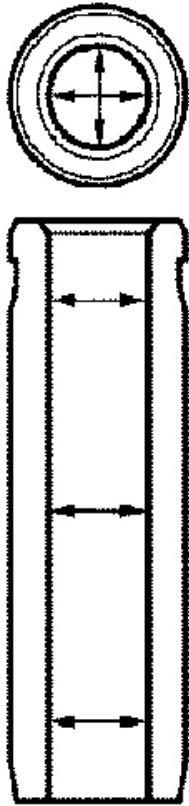
**Standard oil clearance:**

**0.025 to 0.060 mm (0.0010 to 0.0024 in.)**

**Maximum oil clearance: 0.08 mm (0.0031 in.)**

If the clearance is greater than the maximum, replace the valve and guide bush (see steps 11 and 12).





G02998604

**Fig. 338: Measuring Inside Diameter Of Guide Bush Using Caliper Gauge (Exhaust Valve Guide Bush)**

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

#### 10. INSPECT EXHAUST VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the inside diameter of the guide bush.

**Bush inside diameter:**

**5.510 to 5.530 mm (0.2169 to 0.2177 in.)**

If the journal diameter is not as specified, check the oil clearance.

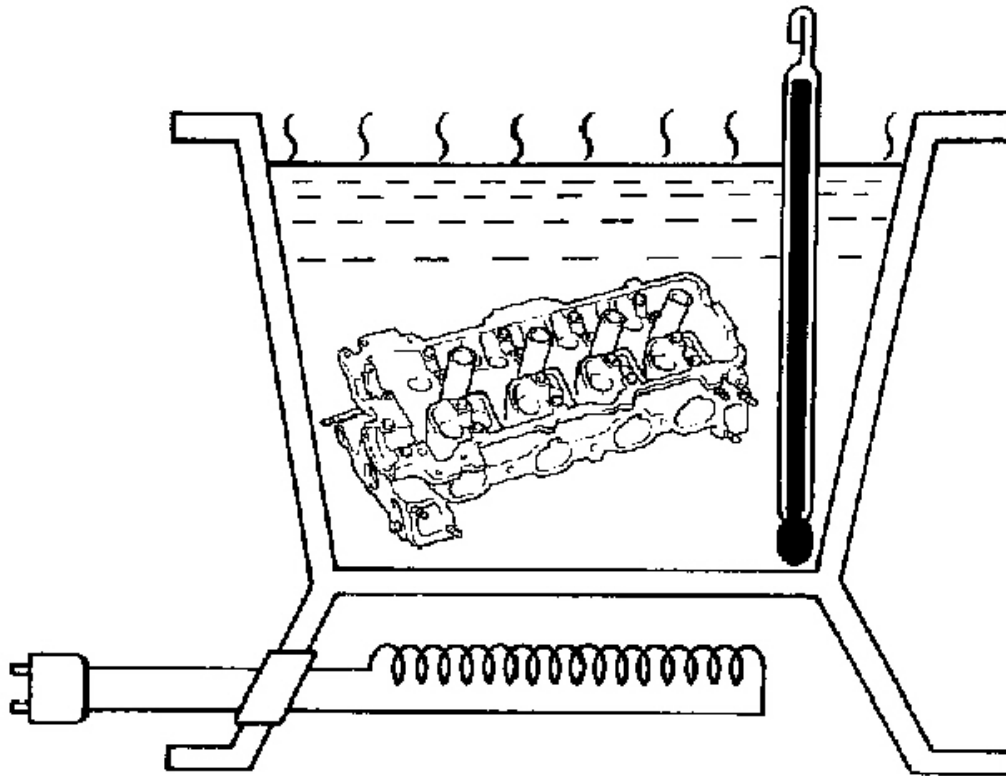
- b. Subtract the valve stem diameter measurement (see step 7) from the guide bush inside diameter measurement.

**Standard oil clearance:**

**0.030 to 0.065 mm (0.0012 to 0.0026 in.)**

**Maximum oil clearance: 0.10 mm (0.0039 in.)**

If the clearance is greater than the maximum, replace the valve and guide bush (see steps 12 and 14).



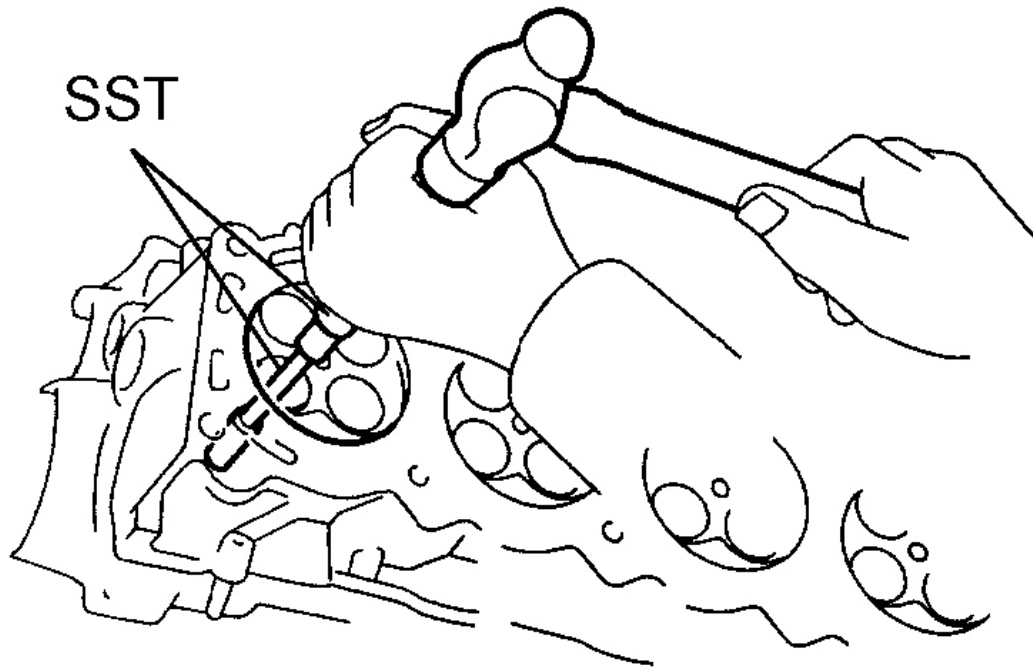
**G02998605**

**Fig. 339: Heating Cylinder Head**

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

**11. REMOVE INTAKE VALVE GUIDE BUSH**

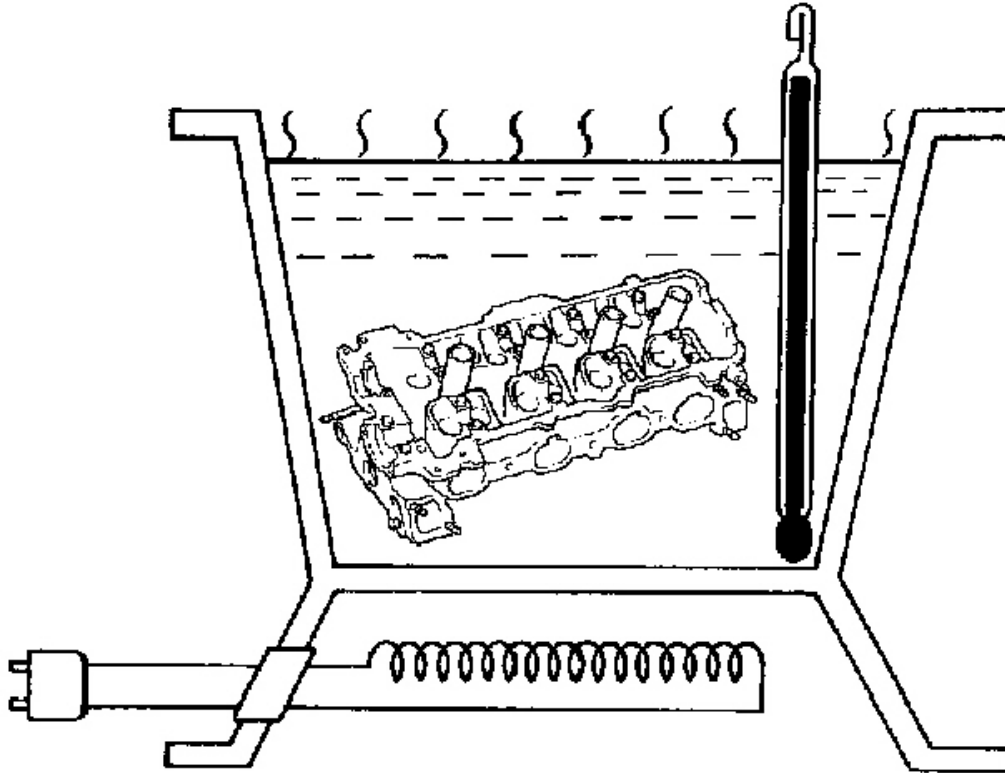
- a. Gradually heat the cylinder head to approximately 80 to 100°C (176 to 212° F).



G02998606

**Fig. 340: Taping Out Guide Bush Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a hammer, tap out the guide bush.  
SST 09201-01055, 09950-70010 (09951-07100)



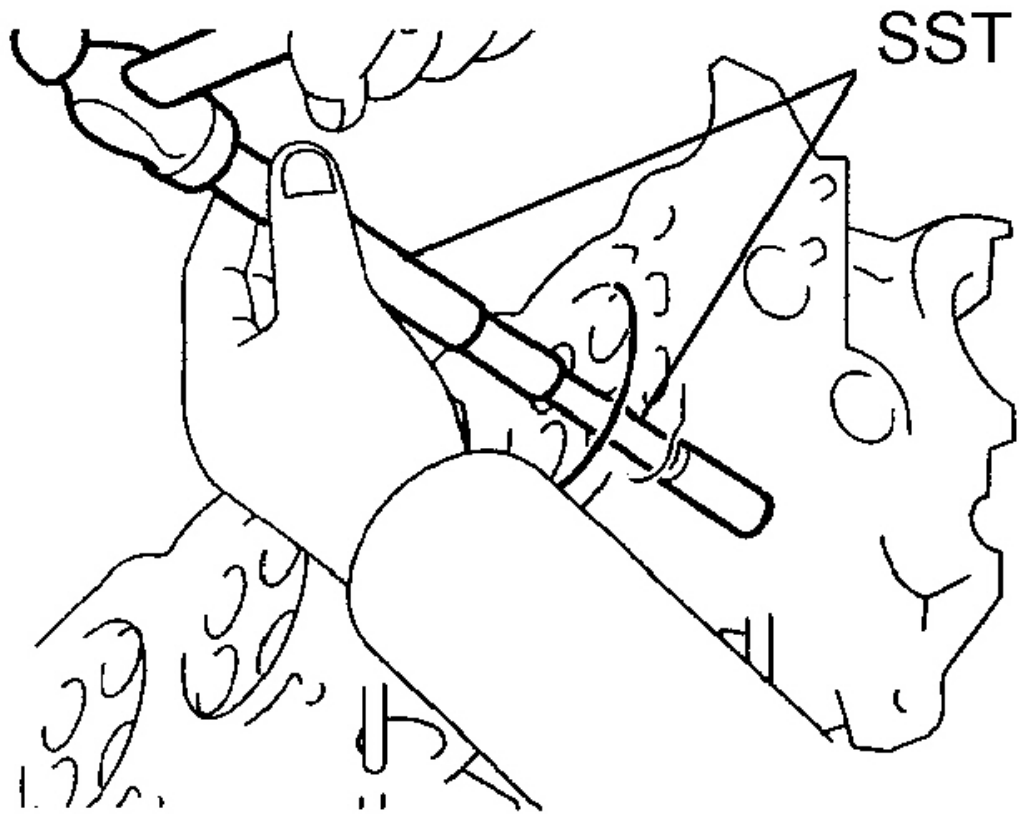
G02998607

**Fig. 341: Heating Cylinder Head**

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

**12. REMOVE EXHAUST VALVE GUIDE BUSH**

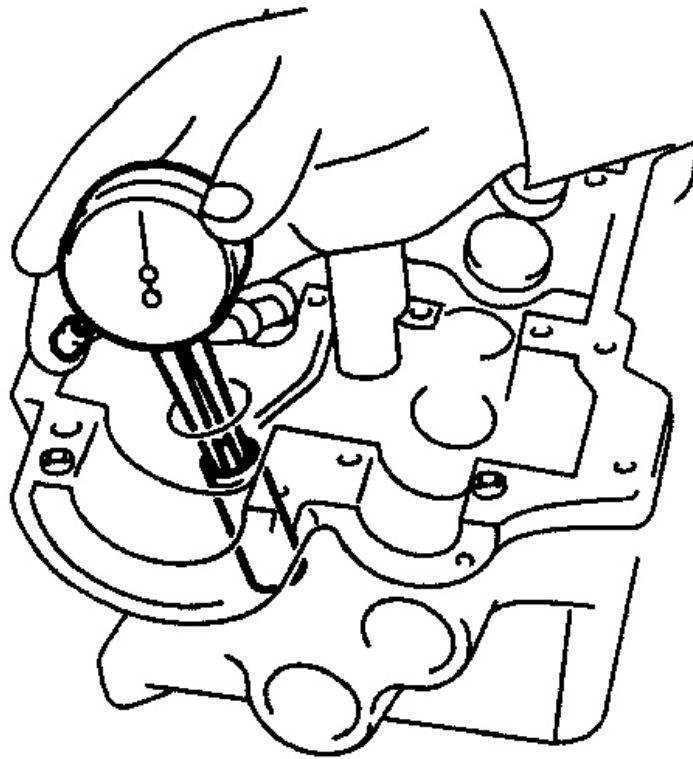
- a. Gradually heat the cylinder head to approximately 80 to 100° C (176 to 212° F).



**G02998608**

**Fig. 342: Taping Out Guide Bush Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a hammer, tap out the guide bush.  
SST 09201-01055, 09950-70010 (09951-07100)



G02998609

**Fig. 343: Measuring Bush Bore Diameter Of Cylinder Head Using Caliper Gauge**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### 13. INSTALL INTAKE VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the bush bore diameter of the cylinder head.
- b. Select a new guide bush (STD or O/S 0.05).

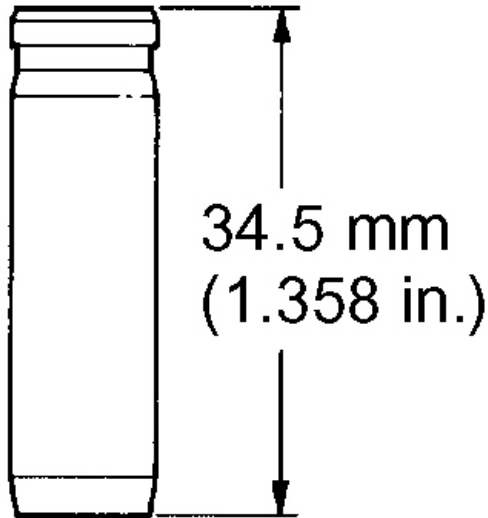
#### **GUIDE BUSH REFERENCE**

<b>Bush size</b>	<b>Bush bore diameter</b>
Use STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
Use O/S 0.05	10.335 to 10.356 mm (0.4068 to 0.4077 in.)

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore diameter to between 10.335 and 10.356 mm (0.4068 to 0.4077 in.).

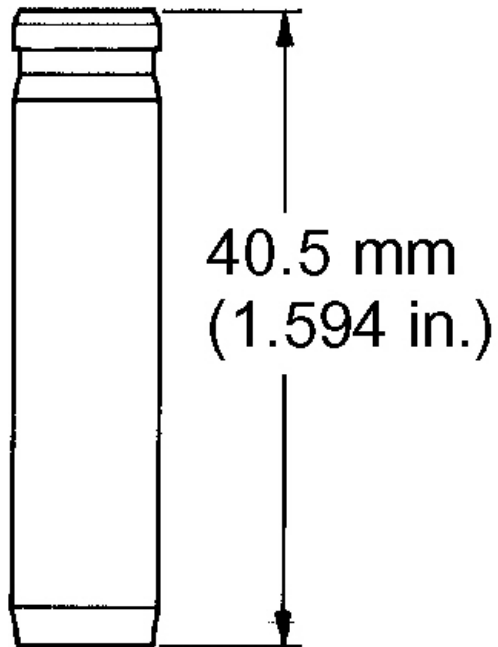
If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

## Intake



G02998610

## Exhaust

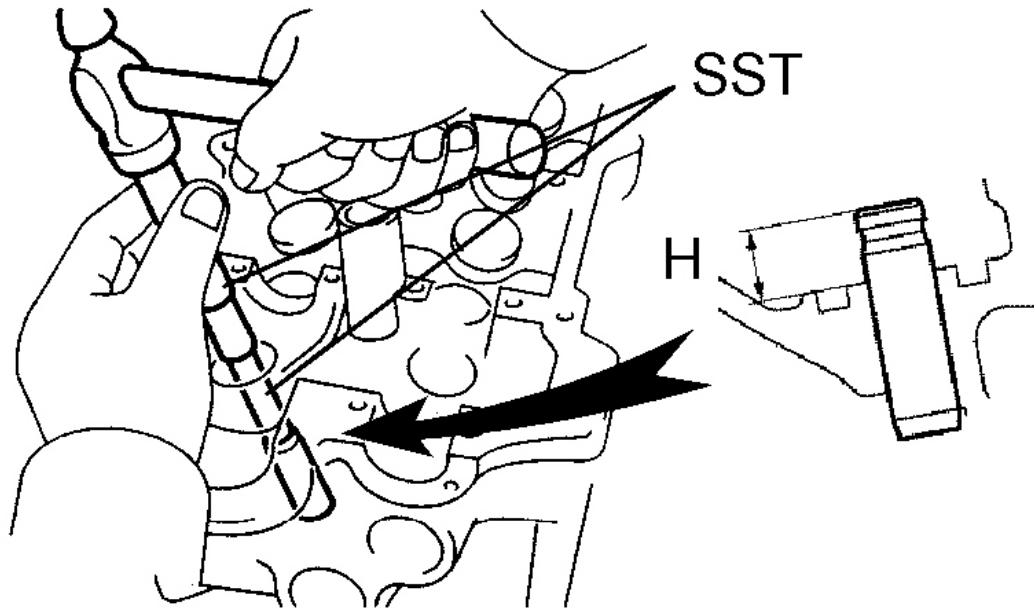


**Fig. 344: Measuring Intake And Exhaust Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Different the bushes are used for the intake and exhaust.

**Bush length: 34.5 mm (1.358 in.)**



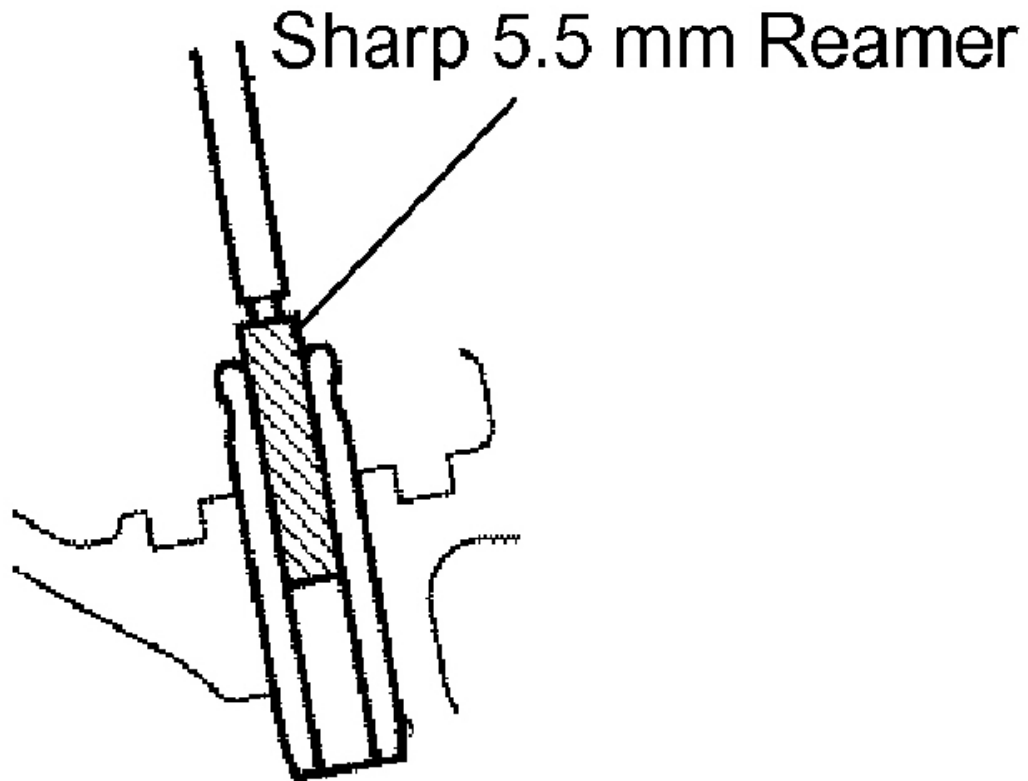
G02998611

**Fig. 345: Taping Guide Bush Using SST And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Gradually heat the cylinder head to approximately 80 to 100° C (176 to 212° F).
- d. Using SST and a hammer, tap in a new guide bush to the specified protrusion height.  
SST 09201-01055, 09950-70010 (09951-07100)

**Protrusion height (H): 9.2 to 9.8 mm (0.362 to 0.386 in.)**

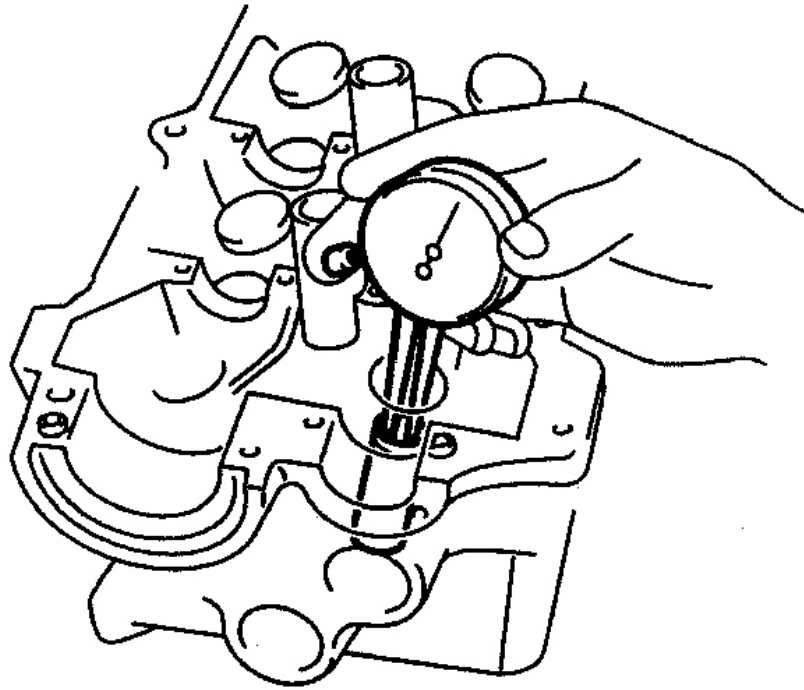




G02998612

**Fig. 346: Identifying Specification Clearance Using Reamer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance (see step 9) between the guide bush and valve stem.



G02998613

**Fig. 347: Measuring Bush Bore Diameter Of Cylinder Head Using Caliper**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**14. INSTALL EXHAUST VALVE GUIDE BUSH**

- a. Using a caliper gauge, measure the bush bore diameter of the cylinder head.
- b. Select a new guide bush (STD or O/S 0.05).

**GUIDE BUSH REFERENCE**

Bush size	Bush bore diameter
Use STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
Use O/S 0.05	10.335 to 10.356 mm (0.4068 to 0.4077 in.)

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore diameter to between 10.335 and 10.356 mm (0.4068 to 0.4077 in.)

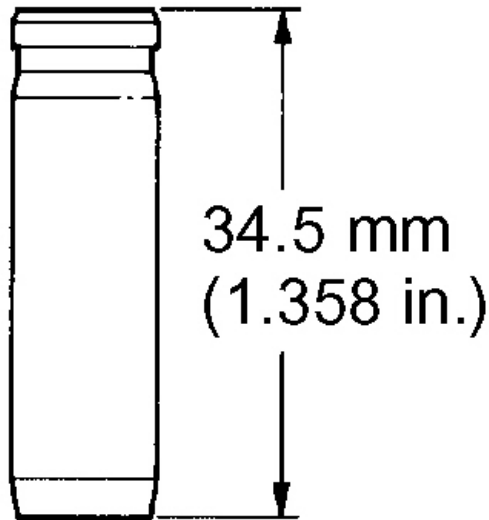
If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

HINT:

Different the bushes are used for the intake and exhaust.

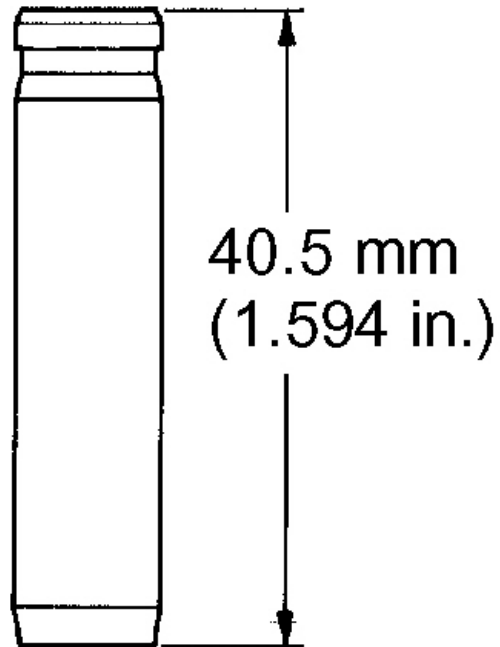
**Bush length: 40.5 mm (1.594 in.)**

**Intake**



**G02998614**

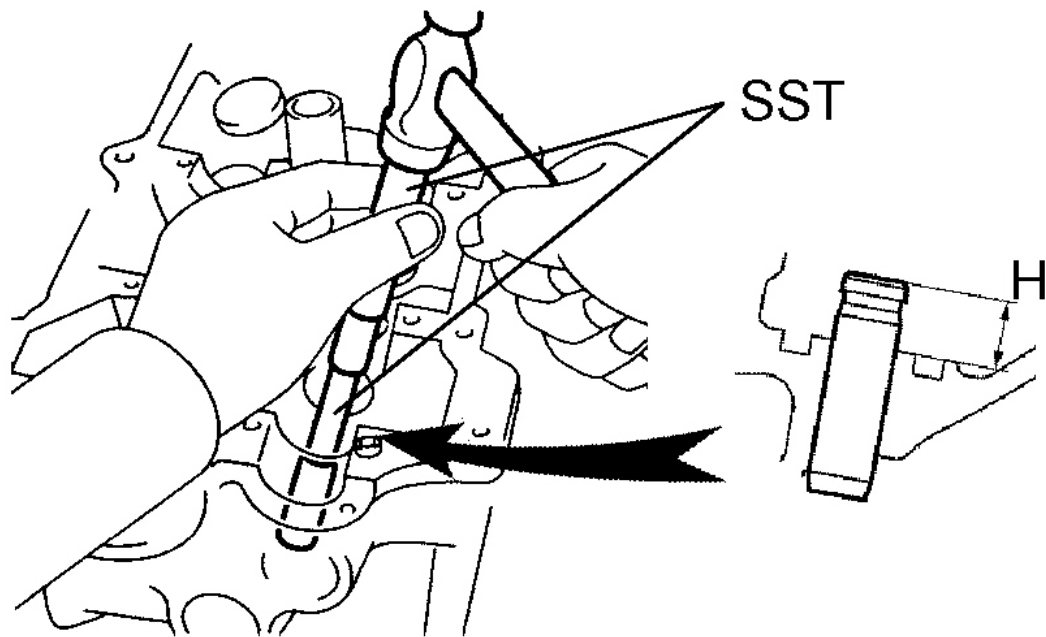
**Exhaust**



**Fig. 348: Identifying Intake And Exhaust Bush Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Gradually heat the cylinder head to approximately 80 to 100 °C (176 to 212°F).
- d. Using SST and a hammer, tap in a new guide bush to the specified protrusion height.  
SST 09201-01055 (09951-07100), 09950-70010

**Protrusion height (H): 8.2 to 8.8 mm (0.323 to 0.346 in.)**

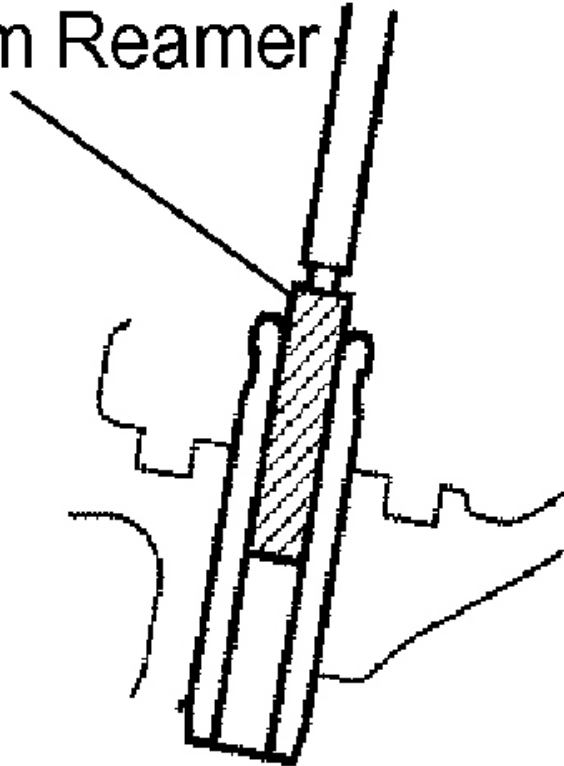


G02998615

**Fig. 349: Taping Guide Bush Using SST And Hammer**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- e. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance (see step 10) between the guide bush and valve stem.

## Sharp 5.5 mm Reamer

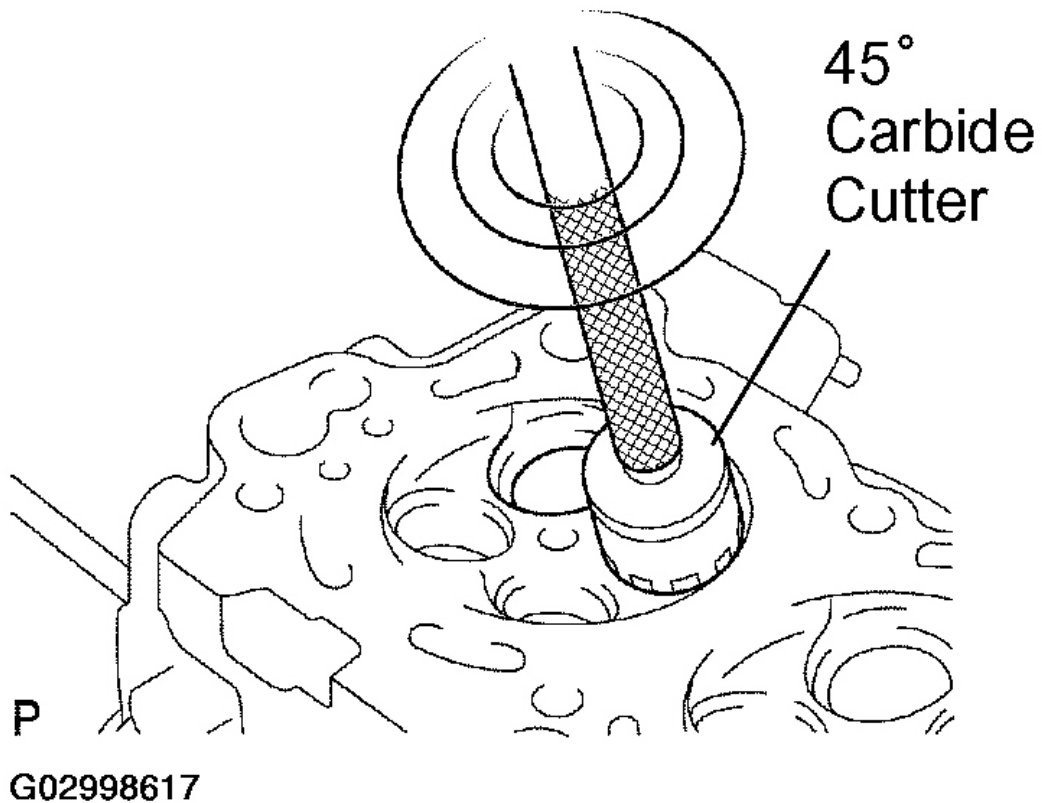


G02998616

**Fig. 350: Identifying Specification Clearance Using Reamer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

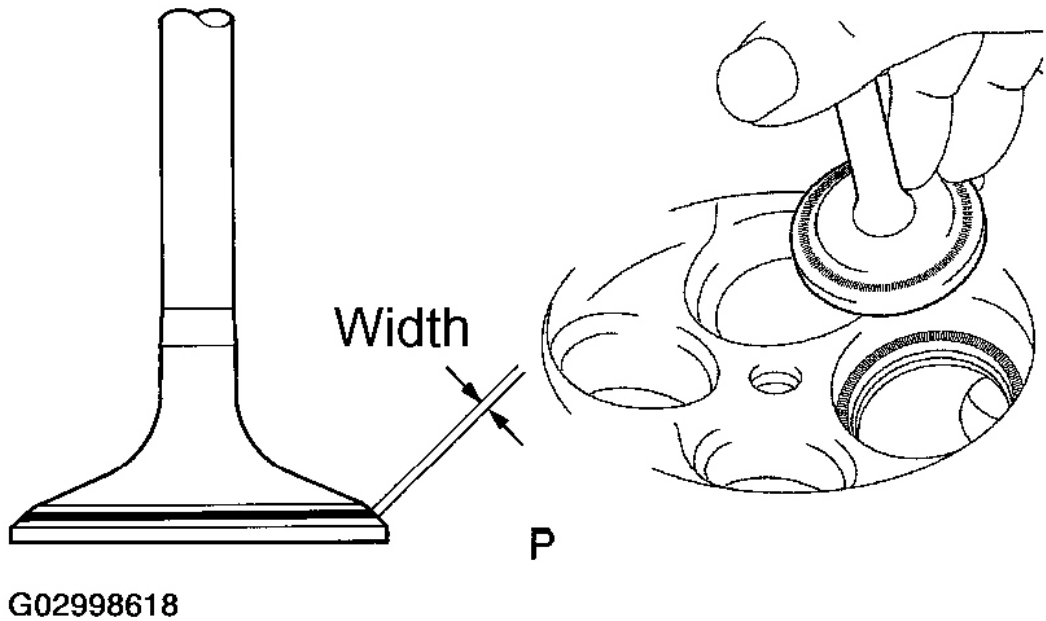
### 15. INSPECT INTAKE VALVE SEAT

- a. Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



**Fig. 351: Checking Intake Valve Seat Identify**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

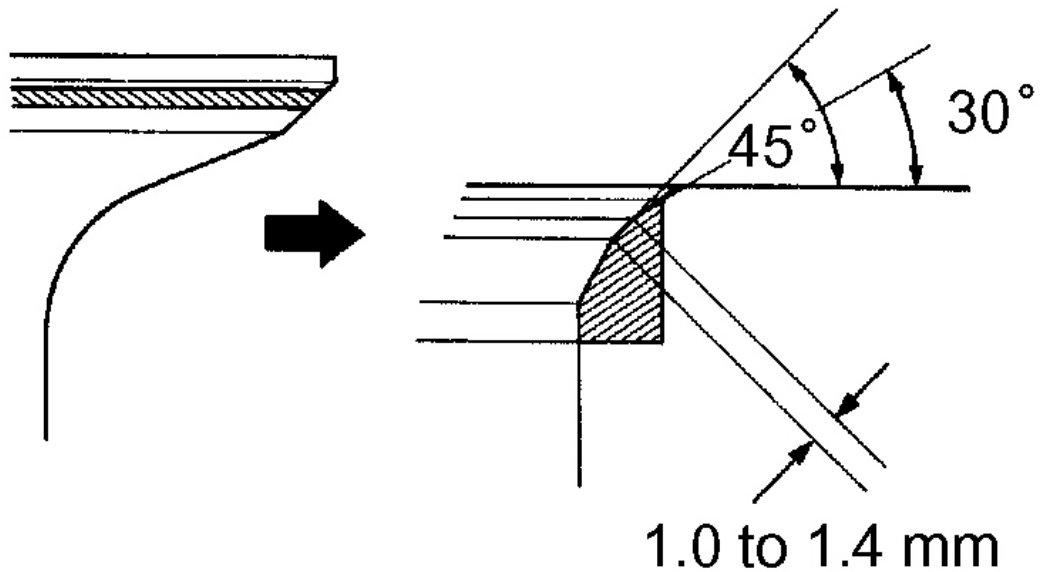
- b. Check the valve seating position.
  1. Apply a light coat of Prussian blue (or white lead) to the valve face.
  2. Lightly press the valve against the seat. Do not rotate the valve.
- c. Check the valve face and seat for the following:
  1. If blue appears 360° around the face, the valve is concentric. If not, replace the valve.



**Fig. 352: Checking Valve Seating Position**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
3. Check that the seat contact is in the middle of the valve face and has the width below.

**Width: 1.0 to 1.4 mm (0.039 to 0.055 in.)**



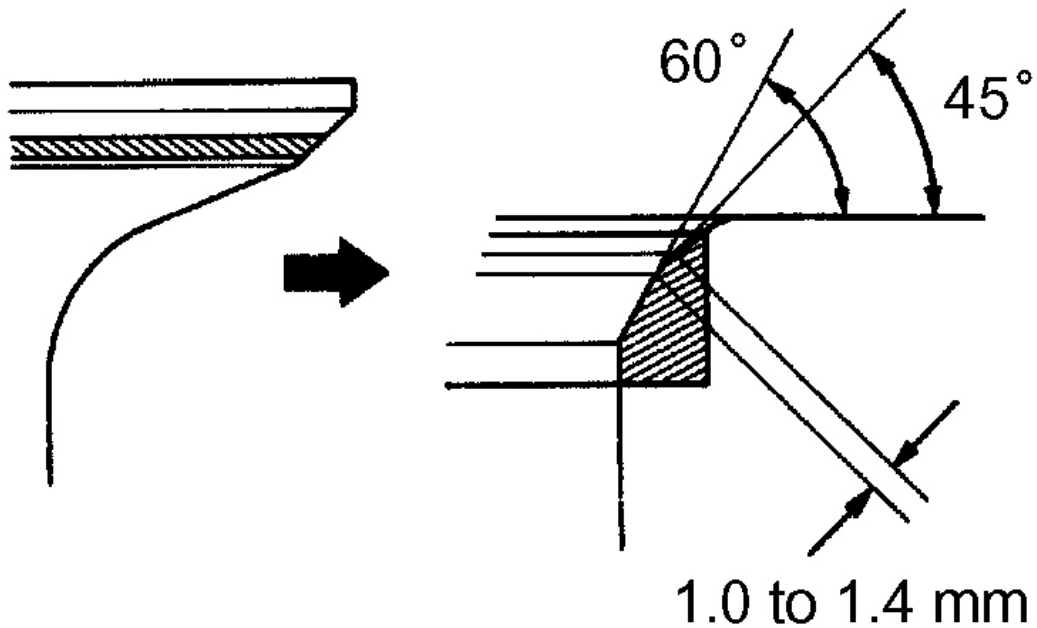
G02998619

**Fig. 353: Checking Seat Contact Surface (1 Of 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If not, correct the intake valve seats as follows:

- d. If the seating is too high on the valve face: Use 30° and 45° cutters to correct the seat.
- e. If the seating is too low on the valve face: Use 60° and 45° cutters to correct the seat.



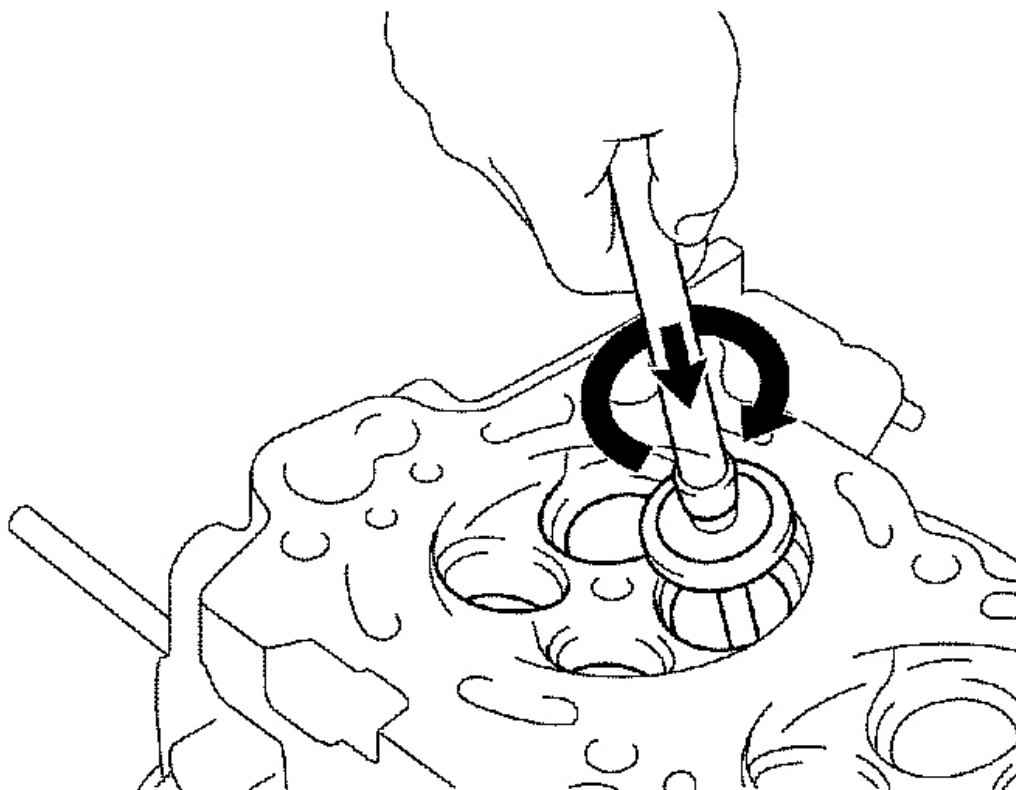


G02998620

**Fig. 354: Checking Seat Contact Surface (2 Of 2)**

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

- f. Handrub the valve and valve seat with an abrasive compound.
- g. After handrubbing, clean the valve and valve seat.

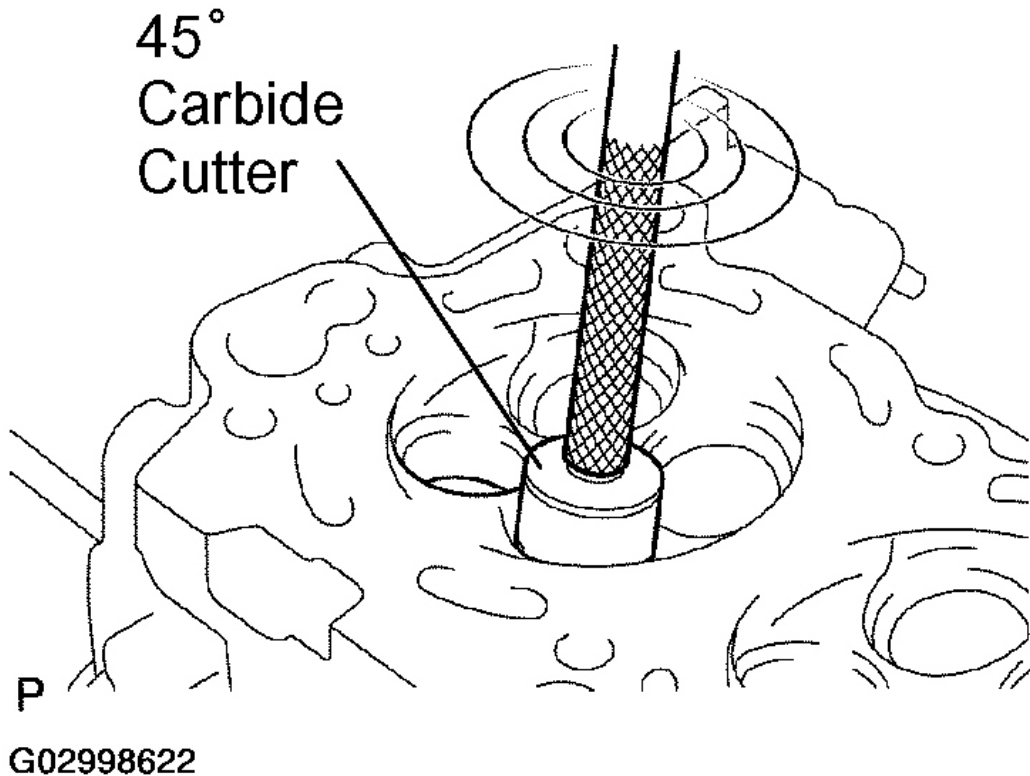


**G02998621**

**Fig. 355: Cleaning Valve And Valve Seat**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**16. INSPECT EXHAUST VALVE SEAT**

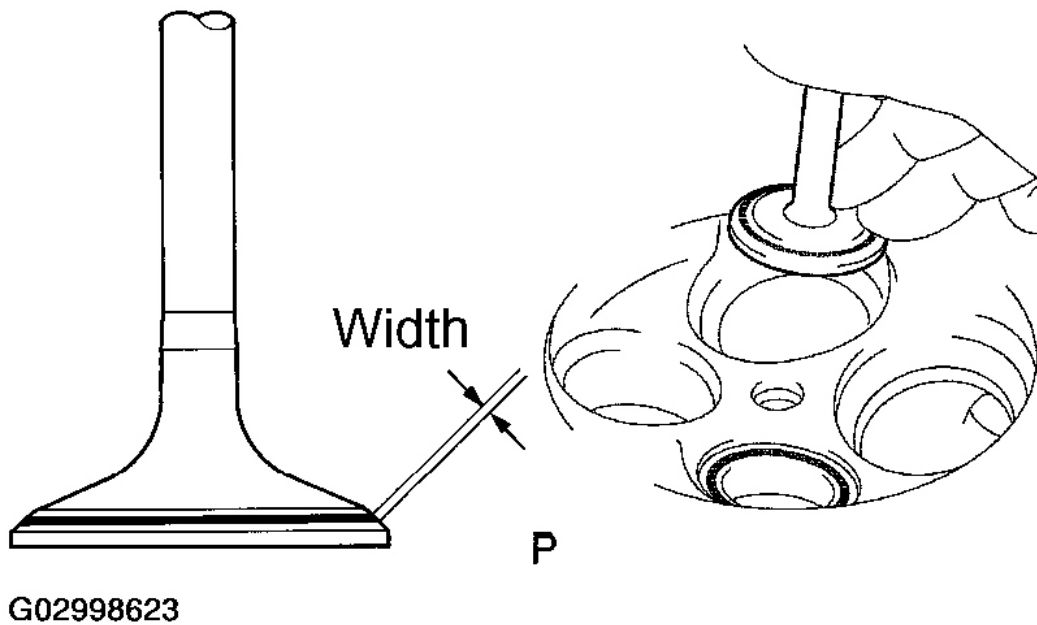
- a. Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



**Fig. 356: Inspecting Exhaust Valve Seat**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check the valve seating position.
  1. Apply a light coat of Prussian blue (or white lead) to the valve face.
  2. Lightly press the valve against the seat. Do not rotate valve.
- c. Check the valve face and seat for the following:
  1. If blue appears 360° around the valve face, the valve seat is concentric. If not, replace the valve.
  2. If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
  3. Check that the seat contact is in the middle of the valve face and has the width below.

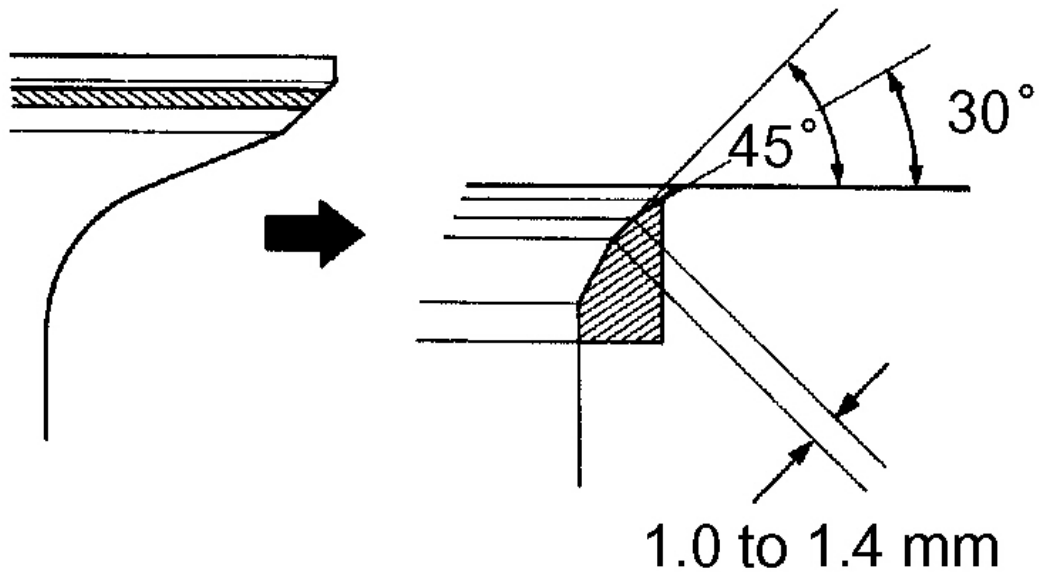
**Width: 1.0 to 1.4 mm (0.039 to 0.055 in.)**



**Fig. 357: Checking Valve Seating Position**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If not, correct the exhaust valve seats as follows:

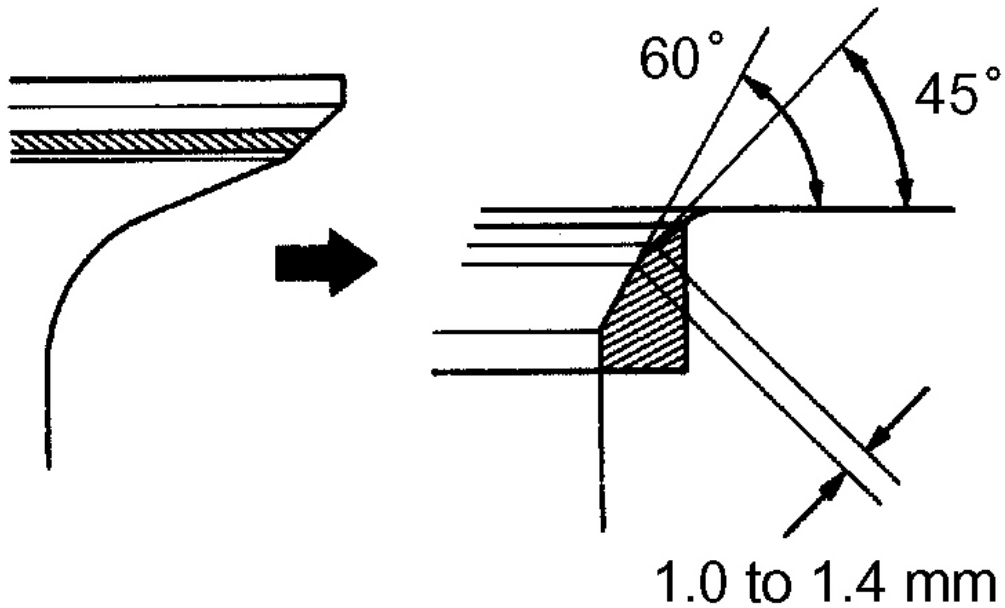
- d. If the seating is too high on the valve face: Use 30° and 45° cutters to correct the seat.



G02998624

**Fig. 358: Identifying Cutters Angel Seating Position (To High)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

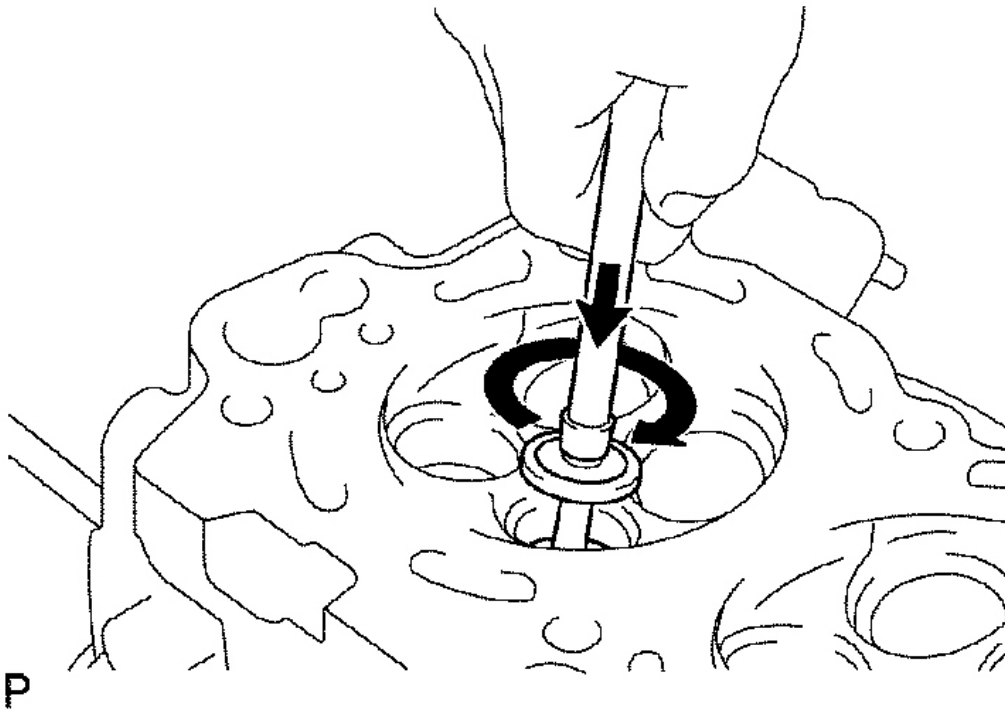
- e. If the seating is too low on the valve face: Use 60° and 45° cutters to correct the seat.



G02998625

**Fig. 359: Identifying Cutters Angel Seating Position (Lo High)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Handrub the valve and valve seat with an abrasive compound.
- g. After handrubbing, clean the valve and valve seat.



P

G02998626

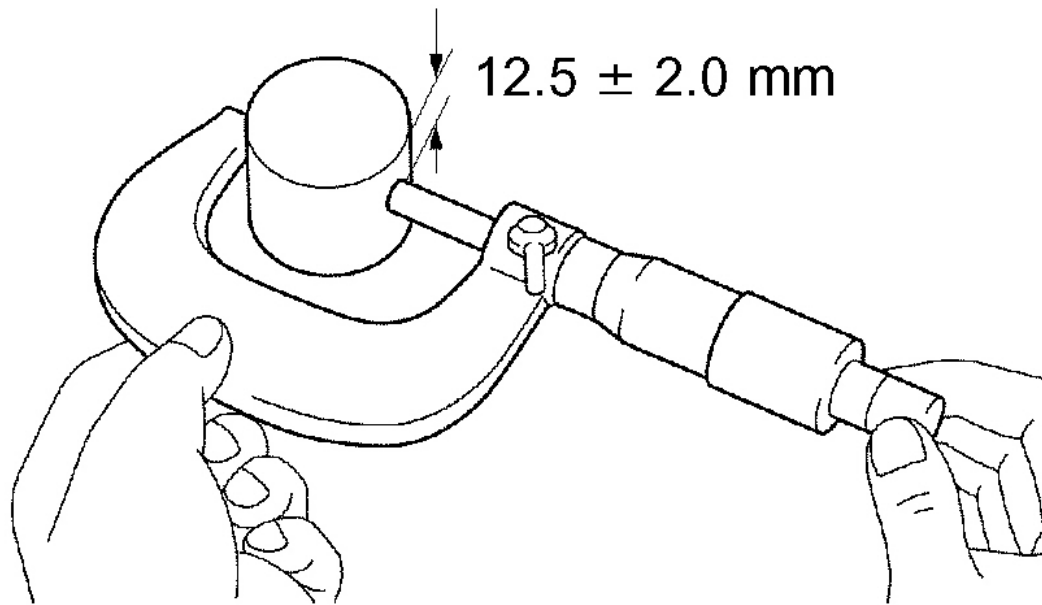
**Fig. 360: Cleaning Valve And Valve Seat**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 17. INSPECT VALVE LIFTER

- a. Using a micrometer, measure the lifter diameter at the  $12.5 \pm 2.0$  mm ( $0.492 \pm 0.079$  in.) from the top surface.

**Lifter diameter: 30.966 to 30.978 mm (1.2191 to 1.2196 in.)**

If the lifter diameter is not as specified, check the oil clearance.



G02998627

**Fig. 361: Measuring Lifter Diameter Using Micrometer**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

**Lifter bore diameter: 31.000 to 31.016 mm (1.2205 to 1.2211 in.)**

If the lifter diameter is not as specified, check the oil clearance.

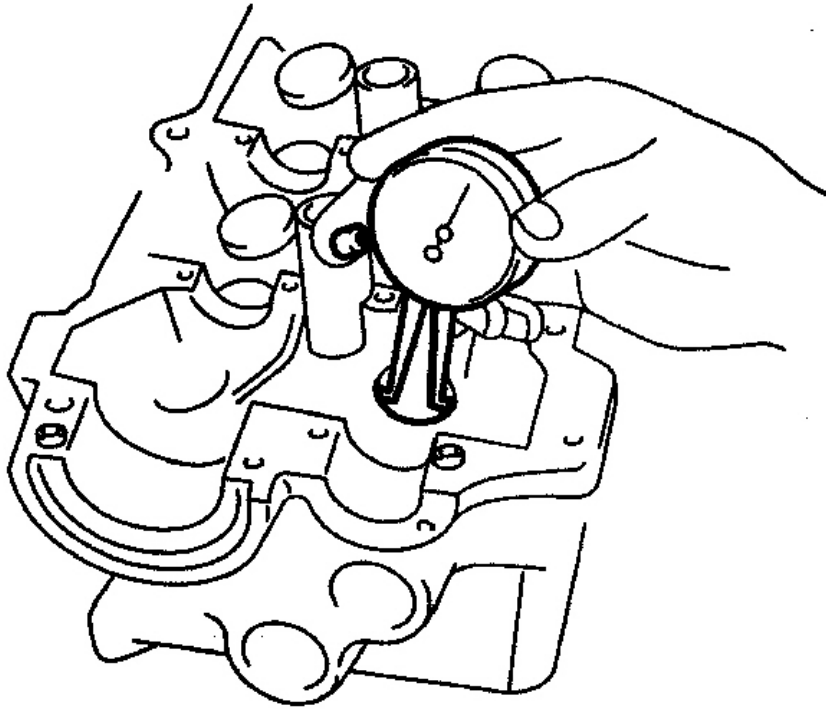
- c. Subtract the lifter diameter measurement from the lifter bore diameter measurement.

**Standard oil clearance: 0.024 to 0.048 mm (0.0009 to 0.0018 in.)**

**Maximum oil clearance: 0.07 mm (0.0028 in.)**

If the oil clearance is greater than the maximum, replace the lifter. If necessary, replace the cylinder head.





G02998628

**Fig. 362: Measuring Lifter Bore Diameter Of Cylinder Head Using Caliper Gauge**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

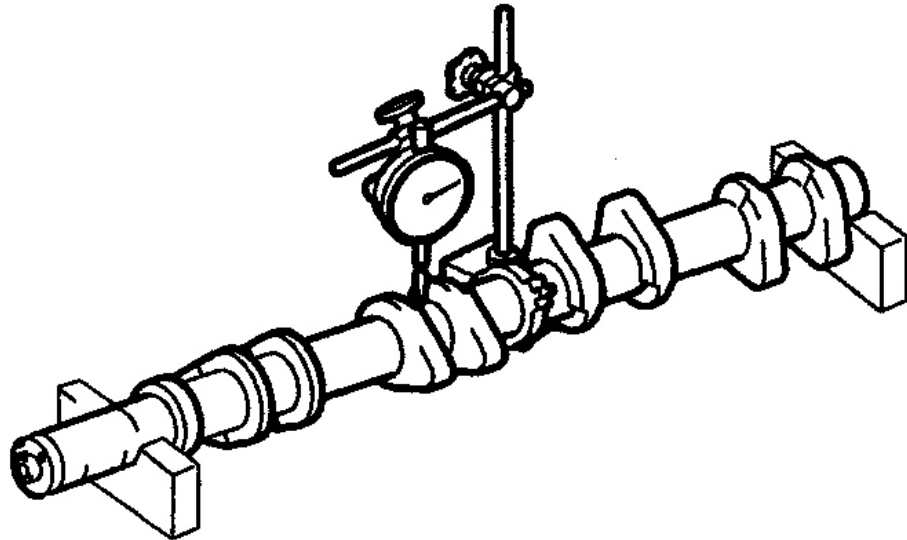
## 18. INSPECT CAMSHAFT

- a. Inspect the circle runout.
  1. Place the camshaft on V-blocks.
  2. Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.08 mm (0.0031 in.)**

If the circle runout is greater than the maximum, replace the camshaft.

# Intake of RH Bank



G02998629

**Fig. 363: Measuring Circle Runout At Center Journal Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

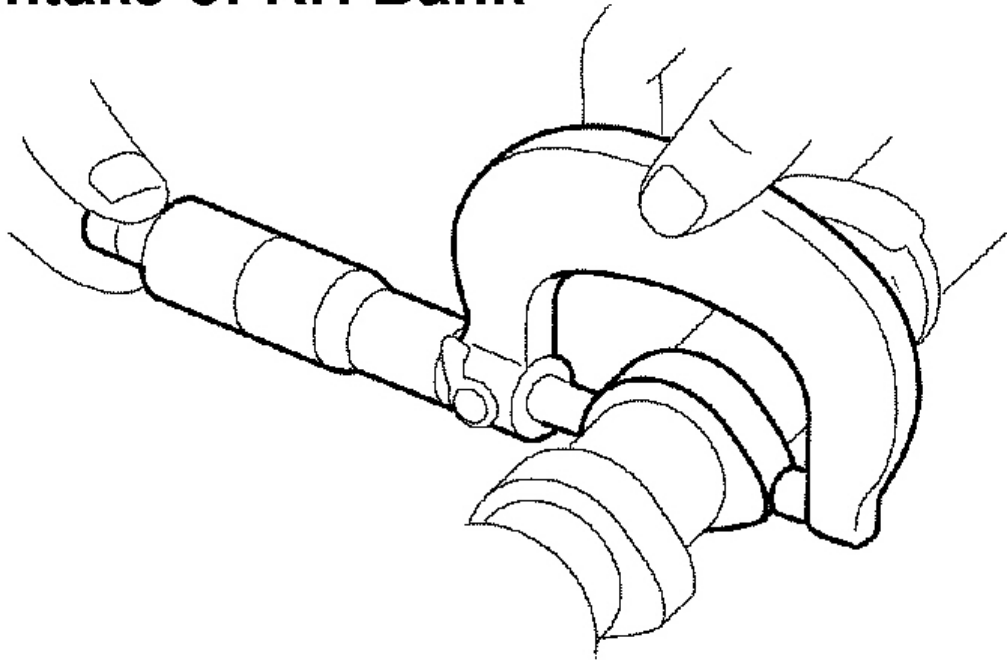
- b. Using a micrometer, measure the cam lobe height.

**Standard cam lobe height: 42.610 to 42.710 mm (1.6776 to 1.6815 in.)**

**Minimum cam lobe height: 42.46 mm (1.6717 in.)**

If the cam lobe height is less than the minimum, replace the camshaft.

# Intake of RH Bank



G02998630

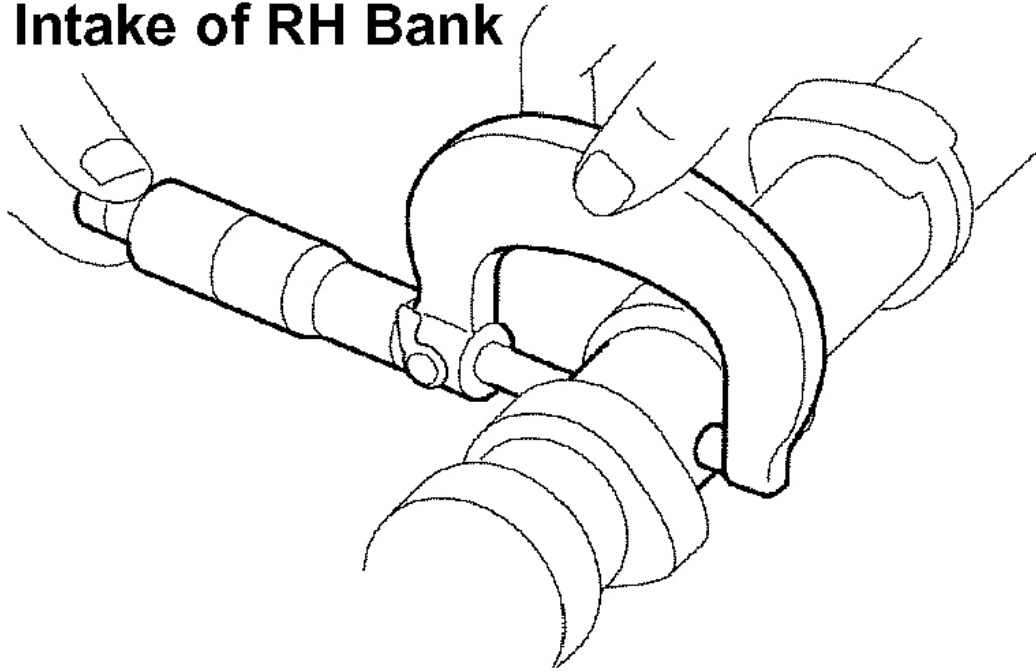
**Fig. 364: Measuring Cam Lobe Height Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect the journal diameter of the camshaft.
  - 1. Using a micrometer, measure the journal diameter of the camshaft for the camshaft bearing.

**Journal diameter: 26.954 to 26.970 mm (1.0612 to 1.0618 in.)**

If the journal diameter is not as specified, check the oil clearance.

## Intake of RH Bank



G02998631

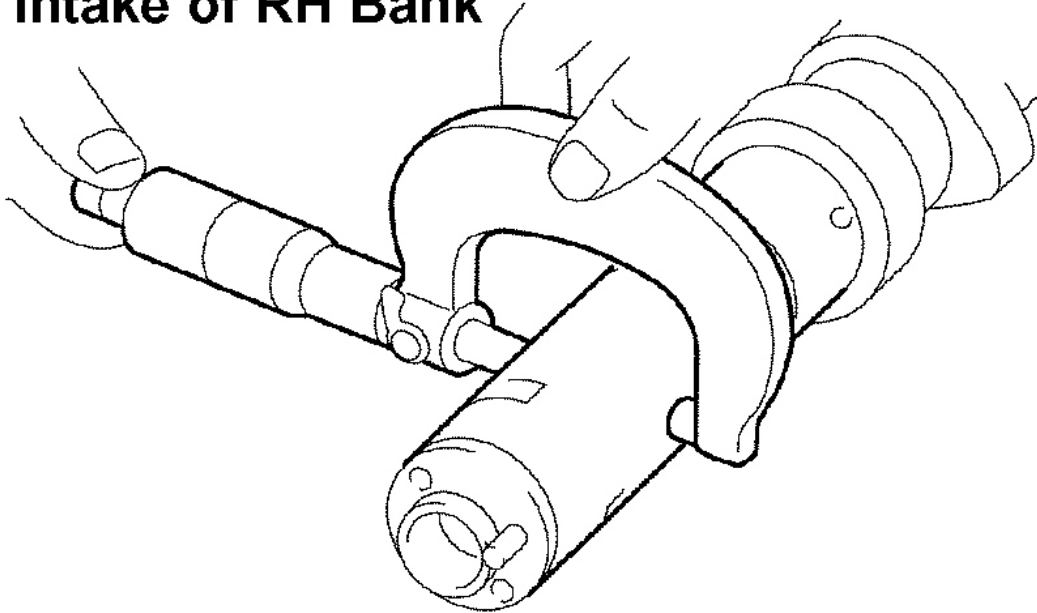
**Fig. 365: Measuring Journal Diameter Of Camshaft Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a micrometer, measure the journal diameter for the camshaft timing tube.

**Journal diameter: 30.984 to 31.000 mm (1.2198 to 1.2205 in.)**

If the journal diameter is not as specified, check the oil clearance.

## Intake of RH Bank



G02998632

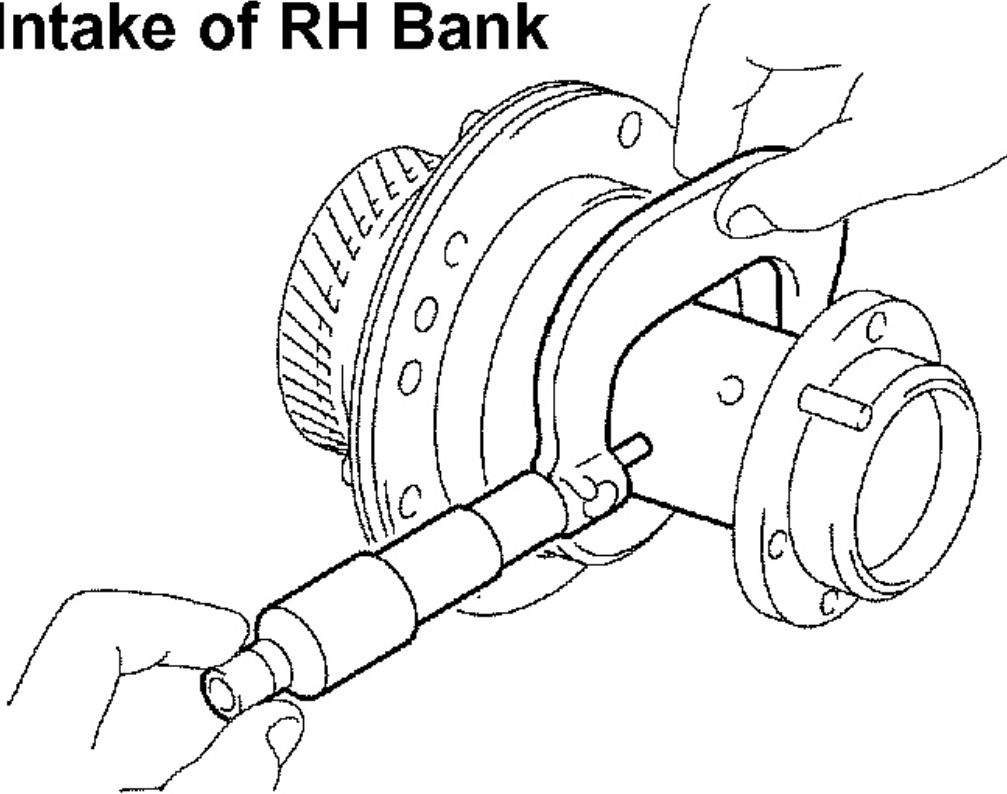
**Fig. 366: Measuring Journal Diameter Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Inspect the journal diameter of the camshaft timing tube.
  1. Using a micrometer, measure the journal diameter.

**Journal diameter: 39.955 to 39.964 mm (1.5730 to 1.5734 in.)**

If the journal diameter is not as specified, check the oil clearance.

# Intake of RH Bank



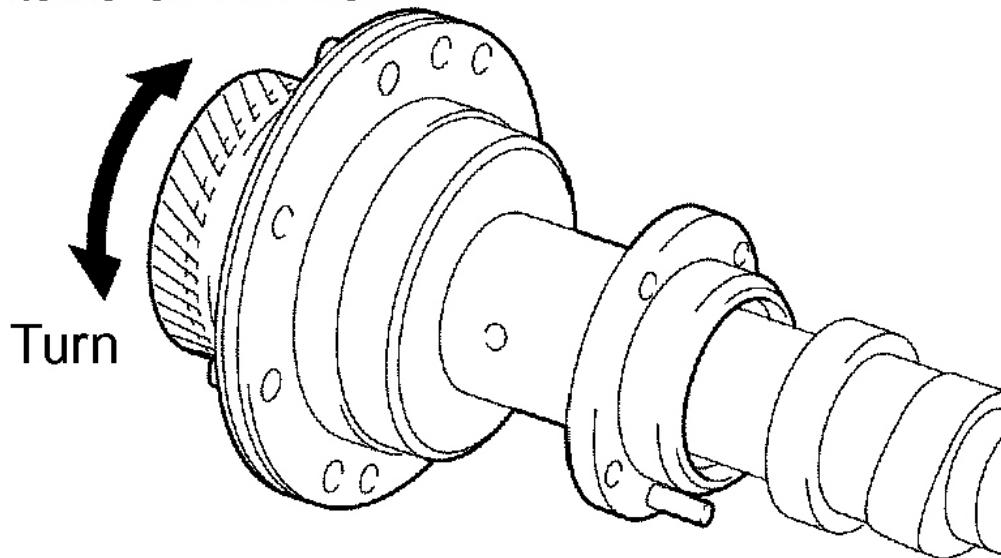
G02998633

**Fig. 367: Measuring Journal Diameter Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the camshaft timing tube to the camshaft, and check that the timing tube turns smoothly.

If necessary, replace the timing tube and camshaft.

## Intake of RH Bank



G02998634

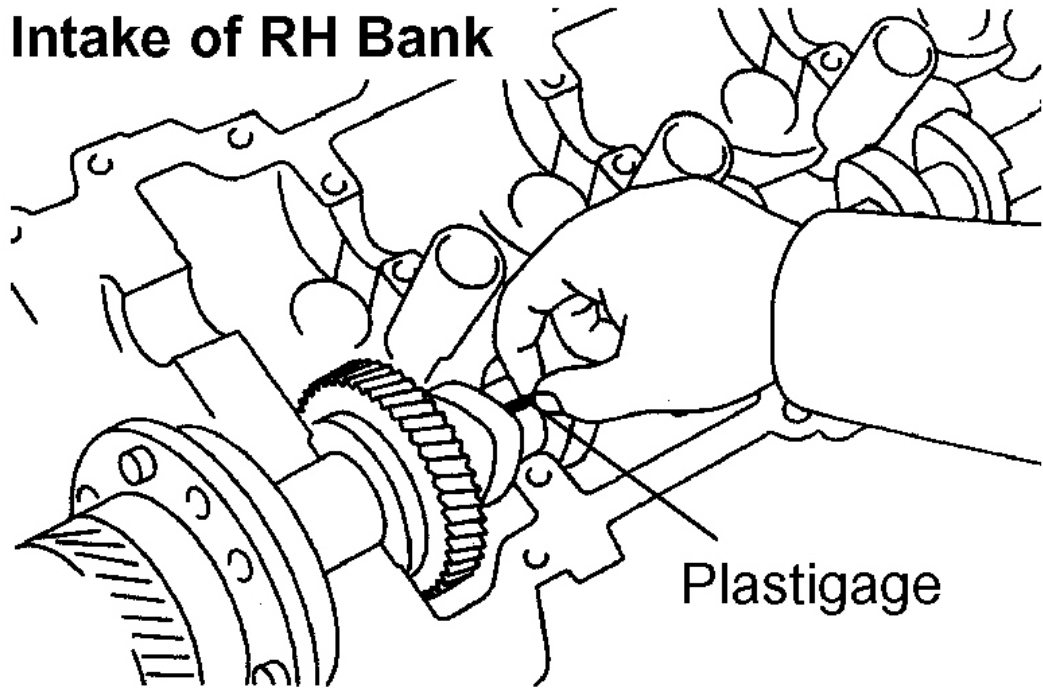
**Fig. 368: Installing Camshaft Timing Tube**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Check the oil clearance.
  1. Install the camshaft timing tube to the camshaft (see **OVERHAUL** ).
  2. Clean the bearing caps and journals.
  3. Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

4. Place the camshaft on the cylinder head.
5. Lay a strip of Plastigage across each of the journals.
6. Install the bearing caps (see **OVERHAUL** ).

## Intake of RH Bank



G02998635

### Fig. 369: Identifying Plastigage

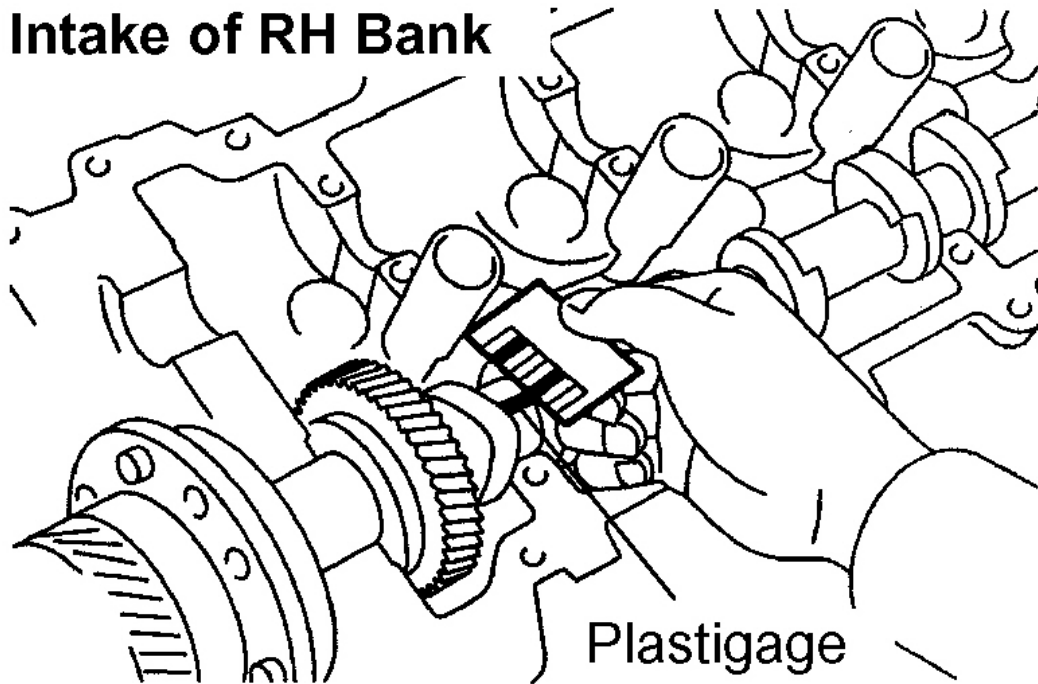
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** Do not turn the camshaft.

7. Remove the bearing caps.
8. Measure the Plastigage at its widest point.



## Intake of RH Bank



G02998636

**Fig. 370: Measuring Plastigage At Widest Point**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### STANDARD OIL CLEARANCE:

#### OIL CLEARANCE SPECIFICATIONS

Camshaft journal	0.030 to 0.067 mm (0.0012 to 0.0026 in.)
Camshaft timing tube journal	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

### MAXIMUM OIL CLEARANCE:

#### MAXIMUM OIL CLEARANCE SPECIFICATIONS

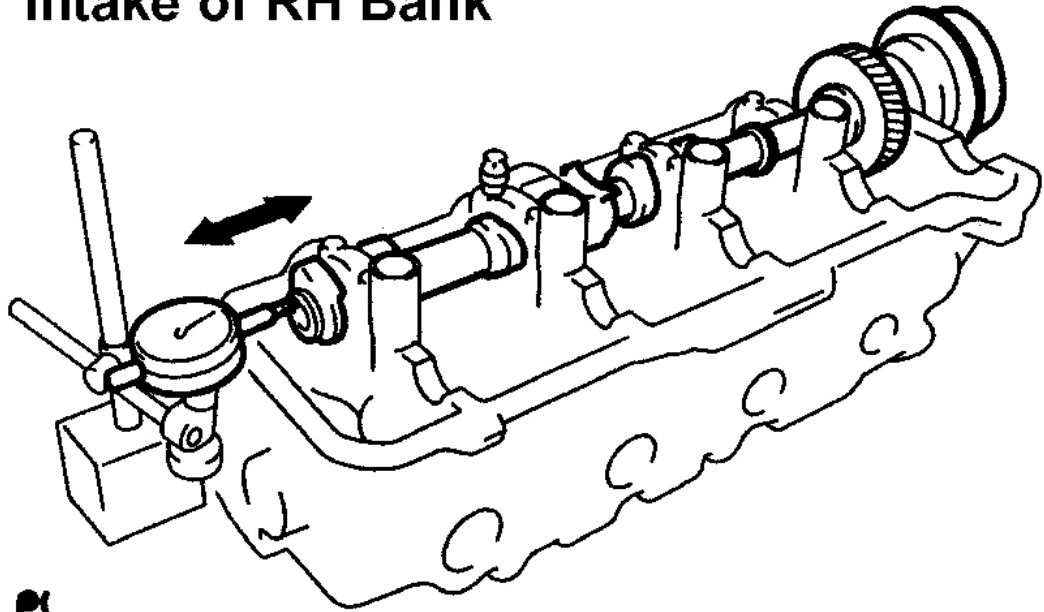
Camshaft journal	0.100 mm (0.0039 in.)
Camshaft timing tube journal	0.085 mm (0.0033 in.)

If the oil clearance is greater than the maximum, replace the camshaft and timing tube. If necessary, replace the bearing caps and cylinder head as a set.

9. Completely remove the Plastigage.
10. Remove the camshaft.

11. Remove the camshaft timing tube from the camshaft.

## Intake of RH Bank



G02998637

**Fig. 371: Measuring Thrust Clearance Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Check the thrust clearance.
  1. Install the camshaft timing tube to the camshaft (see OVERHAUL ).
  2. Install the camshaft (see OVERHAUL ).
  3. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance: 0.060 to 0.100 mm (0.0024 to 0.0039 in.) Maximum thrust clearance: 0.13 mm (0.0051 in.)**

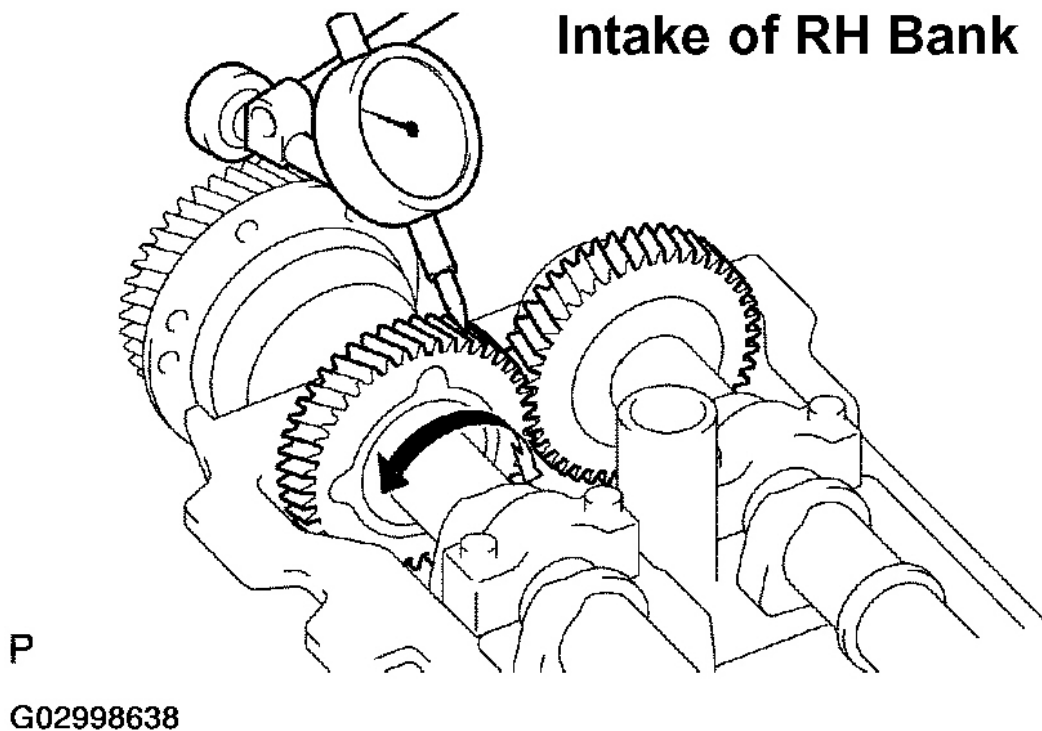
If the thrust clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

4. Remove the camshaft.
  5. Remove the camshaft timing tube from the camshaft.
- h. Check the gear backlash.
    1. Install the drive gear to the camshaft timing tube (see OVERHAUL ).

2. Install the camshaft timing tube to the camshaft (see **OVERHAUL** ).
3. Install the camshaft and No. 2 camshaft without installing the camshaft sub-gear and front bearing cap (see **OVERHAUL** ).
4. Using a dial indicator, measure the backlash.

**Standard backlash: 0.020 to 0.200 mm (0.0008 to 0.0079 in.)**

**Maximum backlash: 0.30 mm (0.0188 in.)**



**Fig. 372: Measuring Backlash Using Dial Indicator**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

If the backlash is greater than the maximum, replace the drive gear and No. 2 camshaft.

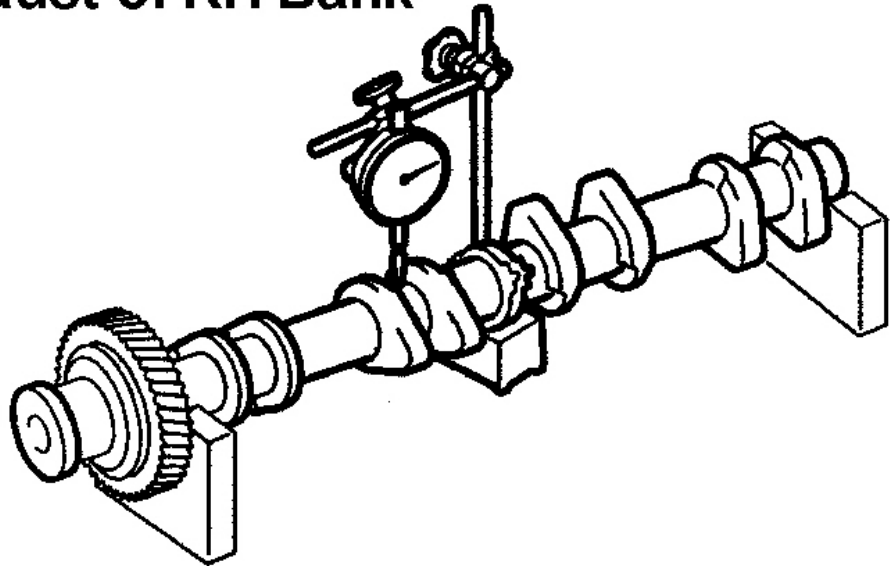
- a. Remove the camshaft and No. 2 camshaft.
  - b. Remove the camshaft timing tube from the camshaft.
  - c. Remove the drive gear from the camshaft timing tube.
- i. INSPECT NO.2 CAMSHAFT**
- a. Inspect the circle runout.
    1. Place the camshaft on V-blocks.

2. Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.08 mm (0.0031 in.)**

If the circle runout is greater than the maximum, replace the No. 2 camshaft.

## Exhaust of RH Bank



G02998639

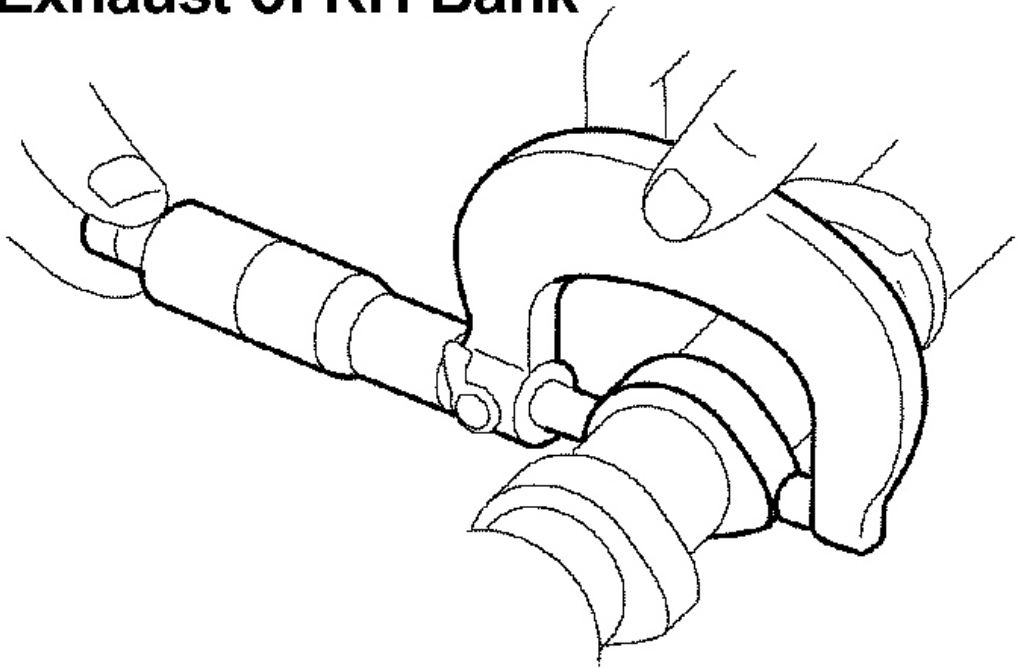
**Fig. 373: Measuring Circle Runout Center Journal Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a micrometer, measure the cam lobe height.

**Standard cam lobe height: 42.630 to 42.730 mm (1.6783 to 1.6823 in.) Minimum cam lobe height: 42.48 mm (1.6724 in.)**

If the cam lobe height is less than the minimum, replace the No. 2 camshaft.

## Exhaust of RH Bank



G02998640

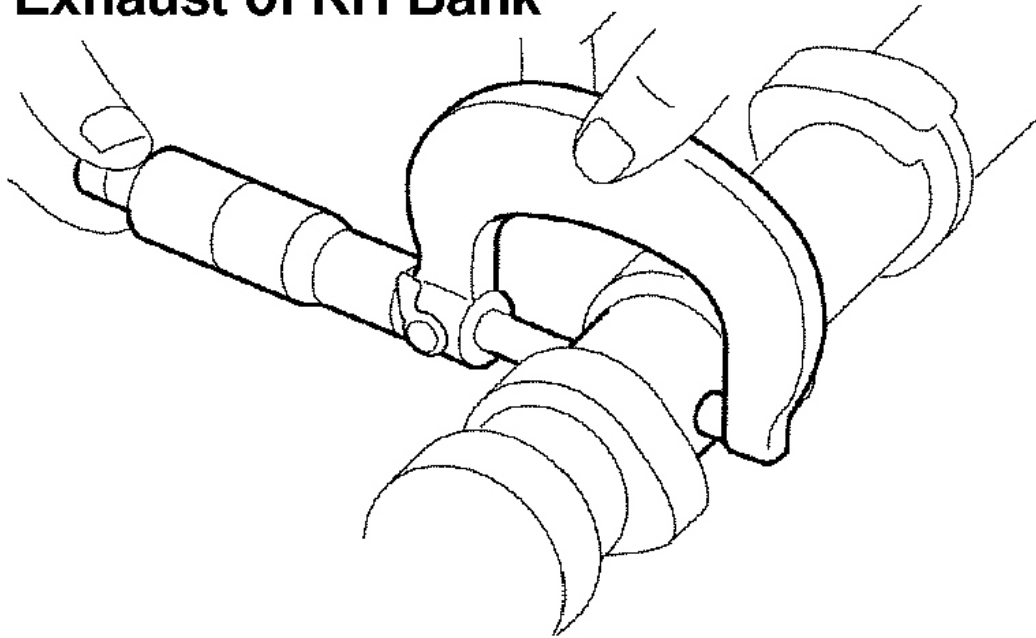
**Fig. 374: Measuring Cam Lobe Height Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a micrometer, measure the journal diameter.

**Journal diameter: 26.954 to 26.970 mm (1.0612 to 1.0618 in.)**

If the journal diameter is not as specified, check the oil clearance.

## Exhaust of RH Bank



G02998641

**Fig. 375: Measuring Journal Diameter Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

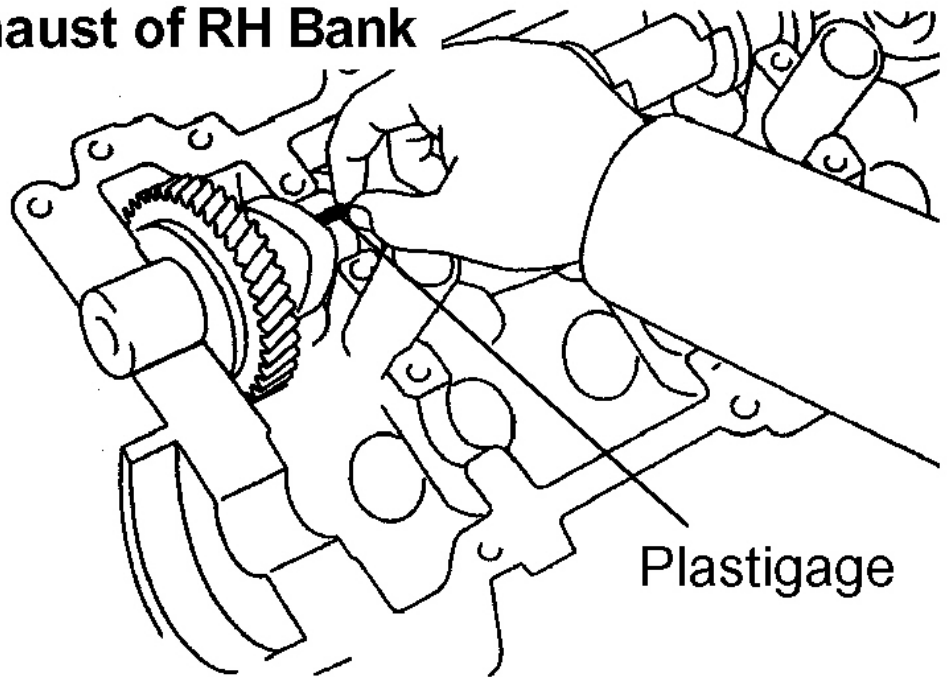
- d. Check the oil clearance.
1. Clean the bearing caps and journals.
  2. Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

3. Place the No. 2 camshaft on the cylinder head.
4. Lay a strip of Plastigage across each of the journals.
5. Install the bearing caps (see **OVERHAUL** ).

**NOTE:** Do not turn the No. 2 camshaft.

## Exhaust of RH Bank



G02998642

### Fig. 376: Checking Oil Clearance

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

6. Remove the bearing caps.
7. Measure the Plastigage at its widest point.

#### **Standard oil clearance:**

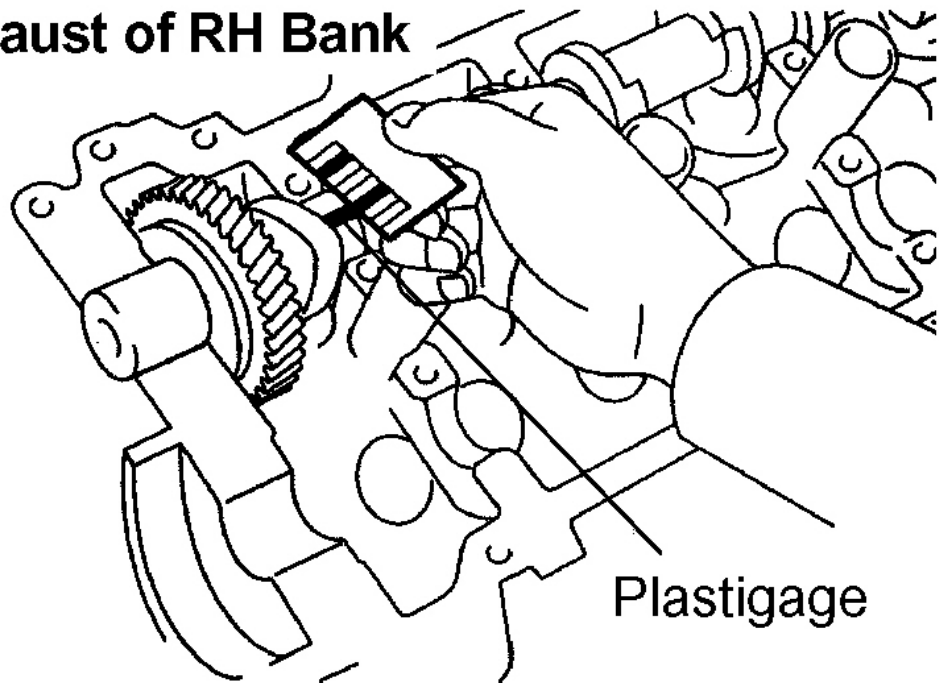
**0.030 to 0.067 mm (0.0012 to 0.0026 in.)**

**Maximum oil clearance: 0.100 mm (0.0039 in.)**

If the oil clearance is greater than the maximum, replace the No. 2 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

8. Completely remove the Plastigage.
9. Remove the No. 2 camshaft.

## Exhaust of RH Bank



G02998643

**Fig. 377: Measuring Plastigage At Widest Point**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Check the thrust clearance.
  1. Install the camshaft (see **OVERHAUL** ).
  2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance:**

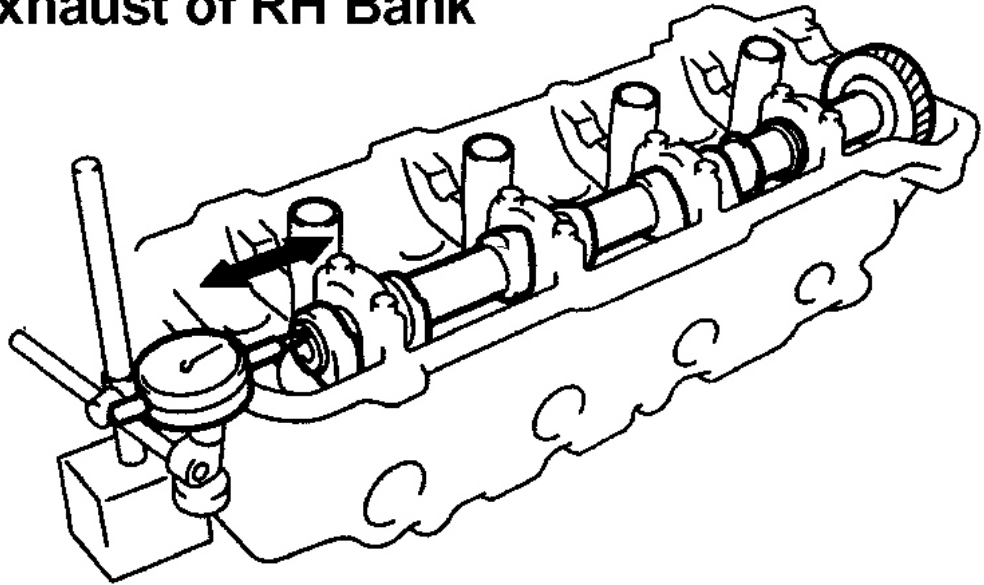
**0.030 to 0.075 mm (0.0012 to 0.0030 in.)**

**Maximum thrust clearance: 0.12 mm (0.0047 in.)**

If the thrust clearance is greater than the maximum, replace the No. 2 camshaft. If necessary, replace the bearing caps and cylinder head as a set.



## Exhaust of RH Bank



G02998644

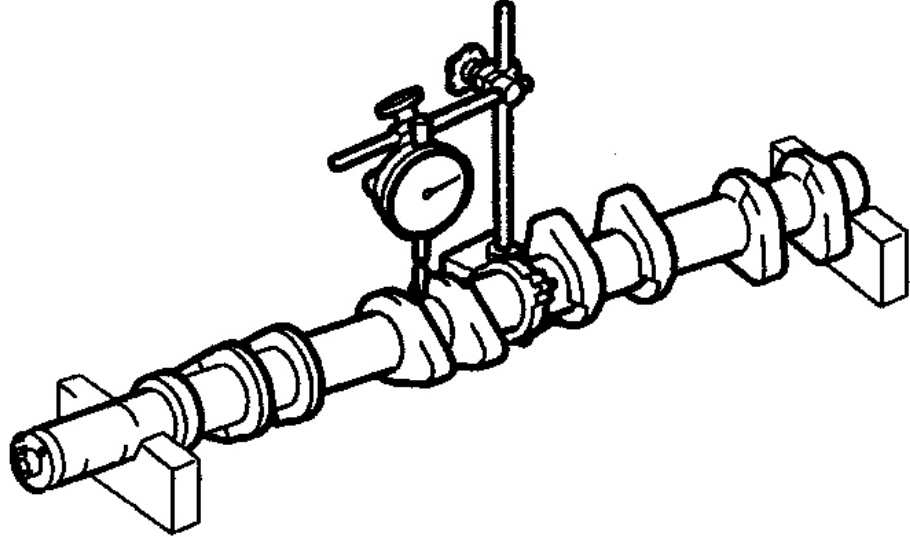
**Fig. 378: Measuring Thrust Clearance Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Remove the No. 2 camshaft.
- j. **INSPECT NO.3 CAMSHAFT SUB-ASSY**
  - a. Inspect the circle runout.
    1. Place the camshaft on V-blocks.
    2. Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.08 mm (0.0031 in.)**

If the circle runout is greater than the maximum, replace the No. 3 camshaft.

## Intake of LH Bank



G02998645

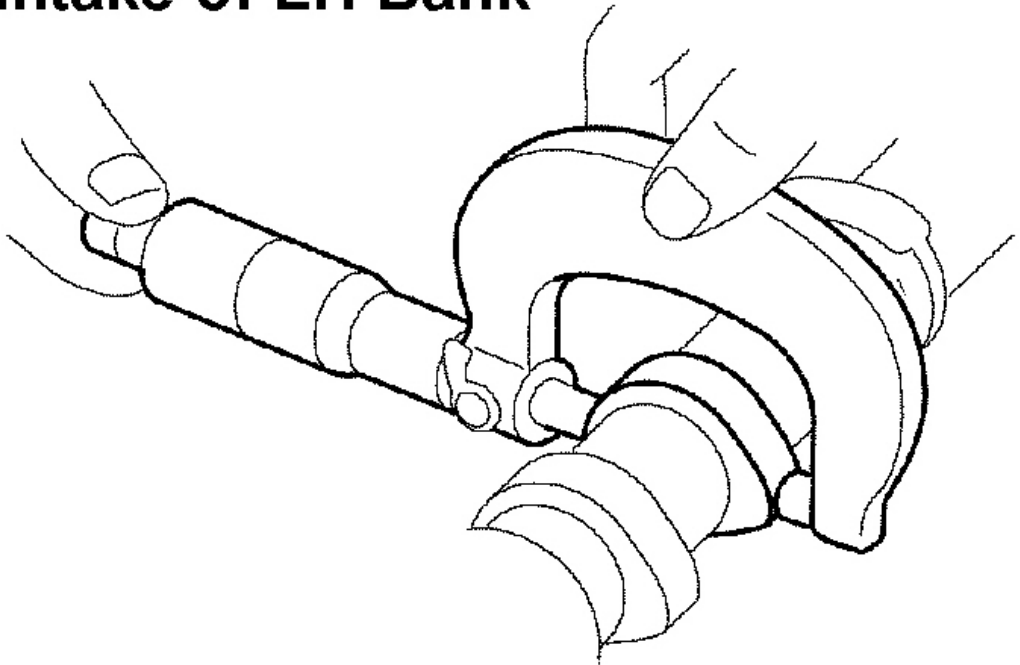
**Fig. 379: Measuring Circle Runout Center Journal Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the cam lobe height.

**Standard cam lobe height: 42.610 to 42.710 mm (1.6776 to 1.6815 in.) Minimum cam lobe height: 42.46 mm (1.6717 in.)**

If the cam lobe height is less than the minimum, replace the No. 3 camshaft.

# Intake of LH Bank



G02998646

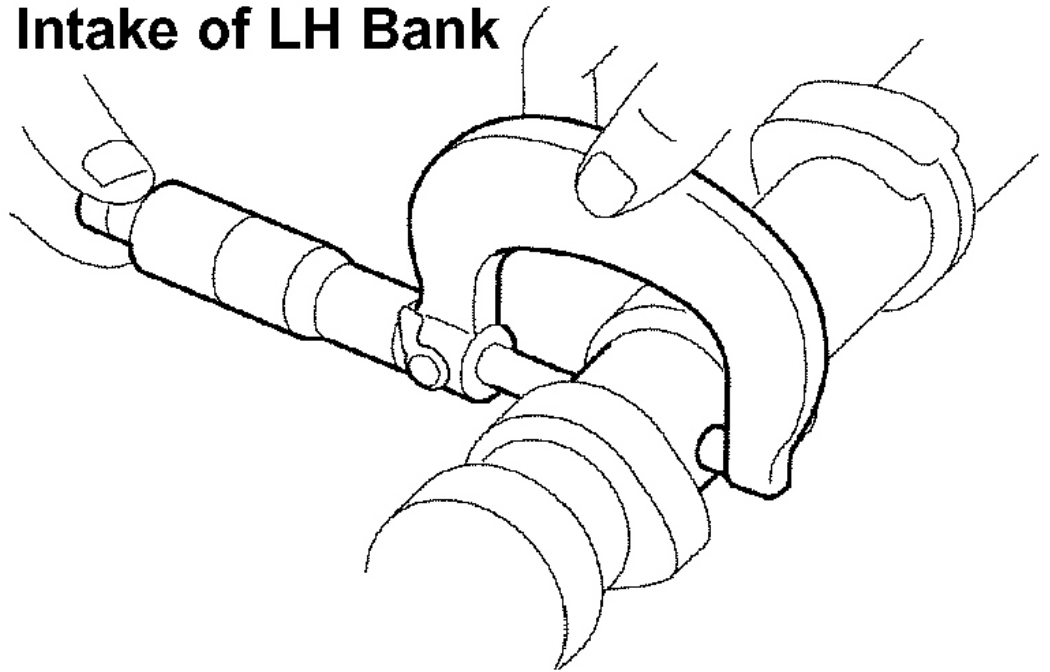
**Fig. 380: Measuring Cam Lobe Height Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect the journal diameter of the camshaft.
  1. Using a micrometer, measure the journal diameter of the No. 3 camshaft for the camshaft bearing.

**Journal diameter: 26.954 to 26.970 mm (1.0612 to 1.0618 in.)**

If the journal diameter is not as specified, check the oil clearance.

## Intake of LH Bank



G02998647

**Fig. 381: Measuring Journal Diameter Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a micrometer, measure the journal diameter for the camshaft timing tube.

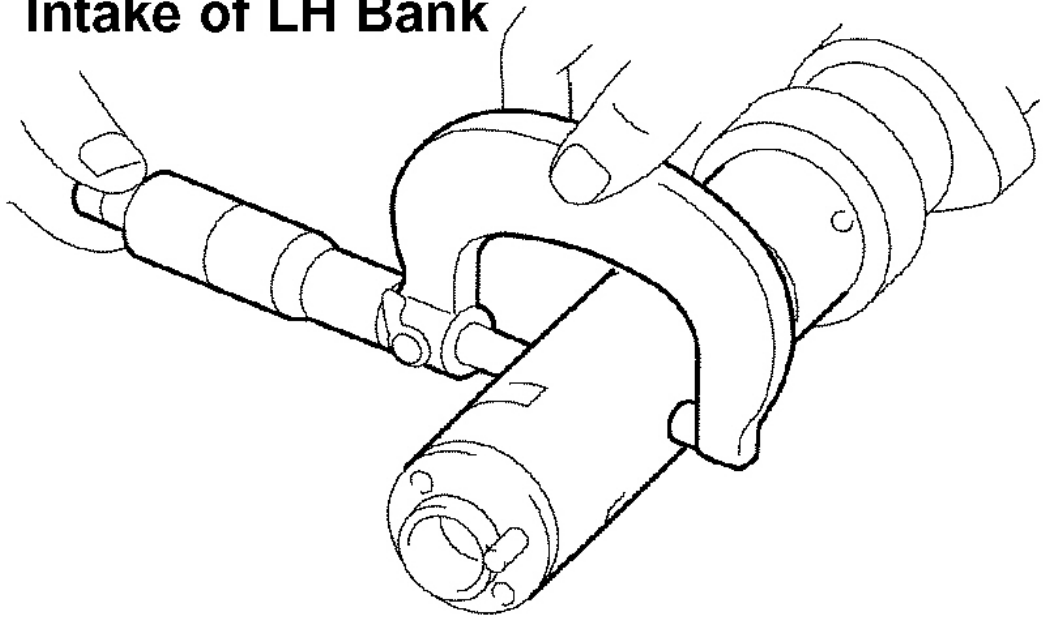
**Journal diameter: 30.984 to 31.000 mm (1.2198 to 1.2205 in.)**

If the journal diameter is not as specified, check the oil clearance.

- d. Inspect the journal diameter of the camshaft timing tube.
  1. Using a micrometer, measure the journal diameter.

**Journal diameter: 39.955 to 39.964 mm (1.5730 to 1.5734 in.)**

## Intake of LH Bank

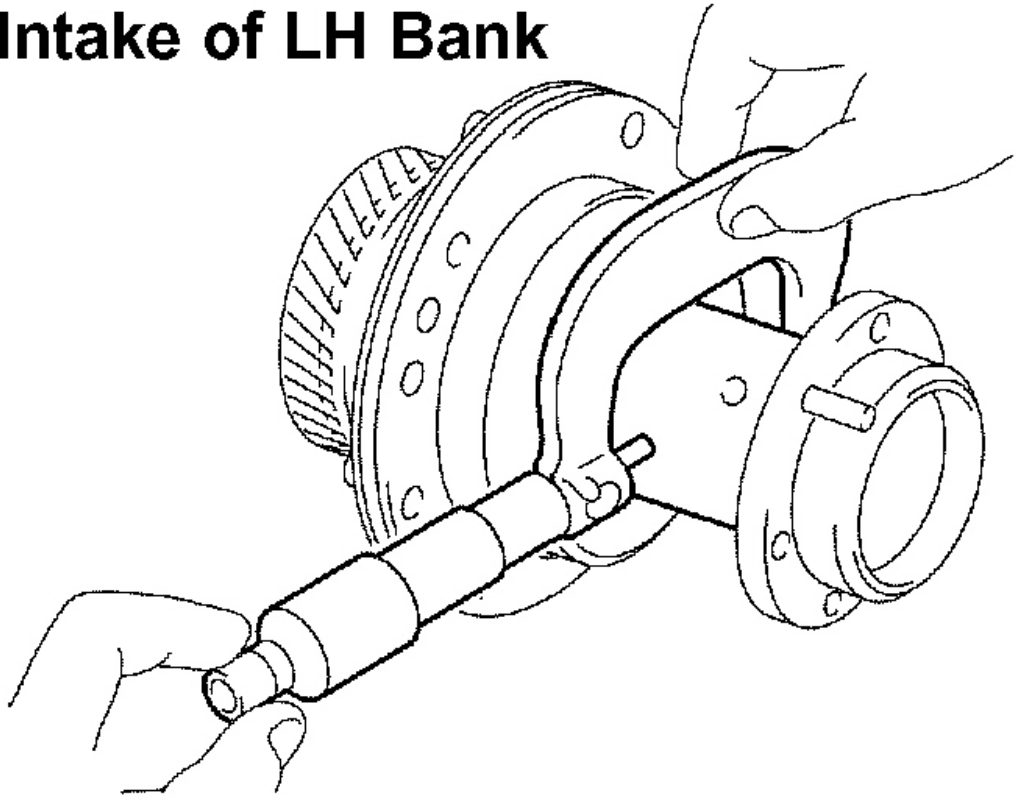


G02998648

**Fig. 382: Measuring Journal Diameter Using Micrometer (1 Of 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the journal diameter is not as specified, check the oil clearance.

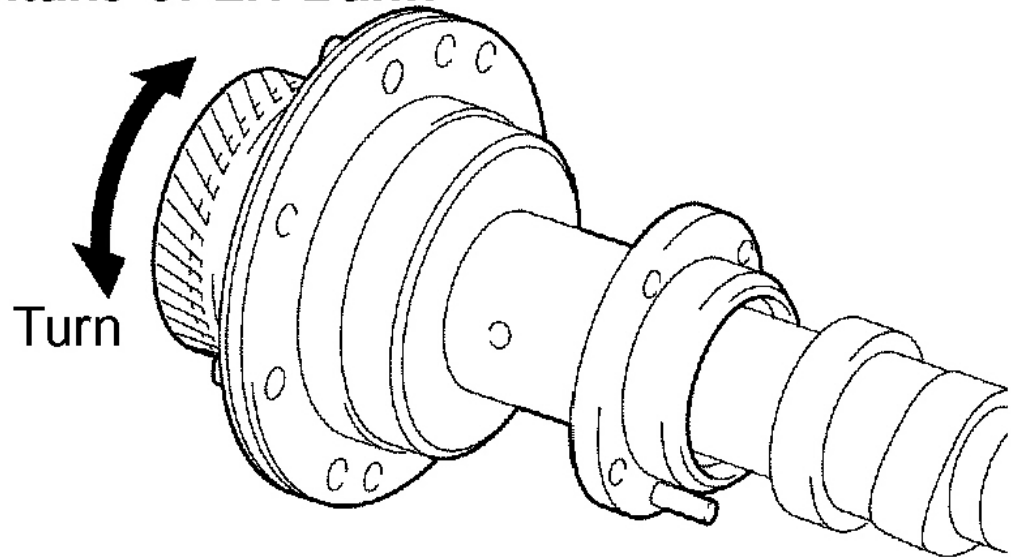
# Intake of LH Bank



G02998649

**Fig. 383: Measuring Journal Diameter Using Micrometer ( Of 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## Intake of LH Bank



G02998650

**Fig. 384: Checking Timing Tube Turns Smoothly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the timing tube to the No. 3 camshaft, and check that the timing tube turns smoothly.

If necessary, replace the timing tube and No. 3 camshaft.

- f. Check the oil clearance.

1. Install the camshaft timing tube to the No. 3 camshaft (see **OVERHAUL** ).
2. Clean the bearing caps and journals.
3. Check that bearings for flaking and scoring.

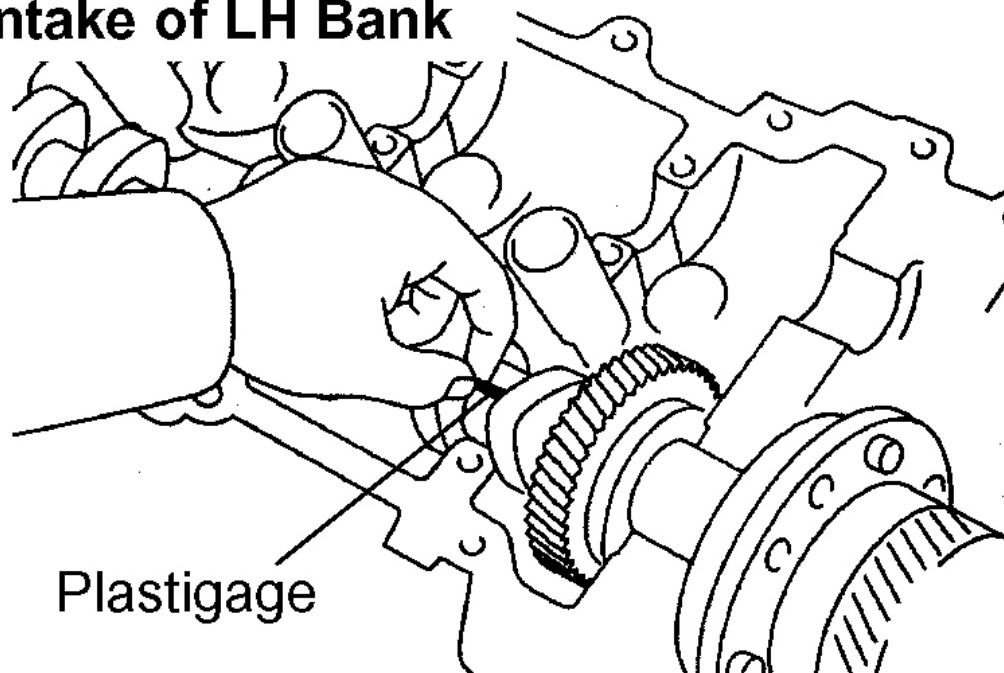
If the bearings are damaged, replace the bearing caps and cylinder head as a set.

4. Place the No. 3 camshaft on the cylinder head.
5. Lay a strip of Plastigage across each of the journals.

Install the bearing caps (see **OVERHAUL** ).

**NOTE:** Do not turn the camshaft.

## Intake of LH Bank



G02998651

### **Fig. 385: Identifying Plastigage**

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

6. Remove the bearing caps.
7. Measure the Plastigage at its widest point.

### **STANDARD OIL CLEARANCE:**

#### **STANDARD OIL CLEARANCE SPECIFICATIONS**

Camshaft journal	0.030 to 0.067 mm (0.0012 to 0.0026 in.)
Camshaft timing tube journal	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

### **MAXIMUM OIL CLEARANCE:**

#### **MAXIMUM OIL CLEARANCE SPECIFICATIONS**

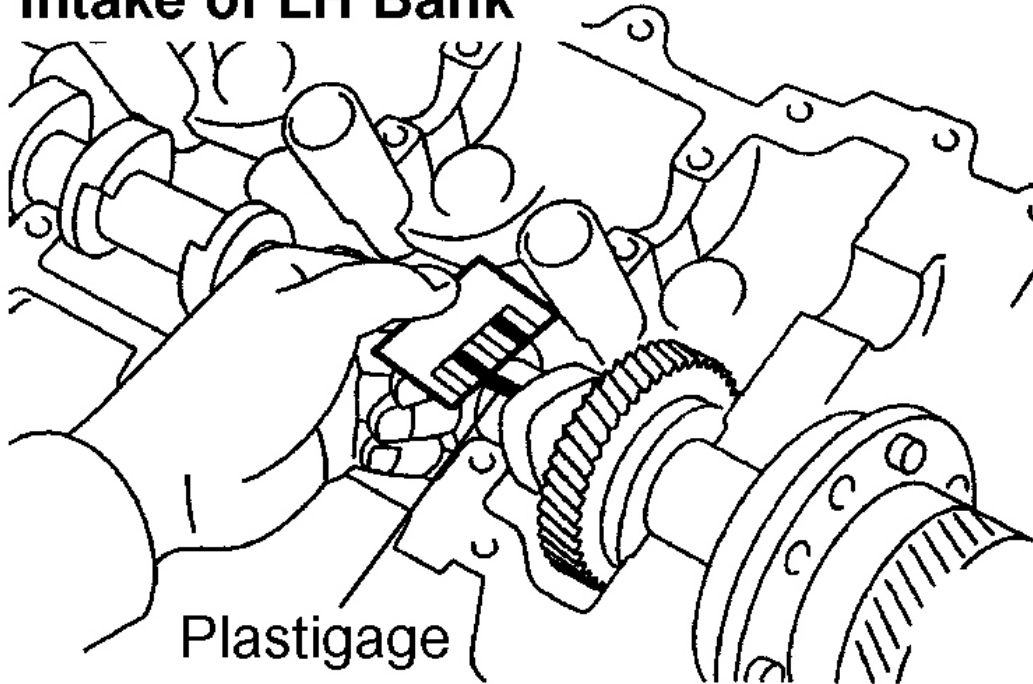
Camshaft journal	0.100 mm (0.0039 in.)
Camshaft timing tube journal	0.085 mm (0.0033 in.)

If the oil clearance is greater than the maximum, replace the No. 3 camshaft and timing tube.  
If necessary, replace the bearing caps and cylinder head as a set.



- g. Completely remove the Plastigage.
- h. Remove the camshaft.
- i. Remove the camshaft timing tube from the No. 3 camshaft.

## Intake of LH Bank



G02998652

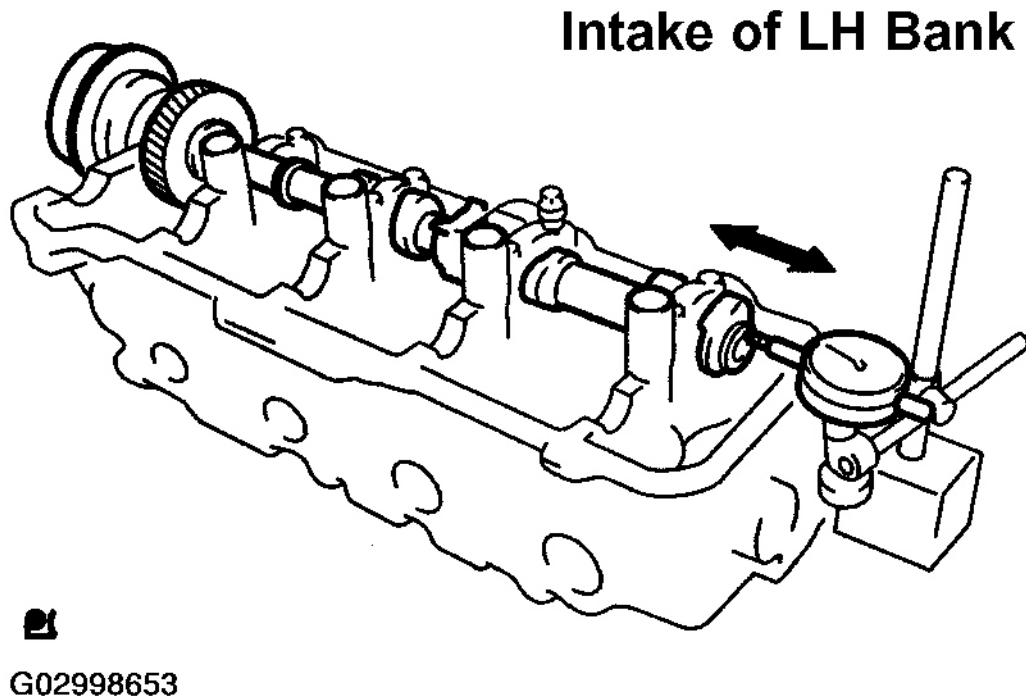
**Fig. 386: Measuring Plastigage At Widest Point**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Check the thrust clearance.
  1. Install the camshaft timing tube to the No. 3 camshaft (see **OVERHAUL** ).
  2. Install the No. 3 camshaft (see **OVERHAUL** ).
  3. Using a dial indicator, measure the thrust clearance while moving the No. 3 camshaft back and forth.

**Standard thrust clearance: 0.060 to 0.100 mm (0.0024 to 0.0039 in.) Maximum thrust clearance: 0.13 mm (0.0051 in.)**

If the thrust clearance is greater than the maximum, replace the No. 3 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

4. Remove the No. 3 camshaft.
5. Remove the camshaft timing tube from the No. 3 camshaft.



**Fig. 387: Measuring Thrust Clearance Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Check the gear backlash.
  1. Install the drive gear to the camshaft timing tube (see **OVERHAUL** ).
  2. Install the camshaft timing tube to the No. 3 camshaft (see **OVERHAUL** ).
  3. Install the No. 3 camshaft and No. 4 camshaft without installing the camshaft sub-gear and front bearing cap (see **OVERHAUL** ).
  4. Using a dial indicator, measure the backlash.

**Standard backlash: 0.020 to 0.200 mm (0.0008 to 0.0079 in.)**

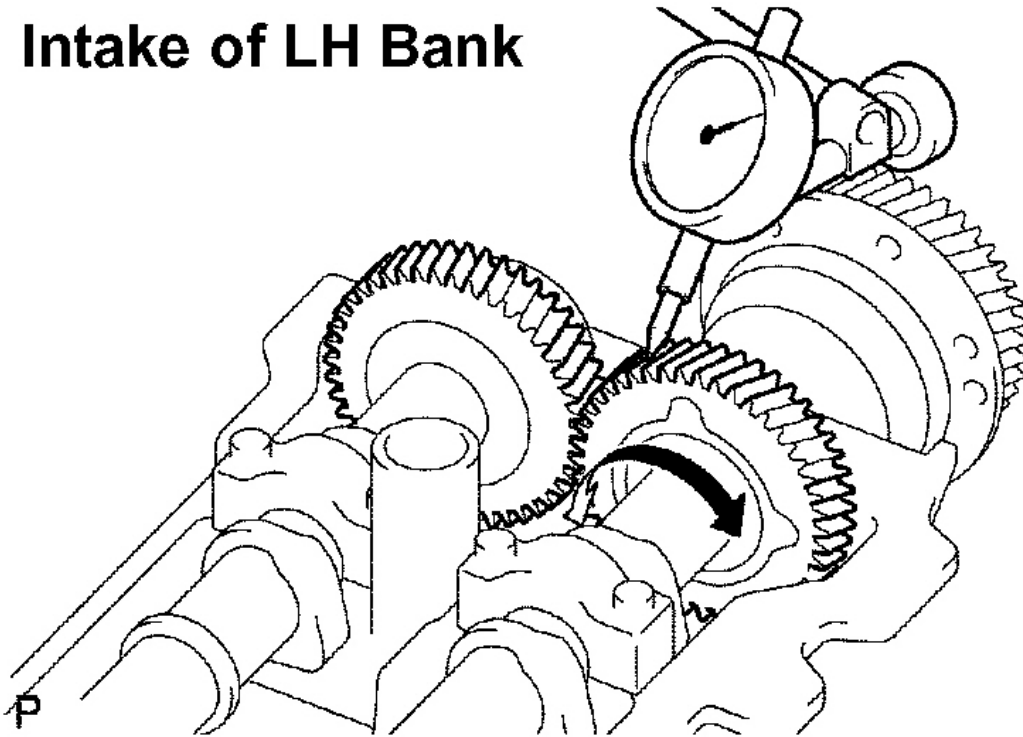
**Maximum backlash: 0.30 mm (0.0188 in.)**

If the backlash is greater than the maximum, replace the drive gear and No. 4 camshaft.

- m. Remove the No. 3 camshaft and No. 4 camshaft.
- n. Remove the camshaft timing tube from the No. 3 camshaft.

- o. Remove the drive gear from the camshaft timing tube.

## Intake of LH Bank



G02998654

**Fig. 388: Measuring Gear Backlash Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

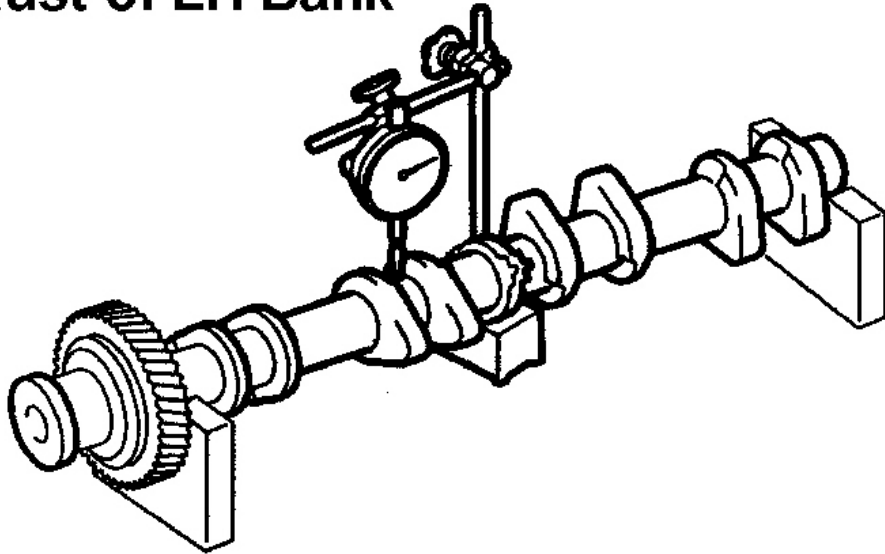
### 19. INSPECT NO.4 CAMSHAFT SUB-ASSY

- a. Inspect the circle runout.
  1. Place the camshaft on V-blocks.
  2. Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.08 mm (0.0031 in.)**

If the circle runout is greater than the maximum, replace the No. 4 camshaft.

## Exhaust of LH Bank



G02998655

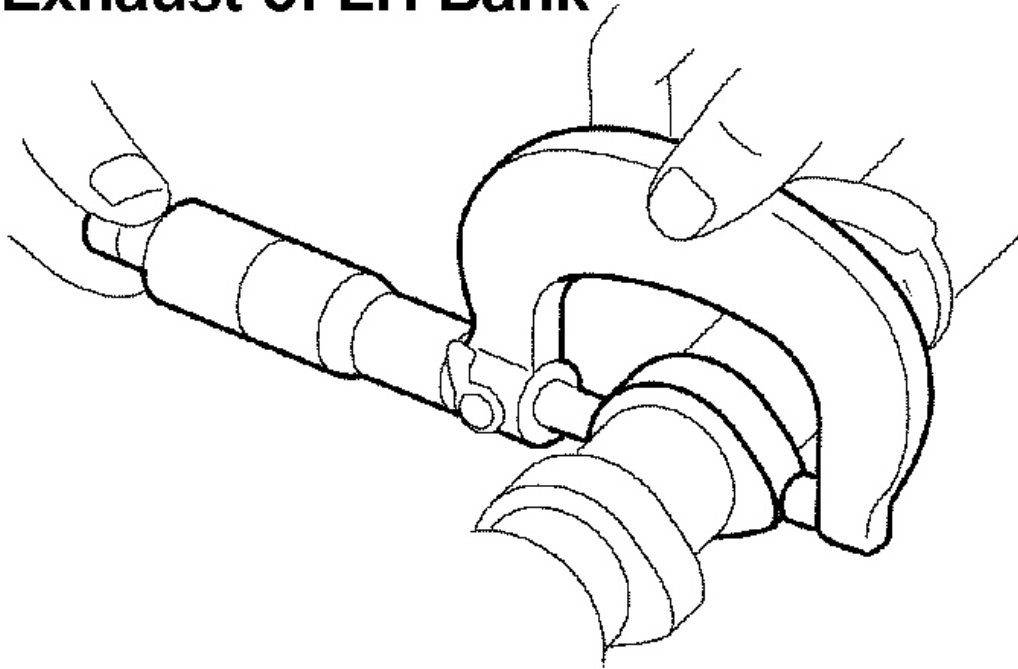
**Fig. 389: Measuring Circle Runout At Center Journal Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the cam lobe height.

**Standard cam lobe height: 42.630 to 42.730 mm (1.6783 to 1.6823 in.) Minimum cam lobe height: 42.48 mm (1.6724 in.)**

If the cam lobe height is less than the minimum, replace the No. 4 camshaft.

## Exhaust of LH Bank



G02998656

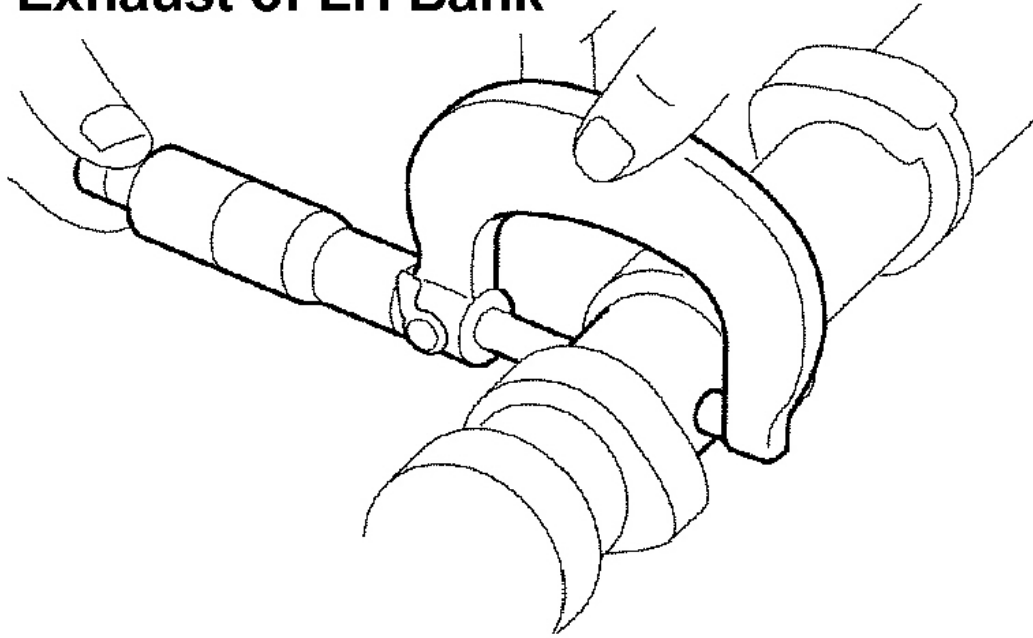
**Fig. 390: Measuring Cam Lobe Height Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a micrometer, measure the journal diameter.

**Journal diameter: 26.954 to 26.970 mm (1.0612 to 1.0618 in.)**

If the journal diameter is not as specified, check the oil clearance.

## Exhaust of LH Bank



G02998657

**Fig. 391: Measuring Journal Diameter Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check the oil clearance.
  1. Clean the bearing caps and journals.
  2. Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

3. Place the No. 4 camshaft on the cylinder head.
4. Lay a strip of Plastigage across each of the journals.
5. Install the bearing caps (see **OVERHAUL** ).

**NOTE:**        **Do not turn the No. 4 camshaft.**

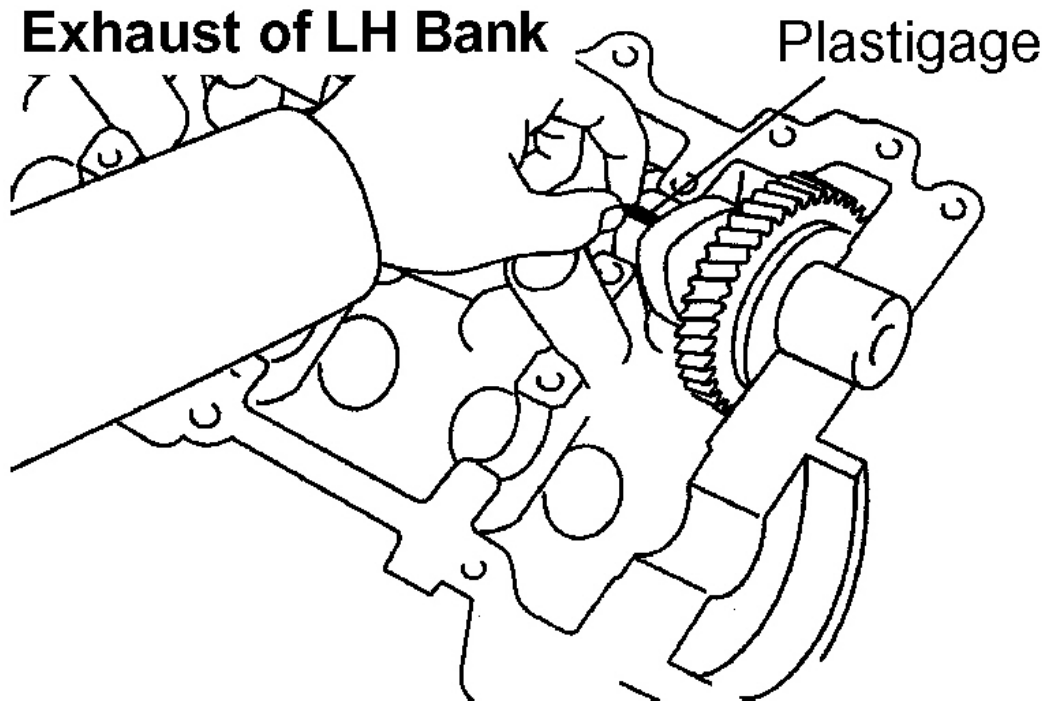
6. Remove the bearing caps.
7. Measure the Plastigage at its widest point.

**Standard oil clearance: 0.030 to 0.067 mm (0.0012 to 0.0026 in.)**

**Maximum oil clearance: 0.100 mm (0.0039 in.)**

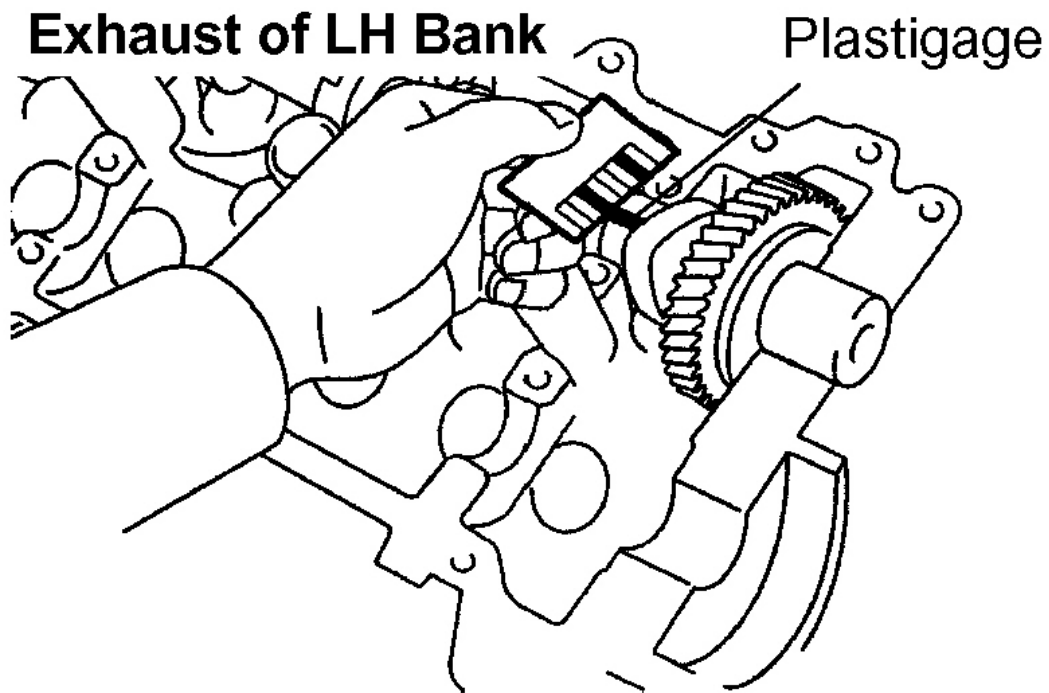
If the oil clearance is greater than the maximum, replace the No. 4 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

8. Completely remove the Plastigage.
9. Remove the No. 4 camshaft.



**G02998658**

**Fig. 392: Identifying Plastigage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G02998659

**Fig. 393: Measuring Plastigage At Widest Point**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Check the thrust clearance.
- f. Install the camshaft (see **OVERHAUL** ).
- g. Using a dial indicator, measure the thrust clearance while moving the No. 4 camshaft back and forth.

**Standard thrust clearance: 0.030 to 0.075 mm (0.0012 to 0.0030 in.) Maximum thrust clearance: 0.12 mm (0.0047 in.)**

If the thrust clearance is greater than the maximum, replace the No. 4 camshaft. If necessary, replace the bearing caps and cylinder head as a set.

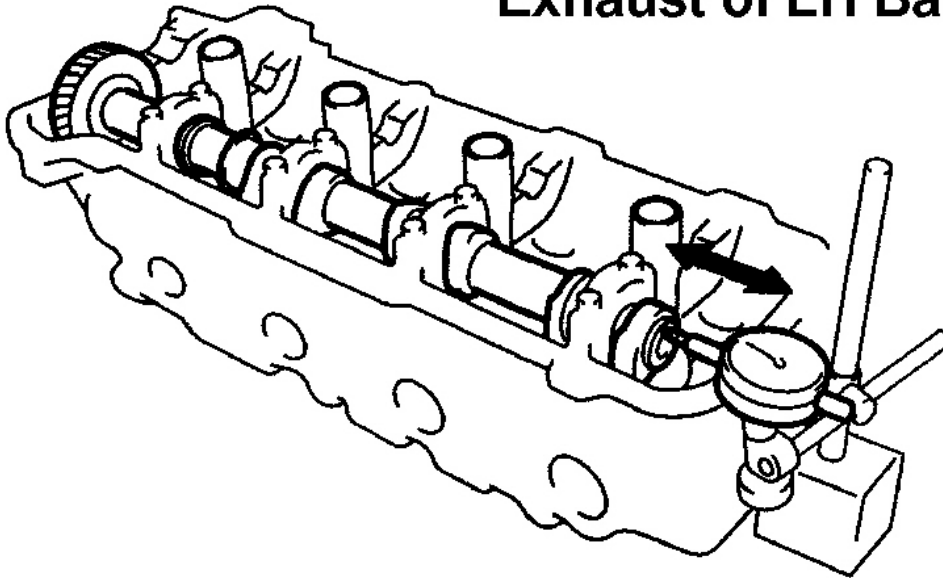
- h. Remove the No. 4 camshaft.

## 20. **INSPECT CYLINDER HEAD SET BOLT**

- a. Using a vernier caliper, measure the thread outside diameter of the bolt.



## Exhaust of LH Bank

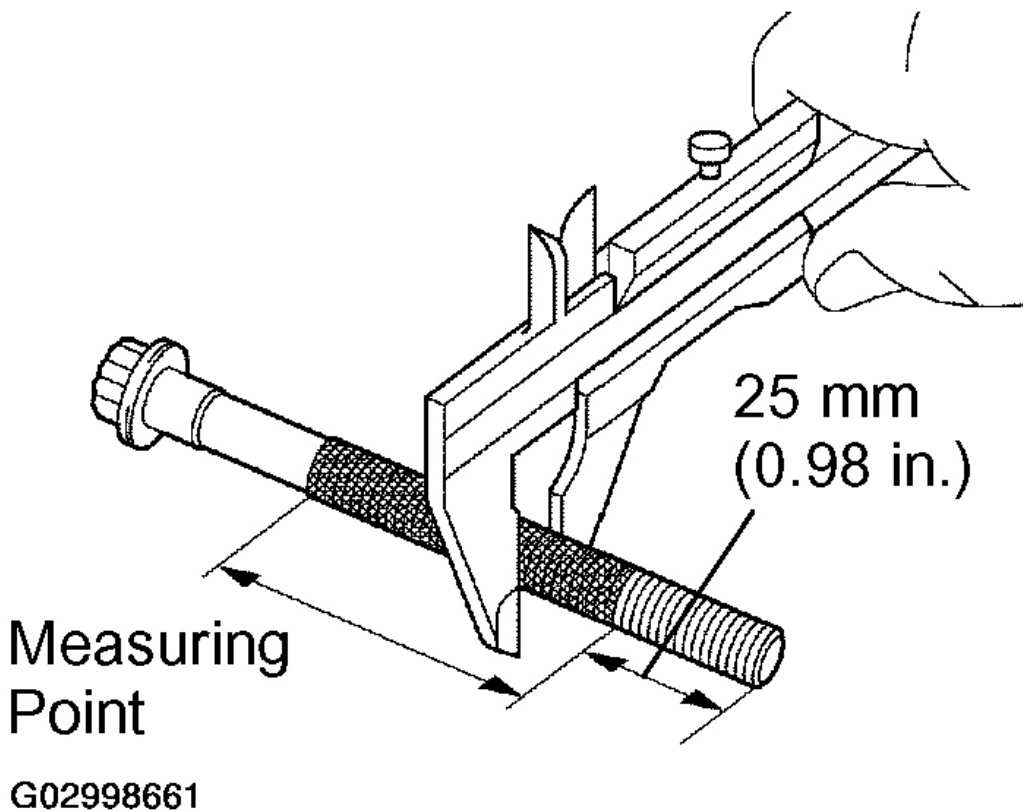


G02998660

**Fig. 394: Measuring Thrust Clearance Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Standard outside diameter: 9.770 to 9.960 mm (0.3846 to 0.3921 in.) Minimum outside diameter: 9.70 mm (0.3819 in.)**

If the diameter is less than the minimum, replace the bolt.



**Fig. 395: Measuring Thread Outside Diameter Of Bolt Using Vernier Caliper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 21. INSTALL SPARK PLUG TUBE

HINT: When using a new cylinder head, the spark plug tubes must be installed.

- a. Apply adhesive to the end of the spark plug tube.

**Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent**

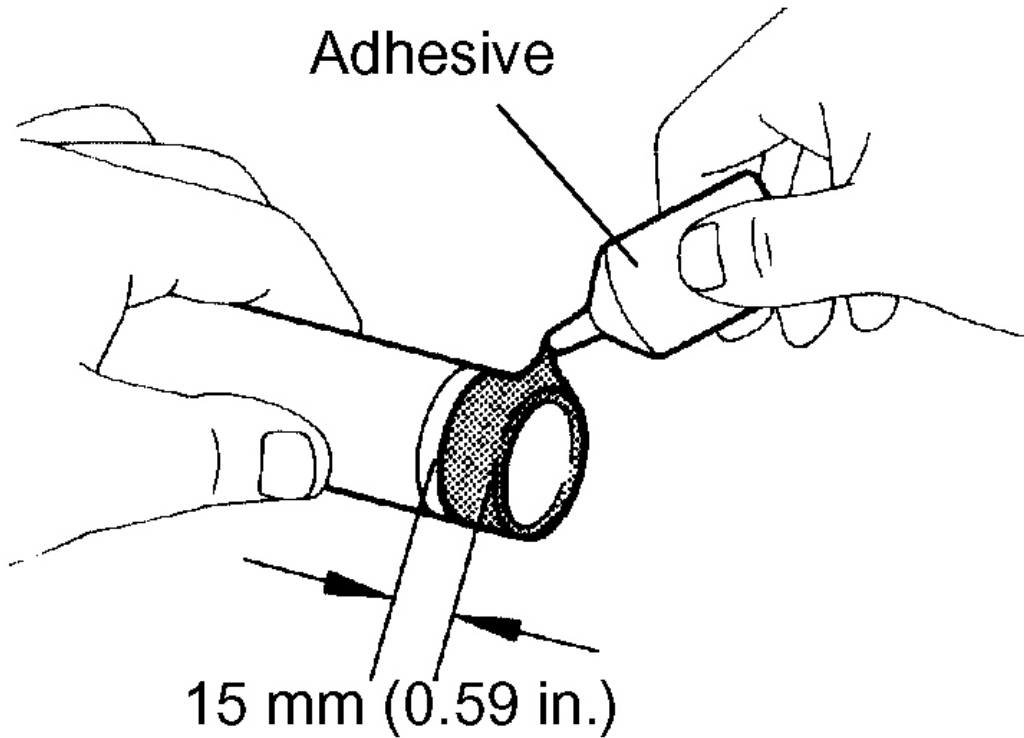
**NOTE:**

- Install the spark plug tube within 3 minutes after applying adhesive.
- Do not deform the spark plug tube.
- Do not expose the seal to coolant for at least 1 hour after installing.

- b. Using a wooden block and hammer, tap in a new spark tube until there is 48.4 to 49.6 mm (1.906 to

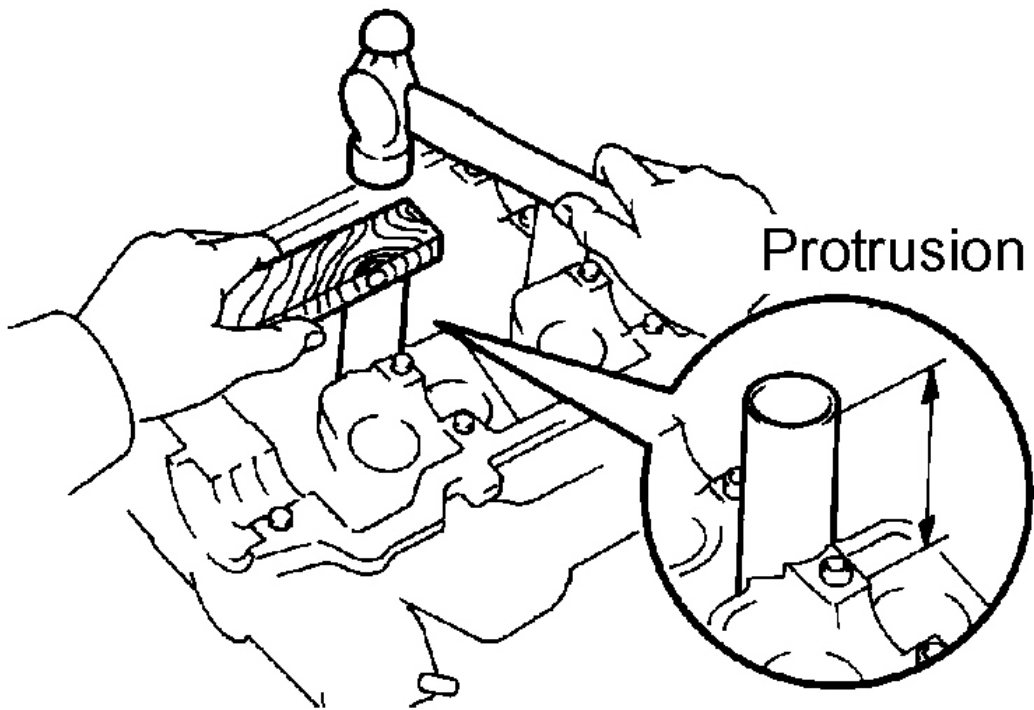
1.953 in.) protruding from the camshaft bearing cap installation surface of the cylinder head.

**NOTE:** Avoid tapping a new spark plug tube in too far by measuring the amount of the protrusion while tapping.



G02998662

**Fig. 396: Applying Adhesive To End Of Spark Plug Tube**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G02998663

**Fig. 397: Taping Spark Tube Using Wooden Block And Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

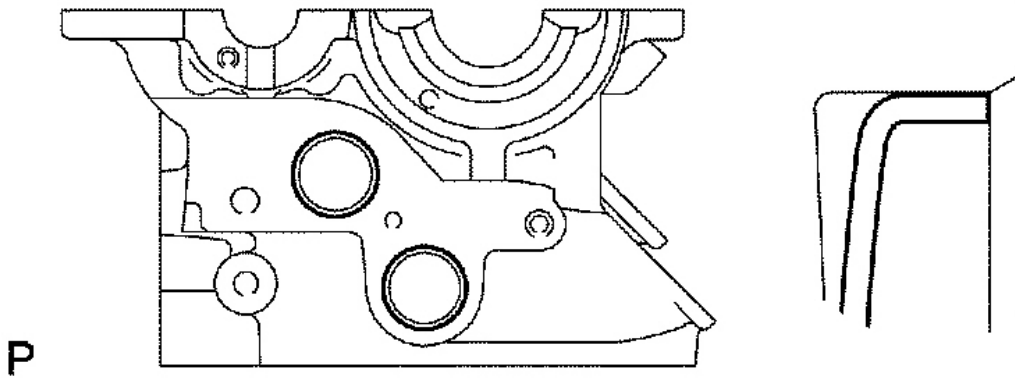
22. **INSTALL TIGHT PLUG NO.1**

- a. Apply adhesive to the end of the spark plug tube.

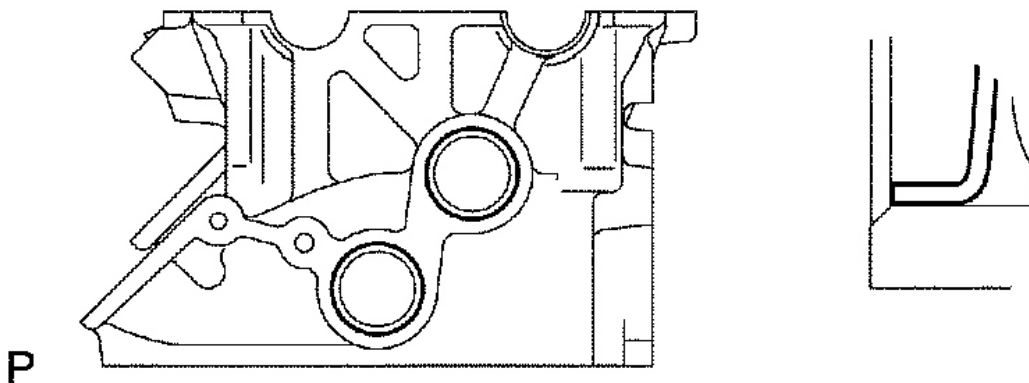
**Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent**

- b. Using SST and a hammer, tap in a new tight plug as shown in the illustration.  
SST 09950-60010 (09951-00200), 09950-70010 (09951-07100)

## Front Side



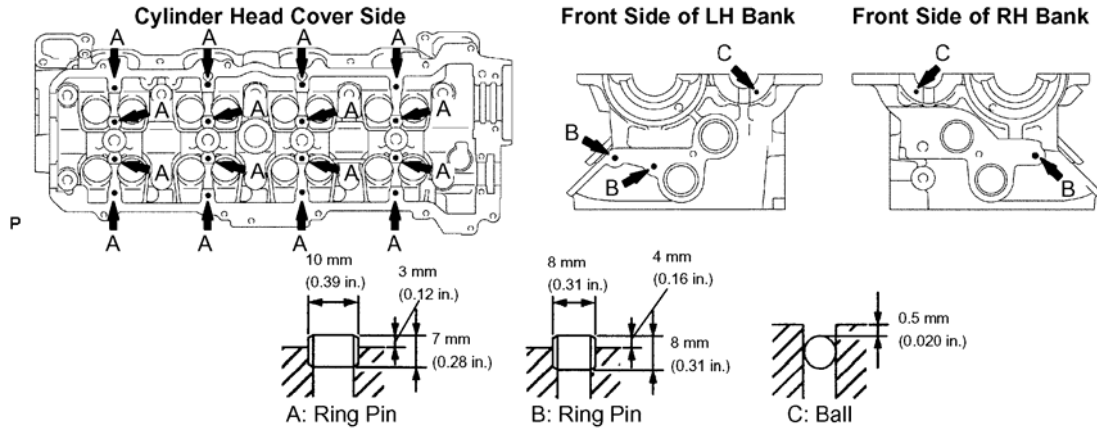
## Rear Side



G02998664

**Fig. 398: Identifying Tight Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

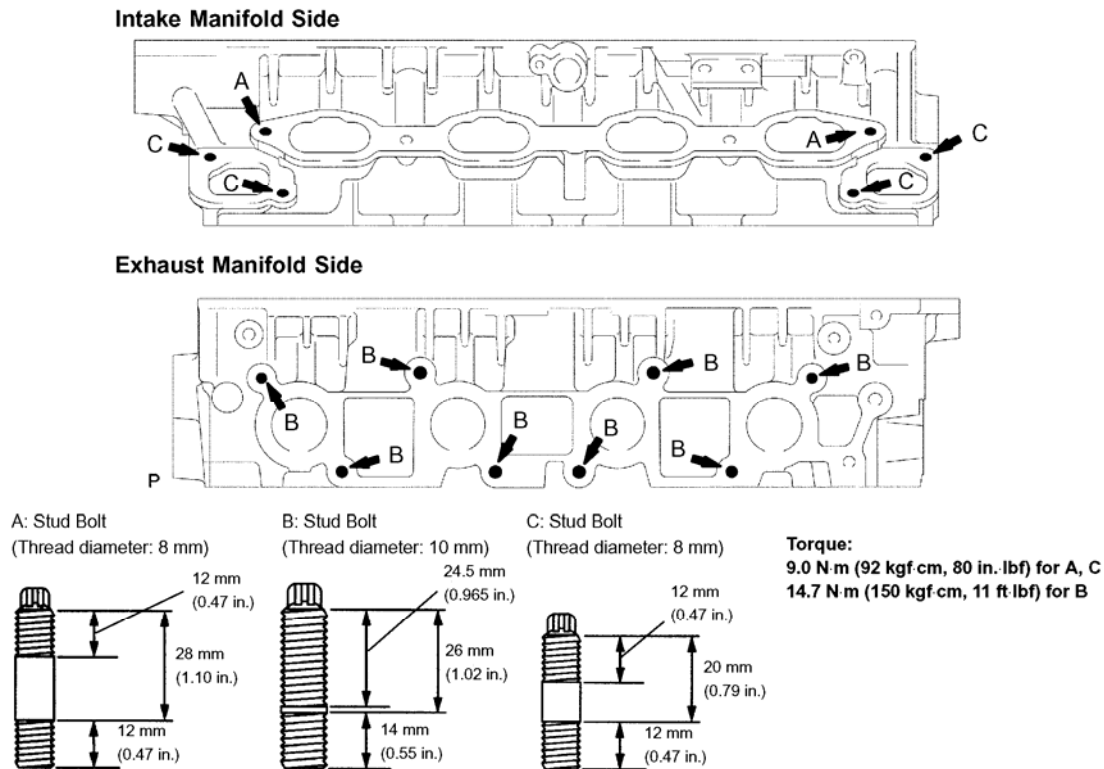
## 23. INSTALL RING W/ HEAD PIN



G02998665

**Fig. 399: Identifying Ring W/ Head Pin Dimension**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 24. INSTALL STUD BOLT



G02998666

**Fig. 400: Identifying Stud Bolt Dimension**

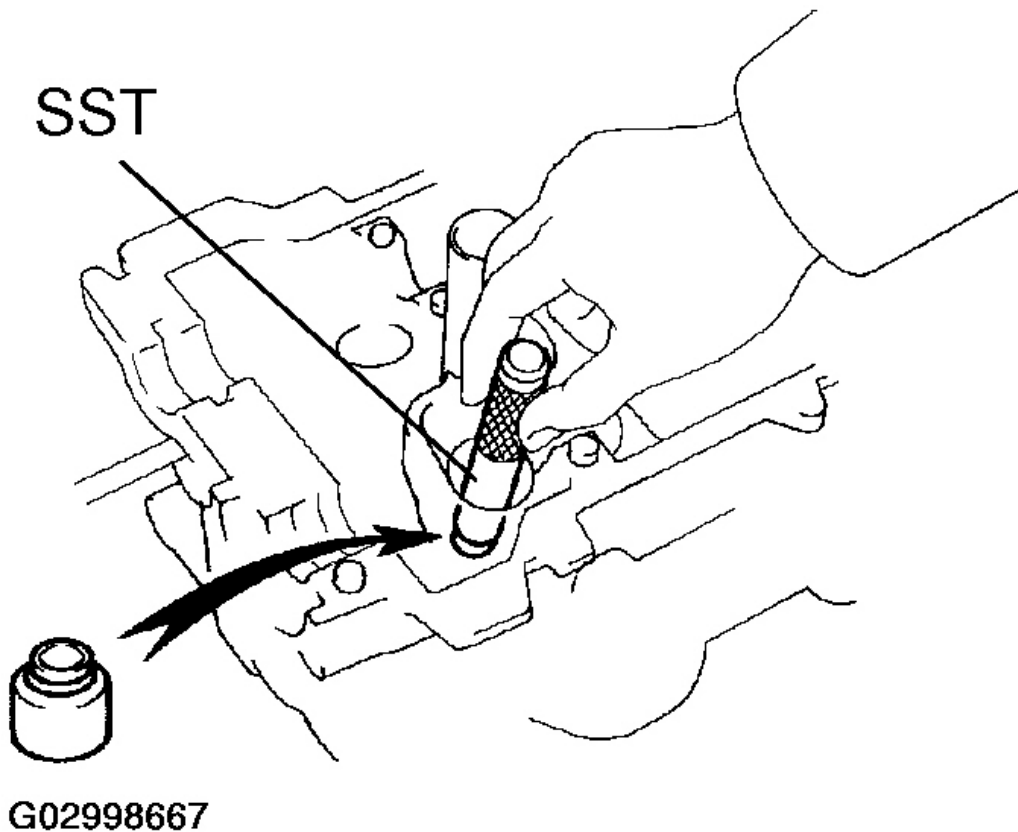
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. **INSTALL VALVE STEM OIL O SEAL OR RING**

- a. Using SST, push in a new oil seal.  
SST 09201-41020

**NOTE:** Failure to use SST will cause the seal to be damaged or improperly seated.

- b. Apply a light coat of engine oil on a new oil seal.

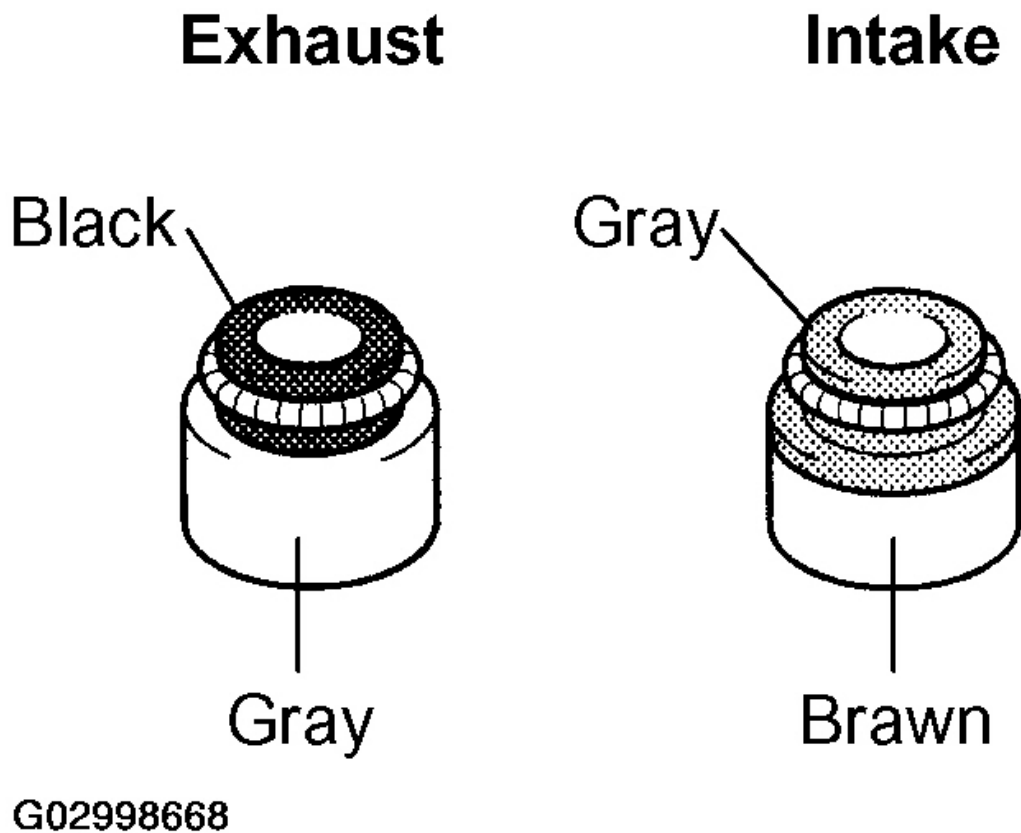


**Fig. 401: Identifying Oil Seal Using SST**

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

**NOTE:** Pay close attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust or installing the exhaust oil seal to the intake can cause installation problems later.

HINT: The intake valve oil seal is brown and the exhaust valve oil seal is gray.

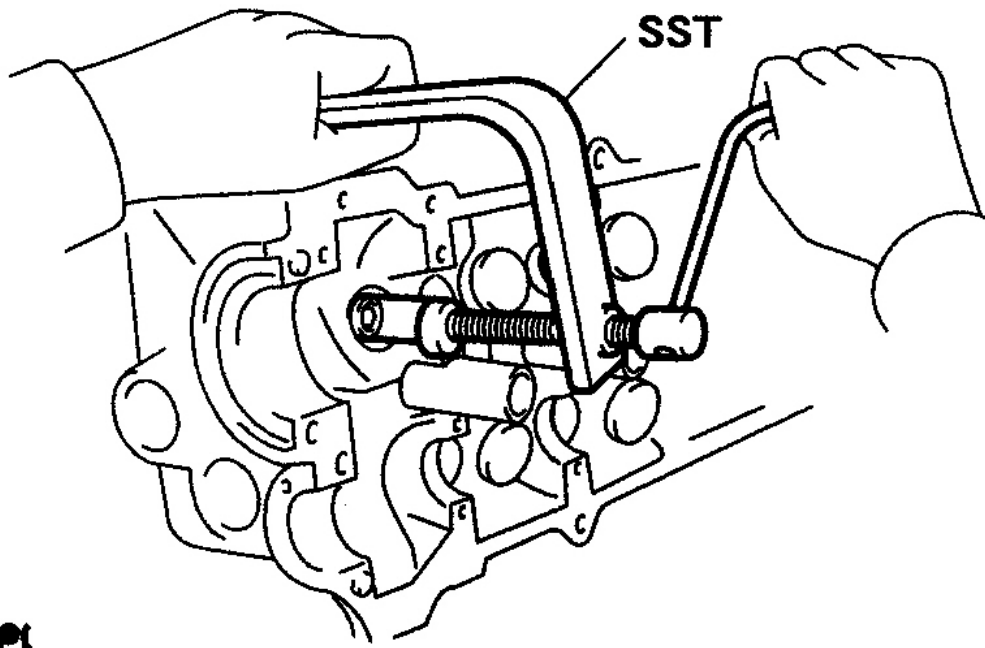


**Fig. 402: Identifying Intake Valve Oil Seal Is Brown And Exhaust Valve Oil Seal Is Gray**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. **INSTALL INTAKE VALVE**

- a. Install the valve, spring seat, compression spring and spring retainer.
- b. Using SST, compress the compression spring and place the 2 keepers around the valve stem.  
SST 09202-70020 (09202-00010)





G02998669

**Fig. 403: Installing Intake Valve Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

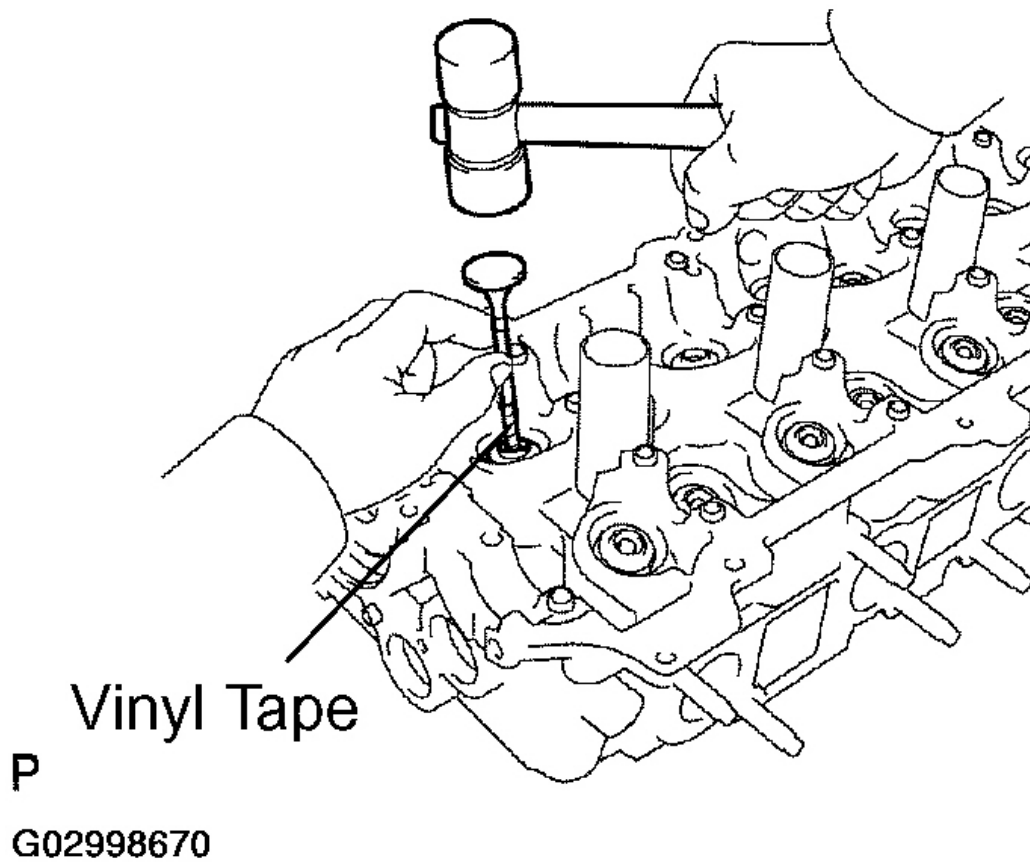
- c. Using a plastic-faced hammer and a discarded valve with its tip wrapped in tape, lightly tap the installed valve to ensure that it is securely fit.

**NOTE:** Be careful not to damage the valve stem tip.

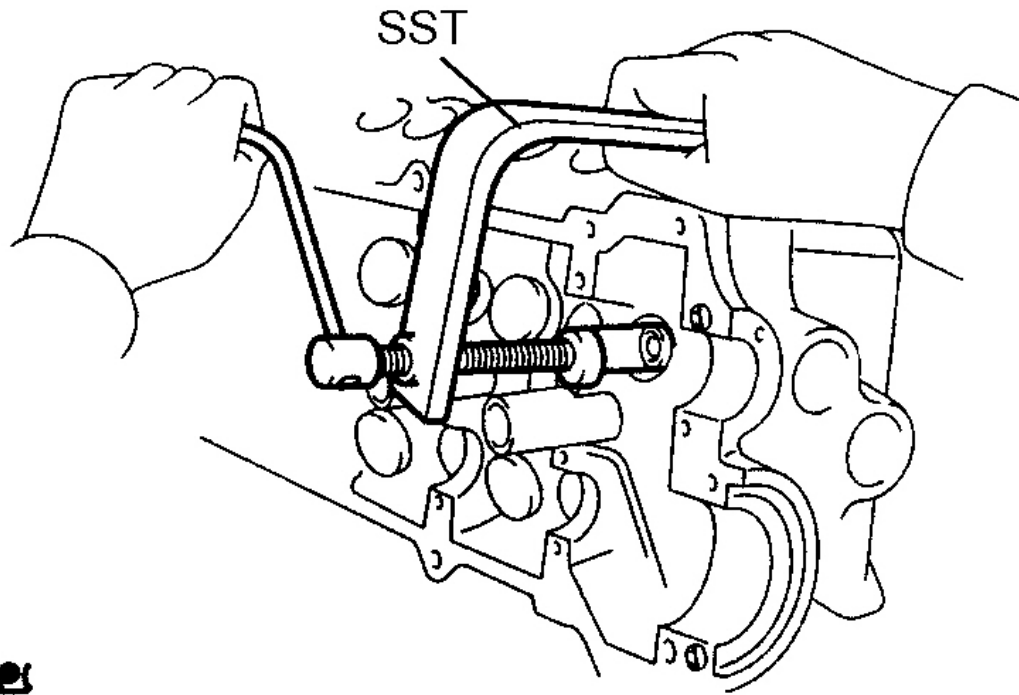
## 27. INSTALL EXHAUST VALVE

- a. Install the valve, spring seat, compression spring and spring retainer.

**NOTE:** Install the same parts in the same combination to the original locations.



**Fig. 404: Installing Valve Using Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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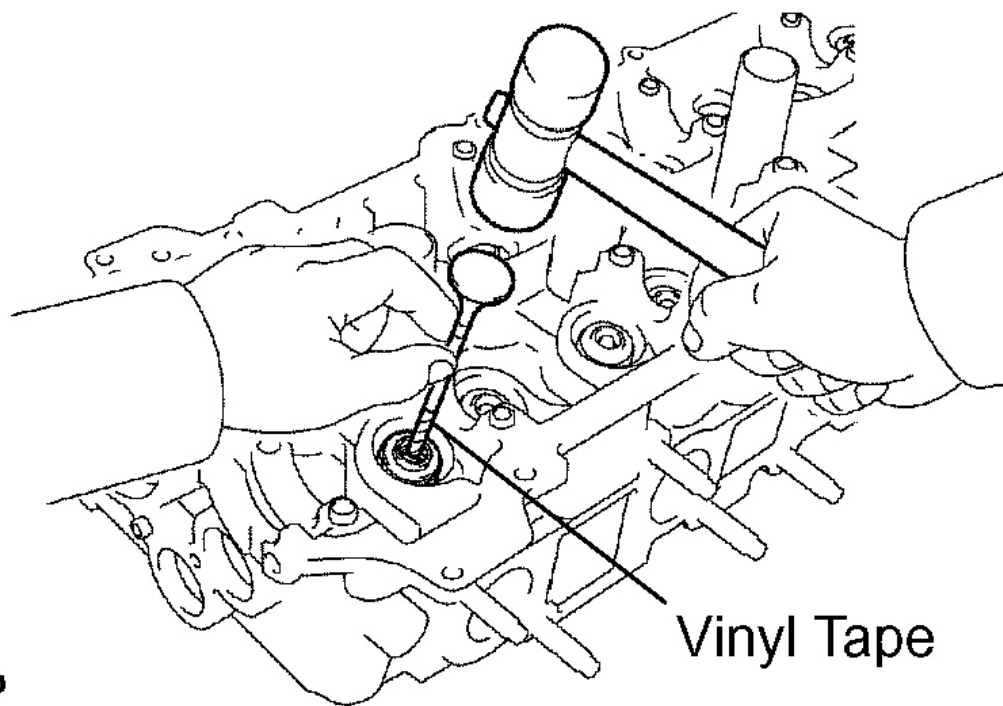
**Fig. 405: Installing Exhaust Valve Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, compress the compression spring and place the 2 keepers around the valve stem.  
SST 09202-70020 (09202-00010)
- c. Using a plastic-faced hammer and a discarded valve with its tip wrapped in tape, lightly tap the installed valve to ensure that it is securely fit.

**NOTE:**        **Be careful not to damage the valve stem tip.**

## 28. INSTALL VALVE LIFTER

- a. Install the valve lifter and shim.
- b. Check that the valve lifter rotates smoothly by hand.



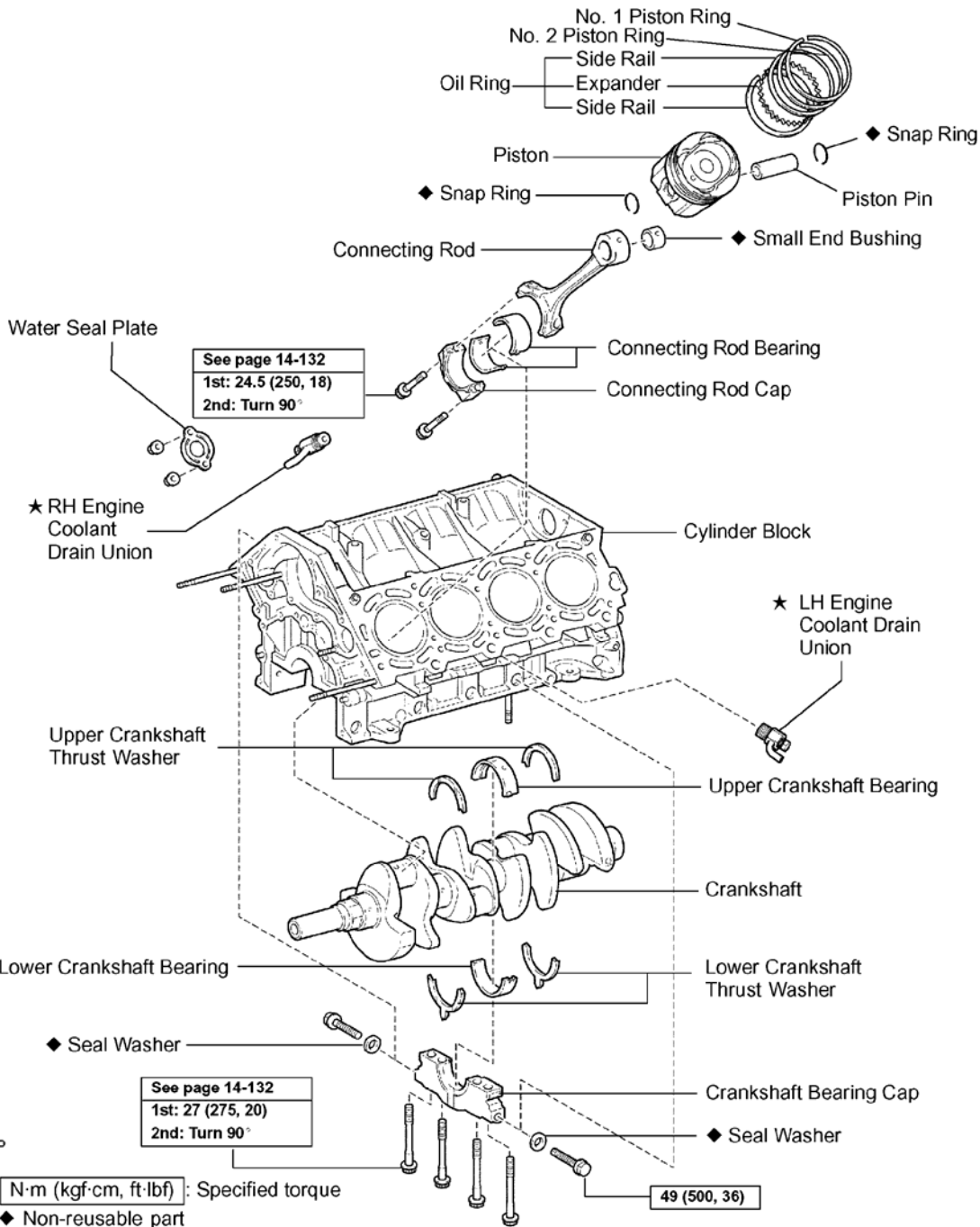
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**Fig. 406: Installing Valve Using Hammer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## CYLINDER BLOCK ASSY

### COMPONENTS



**Fig. 407: Exploded View Of Cylinder Block Assy Components**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

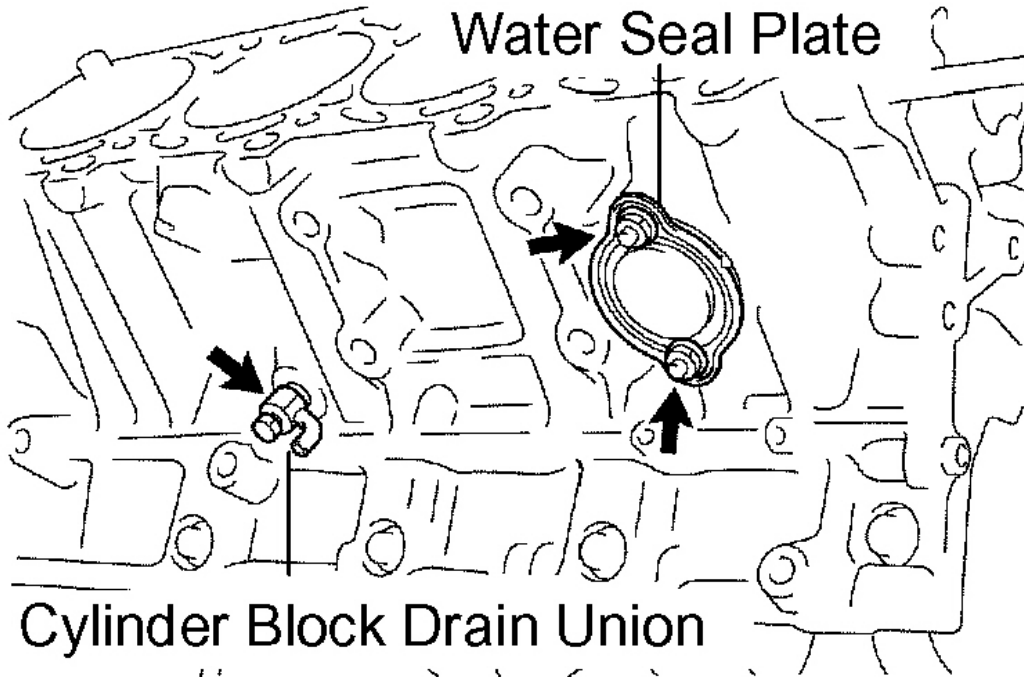
**OVERHAUL**

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. **REMOVE CYLINDER BLOCK DRAIN COCK SUB-ASSY AND WATER SEAL PLATE**

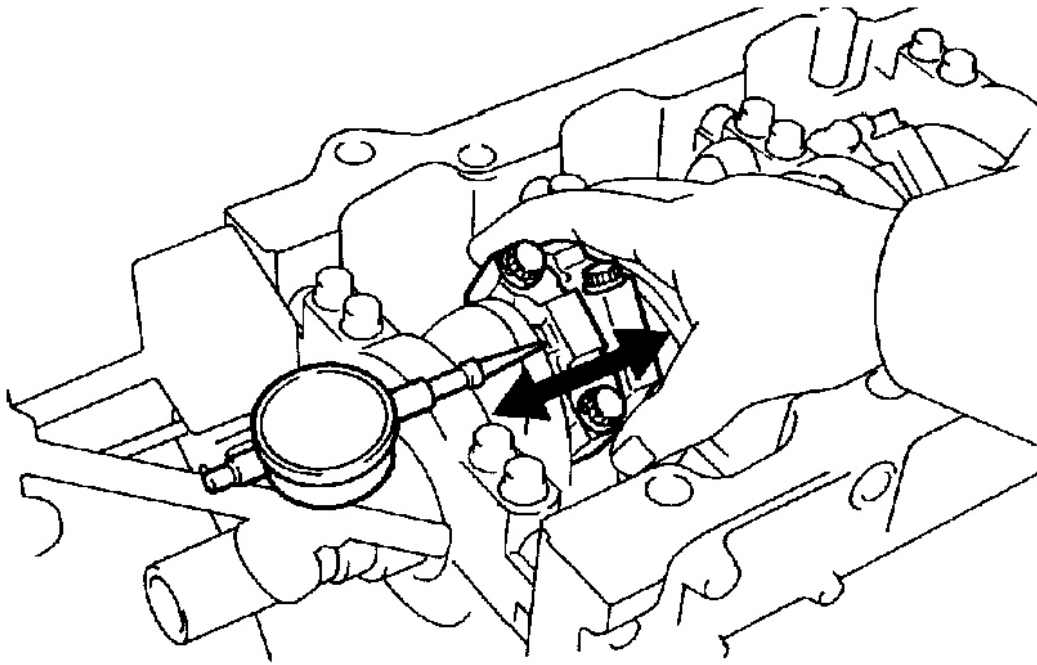
- a. Remove the 2 nuts and seal plate.
- b. Remove the RH and LH drain unions.



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**Fig. 408: Identifying Seal Plate**

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



G02998675

**Fig. 409: Measuring Thrust Clearance Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2. INSPECT CONNECTING ROD THRUST CLEARANCE

- a. Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

**Standard thrust clearance: 0.160 to 0.290 mm (0.0063 to 0.0138 in.) Maximum thrust clearance: 0.35 mm (0.0138 in.)**

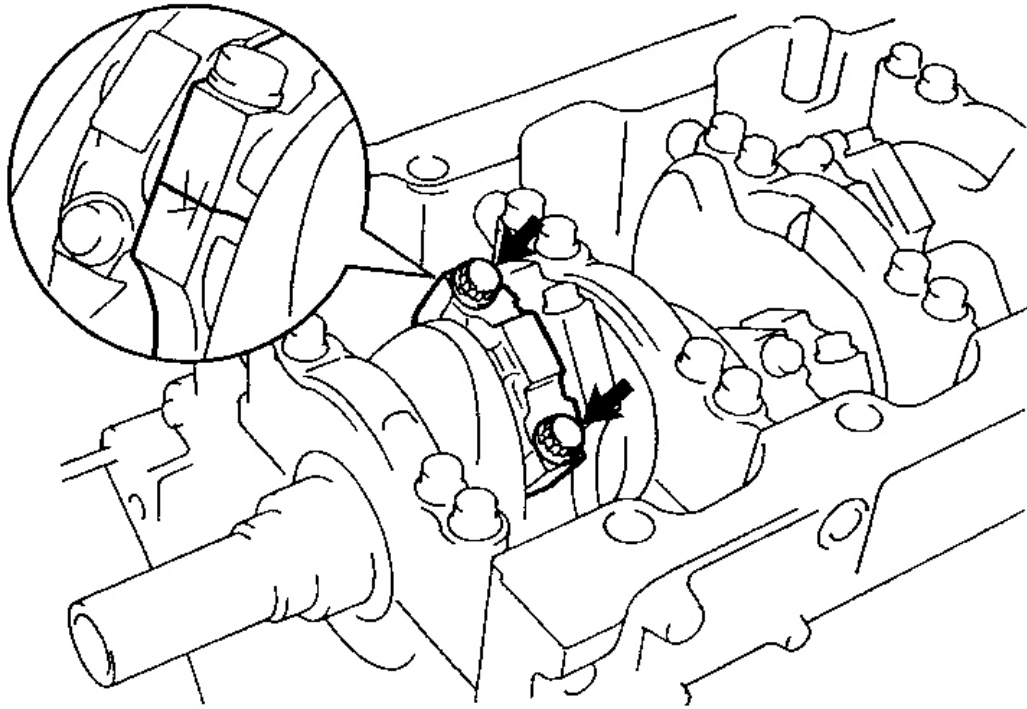
If the thrust clearance is greater than the maximum, replace the connecting rod assembly (s).

If necessary, replace the crankshaft.

**Connecting rod thickness: 22.880 to 22.920 mm (0.9008 to 0.9024 in.)**

## 3. INSPECT CONNECTING ROD OIL CLEARANCE

- a. Check that the matchmarks on the connecting rod and cap ensure correct reassembly.
- b. Remove the 2 connecting rod cap bolts.



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**Fig. 410: Removing Connecting Rod Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using the removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

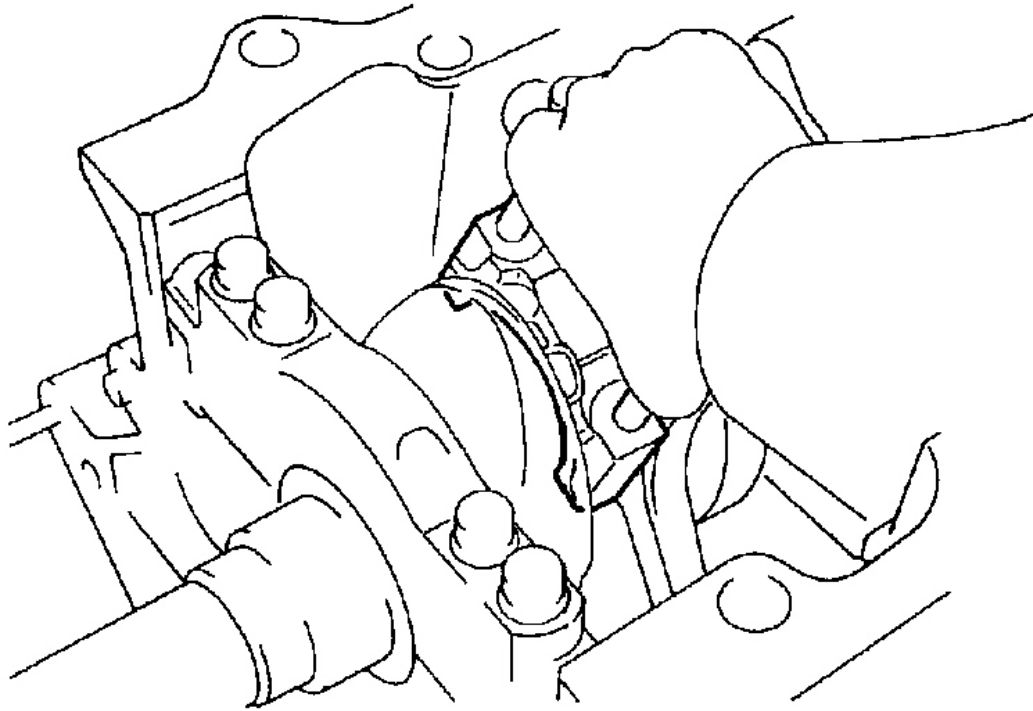
HINT:Keep the lower bearing inserted with the connecting rod cap.

- d. Clean the crank pin and bearing.
- e. Check the crank pin and bearing for pitting and scratches.

If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

- f. Lay a strip of Plastigage across the crank pin.
- g. Install the connecting rod cap with the 2 bolts (see step 26).
- h. Remove the 2 bolts, connecting rod cap and lower bearing (see steps (b) and (c) above).

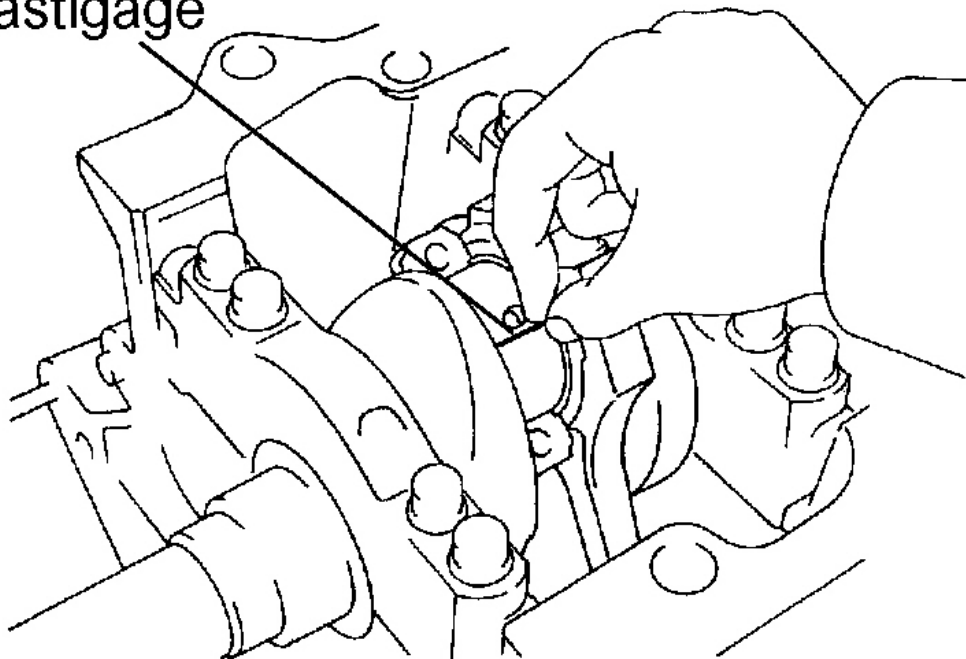




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**Fig. 411: Removing Connecting Rod Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

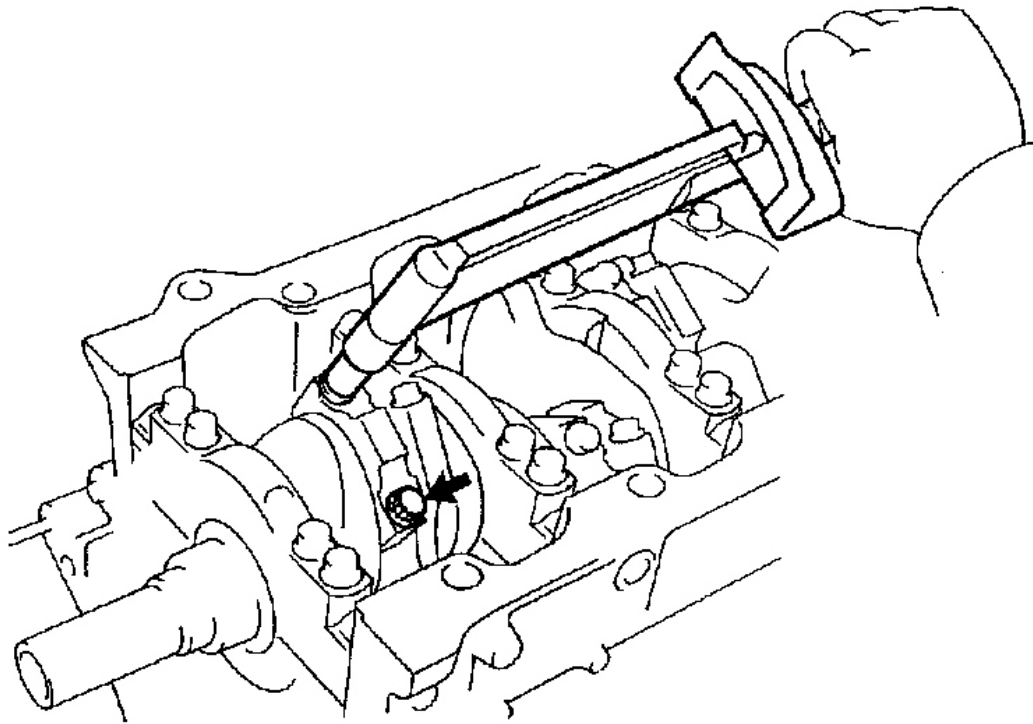
Plastigage



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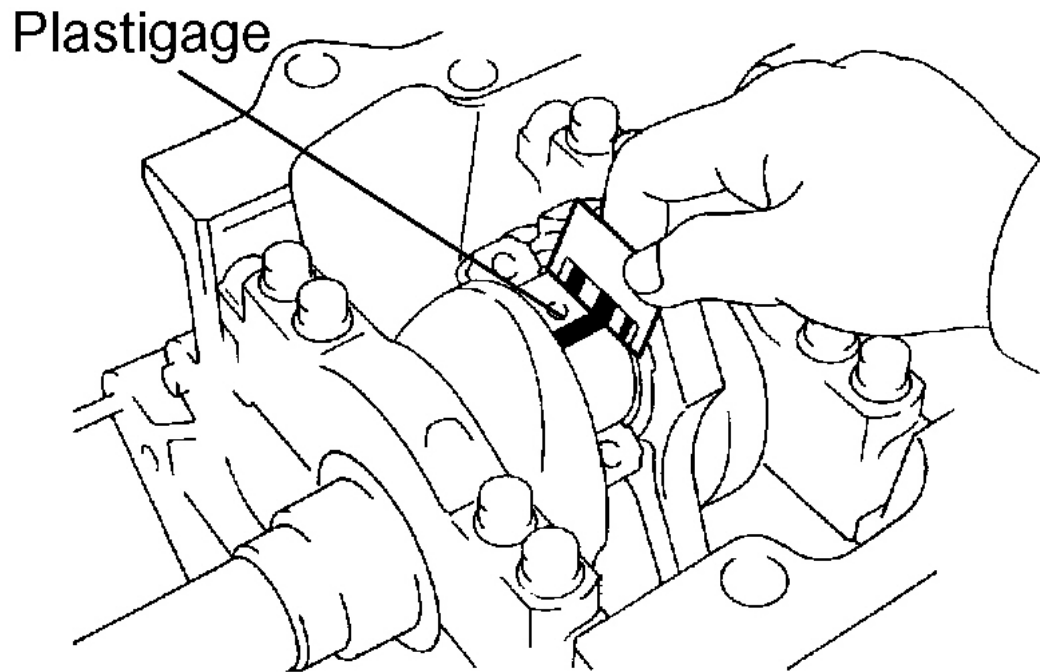
**Fig. 412: Identifying Plastigage**

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



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**Fig. 413: Removing Connecting Rod Cap And Lower Bearing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 414: Measuring Plastigage At Widest Point**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Measure the Plastigage at its widest point.

**Standard oil clearance: 0.021 to 0.047 mm (0.0008 to 0.0019 in.) Maximum oil clearance: 0.059 mm (0.0023 in.)**

If the oil clearance is greater than the maximum, replace the bearings. If necessary, replace the crankshaft.

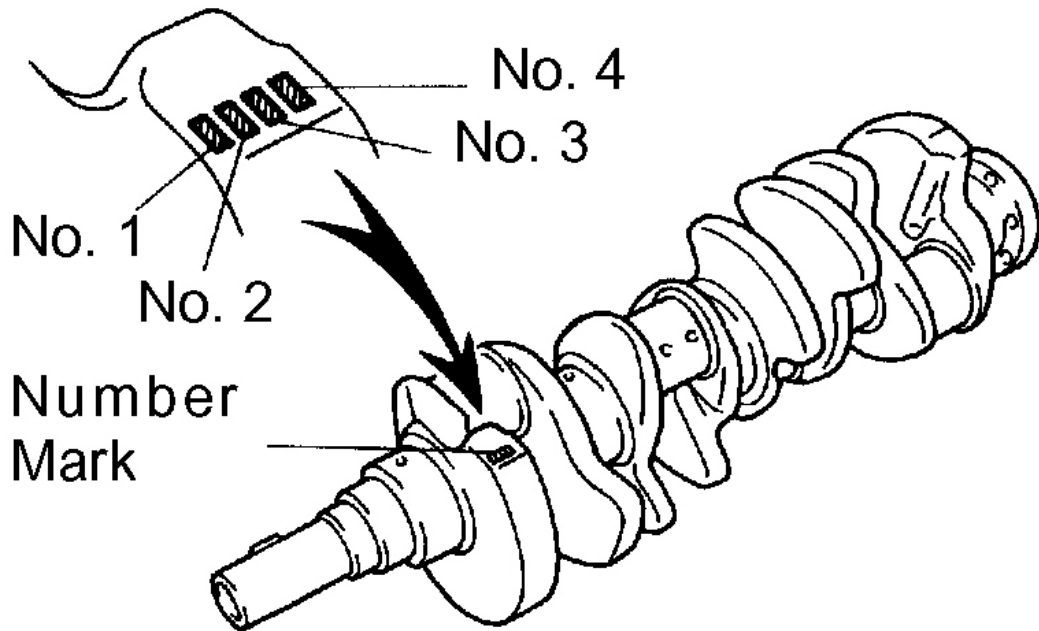
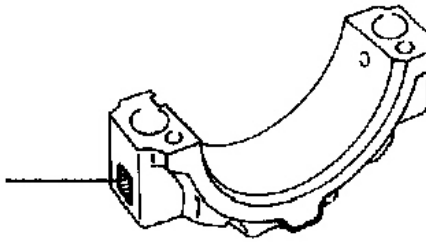
HINT: If using a standard bearing, replace it with one that has the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the connecting rod cap and crankshaft, then select the bearing with the same number as the total. There are 6 sizes of standard bearings, marked 2, 3, 4, 5, 6 and 7.

Item	Number Mark											
Connecting rod	②	②	②	②	②	②	②	②	②	②	②	②
Crankshaft	②	②	②	②	②	②	②	②	②	②	②	②
Use bearing	②	②	②	②	②	②	②	②	②	②	②	②

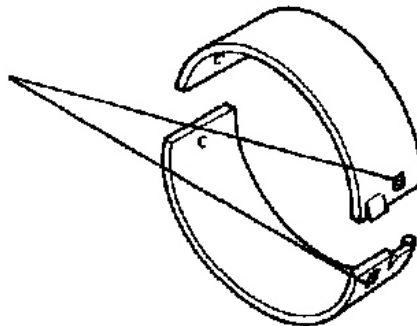
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**Fig. 415: Crankshaft Bearing Number Mark Table**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

Number  
Mark



Number  
Mark



**Fig. 416: Identifying Crankshaft Bearing Number Mark**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

EXAMPLE: Connecting rod cap "3" + Crankshaft "1" =

Total number 4 (Use bearing "4")

**Reference**

**CONNECTING ROD BIG END INSIDE DIAMETER:**

**CONNECTING ROD BIG END INSIDE DIAMETER SPECIFICATIONS**

Mark 1	55.000 to less than 55.006 mm (2.1654 to less than 2.1656 in.)
Mark 2	55.006 to less than 55.012 mm (2.1656 to less than 2.1658 in.)
Mark 3	55.012 to less than 55.018 mm (2.1658 to less than 2.1661 in.)
Mark 4	55.018 to less than 55.024 mm (2.1661 to less than 2.1663 in.)

**CRANKSHAFT CRANK PIN DIAMETER:**

**CRANKSHAFT CRANK PIN DIAMETER SPECIFICATIONS**

Mark 1	51.994 to less than 52.000 mm (2.0470 to less than 2.0472 in.)
Mark 2	51.988 to less than 51.994 mm (2.0468 to less than 2.0470 in.)
Mark 3	51.982 to less than 51.988 mm (2.0465 to less than 2.0468 in.)

**STANDARD SIZED BEARING CENTER WALL THICKNESS:**

**STANDARD SIZED BEARING CENTER WALL THICKNESS SPECIFICATIONS**

Mark 2	1.484 to less than 1.487 mm (0.0584 to less than 0.0585 in.)
Mark 3	1.487 to less than 1.490 mm (0.0585 to less than 0.0587 in.)
Mark 4	1.490 to less than 1.493 mm (0.0587 to less than 0.0588 in.)
Mark 5	1.493 to less than 1.496 mm (0.0588 to less than 0.0589 in.)
Mark 6	1.496 to less than 1.499 mm (0.0589 to less than 0.0590 in.)
Mark 7	1.499 to less than 1.502 mm (0.0590 to less than 0.0591 in.)

j. Completely remove the Plastigage.

**4. REMOVE PISTON AND CONNECTING ROD**

- a. Using a ridge reamer, remove all the carbon from the top of the cylinder.
- b. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

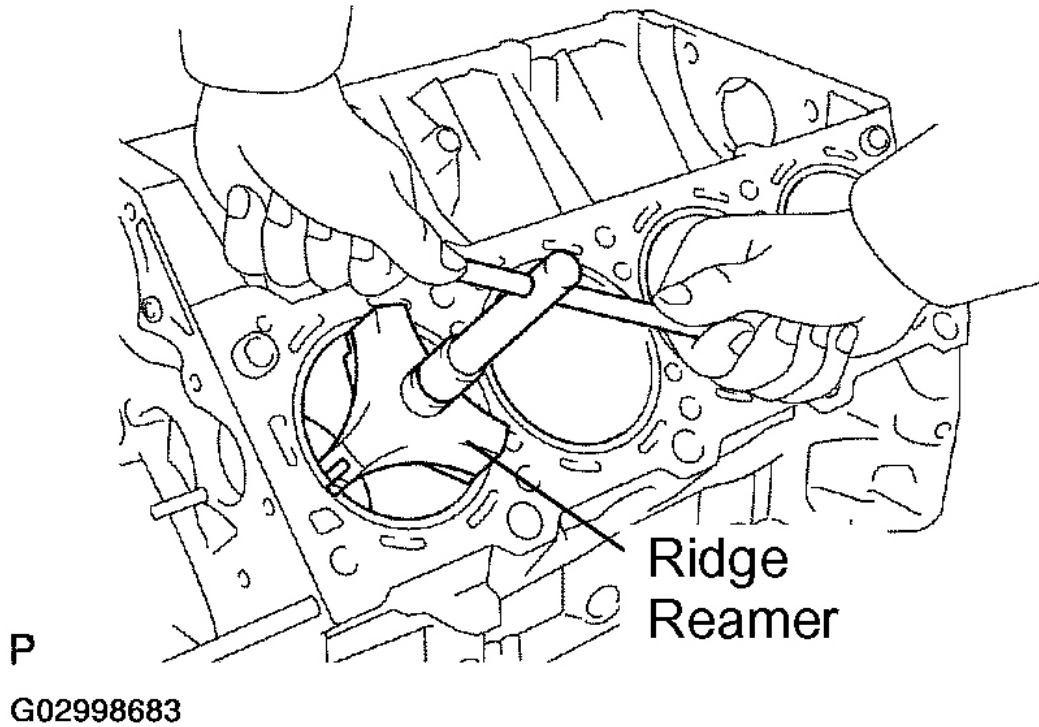
**HINT:**

- Keep the bearings, connecting rod and cap together.
- Be sure to organize the removed piston and connecting rod assemblies in such a way that they can be reinstalled exactly as before.

## 5. REMOVE W/PIN PISTON SUB-ASSY

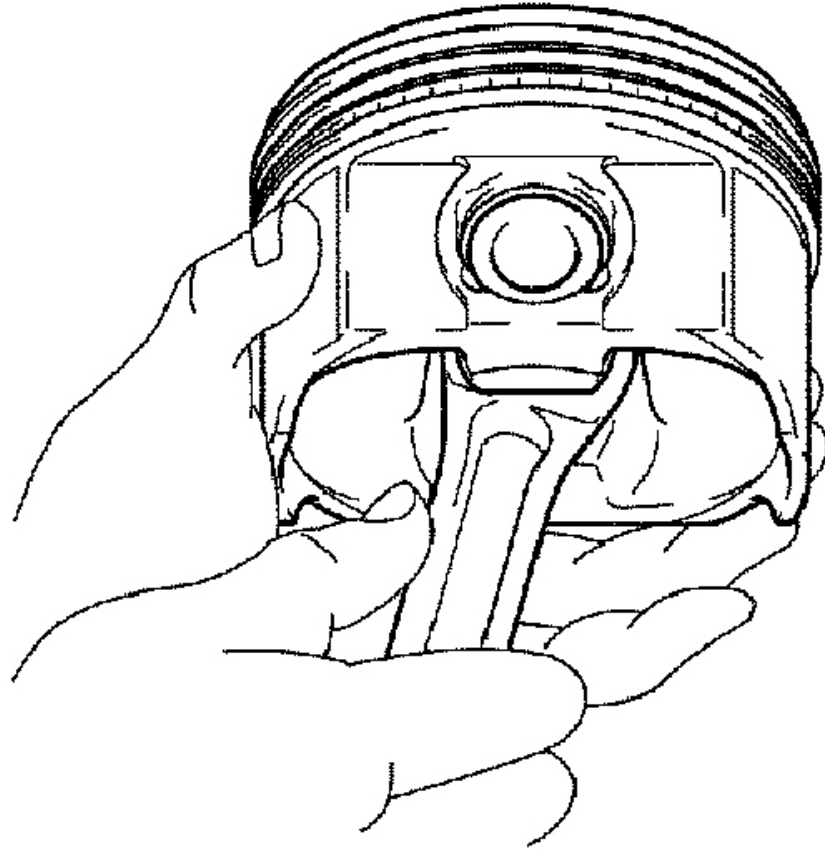
- a. Check the fit between the piston and piston pin.
  1. Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin with a new piston and pin set.



**Fig. 417: Removing Carbon From Top Of Cylinder Using Ridge Reamer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.





**P**

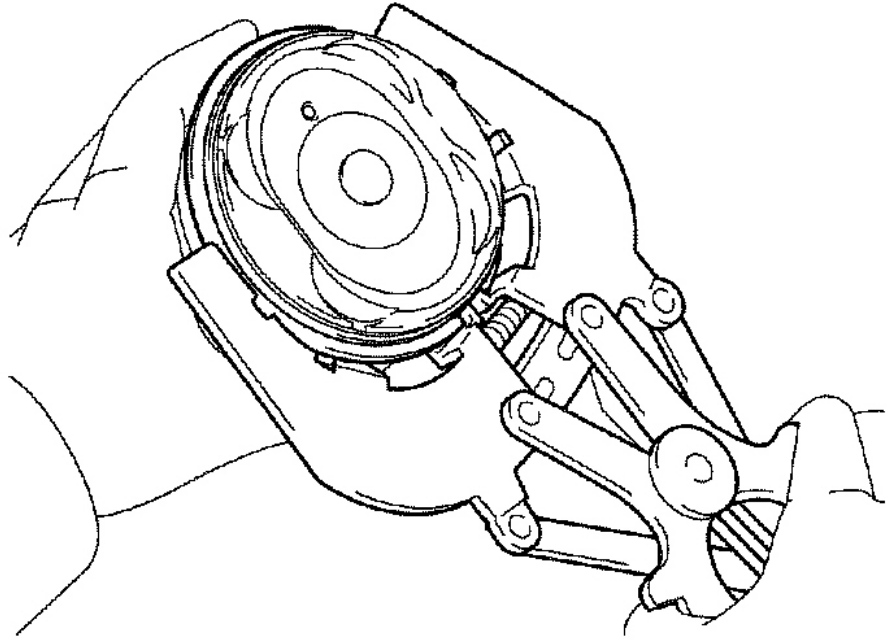
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**Fig. 418: Felting Piston And Pin With Piston And Pin**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Using a piston ring expander, remove the 2 compression rings.

HINT: Be sure to organize the removed piston rings in such a way that they can be reinstalled exactly as before.

- c. Remove the 2 side rails and oil ring by hand.

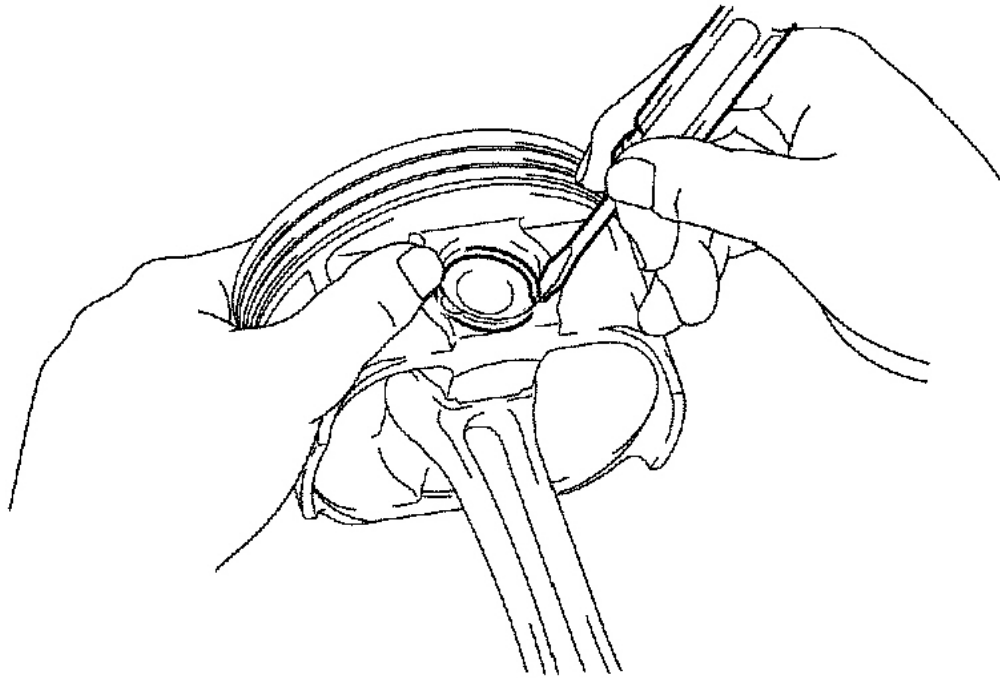


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**Fig. 419: Removing Compression Rings Using Piston Ring Expander**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a small screwdriver, pry out the 2 snap rings.

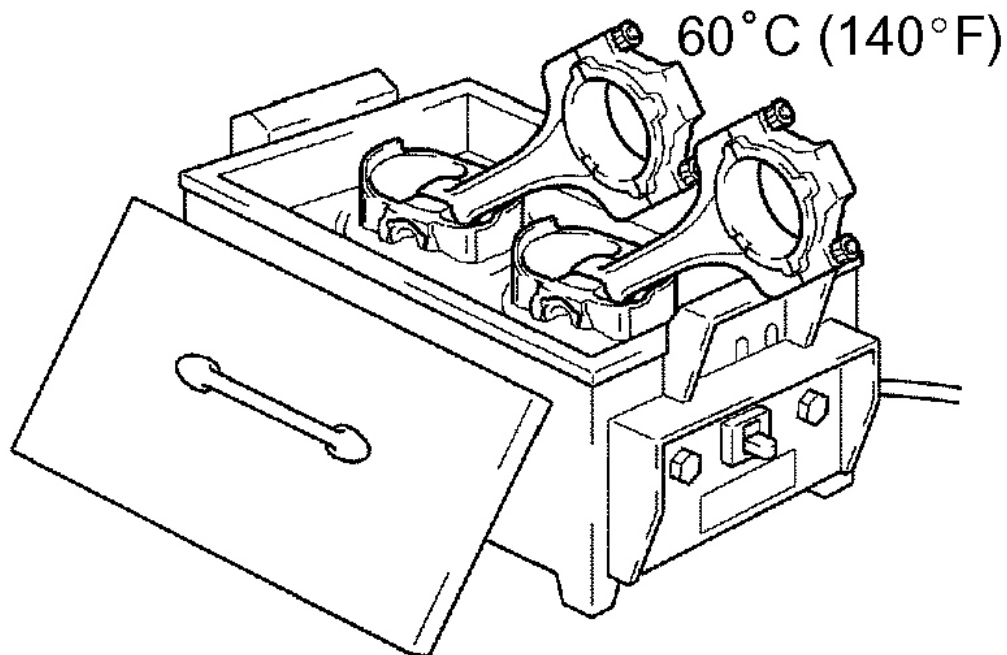


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**Fig. 420: Prying Out Snap Rings Using Small Screwdriver,**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- e. Gradually heat the piston to approximately 60°C (140°F).



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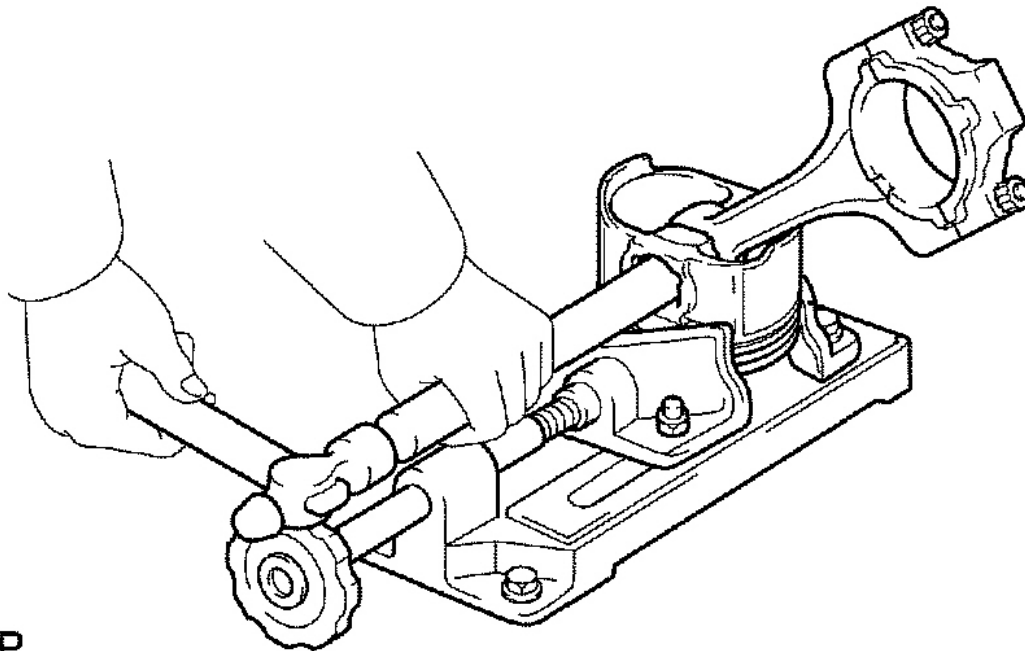
**Fig. 421: Heating Piston**

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

- f. Using a plastic-faced hammer and brass bar, lightly tap out the piston and pin. Then remove the connecting rod.

**HINT:**

- The piston and pin are a matched set.
- Be sure to organize the removed pistons, pins, rings, connecting rods and bearings in such a way that the parts can be reinstalled exactly as before.



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**Fig. 422: Removing Connecting Rod**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### 6. INSPECT CRANKSHAFT THRUST CLEARANCE

- a. Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

**Standard thrust clearance: 0.020 to 0.220 mm (0.0008 to 0.0087 in.) Maximum thrust clearance: 0.30 mm (0.0118 in.)**

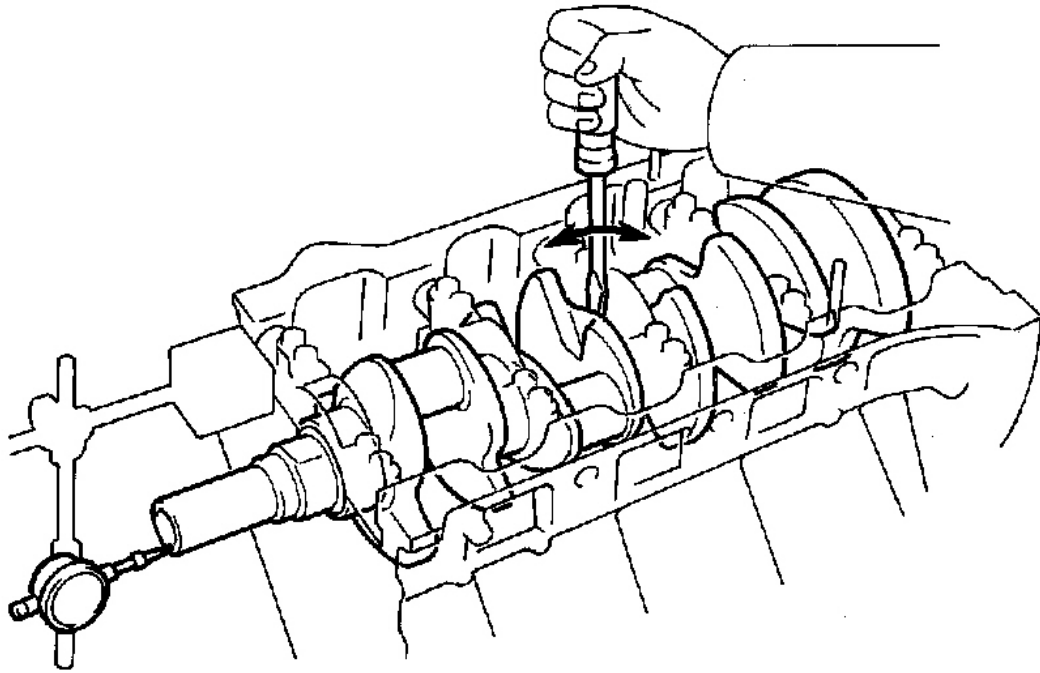
If the thrust clearance is greater than the maximum, replace the thrust washers as a set.

**Thrust washer thickness:**

**2.440 to 2.490 mm (0.0961 to 0.0980 in.)**

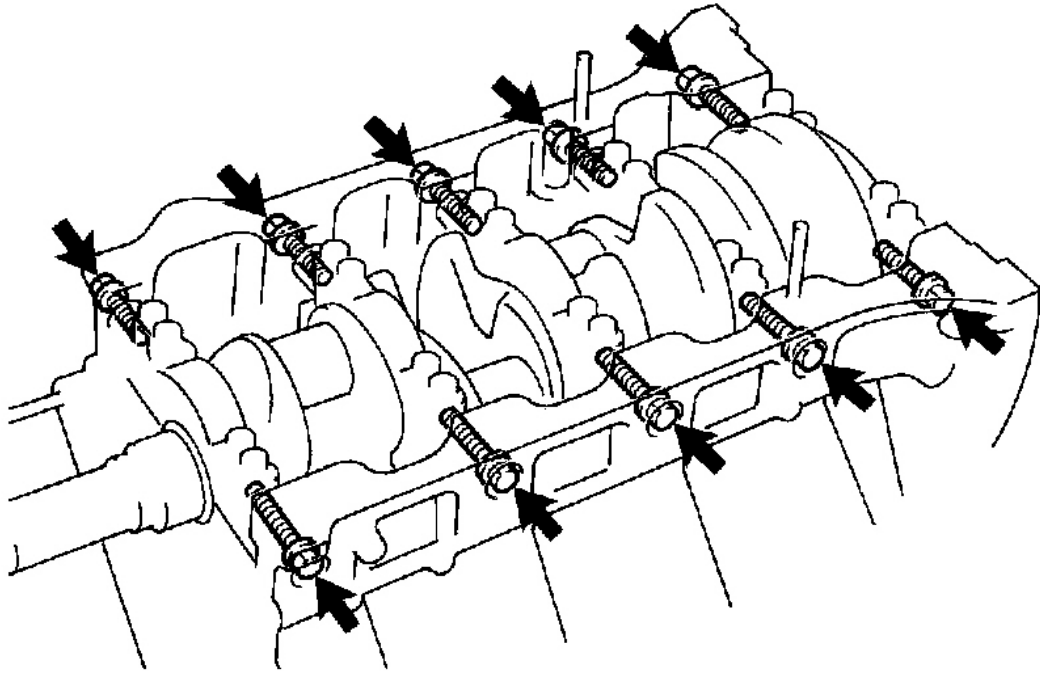
#### 7. INSPECT CRANKSHAFT OIL CLEARANCE

- a. Remove the 10 crankshaft bearing cap bolts.



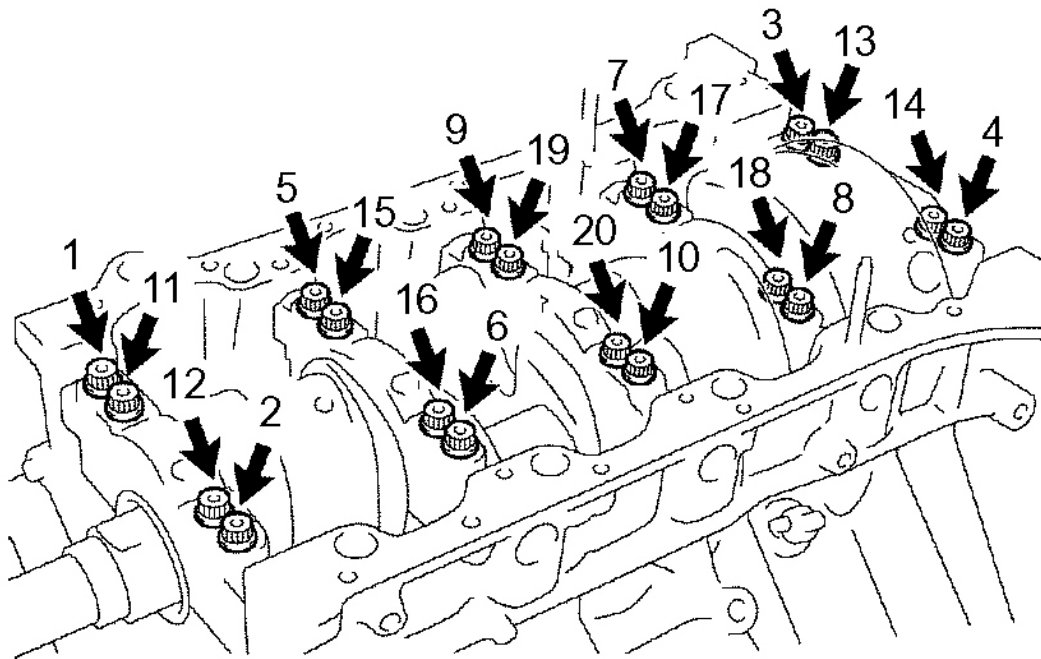
G02998689

**Fig. 423: Measuring Thrust Clearance Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G02998690

**Fig. 424: Removing Crankshaft Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 425: Identifying Crankshaft Bearing Cap Bolts**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

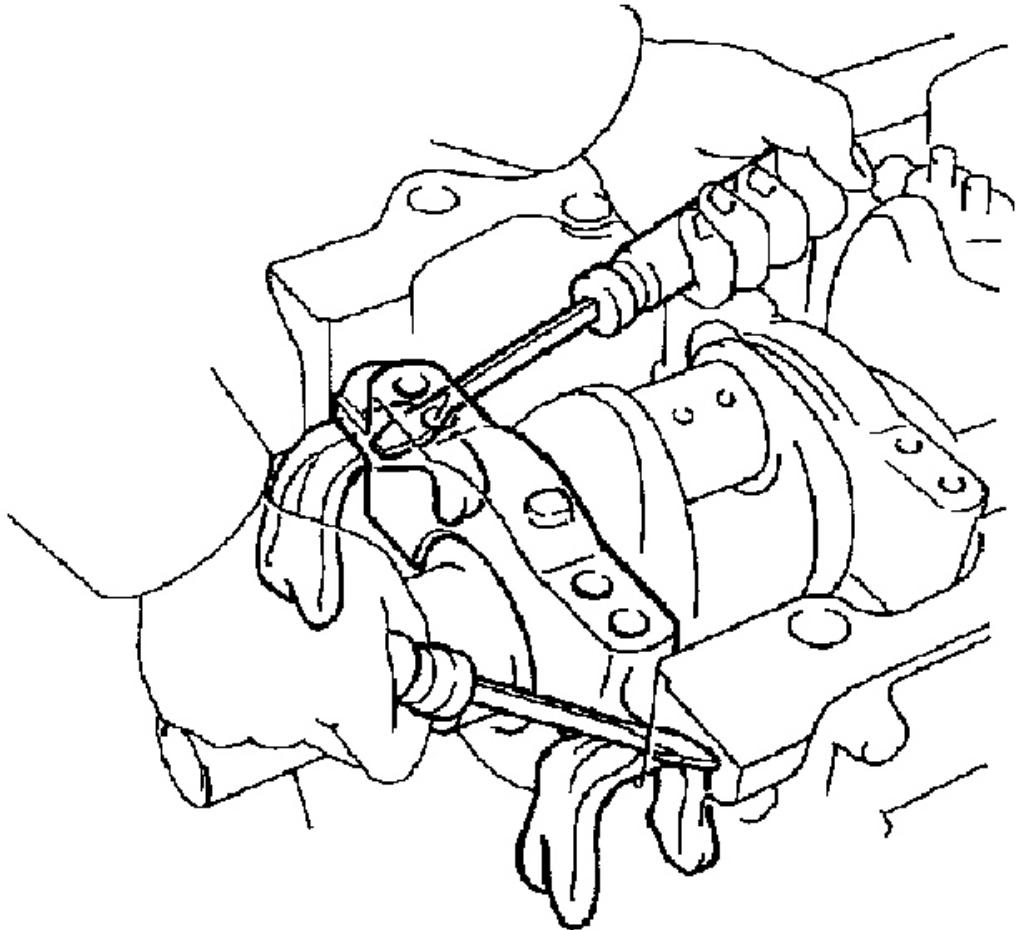
- b. Uniformly loosen and remove the 20 crankshaft bearing cap bolts in the sequence shown in the illustration.
- c. Using 2 screwdrivers, pry out the crankshaft bearing cap, and remove the 5 crankshaft bearing caps, 5 lower bearings and 2 lower thrust washers (No. 3 crankshaft bearing cap only).

**NOTE:** Be careful not to damage the cylinder block.

HINT:

- Keep the lower bearing and bearing cap together.





**G02998692**

**Fig. 426: Prying Out Crankshaft Bearing Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Be sure to organize the bearing caps and lower thrust washers in such a way that they can be reinstalled exactly as before.
- d. Lift out the crankshaft.
- e. Remove the 2 upper thrust washers.

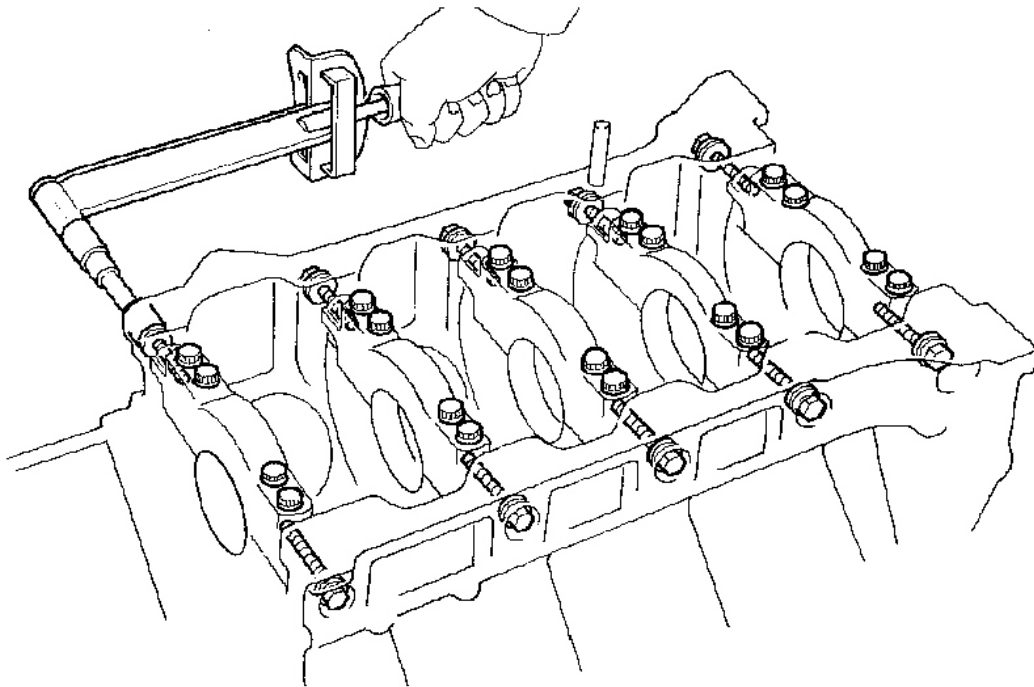
**HINT:**

- Be sure to organize the removed upper thrust washers in such a way that they can be reinstalled exactly as before.

- Keep the upper bearings together with the cylinder block.
- f. Clean each crankshaft journal and bearing.
  - g. Check each crankshaft journal and bearing for pitting and scratches.

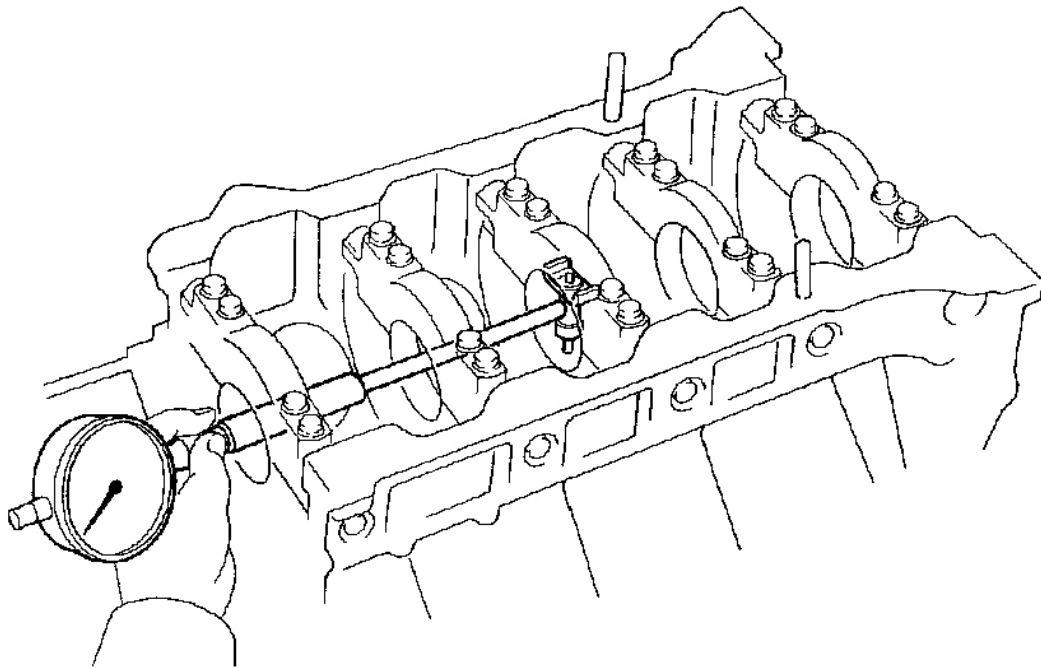
If the journal or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

- h. Install the 10 crankshaft bearings and 5 crankshaft bearing caps with the 30 bolts (see step 25). Do not install the crankshaft.



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**Fig. 427: Installing Crankshaft Bearing Caps**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G02998694

**Fig. 428: Measuring Inside Diameter Of Crankshaft Bearing Using Cylinder Gauge**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Using a cylinder gauge, measure the inside diameter of the crankshaft bearing.

**Bearing inside diameter:**

**66.986 to 67.000 mm (2.6372 to 2.6378 in.)**

- j. Measure the diameter of the crankshaft journal (see step 16).
- k. Subtract the crankshaft journal diameter measurement from the crankshaft bearing inside diameter measurement.

**STANDARD CLEARANCE:**

**STANDARD CLEARANCE**

No. 1 and No. 5	0.017 to 0.033 mm (0.0007 to 0.0013 in.)
Others	0.029 to 0.045 mm (0.0011 to 0.0018 in.)

**MAXIMUM CLEARANCE:**

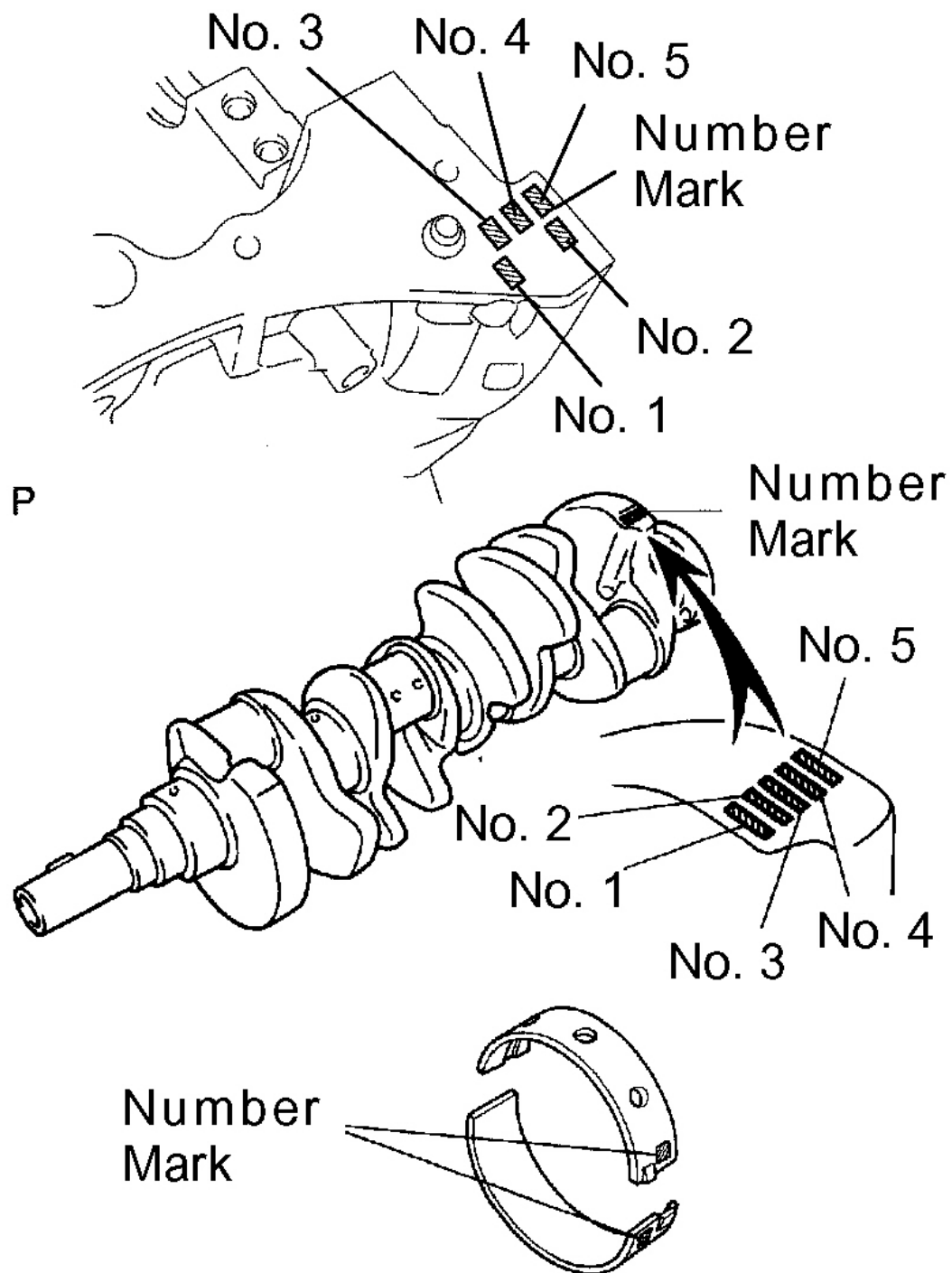
## **MAXIMUM CLEARANCE**

No. 1 and No. 5	0.043 mm (0.0017 in.)
Others	0.055 mm (0.0022 in.)

If the oil clearance is greater than the maximum, replace the bearings. If necessary, replace the crankshaft.

**HINT:** If using a standard bearing, replace it with one that has the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table on the next page for the appropriate bearing number. There are 5 sizes of the standard bearings. For No. 1 and No. 5 position bearings, use bearings marked 3, 4, 5, 6 and 7. For other position bearings, use bearings marked 1, 2, 3, 4 and 5.

**No. 1, No. 5:**



G02998695

**Fig. 429: Identifying Crankshaft Bearings Mark**

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

-		Use bearing	
Cylinder block (A) + Crankshaft (B)	(A) + (B)	Upper	Lower
	0 - 5	3	3
	6 - 8	3	4
	9 - 11	4	4
	12 - 14	4	5
	15 - 17	5	5
	18 - 20	5	6
	21 - 23	6	6
	24 - 26	6	7
	27 - 28	7	7

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**Fig. 430: Upper And Lower Bearing Reference Table (1 Of 2)**

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

EXAMPLE:

Cylinder block "08" + Crankshaft "06" =

Total number 14 (Use bearing "4" (Upper), "5" (Lower))

**Others:**

-		Use bearing	
Cylinder block (A) + Crankshaft (B)	(A) + (B)	Upper	Lower
	0 - 5	1	1
	6 - 8	1	2
	9 - 11	2	2
	12 - 14	2	3
	15 - 17	3	3
	18 - 20	3	4
	21 - 23	4	4
	24 - 26	4	5
	27 - 28	5	5

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**Fig. 431: Upper And Lower Bearing Reference Table (2 Of 2)**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

EXAMPLE:

Cylinder block "08" + Crankshaft "06" =

Total number 14 (Use bearing "2" (Upper), "3" (Lower))

**Reference**

**CYLINDER BLOCK CRANKSHAFT JOURNAL BORE DIAMETER (A):**

**CYLINDER BLOCK CRANKSHAFT JOURNAL BORE DIAMETER SPECIFICATIONS**

Mark 00	72.000 mm (2.8346 in.)
Mark 01	72.001 mm (2.8347 in.)
Mark 02	72.002 mm (2.8347 in.)
Mark 03	72.003 mm (2.8348 in.)
Mark 04	72.004 mm (2.8348 in.)
Mark 05	72.005 mm (2.8348 in.)
Mark 06	72.006 mm (2.8349 in.)
Mark 07	72.007 mm (2.8349 in.)
Mark 08	72.008 mm (2.8350 in.)
Mark 09	72.009 mm (2.8350 in.)
Mark 10	72.010 mm (2.8350 in.)
Mark 11	72.011 mm (2.8351 in.)

Mark 12	72.012 mm (2.8351 in.)
Mark 13	72.013 mm (2.8352 in.)
Mark 14	72.014 mm (2.8352 in.)
Mark 15	72.015 mm (2.8352 in.)
Mark 16	72.016 mm (2.8353 in.)

**CRANKSHAFT JOURNAL DIAMETER (B):**

**CRANKSHAFT JOURNAL DIAMETER SPECIFICATIONS**

Mark 00	67.000 mm (2.6378 in.)
Mark 01	66.999 mm (2.6378 in.)
Mark 02	66.998 mm (2.6377 in.)
Mark 03	66.997 mm (2.6377 in.)
Mark 04	66.996 mm (2.6376 in.)
Mark 05	66.995 mm (2.6376 in.)
Mark 06	66.994 mm (2.6376 in.)
Mark 07	66.993 mm (2.6375 in.)
Mark 08	66.992 mm (2.6375 in.)
Mark 09	66.991 mm (2.6374 in.)
Mark 10	66.990 mm (2.6374 in.)
Mark 11	66.989 mm (2.6374 in.)
Mark 12	66.988 mm (2.6373 in.)

**STANDARD BEARING CENTER WALL THICKNESS: NO. 1 AND NO. 5**

**STANDARD BEARING CENTER WALL THICKNESS SPECIFICATIONS**

Mark 3	2.492 to less than 2.495 mm (0.0981 to less than 0.0982 in.)
Mark 4	2.495 to less than 2.498 mm (0.0982 to less than 0.0983 in.)
Mark 5	2.498 to less than 2.501 mm ar 5 (0.0983 to less than 0.0985 in.)
Mark 6	2.501 to less than 2.504 mm Mark 6 (0.0985 to less than 0.0986 in.)
Mark 7	2.504 to less than 2.507 mm ar 7 (0.0986 to less than 0.0987 in.)

**OTHERS:**

**STANDARD BEARING CENTER WALL THICKNESS SPECIFICATIONS**

Mark 1	2.486 to less than 2.489 mm ar (0.0979 to less than 0.0980 in.)
Mark 2	2.489 to less than 2.492 mm ar 2 (0.0980 to less than 0.0981 in.)
Mark 3	2.492 to less than 2.495 mm Mark 3 (0.0981 to less than 0.0982 in.)
Mark 4	2.495 to less than 2.498 mm ar (0.0982 to less than 0.0983 in.)
Mark 5	2.498 to less than 2.501 mm Mark 5 (0.0983 to less than 0.0985 in.)

1. Remove the 10 bolts, 20 nuts, 5 crankshaft bearing caps and 5 lower crankshaft bearings (see steps

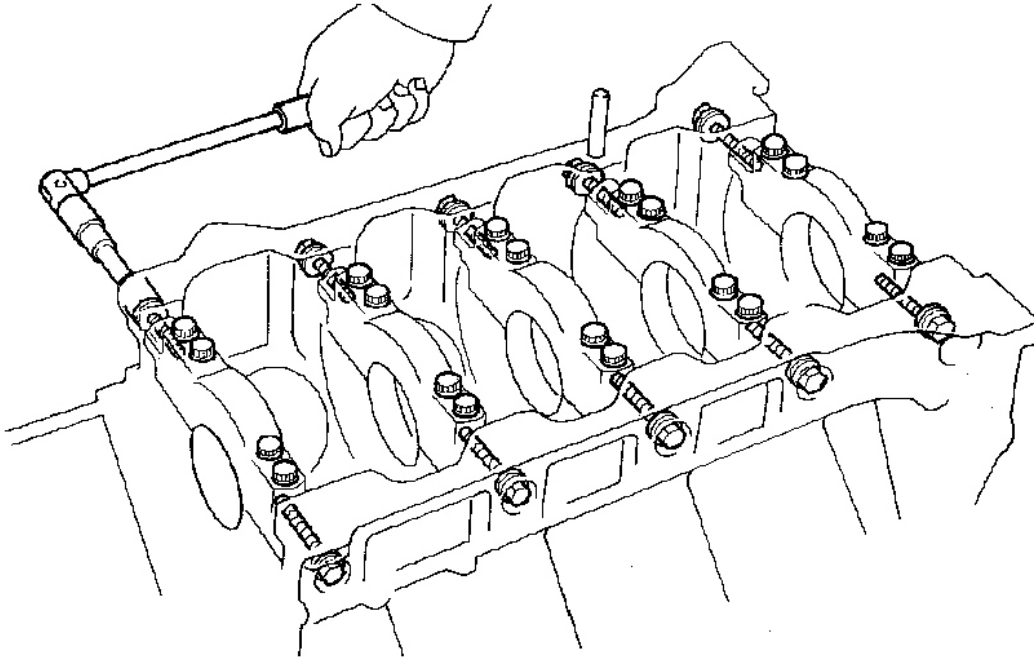


(a) to b (c) on the previous pages).

m. Remove the 5 upper crankshaft bearings from the cylinder block.

HINT:

Be sure to organize the bearing caps, bearings and thrust washers in such a way that they can be reinstalled exactly as before.



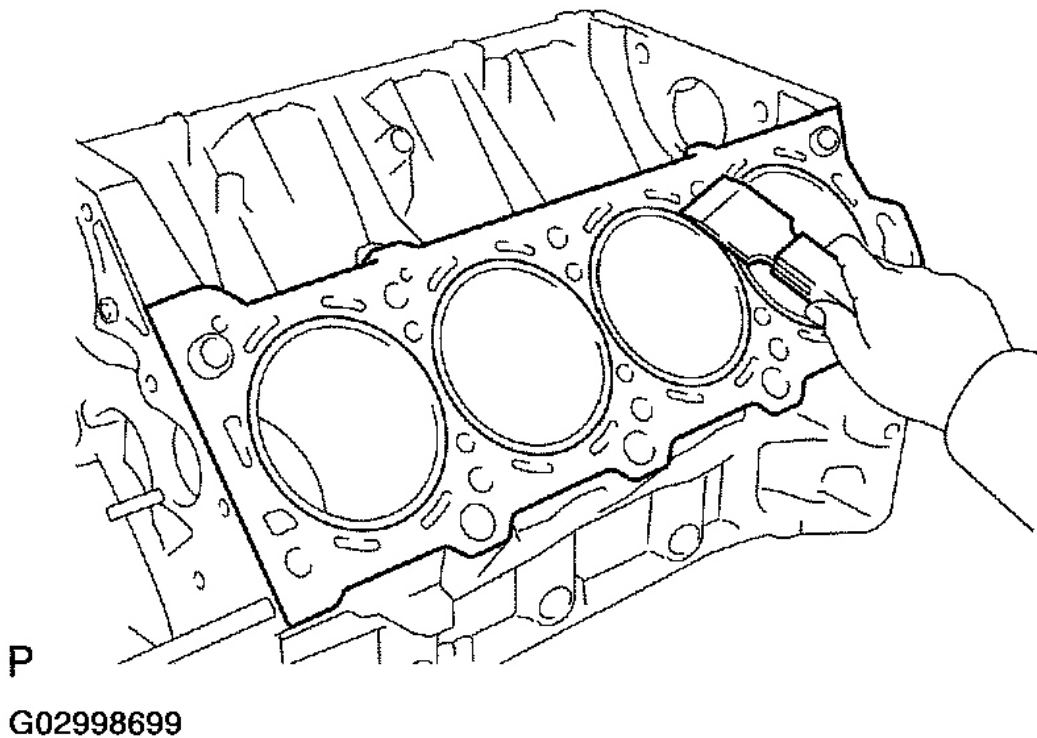
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**Fig. 432: Removing Crankshaft Bearing Caps Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 8. INSPECT CYLINDER BLOCK SUB-ASSY

- a. Clean the cylinder block. Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- b. Using a soft brush and solvent, thoroughly clean the cylinder block.

**NOTE:** If the cylinder is washed at high temperatures, the cylinder liner sticks out beyond the cylinder block. Always wash the cylinder block at a temperature of 45°C (113°F) or less.

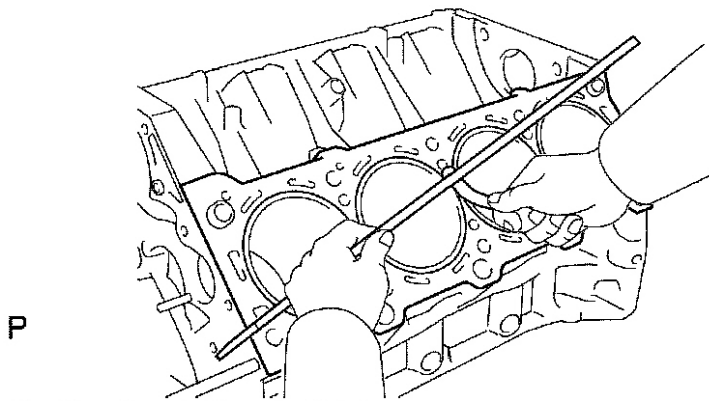


**Fig. 433: Cleaning Cylinder Block Using Gasket Scraper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

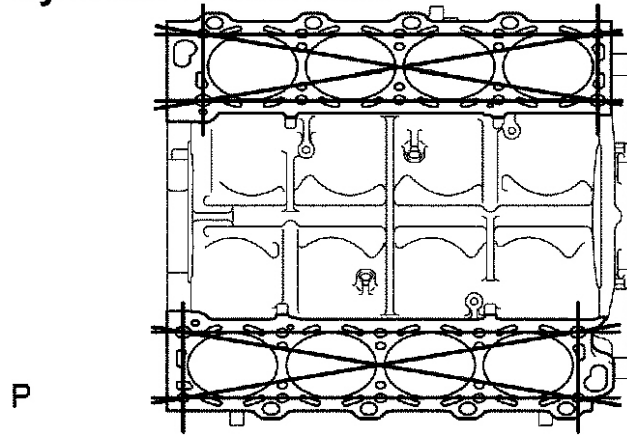
- c. Inspect for warpage.
  - 1. Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and main bearing cap for warpage.

**Maximum warpage: 0.07 mm (0.0028 in.)**

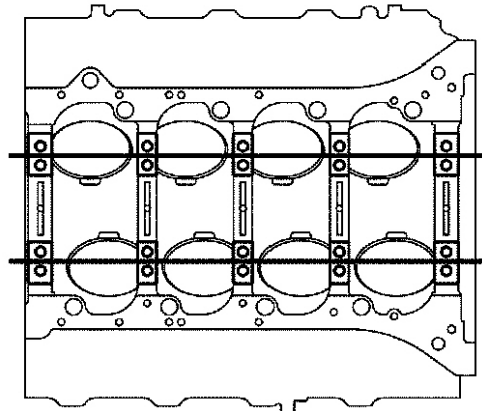
If the warpage is greater than the maximum, replace the cylinder block sub-assy.



**Cylinder Block Side**



**Main Bearing Cap Side**

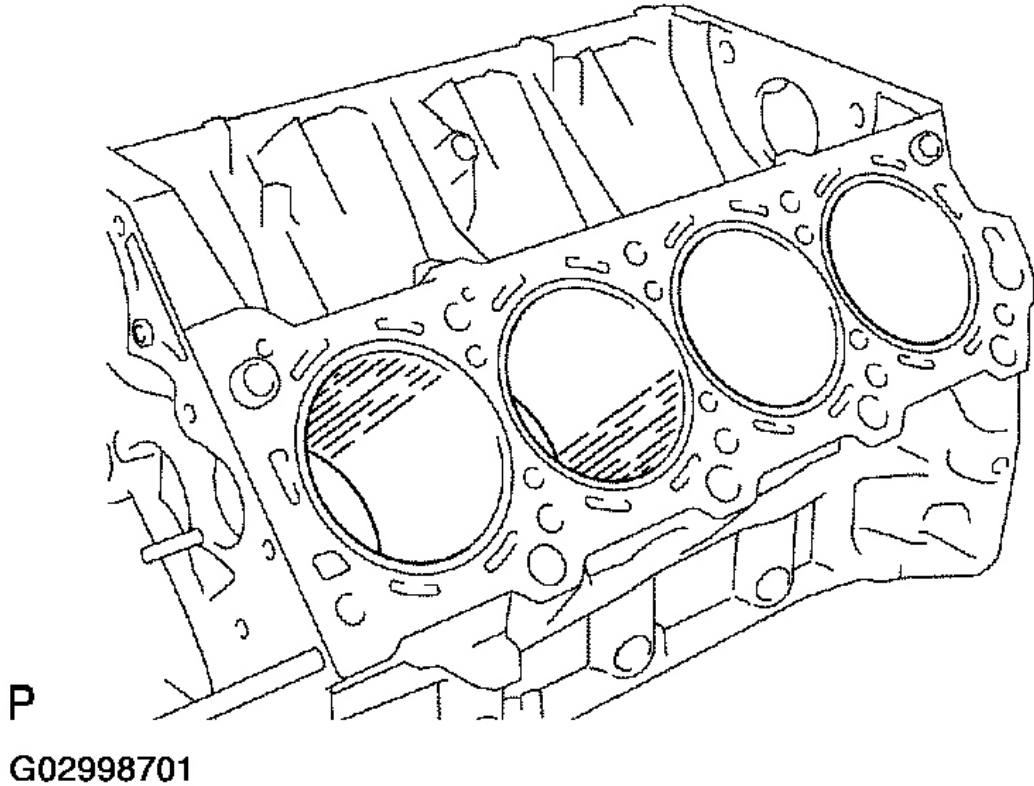


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**Fig. 434: Measuring Surfaces Contacting Cylinder Head**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Visually check the cylinder for vertical scratches.

If deep scratches are present, replace the cylinder block sub-assy.



**Fig. 435: Identifying Cylinder Block Sub-Assy**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Inspect the cylinder bore diameter.

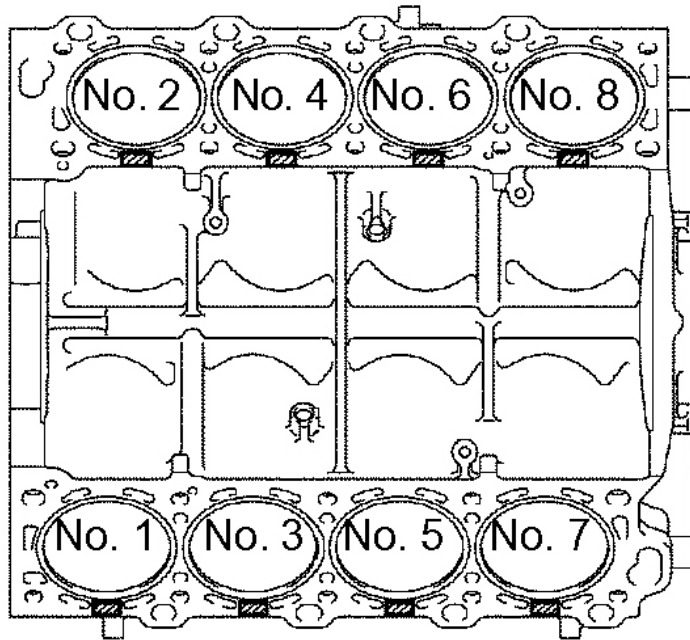
HINT:

There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.

If deep scratches are present, replace the cylinder block sub-assy.

▣: Mark  
1, 2 or 3

Front ←



P

G02998702

**Fig. 436: Identifying Cylinder Bore Diameter**

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

1. Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

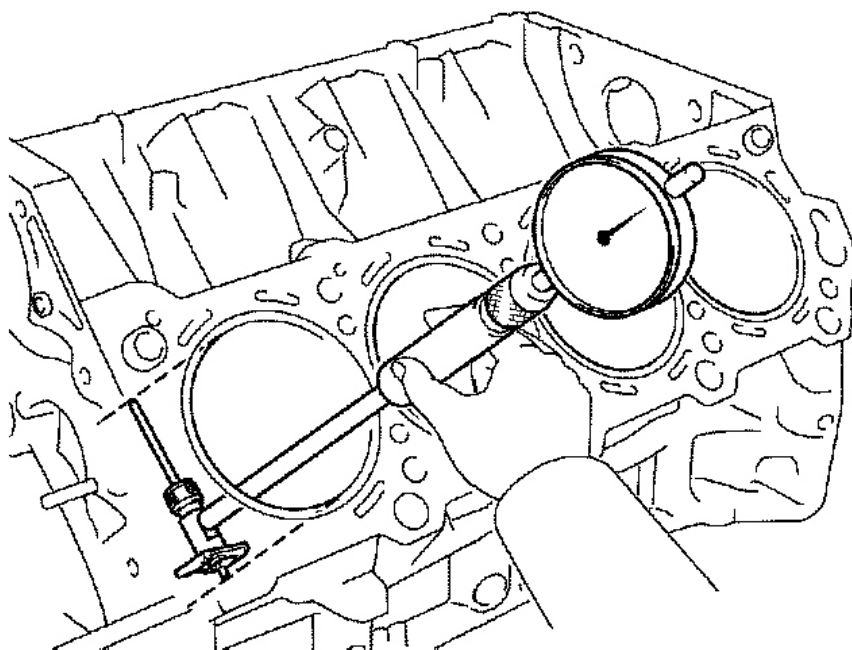
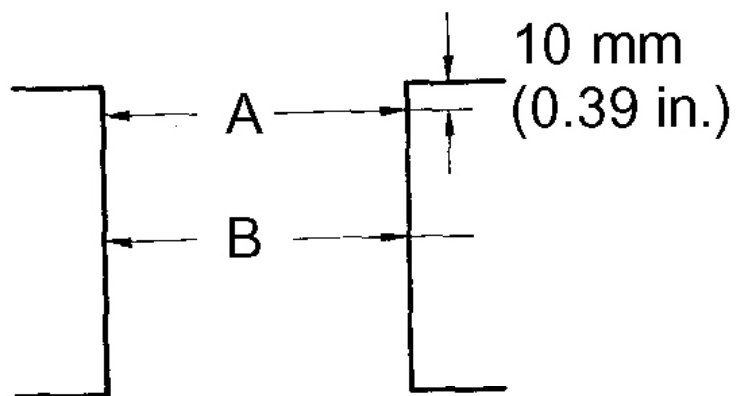
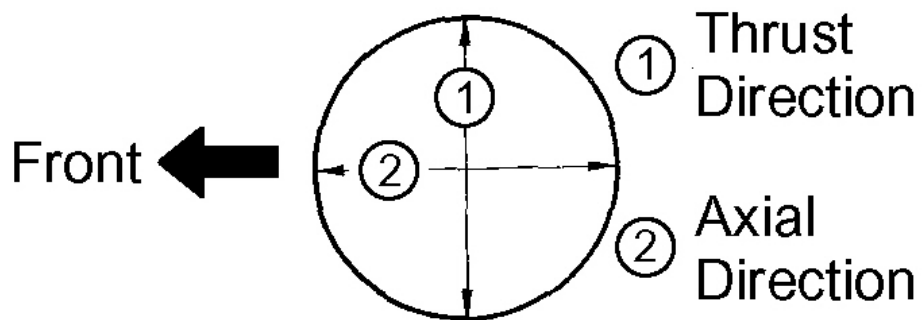
**STANDARD DIAMETER:**

**CYLINDER BORE DIAMETER**

Mark 1	91.000 to 91.008 mm (3.5827 to 3.5830 in.)
Mark 2	91.008 to 91.021 mm (3.5830 to 3.5835 in.)
Mark 3	91.021 to 91.029 mm (3.5835 to 3.5838 in.)

**Maximum diameter: 91.149 mm (3.5885 in.)**

If the average of the diameter is greater than the maximum, replace the cylinder block.



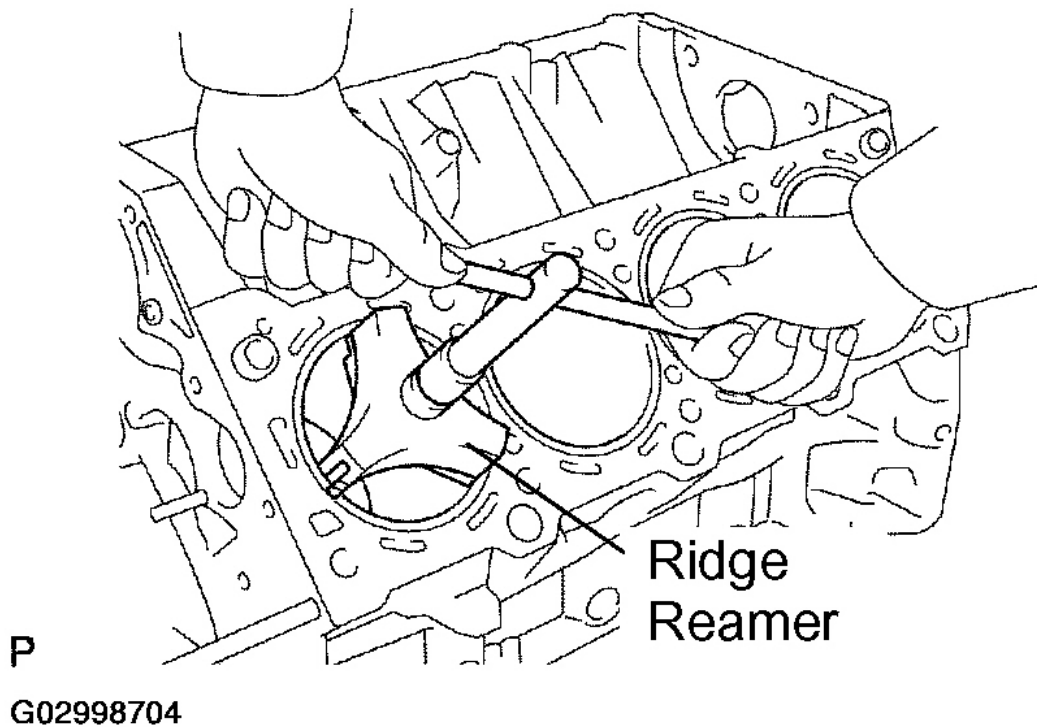
P

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**Fig. 437: Measuring Cylinder Bore Diameter Positions (A) And (B) Using Cylinder Gauge**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Remove the cylinder ridge.

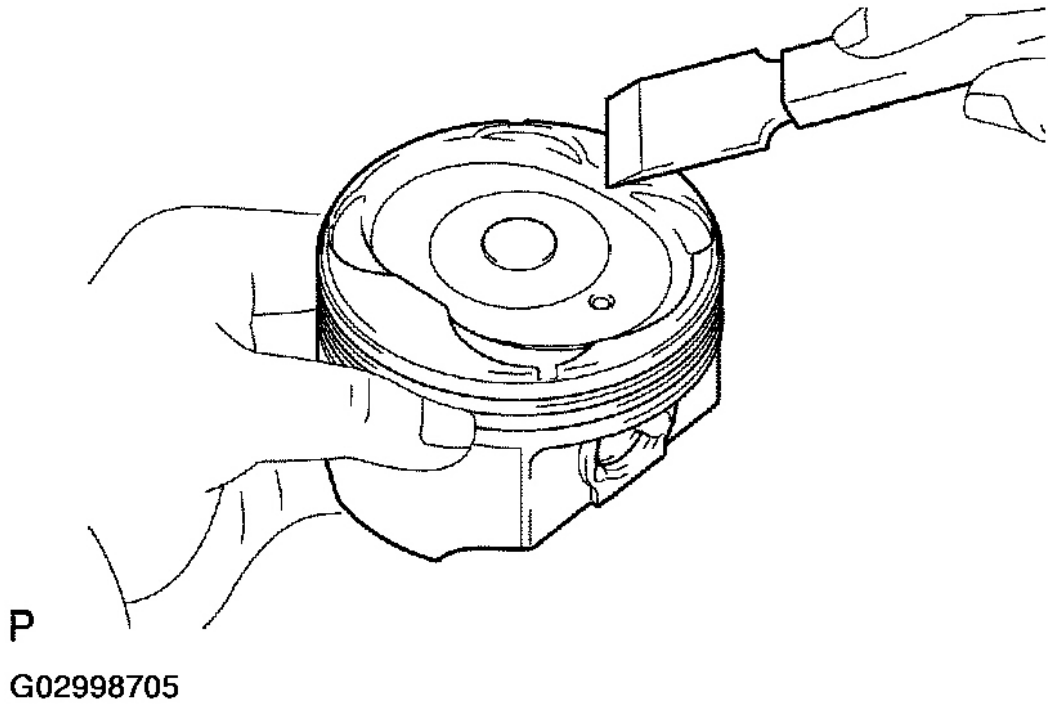
If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.



**Fig. 438: Removing Cylinder Ridge**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**9. INSPECT W/PIN PISTON SUB-ASSY**

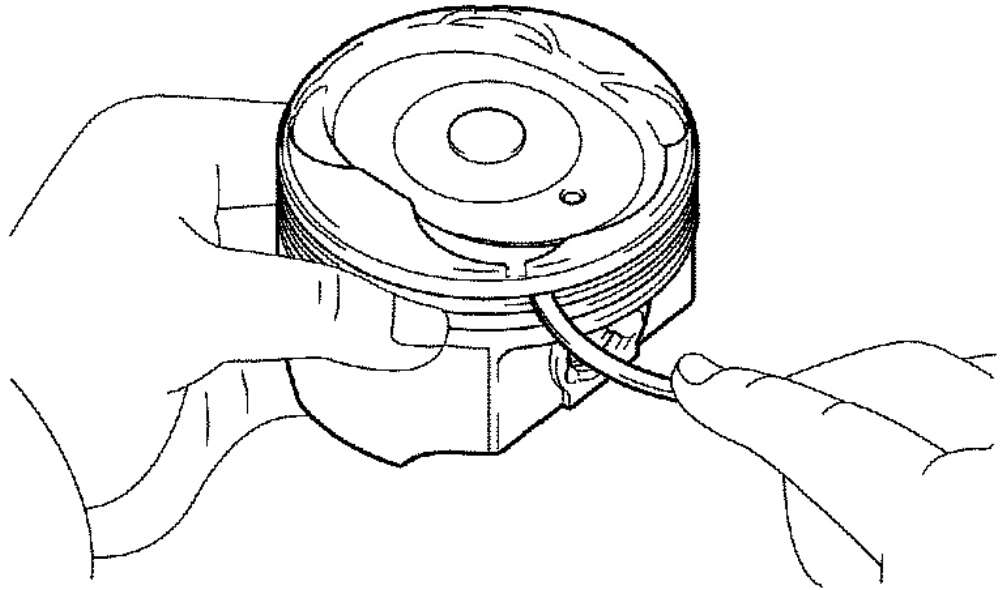
- a. Clean the piston.
  1. Using a gasket scraper, remove the carbon from the piston top.



**Fig. 439: Removing Carbon From Piston Top**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.





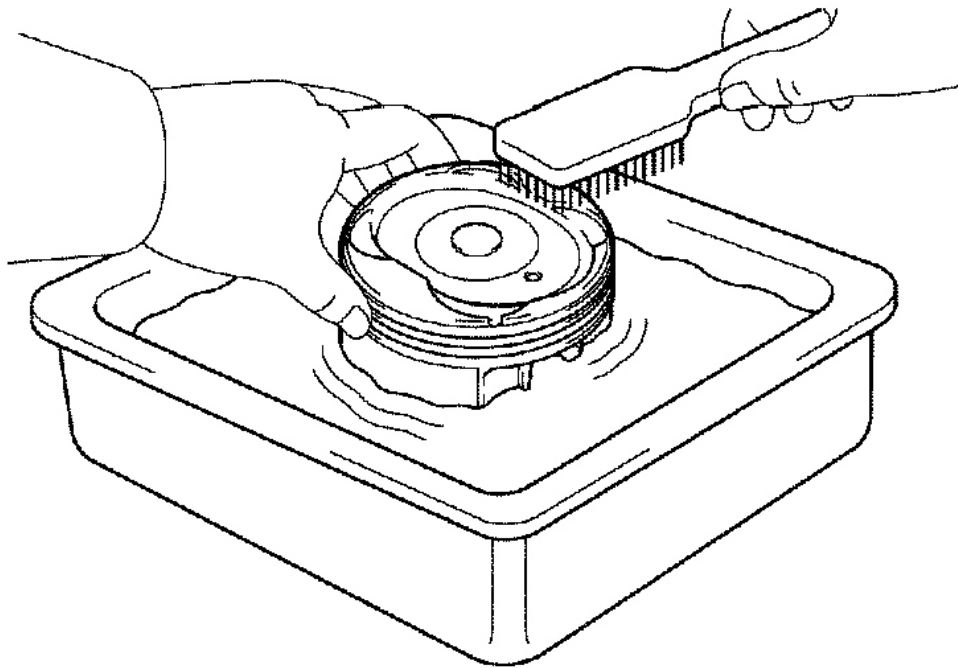
**P**

**G02998706**

**Fig. 440: Cleaning Piston Ring Grooves**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

3. Using solvent and a brush, thoroughly clean the piston.

**NOTE: Do not use a wire brush.**



**P**

**G02998707**

**Fig. 441: Cleaning Piston Using Solvent And Brush**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the piston oil clearance.

**HINT:**

There are 3 standard piston diameter size, marked "1", "2" and "3". The mark is stamped on the piston top.

1. Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 28.1 mm (1.106 in.) from the piston head.

**PISTON DIAMETER:**

**PISTON DIAMETER SPECIFICATIONS**

Mark 1	90.910 to 90.940 mm (3.5791 to 3.5803 in.)
Mark 2	90.920 to 90.948 mm (3.5795 to 3.5806 in.)
Mark 3	90.928 to 90.958 mm (3.5798 to 3.5810 in.)

2. Measure the cylinder bore diameter in the thrust directions (see step 8 above).

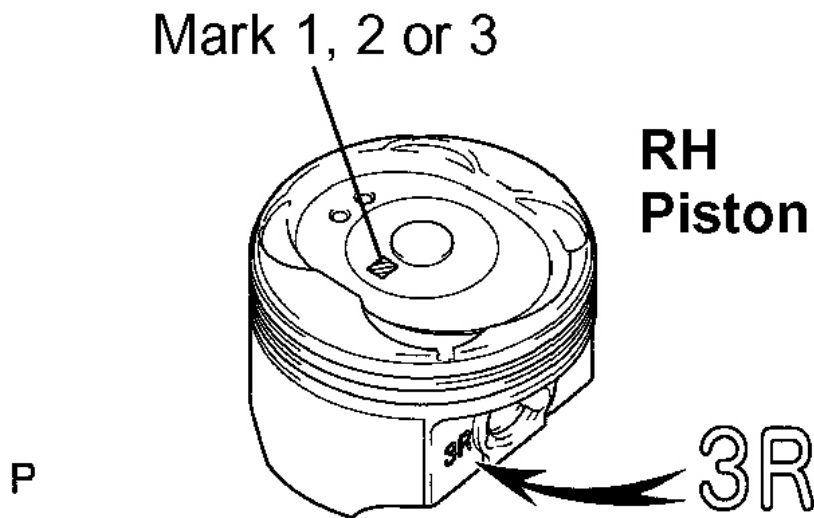
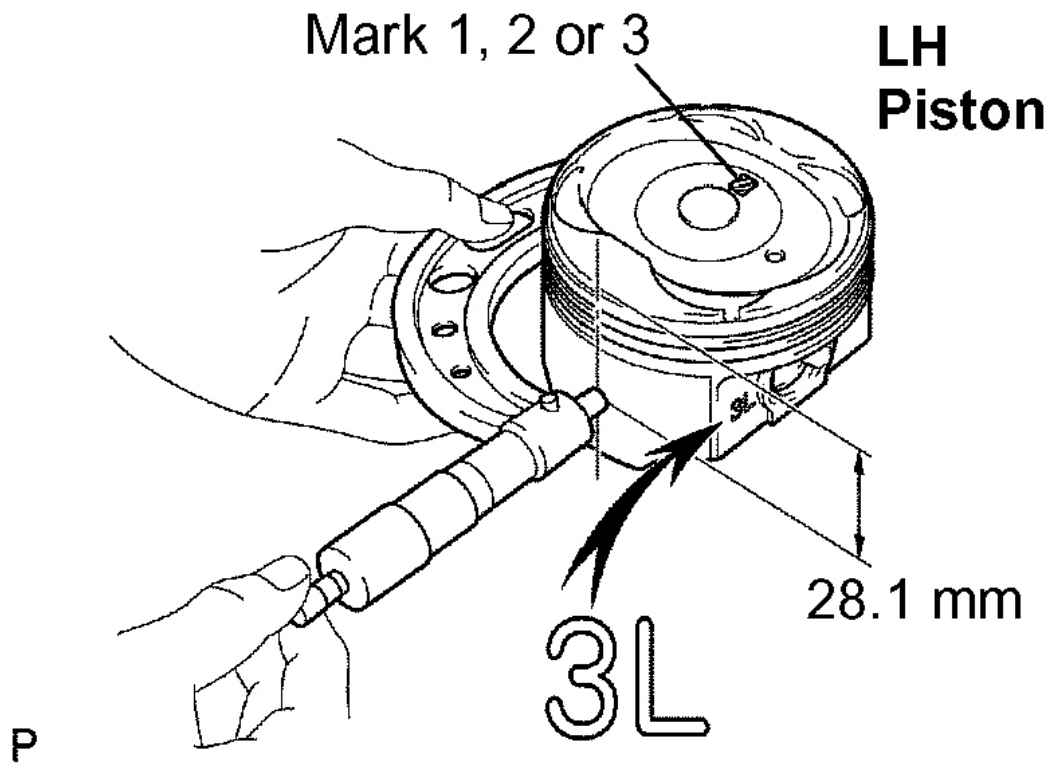
3. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

**Standard oil clearance:**

**0.060 to 0.104 mm (0.0023 to 0.0041 in.)**

**Maximum oil clearance: 0.124 mm (0.0049 in.)**

If the oil clearance is greater than the maximum, replace all the 8 pistons. If necessary, replace the cylinder block sub-assy.



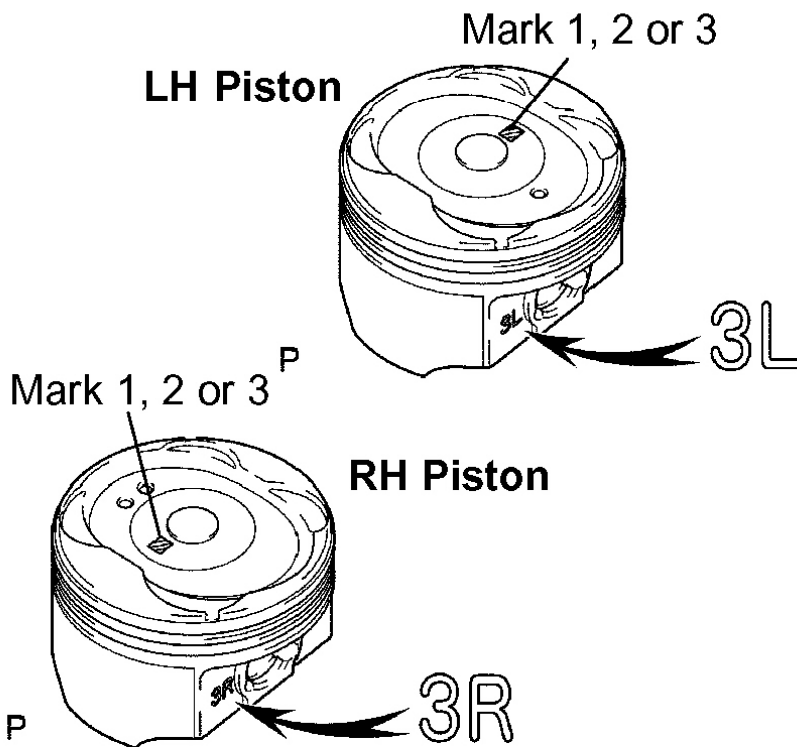
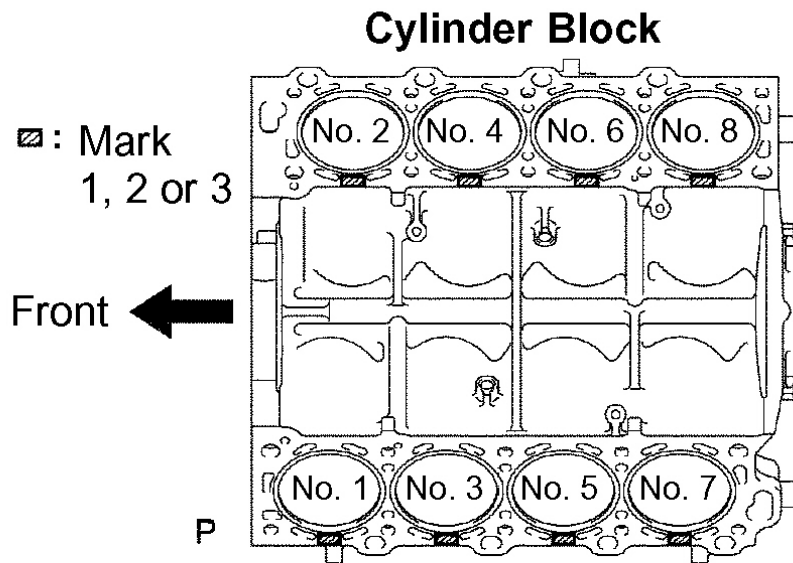
G02998708

**Fig. 442: Measuring Piston Diameter At Right Angles Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## HINT:

Use a new cylinder block:

- Use a piston with the same number mark as the cylinder diameter marked on the cylinder block.
- The shape of the piston varies for the LH and RH banks. The LH piston is marked with "3L" and the RH piston is marked with "3R".

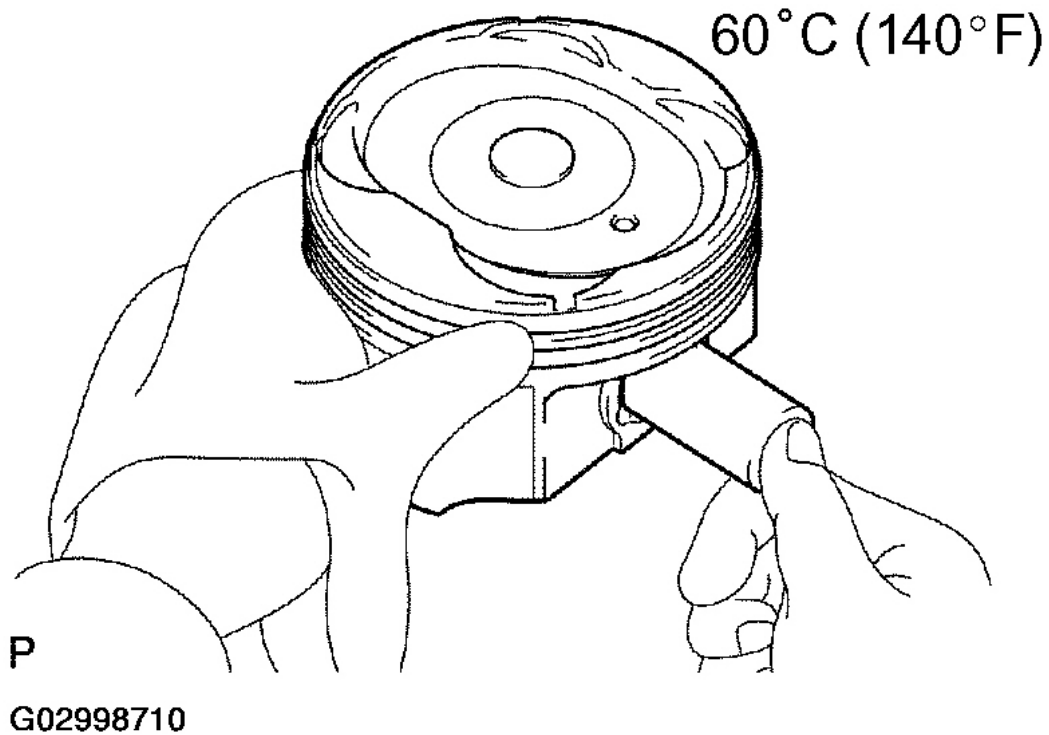


G02998709

**Fig. 443: Identifying Cylinder Block Diameter**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect the piston pin fit.

1. At 60°C (140°F), check that the piston pin can be pushed into the piston pin hole with your thumb.

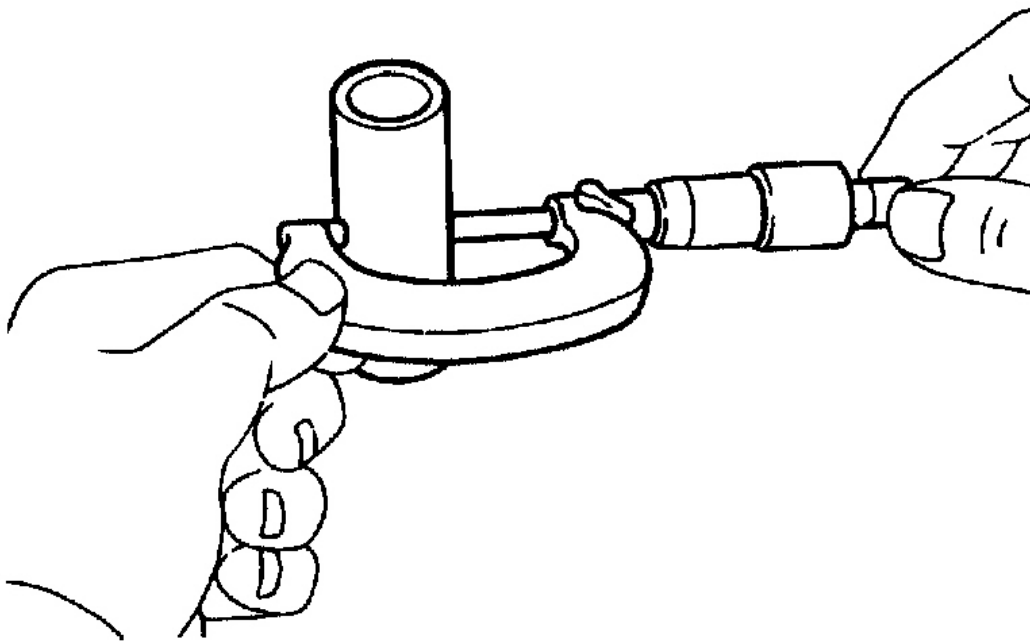


**Fig. 444: Checking Piston Pin**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a micrometer, measure the piston pin diameter.

**Piston pin diameter:**

**21.997 to 22.006 mm (0.8660 to 0.8664 in.)**



G02998711

**Fig. 445: Measuring Piston Pin Diameter Using Micrometer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 10. INSPECT PISTON RING SET

- a. Inspect the piston ring groove clearance.
  1. Using a feeler gauge, measure the clearance between a new piston ring and the wall of the ring groove.

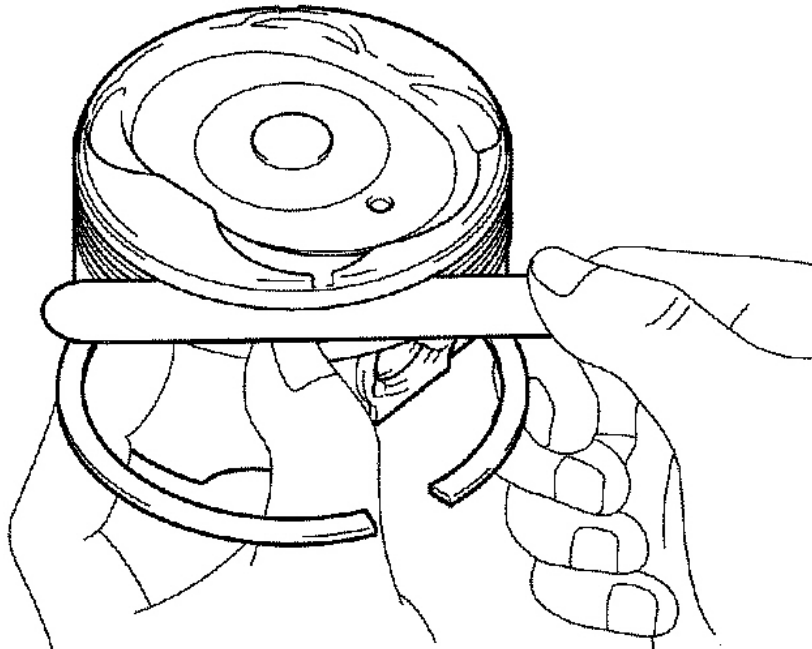
### **RING GROOVE CLEARANCE:**

#### **RING GROOVE CLEARANCE SPECIFICATIONS**

No. 1	0.030 to 0.080 mm (0.0012 to 0.0031 in.)
No. 2	0.020 to 0.060 mm (0.0008 to 0.0024 in.)

If the clearance is not as specified, replace the piston.



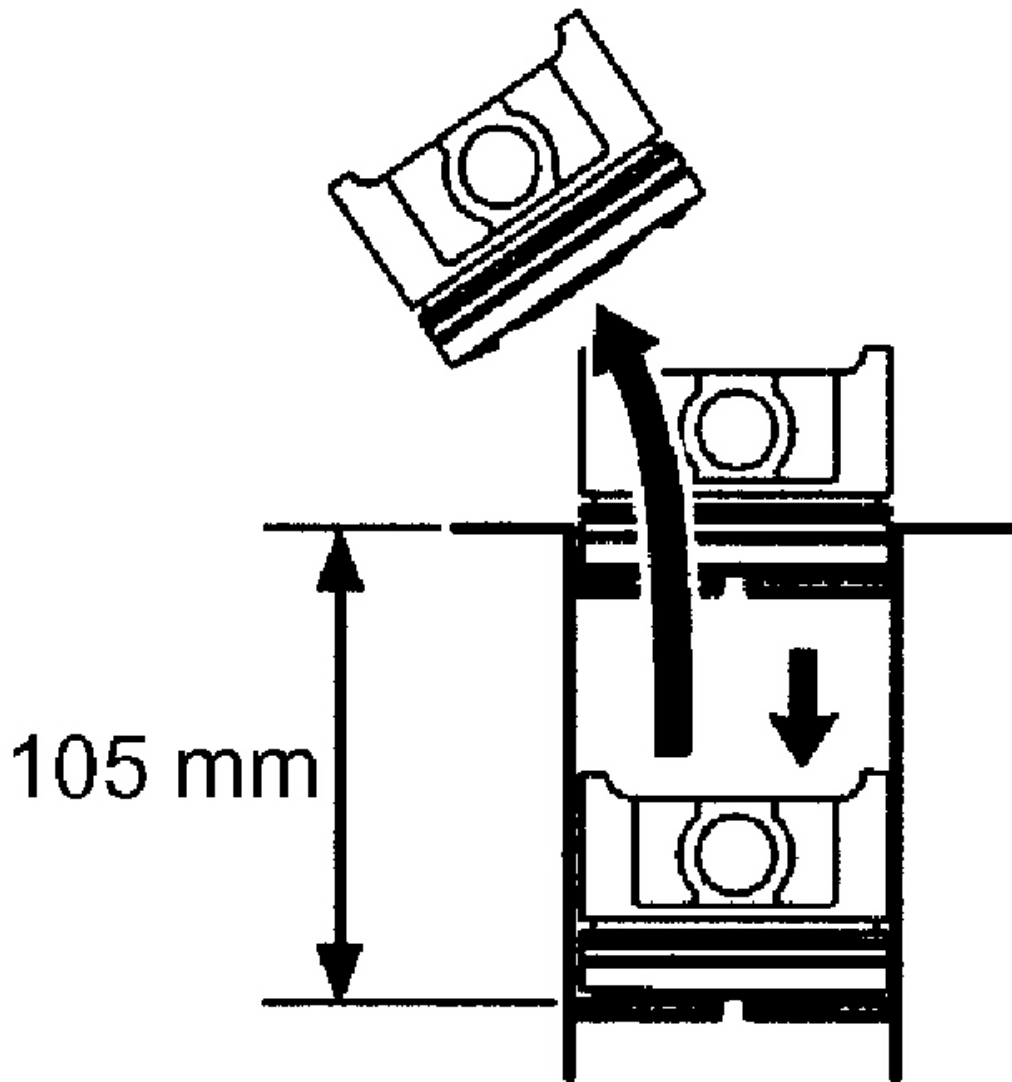


P

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**Fig. 446: Measuring Clearance Between Piston Ring Using Feeler Gauge**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the piston ring end gap.
  1. Insert the piston ring into the cylinder bore.
  2. Using a piston, push the piston ring a little beyond the bottom of the ring travel 105 mm (4.13 in.) from the top of the cylinder block.



G02998713

**Fig. 447: Inserting Piston Ring Into Cylinder Bore**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Using a feeler gauge, measure the end gap.

**STANDARD END GAP:**

**END GAP SPECIFICATIONS**

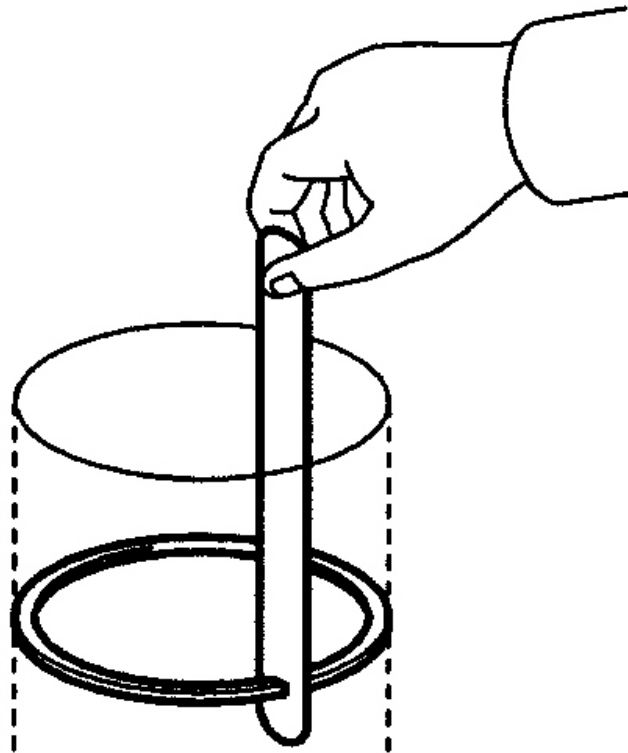


No. 1	0.300 to 0.500 mm (0.0118 to 0.0197 in.)
No. 2	0.400 to 0.600 mm (0.0157 to 0.0236 in.)
Oil (Side rail)	0.150 to 0.500 mm (0.0059 to 0.0197 in.)

**MAXIMUM END GAP:**

**MAXIMUM END GAP SPECIFICATIONS**

No. 1	1.05 mm (0.0413 in.)
No. 2	1.20 mm (0.0472 in.)
Oil (Side rail)	1.10 mm (0.0433 in.)



**G02998714**

**Fig. 448: Measuring Piston Ring Gap Using Feeler Gauge**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the end gap is greater than the maximum, replace the piston ring. If the end gap is greater than the maximum, even with a new piston ring, replace the cylinder block sub-assy.

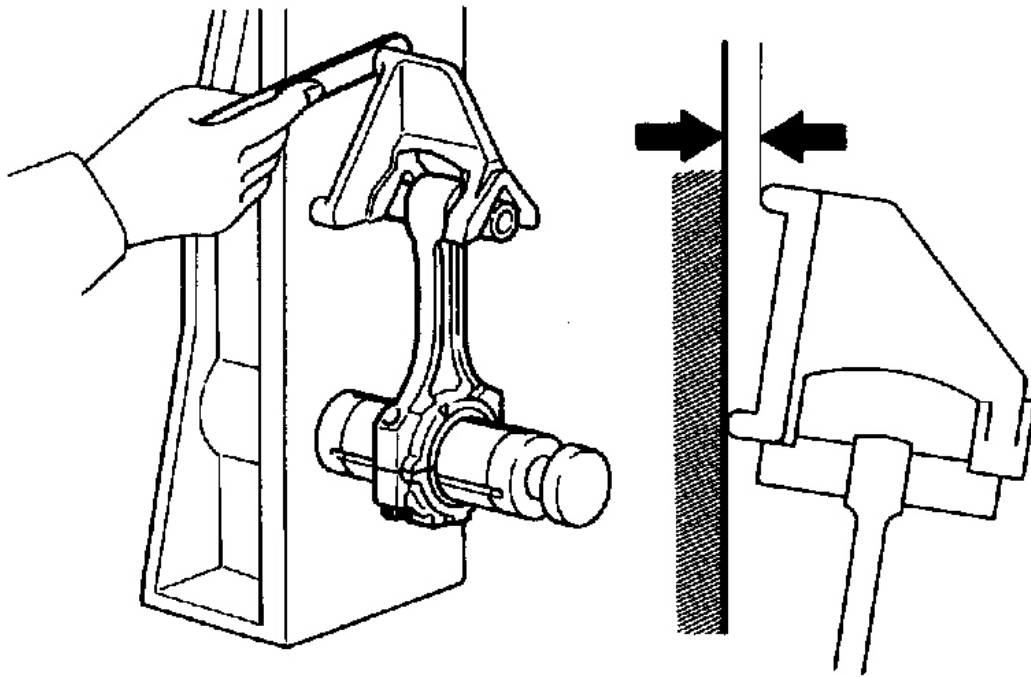
## 11. INSPECT CONNECTING ROD SUB-ASSY

- a. Using a rod aligner and feeler gauge, check the connecting rod alignment.
1. Check if it is bent.

**Maximum bend:**

**0.05 mm (0.0020 in.) per 100 mm (3.94 in.)**

If the bend is greater than the maximum, replace the connecting rod sub-assy.



G02998715

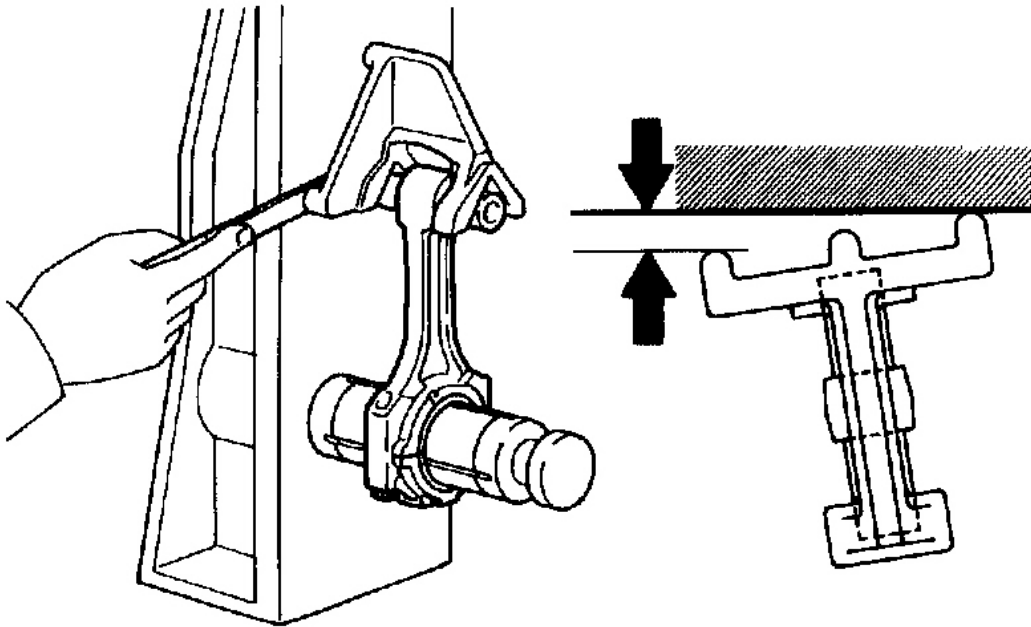
**Fig. 449: Checking Connecting Rod Alignment**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check if it is twisted.

**Maximum twist:**

**0.15 mm (0.0059 in.) per 100 mm (3.94 in.)**

If the twist is greater than the maximum, replace the connecting rod sub-assy.



G02998716

**Fig. 450: Checking Twisted**

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

**12. INSPECT PISTON PIN OIL CLEARANCE**

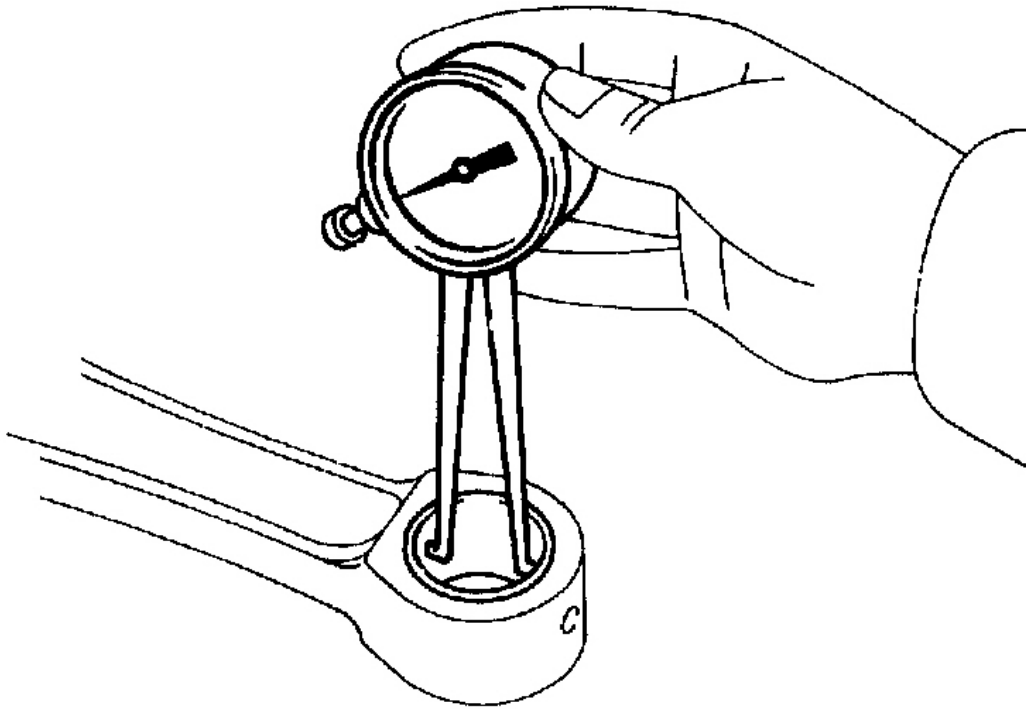
- a. Inspect the piston pin oil clearance.
  1. Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

**Bushing inside diameter:**

**22.005 to 22.014 mm (0.8663 to 0.8667 in.)**

If the bushing inside diameter is not as specified, check the oil clearance.

2. Subtract the piston pin diameter measurement (see step 10) from the bush inside diameter measurement.



G02998717

**Fig. 451: Measuring Inside Diameter Of Connecting Rod Bushing Using Caliper Gauge**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Standard oil clearance:**

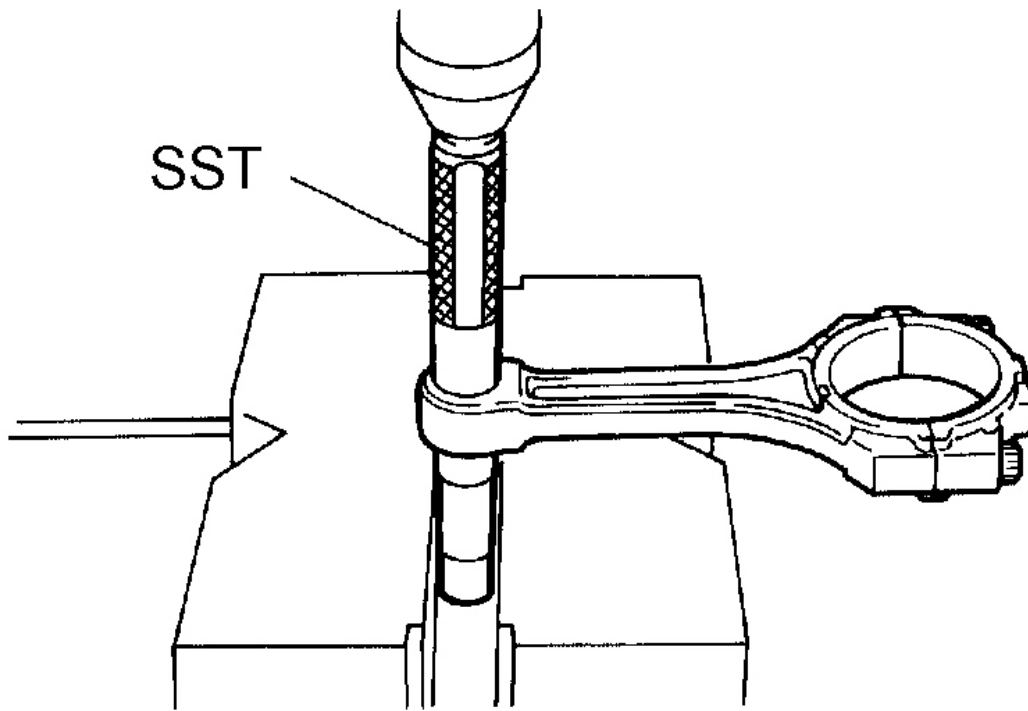
**0.005 to 0.011 mm (0.0002 to 0.0004 in.)**

**Maximum oil clearance: 0.05 mm (0.0020 in.)**

If the oil clearance is greater than the maximum, replace the bush. If necessary, replace the piston and piston pin with a new piston and pin set.

**13. REMOVE CONNECTING ROD SMALL END BUSH**

- a. Using SST and a press, press out the bush.  
SST 09222-30010



G02998718

**Fig. 452: Pressing Out Bush Using SST**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSPECT CONNECTING ROD BOLT**

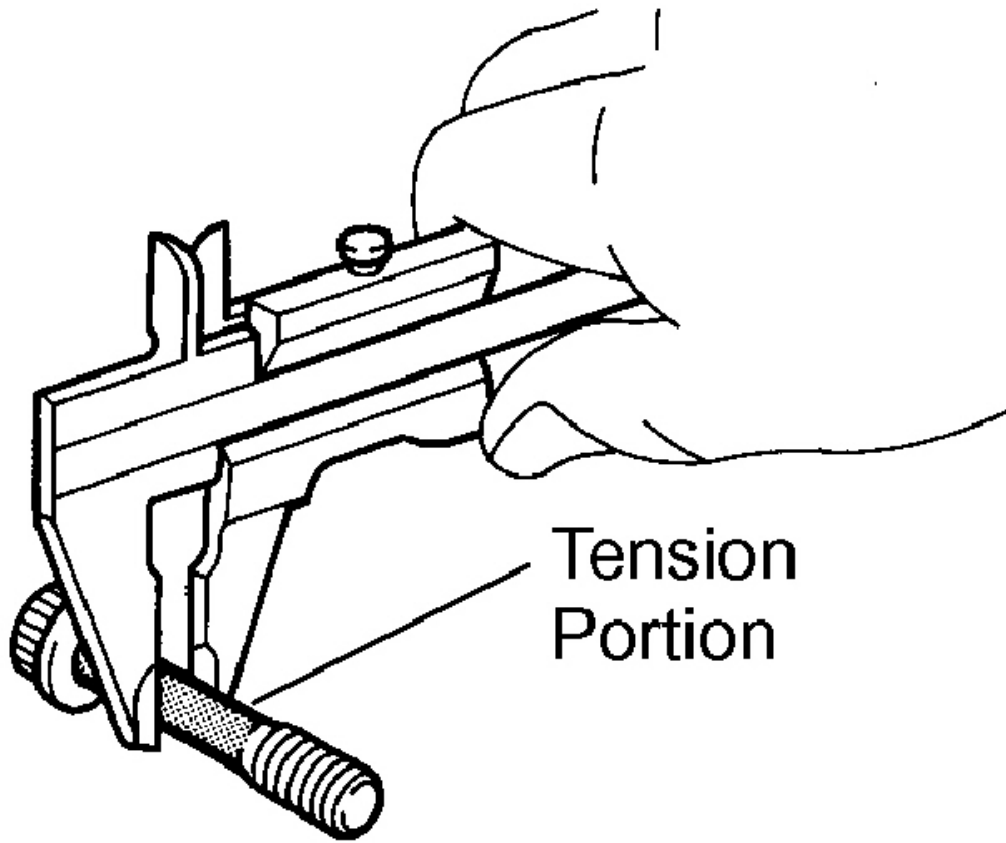
- a. Using a vernier caliper, measure the tension portion of the connecting rod bolt.

**Standard diameter:**

**7.200 to 7.300 mm (0.2835 to 0.2874 in.)**

**Minimum diameter: 7.00 mm (0.2756 in.)**

If the diameter is less than the minimum, replace the bolt.



**G02998719**

**Fig. 453: Measuring Tension Portion Of Connecting Rod Bolt Using Vernier Caliper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**15. INSPECT CRANKSHAFT BEARING CAP BOLT**

- a. Using a vernier caliper, measure the tension portion diameter of the main bearing cap bolt.

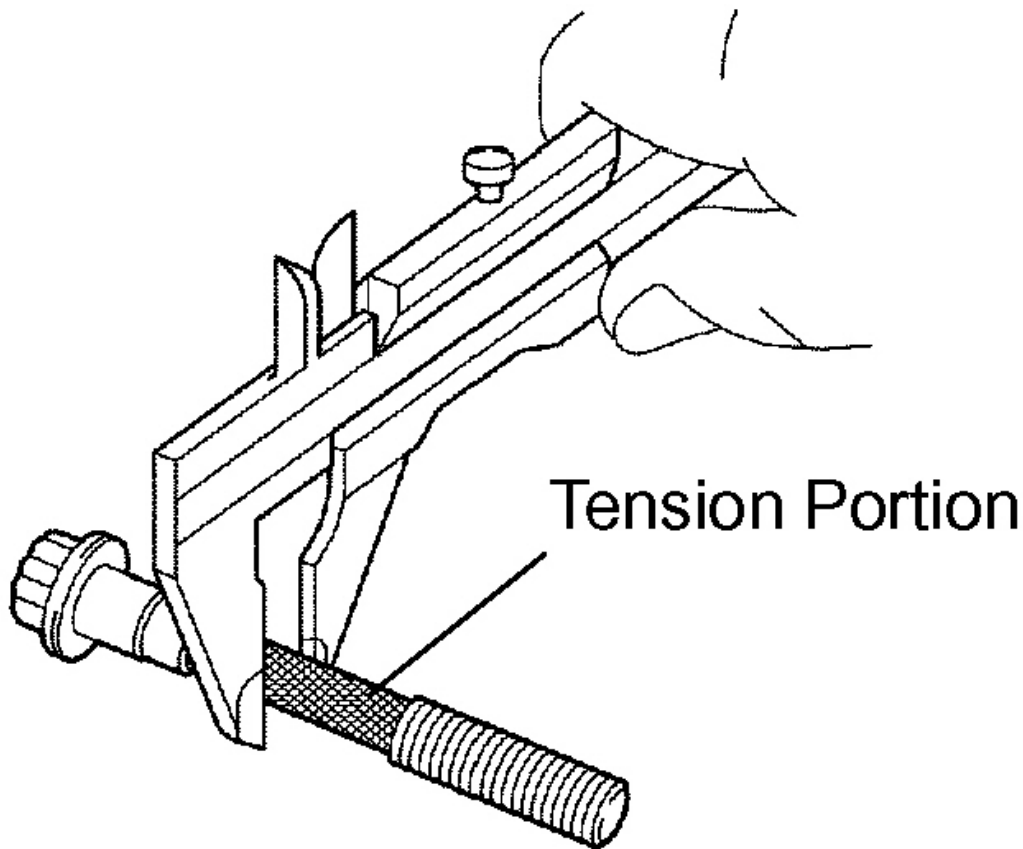
**Standard diameter:**

**7.500 to 7.600 mm (0.2953 to 0.2992 in.)**

**Minimum diameter: 7.20 mm (0.2835 in.)**

If the diameter is less than the minimum, replace the cap bolt.





**G02998720**

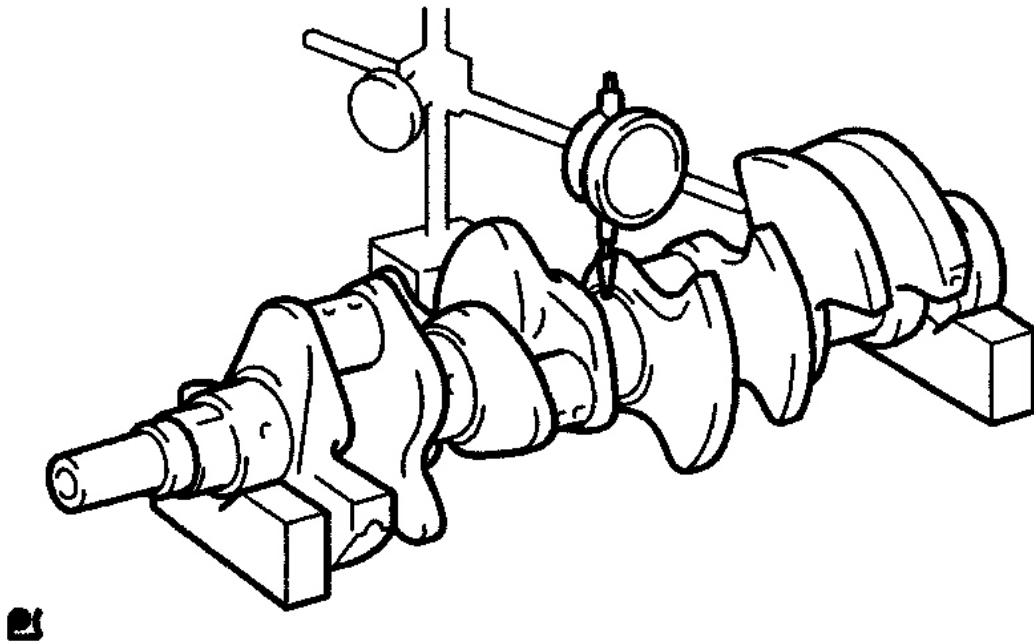
**Fig. 454: Measuring Tension Portion Diameter Of Main Bearing Cap Bolt Using Vernier Caliper**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 16. INSPECT CRANKSHAFT

- a. Inspect for circle runout.
  1. Place the crankshaft on V-blocks.
  2. Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.08 mm (0.0031 in.)**

If the circle runout is greater than the maximum, replace the crankshaft.



G02998721

**Fig. 455: Measuring Circle Runout At Center Journal Using Dial Indicator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the main journals and crank pins.
  1. Using a micrometer, measure the diameter of each main journal and crank pin.

**Main journal diameter:**

**66.988 to 67.000 mm (2.6373 to 2.6378 in.)**

**Crank pin diameter:**

**51.982 to 52.000 mm (2.0465 to 2.0472 in.)**

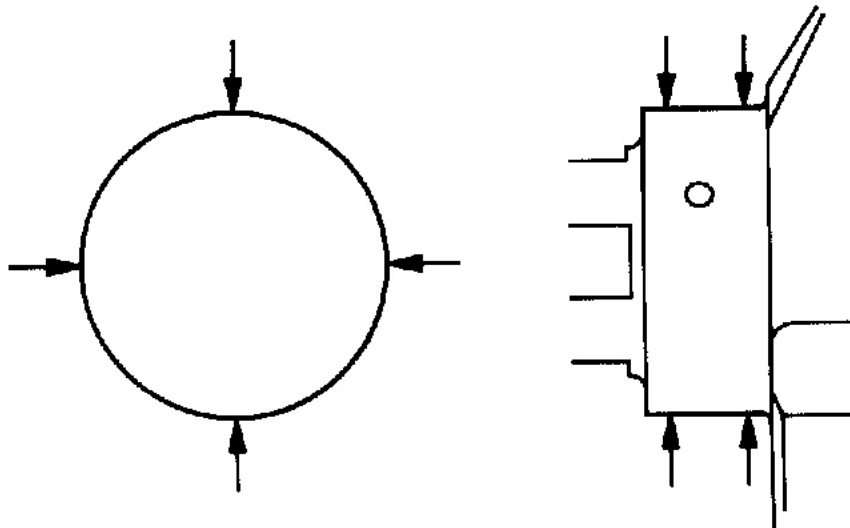
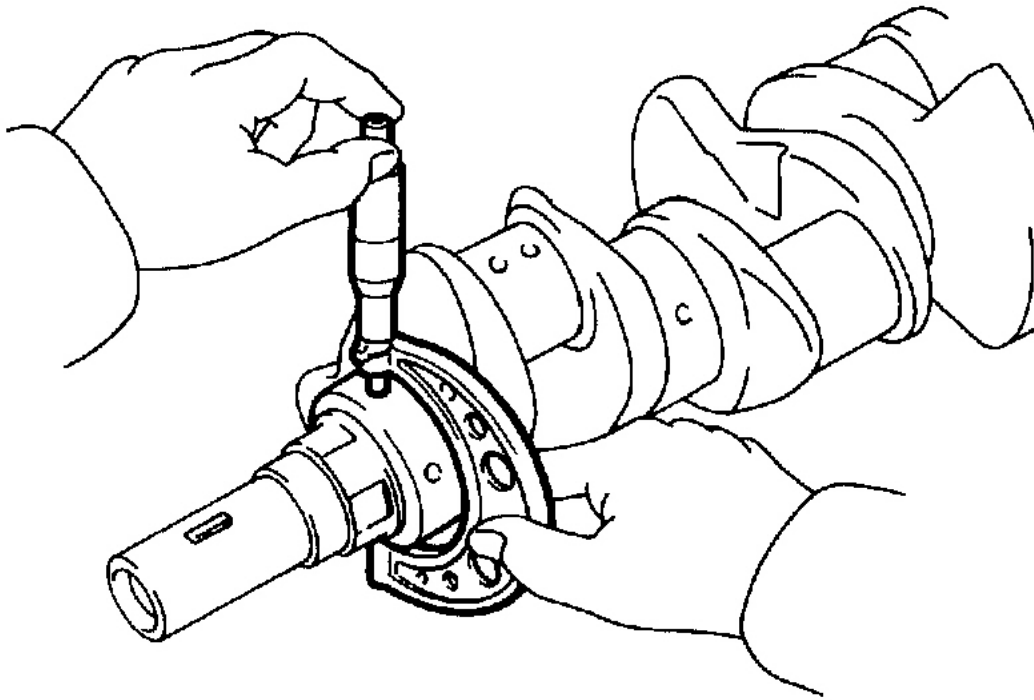
If the diameter is not as specified, check the oil clearance (see steps 3 and 7). If necessary, replace the crankshaft.

2. Check each main journal and crank pin for taper and out-of-round as shown in the illustration.

**Maximum taper and out-of-round:**

**0.02 mm (0.0008 in.)**

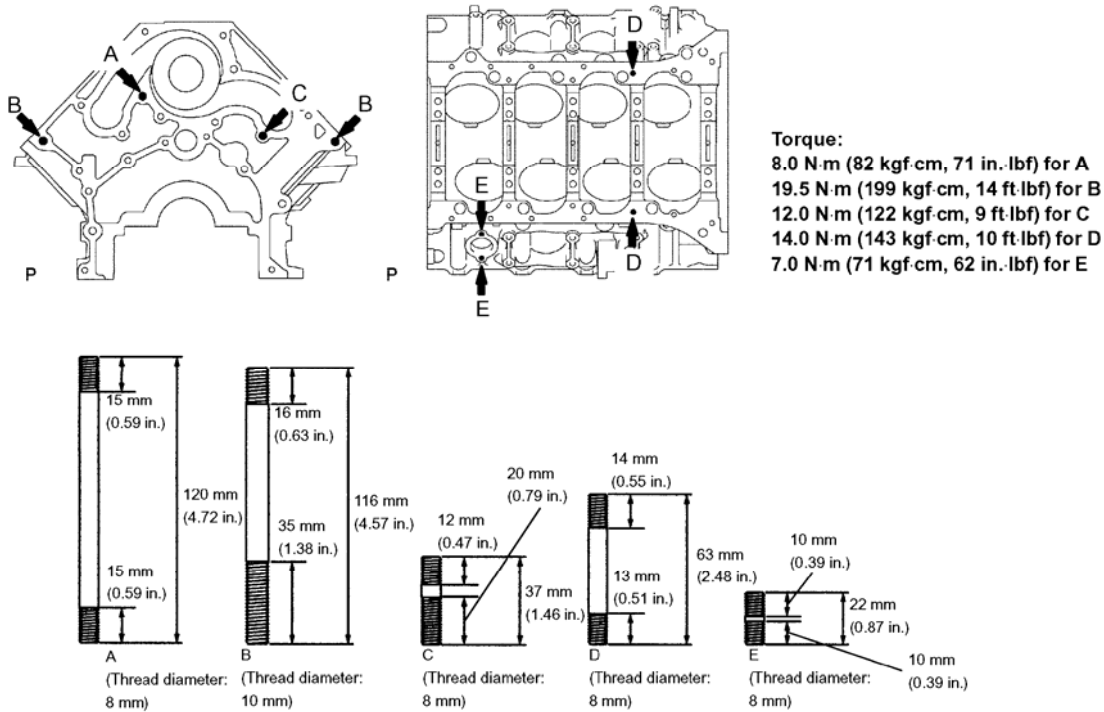
If the taper and out-of-round is greater than the maximum, replace the crankshaft.



G02998722

**Fig. 456: Measuring Diameter Of Each Main Journal And Crank Pin Using Micrometer**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

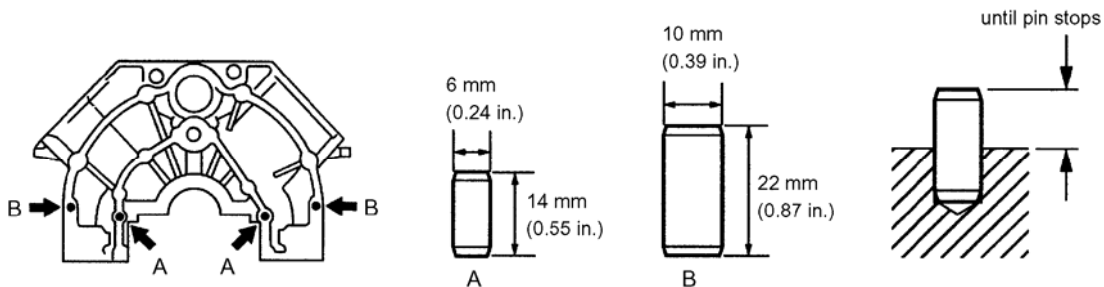
17. INSTALL STUD BOLT



G02998723

**Fig. 457: Identifying Stud Bolt Dimension**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

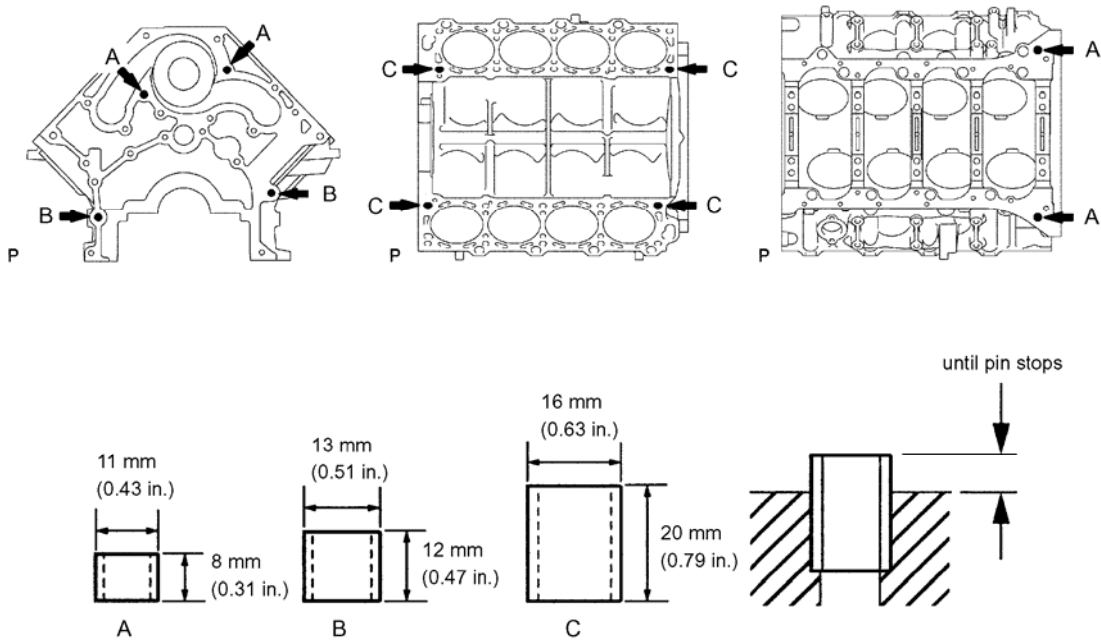
18. INSTALL STRAIGHT PIN



G02998724

**Fig. 458: Identifying Straight Pin Dimension**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL RING PIN



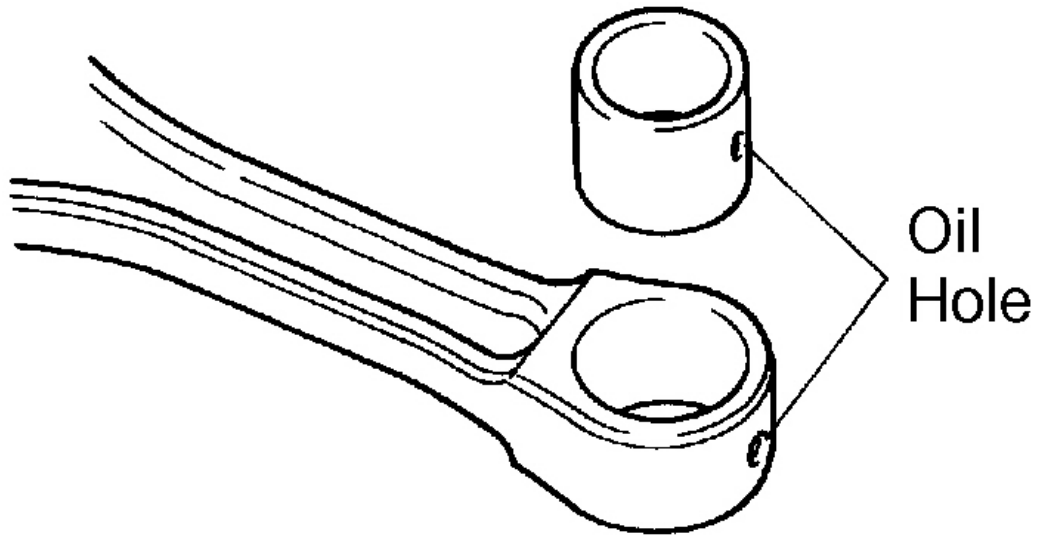
G02998725

**Fig. 459: Identifying Ring Pin Dimension**

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

**20. INSTALL CONNECTING ROD SMALL END BUSH**

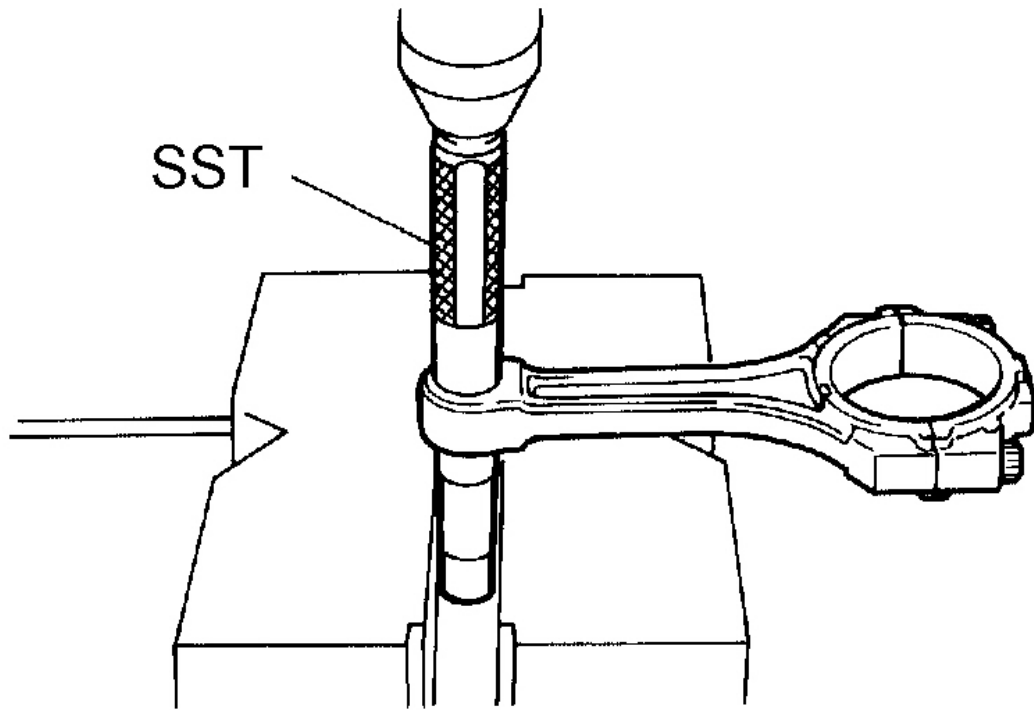
- a. Align the oil holes of a new bush and the connecting rod.



G02998726

**Fig. 460: Aligning Oil Holes Of Bush And Connecting Rod**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a press, press in the bush.  
SST 09222-30010

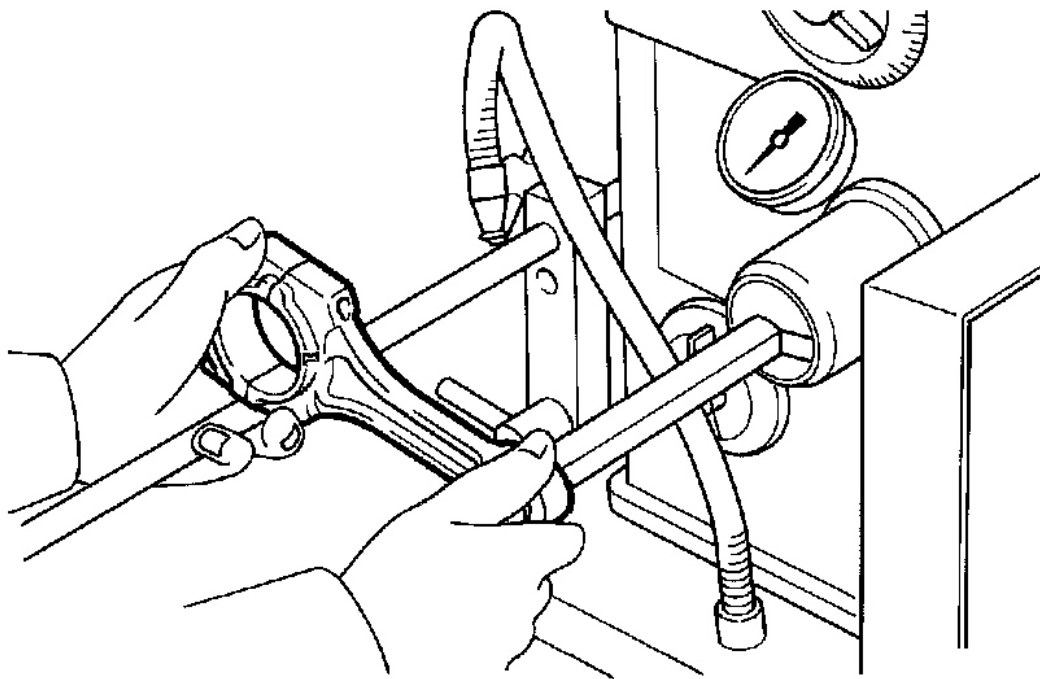


G02998727

**Fig. 461: Pressing Bush Using SST**

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

- c. Using a pin hole grinder, hone the bush to obtain the standard specified clearance (see step 13) between the bush and piston pin.



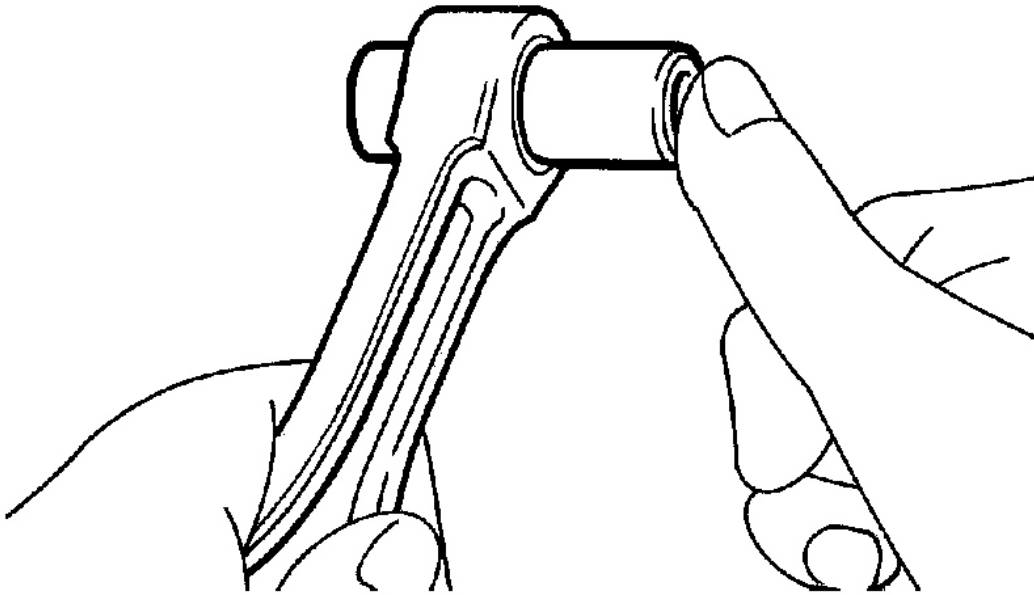
G02998728

**Fig. 462: Using Pin Hole Grinder**

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

- d. Check the piston pin fits at normal room temperature.
  1. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.





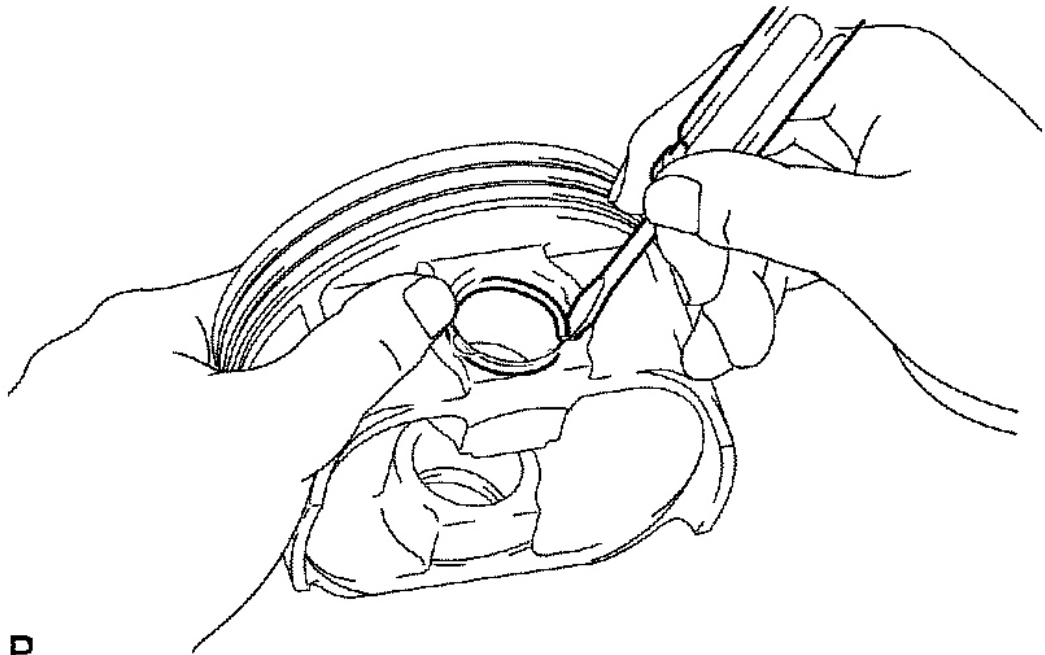
G02998729

**Fig. 463: Checking Piston Pin**

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

**21. INSTALL W/PIN PISTON SUB-ASSY**

- a. Using a small screwdriver, install a new snap ring on one side of the piston pin hole.

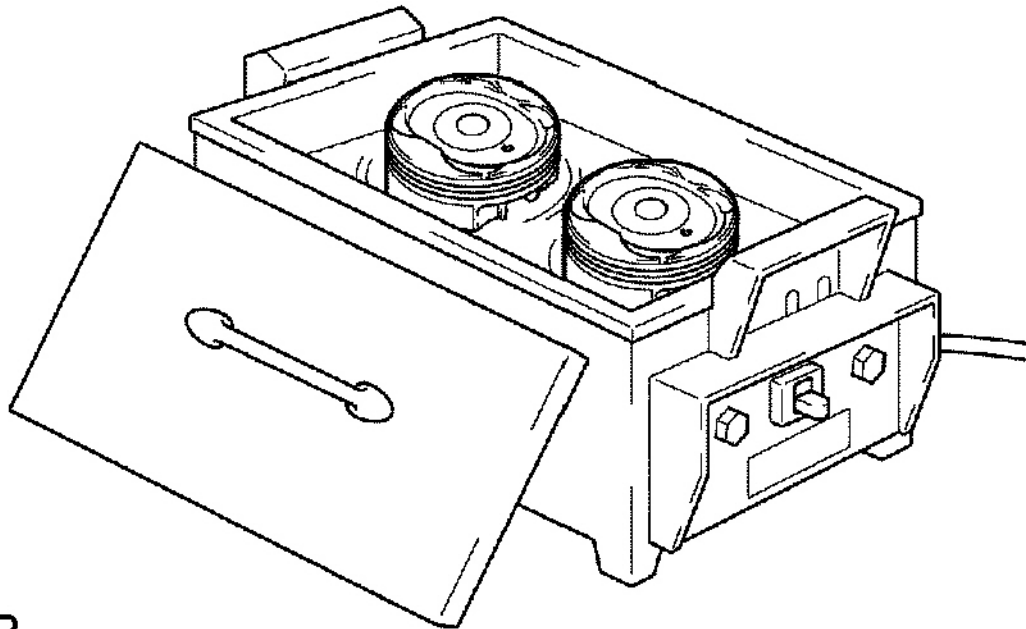


**P**

**G02998730**

**Fig. 464: Installing Snap Ring Using Small Screwdriver**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Gradually heat the piston to about 60°C (140°F).



P

G02998731

**Fig. 465: Heating Piston**

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

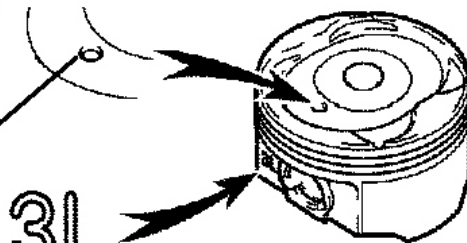
- c. Coat the piston pin with engine oil.
- d. The piston's front mark and the connecting rod's outside mark should face the same direction, as shown in the illustration.

**NOTE:** The installation directions of the piston and connecting rod are different for the LH and RH banks. The LH piston is marked with "3L" and the RH piston is marked with "3R".

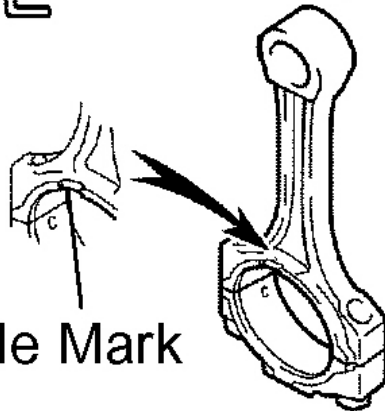
- e. Align the piston pin holes of the piston and connecting rod, and push in the piston pin with your thumb.

## LH Piston

Front  
Mark  
(1 Cavity)



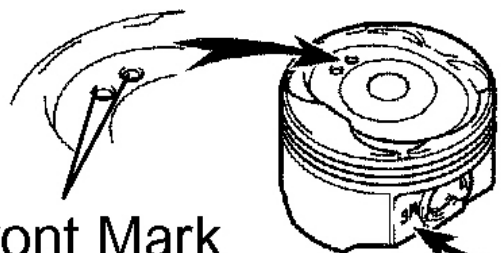
Outside Mark



P

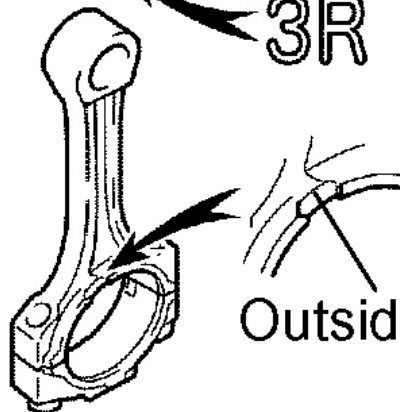
## RH Piston

Front Mark  
(2 Cavities)



3R

Outside Mark

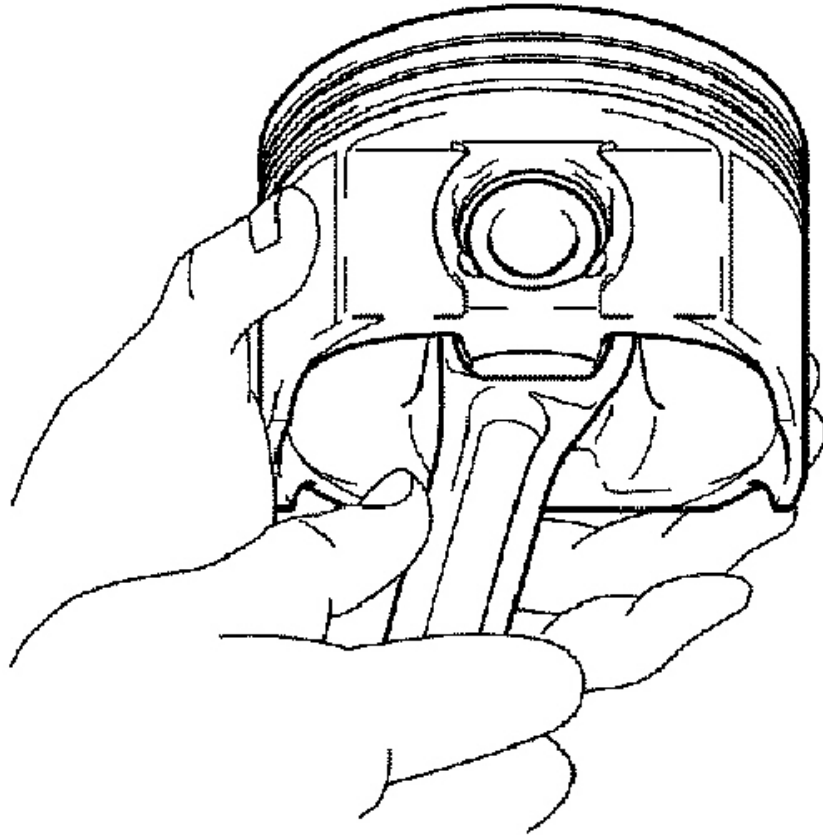


P

**Fig. 466: Aligning Piston Pin Holes**

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

- f. Check the fit between the piston and piston pin.
  - 1. Try to move the piston back and forth on the piston pin.



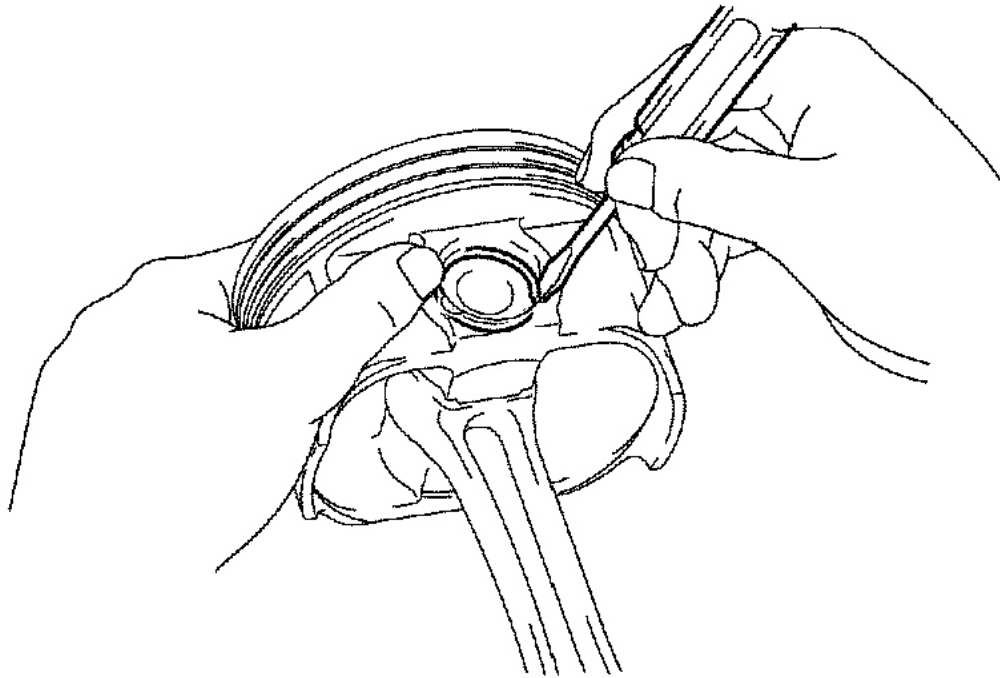
**P**

**G02998733**

**Fig. 467: Fitting Between Piston And Piston Pin**

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

- g. Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.



**P**

**G02998734**

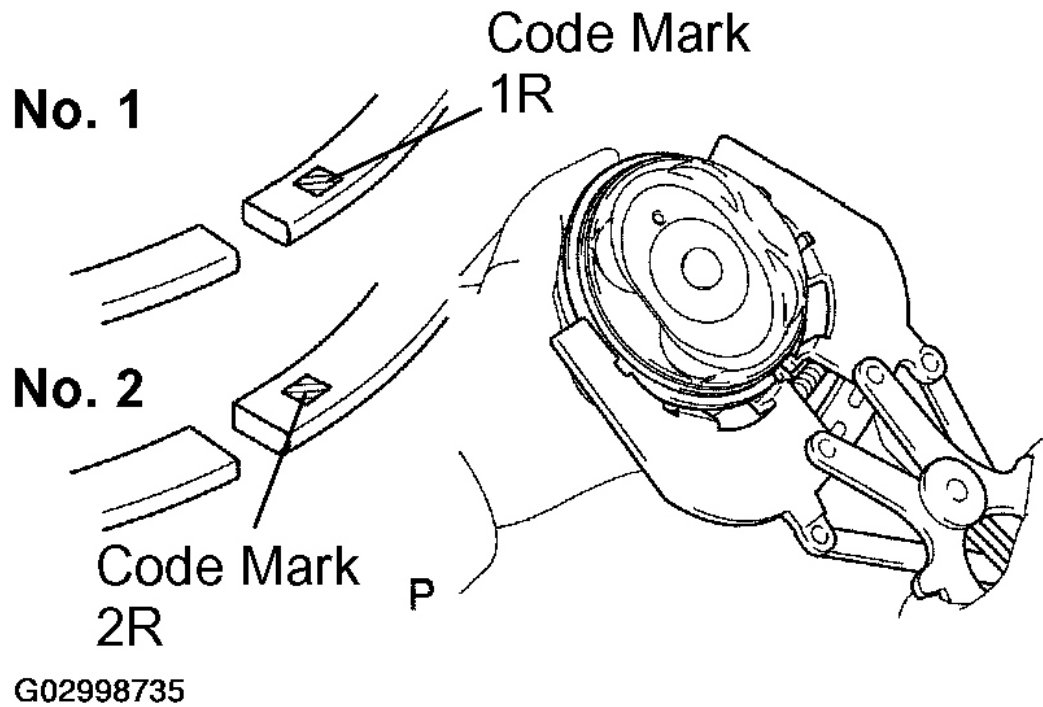
**Fig. 468: Installing Snap Ring Using Small Screwdriver**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- h. Install the oil ring expander and 2 side rails by hand.
- i. Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

**CODE MARK:**

**CODE MARK REFERENCE**

No. 1	1R
No. 2	2R

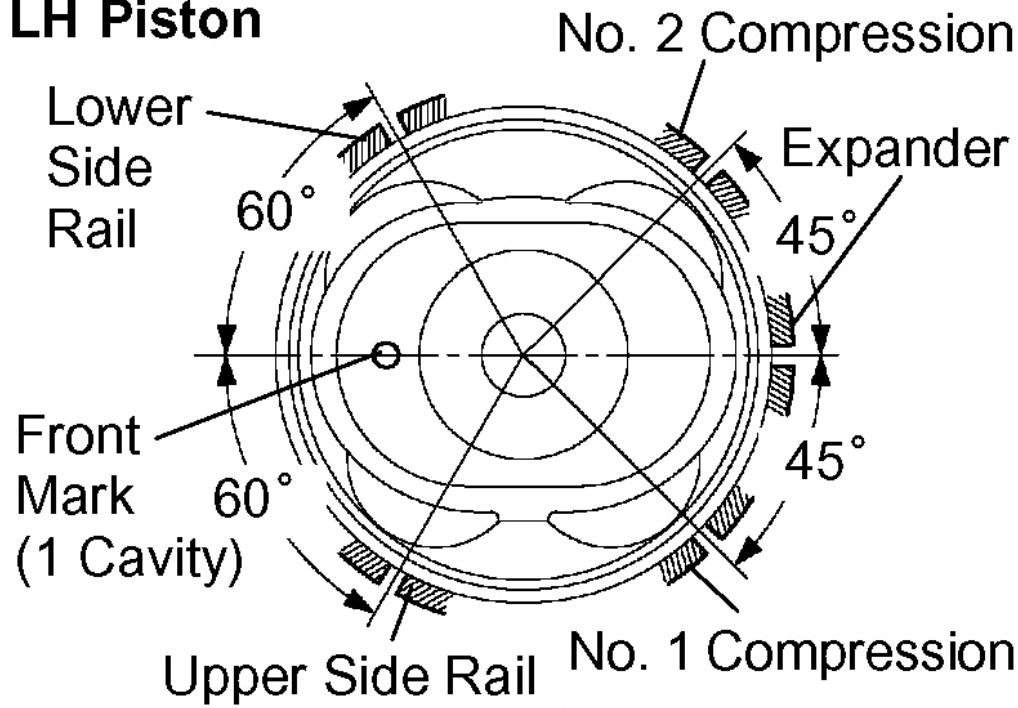


**Fig. 469: Installing Compression Rings Using Piston Ring Expander**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

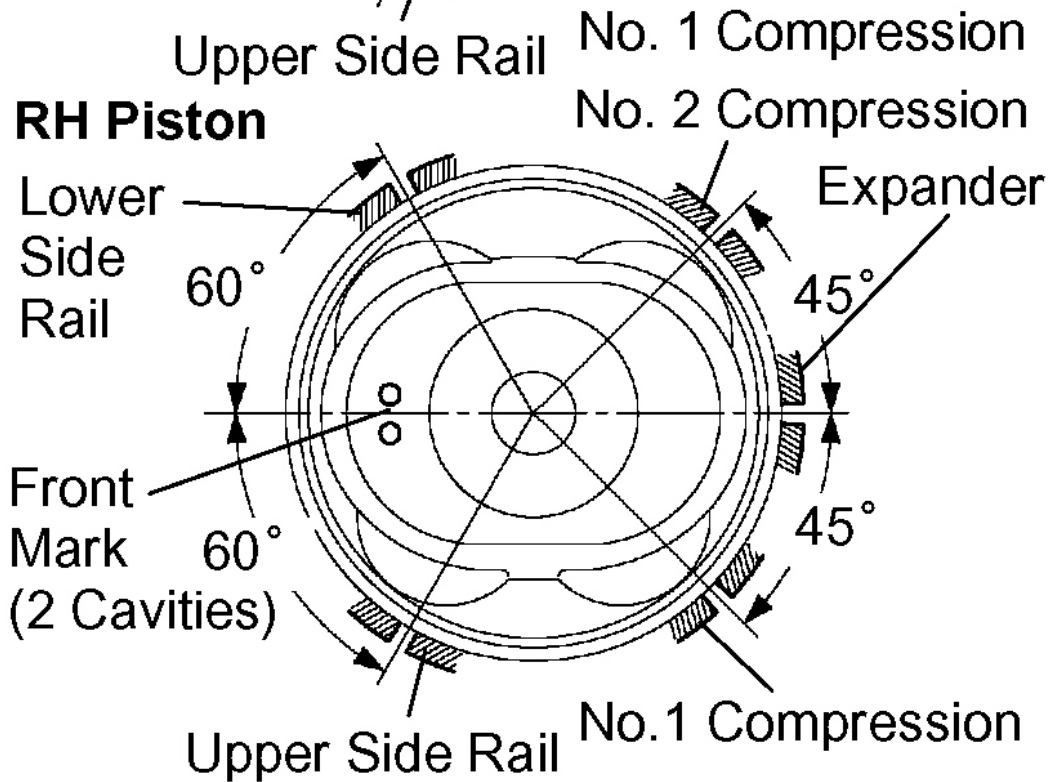
- j. Position the piston rings so that the ring ends are as shown in the illustration.

**NOTE:**        **Do not align the ring ends.**

### LH Piston



### RH Piston



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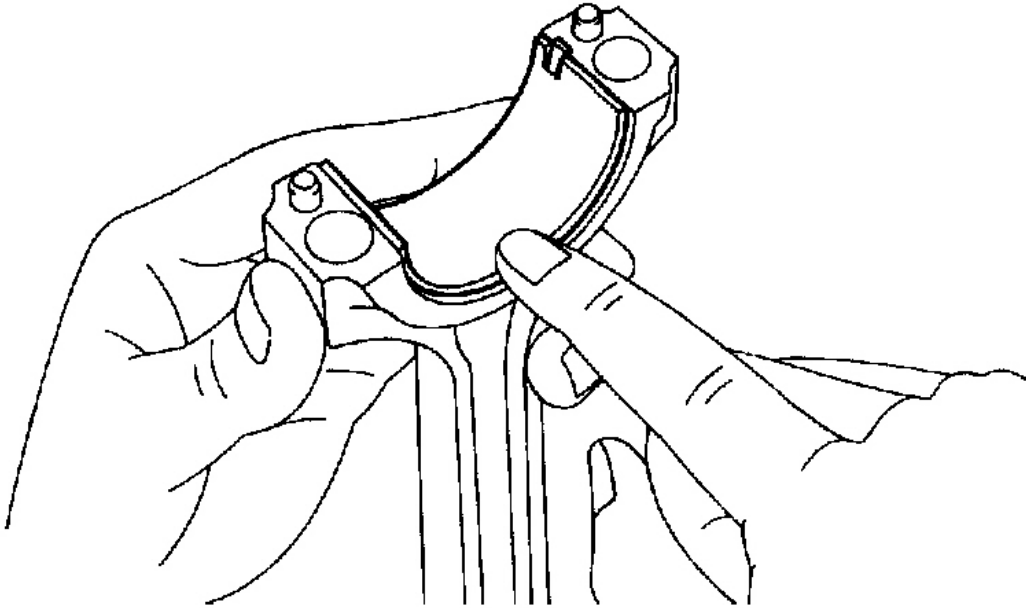
**Fig. 470: Identifying Piston Rings Position**



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

## 22. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the groove of the connecting rod or connecting cap.
- b. Install the bearings in the connecting rod and connecting rod cap.



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### **Fig. 471: Installing Connecting Rod Bearing**

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

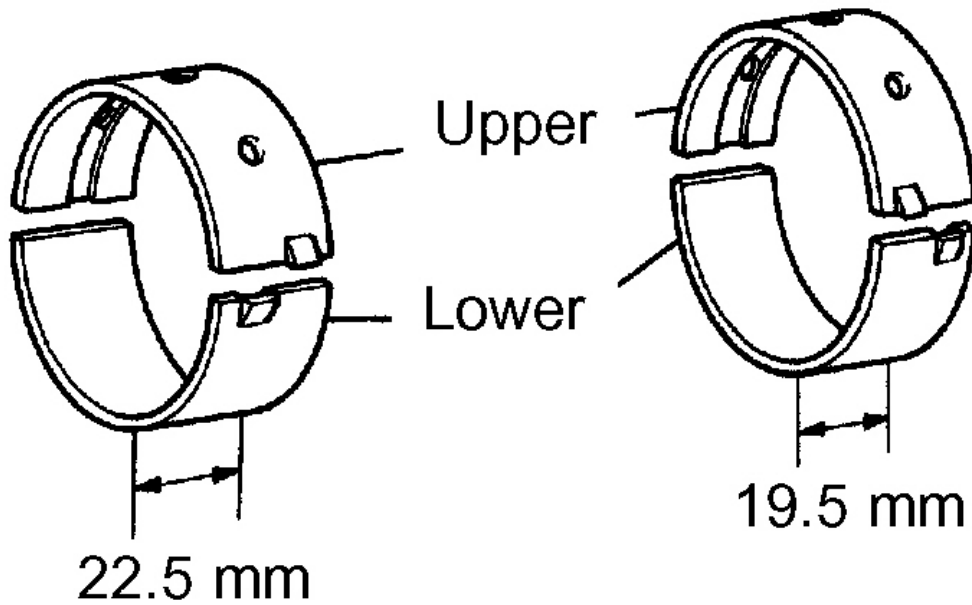
## 23. INSTALL CRANKSHAFT BEARING

HINT:

- Main bearings come in widths of 19.5 mm (0.768 in.) and 22.5 mm (0.886 in.). Install the 22.5 mm (0.886 in.) bearings in the No. 1 and No. 5 cylinder block journal positions with the crankshaft bearing cap. Install the 19.5 mm (0.768 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

**No. 1 and No. 5**

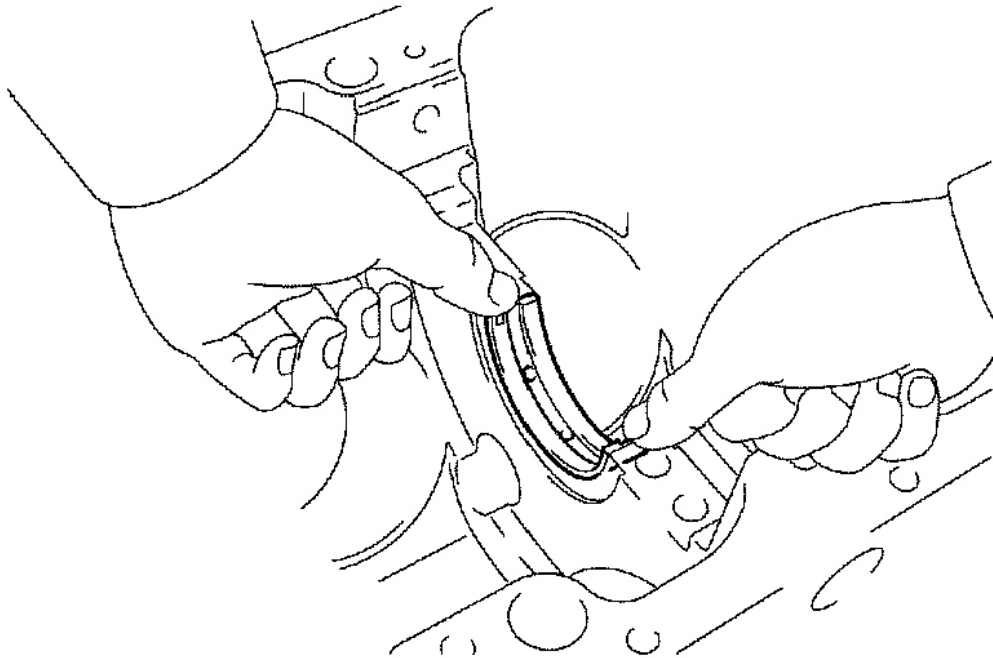
**Others**



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**Fig. 472: Identifying Upper Bearings And Lower Bearings Oil Groove**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.



P

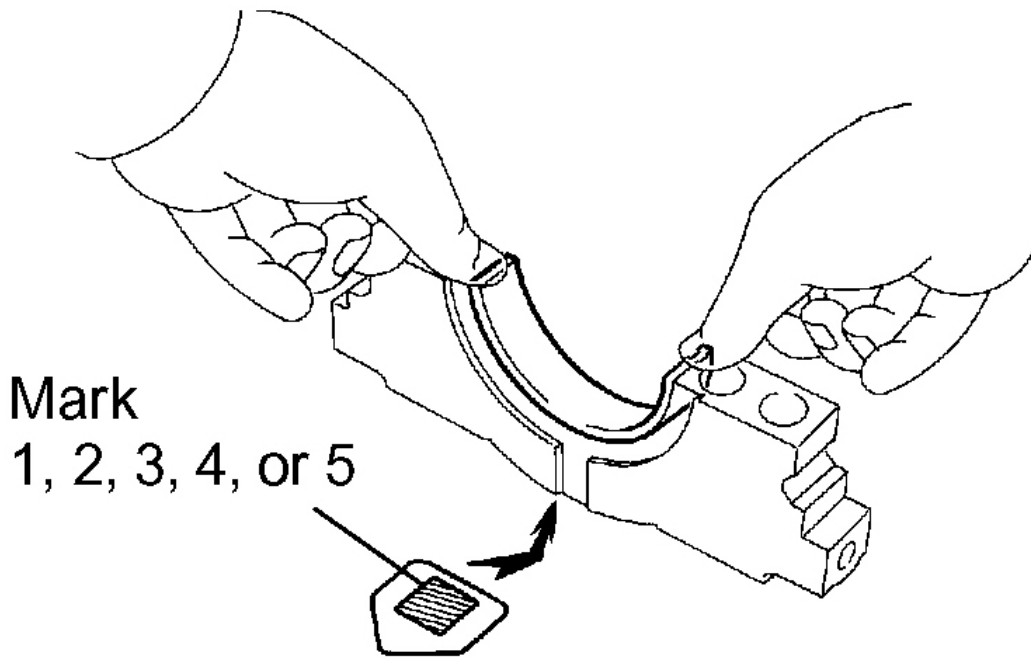
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**Fig. 473: Aligning Bearing Claw And Claw Groove**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Align the bearing claw with the claw groove of the crankshaft bearing cap, and push in the 5 lower bearings.

HINT:

A number is marked on each bearing cap to indicate the installation position.

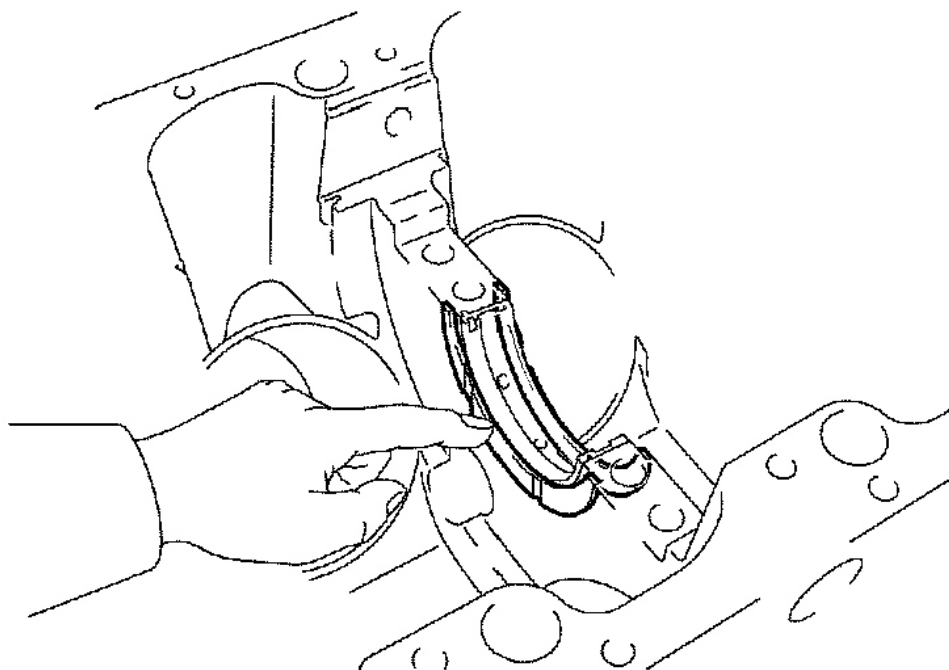


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**Fig. 474: Identifying Bearing Cap Installation Position**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**24. INSTALL CRANKSHAFT THRUST WASHER SET**

- a. Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

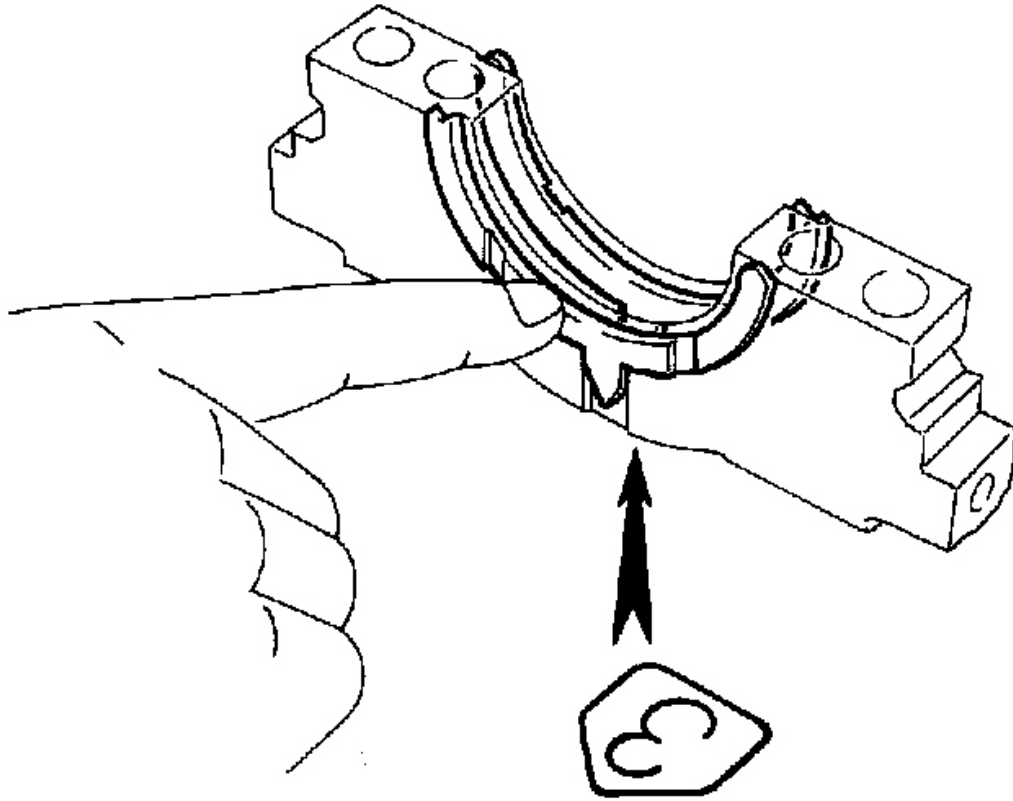


P

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**Fig. 475: Installing Crankshaft Thrust Washer Set**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 thrust washers on the No. 3 bearing cap with the grooves facing outward.

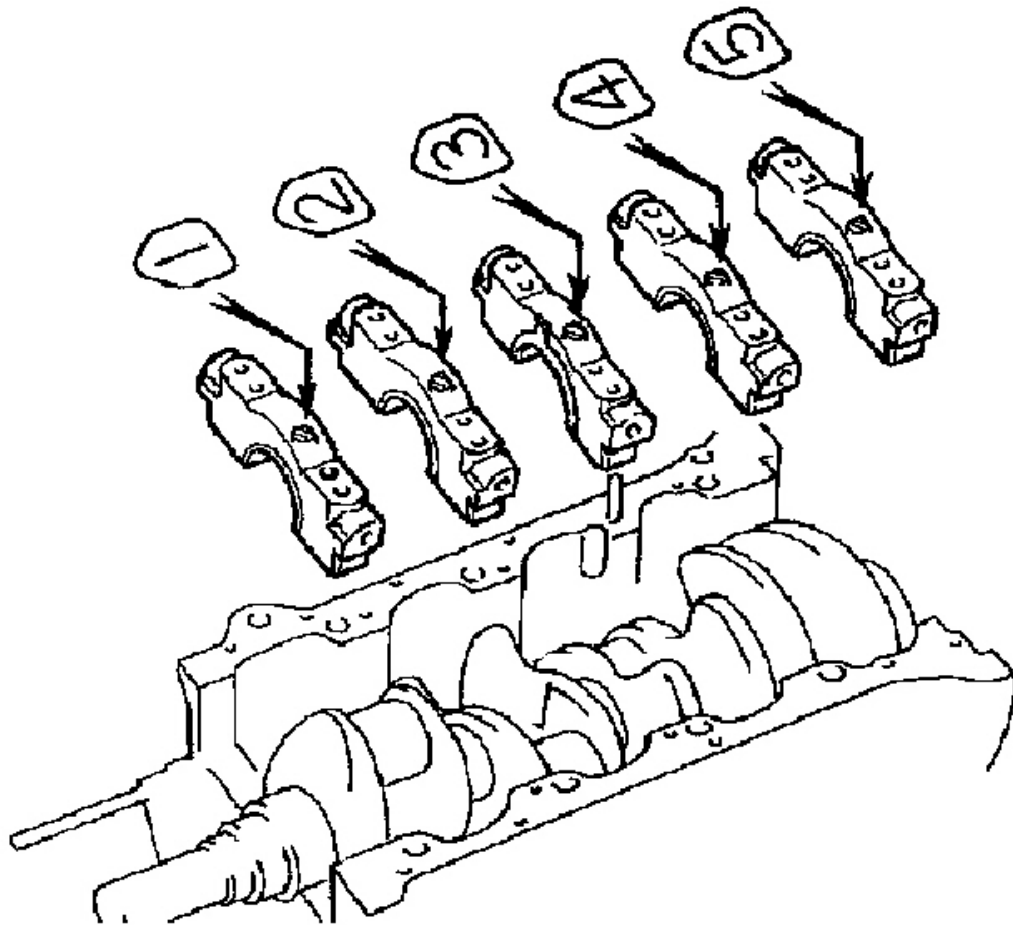


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**Fig. 476: Identifying No. 3 Bearing Cap With The Grooves**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**25. INSTALL CRANKSHAFT**

- a. Place the crankshaft on the cylinder block.
- b. Install the 5 crankshaft bearing caps in their proper locations.



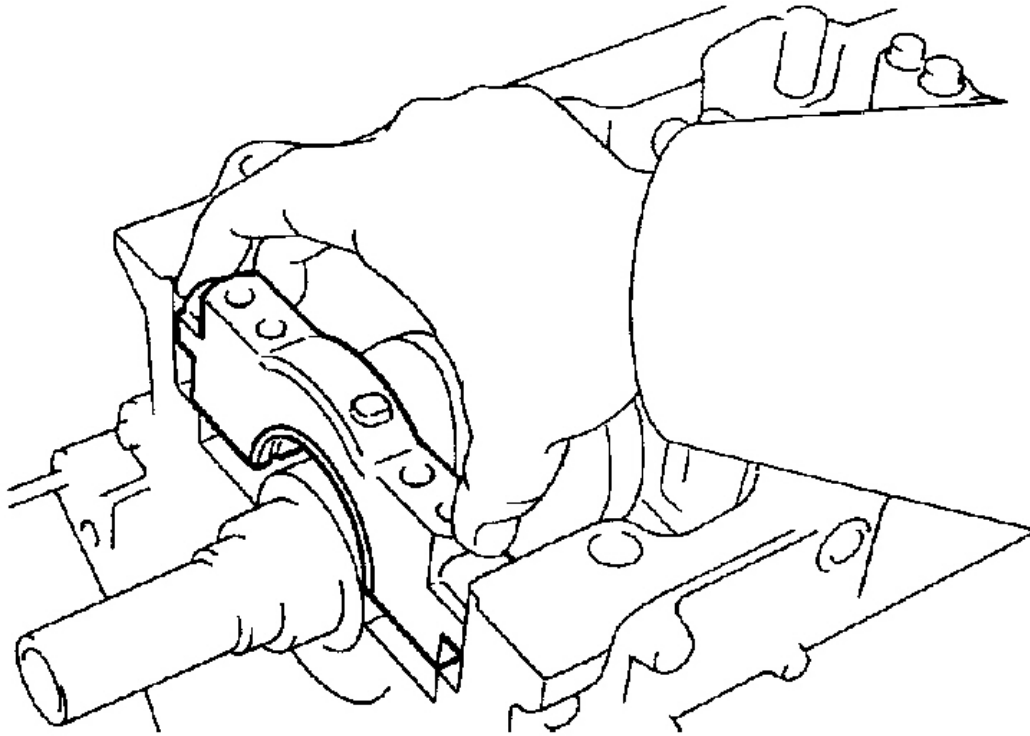
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**Fig. 477: Installing Crankshaft Bearing Caps**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Place the bearing caps level and let them return to their original position by their own weight.

**NOTE:** Do not install the bearing cap by tapping it.



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**Fig. 478: Placing Bearing Caps Level**

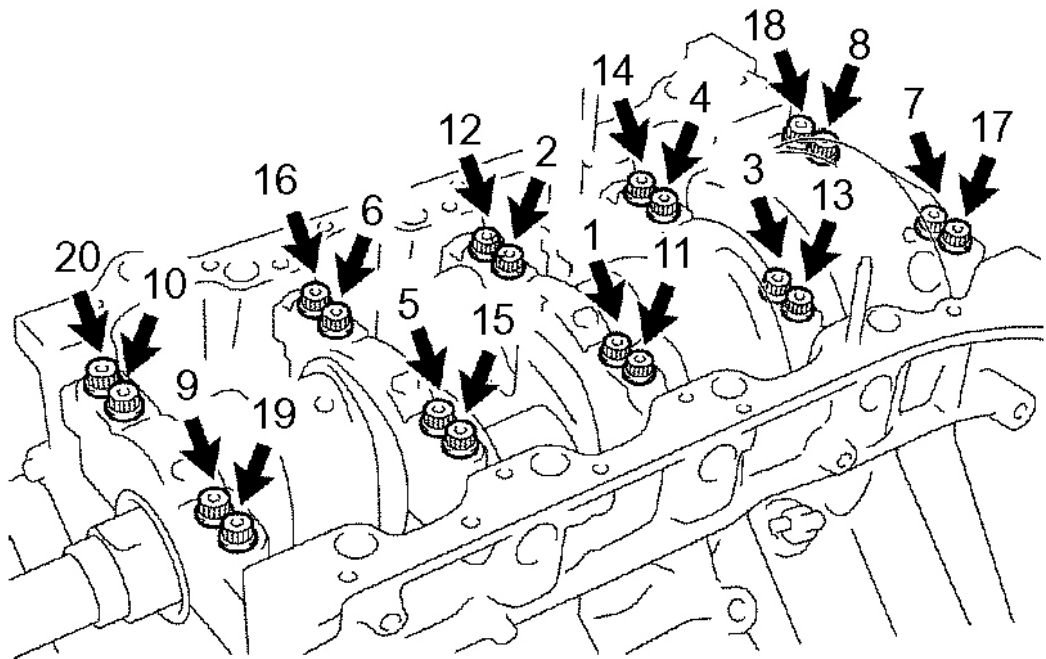
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the crankshaft bearing cap bolts.

HINT:

- The bearing cap bolts are tightened in 2 progressive steps (steps (2) and (4)).
  - If any one of the bearing cap bolts is broken or deformed, replace it.
1. Apply a light coat of engine oil on the threads and under the crankshaft bearing cap bolts.
  2. Install and uniformly tighten the 20 crankshaft bearing cap bolts in several passes in the sequence shown in the illustration.





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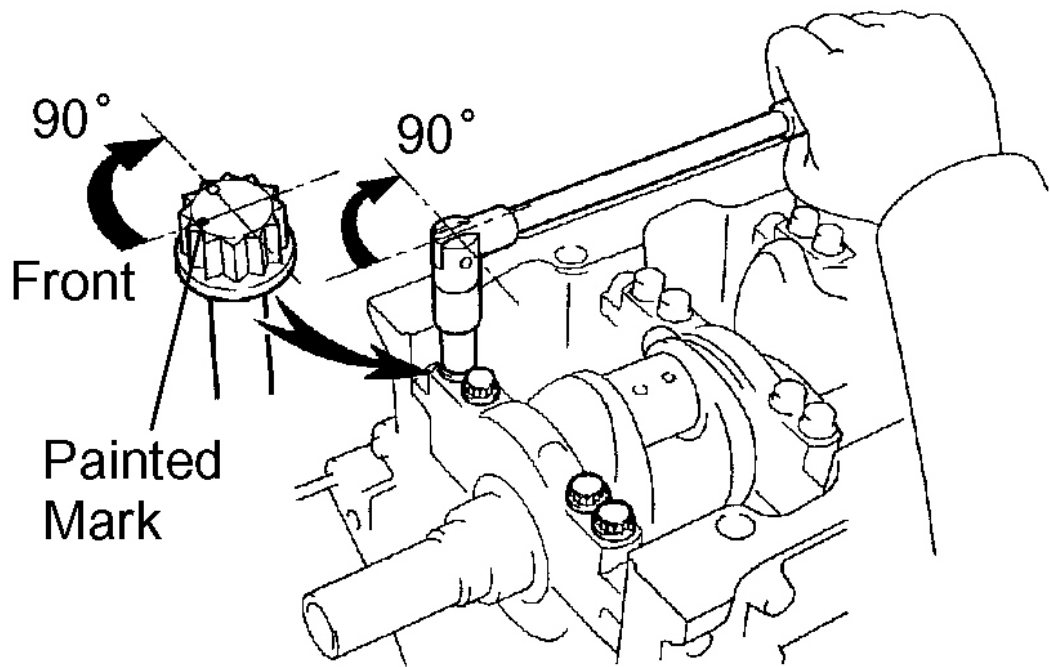
**Fig. 479: Installing Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

If any one of the bearing cap bolts does not meet the torque specification, replace the bearing cap bolt.

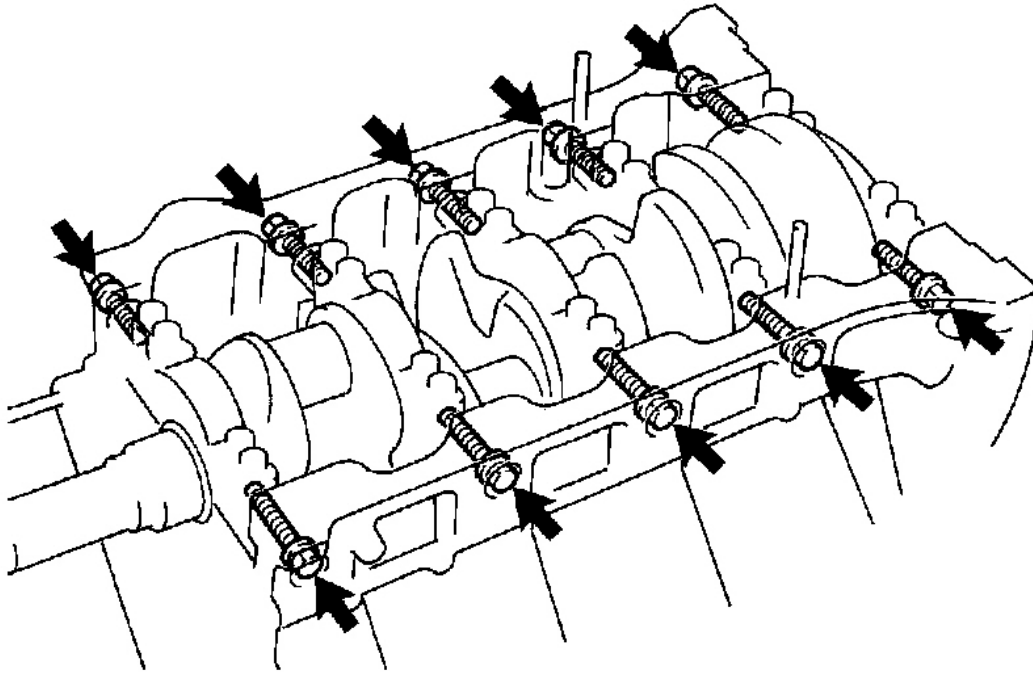
3. Mark the front of the crankshaft bearing cap bolt with paint.
4. Retighten the crankshaft bearing cap bolts by 90° in the sequence shown in the illustration.
5. Check that the painted mark is now at a 90° angle to the front.



G02998746

**Fig. 480: Tightening Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Install a new seal washer to the crankshaft bearing cap bolt.
  7. Install and uniformly tighten the 10 crankshaft bearing cap bolts.  
**Torque: 49 N.m (500 kgf.cm, 36 ft.lbf)**
- d. Check that the crankshaft turns smoothly.
  - e. Check the crankshaft thrust clearance (see step 6).



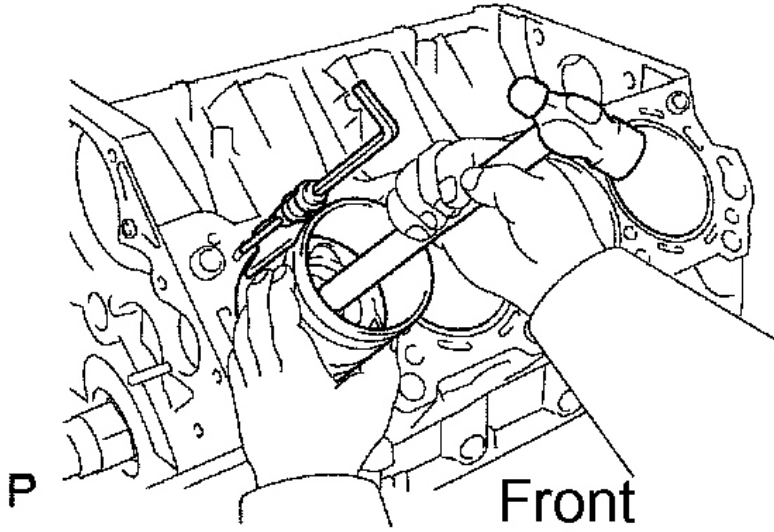
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**Fig. 481: Tightening Crankshaft Bearing Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**26. INSTALL PISTON AND CONNECTING ROD**

- a. Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

**NOTE:** The shape of the piston varies for the LH and RH banks. The LH piston is marked with "3L" and the RH piston is marked with "3R".



Front Mark  
(1 Cavity)

Front

LH  
Piston

3L

Front Mark  
(2 Cavities)

Front

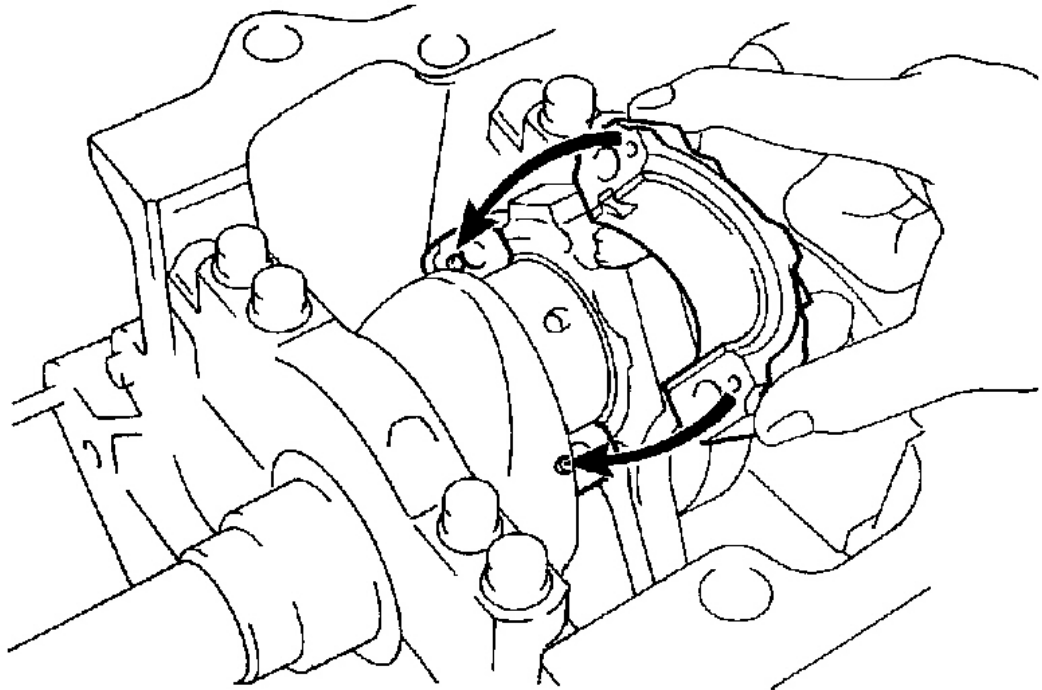
PH  
Piston

3R

P

**Fig. 482: Installing Piston And Connecting Rod**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Place the connecting rod cap on the connecting rod.
  - 1. Match the numbered connecting rod cap with the connecting rod.
  - 2. Align the pin groove of the connecting rod cap with the pins of the connecting rod, and install the connecting rod cap.

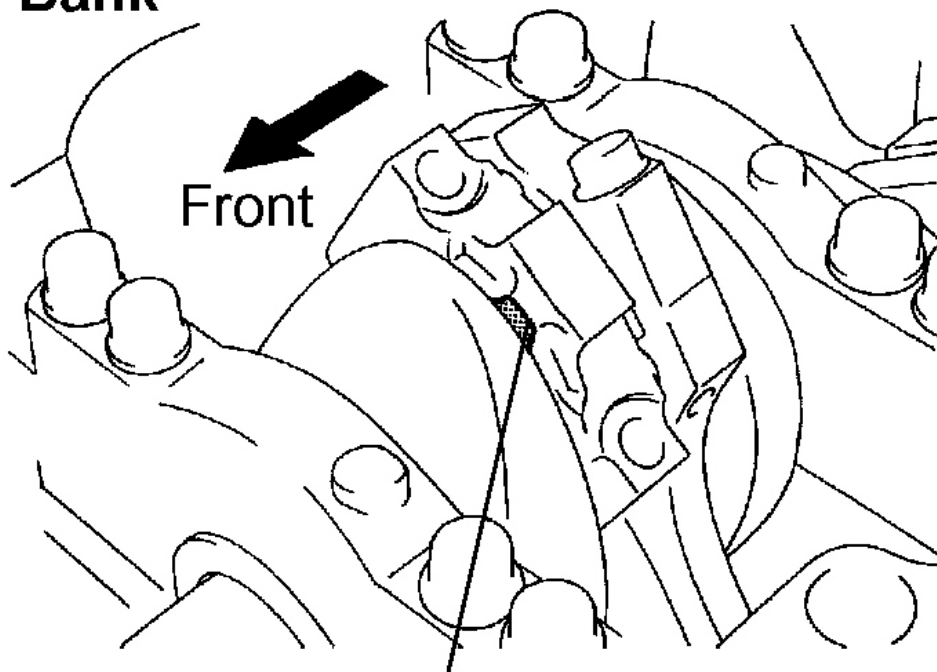


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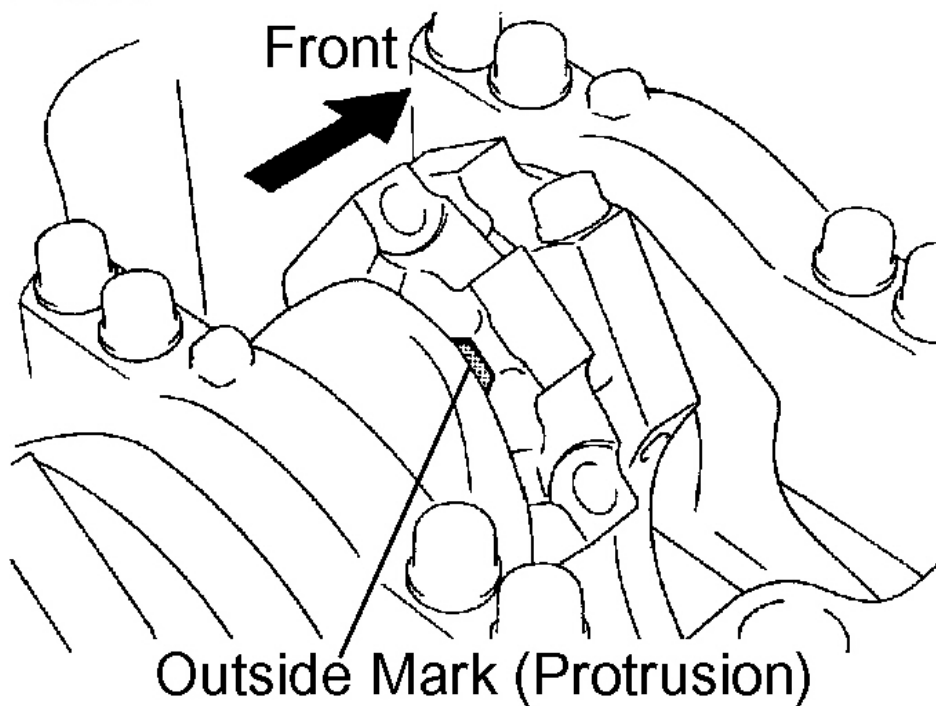
**Fig. 483: Placing Connecting Rod Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 3. Check that the outside mark of the connecting rod cap is facing in correct direction.

**LH Bank**



**RH Bank**      Outside Mark (Protrusion)

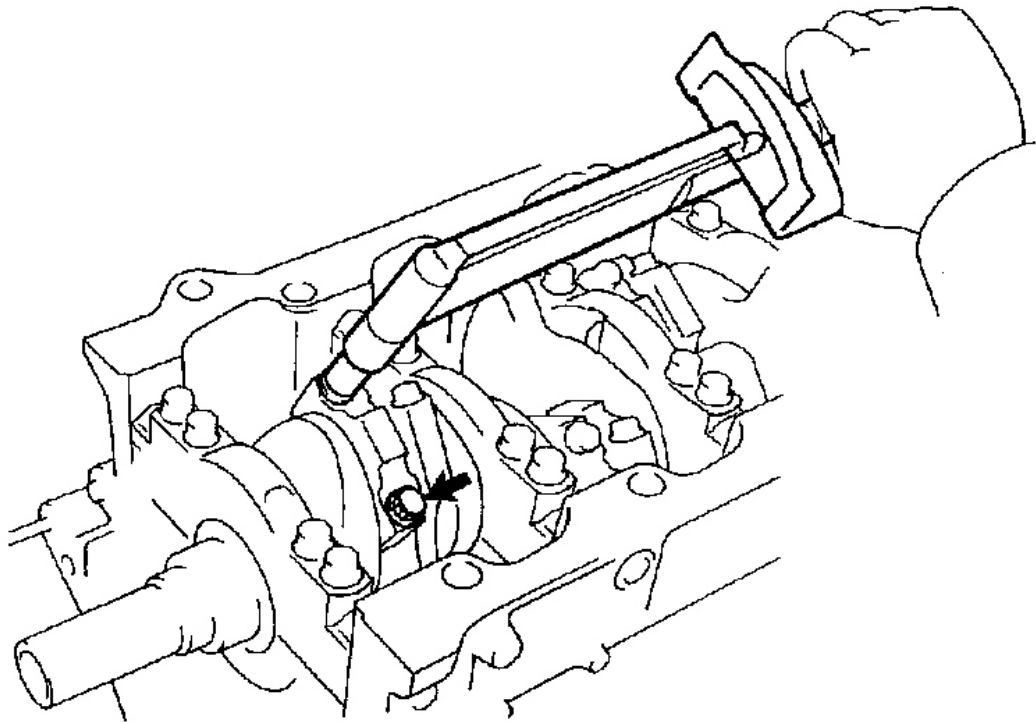


**Fig. 484: Identifying Outside Mark Of Connecting Rod Cap**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the connecting rod cap bolts.

HINT:

- The connecting rod cap bolts are tightened in 2 progressive steps (see steps (2) and (4)).
  - If any one of the connecting rod cap bolts is broken or deformed, replace it.
1. Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
  2. Install and alternately tighten the 2 connecting rod cap bolts in several passes.



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**Fig. 485: Tightening Connecting Rod Cap Bolts**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**Torque: 24.5 N.m (250 kgf.cm, 18 ft.lbf)**

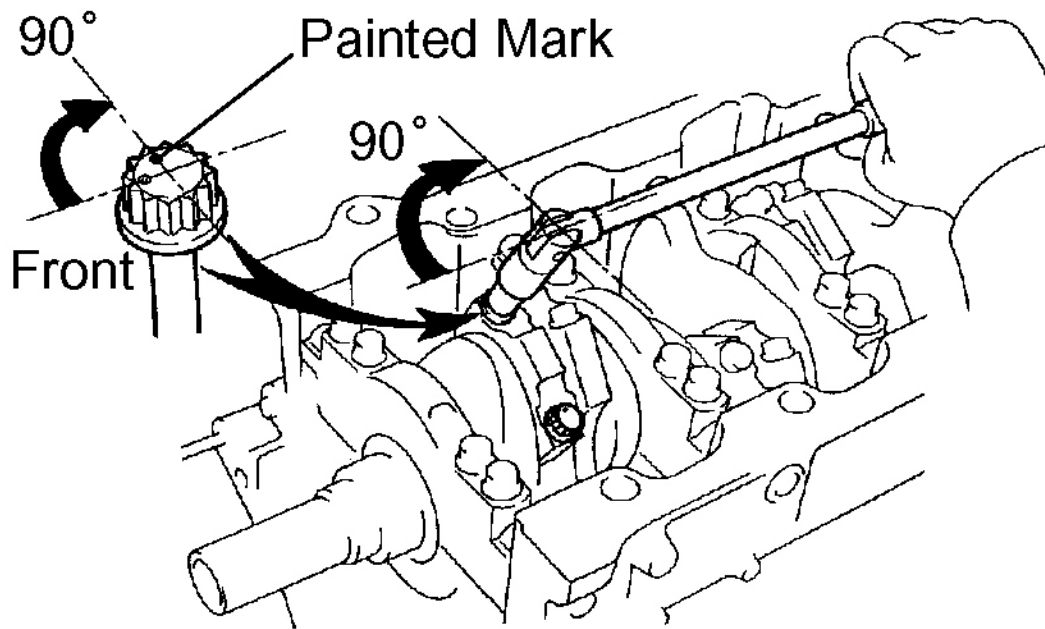
If any one of the connecting rod cap bolts does not meet the torque specification, replace the

connecting rod cap bolts.

3. Mark the front of the connecting rod cap bolt with paint.
  4. Retighten the cap bolts  $90^\circ$  as shown in the illustration.
  5. Check that the painted mark is now at a  $90^\circ$  angle to the front.
- d. Check that the crankshaft turns smoothly.
  - e. Check the connecting rod thrust clearance (see step 2).

## 27. INSTALL WATER SEAL PLATE

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the seal plate and cylinder block.



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### **Fig. 486: Identifying Painted Mark**

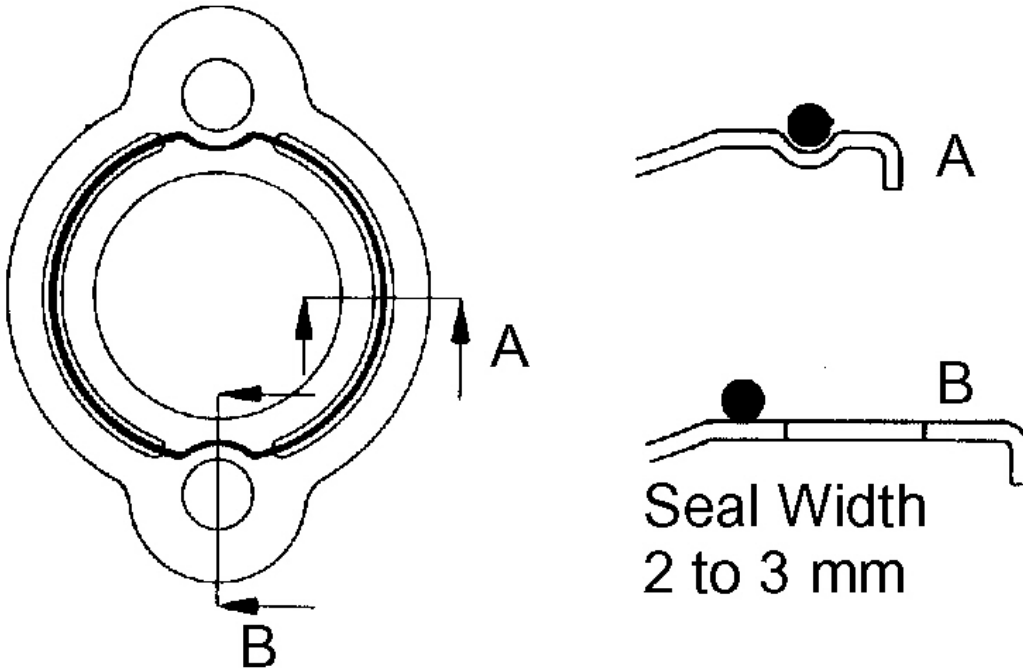
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
  - Thoroughly clean all components to remove all loose material.
  - Using a non-residue solvent, clean both sealing surfaces.
- b. Apply seal packing to the seal plate as shown in the illustration.

**Seal packing: Part No. 08826-00080 or equivalent**



- Install a nozzle that has been cut to a 2 to 3 mm (0.08 to 0.12 in.) opening.
  - Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
  - Immediately remove the nozzle from the tube and reinstall the cap.
- c. Install the seal plate with the 2 nuts. Alternately tighten the nuts in several passes.
- Torque: 14 N.m (143 kgf.cm, 10 ft.lbf)**



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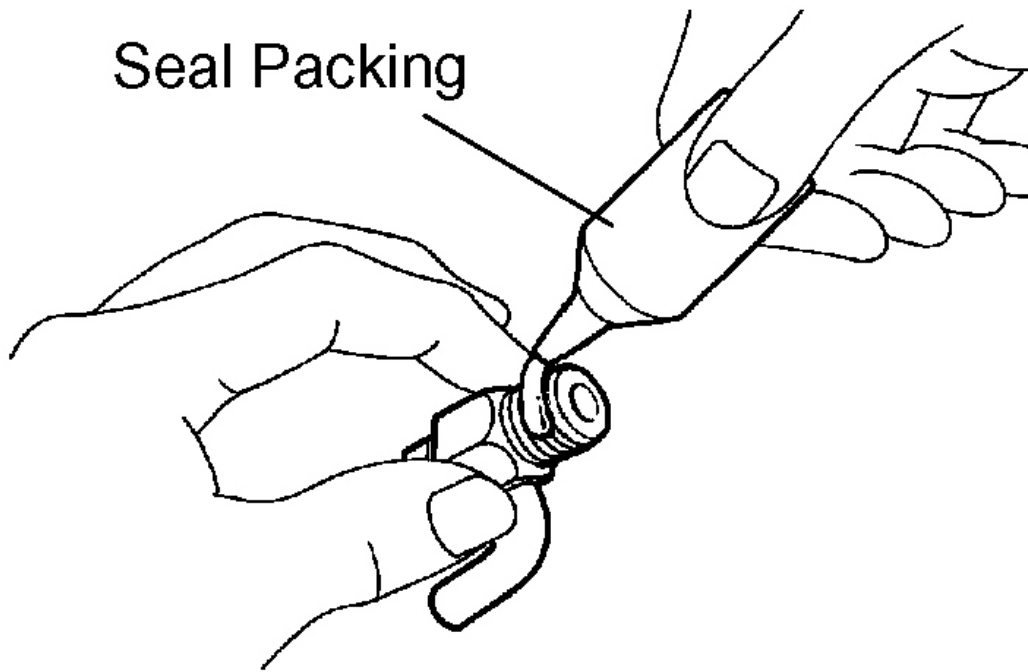
**Fig. 487: Applying Seal Packing**

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

**28. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY**

- a. Apply seal packing to 2 or 3 threads.

**Seal packing: Part No. 08826-00100 or equivalent**



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**Fig. 488: Applying Seal Packing**

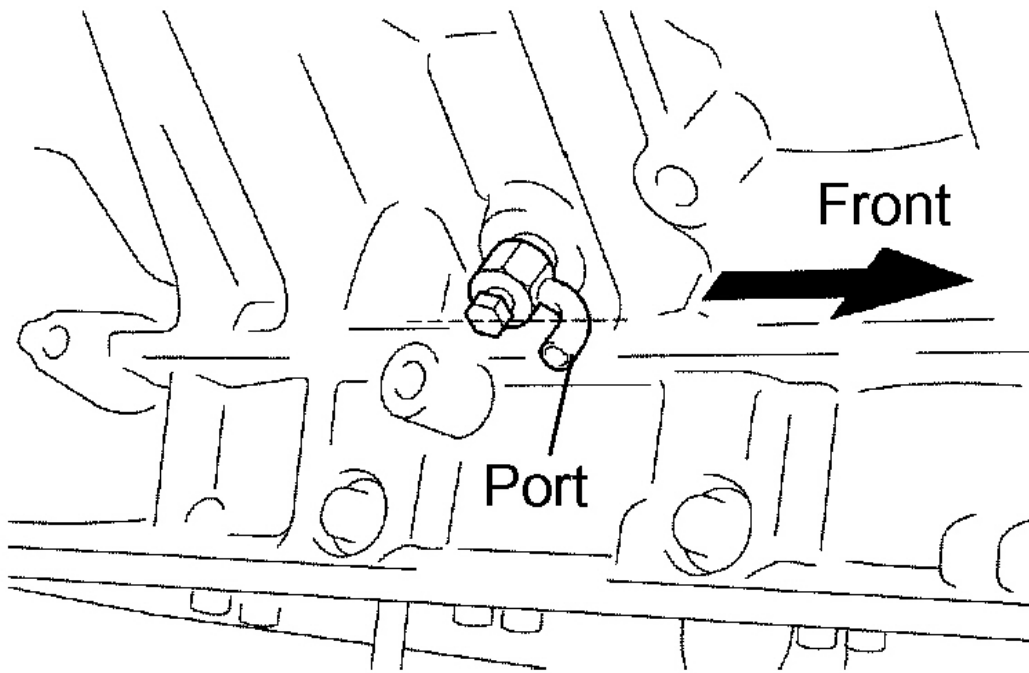
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the RH and LH drain unions.

**Torque: 49 N.m (500 kgf.cm, 36 ft.lbf)**

HINT:

After applying the specified torque, rotate the drain union clockwise until its drain port is facing forward.



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**Fig. 489: Installing RH And LH Drain Unions**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.