

2005 ENGINE

Engine Mechanical - xB

ENGINE

INSPECTION

1. INSPECT ENGINE COOLANT (See ON-VEHICLE INSPECTION)
2. INSPECT ENGINE OIL (See ON-VEHICLE INSPECTION)
3. INSPECT BATTERY (See ON-VEHICLE INSPECTION)
4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSY
5. INSPECT SPARK PLUG (See INSPECTION)
6. INSPECT V-RIBBED BELT
 - a. Check the V-ribbed belt deflection.
 1. Measure the belt deflection.

Pressing force: 98 N (10 kgf, 22 lbf)

BELT DEFLECTION SPECIFICATIONS

	New belt mm (in.)	Used belt mm (in.)
V-ribbed belt (For fan and generator)	7.0 to 8.5 (0.28 to 0.33)	11.0 to 13.0 (0.43 to 0.51)
V-ribbed belt (for vane pump)	8.0 to 10.0 (0.31 to 0.39)	11.0 to 13.0 (0.43 to 0.51)

2. Tension

TENSION SPECIFICATIONS

	New belt N (kg, lb)	Used belt mm (in.)
V-ribbed belt (for fan and generator)	490 to 690 (50 to 70, 110 to 155)	340 to 440 (35 to 45, 76 to 99)
V-ribbed belt (for vane pump)	445 to 667 (45 to 68, 100 to 150)	267 to 445 (27 to 45, 60 to 100)

NOTE:

- Check the drive belt deflection at the specified point.
- When installing a new belt, set its tension as specified value.
- When inspecting the belt which is used for over 5 minutes, apply the specification of "Used Belt".
- When reinstalling the belt which is used for over 5 minutes, adjust its deflection and tension to the intermediate value in each specification of "Used Belt".
- V-ribbed belt tension and deflection should be checked after two

revolutions of engine cranking.

- When using a belt tension gauge, confirm the accuracy by using a master gauge first.

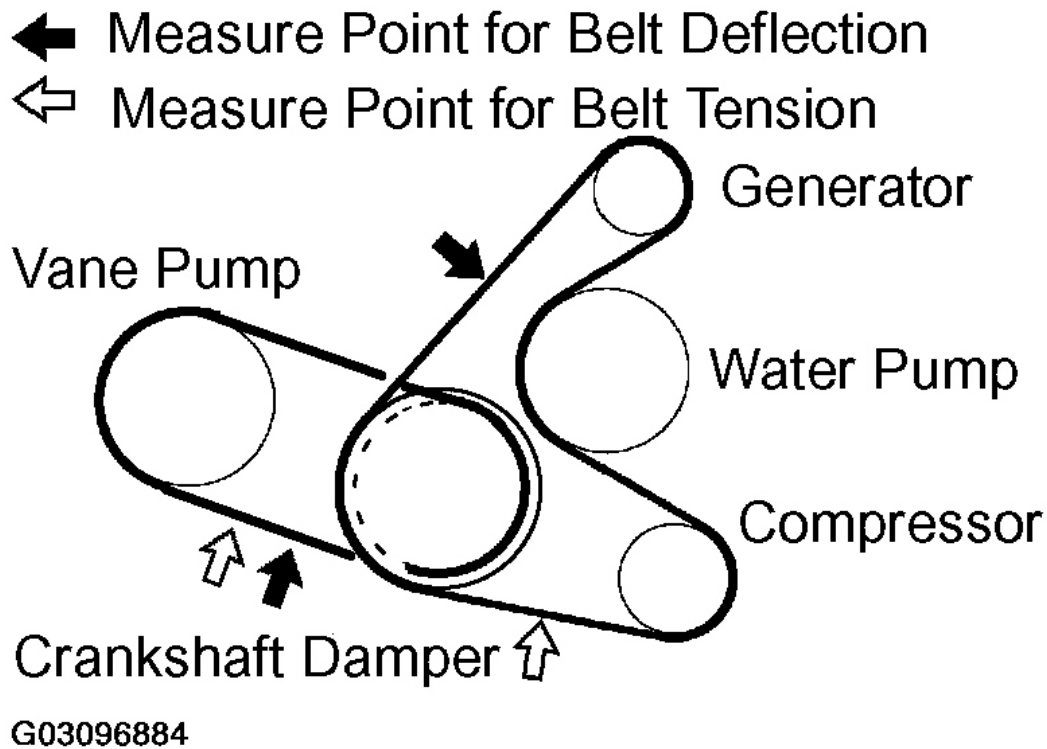


Fig. 1: Identifying Measuring Points For Belt Deflection And Tension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT IGNITION TIMING

- Warm up the engine.
- When using the hand-held tester or OBD II scan tool:
 - Connect the hand-held tester or OBD II scan tool to the DLC3.
 - Enter DATA LIST MODE on the hand-held tester or OBDII scan tool.

Ignition timing: 8 to 12° BTDC

HINT:

Please refer to the Hand-Held Tester Operator's Manual if you need help to select DATA LIST.

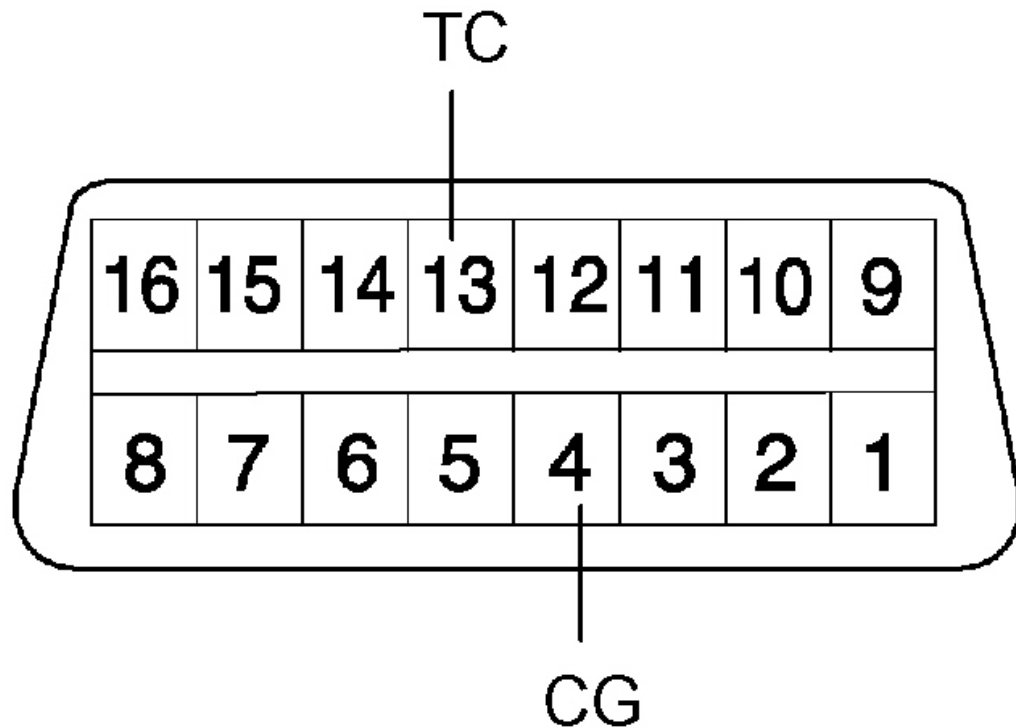
- When not using the hand-held tester or OBD II scan tool:

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

SST 09843-18040

NOTE:

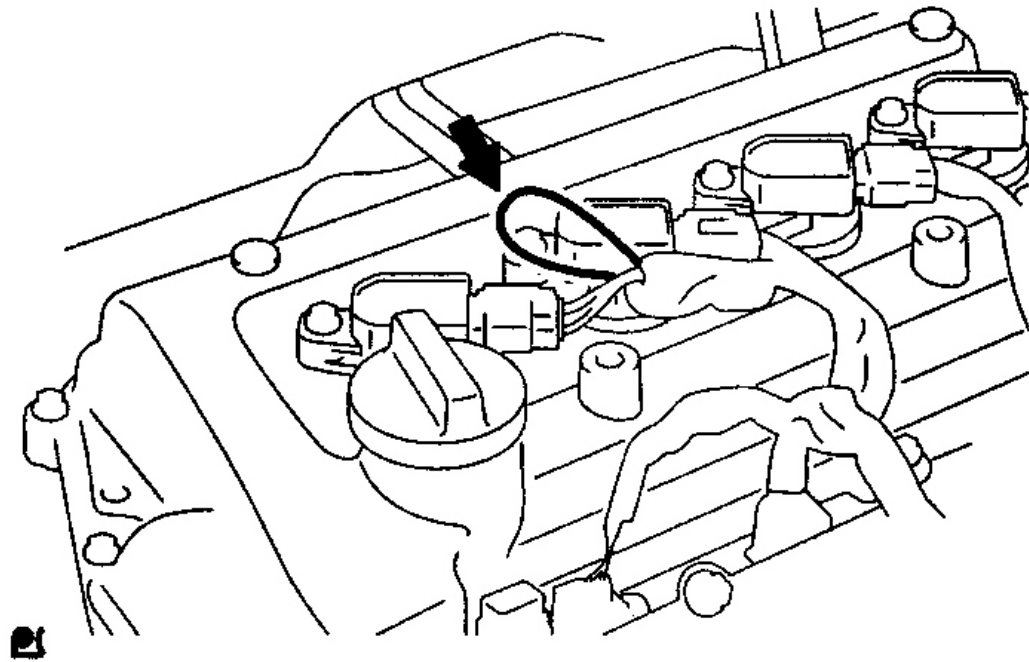
- Make sure of the terminal numbers before connecting them. Connection with a wrong terminal could damage the engine.
- Turn OFF all electrical systems before connecting the terminals.
- Perform this inspection after the cooling fan motor is turned OFF.



G03096885

Fig. 2: Identifying Terminals 13 (TC) And 4 (CG) Of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Remove the cylinder head cover No. 2.
3. Pull out the wire as shown in **Fig. 3**.



G03096886

Fig. 3: Pulling Out Wire

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

4. Connect the tester terminal of the timing light to the pulled-out wire.

NOTE:

- Use a timing light which detects the first signal.
- After checking, be sure to wrap the wire harness with tape.

5. Inspect the ignition timing at idle.

Ignition timing: 8 to 12° BTDC**NOTE:**

When checking the ignition timing, shift the transmission to the neutral or parking position.

HINT:

Run the engine at 1,000 to 1,300 rpm for 5 seconds, check that the engine rpm returns to the idle speed.

6. Disconnect terminals 13 (TC) and 4 (CG) of the DLC3.
7. Inspect the ignition timing at idle.

Ignition timing: 0 to 14° BTDC

8. Confirm that the ignition timing advances when the engine rpm is increased.
9. Remove the timing light.

8. INSPECT ENGINE IDLE SPEED

- a. Warm up the engine.
- b. When using the hand-held tester or OBD II scan tool:
 1. Connect the hand-held tester or OBD II scan tool to the DLC3.
 2. Enter DATA LIST MODE on the hand-held tester or OBDII scan tool.

Idle speed:

IDLE SPEED SPECIFICATIONS

M/T	650 +/- 50 rpm
A/T	700 +/- 50 rpm

NOTE:

- When checking the idle speed, the transmission is in the neutral or parking position.
- Check the idle speed with the cooling fan OFF.
- Switch off all accessories and air conditioning before connecting the hand-held tester or OBDII scan tool.

HINT:

Please refer to the Hand-Held Tester Operator's Manual if you need help to select DATA LIST.

- c. When not using the hand-held tester or OBDII scan tool:
 1. Using SST, connect the tachometer test probe to terminal 9 (TAC) of the DLC3.

SST 09843-18040

2. Check the idle speed. Idle speed:

IDLE SPEED SPECIFICATIONS

M/T	650 +/- 50 rpm
A/T	700 +/- 50 rpm

NOTE:

- When checking the idle speed, the transmission is in the neutral or parking position.

- Check idle speed with the cooling fan OFF.
- Switch off all accessories and air conditioning before connecting the test prove to the terminal.

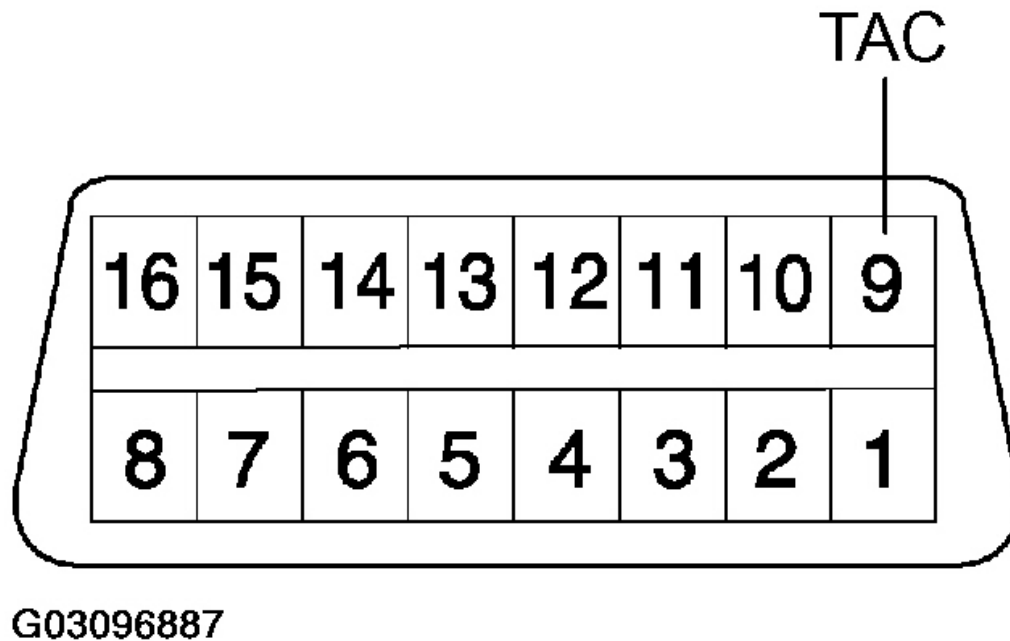


Fig. 4: Identifying Terminal 9 (TAC) of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSPECT COMPRESSION

- Warm up and stop the engine.
- Disconnect the injector connectors.
- Remove the ignition coils.
- Remove the spark plugs.
- Inspect the cylinder compression pressure.
 1. Insert a compression gauge into the spark plug hole.
 2. Fully open the throttle.
 3. While cranking the engine, measure the compression pressure.

SST 09992-00500

Compression pressure:

1,471 kPa (15.0 kgf/cm² , 213 psi)

Minimum pressure:

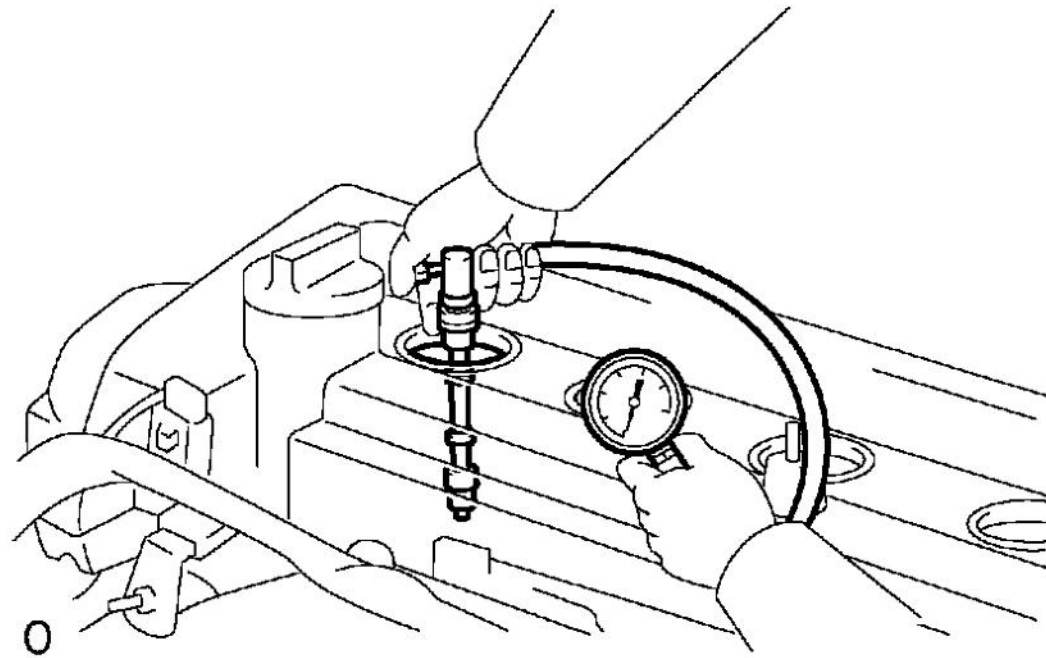
1,079 kPa (11.0 kgf/cm² , 156 psi)

Difference between each cylinder:

98 kPa (1.0 kgf/cm² , 14 psi)

NOTE:

- Always use a fully charged battery to obtain the engine speed of 250 rpm or more.
- Check other cylinder's compression pressure in the same way.
- This measurement must be done as shortly as possible.



G03096888

Fig. 5: Measuring Compression Pressure

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

4. If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and inspect it again.

HINT:

- If adding oil increases the compression, the piston rings and/or cylinder bore may be worn or damaged.
- If the pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

10. INSPECT CO/HC

- Start the engine.
- Run the engine at 2,500 rpm for approximately 180 seconds.
- Insert the CO/HC meter testing probe at least 40 cm (1.3 ft) into the tailpipe during idling.
- Immediately check the CO/HC concentration at idle and 2,500 rpm.

HINT:

When doing the 2 mode (with the engine is at idle and 2,500 rpm) test, these measuring orders are prescribed by the applicable local regulations.

If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.

- Check the heated oxygen sensor operation (See **INSPECTION**).
- See **Fig. 6** for possible causes, and then inspect the applicable causes and repair it if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignition: • Incorrect timing • Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaks in intake and exhaust valves 4. Leaks in cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hoses • Intake manifold • Throttle body • ISC • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI systems: • Faulty pressure regulator • Defective water temperature sensor • Defective mass air flow meter • Faulty ECM • Faulty injectors • Faulty throttle position sensor

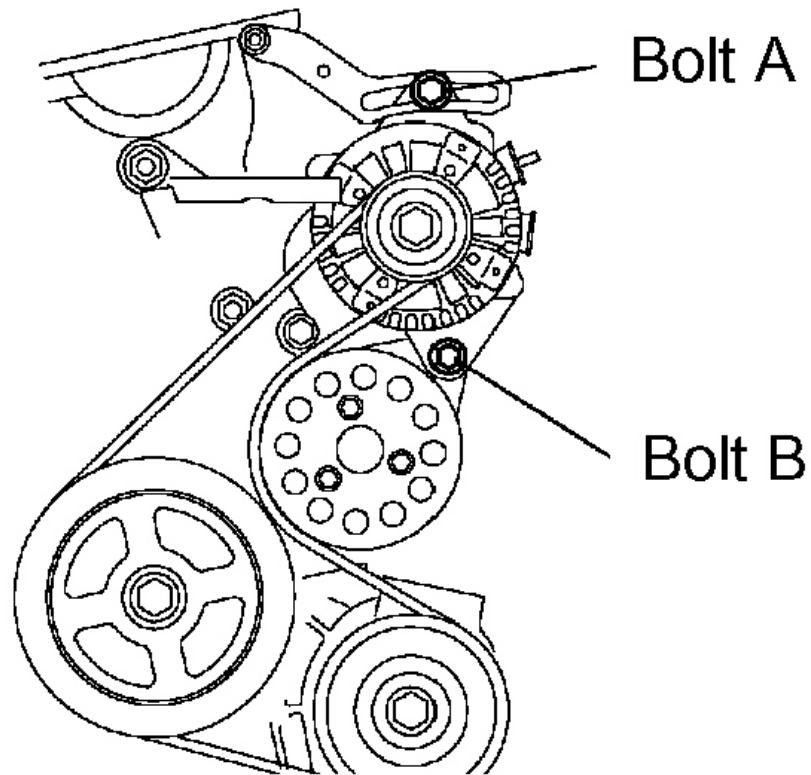
G03096889

Fig. 6: CO/HC Troubleshooting Table
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DRIVE BELT

REPLACEMENT

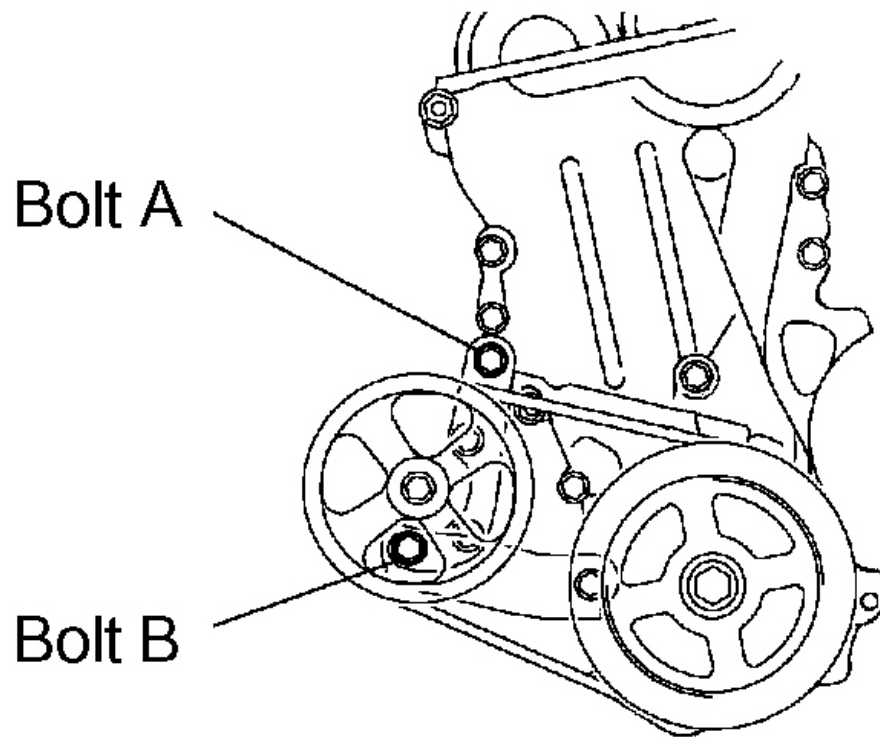
1. **REMOVE FAN AND GENERATOR V BELT**
 - a. Loosen bolts A and B.
 - b. Release the V-ribbed belt tension and remove the V-ribbed belt.



G03096890

Fig. 7: Removing Fan And Generator V Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE ENGINE UNDER COVER RH (See REPLACEMENT)**
3. **REMOVE VANE PUMP V BELT**
 - a. Loosen bolts A and B.
 - b. Release the V-ribbed belt tension, and remove the V-ribbed belt.



I
G03096891

Fig. 8: Removing Vane Pump V Belt

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

4. INSTALL VANE PUMP V BELT

- a. Temporarily install the V-ribbed belt on each pulley.

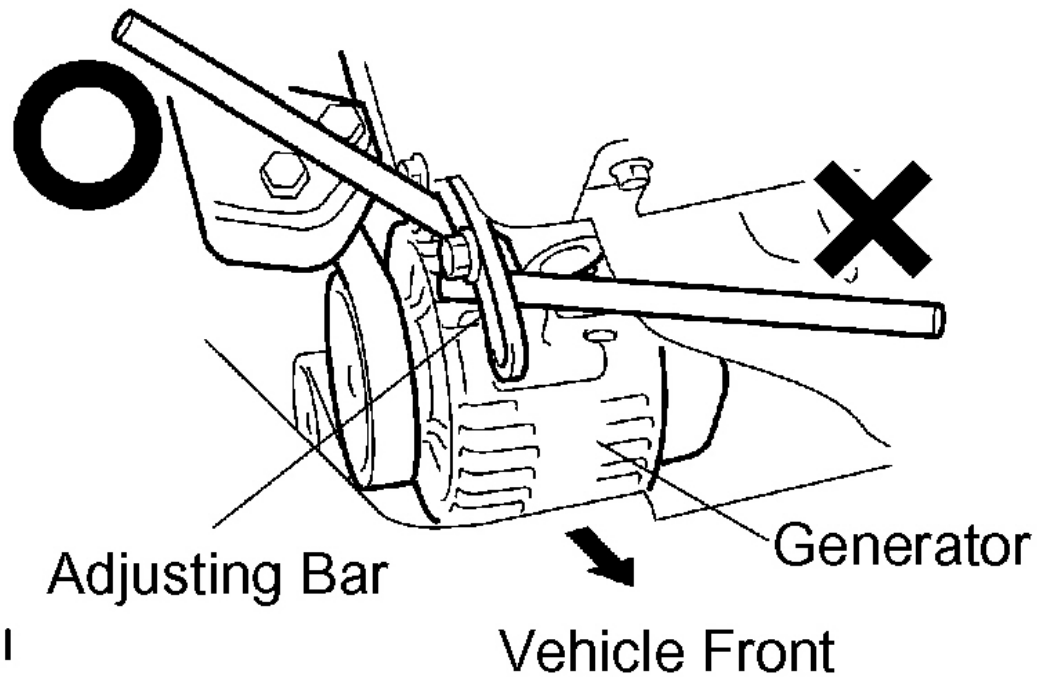
5. INSTALL FAN AND GENERATOR V BELT

- a. Temporarily install the V-ribbed belt on each pulley.

6. ADJUST FAN AND GENERATOR V BELT

- a. Insert the adjusting bar between the engine RH mount bracket and generator. Push the bar towards the vehicle front to adjust the V-ribbed belt tension.

NOTE: Do not insert the bar between the oil control valve and generator. It could damage the oil control valve.



G03096892

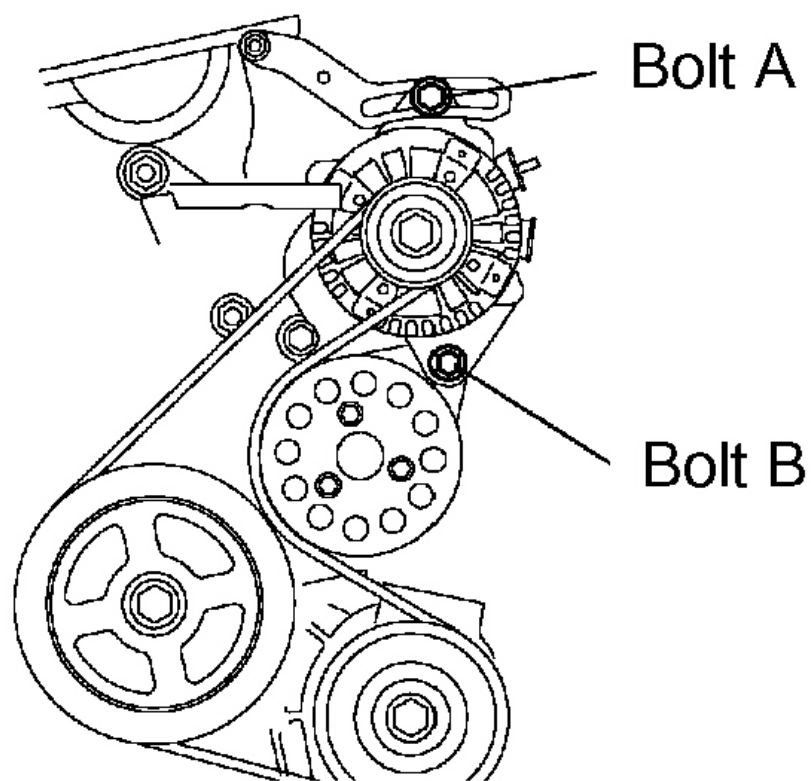
Fig. 9: Adjusting Fan And Generator V Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. First tighten bolt A, then tighten bolt B.

Torque:

Bolt A: 19 N.m (189 kgf.cm, 14 ft.lbf)

Bolt B: 54 N.m (550 kgf.cm, 40 ft.lbf)



G03096893

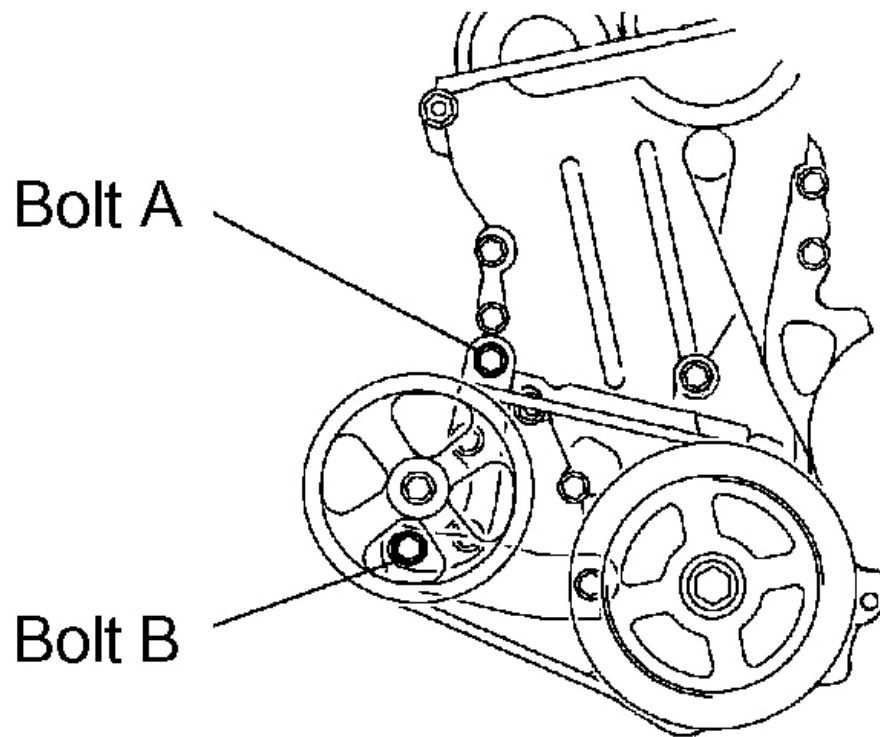
Fig. 10: Tightening Bolts A And B

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

7. ADJUST VANE PUMP V BELT

- Using the bar, adjust the V-ribbed belt tension.
- First tighten bolt B, then tighten bolt A.

Torque: 44 N.m (449 kgf.cm, 33 ft.lbf)



I
G03096894

Fig. 11: Adjusting Vane Pump V Belt

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

8. INSPECT DRIVE BELT DEFLECTION AND TENSION (See INSPECTION)
9. INSTALL ENGINE UNDER COVER RH

Torque:

5.0 N.m (51 kgf.cm, 44 in.lbf) for bolt

5.0 N.m (51 kgf.cm, 44 in.lbf) for nut

VALVE CLEARANCE

ADJUSTMENT

1. REMOVE CYLINDER HEAD COVER NO. 2

- a. Remove the 4 nuts and cylinder head cover No. 2.

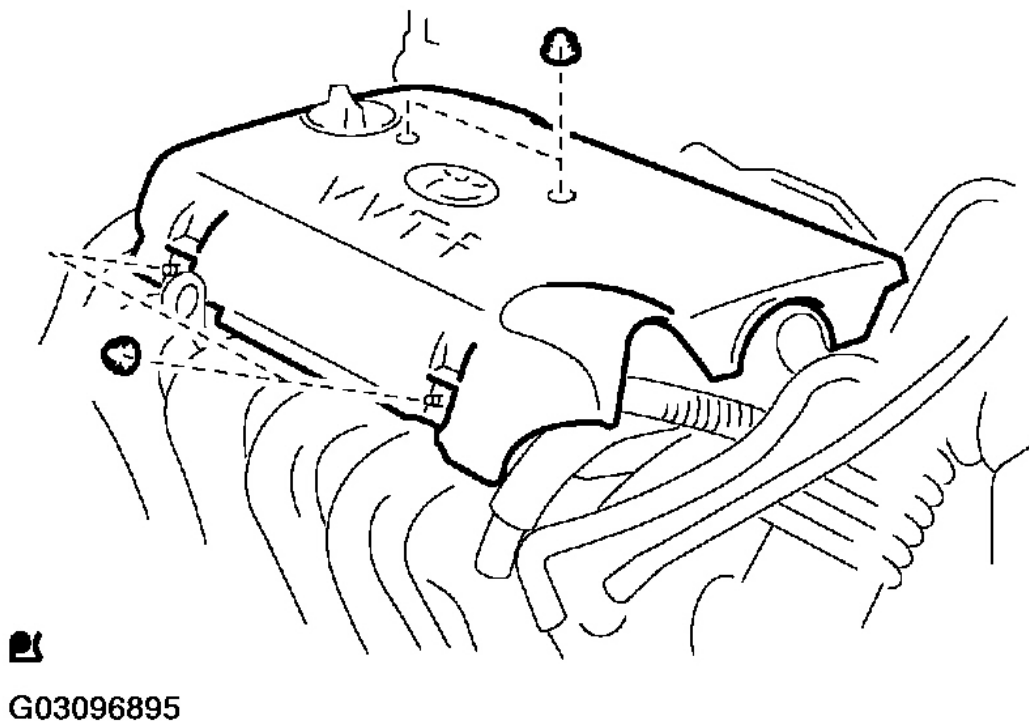
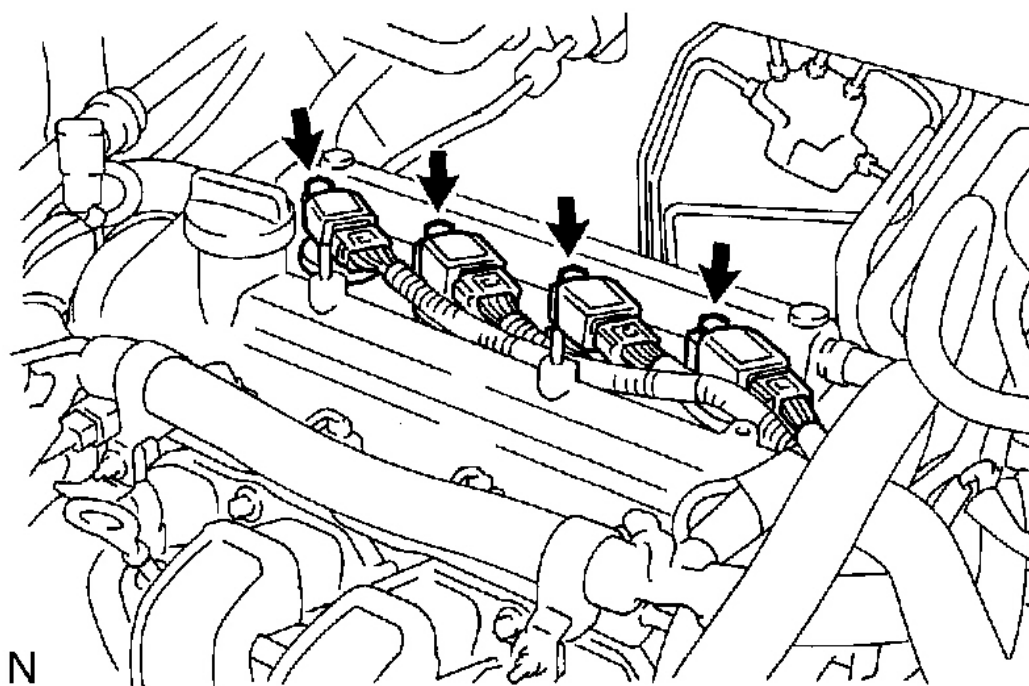


Fig. 12: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE IGNITION COIL NO. 1

- a. Remove the 4 bolts and pull out the 4 ignition coils.



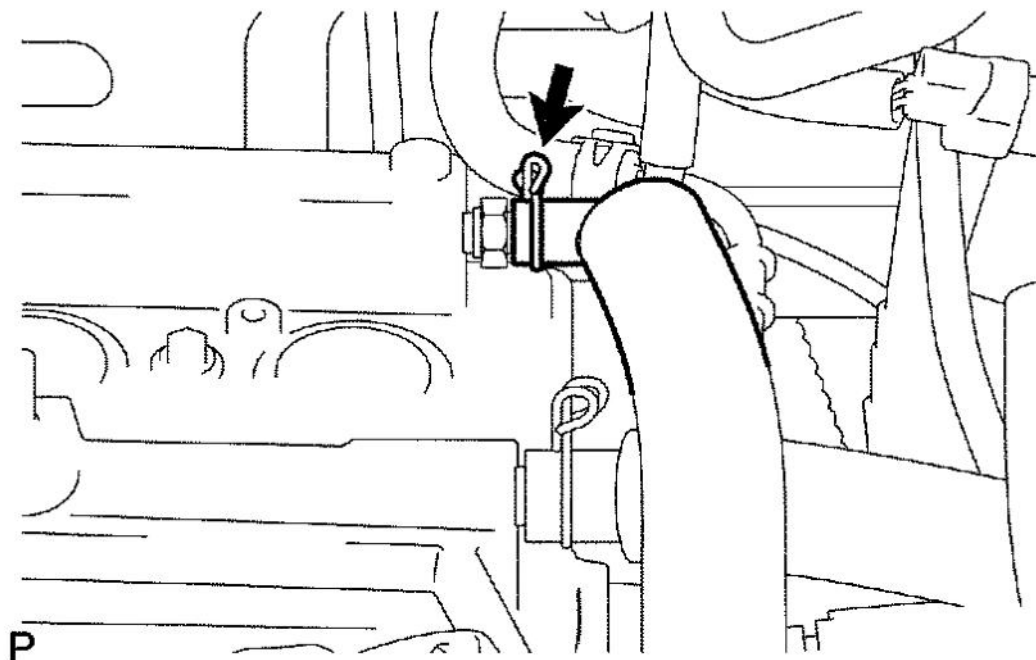
G03096896

Fig. 13: Removing Ignition Coil No. 1

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

3. DISCONNECT VENTILATION HOSE

- a. Disconnect the ventilation hose from the cylinder head cover.



P

G03096897

Fig. 14: Disconnecting Ventilation Hose

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

4. DISCONNECT VENTILATION HOSE NO. 2

- a. Disconnect the ventilation hose No. 2 from the cylinder head cover.

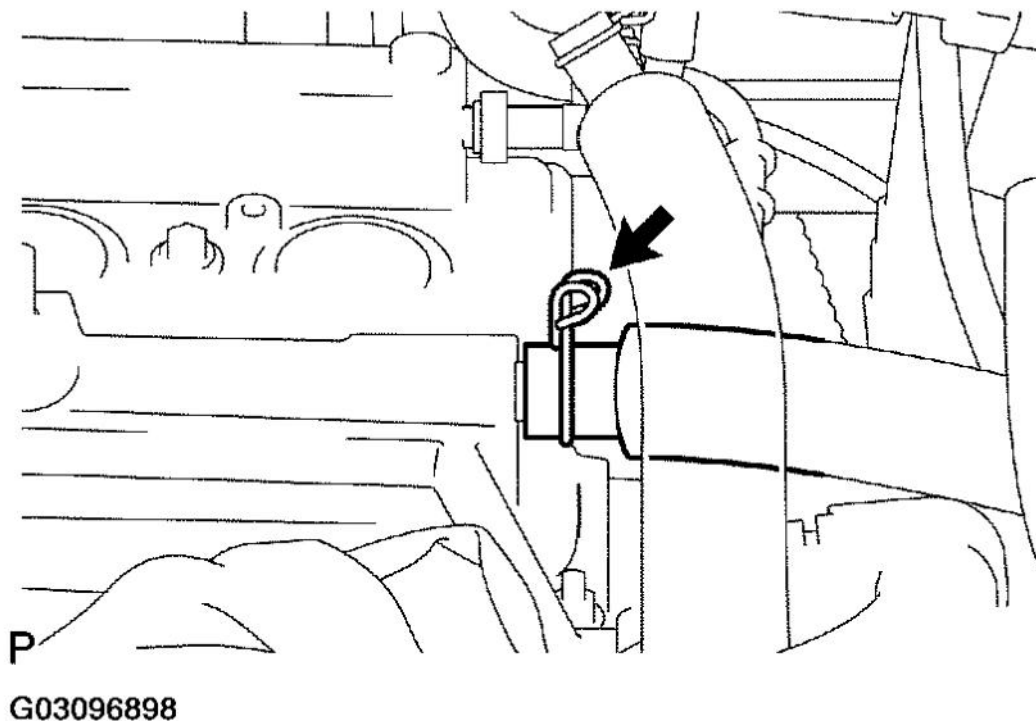


Fig. 15: Disconnecting Ventilation Hose No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE CYLINDER HEAD COVER SUB-ASSY

- a. Remove the 9 bolts and 2 nuts, and then remove the cylinder head cover.

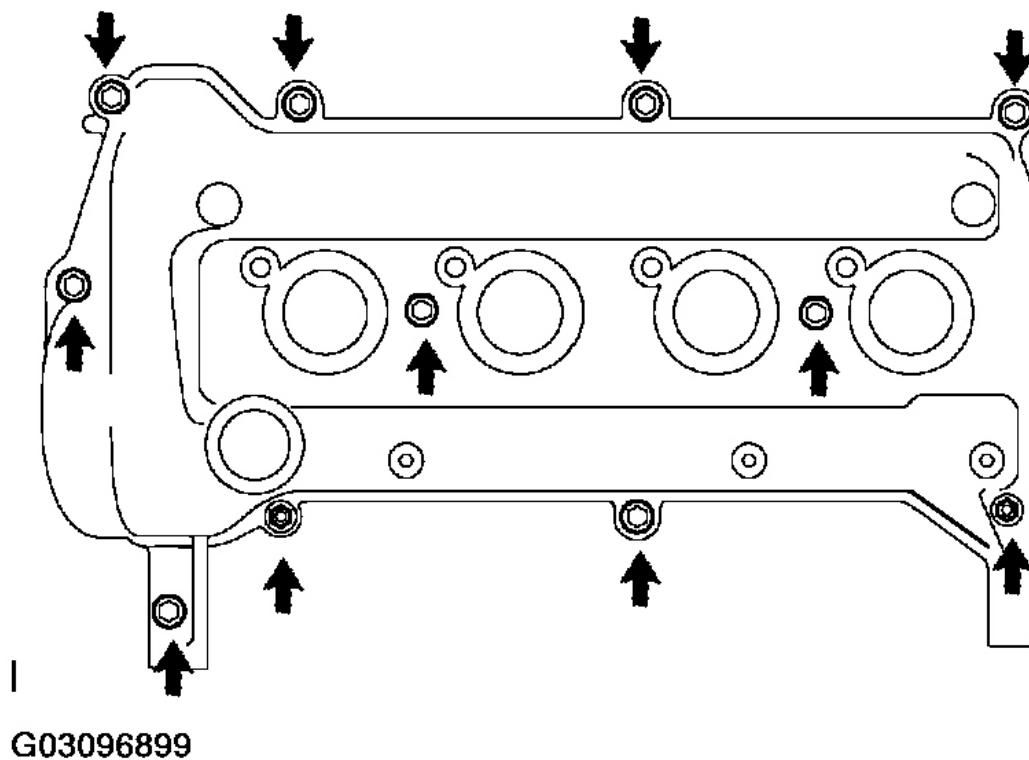


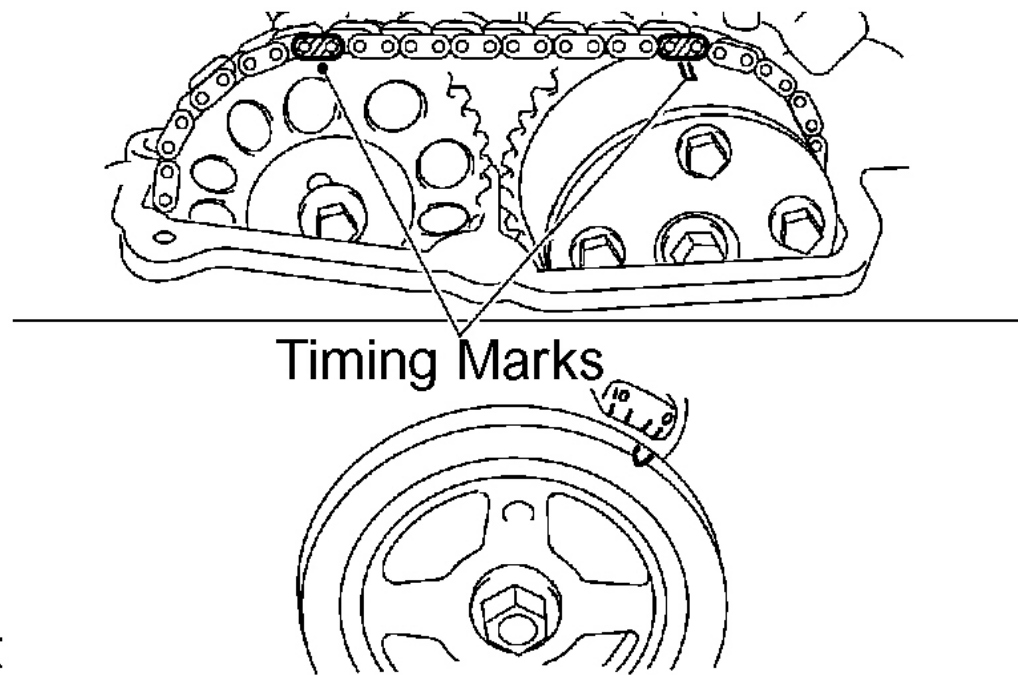
Fig. 16: Removing Cylinder Head Cover Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE ENGINE UNDER COVER RH (See REPLACEMENT)**
7. **INSPECT VALVE CLEARANCE**

HINT:

Inspect and adjust the valve clearance when the engine is cold.

- a. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.
 2. Check that both timing marks on the camshaft timing sprocket and the camshaft timing gear are facing upward as shown in **Fig. 17**.



I

G03096900

Fig. 17: Checking That Both Timing Marks On Camshaft Timing Sprocket And Camshaft Timing Gear Are Facing Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

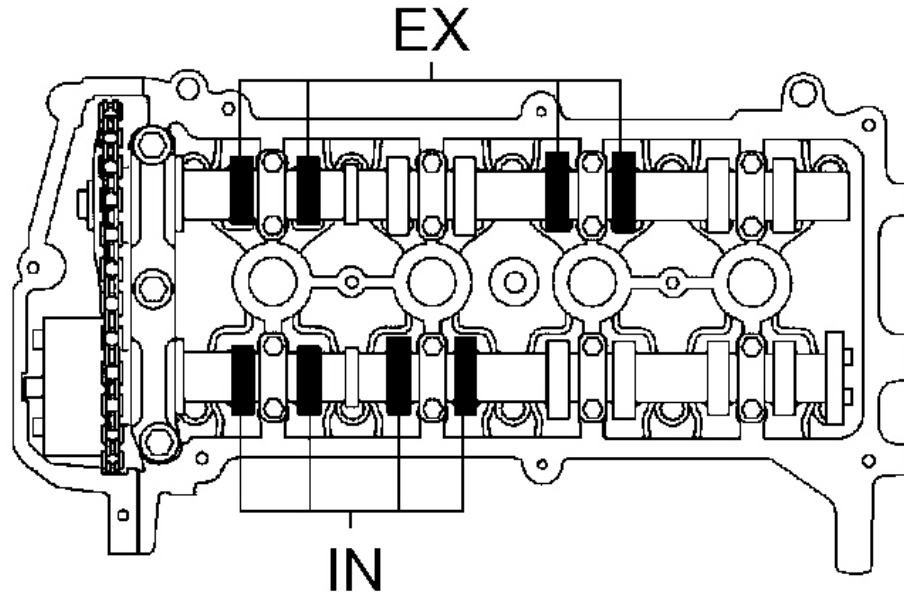
- b. Check the valves indicated in **Fig. 18**.
1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

Valve clearance (Cold):

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.)

No. 1 Cylinder TDC/Compression



G03096901

Fig. 18: Identifying Intake And Exhaust Valves On No. 1 Cylinder TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.
- c. Turn the crankshaft 1 complete revolution until its timing notch and the timing mark "0" of the chain cover are aligned.
- d. Check the valves indicated in **Fig. 19**.
 1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

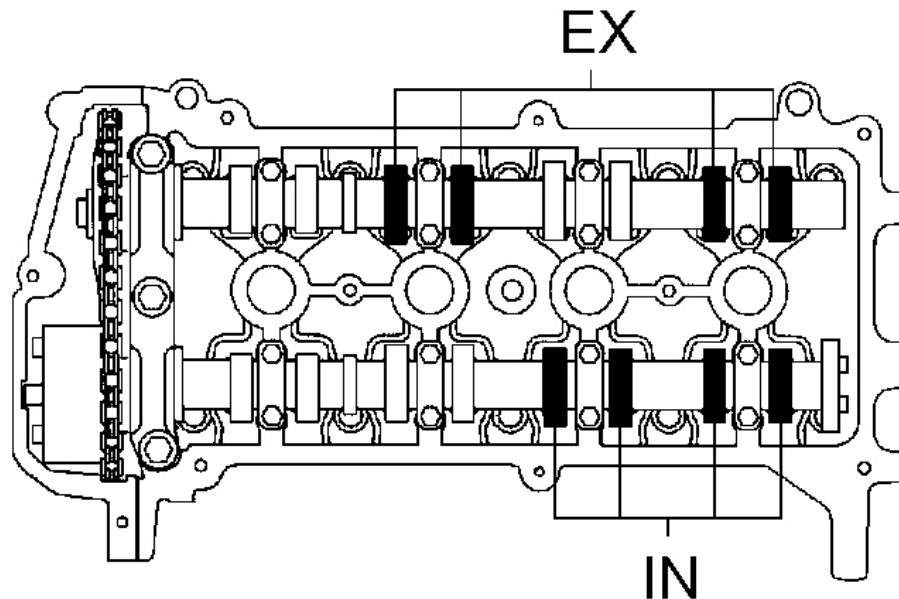
Valve clearance (Cold) :

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 any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

No. 4 Cylinder TDC/Compression

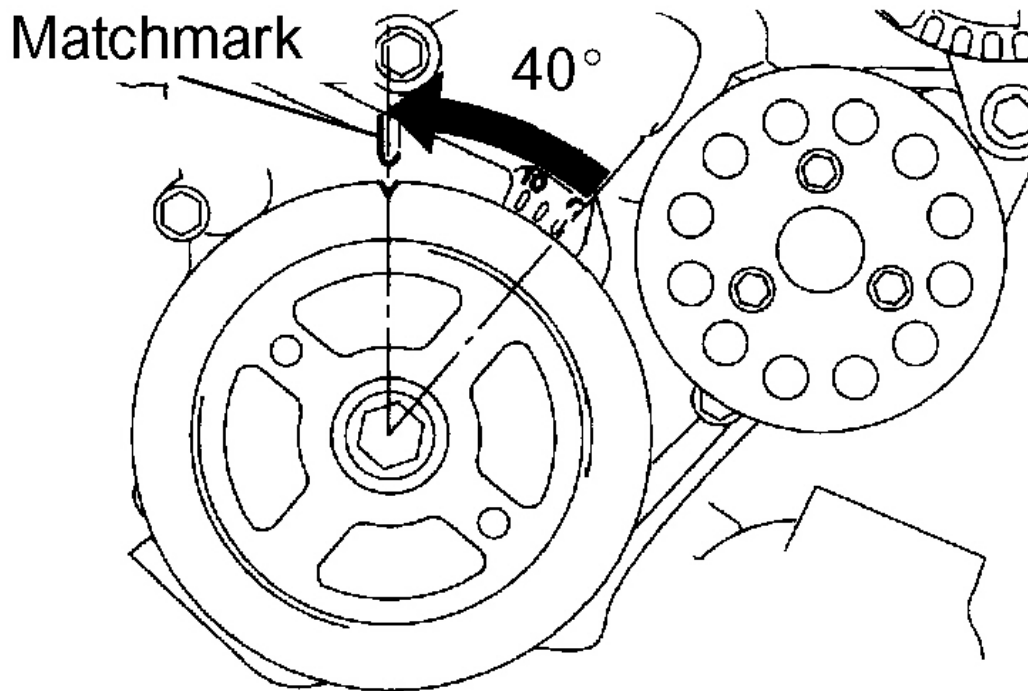


G03096902

Fig. 19: Identifying Intake And Exhaust Valves On No. 4 Cylinder TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. ADJUST VALVE CLEARANCE

NOTE: When rotating the camshaft with the timing chain removed, rotate the crankshaft damper counterclockwise 40° from the TDC and align its timing notch with the matchmark of the timing chain cover to prevent the pistons from coming into contact with the valves.



G03096903

Fig. 20: Rotating Crankshaft Damper Counterclockwise 40° From TDC And Aligning Timing Notch With Matchmark Of Timing Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the crankshaft damper until its timing notch and timing mark "0" of the chain cover are aligned.
 2. Check that both timing marks on the camshaft timing sprocket and valve timing controller assembly are facing upward as shown in **Fig. 21**.

HINT:

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

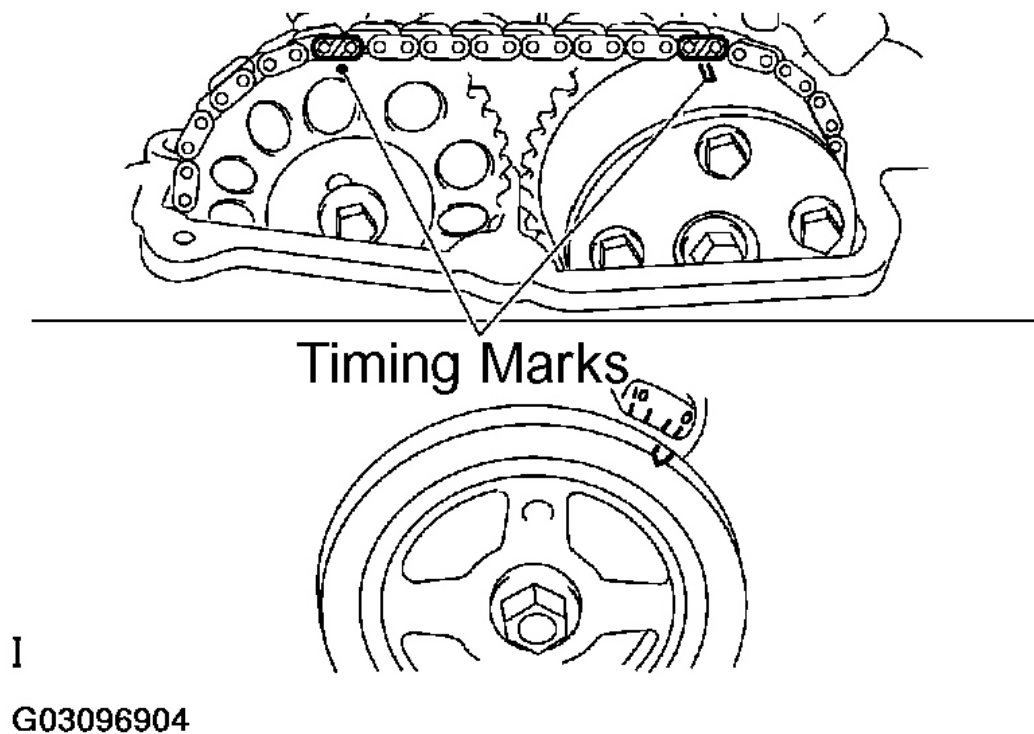


Fig. 21: Checking That Both Timing Marks On Camshaft Timing Sprocket And Valve Timing Controller Assembly Are Facing Upward
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Put paint marks on the timing chain in place where the timing marks of the camshaft timing sprocket and the camshaft timing gear are located.

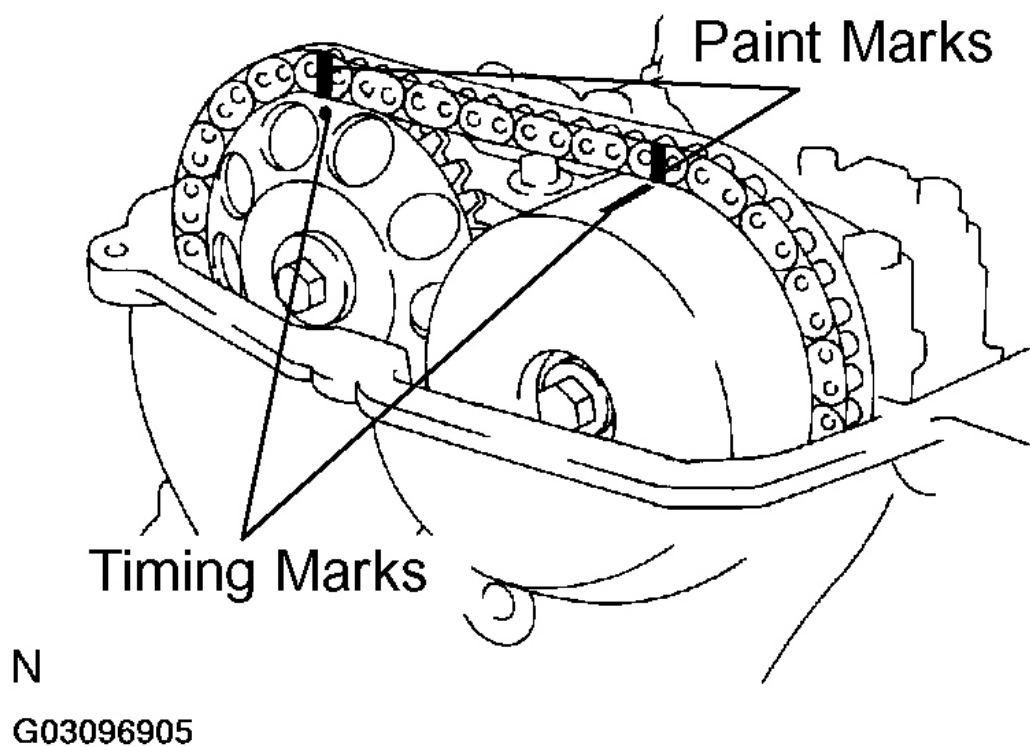


Fig. 22: Putting Paint Marks On Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using an 8 mm hexagon wrench, remove the screw plug.

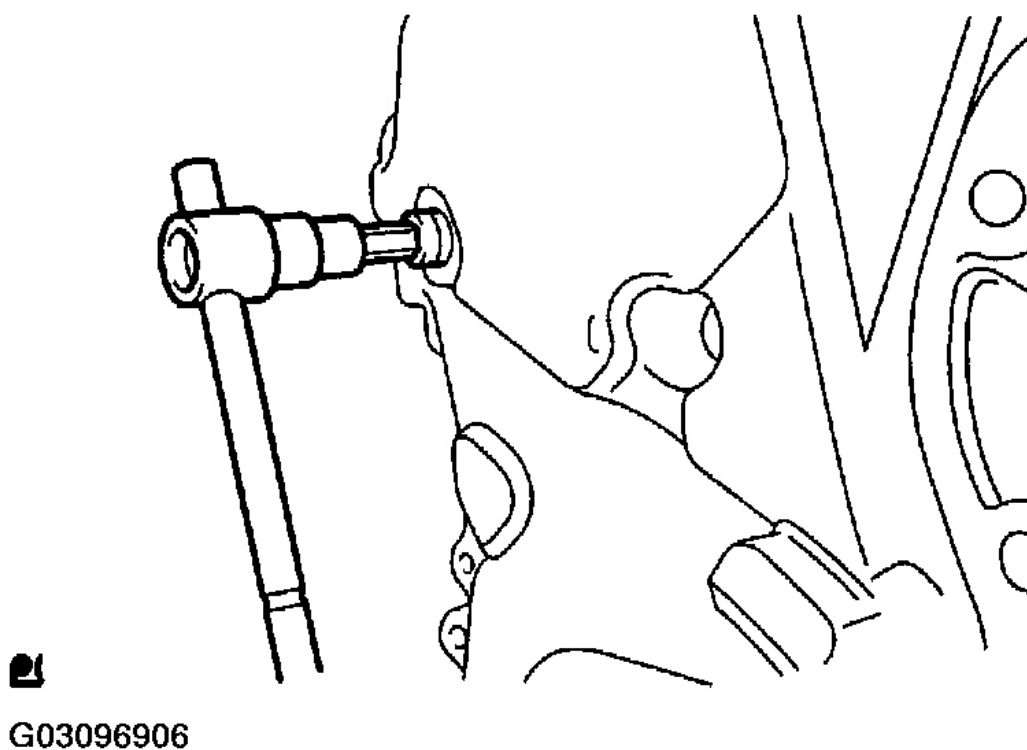


Fig. 23: Removing Screw Plug

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

- d. Insert a screwdriver into the service hole of the chain tensioner to the hole stopper plate of the chain tensioner at upward position.
- e. Using a wrench, rotate the camshaft No. 2 clockwise to push in the plunger of the chain tensioner.

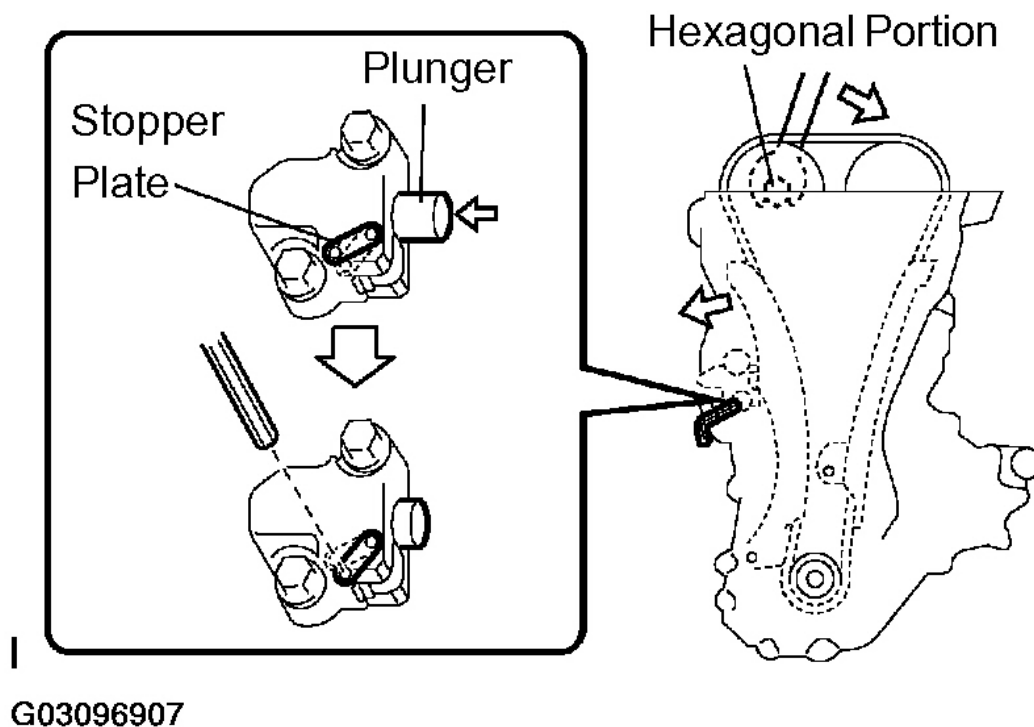


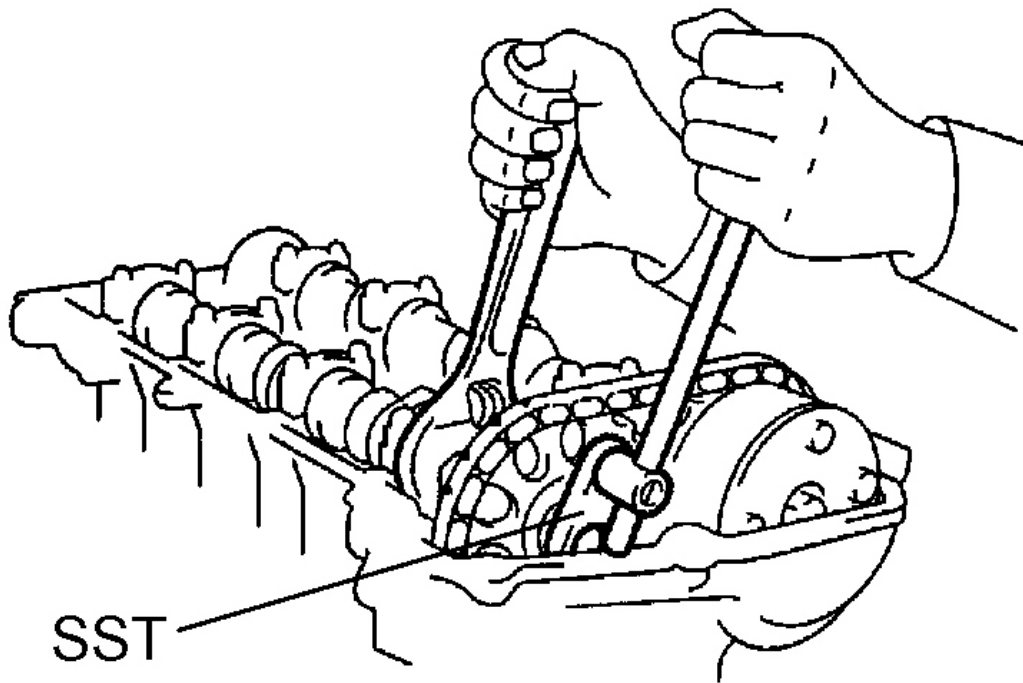
Fig. 24: Rotating Camshaft No. 2 Clockwise To Push In Plunger Of Chain Tensioner
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Remove the screwdriver from the service hole, then align the hole of the stopper plate with the service hole and insert a 2 to 3 mm (0.08 to 0.12 in.) diameter bar into the holes to hold the stopper plate.

HINT:

- Fix the stopper plate using the bar while rotating the camshaft right and left slightly.
 - Hold the bar with tape so that the bar does not come off.
- g. Hold the camshaft with a wrench on the hexagonal lobe, and remove the bolt.

SST 09023-38400



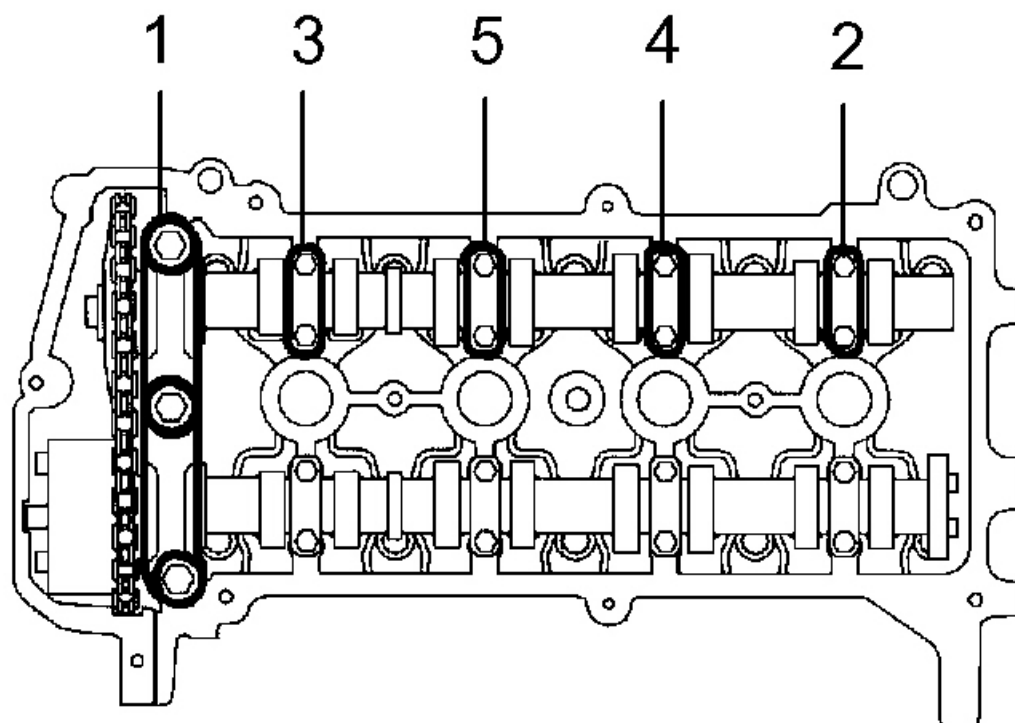
G03096908

Fig. 25: Removing Bolt

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

- h. Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in **Fig. 26**, then remove the 5 bearing caps.

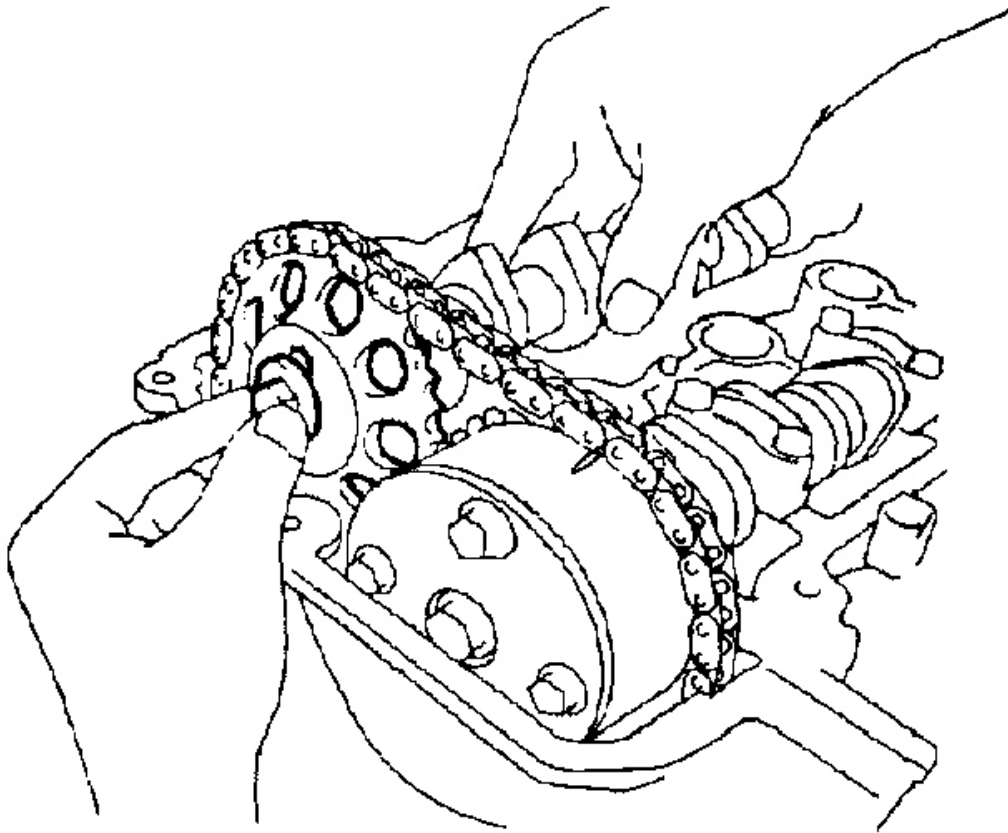
NOTE: Loosen each bolt uniformly keeping the camshaft level.



G03096909

Fig. 26: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Remove the fringe bolt with the No. 2 camshaft lifting up, then detach the No. 2 camshaft and camshaft timing sprocket.



G03096910

Fig. 27: Removing Fringe Bolt With No. 2 Camshaft Lifting Up
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in **Fig. 28**, then remove the 4 bearing caps.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

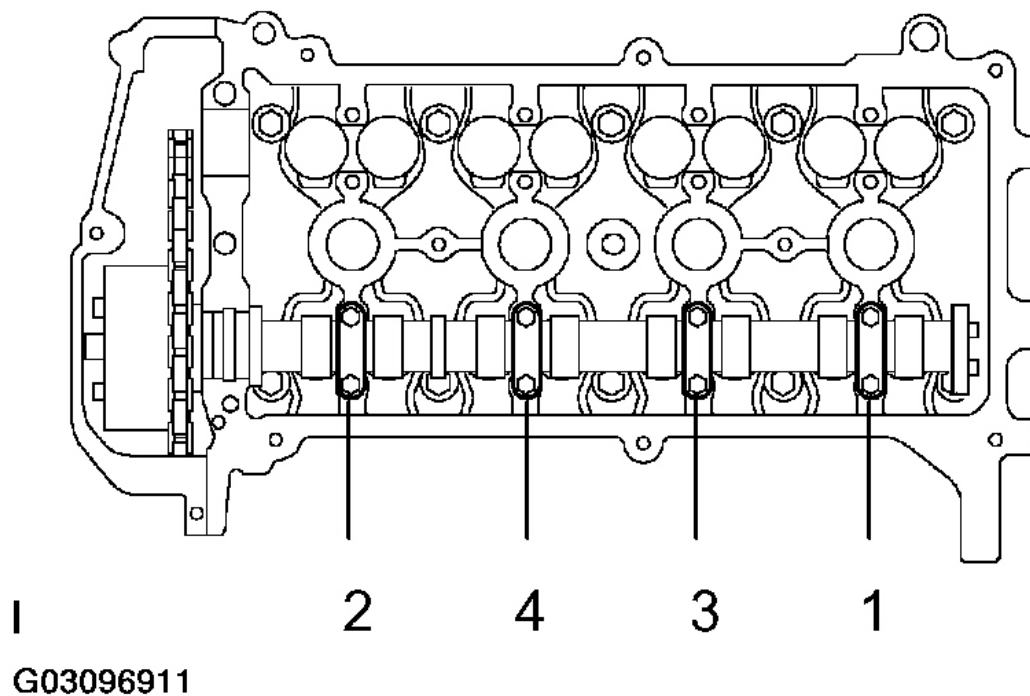
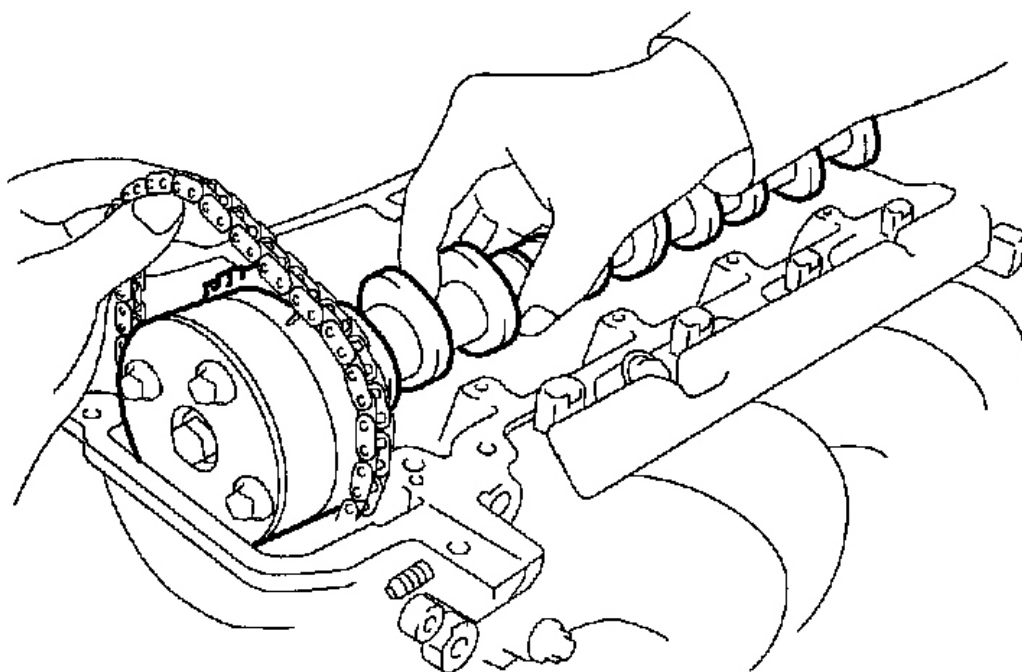


Fig. 28: Removing Bearing Caps In Sequence

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

- k. Hold the timing chain by hand, and remove the camshaft and camshaft timing gear assembly.



G03096912

Fig. 29: Removing Camshaft And Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Tie the timing chain with a string as shown in **Fig. 30**.

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

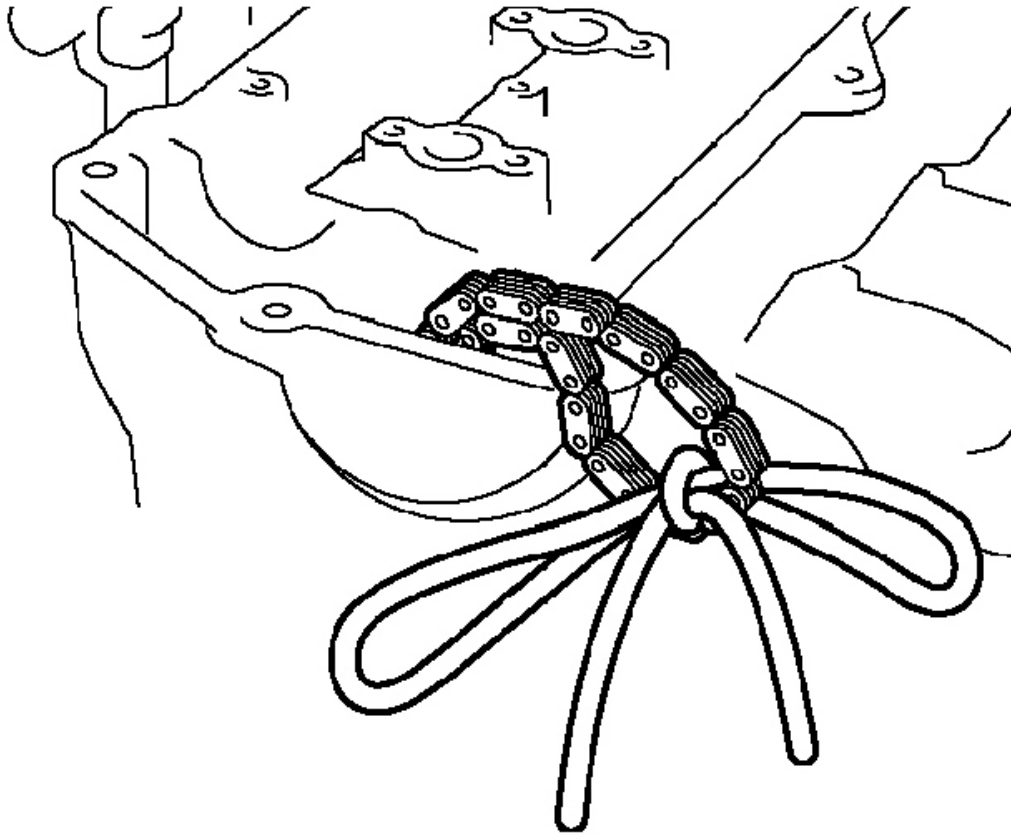
**G03096913**

Fig. 30: Tying Timing Chain With String

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

- m. Remove the valve lifters.
- n. Using a micrometer, measure the thickness of the removed lifter.
- o. Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

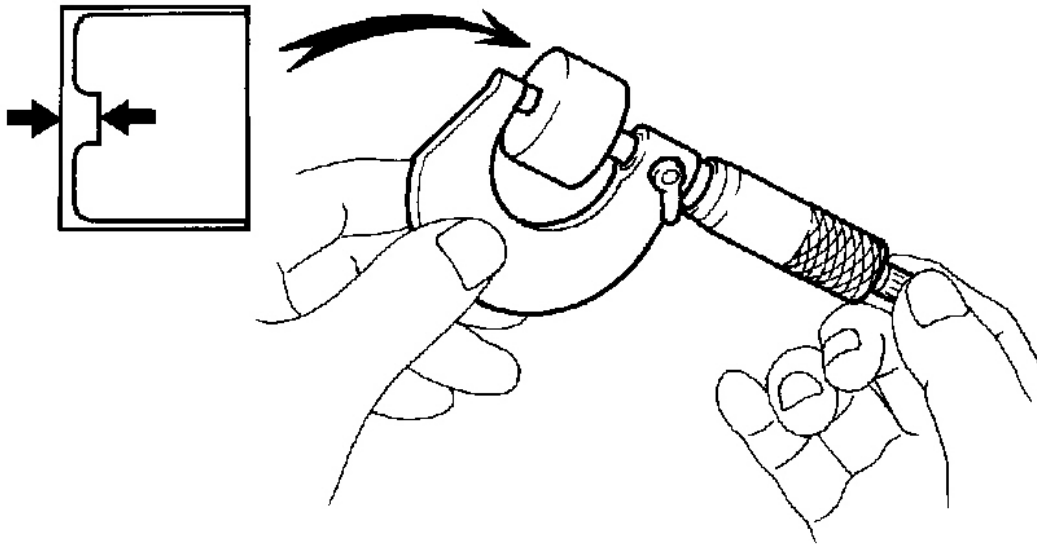
VALVE CLEARANCE SPECIFICATIONS

A	Thickness of new lifter
B	Thickness of used lifter
C	Measured valve clearance

Specified value (Cold):

Intake: $A = B + (C - 0.20 \text{ mm (0.008 in.)})$

Exhaust: $A = B + (C - 0.30 \text{ mm (0.012 in.)})$



G03096914

Fig. 31: Measuring Thickness Of Removed Lifter
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- p. Select a new lifter with a thickness as close as possible to the calculated values.

EXAMPLE (Intake):

Measured valve clearance = 0.40 mm (0.0158 in.)

$0.40 \text{ mm (0.0158 in.)} - 0.20 \text{ mm (0.0079 in.)} = 0.20 \text{ mm (0.0079 in.)}$

(Measured - Specification = Excess clearance)

Used lifter measurement = 5.25 mm (0.2067 in.)

$0.20 \text{ mm (0.0079 in.)} + 5.25 \text{ mm (0.2067 in.)} = 5.45 \text{ mm (0.2146 in.)}$

(Excess clearance + Used lifter = Ideal new lifter)

Closest new lifter = 5.45 mm (0.2146 in.)

Select No. "46" lifter (5.46 mm (0.2150 in.))

G03096915

Fig. 32: Selecting A New Lifter (Example)

2005 ENGINE Engine Mechanical - xB

[illegible]

Fig. 34: Valve Lifter Selection Table (Exhaust)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- q. Reinstall the valve lifters.
- r. Apply a light coat of engine oil to the camshaft journals.
- s. Install the timing chain onto the camshaft timing gear with the painted link and timing marks aligned as shown in **Fig. 35**.

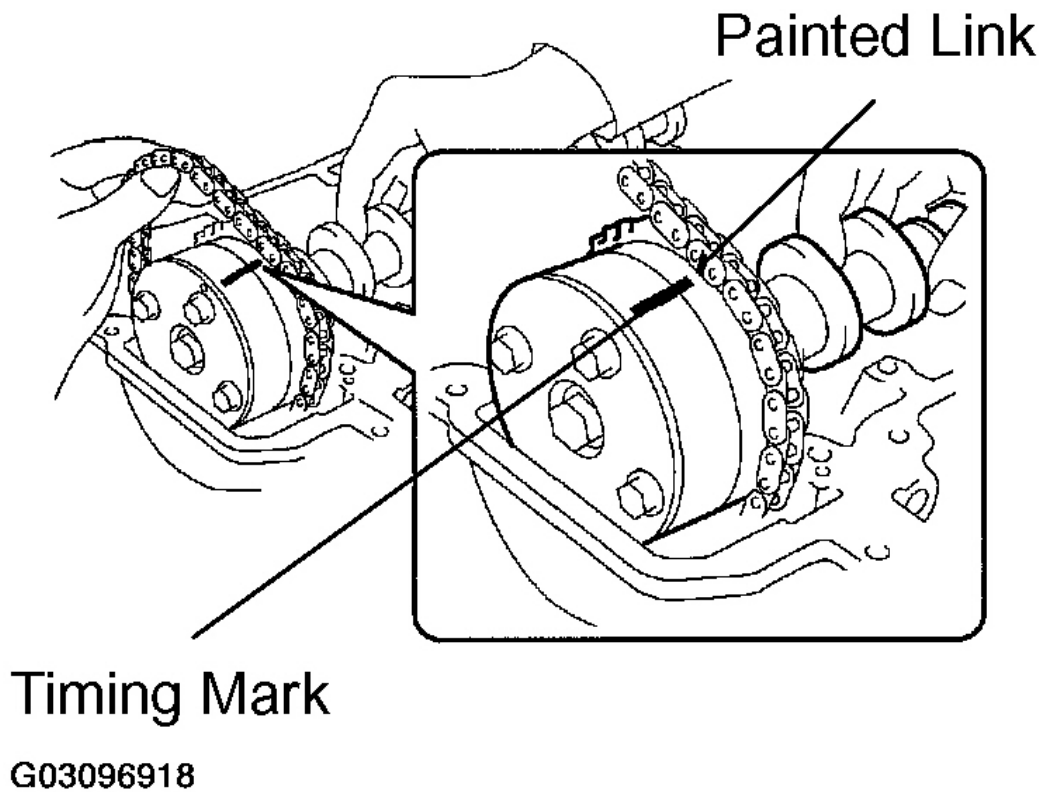


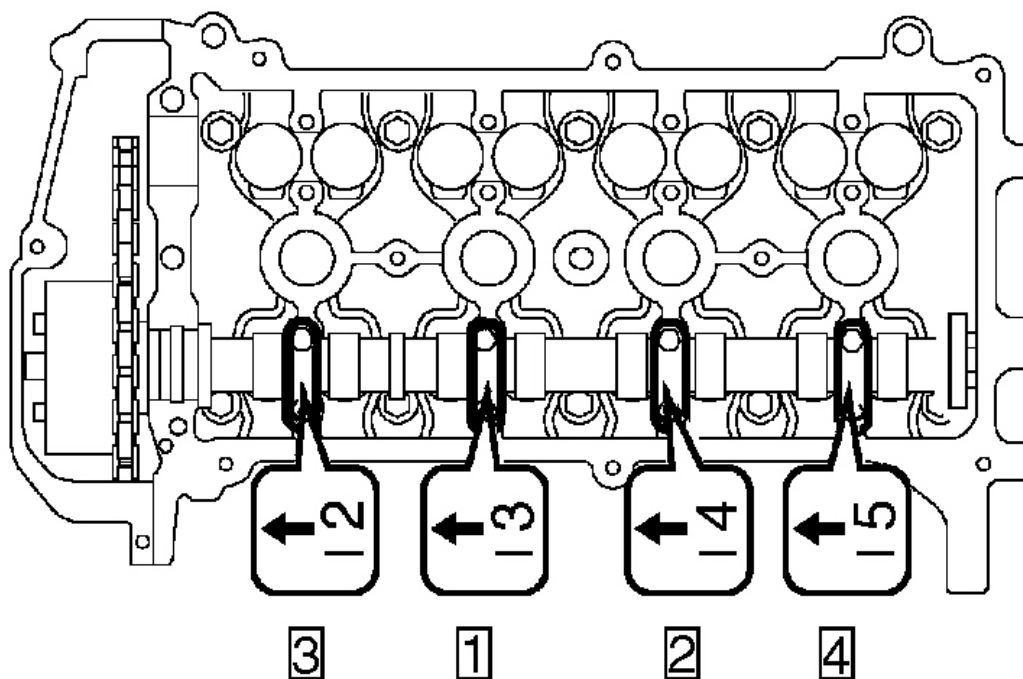
Fig. 35: Installing Timing Chain Onto Camshaft Timing Gear With Painted Link And Timing Marks Aligned

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

- t. Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 36**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: Tighten each bolt uniformly keeping the camshaft level.

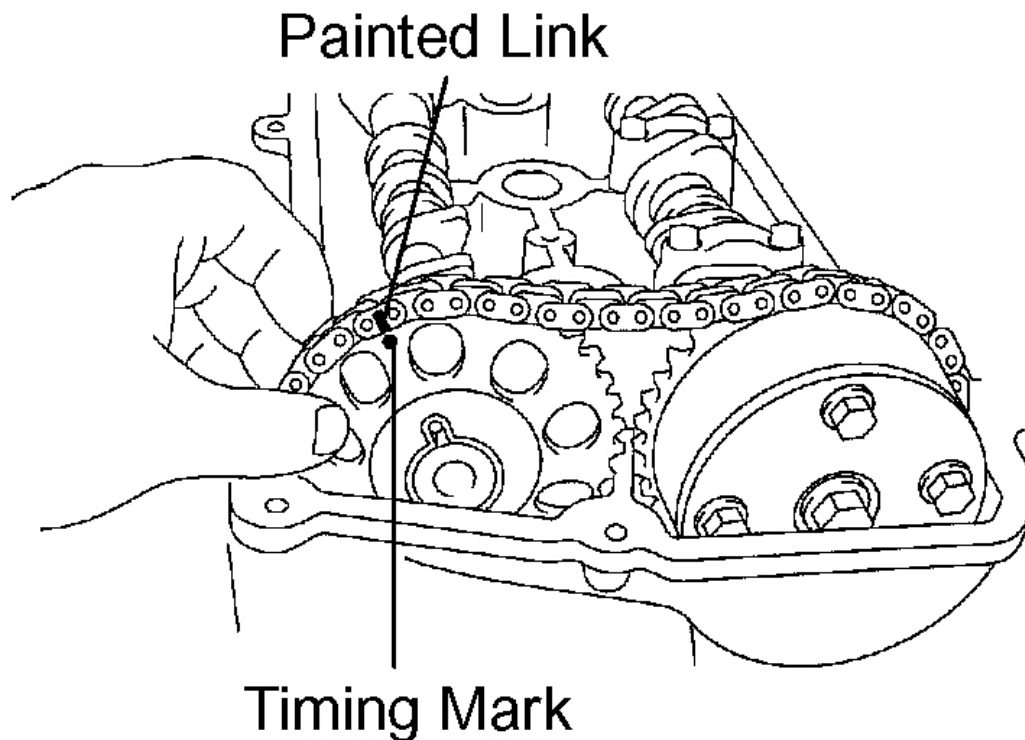


G03096919

Fig. 36: Tightening Bolts In Sequence

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

- u. Hold the timing chain, and align the timing mark on the camshaft timing sprocket with the painted link of the timing chain.

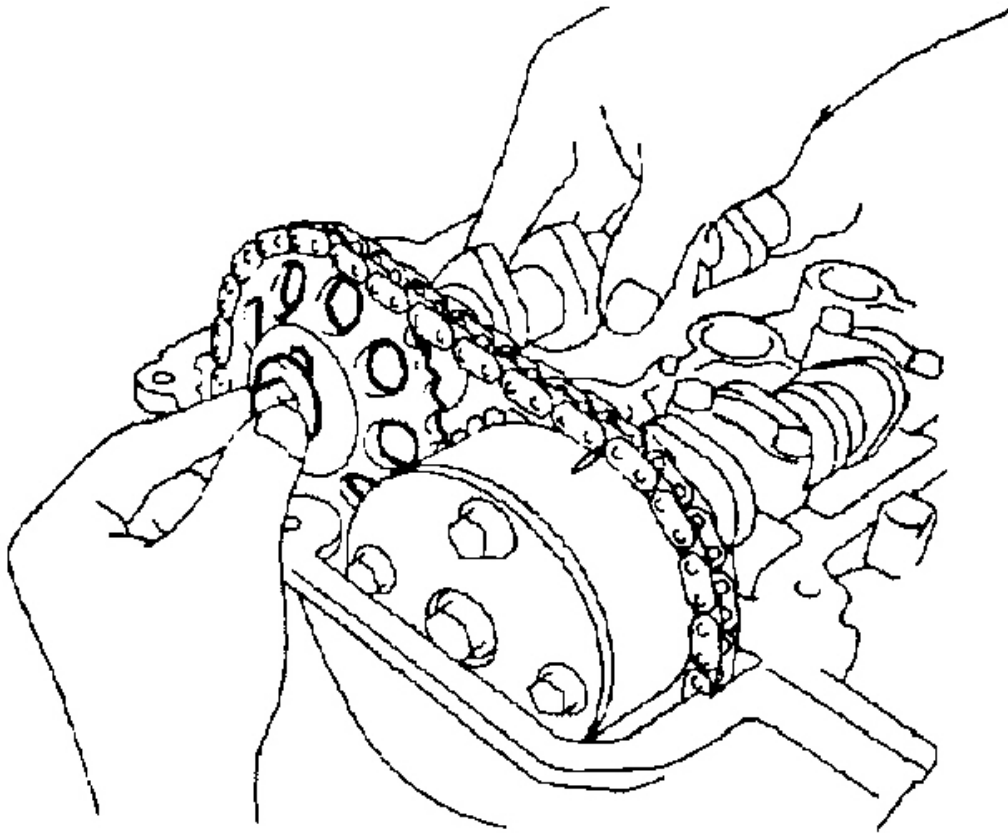


G03096920

Fig. 37: Aligning Timing Mark On Camshaft Timing Sprocket With Painted Link Of Timing Chain

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

- v. Align the alignment pin hole located on the camshaft timing sprocket with the alignment pin of the camshaft, and install the sprocket into the camshaft.



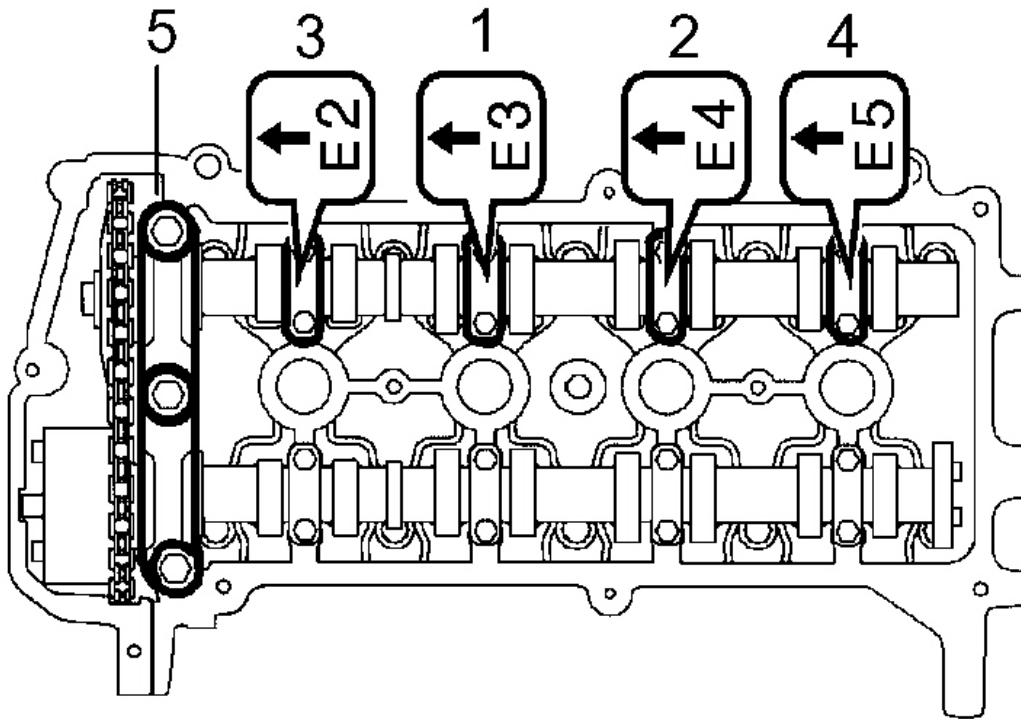
G03096921

Fig. 38: Installing Sprocket Into Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- w. Temporarily install the timing sprocket bolt.
- x. Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 39**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: **Tighten each bolt uniformly keeping the camshaft level.**



G03096922

Fig. 39: Tightening Bolts In Sequence

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

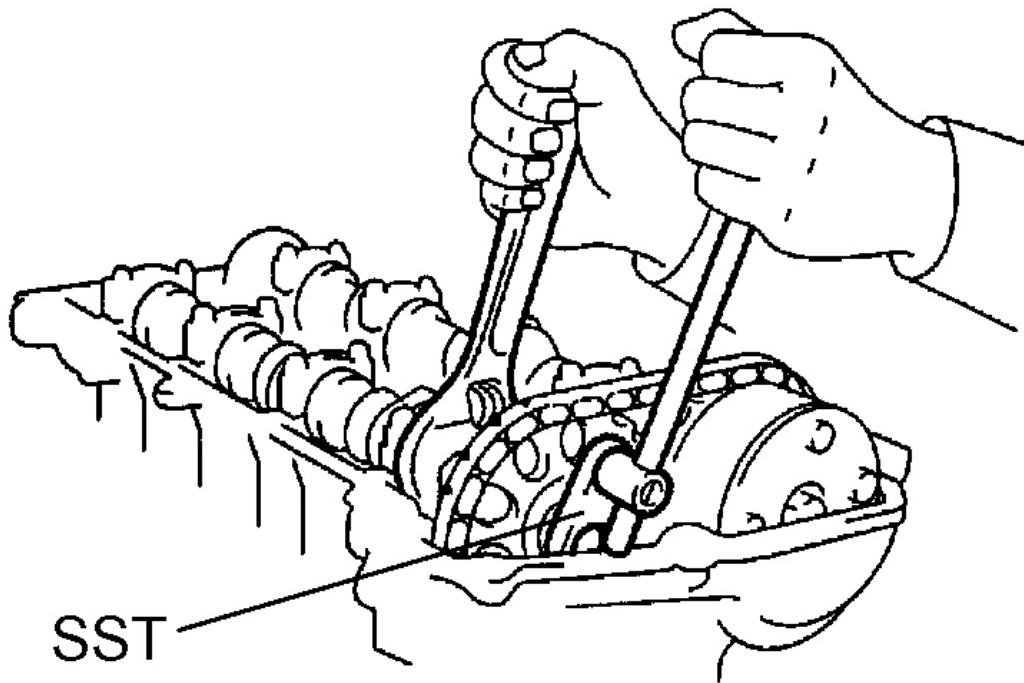
- y. Install the bearing cap No. 1.

Torque: 23 N.m (235 kgf.cm, 17 ft.lbf)

- z. Hold the camshaft with a wrench on the hexagon lobe, and install the bolt.

SST 09023-38400

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

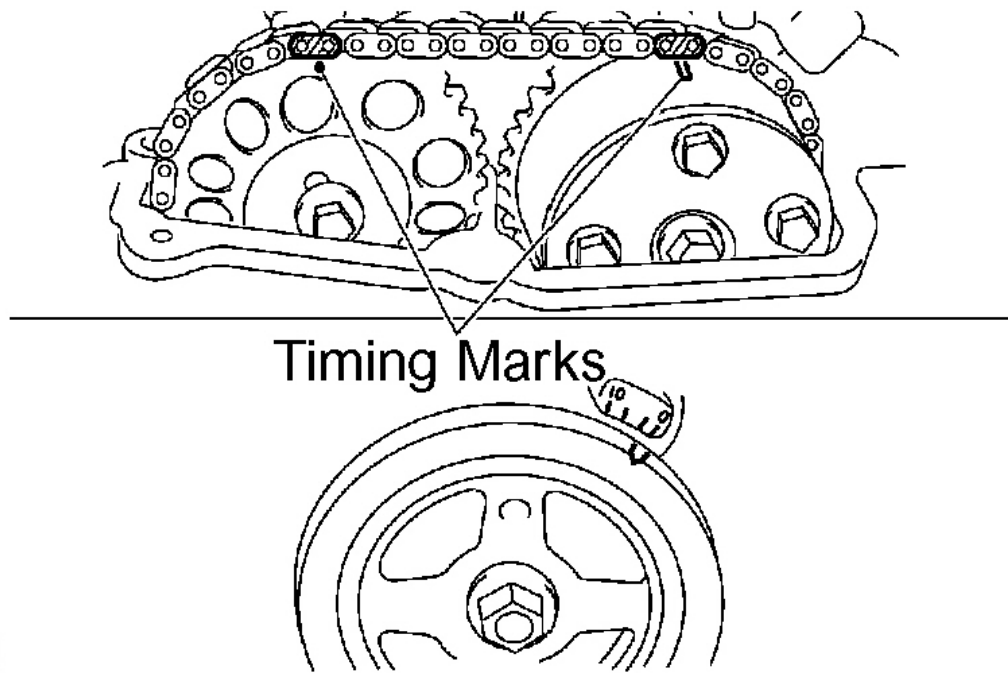


G03096923

Fig. 40: Installing Bolt

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

- aa. Remove the bar from the timing chain tensioner.
- ab. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.
- ac. Check that all the pairs of the timing marks are aligned.



I

G03096924

Fig. 41: Checking That All Pairs Of Timing Marks Are Aligned
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

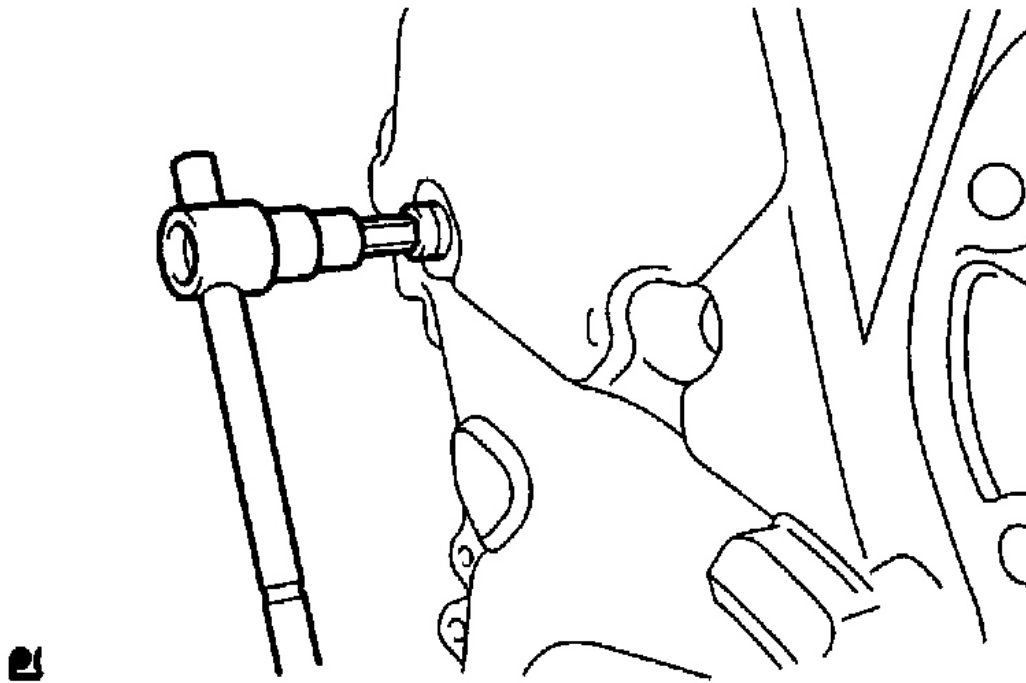
- ad. Apply seal packing to 2 or 3 threads of the screw plug end.

Seal packing:

Part No. 08833 - 00070 or equivalent

- ae. Using an 8 mm hexagon wrench, install the screw plug.

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



G03096925

Fig. 42: Installing Screw Plug

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

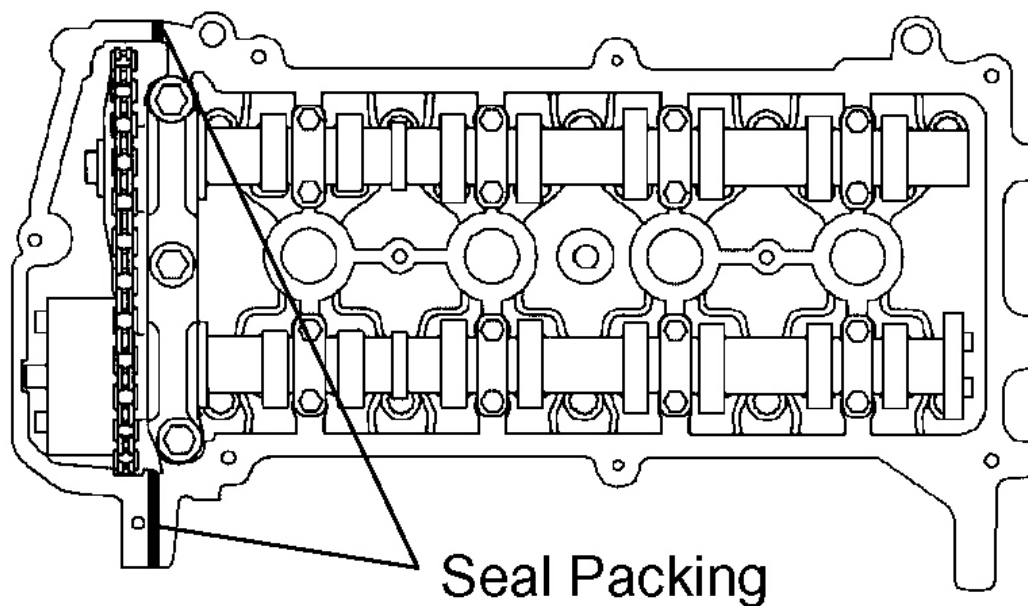
9. INSTALL CYLINDER HEAD COVER SUB-ASSY

- a. Apply seal packing to the 2 locations shown in **Fig. 43**.

Seal packing: Part No. 08826 - 00080 or equivalent

NOTE:

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes of applying seal packing.
- Do not start the engine for at least 2 hours of installation.

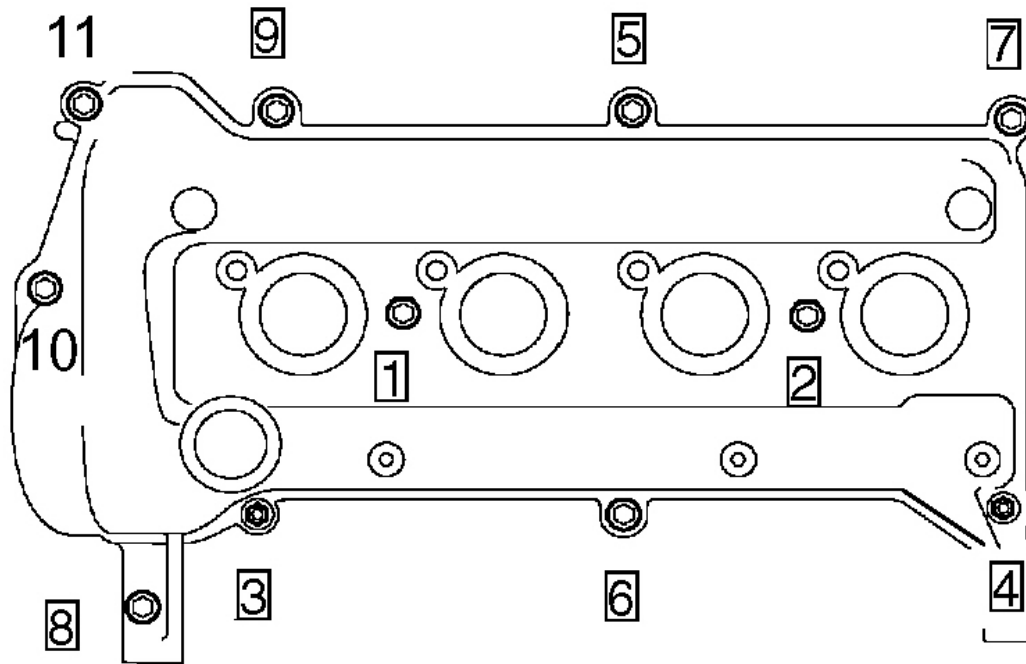


G03096926

Fig. 43: Identifying Seal Packing Application Areas
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.
- c. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in **Fig. 44**.

Torque: 10 N.m (102 kgf.cm, 7.4 ft.lbf)



G03096927

Fig. 44: Tightening Bolts And Nuts In Sequence

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

10. INSTALL IGNITION COIL NO. 1**Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)****11. INSTALL CYLINDER HEAD COVER NO. 2**

- a. First tighten A nuts, then tighten bolts B.

Torque: 7.0 N.m (71 kgf.cm, 62 in.lbf)

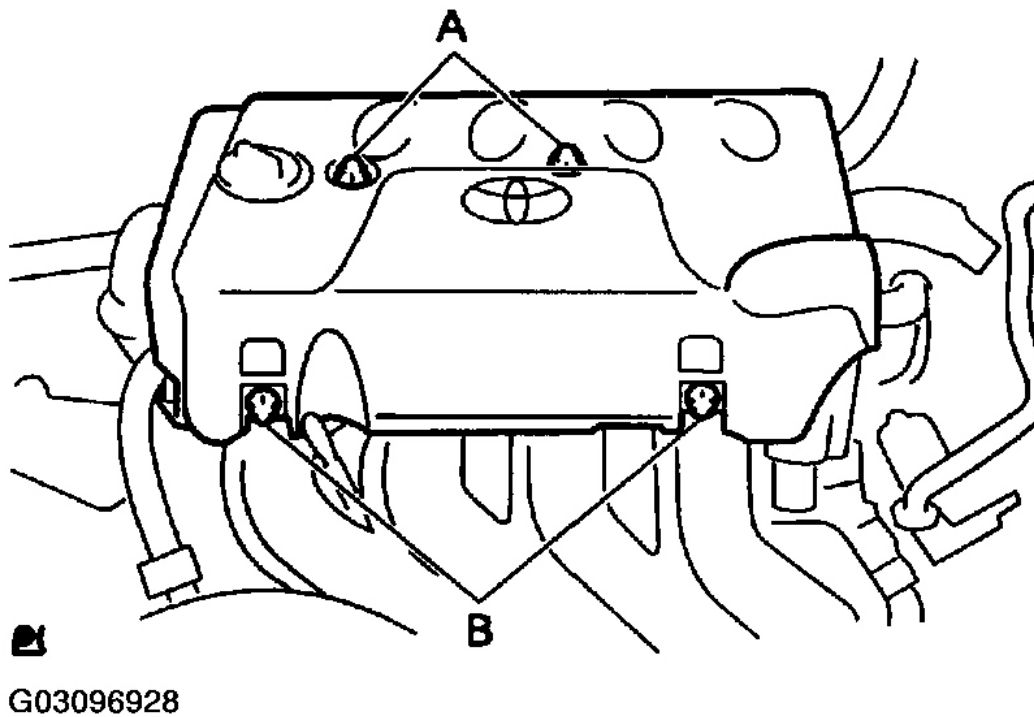


Fig. 45: Installing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL ENGINE UNDER RH

Torque:

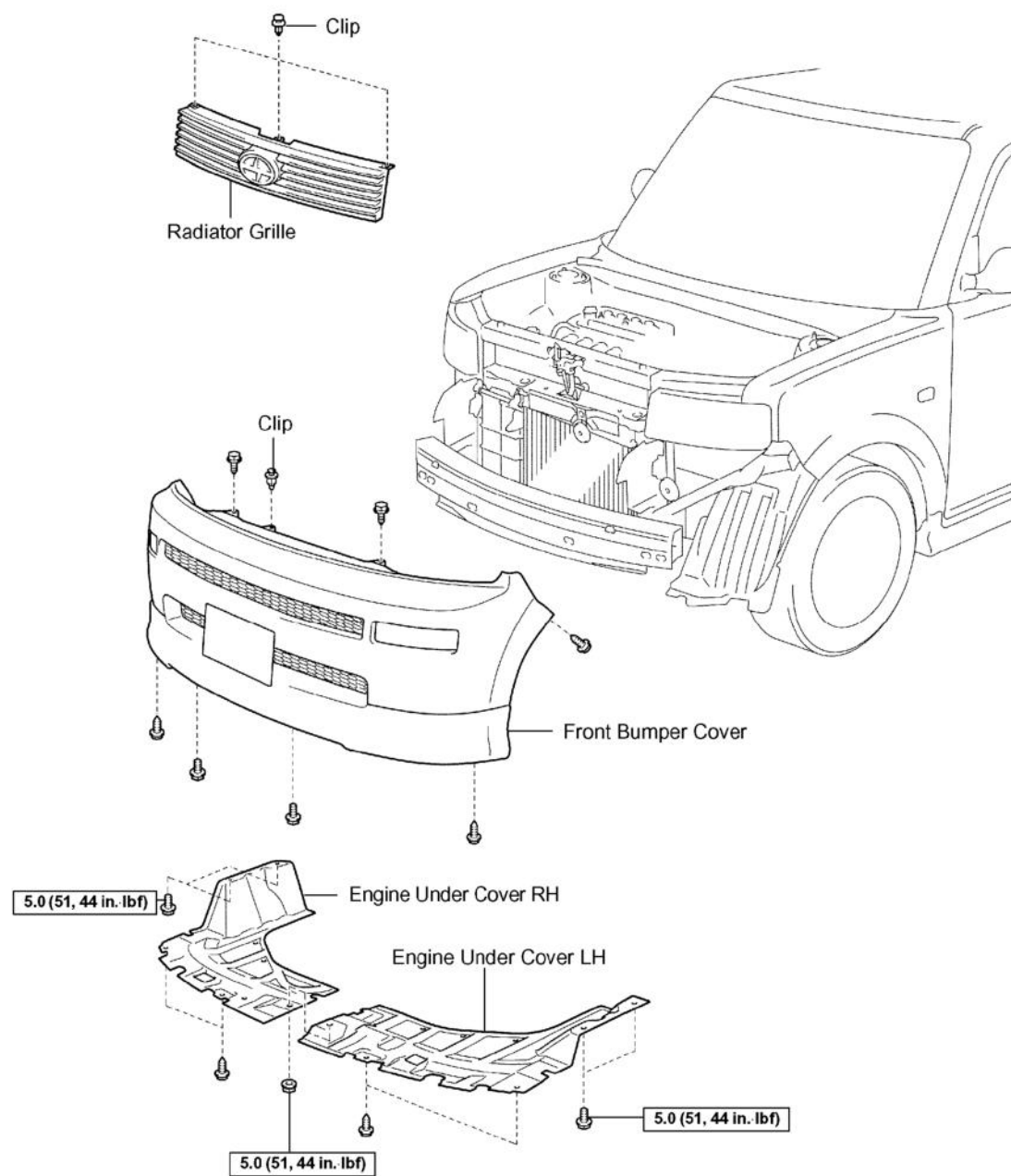
5.0 N.m (51 kgf.cm, 44 in.lbf) for bolt

5.0 N.m (51 kgf.cm, 44 in.lbf) for nut

13. CHECK FOR ENGINE OIL LEAKS

PARTIAL ENGINE ASSY

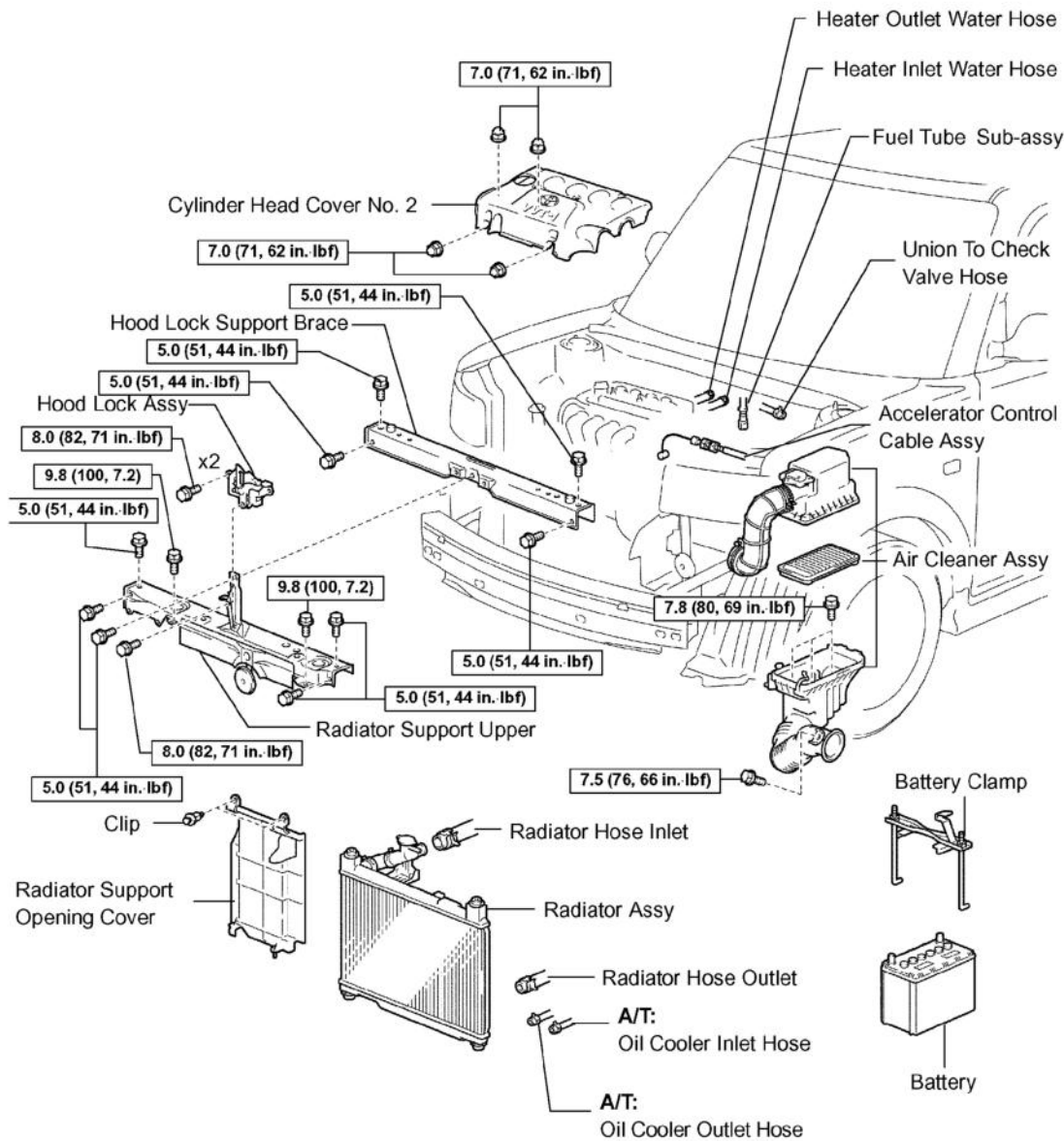
COMPONENTS



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

G03096929

Fig. 46: Exploded View Of Partial Engine Assy Components (1 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

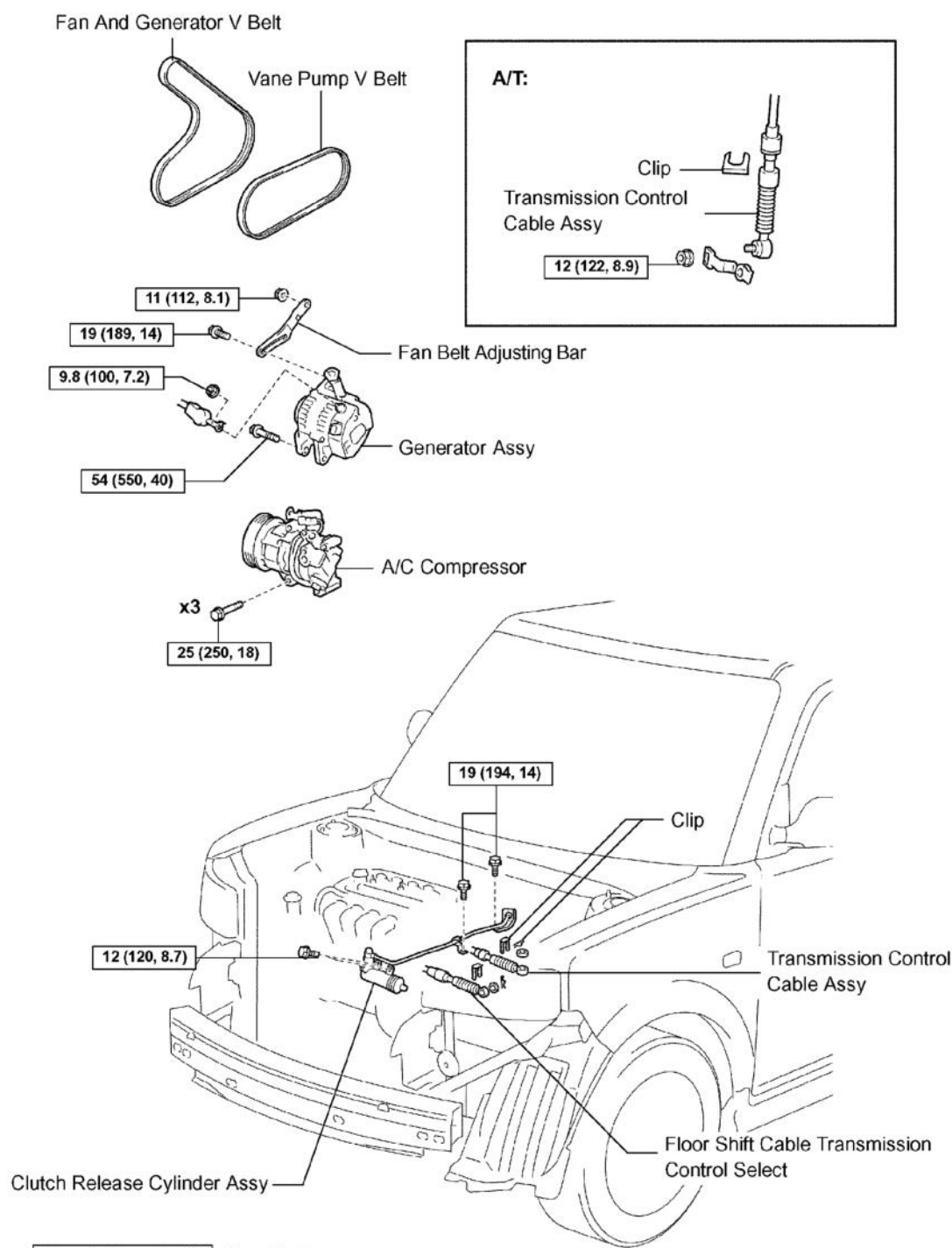


P

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

G03096930

Fig. 47: Exploded View Of Partial Engine Assy Components (2 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

P

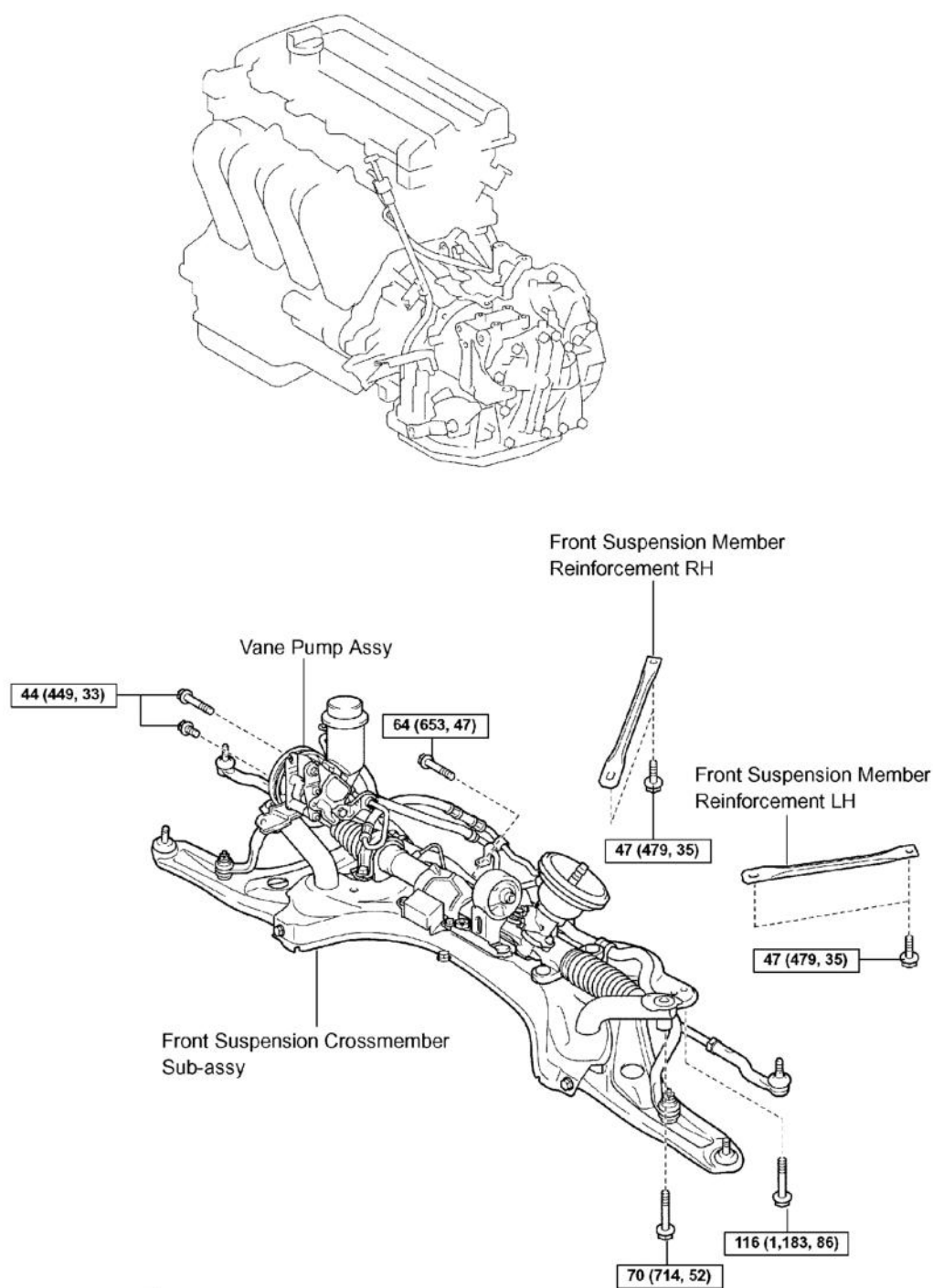
G03096931

Fig. 48: Exploded View Of Partial Engine Assy Components (3 Of 10)

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



© 2011 Mitchell Repair Information Company, LLC.

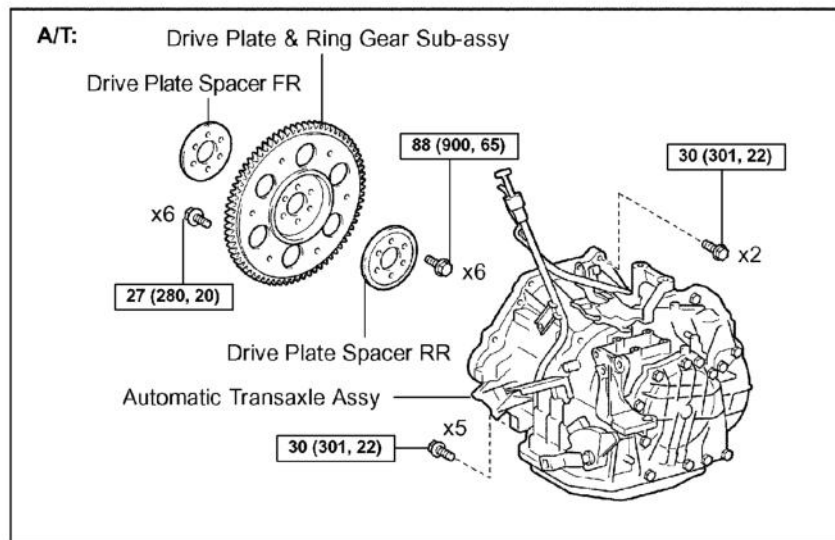
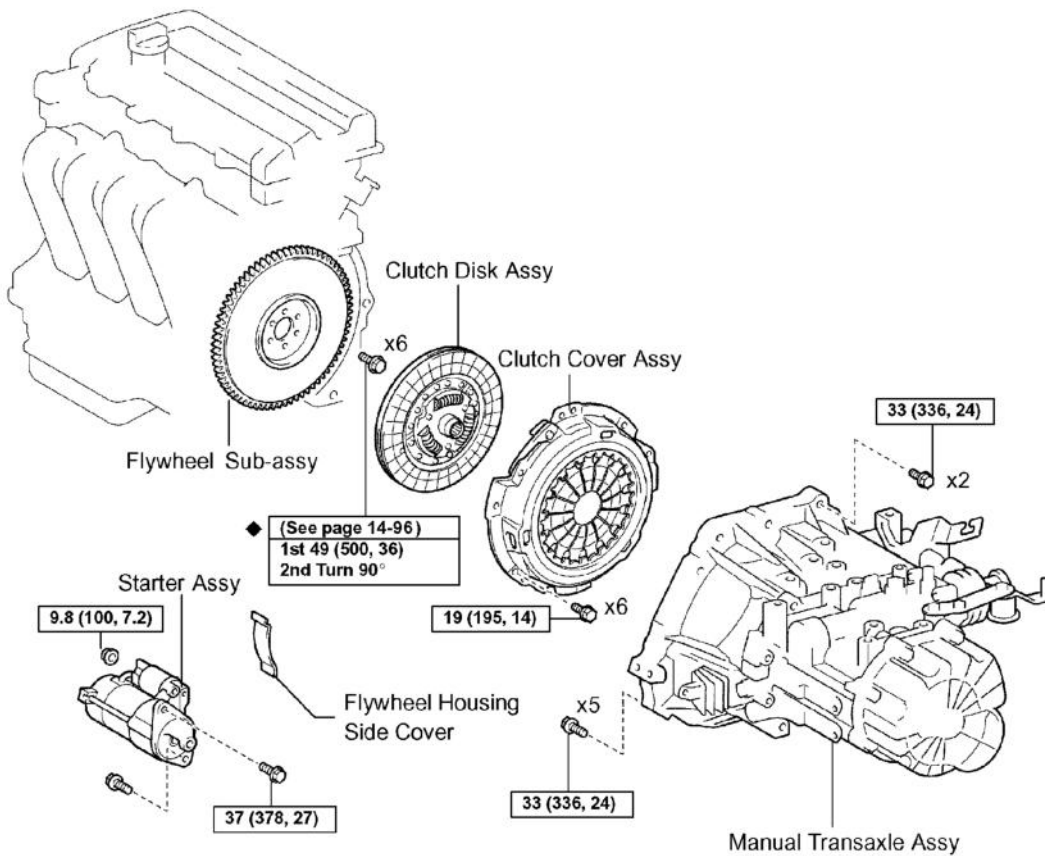


N-m (kgf-cm, ft-lbf) : Specified torque

P

G03096933

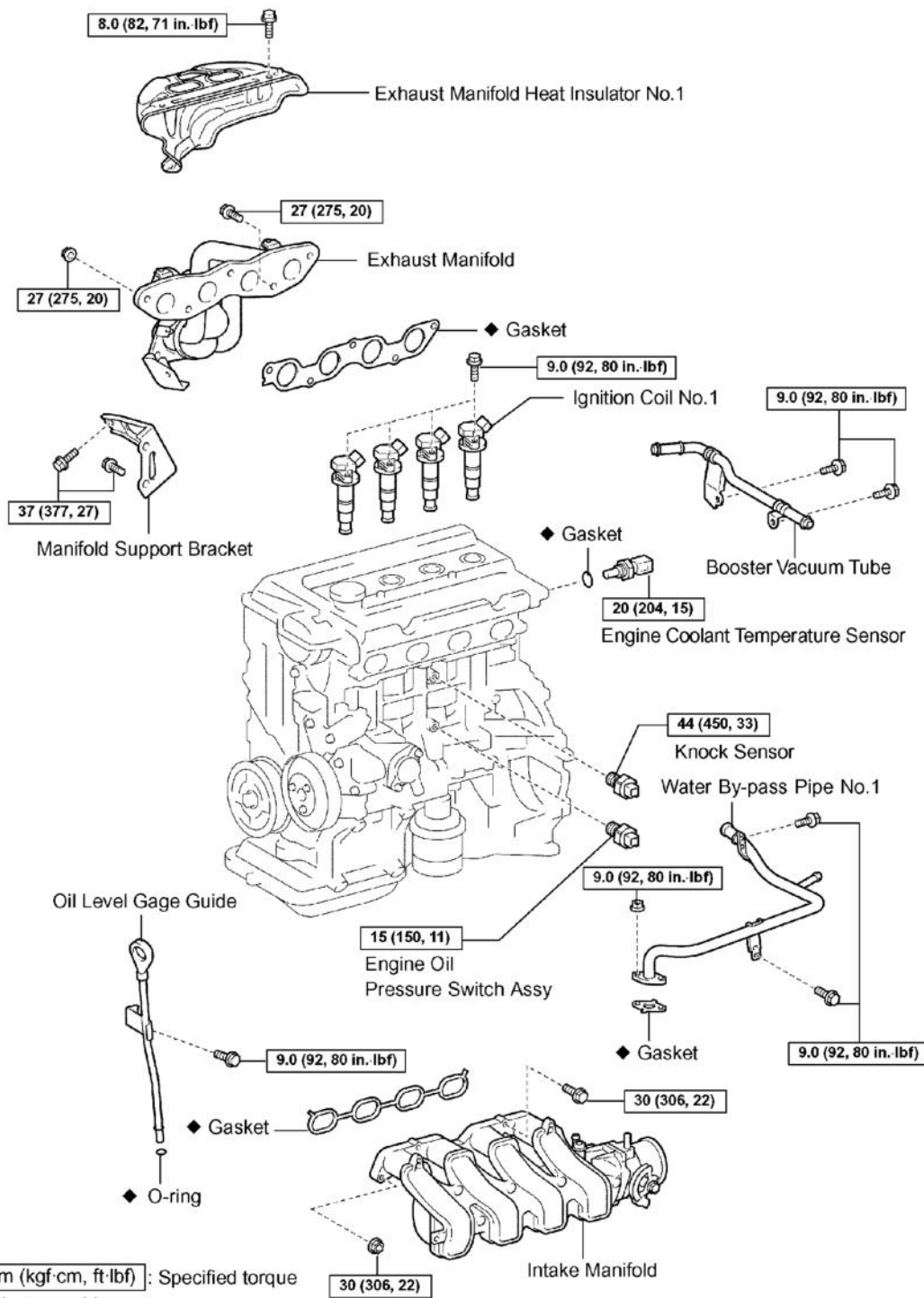
Fig. 50: Exploded View Of Partial Engine Assy Components (5 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



P A77935
G03096934

N·m (kgf·cm, ft·lbf) : Specified torque ♦ Non-reusable part

Fig. 51: Exploded View Of Partial Engine Assy Components (6 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G03096935

Fig. 52: Exploded View Of Partial Engine Assy Components (7 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

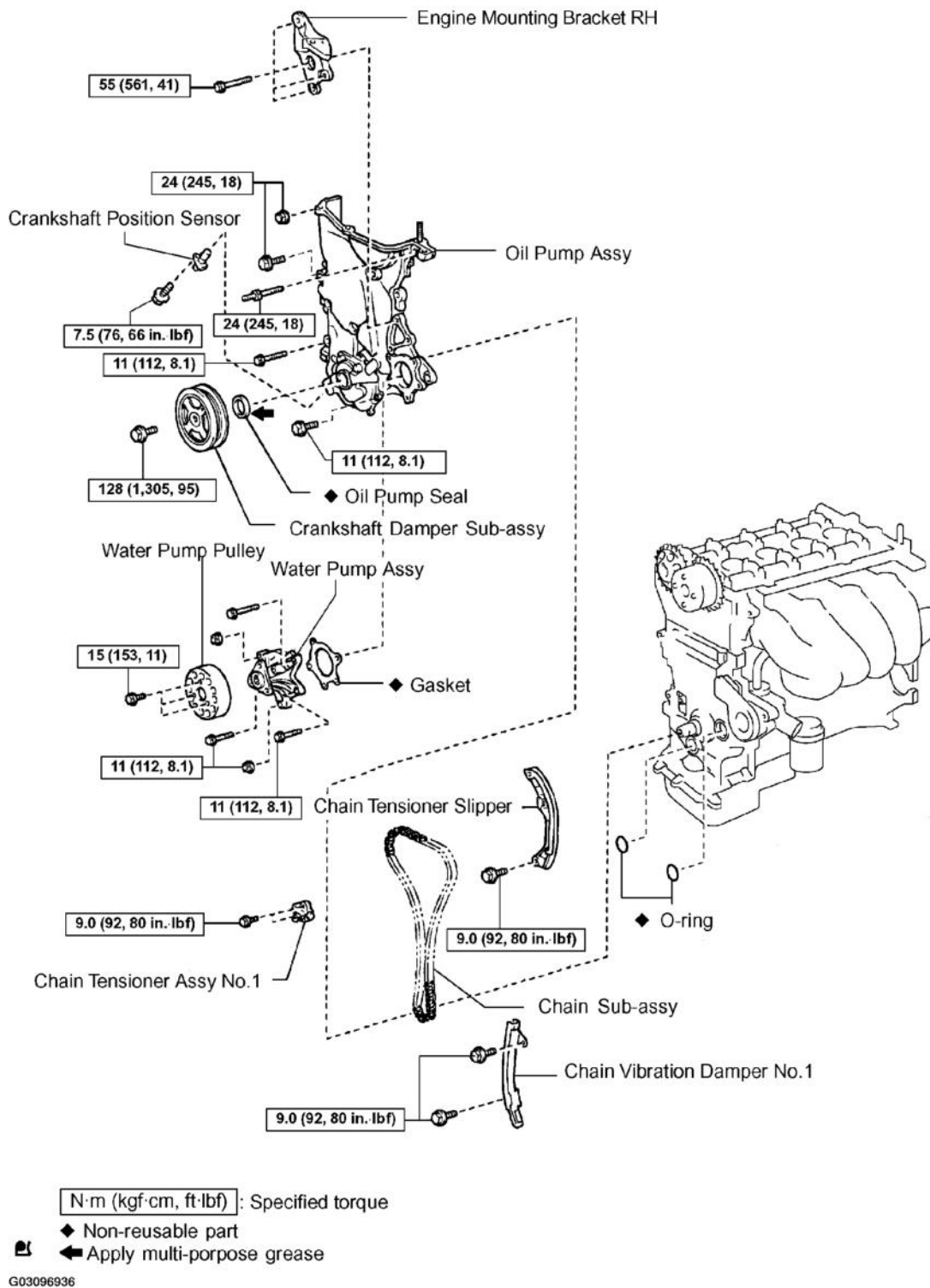
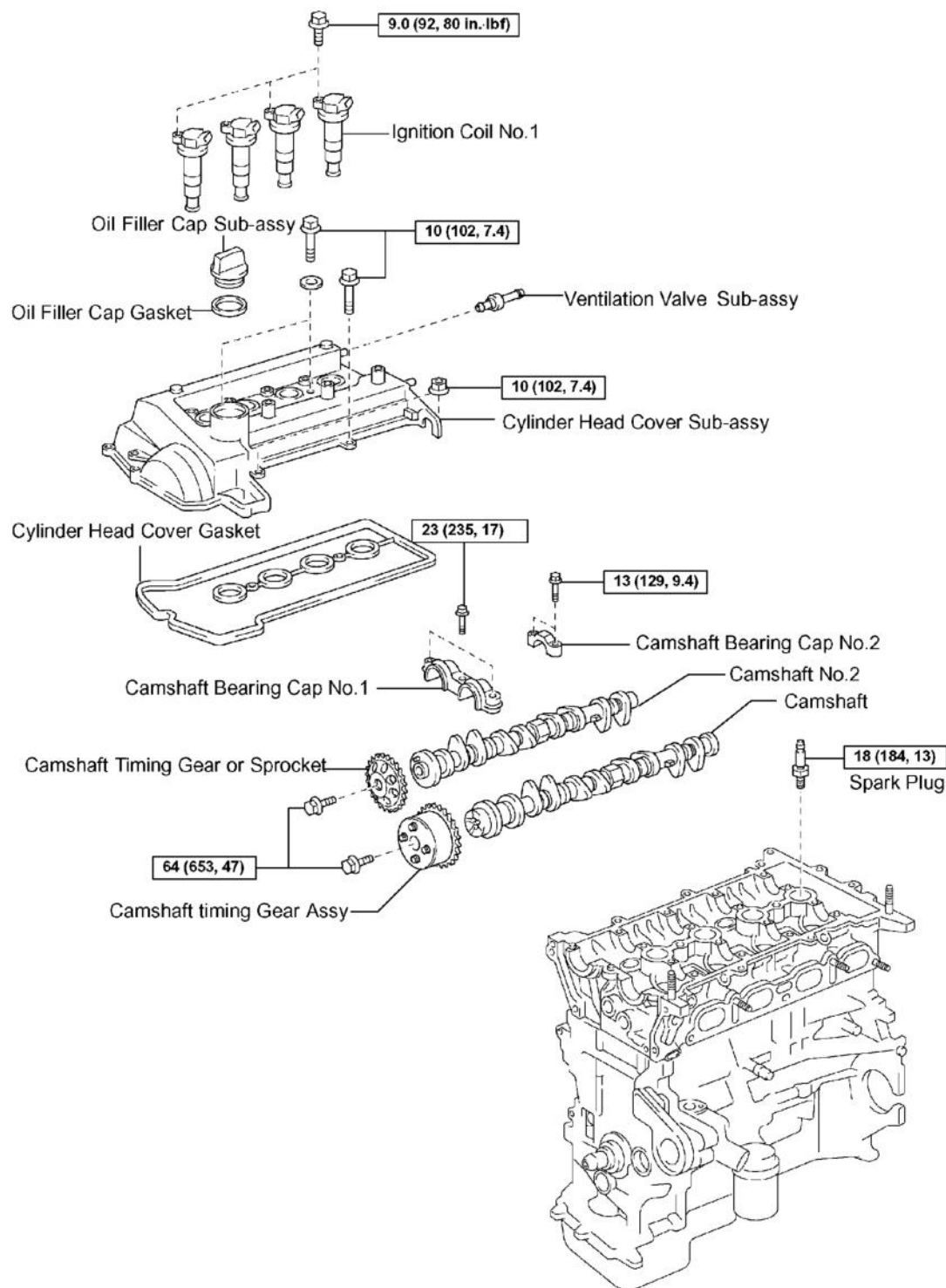


Fig. 53: Exploded View Of Partial Engine Assy Components (8 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

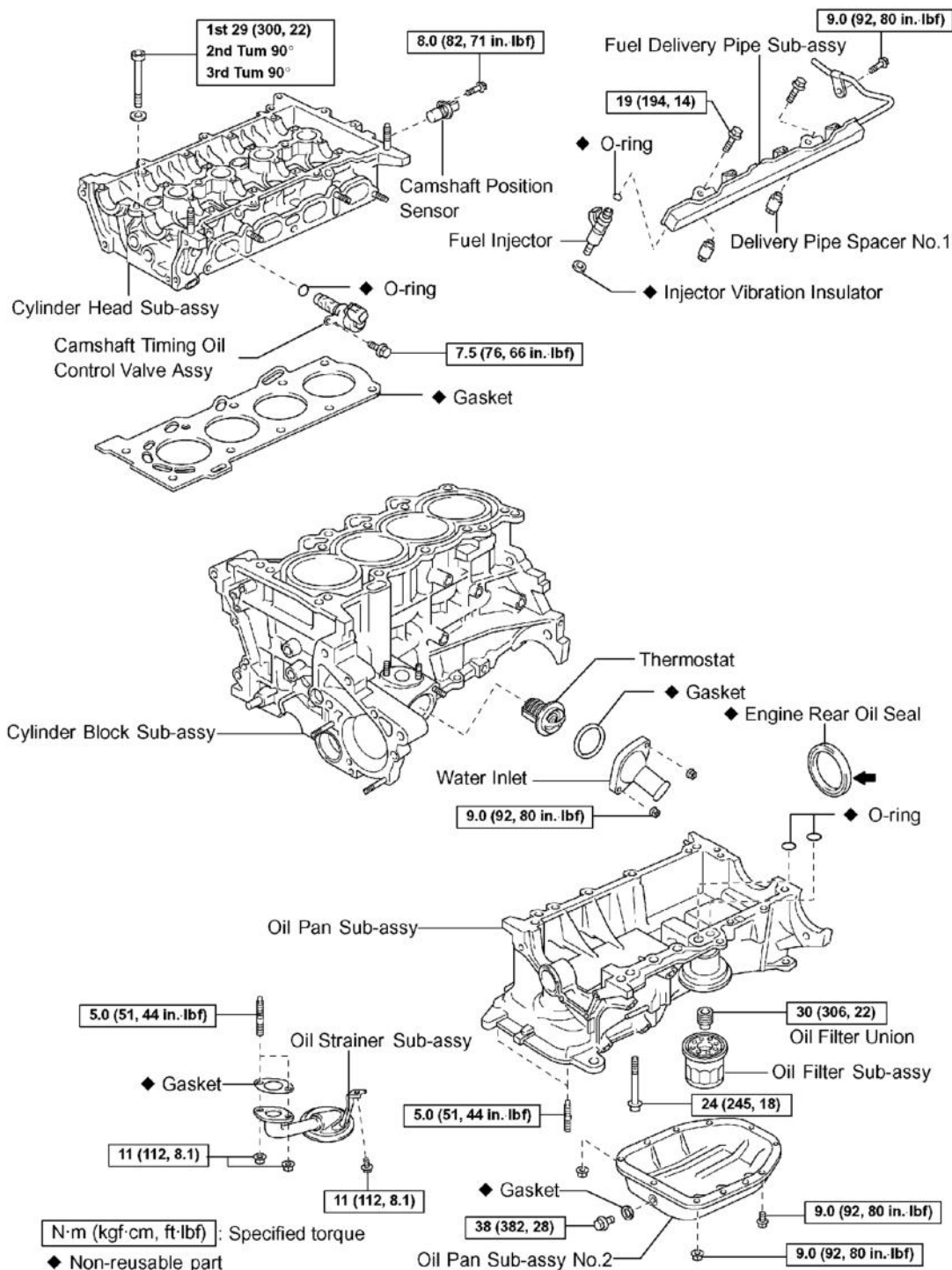


N·m (kgf·cm, ft·lbf) : Specified torque

Y

G03096937

Fig. 54: Exploded View Of Partial Engine Assy Components (9 Of 10)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

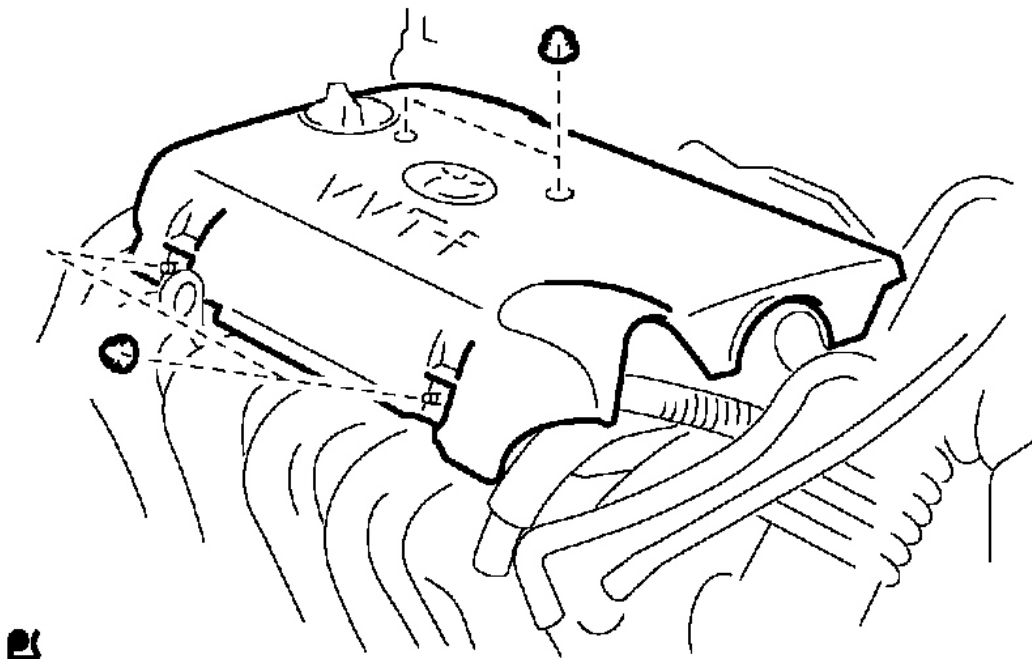


G03096938

Fig. 55: Exploded View Of Partial Engine Assy Components (10 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See PRECAUTION)
2. **REMOVE ENGINE UNDER COVER RH** (See REPLACEMENT)
3. **REMOVE ENGINE UNDER COVER LH** (See REPLACEMENT)
4. **DRAIN ENGINE COOLANT** (See REPLACEMENT)
5. **REMOVE FRONT WHEELS**
6. **REMOVE RADIATOR GRILLE** (See REPLACEMENT)
7. **REMOVE FRONT BUMPER COVER** (See REPLACEMENT)
8. **REMOVE CYLINDER HEAD COVER NO. 2**
 - a. Remove the 4 nuts and cylinder head cover No. 2.



G03096939

Fig. 56: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE BATTERY**
10. **REMOVE AIR CLEANER ASSY** (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)
11. **DISCONNECT FUEL TUBE SUB-ASSY** (See PRECAUTION)

SST 09268-21010

12. **DISCONNECT ACCELERATOR CONTROL CABLE ASSY** (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)
13. **REMOVE RADIATOR ASSY** (See REPLACEMENT)
14. **DISCONNECT TRANSMISSION CONTROL CABLE ASSY (MANUAL TRANSAXLE)** (See REPLACEMENT)
15. **DISCONNECT TRANSMISSION CONTROL CABLE ASSY (AUTOMATIC TRANSAXLE)** (See REPLACEMENT)
16. **SEPARATE CLUTCH RELEASE CYLINDER ASSY (MANUAL TRANSAXLE)** (See OVERHAUL)
17. **DISCONNECT UNION TO CHECK VALVE HOSE**
 - a. Disconnect the union to check valve hose from the brake booster.

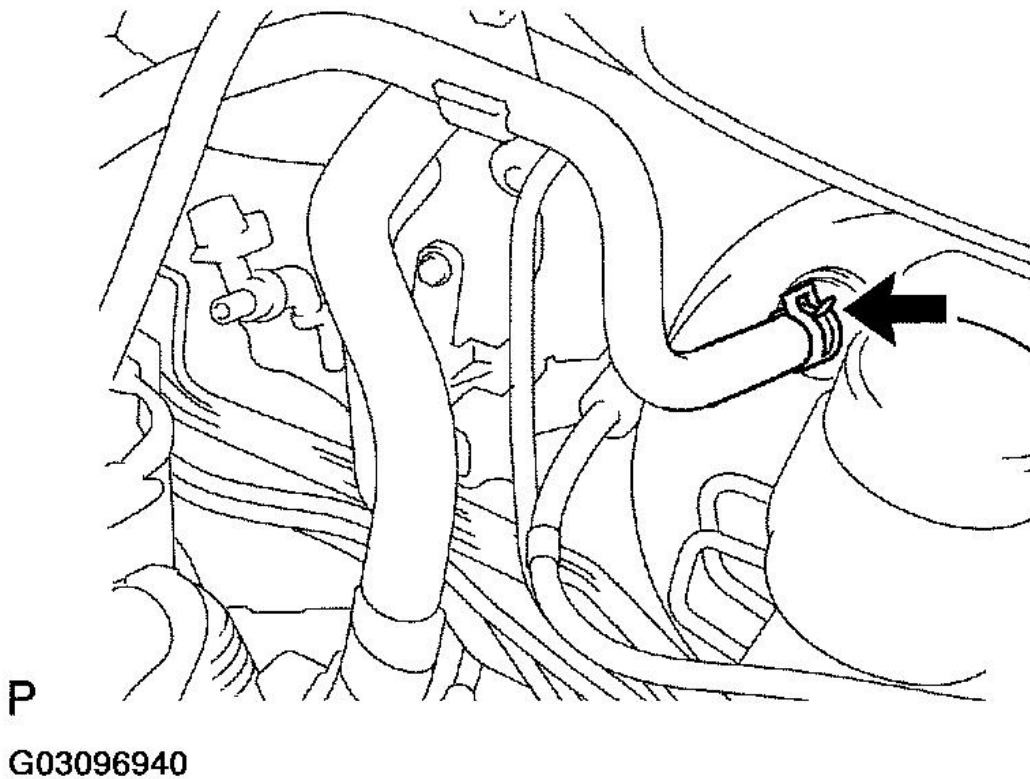
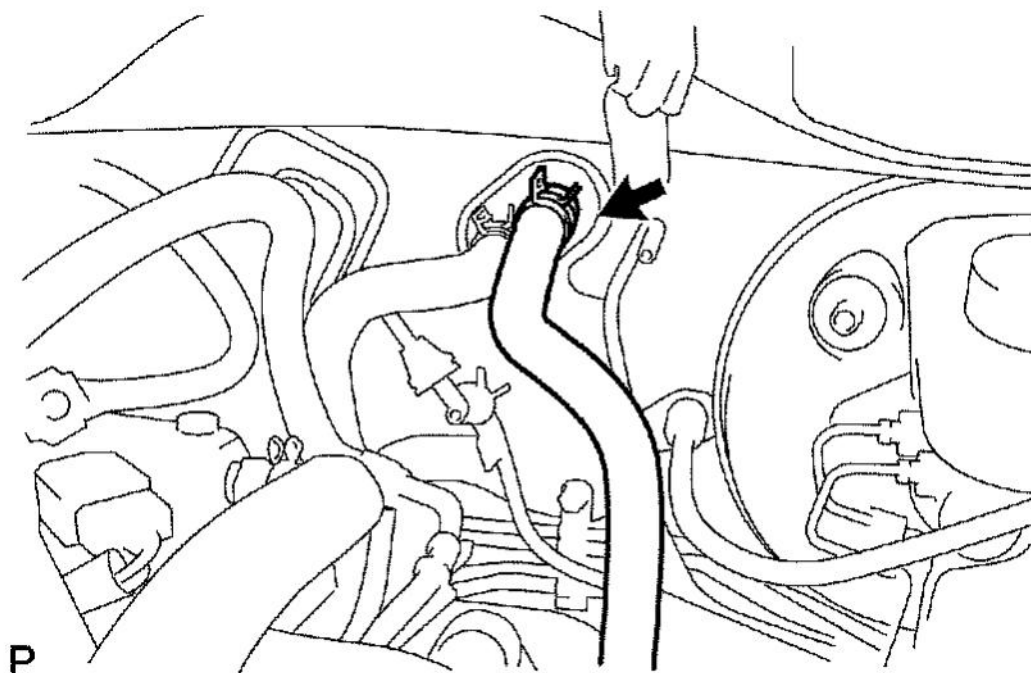


Fig. 57: Disconnecting Union To Check Valve Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **DISCONNECT HEATER WATER INLET HOSE A**
 - a. Disconnect the heater water inlet hose from the air conditioner tube.



G03096941

Fig. 58: Disconnecting Heater Water Inlet Hose A
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **DISCONNECT HEATER WATER OUTLET HOSE A (FROM HEATER UNIT)**
 - a. Disconnect the heater water outlet hose from the air conditioner tube.

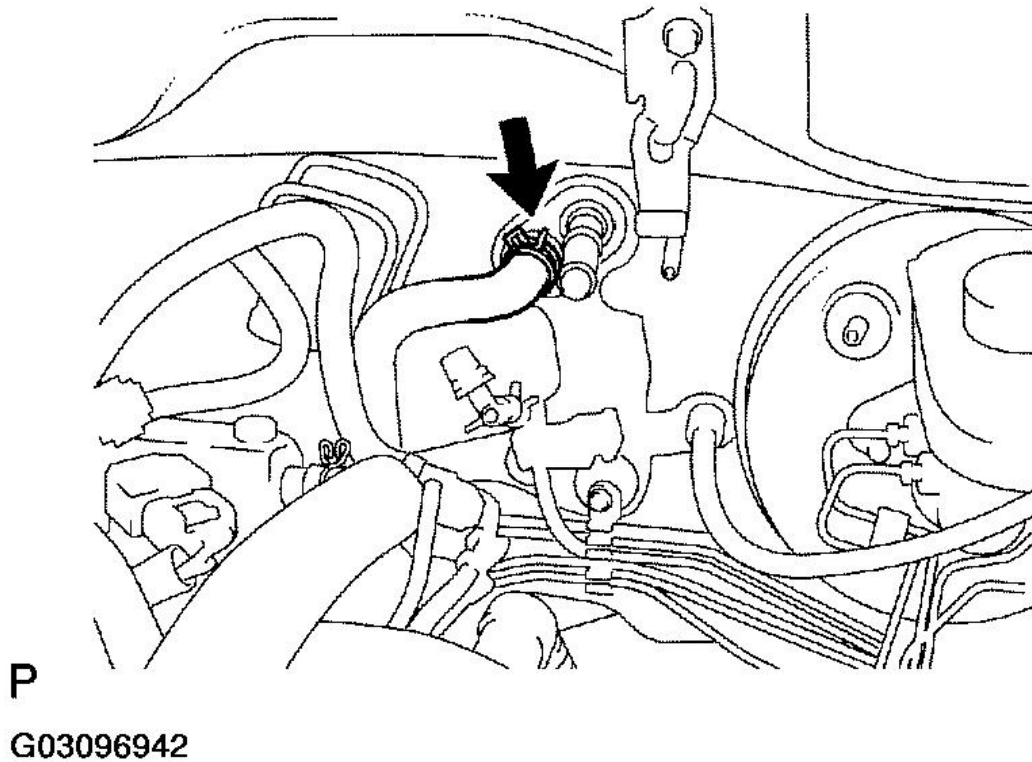


Fig. 59: Disconnecting Heater Water Outlet Hose A (From Heater Unit)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. DISCONNECT ENGINE WIRE

- Remove the glove compartment door.
- Disconnect the engine wire harness from the ECM and junction block.
- Pull out the engine wire.
- Disconnect the engine wire from the engine room junction block.
- Remove the body ground.

21. REMOVE FAN AND GENERATOR V BELT (See REPLACEMENT)

22. REMOVE A/C COMPRESSOR (See REPLACEMENT)

HINT:

Secure the hoses off to the side instead of detaching.

23. REMOVE FLOOR PANEL BRACE FRONT (SEE REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)

24. REMOVE EXHAUST PIPE ASSY FRONT (SEE REMOVAL & INSTALLATION AND

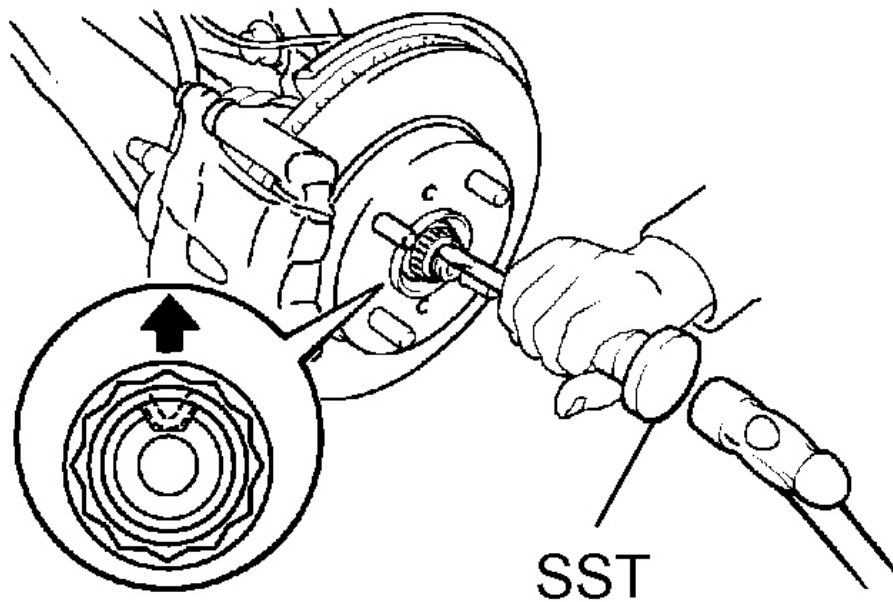
DISASSEMBLY & REASSEMBLY)**25. SEPARATE STEERING INTERMEDIATE SHAFT ASSY (SEE OVERHAUL)****26. REMOVE FRONT AXLE HUB LH NUT**

- a. Using SST and a hammer, remove the lock nut.

SST 09930-00010

NOTE:

- When removing the nut, remove the lock nut completely.
- Do not damage the threads of the drive shaft.
- Do not use SST with its tip sharpened.
- Set SST in the groove with the flat face facing upward.



G03096943

Fig. 60: Removing Front Axle Hub LH Nut

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

- b. Using a 30 mm socket wrench, remove the lock nut.

HINT:

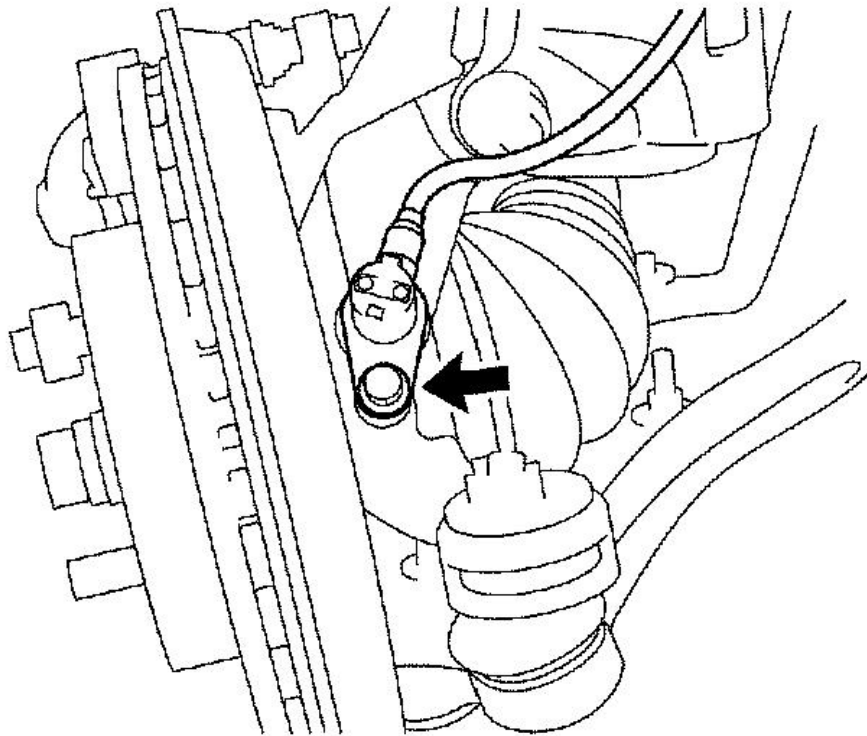
Perform the same procedure as above on the opposite side.

27. DISCONNECT SPEED SENSOR FRONT LH (W/ABS)

- a. Remove the bolt, disconnect the speed sensor from the steering knuckle.

HINT:

Perform the same procedure as above on the opposite side.



P

G03096944

Fig. 61: Disconnecting Speed Sensor Front LH (W/ABS)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. SEPARATE TIE ROD END SUB-ASSY LH

- a. Using SST, disconnect the tie rod end from the steering knuckle.

SST 09628-62011

NOTE: Do not damage the dust cover of the ball joint.

HINT:

Perform the same procedure as above on the opposite side.

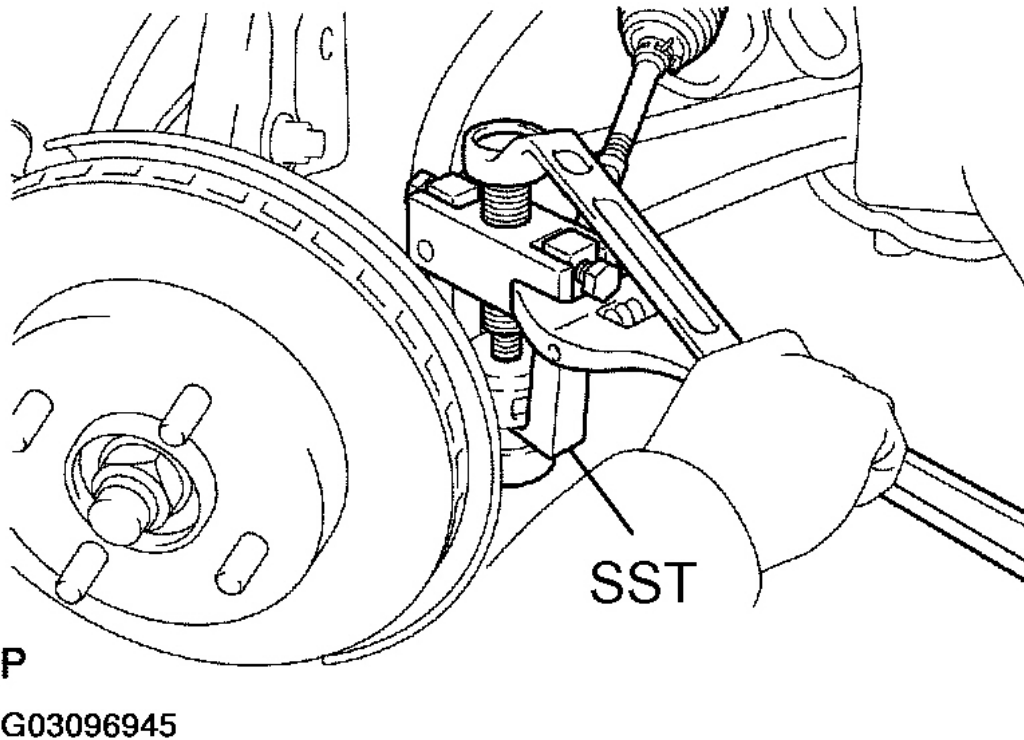


Fig. 62: Separating Tie Rod End Sub-Assy LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

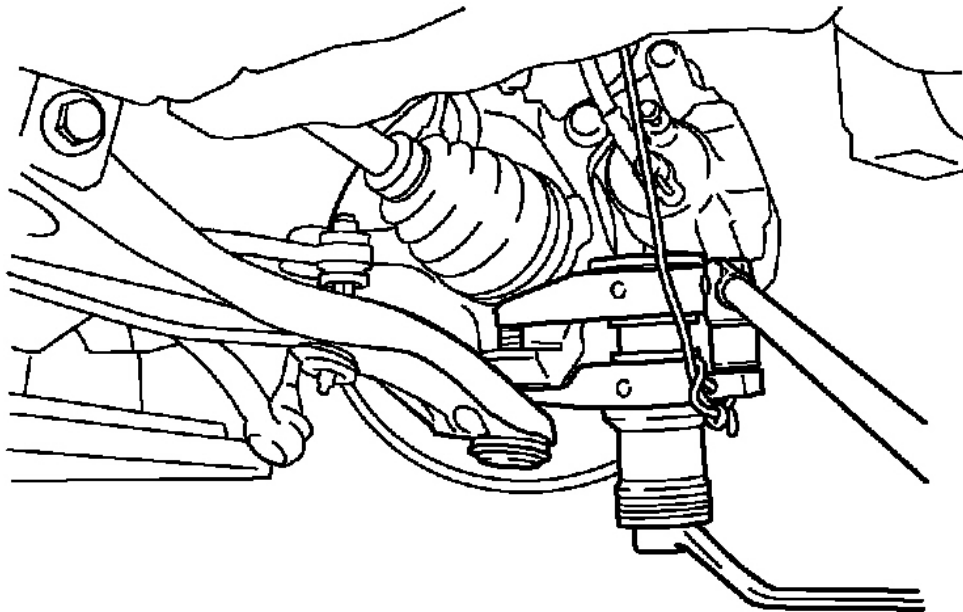
29. SEPARATE FRONT SUSPENSION ARM SUB-ASSY LOWER NO. 1 LH

- a. Using SST, disconnect the front suspension arm lower from the steering knuckle.

SST 09628-00011

HINT:

Perform the same procedure as above on the opposite side.



T

G03096946

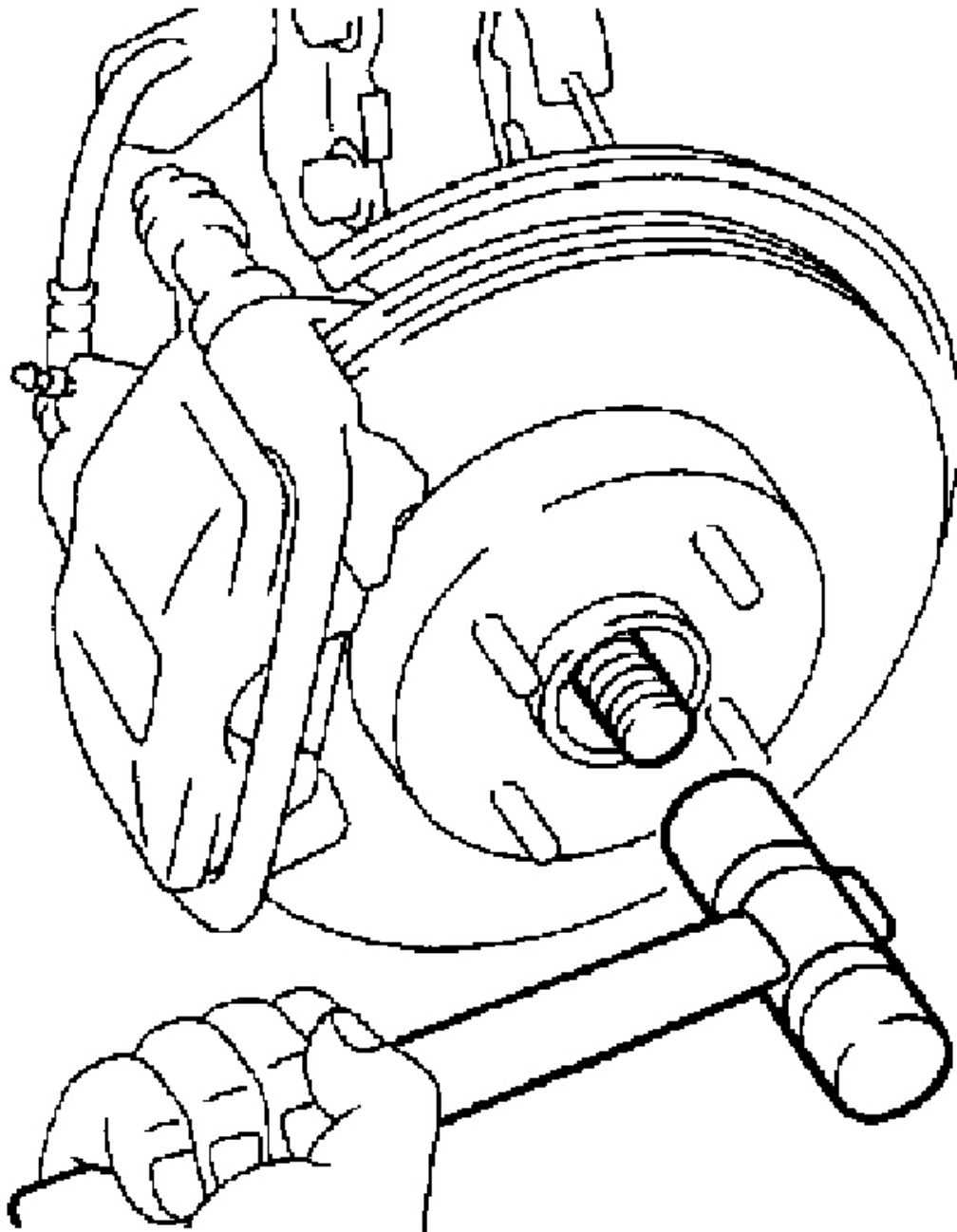
Fig. 63: Separating Front Suspension Arm Sub-Assy Lower No. 1 LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. SEPARATE FRONT DRIVE SHAFT ASSY LH

- a. Using a plastic hammer, detach the drive shaft from the axle hub by tapping.

HINT:

Perform the same procedure as above on the opposite side.



G03096947

Fig. 64: Separating Front Drive Shaft Assy LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

- a. Set the engine lifter.
- b. Remove the bolt which is used to fix the liquid tube to the engine mounting insulator RH.
- c. Remove the 5 bolts and nut, and then remove the engine mounting insulator RH.

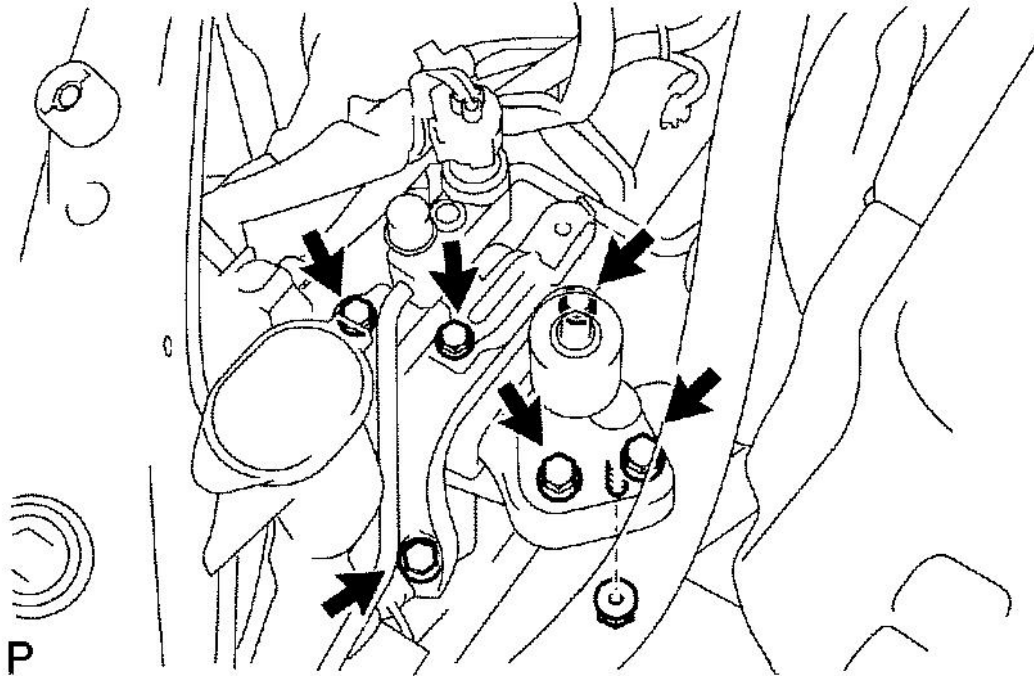
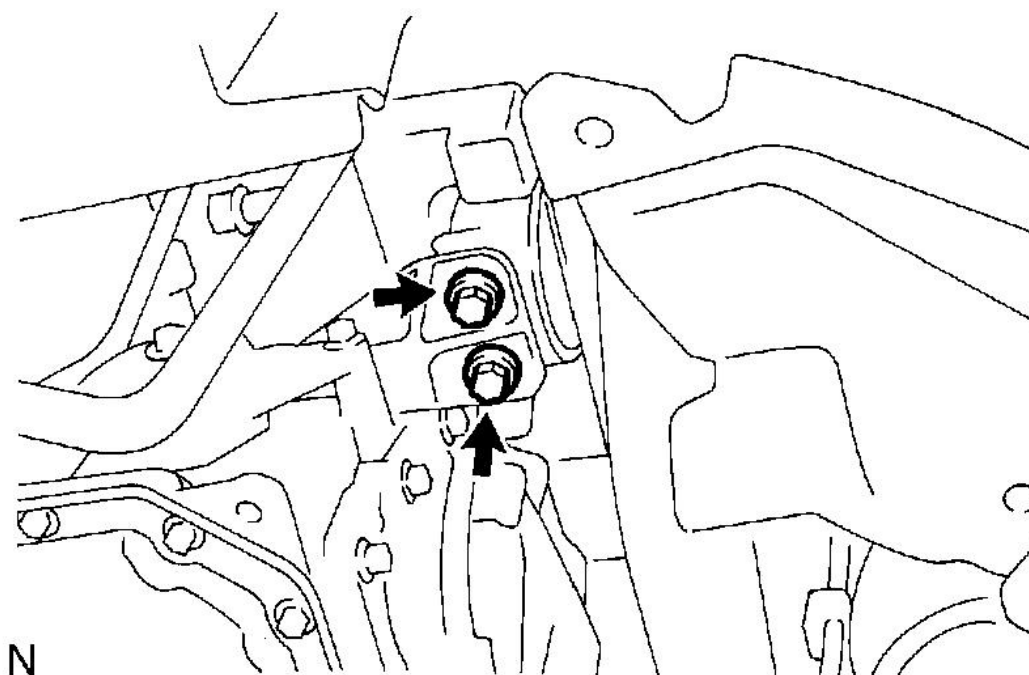
**G03096948**

Fig. 65: Removing Engine Assembly With Transaxle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the 2 bolts and detach the engine mounting bracket from the engine mounting insulator LH.



G03096949

Fig. 66: Detaching Engine Mounting Bracket From Engine Mounting Insulator LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the engine together with the transaxle.
 - 1. Remove the 8 bolts shown in **Fig. 67**.

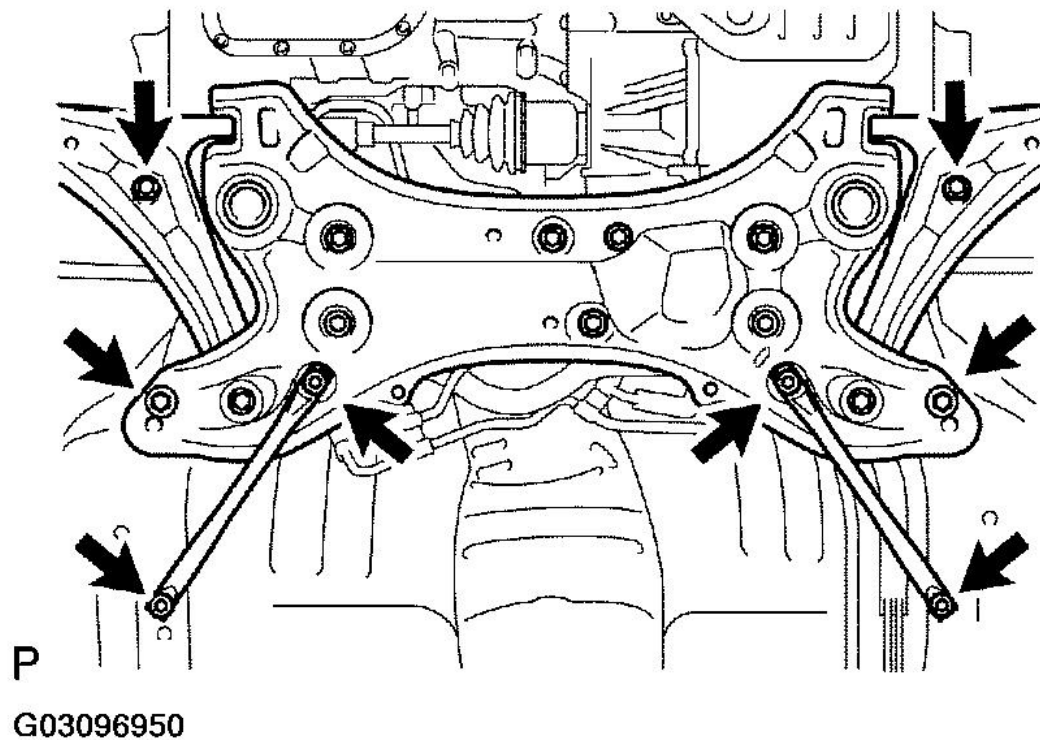


Fig. 67: Removing Bolts

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

2. Carefully remove the engine assembly from the vehicle.
- f. Remove the bolt and condenser.
- g. Install the 2 engine hangers as shown in **Fig. 68**.

Parts No.:

No. 1 engine hanger 12281-21010

Bolt 91642-81025

Torque: 40 N.m (408 kgf.cm, 30 ft.lbf)

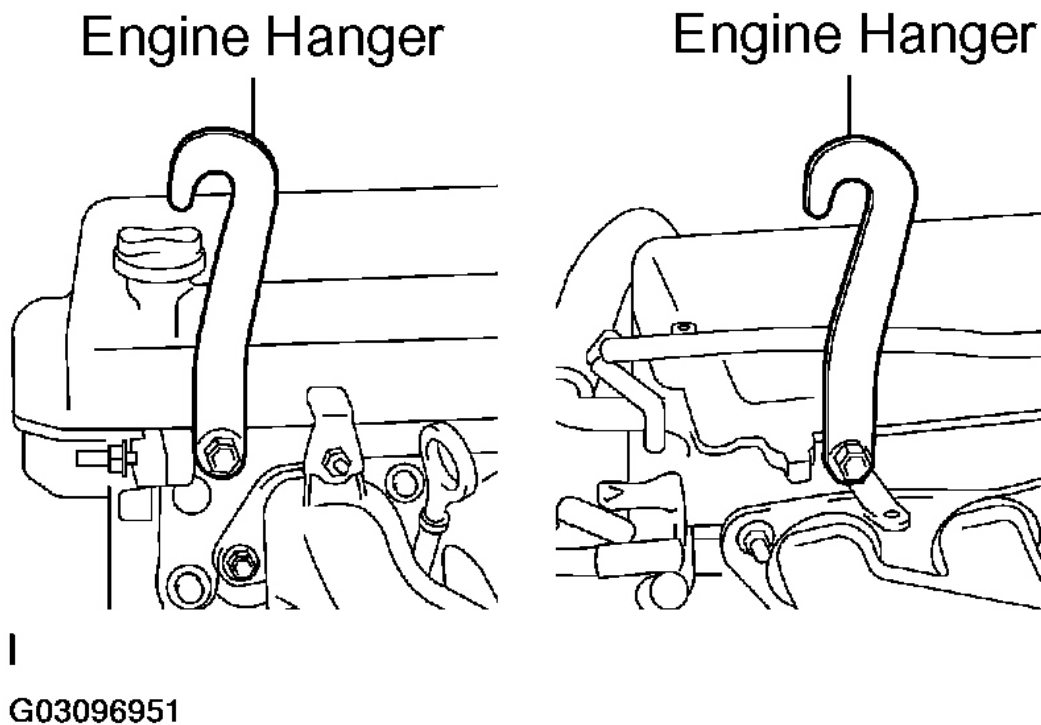


Fig. 68: Installing Engine Hangers

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

- h. Attach the engine sling and hang the engine with the chain block.
- 32. **REMOVE VANE PUMP V BELT** (See **REPLACEMENT**)
- 33. **REMOVE VANE PUMP ASSY**
 - a. Disconnect the power steering oil pressure sensor harness.
 - b. Remove the 2 bolts and vane pump assembly.

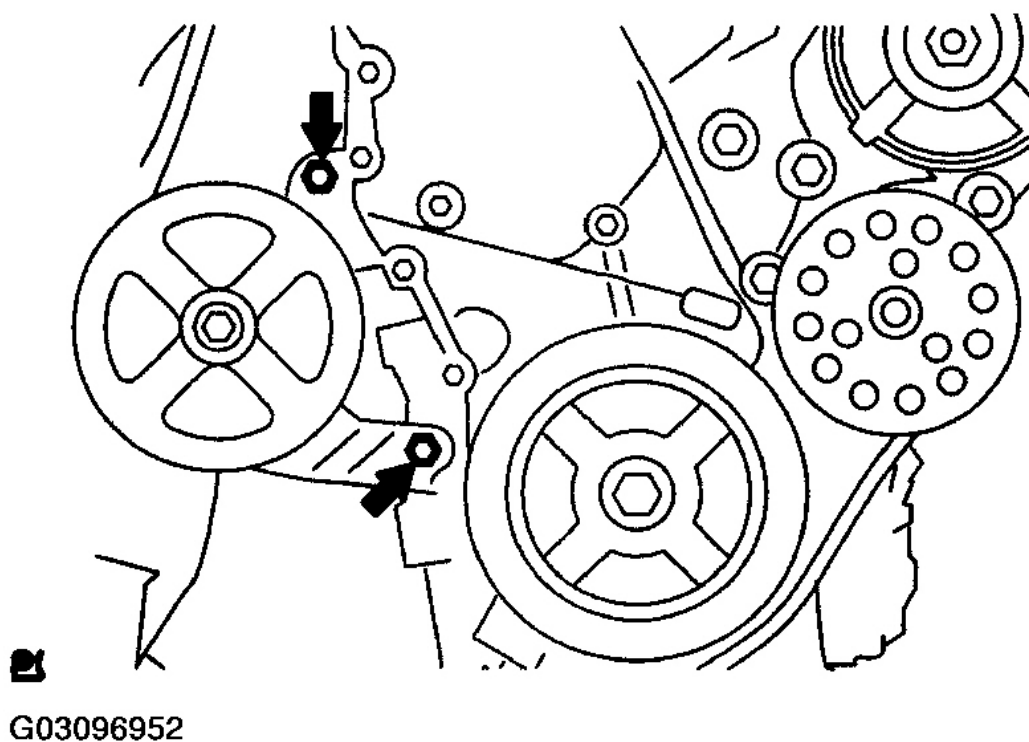
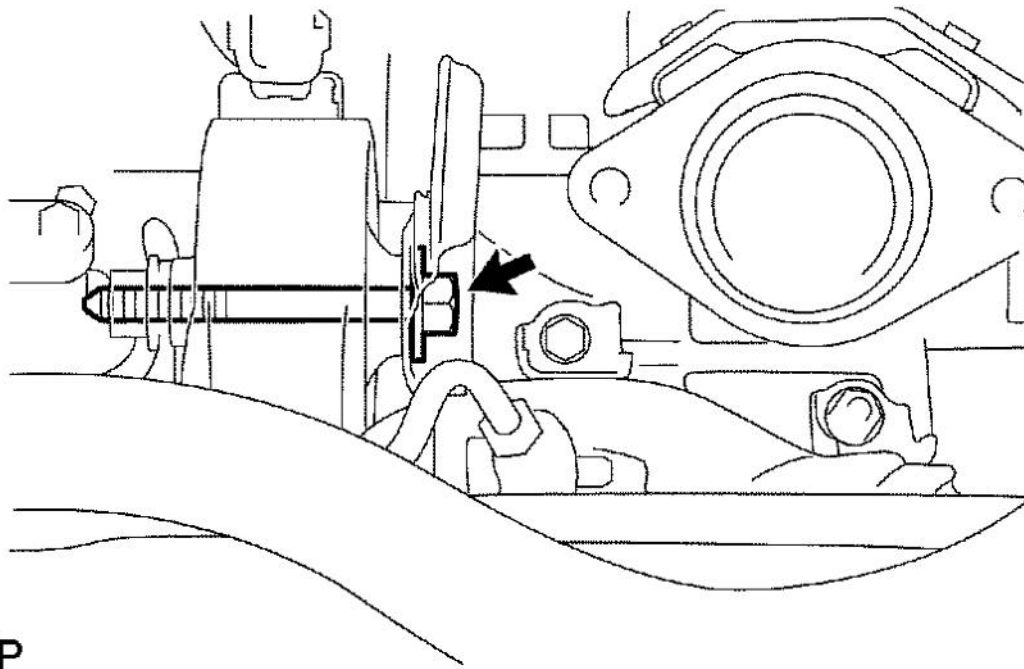


Fig. 69: Removing Vane Pump Assy

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

34. REMOVE FRONT SUSPENSION CROSSMEMBER SUB-ASSY

- a. Remove the through bolt.



P

G03096953

Fig. 70: Removing Through Bolt

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

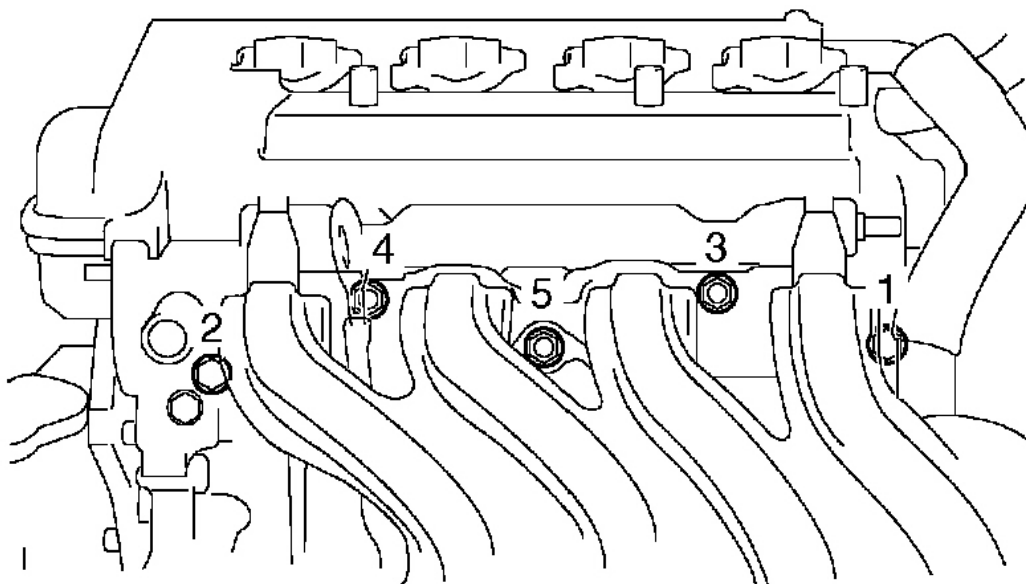
- b. Separate the engine and transaxle assembly from the suspension crossmember.
- 35. **REMOVE STARTER ASSY** (See REPLACEMENT)
- 36. **REMOVE GENERATOR ASSY** (See REPLACEMENT)
- 37. **REMOVE MANUAL TRANSAXLE ASSY (MANUAL TRANSAXLE)** (See REPLACEMENT)
- 38. **REMOVE AUTOMATIC TRANSAXLE ASSY (AUTOMATIC TRANSAXLE)** (See REPLACEMENT)
- 39. **REMOVE CLUTCH COVER ASSY (MANUAL TRANSAXLE)** (See OVERHAUL)
- 40. **REMOVE CLUTCH DISC ASSY (MANUAL TRANSAXLE)** (See OVERHAUL)
- 41. **REMOVE DRIVE PLATE AND RING GEAR OR FLYWHEEL** (See REPLACEMENT)

SST 09330-00021, 09213-58012 (91111-50845)

- 42. **REMOVE VENTILATION HOSE**
- 43. **REMOVE VENTILATION HOSE NO. 2**
- 44. **REMOVE INTAKE MANIFOLD**

- a. Using several steps, remove the 3 bolts and 2 nuts in the sequence shown in **Fig. 71**, then remove

- the intake manifold.
- b. Remove the gasket from the intake manifold.



G03096954

Fig. 71: Removing Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. REMOVE BOOSTER VACUUM TUBE

- a. Remove the 2 bolts and booster vacuum tube.

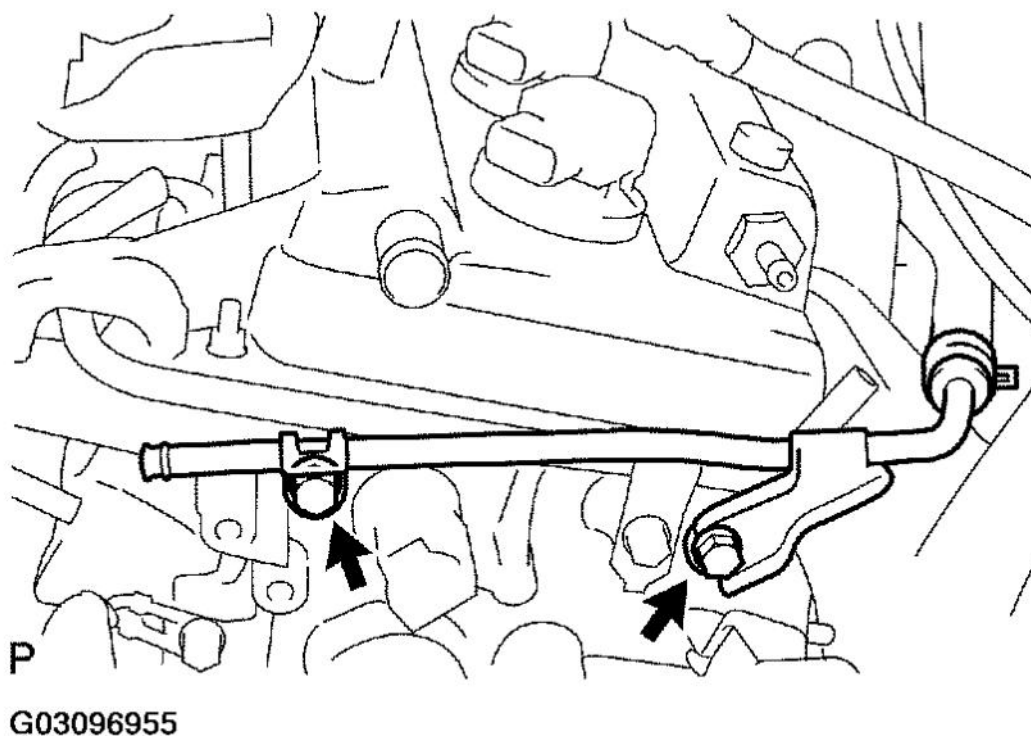


Fig. 72: Removing Booster Vacuum Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. **REMOVE MANIFOLD SUPPORT BRACKET**
 - a. Remove the 3 bolts and manifold support bracket.

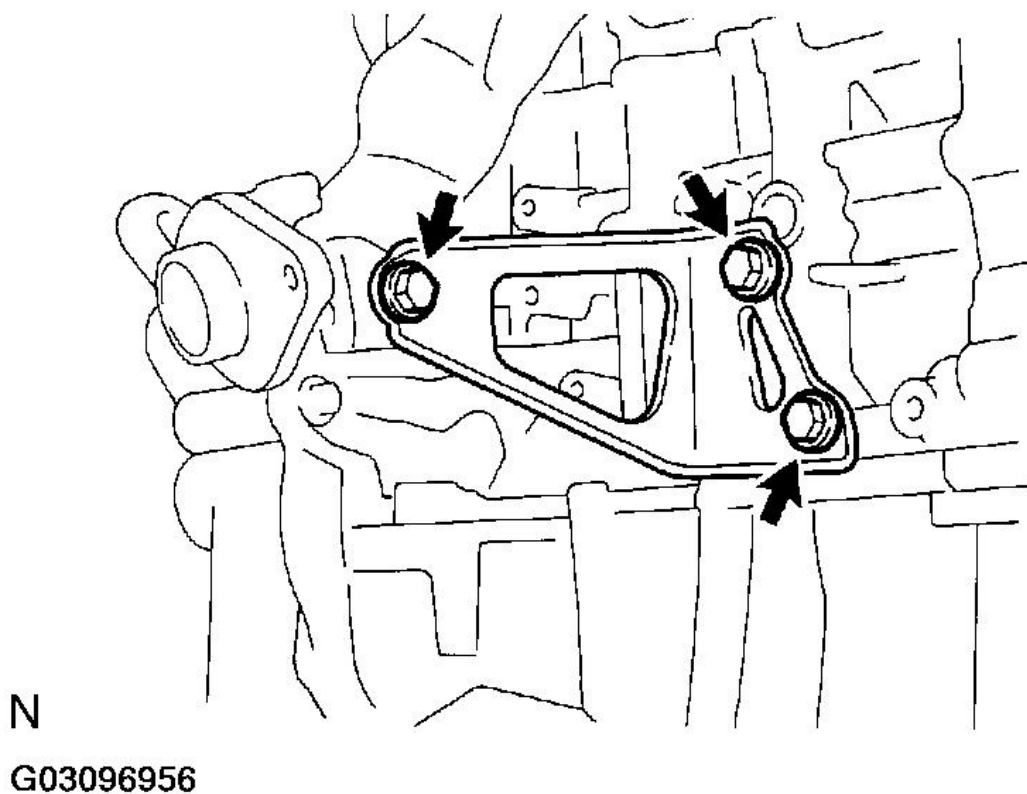
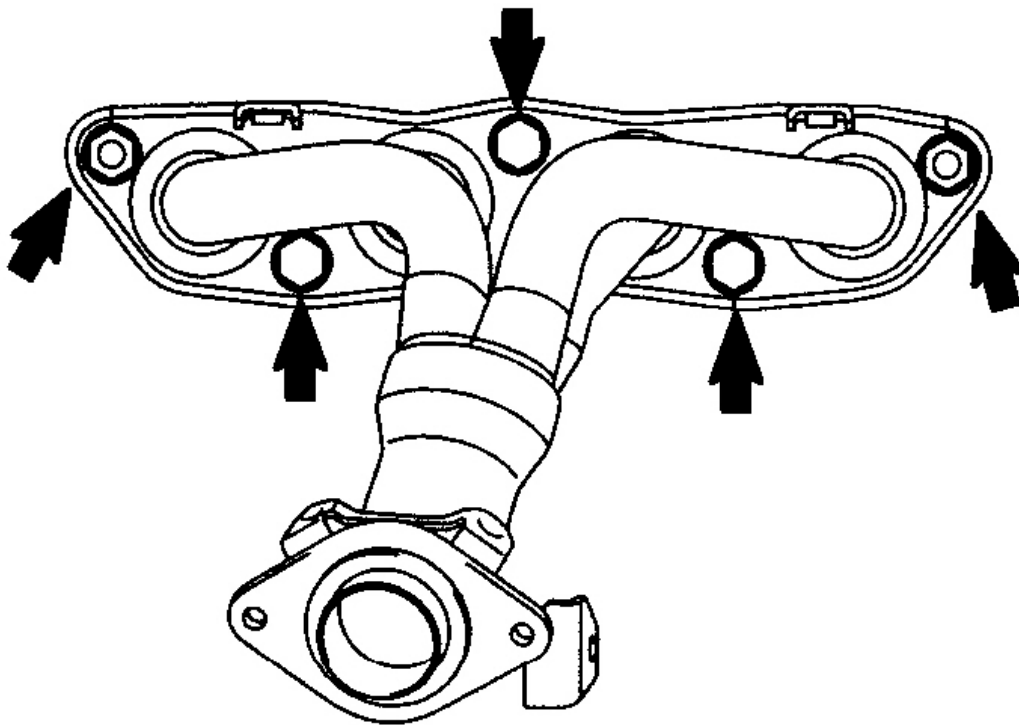


Fig. 73: Removing Manifold Support Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. **REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO. 1**
 - a. Remove the 4 bolts and exhaust manifold heat insulator.
48. **REMOVE EXHAUST MANIFOLD**
 - a. Remove the 3 bolts and 2 nuts, and then remove the exhaust manifold.



G03096957

Fig. 74: Removing Exhaust Manifold

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

49. REMOVE IGNITION COIL NO. 1

- a. Remove the 4 bolts and pull out the 4 ignition coils.

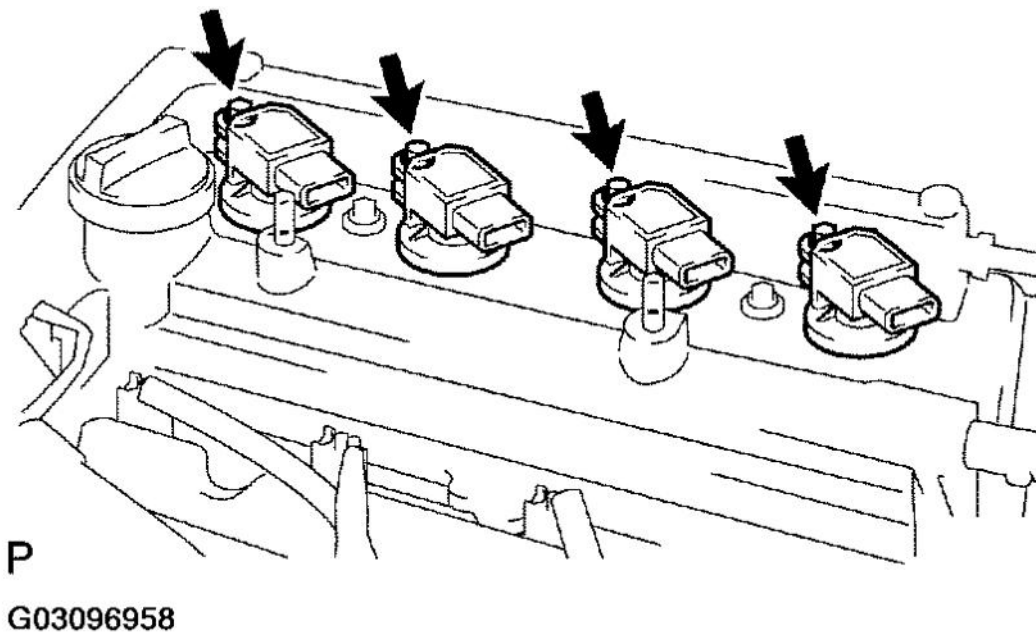


Fig. 75: Removing Bolts And Pulling Out Ignition Coils
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. REMOVE WATER BY-PASS PIPE NO. 1

- a. Remove the 2 nuts and 2 bolts, and then remove the water by-pass pipe.

51. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

- a. Using SST, remove the engine coolant temperature sensor.

SST 09817-33190

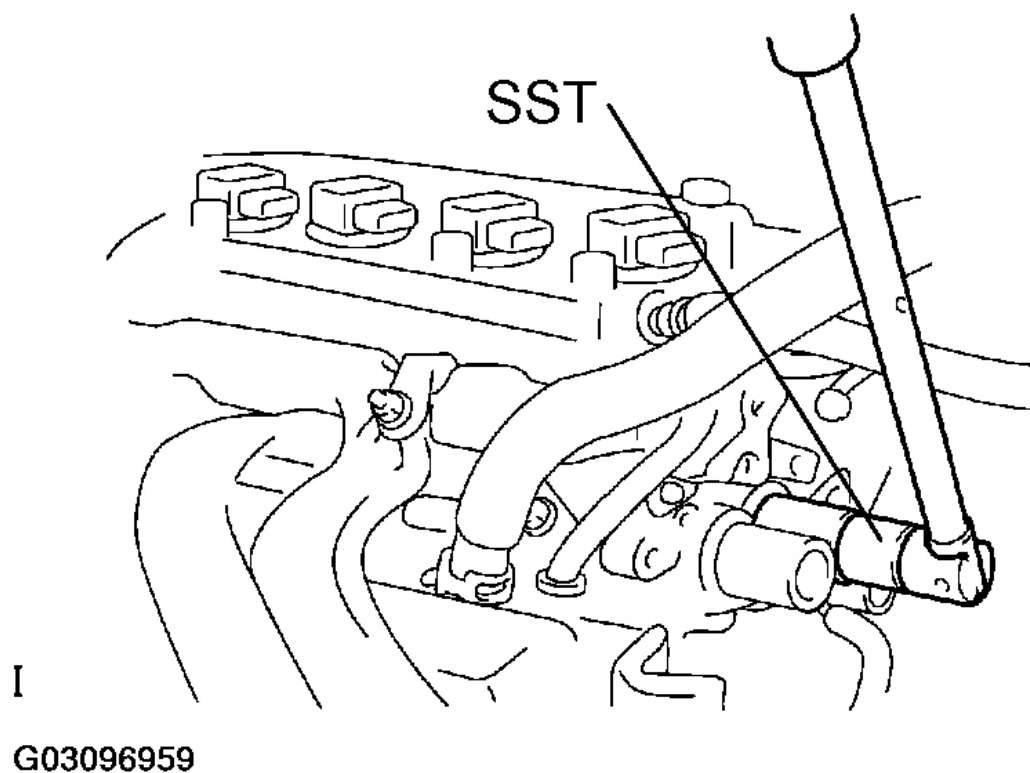
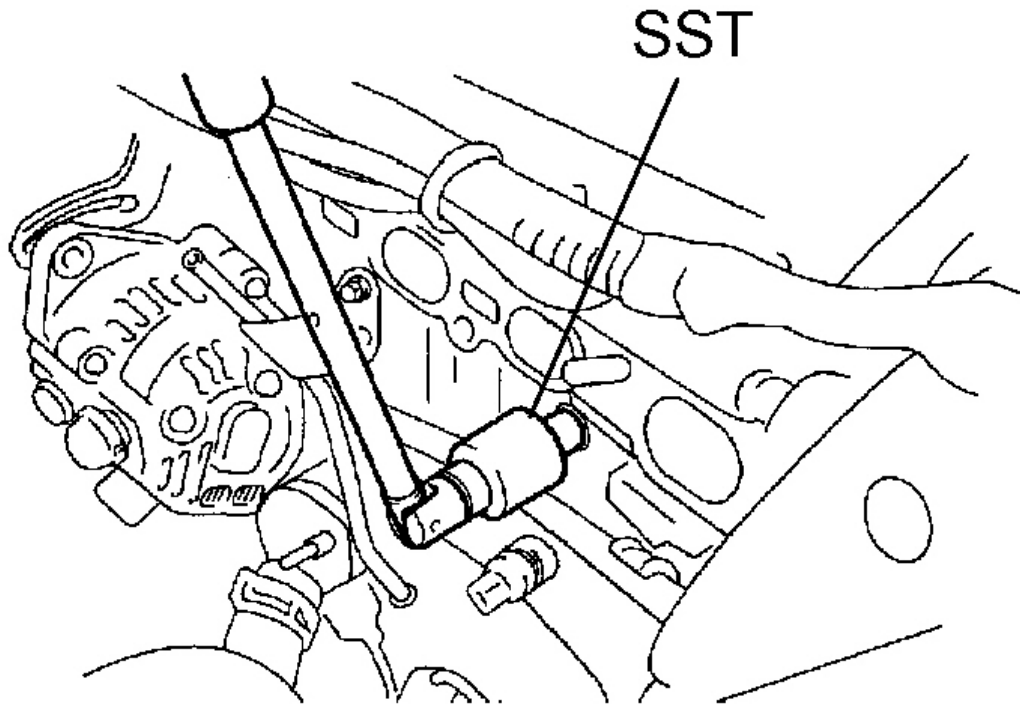


Fig. 76: Removing Engine Coolant Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. REMOVE KNOCK SENSOR

- a. Using SST, remove the knock sensor.

SST 09816-30010



G03096960

Fig. 77: Removing Knock Sensor

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

53. REMOVE ENGINE OIL PRESSURE SWITCH ASSY

- a. Using SST, remove the oil pressure switch.

SST 09268-46021

54. REPLACE PARTIAL ENGINE ASSY

55. INSTALL ENGINE OIL PRESSURE SWITCH ASSY

- a. Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Part No. 08833-00080, THREE BOND 1344

LOCTITE 242 or equivalent

- b. Using SST, install the oil pressure switch.

SST 09268-46021

Torque: 15 N.m (150 kgf.cm, 11 ft.lbf)

NOTE: Do not start the engine for at least 1 hour after installation.

56. INSTALL KNOCK SENSOR

- a. Using SST, install the knock sensor.

SST 09816-30010

Torque: 44 N.m (450 kgf.cm, 33 ft.lbf)

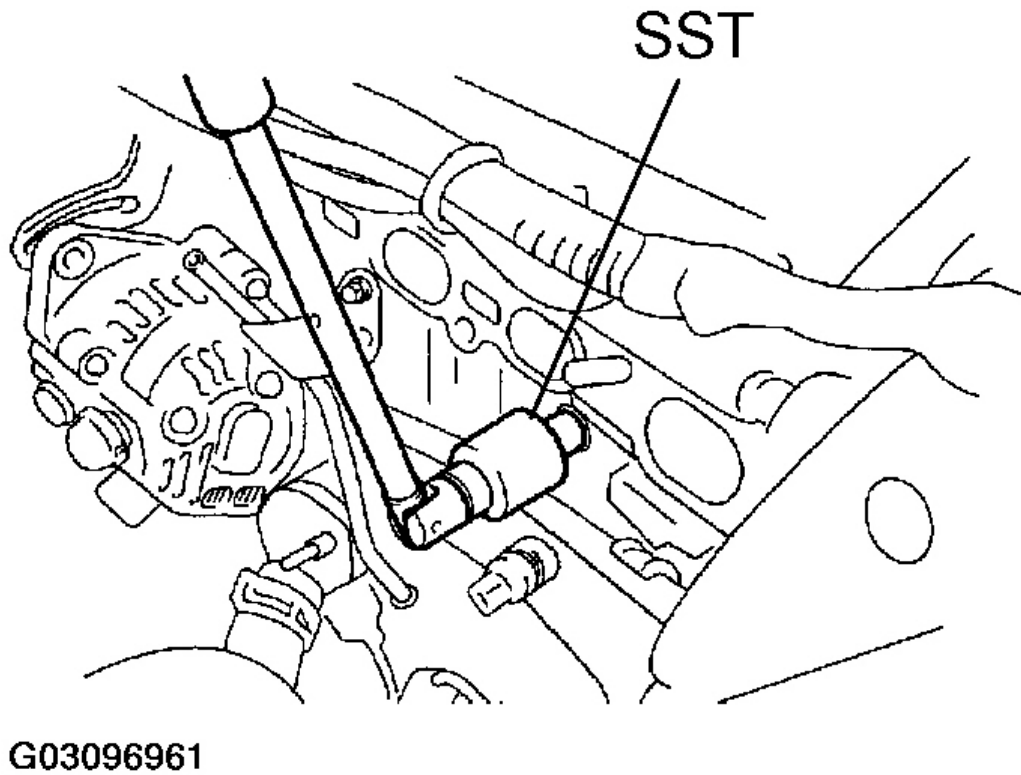


Fig. 78: Installing Knock Sensor

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

57. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

- a. Install a new gasket onto the engine coolant temperature sensor.
- b. Using SST, fix the engine coolant temperature sensor.

SST 09817-33190

Torque: 20 N.m (204 kgf.cm, 15 ft.lbf)

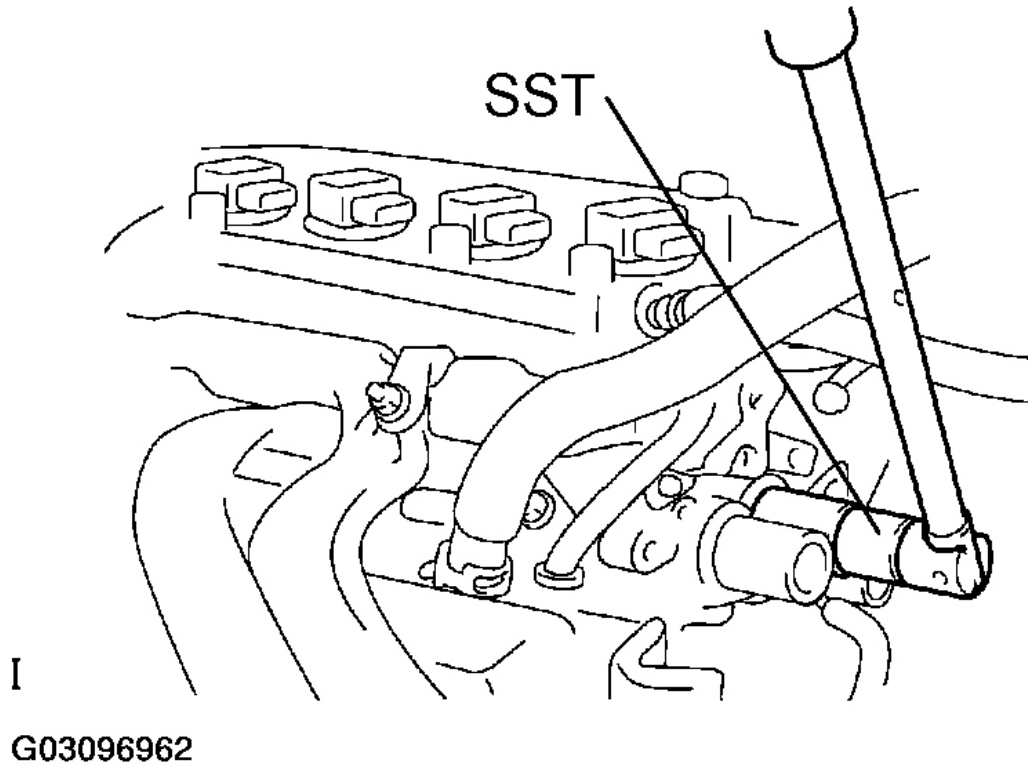


Fig. 79: Installing Engine Coolant Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. INSTALL WATER BY-PASS PIPE NO. 1

- a. Install a new gasket and the water bypass pipe with the 2 bolts and 2 nuts.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

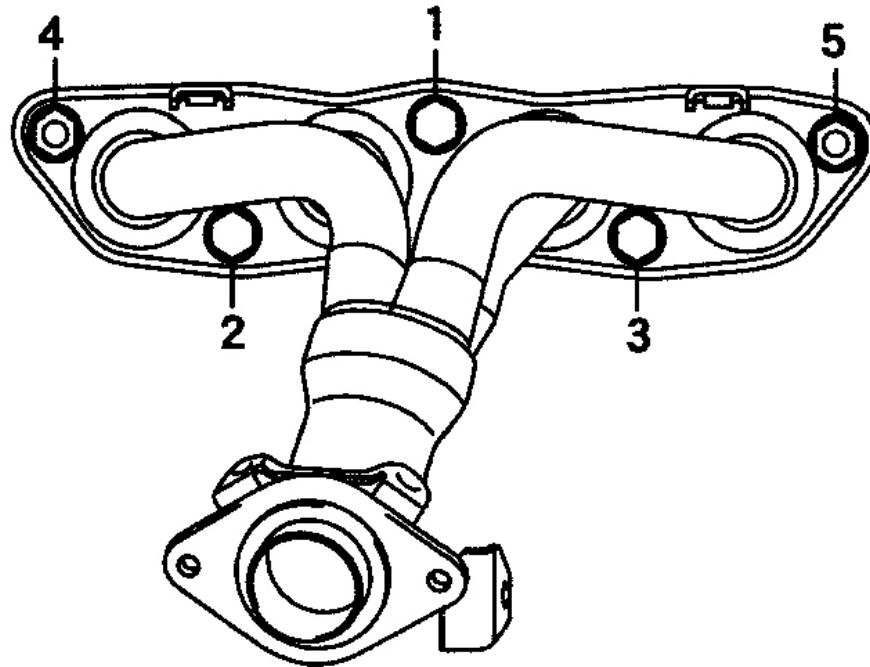
59. INSTALL IGNITION COIL NO. 1

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

60. INSTALL EXHAUST MANIFOLD

- a. Using several steps, install a new exhaust manifold gasket and the exhaust manifold with the 3 bolts and 2 nuts in the sequence shown in **Fig. 80**.

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



G03096963

Fig. 80: Installing Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO. 1

- a. Install the exhaust manifold heat insulator No. 1 with the 4 bolts.

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

62. INSTALL MANIFOLD SUPPORT BRACKET

- a. Install the manifold support bracket with the 3 bolts.

Torque: 37 N.m (377 kgf.cm, 27 ft.lbf)

63. INSTALL BOOSTER VACUUM TUBE

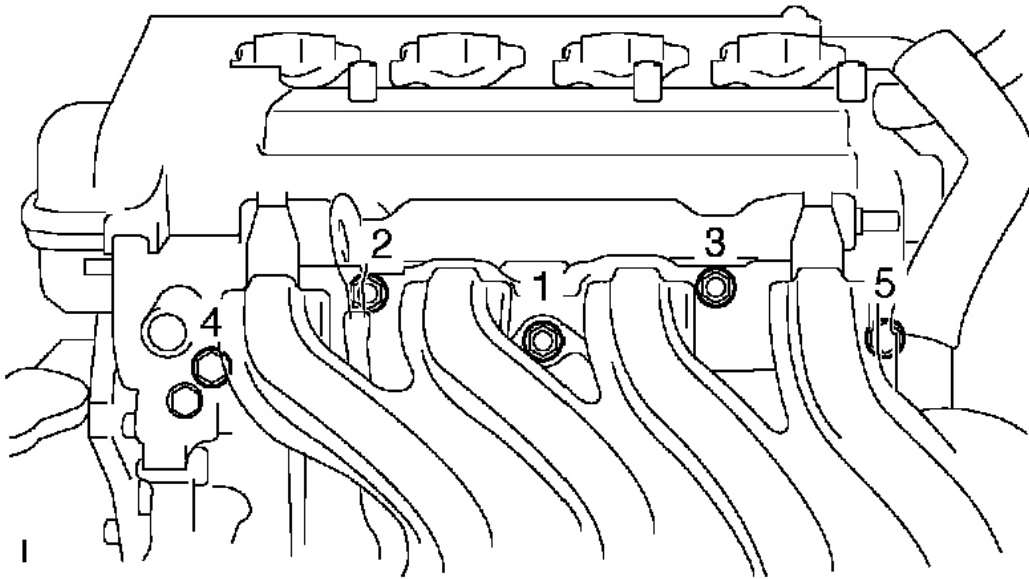
- a. Install the booster vacuum tube with the 2 bolts.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

64. INSTALL INTAKE MANIFOLD

- a. Install a new gasket onto the intake manifold.
- b. Install the intake manifold with the 3 bolts and 2 nuts. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in **Fig. 81**.

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



G03096964

Fig. 81: Tightening Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

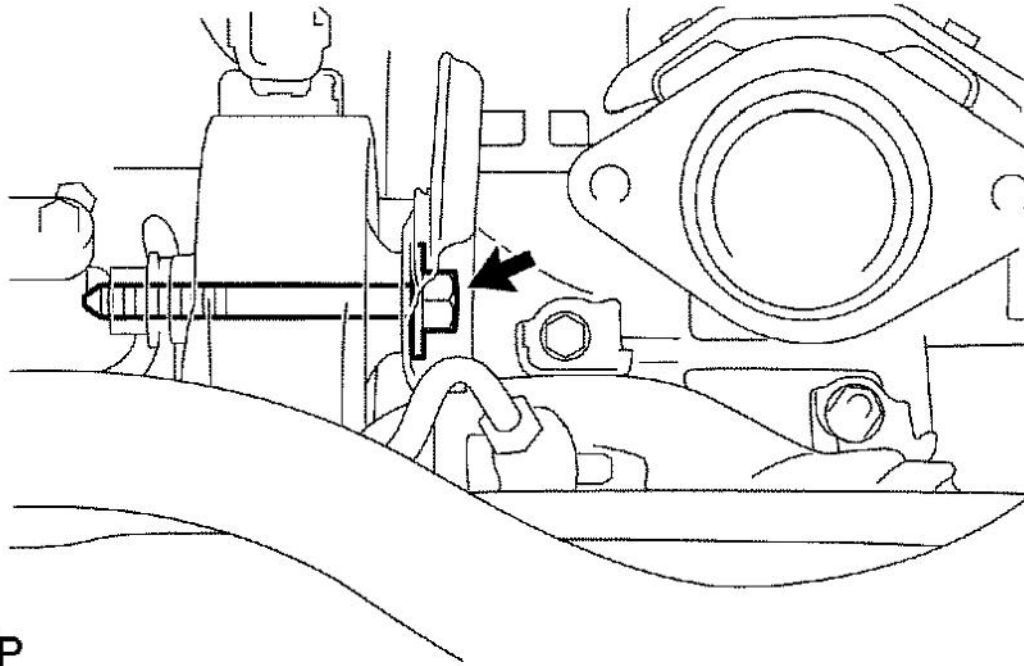
65. INSTALL DRIVE PLATE AND RING GEAR OR FLYWHEEL (See REPLACEMENT)

SST 09213-58012 (91111-50845), 09330-00021

- 66. INSTALL CLUTCH DISC ASSY (MANUAL TRANSAXLE) (See OVERHAUL)**
- 67. INSTALL CLUTCH COVER ASSY (MANUAL TRANSAXLE) (See OVERHAUL)**
- 68. INSTALL MANUAL TRANSAXLE ASSY (MANUAL TRANSAXLE) (See REPLACEMENT)**
- 69. INSTALL AUTOMATIC TRANSAXLE ASSY (AUTOMATIC TRANSAXLE) (See REPLACEMENT)**
- 70. INSTALL GENERATOR ASSY (See REPLACEMENT)**
- 71. INSTALL STARTER ASSY (See REPLACEMENT)**
- 72. INSTALL FRONT SUSPENSION CROSSMEMBER SUB-ASSY**

- a. Fasten the bolt to secure the engine and transaxle assembly to the suspension crossmember.

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



P

G03096965

Fig. 82: Fastening Bolt To Secure Engine And Transaxle Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

73. INSTALL VANE PUMP ASSY

- a. Install the vane pump assembly with the 2 bolts.

Torque: 44 N.m (449 kgf.cm, 33 ft.lbf)

HINT:

After adjusting the V-ribbed belt, first tighten bolt A, then tighten bolt B.

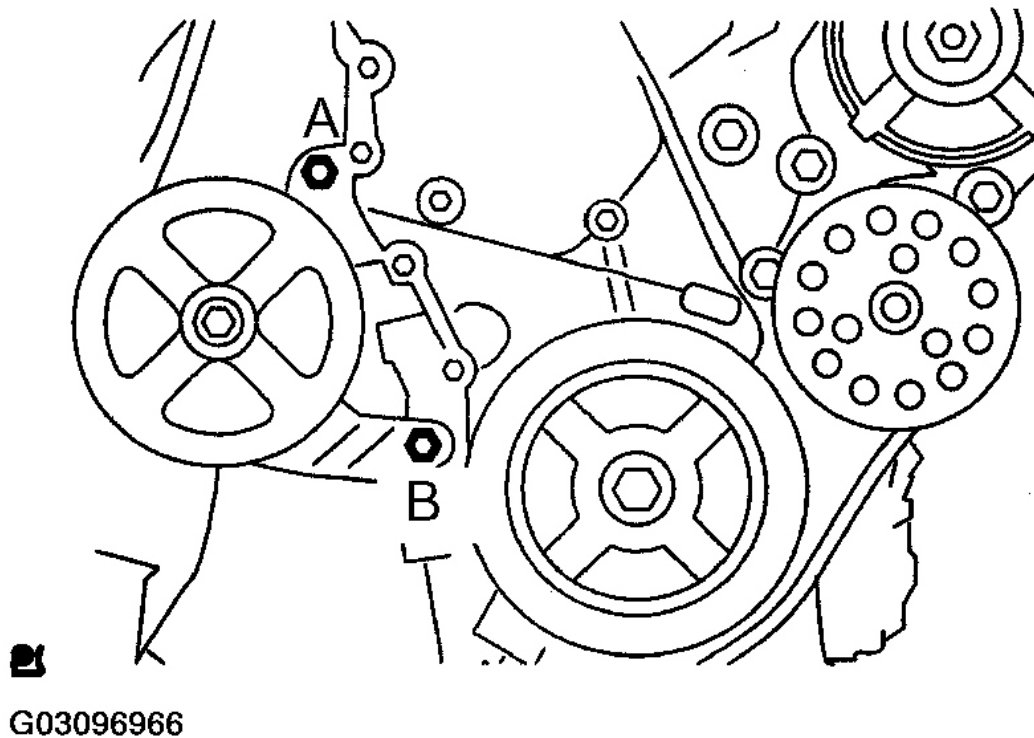


Fig. 83: Tightening Bolt A, Then Bolt B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

74. **INSTALL VANE PUMP V BELT**
 - a. Temporarily install the V-ribbed belt on each pulley.
75. **ADJUST VANE PUMP V BELT (See REPLACEMENT)**
76. **INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**
 - a. Set the engine with the transaxle on the engine lifter.
 - b. Install the engine with the transaxle onto the engine compartment.
 - c. Temporarily install the suspension crossmember with the 8 bolts.

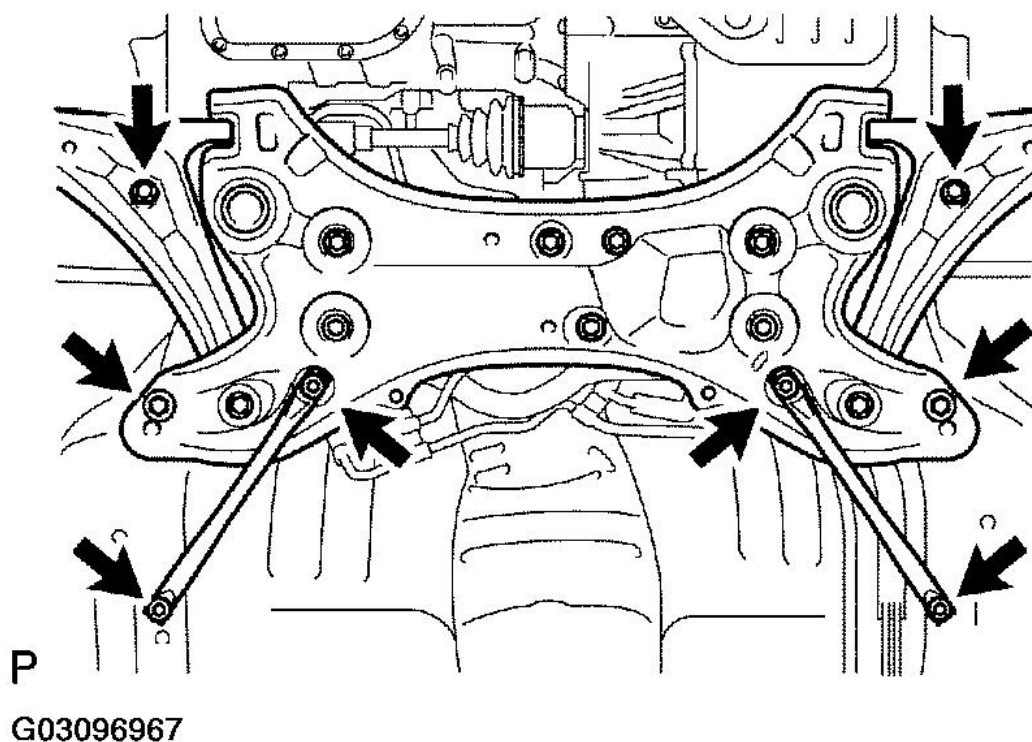
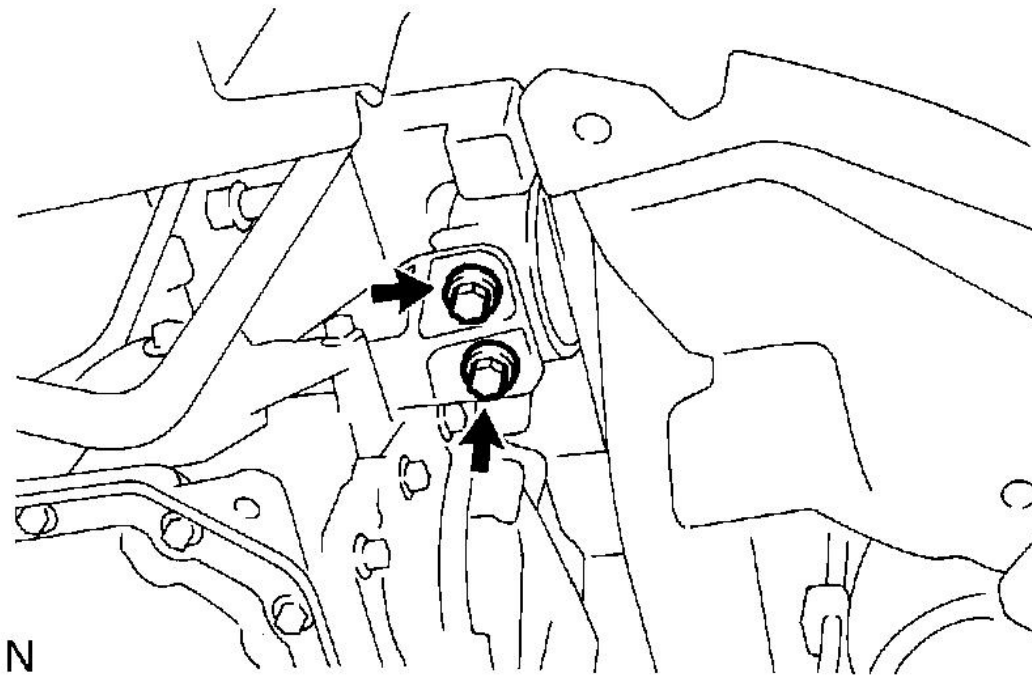


Fig. 84: Temporarily Installing Suspension Crossmember With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the engine mounting bracket LH onto the engine mounting insulator LH with the 2 bolts.

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



N

G03096968

Fig. 85: Installing Engine Mounting Bracket LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the engine mounting insulator RH with the 5 bolts and nut.

Torque:

Bolt A: 45 N.m (459 kgf.cm, 33 ft.lbf)

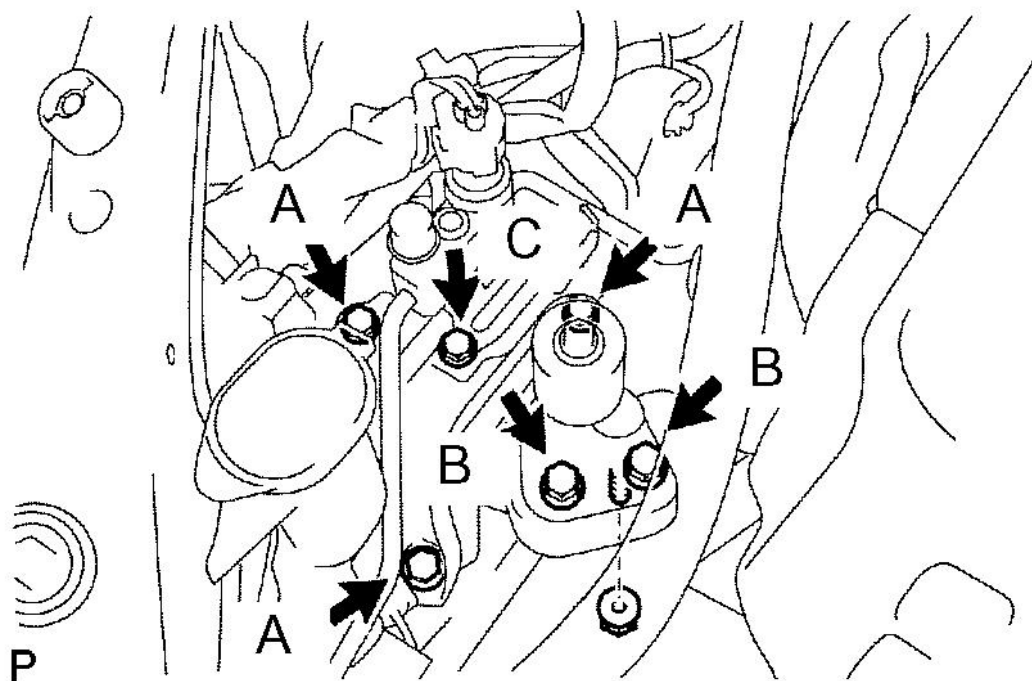
Bolt B: 52 N.m (530 kgf.cm, 38 ft.lbf)

Nut: 52 N.m (530 kgf.cm, 38 ft.lbf)

- f. Install the liquid tube with the bolt.

Torque:

Bolt C: 9.8 N.m (100 kgf.cm, 7.2 ft.lbf)



G03096969

Fig. 86: Installing Engine Mounting Insulator RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Insert SST into the positioning holes of the right hand crossmember and vehicle.

SST 09670-00010

- h. Temporarily tighten bolt A, then tighten bolt B.

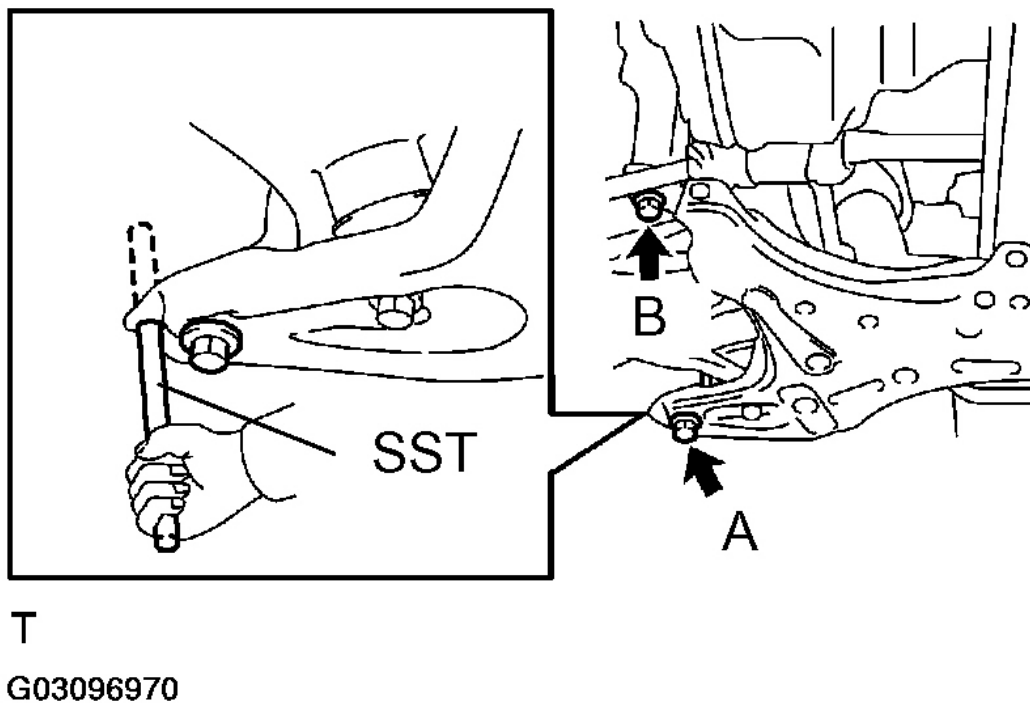


Fig. 87: Temporarily Tightening Bolt A, Then Bolt B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Insert SST into the positioning holes of the left-hand crossmember and vehicle.

SST 09670-00010

- j. Temporarily tighten bolt A, then tighten bolt B.
- k. Insert SST into the positioning holes of the right-hand crossmember and vehicle again, then tighten the bolts to the specified torque.

SST 09670-00010

Torque:

Bolt A: 116 N.m (1,183 kgf.cm, 86 ft.lbf)

Bolt B: 70 N.m (714 kgf.cm, 52 ft.lbf)

- l. Insert SST into the positioning holes of the left-hand crossmember and vehicle again, then tighten the bolts to the specified torque.

SST 09670-00010

Torque:

Bolt A: 116 N.m (1,183 kgf.cm, 86 ft.lbf)

Bolt B: 70 N.m (714 kgf.cm, 52 ft.lbf)

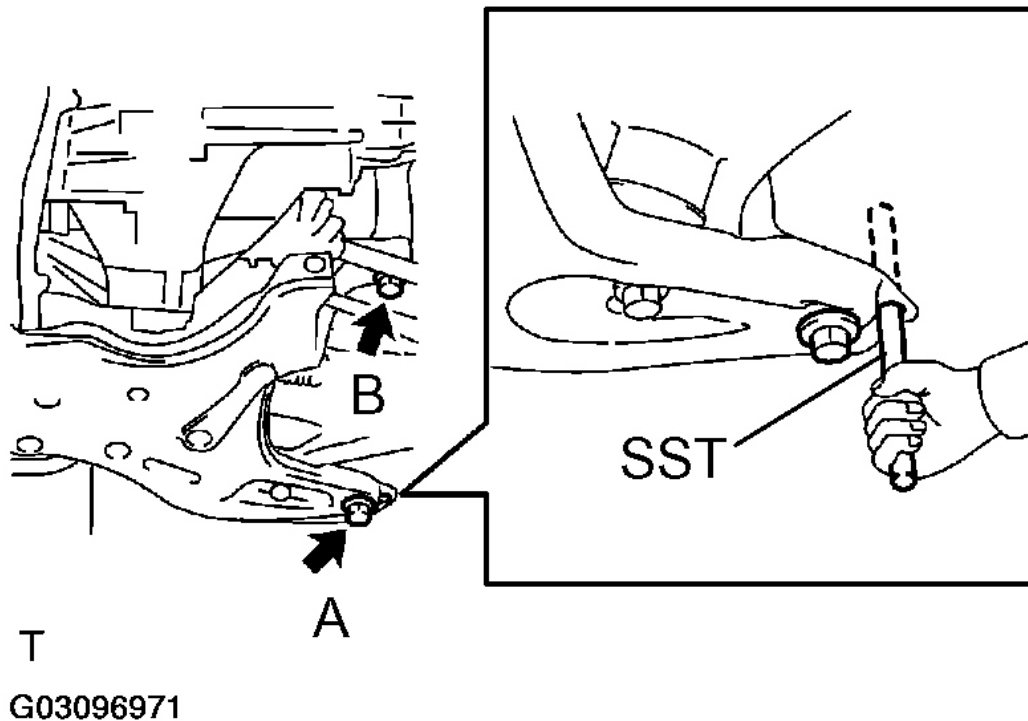


Fig. 88: Tightening Bolts To Right-Hand And Left-Hand Crossmembers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Tighten the 4 bolts shown in Fig. 89.

Torque: 47 N.m (479 kgf.cm, 35 ft.lbf)

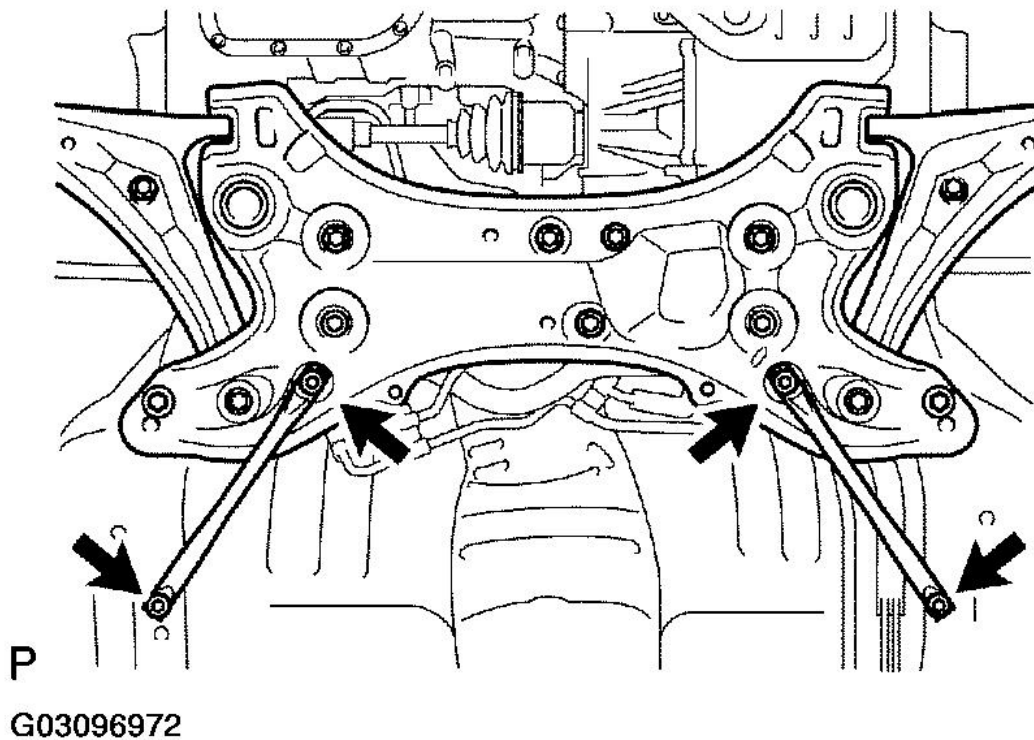


Fig. 89: Tightening Bolts

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

77. INSTALL FRONT SUSPENSION ARM SUB-ASSY LOWER NO. 1 LH

- a. Install the front suspension arm lower onto the steering knuckle with the nut.

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

- b. Install a new clip.

HINT:

Perform the same procedure as above on the opposite side.

78. INSTALL TIE ROD END SUB-ASSY LH

- a. Connect the tie rod end to the steering knuckle with the nut.

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

- b. Install a new cotter pin.

NOTE:

- **Be careful of the threads and tapered portions of the tie rod end not to make contact with oils.**
- **After tightening the castle nut, turn it clockwise within 60° to align the pin holes for the cotter pin.**

HINT:

Perform the same procedure as above on the opposite side.

79. CONNECT SPEED SENSOR FRONT LH (W/ABS)

- a. Install the speed sensor with the bolt.

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

HINT:

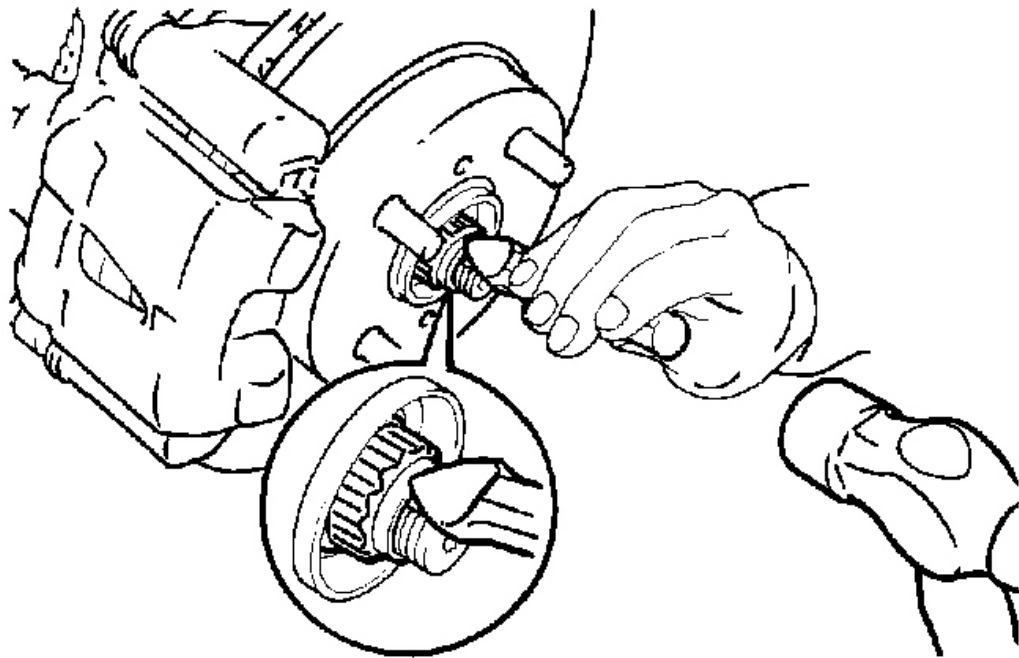
Perform the same procedure as above on the opposite side.

80. INSTALL FRONT AXLE HUB LH NUT

- a. Using a 30 mm socket wrench, install the new hub nut.

Torque: 216 N.m (2,203 kgf.cm, 160 ft.lbf)

- b. Using a chisel, stake the hub nut.



G03096973

Fig. 90: Staking Hub Nut

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

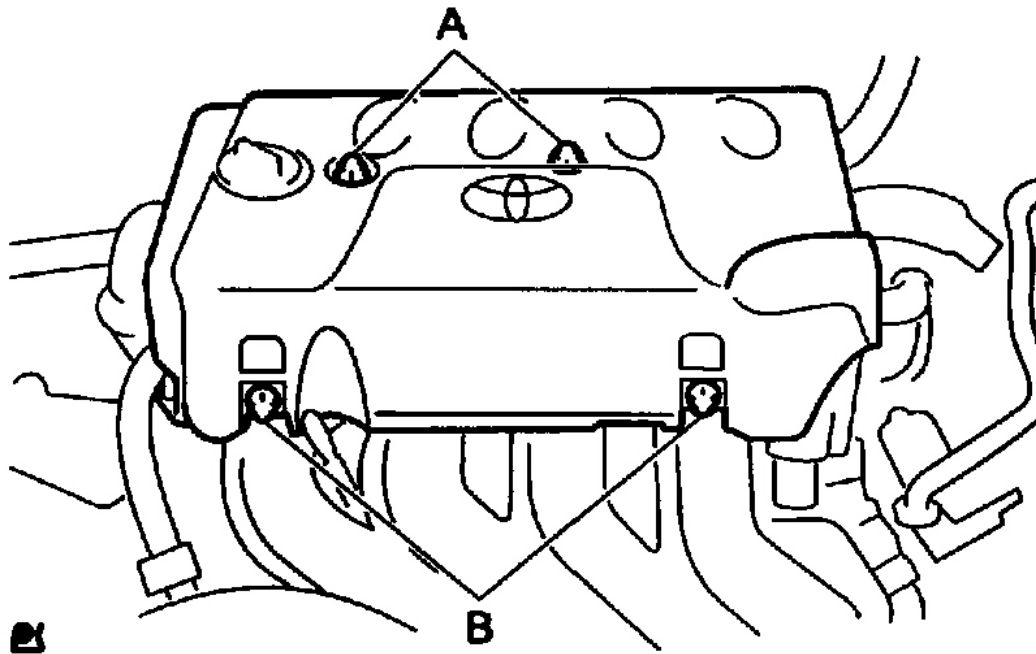
HINT:

Perform the same procedure as above on the opposite side.

81. **INSTALL STEERING INTERMEDIATE SHAFT ASSY (SEE OVERHAUL)**
82. **INSTALL EXHAUST PIPE ASSY FRONT (SEE REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
83. **INSTALL FLOOR PANEL BRACE FRONT (SEE REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
84. **INSTALL A/C COMPRESSOR (See REPLACEMENT)**
85. **INSTALL FAN AND GENERATOR V BELT**
 - a. Temporarily install the V-ribbed belt on each pulley.
86. **ADJUST FAN AND GENERATOR V BELT (See INSPECTION)**
87. **INSTALL RADIATOR ASSY (See REPLACEMENT)**

88. CONNECT FUEL TUBE SUB-ASSY (See PRECAUTION)
89. INSTALL AIR CLEANER ASSY (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)
90. INSTALL CYLINDER HEAD COVER NO. 2
 - a. First tighten A nuts, then tighten bolts B.

Torque: 7.0 N.m (71 kgf.cm, 62 in.lbf)



G03096974

Fig. 91: Installing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

91. INSTALL FRONT BUMPER COVER (See REPLACEMENT)
92. INSTALL ENGINE UNDER COVER LH

Torque:

5.0 N.m (51 kgf.cm, 44 in.lbf) for bolt

5.0 N.m (51 kgf.cm, 44 in.lbf) for nut

93. INSTALL ENGINE UNDER COVER RH

Torque:

5.0 N.m (51 kgf.cm, 44 in.lbf) for bolt

5.0 N.m (51 kgf.cm, 44 in.lbf) for nut

- 94. **ADD ENGINE OIL**
- 95. **ADD ENGINE COOLANT (See REPLACEMENT)**
- 96. **CHECK FOR ENGINE OIL LEAKS**
- 97. **CHECK FOR ENGINE COOLANT LEAKS (See ON-VEHICLE INSPECTION)**
- 98. **CHECK FOR FUEL LEAKS**
- 99. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT**
- 100. **CHECK IDLE SPEED AND IGNITION TIMING (See INSPECTION)**
- 101. **INSPECT CO/HC (See INSPECTION)**
- 102. **CHECK ABS SPEED SENSOR SIGNAL (W/ABS)**

OVERHAUL**1. REMOVE SPARK PLUG**

- a. Using a spark plug wrench, remove the spark plugs.

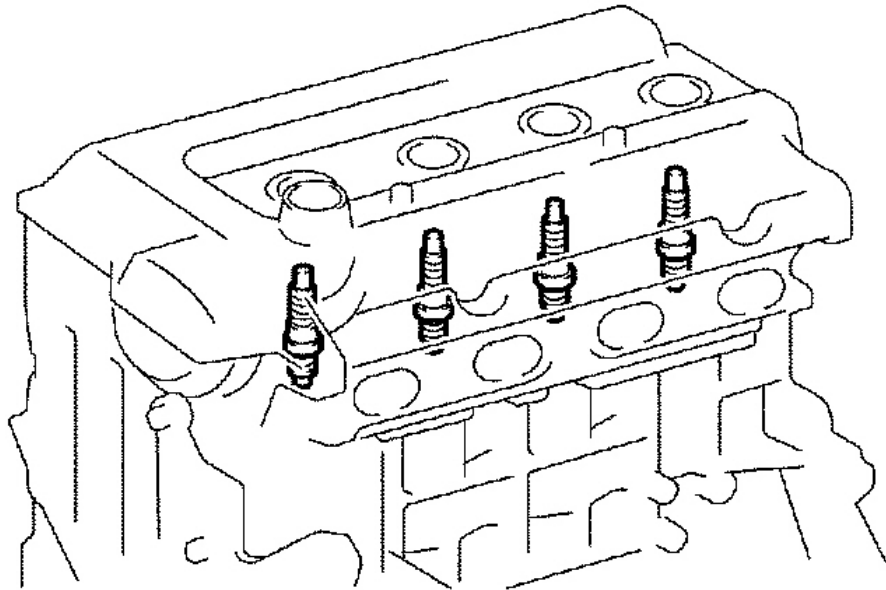
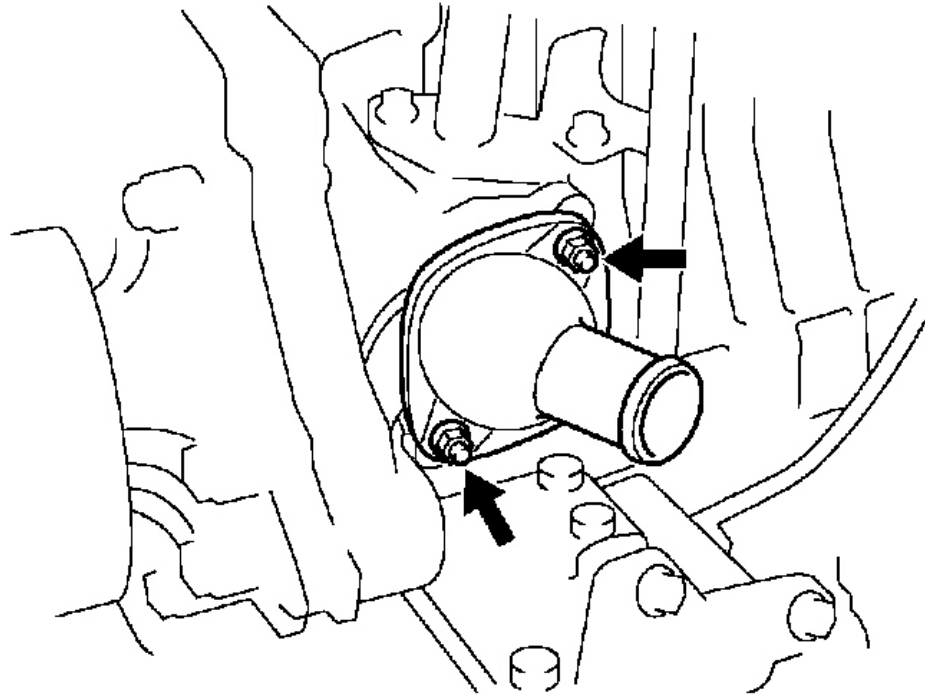
**P****G03096975**

Fig. 92: Removing Spark Plugs

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

2. REMOVE THERMOSTAT

- a. Remove the 2 nuts and water inlet.



Y

G03096976

Fig. 93: Removing Nuts And Water Inlet

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

- b. Remove the thermostat.
- c. Remove the gasket from the thermostat.

3. REMOVE OIL FILLER CAP SUB-ASSY

- a. Remove the oil filler cap from the cylinder head cover.

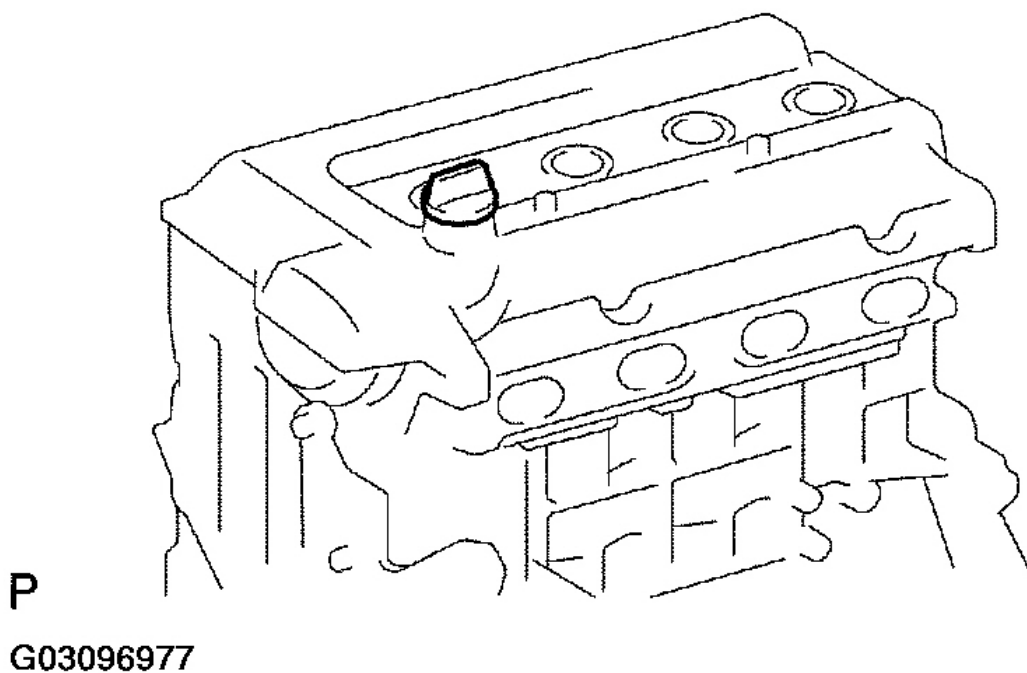
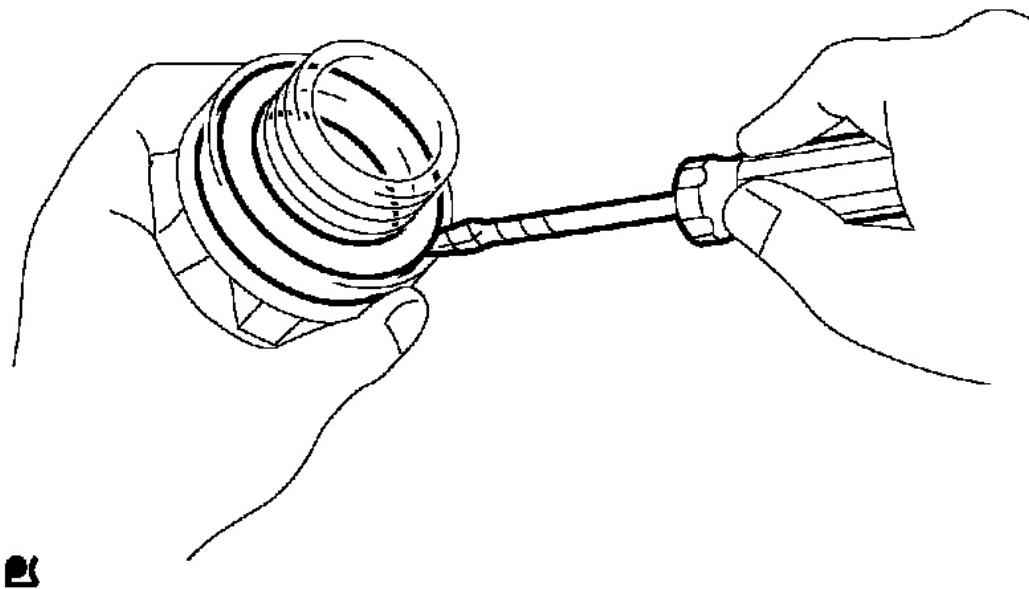


Fig. 94: Removing Oil Filler Cap Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE OIL FILLER CAP GASKET

- a. Using a screwdriver, remove the gasket from the oil filler cap.



 G03096978

Fig. 95: Removing Oil Filler Cap Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE CRANKSHAFT POSITION SENSOR

- a. Remove the bolt and crankshaft position sensor.

6. REMOVE VENTILATION VALVE SUB-ASSY

- a. Remove the ventilation valve from the cylinder head cover.

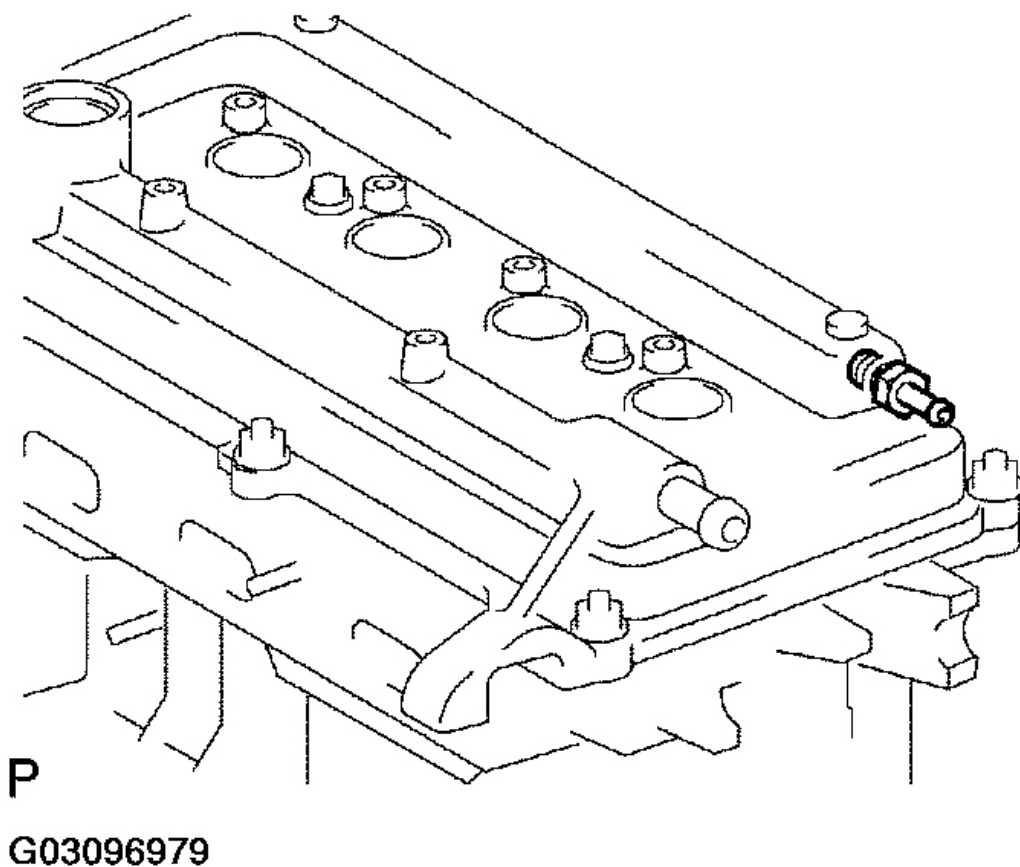


Fig. 96: Removing Ventilation Valve Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE CYLINDER HEAD COVER SUB-ASSY

- a. Remove the 9 bolts and 2 nuts, and then remove the cylinder head cover.

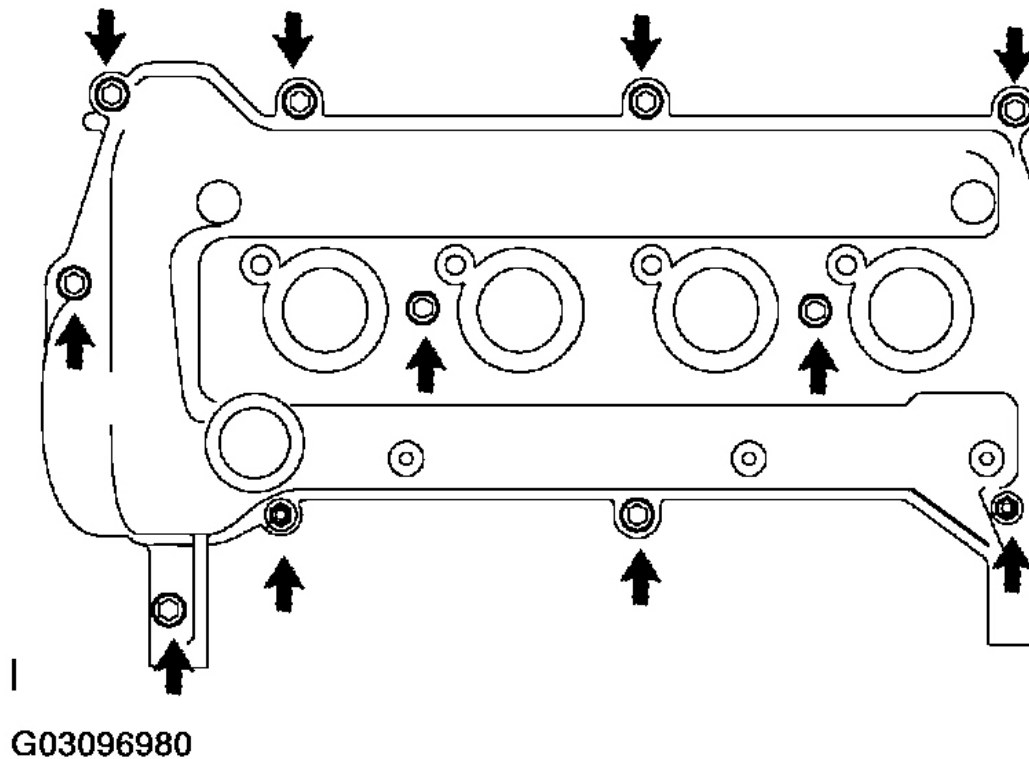


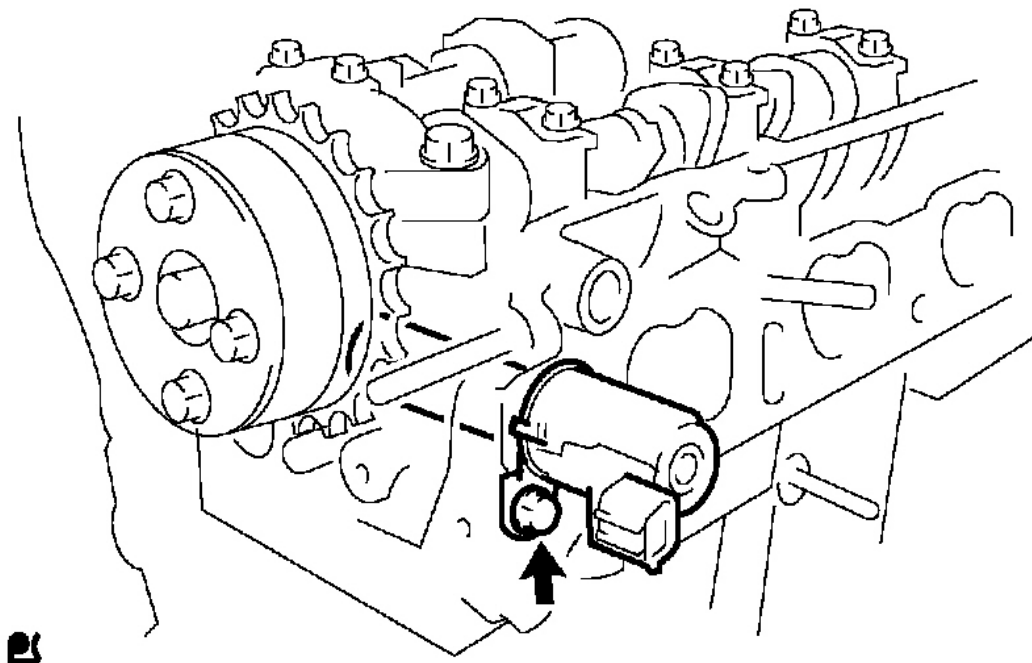
Fig. 97: Removing Bolts And Nuts, Then Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE CYLINDER HEAD COVER GASKET

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

9. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY

- a. Remove the bolt and camshaft timing oil control valve.



G03096981

Fig. 98: Removing Camshaft Timing Oil Control Valve Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE OIL LEVEL GAGE GUIDE

- a. Remove the bolt and oil level gage guide.

11. REMOVE WATER PUMP PULLEY

- a. Using SST, hold the pump pulley.

SST 09960-10010 (09962-01000, 09963-00600)

- b. Remove the 3 bolts and pump pulley.

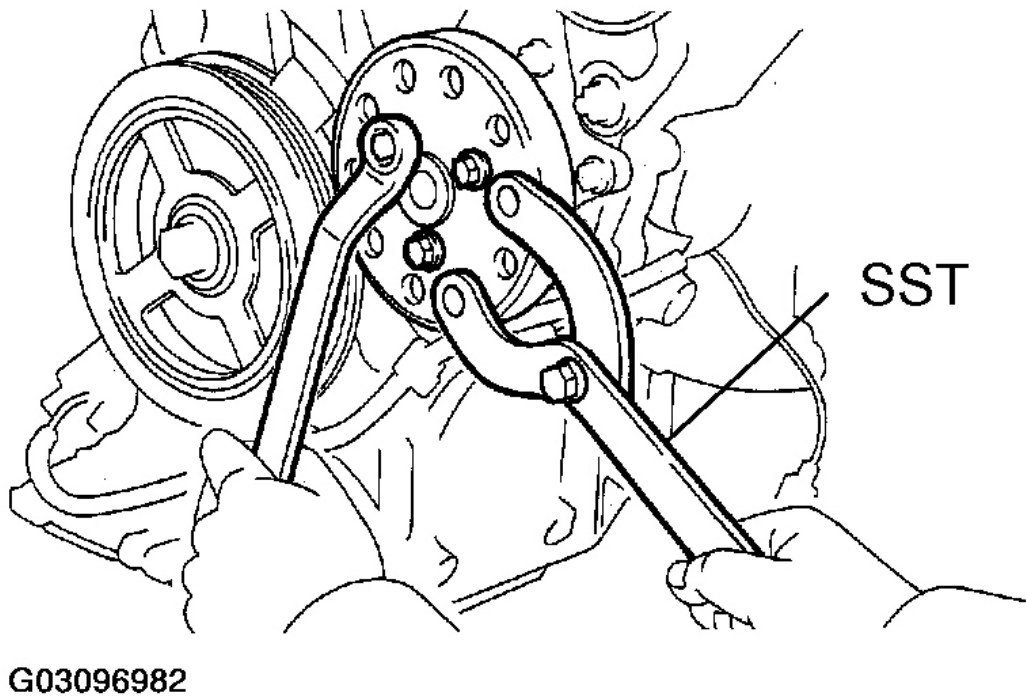
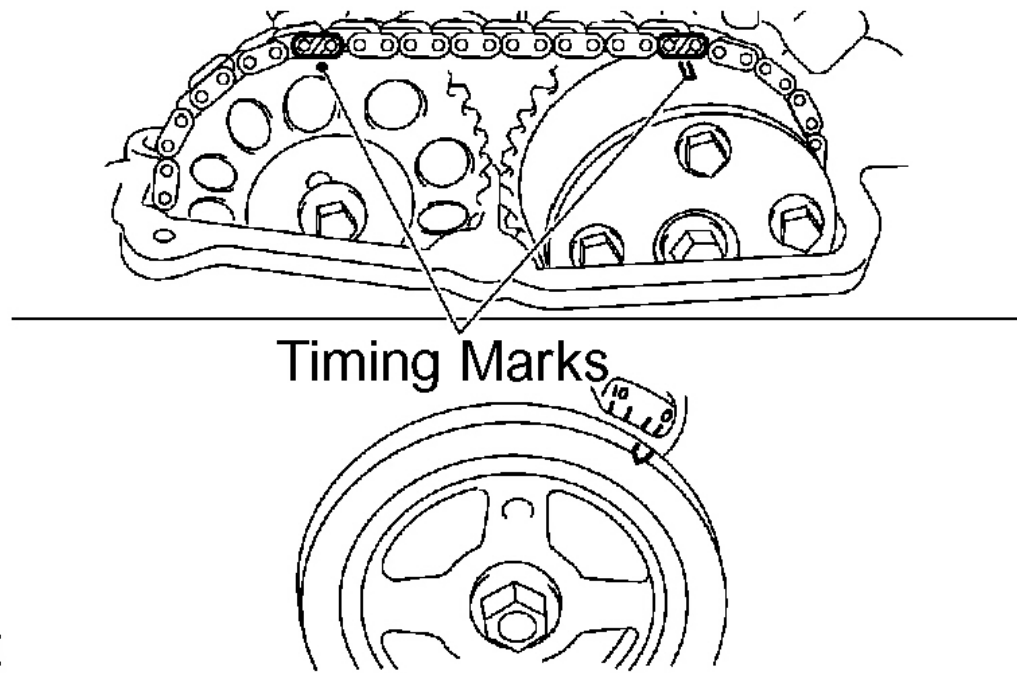


Fig. 99: Removing Water Pump Pulley

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

12. REMOVE CRANKSHAFT DAMPER SUB-ASSY

- a. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.
 2. Check that both timing marks on the camshaft timing sprocket and the camshaft timing gear are facing upward as shown in **Fig. 100**.



I

G03096983

Fig. 100: Removing Crankshaft Damper Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

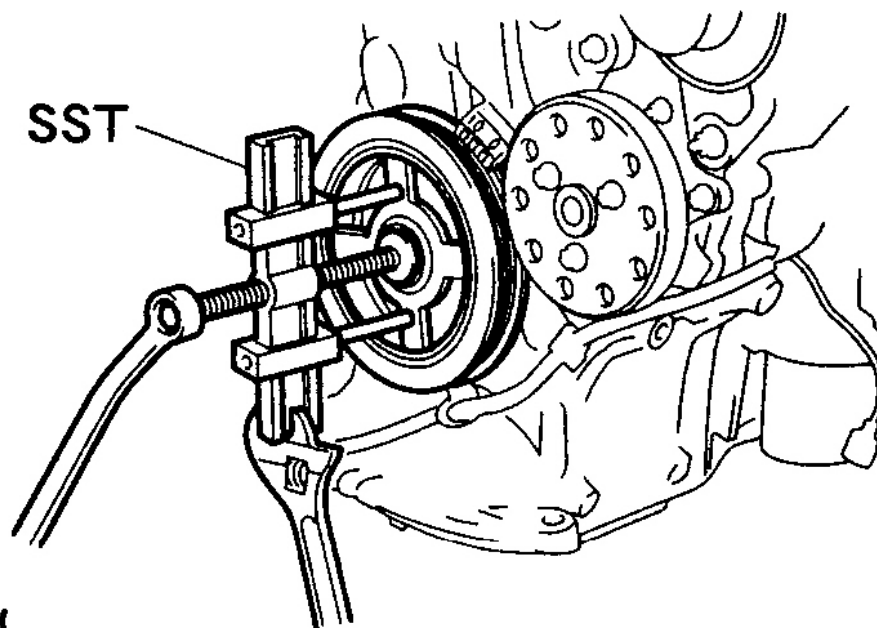
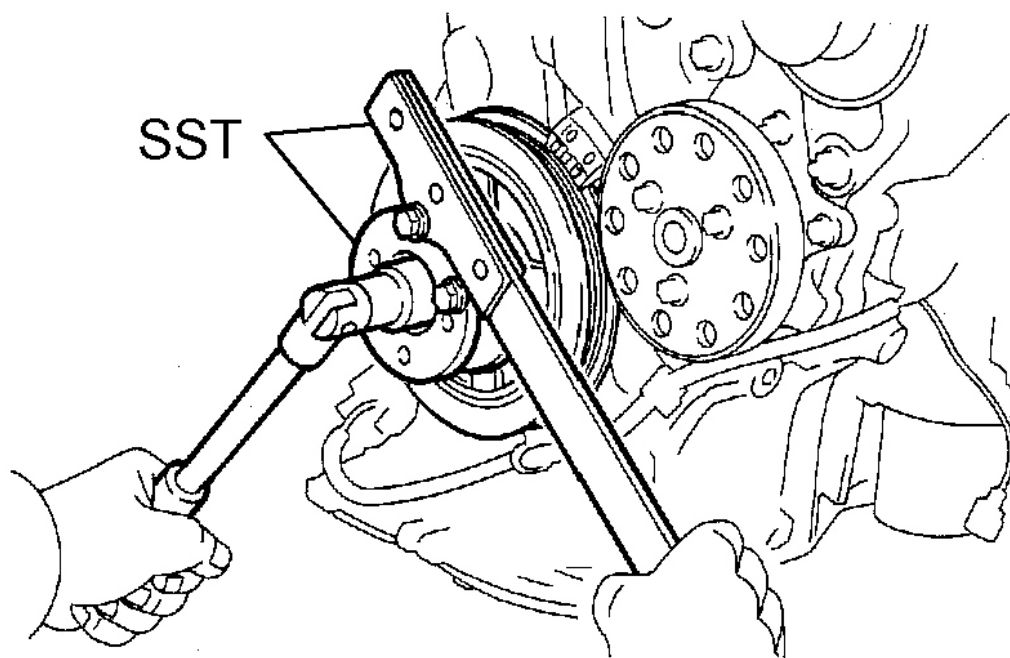
- b. Using SST, remove the pulley bolt.

SST 09213-58012 (91111-50845), 09330-00021

HINT:

If necessary, remove the damper with SST.

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



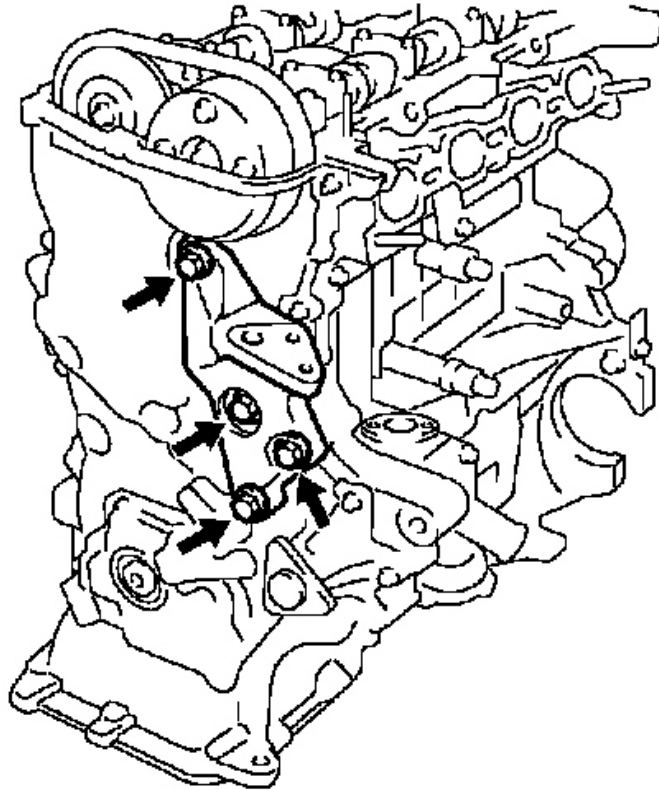
G03096984

Fig. 101: Removing Pulley Bolt And Damper

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

13. REMOVE TRANSVERSE ENGINE ENGINE MOUNTING BRACKET

- a. Remove the 4 bolts and engine mounting bracket RH.



Y

G03096985

Fig. 102: Removing Transverse Engine Engine Mounting Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE WATER PUMP ASSY

- a. Remove the 3 bolts and 2 nuts.
- b. Remove the water pump and gasket.

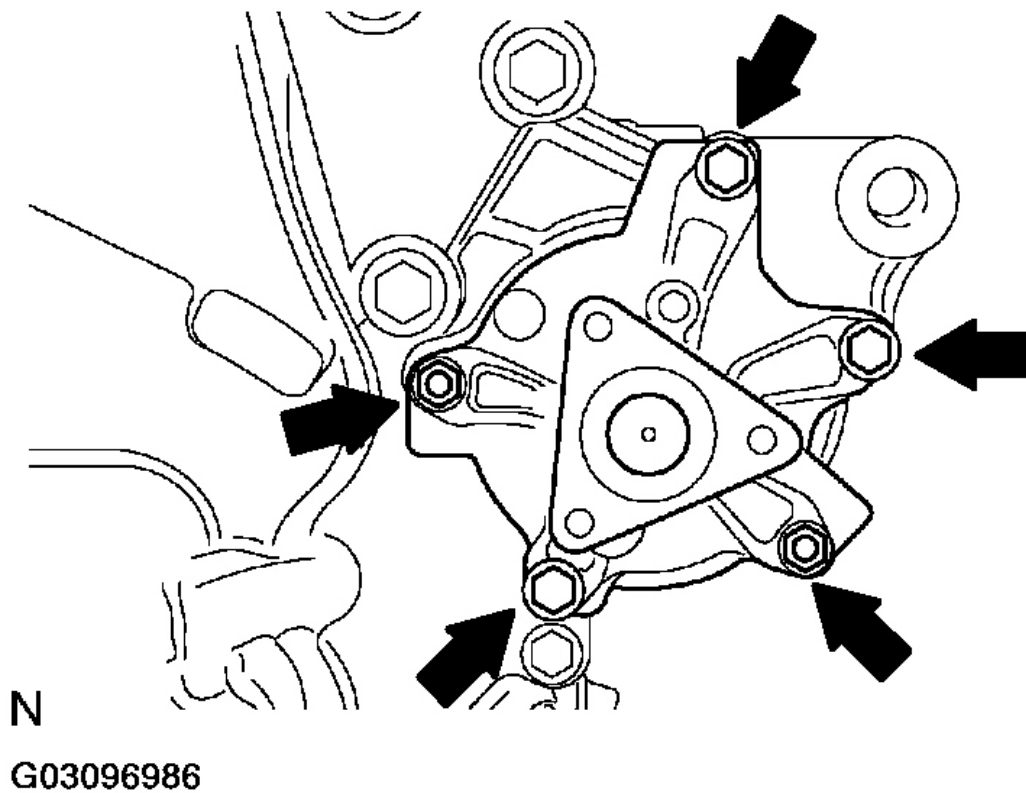
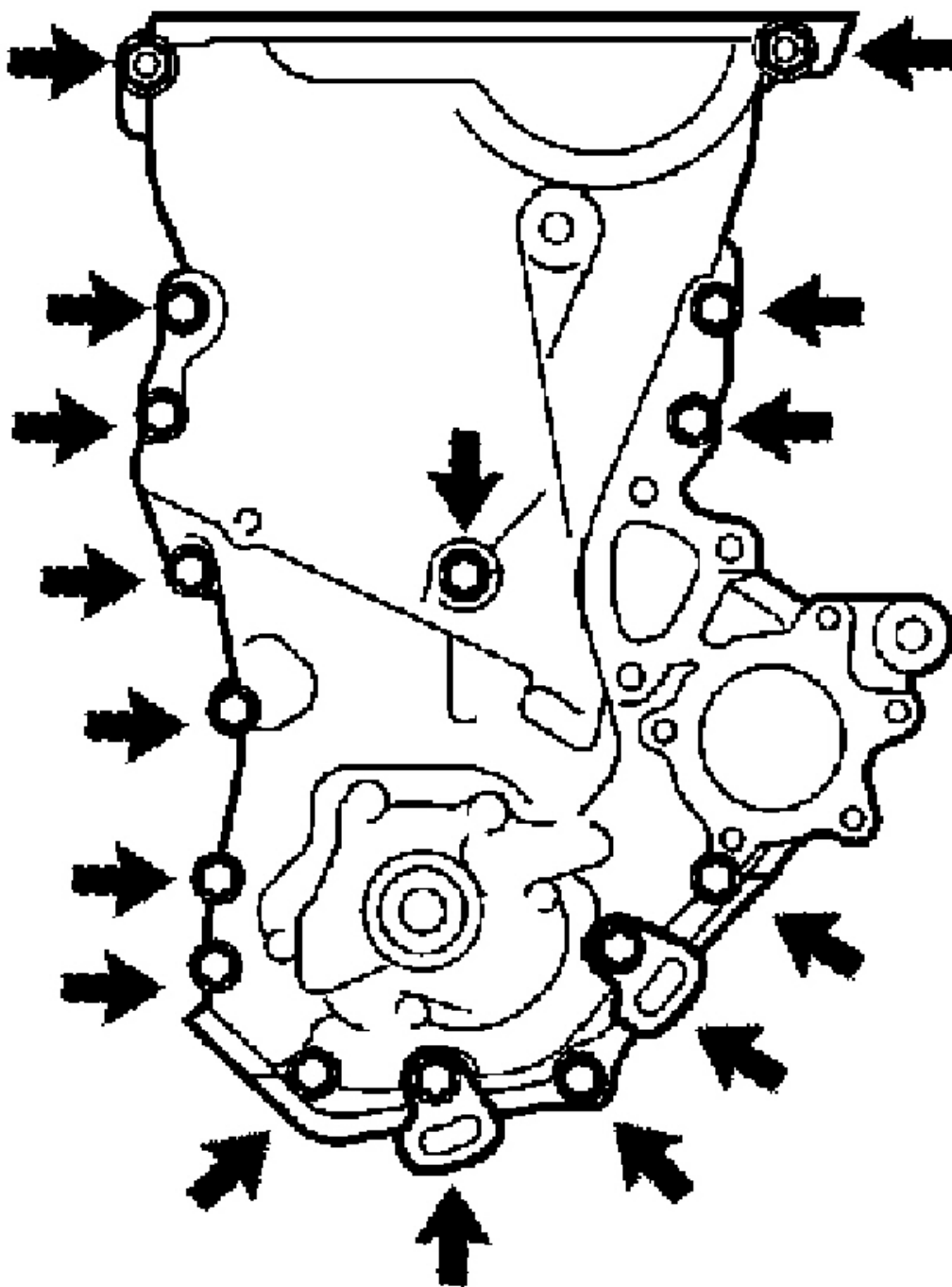


Fig. 103: Removing Water Pump Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE OIL PUMP ASSY

- a. Remove the 15 bolts and nut.



G03096987

Fig. 104: Removing Bolts And Nut

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

- b. Using a screwdriver with the tip wrapped in tape, remove the oil pump by prying between the cylinder head and cylinder block.

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

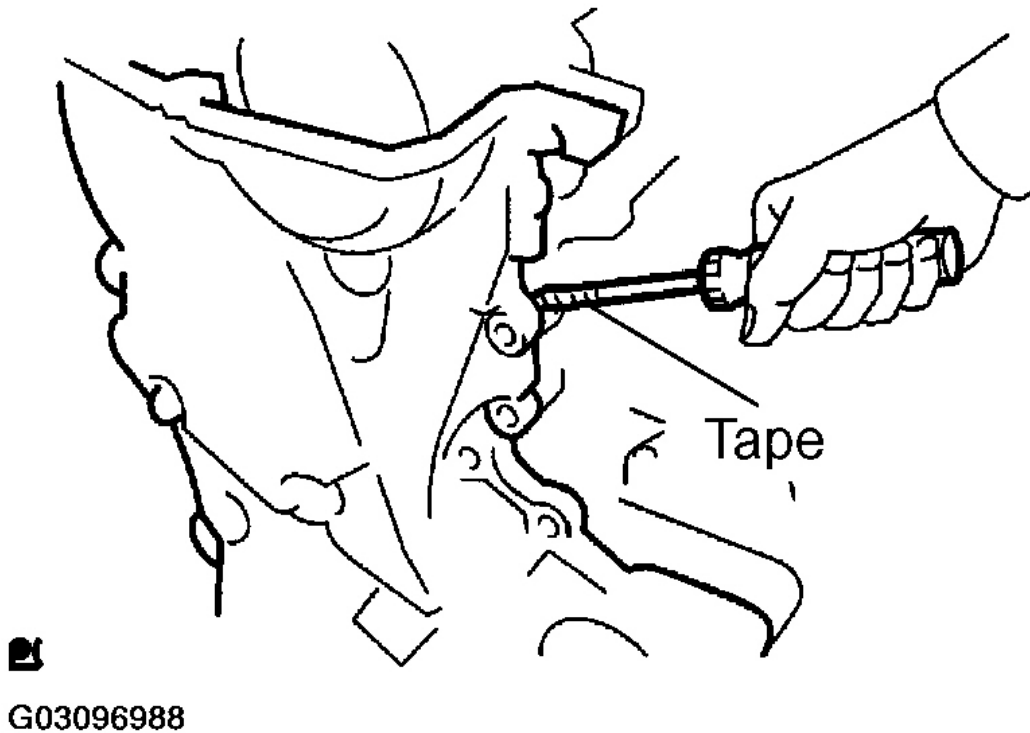


Fig. 105: Removing Oil Pump

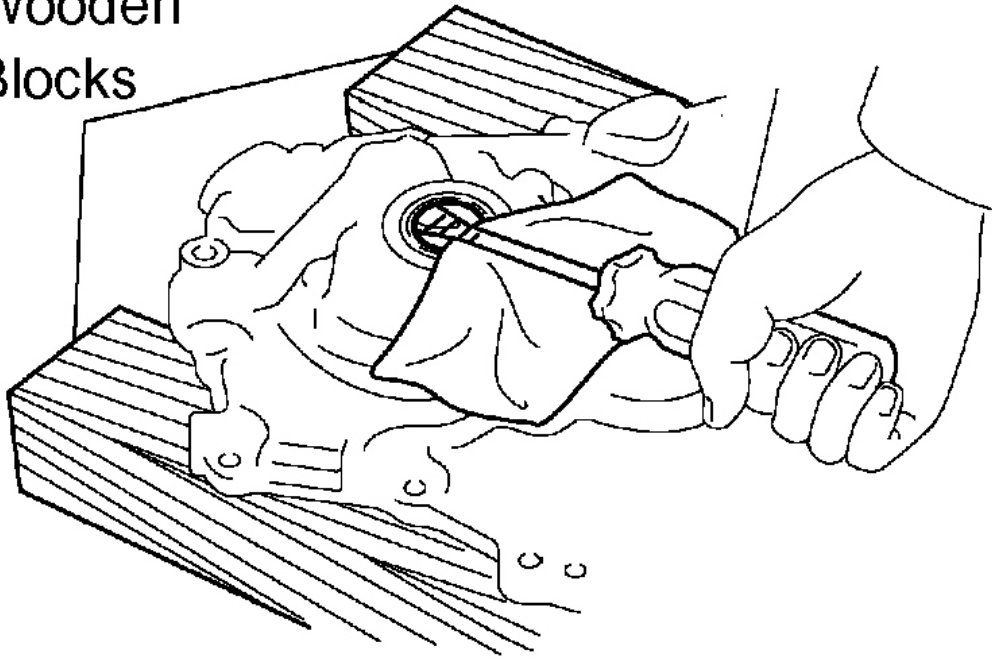
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 2 O-rings from the cylinder block and oil pan No. 1.
- d. Using an 8 mm hexagon wrench, remove the screw plug from the oil pump.

16. REMOVE OIL PUMP SEAL

- a. Using a screwdriver with the tip wrapped in tape, remove the oil seal.

Wooden
Blocks



G03096989

Fig. 106: Removing Oil Pump Seal

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

17. REMOVE CHAIN TENSIONER ASSY NO. 1

NOTE:

- Do not rotate the crankshaft with the chain tensioner removed.
 - When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC first.
- a. Rotate the stopper plate of the chain tensioner upward with a screwdriver, push in the plunger of the tensioner as shown in **Fig. 107**.

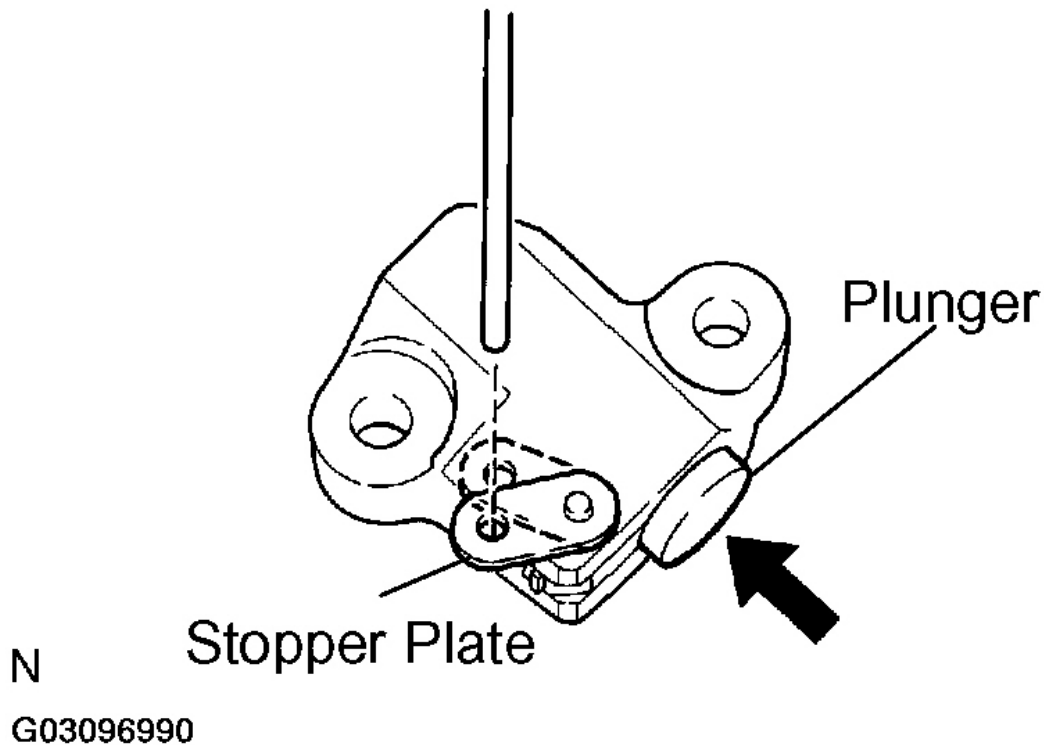
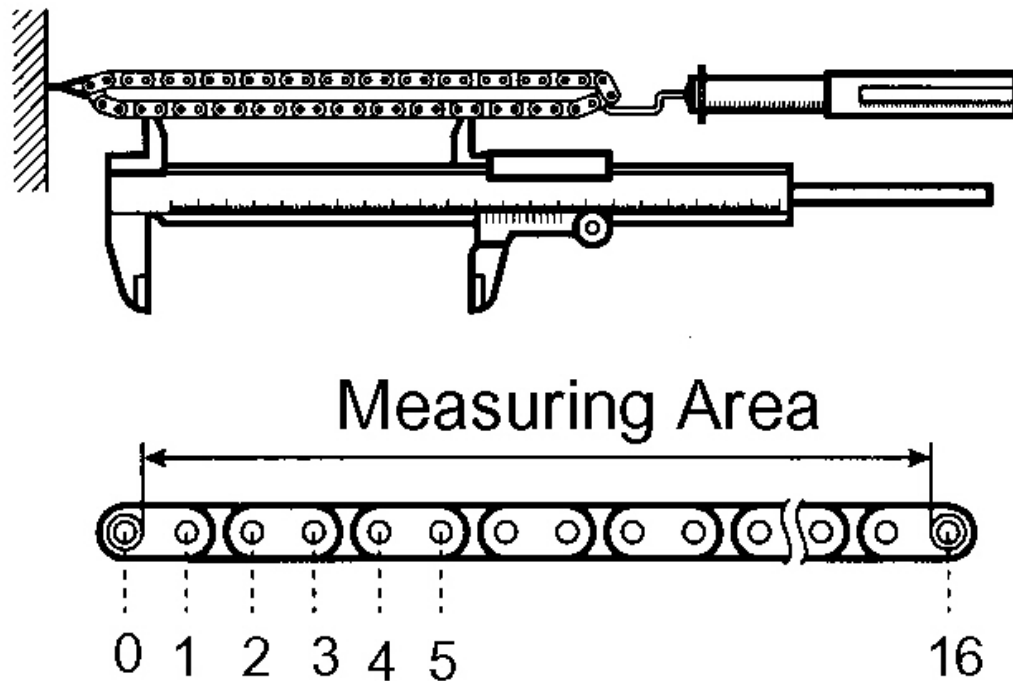


Fig. 107: Pushing In Plunger Of Tensioner

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

- b. Rotate the stopper plate of the tensioner downward, insert a 2.5 mm (0.098 in.) diameter bar into the holes of the stopper plate and tensioner to hold the stopper plate.
 - c. Remove the 2 bolts and chain tensioner.
18. **REMOVE CHAIN TENSIONER SLIPPER**
 - a. Remove the bolt and chain tensioner slipper.
 19. **REMOVE CHAIN VIBRATION DAMPER NO. 1**
 - a. Remove the 2 bolts and chain vibration damper.
 20. **REMOVE CHAIN SUB-ASSY**
 21. **INSPECT CHAIN SUB-ASSY**
 - a. Using a spring scale, pull the timing chain with 140 N (14.3 kgf, 31.5 lb) and measure the length of it.

Maximum chain elongation: 123.2 mm (4.850 in.)



G03096991

Fig. 108: Measuring Length Of Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

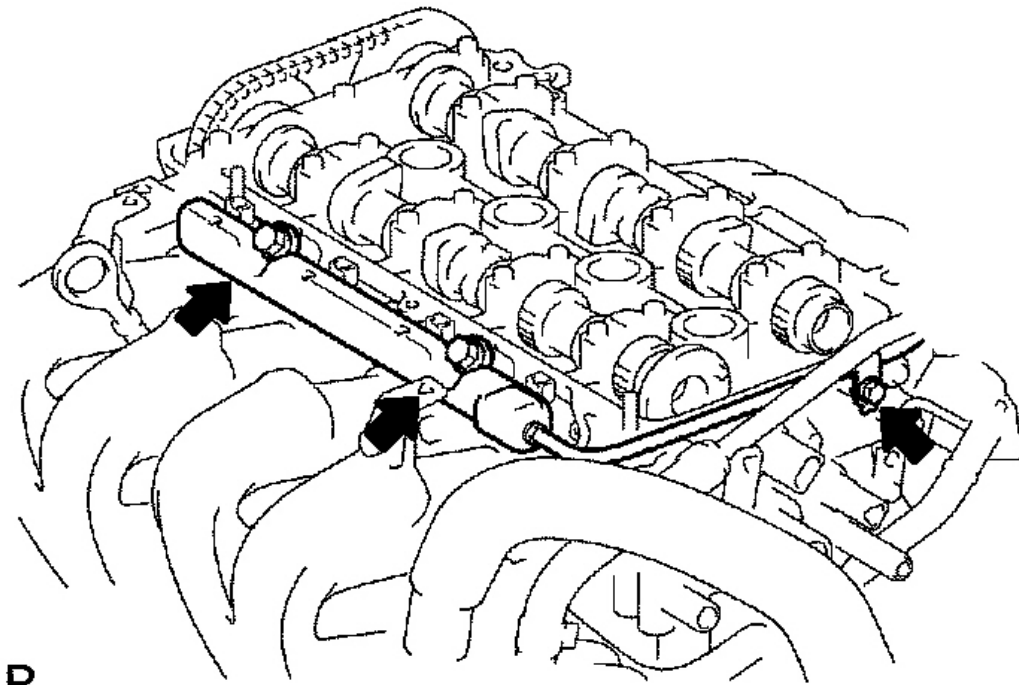
If the elongation is greater than maximum, replace the chain.

HINT:

Perform the same measurement by pulling at 3 or more random places to obtain an average length.

22. REMOVE FUEL DELIVERY PIPE SUB-ASSY

- a. Remove the 3 bolts and fuel delivery pipe together with the 4 fuel injectors.



P

G03096992

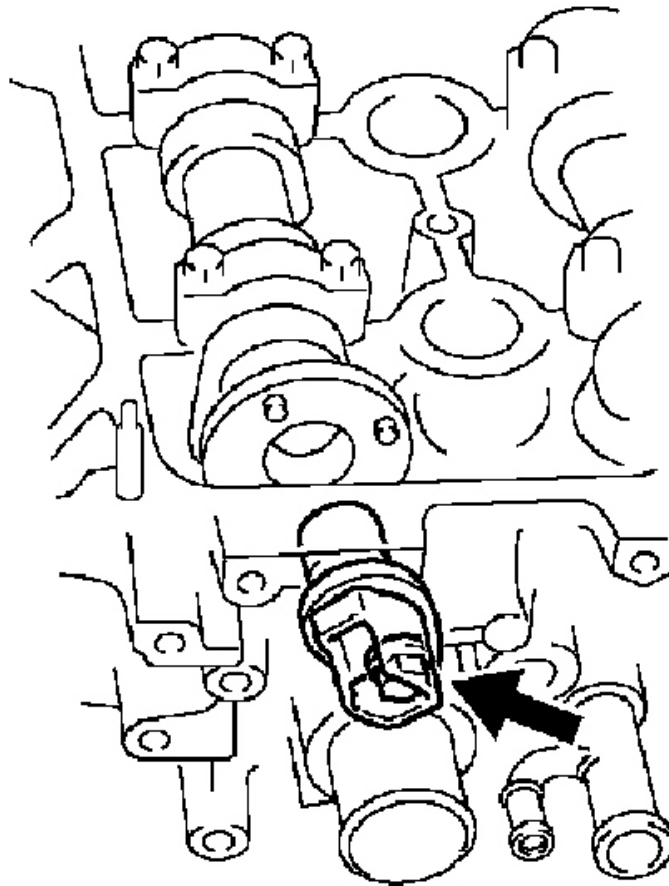
Fig. 109: Removing Fuel Delivery Pipe Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. REMOVE FUEL INJECTOR ASSY

- a. Pull out the 4 injectors from the delivery pipe.

24. REMOVE CAMSHAFT POSITION SENSOR

- a. Remove the bolt and camshaft position sensor.



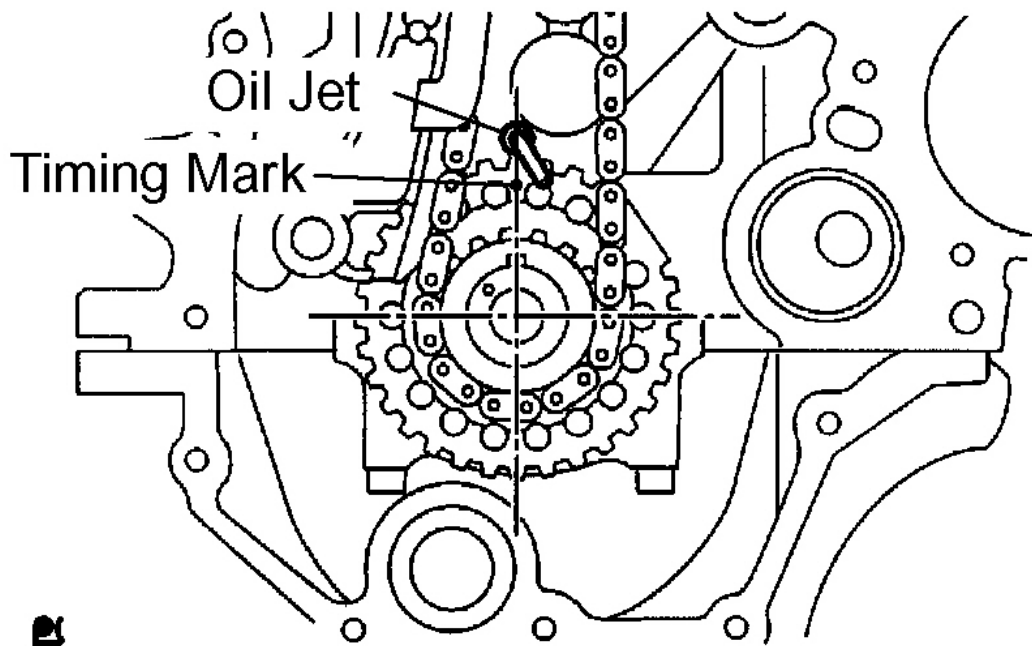
Y

G03096993

Fig. 110: Removing Camshaft Position Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. REMOVE NO. 2 CAMSHAFT

NOTE: When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC first, and align the oil jet hole with the paint mark. This prevents contact of the pistons with the valves.



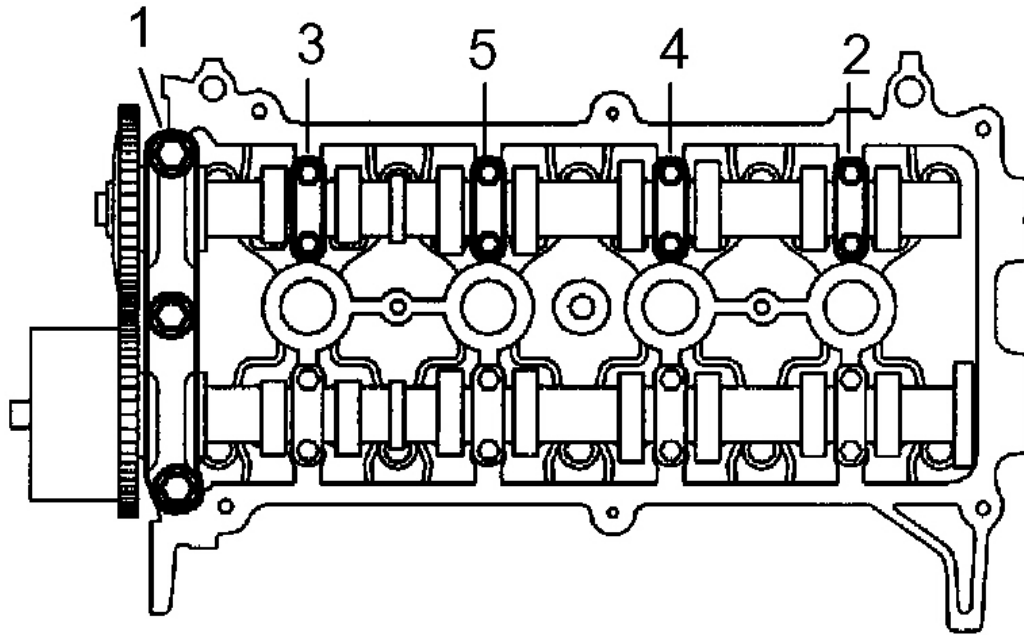
G03096994

Fig. 111: Aligning Oil Jet Hole With Paint Mark

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

- a. Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in **Fig. 112**, then remove the 5 bearing caps and No. 2 camshaft.

NOTE: Loosen each bolt uniformly keeping the camshaft level.



G03096995

Fig. 112: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE CAMSHAFT TIMING GEAR OR SPROCKET

- a. Clamp the camshaft in a vise.
- b. Remove the fringe bolt and camshaft timing sprocket.

NOTE: Be careful not to damage the camshaft.

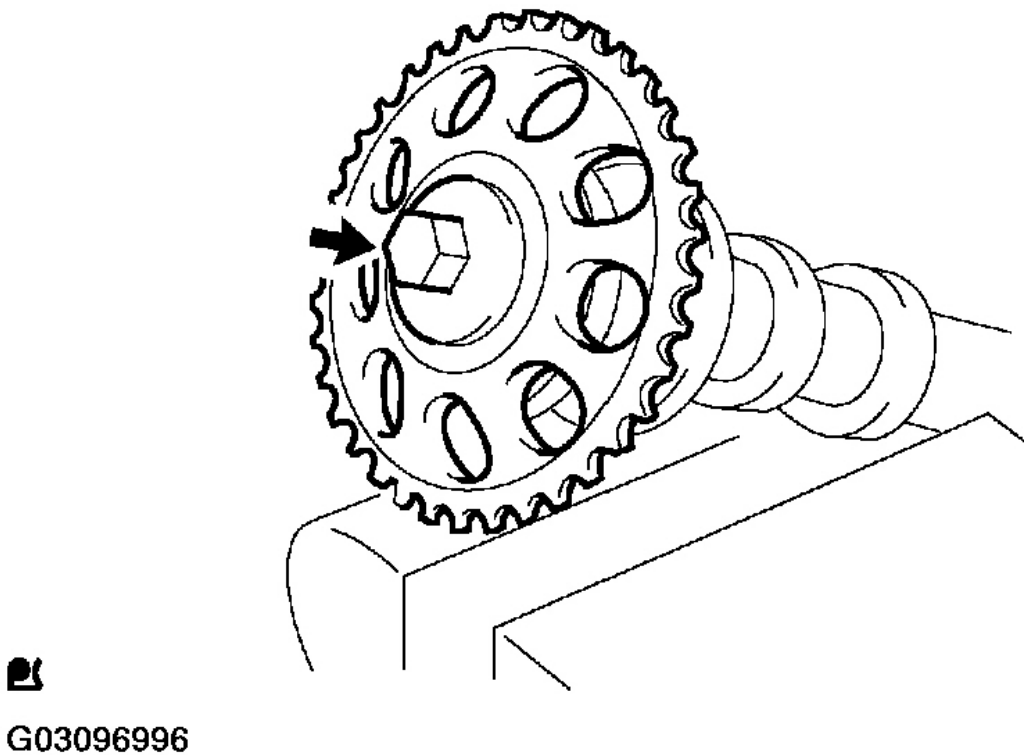


Fig. 113: Removing Camshaft Timing Gear Or Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. REMOVE CAMSHAFT

- a. Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in **Fig. 114**, then remove the 4 bearing caps and camshaft.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

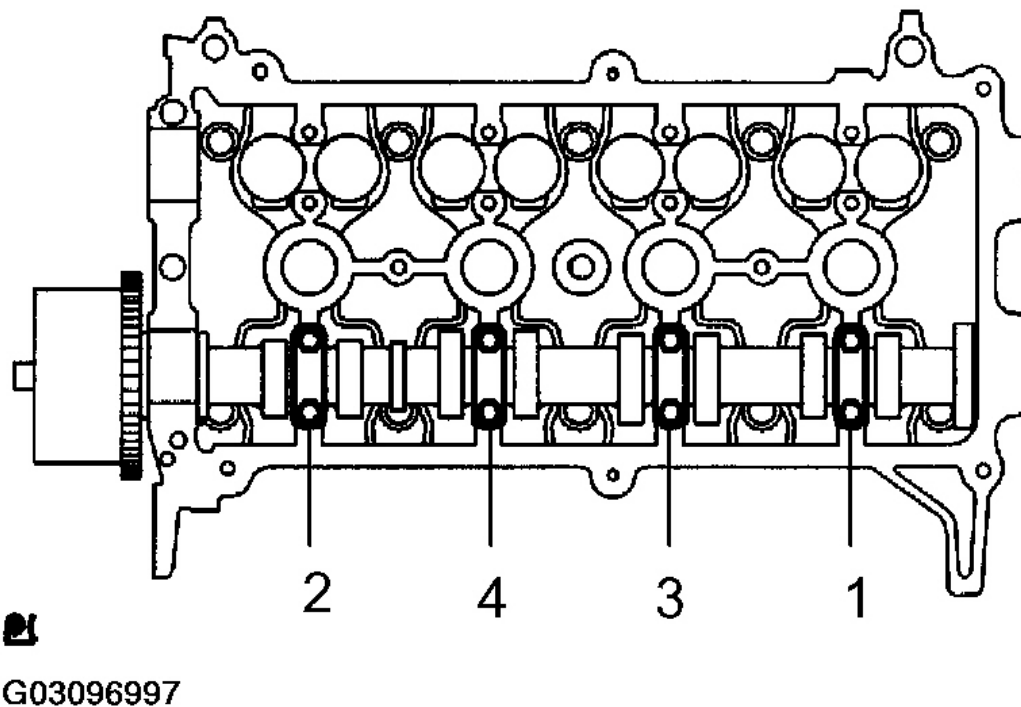


Fig. 114: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. INSPECT CAMSHAFT TIMING GEAR ASSY

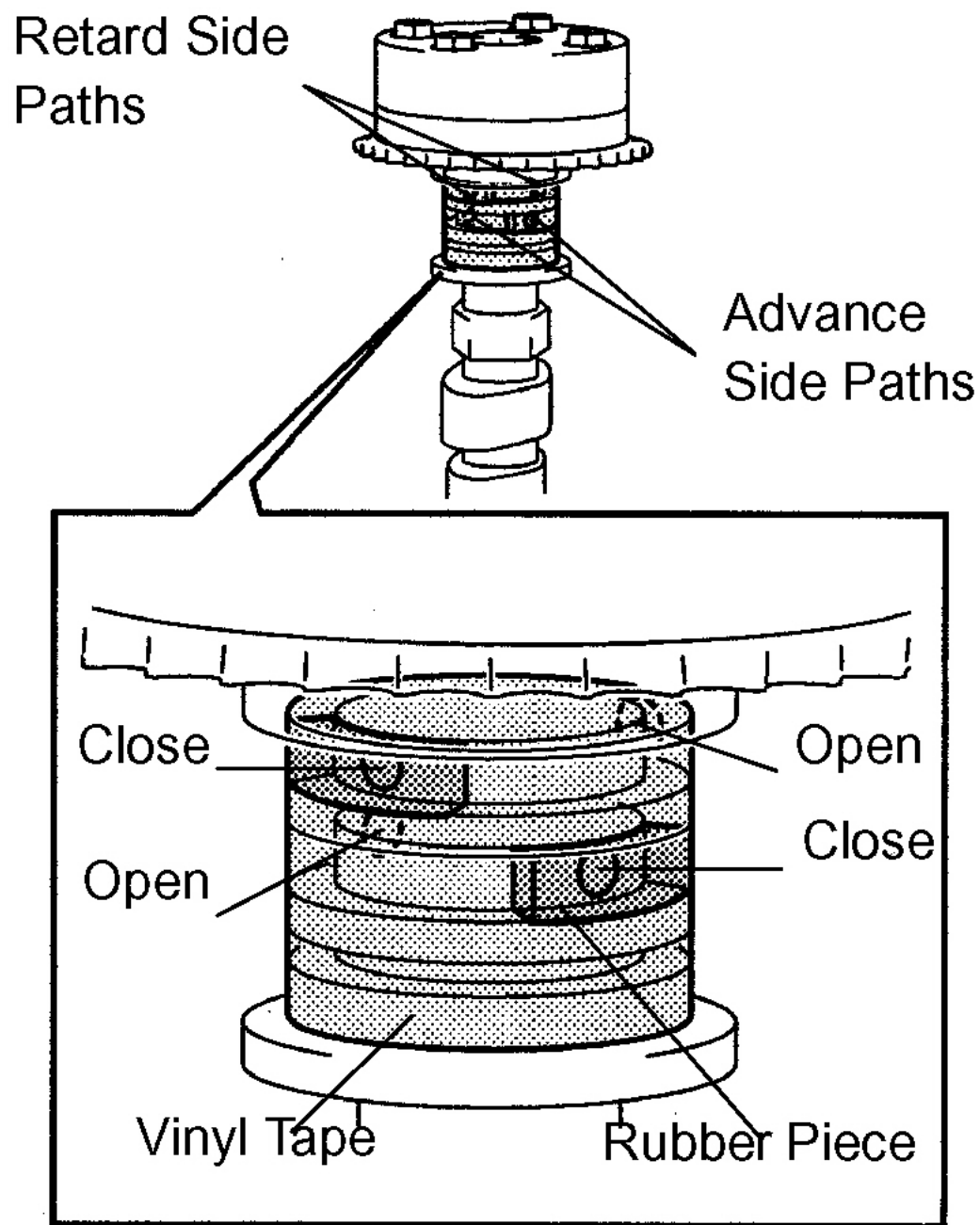
- a. Check the lock of the camshaft timing gear.
 1. Clamp the camshaft in a vise, and check that the camshaft timing gear is locked.

NOTE: Be careful not to damage the camshaft.

- b. Release the lock pin.
 1. Cover the 4 oil paths of the cam journal with tape as shown in **Fig. 115**.

HINT:

One of the 2 grooves located on the cam journal is for retarding cam timing (upper) and the other is for advancing cam timing (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with the tape.



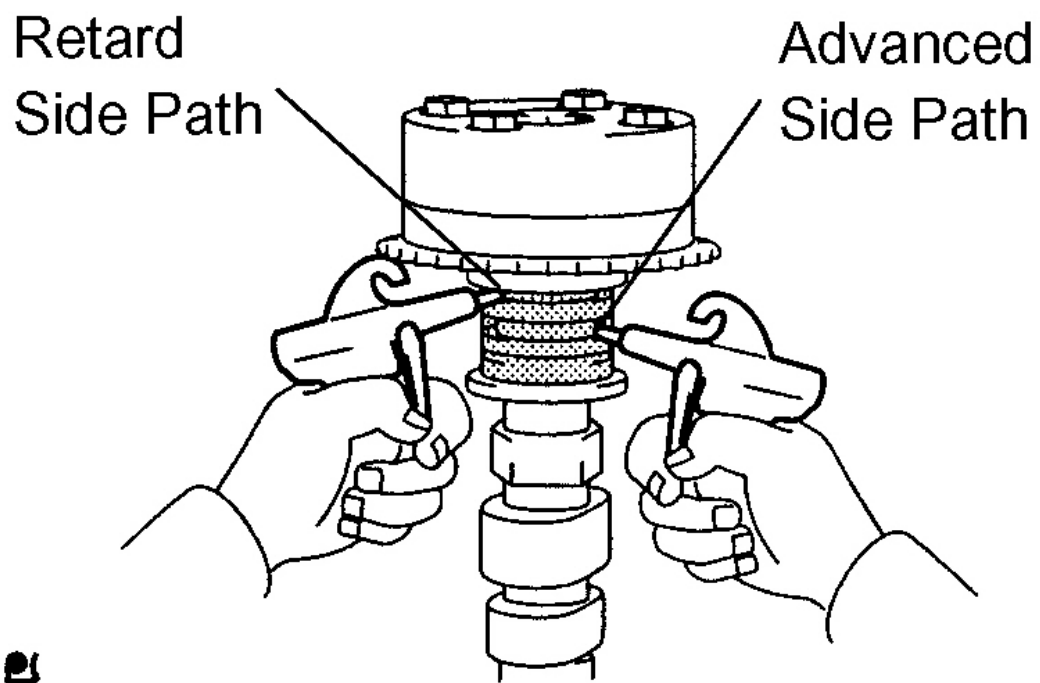
G03096998

Fig. 115: Covering Oil Paths Of Cam Journal With Tape

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

2. Punctuate the tape for the advance oil path and for the retard oil path on the opposite side from the advance oil path.
3. Put air pressure into two broken paths (the advance side path and the retard side path) with about 150 kPa (1.5 kgf/cm²).

NOTE: Cover the paths with shop rag prevent oil splashing.



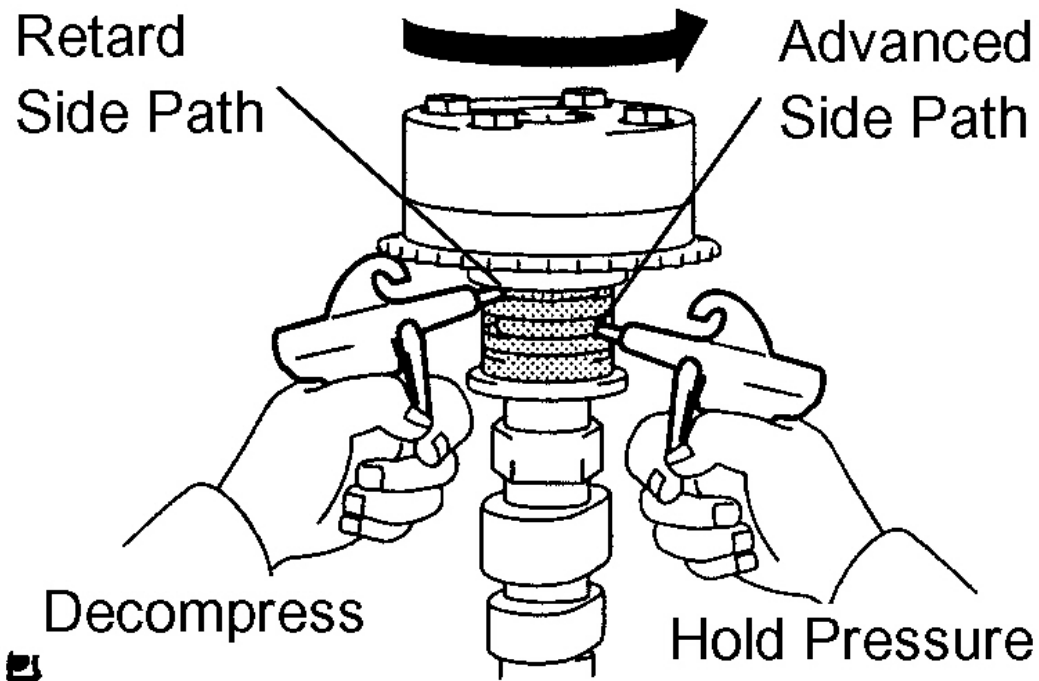
G03096999

Fig. 116: Putting Air Pressure Into Two Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Confirm if the camshaft timing gear assembly revolves in the timing advance direction when reducing the air pressure of the timing retard path.

HINT:

The lock pin is released, and the camshaft timing gear revolves in the timing advance direction.



G03097000

Fig. 117: Confirming Camshaft Timing Gear Assembly Revolves In Timing Advance Direction

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

5. When the camshaft timing gear reaches the most advanced position, remove the air pressure of the timing retard side path, and then release the air pressure of the timing advance side path.

NOTE: Camshaft timing assembly gear occasionally shifts to the retard side abruptly, if the air compression of the advanced side path is released first. It often results in the breakage of the lock pin.

c. Check smooth revolution.

1. Except the position where the lock pin meets at the most retarded angle, let the valve timing controller assembly turn back and forth and check the movable range and that there is no disturbance.

Standard: Smooth movable range is about 22.5°

NOTE: Be sure to perform this check by hand, instead of air pressure.

d. Check the lock is at the most retarded position.

1. Confirm that the camshaft timing gear assembly is locked at the most retarded position.

29. REMOVE CAMSHAFT TIMING GEAR ASSY

- a. Turn the valve timing controller assembly at the most advanced angle.
- b. Remove the fringe bolt and camshaft timing gear assembly.

NOTE:

- Be careful not to remove the other 4 bolts.
- If reusing the camshaft timing gear, unlock the lock pin inside the camshaft timing gear first.

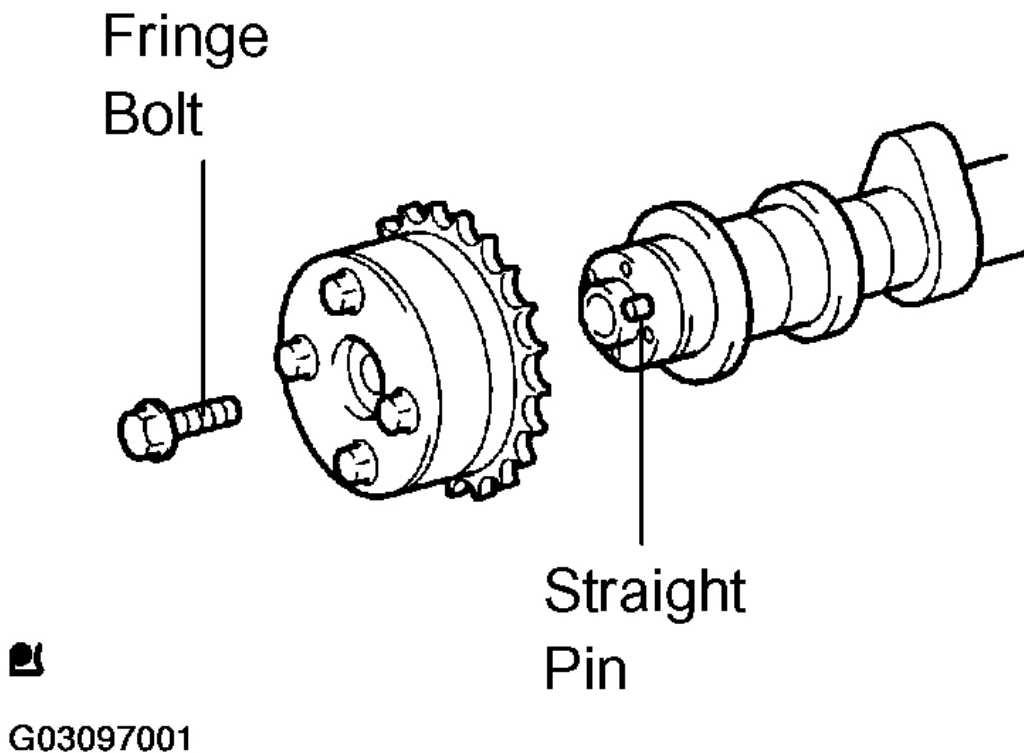


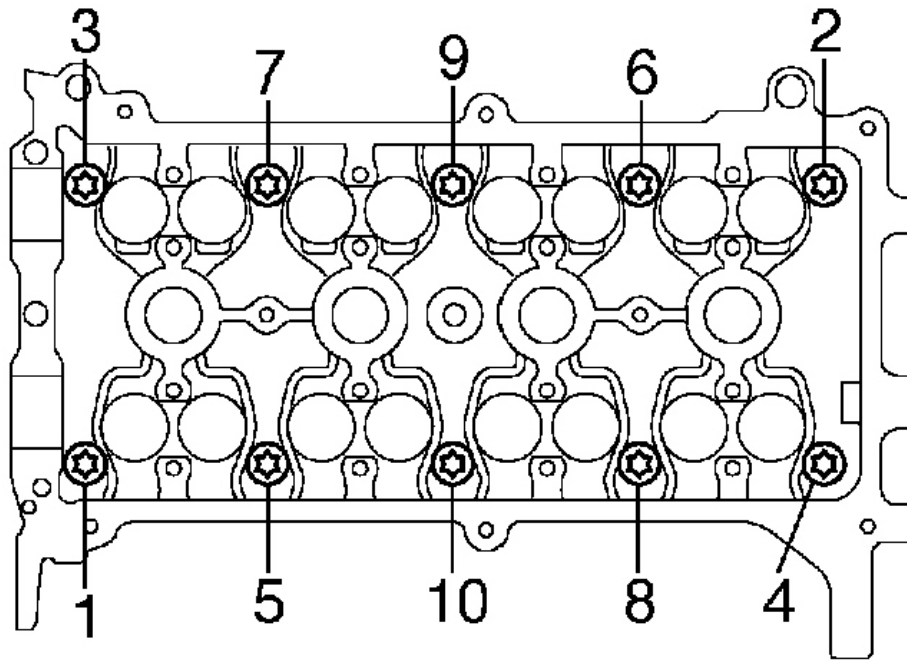
Fig. 118: Removing Camshaft Timing Gear Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. REMOVE CYLINDER HEAD SUB-ASSY

- a. Using several steps, uniformly loosen and remove the 10 cylinder head bolts with an 8 mm bi-hexagon wrench in the sequence shown in **Fig. 119**. Remove the 10 cylinder head bolts and plate washers.

NOTE:

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



G03097002

Fig. 119: Removing Cylinder Head Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. **REMOVE CYLINDER HEAD GASKIT**
32. **REMOVE OIL FILTER SUB-ASSY**
 - a. Using SST, remove the oil filter.

SST 09228-06501

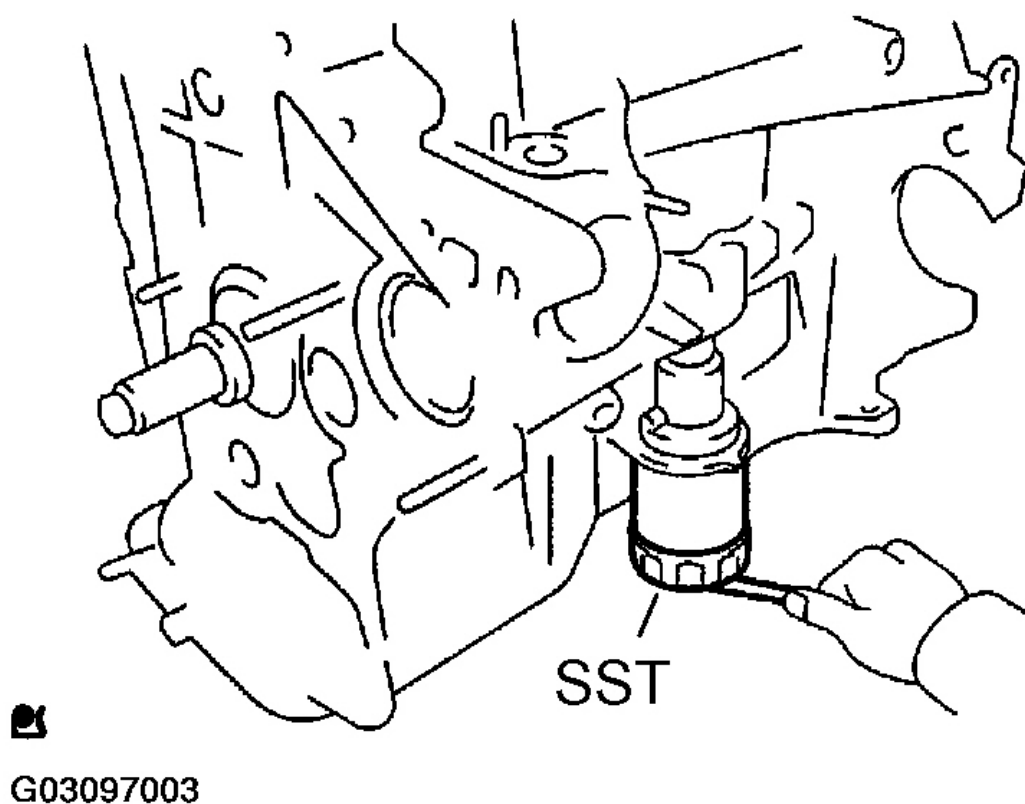


Fig. 120: Removing Oil Filter Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. REMOVE OIL FILTER UNION

- a. Using a 12 mm hexagon wrench, remove the oil filter union.

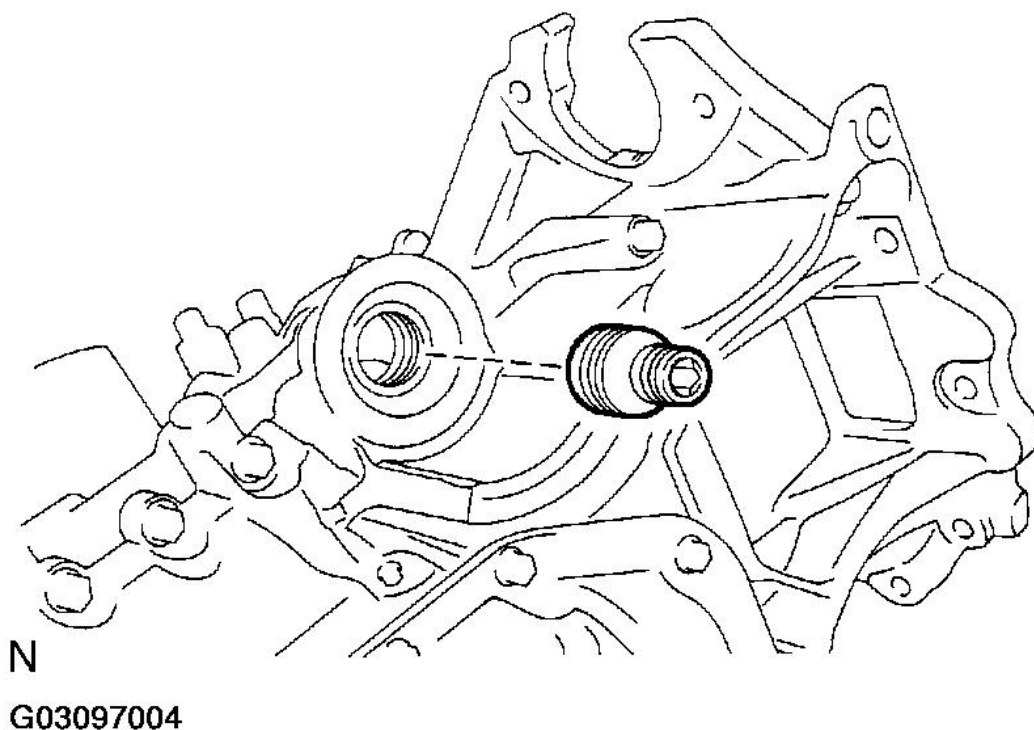


Fig. 121: Removing Oil Filter Union
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. REMOVE ENGINE REAR OIL SEAL

- a. Using a knife, cut off the oil seal lip.
- b. Using a screwdriver with the tip wrapped in tape, pry out the oil seal.

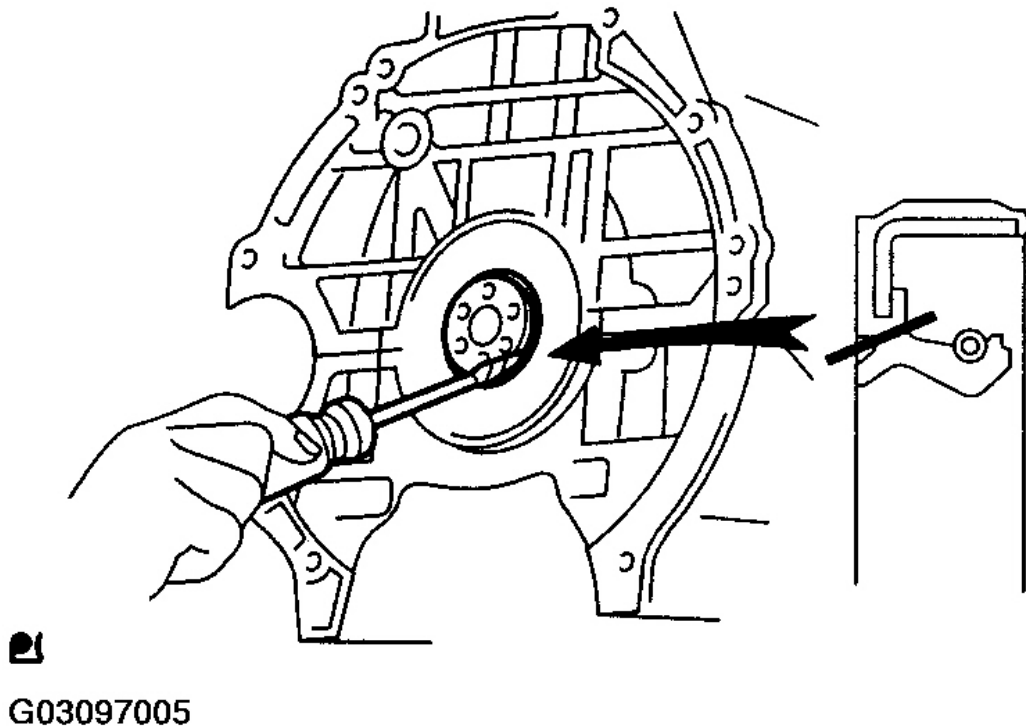


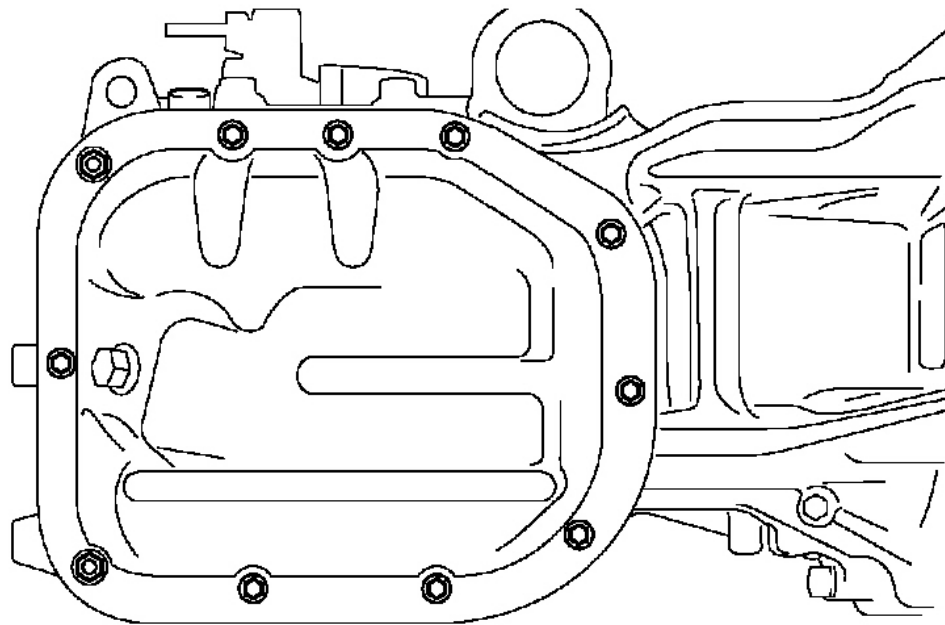
Fig. 122: Prying Out Oil Seal

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

NOTE: After removal, check if the crankshaft is not damaged. If it is damaged, smooth the surface with 400-grit sandpaper.

35. REMOVE OIL PAN SUB-ASSY NO. 2

- a. Remove the oil pan drain plug and gasket.
- b. Remove the 9 bolts and 2 nuts.

**N****G03097006****Fig. 123: Removing Bolts And Nuts****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- c. Insert the blade of SST between the oil pan No. 1 and oil pan No. 2, and cut off the applied sealer and remove the oil pan No. 2.

SST 09032-00100

NOTICE:**Be careful not to damage the oil pan No. 1 and oil pan No. 2.**

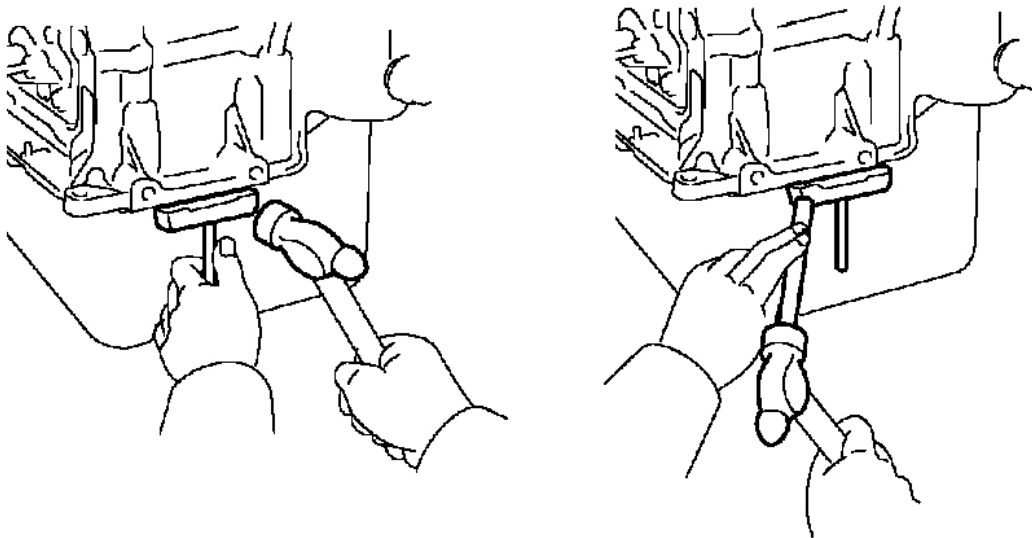
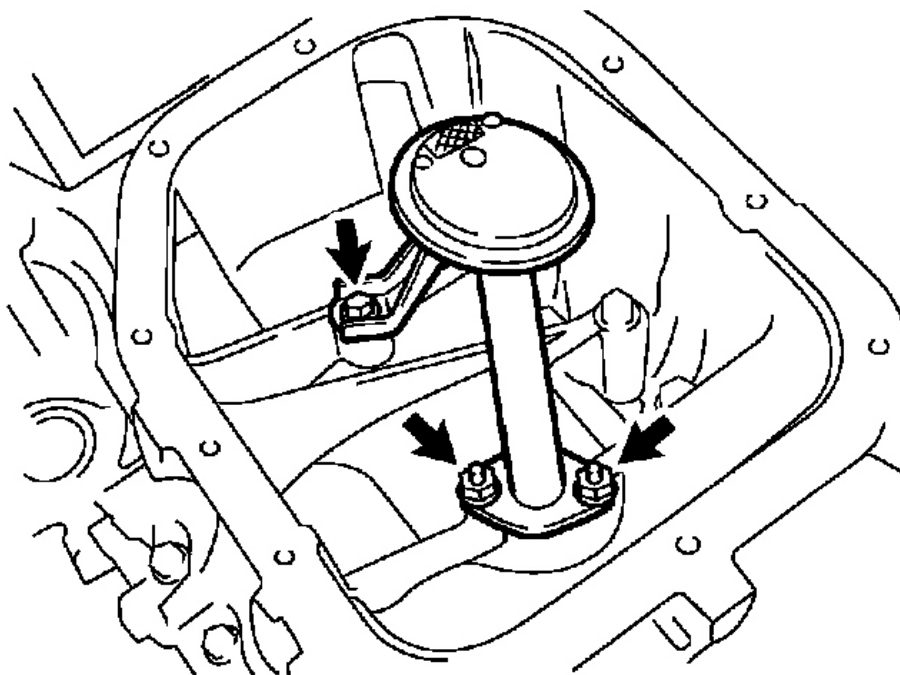
**G03097007**

Fig. 124: Cutting Off Applied Sealer And Removing Oil Pan No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. REMOVE OIL STRAINER SUB-ASSY

- a. Remove the bolt and 2 nuts.



N

G03097008

Fig. 125: Removing Bolts And Nuts

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

- b. Remove the oil strainer and gasket.
37. **REMOVE OIL PAN SUB-ASSY**
- a. Loosen and remove the 13 bolts uniformly in several steps.

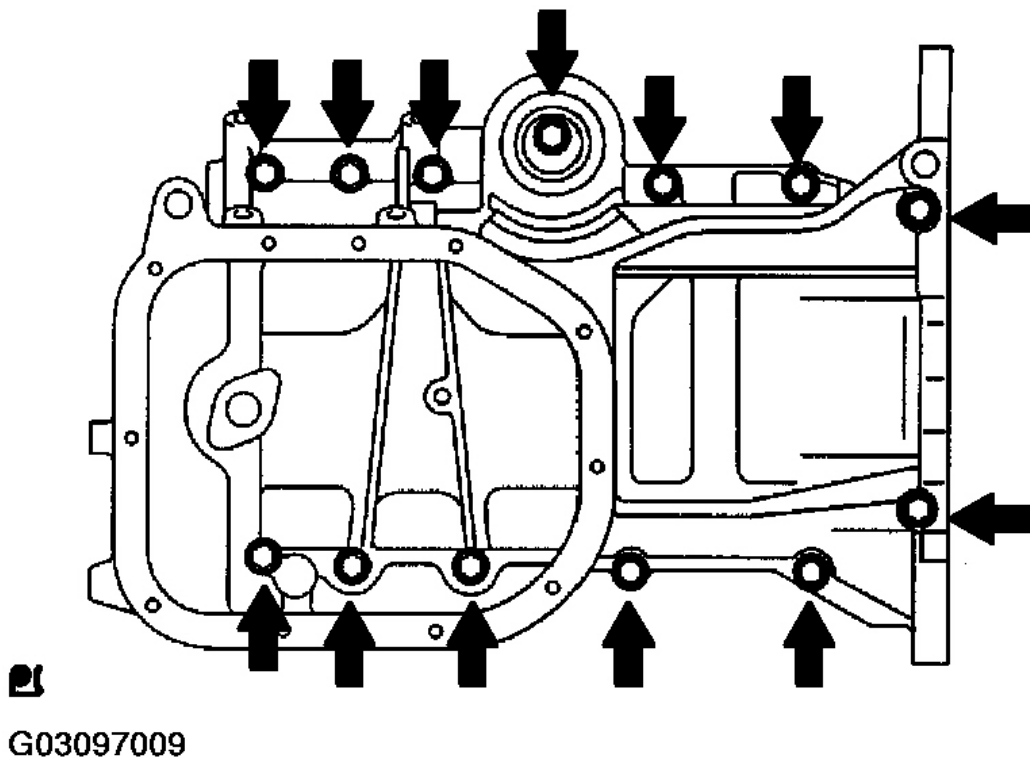


Fig. 126: Removing Bolts Uniformly In Several Steps

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

- b. Using a screwdriver, remove the oil pan No. 1 by prying between the cylinder block and oil pan No. 1.

NOTE: Be careful not to damage the contact surfaces of the oil pan No. 1 and cylinder block.

- c. Remove the 2 O-rings from the cylinder block.
- d. Remove the 4 stud bolts.

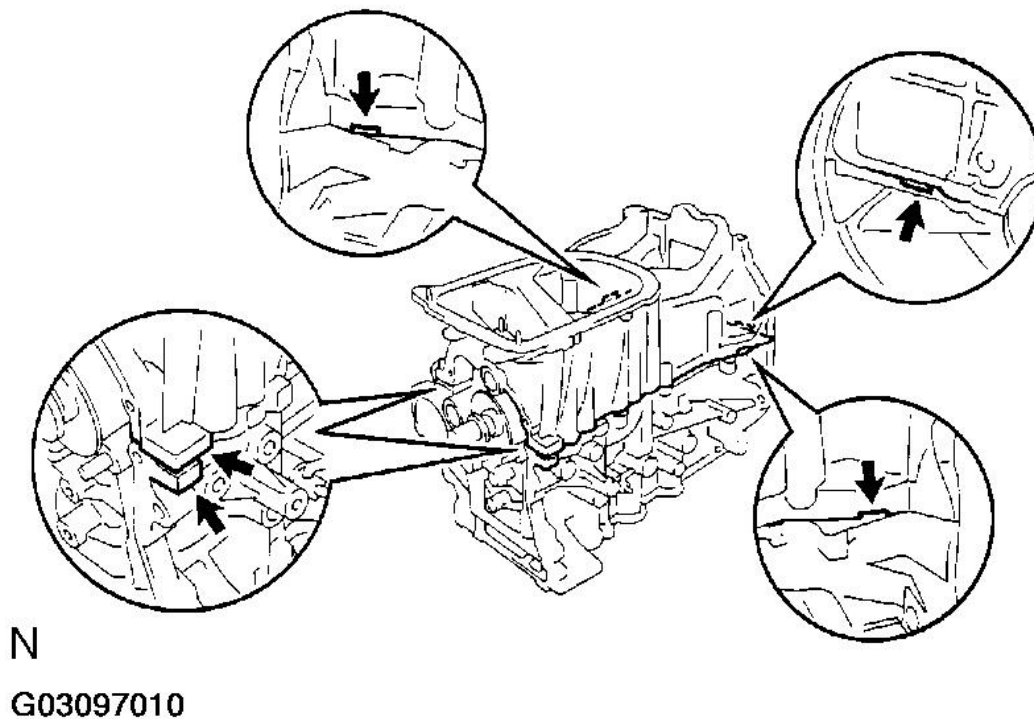
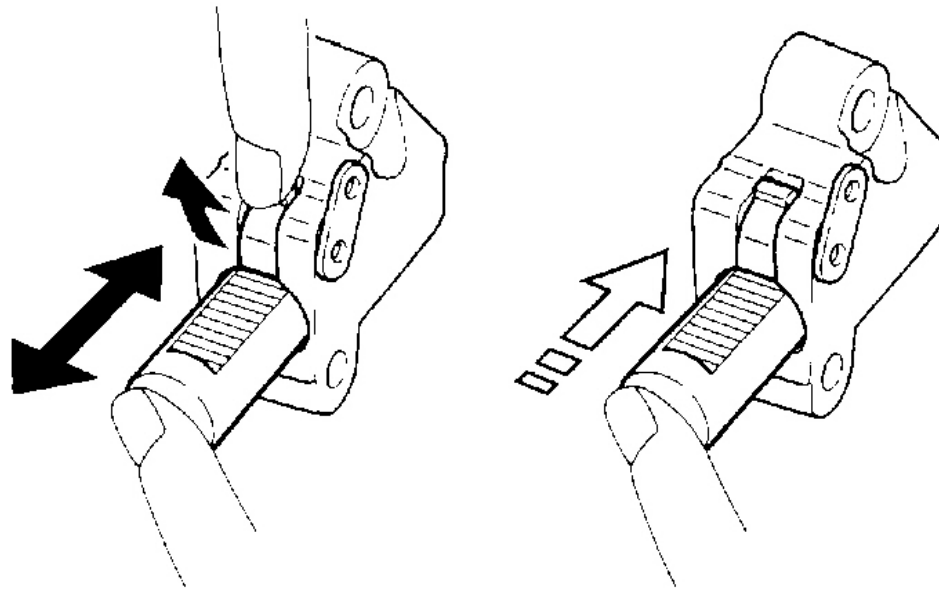


Fig. 127: Removing Stud Bolts

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

38. INSPECT CHAIN TENSIONER ASSY NO. 1

- a. Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.
- b. Release the ratchet pawl and check that the plunger is locked in place by the ratchet pawl and does not move when pushing with your finger.



N

G03097011

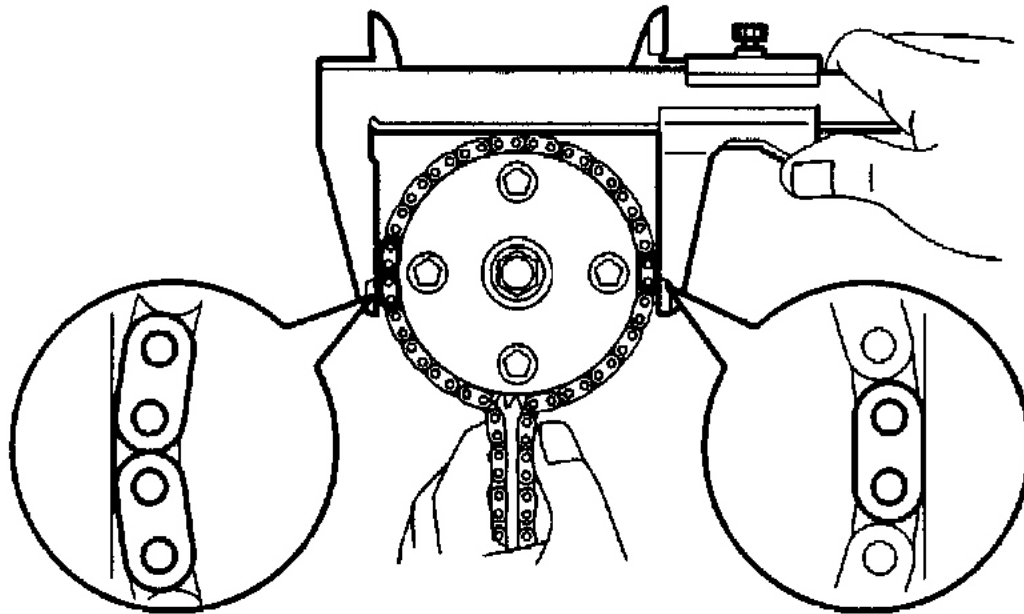
Fig. 128: Inspecting Chain Tensioner Assy No. 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. INSPECT CAMSHAFT TIMING GEAR ASSY

- a. Wrap the chain around the timing sprocket.
- b. Using vernier calipers, measure a diameter of the timing gear with the chain wrapped.

Minimum gear diameter (w/chain):

96.2 mm (3.787 in.)



G03097012

Fig. 129: Measuring Diameter Of Timing Gear With Chain Wrapped
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the diameter is less than minimum, replace the sprocket.

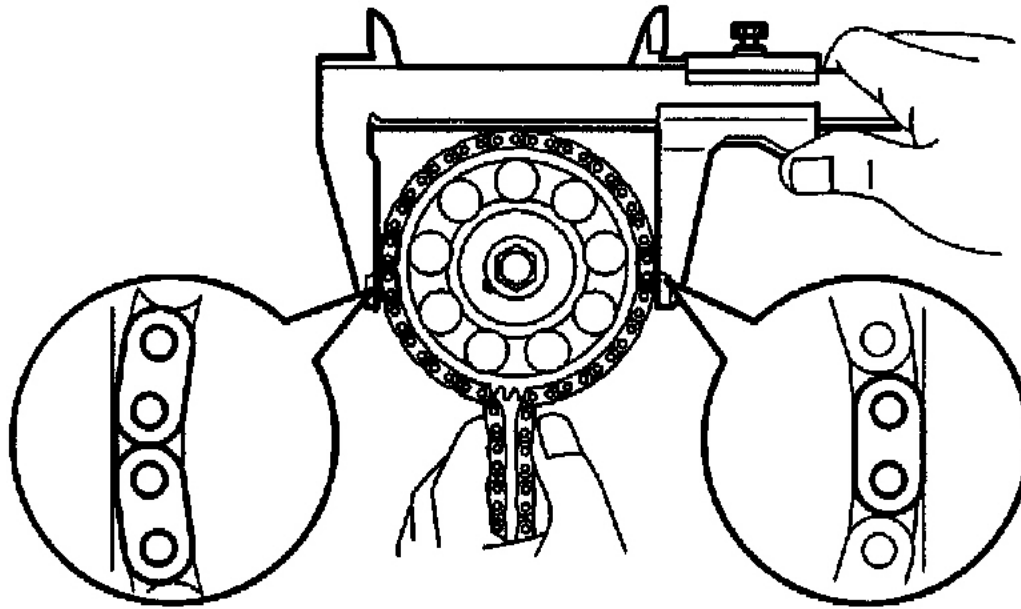
NOTE: Vernier calipers must come into contact with the chain link for measuring.

40. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

- a. Wrap the chain around the timing sprocket.
- b. Using vernier calipers, measure the diameter of the timing gear with the chain wrapped.

Minimum gear diameter (w/chain):

96.2 mm (3.787 in.)



G03097013

Fig. 130: Measuring Diameter Of Timing Gear With Chain Wrapped
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

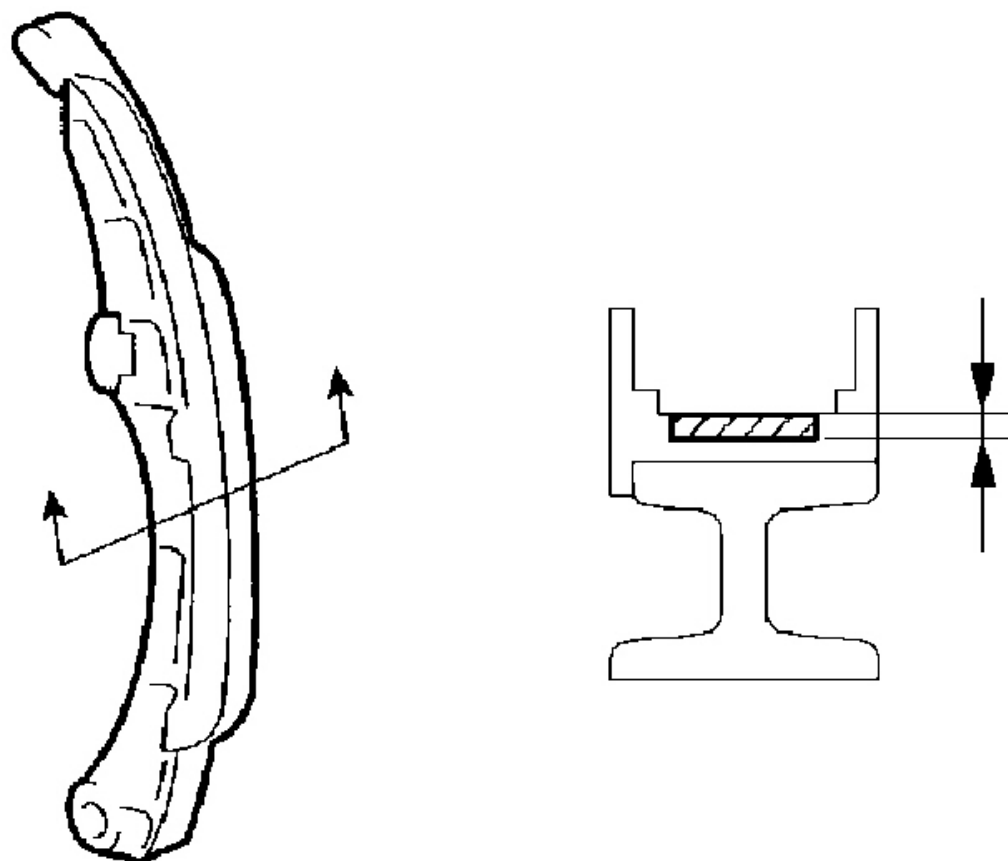
If the diameter is less than minimum, replace the sprocket.

NOTE: Vernier calipers must come into contact with the chain link for measuring.

41. INSPECT CHAIN TENSIONER SLIPPER

- a. Measure the chain tensioner slipper wear.

Maximum wear: 1.0 mm (0.039 in.)



G03097014

Fig. 131: Measuring Chain Tensioner Slipper Wear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the wear is greater than maximum, replace the slipper.

42. INSPECT CHAIN VIBRATION DAMPER NO. 1

- a. Measure the vibration damper wear.

Maximum wear: 1.0 mm (0.039 in.)

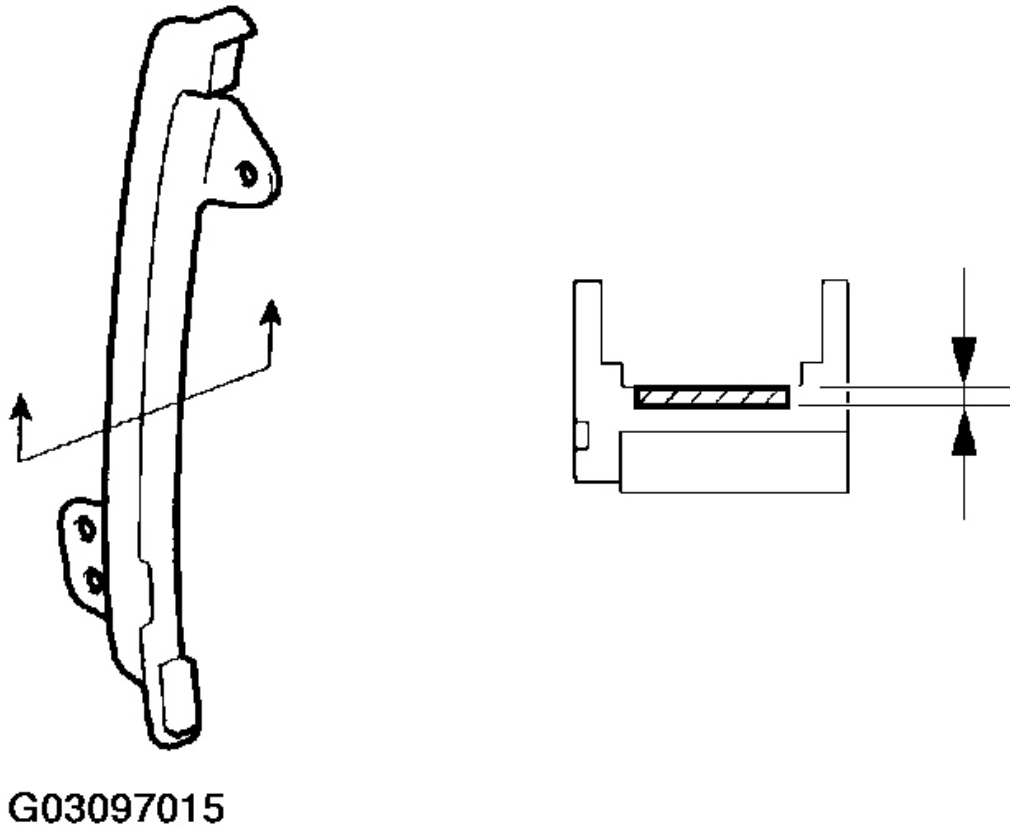


Fig. 132: Measuring Vibration Damper Wear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the wear is greater than maximum, replace the damper.

43. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the length of head bolts from the seat to the end.

Standard bolt length:

142.8 to 144.2 mm (5.622 to 5.677 in.)

Maximum bolt length: 147.1 mm (5.791 in.)

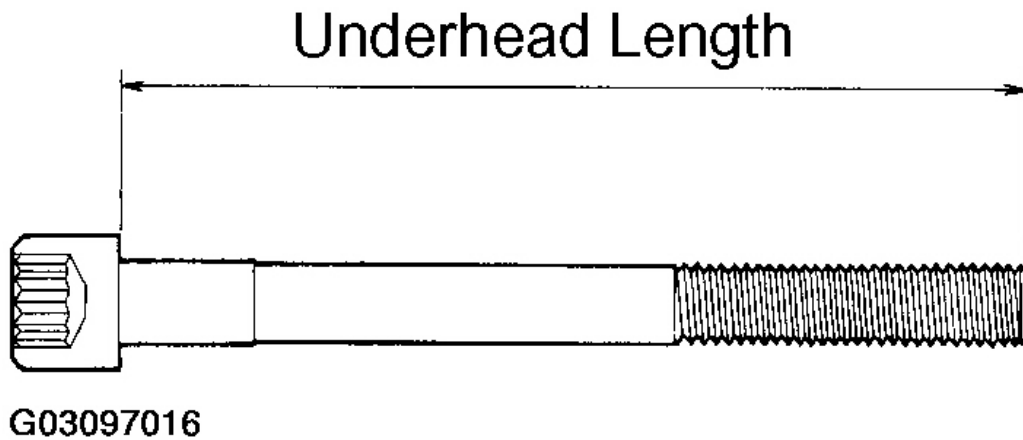


Fig. 133: Measuring Length Of Head Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the length exceeds the maximum, replace the bolt.

44. INSTALL OIL PAN SUB-ASSY

- a. Using a torx socket wrench E5, install the 4 stud bolts.

Torque: 5.0 N.m (50 kgf.cm, 44 in.lbf)

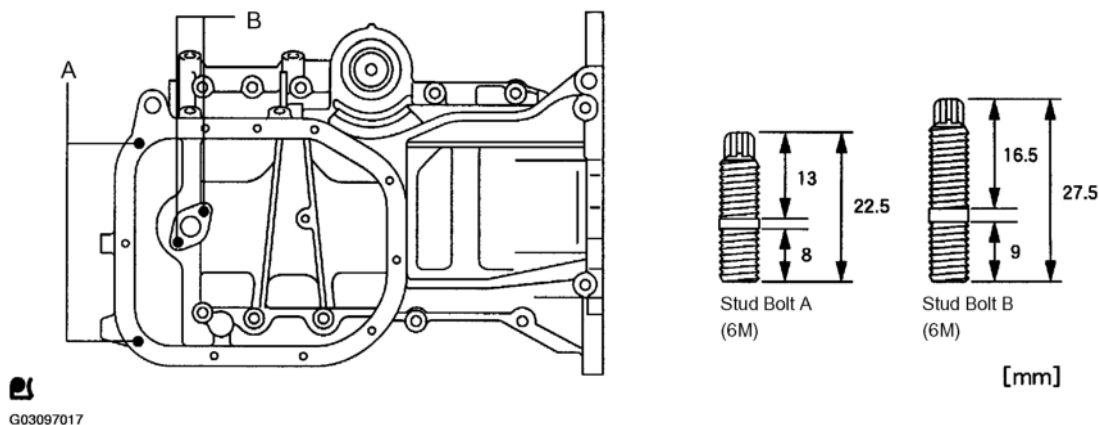


Fig. 134: Installing Stud Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove any old packing material from the contact surface.
- c. Apply a continuous bead of seal packing (Diameter 2.0 mm to 3.0 mm (0.079 to 0.118 in.)) to the

oil pan mating surface as shown in **Fig. 135**.

Seal packing:

Part No. 08826-00080 or equivalent

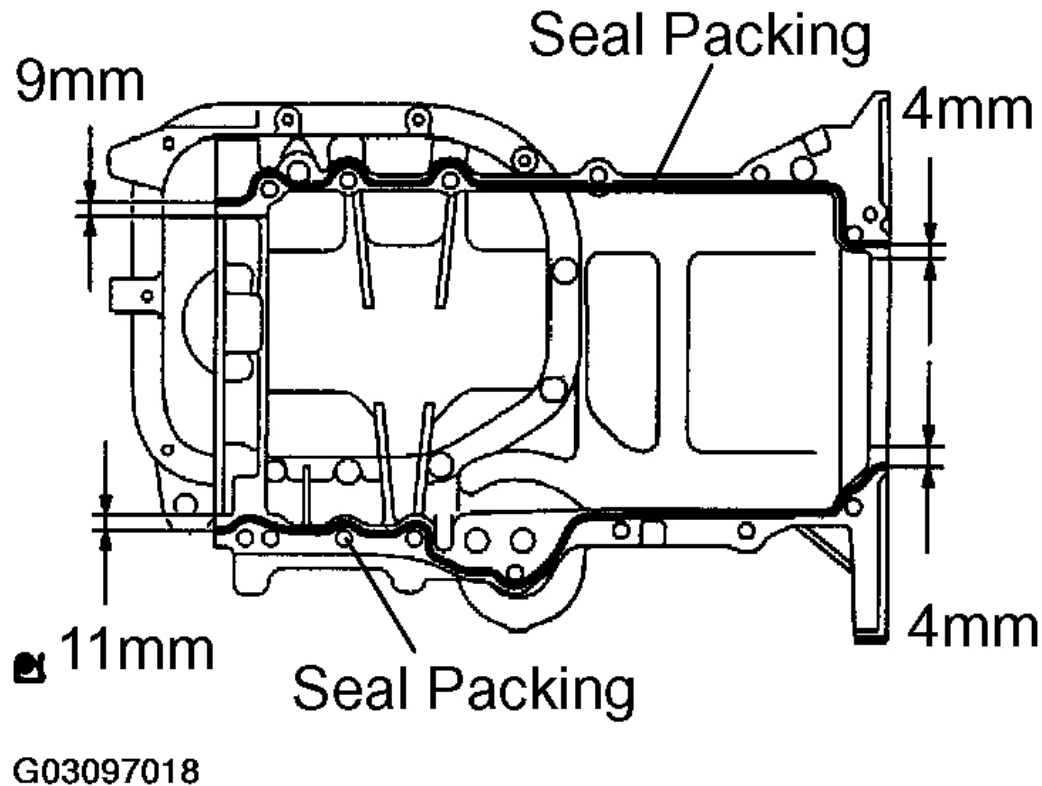


Fig. 135: Applying Continuous Bead Of Seal Packing To Oil Pan Mating Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying the seal packing.
- Do not expose the seal to engine oil for at least 2 hours after installation.

- d. Install 2 new O-rings onto the cylinder block.
- e. Using several steps, install and uniformly tighten the 13 bolts in the sequence shown in **Fig. 136**.

Torque: 24 N.m (245 kgf.cm, 18 ft.lbf)

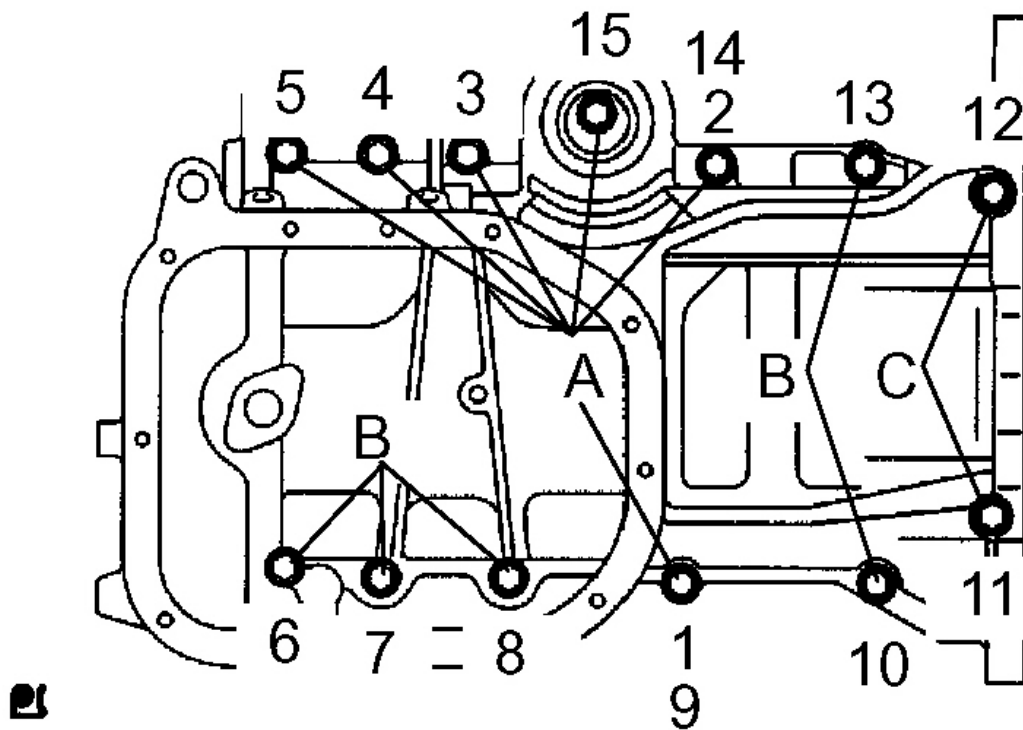
HINT:

Each bolt length as follows.

Bolt A: 49 mm (1.93 in.)

Bolt B: 88 mm (3.47 in.)

Bolt C: 144 mm (5.67 in.)



G03097019

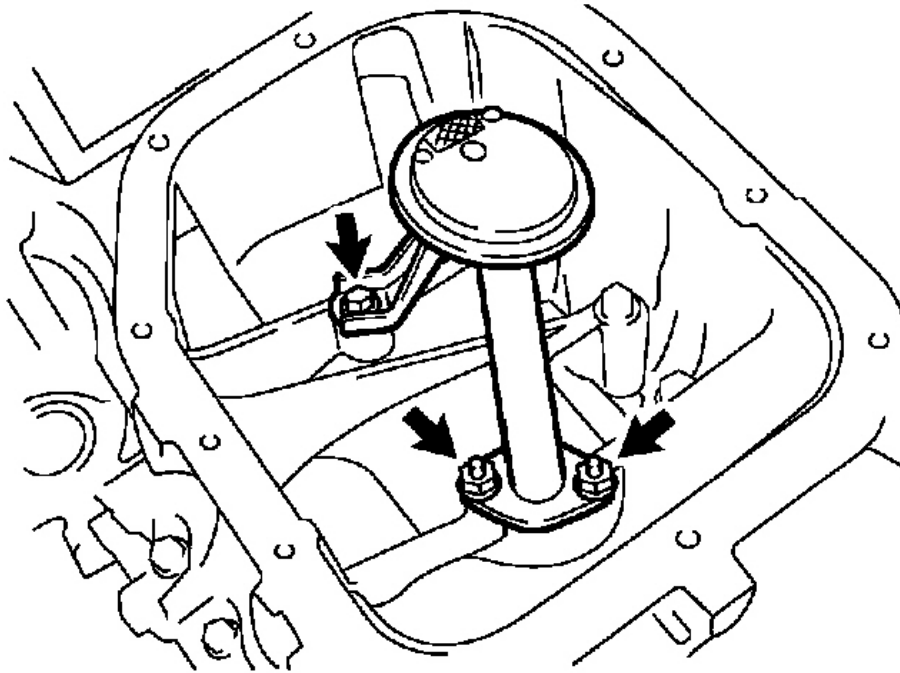
Fig. 136: Tightening Bolts In Sequence

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

45. INSTALL OIL STRAINER SUB-ASSY

- a. Install a new gasket and the oil strainer with the 2 nuts and bolt.

Torque: 11 N.m (112 kgf.cm, 8.1 ft.lbf)



N

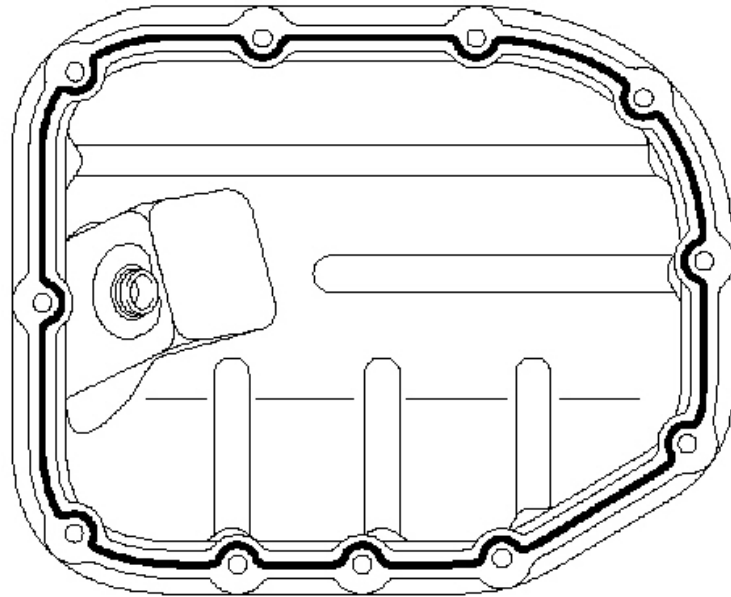
G03097020

Fig. 137: Installing New Gasket And Oil Strainer With Nuts And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. INSTALL OIL PAN SUB-ASSY NO. 2

- a. Remove any old packing material from the contact surface.
- b. Apply a continuous bead of seal packing (Diameter 2.5 to 3.5 mm (0.0984 to 0.1378 in.)) to the oil pan mating surface as shown in **Fig. 138**.

Seal packing: Part No. 08826-00080 or equivalent



N

Seal Width 2.5 to 3.5 mm

G03097021

Fig. 138: Applying Continuous Bead Of Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying the seal packing.
- Do not expose the seal to engine oil for at least 2 hours after installation.
- Do not start the engine within 2 hours of installation.

- c. Install the oil pan No. 2 with the 9 bolts and 2 nuts.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

- d. Install the drain plug with a new gasket.

Torque: 38 N.m (382 kgf.cm, 28 ft.lbf)

47. INSTALL OIL FILTER UNION

- a. Using a 12 mm hexagon wrench, install the oil filter union.

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

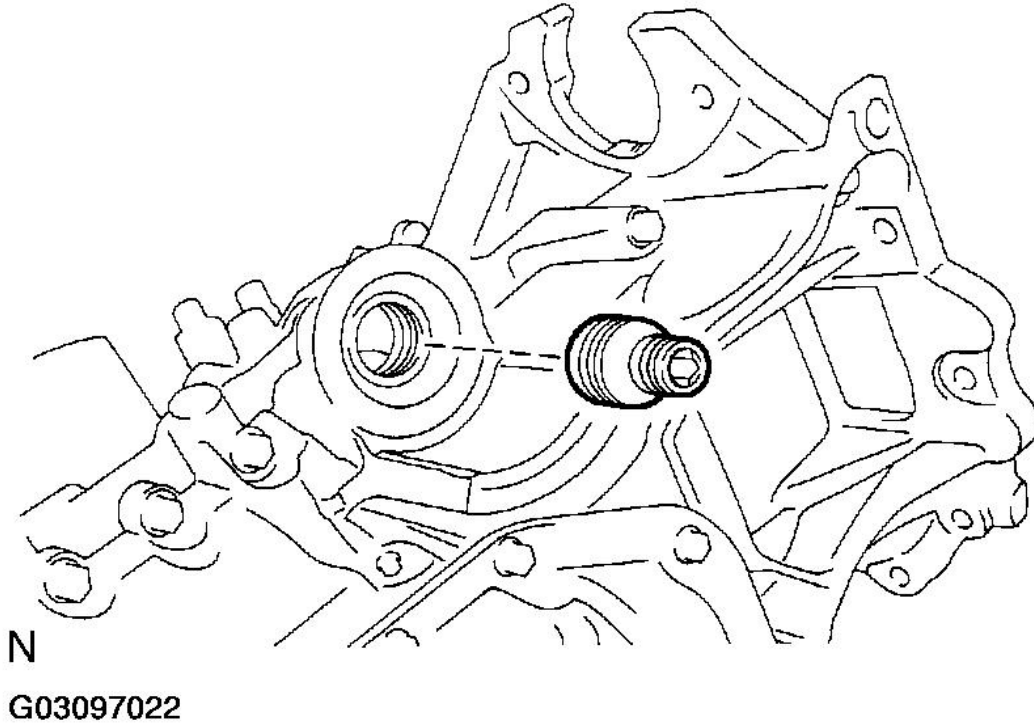


Fig. 139: Installing Oil Filter Union

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

48. INSTALL OIL FILTER SUB-ASSY

- a. Check and clean the oil filter installation surface.
- b. Apply clean engine oil to the gasket of a new oil filter.
- c. Lightly screw the oil filter into place, and tighten it until the gasket comes into contact with the seat.
- d. Using SST, tighten it an additional 3/4 turn.

SST 09228-06501

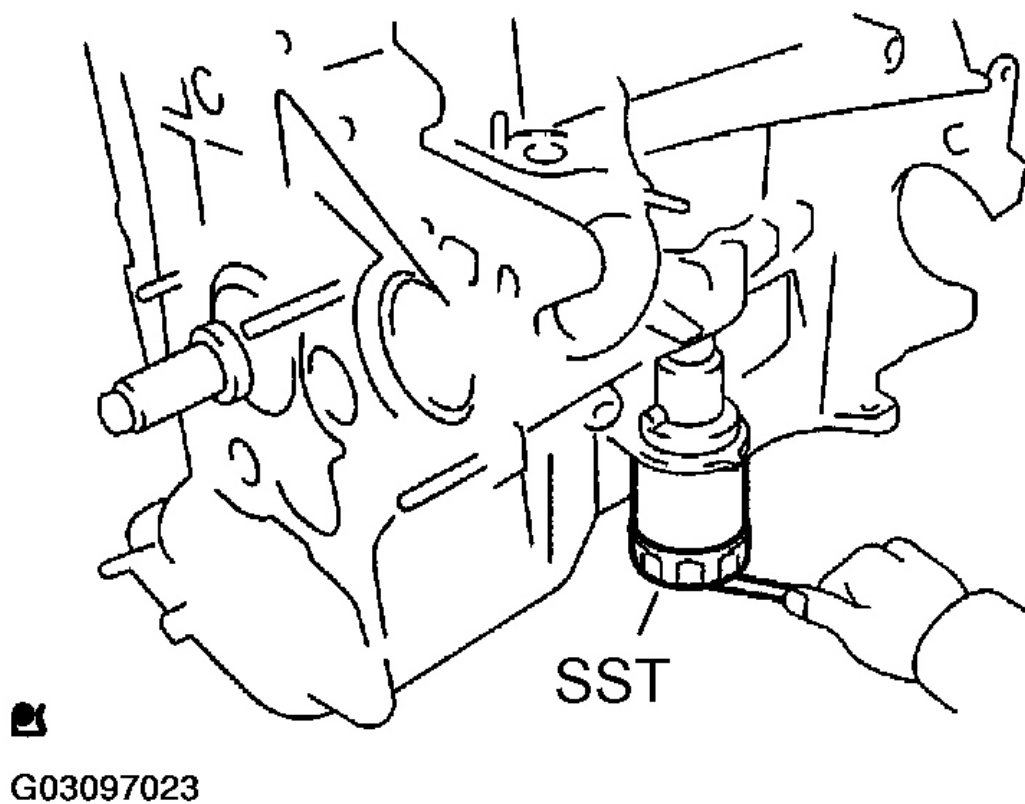


Fig. 140: Installing Oil Filter

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

49. INSTALL CYLINDER HEAD GASKET

- a. Place a new cylinder head gasket on the cylinder block with the Lot No. stamp facing upward.

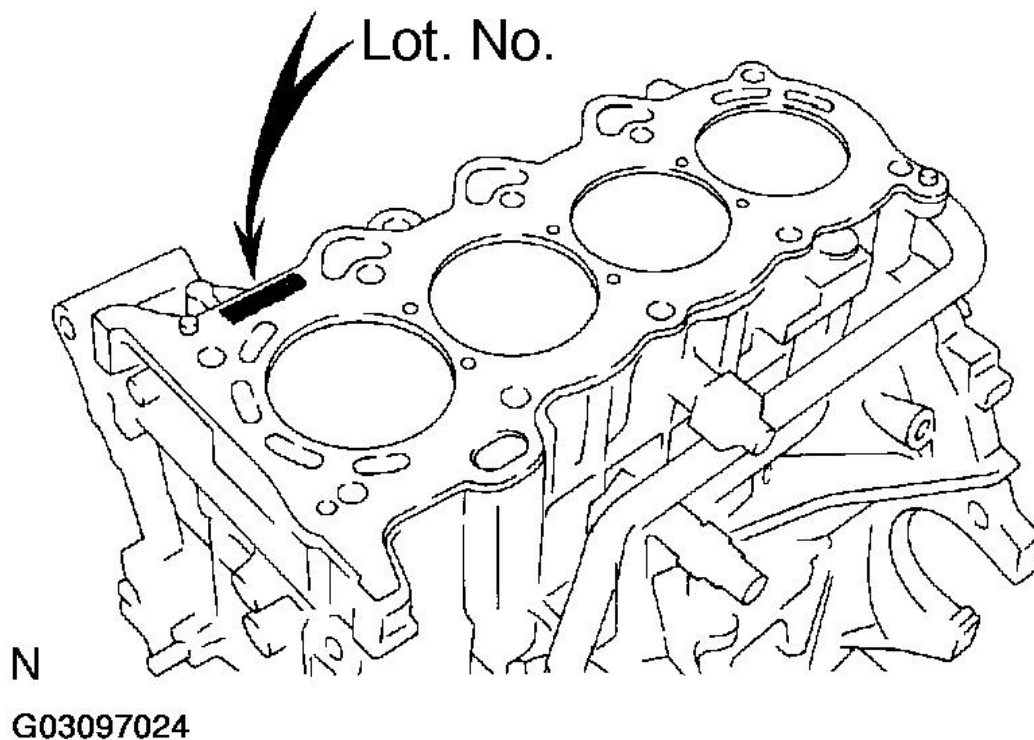


Fig. 141: Placing New Cylinder Head Gasket On Cylinder Block With Lot No. Stamp Facing Upward

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

NOTE:

- Remove any oil from the contact surface.
- Pay attention to the mounting orientation of the cylinder head gasket.
- Place the cylinder head on the cylinder head gently in order not to damage the gasket at the bottom part of the head.

50. INSTALL CYLINDER HEAD SUB-ASSY

HINT:

The cylinder head bolts are tightened in 2 successive steps.

- a. Apply a continuous bead of seal packing (Diameter 3.5 to 4.5 mm (0.138 to 0.177 in.)) as shown in **Fig. 142**.

NOTE:

- Remove any oil from the contact surface.

- Install the oil pan within 3 minutes of applying seal packing.

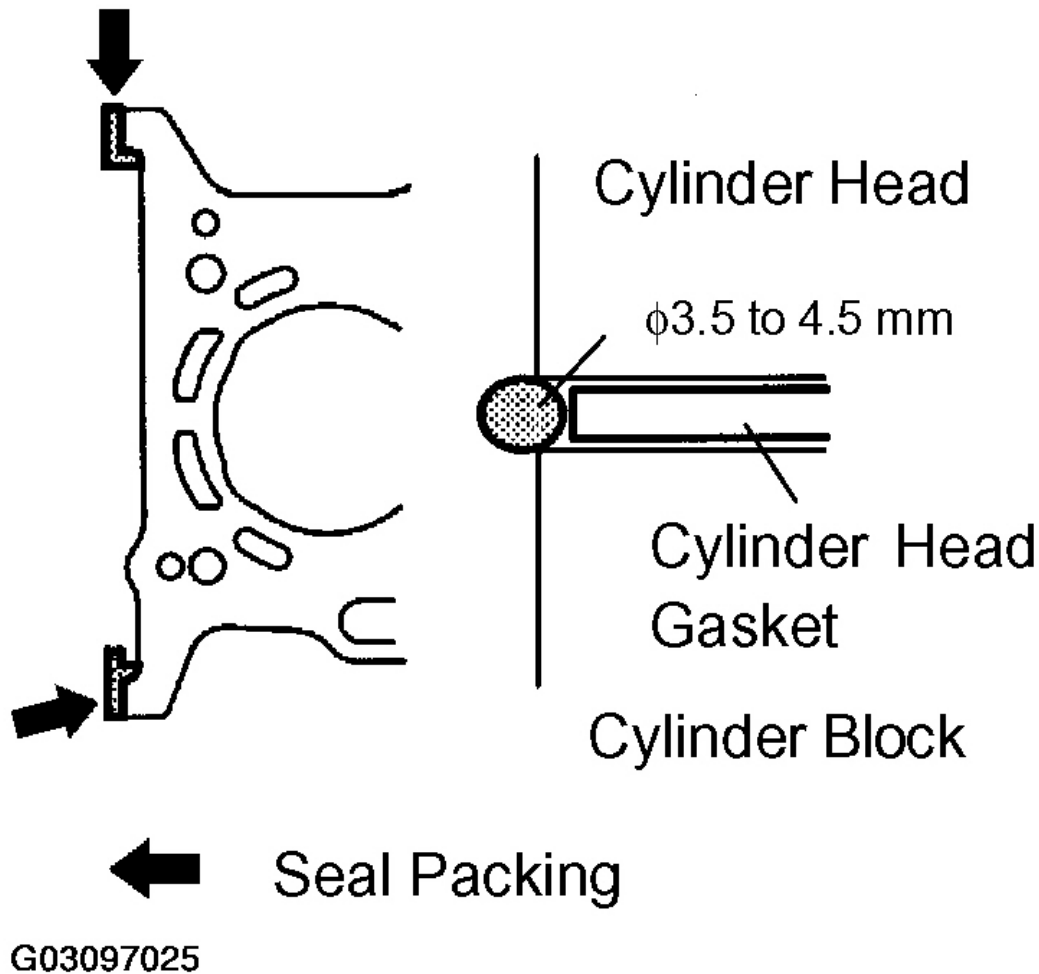
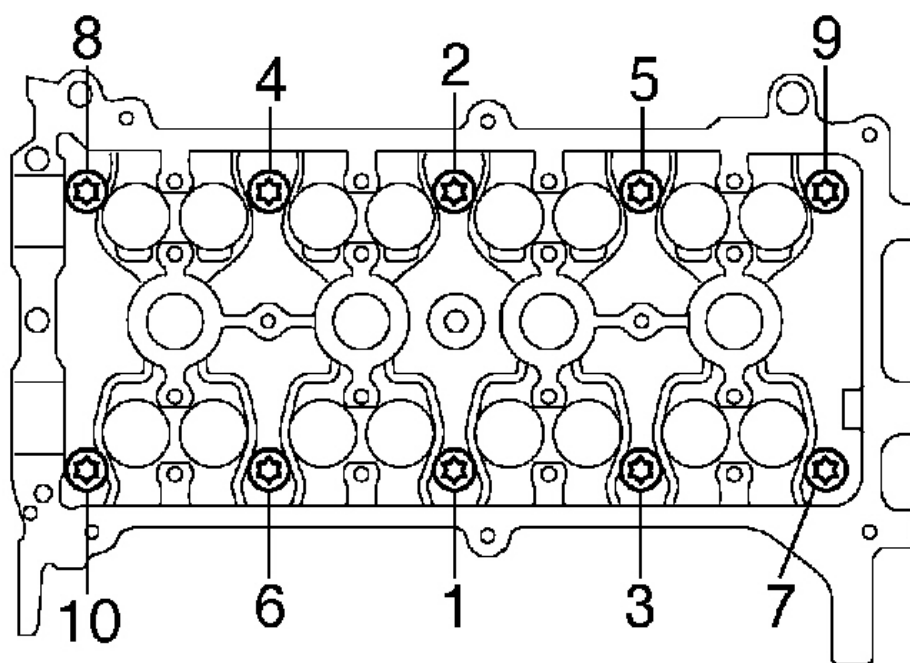


Fig. 142: Applying Continuous Bead Of Seal Packing

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

- Apply a light coat of engine oil to the threads of the cylinder head bolts.
- Using several steps, install and uniformly tighten the 10 cylinder head bolts and plate washers with an 8 mm bi-hexagon wrench in the sequence shown in **Fig. 143**.

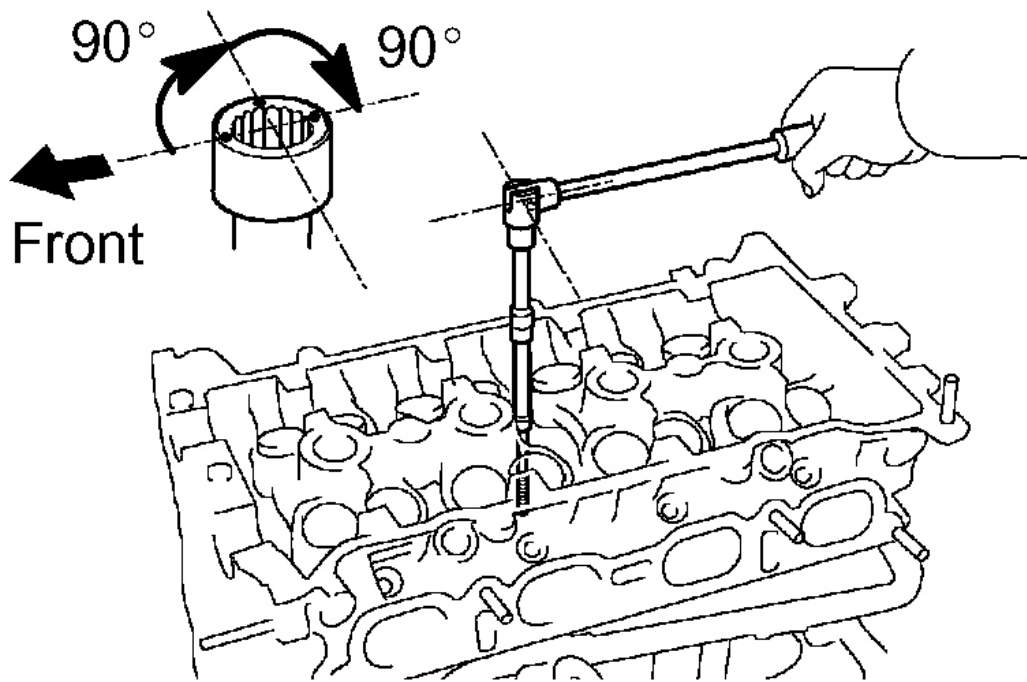
Torque: 29 N.m (300 kgf.cm, 22 ft.lbf)



G03097026

Fig. 143: Tightening Cylinder Head Bolts And Plate Washers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Mark the front of the cylinder head bolt with paint.
- e. Using the same sequence as step c, retighten the cylinder head bolts by additional 90° and one more additional 90° as shown in **Fig. 144**.



G03097027

Fig. 144: Retightening Cylinder Head Bolts By Additional 90° And One More Additional 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Check that each paint mark is now at the 180° angle to the front.

51. INSTALL ENGINE REAR OIL SEAL

- a. Apply multi-purpose grease to a new oil seal lip.

NOTE: Keep the lip free of 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.

SST 09223-56010

NOTE:

- Be careful not to tap the oil seal at an angle.
- Wipe any extra grease off the crankshaft.

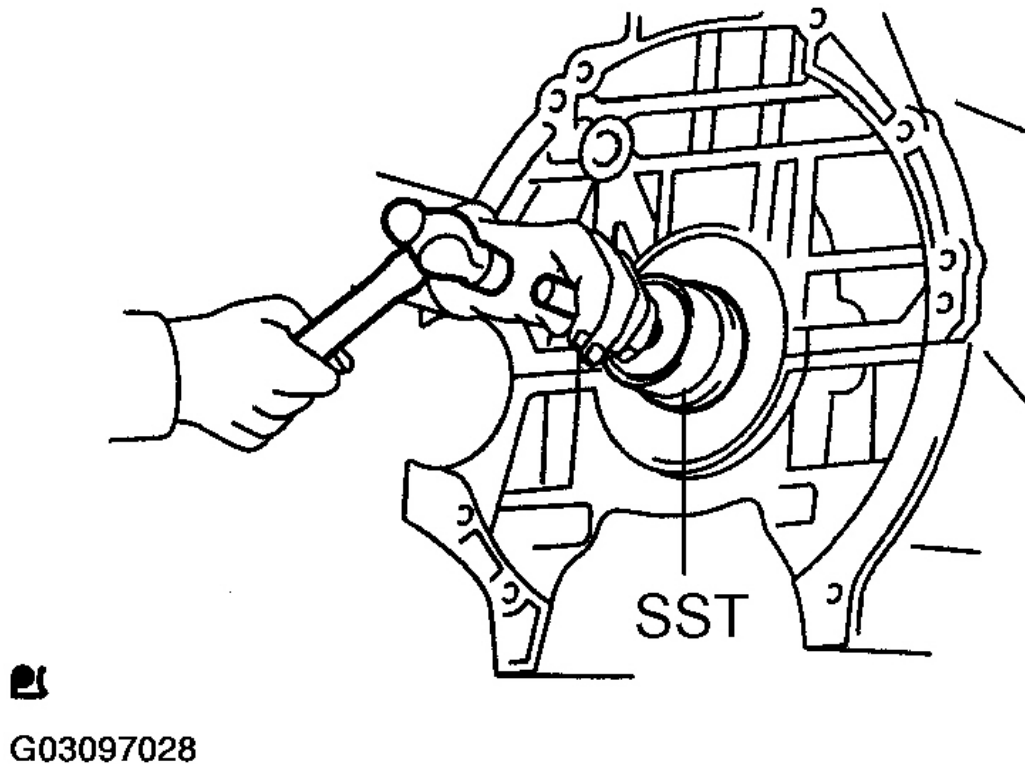


Fig. 145: Tapping In Oil Seal Until Surface Is Flush With Rear Oil Seal Retainer Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. INSTALL CAMSHAFT TIMING GEAR ASSY

- Put the camshaft timing gear assembly and camshaft together with the straight pin off the groove.
- Turn the camshaft timing gear assembly clockwise while pushing it lightly towards the camshaft. Push further at the position where the pin fits into the groove.

NOTE: Be careful not to turn the camshaft timing gear to the retard angle side (to the right).

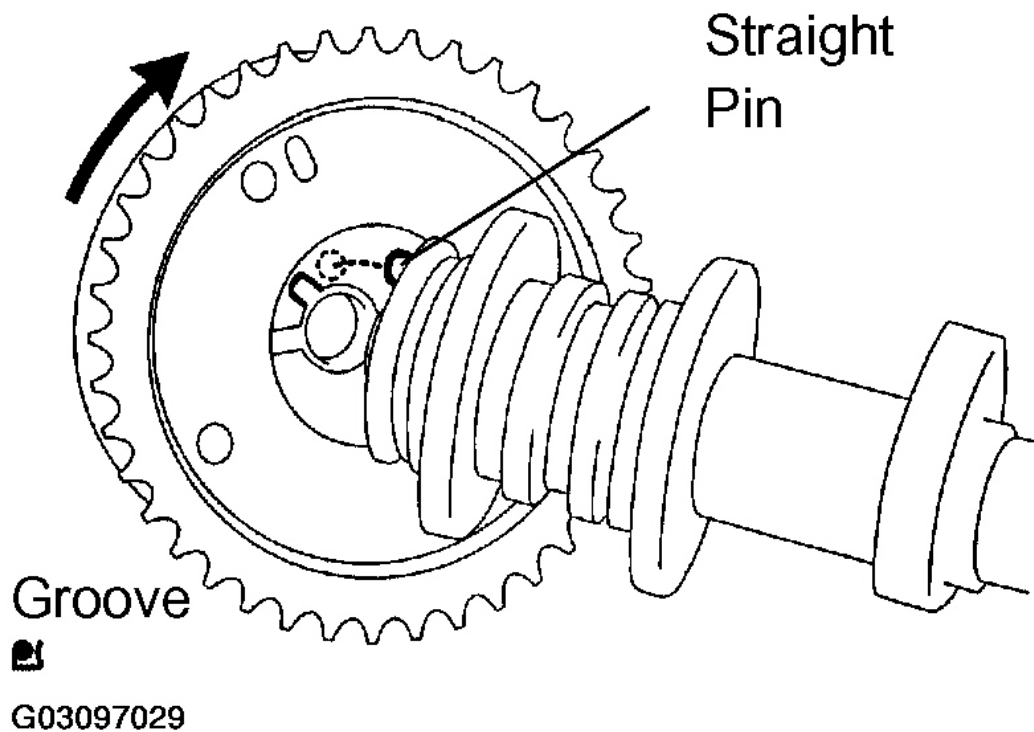


Fig. 146: Turning Camshaft Timing Gear Assembly Clockwise While Pushing It Lightly Towards Camshaft

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

- c. Check that there is no clearance between the gear fringe and camshaft.
- d. Tighten the fringe bolt with the camshaft timing gear fixed.

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

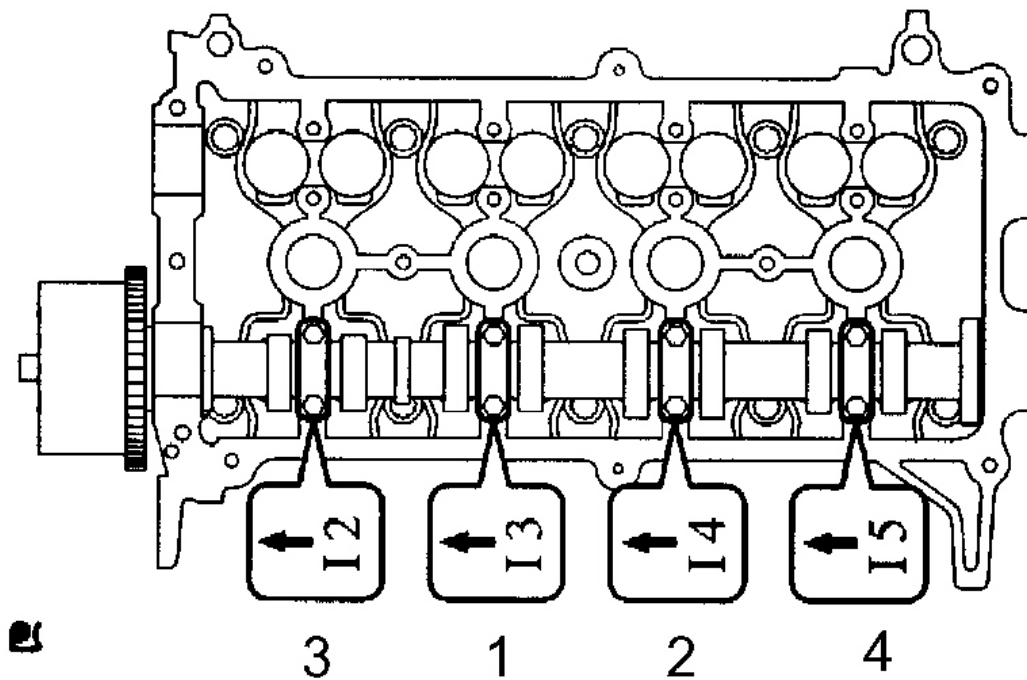
- e. Check that the camshaft timing gear assembly can move to the retard angle (to the right) and is locked in the most retarded position.

53. INSTALL CAMSHAFT

- a. Apply a light coat of engine oil to the camshaft journals.
- b. Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.
- c. Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 147**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: Tighten each bolt uniformly keeping the camshaft level.



G03097030

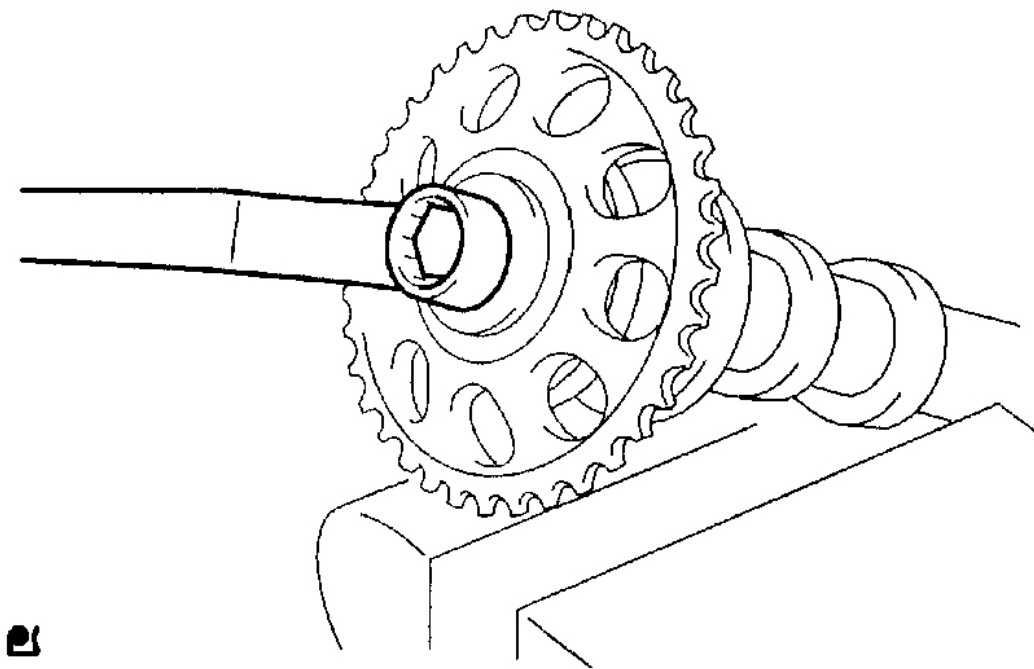
Fig. 147: Tightening Bolts In Sequence

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

54. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET

- Clamp the camshaft in a vise.
- Align the knock pin hole of the camshaft timing sprocket with the knock pin of the camshaft, and install the camshaft timing sprocket.

Torque: 64 N.m (653 kgf.cm, 47 ft.lbf)**NOTE: Be careful not to damage the camshaft.**



G03097031

Fig. 148: Installing Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. INSTALL NO. 2 CAMSHAFT

- Apply a light coat of engine oil to the camshaft journals.
- Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.
- Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 149**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: Tighten each bolt uniformly keeping the camshaft level.

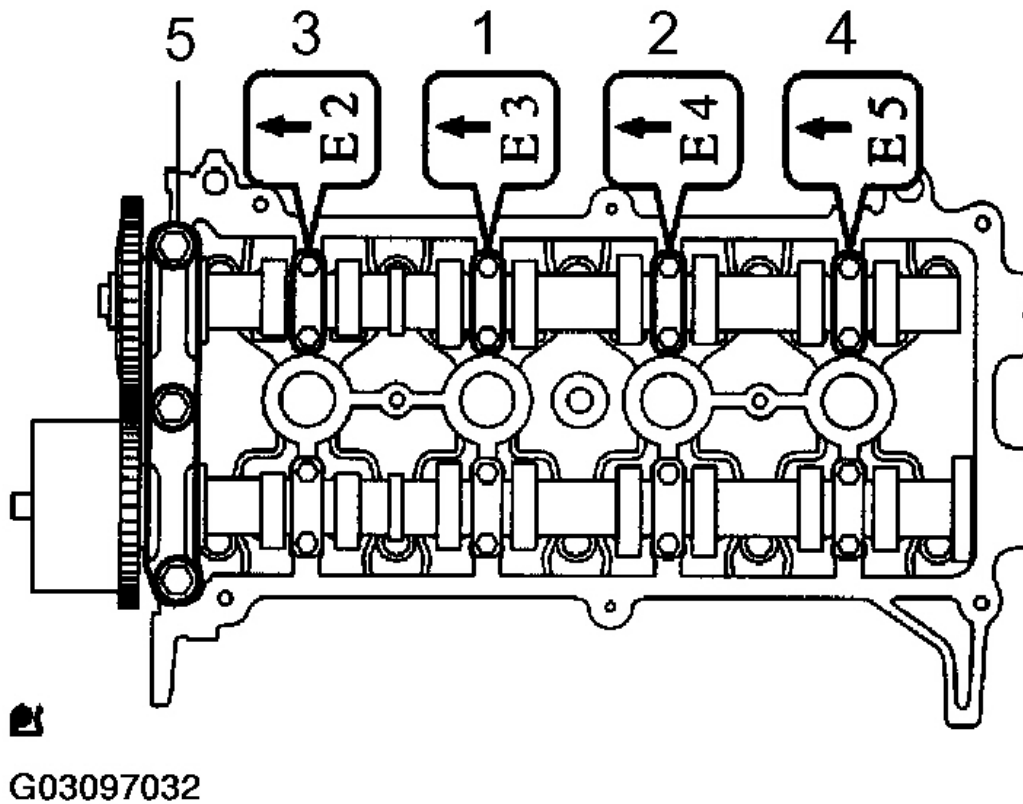


Fig. 149: Tightening Bolts In Sequence

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

- d. Install the bearing cap No. 1.

Torque: 23 N.m (235 kgf.cm, 17 ft.lbf)

56. INSTALL CAMSHAFT POSITION SENSOR

- a. Apply engine oil to the O-ring.

NOTE: If the O-ring is damaged, replace the camshaft position sensor.

- b. Install the camshaft position sensor with the bolt.

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

57. INSTALL CHAIN SUB-ASSY

- a. After setting the crankshaft at ATDC 40 to 140°, set cams of intake and exhaust timing sprockets at

ATDC 20° and then reset the crankshaft at ATDC 20°.

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

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

- c. Align the matchmarks of the camshaft timing sprocket, camshaft timing gear and crankshaft timing sprocket with each mark plate (colored in yellow) of the timing chain.

HINT:

To prevent the exhaust camshaft from springing back, turn it using a wrench and set it at the mark on the chain.

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

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

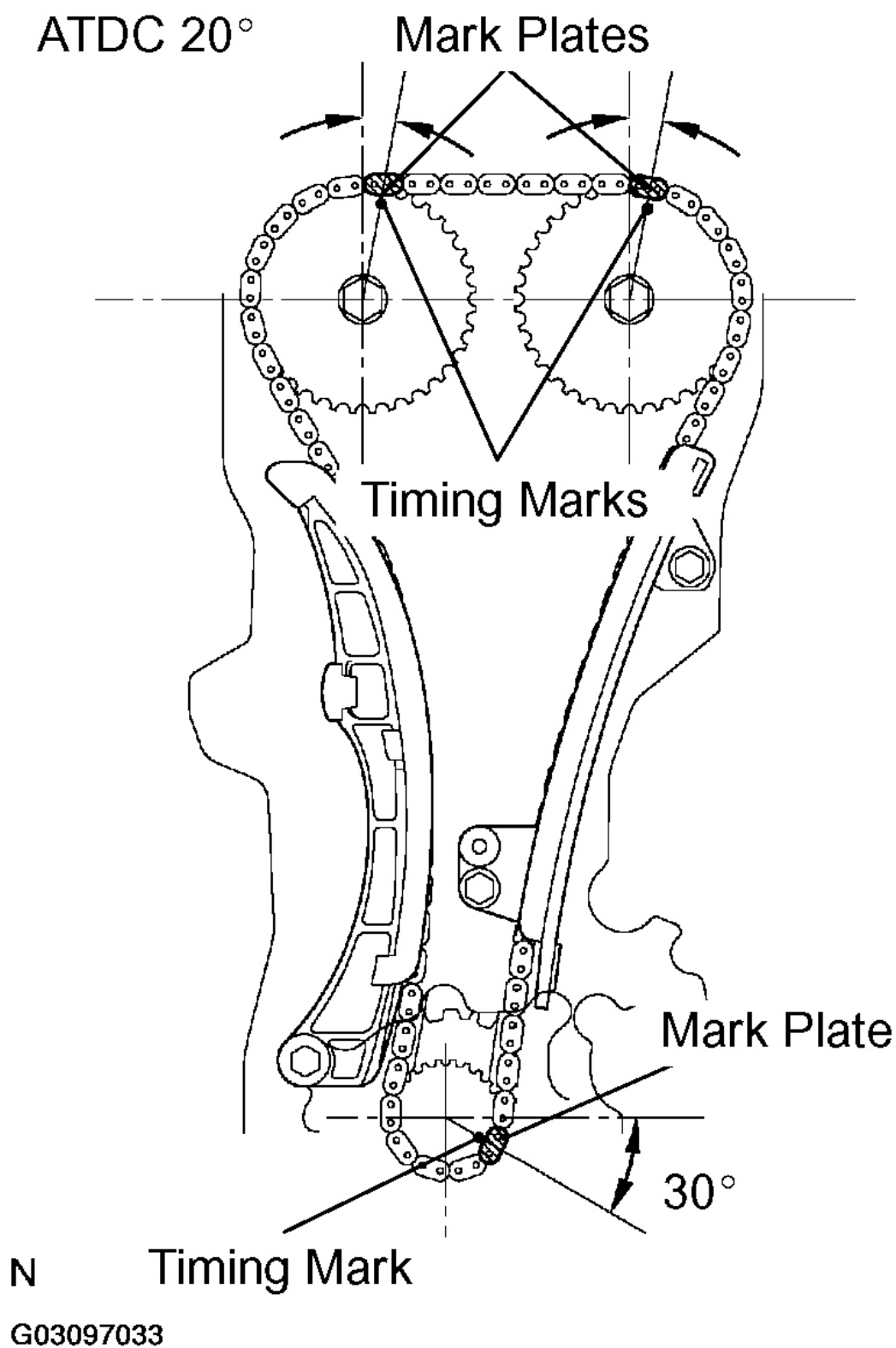
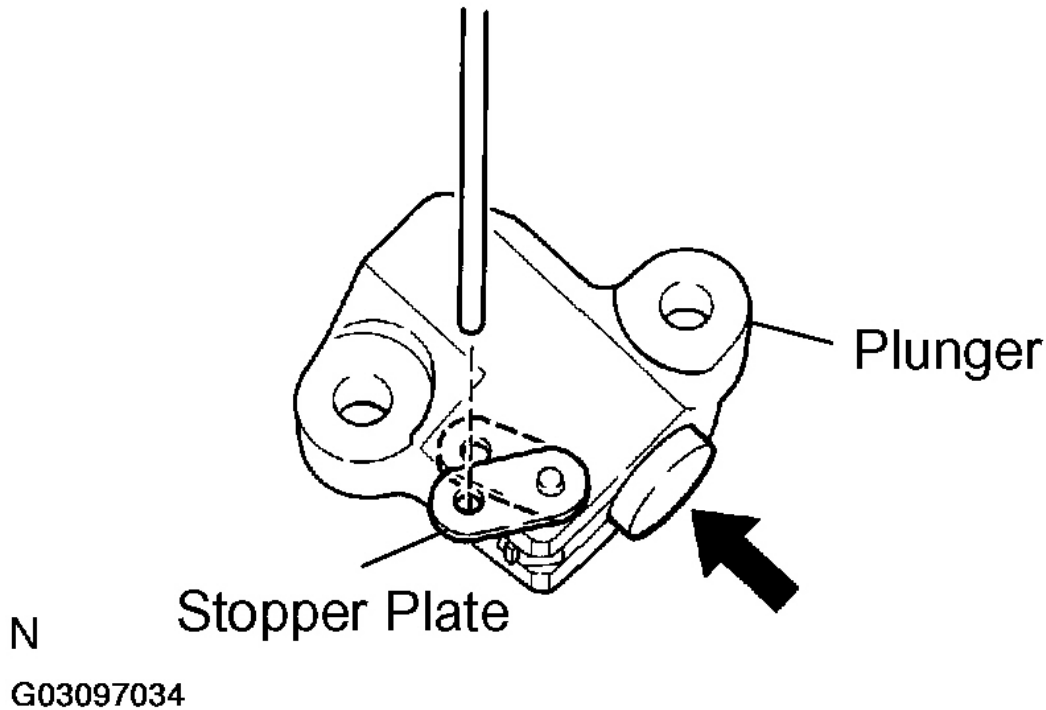


Fig. 150: Installing Chain Sub-Assy

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

- e. Rotate the stopper plate of the chain tensioner upward as shown in **Fig. 151**, push in the plunger of the tensioner.

**Fig. 151: Rotating Stopper Plate Of Chain Tensioner Upward**

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

- f. Rotate the stopper plate of the tensioner downward, insert a 2.5 mm (0.098 in.) diameter bar into the holes of the stopper plate and tensioner to hold the stopper plate.
- g. Install the chain tensioner with the 2 bolts.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

- h. Remove the bar from the chain tensioner.
- i. Check the tension between the intake and exhaust camshaft timing sprockets.

58. INSTALL OIL PUMP SEAL

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

SST 09950-60010 (09951-00250, 09951-00380, 09952-06010), 09950-70010 (09951-07100)

NOTE:

- Be careful not to tap the oil seal at an angle.
- Keep the lip free of foreign objects.

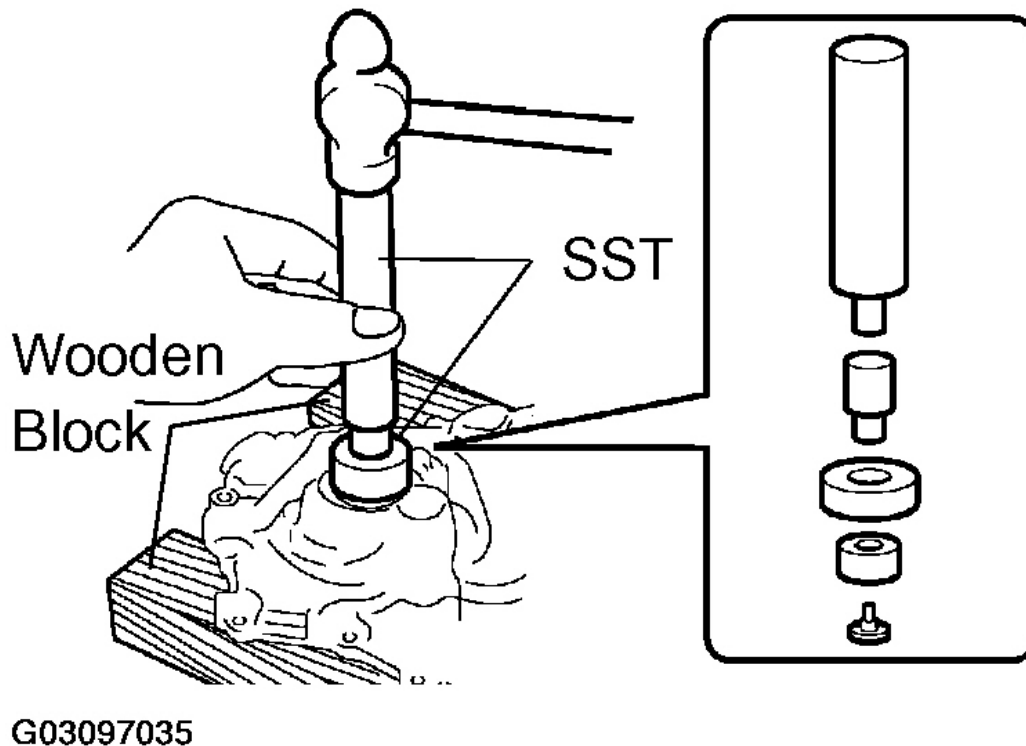
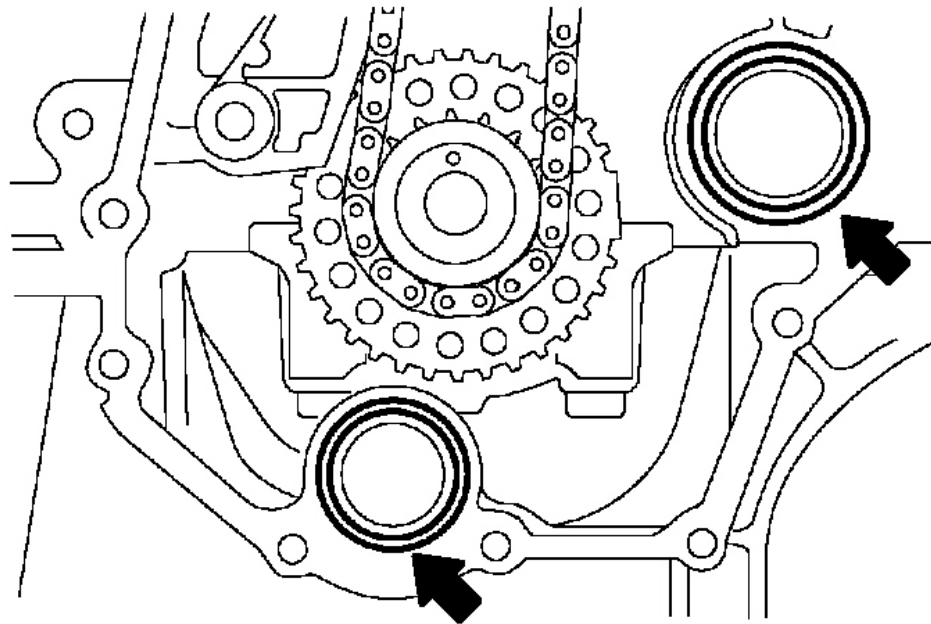


Fig. 152: Tapping In New Oil Seal Until Surface Is Flush With Timing Chain Cover Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply multi-purpose grease to the oil seal lip.

59. INSTALL OIL PUMP ASSY

- a. Install 2 new O-rings onto the 2 locations as shown in **Fig. 153**.



G03097036

Fig. 153: Installing New O-Rings

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

- b. Remove any old packing material from the contact surface.
- c. Apply seal packing to the oil pump assembly, cylinder head and cylinder block as shown in **Fig. 154**.

Seal packing:**Water pump part: part No. 08826 - 00100 or equivalent****Other part: part No. 08826 - 00080 or equivalent****NOTE:**

- Remove any oil from the contact surface.
- Install the oil pump within 3 minutes of applying the seal packing.
- Do not expose the seal to engine oil for at least 2 hours after installation.
- Do not start the engine for at least 2 hours after installation.

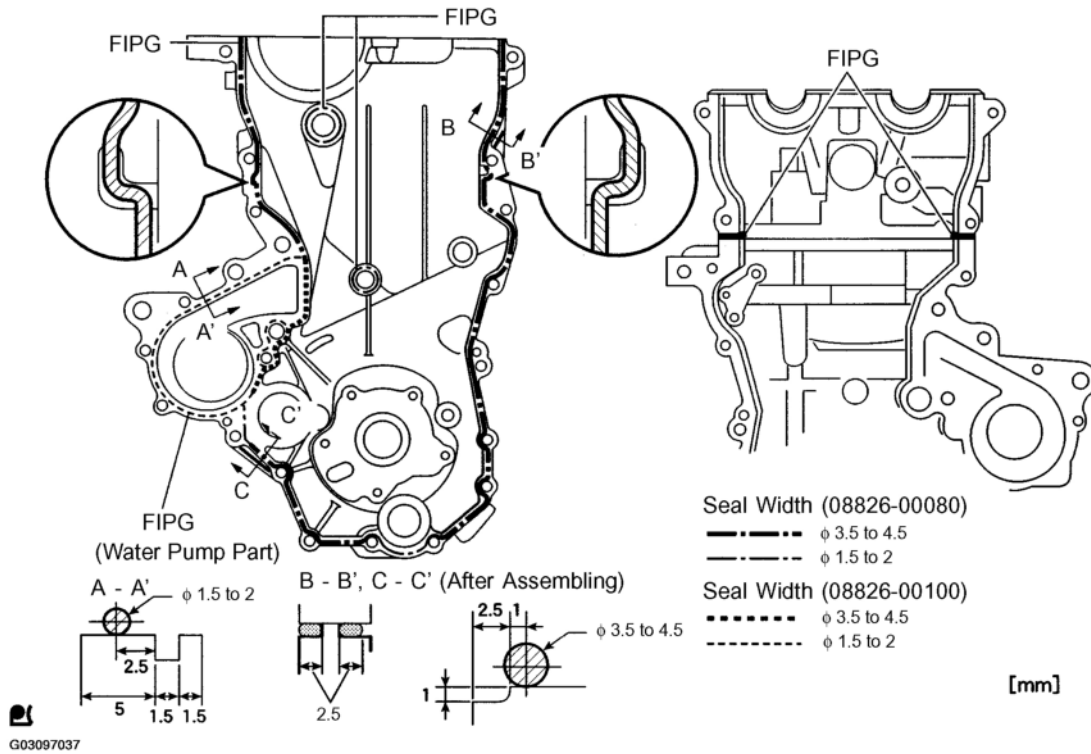


Fig. 154: Applying Seal Packing To Oil Pump Assembly, Cylinder Head And Cylinder Block
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the keyway of the oil pump drive rotor with the rectangular portion of the crankshaft, and slide the oil pump into place.

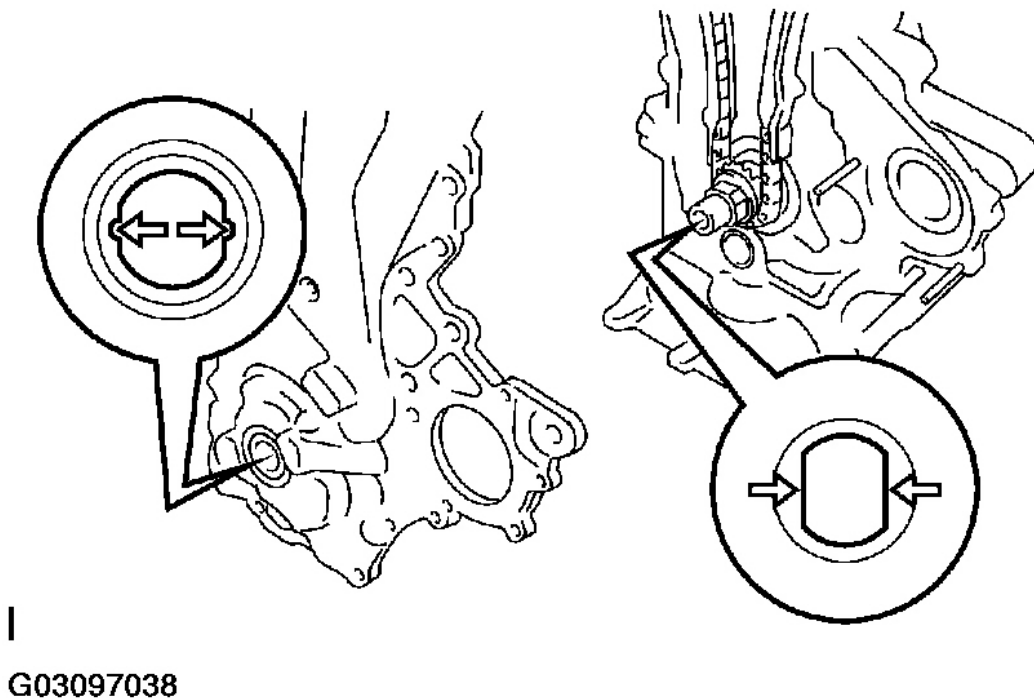


Fig. 155: Aligning Keyway Of Oil Pump Drive Rotor With Rectangular Portion Of Crankshaft

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

- e. Install the oil pump assembly with the 15 bolts and nut. Uniformly tighten the bolts and nut in several steps.

Torque:

Bolt A: 24 N.m (245 kgf.cm, 18 ft.lbf)

Bolt B: 11 N.m (112 kgf.cm, 8.1 ft.lbf)

Bolt C: 11 N.m (112 kgf.cm, 8.1 ft.lbf)

Nut D: 24 N.m (245 kgf.cm, 18 ft.lbf)

Bolt E: 24 N.m (245 kgf.cm, 18 ft.lbf)

NOTE:

- Pay attention not to disturb the seal packing.
- After installing the oil pump assembly, the mounting bracket and water pump must be installed within 15 minutes.

HINT:

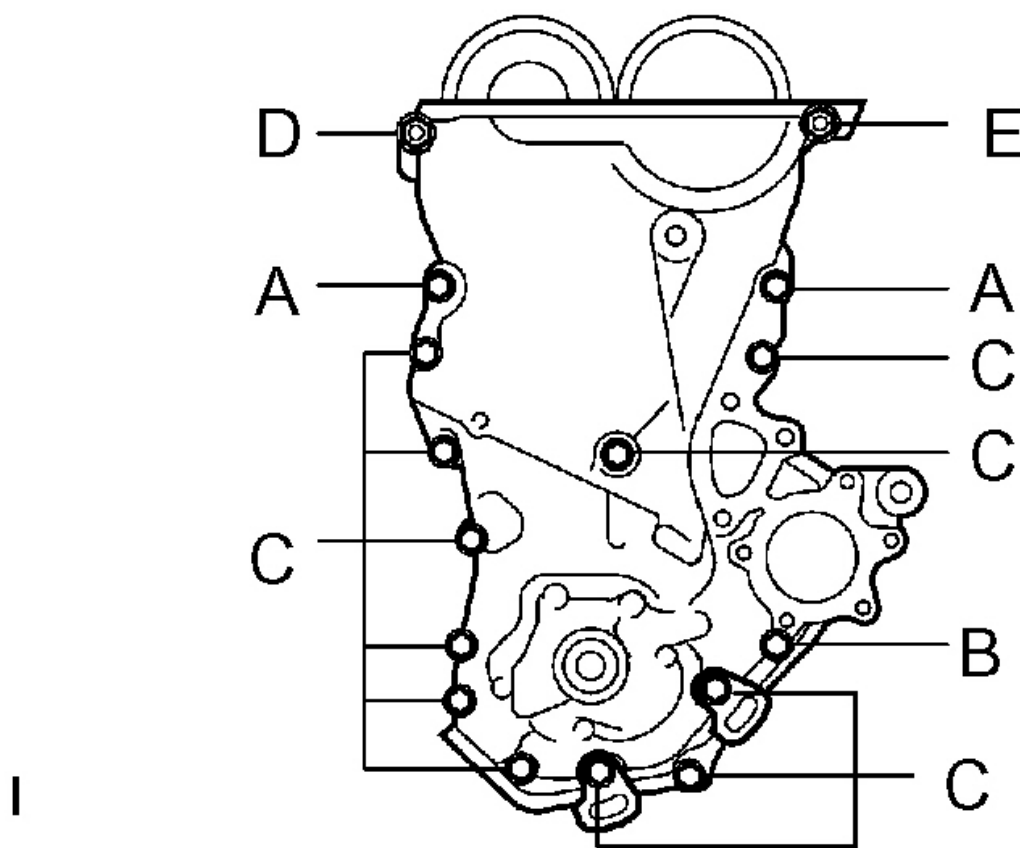
Each bolt length is as follows.

A 30 mm (1.18 in.)

B 35 mm (1.38 in.)

C 20 mm (0.79 in.)

E 20 and 14 mm (0.79 and 0.55 in.) double ended bolt



G03097039

Fig. 156: Installing Oil Pump Assembly With Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. INSTALL WATER PUMP ASSY

- a. Install the water pump and a new gasket with the 3 bolts and 2 nuts.

Torque: 11 N.m (112 kgf.cm, 8.1 ft.lbf)

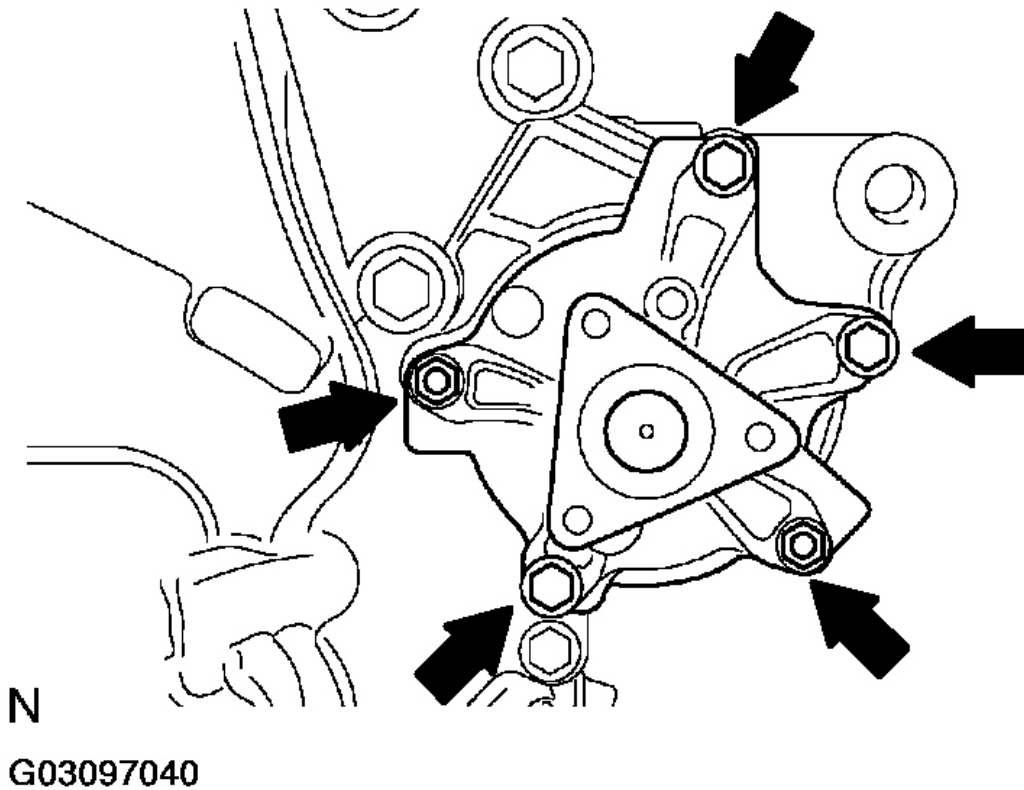


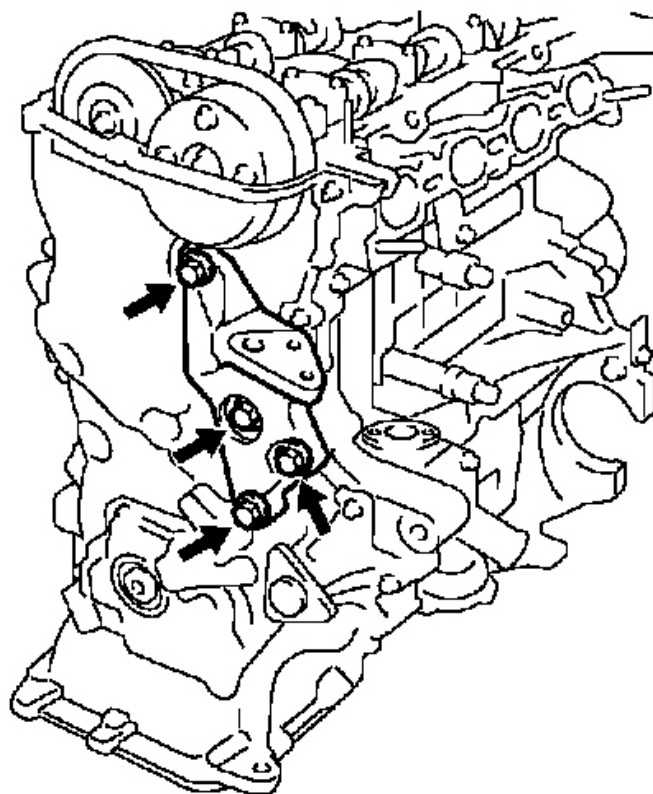
Fig. 157: Installing Water Pump Assy

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

61. INSTALL TRANSVERSE ENGINE ENGINE MOUNTING BRACKET

- a. Install the engine mounting bracket RH with the 4 bolts.

Torque: 55 N.m (561 kgf.cm, 41 ft.lbf)



Y

G03097041

Fig. 158: Installing Transverse Engine Mounting Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. INSTALL WATER PUMP PULLEY

- a. Using SST, install the pump pulley with the 3 bolts.

SST 09960-10010 (09962-01000, 09963-00600)

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

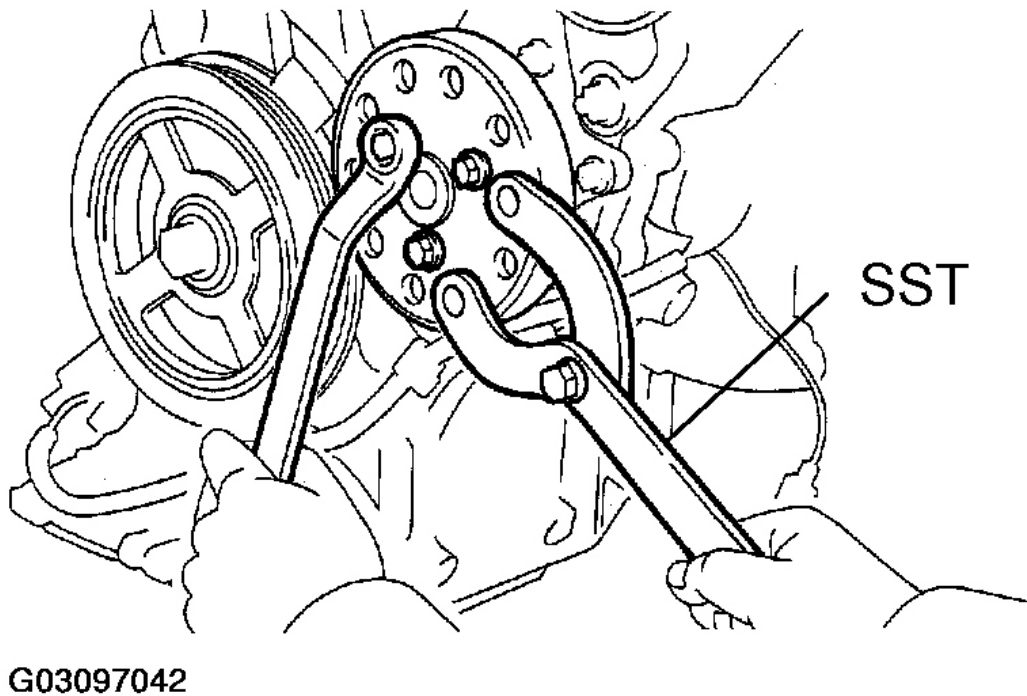


Fig. 159: Installing Water Pump Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. INSTALL CRANKSHAFT DAMPER SUB-ASSY

- a. Align the hole of the crankshaft damper with the pin position and install the crankshaft damper.
- b. Using SST, install the pulley bolt.

SST 09330-00021, 09213-58012 (91111-50845)

Torque: 128 N.m (1,305 kgf.cm, 95 ft.lbf)

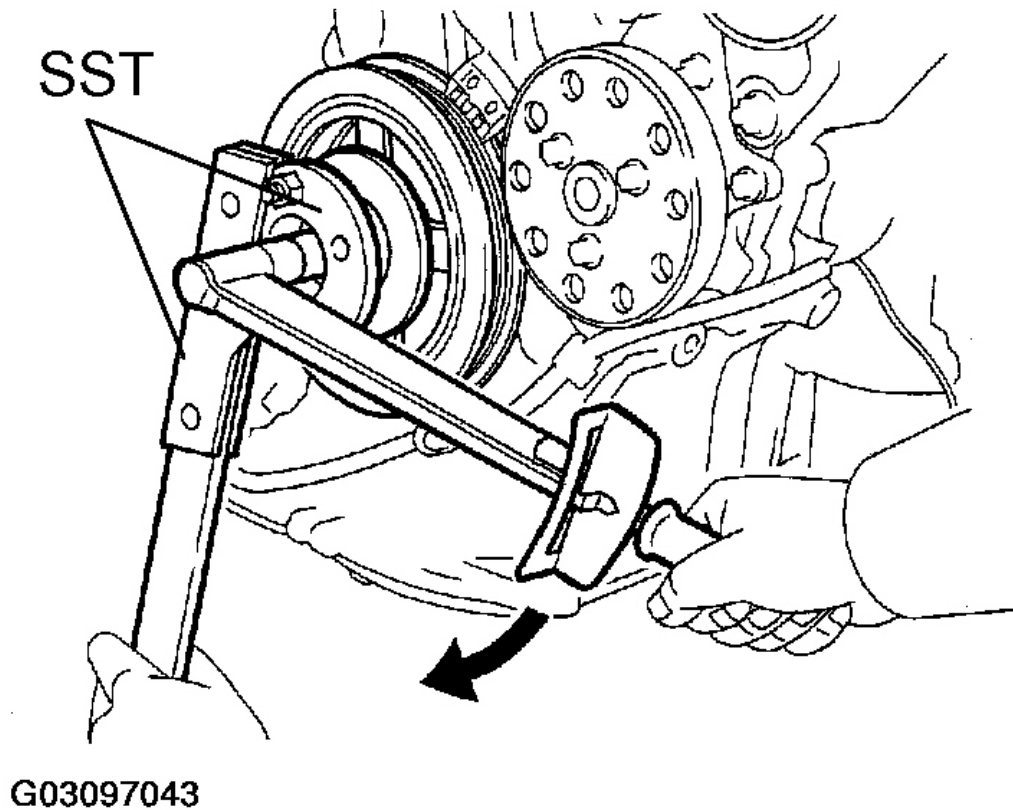


Fig. 160: Installing Crankshaft Damper Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. INSPECT VALVE CLEARANCE

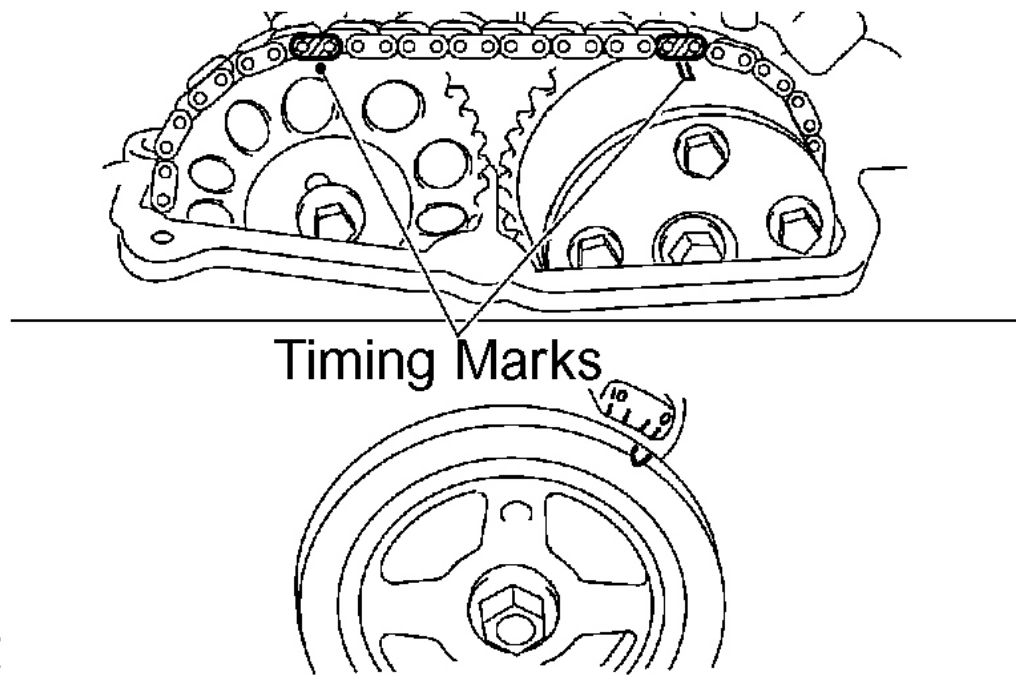
HINT:

Inspect and adjust the valve clearance when the engine is cold.

- a. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.
 2. Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in **Fig. 161**.

HINT:

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



I

G03097044

Fig. 161: Checking That Both Timing Marks On Camshaft Timing Sprocket And Camshaft Timing Gear Are Facing Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Check the valves indicated in **Fig. 162**.

1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.

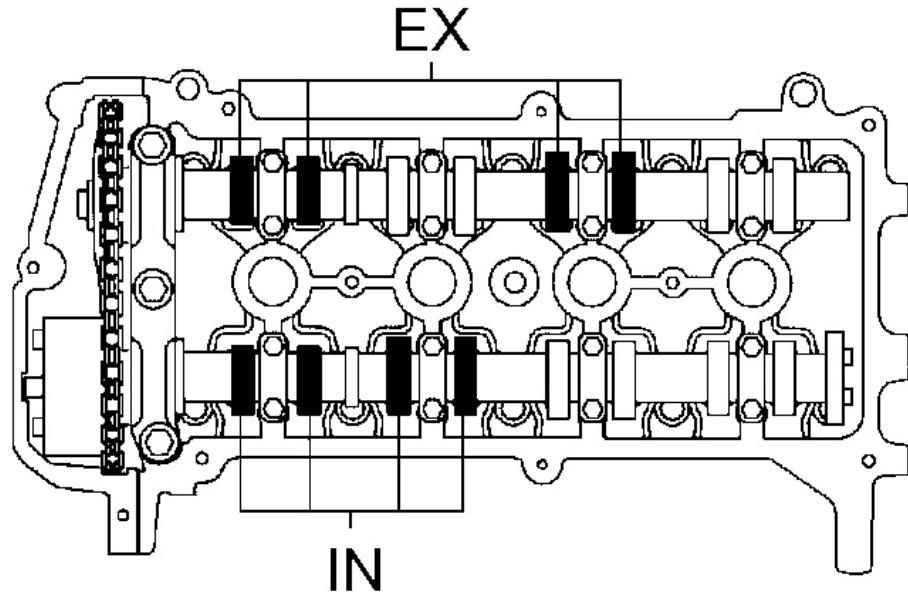
Valve clearance (Cold) :

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 any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

No. 1 Cylinder TDC/Compression



G03097045

Fig. 162: Measuring Clearance Between Valve Lifter And Camshaft For No. 1 Cylinder TDC/Compression

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

- c. Turn the crankshaft 1 complete revolution until its timing notch and the timing mark "0" of the chain cover are aligned.
- d. Check the valves indicated in **Fig. 163**.
 1. Using a feeler gauge, measure the clearance between the valve lifter and the camshaft.

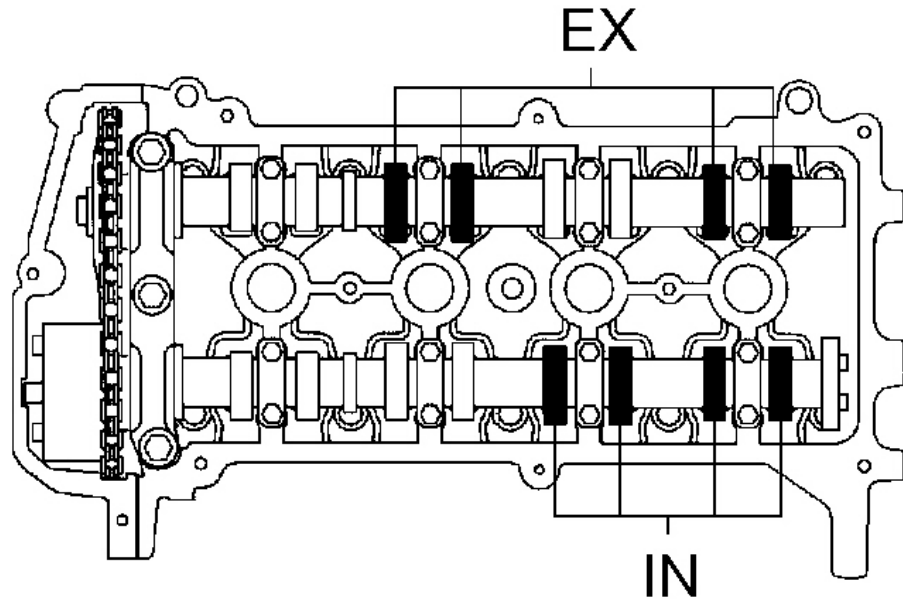
Valve clearance (Cold) :

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 any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

No. 4 Cylinder TDC/Compression



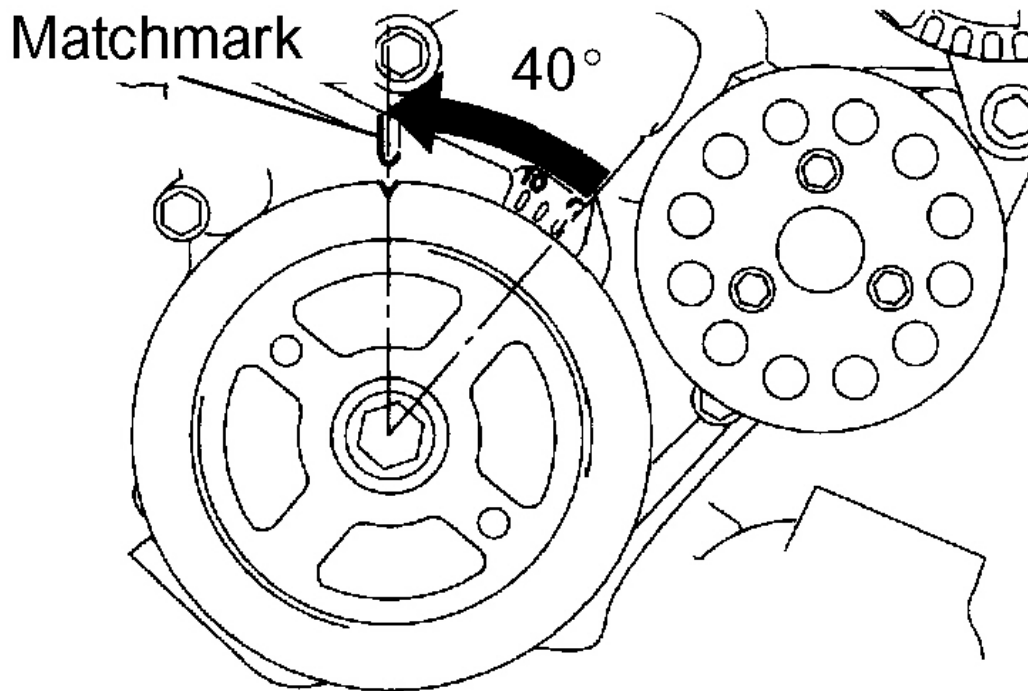
G03097046

Fig. 163: Measuring Clearance Between Valve Lifter And Camshaft For No. 4 Cylinder TDC/Compression

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

65. ADJUST VALVE CLEARANCE

NOTE: When rotating the camshaft with the timing chain removed, rotate the crankshaft damper counterclockwise 40° from the TDC and align its timing notch with timing mark of the chain cover to prevent the pistons from coming into contact with the valves.

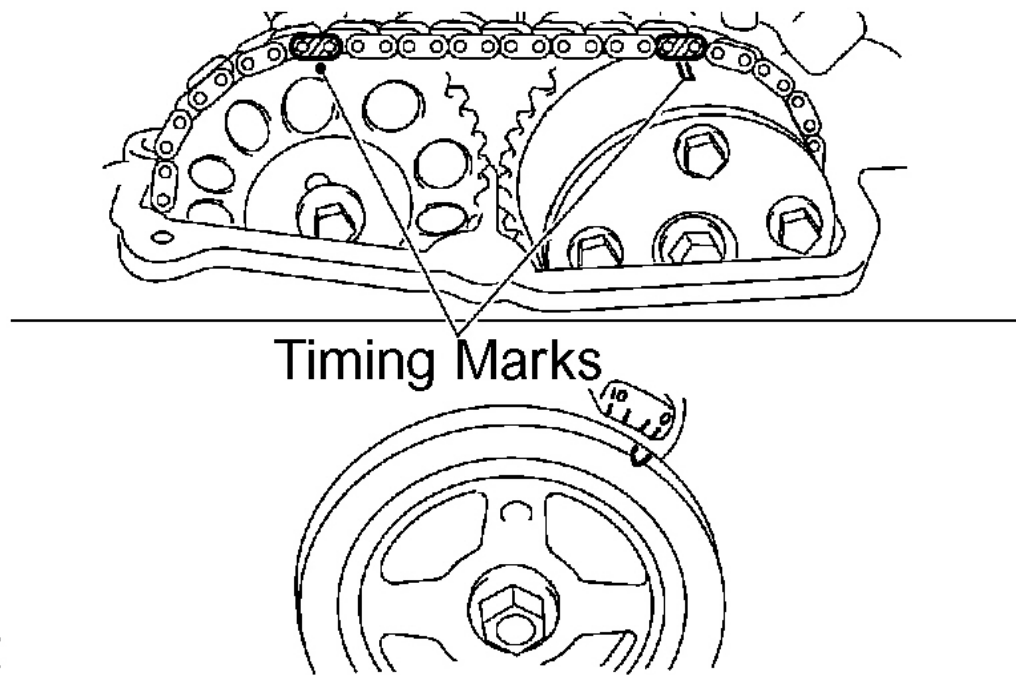


G03097047

Fig. 164: Rotating Crankshaft Damper Counterclockwise 40° From TDC And Aligning Timing Notch With Timing Mark Of Chain Cover

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

- a. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.
 2. Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in **Fig. 165**.



I

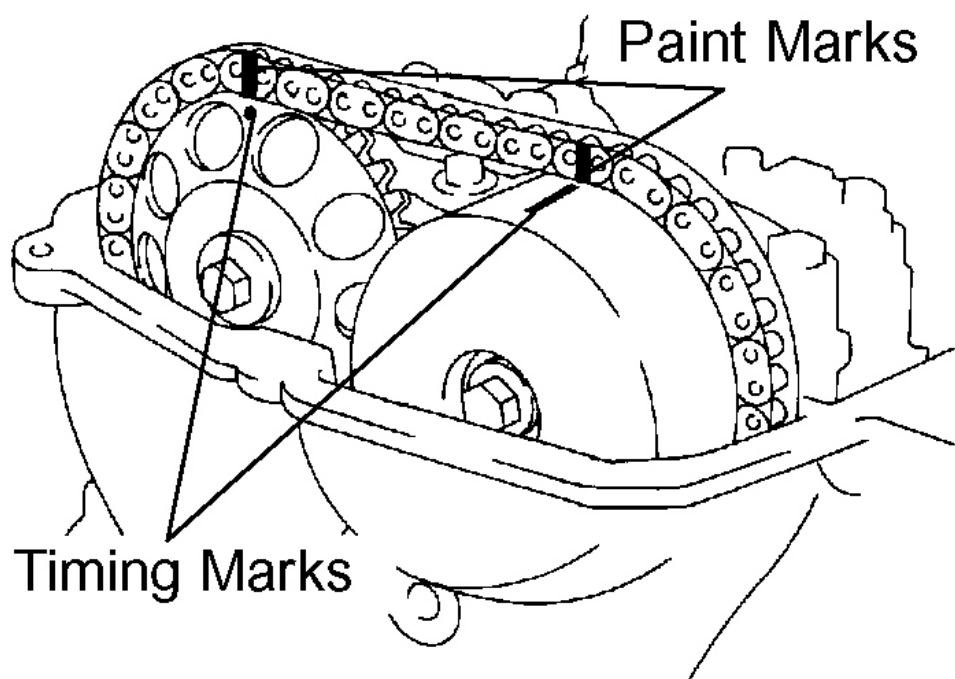
G03097048

Fig. 165: Checking That Both Timing Marks On Camshaft Timing Sprocket And Camshaft Timing Gear Are Facing Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

- b. Put paint marks on the timing chain in place where the timing marks of the camshaft timing sprocket and camshaft timing gear are located.



N

G03097049

Fig. 166: Locating Paint Marks And Timing Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using an 8 mm hexagon wrench, remove the screw plug.

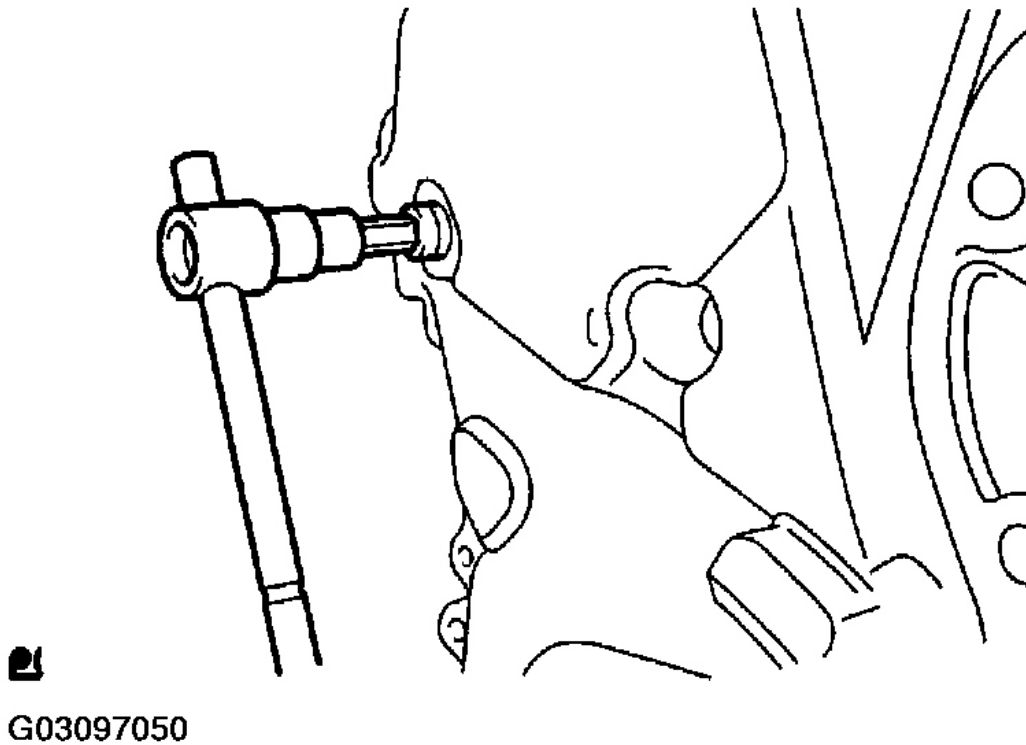


Fig. 167: Removing Screw Plug

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

- d. Insert a screwdriver into service hole of the chain tensioner to hold the stopper plate of the chain tensioner at upward position.
- e. Using a wrench, rotate the camshaft No. 2 clockwise to push in the plunger of the chain tensioner.
- f. Remove the screwdriver from the service hole, then align the hole of the stopper plate with the service hole and insert a 2 to 3 mm (0.08 to 0.12 in.) diameter bar into the holes to hold the stopper plate.

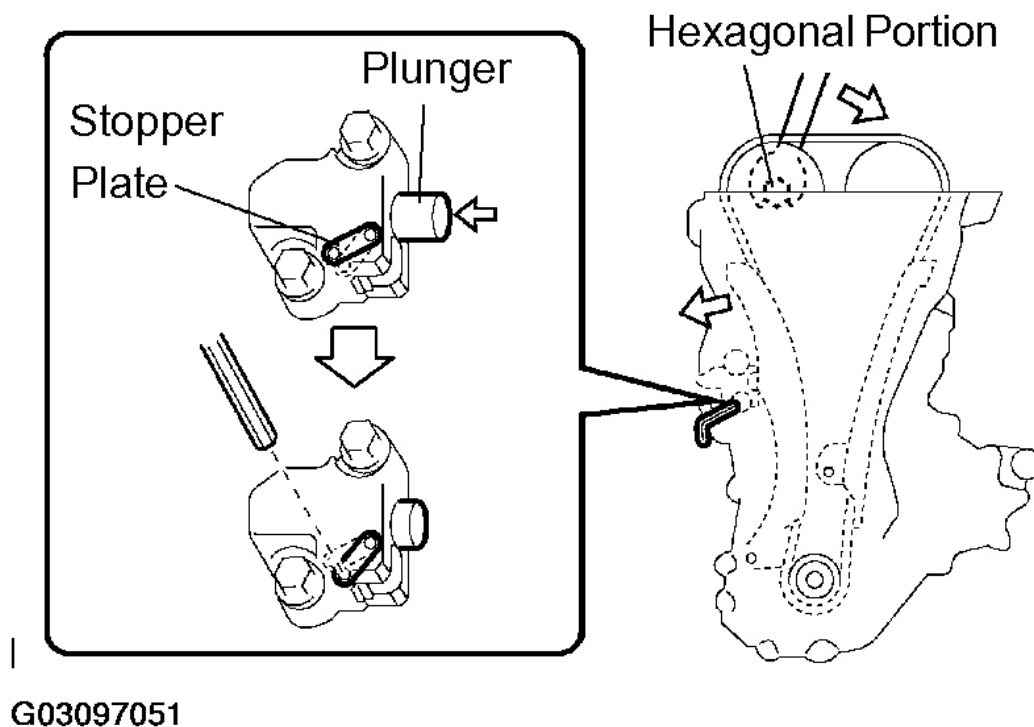
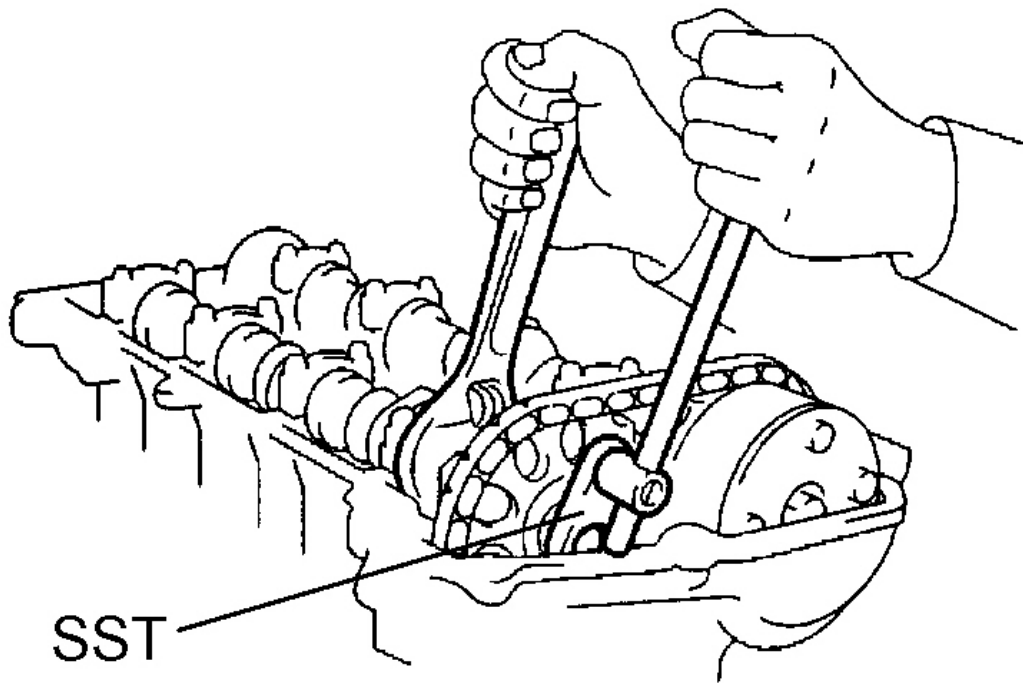


Fig. 168: Inserting Diameter Bar Into Holes To Hold Stopper Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- Fix the stopper plate using the bar while rotating the camshaft right and left slightly.
 - Hold the bar with tape so that the bar does not come off.
- g. Hold the camshaft with a wrench on the hexagonal lobe, and remove the bolt.

SST 09023-38400



G03097052

Fig. 169: Removing Bolt

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

- h. Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in **Fig. 170**, then remove the 5 bearing caps.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

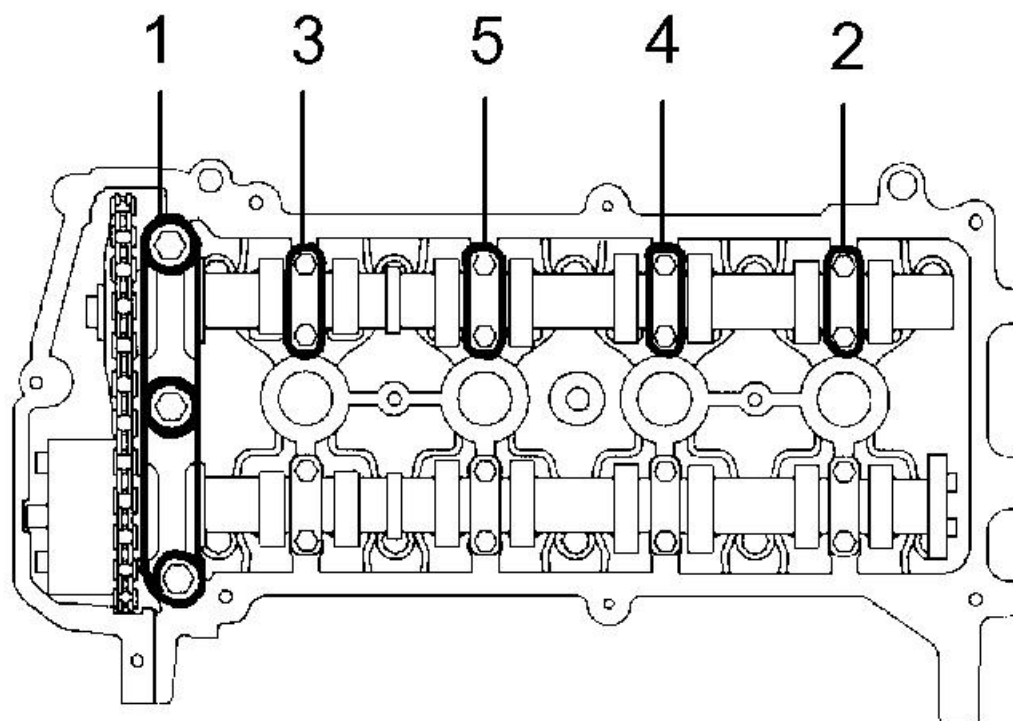
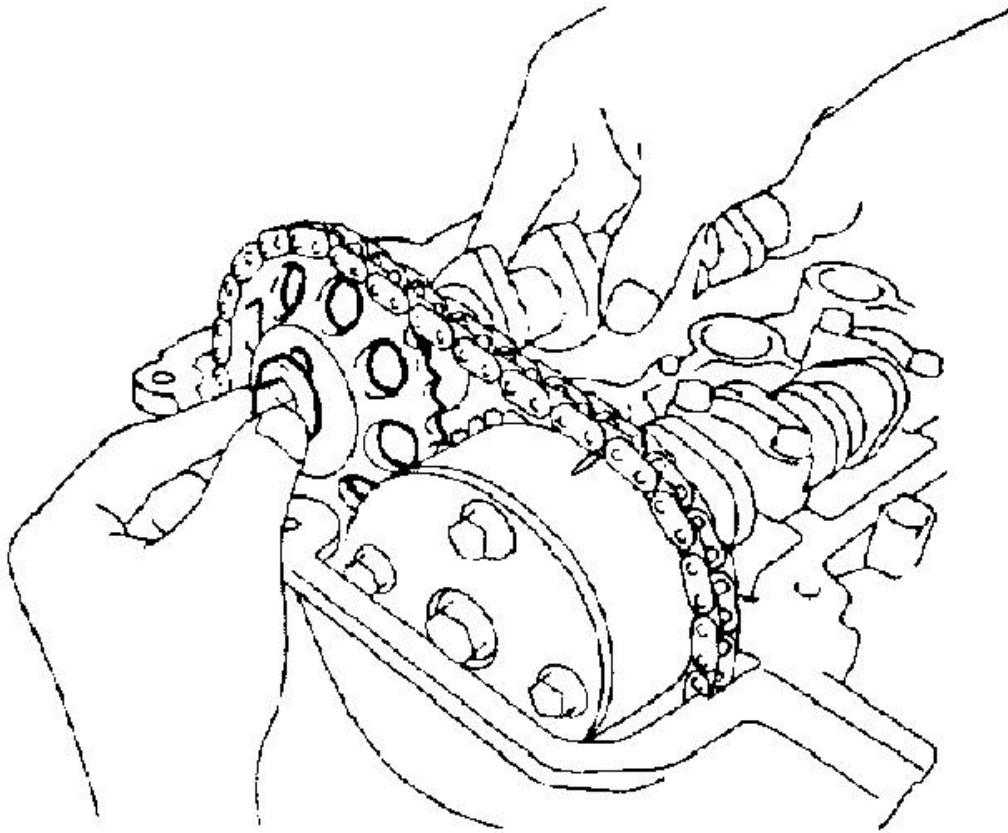
**G03097053**

Fig. 170: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Remove the fringe bolt with the No. 2 camshaft lifted up, then detach the No. 2 camshaft and camshaft timing sprocket.



G03097054

Fig. 171: Removing Fringe Bolt With No. 2 Camshaft Lifted Up
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in **Fig. 172**, then remove the 4 bearing caps.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

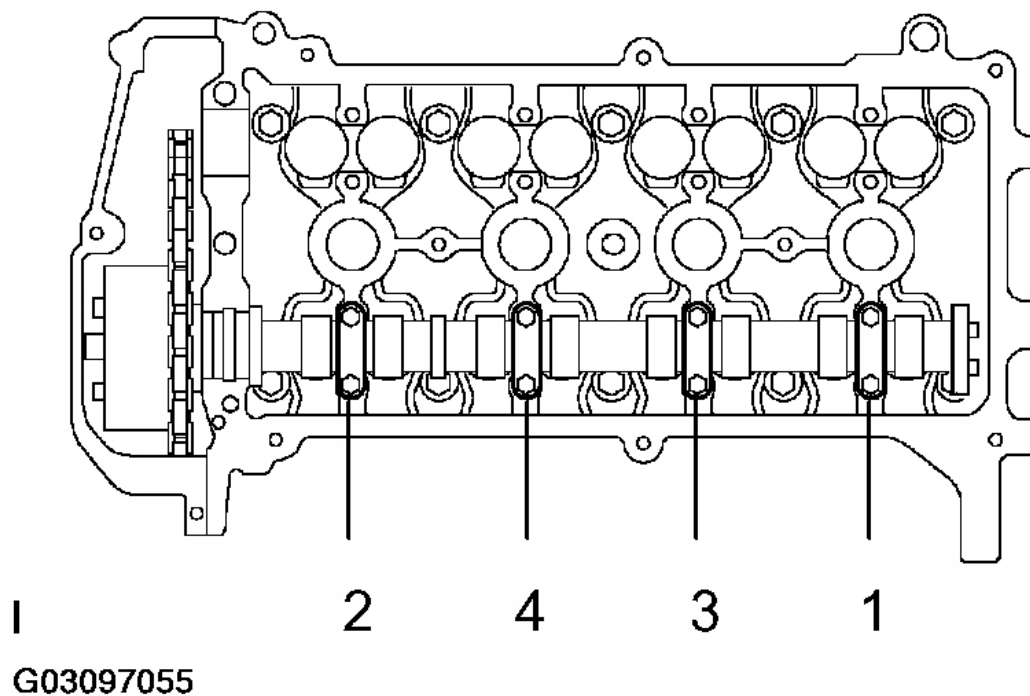
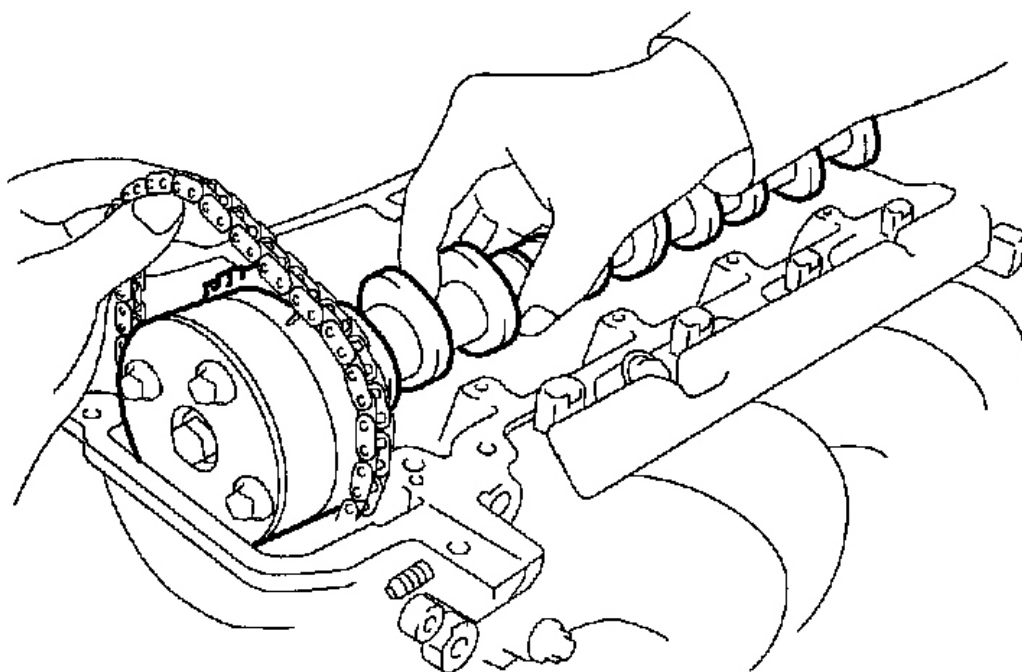


Fig. 172: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Hold the timing chain by hand, and remove the camshaft and camshaft timing gear assembly.



G03097056

Fig. 173: Removing Camshaft And Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Tie the timing chain with a string as shown in **Fig. 174**.

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

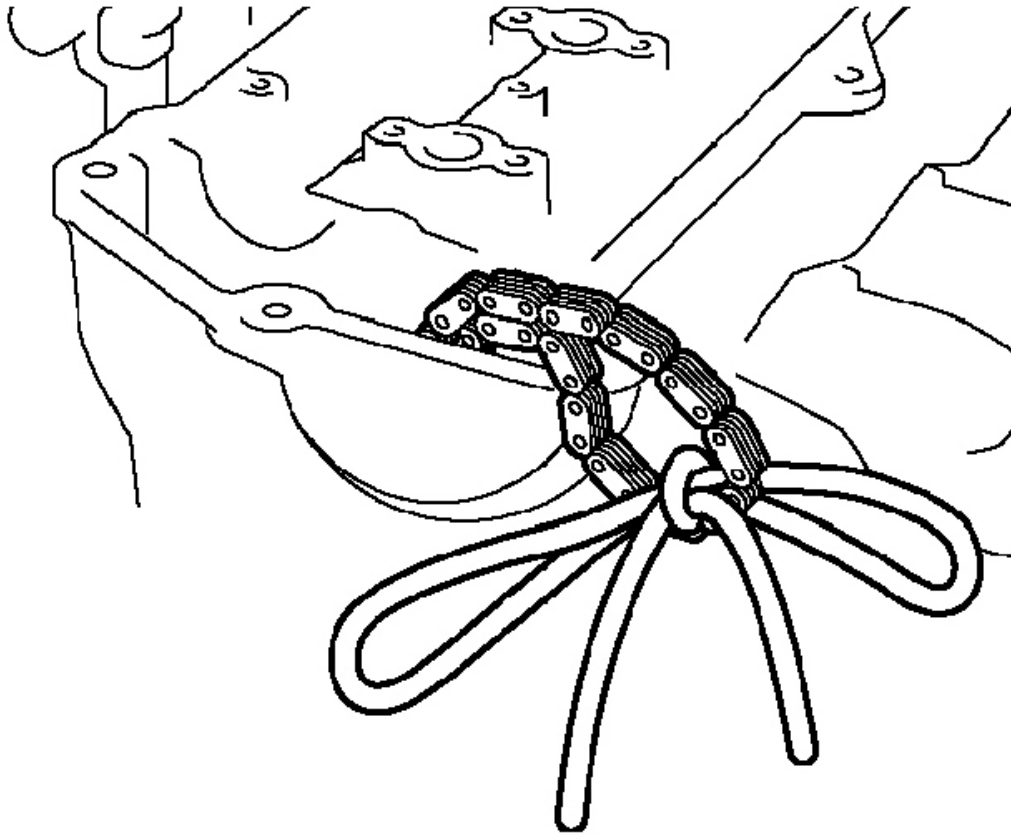
**G03097057**

Fig. 174: Tying Timing Chain With String
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Remove the valve lifters.
- n. Using a micrometer, measure the thickness of the removed lifter.
- o. Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

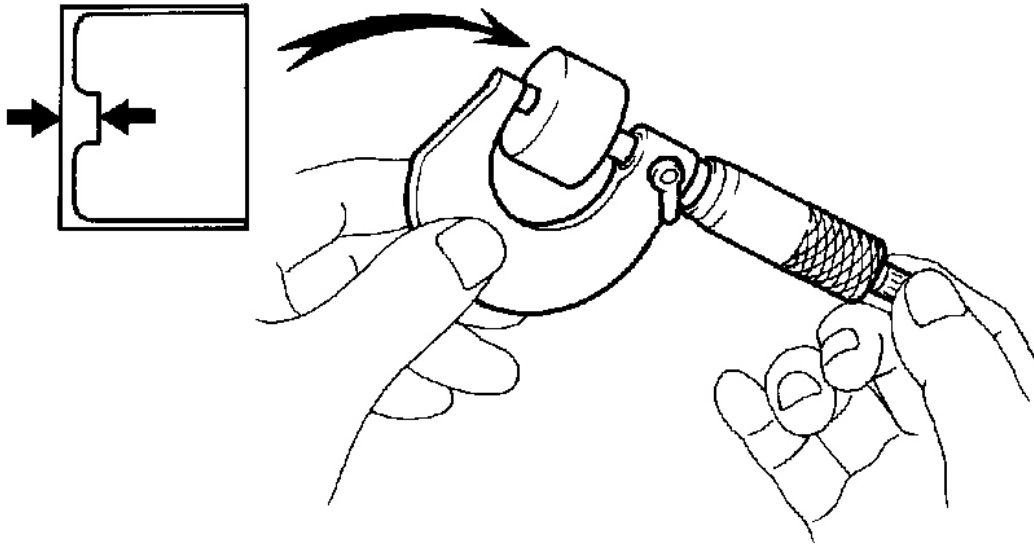
VALVE CLEARANCE SPECIFICATIONS

A	Thickness of new lifter
B	Thickness of used lifter
C	Measured valve clearance

Specified value (Cold):

Intake $A = B + (C - 0.20 \text{ mm (0.008 in.)})$

Exhaust $A = B + (C - 0.30 \text{ mm (0.012 in.)})$



G03097058

Fig. 175: Measuring Valve Thickness

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

- p. Select a new lifter with a thickness as close to the calculated values as possible.

EXAMPLE (Intake):

Measured valve clearance = 0.40 mm (0.0158 in.)

$0.40 \text{ mm (0.0158 in.)} - 0.20 \text{ mm (0.0079 in.)} = 0.20 \text{ mm (0.0079 in.)}$

(Measured - Specification = Excess clearance)

Used lifter measurement = 5.25 mm (0.2067 in.)

$0.20 \text{ mm (0.0079 in.)} + 5.25 \text{ mm (0.2067 in.)} = 5.45 \text{ mm (0.2146 in.)}$

(Excess clearance + Used lifter = Ideal new lifter)

Closest new lifter = 5.45 mm (0.2146 in.)

Select No. 46 lifter (5.46 mm (0.2150 in.))

G03097059

Fig. 176: Selecting New Lifter (Example)

2005 Scion xB
2005 ENGINE Engine Mechanical - xB

2005 Scion xB
2005 ENGINE Engine Mechanical - xB

Installed Lifter (mm) (in.)				Valve Lifter Selection Chart (Exhaust)																																																																																																																									
Measured Clearance (mm)	Measured Clearance (in.)	Installed Lifter (mm) (in.)	Installed Lifter (mm) (in.)	0.002 - 0.003 (0.0007 - 0.0013)	0.003 - 0.004 (0.0012 - 0.0016)	0.004 - 0.005 (0.0016 - 0.0020)	0.005 - 0.006 (0.0020 - 0.0024)	0.006 - 0.007 (0.0024 - 0.0028)	0.007 - 0.008 (0.0028 - 0.0032)	0.008 - 0.009 (0.0032 - 0.0036)	0.009 - 0.010 (0.0036 - 0.0040)	0.010 - 0.011 (0.0040 - 0.0044)	0.011 - 0.012 (0.0044 - 0.0048)	0.012 - 0.013 (0.0048 - 0.0052)	0.013 - 0.014 (0.0052 - 0.0056)	0.014 - 0.015 (0.0056 - 0.0060)	0.015 - 0.016 (0.0060 - 0.0064)	0.016 - 0.017 (0.0064 - 0.0068)	0.017 - 0.018 (0.0068 - 0.0072)	0.018 - 0.019 (0.0072 - 0.0076)	0.019 - 0.020 (0.0076 - 0.0080)	0.020 - 0.021 (0.0080 - 0.0084)	0.021 - 0.022 (0.0084 - 0.0088)	0.022 - 0.023 (0.0088 - 0.0092)	0.023 - 0.024 (0.0092 - 0.0096)	0.024 - 0.025 (0.0096 - 0.0100)	0.025 - 0.026 (0.0100 - 0.0104)	0.026 - 0.027 (0.0104 - 0.0108)	0.027 - 0.028 (0.0108 - 0.0112)	0.028 - 0.029 (0.0112 - 0.0116)	0.029 - 0.030 (0.0116 - 0.0120)	0.030 - 0.031 (0.0120 - 0.0124)	0.031 - 0.032 (0.0124 - 0.0128)	0.032 - 0.033 (0.0128 - 0.0132)	0.033 - 0.034 (0.0132 - 0.0136)	0.034 - 0.035 (0.0136 - 0.0140)	0.035 - 0.036 (0.0140 - 0.0144)	0.036 - 0.037 (0.0144 - 0.0148)	0.037 - 0.038 (0.0148 - 0.0152)	0.038 - 0.039 (0.0152 - 0.0156)	0.039 - 0.040 (0.0156 - 0.0160)	0.040 - 0.041 (0.0160 - 0.0164)	0.041 - 0.042 (0.0164 - 0.0168)	0.042 - 0.043 (0.0168 - 0.0172)	0.043 - 0.044 (0.0172 - 0.0176)	0.044 - 0.045 (0.0176 - 0.0180)	0.045 - 0.046 (0.0180 - 0.0184)	0.046 - 0.047 (0.0184 - 0.0188)	0.047 - 0.048 (0.0188 - 0.0192)	0.048 - 0.049 (0.0192 - 0.0196)	0.049 - 0.050 (0.0196 - 0.0200)	0.050 - 0.051 (0.0200 - 0.0204)	0.051 - 0.052 (0.0204 - 0.0208)	0.052 - 0.053 (0.0208 - 0.0212)	0.053 - 0.054 (0.0212 - 0.0216)	0.054 - 0.055 (0.0216 - 0.0220)	0.055 - 0.056 (0.0220 - 0.0224)	0.056 - 0.057 (0.0224 - 0.0228)	0.057 - 0.058 (0.0228 - 0.0232)	0.058 - 0.059 (0.0232 - 0.0236)	0.059 - 0.060 (0.0236 - 0.0240)	0.060 - 0.061 (0.0240 - 0.0244)	0.061 - 0.062 (0.0244 - 0.0248)	0.062 - 0.063 (0.0248 - 0.0252)	0.063 - 0.064 (0.0252 - 0.0256)	0.064 - 0.065 (0.0256 - 0.0260)	0.065 - 0.066 (0.0260 - 0.0264)	0.066 - 0.067 (0.0264 - 0.0268)	0.067 - 0.068 (0.0268 - 0.0272)	0.068 - 0.069 (0.0272 - 0.0276)	0.069 - 0.070 (0.0276 - 0.0280)	0.070 - 0.071 (0.0280 - 0.0284)	0.071 - 0.072 (0.0284 - 0.0288)	0.072 - 0.073 (0.0288 - 0.0292)	0.073 - 0.074 (0.0292 - 0.0296)	0.074 - 0.075 (0.0296 - 0.0300)	0.075 - 0.076 (0.0300 - 0.0304)	0.076 - 0.077 (0.0304 - 0.0308)	0.077 - 0.078 (0.0308 - 0.0312)	0.078 - 0.079 (0.0312 - 0.0316)	0.079 - 0.080 (0.0316 - 0.0320)	0.080 - 0.081 (0.0320 - 0.0324)	0.081 - 0.082 (0.0324 - 0.0328)	0.082 - 0.083 (0.0328 - 0.0332)	0.083 - 0.084 (0.0332 - 0.0336)	0.084 - 0.085 (0.0336 - 0.0340)	0.085 - 0.086 (0.0340 - 0.0344)	0.086 - 0.087 (0.0344 - 0.0348)	0.087 - 0.088 (0.0348 - 0.0352)	0.088 - 0.089 (0.0352 - 0.0356)	0.089 - 0.090 (0.0356 - 0.0360)	0.090 - 0.091 (0.0360 - 0.0364)	0.091 - 0.092 (0.0364 - 0.0368)	0.092 - 0.093 (0.0368 - 0.0372)	0.093 - 0.094 (0.0372 - 0.0376)	0.094 - 0.095 (0.0376 - 0.0380)	0.095 - 0.096 (0.0380 - 0.0384)	0.096 - 0.097 (0.0384 - 0.0388)	0.097 - 0.098 (0.0388 - 0.0392)	0.098 - 0.099 (0.0392 - 0.0396)	0.099 - 0.100 (0.0396 - 0.0400)	0.100 - 0.101 (0.0400 - 0.0404)	0.101 - 0.102 (0.0404 - 0.0408)	0.102 - 0.103 (0.0408 - 0.0412)	0.103 - 0.104 (0.0412 - 0.0416)	0.104 - 0.105 (0.0416 - 0.0420)	0.105 - 0.106 (0.0420 - 0.0424)	0.106 - 0.107 (0.0424 - 0.0428)	0.107 - 0.108 (0.0428 - 0.0432)	0.108 - 0.109 (0.0432 - 0.0436)	0.109 - 0.110 (0.0436 - 0.0440)	0.110 - 0.111 (0.0440 - 0.0444)	0.111 - 0.112 (0.0444 - 0.0448)	0.112 - 0.113 (0.0448 - 0.0452)	0.113 - 0.114 (0.0452 - 0.0456)	0.114 - 0.115 (0.0456 - 0.0460)	0.115 - 0.116 (0.0460 - 0.0464)	0.116 - 0.117 (0.0464 - 0.0468)	0.117 - 0.118 (0.0468 - 0.0472)	0.118 - 0.119 (0.0472 - 0.0476)	0.119 - 0.120 (0.0476 - 0.0480)	0.120 - 0.121 (0.0480 - 0.0484)	0.121 - 0.122 (0.0484 - 0.0488)	0.122 - 0.123 (0.0488 - 0.0492)	0.123 - 0.124 (0.0492 - 0.0496)

G03097061

Fig. 178: Valve Lifter Selection Table (Exhaust)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- q. Reinstall the valve lifters.
- r. Apply a light coat of engine oil to the camshaft journals.
- s. Install the timing chain onto the camshaft timing gear with the painted link and timing marks are aligned as shown in **Fig. 179**.

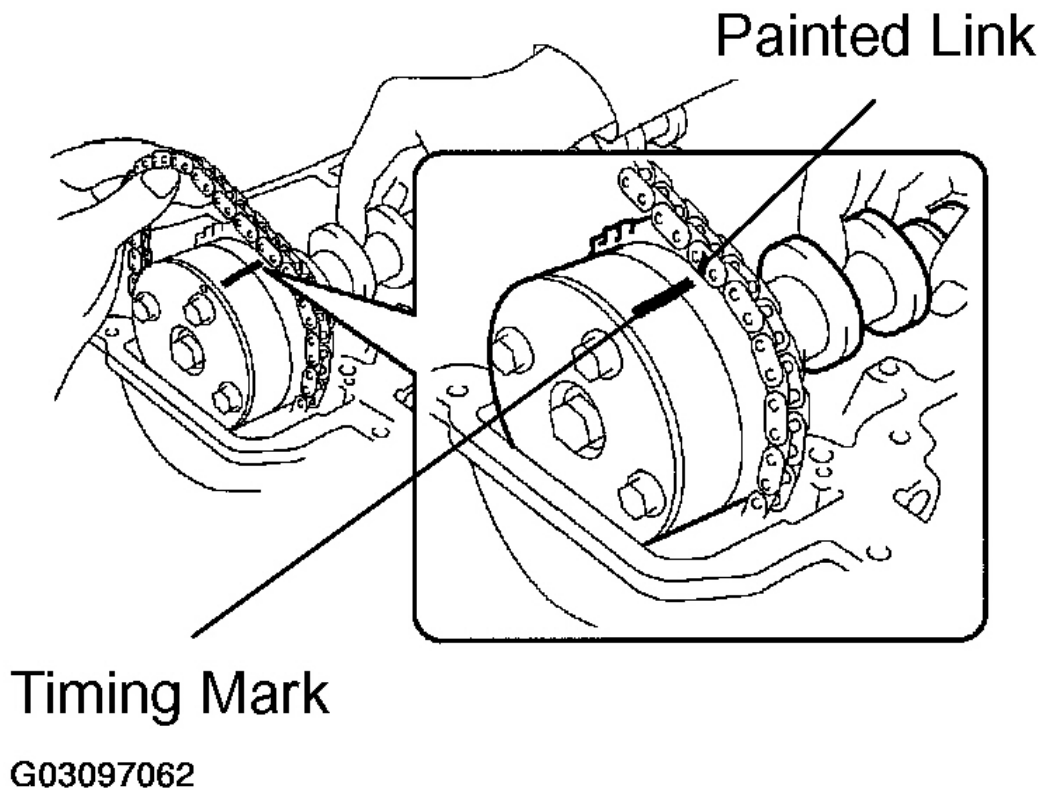


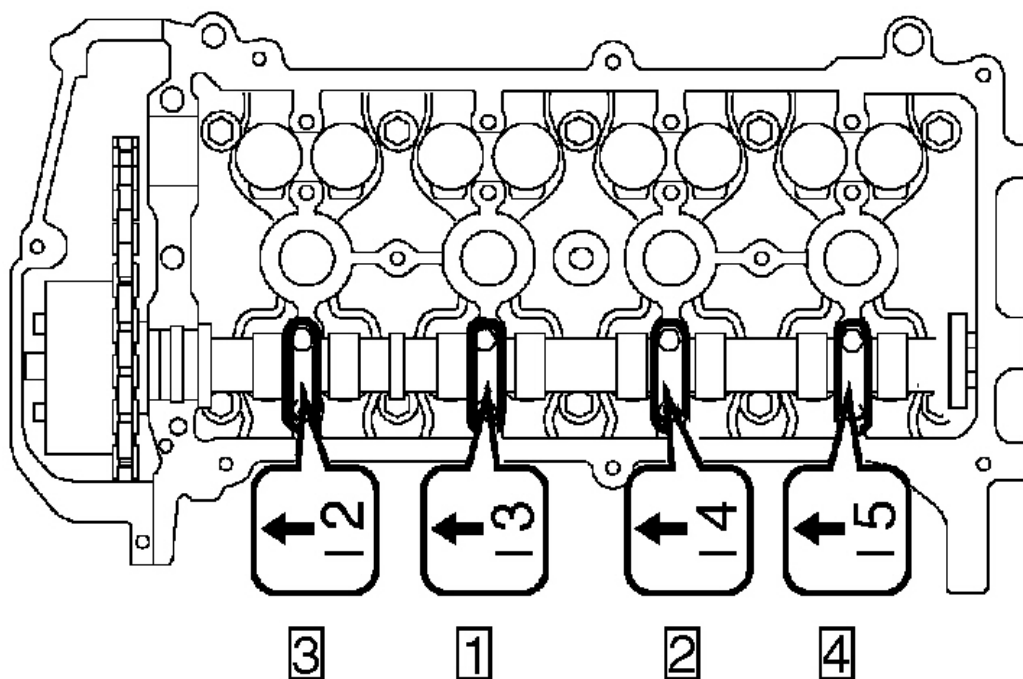
Fig. 179: Installing Timing Chain Onto Camshaft Timing Gear With Painted Link And Timing Marks Aligned

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

- t. Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 180**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: Tighten each bolt uniformly keeping the camshaft level.

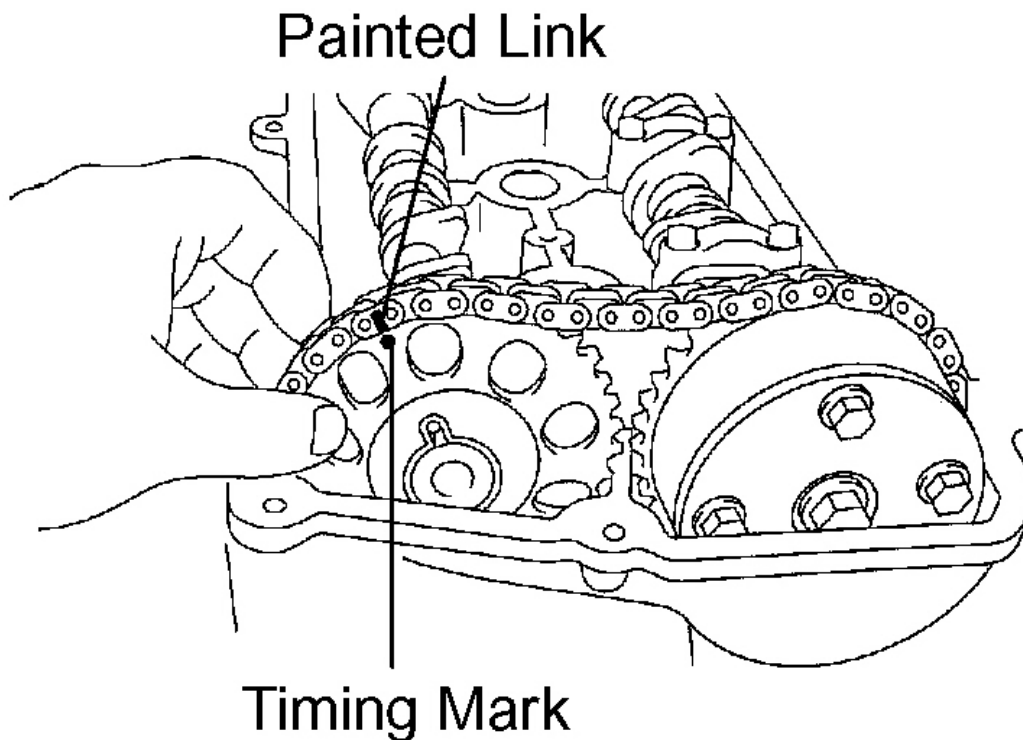


G03097063

Fig. 180: Identifying Bolt Tightening Sequence

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

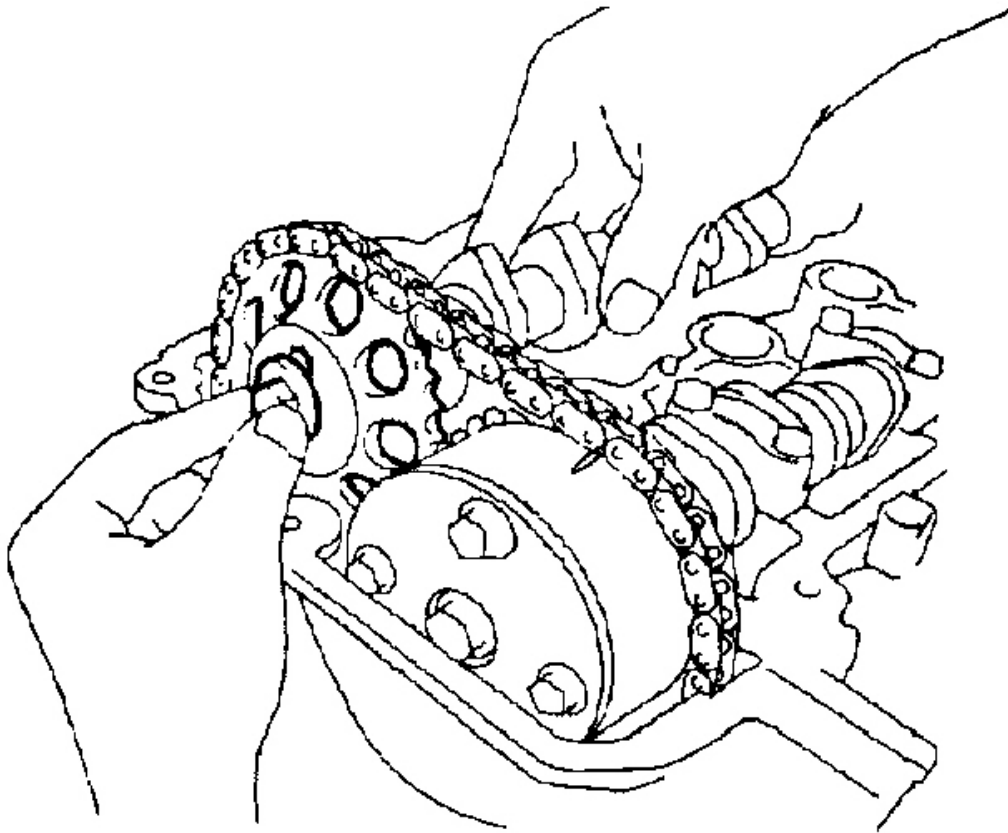
- u. Hold the timing chain, and align the timing mark on the camshaft timing sprocket with the painted link on the timing chain.



G03097064

Fig. 181: Aligning Timing Mark On Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- v. Align the alignment pin hole on the camshaft timing sprocket with the alignment pin of the camshaft, and install the sprocket to the camshaft.



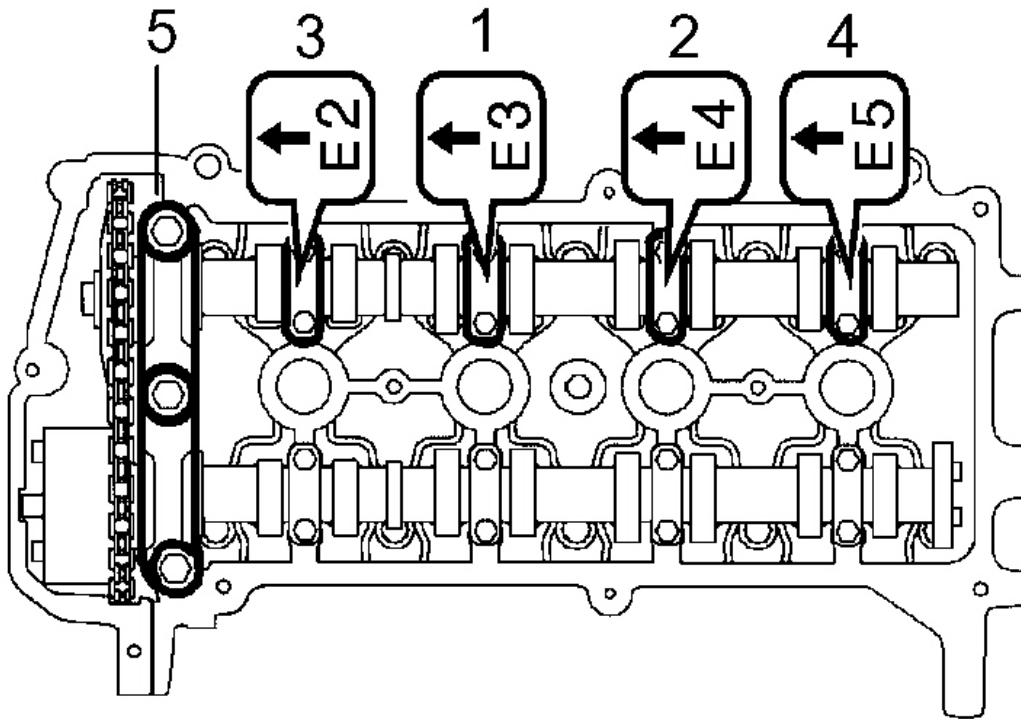
G03097065

Fig. 182: Installing Sprocket To Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- w. Temporarily install the timing sprocket bolt.
- x. Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 183**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: **Tighten each bolt uniformly keeping the camshaft level.**



G03097066

Fig. 183: Tightening Bolts In Sequence

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

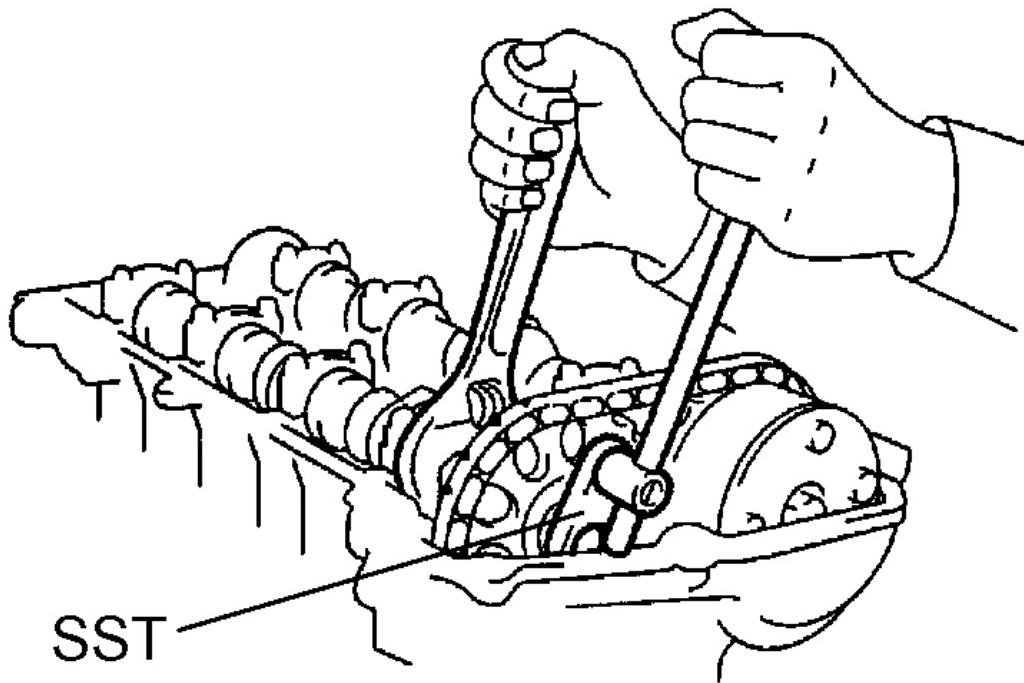
- y. Install the bearing cap No. 1.

Torque: 23 N.m (235 kgf.cm, 17 ft.lbf)

- z. Hold the camshaft with a wrench on the hexagonal lobe, and install the bolt.

SST 09023-38400

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



G03097067

Fig. 184: Installing Bolt While Holding Camshaft With Wrench On Hexagonal Lobe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- aa. Remove the bar from the timing chain tensioner.
- ab. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.

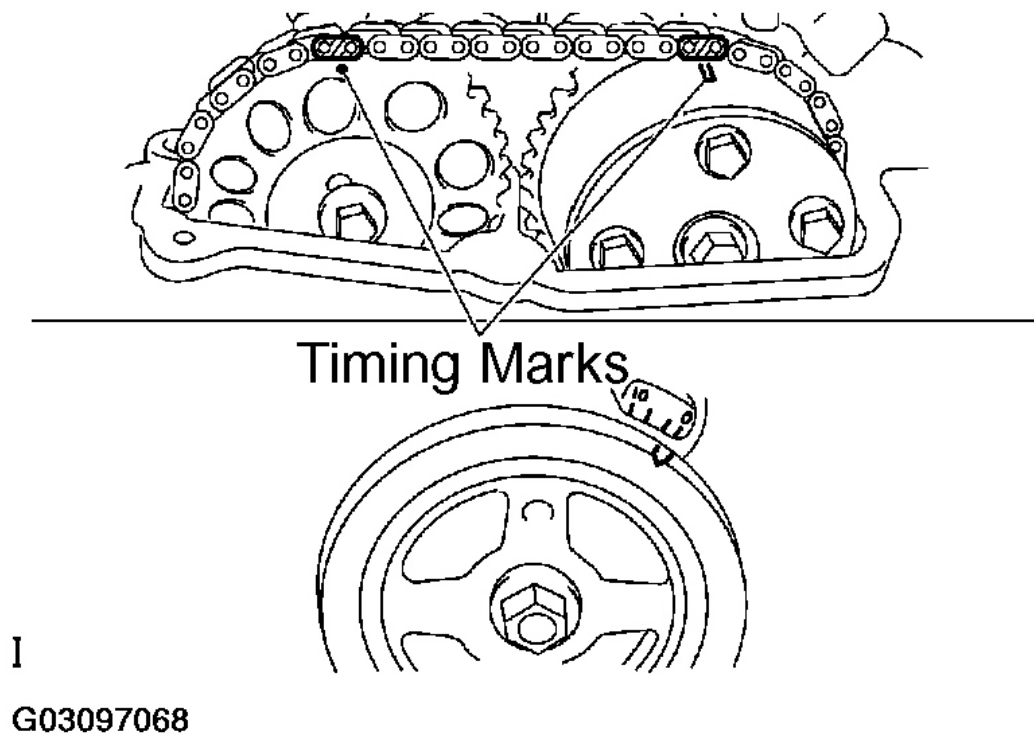


Fig. 185: Aligning Timing Notch And Timing Mark "0" Of Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- ac. Check that all the pairs of the matchmarks are aligned.
- ad. Apply the seal packing 2 or 3 threads to the screw plug end.

Seal packing:

Part No. 08833 - 00070 or equivalent

- ae. Using an 8 mm hexagon wrench, install the screw plug.

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

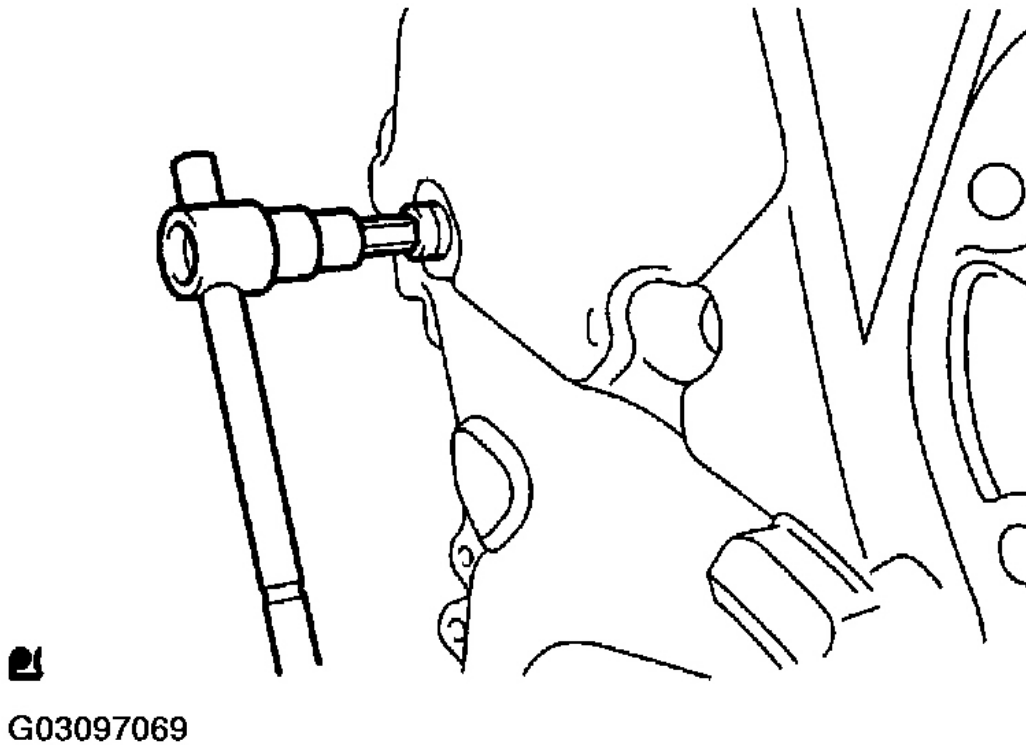
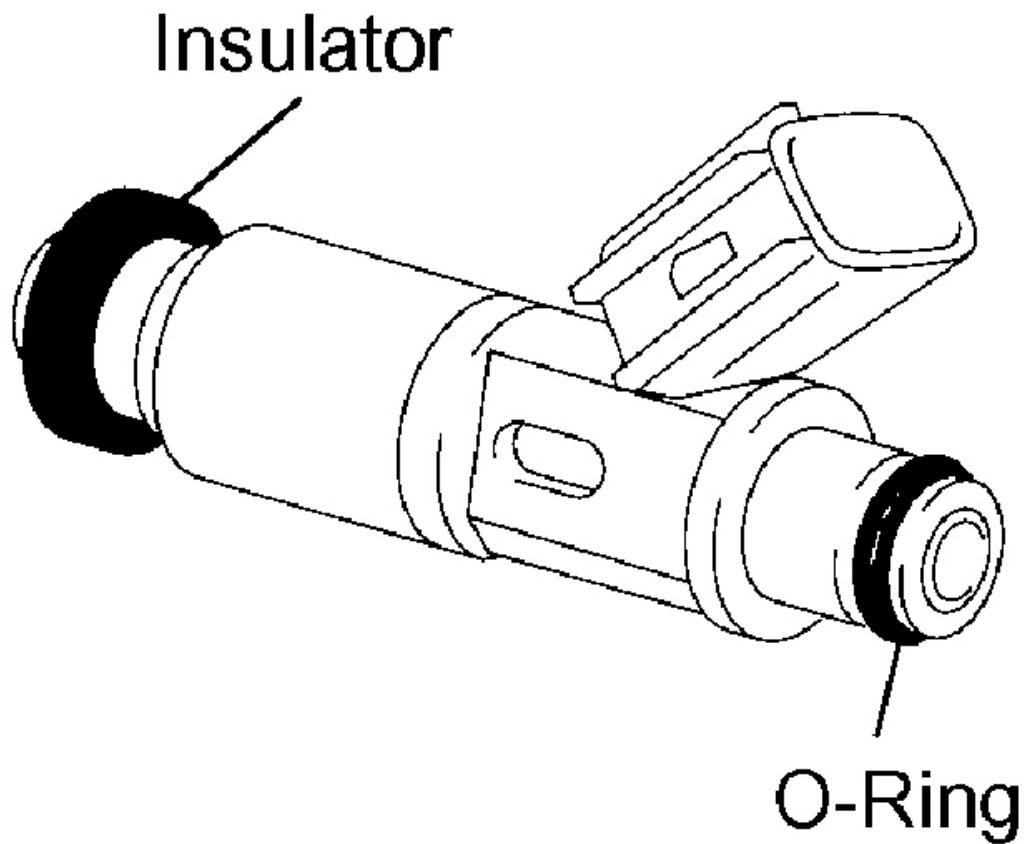


Fig. 186: Installing Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

66. INSTALL FUEL INJECTOR ASSY

- a. Install new insulators onto each fuel injector.
- b. Apply a light coat of grease or gasoline to a new O-ring and install it onto each fuel injector.
- c. Apply a light coat of grease or gasoline to the place where a delivery pipe comes into contact with the O-ring.



G03097070

Fig. 187: Installing New Insulators And Greasing New O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. While turning the injector clockwise and counterclockwise, push it to the delivery pipe.

NOTE:

- Be careful not to twist the O-ring.
- After installing the fuel injectors, check that they turn smoothly. If not, replace it with a new O-ring.

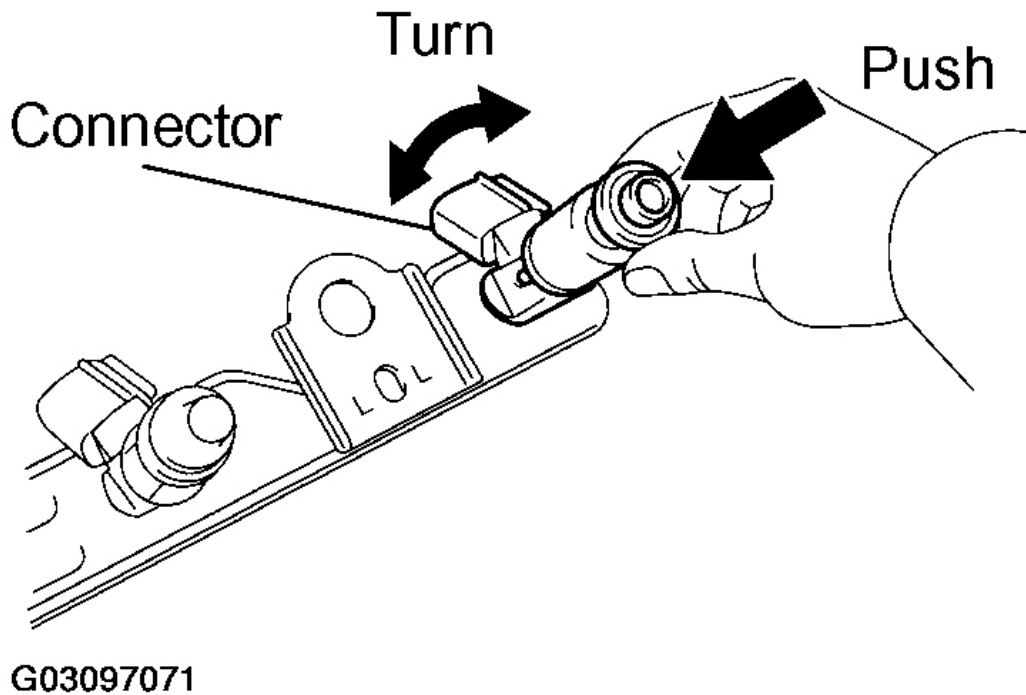


Fig. 188: Turning Injector Clockwise And Counterclockwise And Pushing It To Delivery Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

67. INSTALL FUEL DELIVERY PIPE SUB-ASSY

- Install the 2 spacers onto the cylinder head.
- Install the fuel delivery pipe and 4 fuel injectors together.

Torque:

Bolt A: 19 N.m (194 kgf.cm, 14 ft.lbf)

Bolt B: 9.0 N in (92 kgf.cm, 80 in.lbf)

NOTE:

- Be careful not to drop the fuel injectors when installing the fuel delivery pipe.
- Check that the fuel injectors rotate smoothly after installing the fuel delivery pipe.

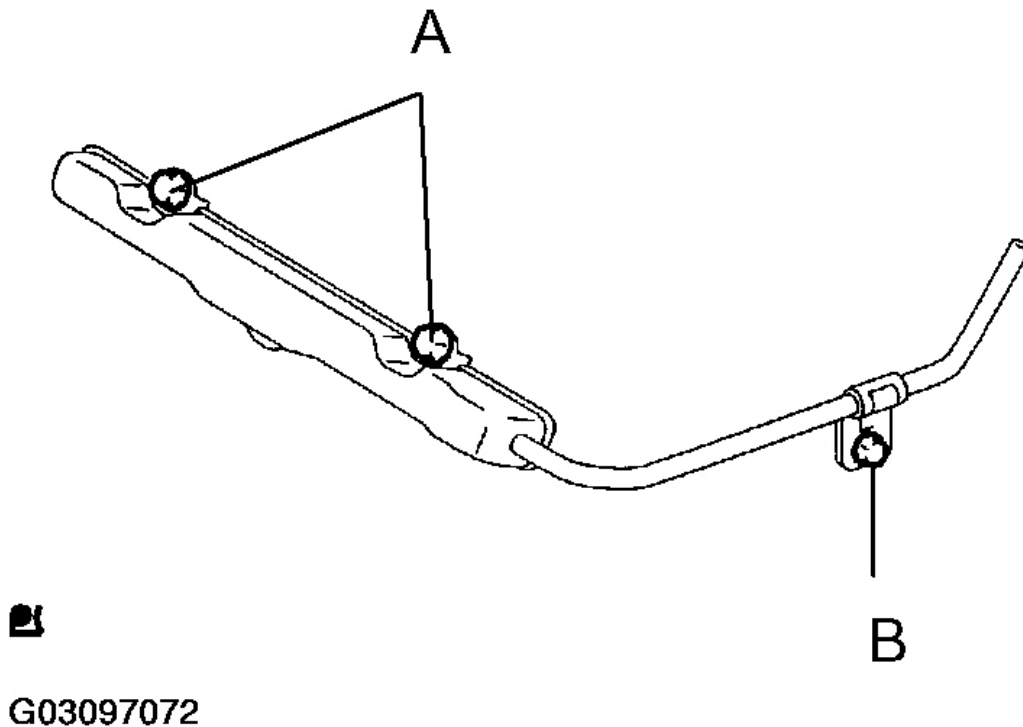


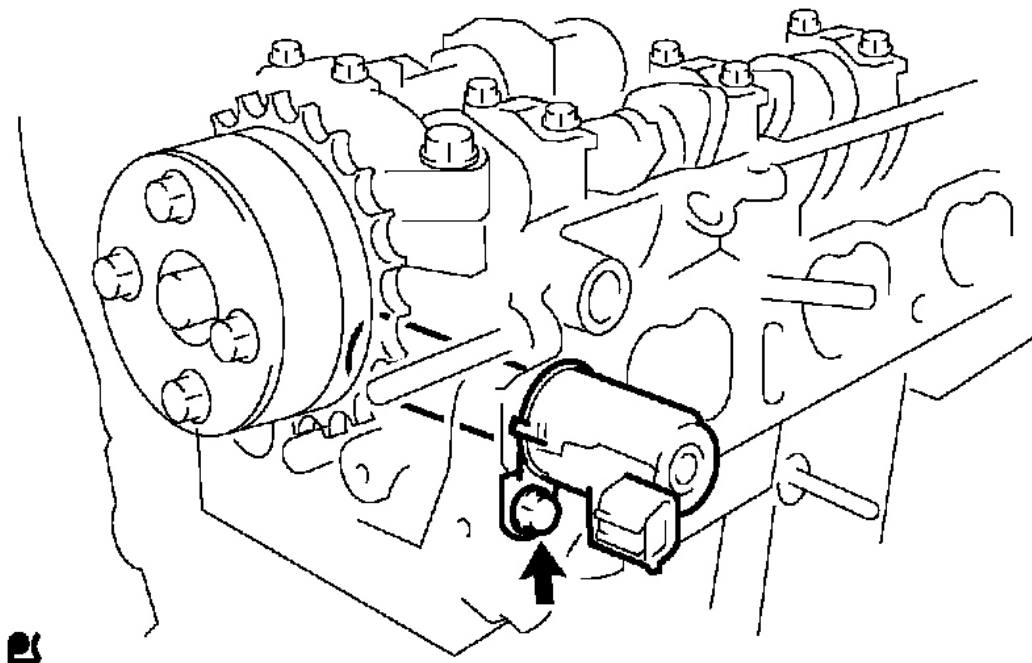
Fig. 189: Installing Fuel Delivery Pipe And Fuel Injectors Together
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

68. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY

- Apply a light coat of engine oil to a new O-ring, and install it onto the camshaft timing oil control valve.
- Install the camshaft timing oil control valve with the bolt.

Torque: 7.5 N.m (76 kgf.cm, 66 in.lbf)

NOTE: Be careful not to twist the O-ring.



G03097073

Fig. 190: Installing Camshaft Timing Oil Control Valve With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

69. INSTALL CYLINDER HEAD COVER SUB-ASSY

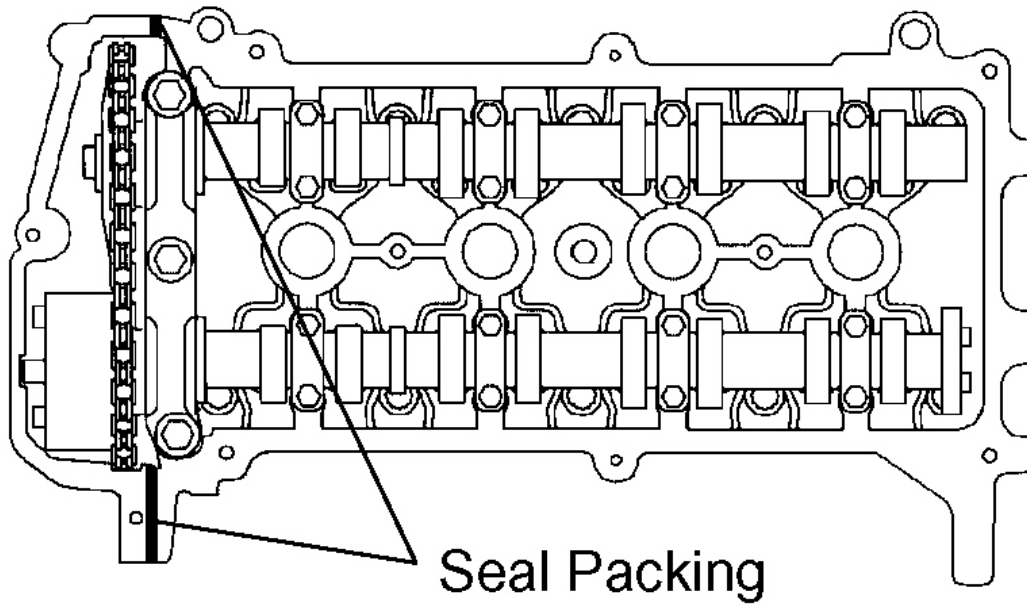
- Install the gasket onto the cylinder head cover.
- Apply the seal packing to the 2 locations as shown in **Fig. 191**.

Seal packing:

Part No. 08826 - 00080 or equivalent

NOTE:

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes of applying the seal packing.
- Do not start the engine for at least 2 hours after installation.



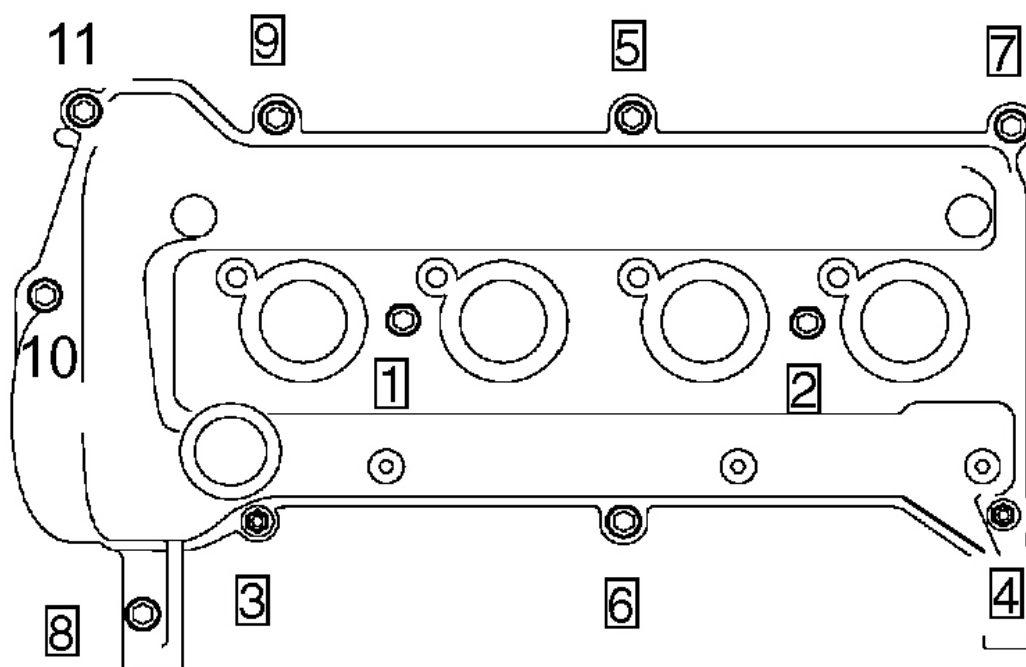
G03097074

Fig. 191: Identifying Seal Packing Application Areas

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

- c. Install the cylinder head cover with the 9 bolt, 2 seal washers and 2 nuts.
- d. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in **Fig. 192**.

Torque: 10 N.m (102 kgf.cm, 7.4 ft.lbf)



G03097075

Fig. 192: Tightening Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

70. INSTALL VENTILATION VALVE SUB-ASSY

- a. Install the ventilation valve onto the cylinder head cover.

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

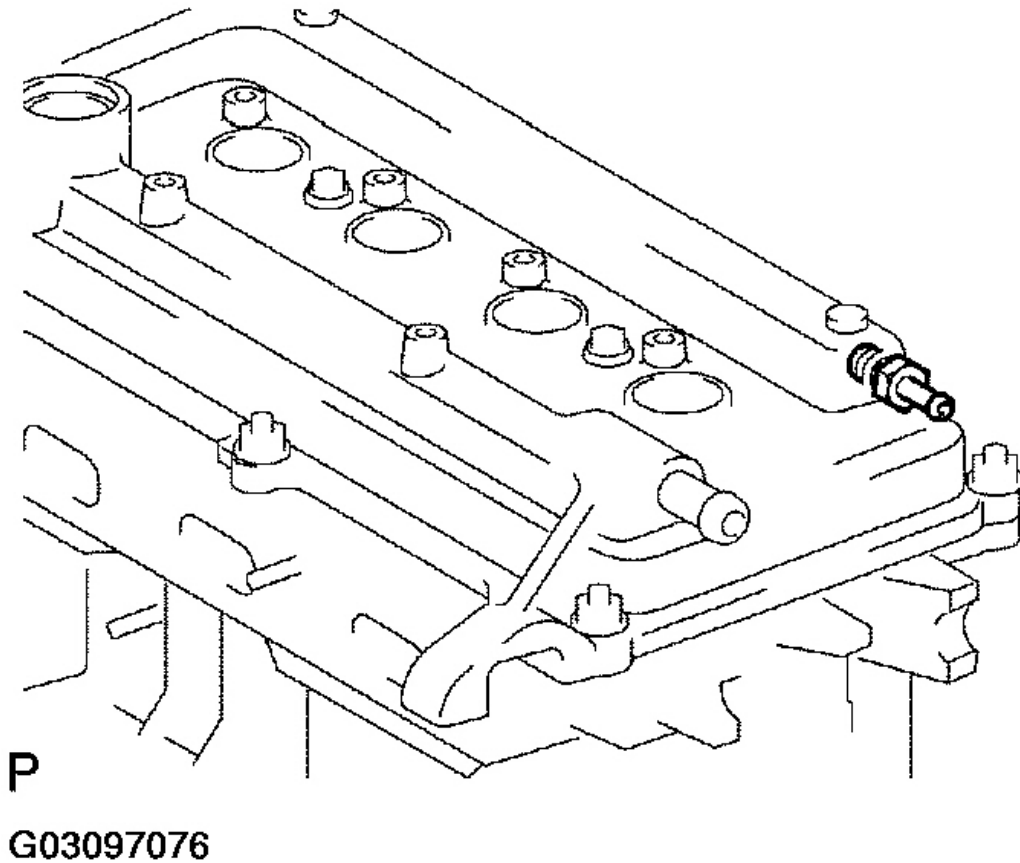


Fig. 193: Installing Ventilation Valve Sub-Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

71. INSTALL OIL LEVEL GAGE GUIDE

- a. Apply engine oil to a new O-ring.
- b. Install the oil level gauge guide with the bolt.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

72. INSTALL CRANKSHAFT POSITION SENSOR

- a. Apply a light coat of engine oil to the O-ring on the crankshaft position sensor.

NOTE: If the O-ring is damaged, replace the crankshaft position sensor.

- b. Install the crankshaft position sensor with the bolt.

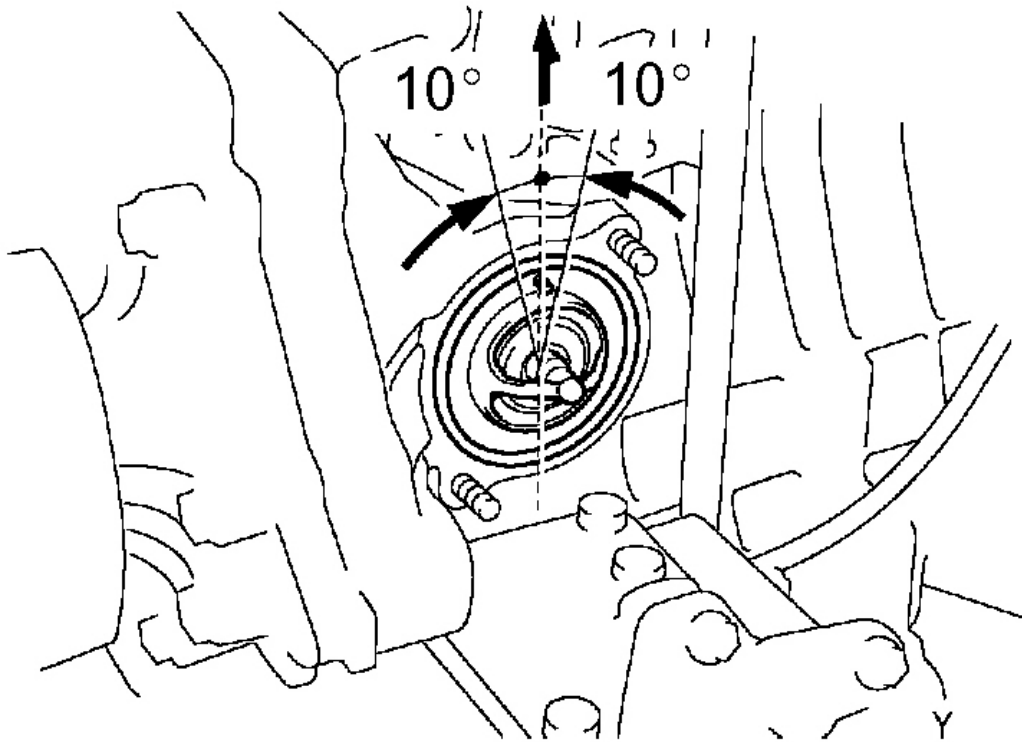
Torque: 7.5 N.m (76 kgf.cm. 66 in.lbf)

73. INSTALL THERMOSTAT

- a. Install a new gasket onto the thermostat.
- b. Install the thermostat with the jiggle valve facing upward.

HINT:

The jiggle valve may be set within 10° at either side as shown in **Fig. 194**.



G03097077

Fig. 194: Installing Thermostat With Jiggle Valve Facing Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the water inlet with the 2 nuts.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

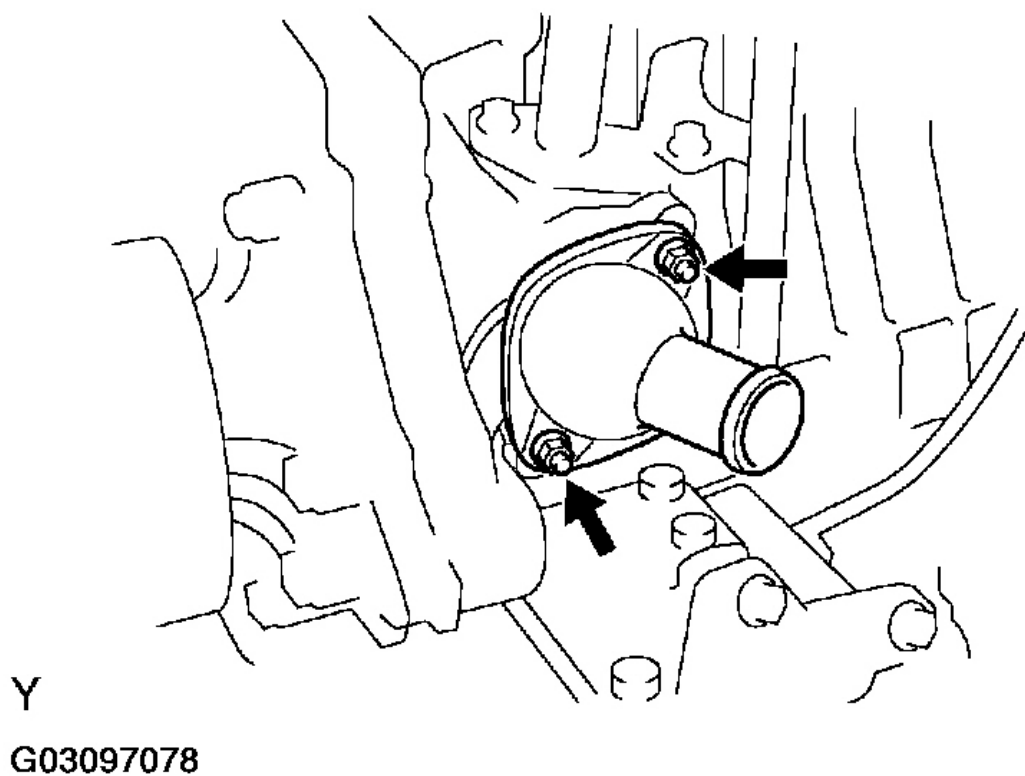


Fig. 195: Installing Water Inlet With Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

74. INSTALL SPARK PLUG

- a. Using a spark plug wrench, install the spark plugs.

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

CHAIN SUB-ASSY

COMPONENTS

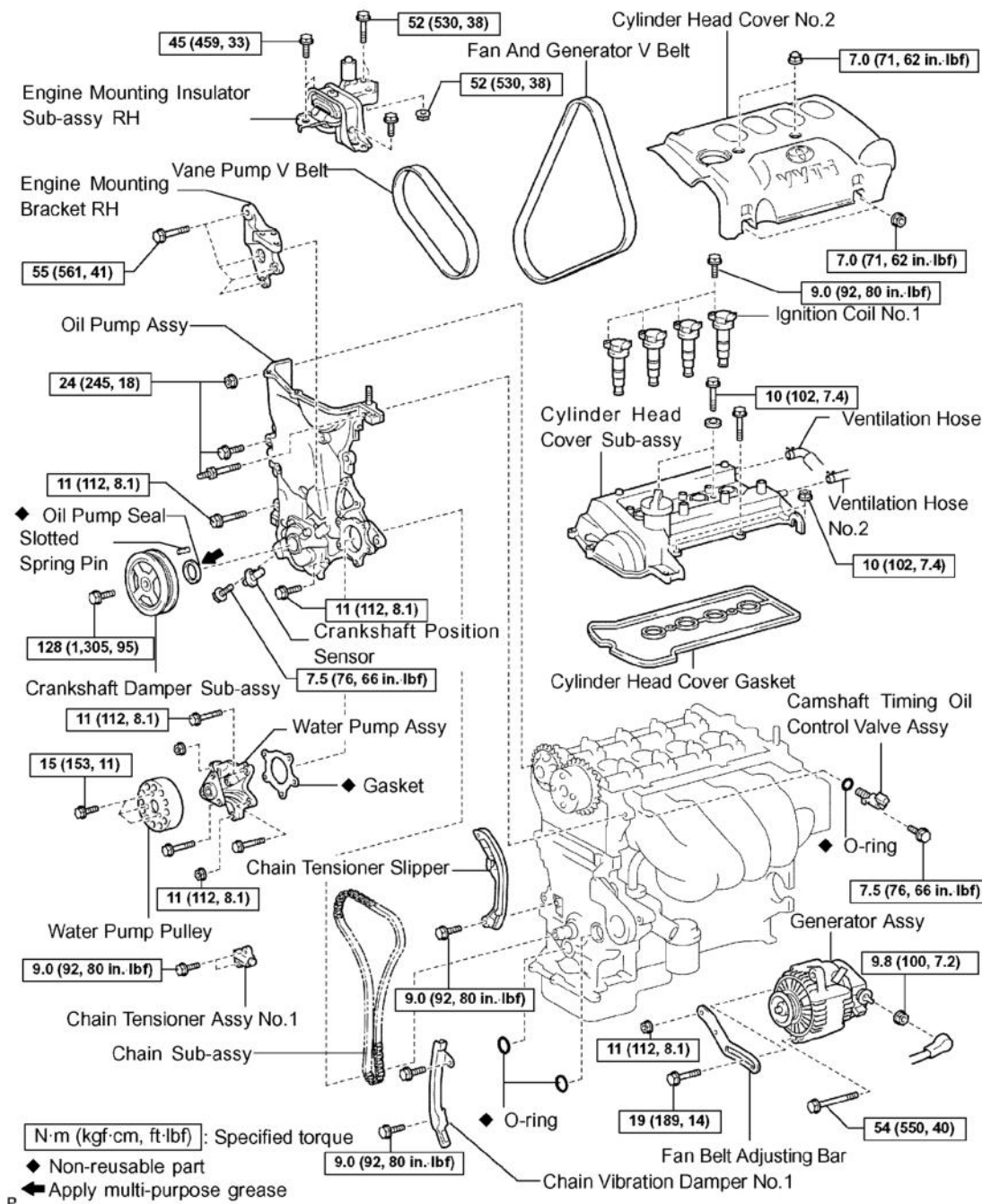


Fig. 196: Exploded View Of Chain Sub-Assembly Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

1. REMOVE FRONT WHEEL RH
2. REMOVE CYLINDER HEAD COVER NO. 2

- a. Remove the 4 nuts and cylinder head cover No. 2.

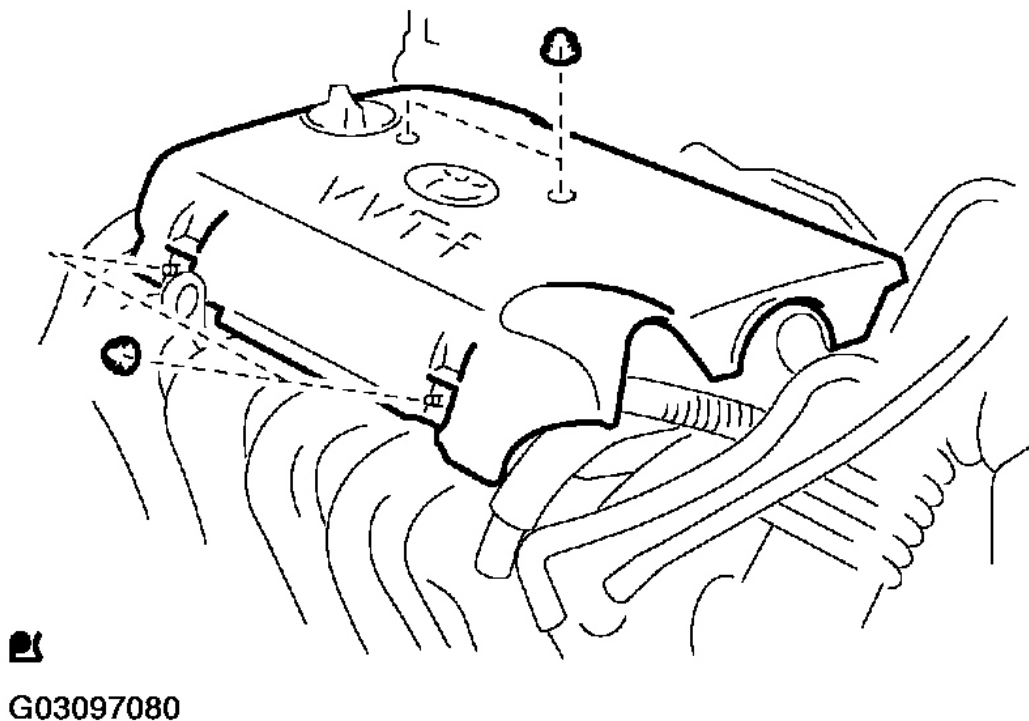
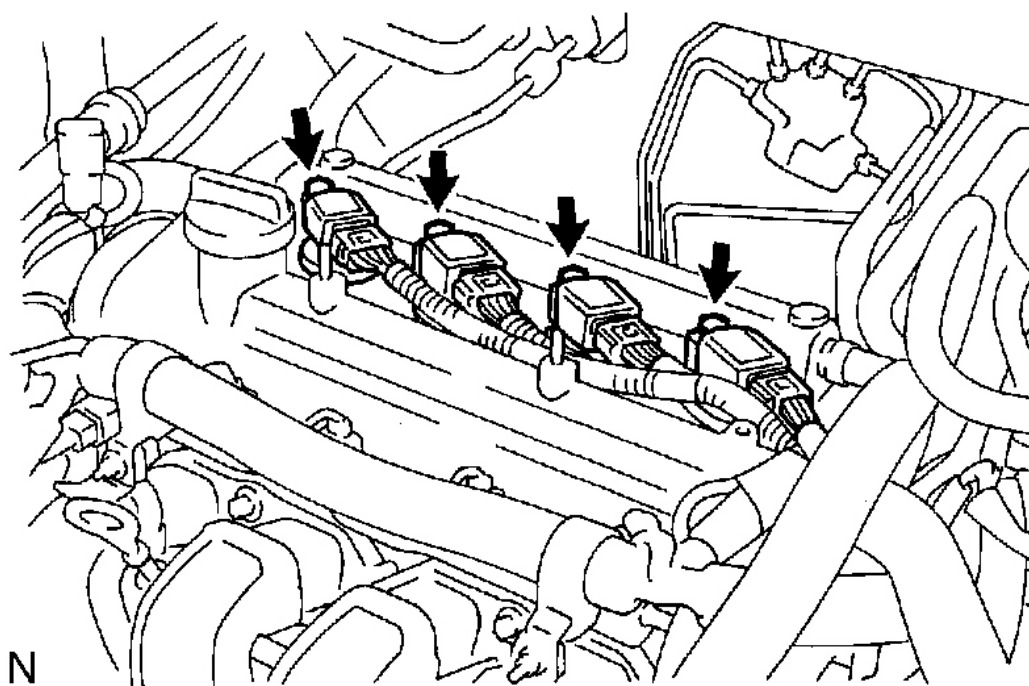


Fig. 197: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. REMOVE IGNITION COIL NO. 1

- a. Remove the 4 bolts and pull out the 4 ignition coils.



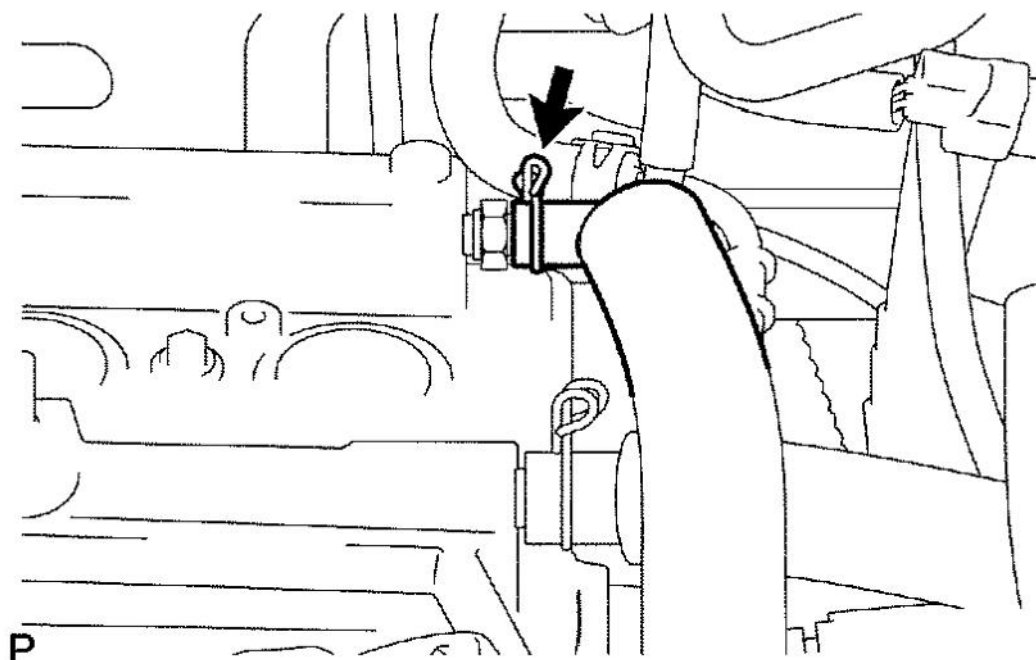
G03097081

Fig. 198: Removing Ignition Coil No. 1

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

4. DISCONNECT VENTILATION HOSE

- a. Disconnect the ventilation hose from the cylinder head cover.



P

G03097082

Fig. 199: Disconnecting Ventilation Hose

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

5. DISCONNECT VENTILATION HOSE NO. 2

- a. Disconnect the ventilation hose No. 2 from the cylinder head cover.

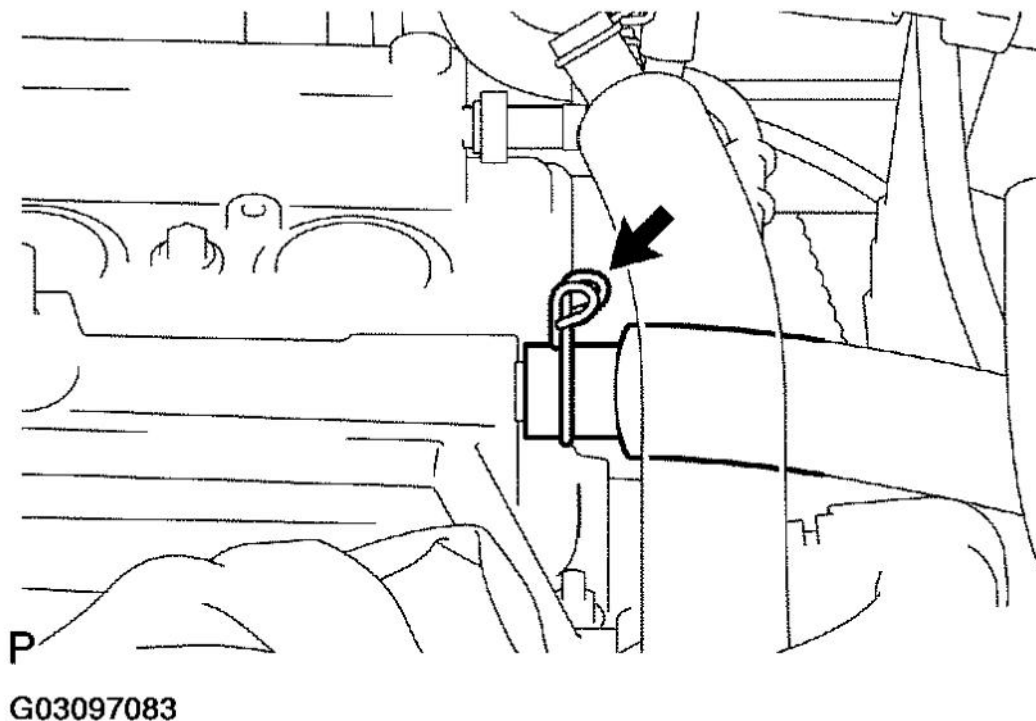
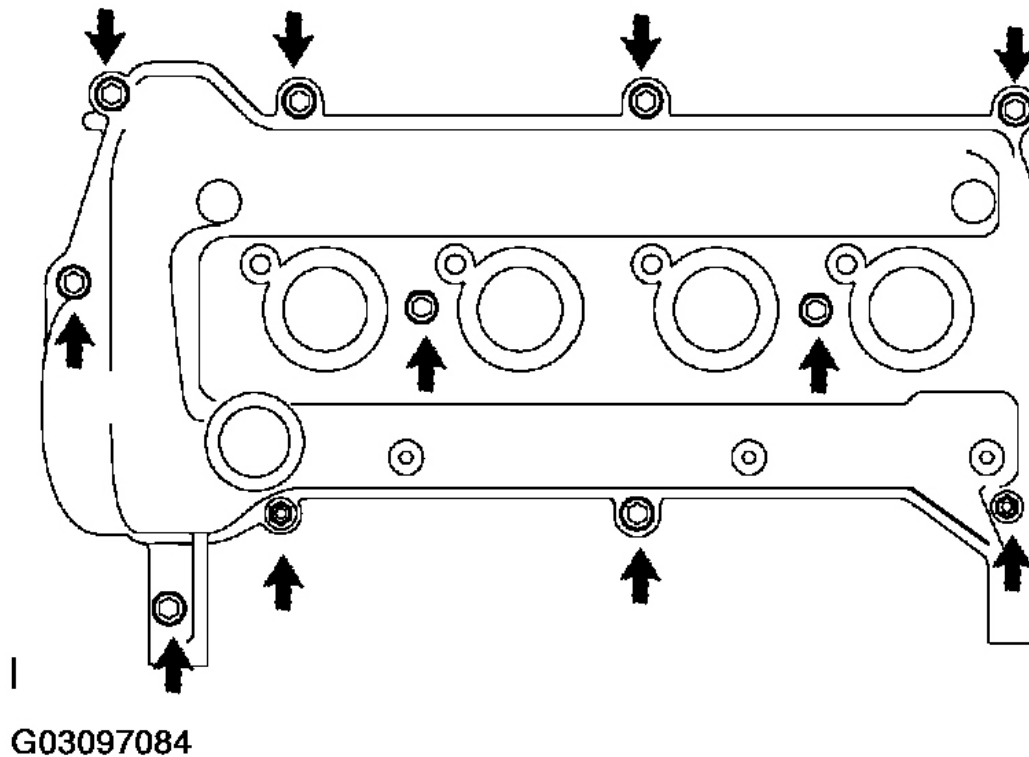


Fig. 200: Disconnecting Ventilation Hose No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

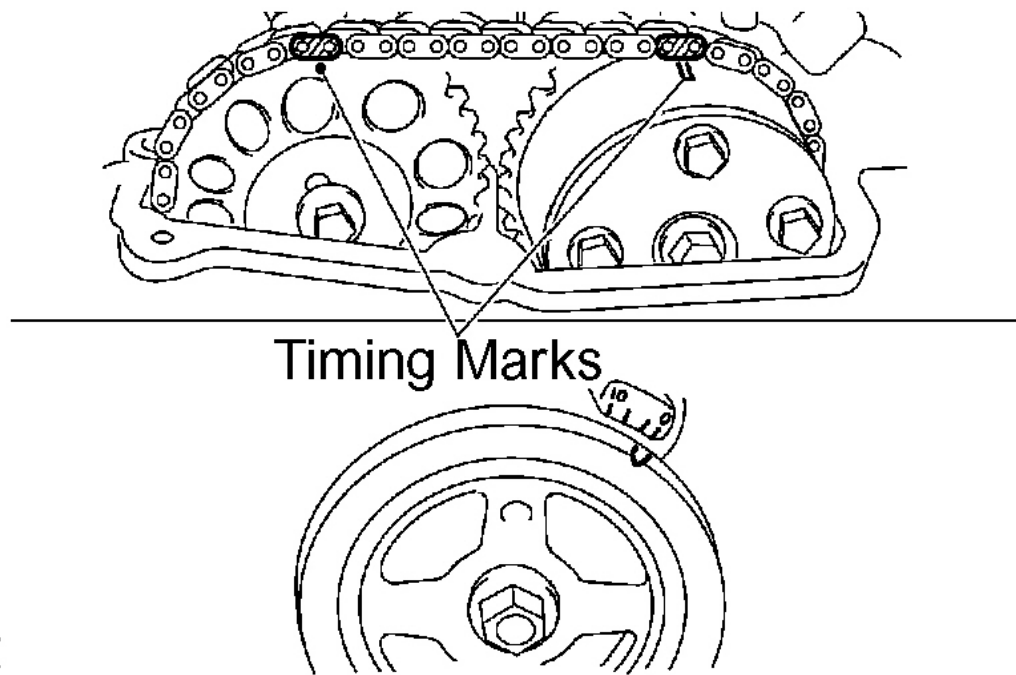
6. REMOVE CYLINDER HEAD COVER SUB-ASSY

- a. Remove the 9 bolts and 2 nuts, and then remove the cylinder head cover.

**Fig. 201: Removing Bolts And Nuts**

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

7. REMOVE FAN AND GENERATOR V BELT (See REPLACEMENT)
8. REMOVE GENERATOR ASSY (See REPLACEMENT)
9. REMOVE ENGINE UNDER COVER RH (See REPLACEMENT)
10. DRAIN ENGINE OIL
11. DRAIN ENGINE COOLANT (See REPLACEMENT)
12. REMOVE VANE PUMP V BELT (See REPLACEMENT)
13. REMOVE WATER PUMP PULLEY (See REPLACEMENT)
14. REMOVE WATER PUMP ASSY (See REPLACEMENT)
15. REMOVE CRANKSHAFT DAMPER SUB-ASSY
 - a. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.
 2. Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in Fig. 202.



G03097085

Fig. 202: Checking That Both Timing Marks On Camshaft Timing Sprocket And Camshaft Timing Gear Are Facing Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

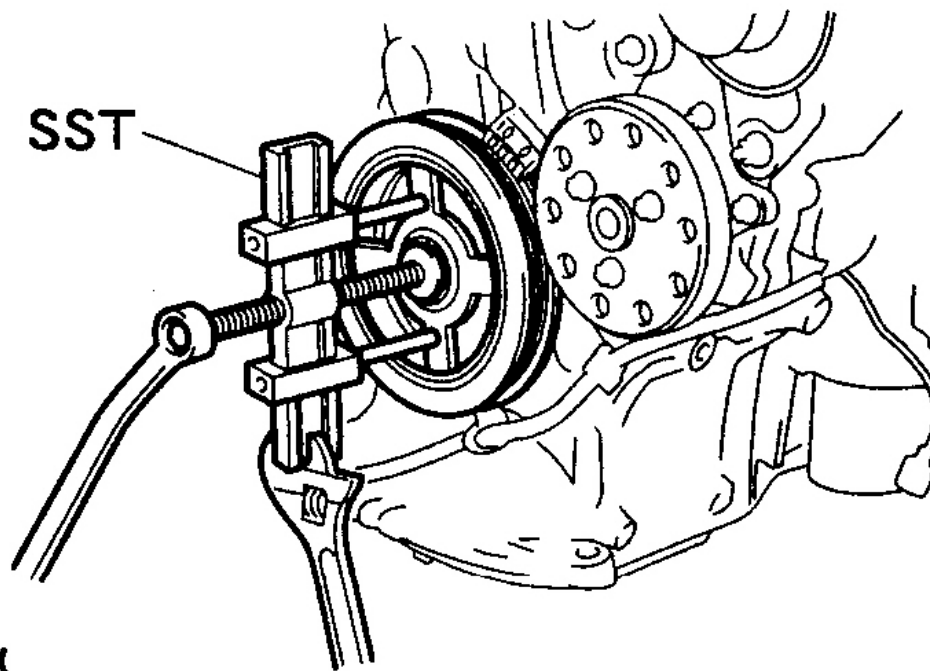
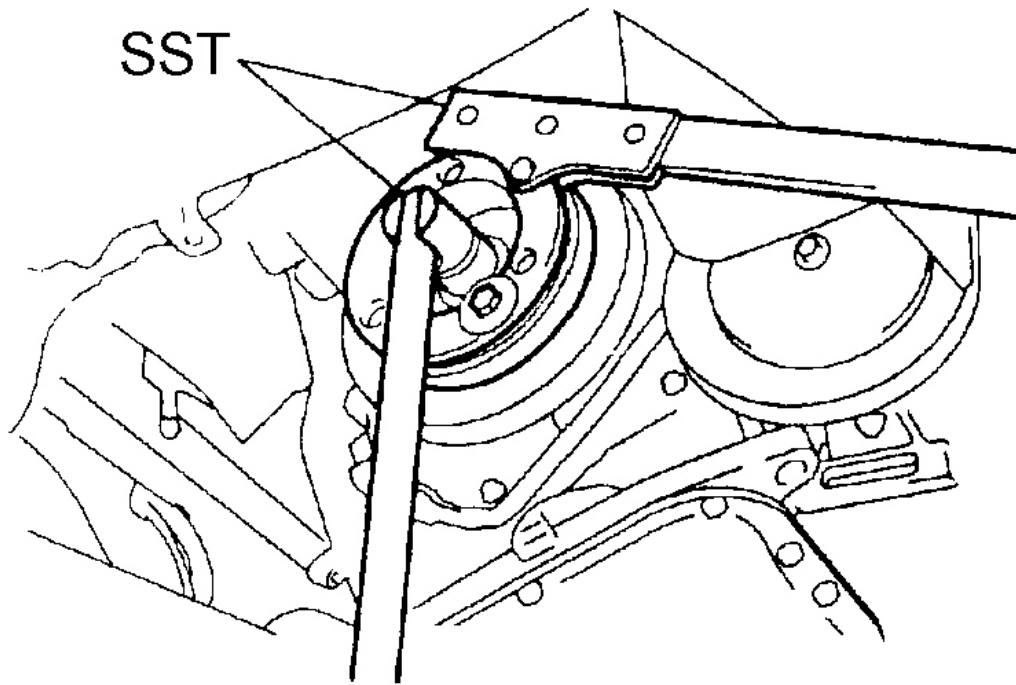
- b. Using SST, remove the pulley bolt.

SST 09213-58012 (91111-50845), 09330-00021

HINT:

If necessary, remove the damper with SST.

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



G03097086

Fig. 203: Removing Pulley Bolt And Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY

- a. Disconnect the oil control valve connector.
- b. Remove the bolt, oil control valve and O-ring

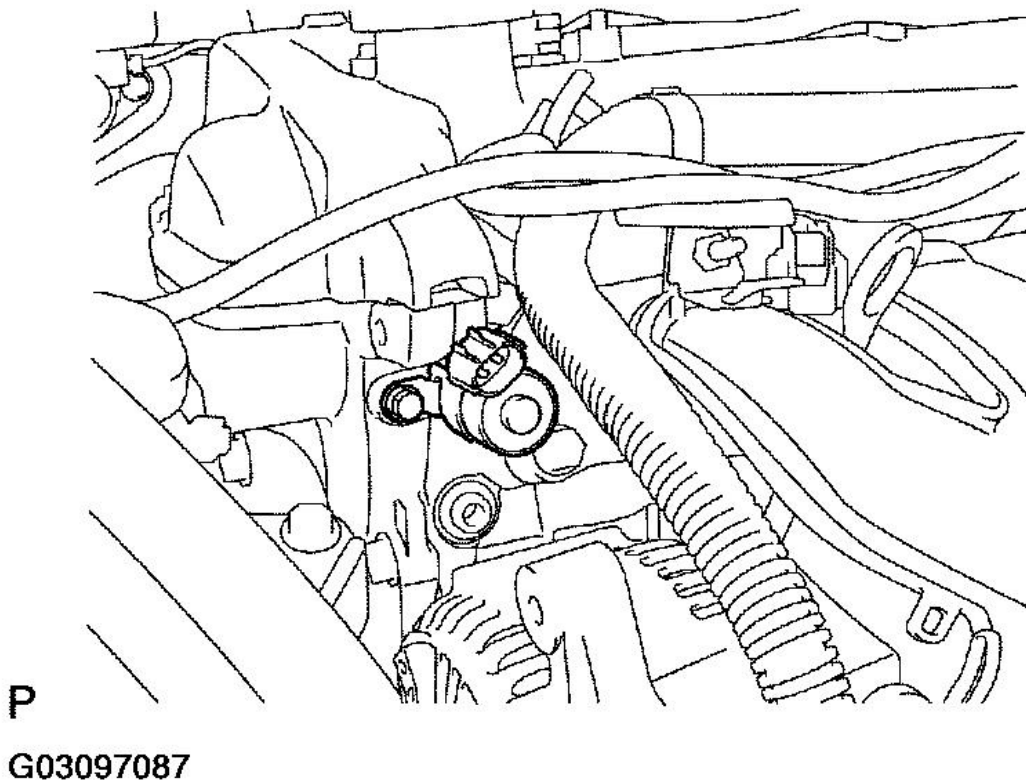


Fig. 204: Removing Camshaft Timing Oil Control Valve Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. REMOVE CRANKSHAFT POSITION SENSOR (See REPLACEMENT)

18. REMOVE ENGINE MOUNTING INSULATOR SUB-ASSY RH

- a. Place a wooden block on a jack underneath the engine.

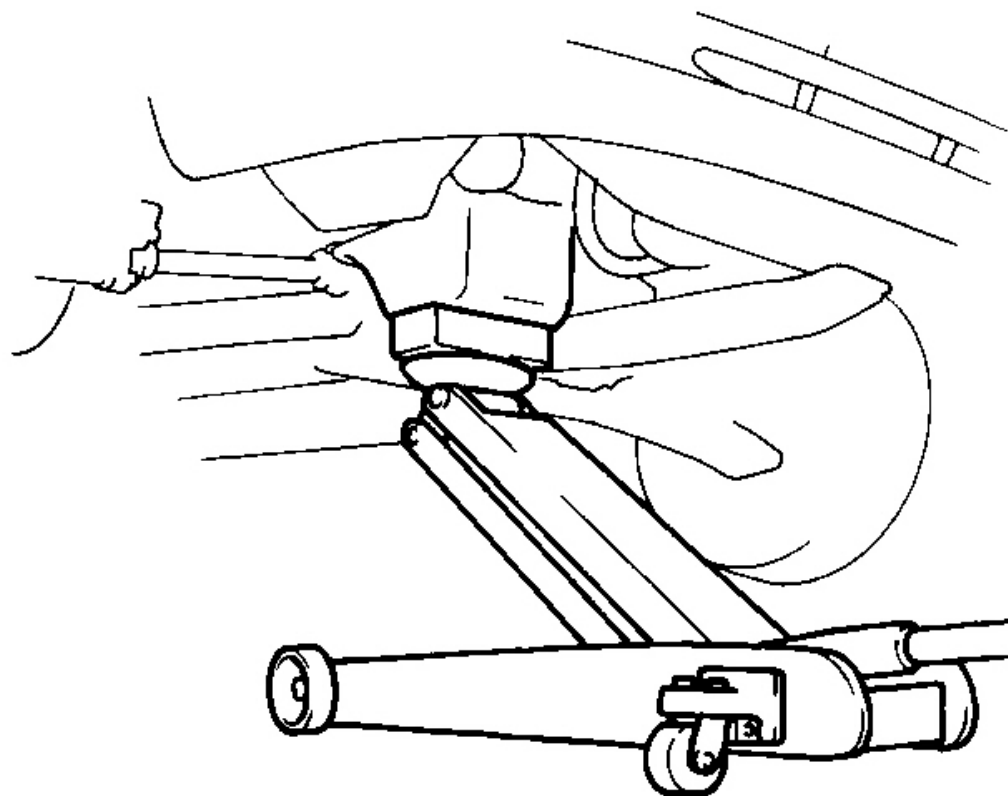
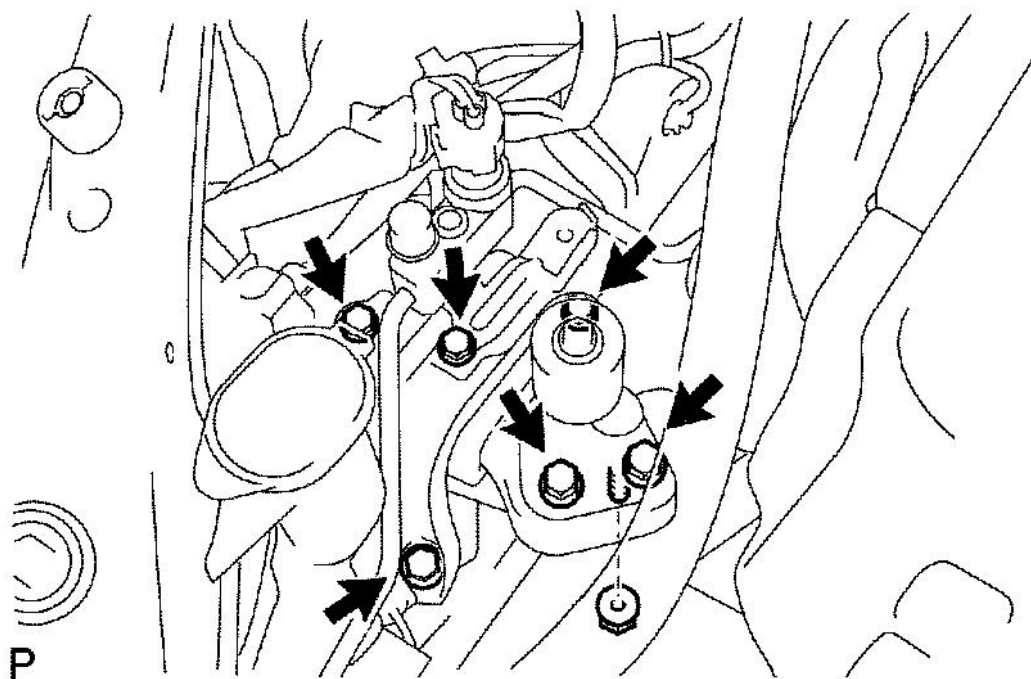
**G03097088**

Fig. 205: Placing Wooden Block On Jack Underneath Engine
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bolt which is used to fix the liquid tube to the engine mounting insulator RH.
- c. Remove the 5 bolts and nut, and then remove the engine mounting insulator RH.



G03097089

Fig. 206: Removing Bolts And Nuts

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

19. REMOVE TRANSVERSE ENGINE ENGINE MOUNTING BRACKET

- a. Remove the 4 bolts and engine mounting bracket RH.

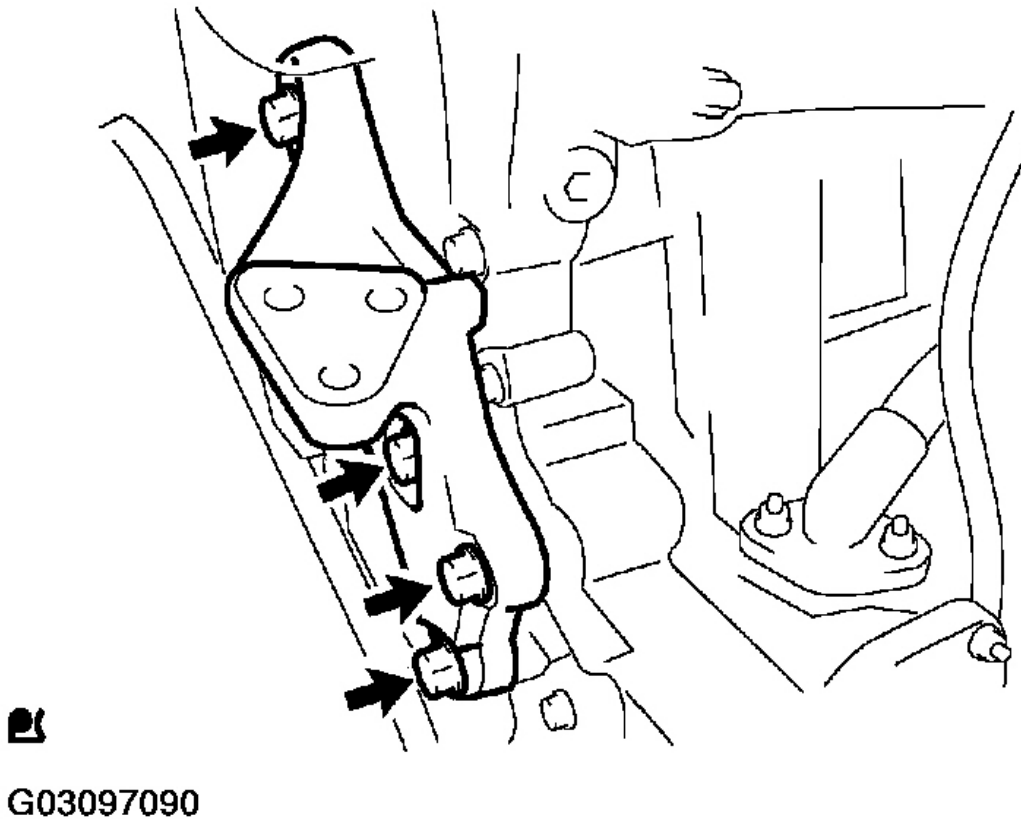


Fig. 207: Removing Bolts And Engine Mounting Bracket RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. REMOVE OIL PUMP ASSY (See REPLACEMENT)
21. REMOVE OIL PUMP SEAL (See REPLACEMENT)
22. REMOVE CHAIN TENSIONER ASSY NO. 1

NOTE:

- Do not rotate the crankshaft with the chain tensioner removed.
 - When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC first.
- a. Rotate the stopper plate of the chain tensioner upward as shown in Fig. 208, push in the plunger of the tensioner.

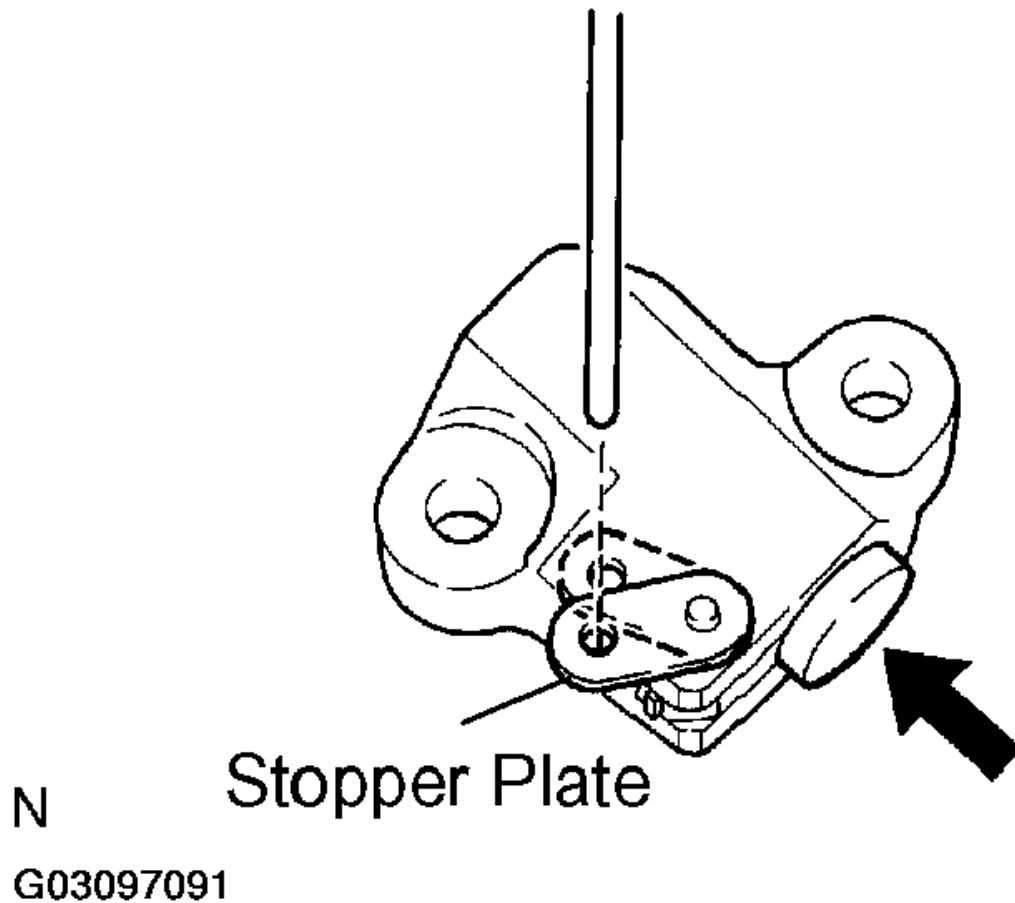


Fig. 208: Rotating Stopper Plate Of Chain Tensioner Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

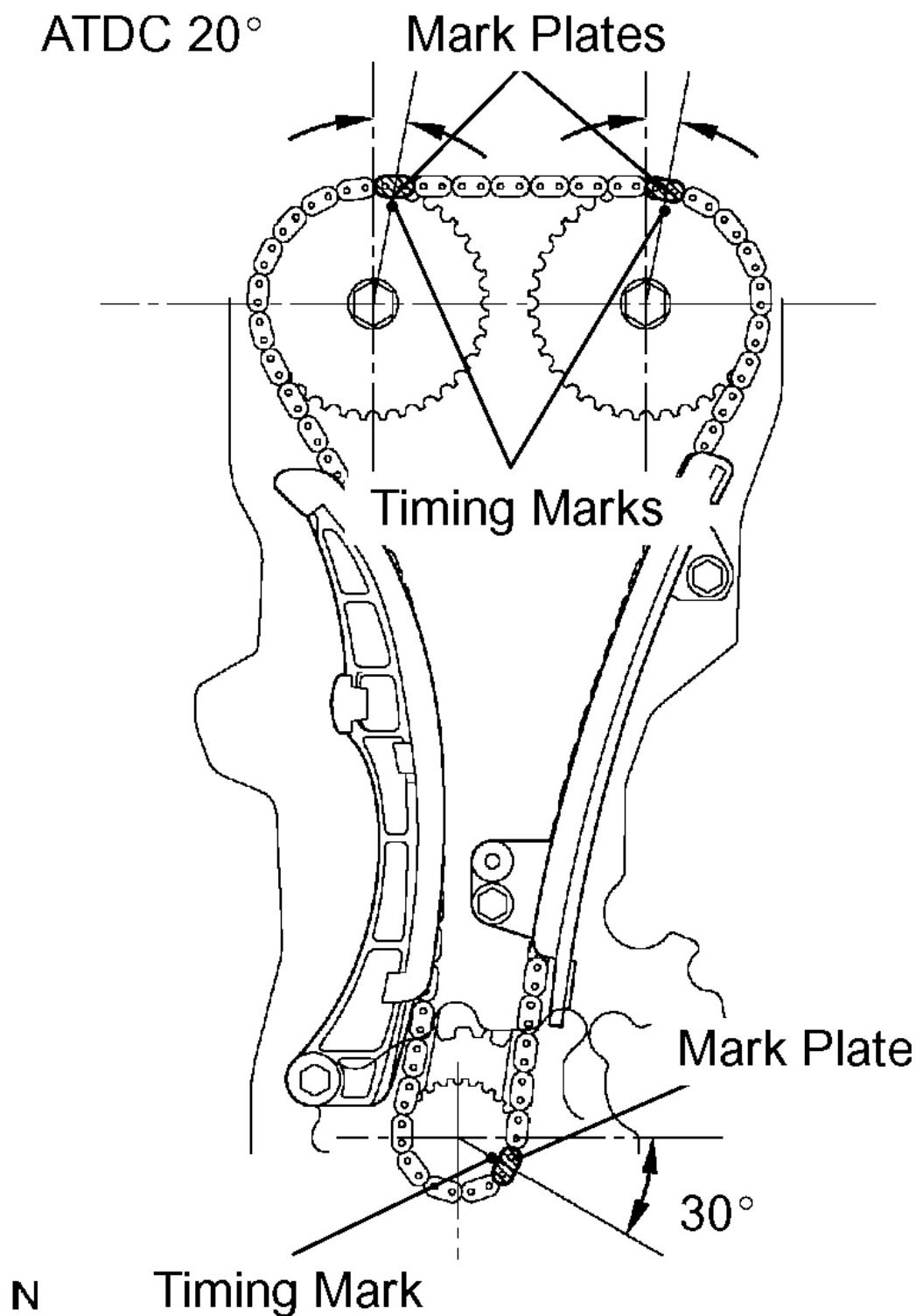
- b. Rotate the stopper plate of the tensioner downward, insert a 2.5 mm (0.098 in.) diameter bar into the holes of the stopper plate and tensioner to hold the stopper plate.
23. **REMOVE CHAIN TENSIONER SLIPPER**
 - a. Remove the bolt and chain tensioner slipper.
24. **REMOVE CHAIN VIBRATION DAMPER NO. 1**
 - a. Remove the 2 bolts and chain vibration damper.
25. **REMOVE CHAIN SUB-ASSY**
26. **INSTALL CHAIN SUB-ASSY**
 - a. After setting the crankshaft at ATDC 40 to 140°, set cams of intake and exhaust timing sprockets at ATDC 20° and then reset the crankshaft at ATDC 20°.
 - b. Install the chain vibration damper with the 2 bolts.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

- c. Align the matchmarks of the camshaft timing sprocket, camshaft timing gear and crankshaft timing sprocket with each mark plate (colored in yellow) of the timing chain.

HINT:

To prevent the exhaust camshaft from springing back, turn it using a wrench and set it at the mark on the chain.



G03097092

Fig. 209: Aligning Matchmarks Of Camshaft Timing Sprocket, Camshaft Timing Gear And Crankshaft Timing Sprocket With Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

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

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

- f. Remove the bar from the chain tensioner.

- g. Check the tension between the intake and exhaust camshaft timing sprockets.

27. INSTALL OIL PUMP SEAL (See REPLACEMENT)

SST 09950-60010 (09951-00250, 09951-00380, 09952-06010), 09950-70010 (09951-07100)

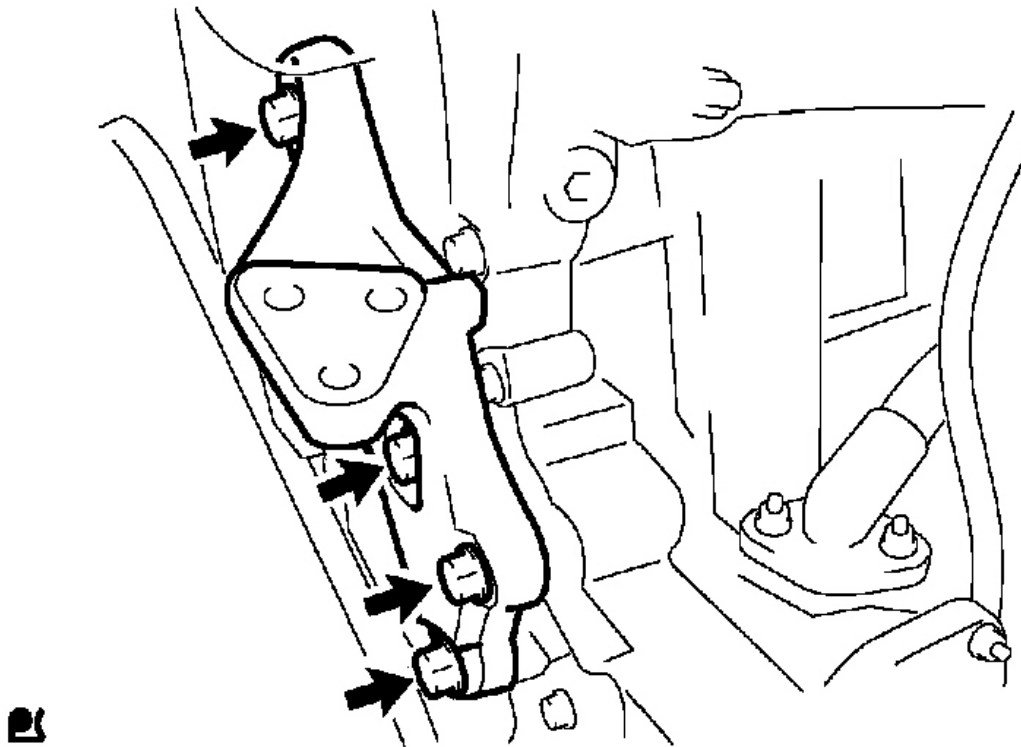
28. INSTALL OIL PUMP ASSY (See REPLACEMENT)

29. INSTALL WATER PUMP ASSY (See REPLACEMENT)

30. INSTALL TRANSVERSE ENGINE ENGINE MOUNTING BRACKET

- a. Install the engine mounting bracket RH with the 4 bolts.

Torque: 55 N.m (561 kgf.cm, 41 ft.lbf)



G03097093

Fig. 210: Installing Transverse Engine Engine Mounting Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL ENGINE MOUNTING INSULATOR SUB-ASSY RH

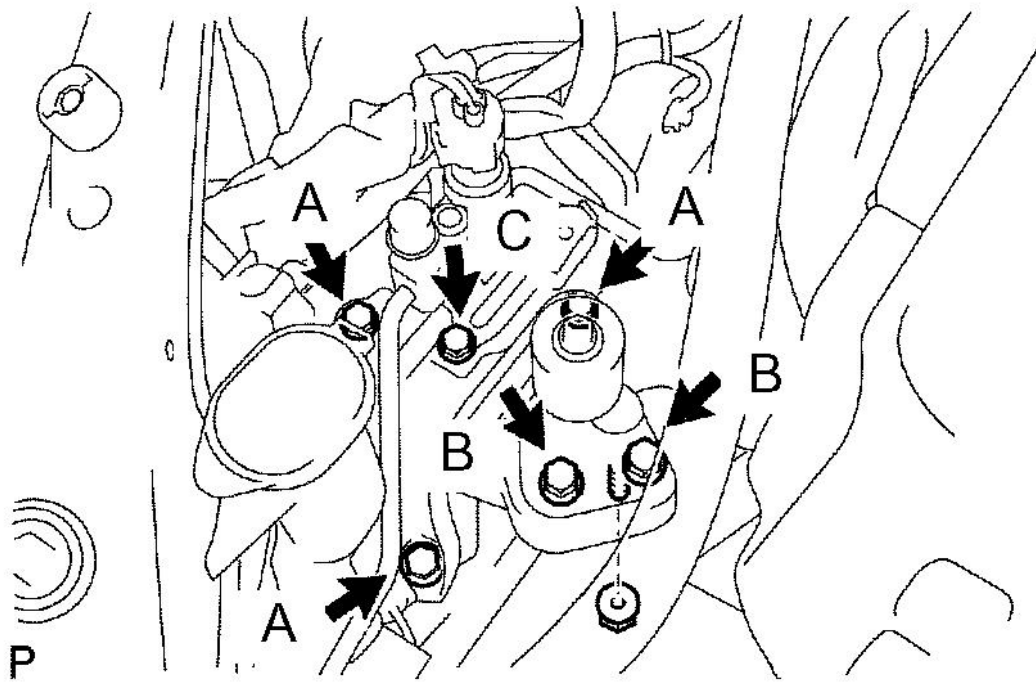
- a. Install the RH engine mounting insulator with the 5 bolts and nut.

Torque:

Bolt A: 45 N.m (459 kgf.cm, 33 ft.lbf)

Bolt B: 52 N.m (530 kgf.cm, 38 ft.lbf)

Nut: 52 N.m (530 kgf.cm, 38 ft.lbf)



G03097094

Fig. 211: Installing RH Engine Mounting Insulator With Bolts And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the liquid tube with the bolt.

Torque:

Bolt C: 9.8 N.m (100 kgf.cm, 7.2 ft.lbf)

32. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY

- a. Apply a light coat of engine oil to a new O-ring, and install it onto the camshaft timing oil control valve.
- b. Install the camshaft timing oil control valve with the bolt.

Torque: 7.5 N.m (76 kgf.cm, 66 in.lbf)

NOTE: Be careful not to twist an O-ring.

33. INSTALL CRANKSHAFT POSITION SENSOR (See REPLACEMENT)

34. INSTALL WATER PUMP PULLEY (See REPLACEMENT)

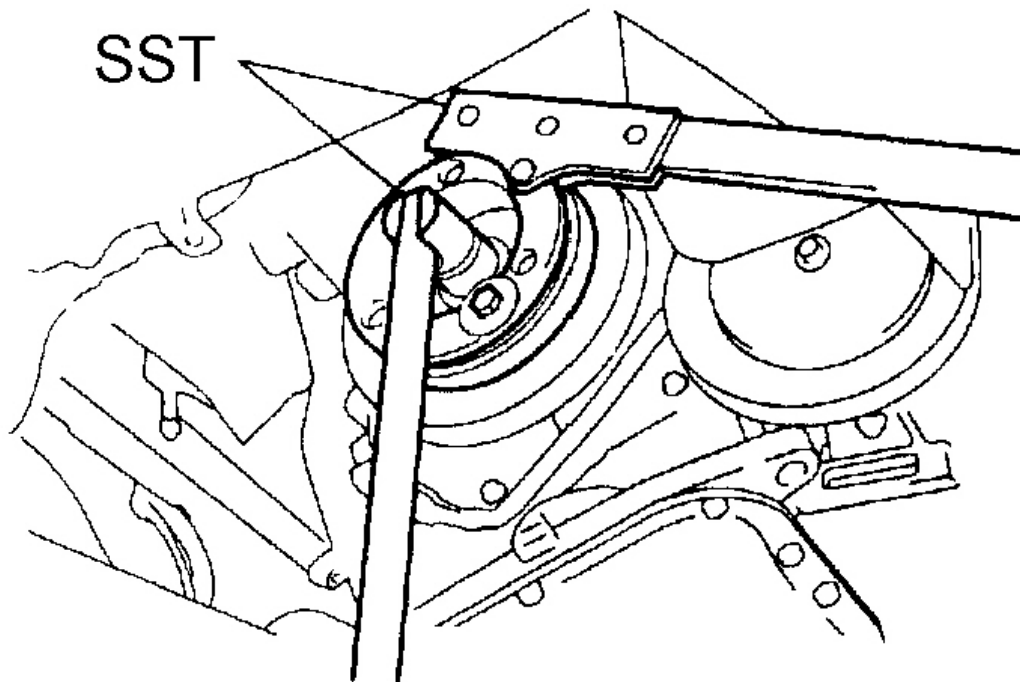
SST 09960-10010 (09962-01000, 09963-00600)

35. INSTALL CRANKSHAFT DAMPER SUB-ASSY

- a. Align pin hole of the crankshaft damper with the pin position and install the crankshaft damper.
- b. Using SST, install the pulley bolt.

SST 09330-00021, 09213-58012 (91111-50845)

Torque: 128 N.m (1,305 kgf.cm, 95 ft.lbf)



G03097095

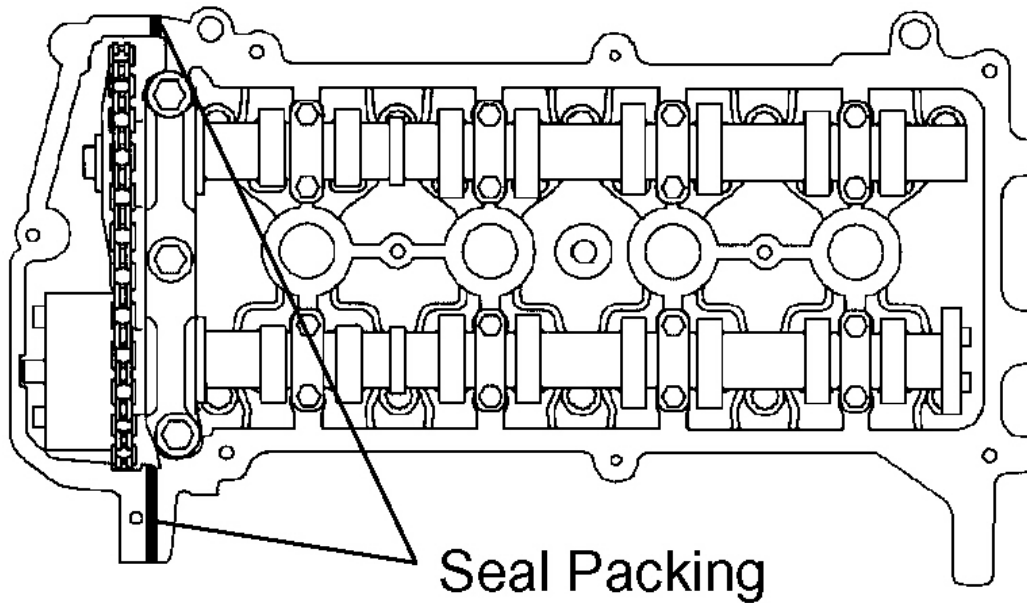
Fig. 212: Installing Pulley Bolt

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

36. INSTALL CYLINDER HEAD COVER SUB-ASSY

- a. Apply the seal packing to the 2 locations shown in **Fig. 213**.

Seal packing: Part No. 08826 - 00080 or equivalent



G03097096

Fig. 213: Identifying Seal Packing Application Areas

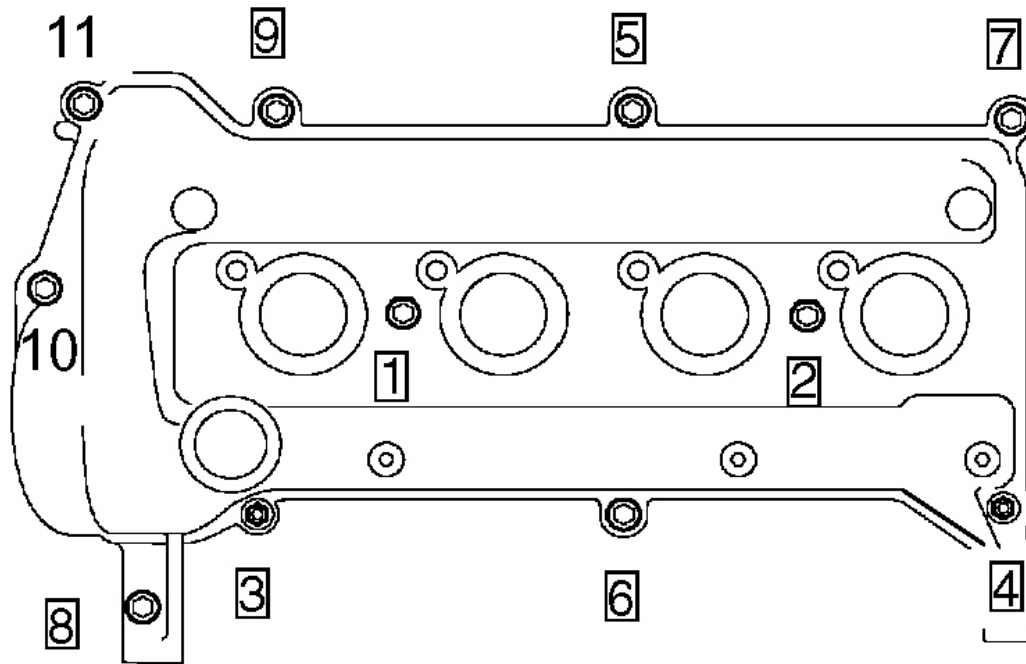
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes of applying the seal packing.
- Do not start the engine for at least 2 hours after installation.

- b. Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.
- c. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in **Fig. 214**.

Torque: 10 N.m (102 kgf.cm, 7.4 ft.lbf)



G03097097

Fig. 214: Tightening Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. INSTALL IGNITION COIL NO. 1

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

38. INSTALL CYLINDER HEAD COVER NO. 2

- a. First tighten A nuts, then tighten bolts B.

Torque: 7.0 N.m (71 kgf.cm, 62 in.lbf)

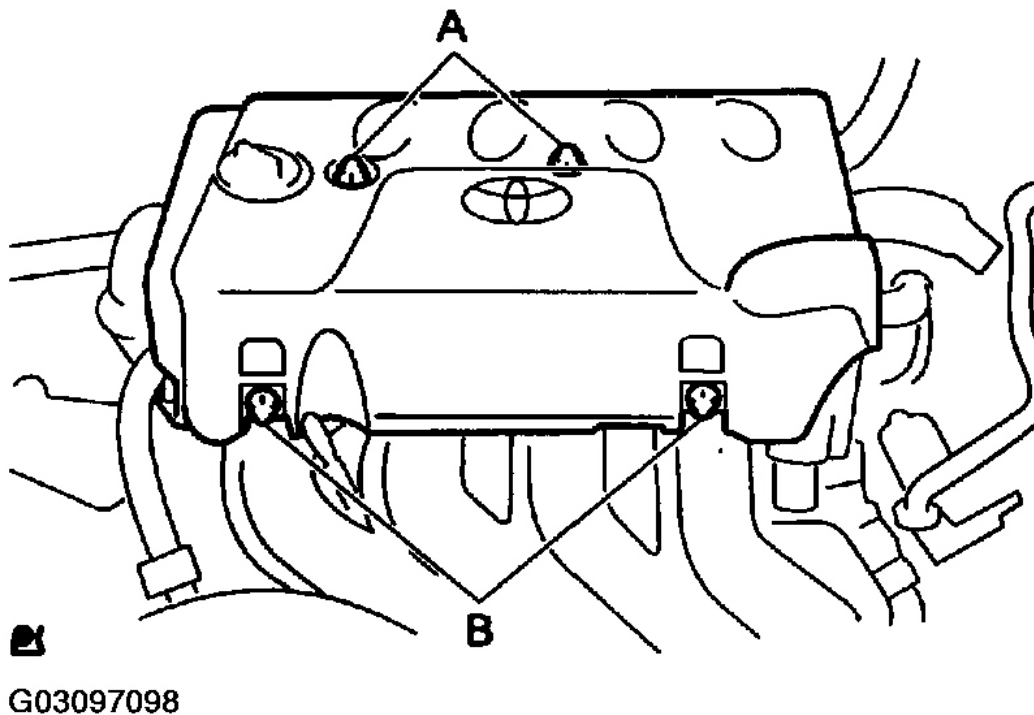


Fig. 215: Installing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. **INSTALL GENERATOR ASSY** (See REPLACEMENT)
40. **INSTALL VANE PUMP V BELT**
 - a. Temporarily install the V-ribbed belt onto each pulley.
41. **INSTALL FAN AND GENERATOR V BELT**
 - a. Temporarily install the V-ribbed belt onto each pulley.
42. **ADJUST VANE PUMP V BELT** (See REPLACEMENT)
43. **ADJUST FAN AND GENERATOR V BELT** (See REPLACEMENT)
44. **INSPECT DRIVE BELT DEFLECTION AND TENSION** (See INSPECTION)
45. **INSTALL OIL PAN DRAIN PLUG**
 - a. Install the drain plug with a new gasket.

Torque: 38 N.m (382 kgf.cm, 28 ft.lbf)

46. **INSTALL ENGINE UNDER COVER RH**

Torque:

5.0 N.m (51 kgf.cm, 44 in.lbf) for bolt

5.0 N.m (51 kgf.cm, 44 in.lbf) for nut

47. ADD ENGINE OIL

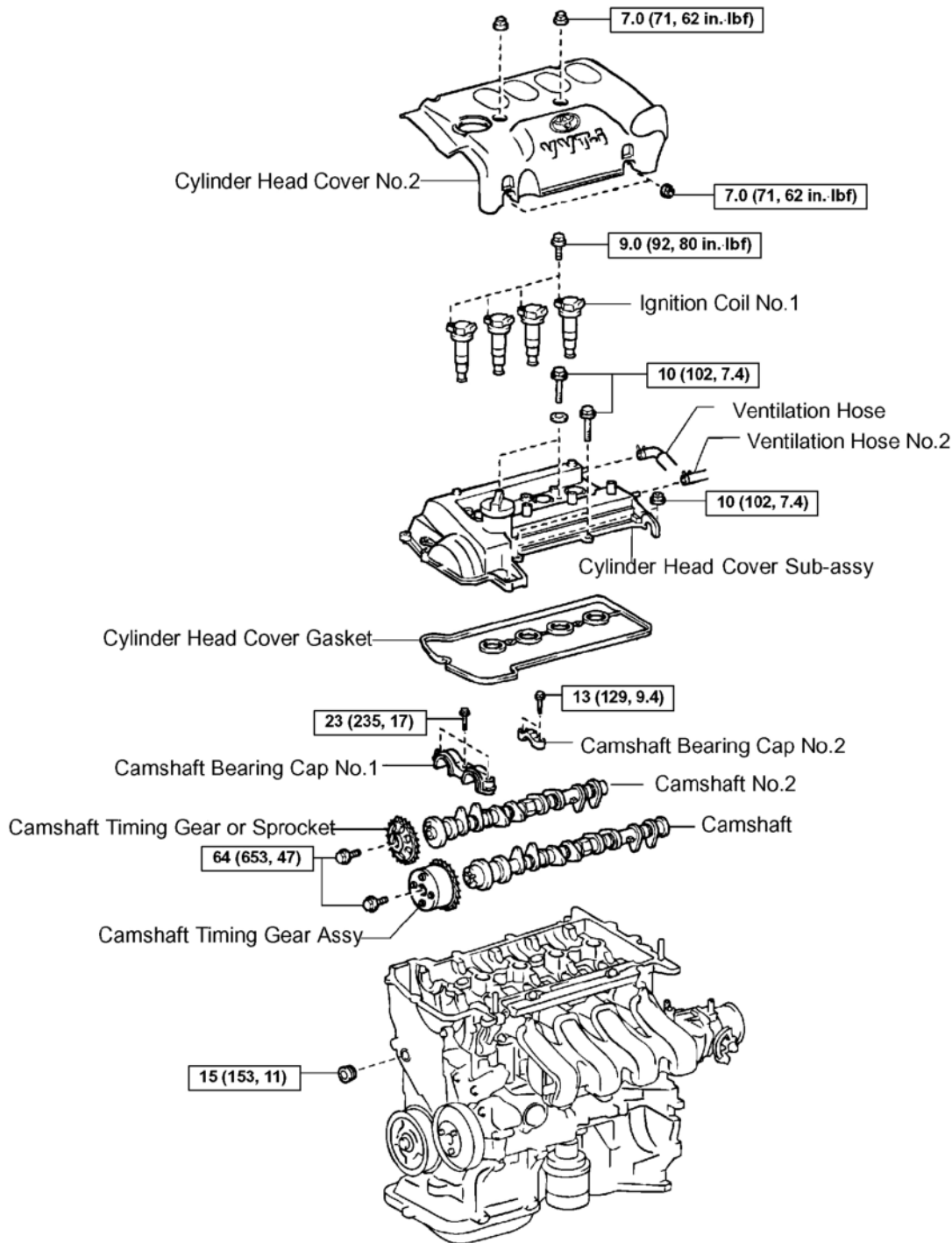
48. CHECK FOR ENGINE OIL LEAKS

49. ADD ENGINE COOLANT (See REPLACEMENT)

50. CHECK FOR ENGINE COOLANT LEAKS (See ON-VEHICLE INSPECTION)

CAMSHAFT

COMPONENTS



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

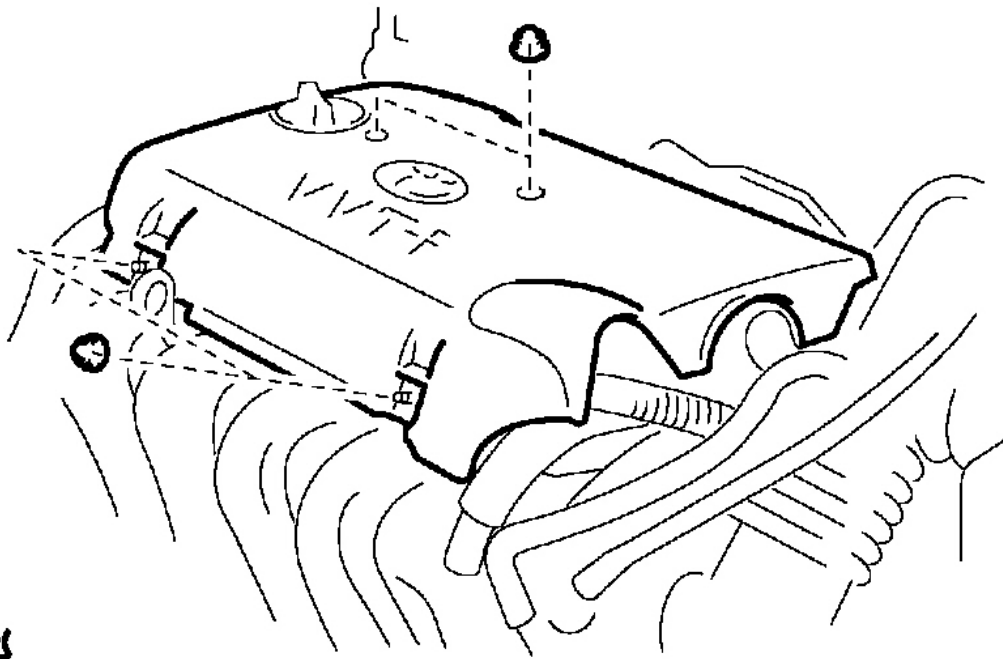
G03097099

Fig. 216: Identifying Camshaft Components

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

REPLACEMENT**1. REMOVE CYLINDER HEAD COVER NO. 2**

- a. Remove the 4 nuts and cylinder head cover No. 2.



G03097100

Fig. 217: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE IGNITION COIL NO. 1

- a. Remove the 4 bolts and pull out the 4 ignition coils.

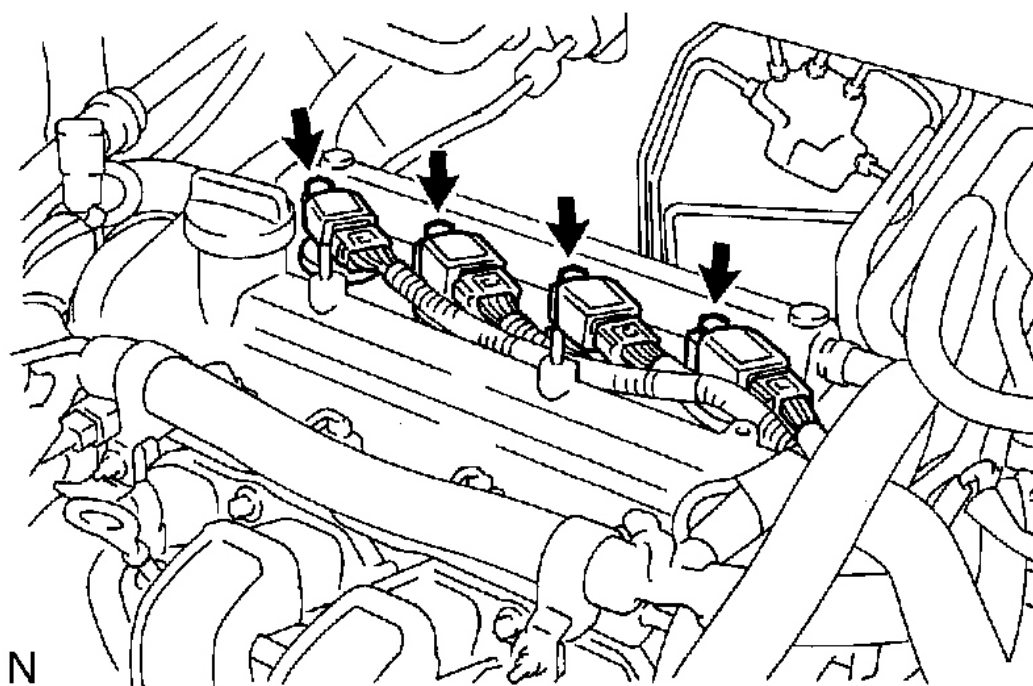
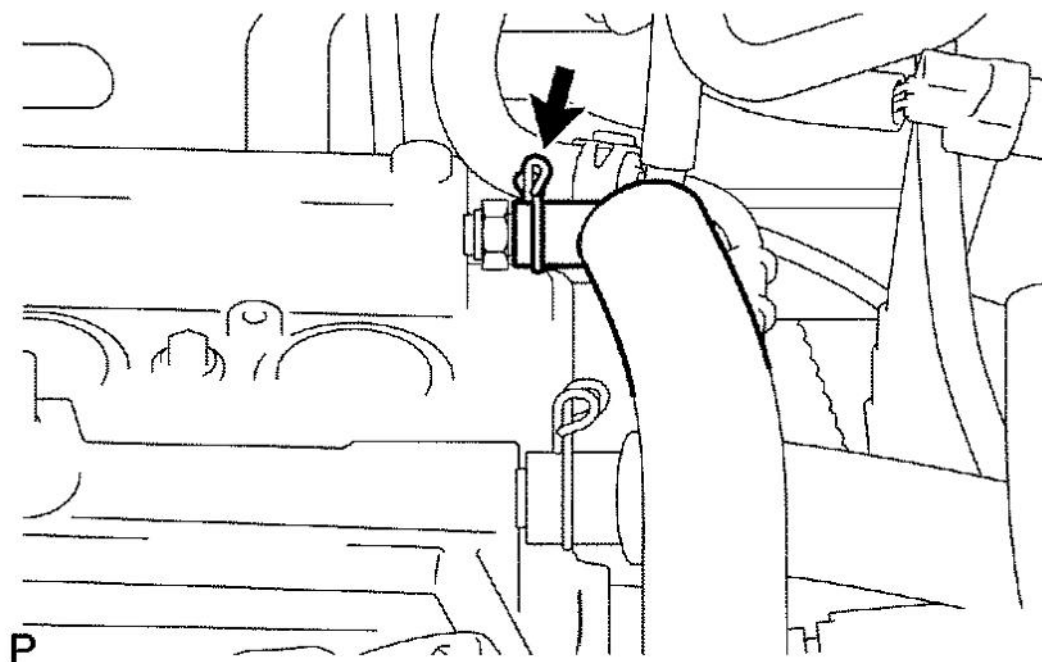


Fig. 218: Removing Ignition Coil No. 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. DISCONNECT VENTILATION HOSE

- a. Disconnect the ventilation hose from the cylinder head cover.



G03097102

Fig. 219: Disconnecting Ventilation Hose

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

4. DISCONNECT VENTILATION HOSE NO. 2

- a. Disconnect the ventilation hose No. 2 from the cylinder head cover.

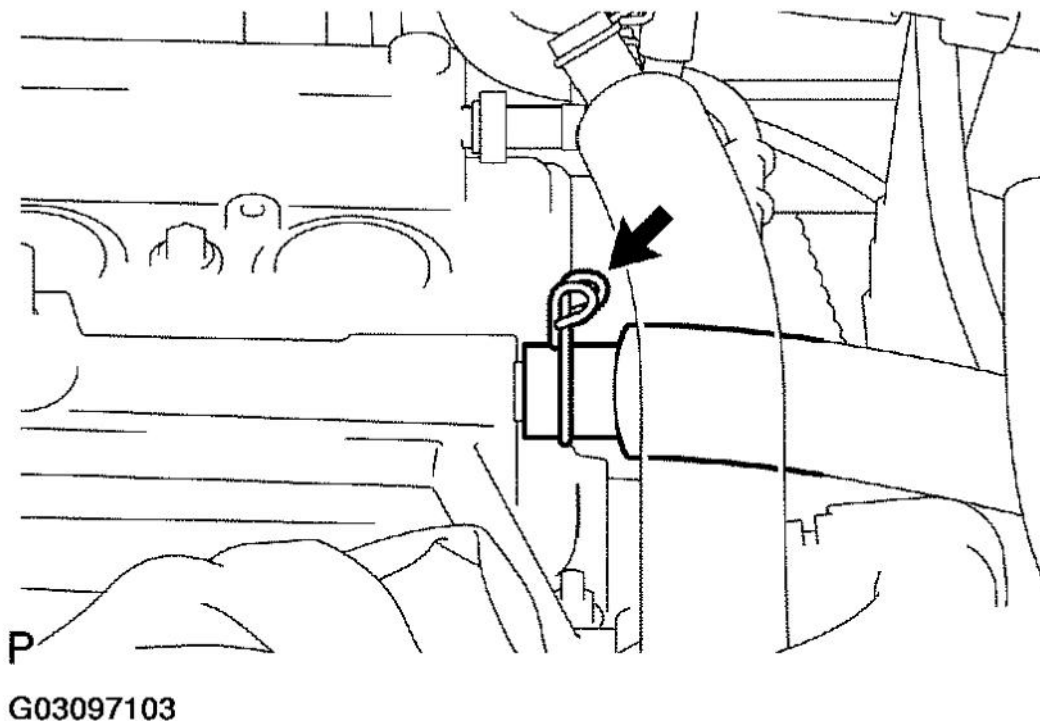


Fig. 220: Disconnecting Ventilation Hose No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE CYLINDER HEAD COVER SUB-ASSY

- a. Remove the 9 bolts and 2 nuts, and then remove the cylinder head cover.

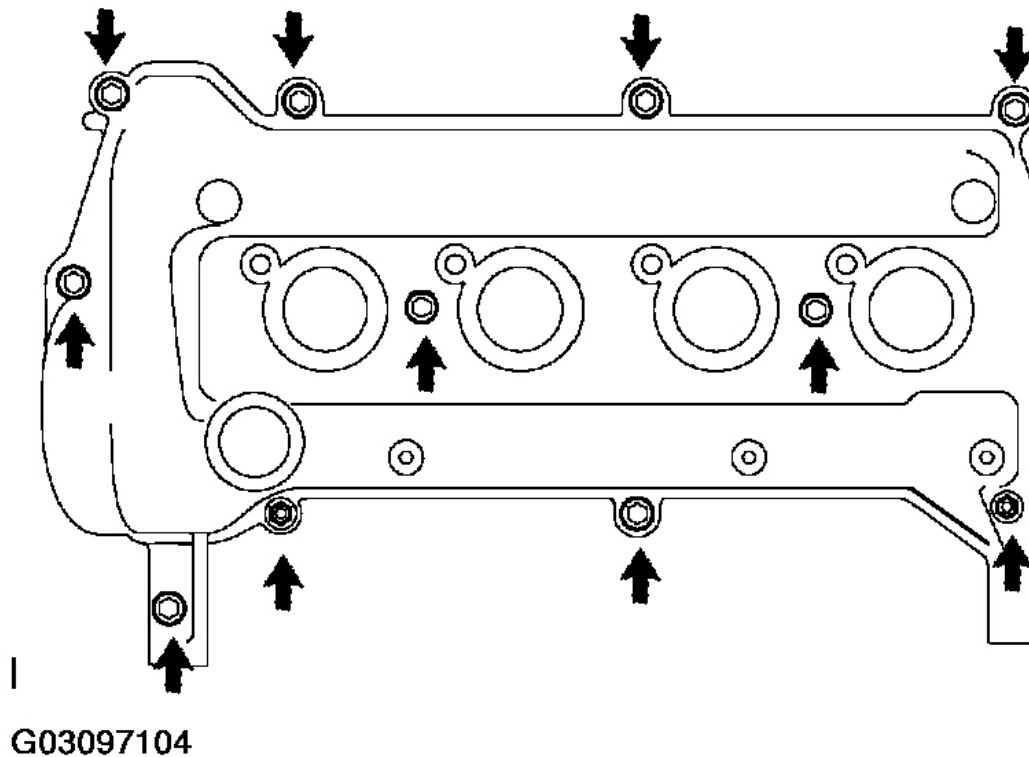
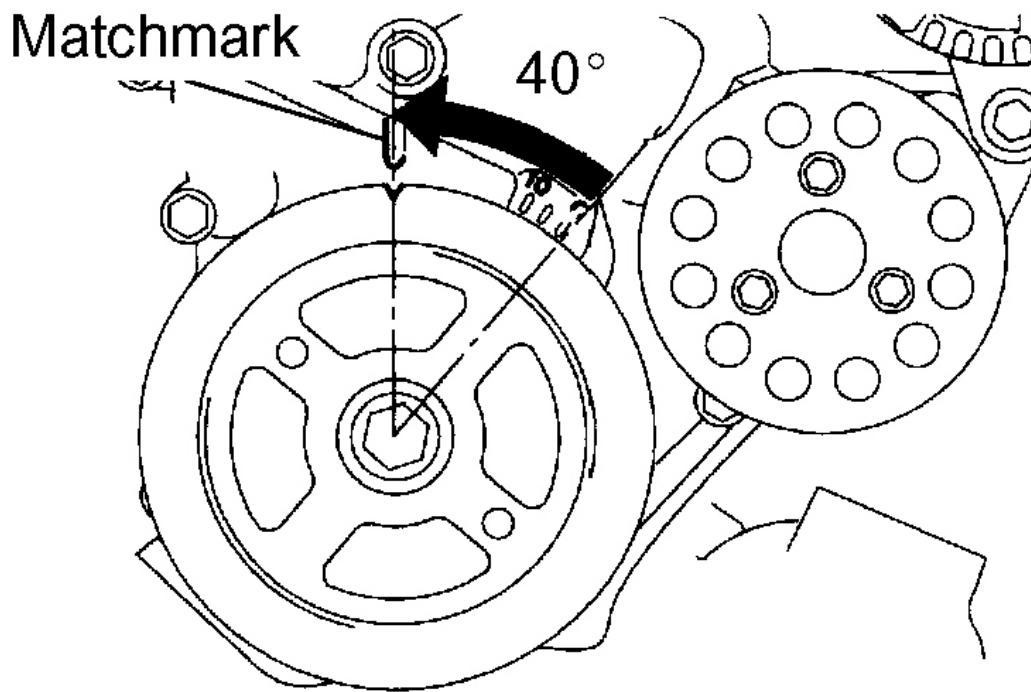


Fig. 221: Remove Bolts And Nuts, And Then Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE ENGINE UNDER COVER RH (See REPLACEMENT)
7. REMOVE NO. 2 CAMSHAFT

NOTE: When rotating the camshaft with the timing chain removed, rotate the crankshaft damper counterclockwise 40° from the TDC and align its timing notch with the matchmark of the chain cover to prevent the pistons from coming into contact with the valves.

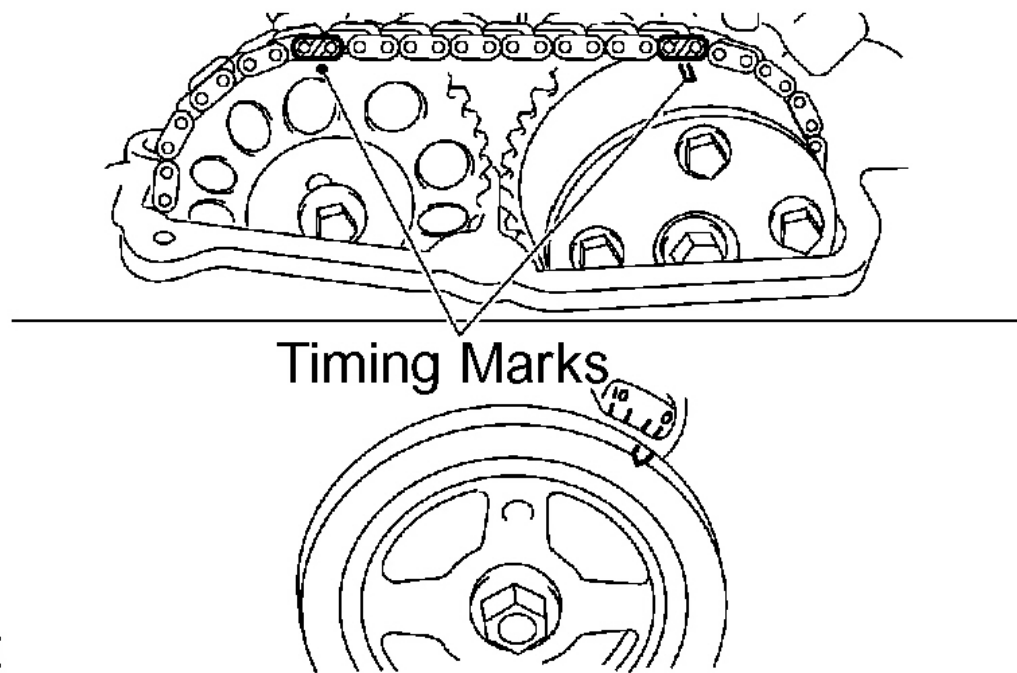


G03097105

Fig. 222: Rotating Crankshaft Damper Counterclockwise 40° From TDC And Aligning Timing Notch With Matchmark Of Chain Cove

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

- a. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.
 2. Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in **Fig. 223**.



I

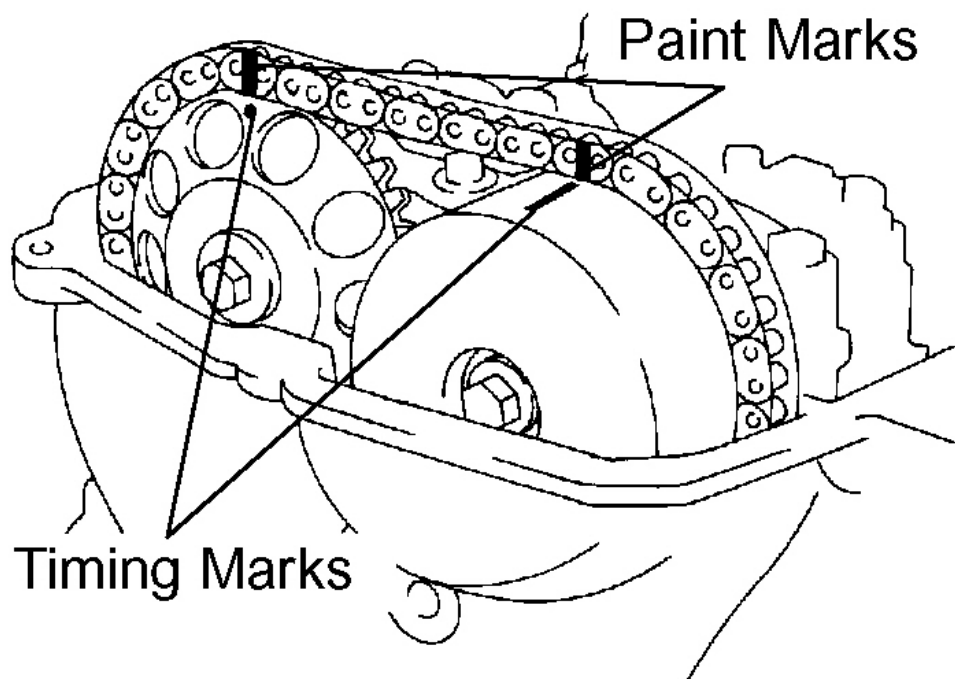
G03097106

Fig. 223: Checking That Both Timing Marks On Camshaft Timing Sprocket And Camshaft Timing Gear Are Facing Upward
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

- b. Put paint marks on the timing chain in place where the timing marks of the camshaft timing sprocket and camshaft timing gear are located.

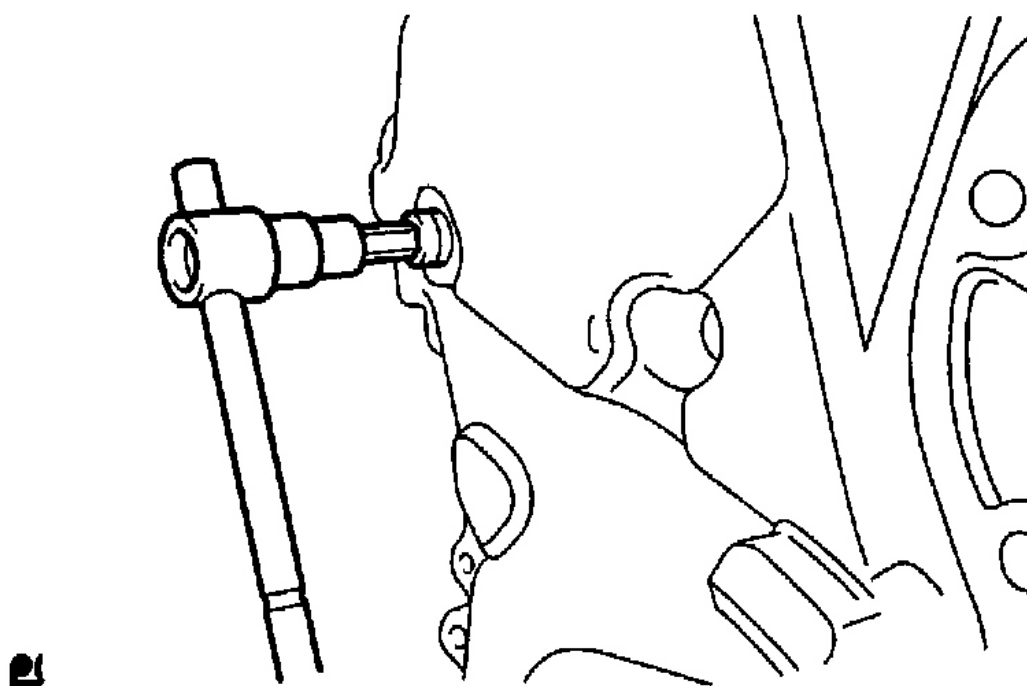


N

G03097107

Fig. 224: Locating Paint Marks And Timing Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using an 8 mm hexagon wrench, remove the screw plug.



G03097108

Fig. 225: Removing Screw Plug

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

- d. Insert a screwdriver into the service hole of the chain tensioner to hold the stopper plate of the chain tensioner at upward position.
- e. Using a wrench, rotate the camshaft No. 2 clockwise to push in the plunger of the chain tensioner.

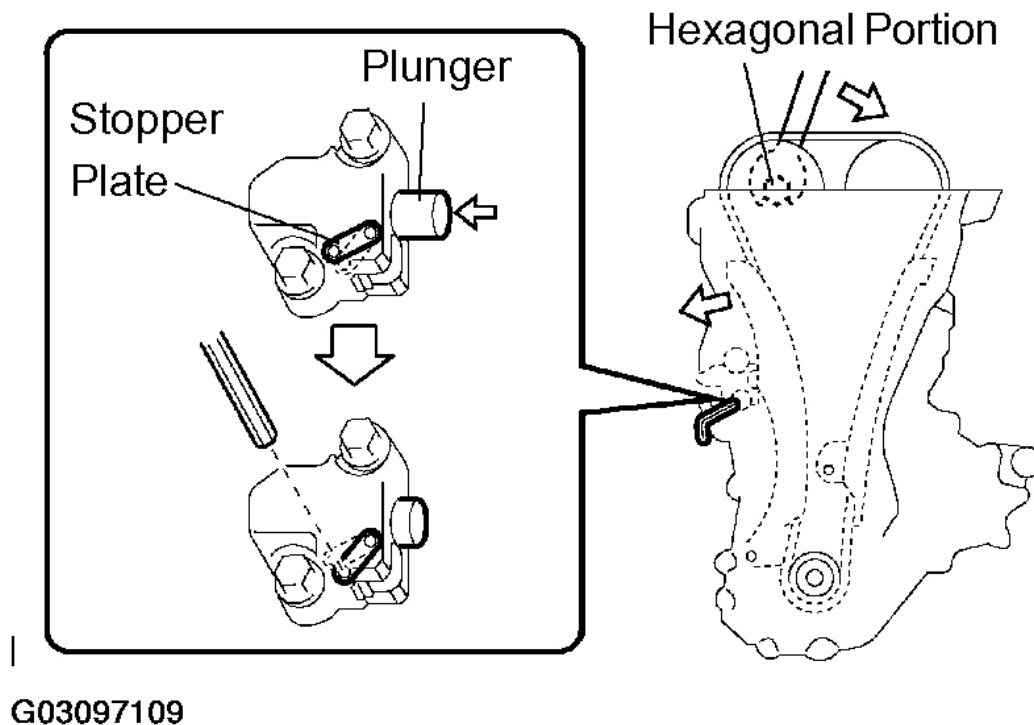


Fig. 226: Rotating Camshaft No. 2 Clockwise To Push In Plunger Of Chain Tensioner
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Remove the screwdriver from the service hole, then align the hole of the stopper plate with the service hole and insert a 2 to 3 mm (0.08 to 0.12 in.) diameter bar into the holes to hold the stopper plate.

HINT:

- Fix the stopper plate using the bar while rotating the camshaft right and left slightly.
 - Hold the bar with tape so that the bar does not come off.
- g. Hold the camshaft with a wrench on the hexagonal lobe, and remove the bolt.

SST 09023-38400

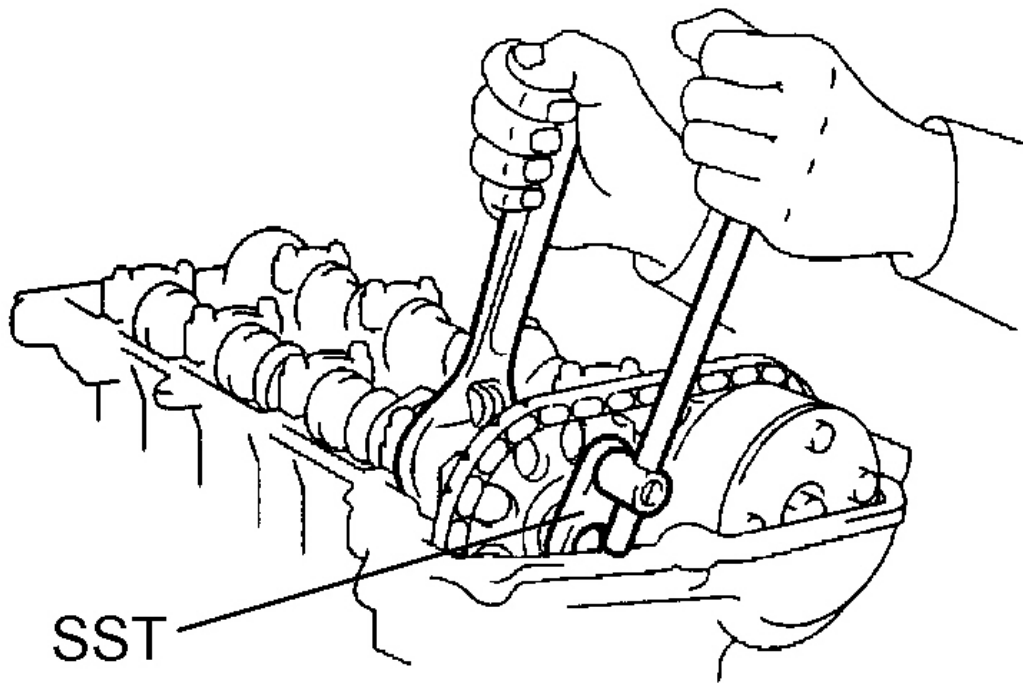
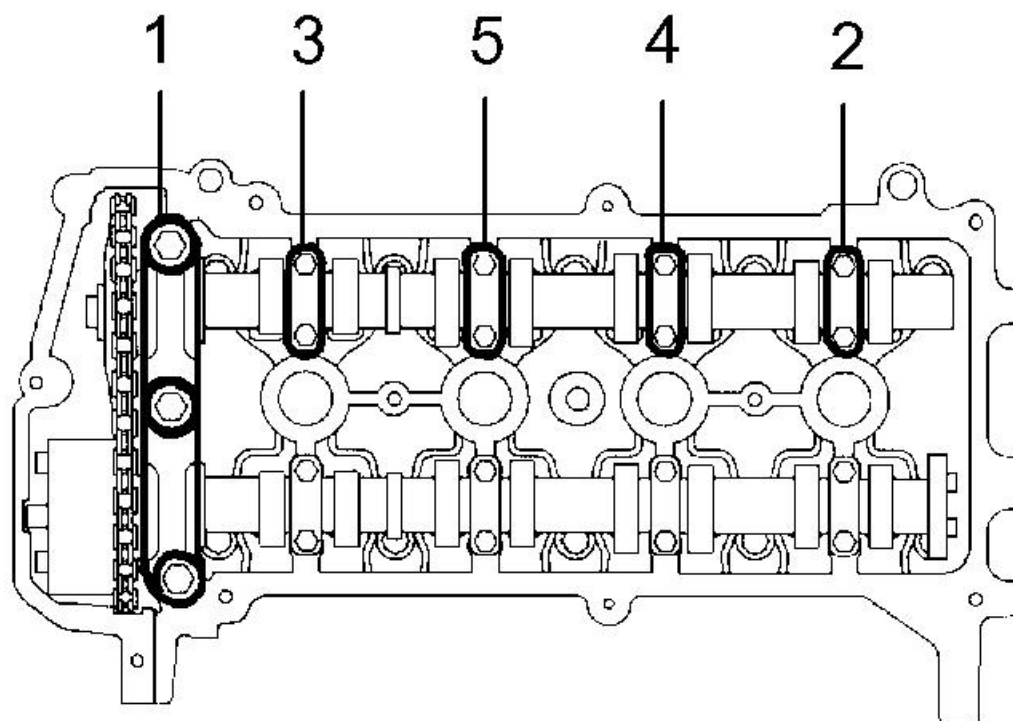


Fig. 227: Removing Bolt While Holding Camshaft With Wrench On Hexagonal Lobe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in **Fig. 228**, then remove the 5 bearing caps.

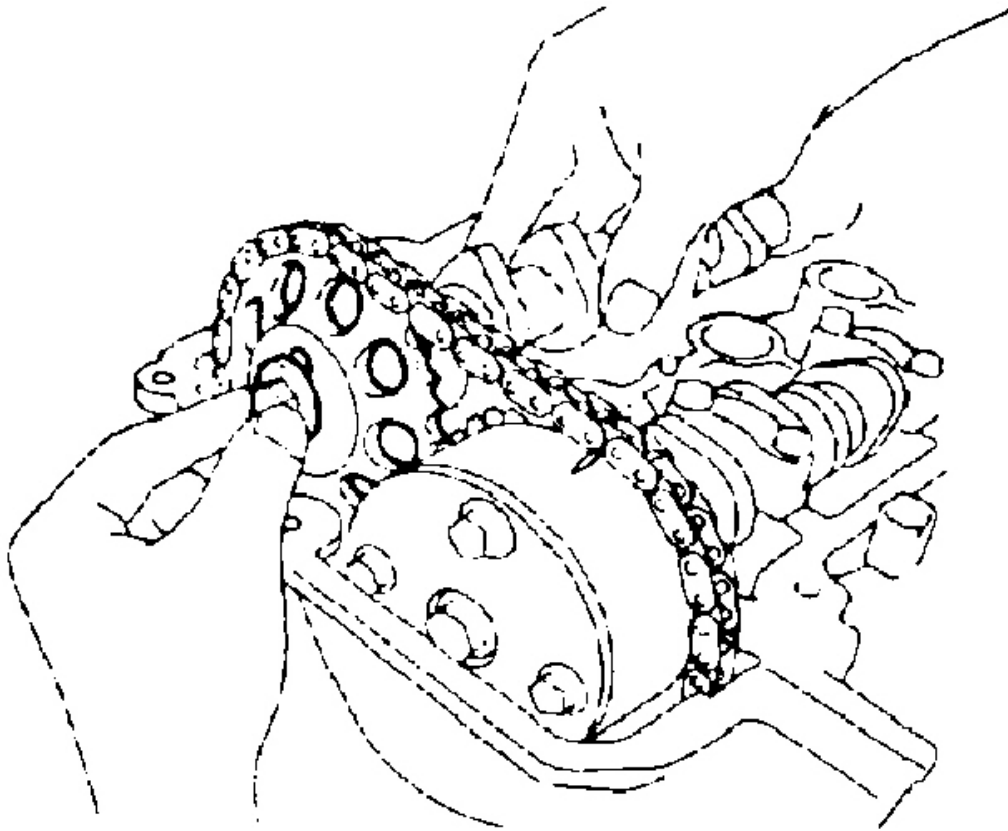


G03097111

Fig. 228: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

- i. Remove the fringe bolt with the No. 2 camshaft lifted up, then detach the No. 2 camshaft and camshaft timing sprocket.



G03097112

Fig. 229: Removing Fringe Bolt With No. 2 Camshaft Lifted Up
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE CAMSHAFT

- a. Using several steps, loosen and remove the 8 bearing cap bolts uniformly in the sequence shown in **Fig. 229**, then remove the 4 bearing caps.

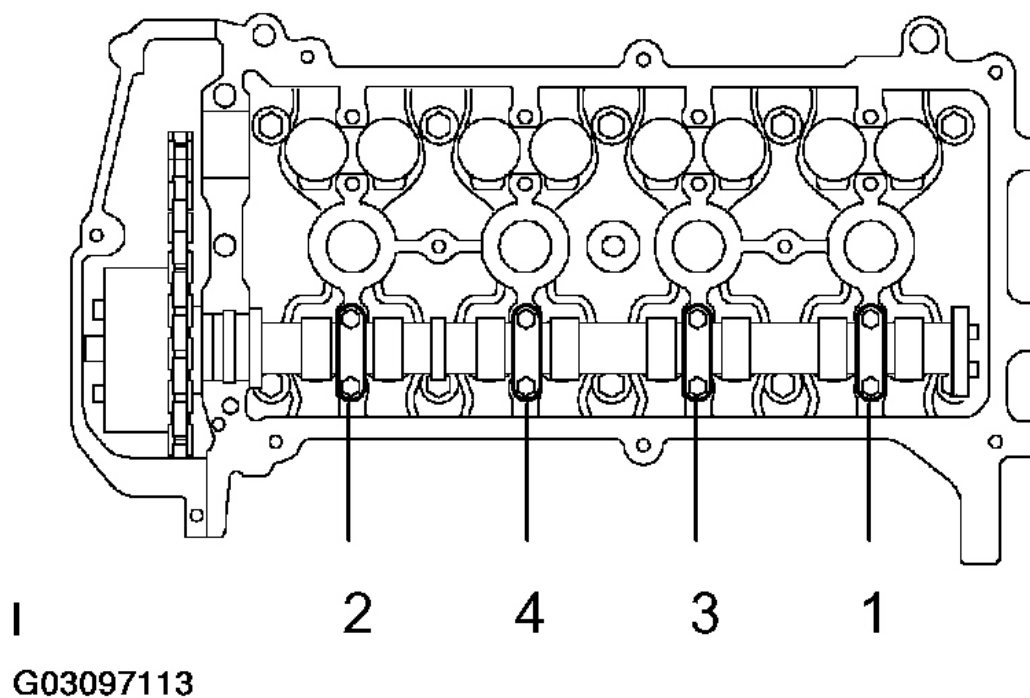
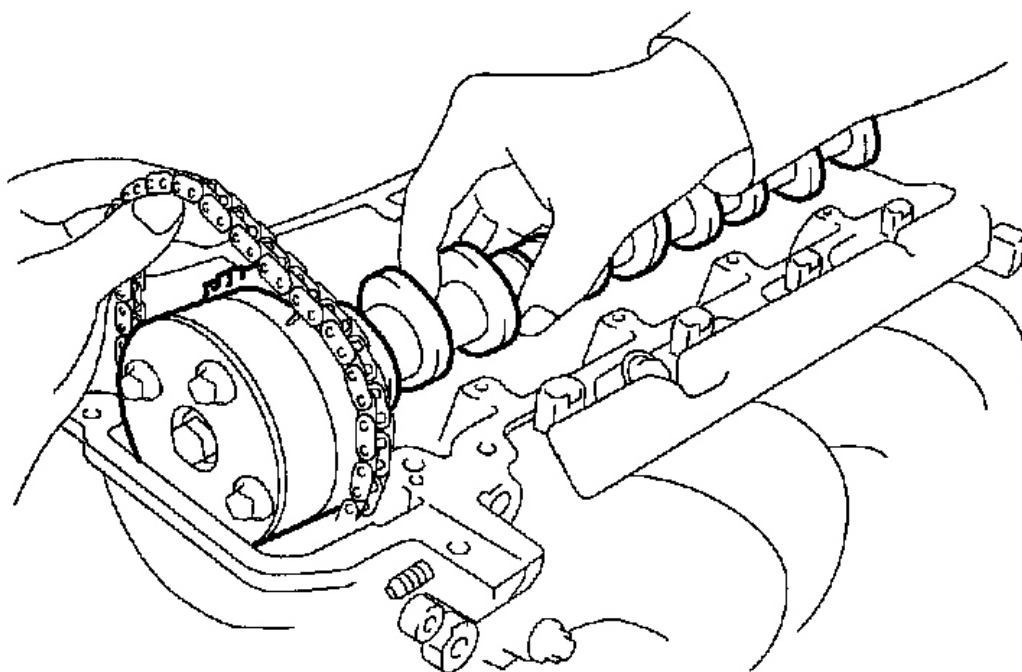


Fig. 230: Removing Bearing Cap Bolts Uniformly In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

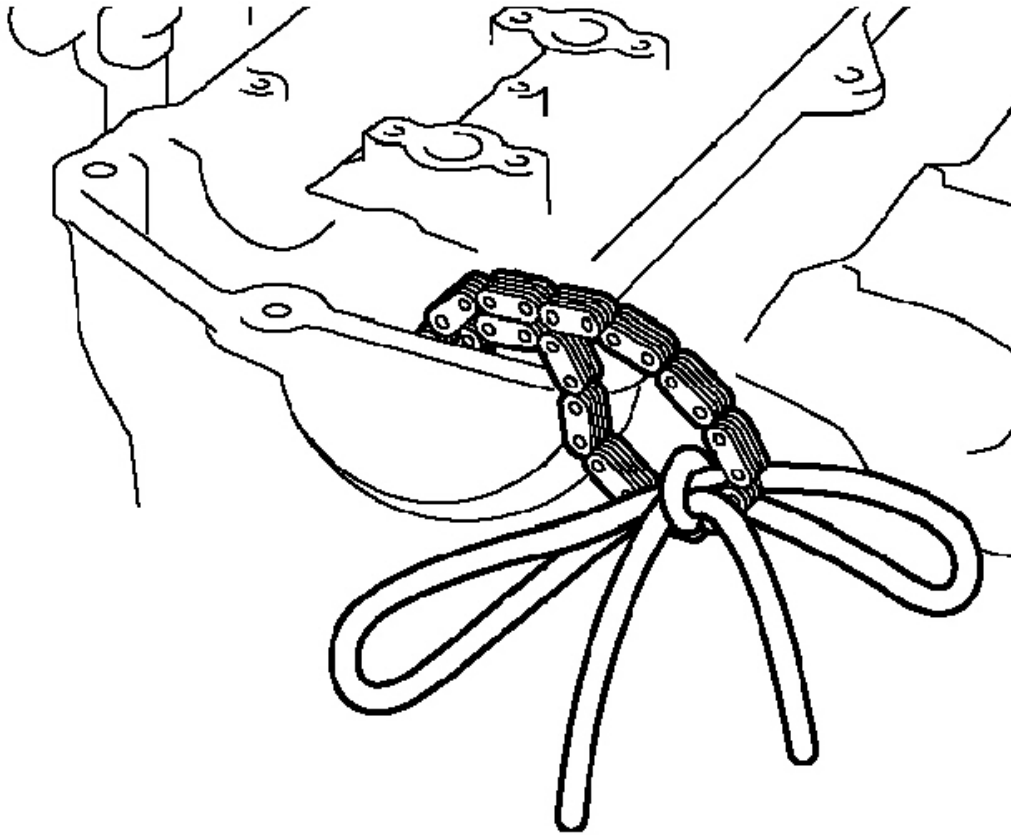
- b. Hold the timing chain by hand, and remove the camshaft and camshaft timing gear assembly.



G03097114

Fig. 231: Removing Camshaft And Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Tie the timing chain with a string as shown in **Fig. 232**.



G03097115

Fig. 232: Tie Timing Chain With String
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

9. REMOVE CAMSHAFT TIMING GEAR ASSY

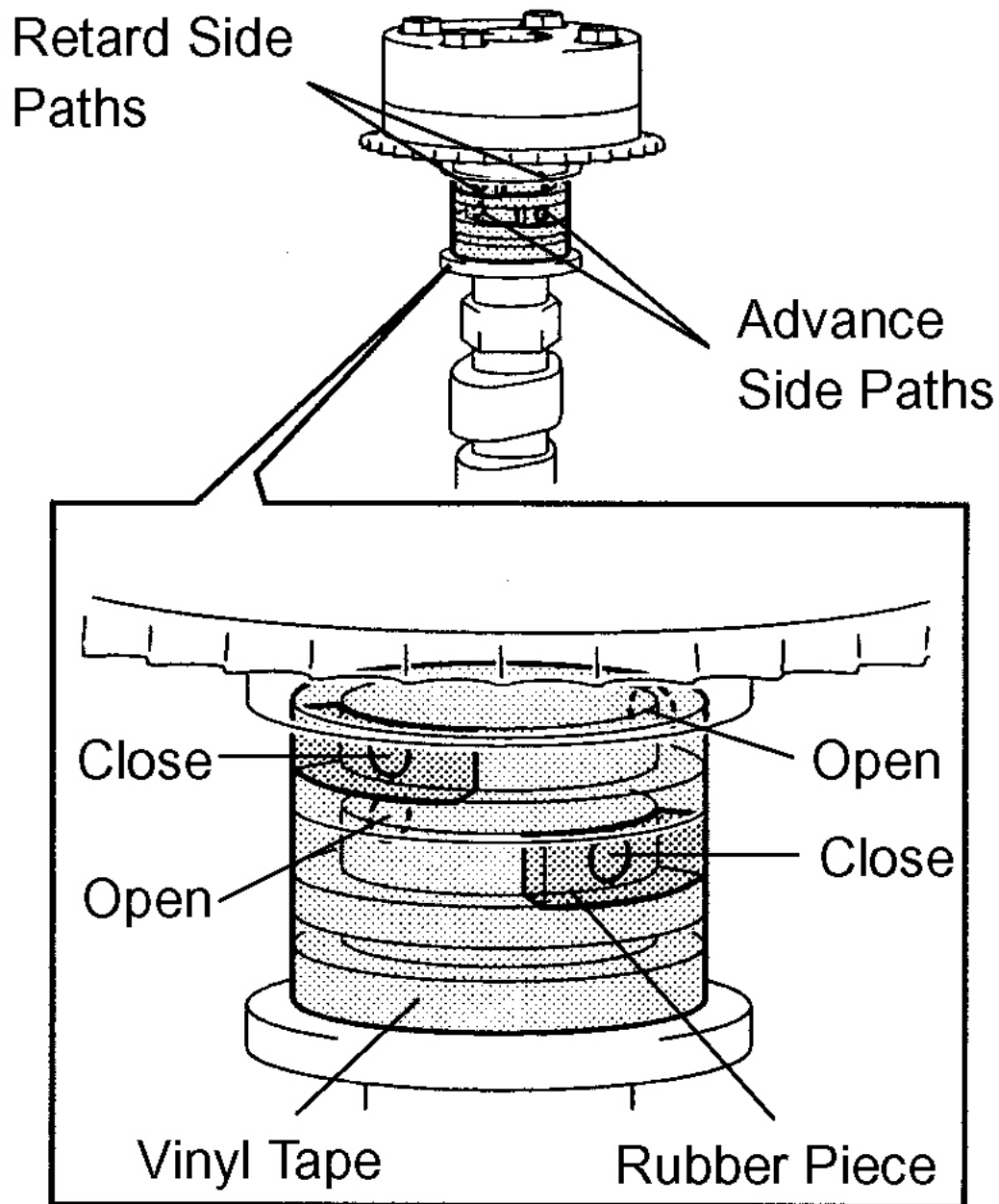
- a. Clamp the camshaft in a vise, and confirm that it is locked.

NOTE: Be careful not to damage the camshaft.

- b. Cover the 4 oil paths of the cam journal with tape as shown in **Fig. 233**.

HINT:

One of the 2 grooves located on the cam journal is for retarding cam timing (upper) and the other is for advancing cam timing (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with the tape.

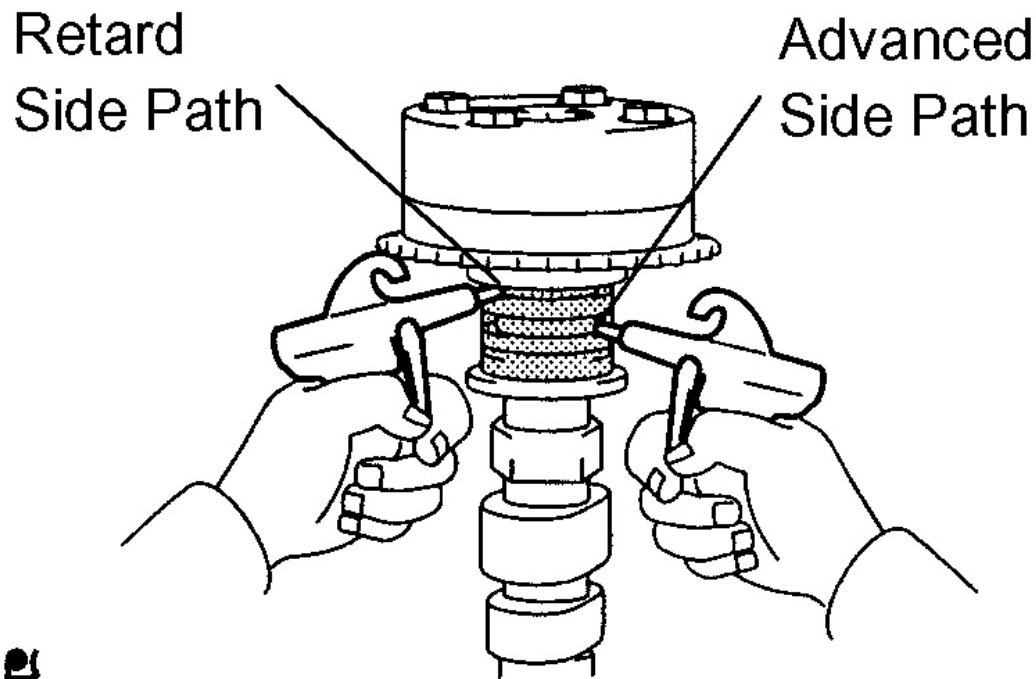


G03097116

Fig. 233: Covering Oil Paths Of Cam Journal With Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Punctuate the tape for the advance oil path and for the retard oil path on the opposite side from the advance oil path.
- d. Put air pressure into two broken paths (the advance side path and the retard side path) with about 150 kPa (1.5 kgf/cm²).

NOTE: Cover the paths with shop rag to prevent oil splashing.



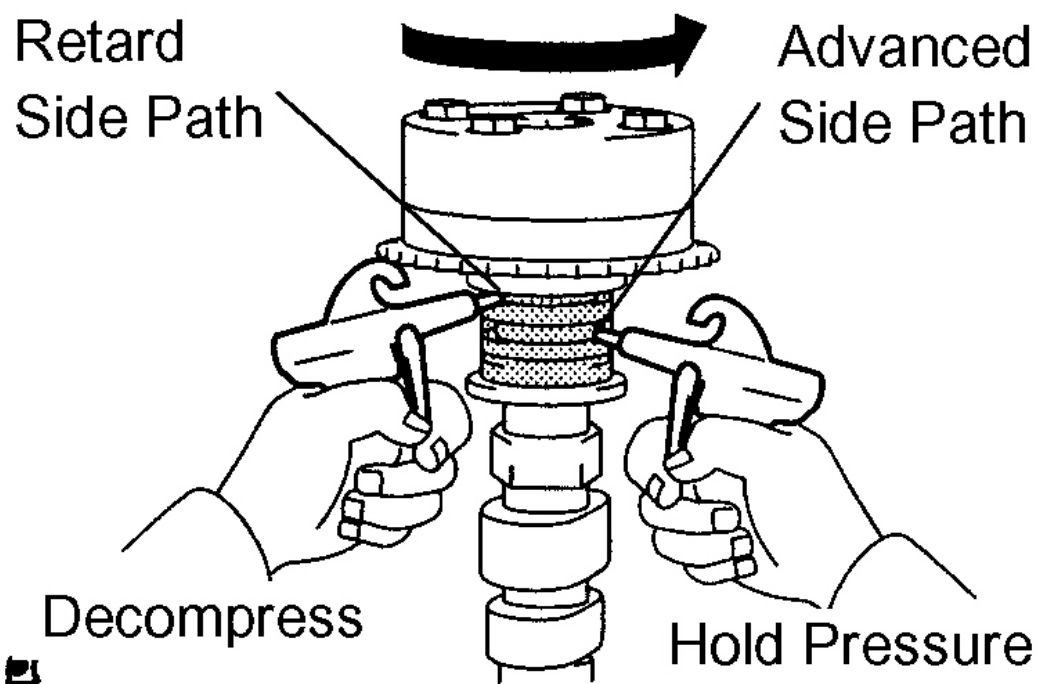
G03097117

Fig. 234: Putting Air Pressure Into Two Broken Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Confirm if the camshaft timing gear assembly revolves in the timing advance direction when reducing the air pressure of the timing retard path.

HINT:

The lock pin is released, and the camshaft timing gear revolves in the timing advance direction.



G03097118

Fig. 235: Confirming If Camshaft Timing Gear Assembly Revolves In Timing Advance Direction

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

- f. When the camshaft timing gear reaches the most advanced position, remove the air pressure of the timing retard side path, and then release the air pressure of the timing advance side path.

NOTE: Camshaft timing gear assembly occasionally shifts to the retard side abruptly, if the air compression of the advanced side path is released first. It often results in the breakage of the lock pin.

- g. Remove the fringe bolt of the camshaft timing gear assembly.

NOTE:

- Be careful not to remove the other 4 bolts.
- In case of reusing the camshaft timing gear, unlock the lock pin inside the camshaft timing gear first.

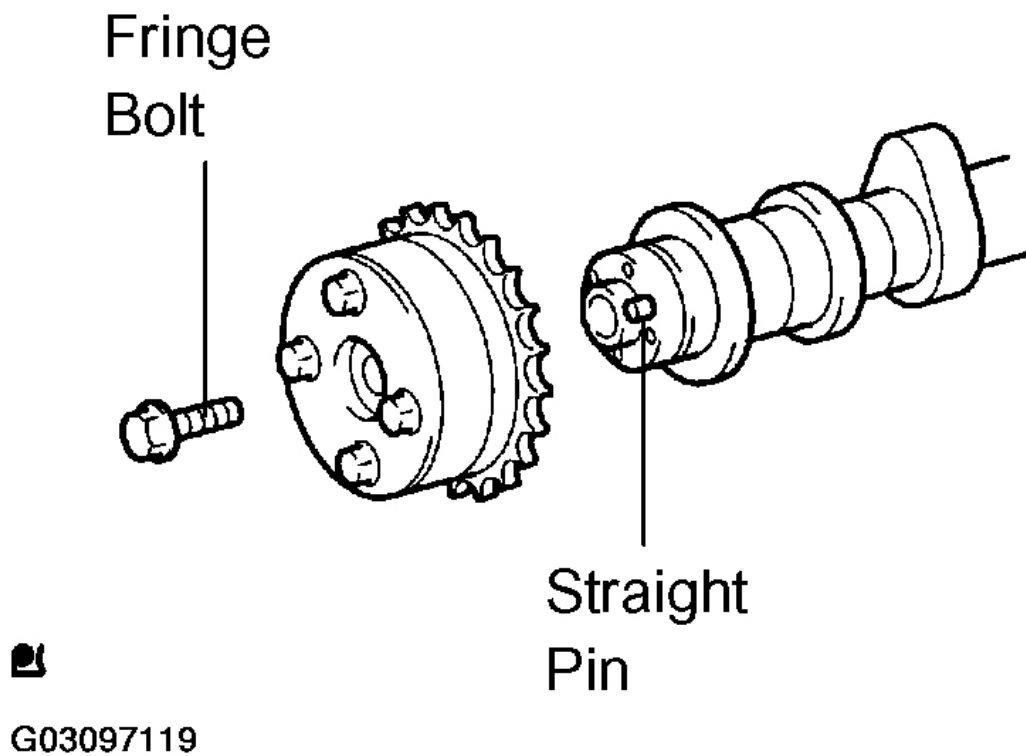


Fig. 236: Removing Fringe Bolt Of Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL CAMSHAFT TIMING GEAR ASSY

- Put the camshaft timing gear assembly and camshaft together with the straight pin off the groove.
- Turn the camshaft timing gear assembly clockwise while pushing it lightly towards the camshaft. Push further at the position where the pin fits into the groove.

NOTE: Be careful not to turn the camshaft timing gear to the retarded angle (to the right).

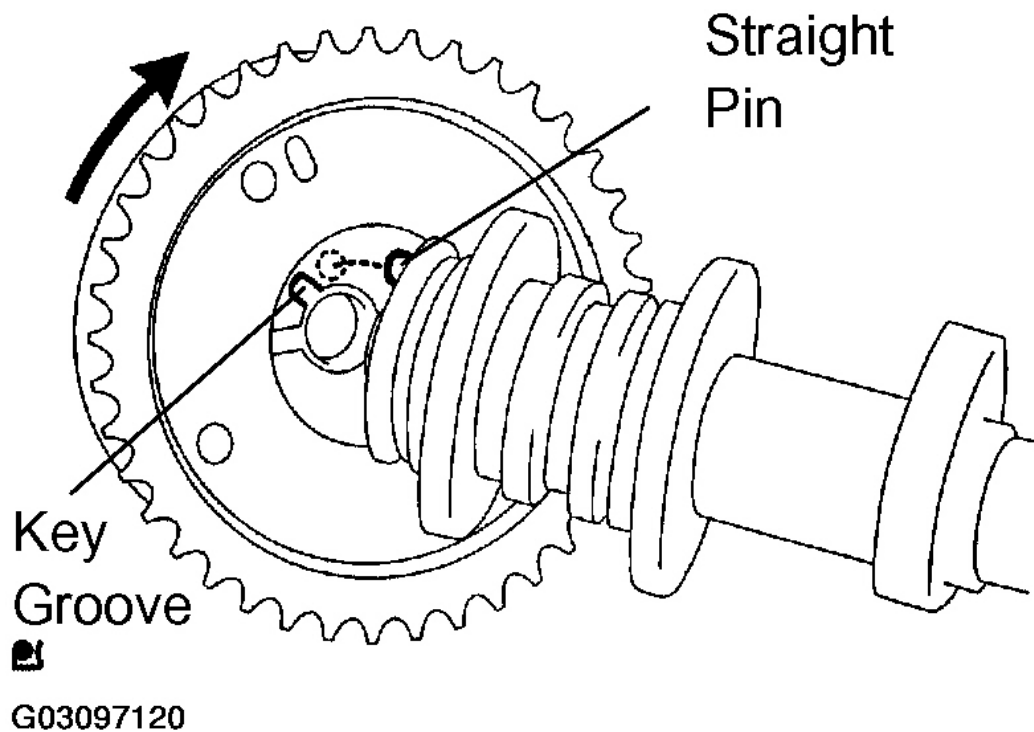


Fig. 237: Turning Camshaft Timing Gear Assembly Clockwise While Pushing It Lightly Towards Camshaft

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

- c. Check that there is no clearance between the gear fringe and camshaft.
- d. Tighten the fringe bolt with the camshaft timing gear fixed.

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

- e. Check that the camshaft timing gear assembly can move to the retarded angle (to the right) and is locked in the most retarded position.

11. INSTALL CAMSHAFT

- a. Apply a light coat of engine oil to the camshaft journals.
- b. Install the timing chain onto the camshaft timing gear with the painted link aligned with the timing mark on the camshaft timing gear as shown in **Fig. 238**.

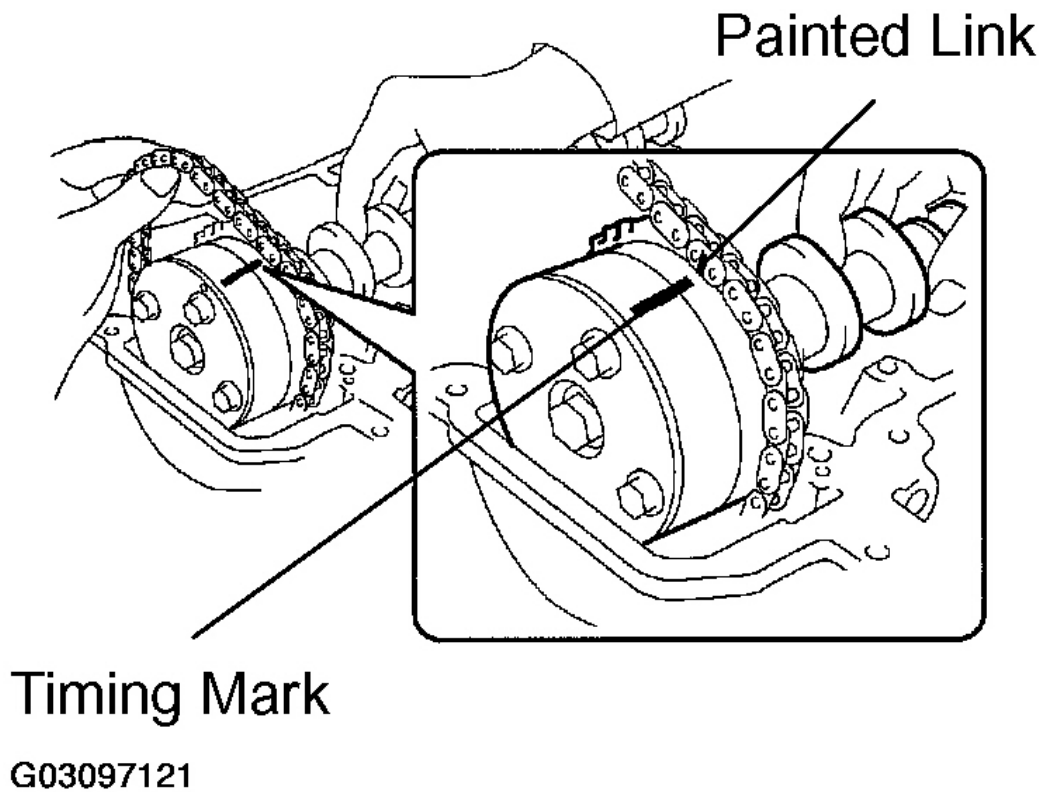
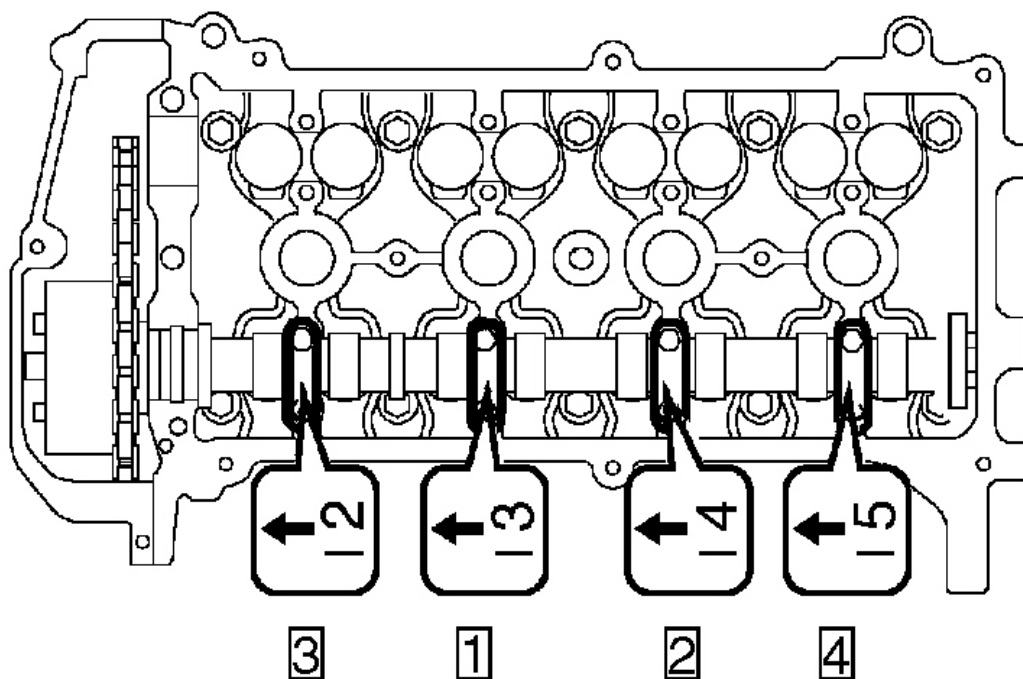


Fig. 238: Aligning Painted Link With Timing Mark On Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 239**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: **Tighten each bolt uniformly keeping the camshaft level.**

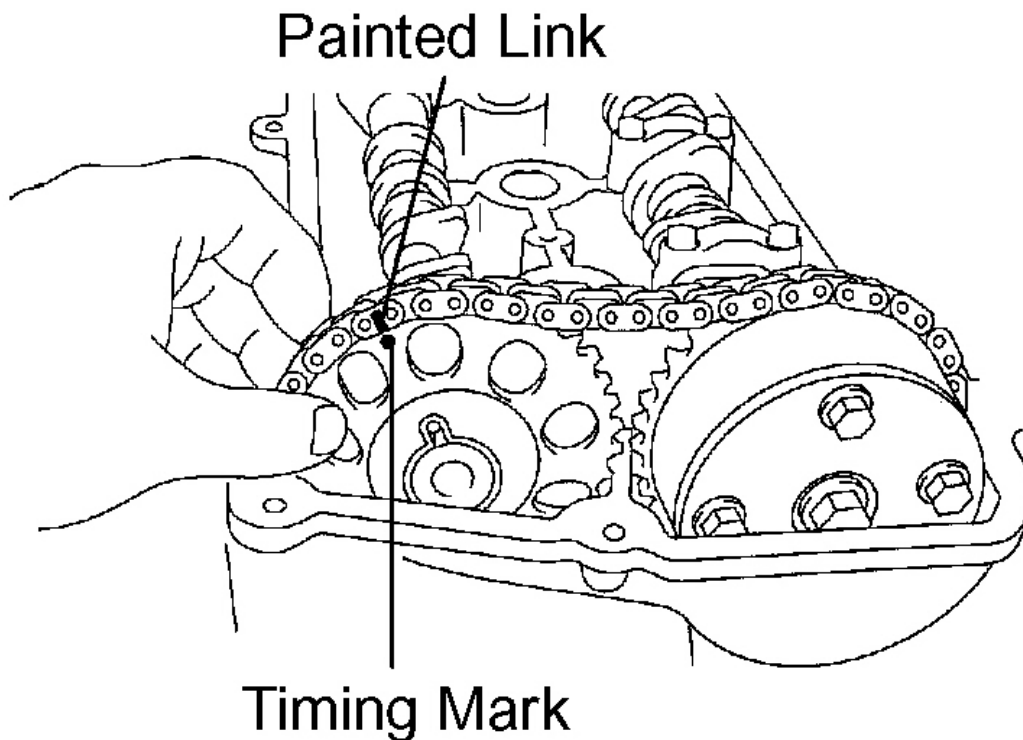


G03097122

Fig. 239: Identifying Bolt Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL NO. 2 CAMSHAFT

- a. Hold the timing chain, and align the painted link on the timing chain with the timing mark on the camshaft timing sprocket.

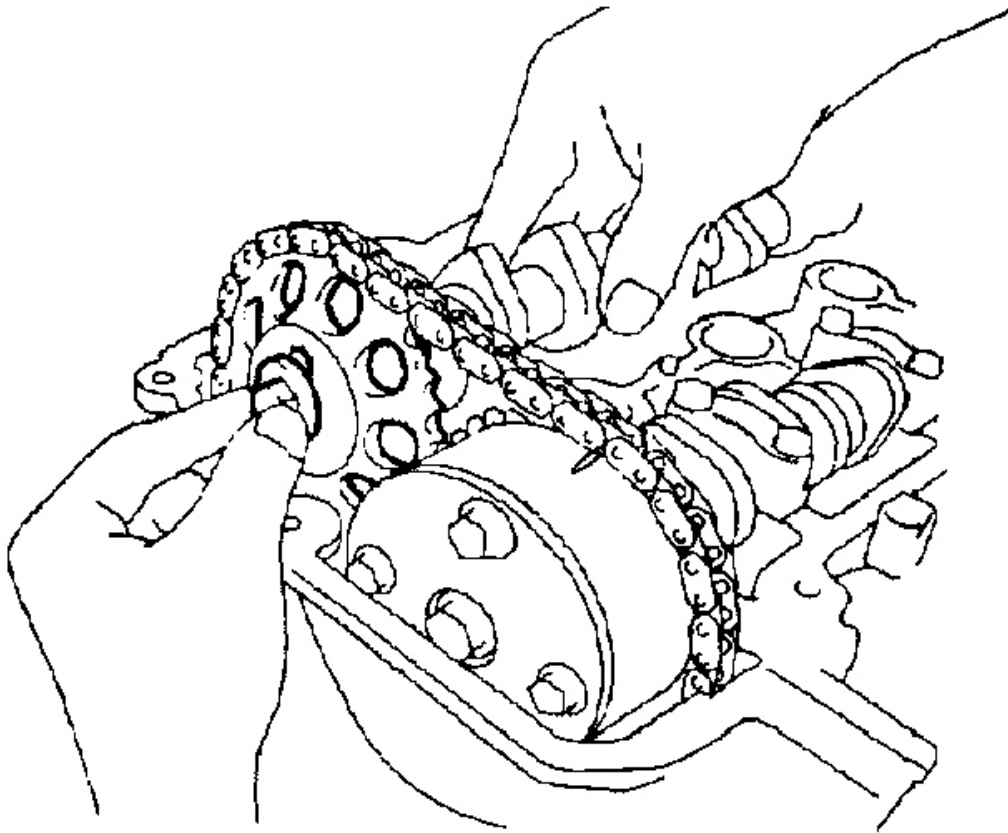


G03097123

Fig. 240: Aligning Painted Link On Timing Chain With Timing Mark On Camshaft Timing Sprocket

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

- b. Align the alignment pin hole of the camshaft timing sprocket with the alignment pin of the camshaft, and install the sprocket into the camshaft.



G03097124

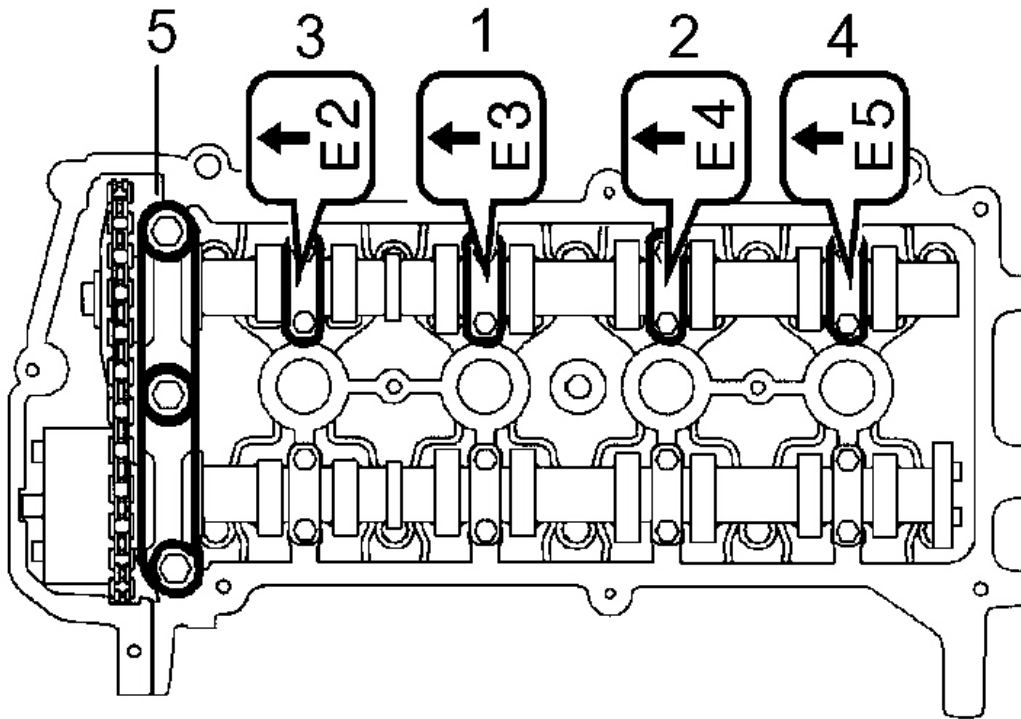
Fig. 241: Aligning Alignment Pin Hole Of Camshaft Timing Sprocket With Alignment Pin Of Camshaft

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

- c. Temporarily install the timing sprocket bolt.
- d. Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 242**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: Tighten each bolt uniformly keeping the camshaft level.



G03097125

Fig. 242: Tightening Bolts In Sequence

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

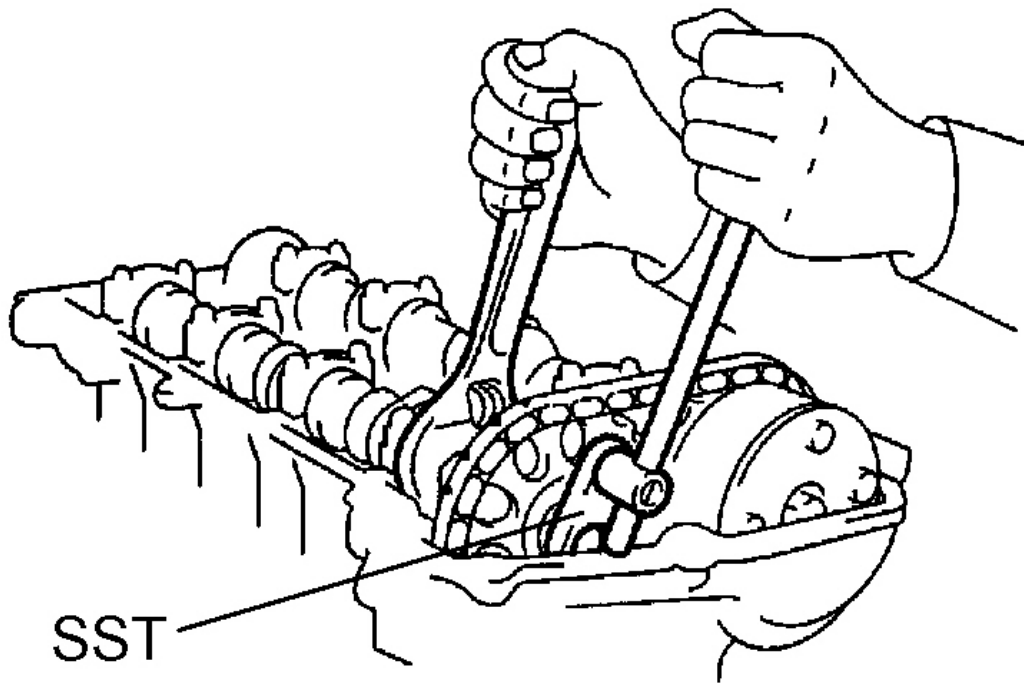
- e. Install the bearing cap No. 1.

Torque: 23 N.m (235 kgf.cm, 17 ft.lbf)

- f. Hold the camshaft with a wrench on the hexagonal lobe, and install the bolt.

SST 09023-38400

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



G03097126

Fig. 243: Installing Bolt While Holding Camshaft With Wrench On Hexagonal Lobe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Remove the bar from the timing chain tensioner.
- h. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned.

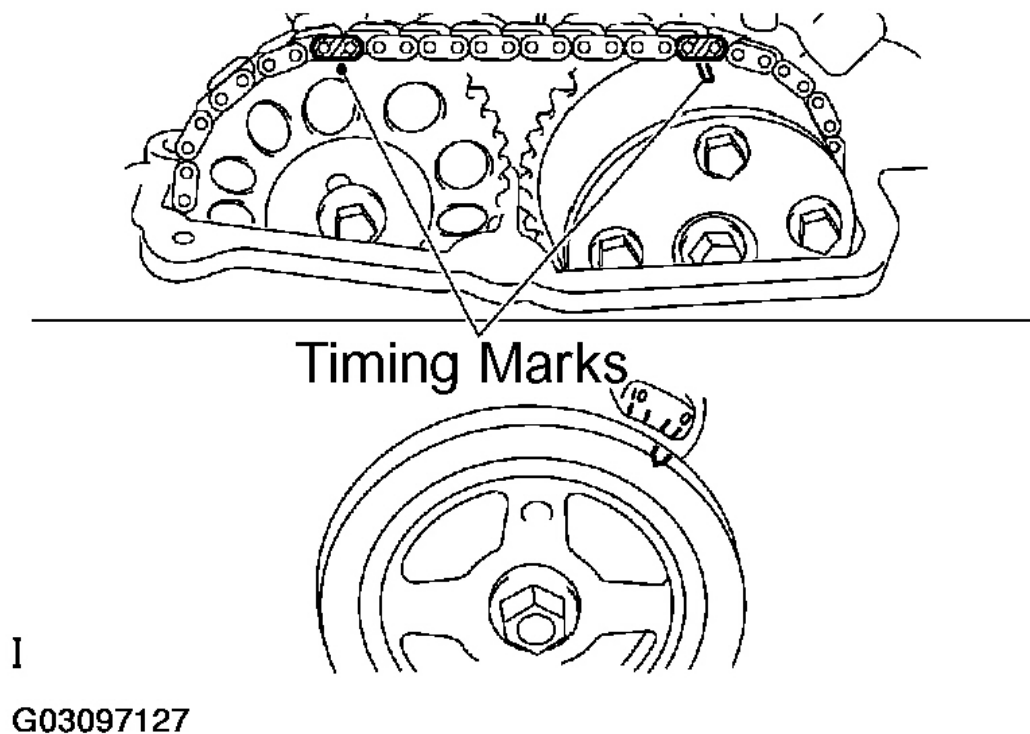


Fig. 244: Aligning Crankshaft Damper Timing Notch With Timing Mark "0" Of Chain Cover

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

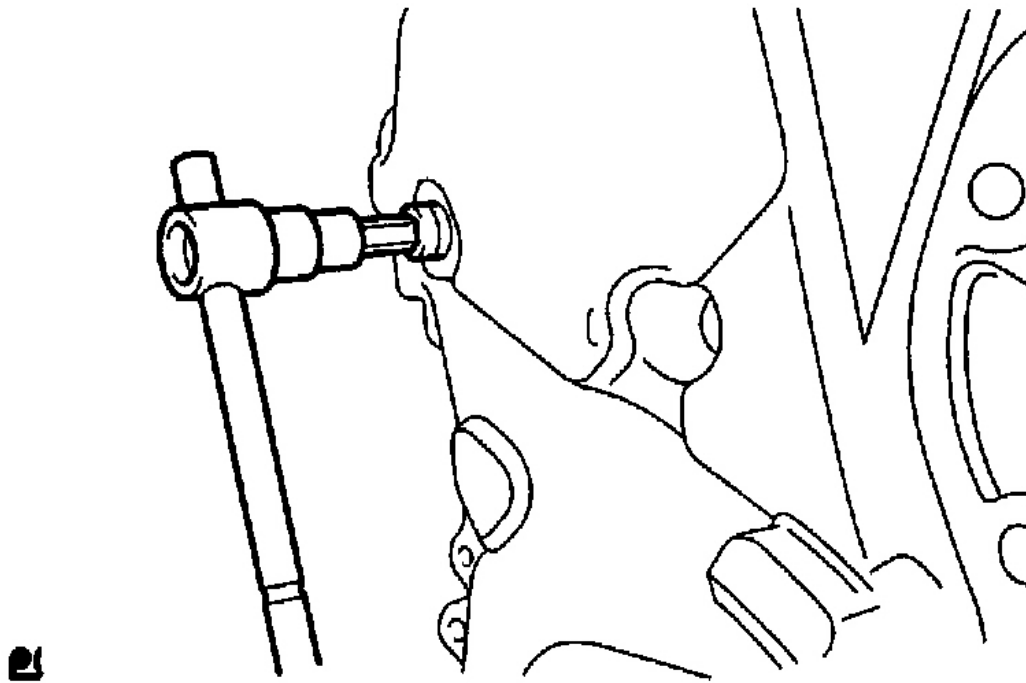
- i. Check that all the pairs of the timing marks are aligned
- j. Apply the seal packing to 2 or 3 threads of the screw plug end.

Seal packing:

Part No. 08833 - 00070 or equivalent

- k. Using an 8 mm hexagon wrench, install the screw plug.

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



G03097128

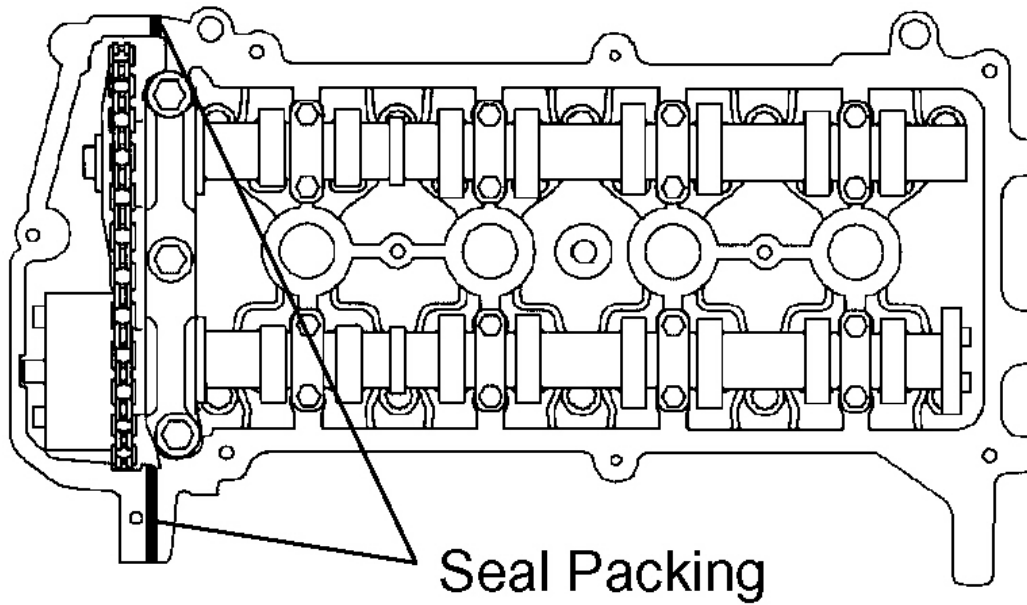
Fig. 245: Installing Screw Plug

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

13. INSPECT VALVE CLEARANCE (See ADJUSTMENT)
14. ADJUST VALVE CLEARANCE (See ADJUSTMENT)
15. INSTALL CYLINDER HEAD COVER SUB-ASSY
 - a. Apply the seal packing to the 2 locations shown in Fig. 246.

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

- Remove any oil from the contact surface.
- Install the cylinder head cover within 3 minutes of applying the seal packing.
- Do not start the engine for at least 2 hours after installation.



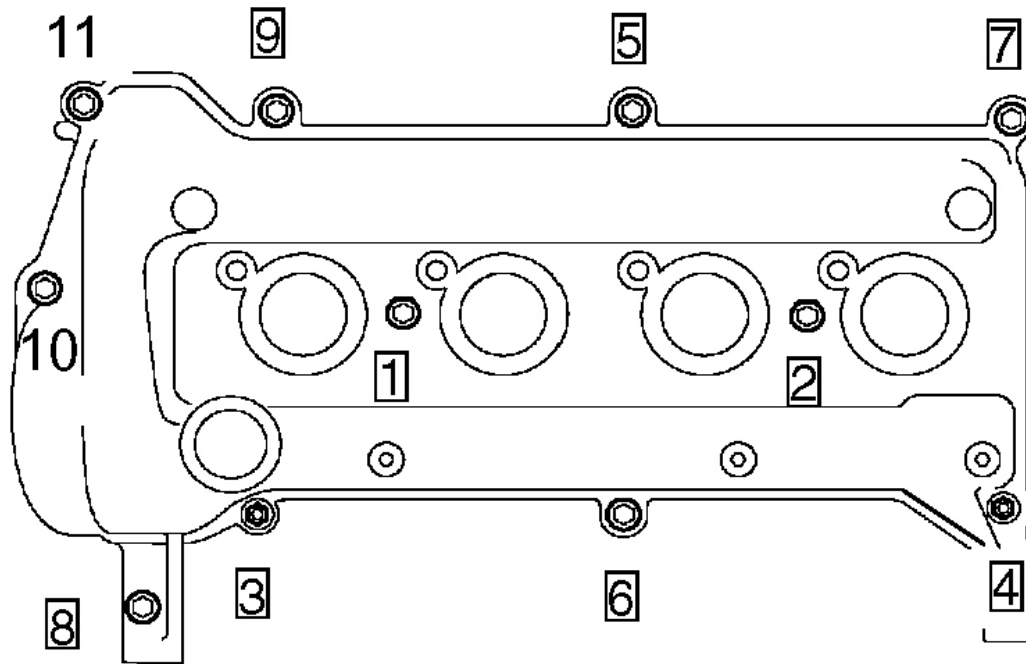
G03097129

Fig. 246: Identifying Seal Packing Application Areas

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

- b. Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.
- c. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in **Fig. 247**.

Torque: 10 N.m (102 kgf.cm, 7.4 ft.lbf)



G03097130

Fig. 247: Tightening Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL IGNITION COIL NO. 1

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

17. INSTALL CYLINDER HEAD COVER NO. 2

- a. First tighten A nuts, then tighten bolts B.

Torque: 7.0 N.m (71 kgf.cm, 62 in.lbf)

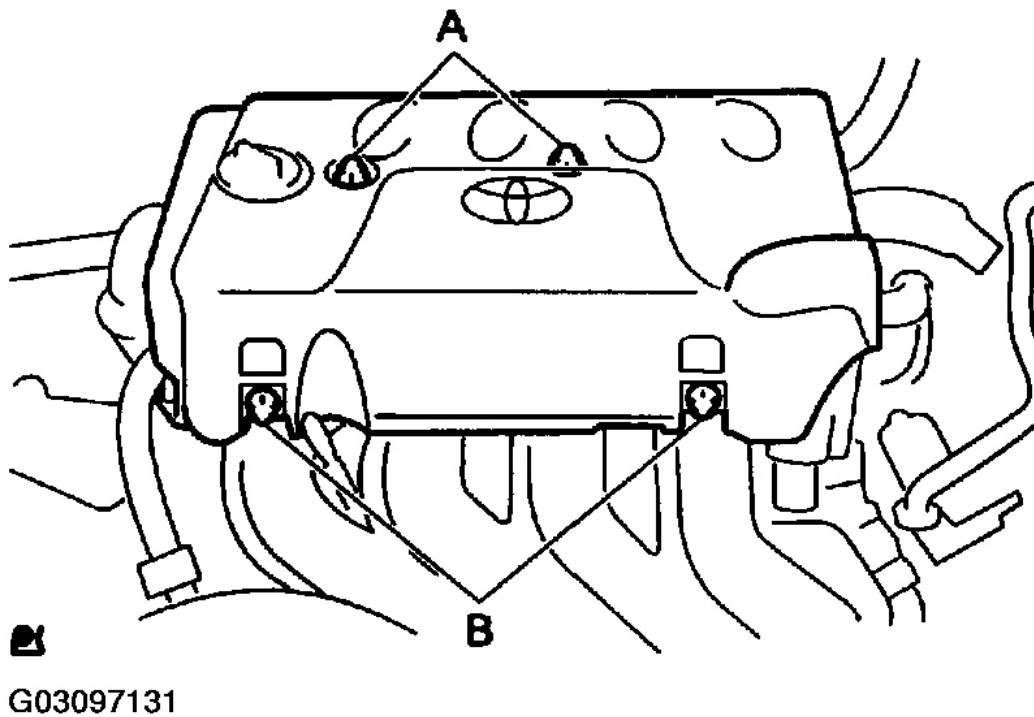


Fig. 248: Installing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. INSTALL ENGINE UNDER COVER RH

Torque:

5.0 N.m (51 kgf.cm, 44 in.lbf) for bolt

5.0 N.m (51 kgf.cm, 44 in.lbf) for nut

19. CHECK FOR ENGINE OIL LEAKS

CYLINDER HEAD GASKET

COMPONENTS

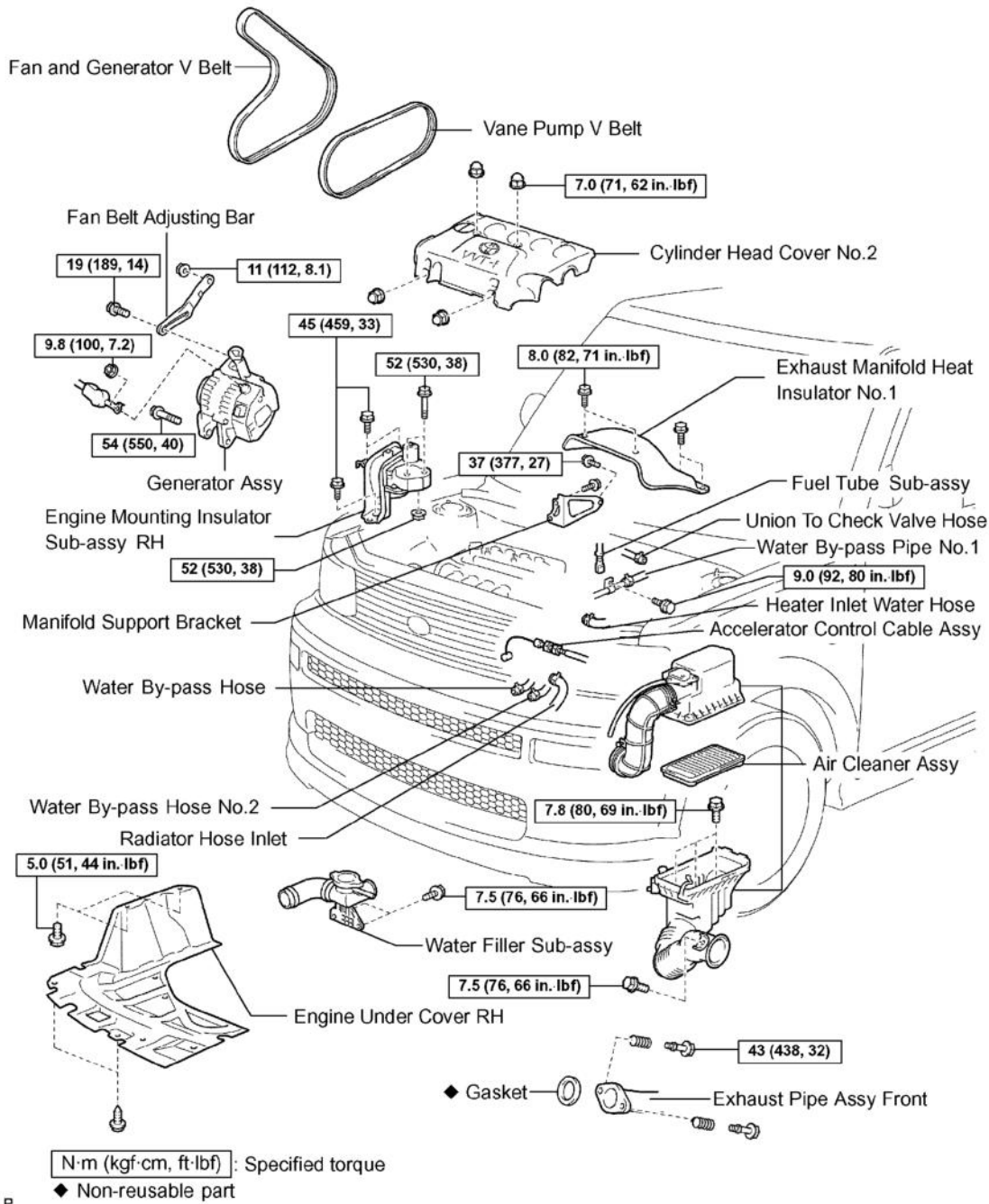
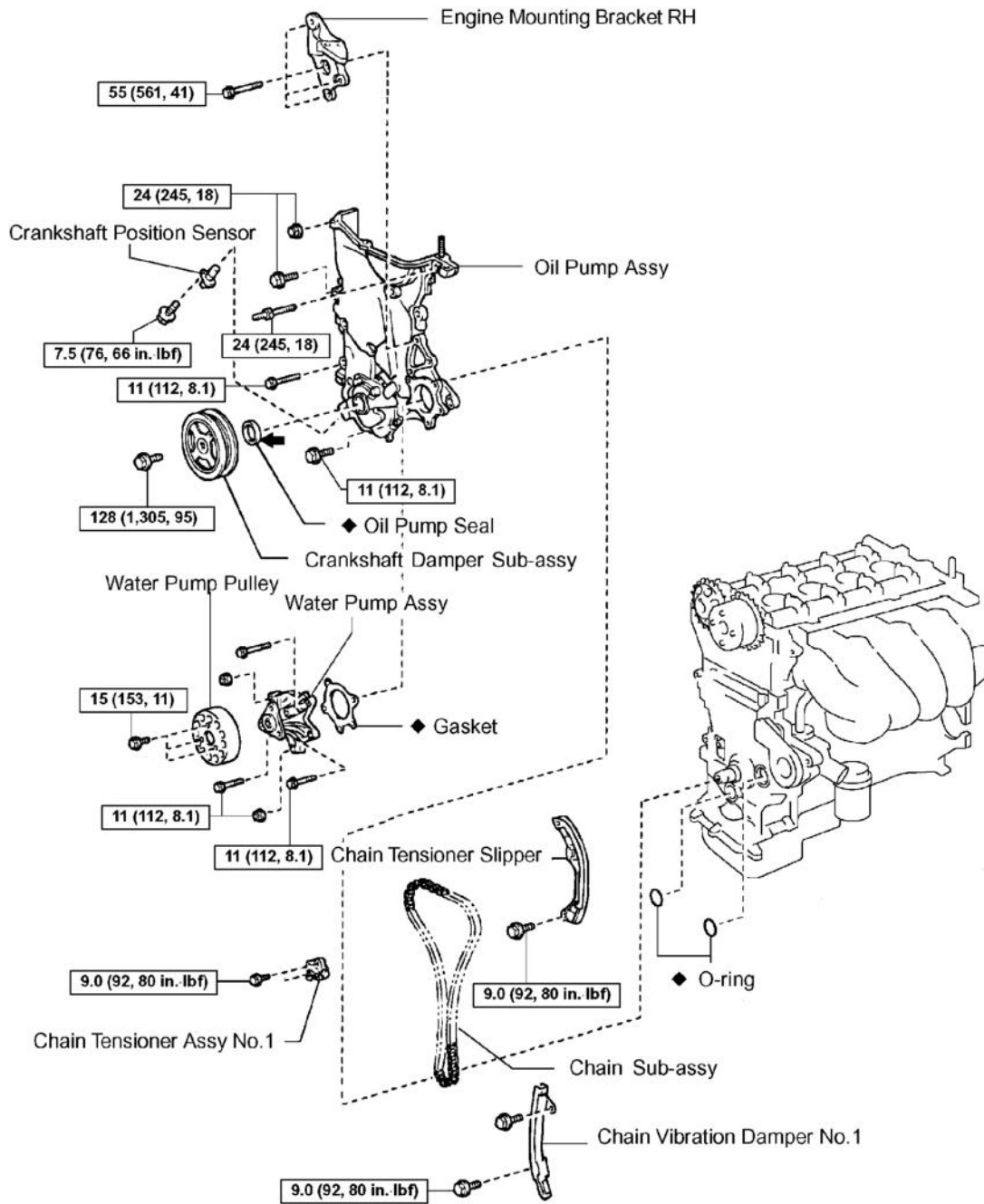


Fig. 249: Exploded View Of Cylinder Head Gasket Components (1 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



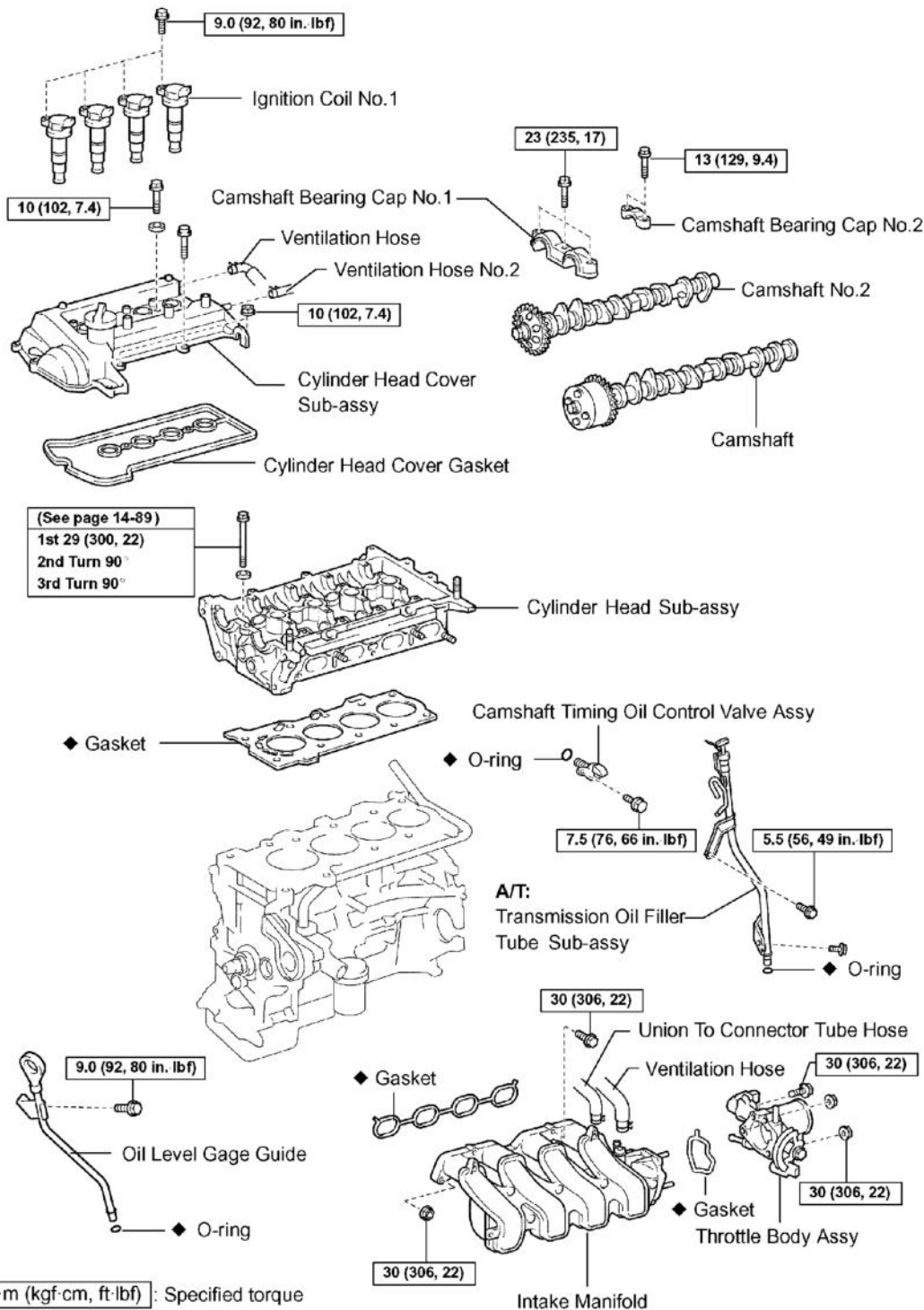
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

← Apply multi-purpose grease

G03097133

Fig. 250: Exploded View Of Cylinder Head Gasket Components (2 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G03097134

Fig. 251: Exploded View Of Cylinder Head Gasket Components (3 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See **PRECAUTION**)
2. **REMOVE CHAIN SUB-ASSY** (See **REPLACEMENT**)
3. **SEPARATE EXHAUST PIPE ASSY FRONT**
 - a. Remove the 2 bolts and 2 compression springs which are installed on the front side of the exhaust pipe.

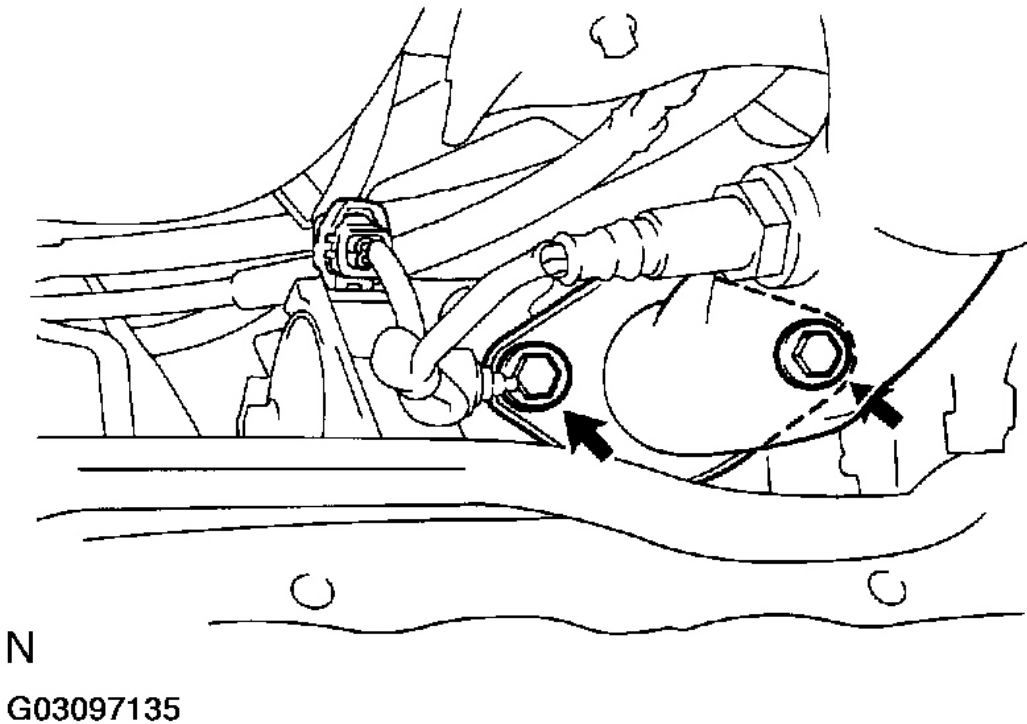


Fig. 252: Separating Exhaust Pipe Assy Front
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO. 1**
 - a. Remove the 4 bolts and exhaust manifold heat insulator.
5. **REMOVE MANIFOLD SUPPORT BRACKET**
 - a. Remove the 3 bolts and manifold support bracket.

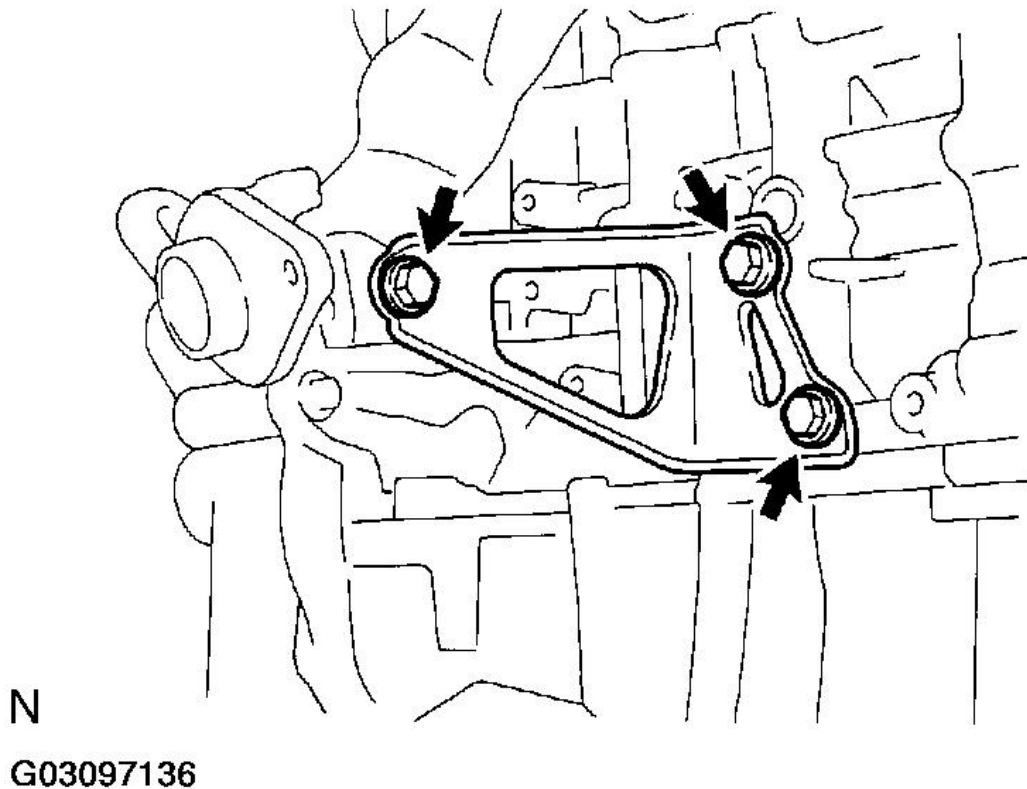


Fig. 253: Removing Manifold Support Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

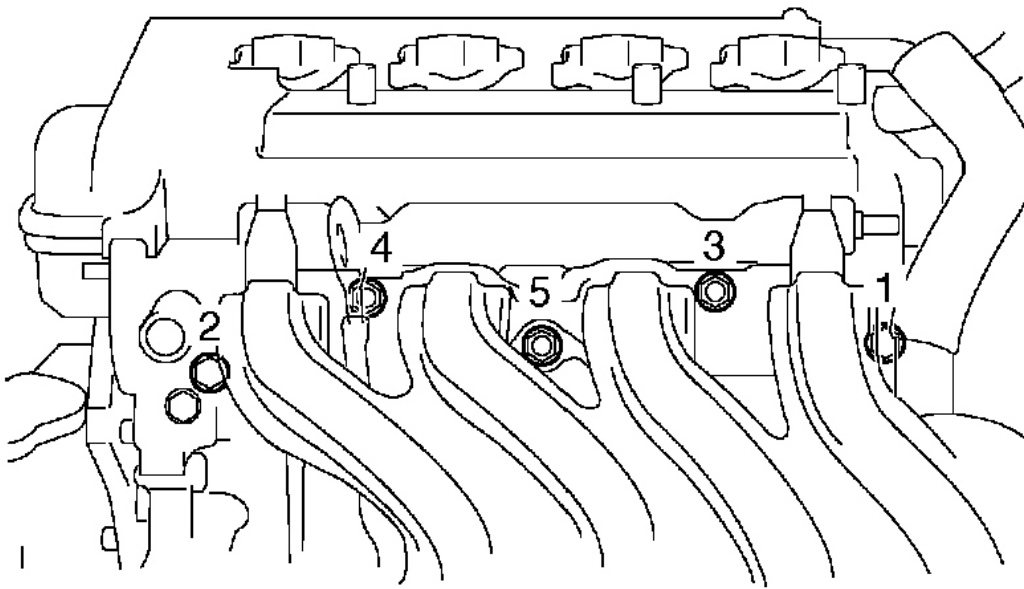
6. **REMOVE AIR CLEANER ASSY (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
7. **SEPARATE ACCELERATOR CONTROL CABLE ASSY (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
8. **REMOVE THROTTLE BODY ASSY (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
9. **SEPARATE ENGINE WIRE**
10. **REMOVE WATER FILLER SUB-ASSY**
 - a. Disconnect the radiator inlet hose.
 - b. Disconnect the radiator hose No. 3.
 - c. Disconnect the radiator reservoir tank hose.
 - d. Remove the 2 bolts and water filler.



Fig. 254: Removing Water Filler Sub-Assy

11. REMOVE INTAKE MANIFOLD

- a. Using several steps, remove the 3 bolts and 2 nuts in the sequence shown in **Fig. 255**, then remove the intake manifold.



G03097138

Fig. 255: Removing Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the gasket from the intake manifold.
- 12. **REMOVE OIL LEVEL GAGE GUIDE**
 - a. Remove the oil level gage from the oil level gage guide.
 - b. Remove the bolt and oil level gage guide.

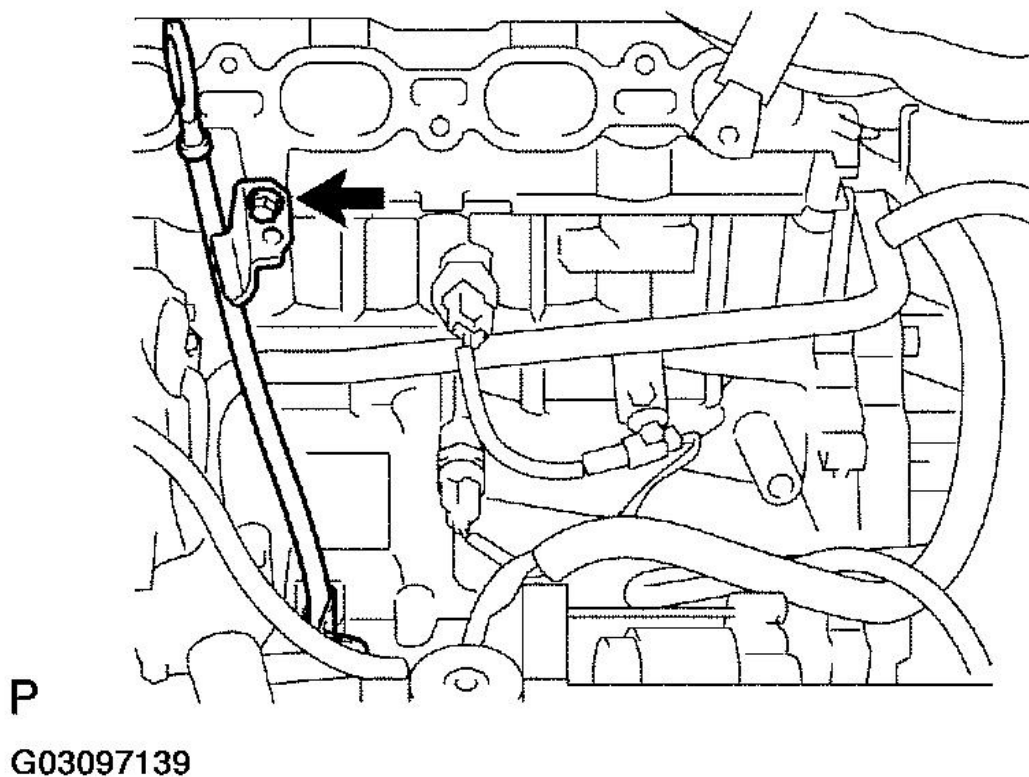


Fig. 256: Removing Oil Level Gage Guide
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. DISCONNECT UNION TO CHECK VALVE HOSE

- a. Disconnect the union to check valve hose from the brake booster.

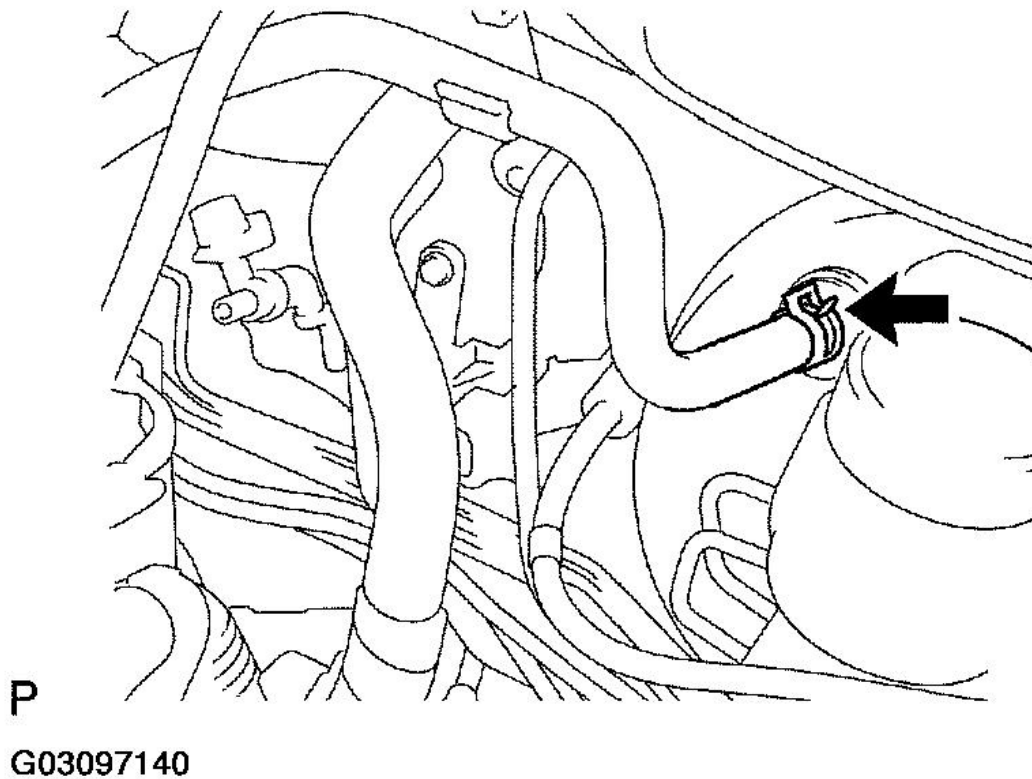


Fig. 257: Disconnecting Union To Check Valve Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. DISCONNECT RADIATOR HOSE INLET

- a. Disconnect the radiator hose inlet from the union.

15. DISCONNECT FUEL TUBE SUB-ASSY

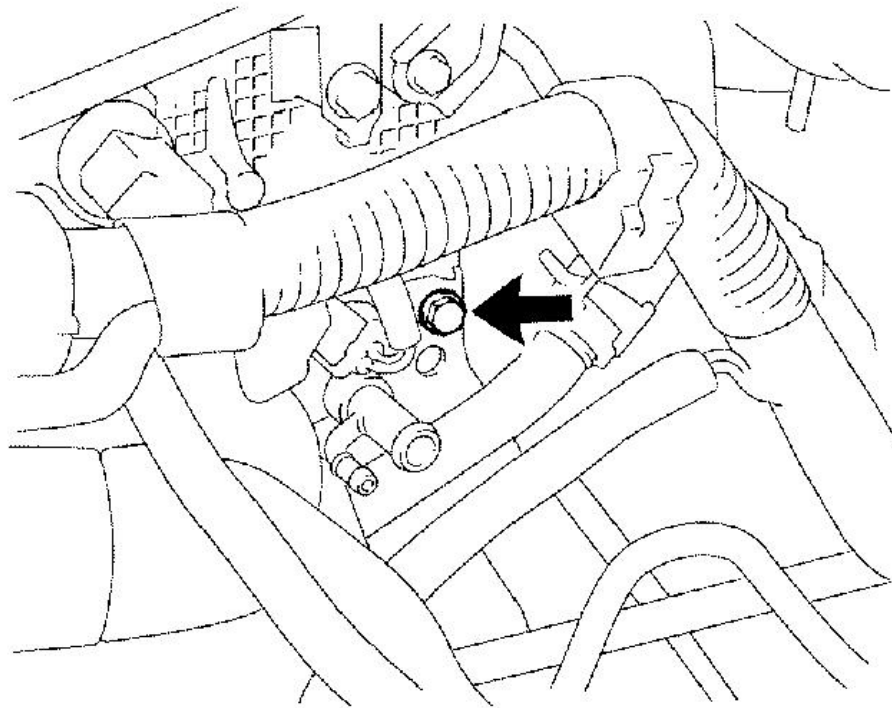
SST 09268-21010

16. DISCONNECT HEATER WATER INLET HOSE A

- a. Disconnect the heater water inlet hose from the water bypass pipe No. 2.

17. SEPARATE WATER BY-PASS PIPE NO. 1

- a. Remove the set bolt of the water by-pass pipe No. 1.



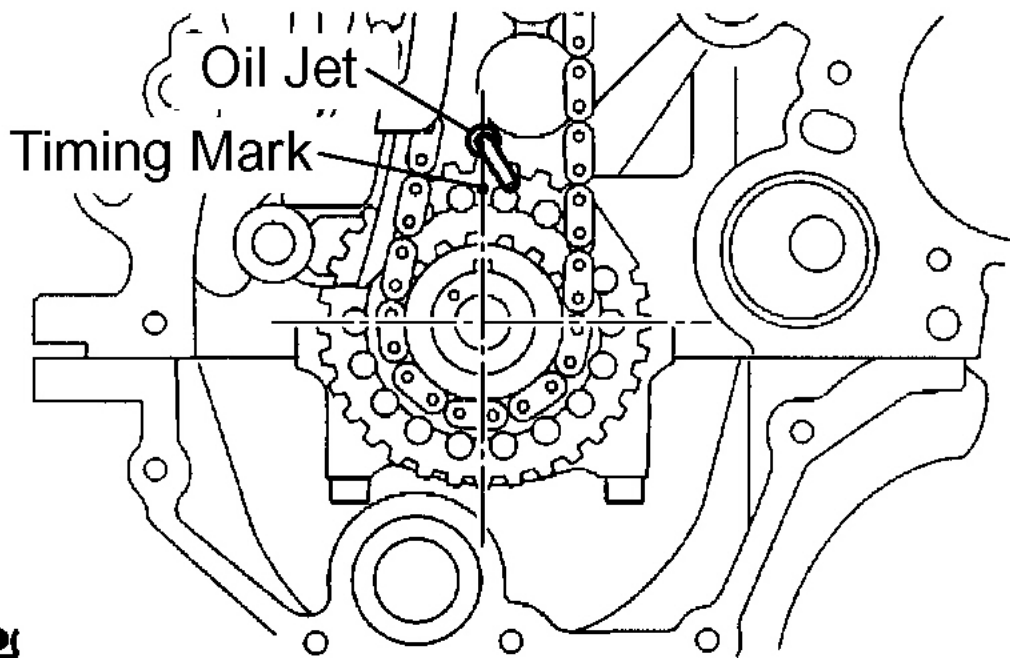
P

G03097141

Fig. 258: Removing Set Bolt Of Water By-Pass Pipe No. 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. REMOVE CAMSHAFT

NOTE: When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC and align the oil jet hole with the timing mark to prevent the pistons from coming into contact with the valves.



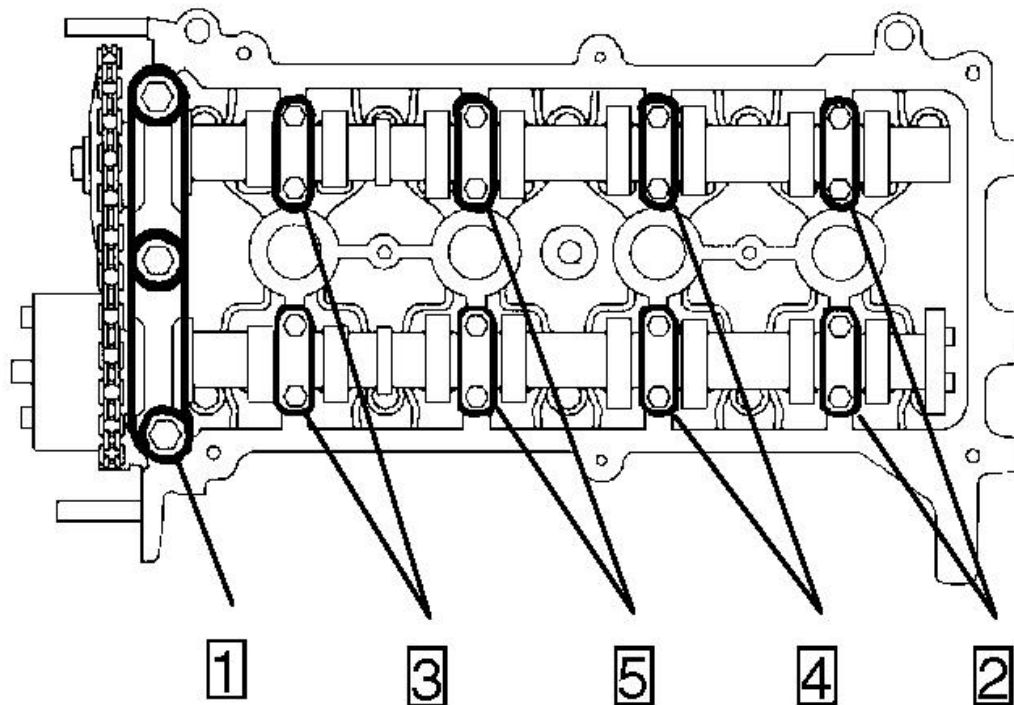
G03097142

Fig. 259: Rotating Crankshaft Counterclockwise 40° From TDC And Aligning Oil Jet Hole With Timing Mark

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

- a. Using several steps, uniformly loosen and remove the 19 bearing cap bolts in the sequence shown in **Fig. 260**, and then remove the 9 bearing caps, the No. 1 and No. 2 camshafts.

NOTE: Loosen each bolt uniformly keeping the camshaft level.



G03097143

Fig. 260: Removing Bearing Cap Bolts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. REMOVE CYLINDER HEAD SUB-ASSY

- a. Using several steps, uniformly loosen and remove the 10 cylinder head bolts with an 8 mm bi-hexagon wrench in the sequence shown in **Fig. 261**. Remove the 10 cylinder head bolts and plate washers.

NOTE:

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

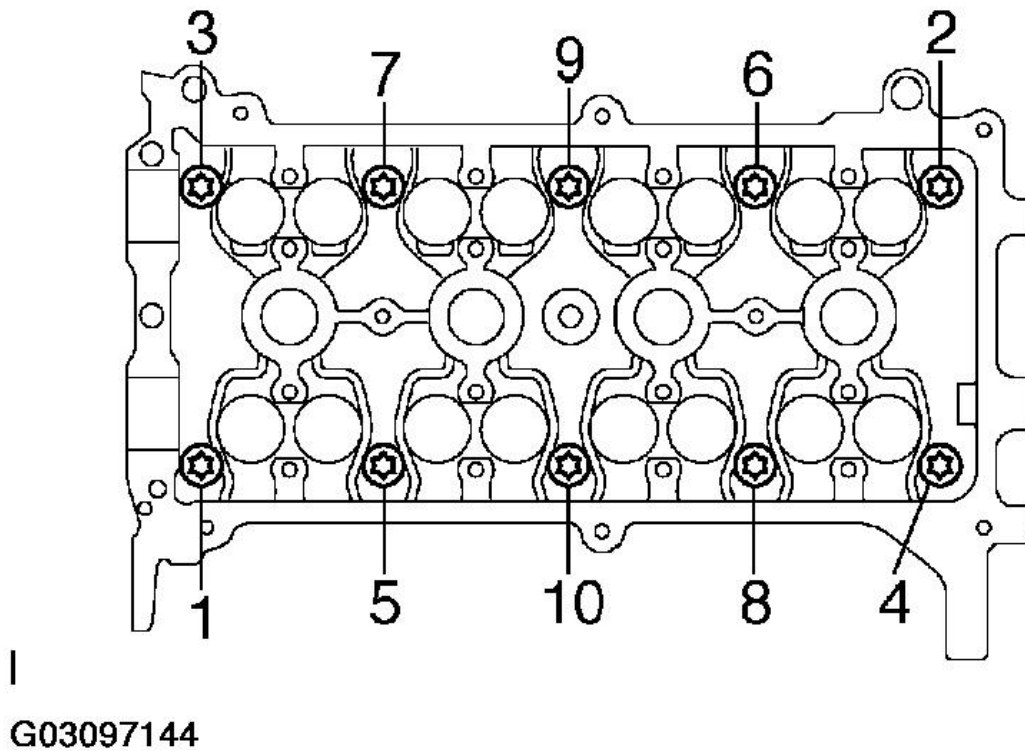


Fig. 261: Removing Cylinder Head Sub-Assy

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

20. REMOVE CYLINDER HEAD GASKET

21. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the length of the cylinder head bolts from the seat to the end.

Standard bolt length:

142.8 to 144.2 mm (5.622 to 5.677 in.)

Maximum bolt length: 147.1 mm (5.791 in.)

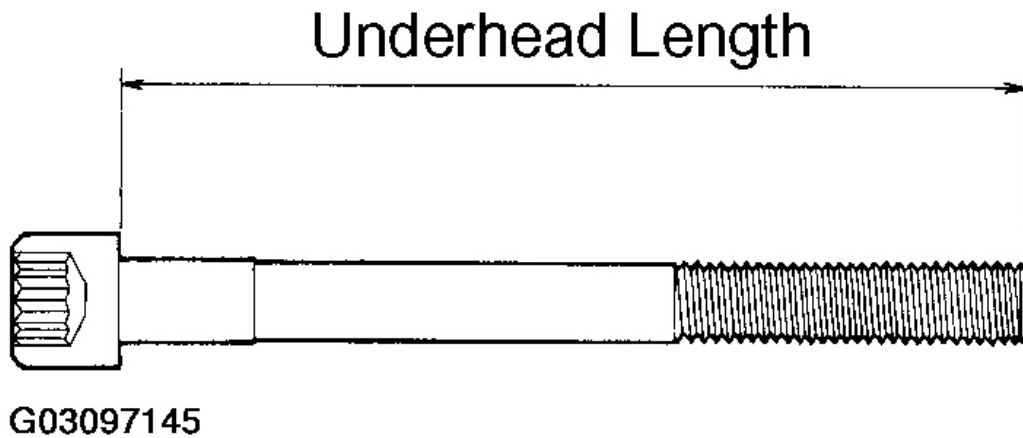


Fig. 262: Measuring Length Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the length exceeds the maximum, replace the bolt.

22. INSTALL CYLINDER HEAD GASKET

- a. Place a new cylinder head gasket on the cylinder block with the Lot No. stamp facing upward.

NOTE:

- Remove any oil from the contact surface.
- Be careful of the mounting orientation.
- Place the cylinder head on the gasket gently to prevent damage to the gasket at the bottom part of the head.

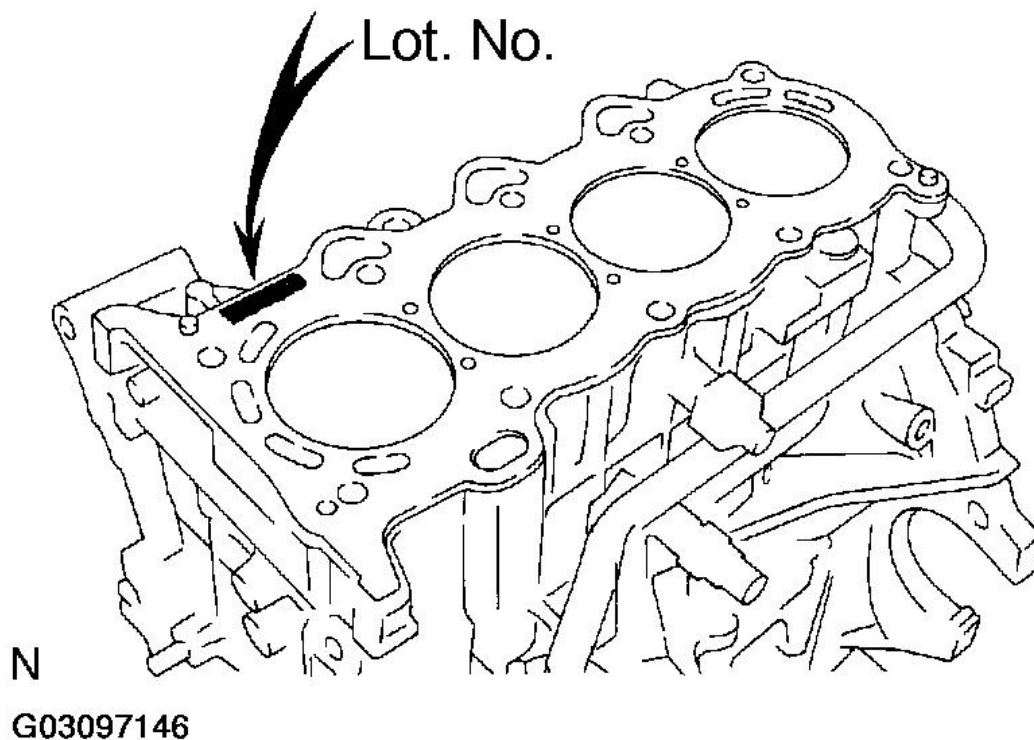


Fig. 263: Placing New Cylinder Head Gasket On Cylinder Block With Lot No. Stamp Facing Upward

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

23. INSTALL CYLINDER HEAD SUB-ASSY

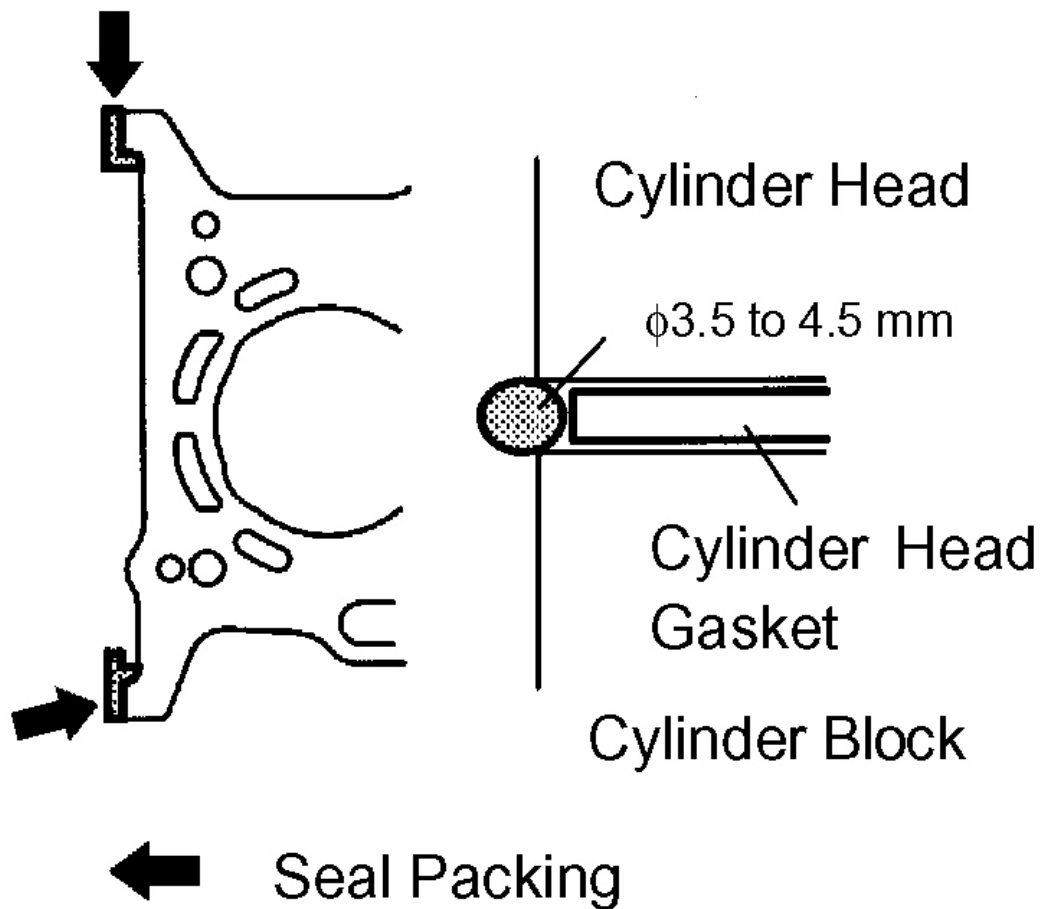
HINT:

The cylinder head bolts are tightened in 2 successive steps.

- Apply a continuous bead of the seal packing (Diameter 3.5 to 4.5 mm (0.1378 to 0.1772 in.)) as shown in **Fig. 264**.

NOTE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying the seal packing.



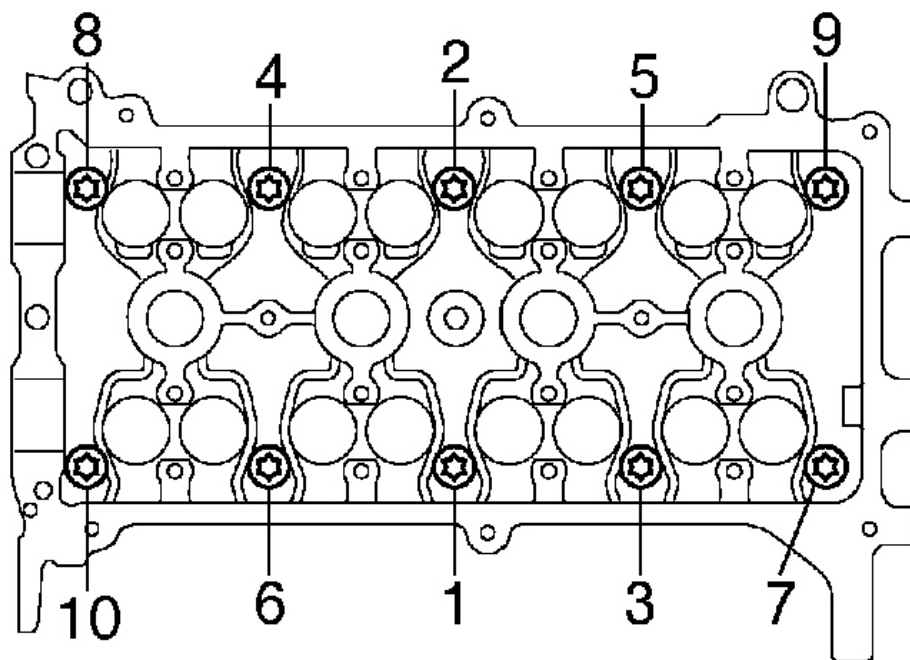
G03097147

Fig. 264: Applying Continuous Bead Of Seal Packing

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

- b. Apply a light coat of engine oil to the threads of the cylinder head bolts.
- c. Using several steps, install and tighten the 10 cylinder head bolts and plate washers uniformly with an 8 mm bi-hexagon wrench in the sequence shown in **Fig. 265**.

Torque: 29 N.m (300 kgf.cm, 22 ft.lbf)

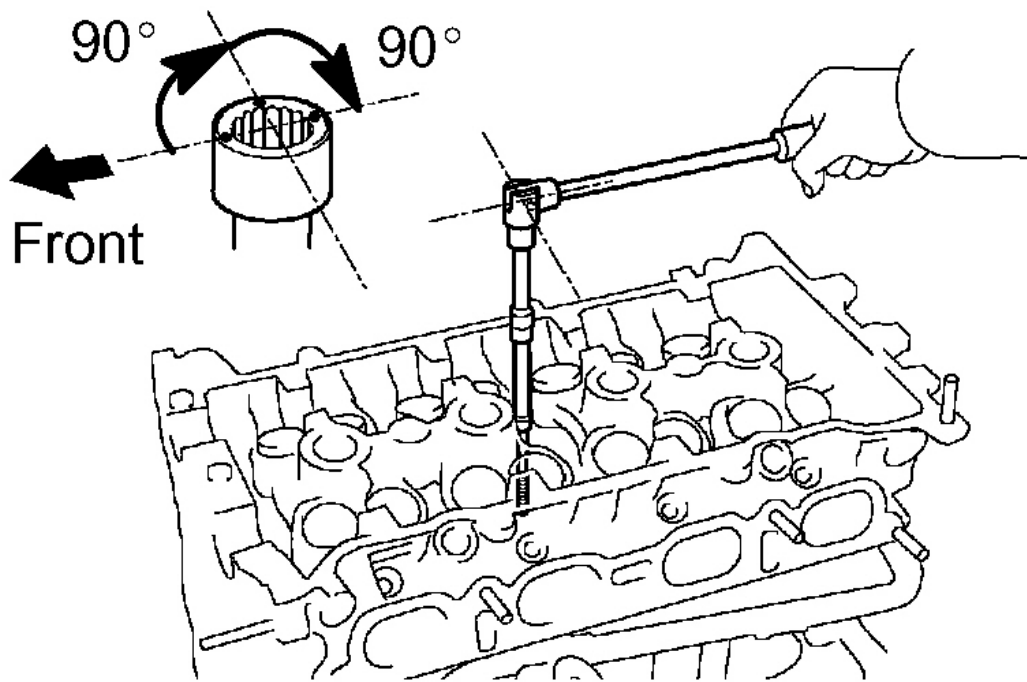


G03097148

Fig. 265: Tightening Cylinder Head Bolts And Plate In Sequence

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

- d. Mark the front of the cylinder head bolts with paint.
- e. Using the same sequence as step c, retighten the cylinder head bolts by additional 90° and one more additional 90° as shown in **Fig. 266**.



G03097149

Fig. 266: Retightening Cylinder Head Bolts By Additional 90° And One More Additional 90° In Sequence

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

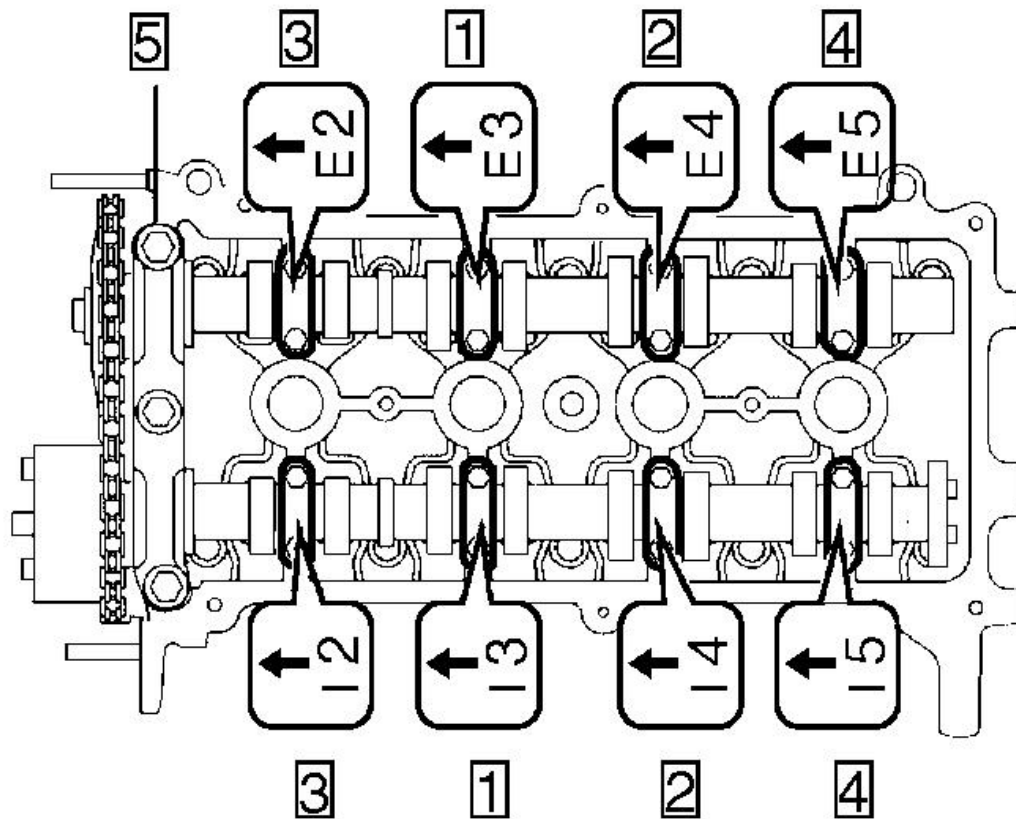
- f. Check that each paint mark is now at 180° opposite to the front.

24. INSTALL CAMSHAFT

- Apply a light coat of engine oil to the camshaft journals.
- Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.
- Examine the front marks and numbers and tighten the bolts in the sequence shown in **Fig. 267**.

Torque: 13 N.m (129 kgf.cm, 9.4 ft.lbf)

NOTE: Tighten each bolt uniformly keeping the camshaft level.



G03097150

Fig. 267: Tightening Bolts In Sequence

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

- d. Install the bearing cap No. 1.

Torque: 23 N.m (235 kgf.cm, 17 ft.lbf)

25. INSTALL WATER BY-PASS PIPE NO. 1

- a. Install the water by-pass pipe No. 1 with the bolt.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

26. CONNECT FUEL TUBE SUB-ASSY (See PRECAUTION)

27. INSTALL OIL LEVEL GAGE GUIDE

- a. Apply engine oil to a new O-ring.

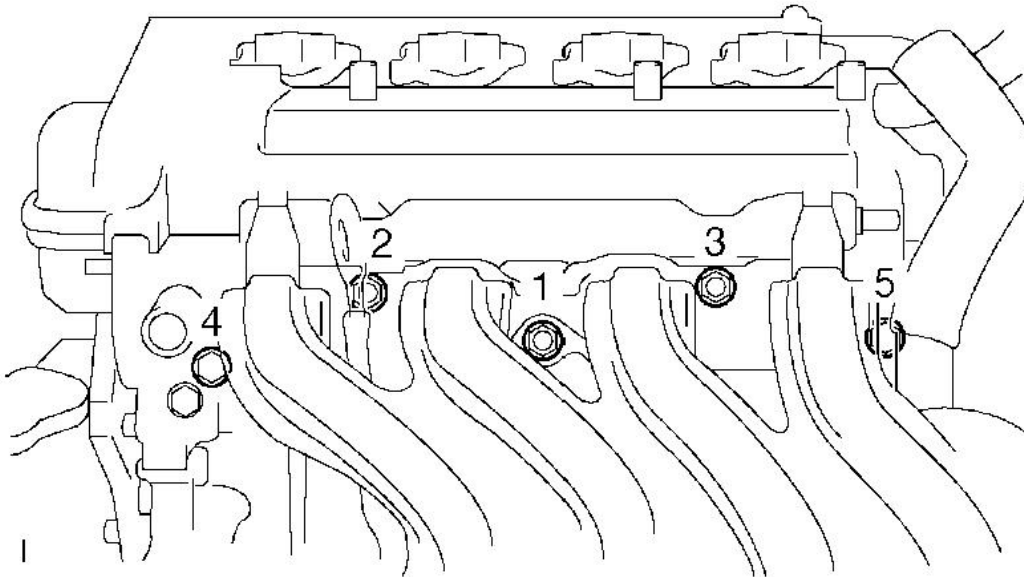
- b. Install the oil level gauge guide with the bolt.

Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)

28. INSTALL INTAKE MANIFOLD

- a. Install a new gasket onto the intake manifold.
- b. Install the intake manifold with the 3 bolts and 2 nuts. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in **Fig. 268**.

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



G03097151

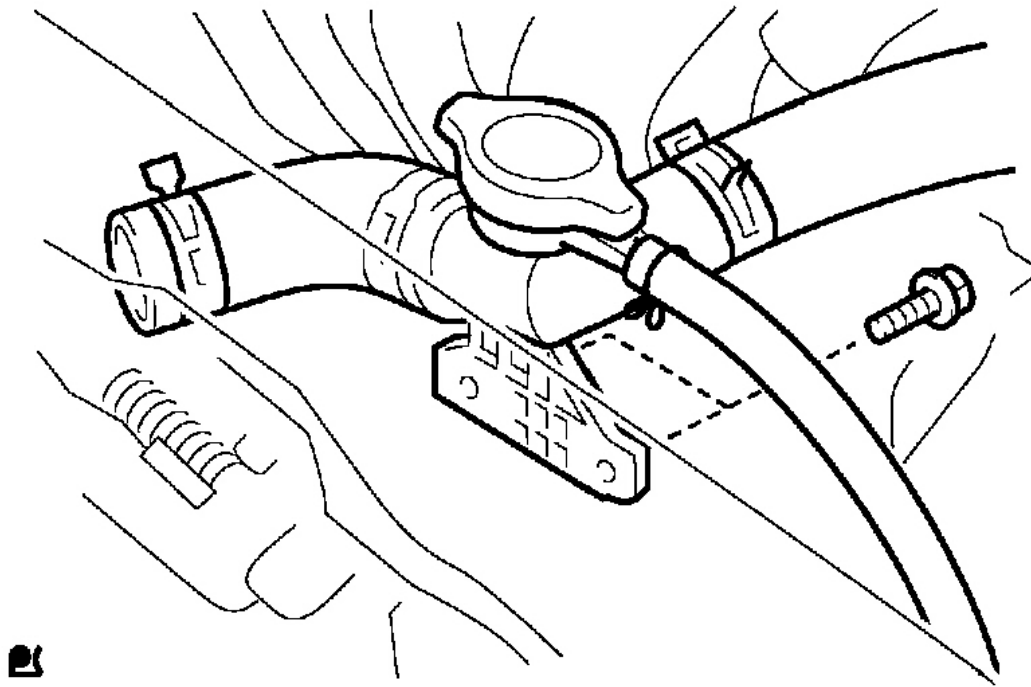
Fig. 268: Tightening Bolts And Nuts In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. INSTALL WATER FILLER SUB-ASSY

- a. Install the water filler with the 2 bolts.

Torque: 7.5 N.m (76 kgf.cm, 66 in.lbf)

- b. Connect the radiator reservoir tank hose.
- c. Connect the radiator hose No. 3.
- d. Connect the radiator inlet hose.



G03097152

Fig. 269: Installing Water Filler Sub-Assy

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

30. **INSTALL THROTTLE BODY ASSY** (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)
31. **INSTALL AIR CLEANER ASSY** (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)
32. **INSTALL MANIFOLD SUPPORT BRACKET**
 - a. Install the manifold support bracket with the 3 bolts.

Torque: 37 N.m (377 kgf.cm, 27 ft.lbf)

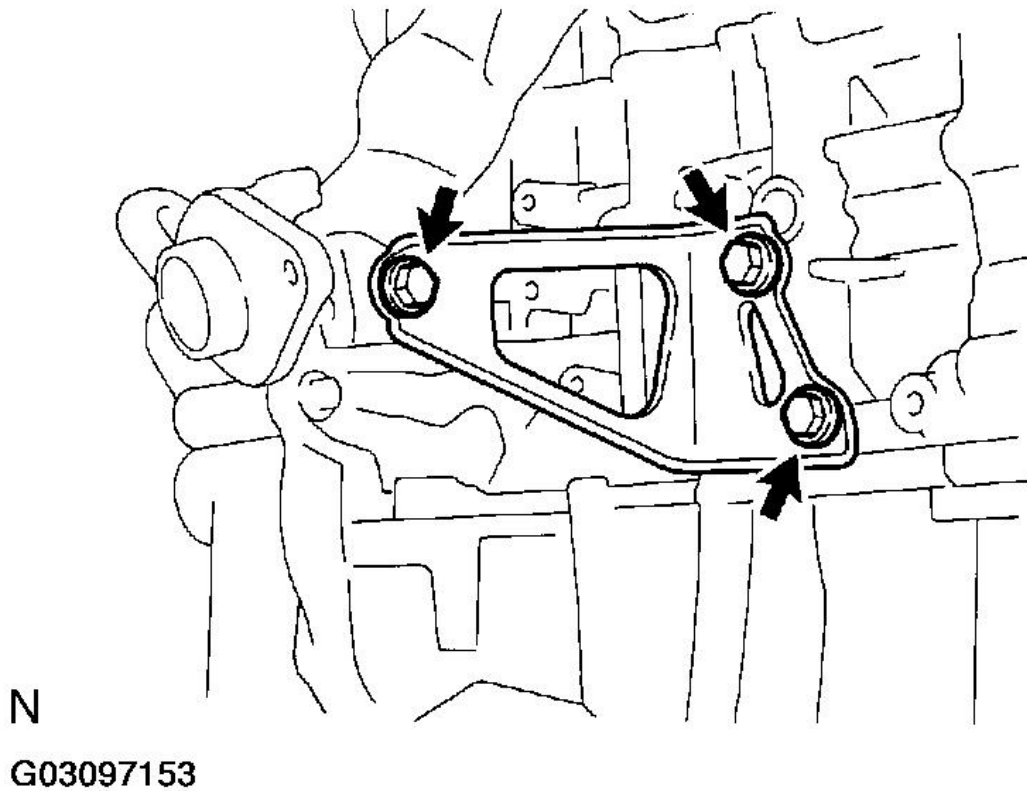


Fig. 270: Installing Manifold Support Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO. 1

- a. Install the exhaust manifold heat insulator No. 1 with the 4 bolts.

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

34. CONNECT EXHAUST PIPE ASSY FRONT

- a. Place a new gasket on the exhaust manifold.
- b. Install the 2 compression springs and 2 bolts.

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

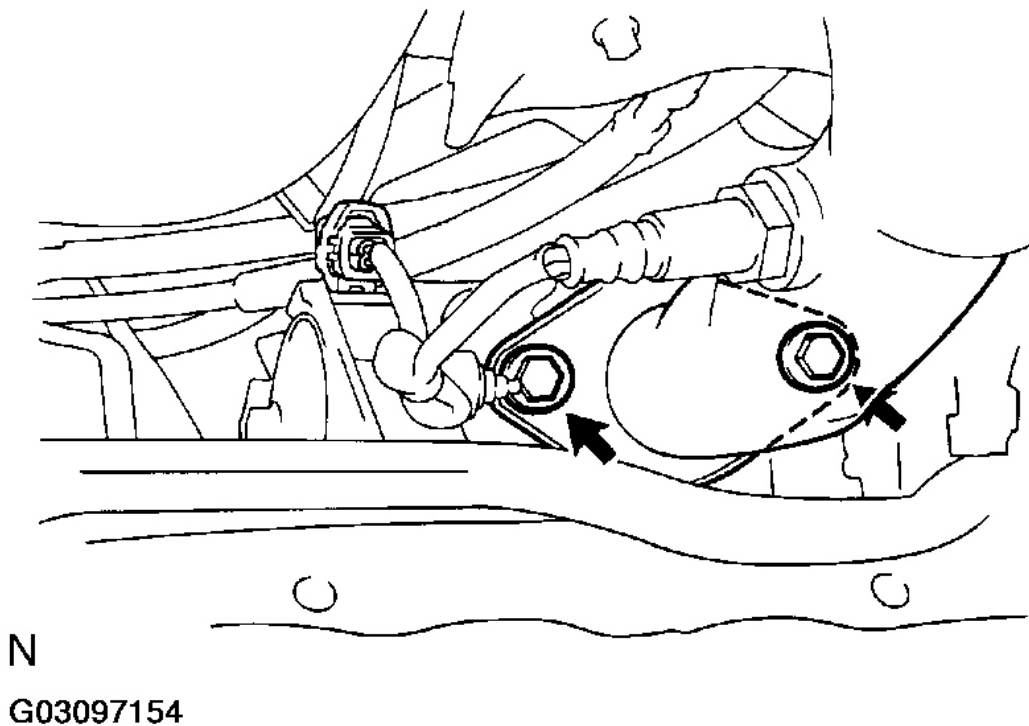


Fig. 271: Connecting Exhaust Pipe Assy Front
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. **INSTALL CHAIN SUB-ASSY (See REPLACEMENT)**
36. **ADD ENGINE OIL**
37. **CHECK FOR ENGINE OIL LEAKS**
38. **ADD ENGINE COOLANT (See REPLACEMENT)**
39. **CHECK FOR ENGINE COOLANT LEAKS (See ON-VEHICLE INSPECTION)**
40. **CHECK FOR FUEL LEAKS**

OIL PUMP SEAL

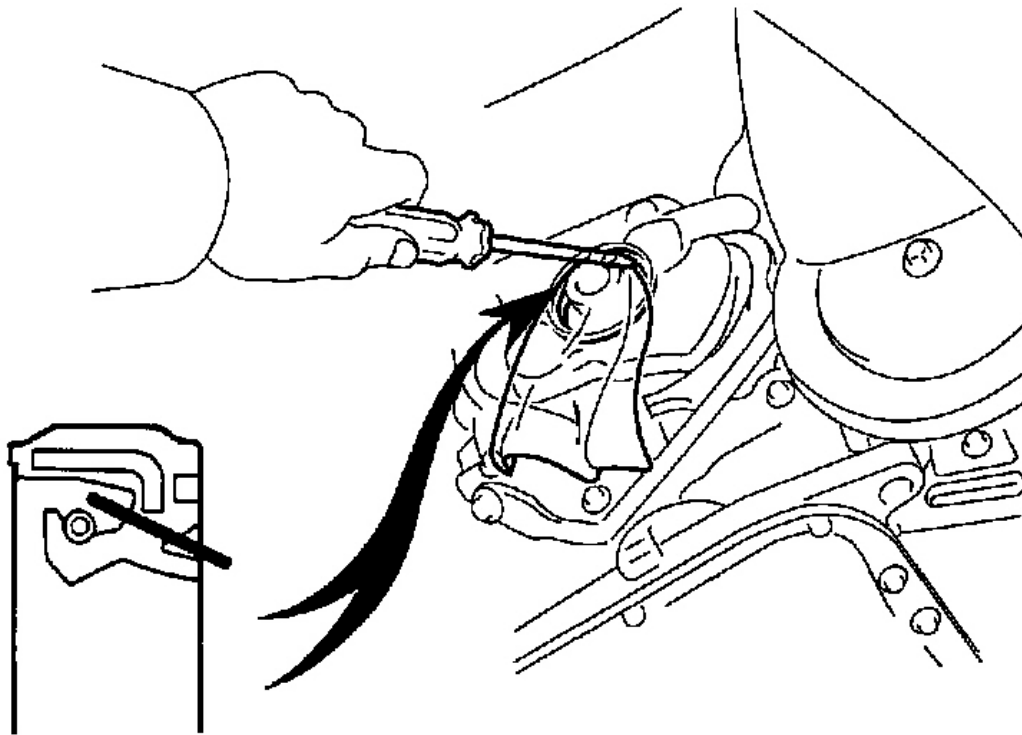
REPLACEMENT

1. **REMOVE FAN AND GENERATOR V BELT (See REPLACEMENT)**
2. **REMOVE FRONT WHEEL RH**
3. **REMOVE ENGINE UNDER COVER RH (See REPLACEMENT)**
4. **REMOVE VANE PUMP V BELT (See REPLACEMENT)**
5. **REMOVE CRANKSHAFT DAMPER SUB-ASSY (See REPLACEMENT)**

SST 09213-58012 (91111-50845), 09330-00021, 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)

6. REMOVE OIL PUMP SEAL

- a. Using a knife, cut off the oil seal lip.
- b. Using a screwdriver with the tip wrapped in tape, pry out the oil seal.



G03097155

Fig. 272: Removing Oil Pump Seal

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

NOTE: After removal, check if the crankshaft is not damaged. If it is damaged, smooth the surface with 400-grit sandpaper.

7. INSTALL OIL PUMP SEAL

- a. Apply multi-purpose grease to a new oil seal lip.

NOTE: Keep the lip free of foreign objects.

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

SST 09223-22010

NOTE:

- Be careful not to tap the oil seal at an angle.
- Wipe any extra grease off the crankshaft.

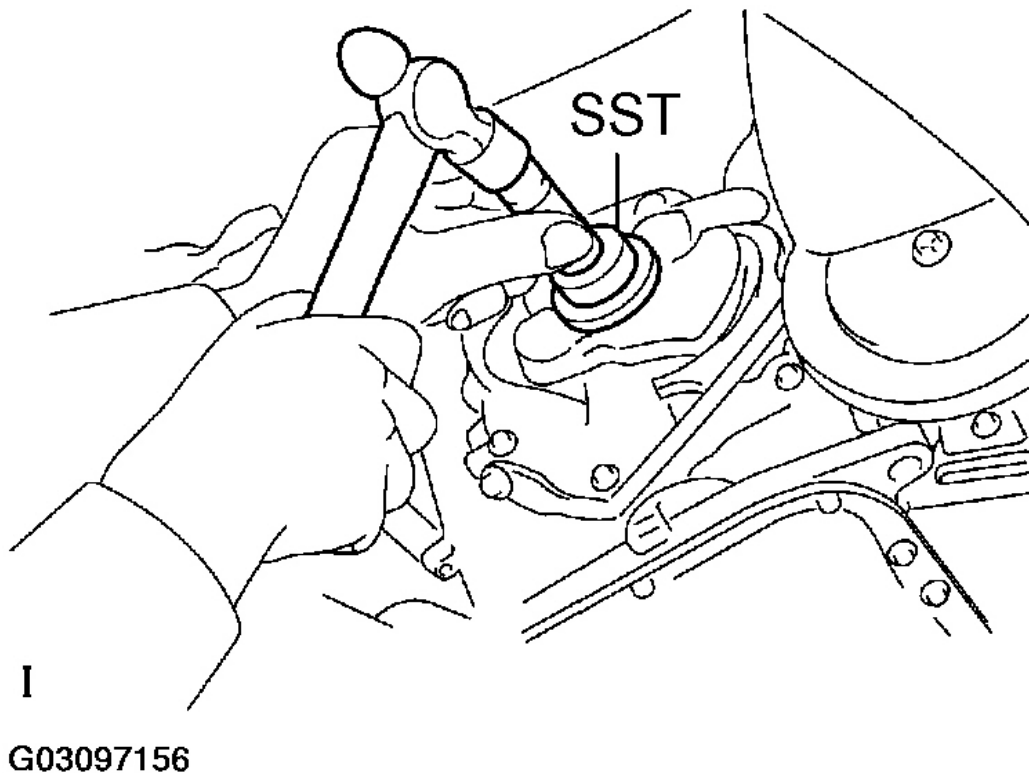


Fig. 273: Tapping In Oil Seal Until Surface Is Flush With Oil Pump Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL CRANKSHAFT DAMPER SUB-ASSY (See REPLACEMENT)

SST 09330-00021, 09213-58012 (91111-50845)

9. INSTALL VANE PUMP V BELT

- a. Temporarily install the V-ribbed belt on each pulley.

10. INSTALL FAN AND GENERATOR V BELT

- a. Temporarily install the V-ribbed belt on each pulley.

11. **ADJUST FAN AND GENERATOR V BELT (See REPLACEMENT)**
12. **ADJUST VANE PUMP V BELT (See REPLACEMENT)**
13. **INSPECT DRIVE BELT DEFLECTION AND TENSION (See INSPECTION)**
14. **INSTALL ENGINE UNDER COVER RH**

Torque:

5.0 N.m (51 kgf.cm, 44 in.lbf) for bolt

5.0 N.m (51 kgf.cm, 44 in.lbf) for nut

15. **ADD ENGINE OIL**
16. **CHECK FOR ENGINE OIL LEAKS**

ENGINE REAR OIL SEAL**REPLACEMENT**

1. **REMOVE MANUAL TRANSAXLE ASSY (MANUAL TRANSAXLE) (See REPLACEMENT)**
2. **REMOVE AUTOMATIC TRANSAXLE ASSY (AUTOMATIC TRANSAXLE) (See REPLACEMENT)**
3. **REMOVE CLUTCH COVER ASSY (MANUAL TRANSAXLE) (See OVERHAUL)**
4. **REMOVE CLUTCH DISC ASSY (MANUAL TRANSAXLE) (See OVERHAUL)**
5. **REMOVE DRIVE PLATE AND RING GEAR OR FLYWHEEL**
 - a. Hold the crankshaft damper with SST, then remove the flywheel or drive plate.

SST 09213-58012 (91111-50845), 09330-00021

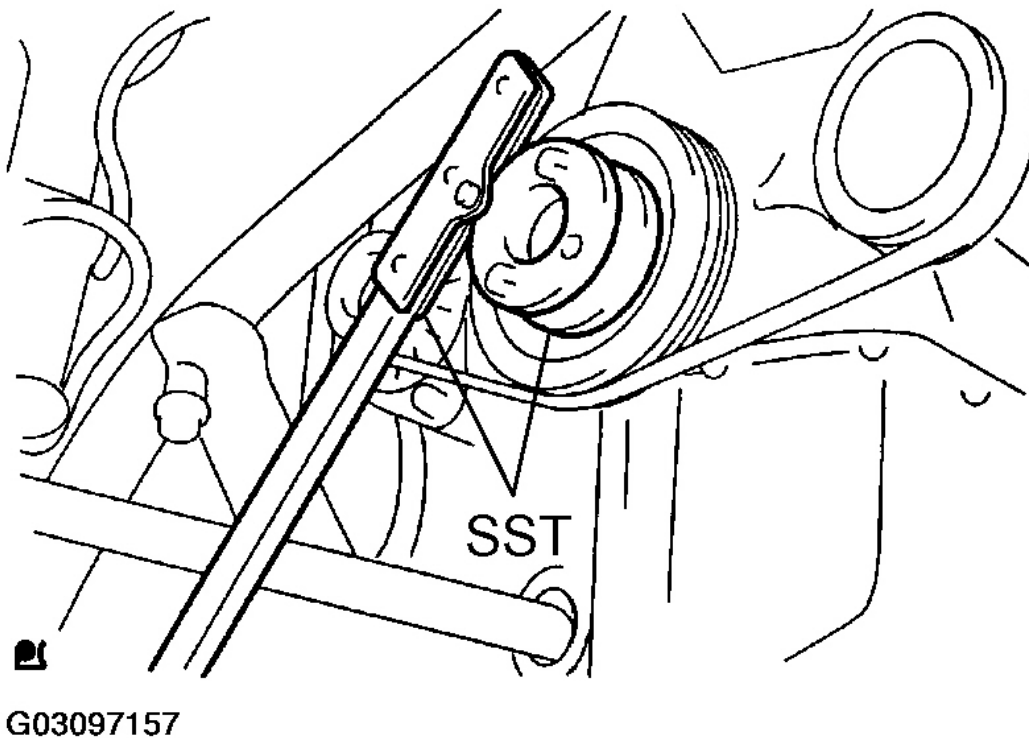


Fig. 274: Removing Drive Plate And Ring Gear Or Flywheel
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE ENGINE REAR OIL SEAL

- a. Using a knife, cut off the oil seal lip.
- b. Using a screwdriver with the tip wrapped in tape, pry out the oil seal.

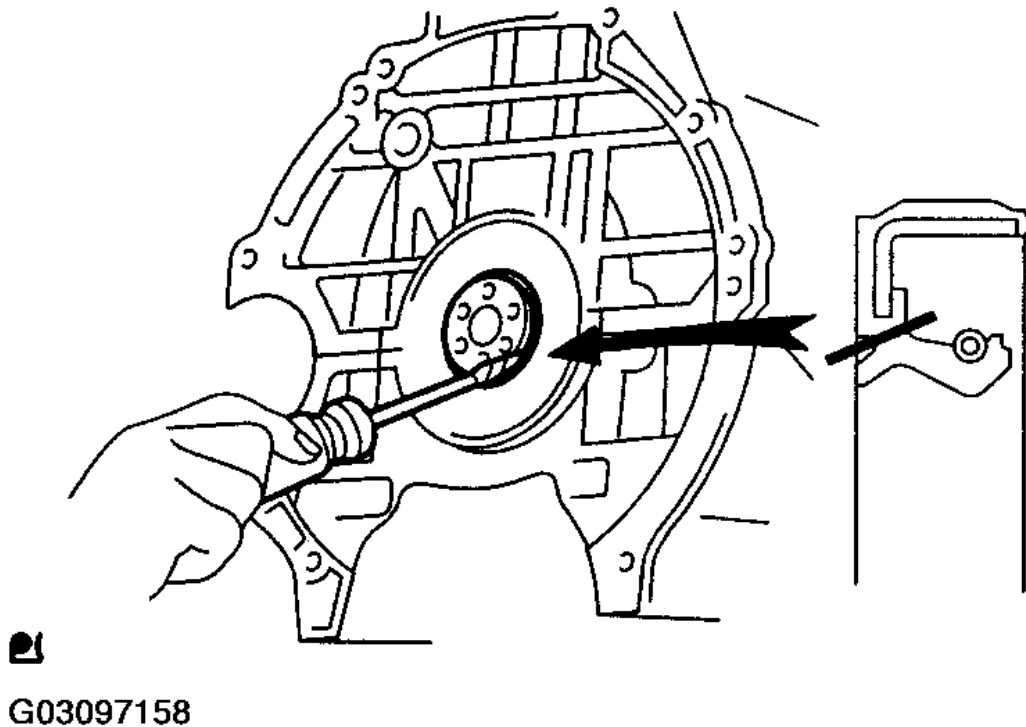


Fig. 275: Removing Engine Rear Oil Seal

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

NOTE: After removal, check if the crankshaft is not damaged. If it is damaged, smooth the surface with 400-grit sandpaper.

7. INSTALL ENGINE REAR OIL SEAL

- Apply multi-purpose grease to a new oil seal lip.

NOTE: Keep the lip free of foreign materials.

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

SST 09223-56010

NOTE:

- Be careful not to tap the oil seal at an angle.
- Wipe any extra grease off the crankshaft.

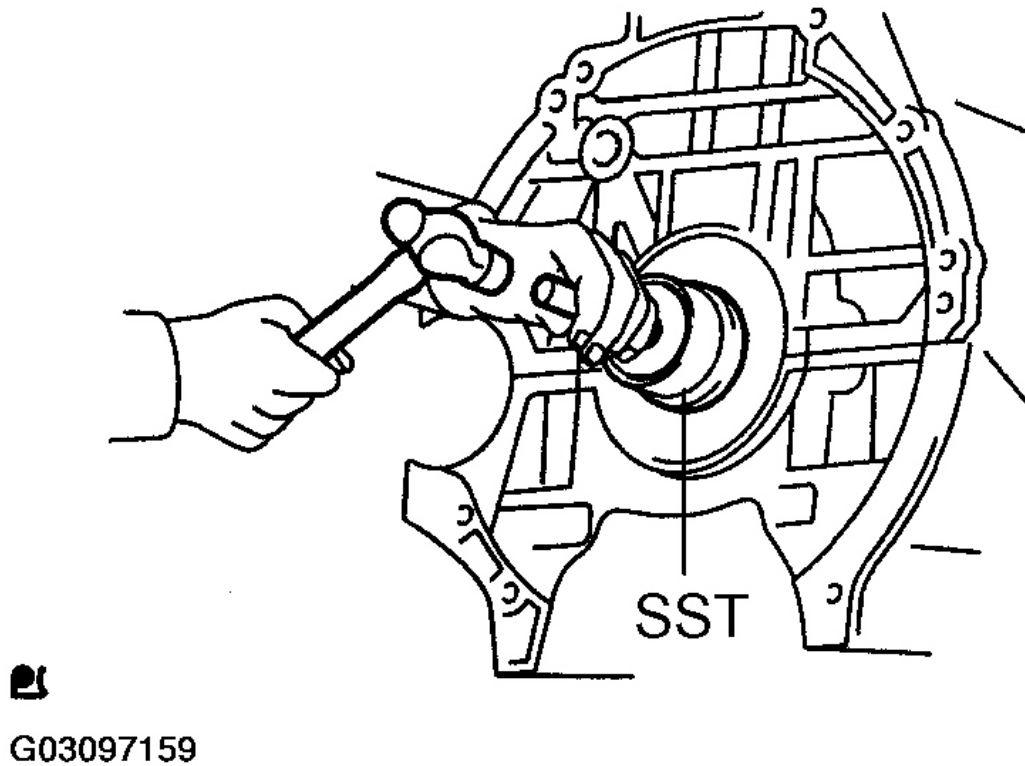


Fig. 276: Tapping In Oil Seal Until Surface Is Flush With Rear Oil Seal Retainer Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL DRIVE PLATE AND RING GEAR OR FLYWHEEL

- a. Hold the crankshaft with SST.

SST 09213-58012 (91111-50845), 09330-00021

Adhesive:

Part No. 0933-00070, THREE BOND or equivalent

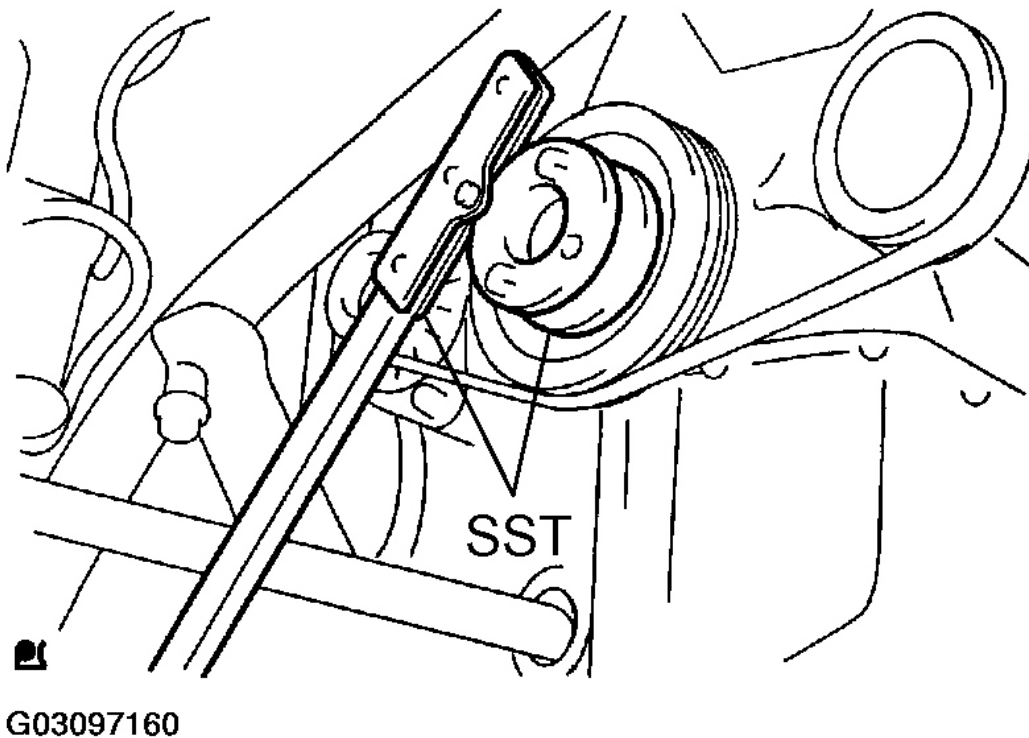
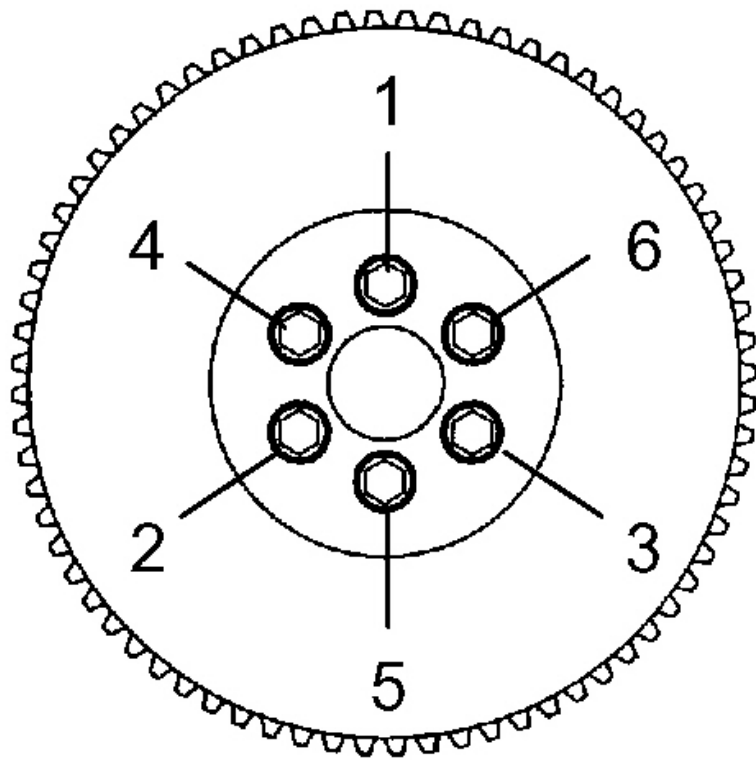


Fig. 277: Holding Crankshaft With SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the drive plate. (A/T)
1. Clean the bolts and bolt holes.
 2. Apply adhesive to the bolts.
 3. Using several steps, uniformly install and tighten the 6 bolts in the sequence shown in **Fig. 278**.

Torque: 88 N.m (900 kgf.cm, 65 ft.lbf)



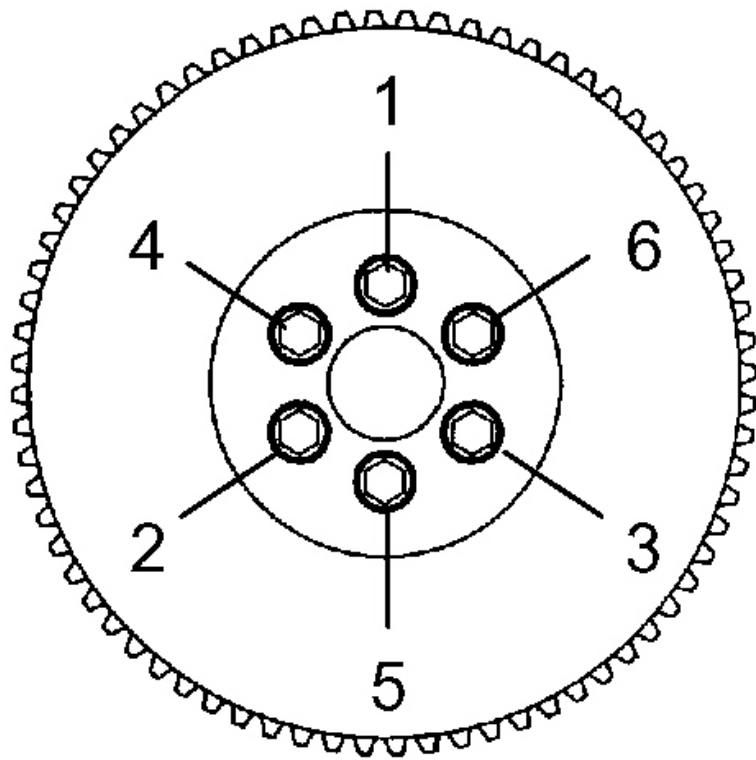
G03097161

Fig. 278: Tightening Bolts In Sequence

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

- c. Install the flywheel. (M/T)
 1. Clean the bolt holes.
 2. Using several steps, uniformly install and tighten 6 new bolts in the sequence shown in **Fig. 279**.

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



G03097162

Fig. 279: Tightening New Bolts In Sequence

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

NOTE: Do not reuse the flywheel bolt. It may cause breakage of the flywheel bolt.

3. Put a front mark on each flywheel bolt with paint.
4. Retighten the flywheel bolts by an additional 90° in the same sequence as step 2.
5. Check that each paint mark is at 90° position from the original location.

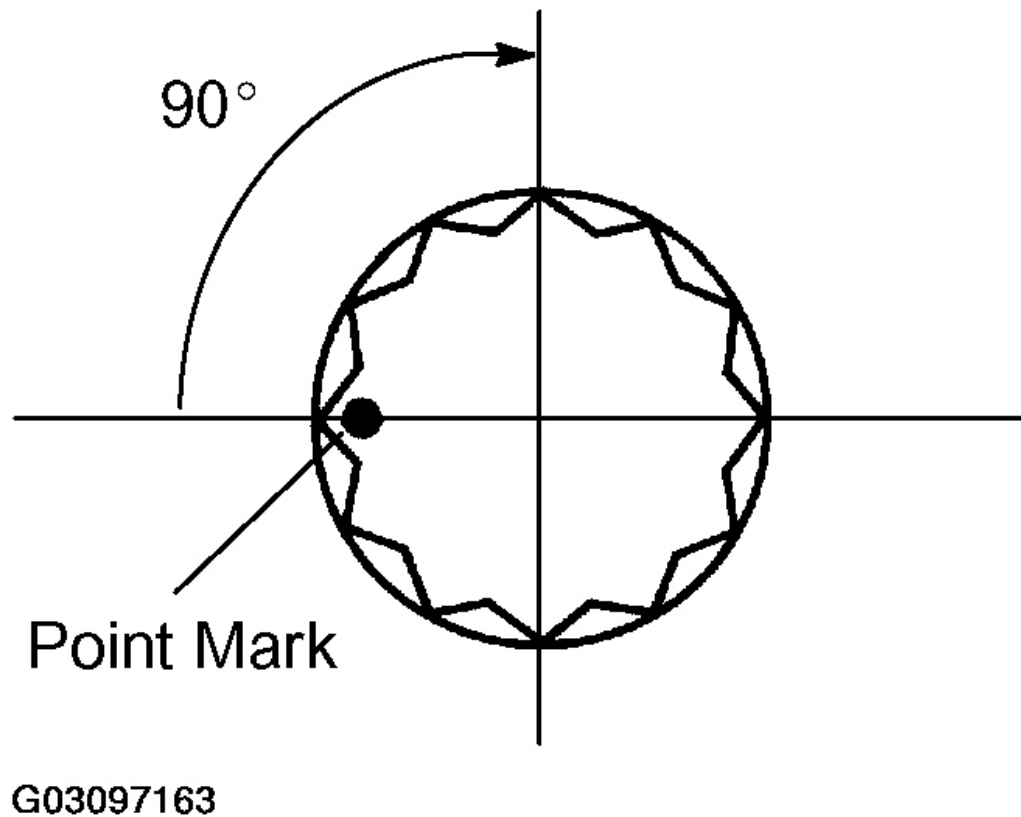
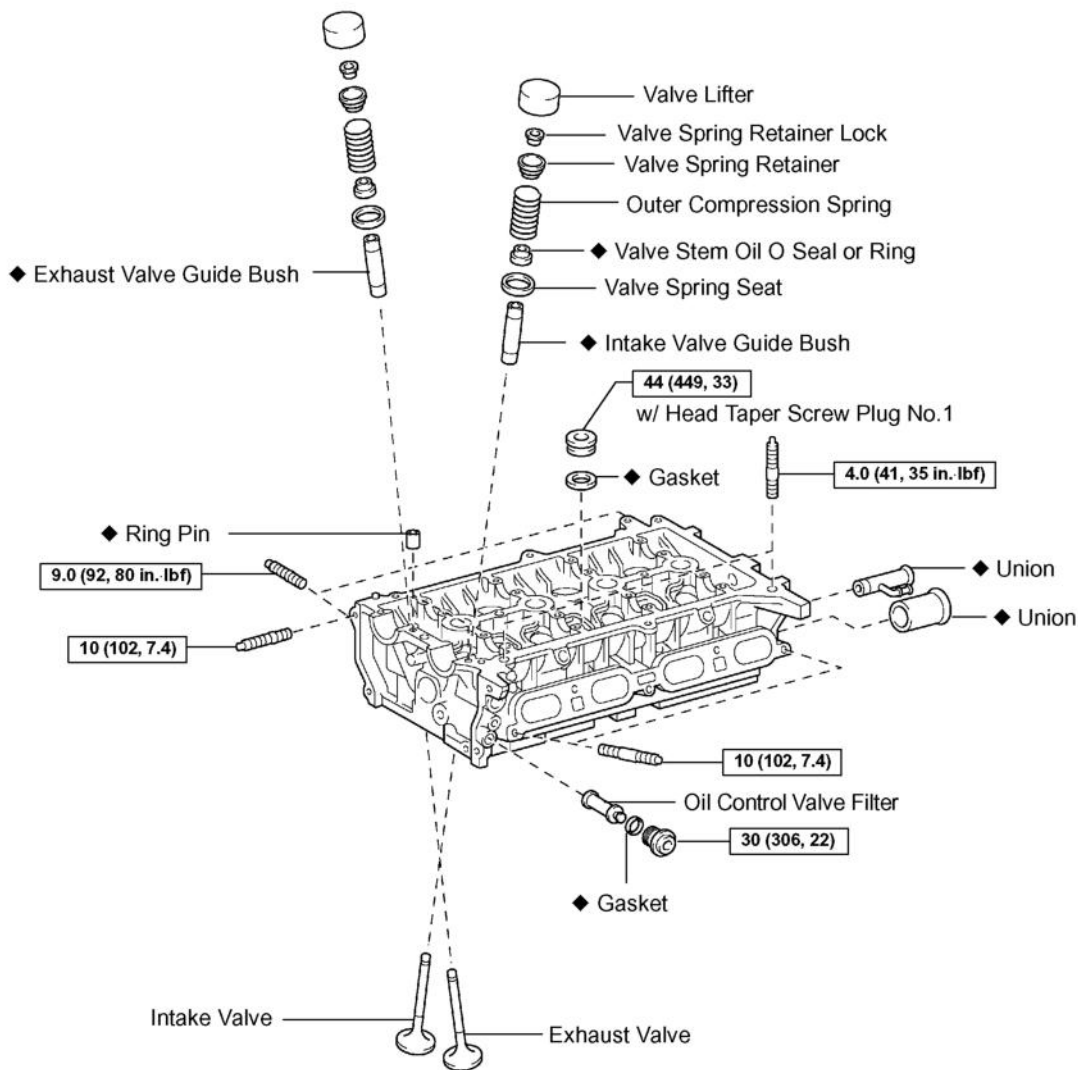


Fig. 280: Checking That Each Paint Mark Is At 90° Position From Original Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL CLUTCH DISC ASSY (MANUAL TRANSAXLE)** (See **OVERHAUL**)
10. **INSTALL CLUTCH COVER ASSY (MANUAL TRANSAXLE)** (See **OVERHAUL**)
11. **INSTALL MANUAL TRANSAXLE ASSY (MANUAL TRANSAXLE)** (See **REPLACEMENT**)
12. **INSTALL AUTOMATIC TRANSAXLE ASSY (AUTOMATIC TRANSAXLE)** (See **REPLACEMENT**)
13. **CHECK FOR ENGINE OIL LEAKS**

CYLINDER HEAD ASSY

COMPONENTS



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

◆ Non-reusable part

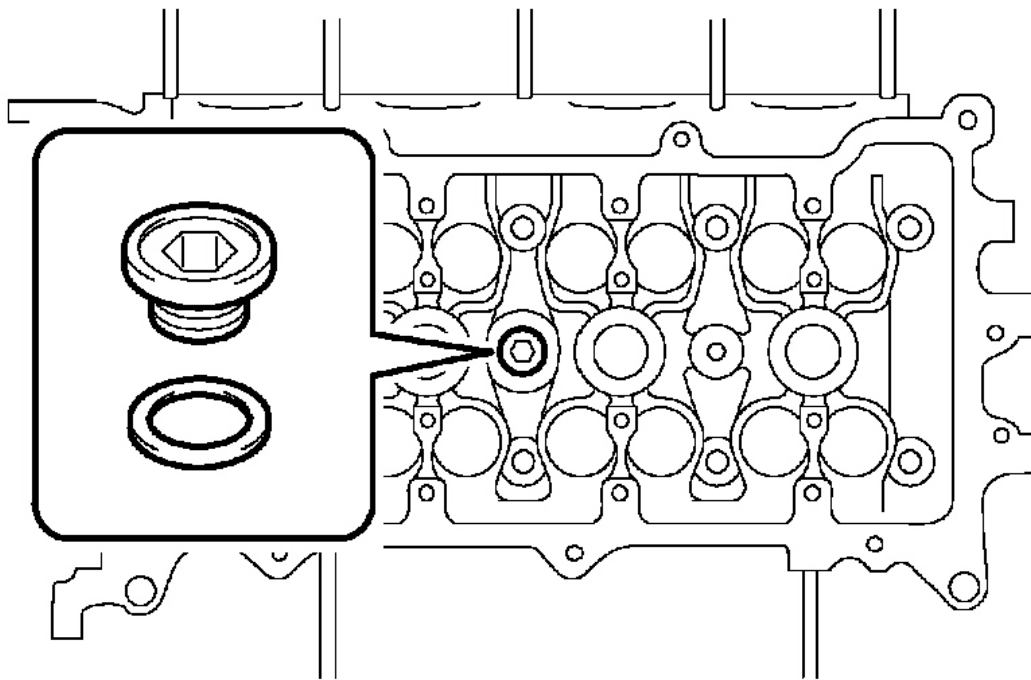
G03097164

Fig. 281: Exploded View Of Cylinder Head Assy Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OVERHAUL

1. REMOVE W/HEAD TAPER SCREW PLUG NO. 1

- Using a 10 mm socket hexagon wrench, remove the taper screw plug and gasket.



G03097165

Fig. 282: Removing Taper Screw Plug And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

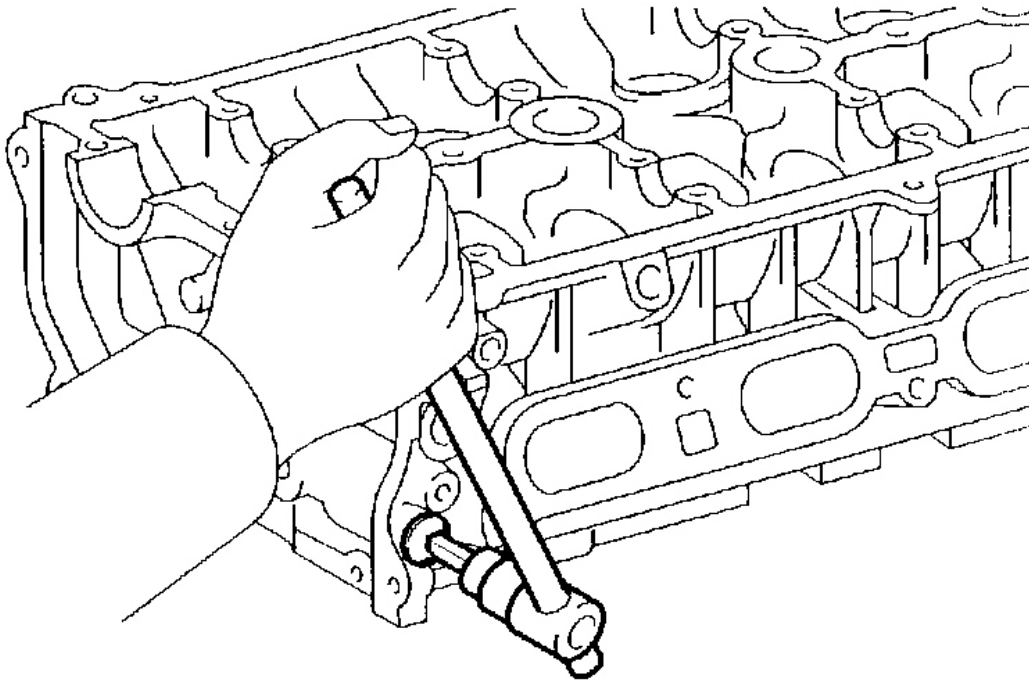
2. REMOVE VALVE LIFTER

HINT:

Keep the valve lifters in the correct order so they can be returned to the original locations when re-assembling.

3. REMOVE OIL CONTROL VALVE FILTER

- a. Using an 8 mm hexagon wrench, remove the taper screw plug.



G03097166

Fig. 283: Removing Taper Screw Plug

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

- b. Remove the filter and gasket.

4. REMOVE INTAKE VALVE

- a. Using SST, compress the valve spring and remove the 2 keepers, retainer, and valve spring.

SST 09202-70020 (09202-00010)

HINT:

Keep the valves, valve springs, spring seats and spring retainers in the correct order so they can be returned to the original locations when re-assembling.

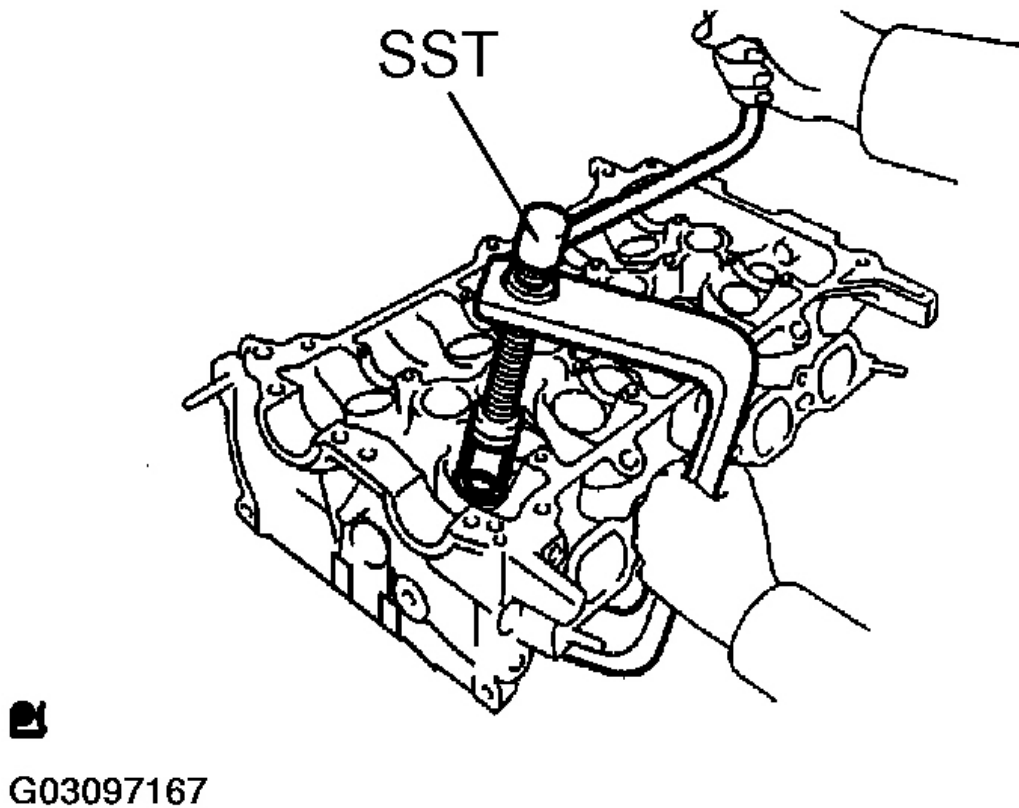


Fig. 284: Removing Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE EXHAUST VALVE

- Using SST, compress the valve spring and remove the 2 keepers, retainer, and valve spring.

SST 09202-70020 (09202-00010)

HINT:

Keep the valves, valve springs, spring seats and spring retainers in the correct order so they can be returned to the original locations when re-assembling.

6. REMOVE VALVE STEM OIL "O" SEAL OR RING

- Using needle-nose pliers, remove the oil seal.

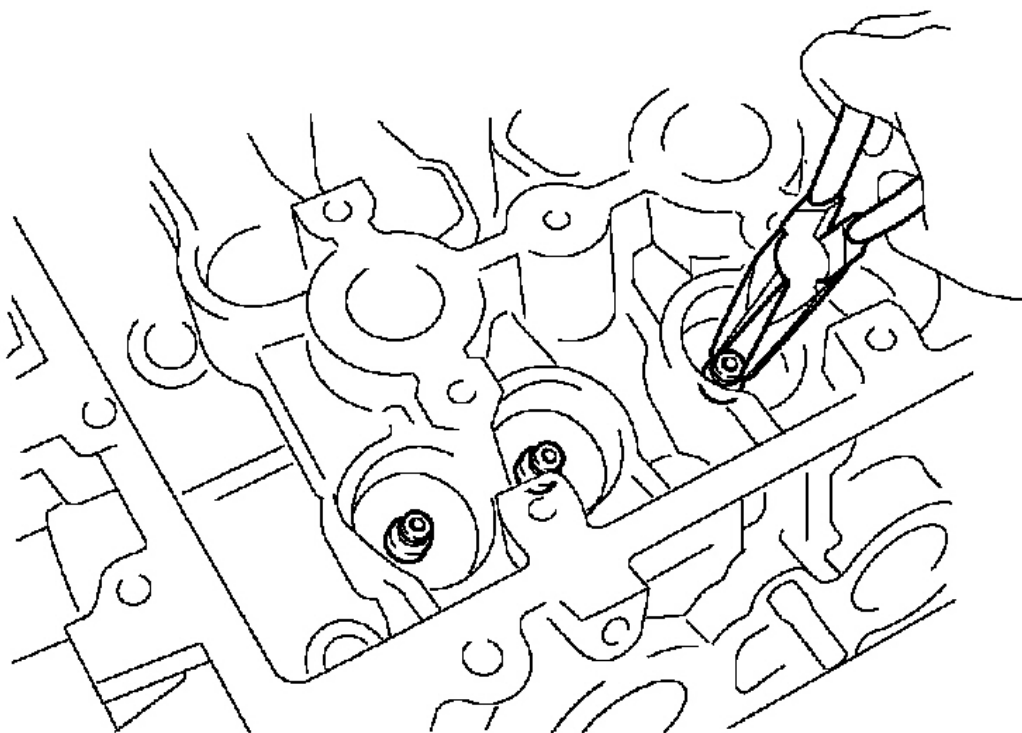
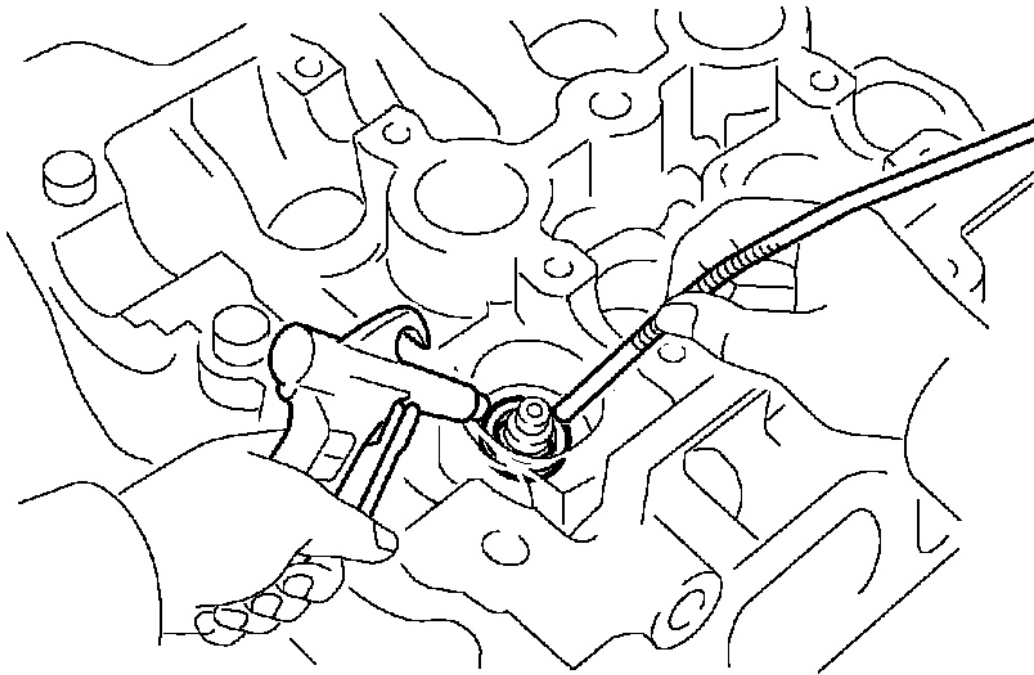
**G03097168**

Fig. 285: Removing Valve Stem Oil "O" Seal Or Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE VALVE SPRING SEAT

- a. Using a compressed air and magnetic finger, remove the valve spring seats.



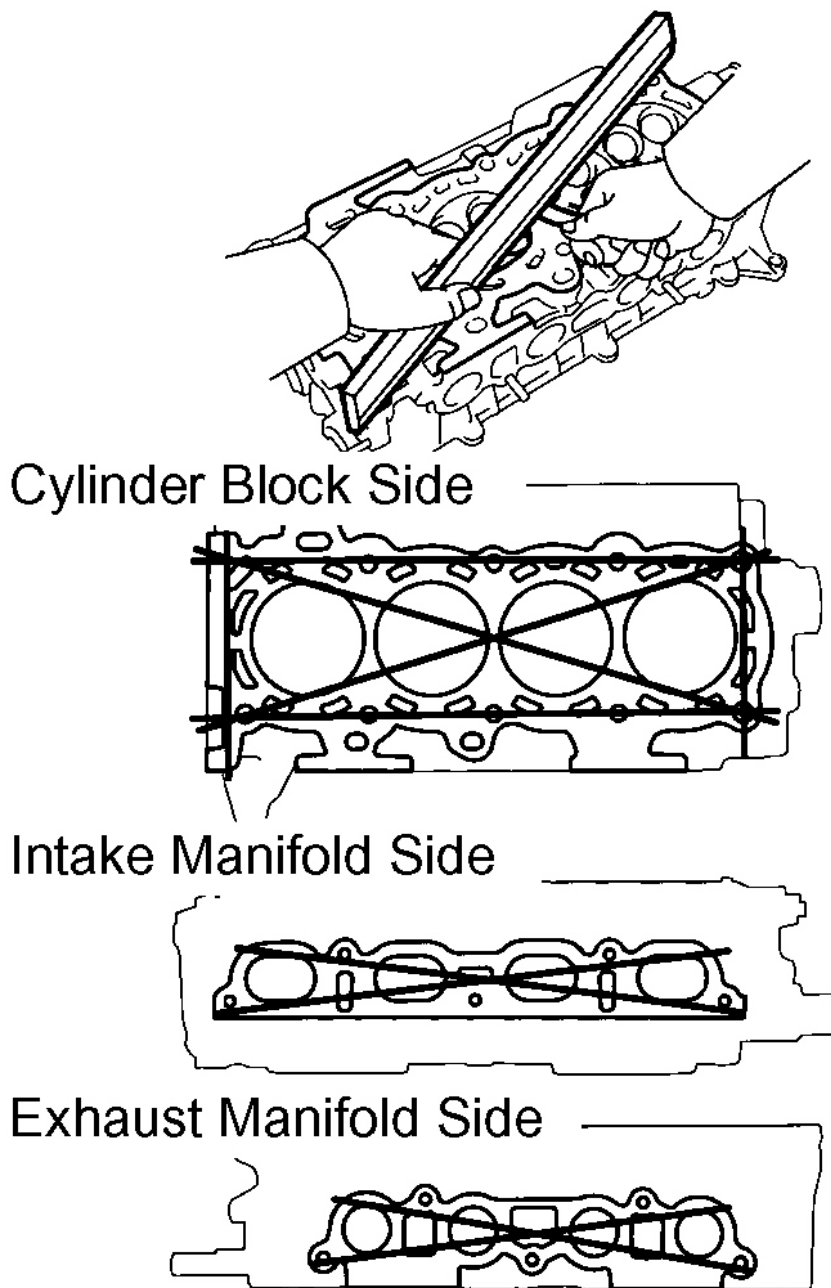
G03097169

Fig. 286: Removing Valve Spring Seat

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

8. **REMOVE UNION**
9. **REMOVE STUD BOLT**
 - a. Using Torx socket wrench E5 and E7, remove the 7 stud bolts.
10. **REMOVE CAMSHAFT BEARING CAP SETTING RING PIN**
11. **INSPECT CYLINDER HEAD FOR FLATNESS**
 - a. Using a precision straight edge and feeler gauge, measure the surface that is in contact with the cylinder block and manifolds for warpage.

Maximum warpage:**Cylinder block side 0.05 mm (0.0020 in.)****Intake manifold side 0.10 mm (0.0039 in.)****Exhaust manifold side 0.10 mm (0.0039 in.)**



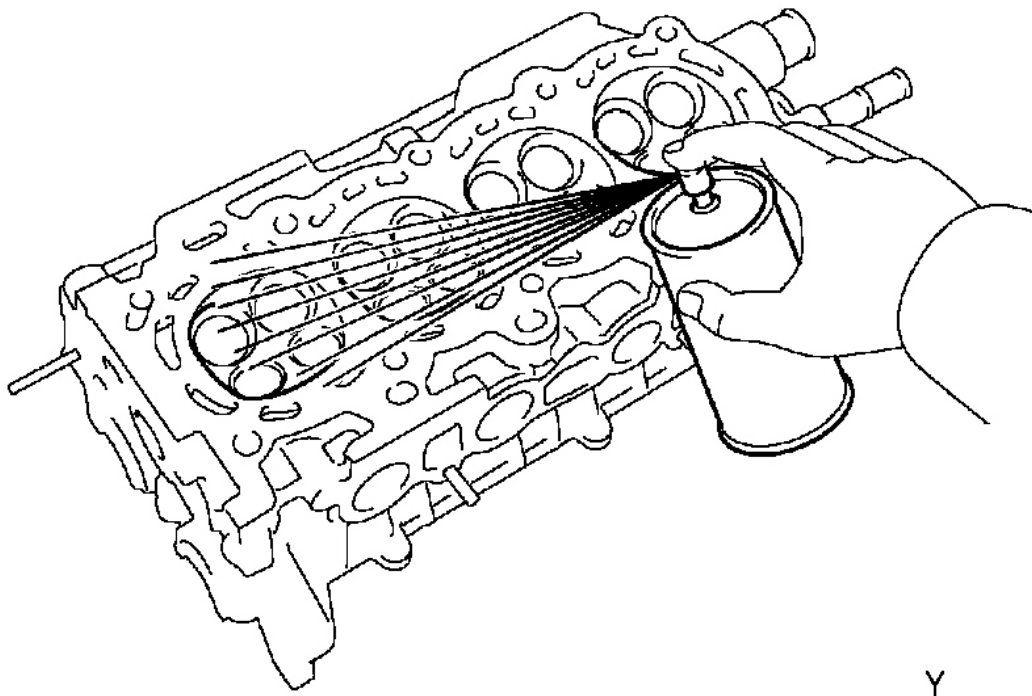
G03097170

Fig. 287: Inspecting Cylinder Head For Flatness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSPECT CYLINDER HEAD FOR CRACKS

- Using a dye penetrate, check the combustion chamber, intake ports, exhaust ports and cylinder

block surface for cracks.



G03097171

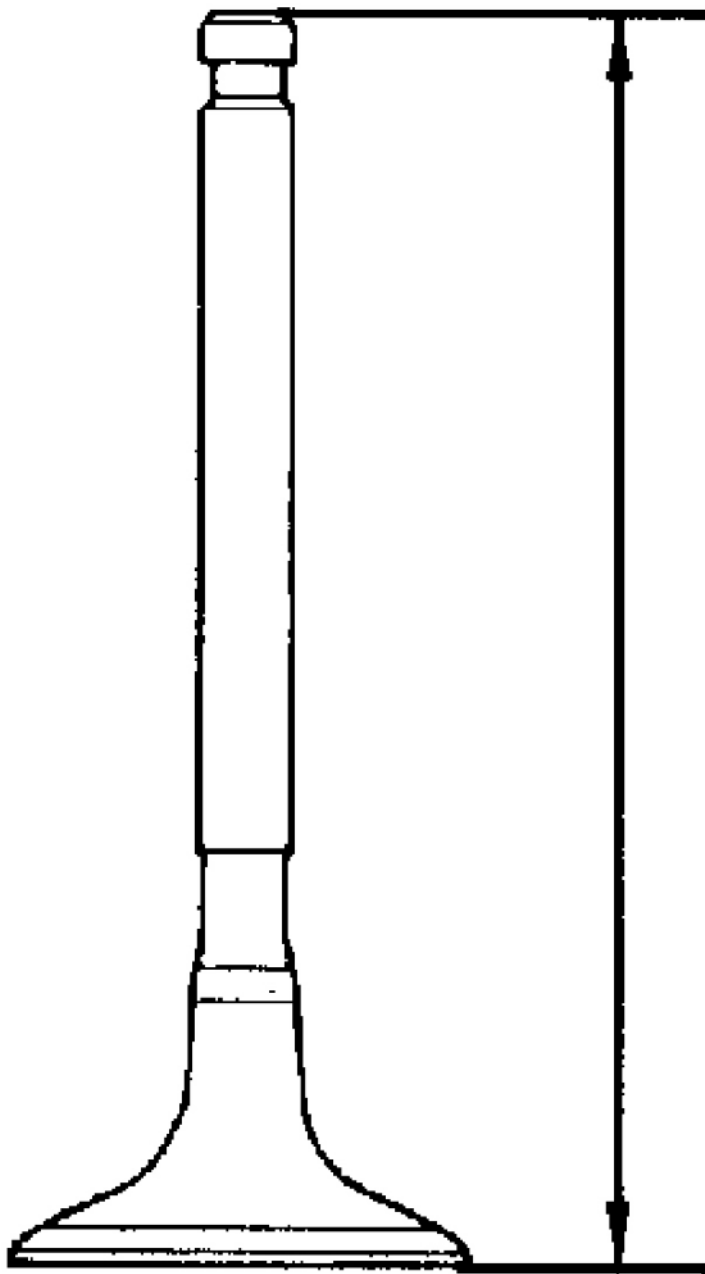
Fig. 288: Inspecting Cylinder Head For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSPECT INTAKE VALVE

- a. Measure the valve overall length.

Standard overall length: 89.25 mm (3.5138 in.)

Minimum overall length: 88.75 mm (3.4941 in.)



G03097172

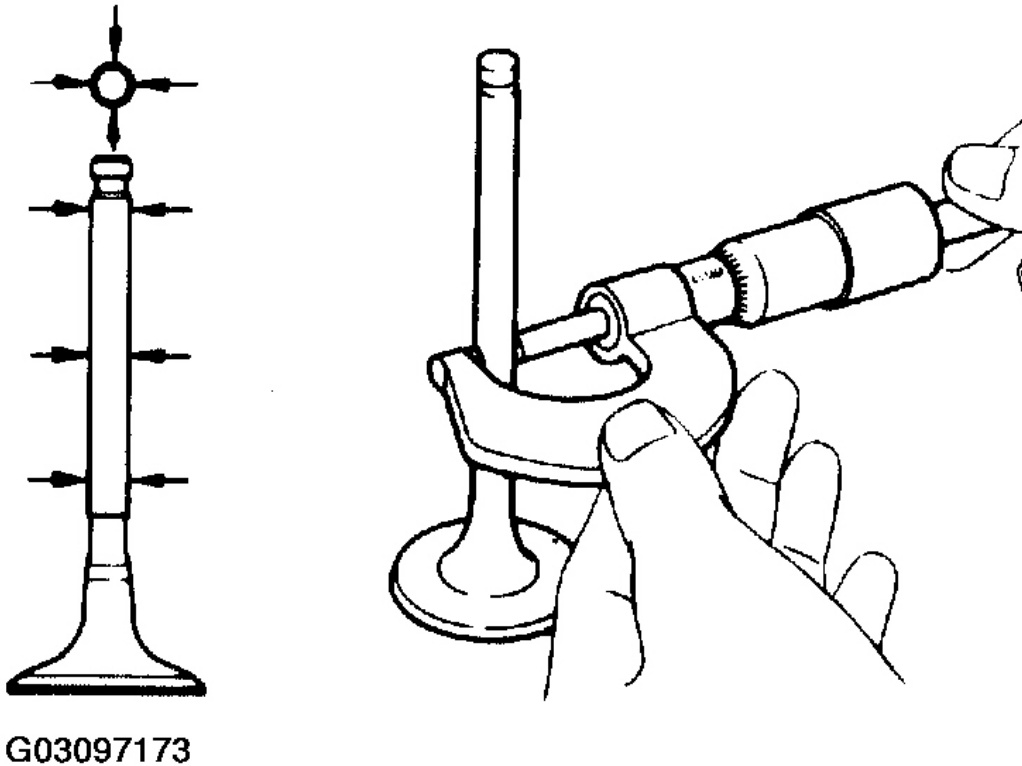
Fig. 289: Inspecting Intake Valve

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

- b. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

4.970 to 4.985 mm (0.1957 to 0.1963 in.)



G03097173

Fig. 290: Measuring Diameter Of Valve Stem

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

- c. Measure the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

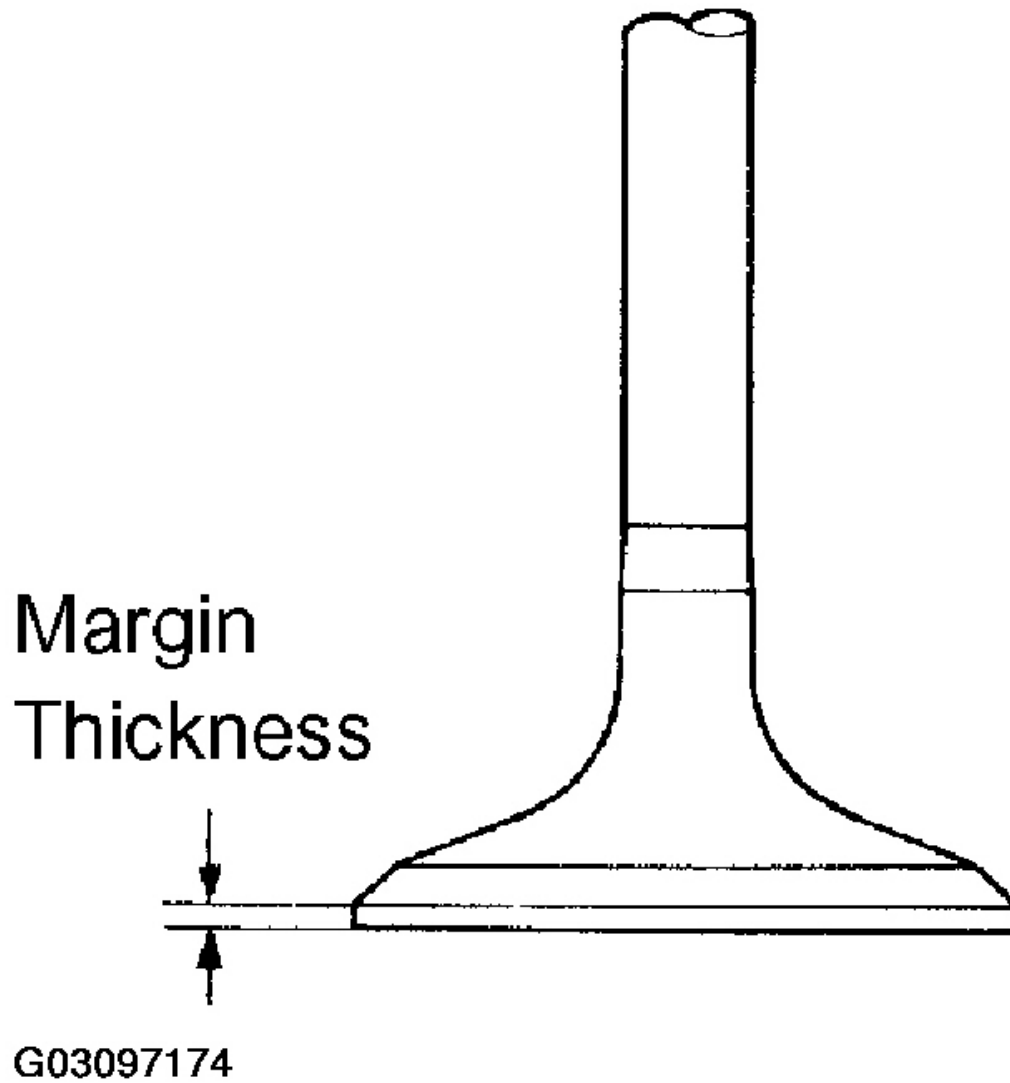


Fig. 291: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT EXHAUST VALVE

- a. Measure the valve overall length.

Standard overall length: 87.90 mm (3.4606 in.)

Minimum overall length: 87.40 mm (3.4409 in.)

- b. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter: 4.965 to 4.980 mm (0.1955 to 0.1961 in.)

- c. Measure the valve head margin thickness.

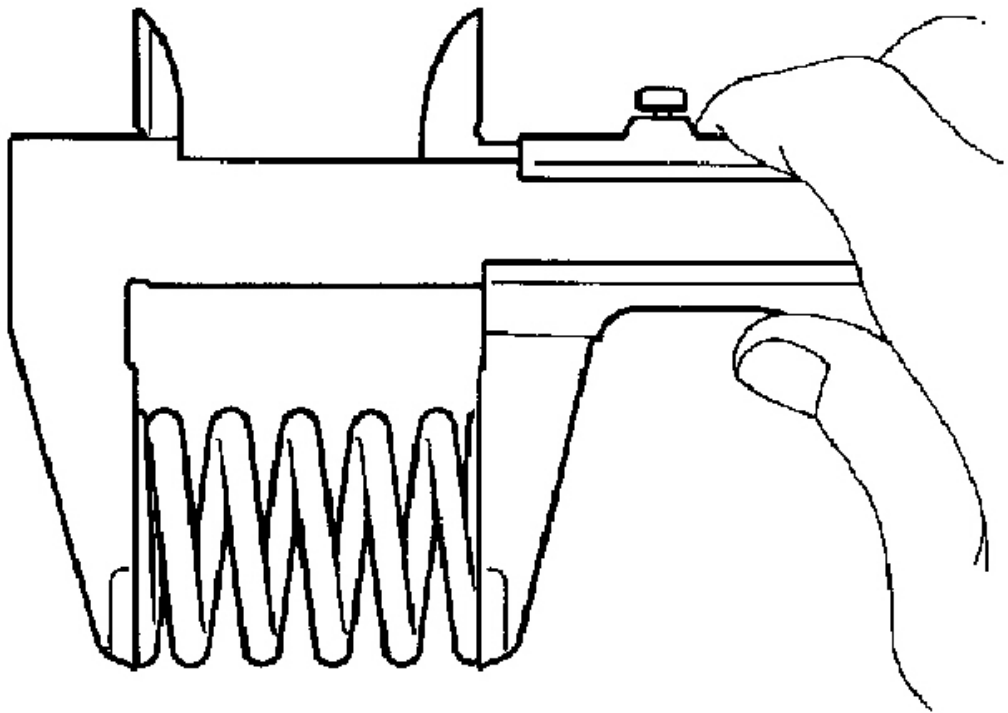
Standard margin thickness: 1.15 mm (0.045 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

15. INSPECT OUTER COMPRESSION SPRING

- a. Using vernier calipers, measure the free length of the valve spring.

Free length: 45.1 mm (1.776 in.)



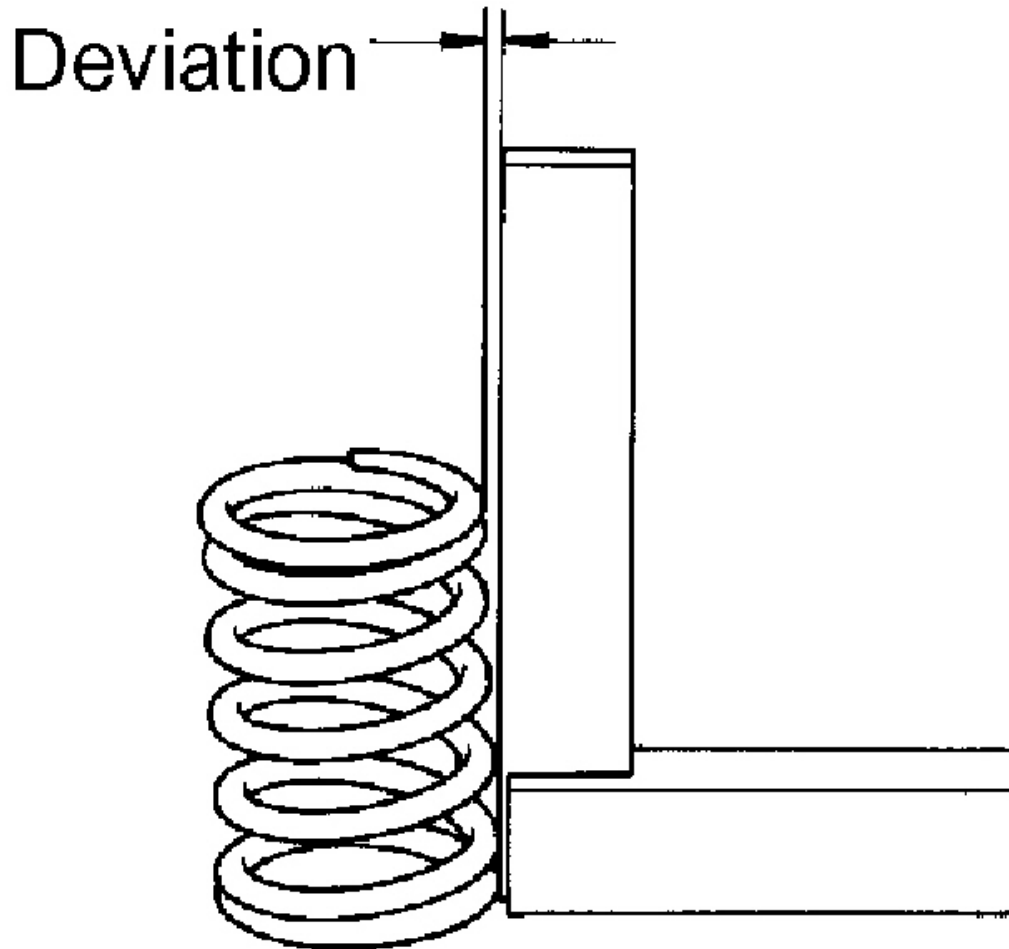
G03097175

Fig. 292: Measuring Free Length Of Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a steel square, measure the deviation of the valve spring.

Maximum deviation: 1.6 mm (0.063 in.)

Maximum angle (reference): 2°



G03097176

Fig. 293: Measuring Deviation Of Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

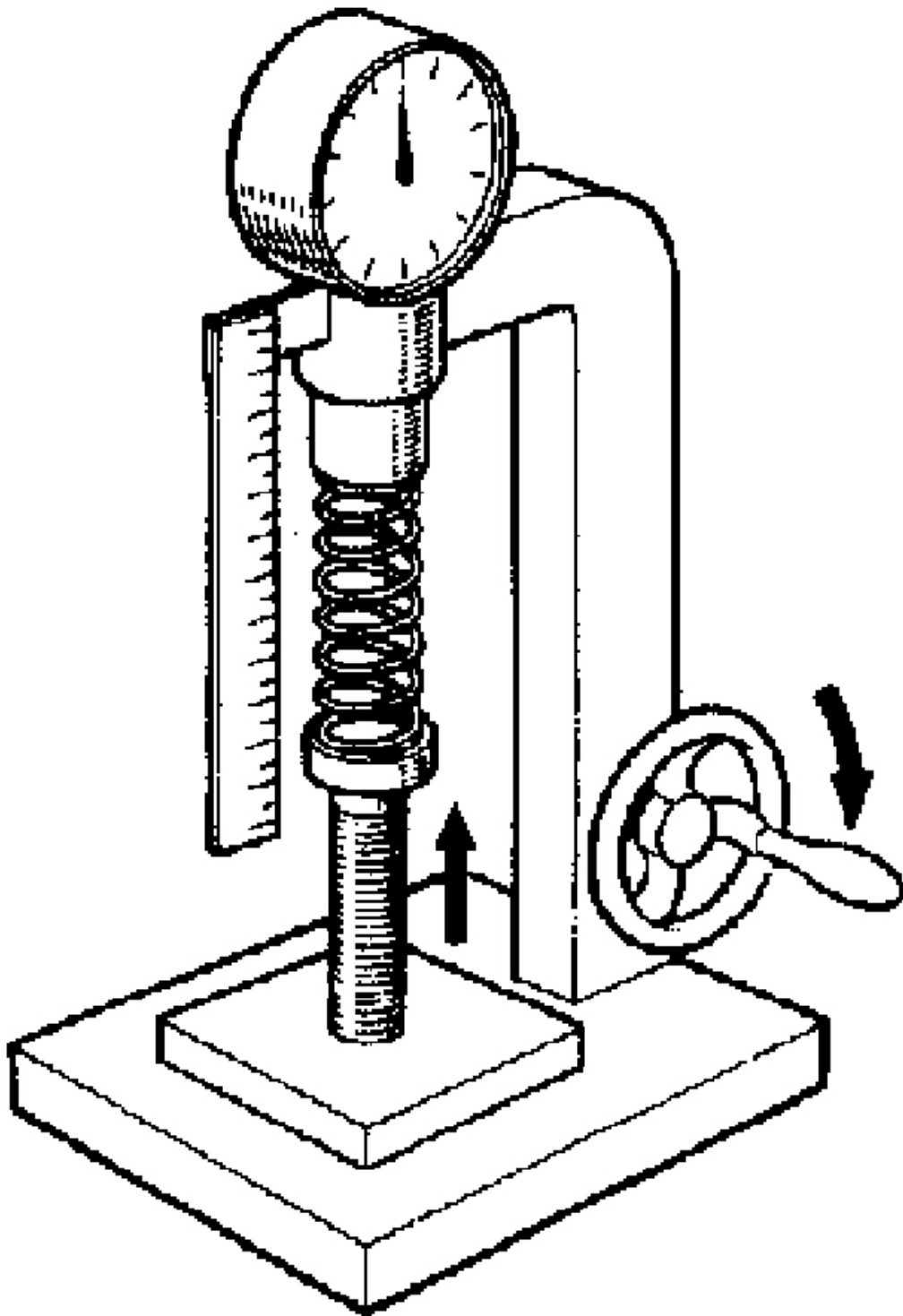
- c. Using a spring tester, measure the tension of the valve spring at the specified installed length.

Installed tension:

149 to 165 N (15.2 to 16.8 kgf, 33.5 to 37.1 lbf) at 32.5 mm (1.280 in.)

Maximum working tension:

286 to 316 N (29.1 to 32.2 kgf, 64.2 to 71.0 lbf) at 23.9 mm (0.941 in.)



G03097177

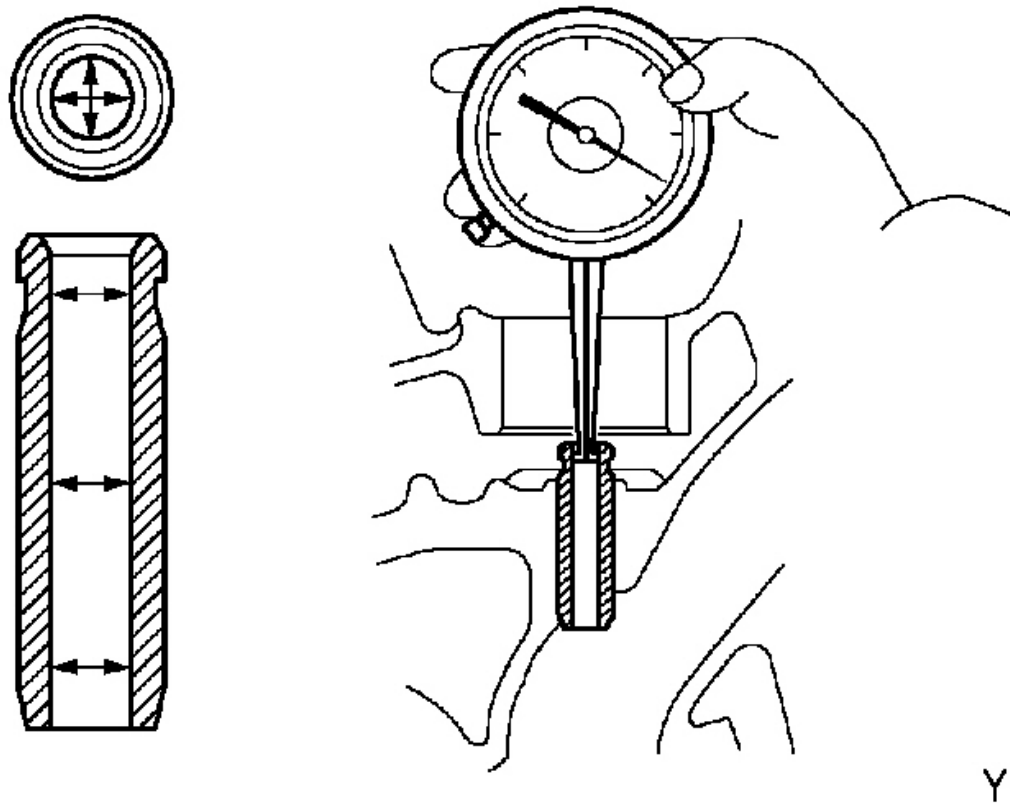
Fig. 294: Measuring Tension Of Valve Spring

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

If the installed tension is not as specified, replace the valve spring.

16. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE

- a. Using a caliper gauge, measure the inside diameter of the guide bushing.

Bushing inside diameter:**5.010 to 5.030 mm (0.1972 to 0.1980 in.)****G03097178****Fig. 295: Measuring Inside Diameter Of Guide Bushing**

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

- b. Subtract the valve stem diameter measurement from the guide bushing inside diameter

measurement.

Standard oil clearance:

Intake 0.025 to 0.060 mm (0.0010 to 0.0024 in.)

Exhaust 0.030 to 0.065 mm (0.0012 to 0.0026 in.)

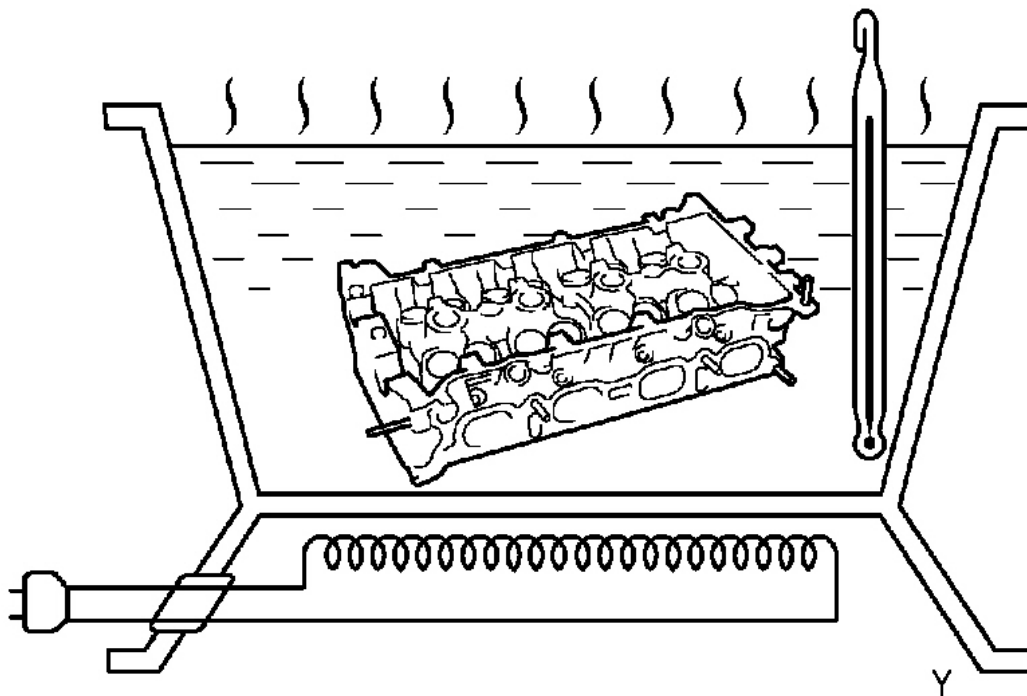
Maximum oil clearance:

Intake 0.08 mm (0.0032 in.)

Exhaust 0.10 mm (0.0039 in.)

17. REMOVE INTAKE VALVE GUIDE BUSH

- a. Heat the cylinder head to 80 to 100°C (176 to 212°F).



G03097179

Fig. 296: Heating Cylinder Head To 80 To 100°C
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

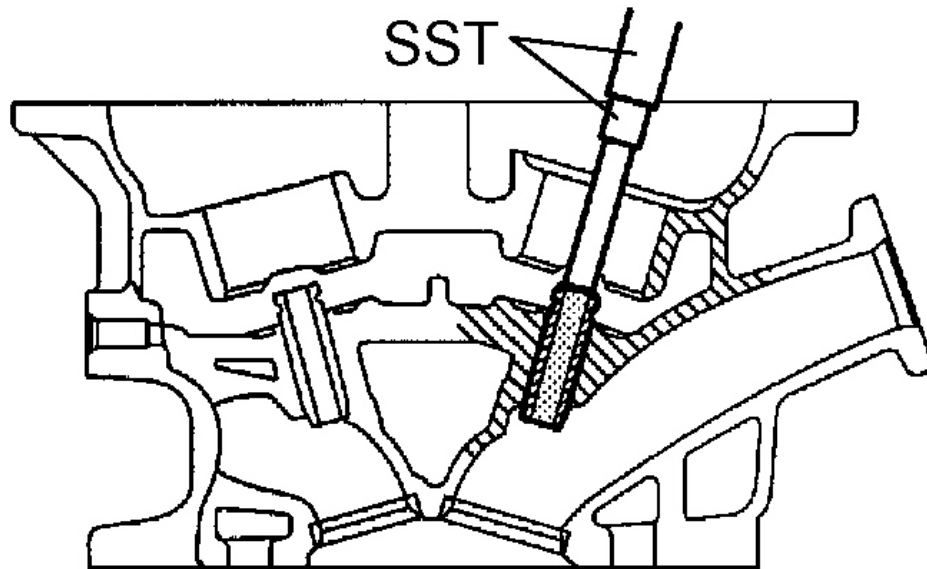
- b. Using SST and a hammer, tap out the guide bushing.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

18. REMOVE EXHAUST VALVE GUIDE BUSH

- a. Heat the cylinder head to 80 to 100°C (176 to 212°F).
- b. Using SST and a hammer, tap out the guide bushing.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



G03097180

Fig. 297: Tapping Out Guide Bushing

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

19. INSTALL INTAKE VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Diameter: 9.685 to 9.706 mm (0.3813 to 0.3821 in.)

If the bushing bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bushing bore to the dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).

HINT:

BUSHING BORE SPECIFICATIONS

Bushing bore diameter mm (in.)	Bushing size
9.685 to 9.706 (0.3813 to 0.3821)	STD
9.735 to 9.755 (0.3833 to 0.3841)	O/S 0.05

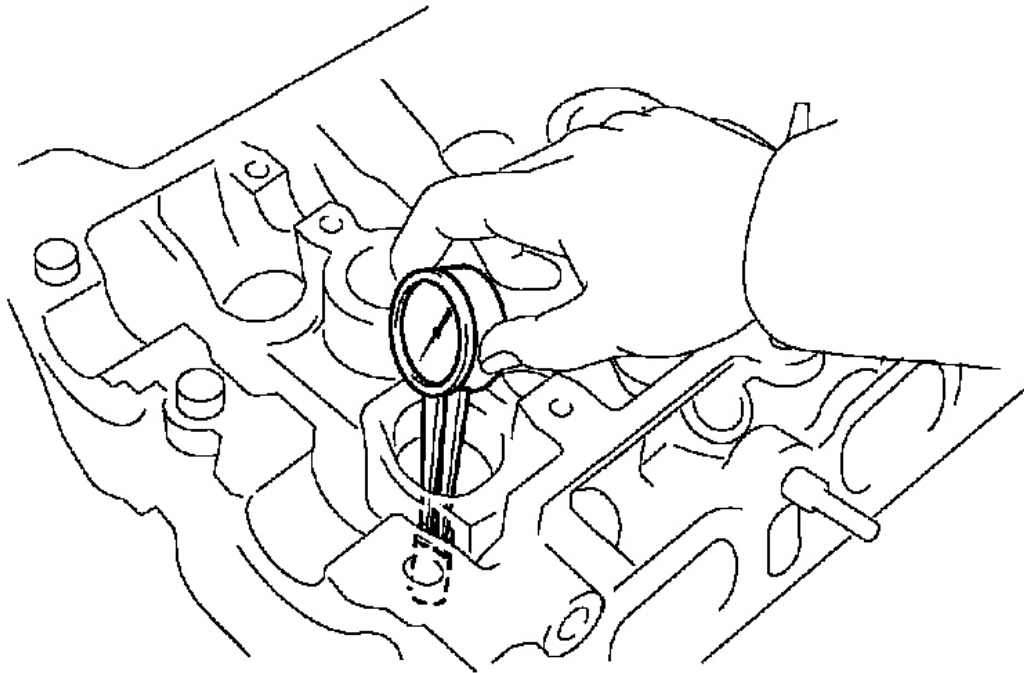
**G03097181**

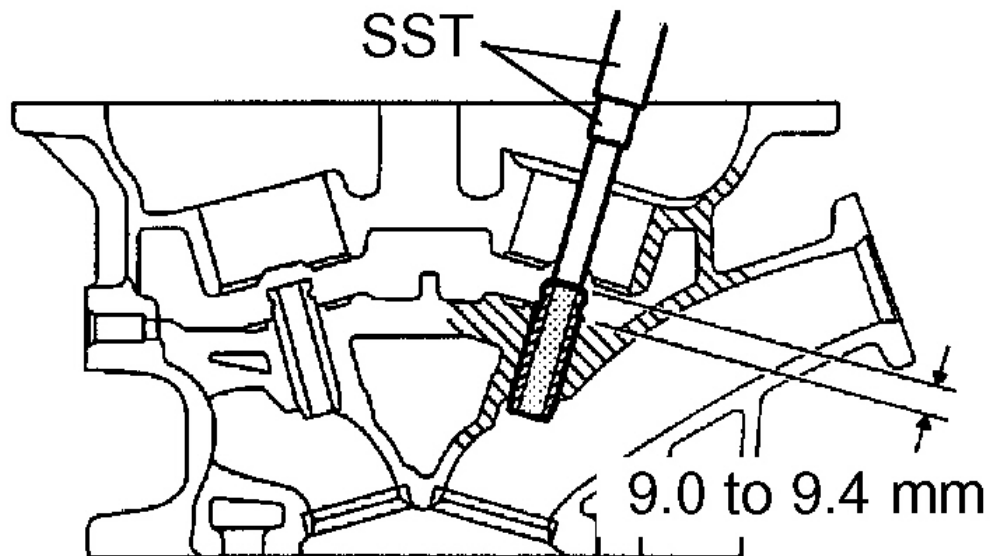
Fig. 298: Measuring Bushing Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Heat the cylinder head to 80 to 100°C (176 to 212°F)
- c. Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Protrusion height:

9.0 to 9.4 mm (0.354 to 0.370 in.)



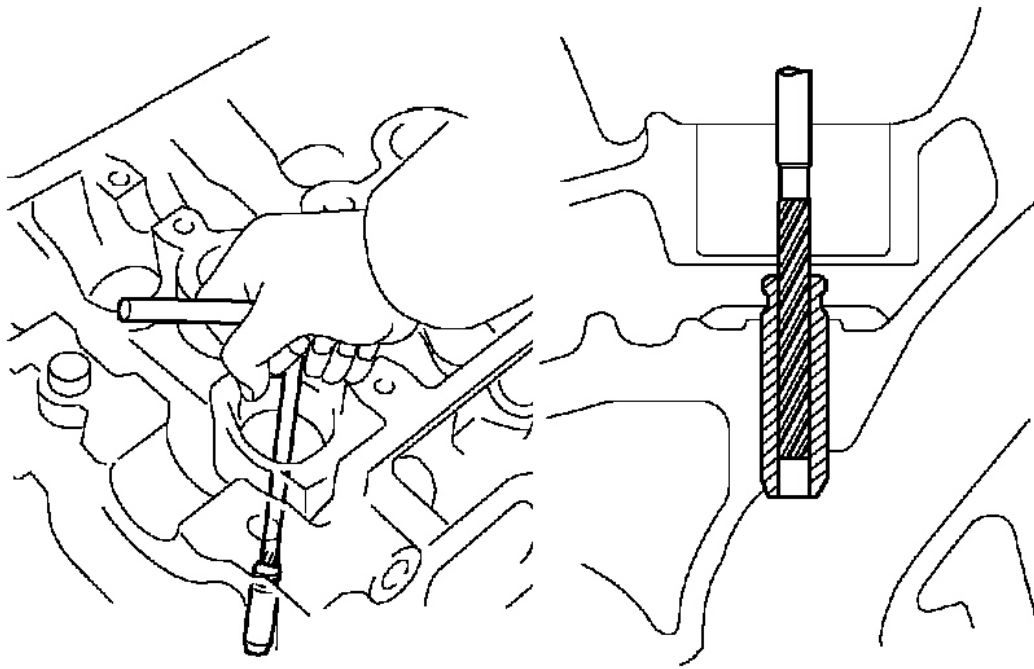
G03097182

Fig. 299: Tapping In New Guide Bushing To Specified Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a sharp 5 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and valve stem.

Standard oil clearance:

0.025 to 0.060 mm (0.0010 to 0.0024 in.)



G03097183

Fig. 300: Reaming Guide Bushing

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

20. INSTALL EXHAUST VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Diameter: 9.685 to 9.706 mm (0.3813 to 0.3821 in.)

If the bushing bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bushing bore to the dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).

HINT:

BUSHING BORE SPECIFICATIONS

Bushing bore diameter mm (in.)	Bushing size
9.685 to 9.706 (0.3813 to 0.3821)	Use STD
9.735 to 9.755 (0.3833 to 0.3841)	Use O/S 0.05

- b. Heat the cylinder head to 80 to 100°C (176 to 212°F)
- c. Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Protrusion height: 9.0 to 9.4 mm (0.354 to 0.370 in.)

- d. Using a sharp 5 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and valve stem.

Standard oil clearance: 0.030 to 0.065 mm (0.0012 to 0.0026 in.)

21. INSPECT VALVE SEATS

- a. Apply a light coat of prussian blue (or white lead) to the valve face.
- b. Lightly press the valve against the seat.
- c. Check the valve face and seat according to the following procedures.
 1. If blue appears 360° around the face, the valve 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 with the width between 1.0 to 1.4 mm (0.039 to 0.055 in.).

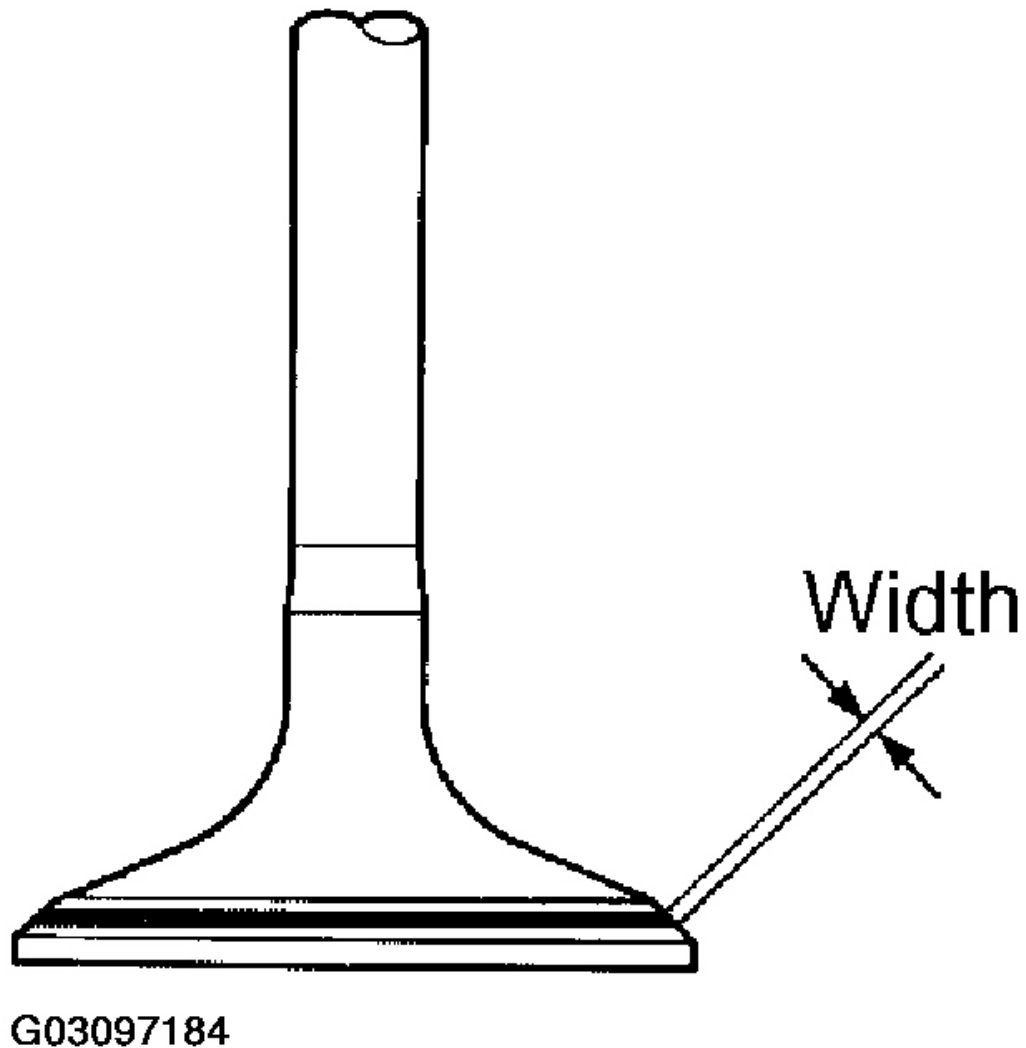
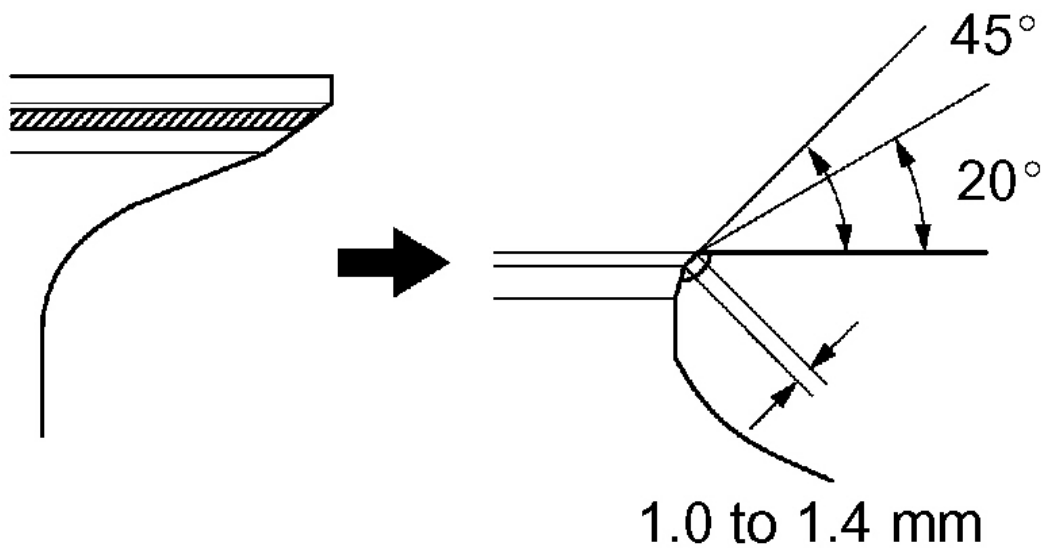


Fig. 301: Checking Seat Contact Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. REPAIR INTAKE VALVE SEAT

NOTE: Releasing the seat cutter pressure gradually helps to make smoother valve seat faces.

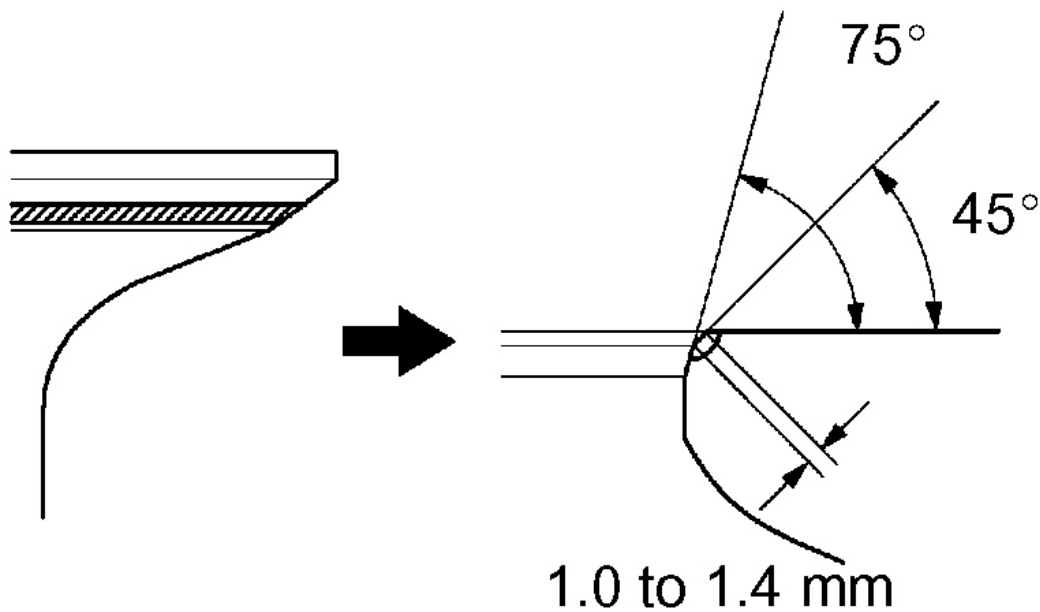
- a. If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.



G03097185

Fig. 302: Using 20° And 45° Cutters To Correct Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



G03097186

Fig. 303: Using 75° And 45° Cutters To Correct Seat
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Hand-lap the valve and valve seat with an abrasive compound.
- d. Recheck the valve seating position.

23. REPAIR EXHAUST VALVE SEAT

NOTE: Releasing the seat cutter pressure gradually helps to make smoother valve seat faces.

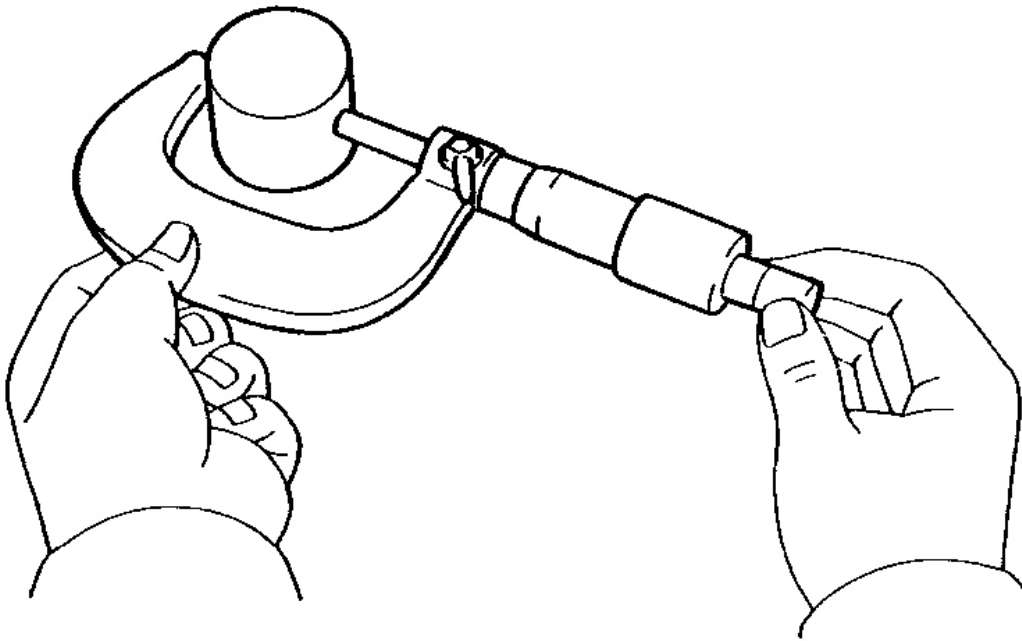
- a. If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.
- b. If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
- c. Hand-lap the valve and valve seat with an abrasive compound.
- d. Recheck the valve seating position.

24. INSPECT VALVE LIFTER

- a. Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 to 30.976 mm (1.2191 to 1.2195 in.)



G03097187

Fig. 304: Measuring Lifter Diameter

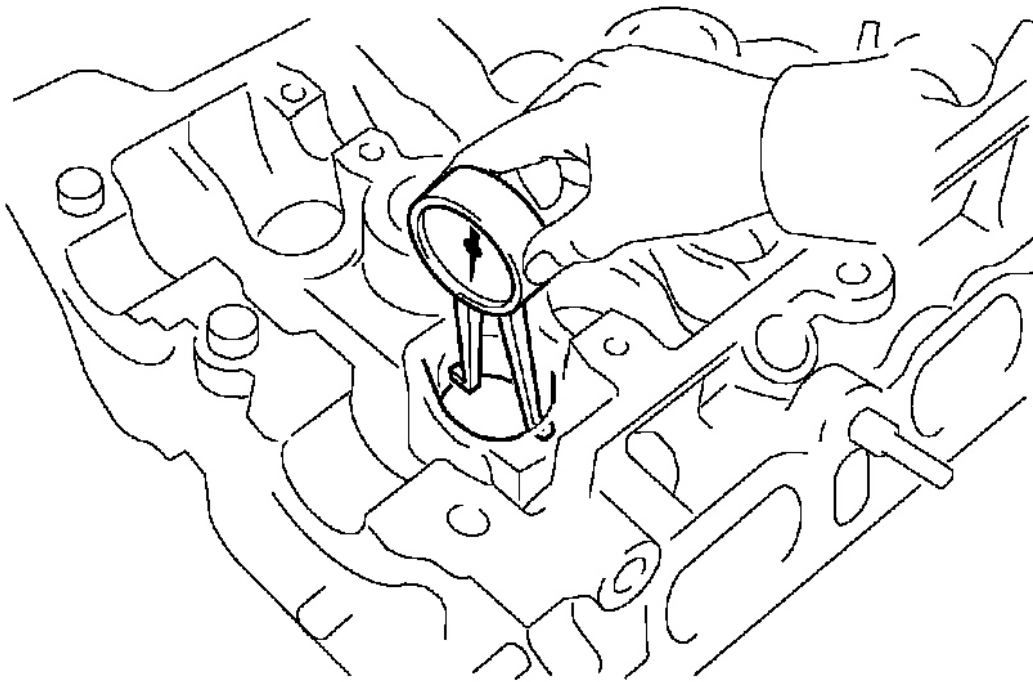
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. INSPECT VALVE LIFTER OIL CLEARANCE

- a. Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

31.000 to 31.025 mm (1.2205 to 1.2215 in.)



G03097188

Fig. 305: Measuring Lifter Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance:

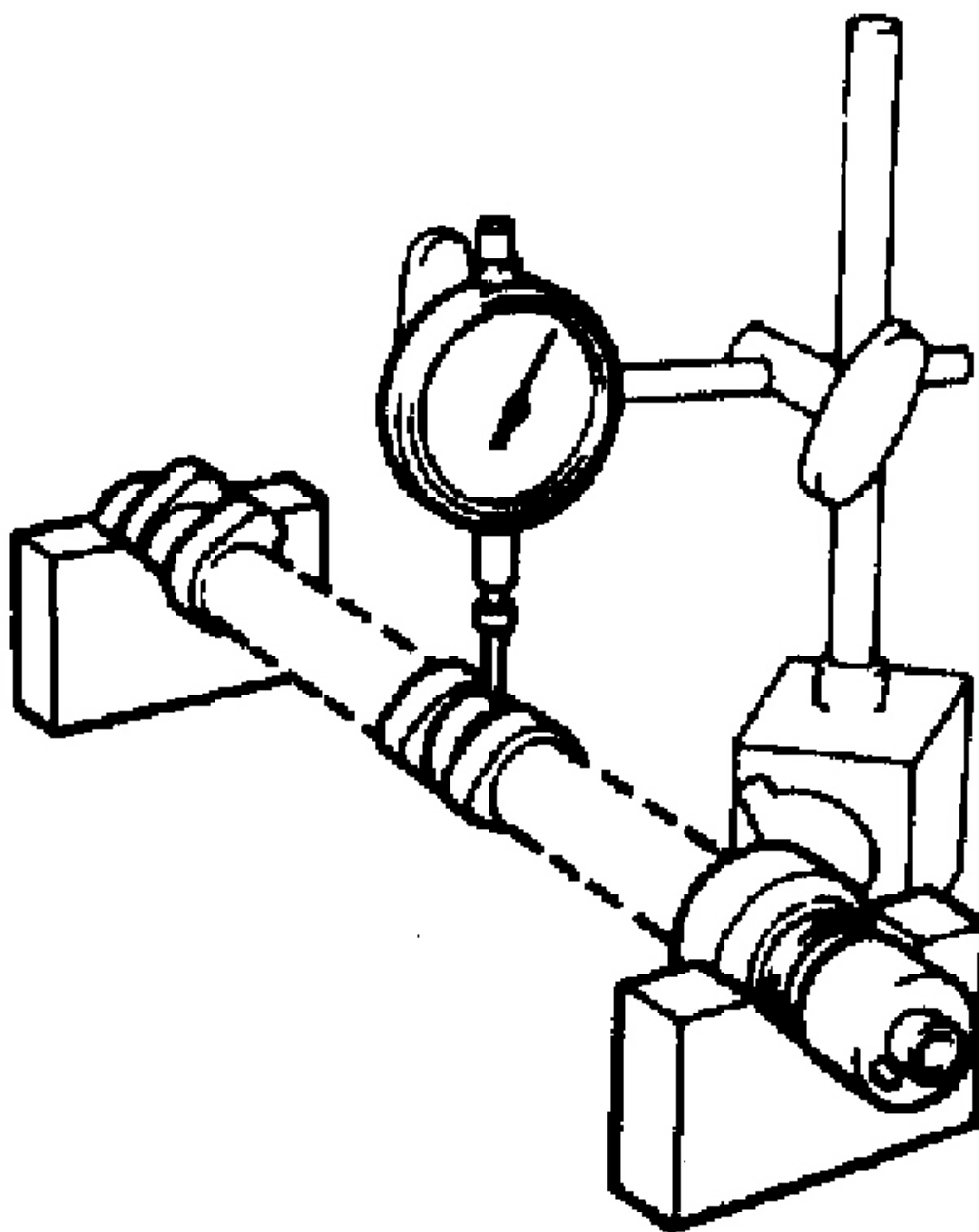
0.024 to 0.059 mm (0.0009 to 0.0023 in.)

Maximum oil clearance: 0.1 mm (0.0039 in.)

26. INSPECT CAMSHAFT

- a. Inspect the camshaft for runout.
 - 1. Place the camshaft on V-blocks.
 - 2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.03 mm (0.0012 in.)



G03097189

Fig. 306: Measuring Circle Runout At Center Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the circle runout is greater than maximum, replace the camshaft.

b. Inspect the cam lobes.

1. Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

44.617 to 44.717 mm (1.7566 to 1.7605 in.)

Minimum cam lobe height: 43.16 mm (1.6992 in.)

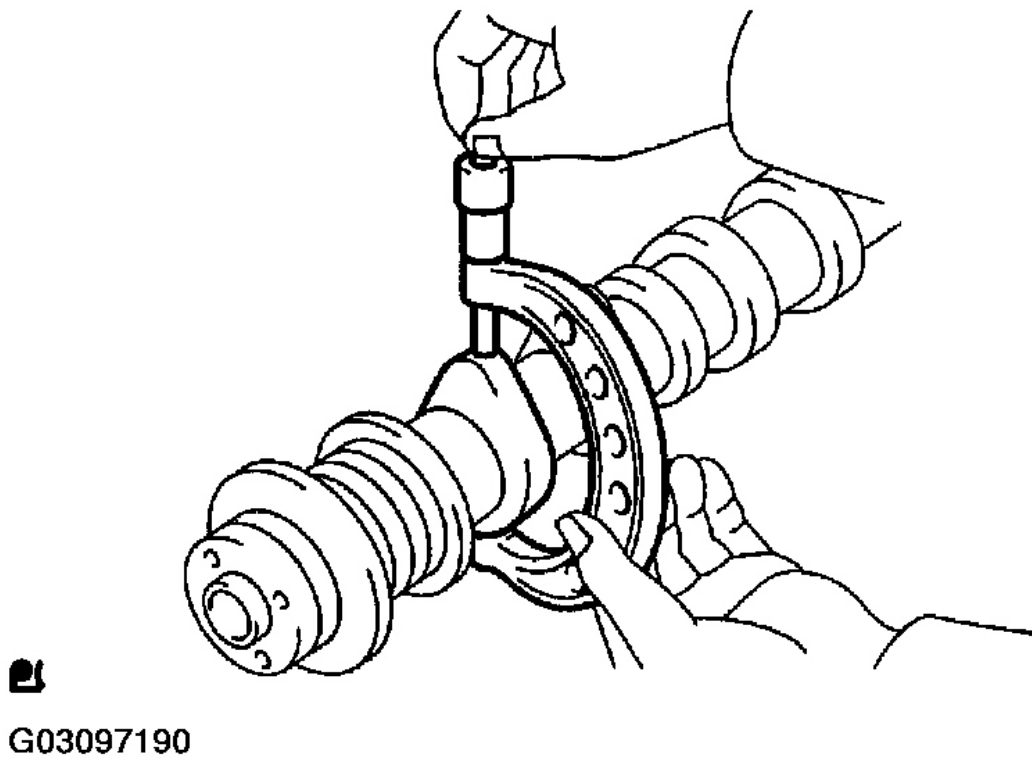


Fig. 307: Measuring Cam Lobe Height

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

If the cam lobe height is less than minimum, replace the camshaft.

c. Inspect the camshaft journals.

1. Using a micrometer, measure the journal diameter.

No. 1 journal diameter:

34.449 to 34.465 mm (1.3563 to 1.3569 in.)

Other journals diameter:

22.949 to 22.965 mm (0.9035 to 0.9041 in.)

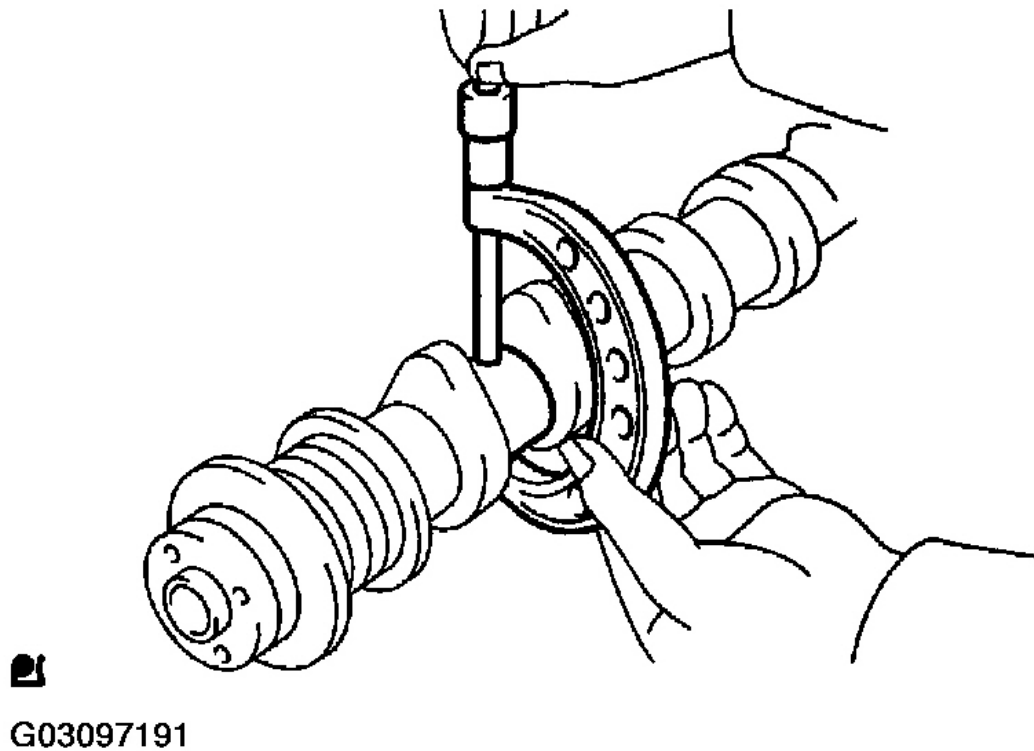


Fig. 308: Measuring Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the journal diameter is not as specified, check the oil clearance.

27. INSPECT NO. 2 CAMSHAFT

- a. Inspect the camshaft for runout.
 1. Place the camshaft on V-blocks.
 2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.03 mm (0.0012 in.)

If the circle runout is greater than maximum, replace the camshaft.

- b. Inspect the cam lobes.
 1. Using a micrometer, measure the cam lobe height.

Standard cam lobe height:**44.666 to 44.766 mm (1.7585 to 1.7624 in.)****Minimum cam lobe height:****44.52 mm (1.7528 in.)**

If the cam lobe height is less than minimum, replace the camshaft.

- c. Inspect the camshaft journals.
 - 1. Using a micrometer, measure the journal diameter.

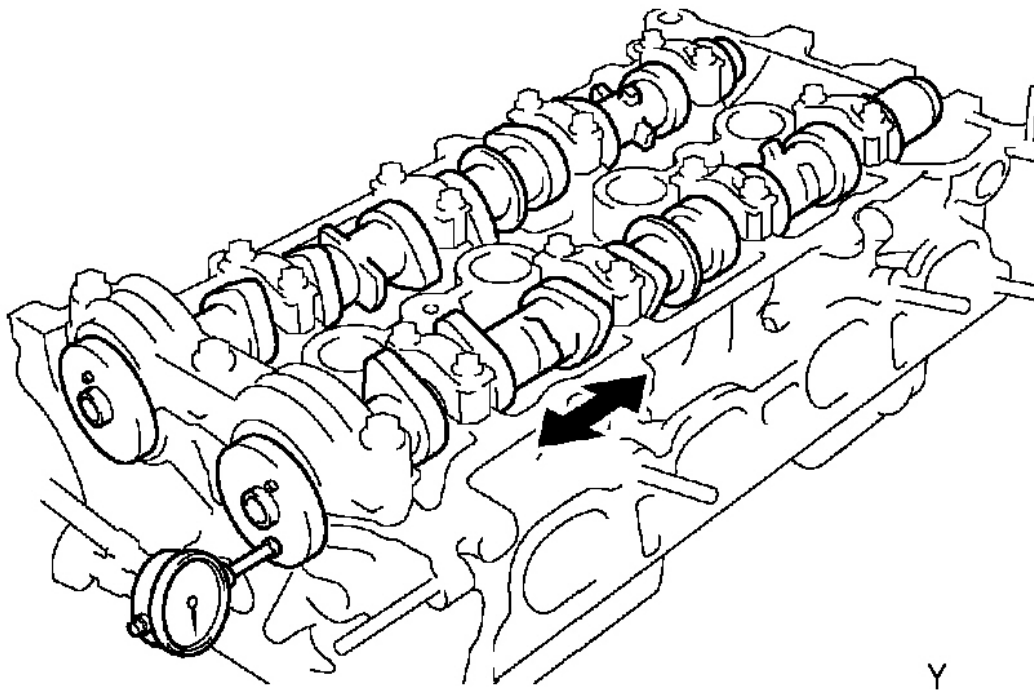
No. 1 journal diameter: 34.449 to 34.465 mm (1.3563 to 1.3569 in.)**Other journals diameter: 22.949 to 22.965 mm (0.9035 to 0.9041 in.)**

If the journal diameter is not as specified, check the oil clearance.

28. INSPECT CAMSHAFT THRUST CLEARANCE

- a. Install the camshafts.
- b. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:**0.040 to 0.095 mm (0.0016 to 0.0037 in.)****Maximum thrust clearance: 0.11 mm (0.0043 in.)**



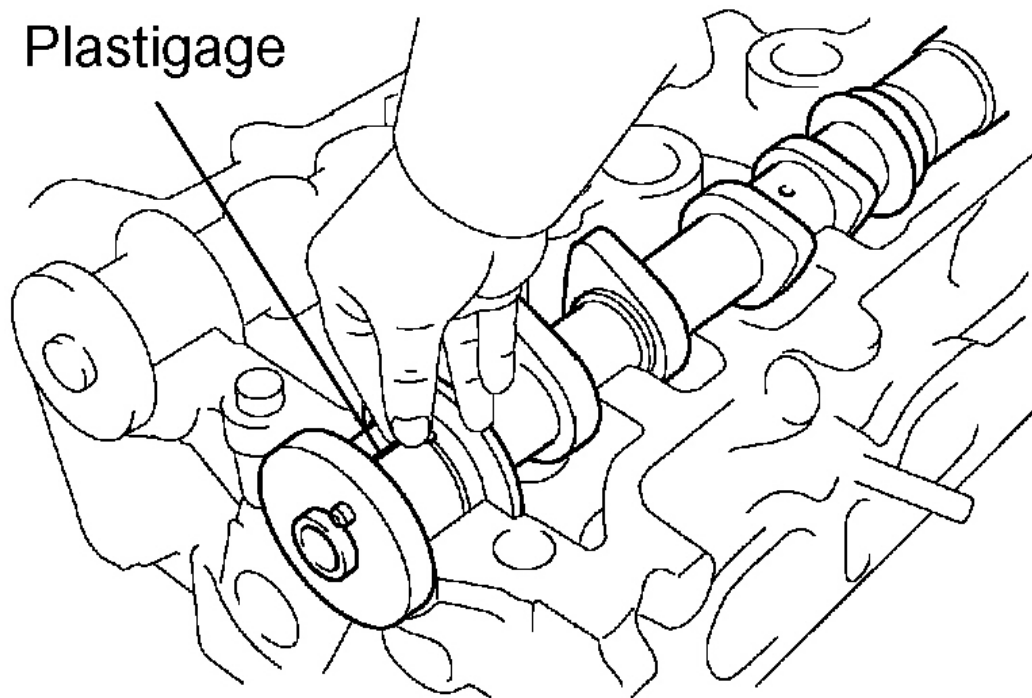
G03097192

Fig. 309: Measuring Thrust Clearance While Moving Camshaft Back And Forth
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head together.

29. INSPECT CAMSHAFT OIL CLEARANCE

- a. Clean the bearing caps and camshaft journals.
- b. Place the camshafts on the cylinder head.
- c. Lay a strip of Plastigage across each of the camshaft journals.



G03097193

Fig. 310: Laying Strip Of Plastigage Across Each Of Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the bearing caps.

Torque:

No. 1 23 N.m (235 kgf.cm, 17 ft.lbf)

No. 2 13 N.m (129 kgf.cm, 9.4 ft.lbf)

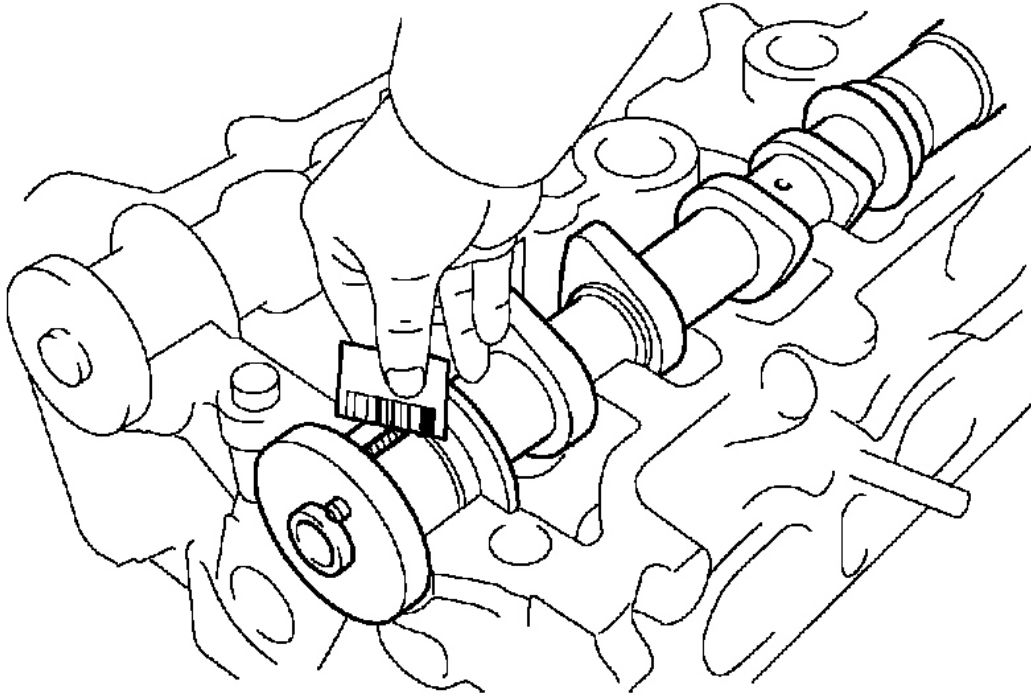
NOTE: Do not turn the camshaft.

- e. Remove the bearing caps.
f. Measure the Plastigage at its widest point.

Standard oil clearance:

0.035 to 0.072 mm (0.0014 to 0.0028 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)



G03097194

Fig. 311: Measuring Plastigage At Its Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

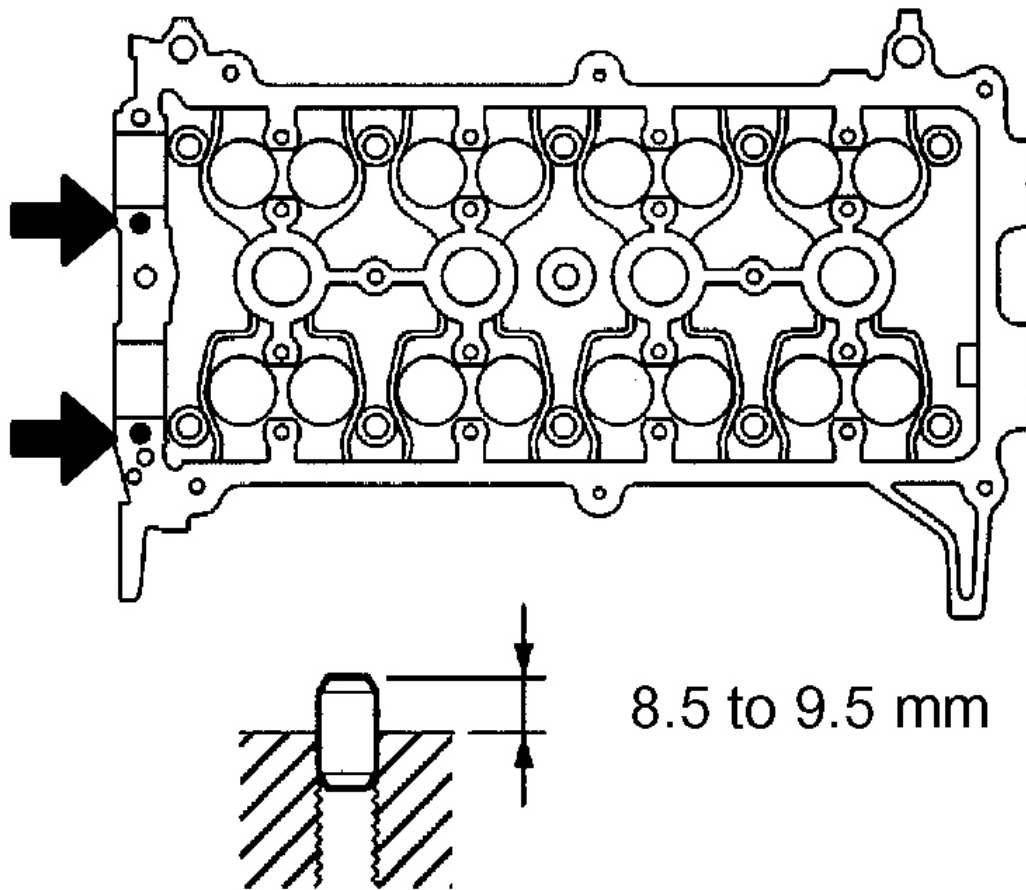
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head together.

NOTE: Completely remove the Plastigage.

30. INSTALL CAMSHAFT BEARING CAP SETTING RING PIN

- a. Using a plastic-faced hammer, tap in a new ring pin to the specified protrusion height.

Protrusion height: 8.5 to 9.5 mm (0.3346 to 0.3740 in.)



G03097195

Fig. 312: Tapping In New Ring Pin To Specified Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL STUD BOLT

- Using Torx socket wrench E5 and E7, install the 7 stud bolts.

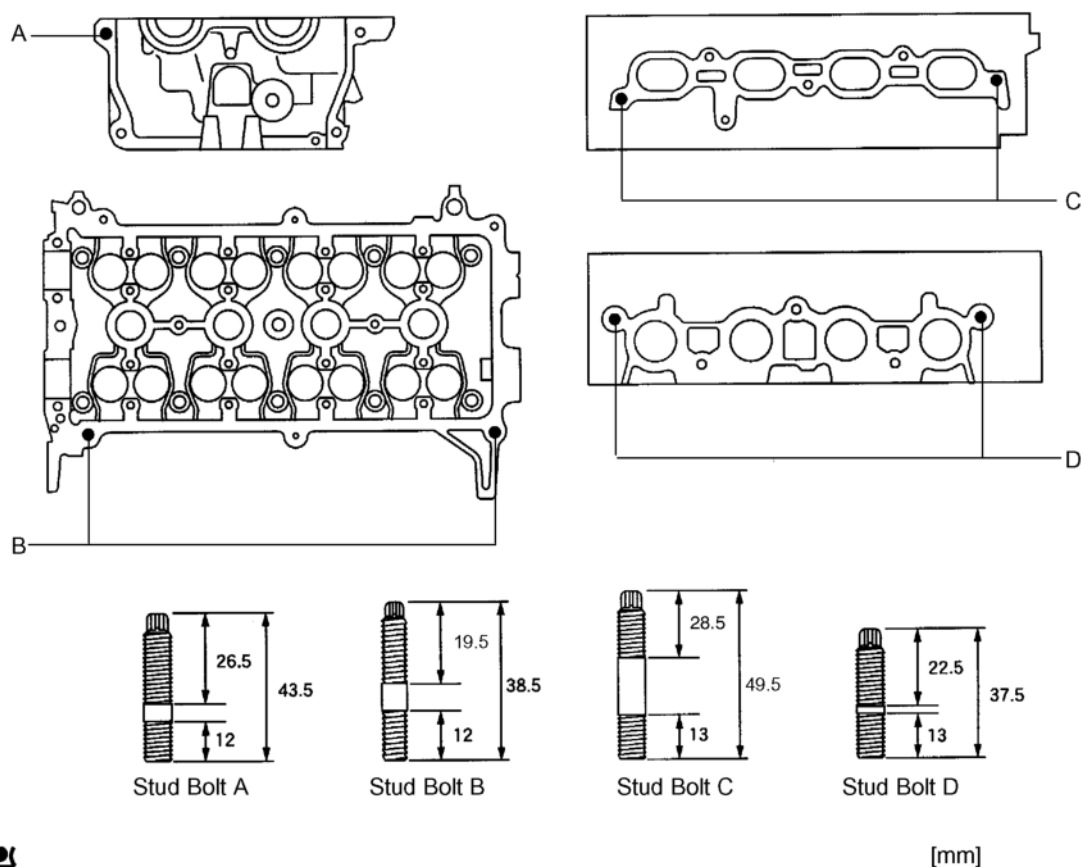
Torque:

Bolt A: 10 N.m (102 kgf.cm, 7.4 ft.lbf)

Bolt B: 4.0 N.m (41 kgf.cm, 35 in.lbf)

Bolt C: 10 N.m (102 kgf.cm, 7.4 ft.lbf)

Bolt D: 9.0 N.m (92 kgf.cm, 80 in.lbf)

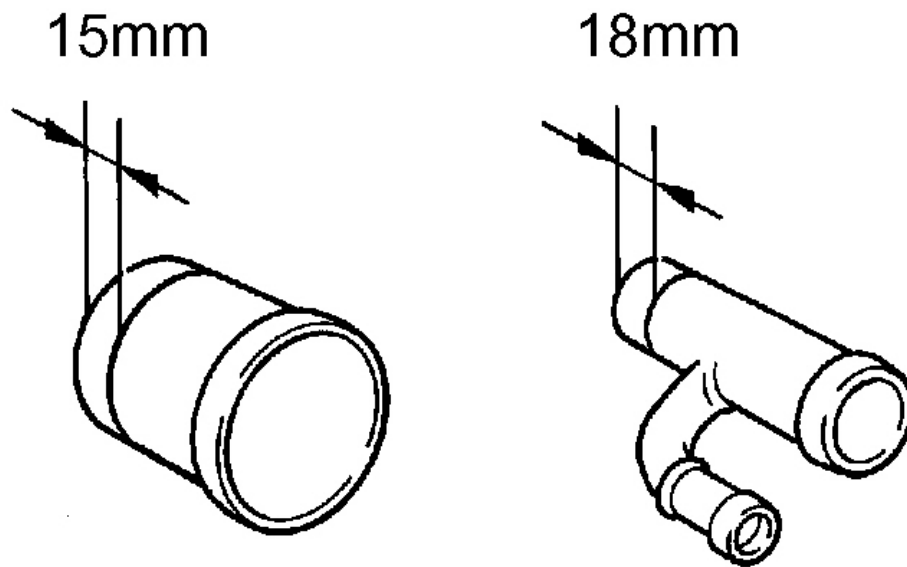


G03097196

Fig. 313: Identifying Stud Bolt Measurements And Locations
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL UNION

- Mark the standard position away from the edge onto the new water hose unions as shown in **Fig. 314**.



N

G03097197

Fig. 314: Marking Standard Position Away From Edge Onto New Water Hose Unions
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Apply adhesive to the water hose union hole of the cylinder head.

Adhesive:

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

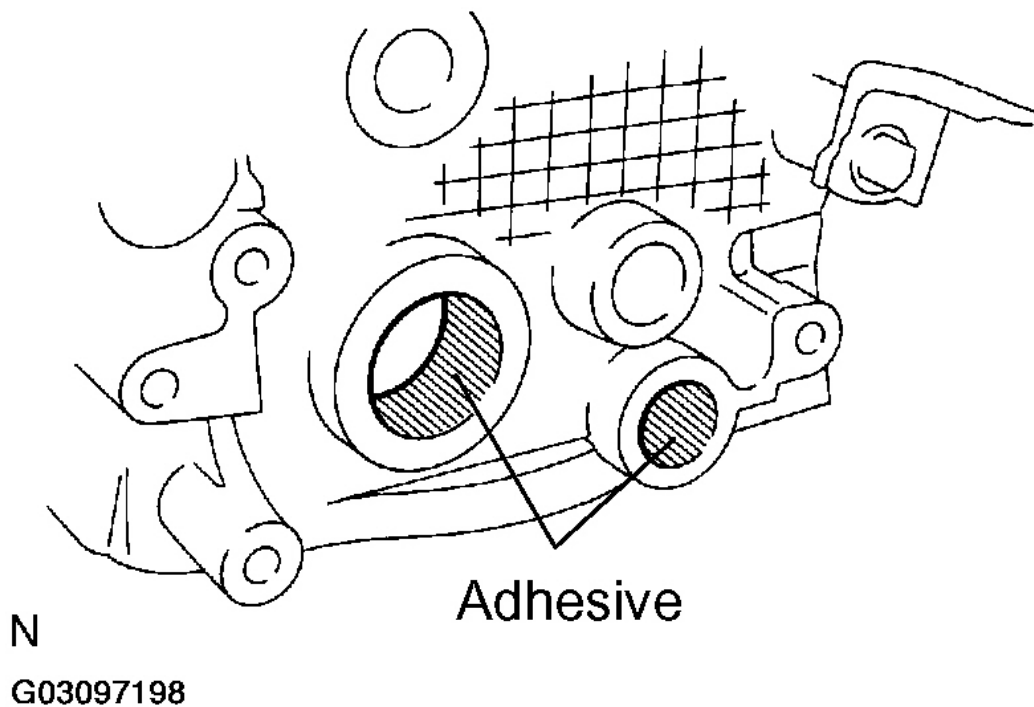


Fig. 315: Applying Adhesive To Water Hose Union Hole Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a press, press in a new water hose union until the marks come to the same level as the one of the cylinder head surface.

Standard protrusion:

A: 29 mm (1.14 in.)

B: 44 mm (1.73 in.)

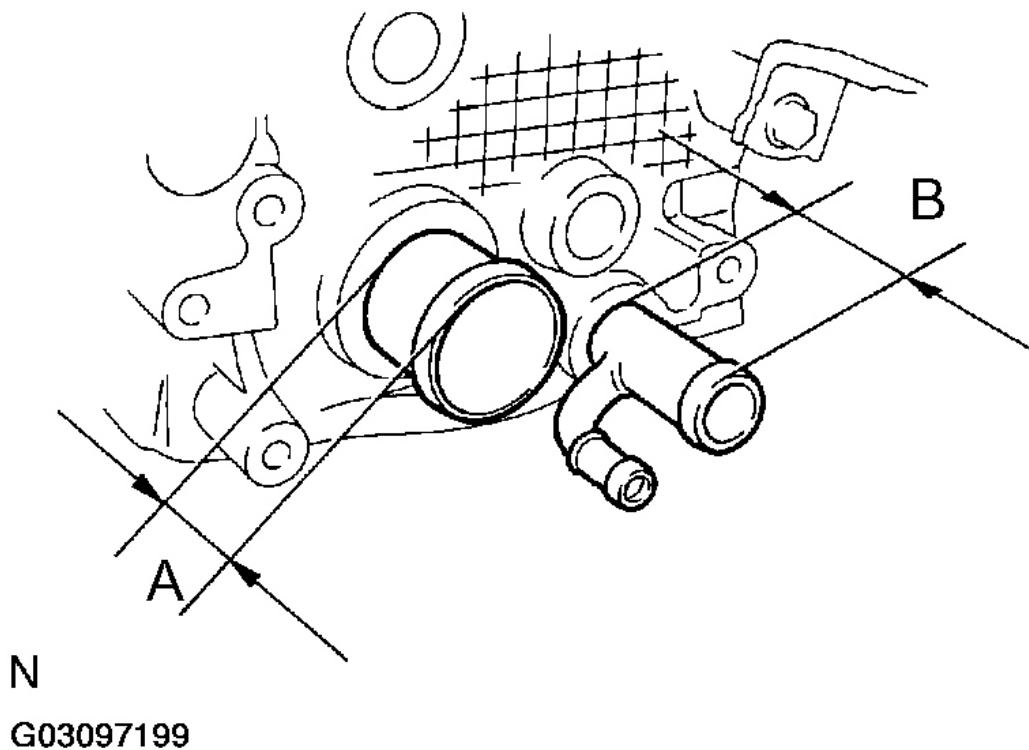


Fig. 316: Pressing In New Water Hose Union
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Install the water hose union within 3 minutes of applying adhesive.
- Do not expose the water house union to engine coolant for at least 1 hour after installation.

33. INSTALL VALVE STEM OIL O SEAL OR RING

- a. Apply a light coat of engine oil to the valve stem.

NOTE:

Installing the oil seal for intake and exhaust onto the opposite valve guide bush may cause failures.

HINT:

The intake valve oil seal is light brown and the exhaust valve oil seal is gray.

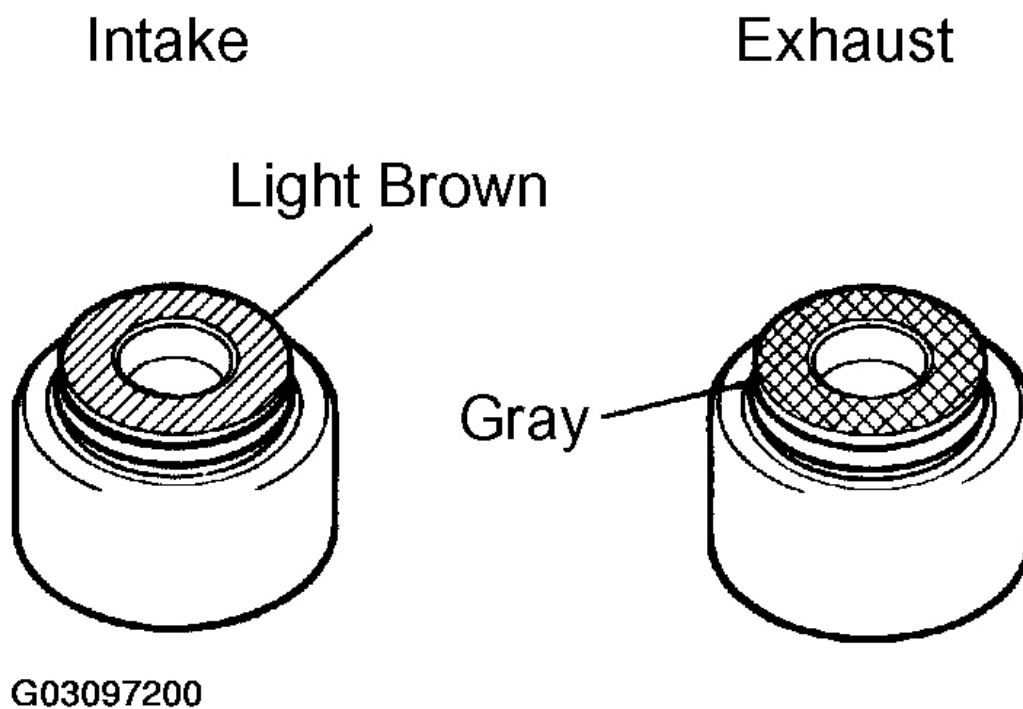


Fig. 317: Identifying Intake Valve Oil Seal And Exhaust Valve Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, push in a new oil seal.

SST 09201-41020

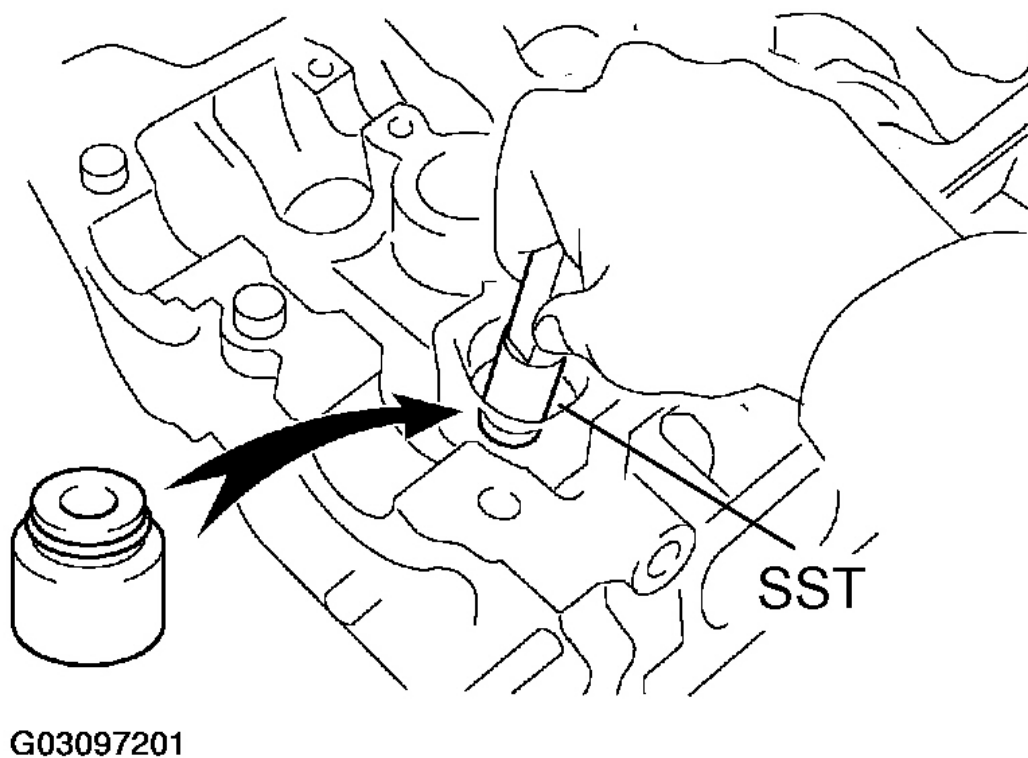
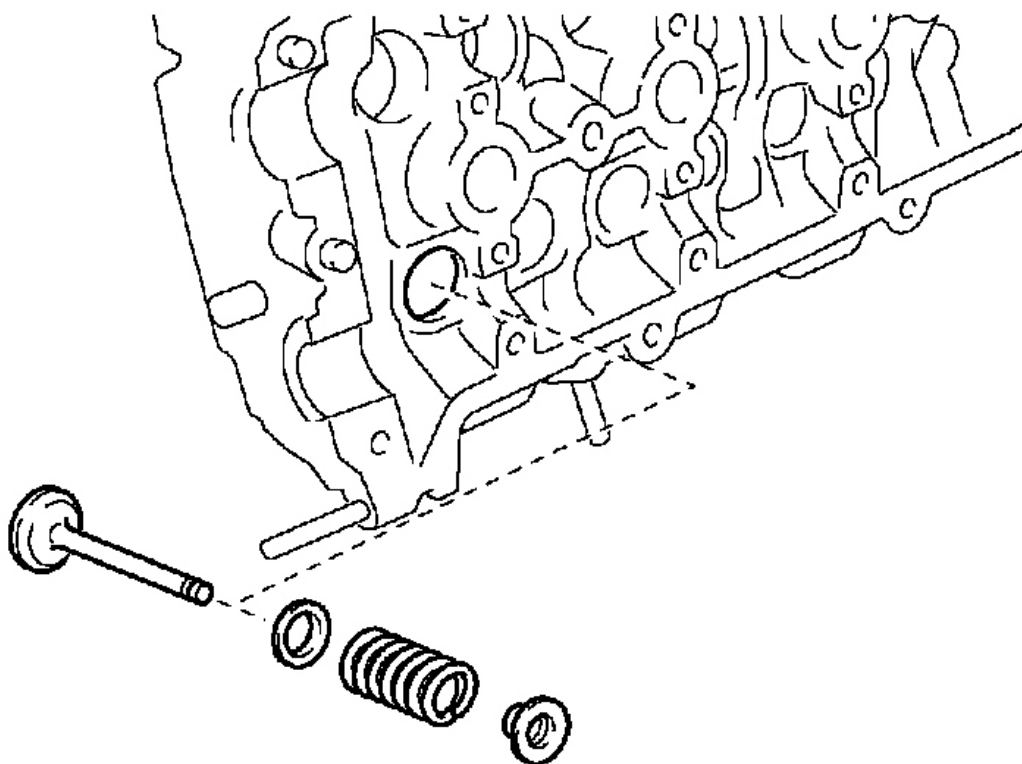


Fig. 318: Pushing In New Oil Seal

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

34. INSTALL INTAKE VALVE

- a. Install the valve, spring seat, valve spring, and spring retainer.



G03097202

Fig. 319: Installing Valve, Spring Seat, Valve Spring, And Spring Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, compress the valve spring and place the valve spring retainer lock around the valve stem.

SST 09202-70020 (09202-00010)

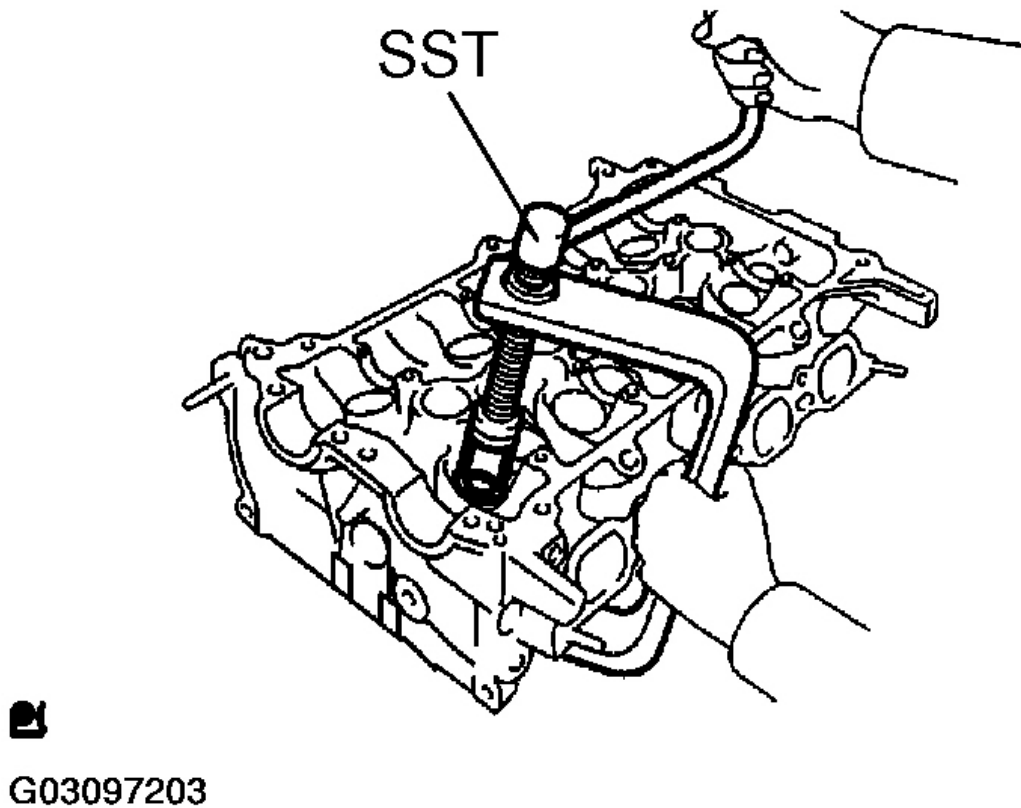


Fig. 320: Compressing Valve Spring And Placing Valve Spring Retainer Lock Around Valve Stem

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

- c. Using a plastic-faced hammer and discarded valve with the tip wrapped in tape, lightly tap the installed valve to ensure proper fit.

NOTE: Be careful not to damage the valve stem tip.

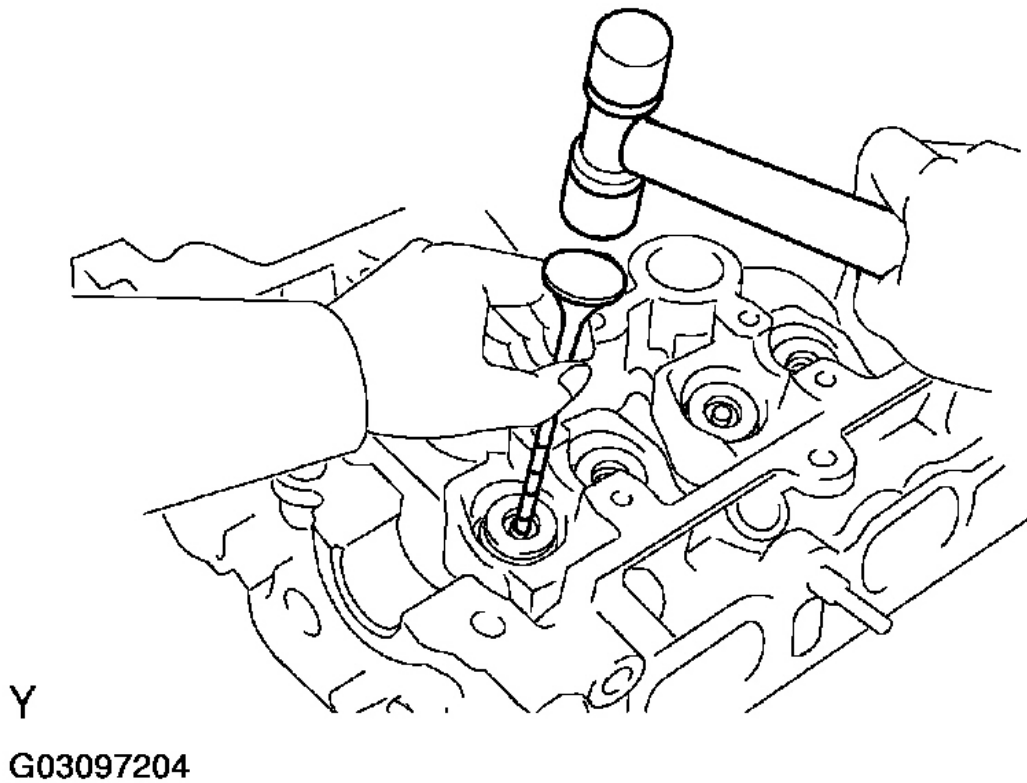


Fig. 321: Tapping Installed Valve

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

35. INSTALL EXHAUST VALVE

- Install the valve, spring seat, valve spring, and spring retainer.
- Using SST, compress the valve spring and place the valve spring retainer lock around the valve stem.

SST 09202-70020 (09202-00010)

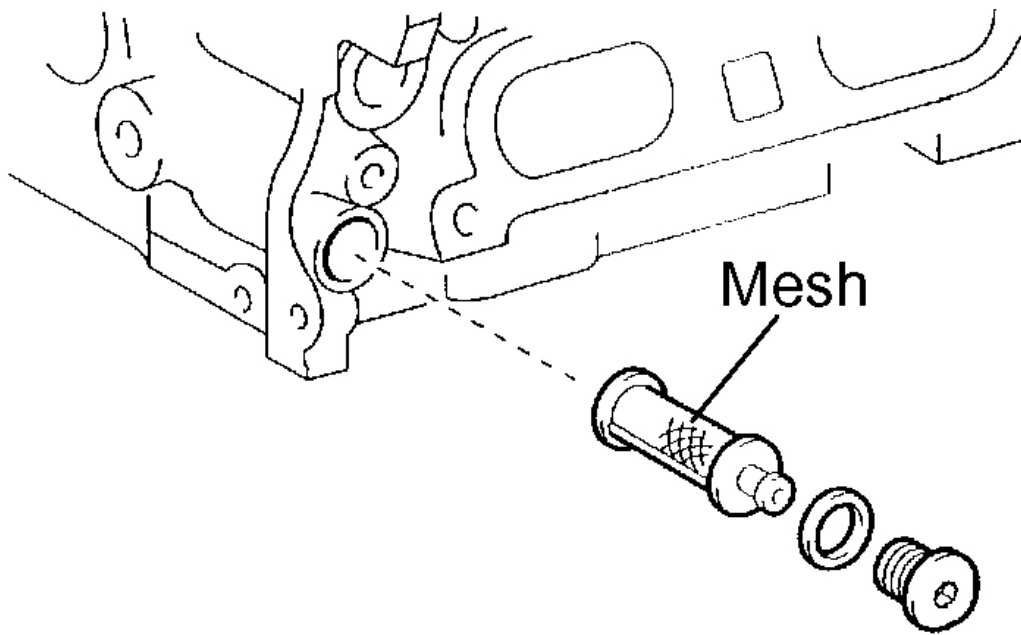
- Using a plastic-faced hammer and discarded valve with the tip wrapped in tape, lightly tap the installed valve to ensure proper fit.

NOTE: Be careful not to damage the valve stem tip.

36. INSTALL OIL CONTROL VALVE FILTER

- Using an 8 mm hexagon wrench, place a new gasket on the plug and install the filter.

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



G03097205

Fig. 322: Installing Oil Control Valve Filter

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

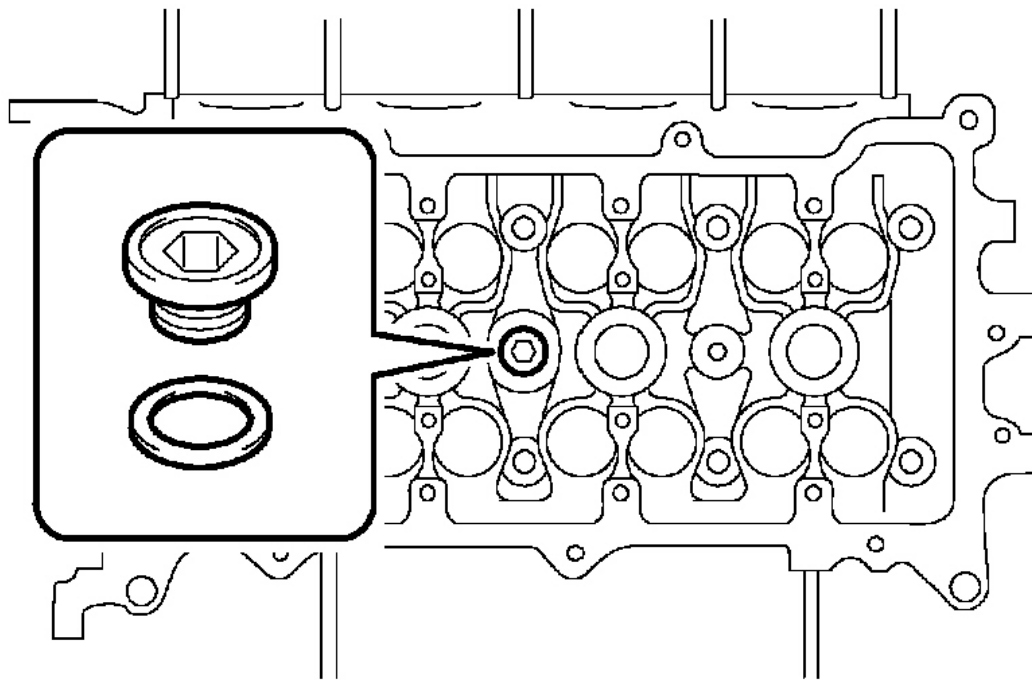
37. INSTALL VALVE LIFTER

- a. Apply a light coat of engine oil to the valve lifter.
- b. Install the valve lifter.
- c. Check that the valve lifter rotates smoothly by hand.

38. REMOVE W/HEAD TAPER SCREW PLUG NO. 1

- a. Using a 10 mm socket hexagon wrench, install the taper screw plug with a new gasket.

Torque: 44 N.m (449 kgf.cm, 33 ft.lbf)



G03097206

Fig. 323: Removing W/Head Taper Screw Plug No. 1
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER BLOCK ASSY (1NZ-FE) (FROM APRIL, 2004)

COMPONENTS

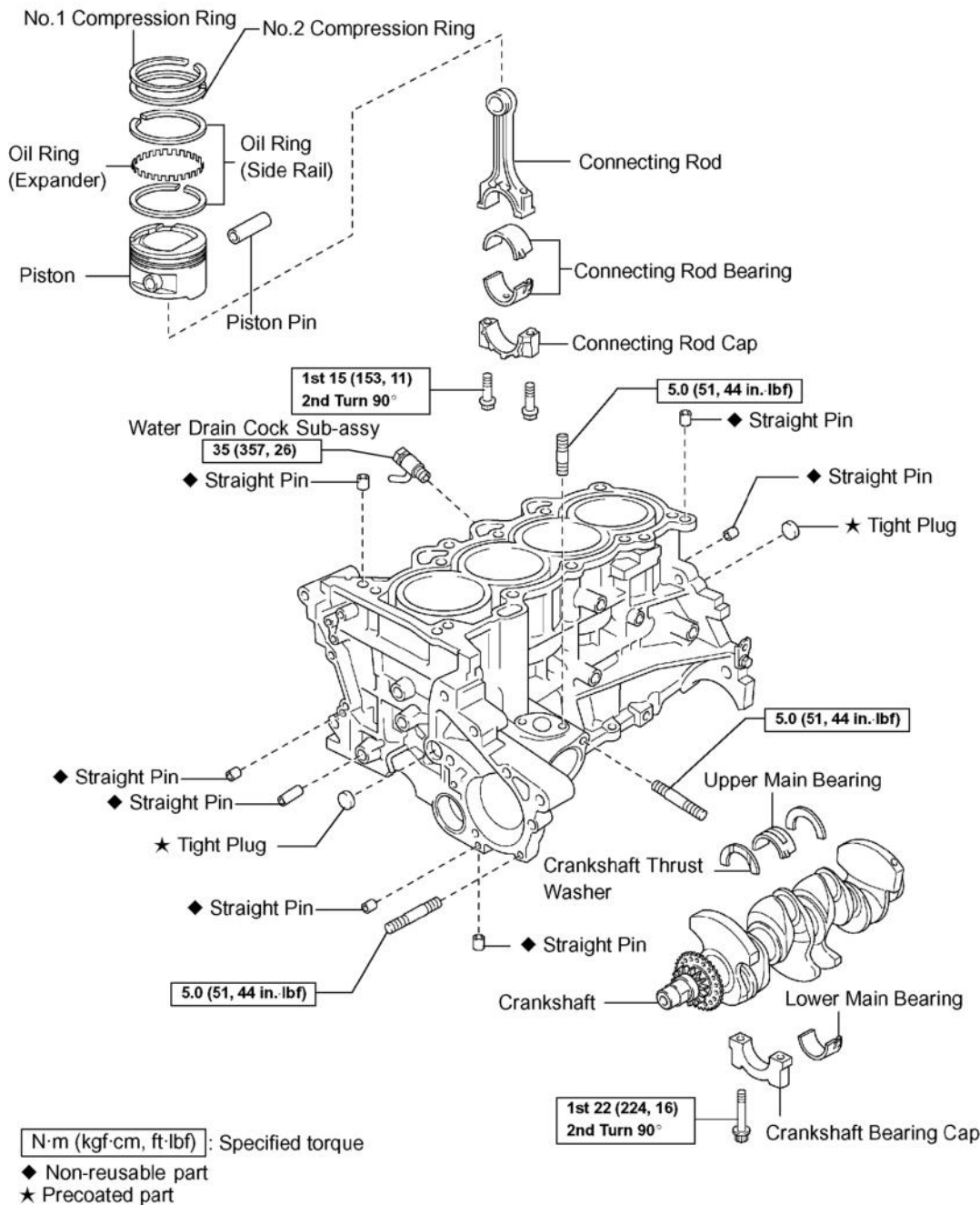


Fig. 324: Exploded View Of Cylinder Block Assy Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OVERHAUL

1. INSPECT CONNECTING ROD THRUST CLEARANCE

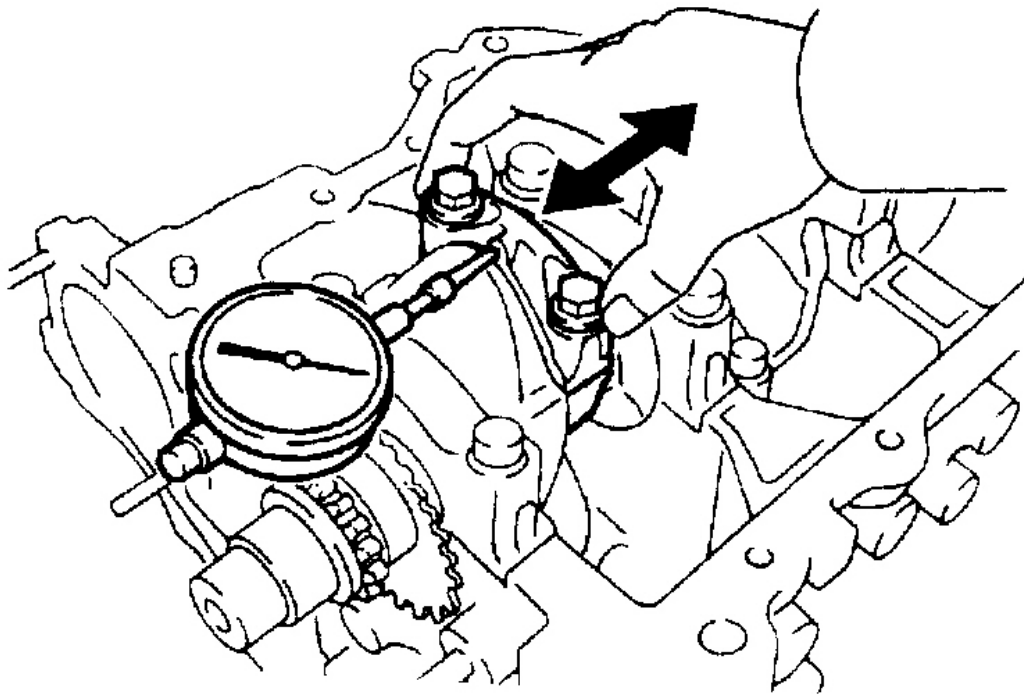
- Using a dial indicator, measure the thrust clearance while moving the connecting rod back and

forth.

Standard thrust clearance:

0.16 to 0.36 mm (0.0063 to 0.0142 in.)

Maximum thrust clearance: 0.36 mm (0.0142 in.)



G03097208

Fig. 325: Measuring Thrust Clearance While Moving Connecting Rod Back And Forth
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the thrust clearance is greater than maximum, replace the connecting rod.

2. INSPECT CONNECTING ROD OIL CLEARANCE

- a. Check that the matchmarks on the connecting rod and cap are aligned to ensure the correct reassembly.
- b. Using SST, remove the 2 connecting rod cap bolts.

SST 09205-16010

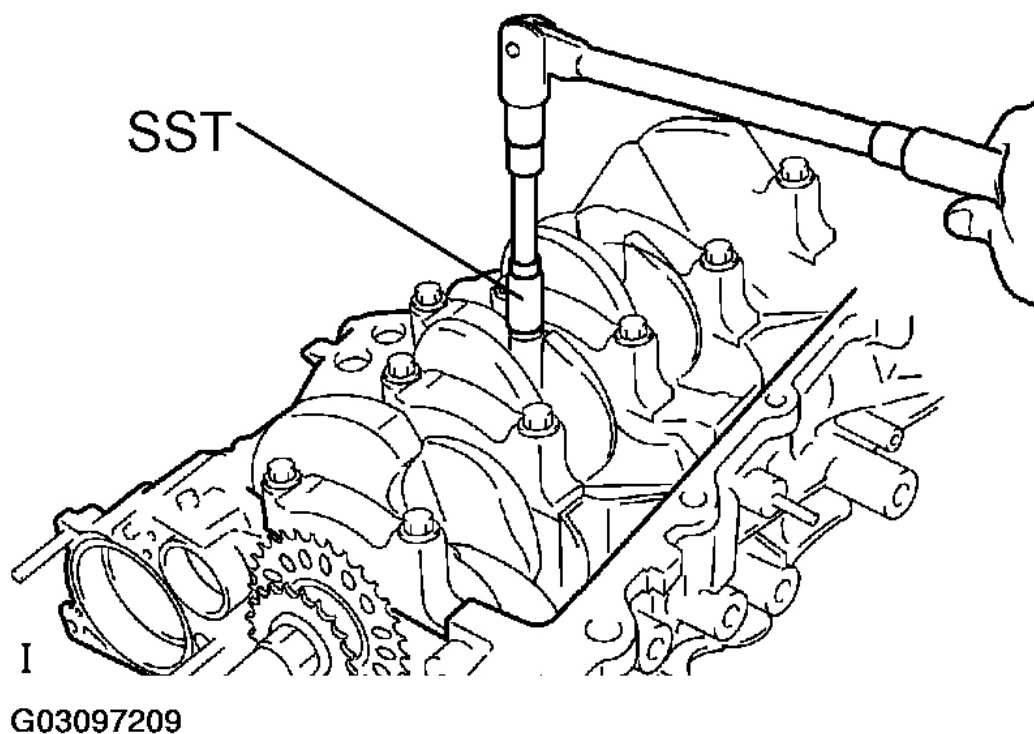
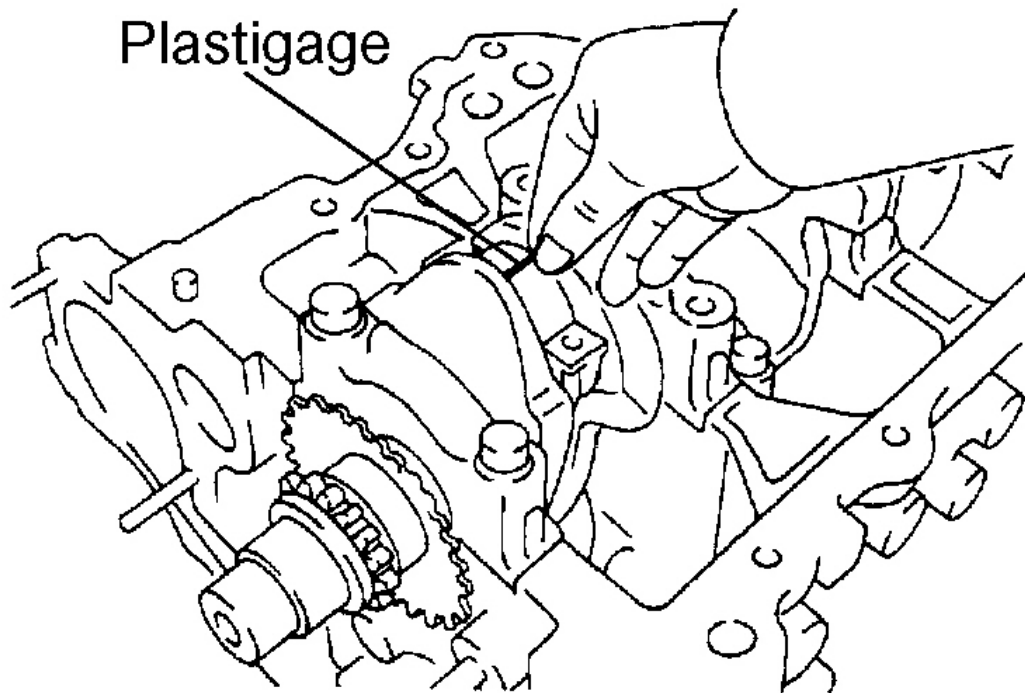


Fig. 326: Removing Connecting Rod Cap Bolts

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

- c. Clean the crank pin and bearing.
- d. Check the crank pin and bearing for pittings and scratches.
- e. Lay a strip of Plastigage across the crank pin.



G03097210

Fig. 327: Laying Strip Of Plastigage Across Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Match together the connecting rod and cap in the correct combination. Then install the cap onto the connecting rod, making sure that the front mark on the cap is correctly oriented.

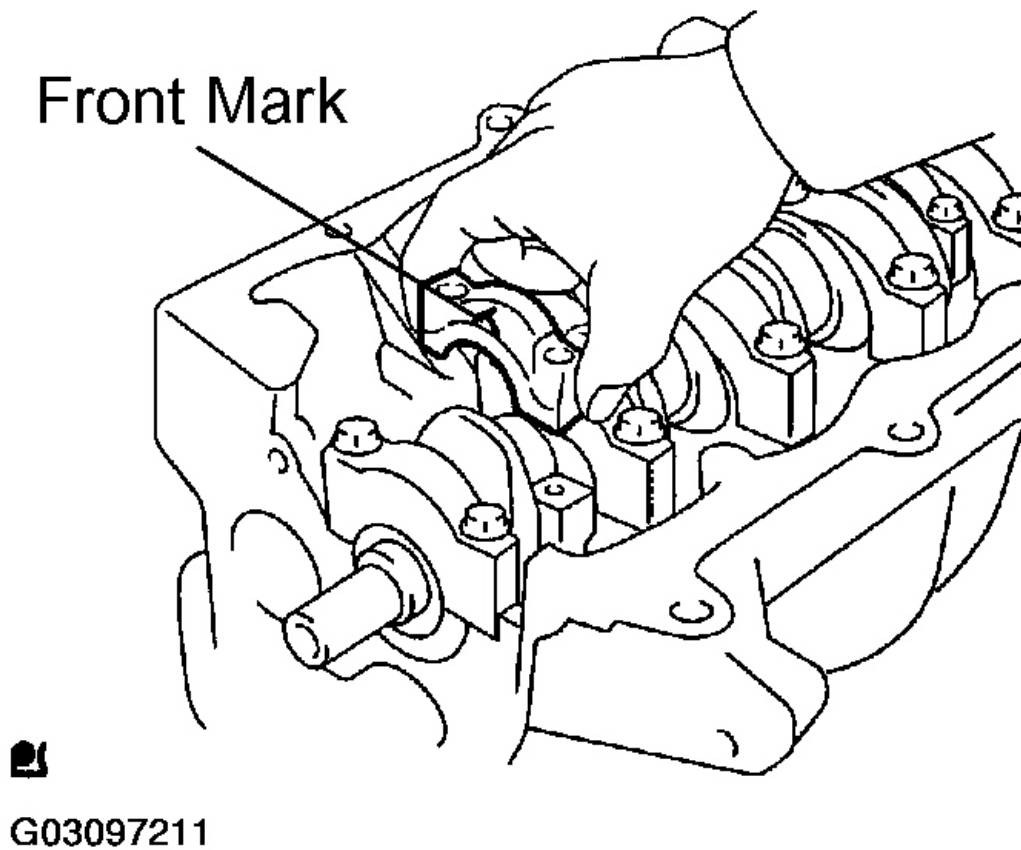


Fig. 328: Installing Cap Onto Connecting Rod Ensuring That Front Mark On Cap Is Correctly Oriented

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

- g. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.
- h. Using SST, tighten the bolts in several steps to the specified torque.

SST 09205-16010

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

NOTE: Do not turn the crankshaft.

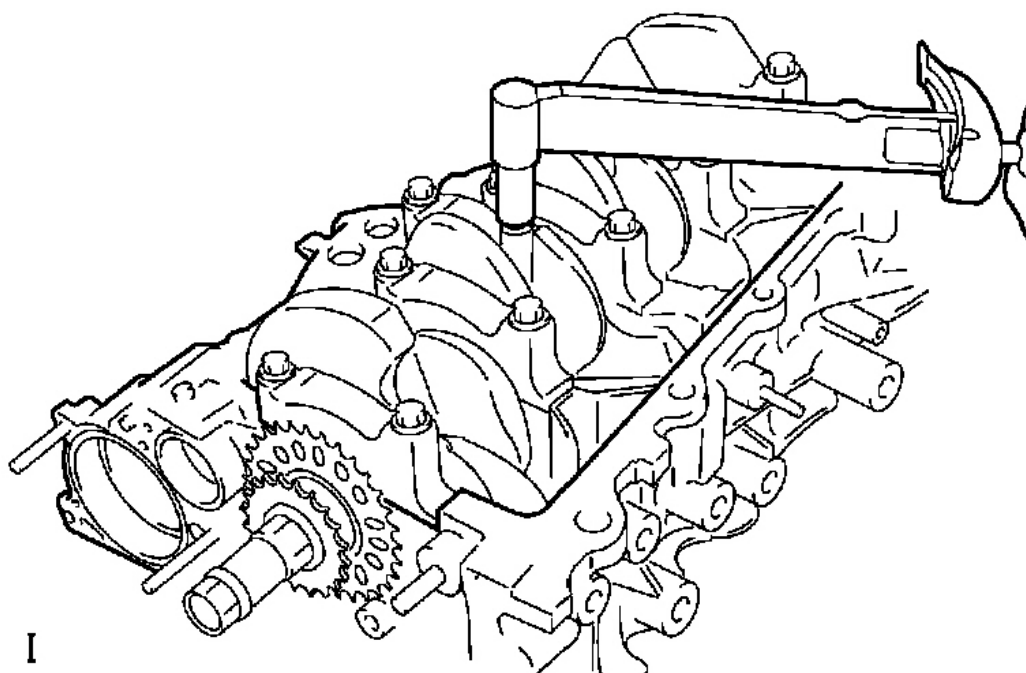
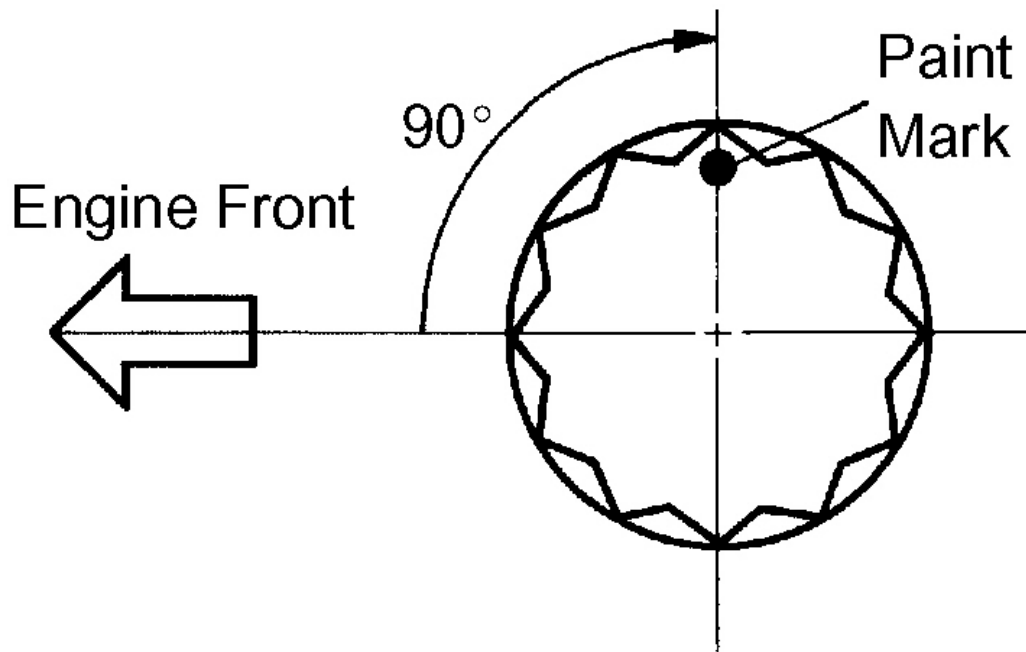


Fig. 329: Tightening Bolts In Several Steps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Mark the front of the connecting cap bolts with paint.
- j. Retighten the cap bolts by 90° as shown in **Fig. 330**.

NOTE: **Do not turn the crankshaft.**



G03097213

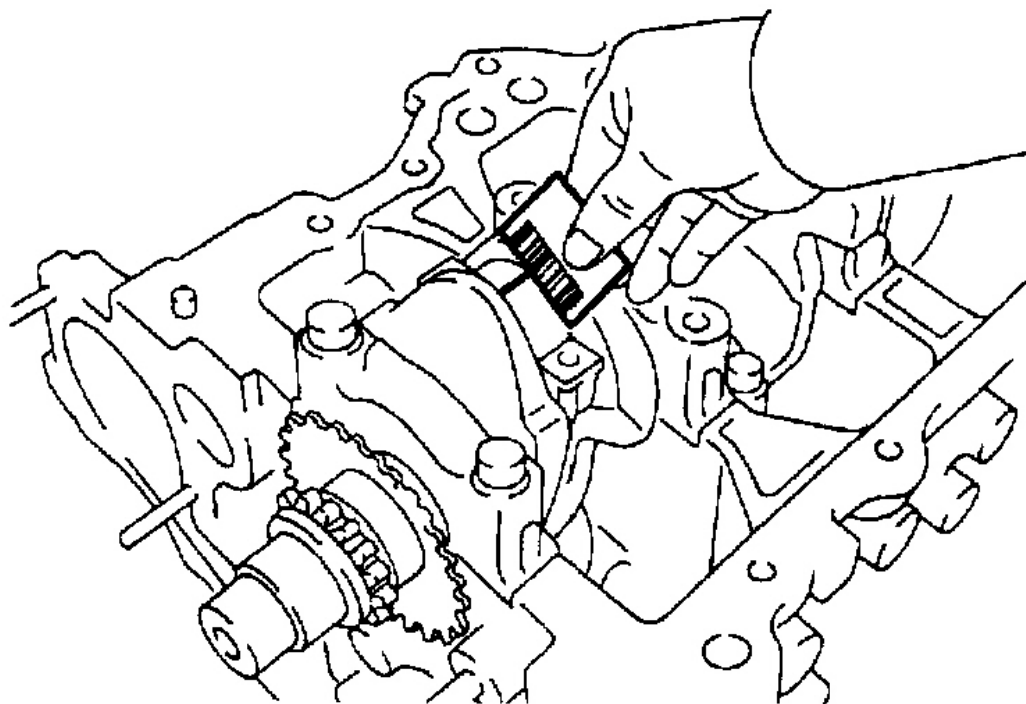
Fig. 330: Retightening Cap Bolts By 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Remove the 2 bolts, connecting rod cap and lower bearing.
- l. Measure the Plastigage at its widest point.

Standard oil clearance:

0.016 to 0.040 mm (0.0006 to 0.0016 in.)

Maximum oil clearance: 0.06 mm (0.0024 in.)

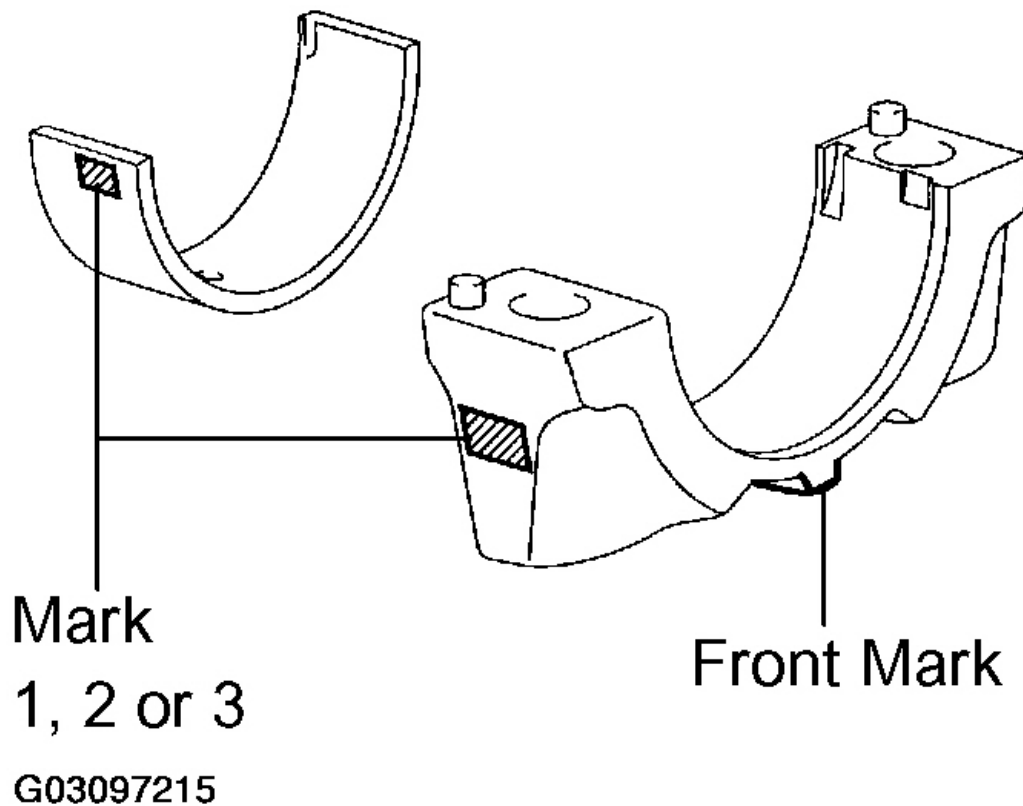


G03097214

Fig. 331: Measuring Plastigage At Its Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: **Completely remove the Plastigage.**

- m. If the width is greater than maximum, select and replace the bearing. If necessary, use the undersize bearing.

**Fig. 332: Identifying Bearing Marks**

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

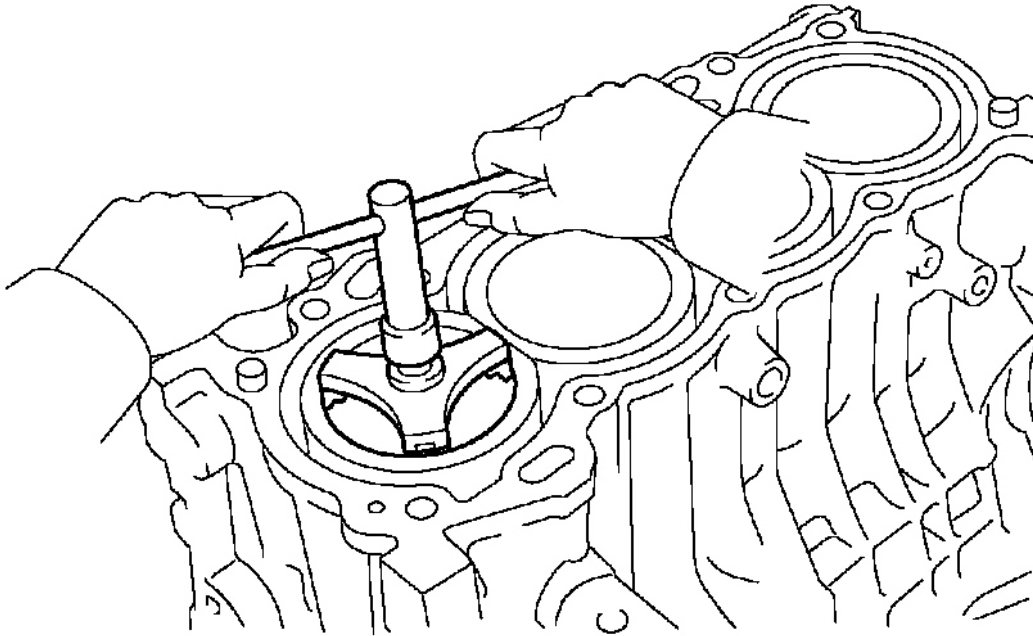
HINT:

BEARING SPECIFICATIONS

Number Mark	Connecting Rod External Diameter mm (in.)	Center Bearing Thickness mm (in.)	Oil Clearance mm (in.)
1	43.000 to 43.008 (1.69291 to 1.69323)	1.491 to 1.494 (0.05870 to 0.05882)	0.012 to 0.034 (0.00047 to 0.00134)
2	43.008 to 43.016 (1.69323 to 1.69354)	1.494 to 1.497 (0.05882 to 0.05894)	0.014 to 0.036 (0.00055 to 0.00142)
3	43.016 to 43.024 (1.69354 to 1.69386)	1.497 to 1.500 (0.05894 to 0.05906)	0.016 to 0.038 (0.00063 to 0.00150)
U/S 0.25	43.000 to 43.024 (1.69291 to 1.69386)	1.608 to 1.614 (0.06331 to 0.06354)	0.016 to 0.040 (0.00063 to 0.00157)

3. REMOVE PISTON SUB-ASSY W/CONNECTING ROD

- a. Using a ridge reamer, remove all carbon from the top of the cylinder.



G03097216

Fig. 333: Removing All Carbon From Top Of Cylinder

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

- b. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearing, connecting rod and cap together.
- Keep the piston and the connecting rod assemblies in the correct order so they can be returned to the original locations when re-assembling.

4. REMOVE CONNECTING ROD BEARING

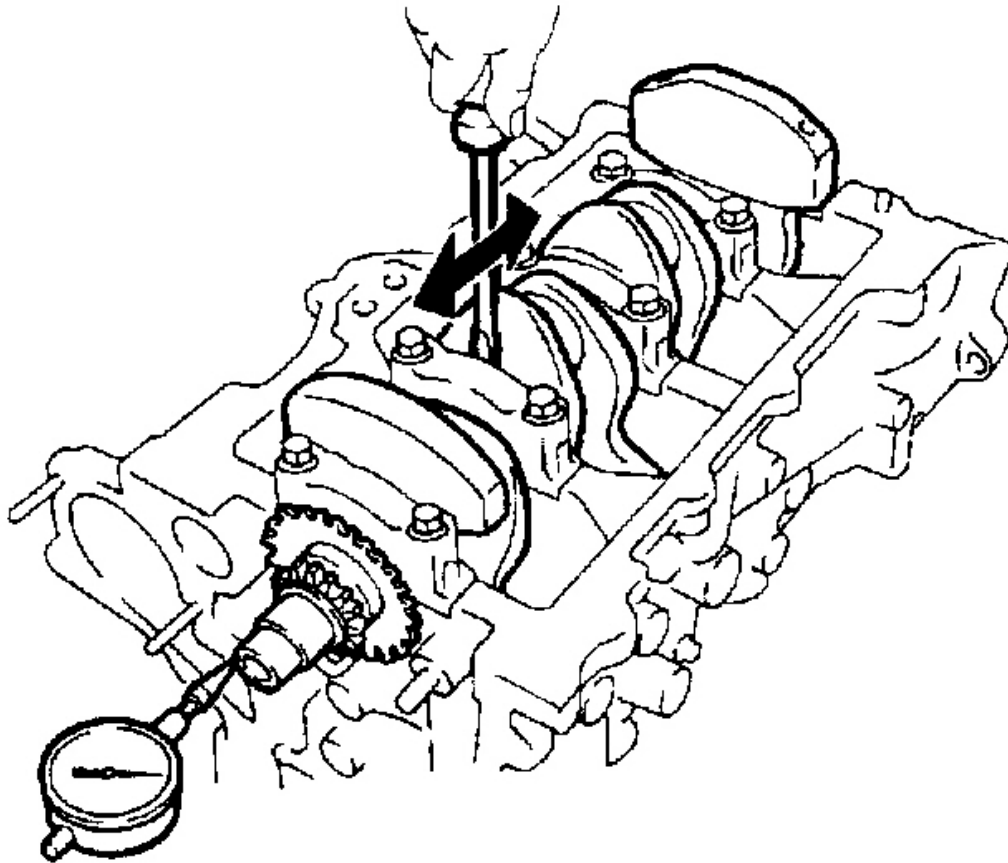
5. INSPECT CRANKSHAFT THRUST CLEARANCE

- a. Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.09 to 0.19 mm (0.0035 to 0.0075 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)



G03097217

Fig. 334: Measuring Thrust Clearance While Prying Crankshaft Back And Forth With Screwdriver

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

If the thrust clearance is greater than maximum, replace the thrust washers as a set. Check the crankshaft and block for wear and repair or replace if necessary.

HINT:

Thrust washer thickness is 2.43 to 2.48 mm (0.0957 to 0.0976 in.).

6. REMOVE CRANKSHAFT

- a. Using several steps, uniformly loosen and remove the 10 bearing cap sub-assembly bolts with SST in the sequence shown in **Fig. 335**.

SST 09011-38121

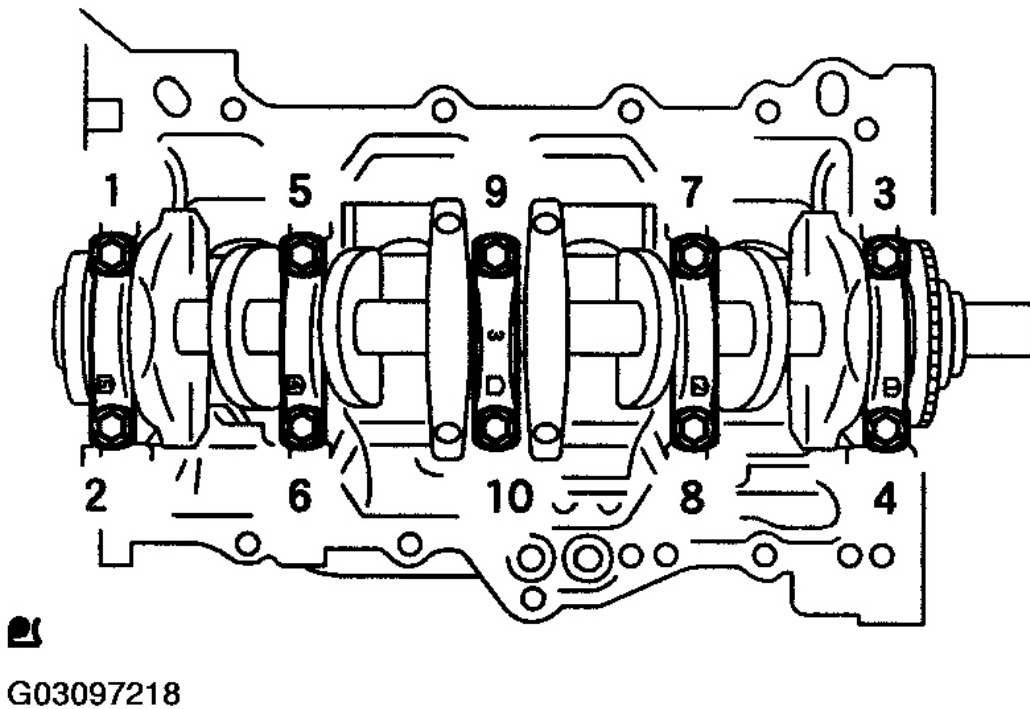


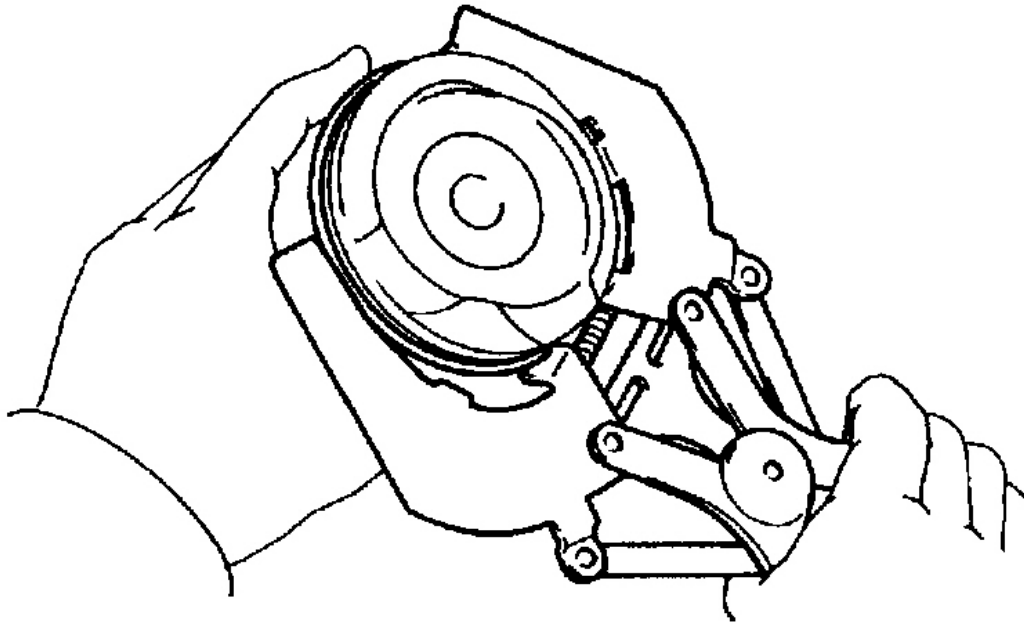
Fig. 335: Removing Bearing Cap Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the bearing cap and crankshaft.
7. **REMOVE CRANKSHAFT BEARING**
8. **REMOVE PISTON RING SET**

HINT:

Keep the piston rings in the correct combination and correct order so they can be returned to the original locations when reassembling.

- a. Using a piston ring expander, remove the 2 compression rings.



G03097219

Fig. 336: Removing Compression Rings

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

- b. Remove the 2 side rails and oil ring by hand.

9. REMOVE W/PIN PISTON SUB-ASSY

- a. Using SST, press out the piston pin from the piston.

SST 09221-25026 (09221-00021, 09221-00030, 09221-00190, 09221-00141, 09221-00150)

NOTE: Keep the pistons, pins, rings, connecting rods and bearings in the correct order so they can be returned to the original locations when re-assembling.

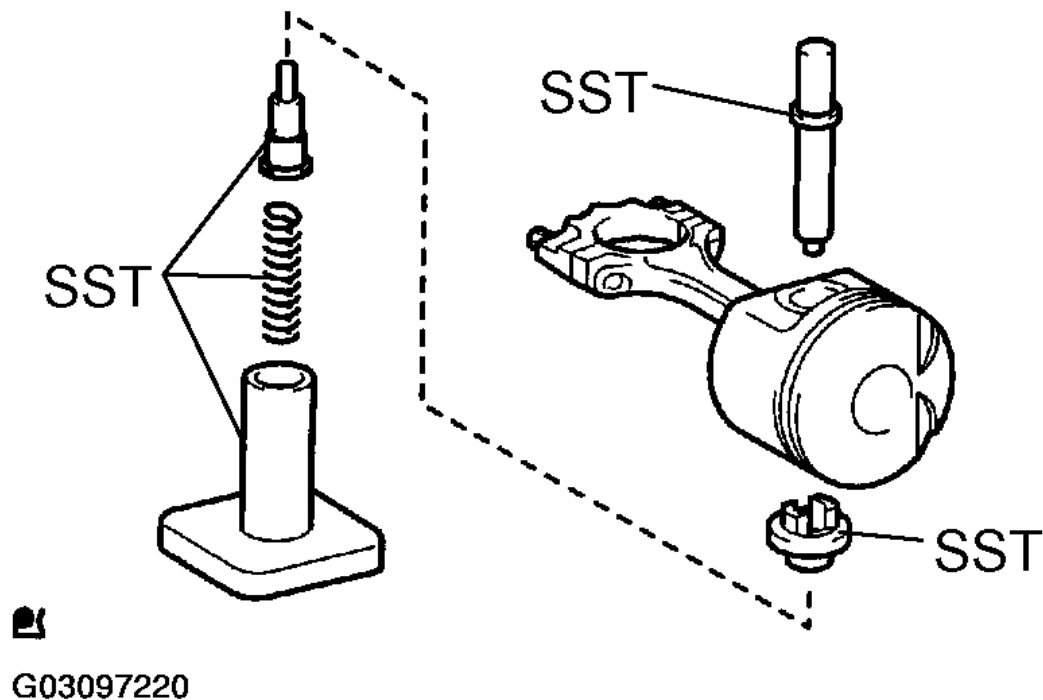
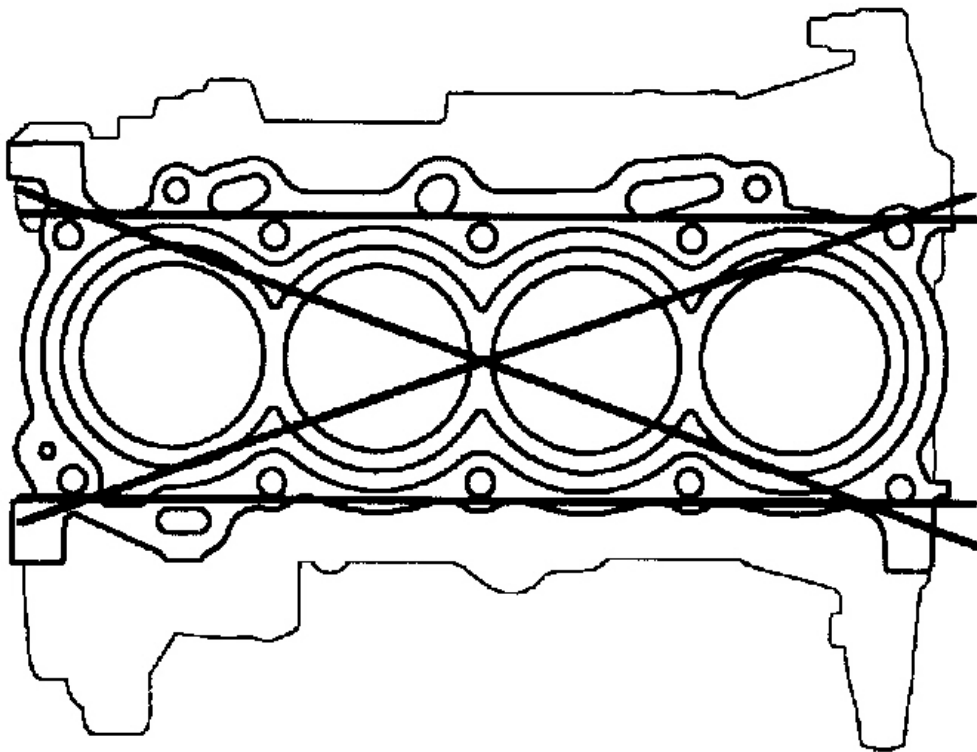
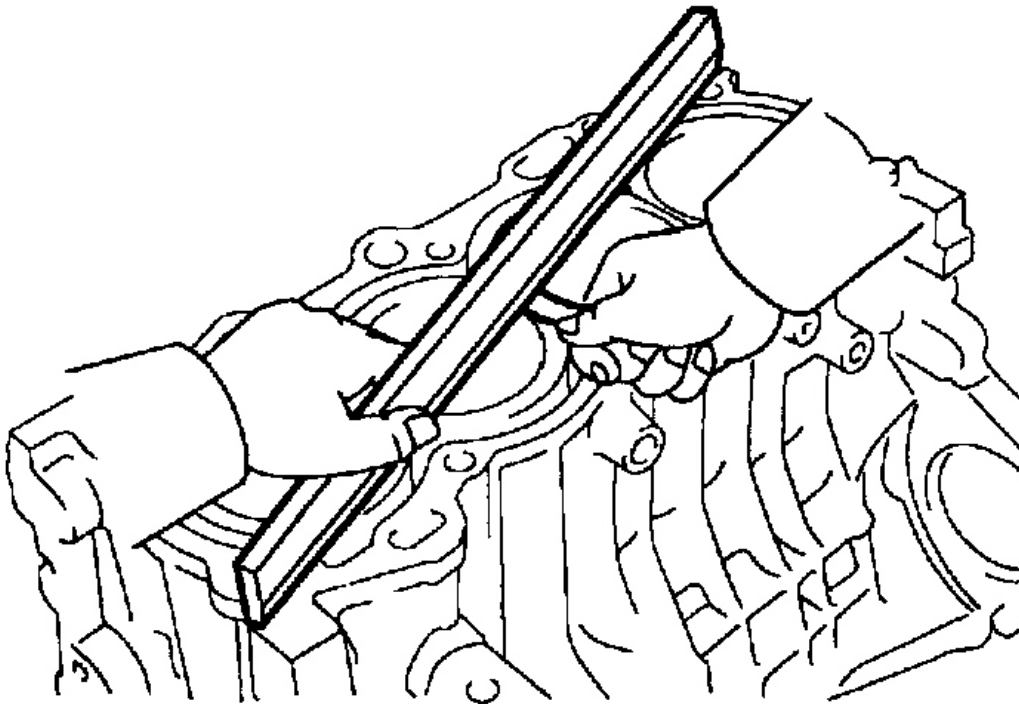


Fig. 337: Pressing Out Piston Pin From Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **REMOVE CYLINDER BLOCK WATER DRAIN COCK PLUG**
11. **REMOVE STUD BOLT**
 - a. Using Torx socket wrench E5, remove the 6 stud bolts.
12. **REMOVE STRAIGHT PIN**
13. **REMOVE STRAIGHT PIN**
14. **REMOVE TIGHT PLUG**
15. **INSPECT CYLINDER BLOCK FOR FLATNESS**
 - a. Using a precision straight edge and feeler gauge, measure the surface which is in contact with the cylinder head gasket for warpage.

Maximum warpage: 0.05 mm (0.0020 in.)



G03097221

Fig. 338: Measuring Surface In Contact With Cylinder Head Gasket For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

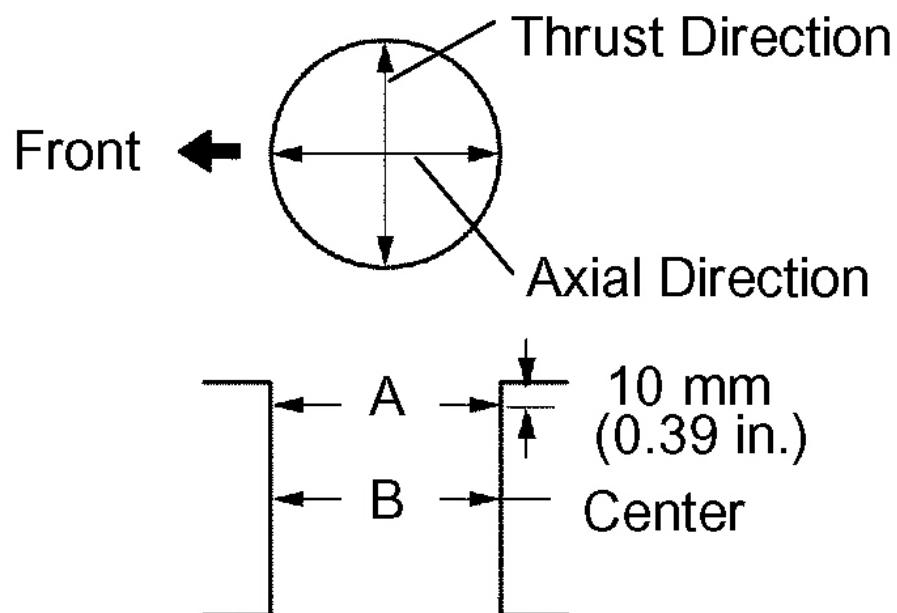
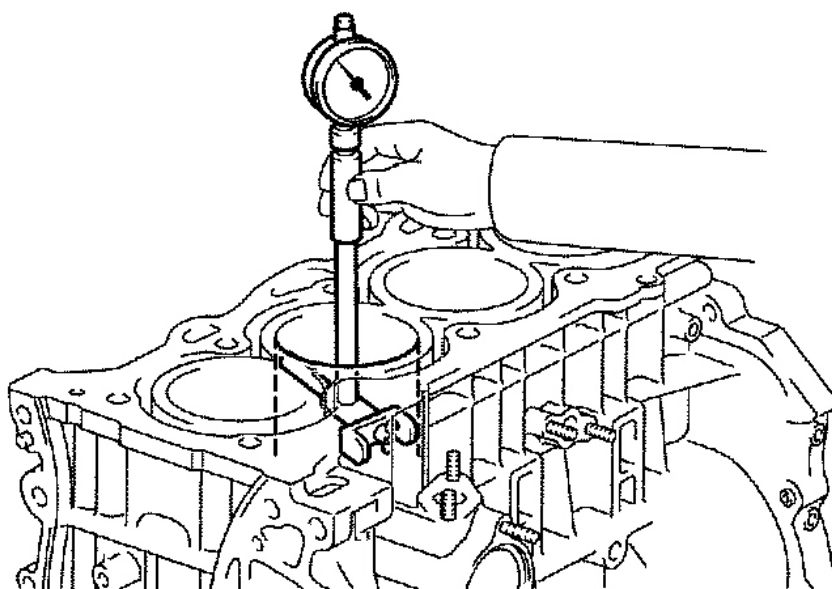
16. INSPECT CYLINDER BORE

- a. Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.
- b. Calculate the average of thrust diameter and axial diameter at the "A" position in **Fig. 339**.
- c. Calculate the average of thrust diameter and axial diameter at the "B" position in **Fig. 339**.

Standard diameter:

75.000 to 75.133 mm (2.9528 to 2.9580 in.)

If the value obtained at step b or c is not within the range of the standard diameter, replace the cylinder block.



P

G03097222

Fig. 339: Inspecting Cylinder Bore

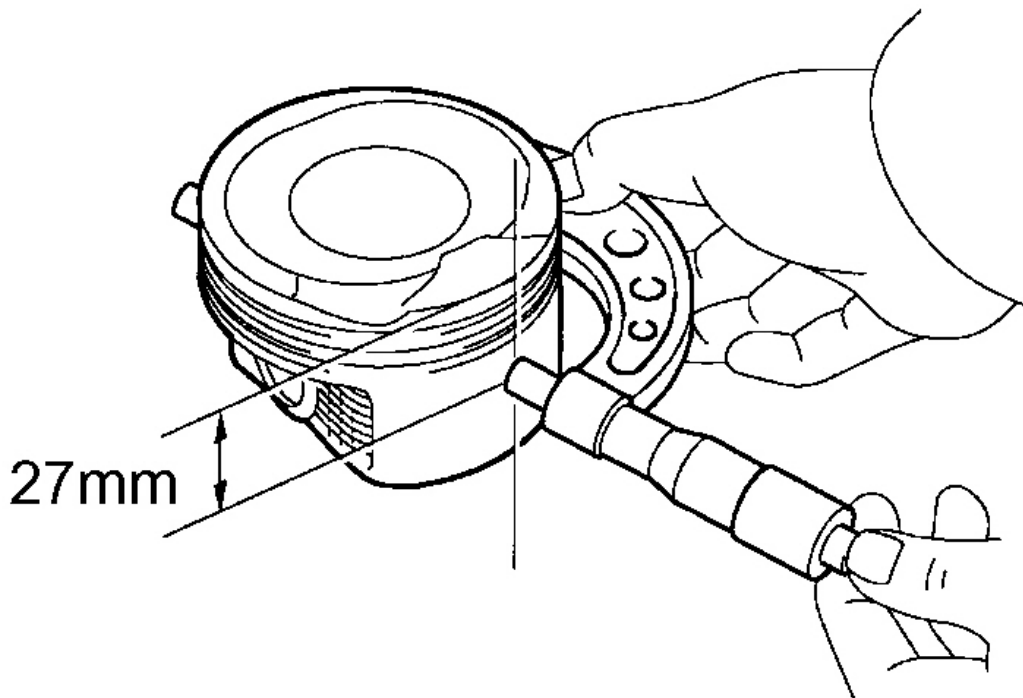
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSPECT W/PIN PISTON SUB-ASSY

- a. Using a micrometer, measure the piston diameter at right angles to the piston pin center line, and at a position 27 mm (1.06 in.) from the top of the piston head.

Piston diameter:

74.945 to 74.955 mm (2.9506 to 2.9510 in.)



G03097223

Fig. 340: Inspecting W/Pin Piston Sub-Assy

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

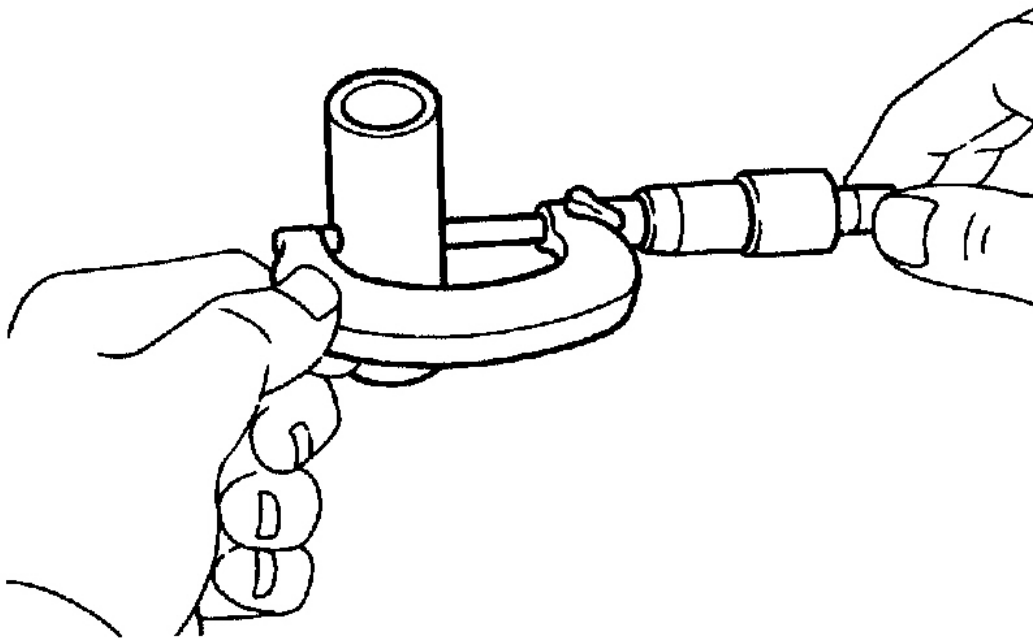
- b. Using a caliper gauge, measure the piston pin hole diameter of the piston.

Piston pin hole diameter at 20 C (68 F): 18.013 to 18.016 mm (0.7092 to 0.7093 in.)

- c. Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

18.001 to 18.004 mm (0.7087 to 0.7088 in.)



G03097224

Fig. 341: Measuring Piston Pin Diameter

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

- d. Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance:**0.009 to 0.015 mm (0.0004 to 0.0006 in.)****Maximum oil clearance:****0.050 mm (0.0020 in.)**

If the clearance is greater than maximum, replace the bushing. If necessary, replace both the piston and piston pin together.

18. INSPECT PISTON CLEARANCE

- a. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.045 to 0.068 mm (0.0018 to 0.0027 in.)**Maximum oil clearance: 0.08 mm (0.0032 in.)**

If the oil clearance is greater than maximum, replace all 4 pistons. If necessary, replace the cylinder block.

19. INSPECT CONNECTING ROD SUB-ASSY

- a. Using a caliper gauge, measure the internal diameter of the connecting rod.

Connecting rod inside diameter:

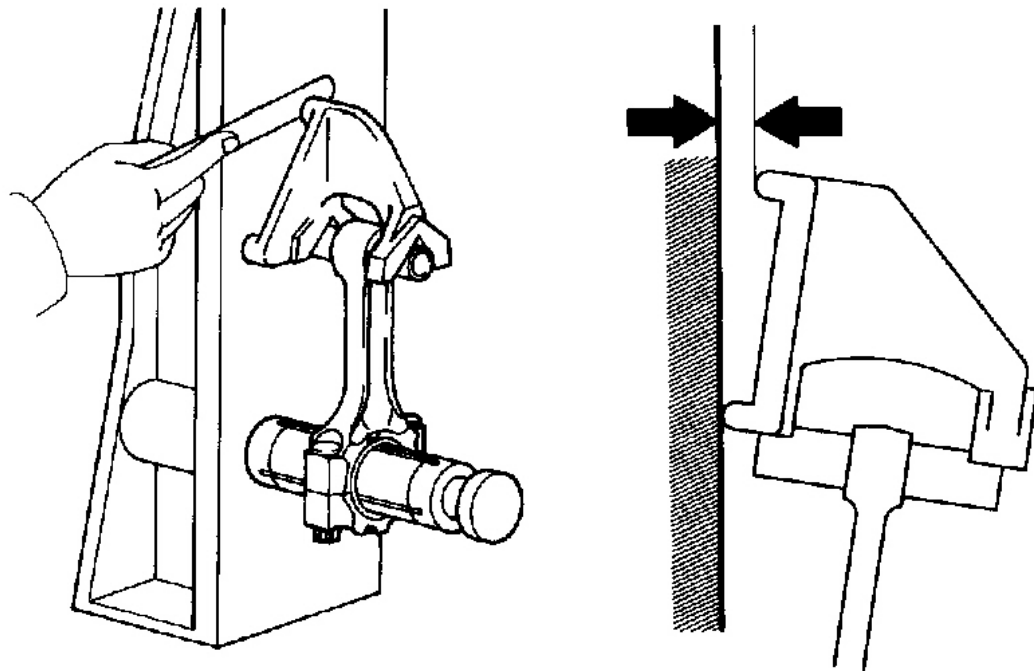
17.965 to 17.985 mm (0.7073 to 0.7081 in.)

If the diameter is greater than maximum, replace the connecting rod.

- b. Using a rod aligner and feeler gauge, check the connecting rod alignment.
 1. Check for misalignment.

Maximum misalignment:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)



G03097225

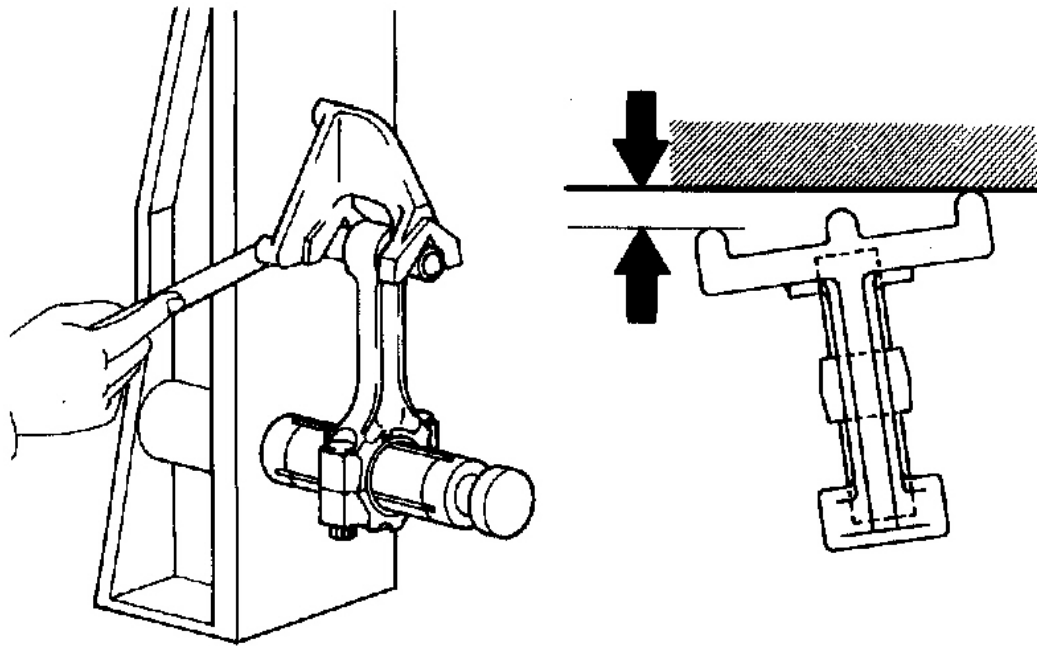
Fig. 342: Checking Connecting Rod Alignment
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the misalignment is greater than maximum, replace the connecting rod assembly.

2. Check for twist.

Maximum twist:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)



G03097226

Fig. 343: Checking For Twist

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

If the twist is greater than maximum, replace the connecting rod assembly.

20. INSPECT RING GROOVE CLEARANCE

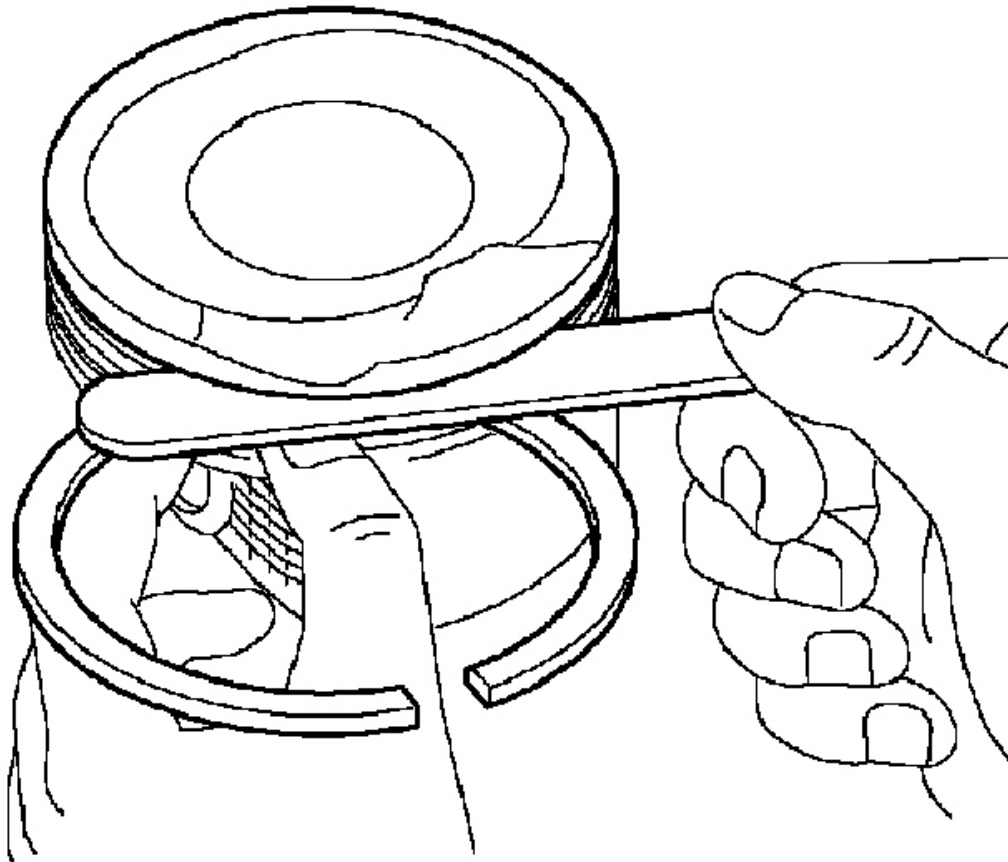
- a. Using a feeler gauge, measure the clearance between a new piston ring and the wall of the ring groove.

Standard ring groove clearance:

STANDARD RING GROOVE CLEARANCE

Ring	Standard mm (in.)
No. 1	0.03 to 0.07 (0.0012 to 0.0028)

No. 2	0.02 to 0.06 (0.0008 to 0.0024)
Oil	0.02 to 0.06 (0.0008 to 0.0024)



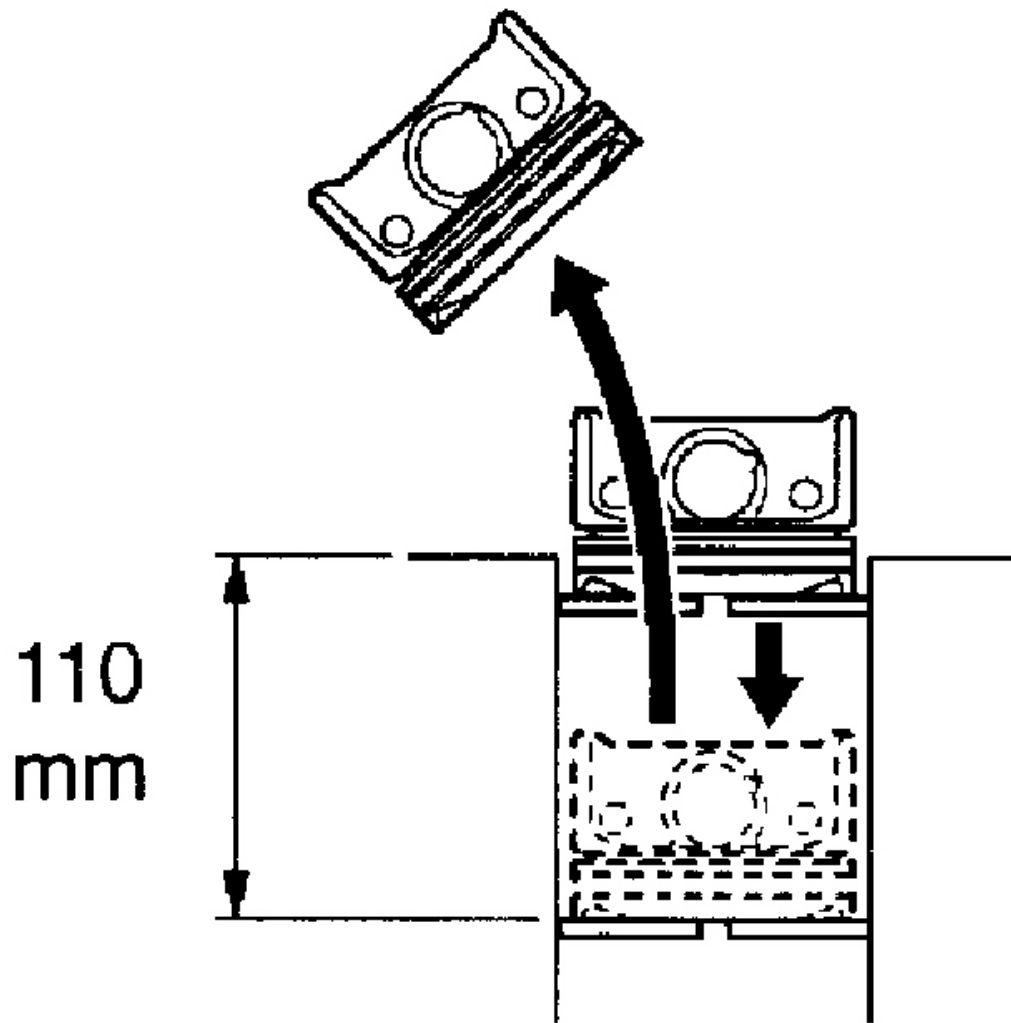
G03097227

Fig. 344: Inspecting Ring Groove Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the clearance is not as specified, replace the piston.

21. INSPECT PISTON RING END GAP

- Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.



G03097228

Fig. 345: Pushing Piston Ring A Little Beyond Bottom Of Ring Travel
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

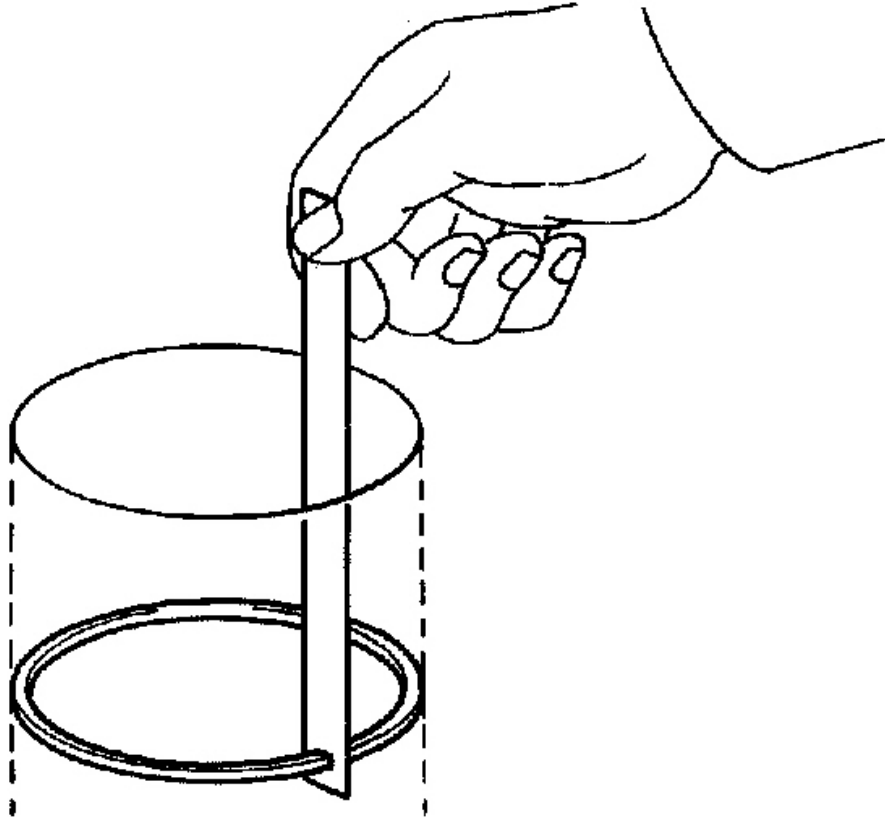
- b. Using a feeler gauge, measure the end gap.

Standard end gap:

STANDARD END GAP SPECIFICATIONS

Ring	Standard mm (in.)	Maximum mm (in.)
No. 1	0.25 to 0.35 (0.0098 to 0.0138)	0.91 (0.0358)

No. 2	0.35 to 0.50 (0.0138 to 0.0197)	1.06 (0.0417)
Oil	0.10 to 0.35 (0.0039 to 0.0138)	0.82 (0.0323)



39

G03097229**Fig. 346: Measuring End Gap****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

If the end gap is greater than maximum, replace the piston ring and oil ring.

22. INSPECT CONNECTING ROD BOLT

- a. Using vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter:**6.6 to 6.7 mm (0.260 to 0.264 in.)**

Maximum diameter: 6.4 mm (0.252 in.)

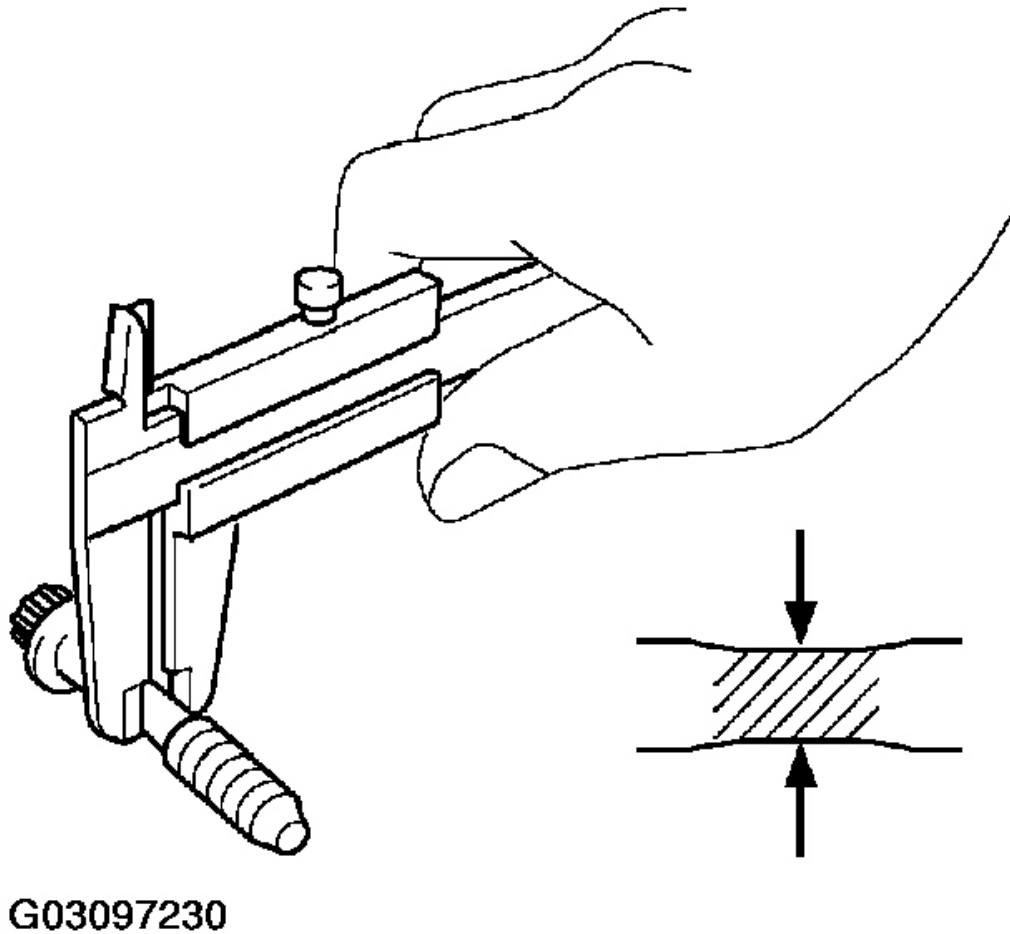


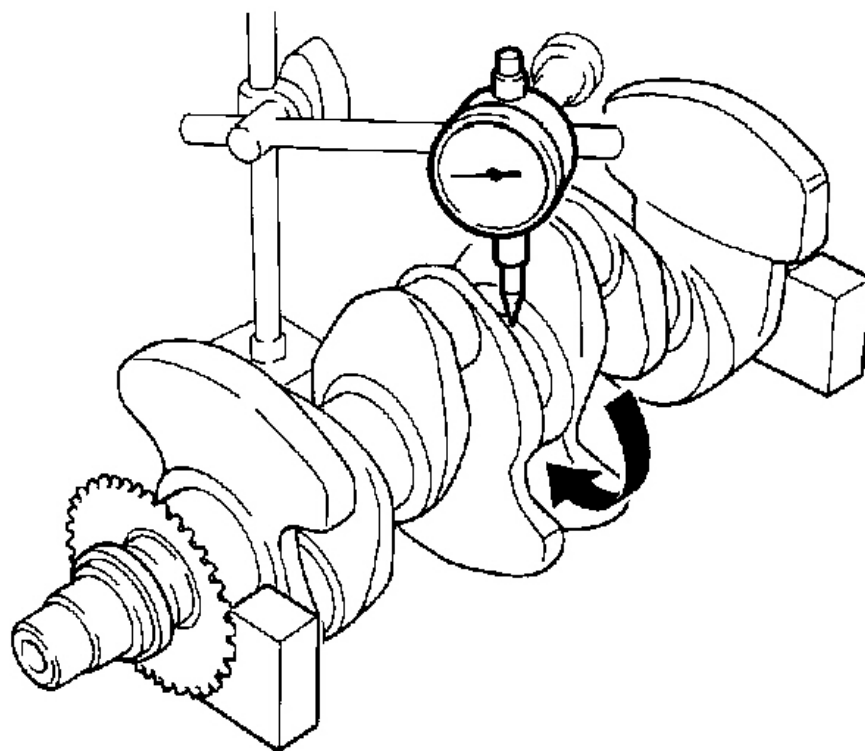
Fig. 347: Measuring Tension Portion Diameter Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the diameter is less than minimum, replace the bolt.

23. INSPECT CRANKSHAFT

- Using a dial indicator and V-blocks, measure the circle runout as shown in **Fig. 348**.

Maximum circle runout: 0.03 mm (0.0012 in.)



N

G03097231

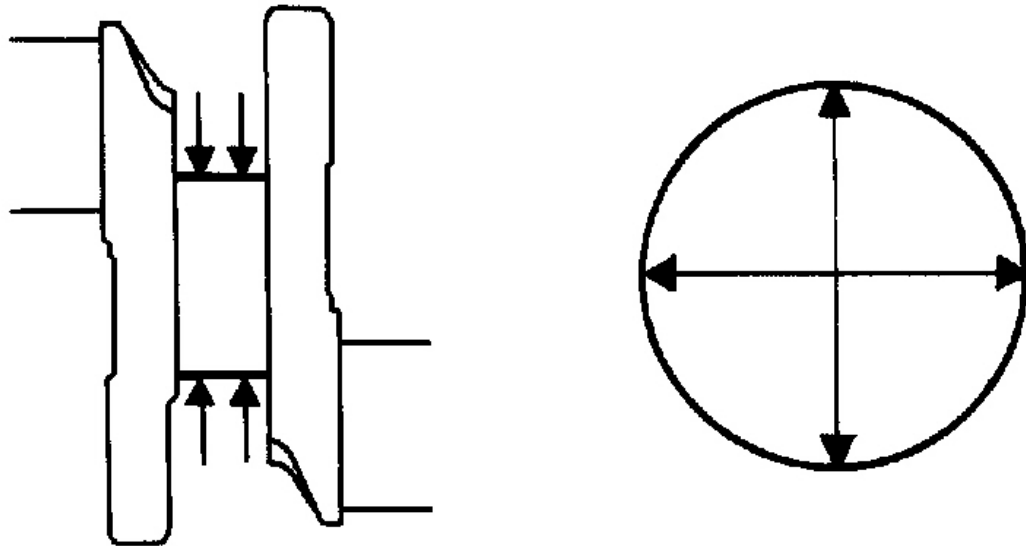
Fig. 348: Measuring Circle Runout

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

If the circle runout is greater than maximum, replace the crankshaft.

- b. Inspect the diameter.
 - 1. Using a micrometer, measure the diameter of each main journal as shown in **Fig. 349**.

Diameter: 45.988 to 46.000 mm (1.8106 to 1.8110 in.)



G03097232

Fig. 349: Measuring Diameter Of Each Main Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Calculate the taper and distortion of the main journal.

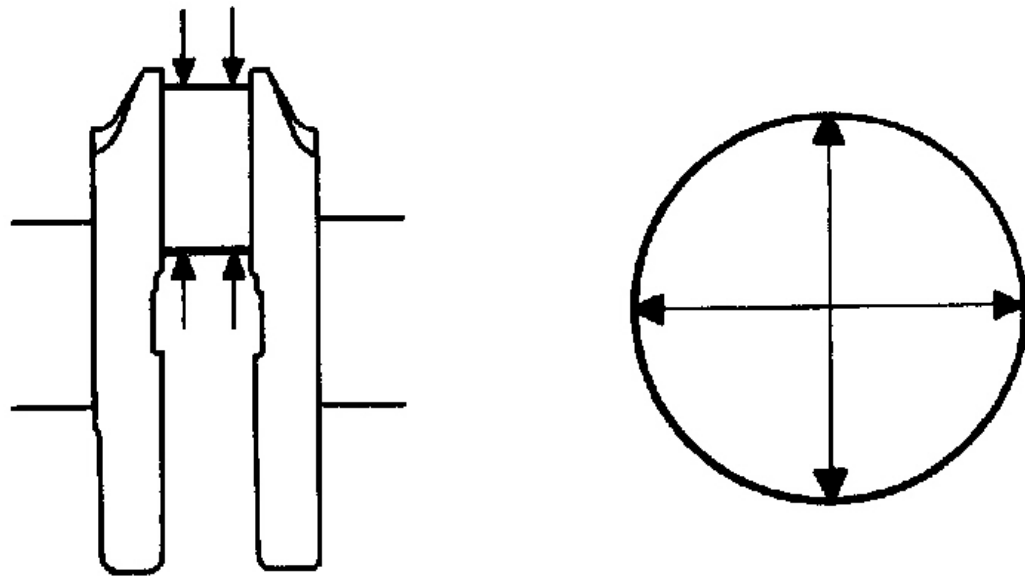
Maximum taper and distortion:

0.02 mm (0.0008 in.)

If the taper and distortion are greater than maximum, replace the crankshaft.

3. Using a micrometer, measure the diameter of each crank pin as shown in **Fig. 350**.

Diameter: 39.992 to 40.000 mm (1.5745 to 1.5748 in.)



G03097233

Fig. 350: Measuring Diameter Of Each Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Calculate the taper and distortion of the crank pin.

Maximum taper and distortion: 0.02 mm (0.0008 in.)

If the taper and out-of-roundness are greater than maximum, replace the crankshaft.

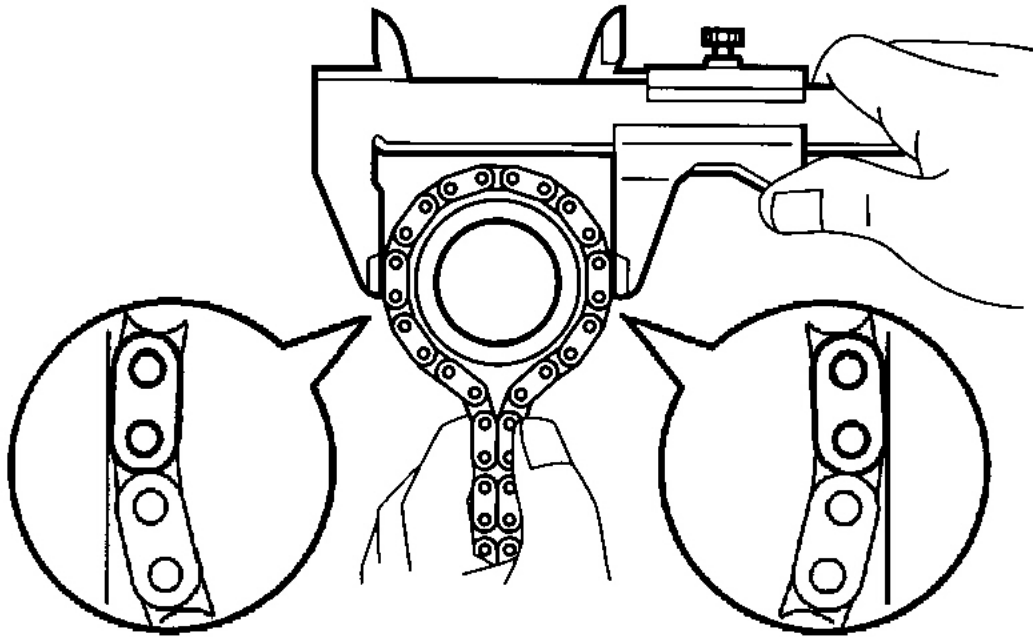
- c. Wrap the chain around the timing sprocket.
- d. Using vernier calipers, measure the timing sprocket diameter with the chain wrapped.

Standard sprocket diameter (w/chain):

51.72 mm (2.0362 in.)

Maximum sprocket diameter (w/chain): 50.5 mm (1.988 in.)

NOTE: When measuring the diameter, vernier calipers must be in contact with the chain roller.



G03097234

Fig. 351: Measuring Timing Sprocket Diameter With Chain Wrapped
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

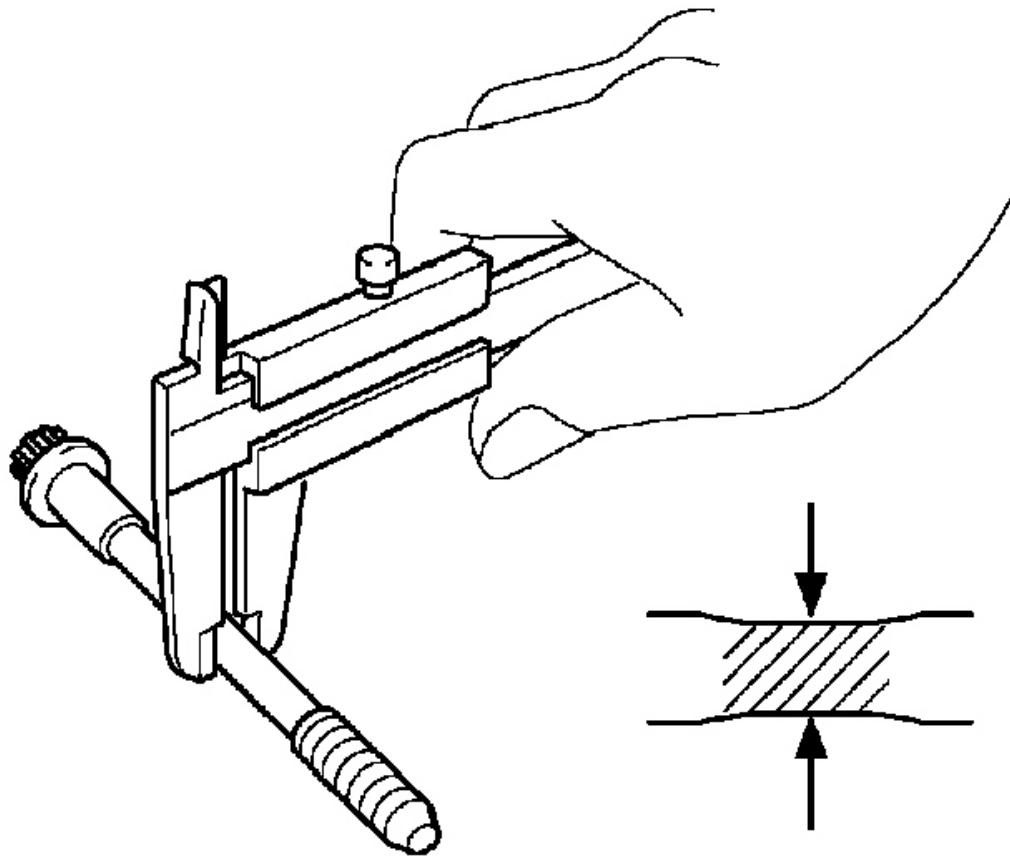
If the diameter is less than minimum, replace the chain and crankshaft.

24. INSPECT CRANKSHAFT BEARING CAP SET BOLT

- a. Using vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter: 7.3 to 7.5 mm (0.287 to 0.295 in.)

Minimum diameter: 7.2 mm (0.283 in.)



G03097235

Fig. 352: Measuring Tension Portion Diameter Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the diameter is less than minimum, replace the bolt.

25. INSPECT CRANKSHAFT OIL CLEARANCE

- Clean each main journal and bearing.
- Install the upper bearing with the oil groove onto the cylinder block, and the lower bearing onto the bearing cap.

NOTE: Do not apply engine oil to the contact surfaces of the cylinder block and the back side of the bearing.

HINT:

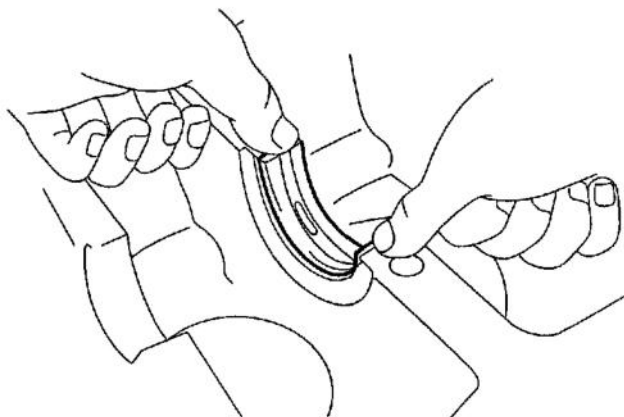
Mass production parts do not have claws as marks. If reusing the mass production parts, measure the clearance of both sides with the bearing in the center of the bearing cap.

Specified clearance:

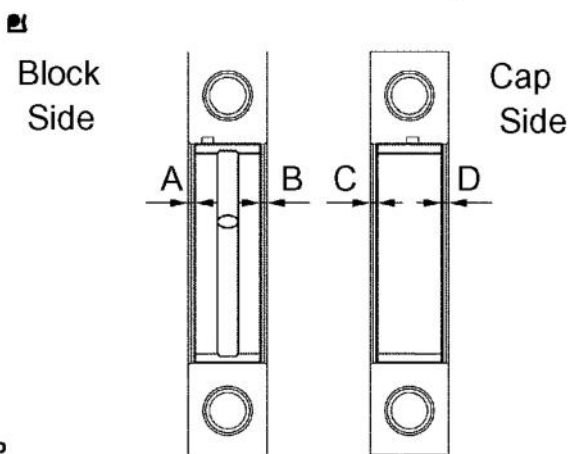
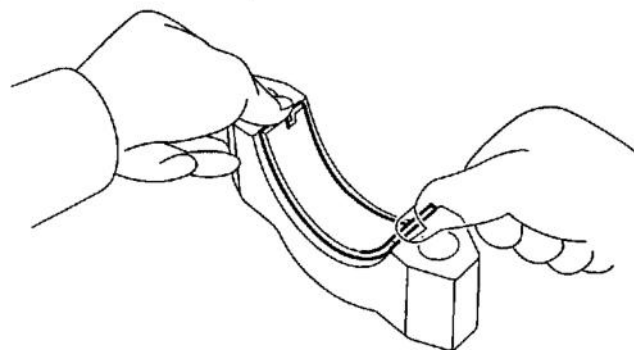
A - B = within 0.8 mm (0.032 in.)

C - D = within 0.4 mm (0.016 in.)

Upper Bearing



Lower Bearing



P

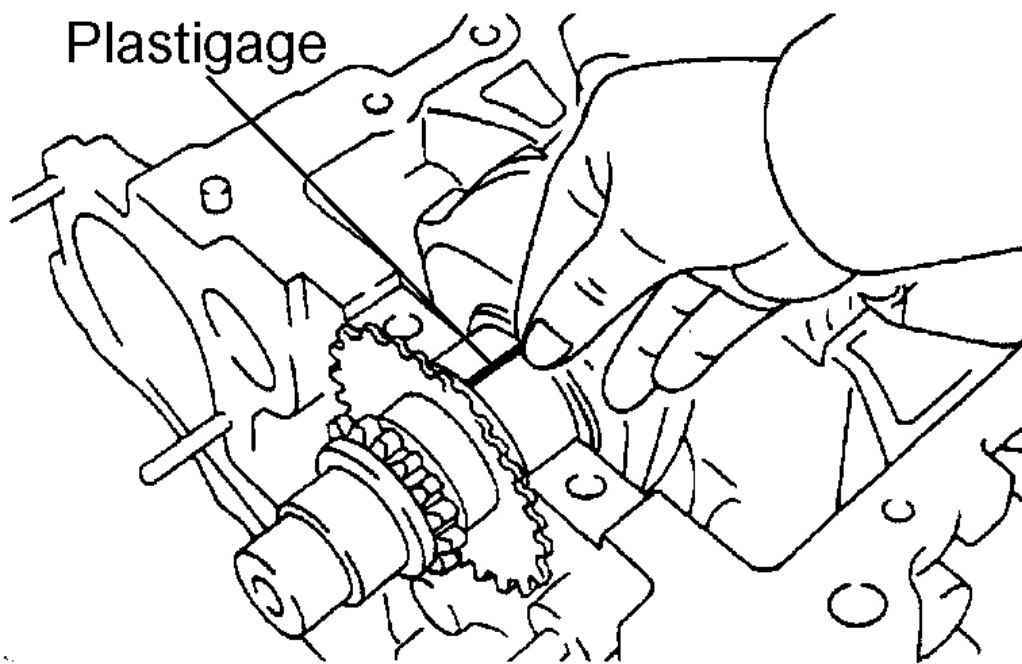
G03097236

Fig. 353: Installing Upper Bearing With Oil Groove Onto Cylinder Block, And Lower Bearing Onto Bearing Cap

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

- c. Install the crankshaft onto the cylinder block.

- d. Lay a strip of Plastigage across each journal.



G03097237

Fig. 354: Laying Strip Of Plastigage Across Each Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Check the front marks and numbers and install the bearing caps onto the cylinder block.

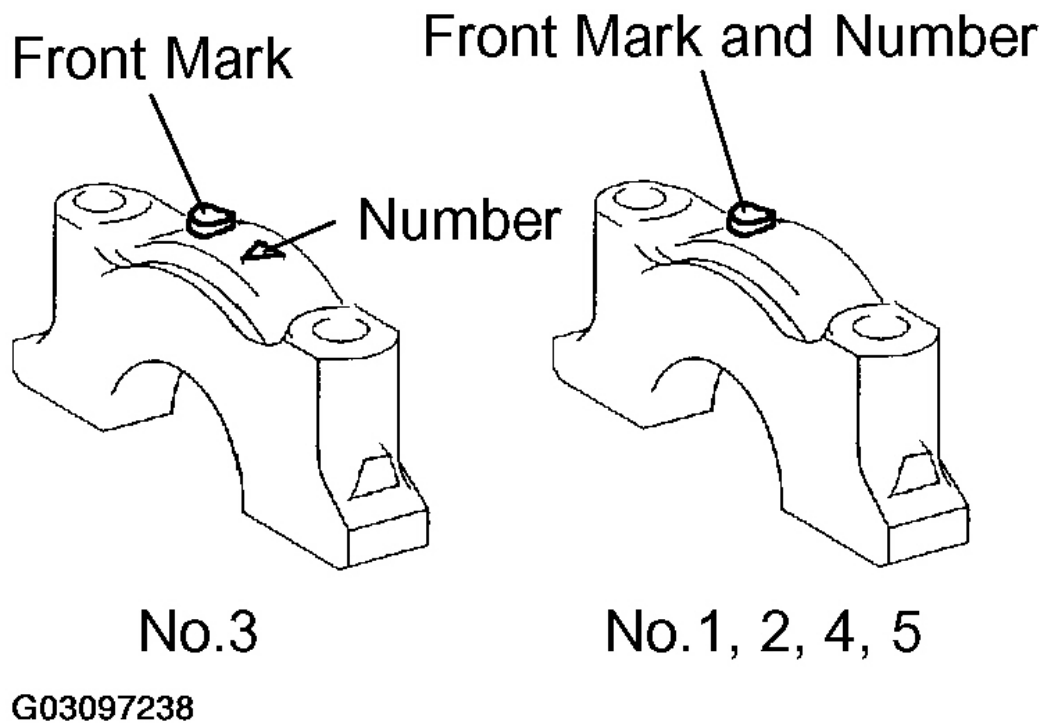


Fig. 355: Checking Front Marks And Numbers And Installing Bearing Caps Onto Cylinder Block

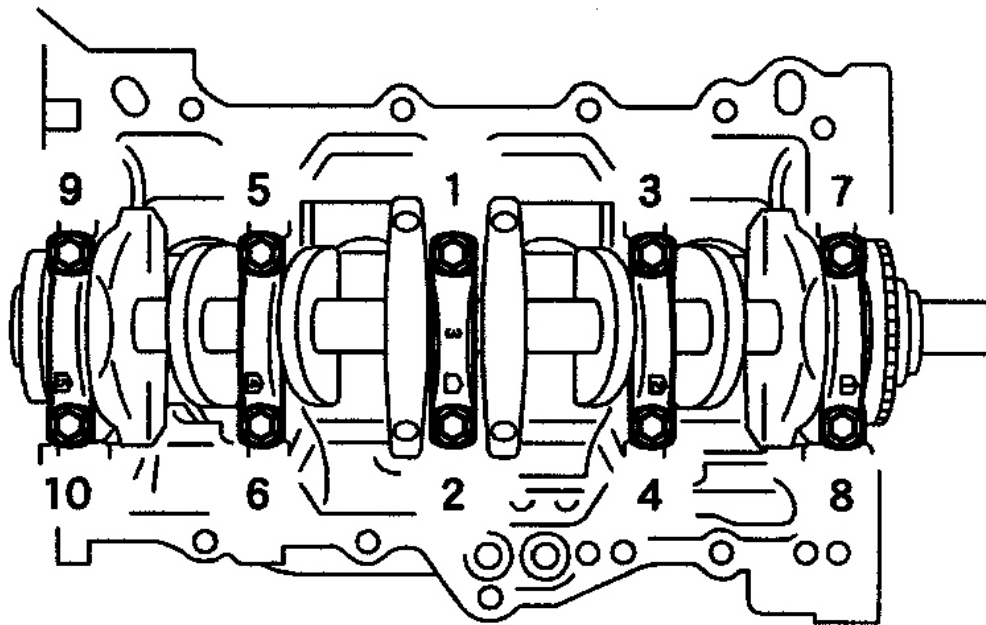
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Apply a light coat of engine oil to the threads of the bearing cap bolts.
- g. Using several steps, tighten the bolts with SST in the sequence shown in **Fig. 356**.

SST 09011-38121

Torque: 22 N.m (224 kgf.cm, 16 ft.lbf)

NOTE: Do not turn the crankshaft.



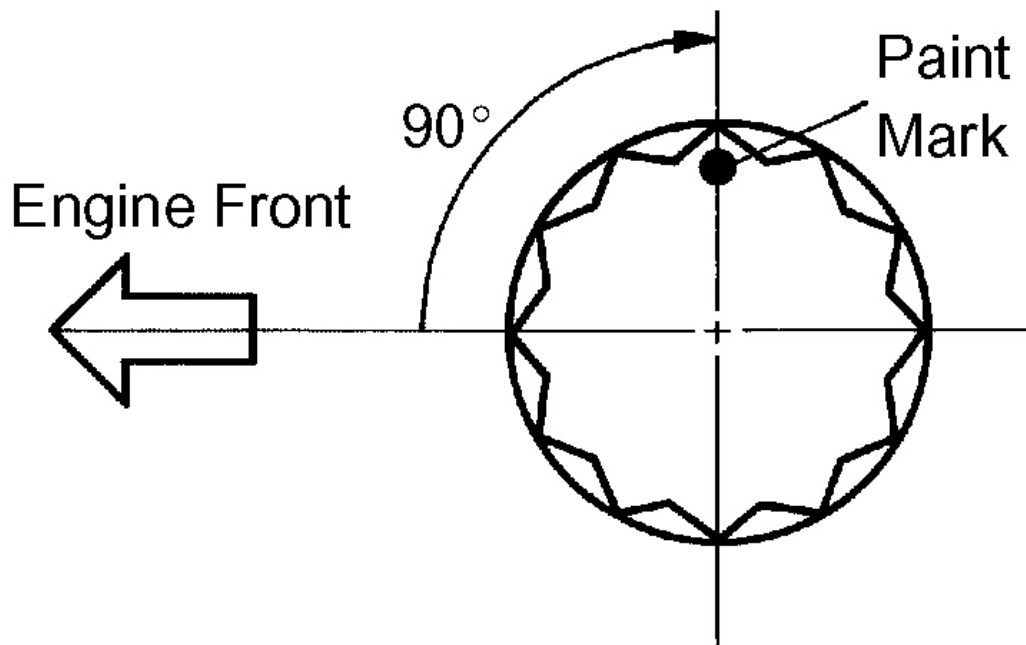
G03097239

Fig. 356: Tightening Bolts In Sequence

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

- h. Mark the front of the bearing cap bolts with paint.
- i. Retighten the bearing cap bolts by 90° in the same sequence as step.
- j. Check that each painted mark is now at a 90° angle to the front.

NOTE: **Do not turn the crankshaft.**



G03097240

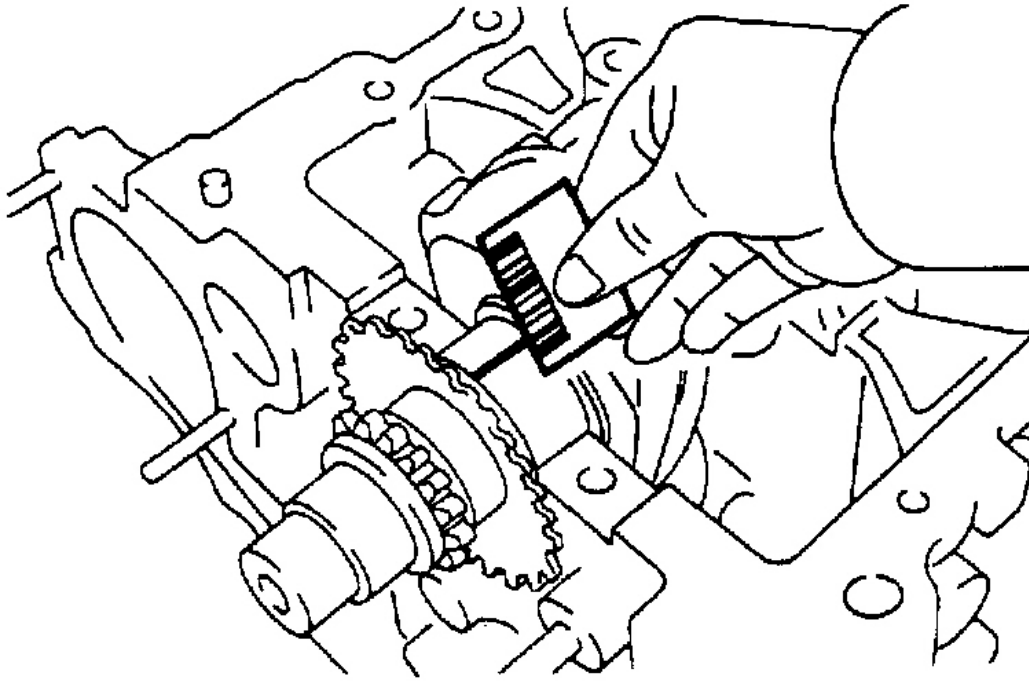
Fig. 357: Checking Each Painted Mark Is Now At 90° Angle To Front
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- k. Remove the bearing cap sub-assembly.
- l. Measure the Plastigage at its widest point.

Standard oil clearance:

0.01 to 0.023 mm (0.0004 to 0.0009 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)



G03097241

Fig. 358: Measuring Plastigage At Its Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Completely remove the Plastigage.

NOTE: Completely remove the Plastigage.

HINT:

- If the width is greater than maximum, select and replace the bearing. If necessary, use the undersize bearing.
- To select the correct bearing size, calculate the bearing number by adding together the numbers imprinted on the cylinder block and crank journal.
- Example:

Imprinted number on the cylinder block is 3.

Imprinted number on the crank journal is 5.

$$3+5=8$$

Select the bearing with the bearing number 3.

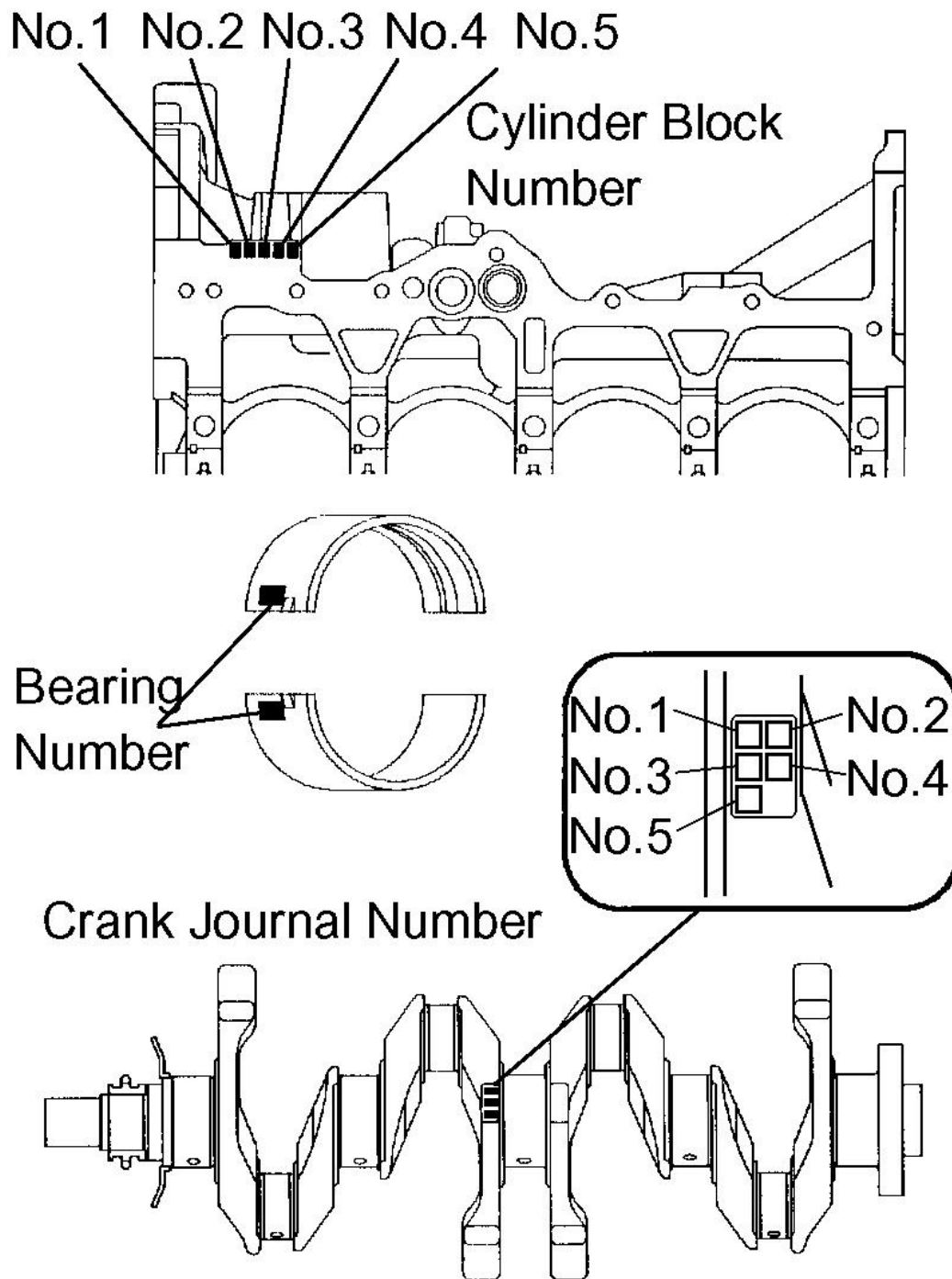
CYLINDER BLOCK AND CRANK JOURNAL NUMBER SPECIFICATIONS

Number	Cylinder Block Number mm (in.)	Crank Journal Number mm (in.)
0	50.000 to 50.003 (1.96850 to 1.96862)	45.998 to 46.000 (1.81094 to 1.81102)
1	50.003 to 50.005 (1.96862 to 1.96870)	45.996 to 45.998 (1.81087 to 1.81094)
2	50.005 to 50.007 (1.96870 to 1.96878)	45.994 to 45.996 (1.81079 to 1.81087)
3	50.007 to 50.010 (1.96878 to 1.96890)	45.992 to 45.994 (1.81071 to 1.81079)
4	50.010 to 50.012 (1.96890 to 1.96898)	45.990 to 45.992 (1.81063 to 1.81071)
5	50.012 to 50.014 (1.96898 to 1.96906)	45.988 to 45.990 (1.81055 to 1.81063)
6	50.014 to 50.016 (1.96906 to 1.96913)	-

Cylinder Block Number + Crank Journal Number	Bearing Number	Center Bearing Thickness mm (in.)	Oil Clearance mm (in.)
0~2	1	1.992 to 1.995 (0.07843 to 0.07854)	0.010 to 0.023 (0.00039 to 0.00091)
3~5	2	1.995 to 1.998 (0.07854 to 0.07866)	↑
6~8	3	1.998 to 2.001 (0.07866 to 0.07878)	↑
9~11	4	2.001 to 2.004 (0.07878 to 0.07890)	↑
-	U/S 0.25	2.111 to 2.117 (0.08311 to 0.08335)	↑

G03097243

Fig. 359: Identifying Bearing Number Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G03097242

Fig. 360: Identifying Cylinder Block, Bearing And Crank Journal Numbers
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

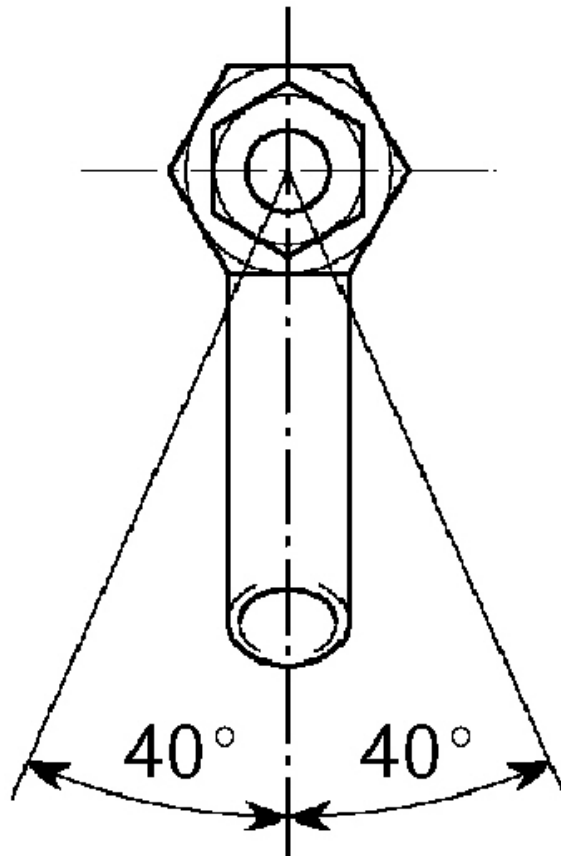
26. INSTALL CYLINDER BLOCK WATER DRAIN COCK PLUG

- a. Apply 2 or 3 threads of adhesive to the drain union, and install it within 3 minutes of applying.
- b. After applying the specified torque, rotate the drain union clockwise until its drain port faces downward.

Torque: 35 N.m (357 kgf.cm, 26 ft.lbf)

NOTE:

- **Install the water drain cock within 3 minutes of applying adhesive.**
- **Do not put in coolant for at least 1 hour after installation.**
- **Do not rotate the drain union more than 360° in step b, and never loosen it after setting the union correctly.**
- **The pipe of the drain cock should be within 40° of the vertical.**



Y

G03097244

Fig. 361: Ensuring Pipe Of Drain Cock Within 40° Of Vertical
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. INSTALL TIGHT PLUG

- Apply adhesive to the tight plugs.
- Using SST, tap in the new tight plugs as shown in **Fig. 362**.

SST 09950-60010 (09951-00180), 09950-70010 (09951-07100)

Standard depth: 0.2 to 1.2 mm (0.008 to 0.047 in.)

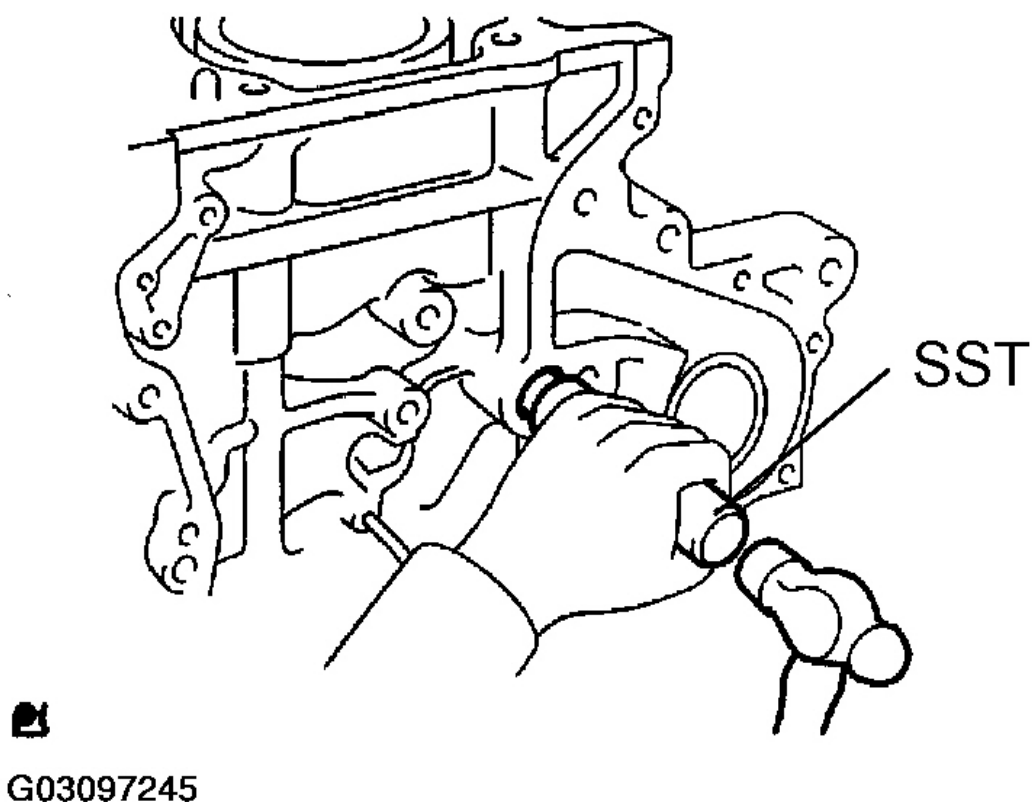


Fig. 362: Tapping In New Tight Plugs

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

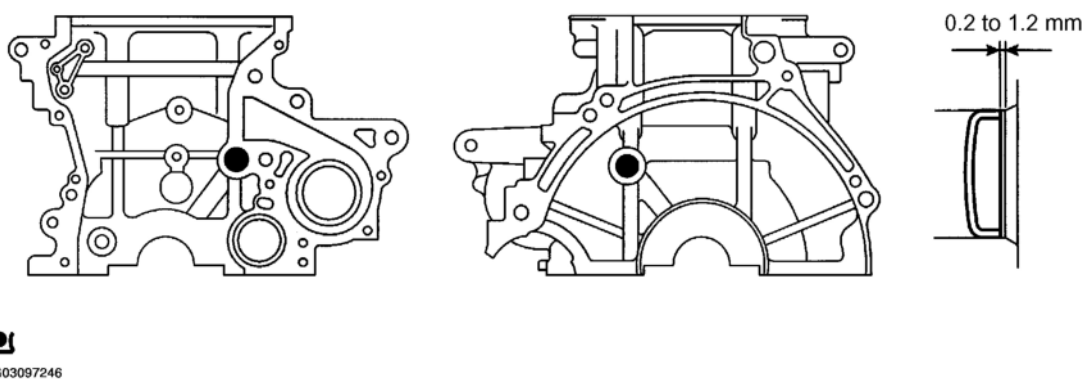


Fig. 363: Identifying Tight Plug

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

28. INSTALL STRAIGHT PIN

- a. Using a plastic-faced hammer, tap in the new straight pin.

Standard protrusion:

8.5 to 9.5 mm (0.335 to 0.374 in.)

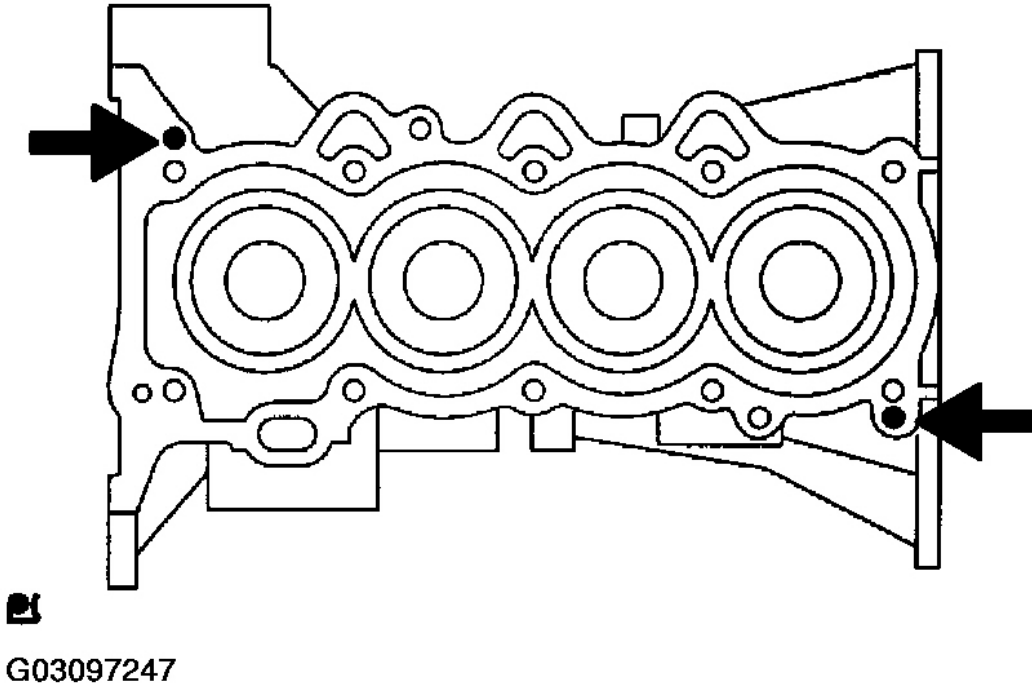


Fig. 364: Installing Straight Pin

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

29. INSTALL STRAIGHT PIN

- a. Using a plastic-faced hammer, tap in the new straight pin.

Standard protrusion:

Pin A: 3.5 to 4.5 mm (0.138 to 0.177 in.)

Pin B: 18.5 to 19.5 mm (0.728 to 0.768 in.)

Pin C: 8.5 to 9.5 mm (0.335 to 0.374 in.)

Pin D: 11.5 to 12.5 mm (0.453 to 0.492 in.)

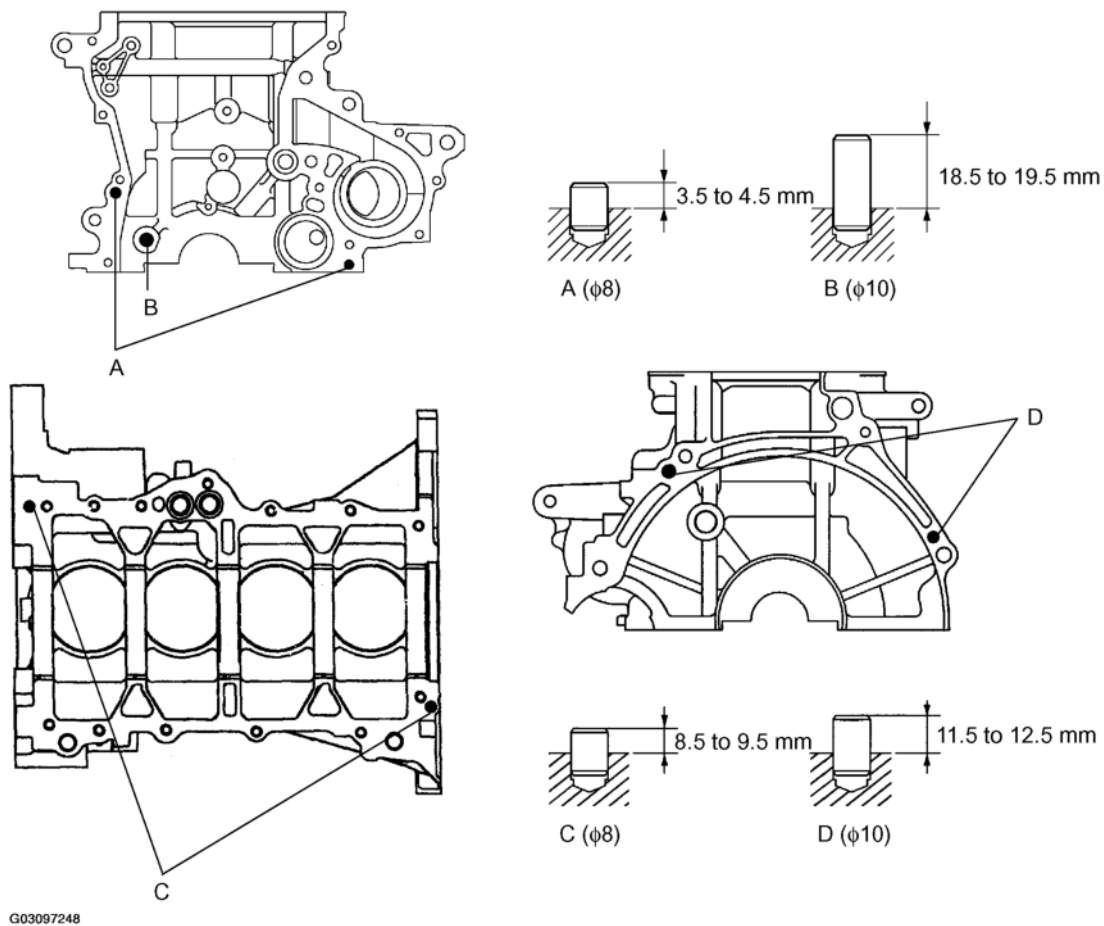
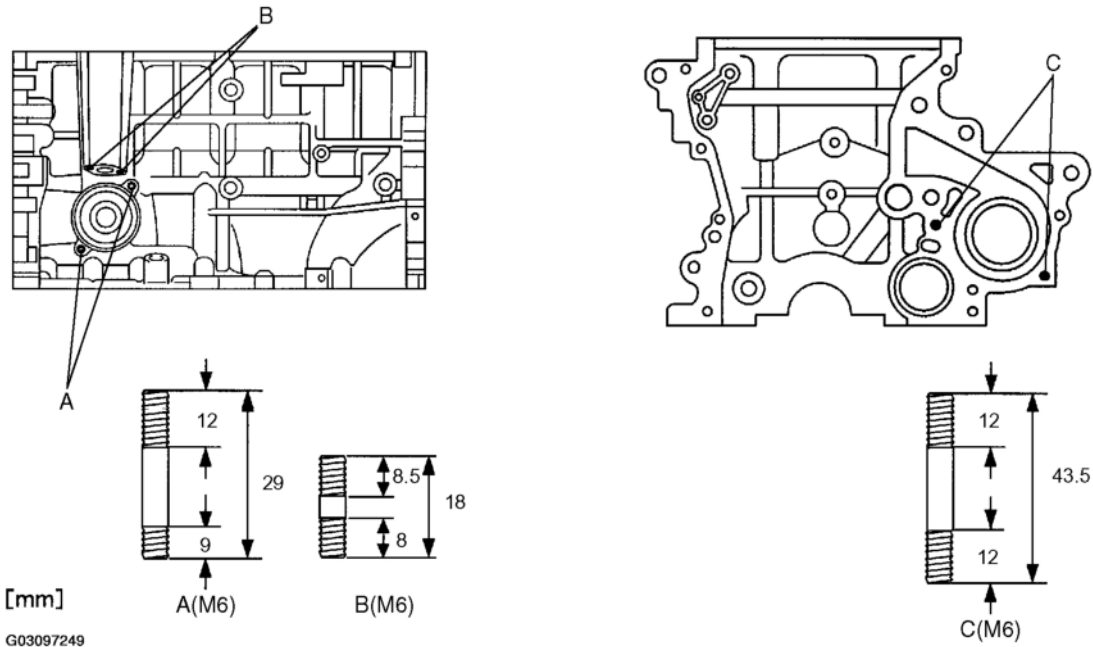


Fig. 365: Identifying Straight Pin Installation Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. INSTALL STUD BOLT

- Using Torx socket wrench E5, install the 6 stud bolts.

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

**Fig. 366: Identifying Stud Bolt Specifications**

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

31. INSTALL CRANKSHAFT

- Install the upper bearing with the oil groove onto the cylinder block, and the lower bearing onto the bearing cap.

NOTE: Do not apply engine oil to the contact surface of the cylinder block or the back side of the bearing.

HINT:

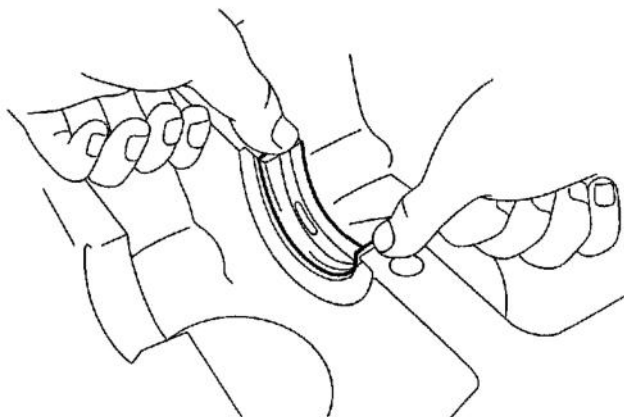
Mass production parts do not have claws as marks. If reusing the mass production parts, measure the clearance of both sides with the bearing in the center of the bearing cap.

Specified clearance:

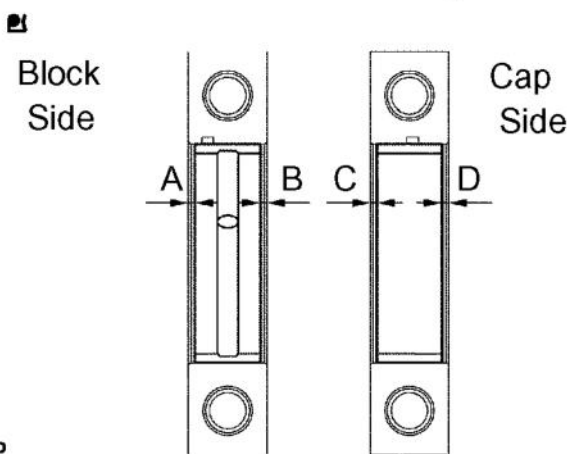
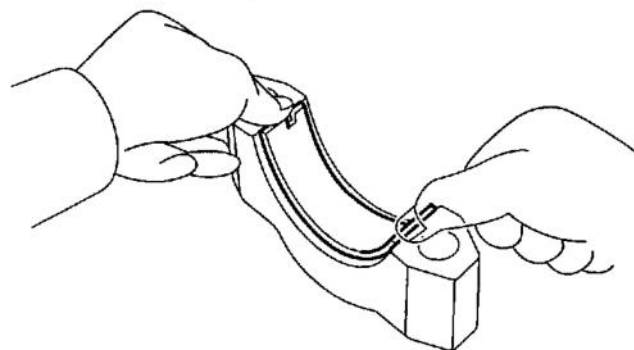
A - B = within 0.8 mm (0.032 in.)

C - D = within 0.4 mm (0.016 in.)

Upper Bearing



Lower Bearing



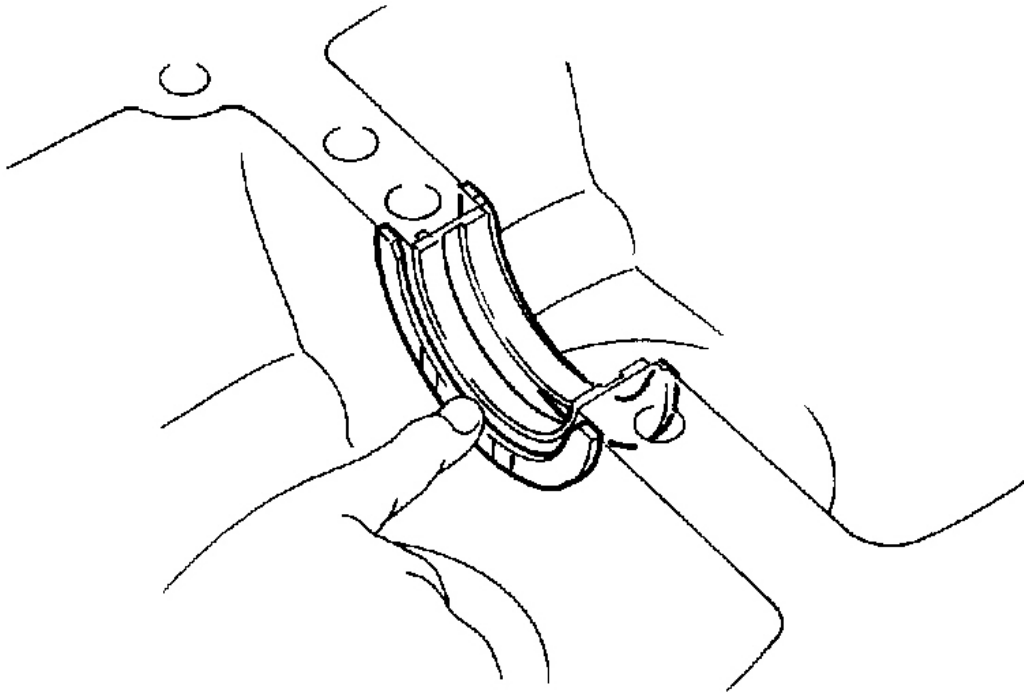
P

G03097250

Fig. 367: Installing Crankshaft

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

- b. Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil grooves facing outward.



G03097251

Fig. 368: Installing Thrust Washers Onto No. 3 Journal Position Of Cylinder Block With Oil Grooves Facing Outward

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

- c. Apply engine oil to the upper bearing and install the crankshaft onto the cylinder block.
- d. Check the front marks and numbers and install the bearing caps onto the cylinder block.

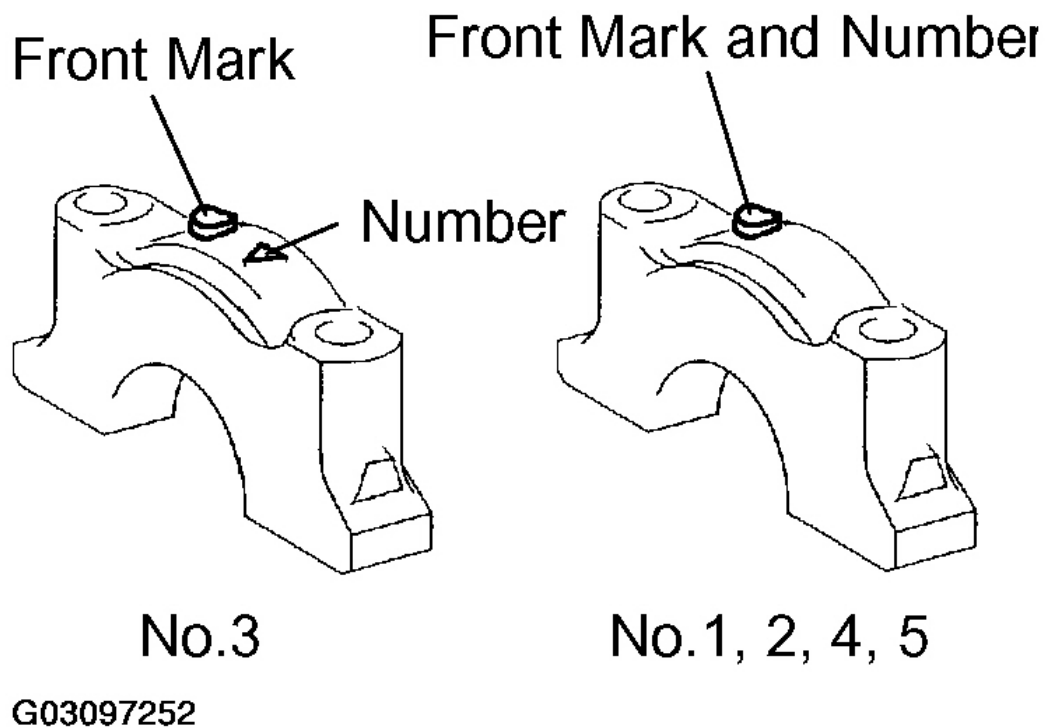


Fig. 369: Checking Front Marks And Numbers And Installing Bearing Caps Onto Cylinder Block

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

- e. Apply a light coat of engine oil to the threads of the bearing cap bolts.
- f. Using several steps, tighten the bolts with SST in the sequence shown in **Fig. 370**.

SST 09011-38121

Torque: 22 N.m (224 kgf.cm, 16 ft.lbf)

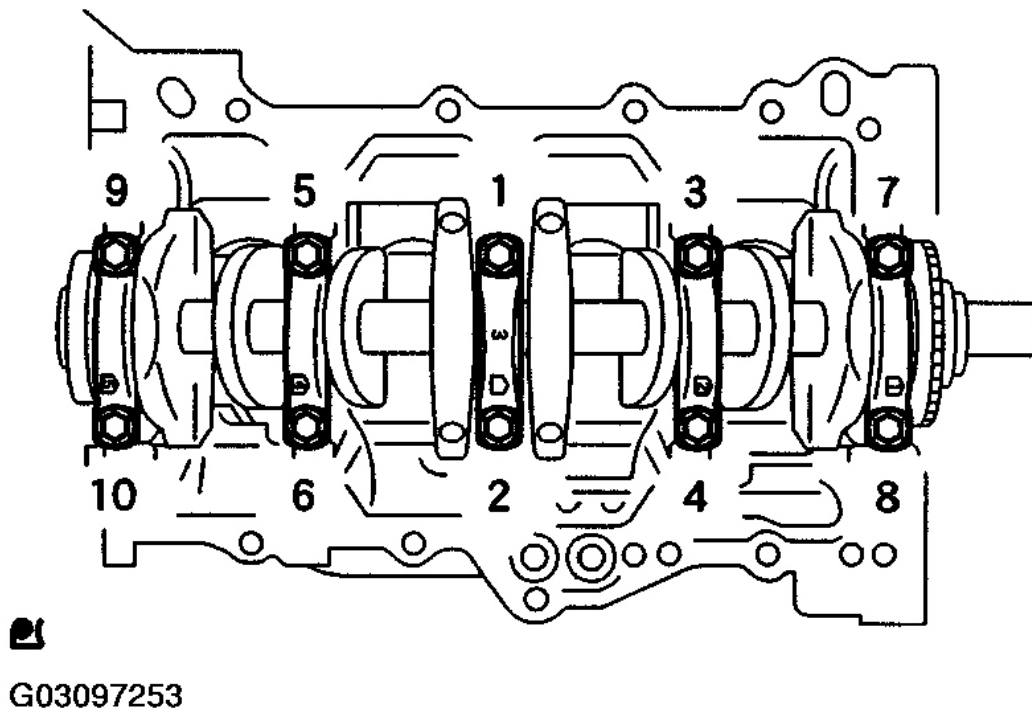
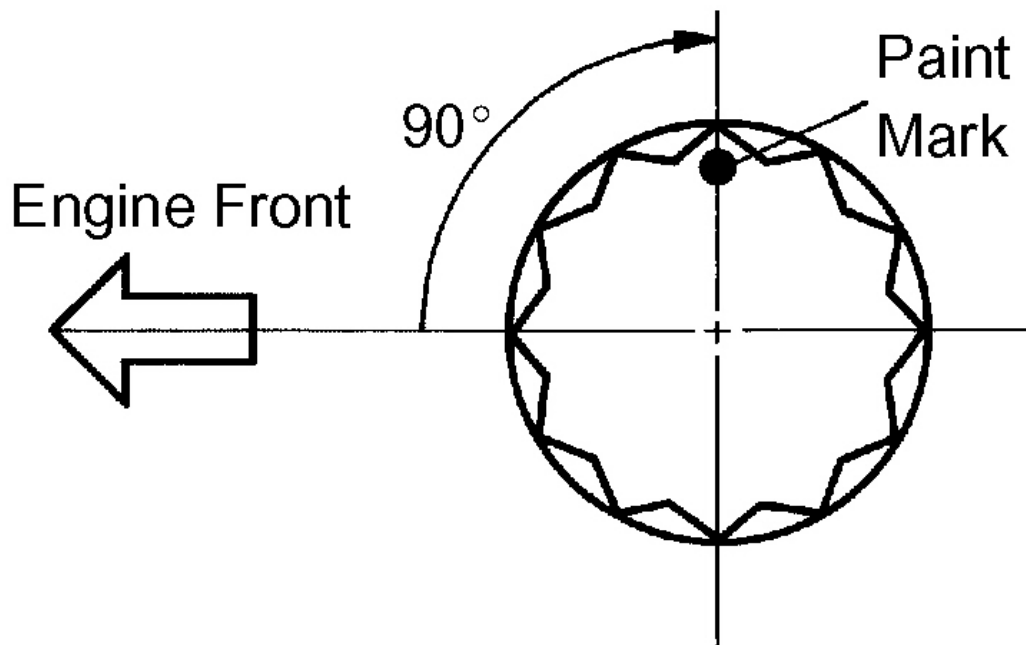


Fig. 370: Tightening Bolts In Sequence

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

NOTE: Check that the crankshaft turns smoothly.

- g. Mark the front of the bearing cap bolts with paint.
- h. Retighten the bearing cap bolts by 90° in the same sequence as step (g).
- i. Check that each painted mark is now at a 90° angle to the front.

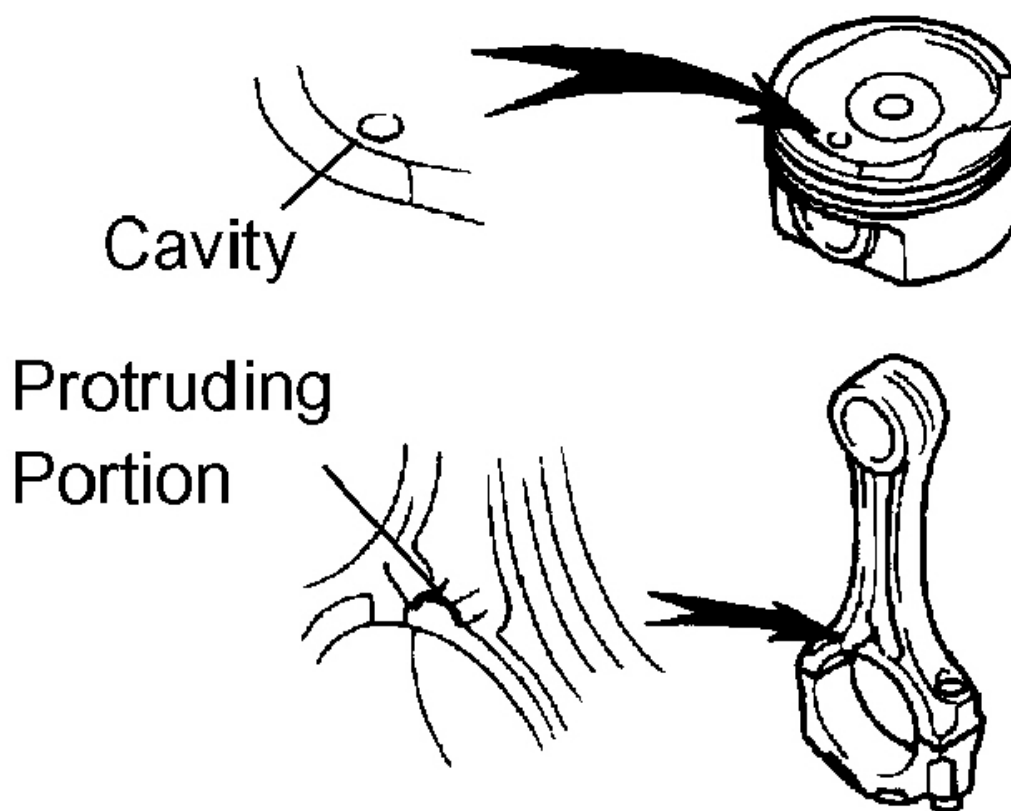


G03097254

Fig. 371: Checking That Each Painted Mark Is At 90° Angle To Front
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL W/PIN PISTON SUB-ASSY

- a. Coat the inner surface of the connecting rod bore and piston pin with engine oil.
- b. Align the cavity of the piston with the protruding portion of the connecting rod.



G03097255

Fig. 372: Aligning Cavity Of Piston With Protruding Portion Of Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST, push in the piston pin.

SST 09221-25026 (09221-00021, 09221-00030, 09221-00190, 09221-00141, 09221-00150)

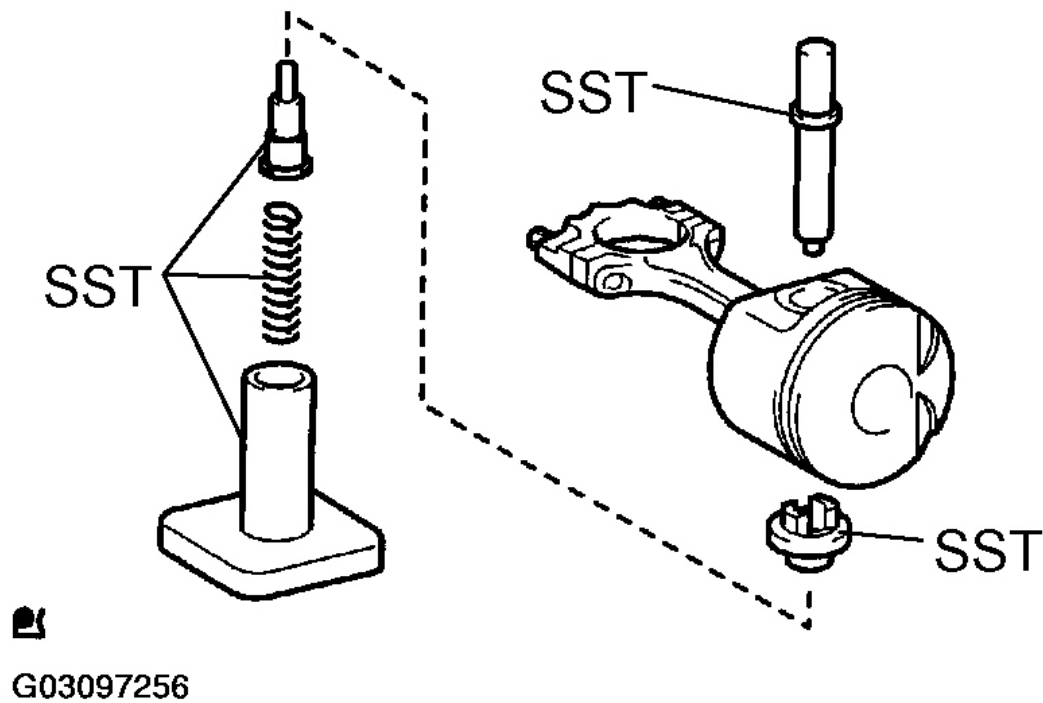


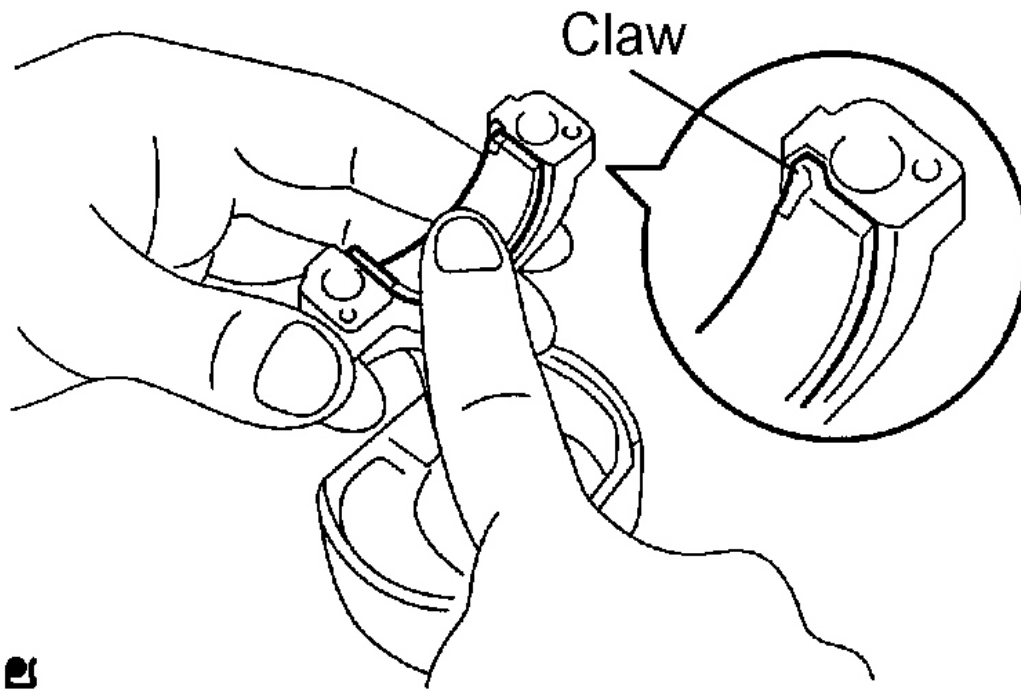
Fig. 373: Pushing In Piston Pin

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

NOTE: Keep the pistons, pins, rings, connecting rods and bearings in the correct order so they can be returned to the original locations when re-assembling.

33. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the grooves of the connecting rod and connecting cap.



G03097257

Fig. 374: Aligning Bearing Claw With Grooves Of Connecting Rod And Connecting Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

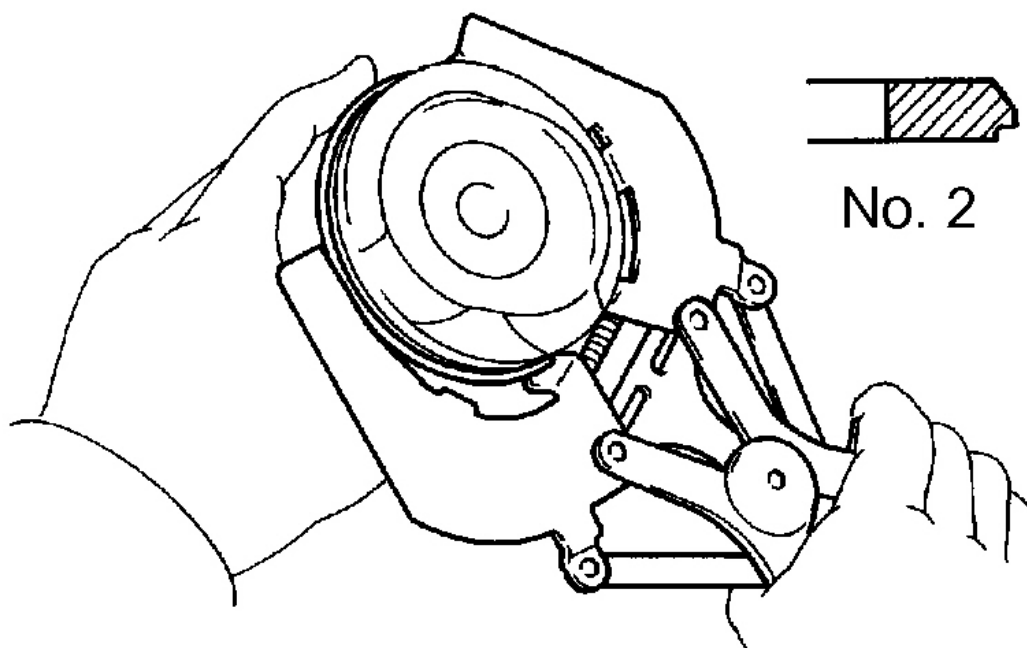
NOTE: Clean the back side of the bearing and the bearing surface of the connecting rod and keep them free of oils.

34. INSTALL PISTON RING SET

HINT:

If reusing the piston rings, install them onto the matched pistons with the surfaces facing correctly.

- a. Install the oil ring expander and 2 side rails by hand.
- b. Using a piston ring expander, install the 2 compression rings.



G03097258

Fig. 375: Installing Piston Ring Set

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

- c. Position the piston rings so that the ring ends are as shown in **Fig. 376**.

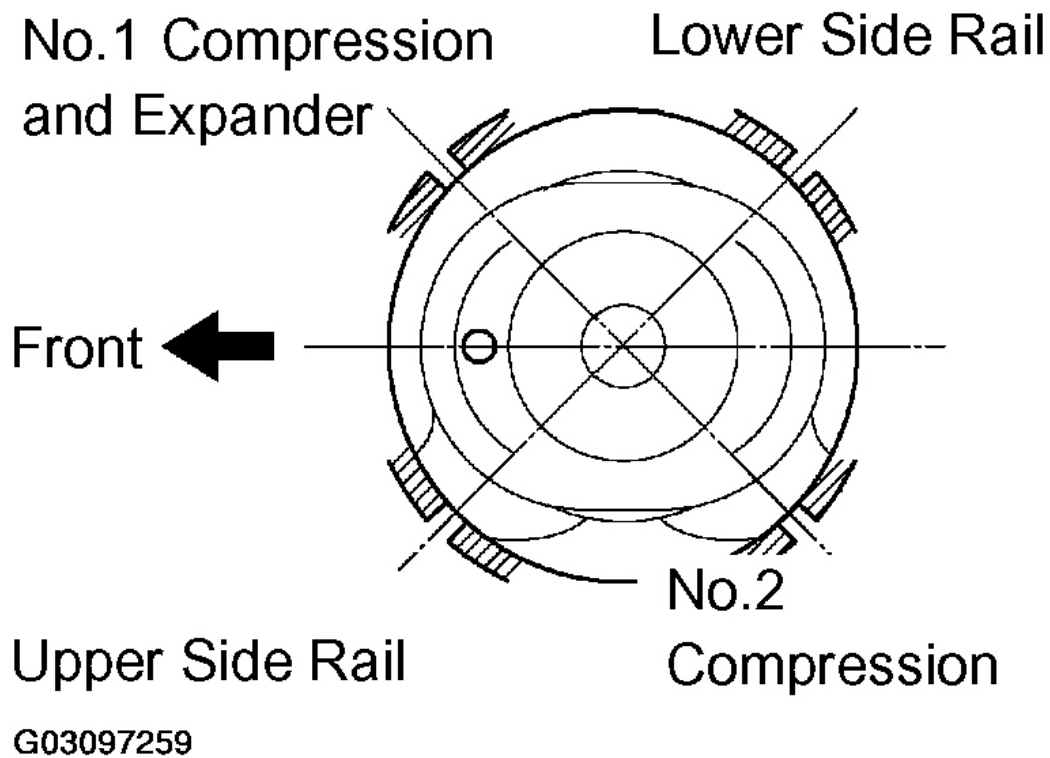


Fig. 376: Positioning Piston Ring Ends

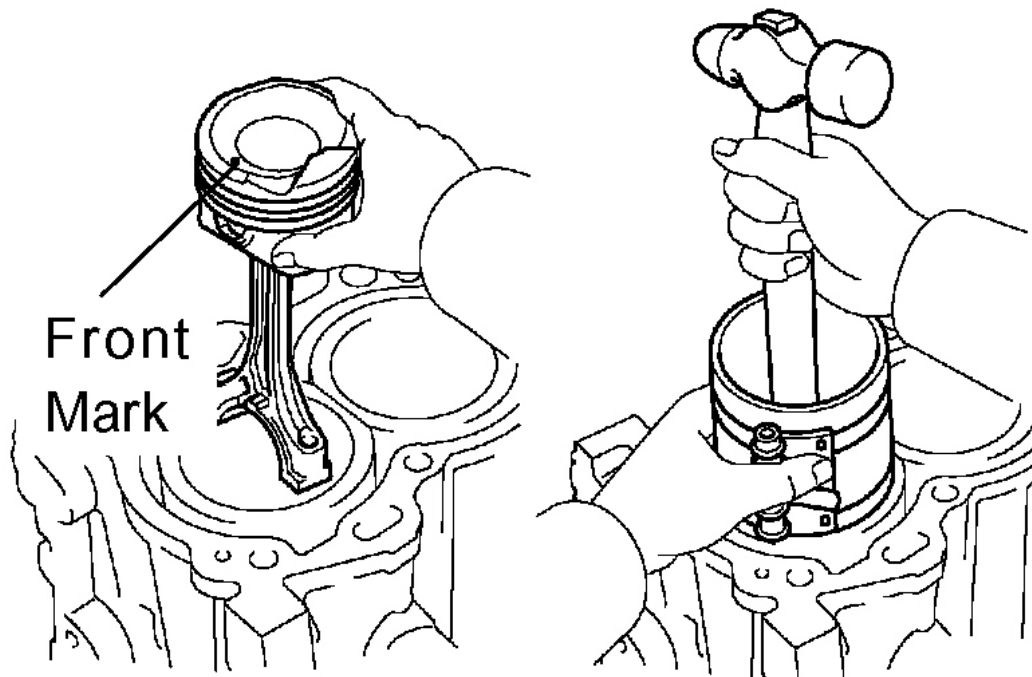
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. INSTALL PISTON SUB-ASSY W/CONNECTING ROD

- Apply engine oil to the cylinder walls, pistons, and surfaces of the connecting rod bearings.
- Check the position of the piston ring ends.
- 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:

- Clean the back side of the bearing and the bearing surface of the connecting rod cap and keep them free of oils.
- Match the numbered connecting rod cap with the correct connecting rod.



G03097260

Fig. 377: Pushing Correctly Numbered Piston And Connecting Rod Assemblies Into Each Cylinder With Front Mark Of Piston Facing Forward

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

- d. Match together the connecting rod and cap in the correct combination. Then install the cap onto the connecting rod, making sure that the front mark on the cap is correctly oriented.

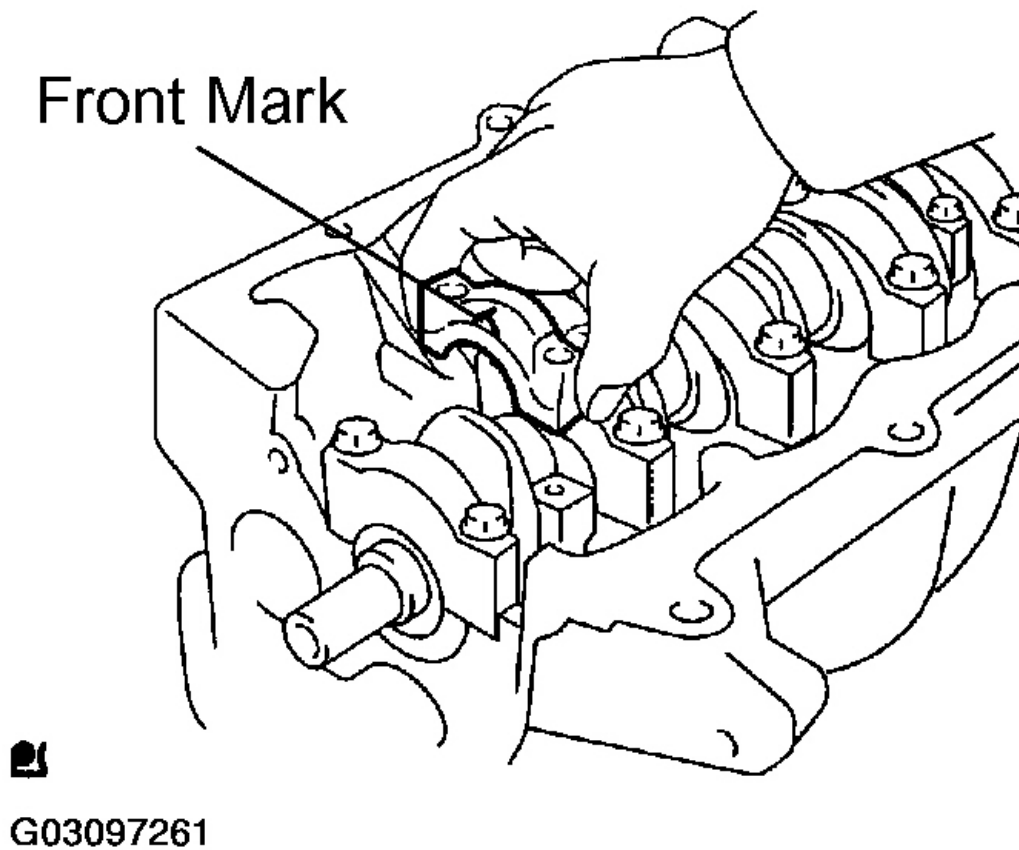
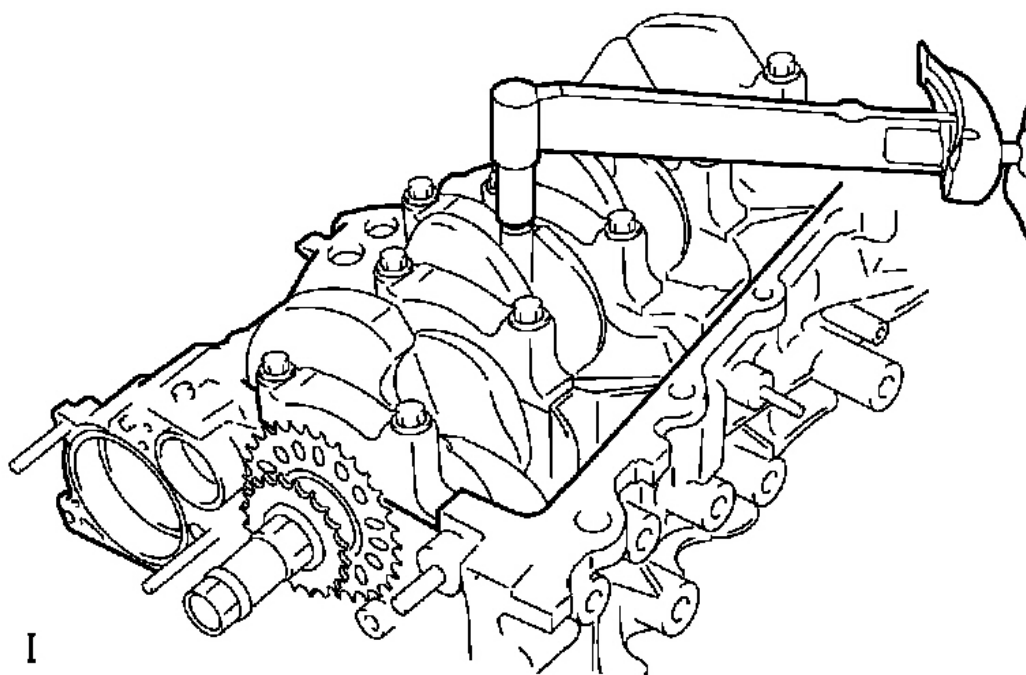


Fig. 378: Installing Cap Onto Connecting Rod, Ensuring That Front Mark On Cap Is Correctly Oriented

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

- e. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.
- f. Using SST, tighten the bolts in several steps to the specified torque.

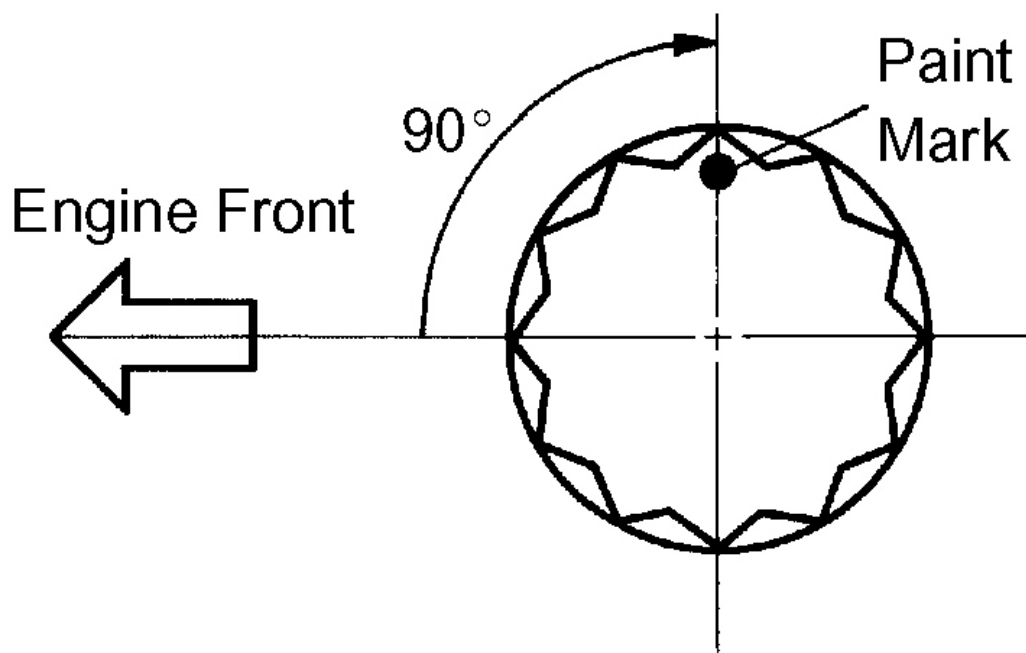
Torque: 15 N.m (153 kgf.cm, 11 ft.lbf)



G03097262

Fig. 379: Tightening Bolts In Several Steps To Specified Torque
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Mark the front of the connecting cap bolts with paint.
- h. Retighten the cap bolts by 90° as shown in **Fig. 380**.
- i. Check that each painted mark is at a 90° angle to the front.



G03097263

Fig. 380: Checking That Each Painted Mark Is At 90° Angle To Front
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Check that the crankshaft turns smoothly.

SST 09205-16010