

2005 ENGINE**Engine Mechanical - xA****ENGINE****INSPECTION**

1. **INSPECT ENGINE COOLANT** (See **REPLACEMENT**)
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)

V-RIBBED BELT DEFLECTION SPECIFICATION

-	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. Belt tension

V-RIBBED BELT TENSION SPECIFICATION

-	New belt N (kg,lb)	Used belt N (kg,lb)
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)

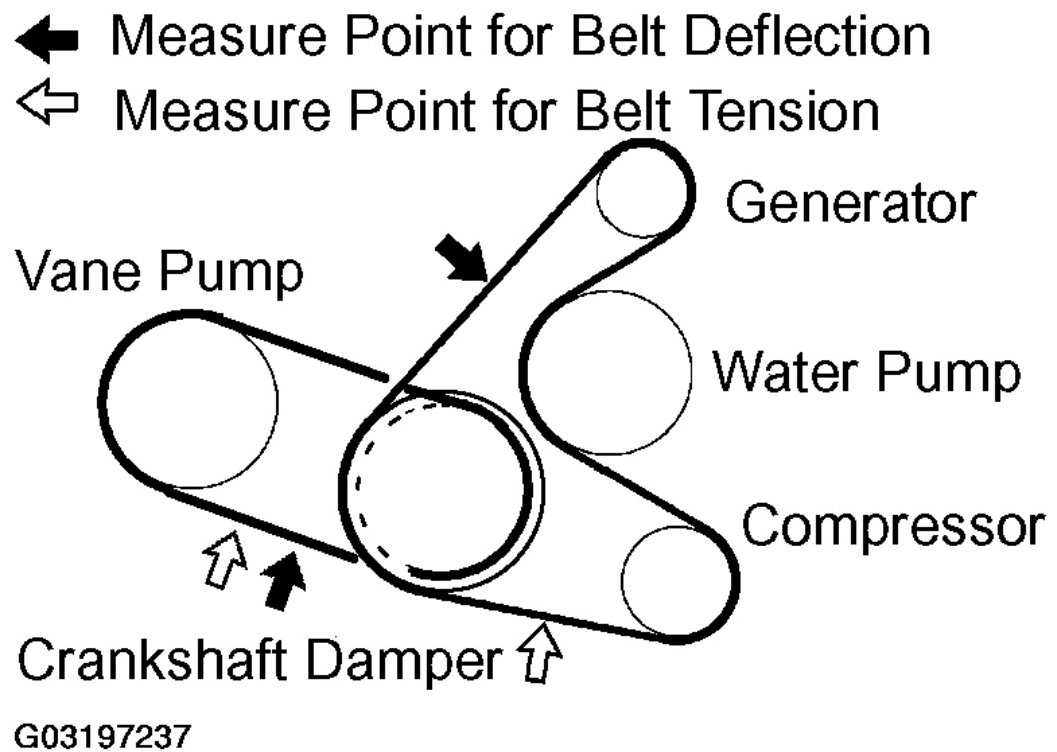


Fig. 1: Identifying V-Ribbed Belt Deflection & Tension Measuring Points
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Check the drive belt deflection at the specified point.
- When installing a new belt, set its tension value as specified.
- When inspecting the belt which is used over 5 minutes, apply the specification of "Used Belt".
- When reinstalling the belt which is used over 5 minutes, adjust its deflection and tension to the intermediate value of each specification of "Used Belt".
- V-ribbed belt tension and deflection should be checked after two revolution of engine cranking.
- When using a belt tension gauge, confirm the accuracy by using a master gauge first.

7. INSPECT IGNITION TIMING

- Warm up the engine.
- When using the hand-held tester or OBD II scan tool:

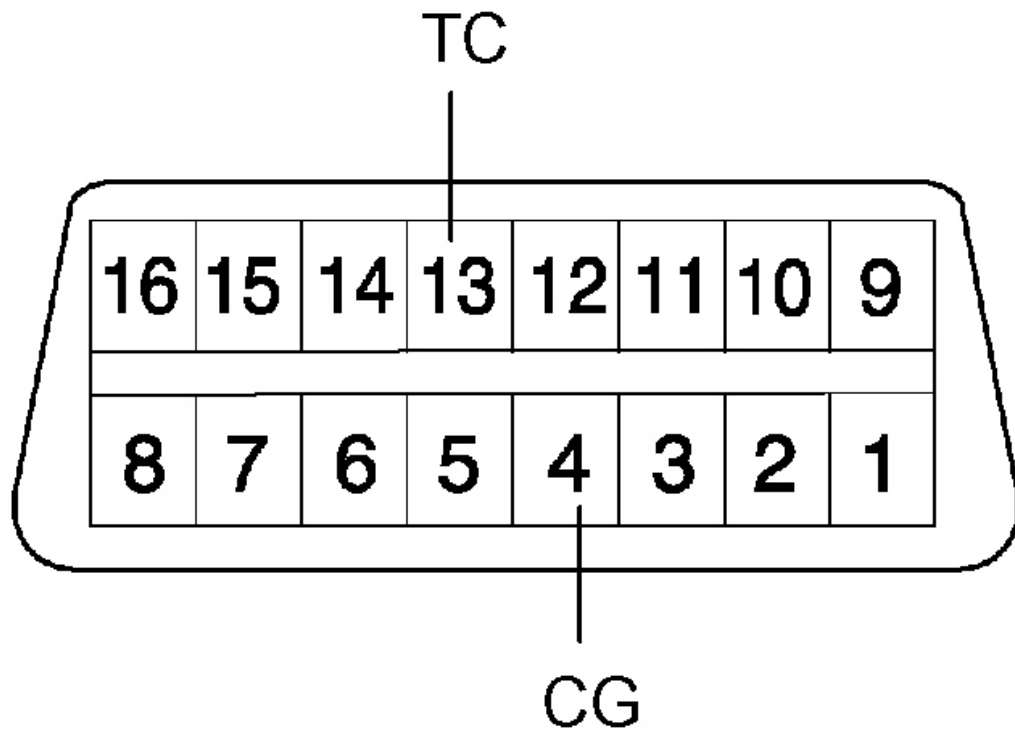
1. Connect the hand-held tester or OBD II scan tool to the DLC3.
2. Enter DATA LIST MODE on the hand-held tester or OBD II scan tool.

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.

- c. When not using the hand-held tester or OBD II scan tool:
 1. Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.



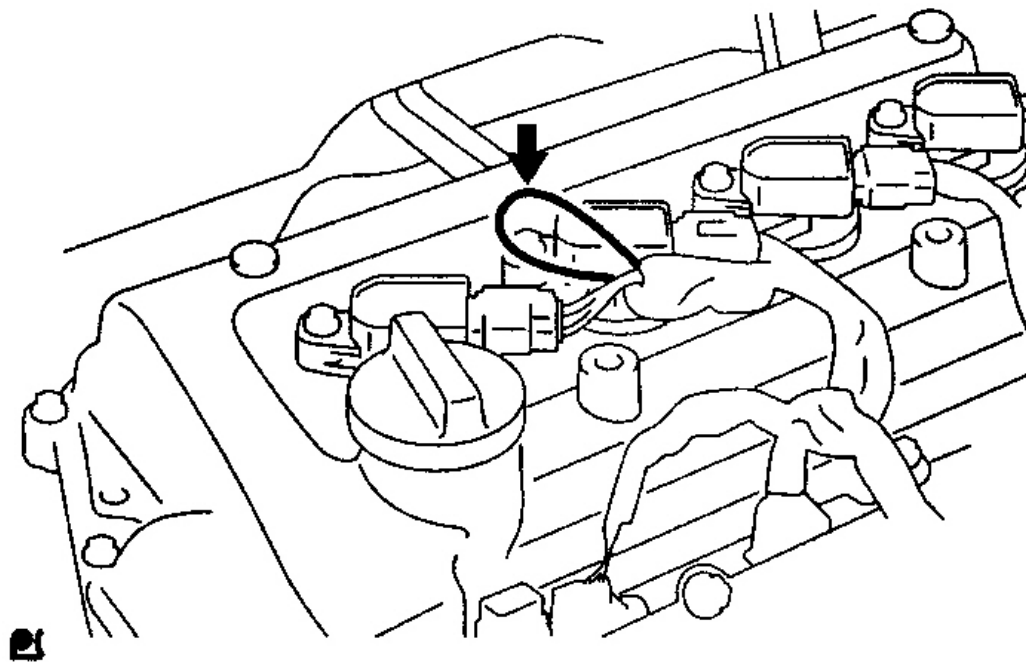
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Fig. 2: Identifying DLC3 Terminals 13 (TC) & 4 (CG)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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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.
2. Remove the cylinder head cover No.2.
 3. Pull out the wire harness as shown in the illustration.



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Fig. 3: Removing Wire Harness

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

4. Connect the clip of the timing light to the engine.

NOTE:

- Use a timing light which can detect the first signal.
- After checking, be sure to tape the wire harness.

5. Inspect ignition timing at idle.

Ignition timing: 8 to 12° BTDC

NOTE: When checking the ignition timing, shift the transmission to the park or neutral position.

HINT:

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

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

Ignition timing: 0 to 14° BTDC

8. Confirm that 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 OBD II scan tool.

Idle speed:

IDLE SPEED SPECIFICATION

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

NOTE:

- When checking the idle speed, the transmission is in the park or neutral position.
- Check the idle speed with cooling fan OFF.
- Switch off all accessories and air conditioning before connecting the hand-held tester or OBD II 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 OBD II scan tool:
 1. Using SST, connect the tachometer test lead to terminal 9 (TAC) of DLC3.

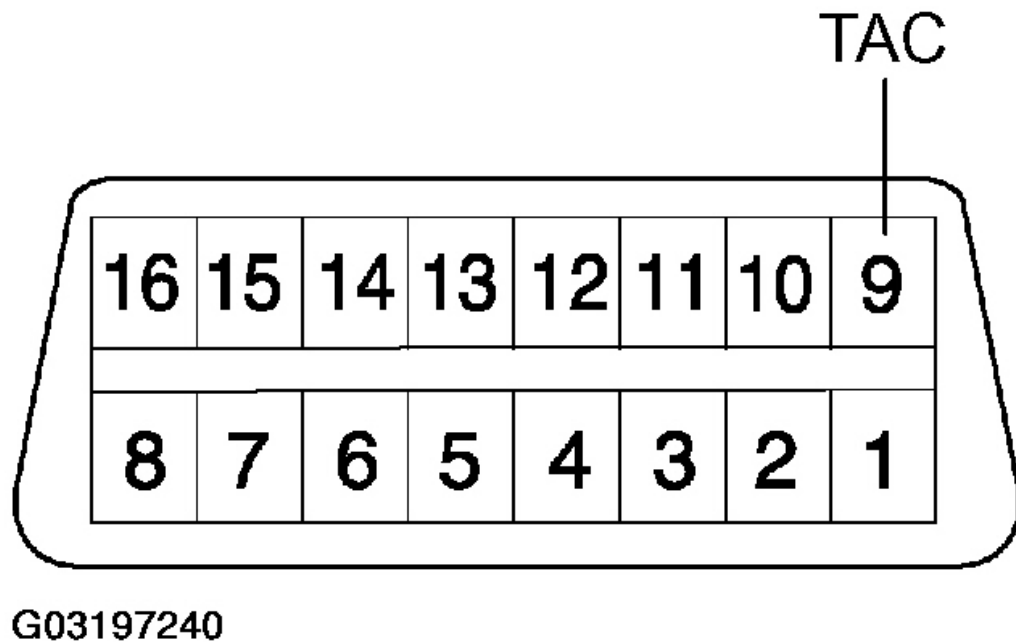


Fig. 4: Identifying Terminal 9 (TAC) Of DLC3
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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2. Check the idle speed.

Idle speed:

IDLE SPEED SPECIFICATION

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

NOTE:

- When checking the idle speed, the transmission is in the park or neutral position.
- Check the idle speed with cooling fan OFF.
- Switch off all accessories and air conditioning before connecting the test lead to the terminal.

9. INSPECT COMPRESSION

- a. Warm up and stop the engine.

- b. Disconnect the injector connectors.
- c. Remove the ignition coils.
- d. Remove the spark plugs.
- e. Inspect 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)

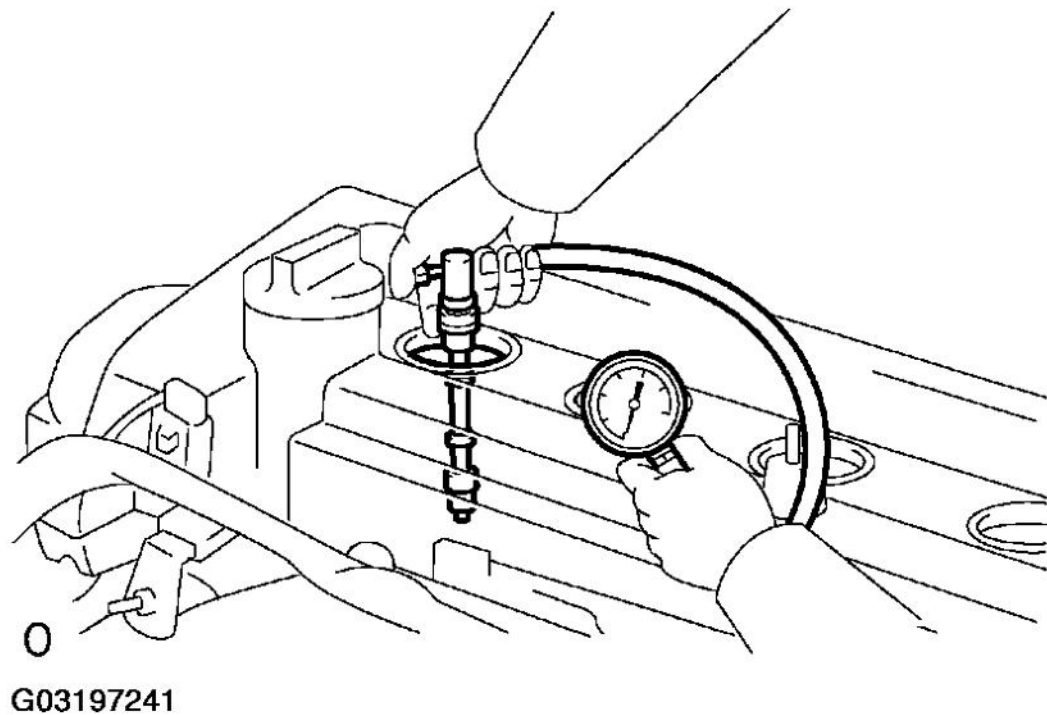


Fig. 5: Checking Cylinder Compression Pressure
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

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

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

HINT:

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

10. INSPECT CO/HC

- a. Start the engine.

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

HINT:

When doing the 2 mode (with the engine is in the idle and 2,500 rpm) test, these procedures may vary according to local rules.

- e. If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
 1. Check the heated oxygen sensor operation. (See **INSPECTION**)
 2. See the table below for possible causes, and then inspect the applicable causes and repair it if necessary.

CO/HC PROBLEM DIAGNOSTIC

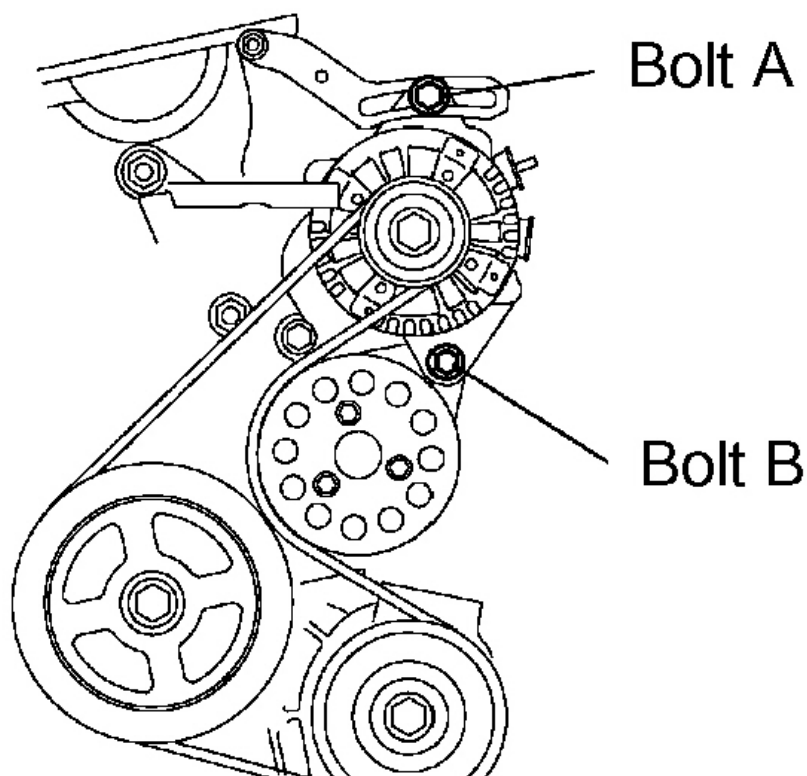
CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignition: • Incorrect timing • Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaks in intake and exhaust valves 4. Leaks in cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: • PCV hoses • Intake manifold • Throttle body • ISCV • 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

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



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Fig. 6: Removing Fan & Generator V Belt Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE VANE PUMP V BELT**
 - a. Loosen bolts A and B.

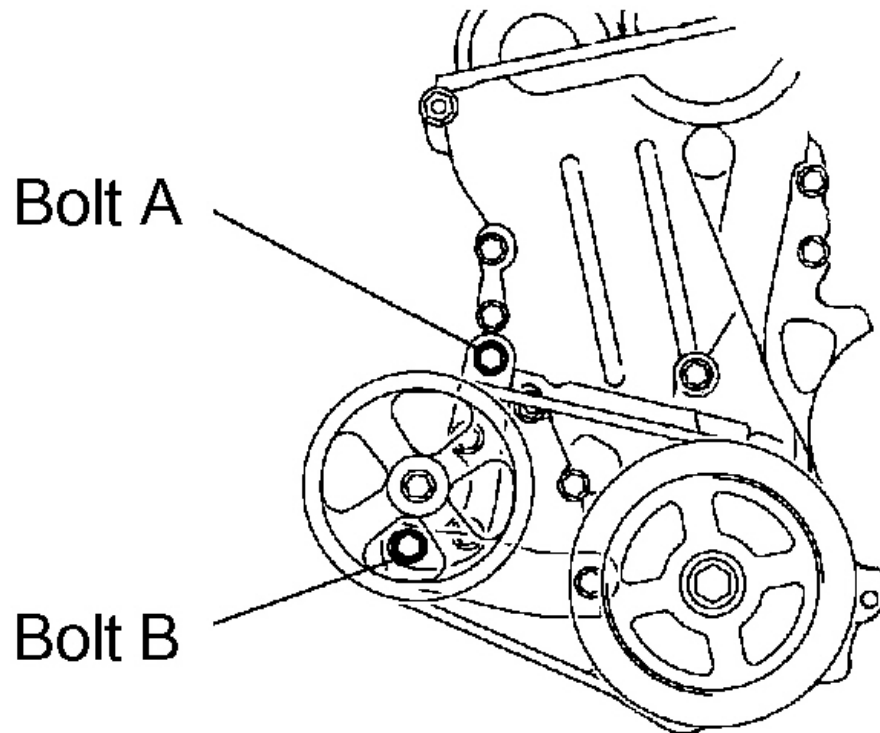
- b. Release the V-ribbed belt tension, and remove the V-ribbed belt.

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.



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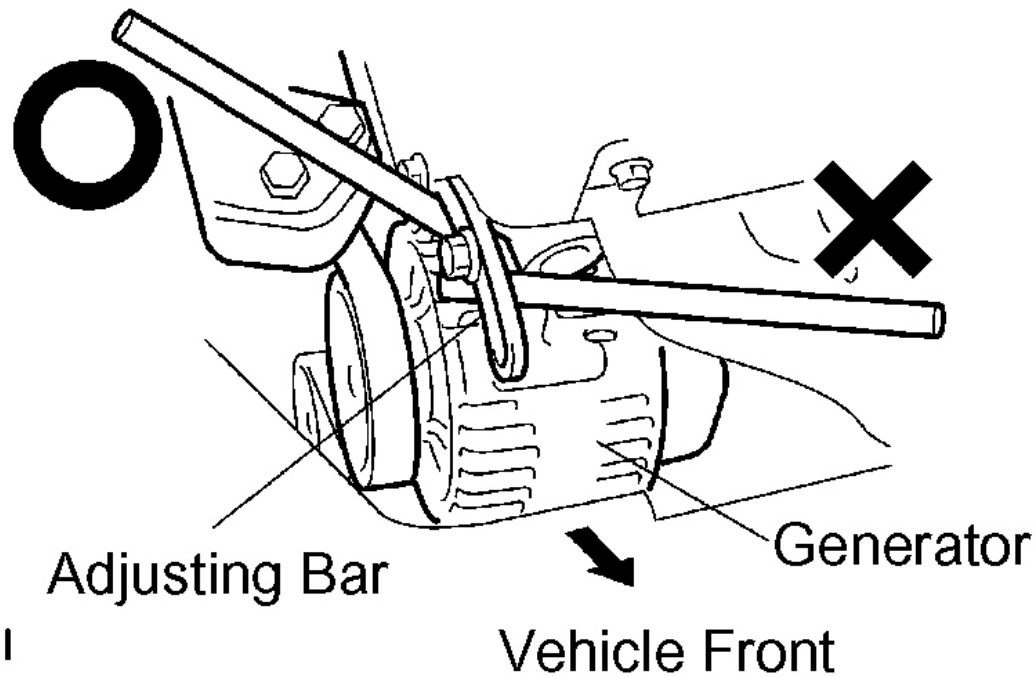
Fig. 7: Removing Vane Pump V Belt Bolts

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

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.



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Fig. 8: Pushing Adjusting Bar Towards Vehicle Front For Adjusting V-Ribbed Belt Tension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

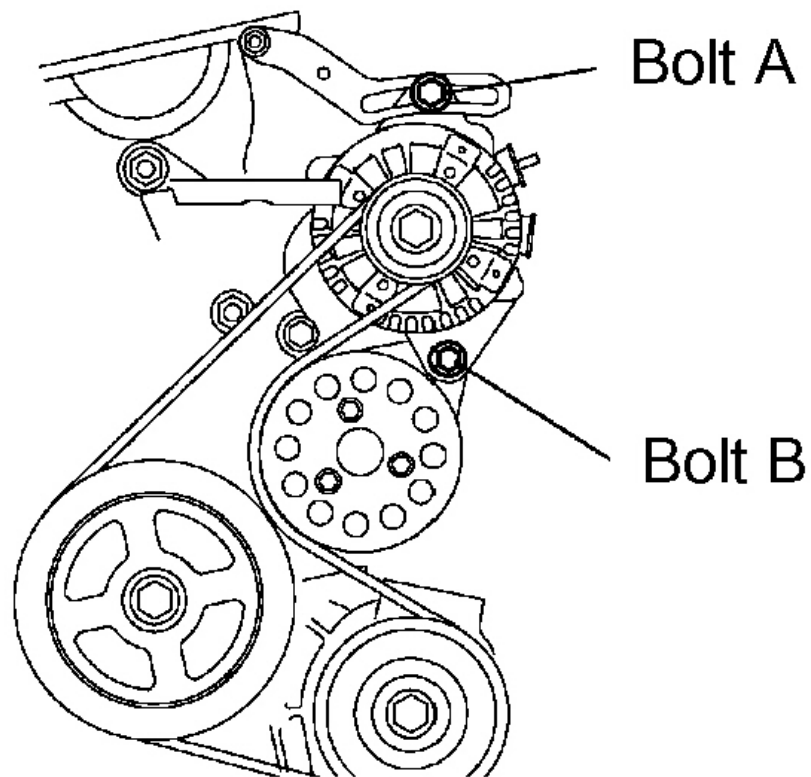
Torque:

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

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

7. ADJUST VANE PUMP V BELT

- a. Using the bar, adjust the V-ribbed belt tension.

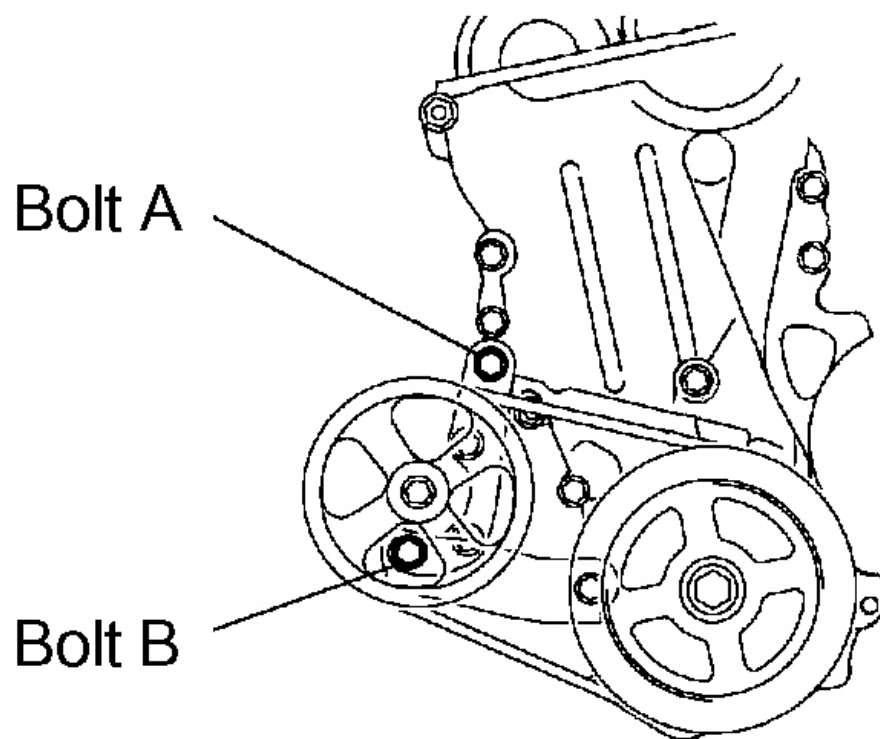


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Fig. 9: Tightening Fan & Generator V Belt Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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



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Fig. 10: Tightening Vane Pump V Belt Bolts

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

8. INSPECT DRIVE BELT DEFLECTION AND TENSION (See INSPECTION)

VALVE CLEARANCE

ADJUSTMENT

1. REMOVE CYLINDER HEAD COVER NO.2

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

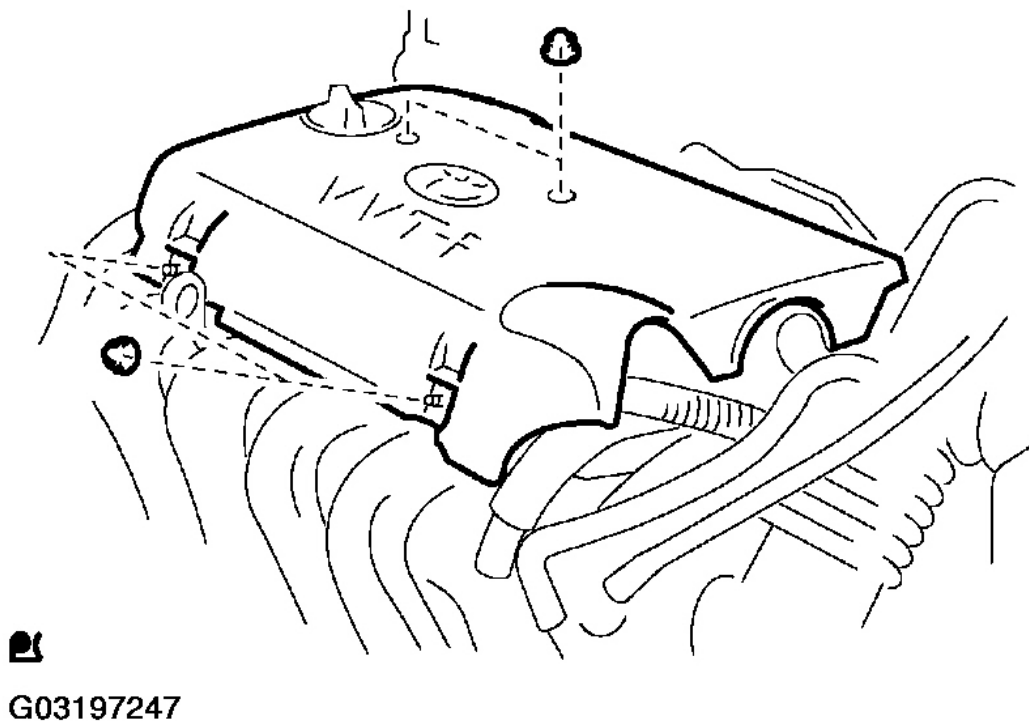
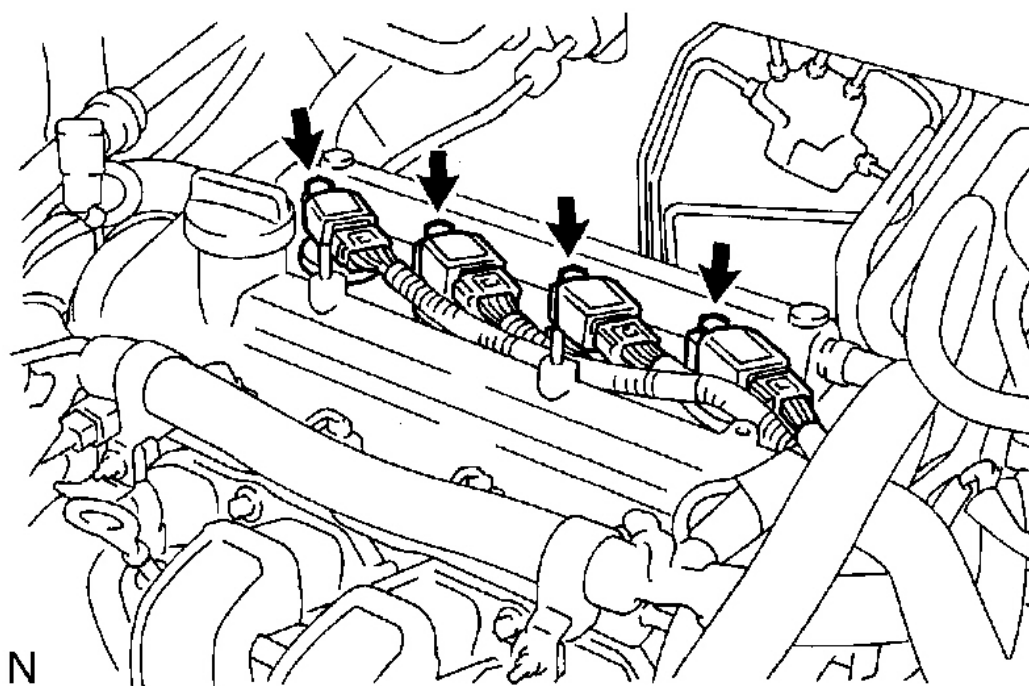


Fig. 11: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE IGNITION COIL No. 1

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



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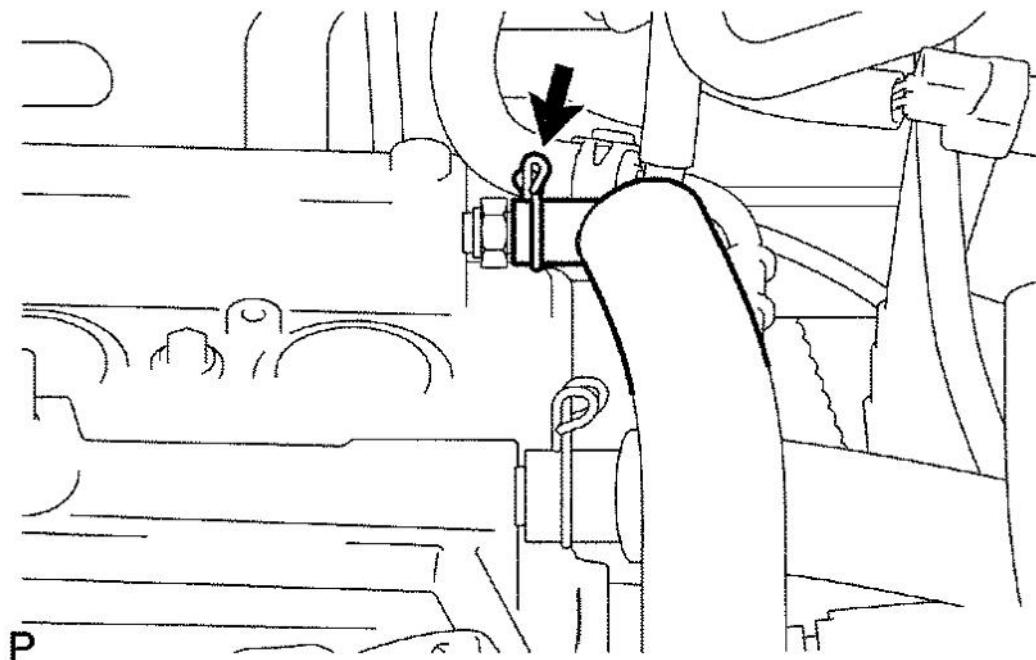
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Fig. 12: Removing Ignition Coils

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

3. DISCONNECT VENTILATION HOSE

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



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Fig. 13: Disconnecting Ventilation Hose From Cylinder Head Cover
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.

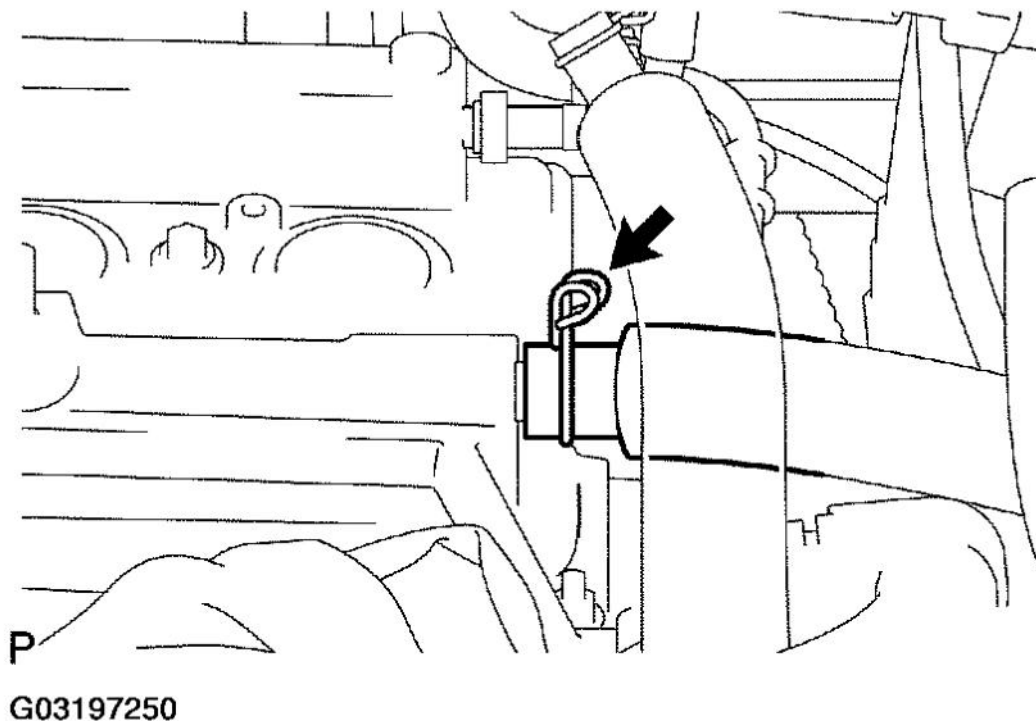


Fig. 14: Disconnecting Ventilation Hose No. 2 From Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE CYLINDER HEAD COVER SUB-ASSY

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

6. REMOVE ENGINE UNDER COVER RH

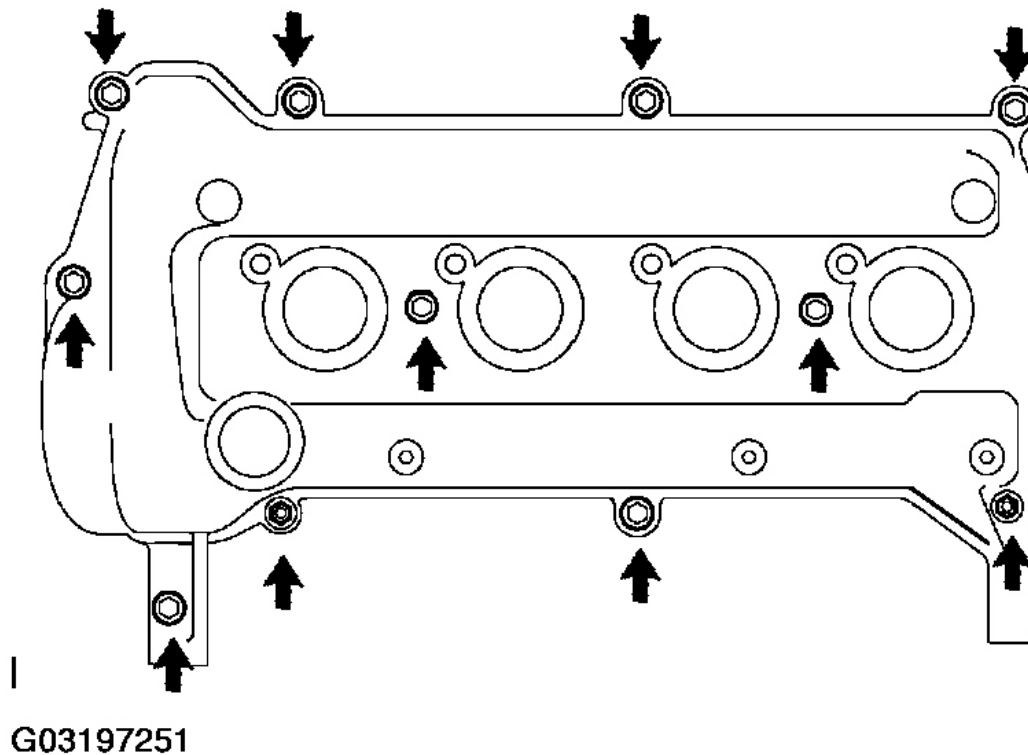


Fig. 15: Removing Cylinder Head Cover

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

7. INSPECT VALVE CLEARANCE

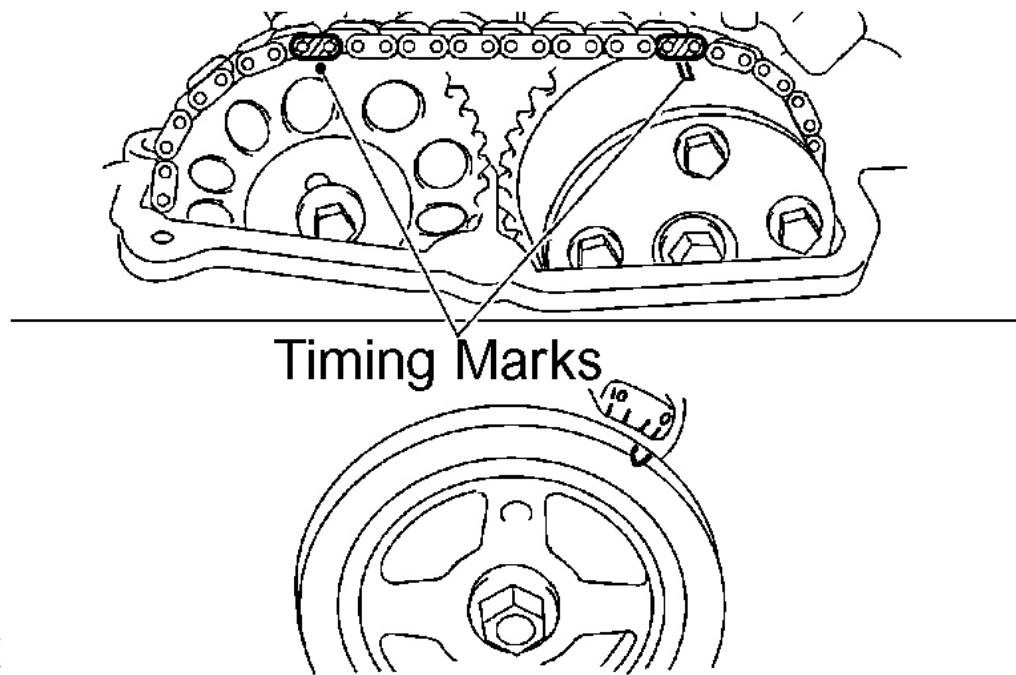
HINT:

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

- a. Set the No. 1 cylinder to 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 facing upward as shown in the illustration.

HINT:

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



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Fig. 16: Identifying Timing Marks On Camshaft Timing Sprocket & Camshaft Timing Gear

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

- b. Check the valves indicated in the illustration.

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

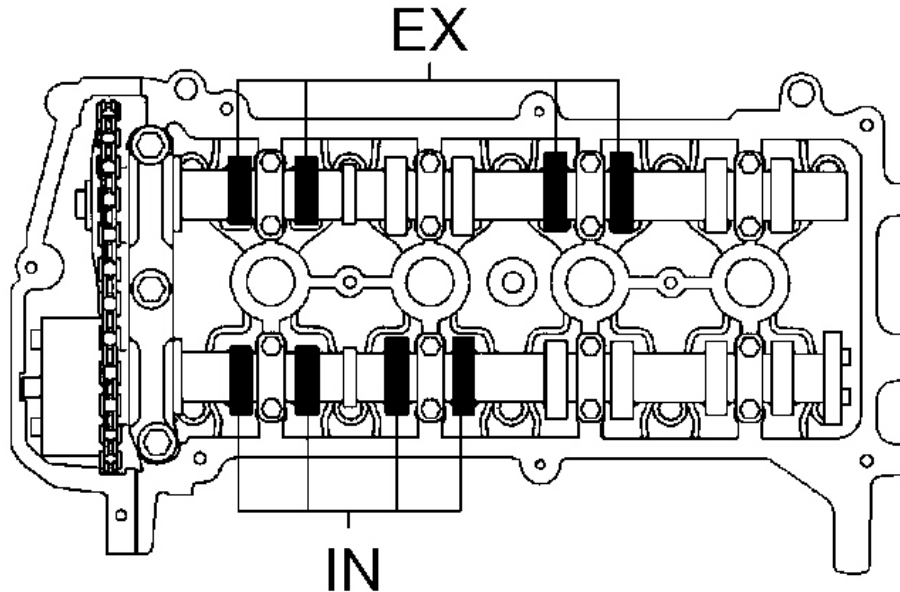
Valve clearance (Cold) :

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.
- c. Turn the crankshaft 1 complete revolution until its timing notch and the timing mark "0" of the chain cover are aligned.

No.1 Cylinder TDC/Compression



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Fig. 17: Setting No. 1 Cylinder To TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

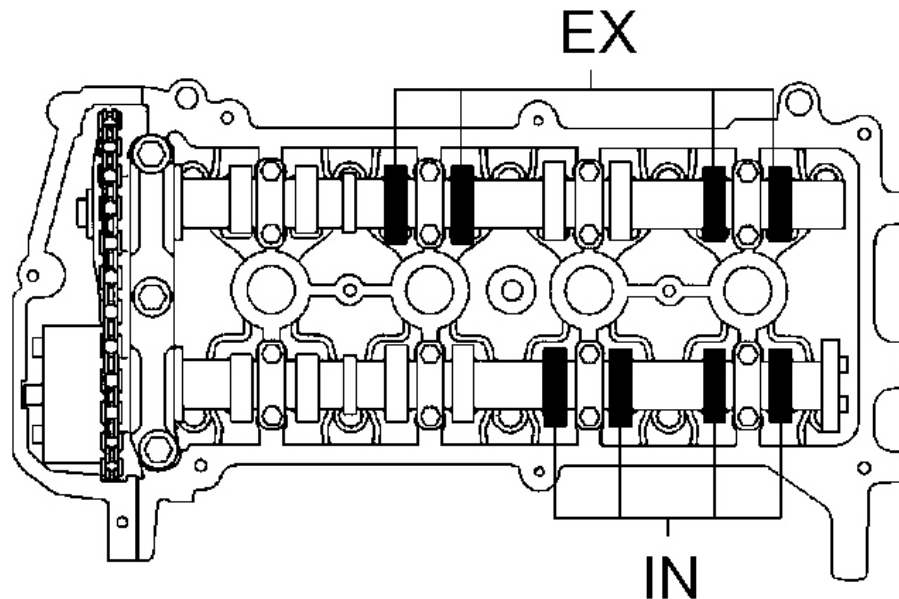
Valve clearance (Cold) :

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

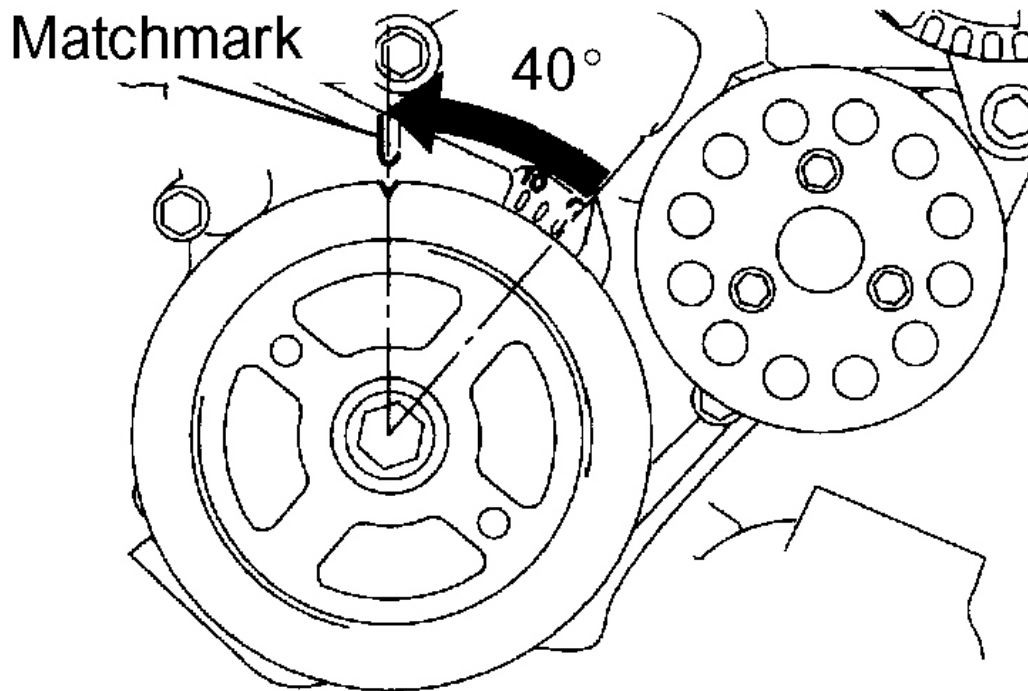


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Fig. 18: Setting No. 4 Cylinder To TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.



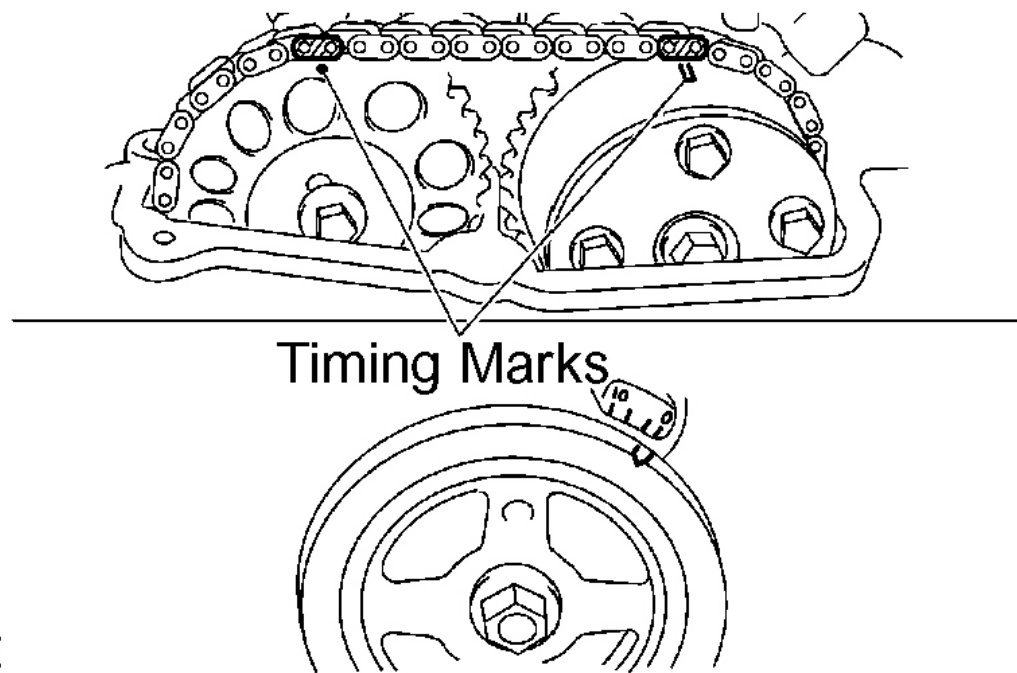
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Fig. 19: Rotating Crankshaft Damper Counterclockwise 40° From TDC & Align Its Timing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 the illustration.

HINT:

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



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Fig. 20: Identifying Timing Marks On Camshaft Timing Sprocket & Valve Timing Controller Assembly

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.

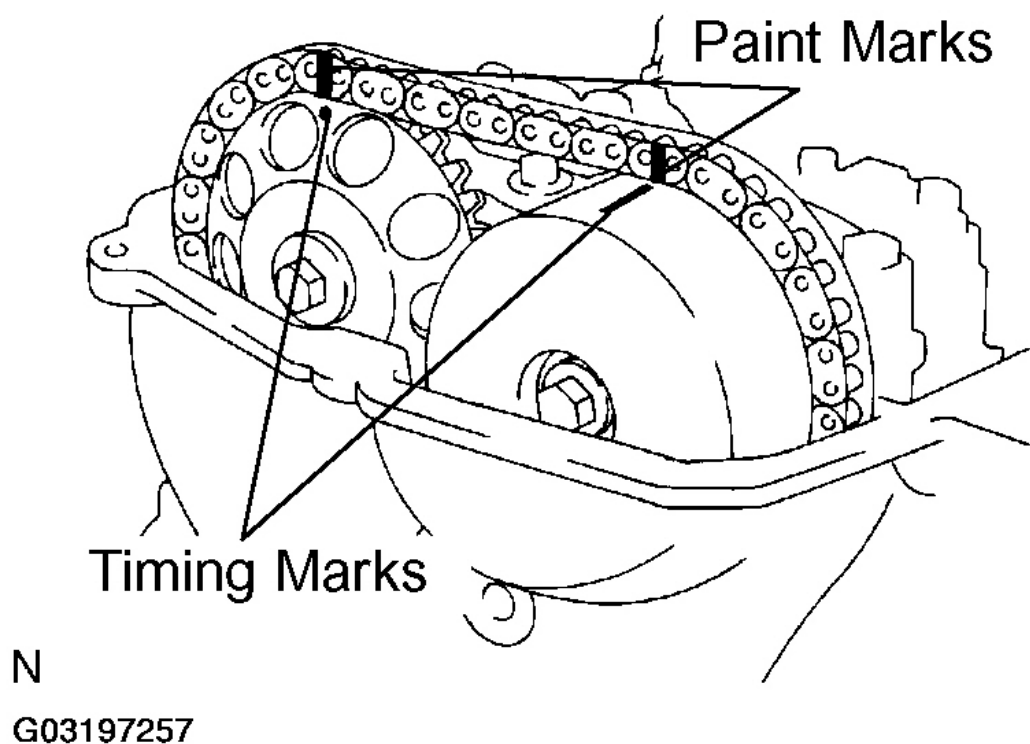
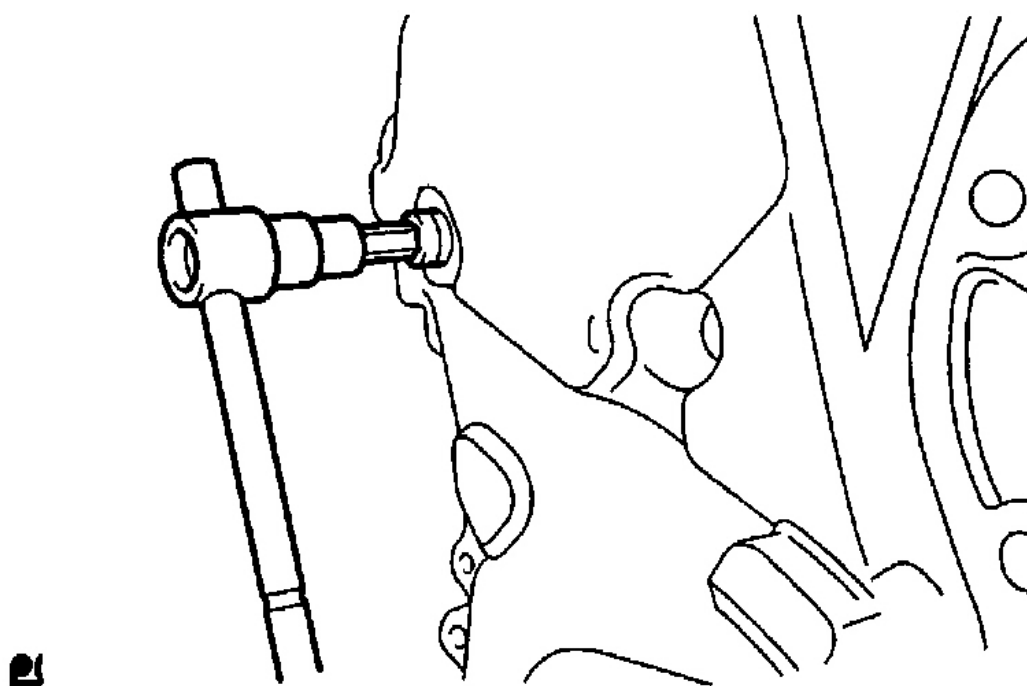


Fig. 21: Putting Paint Marks On Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



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Fig. 22: 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.

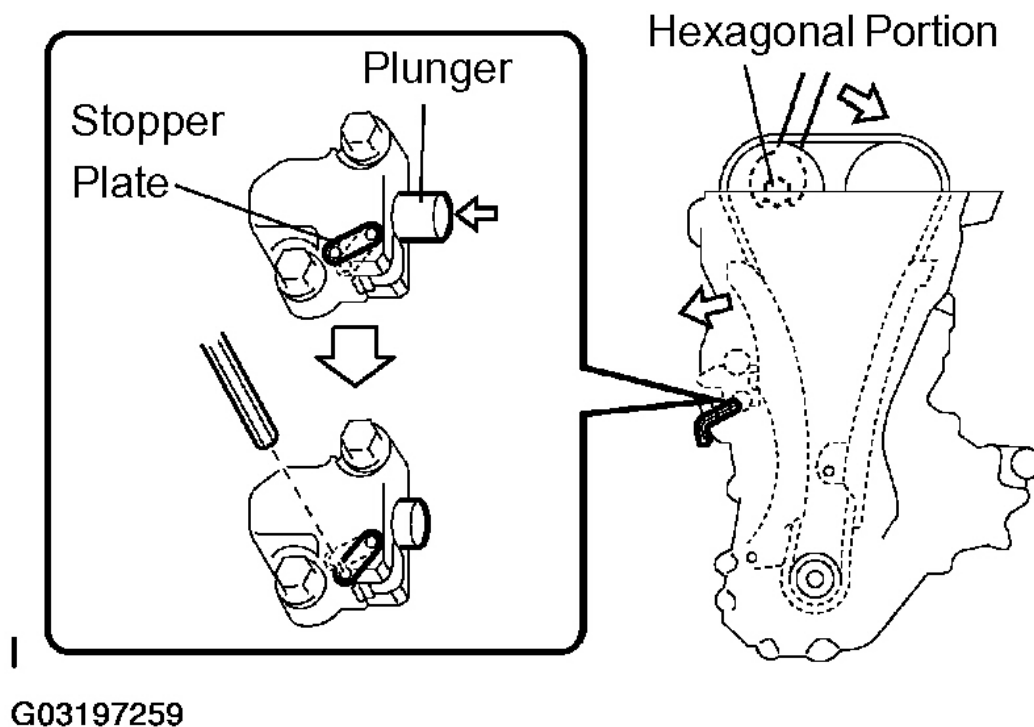


Fig. 23: Pushing In Plunger Of Chain Tensioner

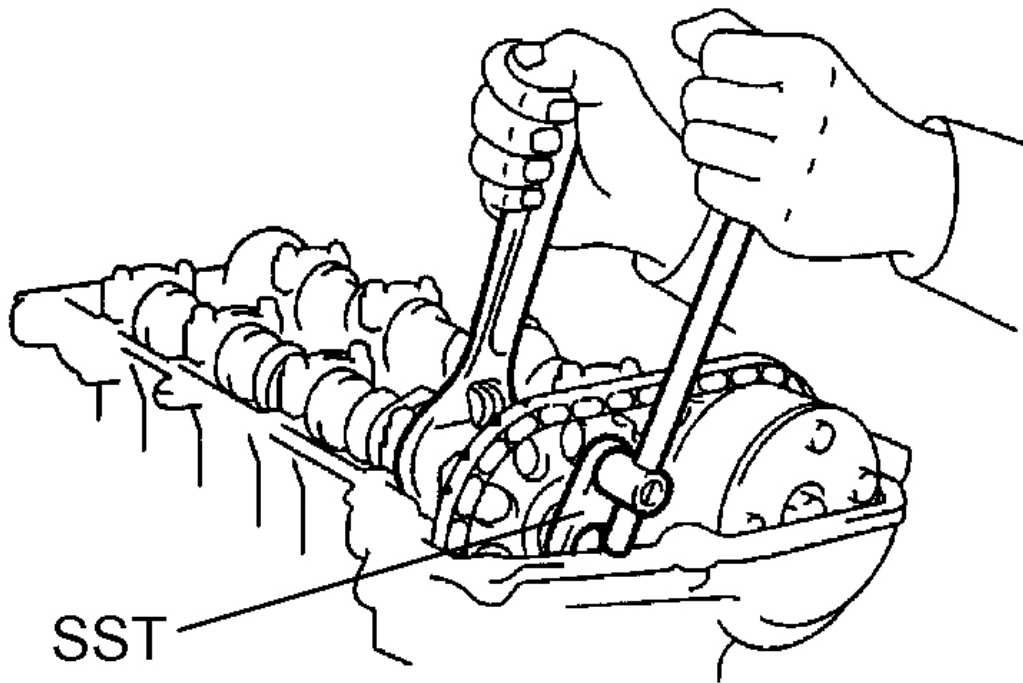
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

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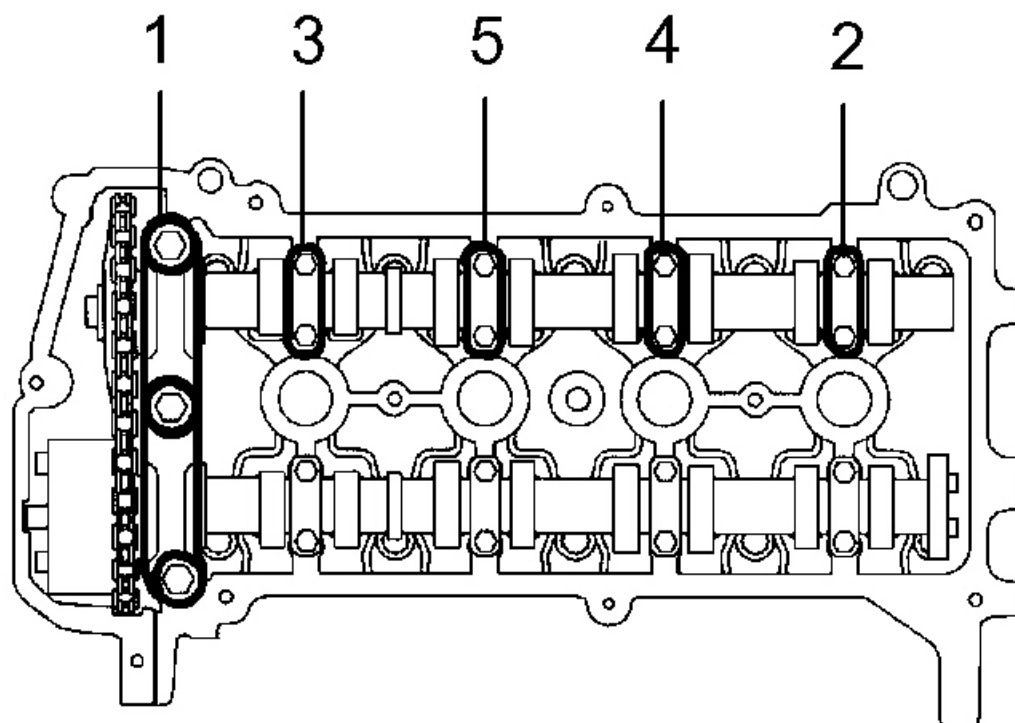
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Fig. 24: Removing Camshaft Bolt

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 the illustration, then remove the 5 bearing caps.

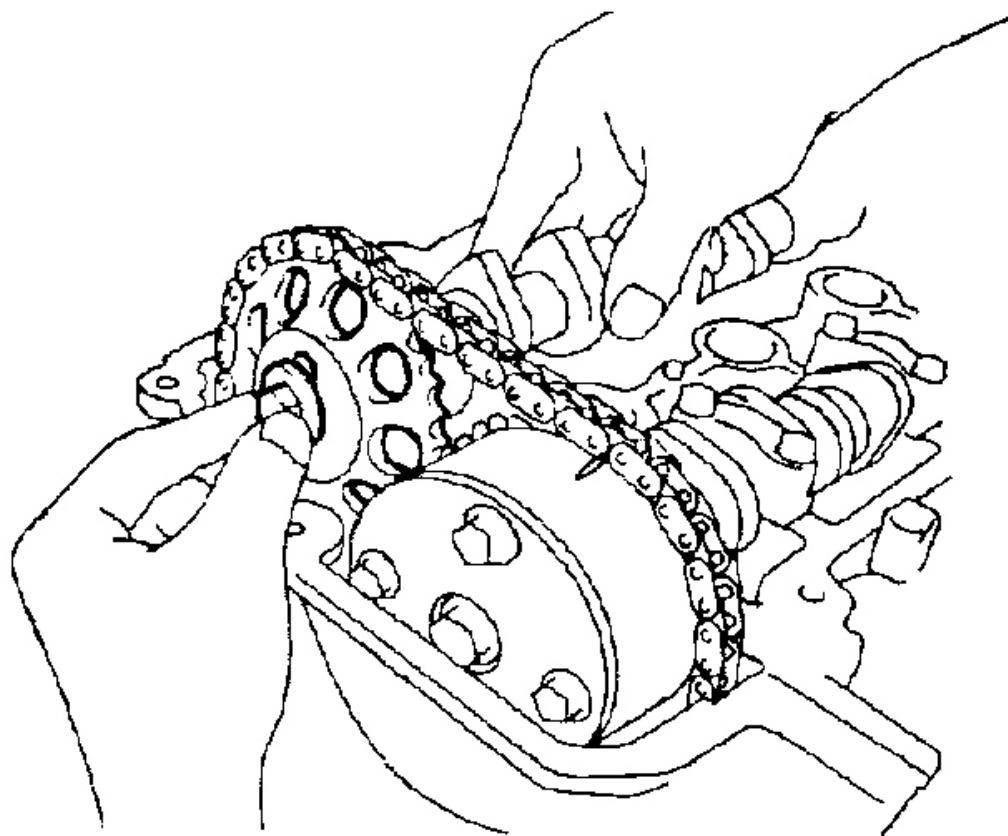
NOTE: Loosen each bolt uniformly keeping the camshaft level.



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Fig. 25: Identifying Removal Sequence Of Bearing Cap Bolts
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 the camshaft timing sprocket.



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Fig. 26: Removing Fringe Bolt

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 the illustration, then remove the 4 bearing caps.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

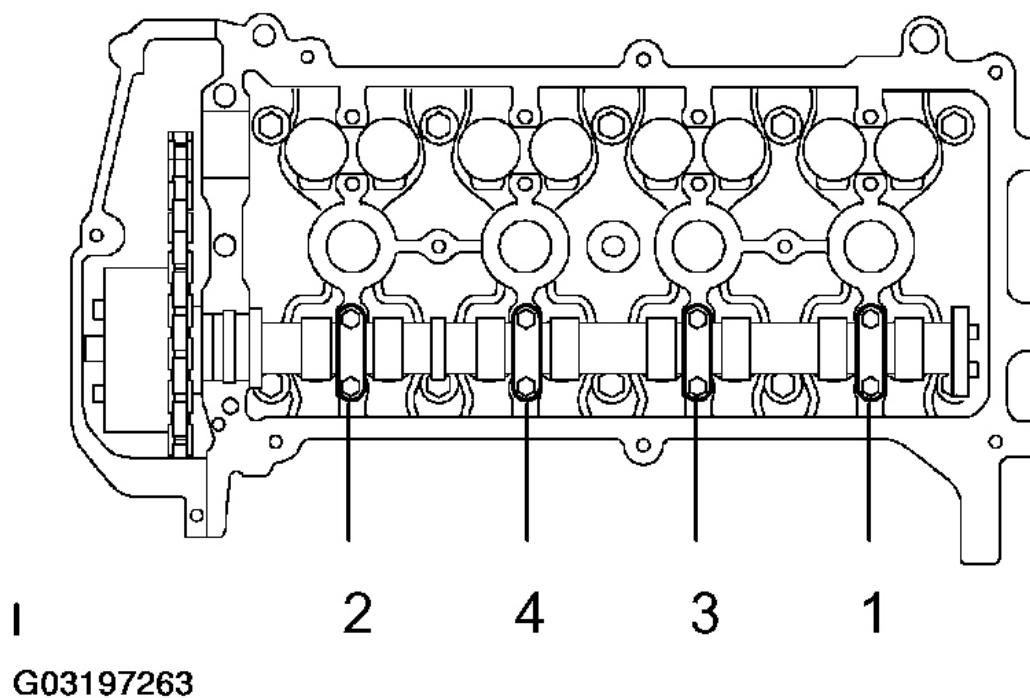
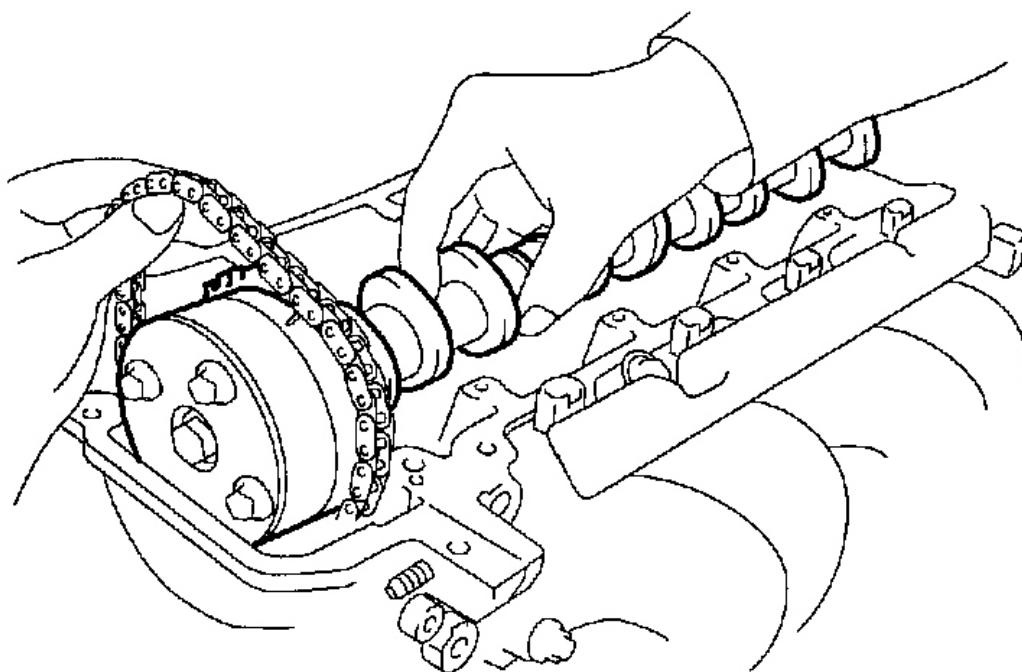


Fig. 27: Identifying Removal Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

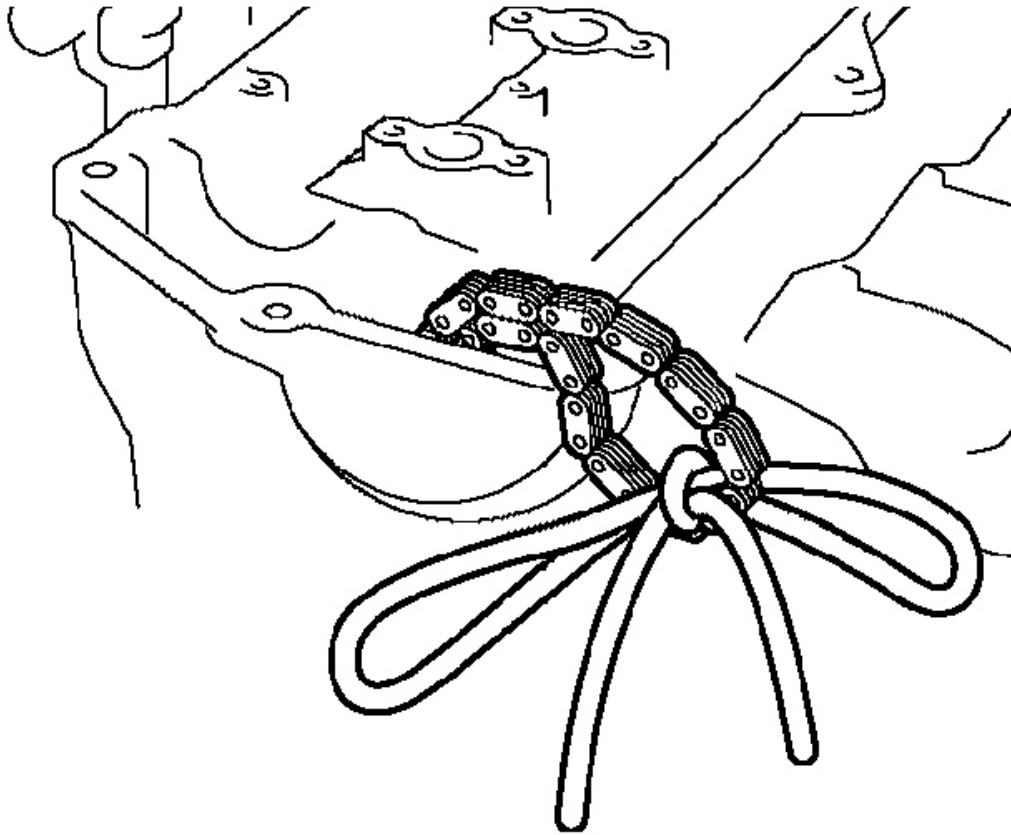


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Fig. 28: Removing Camshaft & Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Tie the timing chain with a string as shown in the illustration.

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

**G03197265****Fig. 29: Tie 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.

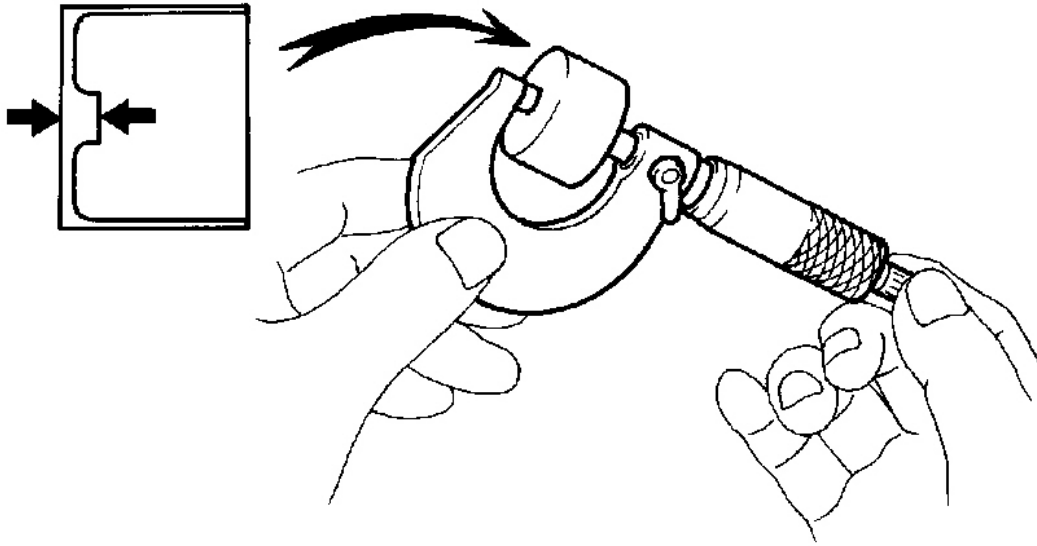
LIFTER THICKNESS

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



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Fig. 30: Measuring Thickness Of Removed Lifter
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

EXAMPLE: (Intake)

Measured valve clearance = 0.40 mm (0.0158 in.)

0.40 mm (0.0158 in.) - 0.20 mm (0.0079 in.) = 0.20 mm (0.0079 in.)

(Measured - Specification = Excess clearance)

Used lifter measurement = 5.25 mm (0.2067 in.)

0.20 mm (0.0079 in.) + 5.25 mm (0.2067 in.) = 5.45 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.))

HINT:

- Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).
- Refer to the New Lifter Thickness table .

Valve Lifter Selection Chart (Intake)

Intake Valve Thickness mm (in.)	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2032)	5.180 (0.2040)	5.200 (0.2048)	5.220 (0.2056)	5.240 (0.2064)	5.260 (0.2072)	5.280 (0.2080)	5.300 (0.2088)	5.320 (0.2096)	5.340 (0.2104)	5.360 (0.2112)	5.380 (0.2120)	5.400 (0.2128)	5.420 (0.2136)	5.440 (0.2144)	5.460 (0.2152)	5.480 (0.2160)	5.500 (0.2168)	5.520 (0.2176)	5.540 (0.2184)	5.560 (0.2192)	5.580 (0.2200)	5.600 (0.2208)	5.620 (0.2216)	5.640 (0.2224)	5.660 (0.2232)	5.680 (0.2240)	5.700 (0.2248)	5.720 (0.2256)	5.740 (0.2264)		
0.000 - 0.020 (0.0000 - 0.0008)																																					
0.020 - 0.040 (0.0008 - 0.0016)																																					
0.040 - 0.060 (0.0016 - 0.0024)																																					
0.060 - 0.080 (0.0024 - 0.0032)																																					
0.080 - 0.100 (0.0032 - 0.0040)																																					
0.100 - 0.120 (0.0040 - 0.0048)																																					
0.120 - 0.140 (0.0048 - 0.0056)																																					
0.140 - 0.160 (0.0056 - 0.0064)																																					
0.160 - 0.180 (0.0064 - 0.0072)																																					
0.180 - 0.200 (0.0072 - 0.0080)																																					
0.200 - 0.220 (0.0080 - 0.0088)																																					
0.220 - 0.240 (0.0088 - 0.0096)																																					
0.240 - 0.260 (0.0096 - 0.0104)																																					
0.260 - 0.280 (0.0104 - 0.0112)																																					
0.280 - 0.300 (0.0112 - 0.0120)																																					
0.300 - 0.320 (0.0120 - 0.0128)																																					
0.320 - 0.340 (0.0128 - 0.0136)																																					
0.340 - 0.360 (0.0136 - 0.0144)																																					
0.360 - 0.380 (0.0144 - 0.0152)																																					
0.380 - 0.400 (0.0152 - 0.0160)																																					
0.400 - 0.420 (0.0160 - 0.0168)																																					
0.420 - 0.440 (0.0168 - 0.0176)																																					
0.440 - 0.460 (0.0176 - 0.0184)																																					
0.460 - 0.480 (0.0184 - 0.0192)																																					
0.480 - 0.500 (0.0192 - 0.0200)																																					
0.500 - 0.520 (0.0200 - 0.0208)																																					
0.520 - 0.540 (0.0208 - 0.0216)																																					
0.540 - 0.560 (0.0216 - 0.0224)																																					
0.560 - 0.580 (0.0224 - 0.0232)																																					
0.580 - 0.600 (0.0232 - 0.0240)																																					
0.600 - 0.620 (0.0240 - 0.0248)																																					
0.620 - 0.640 (0.0248 - 0.0256)																																					
0.640 - 0.660 (0.0256 - 0.0264)																																					
0.660 - 0.680 (0.0264 - 0.0272)																																					
0.680 - 0.700 (0.0272 - 0.0280)																																					
0.700 - 0.720 (0.0280 - 0.0288)																																					
0.720 - 0.740 (0.0288 - 0.0296)																																					
0.740 - 0.760 (0.0296 - 0.0304)																																					
0.760 - 0.780 (0.0304 - 0.0312)																																					
0.780 - 0.800 (0.0312 - 0.0320)																																					
0.800 - 0.820 (0.0320 - 0.0328)																																					

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Fig. 31: Intake Valve Lifter Selection Table
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

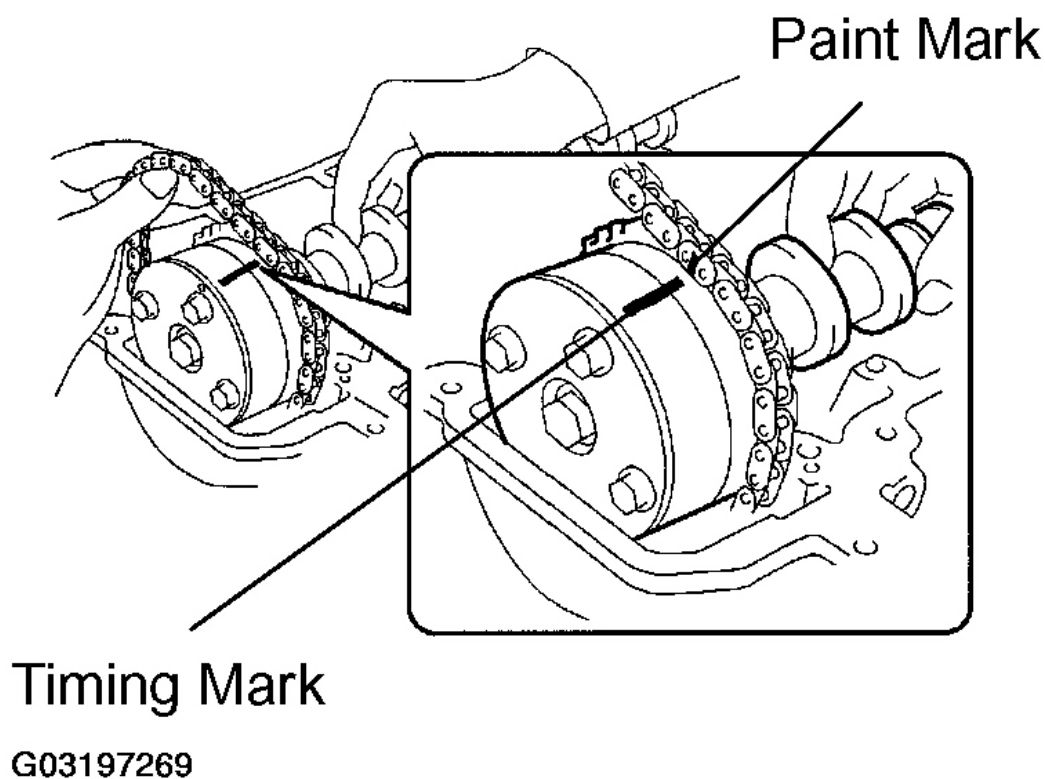


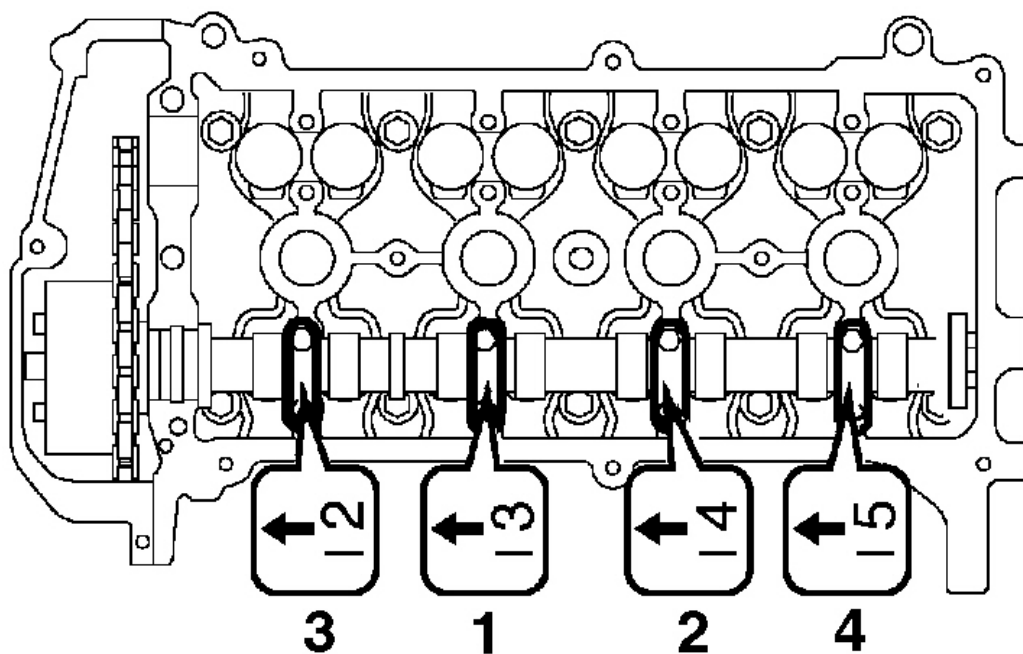
Fig. 33: Installing Timing Chain Onto Camshaft Timing Gear

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 the illustration.

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

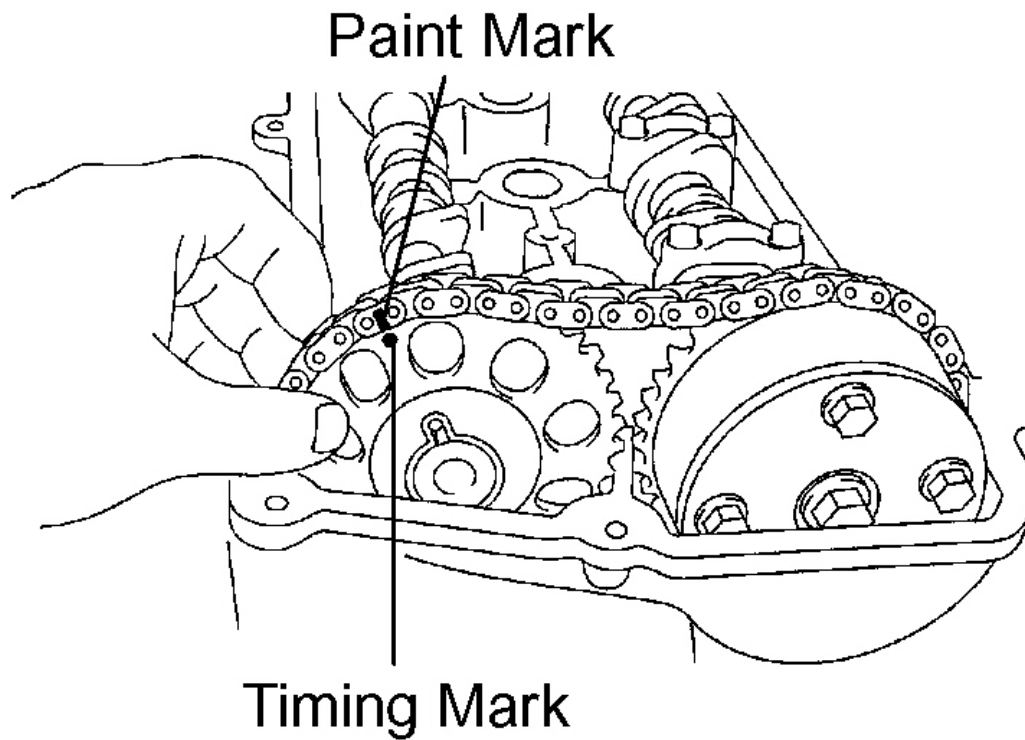
NOTE: Tighten each bolt uniformly keeping the camshaft level.



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Fig. 34: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

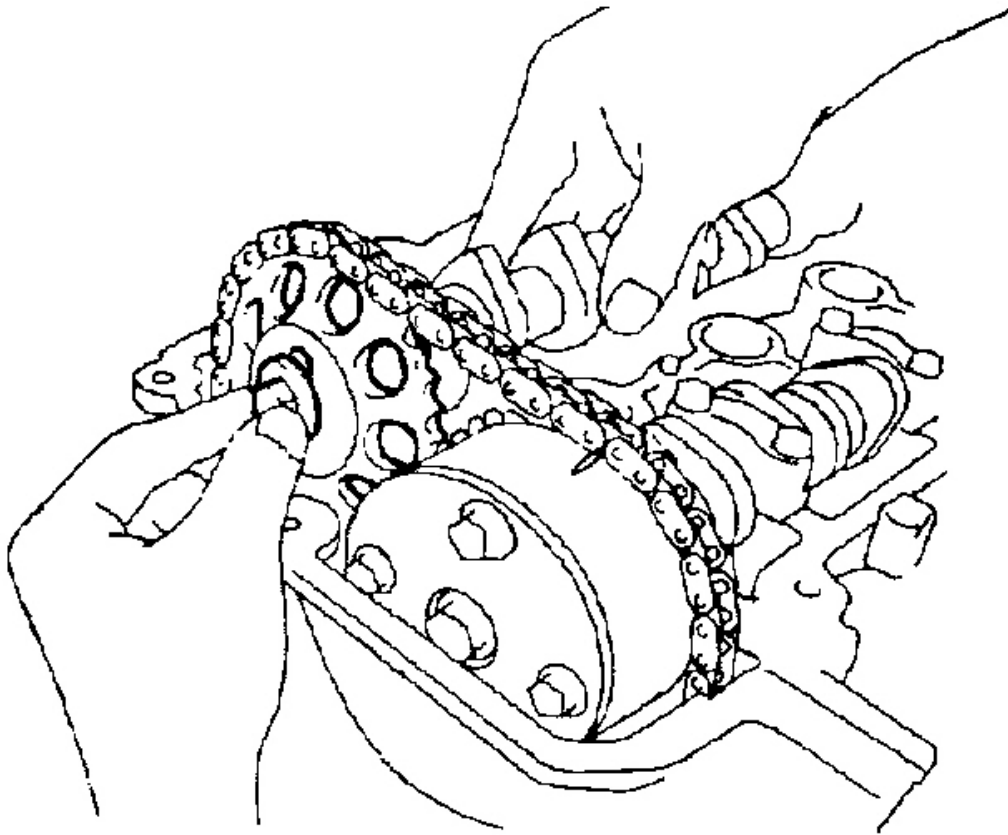


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Fig. 35: Aligning Match Mark On Camshaft Timing Sprocket With Paint Mark Of Timing Chain

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 into the camshaft.
- w. Temporarily install the timing sprocket bolt.



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Fig. 36: Installing Timing Sprocket Bolt

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

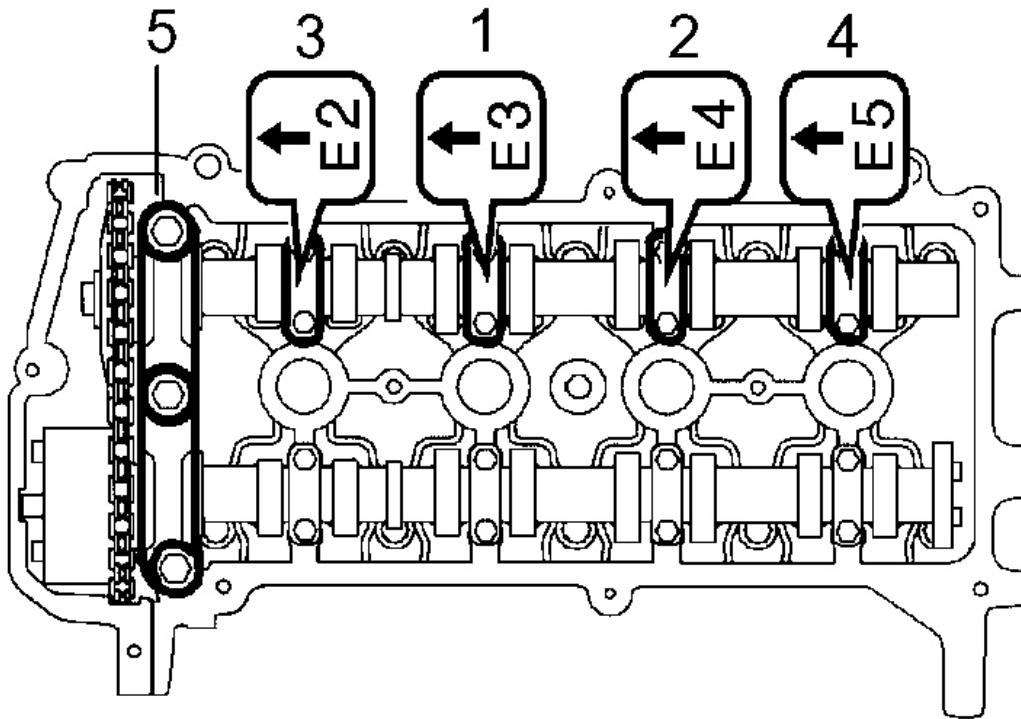
- x. Examine the front marks and numbers and tighten the bolts in the sequence shown in the illustration.

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

NOTE: Tighten each bolt uniformly keeping the camshaft level.

- y. Install the bearing cap No. 1.

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



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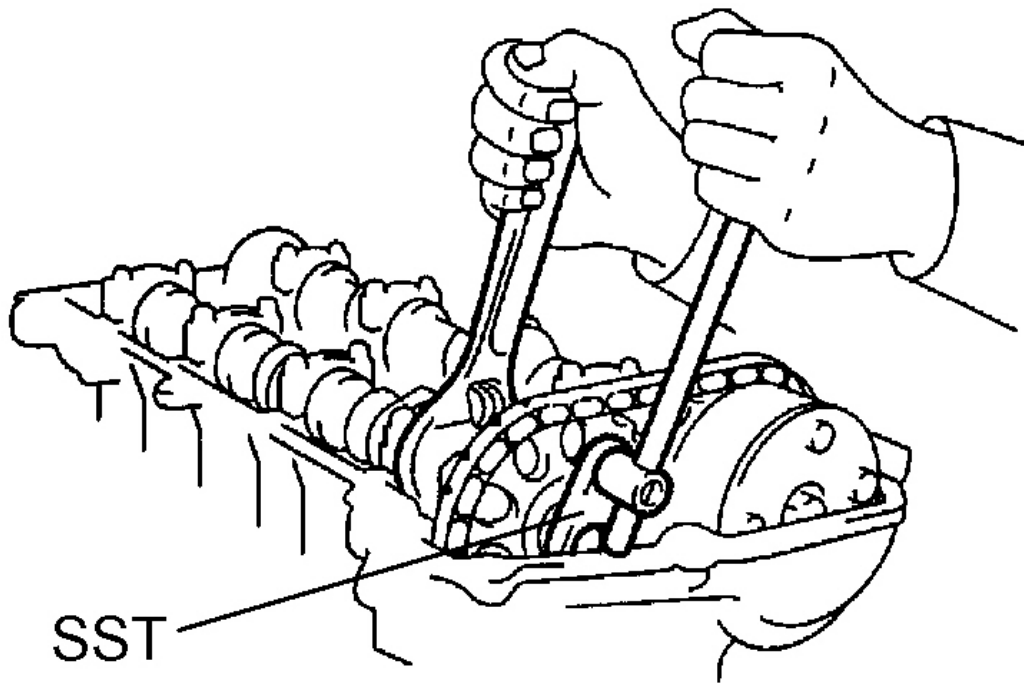
Fig. 37: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

SST 09023-38401

- aa. Remove the bar from the timing chain tensioner.

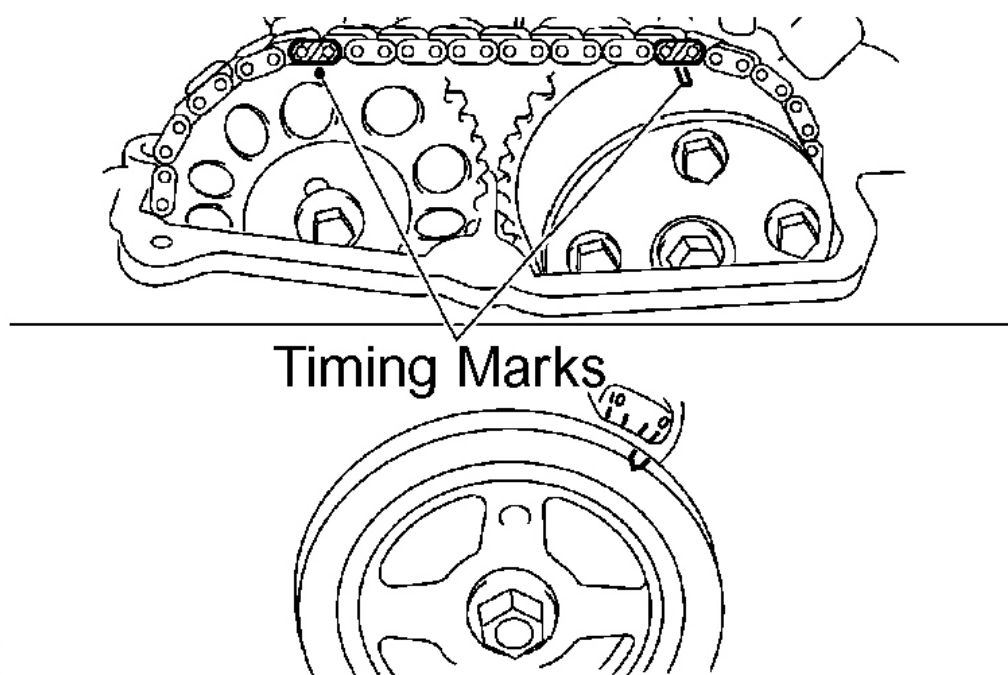


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Fig. 38: Installing Camshaft Bolt

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

- 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.



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Fig. 39: Aligning Timing Marks

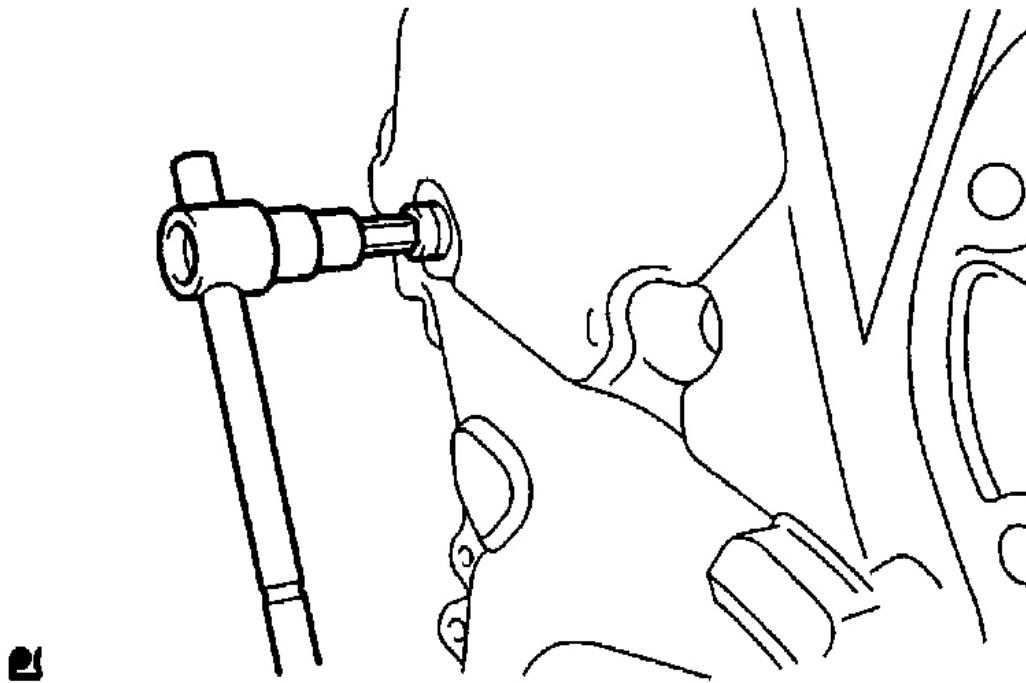
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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)



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Fig. 40: Installing Screw Plug

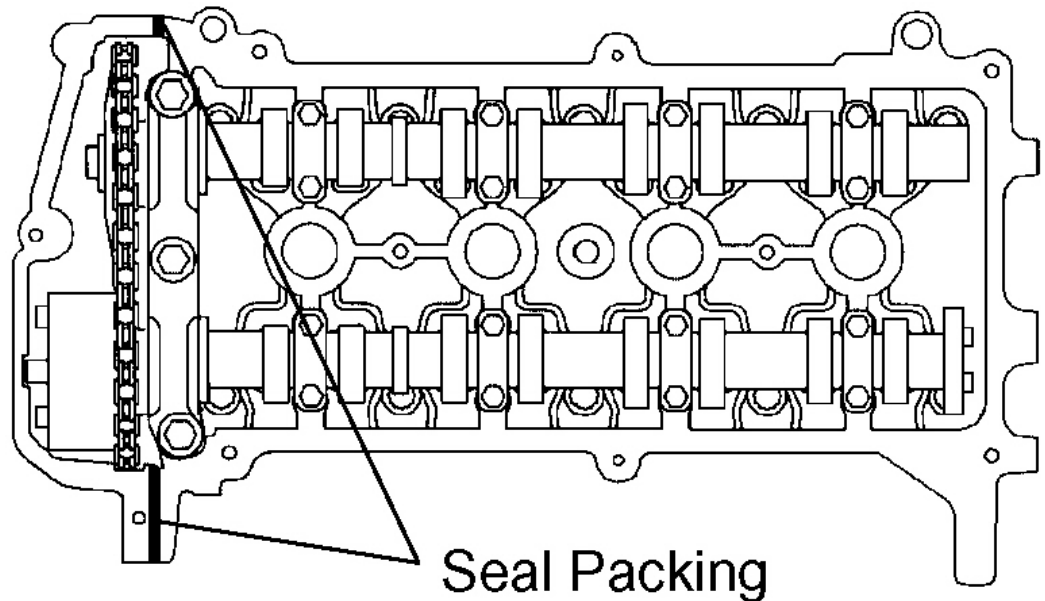
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL CYLINDER HEAD COVER SUB-ASSY

- a. Apply seal packing to the 2 locations shown in the illustration.

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.



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Fig. 41: Applying Seal Packing**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

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

Torque: 10 N.m (102 kgf.cm, 7.4 ft.lbf)**10. INSTALL IGNITION COIL No. 1****Torque: 9.0 N.m (92 kgf.cm, 80 in.lbf)**

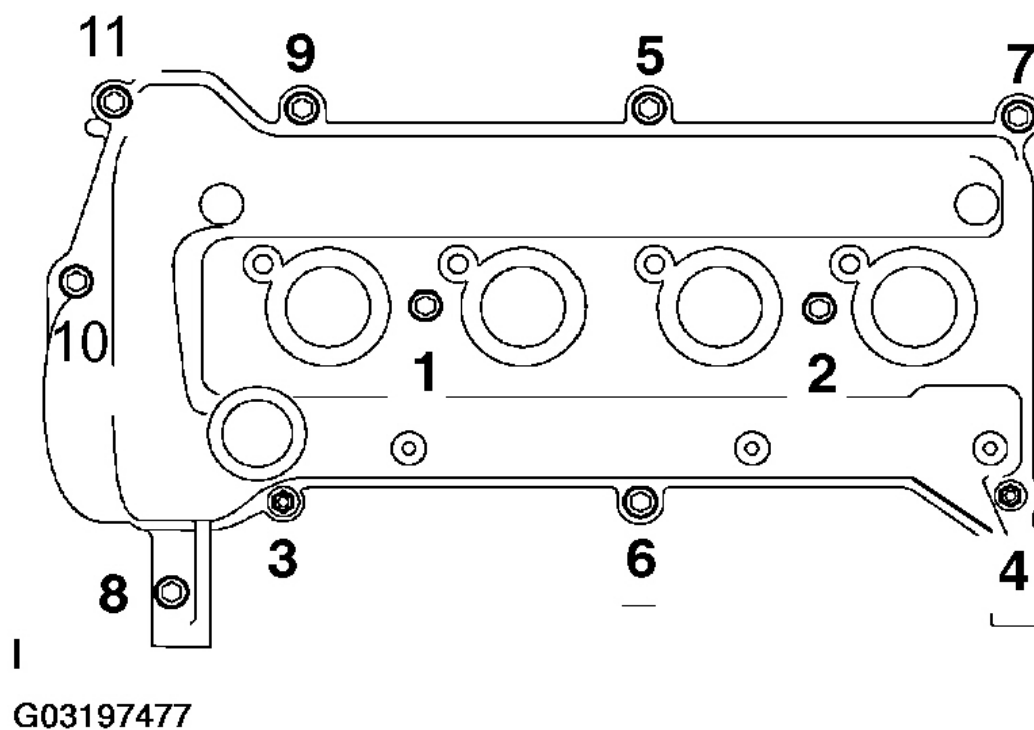


Fig. 42: Installing Cylinder Head Cover

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

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)

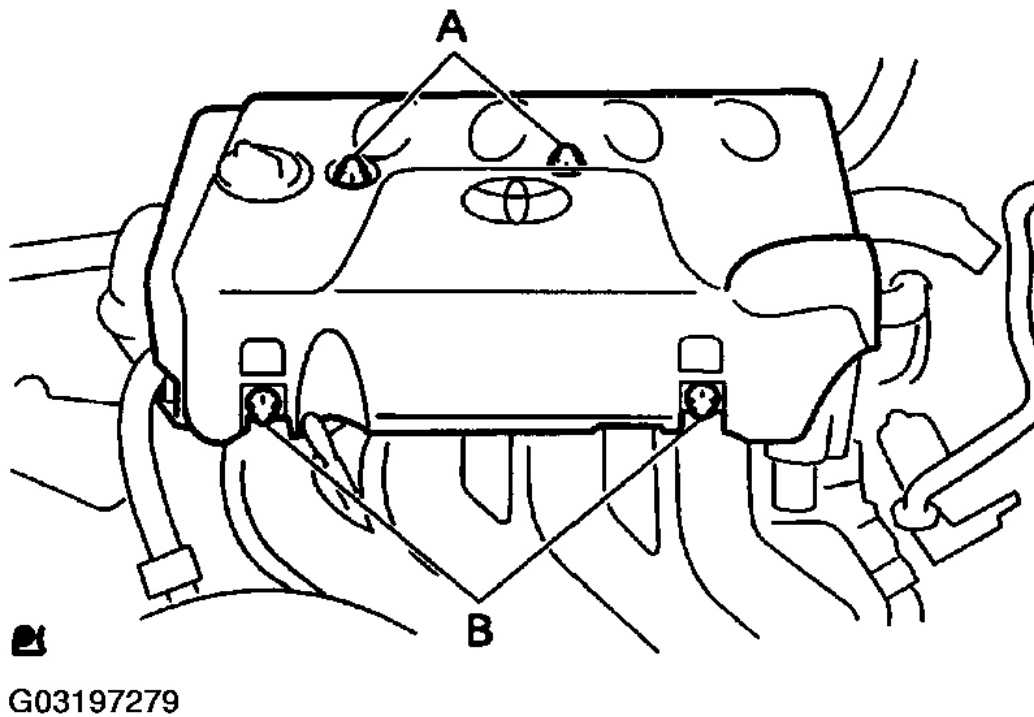
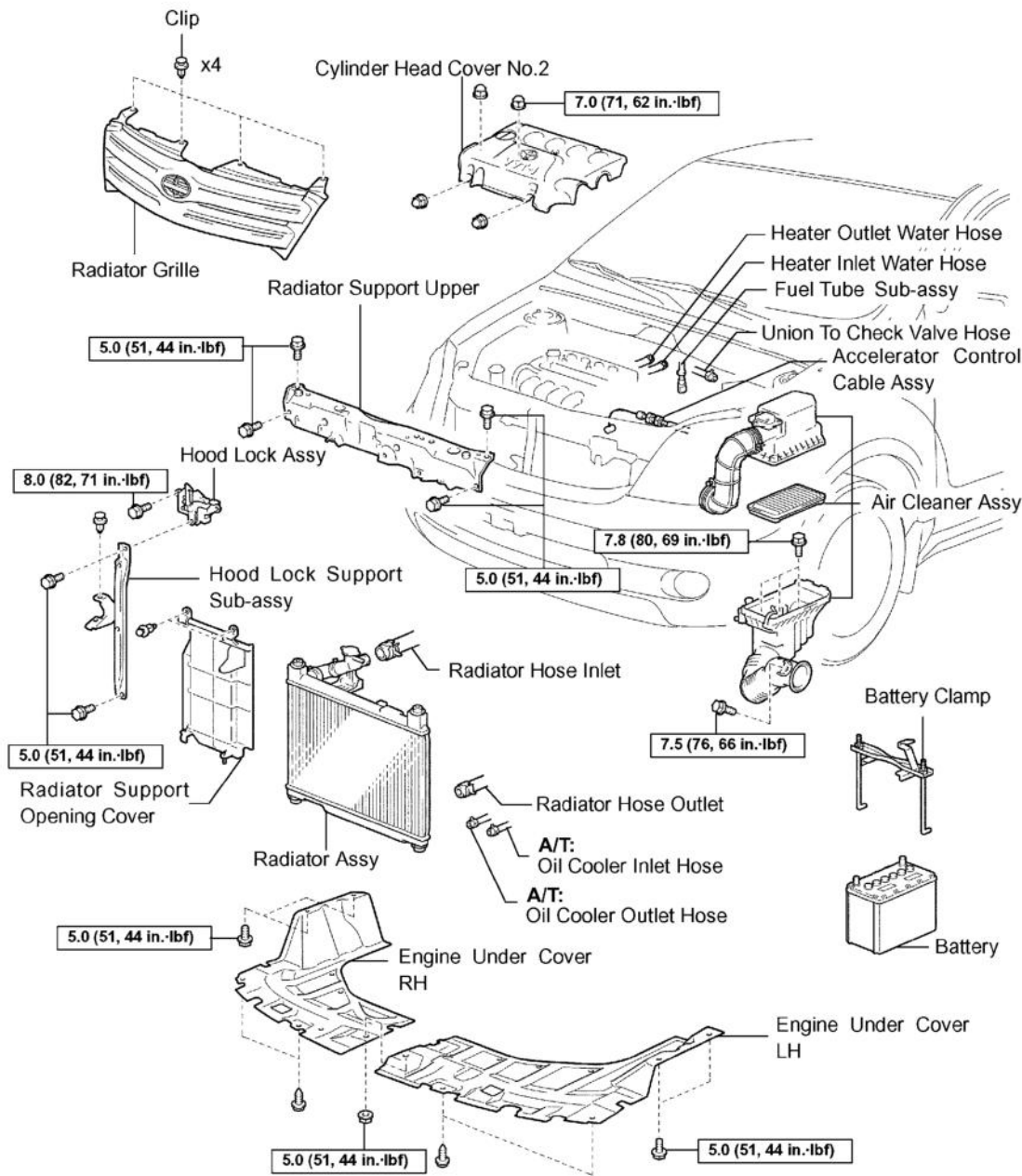


Fig. 43: Installing Cylinder Head Cover No. 2
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. CHECK FOR ENGINE OIL LEAKS

PARTIAL ENGINE ASSY

COMPONENTS



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

P

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Fig. 44: Identifying Engine Assy Components (1 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

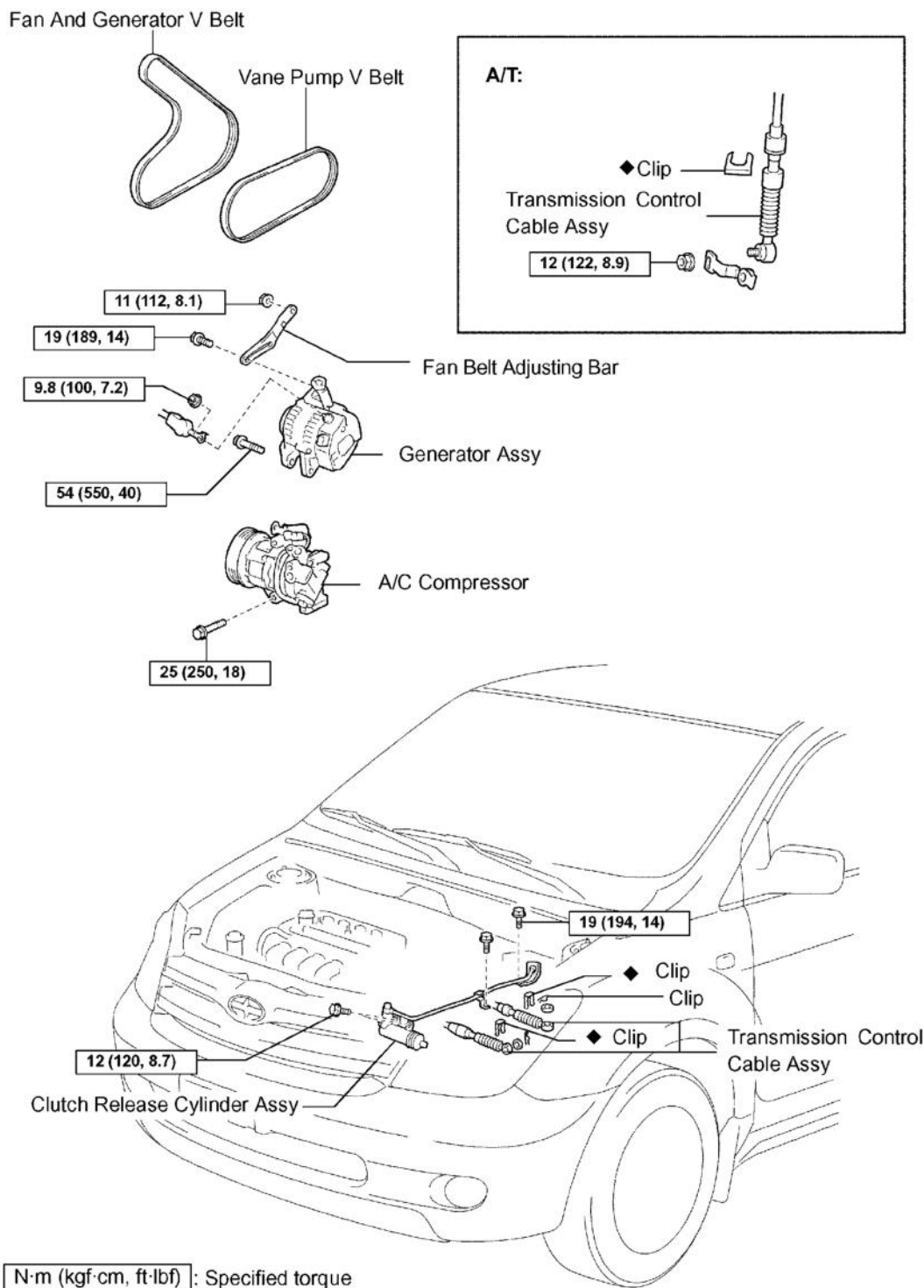
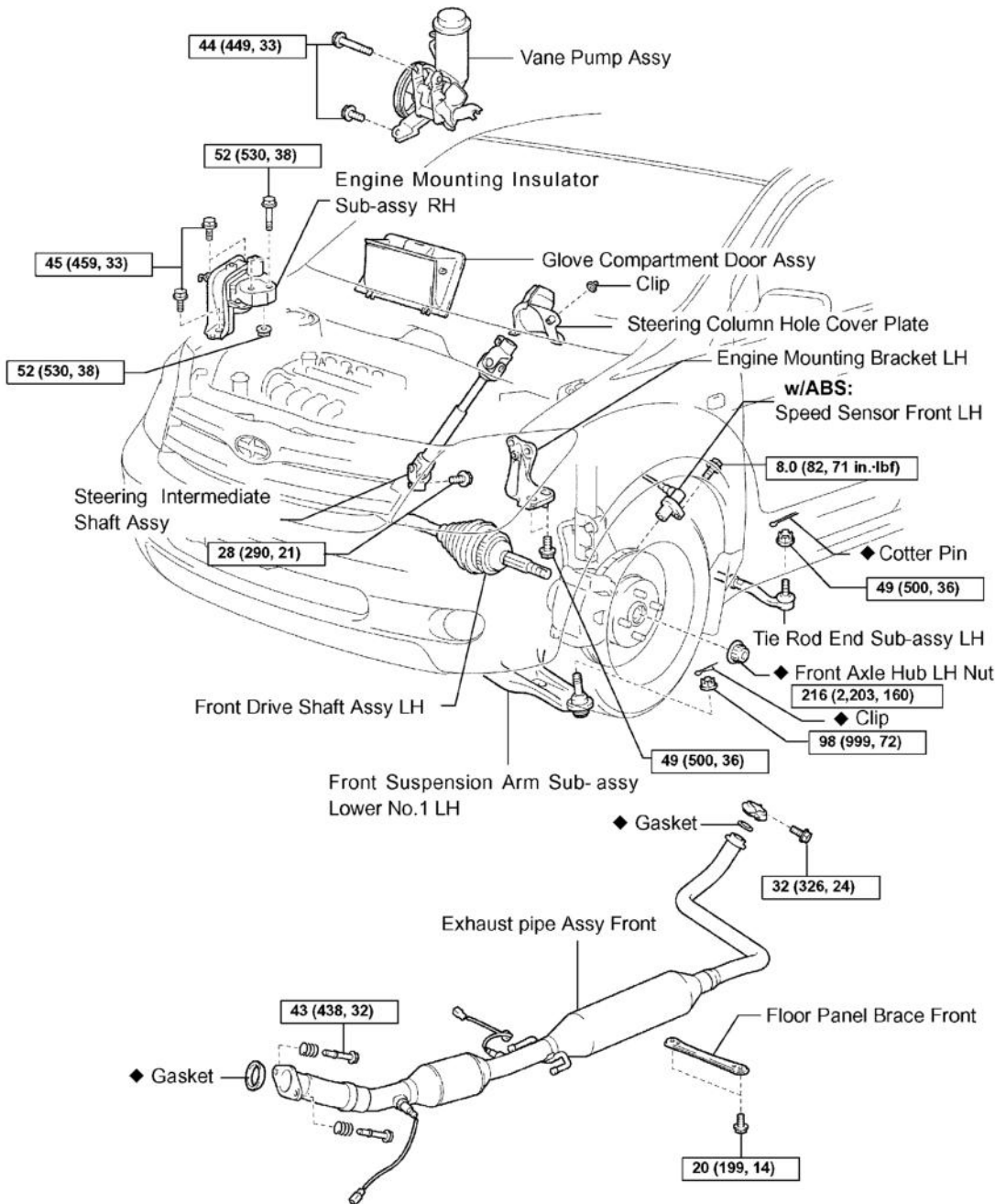


Fig. 45: Identifying Engine Assy Components (2 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

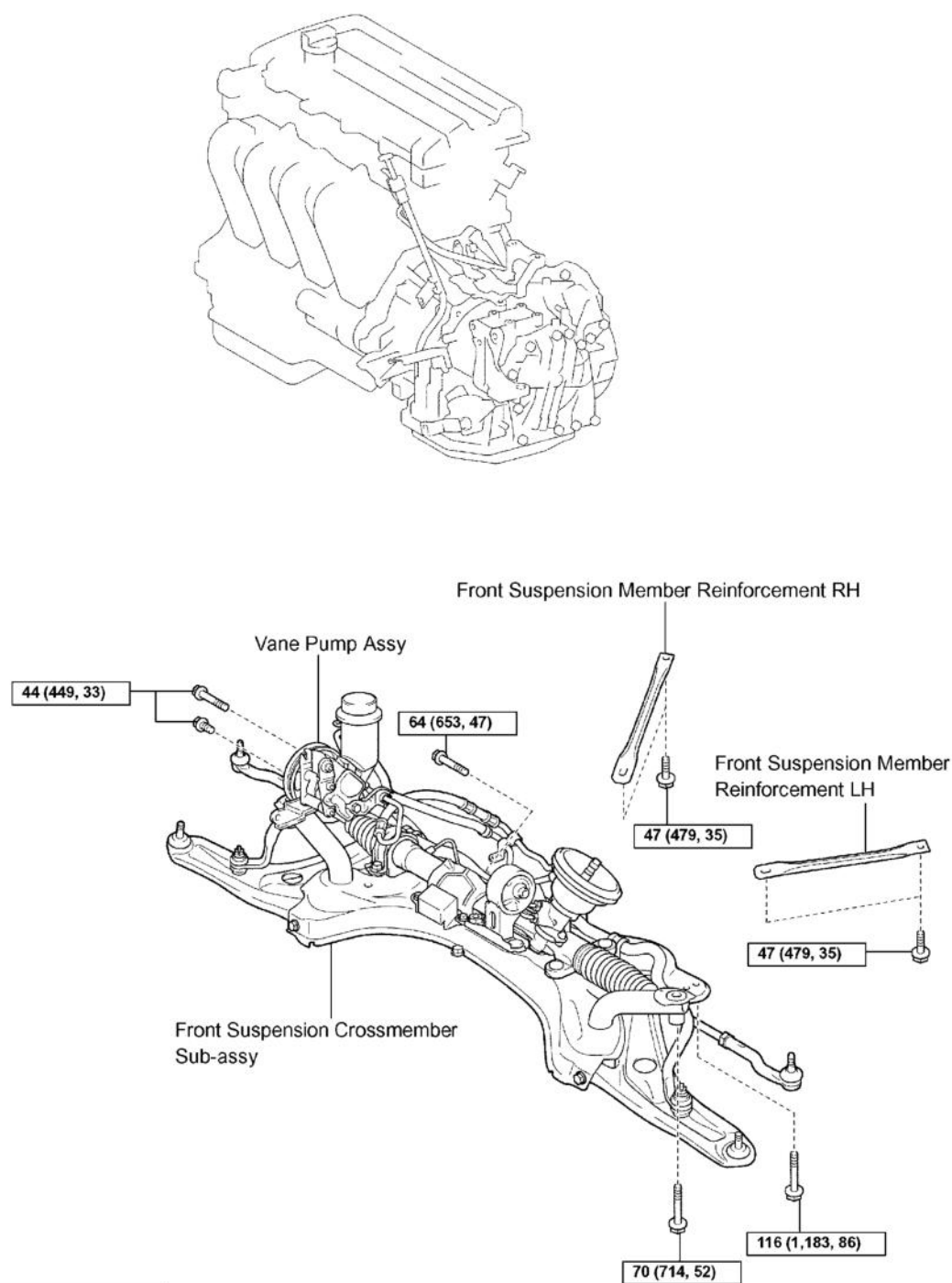


N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

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Fig. 46: Identifying Engine Assy Components (3 Of 9)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

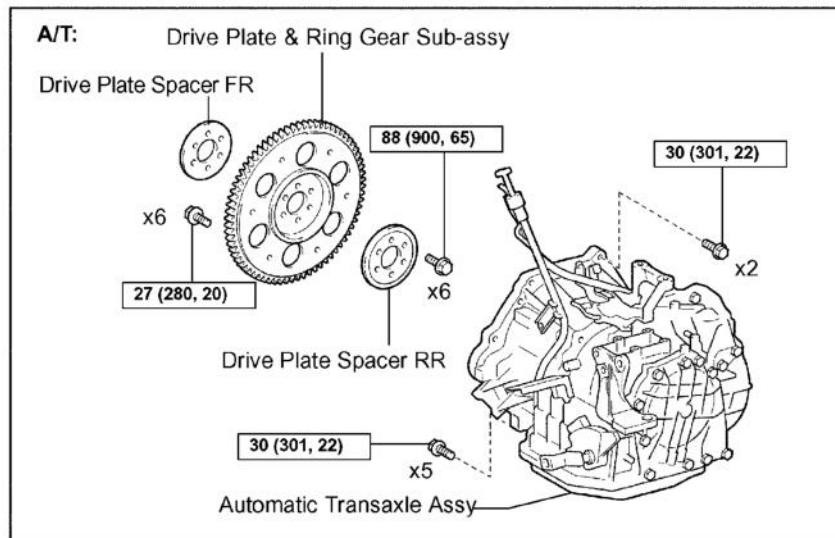
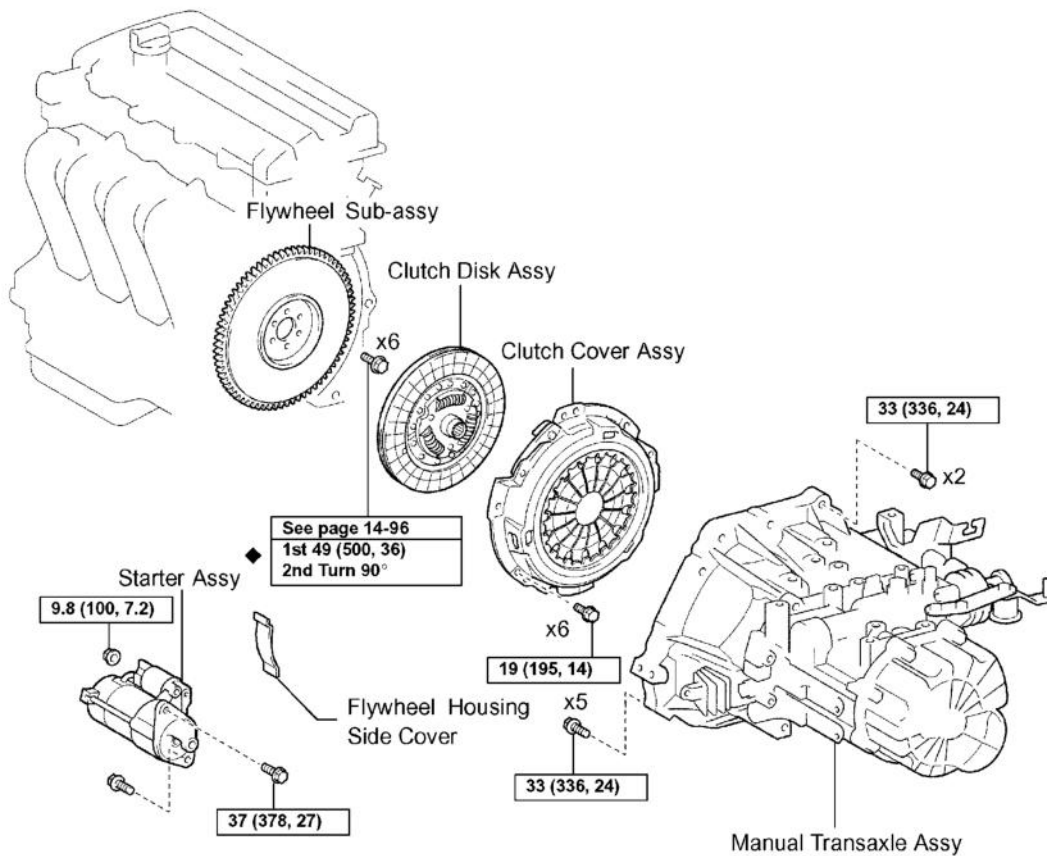


N·m (kgf·cm, ft·lbf) : Specified torque

P

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Fig. 47: Identifying Engine Assy Components (4 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

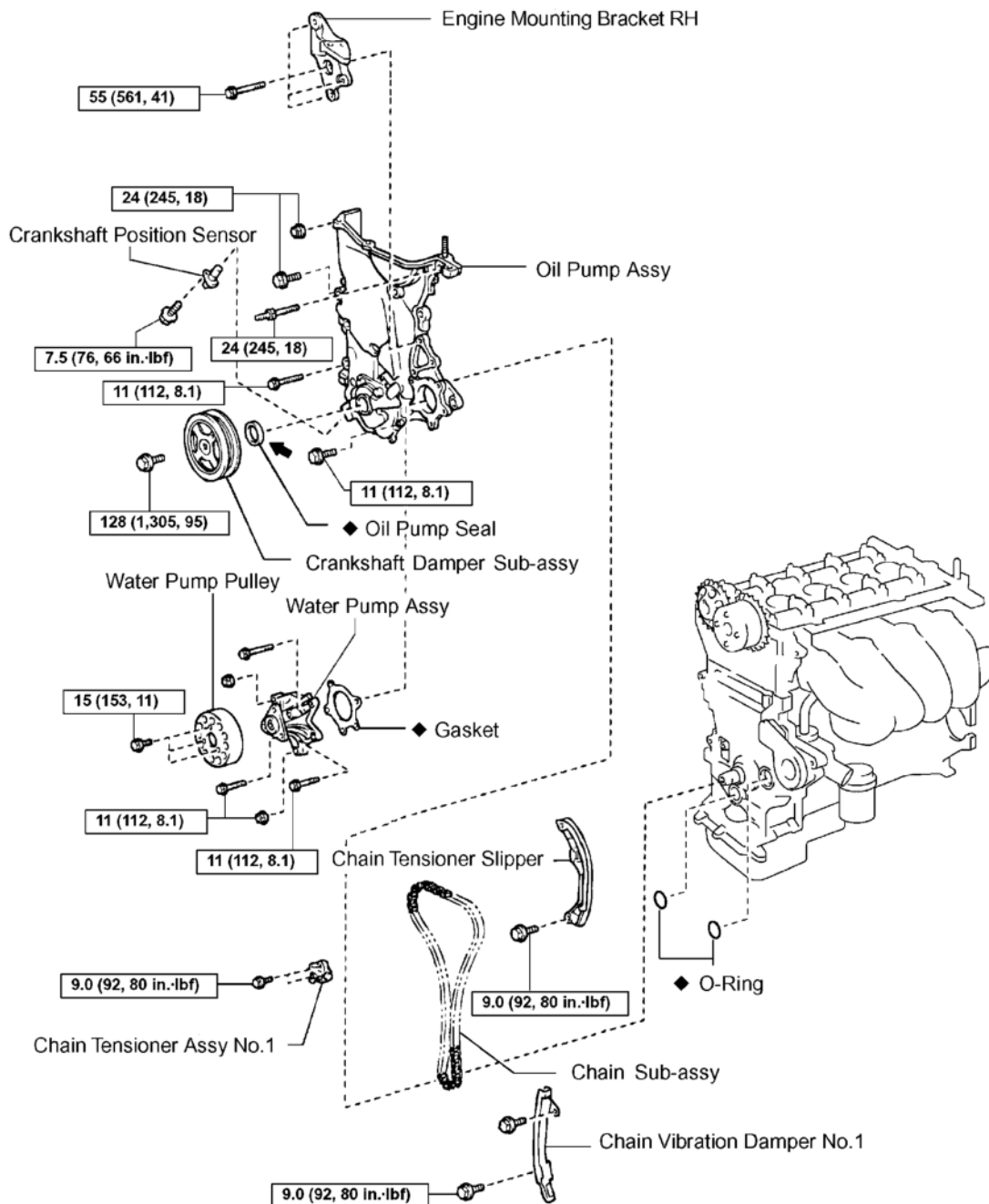


N·m (kgf·cm, ft·lbf): Specified torque ♦ Non-reusable part

P

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Fig. 48: Identifying Engine Assy Components (5 Of 9)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



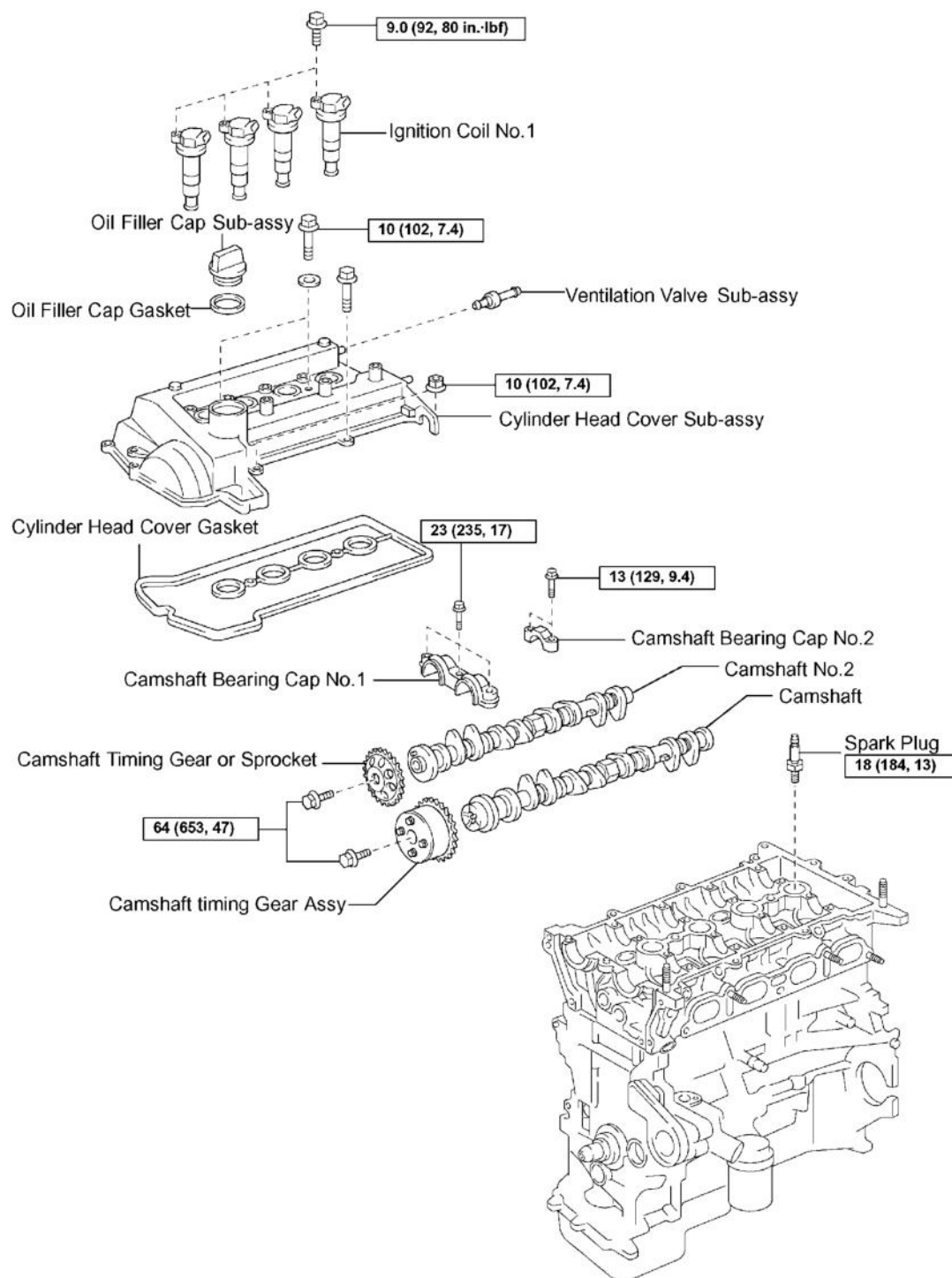
N·m (kgf·cm, ft·lbf) : Specified torque

◆ Non-reusable part

Apply multi-purpose grease

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Fig. 50: Identifying Engine Assy Components (7 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

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Fig. 51: Identifying Engine Assy Components (8 Of 9)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2005 ENGINE Engine Mechanical - xA



sábado, 16 de octubre de 2021 09:01:16 a. m.

REPLACEMENT

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

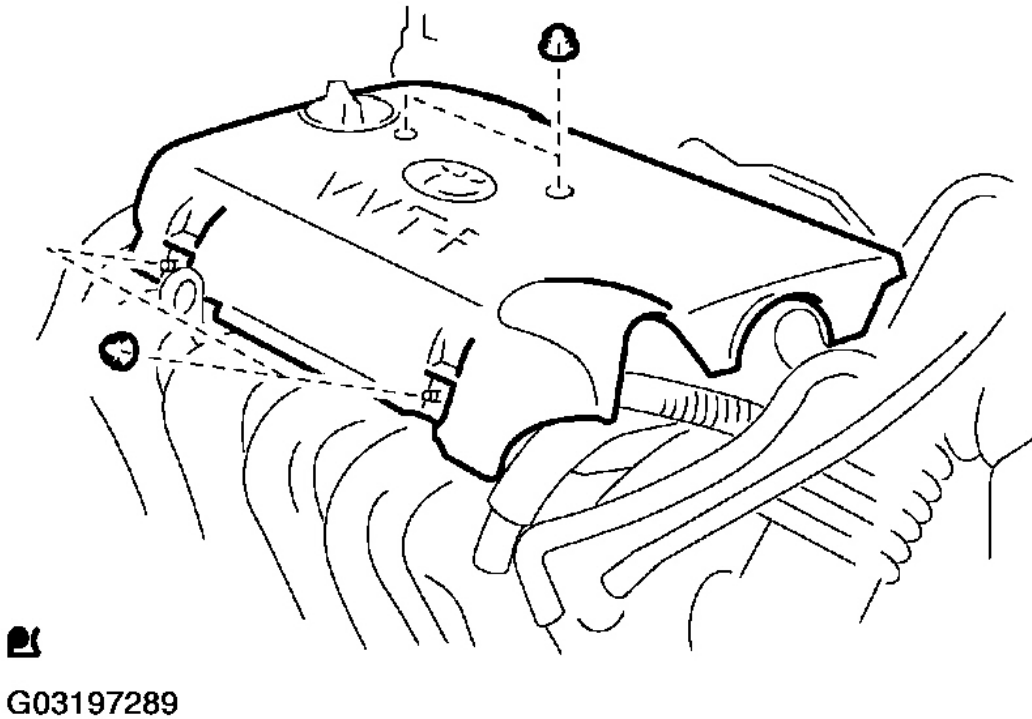


Fig. 53: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **REMOVE BATTERY**
8. **REMOVE AIR CLEANER ASSY** (See **REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY**)
9. **DISCONNECT FUEL TUBE SUB-ASSY** (See **FUEL SYSTEM**)

SST 09268-21010

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

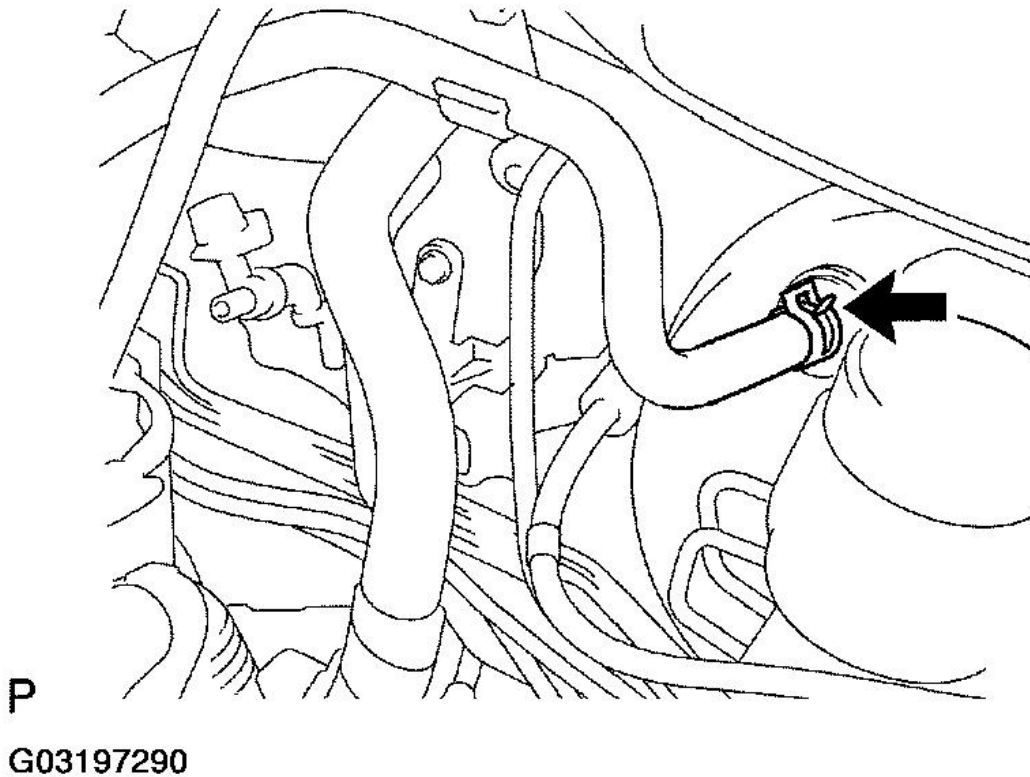
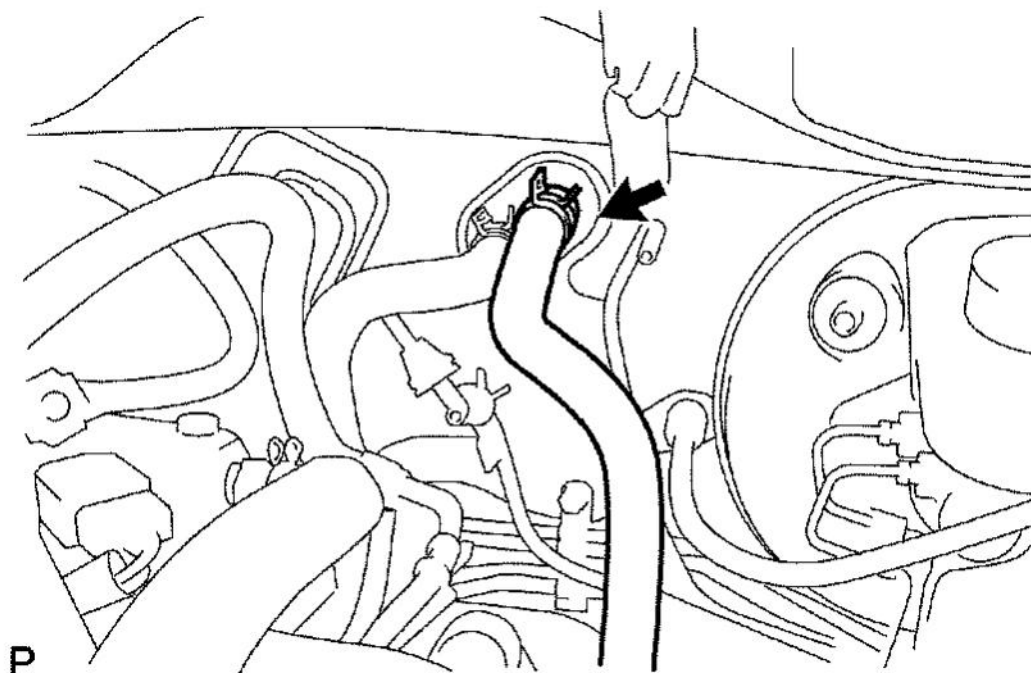


Fig. 54: Disconnecting Union

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

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



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Fig. 55: Disconnecting Heater Water Inlet Hose From Air Conditioner Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

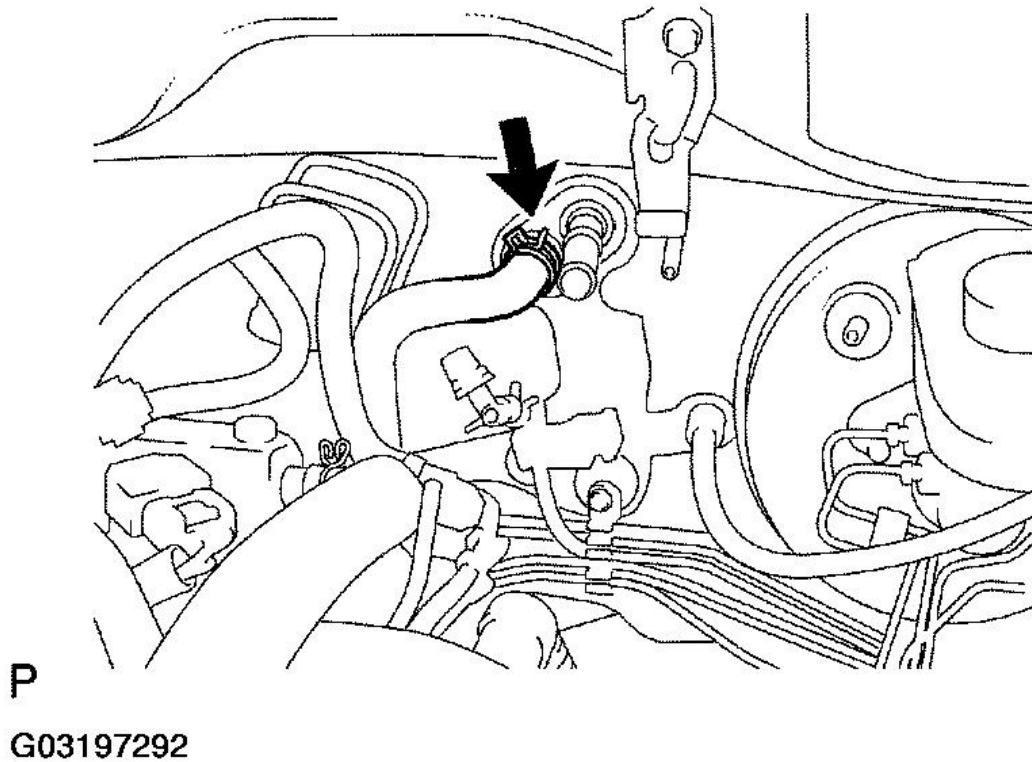


Fig. 56: Disconnecting Heater Water Outlet Hose From Air Conditioner Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. DISCONNECT ENGINE WIRE

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

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

20. REMOVE A/C COMPRESSOR (See REPLACEMENT)

HINT:

Secure the hoses off to the side instead of detaching.

21. REMOVE FLOOR PANEL BRACE FRONT (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)

22. REMOVE EXHAUST PIPE ASSY FRONT (See REMOVAL & INSTALLATION AND

DISASSEMBLY & REASSEMBLY)**23. SEPARATE STEERING INTERMEDIATE SHAFT ASSY (See OVERHAUL)****24. 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 the tip sharpened.
- Set SST to the groove with the flat face facing upward.

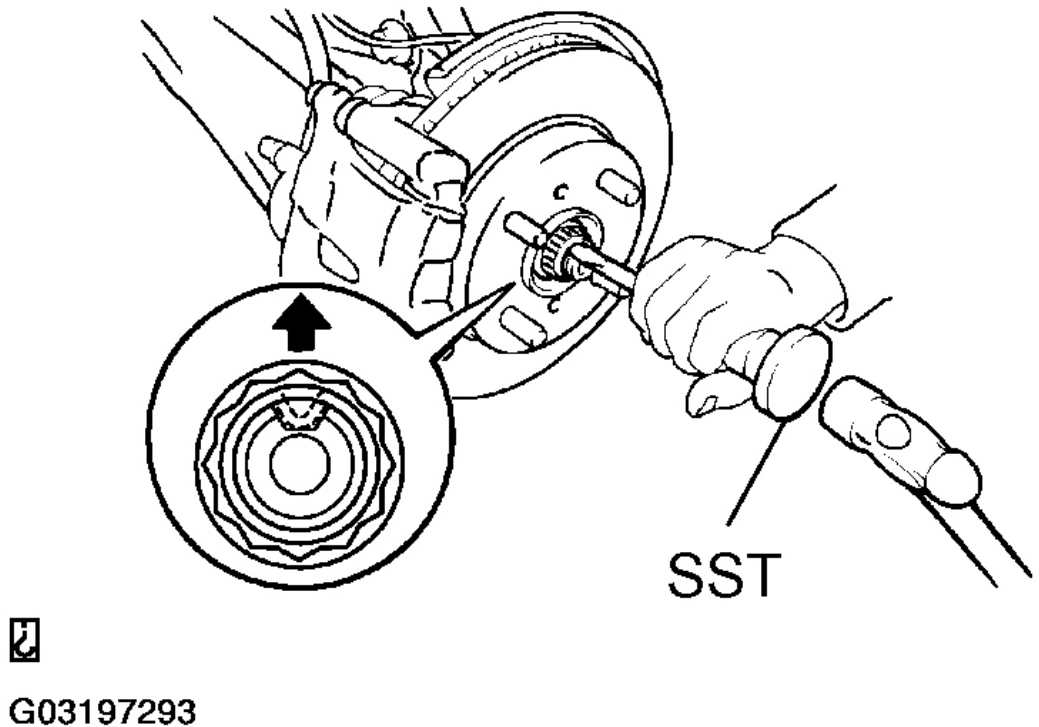


Fig. 57: Removing Front Axle Hub Lock Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

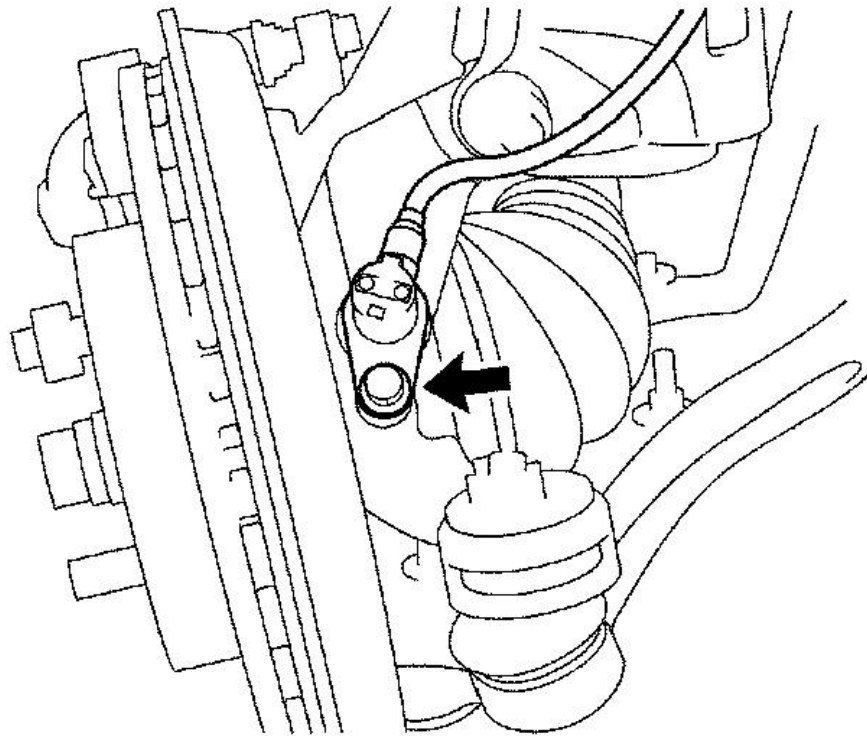
Perform the same procedure as above on the opposite side.

25. 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.



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Fig. 58: Disconnecting Speed Sensor From Steering Knuckle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. SEPARATE TIE ROD END SUB-ASSY LH

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

SST 09628-6201 1

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

HINT:

Perform the same procedure as above on the opposite side.

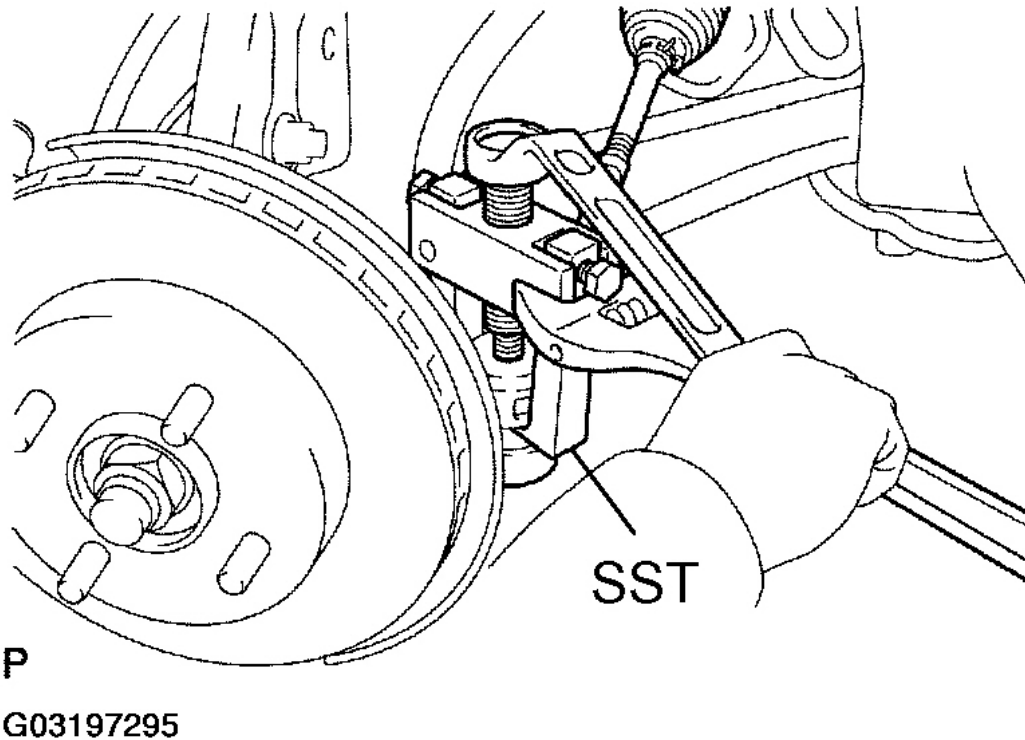


Fig. 59: Disconnecting Tie Rod End From Steering Knuckle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

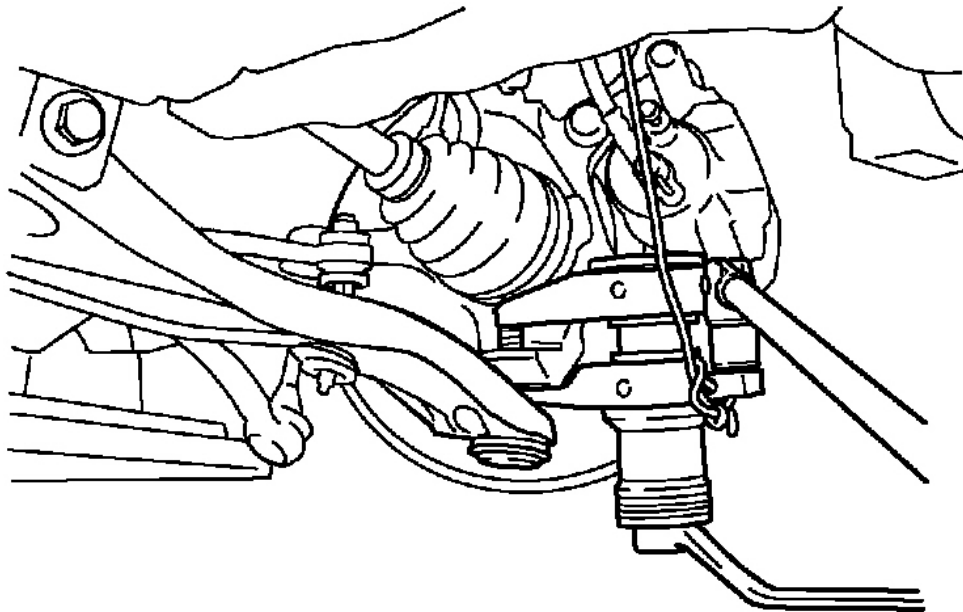
27. SEPARATE FRONT SUSPENSION ARM SUB-ASSY LOWER No. 1 LH

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

SST 09628-0001 1

HINT:

Perform the same procedure as above on the opposite side.



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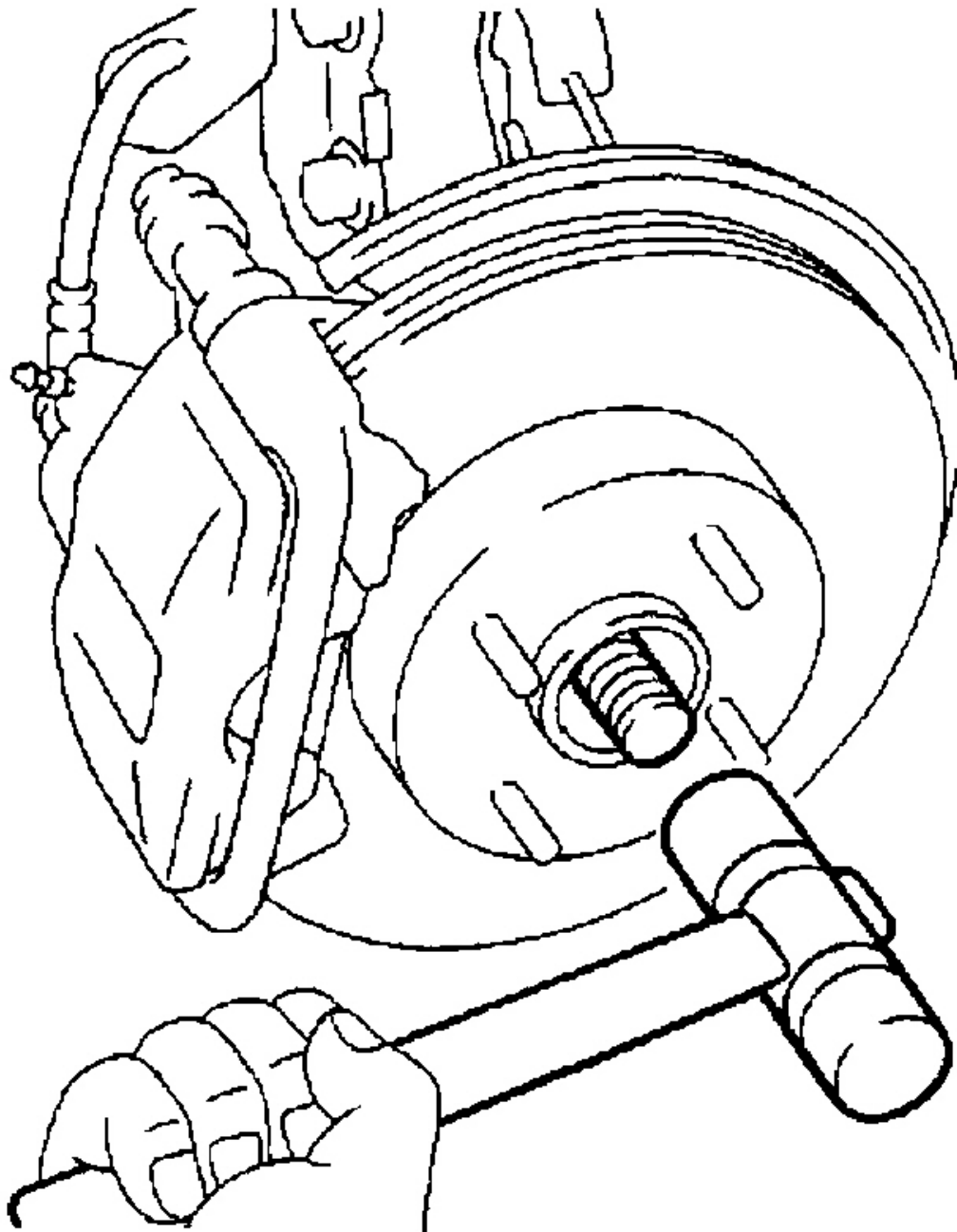
Fig. 60: Disconnecting Front Suspension Arm Lower From Steering Knuckle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. 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.

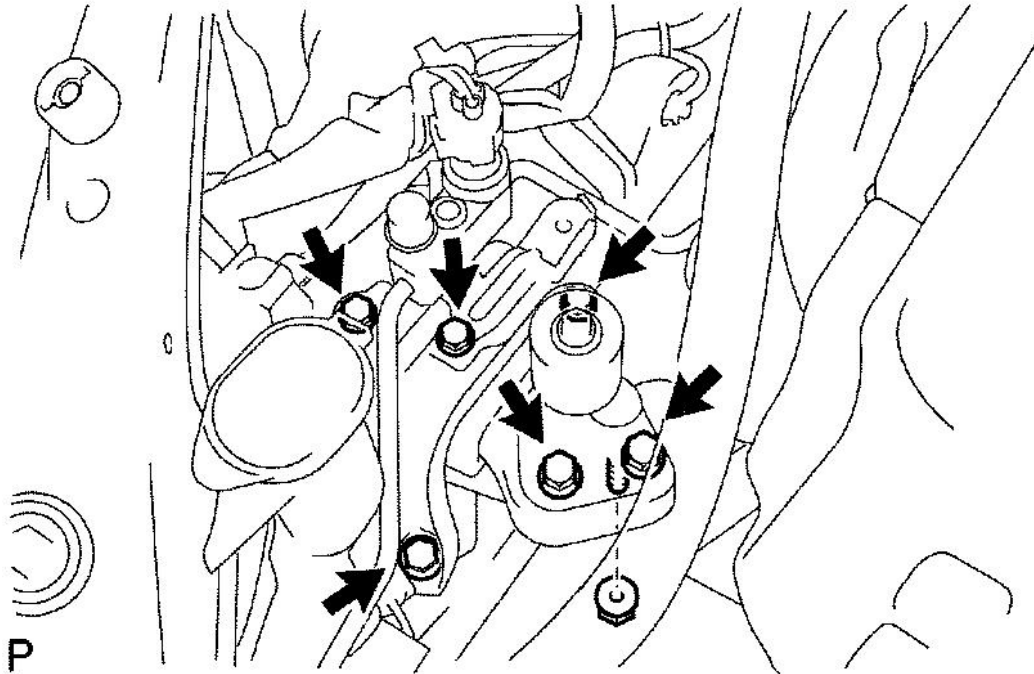


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Fig. 61: Removing Drive Shaft From Axle Hub By Tapping
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

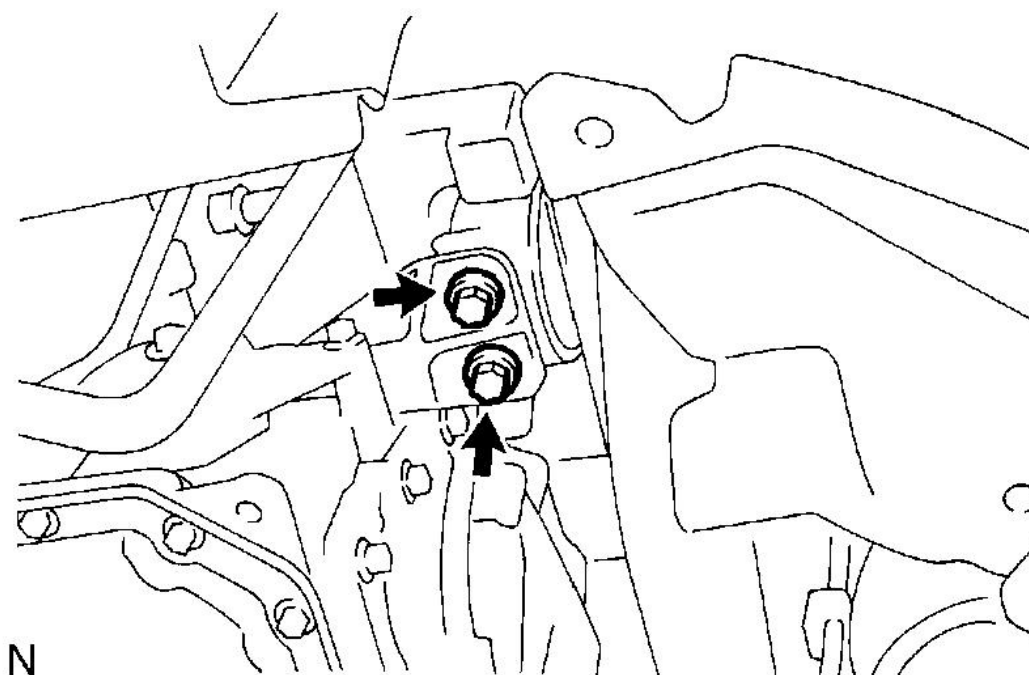
- a. Set the engine lifter.
- b. Remove the bolt which is used to fix the liquid tube to the engine mounting insulator RH.
- c. Remove the 5 bolts, the nut and engine mounting insulator RH.



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Fig. 62: Removing Engine Mounting Insulator RH
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.



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Fig. 63: Removing Engine Mounting Bracket From Engine Mounting Insulator LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the engine together with transaxle.
 - 1. Remove the 8 bolts shown in the illustration.
 - 2. Carefully remove the engine assembly from the vehicle.

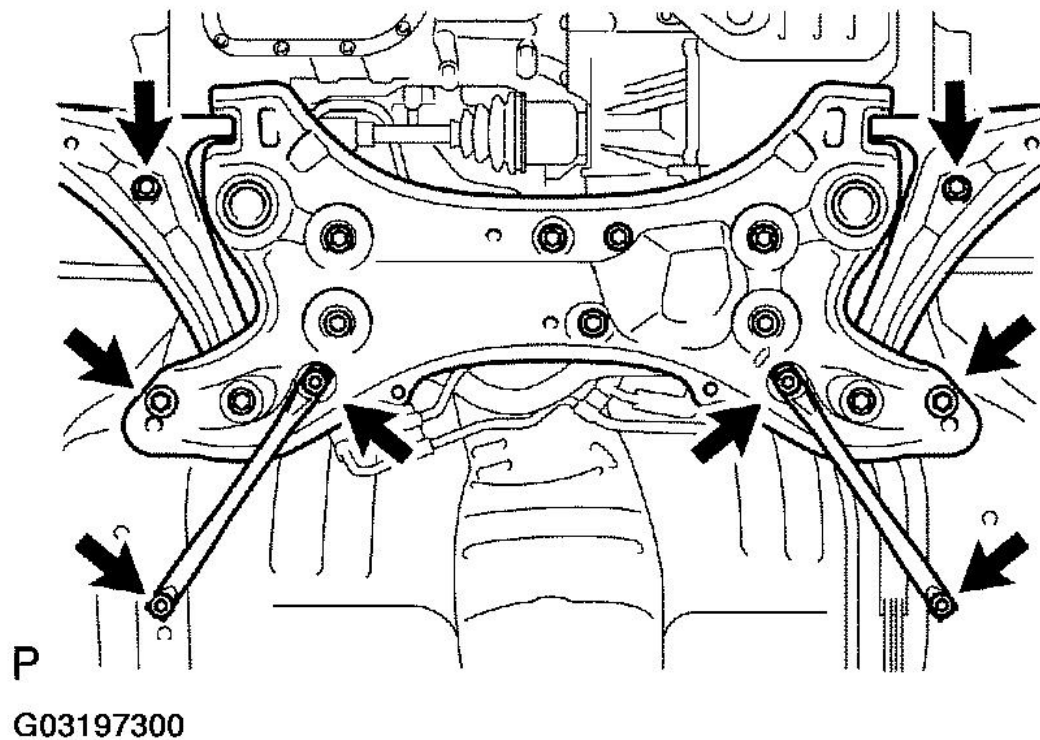


Fig. 64: Removing Suspension Crossmember
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Remove the bolt and the condenser.
- g. Install the 2 engine hangers as shown in the illustration.

Parts No.:

No. 1 engine hanger 12281-21010

Bolt 91642-81025

Torque: 40 N.m (408 kgf.cm, 30 ft.lbf) (h) Attach the engine sling and hang the engine with the chain block.

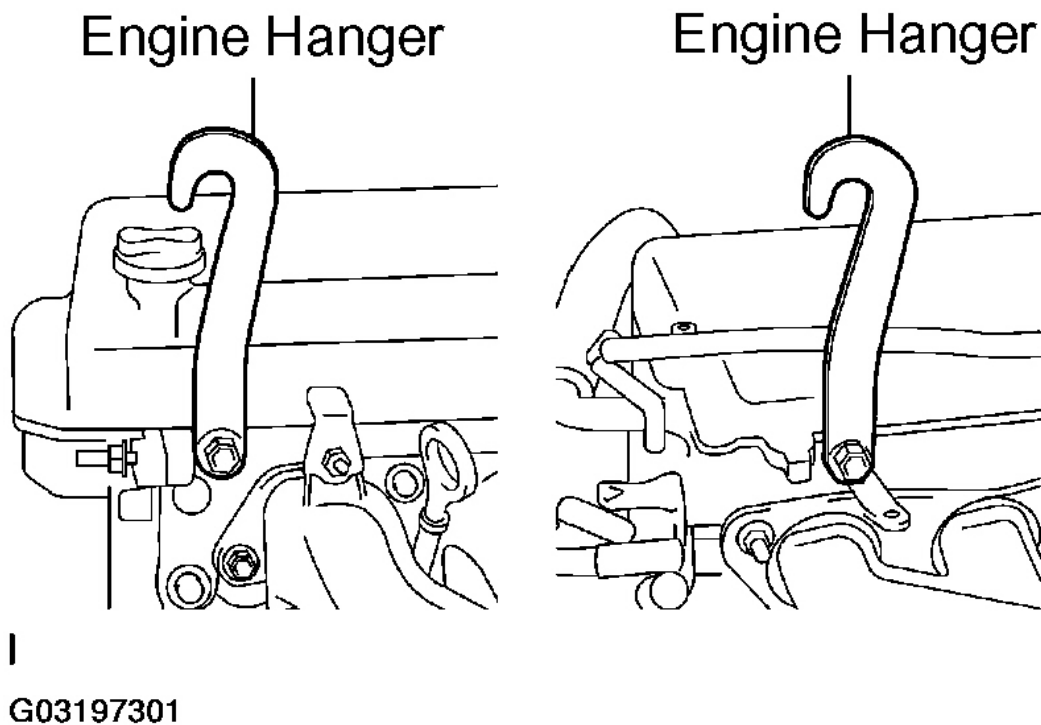


Fig. 65: Installing Engine Hangers

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

30. **REMOVE VANE PUMP V BELT (See REPLACEMENT)**
31. **REMOVE VANE PUMP ASSY**
 - a. Disconnect the power steering oil pressure sensor harness.
 - b. Remove the 2 bolts and vane pump assembly.

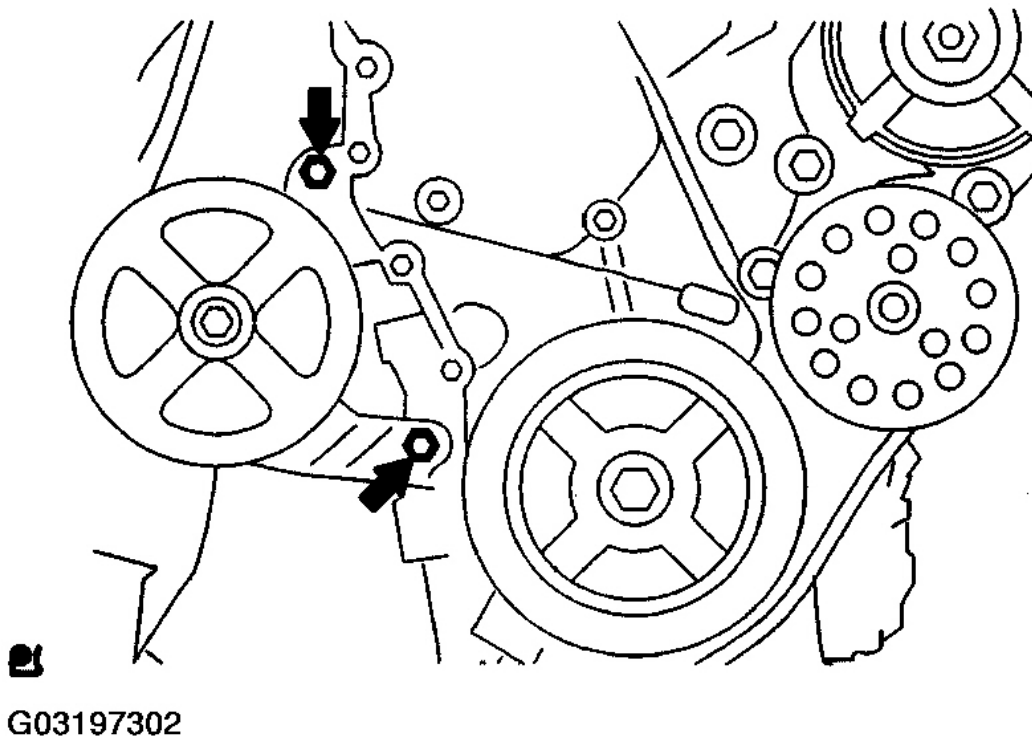
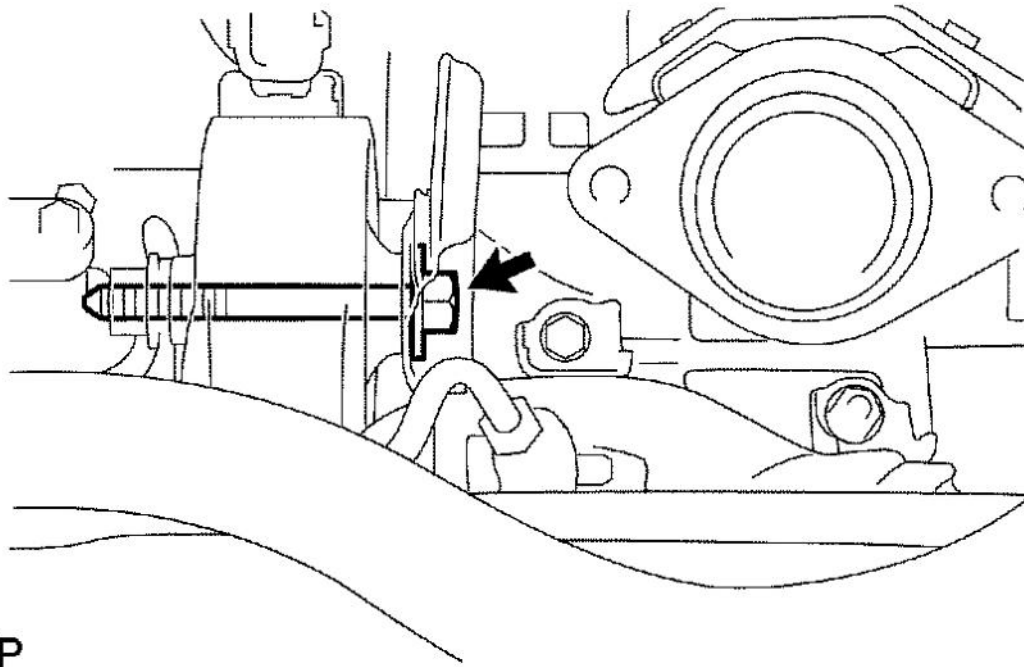


Fig. 66: Removing Vane Pump Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. **REMOVE FRONT SUSPENSION CROSSMEMBER SUB-ASSY**
 - a. Remove the through bolt.
 - b. Separate the engine and the transaxle assembly from the suspension crossmember.
33. **REMOVE STARTER ASSY (See REPLACEMENT)**
34. **REMOVE GENERATOR ASSY (See REPLACEMENT)**



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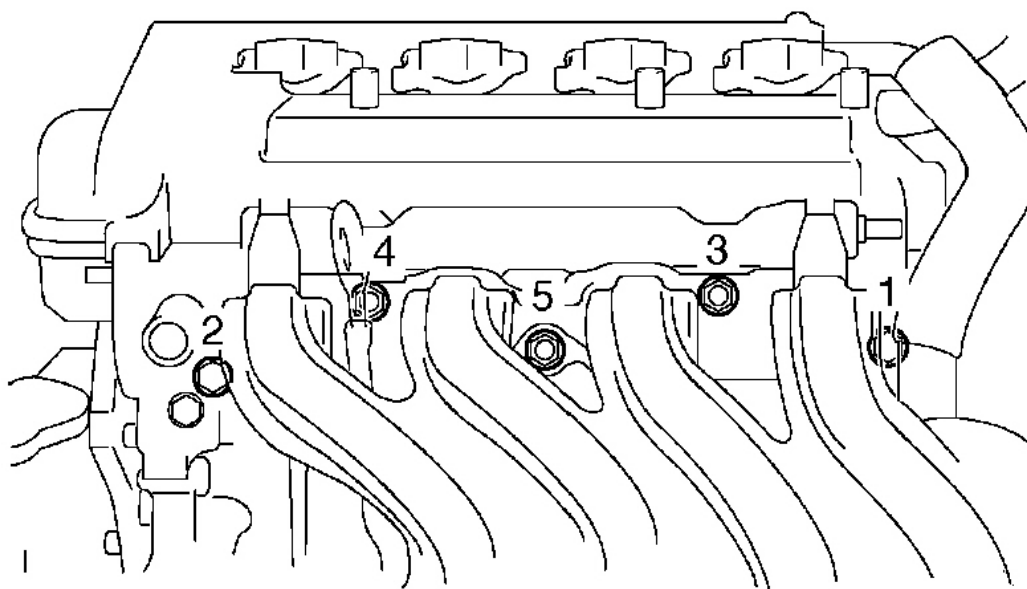
Fig. 67: Removing Through Bolt

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

35. **REMOVE MANUAL TRANSAXLE ASSY (MANUAL TRANSAXLE) (See REPLACEMENT)**
36. **REMOVE AUTOMATIC TRANSAXLE ASSY (AUTOMATIC TRANSAXLE) (See REPLACEMENT)**
37. **REMOVE CLUTCH COVER ASSY (MANUAL TRANSAXLE) (See OVERHAUL)**
38. **REMOVE CLUTCH DISC ASSY (MANUAL TRANSAXLE) (See OVERHAUL)**
39. **REMOVE DRIVE PLATE AND RING GEAR OR FLYWHEEL (See REPLACEMENT)**

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

40. **REMOVE VENTILATION HOSE**
41. **REMOVE VENTILATION HOSE NO.2**
42. **REMOVE INTAKE MANIFOLD**
 - a. Using several steps, remove the 3 bolts and 2 nuts in the sequence shown in the illustration, then remove the intake manifold.
 - b. Remove the gasket from the intake manifold.



G03197304

Fig. 68: Identifying Removal Sequence Of Intake Manifold Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. REMOVE BOOSTER VACUUM TUBE

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

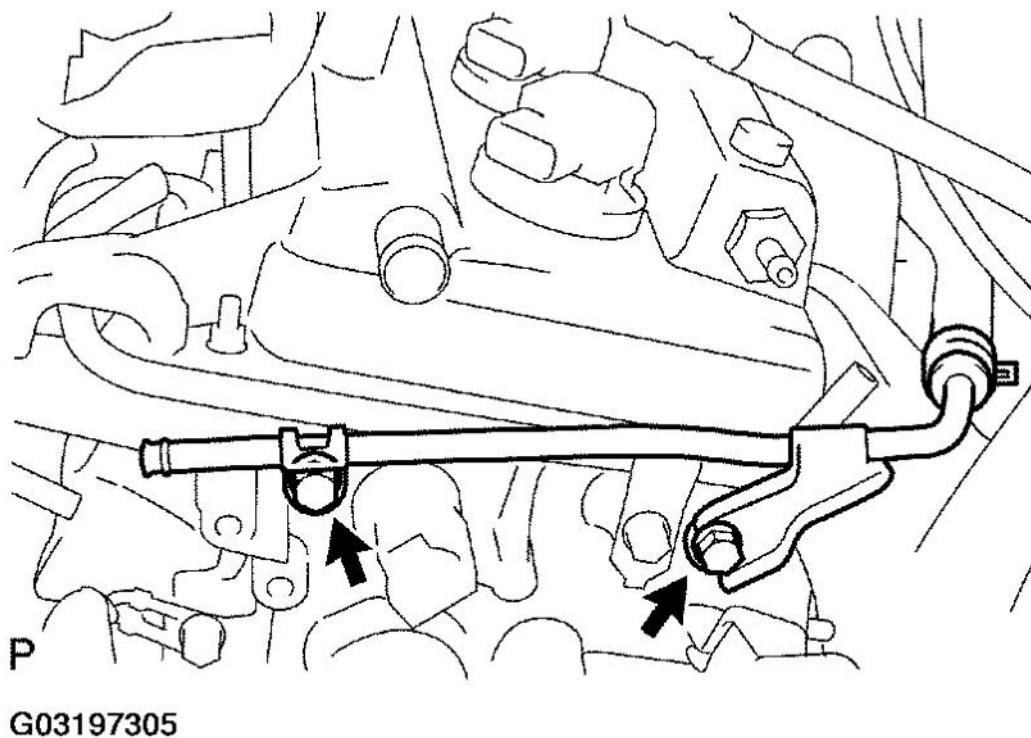


Fig. 69: Removing Booster Vacuum Tube

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

44. REMOVE MANIFOLD SUPPORT BRACKET

- a. Remove the 3 bolts and the manifold support bracket.

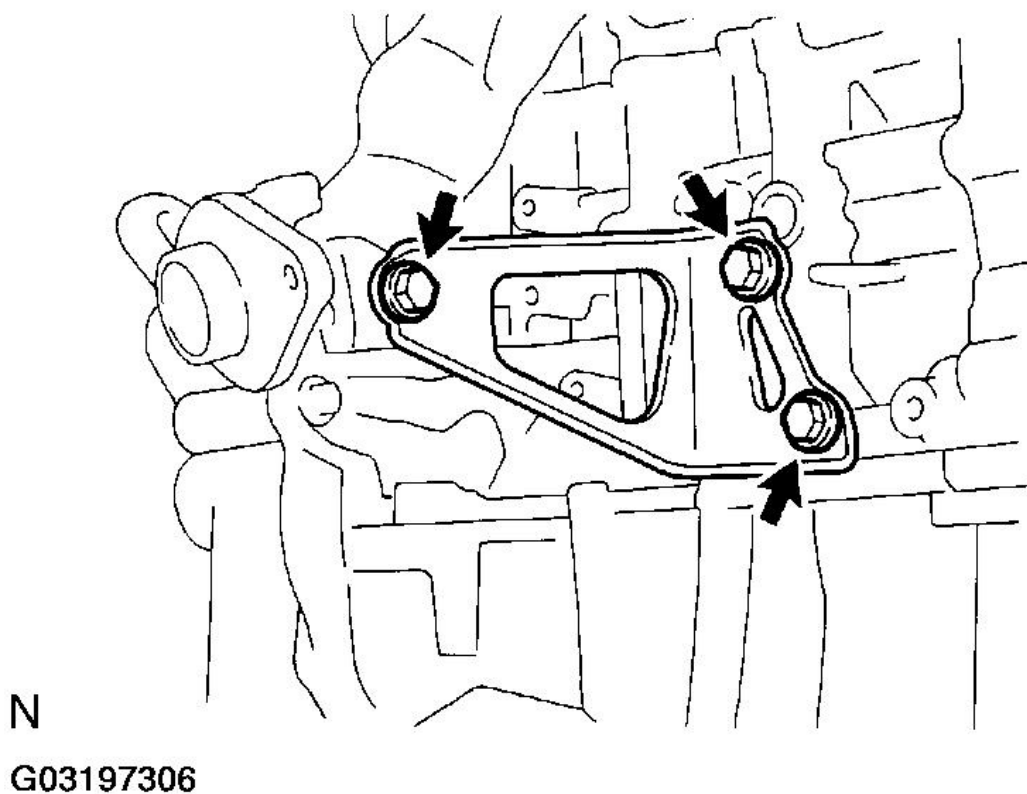
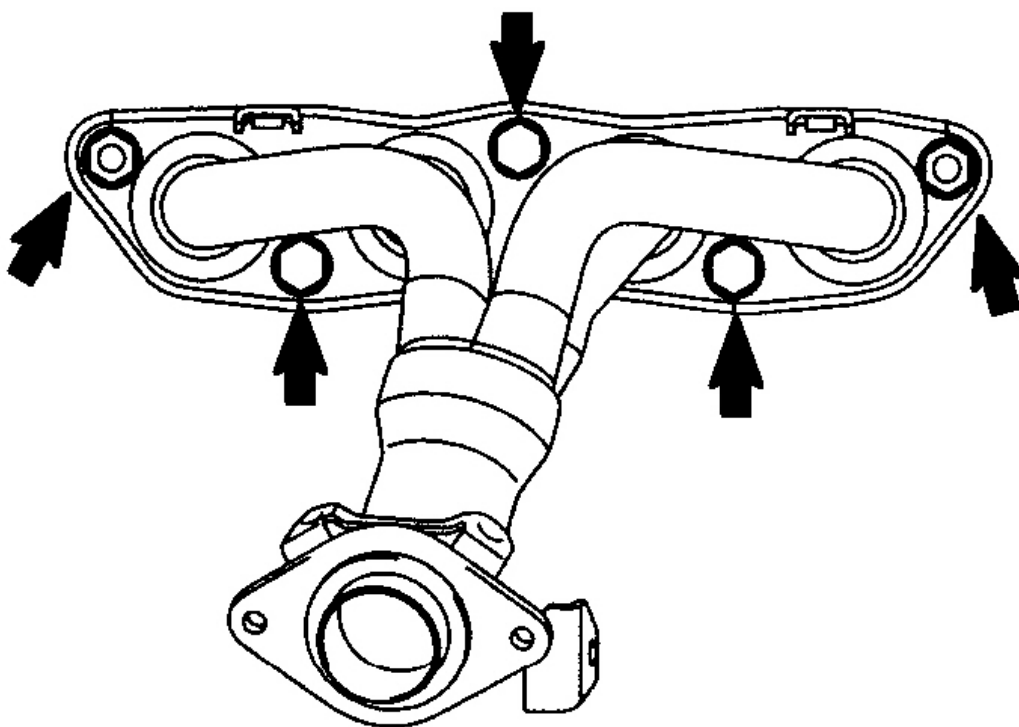


Fig. 70: Removing Manifold Support Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. **REMOVE EXHAUST MANIFOLD HEAT INSULATOR No. 1**
 - a. Remove the 4 bolts and the exhaust manifold heat insulator.
46. **REMOVE EXHAUST MANIFOLD**
 - a. Remove the 3 bolts, the 2 nuts and the exhaust manifold.



G03197307

Fig. 71: Removing Exhaust Manifold

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

47. REMOVE IGNITION COIL No. 1

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

48. REMOVE WATER BY-PASS PIPE No. 1

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

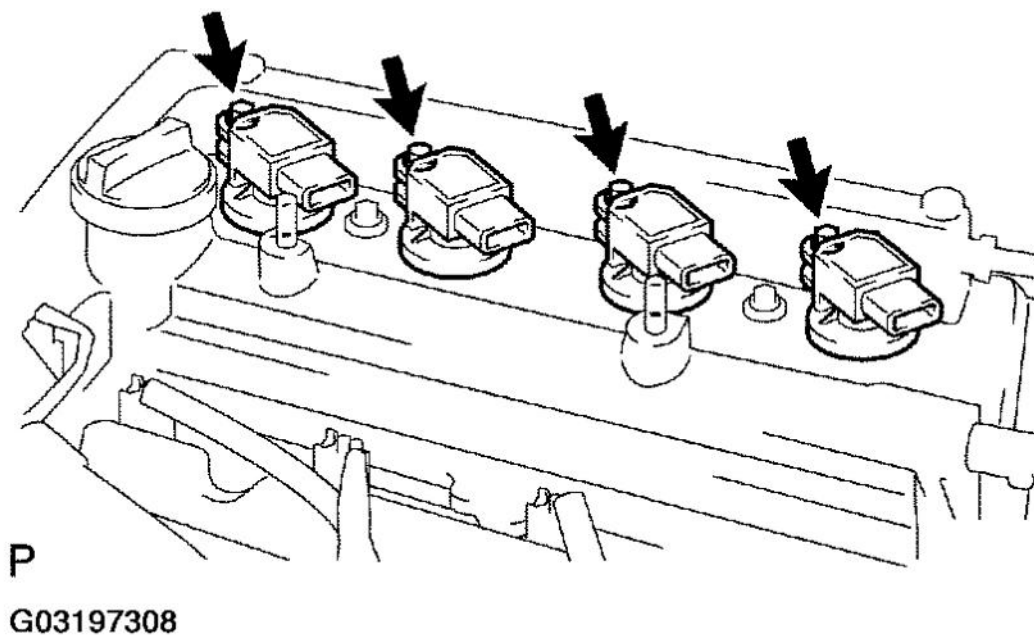


Fig. 72: Removing Ignition Coils

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

49. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

- a. Using SST, remove the water temperature sensor.

SST 09817-33190

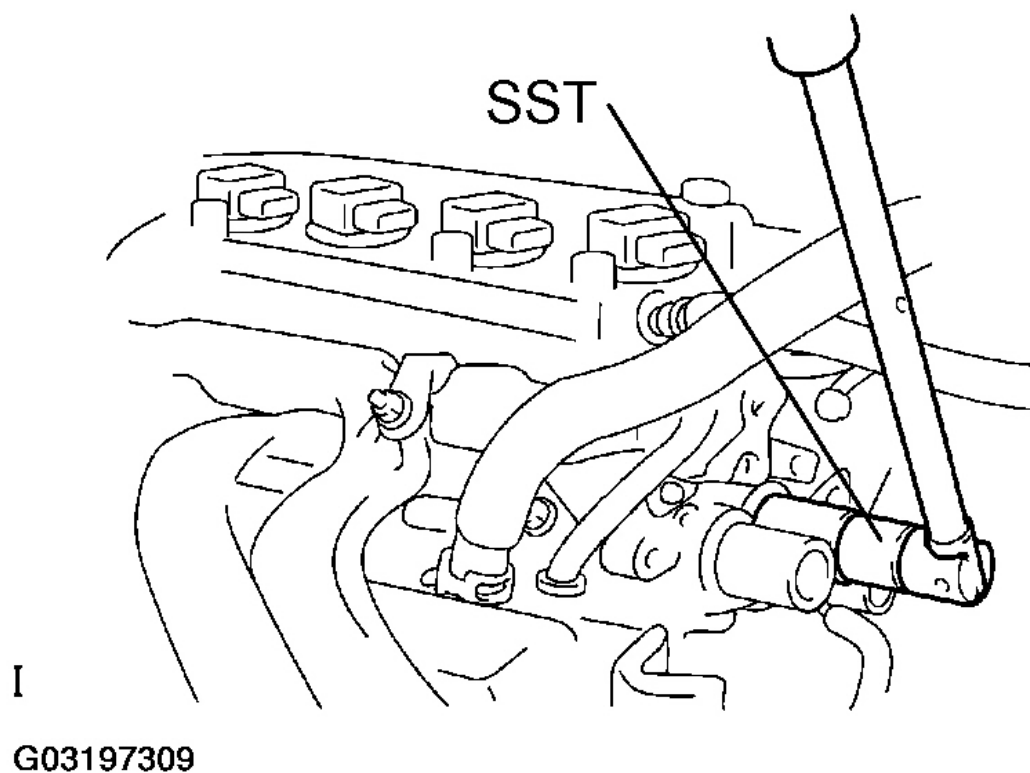
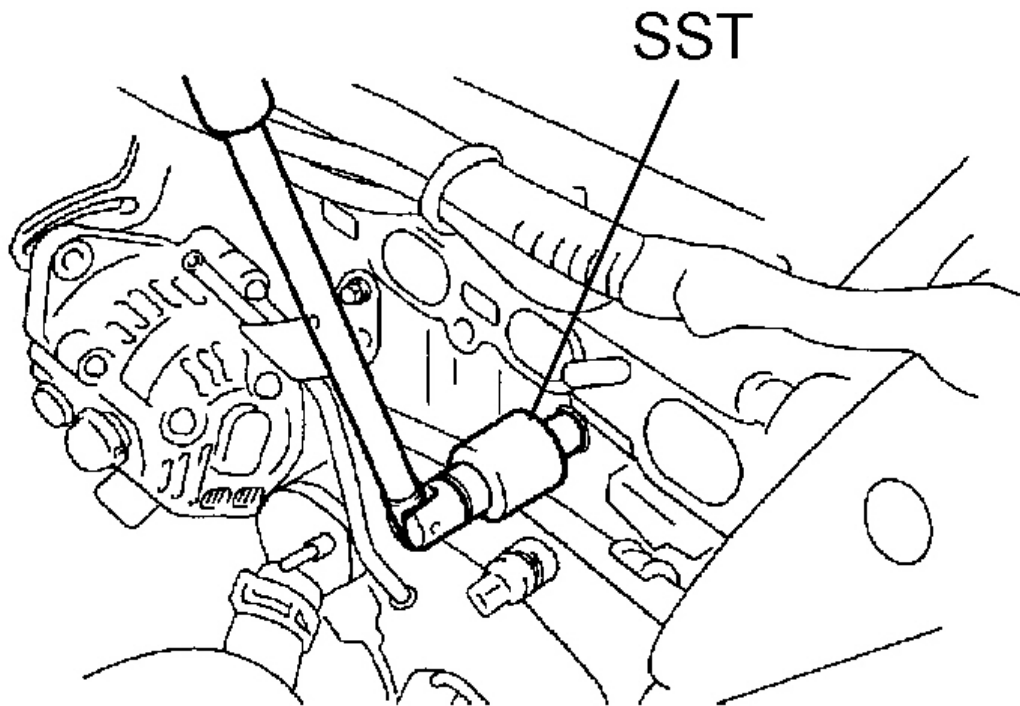


Fig. 73: Removing Water Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. REMOVE KNOCK SENSOR

- a. Using SST, remove the knock sensor.

SST 09816-30010



G03197310

Fig. 74: Removing Knock Sensor

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

51. REMOVE ENGINE OIL PRESSURE SWITCH ASSY

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

SST 09268-46021

52. REPLACE PARTIAL ENGINE ASSY

53. 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)

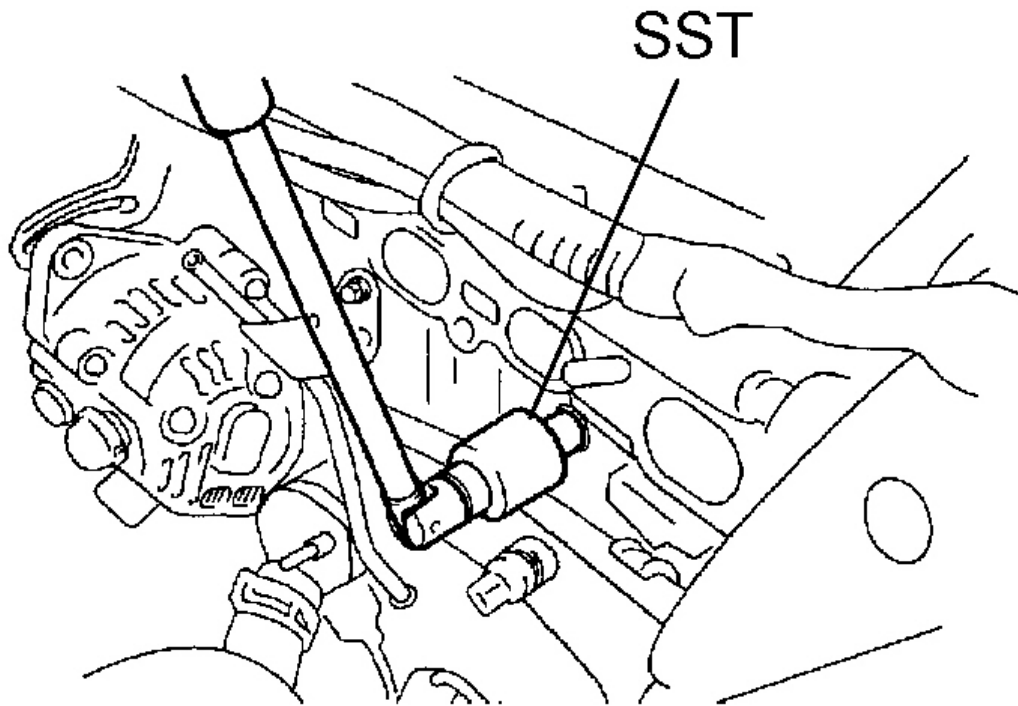
NOTE: Do not start the engine for at least 1 hour after installation.

54. INSTALL KNOCK SENSOR

- a. Using SST, install the knock sensor.

SST 09816-30010

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



G03197311

Fig. 75: Installing Knock Sensor

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

55. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

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

SST 09817-33190

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

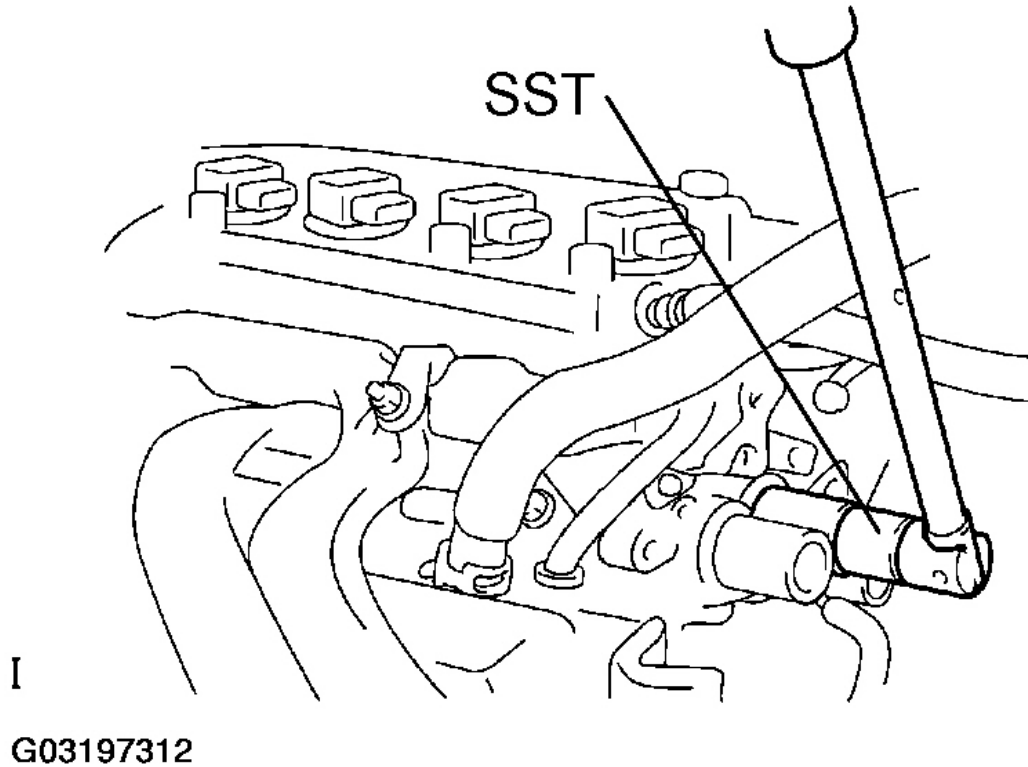


Fig. 76: Installing Water Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. INSTALL WATER BY-PASS PIPE No. 1

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

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

57. INSTALL IGNITION COIL No. 1

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

58. INSTALL EXHAUST MANIFOLD

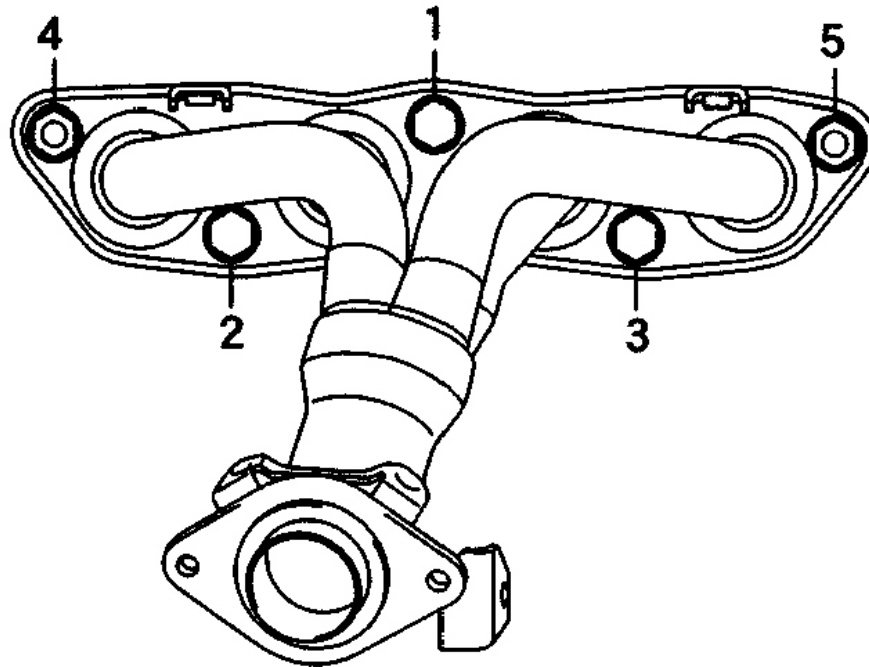
- a. Using several steps, install a new exhaust manifold gasket and exhaust manifold with the 3 bolts and 2 nuts in the sequence shown in the illustration.

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

59. 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)



G03197313

Fig. 77: Identifying Tightening Sequence Of Exhaust Manifold Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. INSTALL MANIFOLD SUPPORT BRACKET

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

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

61. INSTALL BOOSTER VACUUM TUBE

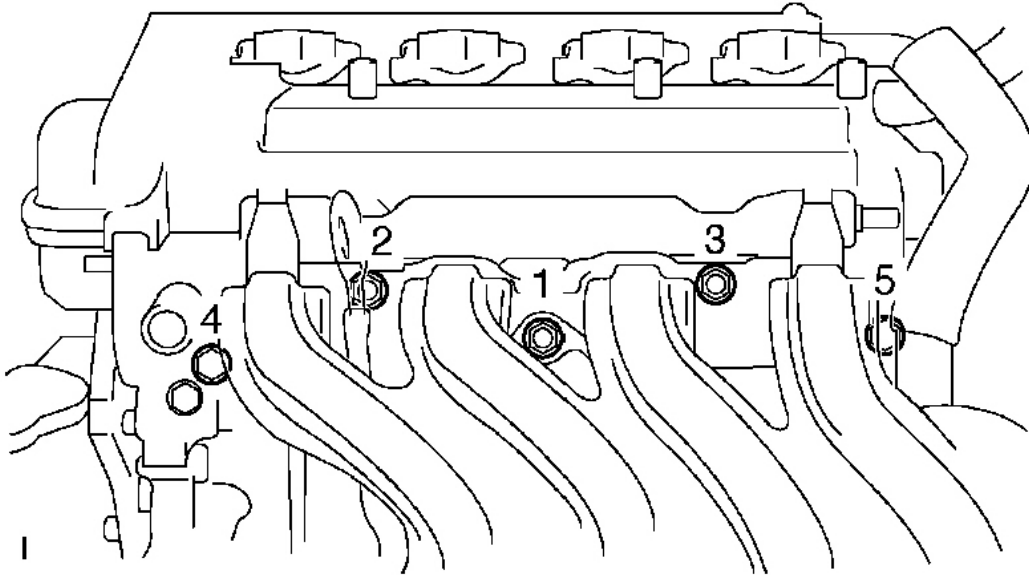
- a. Install the booster vacuum tube with the 2 bolts.

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

62. 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 the illustration.

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



G03197314

Fig. 78: Identifying Tightening Sequence Of Intake Manifold Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

64. INSTALL CLUTCH DISC ASSY (MANUAL TRANSAXLE) (See OVERHAUL)

65. INSTALL CLUTCH COVER ASSY (MANUAL TRANSAXLE) (See OVERHAUL)

66. INSTALL MANUAL TRANSAXLE ASSY (MANUAL TRANSAXLE) (See REPLACEMENT)

67. INSTALL AUTOMATIC TRANSAXLE ASSY (AUTOMATIC TRANSAXLE) (See REPLACEMENT)

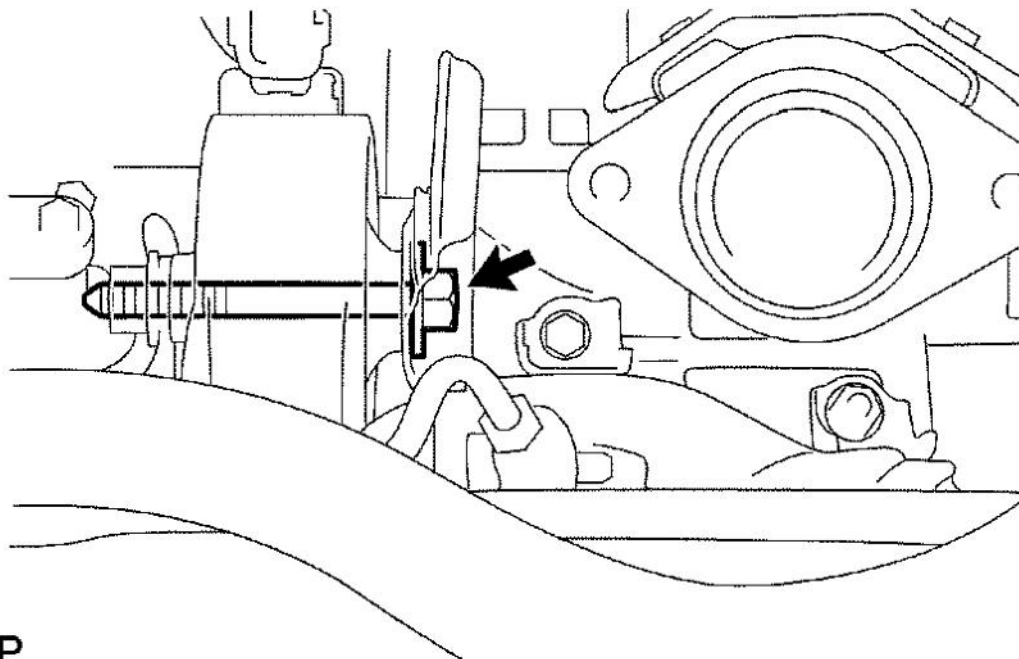
68. INSTALL GENERATOR ASSY (See REPLACEMENT)

69. INSTALL STARTER ASSY (See REPLACEMENT)

70. 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

G03197315

Fig. 79: Installing Bolt Securing Engine & Transaxle Assembly To Suspension Crossmember
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

71. INSTALL VANE PUMP ASSY

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

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

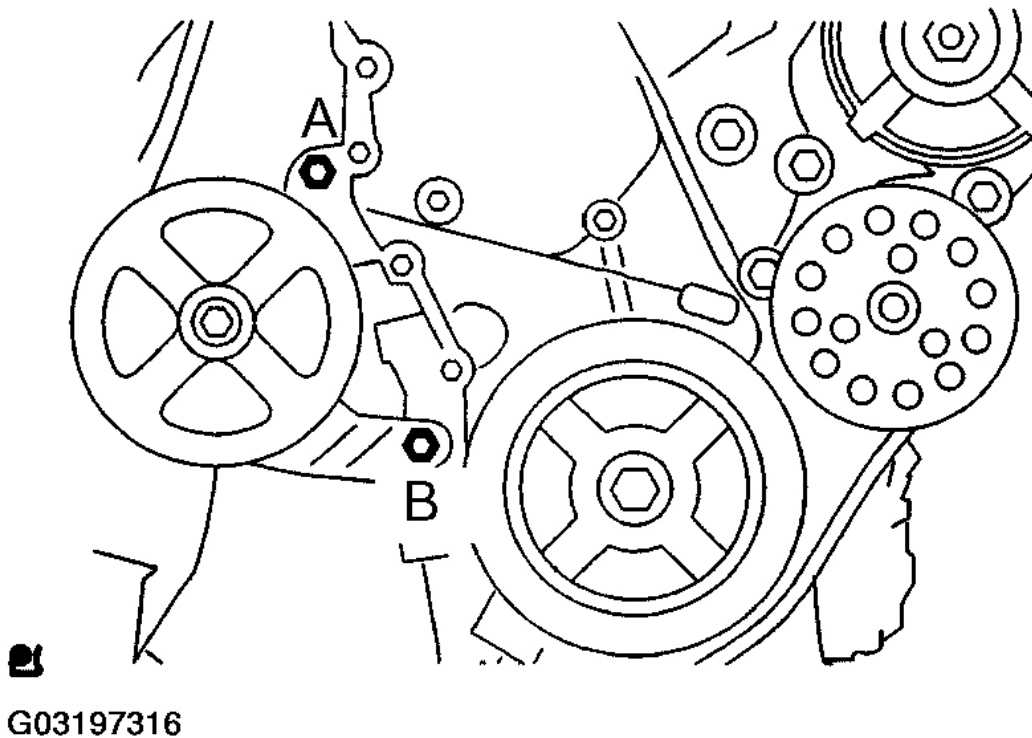


Fig. 80: Installing Vane Pump Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

72. INSTALL VANE PUMP V BELT

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

73. ADJUST VANE PUMP V BELT

74. 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.

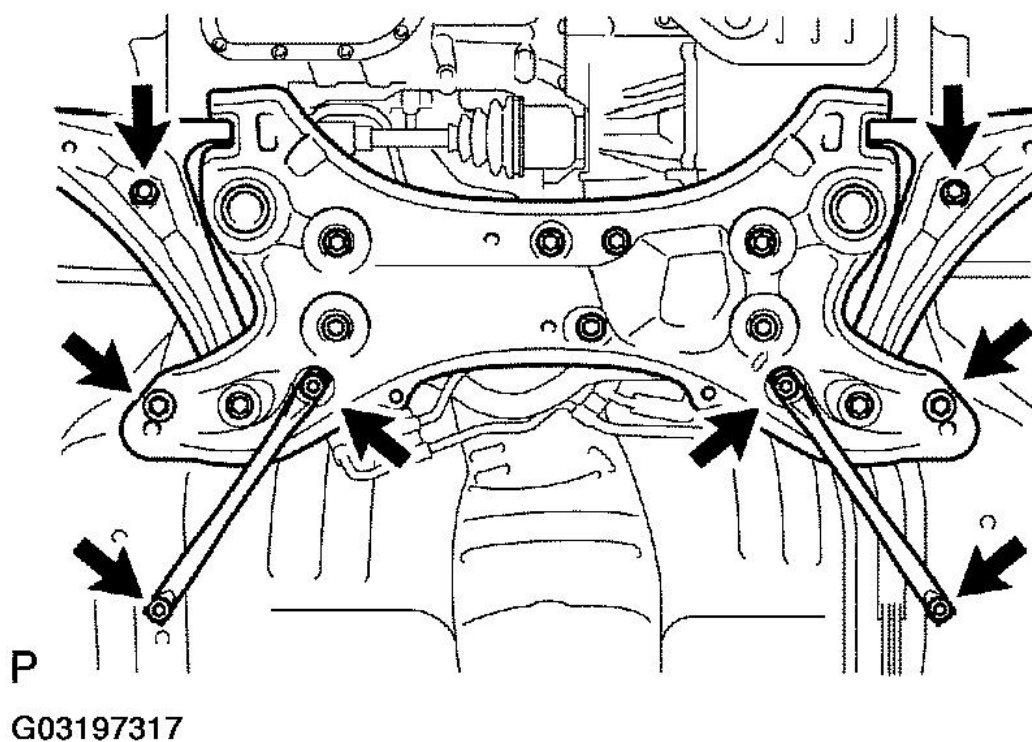
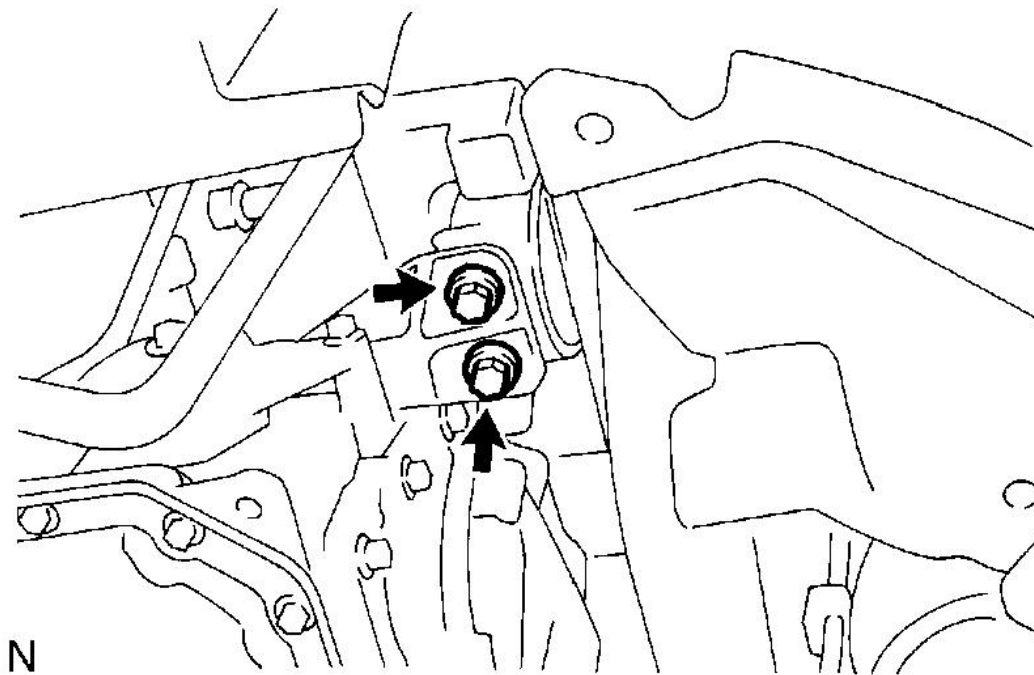


Fig. 81: Installing Suspension Crossmember

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)



G03197318

Fig. 82: Installing Engine Mounting Bracket LH Onto Engine Mounting Insulator 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)

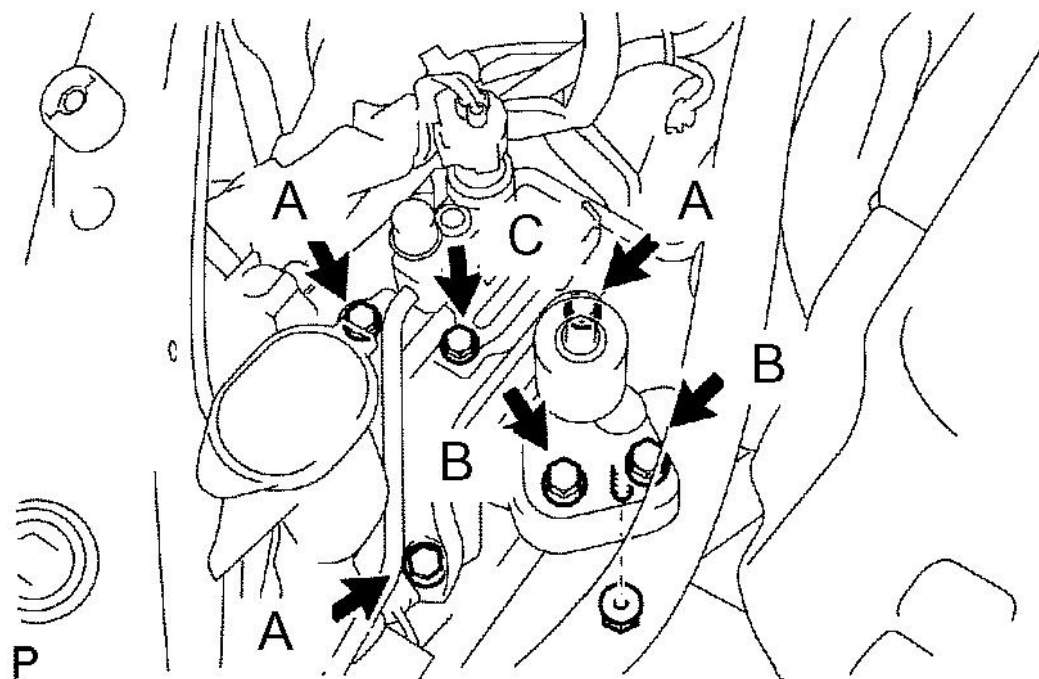
Bolt B 52 N in (530 kgf.cm, 38 ft.lbf)

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)



G03197319

Fig. 83: Installing Engine Mounting Insulator RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09670-00010

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

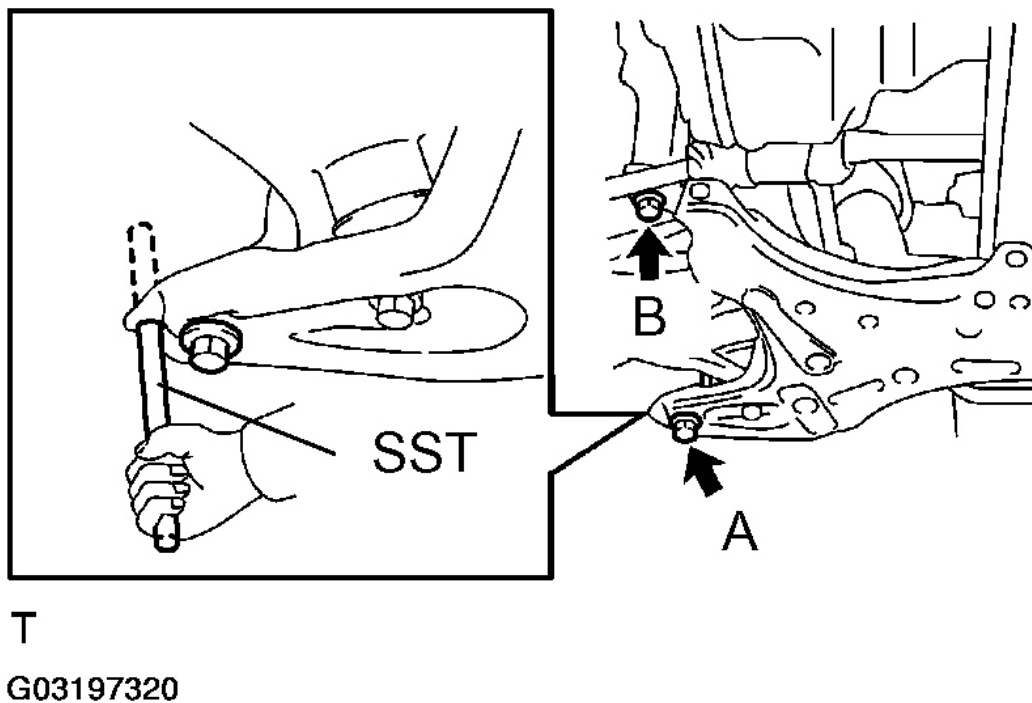


Fig. 84: Tightening Right-Hand Crossmember Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09670-00010

- j. Temporarily tighten bolt A, then tighten bolt B.
- k. Insert SST into the positioning holes on the right-hand crossmember and the right-hand of the vehicle, 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)

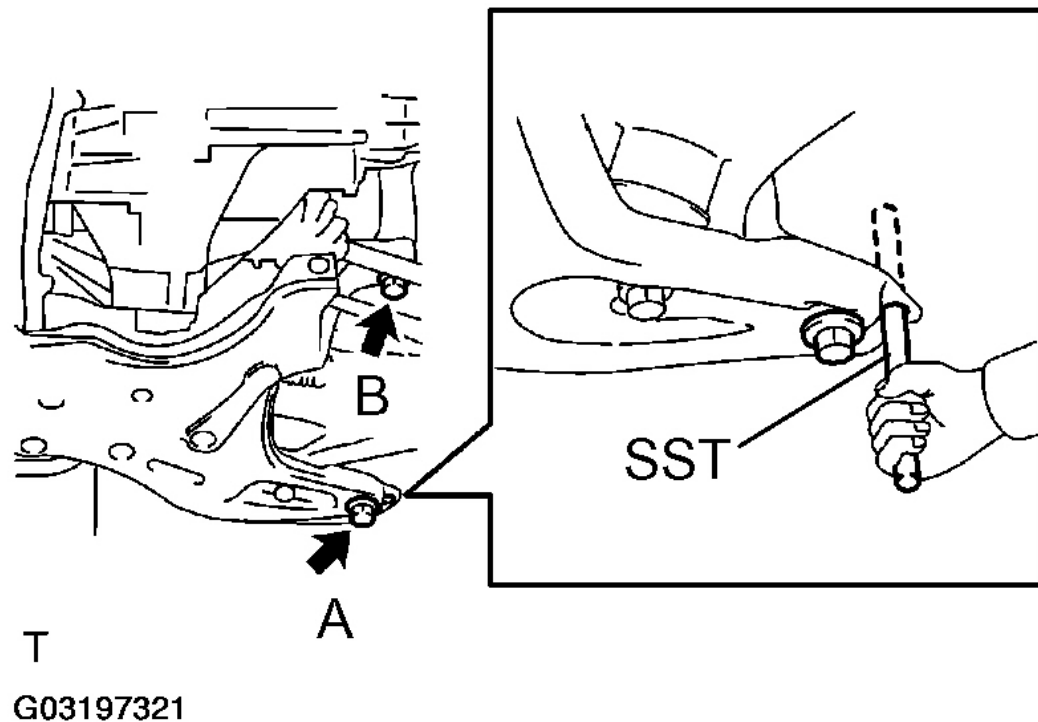


Fig. 85: Tightening Left-Hand Crossmember Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Insert SST into the positioning holes on the left-hand crossmember and the left-hand of the vehicle, 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)

- m. Tighten the 4 bolts, shown in the illustration.

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

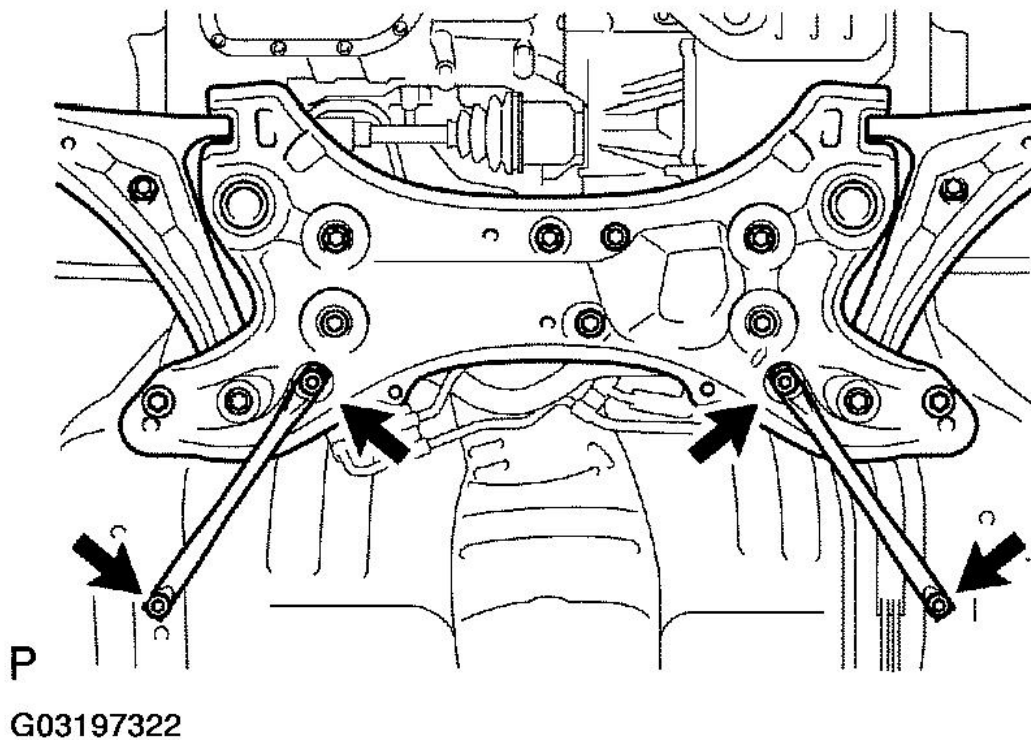


Fig. 86: Tightening Crossmember Bolts

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

75. INSTALL FRONT SUSPENSION ARM SUB-ASSY LOWER No. 1 LH

- a. Install the front suspension arm lower to 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.

76. 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 taper portions of the tie rod end to prevent 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.

77. 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.

78. INSTALL FRONT AXLE HUB LH NUT

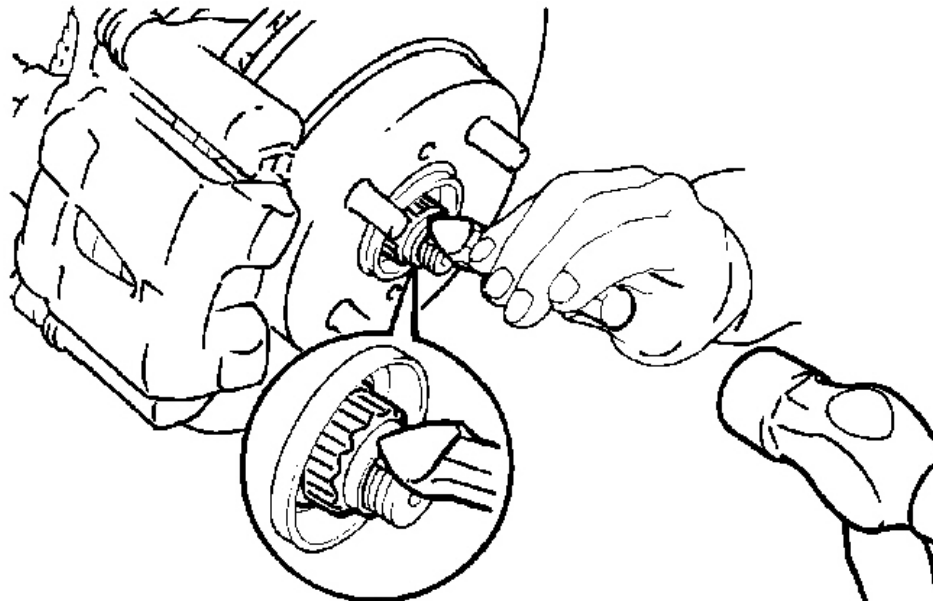
- a. Using a 30 mm socket wrench, install the new hub nut.

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

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

HINT:

Perform the same procedure as above on the opposite side.



G03197323

Fig. 87: Staking Hub Nut Using Chisel
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

79. **INSTALL STEERING INTERMEDIATE SHAFT ASSY (See OVERHAUL)**
80. **INSTALL EXHAUST PIPE ASSY FRONT (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
81. **INSTALL FLOOR PANEL BRACE FRONT (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
82. **INSTALL A/C COMPRESSOR (See REPLACEMENT)**
83. **INSTALL FAN AND GENERATOR V BELT**
 - a. Temporarily install the V-ribbed belt on each pulley.
84. **ADJUST FAN AND GENERATOR V BELT (See REPLACEMENT)**
85. **INSTALL RADIATOR ASSY (See REPLACEMENT)**
86. **CONNECT FUEL TUBE SUB-ASSY (See FUEL SYSTEM)**
87. **INSTALL AIR CLEANER ASSY (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)**
88. **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)

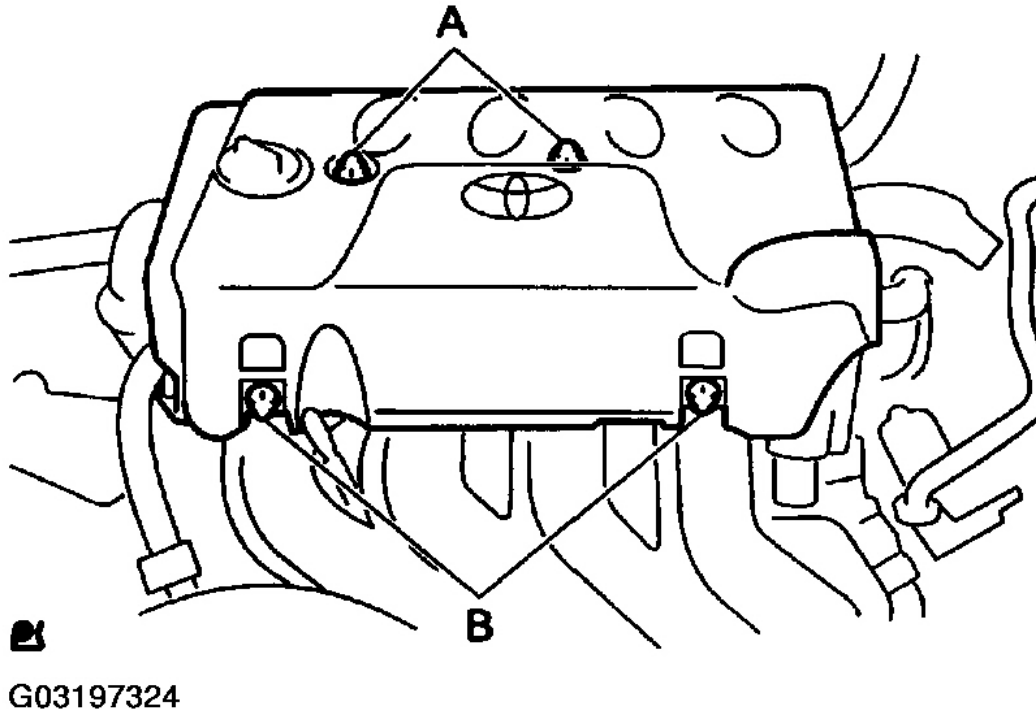


Fig. 88: Installing Cylinder Head Cover No. 2

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

89. **ADD ENGINE OIL**
90. **ADD ENGINE COOLANT (See REPLACEMENT)**
91. **CHECK FOR ENGINE OIL LEAKS**
92. **CHECK FOR ENGINE COOLANT LEAKS (See ON-VEHICLE INSPECTION)**
93. **CHECK FOR FUEL LEAKS (See ON-VEHICLE INSPECTION)**
94. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT (See ADJUSTMENT)**
95. **CHECK IDLE SPEED AND IGNITION TIMING (See INSPECTION)**
96. **INSPECT CO/HC (See INSPECTION)**
97. **CHECK ABS SPEED SENSOR SIGNAL (W/ ABS)**

OVERHAUL

1. REMOVE SPARK PLUG

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

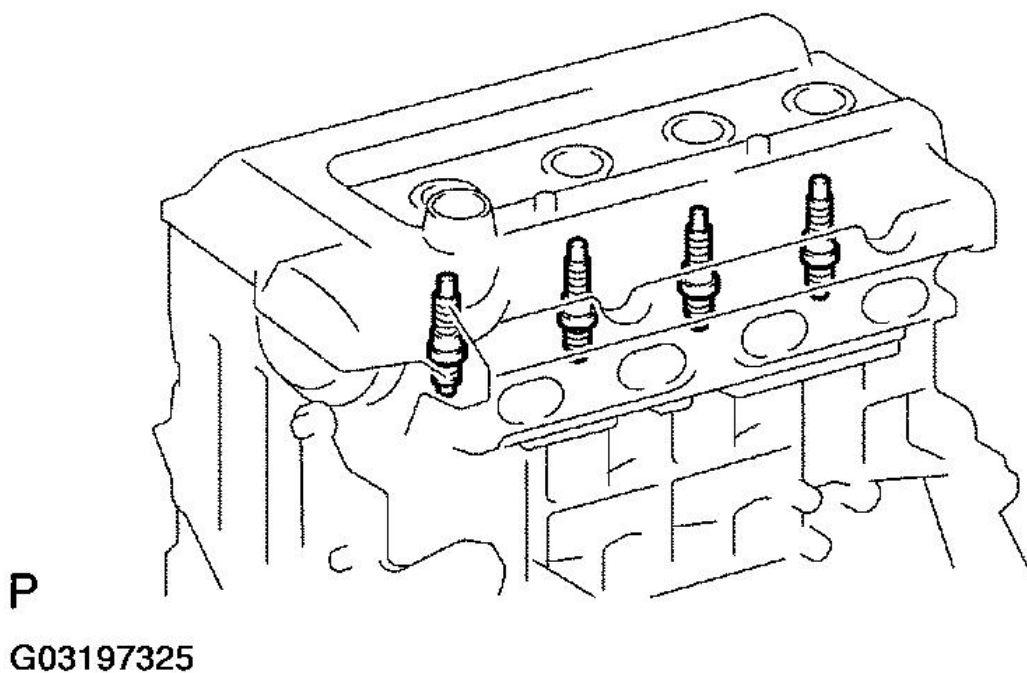


Fig. 89: Removing Spark Plugs

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

2. REMOVE THERMOSTAT

- a. Remove the 2 nuts and the water inlet.
- b. Remove the thermostat.
- c. Remove the gasket from the thermostat.

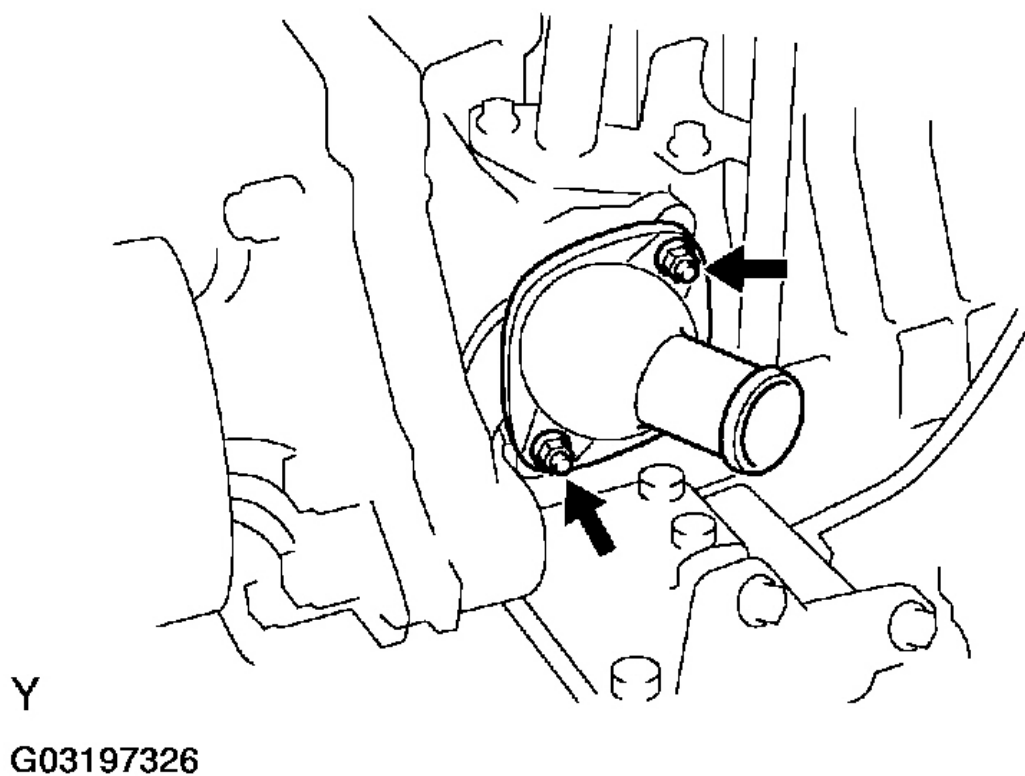


Fig. 90: Removing Water Inlet & Thermostat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. REMOVE OIL FILLER CAP SUB-ASSY

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

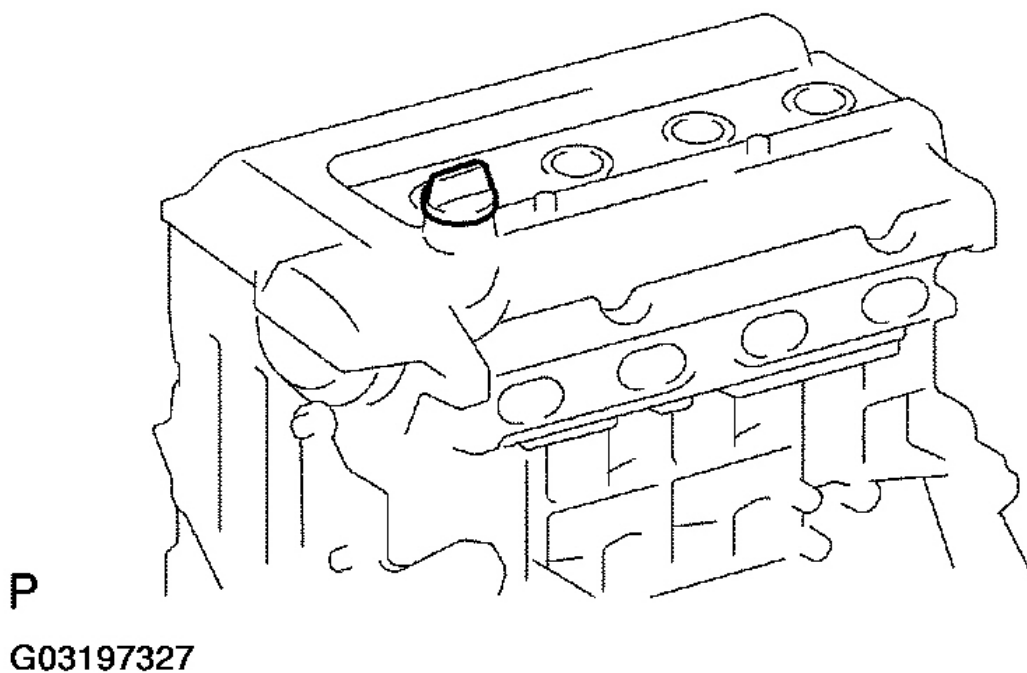
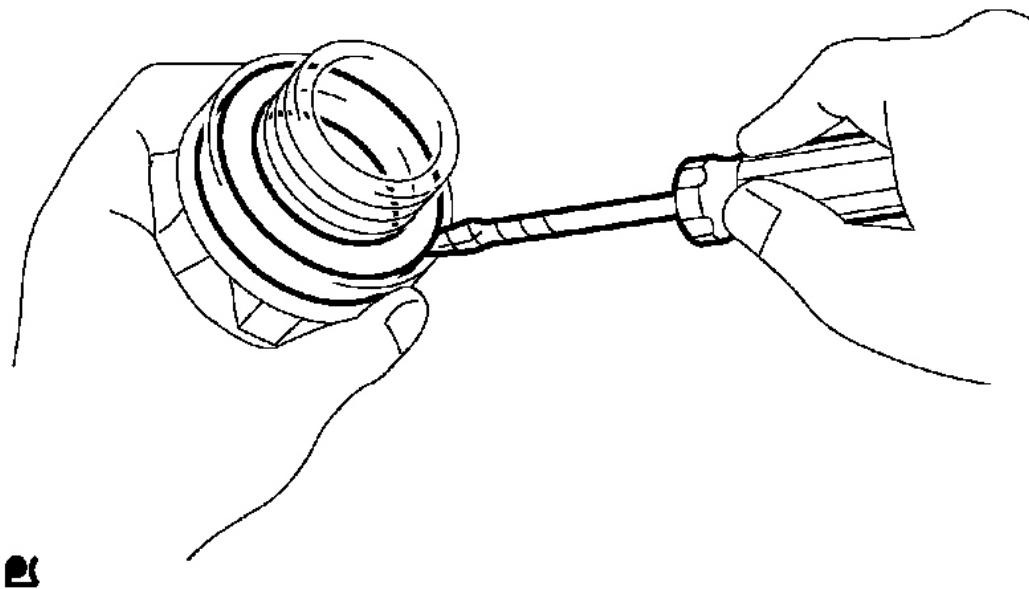


Fig. 91: Removing Oil Filler Cap From Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE OIL FILLER CAP GASKET

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



G03197328

Fig. 92: Removing Gasket From Oil Filler Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE CRANKSHAFT POSITION SENSOR

- a. Remove the bolt and the crankshaft position sensor.

6. REMOVE VENTILATION VALVE SUB-ASSY

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

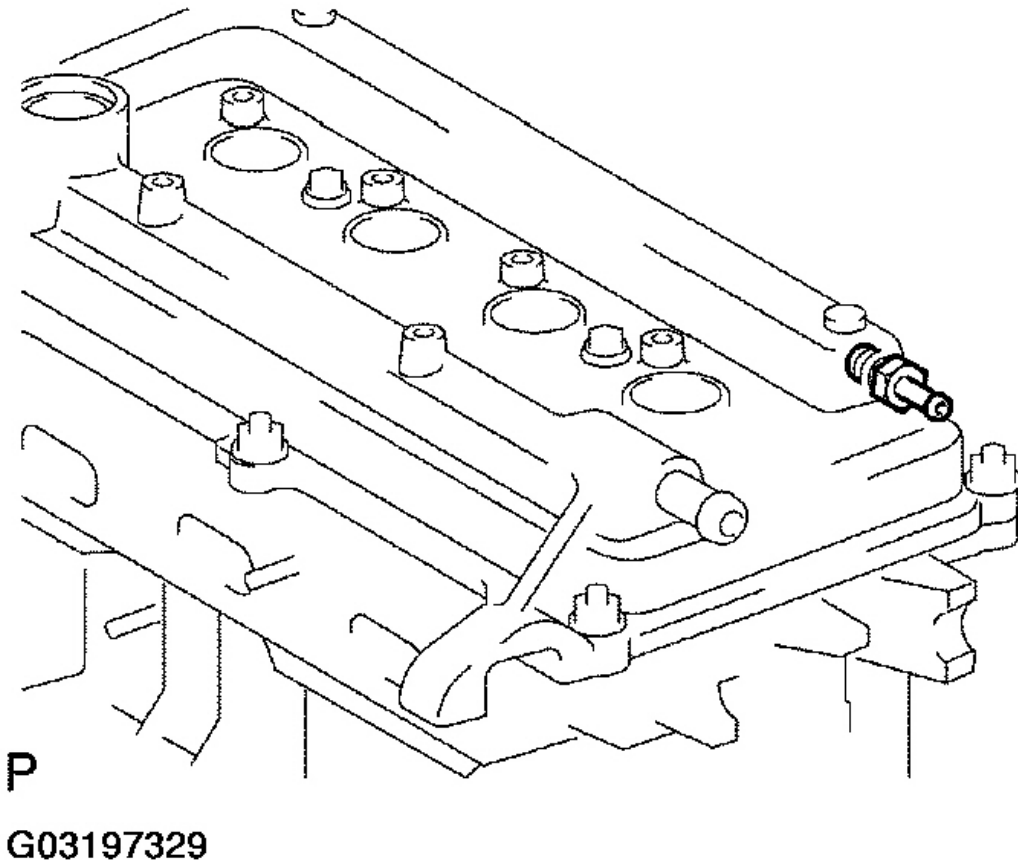


Fig. 93: Removing Ventilation Valve From Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE CYLINDER HEAD COVER SUB-ASSY

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

8. REMOVE CYLINDER HEAD COVER GASKET

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

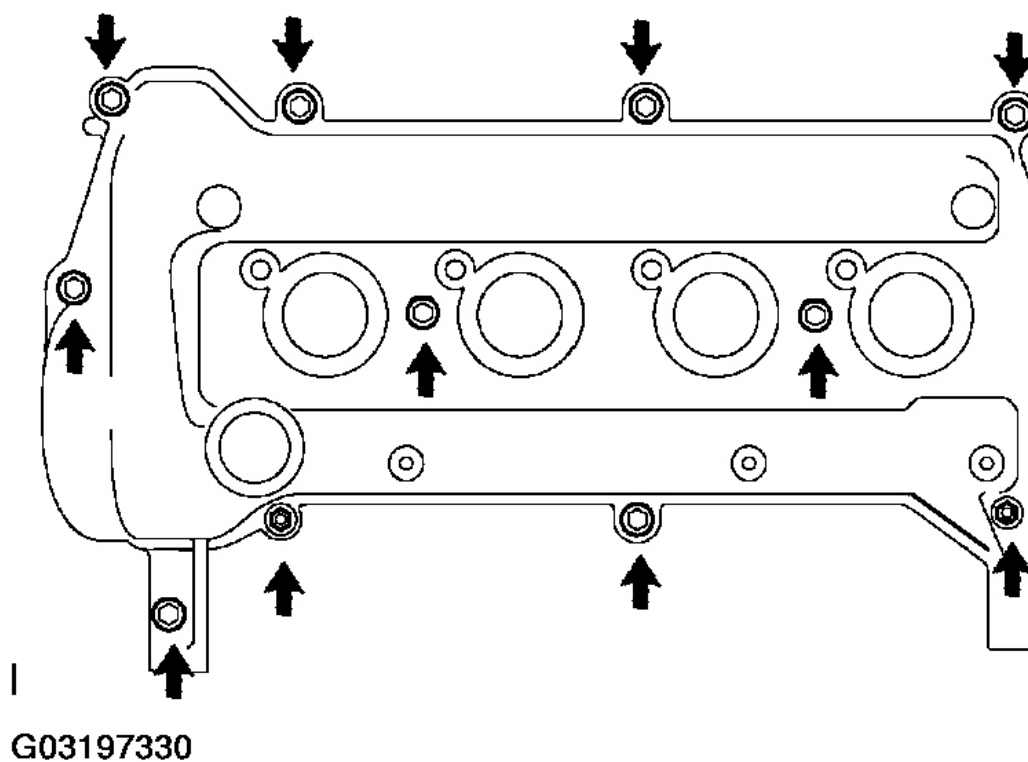
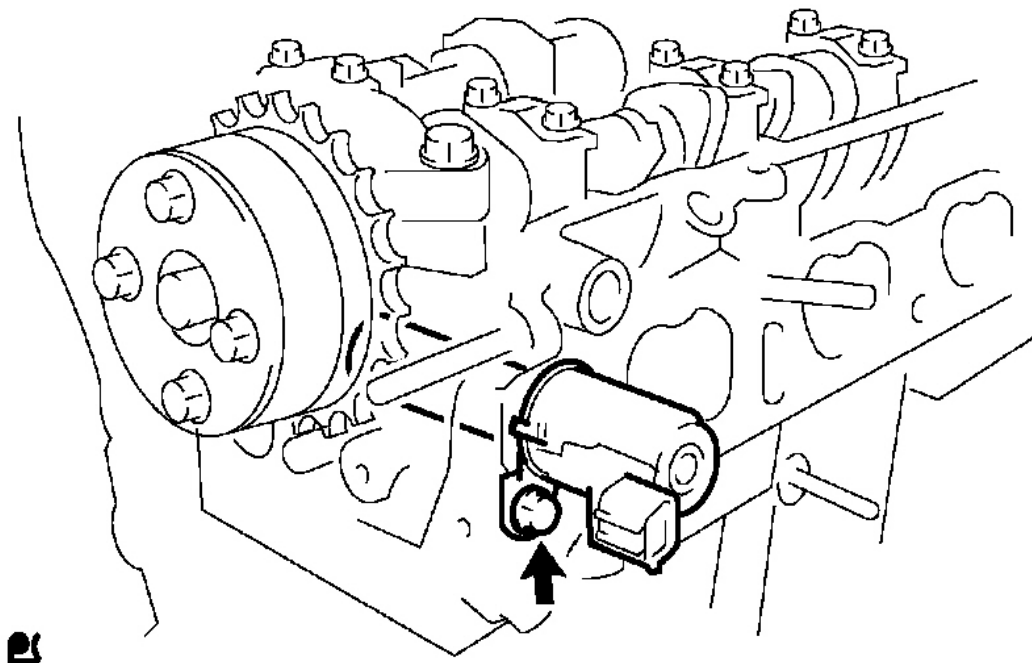


Fig. 94: Removing Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY

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



G03197331

Fig. 95: Removing Camshaft Timing Oil Control Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE OIL LEVEL GAUGE GUIDE

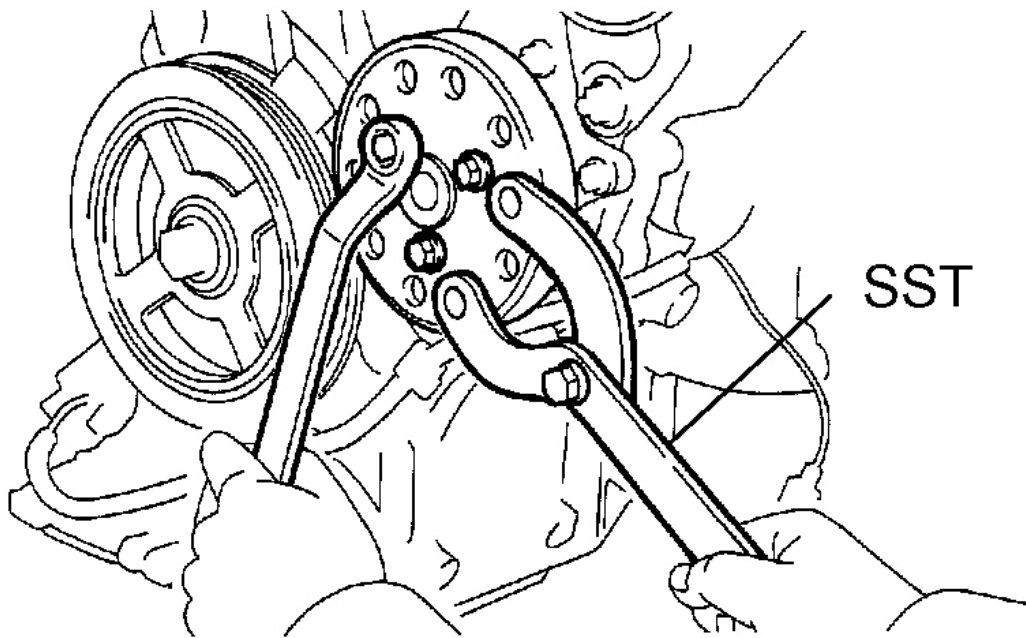
- a. Remove the bolt and the oil level gauge guide.

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 the pump pulley.



G03197332

Fig. 96: Removing Water Pump Pulley

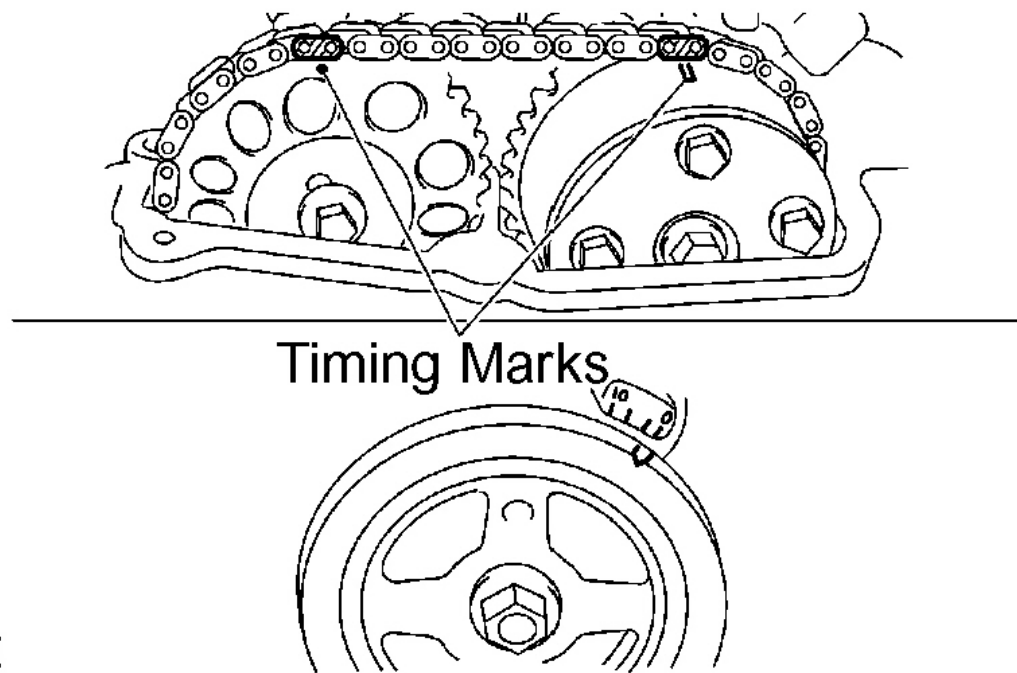
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. REMOVE CRANKSHAFT DAMPER SUB-ASSY

- a. Set the No. 1 cylinder to 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 the illustration.

HINT:

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



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Fig. 97: Identifying Timing Marks On Camshaft Timing Sprocket & Camshaft Timing Gear

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

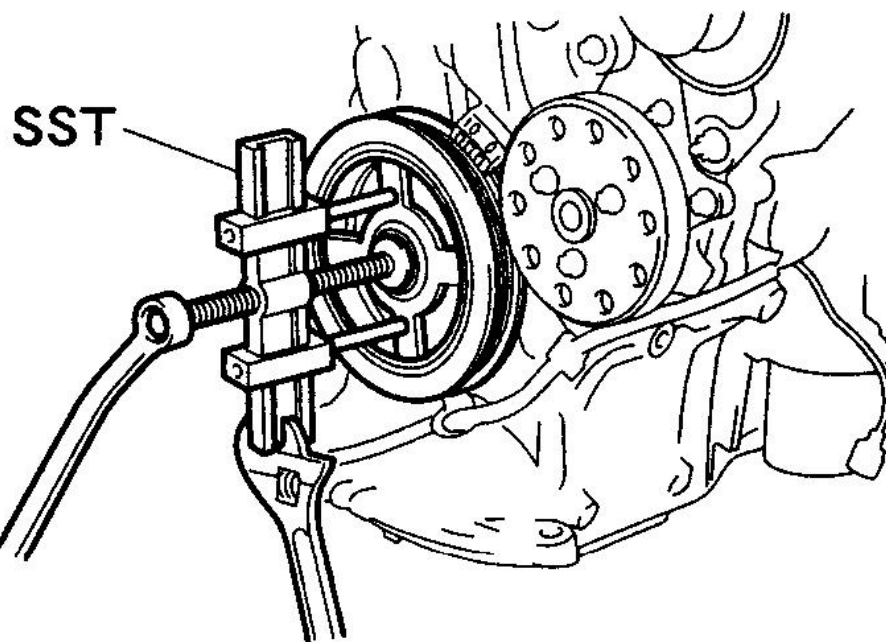
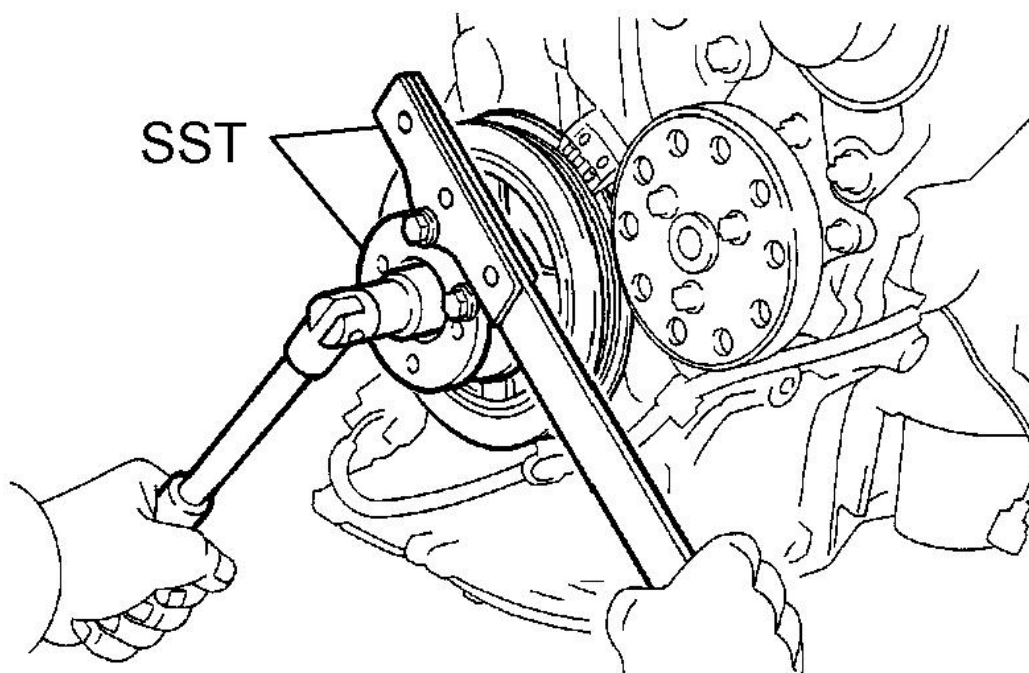
- b. Using SST, remove the pulley bolt.

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)

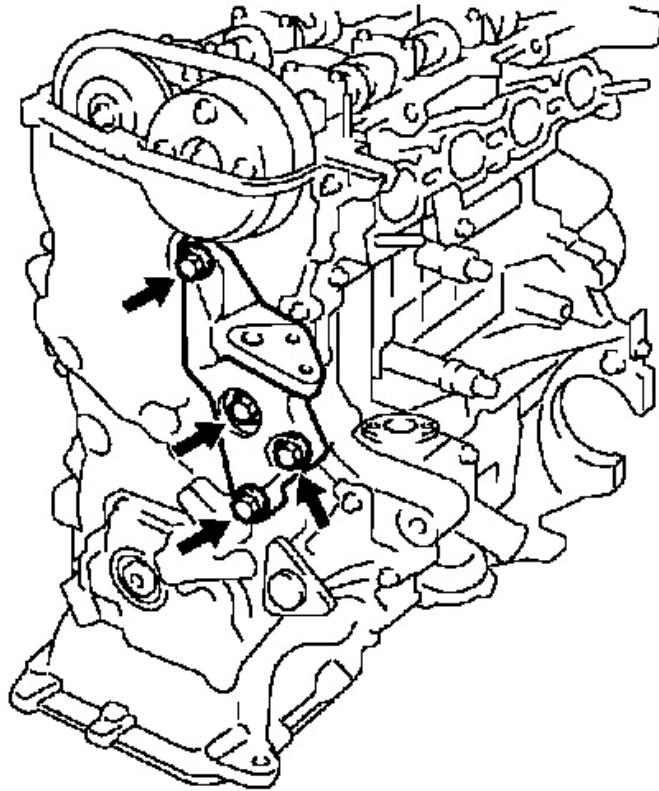


G03197334

Fig. 98: Removing Crankshaft Damper Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE ENGINE MOUNTING BRACKET RH

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



Y

G03197335

Fig. 99: Removing Engine Mounting Bracket RH
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 the gasket.

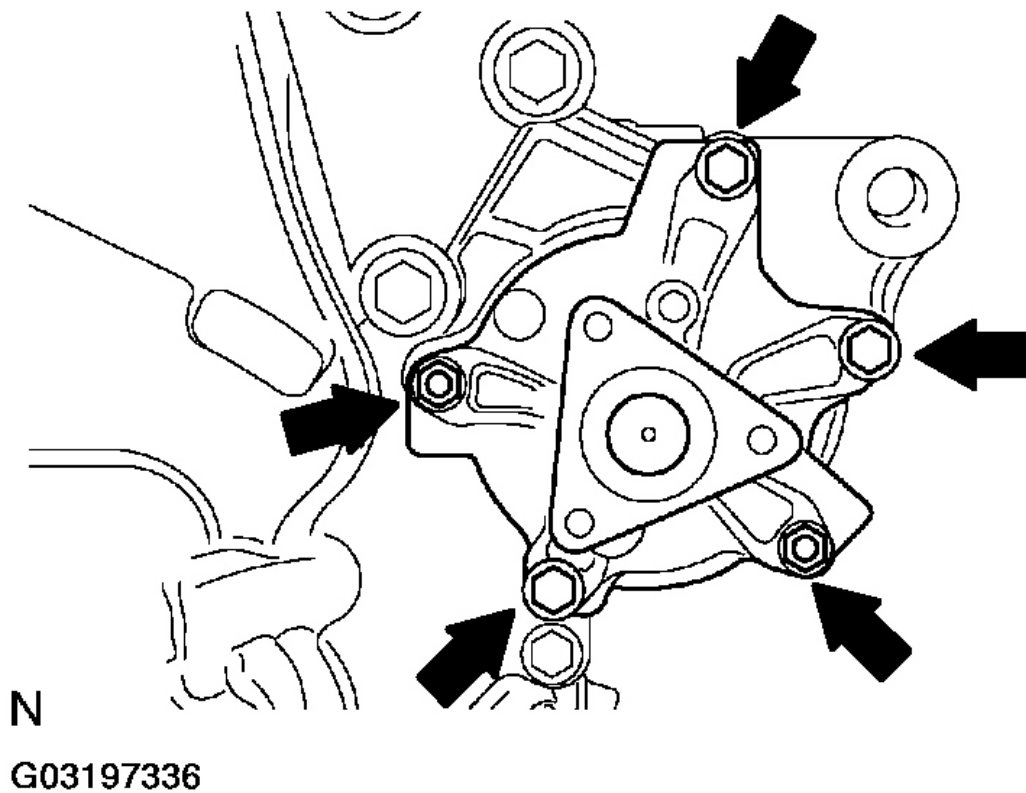
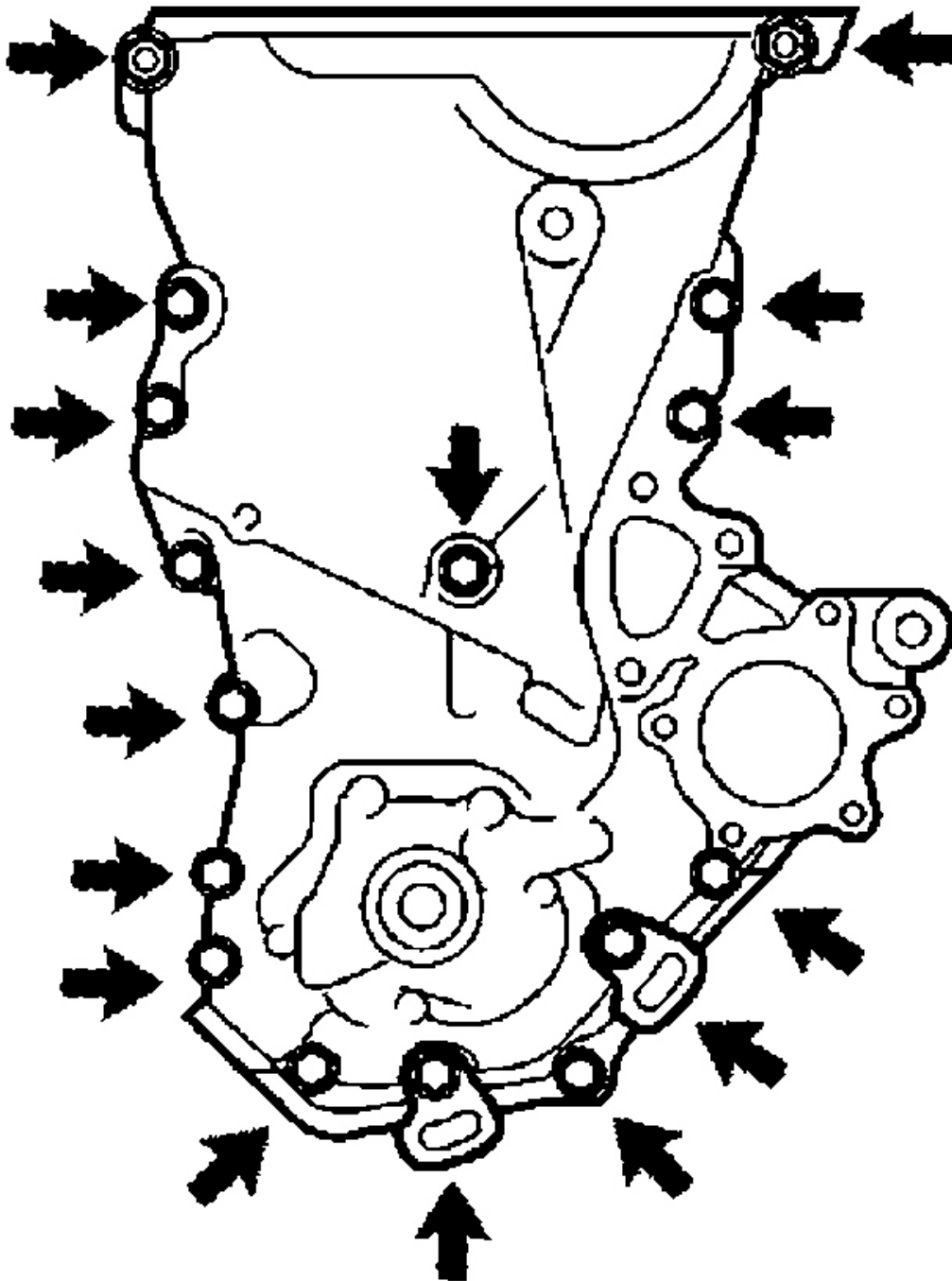


Fig. 100: Removing Water Pump Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE OIL PUMP ASSY

- a. Remove the 15 bolts and nut.



G03197337

Fig. 101: Removing Oil Pump Assy

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, the cylinder head and the cylinder block.

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

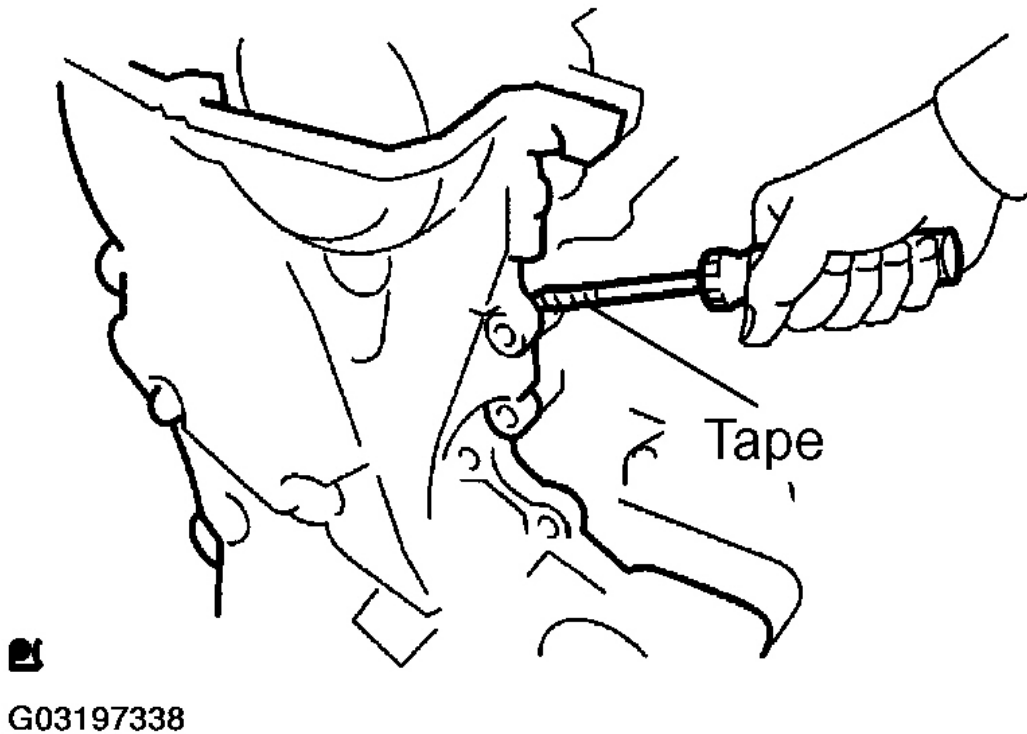
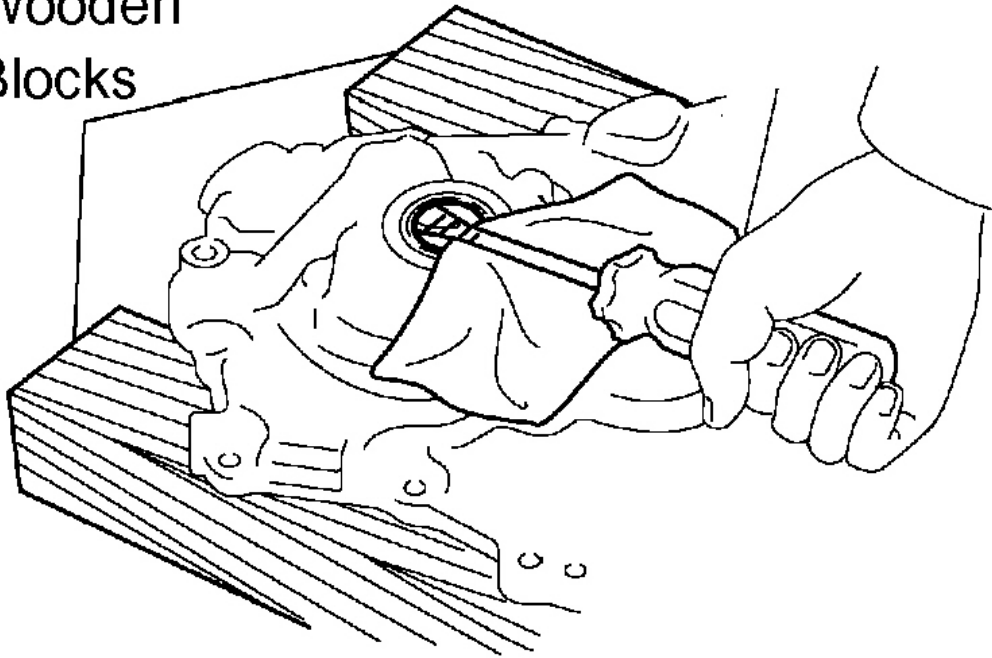


Fig. 102: Removing Oil Pump By Prying Between Cylinder Head & Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. REMOVE OIL PUMP SEAL

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

Wooden
Blocks



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Fig. 103: 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. While rotating the stopper plate of the chain tensioner upward with a screwdriver, push in the plunger of the tensioner as shown in the illustration.
 - b. While rotating 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 the tensioner to hold the stopper plate.

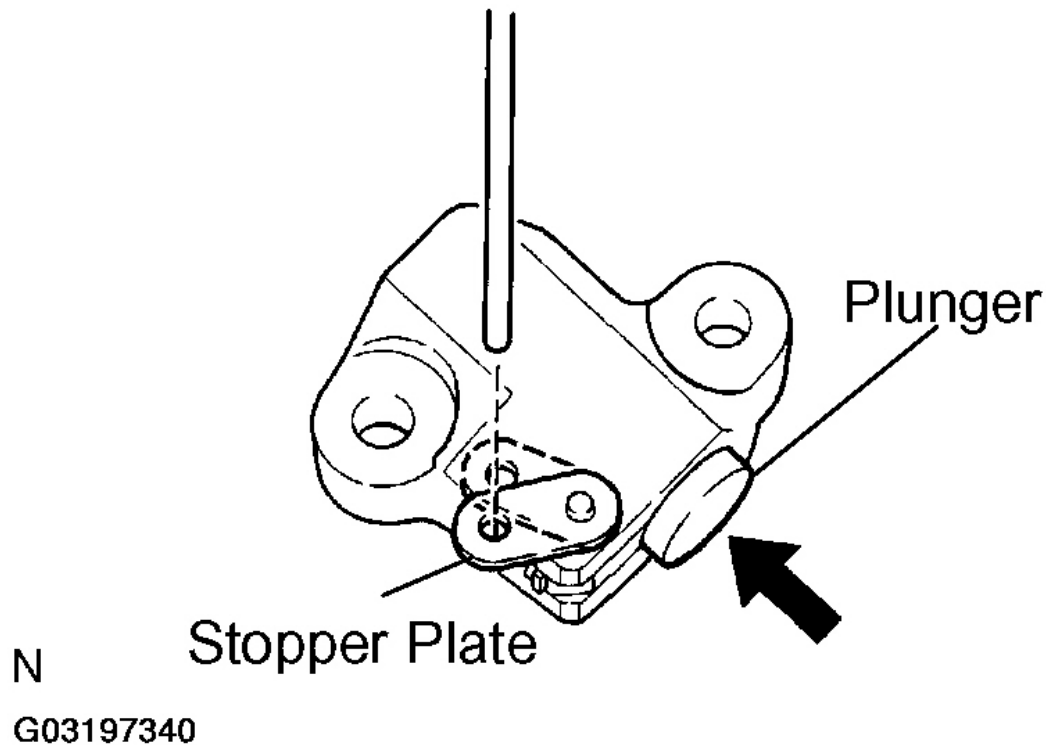


Fig. 104: Pushing In Plunger Of Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 2 bolts and the chain tensioner.
- 18. **REMOVE CHAIN TENSIONER SLIPPER**
 - a. Remove the bolt and the chain tensioner slipper.
- 19. **REMOVE CHAIN VIBRATION DAMPER No. 1**
 - a. Remove the 2 bolts and the 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.)

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

HINT:

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

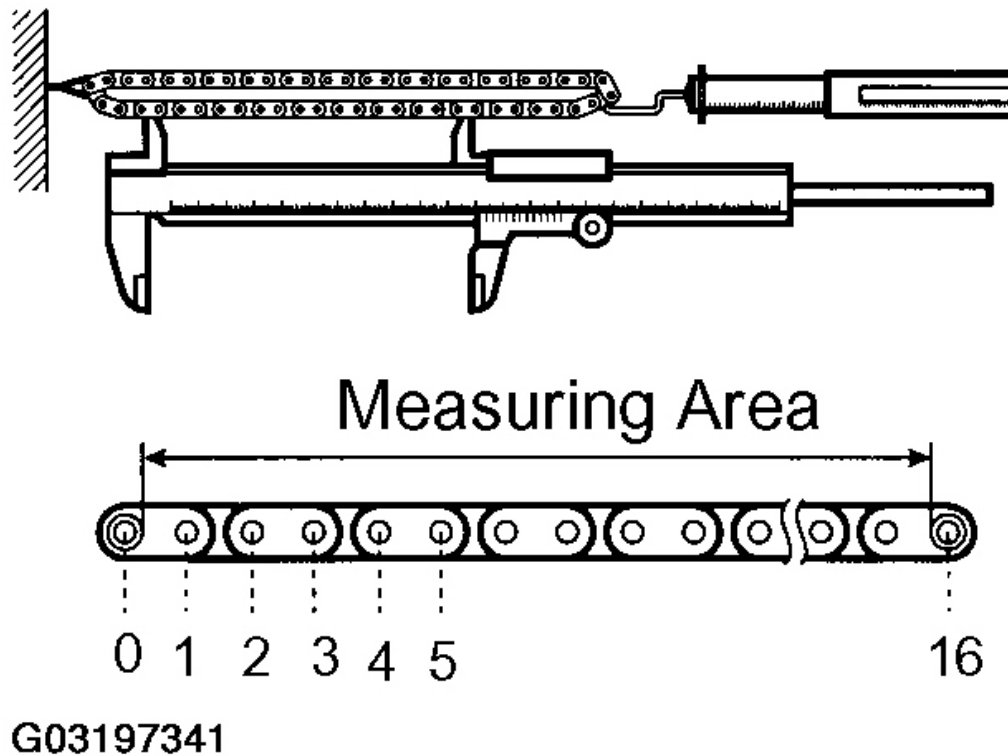
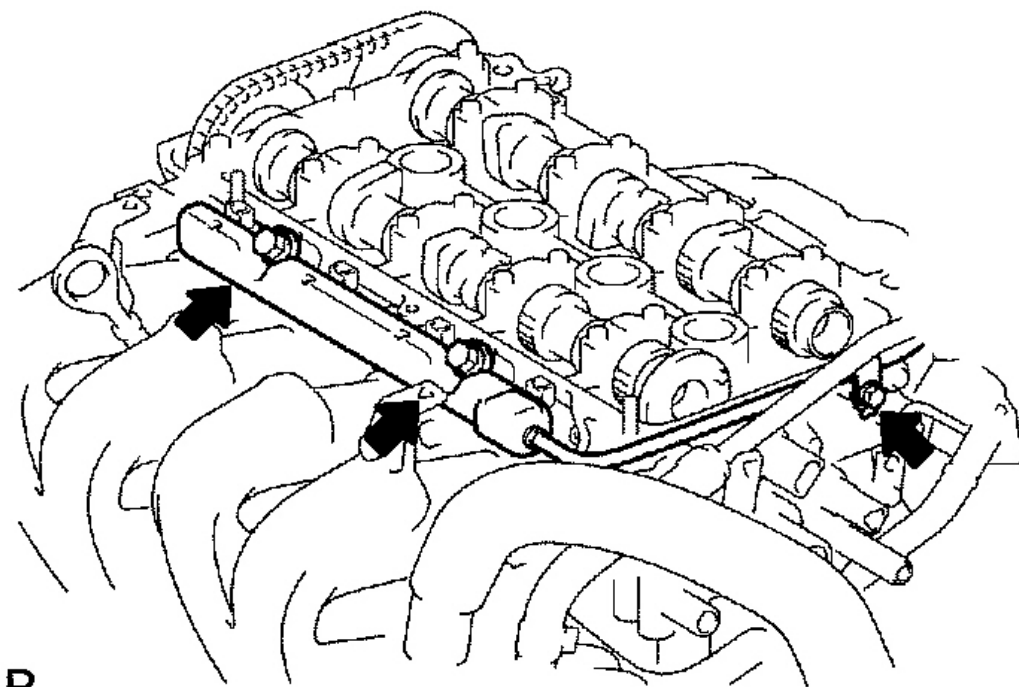


Fig. 105: Checking Timing Chain Length

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

22. REMOVE FUEL DELIVERY PIPE SUB-ASSY

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



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Fig. 106: Removing Fuel Delivery Pipe

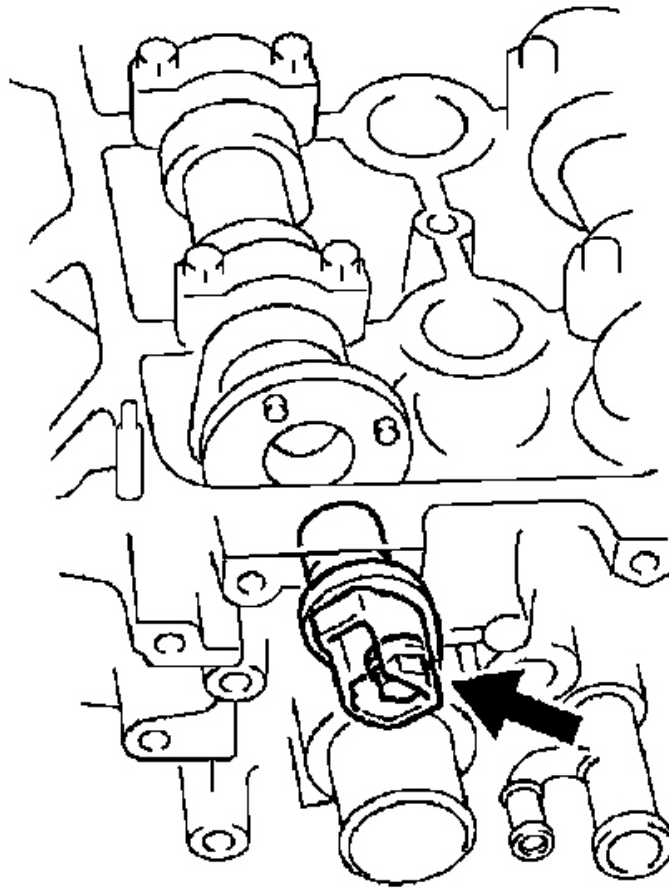
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 the camshaft position sensor.



Y

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Fig. 107: 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.

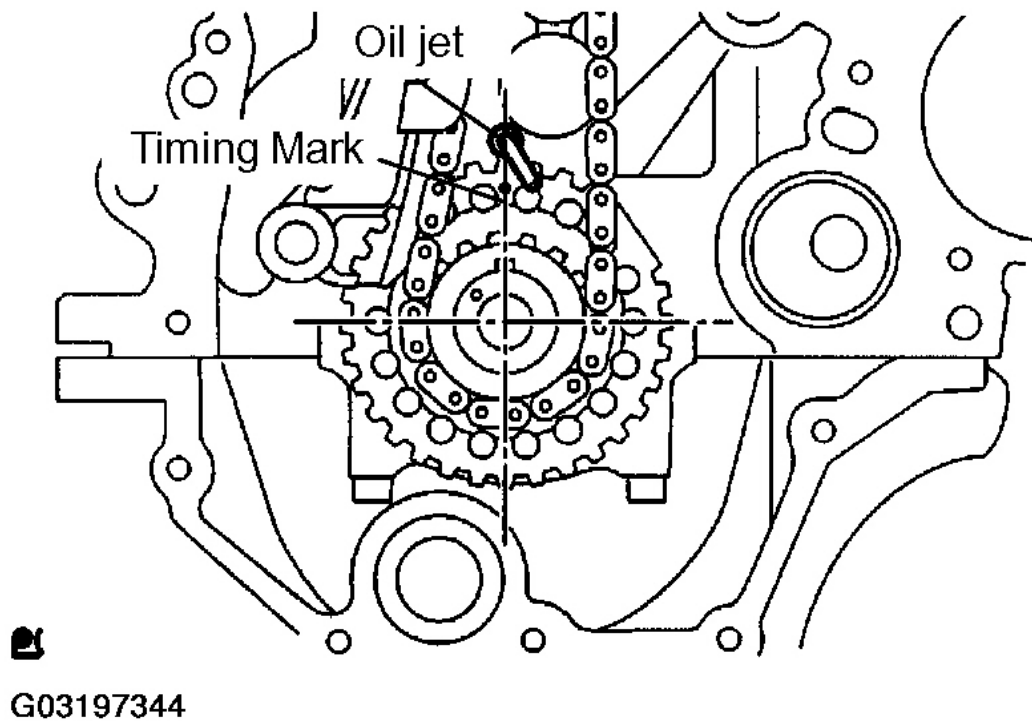
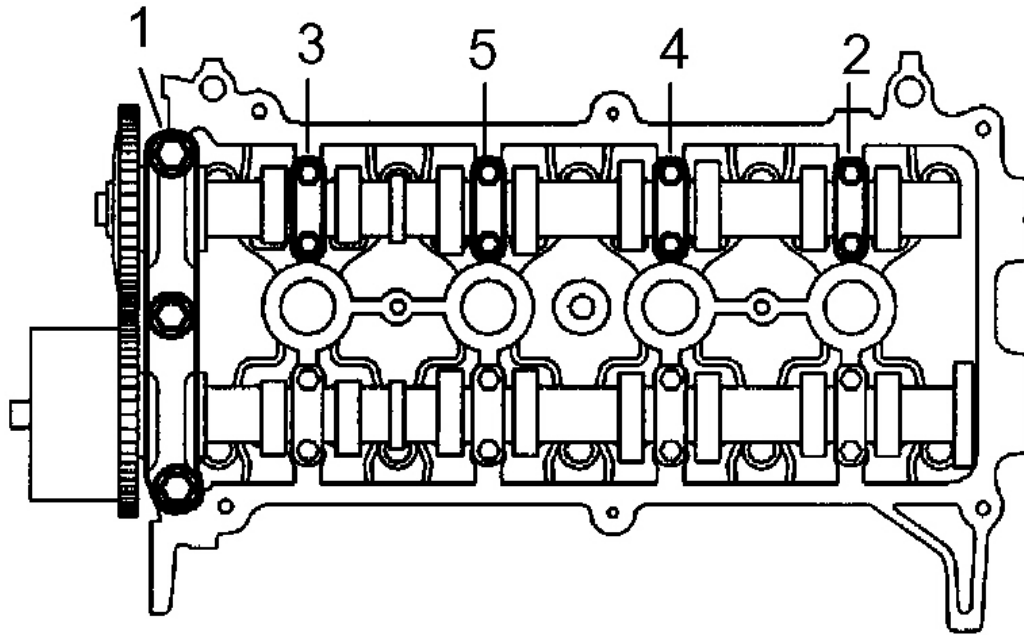


Fig. 108: Aligning Oil Jet Hole With Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Loosen each bolt uniformly keeping the camshaft level.



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Fig. 109: Identifying Loosening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE CAMSHAFT TIMING GEAR OR SPROCKET

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

NOTE: Be careful not to damage the camshaft.

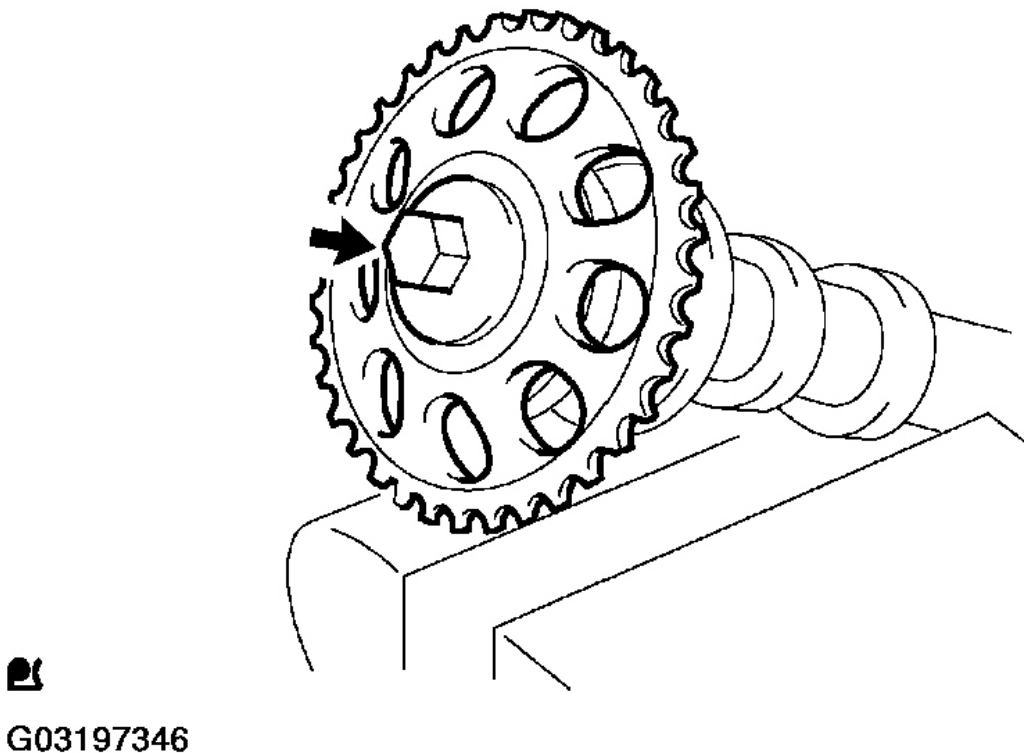


Fig. 110: Removing Fringe Bolt & Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. REMOVE CAMSHAFT

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

NOTE: Loosen each bolt uniformly keeping the camshaft level.

28. INSPECT CAMSHAFT TIMING GEAR ASSY

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

NOTE: Be careful not to damage the camshaft.

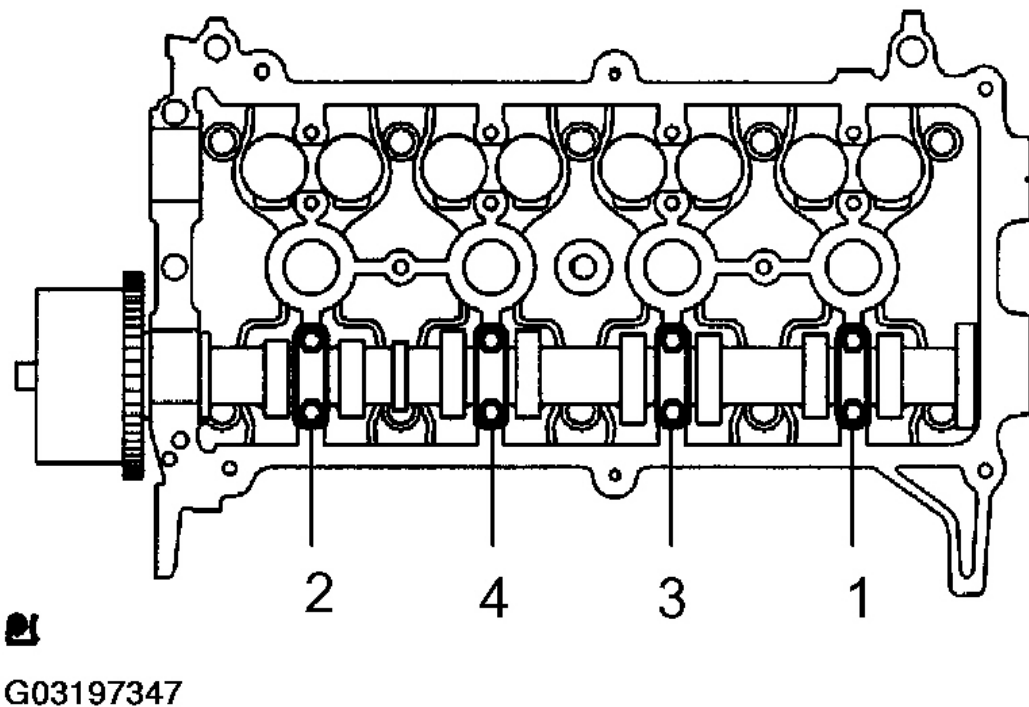


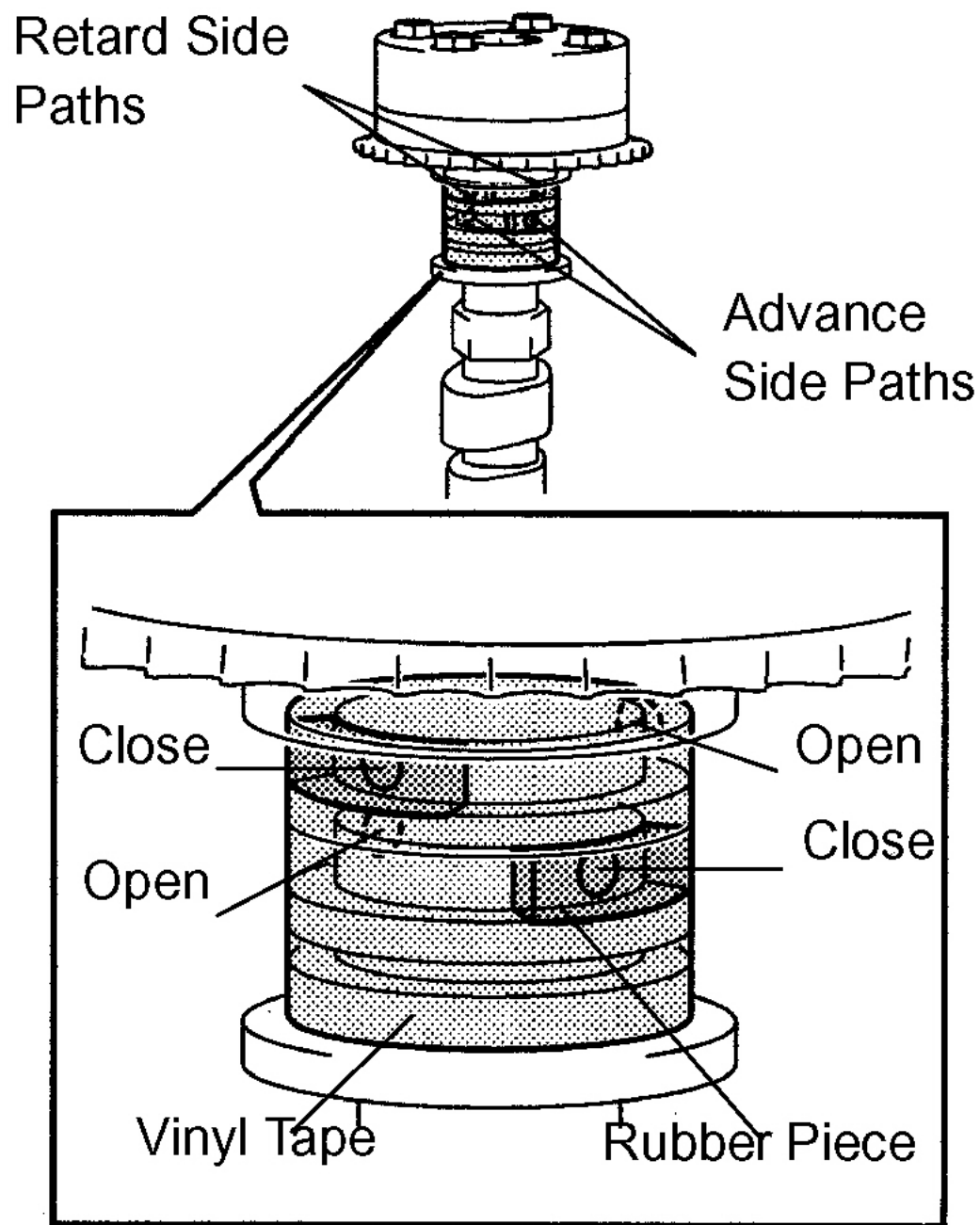
Fig. 111: Identifying Loosening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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.

2. Punctuate the tape for the advance oil path and for the retard oil path on the opposite side from the advance oil path.



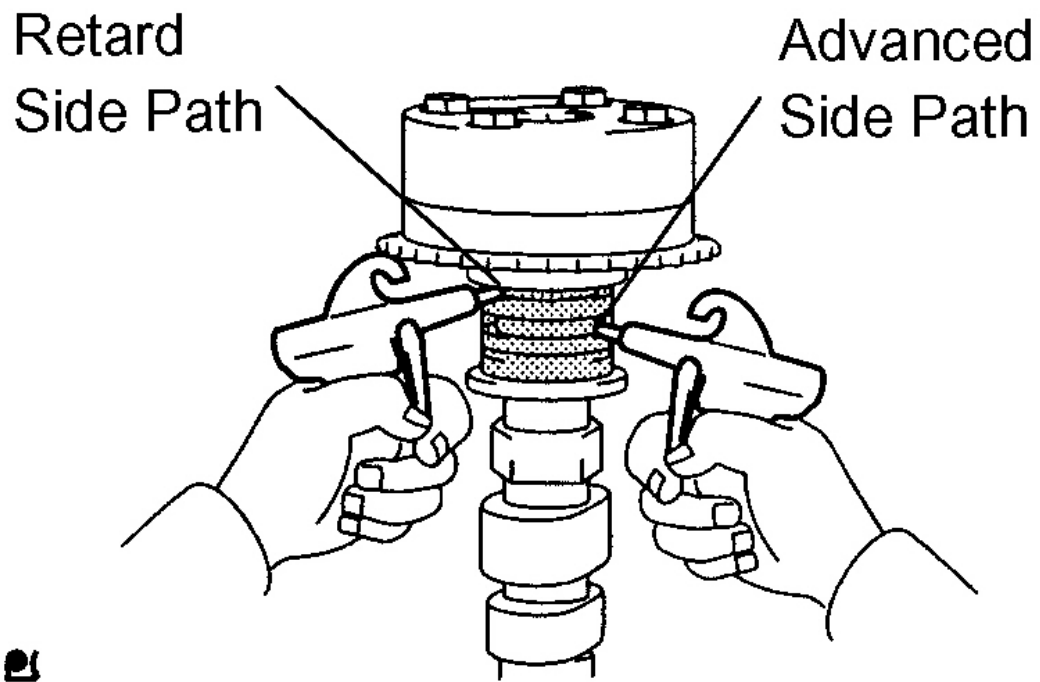
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Fig. 112: Covering Oil Paths Of Cam Journal With Tape

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

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 to prevent oil splashing.



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Fig. 113: 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 camshaft timing gear revolves in the advance direction.

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 timing advance side path.

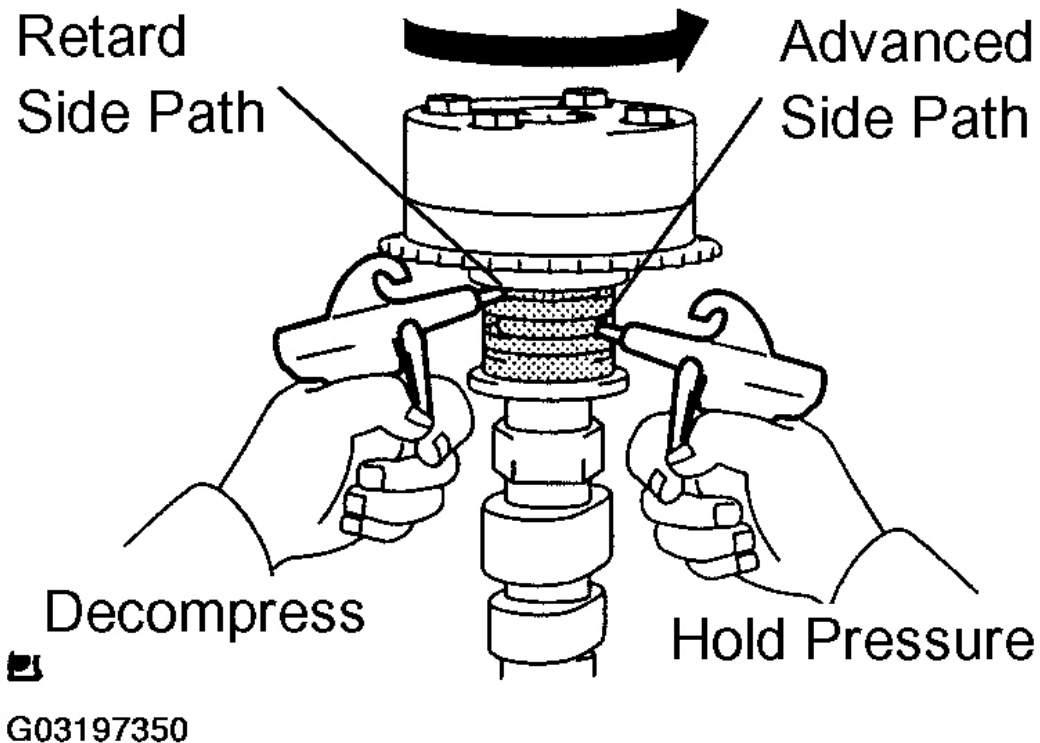


Fig. 114: Removing Air Pressure Of Timing Retard Side Path
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.

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 in 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.

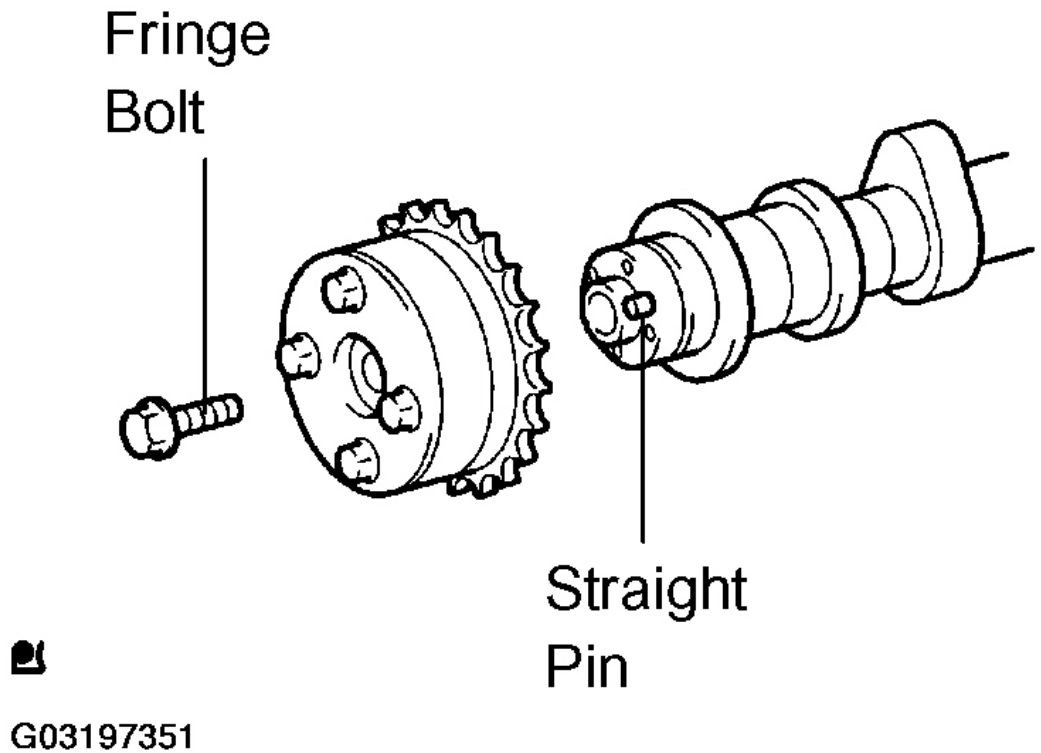


Fig. 115: Removing Fringe Bolt & Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 the illustration. Remove the 10 cylinder head bolts and the plate washers.

NOTE:

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

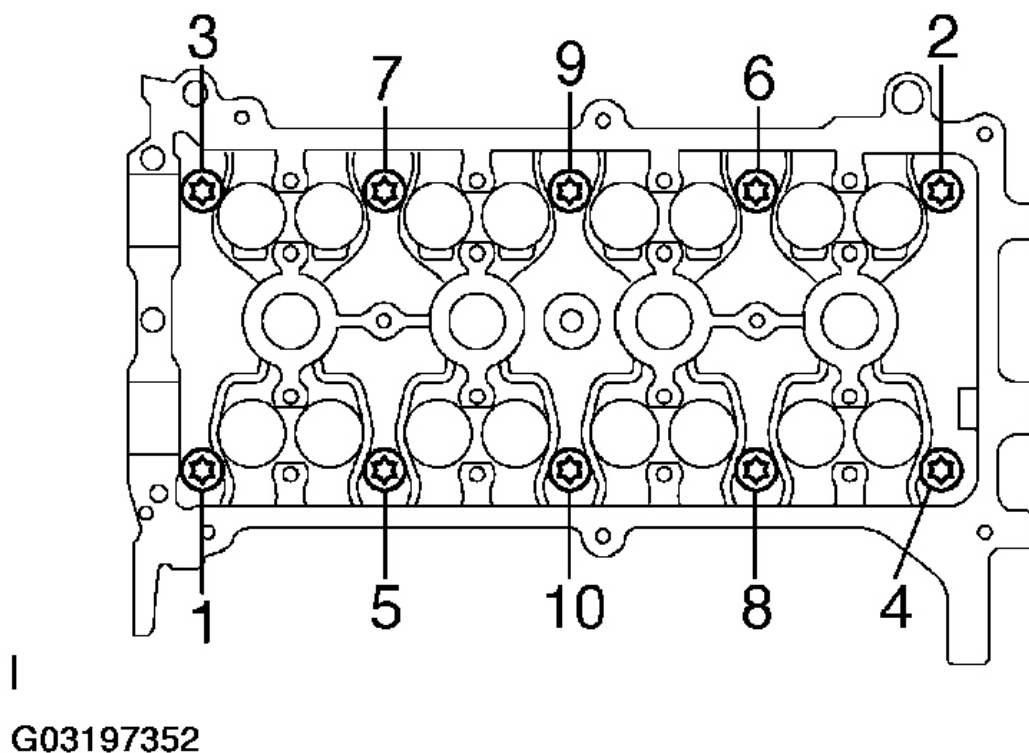


Fig. 116: Identifying Removal Sequence Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. **REMOVE CYLINDER HEAD GASKET**

32. **REMOVE OIL FILTER SUB-ASSY**

- a. Using SST, remove the oil filter.

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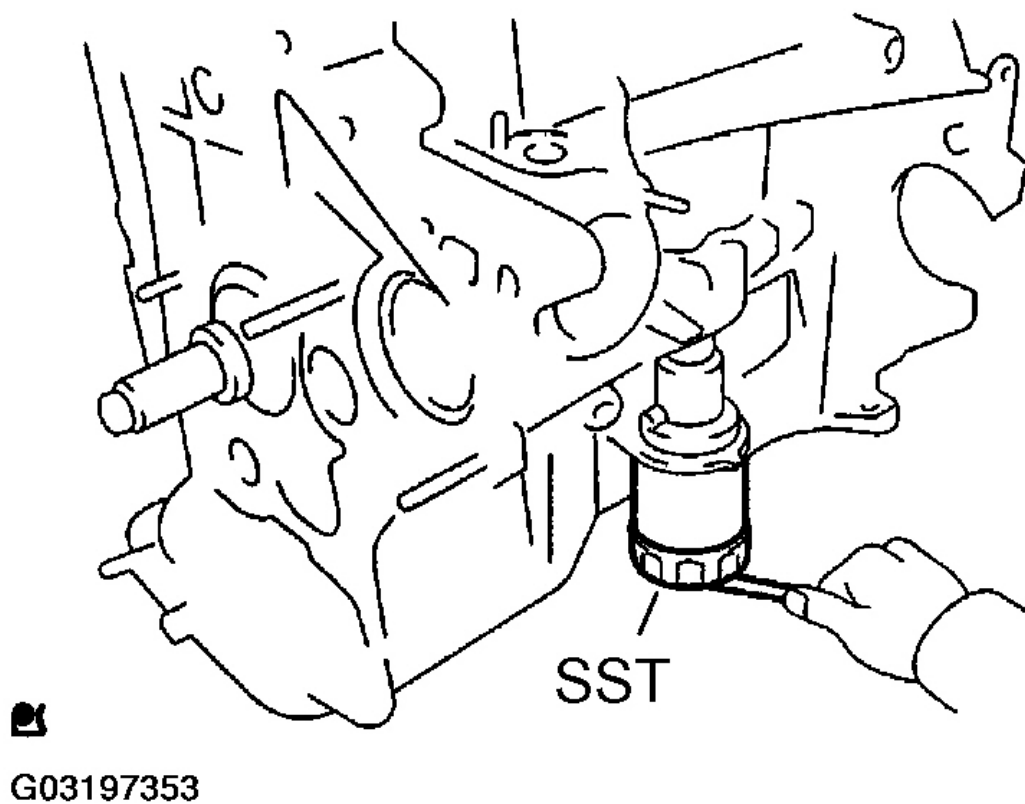


Fig. 117: Removing Oil Filter

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.

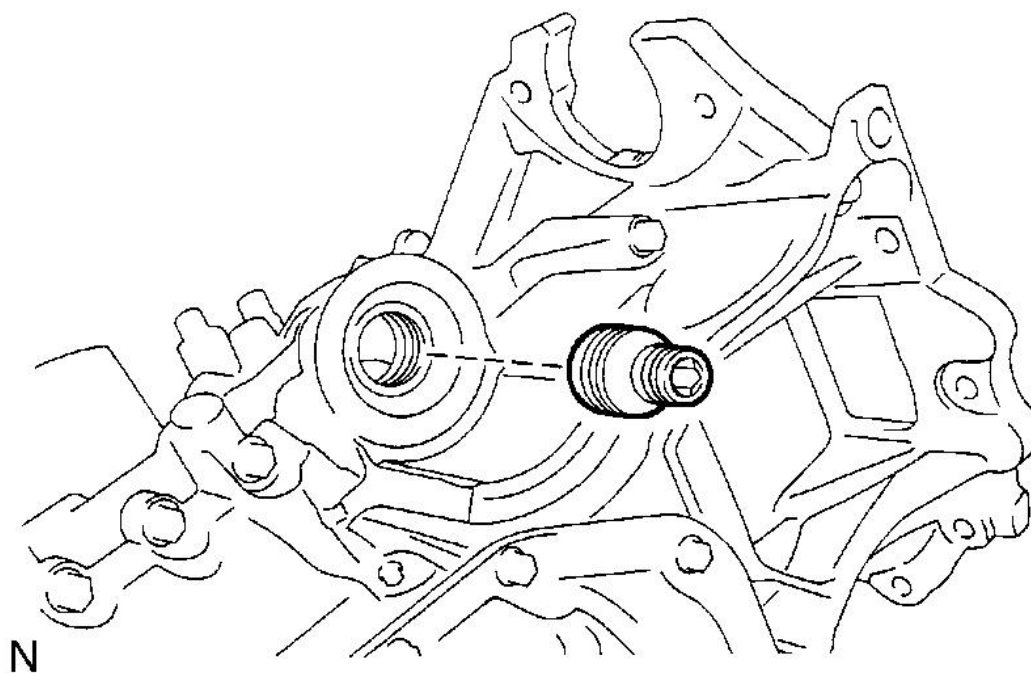
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Fig. 118: Removing Oil Filter Union

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.

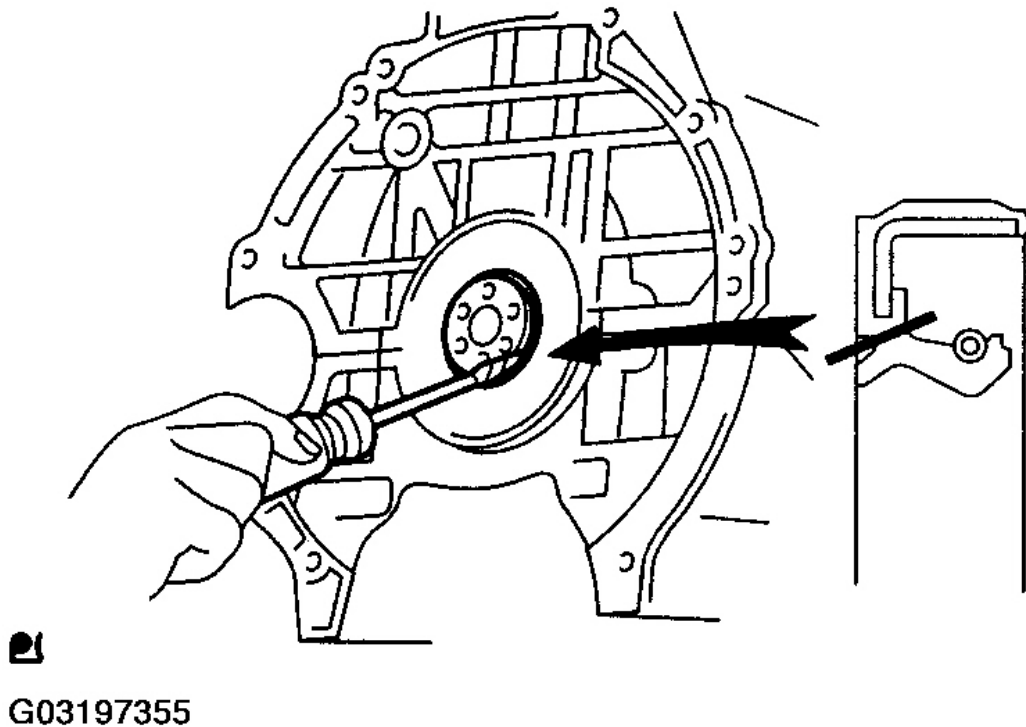
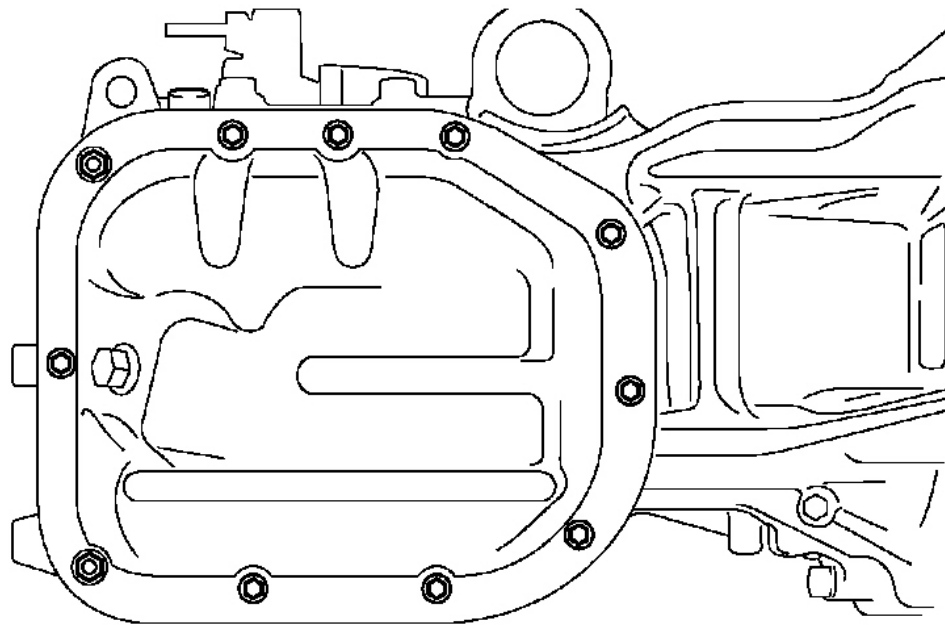


Fig. 119: Removing Engine Rear Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

35. REMOVE OIL PAN SUB-ASSY NO.2

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



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Fig. 120: Identifying Oil Pan Bolts

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

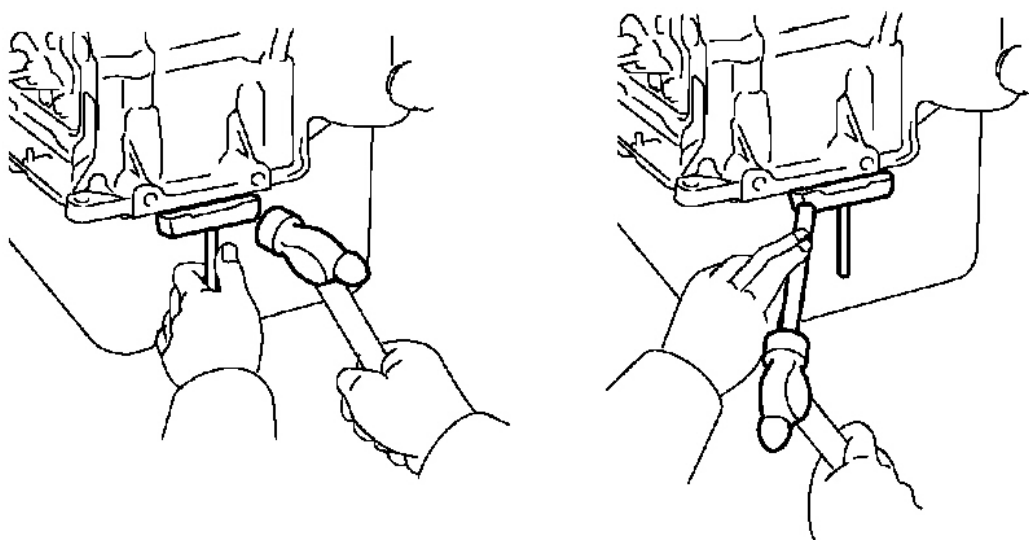
- c. Insert the blade of SST between oil pan No. 1 and oil pan No.2, and cut off applied sealer and remove the oil pan No.2.

SST 09032-00100

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

36. REMOVE OIL STRAINER SUB-ASSY

- a. Remove the bolt and 2 nuts.
- b. Remove the oil strainer and the gasket.

**G03197357****Fig. 121: Cutting Off Applied Sealer****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****37. REMOVE OIL PAN SUB-ASSY**

- a. Loosen and remove the 13 bolts uniformly in several steps.

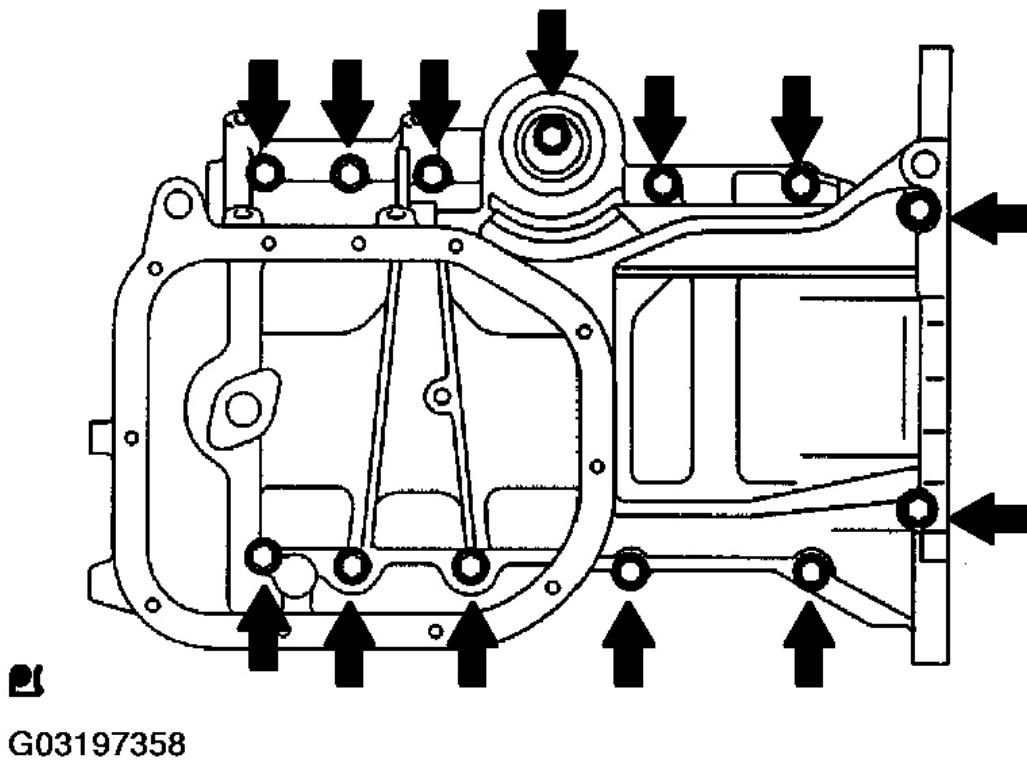


Fig. 122: Removing Oil Pan Assy Bolts

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 the oil pan No. 1.

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

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

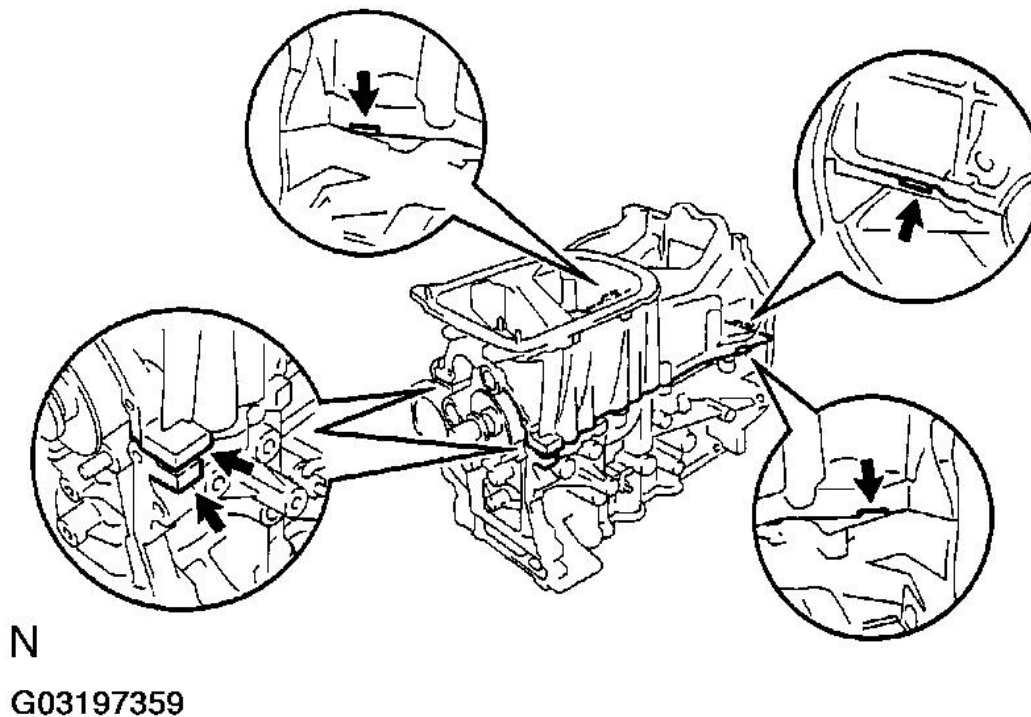
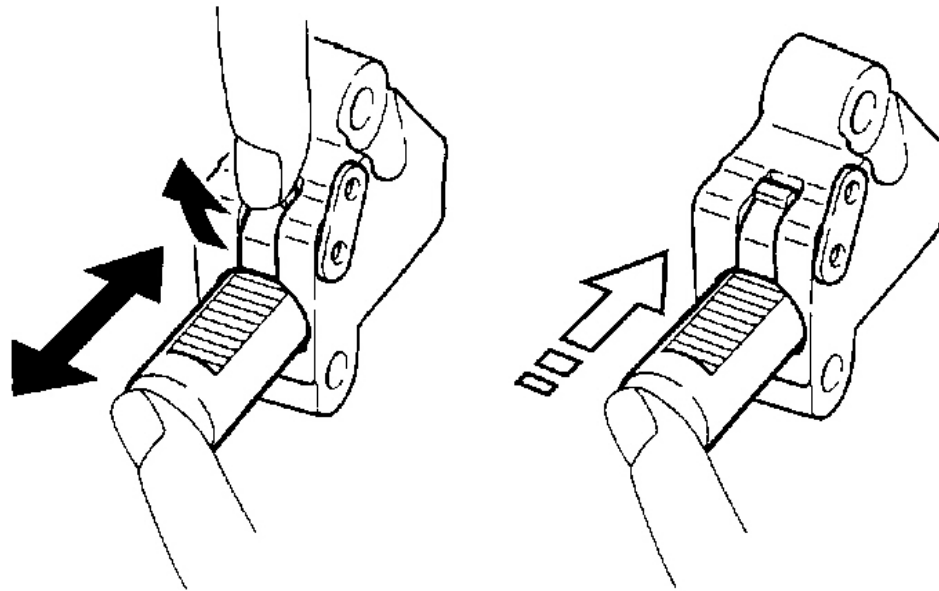


Fig. 123: Removing Oil Pan No. 1

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 pushed with your finger.



N

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Fig. 124: Checking Smoothly Movement Of Plunger
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. INSPECT CAMSHAFT TIMING GEAR ASSY

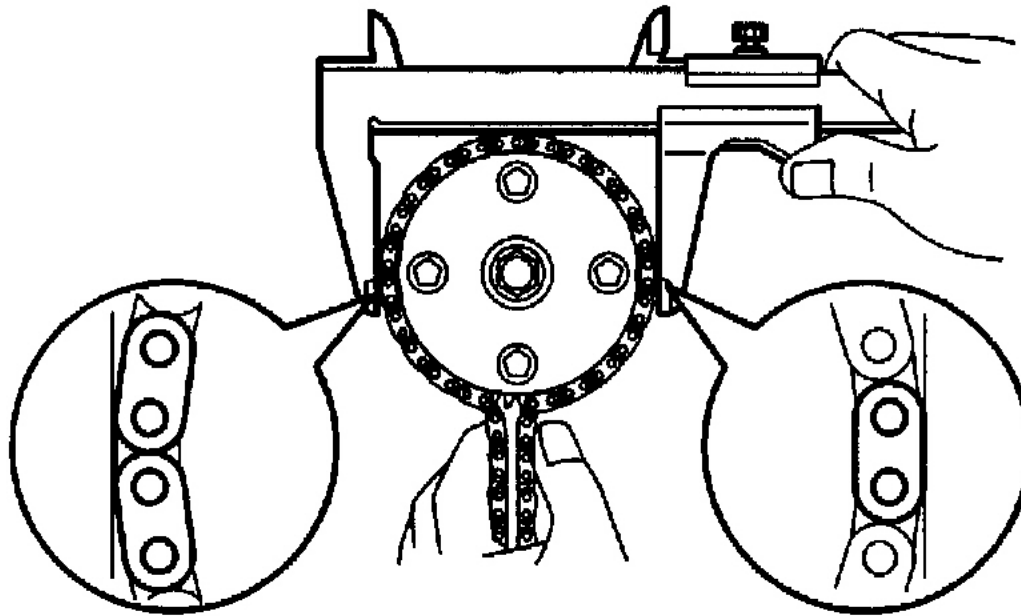
- Wrap the chain around the timing sprocket.
- Using a vernier calipers, measure the diameter of the timing gear with the chain.

Minimum gear diameter (w/ chain):

96.2 mm (3.787 in.)

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

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



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Fig. 125: Measuring Diameter Of Camshaft Timing Gear With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. INSPECT CAMSHAFT TIMING GEAR OR SPROCKET

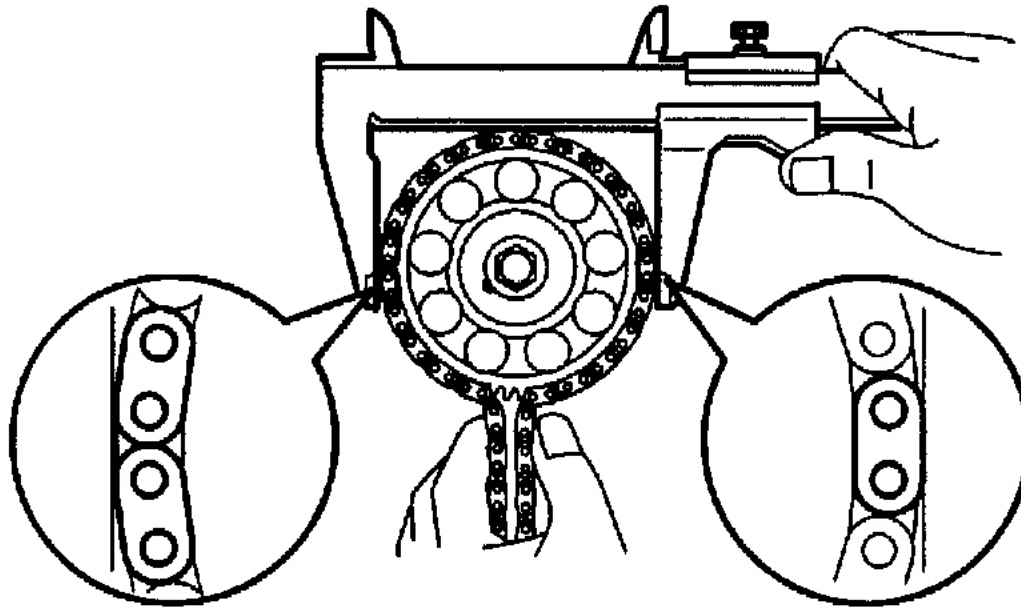
- Wrap the chain around the timing sprocket.
- Using a vernier calipers, measure the diameter of the timing gear with the chain.

Minimum gear diameter (w / chain):

96.2 mm (3.787 in.)

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

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



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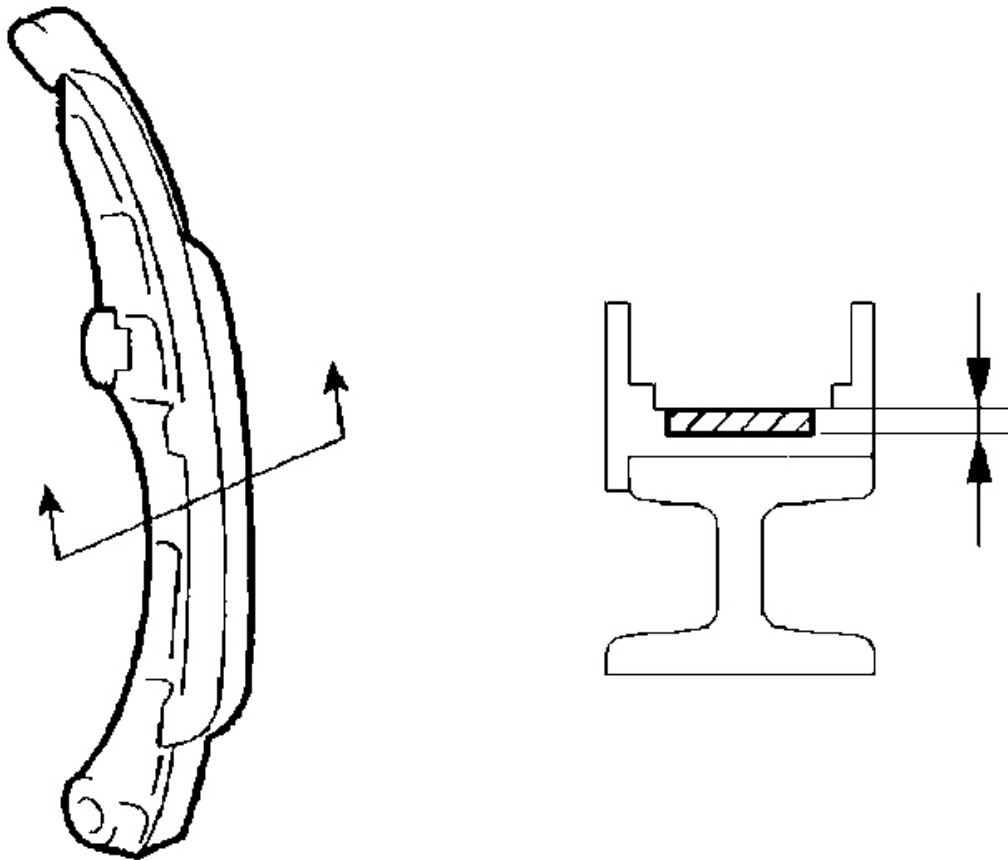
Fig. 126: Measuring Diameter Of Camshaft Timing Sprocket With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. INSPECT CHAIN TENSIONER SLIPPER

- a. Measure the chain tensioner slipper wear.

Maximum wear: 1.0 mm (0.039 in.)

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



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Fig. 127: Identifying Chain Tensioner Slipper Wear Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. INSPECT CHAIN VIBRATION DAMPER No. 1

- a. Measure the vibration damper wear.

Maximum wear: 1.0 mm (0.039 in.)

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

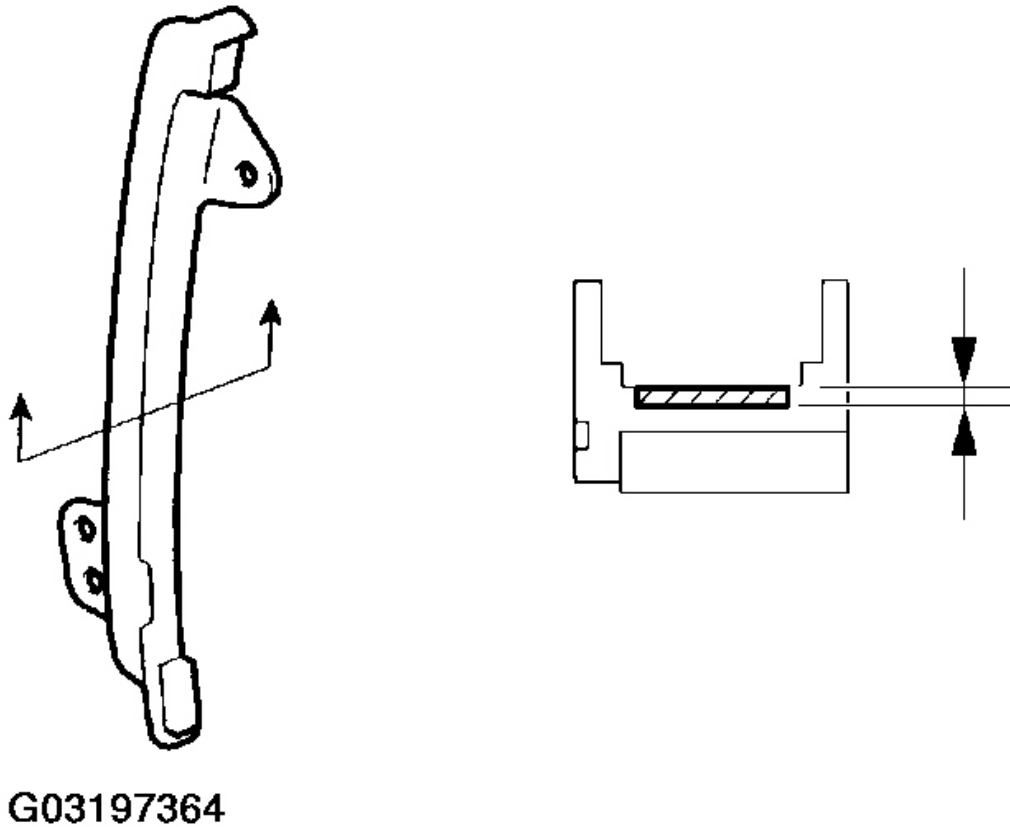


Fig. 128: Identifying Vibration Damper Wear Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.)

If the length exceeds the maximum, replace the bolt.

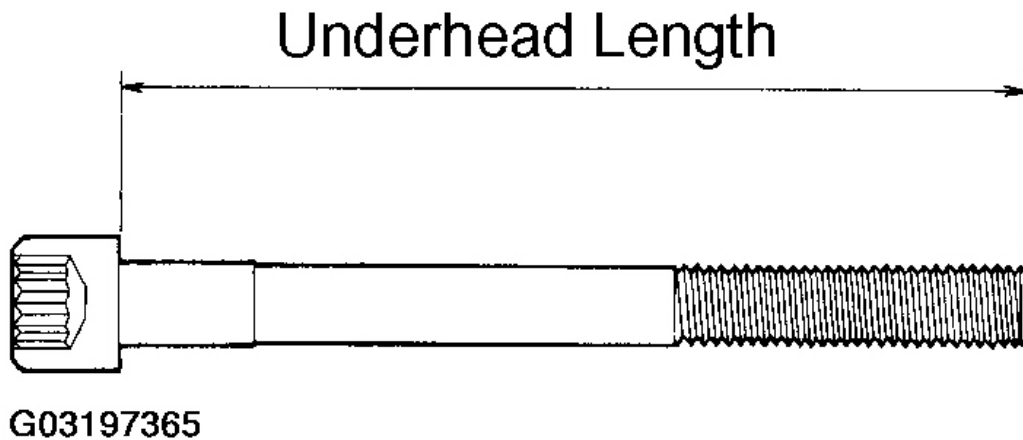


Fig. 129: Identifying Length Of Head Bolts From Seat To End
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. INSTALL OIL PAN SUB-ASSY

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

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

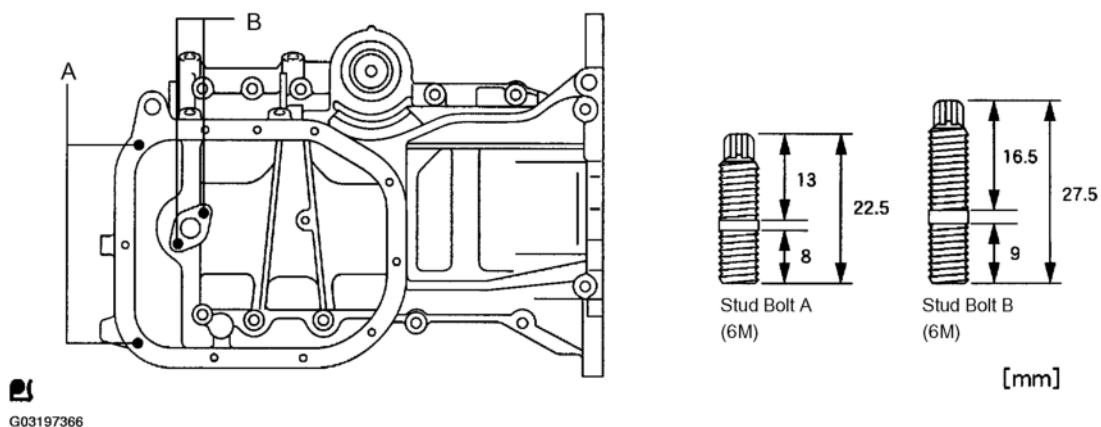
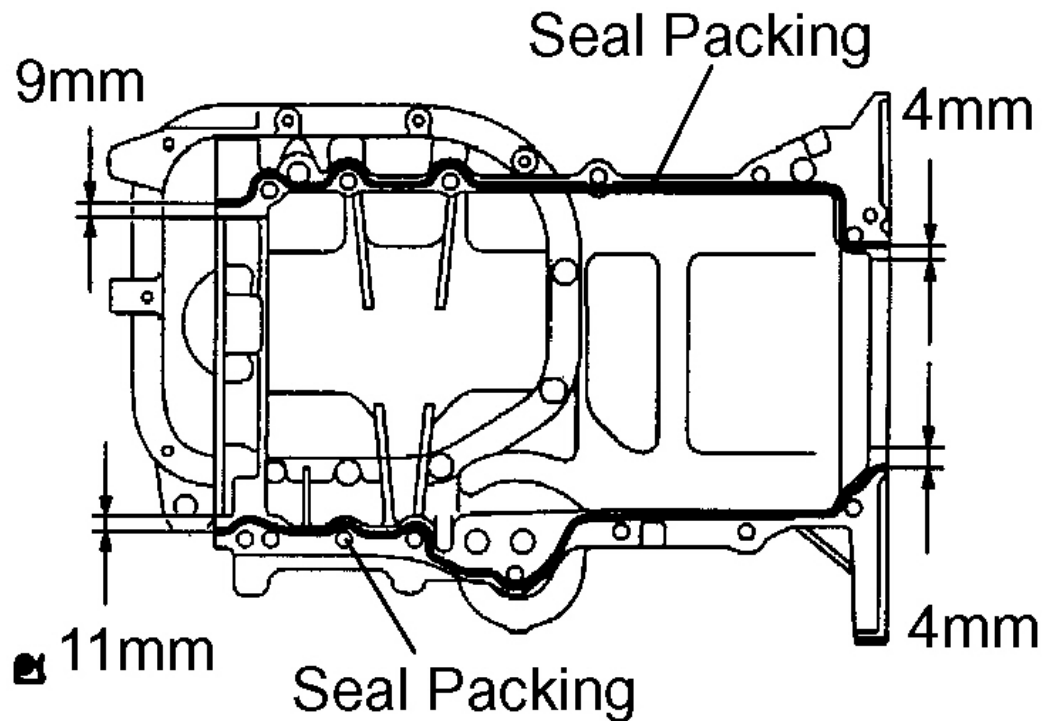


Fig. 130: Installing Stud Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 the illustration.



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Fig. 131: Applying Continuous Bead Of Seal Packing To Oil Pan Mating Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing:

Part No. 08826-00080 or equivalent

NOTE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying 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 the illustration.

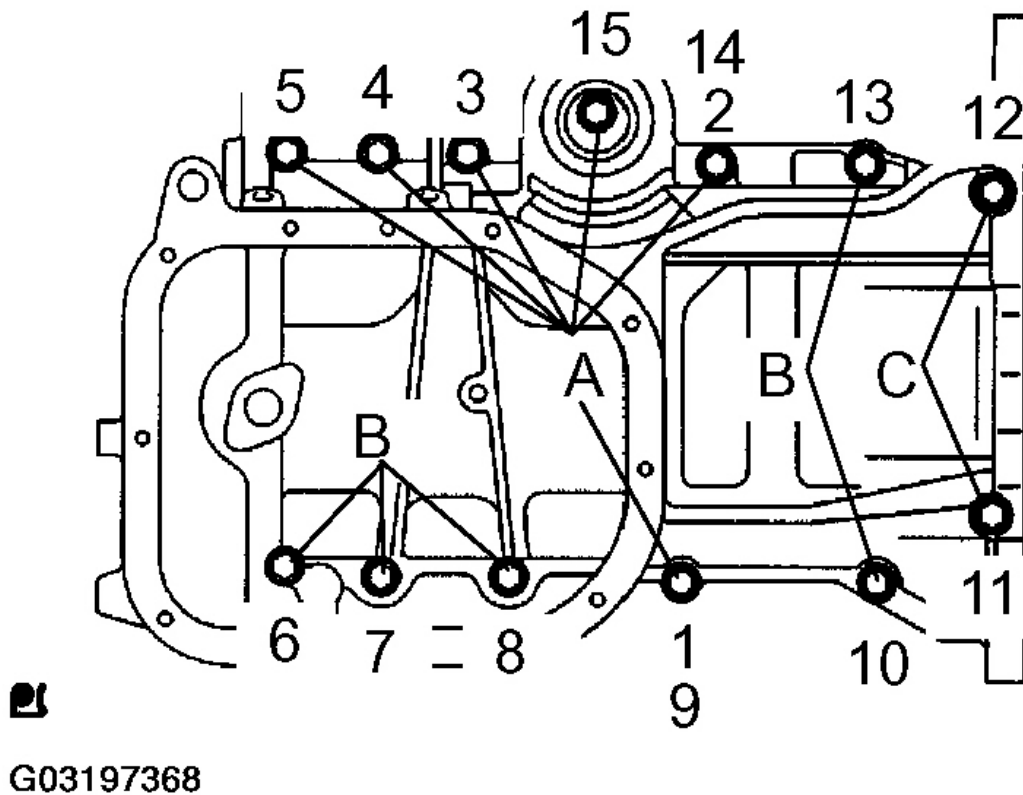


Fig. 132: Identifying Tightening Sequence Of Oil Pan Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.)

45. INSTALL OIL STRAINER SUB-ASSY

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

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

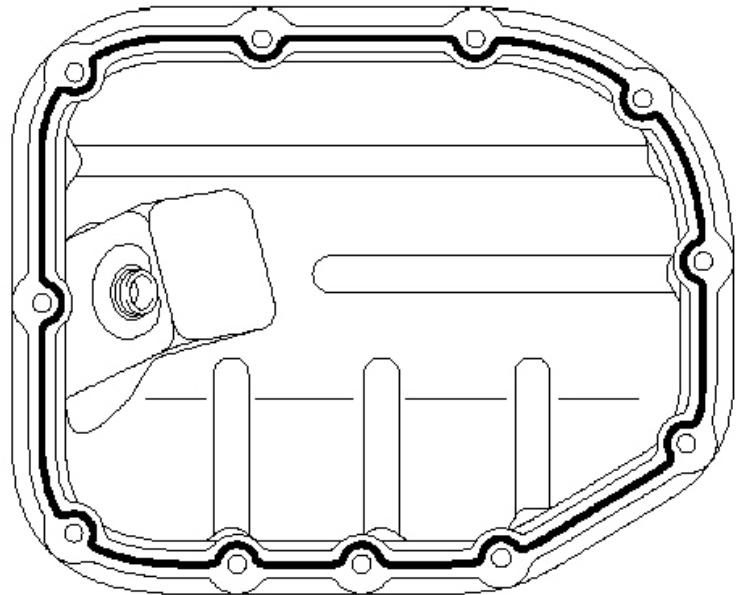
46. INSTALL OIL PAN SUB-ASSY NO.2

- 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 the illustration.

Seal packing: Part No. 08826-00080 or equivalent

NOTE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying 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.



N Seal Width 2.5 to 3.5 mm
G03197369

Fig. 133: Applying Continuous Bead Of Seal Packing To Oil Pan Mating Surface

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

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

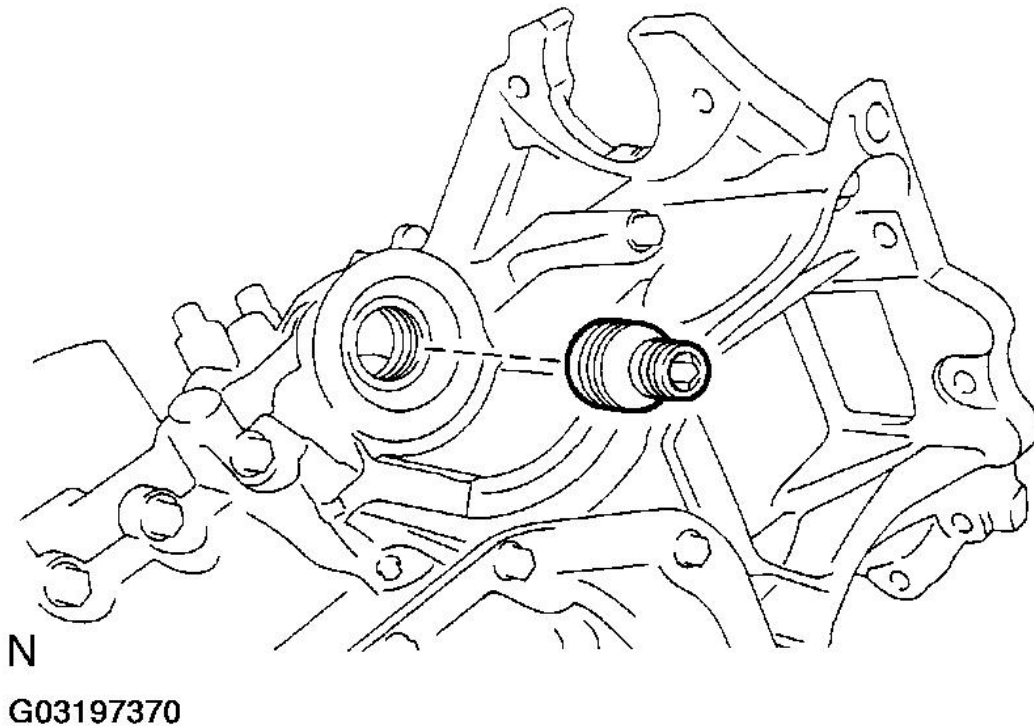


Fig. 134: Installing Oil Filter Union

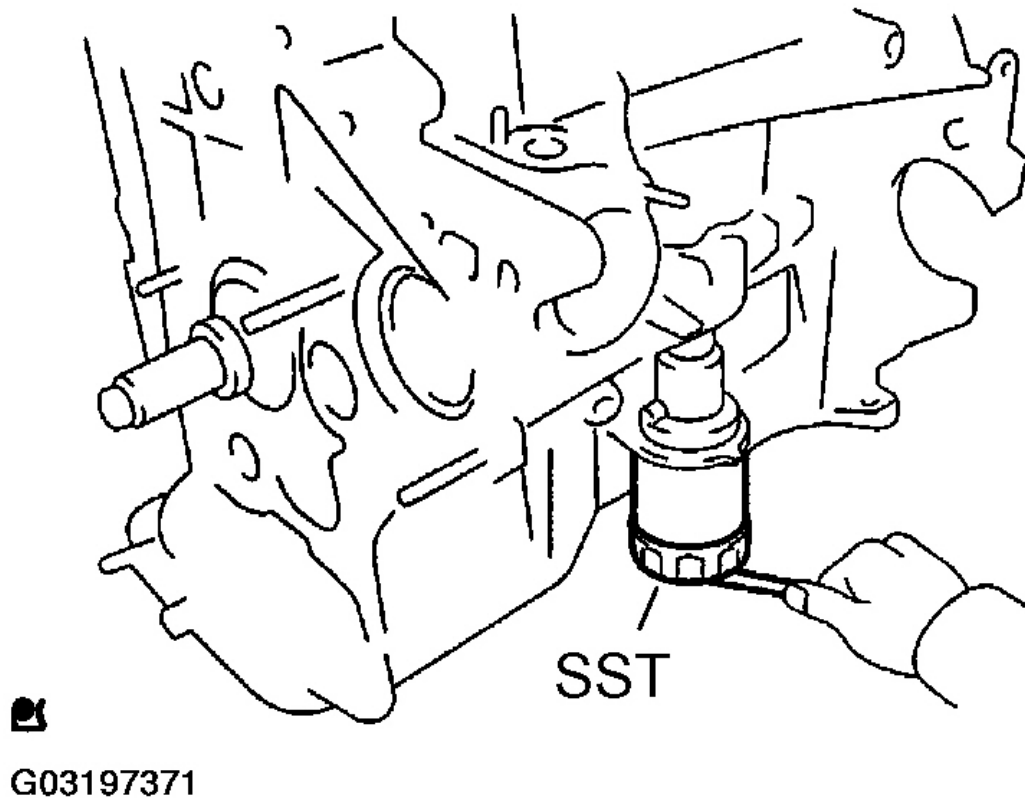
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

48. INSTALL OIL FILTER SUB-ASSY

- a. Check and clean the oil filter installation surface.
- b. Apply clean engine oil to the gasket of the 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. 135: 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.

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.

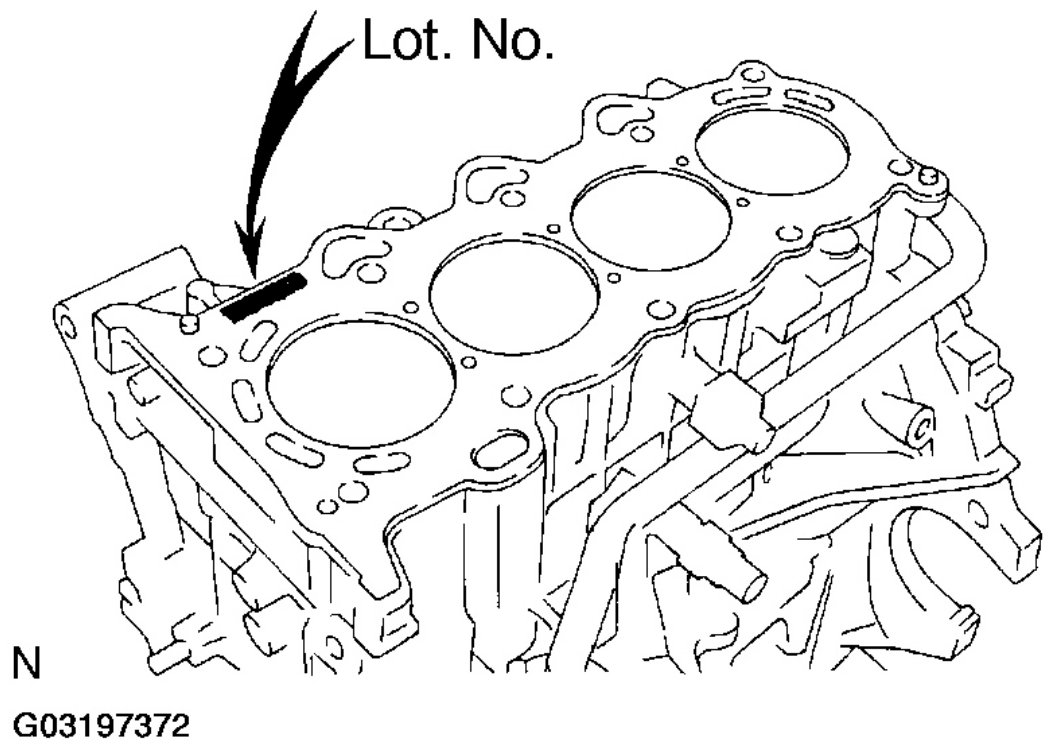


Fig. 136: Placing New Cylinder Head Gasket On Cylinder Block With Lo No Stamp Facing Upward

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

50. INSTALL CYLINDER HEAD SUB-ASSY

HINT:

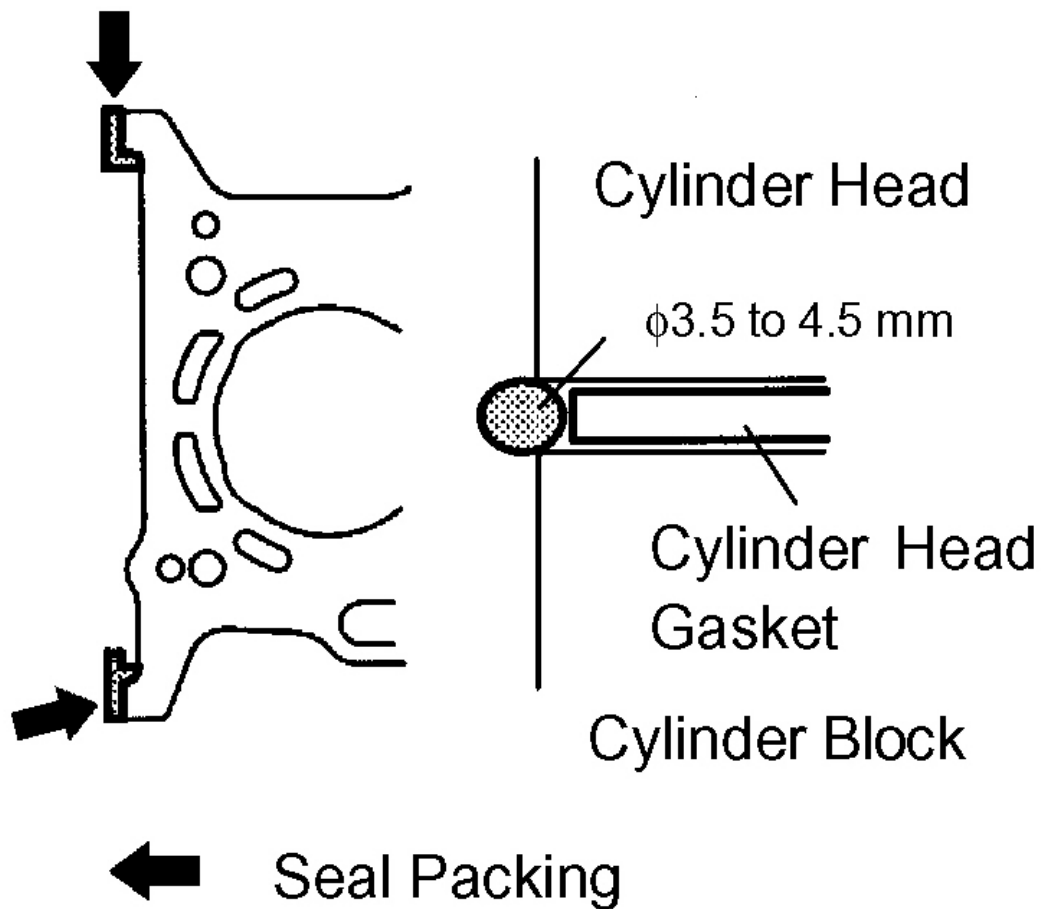
The cylinder head bolts are tightened in 2 successive steps.

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

NOTE:

- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying seal packing.

- Apply a light coat of engine oil to the threads of the cylinder head bolts.



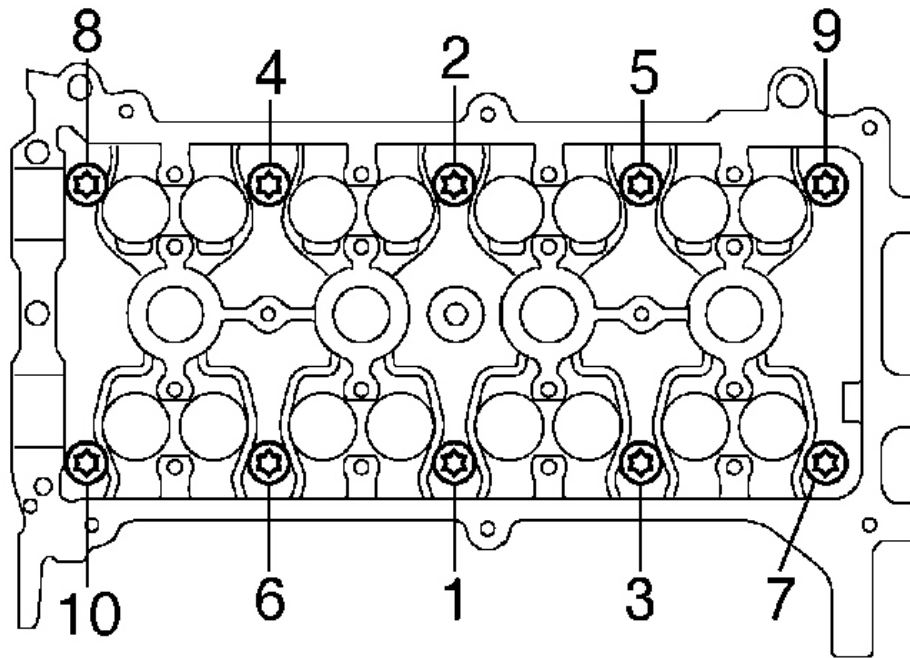
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Fig. 137: Applying Continuous Bead Of Seal Packing

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

- c. 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 the illustration.

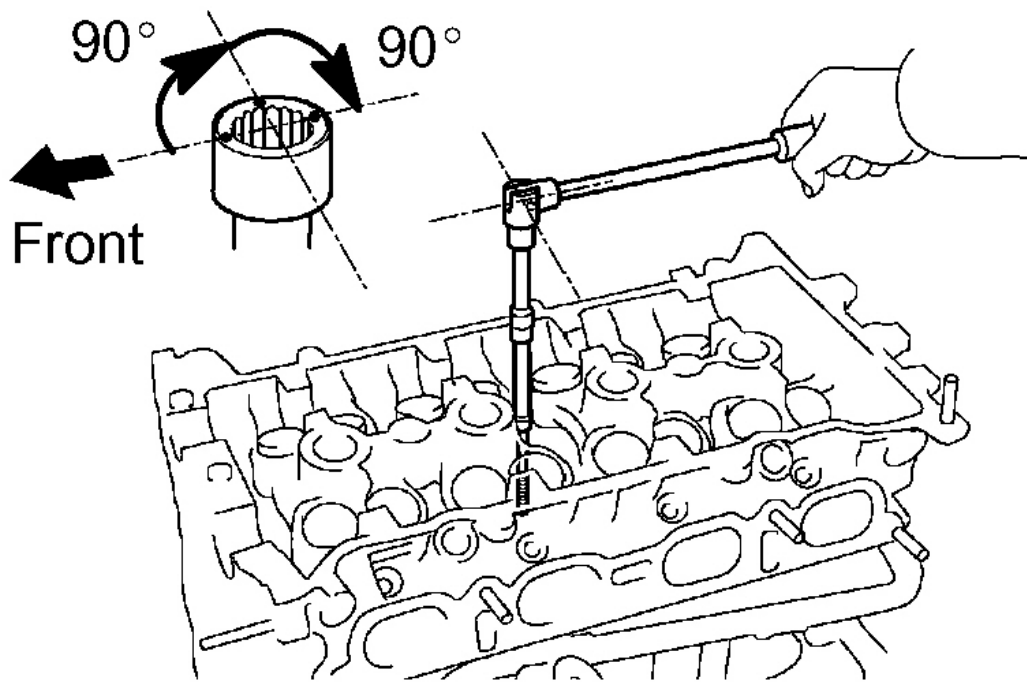
Torque: 29 N.m (300 kgf.cm, 22 ft.lbf)



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

- d. Mark the front of the cylinder head bolt with paint.
- e. Retighten the cylinder head bolts by additional 90° and one more additional 90° as shown in the illustration.
- f. Check that the paint mark is now at a 180° angle to the front.



G03197375

Fig. 139: Retightening Cylinder Head Bolts By Additional 90° & One More Additional 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. 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.

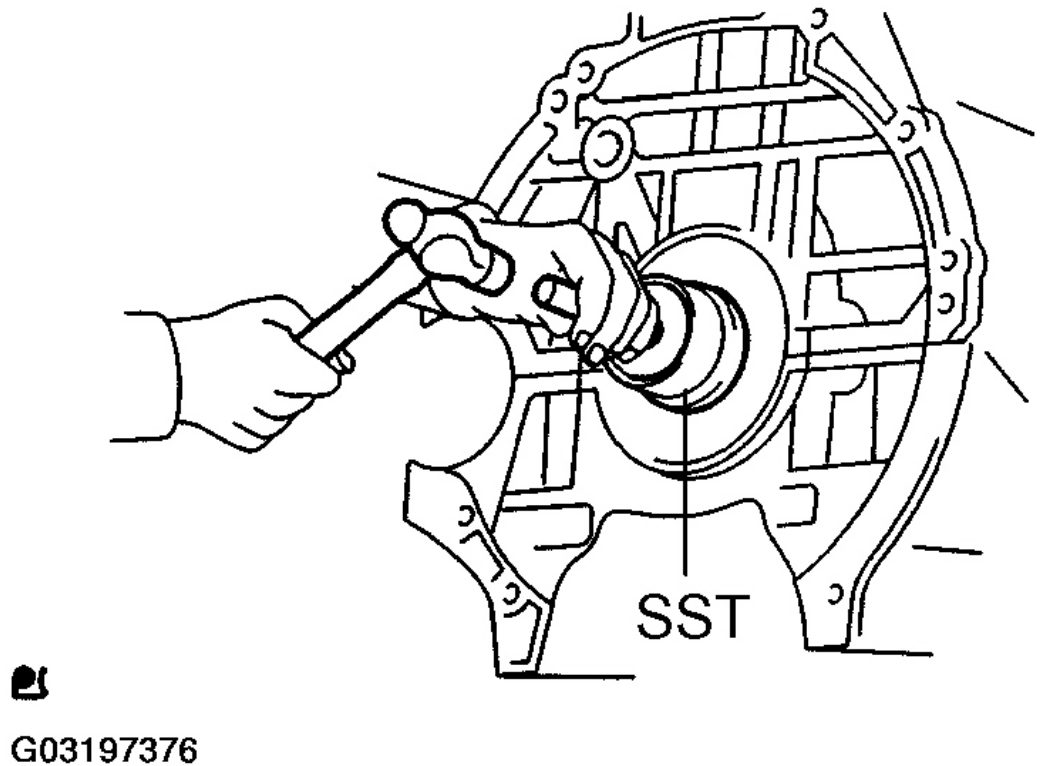


Fig. 140: Installing Engine Rear Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. INSTALL CAMSHAFT TIMING GEAR ASSY

- Put the camshaft timing gear assembly and the 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 (to the right).

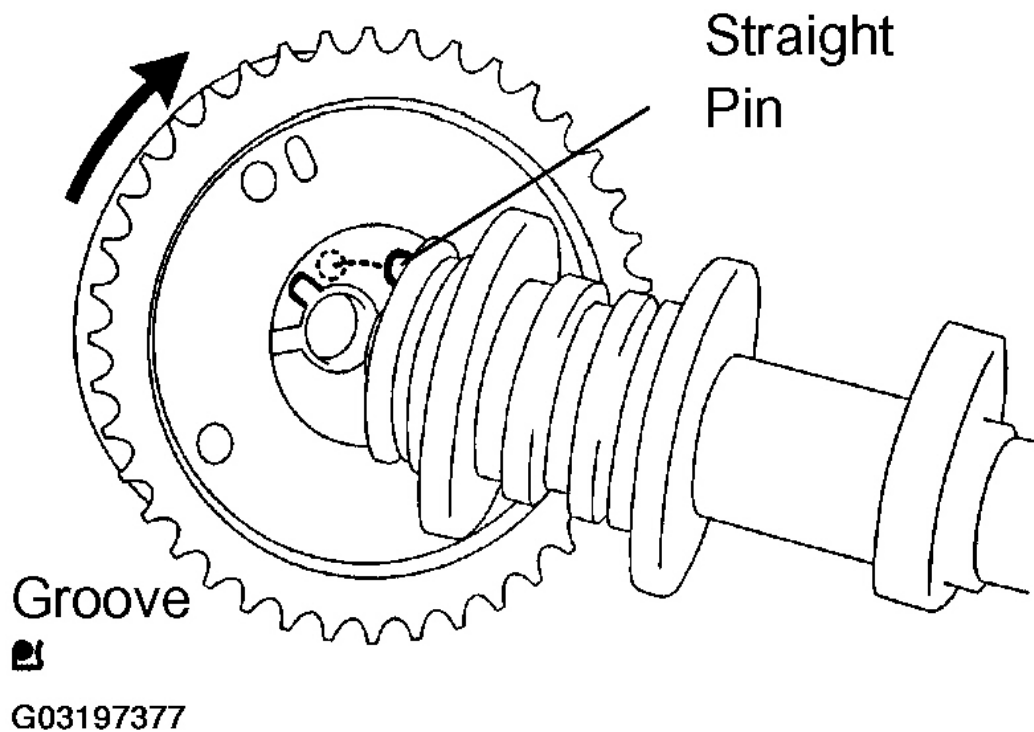


Fig. 141: Installing Camshaft Timing Gear Assy
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

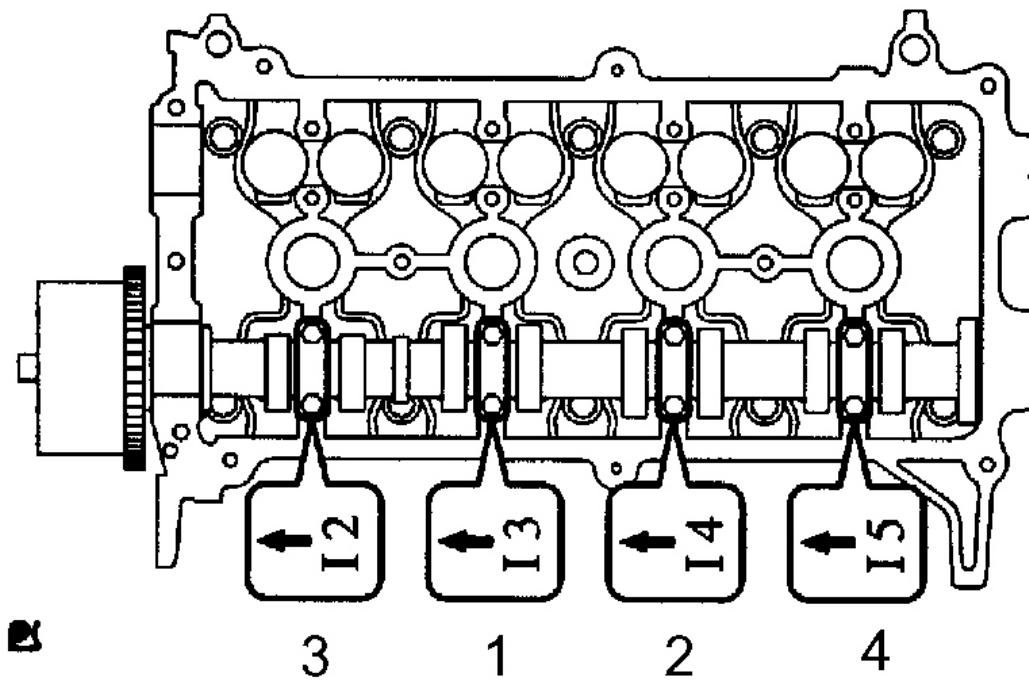
- e. Check that the camshaft timing gear assembly can move to the retard angle (to the right) and is locked in the most retarded position.

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 the illustration.

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

NOTE: Tighten each bolt uniformly keeping the camshaft level.

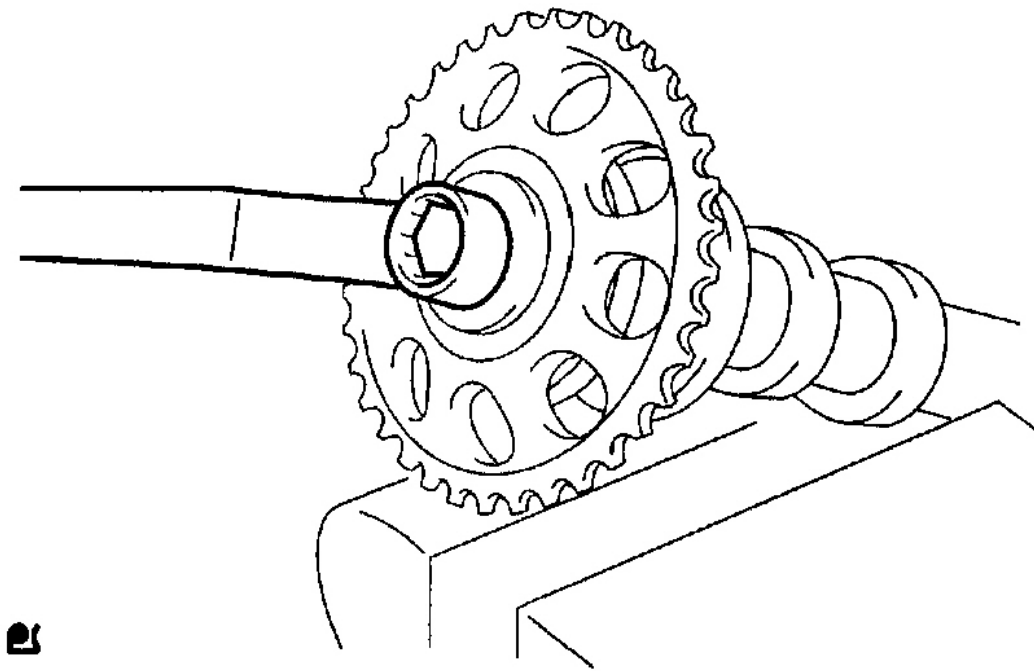


G03197378

Fig. 142: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. INSTALL CAMSHAFT TIMING GEAR OR SPROCKET

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



G03197379

Fig. 143: Installing Camshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Be careful not to damage the camshaft.

55. INSTALL NO.2 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 the illustration.

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

NOTE: Tighten each bolt uniformly keeping the camshaft level.

- d. Install the bearing cap No. 1.

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

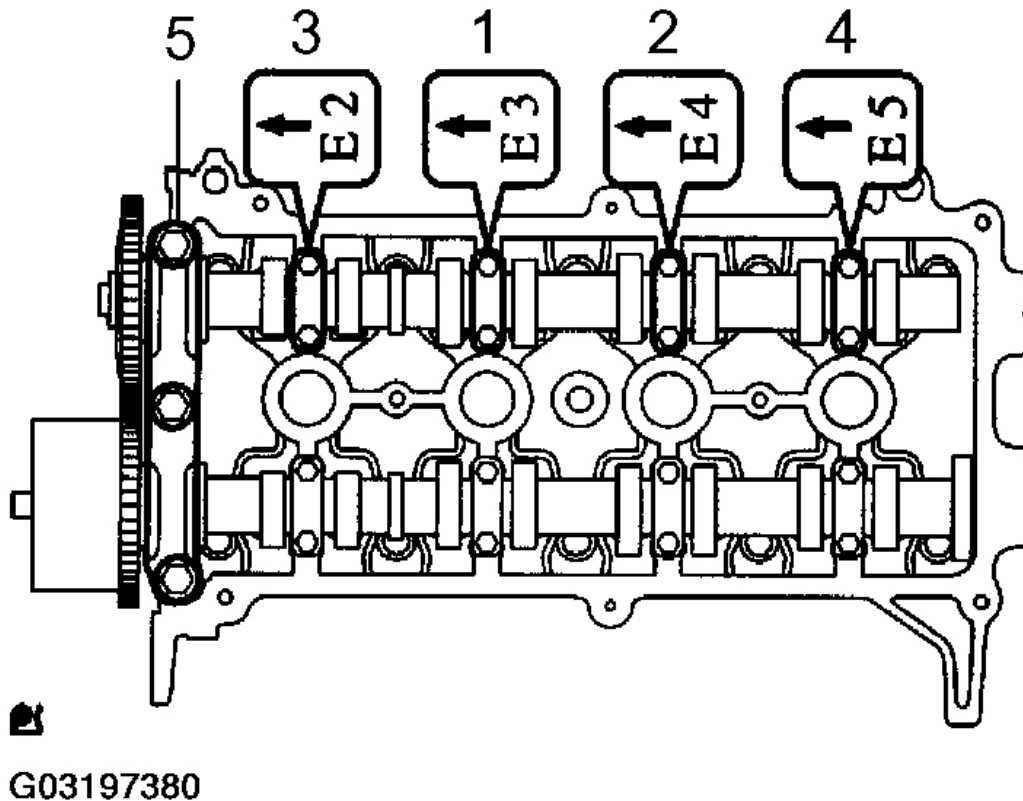


Fig. 144: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 the 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 spring 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)

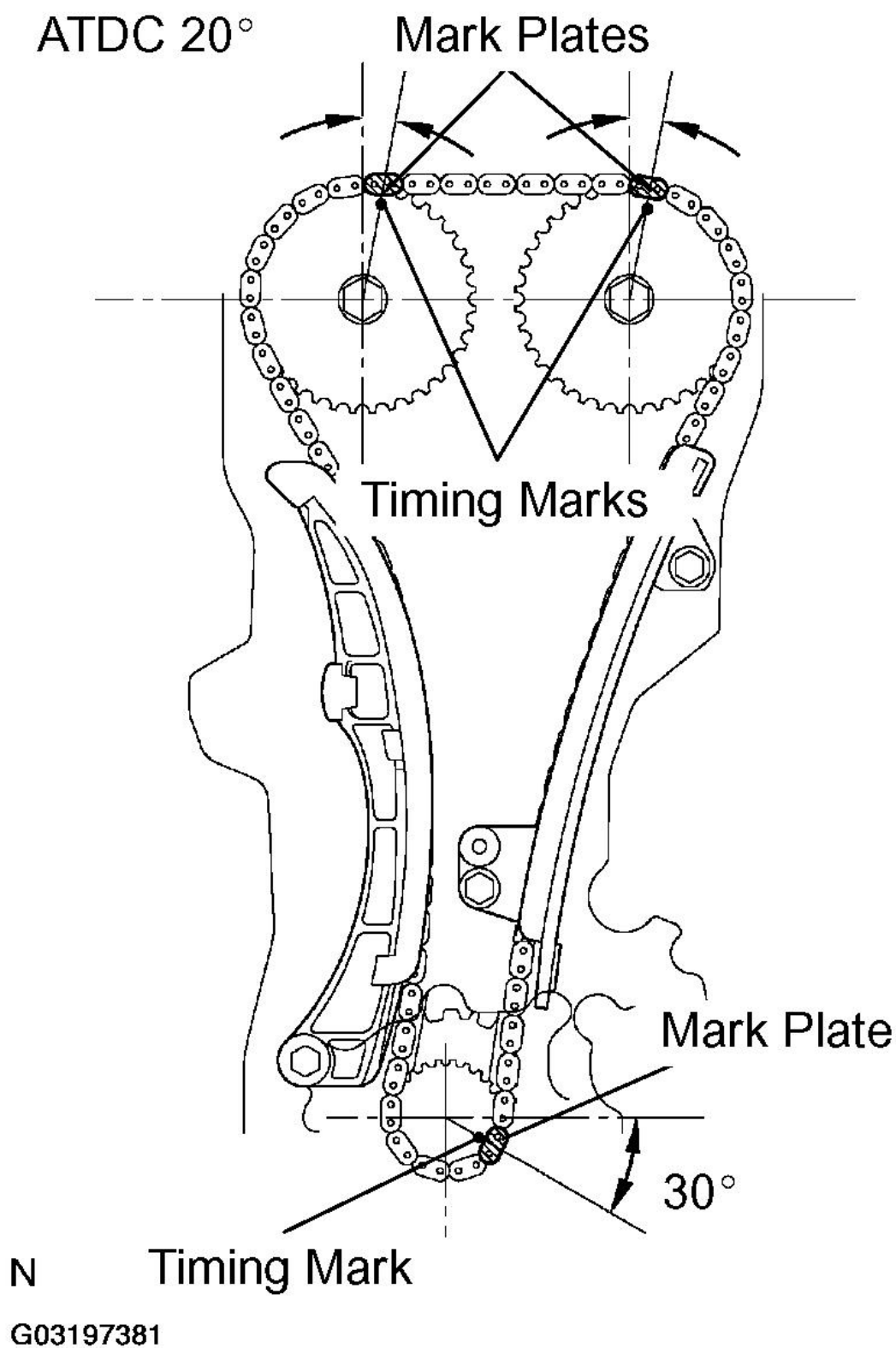


Fig. 145: Aligning Matchmarks Of Camshaft Timing Sprocket & Crankshaft Timing Sprocket With Mark Plate Of Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. While rotating the stopper plate of the chain tensioner upward as shown in the illustration push in the plunger of the tensioner.
- f. While rotating 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 the 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 sprocket.

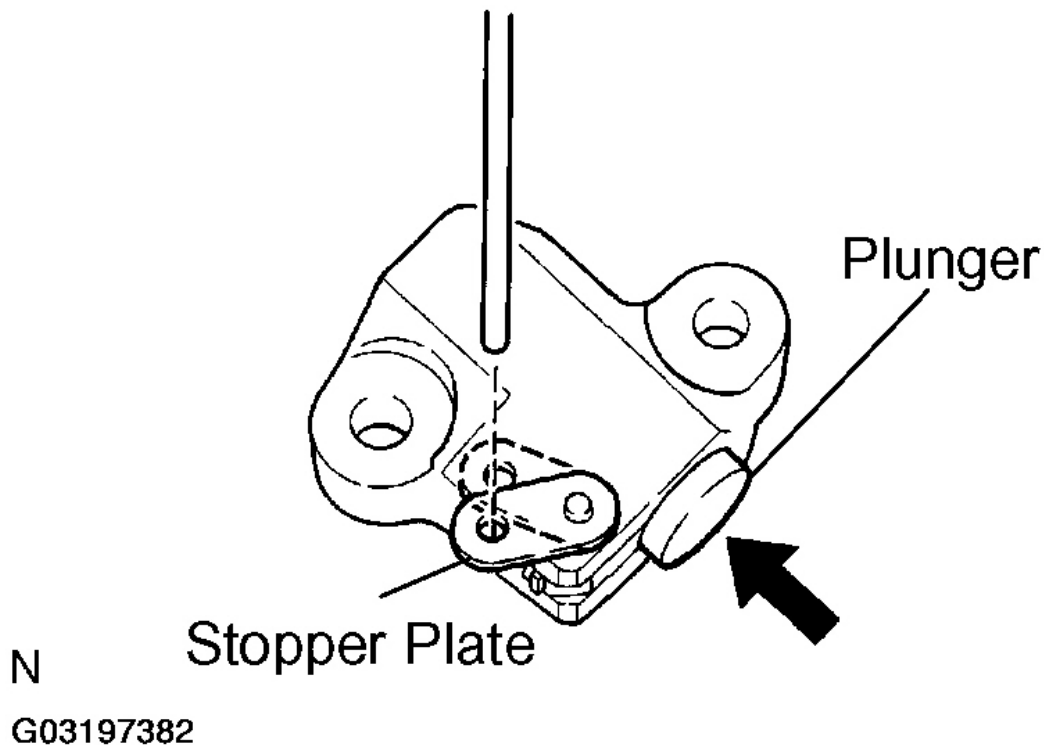


Fig. 146: Pushing In Plunger Of Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.

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

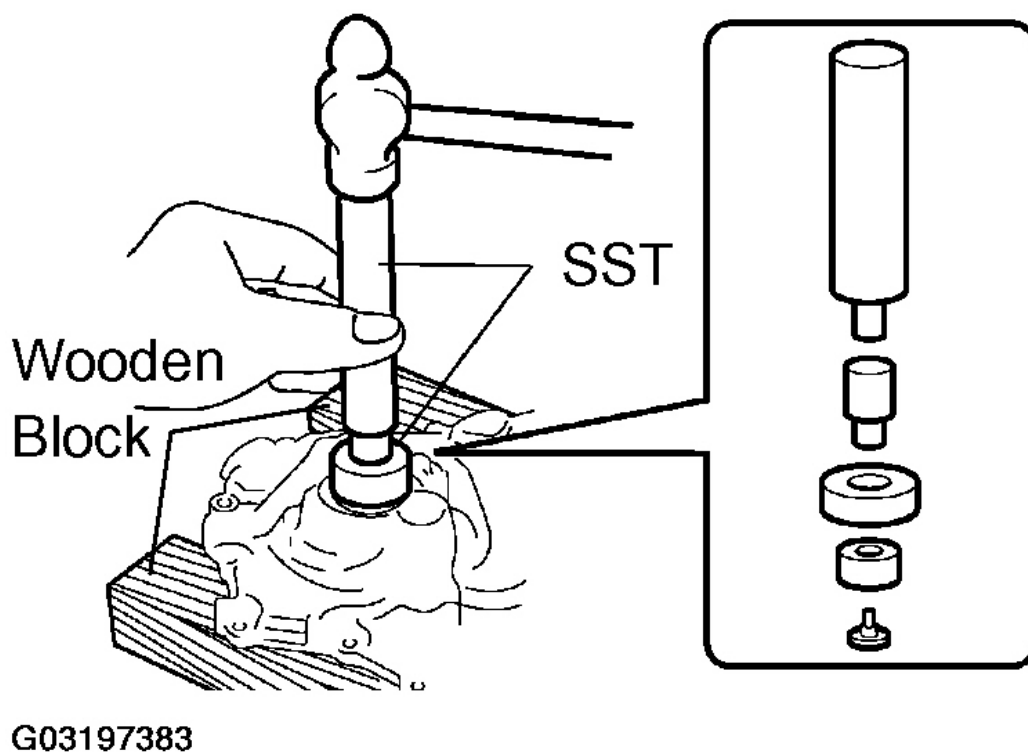


Fig. 147: Installing Oil Pump Seal

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

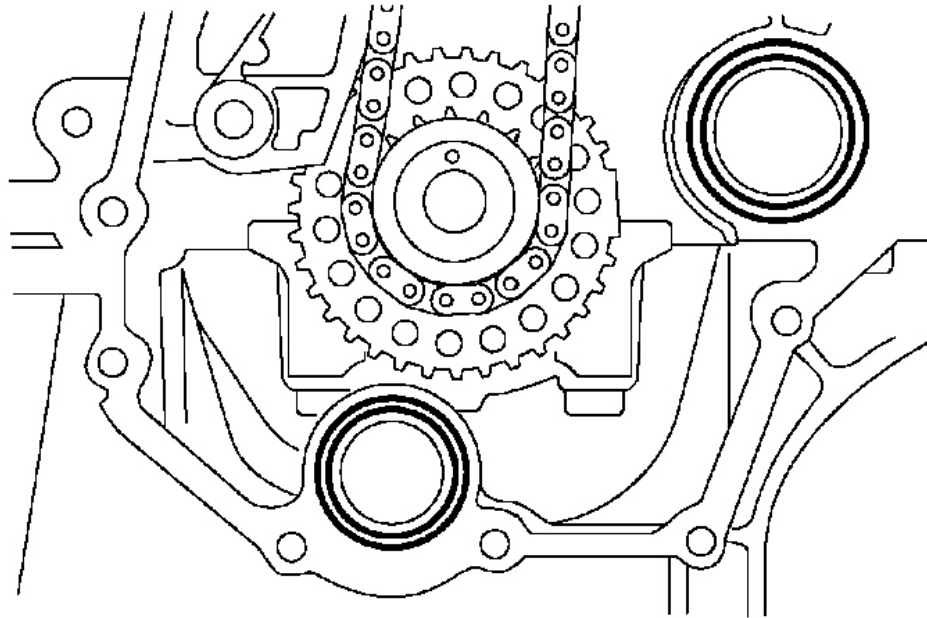
59. INSTALL OIL PUMP ASSY

- Install 2 new O-rings onto the 2 locations as shown in the illustration.
- Remove any old packing material from the contact surface.
- Apply seal packing to the oil pump assembly, the cylinder head and the cylinder block as shown in the illustration below.

Seal packing:

Water pump part: part No. 08826 - 00100 or equivalent

Other part part: No. 08826 - 00080 or equivalent



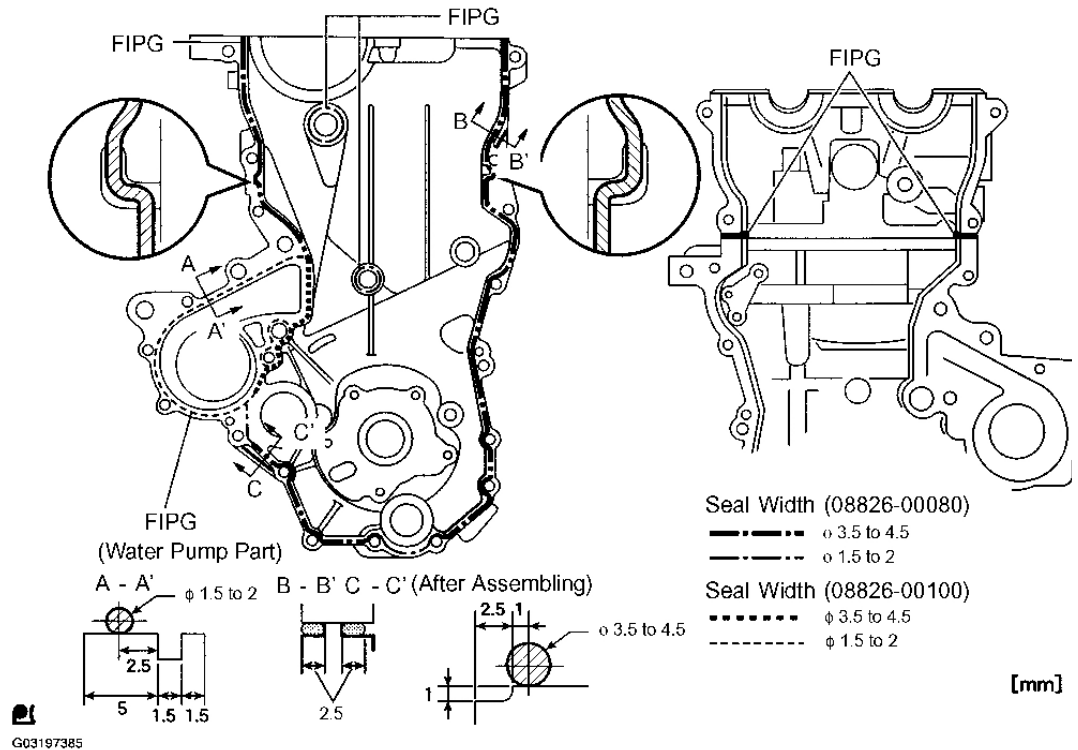
G03197384

Fig. 148: Installing New O-Rings

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

NOTE:

- Remove any oil from the contact surface.
- Install the oil pump within 3 minutes of applying 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. 149: Applying Seal Packing To Oil Pump Assembly, Cylinder Head
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.

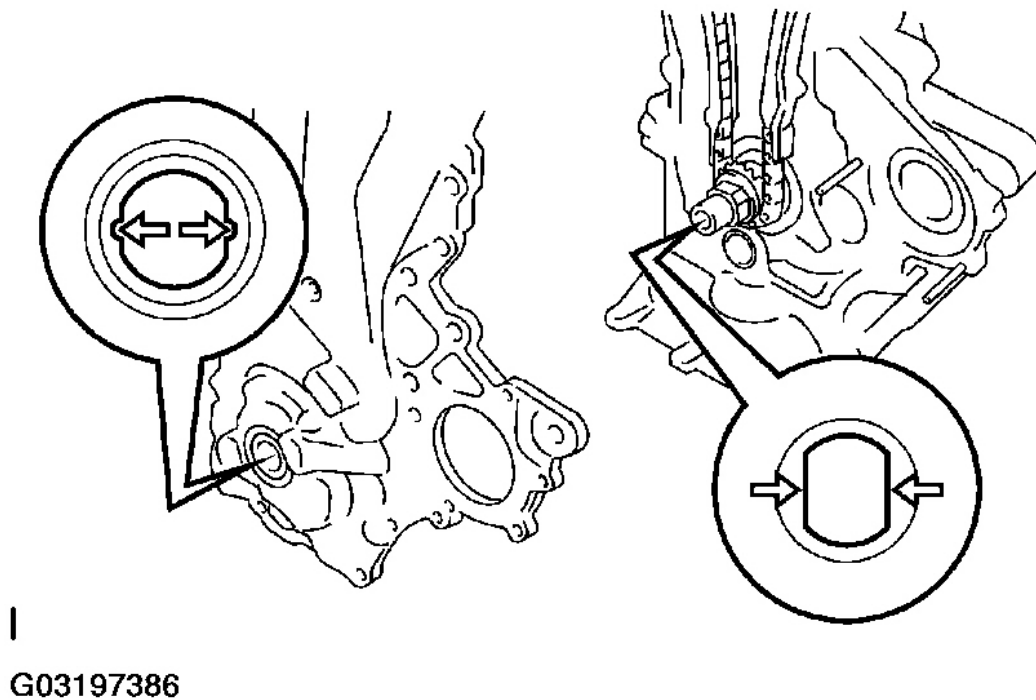


Fig. 150: Aligning Keyway Of Oil Pump Drive Rotor With Rectangular Portion Of Crankshaft

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 the 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, must install the mounting brack and water pump within 15 minutes.



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

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 to 14 mm (0.79 to 0.55 in.)

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)

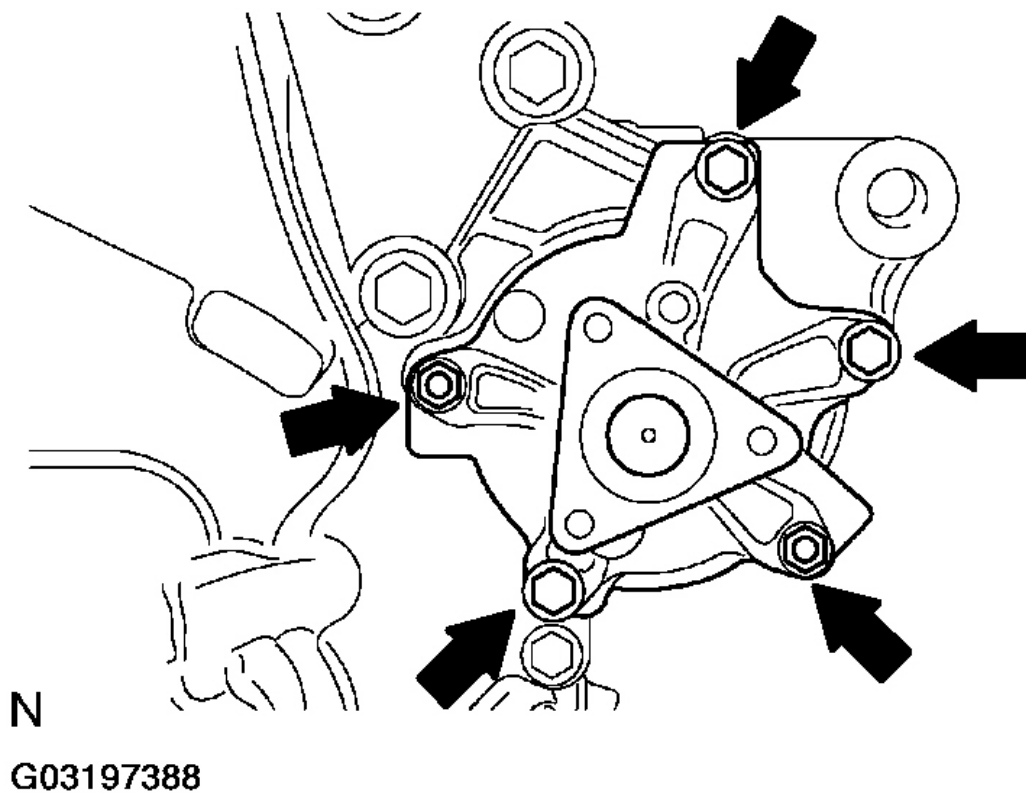


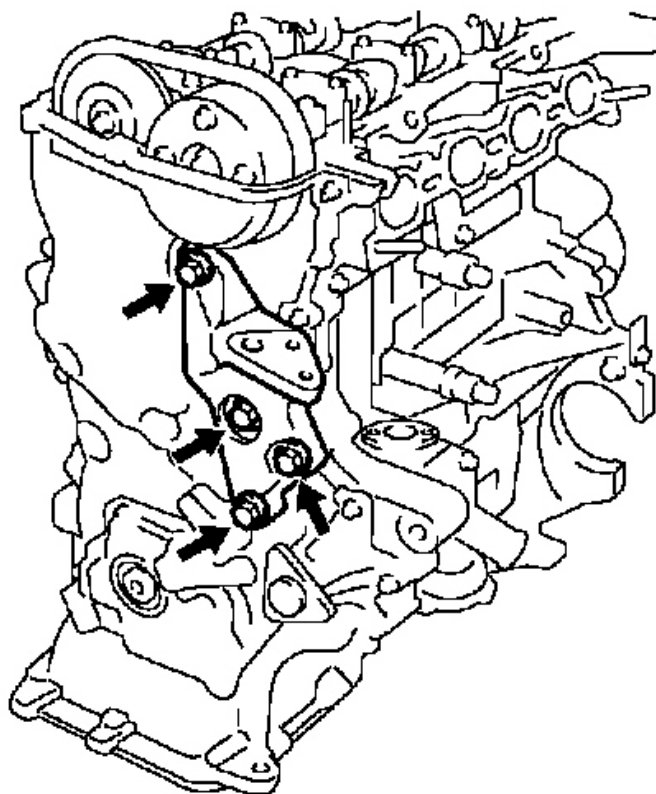
Fig. 152: Installing Water Pump Assy

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

61. INSTALL ENGINE MOUNTING BRACKET RH

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

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



Y

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Fig. 153: Installing Engine Mounting Bracket RH
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.

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

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

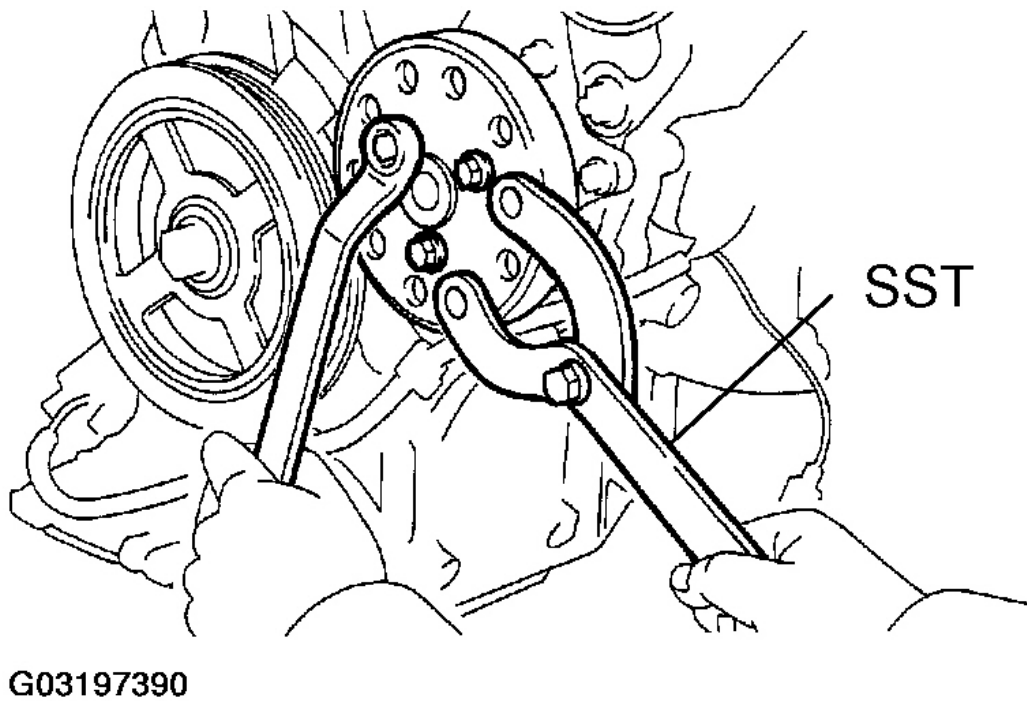


Fig. 154: Installing Water Pump Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

63. INSTALL CRANKSHAFT DAMPER SUB-ASSY

- a. Align the 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)

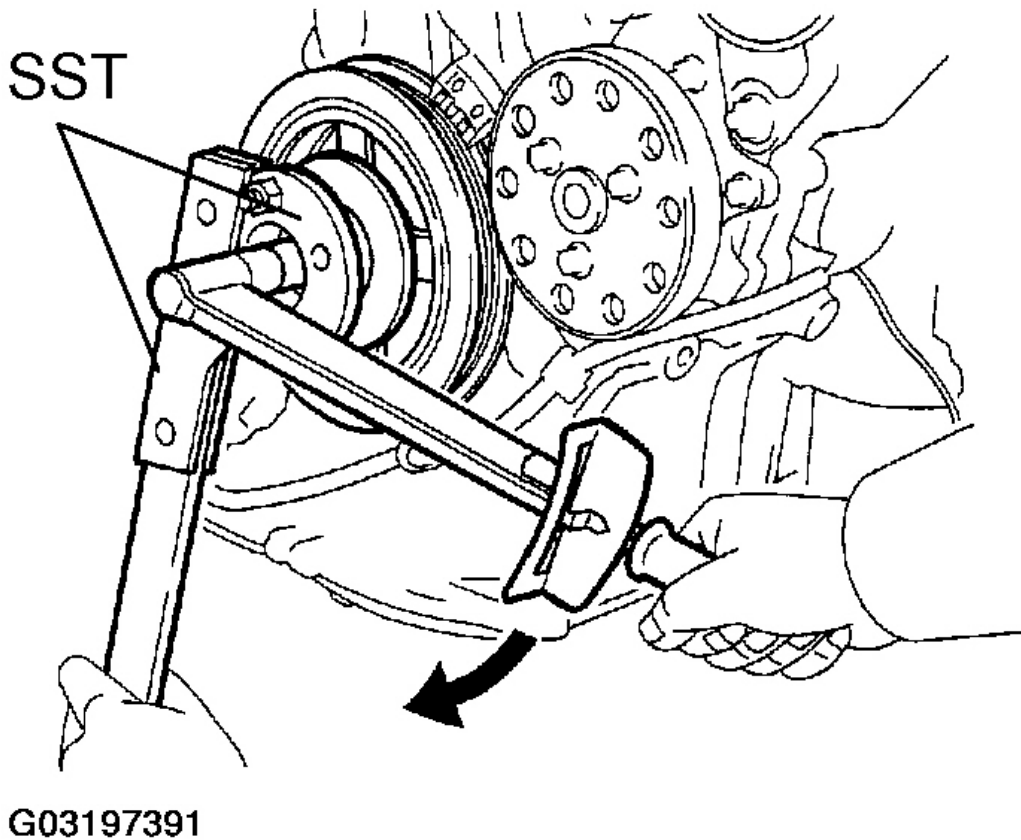


Fig. 155: Installing Crankshaft Damper Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

64. INSPECT VALVE CLEARANCE

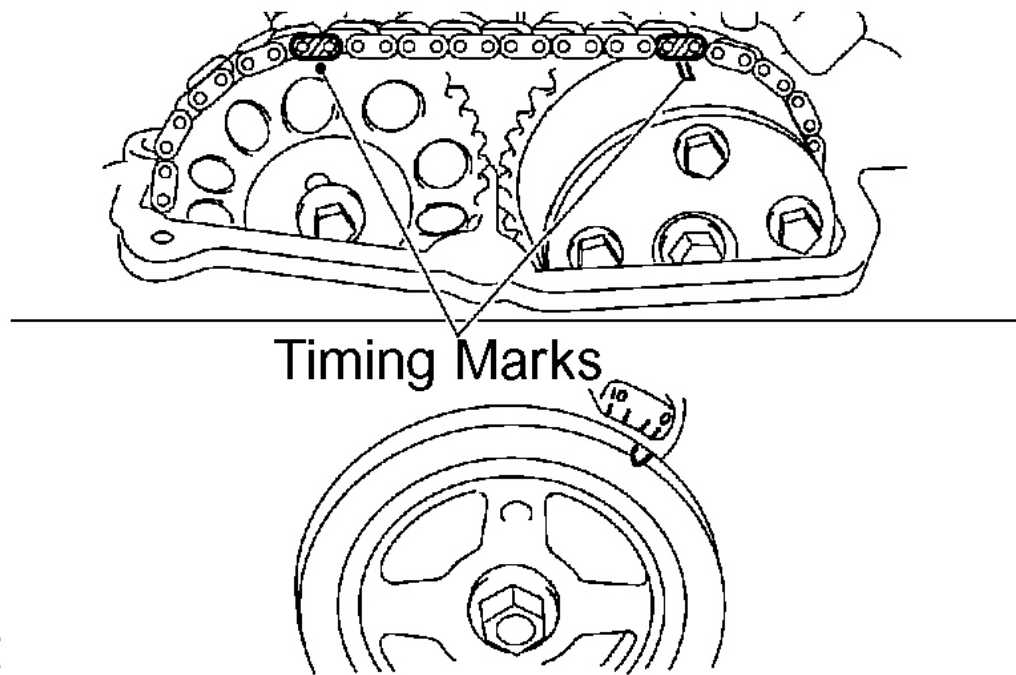
HINT:

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" or 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 the illustration.

HINT:

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



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Fig. 156: Identifying Timing Marks On Camshaft Timing Sprocket & Camshaft Timing Gear

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

- b. Check the valves indicated in the illustration.

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.
- c. Turn the crankshaft 1 complete revolution until its timing notch and the timing mark "0" of the chain cover are aligned.

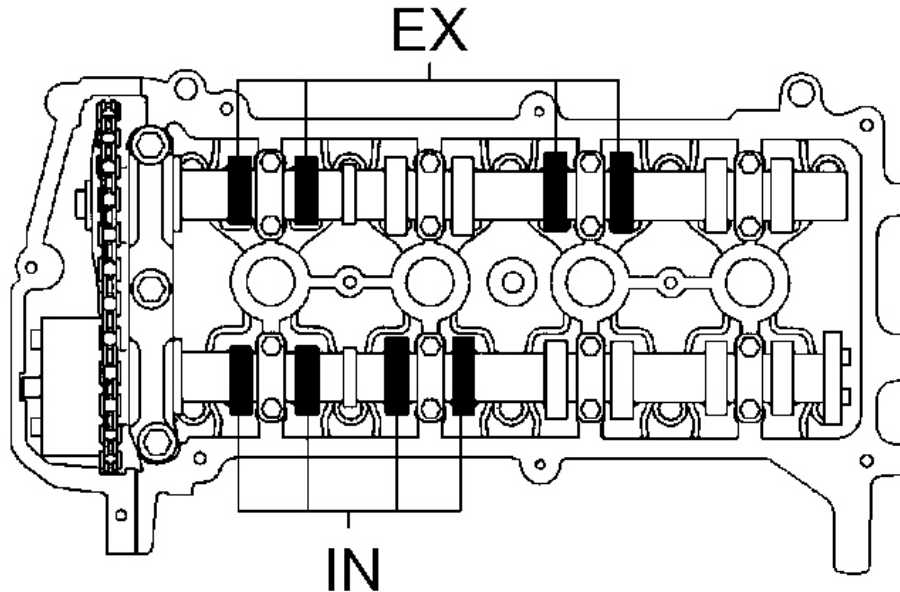
No.1 Cylinder TDC/Compression**G03197393**

Fig. 157: Setting No. 1 Cylinder To TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

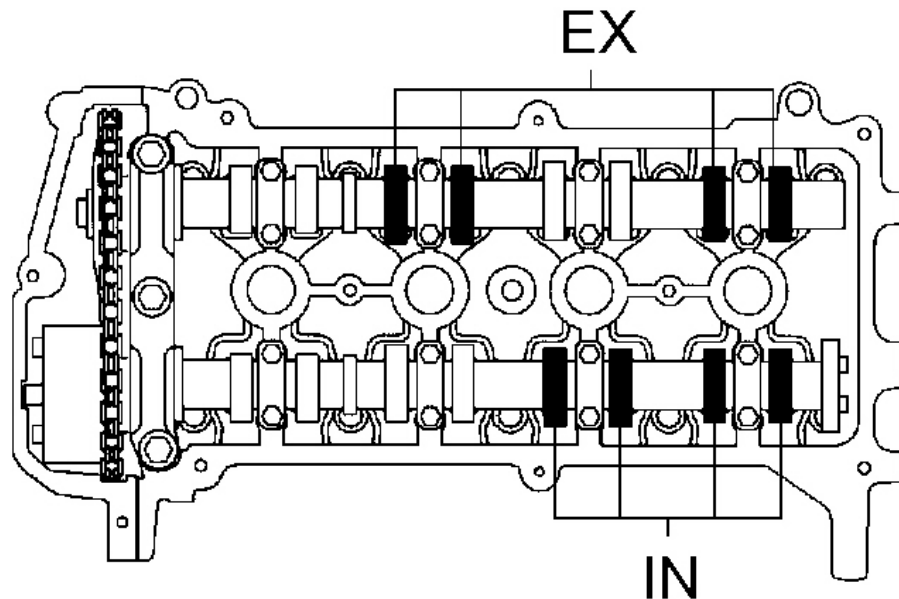
Valve clearance (Cold) :

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

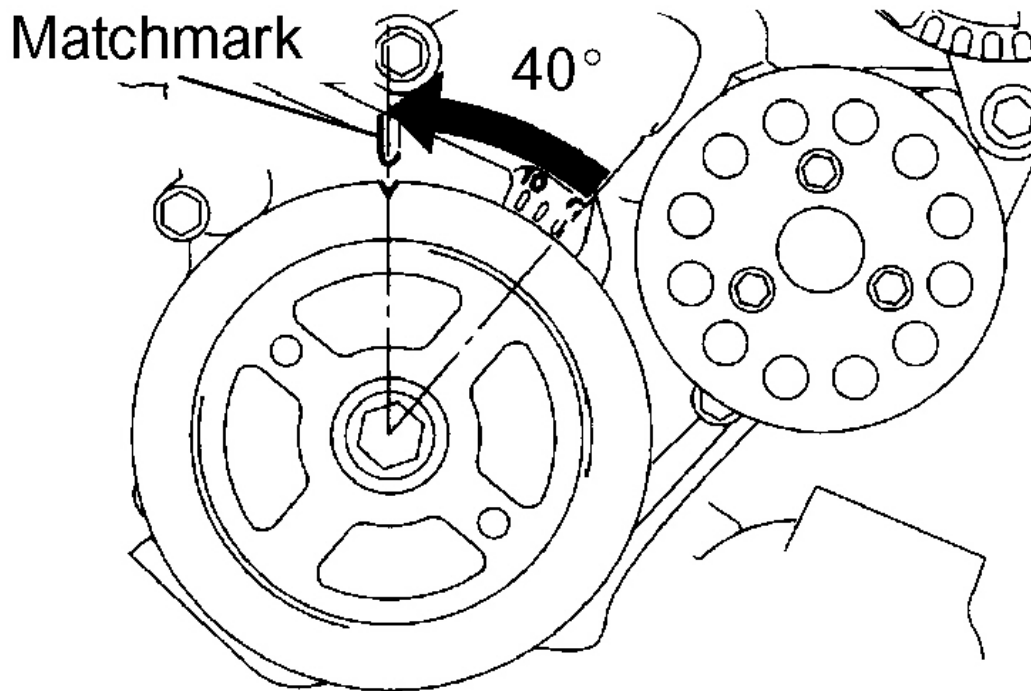


G03197394

Fig. 158: Setting No. 4 Cylinder To 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.



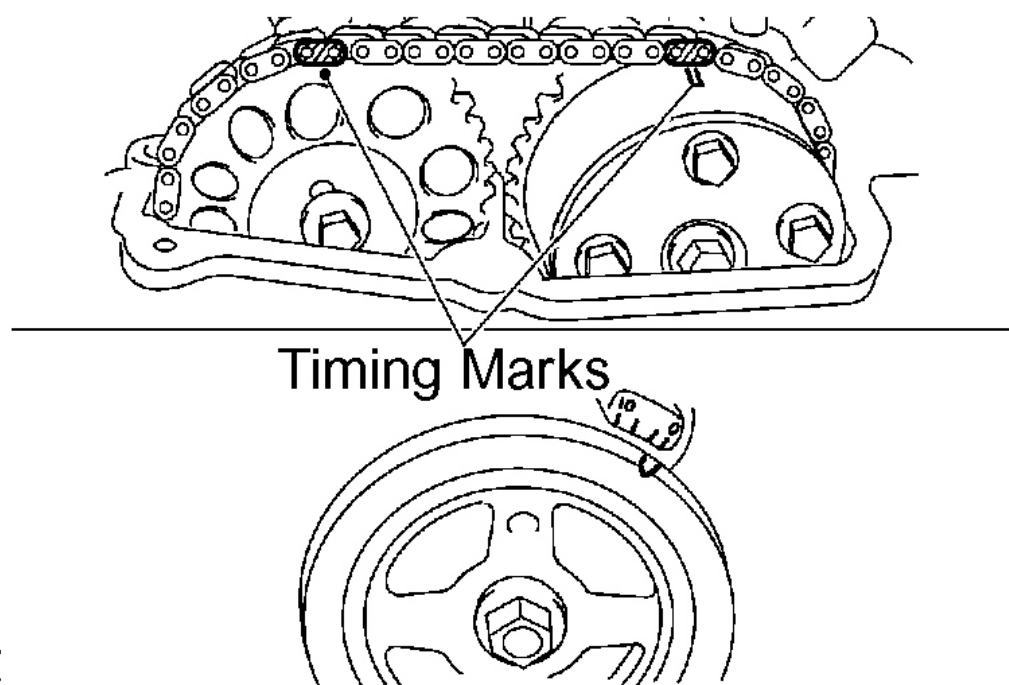
G03197395

Fig. 159: Rotating Crankshaft Damper Counterclockwise 40° From TDC
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 the camshaft timing gear are facing upward as shown in the illustration.

HINT:

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



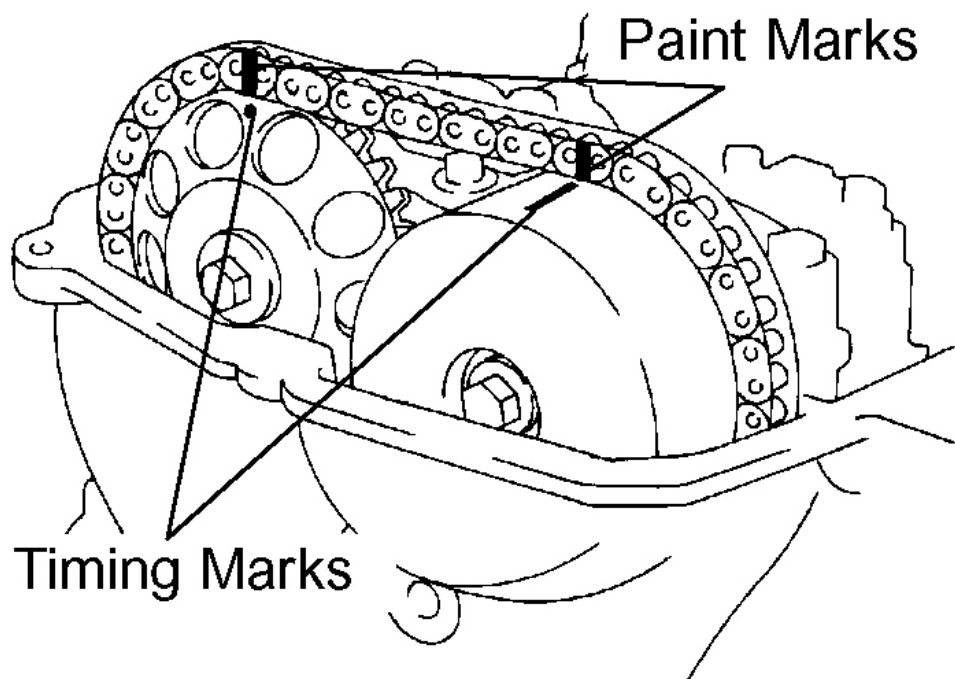
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Fig. 160: Aligning Timing Marks Of Camshaft Timing Sprocket & Camshaft Timing Gear

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.

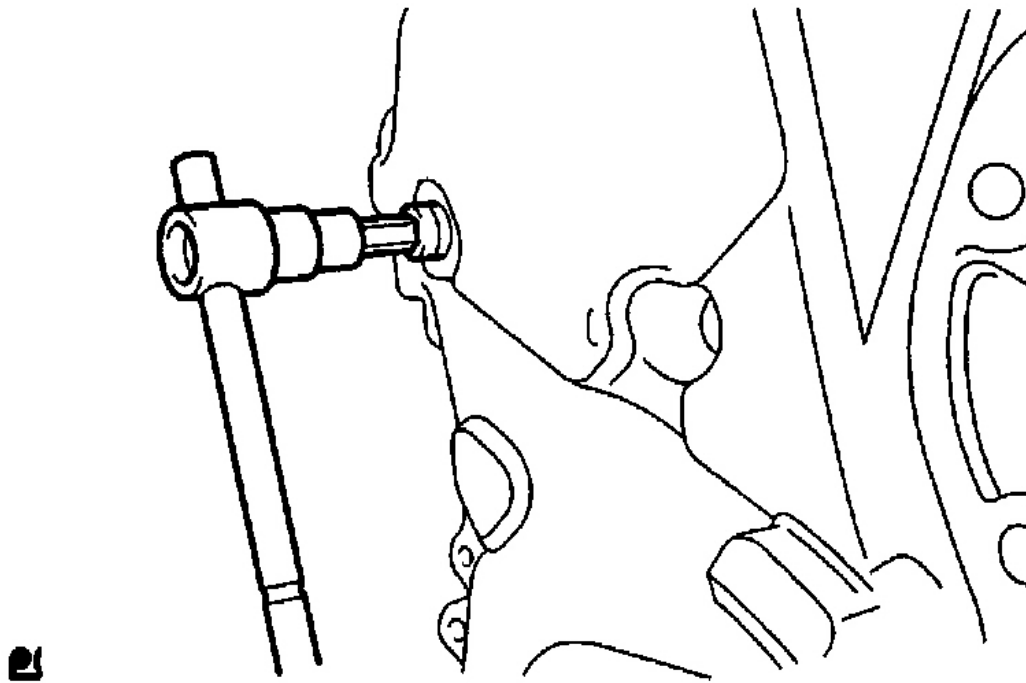


N

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Fig. 161: 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.

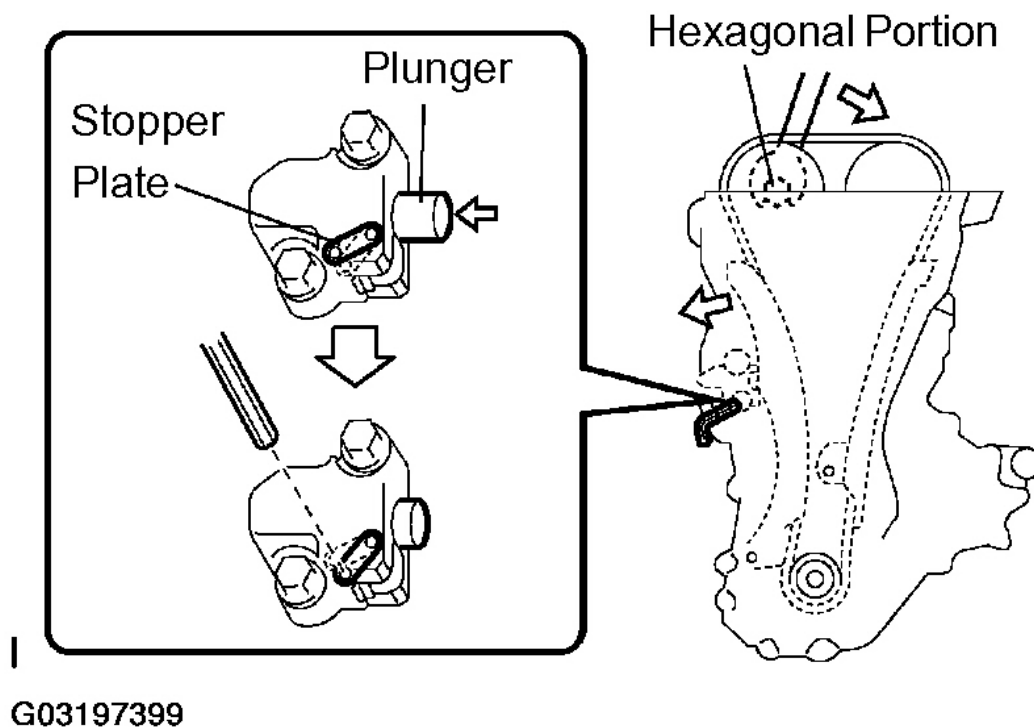


G03197398

Fig. 162: 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 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.



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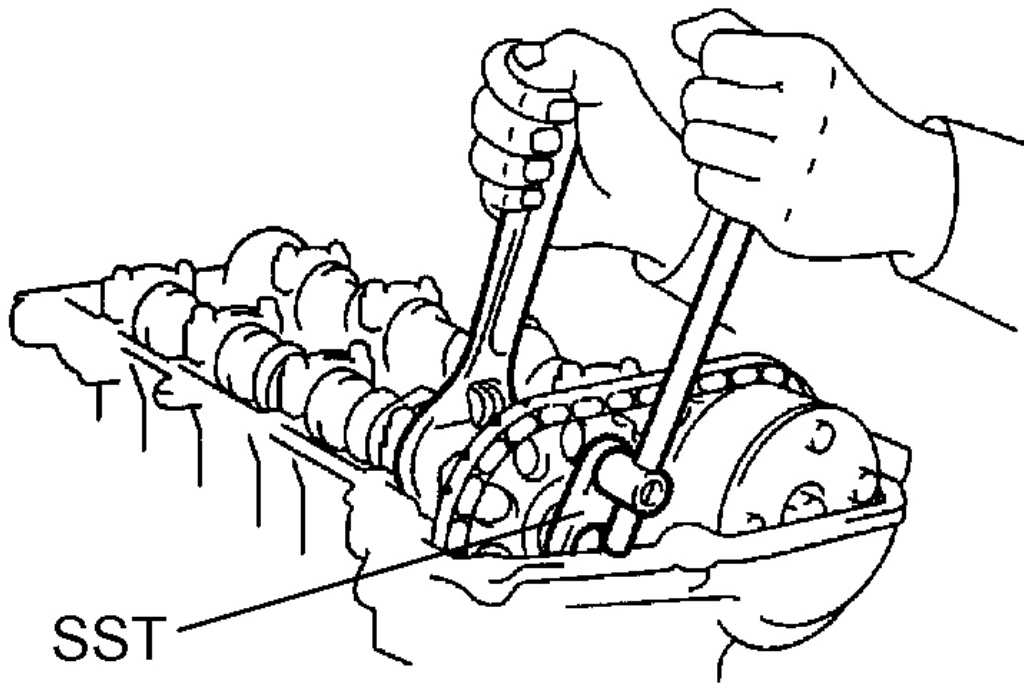
Fig. 163: Inserting Screwdriver Into Service Hole Of Chain Tensioner & Pushing In Plunger Of Chain Tensioner

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 09023-38401



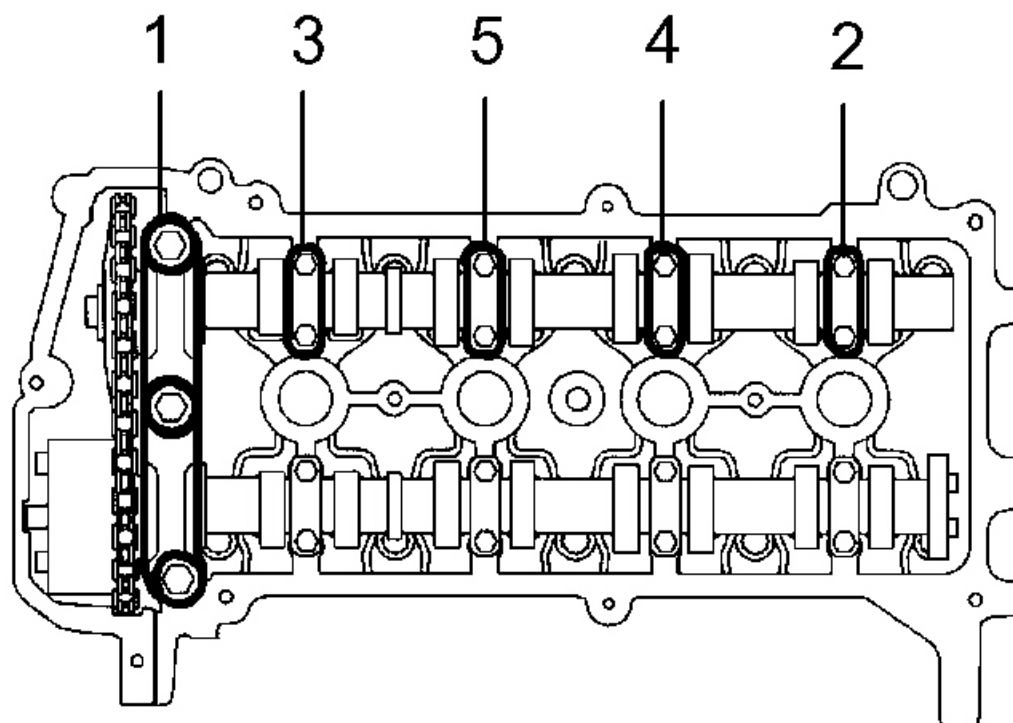
G03197400

Fig. 164: Removing Camshaft 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 the illustration, then remove the 5 bearing caps.

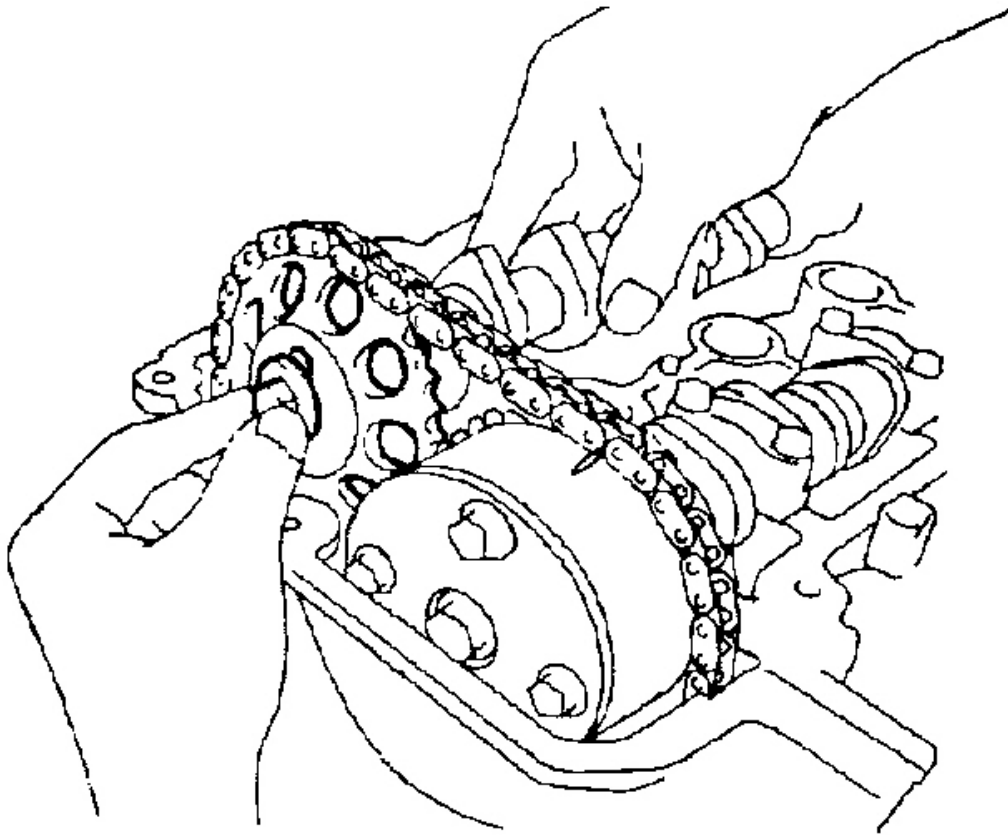
NOTE: Loosen each bolt uniformly keeping the camshaft level.



G03197401

Fig. 165: Identifying Loosening Sequence Of Bearing Cap Bolts
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 the camshaft timing sprocket.



G03197402

Fig. 166: Removing Camshaft Timing Sprocket
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 the illustration, then remove the 4 bearing caps.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

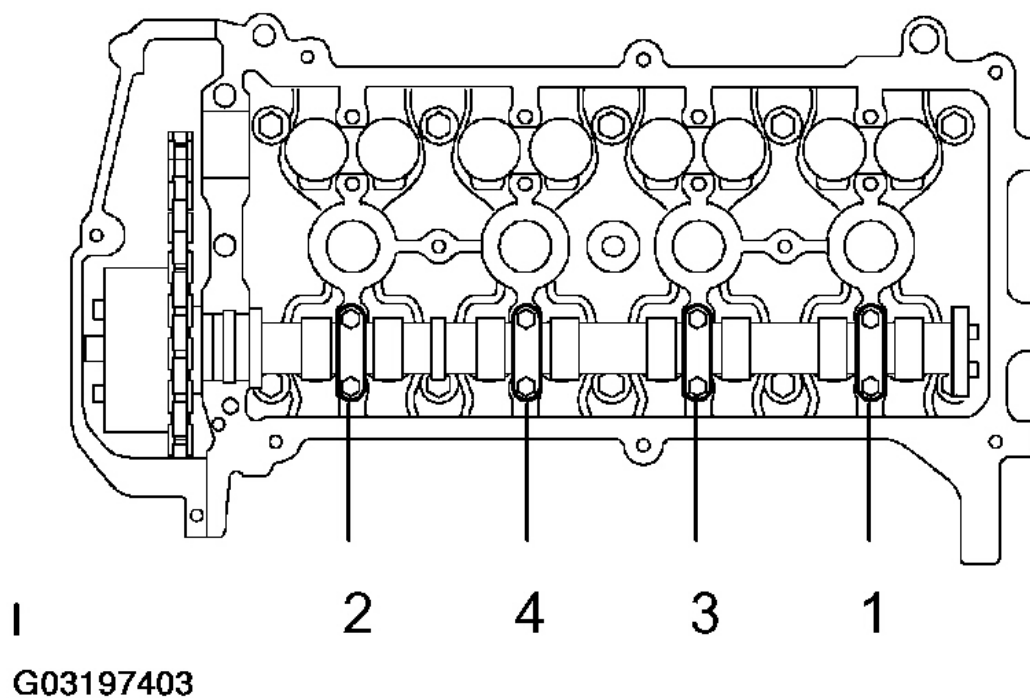
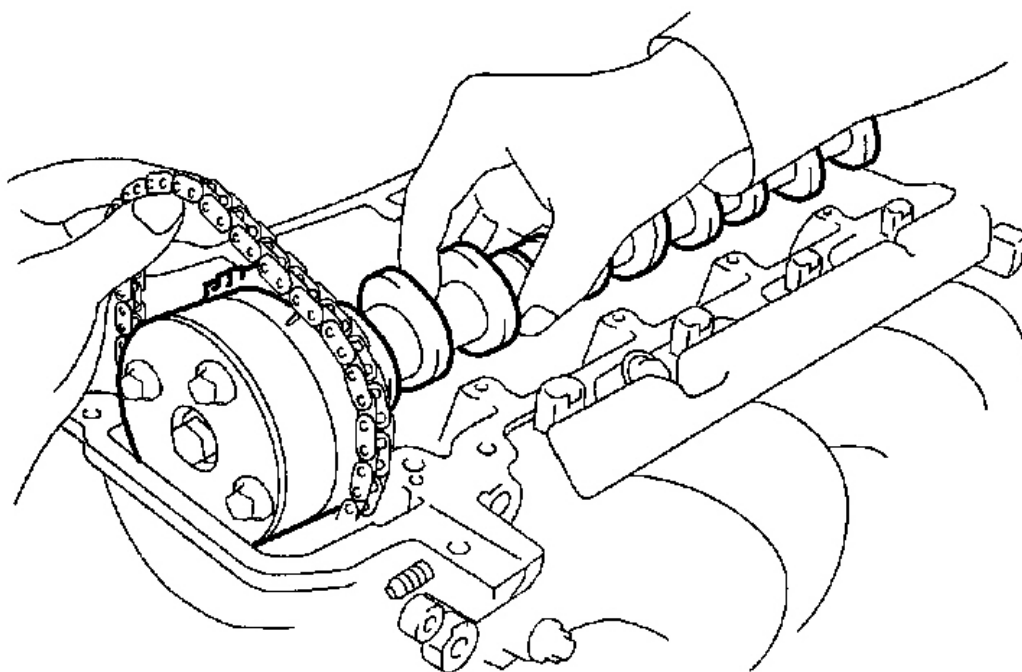


Fig. 167: Identifying Loosening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



G03197404

Fig. 168: Removing Camshaft & Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Tie the timing chain with a string as shown in the illustration.

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

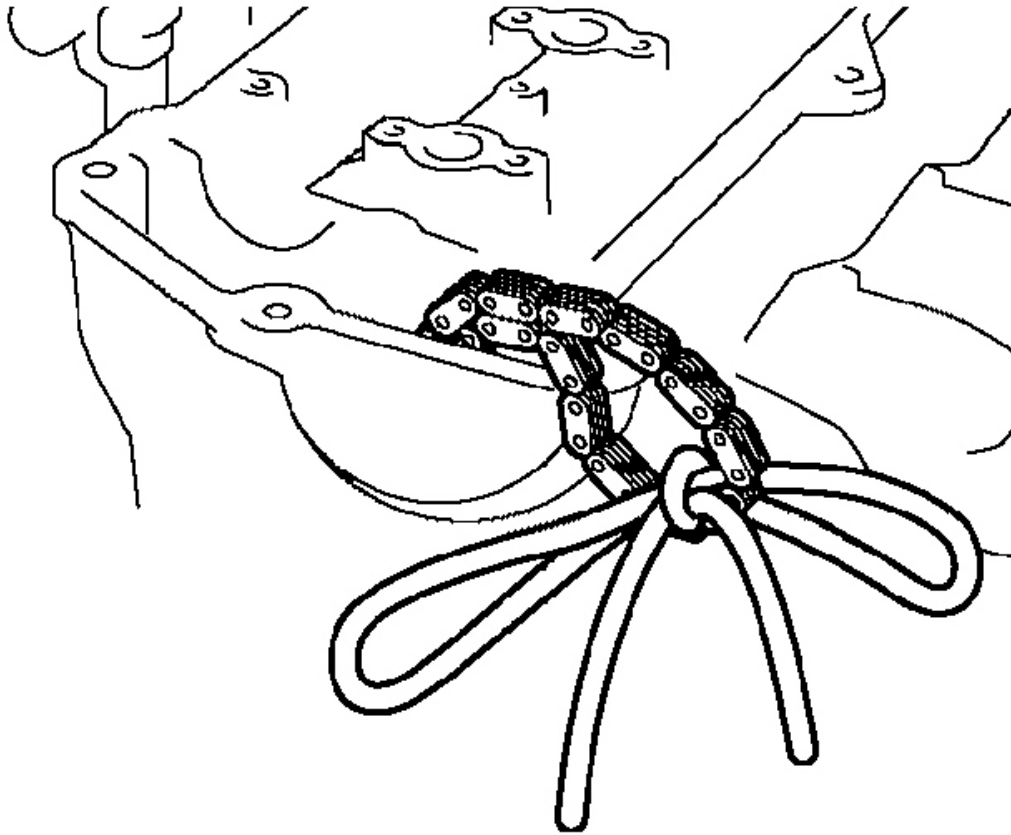
**G03197405**

Fig. 169: 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.

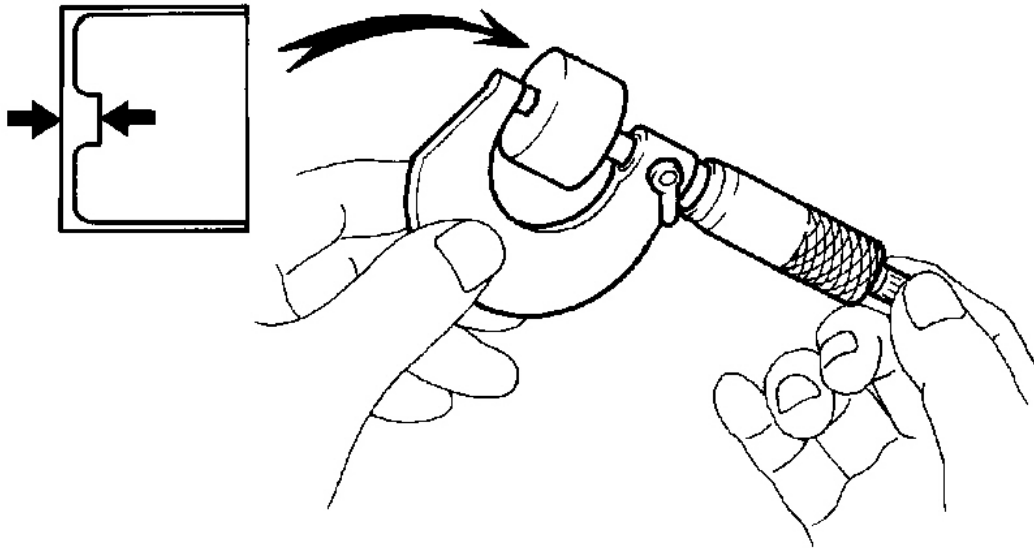
LIFTER THICKNESS

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



G03197406

Fig. 170: Measuring Thickness Of Removed Lifter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

EXAMPLE: (Intake)

Measured valve clearance = 0.40 mm (0.0158 in.)

0.40 mm (0.0158 in.) - 0.20 mm (0.0079 in.) = 0.20 mm (0.0079 in.)

(Measured - Specification = Excess clearance)

Used lifter measurement = 5.25 mm (0.2067 in.)

0.20 mm (0.0079 in.) + 5.25 mm (0.2067 in.) = 5.45 mm (0.2146 in.)

(Excess clearance + Used lifter = Ideal new lifter)

Closest new lifter = 5.45 mm (0.2146 in.)

		Valve Lifter Selection Chart (Exhaust)	
Measured clearance mm (in.)	Installed lifter thickness mm (in.)		
0.050 (0.0020)	5.000 (0.1969)		
0.055 (0.0022)	5.005 (0.1971)		
0.060 (0.0024)	5.010 (0.1973)		
0.065 (0.0026)	5.015 (0.1975)		
0.070 (0.0028)	5.020 (0.1977)		
0.075 (0.0030)	5.025 (0.1979)		
0.080 (0.0032)	5.030 (0.1981)		
0.085 (0.0034)	5.035 (0.1983)		
0.090 (0.0036)	5.040 (0.1985)		
0.095 (0.0038)	5.045 (0.1987)		
0.100 (0.0040)	5.050 (0.1989)		
0.105 (0.0042)	5.055 (0.1991)		
0.110 (0.0044)	5.060 (0.1993)		
0.115 (0.0046)	5.065 (0.1995)		
0.120 (0.0048)	5.070 (0.1997)		
0.125 (0.0050)	5.075 (0.1999)		
0.130 (0.0052)	5.080 (0.2001)		
0.135 (0.0054)	5.085 (0.2003)		
0.140 (0.0056)	5.090 (0.2005)		
0.145 (0.0058)	5.095 (0.2007)		
0.150 (0.0060)	5.100 (0.2009)		
0.155 (0.0062)	5.105 (0.2011)		
0.160 (0.0064)	5.110 (0.2013)		
0.165 (0.0066)	5.115 (0.2015)		
0.170 (0.0068)	5.120 (0.2017)		
0.175 (0.0070)	5.125 (0.2019)		
0.180 (0.0072)	5.130 (0.2021)		
0.185 (0.0074)	5.135 (0.2023)		
0.190 (0.0076)	5.140 (0.2025)		
0.195 (0.0078)	5.145 (0.2027)		
0.200 (0.0080)	5.150 (0.2029)		
0.205 (0.0082)	5.155 (0.2031)		
0.210 (0.0084)	5.160 (0.2033)		
0.215 (0.0086)	5.165 (0.2035)		
0.220 (0.0088)	5.170 (0.2037)		
0.225 (0.0090)	5.175 (0.2039)		
0.230 (0.0092)	5.180 (0.2041)		
0.235 (0.0094)	5.185 (0.2043)		
0.240 (0.0096)	5.190 (0.2045)		
0.245 (0.0098)	5.195 (0.2047)		
0.250 (0.0100)	5.200 (0.2049)		
0.255 (0.0102)	5.205 (0.2051)		
0.260 (0.0104)	5.210 (0.2053)		
0.265 (0.0106)	5.215 (0.2055)		
0.270 (0.0108)	5.220 (0.2057)		
0.275 (0.0110)	5.225 (0.2059)		
0.280 (0.0112)	5.230 (0.2061)		
0.285 (0.0114)	5.235 (0.2063)		
0.290 (0.0116)	5.240 (0.2065)		
0.295 (0.0118)	5.245 (0.2067)		
0.300 (0.0120)	5.250 (0.2069)		
0.305 (0.0122)	5.255 (0.2071)		
0.310 (0.0124)	5.260 (0.2073)		
0.315 (0.0126)	5.265 (0.2075)		
0.320 (0.0128)	5.270 (0.2077)		
0.325 (0.0130)	5.275 (0.2079)		
0.330 (0.0132)	5.280 (0.2081)		
0.335 (0.0134)	5.285 (0.2083)		
0.340 (0.0136)	5.290 (0.2085)		
0.345 (0.0138)	5.295 (0.2087)		
0.350 (0.0140)	5.300 (0.2089)		
0.355 (0.0142)	5.305 (0.2091)		
0.360 (0.0144)	5.310 (0.2093)		
0.365 (0.0146)	5.315 (0.2095)		
0.370 (0.0148)	5.320 (0.2097)		
0.375 (0.0150)	5.325 (0.2099)		
0.380 (0.0152)	5.330 (0.2101)		
0.385 (0.0154)	5.335 (0.2103)		
0.390 (0.0156)	5.340 (0.2105)		
0.395 (0.0158)	5.345 (0.2107)		
0.400 (0.0160)	5.350 (0.2109)		
0.405 (0.0162)	5.355 (0.2111)		
0.410 (0.0164)	5.360 (0.2113)		
0.415 (0.0166)	5.365 (0.2115)		
0.420 (0.0168)	5.370 (0.2117)		
0.425 (0.0170)	5.375 (0.2119)		
0.430 (0.0172)	5.380 (0.2121)		
0.435 (0.0174)	5.385 (0.2123)		
0.440 (0.0176)	5.390 (0.2125)		
0.445 (0.0178)	5.395 (0.2127)		
0.450 (0.0180)	5.400 (0.2129)		
0.455 (0.0182)	5.405 (0.2131)		
0.460 (0.0184)	5.410 (0.2133)		
0.465 (0.0186)	5.415 (0.2135)		
0.470 (0.0188)	5.420 (0.2137)		
0.475 (0.0190)	5.425 (0.2139)		
0.480 (0.0192)	5.430 (0.2141)		
0.485 (0.0194)	5.435 (0.2143)		
0.490 (0.0196)	5.440 (0.2145)		
0.495 (0.0198)	5.445 (0.2147)		
0.500 (0.0200)	5.450 (0.2149)		
0.505 (0.0202)	5.455 (0.2151)		
0.510 (0.0204)	5.460 (0.2153)		
0.515 (0.0206)	5.465 (0.2155)		
0.520 (0.0208)	5.470 (0.2157)		
0.525 (0.0210)	5.475 (0.2159)		
0.530 (0.0212)	5.480 (0.2161)		
0.535 (0.0214)	5.485 (0.2163)		
0.540 (0.0216)	5.490 (0.2165)		
0.545 (0.0218)	5.495 (0.2167)		
0.550 (0.0220)	5.500 (0.2169)		
0.555 (0.0222)	5.505 (0.2171)		
0.560 (0.0224)	5.510 (0.2173)		
0.565 (0.0226)	5.515 (0.2175)		
0.570 (0.0228)	5.520 (0.2177)		
0.575 (0.0230)	5.525 (0.2179)		
0.580 (0.0232)	5.530 (0.2181)		
0.585 (0.0234)	5.535 (0.2183)		
0.590 (0.0236)	5.540 (0.2185)		
0.595 (0.0238)	5.545 (0.2187)		
0.600 (0.0240)	5.550 (0.2189)		
0.605 (0.0242)	5.555 (0.2191)		
0.610 (0.0244)	5.560 (0.2193)		
0.615 (0.0246)	5.565 (0.2195)		
0.620 (0.0248)	5.570 (0.2197)		
0.625 (0.0250)	5.575 (0.2199)		
0.630 (0.0252)	5.580 (0.2201)		
0.635 (0.0254)	5.585 (0.2203)		
0.640 (0.0256)	5.590 (0.2205)		
0.645 (0.0258)	5.595 (0.2207)		
0.650 (0.0260)	5.600 (0.2209)		
0.655 (0.0262)	5.605 (0.2211)		
0.660 (0.0264)	5.610 (0.2213)		
0.665 (0.0266)	5.615 (0.2215)		
0.670 (0.0268)	5.620 (0.2217)		
0.675 (0.0270)	5.625 (0.2219)		
0.680 (0.0272)	5.630 (0.2221)		
0.685 (0.0274)	5.635 (0.2223)		
0.690 (0.0276)	5.640 (0.2225)		
0.695 (0.0278)	5.645 (0.2227)		
0.700 (0.0280)	5.650 (0.2229)		
0.705 (0.0282)	5.655 (0.2231)		
0.710 (0.0284)	5.660 (0.2233)		
0.715 (0.0286)	5.665 (0.2235)		
0.720 (0.0288)	5.670 (0.2237)		
0.725 (0.0290)	5.675 (0.2239)		
0.730 (0.0292)	5.680 (0.2241)		
0.735 (0.0294)	5.685 (0.2243)		
0.740 (0.0296)	5.690 (0.2245)		
0.745 (0.0298)	5.695 (0.2247)		
0.750 (0.0300)	5.700 (0.2249)		
0.755 (0.0302)	5.705 (0.2251)		
0.760 (0.0304)	5.710 (0.2253)		
0.765 (0.0306)	5.715 (0.2255)		
0.770 (0.0308)	5.720 (0.2257)		
0.775 (0.0310)	5.725 (0.2259)		
0.780 (0.0312)	5.730 (0.2261)		
0.785 (0.0314)	5.735 (0.2263)		
0.790 (0.0316)	5.740 (0.2265)		
0.795 (0.0318)	5.745 (0.2267)		
0.800 (0.0320)	5.750 (0.2269)		
0.805 (0.0322)	5.755 (0.2271)		
0.810 (0.0324)	5.760 (0.2273)		
0.815 (0.0326)	5.765 (0.2275)		
0.820 (0.0328)	5.770 (0.2277)		
0.825 (0.0330)	5.775 (0.2279)		
0.830 (0.0332)	5.780 (0.2281)		
0.835 (0.0334)	5.785 (0.2283)		
0.840 (0.0336)	5.790 (0.2285)		
0.845 (0.0338)	5.795 (0.2287)		
0.850 (0.0340)	5.800 (0.2289)		
0.855 (0.0342)	5.805 (0.2291)		
0.860 (0.0344)	5.810 (0.2293)		
0.865 (0.0346)	5.815 (0.2295)		
0.870 (0.0348)	5.820 (0.2297)		
0.875 (0.0350)	5.825 (0.2299)		
0.880 (0.0352)	5.830 (0.2301)		
0.885 (0.0354)	5.835 (0.2303)		
0.890 (0.0356)	5.840 (0.2305)		
0.895 (0.0358)	5.845 (0.2307)		
0.900 (0.0360)	5.850 (0.2309)		
0.905 (0.0362)	5.855 (0.2311)		
0.910 (0.0364)	5.860 (0.2313)		
0.915 (0.0366)	5.865 (0.2315)		
0.920 (0.0368)	5.870 (0.2317)		
0.925 (0.0370)	5.875 (0.2319)		
0.930 (0.0372)	5.880 (0.2321)		
0.935 (0.0374)	5.885 (0.2323)		
0.940 (0.0376)	5.890 (0.2325)		
0.945 (0.0378)	5.895 (0.2327)		
0.950 (0.0380)	5.900 (0.2329)		
0.955 (0.0382)	5.905 (0.2331)		
0.960 (0.0384)	5.910 (0.2333)		
0.965 (0.0386)	5.915 (0.2335)		
0.970 (0.0388)	5.920 (0.2337)		
0.975 (0.0390)	5.925 (0.2339)		
0.980 (0.0392)	5.930 (0.2341)		
0.985 (0.0394)	5.935 (0.2343)		
0.990 (0.0396)	5.940 (0.2345)		
0.995 (0.0398)	5.945 (0.2347)		
1.000 (0.0400)	5.950 (0.2349)		

Exhaust valve clearance (Cold):

0.25 to 0.35 mm (0.010 to 0.014 in.)

EXAMPLE: The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.440 mm (0.0173 in.).

Replace the 5.340 mm (0.2102 in.) lifter with a new No. 48 lifter.

G03197408

Fig. 172: Exhaust Valve Lifter Selection Table
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Reinstall the valve lifters.
- Apply a light coat of engine oil to the camshaft journals.
- Install the timing chain onto the camshaft timing gear with the paint mark and the timing marks aligned as shown in the illustration.

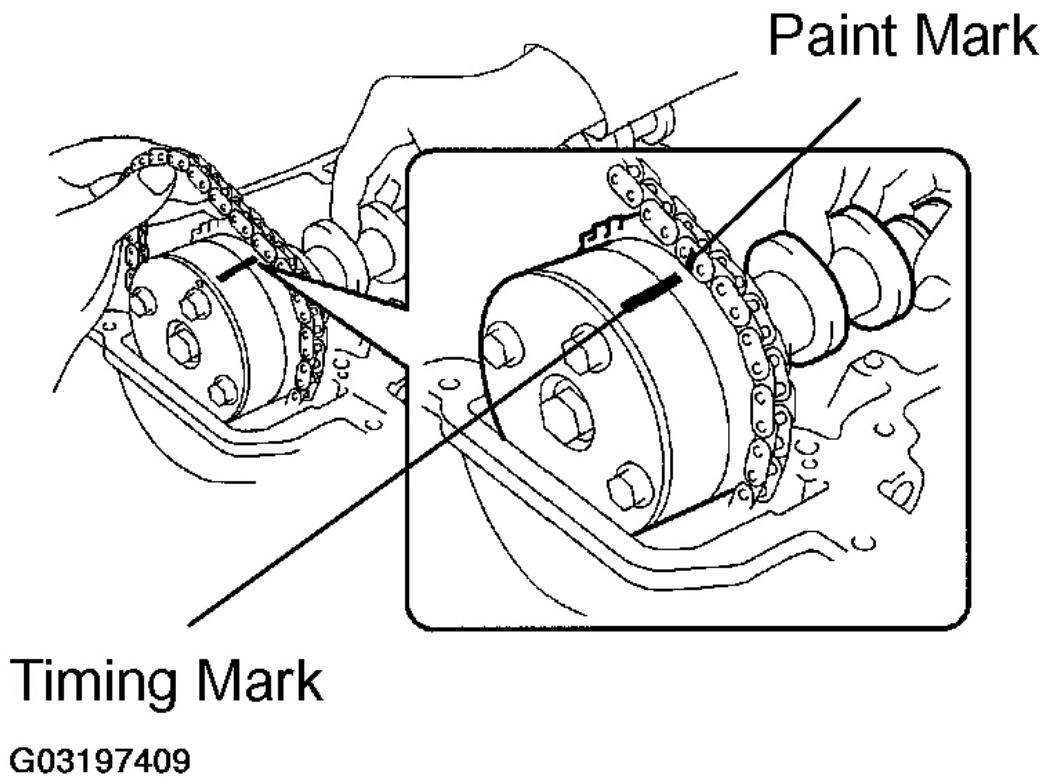


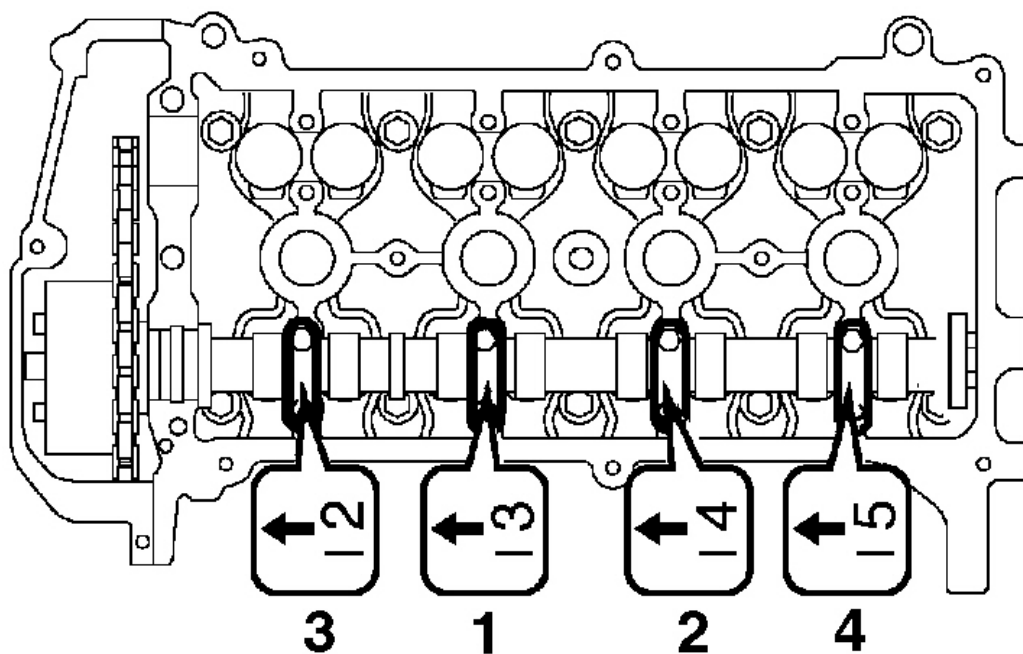
Fig. 173: Installing Timing Chain Onto Camshaft Timing Gear

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 the illustration.

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

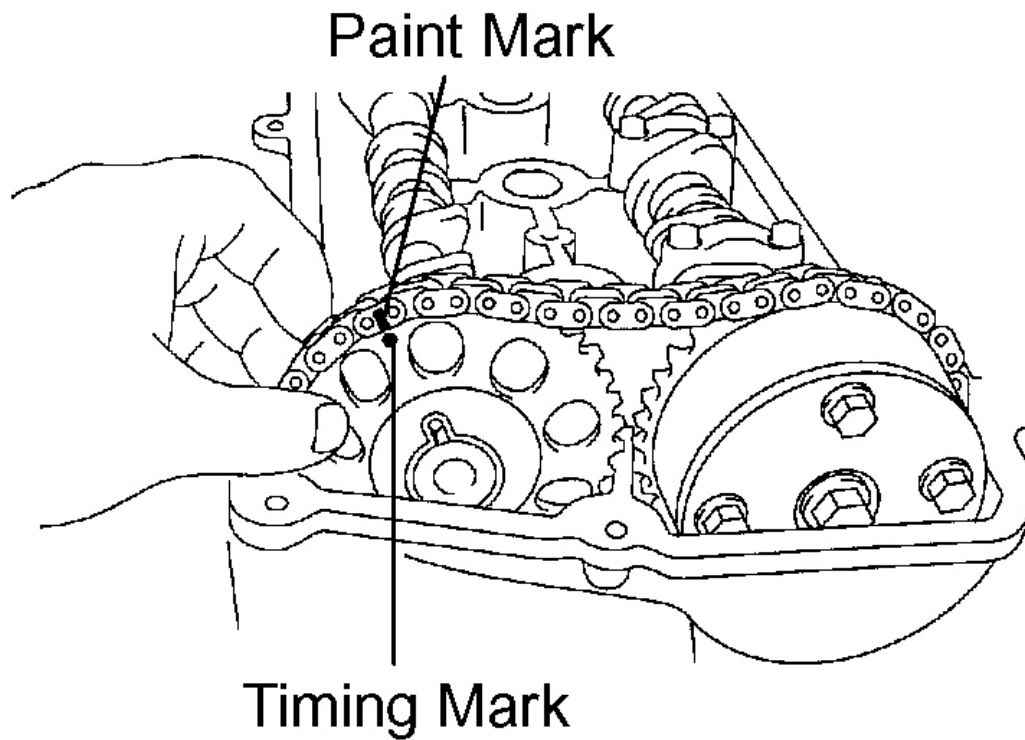
NOTE: Tighten each bolt uniformly keeping the camshaft level.



G03197469

Fig. 174: Identifying Tightening Sequence Of Bearing Cap Bolts
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 paint mark on the timing chain.

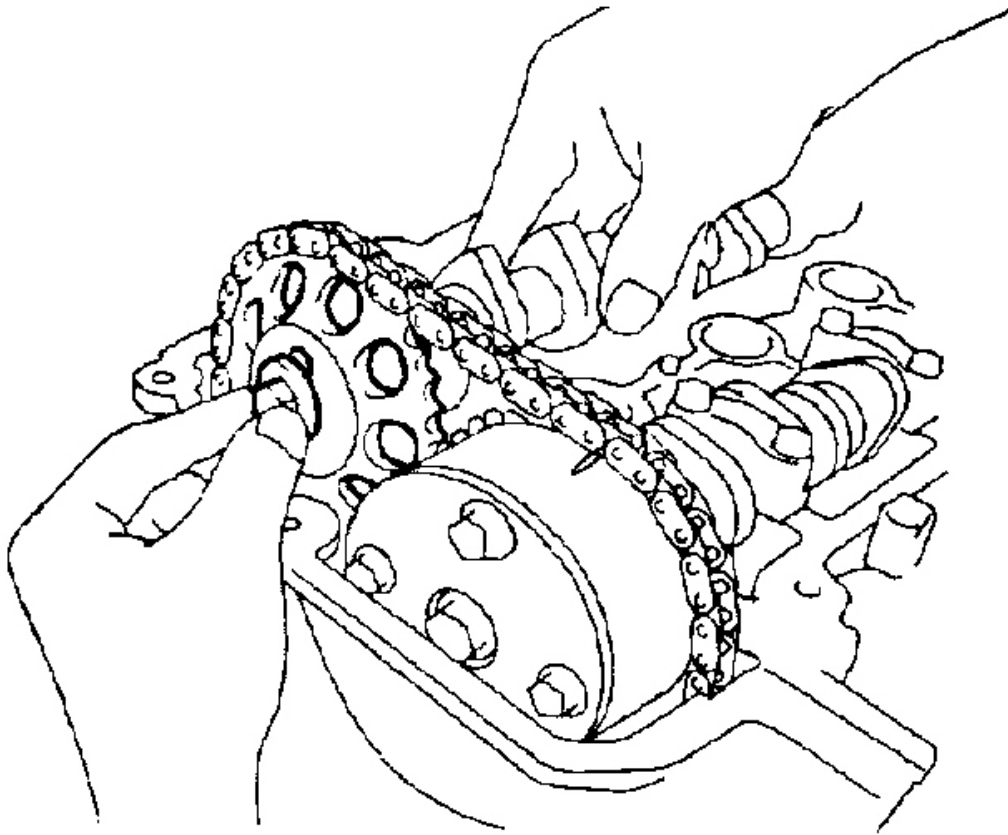


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Fig. 175: Aligning Timing Mark On Camshaft Timing Sprocket With Paint Mark On Timing Chain

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.
- w. Temporarily install the timing sprocket bolt.



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Fig. 176: Installing Timing Sprocket Bolt

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

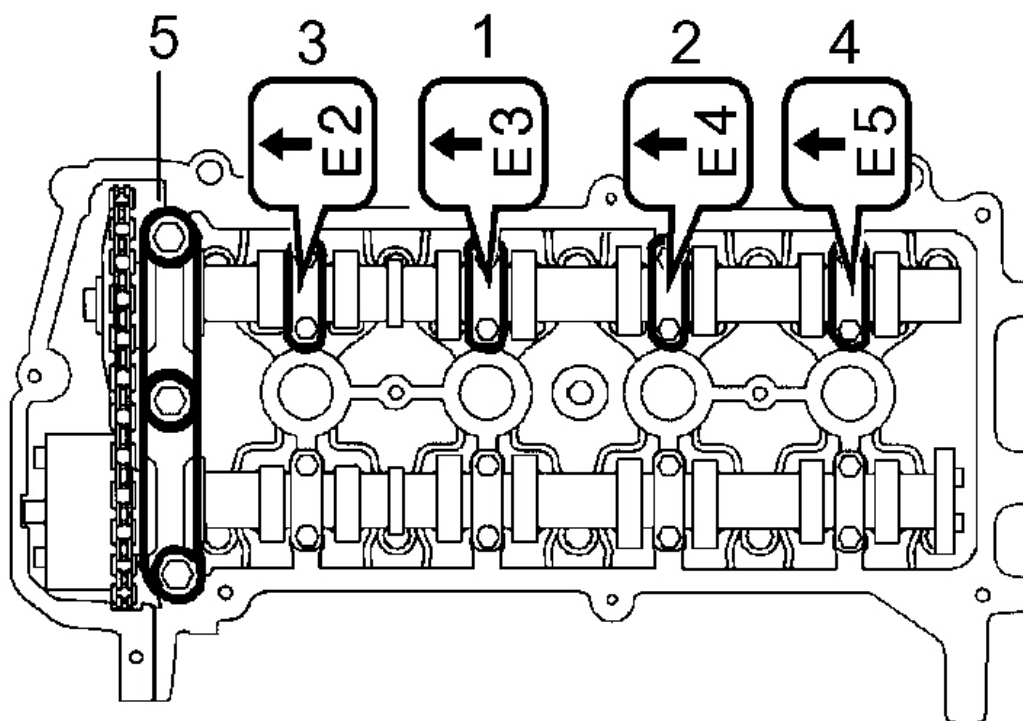
- x. Examine the front marks and numbers and tighten the bolts in the sequence shown in the illustration.

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

NOTE: Tighten each bolt uniformly keeping the camshaft level.

- y. Install the bearing cap No. 1.

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



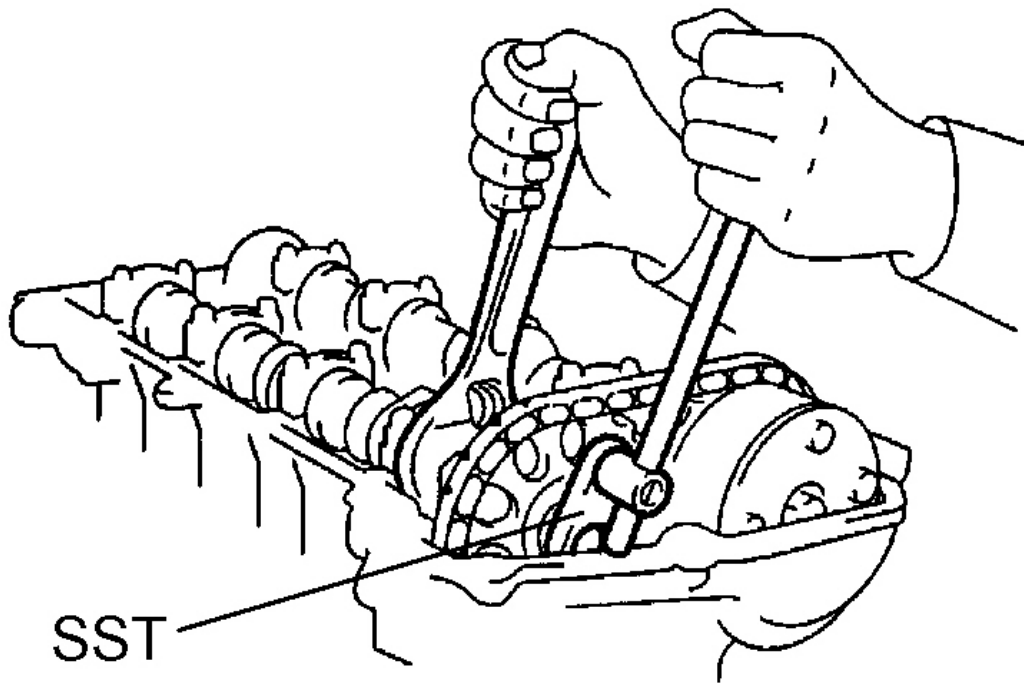
G03197413

Fig. 177: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

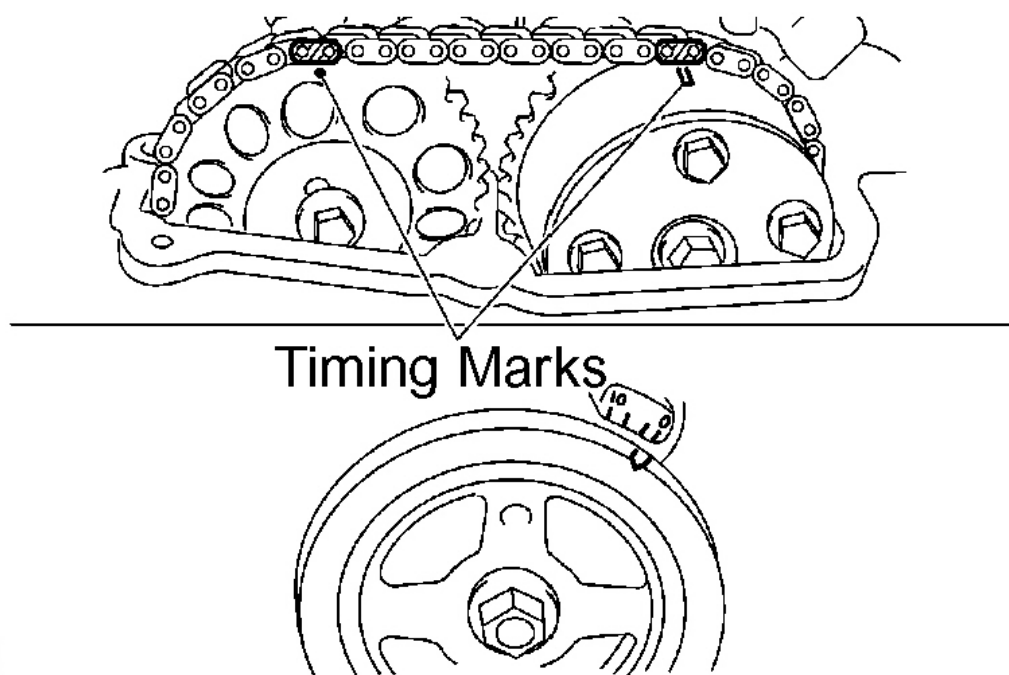
SST 09023-38401



G03197414

Fig. 178: Installing Camshaft 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 matchmarks are aligned.



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Fig. 179: Aligning Timing Marks

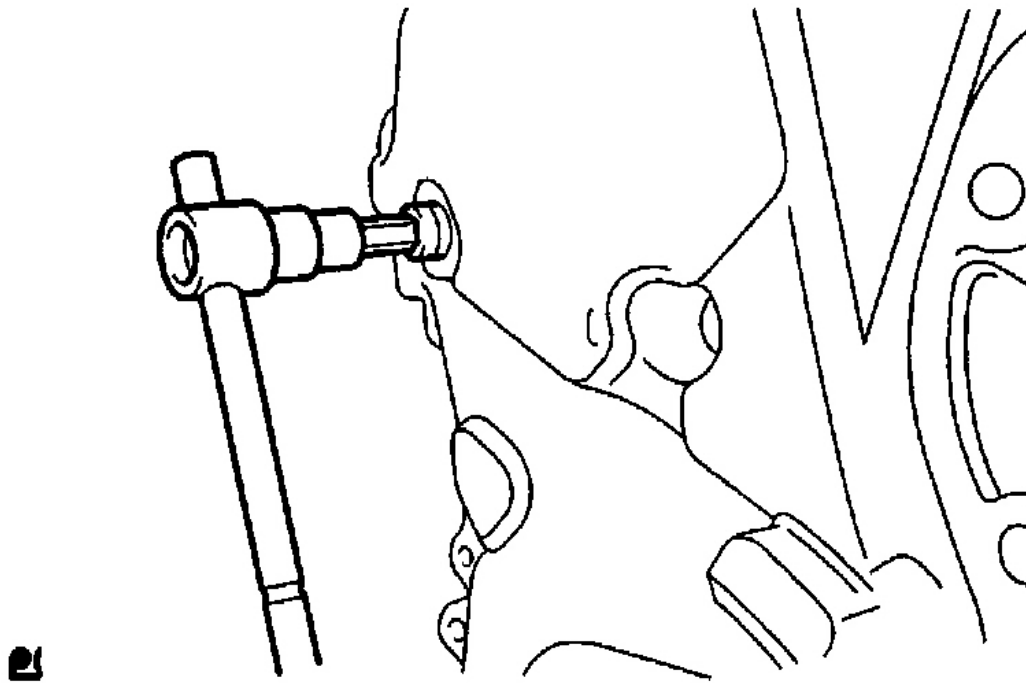
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- ad. Apply 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)



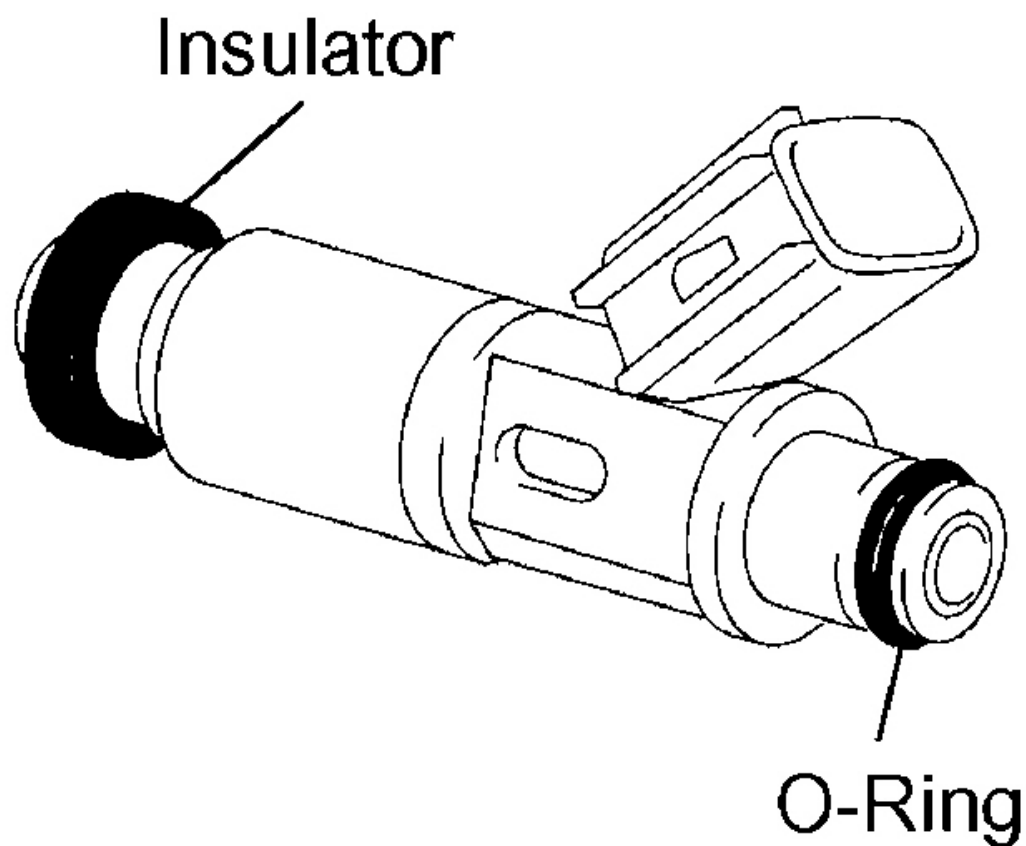
G03197416

Fig. 180: 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 spindle oil or gasoline to new O-rings and install it onto each fuel injector.
- c. Apply a light coat of spindle oil or gasoline to the place where a delivery pipe comes into contact with the O-ring.



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Fig. 181: Installing New O-Rings On Fuel Injector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

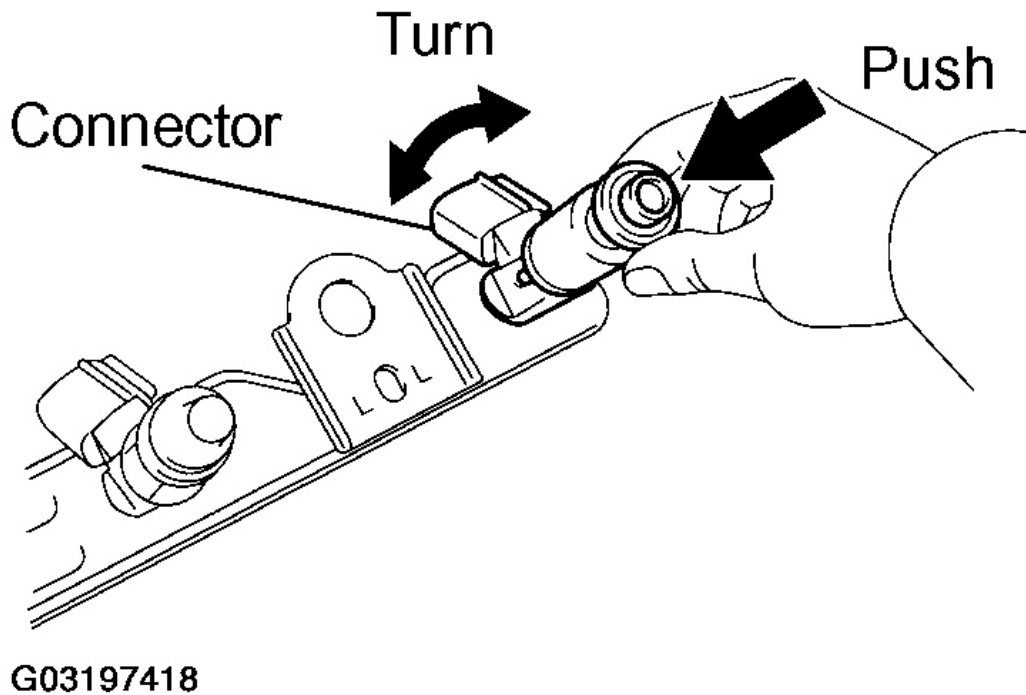


Fig. 182: Pushing Injector Into Delivery Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

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

67. INSTALL FUEL DELIVERY PIPE SUB-ASSY

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

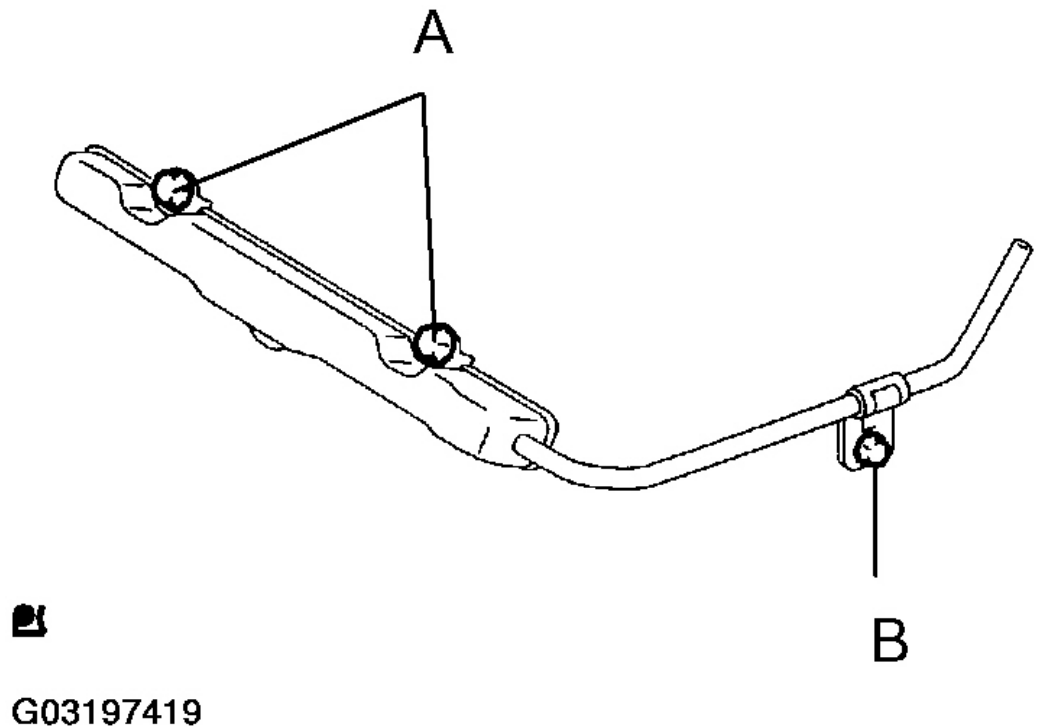
Torque:

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

Bolt B 9.0 N.m (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. 183: Tightening Bolts**

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.

69. INSTALL CYLINDER HEAD COVER SUB-ASSY

- Install the gasket onto the cylinder head cover.

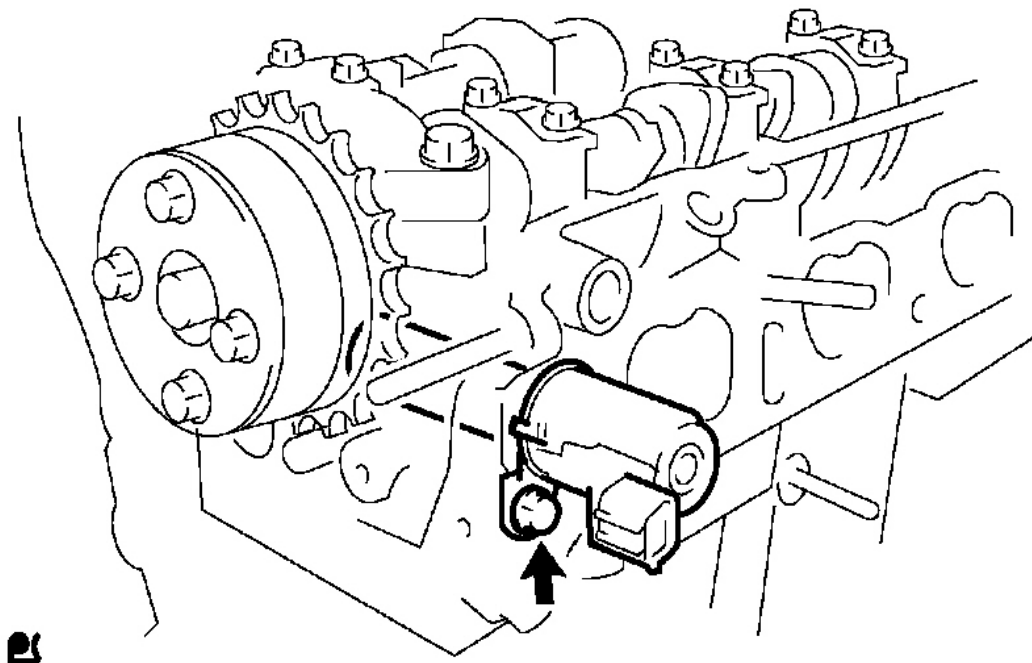
**G03197420**

Fig. 184: Installing Camshaft Timing Oil Control Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

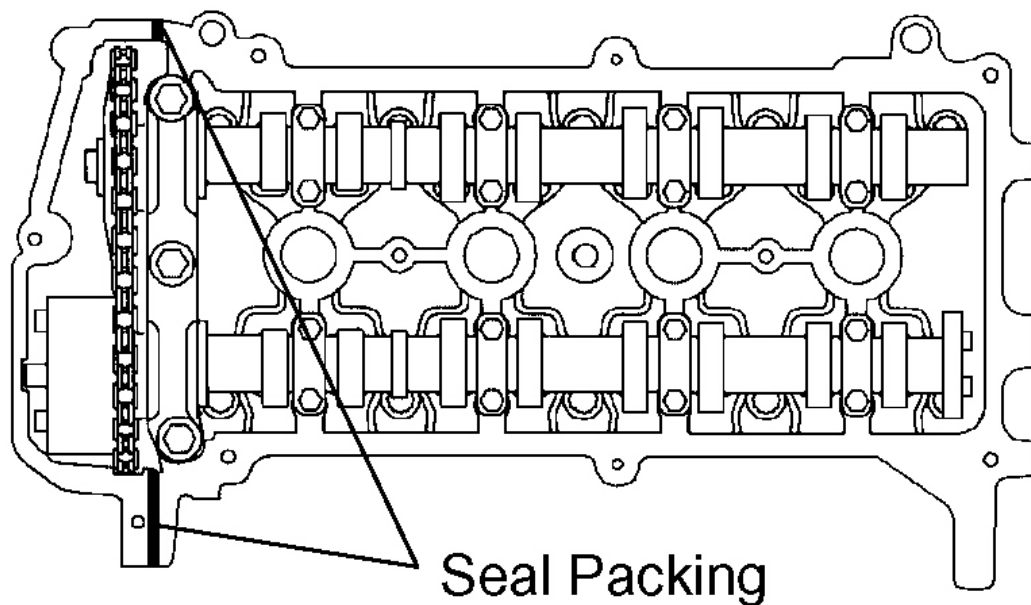
- b. Apply seal packing to the 2 locations as shown in the illustration.

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 after installation.



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Fig. 185: Applying Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

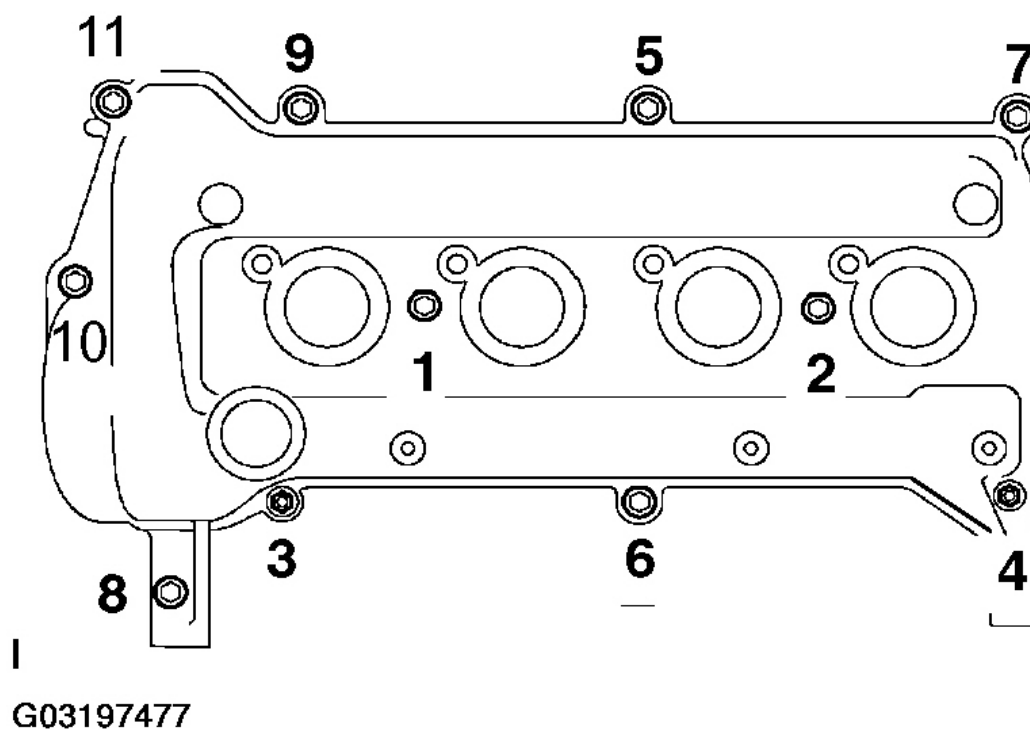


Fig. 186: Installing Cylinder Head Cover

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)

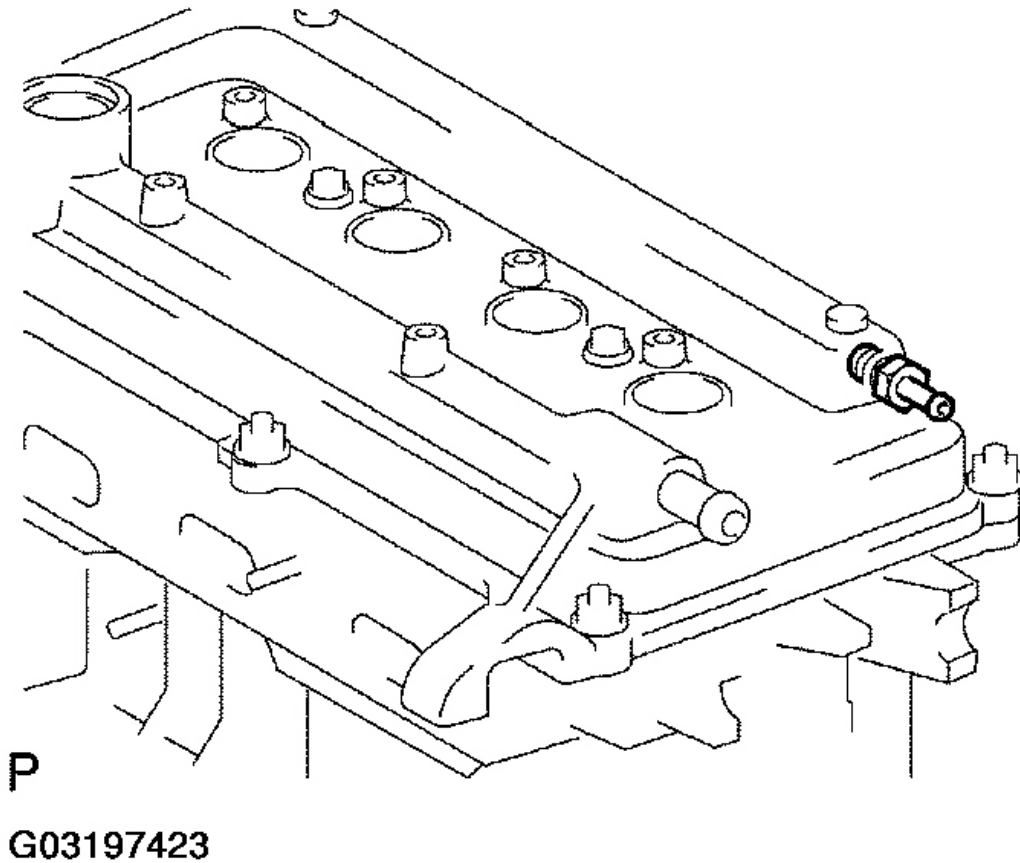


Fig. 187: Installing Ventilation Valve Onto Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

71. INSTALL OIL LEVEL GAGE GUIDE

- a. Apply engine oil to a new O-ring.
- b. Install the oil level gage 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.

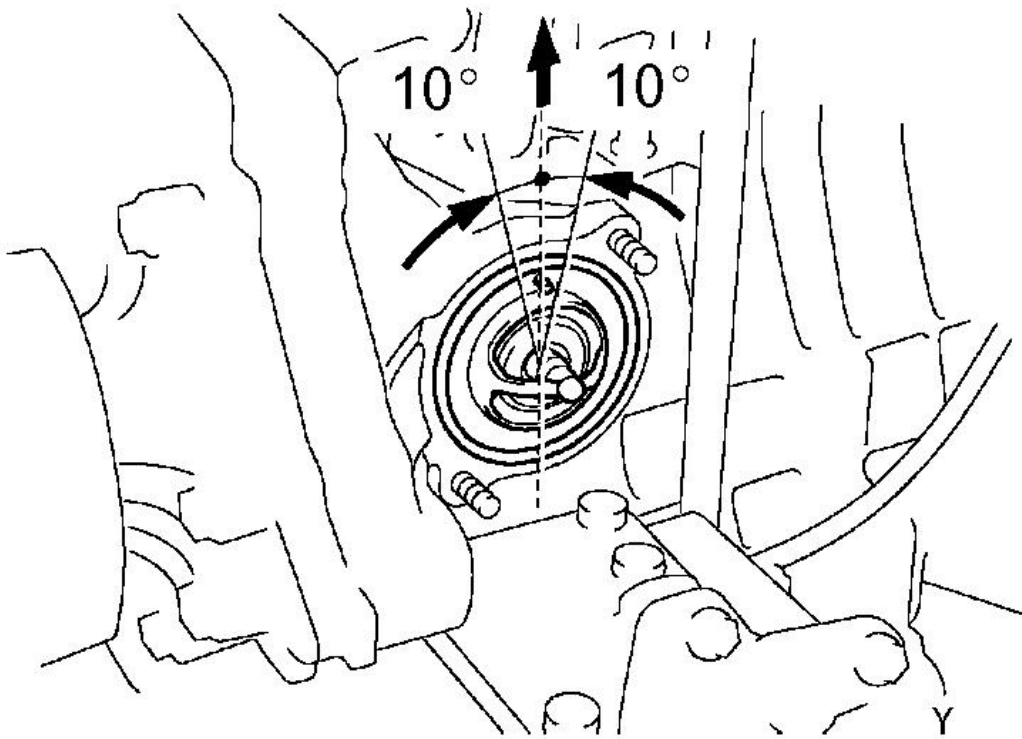
Torque: 7.5 N.m (76 kgf.cm, 66 in.lbf)

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 the illustration.



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Fig. 188: 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)

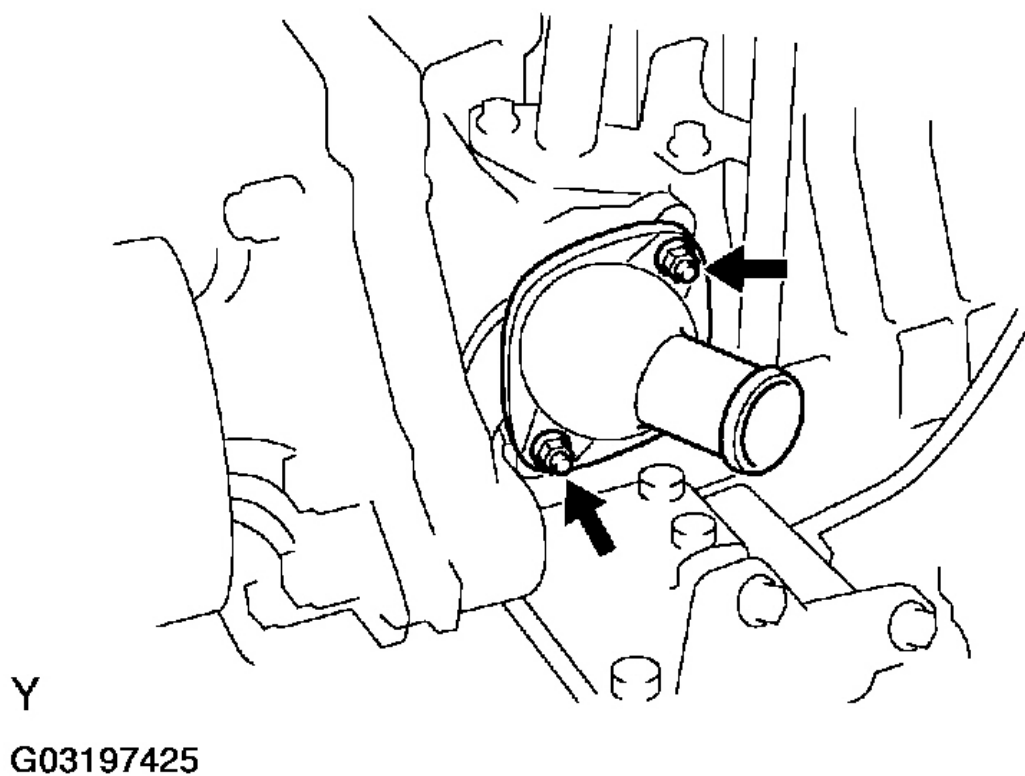


Fig. 189: Installing Water Inlet
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

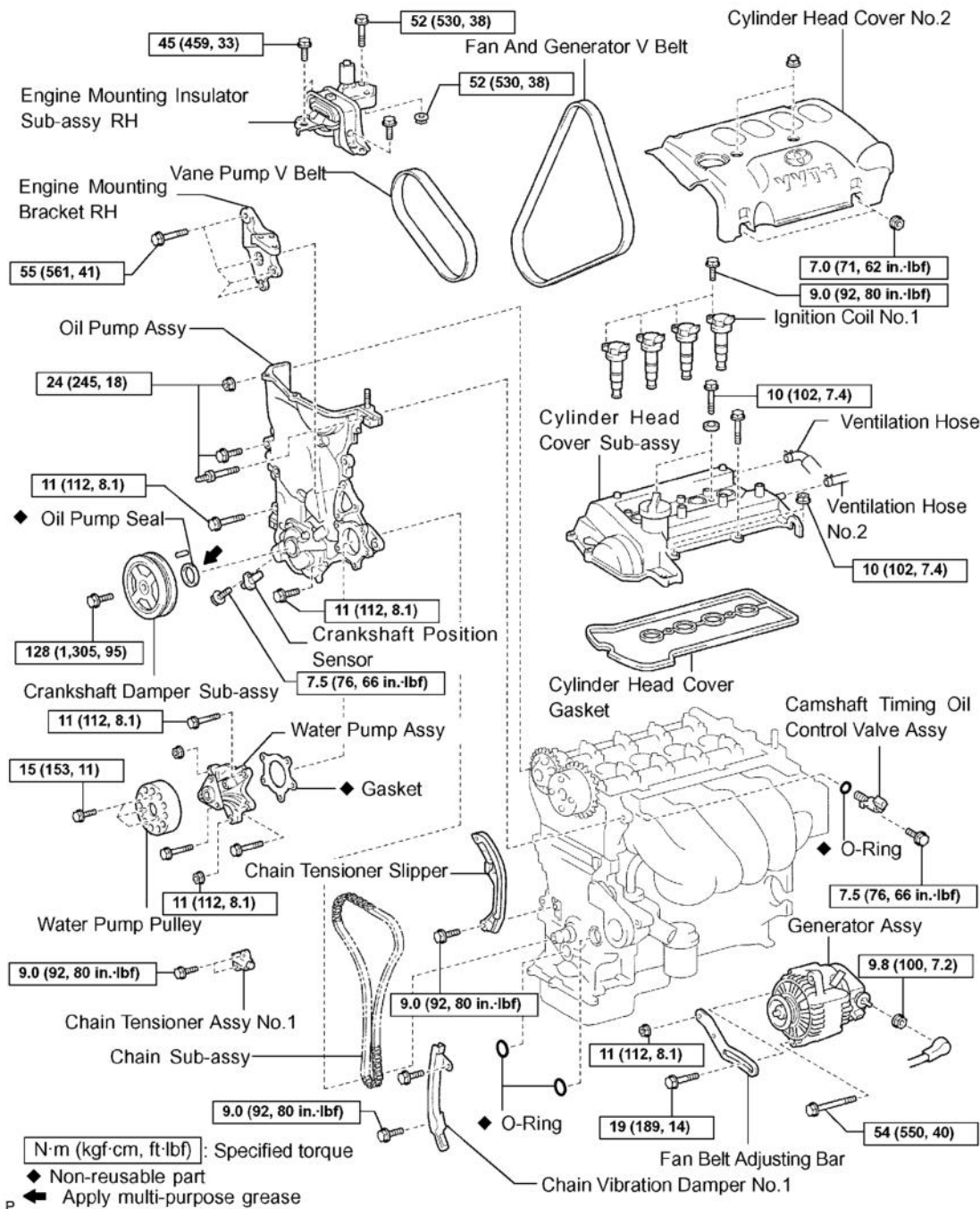


Fig. 190: Identifying Chain Sub-Assy Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

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

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

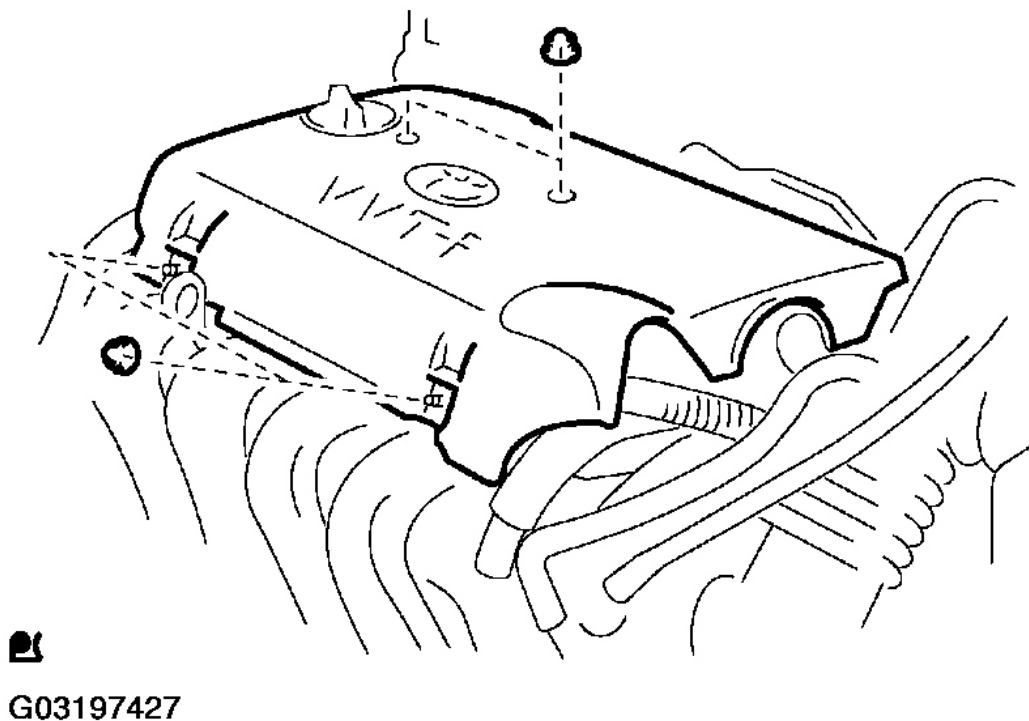
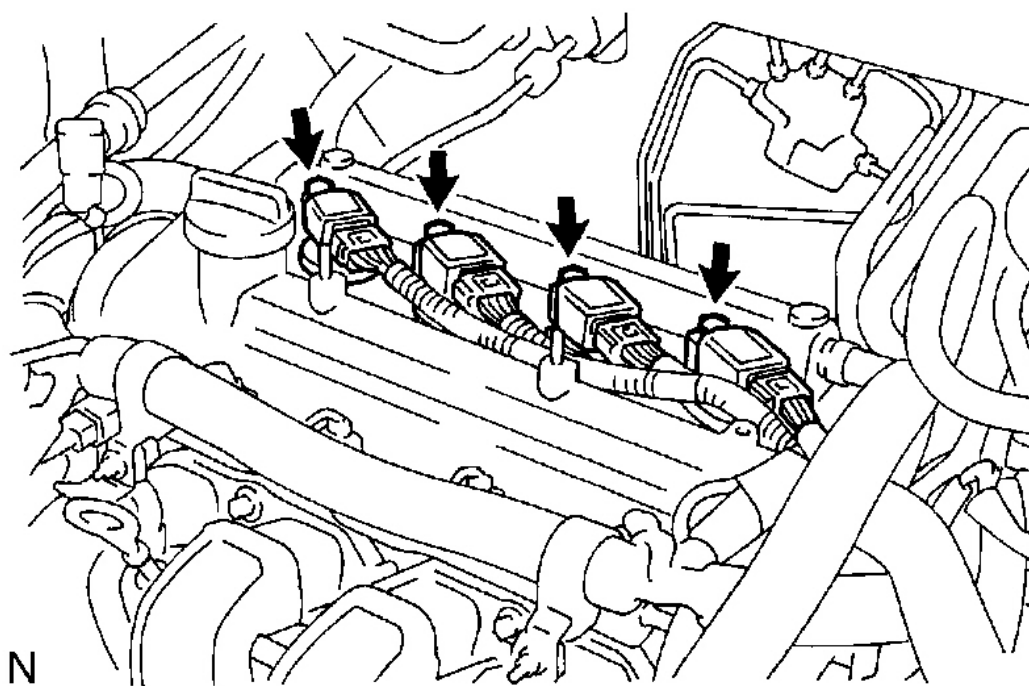


Fig. 191: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. REMOVE IGNITION COIL No. 1

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



N

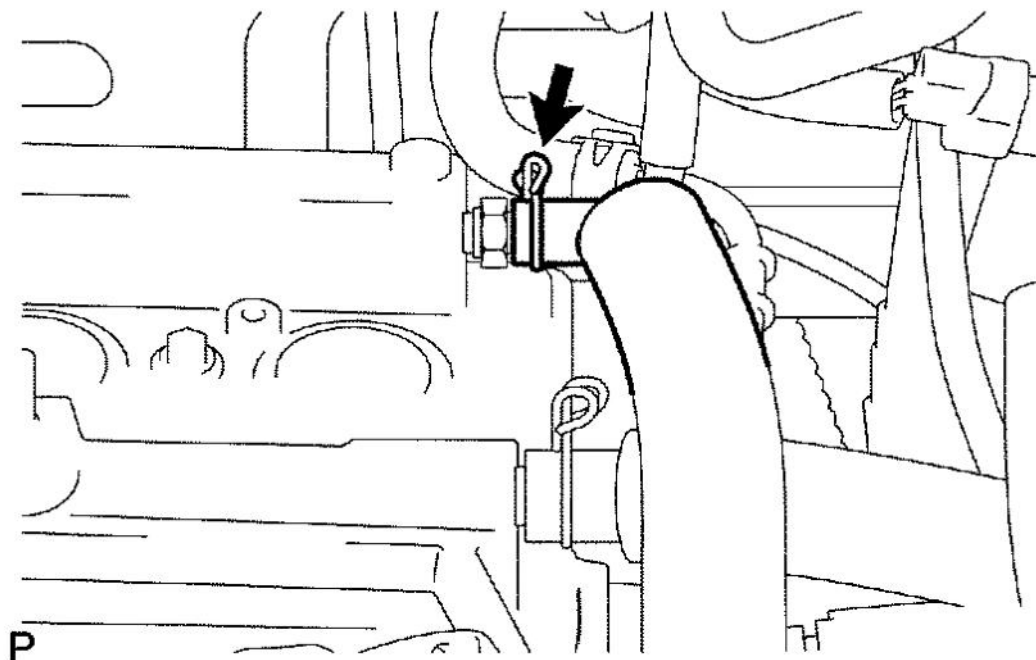
G03197428

Fig. 192: Removing Ignition Coils

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

4. DISCONNECT VENTILATION HOSE

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



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Fig. 193: Disconnecting Ventilation Hose From Cylinder Head Cover
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.

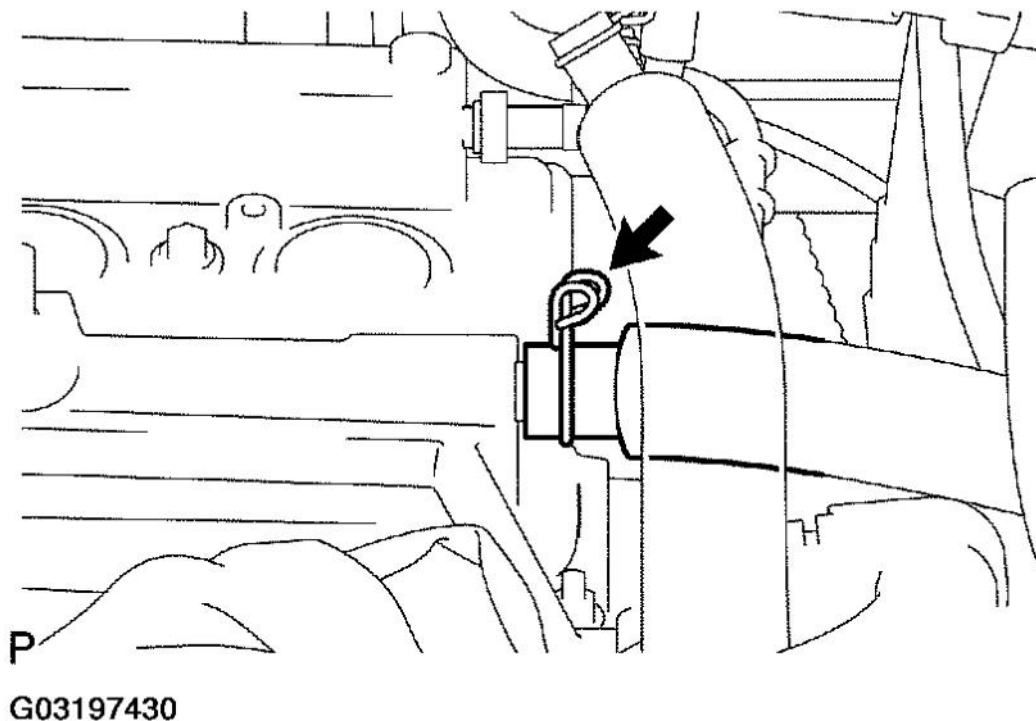


Fig. 194: Disconnecting Ventilation Hose No. 2 From Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE CYLINDER HEAD COVER SUB-ASSY

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

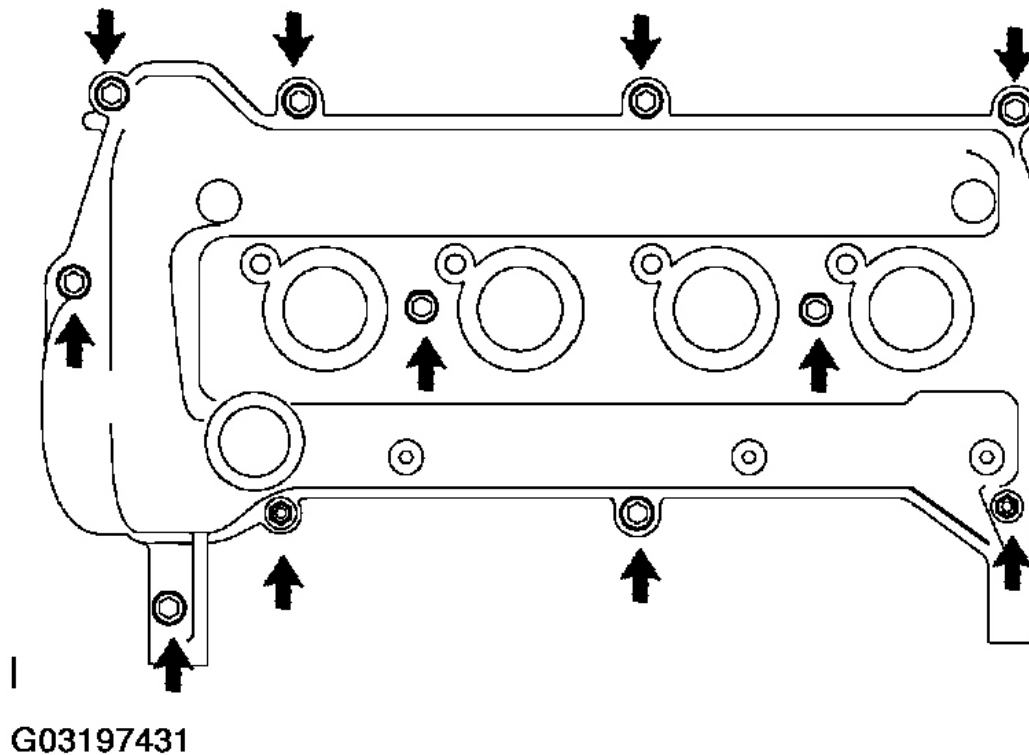


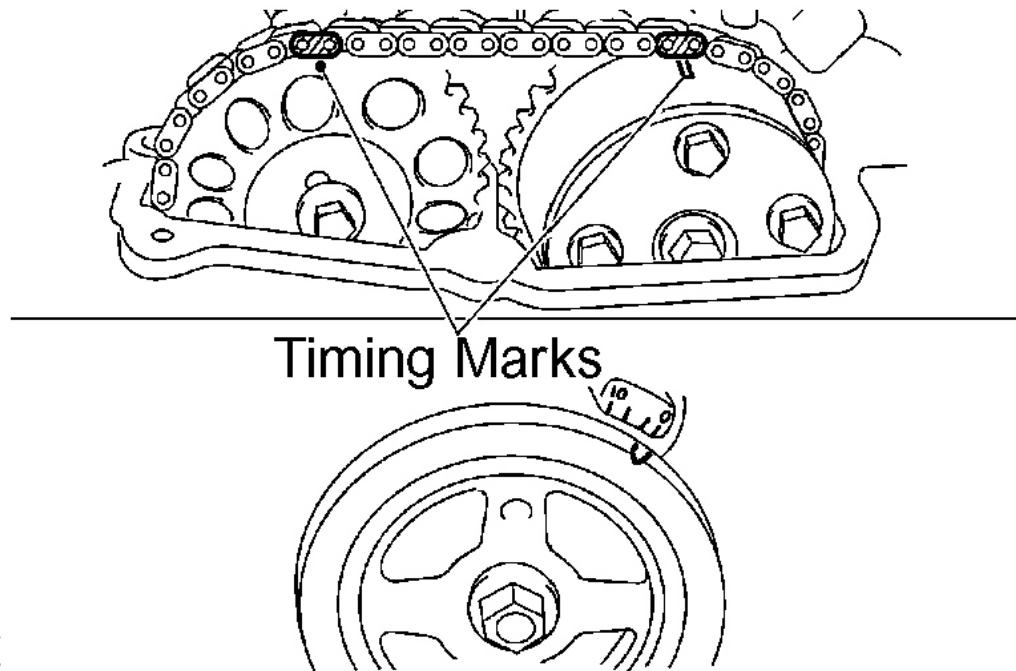
Fig. 195: Removing Cylinder Head Cover

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**
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 the camshaft timing gear are facing upward as shown in the illustration.

HINT:

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



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Fig. 196: Identifying Timing Marks On Camshaft Timing Sprocket & Camshaft Timing Gear

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

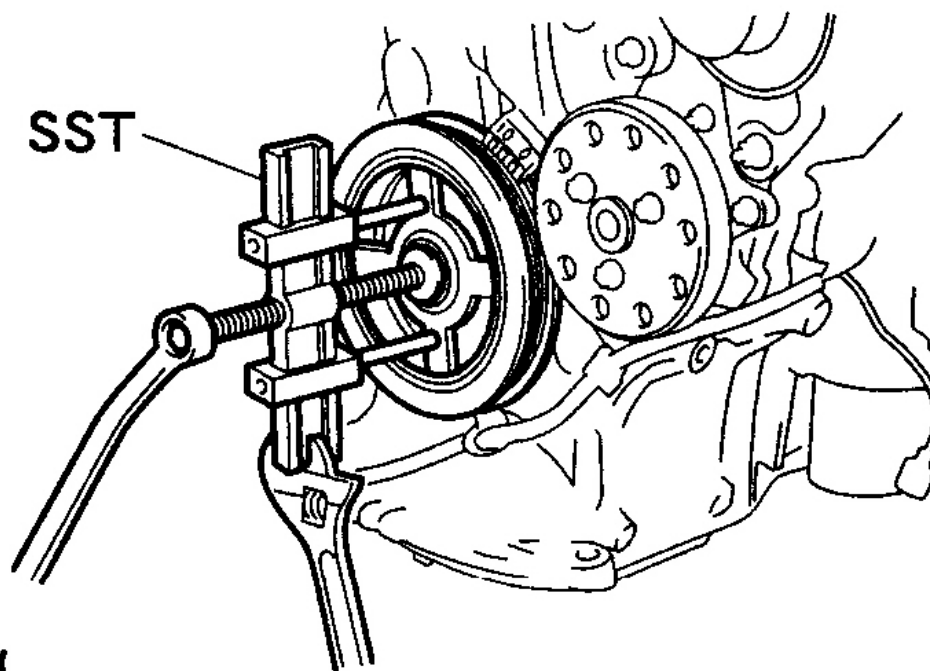
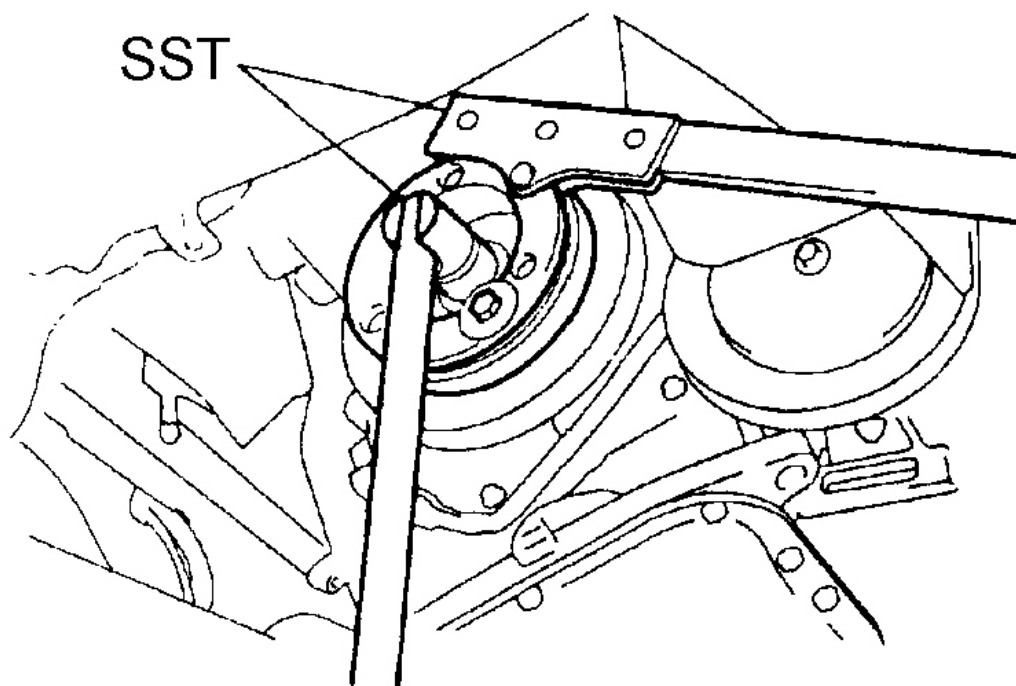
- b. Using SST, remove the pulley bolt.

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

HINT:

If necessary, remove the damper with SST.

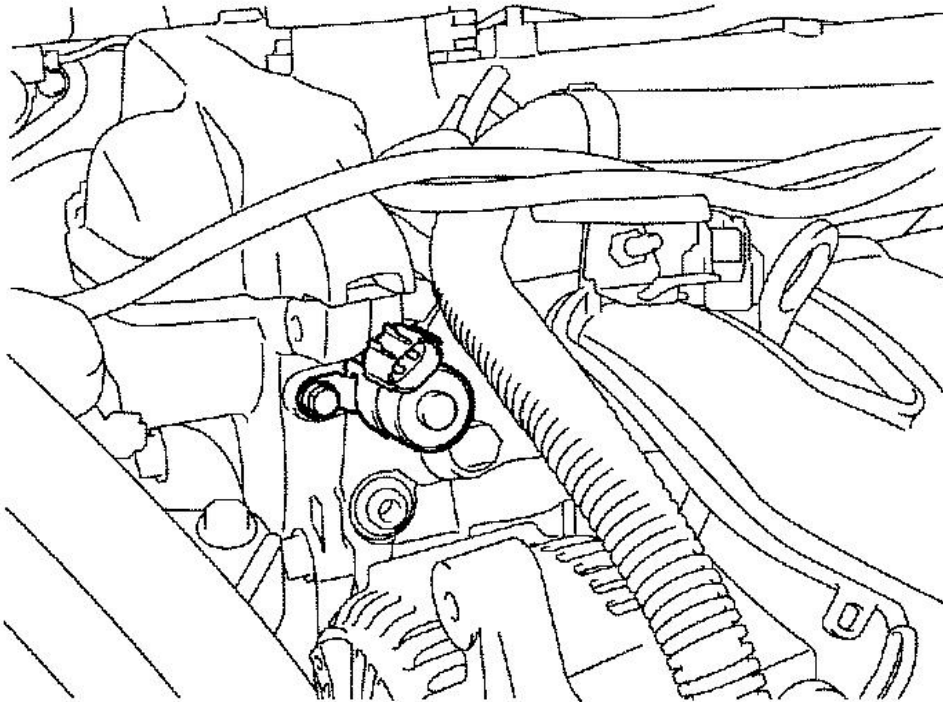
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)



G03197433

Fig. 197: Removing Crankshaft Damper Pulley Bolt
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 the O-ring.
17. **REMOVE CRANKSHAFT POSITION SENSOR (See REPLACEMENT)**



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Fig. 198: Removing Camshaft Timing Oil Control Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE ENGINE MOUNTING INSULATOR SUB-ASSY RH**
 - a. Place a wooden block on a jack underneath the engine.

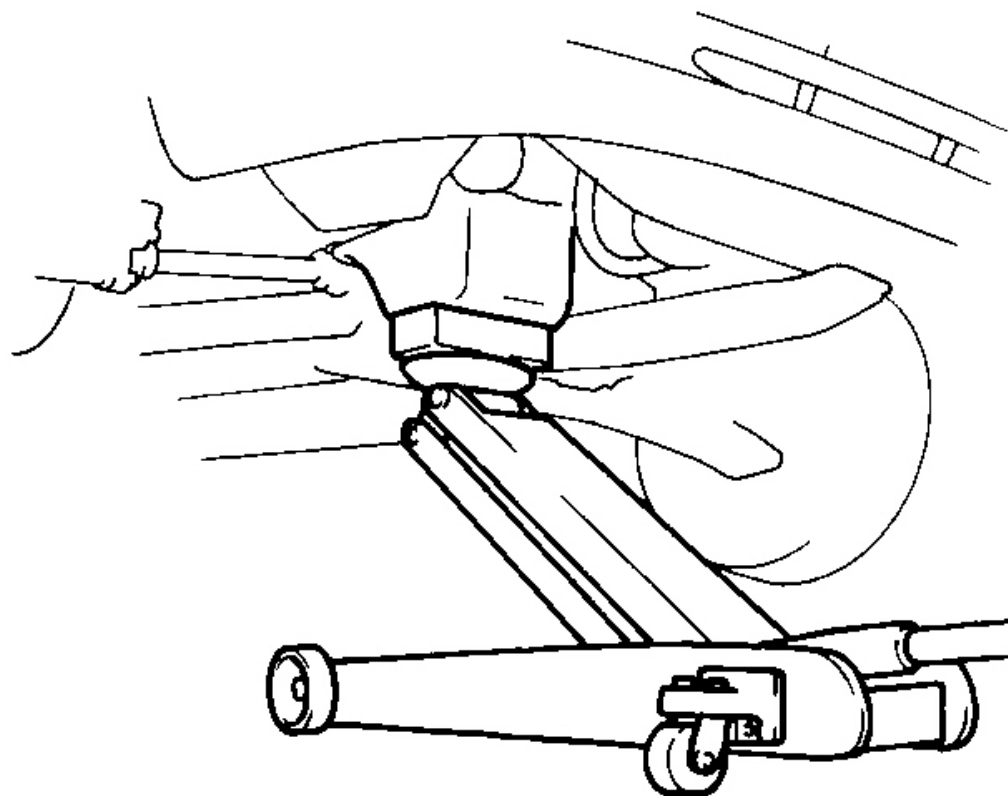
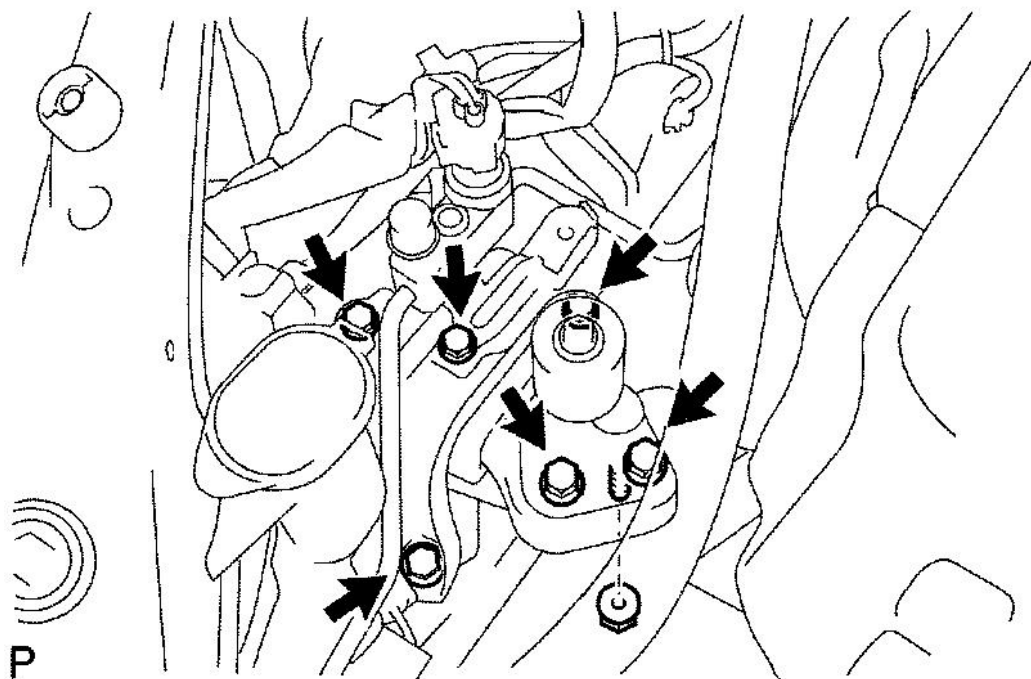
**G03197435**

Fig. 199: 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.



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Fig. 200: Removing Engine Mounting Insulator RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE ENGINE MOUNTING BRACKET RH**
 - a. Remove the 4 bolts and the engine mounting bracket RH.
20. **REMOVE OIL PUMP ASSY (See REPLACEMENT)**
21. **REMOVE OIL PUMP SEAL (See REPLACEMENT)**

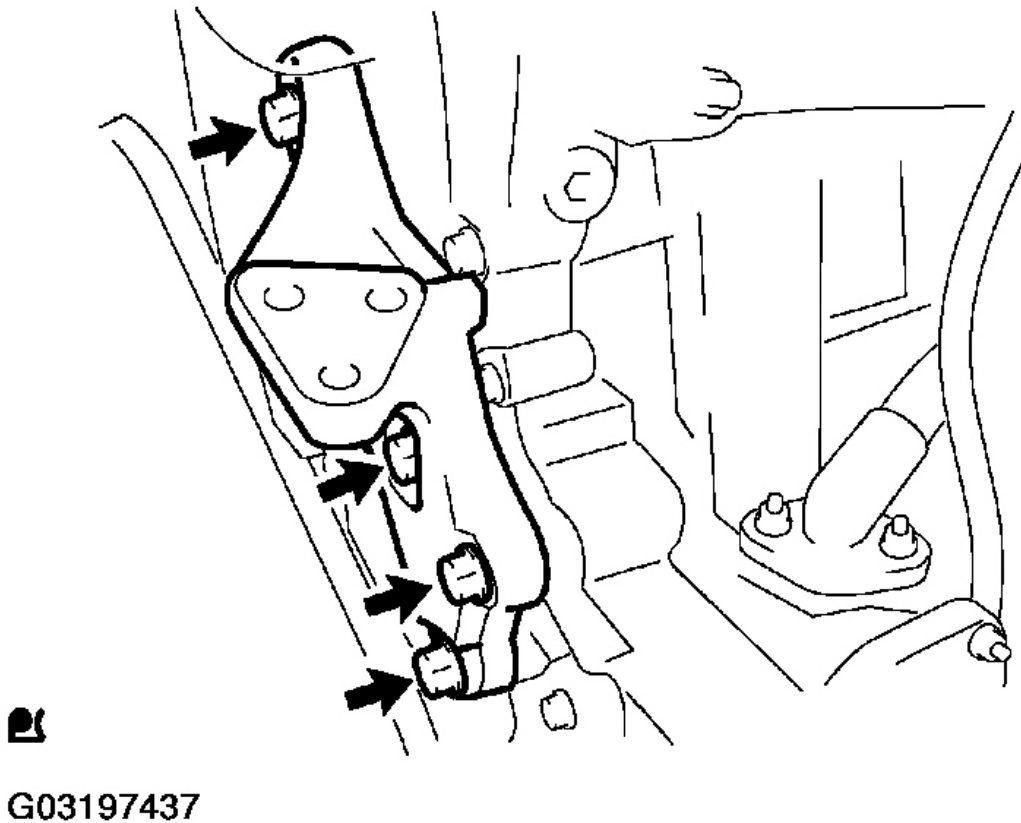


Fig. 201: Removing Engine Mounting Bracket RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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. While rotating the stopper plate of the chain tensioner upward as shown in the illustration push in the plunger of the tensioner.
 - b. While rotating 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 the tensioner to hold the stopper plate.

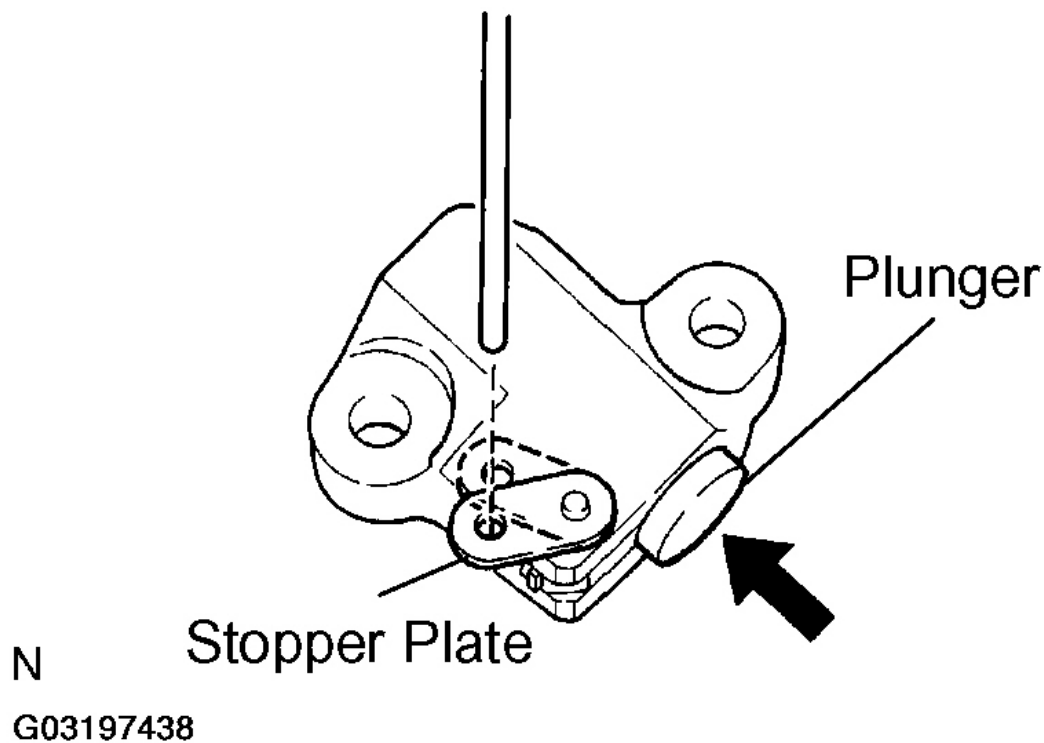


Fig. 202: Pushing In Plunger Of Tensioner While Rotating Stopper Plate Of Chain Tensioner Upward

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

23. REMOVE CHAIN TENSIONER SLIPPER

- a. Remove the bolt and the chain tensioner slipper.

24. REMOVE CHAIN VIBRATION DAMPER No. 1

- a. Remove the 2 bolts and the 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, the camshaft timing gear and the crankshaft timing sprocket with each mark plate (colored in yellow) of the timing chain.

HINT:

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

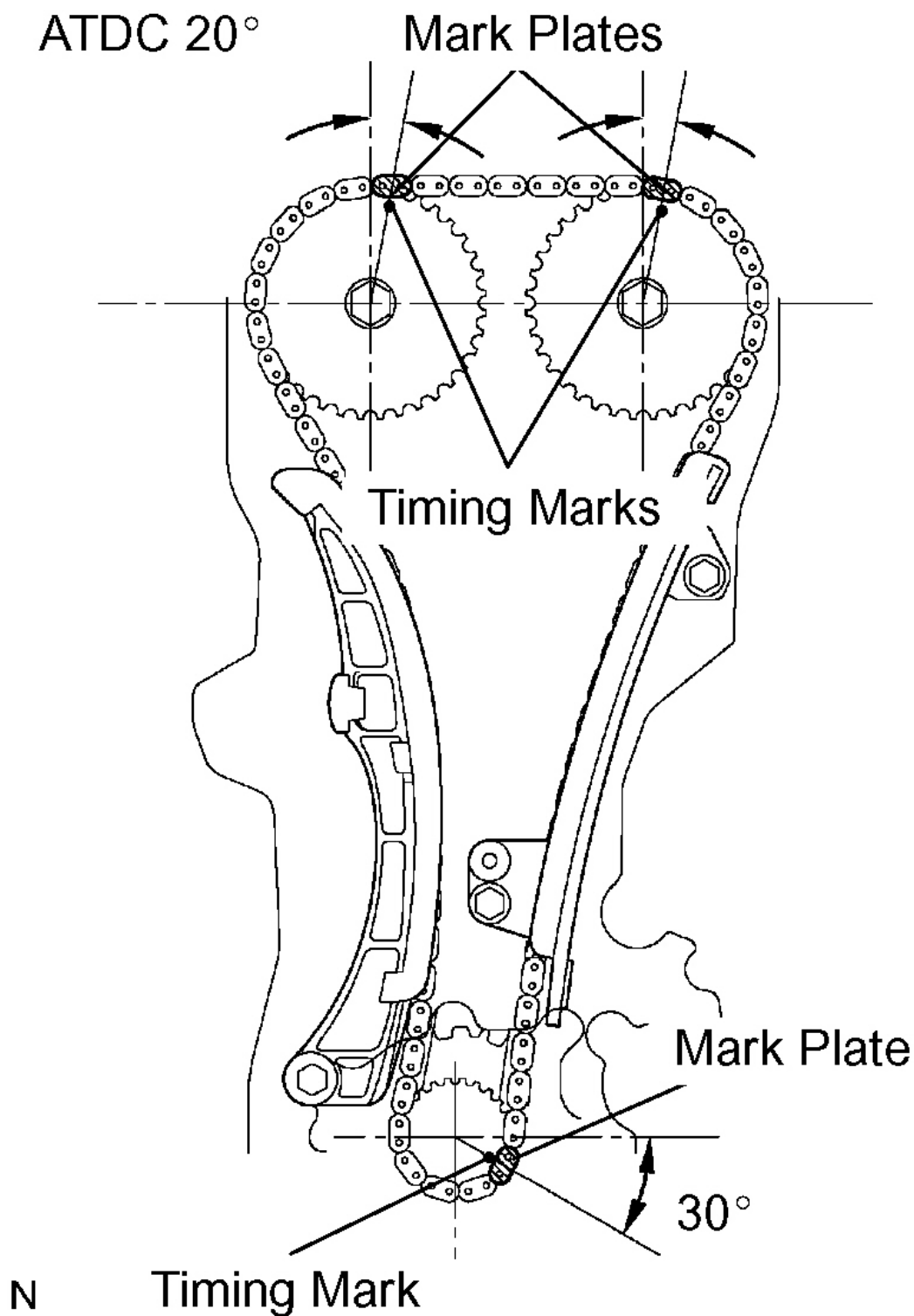
- d. Install the chain tensioner slipper with the bolt.

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

- 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 sprocket.



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Fig. 203: Aligning Matchmarks Of Camshaft Timing Sprocket & Crankshaft Timing Sprocket With Mark Plate Of Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. **INSTALL OIL PUMP SEAL (See REPLACEMENT)**

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

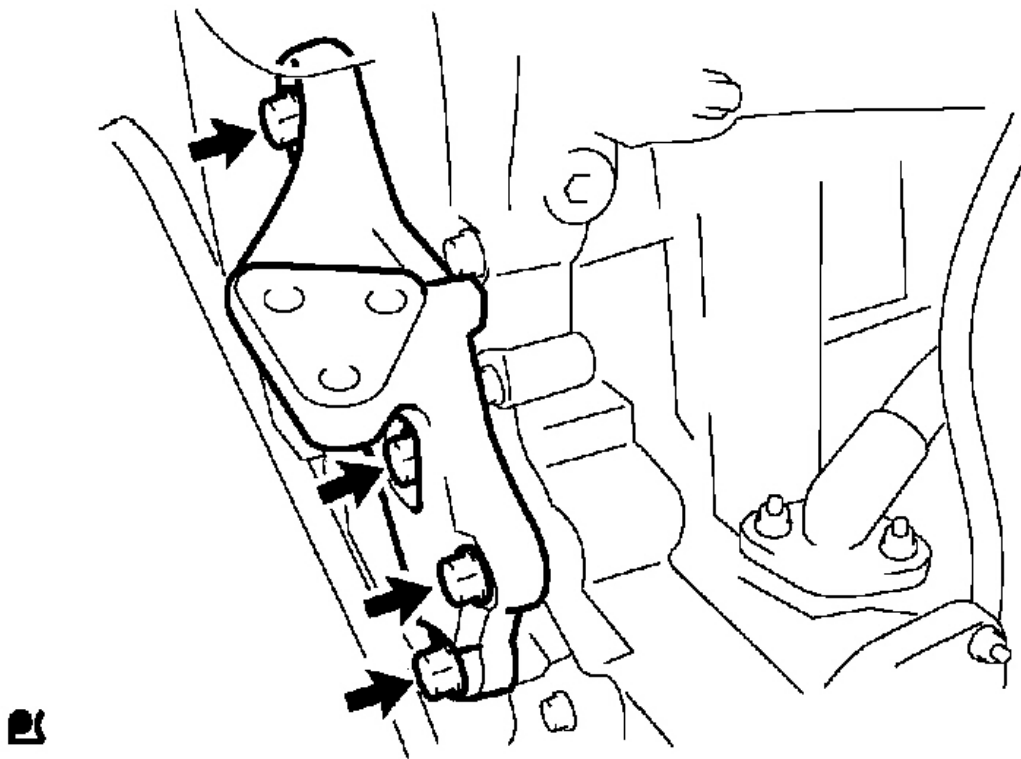
28. **INSTALL OIL PUMP ASSY (See REPLACEMENT)**

29. **INSTALL WATER PUMP ASSY (See REPLACEMENT)**

30. **INSTALL ENGINE MOUNTING BRACKET RH**

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

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



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Fig. 204: Installing Engine Mounting Bracket RH
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 the nut.

Torque:

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

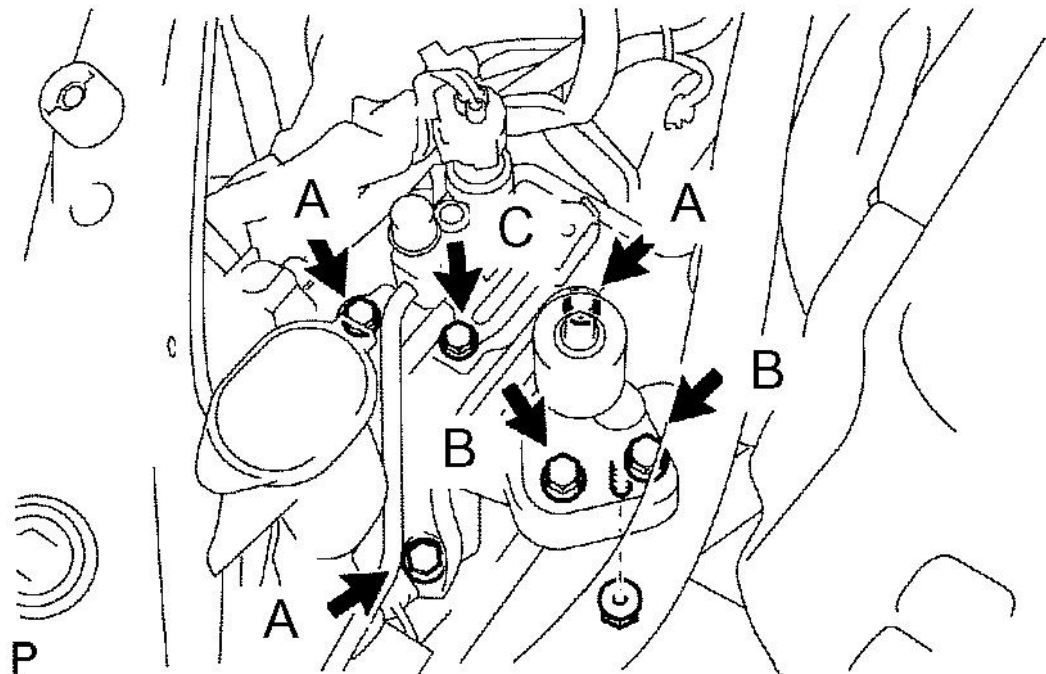
Bolt B 52 N.m (530 kgf.cm, 38 ft.lbf)

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

- b. Install the liquid tube with the bolt.

Torque:

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



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Fig. 205: Installing RH Engine Mounting Insulator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY

- a. Apply a light coat of 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)**

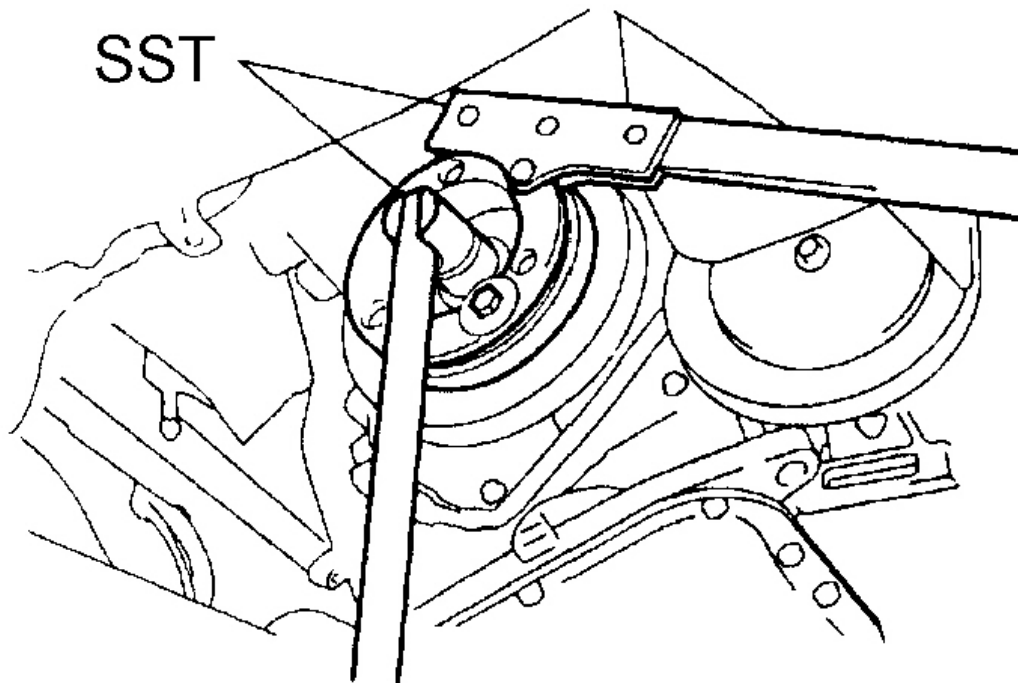
SST 09960-10010 (09962-01000, 09963-00600)

35. **INSTALL CRANKSHAFT DAMPER SUB-ASSY**

- a. Align the 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)



G03197442

Fig. 206: Installing Crankshaft Damper Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

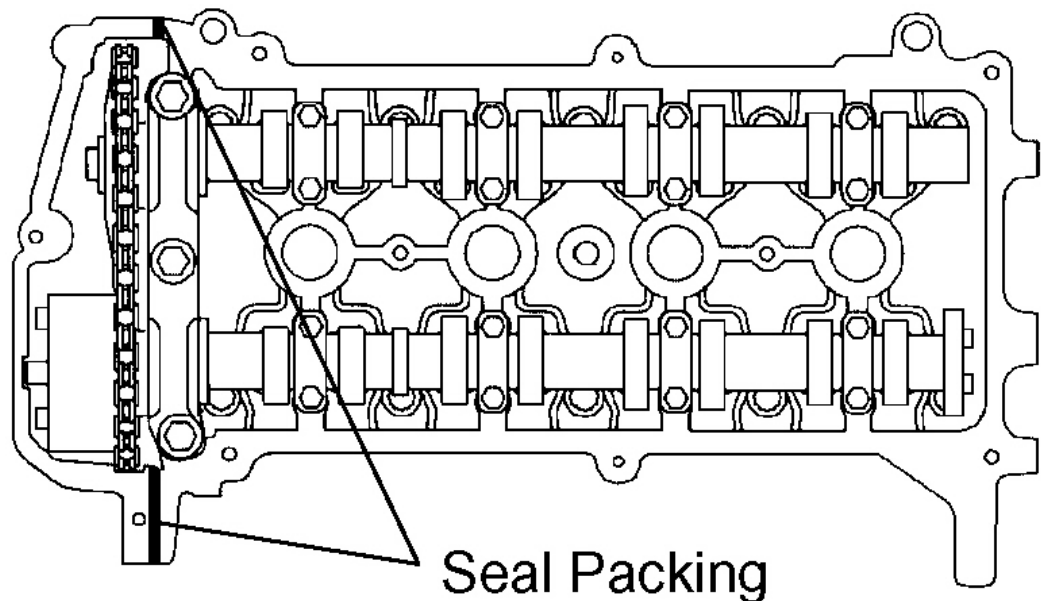
36. INSTALL CYLINDER HEAD COVER SUB-ASSY

- a. Apply seal packing to the 2 locations shown in the illustration.

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 after installation.



G03197443

Fig. 207: Applying Seal Packing

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

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

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

37. INSTALL IGNITION COIL No. 1

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

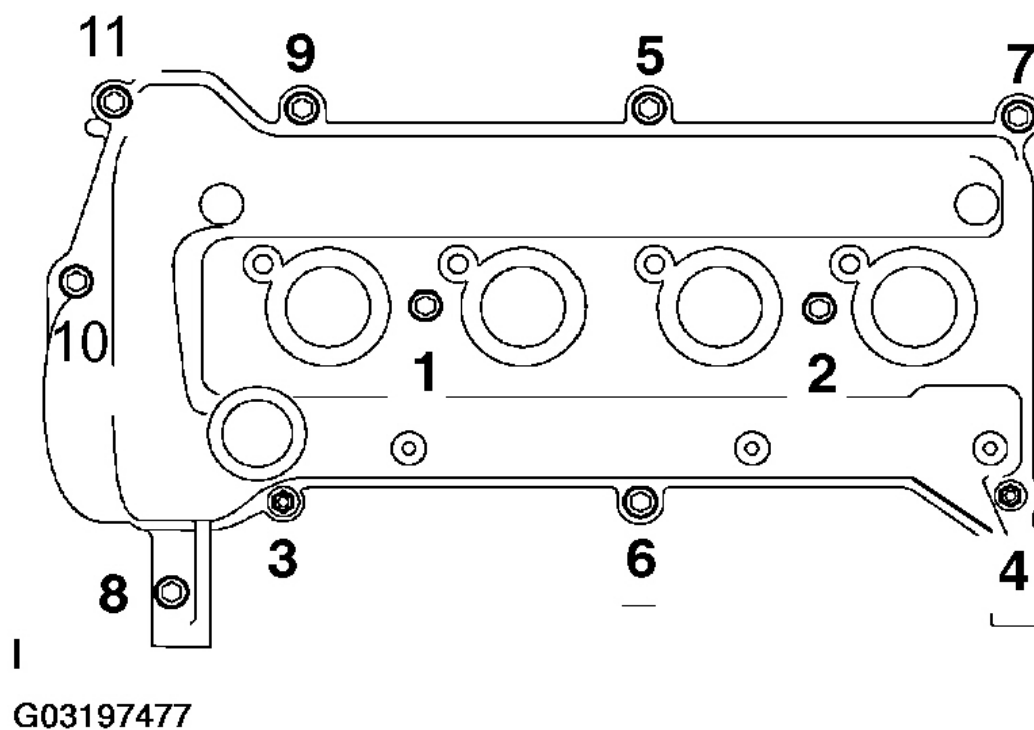


Fig. 208: Installing Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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)

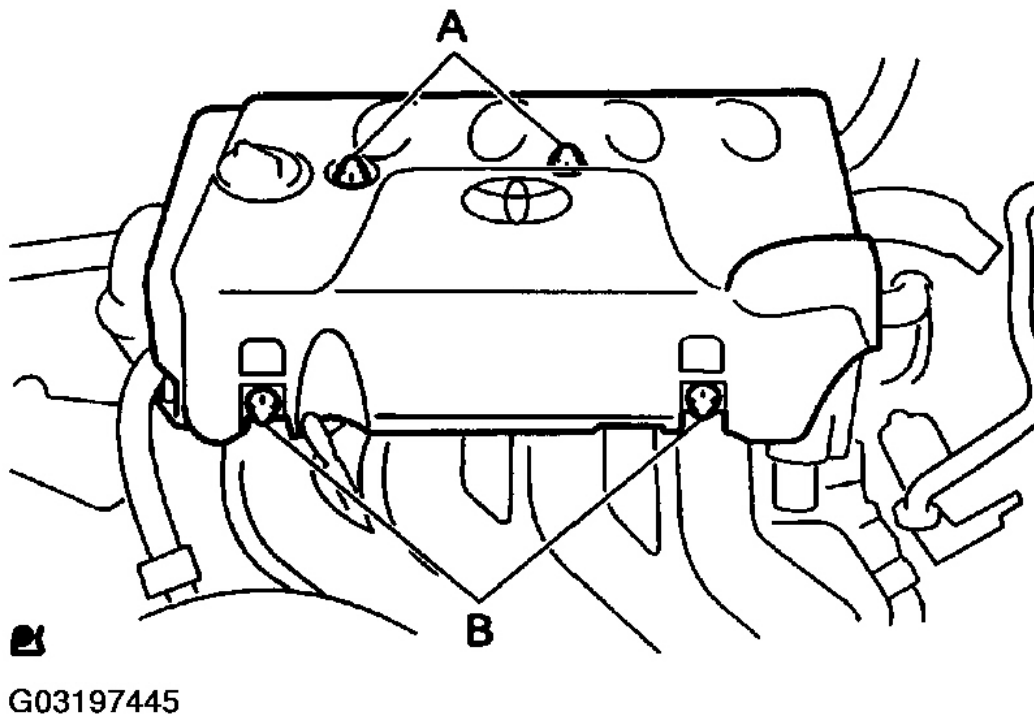


Fig. 209: Installing Cylinder Head Cover No 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 FAN AND GENERATOR V BELT** (See REPLACEMENT)
43. **ADJUST VANE PUMP 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.

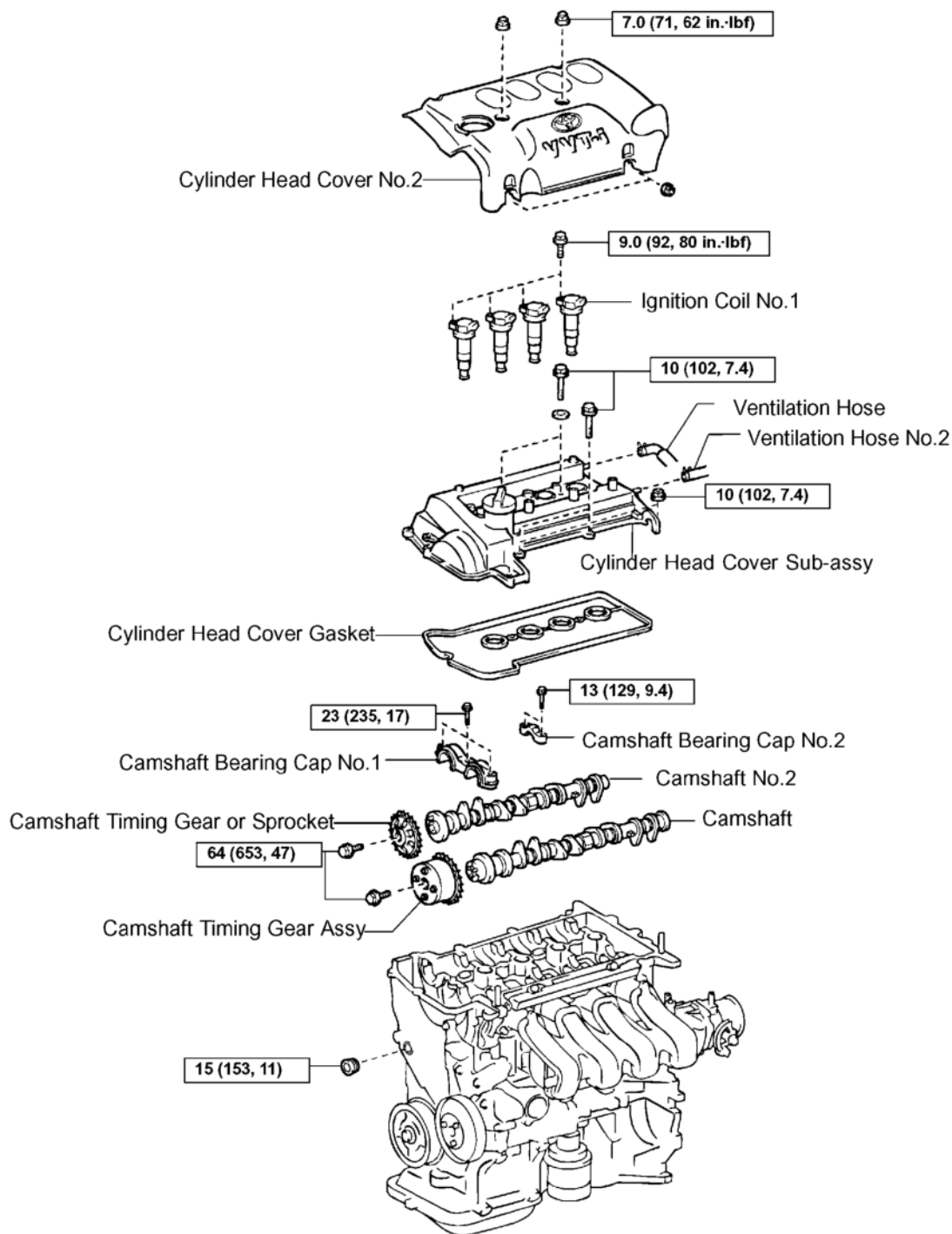
Torque: 38 N.m (382 kgf.cm, 28 ft.lbf)

46. **ADD ENGINE OIL**
47. **CHECK FOR ENGINE OIL LEAKS**
48. **ADD ENGINE COOLANT** (See REPLACEMENT)

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

CAMSHAFT

COMPONENTS



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

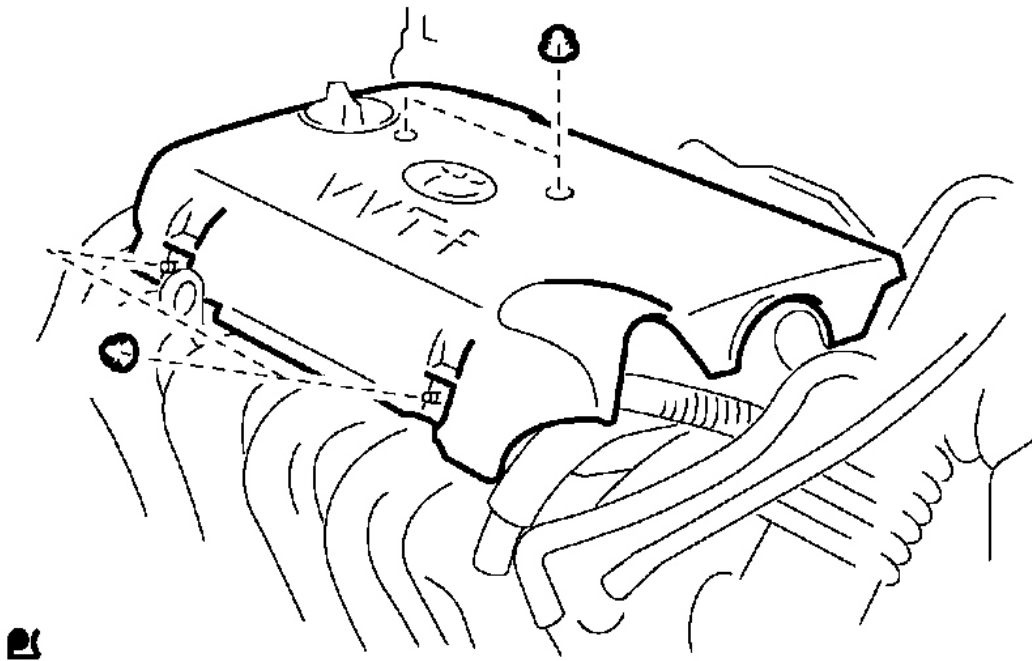
G03197446

Fig. 210: 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 the cylinder head cover No.2.

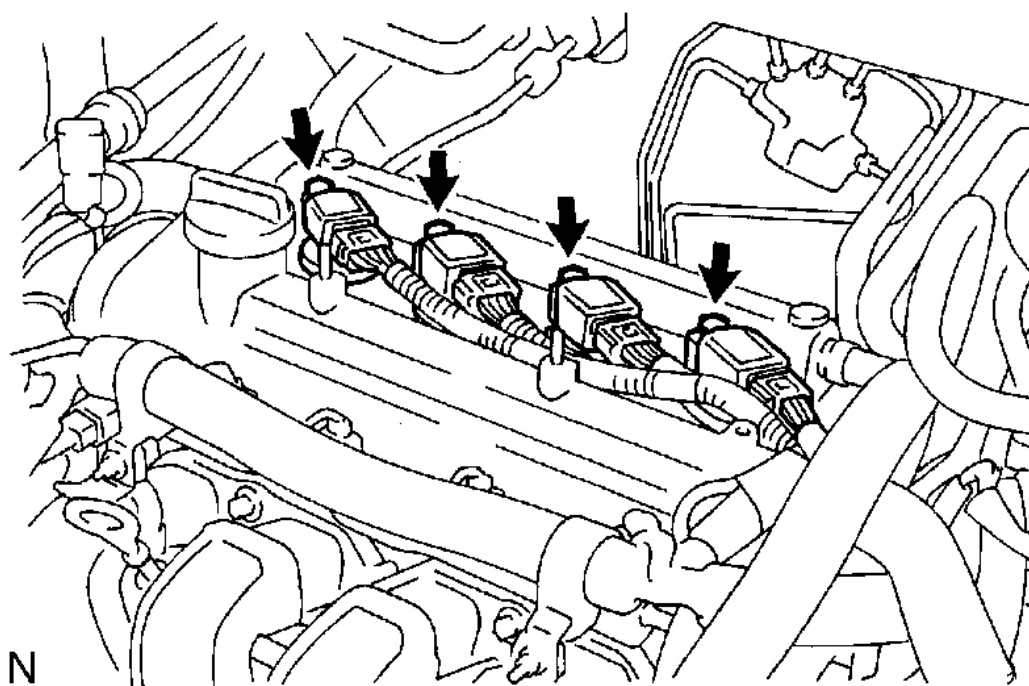


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Fig. 211: Removing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE IGNITION COIL No. 1

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



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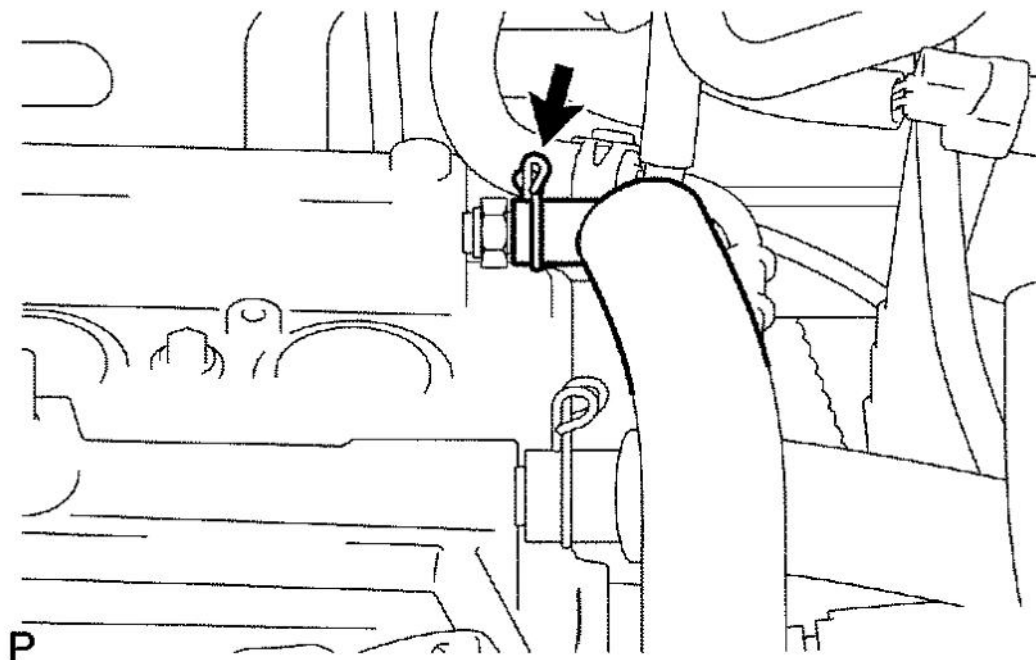
G03197448

Fig. 212: Removing Ignition Coils

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

3. DISCONNECT VENTILATION HOSE

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



G03197449

Fig. 213: Disconnecting Ventilation Hose From Cylinder Head Cover
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.

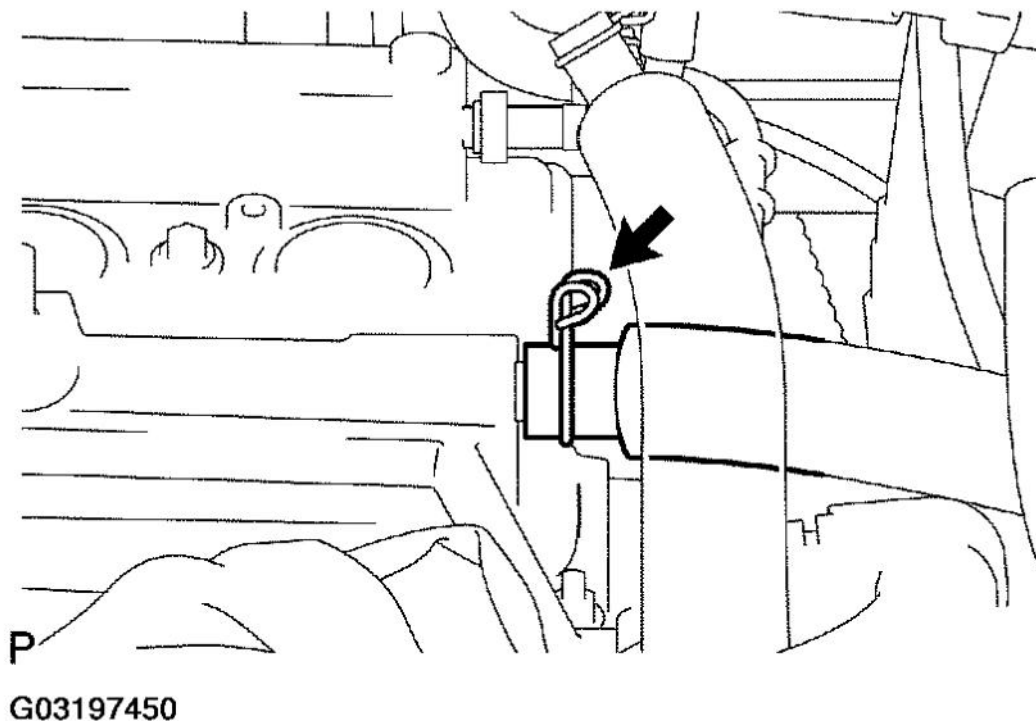


Fig. 214: Disconnecting Ventilation Hose No. 2 From Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE CYLINDER HEAD COVER SUB-ASSY

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

6. REMOVE ENGINE UNDER COVER RH

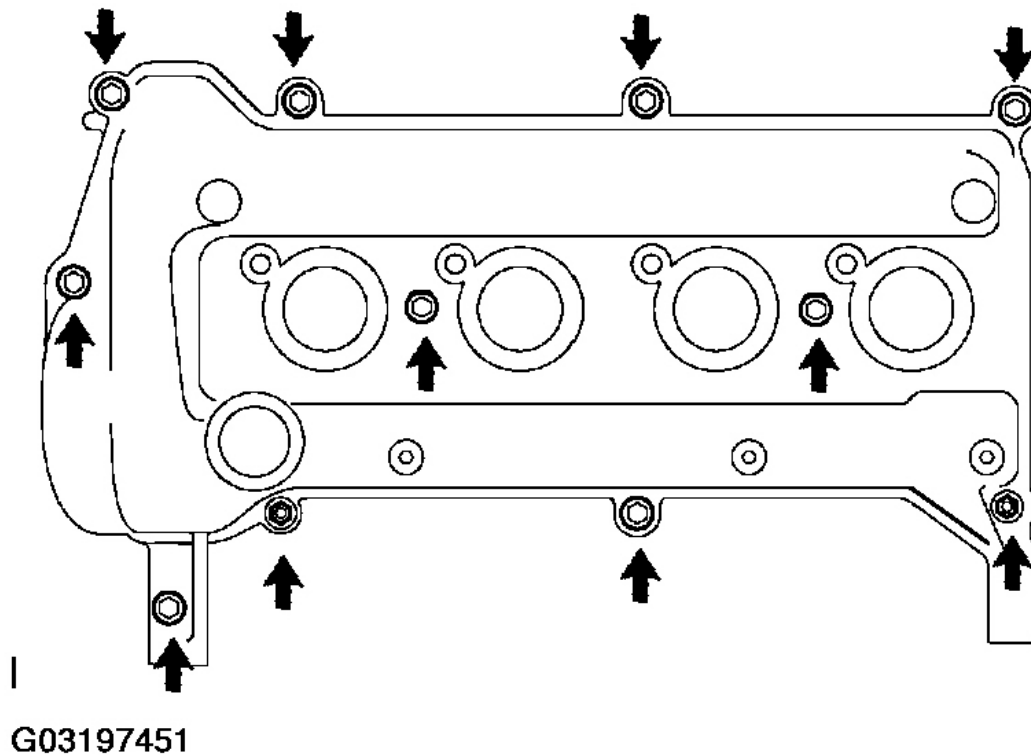
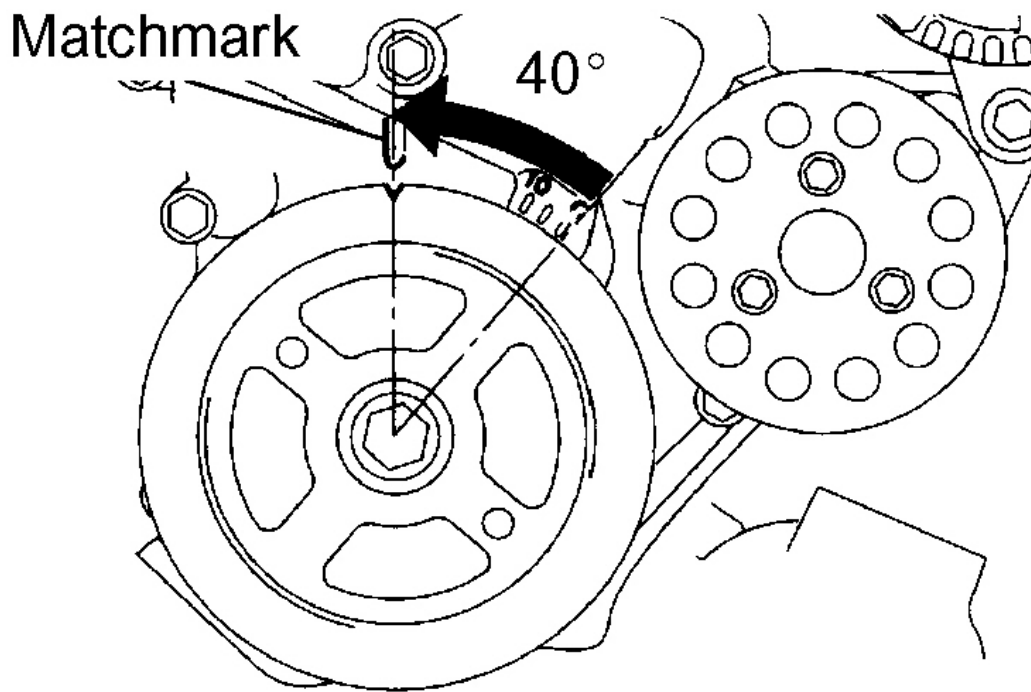


Fig. 215: Removing Cylinder Head Cover

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

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 matchmark of the chain cover to prevent the pistons from coming into contact with the valves.



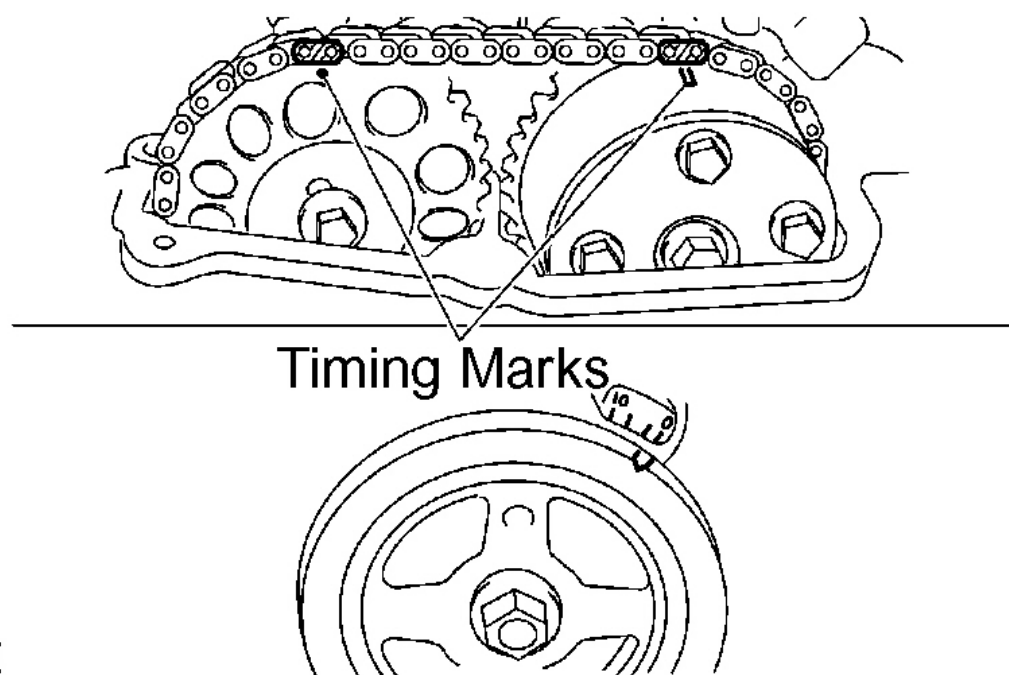
G03197452

Fig. 216: Rotating Crankshaft Damper Counterclockwise 40° From TDC
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 the camshaft timing gear are facing upward as shown in the illustration.

HINT:

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

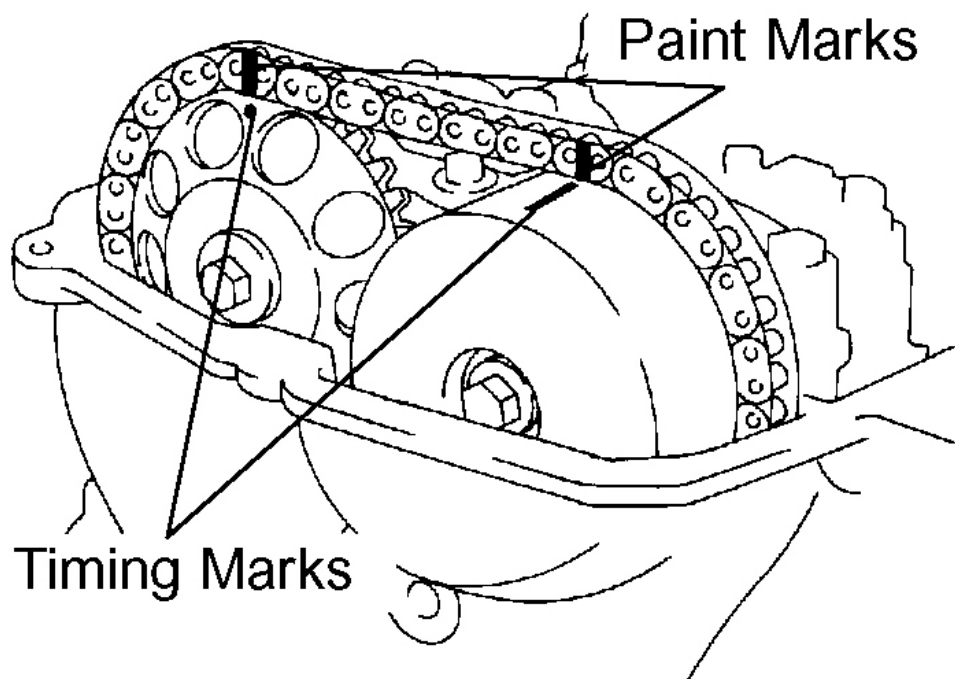


G03197453

Fig. 217: Identifying Timing Marks On Camshaft Timing Sprocket & Camshaft Timing Gear

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.

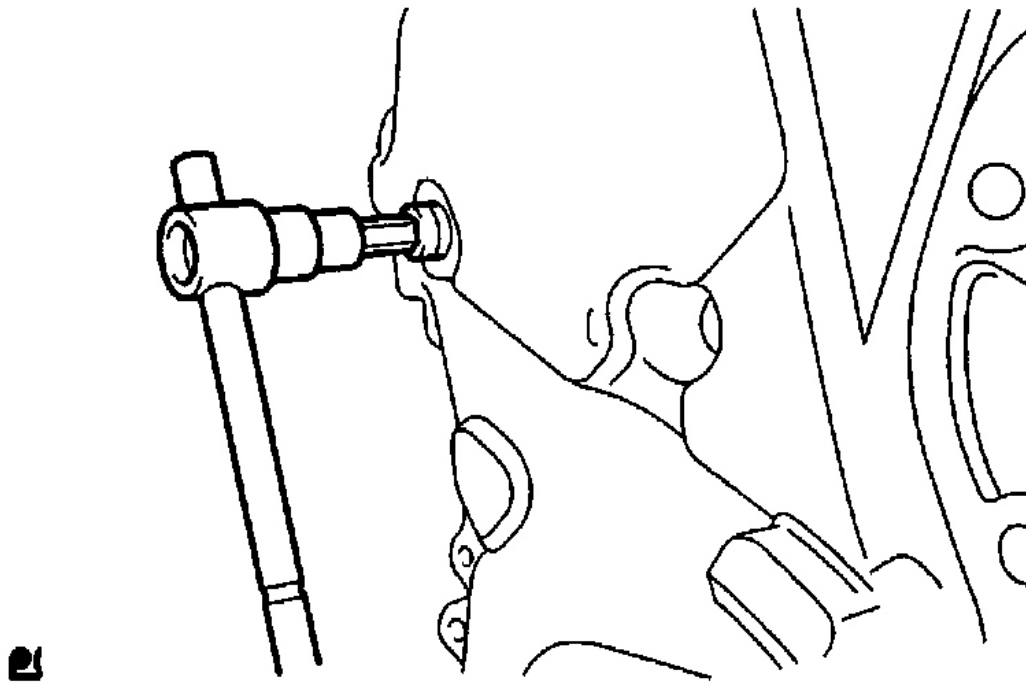


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Fig. 218: Putting Paint Marks On Timing Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



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Fig. 219: Removing Screw Plug

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

- d. Insert a screwdriver into service the hole of the chain tensioner to the hold 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.

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.

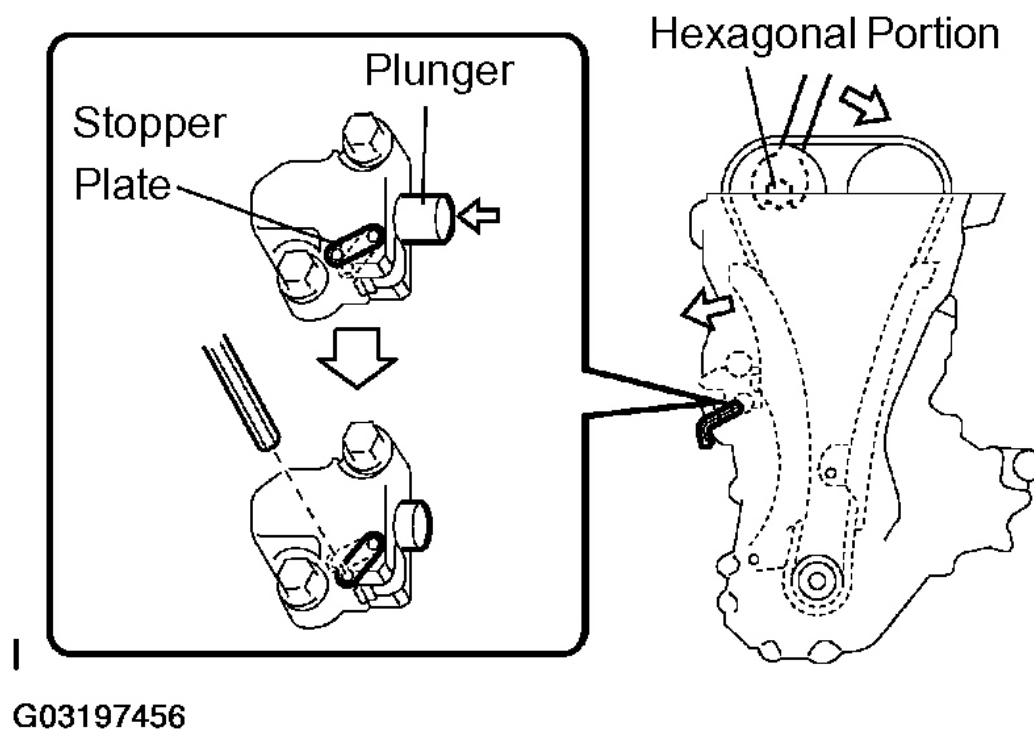
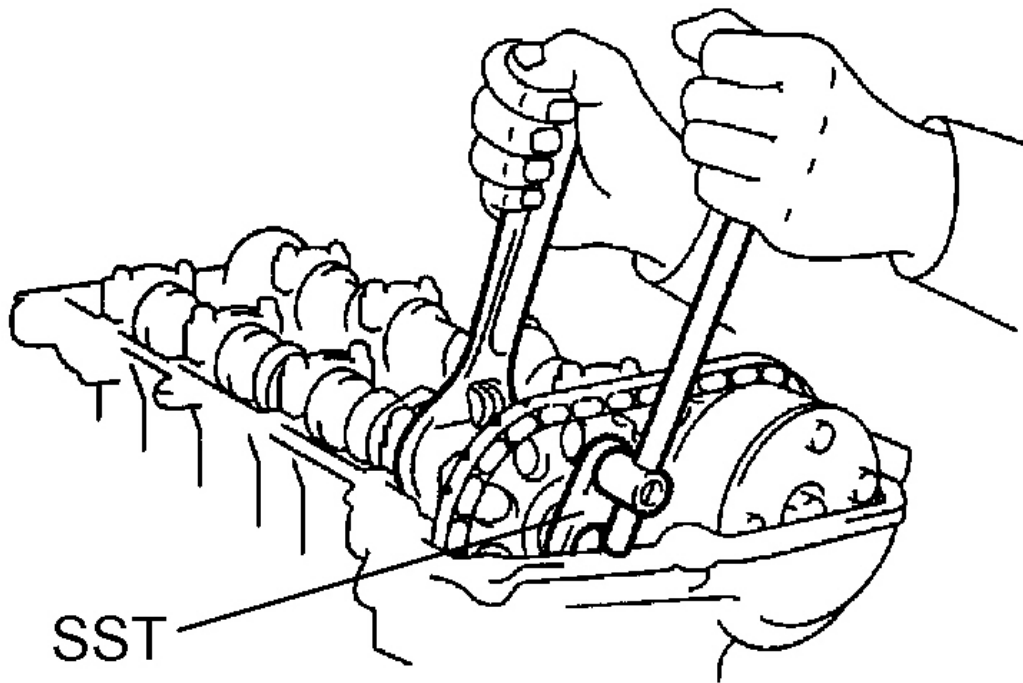


Fig. 220: Pushing In Plunger Of Chain Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Hold the camshaft with a wrench on the hexagonal lobe, and remove the bolt.

SST 09023-38401



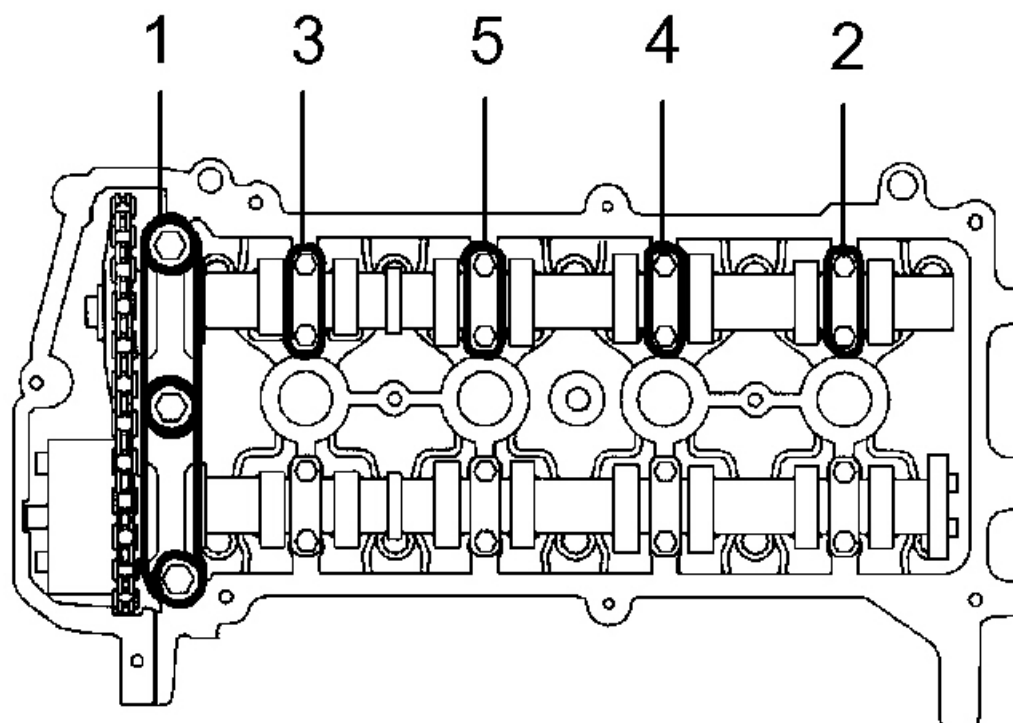
G03197457

Fig. 221: Removing Camshaft 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 the illustration, then remove the 5 bearing caps.

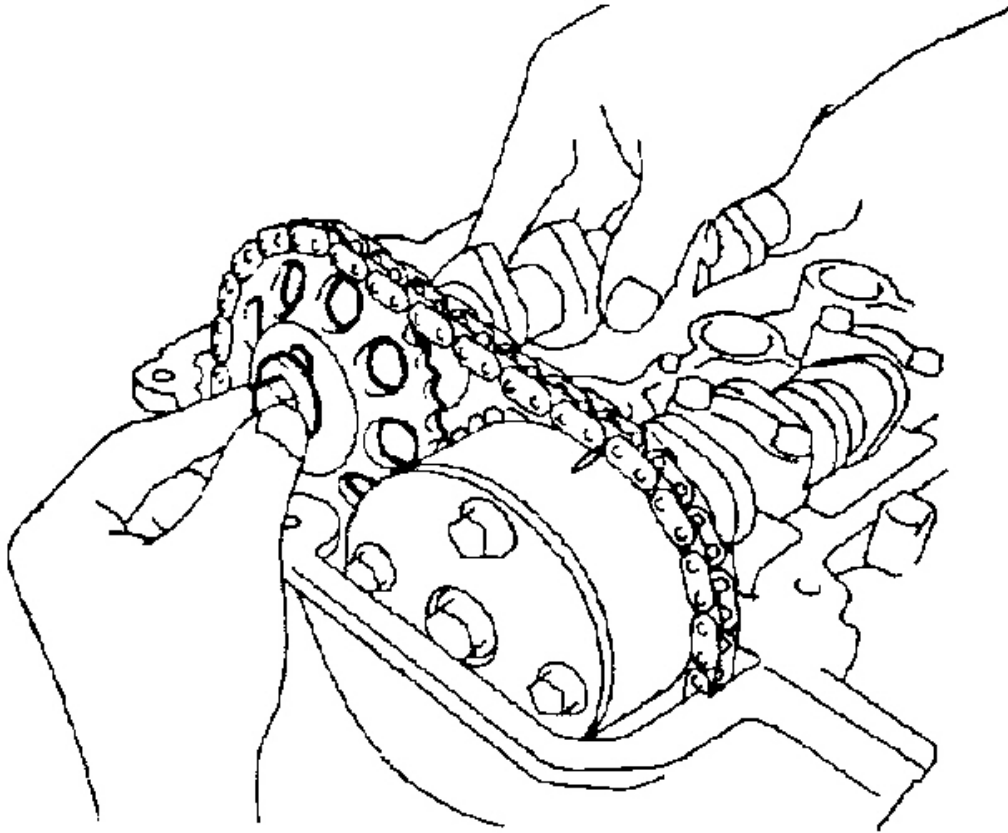
NOTE: Loosen each bolt uniformly keeping the camshaft level.



G03197458

Fig. 222: Identifying Removal Sequence Of Bearing Cap Bolts
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 the camshaft timing sprocket.



G03197459

Fig. 223: Removing Camshaft Timing Sprocket
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 the illustration, then remove the 4 bearing caps.

NOTE: Loosen each bolt uniformly keeping the camshaft level.

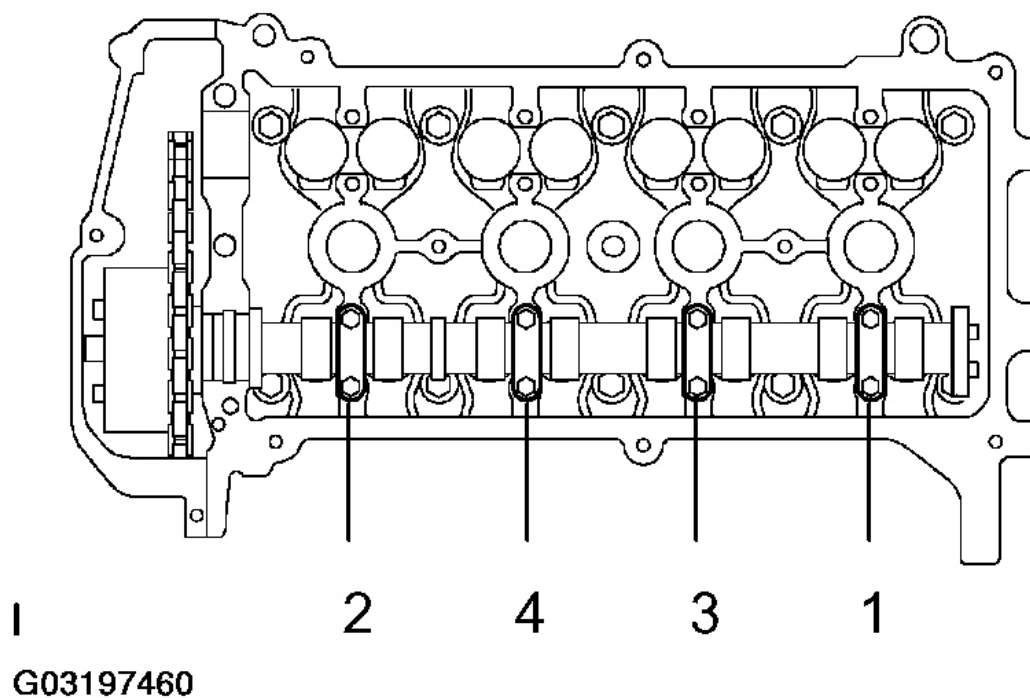
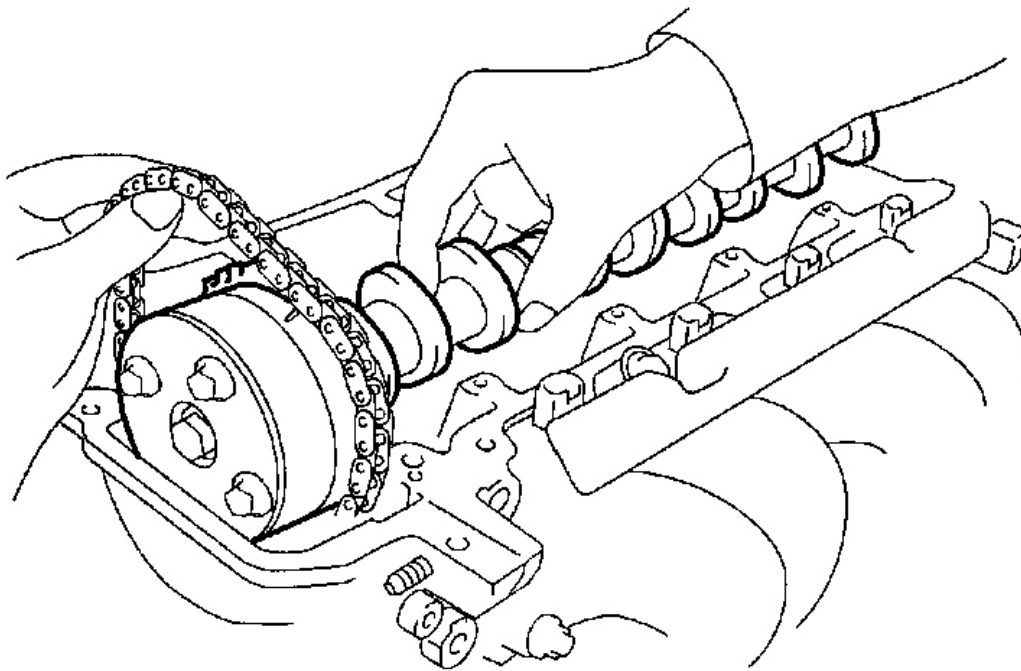


Fig. 224: Identifying Removal Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

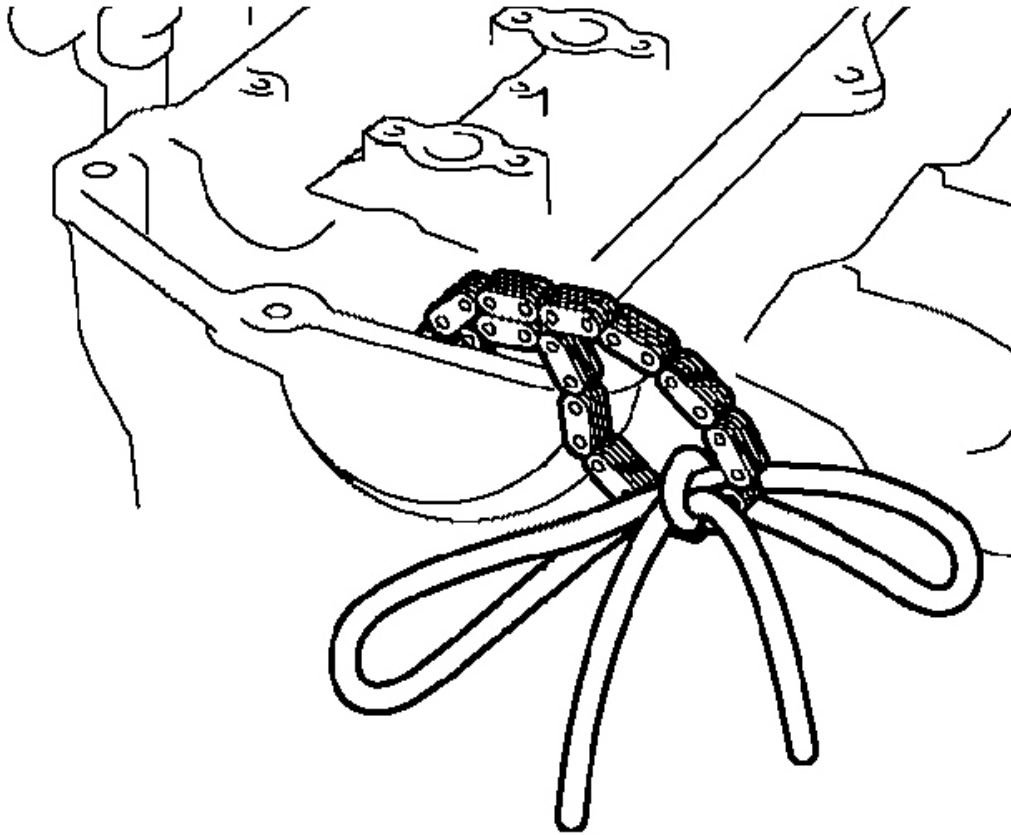
- b. Hold the timing chain by hand, and remove the camshaft and camshaft timing gear assembly.



G03197461

Fig. 225: Removing Camshaft & Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Tie the timing chain with a string as shown in the illustration.



G03197462

Fig. 226: Tie Timing Chain With String
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

9. REMOVE CAMSHAFT TIMING GEAR ASSY

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

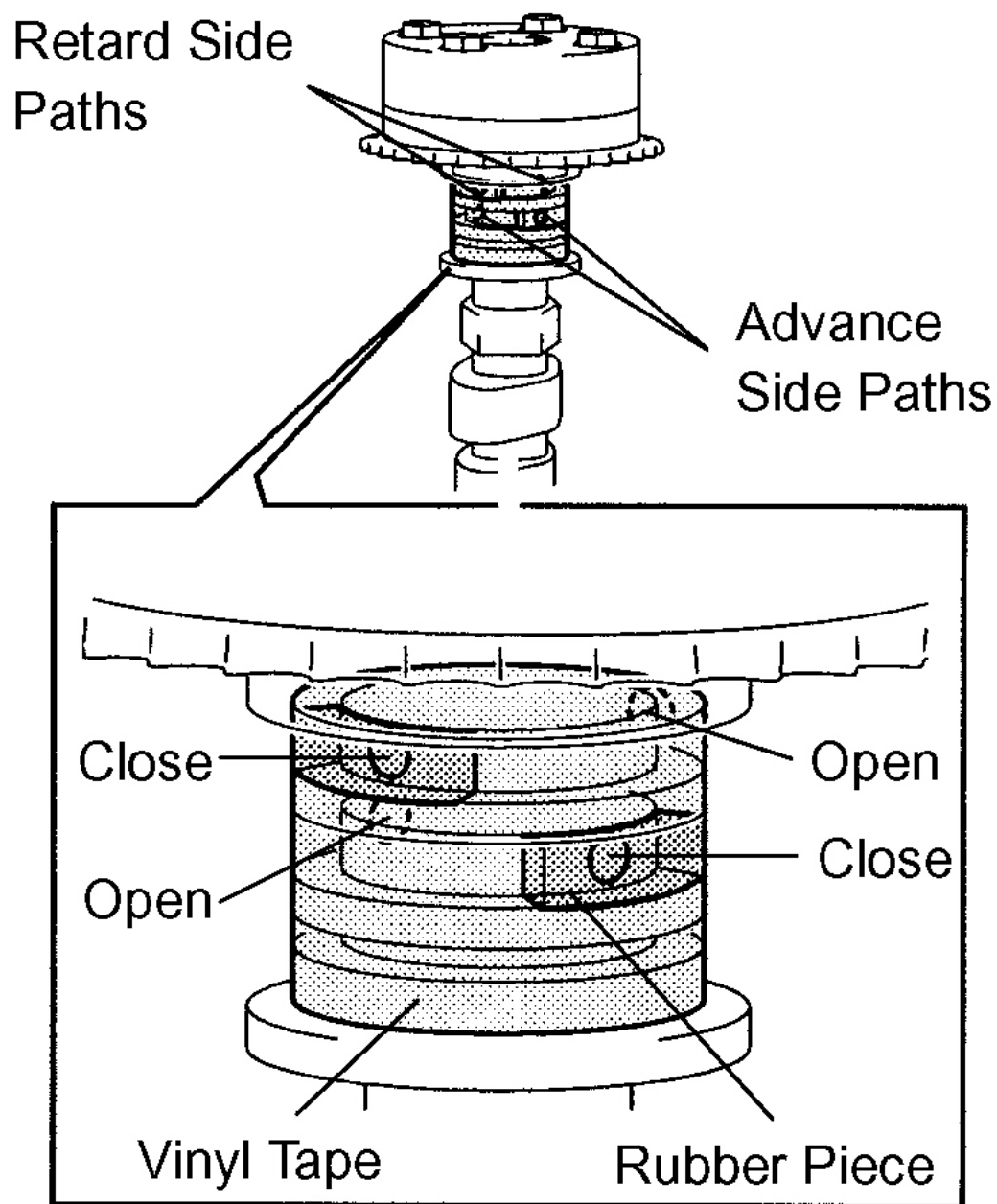
NOTE: Be careful not to damage the camshaft.

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

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.

- c. Punctuate the tape for the advance oil path and for the retard oil path on the opposite side from the advance oil path.

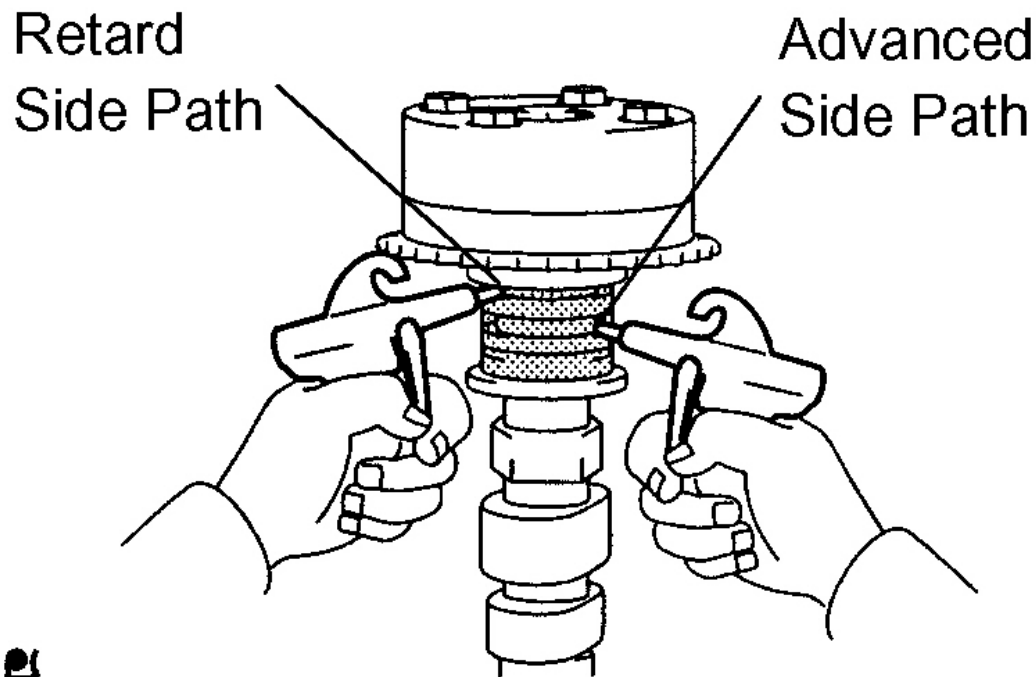


G03197463

Fig. 227: Covering Oil Paths Of Cam Journal With Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.



G03197464

Fig. 228: Putting Air Pressure Into Two Broken Paths (Advance Side Path & Retard Side Path)

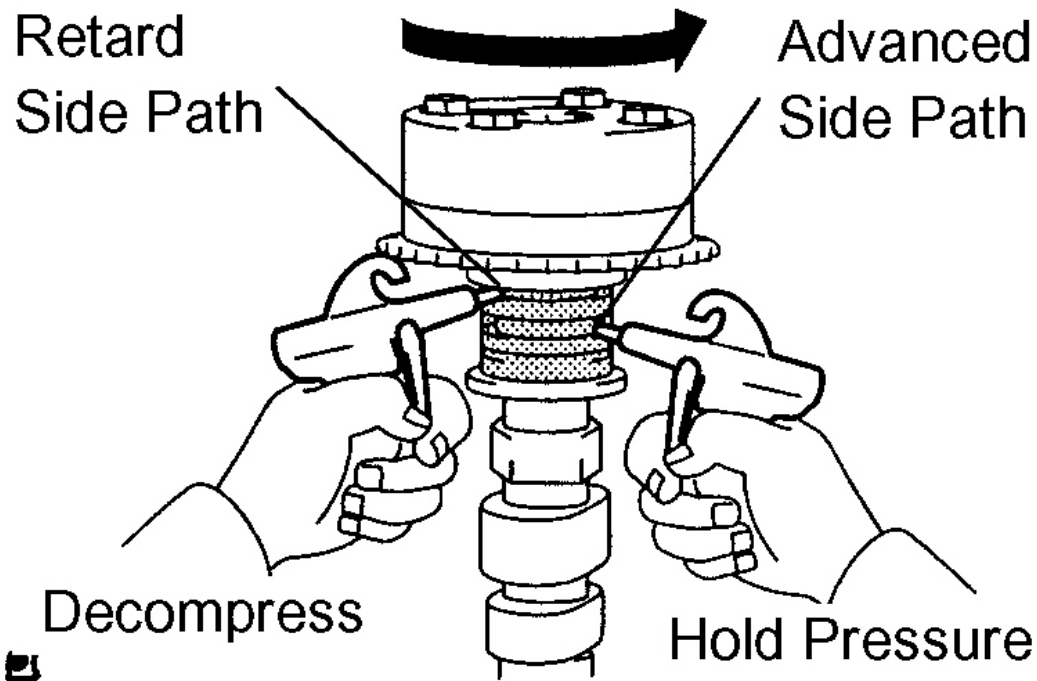
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 camshaft timing gear revolves in the advance direction.

- 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 timing advance side path.



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Fig. 229: Removing Air Pressure Of Timing Retard Side Path
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 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 camshaft timing gear first.

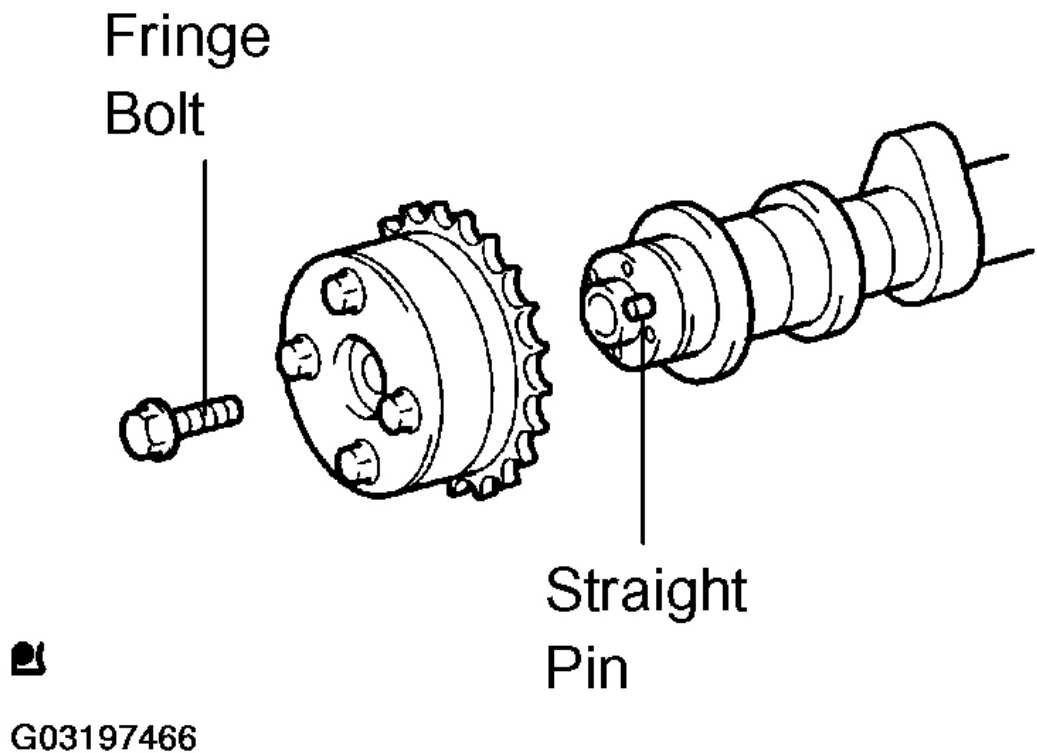


Fig. 230: Removing Fringe Bolt Of Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 retard angle (to the right).

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

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

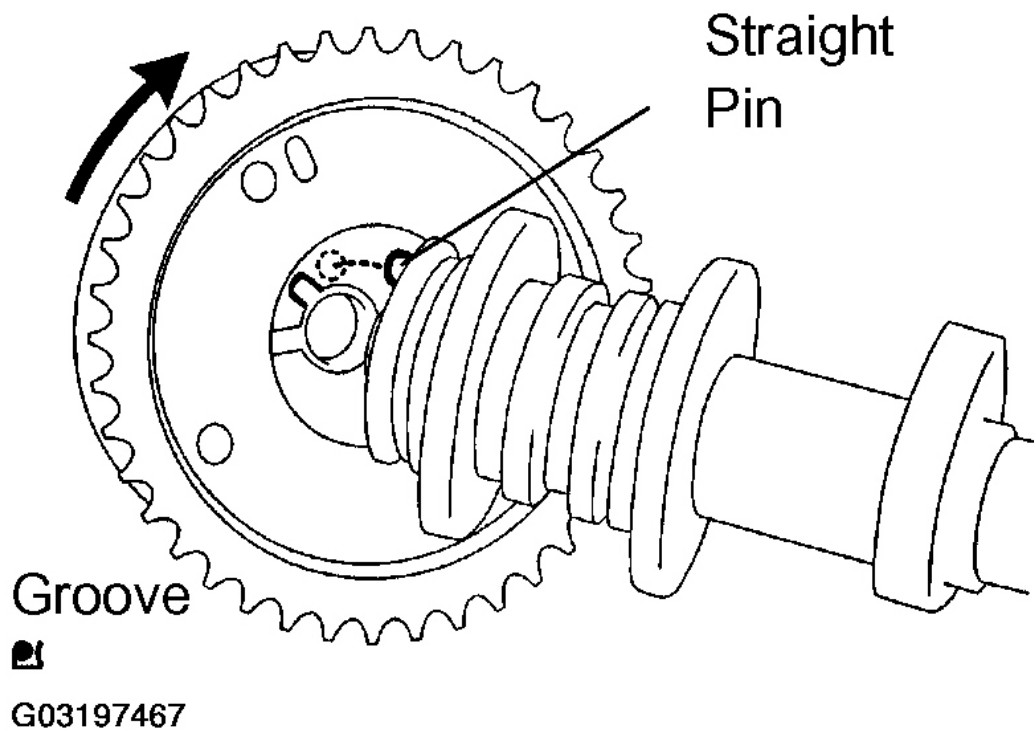


Fig. 231: Installing Camshaft Timing Gear

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

- 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.

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 paint mark aligned with the timing mark on the camshaft timing gear as shown in the illustration.

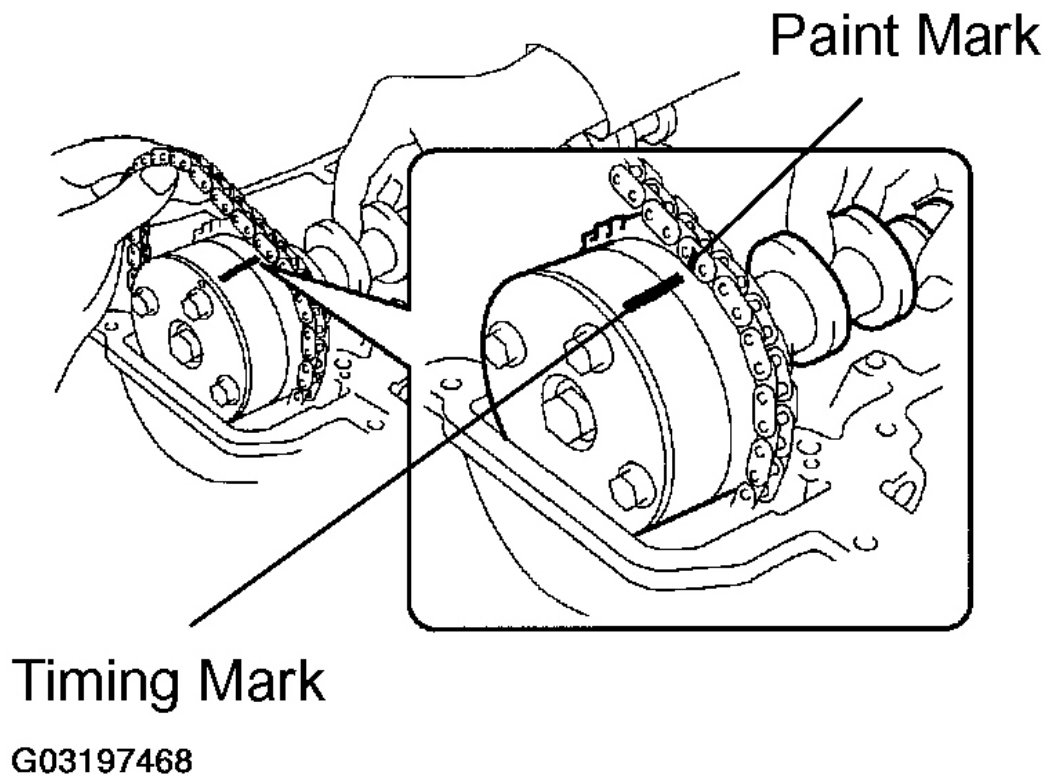


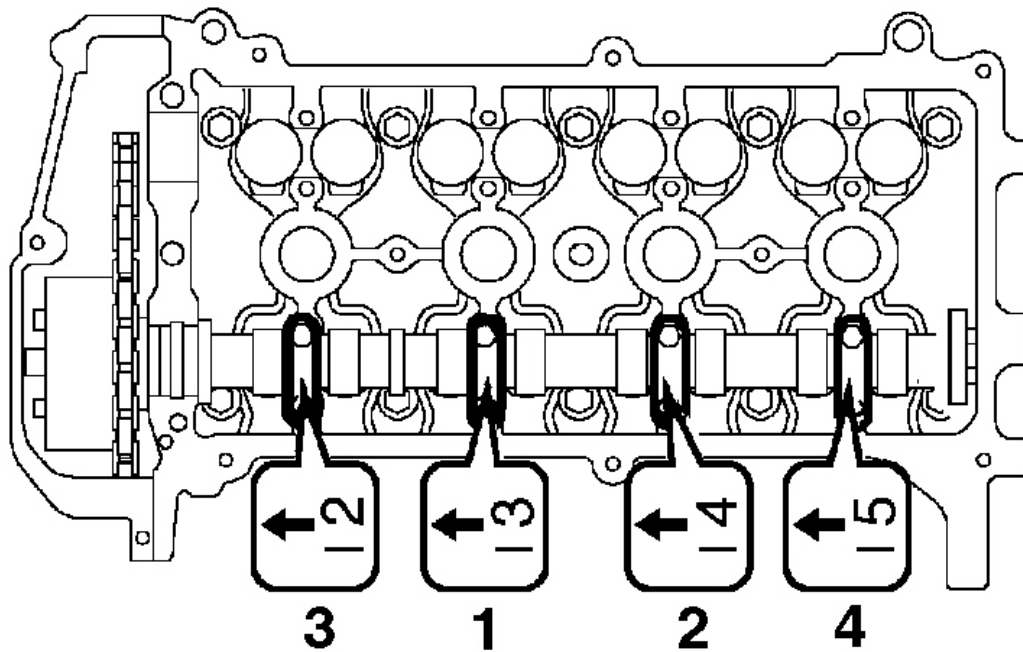
Fig. 232: Installing Timing Chain Onto Camshaft Timing Gear

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 the illustration.

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

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

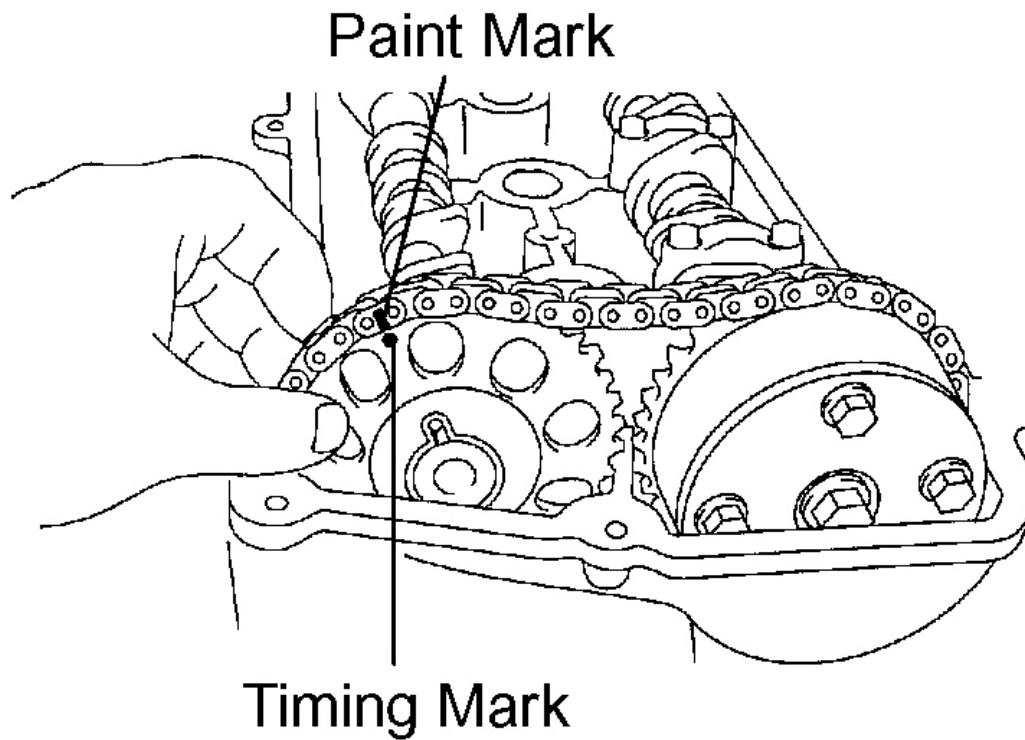


G03197469

Fig. 233: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL NO.2 CAMSHAFT

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

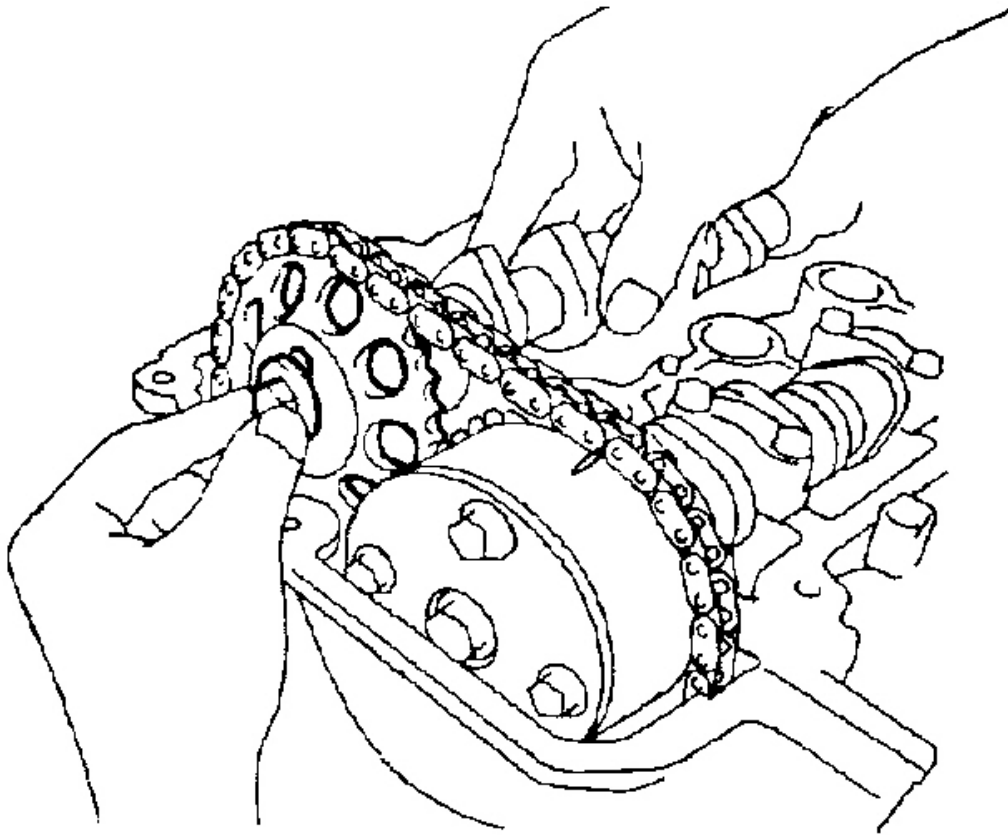


G03197470

Fig. 234: Aligning Paint Mark 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.
- c. Temporarily install the timing sprocket bolt.



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Fig. 235: Installing Timing Sprocket Bolt

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

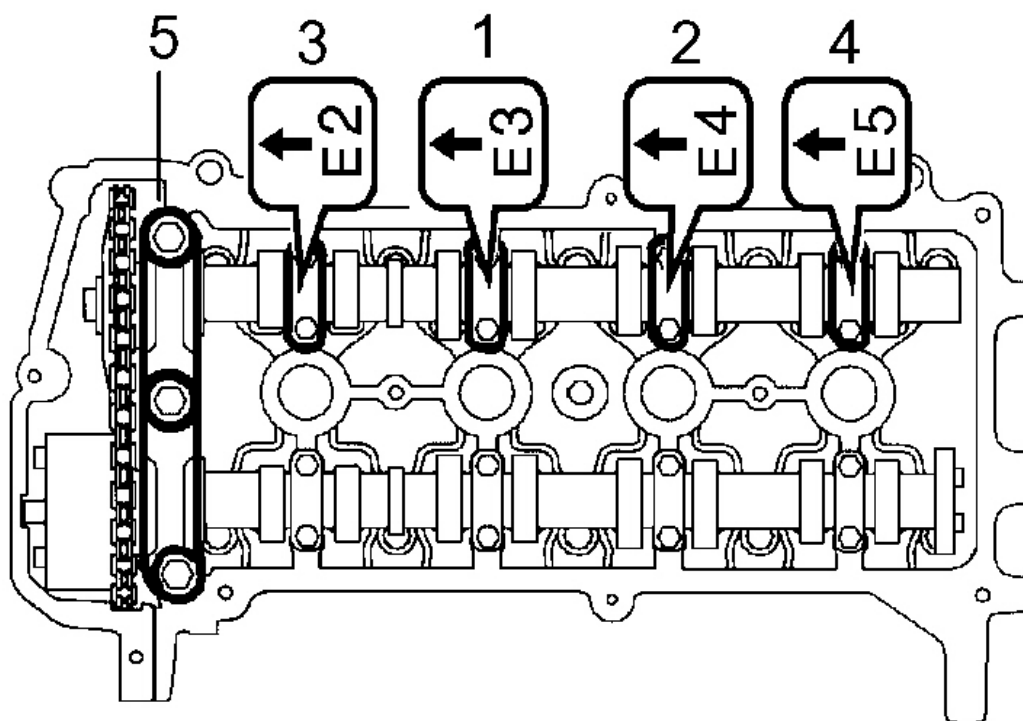
- d. Examine the front marks and numbers and tighten the bolts in the sequence shown in the illustration.

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

NOTE: Tighten each bolt uniformly keeping the camshaft level.

- e. Install the bearing cap No. 1.

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



G03197472

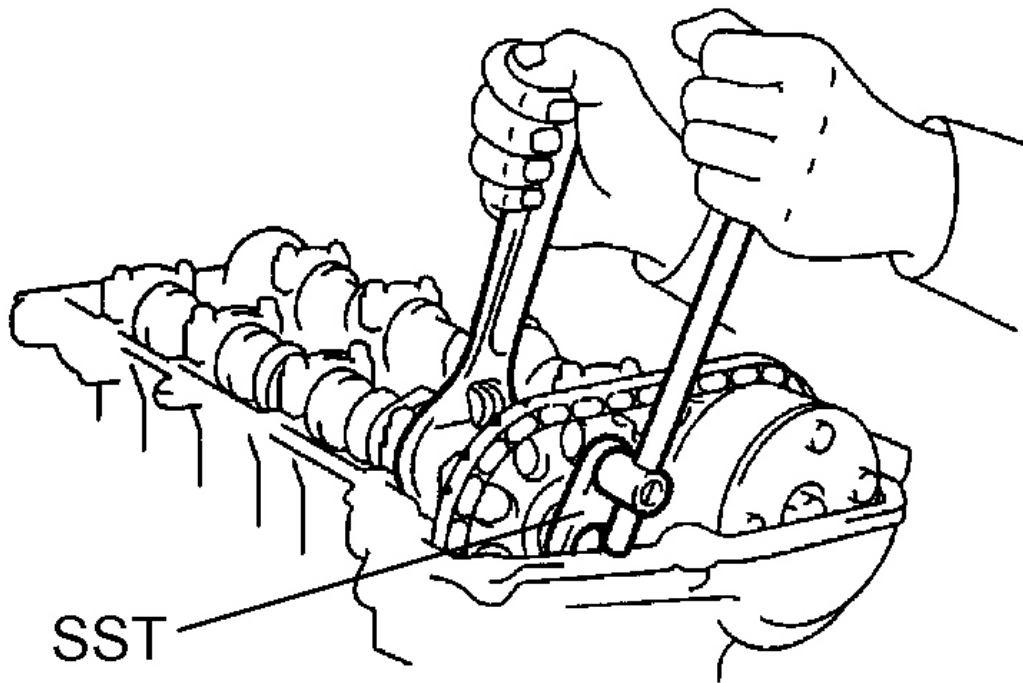
Fig. 236: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09023-38401

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

- g. Remove the bar from the timing chain tensioner.



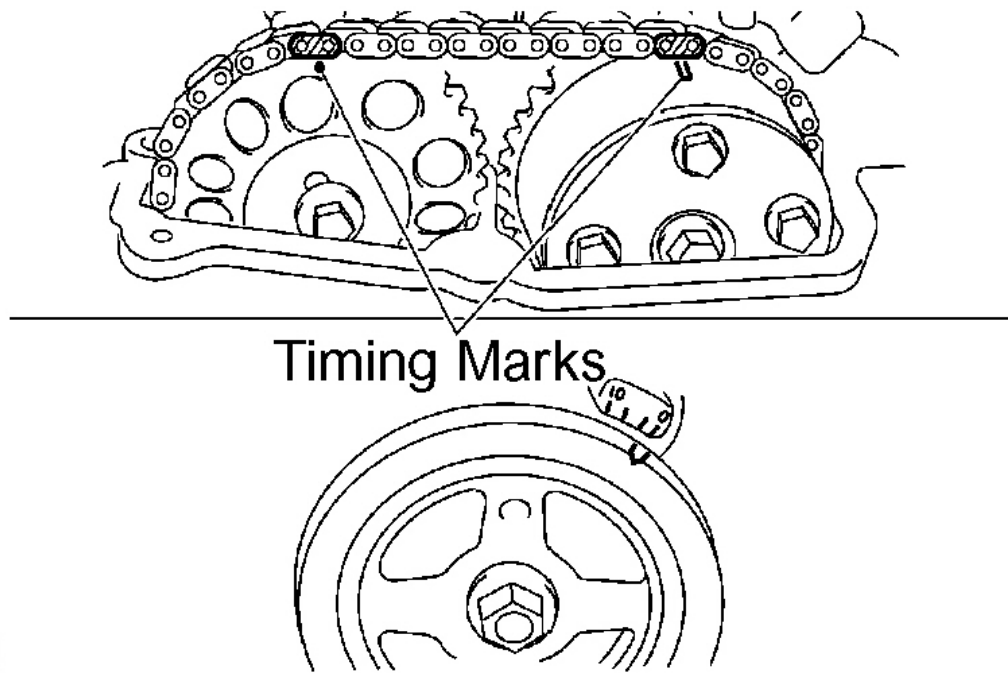
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Fig. 237: Installing Camshaft Bolt

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

- h. Turn the crankshaft damper until its timing notch and the timing mark "0" of the chain cover are aligned
- i. Check that all the pairs of the timing marks are aligned.
- j. Apply seal packing to 2 or 3 threads of the screw plug end.

Seal packing:**Part No. 08833 - 00070 or equivalent**



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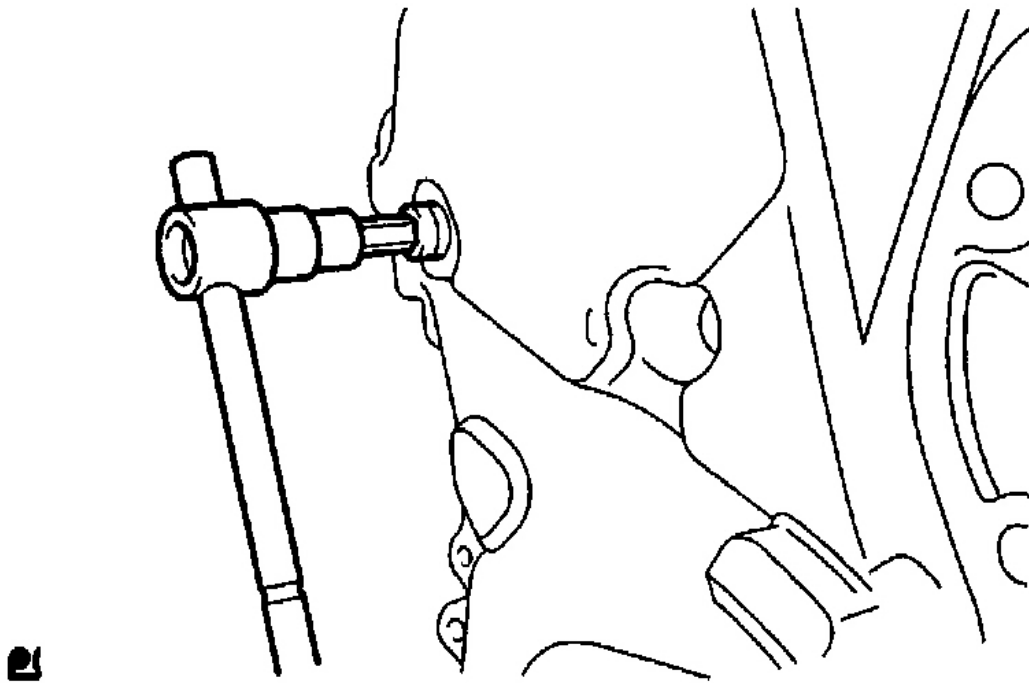
Fig. 238: Aligning Timing Marks

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

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

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

13. **INSPECT VALVE CLEARANCE (See ADJUSTMENT)**
14. **ADJUST VALVE CLEARANCE (See ADJUSTMENT)**



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Fig. 239: Installing Screw Plug

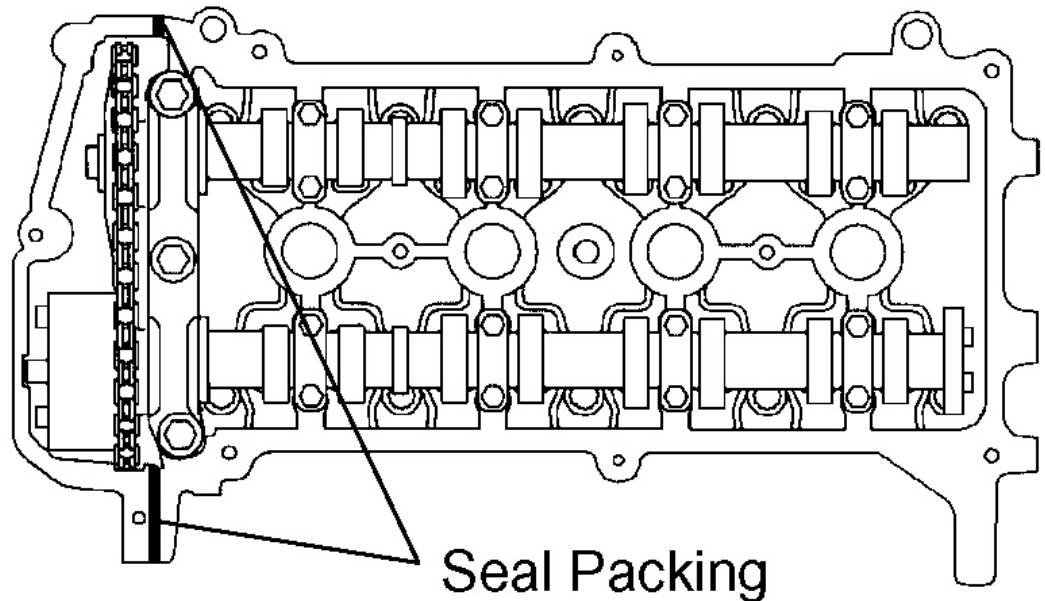
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL CYLINDER HEAD COVER SUB-ASSY

- a. Apply seal packing to the 2 locations shown in the illustration.

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 packin
- Do not start the engine for at least 2 hours after installation.



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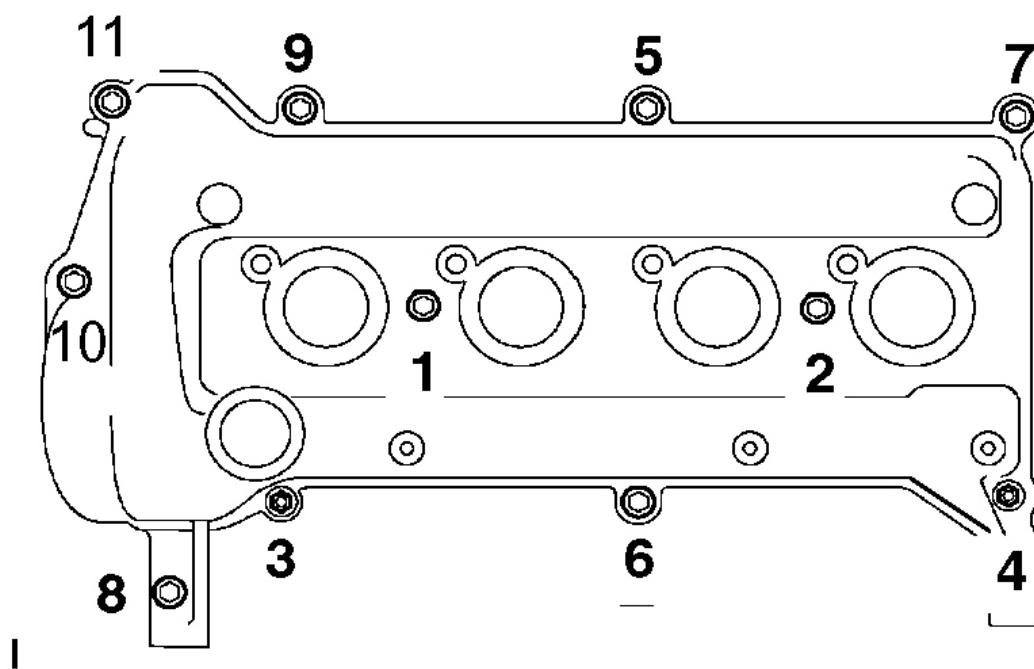
Fig. 240: Applying Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

16. INSTALL IGNITION COIL No. 1

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



G03197477

Fig. 241: Installing Cylinder Head Cover

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

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)

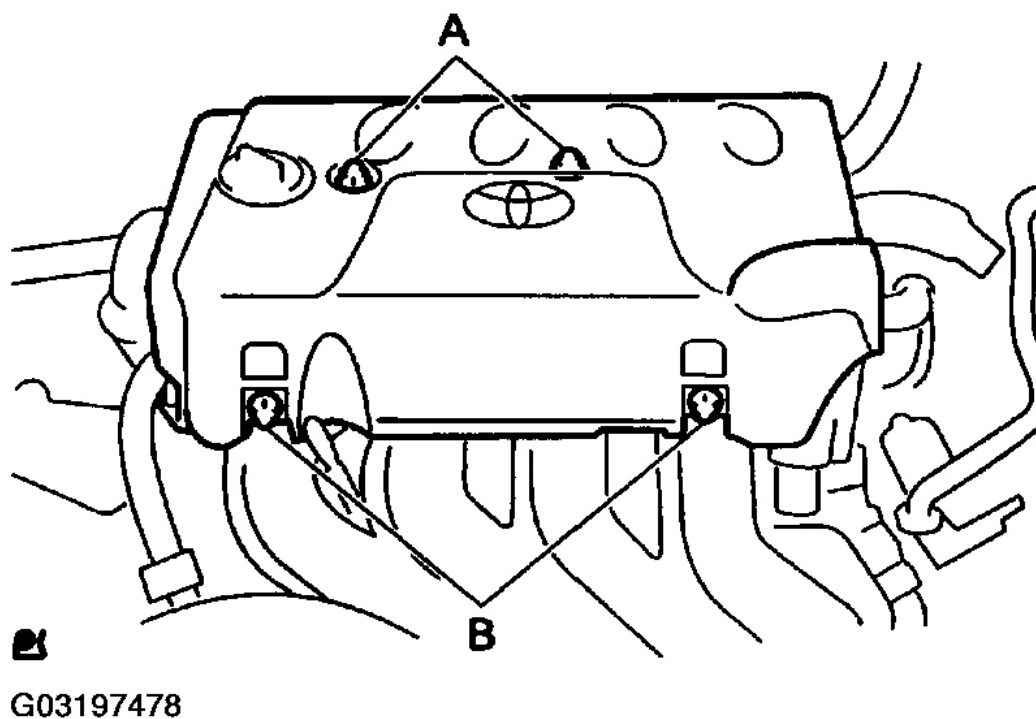
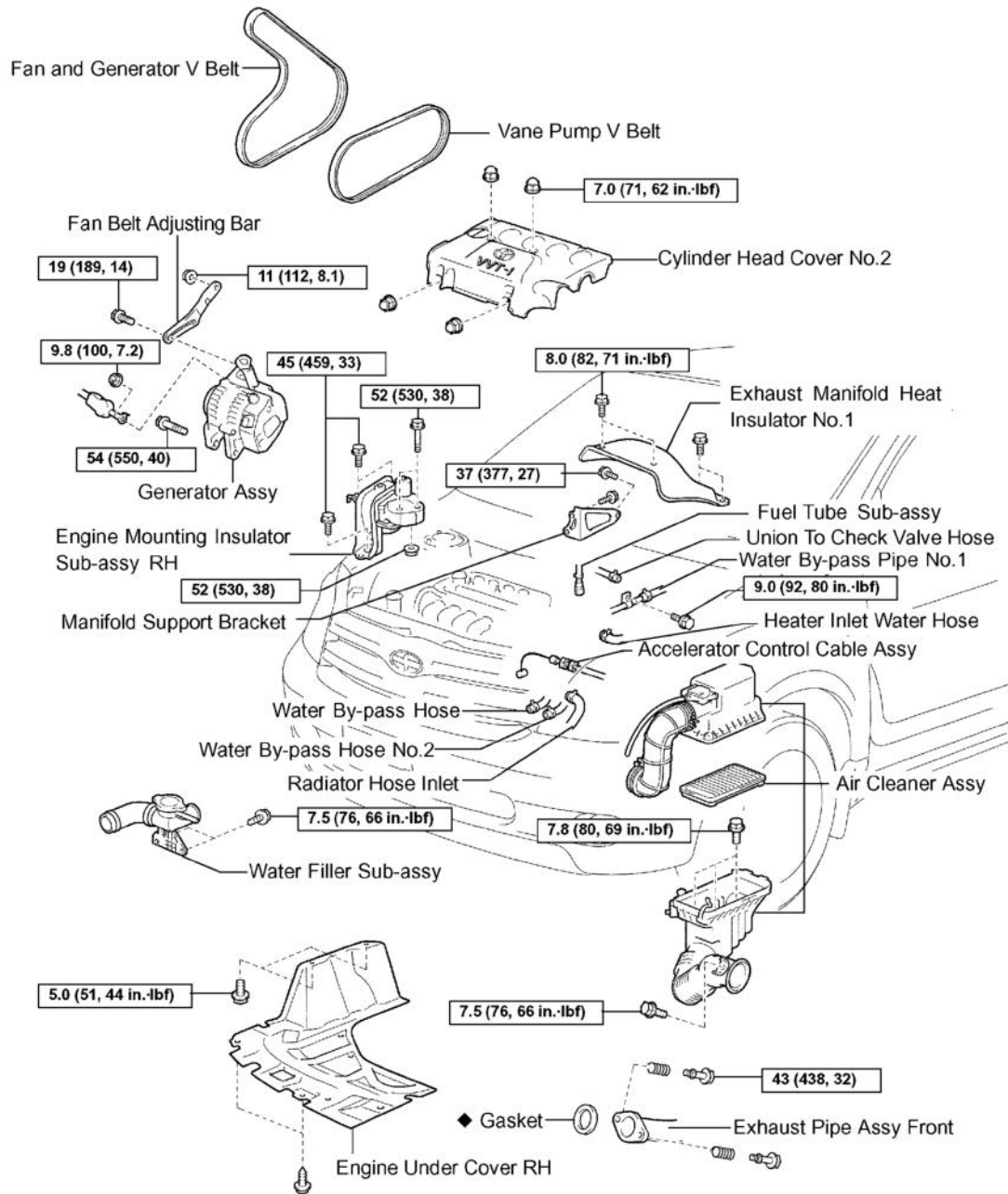


Fig. 242: Installing Cylinder Head Cover No. 2
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. CHECK FOR ENGINE OIL LEAKS

CYLINDER HEAD GASKET

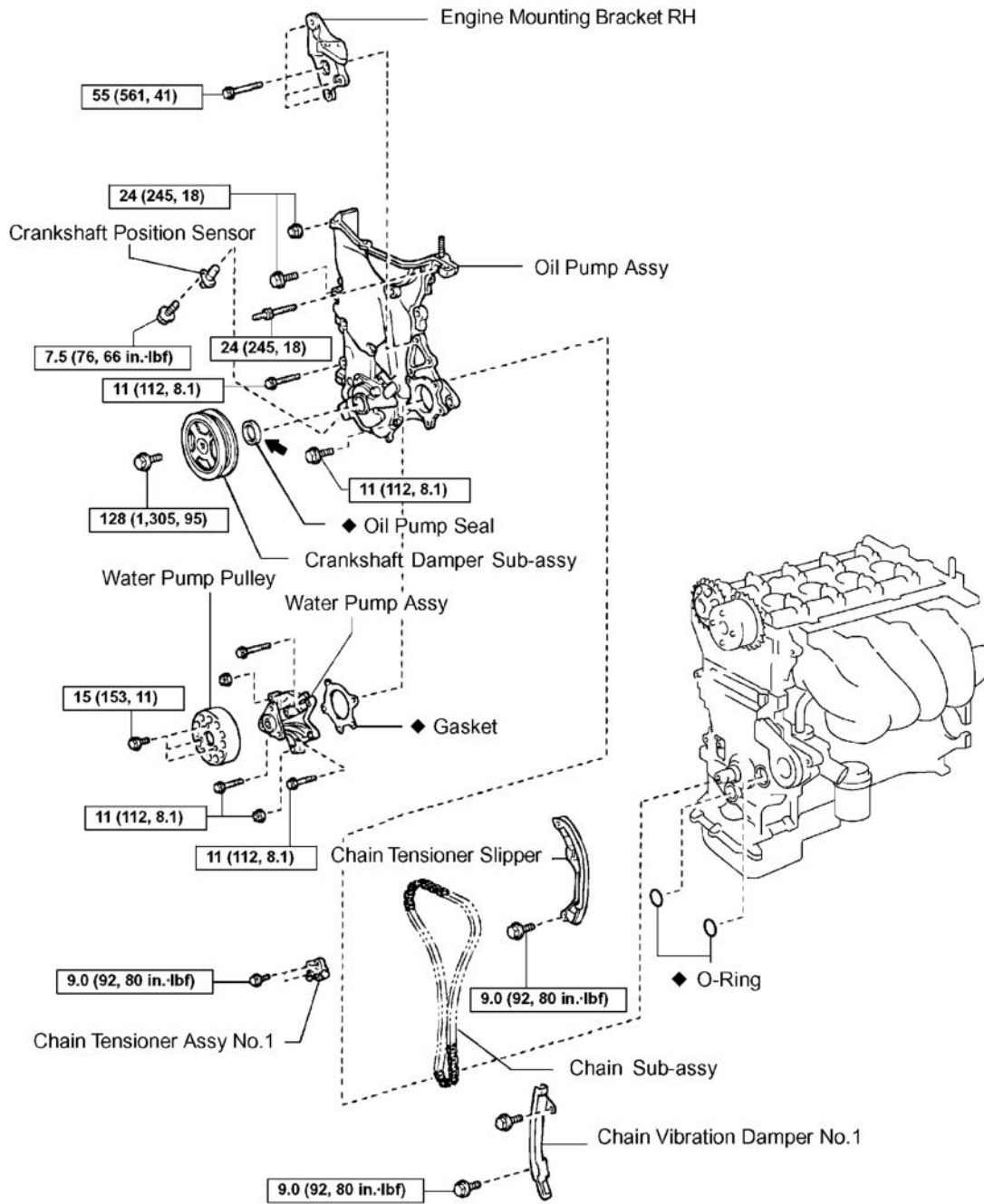
COMPONENTS



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

G03197479

Fig. 243: Identifying Engine Components Related To Cylinder Head (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

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Fig. 244: Identifying Engine Components Related To Cylinder Head (2 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

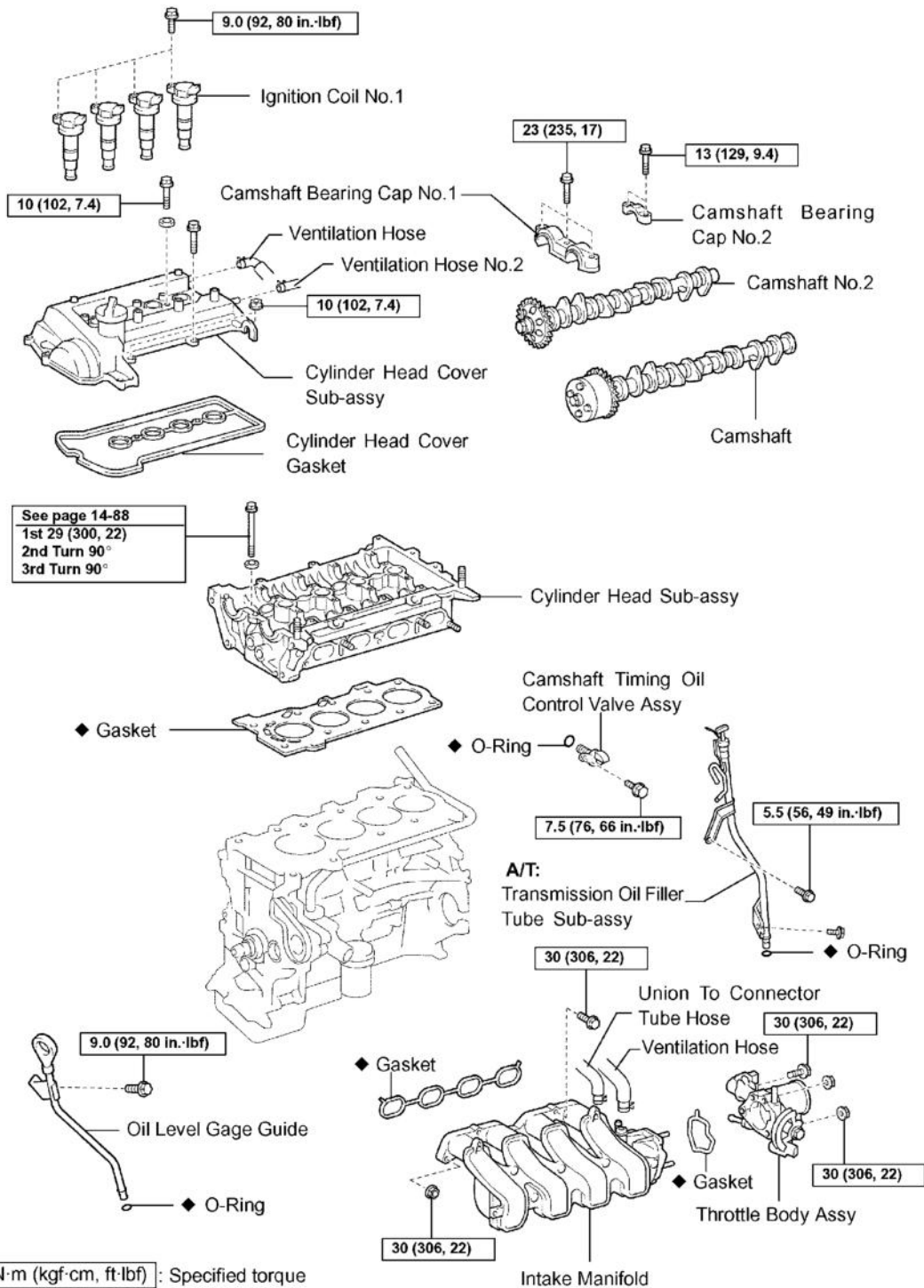


Fig. 245: Identifying Engine Components Related To Cylinder Head (3 Of 3)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See FUEL SYSTEM)
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.

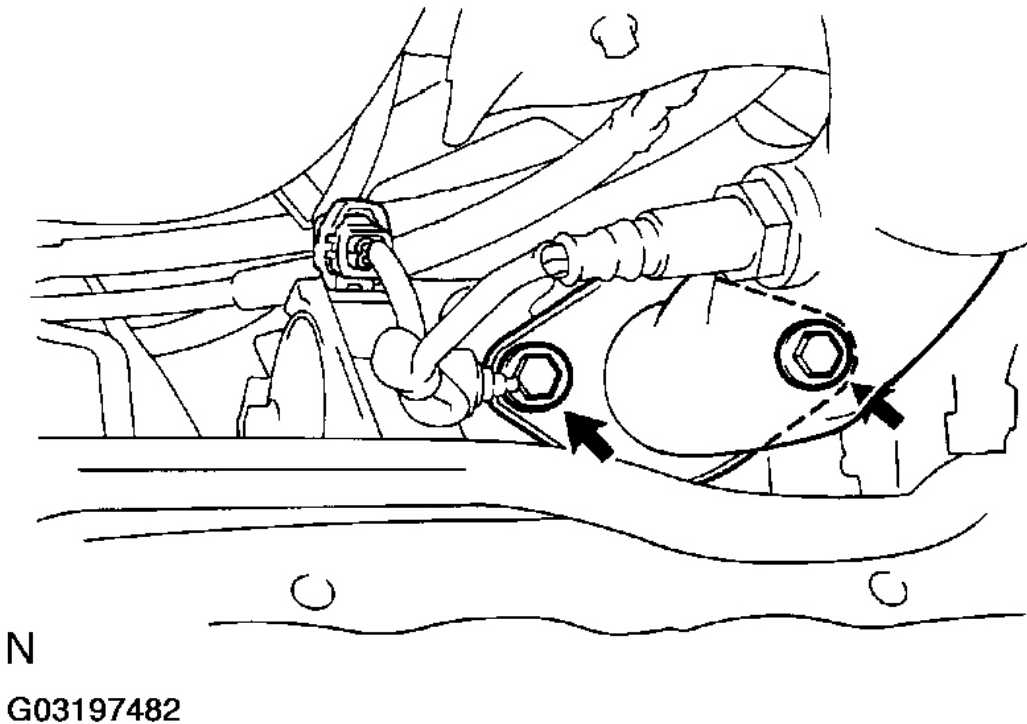


Fig. 246: Removing Exhaust Pipe Assy Front
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.
6. **REMOVE AIR CLEANER ASSY** (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)
7. **DISCONNECT ACCELERATOR CONTROL CABLE ASSY** (See REMOVAL & INSTALLATION AND DISASSEMBLY & REASSEMBLY)
8. **REMOVE THROTTLE BODY ASSY** (See REMOVAL & INSTALLATION AND

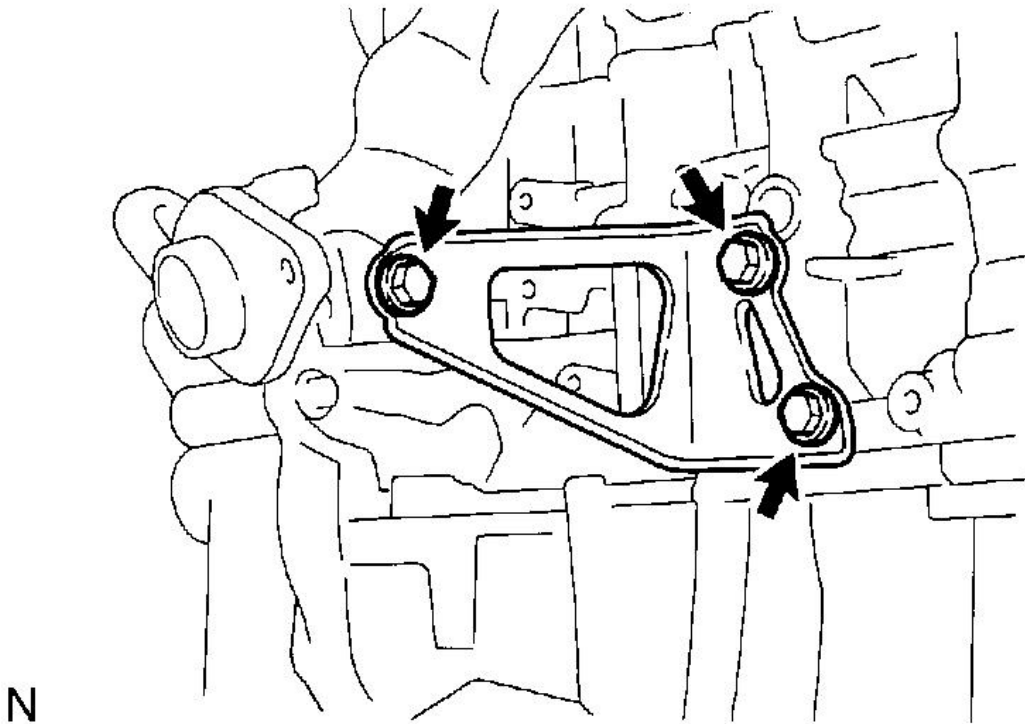
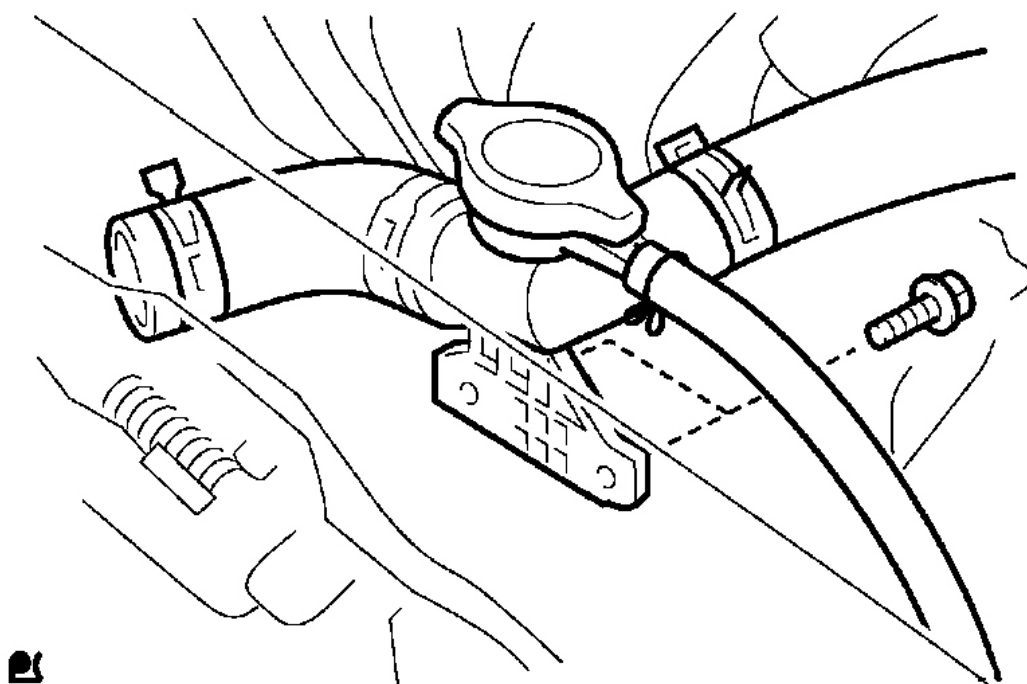
DISASSEMBLY & REASSEMBLY)**9. DISCONNECT ENGINE WIRE****N****G03197483**

Fig. 247: Removing Manifold Support Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.



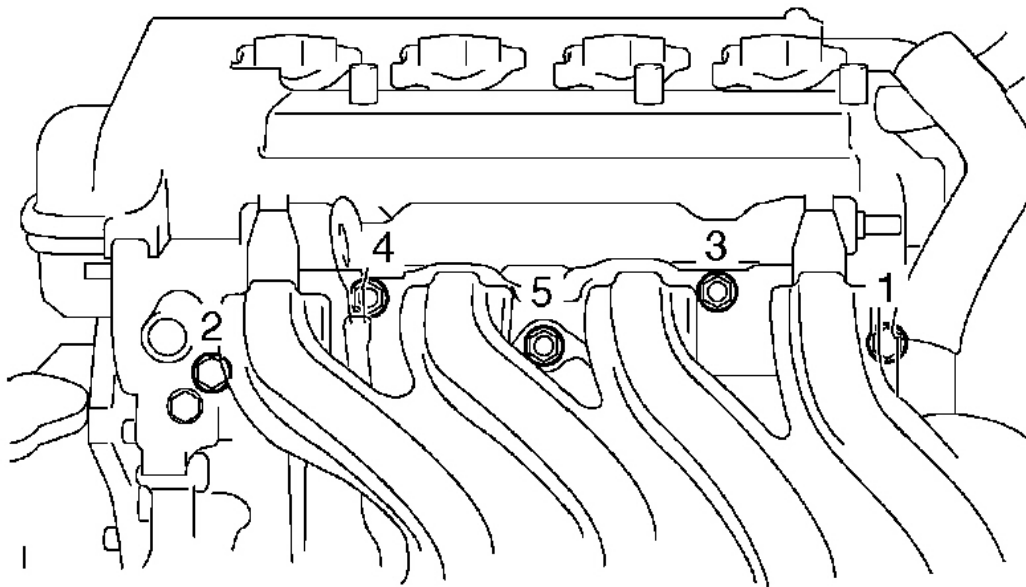
G03197484

Fig. 248: Removing Water Filler

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

11. REMOVE INTAKE MANIFOLD

- a. Using several steps, remove the 3 bolts and 2 nuts in the sequence shown in the illustration, then remove the intake manifold.
- b. Remove the gasket from the intake manifold.



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Fig. 249: Identifying Removal Sequence Of Intake Manifold Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. REMOVE OIL LEVEL GAUGE GUIDE

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

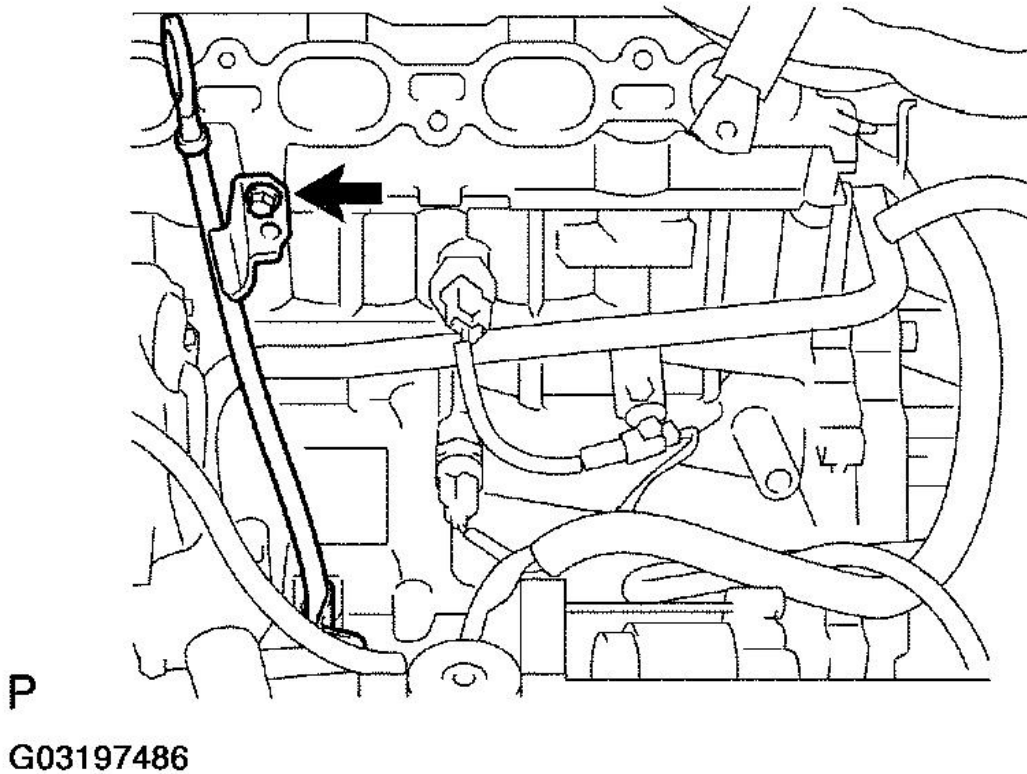


Fig. 250: Removing Oil Level Gauge Guide
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **DISCONNECT UNION TO CHECK VALVE HOSE**
 - a. Disconnect the union to check the valve hose for the brake booster.
14. **DISCONNECT RADIATOR HOSE INLET**
 - a. Disconnect the radiator hose inlet from the union.
15. **DISCONNECT FUEL TUBE SUB-ASSY (See FUEL SYSTEM)**

SST 09268-21010
16. **DISCONNECT HEATER WATER INLET HOSE A**
 - a. Disconnect the heater water inlet hose from the water bypass pipe No.2.

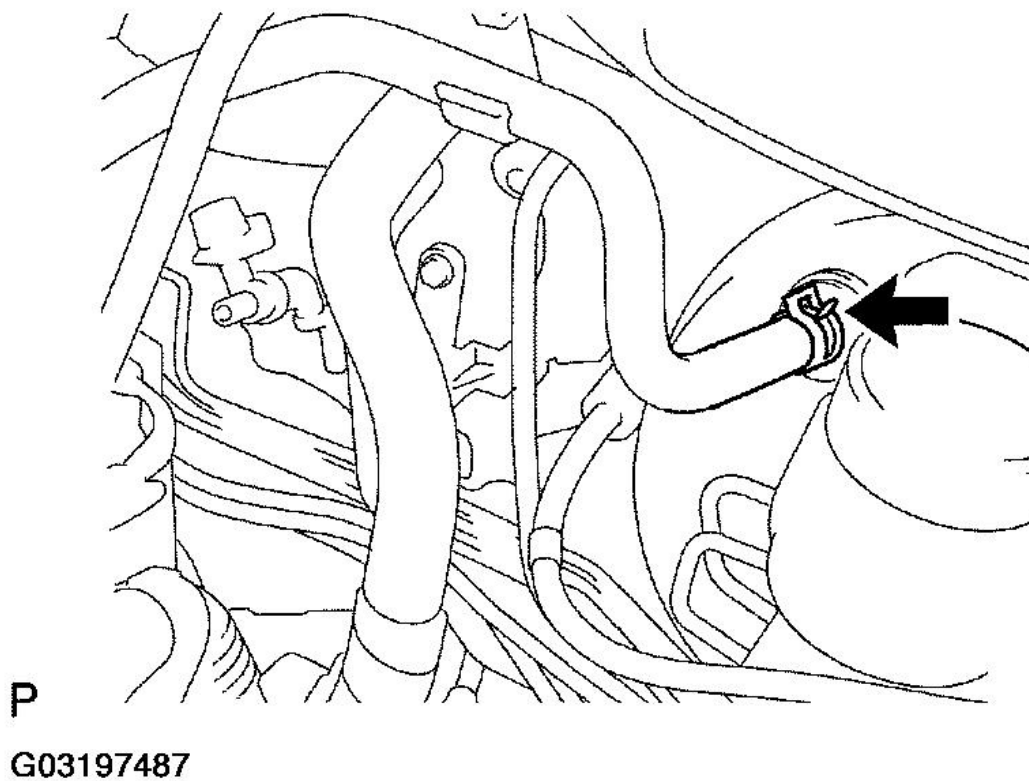
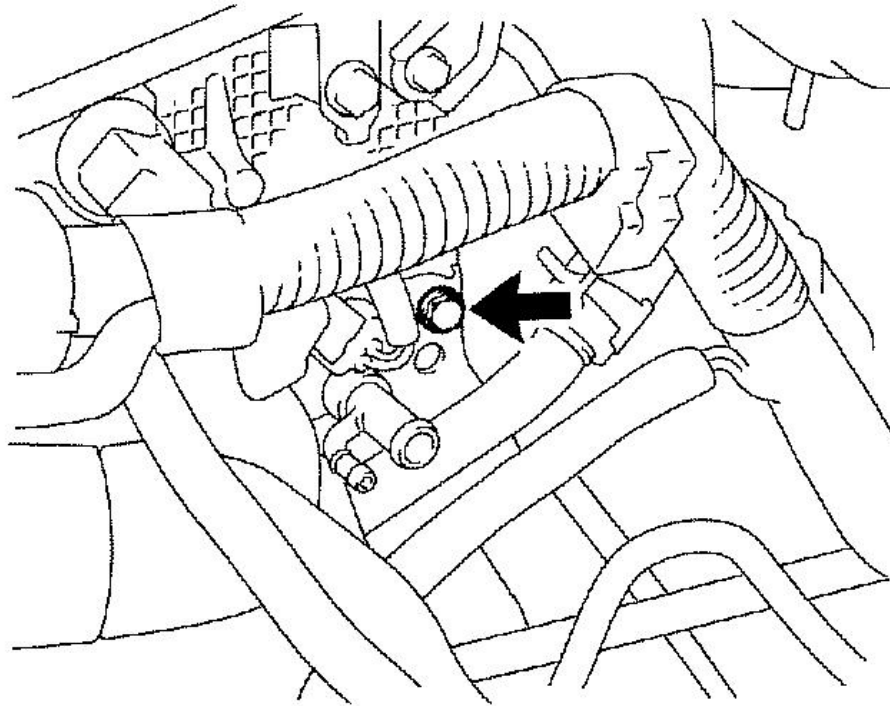


Fig. 251: Disconnecting Union
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. SEPARATE WATER BY-PASS PIPE No. 1

- a. Remove the set bolt of the water by-pass pipe No. 1.



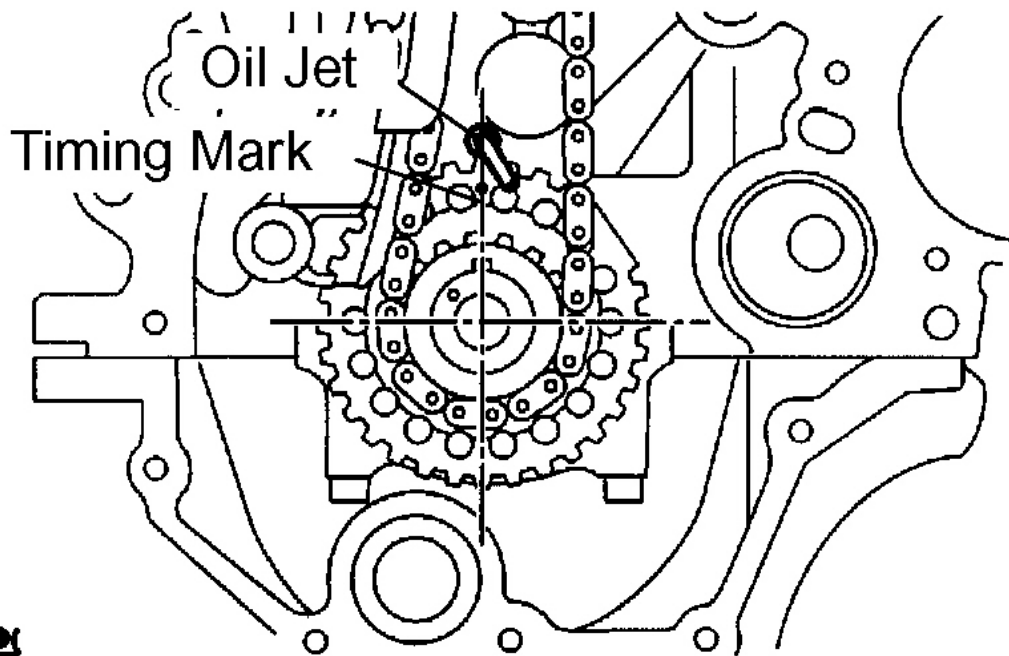
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G03197488

Fig. 252: 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 paint mark to prevent the pistons from coming into contact with the valves.



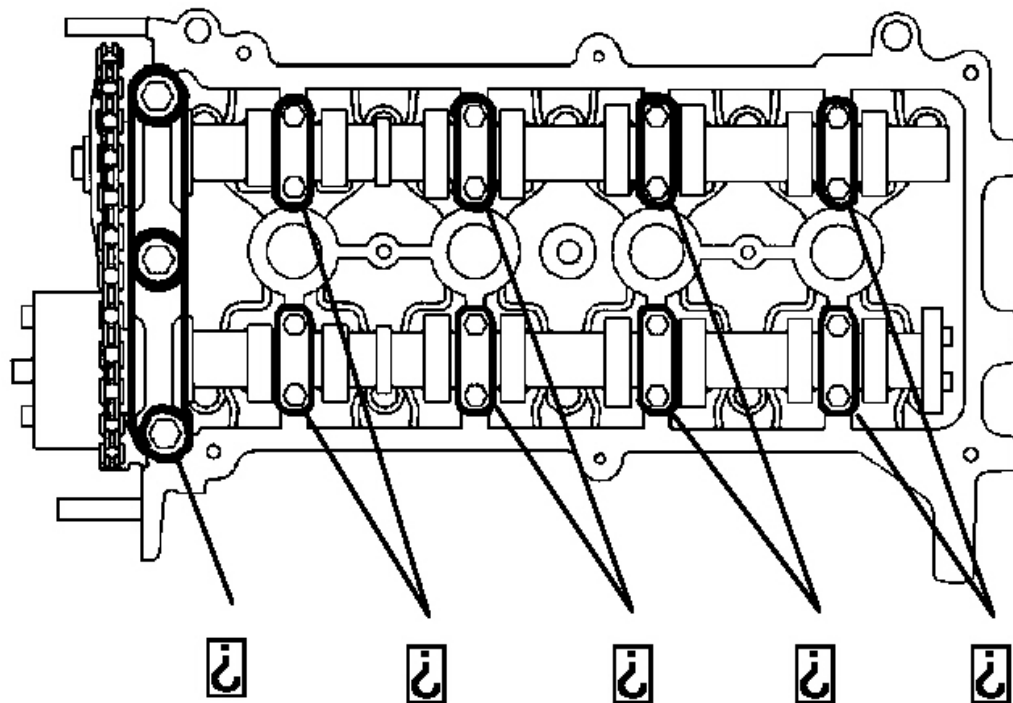
G03197489

Fig. 253: 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 19 bearing cap bolts in the sequence shown in the illustration, and then remove the 9 bearing caps, the No. 1 and the No.2 camshafts.

NOTE: Loosen each bolt uniformly keeping the camshaft level.



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Fig. 254: Identifying Removal Sequence Of Bearing Cap Bolts
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 the illustration. Remove the 10 cylinder head bolts and plate washers.

NOTE:

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

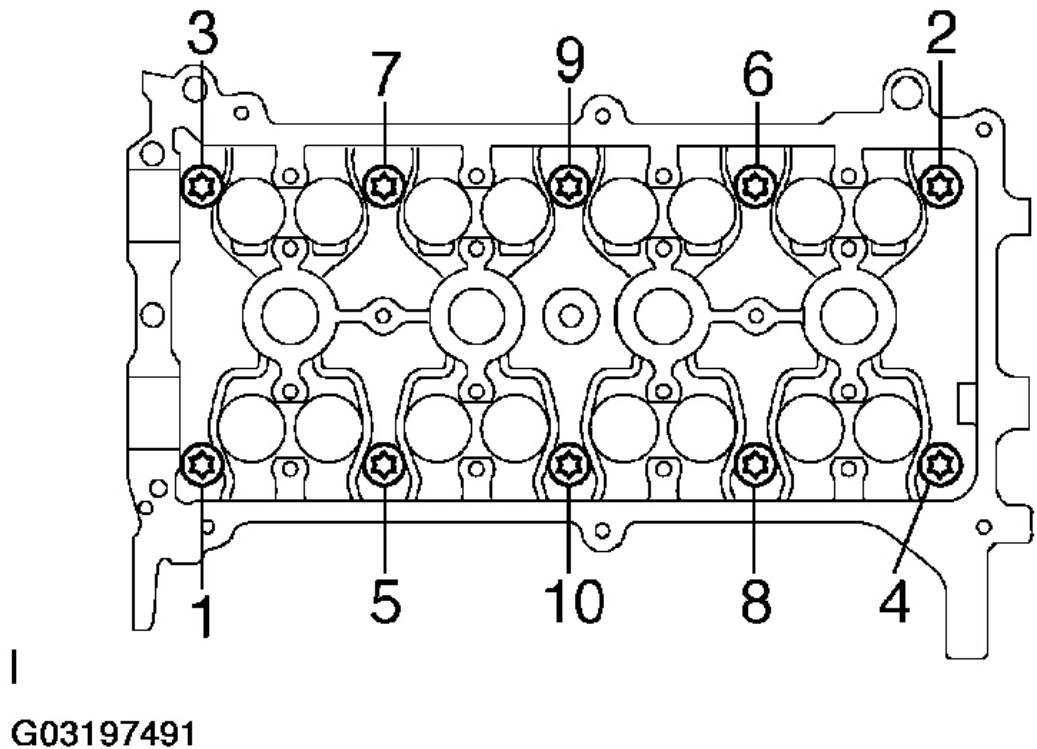


Fig. 255: Identifying Removal Sequence Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. REMOVE CYLINDER HEAD GASKET

21. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the length of 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.)

If the length exceeds maximum, replace the bolt.

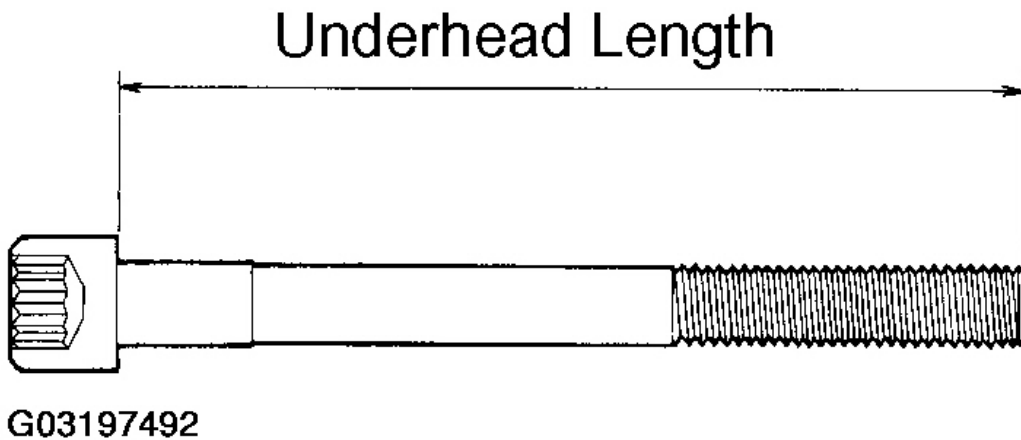


Fig. 256: Identifying Length Of Head Bolts From Seat To End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 not to damage the gasket the bottom part of the head.

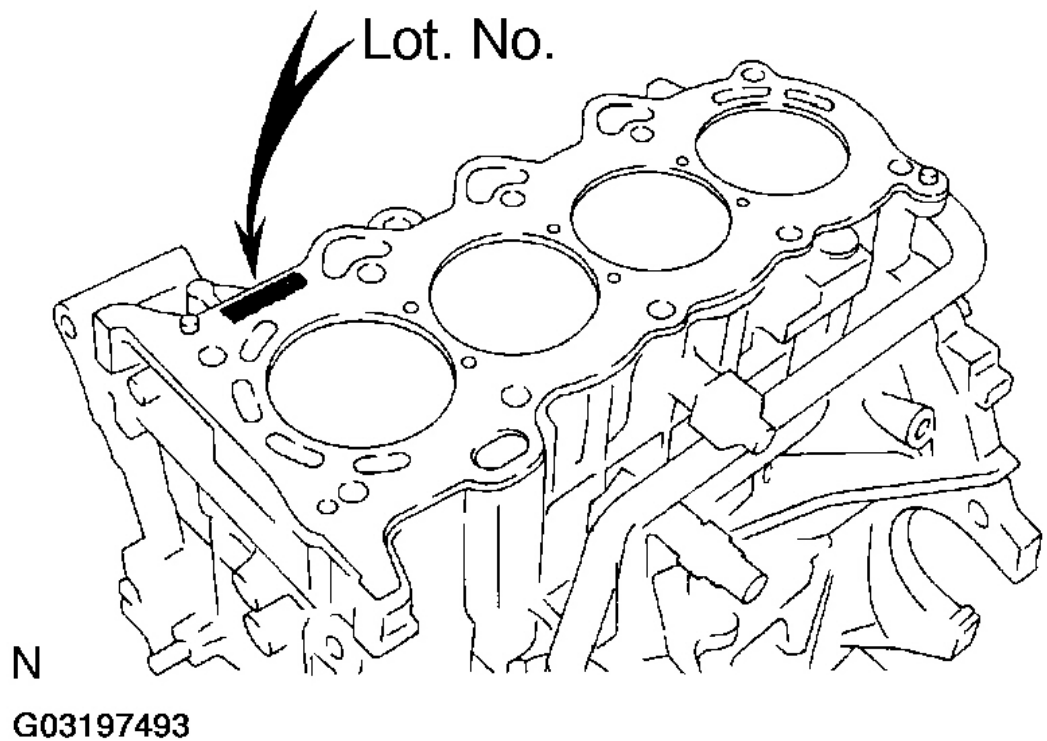


Fig. 257: Placing New Cylinder Head Gasket On Cylinder Block With Lot No. Stamp Facing Upward

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

23. INSTALL CYLINDER HEAD SUB-ASSY

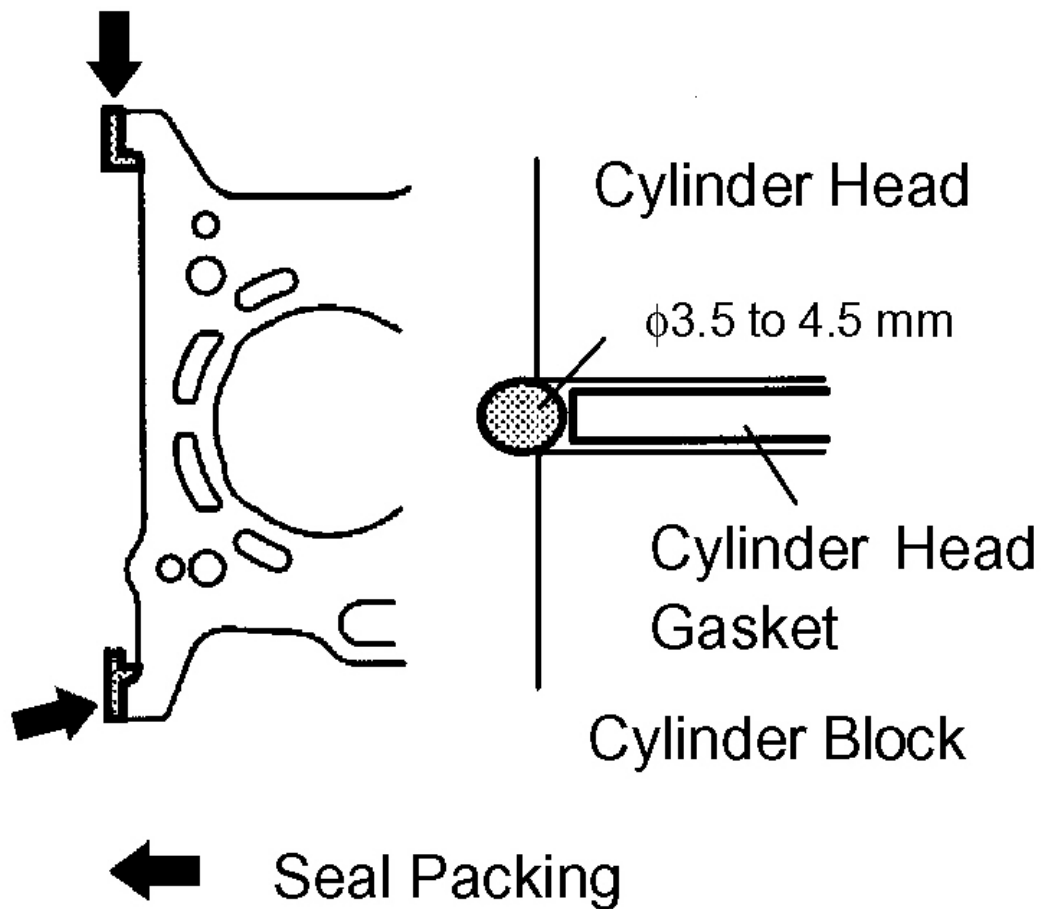
HINT:

The cylinder head bolts are tightened in 2 successive steps.

- Apply a continuous bead of seal packing (Diameter 3.5 to 4.5 mm (0.1378 to 0.1772 in.)) as shown in the illustration.

NOTE:

- Remove any oil from the contact surface.
 - Install the cylinder head within 3 minutes of applying seal packing.
- Apply a light coat of engine oil to the threads of the cylinder head bolts.



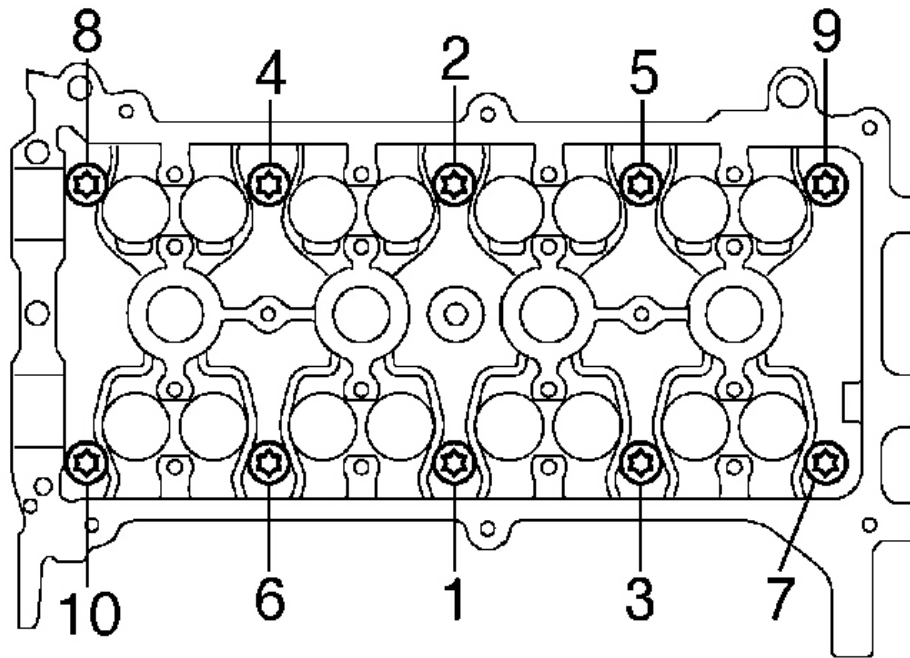
G03197494

Fig. 258: Applying Continuous Bead Of Seal Packing

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

- 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 the illustration.

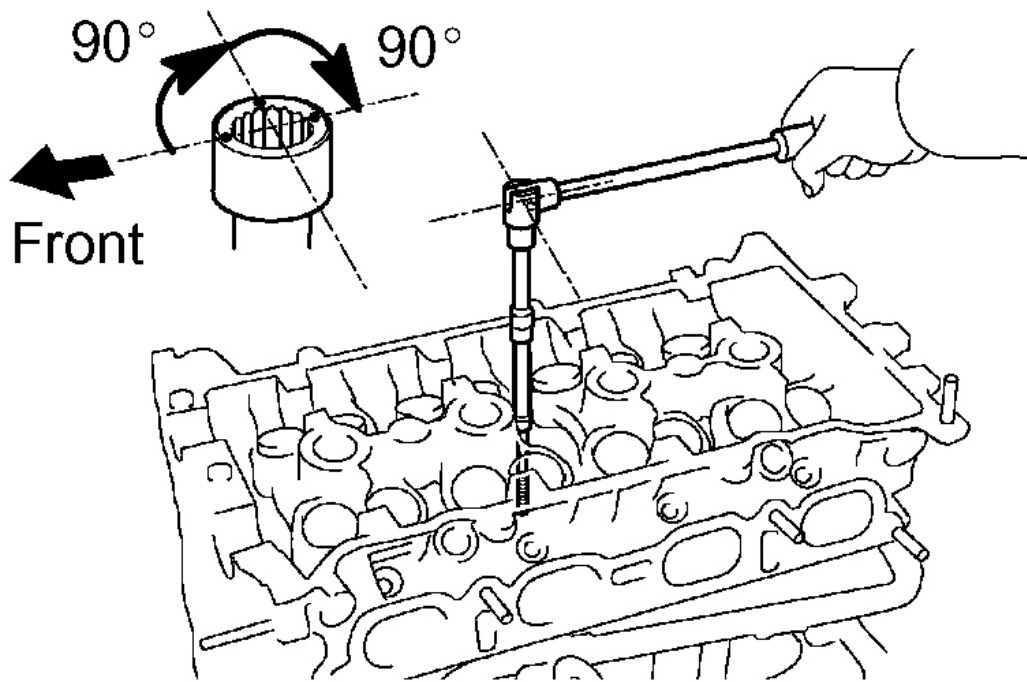
Torque: 29 N.m (300 kgf.cm, 22 ft.lbf)



G03197495

Fig. 259: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Mark the front of the cylinder head bolt with paint.
- e. Retighten the cylinder head bolts by additional 90° and one more additional 90° as shown in the illustration.
- f. Check that the paint mark is now at 180° opposite to the front.



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Fig. 260: Retightening Cylinder Head Bolts By Additional 90° & One More Additional 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. INSTALL CAMSHAFT

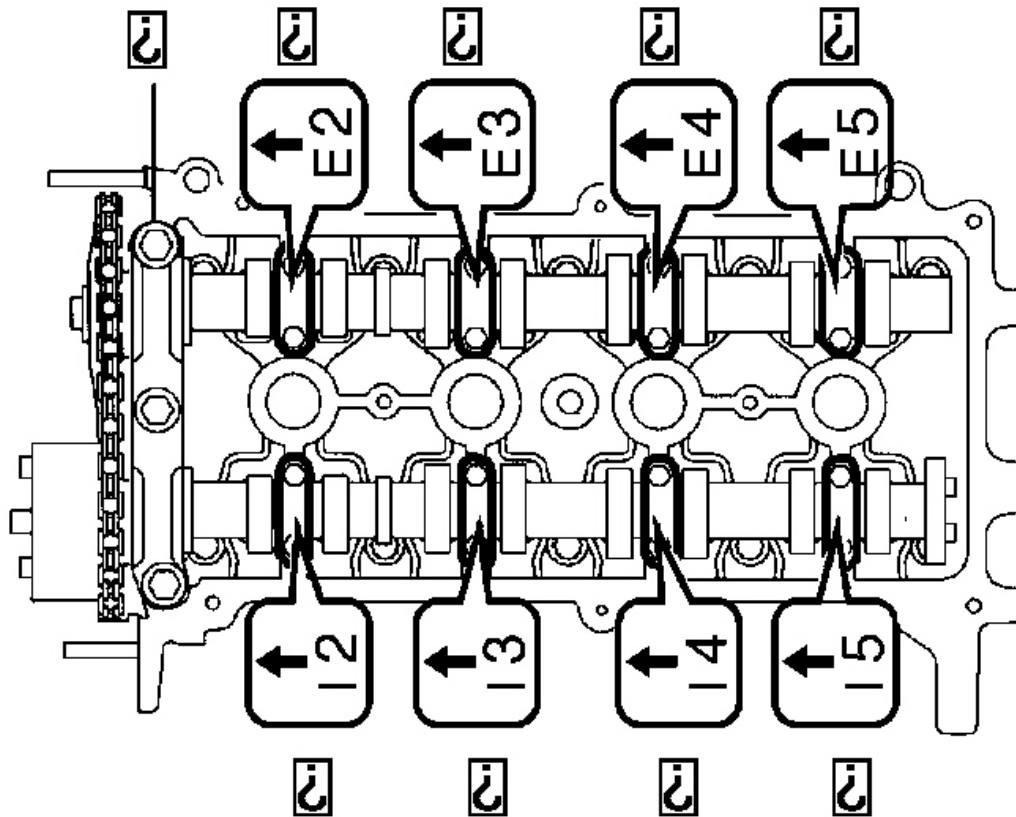
- Apply a light coat of engine oil to the camshaft journals.
- Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.
- Examine the front marks and numbers and tighten the bolts in the sequence shown in the illustration.

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

NOTE: Tighten each bolt uniformly keeping the camshaft level.

- Install the bearing cap No. 1.

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



G03197497

Fig. 261: Identifying Tightening Sequence Of Bearing Cap Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 FUEL SYSTEM)

27. INSTALL OIL LEVEL GAGE GUIDE

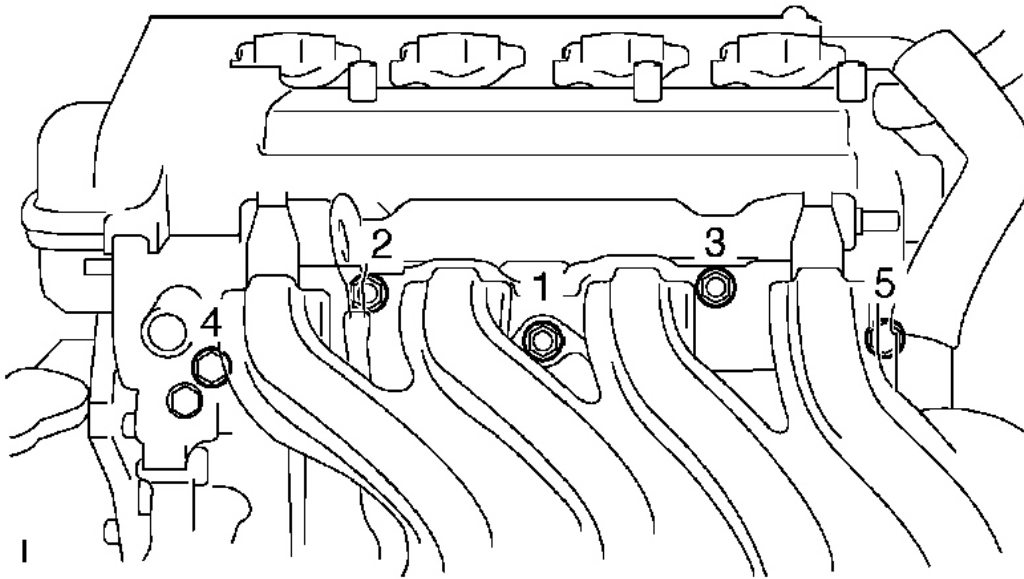
- a. Apply engine oil to a new O-ring.
- b. Install oil level gauge guide with the bolt.

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 the illustration.

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



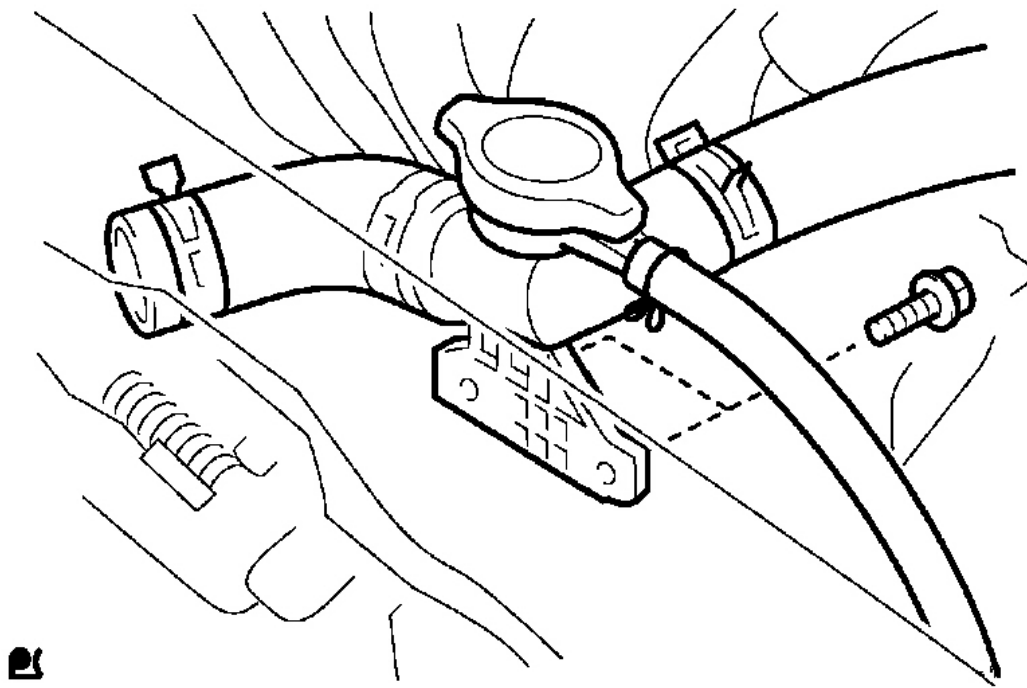
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Fig. 262: Identifying Tightening Sequence Of Intake Manifold Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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)



G03197499

Fig. 263: Installing Water Filler

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

- b. Connect the radiator reservoir tank hose.
 - c. Connect the radiator hose No.3.
 - d. Connect the radiator inlet hose.
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)

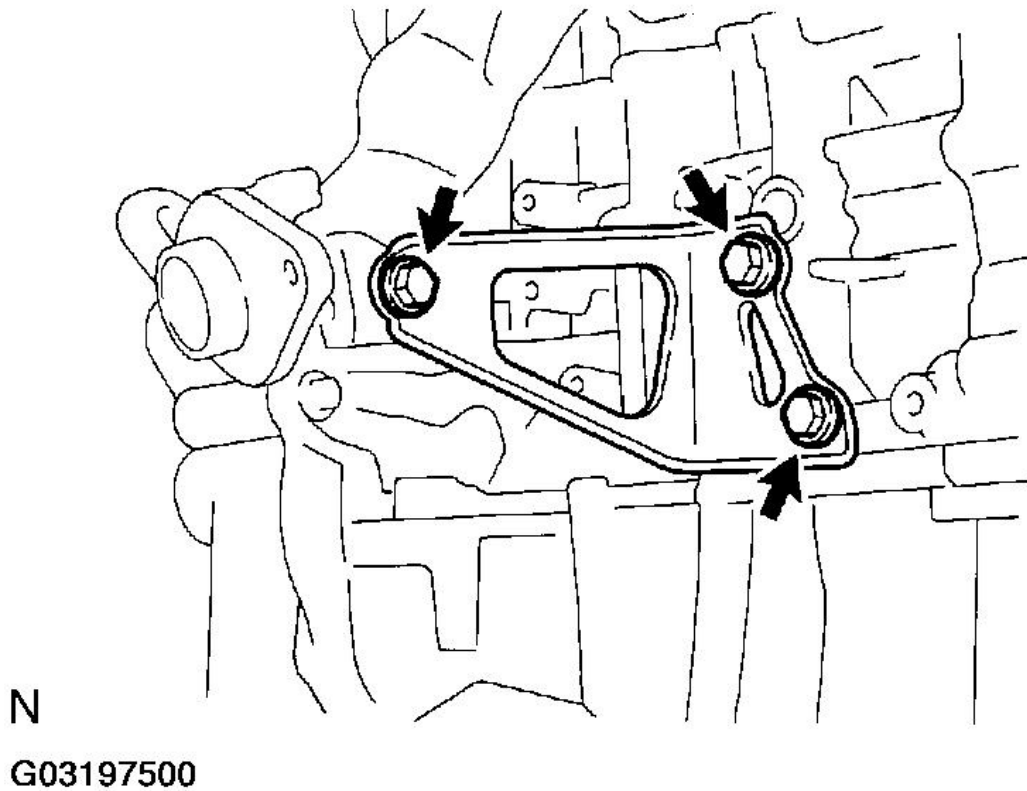


Fig. 264: Installing Manifold Support Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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)

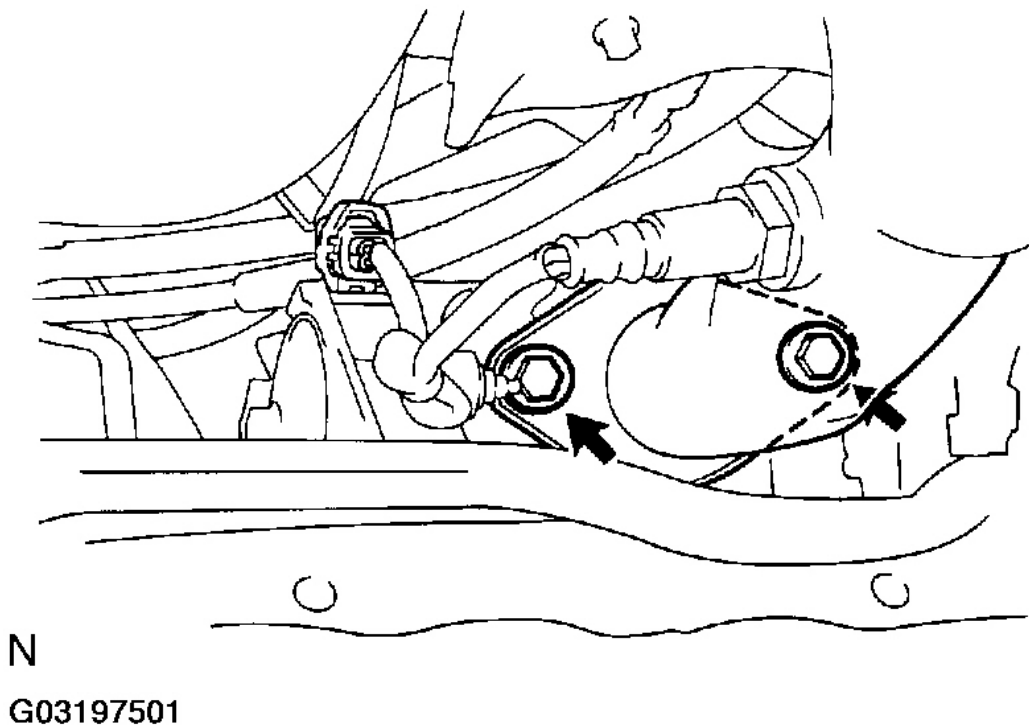


Fig. 265: Installing Exhaust Pipe Assy Front
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 (See ON-VEHICLE INSPECTION)**

OIL PUMP SEAL

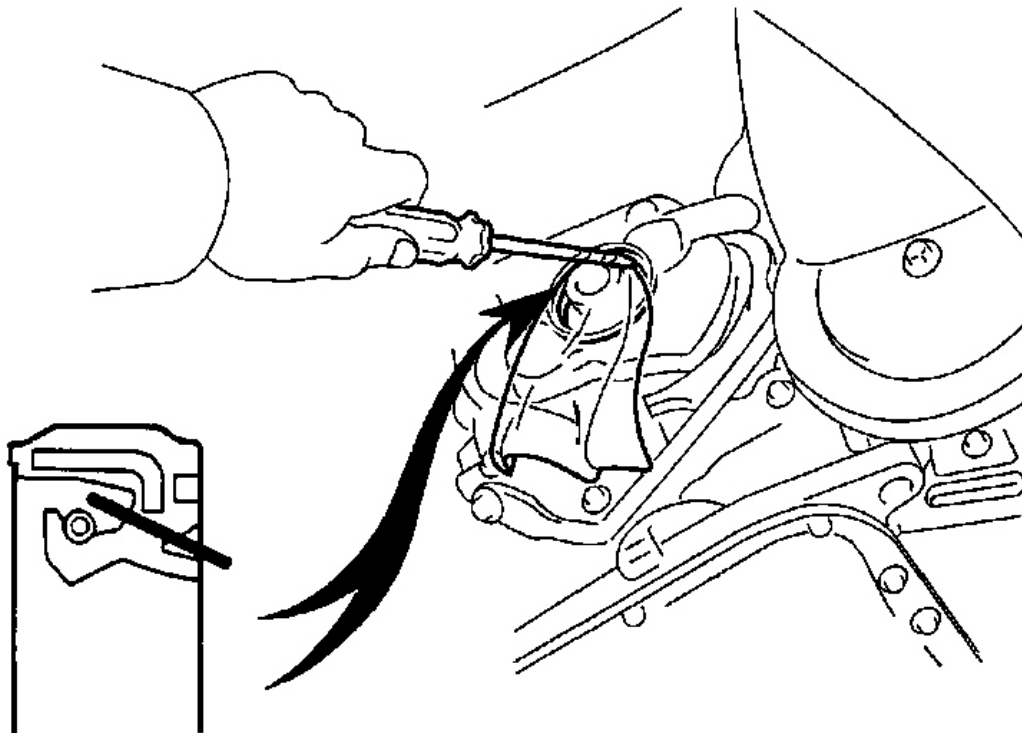
REPLACEMENT

1. **REMOVE FAN AND GENERATOR V BELT (See REPLACEMENT)**
2. **REMOVE FRONT WHEEL RH**
3. **REMOVE ENGINE UNDER COVER RH**
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.



G03197502

Fig. 266: 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.

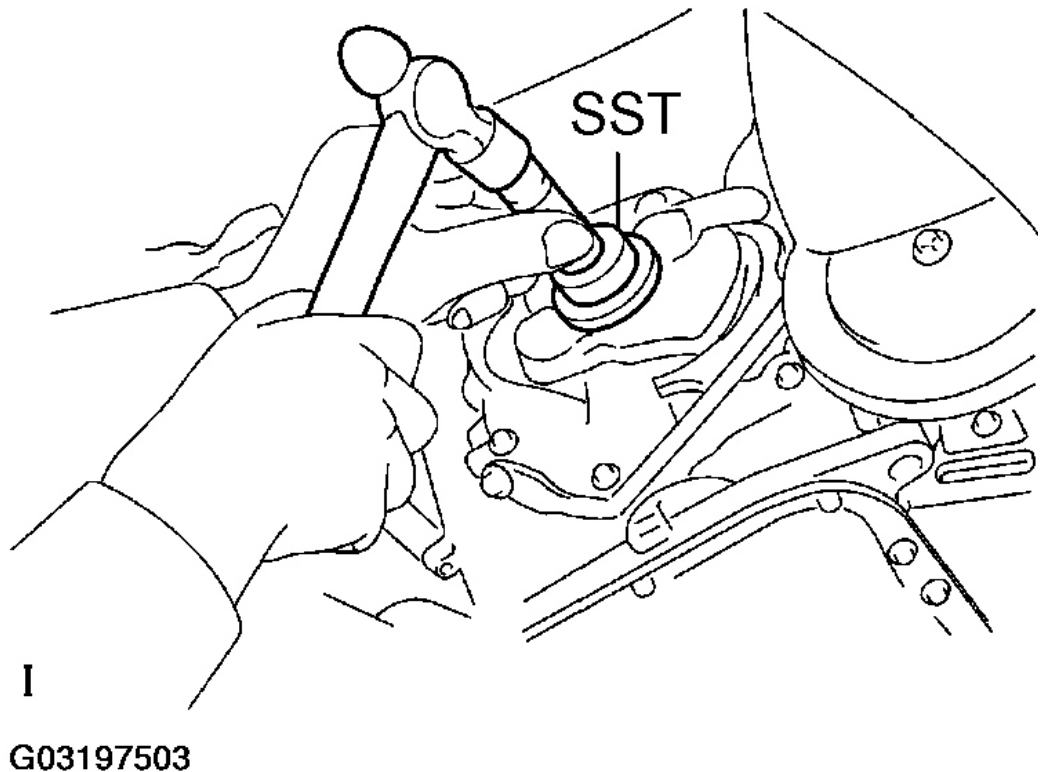


Fig. 267: Installing Oil Pump Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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. **ADD ENGINE OIL**
15. **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

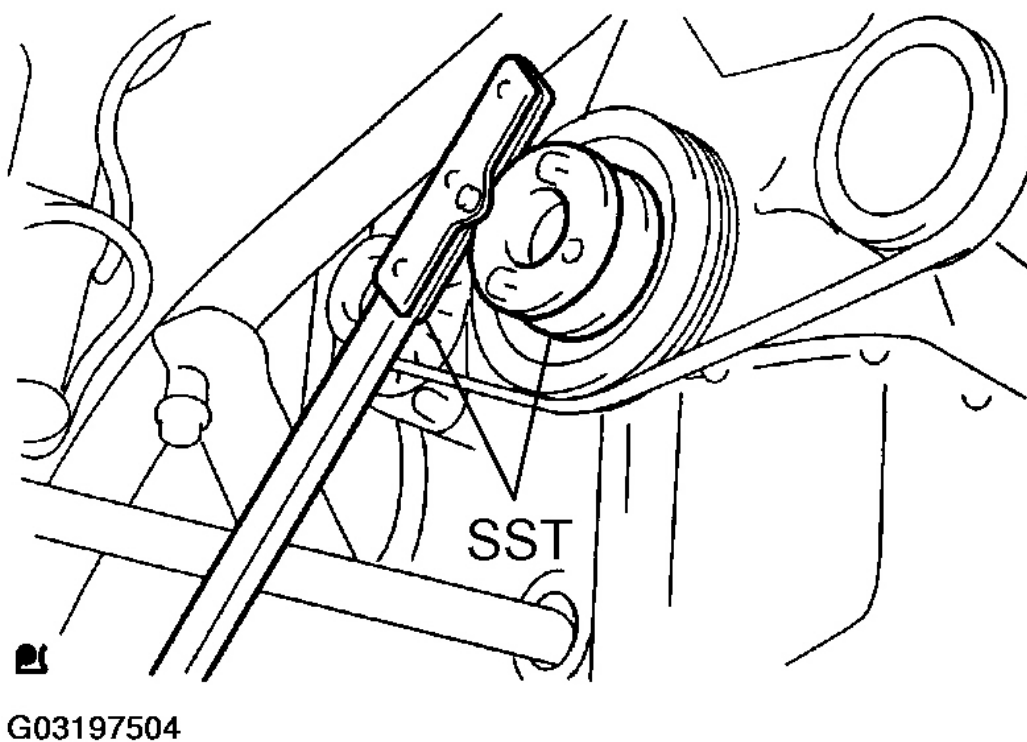


Fig. 268: Removing Flywheel
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.

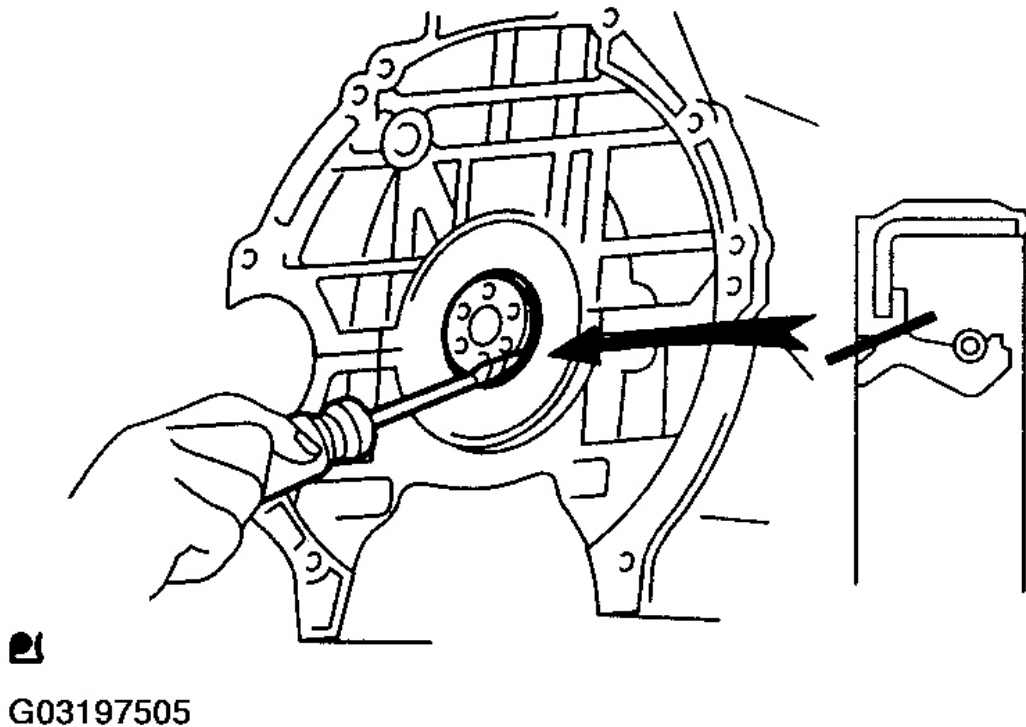


Fig. 269: Removing Engine Rear Oil Seal

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.

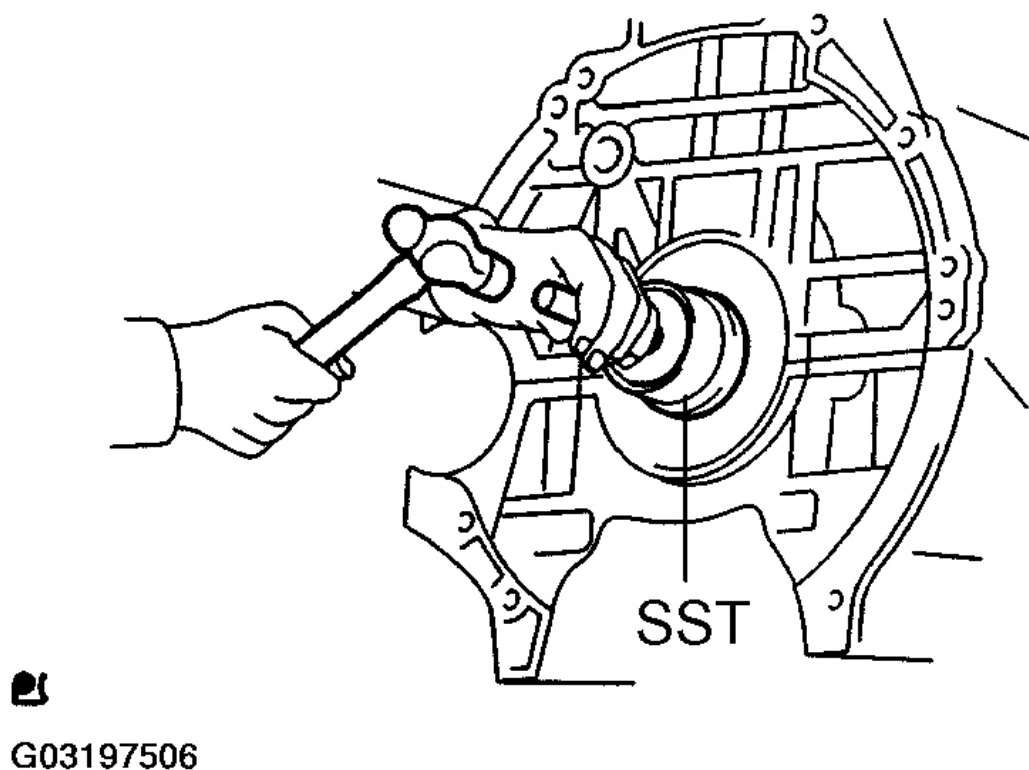


Fig. 270: Installing Engine Rear Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

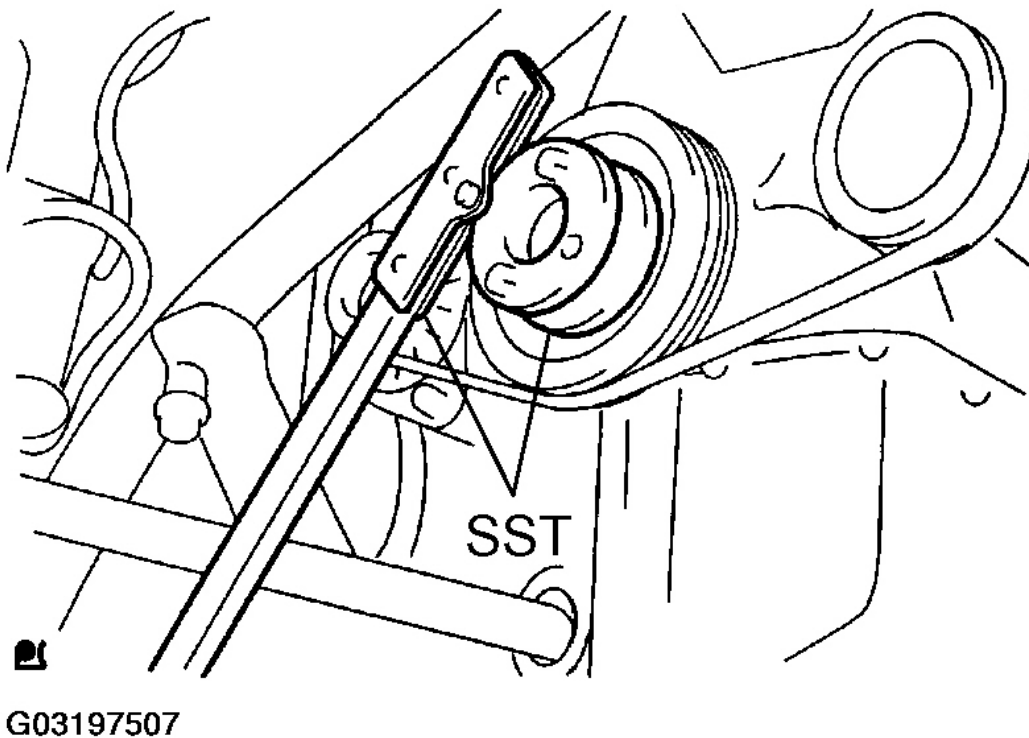
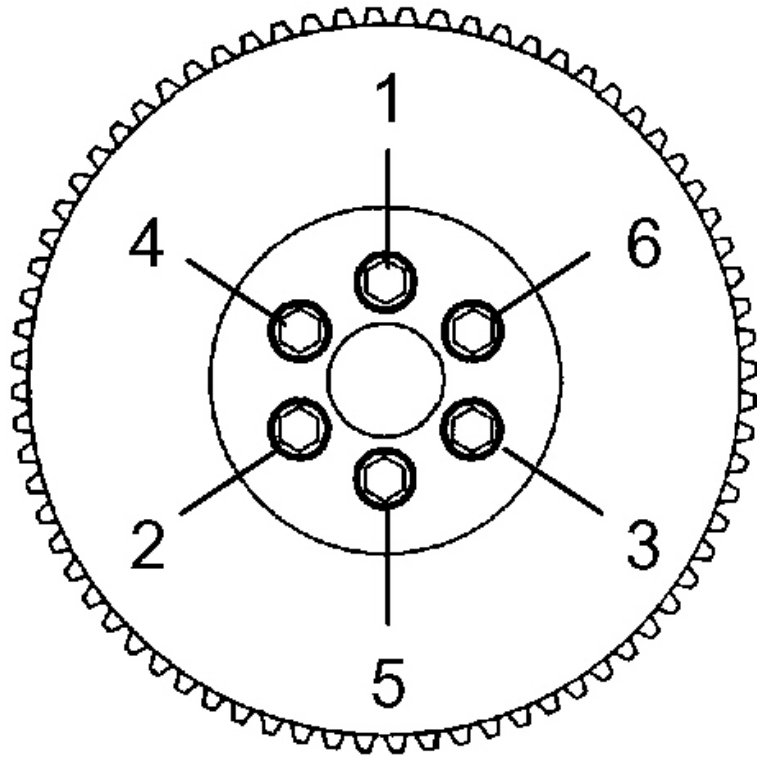


Fig. 271: Installing Flywheel

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

- b. Install the drive plate. (A/T)
 - 1. Clean the bolt and bolt hole.
 - 2. Apply adhesive to the bolts.
 - 3. Using several steps, uniformly install and tighten the 6 bolts in the sequence shown in the illustration.

Torque: 88 N.m (900 kgf.cm, 65 ft.lbf)



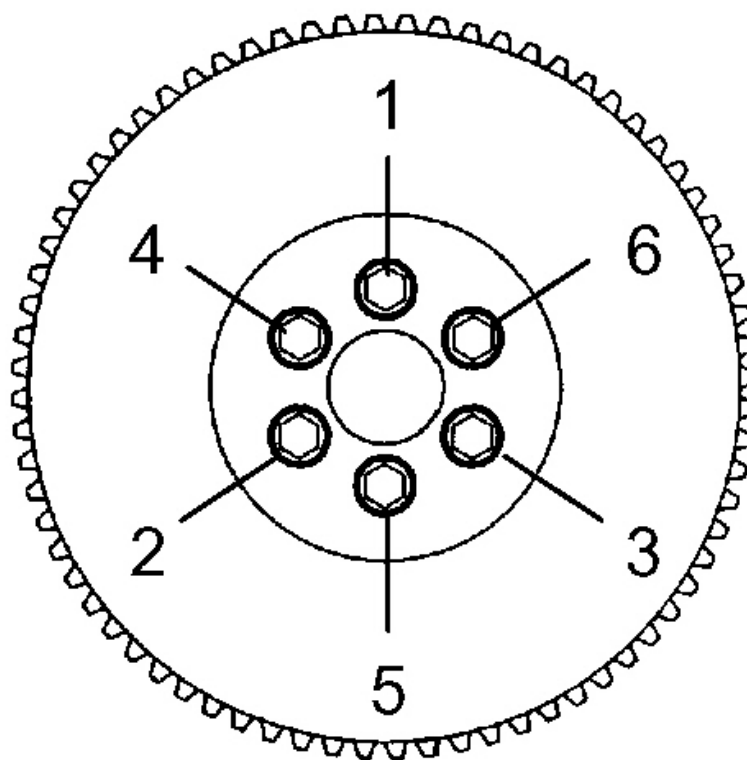
G03197508

Fig. 272: Identifying Tightening Sequence Of Drive Plate Bolt (A/T)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the flywheel. (M/T)
1. Clean the bolt hole.
 2. Using several steps, uniformly install and tighten 6 new bolts in the sequence shown in the illustration.

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

NOTE: Do not reuse the flywheel bolt. It may cause breakage of the flywheel bolt.



G03197509

Fig. 273: Identifying Tightening Sequence Of Flywheel Bolt (M/T)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Mark the flywheel bolt with paint.
4. Retighten the flywheel bolts by an additional 90°.
5. Check that the paint mark is at 90° position from the original location.

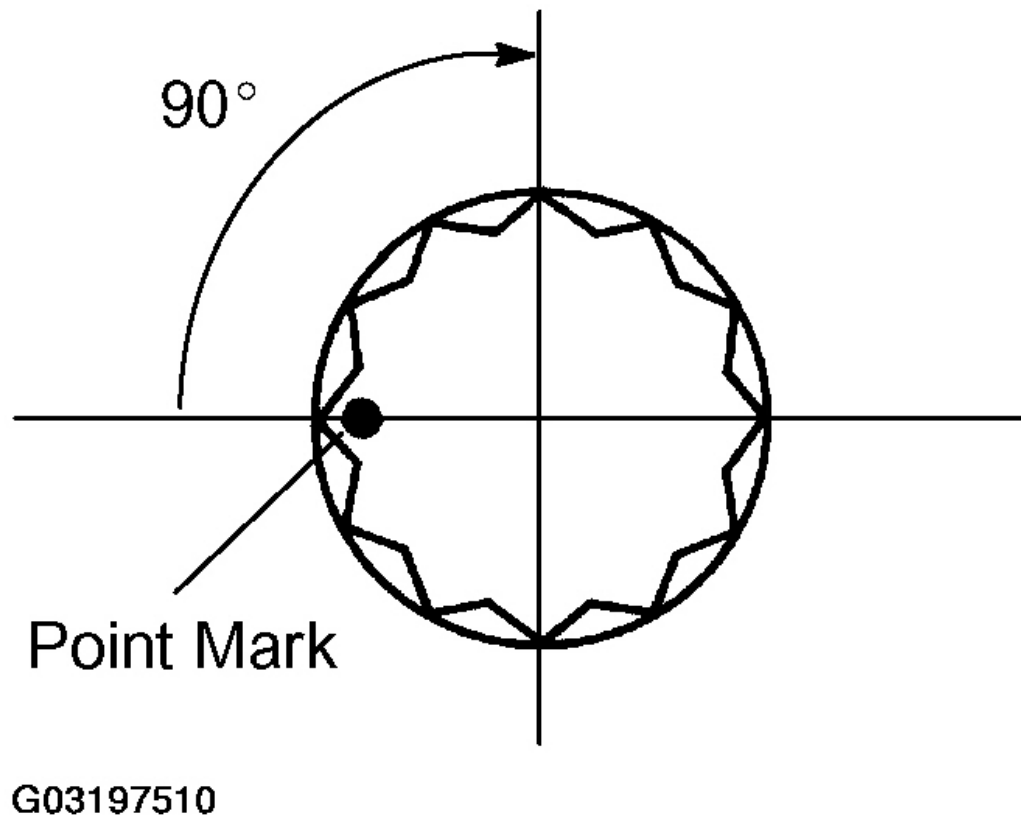
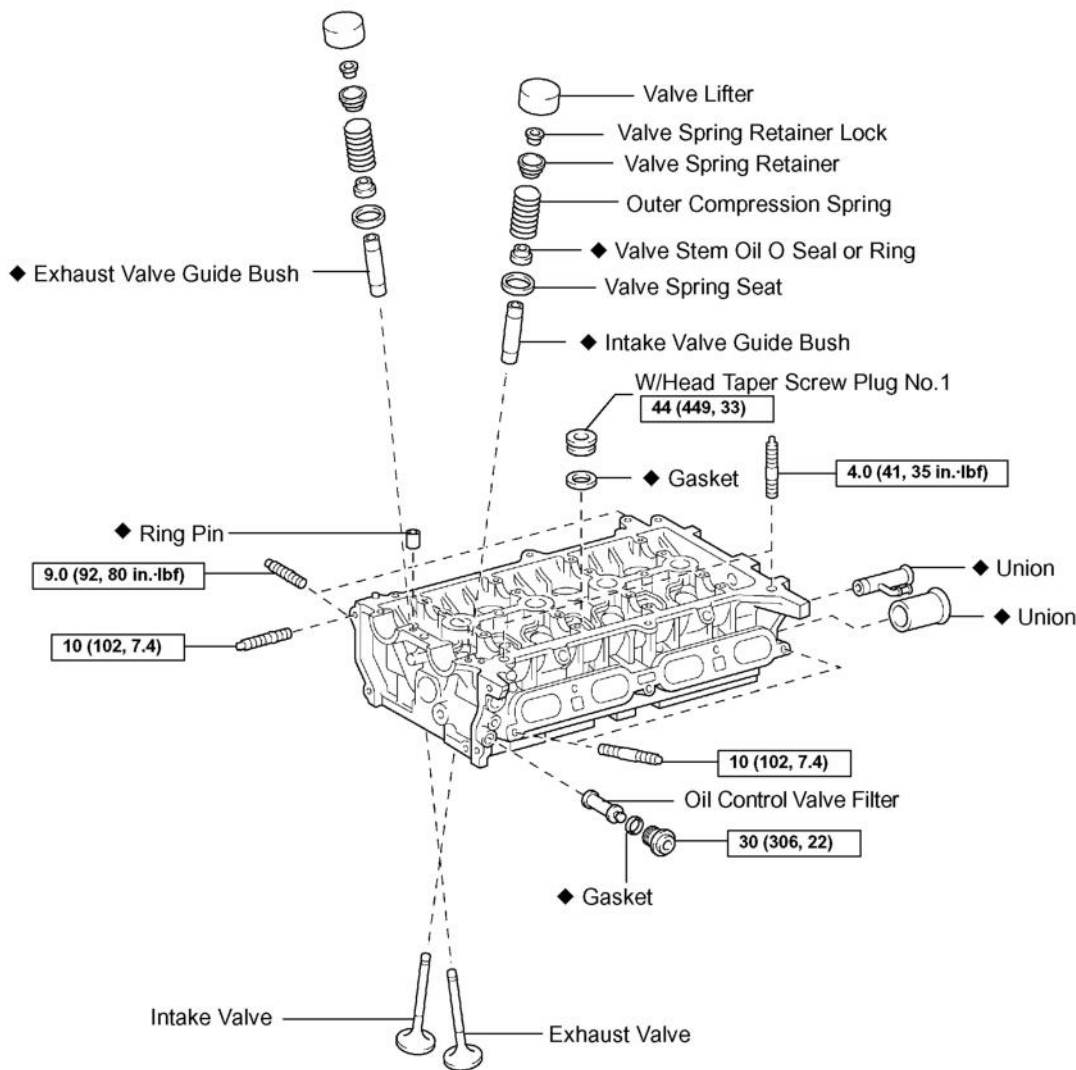


Fig. 274: Retightening Flywheel Bolts By Additional 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Y

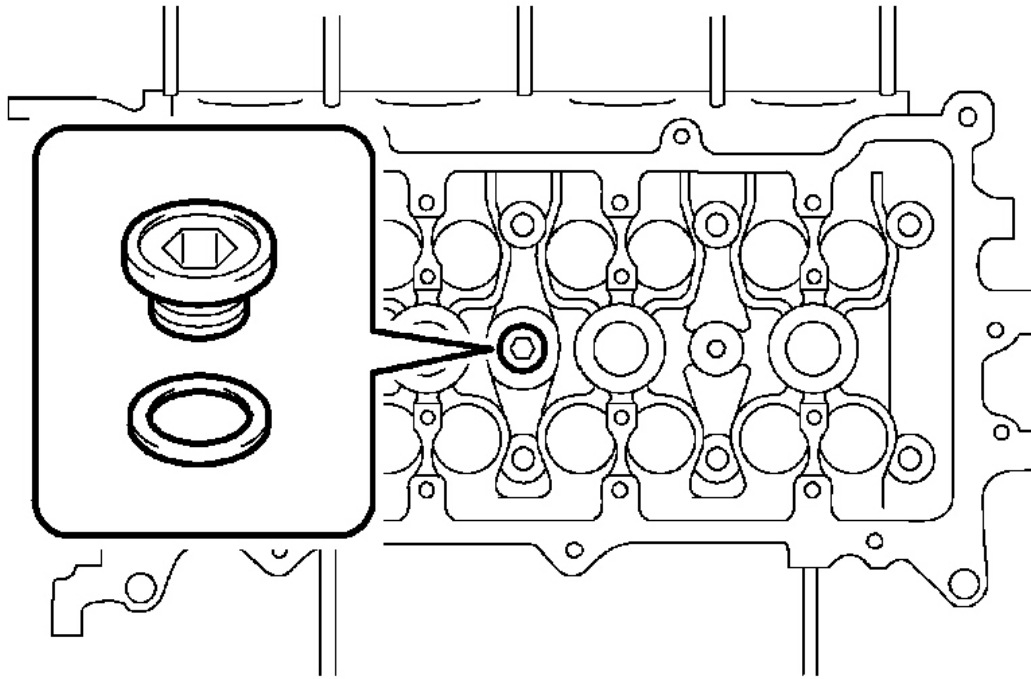
G03197511

Fig. 275: Identifying 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 the gasket.



G03197512

Fig. 276: Identifying Taper Screw Plug & Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

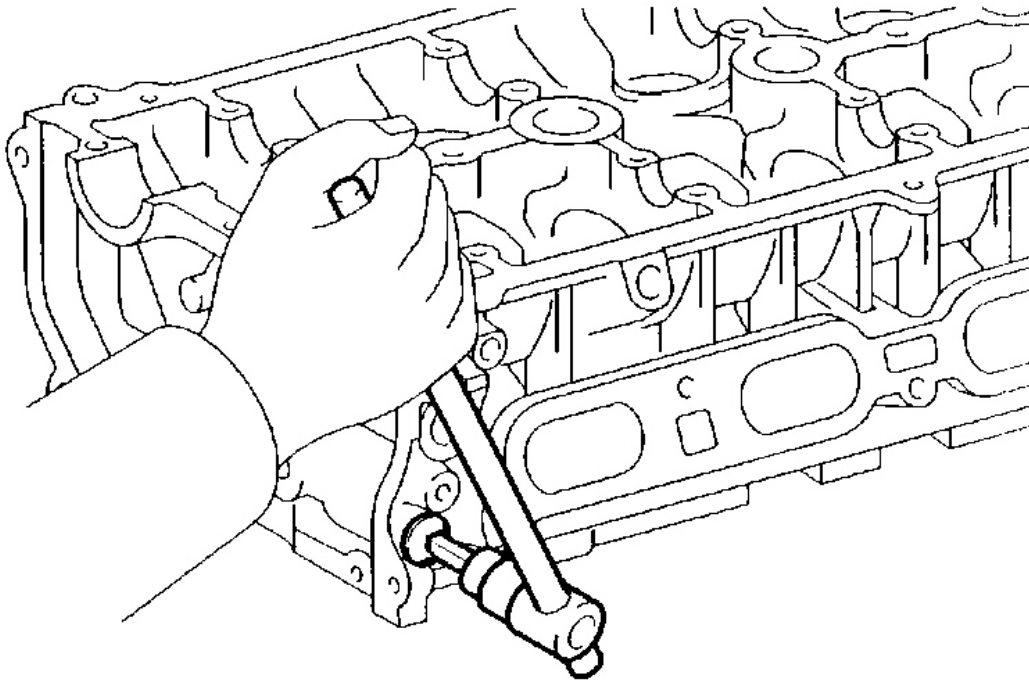
2. REMOVE VALVE LIFTER

HINT:

Keep the valve lifters in 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.
- b. Remove the filter and gasket.

**G03197513****Fig. 277: Removing Taper Screw Plug****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****4. REMOVE INTAKE VALVE**

- a. Using SST, compress the valve spring and remove the 2 retainer locks, retainer, and valve spring.

SST 09202-70020 (09202-00010)

HINT:

Keep the valves, valve springs, spring seats and spring retainers in correct order so they can be returned to the original locations when re-assembling.

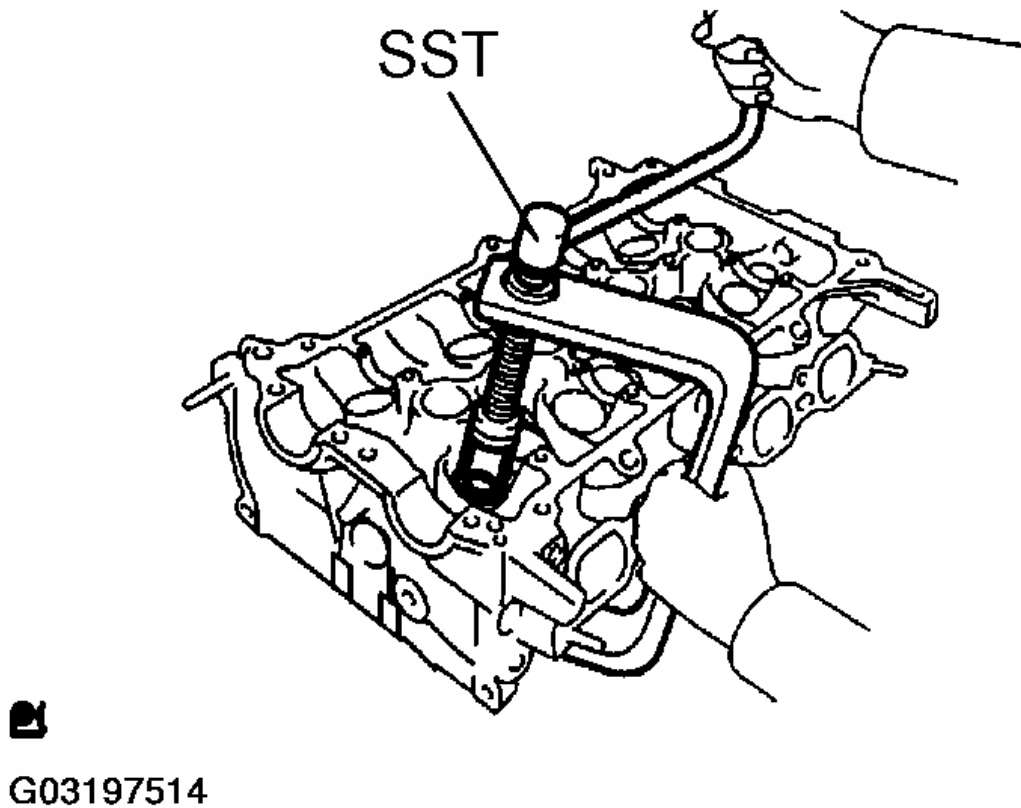


Fig. 278: Removing Retainer Locks, Retainer & Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE EXHAUST VALVE

- a. Using SST, compress the valve spring and remove the 2 retainer locks, retainer, and valve spring.

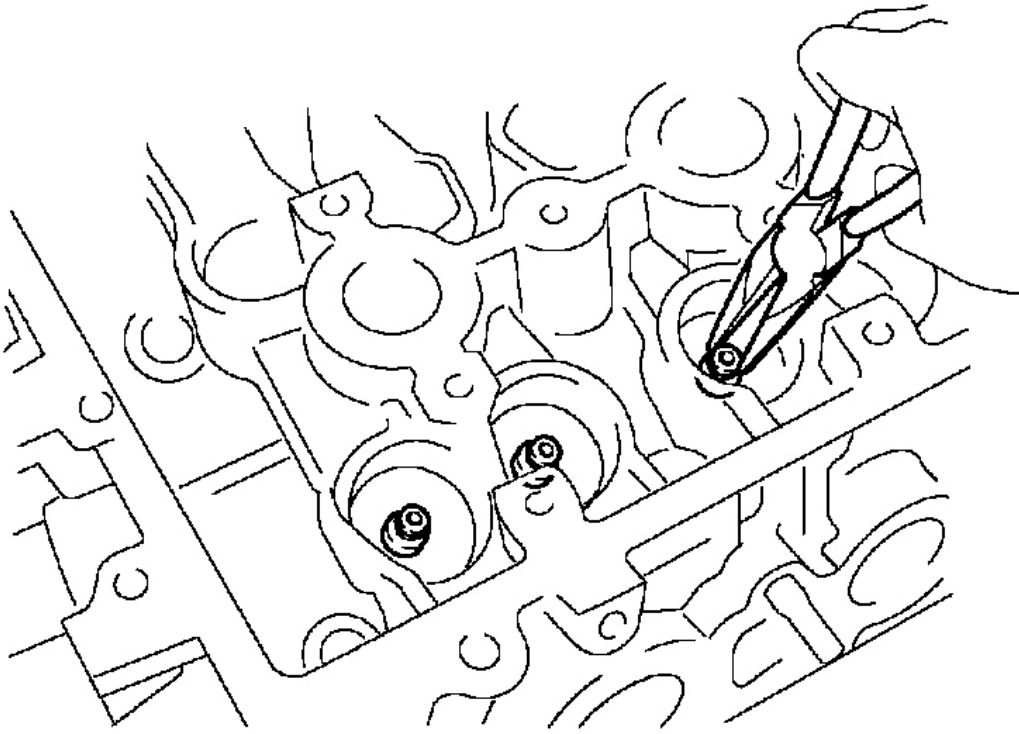
SST 09202-70020 (09202-00010)

HINT:

Keep the valves, valve springs, spring seats and spring retainers in correct order so they can be returned to the original locations when re-assembling.

6. REMOVE VALVE STEM OIL SEAL OR RING

- a. Using needle-nose pliers, remove the oil seal.



G03197515

Fig. 279: Removing Oil Seal Using Needle-Nose Pliers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE VALVE SPRING SEAT

- a. Using a compressed air and a magnetic finger, remove the valve spring seats.

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

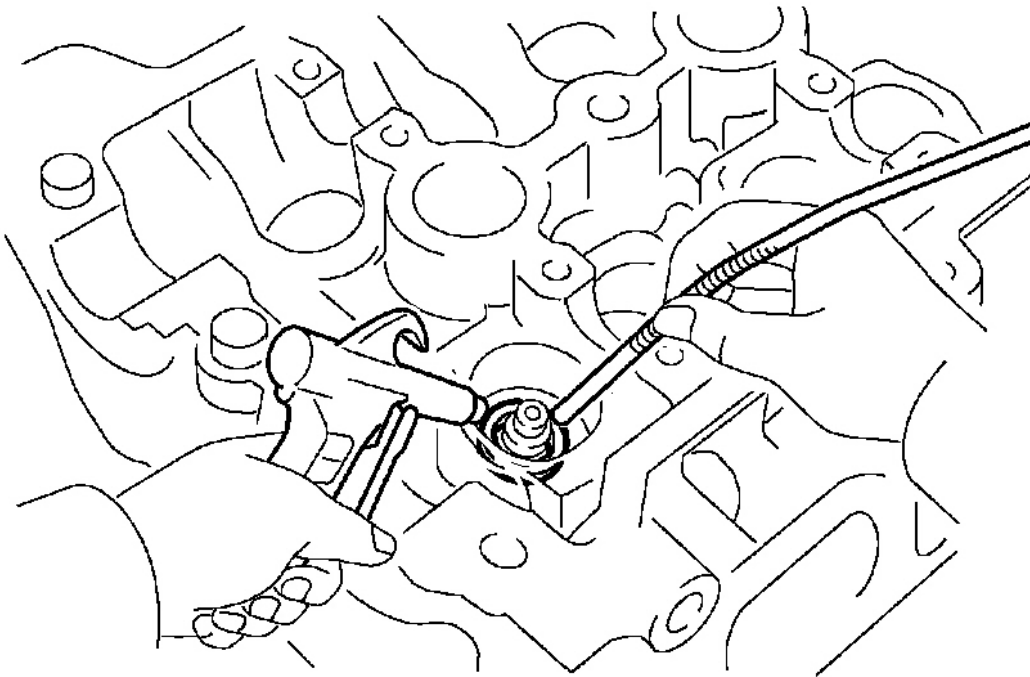
**G03197516**

Fig. 280: Removing Valve Spring Seats

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

11. INSPECT CYLINDER HEAD FOR FLATNESS

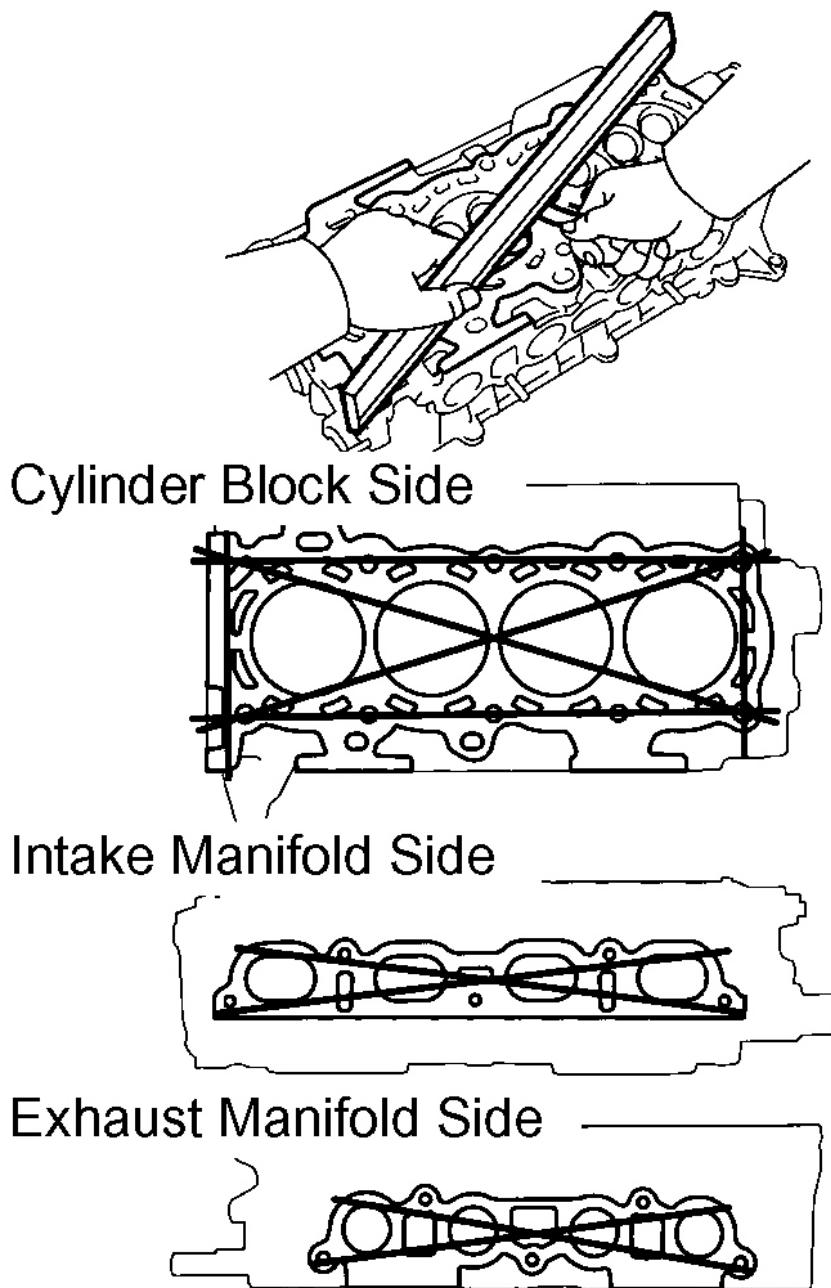
- a. Using a precision straight edge and a feeler gauge, measure the surface that is in contact with the cylinder block and the manifolds for warpage.

Maximum warpage:

Cylinder block surface 0.05 mm (0.0020 in.)

Intake manifold surface 0.10 mm (0.0039 in.)

Exhaust manifold surface 0.10 mm (0.0039 in.)



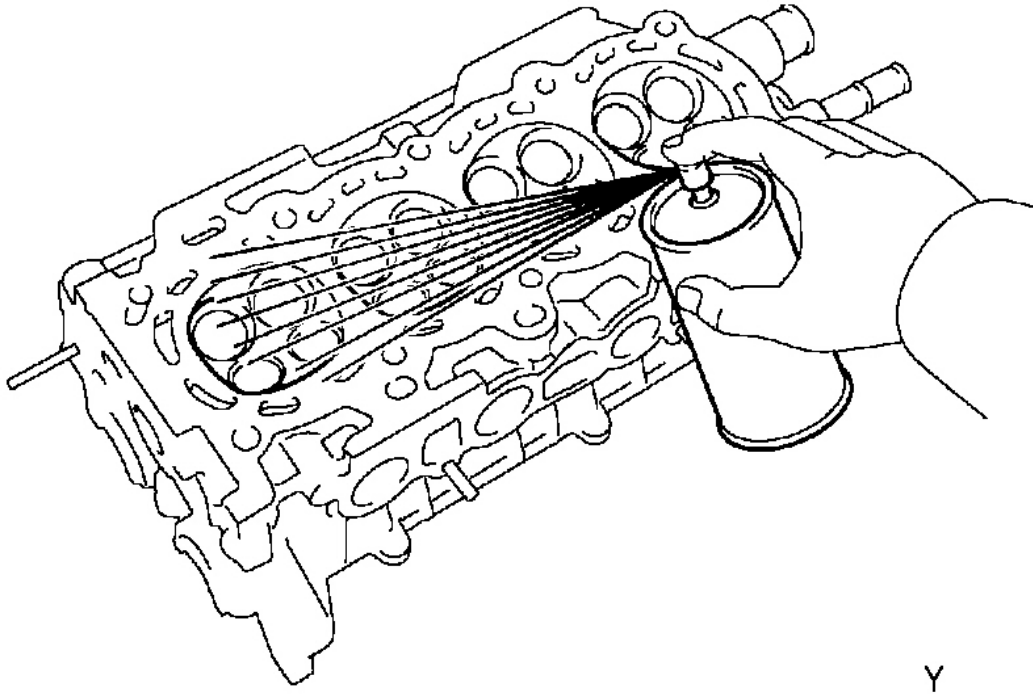
G03197517

Fig. 281: Checking 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.



G03197518

Fig. 282: Checking Combustion Chamber, Intake Ports, Exhaust Ports & Cylinder Block Surface For Cracks

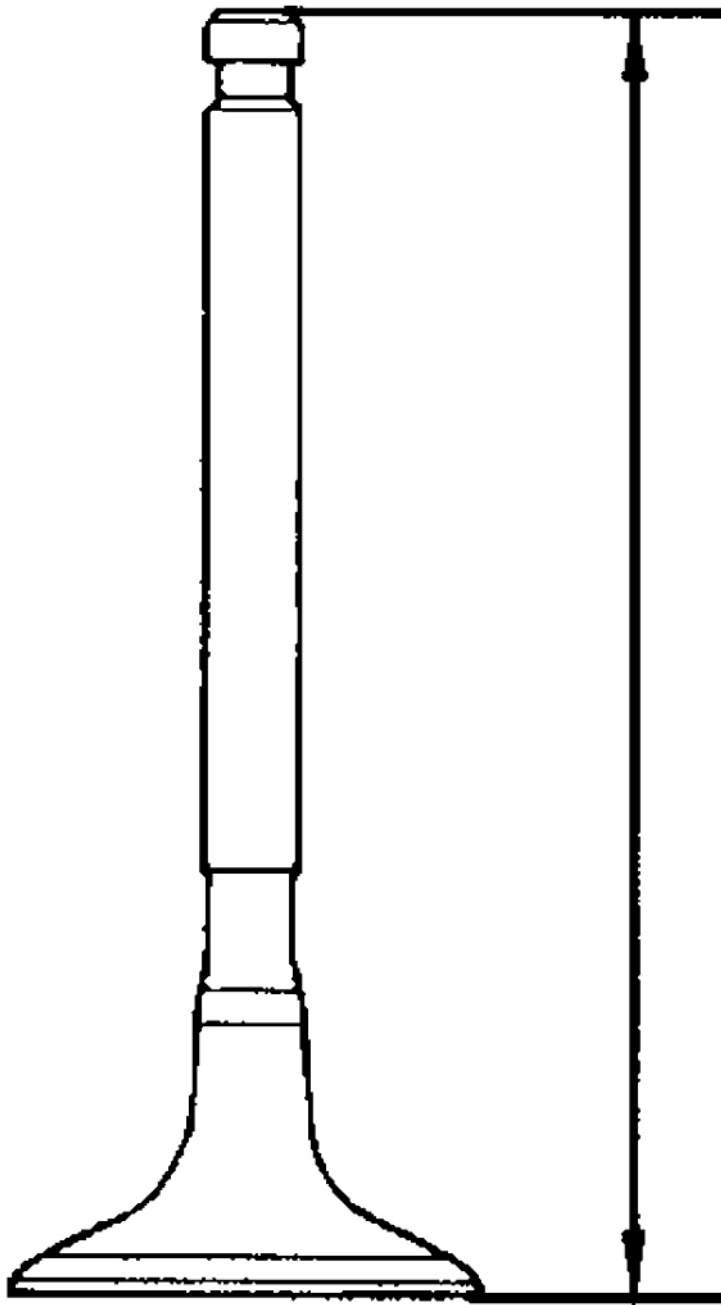
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSPECT INTAKE VALVE

- a. Check the valve overall length.

Standard overall length: 89.25 mm (3.5138 in.)

Minimum overall length: 88.75 mm (3.4941 in.)



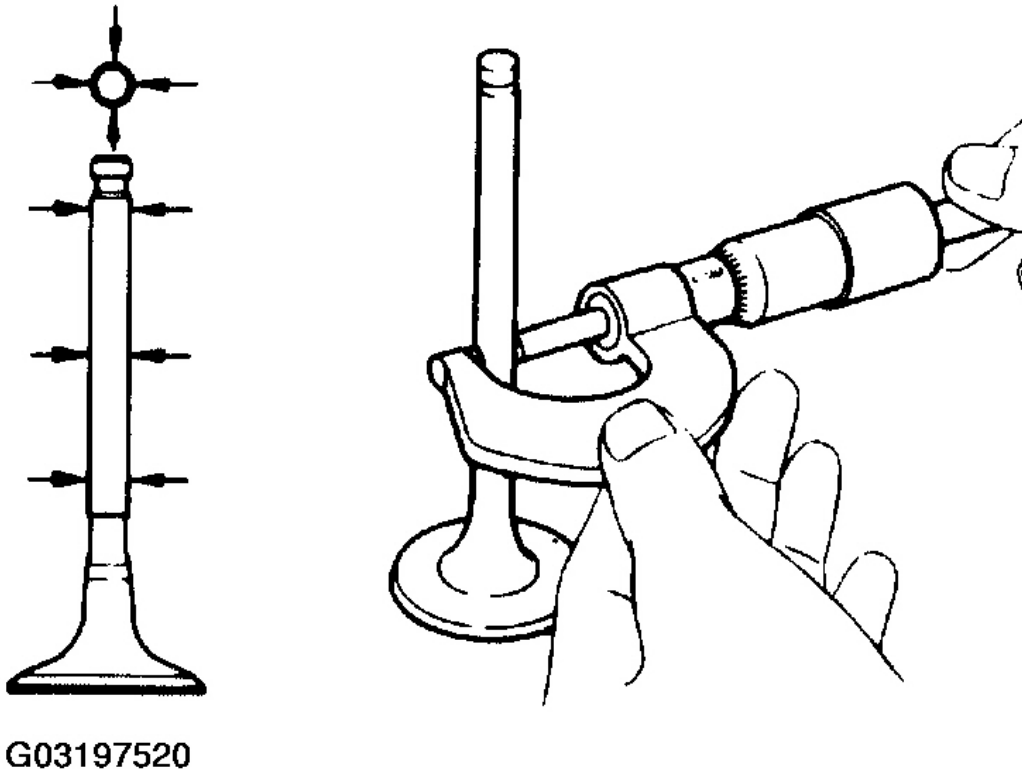
G03197519

Fig. 283: Identifying Valve Overall Length
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.)



G03197520

Fig. 284: Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check the valve head margin thickness.

Standard margin thickness: 1.0 mm (0.039 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

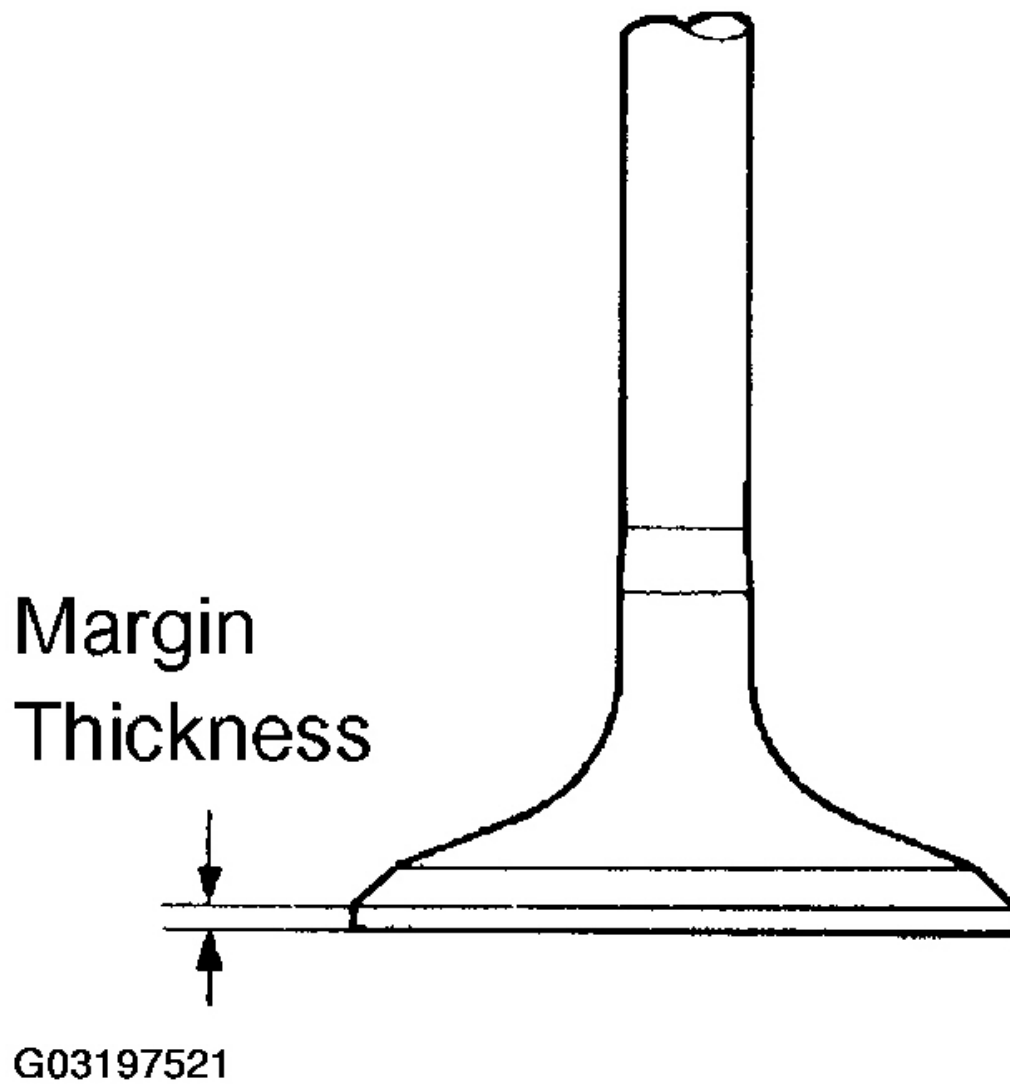


Fig. 285: Identifying Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT EXHAUST VALVE

- a. Check 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. Check the valve head margin thickness.

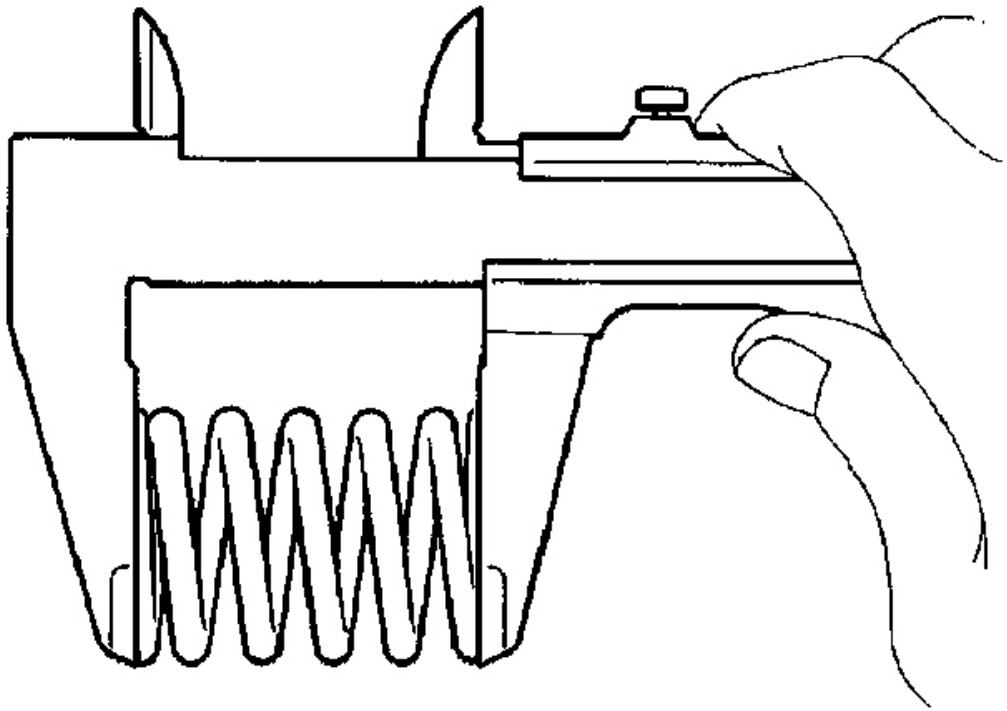
Standard margin thickness: 1.15 mm (0.045 in.)

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.)



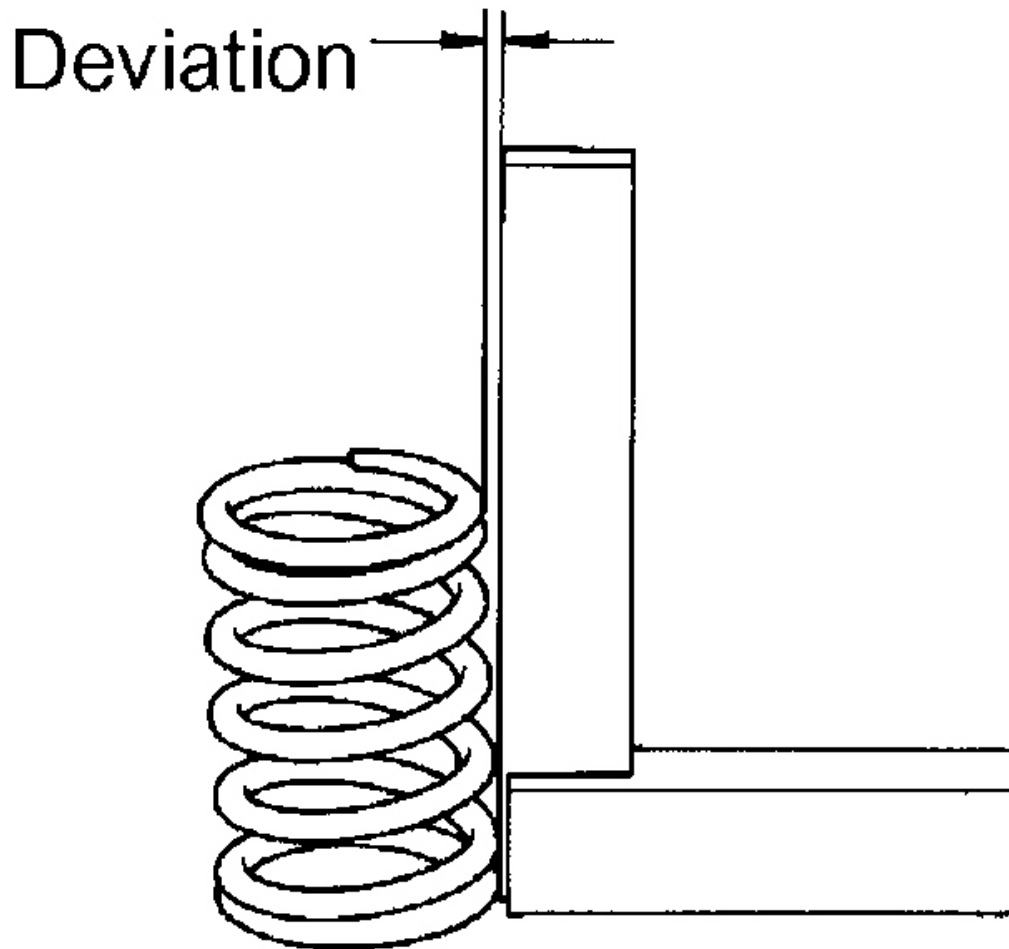
G03197522

Fig. 286: 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°



G03197523

Fig. 287: Measuring Deviation Of Valve Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a spring tester, measure tension of the valve spring at the specified installed length.

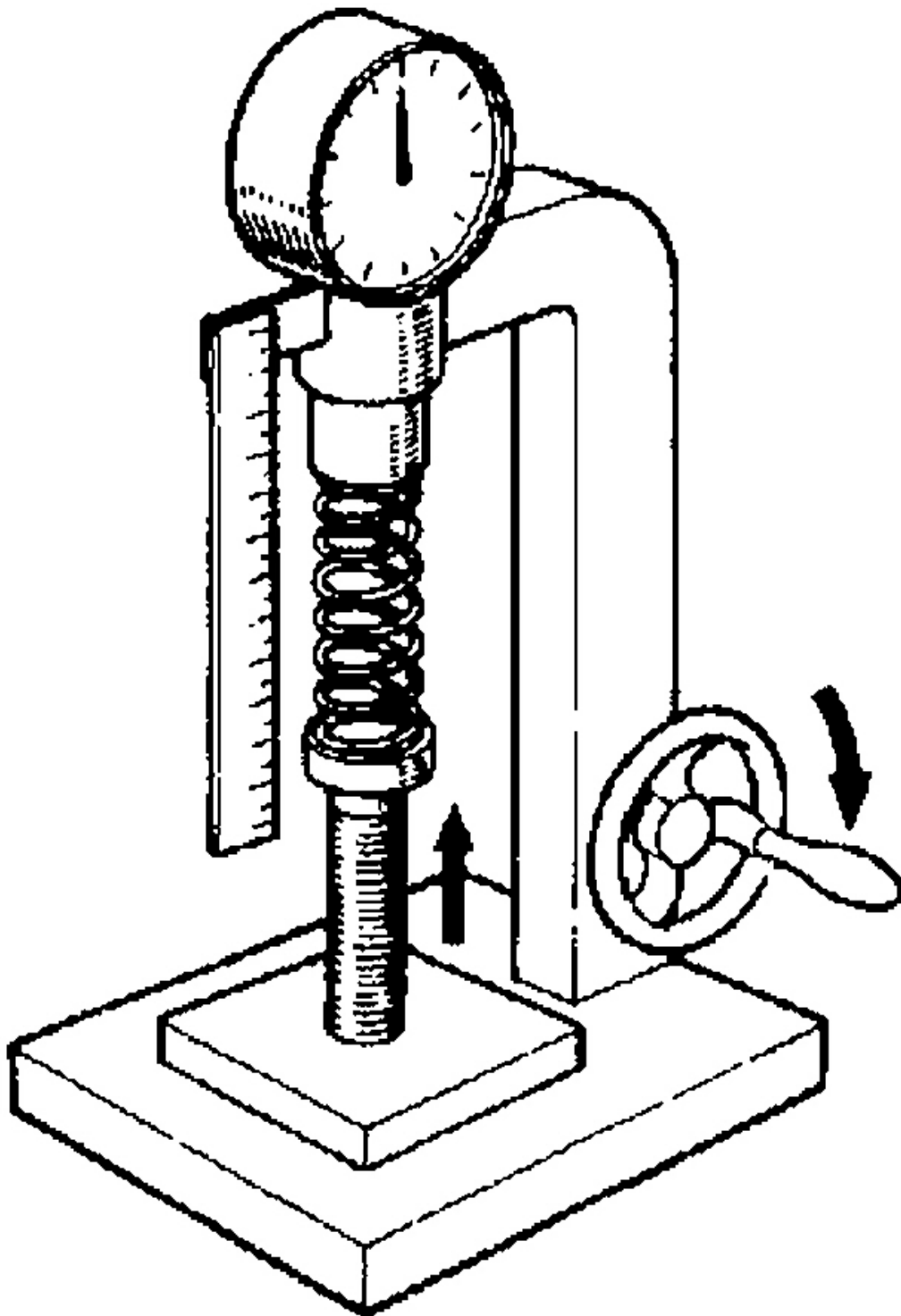
Installed tension:

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.)

If the installed tension is not as specified, replace the valve spring.



G03197524

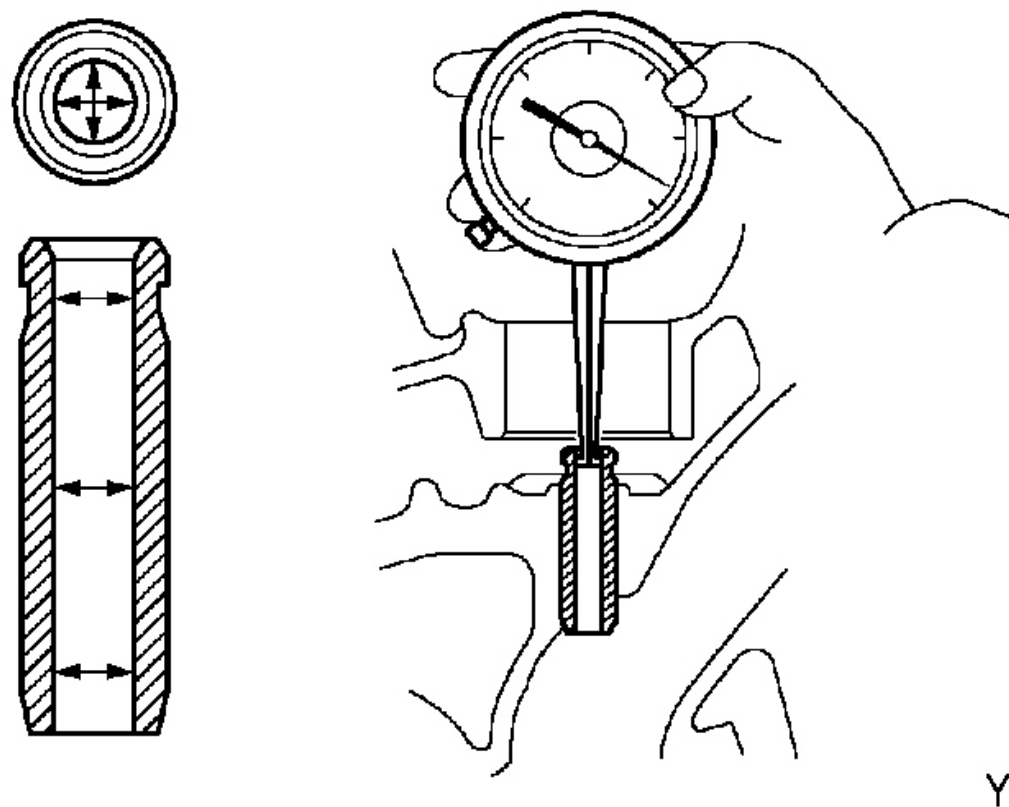
Fig. 288: Measuring Tension Of Valve Spring**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****16. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE**

- 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.)**

- 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.)**

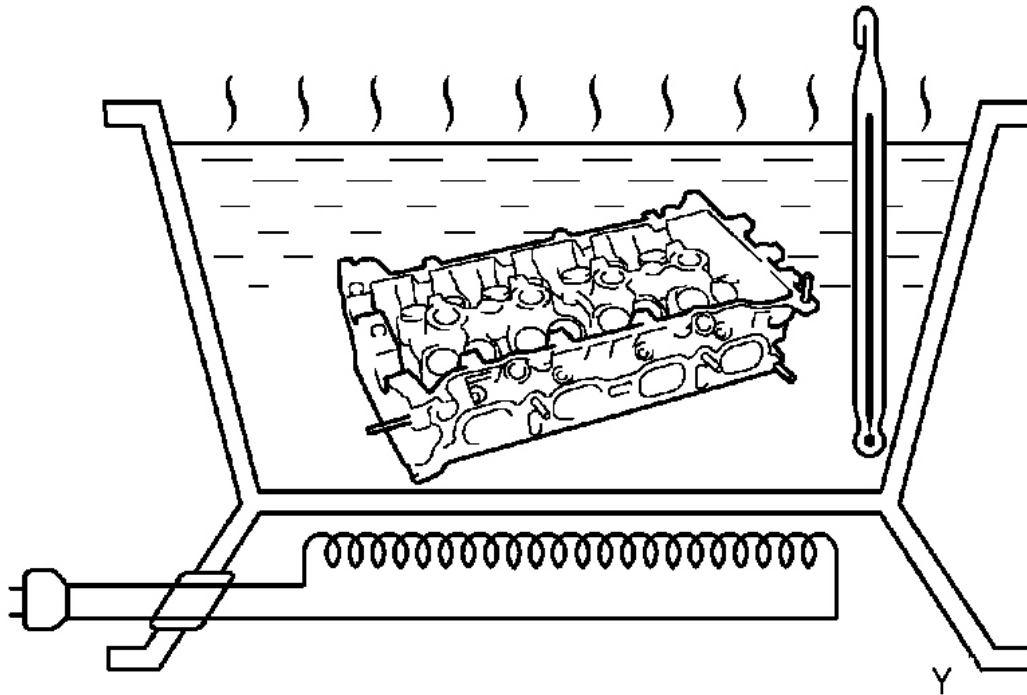


G03197525

Fig. 289: Measuring Inside Diameter Of Guide Bushing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. REMOVE INTAKE VALVE GUIDE BUSH

- a. Heat the cylinder head to 80 to 100°C (176 to 212°F).



G03197526

Fig. 290: Heating Cylinder Head

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

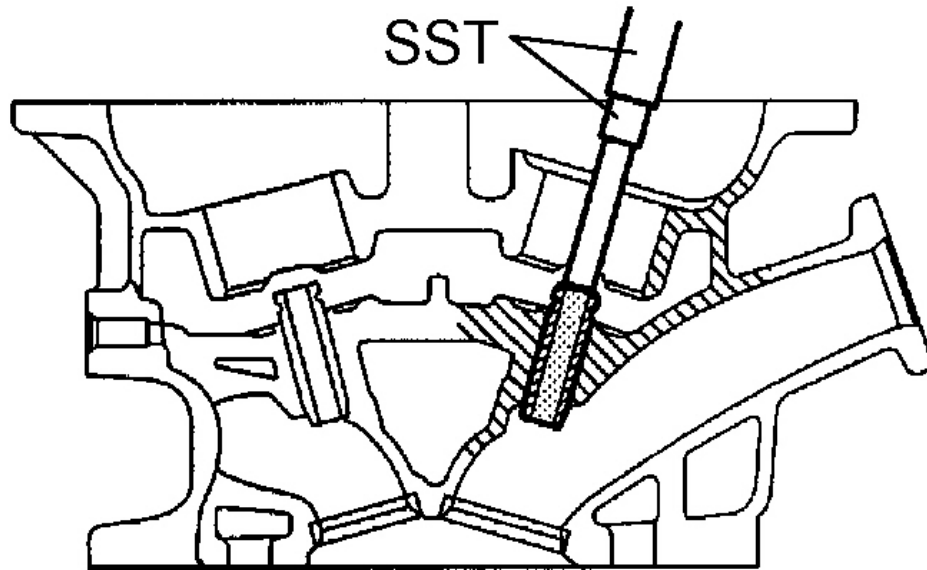
- b. Using SST and a hammer, tap out the guide bushing.

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)



G03197527

Fig. 291: 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.

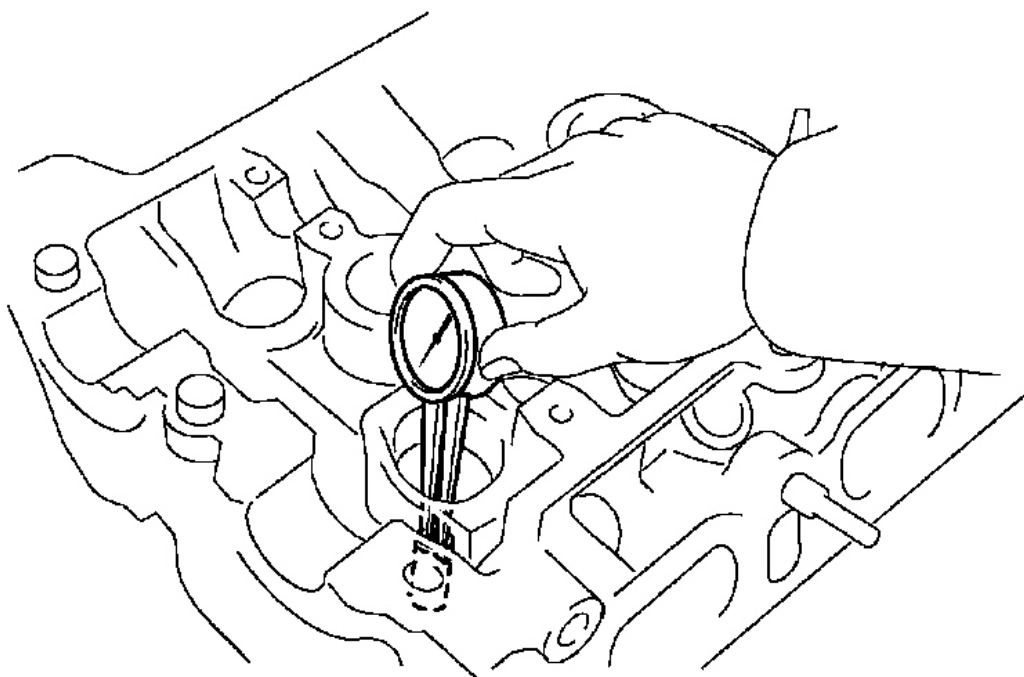
Diameter: 9.685 to 9.706 mm (0.3813 to 0.3821 in.)

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 DIAMETER AND BUSHING SIZE SPECIFICATION

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



G03197528

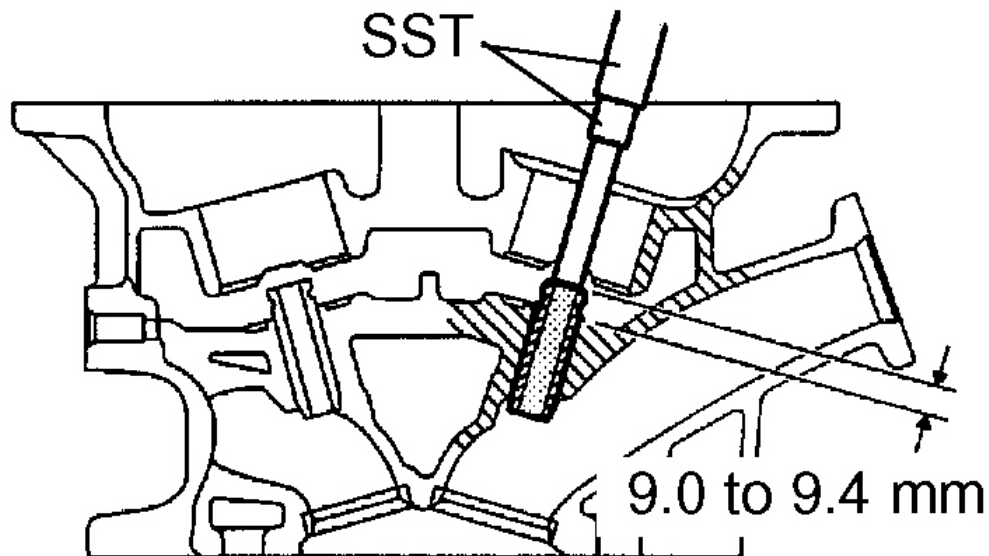
Fig. 292: Measuring Bushing Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.)



G03197529

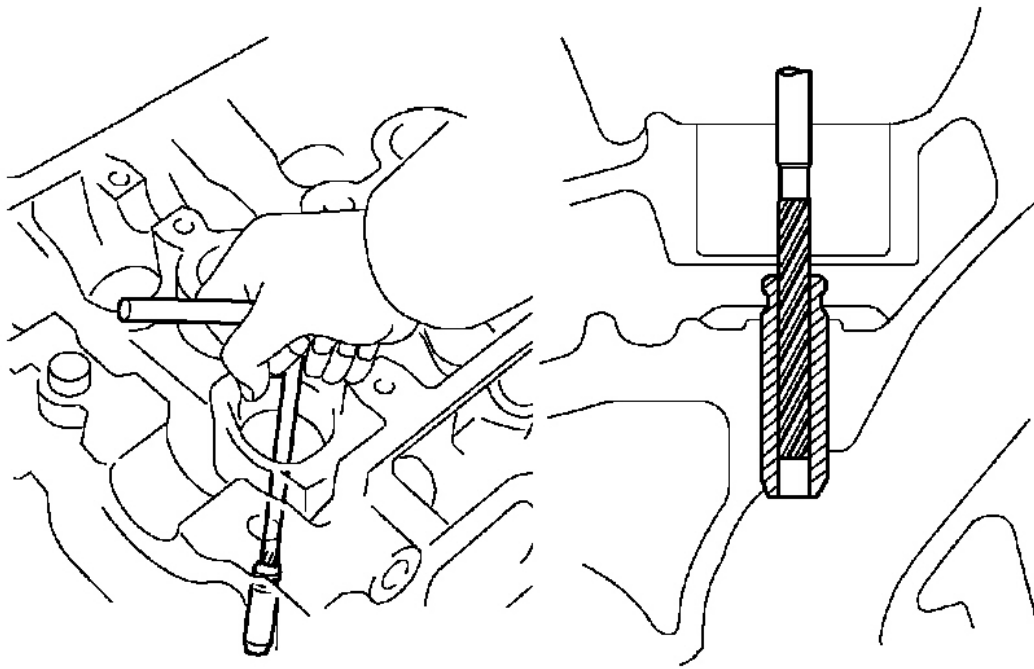
Fig. 293: Taping In New Guide Bushing

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 the valve stem.

Standard oil clearance:

0.025 to 0.060 mm (0.0010 to 0.0024 in.)



G03197530

Fig. 294: 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 DIAMETER AND BUSHING SIZE SPECIFICATION

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 procedure.
 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.).

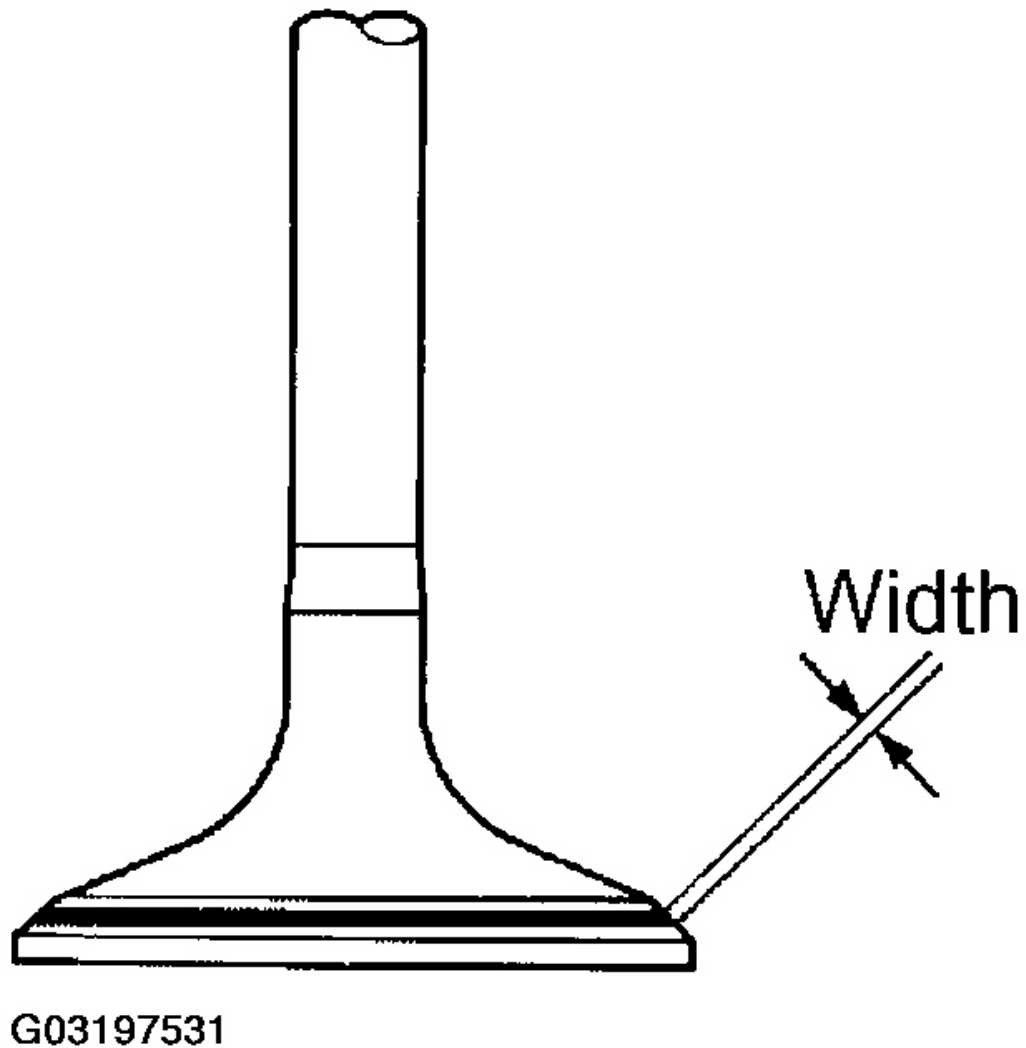
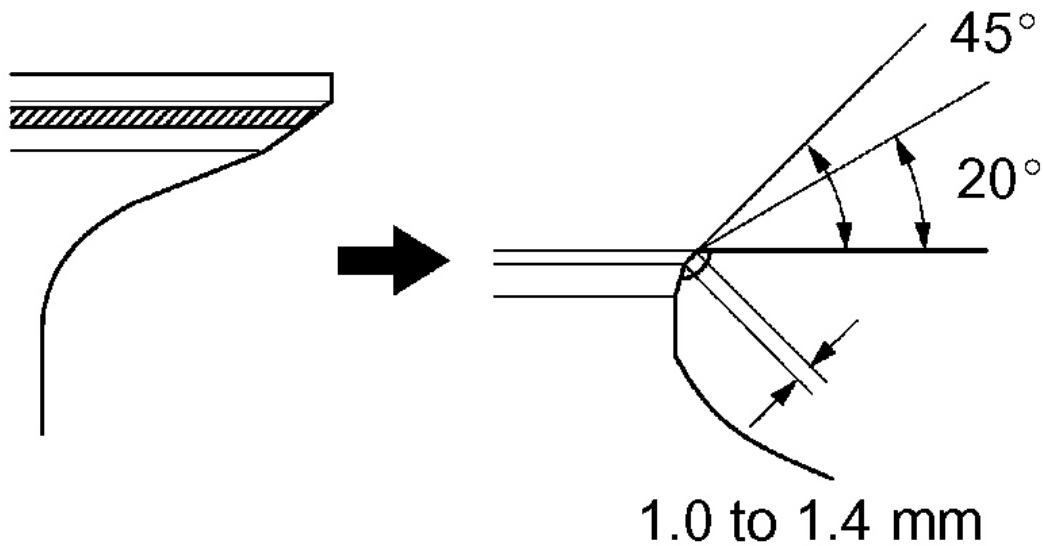


Fig. 295: Identifying Valve Seat Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. REPAIR INTAKE VALVE SEAT

NOTE: Releasing the seat-cutter pressure gradually helps to make smoother valve seat faces.

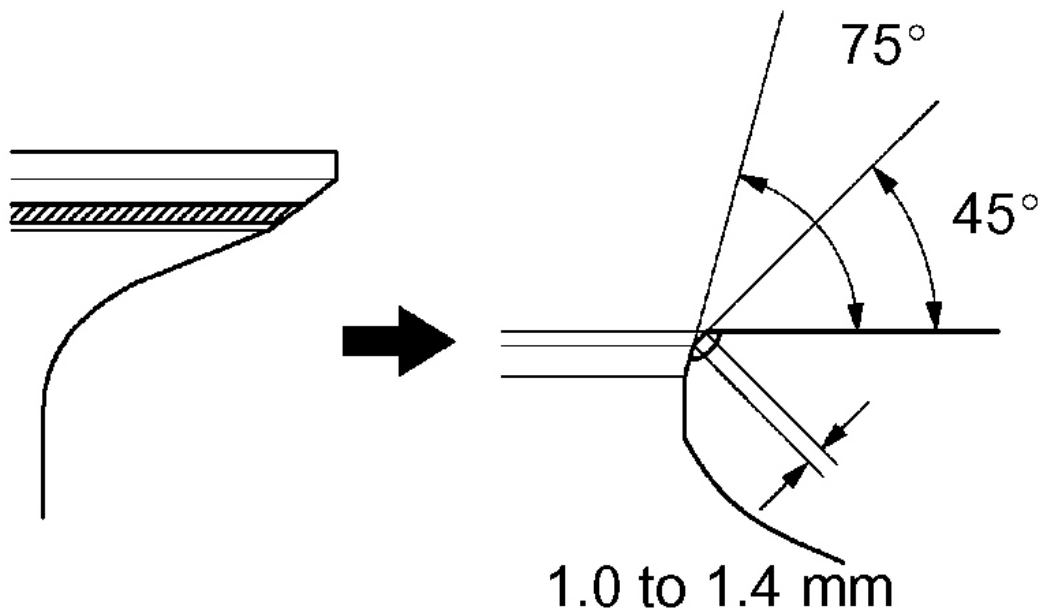
- a. If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.



G03197532

Fig. 296: Identifying Intake Valve Seat Cutter Angle (If Seating Too High On Valve Face)
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.
- c. Hand-lap the valve and valve seat with an abrasive compound.
- d. Recheck the valve seating position.



G03197533

Fig. 297: Identifying Intake Valve Seat Cutter Angle (If Seating Too Low On Valve Face)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. REPAIR EXHAUST VALVE SEAT

NOTE: Releasing the seat-cutter pressure gradually helps to make smoother valve seat faces.

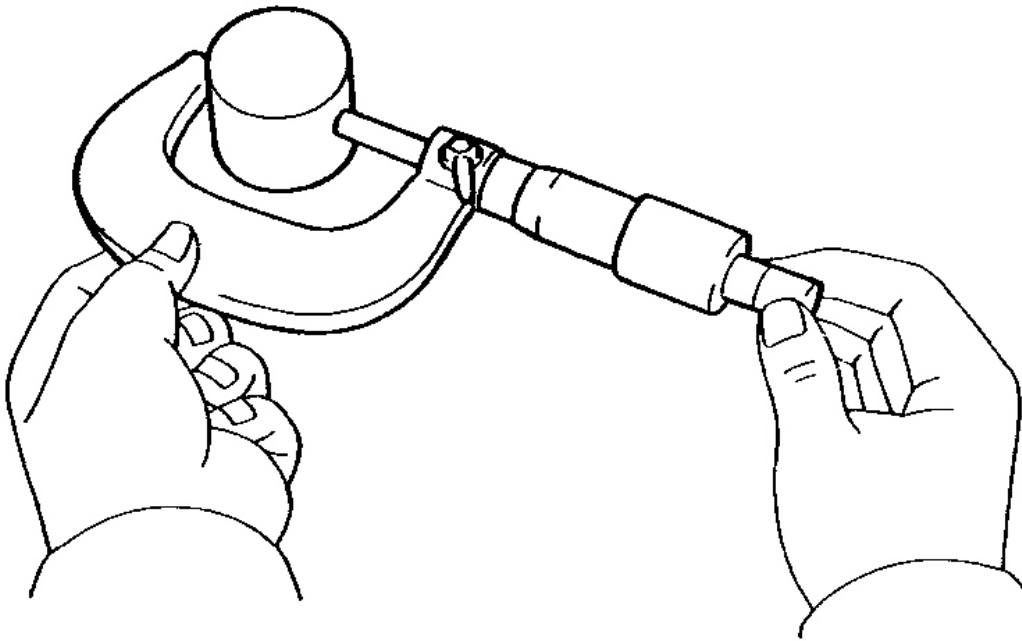
- If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.
- If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
- Hand-lap the valve and valve seat with an abrasive compound.
- Recheck the valve seating position.

24. INSPECT VALVE LIFTER

- Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 to 30.976 mm (1.2191 to 1.2195 in.)



G03197534

Fig. 298: Measuring Lifter Diameter

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

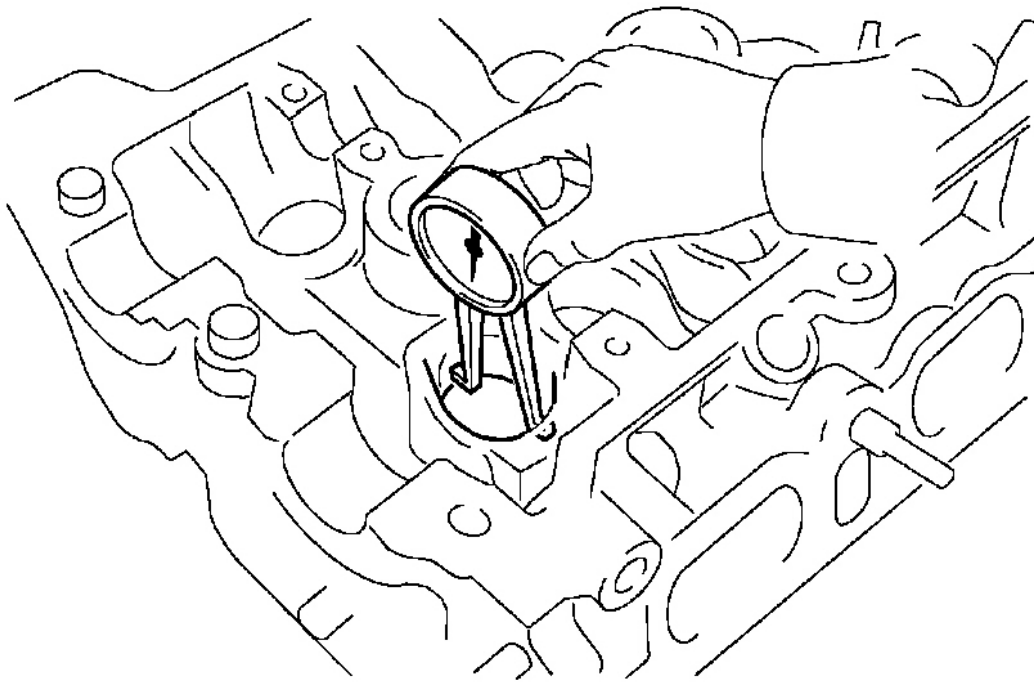
25. INSPECT VALVE LIFTER OIL CLEARANCE

- 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.)**

- 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.)**



G03197535

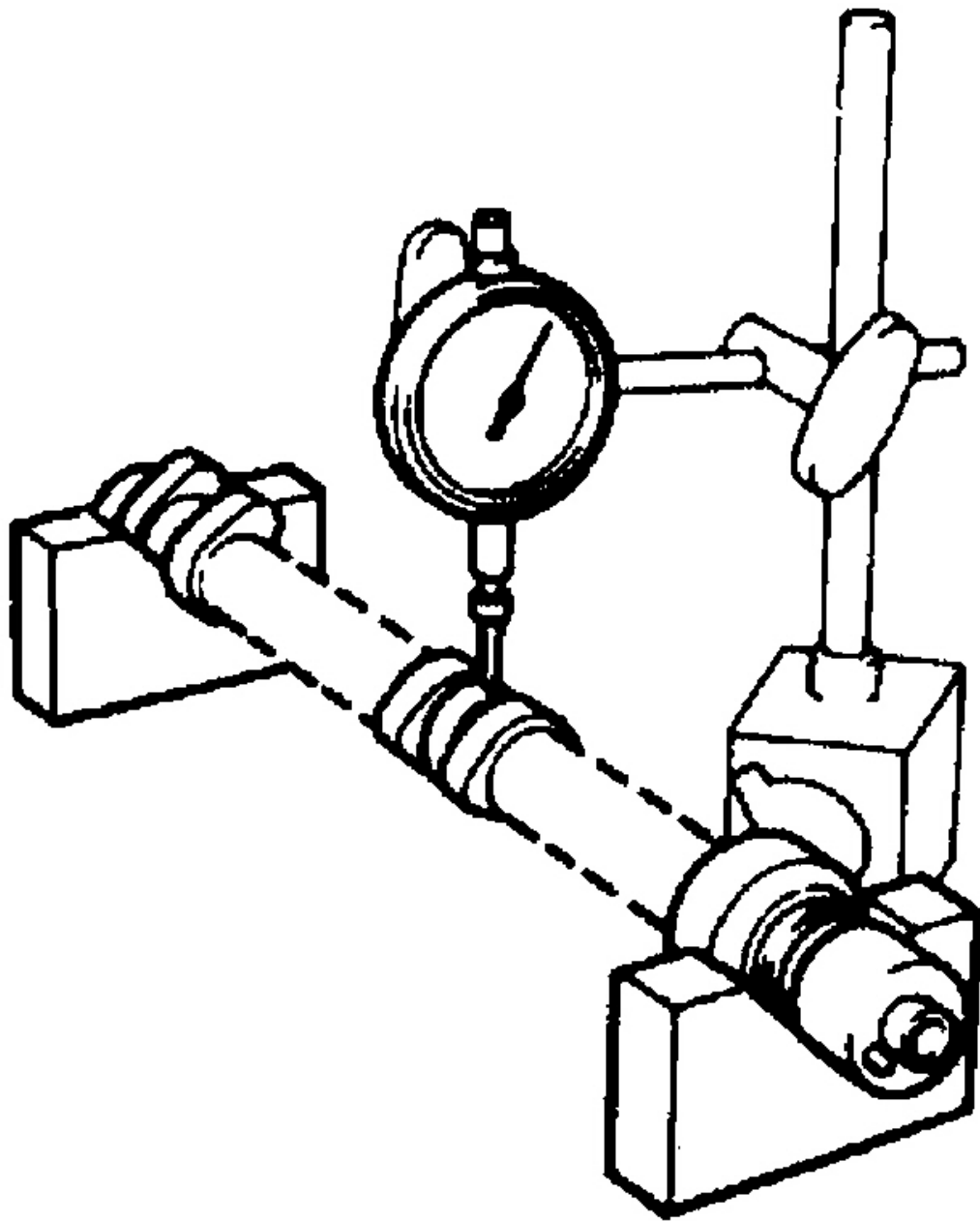
Fig. 299: Measuring Lifter Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.)

If the circle runout is greater than maximum, replace the camshaft.



G03197536

Fig. 300: Checking Camshaft Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.)

If the cam lobe height is less than minimum, replace the camshaft.

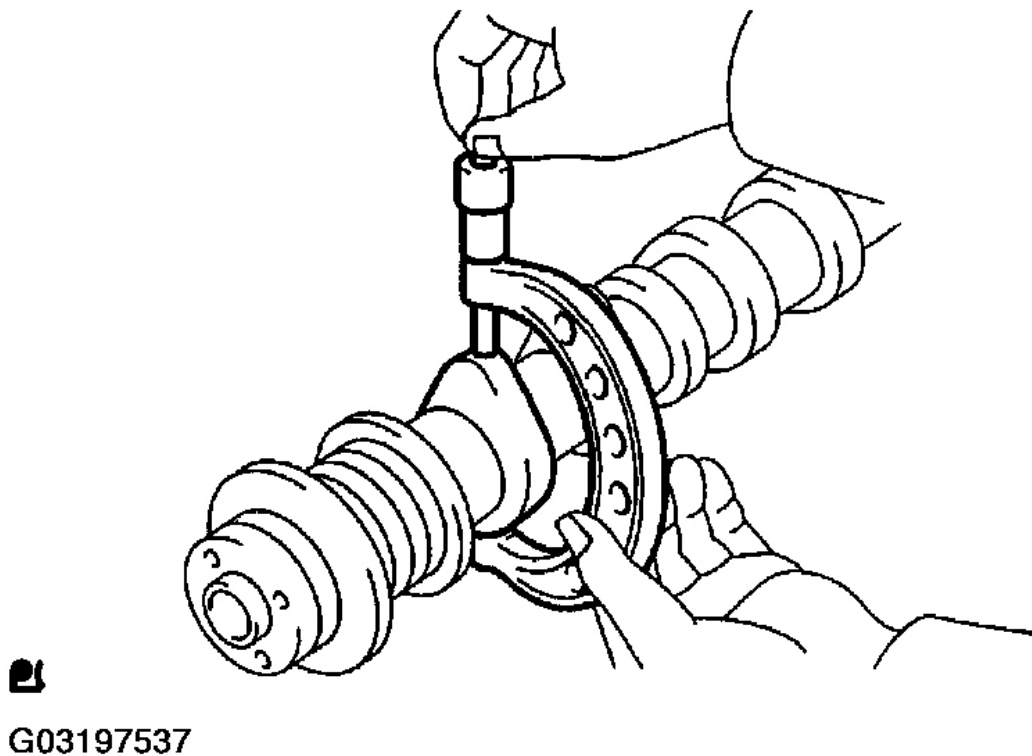


Fig. 301: Measuring Cam Lobe Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

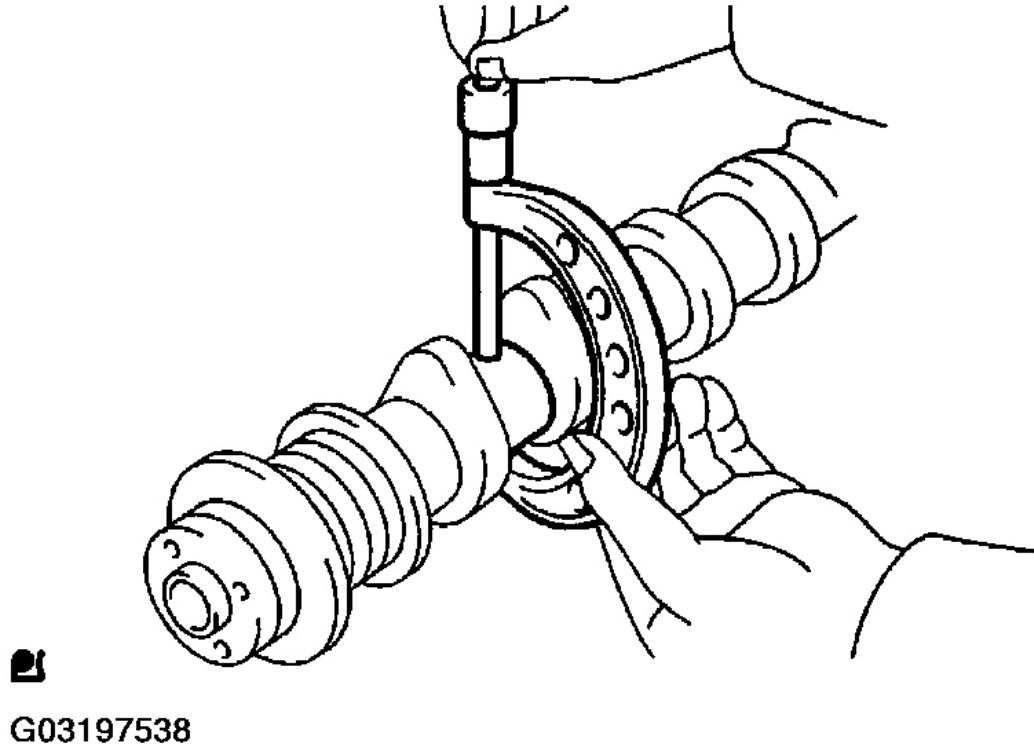


Fig. 302: Measuring Journal Diameter

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

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.)**

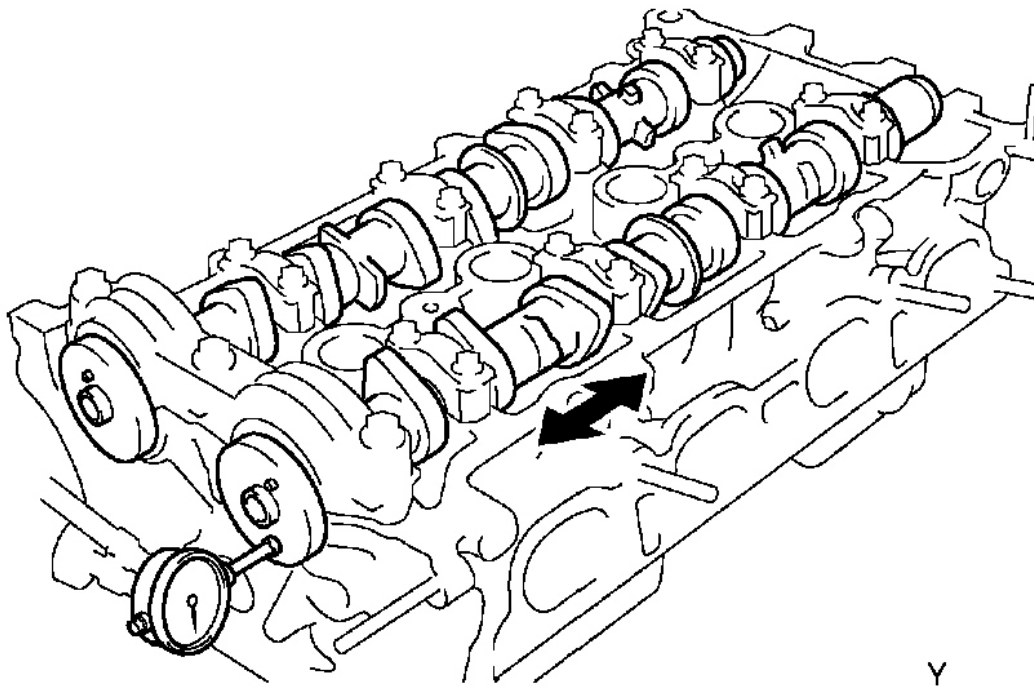
If the journal diameter is not as specified, check the oil clearance.

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.)**

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and the cylinder head together.



G03197539

Fig. 303: Measuring Thrust Clearance While Moving Camshaft Back & Forth
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. INSPECT CAMSHAFT OIL CLEARANCE

- a. Clean the bearing caps and the camshaft journals.
- b. Place the camshafts on the cylinder head.
- c. Lay a strip of Plastigage across each of the camshaft journal.
- d. Install the bearing caps.

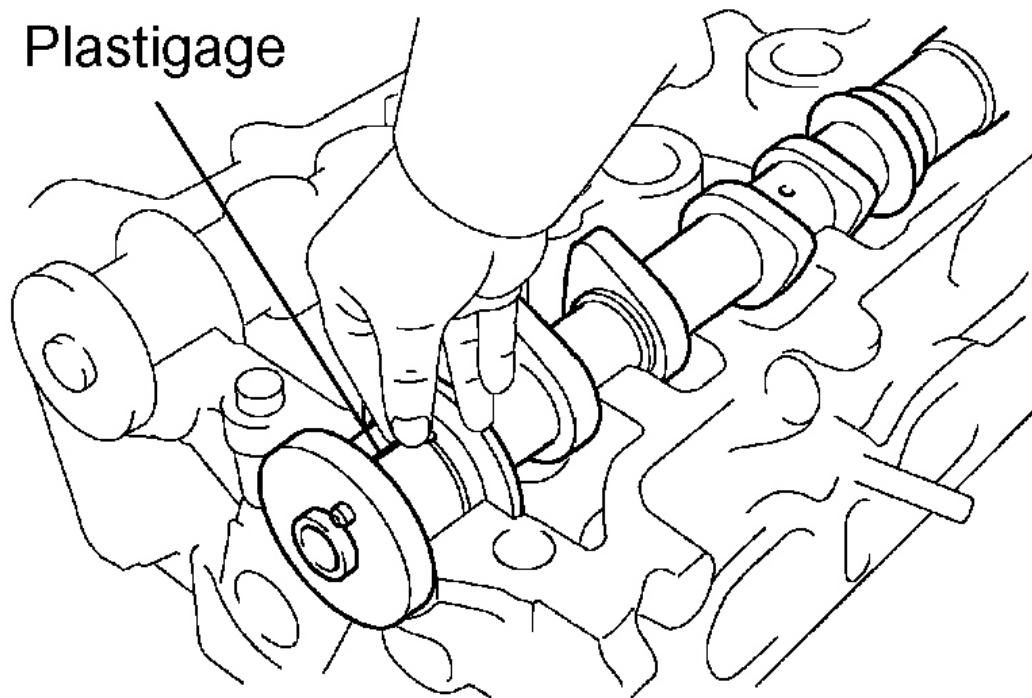
Torque:

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.



G03197540

Fig. 304: Laying Strip Of Plastigage Across Each Of Camshaft Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Measure the Plastigage at its widest point.

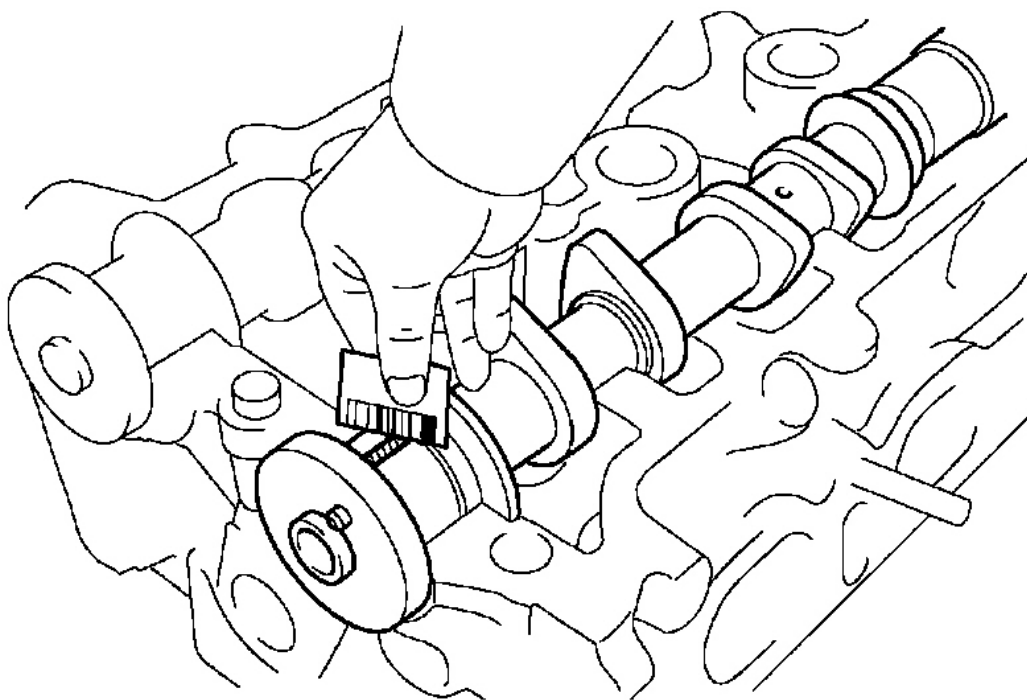
Standard oil clearance:

0.035 to 0.072 mm (0.0014 to 0.0028 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and the cylinder head together.

NOTE: Completely remove the Plastigage.



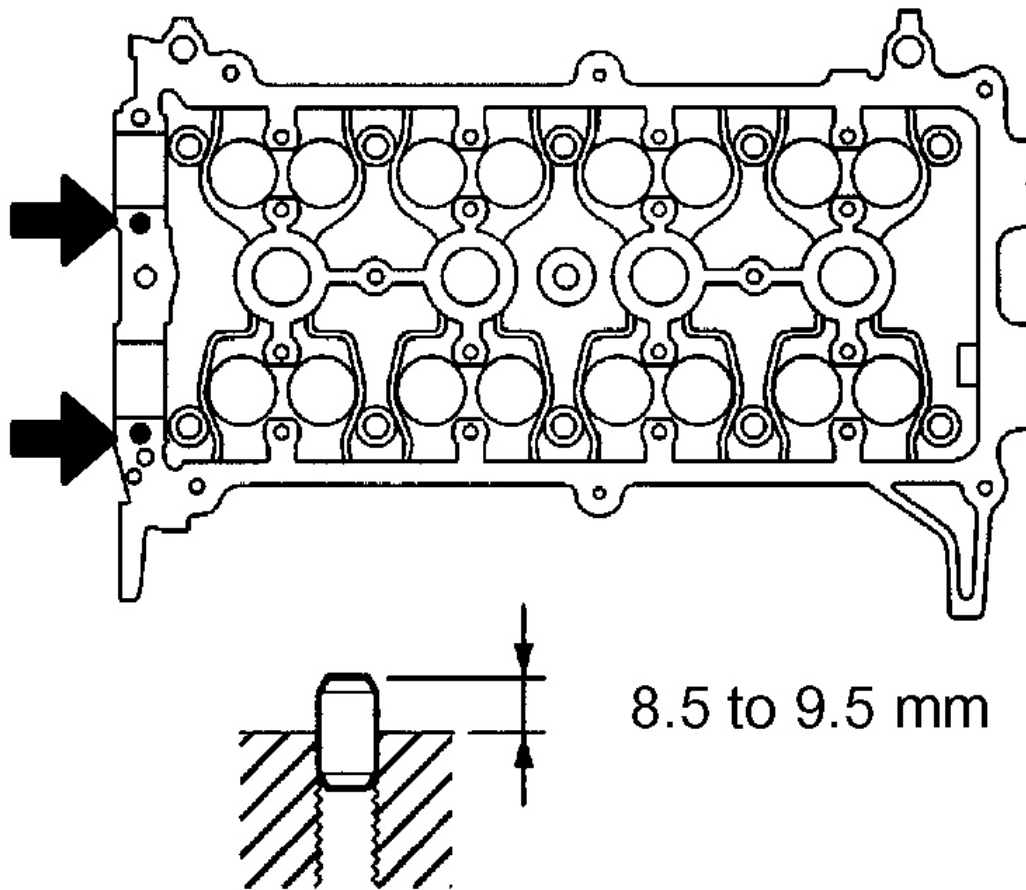
G03197541

Fig. 305: Measuring Plastigage At Its Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 (0.335 to 0.374 in.)



G03197542

Fig. 306: Taping In New Ring Pin To Specified Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL STUD BOLT

- a. Using Torx socket wrench E5 and E7, install the 7 stud bolts.

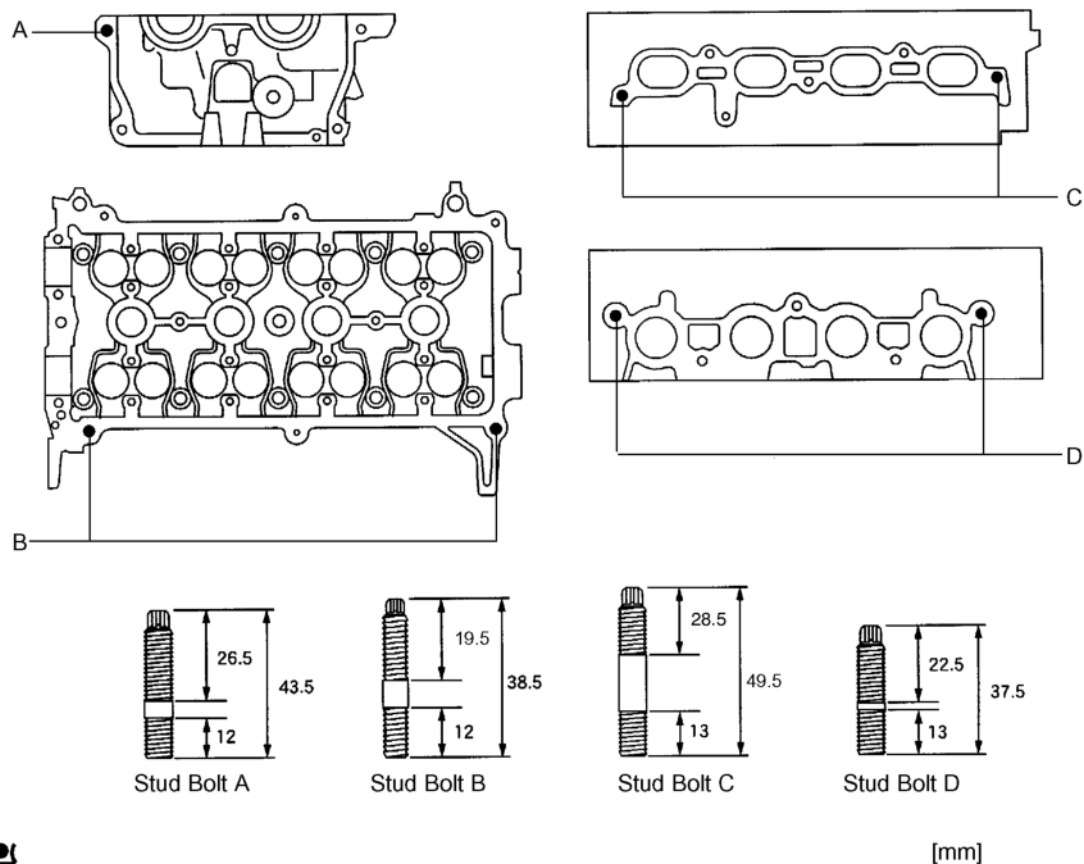
Torque:

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 in (92 kgf.cm, 80 in.lbf)



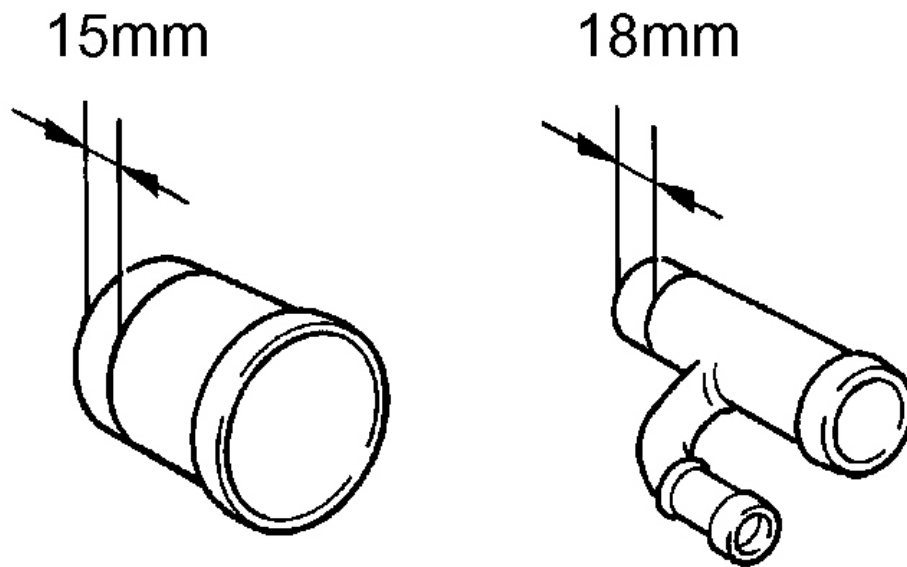
G03197543

Fig. 307: Installing Stud Bolts

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

32. INSTALL UNION

- a. Mark the standard position away from the edge, onto the new water hose unions as shown in the illustration.



N

G03197544

Fig. 308: Identifying 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

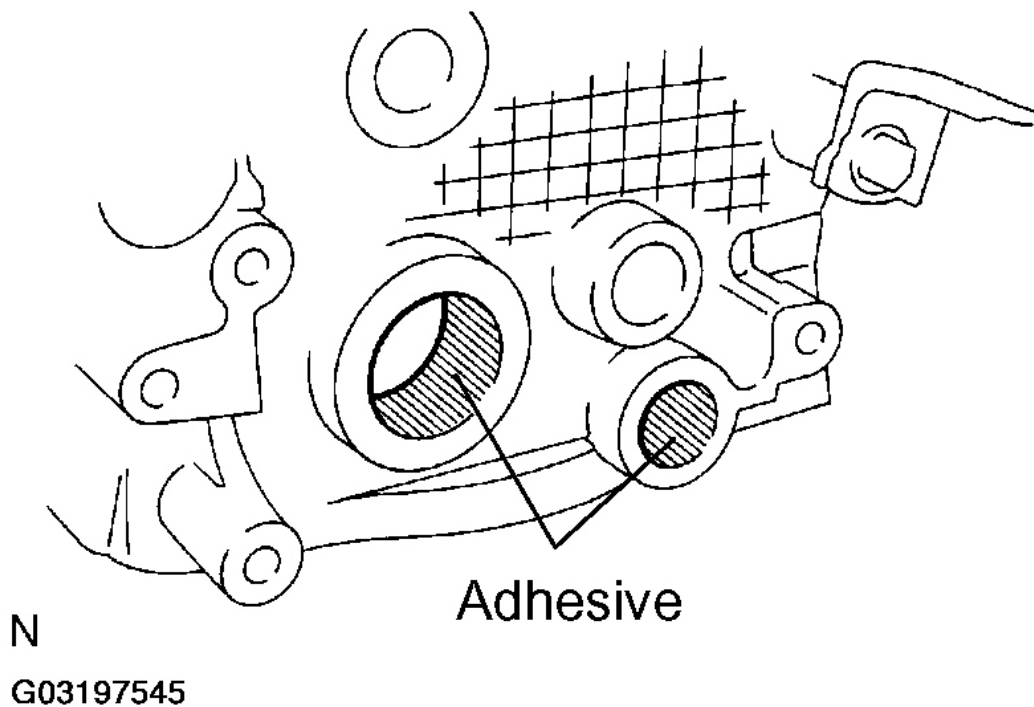


Fig. 309: Applying Adhesive To Water Hose Union Hole Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.)

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 one hour after installation.

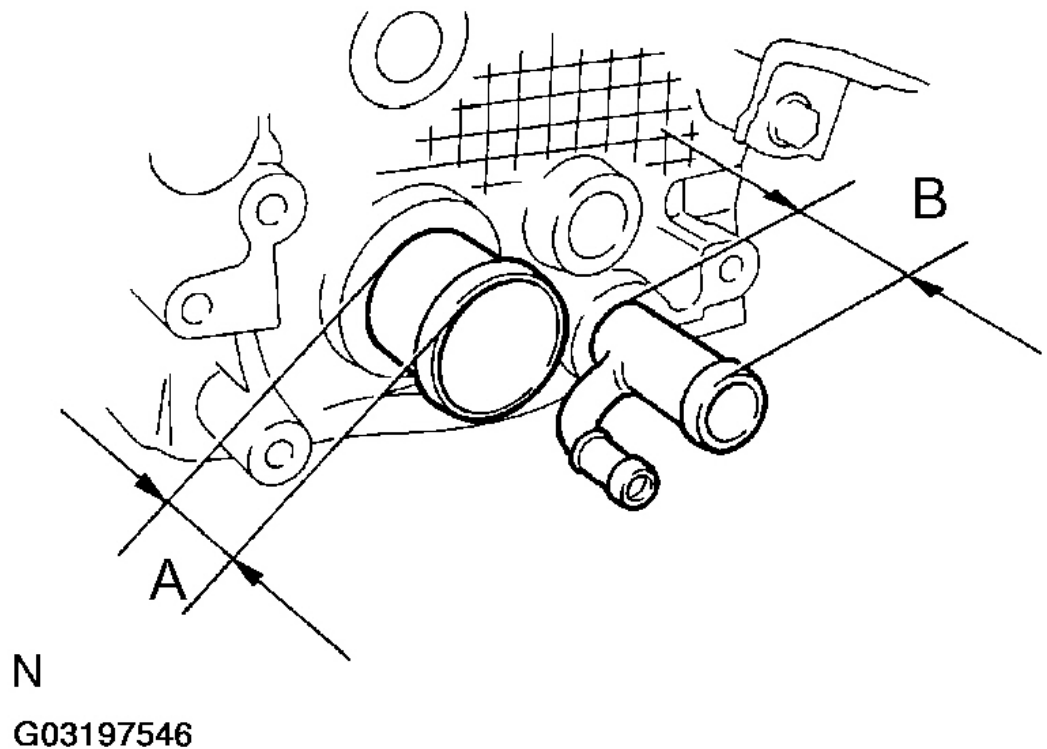


Fig. 310: Installing Water Hose Union
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.

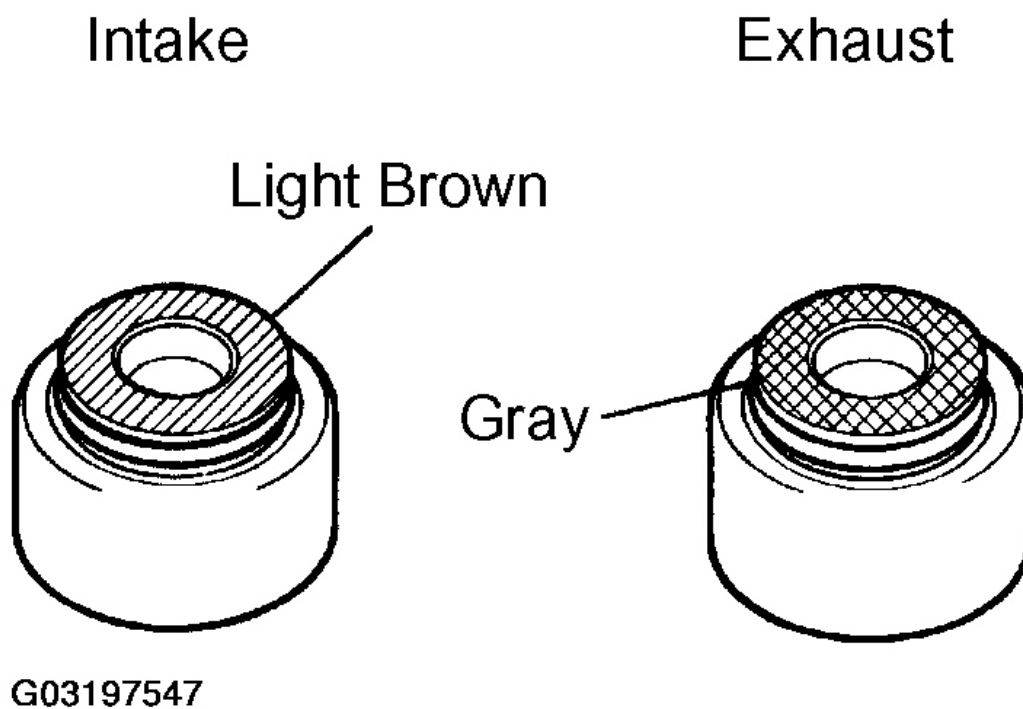


Fig. 311: Identifying Intake Valve Oil Seal & Exhaust Valve Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, push in a new oil seal.

SST 09201-41020

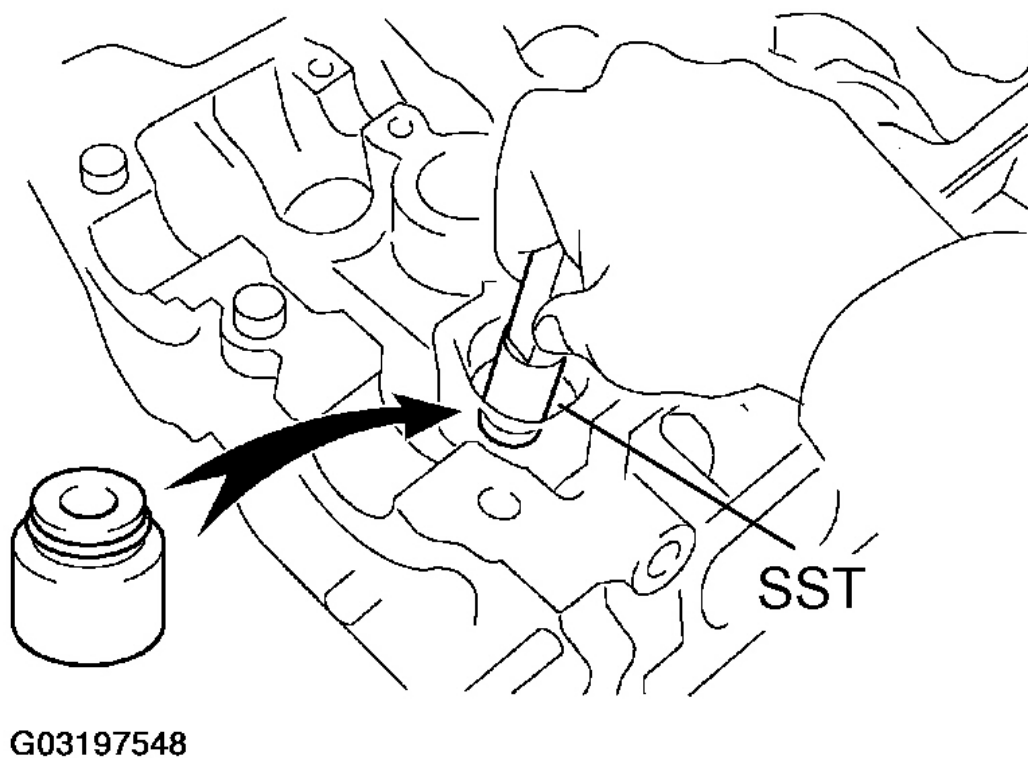


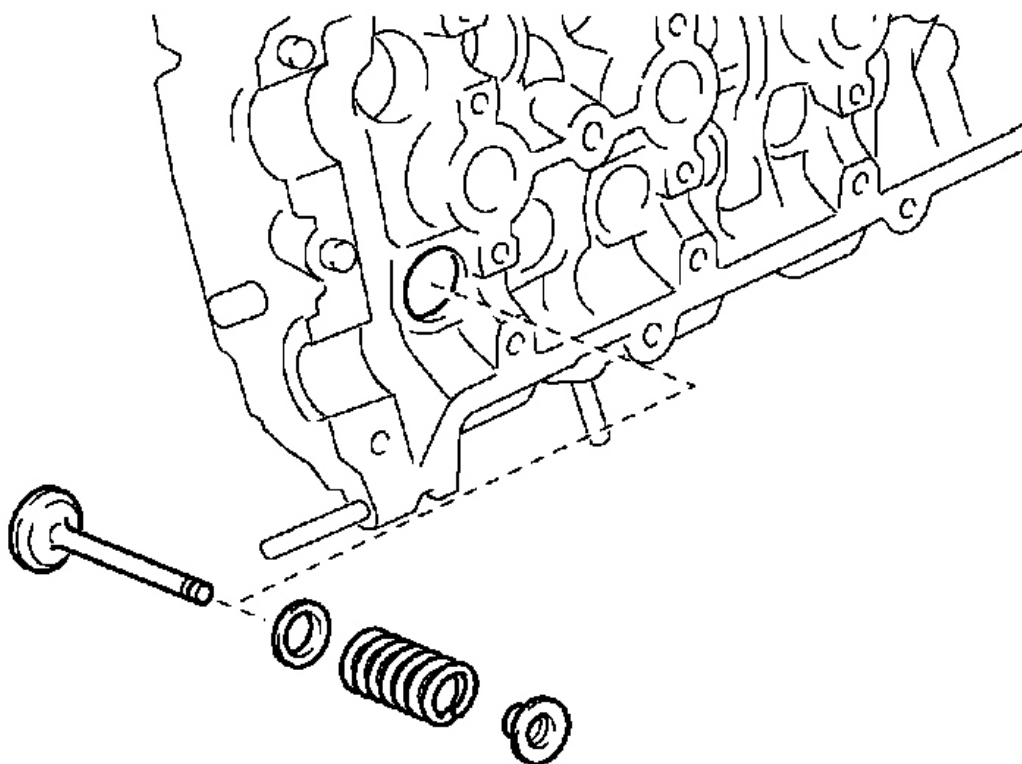
Fig. 312: Installing New Oil Seal

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

34. INSTALL INTAKE VALVE

- a. Install the valve, spring seat, valve spring, and spring retainer.

NOTE: **Install the same parts in the same combination to the original locations.**



G03197549

Fig. 313: Installing Valve, Spring Seat, Valve Spring & Spring Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, compress the valve spring and place the 2 retainer locks around the valve stem.

SST 09202-70020 (09202-00010)

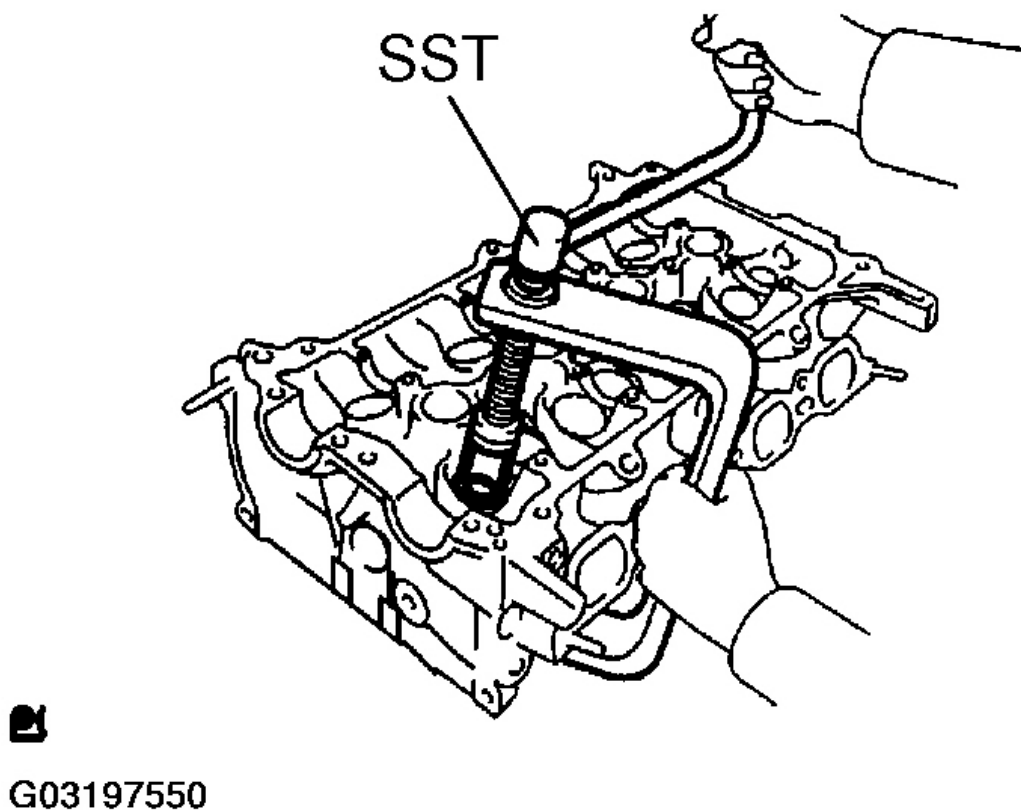


Fig. 314: Compressing Valve Spring

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

- c. Using a plastic-faced hammer and the valve stem (not in use) with the tip wrapped in tape, lightly tap the valve stem tip to ensure a proper fit.

NOTE: Be careful not to damage the valve stem tip.

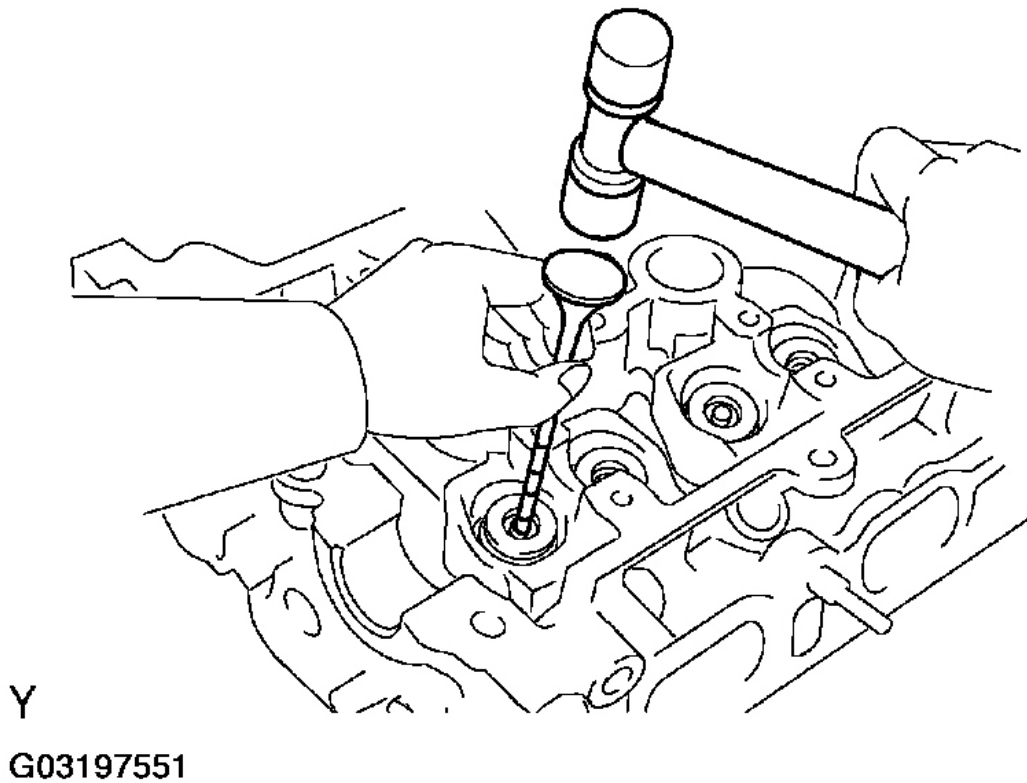


Fig. 315: Installing Valve Stem

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 2 retainer locks around the valve stem.

SST 09202-70020 (09202-00010)

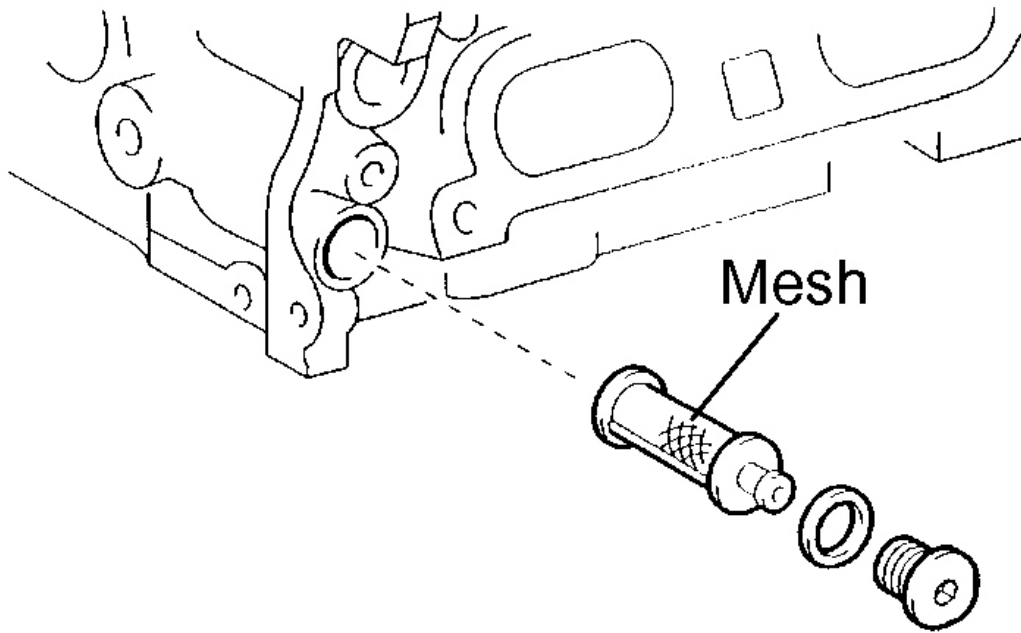
- Using a plastic-faced hammer and the valve stem (not in use) with the tip wrapped in tape, lightly tap the valve stem tip to ensure a proper fit.

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)



G03197552

Fig. 316: Installing Oil Control Valve Filter

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

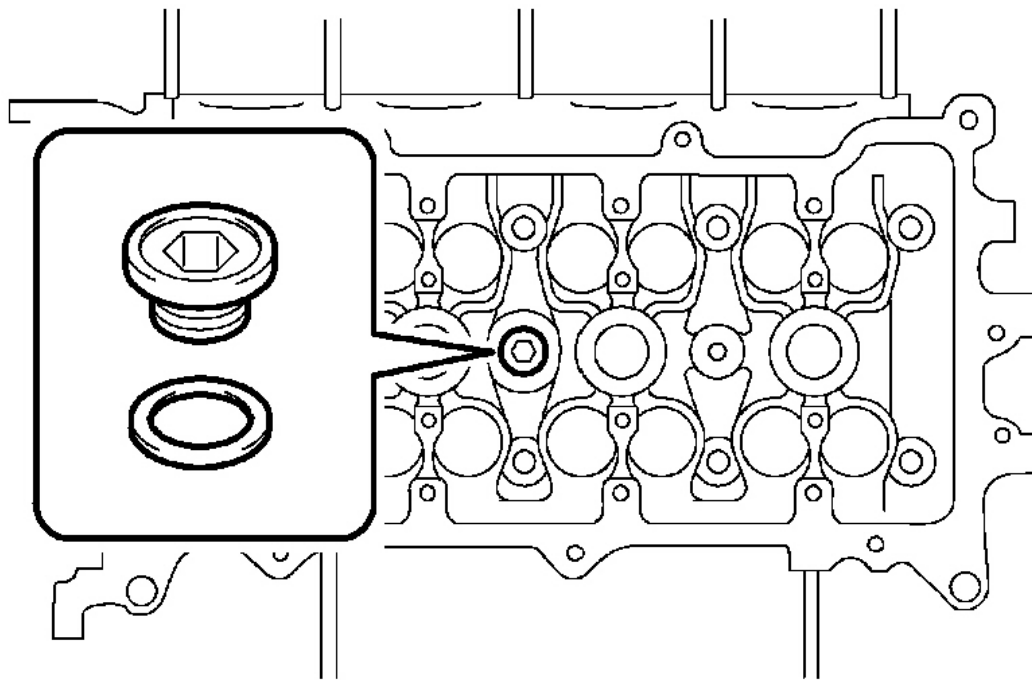
37. INSTALL VALVE LIFTER

- 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)



G03197553

Fig. 317: Installing Taper Screw Plug With New Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER BLOCK ASSY

COMPONENTS

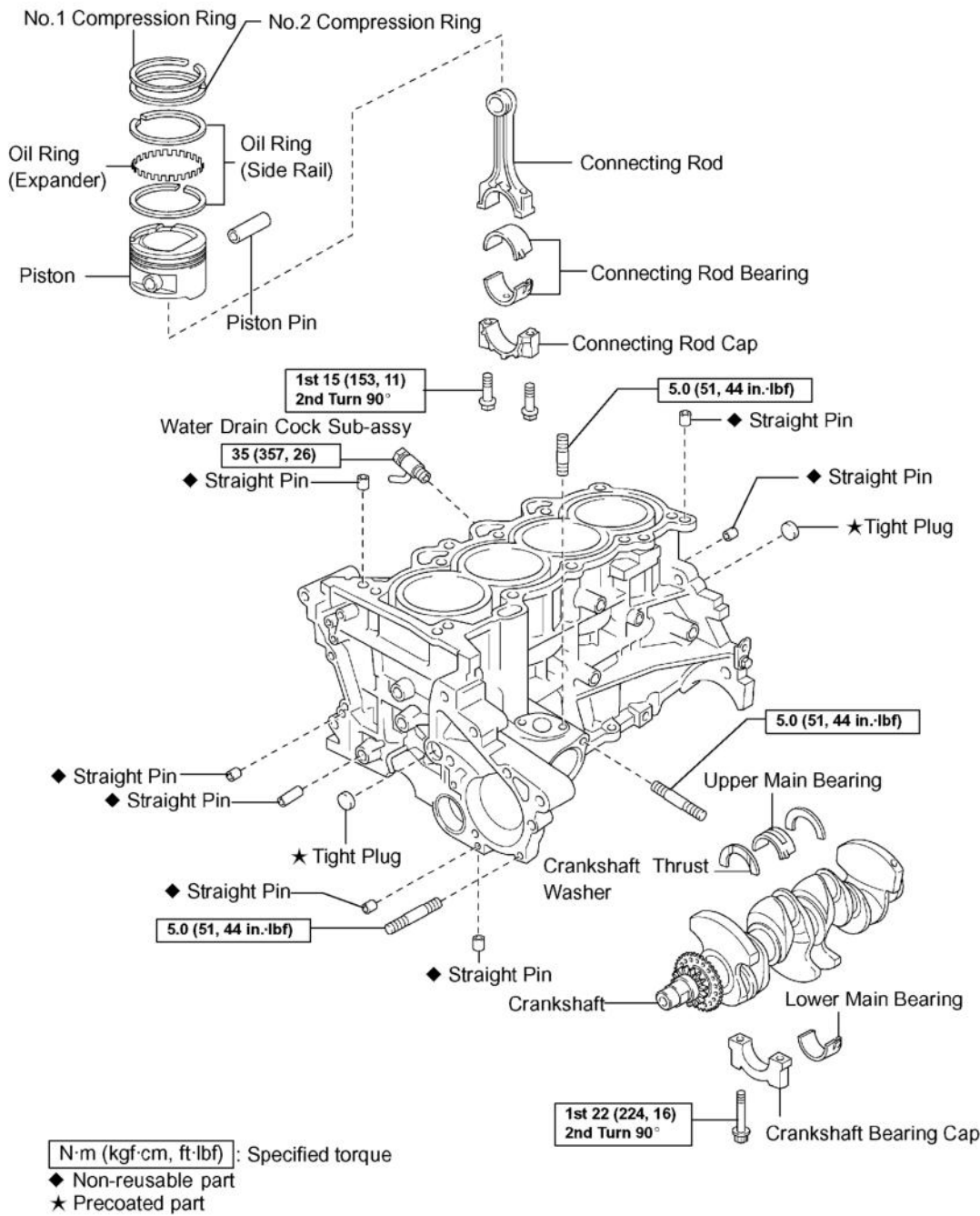


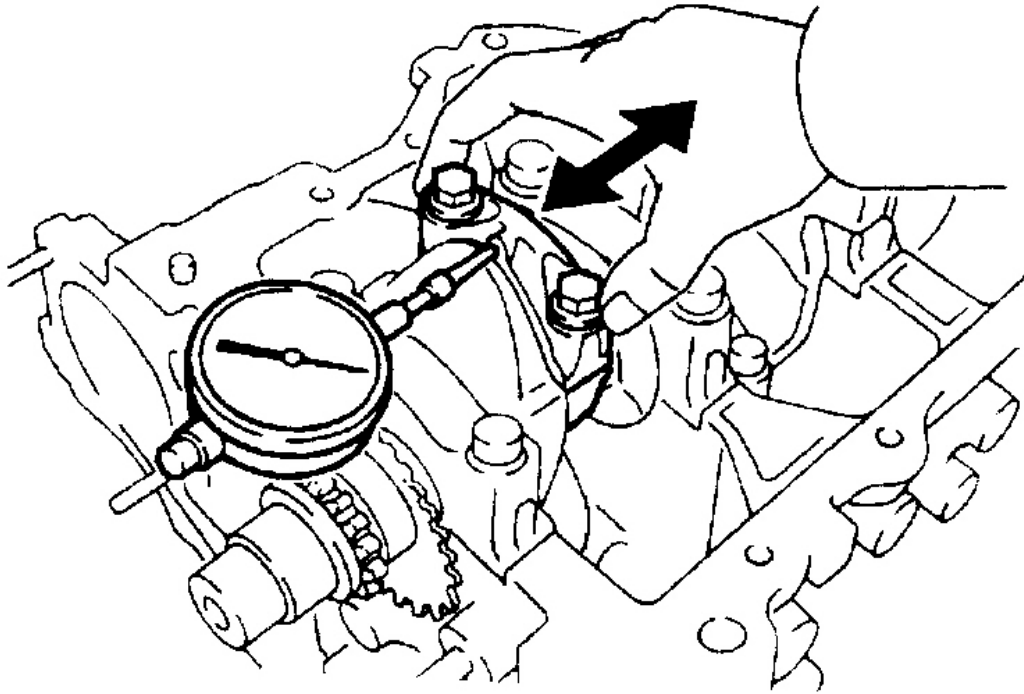
Fig. 318: Identifying Cylinder Block Assy Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OVERHAUL

1. INSPECT CONNECTING ROD THRUST CLEARANCE

- Using a dial indicator, measure the thrust clearance while moving the connecting rod back and

forth.



G03197555

Fig. 319: Measuring Thrust Clearance While Moving Connecting Rod Back & Forth
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance:

0.16 to 0.36 mm (0.0063 to 0.0142 in.)

Maximum thrust clearance: 0.36 mm (0.0142 in.)

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

- c. Clean the crank pin and bearing.
- d. Check the crank pin and bearing for pitting and scratches.

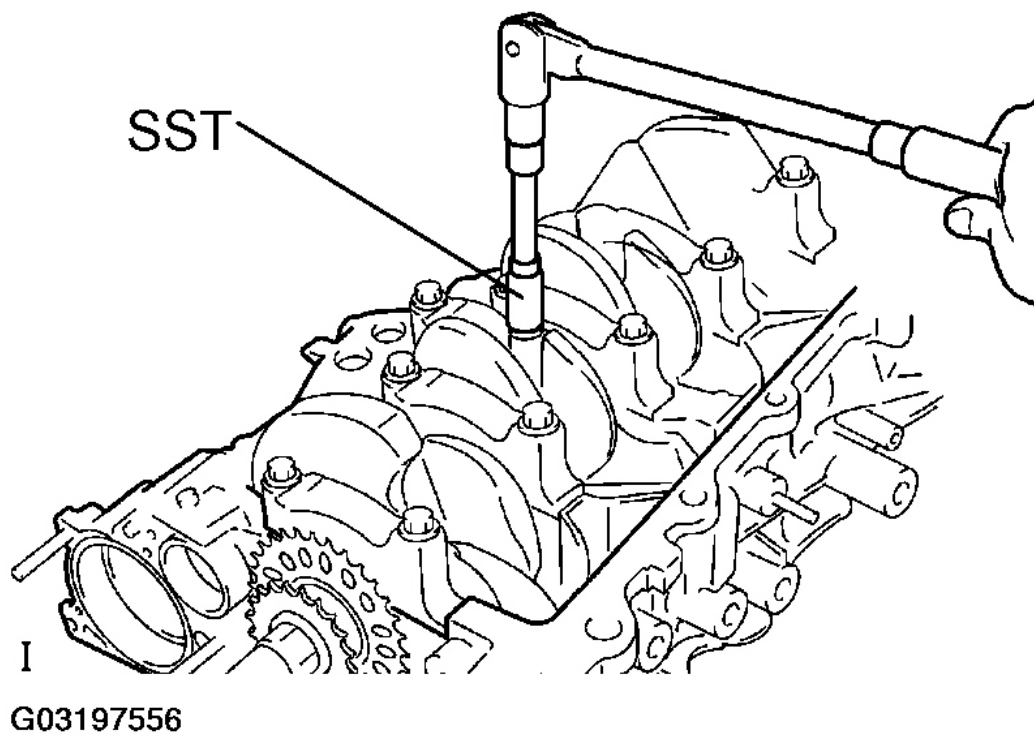
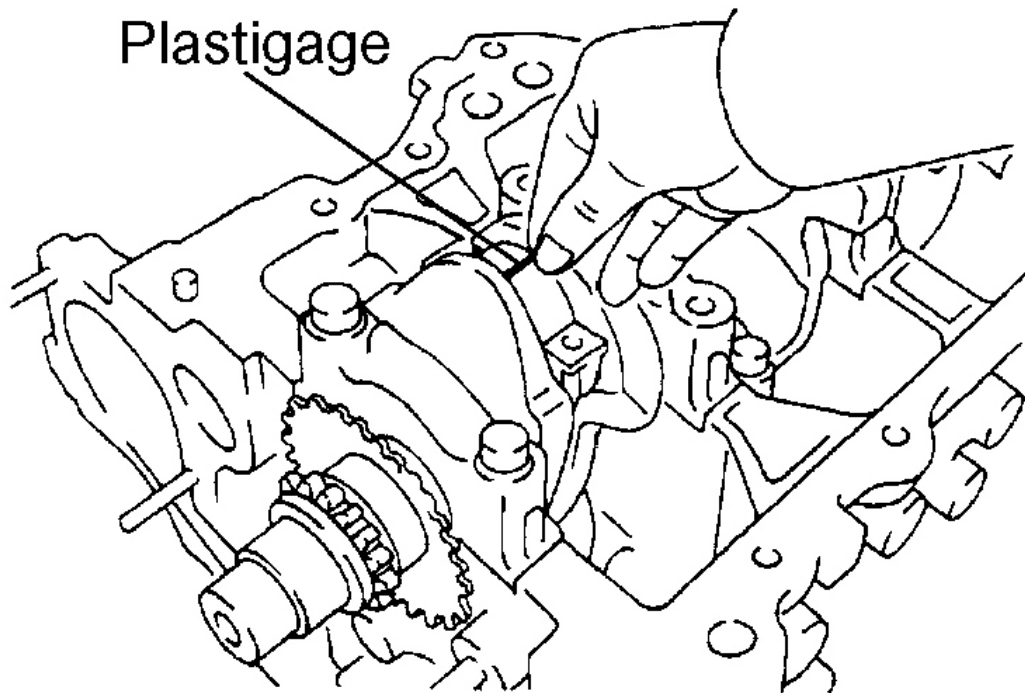


Fig. 320: Removing Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Lay a strip of Plastigage across the crank pin.



G03197557

Fig. 321: 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.
- g. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.

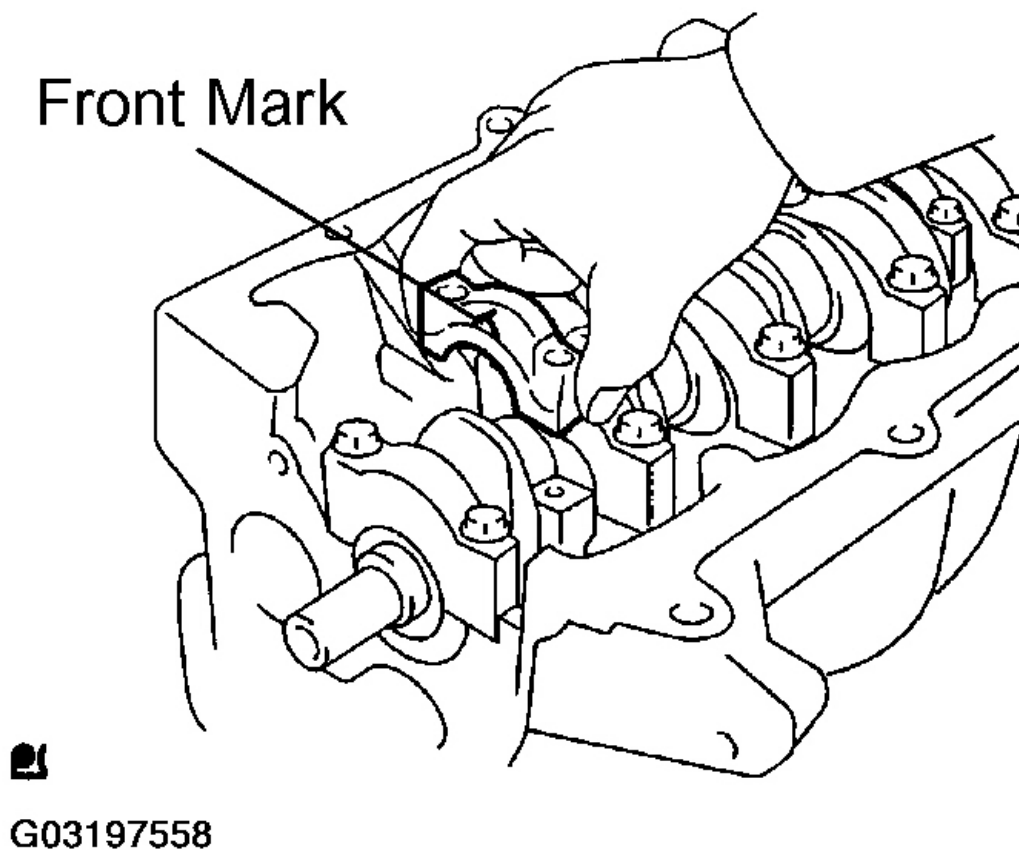


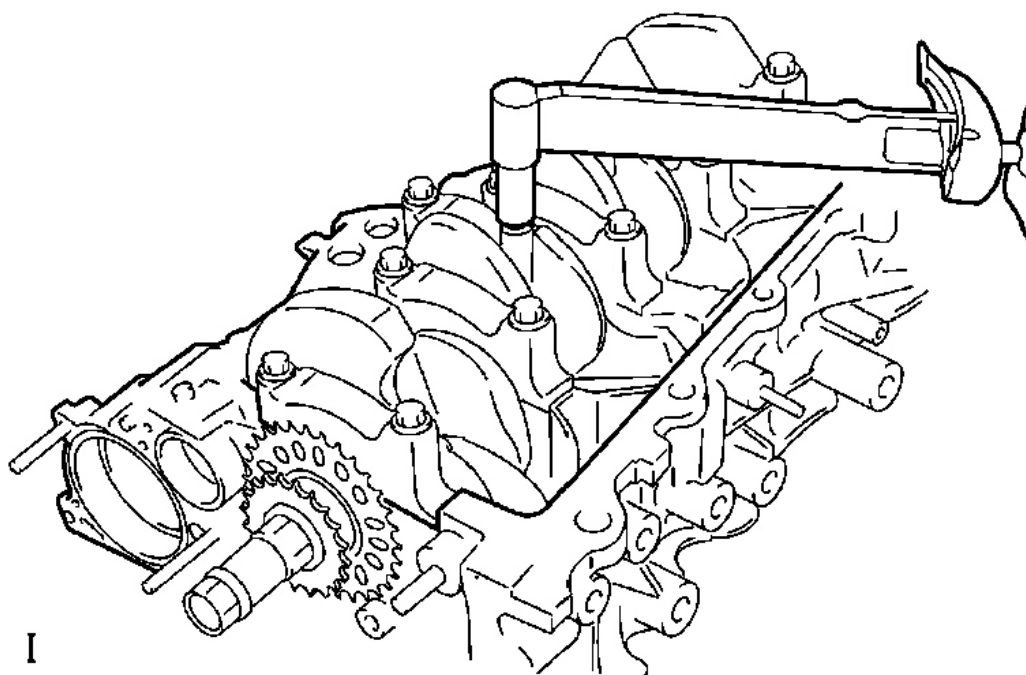
Fig. 322: Identifying Front Mark On Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Using SST, tighten the bolts in several steps by the specified torque.

SST 09205-16010

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

NOTE: Do not turn the crankshaft.



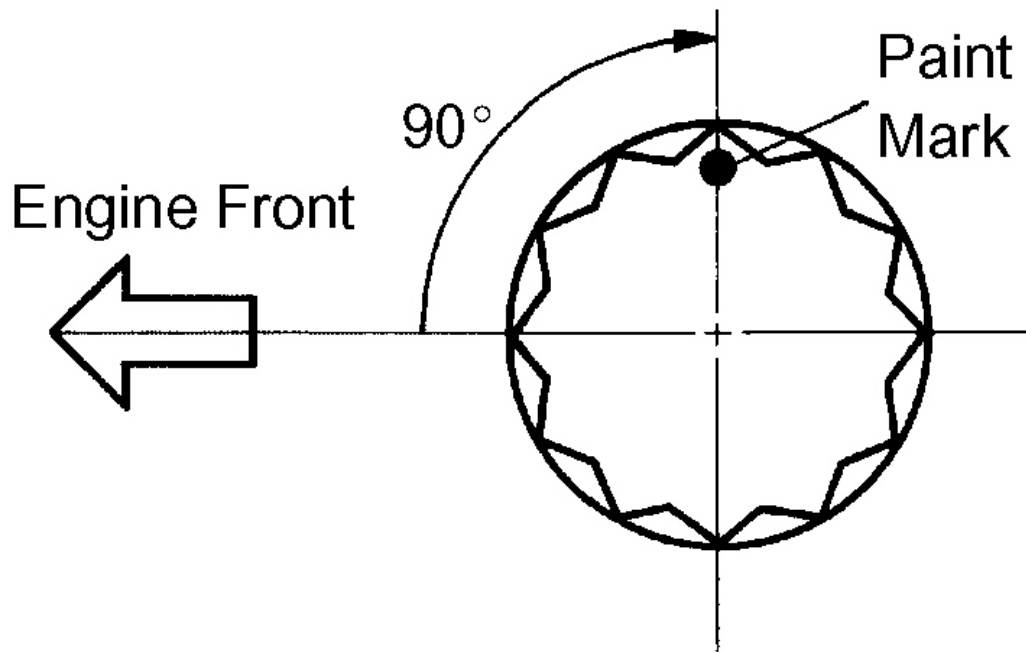
G03197559

Fig. 323: Tightening Connecting Rod Cap Bolt
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 the illustration.

NOTE: **Do not turn the crankshaft.**

- k. Remove the 2 bolts, connecting rod cap and lower bearing.



G03197560

Fig. 324: Retightening Connecting Rod Cap Bolt By 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. 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.)

NOTE: Completely remove the Plastigage.

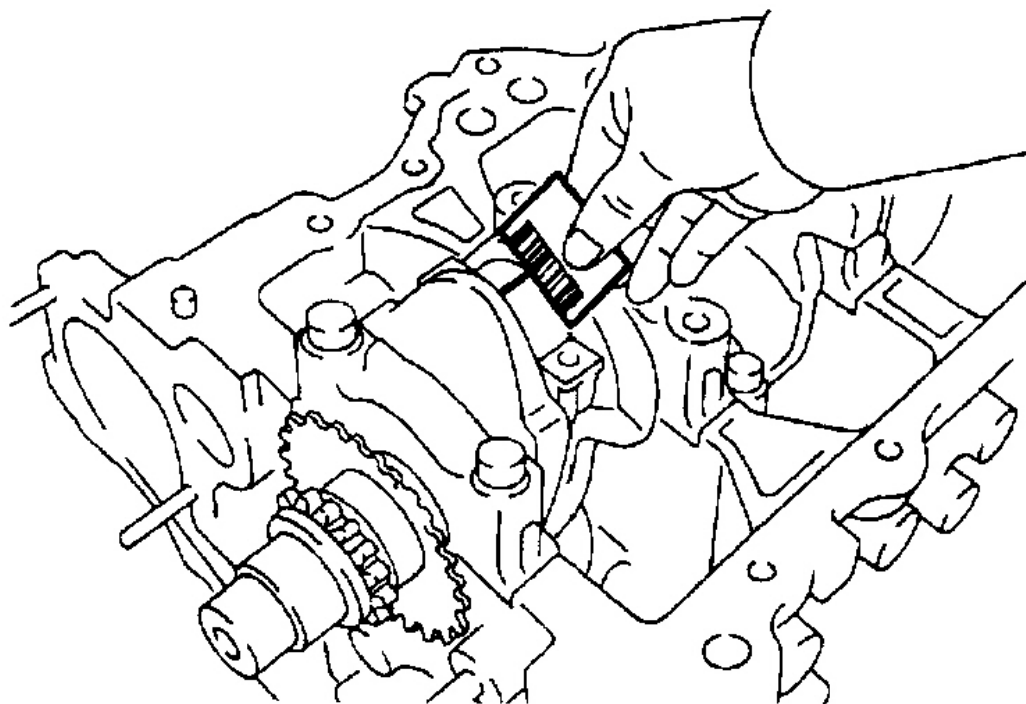
**G03197561**

Fig. 325: Measuring Plastigage At Its Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. If the width is greater than maximum, select and replace the bearing. If necessary, use the undersize bearing.

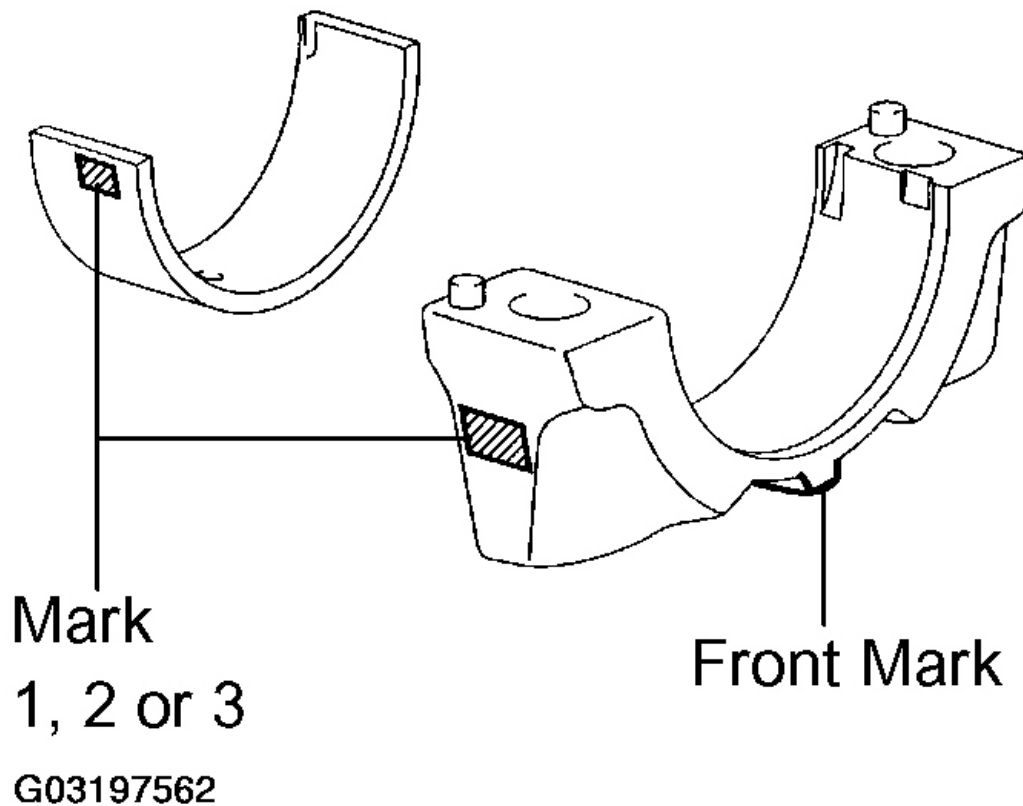


Fig. 326: Identifying Marking On Bearing
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

CONNECTING ROD EXTERNAL DIAMETER, CENTER BEARING THICKNESS AND OIL CLEARANCE SPECIFICATION

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.
- 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 that they can be returned to the original locations when re-assembling.

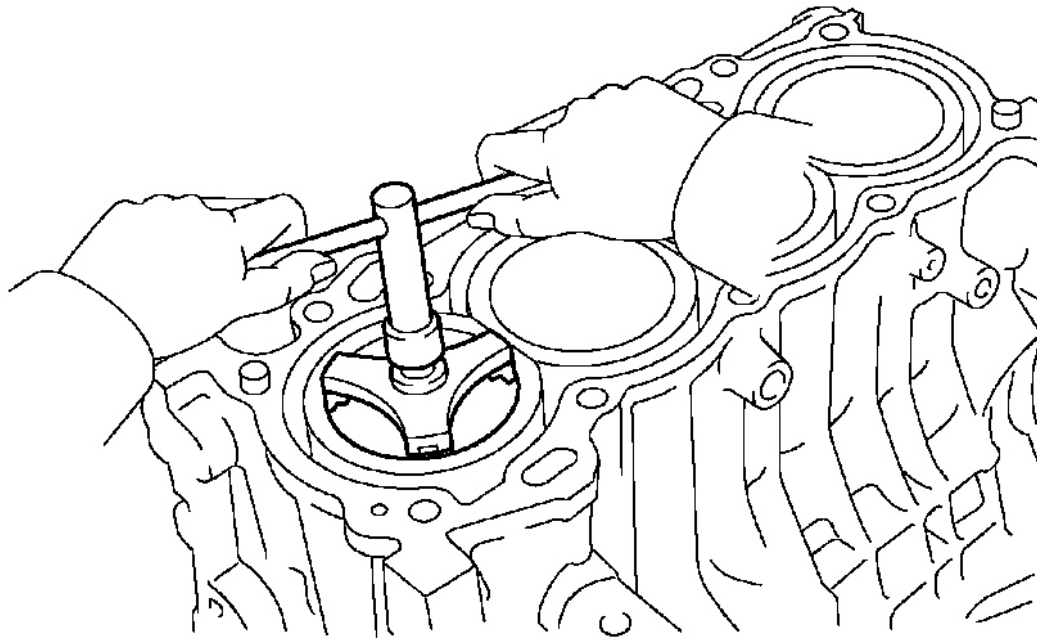
**G03197563**

Fig. 327: Removing Carbon From Top Of Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.

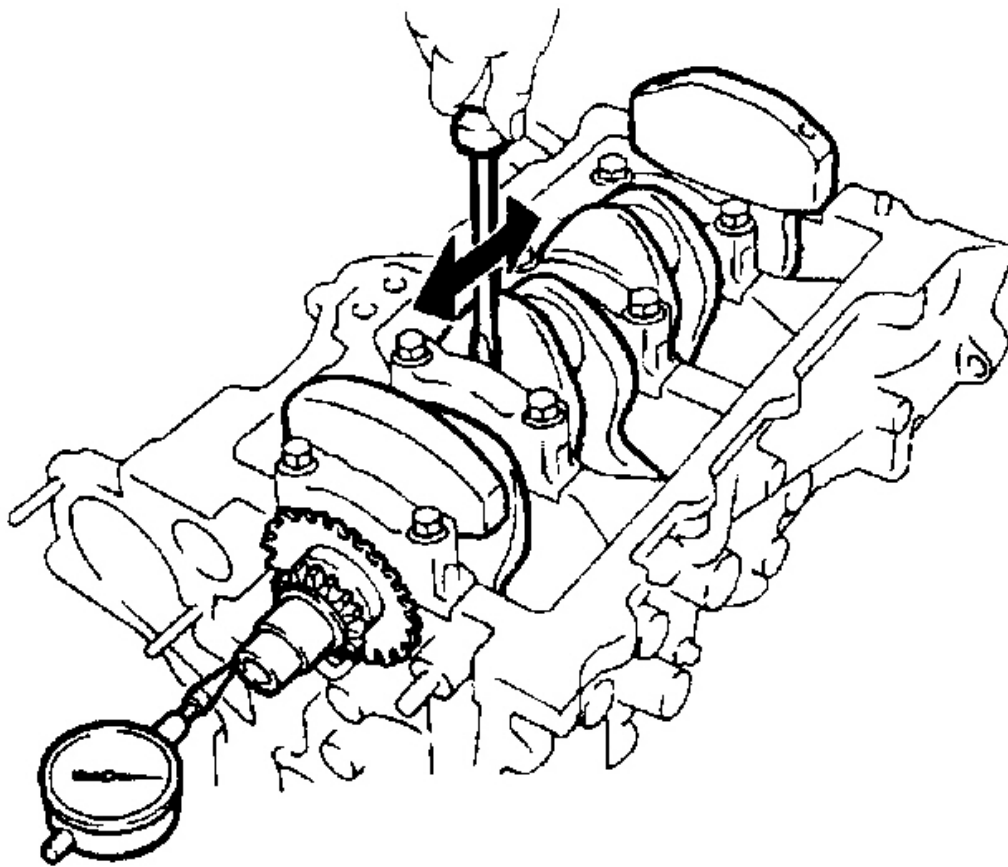
Standard thrust clearance:**0.09 to 0.19 mm (0.0035 to 0.0075 in.)**

Maximum thrust clearance: 0.30 mm (0.0118 in.)

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: 2.43 to 2.48 mm (0.0957 to 0.0976 in.)



G03197564

Fig. 328: Measuring Thrust Clearance While Prying Crankshaft Back & Forth With Screwdriver

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

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 the illustration.

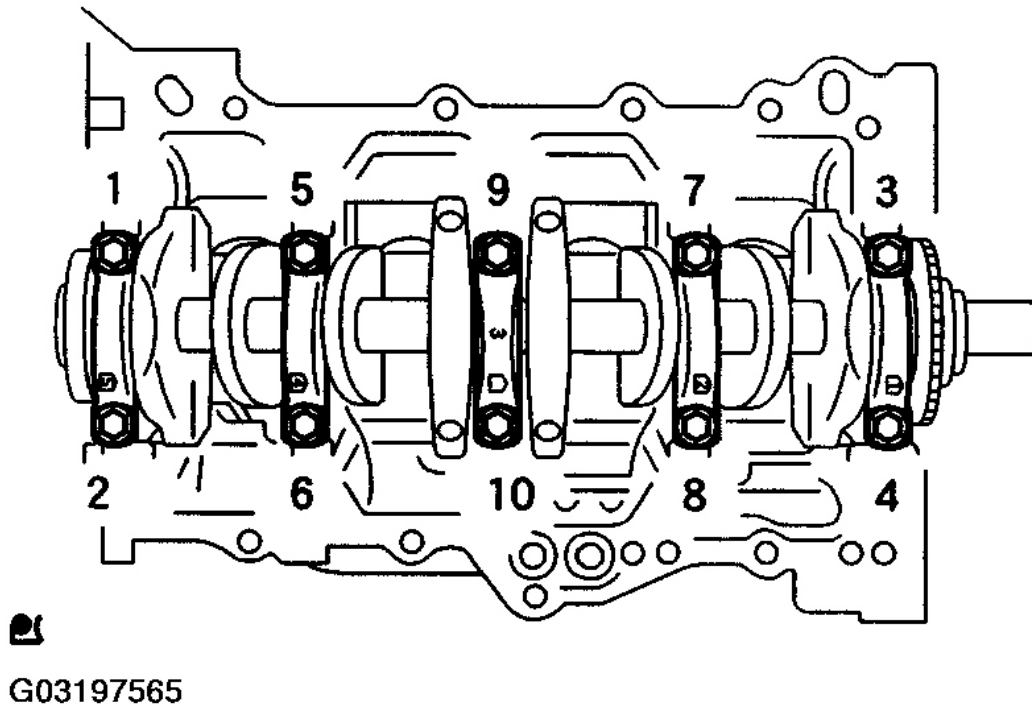


Fig. 329: Identifying Removal Sequence Of Bearing Cap Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

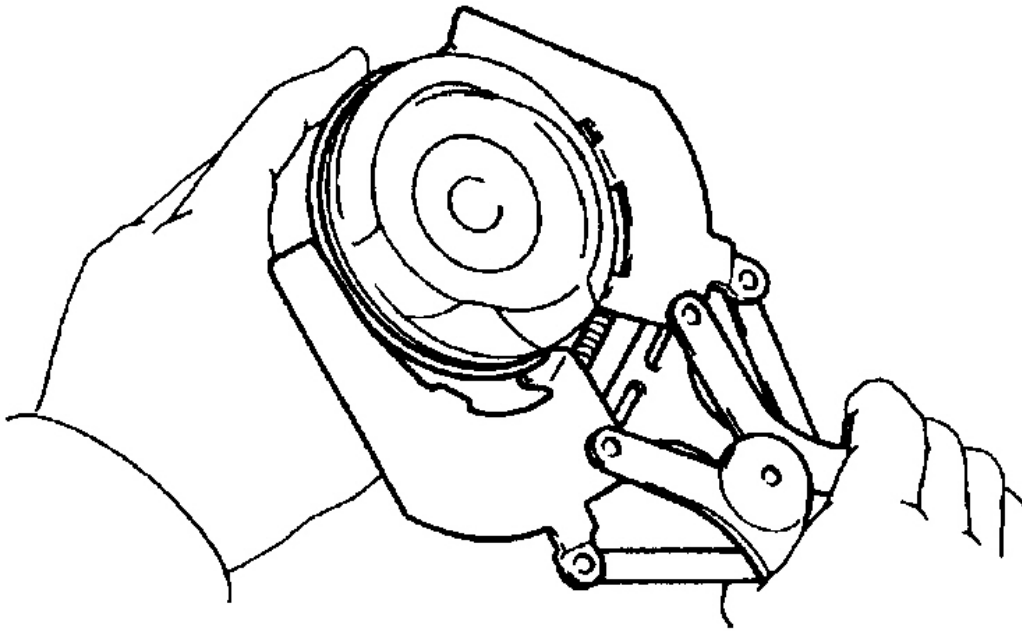
SST 09011-38121

- b. Remove the bearing cap and the crankshaft.
7. **REMOVE CRANKSHAFT BEARING**
8. **REMOVE PISTON RING SET**

HINT:

Keep the piston rings in correct combination and correct order so that they can be returned to the original locations when reassembling.

- a. Using a piston ring expander, remove the 2 compression rings.
- b. Remove the 2 side rails and the oil ring by hand.



G03197566

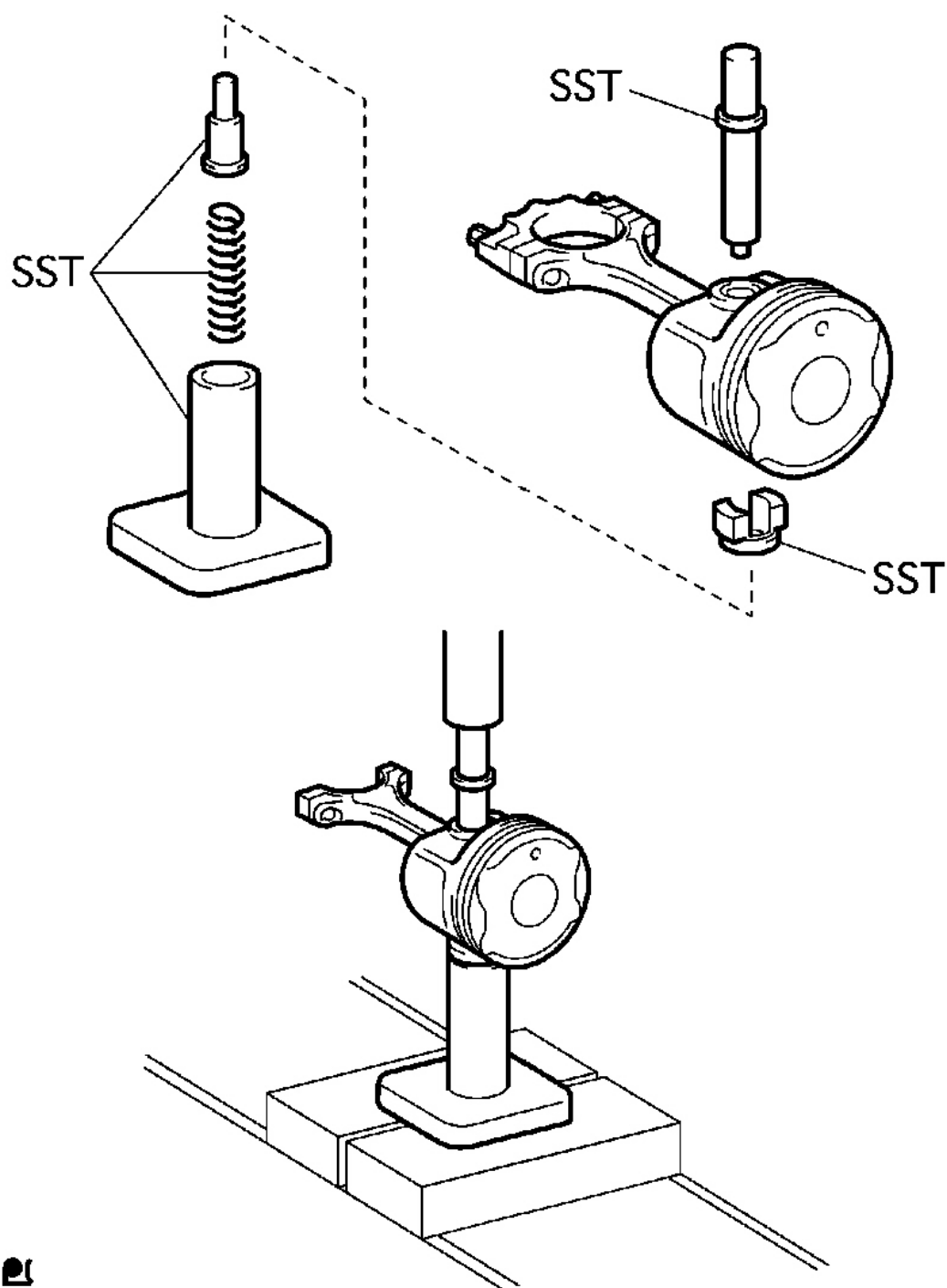
Fig. 330: Removing Compression Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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: Do not change the combination of the piston and piston pin so that they can be returned to the original locations when reassembling.



G03197567

Fig. 331: Removing Piston Pin From Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY**11. REMOVE STUD BOLT**

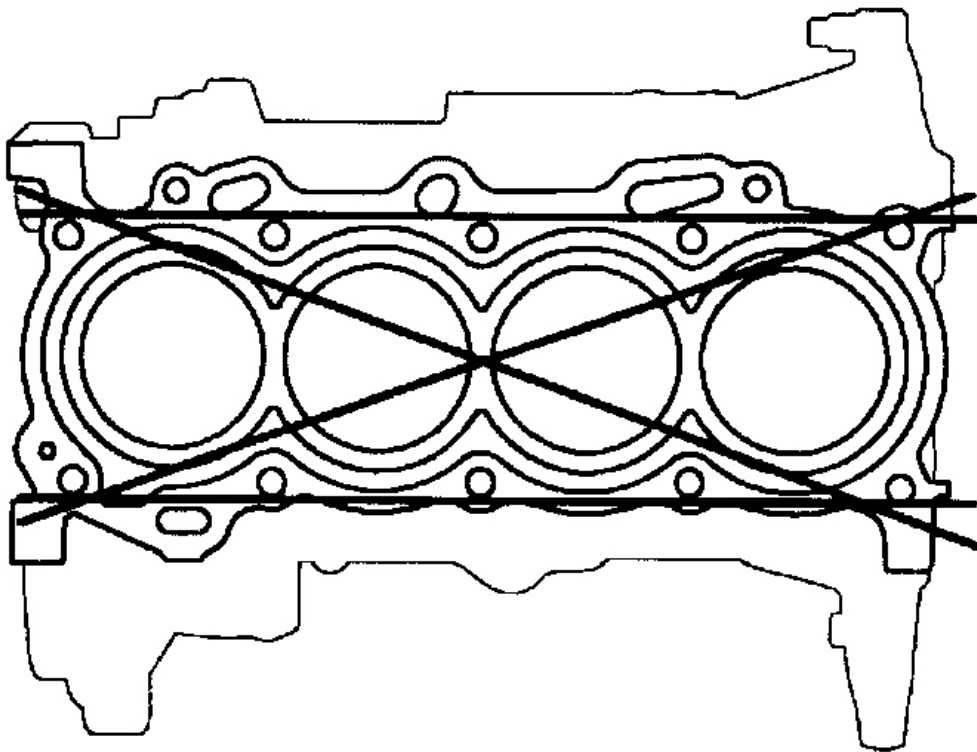
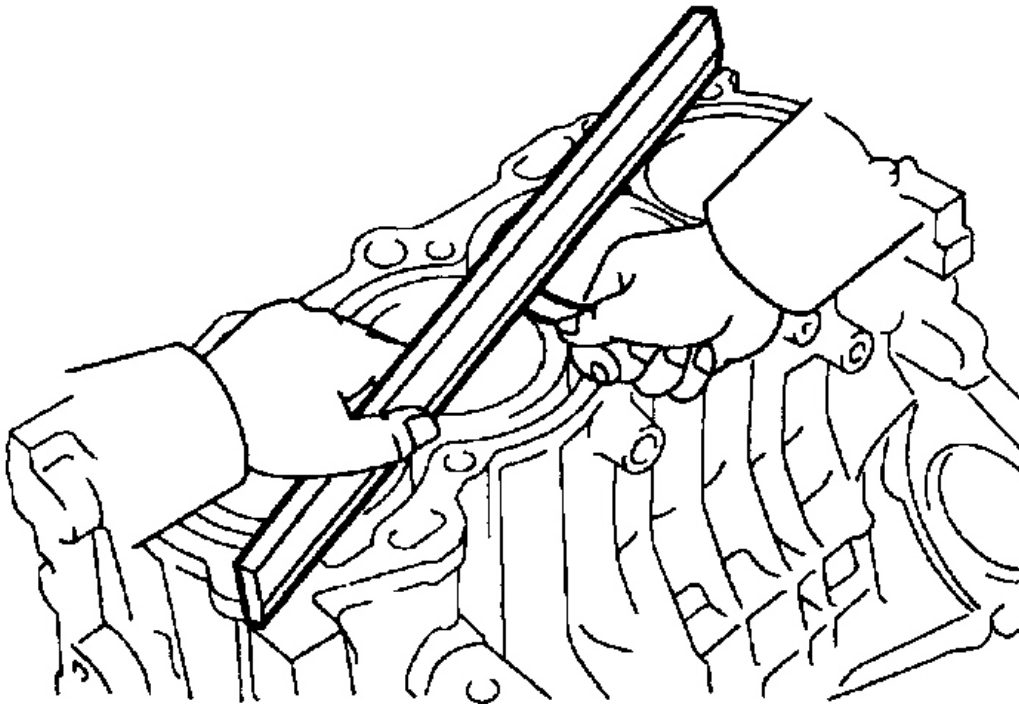
- a. Using Torx socket wrench E5, remove the 6 stud bolts.

12. REMOVE STRAIGHT PIN**13. REMOVE CYLINDER HEAD SET 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.)

If the warpage is greater than maximum, replace the cylinder block.



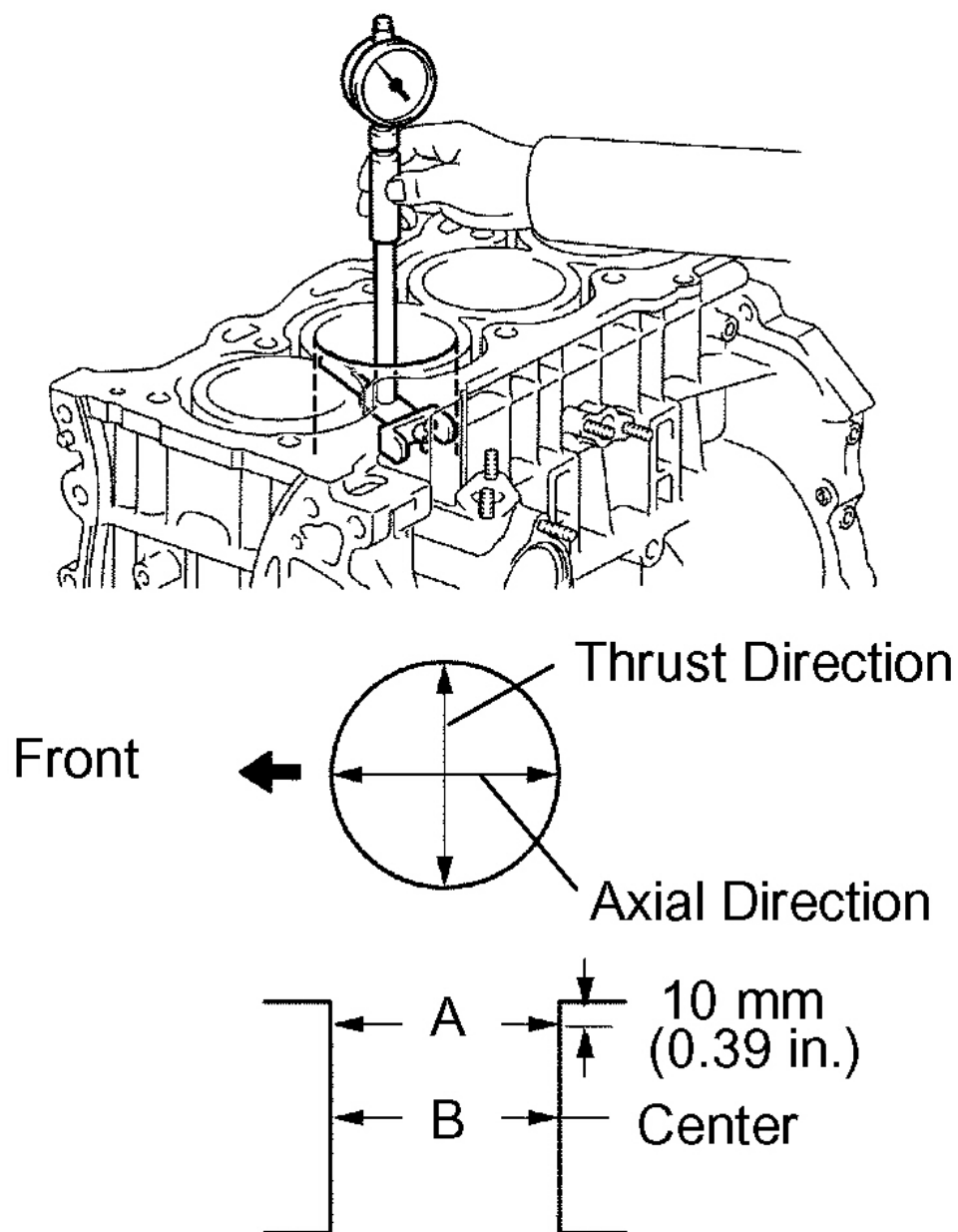
G03197568

Fig. 332: Checking Cylinder Block For Flatness**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 the illustration.
- c. Calculate the average of thrust diameter and axial diameter at the "B" position in the illustration.

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

G03197569

Fig. 333: Measuring Cylinder Bore Diameter In Thrust & Axial Directions
 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.

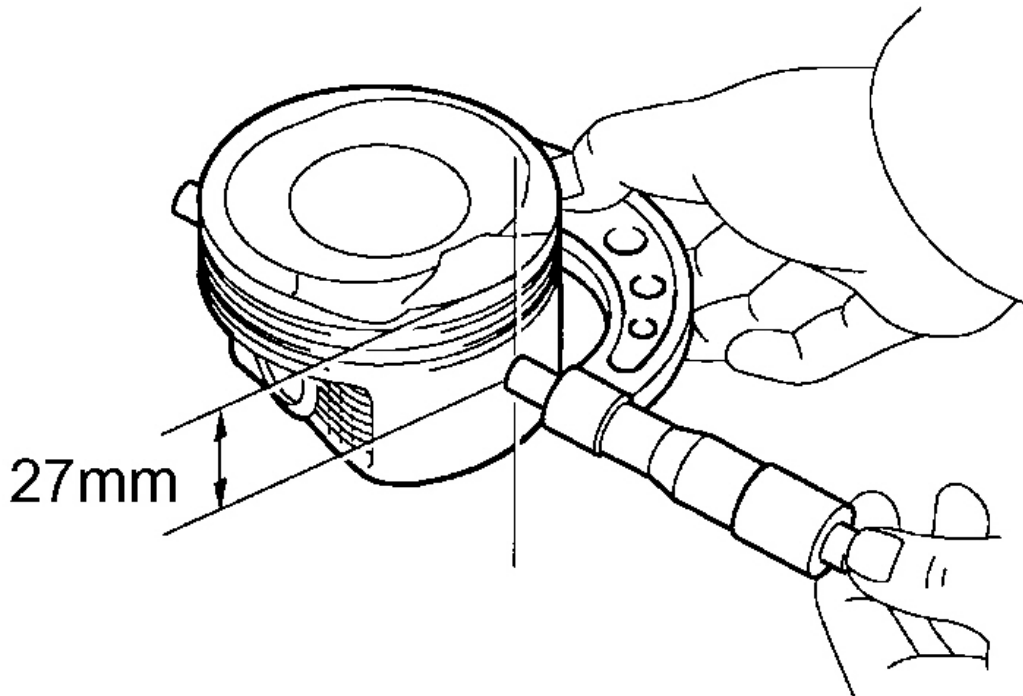
Piston diameter:

74.945 to 74.955 mm (2.9506 to 2.9510 in.)

- 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.)



G03197570

Fig. 334: Measuring Piston Diameter

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

- c. Using a micrometer, measure the piston pin diameter.

Piston pin diameter:

18.001 to 18.004 mm (0.7087 to 0.7088 in.)

- d. Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

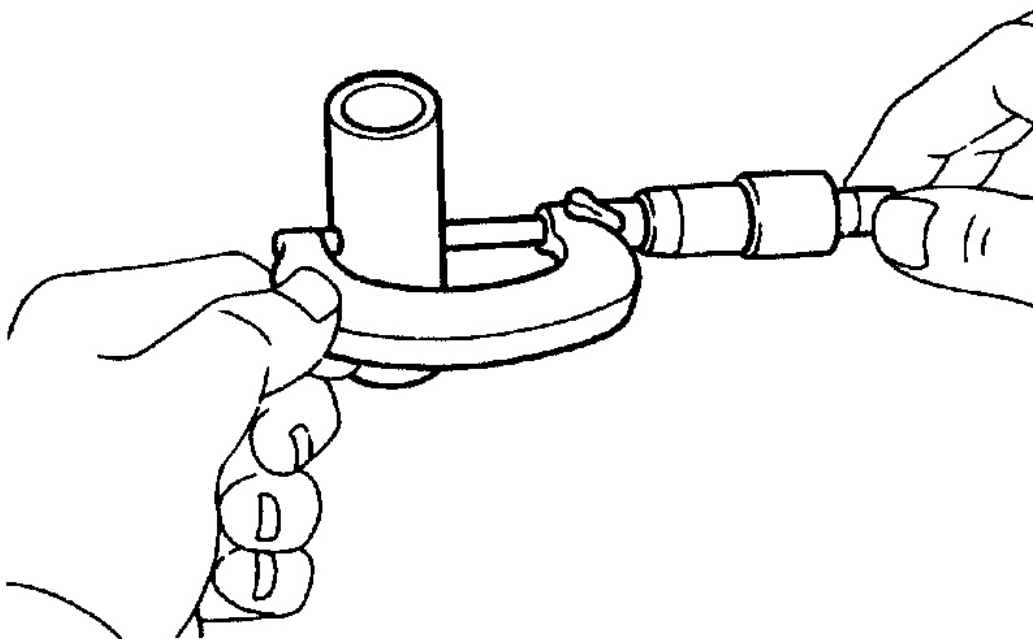
Standard oil clearance:

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.



G03197571

Fig. 335: Measuring Piston Pin Diameter

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

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.)

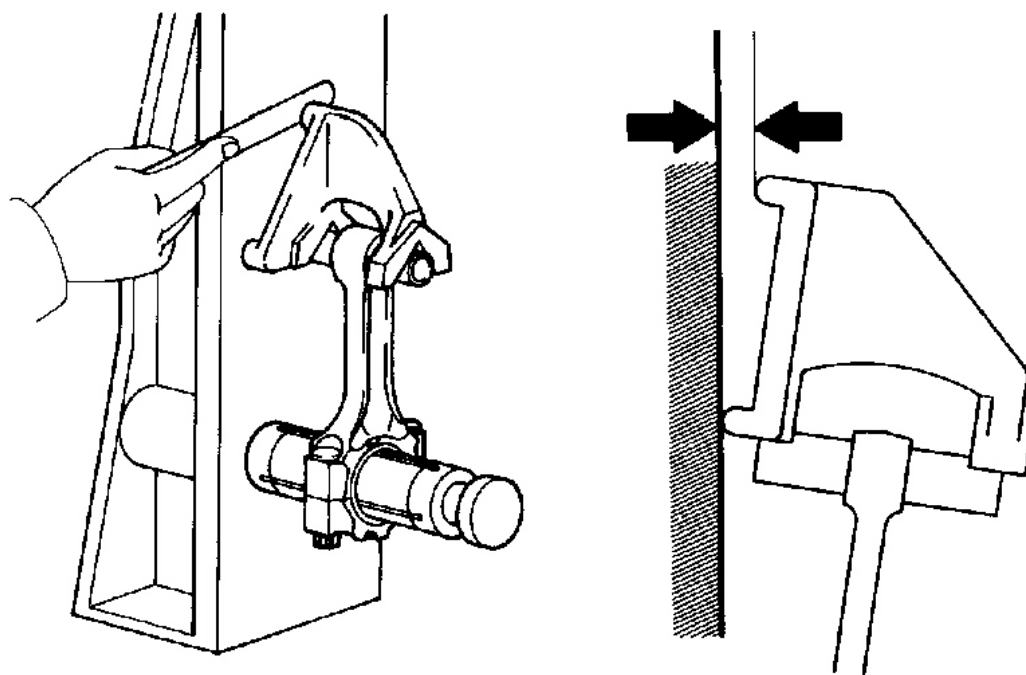
If the diameter is greater than maximum, replace the connecting rod.

- 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.)

If the misalignment is greater than maximum, replace the connecting rod assembly.



G03197572

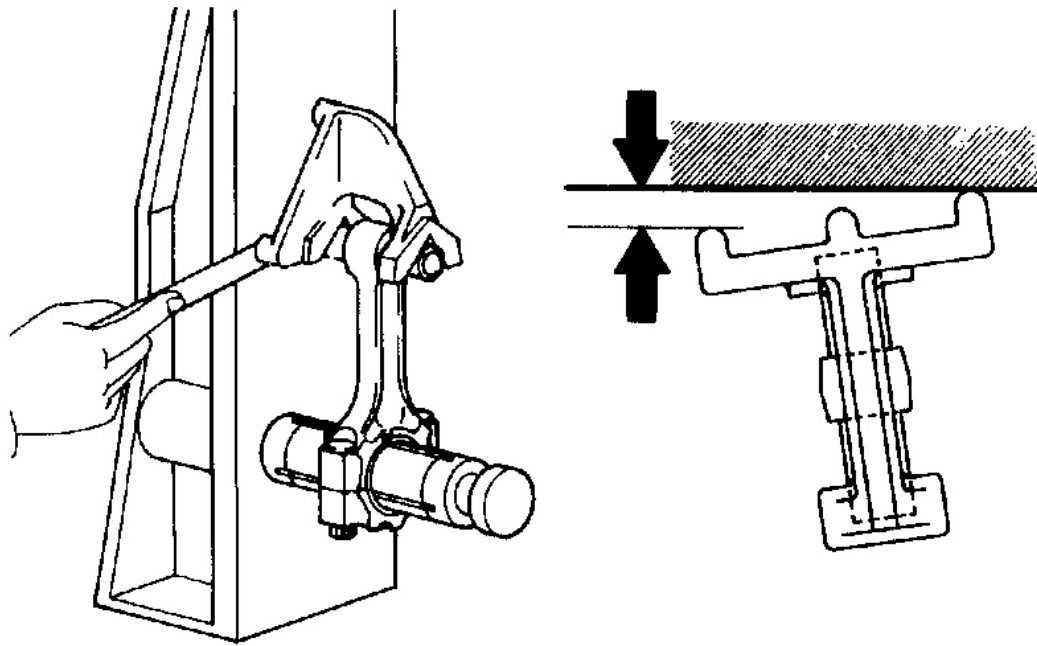
Fig. 336: Checking Connecting Rod Alignment
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check for twist.

Maximum twist:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If the twist is greater than maximum, replace the connecting rod assembly.



G03197573

Fig. 337: Checking Connecting Rod For Twist
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSPECT RING GROOVE CLEARANCE

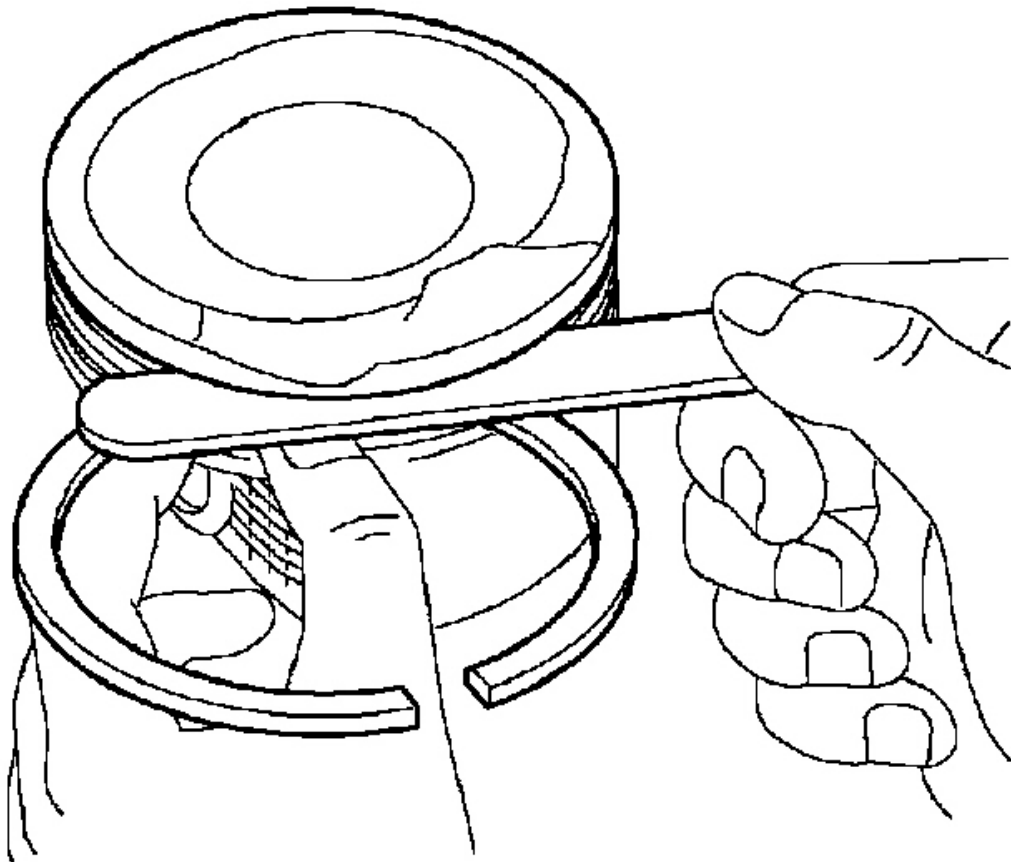
- Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Standard ring groove clearance:

STANDARD RING GROOVE CLEARANCE SPECIFICATION

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)

If the clearance is not as specified, replace the piston.

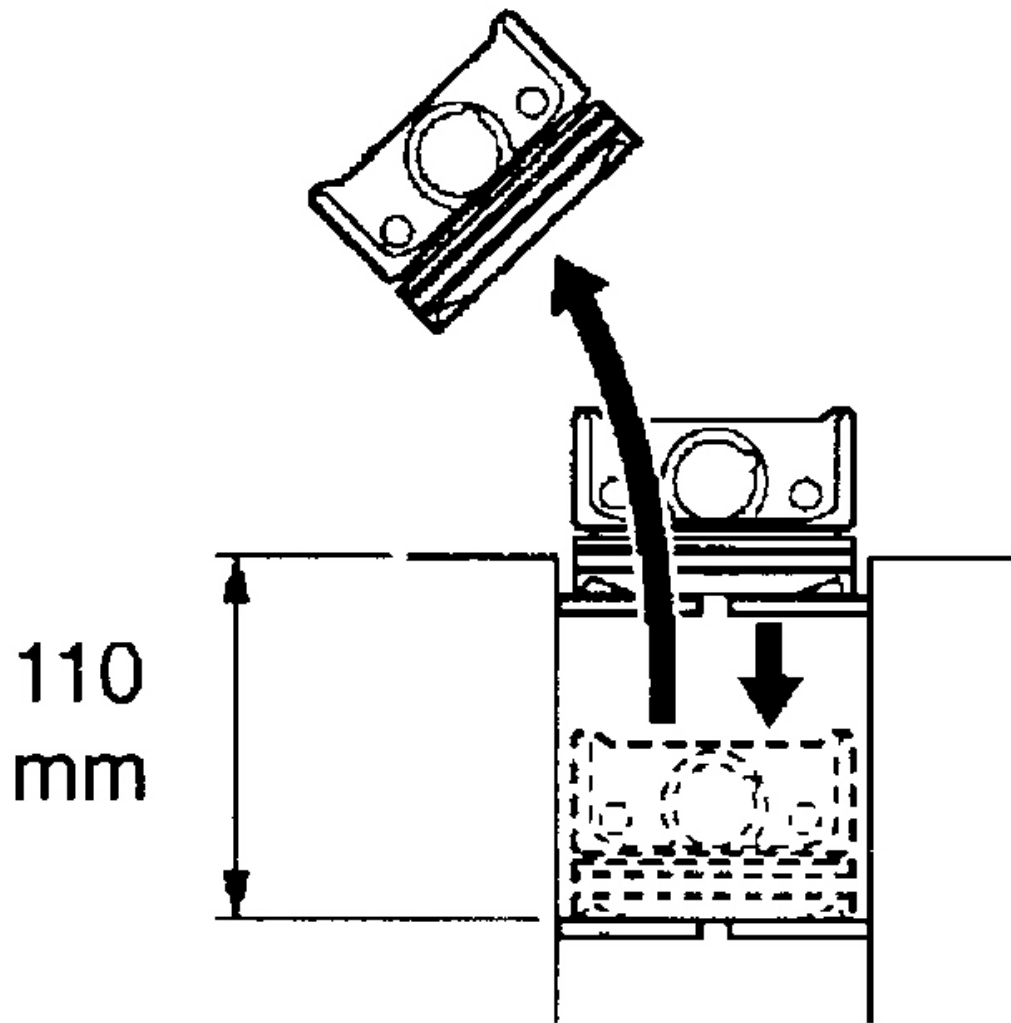


G03197574

Fig. 338: Measuring Clearance Between New Piston Ring & Wall Of Ring Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSPECT PISTON RING END GAP

- a. 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.



G03197575

Fig. 339: Pushing Piston Ring Using Piston
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a feeler gauge, measure the end gap.

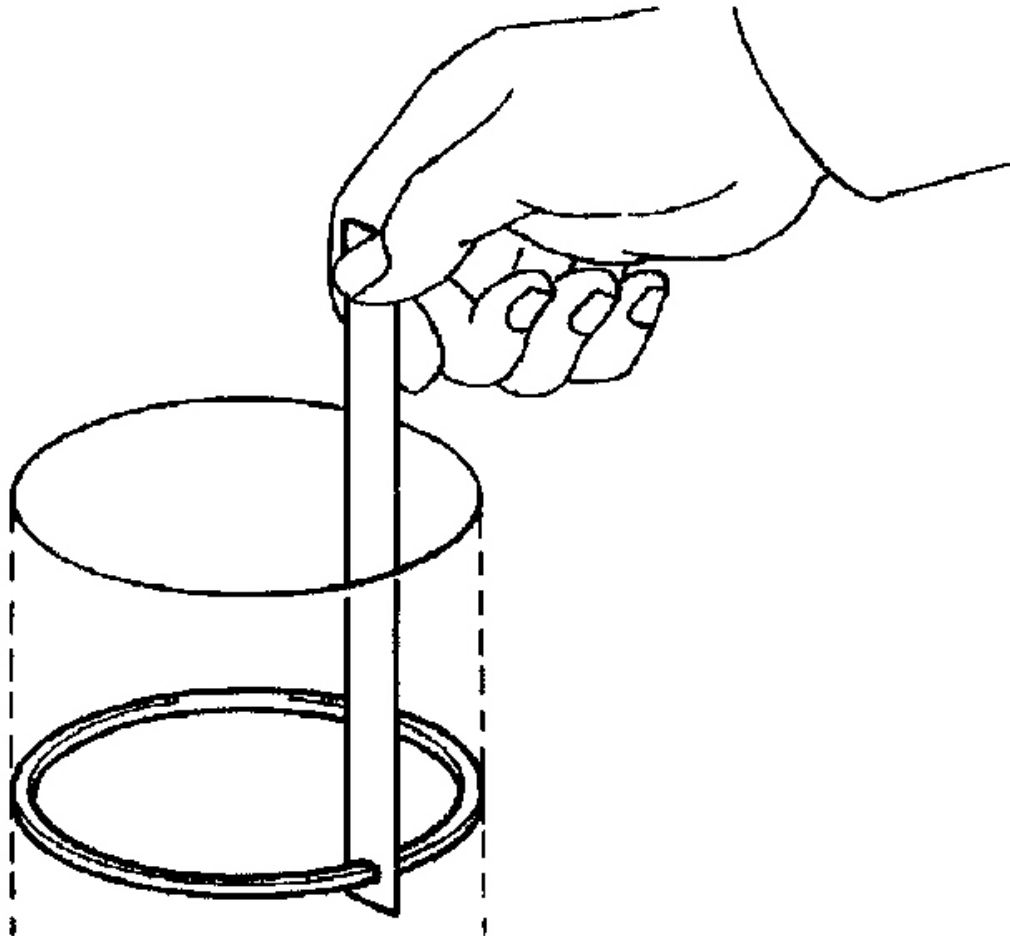
Standard End Gap:

STANDARD RING END GAP SPECIFICATION

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)

If the end gap is greater than maximum, replace the piston ring and oil ring.



G03197576

Fig. 340: Measuring Ring End Gap

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

22. INSPECT CONNECTING ROD BOLT

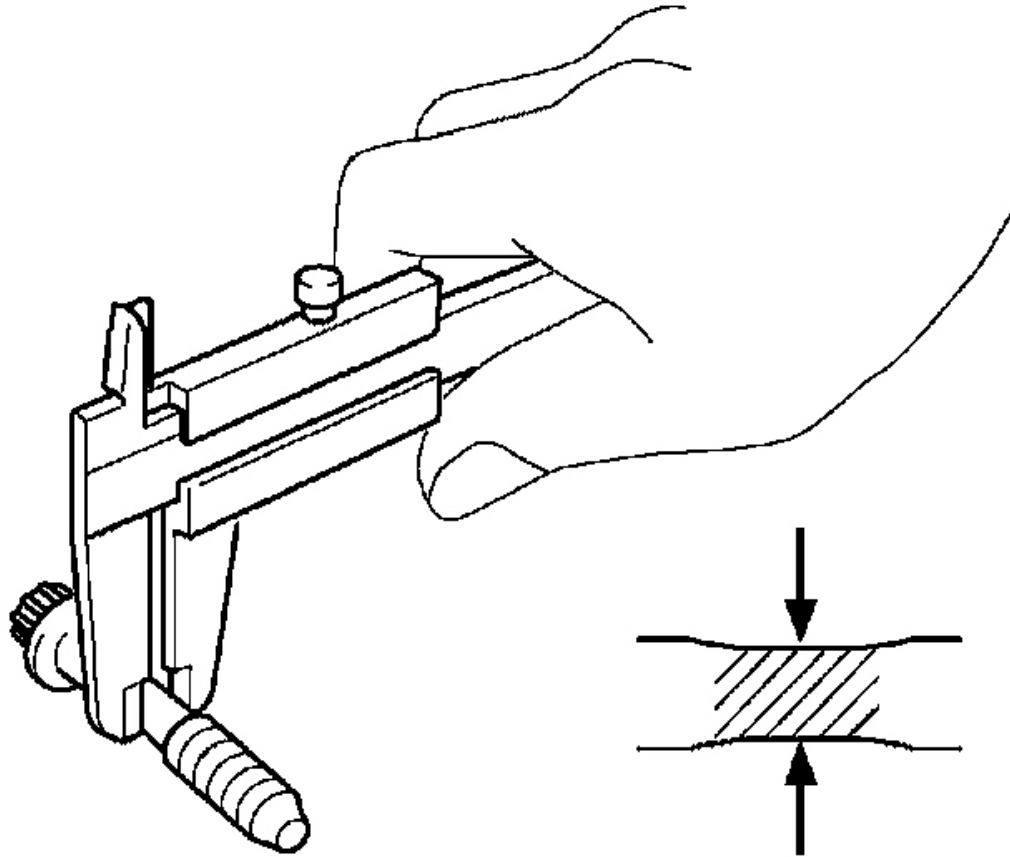
- Using a vernier calipers, measure the tension portion diameter of the bolt.

Standard diameter:

6.6 to 6.7 mm (0.260 to 0.264 in.)

Maximum diameter: 6.4 mm (0.252 in.)

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



G03197577

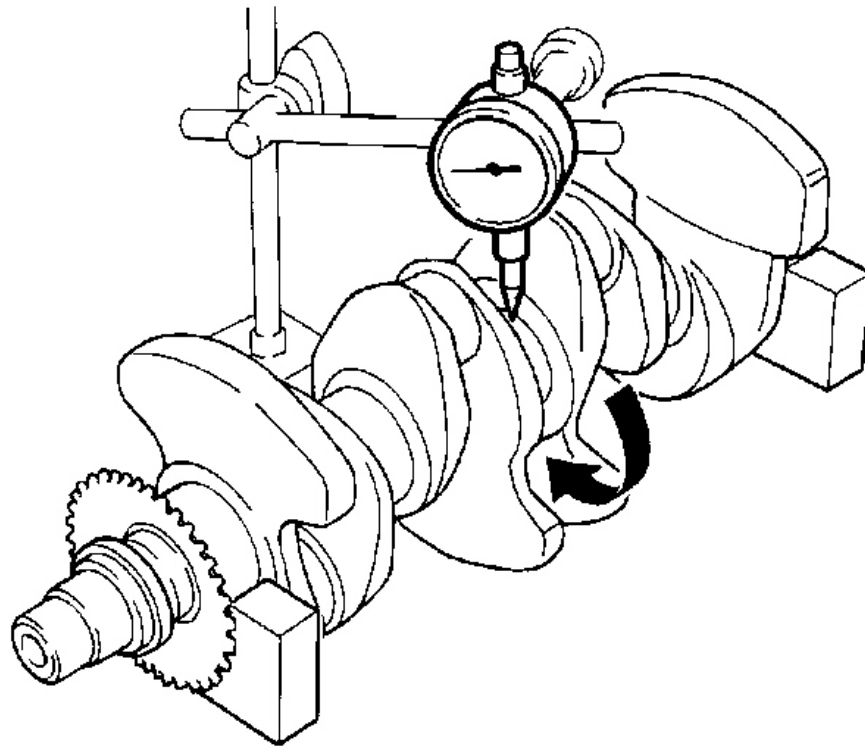
Fig. 341: Measuring Tension Portion Diameter Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. INSPECT CRANKSHAFT

- a. Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.

Maximum circle runout: 0.03 mm (0.0012 in.)

If the circle runout is greater than maximum, replace the crankshaft.



N

G03197578

Fig. 342: Measuring Circle Runout Of Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the diameter.
1. Using a micrometer, measure the diameter of each main journal as illustrated.

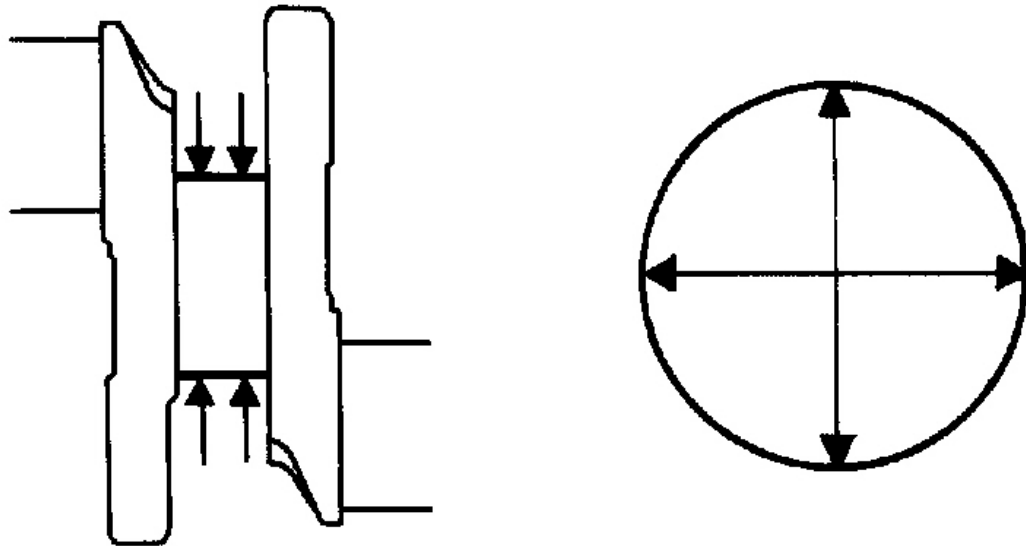
Diameter: 45.988 to 46.000 mm (1.8106 to 1.8110 in.)

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.



G03197579

Fig. 343: Identifying Diameter Of Main Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Using a micrometer, measure the diameter of each crank pin as illustrated.

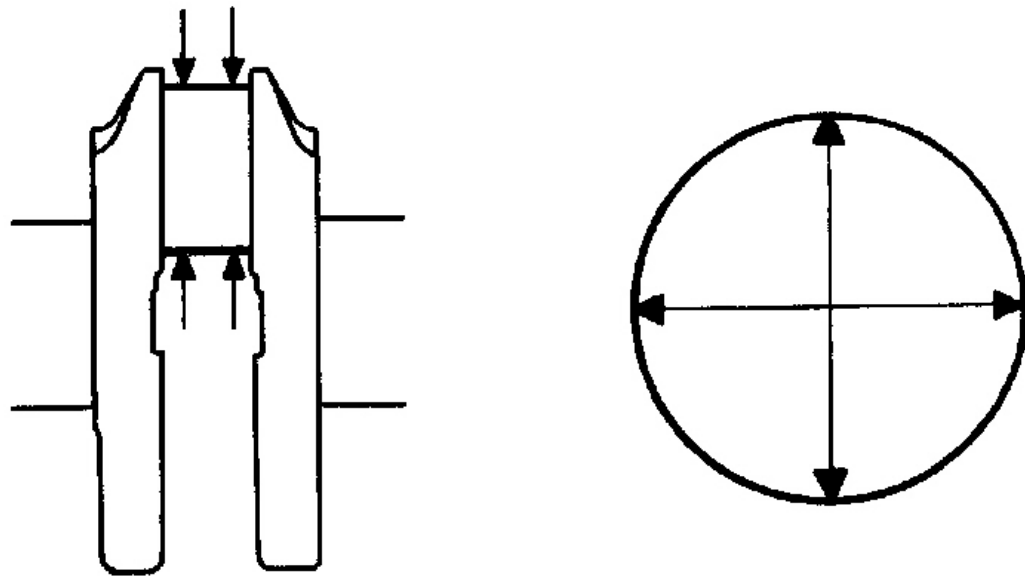
Diameter: 39.992 to 40.000 mm (1.5745 to 1.5748 in.)

4. Calculate the taper and distortion of the crank pin.

Maximum taper and distortion:

0.02 mm (0.0008 in.)

If the taper and distortion are greater than maximum, replace the crankshaft.



G03197580

Fig. 344: Identifying Diameter Of Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Wrap the chain around the timing sprocket.
- d. Using a vernier calipers, measure the timing sprocket diameter with the chain.

Standard sprocket diameter (w/ chain):

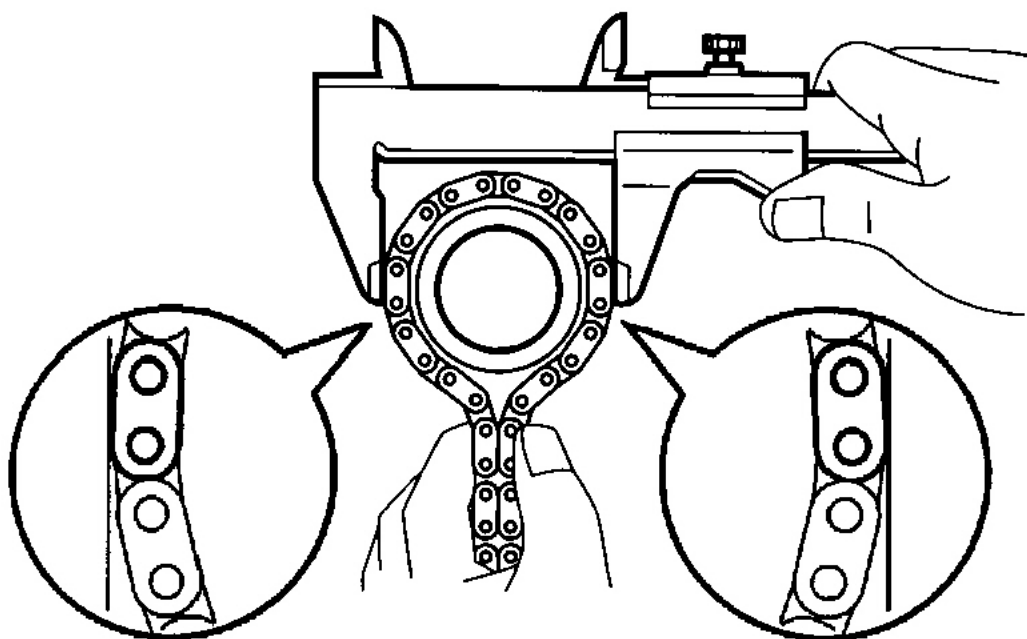
51.72 mm (2.0362 in.)

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.

If the diameter is less than minimum, replace the chain and crankshaft.

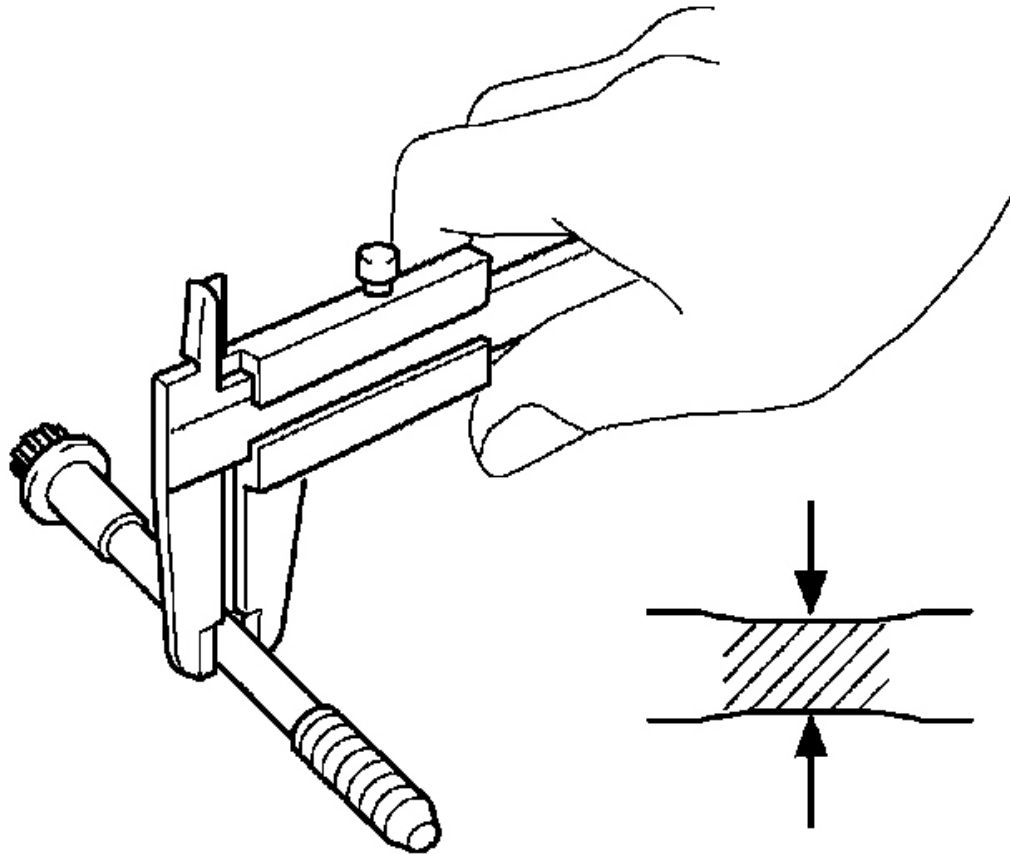


G03197581

Fig. 345: Measuring Timing Sprocket Diameter With Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. INSPECT CRANKSHAFT BEARING CAP SET BOLT

- a. Using vernier calipers, measure the tension portion diameter of the bolt.



G03197582

Fig. 346: Measuring Tension Portion Diameter Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard diameter: 7.3 to 7.5 mm (0.287 to 0.295 in.)

Minimum diameter: 7.2 mm (0.283 in.)

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

25. INSPECT CRANKSHAFT OIL CLEARANCE

- a. Clean each main journal and bearing.
- b. 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 or the back side of the bearing.**

HINT:

The 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.

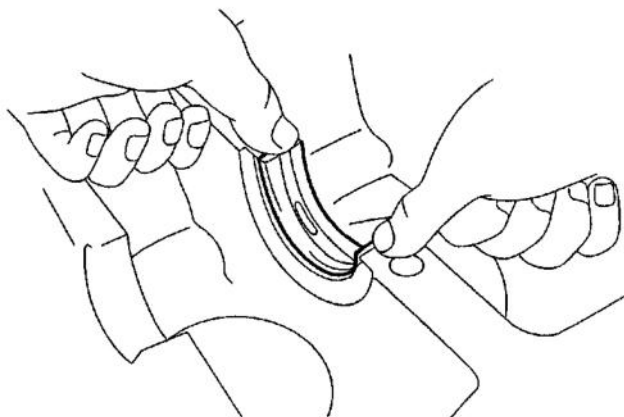
Specified clearance:

A - B = within 0.8 mm (0.032 in.)

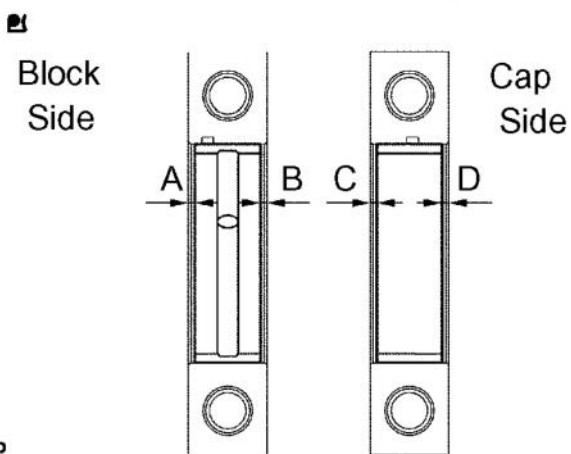
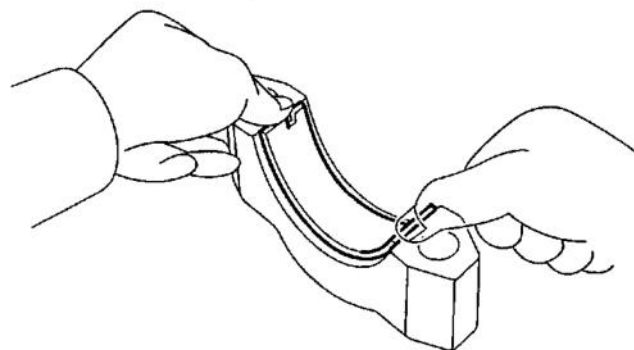
C - D = within 0.4 mm (0.016 in.)

- c. Install the crankshaft onto the cylinder block.

Upper Bearing



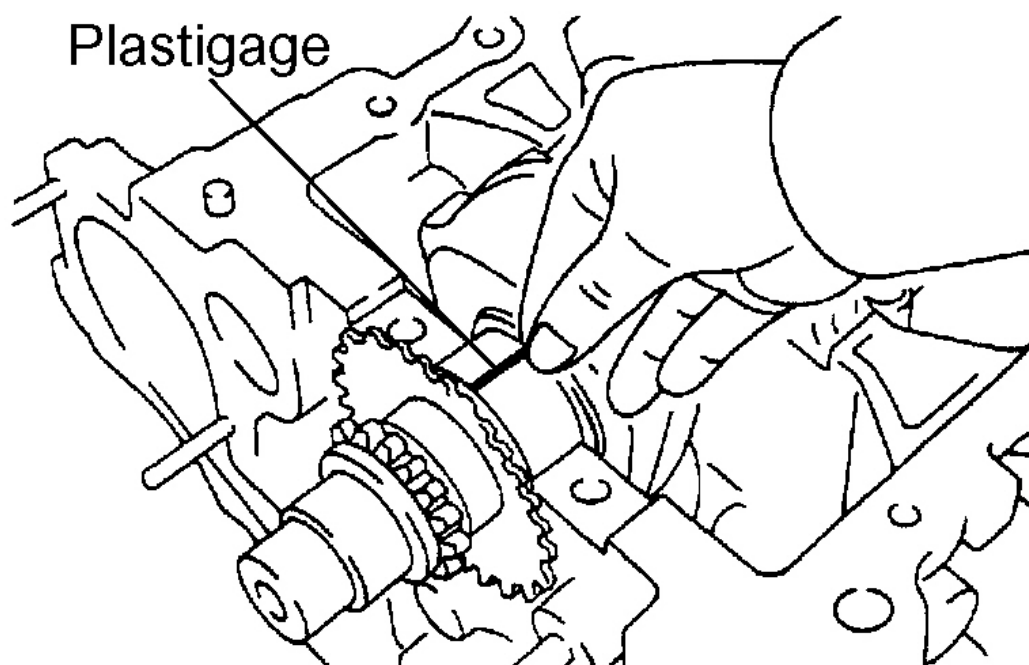
Lower Bearing



G03197583

Fig. 347: Installing Upper Bearing Onto Cylinder Block & Lower Bearing Onto Bearing Cap
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Lay a strip of Plastigage across each journal.



G03197584

Fig. 348: 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.
- f. Apply a light coat of engine oil to the threads of the bearing cap bolts.

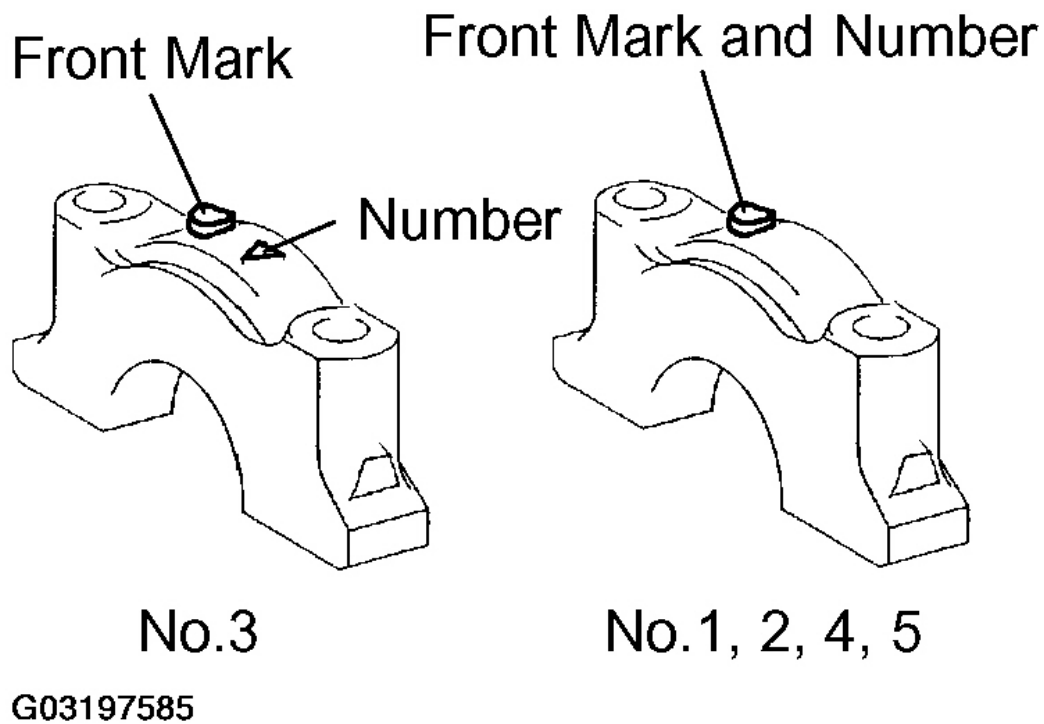


Fig. 349: Identifying Front Mark & Number On Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Using SST, tighten the bolts in several steps by the specified torque in the sequence shown in the illustration.

SST 09011-38121

Torque: 22 N.m (224 kgf.cm, 16 ft.lbf)

NOTE: Do not turn the crankshaft.

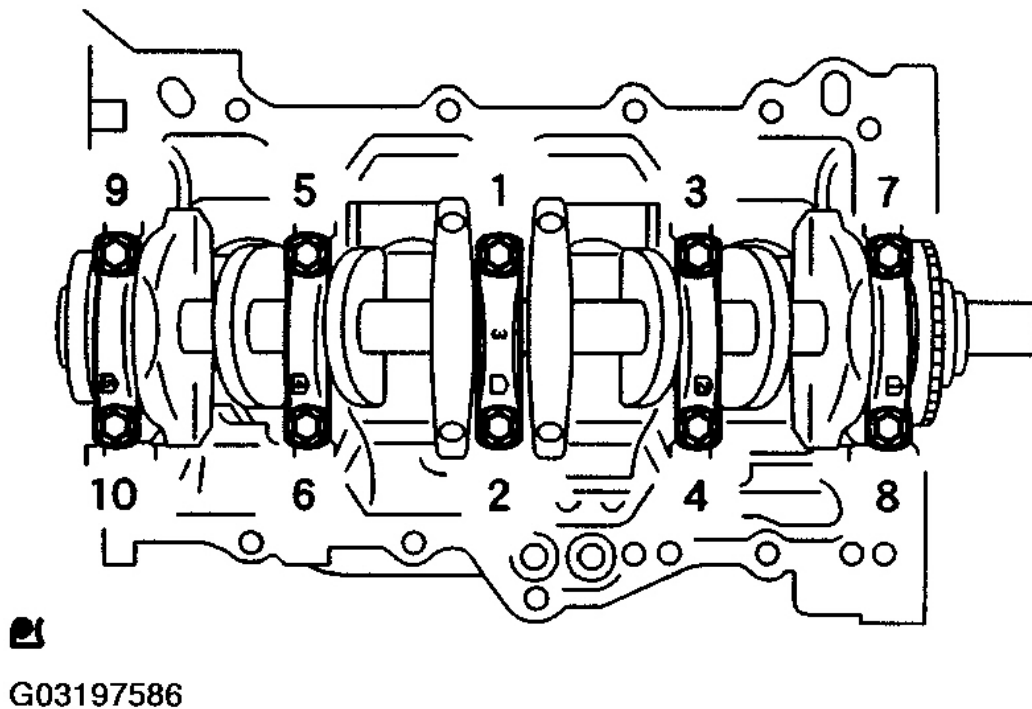
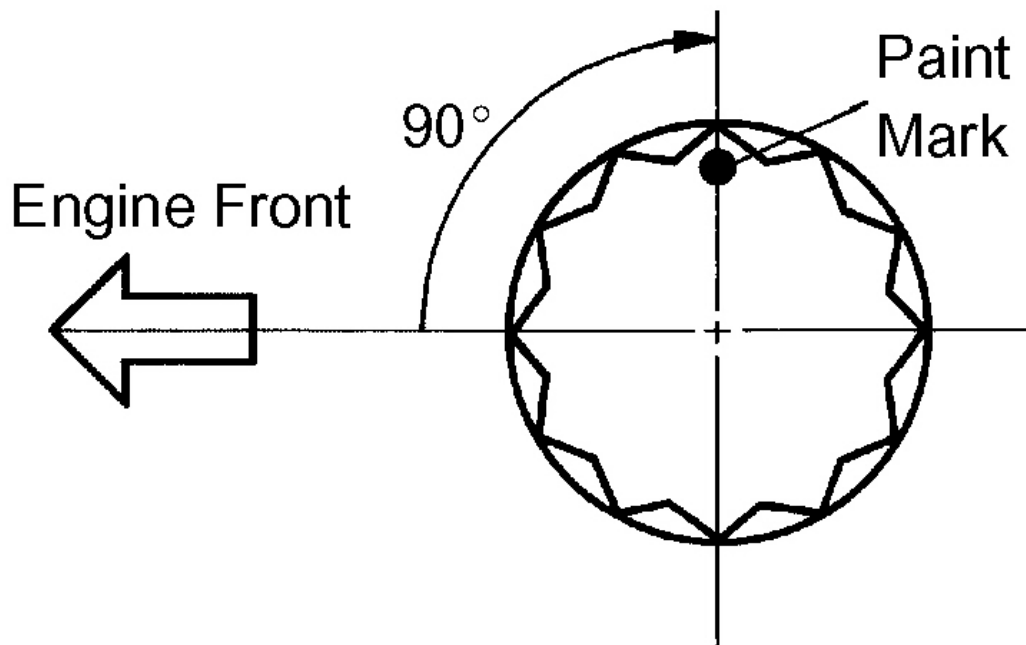


Fig. 350: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 (g).
- j. Check that the painted mark is now at a 90° angle to the front.

NOTE: Do not turn the crankshaft.

- k. Remove the bearing cap sub-assembly.



G03197587

Fig. 351: Retightening Bearing Cap Bolts By 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Measure the Plastigage at its widest point.

Standard oil clearance:

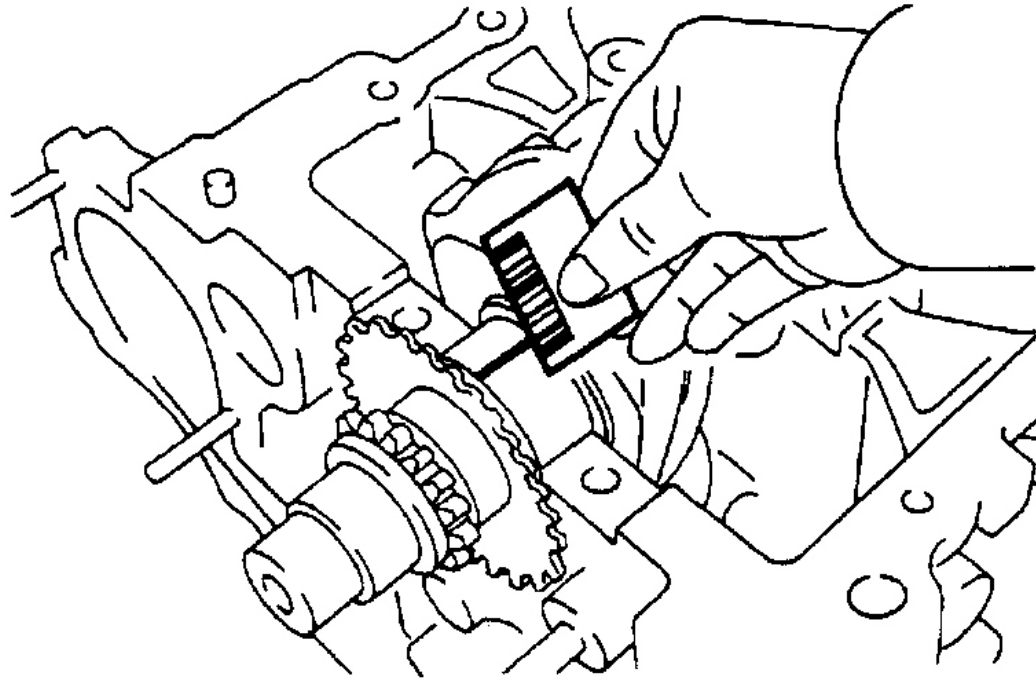
0.01 to 0.023 mm (0.0004 to 0.0009 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

NOTE: Completely remove the Plastigage.

HINT:

- If the width is greater than maximum, select and replace the bearing. If necessary, use the undersize bearing.



G03197588

Fig. 352: Measuring Plastigage At Its Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

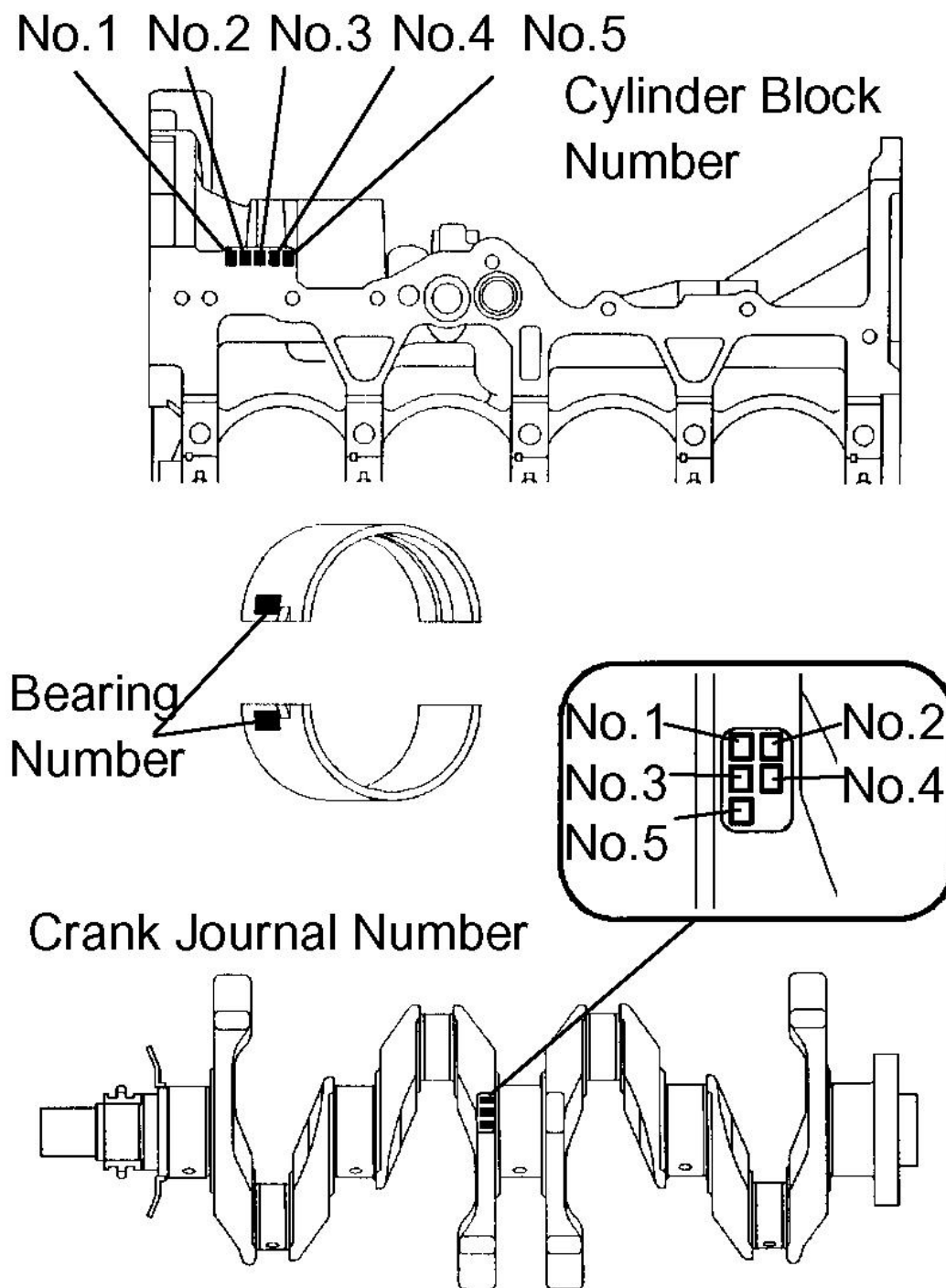
CYLINDER BLOCK NUMBER AND CRANK JOURNAL NUMBER SPECIFICATION

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)

2005 Scion xA

2005 ENGINE Engine Mechanical - xA

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)	-



G03197589

Fig. 353: Identifying Cylinder Block Number & Crank Journal Number Location
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CENTER BEARING THICKNESS AND OIL CLEARANCE SPECIFICATION

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)	^

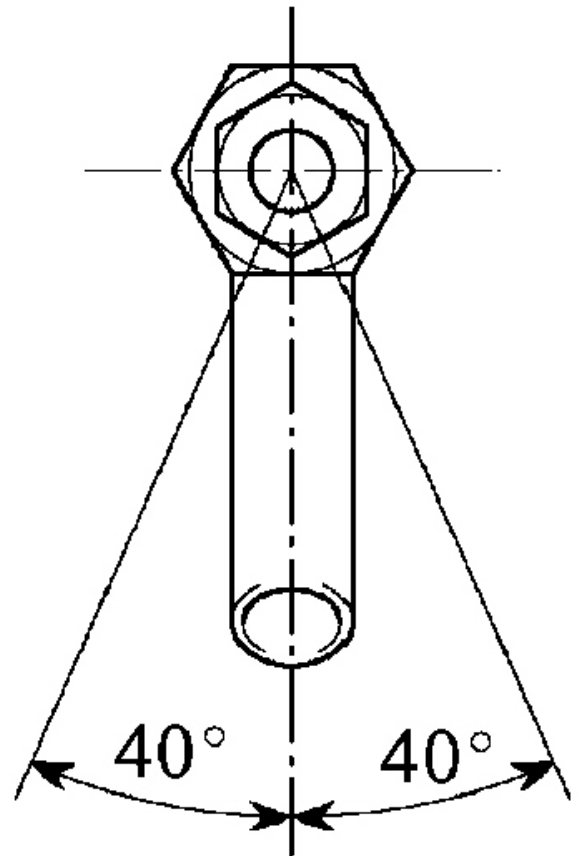
26. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSY

- a. Apply two or three 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 loos it after setting the union correctly.
- The pipe of the drain cock should be within 40° of the vertical.



Y

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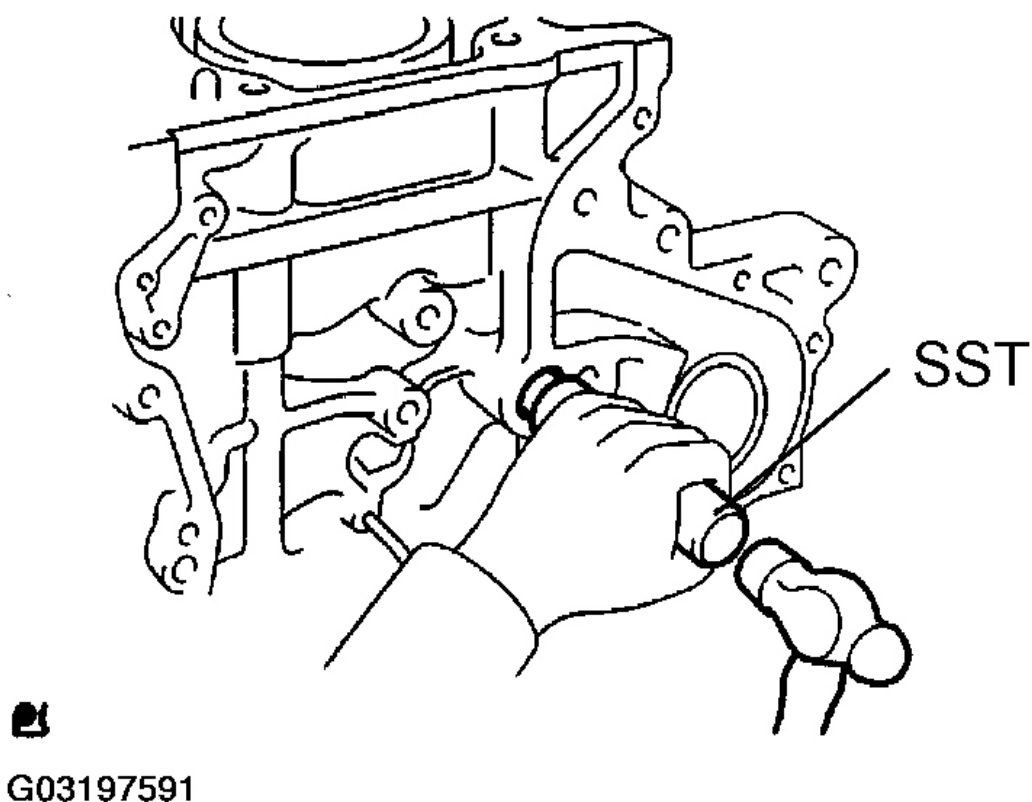
Fig. 354: Identifying Water Drain Cock Pipe Position (40° Vertical)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. INSTALL TIGHT PLUG

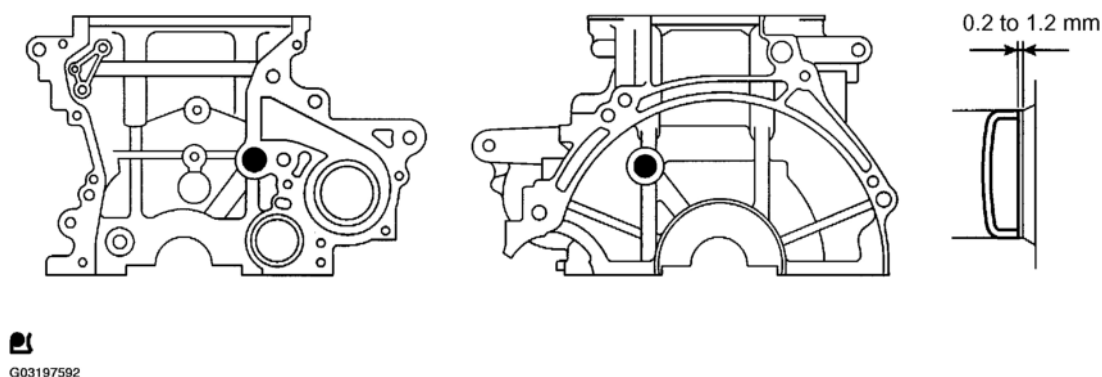
- Apply adhesive to tight plugs.
- Using SST, tap in the new tight plugs as shown in the illustration.

SST 09950-60010 (09951-00180), 09950-70010 (09951-07100)

Standard depth: 0.2 to 1.2 mm (0.008 to 0.047 in.)

**Fig. 355: Installing Tight Plug**

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

**Fig. 356: Identifying Standard Depth Of Tight Plug**

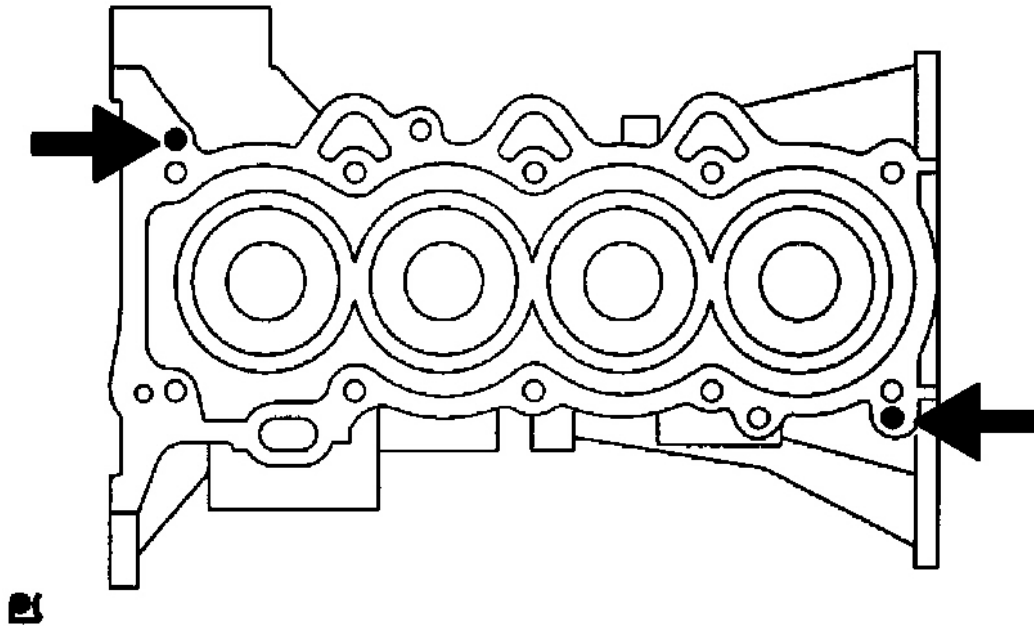
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. INSTALL CYLINDER HEAD SET STRAIGHT PIN

- a. Using a plastic-faced hammer, tap in the straight pin.

Standard protrusion:

8.5 to 9.5 mm (0.335 to 0.374 in.)



G03197593

Fig. 357: Installing Cylinder Head Set Straight Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. INSTALL STRAIGHT PIN

- a. Using a plastic-faced hammer, tap in the 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.)

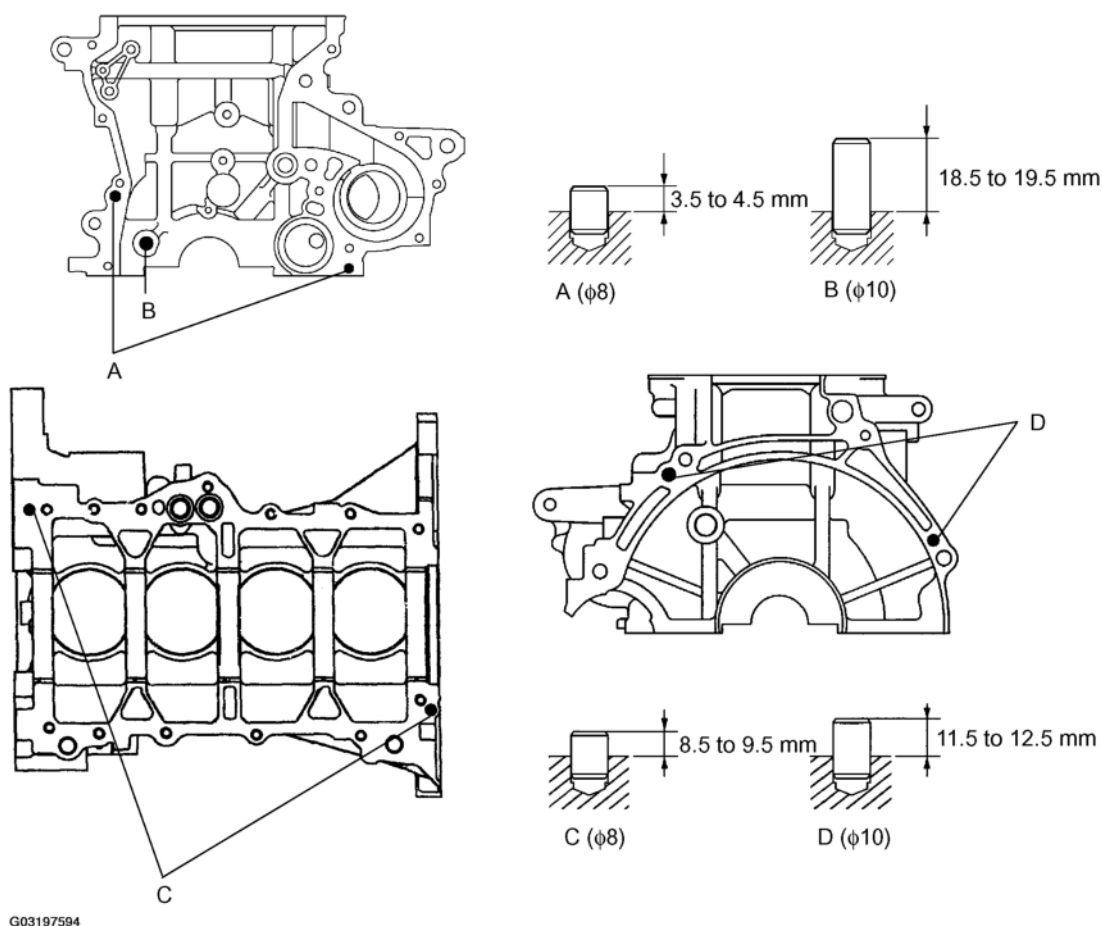
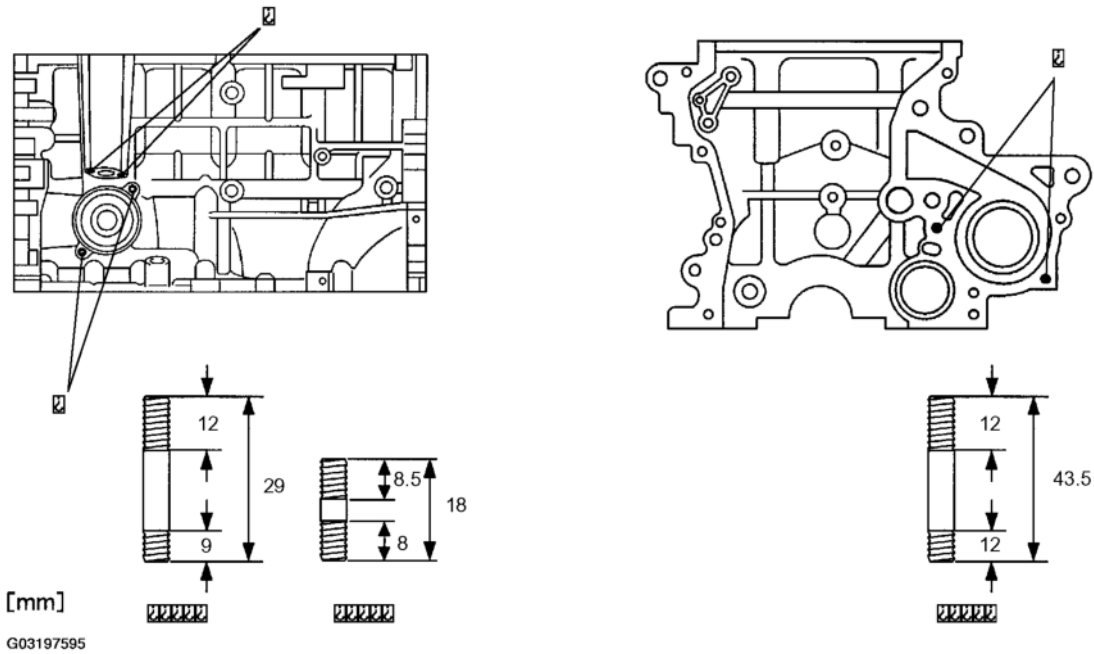


Fig. 358: Identifying Standard Protrusion Of Straight Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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. 359: Installing Stud Bolts**

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

31. INSTALL CRANKSHAFT

- a. 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 backside of the bearing.

HINT:

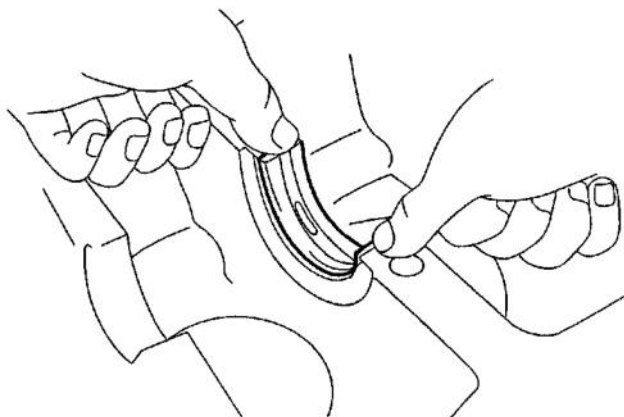
Mass production parts do not have claws as marks. If reusing the mass production parts, measure the clearance of both sides with the bearing in the center of the bearing cap.

Specified clearance:

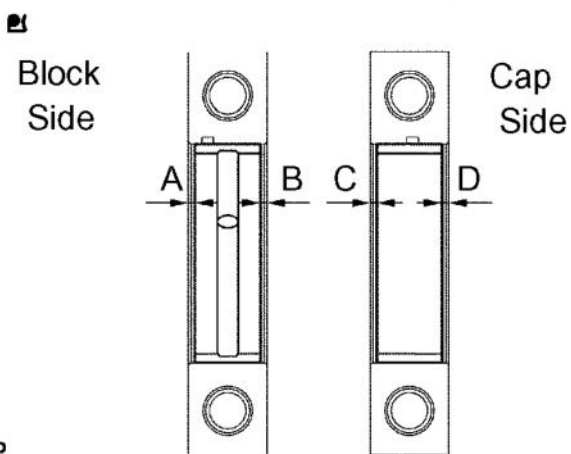
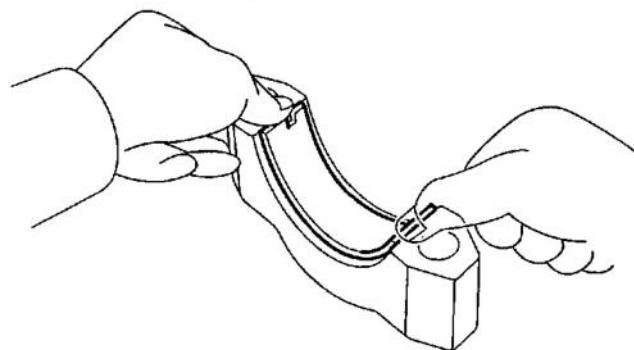
A - B = within 0.8 mm (0.032 in.)

C - D = within 0.4 mm (0.016 in.)

Upper Bearing



Lower Bearing



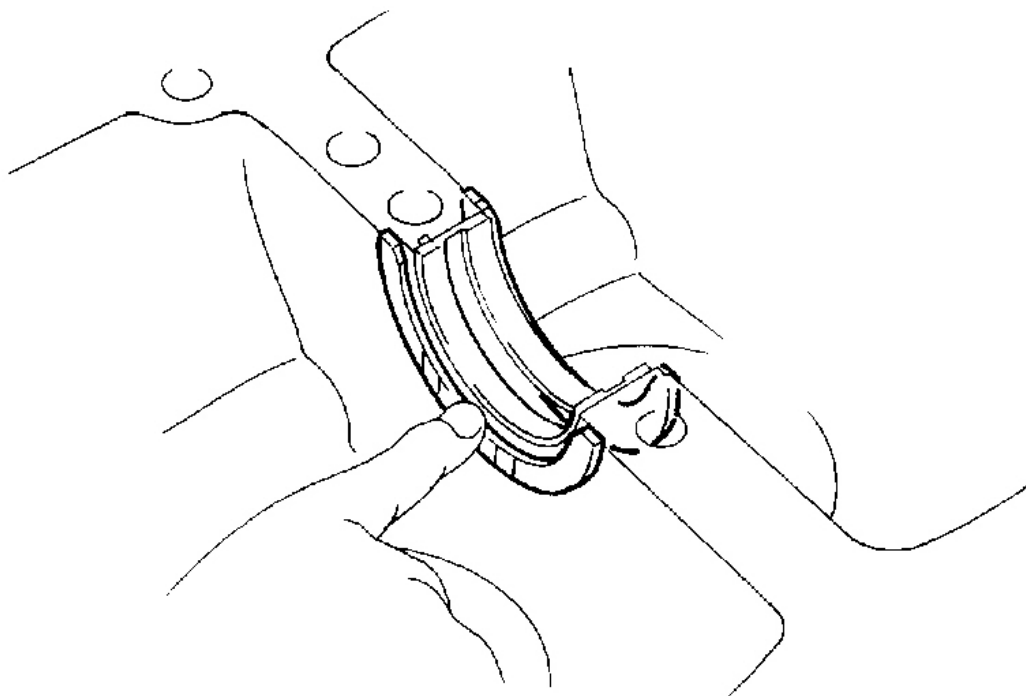
P

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Fig. 360: Installing Upper Bearing Onto Cylinder Block & Lower Bearing Onto Bearing Cap
 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.

- c. Apply engine oil to the upper bearing and install the crankshaft onto the cylinder block.



G03197597

Fig. 361: Installing Thrust Washers Onto No. 3 Journal Position Of Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check the front marks and numbers and install the bearing caps onto the cylinder block.
- e. Apply a light coat of engine oil to the threads of the bearing cap bolts.

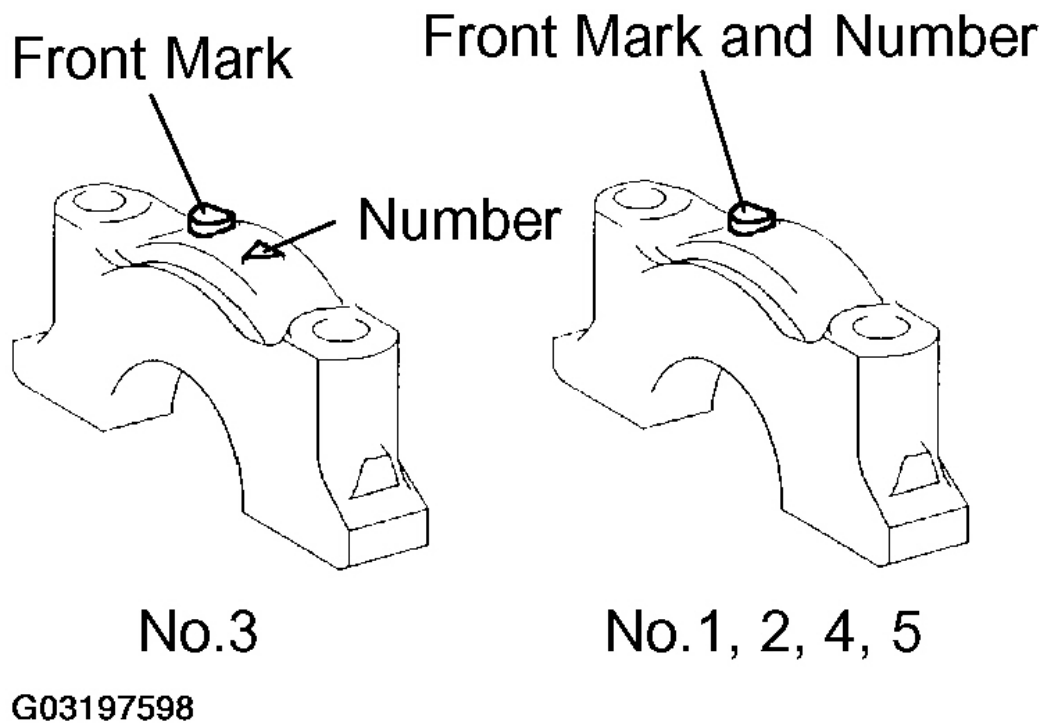


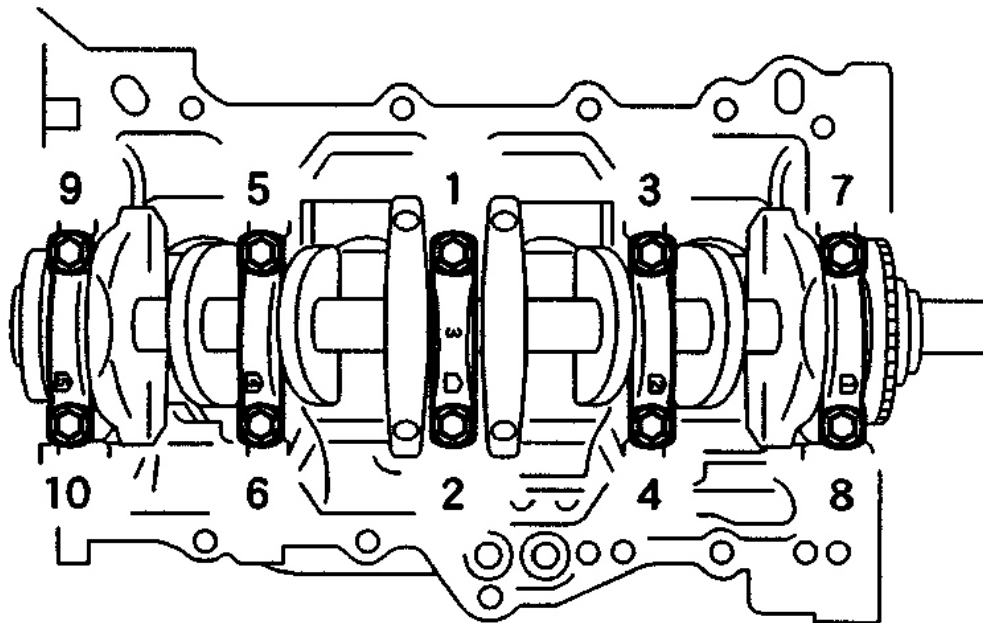
Fig. 362: Identifying Front Mark & Number On Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using SST, tighten the bolts in several steps by the specified torque in the sequence shown in the illustration.

SST 09011-38121

Torque: 22 N.m (224 kgf.cm, 16 ft.lbf)

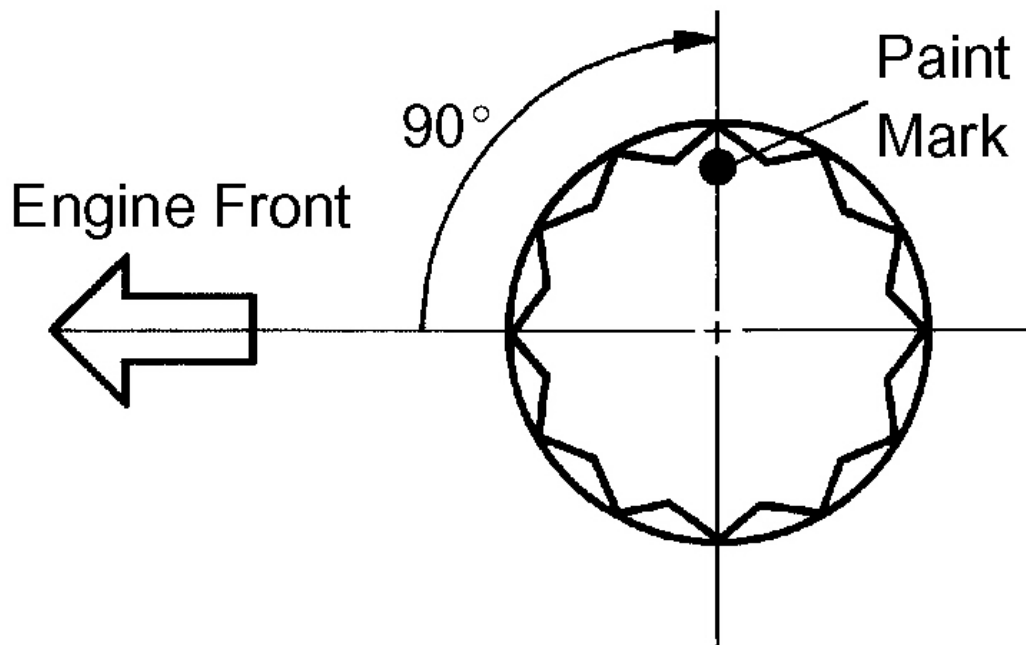
NOTE: Check that the crankshaft turns smoothly.



G03197599

Fig. 363: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 the painted mark is now at a 90° angle to the front.

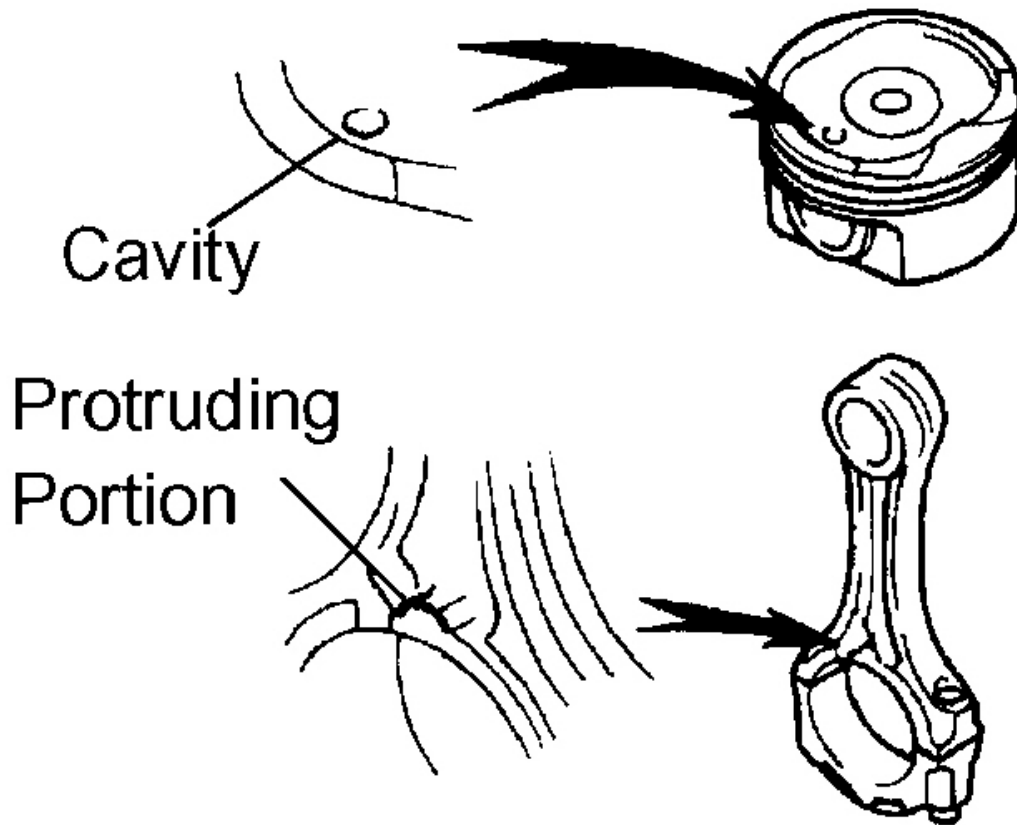


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Fig. 364: Retightening Bearing Cap Bolts By 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.



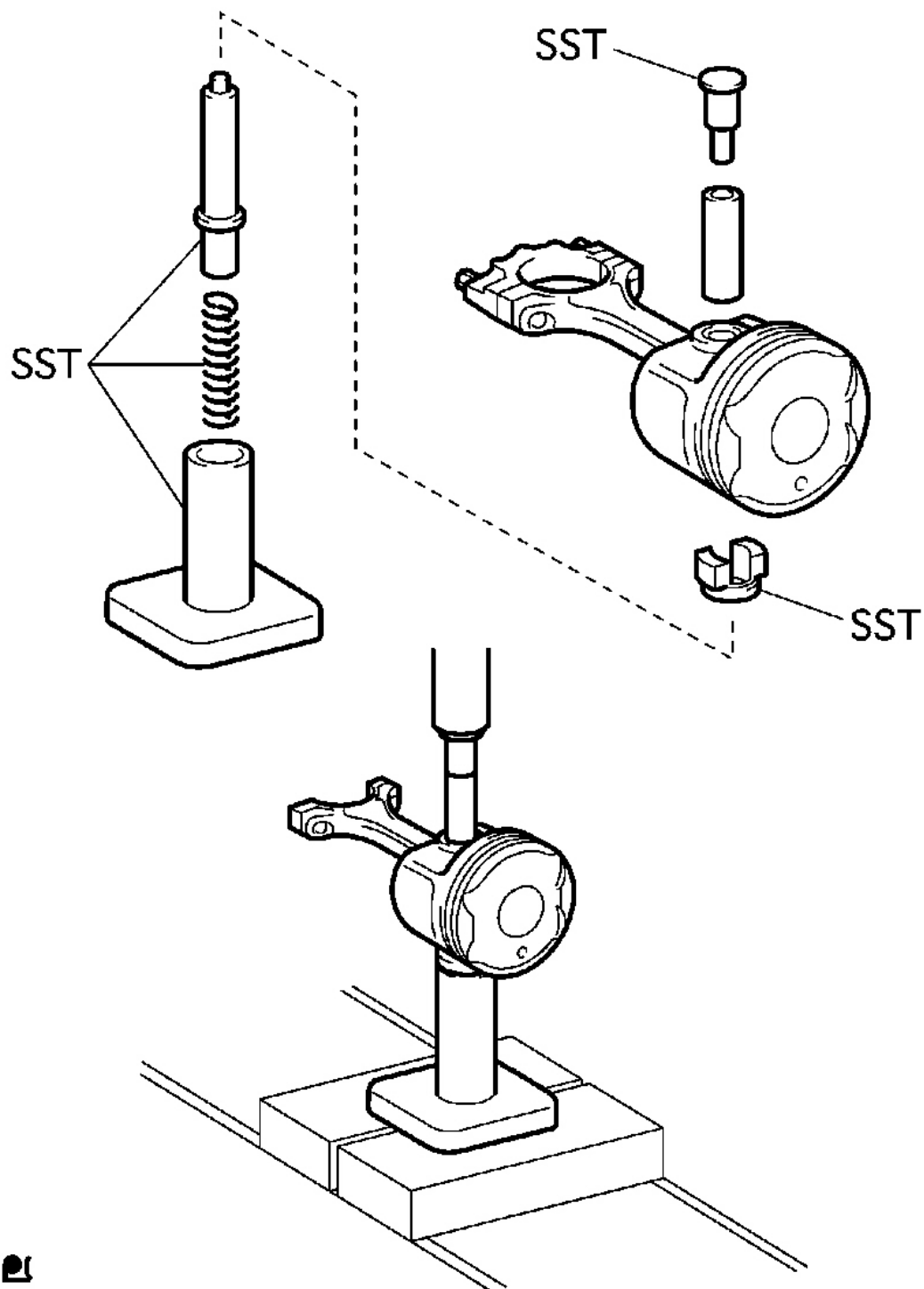
G03197601

Fig. 365: Aligning Cavity Of Piston With Protruding Portion Of Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST and a press, press into the piston pin.

SST 09221-25026 (09221-00021, 09221-00030, 09221-00190, 09221-00141, 09221-00150)

NOTE: Do not change the combination of the piston and piston pin so that they can be returned to the original locations when reassembling.



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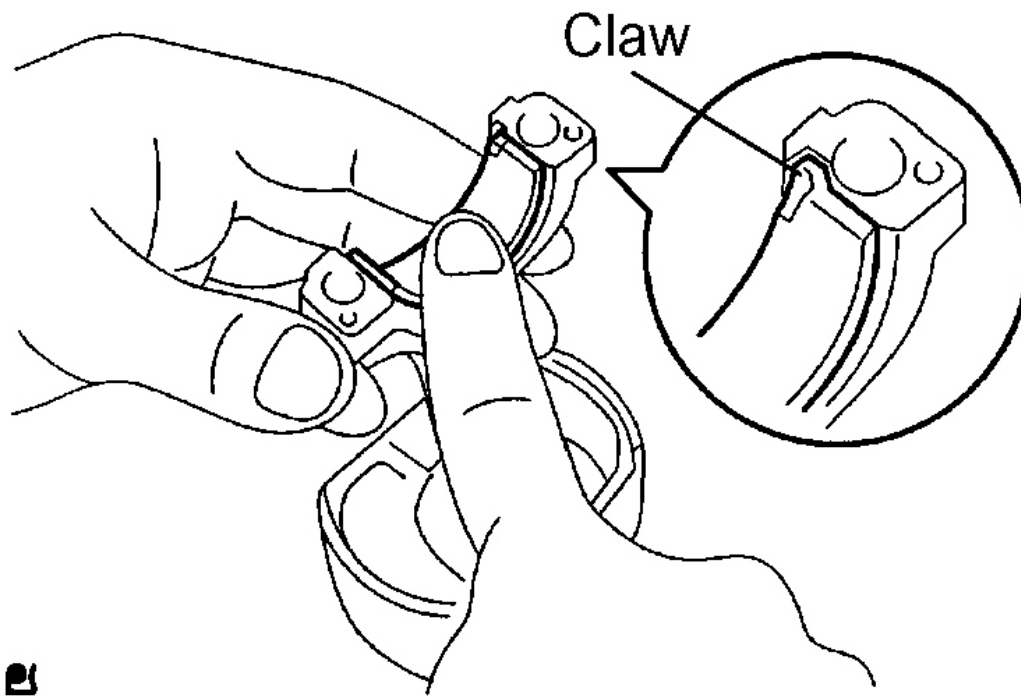
Fig. 366: Installing Piston Pin

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

33. INSTALL CONNECTING ROD BEARING

- a. Align the bearing claw with the grooves of the connecting rod and connecting cap.

NOTE: Clean the backside of the bearing and the bearing surface of the connecting rod and keep them free of oils.



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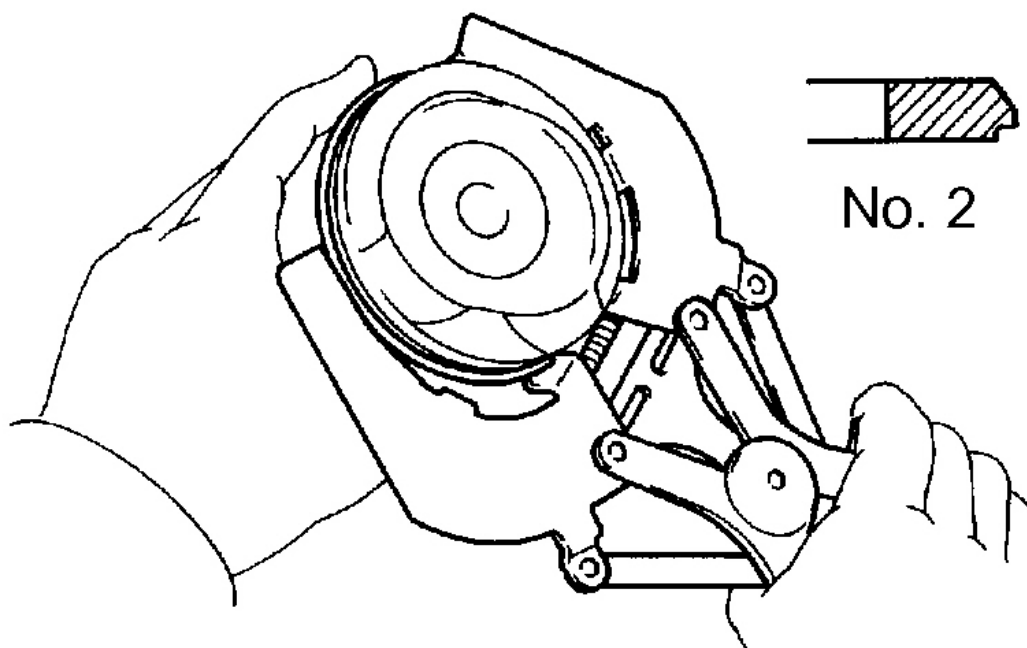
Fig. 367: Aligning Bearing Claw With Grooves Of Connecting Rod & Connecting Cap

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

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.

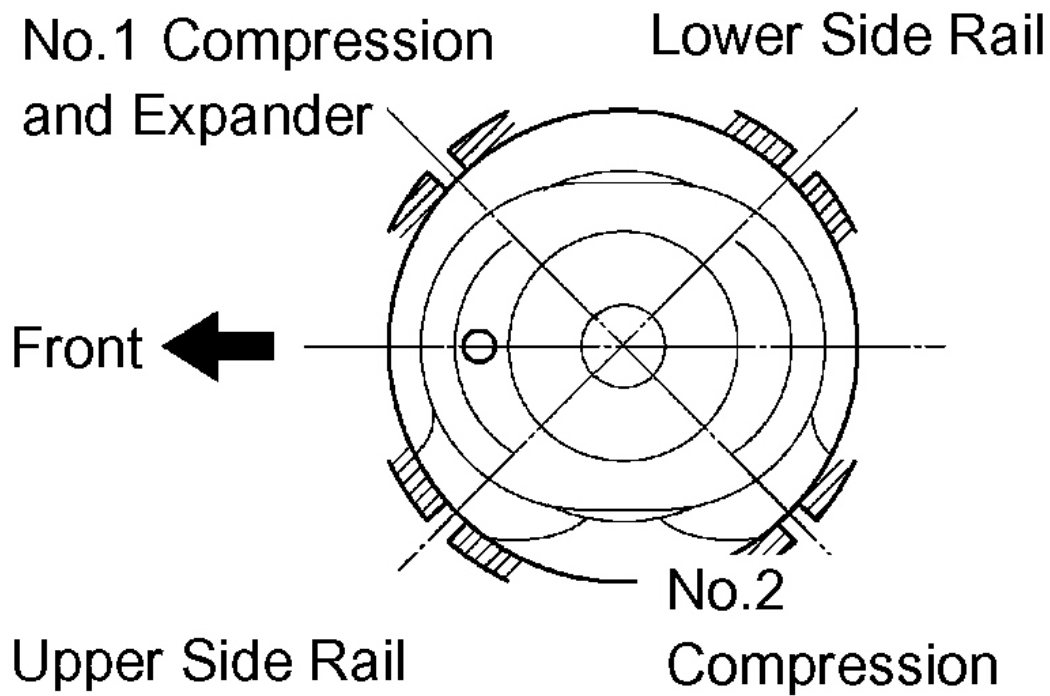


G03197604

Fig. 368: Installing Compression Rings

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

- c. Position the piston rings so that the ring ends are as shown.
35. **INSTALL PISTON SUB-ASSY W/CONNECTING ROD**
- a. Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.
 - b. Check the position of the piston ring ends.



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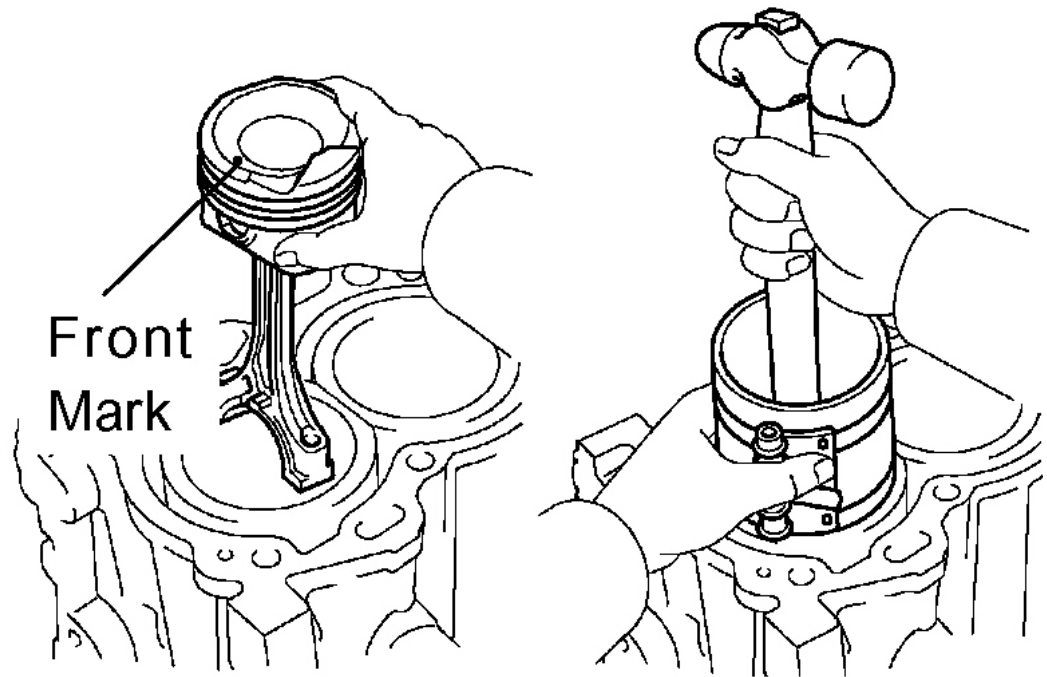
Fig. 369: Identifying Piston Ring Ends Position

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

- c. Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark on the piston facing forward.

NOTE:

- Clean the backside 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.



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Fig. 370: Pushing Piston & Connecting Rod Assemblies Into Cylinder
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.
- e. Apply a light coat of engine oil to the threads of the connecting rod cap bolts.

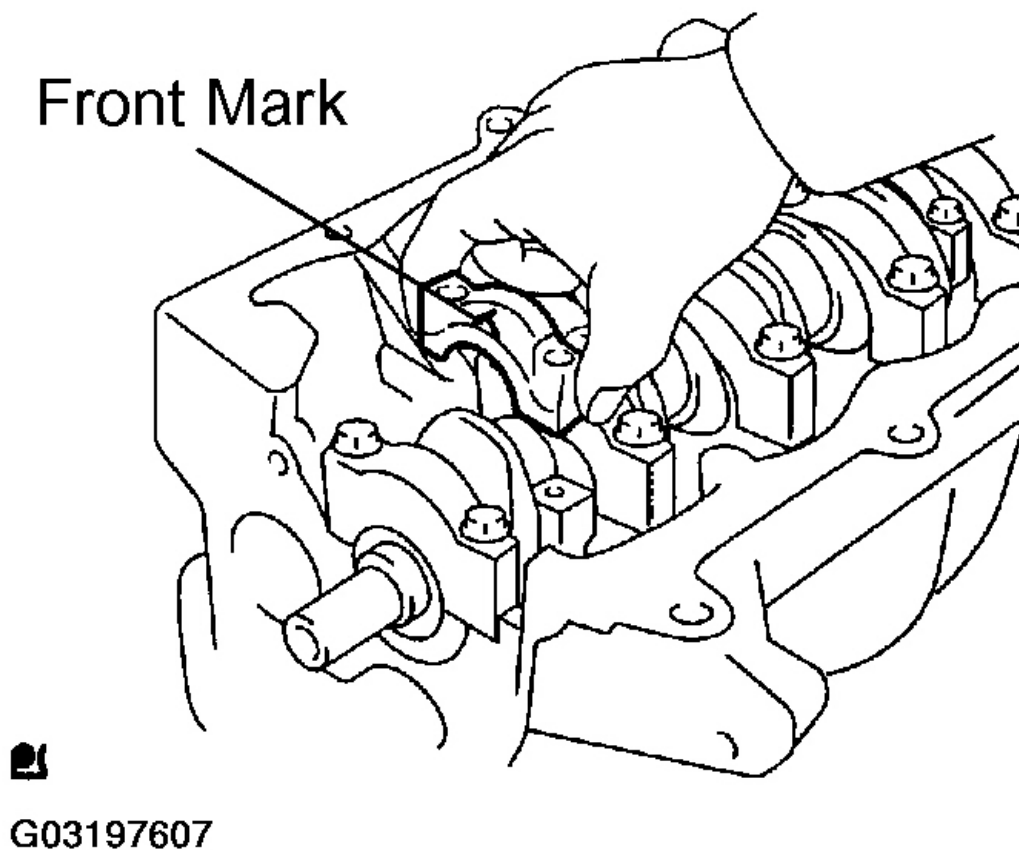
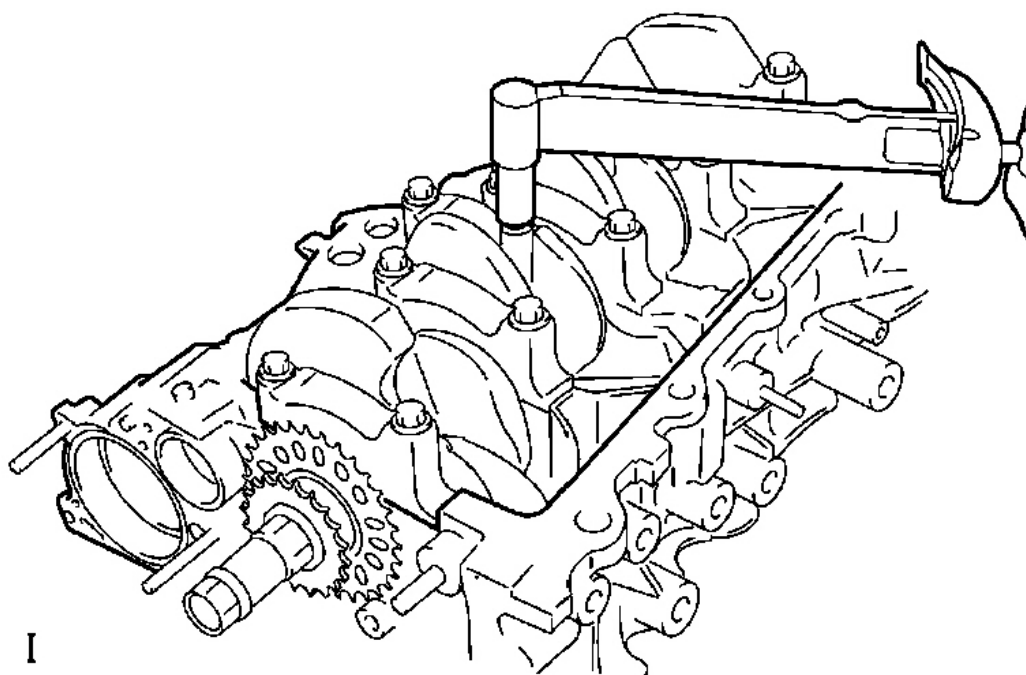


Fig. 371: Identifying Front Mark On Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using SST, tighten the bolts in several steps by the specified torque.

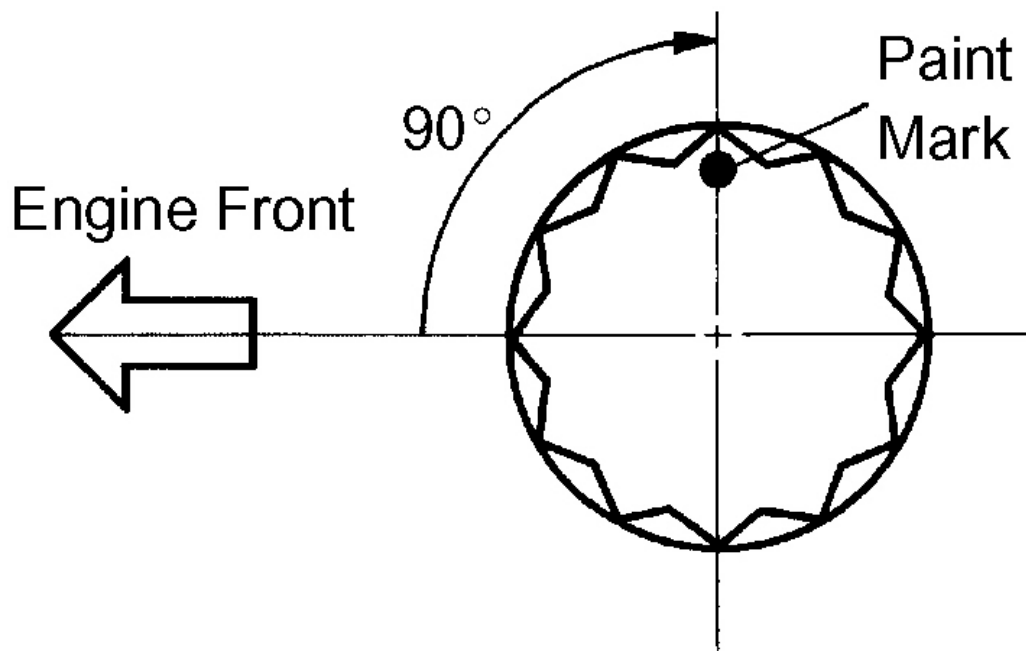
Torque: 15 N.m (153 kgf.cm, 11 ft.lbf)



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Fig. 372: Tightening Connecting Rod Cap Bolt
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.
- i. Check that the crankshaft turns smoothly.



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Fig. 373: Retightening Connecting Rod Cap Bolt By 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.