

2009 ENGINE**Engine Mechanical (2UZ-FE) - 4Runner****ENGINE****ON-VEHICLE INSPECTION**

1. **INSPECT ENGINE COOLANT** (See ON-VEHICLE INSPECTION)
2. **INSPECT ENGINE OIL** (See ON-VEHICLE INSPECTION)
3. **INSPECT BATTERY SPECIFIC GRAVITY** (See ON-VEHICLE INSPECTION)
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
5. **INSPECT FAN AND GENERATOR V BELT**

HINT:

As the belt tensioner coordinates belt tension automatically by its mechanism, you do not need to adjust it by yourself.

- a. Check that the indicator mark on the automatic tensioner is within the A range as shown in the illustration.

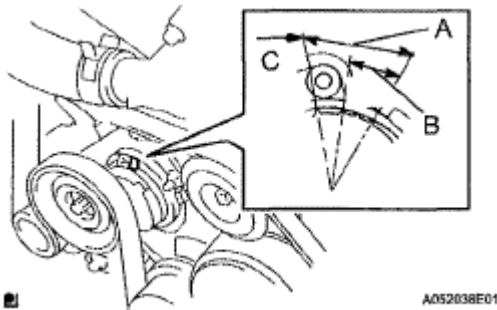


Fig. 1: Identifying Indicator Mark On Automatic Tensioner

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

- b. When the mark is out of the standard range, replace the V belt with a new one.
6. **INSPECT V-RIBBED BELT TENSIONER ASSEMBLY** (See INSPECTION)
7. **WARM UP ENGINE**
8. **INSPECT IGNITION TIMING**
 - a. When using the Techstream:
 1. Warm up the engine.
 2. Turn the ignition switch OFF.
 3. Connect Techstream to the DLC3.
 4. Turn the ignition switch ON.

5. Turn the tester ON.
6. Enter the following menus:

Select: Powertrain / Engine and ECT / Data List / IGN Advance.

Ignition timing: 5 to 15° BTDC at idle (Transmission in neutral)

- b. When not using the Techstream:

1. Remove the V-bank cover.
2. Connect the tester probe of a timing light to the wire of the ignition coil connector for the No. 1 cylinder.

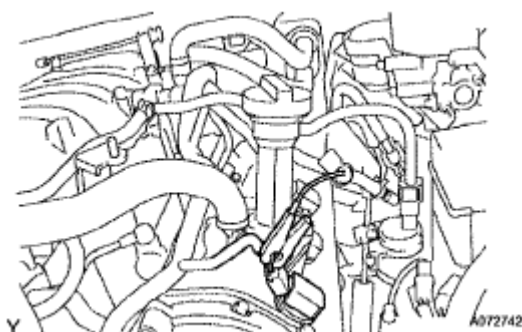


Fig. 2: Connecting Tester Probe To Ignition Coil Wire
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Using SST, connect the tachometer probe to terminal TAC of the DLC3.

SST 09843-18030

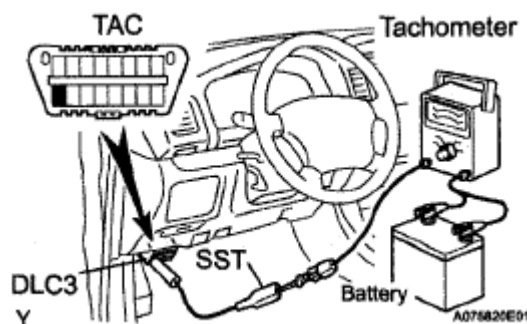


Fig. 3: Identifying Tachometer Probe To Terminal TAC Of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Using SST, connect terminals TC and CG of the DLC3.

SST 09843-18040

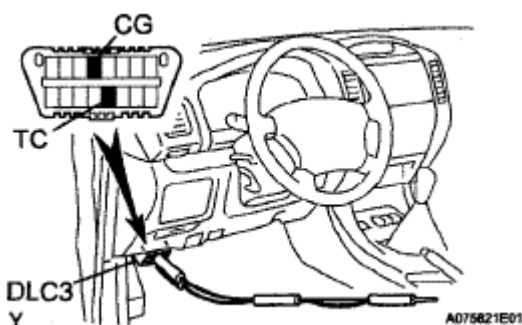


Fig. 4: Identifying Terminals TC And CG Of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Ignition timing: 5 to 15° BTDC at idle (Transmission in neutral)

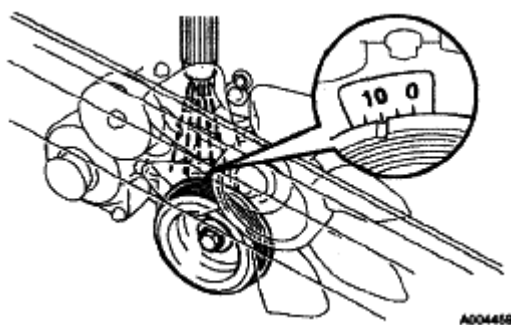


Fig. 5: Identifying Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Remove the SST from the DLC3.
7. Disconnect the timing light from the engine.
8. Install the V-bank cover.

9. INSPECT ENGINE IDLE SPEED

- a. When using the Techstream:
 1. Warm up the engine.
 2. Turn the ignition switch OFF.
 3. Connect Techstream to the DLC3.
 4. Turn the ignition switch ON.
 5. Turn the tester ON.
 6. Enter the following menus:

Select: Powertrain / Engine and ECT / Data List / Engine Speed.

7. Run the engine at 2,500 rpm for approximately 90 seconds.

8. Check the idle speed.

Idle speed: 650 to 750 rpm

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

- b. When not using the Techstream:

1. Using SST, connect the tachometer probe to terminal TAC of the DLC3.

SST 09843-18030

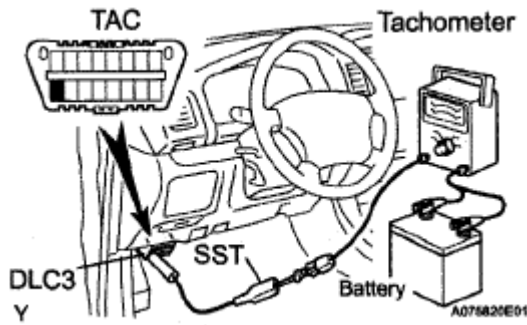


Fig. 6: Identifying Tachometer Probe To Terminal TAC Of DLC3
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Run the engine at 2,500 rpm for approximately 90 seconds.
3. Check the idle speed.

Idle speed: 650 to 750 rpm

4. Remove the SST from the DLC3.
5. Disconnect the tachometer from the DLC3.

10. INSPECT COMPRESSION

- a. Remove the V-bank cover sub-assembly.
- b. Remove the air cleaner hose assembly.
- c. Disconnect the throttle control motor connector.
- d. Remove the 8 ignition coils.
- e. Remove the 8 spark plugs.
- f. Disconnect the 8 injector connectors.
- g. Inspect the cylinder compression pressure.
 1. Insert a compression gauge into the spark plug hole (Procedure "A").

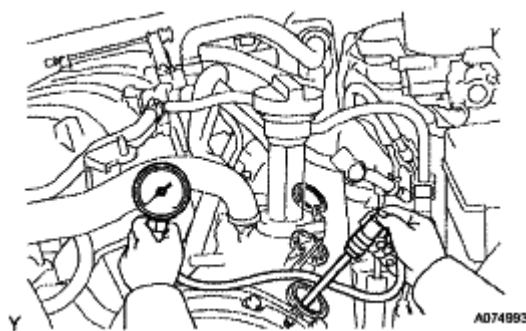


Fig. 7: Identifying Compression Gauge Into Spark Plug Hole
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Fully open the throttle forcibly by hand.
3. While cranking the engine, measure the compression pressure (Procedure "B").

HINT:

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

4. Repeat procedures "A" to "B" for each cylinder.

NOTE: This measurement must be done as quickly as possible.

Compression pressure: 1,373 kPa (14.0 kgf/cm² , 199 psi) or more

Minimum pressure: 1,030 kPa (10.5 kgf/cm² , 149 psi)

Difference between each cylinder: 98 kPa (1.0 kgf/cm² , 14 psi) or less

5. If the cylinder compression in one or more cylinders is low, pour a small amount of engine oil into the cylinder through the spark plug hole and repeat procedures "A" to "B" for the cylinders with low compression.
 - If adding oil helps the compression, the piston rings and/or cylinder bore may be worn or damaged.
 - If pressure stays low, a valve may be sticking, seating is improper, or there may be leakage past the gasket.
- h. Connect the 8 injector connectors.
- i. Install the 8 spark plugs.
- j. Install the 8 ignition coils.
- k. Connect the throttle control motor connector.
- l. Install the air cleaner hose assembly.
- m. Install the V-bank cover sub-assembly.

11. INSPECT CO/HC

HINT:

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

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

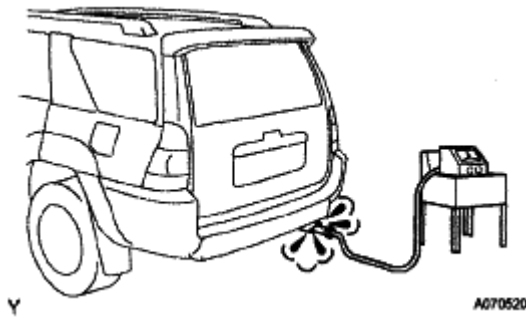


Fig. 8: Identifying CO/HC Meter Testing Probe Into Tailpipe During Idling
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Immediately check CO/HC concentration at idle and/or 2,500 rpm.

HINT:

When performing the 2 mode (2,500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.

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

- Check the heated oxygen sensor operation (See **DTC P0136 OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 1 SENSOR 2); DTC P0137 OXYGEN SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2); DTC P0138 OXYGEN SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2); DTC P0156 OXYGEN SENSOR CIRCUIT MALFUNCTION (BANK 2 SENSOR 2); DTC P0157 OXYGEN SENSOR CIRCUIT LOW VOLTAGE (BANK 2 SENSOR 2); DTC P0158 OXYGEN SENSOR CIRCUIT HIGH VOLTAGE (BANK 2 SENSOR 2)** and **DTC P2195 OXYGEN (A/F) SENSOR SIGNAL STUCK LEAN (BANK 1 SENSOR 1); DTC P2196 OXYGEN (A/F) SENSOR SIGNAL STUCK RICH (BANK 1 SENSOR 1); DTC P2197 OXYGEN (A/F) SENSOR SIGNAL STUCK LEAN (BANK 2 SENSOR 1); DTC P2198 OXYGEN (A/F) SENSOR SIGNAL STUCK RICH (BANK 2 SENSOR 1)**).
- See the table below for possible causes, then inspect and correct the applicable causes if necessary.

CO AND HC SYMPTOM REFERENCE CHART

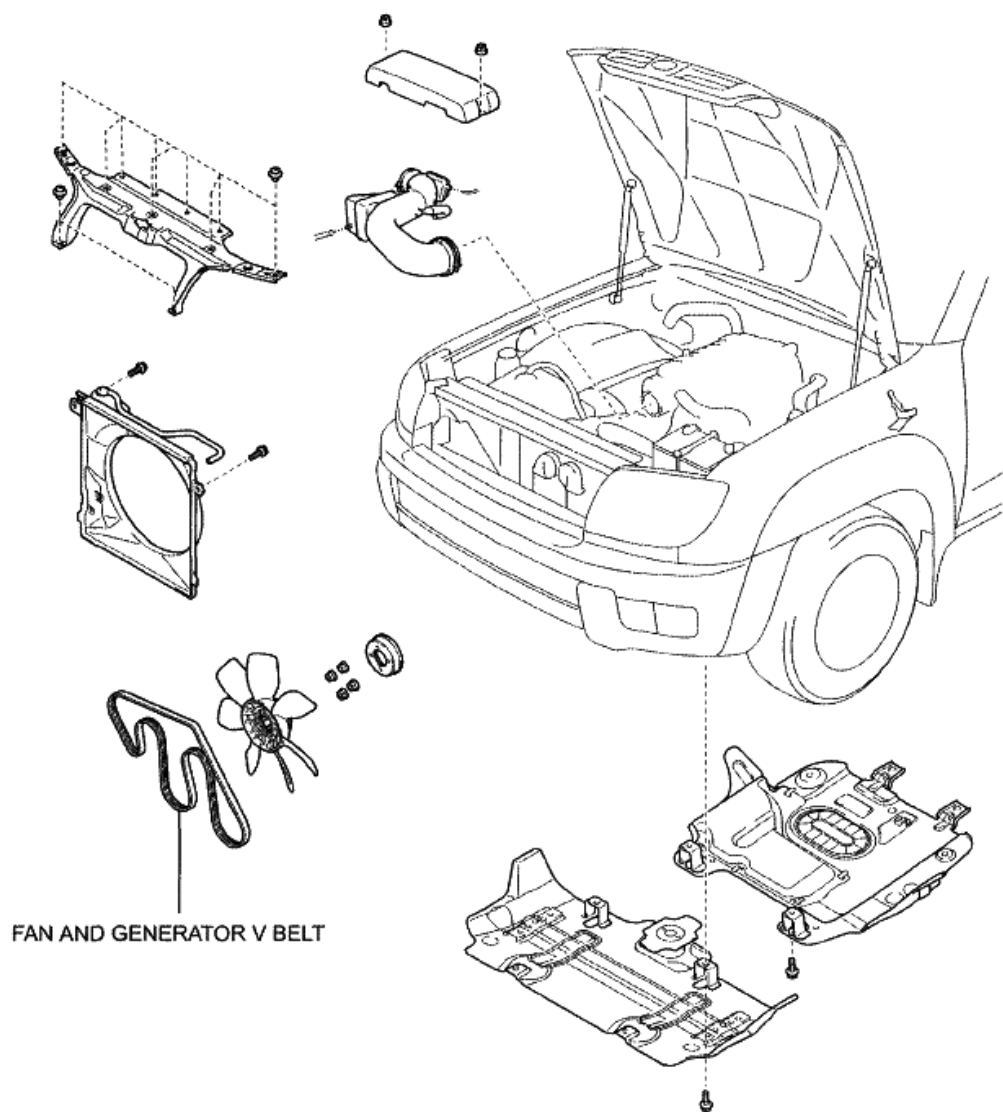
CO	HC	Symptom	Cause
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2009 Toyota 4Runner Limited

2009 ENGINE Engine Mechanical (2UZ-FE) - 4Runner

Normal	High	Rough idle	1. Faulty ignitions: ○ Incorrect timing ○ Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: ○ PCV hose ○ Intake manifold ○ Throttle body 2. Lean mixture causing misfire
High	High	Rough idle Black smoke from exhaust)	1. Restricted air filter 2. Faulty SFI system: ○ Faulty pressure regulator ○ Defective ECT sensor ○ Faulty ECM ○ Faulty injector ○ Faulty throttle position sensor ○ Faulty MAF sensor

DRIVE BELT**COMPONENTS**



Y

A119828E03

Fig. 9: Identifying Drive Belt Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FAN AND GENERATOR V BELT

- Loosen the belt tension by turning the belt tensioner counterclockwise, and then remove the fan and generator V belt.

HINT:

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

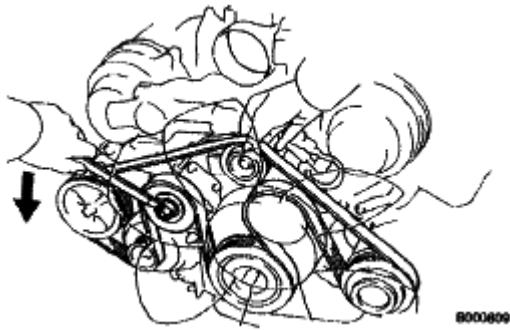


Fig. 10: Identifying Fan And Generator V Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT V-RIBBED BELT TENSIONER ASSEMBLY

- Remove the V belt from the tensioner pulley. Then check that nothing gets caught the tensioner by turning it clockwise and counterclockwise.
- When a malfunction exists, replace the tensioner.

INSTALLATION

1. INSTALL FAN AND GENERATOR V BELT

- Set the V belt onto every parts except the No. 2 idler pulley, as shown in the illustration.

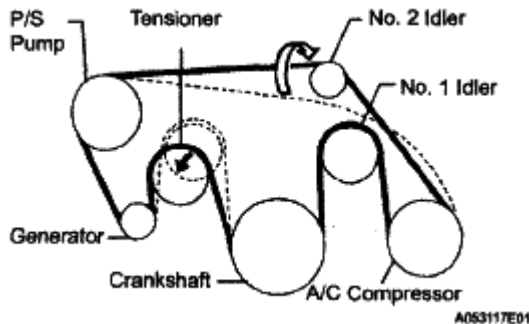


Fig. 11: Identifying Generator V Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Loosen the V belt by turning the belt tensioner counterclockwise.
- Set the V belt to the No. 2 idler pulley.
- After installing a new belt, check that the mark is within the B range as shown in the illustration.

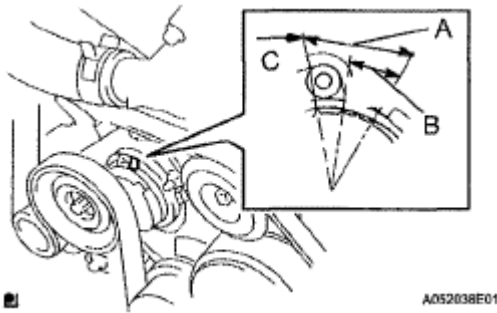


Fig. 12: Identifying Mark Is Within B Range
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE CLEARANCE

ADJUSTMENT

1. **DRAIN ENGINE COOLANT** (See REPLACEMENT)
2. **SEPARATE BATTERY NEGATIVE TERMINAL**
3. **REMOVE THROTTLE BODY COVER SUB-ASSEMBLY**
4. **REMOVE AIR CLEANER HOSE ASSEMBLY**
5. **REMOVE RADIATOR SUPPORT SEAL UPPER**
6. **REMOVE FAN AND GENERATOR V BELT** (See REMOVAL)
7. **REMOVE OIL COOLER PIPE** (See REMOVAL)
8. **REMOVE IGNITION COIL ASSEMBLY**
9. **REMOVE NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH** (See REMOVAL)
10. **REMOVE NO. 2 TIMING CHAIN OR BELT COVER** (See REMOVAL)
11. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
 - a. Remove the 9 bolts, 9 seal washers and cylinder head cover.
12. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH**
 - a. Disconnect the PCV hose.
 - b. Remove the 9 bolts, 9 seal washers and cylinder head cover.
13. **SET NO. 1 CYLINDER TO TDC / COMPRESSION**
 - a. Turn the crankshaft pulley to align its notch with timing mark "0" of the No. 1 timing belt cover.

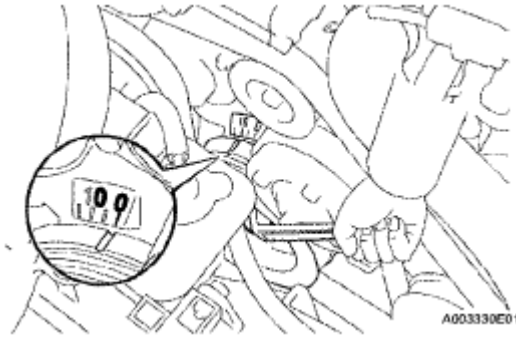


Fig. 13: Aligning Notch With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the timing marks of the camshaft timing pulleys and timing belt rear plates are aligned. If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.

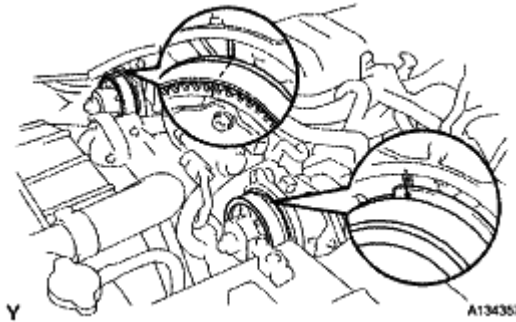


Fig. 14: Aligning Timing Marks Of Camshaft Timing Pulleys And Timing Belt Rear Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT VALVE CLEARANCE

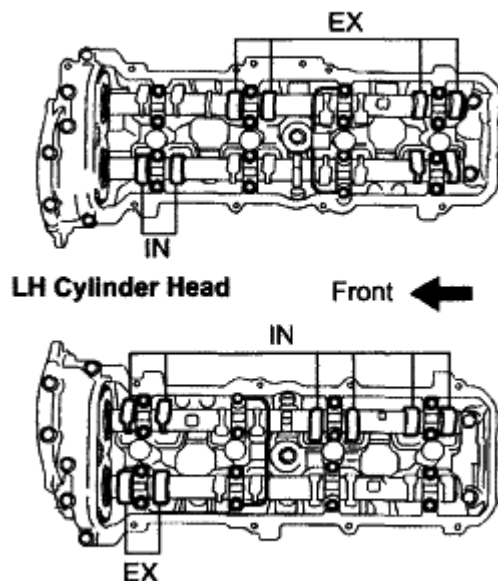
- a. Check only the valves indicated.
 1. Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
 2. Record the out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

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.)

RH Cylinder Head



A005717E03

Fig. 15: Identifying RH Cylinder Head And LH Cylinder Head
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

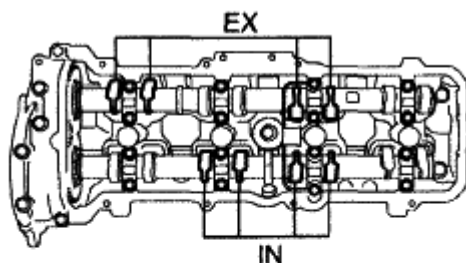
- b. Turn the crankshaft 1 complete revolution (360°) and align the camshaft timing marks.
- c. Check only the valves indicated as shown in the illustration. Measure the valve clearance.

15. **ADJUST VALVE CLEARANCE**

- a. Remove the timing belt (See **REMOVAL**).
- b. Remove the camshafts (RH Bank) (See **REMOVAL**).
- c. Remove the camshafts (LH Bank) (See **REMOVAL**).
- d. Remove the valve lifter and adjusting shim.

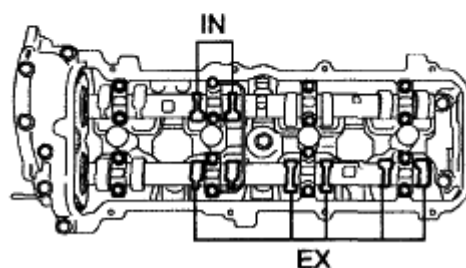
NOTE: Be careful not to drop the adjusting shim into the cylinder head.

RH Cylinder Head



LH Cylinder Head

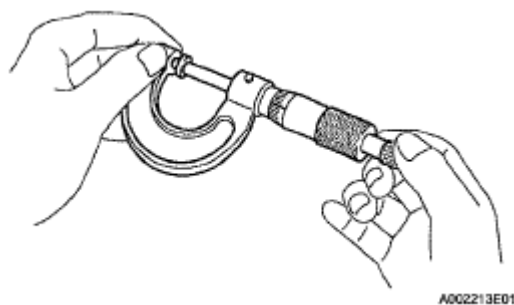
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A004457E03

Fig. 16: Identifying RH Cylinder Head And LH Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Determine the replacement adjusting shim size according to the formula or charts on the following pages.
 1. Using a micrometer, measure the thickness of the removed shim.



A002213E01

Fig. 17: Identifying Thickness Of Removed Shim
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Calculate the thickness of a new shim so that the valve clearance comes within the specified value.

T: Thickness of removed shim

A: Measured valve clearance

N: Thickness of new shim

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

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

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

HINT:

- Shims are available in 41 increments of 0.020 mm (0.0008 in.), from 2.00 mm (0.0787 in.) to 2.80 mm (0.1102 in.).
- Refer to the new adjusting shim thickness table on the next 2 pages.

- h. Reinstall the camshafts (LH Bank) (See INSTALLATION).
 - i. Reinstall the camshafts (RH Bank) (See INSTALLATION).
 - j. Reinstall the timing belt (See INSTALLATION).
 - k. Recheck the valve clearance.
- 16. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH**
 - 17. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**
 - 18. **INSTALL NO. 2 TIMING CHAIN OR BELT COVER (See INSTALLATION)**
 - 19. **INSTALL NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH (See INSTALLATION)**
 - 20. **INSTALL IGNITION COIL ASSEMBLY**
 - 21. **INSTALL OIL COOLER PIPE (See INSTALLATION)**
 - 22. **INSTALL FAN AND GENERATOR V BELT (See INSPECTION)**
 - 23. **INSTALL RADIATOR SUPPORT SEAL UPPER**
 - 24. **INSTALL AIR CLEANER HOSE ASSEMBLY**
 - 25. **INSTALL THROTTLE BODY COVER SUB-ASSEMBLY**
 - 26. **CONNECT BATTERY NEGATIVE TERMINAL**
 - 27. **ADD ENGINE COOLANT (See REPLACEMENT)**

TIMING BELT

COMPONENTS

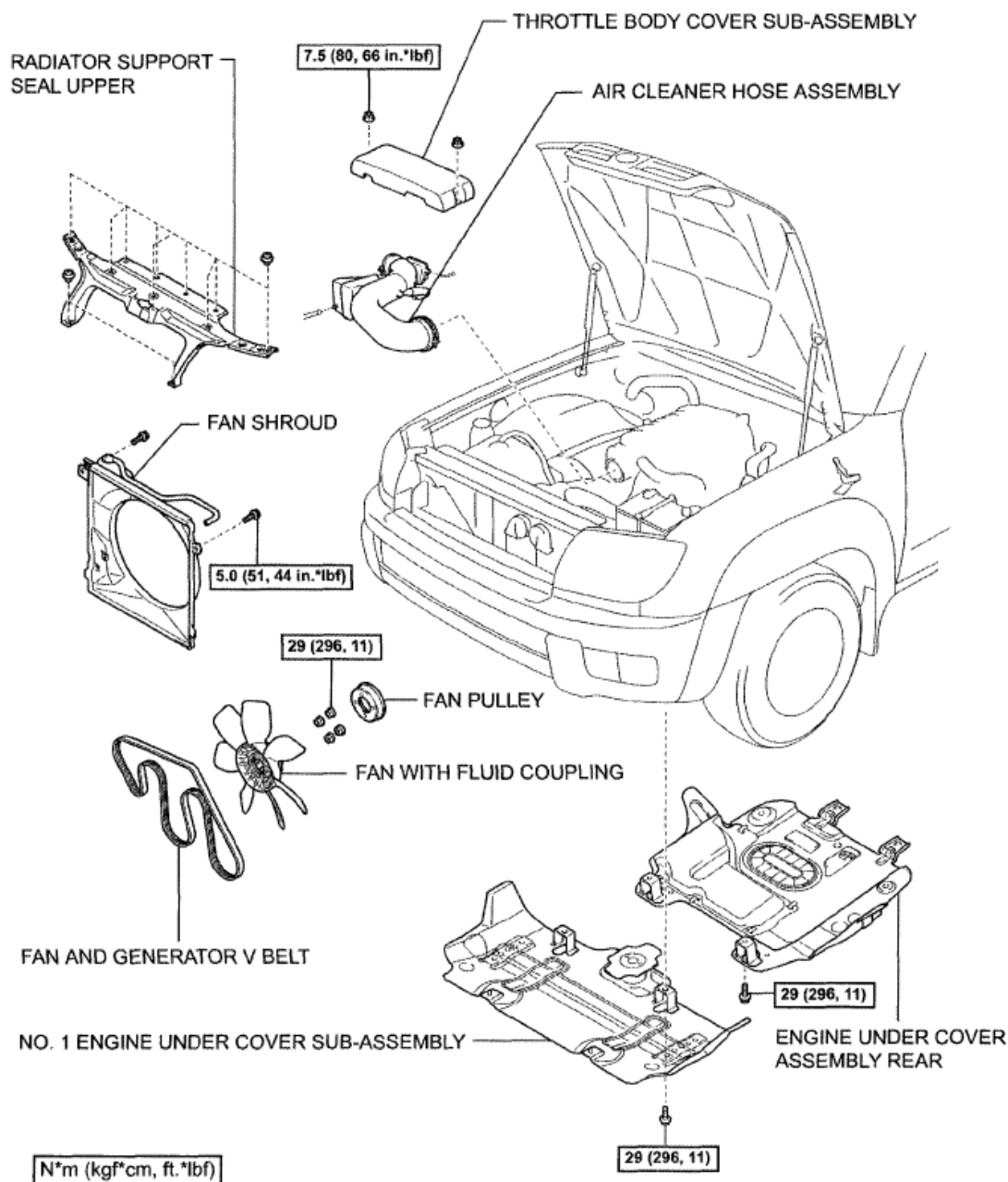


Fig. 20: Exploded View Of Timing Belt Replacement Components With Torque Specifications (1 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

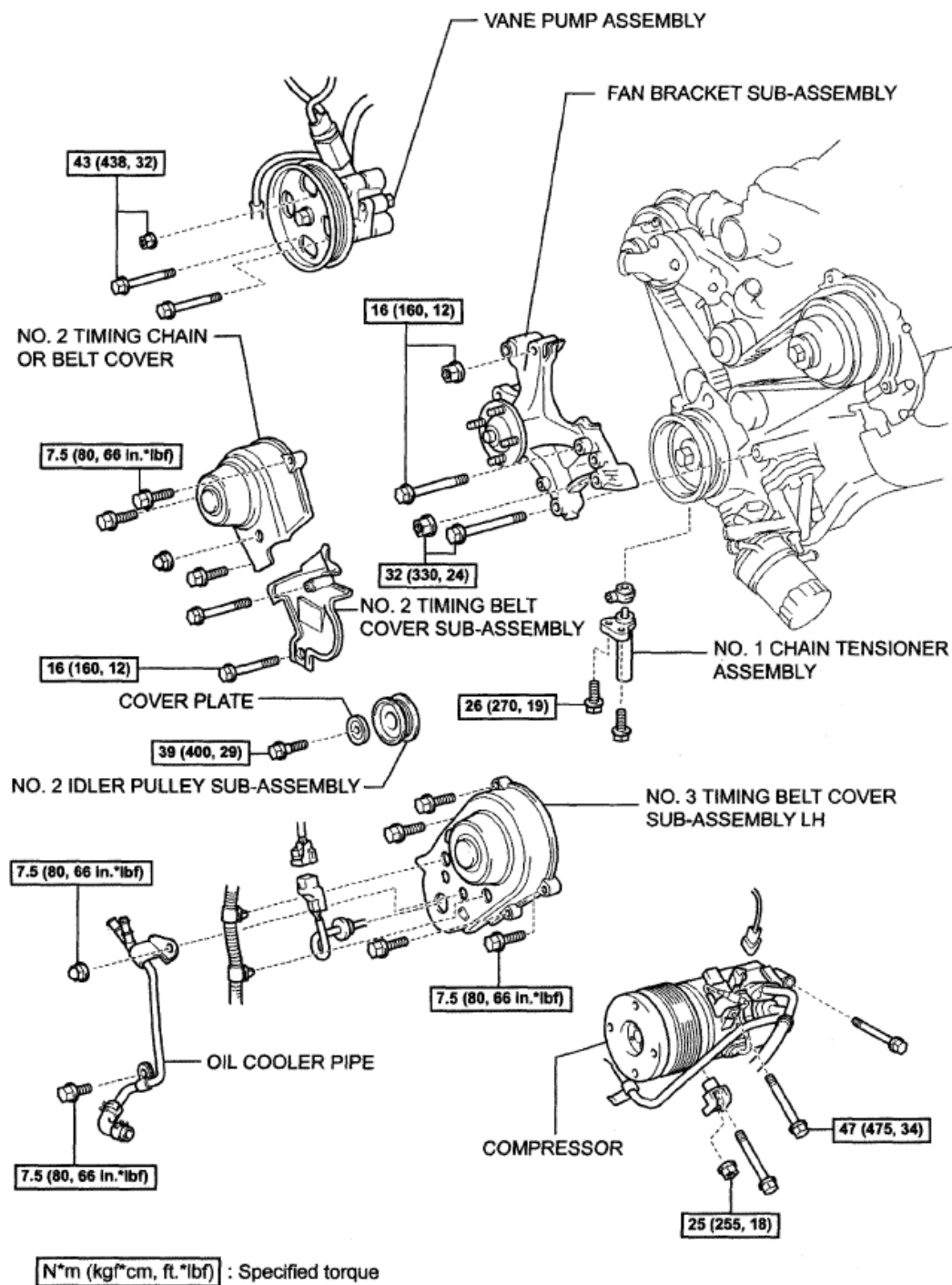
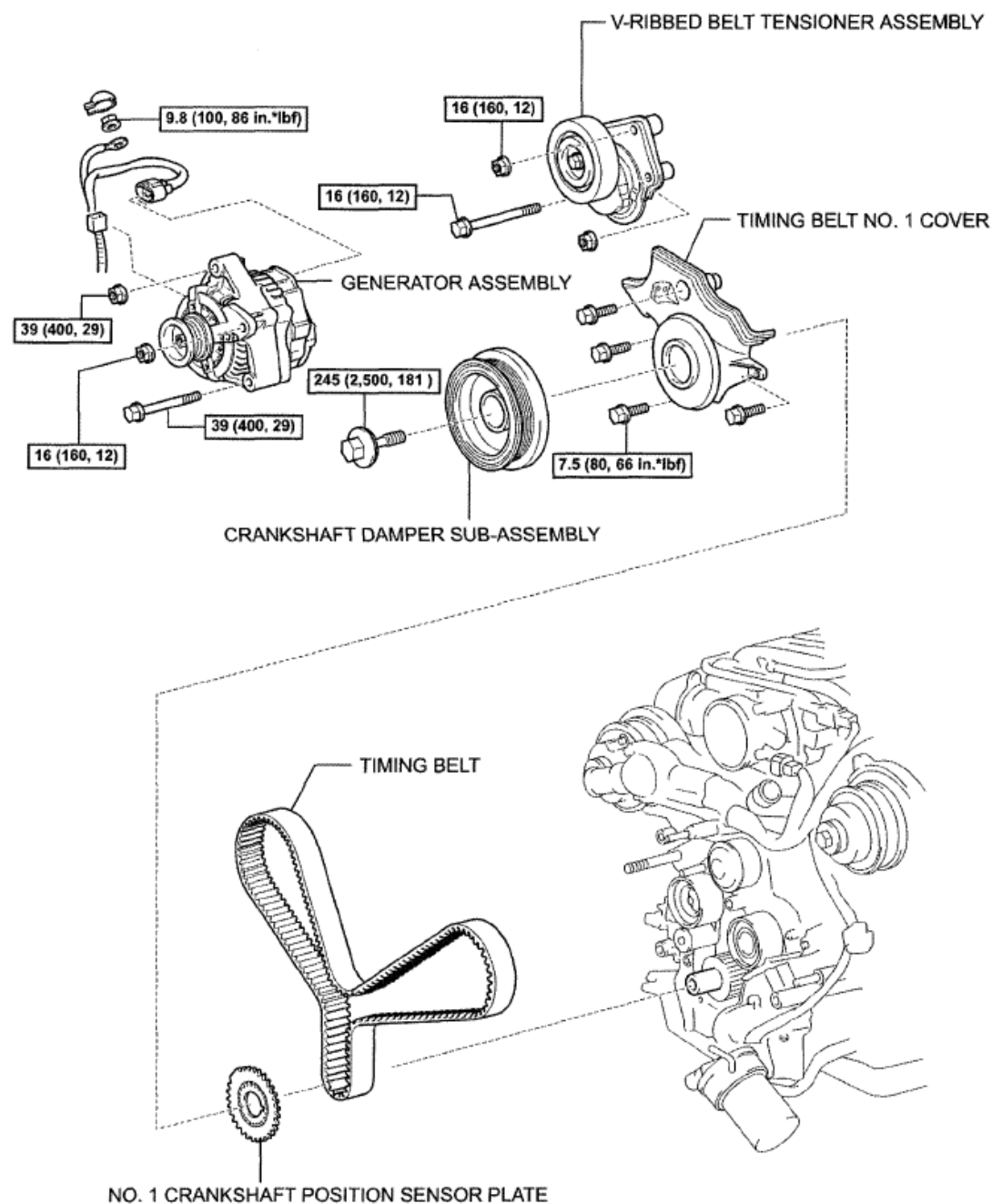


Fig. 21: Exploded View Of Timing Belt Replacement Components With Torque Specifications (2 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

Y

A119830E01

Fig. 22: Exploded View Of Timing Belt Replacement Components With Torque Specifications (3 Of 3)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DRAIN ENGINE COOLANT** (See **REPLACEMENT**)
2. **SEPARATE BATTERY NEGATIVE TERMINAL**

3. REMOVE THROTTLE BODY COVER SUB-ASSEMBLY

- a. Remove the 2 nuts and throttle body cover sub-assembly.

4. REMOVE AIR CLEANER HOSE ASSEMBLY

5. REMOVE RADIATOR SUPPORT SEAL UPPER

- a. Remove the 11 clips and radiator support seal upper.

6. REMOVE FAN AND GENERATOR V BELT (See REMOVAL)

7. REMOVE FAN WITH FLUID COUPLING

- a. Unfasten each clip and the 2 hose clamps, and then separate the 2 oil cooler hoses from the fan shroud.

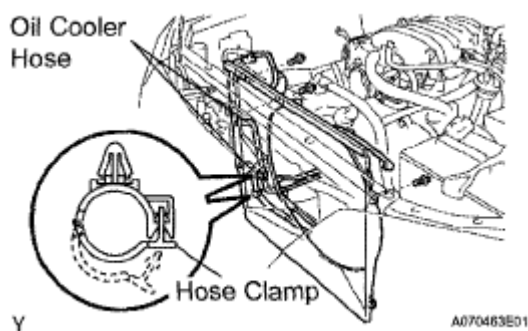


Fig. 23: Identifying Hose Clamp And Oil Cooler Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 3 bolts and separate the fan shroud from the radiator.
- c. Remove the 4 nuts and separate the fan with fluid coupling from the engine.
- d. Remove the fan shroud and fan with fluid coupling together from the vehicle.
- e. Remove the fan pulley.

8. SEPARATE VANE PUMP ASSEMBLY

- a. Disconnect the vacuum hose.
- b. Remove the nut, 2 bolts and vane pump assembly.

HINT:

Hang up the hoses instead of detaching.

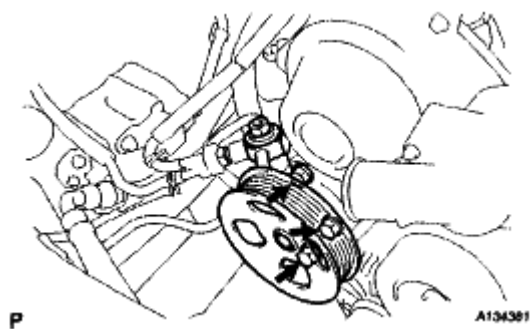


Fig. 24: Identifying Vane Pump Assembly, Nuts And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE GENERATOR ASSEMBLY** (See REMOVAL)
10. **SEPARATE COMPRESSOR**
 - a. Disconnect the compressor connector.
 - b. Remove the nut, 3 bolts, compressor stay and compressor.

HINT:

Hang up the hoses instead of detaching.

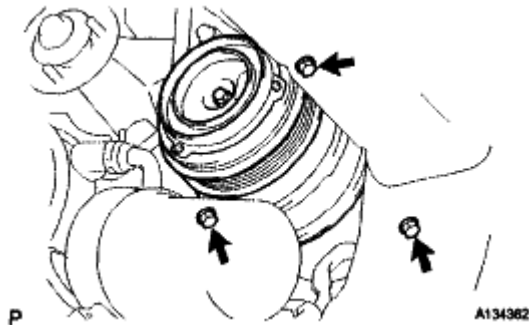


Fig. 25: Identifying Compressor Stay, Compressor, Nuts And Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY**
 - a. Remove the pulley bolt, cover plate and idler pulley.
12. **REMOVE OIL COOLER PIPE**
 - a. Disconnect the 3 hoses.
 - b. Remove the bolt, nut and oil cooler pipe.

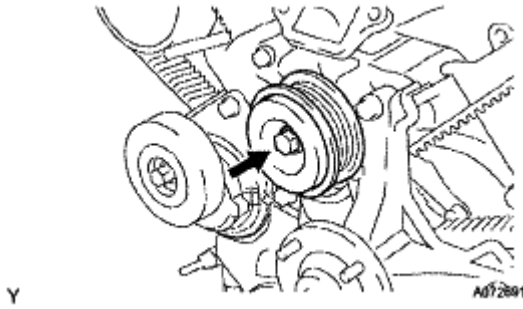


Fig. 26: Identifying Oil Cooler Pipe, Nut And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH

- a. Remove the grommet and separate the cam position sensor connector from the No. 3 timing belt cover sub-assembly LH.

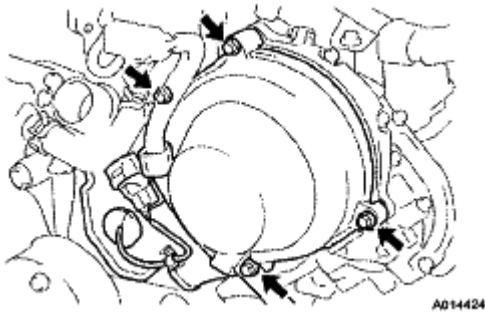


Fig. 27: Identifying Timing Belt Cover Sub-Assembly LH And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 4 bolts and No. 3 timing belt cover sub-assembly LH.

14. REMOVE NO. 2 TIMING CHAIN OR BELT COVER

- a. Remove the nut, 3 bolts and No. 2 timing belt cover.

15. REMOVE NO. 2 TIMING BELT COVER SUB-ASSEMBLY

- a. Remove the 2 bolts and No. 2 timing belt cover sub-assembly.

16. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- a. Remove the bolt, 2 nuts and V-ribbed belt tensioner.

17. REMOVE FAN BRACKET SUB-ASSEMBLY

- a. Remove the 2 nuts, 2 bolts and fan bracket sub-assembly.

18. REMOVE CRANKSHAFT DAMPER SUB-ASSEMBLY

- a. Using SST, remove the pulley bolt.

SST 09213-70011 (09213-70020), 09330-00021

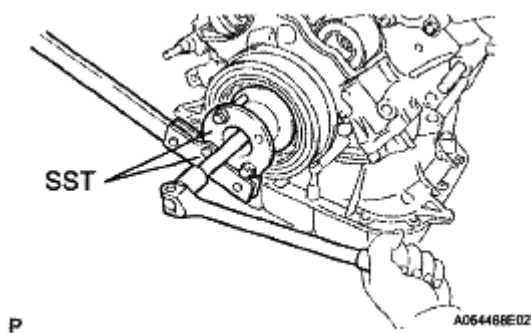


Fig. 28: Identifying Pulley Bolt

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

- b. Using SST, remove the crankshaft pulley.

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

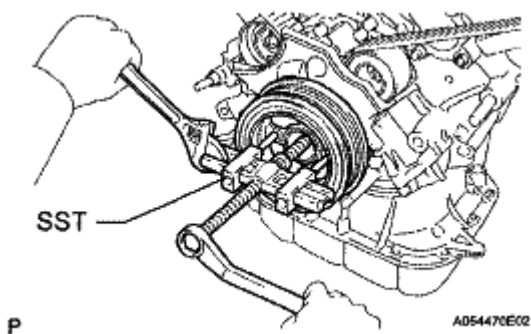


Fig. 29: Identifying Crankshaft Pulley

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

19. REMOVE TIMING BELT NO. 1 COVER

- a. Remove the 4 bolts and timing belt cover.

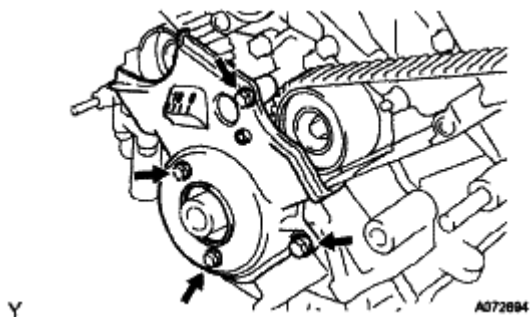


Fig. 30: Identifying Timing Belt Cover And Bolts

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

20. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE

- a. Remove the No. 1 crankshaft position sensor plate.

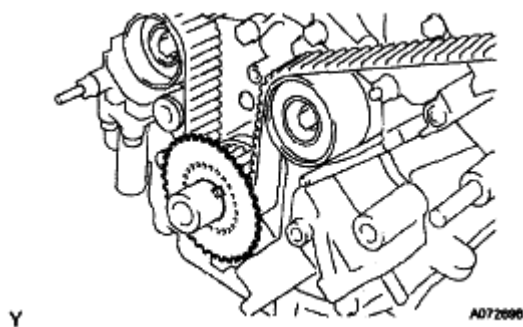


Fig. 31: Identifying Crankshaft Position Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. REMOVE TIMING BELT

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

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

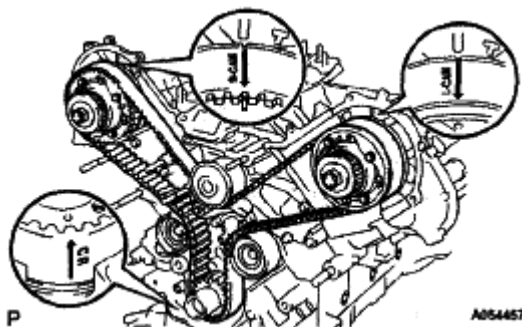


Fig. 32: Identifying Marks On Timing Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

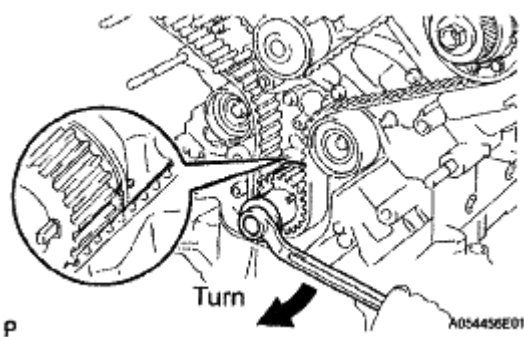


Fig. 33: Aligning Timing Marks Of Crankshaft Timing Pulley And Oil Pump Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

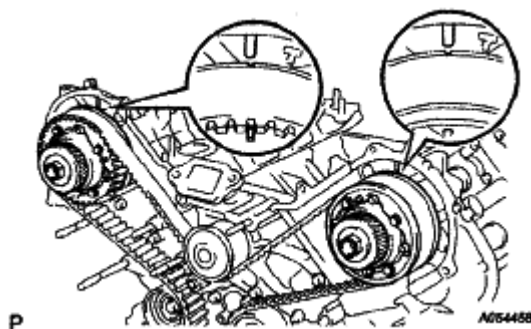


Fig. 34: Identifying Timing Marks Of Camshaft Timing Pulleys
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: If the timing belt is disengaged, having the crankshaft pulley at a wrong angle can cause the piston head and valve head to come into contact with each other when removing the camshaft timing pulley and camshaft, causing damage. So always set the crankshaft pulley at the correct angle.

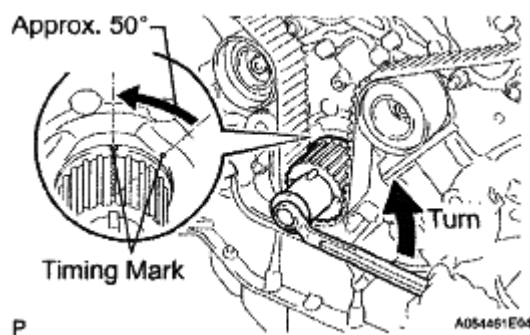


Fig. 35: Turning Crankshaft Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Alternately loosen the 2 bolts, then remove the bolts, the chain tensioner and dust boot.

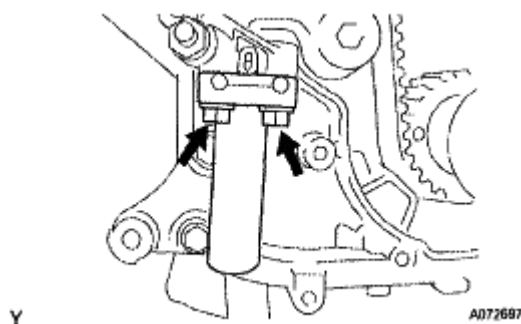


Fig. 36: Identifying Chain Tensioner, Dust Boot And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

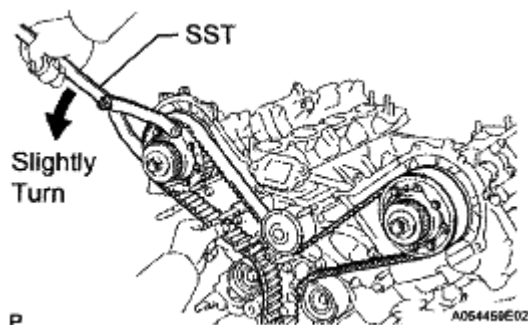


Fig. 37: Identifying Tension Between Camshaft Timing Pulley And Crankshaft Timing Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Disconnect the timing belt from the No. 1 timing belt idler and remove the timing belt.

INSTALLATION

1. INSTALL TIMING BELT

- a. Check the No. 1 timing belt idler and No. 2 timing belt idler.
 1. Visually check the seal portion of the idler pulley for oil leakage.

If leakage is found, replace the idler.

 2. Check that the idler turns smoothly. If necessary, replace the idler.

- b. Check the water pump.
 1. Visually check the air hole and water hole for coolant leakage.

If leakage is found, replace the water pump and timing belt.

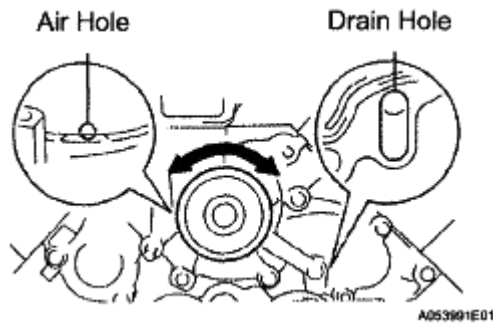


Fig. 38: Identifying Air Hole And Drain Hole
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Turn the pulley, and check that the water pump bearing moves smoothly.
- If necessary, replace the water pump.
- c. Remove any oil or water on the crankshaft pulley, oil pump pulley, water pump pulley, No. 1 idler and No. 2 idler, and keep them clean.

NOTE: Only wipe the pulleys; do not use any cleansing agent.

- d. Set the No. 1 cylinder to the TDC/compression.
 1. Turn the hexagonal portion of the camshaft to align the timing marks of the camshaft timing pulleys and timing belt plates.

HINT:

By turning the camshaft timing pulleys clockwise as follows, installation of the timing pulleys will be easy:

1/2 teeth turn for the left bank camshaft timing pulley

1 tooth turn for the right bank camshaft timing pulley

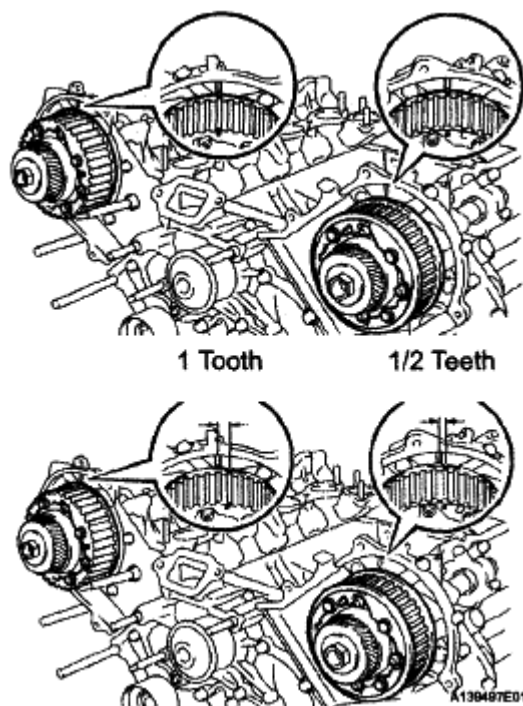


Fig. 39: Identifying Timing Marks Of Camshaft Timing Pulleys And Timing Belt Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

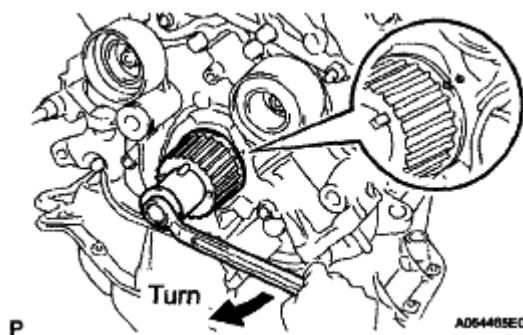


Fig. 40: Identifying Crankshaft Of Crankshaft Timing Pulley And Oil Pump Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Only wipe the pulleys; do not use any cleansing agent.

2. Face the front mark (arrow) on the timing belt forward.
3. Put the timing belt on the crankshaft timing pulley.
 - Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.

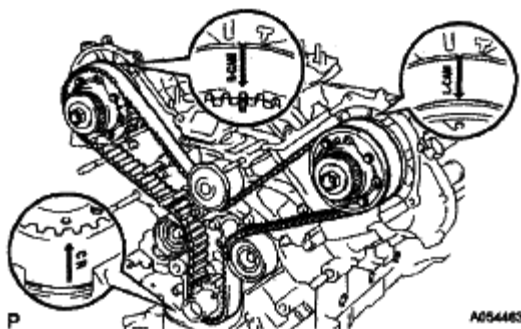


Fig. 41: Identifying Timing Mark Of Crankshaft Timing Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

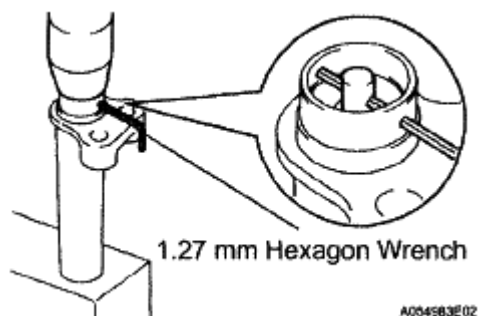


Fig. 42: Identifying Hexagon Wrench Holes Position Of Push Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Release the press.
4. Install the dust boot to the belt tensioner.
- g. Install the belt tensioner.
 1. Temporarily install the belt tensioner with the 2 bolts.

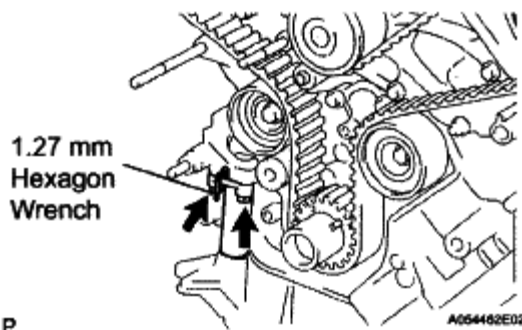


Fig. 43: Identifying Belt Tensioner With Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Alternately tighten the 2 bolts.

Torque: 26 N*m (270 kgf*cm, 19 ft.*lbf)

3. Using pliers, remove the 1.27 mm hexagon wrench from the chain tensioner.
- h. Check the valve timing.
 1. Using the crankshaft damper bolt, slowly turn the crankshaft pulley 2 revolutions from the TDC to TDC.

NOTE: Always turn the crankshaft pulley clockwise.

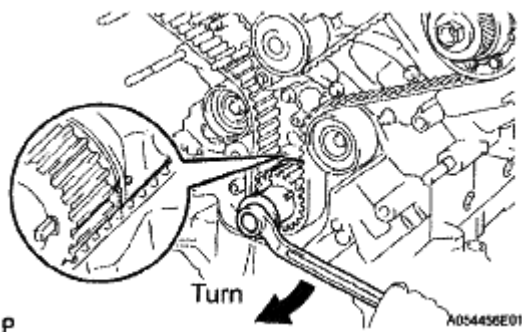


Fig. 44: Identifying Crankshaft Pulley
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check that each pulley is aligned with each timing mark as shown in the illustration.

If the timing marks are not aligned, remove the timing belt and reinstall it.

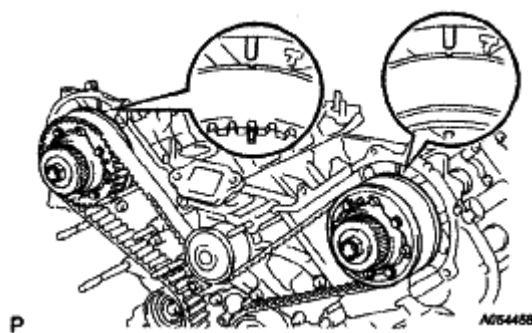


Fig. 45: Aligning Pulley With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Remove the crankshaft damper bolt.
2. **INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE**
 - a. Install the sensor plate as shown in the illustration.

NOTE: Take care not to install it in a wrong direction.

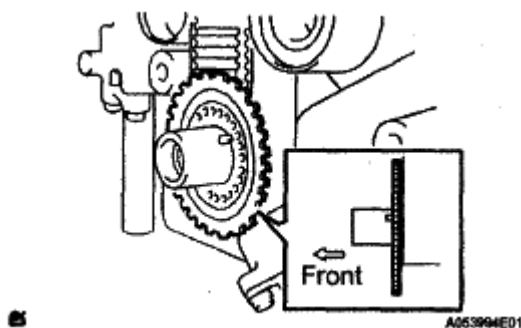


Fig. 46: Identifying Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL TIMING BELT NO. 1 COVER**
 - a. Install the timing belt cover with the 4 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

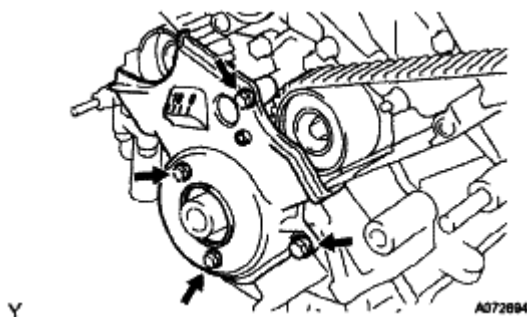


Fig. 47: Identifying Timing Belt Cover And Bolts

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

4. INSTALL CRANKSHAFT DAMPER SUB-ASSEMBLY

- a. Align the pulley set key with the key groove of the crankshaft damper.
- b. Using SST and a hammer, tap in the crankshaft damper.

SST 09223-46011

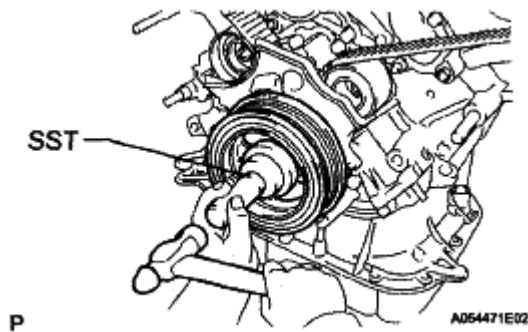


Fig. 48: Tapping Crankshaft Damper

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

- c. Using SST, install the damper bolt.

SST 09213-70011 (09213-70020), 09330-00021

Torque: 245 N*m (2,498 kgf*cm, 181 ft.*lbf)

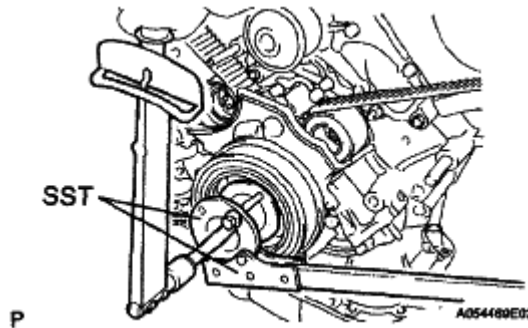


Fig. 49: Identifying Damper Bolt

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

5. INSTALL FAN BRACKET SUB-ASSEMBLY

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

Torque:

For 12 mm head

16 N*m (160 kgf*cm, 12 ft.*lbf)

For 14 mm head

32 N*m (326 kgf*cm, 24 ft.*lbf)

HINT:

Each bolt length is as follows:

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

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

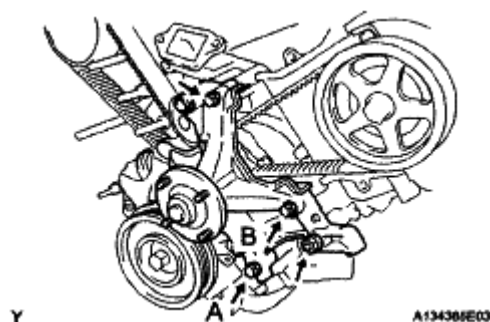


Fig. 50: Identifying Fan Bracket Sub-Assembly Bolts And Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- a. Install the belt tensioner with the bolt and 2 nuts.

Torque: 16 N*m (160 kgf*cm, 11 ft.*lbf)

HINT:

Use a bolt 106 mm (4.17 in.) in length.

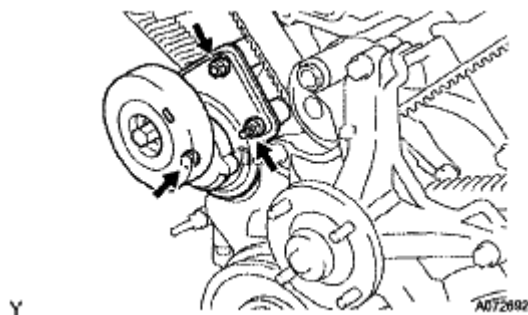


Fig. 51: Identifying Belt Tensioner, Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL NO. 2 TIMING BELT COVER SUB-ASSEMBLY

- a. Install the timing belt cover and fit the claws and pins into each part.
- b. Install the timing belt cover with the 2 bolts.

Torque: 16 N*m (160 kgf*cm, 12 ft.*lbf)

HINT:

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

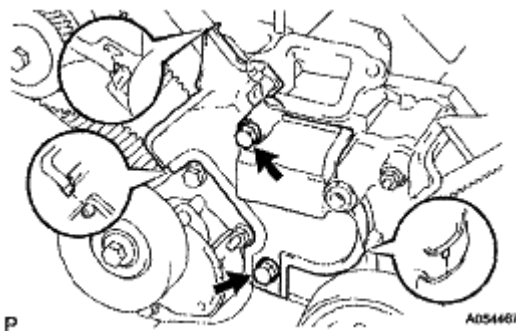


Fig. 52: Identifying Timing Belt Cover And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH

- a. Install the timing belt cover sub-assembly with the 4 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

- b. Install the camshaft position sensor connector and grommet to the timing belt cover.

9. INSTALL NO. 2 TIMING CHAIN OR BELT COVER

- a. Install the timing chain or belt cover with the nut and 3 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

10. INSTALL OIL COOLER PIPE

- a. Install the oil cooler pipe with the bolt and nut.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

- b. Connect the 3 hoses.

11. INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY

- a. Install the idler pulley and cover plate with the bolt.

Torque: 39 N*m (398 kgf*cm, 29 ft.*lbf)

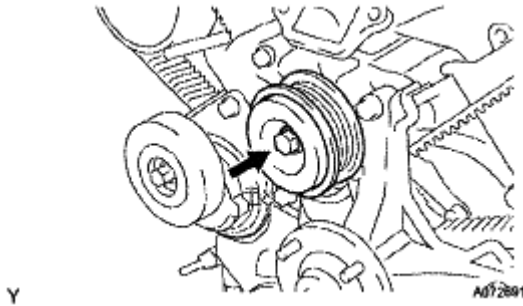


Fig. 53: Identifying No. 2 Idler Pulley & Cover Plate Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL COMPRESSOR

- a. Install the compressor with the stay, nut and 3 bolts.

Torque:

Bolt

47 N*m (475 kgf*cm, 34 ft.*lbf)

Nut

25 N*m (255 kgf*cm, 18 ft.*lbf)

13. INSTALL GENERATOR ASSEMBLY (See INSTALLATION)

14. INSTALL VANE PUMP ASSEMBLY

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

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

15. INSTALL FAN WITH FLUID COUPLING

- a. Install the fan pulley to the engine.
- b. Put the fan with fluid coupling and fan shroud together into the engine room.
- c. Install the fan shroud with the 3 bolts.

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

- d. Install the fan with fluid coupling with the 4 nuts.

Torque: 29 N*m (296 kgf*cm, 21 ft.*lbf)

16. INSTALL FAN AND GENERATOR V BELT (See INSPECTION)

17. **INSTALL RADIATOR SUPPORT SEAL UPPER**
18. **INSTALL AIR CLEANER HOSE ASSEMBLY**
19. **INSTALL THROTTLE BODY COVER SUB-ASSEMBLY**
 - a. Install the throttle body cover sub-assembly with the 2 nuts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

20. **ADD ENGINE COOLANT** (See **REPLACEMENT**)
21. **CHECK FOR ENGINE COOLANT LEAKS** (See **REPLACEMENT**)

CAMSHAFT (FOR BANK 1)

COMPONENTS

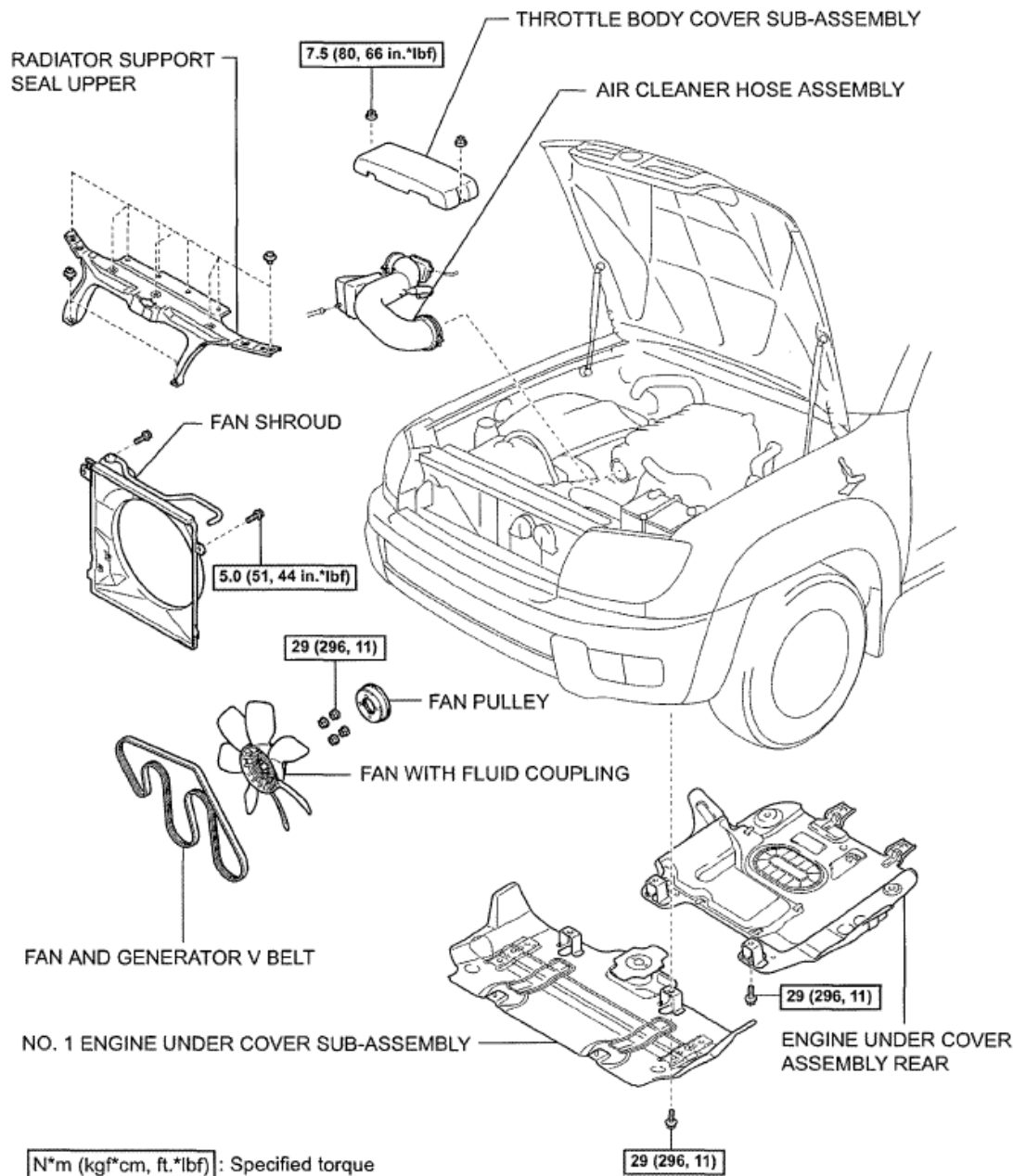
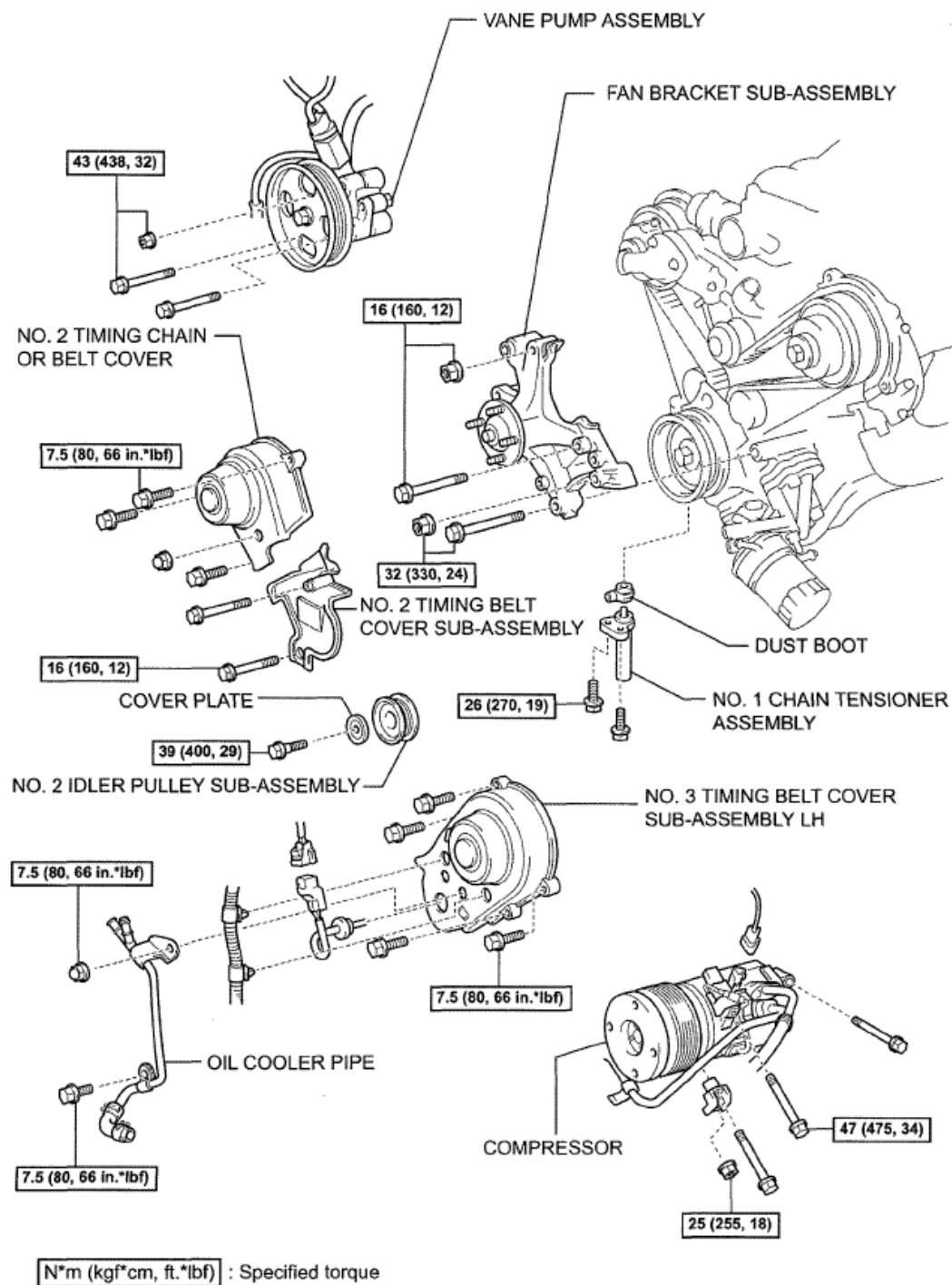
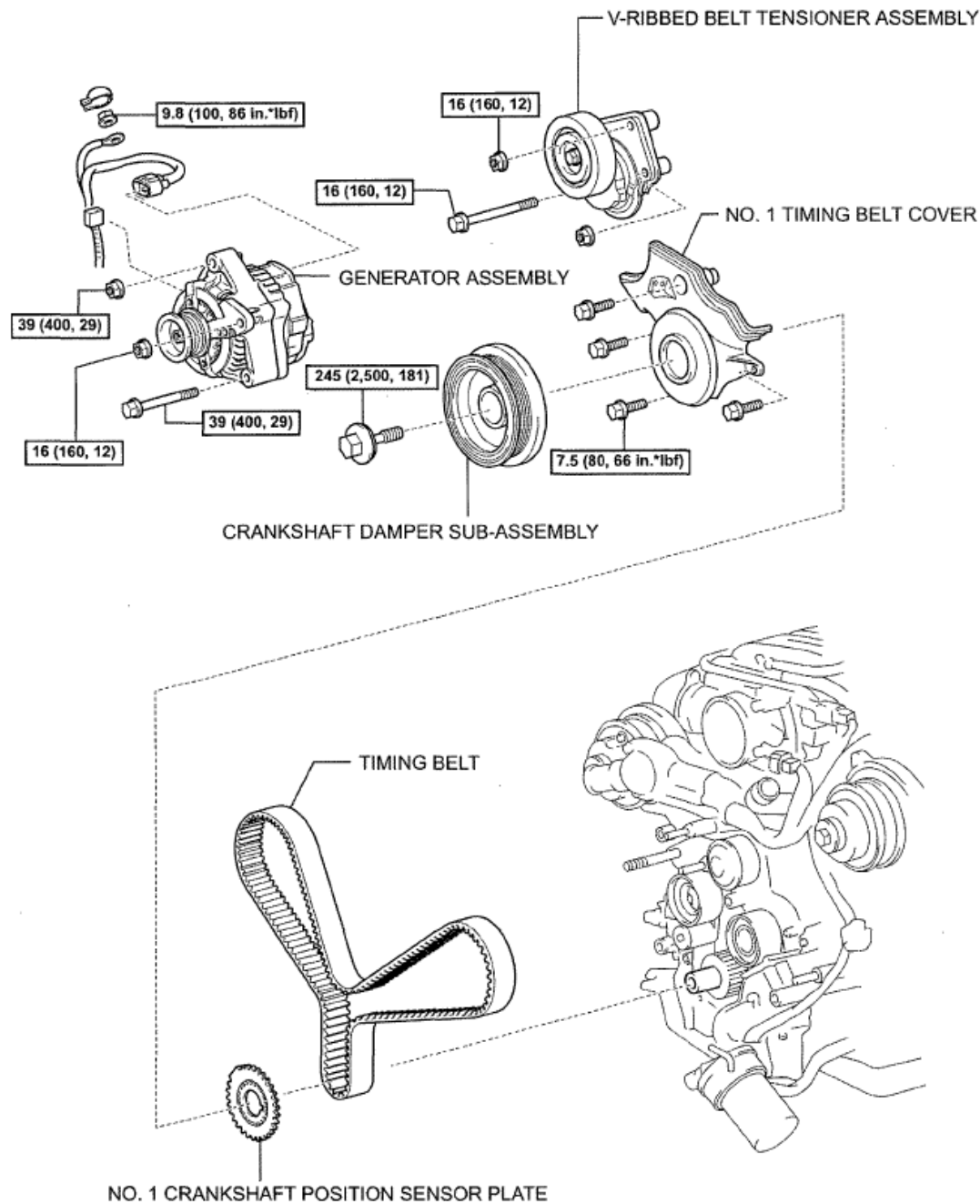


Fig. 54: Identifying Camshaft Replacement Components With Torque Specifications (1 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119829E04

Fig. 55: Identifying Camshaft Replacement Components With Torque Specifications (2 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A115830E07

Fig. 56: Identifying Camshaft Replacement Components With Torque Specifications (3 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

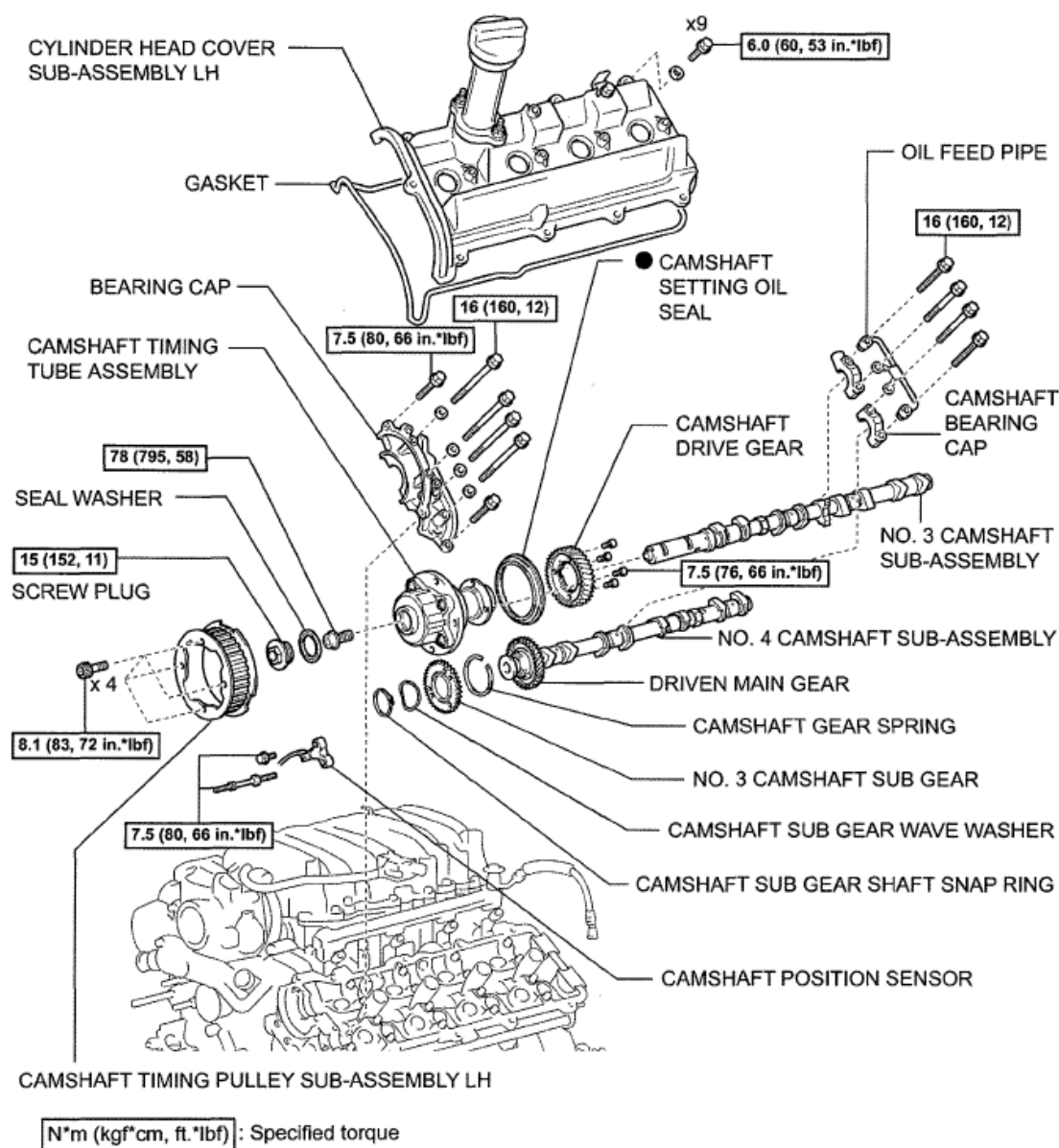


Fig. 57: Identifying Camshaft Replacement Components With Torque Specifications (4 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **DRAIN ENGINE COOLANT** (See **REPLACEMENT**)
2. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
3. **REMOVE THROTTLE BODY COVER SUB-ASSEMBLY** (See **REMOVAL**)
4. **REMOVE AIR CLEANER HOSE ASSEMBLY** (See **REMOVAL**)
5. **REMOVE RADIATOR SUPPORT SEAL UPPER** (See **REMOVAL**)

6. REMOVE FAN AND GENERATOR V BELT (See REMOVAL)
7. REMOVE FAN WITH FLUID COUPLING (See REMOVAL)
8. SEPARATE VANE PUMP ASSEMBLY (See REMOVAL)
9. REMOVE GENERATOR ASSEMBLY (See REMOVAL)
10. SEPARATE COMPRESSOR (See REMOVAL)
11. REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY (See REMOVAL)
12. REMOVE OIL COOLER PIPE (See REMOVAL)
13. REMOVE NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH (See REMOVAL)
14. REMOVE NO. 2 TIMING CHAIN OR BELT COVER (See REMOVAL)
15. REMOVE NO. 2 TIMING BELT COVER SUB-ASSEMBLY (See REMOVAL)
16. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See REMOVAL)
17. REMOVE FAN BRACKET SUB-ASSEMBLY (See REMOVAL)
18. REMOVE CRANKSHAFT DAMPER SUB-ASSEMBLY (See REMOVAL)
19. REMOVE NO. 1 TIMING BELT COVER (See REMOVAL)
20. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See REMOVAL)
21. REMOVE TIMING BELT (See REMOVAL)
22. REMOVE IGNITION COIL ASSEMBLY
 - a. Disconnect the 4 ignition coil connectors.
 - b. Remove the 4 bolts and 4 ignition coils.
23. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH
 - a. Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.

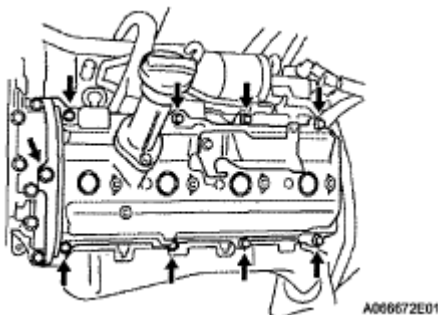


Fig. 58: Identifying Cylinder Head Cover Sub-Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. REMOVE CAMSHAFT TIMING PULLEY SUB-ASSEMBLY LH
 - a. Hold the camshaft with a wrench, and remove the 4 bolts and timing pulley.

NOTE: Do not remove the 4 "TORX" bolts shown in the illustration. If the camshaft timing tube is removed, replace the timing tube assembly.

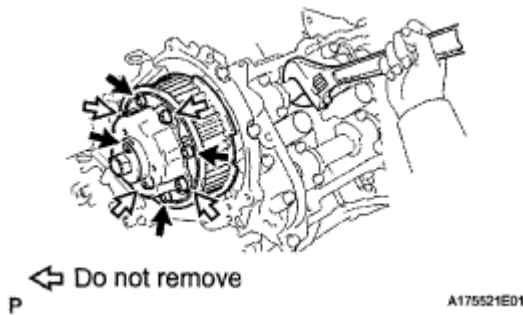


Fig. 59: Identifying Camshaft Timing Pulley Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. REMOVE CAMSHAFT POSITION SENSOR

- a. Remove the bolt, stud bolt and camshaft position sensor.

26. REMOVE NO. 3 AND NO. 4 CAMSHAFT SUB-ASSEMBLY

NOTE:

- As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged. To avoid this, the following steps should be carried out.
- Having the crankshaft pulley at a wrong angle can cause the piston head and valve head to come into contact with each other when removing the camshaft. Always set the crankshaft pulley at the correct angle as shown in the illustration.

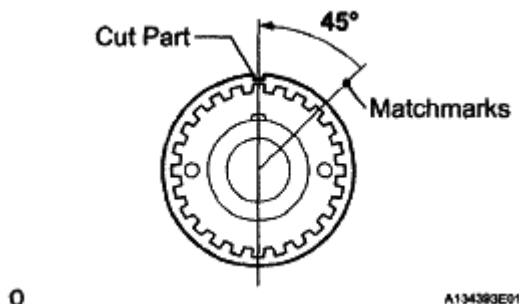
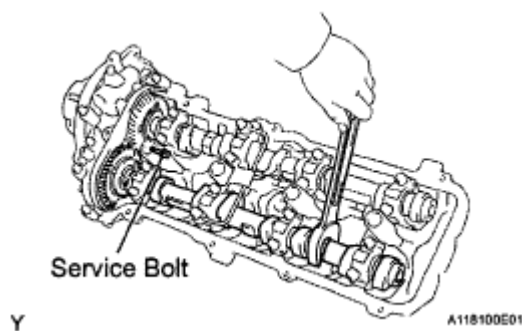


Fig. 60: Identifying Crankshaft Pulley Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Bring the service bolt hole of the sub gear upward by turning the hexagonal portion of the No. 4 camshaft with a wrench.

**Fig. 61: Identifying Service Bolt**

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

- b. Secure the sub gear to the main gear with a service bolt.

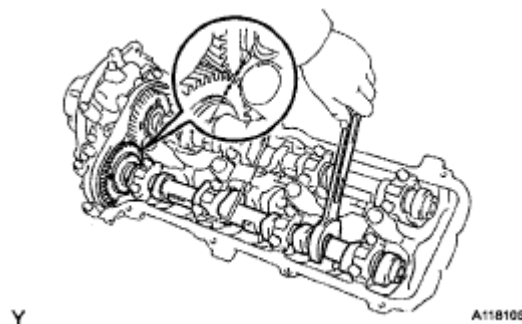
Recommended service bolt**RECOMMENDED SERVICE BOLT**

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 to 20 mm

HINT:

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

- c. Align the timing marks (2 dot marks each) of the camshaft drive and driven gears by turning the hexagonal portion of the No. 4 camshaft with a wrench.

**Fig. 62: Identifying Timing Marks Of Camshaft Drive And Driven Main Gears**

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

- d. Uniformly loosen and remove the 22 bearing cap bolts in several steps, in the order shown in the illustration.

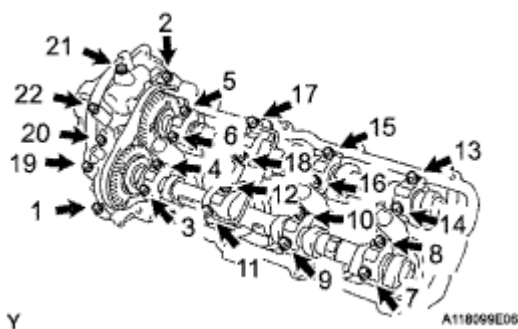


Fig. 63: Identifying Bearing Cap Bolts In Sequence (Bank 1)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter, and camshafts.

HINT:

Arrange the bearing caps in the correct order.

- f. Mount the hexagonal portion of the camshaft in a vise.

NOTE:

- Be careful not to damage the camshaft.
- Do not remove the 4 bolts shown in the illustration. If any of them are loosened or removed, the backlash of the gear in the timing tube will go out of adjustment. In this case, replace the timing tube assembly with a new one.

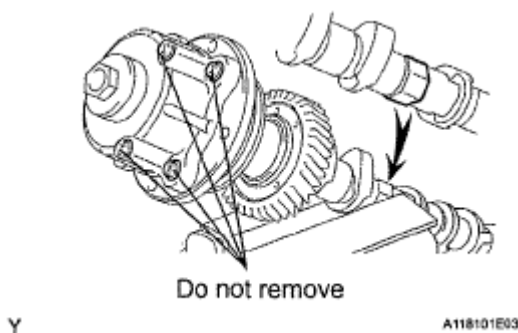


Fig. 64: Identifying Camshaft Hexagonal Portion In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Remove the screw plug and seal washer.
- h. Using a 10 mm hexagon wrench, remove the bolt.

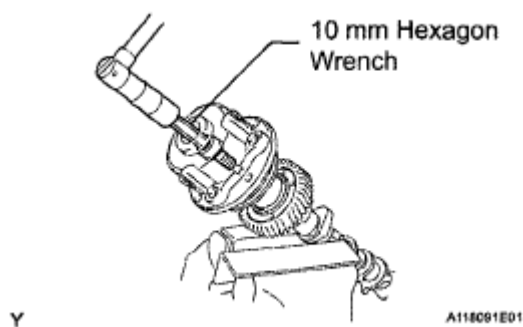


Fig. 65: Identifying Timing Tube Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Pull out the timing tube and drive gear from the camshaft.
- j. Using SST and a 5 mm hexagon wrench, remove the 4 bolts, drive gear and oil seal.

SST 09960-10010 (09962-01000, 09963-00500)

NOTE: Be careful not to damage the timing tube.

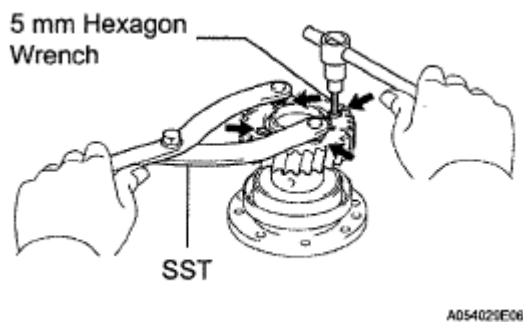


Fig. 66: Identifying Bolts, Drive Gear And Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. REMOVE SEMI-CIRCULAR PLUG

28. REMOVE CAMSHAFT SUB GEAR

- a. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

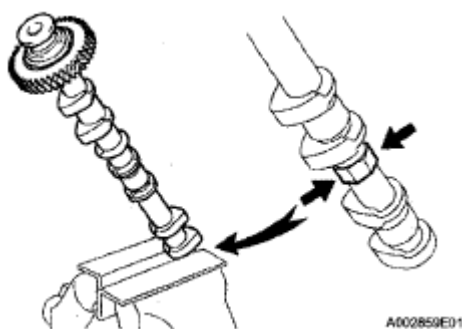


Fig. 67: Identifying Camshaft Hexagon Head Portion In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, turn the sub gear clockwise and remove the service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

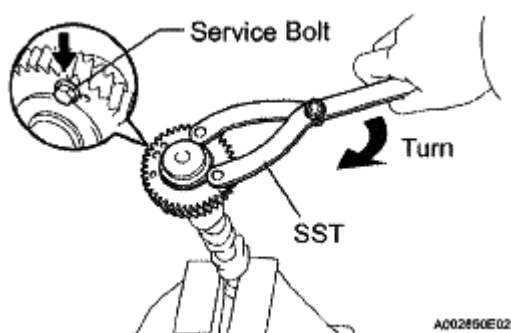


Fig. 68: Identifying Service Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using snap ring pliers, remove the snap ring.

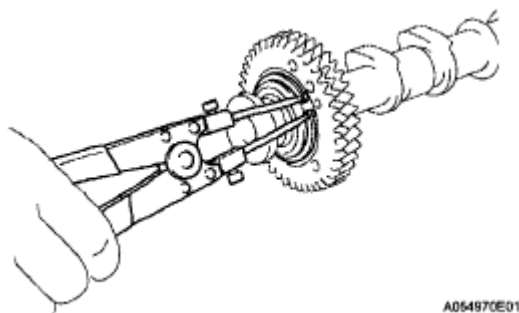


Fig. 69: Identifying Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the wave washer, sub gear and gear spring.
e. Using a vernier caliper, measure the gap distance of the gear spring.

Gap distance: 18.2 to 18.8 mm (0.717 to 0.740 in.)

If the gap distance is not as specified, replace the gear spring.

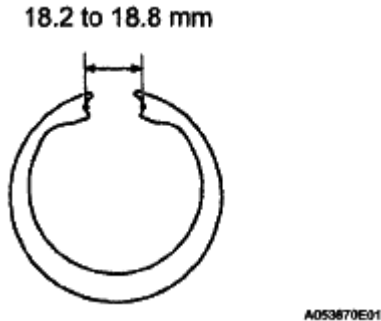


Fig. 70: Identifying Gap Of Gear Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CAMSHAFT

- a. Inspect the camshaft runout.
 1. Place the camshaft on V-blocks.
 2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.08 mm (0.0031 in.)

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

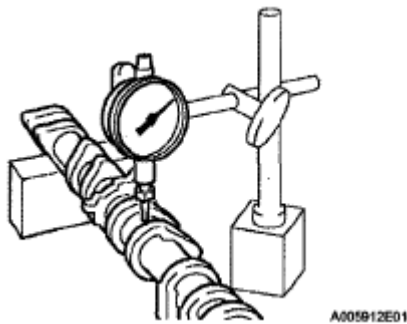


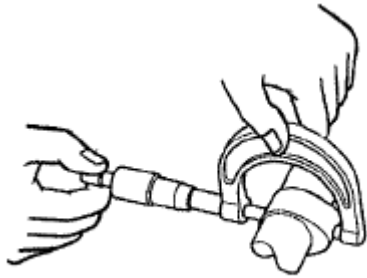
Fig. 71: Measuring Circle Runout At Center Journal Using Dial Indicator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the cam lobes.
 1. Using a micrometer, measure the cam lobe height.

Standard cam lobe height

STANDARD CAM LOBE HEIGHT

Item	Specified Condition
Intake	41.94 to 42.04 mm (1.6512 to 1.6551 in.)
Exhaust	41.96 to 42.06 mm (1.6520 to 1.6559 in.)



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Fig. 72: Measuring Cam Lobe Height Using Micrometer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Minimum cam lobe height

MINIMUM CAM LOBE HEIGHT

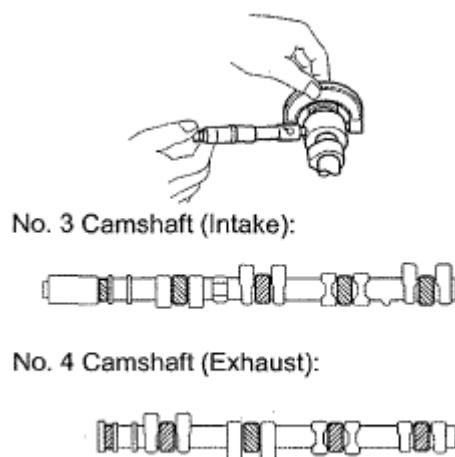
Item	Specified Condition
Intake	41.79 mm (1.6453 in.)
Exhaust	41.81 mm (1.6461 in.)

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

- c. Inspect the camshaft journals.
 - 1. Using a micrometer, measure the journal diameter.

Journal diameter: 26.954 to 26.970 mm (1.0612 to 1.0618 in.)

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



A175501E01

Fig. 73: Measuring Camshaft Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT CAMSHAFT TIMING TUBE ASSEMBLY

- a. Using a micrometer, measure the journal diameter.

Journal diameter: 39.955 to 39.964 mm (1.5730 to 1.5734 in.)

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

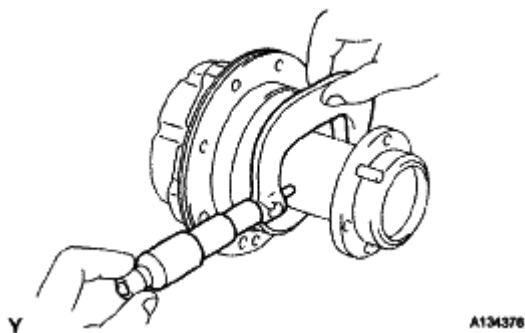


Fig. 74: Measuring Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the timing tube to the intake camshaft, and check that the timing tube turns smoothly.

If necessary, replace the timing tube and intake camshaft.

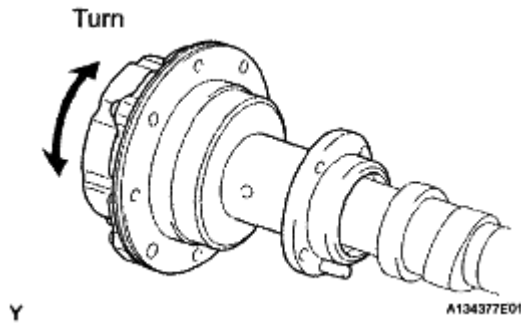


Fig. 75: Checking Timing Tube Turns Smoothly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT CAMSHAFT OIL CLEARANCE

- Install the camshaft timing tube to the camshaft (See **REASSEMBLY**).
- Clean the bearing caps and camshaft journals.
- Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

- Place the camshafts on the cylinder head.
- Lay a strip of Plastigage across each of the camshaft journals.

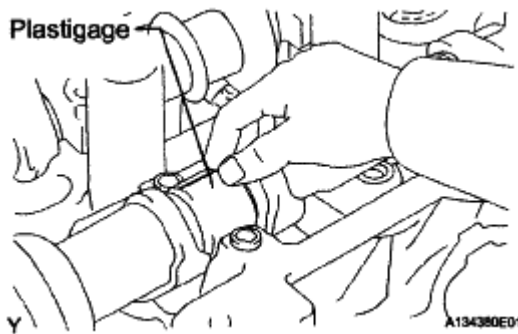


Fig. 76: Laying Strip Of Plastigage Across Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Install the bearing caps (See **INSTALLATION**).

NOTE: Do not turn the camshaft.

- Remove the bearing caps.
- Measure the Plastigage at its widest point.

Standard oil clearance

STANDARD OIL CLEARANCE

Camshaft journal	Camshaft timing tube journal
0.030 to 0.071 mm (0.0012 to 0.0028 in.)	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

Maximum oil clearance

MAXIMUM OIL CLEARANCE

Camshaft journal	Camshaft timing tube journal
0.100 mm (0.0039 in.)	0.075 mm (0.0030 in.)

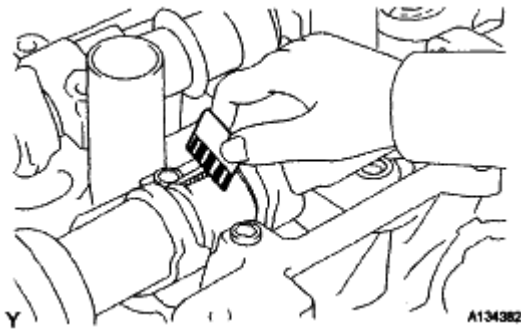


Fig. 77: Measuring Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

- i. Remove the camshafts.
- j. Completely remove the Plastigage.

4. INSPECT CAMSHAFT THRUST CLEARANCE

- a. Inspect the clearance on the intake side.
 1. Install the No. 3 camshaft.
 2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance: 0 to 0.040 mm (0 to 0.0016 in.)

Maximum thrust clearance: 0.12 mm (0.0047 in.)

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

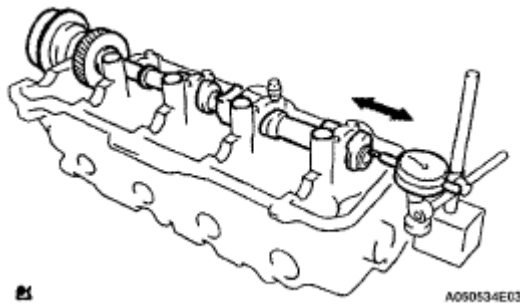


Fig. 78: Measuring Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Remove the No. 3 camshaft.
- b. Inspect the clearance on the exhaust side.
 1. Install the No. 4 camshaft.
 2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance: 0.030 to 0.070 mm (0.0012 to 0.0028 in.)

Maximum thrust clearance: 0.10 mm (0.0039 in.)

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

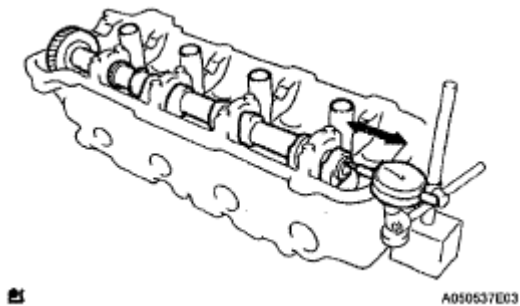


Fig. 79: Identifying Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Remove the No. 4 camshaft.
- 5. INSPECT CAMSHAFT GEAR BACKLASH**
- a. Install the drive gear to the camshaft timing tube.
 - b. Install the camshaft timing tube to the No. 3 camshaft.
 - c. Install the No. 3 camshaft and No. 4 camshaft without installing the camshaft sub gear and front bearing cap.
 - d. Using a dial indicator, measure the backlash.

Standard backlash: 0.020 to 0.200 mm (0.0008 to 0.0079 in.)

Maximum backlash: 0.30 mm (0.0118 in.)

If the backlash is greater than the maximum, replace the drive gear and No. 4 camshaft.

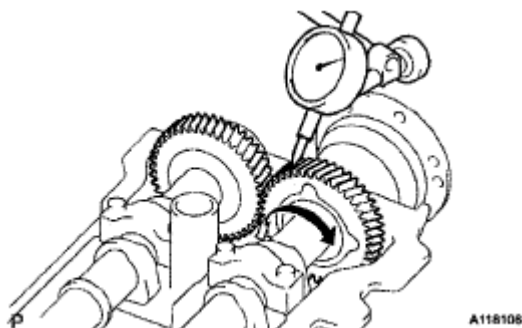


Fig. 80: Identifying Camshaft Gear Backlash
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the No. 3 camshaft and No. 4 camshaft.
- f. Remove the camshaft timing tube from the No. 3 camshaft.
- g. Remove the drive gear from the camshaft timing tube.

INSTALLATION

1. INSTALL CAMSHAFT SUB GEAR

- a. Install the gear spring [1], sub gear [2] and wave washer [3].

HINT:

Attach the pins on the gears to the gear spring ends.

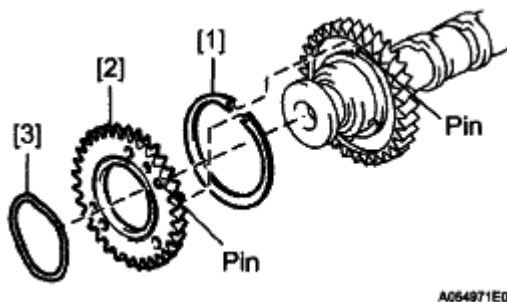


Fig. 81: Identifying Gear Spring, Sub Gear And Wave Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

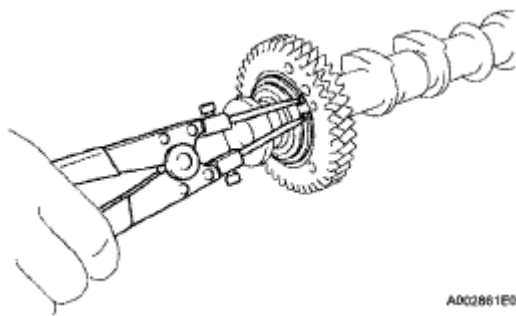


Fig. 82: Identifying Snap Ring

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

- c. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

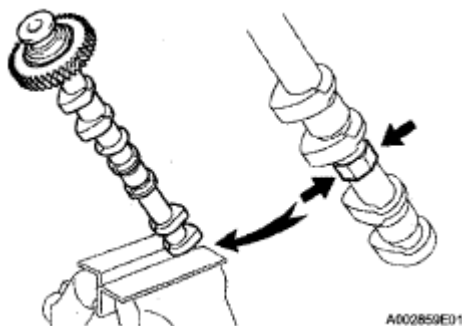


Fig. 83: Identifying Camshaft Hexagon Head Portion In Vise

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

- d. Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise.

Temporarily install a service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

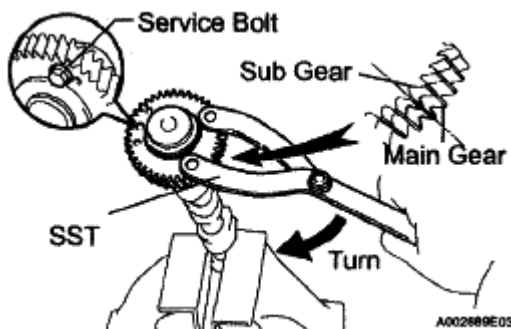


Fig. 84: Identifying Service Bolt

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

- e. Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.

2. INSTALL CAMSHAFT TIMING TUBE ASSEMBLY

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

NOTE:

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

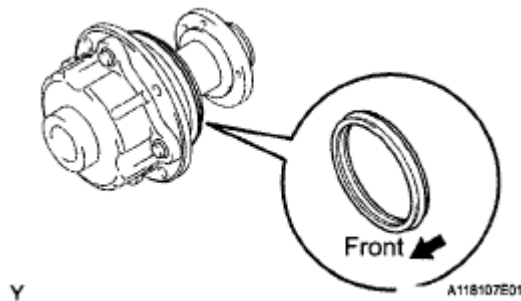


Fig. 85: Identifying Oil Seal Into Camshaft Timing Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing tube knock pin with the knock pin groove of the drive gear, and temporarily install the drive gear with the 4 bolts.

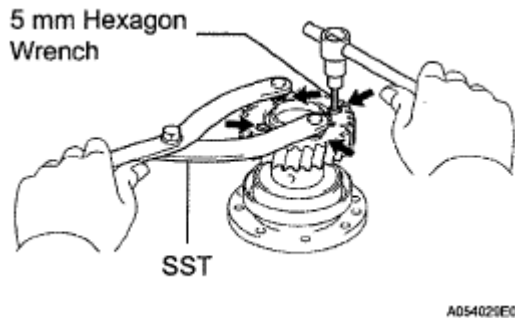


Fig. 86: Identifying Timing Tube Knock Pin With Knock Pin Groove Of Drive Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST and a 5 mm hexagon wrench, uniformly tighten the 4 bolts in several steps.

SST 09960-10010 (09962-01000, 09963-00500)

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

NOTE:

Be careful not to damage the timing tube.

- d. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

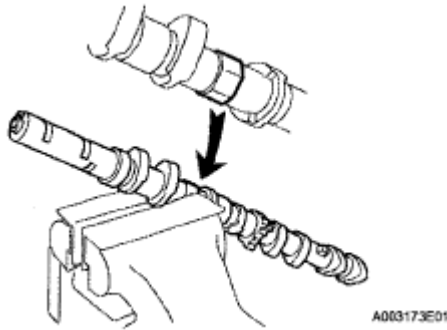


Fig. 87: Identifying Hexagon Head Portion Of Camshaft In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

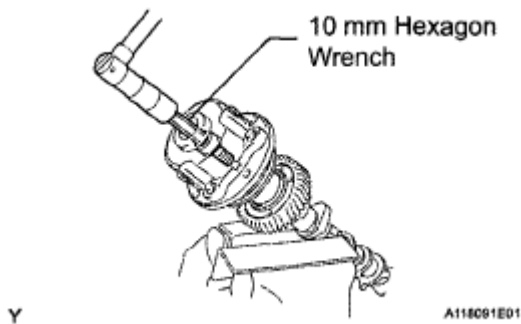


Fig. 88: Identifying Timing Tube Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the seal washer and screw plug.

Torque: 15 N*m (152 kgf*cm, 11 ft.*lbf)

3. INSTALL NO. 3 AND NO. 4 CAMSHAFT SUB-ASSEMBLY

NOTE:

- As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged. To avoid this, the following steps should

be carried out.

- Having the crankshaft pulley at a wrong angle can cause the piston head and valve head to come into contact with each other when installed the camshaft. Always set the crankshaft pulley at the correct angle as shown in the illustration.

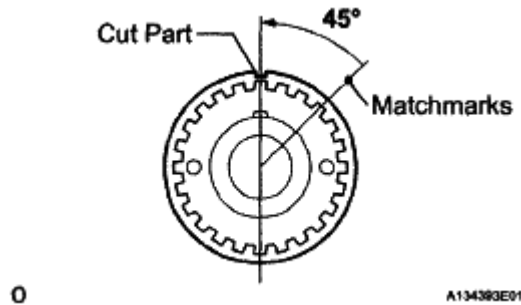


Fig. 89: Identifying Crankshaft Pulley Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Apply engine oil to the thrust portions of the camshafts.
- Align the timing marks (2 dot marks each) of the camshaft drive and driven main gears, and set the No. 3 and No. 4 camshafts in place.

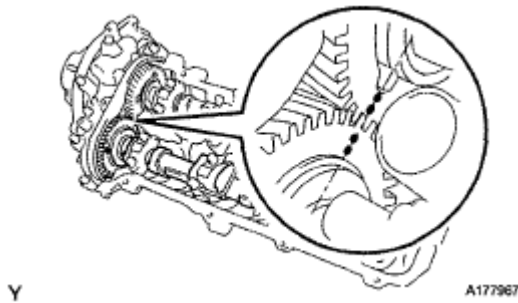


Fig. 90: Identifying Timing Marks Of Camshaft Drive And Driven Main Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

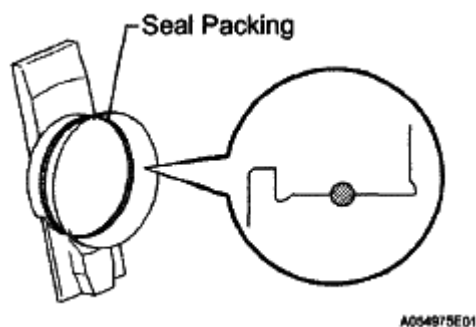


Fig. 91: Identifying Seal Packing And Housing Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the camshaft housing plug and oil control valve filter to the cylinder head as shown in the illustration.

NOTE: Be careful of the installation direction.

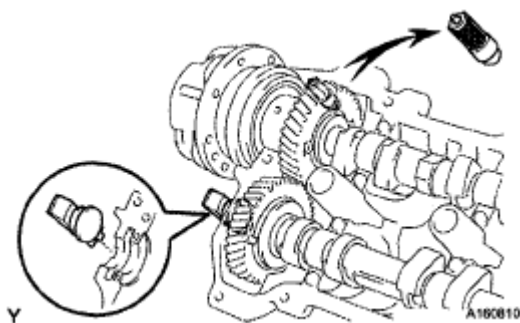


Fig. 92: Identifying Camshaft Housing Plug And Oil Control Valve Filter To Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply seal packing to the front bearing cap.
 1. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.

HINT:

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.

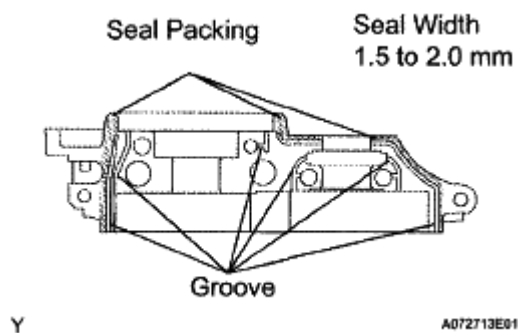


Fig. 93: Identifying Seal Packing And Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Apply seal packing to the bearing cap as shown in the illustration.

Standard seal diameter: 1.5 to 2.0 mm (0.059 to 0.079 in.)

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

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

HINT:

- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap.

- f. Install the front bearing cap.

HINT:

The thrust position of the camshaft will be determined after installing the front bearing cap.

- g. Install the other bearing caps in the order shown with the arrow mark facing forward.

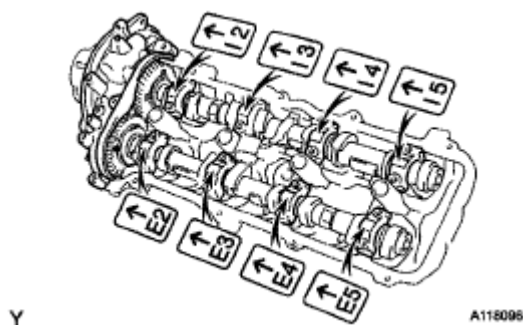


Fig. 94: Identifying Installing Sequence Of Bearing Caps (Bank 1)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Push in the camshaft setting oil seal.

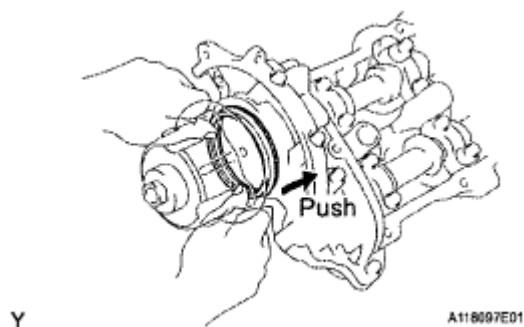


Fig. 95: Pushing In Camshaft Oil Seal

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

- i. Install a new seal washer to the bearing cap bolts (A and B).

NOTE: Do not apply engine oil under the heads of bearing cap bolts.

HINT:

Each bolt length is as follows:

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

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

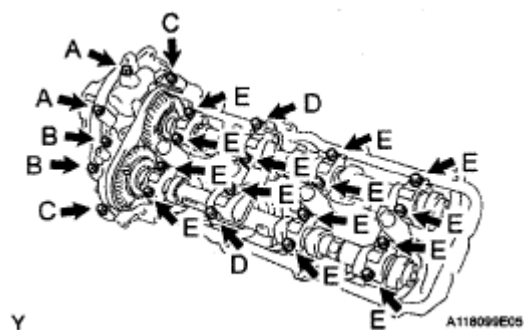


Fig. 96: Identifying Bearing Cap Bolts Length

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

- j. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts (D and E).

NOTE: Do not apply engine oil under the heads of bearing cap bolts C.

HINT:

Each bolt length is as follows:

25 mm (0.98 in.) for C

55 mm (2.17 in.) for D

40 mm (1.57 in.) for E

- k. Temporarily install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.
- l. Uniformly tighten the 22 bearing cap bolts in several steps, in the order shown in the illustration.

Torque:

For bolt C

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

For others

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

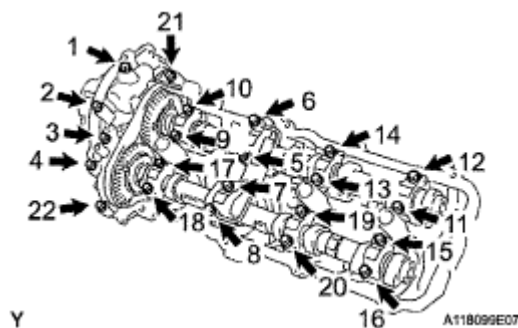


Fig. 97: Identifying Bearing Cap Bolts Tightening Sequence (Bank 1)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Bring the service bolt installed in the driven sub gear upward by turning the hexagonal portion of the camshaft with a wrench.
- n. Remove the service bolt.

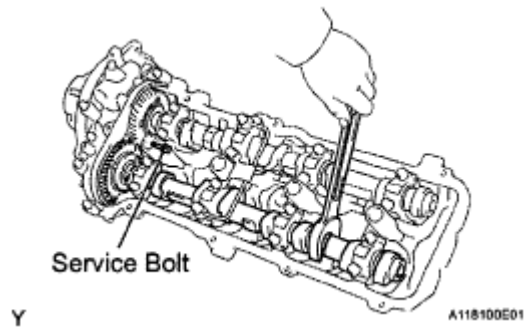


Fig. 98: Identifying Service Bolt

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

4. INSPECT VALVE CLEARANCE

- a. Turn the camshaft and position the cam lobes upward, and check and adjust the valve clearance (See **ADJUSTMENT**).

5. INSTALL SEMICIRCULAR PLUG

- a. Remove any old packing (FIPG) material.
- b. Apply seal packing to the 2 semicircular plug grooves.

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

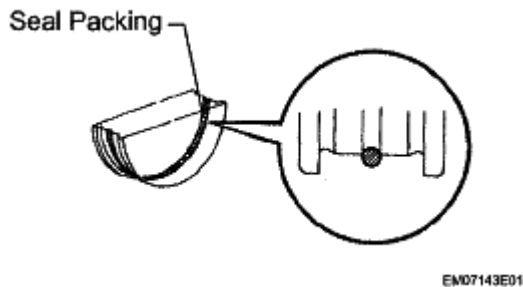


Fig. 99: Applying Seal Packing To Semicircular Plug Grooves

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

- c. Install the 2 semicircular plugs to the cylinder head.

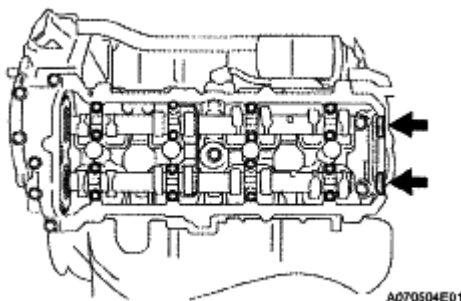


Fig. 100: Identifying Semicircular Plugs To Cylinder Heads

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

6. INSTALL CAMSHAFT POSITION SENSOR

- a. Install the camshaft position sensor with the bolt and stud bolt.

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

7. INSTALL CAMSHAFT TIMING PULLEY SUB-ASSEMBLY LH

- a. Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.
- b. Temporarily install the 4 bolts of the camshaft timing pulley.
- c. Hold the hexagonal portion of the camshaft.
- d. Using a 5 mm hexagon wrench, tighten the 4 bolts.

Torque: 8.1 N*m (83 kgf*cm, 72 in.*lbf)

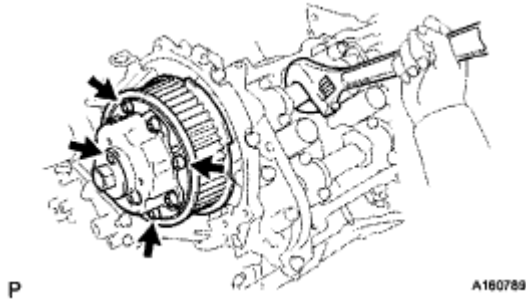


Fig. 101: Identifying Camshaft Timing Pulley Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY LH

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

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

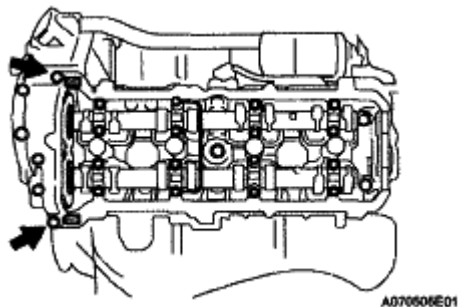


Fig. 102: Applying Seal Packing To Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Torque: 6.0 N*m (60 kgf*cm, 53 in.*lbf)

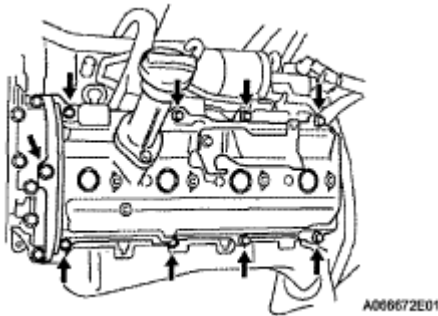


Fig. 103: Identifying Cylinder Head Cover With Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL IGNITION COIL ASSEMBLY

- a. Install the 4 bolts and 4 ignition coils.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

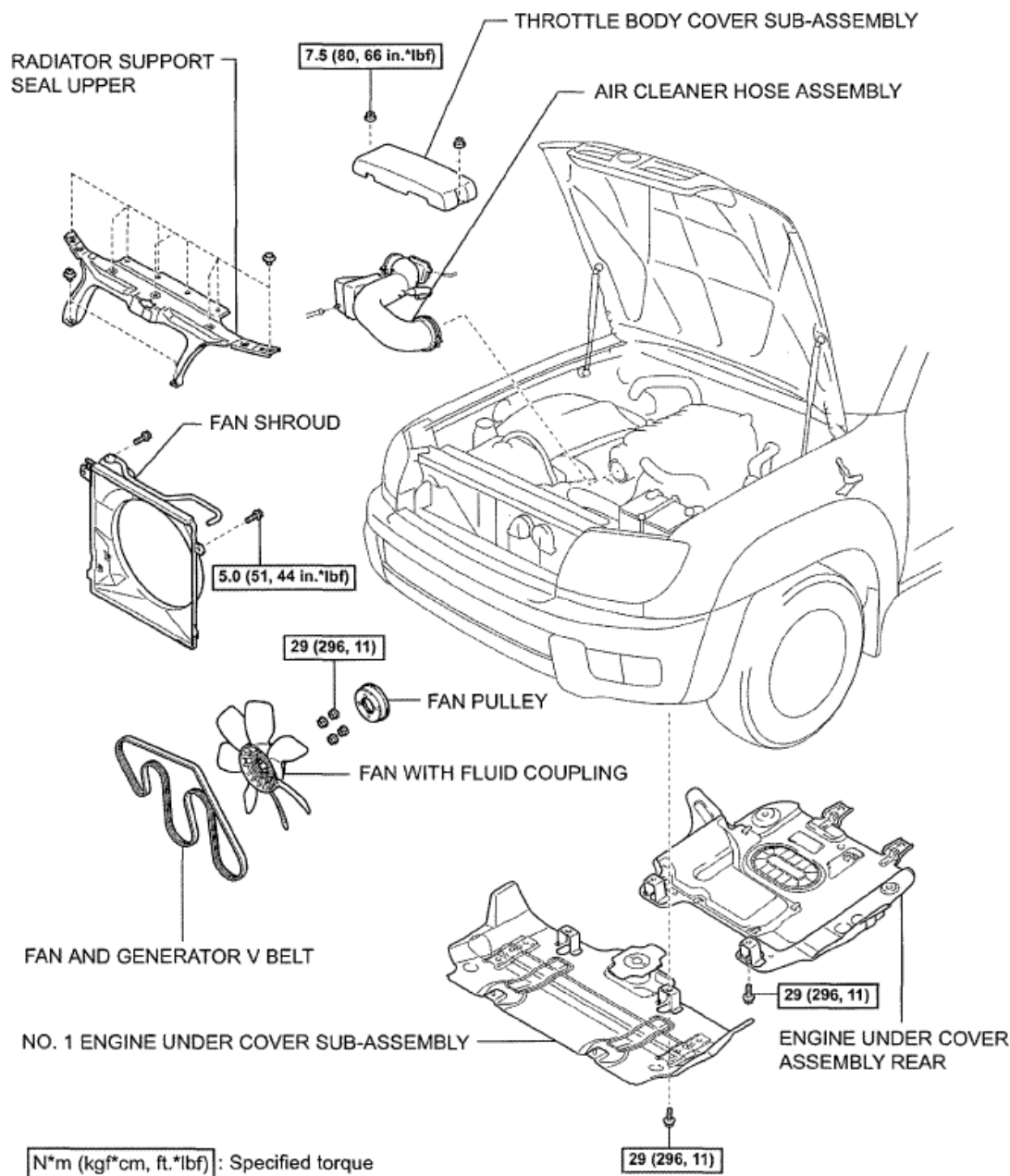
- b. Connect the 4 ignition coil connectors.

10. **INSTALL TIMING BELT (See INSTALLATION)**
11. **INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See INSTALLATION)**
12. **INSTALL NO. 1 TIMING BELT COVER (See INSTALLATION)**
13. **INSTALL CRANKSHAFT DAMPER SUB-ASSEMBLY (See INSTALLATION)**
14. **INSTALL FAN BRACKET SUB-ASSEMBLY (See INSTALLATION)**
15. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See INSTALLATION)**
16. **INSTALL NO. 2 TIMING BELT COVER SUB-ASSEMBLY (See INSTALLATION)**
17. **INSTALL NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH (See INSTALLATION)**
18. **INSTALL NO. 2 TIMING CHAIN OR BELT COVER (See INSTALLATION)**
19. **INSTALL OIL COOLER PIPE (See INSTALLATION)**
20. **INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY (See INSTALLATION)**
21. **INSTALL COMPRESSOR (See INSTALLATION)**
22. **INSTALL GENERATOR ASSEMBLY (See INSTALLATION)**
23. **INSTALL VANE PUMP ASSEMBLY (See INSTALLATION)**
24. **INSTALL FAN WITH FLUID COUPLING (See INSTALLATION)**
25. **INSTALL FAN AND GENERATOR V BELT (See INSPECTION)**
26. **INSTALL RADIATOR SUPPORT SEAL UPPER**

- 27. **INSTALL AIR CLEANER HOSE ASSEMBLY**
- 28. **INSTALL THROTTLE BODY COVER SUB-ASSEMBLY (See INSTALLATION)**
- 29. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
- 30. **ADD ENGINE COOLANT (See REPLACEMENT)**
- 31. **CHECK FOR ENGINE COOLANT LEAKS (See REPLACEMENT)**

CAMSHAFT (FOR BANK 2)

COMPONENTS



A119828E05

Fig. 104: Identifying Camshaft Replacement Components (For Bank 2) With Torque Specifications (1 Of 4)

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

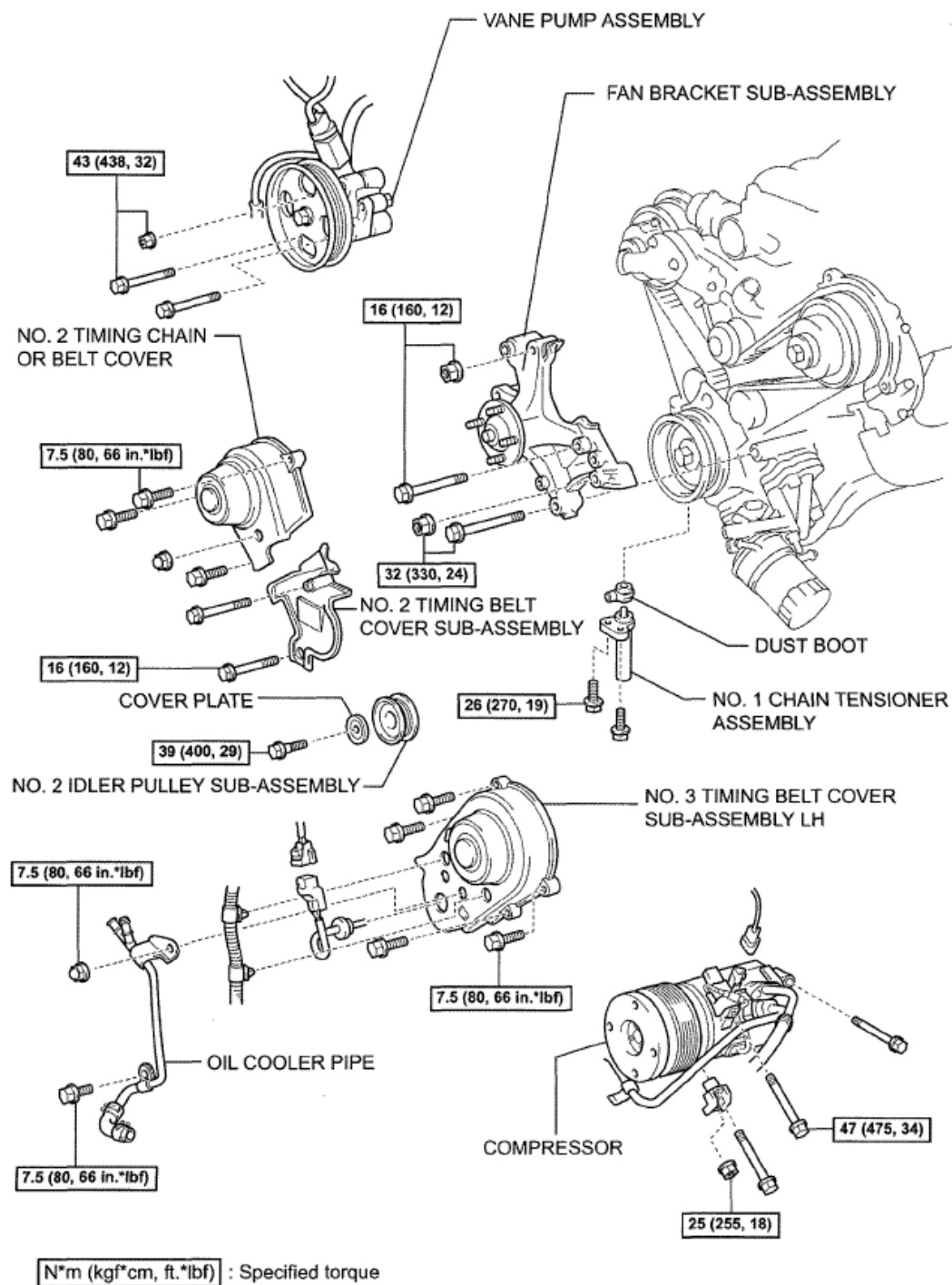
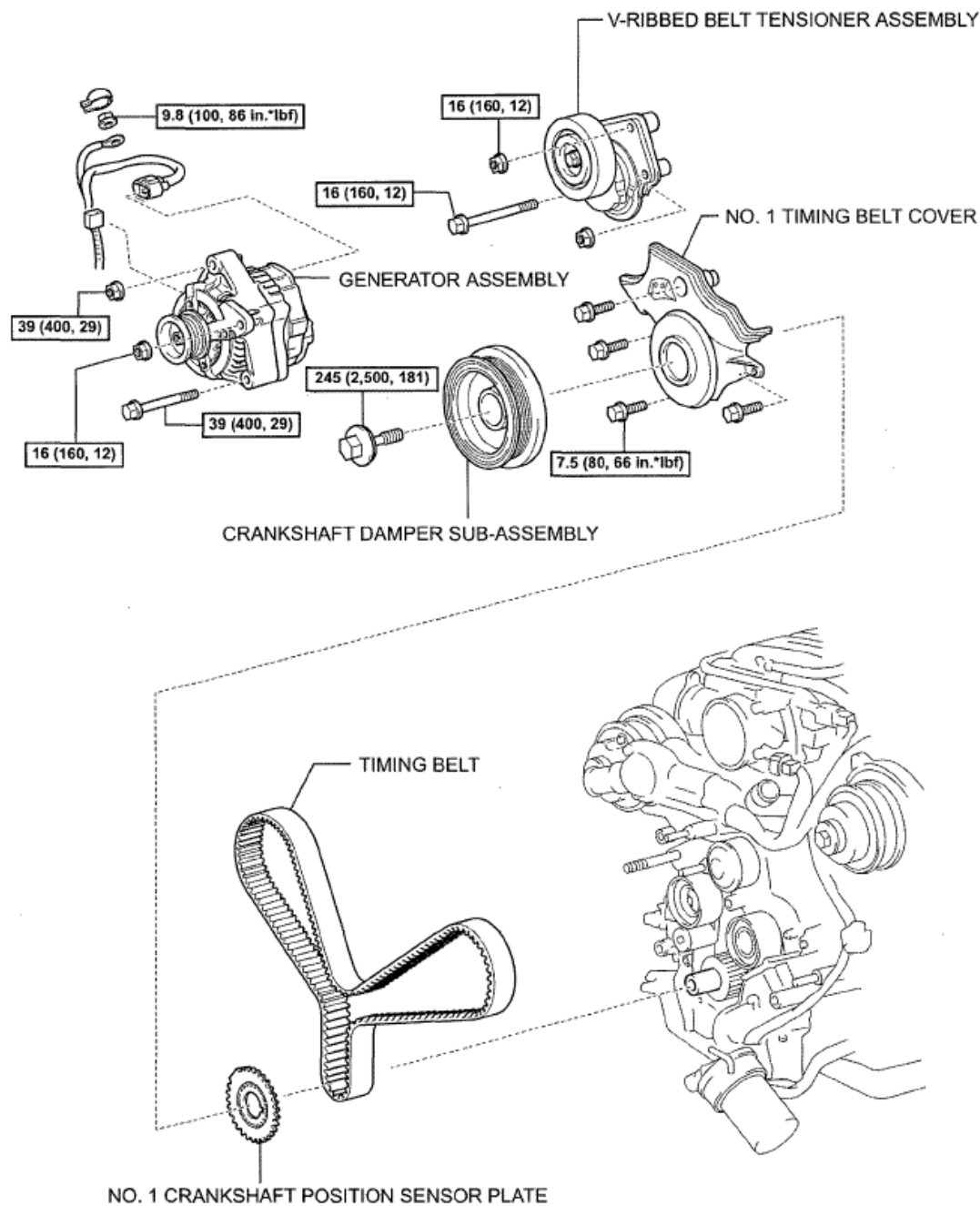


Fig. 105: Identifying Camshaft Replacement Components (For Bank 2) With Torque Specifications (2 Of 4)

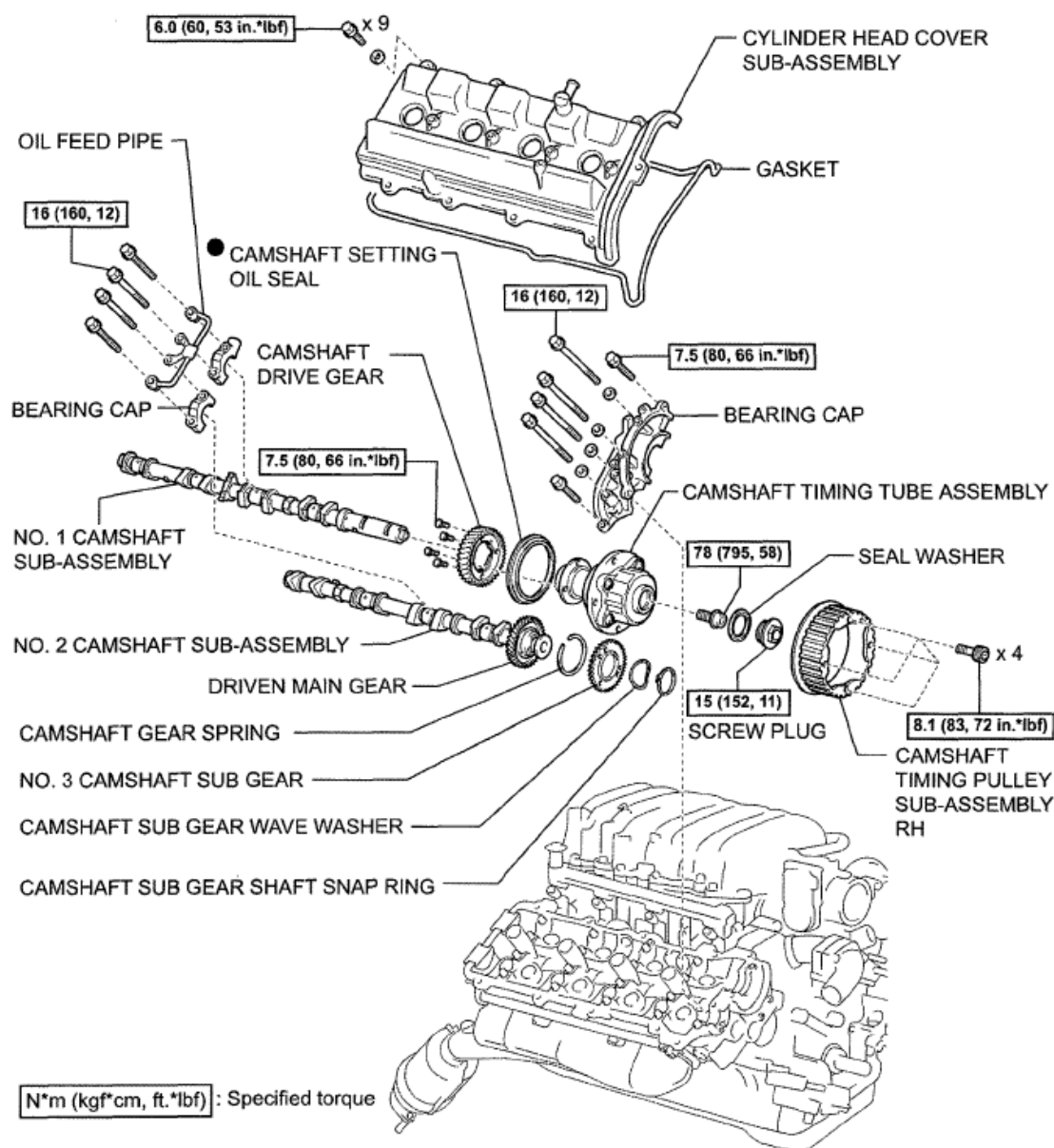
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A115830E07

Fig. 106: Identifying Camshaft Replacement Components (For Bank 2) With Torque Specifications (3 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119B31E05

Fig. 107: Identifying Camshaft Replacement Components (For Bank 2) With Torque Specifications (4 Of 4)

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

REMOVAL

1. **DRAIN ENGINE COOLANT** (See [REPLACEMENT](#))
2. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
3. **REMOVE THROTTLE BODY COVER SUB-ASSEMBLY** (See [REMOVAL](#))
4. **REMOVE AIR CLEANER HOSE ASSEMBLY** (See [REMOVAL](#))

5. REMOVE RADIATOR SUPPORT SEAL UPPER (See REMOVAL)
6. REMOVE FAN AND GENERATOR V BELT (See REMOVAL)
7. REMOVE FAN WITH FLUID COUPLING (See REMOVAL)
8. SEPARATE VANE PUMP ASSEMBLY (See REMOVAL)
9. REMOVE GENERATOR ASSEMBLY (See REMOVAL)
10. SEPARATE COMPRESSOR (See REMOVAL)
11. REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY (See REMOVAL)
12. REMOVE OIL COOLER PIPE (See REMOVAL)
13. REMOVE NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH (See REMOVAL)
14. REMOVE NO. 2 TIMING CHAIN OR BELT COVER (See REMOVAL)
15. REMOVE NO. 2 TIMING BELT COVER SUB-ASSEMBLY (See REMOVAL)
16. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See REMOVAL)
17. REMOVE FAN BRACKET SUB-ASSEMBLY (See REMOVAL)
18. REMOVE CRANKSHAFT DAMPER SUB-ASSEMBLY (See REMOVAL)
19. REMOVE NO. 1 TIMING BELT COVER (See REMOVAL)
20. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See REMOVAL)
21. REMOVE TIMING BELT (See REMOVAL)
22. REMOVE IGNITION COIL ASSEMBLY
 - a. Disconnect the 4 ignition coil connectors.
 - b. Remove the 4 bolts and 4 ignition coils.
23. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY
 - a. Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.

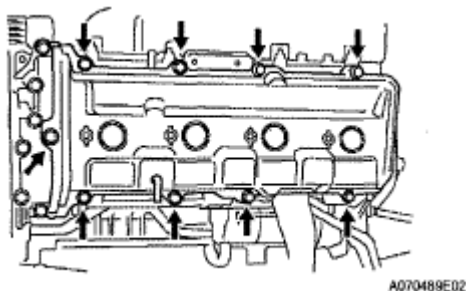


Fig. 108: Identifying Bolts, Seal Washers, Cylinder Head Cover And Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. REMOVE CAMSHAFT TIMING PULLEY SUB-ASSEMBLY RH
 - a. Hold the camshaft with a wrench, and remove the 4 bolts and timing pulley.

NOTE: Do not remove the 4 "TORX" bolts shown in the illustration. If the camshaft timing tube is removed, replace the timing tube assembly.

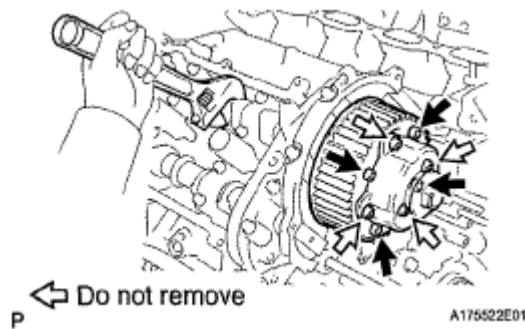


Fig. 109: Identifying Camshaft Timing Pulley Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. REMOVE NO. 1 AND NO. 2 CAMSHAFT SUB-ASSEMBLY

NOTE:

- As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being removed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged. To avoid this, the following steps should be carried out.
- Having the crankshaft pulley at a wrong angle can cause the piston head and valve head to come into contact with each other when removing the camshaft. Always set the crankshaft pulley at the correct angle as shown in the illustration.

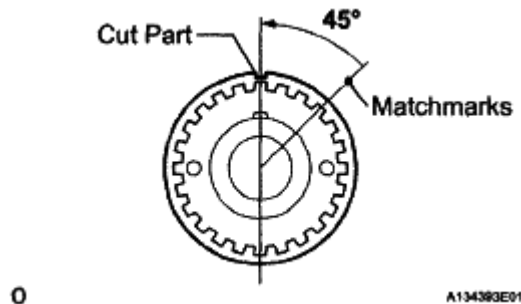
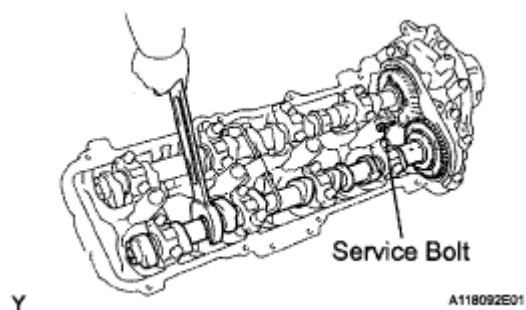


Fig. 110: Identifying Crankshaft Pulley Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Bring the service bolt hole of the sub gear upward by turning the hexagonal portion of the No. 2 camshaft with a wrench.

**Fig. 111: Identifying Service Bolt**

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

- b. Secure the sub gear to the main gear with a service bolt.

Recommended service bolt

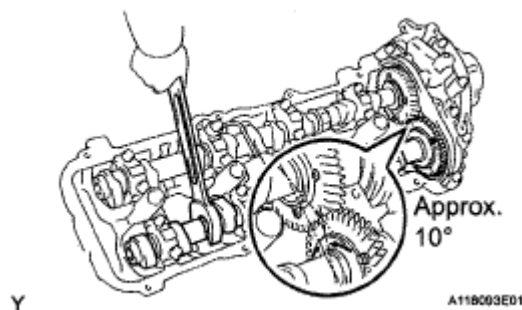
RECOMMENDED SERVICE BOLT

Thread diameter	6 mm
Thread pitch	1.0 mm
Bolt length	16 to 20 mm

HINT:

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

- c. Set the timing marks (1 dot mark each) of the camshaft drive and driven gears at an angle of approximately 10° by turning the hexagonal portion of the No. 2 camshaft with a wrench.

**Fig. 112: Identifying Timing Marks Of Camshaft Drive And Driven Main Gears**

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

- d. Uniformly loosen and remove the 22 bearing cap bolts in several steps, in the order shown in the illustration.

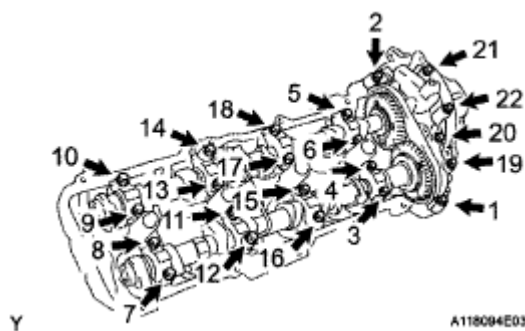


Fig. 113: Identifying Bearing Cap Bolts Loosening Sequence (Bank 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the oil feed pipe, 9 bearing caps, camshaft housing plug, oil control valve filter, and camshafts.

HINT:

Arrange the bearing caps in the correct order.

- f. Mount the hexagonal portion of the camshaft in a vise.

NOTE:

- Be careful not to damage the camshaft.
- Do not remove the 4 bolts shown in the illustration. If any of them are loosened or removed, the backlash of the gear in the timing tube will go out of adjustment. In this case, replace the timing tube assembly with a new one.

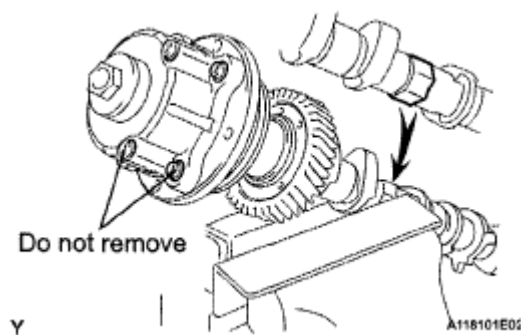


Fig. 114: Identifying Camshaft Hexagonal Portion In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Remove the screw plug and seal washer.
- h. Using a 10 mm hexagon wrench, remove the bolt.

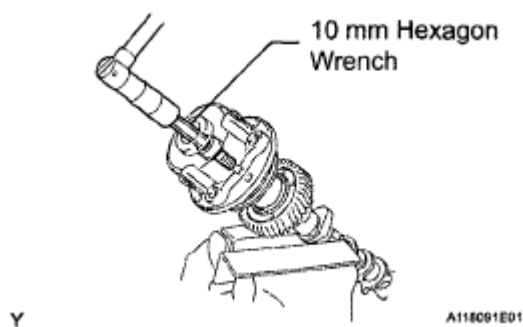


Fig. 115: Identifying Timing Tube Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Pull out the timing tube and drive gear from the camshaft.
- j. Using SST and a 5 mm hexagon wrench, remove the 4 bolts, drive gear and oil seal.

SST 09960-10010 (09962-01000, 09963-00500)

NOTE: Be careful not to damage the timing tube.

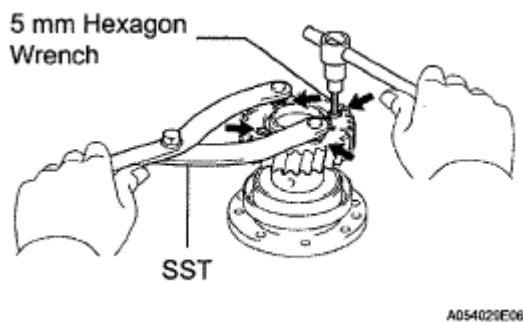


Fig. 116: Identifying Bolts, Drive Gear And Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE SEMICIRCULAR PLUG

27. REMOVE CAMSHAFT SUB GEAR

- a. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

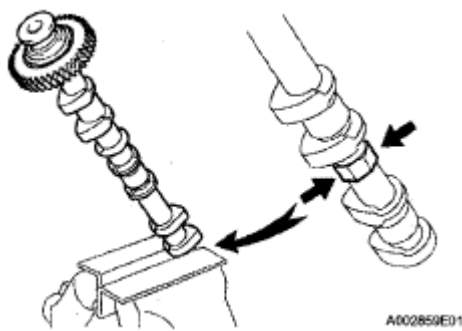


Fig. 117: Identifying Camshaft Hexagon Head Portion In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, turn the sub gear clockwise and remove the service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

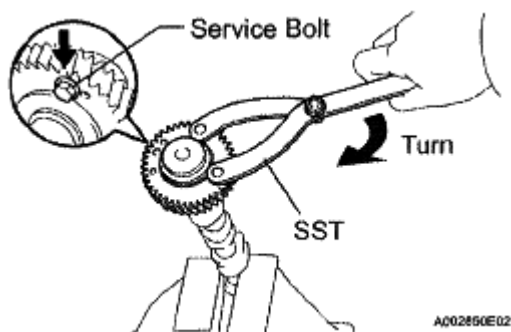


Fig. 118: Identifying Service Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using snap ring pliers, remove the snap ring.

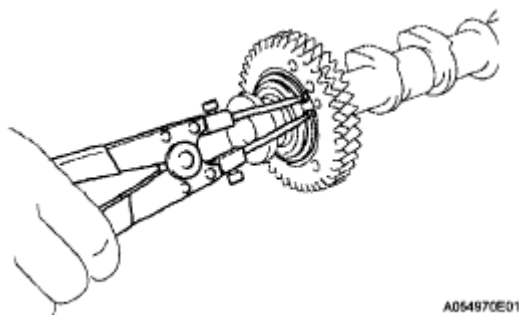


Fig. 119: Identifying Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Remove the wave washer, sub gear and gear spring.
e. Using a vernier caliper, measure the gap distance of the gear spring.

Gap distance: 18.2 to 18.8 mm (0.717 to 0.740 in.)

If the gap distance is not as specified, replace the gear spring.

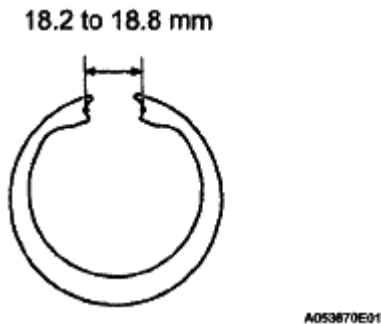


Fig. 120: Identifying Gap Of Gear Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CAMSHAFT

- a. Inspect the camshaft runout.
 1. Place the camshaft on V-blocks.
 2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.08 mm (0.0031 in.)

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

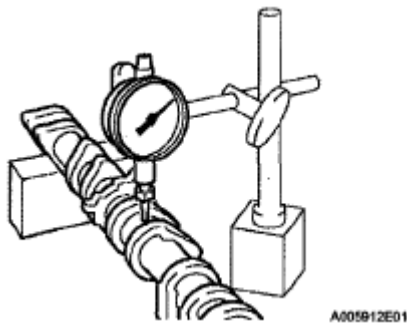


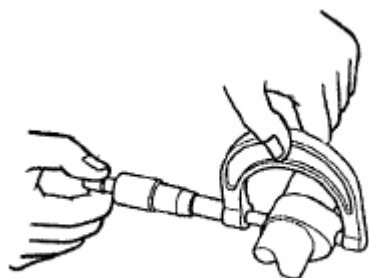
Fig. 121: Identifying Camshafts Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the cam lobes.
 1. Using a micrometer, measure the cam lobe height.

Standard cam lobe height

STANDARD CAM LOBE HEIGHT

Item	Specified Condition
Intake	41.94 to 42.04 mm (1.6512 to 1.6551 in.)
Exhaust	41.96 to 42.06 mm (1.6520 to 1.6559 in.)



EM02011E01

Fig. 122: Measuring Cam Lobe Height Using Micrometer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Minimum cam lobe height

MINIMUM CAM LOBE HEIGHT

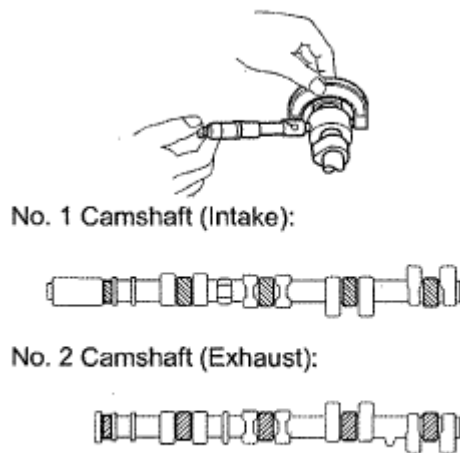
Item	Specified Condition
Intake	41.79 mm (1.6453 in.)
Exhaust	41.81 mm (1.6461 in.)

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

- c. Inspect the camshaft journals.
 1. Using a micrometer, measure the journal diameter.

Journal diameter: 26.954 to 26.970 mm (1.0612 to 1.0618 in.)

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



A175500ED1

Fig. 123: Measuring Camshaft Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT CAMSHAFT TIMING TUBE ASSEMBLY

- a. Using a micrometer, measure the journal diameter.

Journal diameter: 39.955 to 39.964 mm (1.5730 to 1.5734 in.)

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

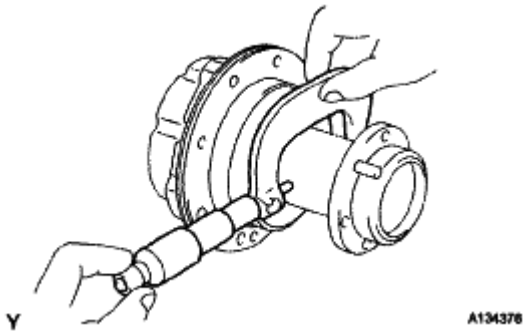


Fig. 124: Measuring Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the timing tube to the intake camshaft, and check that the timing tube turns smoothly. If necessary, replace the timing tube and intake camshaft.

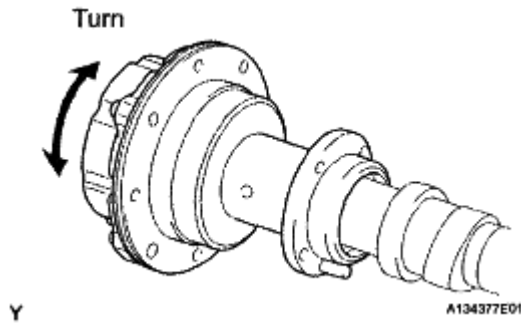


Fig. 125: Identifying Timing Tube And Intake Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT CAMSHAFT OIL CLEARANCE

- Install the camshaft timing tube to the camshaft (See **REASSEMBLY**).
- Clean the bearing caps and camshaft journals.
- Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

- Place the camshafts on the cylinder head.
- Lay a strip of Plastigage across each of the camshaft journals.

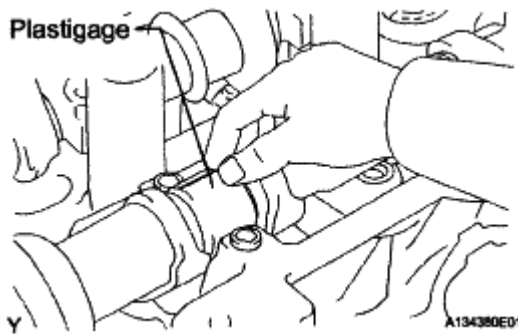


Fig. 126: Laying Strip Of Plastigage Across Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Install the bearing caps (See **INSTALLATION**).

NOTE: Do not turn the camshaft.

- Remove the bearing caps.
- Measure the Plastigage at its widest point.

Standard oil clearance

STANDARD OIL CLEARANCE

Camshaft journal	Camshaft timing tube journal
0.030 to 0.071 mm (0.0012 to 0.0028 in.)	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

Maximum oil clearance**MAXIMUM OIL CLEARANCE**

Camshaft journal	Camshaft timing tube journal
0.100 mm (0.0039 in.)	0.075 mm (0.0030 in.)

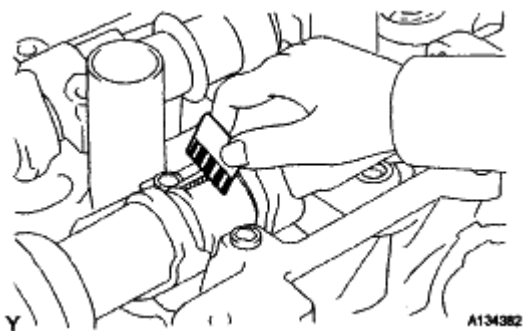


Fig. 127: Measuring Plastigage To Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

- i. Remove the camshafts.
 - j. Completely remove the Plastigage.
4. **INSPECT CAMSHAFT THRUST CLEARANCE**
- a. Inspect the clearance on the intake side.

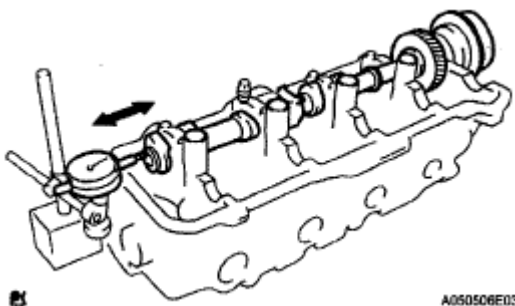


Fig. 128: Identifying Camshaft Thrust Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 1. Install the No. 1 camshaft.
- 2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and

forth.

Standard thrust clearance: 0 to 0.040 mm (0 to 0.0016 in.)

Maximum thrust clearance: 0.12 mm (0.0047 in.)

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

3. Remove the No. 1 camshaft.
- b. Inspect the clearance on the exhaust side.

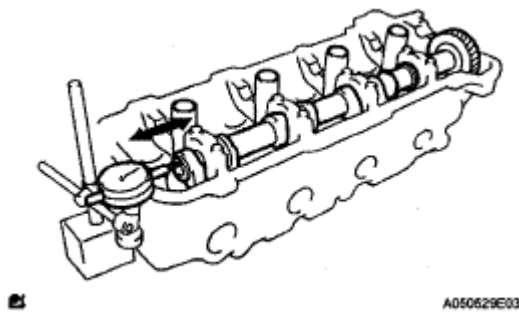


Fig. 129: Identifying Clearance On Exhaust Side

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

1. Install the No. 2 camshaft.
2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance: 0.030 to 0.070 mm (0.0012 to 0.0028 in.)

Maximum thrust clearance: 0.10 mm (0.0039 in.)

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

3. Remove the No. 2 camshaft.

5. INSPECT CAMSHAFT GEAR BACKLASH

- a. Install the drive gear to the camshaft timing tube.
- b. Install the camshaft timing tube to the No. 1 camshaft.
- c. Install the No. 1 camshaft and No. 2 camshaft without installing the camshaft sub gear and front bearing cap.
- d. Using a dial indicator, measure the backlash.

Standard backlash: 0.020 to 0.200 mm (0.0008 to 0.0079 in.)

Maximum backlash: 0.30 mm (0.0118 in.)

If the backlash is greater than the maximum, replace the camshaft drive gear and No. 1 camshaft.

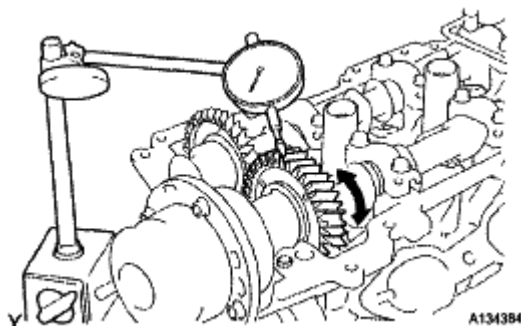


Fig. 130: Identifying Camshaft Gear Backlash
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the No. 1 camshaft and No. 2 camshaft.
- f. Remove the camshaft timing tube from the No. 1 camshaft.
- g. Remove the drive gear from the camshaft timing tube.

INSTALLATION

1. INSTALL CAMSHAFT SUB GEAR

- a. Install the gear spring [1], sub gear [2] and wave washer [3].

HINT:

Attach the pins on the gears to the gear spring ends.

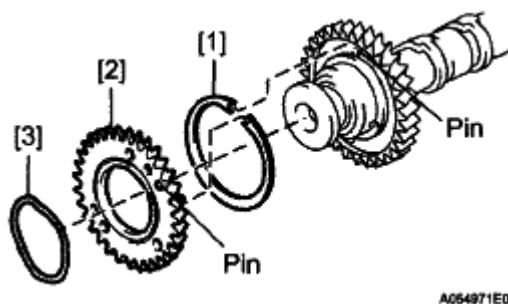


Fig. 131: Identifying Gear Spring, Sub Gear And Wave Washer
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

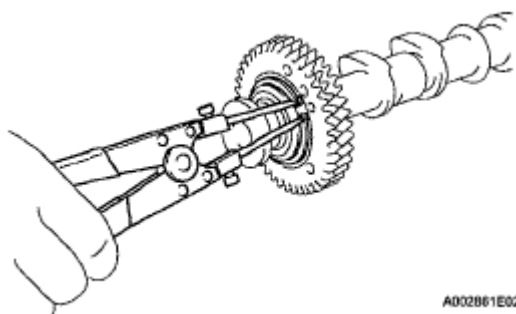


Fig. 132: Identifying Snap Ring

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

- c. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

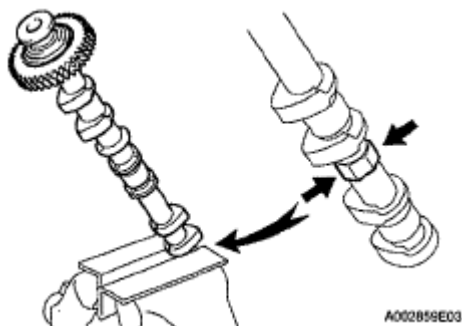


Fig. 133: Identifying Hexagonal Portion Of Camshaft In Vise

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

- d. Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise. Temporarily install a service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

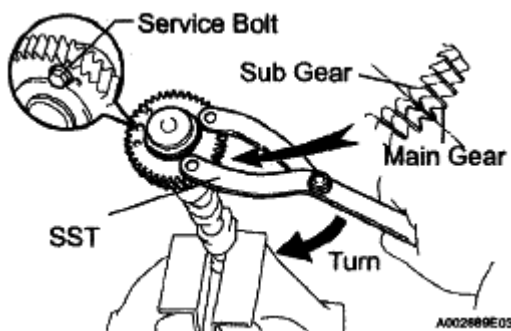


Fig. 134: Identifying Service Bolt

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

- e. Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.

2. INSTALL CAMSHAFT TIMING TUBE ASSEMBLY

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

NOTE:

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

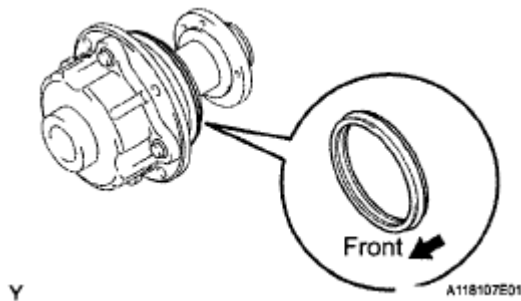


Fig. 135: Identifying Oil Seal Into Camshaft Timing Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the timing tube knock pin with the knock pin groove of the drive gear, and temporarily install the drive gear with the 4 bolts.

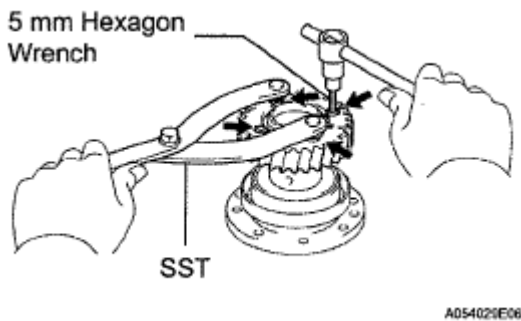


Fig. 136: Identifying Drive Gear Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST and a 5 mm hexagon wrench, uniformly tighten the 4 bolts in several steps.

SST 09960-10010 (09962-01000, 09963-00500)

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

NOTE:

Be careful not to damage the timing tube.

- d. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

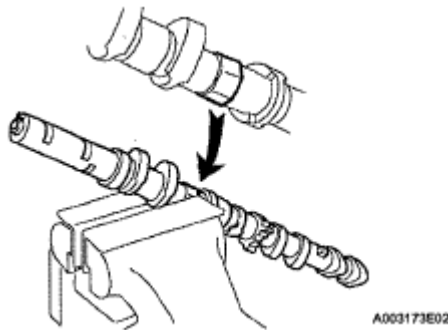


Fig. 137: Identifying Hexagonal Portion Of Camshaft In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Align the camshaft knock pin with the knock pin groove of the timing tube, and push the timing tube by hand until the camshaft knock pin touches the bottom of the timing tube knock pin groove.

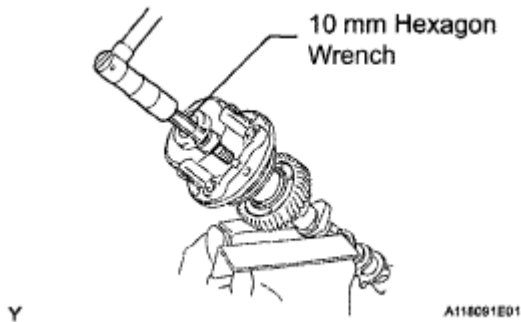


Fig. 138: Identifying Timing Tube Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using a 10 mm hexagon wrench, install the bolt.

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

- g. Install the seal washer and screw plug.

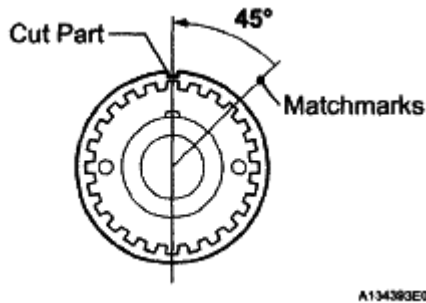
Torque: 15 N*m (152 kgf*cm, 11 ft.*lbf)

3. INSTALL NO. 1 AND NO. 2 CAMSHAFT SUB-ASSEMBLY

NOTE:

- As the thrust clearance of the camshaft is small, the camshaft must be kept level while it is being installed. If the camshaft is not kept level, the portion of the cylinder head which receives the shaft thrust may crack or be damaged. To avoid this, the following steps should be carried out.

- Having the crankshaft pulley at a wrong angle can cause the piston head and valve head to come into contact with each other when installing the camshaft. Be sure to set the crankshaft pulley at the correct angle as shown in the illustration.

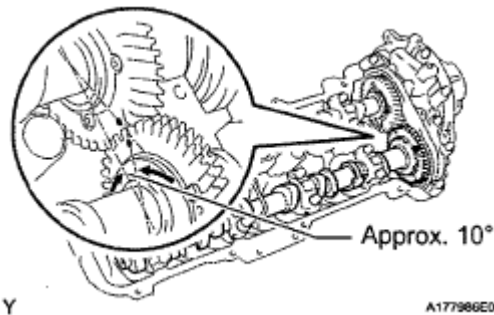


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Fig. 139: Identifying Crankshaft Pulley Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Apply engine oil to the thrust positions of the intake and exhaust camshafts.
- Align the timing marks (1 dot marks each) of the camshaft drive and driven main gears, and set the No. 1 and No. 2 camshafts in place. Set the timing marks (1 dot mark each) of the camshaft drive and driven main gears at an angle of approximately 10°.



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Fig. 140: Identifying Timing Marks Of Camshaft Drive And Driven Main Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

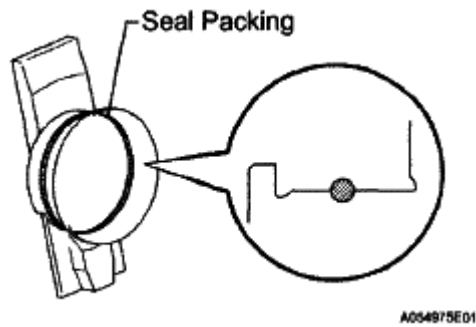


Fig. 141: Identifying Seal Packing And Housing Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the camshaft housing plug and oil control valve filter to the cylinder head as shown in the illustration.

NOTE: Be careful of the installation direction.

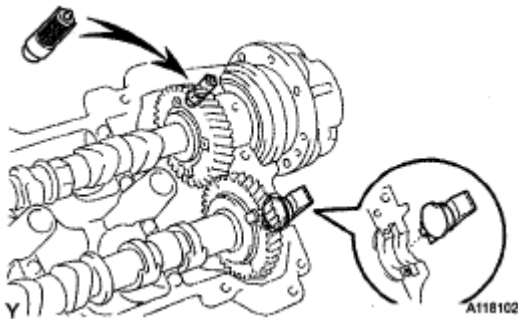


Fig. 142: Identifying Camshaft Housing Plug To Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply seal packing to the front bearing cap.
 1. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.

HINT:

- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and grooves.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.

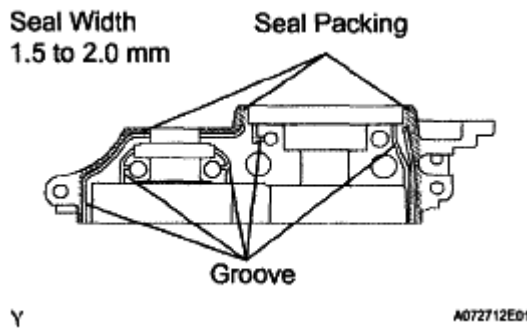


Fig. 143: Applying Seal Packing To Front Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Apply seal packing to the bearing cap as shown in the illustration.

Standard seal diameter: 1.5 to 2.0 mm (0.059 to 0.079 in.)

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

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

HINT:

- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap.

- f. Install the front bearing cap.

HINT:

The thrust position of the camshaft will be determined after installing the front bearing cap.

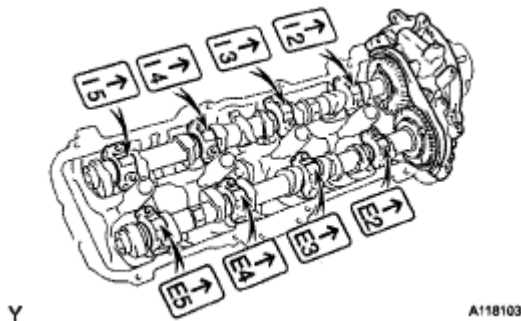


Fig. 144: Identifying Installing Sequence Of Bearing Caps (Bank 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Install the other bearing caps in the order shown with the arrow mark facing forward.

- h. Push in the camshaft setting oil seal.

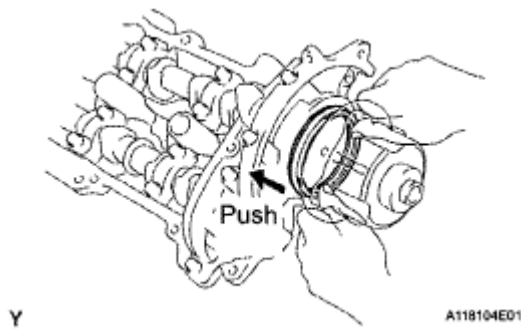


Fig. 145: Identifying Pushing In Camshaft Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Install new seal washers to the bearing cap bolts (A and B).

NOTE: Do not apply engine oil under the heads of bearing cap bolts.

HINT:

Each bolt length is as follows:

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

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

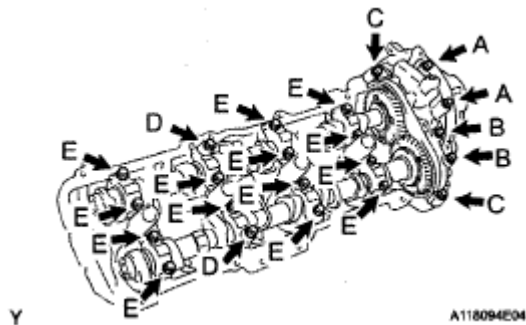


Fig. 146: Identifying Bearing Cap Bolts Length (Bank 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts (D and E).

NOTE: Do not apply engine oil under the heads of bearing cap bolts C.

HINT:

Each bolt length is as follows:

25 mm (0.98 in.) for C

55 mm (2.17 in.) for D

40 mm (1.57 in.) for E

- k. Temporarily install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.
- l. Uniformly tighten the 22 bearing cap bolts in several steps, in the order shown in the illustration.

Torque:

For bolt C

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

For others

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

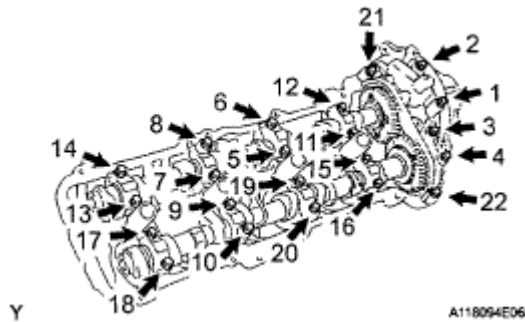


Fig. 147: Identifying Bearing Cap Bolts Tightening Sequence (Bank 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- m. Bring the service bolt installed in the driven sub gear upward by turning the hexagonal portion of the camshaft with a wrench.
- n. Remove the service bolt.

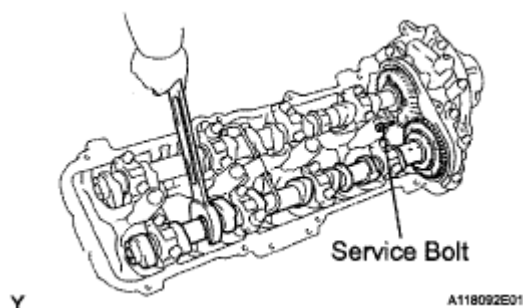


Fig. 148: Identifying Service Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSPECT VALVE CLEARANCE

- a. Turn the camshaft and position the cam lobes upward, and check and adjust the valve clearance (See **ADJUSTMENT**).

5. INSTALL SEMICIRCULAR PLUG

- a. Remove any old packing (FIPG) material.
- b. Apply seal packing to the 2 semicircular plug grooves.

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

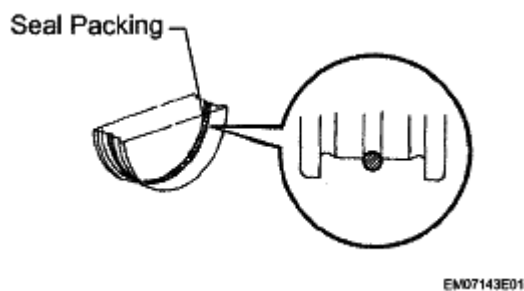


Fig. 149: Identifying Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the 2 semicircular plugs to the cylinder head.

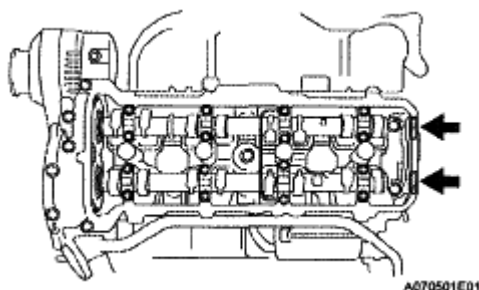


Fig. 150: Identifying Semicircular Plugs To Cylinder Heads
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL CAMSHAFT TIMING PULLEY SUB ASSEMBLY RH

- Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.
- Temporarily install the 4 bolts of the camshaft timing pulley.
- Hold the hexagonal portion of the camshaft.
- Using a 5 mm hexagon wrench, tighten the 4 bolts.

Torque: 8.1 N*m (83 kgf*cm, 72 ft.*lbf)

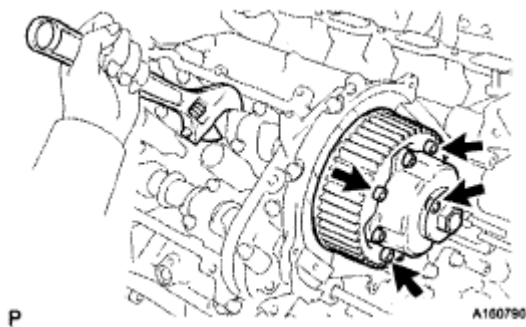


Fig. 151: Identifying Camshaft Timing Pulley Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

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

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

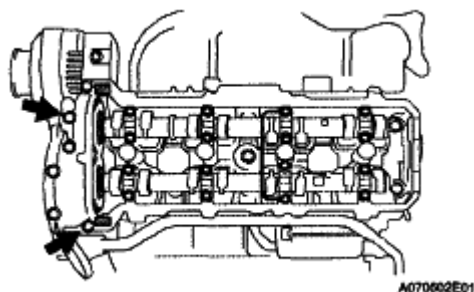


Fig. 152: Applying Seal Packing To Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Install the gasket to the cylinder head cover.
- Install the seal washers to the bolts.
- Install the cylinder head cover with the 9 bolts. Uniformly tighten the bolts in several steps.

Torque: 6.0 N*m (60 kgf*cm, 53 in.*lbf)

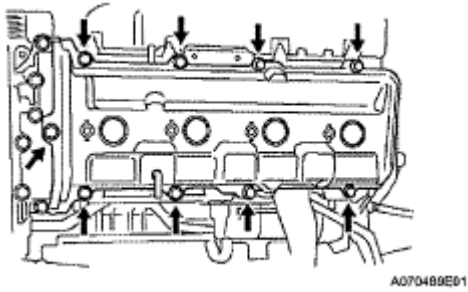


Fig. 153: Identifying Cylinder Head Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

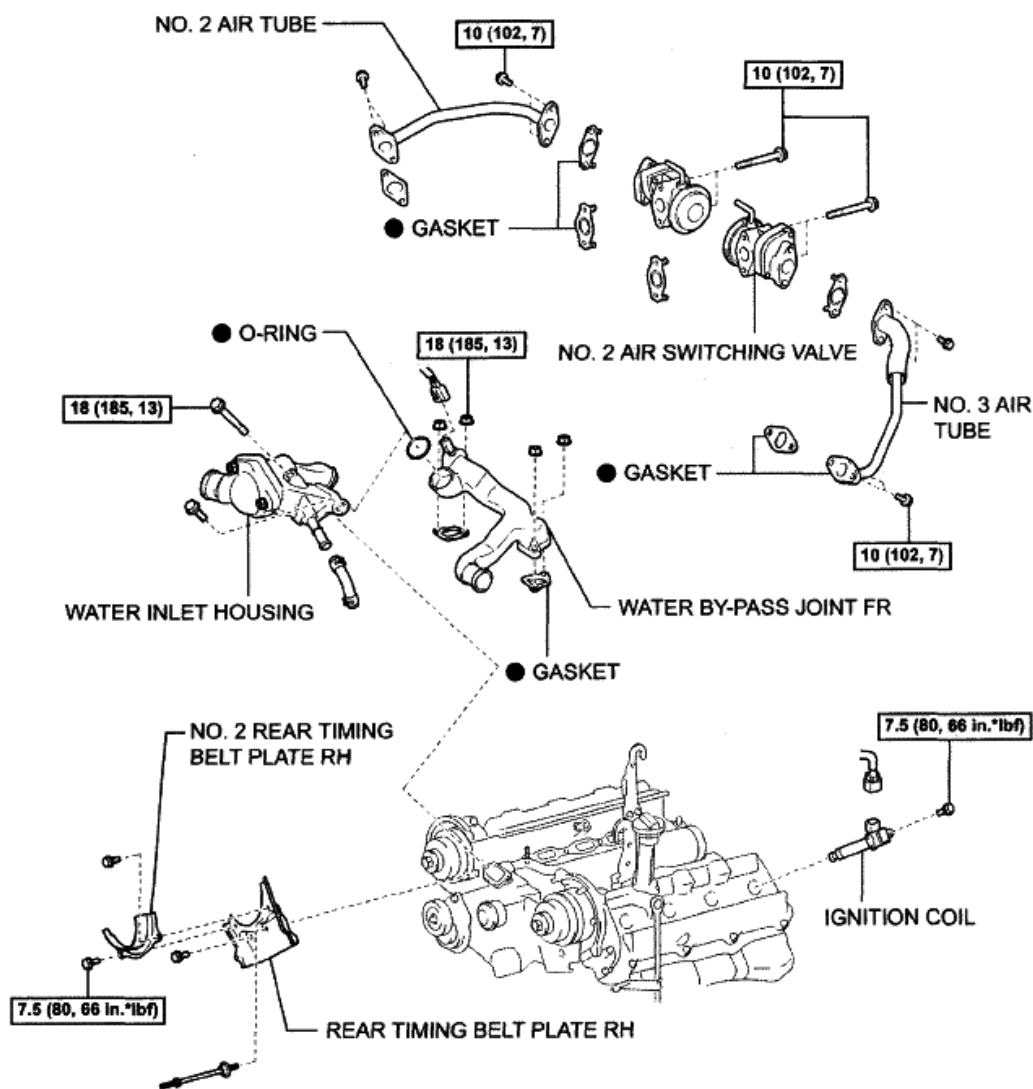
8. INSTALL IGNITION COIL ASSEMBLY

- a. Install the 4 bolts and 4 ignition coils.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

- b. Connect the 4 ignition coil connectors.

9. **INSTALL TIMING BELT (See INSTALLATION)**
10. **INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See INSTALLATION)**
11. **INSTALL NO. 1 TIMING BELT COVER (See INSTALLATION)**
12. **INSTALL CRANKSHAFT DAMPER SUB-ASSEMBLY (See INSTALLATION)**
13. **INSTALL FAN BRACKET SUB-ASSEMBLY (See INSTALLATION)**
14. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See INSTALLATION)**
15. **INSTALL NO. 2 TIMING BELT COVER SUB-ASSEMBLY (See INSTALLATION)**
16. **INSTALL NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH (See INSTALLATION)**
17. **INSTALL NO. 2 TIMING CHAIN OR BELT COVER (See INSTALLATION)**
18. **INSTALL OIL COOLER PIPE (See INSTALLATION)**
19. **INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY (See INSTALLATION)**
20. **INSTALL COMPRESSOR (See INSTALLATION)**
21. **INSTALL GENERATOR ASSEMBLY (See INSTALLATION)**
22. **INSTALL VANE PUMP ASSEMBLY (See INSTALLATION)**
23. **INSTALL FAN WITH FLUID COUPLING (See INSTALLATION)**
24. **INSTALL FAN AND GENERATOR V BELT (See INSPECTION)**
25. **INSTALL RADIATOR SUPPORT SEAL UPPER**
26. **INSTALL AIR CLEANER HOSE ASSEMBLY**
27. **INSTALL THROTTLE BODY COVER SUB-ASSEMBLY (See INSTALLATION)**
28. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
29. **ADD ENGINE COOLANT (See REPLACEMENT)**
30. **CHECK FOR ENGINE COOLANT LEAKS (See REPLACEMENT)**



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

● Non-reusable part

P

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Fig. 155: Exploded View Of Cylinder Head Replacement Components With Torque Specifications (2 Of 4)

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

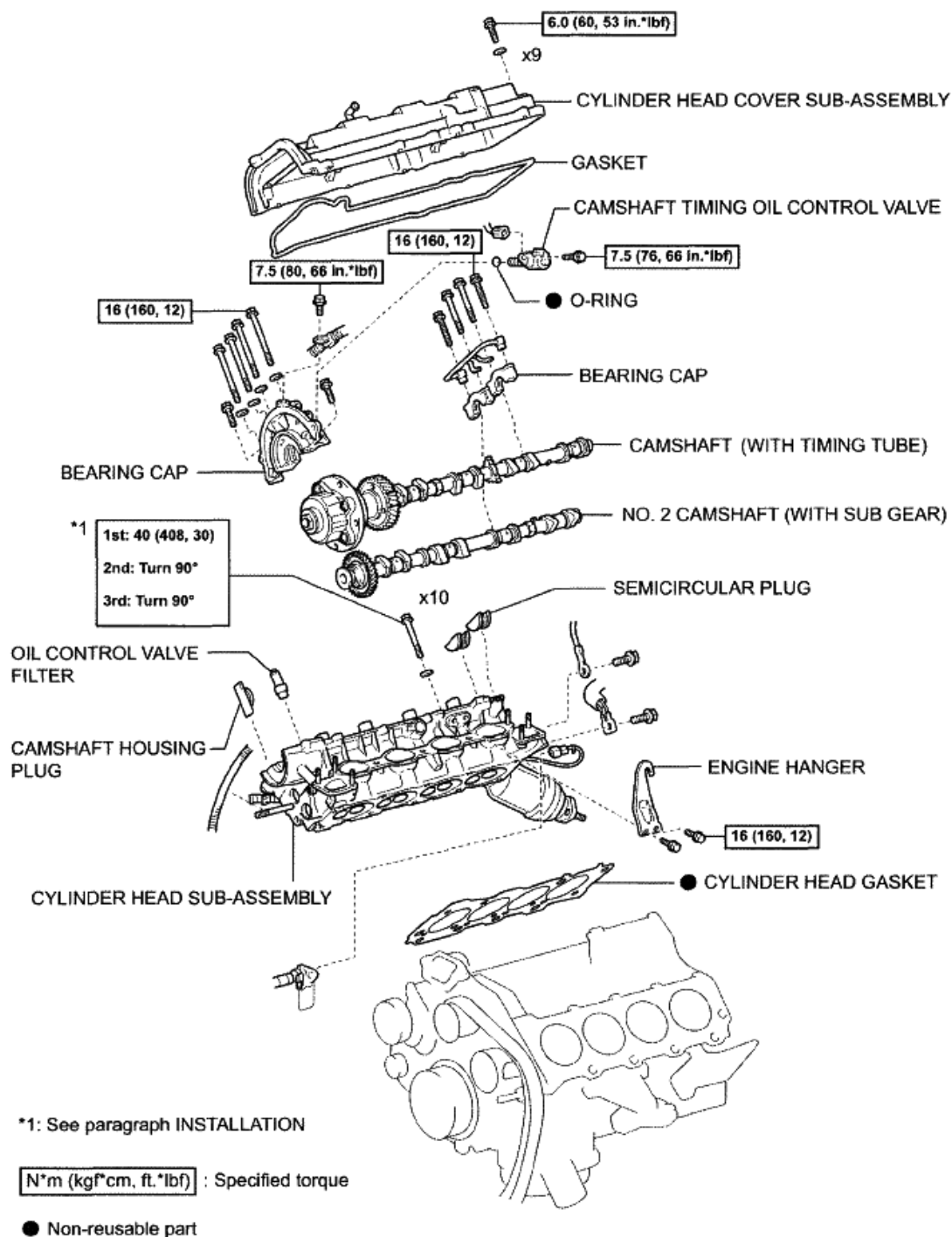


Fig. 156: Exploded View Of Cylinder Head Replacement Components With Torque Specifications (3 Of 4)

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

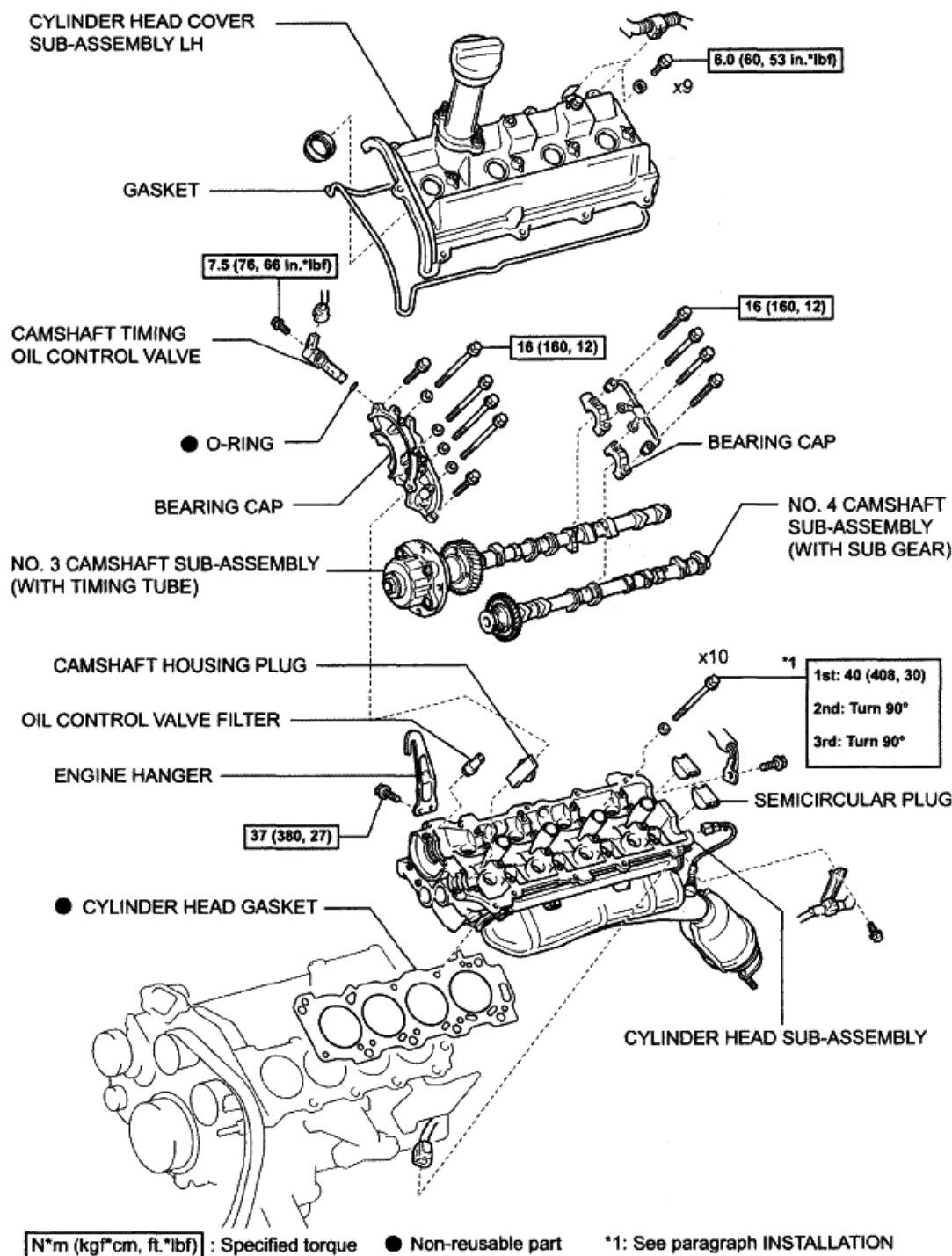


Fig. 157: Exploded View Of Cylinder Head Replacement Components With Torque Specifications (4 Of 4)

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

REMOVAL

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See **REMOVAL**)
2. **REMOVE TIMING BELT**

HINT:

(See **REMOVAL**)

3. **REMOVE CAMSHAFT (for RH Side)** (See **REMOVAL**)
4. **REMOVE CAMSHAFT (for LH Side)**

SST 09960-10010 (09962-01000, 09963-00500)

5. **REMOVE TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY**
 - a. Remove the bolt and transmission oil filler tube.
6. **REMOVE OIL LEVEL GAGE GUIDE**
 - a. Remove the bolt and oil level gauge guide.
7. **REMOVE INTAKE MANIFOLD ASSEMBLY** (See **REMOVAL**)
8. **REMOVE WATER INLET HOUSING**
 - a. Remove the 2 bolts.
 - b. Remove the water inlet housing and O-ring from the engine.
9. **REMOVE WATER BY-PASS JOINT FR**
 - a. Remove the 4 nuts.
 - b. Remove the water by-pass joint and 2 gaskets.
10. **REMOVE WATER BY-PASS PIPE SUB-ASSEMBLY**
 - a. Remove the bolt and water by-pass pipe.
11. **REMOVE NO. 2 AIR SWITCHING VALVE** (See **REMOVAL**)
12. **REMOVE WATER BY-PASS JOINT RR**
 - a. Remove the 4 nuts, water by-pass joint and 2 gaskets.
13. **REMOVE ENGINE WIRE**
14. **REMOVE NO. 2 REAR TIMING BELT PLATE RH**
 - a. Remove the 2 bolts and No. 2 rear timing belt plate RH.
15. **REMOVE REAR TIMING BELT PLATE RH**
 - a. Remove the bolt, stud bolt and rear timing plate RH.
16. **REMOVE NO. 2 REAR TIMING BELT PLATE LH**
 - a. Remove the 2 bolts and No. 2 rear timing belt plate LH.
17. **REMOVE REAR TIMING BELT PLATE LH**
 - a. Remove the bolt and rear timing belt plate LH.
18. **REMOVE FRONT EXHAUST PIPE**
 - a. Remove the 2 bolts and separate the front exhaust pipe.
19. **REMOVE CYLINDER HEAD SUB-ASSEMBLY**

- a. Uniformly loosen the 10 cylinder head bolts in the order shown in the illustration. Remove the bolts and plate washers.

NOTE:

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

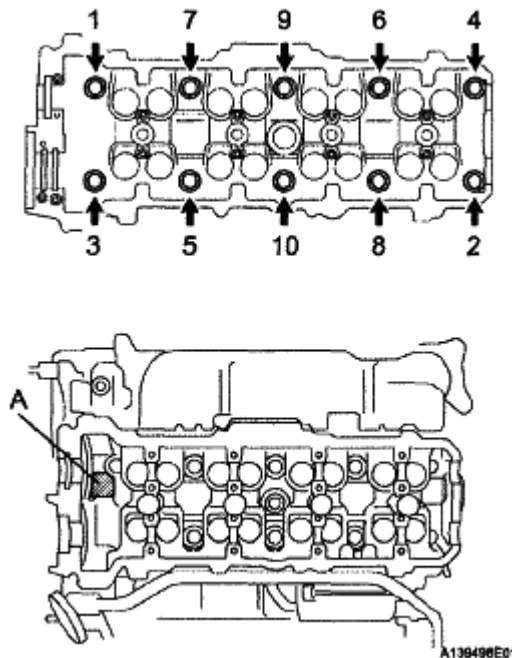


Fig. 158: Identifying Cylinder Head Sub-Assembly Bolts Loosening Sequence (RH)

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

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

HINT:

If the cylinder head is lifted off, pry off between the cylinder head and cylinder block with a screwdriver.

NOTE:

- Be careful not to damage the contact surfaces of the cylinder head and cylinder block.
- The cylinder head should not be tilted so as to secure the valve lifter. If the cylinder head is tilted, remove the valve lifter and

check that the adjusting shim is set correctly.

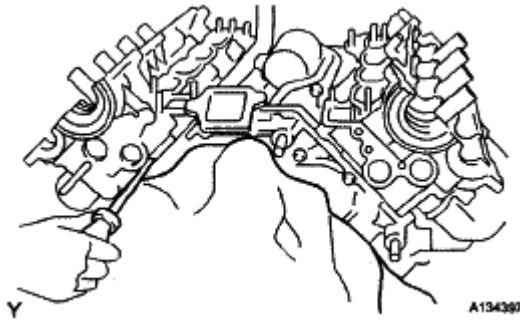


Fig. 159: Identifying Cylinder Head From Dowels On Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. REMOVE CYLINDER HEAD SUB-ASSEMBLY LH

- Uniformly loosen the 10 cylinder head bolts in the order shown in the illustration. Remove the bolts and plate washers.

HINT:

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

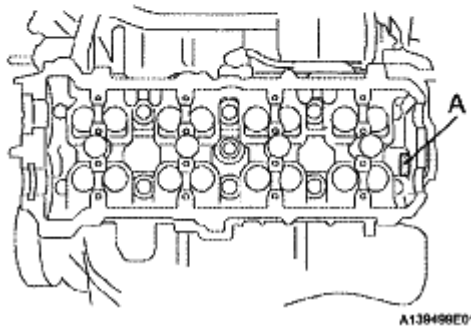
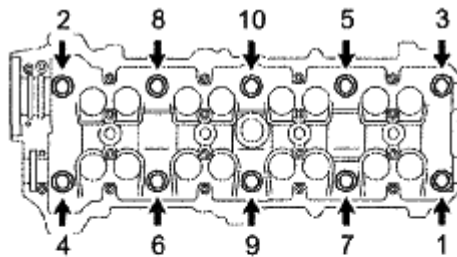


Fig. 160: Identifying Cylinder Head Sub-Assembly Bolts In Sequence (LH)

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

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

HINT:

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

NOTE:

- Be careful not to damage the contact surfaces of the cylinder head and cylinder block.
- The cylinder head should not be tilted so as to secure the valve lifter. If the cylinder head is tilted, remove the valve lifter and check that the adjusting shim is set correctly.

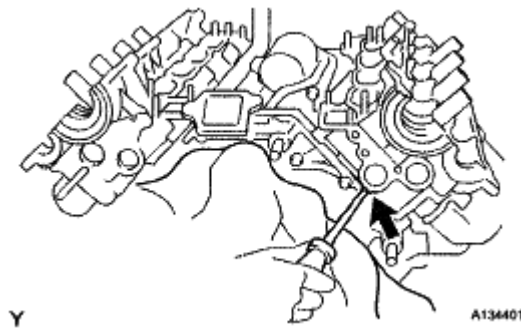


Fig. 161: Identifying Cylinder Head And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. REMOVE CYLINDER HEAD GASKET

22. REMOVE NO. 2 CYLINDER HEAD GASKET

INSPECTION

1. CLEAN CYLINDER BLOCK SUB-ASSEMBLY

- a. Turn the crankshaft, and bring each piston to the top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston top surface.

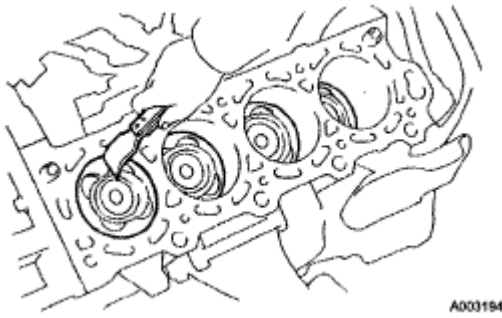


Fig. 162: Using Gasket Scraper To Remove Carbon From Piston Top Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a gasket scraper, remove all the gasket material from the cylinder block surface.

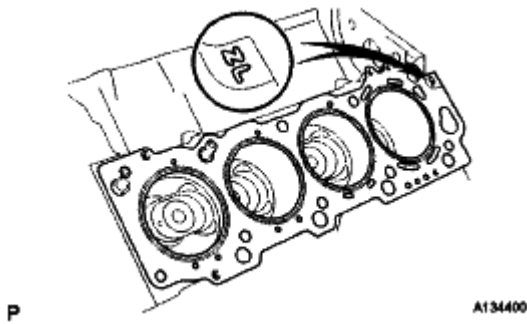


Fig. 163: Identifying Material On Cylinder Block Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using compressed air, blow carbon and oil from the bolt holes.

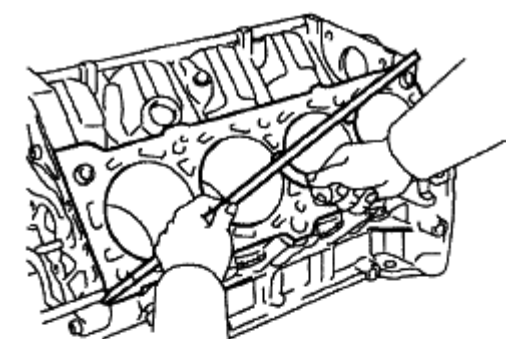
CAUTION: Protect your eyes when using compressed air.

2. CHECK CYLINDER BLOCK FOR WARPAGE

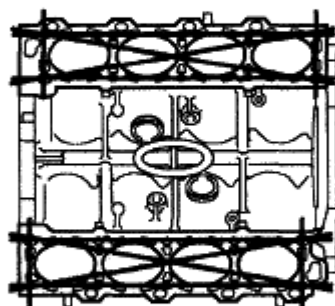
- a. Inspect for warpage.
 1. Using a precision straight edge and feeler gauge, measure the warpage of the contact surfaces of the cylinder head and crankshaft bearing cap.

Maximum warpage: 0.07 mm (0.0028 in.)

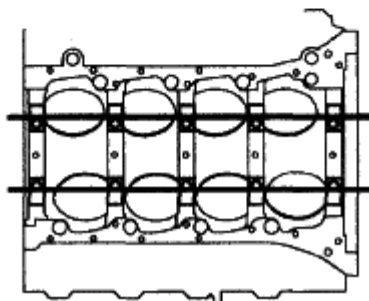
If warpage is greater than the maximum, replace the cylinder block sub-assembly.



Cylinder Head Side



Crankshaft Bearing Cap Side

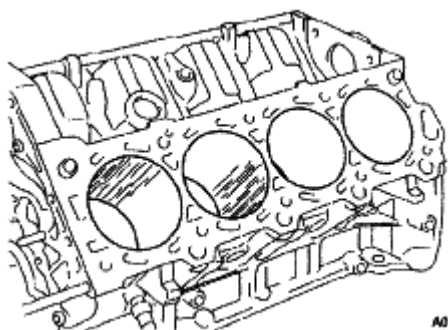


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Fig. 164: Checking Cylinder Block For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Visually check the cylinder for vertical scratches. If deep scratches are present, rebore all the 8 cylinders and replace all the 8 pistons. If necessary, replace the cylinder block.



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Fig. 165: Identifying Cylinder Block

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

3. CLEAN CYLINDER HEAD SUB-ASSEMBLY

a. Clean the cylinder head.

1. Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

NOTE: Be careful not to scratch the cylinder block contact surface.

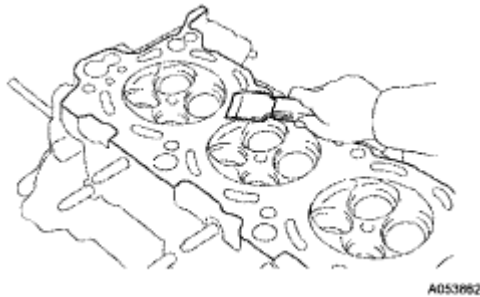


Fig. 166: Using Gasket Scraper To Remove Gasket Material From Cylinder Block Contact Surface

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

2. Using a wire brush, remove all the carbon from the combustion chambers.

NOTE: Be careful not to scratch the cylinder block contact surface.

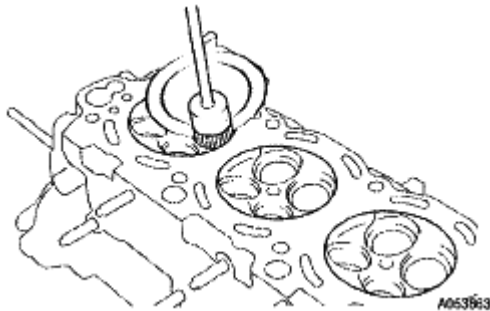


Fig. 167: Using Wire Brush To Remove Carbon From Combustion Chambers

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

3. Using a valve guide bushing brush and solvent, clean all the guide bushes.

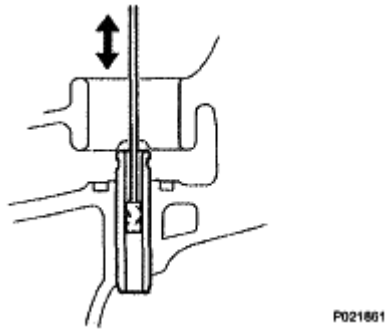


Fig. 168: Identifying Guide Bushes
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Using a soft brush and solvent, thoroughly clean the cylinder head.

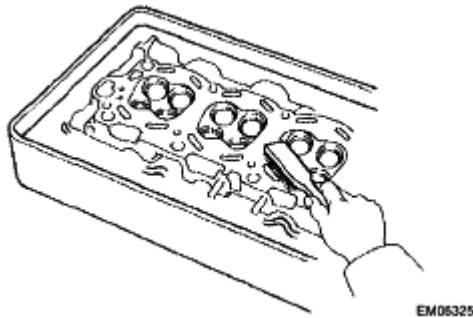


Fig. 169: Cleaning Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. CHECK CYLINDER HEAD FOR WARPAGE

- a. Inspect for warpage.
 1. Using a precision straight edge and feeler gauge, measure the warpage of the contact surfaces of the cylinder block and the manifolds.

Maximum warpage: 0.10 mm (0.0039 in.)

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

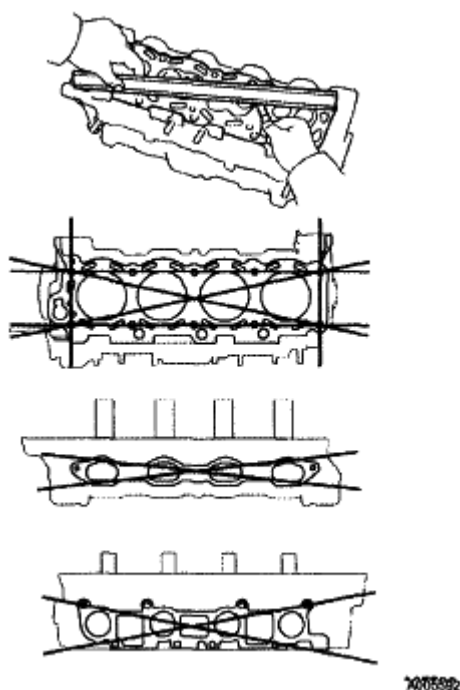


Fig. 170: Identifying Cylinder Head For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect for cracks.
 - 1. Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

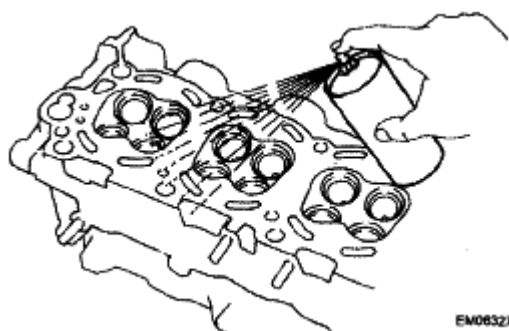


Fig. 171: Identifying Cylinder Block Surface For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter: 9.810 to 9.960 mm (0.3862 to 0.3921 in.)

Minimum outside diameter: 9.700 mm (0.3819 in.)

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

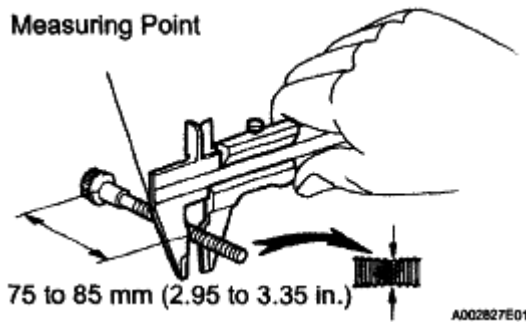


Fig. 172: Identifying Thread Outside Diameter Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL NO. 2 CYLINDER HEAD GASKET

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

HINT:

A mark is placed on the rear side of the cylinder head gasket to distinguish the LH and RH banks, a "2R" mark for the RH bank and a "2L" mark for the LH bank.

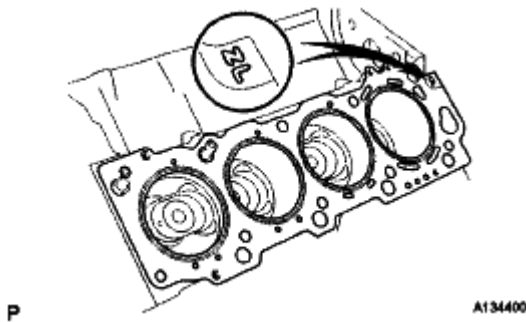


Fig. 173: Identifying Material On Cylinder Block Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful of the installation direction.

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

2. INSTALL CYLINDER HEAD GASKET

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

HINT:

A mark is placed on the rear side of the cylinder head gasket to distinguish the LH and RH banks, a "2R" mark for the RH bank and a "2L" mark for the LH bank.

NOTE: Be careful of the installation direction.

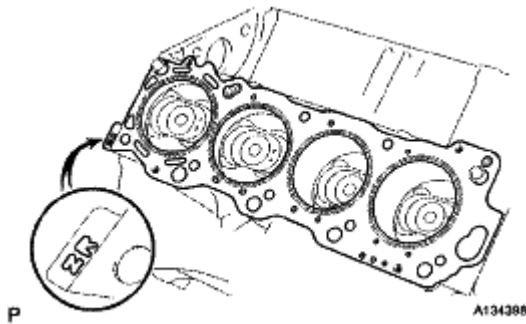


Fig. 174: Identifying Cylinder Head Gasket In Cylinder Block
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Place the cylinder head in position on the cylinder head gasket.

3. INSTALL CYLINDER HEAD SUB-ASSEMBLY LH

- a. Check that the timing mark of the crankshaft timing pulley is in the position shown in the illustration, and that the piston is below the TDC of compression.
- b. Install the cylinder head with the exhaust manifold to the cylinder block.

HINT:

- The cylinder head bolts are tightened in 2 progressive steps.
- If any cylinder head bolt is broken or deformed, replace it.

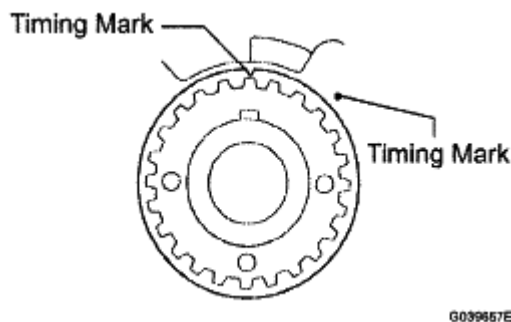


Fig. 175: Identifying Timing Mark Of Crankshaft Timing Pulley
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- d. Install the plate washer to the cylinder head bolt.
- e. Install and uniformly tighten the 10 cylinder head bolts, and plate washers, in the order shown in the illustration.

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

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

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

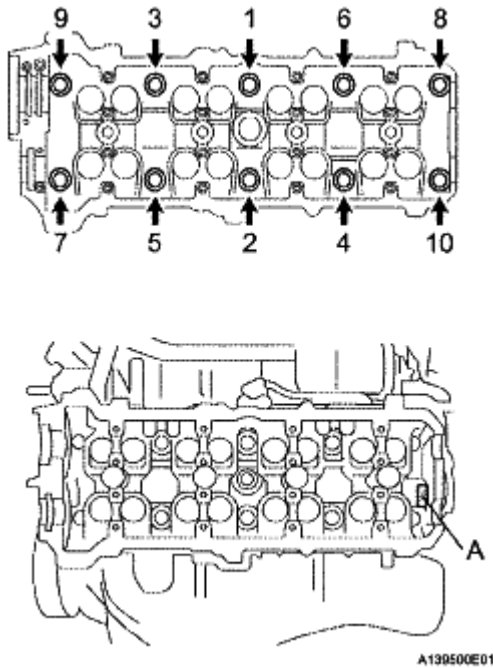


Fig. 176: Identifying Cylinder Head Bolt Tightening Sequence (LH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Mark the front of the cylinder head bolt head with paint.
- g. Retighten the cylinder head bolts by 90° in the order shown.

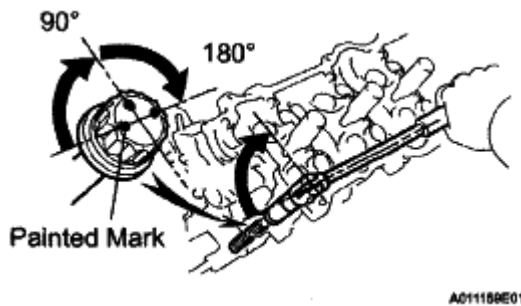


Fig. 177: Retightening Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Retighten the cylinder head bolts by an additional 90°.
- i. Check that the painted mark is now at a 180° angle to front.

4. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- a. Check that the timing mark of the crankshaft timing pulley is in the position shown in the illustration, and that the piston is below the TDC of compression.

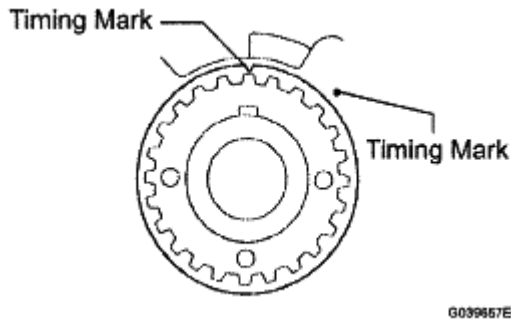


Fig. 178: Identifying Timing Mark Of Crankshaft Timing Pulley
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cylinder head with the exhaust manifold to the cylinder block.

HINT:

- The cylinder head bolts are tightened in 2 progressive steps.
- If any cylinder head bolt is broken or deformed, replace it.
- c. Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.
- d. Install the plate washer to the cylinder head bolt.
- e. Install and uniformly tighten the 10 cylinder head bolts, and plate washers, in the order shown in the illustration.

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

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

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

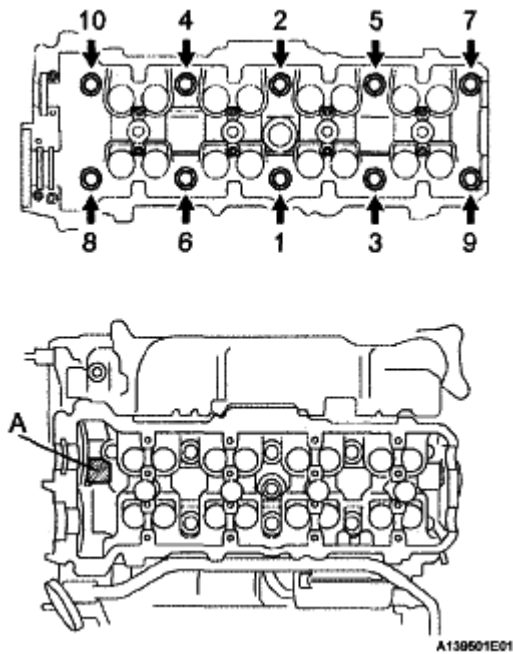


Fig. 179: Identifying Cylinder Head Bolts Tightening Sequence (RH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Mark the front of the cylinder head bolt head with paint.
- g. Retighten the cylinder head bolts by 90° in the order shown.

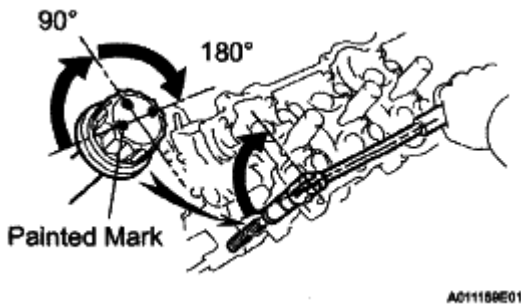


Fig. 180: Tightening Cylinder Head Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Retighten the cylinder head bolts by an additional 90° .
 - i. Check that the painted mark is now at a 180° angle to front.
- 5. INSTALL FRONT EXHAUST PIPE**
- a. Place a new gasket to the front exhaust pipe.
 - b. Install the 2 nuts and front exhaust pipe.

Torque: 62 N*m (632 kgf*cm, 46 ft.*lbf)

6. INSTALL REAR TIMING BELT PLATE LH

- a. Install the bolt and rear timing belt plate LH.

Torque: 7.5 N*m (80 kgf*cm, 66 ft.*lbf)

7. INSTALL NO. 2 REAR TIMING BELT PLATE LH

- a. Install the 2 bolts and No. 2 rear timing belt plate LH.

Torque: 7.5 N*m (80 kgf*cm, 66 ft.*lbf)

8. INSTALL REAR TIMING BELT PLATE RH

- a. Install the timing belt plate with the bolt and stud bolt.

Torque: 7.5 N*m (80 kgf*cm, 66 ft.*lbf)

9. INSTALL NO. 2 REAR TIMING BELT PLATE RH

- a. Install the timing belt plate with the 2 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 ft.*lbf)

10. INSTALL WATER BY-PASS JOINT RR (See INSTALLATION)

11. INSTALL NO. 2 AIR SWITCHING VALVE (See INSTALLATION)

12. INSTALL WATER BY-PASS JOINT FR (See INSTALLATION)

13. INSTALL WATER INLET HOUSING (See INSTALLATION)

14. INSTALL WATER BY-PASS PIPE SUB-ASSEMBLY

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

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

15. INSTALL INTAKE MANIFOLD ASSEMBLY (See INSTALLATION)

16. INSTALL OIL LEVEL GAGE GUIDE

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

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

17. INSTALL TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY

- a. Install the transmission oil filler tube sub-assembly with the bolt.

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

18. **INSTALL CAMSHAFT (for LH Side) (See INSTALLATION)**
19. **INSTALL CAMSHAFT (for RH Side) (See INSTALLATION)**
20. **INSTALL TIMING BELT**

HINT:

(See INSTALLATION)

ENGINE FRONT OIL SEAL

COMPONENTS

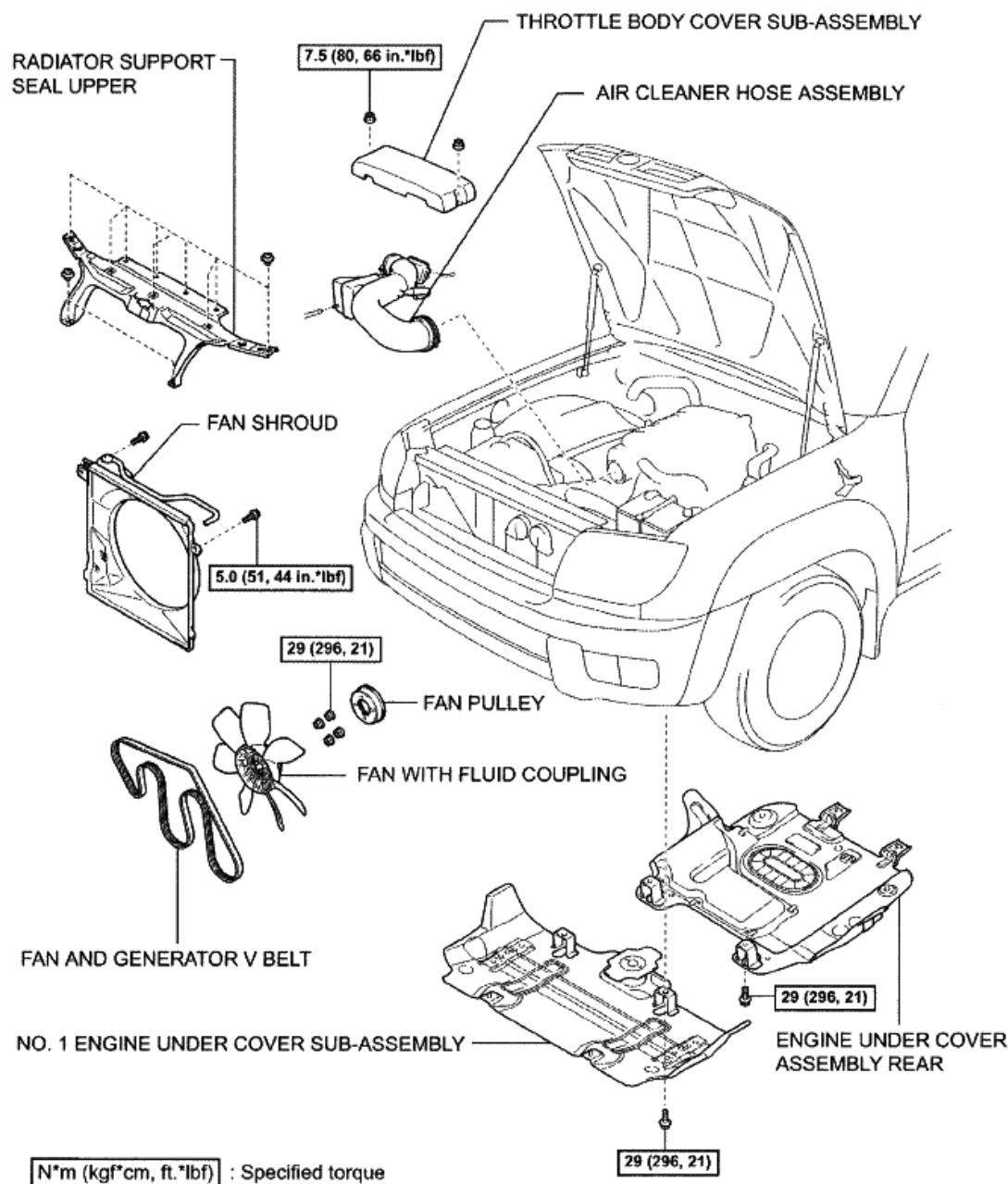
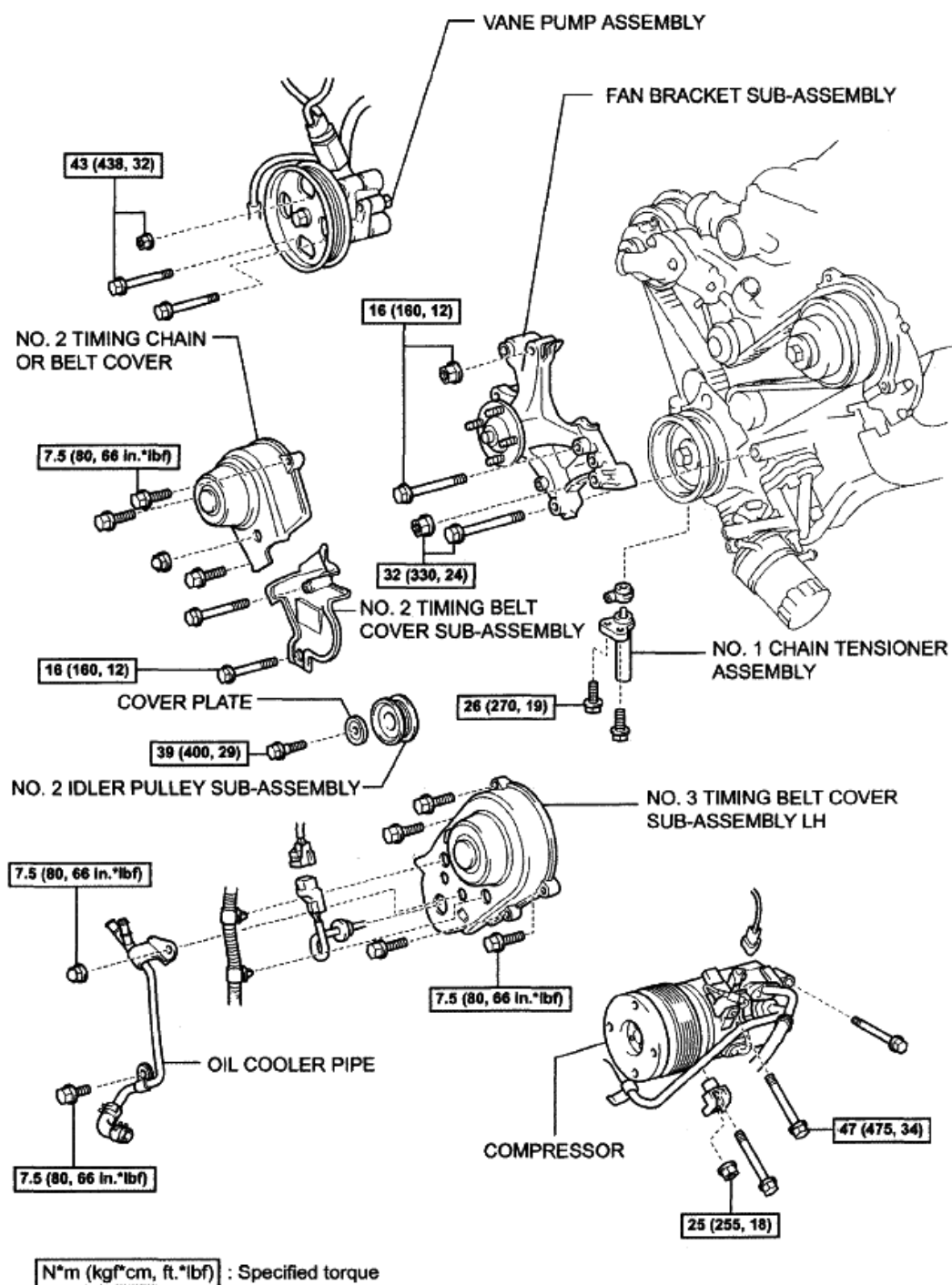


Fig. 181: Exploded View Of Front Engine Oil Seal Replacement Components With Torque Specifications (1 Of 4)

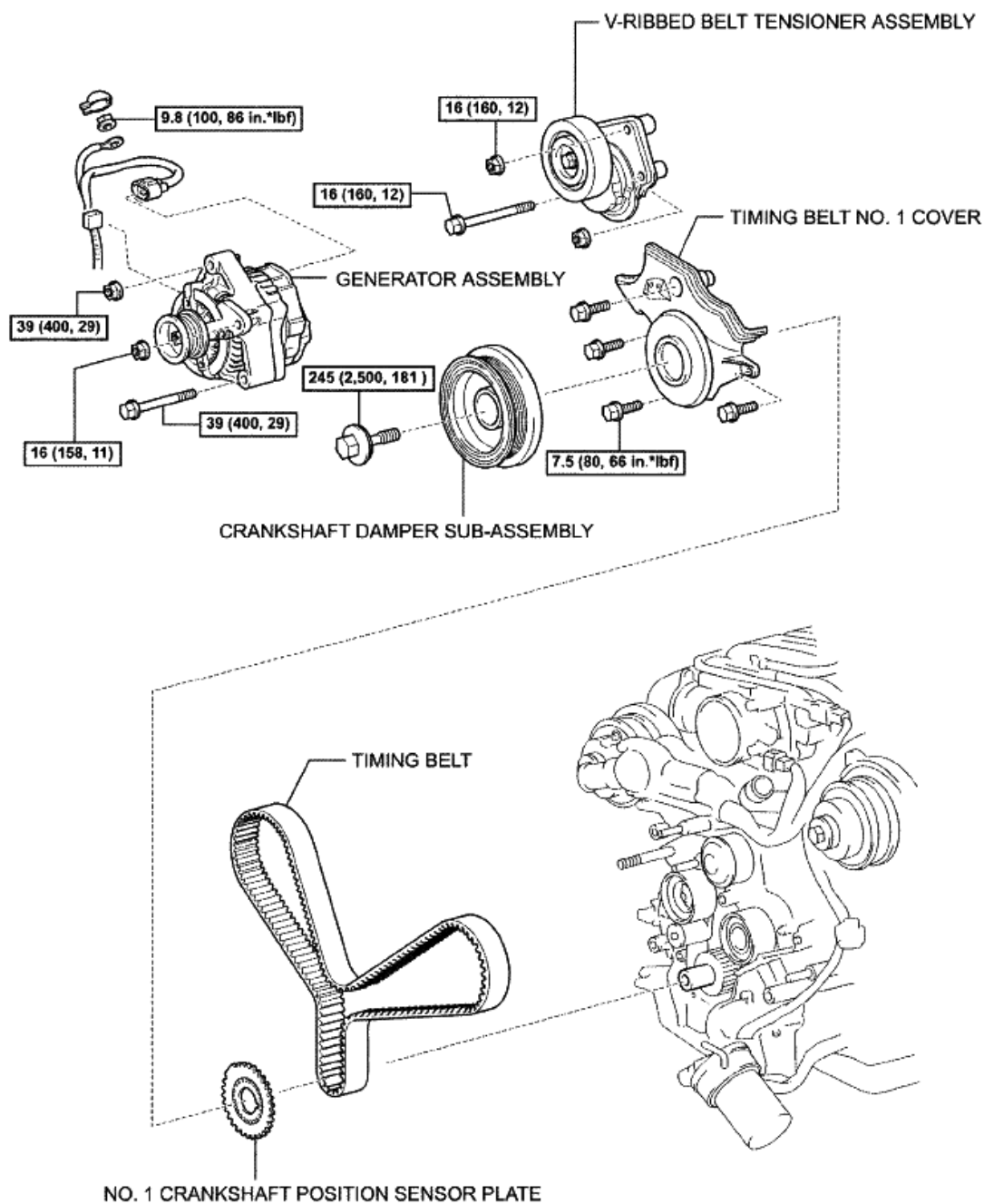
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119829E03

Fig. 182: Exploded View Of Front Engine Oil Seal Replacement Components With Torque Specifications (2 Of 4)

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



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

A119830E02

Fig. 183: Exploded View Of Front Engine Oil Seal Replacement Components With Torque Specifications (3 Of 4)

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

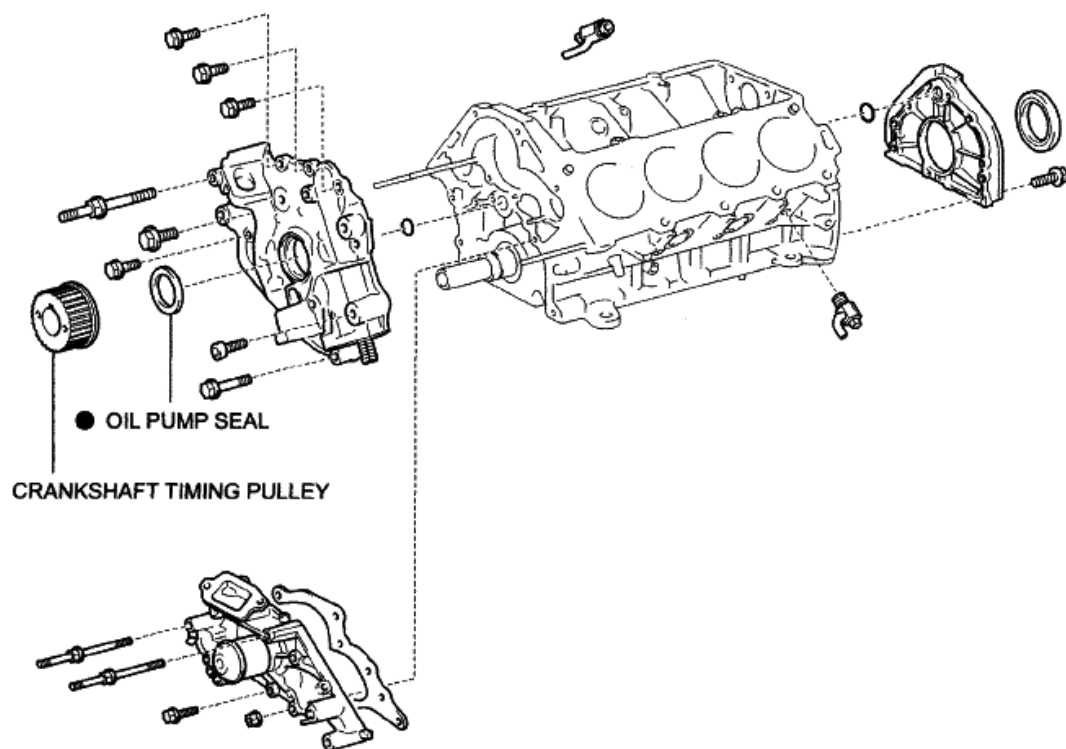


Fig. 184: Exploded View Of Front Engine Oil Seal Replacement Components (4 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE TIMING BELT

HINT:

(See **REMOVAL**)

2. REMOVE CRANKSHAFT TIMING PULLEY

- Using SST, remove the timing pulley.

SST 09950-50013 (09951 -05010, 09952-05010, 09953-05010, 09953-05020, 09954-05011)

NOTE: Do not turn the timing pulley.

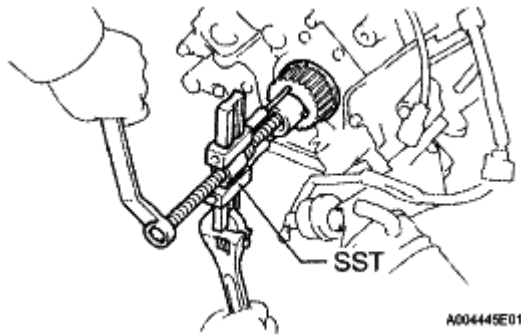


Fig. 185: Identifying Crankshaft Timing Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. REMOVE OIL PUMP SEAL

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

NOTE: Be careful not to damage the crankshaft.

HINT:

Tape the screwdriver tip before use.

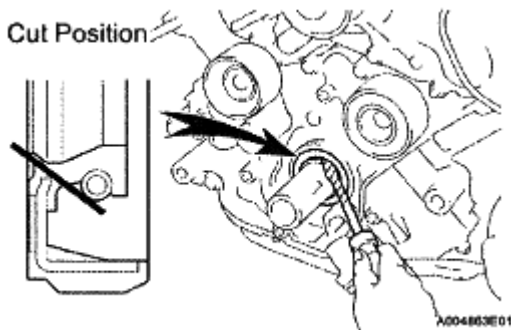


Fig. 186: Identifying Oil Pump Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL OIL PUMP SEAL

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

SST 09316-60011 (09316-00011)

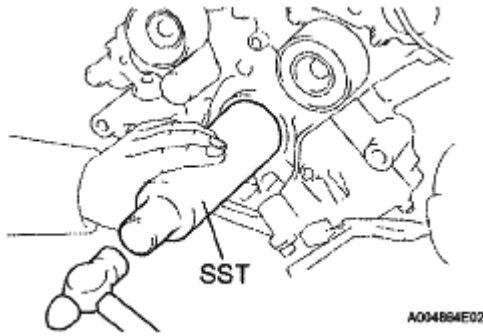


Fig. 187: Identifying Oil Pump Seal

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

2. INSTALL CRANKSHAFT TIMING PULLEY

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

SST 09223-46011

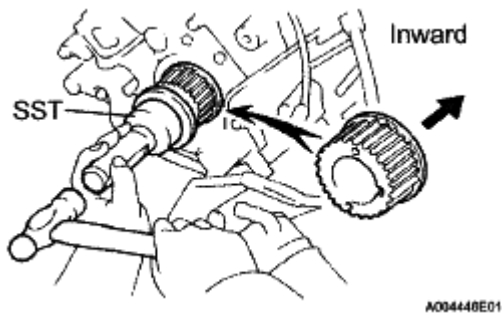


Fig. 188: Identifying Tapping Timing Pulley With Flange Side Facing

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

3. INSTALL TIMING BELT

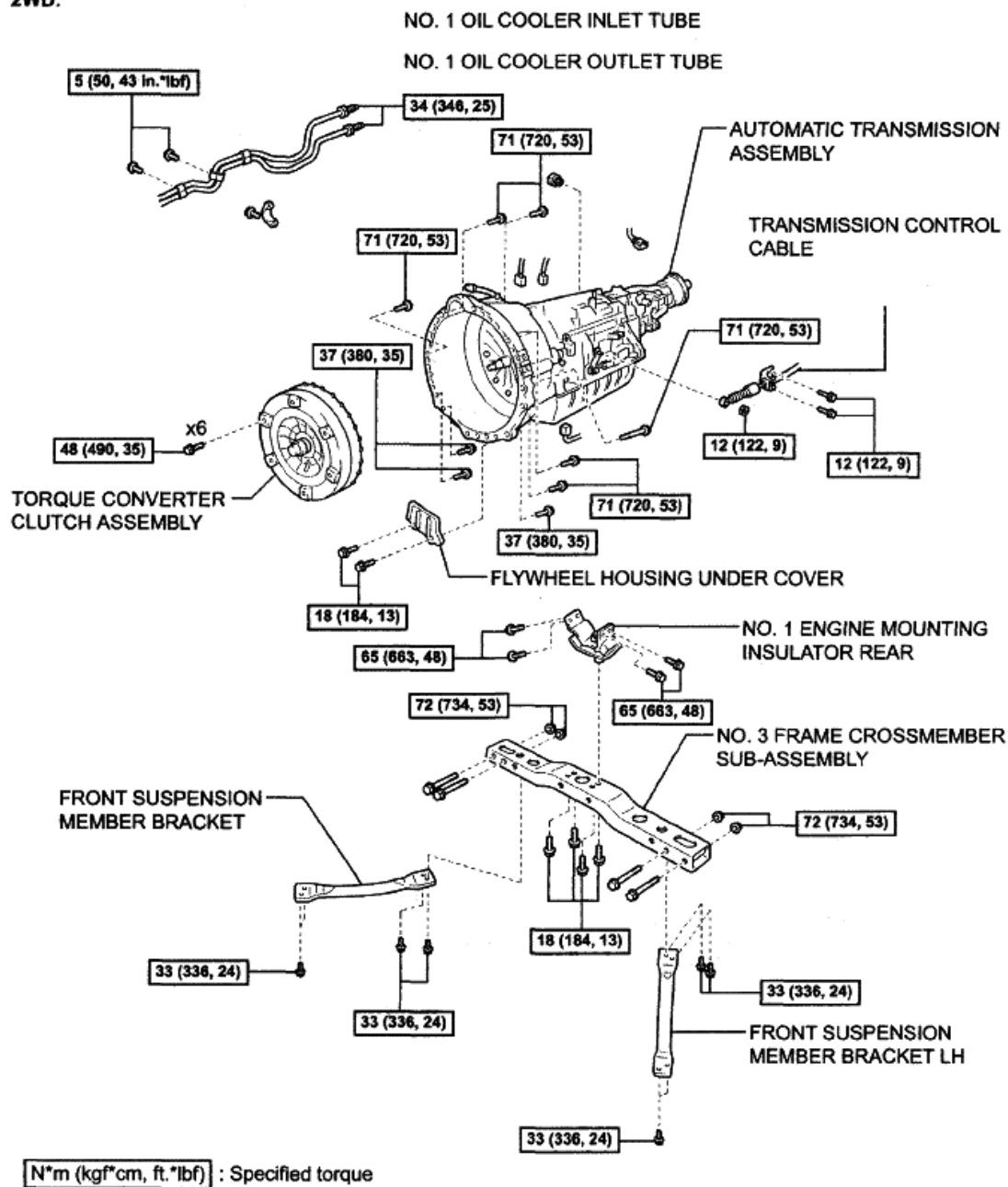
HINT:

(See INSTALLATION)

ENGINE REAR OIL SEAL

COMPONENTS

2WD:

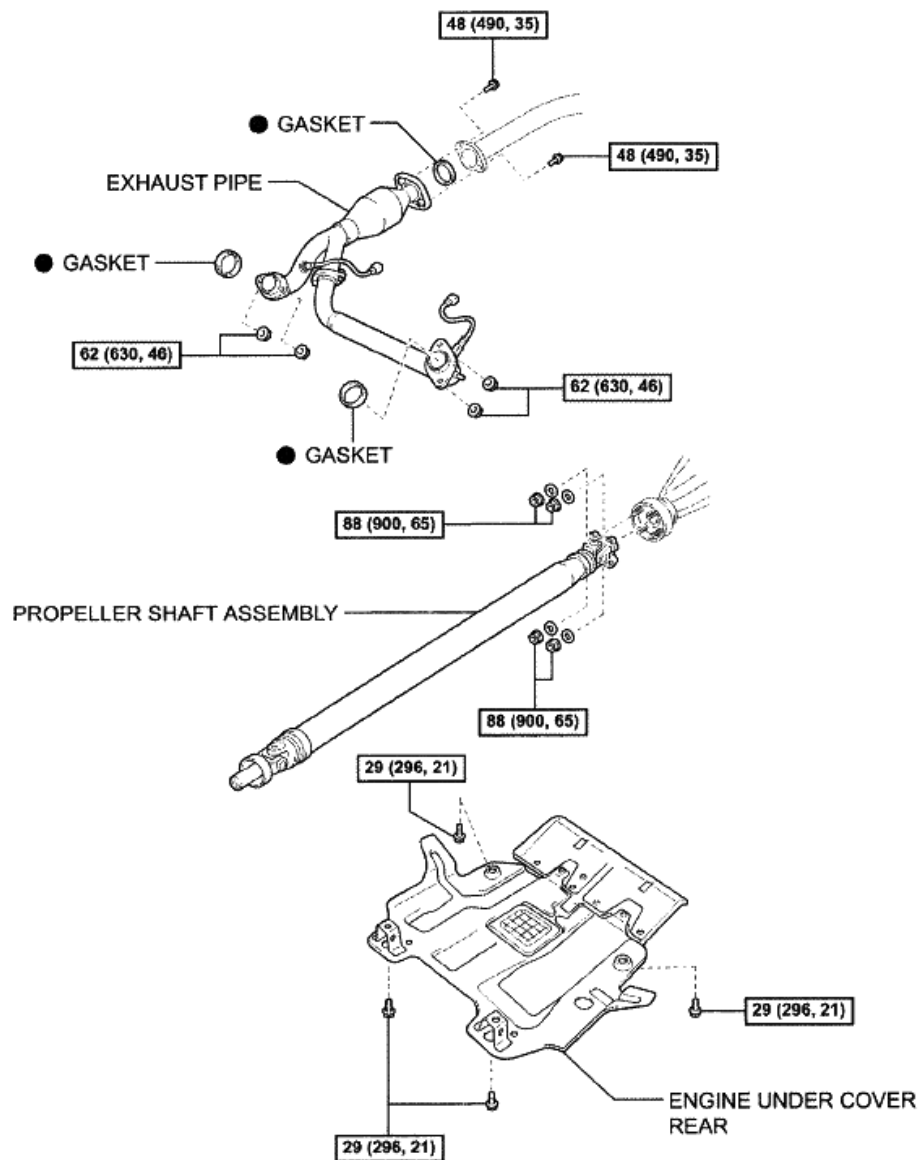


P

C119722E04

Fig. 189: Exploded View Of Engine Rear Oil Seal Replacement Components With Torque Specifications (1 Of 6)

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



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

● Non-reusable part

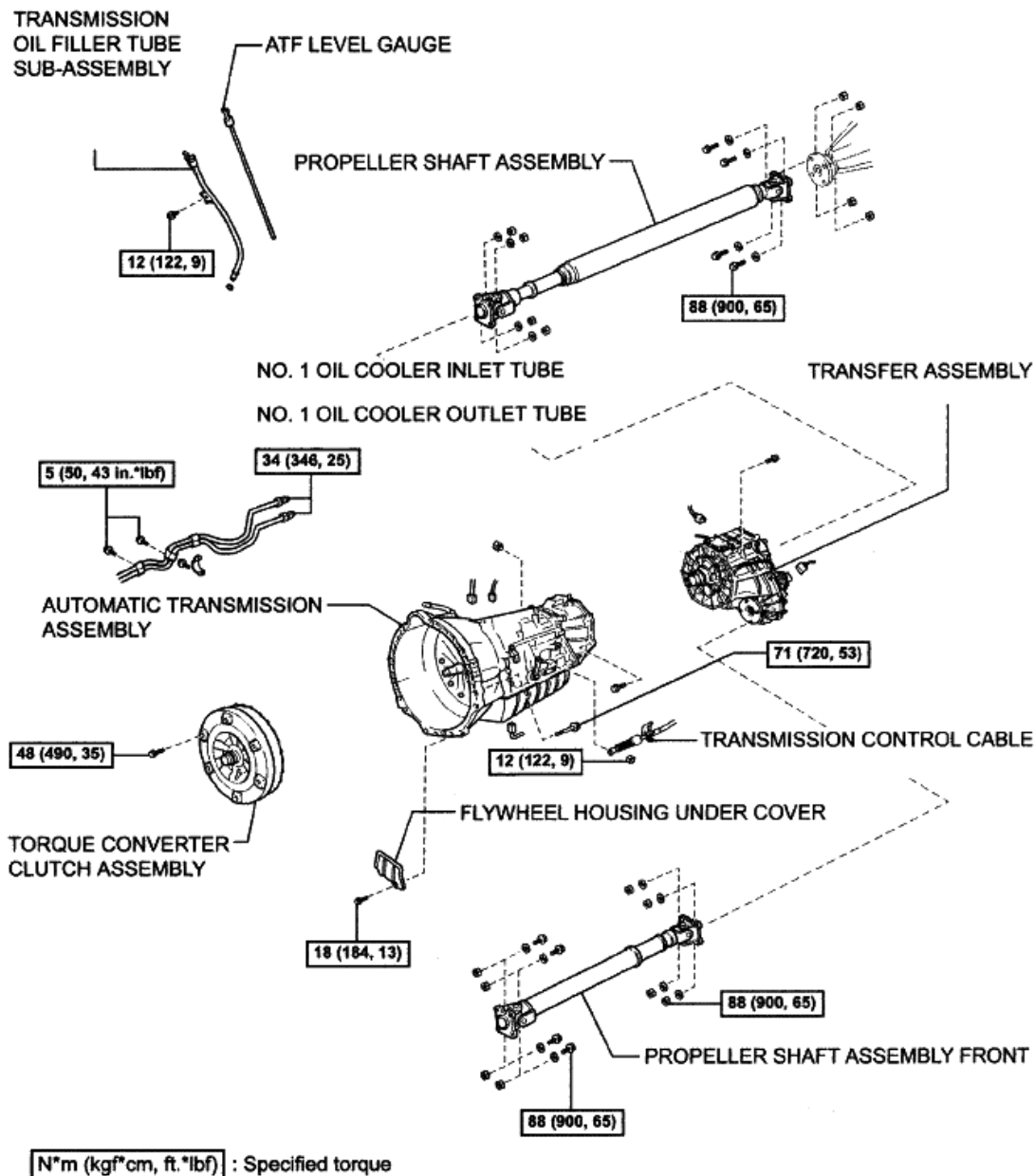
P

C119723E02

Fig. 190: Exploded View Of Engine Rear Oil Seal Replacement Components With Torque Specifications (2 Of 6)

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

4WD:

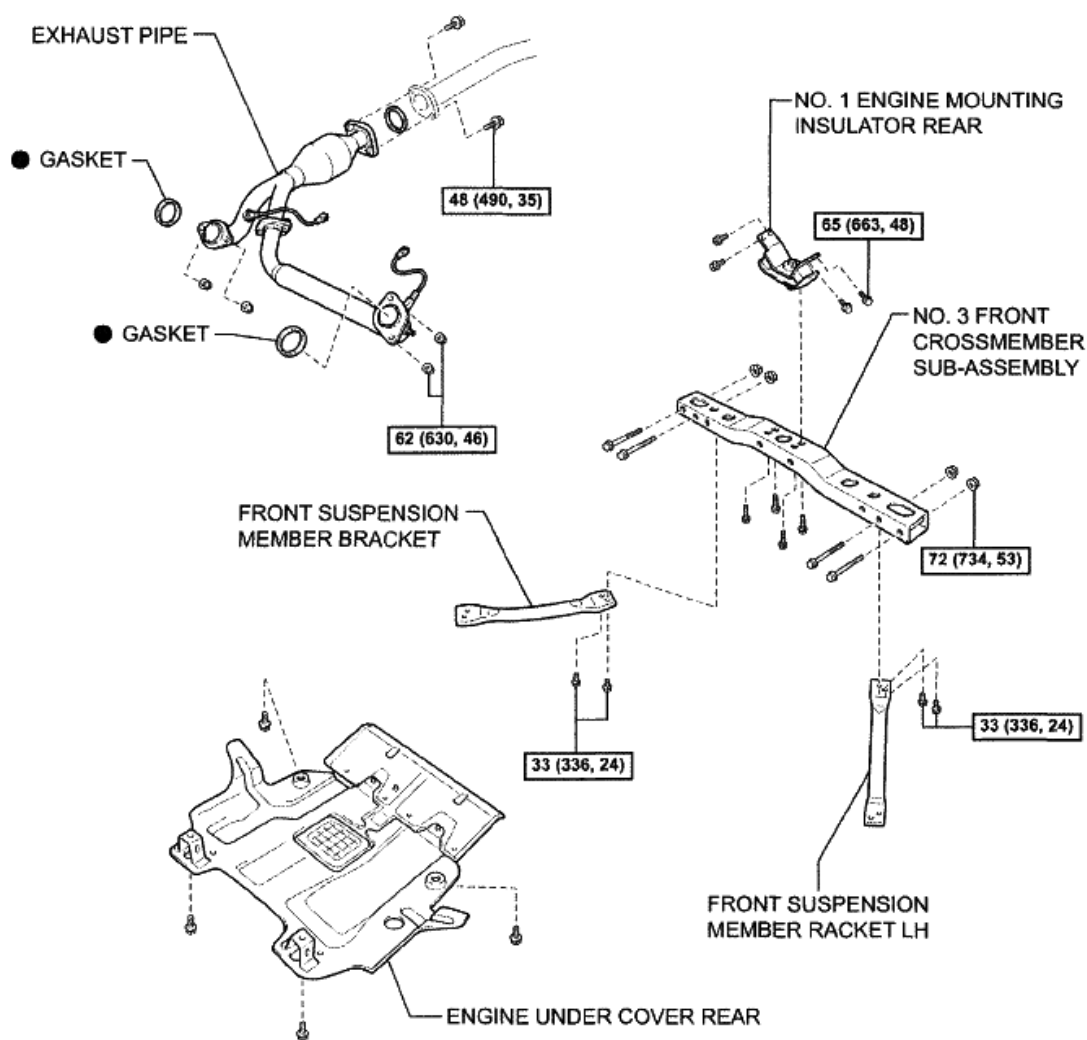


N

C119729E04

Fig. 191: Exploded View Of Engine Rear Oil Seal Replacement Components With Torque Specifications (3 Of 6)

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



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

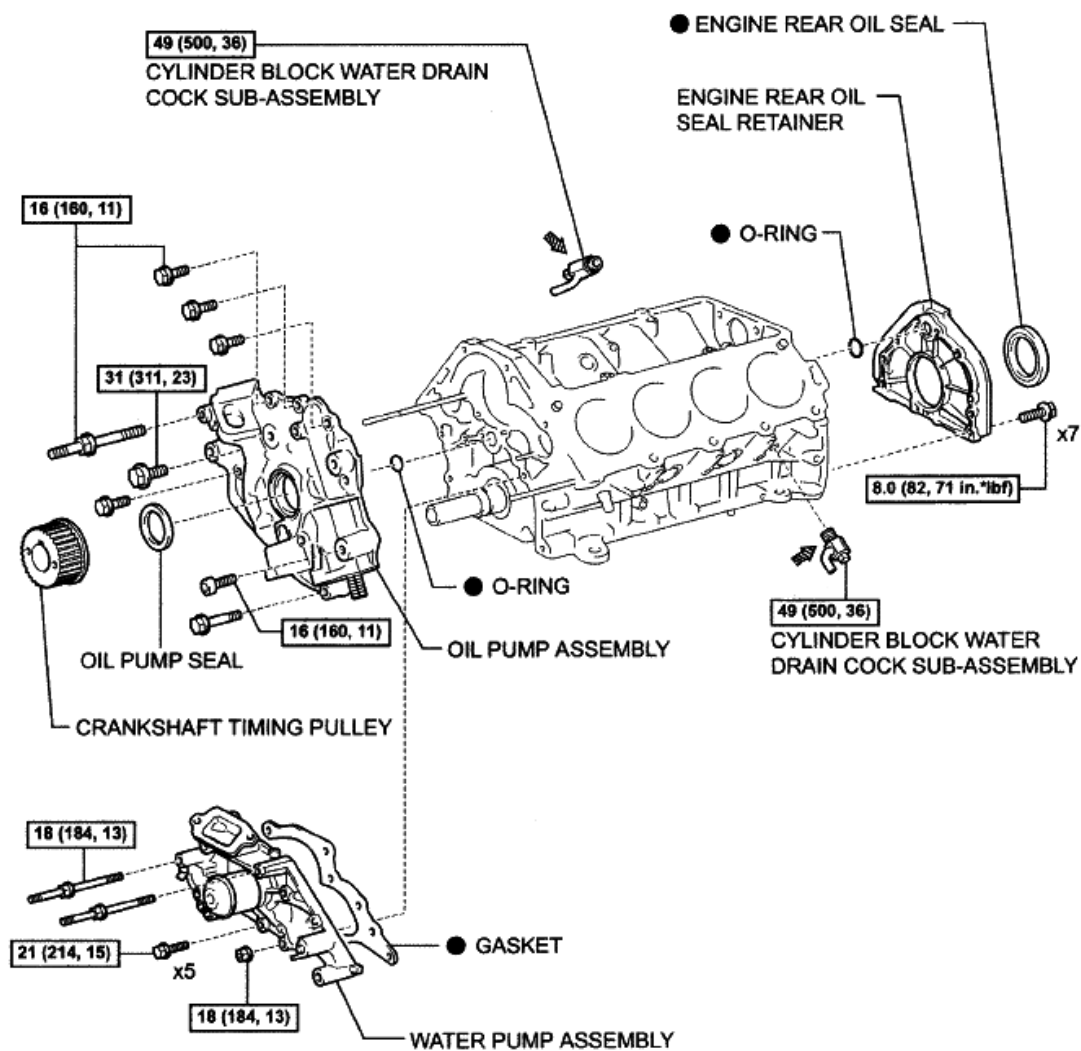
● Non-reusable part

N

C119/30E03

Fig. 192: Exploded View Of Engine Rear Oil Seal Replacement Components With Torque Specifications (4 Of 6)

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



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

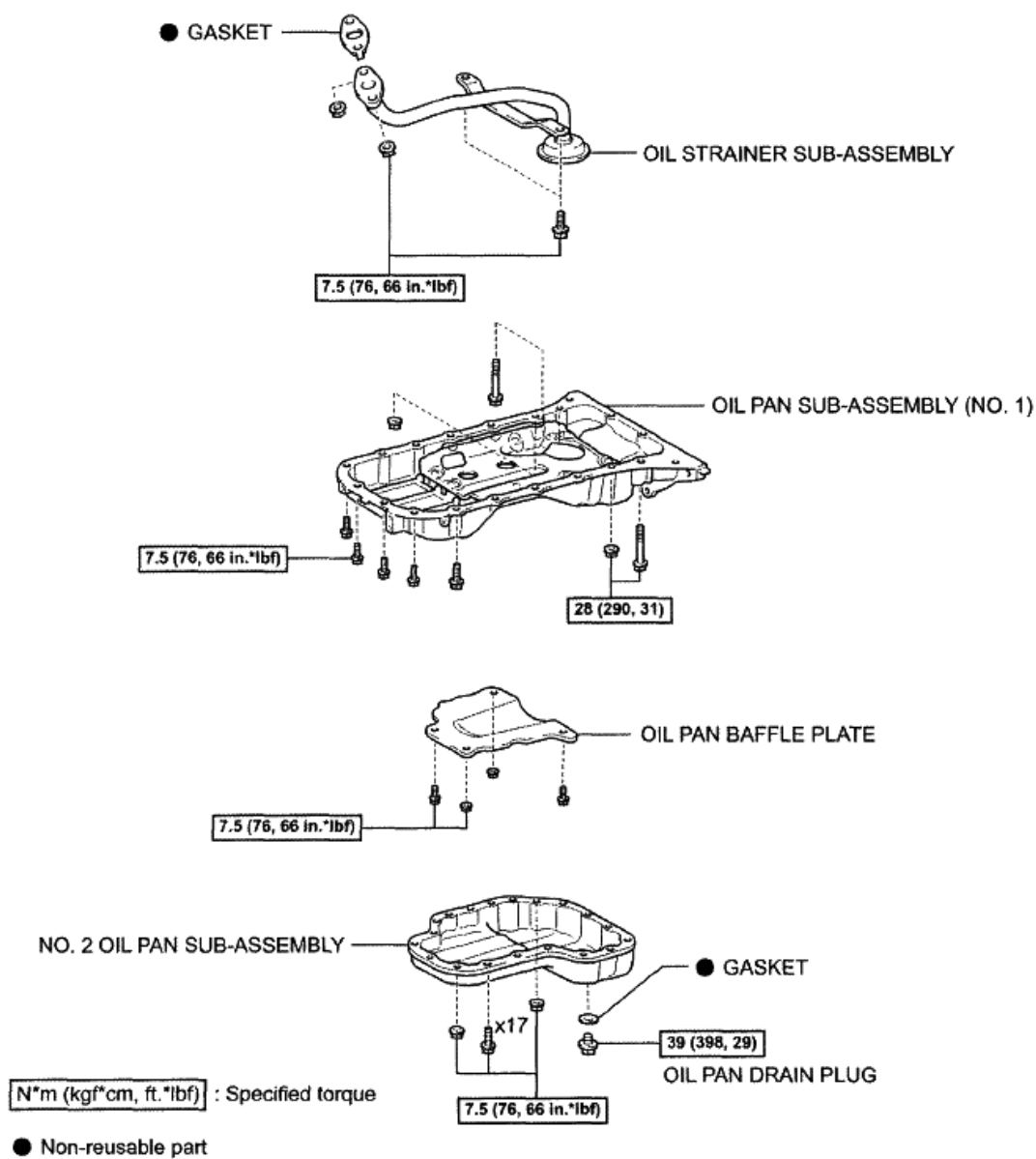
● Non-reusable part ➡ Precoated part

Y

A119825E04

Fig. 193: Exploded View Of Engine Rear Oil Seal Replacement Components With Torque Specifications (5 Of 6)

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



A119930E03

Fig. 194: Exploded View Of Engine Rear Oil Seal Replacement Components With Torque Specifications (6 Of 6)

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

REMOVAL

1. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY (for 2WD)

HINT:

(See **REMOVAL**)

2. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY (for 4WD)

HINT:

(See **REMOVAL**)

3. REMOVE DRIVE PLATE & RING GEAR SUB-ASSEMBLY

- a. Using SST, hold the crankshaft.

SST 09213-70011, 09330-00021

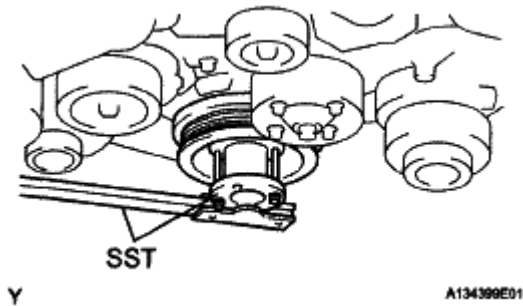


Fig. 195: Identifying Crankshaft Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 8 bolts, front spacer, drive plate and rear spacer.



Fig. 196: Identifying Front Spacer, Drive Plate And Rear Spacer Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE ENGINE REAR OIL SEAL

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

NOTE: Be careful not to damage the crankshaft.

HINT:

Tape the screwdriver tip before use.

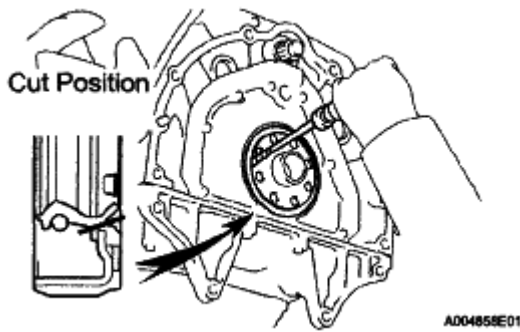


Fig. 197: Identifying Engine Rear Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL ENGINE REAR OIL SEAL

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

SST 09223-56010

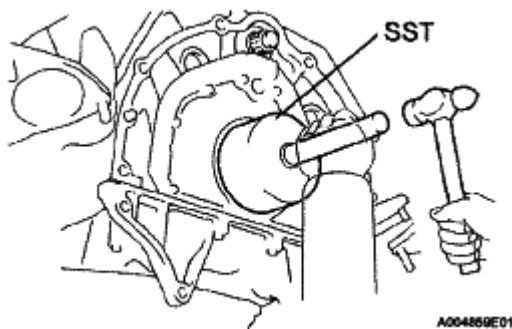


Fig. 198: Tapping In Engine Rear Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL DRIVE PLATE & RING GEAR SUB-ASSEMBLY

- a. Using SST, hold the crankshaft.

SST 09213-70011, 09330-00021

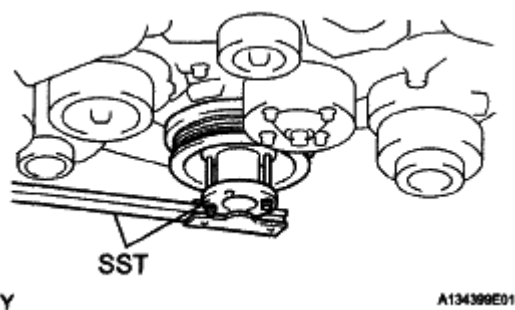


Fig. 199: Identifying Crankshaft Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

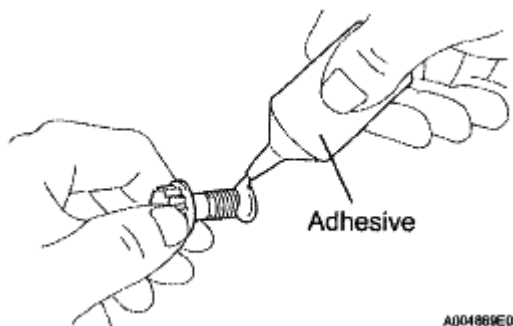


Fig. 200: Applying Adhesive To 2 Or 3 Threads Of Mounting Bolt End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the front spacer, drive plate and rear spacer on the crankshaft.
- d. Install and uniformly tighten the 8 mounting bolts in several steps, in the order shown in the illustration.

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

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

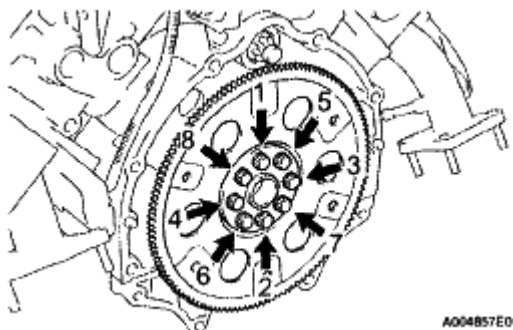


Fig. 201: Identifying Mounting Bolts

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

- e. Mark the mounting bolt with paint (Procedure "A").

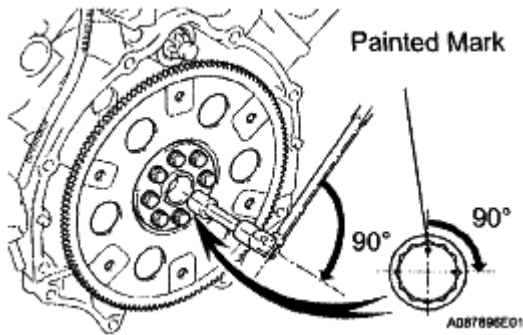


Fig. 202: Identifying Marking On Mounting Bolt

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

- f. Retighten the mounting bolts by 90° in the order shown.
- g. Check that the painted mark is now at a 90° angle to the mark placed in procedure "A".

3. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 4WD)

HINT:

(See INSTALLATION)

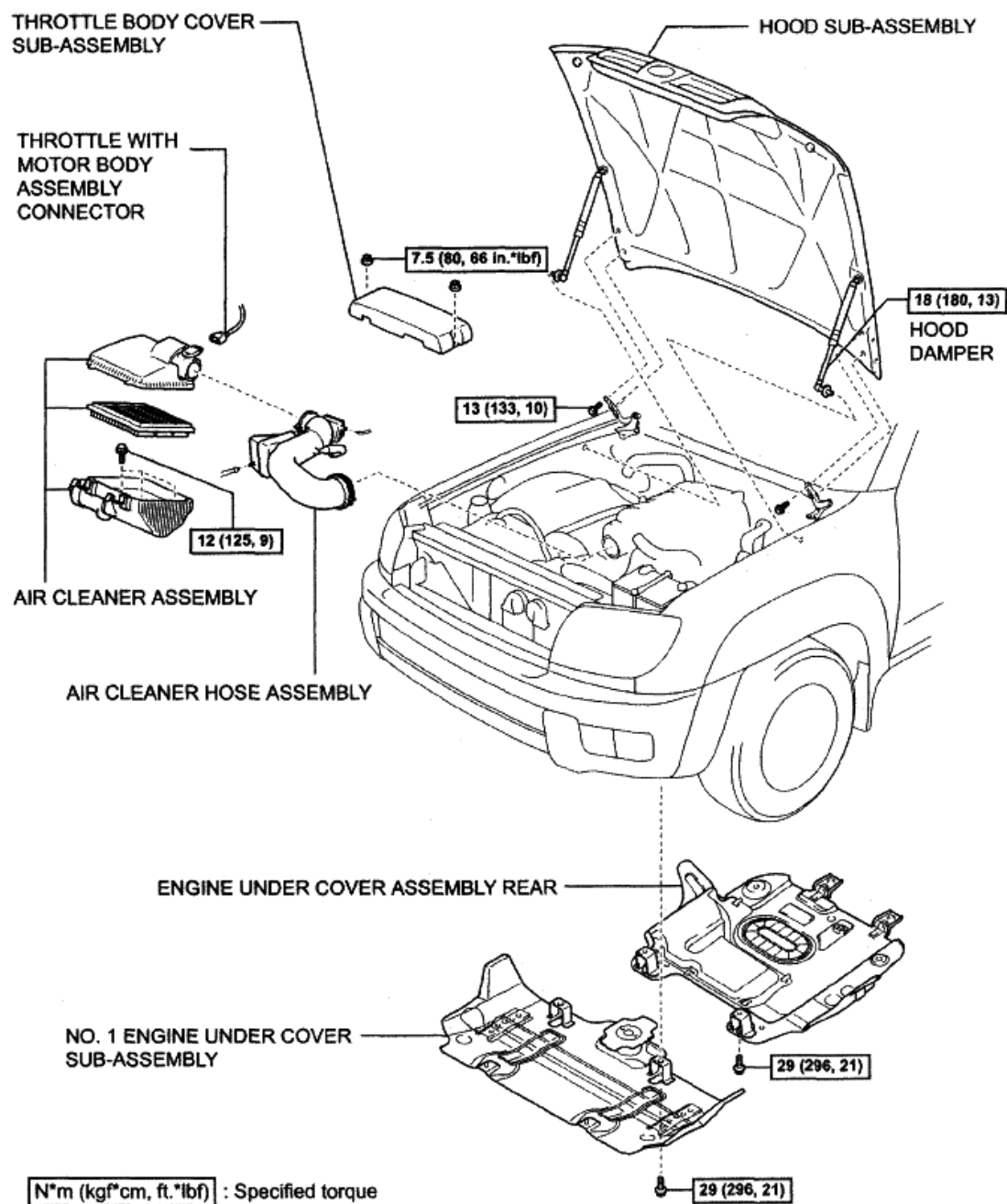
4. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 2WD)

HINT:

(See INSTALLATION)

ENGINE ASSEMBLY

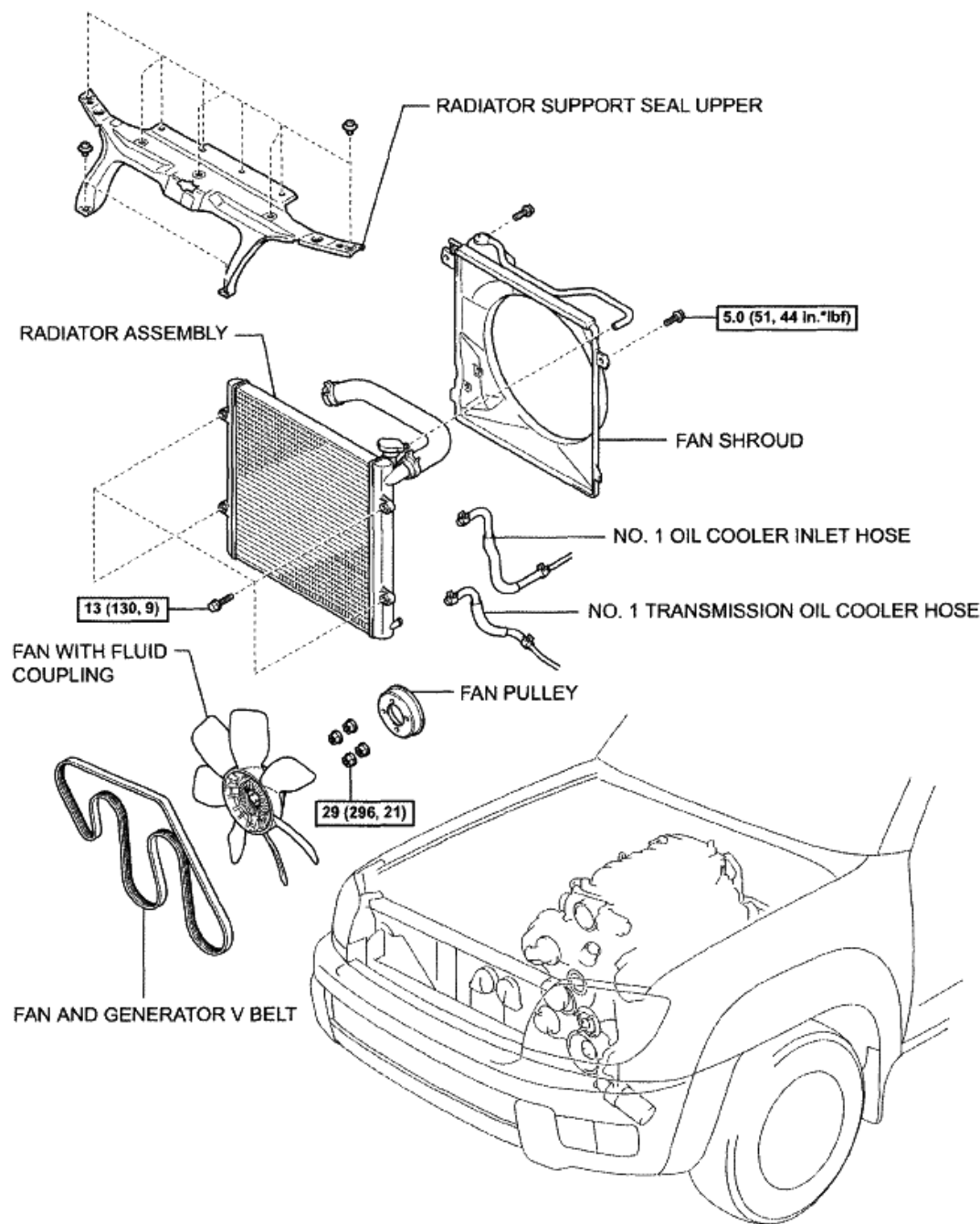
COMPONENTS



A119814E02

Fig. 203: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (1 Of 13)

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



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

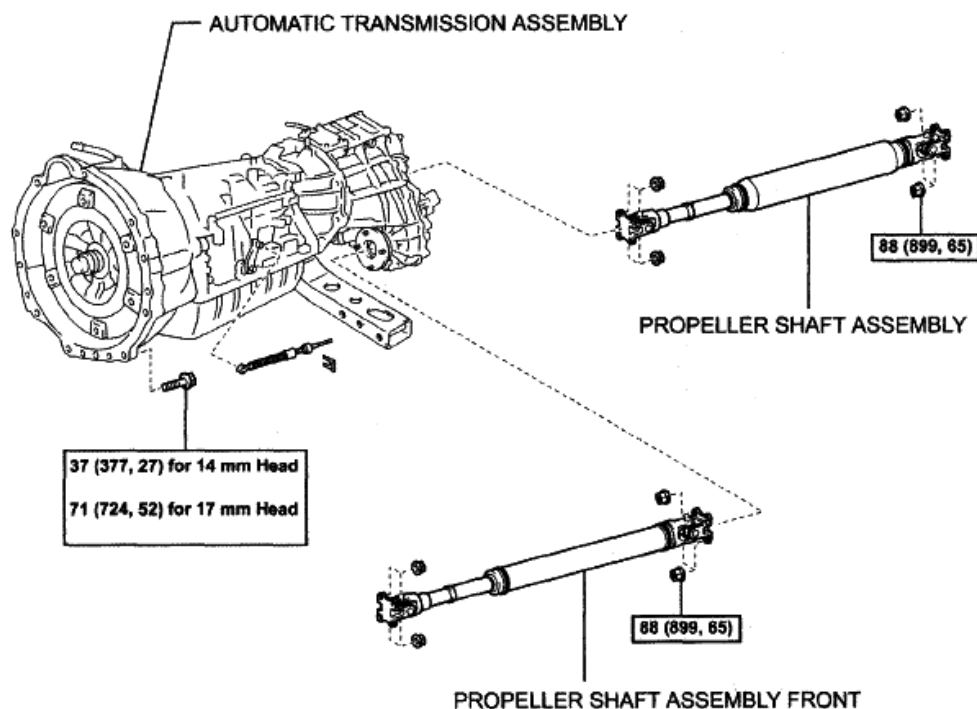
Y

A118815E01

Fig. 204: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (2 Of 13)

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

4WD



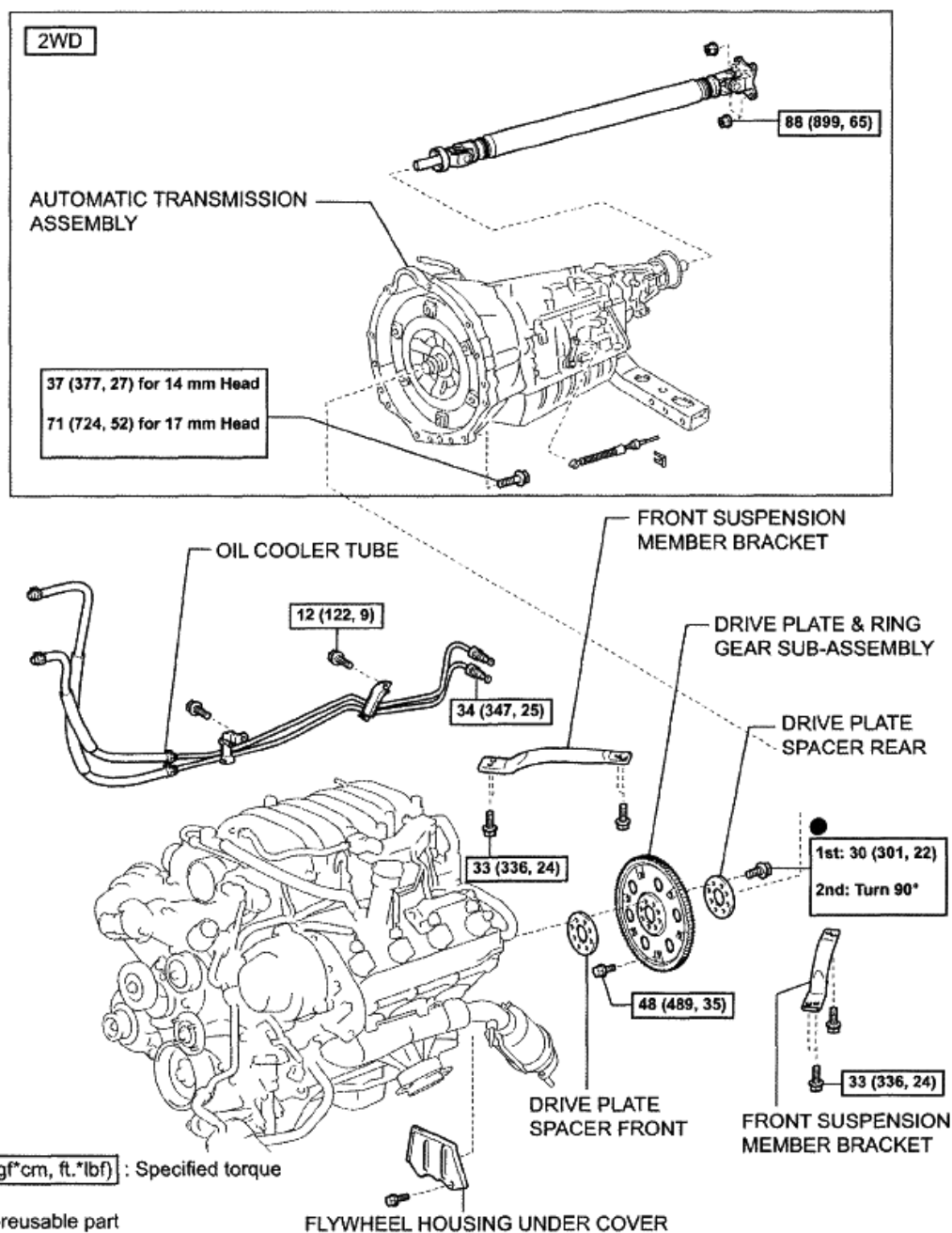
N*m (kgf*cm, ft.*lbf) : Specified torque

Y

A119816E01

Fig. 205: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (3 Of 13)

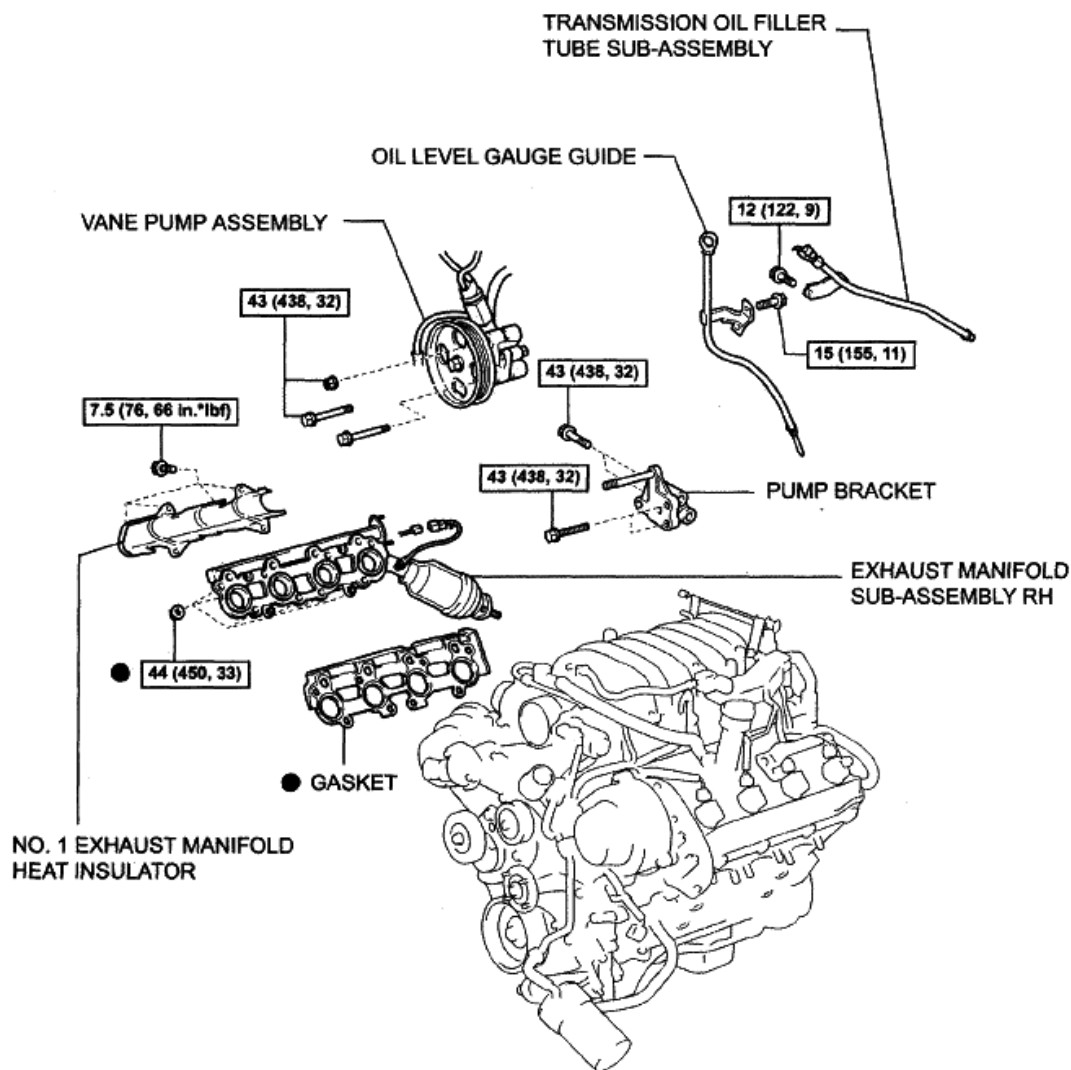
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A137102E01

Fig. 206: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (4 Of 13)

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



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

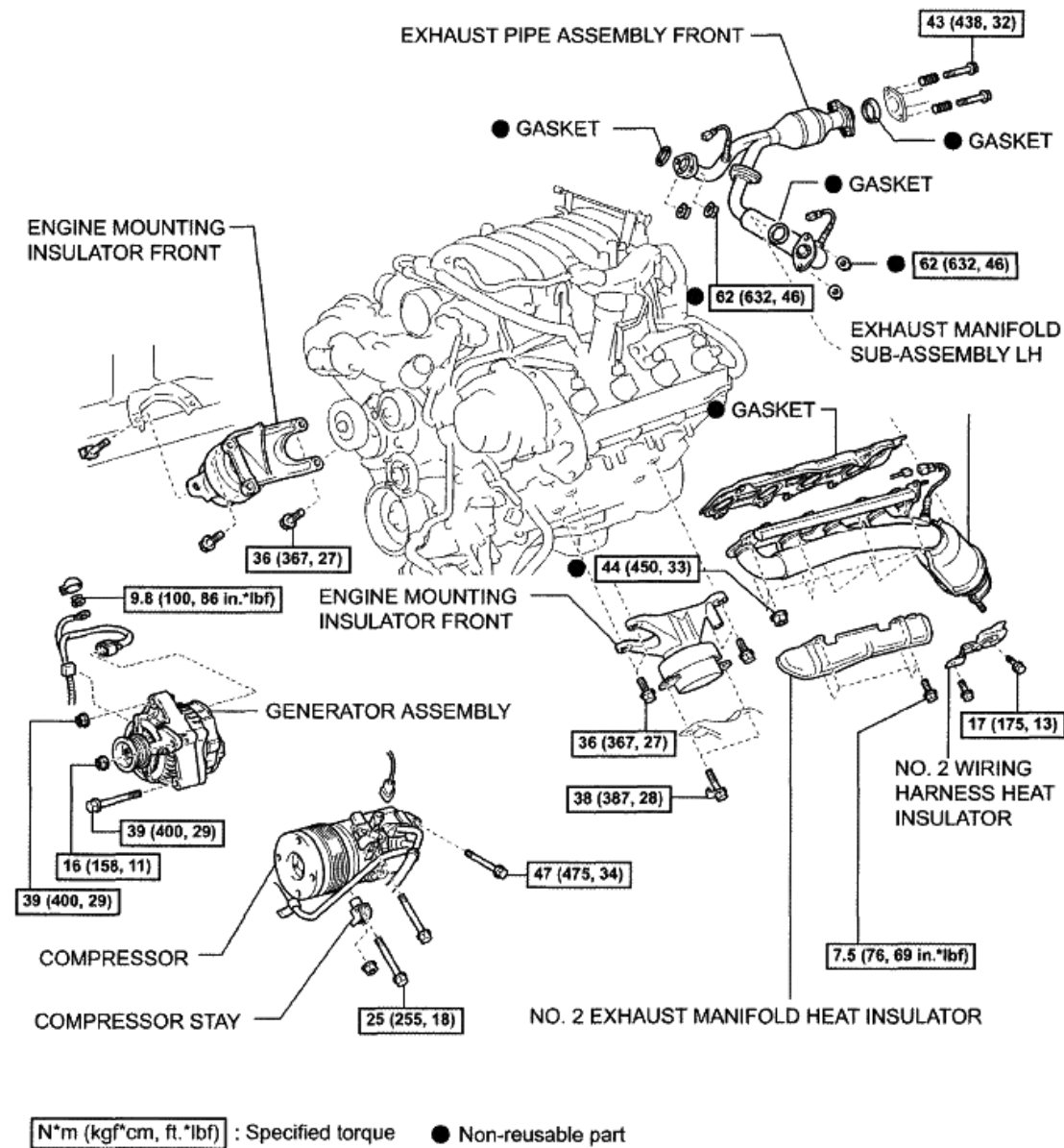
● Non-reusable part

Y

A119817E01

Fig. 207: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (5 Of 13)

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



A119818E01

Fig. 208: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (6 Of 13)

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

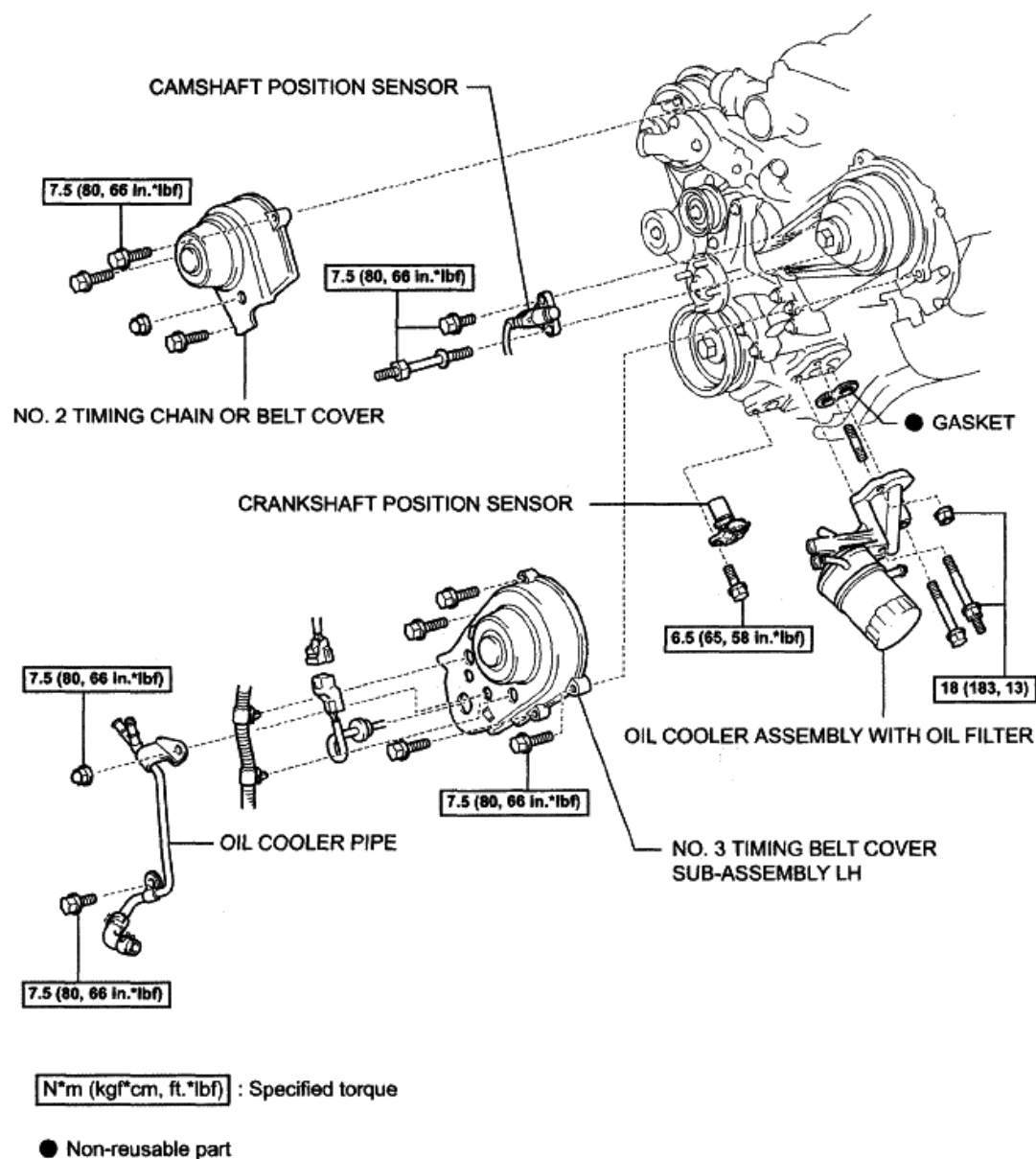
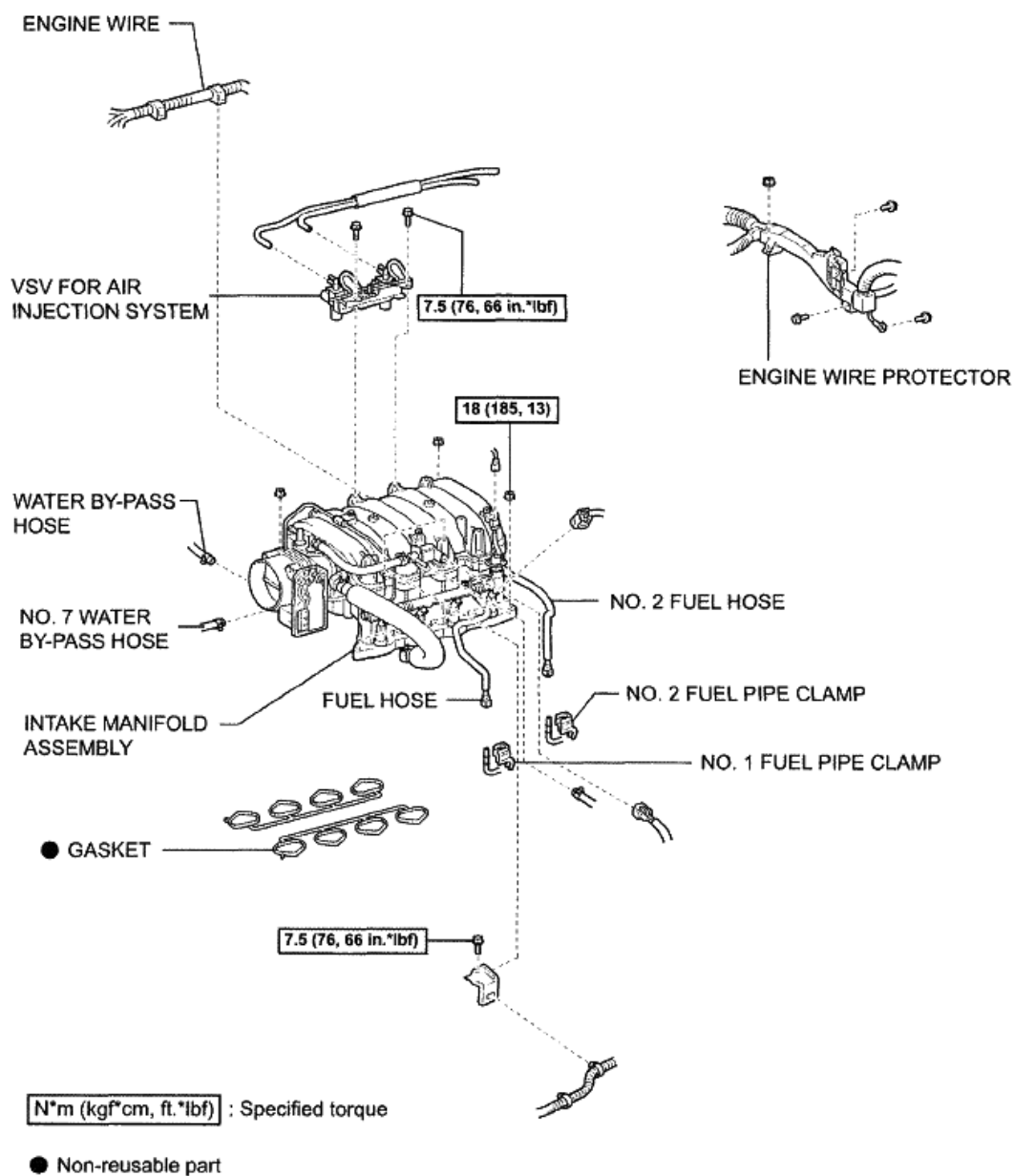


Fig. 209: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (7 Of 13)

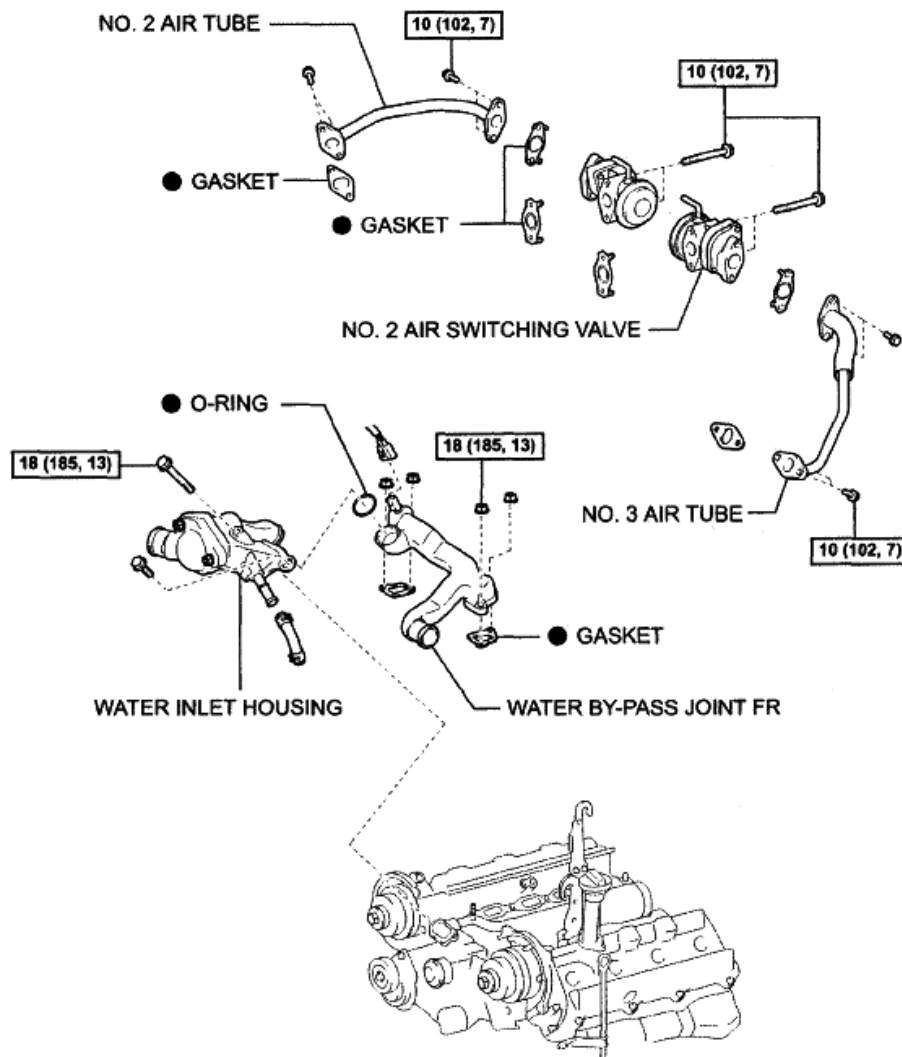
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119620E06

Fig. 210: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (8 Of 13)

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



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

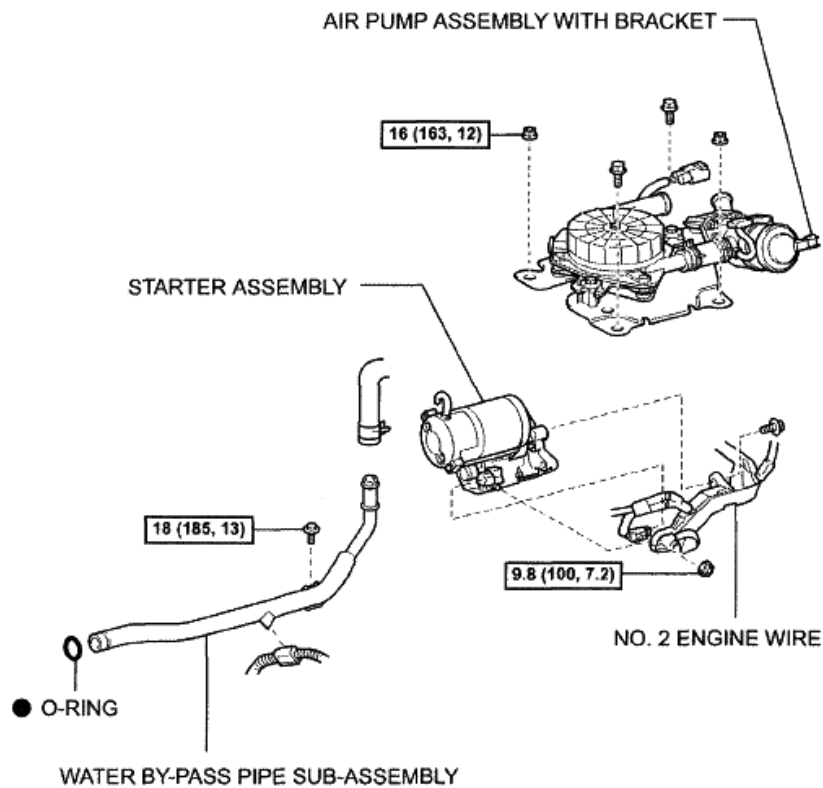
● Non-reusable part

P

A130721E01

Fig. 211: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (9 Of 13)

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



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

● Non-reusable part

Y

A119821ED1

Fig. 212: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (10 Of 13)

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

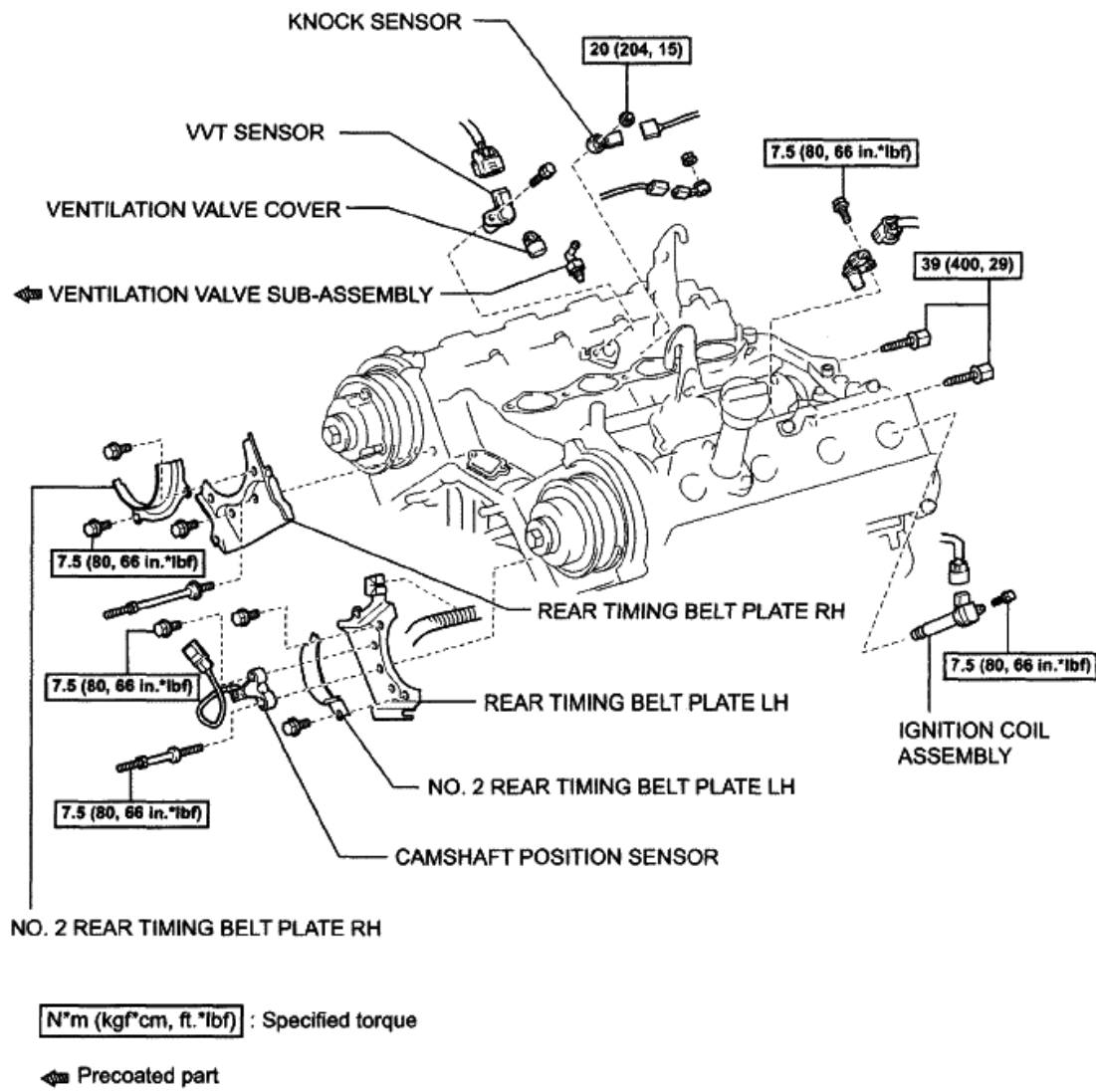
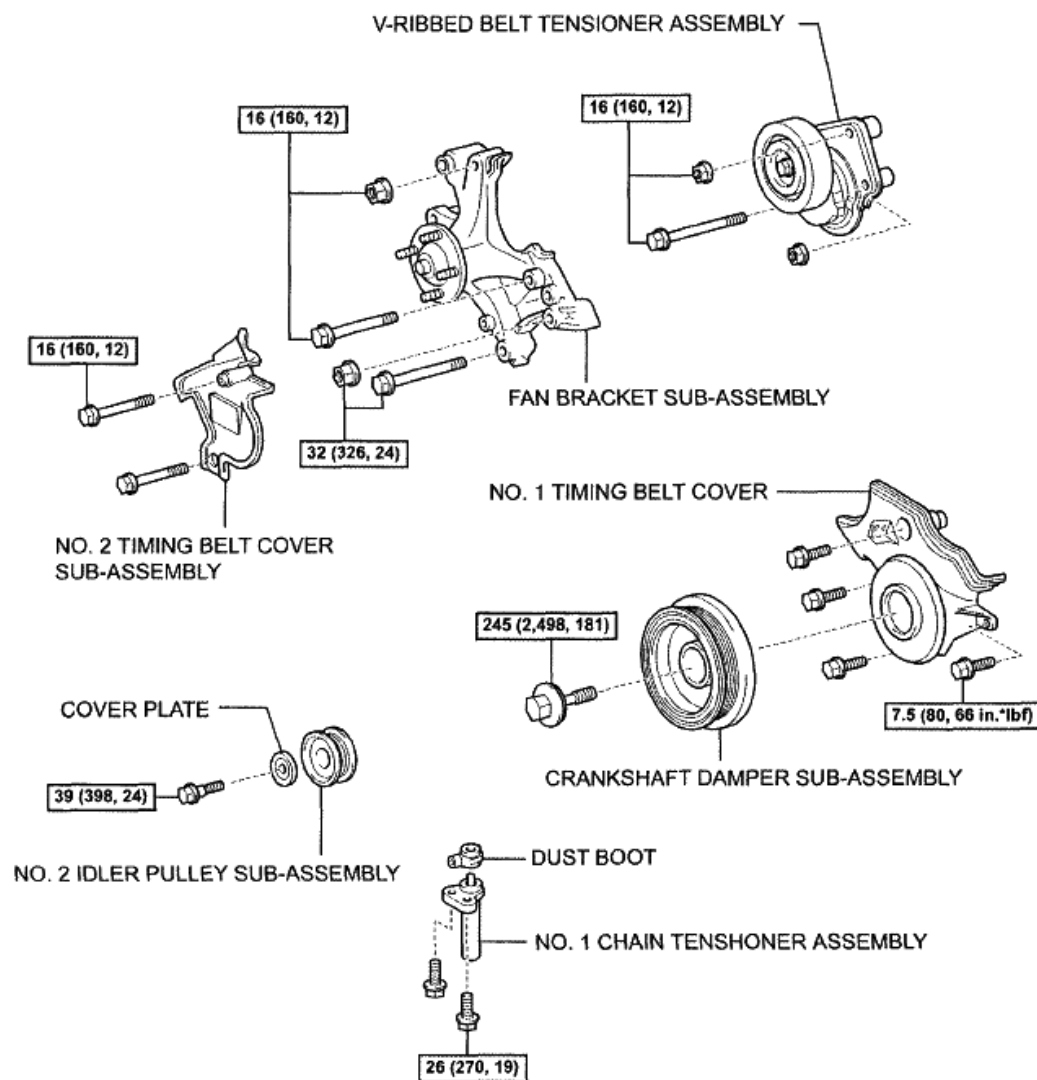


Fig. 213: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (11 Of 13)

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



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

A119B22E00

Fig. 214: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (12 Of 13)

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

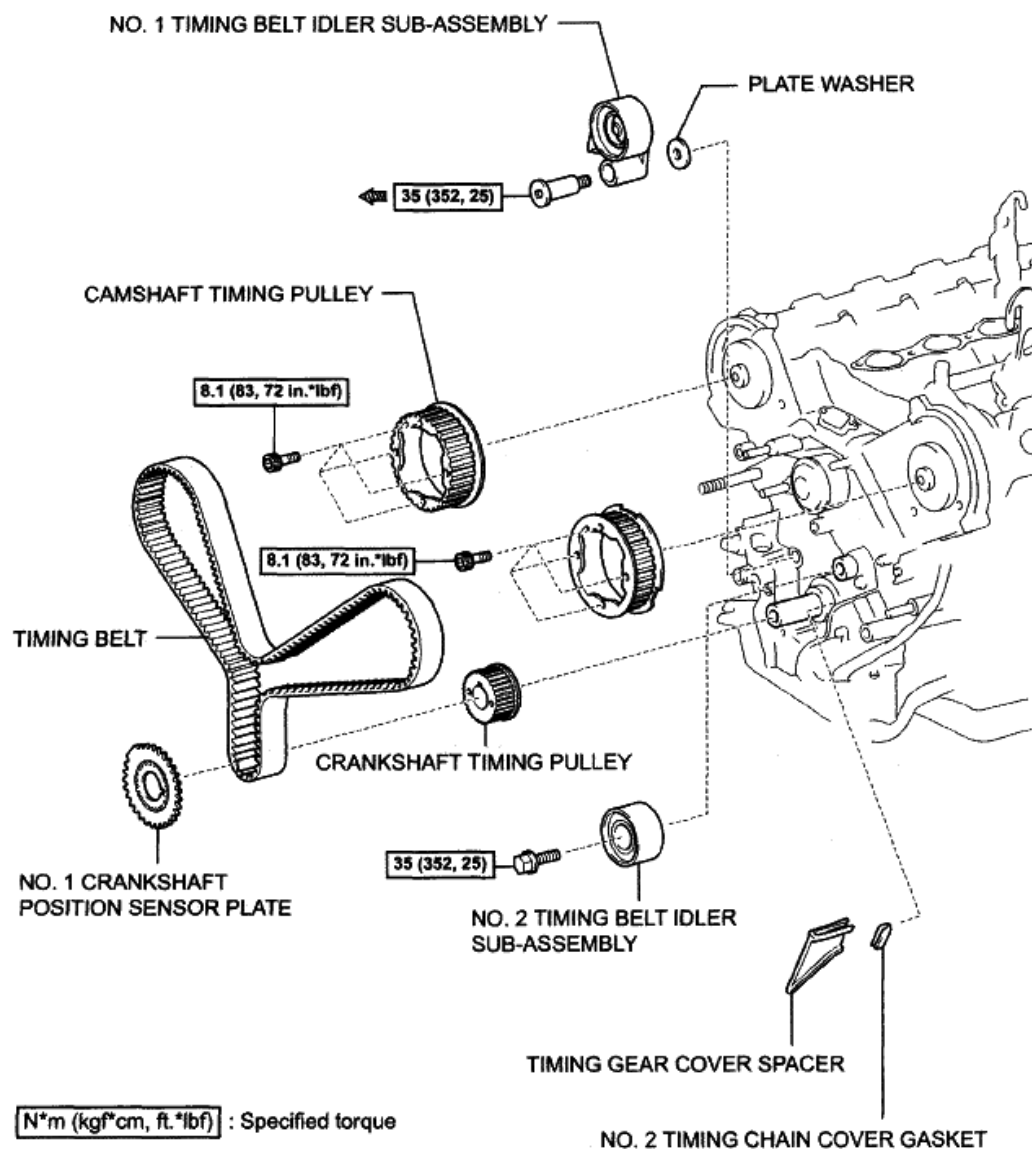


Fig. 215: Exploded View Of Engine Assembly Replacement Components With Torque Specifications (13 Of 13)

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

REMOVAL

1. **DISCHARGE FUEL SYSTEM PRESSURE** (See **REMOVAL**)
2. **REMOVE AUTOMATIC TRANSMISSION ASSEMBLY** (for 2WD)

HINT:

(See **REMOVAL**)

3. REMOVE AUTOMATIC TRANSMISSION ASSEMBLY (for 4WD)

HINT:

(See **REMOVAL**)

4. REMOVE HOOD SUB-ASSEMBLY

- a. Disconnect the windshield washer hose.
- b. Disconnect the hood dampers.
- c. Remove the 4 bolts and hood sub-assembly.

5. REMOVE THROTTLE BODY COVER SUB-ASSEMBLY

- a. Remove the 2 nuts and throttle body cover sub-assembly.

6. REMOVE AIR CLEANER HOSE ASSEMBLY

- a. Disconnect the vacuum hoses (for P/S idle up and for fuel pressure regulator) and ventilation hose.

7. REMOVE AIR CLEANER ASSEMBLY

- a. Disconnect the intake air flow meter connector.
- b. Disconnect the ground cable from the body.
- c. Remove the air cleaner cap and air cleaner element.
- d. Remove the 3 bolts and air cleaner assembly.

8. REMOVE NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY**9. REMOVE ENGINE UNDER COVER ASSEMBLY REAR****10. DRAIN ENGINE COOLANT (See **REPLACEMENT**)****11. DRAIN ENGINE OIL**

- a. Remove the oil pan drain plug and drain the engine oil.
- b. Clean the oil pan drain plug and install a new gasket and the drain plug.

Torque: 39 N*m (398 kgf*cm, 29 ft.*lbf)

12. REMOVE RADIATOR ASSEMBLY

HINT:

(See **REMOVAL**)

13. REMOVE FAN SHROUD

- a. Disconnect the fasteners of the clamp and oil cooler hoses from the fan shroud in sequence.
- b. Remove the fan shroud with fan.

14. DISCONNECT NO. 2 FUEL HOSE

- a. Observe the following precautions when disconnecting the fuel tube connector:
 1. Remove the No. 2 fuel pipe clamp.

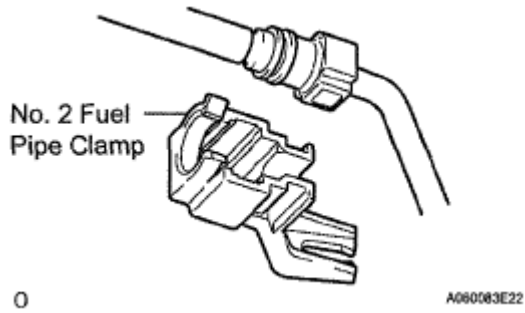


Fig. 216: Identifying No. 2 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check if there is any dirt on the pipe and around the connector before disconnecting them. Clean the dirt away if necessary.
3. Disconnect the connector from the hose while pinching part A with fingers as shown in the illustration.

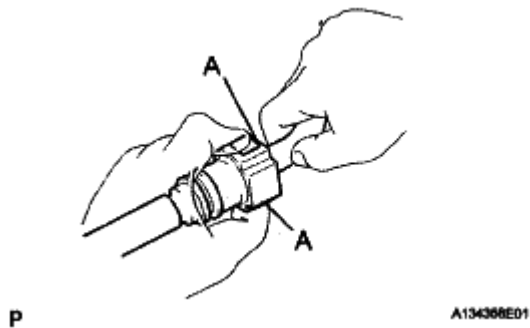


Fig. 217: Disconnecting Connector From Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. When the connector and the pipe are stuck, pinch the fuel pipe with fingers and push the fuel tube connector to the fuel pipe by pressing the release buttons, then pull the connector out from the pipe. Do not use any tool at this time.

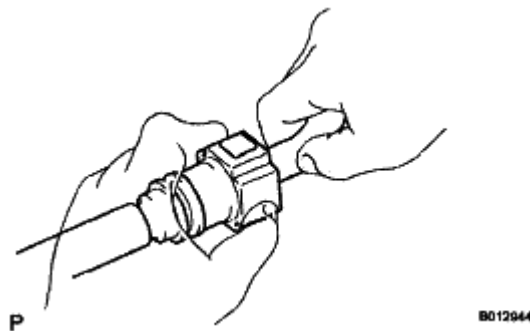


Fig. 218: Pushing Fuel Tube Connector To Fuel Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Check if there is any dirt or other foreign objects on the seal surface of the disconnected pipe and clean it away.
6. Do not damage the disconnected pipe and connector, and prevent intrusion of foreign objects by covering them with a plastic bag.

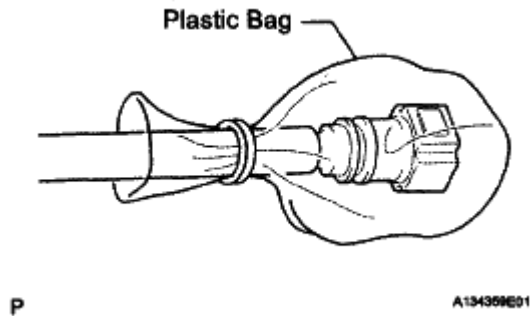


Fig. 219: Covering Connector With Plastic Bag
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. DISCONNECT FUEL HOSE

- a. Observe the following precautions when disconnecting the fuel tube connector:
 1. Remove the No. 1 fuel pipe clamp.

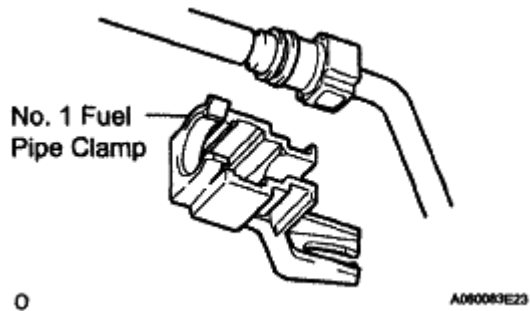


Fig. 220: Identifying No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check if there is any dirt on the pipe and around the connector before disconnecting them. Clean the dirt away if necessary.
3. Disconnect the connector from the hose while pinching part A with fingers as shown in the illustration.

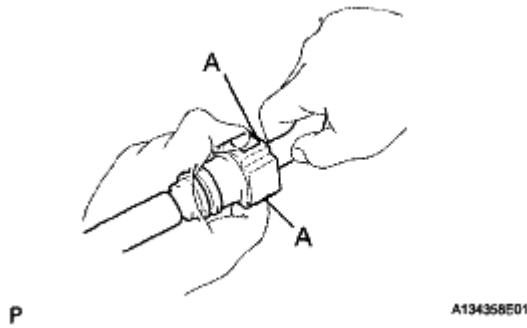


Fig. 221: Identifying Connector From Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. When the connector and the pipe are stuck, pinch the fuel pipe with fingers and push the fuel tube connector to the fuel pipe by pressing the release buttons, then pull the connector out from the pipe. Do not use any tool at this time.

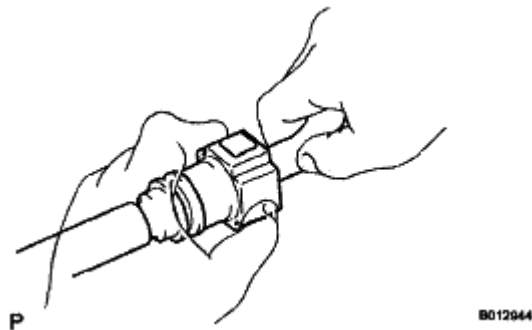


Fig. 222: Pushing Fuel Tube Connector To Fuel Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Check if there is any dirt or other foreign objects on the seal surface of the disconnected pipe and clean it away.
6. Do not damage the disconnected pipe and connector, and prevent intrusion of foreign objects by covering them with a plastic bag.

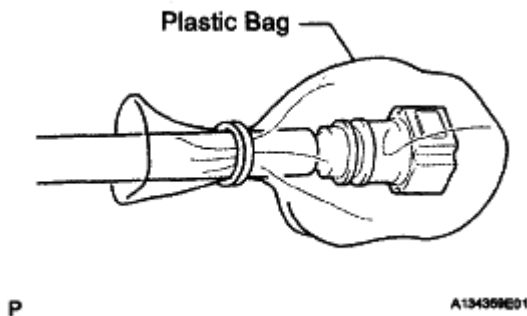


Fig. 223: Covering Connector With Plastic Bag
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **DISCONNECT FUEL VAPOR FEED HOSE ASSEMBLY**
17. **REMOVE FAN AND GENERATOR V BELT (See REMOVAL)**
18. **SEPARATE VANE PUMP ASSEMBLY**
 - a. Disconnect the vacuum hose.
 - b. Remove the nut, 2 bolts and vane pump assembly.

HINT:

Hang up the hose instead of detaching.

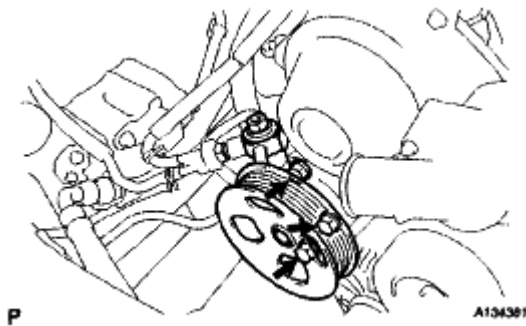


Fig. 224: Identifying Vane Pump Assembly, Nuts And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **SEPARATE COMPRESSOR**
 - a. Disconnect the compressor connector.
 - b. Remove the nut, 3 bolts, compressor stay and compressor.

HINT:

Hang up the hoses instead of detaching.

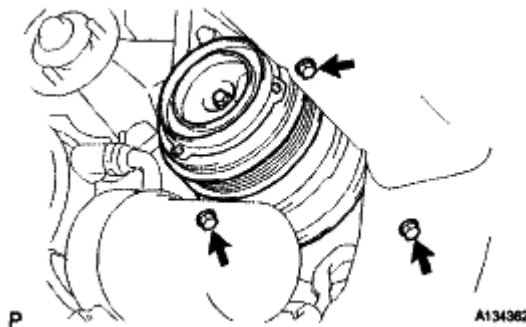


Fig. 225: Identifying Compressor Stay, Compressor, Nuts And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE FAN WITH FLUID COUPLING**

- a. Remove the 4 nuts and fan with fluid coupling.

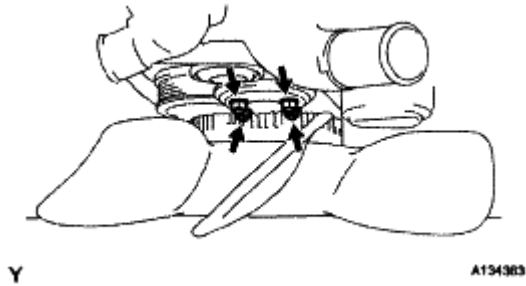


Fig. 226: Identifying Fan With Fluid Coupling Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the fan pulley.
21. **REMOVE TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY**
 - a. Remove the bolt and transmission oil filler tube.
 22. **REMOVE OIL LEVEL GAUGE GUIDE**
 - a. Remove the bolt and oil level gauge guide.
 - b. Remove the O-ring.
 23. **DISCONNECT HEATER HOSE**
 24. **SEPARATE ENGINE WIRE**
 - a. Remove the front door scuff plate RH (See **REMOVAL**).
 - b. Remove the cowl side trim board RH (See **REMOVAL**).
 - c. Remove the glove compartment door (See **REMOVAL**).
 - d. Disconnect each connector for the ECM, four-wheel- drive-control ECU (4WD only) and instrument panel wire before pulling out the engine wire into the engine room.
 - e. Disconnect the 3 ground cables from the body.

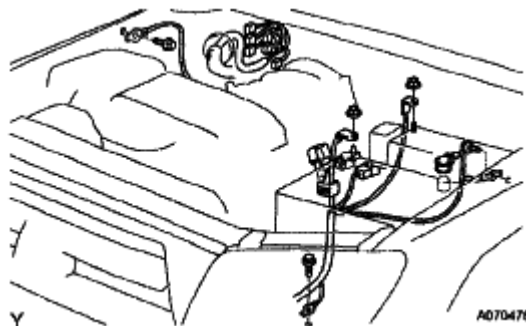


Fig. 227: Identifying Ground Cables On Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Disconnect the No. 2 engine wire from the battery terminals (positive and negative) and engine room relay block.

25. REMOVE ENGINE ASSEMBLY

- a. Attach the engine chain hoist to the engine hangers.
- b. Remove the 4 nuts and 4 bolts.
- c. Lift the engine out of the vehicle slowly and carefully.

HINT:

Make sure that the engine is kept clear of all wiring hoses and cables.

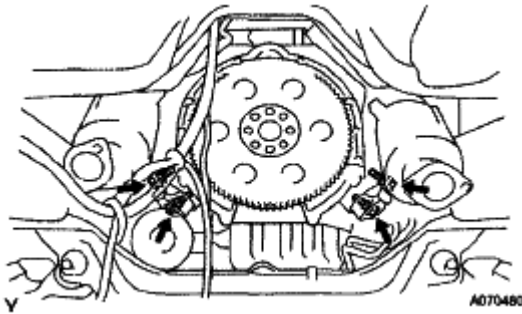


Fig. 228: Identifying Engine Assembly Nuts & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. REMOVE ENGINE WIRE

- a. Disconnect the VSV connector.
- b. Disconnect the solenoid connector.

27. REMOVE INTAKE MANIFOLD ASSEMBLY (See REMOVAL)**28. REMOVE NO. 2 WIRING HARNESS HEAT INSULATOR**

- a. Remove the 2 bolts and No. 2 wiring harness heat insulator.

29. REMOVE NO. 2 ENGINE WIRE

- a. Remove the bolt and separate the ground cable wire.
- b. Remove the nut, 2 bolts and No. 2 engine wire.

30. REMOVE NO. 1 ENGINE MOUNTING BRACKET FRONT RH

- a. Remove the 4 bolts and the engine-mounting bracket together with the engine-mounting insulator front.

31. REMOVE NO. 1 ENGINE MOUNTING BRACKET FRONT LH

- a. Remove the 4 bolts and the engine-mounting bracket together with the engine-mounting insulator front.

32. REMOVE GENERATOR ASSEMBLY (See REMOVAL)**33. REMOVE HEATER HOSE****34. REMOVE DRIVE PLATE & RING GEAR SUB-ASSEMBLY (See REMOVAL)****35. REMOVE OIL COOLER PIPE**

- a. Disconnect the 3 hoses.

- b. Remove the bolt, nut and oil cooler pipe.

36. REMOVE PUMP BRACKET

- a. Remove the 4 bolts and pump bracket.

37. REMOVE NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH

- a. Remove the grommet and separate the cam position sensor connector from the No. 3 timing belt cover sub-assembly LH.
- b. Remove the 4 bolts and No. 3 timing belt cover sub-assembly LH.

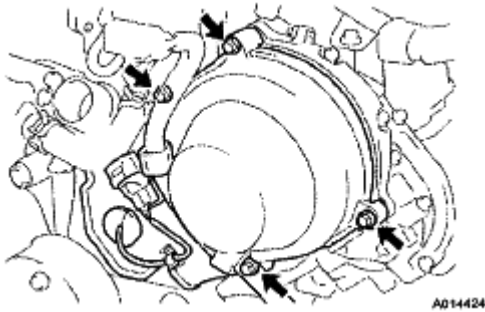


Fig. 229: Identifying Timing Belt Cover Sub-Assembly LH And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. REMOVE NO. 2 TIMING CHAIN OR BELT COVER

- a. Remove the nut, 3 bolts and No. 2 timing belt cover.

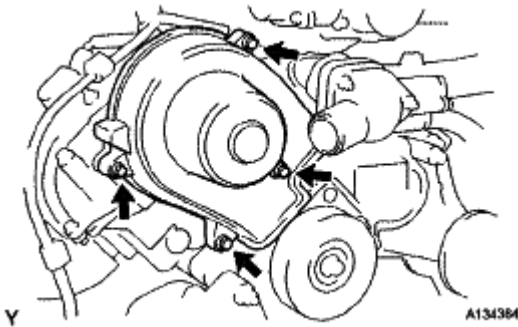


Fig. 230: Identifying Timing Belt Cover, Nut And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. REMOVE NO. 2 TIMING BELT COVER SUB-ASSEMBLY

- a. Remove the 2 bolts and No. 2 timing belt cover sub-assembly.

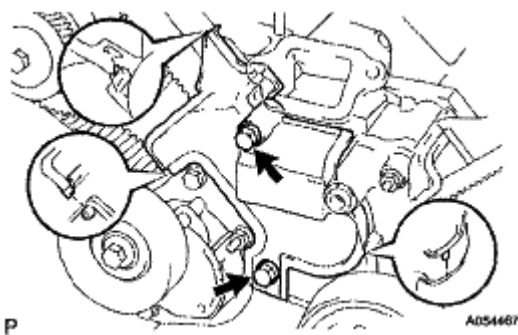


Fig. 231: Identifying No. 2 Timing Belt Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- a. Remove the bolt, 2 nuts and V-ribbed belt tensioner.

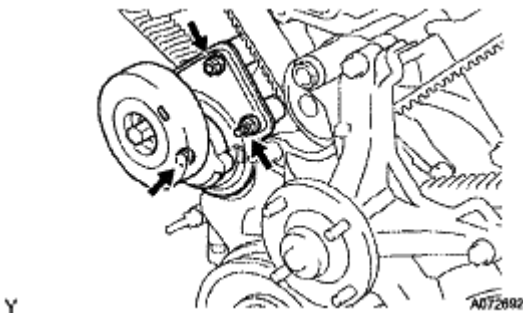


Fig. 232: Identifying Belt Tensioner, Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. REMOVE FAN BRACKET SUB-ASSEMBLY

- a. Remove the 2 nuts, 2 bolts and fan bracket sub-assembly.

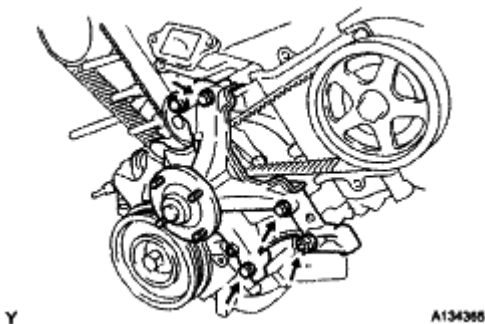


Fig. 233: Identifying Fan Bracket Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. REMOVE IGNITION COIL ASSEMBLY

- a. Remove the 8 bolts and 8 ignition coils.

43. REMOVE CAMSHAFT POSITION SENSOR

- a. Remove the bolt, stud bolt and camshaft position sensor.

44. REMOVE CRANKSHAFT POSITION SENSOR

- a. Remove the bolt and crankshaft position sensor.

45. REMOVE VVT SENSOR

- a. Remove the 2 bolts and VVT sensors.

46. REMOVE WATER BY-PASS PIPE SUB-ASSEMBLY

- a. Remove the wire clamp.
- b. Remove the bolt and water by-pass.
- c. Remove the O-ring from the water by-pass pipe sub-assembly.

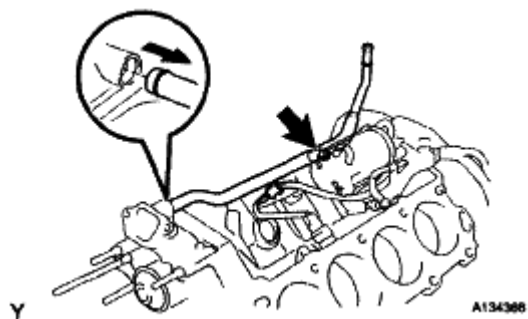


Fig. 234: Identifying O-ring And Water By-Pass Pipe Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. REMOVE NO. 2 AIR SWITCHING VALVE (See REMOVAL)

48. REMOVE WATER BY-PASS JOINT RR

- a. Remove the 4 nuts and water by-pass joint.
- b. Remove the 2 gaskets from the water by-pass joint.

49. REMOVE AIR PUMP ASSEMBLY WITH BRACKET (See REMOVAL)

50. REMOVE STARTER ASSEMBLY

- a. Disconnect the No. 2 engine wire.
- b. Remove the 2 bolts and starter assembly.

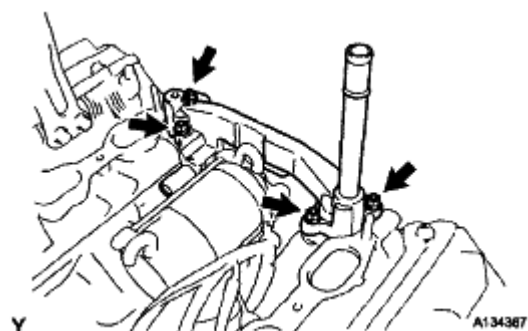


Fig. 235: Identifying Starter Assembly And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **REMOVE KNOCK SENSOR** (See REMOVAL)
52. **REMOVE WATER INLET HOUSING** (See REMOVAL)
53. **REMOVE WATER BY-PASS JOINT FR**
 - a. Remove the 4 nuts, water by-pass joint and 2 gaskets.

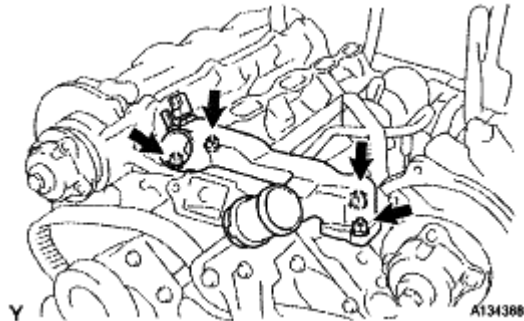


Fig. 236: Identifying Water By-Pass Joint And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH**
 - a. Remove the 4 bolts and No. 1 exhaust manifold heat insulator.
 - b. Disconnect the oxygen sensor connector.
 - c. Remove the 8 nuts and exhaust manifold sub-assembly.
55. **REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH**
 - a. Remove the 4 bolts and No. 2 exhaust manifold heat insulator.
 - b. Disconnect the oxygen sensor connector.
 - c. Remove the 8 nuts and exhaust manifold sub-assembly.
56. **REMOVE OIL COOLER ASSEMBLY**
 - a. Remove the 2 bolts and nut.
 - b. Remove the oil cooler assembly with bracket and gasket.
57. **REMOVE VENTILATION VALVE SUB-ASSEMBLY**
 - a. Remove the ventilation valve cover.
 - b. Remove the ventilation valve sub-assembly.
58. **REPLACE PARTIAL ENGINE ASSEMBLY**

INSTALLATION

1. **INSTALL VENTILATION VALVE SUB-ASSEMBLY**
 - a. Apply adhesive to 2 or 3 threads.

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

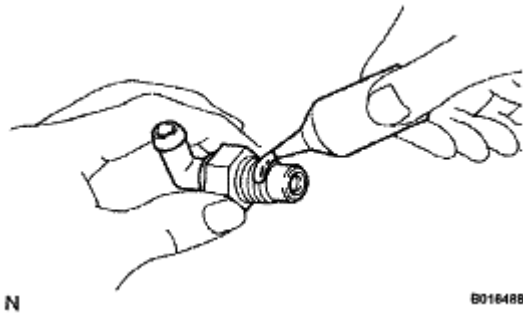


Fig. 237: Applying Adhesive To Threads
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the ventilation valve.

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

HINT:

After tightening the valve to the specified torque, turn the ventilation valve clockwise with the port facing in the direction indicated in the illustration.

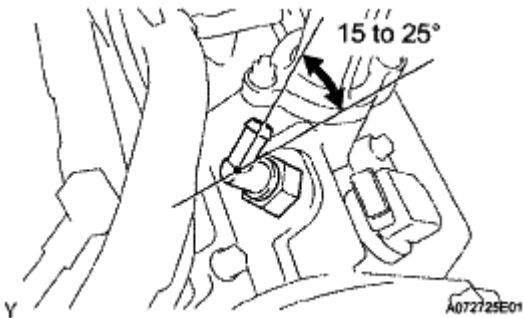


Fig. 238: Identifying Ventilation Valve Tightening Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the ventilation valve cover to the ventilation valve.
- d. Connect the ventilation hose to the ventilation valve.

2. INSTALL OIL COOLER ASSEMBLY

- a. Place a new gasket into the groove of the oil cooler.
- b. Apply a light coat of engine oil to the gasket.
- c. Install the oil cooler assembly with the 2 bolts and nut.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

3. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH

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

NOTE: Be careful of the installation direction.

- b. Install the exhaust manifold with 8 new nuts. Uniformly tighten the nuts in diagonally.

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

- c. Install the heat insulator with the 4 bolts.

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

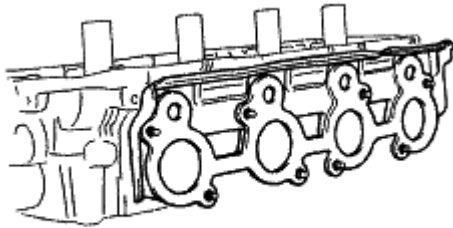


Fig. 239: Identifying Exhaust Manifold Sub-Assembly LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH

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

NOTE: Be careful of the installation direction.

- b. Install the exhaust manifold with 8 new nuts. Uniformly tighten the nuts diagonally.

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

- c. Install the heat insulator with the 4 bolts.

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

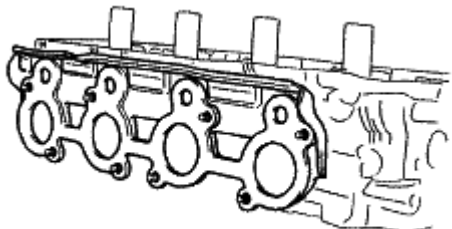


Fig. 240: Identifying Exhaust Manifold Sub-Assembly RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL WATER BY-PASS JOINT FR

- With the flat-bottom of each new gasket facing downward as shown in the illustration, install the 2 gaskets to the engine front side.
- Install the water by-pass joint with the 4 nuts. Alternately tighten the nuts.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

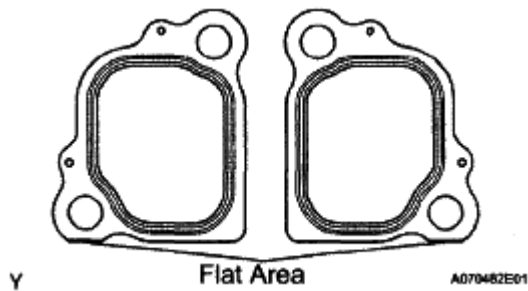


Fig. 241: Identifying Water By-Pass Joint FR
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL WATER INLET HOUSING (See INSTALLATION)

7. INSTALL KNOCK SENSOR (See INSTALLATION)

8. INSTALL STARTER ASSEMBLY

- Install the starter assembly with the 2 bolts.

Torque: 39 N*m (400 kgf*cm, 29 ft.*lbf)

- Connect the No. 2 engine wire.

Torque: 9.8 N*m (100 kgf*cm, 7.2 ft.*lbf)

9. INSTALL AIR PUMP ASSEMBLY WITH BRACKET (See INSTALLATION)

10. INSTALL WATER BY-PASS JOINT RR

- With the flat-bottom of each new gasket facing downward as shown in the illustration, install the 2 gaskets to the engine rear side.

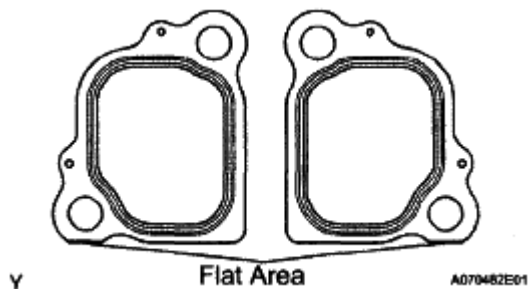


Fig. 242: Identifying Gasket Facing Flat Area

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

- b. Install the water by-pass joint with the 4 nuts. Alternately tighten the nuts.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

11. INSTALL NO. 2 AIR SWITCHING VALVE (See INSTALLATION)

12. INSTALL WATER BY-PASS PIPE SUB-ASSEMBLY

- a. Install a new O-ring to the water by-pass pipe.
- b. Apply soapy water to the O-ring.
- c. Push in the water by-pass pipe end into the pipe hole of the water pump.

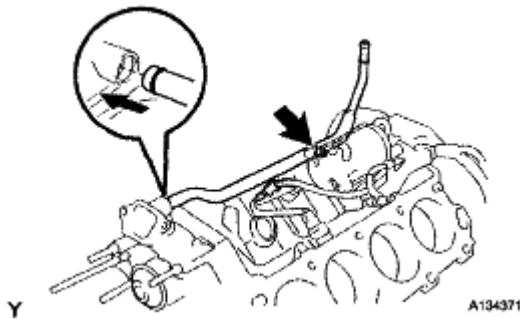


Fig. 243: Identifying Water By-Pass Pipe End And Water Pump

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

- d. Install the water by-pass pipe with the bolt.

Torque: 18 N*m (185 kgf*cm, 13 ft.*lbf)

13. INSTALL VVT SENSOR

- a. Install the VVT sensors with the 2 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

14. INSTALL CRANKSHAFT POSITION SENSOR

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

Torque: 6.5 N*m (65 kgf*cm, 58 in.*lbf)

15. INSTALL CAMSHAFT POSITION SENSOR

- a. Install the camshaft position sensor with the bolt and the stud bolt.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

16. INSTALL IGNITION COIL ASSEMBLY

- a. Install the 8 ignition coils with the 8 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

17. INSTALL FAN BRACKET SUB-ASSEMBLY

- a. Install the fan bracket with the 2 bolts and 2 nuts.

Torque:

12 mm head

16 N*m (160 kgf*cm, 12 ft.*lbf)

14 mm head

32 N*m (326 kgf*cm, 24 ft.*lbf)

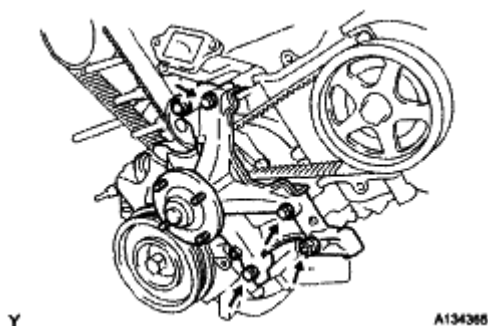


Fig. 244: Identifying Fan Bracket Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- a. Install the v-ribbed belt tensioner with the bolt and 2 nuts.

Torque: 16 N*m (160 kgf*cm, 12 ft.*lbf)

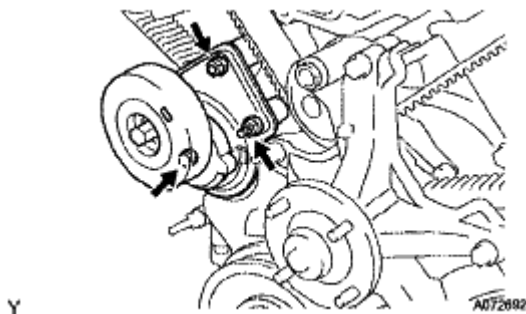


Fig. 245: Identifying Belt Tensioner, Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL NO. 2 TIMING BELT COVER SUB-ASSEMBLY

- a. Install the No. 2 timing belt cover sub-assembly with the 2 bolts.

Torque: 16 N*m (160 kgf*cm, 12 ft.*lbf)

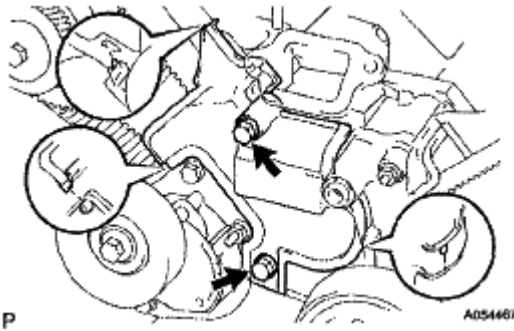


Fig. 246: Identifying Timing Belt Cover And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSTALL NO. 2 TIMING CHAIN OR BELT COVER

- a. Install the timing chain or belt cover with the nut and 3 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

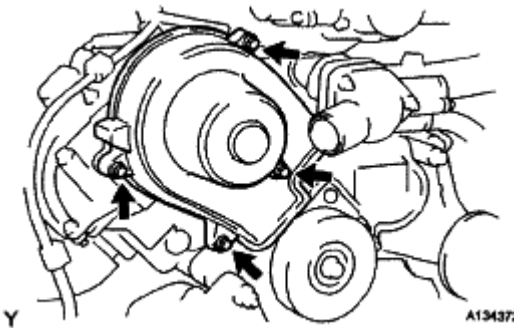


Fig. 247: Identifying Timing Chain Or Belt Cover With Nut And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSTALL NO. 3 TIMING BELT COVER SUB-ASSEMBLY LH

- a. Install the timing belt cover sub-assembly with the 4 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

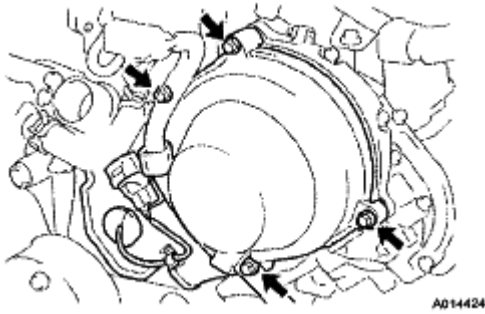


Fig. 248: Identifying Timing Belt Cover Sub-Assembly LH And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the camshaft position sensor connector and grommet to the timing belt cover.

22. INSTALL PUMP BRACKET

- a. Install the pump bracket with the 4 bolts.

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

23. INSTALL OIL COOLER PIPE

- a. Install the oil cooler pipe with the bolt and nut.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

- b. Connect the 3 hoses.

24. INSTALL DRIVE PLATE & RING GEAR SUB-ASSEMBLY (See INSTALLATION)

25. INSTALL HEATER HOSE

26. INSTALL GENERATOR ASSEMBLY (See INSTALLATION)

27. INSTALL NO. 1 ENGINE MOUNTING BRACKET FRONT LH

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

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

28. INSTALL NO. 1 ENGINE MOUNTING BRACKET FRONT RH

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

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

29. INSTALL NO. 2 ENGINE WIRE

- a. Install the engine wire protector with the nut and 2 bolts.
- b. Connect the ground cable wire clamp with the bolt.

30. INSTALL NO. 2 WIRING HARNESS HEAT INSULATOR

- a. Install the wiring harness heat insulator with the 2 bolts.

Torque: 17 N*m (175 kgf*cm, 13 ft.*lbf)

31. INSTALL INTAKE MANIFOLD ASSEMBLY (See INSTALLATION)

32. INSTALL ENGINE WIRE

33. INSTALL ENGINE ASSEMBLY

- a. Attach the engine chain hoist to the engine hangers.
- b. Slowly lower the engine assembly into the engine compartment.
- c. Attach the engine mounting brackets to the frame brackets.
- d. Install the engine mounting brackets with the 4 nuts and 4 bolts.

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

- e. Remove the engine chain hoist.

34. INSTALL ENGINE WIRE

35. CONNECT HEATER HOSE

36. INSTALL OIL LEVEL GAUGE GUIDE

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

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

37. INSTALL TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY

- a. Install a new O-ring to the oil filler tube sub-assembly.
- b. Install the transmission oil filler tube sub-assembly with the bolt.

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

38. INSTALL FAN WITH FLUID COUPLING

- a. Install the fan pulley to the engine.
- b. Install the fan with fluid coupling with the 4 nuts.

Torque: 29 N*m (296 kgf*cm, 21 ft.*lbf)

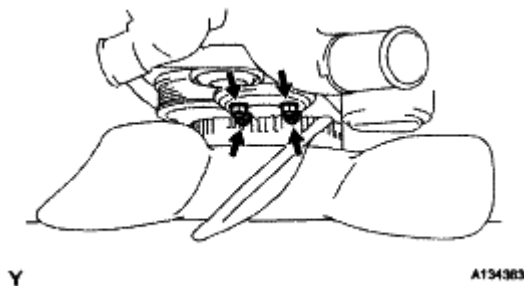


Fig. 249: Identifying Fluid Coupling And Nuts

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

39. INSTALL COMPRESSOR

- a. Install the compressor with the stay, nut and 3 bolts.

Torque:

Bolt

47 N*m (475 kgf*cm, 34 ft.*lbf)

Nut

25 N*m (255 kgf*cm, 18 ft.*lbf)

- b. Connect the compressor connector.

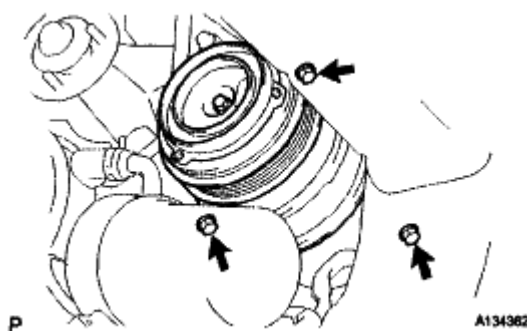


Fig. 250: Identifying Compressor Stay, Compressor, Nuts And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. INSTALL VANE PUMP ASSEMBLY

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

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

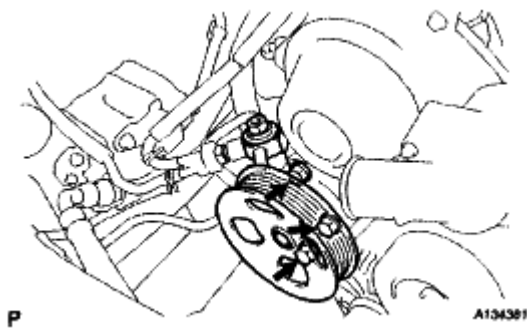


Fig. 251: Identifying Vane Pump Assembly, Nuts And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 41. **INSTALL FAN AND GENERATOR V BELT (See INSPECTION)**
- 42. **CONNECT FUEL VAPOR FEED HOSE ASSEMBLY**
- 43. **CONNECT FUEL HOSE**
- 44. **CONNECT NO. 2 FUEL HOSE**
- 45. **INSTALL FAN SHROUD**

- a. Install the fan shroud with the fan into the engine room.

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

- 46. **INSTALL RADIATOR ASSEMBLY (See INSTALLATION)**
- 47. **ADD ENGINE COOLANT (See REPLACEMENT)**
- 48. **ADD ENGINE OIL**
- 49. **INSTALL ENGINE UNDER COVER ASSEMBLY REAR**
- 50. **INSTALL NO. 1 ENGINE UNDER COVER SUB-ASSEMBLY**
- 51. **INSTALL AIR CLEANER ASSEMBLY**

- a. Install the air cleaner assembly with the 3 bolts.

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

- b. Connect the wire harness clamp and the ground cable.

Torque: 8.3 N*m (85 kgf*cm, 73 in.*lbf)

- 52. **INSTALL AIR CLEANER HOSE ASSEMBLY**
- 53. **INSTALL THROTTLE BODY COVER SUB-ASSEMBLY**
 - a. Install the throttle body cover sub-assembly with the 2 nuts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

- 54. **INSTALL HOOD SUB-ASSEMBLY**

- a. Install the hood with the 4 bolts.

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

- b. Connect the hood damper.

Torque: 18 N*m (180 kgf*cm, 13 ft.*lbf)

- c. Connect the windshield washer hose.

- 55. **INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 2WD)**

HINT:

(See INSTALLATION)

56. INSTALL AUTOMATIC TRANSMISSION ASSEMBLY (for 4WD)

HINT:

(See INSTALLATION)

57. CHECK FOR ENGINE COOLANT LEAKAGE (See REPLACEMENT)

58. CHECK FOR EXHAUST GAS LEAKAGE

59. CHECK FOR FUEL LEAK (See ON-VEHICLE INSPECTION)

60. INSPECT AUTOMATIC TRANSMISSION FLUID

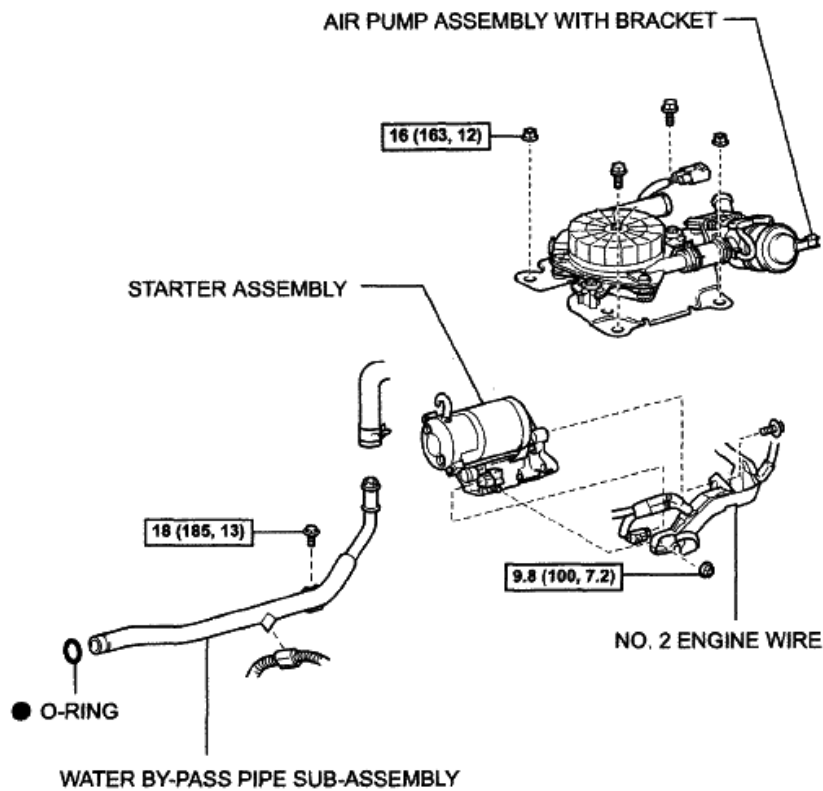
HINT:

(See INSPECTION PROCEDURE)

61. CHECK FOR ENGINE OIL LEAKAGE

ENGINE UNIT

COMPONENTS

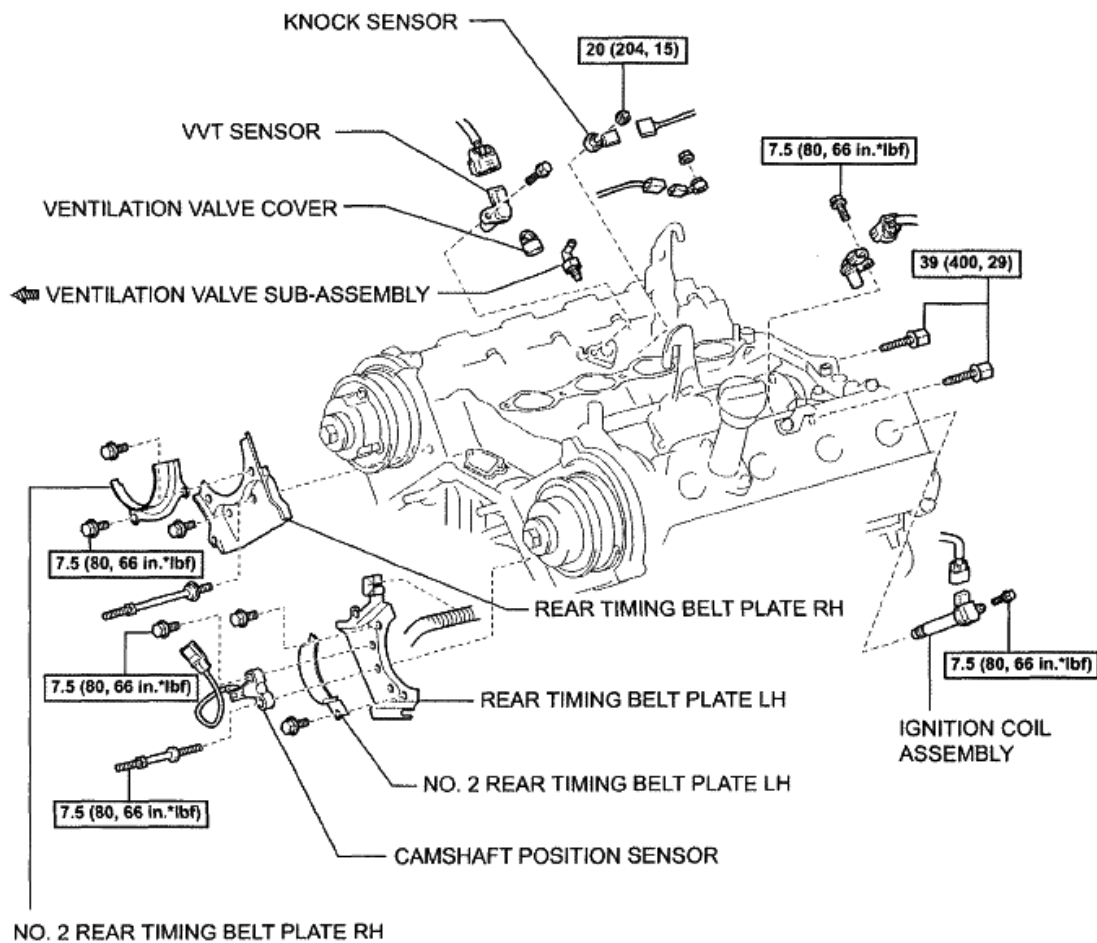


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

A119821E02

Fig. 252: Identifying Engine Unit Replacement Components With Torque Specifications (1 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



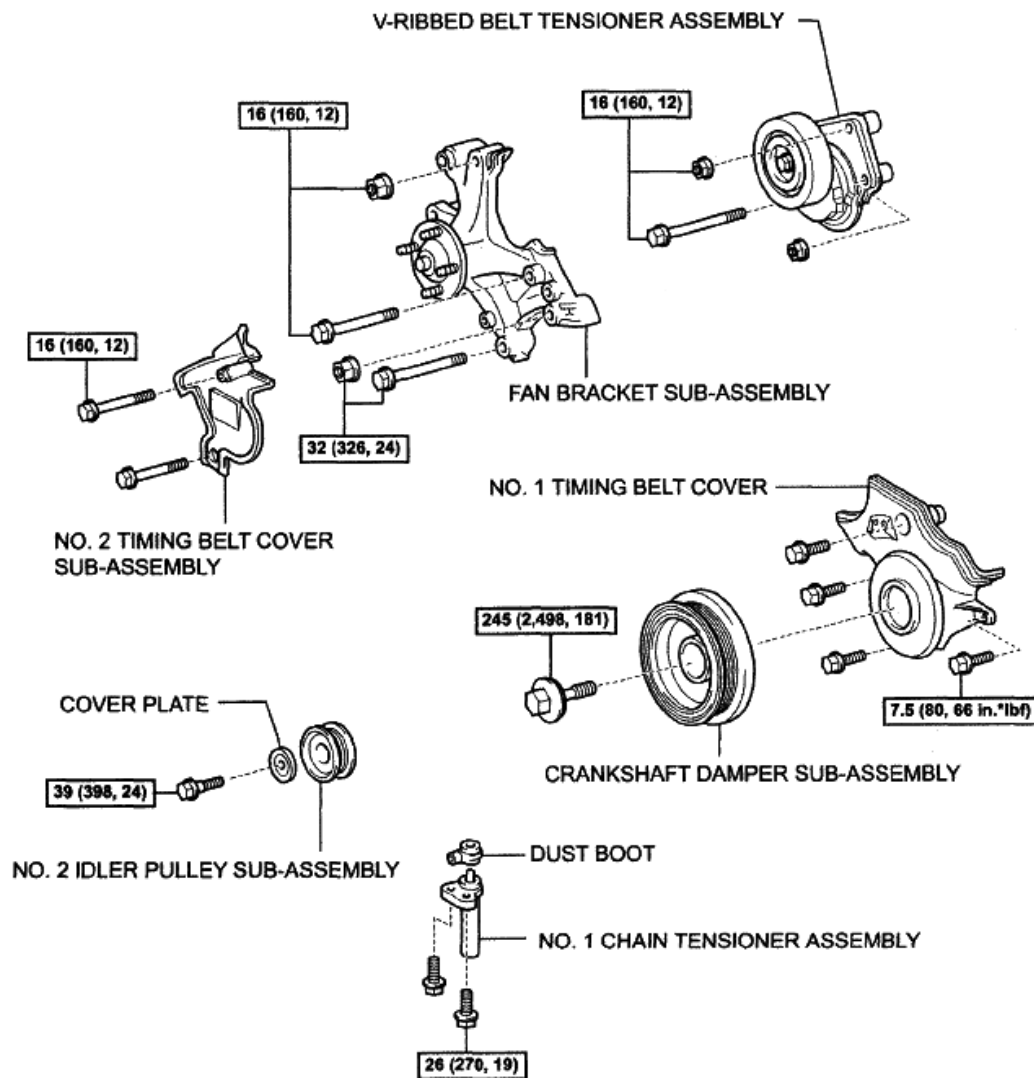
N*m (kgf*cm, ft.*lbf) : Specified torque

Precoated part

Y

A119927E02

Fig. 253: Identifying Engine Unit Replacement Components With Torque Specifications (2 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

A119422E09

Fig. 254: Identifying Engine Unit Replacement Components With Torque Specifications (3 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

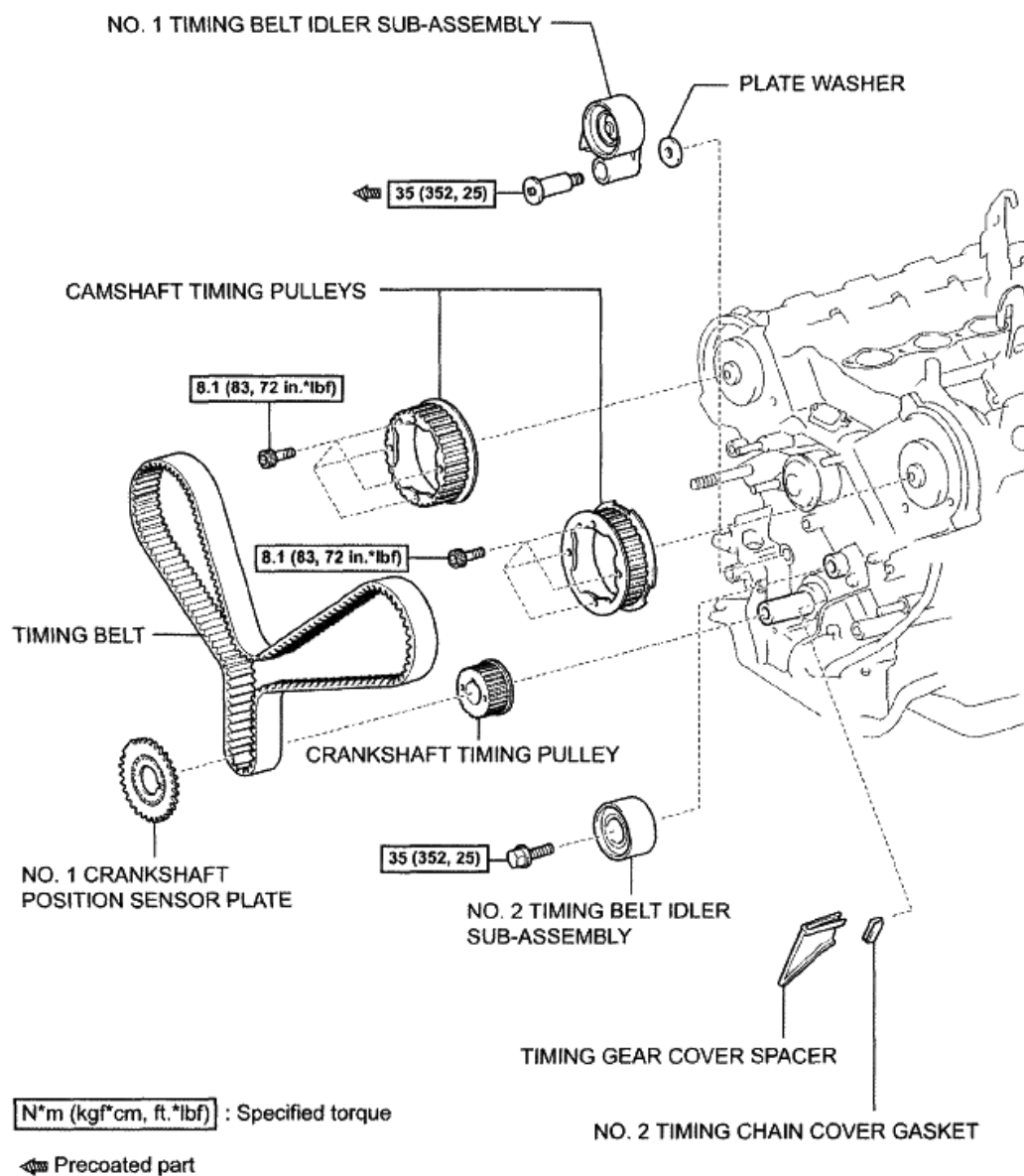


Fig. 255: Identifying Engine Unit Replacement Components With Torque Specifications (4 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

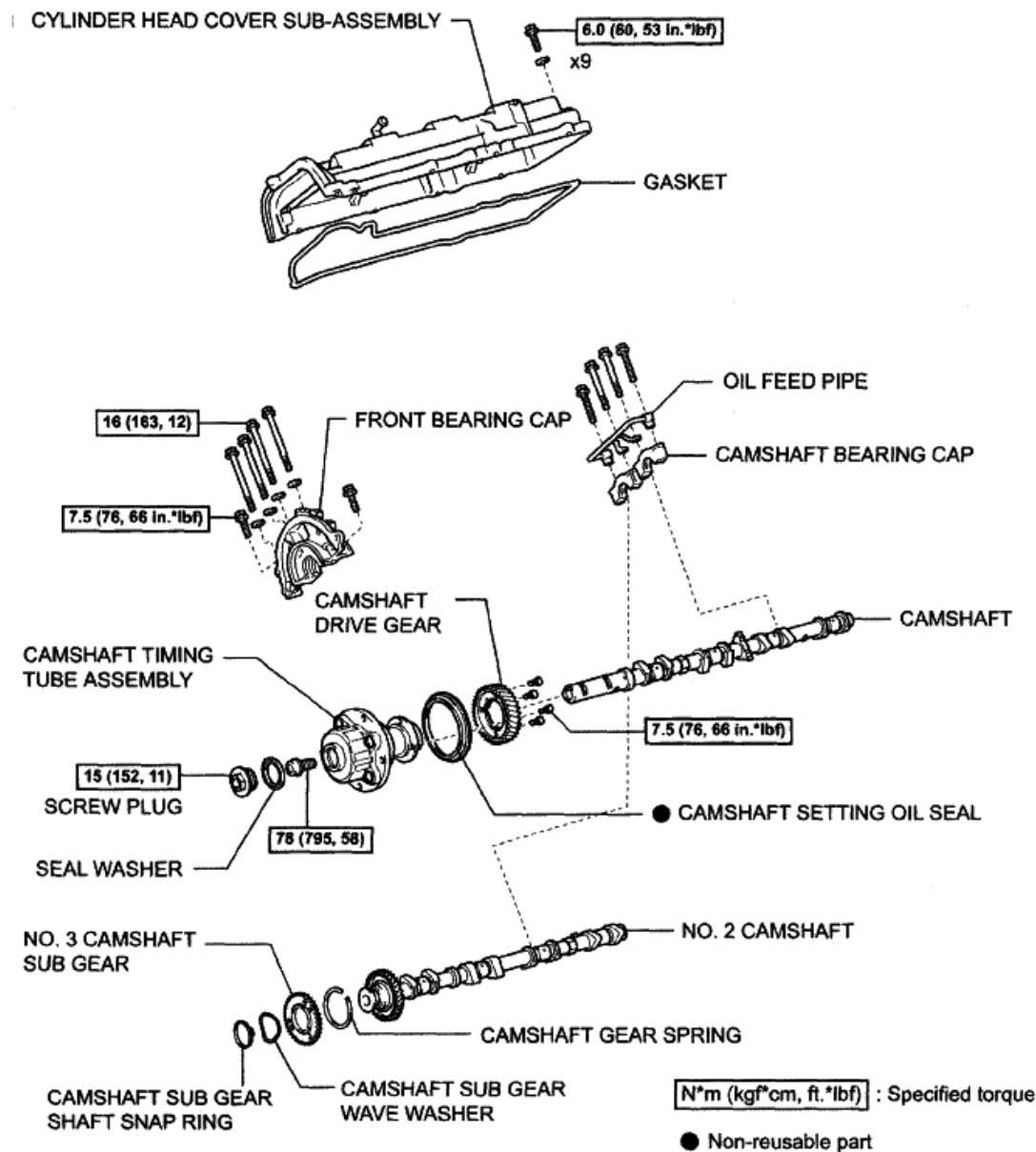
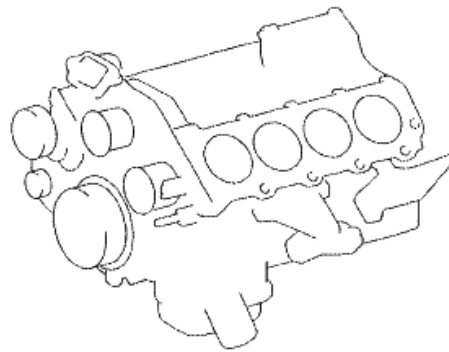
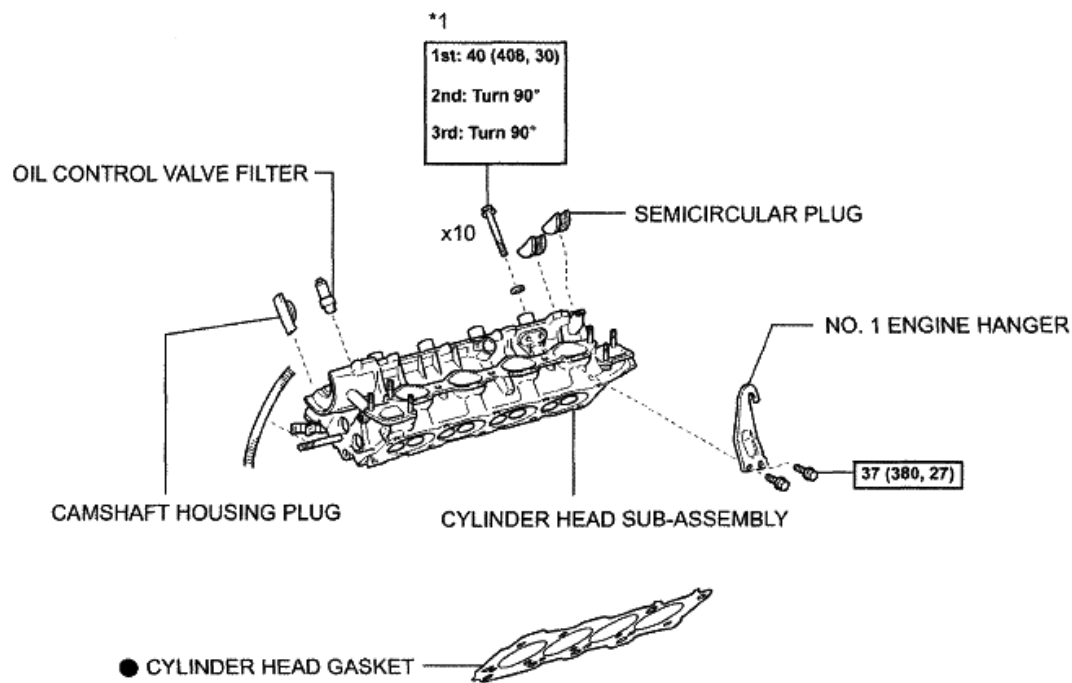


Fig. 256: Identifying Engine Unit Replacement Components With Torque Specifications (5 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



*1: See paragraph REASSEMBLY

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

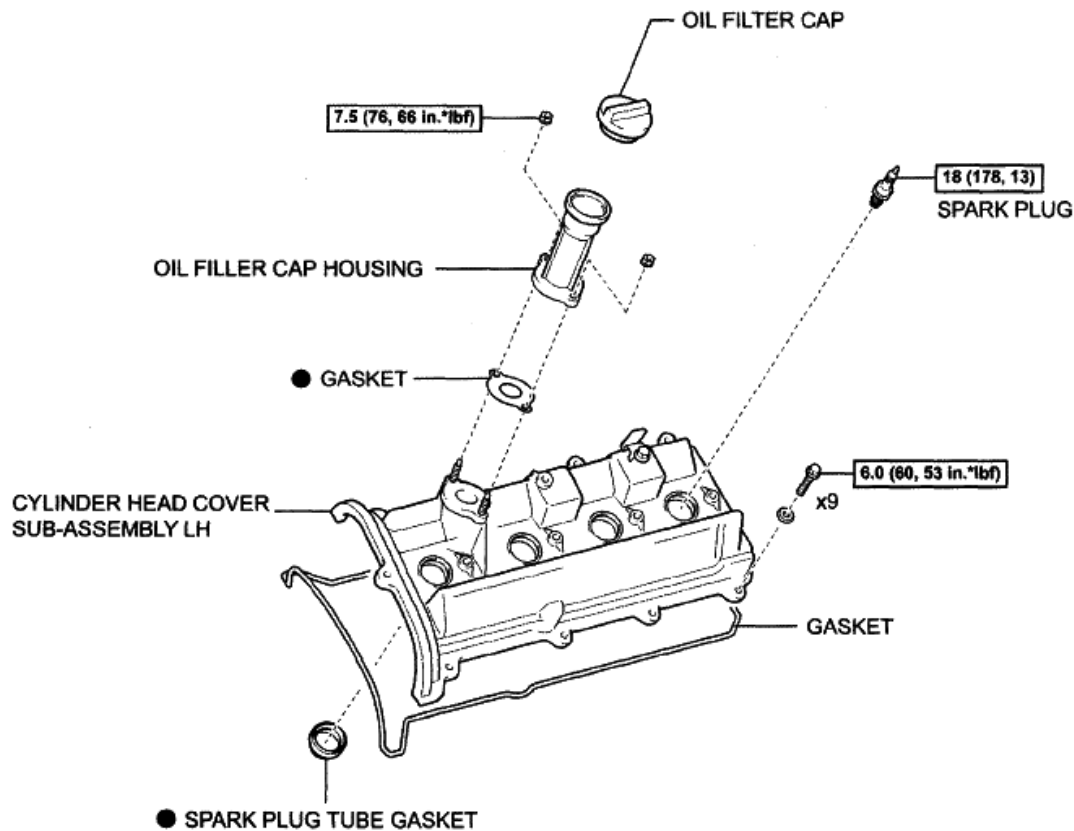
● Non-reusable part

Y

A119829E01

Fig. 257: Identifying Engine Unit Replacement Components (6 Of 13)

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



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

● Non-reusable part

P

A119824E01

Fig. 258: Identifying Engine Unit Replacement Components With Torque Specifications (7 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

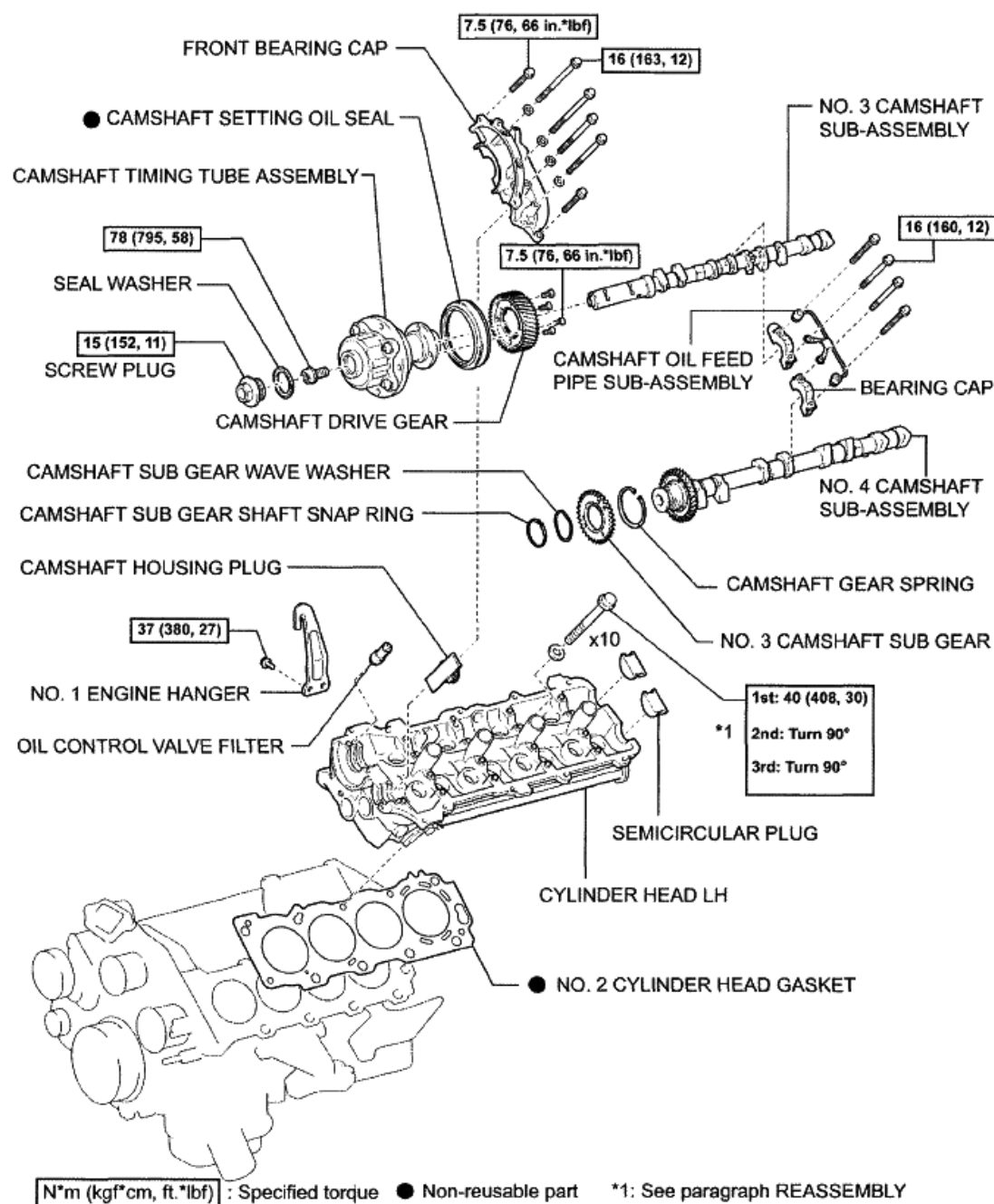
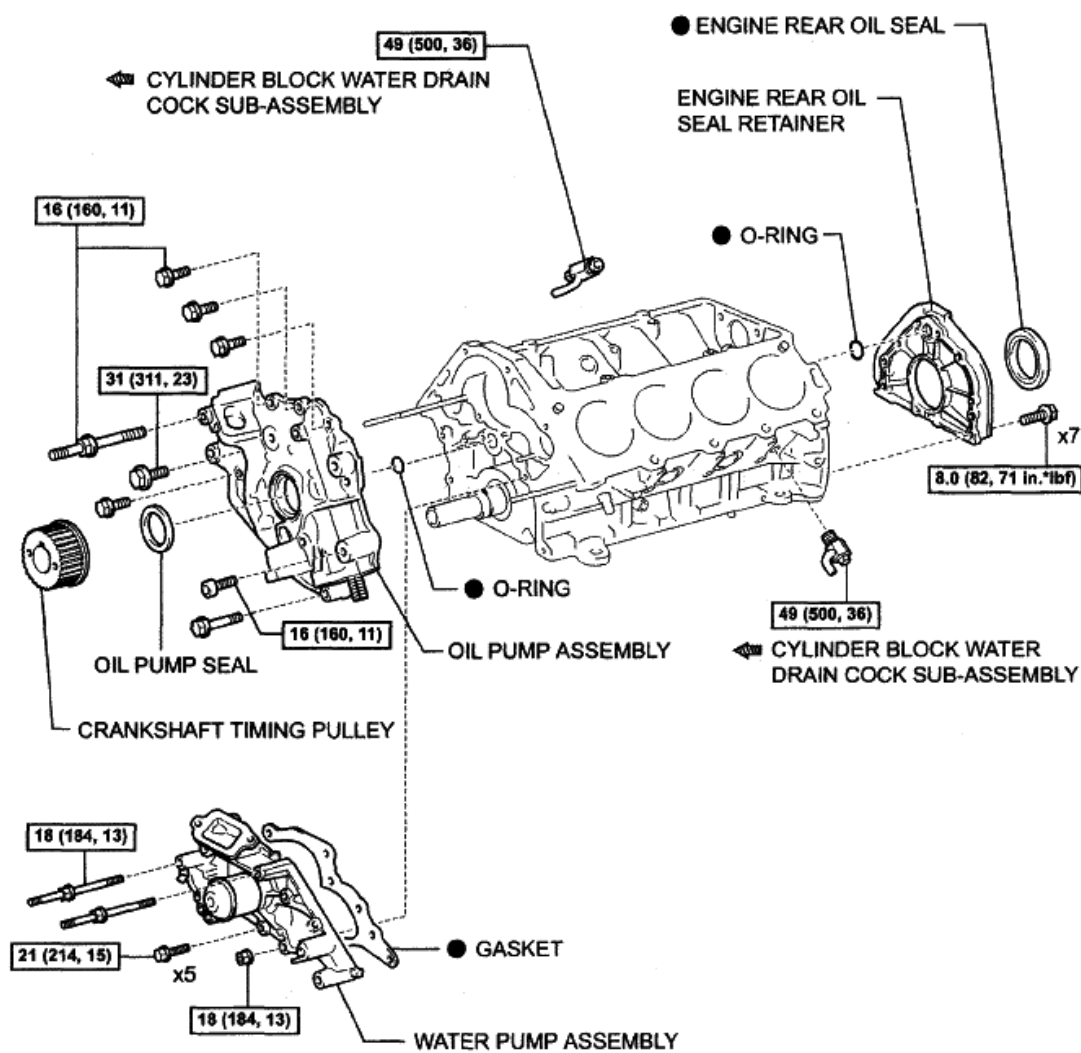


Fig. 259: Identifying Engine Unit Replacement Components With Torque Specifications (8 Of 13)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

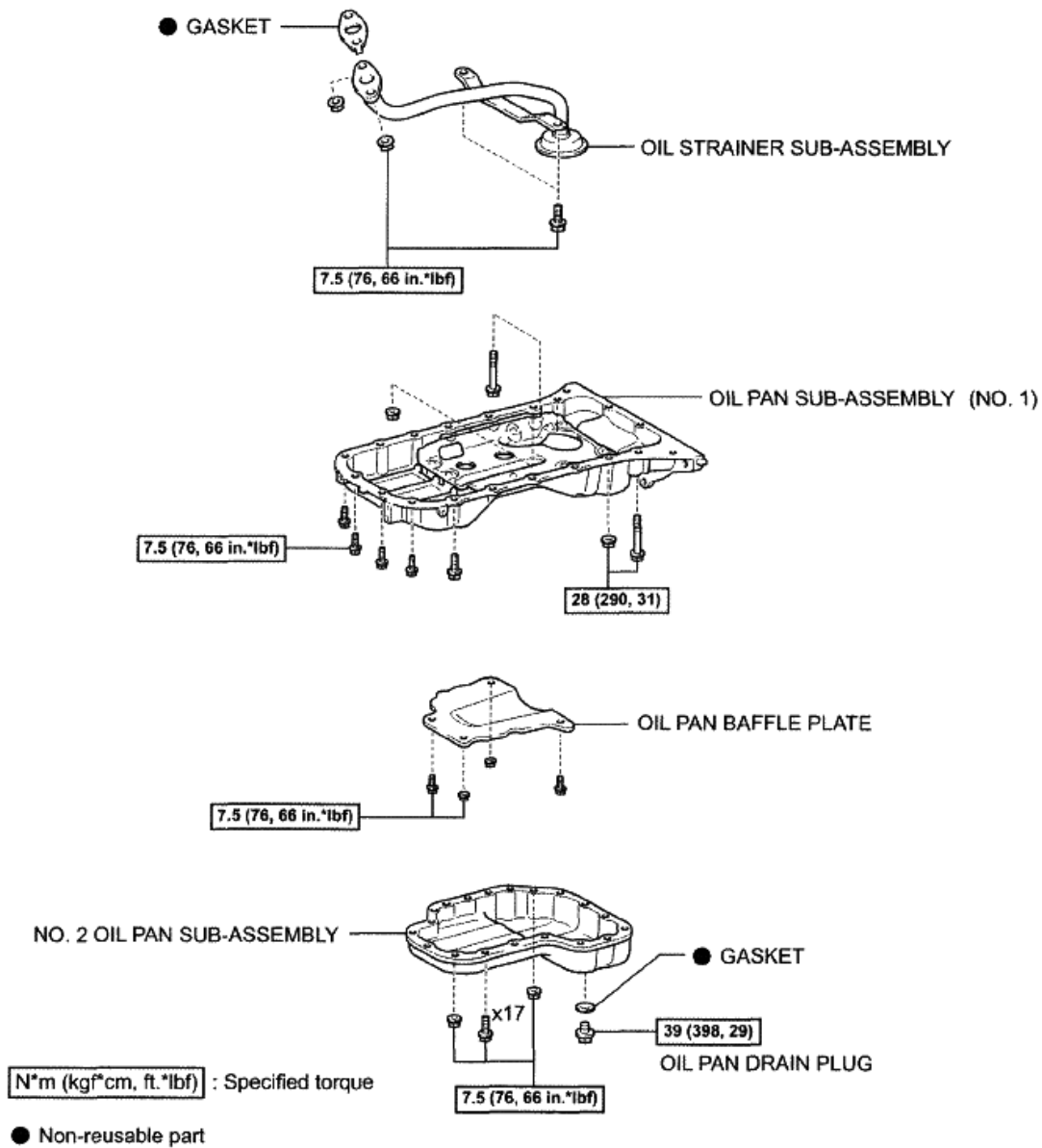


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part ● Precoated part

A119825E02

Fig. 260: Identifying Engine Unit Replacement Components With Torque Specifications (9 Of 13)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A119930E01

Fig. 261: Identifying Engine Unit Replacement Components With Torque Specifications (10 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

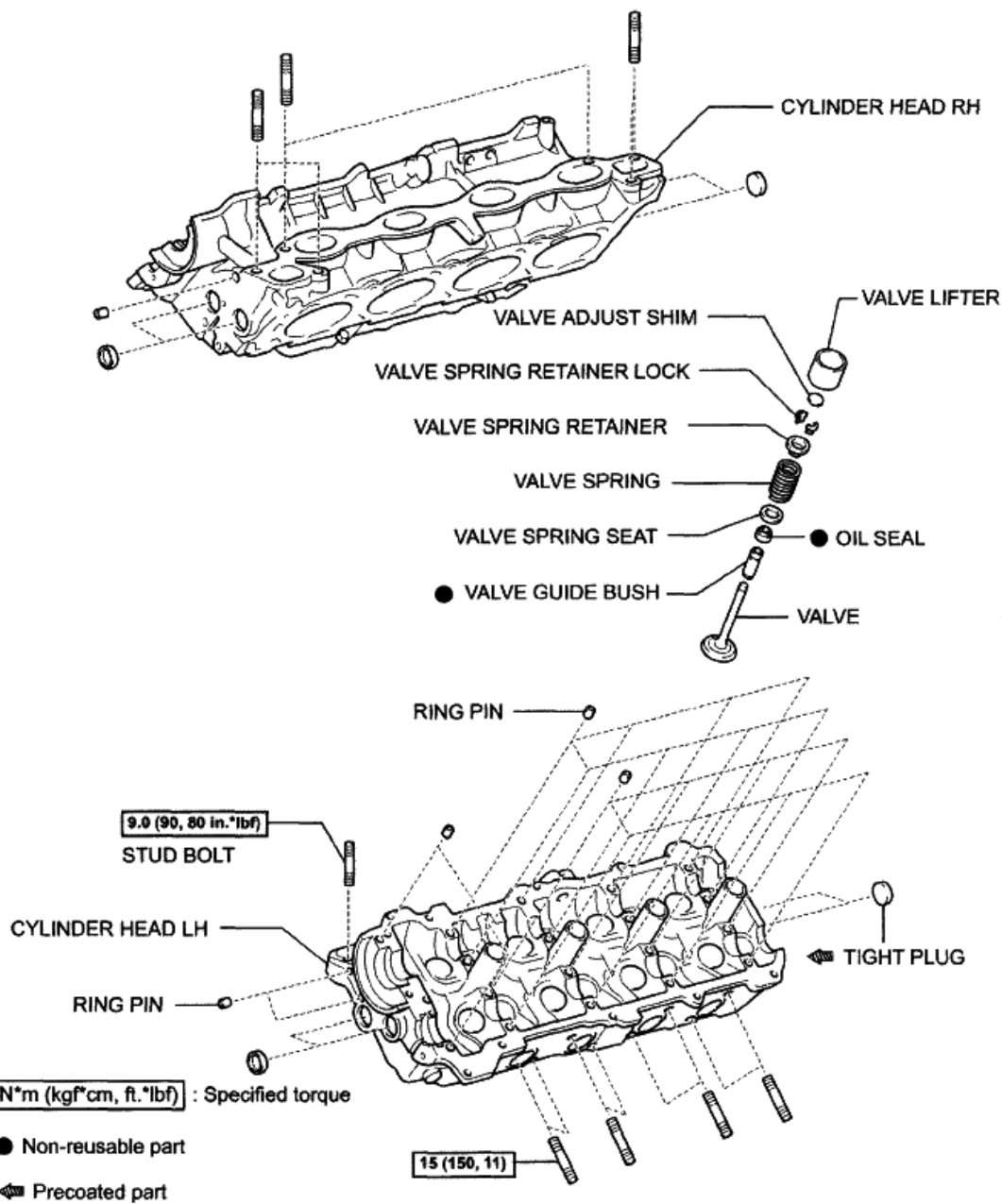
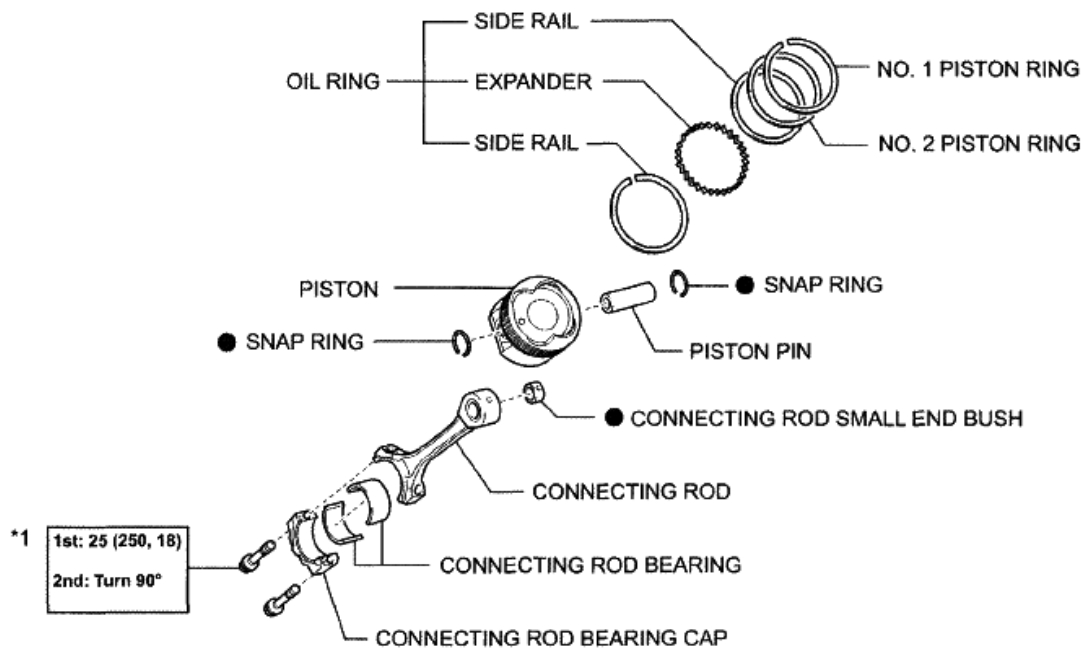


Fig. 262: Identifying Engine Unit Replacement Components With Torque Specifications (11 Of 13)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



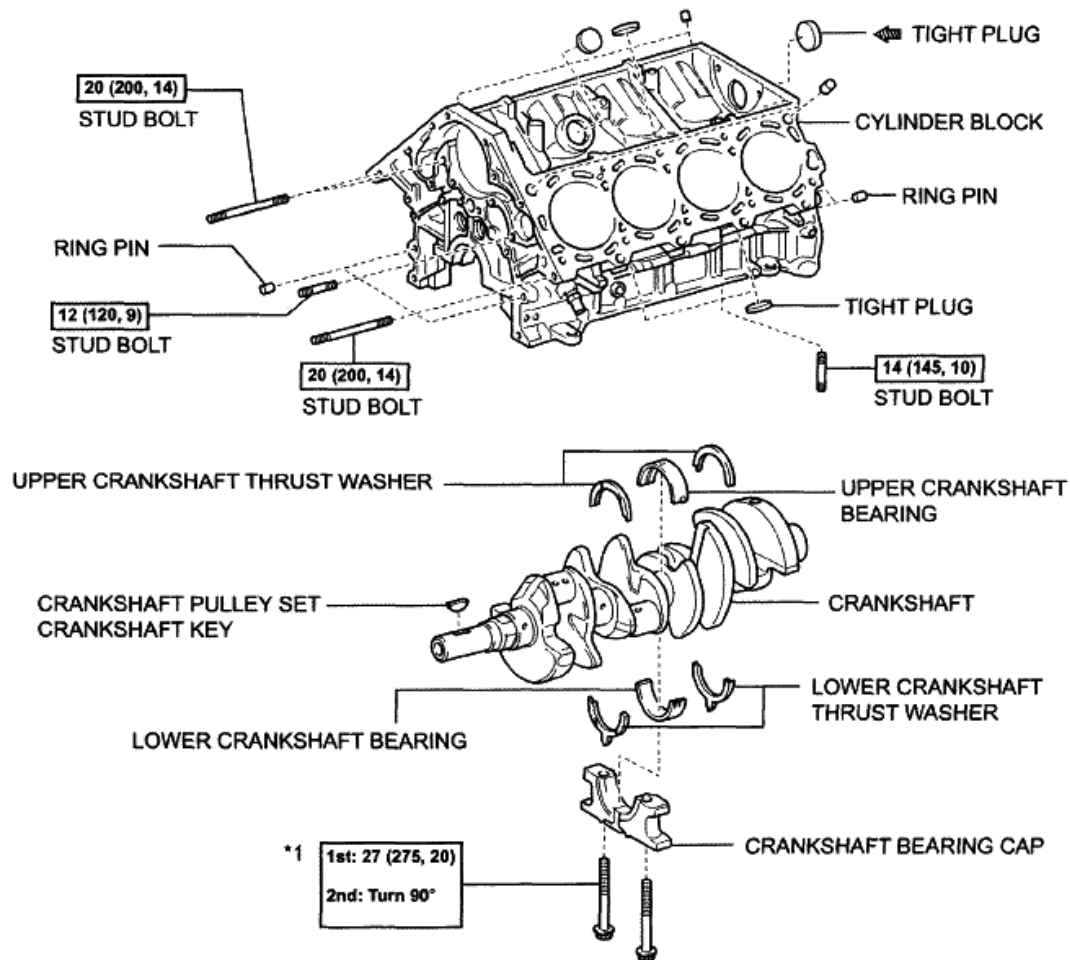
*1: See paragraph REASSEMBLY

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

● Non-reusable part

A119827E04

Fig. 263: Identifying Engine Unit Replacement Components With Torque Specification (12 Of 13)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



*1: See paragraph REASSEMBLY

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

Precoated part

A119931E01

Fig. 264: Identifying Engine Unit Replacement Components With Torque Specifications (13 Of 13)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new ones.

1. REMOVE ENGINE HANGERS

- a. Remove the 4 bolts and engine hangers.

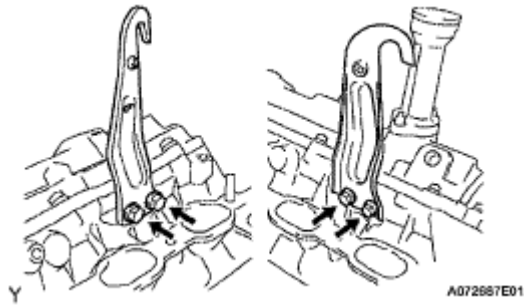


Fig. 265: Identifying Bolts And Engine Hangers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY**
 - a. Remove the 2 water drain cocks.
3. **REMOVE SPARK PLUG**
4. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
5. **REMOVE OIL FILLER CAP HOUSING**
 - a. Remove the 2 nuts and oil filler cap housing.

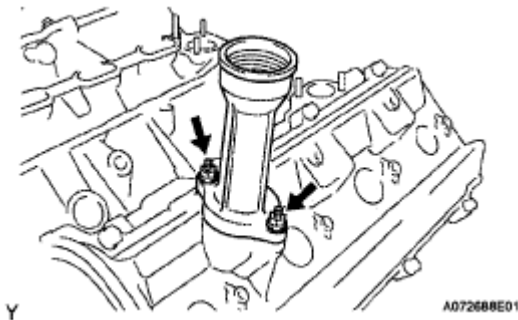


Fig. 266: Identifying Oil Filler Cap Housing Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
 - a. Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.

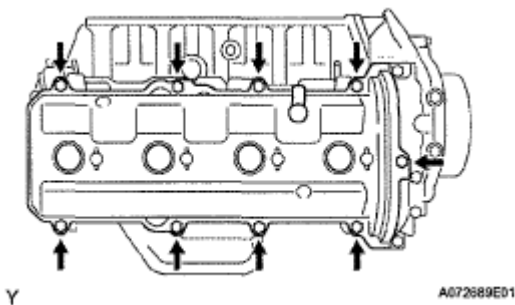


Fig. 267: Identifying Bolts, Seal Washers, Cylinder Head Cover And Gasket

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

7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY LH

- a. Remove the 9 bolts, 9 seal washers, cylinder head cover and gasket.

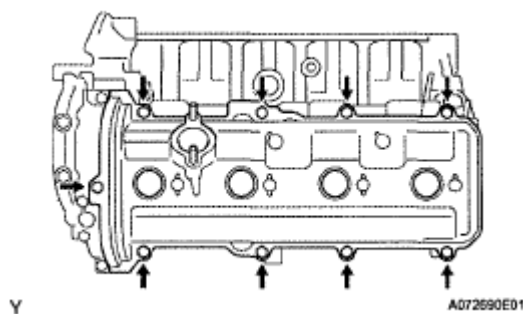


Fig. 268: Identifying Bolts, Seal Washers, Cylinder Head Cover And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY

- a. Remove the pulley bolt, cover plate and idler pulley.

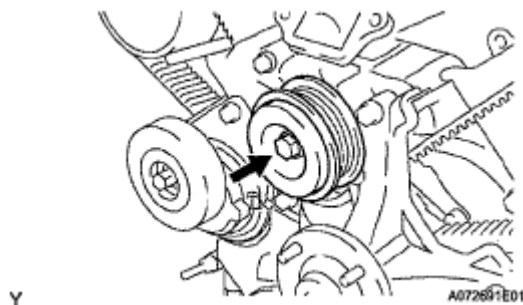


Fig. 269: Identifying Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. REMOVE NO. 2 TIMING BELT COVER SUB-ASSEMBLY

- a. Remove the 2 bolts and timing belt cover.

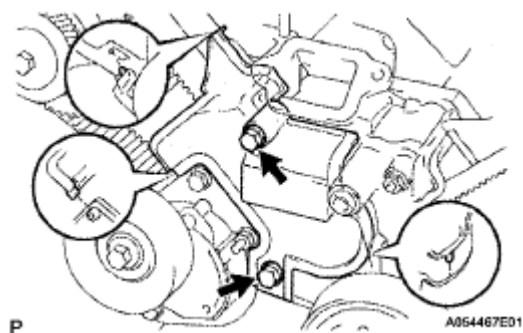


Fig. 270: Identifying Timing Belt Cover With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- a. Remove the bolt, 2 nuts and belt tensioner.

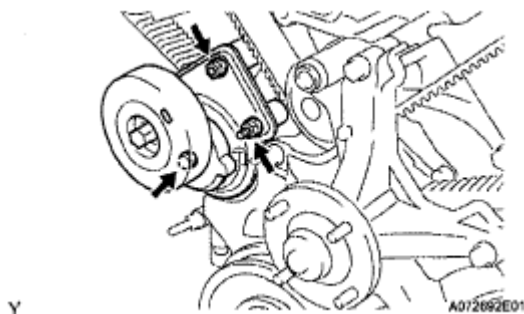


Fig. 271: Identifying Belt Tensioner With Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. REMOVE FAN BRACKET SUB-ASSEMBLY

- a. Remove the 2 bolts, 2 nuts and fan bracket.

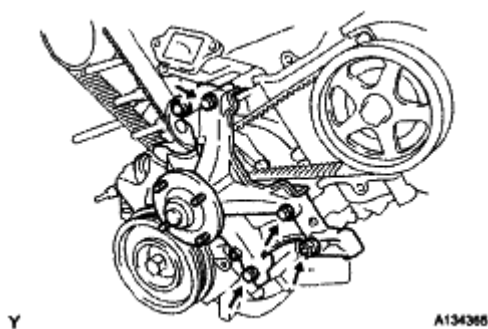


Fig. 272: Identifying Fan Bracket Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. REMOVE CRANKSHAFT DAMPER SUB-ASSEMBLY

- a. Using SST, remove the pulley bolt.

SST 09213-70011 (09213-70020), 09330-00021

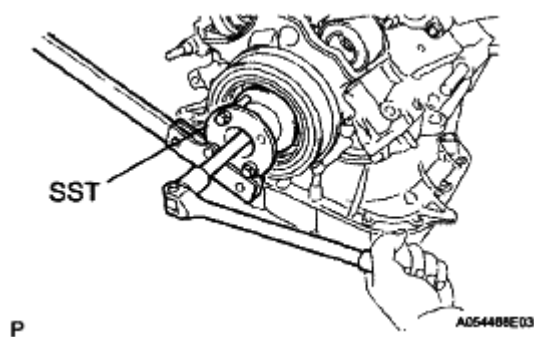


Fig. 273: Identifying Pulley Bolt

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

- b. Using SST, remove the crankshaft pulley.

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

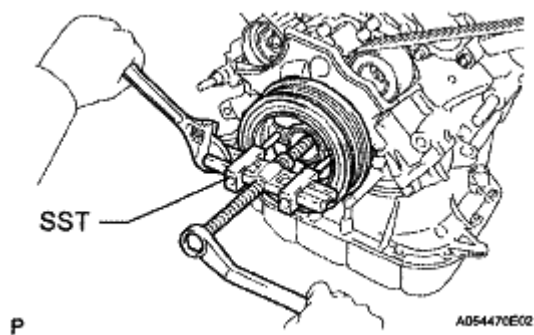


Fig. 274: Identifying Crankshaft Pulley

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

13. REMOVE NO. 1 TIMING BELT COVER

- a. Remove the 4 bolts and timing belt cover.

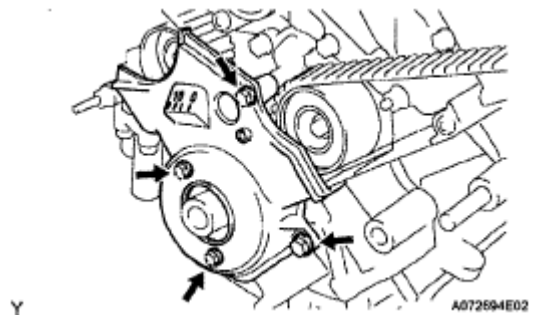


Fig. 275: Identifying Timing Belt Cover With Bolts

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

14. REMOVE TIMING GEAR COVER SPACER

- a. Remove the cover spacer and gasket.

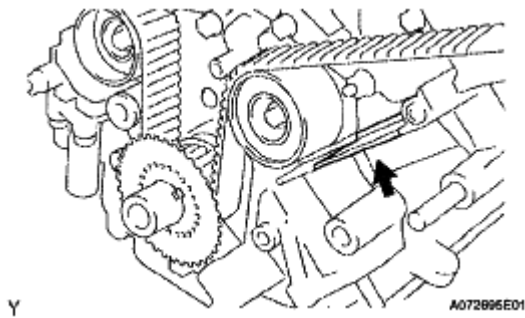


Fig. 276: Identifying Cover Spacer And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE

- a. Remove No. 1 crankshaft position sensor plate.

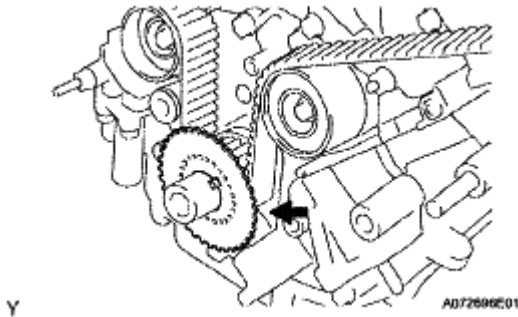


Fig. 277: Identifying Crankshaft Position Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. SET NO. 1 CYLINDER TO TDC / COMPRESSION

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

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

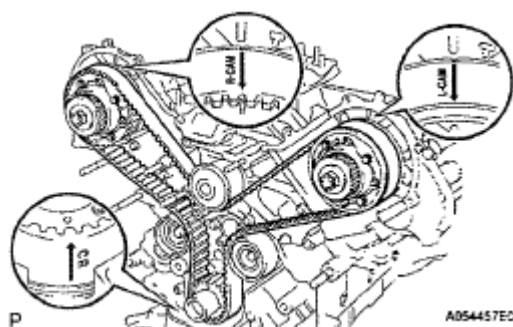


Fig. 278: Identifying Installation Marks On Timing Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

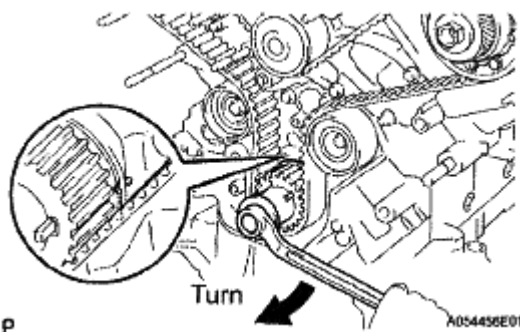


Fig. 279: Turning Crankshaft Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check that the timing marks of the camshaft timing pulleys and timing belt plates are aligned.
- If not, turn the crankshaft 1 complete revolution (360°).

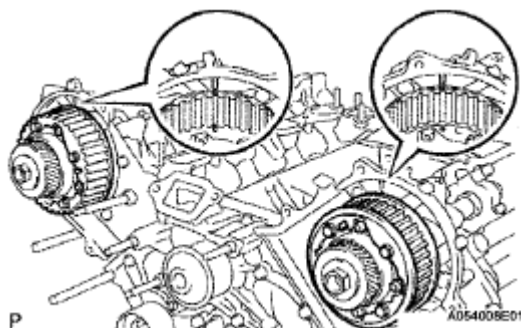


Fig. 280: Identifying Timing Marks Of Camshaft Timing Pulleys And Timing Belt Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. REMOVE TIMING BELT

- a. Set the No. 1 cylinder to approx. 45° BTDC/compression.
 1. Using the crankshaft damper bolt, turn the crankshaft counterclockwise by approx. 45°.

NOTE: If the timing belt is disengaged, having the crankshaft pulley at a wrong angle can cause the piston head and valve head to come into contact with each other when removing the camshaft timing pulley and camshaft, causing damage. So always set the crankshaft pulley at the correct angle.

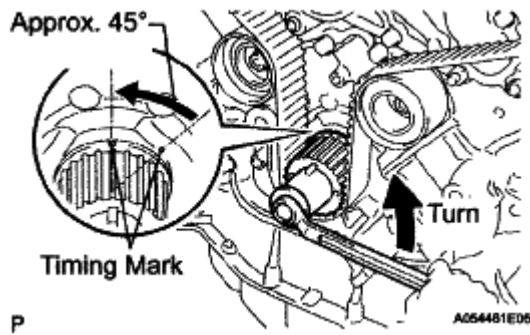


Fig. 281: Identifying Crankshaft Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Alternately loosen the 2 bolts, then remove the bolts, chain tensioner and dust boot.

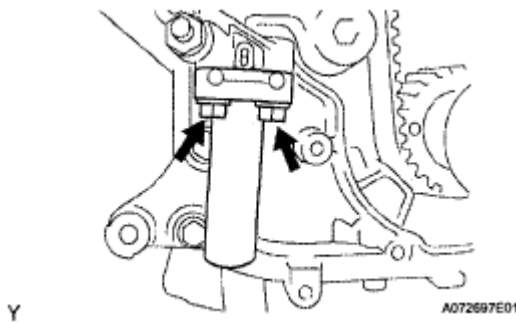


Fig. 282: Identifying Belt Tensioner Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

- d. Disconnect the timing belt from the No. 1 timing belt idler and remove the timing belt.

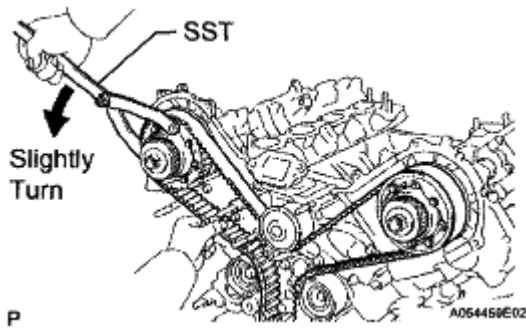


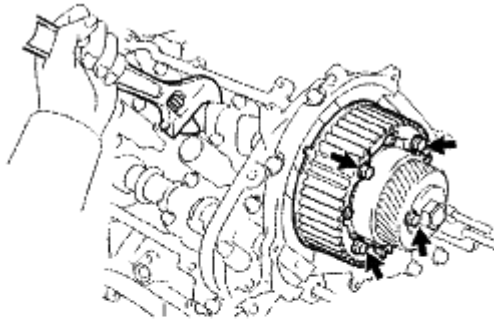
Fig. 283: Identifying Tension Between Camshaft Timing Pulley And Crankshaft Timing Pulley

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

18. REMOVE CAMSHAFT TIMING PULLEYS

- a. Hold the crankshaft with a wrench, and remove the 8 bolts and 2 timing pulleys.

RH Bank:



LH Bank:

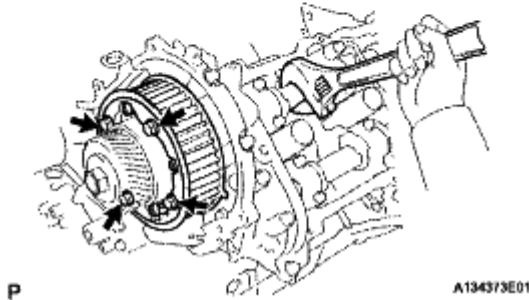


Fig. 284: Identifying Bolts And Timing Pulleys

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

19. REMOVE NO. 1 TIMING BELT IDLER SUB-ASSEMBLY

- a. Using a 10 mm hexagon wrench, remove the bolt, idler and plate washer.

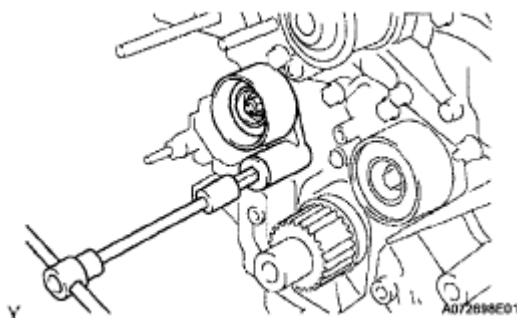


Fig. 285: Identifying Bolt, No. 1 Timing Belt Idler
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. REMOVE NO. 2 TIMING BELT IDLER SUB-ASSEMBLY

- a. Remove the bolt and idler.

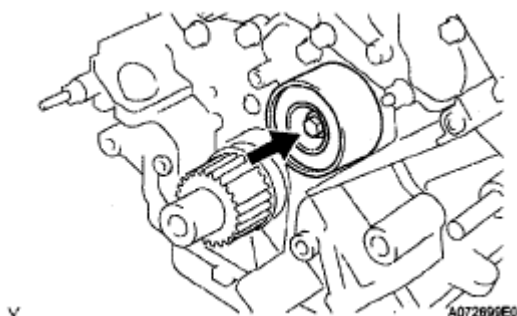


Fig. 286: Identifying Idler With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. REMOVE CRANKSHAFT TIMING PULLEY

- a. Using SST, remove the timing pulley.

SST 09950-50013 (09951 -05010, 09952-05010, 09953-05010, 09953-05020, 09954-05011)

NOTE: Do not turn the timing pulley.

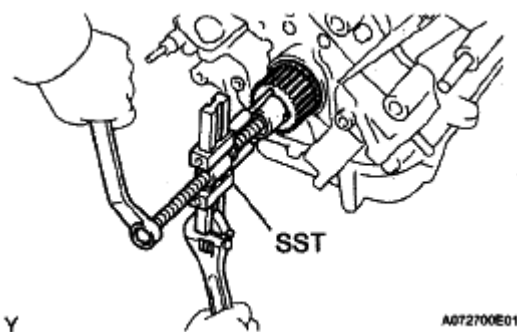


Fig. 287: Identifying Timing Pulley

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

22. REMOVE NO. 2 REAR TIMING BELT PLATE RH

- a. Remove the 2 bolts and No. 2 rear timing belt plate RH.

23. REMOVE REAR TIMING BELT PLATE RH

- a. Remove the bolt, stud bolt and rear timing belt plate RH.

24. REMOVE NO. 2 REAR TIMING BELT PLATE LH

- a. Remove the 2 bolts and No. 2 rear timing belt plate LH.

25. REMOVE REAR TIMING BELT PLATE LH

- a. Remove the bolt and rear timing belt plate LH.

26. REMOVE CAMSHAFTS

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

- a. Remove the camshafts of the RH bank.
 1. In order to install a service bolt to the sub and main gears, turn the camshaft with a wrench. The hexagonal portion of the camshaft is used for turning the camshaft with the wrench.
 2. Secure the sub-gear to the main gear with a service bolt.

Recommended service bolt:

RECOMMENDED SERVICE BOLT

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

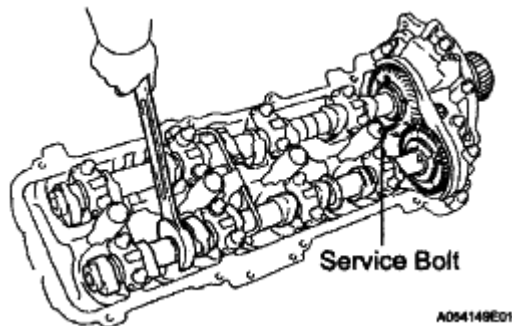


Fig. 288: Identifying Service Bolt

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

HINT:

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

3. Set the timing mark (1-dot mark) of the camshaft main gear at approx. 10° angle by turning the hexagonal portion of the exhaust camshaft with a wrench.

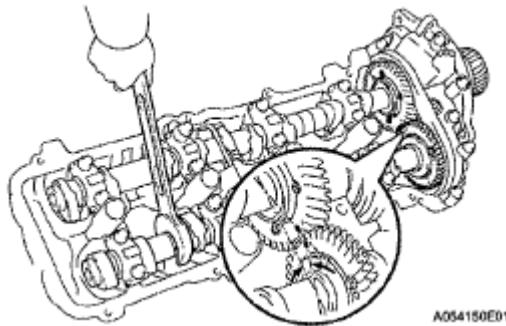


Fig. 289: Identifying Timing Mark (1-Dot Mark) Of Camshaft Main Gear At Approx 10° Angle

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

4. Uniformly loosen the 22 bearing cap bolts in the order shown in the illustration, then remove all the bolts.

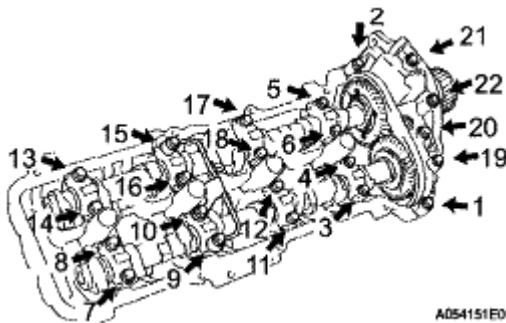


Fig. 290: Identifying Bearing Cap Bolts Loosening Sequence

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

5. Remove the oil feed pipe, 9 bearing caps, oil control valve filter, camshaft housing plug and 2 camshafts.
- b. Remove the camshafts on the LH bank.
 1. In order to install a service bolt to the sub and main gears, turn the camshaft with a wrench. The hexagonal portion of the camshaft is used for turning the camshaft with the wrench.
 2. Secure the sub-gear to the main gear with a service bolt.

Recommended service bolt:

RECOMMENDED SERVICE BOLT

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

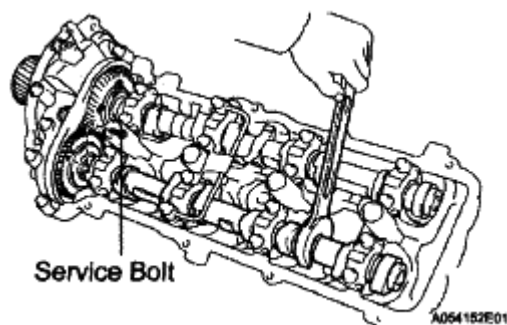


Fig. 291: Identifying Service Bolt

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

HINT:

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

- Align the timing marks (2-dot marks) of the camshaft drive and driven gears by turning the hexagonal portion of the exhaust camshaft with a wrench.

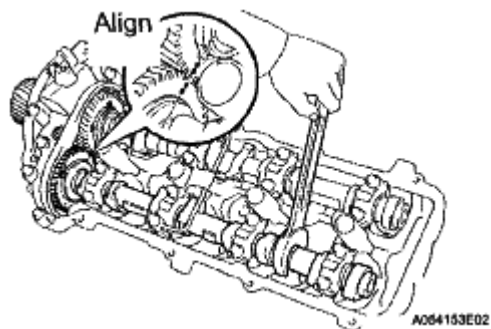


Fig. 292: Identifying Timing Marks Of Camshaft Drive And Driven Gears

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

- Uniformly loosen the 22 bearing cap bolts in the order shown in the illustration, then remove all the bolts.

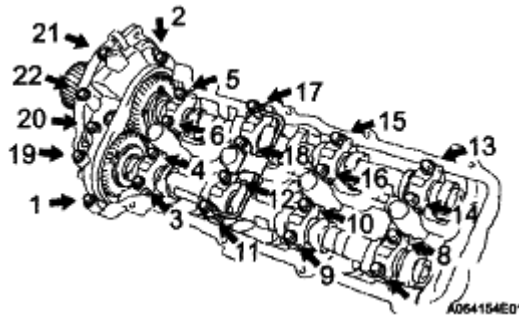


Fig. 293: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Remove the oil feed pipe, 9 bearing caps, oil control valve filter, camshaft housing plug and 2 camshafts.

HINT:

Arrange the bearing caps in the correct order.

27. REMOVE SEMICIRCULAR PLUG

28. REMOVE CYLINDER HEAD SUB-ASSEMBLY

- a. Uniformly loosen the 10 cylinder head bolts on one side of each cylinder head in several steps, in the order shown in the illustration. Likewise, loosen the 10 bolts on the other side. Remove the 20 cylinder head bolts and plate washers.

NOTE:

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

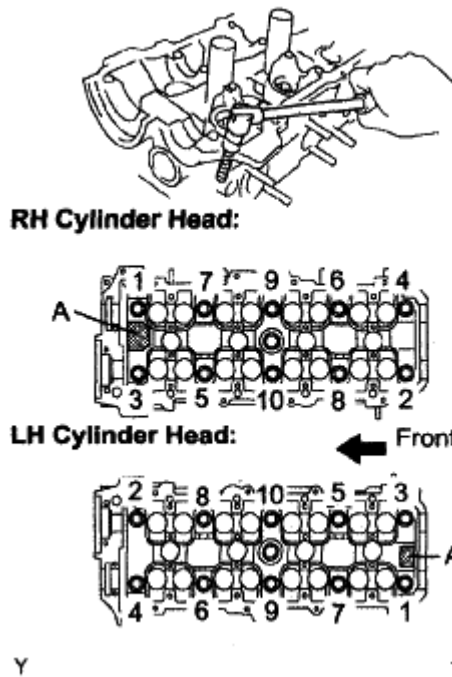


Fig. 294: Identifying Cylinder Head Bolt Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Lift the cylinder head from the dowels on the cylinder block, and place the 2 cylinder heads on wooden blocks on a bench.

NOTE:

- Be careful not to damage the contact surfaces of the cylinder head and cylinder block.
- The cylinder head should not be tilted so as to secure the valve lifter. If the cylinder head is tilted, remove the valve lifter and check that the adjusting shim is set correctly.

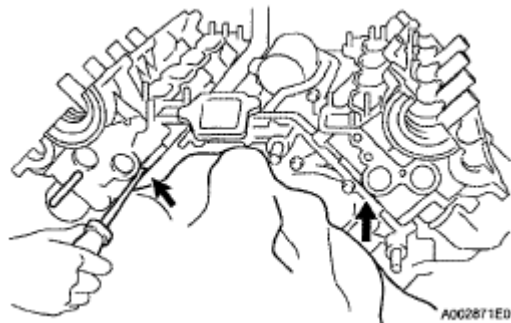


Fig. 295: Identifying Cylinder Head And Cylinder Block With Screwdriver
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

29. REMOVE WATER PUMP ASSEMBLY

- a. Remove the 5 bolts, 2 stud bolts, nut, water pump and gasket.

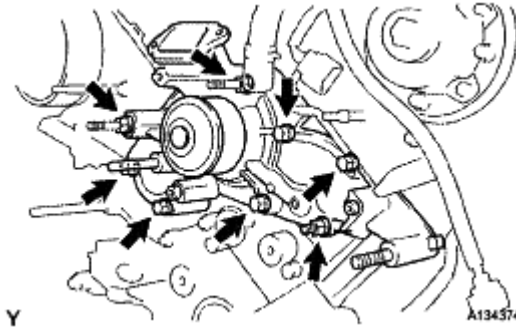


Fig. 296: Identifying Water Pump Assembly

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

30. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY

- a. Remove the 17 bolts and 2 nuts.
- b. Insert the blade of oil pan seal cutter between the oil pan and No. 2 oil pan, and cut off applied sealer.

Remove the No. 2 oil pan.

NOTE:

- Be careful not to damage the contact surface of the oil pan and the No. 2 oil pan.
- Be careful not to damage the No. 2 oil pan flange.

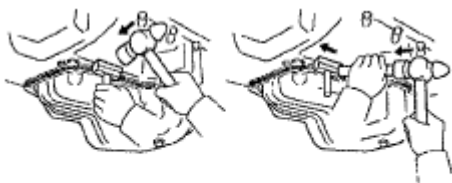


Fig. 297: Identifying No. 2 Oil Pan Sub-Assembly

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

31. REMOVE OIL PAN BAFFLE PLATE NO.1

- a. Remove the 2 bolts, 2 nuts and baffle plate.

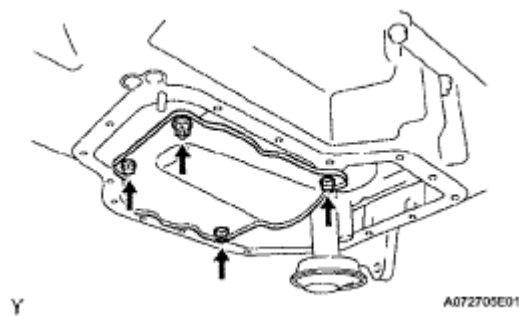


Fig. 298: Identifying Oil Pan Baffle Plate No.1
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. REMOVE OIL PAN SUB-ASSEMBLY

- a. Remove the 18 bolts and 2 nuts.

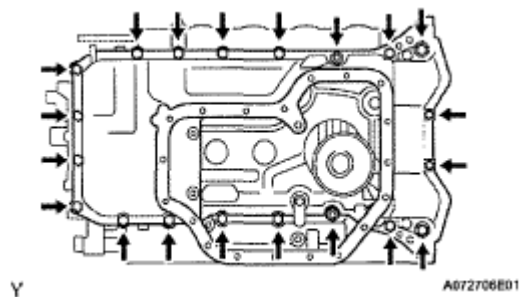
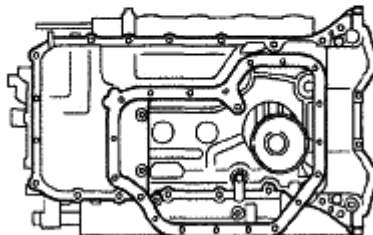
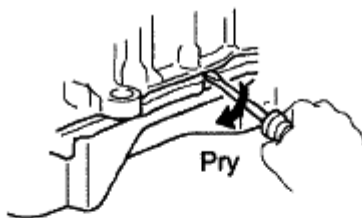


Fig. 299: Identifying Oil Pan Sub-Assembly Bolts And Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver, remove the oil pan by prying between the oil pan and cylinder block in the order shown in the illustration.

NOTE:

- Be careful not to damage the contact surfaces of the cylinder block or oil pan.



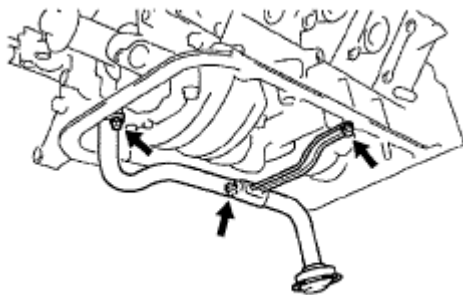
Y

A072707E01

Fig. 300: Identifying Oil Pan And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. REMOVE OIL STRAINER SUB-ASSEMBLY

- a. Remove the 2 bolts, 2 nuts, oil strainer and gasket.



Y

A072708E01

Fig. 301: Identifying Oil Strainer Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. REMOVE OIL PUMP ASSEMBLY

- a. Remove the 7 bolts and stud bolt.

HINT:

Use a 6 mm hexagon wrench to tighten the hexagon head bolt.

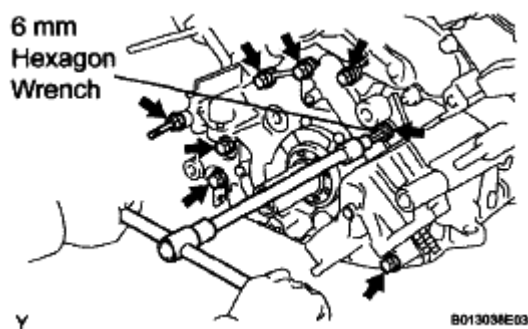


Fig. 302: Identifying Hexagon Head Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver, remove the oil pump by prying the portions between the oil pump and cylinder block.

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

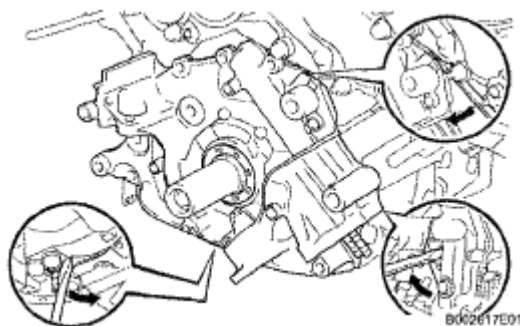


Fig. 303: Identifying Prying Areas For Oil Pump And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the O-ring from the cylinder block.
35. **REMOVE ENGINE REAR OIL SEAL RETAINER**
- a. Remove the 7 bolts.

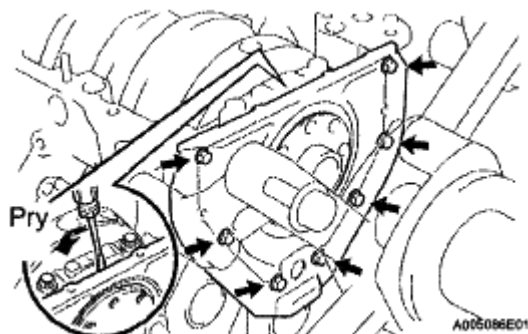


Fig. 304: Identifying Engine Rear Oil Seal Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver, remove the oil seal retainer by prying the portions between the oil seal retainer and crankshaft bearing cap.
- c. Remove the O-ring.

36. REMOVE SPARK PLUG TUBE GASKET

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

NOTE: Be careful not to damage the cylinder head cover. Tape the screwdriver tip.

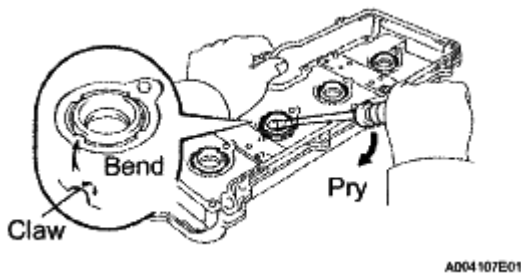


Fig. 305: Identifying Spark Plug Tube Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. REMOVE CAMSHAFT TIMING TUBE ASSEMBLY

- a. Mount the hexagonal portion of the camshaft in a vise.

NOTE:

- Be careful not to damage the camshaft.
- Do not remove the 4 bolts shown in the illustration. If any of them are loosened or removed, the backlash of the gear in the timing tube will go out of adjustment. In this case, replace the timing tube assembly with a new one.

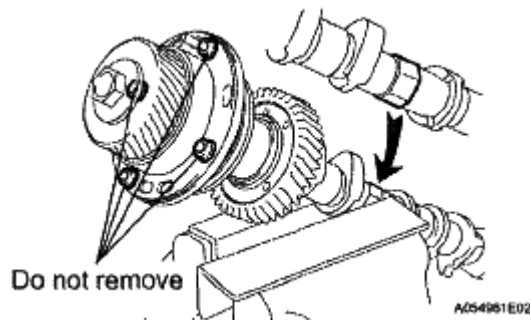


Fig. 306: Identifying Hexagonal Portion Of Camshaft In Vise

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

- b. Remove the screw plug and seal washer.
- c. Using a 10 mm hexagon wrench, and remove the bolt.

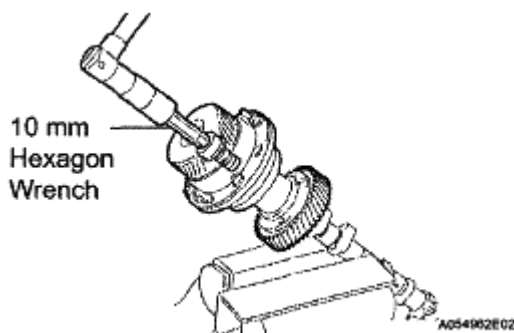


Fig. 307: Identifying Bolt With Hexagon Wrench
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Pull out the timing tube and drive gear assembly from the camshaft.

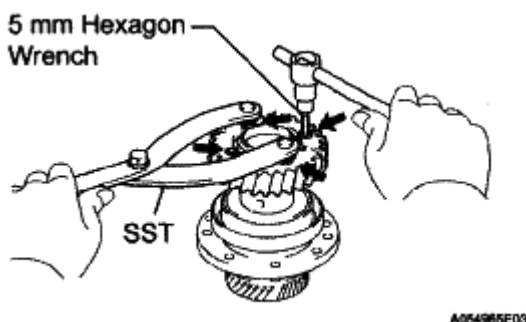


Fig. 308: Identifying Camshaft Timing Tube Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Using SST and a 5 mm hexagon wrench, remove the 4 bolts, drive gear and oil seal.

SST 09960-10010 (09962-01000, 09963-00500)

NOTE: Be careful not to damage the timing tube.

38. REMOVE CAMSHAFT SUB GEAR

- a. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

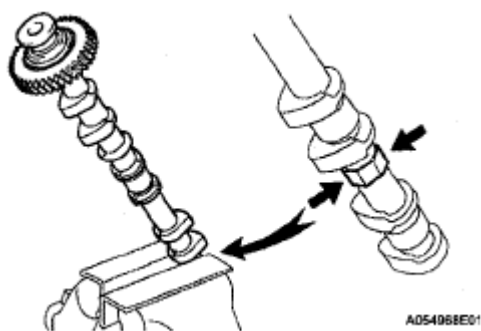


Fig. 309: Identifying Hexagonal Portion Of Camshaft In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, turn the sub gear clockwise, and remove the service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

Recommended service bolt:

RECOMMENDED SERVICE BOLT

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

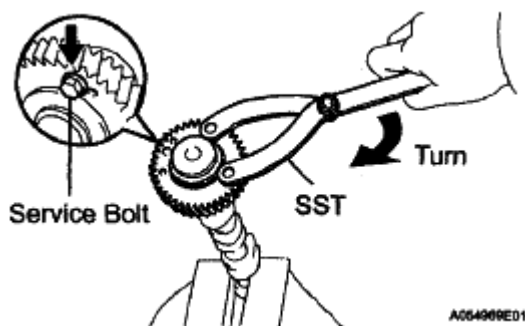
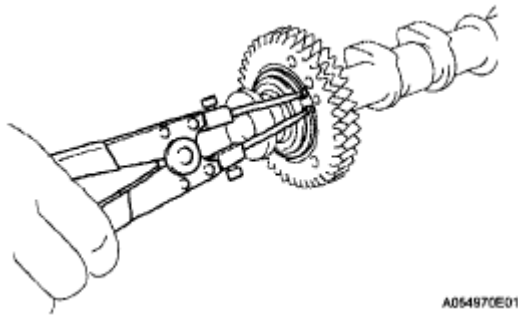


Fig. 310: Identifying Service Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using snap ring pliers, remove the snap ring.

**Fig. 311: Identifying Snap Ring**

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

- d. Remove the wave washer, sub gear and gear spring.

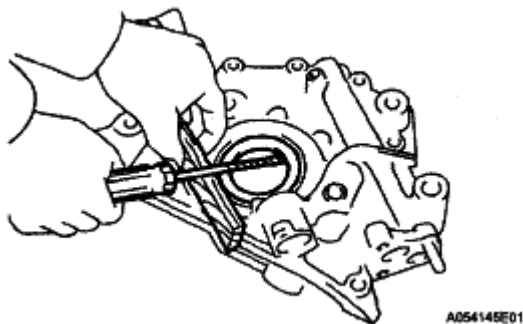
HINT:

Arrange the camshaft sub gears and gear spring (RH and LH sides).

39. REMOVE OIL PUMP SEAL

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

NOTE: Be careful not to damage the oil pump body. Tape the screwdriver tip.

**Fig. 312: Identifying Oil Pump Seal**

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

40. REMOVE ENGINE REAR OIL SEAL

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

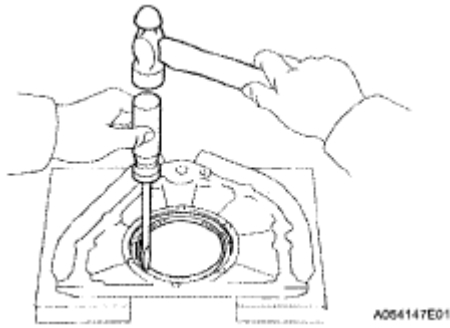


Fig. 313: Identifying Tapping Out Oil Seal
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. REMOVE VALVE LIFTER

- a. Remove the valve lifter and adjusting shim.

HINT:

Arrange the valve lifters and shims in the correct order.

42. REMOVE INTAKE VALVE

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

SST 09202-70020 (09202-00010, 09202-01010)

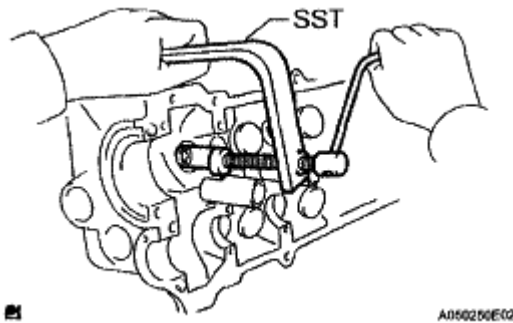


Fig. 314: Identifying Intake Valve
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the spring retainer, valve spring, valve and spring seat.

HINT:

Arrange the valves, valve springs, spring seats and spring retainers in the correct order.

43. REMOVE EXHAUST VALVE

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

SST 09202-70020 (09202-00010, 09202-01010)

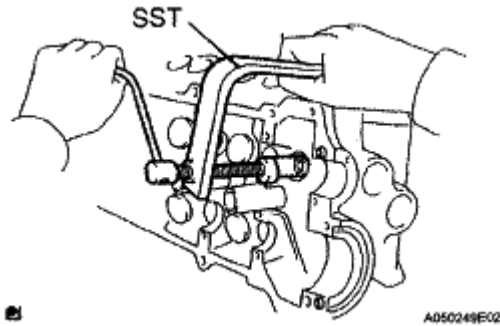


Fig. 315: Identifying Exhaust Valve

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

- b. Remove the spring retainer, valve spring, valve and spring seat.

HINT:

Arrange the valves, valve springs, spring seats and spring retainers in the correct order.

44. REMOVE VALVE STEM OIL SEAL

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



Fig. 316: Identifying Oil Seal

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

45. INSPECT CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance: 0.160 to 0.290 mm (0.0063 to 0.0114 in.)

Maximum thrust clearance: 0.35 mm (0.0138 in.)

If the thrust clearance is greater than the maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

Connecting rod thickness (Reference): 22.880 to 22.920 mm (0.9008 to 0.9024 in.)

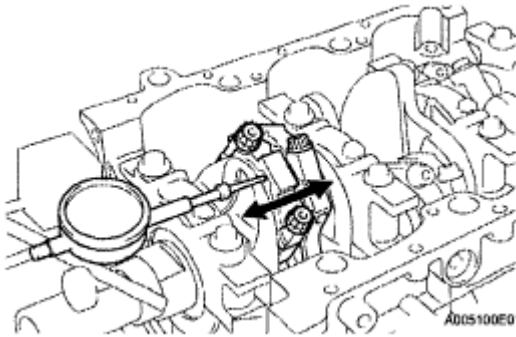


Fig. 317: Identifying Connecting Rod Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. INSPECT CONNECTING ROD OIL CLEARANCE

- a. Check the matchmarks on the connecting rod and cap to ensure correct reassembly.
- b. Remove the 2 connecting rod cap bolts.

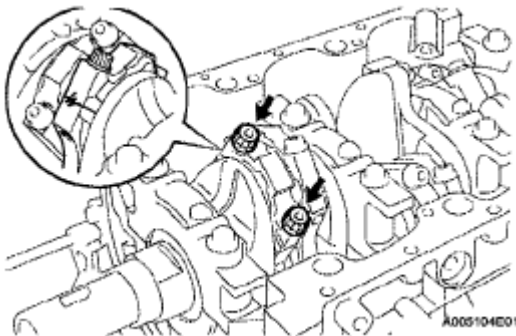


Fig. 318: Identifying Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using the removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:

Keep the lower bearing inserted with the connecting rod cap.

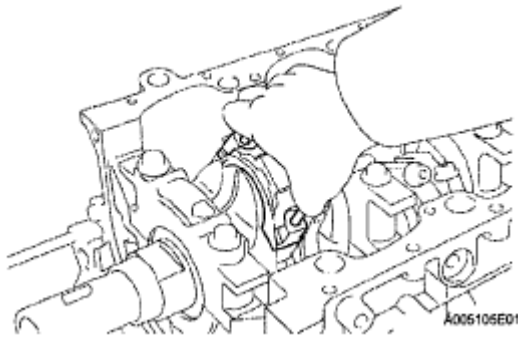


Fig. 319: Removing Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

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

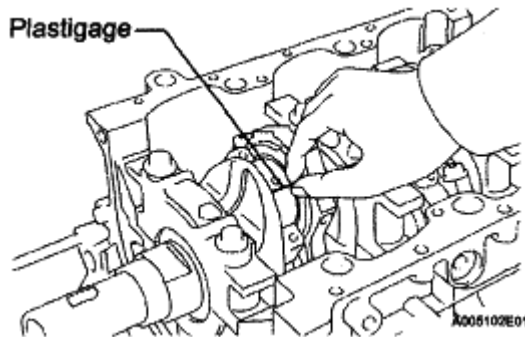


Fig. 320: Laying Strip Of Plastigage With Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Match the numbered connecting rod cap with the connecting rod.
- h. Align the pin groove of the connecting rod cap with the pins of the connecting rod, and install the connecting rod cap.

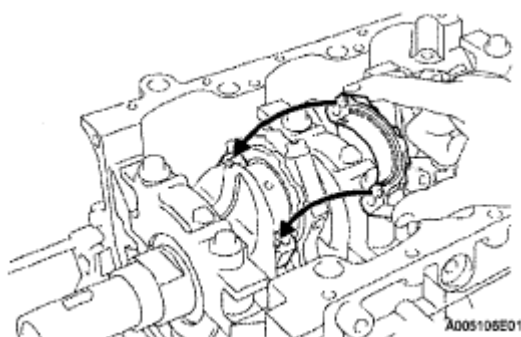


Fig. 321: Identifying Pin Groove Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Check that the outside mark of the connecting rod cap is facing in the correct direction.

HINT:

- The connecting rod cap bolts are tightened in 2 progressive steps.
- If any one of the connecting rod cap bolts is broken or deformed, replace it.

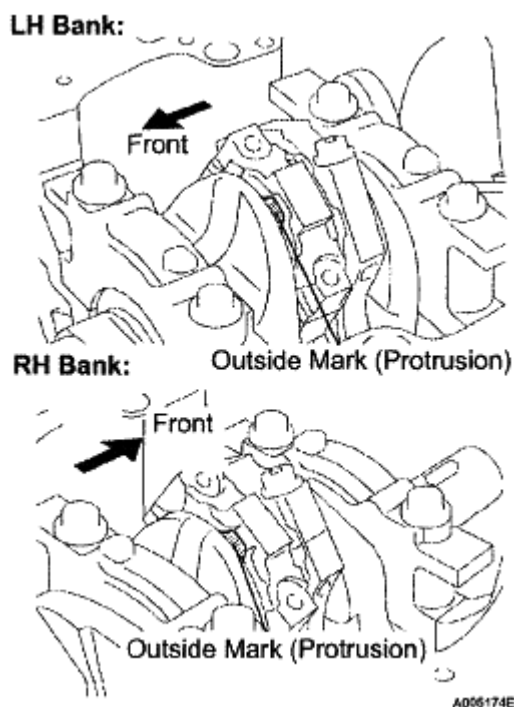


Fig. 322: Identifying Outside Mark Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Apply a light coat of engine oil to the threads and under the heads of the connecting rod cap bolts.
- k. Install and alternately tighten the 2 connecting rod cap bolts in several steps.

Torque: 25 N*m (250 kgf*cm, 18 ft.*lbf)

NOTE: Do not turn the crankshaft.

If any one of the connecting rod cap bolts does not meet the torque specification, replace the connecting rod cap bolts.

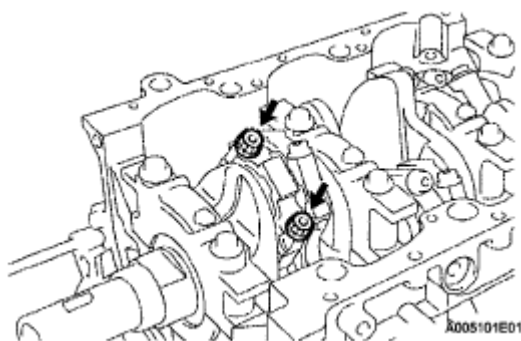


Fig. 323: Identifying Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- l. Mark the front of the connecting cap bolts with paint.
- m. Retighten the cap bolts 90° as shown in the illustration.

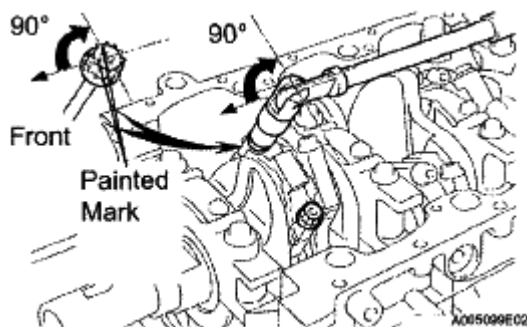
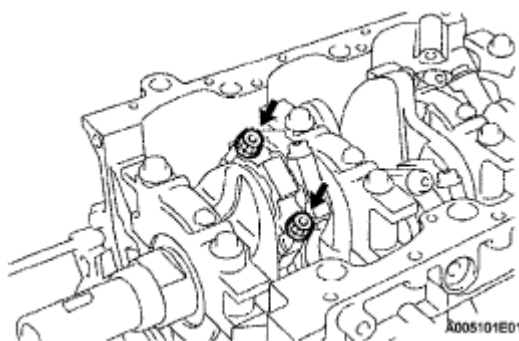


Fig. 324: Retightening Cap Bolts An Additional 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- n. Check that the painted mark is now at a 90° angle to the front.
- o. Remove the 2 bolts, connecting rod cap and lower bearing.

**Fig. 325: Identifying Connecting Rod Cap Bolts**

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

- p. Measure the Plastigage at its widest point.

Standard oil clearance: 0.021 to 0.047 mm (0.0008 to 0.0019 in.)

Maximum oil clearance: 0.065 mm (0.0026 in.)

If the oil clearance is greater than the maximum, replace the bearings. If necessary, replace the crankshaft.

HINT:

If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, add together the numbers imprinted on the connecting rod cap and crankshaft, then select the bearing with the same number as the total. There are 6 sizes of standard bearings, marked "2", "3", "4", "5", "6" and "7".

MAXIMUM OIL CLEARANCE

Item	Number Mark					
Connecting rod cap	1	1	2	1	2	3
Crankshaft	1	2	1	3	2	1
Use bearing	2	3	4	5	6	7

EXAMPLE:

Connecting rod cap "3" + Crankshaft "1" = Total number 4 (Use bearing "4")

Connecting rod big end inside diameter:

CONNECTING ROD BIG END INSIDE DIAMETER

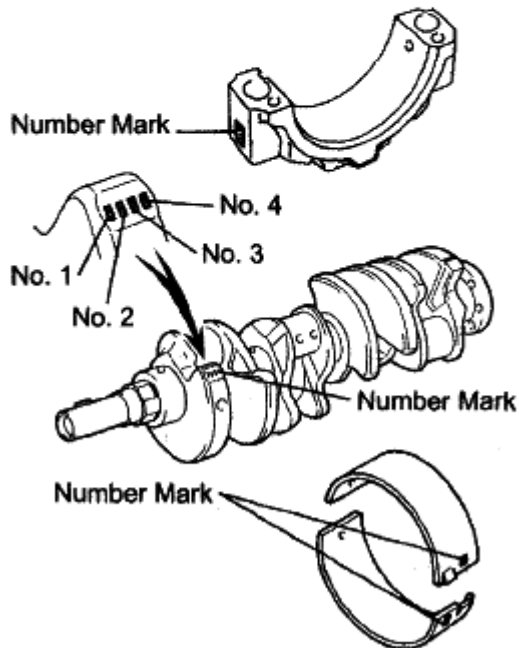
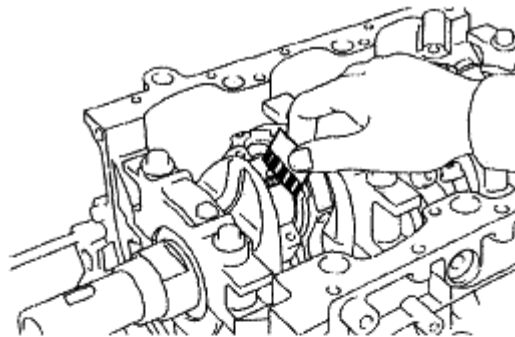
Mark "1"	55.000 to 55.006 mm (2.1654 to 2.1656 in.)
Mark "2"	55.006 to 55.012 mm (2.1656 to 2.1658 in.)
Mark "3"	55.012 to 55.018 mm (2.1658 to 2.1661 in.)

Mark "4"	55.018 to 55.024 mm (2.1661 to 2.1663 in.)
----------	--

Crankshaft crank pin diameter:

CRANKSHAFT CRANK PIN DIAMETER

Mark "1"	51.994 to 52.000 mm (2.0470 to 2.0472 in.)
Mark "2"	51.988 to 51.994 mm (2.0468 to 2.0470 in.)
Mark "3"	51.982 to 51.988 mm (2.0465 to 2.0468 in.)



A139602E01

Fig. 326: Identifying Plastigage With Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard sized bearing center wall thickness:

STANDARD SIZED BEARING CENTER WALL THICKNESS

--	--

Mark "2"	1.487 to 1.490 mm (0.0585 to 0.0587 in.)
Mark "3"	1.490 to 1.493 mm (0.0587 to 0.0588 in.)
Mark "4"	1.493 to 1.496 mm (0.0588 to 0.0589 in.)
Mark "5"	1.496 to 1.499 mm (0.0589 to 0.0590 in.)
Mark "6"	1.499 to 1.502 mm (0.0590 to 0.0591 in.)
Mark "7"	1.502 to 1.505 mm (0.0591 to 0.0593 in.)

q. Completely remove the Plastigage.

47. REMOVE PISTON AND CONNECTING ROD

a. Using a ridge reamer, remove all the carbon from the top of the cylinder.

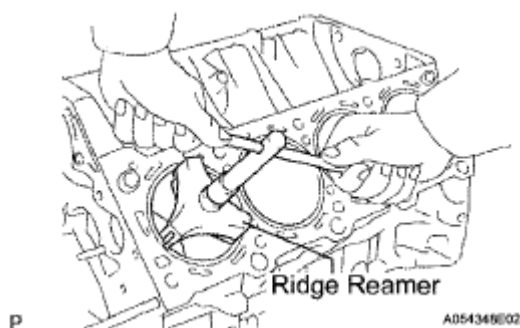


Fig. 327: Using Ridge Reamer To Remove Carbon
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

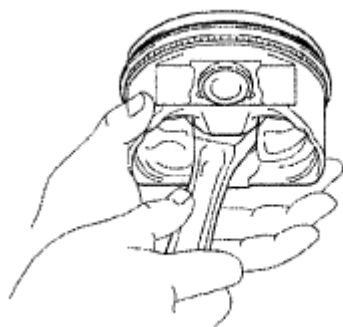
HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

48. REMOVE PISTON

- a. Check the fitting condition between the piston and piston pin.
1. Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.



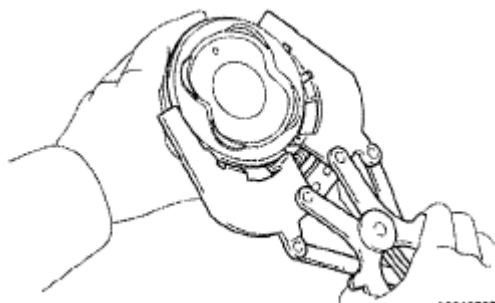
A004862E01

Fig. 328: Identifying Piston And Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

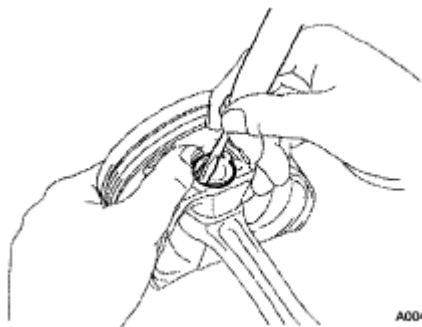
Arrange the piston rings in the correct order.



A004873E01

Fig. 329: Identifying No. 1 And No. 2 Piston Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a screwdriver, pry out the 2 snap rings.



A004869E01

Fig. 330: Identifying Prying Out Snap Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Gradually heat the piston to approx. 60°C (140°F).

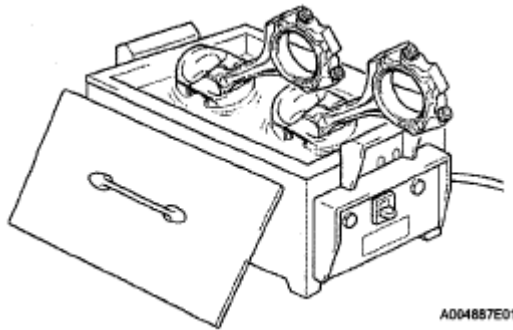


Fig. 331: Heating Piston

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

- f. Using a plastic hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

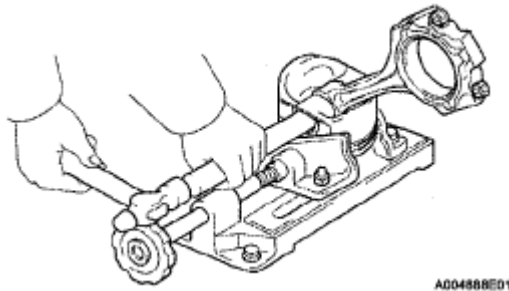


Fig. 332: Removing Connecting Rod

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

49. INSPECT CRANKSHAFT THRUST CLEARANCE

- a. Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance: 0.020 to 0.220 mm (0.0008 to 0.0087 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

If the thrust clearance is greater than the maximum, replace the thrust washers as a set.

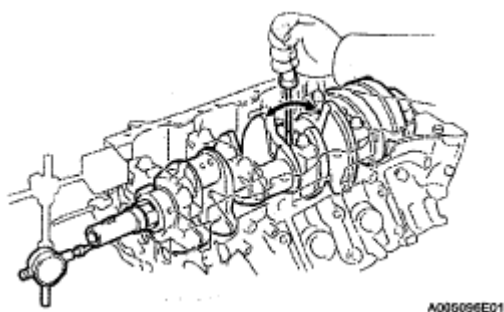


Fig. 333: Identifying Crankshaft Thrust Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Thrust washer thickness

THRUST WASHER THICKNESS

STD	2.440 to 2.490 mm (0.0961 to 0.0980 in.)
O/S 0.125	2.503 to 2.553 mm (0.0985 to 0.1005 in.)

50. INSPECT CRANKSHAFT OIL CLEARANCE

- a. Uniformly loosen and remove the 10 crankshaft bearing cap bolts in several steps, in the order shown in the illustration.

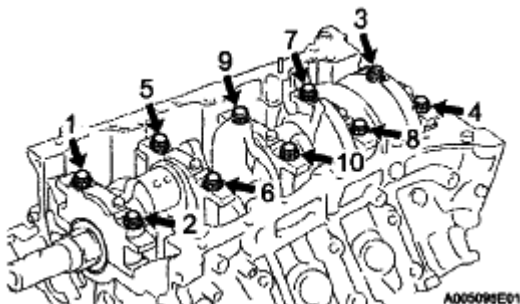


Fig. 334: Identifying Crankshaft Bearing Cap Bolts Loosening Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using 2 screwdrivers, pry out the crankshaft bearing cap, and remove the 5 crankshaft bearing caps, 5 lower bearings and 2 lower thrust washers (No. 3 crankshaft bearing cap only).

NOTE: Be careful not to damage the cylinder block.

HINT:

- Keep the lower bearing and crankshaft bearing cap together.
- Arrange the crankshaft bearing caps and lower thrust washers in the correct order.

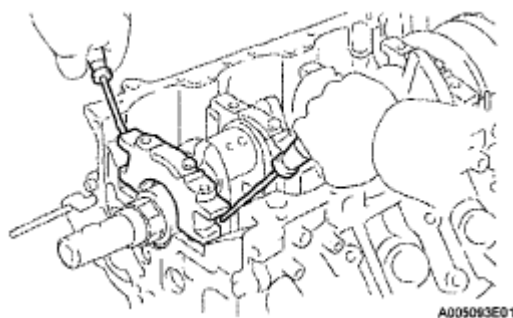


Fig. 335: Identifying Prying Out Crankshaft Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Lift out the crankshaft.
- d. Remove the 2 upper thrust washers.

HINT:

- Arrange the upper thrust washers in the correct order.
- Keep the upper bearings together with the cylinder block.
- e. Clean each crankshaft journal and bearing.
- f. Check each crankshaft journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

- g. Place the crankshaft on the cylinder block.
- h. Lay a strip of Plastigage across each journal.

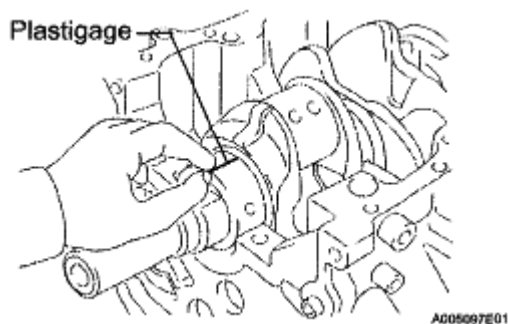


Fig. 336: Laying Strip Of Plastigage Across Each Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Install the 5 crankshaft bearing caps in their proper locations.

HINT:

- The crankshaft bearing cap bolts are tightened in 2 progressive steps (Procedures "A" and

"B").

- If any one of the main bearing cap bolts is broken or deformed, replace it.

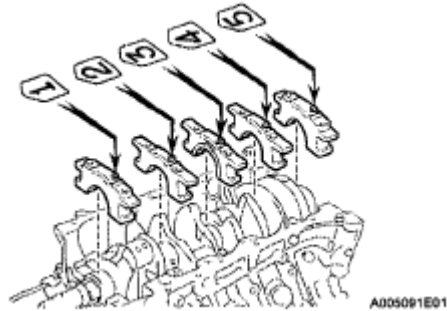


Fig. 337: Identifying Crankshaft Bearing Caps In Proper Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Apply a light coat of engine oil to the threads and under the heads of the crankshaft bearing cap bolts.
- Install and uniformly tighten the 10 crankshaft bearing cap bolts in several steps, in the order shown in the illustration (Procedure "A").

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

NOTE: Do not turn the crankshaft.

If any one of the crankshaft bearing cap bolts does not meet the torque specification, replace the crankshaft bearing cap bolt.

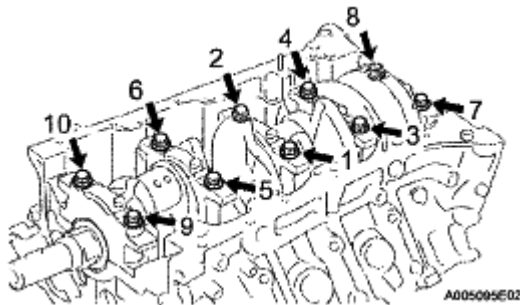


Fig. 338: Identifying Crankshaft Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Mark the front of the crankshaft bearing cap bolts with paint.
- Retighten the crankshaft bearing cap bolts by 90° in the order shown (Procedure "B").
- Check that the painted mark is now at a 90° angle to the front.
- Remove the crankshaft bearing caps.

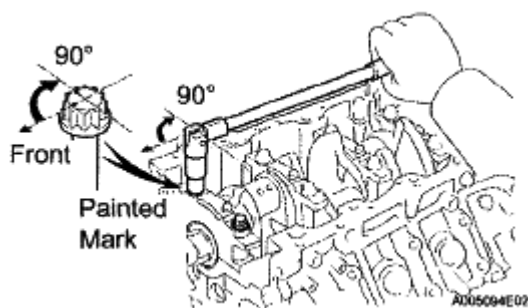


Fig. 339: Identifying Crankshaft Bearing Cap Bolts Tighten Angle
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- p. Measure the Plastigage at its widest point.

Standard clearance

STANDARD CLEARANCE

No. 1 and No. 5	Others
0.028 to 0.046 mm (0.0011 to 0.0018 in.)	0.040 to 0.058 mm (0.0016 to 0.0023 in.)

Maximum clearance

MAXIMUM CLEARANCE

No. 1 and No. 5	Others
0.065 mm (0.0026 in.)	0.065 mm (0.0026 in.)

If the oil clearance is greater than the maximum, replace the bearings. If necessary, replace the crankshaft.

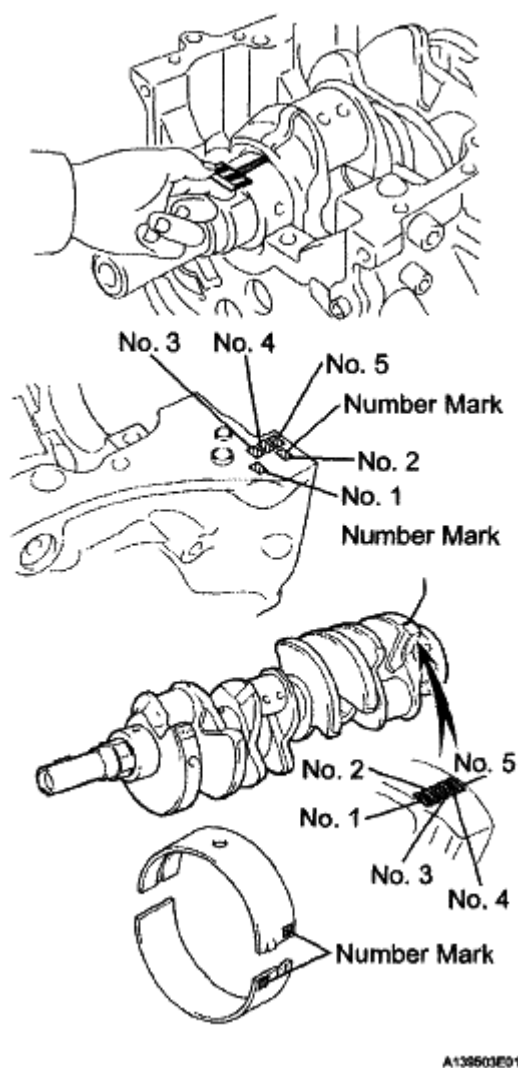
HINT:

If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, add together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 sizes of the standard bearings. For No. 1 and No. 5 position bearings, use bearings marked "3", "4", "5", "6" and "7". For the other position bearings, use bearings marked "1", "2", "3", "4" and "5".

No. 1 and No. 5:

NO. 1 AND NO. 5

-		Use bearing
Cylinder block (A) + Crankshaft (B)	0 to 5	3
	6 to 11	4
	12 to 17	5
	18 to 23	6



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Fig. 340: Identifying Plastigage With Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

EXAMPLE:

Cylinder block "08" + Crankshaft "06" = Total number 14 (Use bearing "5")

Others:

OTHERS

-		Use bearing
Cylinder block (A) + Crankshaft (B)	0 to 5	1
	6 to 11	2
	12 to 17	3

	18 to 23	4
	24 to 28	5

EXAMPLE:

Cylinder block "08" + Crankshaft "06" = Total number 14 (Use bearing "3")

Cylinder block crankshaft journal bore diameter (A):

CYLINDER BLOCK CRANKSHAFT JOURNAL BORE DIAMETER (A)

Mark "00"	72.000 mm (2.8347 in.)
Mark "01"	72.001 mm (2.8347 in.)
Mark "02"	72.002 mm (2.8347 in.)
Mark "03"	72.003 mm (2.8348 in.)
Mark "04"	72.004 mm (2.8348 in.)
Mark "05"	72.005 mm (2.8348 in.)
Mark "06"	72.006 mm (2.8349 in.)
Mark "07"	72.007 mm (2.8349 in.)
Mark "08"	72.008 mm (2.8350 in.)
Mark "09"	72.009 mm (2.8350 in.)
Mark "10"	72.010 mm (2.8350 in.)
Mark "11"	72.011 mm (2.8351 in.)
Mark "12"	72.012 mm (2.8351 in.)
Mark "13"	72.013 mm (2.8352 in.)
Mark "14"	72.014 mm (2.8352 in.)
Mark "15"	72.015 mm (2.8352 in.)
Mark "16"	72.016 mm (2.8353 in.)

Crankshaft journal diameter (B):

CRANKSHAFT JOURNAL DIAMETER

Mark "00"	67.000 mm (2.6378 in.)
Mark "01"	66.999 mm (2.6378 in.)
Mark "02"	66.998 mm (2.6377 in.)
Mark "03"	66.997 mm (2.6377 in.)
Mark "04"	66.996 mm (2.6376 in.)
Mark "05"	66.995 mm (2.6376 in.)
Mark "06"	66.994 mm (2.6376 in.)
Mark "07"	66.993 mm (2.6375 in.)
Mark "08"	66.992 mm (2.6375 in.)
Mark "09"	66.991 mm (2.6374 in.)
Mark "10"	66.990 mm (2.6374 in.)

Mark "11"	66.989 mm (2.6374 in.)
Mark "12"	66.988 mm (2.6373 in.)

Standard bearing center wall thickness No. 1 and No. 5:

STANDARD BEARING CENTER WALL THICKNESS NO. 1 AND NO. 5

Mark "3"	2.487 to 2.490 mm (0.0979 to 0.0980 in.)
Mark "4"	2.490 to 2.493 mm (0.0980 to 0.0982 in.)
Mark "5"	2.493 to 2.496 mm (0.0982 to 0.0983 in.)
Mark "6"	2.496 to 2.499 mm (0.0983 to 0.0984 in.)
Mark "7"	2.499 to 2.502 mm (0.0984 to 0.0985 in.)

Others:

OTHERS

Mark "1"	2.481 to 2.484 mm (0.0977 to 0.0978 in.)
Mark "2"	2.484 to 2.487 mm (0.0978 to 0.0979 in.)
Mark "3"	2.487 to 2.490 mm (0.0979 to 0.0980 in.)
Mark "4"	2.490 to 2.493 mm (0.0980 to 0.0982 in.)
Mark "5"	2.493 to 2.496 mm (0.0982 to 0.0983 in.)

q. Completely remove the Plastigage.

51. REMOVE CRANKSHAFT

- Lift up the crankshaft.
- Remove the 5 upper crankshaft bearings and 2 upper thrust washers from the cylinder block.

HINT:

Arrange the crankshaft bearing caps, bearings and thrust washers in the correct order.

52. REMOVE CRANKSHAFT PULLEY SET CRANKSHAFT KEY

INSPECTION

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new ones.

1. INSPECT TIMING BELT

NOTE:

- Do not bend, twist or turn the timing belt inside out.

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

If there are any defects as shown in the illustration, check the following points:

- If premature parting occurs, check the following:
 - Check for proper installation.
 - Check the timing cover gasket for damage and proper installation.
- If the belt teeth are cracked or damaged, inspect the camshaft.
- If there is noticeable wear or cracks on the belt face, check if there are nicks on the side of the idler pulley lock and water pump.
- If there is wear or damage on only one side of the belt, check the belt guide and alignment of each pulley.
- If there is noticeable wear on the belt teeth, check for damage on the timing belt or foreign objects on the pulley teeth. Check if the gasket is installed correctly.

If necessary, replace the timing belt.

2. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY

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

HINT:

If there is a faint trace of oil on the seal on the push rod side, the tensioner is all right.

If leakage is found, replace the tensioner.

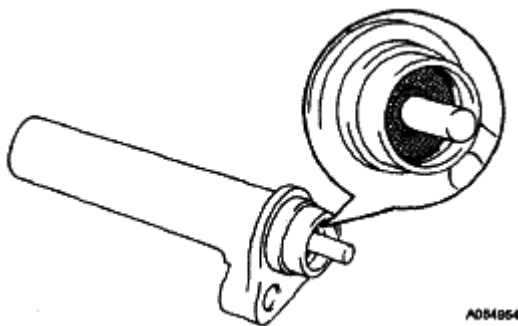


Fig. 341: Checking Seal Portion Of Tensioner

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

- Hold the tensioner by hands and push the push rod strongly as shown in the illustration to check that it does not move.

If the push rod moves, replace the tensioner.

NOTE: Do not face the tensioner push rod downward.

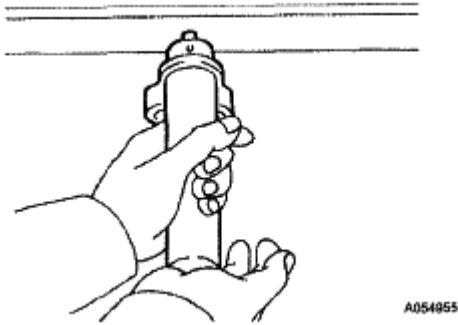


Fig. 342: Holding Tensioner & Pushing Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Protrusion: 11.2 to 12.2 mm (0.440 to 0.480 in.)

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

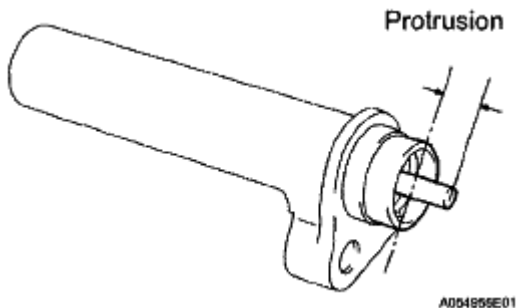


Fig. 343: Measuring Protrusion Of Push Rod From Housing End
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT TIMING BELT IDLER

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

If leakage is found, replace the idler pulley.

- b. Check that the idler pulley turns smoothly. If necessary, replace the idler.

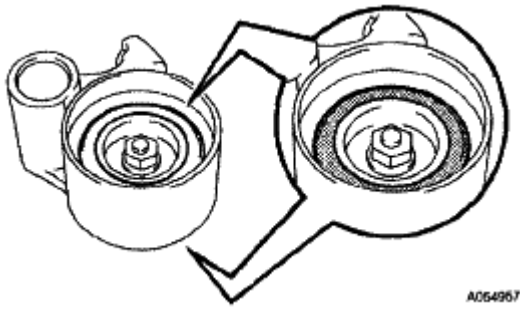


Fig. 344: Identifying Seal Portion Of Idler Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSPECT CYLINDER HEAD SET BOLT

- a. Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter: 9.810 to 9.960 mm (0.3862 to 0.3921 in.)

Minimum outside diameter: 9.700 mm (0.3819 in.)

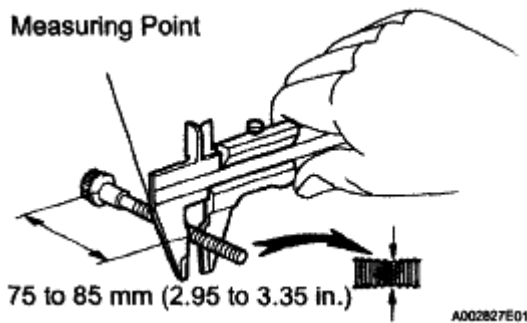


Fig. 345: Identifying Thread Outside Diameter Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSPECT CAMSHAFTS

- 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: 0.08 mm (0.0031 in.)

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

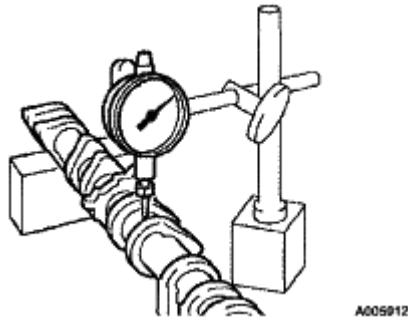


Fig. 346: Identifying Camshaft Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the cam lobes.
 - 1. Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake: 41.94 to 42.04 mm (1.6512 to 1.6551 in.)

Exhaust: 41.96 to 42.06 mm (1.6520 to 1.6559 in.)

Minimum cam lobe height:

Intake: 41.79 mm (1.6453 in.)

Exhaust: 41.81 mm (1.6461 in.)

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

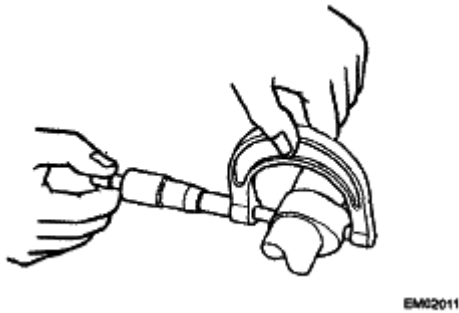


Fig. 347: Identifying Cam Lobe Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect the camshaft journals.
 - 1. Using a micrometer, measure the journal diameter.

Journal diameter: 26.954 to 26.970 mm (1.0612 to 1.0618 in.)

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

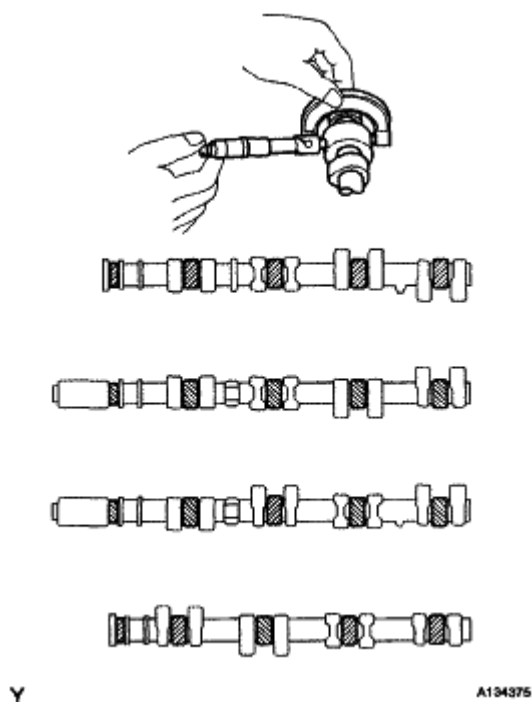


Fig. 348: Measuring Journal Diameter Using Micrometer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSPECT CAMSHAFT TIMING TUBE ASSEMBLY

- a. Using a micrometer, measure the journal diameter.

Journal diameter: 39.955 to 39.964 mm (1.5730 to 1.5734 in.)

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

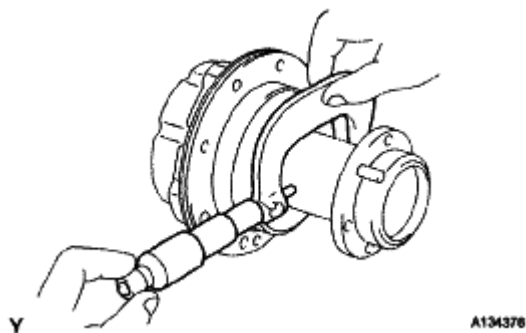


Fig. 349: Measuring Journal Diameter Using Micrometer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the timing tube to the intake camshaft, and check that the timing tube turns smoothly. If necessary, replace the timing tube and intake camshaft.

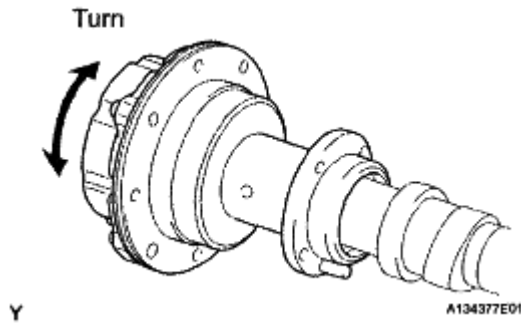


Fig. 350: Checking Timing Tube Turns Smoothly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT CAMSHAFT GEAR SPRING

- a. Using vernier calipers, measure the gap distance of the gear spring.

Gap distance: 18.2 to 18.8 mm (0.717 to 0.740 in.)

If the gap distance is not as specified, replace the gear spring.

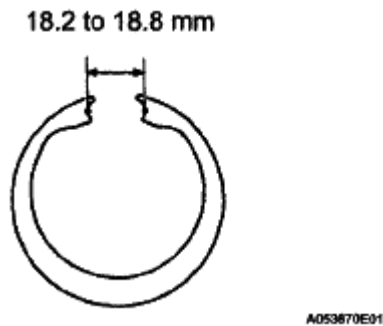


Fig. 351: Measuring Gap Distance Of Gear Spring Using Vernier Calipers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSPECT CYLINDER HEAD SUB-ASSEMBLY

- a. Clean the cylinder head.
 1. Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

NOTE: Be careful not to scratch the cylinder block contact surface.

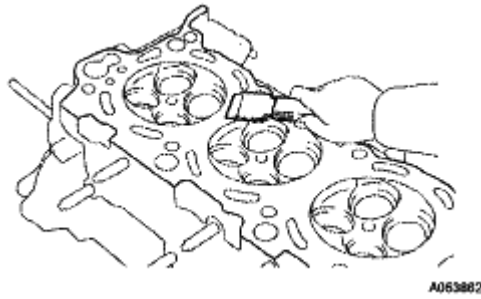


Fig. 352: Cleaning Cylinder Head Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a wire brush, remove all the carbon from the combustion chambers.

NOTE: Be careful not to scratch the cylinder block contact surface.

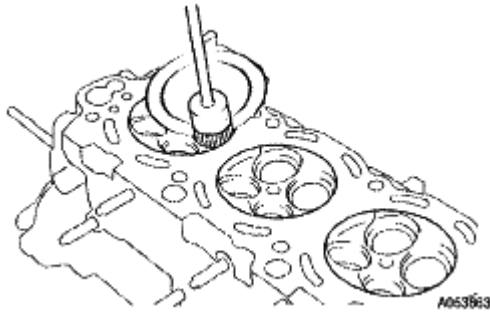


Fig. 353: Using Wire Brush To Remove Carbon From Combustion Chambers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Using a valve guide bushing brush and solvent, clean all the guide bushes.

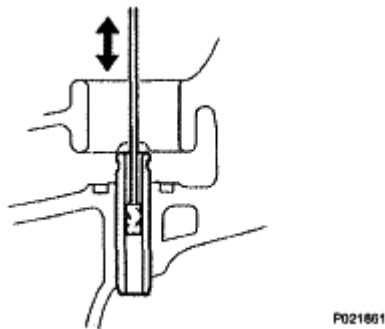


Fig. 354: Identifying Guide Bushes
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Using a soft brush and solvent, thoroughly clean the cylinder head.

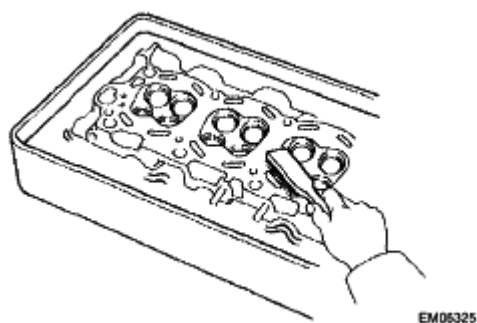


Fig. 355: Cleaning Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Inspect for warpage.

1. Using a precision straight edge and feeler gauge, measure the warpage of the contact surfaces of the cylinder block and the manifolds.

Maximum warpage: 0.10 mm (0.0039 in.)

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

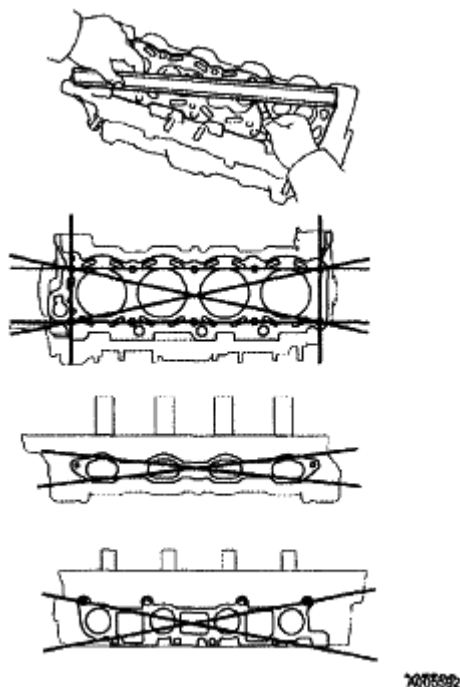


Fig. 356: Checking Cylinder Head For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Inspect for cracks.

1. Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

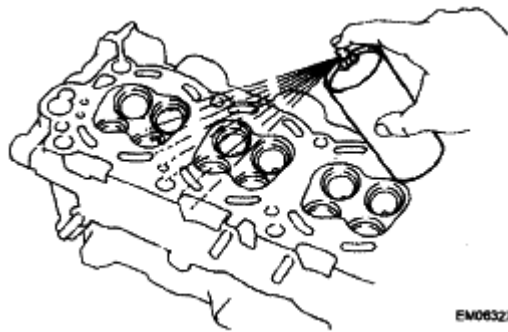


Fig. 357: Inspecting Cylinder Block Surface For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSPECT VALVE

- a. Clean the valves.
 1. Using a gasket scraper, chip off any carbon from the valve head.
 2. Using a wire brush, thoroughly clean the valve.

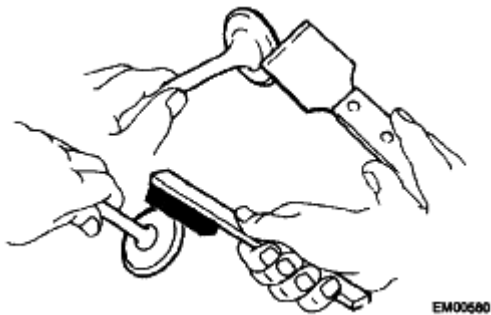


Fig. 358: Identifying Valves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake: 5.470 to 5.485 mm (0.2154 to 0.2159 in.)

Exhaust: 5.465 to 5.480 mm (0.2152 to 0.2157 in.)

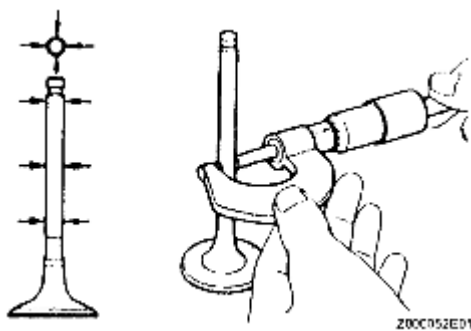


Fig. 359: Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check the valve face angle.
 - 1. Grind the valve enough to remove pits and carbon.
 - 2. Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°

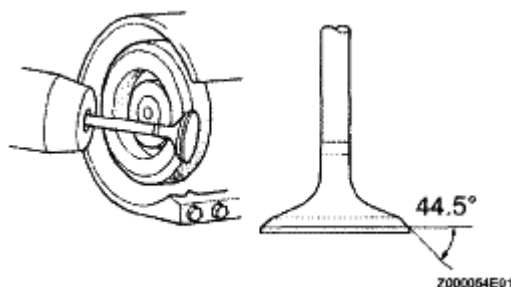


Fig. 360: Identifying Valve Face Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check the valve head margin thickness.

Standard margin thickness:

Intake: 1.25 mm (0.049 in.)

Exhaust: 1.4 mm (0.055 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)

If the margin thickness is less than the minimum, replace the valve.

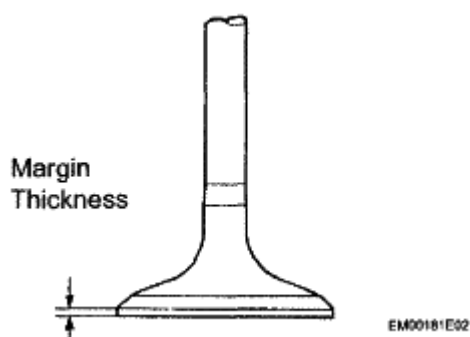


Fig. 361: Identifying Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Check the valve overall length.

Standard overall length:

Intake: 95.05 mm (3.7421 in.)

Exhaust: 95.10 mm (3.7441 in.)

Minimum overall length:

Intake: 94.55 mm (3.7224 in.)

Exhaust: 94.60 mm (3.7244 in.)

If the overall length is less than the minimum, replace the valve.

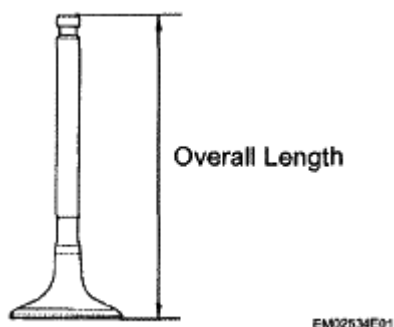


Fig. 362: Identifying Valve Overall Length
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Check the surface of the valve stem tip for wear. If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

NOTE: Do not grind off more than the minimum.

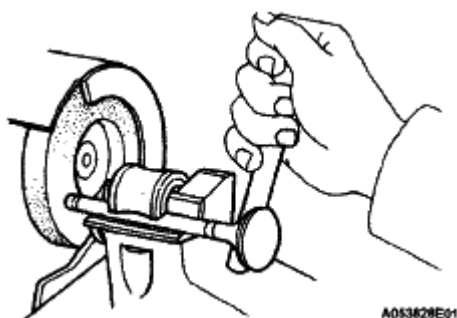


Fig. 363: Identifying Surface Of Valve Stem Tip For Wear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT VALVE SPRING

- a. Using a steel square, measure the deviation of the valve spring.

Maximum deviation: 2.0 mm (0.079 in.)

If the deviation is greater than the maximum, replace the valve spring.

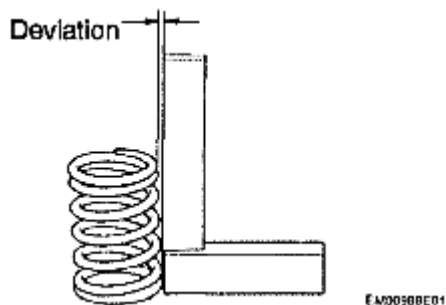


Fig. 364: Identifying Valve Spring
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using vernier calipers, measure the free length of the valve spring.

Free length: 54.1 mm (2.130 in.)

If the free length is not as specified, replace the valve spring.

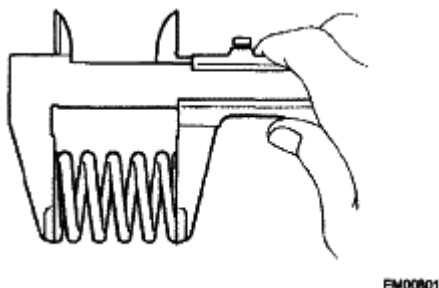


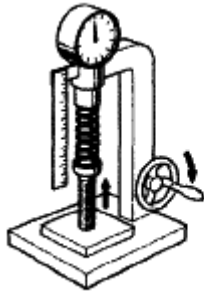
Fig. 365: Identifying Free Length Of Valve Spring

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

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

Installed tension: 210 to 226 N (21.4 to 23.0 kgf, 47.2 to 50.7 lbf) at 35.0 mm (1.378 in.)

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



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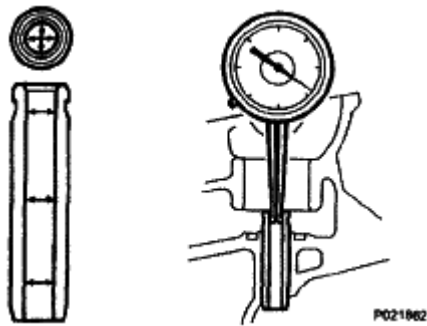
Fig. 366: Identifying Tension Of Valve Spring

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

11. INSPECT VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the inside diameter of the guide bush.

Bush inside diameter: 5.510 to 5.530 mm (0.2169 to 0.2177 in.)



P021062

Fig. 367: Identifying Inside Diameter Of Guide Bush

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

- b. Subtract the valve stem diameter measurement from the guide bush 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 (0.0031 in.)

Exhaust: 0.10 mm (0.0039 in.)

If the clearance is greater than the maximum, replace the valve and guide bush.

12. REMOVE VALVE GUIDE BUSH

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

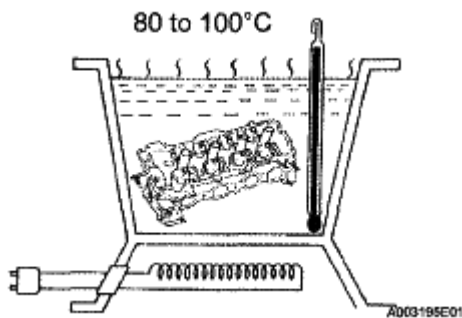


Fig. 368: Heating Cylinder Head

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

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

SST 09201-10000 (09201 -01060), 09950-70010 (09951-07100)

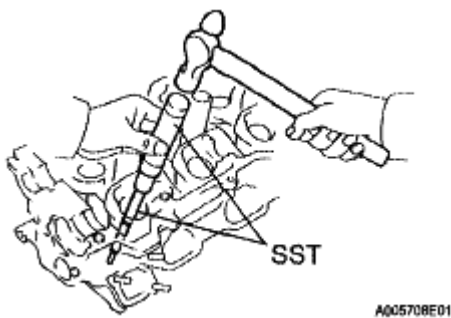
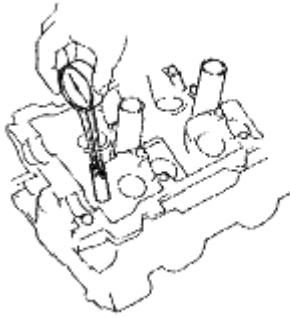


Fig. 369: Identifying Tapping Guide Bush

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

13. INSTALL VALVE GUIDE BUSH

- a. Using a caliper gauge, measure the bush bore diameter of the cylinder head.



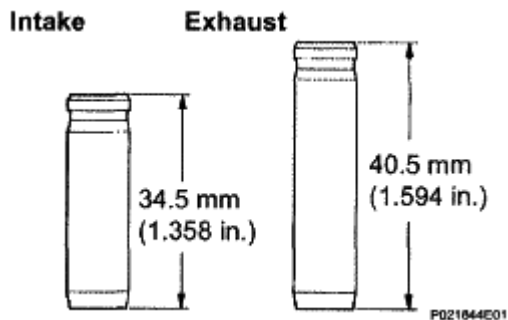
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Fig. 370: Identifying Bush Bore Diameter Of Cylinder Head
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Select a new guide bush (STD or O/S 0.05).

BUSH BORE DIAMETER AND BUSH SIZE

Bush bore diameter	Bush size
10.285 to 10.306 mm (0.4049 to 0.4057 in.)	Use STD
10.335 to 10.356 mm (0.4069 to 0.4077 in.)	Use O/S 0.05



P021844E01

Fig. 371: Identifying Intake Guide Bush And Exhaust Guide Bush Dimension
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore so that the dimension is between 10.335 and 10.356 mm (0.4069 and 0.4077 in.).

If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

HINT:

Different bushes are used for the intake and exhaust.

- c. Gradually heat the cylinder head to 80 to 100°C (176 to 212°F).
 d. Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

Protrusion height:

Intake: 9.2 to 9.8 mm (0.362 to 0.386 in.)

Exhaust: 8.2 to 8.8 mm (0.323 to 0.346 in.)

SST 09201-01055, 09950-70010 (09951-07100)

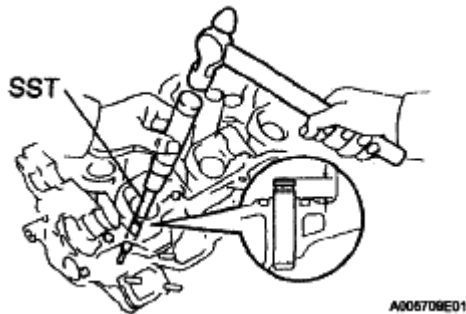


Fig. 372: Tapping Guide Bush

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

- e. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the specified clearance between the guide bush and valve stem.

SST 09201 -10000 (09201 -01060), 09950-70010 (09951-07100)

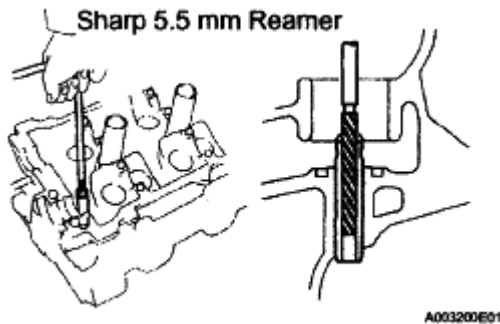


Fig. 373: Identifying Guide Bush

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

14. INSPECT VALVE SEAT

- a. Using a 45° carbide cutter, resurface the valve seats. Clean metal filings from the valve seats.

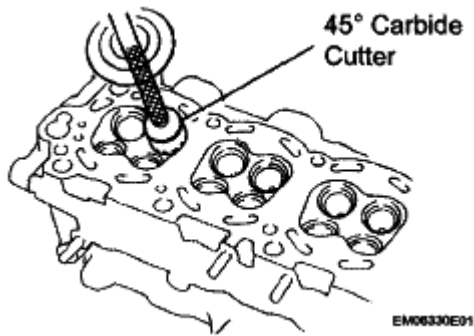


Fig. 374: Resurfacing Valve Seats Using Carbide Cutter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check the valve seating position.
 1. Apply a light coat of prussian blue (or white lead) to the valve face.
 2. Lightly press the valve against the seat. Do not rotate valve.

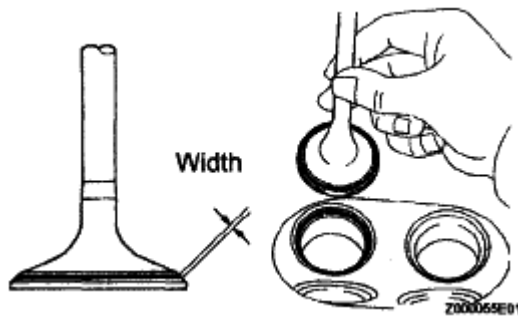


Fig. 375: Identifying Valve Seat Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check the valve face and seat for the following:
 1. If prussian blue appears around the entire face, the valve is centered. If not, replace the valve.
 2. If prussian blue appears around the entire valve seat, the guide and face are centered. If not, resurface the seat.
 3. Check that the seat contacts in the middle of the valve face with the following width:

Width: 1.0 to 1.4 mm (0.039 to 0.055 in.)

15. REPAIR VALVE SEAT

- a. If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

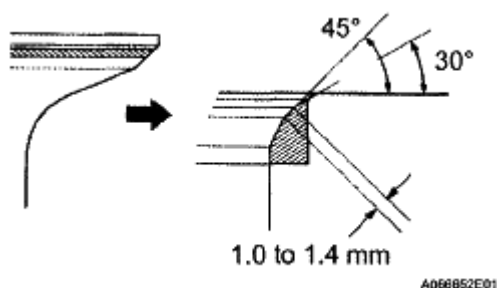


Fig. 376: Identifying Valve Seat Angle

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

- b. If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.

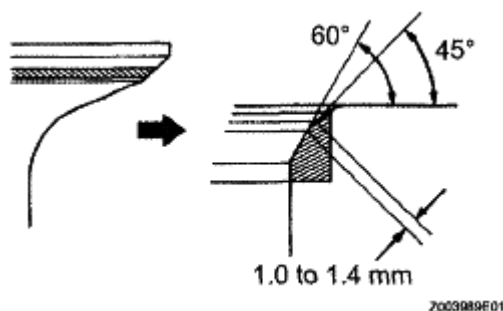


Fig. 377: Identifying Valve Face Angle

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

- c. Handrub the valve and valve seat with an abrasive compound.
d. After handrubbing, clean the valve and valve seat.

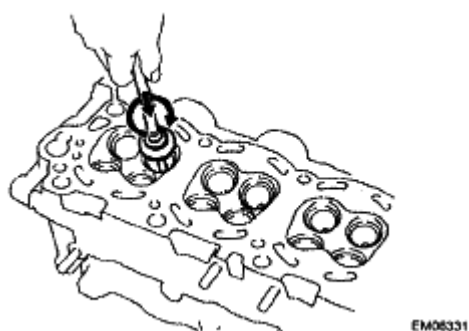


Fig. 378: Cleaning Valve & Valve Seat

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

16. INSPECT VALVE LIFTER

- a. Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter: 31.000 to 31.016 mm (1.2205 to 1.2211 in.)

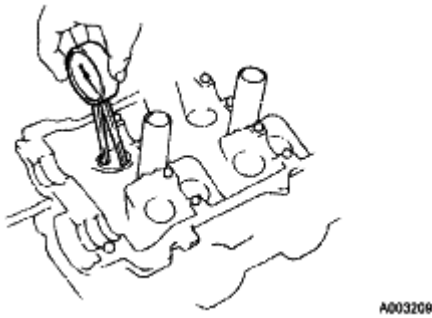


Fig. 379: Measuring Lifter Bore Diameter Of Cylinder Head Using Caliper Gauge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the lifter diameter where the distance from the top surface is 12.3 to 12.7 mm (0.484 to 0.500 in.).

Lifter diameter: 30.968 to 30.976 mm (1.2192 to 1.2195 in.)

- c. Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance: 0.024 to 0.050 mm (0.0009 to 0.0020 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

If the oil clearance is greater than the maximum, replace the lifter. If necessary, replace the cylinder head.

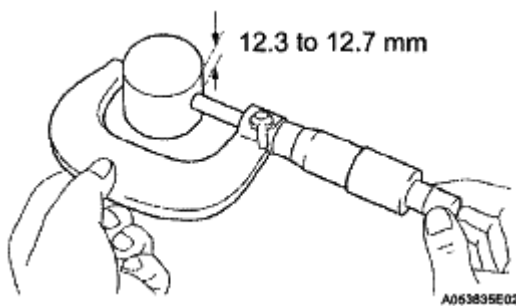


Fig. 380: Measuring Lifter Diameter Using Micrometer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSPECT CAMSHAFT OIL CLEARANCE

- a. Install the camshaft timing tube to the camshaft (See **REASSEMBLY**).
- b. Clean the bearing caps and camshaft journals.
- c. Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

- d. Place the camshafts on the cylinder head.
- e. Lay a strip of Plastigage across each of the camshaft journals.

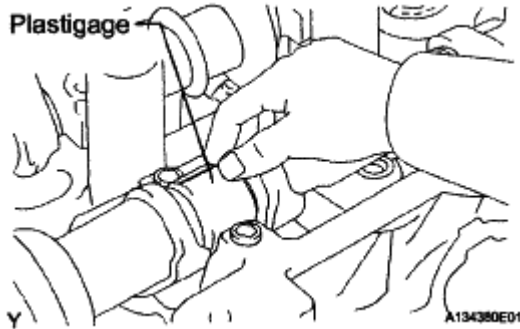


Fig. 381: Laying Strip Of Plastigage Across Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Install the bearing caps (See **REASSEMBLY**).

Torque:

For bolt A

7.5 N*m (76 kgf*cm, 66 ft.*lbf)

For others

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

NOTE: Do not turn the camshaft.

- g. Remove the bearing caps.

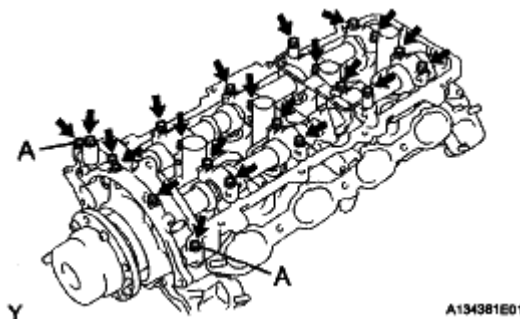


Fig. 382: Identifying Bearing Caps Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Measure the Plastigage at its widest point.

Standard oil clearance**STANDARD OIL CLEARANCE**

Camshaft journal	Camshaft timing tube journal
0.030 to 0.071 mm (0.0012 to 0.0028 in.)	0.036 to 0.057 mm (0.0014 to 0.0022 in.)

Maximum oil clearance**MAXIMUM OIL CLEARANCE**

Camshaft journal	Camshaft timing tube journal
0.100 mm (0.0039 in.)	0.075 mm (0.0030 in.)

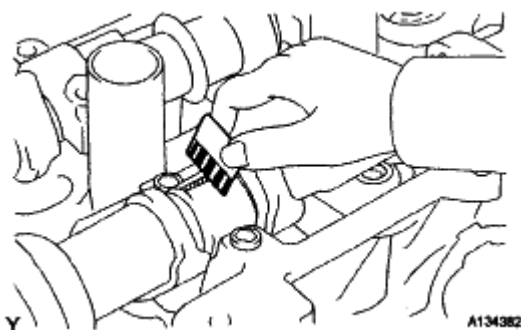


Fig. 383: Identifying Plastigage To Widest Point
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

- i. Remove the camshafts.
- j. Completely remove the Plastigage.

18. INSPECT CAMSHAFT THRUST CLEARANCE

- a. Install the camshaft (See **REASSEMBLY**).
- b. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance**STANDARD THRUST CLEARANCE**

Intake	Exhaust
0 to 0.040 mm (0 to 0.0016 in.)	0.030 to 0.070 mm (0.0012 to 0.0028 in.)

Maximum thrust clearance**MAXIMUM THRUST CLEARANCE**

Intake	Exhaust

0.12 mm (0.0047 in.) | 0.10 mm (0.0039 in.)

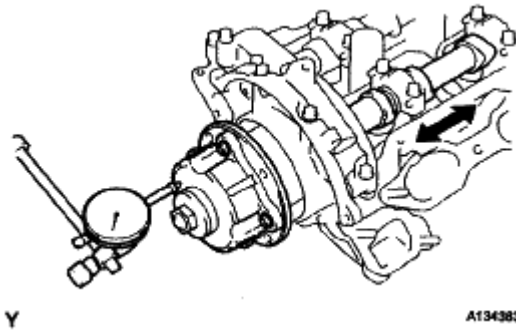


Fig. 384: Identifying Thrust Clearance Camshaft Back And Forth
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

- c. Remove the camshafts.
- d. Remove the camshaft timing tube from the intake camshaft.

19. INSPECT CAMSHAFT GEAR BACKLASH

- a. Install the drive gear to the camshaft timing tube (See **REASSEMBLY**).
- b. Install the camshaft timing tube to the intake camshaft (See **REASSEMBLY**).
- c. Install the camshafts without installing the exhaust camshaft sub-gear No. 3 and front bearing cap (See **REASSEMBLY**).
- d. Using a dial indicator, measure the backlash.

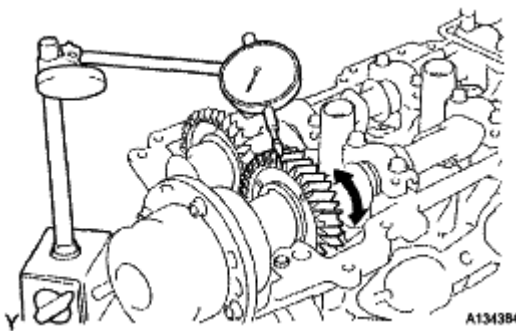


Fig. 385: Identifying Camshaft Gear Backlash
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard backlash: 0.020 to 0.200 mm (0.0008 to 0.0079 in.)

Maximum backlash: 0.30 mm (0.0118 in.)

If the backlash is greater than the maximum, replace the intake camshaft drive gear and exhaust

camshaft.

- e. Remove the camshafts.
- f. Remove the camshaft timing tube from the intake camshaft.
- g. Remove the drive gear from the camshaft timing tube.

20. CLEAN CYLINDER BLOCK SUB-ASSEMBLY

- a. Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- b. Using a soft brush and solvent, thoroughly clean the cylinder block.

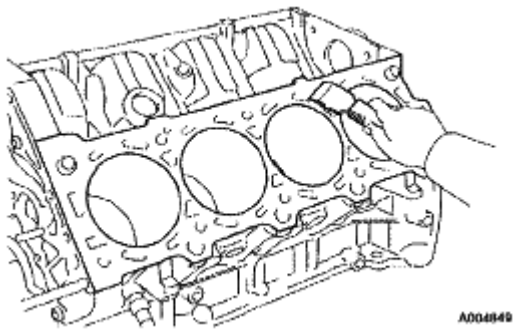


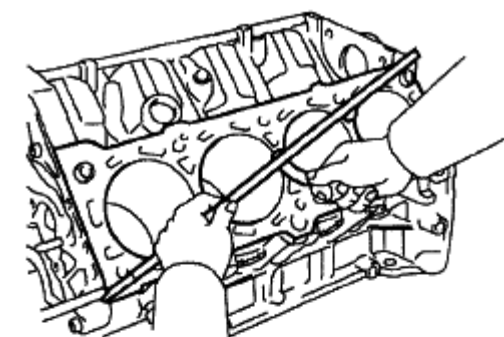
Fig. 386: Cleaning Cylinder Block Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSPECT CYLINDER BLOCK SUB-ASSEMBLY

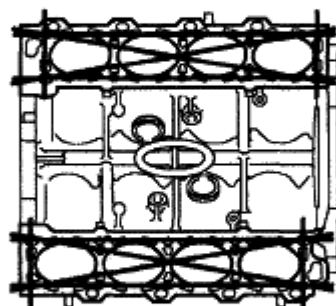
- a. Inspect for warpage.
 - 1. Using a precision straight edge and feeler gauge, measure the warpage of the contact surfaces of the cylinder head and crankshaft bearing cap.

Maximum warpage: 0.07 mm (0.0028 in.)

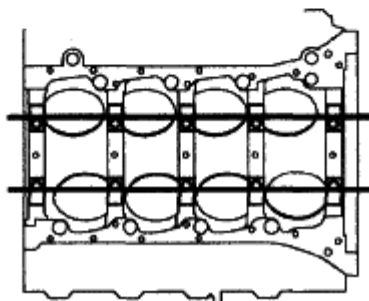
If warpage is greater than the maximum, replace the cylinder block sub-assembly.



Cylinder Head Side



Crankshaft Bearing Cap Side

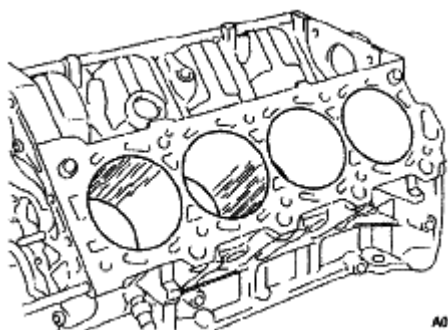


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Fig. 387: Identifying Cylinder Block For Warp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Visually check the cylinder for vertical scratches. If deep scratches are present, rebore all the 8 cylinders and replace all the 8 pistons. If necessary, replace the cylinder block.



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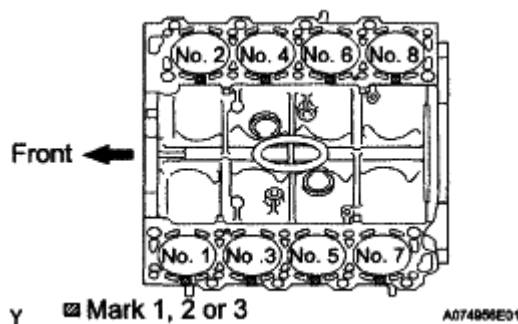
Fig. 388: Identifying Cylinder Block

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

- c. Inspect the cylinder bore diameter.

HINT:

There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.

**Fig. 389: Identifying Sizes Of Standard Cylinder Bore Diameter**

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

- Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

Standard diameter**STANDARD DIAMETER**

STD		
Mark "1"	Mark "2"	Mark "3"
94.002 to 94.010 mm (3.7009 to 3.7012 in.)	94.010 to 94.023 mm (3.7012 to 3.7017 in.)	94.023 to 94.031 mm (3.7017 to 3.7020 in.)

Maximum diameter: 94.230 mm (3.5917 in.)

If the diameter is greater than the maximum, rebore all the 8 cylinders and replace all the 8 pistons. If necessary, replace the cylinder block.

MAXIMUM DIAMETER

STD	94.231 mm (3.7099 in.)
O/S 0.50	94.731 mm (3.7296 in.)

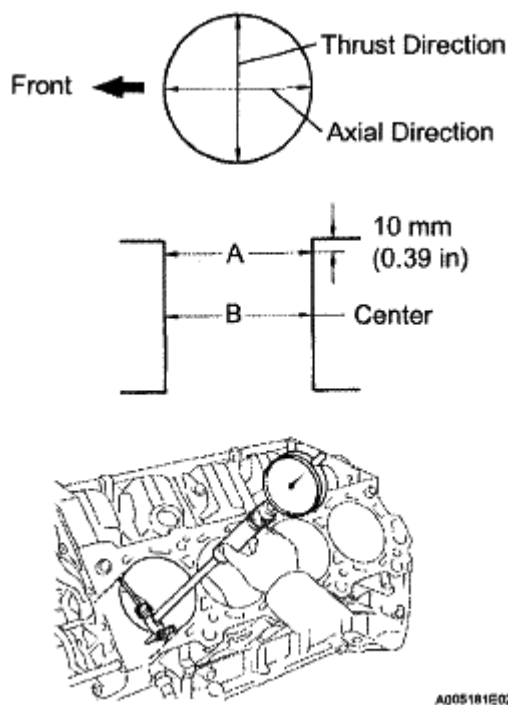


Fig. 390: Identifying Cylinder Bore Diameter Positions A And B In Thrust And Axial Directions

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

- d. Remove the cylinder ridge.

If the wear is less than 0.2mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

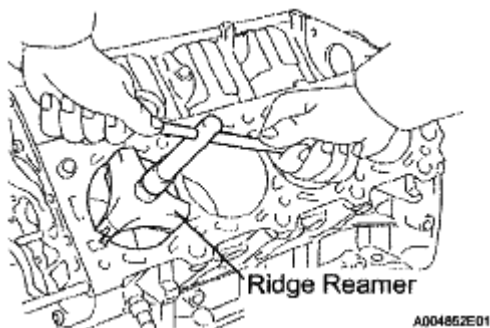
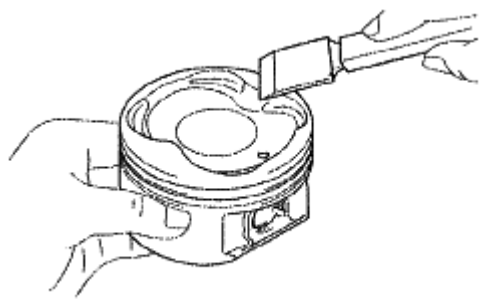


Fig. 391: Identifying Cylinder Ridge

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

22. INSPECT PISTON

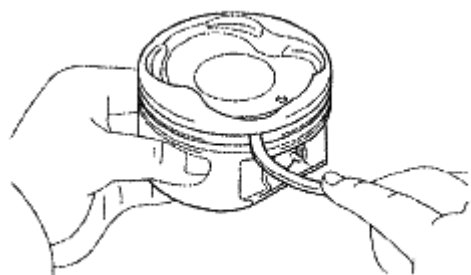
- a. Clean the piston.
 - 1. Using a gasket scraper, remove the carbon from the piston top.



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Fig. 392: Using Gasket Scraper To Remove Carbon From Piston Top
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using a groove cleaning tool or broken ring, clean the piston ring grooves.

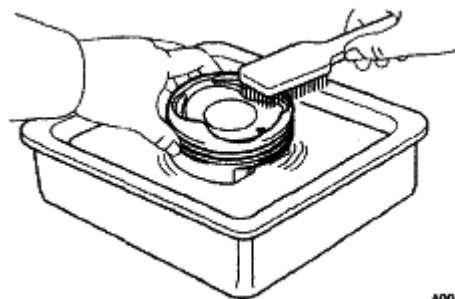


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Fig. 393: Cleaning Piston Ring Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Using solvent and a brush, thoroughly clean the piston.

NOTE: Do not use a wire brush.



A004879

Fig. 394: Cleaning Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the piston oil clearance.

HINT:

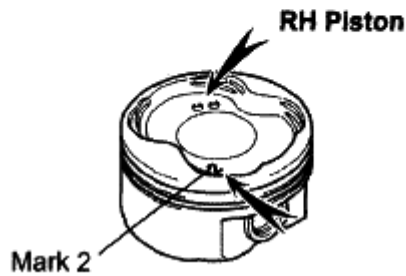
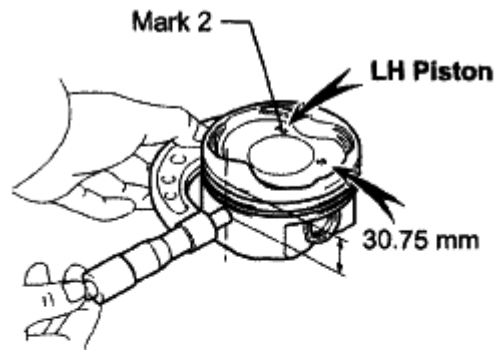
There are 3 sizes of the standard piston diameter, marked "1", "2" or "3" accordingly. The mark is stamped on the piston top.

1. Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 30.75 mm (1.2106 in.) from the piston head.

Piston diameter

PISTON DIAMETER

O/S 0.50	STD		
	Mark "1"	Mark "2"	Mark "3"
94.402 to 94.430 mm (3.7168 to 3.7177 in.)	93.902 to 93.912 mm (3.6969 to 3.6973 in.)	93.912 to 93.920 mm (3.6973 to 3.6976 in.)	93.920 to 93.930 mm (3.6976 to 3.6980 in.)



Y

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Fig. 395: Identifying Piston Oil Clearance

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

2. Measure the cylinder bore diameter in the thrust directions.

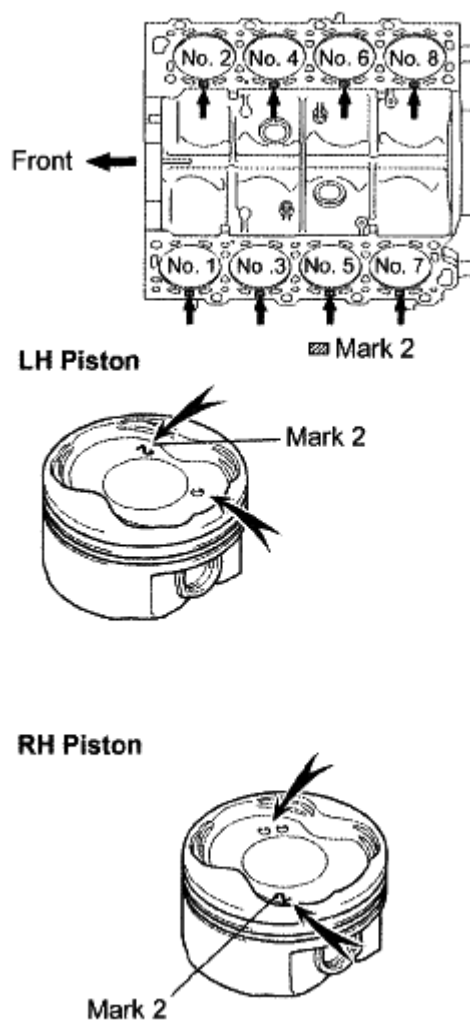


Fig. 396: Identifying Cylinder Bore Diameter In Thrust Directions
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.090 to 0.111 mm (0.0035 to 0.0044 in.)

Maximum oil clearance: 0.13 mm (0.0051 in.)

If the oil clearance is greater than the maximum, replace all the 8 pistons and rebore all the 8 cylinders. If necessary, replace the cylinder block.

HINT:

Use a new cylinder block:

- Use a piston with the same number mark as the cylinder diameter marked on the

cylinder block.

- The shape of the piston varies for the LH and RH banks. The LH piston is marked with 1 cavity and "2", the RH piston with 2 cavities and "2".
- c. Inspect the piston pin fit.
1. Heat the piston to approx. 60°C (140°F), and push the piston pin into the piston pin hole with your thumb.

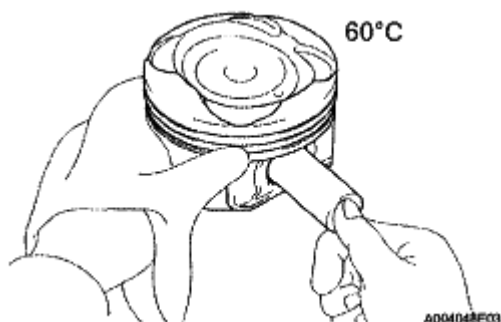


Fig. 397: Pushing Piston Pin Into Piston Pin Hole
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Piston pin diameter: 21.997 to 22.006 mm (0.8660 to 0.8664 in.)

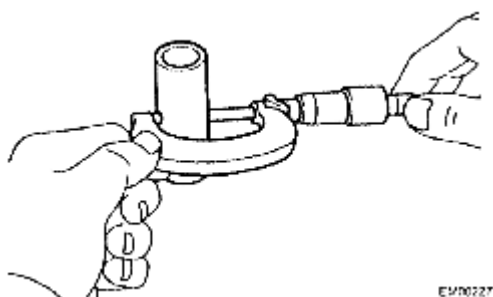
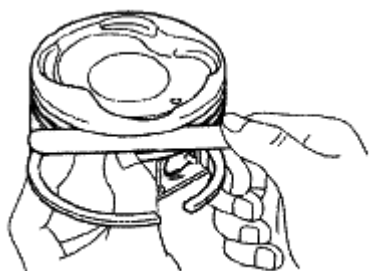


Fig. 398: Measuring Piston Pin Diameter
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. INSPECT PISTON RING SET

- a. Inspect the piston ring groove clearance.



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Fig. 399: Identifying Piston Ring Groove Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

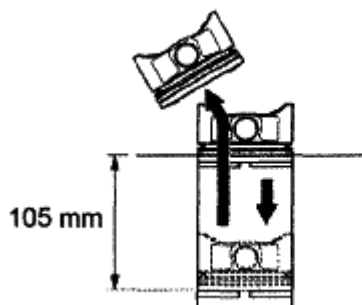
Ring groove clearance

RING GROOVE CLEARANCE

No. 1	No. 2
0.030 to 0.080 mm (0.0012 to 0.0032 in.)	0.020 to 0.060 mm (0.0008 to 0.0024 in.)

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

- b. Inspect the piston ring end gap.



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Fig. 400: Identifying Piston Ring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Insert the piston ring into the cylinder bore.
2. Using a piston, push the piston ring a little beyond the bottom of the ring travel, 105 mm (4.13 in.) from the top of the cylinder block.
3. Using a feeler gauge, measure the end gap.

Standard end gap

STANDARD END GAP

--	--	--

No. 1	No. 2	Oil (Side rail)
0.300 to 0.400 mm (0.0118 to 0.0158 in.)	0.400 to 0.550 mm (0.0158 to 0.0217 in.)	0.130 to 0.380 mm (0.0051 to 0.0150 in.)

Maximum end gap

MAXIMUM END GAP

No. 1	No. 2	Oil (Side rail)
1.10 mm (0.0433 in.)	1.30 mm (0.0512 in.)	0.90 mm (0.0354 in.)

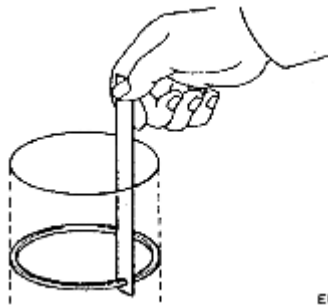


Fig. 401: Identifying End Gap

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

If the end gap is greater than the maximum, replace the piston ring. If the end gap is greater than the maximum, even with a new piston ring, rebore all the 8 cylinders or replace the cylinder block sub-assembly.

24. INSPECT CONNECTING ROD SUB-ASSEMBLY

- Using a rod aligner and feeler gauge, check the connecting rod alignment.

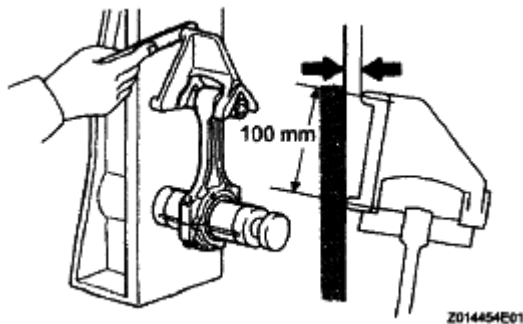


Fig. 402: Identifying Connecting Rod Alignment

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

- Check for bend.

Maximum bend: 0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If bend is greater than the maximum, replace the connecting rod sub-assembly.

2. Check for twist.

Maximum twist: 0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

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

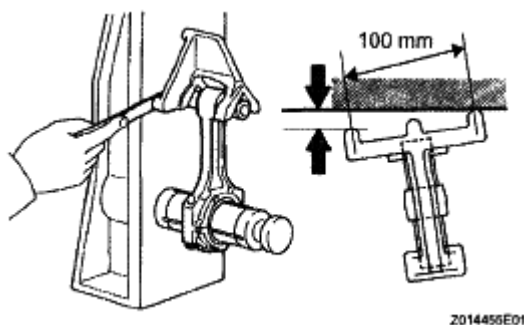


Fig. 403: Identifying Twist

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

- b. Inspect the piston pin oil clearance.

1. Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

Bushing inside diameter: 22.005 to 22.014 mm (0.8663 to 0.8667 in.)

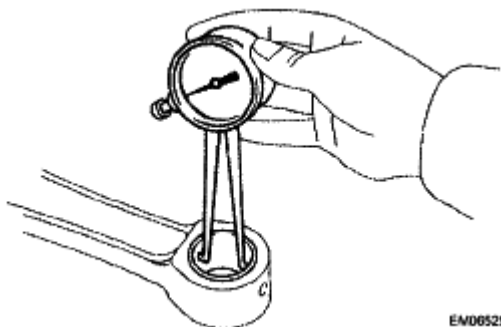


Fig. 404: Identifying Inside Diameter Of Connecting Rod Bushing

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

2. Using a micrometer, measure the piston pin diameter.

Piston pin diameter: 21.997 to 22.006 mm (0.8660 to 0.8664 in.)

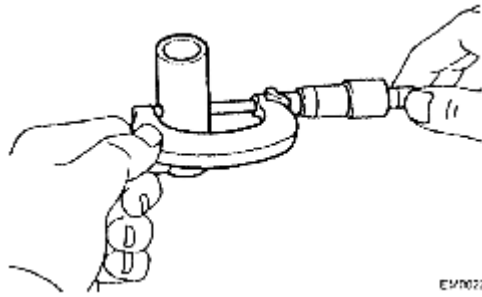


Fig. 405: Measuring Piston Pin Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance: 0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than the maximum, replace the connecting rod sub-assembly. If necessary, replace the piston and piston pin as a set.

25. REMOVE CONNECTING ROD SMALL END BUSH

- a. Using SST and a press, press out the bushing.

SST 09222-30010

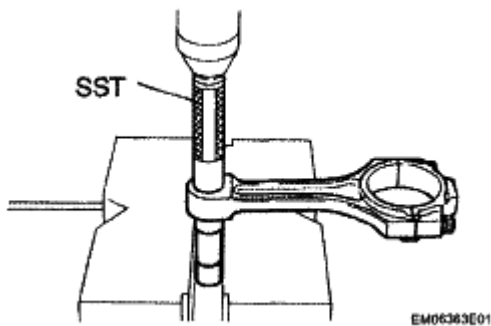
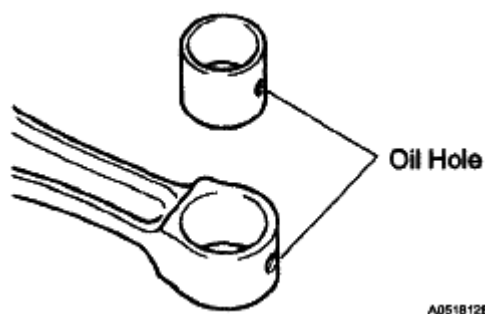


Fig. 406: Pressing Out Bushing Using SST & Press
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. INSTALL CONNECTING ROD SMALL END BUSH

- a. Align the oil holes of a new bushing and the connecting rod.

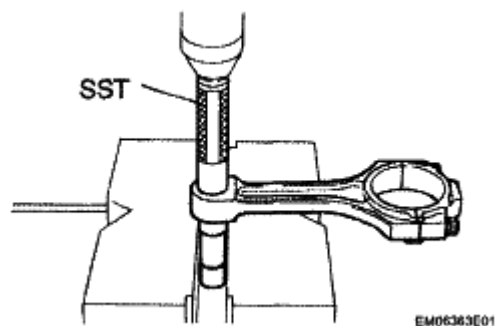


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Fig. 407: Identifying Connecting Rod Small End Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST and a press, press in the bushing.

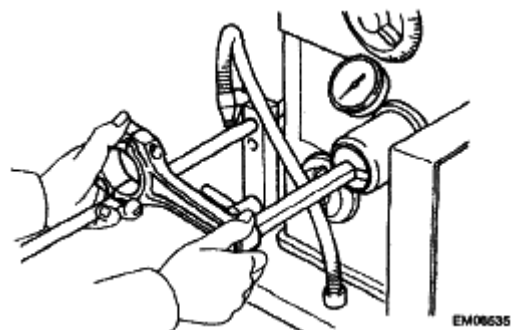
SST 09222-30010



EM06363E01

Fig. 408: Pressing In Bushing Using SST & Press
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a pin hole grinder, hone the bushing to obtain the specified clearance between the bushing and piston pin.



EM06635

Fig. 409: Identifying Clearance Between Bushing And Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.

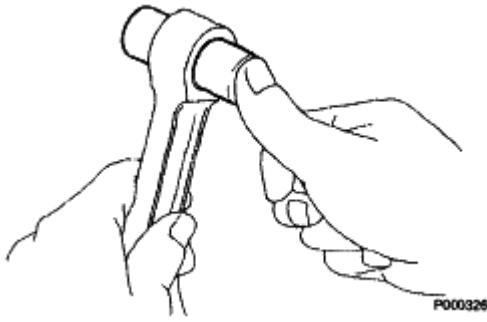


Fig. 410: Pushing Pin Into Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. INSPECT CONNECTING ROD BOLT

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

Standard diameter: 7.200 to 7.300 mm (0.2835 to 0.2874 in.)

Minimum diameter: 7.00 mm (0.2756 in.)

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

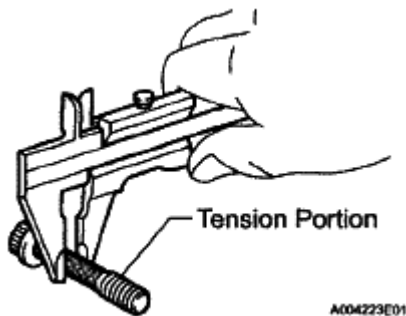


Fig. 411: Identifying Tension Portion Diameter Of Connecting Rod Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. INSPECT CRANKSHAFT BEARING CAP BOLT

- a. Using vernier calipers, measure the thread outside diameter of the crankshaft bearing cap bolt.

Standard diameter: 10.760 to 10.970 mm (0.4236 to 0.4319 in.)

Minimum diameter: 10.40 mm (0.4094 in.)

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

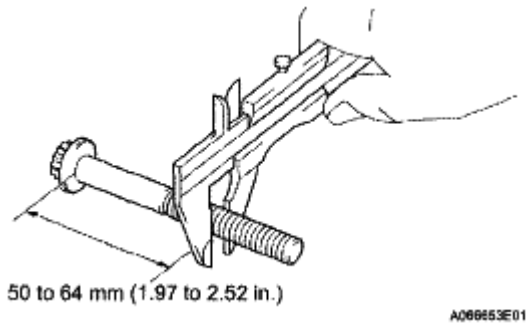


Fig. 412: Identifying Thread Outside Diameter Of Crankshaft Bearing Cap Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. INSPECT CRANKSHAFT

- a. Inspect for circle runout.
 1. Place the crankshaft on V-blocks.
 2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.04 mm (0.0016 in.)

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

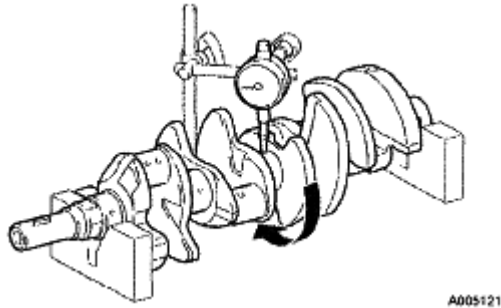


Fig. 413: Measuring Circle Runout At Center Journal Using Dial Indicator
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Inspect the crankshaft journals and crank pins.
 1. Using a micrometer, measure the diameter of each crankshaft journal and crank pin.

Crankshaft journal diameter: 66.988 to 67.000 mm (2.6373 to 2.6378 in.)

Crank pin diameter: 51.982 to 52.000 mm (2.0465 to 2.0472 in.)

If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.

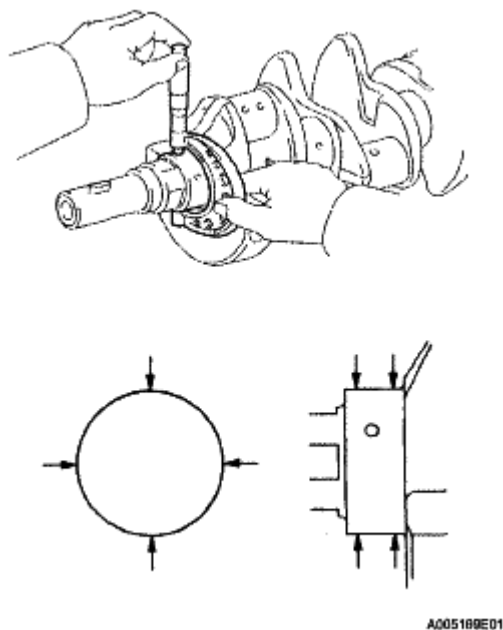


Fig. 414: Identifying Crankshaft Journals And Crank Pins
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check each crankshaft journal and crank pin for taper and out-of-round as shown in the illustration.

Maximum taper and out-of-round: 0.02 mm (0.0008 in.)

If the taper and out-of-round is greater than the maximum, replace the crankshaft.

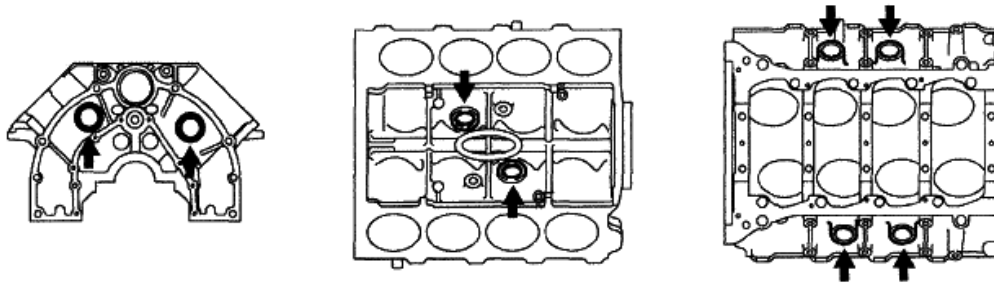
REASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new ones.

1. INSTALL TIGHT PLUG

- a. Install the tight plug.



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Fig. 415: Identifying Tight Plug Location

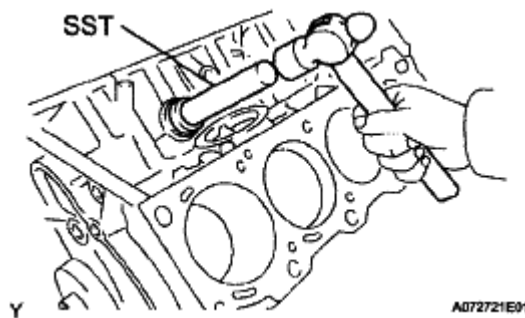
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Apply adhesive to the tight plug.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

2. Using SST and a hammer, tap in a new tight plug as shown in the illustration.

SST 09950-60010 (09951 -00350), 09950-70010 (09951-07100)



Y

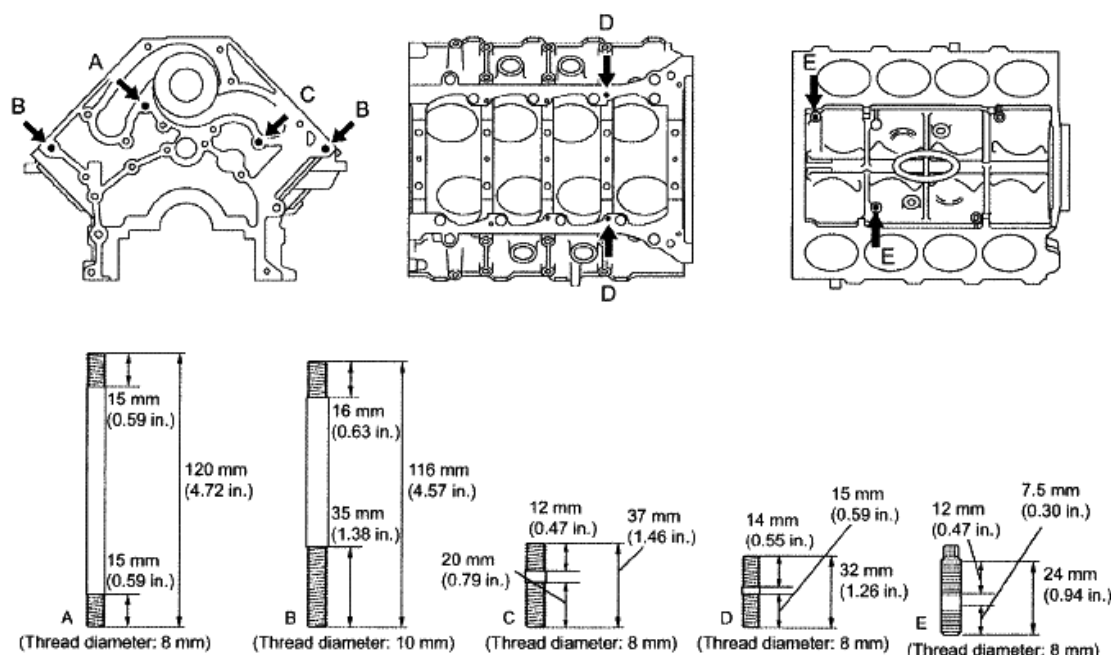
A072721E01

Fig. 416: Tapping In New Tight Plug Using SST & Hammer

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

2. INSTALL STUD BOLT

- a. Install the stud bolt.



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Fig. 417: Identifying Stud Bolt Dimension

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

Torque:

For A

8.0 N*m (80 kgf*cm, 71 in.*lbf)

For B

20 N*m (200 kgf*cm, 14 ft.*lbf)

For C

12 N*m (120 kgf*cm, 9 ft.*lbf)

For D

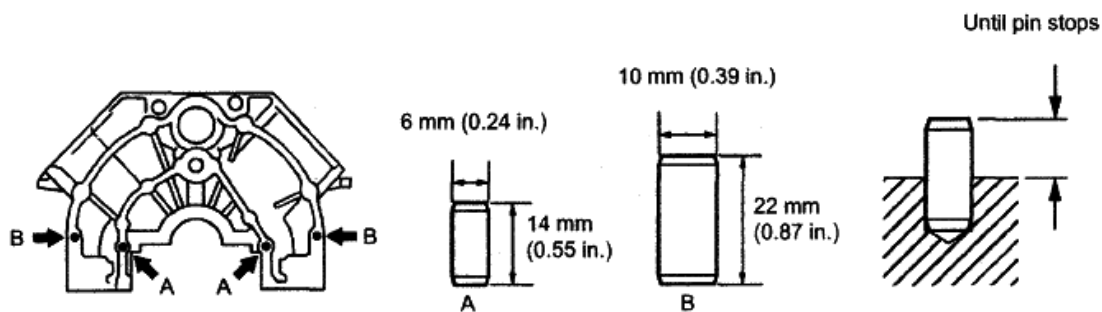
14 N*m (145 kgf*cm, 10 ft.*lbf)

For E

8.0 N*m (80 kgf*cm, 71 ft.*lbf)

3. INSTALL STRAIGHT PIN

- Install the straight pin.



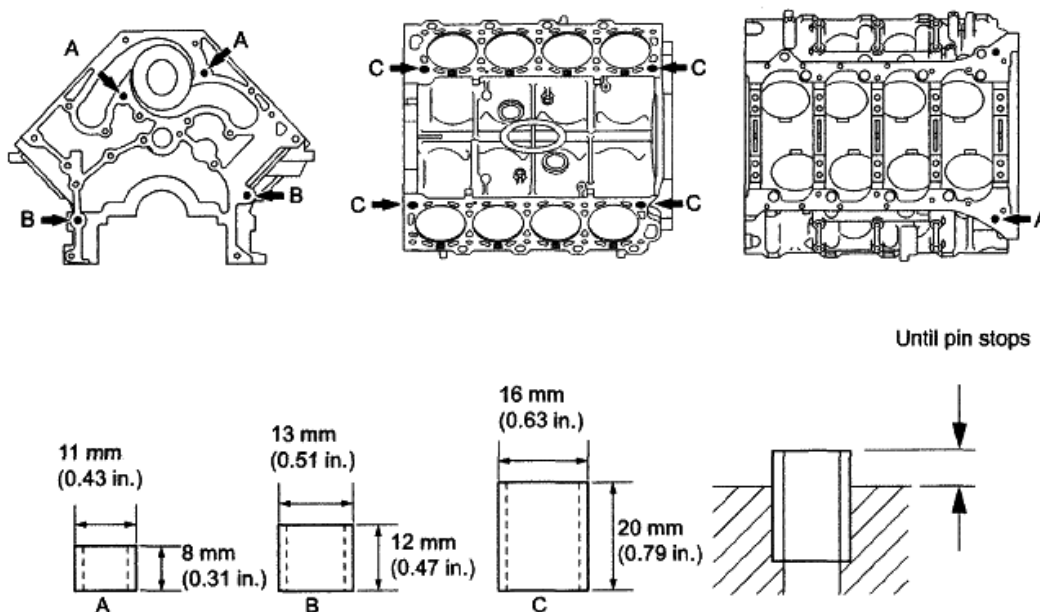
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Fig. 418: Identifying Straight Pin Dimension

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

4. INSTALL RING PIN

- Install the ring pin.



Y

A134388E01

Fig. 419: Identifying Ring Pin Dimension

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

5. INSTALL PISTON

- Using a screwdriver, install a new snap ring on one side of the piston pin hole.

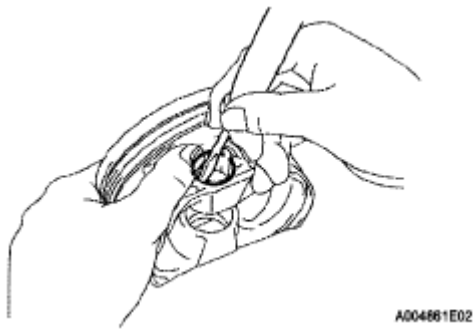


Fig. 420: Identifying Snap Ring On One Side Of Piston Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Gradually heat the piston to about 60°C (140°F).

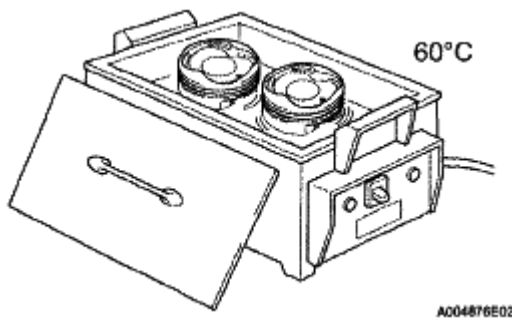


Fig. 421: Heating Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Coat the piston pin with engine oil.
d. Position the piston front mark with respect to the outside mark on the connecting rod as shown in the illustration.

NOTE: The installation directions of the piston and connecting rod are different for the LH and RH banks. The LH piston is marked with 1 cavity and "2", the RH piston with 2 cavities and "2".

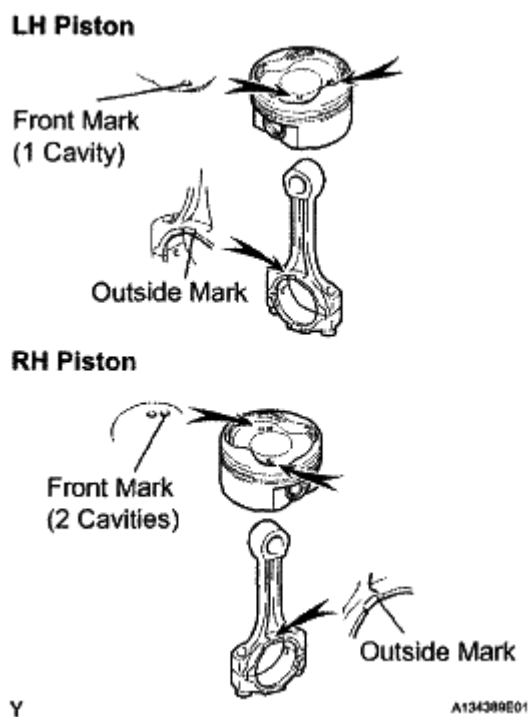


Fig. 422: Identifying Mark Position Of Piston Side
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Align the piston pin holes of the piston and connecting rod, and push in the piston pin with your thumb.
- f. Using a screwdriver, install a new snap ring on the other side of the piston pin hole.

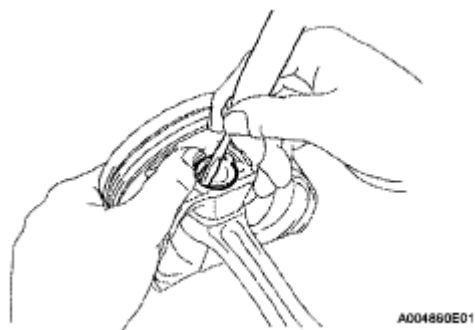


Fig. 423: Identifying Prying Out Snap Rings
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL PISTON RING SET

- a. Install the oil ring expander and 2 side rails by hand.
- b. Using a piston ring expander, install the 2 piston rings with the code mark facing upward.

Code mark:

CODE MARK

No. 1	None
No. 2	2R

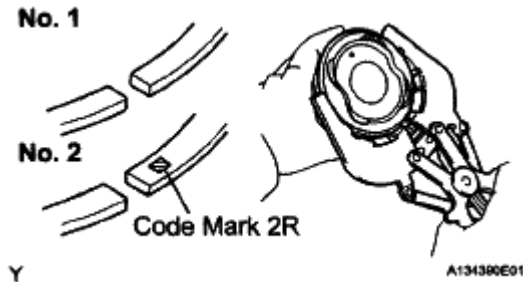


Fig. 424: Identifying Code Mark Of Piston Ring
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Position the piston rings so that the ring ends are as shown in the illustration.

NOTE: Do not align the ring ends.

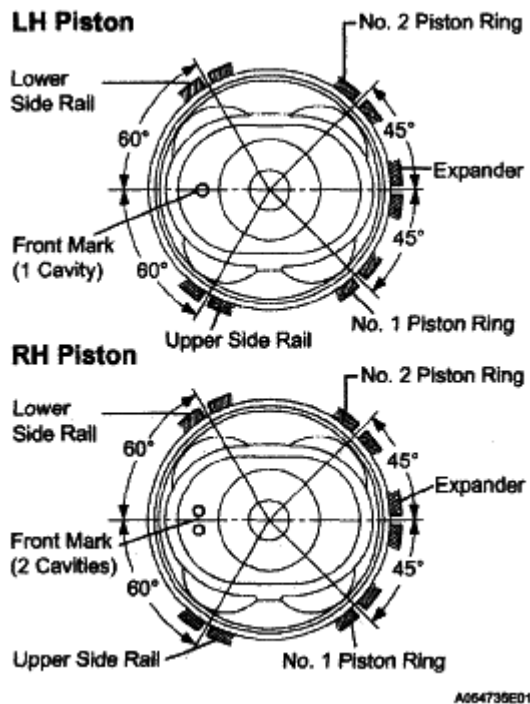


Fig. 425: Identifying Position Of Piston Rings And Ring Ends
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL CONNECTING ROD BEARING

- Align the bearing claw with the groove of the connecting rod or connecting cap.
- Install the bearings in the connecting rod and connecting rod cap.

8. INSTALL CRANKSHAFT BEARING

HINT:

- Main bearings come in widths of 19.5 mm (0.768 in.) and 22.5 mm (0.886 in.). Install the 22.5 mm (0.886 in.) bearings in the No. 1 and No. 5 cylinder block journal positions with the crankshaft bearing cap. Install the 19.5 mm (0.768 in.) bearings in the other positions.
- Upper bearings have an oil groove and oil holes; lower bearings do not.

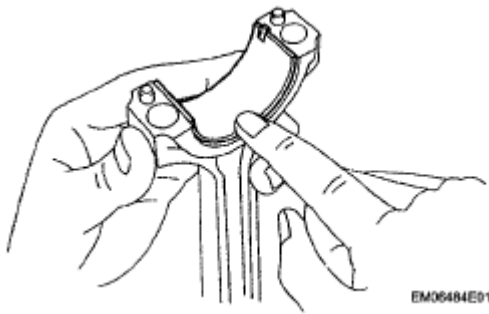


Fig. 426: Identifying Connecting Rod Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- a. Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.

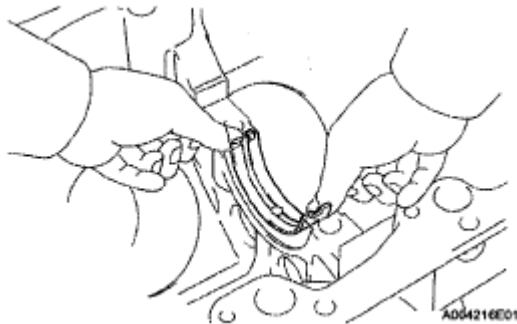


Fig. 427: Aligning Bearing Claw With Claw Groove Of Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Align the bearing claw with the claw groove of the crankshaft bearing cap, and push in the 5 lower bearings.

HINT:

A number is marked on each bearing cap to indicate the installation position.

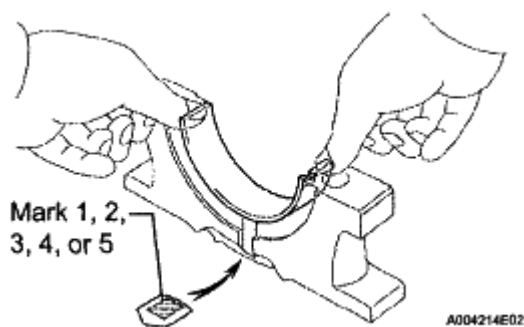


Fig. 428: Aligning Bearing Claw With Claw Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL CRANKSHAFT THRUST WASHER SET

- a. Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

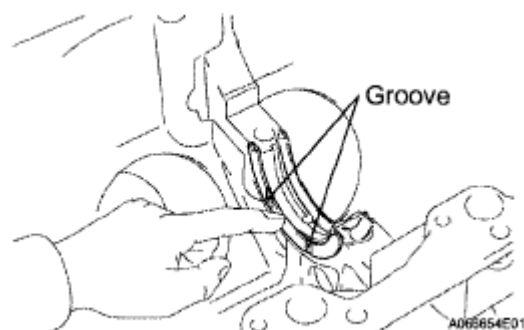


Fig. 429: Identifying Crankshaft Thrust Washer Set
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 thrust washers on the No. 3 bearing cap with the grooves facing outward.

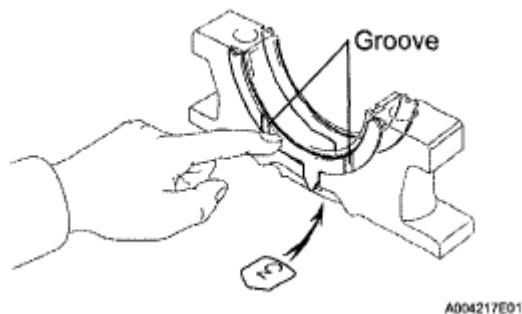


Fig. 430: Installing Thrust Washers On Bearing Cap With Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL CRANKSHAFT PULLEY SET CRANKSHAFT KEY

11. INSTALL CRANKSHAFT

- a. Place the crankshaft on the cylinder block.
- b. Install the 5 crankshaft bearing caps in their proper locations.

HINT:

Place the bearing caps level and let them return to their original positions by their own weight.

NOTE: Do not install the bearing cap by tapping it.

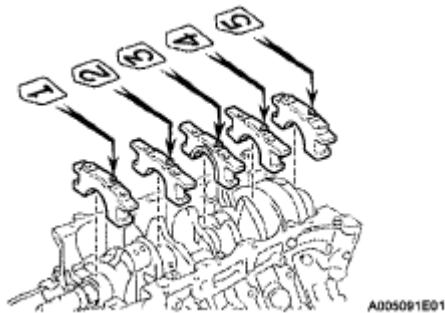


Fig. 431: Installing Crankshaft Bearing Caps In Proper Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the crankshaft bearing cap bolts.

HINT:

- The bearing cap bolts are tightened in 2 progressive steps.
 - If any one of the bearing cap bolts is broken or deformed, replace it.
1. Apply a light coat of engine oil to the threads and under the heads of the crankshaft bearing cap bolts.
 2. Install and uniformly tighten the 10 crankshaft bearing cap bolts in several steps, in the order shown in the illustration.

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

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

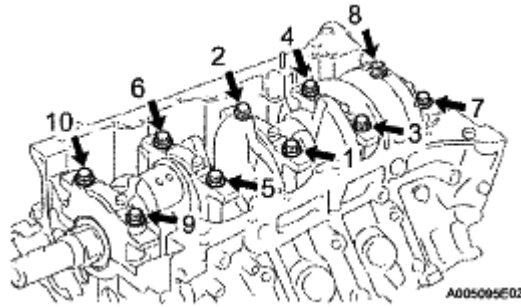


Fig. 432: Identifying Tightening Sequence Of Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Mark the front of the crankshaft bearing cap bolts with paint.
4. Retighten the crankshaft bearing cap bolts by 90° in the order shown.

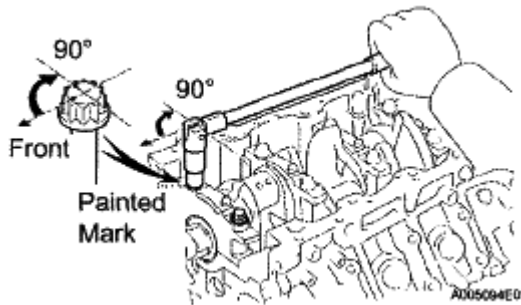


Fig. 433: Tightening Crankshaft Bearing Cap Bolts An Additional 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Check that the painted mark is now at a 90° angle to the front.
6. Check that the crankshaft turns smoothly.

12. INSTALL PISTON AND CONNECTING ROD

- a. Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.

NOTE: The shape of the piston varies for the LH and RH banks. The LH piston is marked with 1 cavity and "2", the RH piston with 2 cavities and "2".

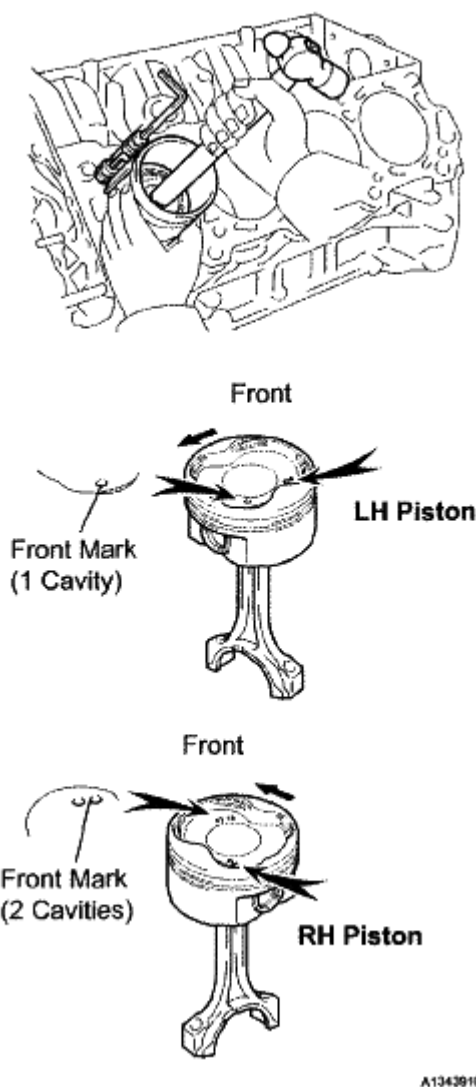


Fig. 434: Identifying Piston And Connecting Rod

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

- b. Place the connecting rod cap on the connecting rod.
 1. Match the numbered connecting rod cap with the connecting rod.
 2. Align the pin groove of the connecting rod cap with the pins of the connecting rod, and install the connecting rod cap.

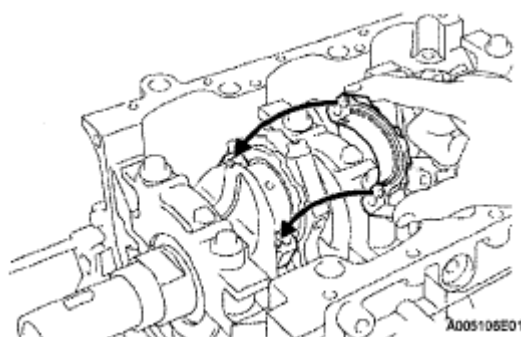


Fig. 435: Identifying Pin Groove Of Connecting Rod Cap
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Check that the outside mark of the connecting rod cap is facing in the correct direction.

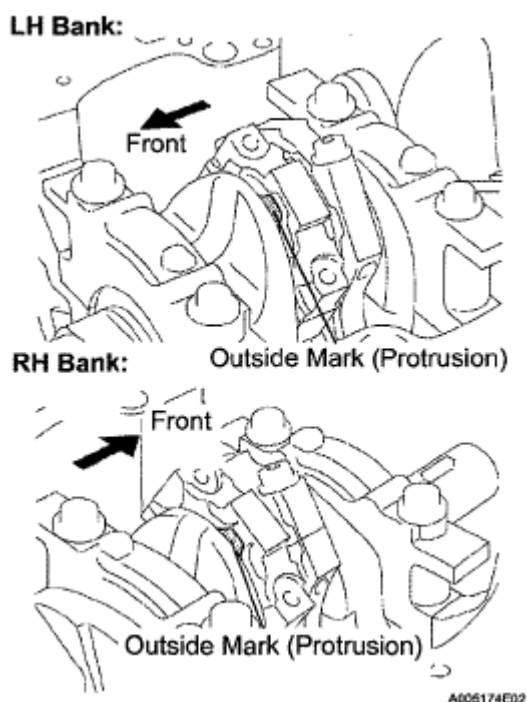


Fig. 436: Identifying Outside Mark Of Connecting Rod Cap
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the connecting rod cap bolts.

HINT:

- The connecting rod cap bolts are tightened in 2 progressive steps.
 - If any one of the connecting rod cap bolts is broken or deformed, replace it.
1. Apply a light coat of engine oil to the threads and under the heads of the connecting rod cap bolts.

2. Install and alternately tighten the 2 connecting rod cap bolts in several steps.

Torque: 25 N*m (250 kgf*cm, 18 ft.*lbf)

If any one of the connecting rod cap bolts does not meet the torque specification, replace the connecting rod cap bolts.

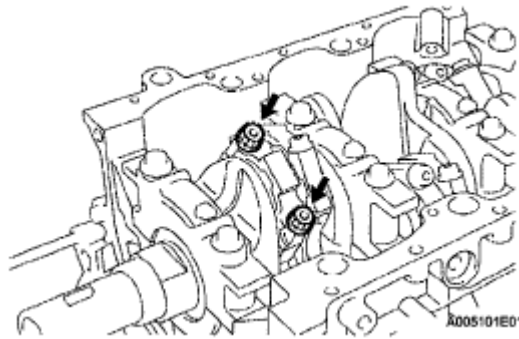


Fig. 437: Identifying Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Mark the front of the connecting cap bolt with paint.
4. Retighten the cap bolts 90° as shown in the illustration.

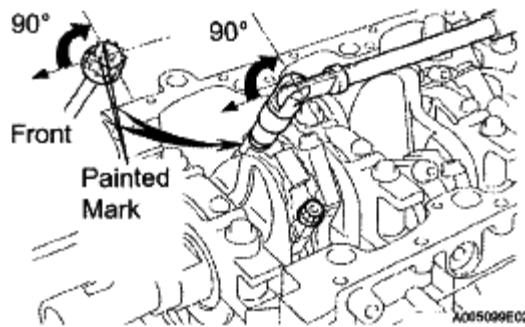


Fig. 438: Tightening Cap Bolts An Additional 90°
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

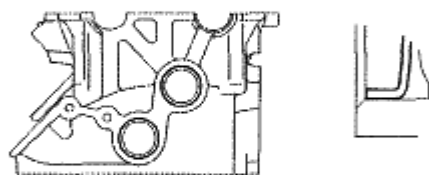
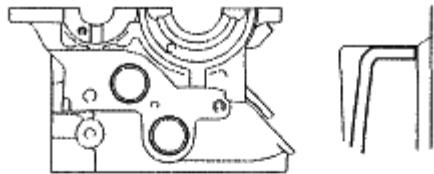
5. Check that the painted mark is now at a 90° angle to the front.
 - d. Check that the crankshaft turns smoothly.
13. **INSTALL NO. 1 TIGHT PLUG**
- a. Apply adhesive to the tight plug.

Adhesive: Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- b. Using SST and a hammer, tap in a new tight plug as shown in the illustration.

SST 09950-60010 (09951 -00300), 09950-70010 (09951-07100)

Front Side



Rear Side

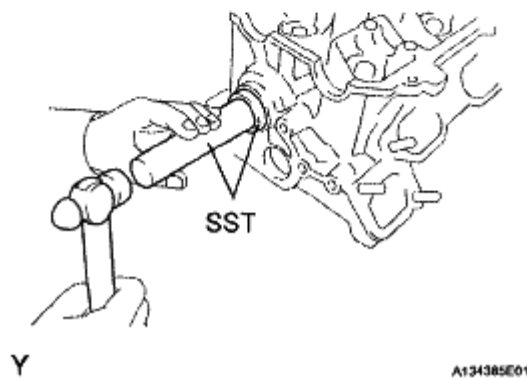
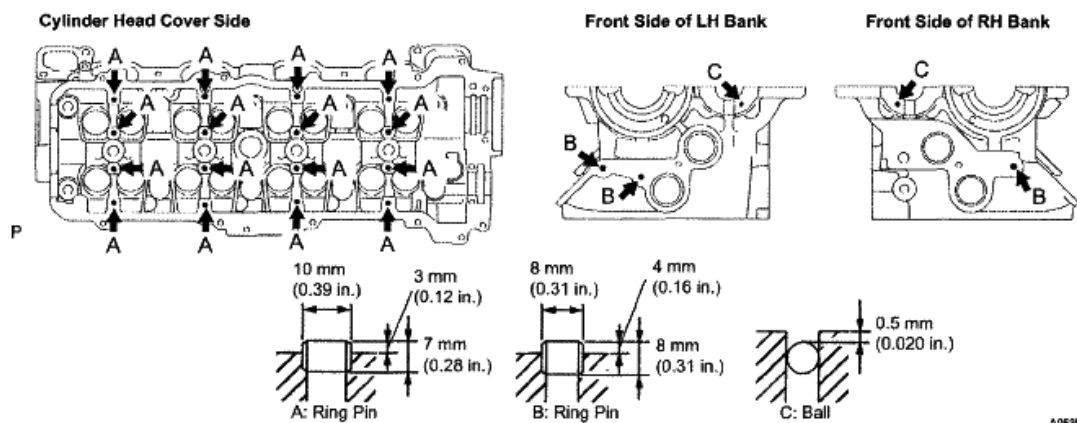


Fig. 439: Tapping Tight Plug

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

14. INSTALL CAMSHAFT BEARING CAP SETTING RING PIN

- a. Install the camshaft bearing cap setting ring pin.



A053B99E01

Fig. 440: Identifying Camshaft Bearing Cap Setting Ring Pin
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL STUD BOLT

- Install the stud bolt.

Torque:

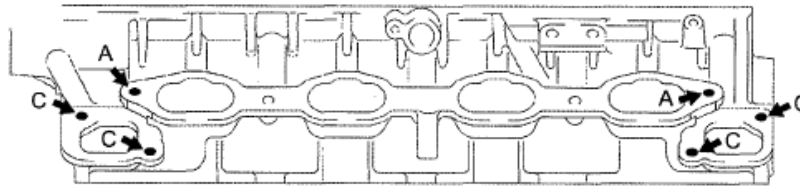
For A and C

9.0 N*m (90 kgf*cm, 80 in.*lbf)

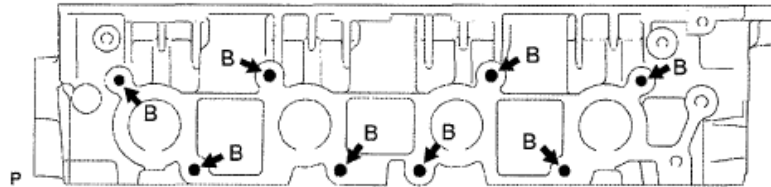
For B

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

Intake Manifold Side



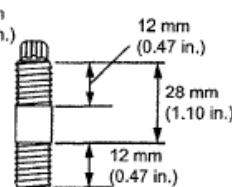
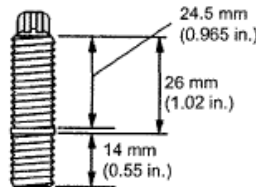
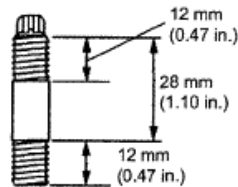
Exhaust Manifold Side



A: Stud Bolt (Thread diameter: 8 mm)

B: Stud Bolt (Thread diameter: 10 mm)

C: Stud Bolt (Thread diameter: 8 mm)



A053860E01

Fig. 441: Identifying Stud Bolt

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

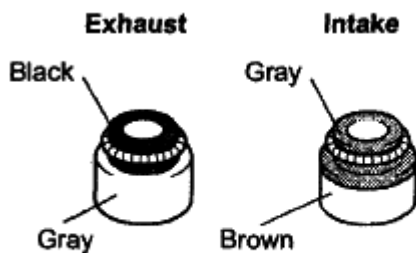
16. INSTALL VALVE STEM OIL SEAL

- Apply a light coat of engine oil to a new oil seal.

NOTE: Pay close attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust or installing the exhaust oil seal to the intake can cause installation problems later.

HINT:

The intake valve oil seal is gray/brown and the exhaust valve oil seal is black/gray.



A053861E03

Fig. 442: Identifying Valve Stem Oil Seal

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

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

SST 09201-41020

NOTE: Failure to use SST will cause the seal to be damaged or improperly seated.

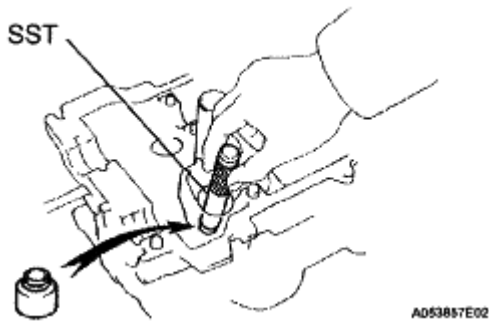


Fig. 443: Identifying Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. INSTALL VALVE

- a. Install the following parts:
 1. Valve (1)
 2. Spring seat (2)
 3. Valve spring (3)
 4. Spring retainer (4)

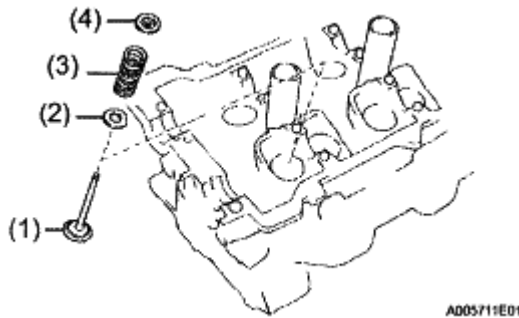


Fig. 444: Identifying Valve Parts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09202-70020 (09202-00010, 09202-01010)

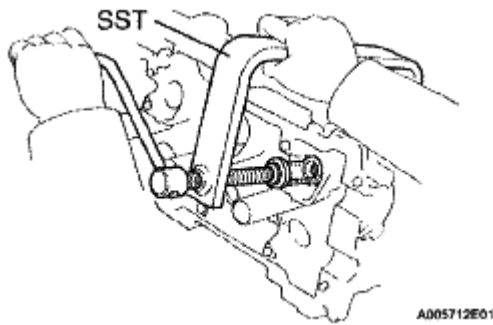


Fig. 445: Identifying Valve Spring

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

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

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

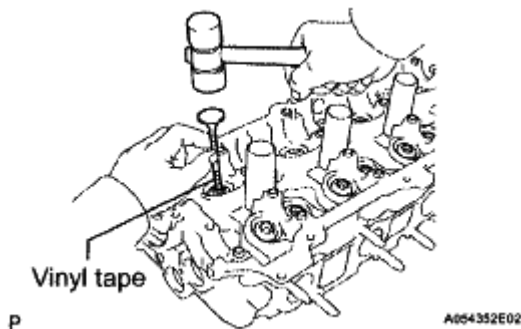


Fig. 446: Tapping Valve Stem Tip

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

18. INSTALL VALVE LIFTER

- a. Install the valve lifter and shim.
- b. Check that the valve lifter rotates smoothly by hand.

19. INSTALL SPARK PLUG TUBE GASKET

- a. Using SST and a hammer, tap in a new gasket until its surface is flush with the upper edge of the cylinder head cover.

SST 09950-60010 (09951-00240, 09951 -00440, 09952-06010), 09950-70010 (09951-07100)

NOTE: Be careful of the installation direction.

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

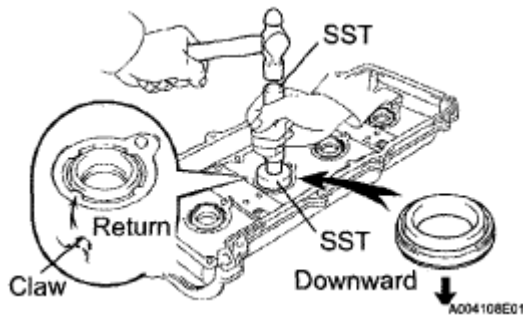


Fig. 447: Identifying Spark Plug Tube Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSTALL CAMSHAFT SETTING OIL SEAL

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

NOTE:

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

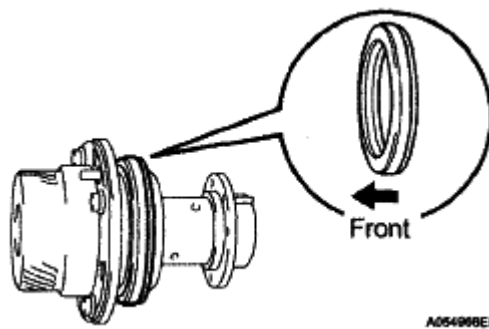


Fig. 448: Identifying Camshaft Setting Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. INSTALL CAMSHAFT TIMING TUBE ASSEMBLY

- Align the timing tube knock pin with the knock pin groove of the drive gear, and temporarily install the drive gear with the 4 bolts.
- Using SST and a 5 mm hexagon wrench, uniformly tighten the 4 bolts in several steps.

SST 09960-10010 (09962-01000, 09963-00500)

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

NOTE:

Be careful not to damage the timing tube.

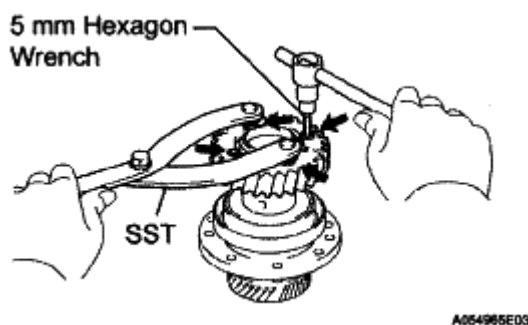


Fig. 449: Identifying Camshaft Timing Tube Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

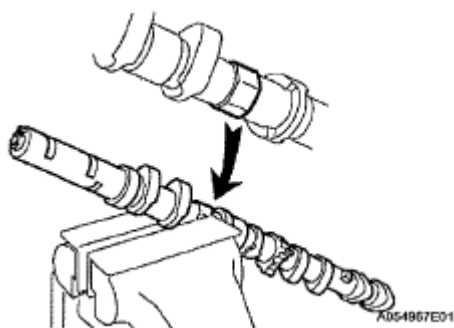


Fig. 450: Identifying Hexagonal Portion Of Camshaft In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Align the camshaft knock pin with the knock pin groove of the timing tube, and push the timing tube by hand until it touches the bottom.
- e. Using a 10 mm hexagon wrench, install the bolt.

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

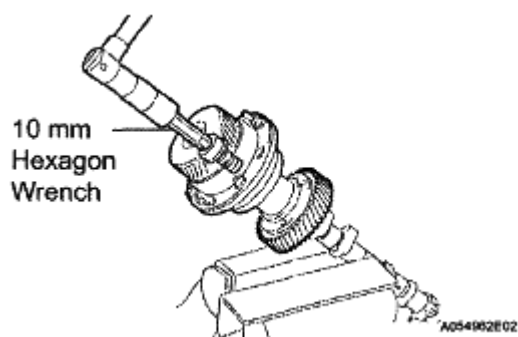


Fig. 451: Identifying Bolt With Hexagon Wrench

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

- f. Install the seal washer and screw plug.

Torque: 15 N*m (152 kgf*cm, 11 ft.*lbf)

22. INSTALL CAMSHAFT SUB GEAR

- a. Install the gear spring [1], sub gear [2] and wave washer [3].

HINT:

Attach the pins on the gears to the gear spring ends.

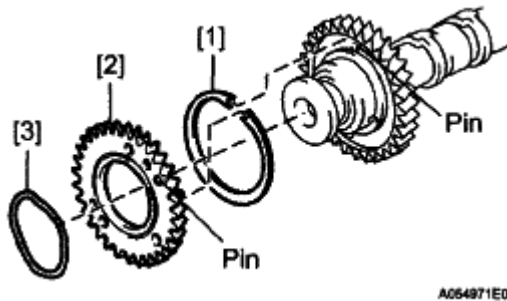


Fig. 452: Identifying Gear Spring, Sub Gear And Wave Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

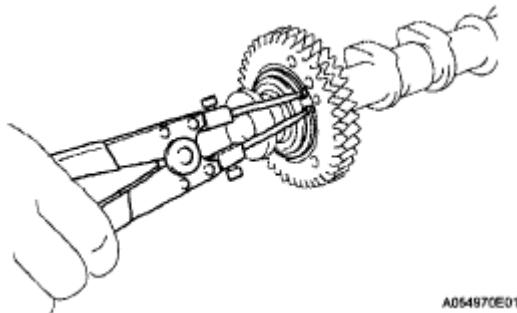


Fig. 453: Identifying Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Mount the hexagonal portion of the camshaft in a vise.

NOTE: Be careful not to damage the camshaft.

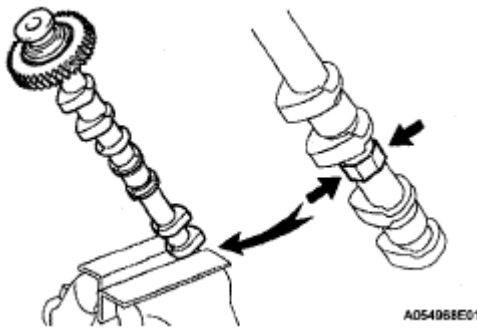


Fig. 454: Identifying Hexagonal Portion Of Camshaft In Vise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using SST, align the holes of the driven main gear and sub gear by turning the sub gear clockwise, and temporarily install a service bolt.

SST 09960-10010 (09962-01000, 09963-00500)

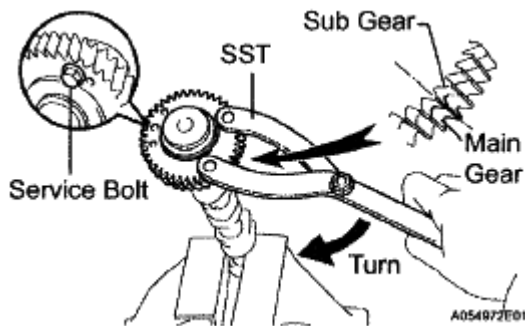


Fig. 455: Aligning Holes Of Driven Main Gear And Sub Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Align the gear teeth of the driven main gear and sub gear, and tighten the service bolt.

Recommended service bolt:

RECOMMENDED SERVICE BOLT

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

23. INSTALL OIL PUMP SEAL

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

SST 09316-60011 (09316-00011)

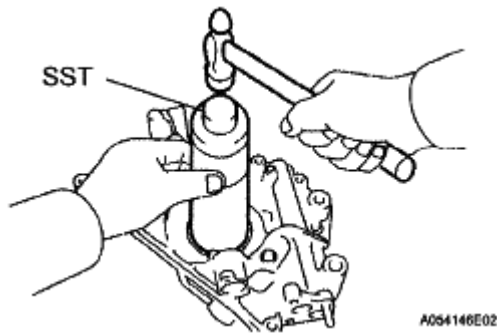


Fig. 456: Identifying Oil Pump Seal

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

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

24. INSTALL ENGINE REAR OIL SEAL

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

SST 09223-56010

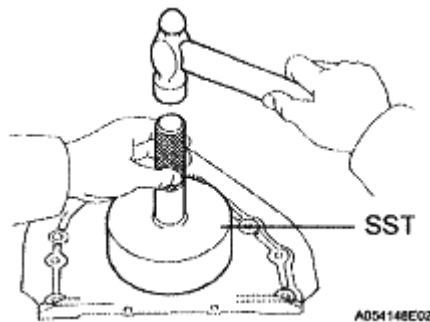


Fig. 457: Identifying Engine Rear Oil Seal

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

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

25. INSTALL ENGINE REAR OIL SEAL RETAINER

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

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

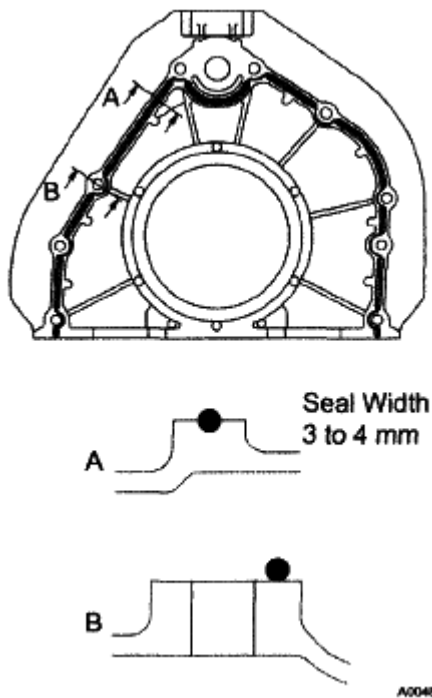


Fig. 458: Applying Seal Packing To Oil Seal Retainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

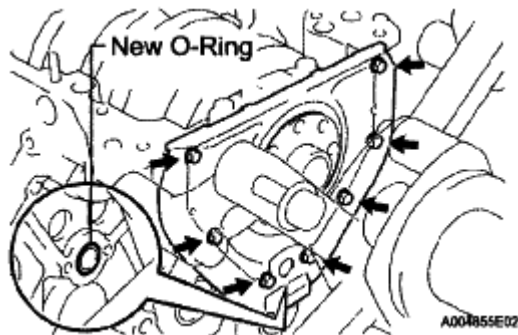


Fig. 459: Identifying O-Ring And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the oil seal retainer with the 7 bolts.

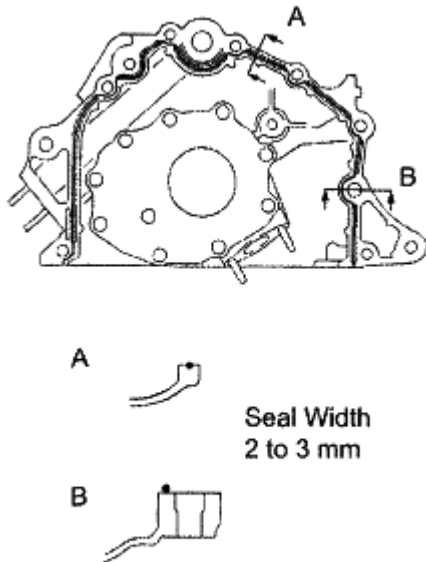
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

26. INSTALL OIL PUMP ASSEMBLY

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the oil pump and cylinder block.
 1. Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
 2. Thoroughly clean all components to remove all the loose material.
 3. Using a non-residue solvent, clean both sealing surfaces.
- b. Apply seal packing to the oil pump as shown in the illustration.

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

NOTE: Avoid applying an excessive amount to the surface, especially around the oil passage.



B000950E03

Fig. 460: Applying Seal Packing To Oil Pump

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

1. Use a nozzle that has been cut to a 2 to 3 mm (0.08 to 0.12 in.) opening.
 2. Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
 3. Immediately remove the nozzle from the tube and reinstall the cap.
- c. Install a new O-ring to the cylinder block.
 - d. Engage the spline teeth of the oil pump drive gear with the large teeth of the crankshaft, and slide the oil pump on the crankshaft.

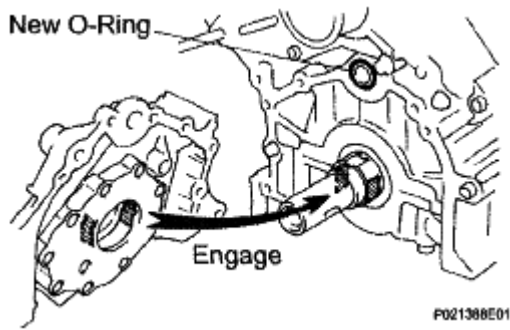


Fig. 461: Engaging Spline Teeth Of Oil Pump Drive Gear With Large Teeth Of Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the oil pump with a new stud bolt and the 7 bolts. Uniformly tighten the bolts diagonally.

HINT:

- Use a 6mm hexagon wrench to tighten the hexagon head bolt.
- The following chart is the reference of the oil pump bolt length.

REFERENCE OF THE OIL PUMP BOLT LENGTH

Bolt	Size of Bolt Head	Length
A	12 mm	50 mm (1.97 in.)
B	14 mm Stud Bolt	102.8 mm (4.047 in.)
C	12 mm	35 mm (1.38 in.)
D	14 mm	44 mm (1.73 in.)
E	6 mm Hexagon	28 mm (1.10 in.)

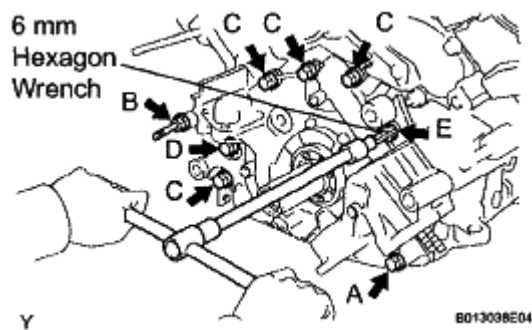


Fig. 462: Identifying Oil Pump With Stud Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque:

For bolts A, B, C and E

16 N*m (160 kgf*cm, 11 ft.*lbf)

For bolt D

31 N*m (311 kgf*cm, 23 ft.*lbf)

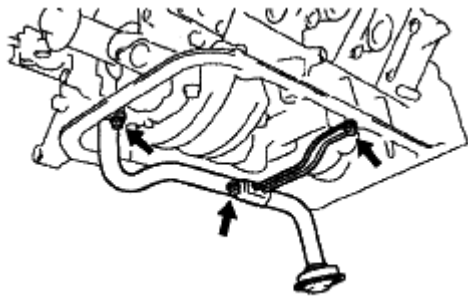
27. INSTALL OIL STRAINER SUB-ASSEMBLY

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

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

HINT:

Use bolts 12 mm (0.47 in.) in length.



Y

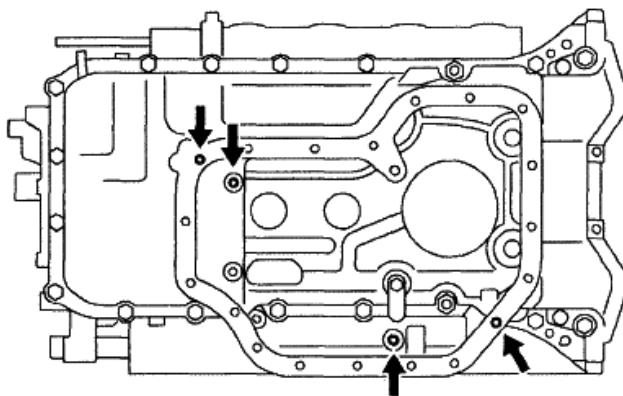
A072708

Fig. 463: Identifying Oil Strainer Bolts

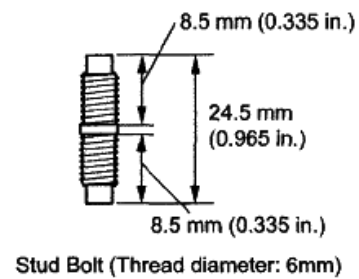
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. INSTALL STUD BOLT

- Install the stud bolt.



Y



A072710E01

Fig. 464: Identifying Stud Bolt Dimension

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

Torque: 3.5 N*m (36 kgf*cm, 31 in.*lbf)

29. INSTALL OIL PAN SUB-ASSEMBLY

- a. Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the No. 1 oil pan, cylinder block, oil pump and rear oil seal retainer.
 - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
 - Thoroughly clean all components to remove all the loose material.
 - Using a non-residue solvent, clean both sealing surfaces.
- b. Apply seal packing to the No. 1 oil pan as shown in the illustration.

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

- Use a nozzle that has been cut to a 3 to 5 mm (0.12 to 0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap.

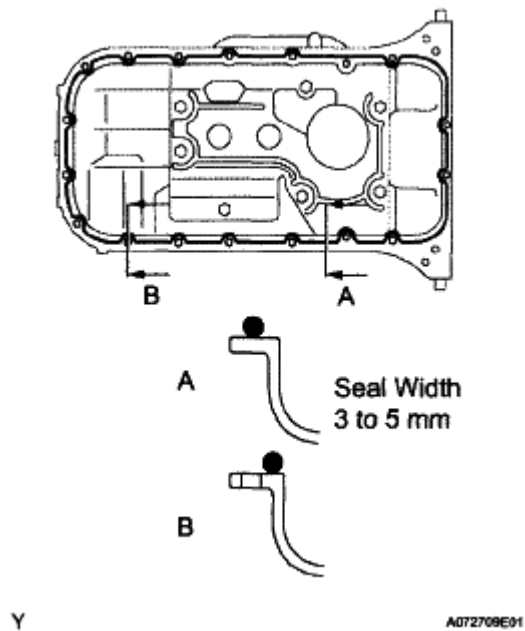


Fig. 465: Identifying Oil Pan Sub-Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Temporarily install the oil pan with the 18 bolts and 2 nuts.

HINT:

The following chart is the reference for the oil pump bolt length.

REFERENCE FOR THE OIL PUMP BOLT LENGTH

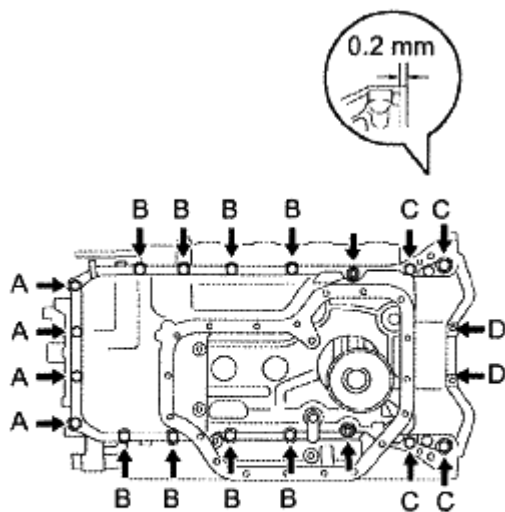
Bolt	Size of Bolt Head	Length
A	10 mm	20 mm (0.79 in.)

B	12 mm	25 mm (0.98 in.)
C	12 mm	60 mm (2.36 in.)
D	10 mm	35 mm (1.38 in.)

- d. Set the oil pan as shown in the illustration.

NOTE: Make sure that the clearance between the rear end of the oil pan and cylinder block is 0.2 mm (0.008 in.) or less.

If the clearance is more than 0.2 mm (0.008 in.), the oil pan will be stretched.



Y

A072710E01

Fig. 466: Identifying Oil Pan Bolt Location

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

- e. Uniformly tighten the bolts and nuts diagonally.

Torque:

For bolts A and D

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

For bolts B, C and nut

28 N*m (286 kgf*cm, 21 ft.*lbf)

30. INSTALL OIL PAN BAFFLE PLATE NO.1

- a. Install the baffle plate with the 2 bolts and 2 nuts.

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

HINT:

Use bolts 12 mm (0.47 in.) in length.

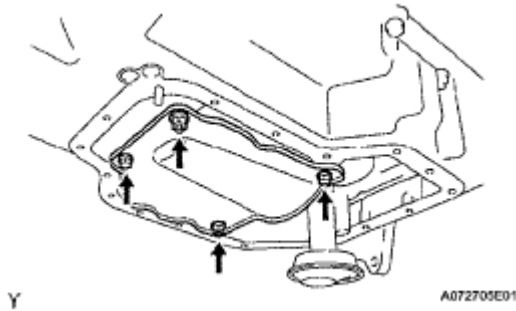


Fig. 467: Identifying Baffle Plate With Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY

- a. Remove any oil packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the No. 1 and No. 2 oil pans.
 - Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
 - Thoroughly clean all components to remove all the loose material.
 - Using a non-residue solvent, clean both sealing surfaces.

NOTE: Do not use a solvent which will affect the painted surfaces.

- b. Apply seal packing to the No. 2 oil pan as shown in the illustration.

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

- Use a nozzle that has been cut to a 3 to 5 mm (0.12 to 0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove the nozzle from the tube and reinstall the cap.

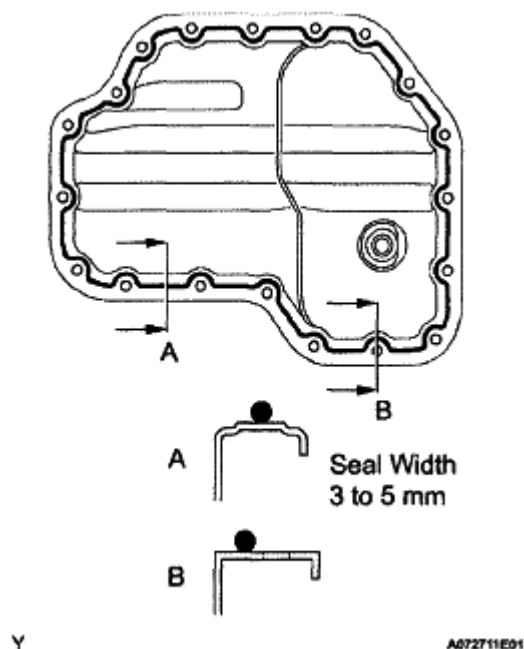


Fig. 468: Identifying Oil Pan Sub-Assembly

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

- c. Install the No. 2 oil pan with the 17 bolts and 2 nuts. Uniformly tighten the bolts and nuts in several steps.

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

HINT:

Use bolts 14 mm (0.55 in.) in length.

32. INSTALL WATER PUMP ASSEMBLY

- a. Install a new gasket and water pump with the 5 bolts, 2 stud bolts and nut. Uniformly tighten the bolts, stud bolts and nut in several steps.

Torque:

Bolt

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

Stud bolt and nut

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

HINT:

Use bolts 35 mm (1.38 in.) in length.

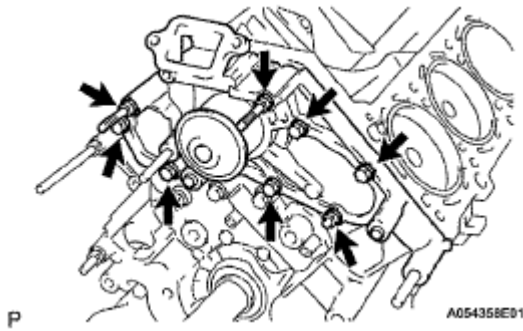


Fig. 469: Identifying Water Pump Assembly Bolts And Stud Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. INSTALL CYLINDER HEAD SUB-ASSEMBLY

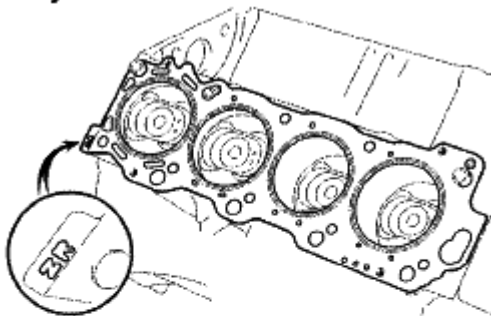
- Place 2 new cylinder head gaskets in position on the cylinder block.

HINT:

A mark is placed on the rear side of the cylinder head gasket to distinguish the LH and RH banks, a "2R" mark for the RH bank and a "2L" mark for the LH bank.

NOTE: Be careful of the installation direction.

RH Cylinder Head



LH Cylinder Head

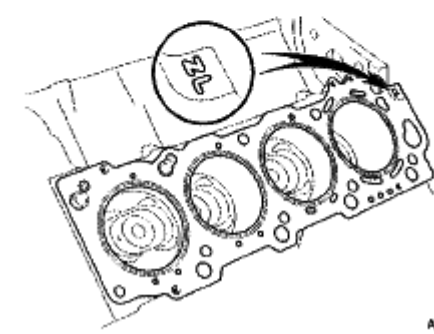


Fig. 470: Identifying Cylinder Head Sub-Assembly

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

- b. Place the 2 cylinder heads in position on the cylinder head gaskets.
- c. Install the cylinder head bolts.

HINT:

- The cylinder head bolts are tightened in 2 progressive steps (Procedures "A" and "B").
 - If any cylinder head bolt is broken or deformed, replace it.
1. Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 2. Install the plate washer to the cylinder head bolt.
 3. Install and uniformly tighten the 10 cylinder head bolts on one side of the cylinder head in several steps in the order shown in the illustration, then do the other side in the same way (Procedure "A").

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

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

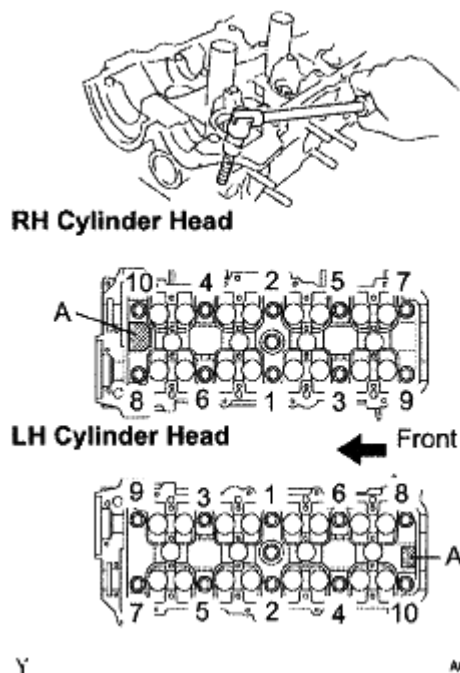


Fig. 471: Identifying Cylinder Head Bolts Tightening Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

block into the oil pan.

4. Mark the front of the cylinder head bolt head with paint.
5. Retighten the cylinder head bolts by 90° in the numerical order shown (Procedure "B").

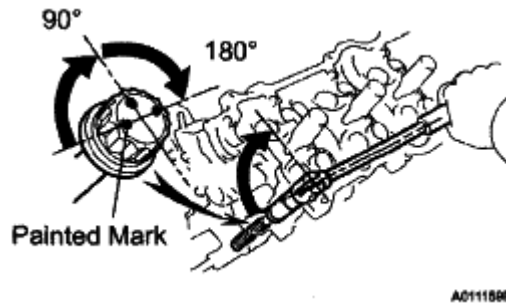


Fig. 472: Retightening Cylinder Head Bolts An Additional 90°
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Retighten the cylinder head bolts by an additional 90°.
7. Check that the painted mark is now at a 180° angle to front.

34. INSTALL CAMSHAFTS

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

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

CAUTION: Having the crankshaft at a wrong angle can cause the piston head and valve head to come into contact with each other when installing the camshaft, causing damage. So always set the crankshaft at the correct angle.

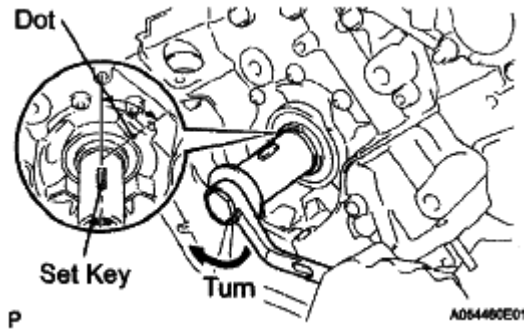


Fig. 473: Identifying Crankshaft

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

- b. Install the camshafts of the RH bank.
 1. Apply engine oil to the thrust portions of the intake and exhaust camshafts.
 2. Align the timing marks (1-dot mark) of the camshaft drive and driven main gears, and place the 2 camshafts.

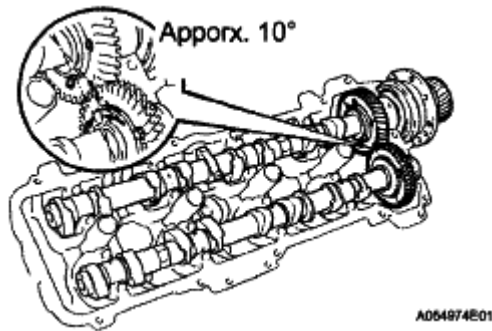


Fig. 474: Aligning Timing Marks Of Camshaft Drive & Driven Main Gears

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

3. Set the timing marks (1-dot mark) of the camshaft drive and driven main gears at approx. 10° angle.
4. Apply seal packing to the camshaft housing plug.
 - Remove the old packing (FIPG) material.
 - Apply seal packing to the housing plug.

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

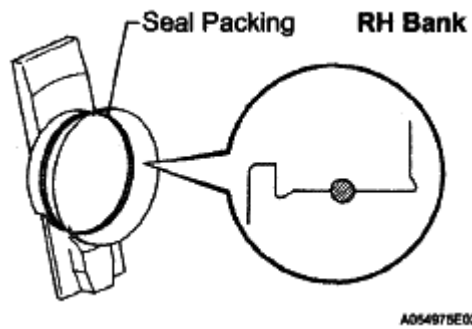


Fig. 475: Identifying Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Be careful of the installation direction.

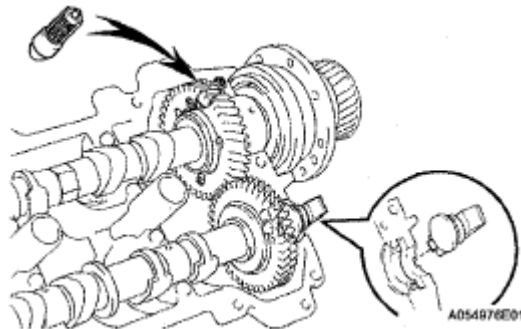


Fig. 476: Identifying Camshaft Housing Plug And Oil Control Valve Filter To Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Apply seal packing to the front bearing cap.
 - Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.

Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove. Thoroughly clean all components to remove all the loose material. Using a non-residue solvent, clean both sealing surfaces.

- Apply seal packing to the bearing cap as shown in the illustration.

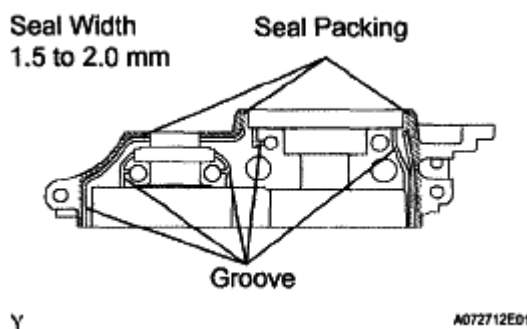


Fig. 477: Applying Seal Packing To Front Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Use a nozzle that has been cut to 1.5 to 2.0 mm (0.059 to 0.079 in.) opening.

Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.

Immediately remove the nozzle from the tube and reinstall the cap.

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

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

7. Install the front bearing cap.

HINT:

The thrust position of the camshaft will be determined after installing the front bearing cap.

8. Install the other bearing caps in the order shown with the arrow mark facing forward.

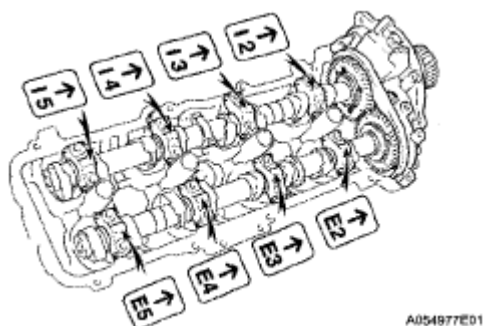


Fig. 478: Identifying Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. Push in the camshaft setting oil seal.

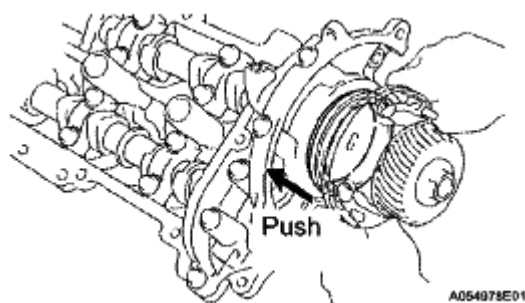


Fig. 479: Identifying Camshaft Setting Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. Install new seal washers to the bearing cap bolts (A and B).

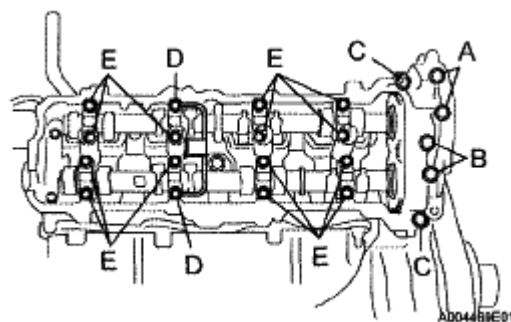


Fig. 480: Identifying Bearing Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts (D and E).

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

HINT:

Each bolt length is as follows:

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

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

25 mm (0.98 in.) for C

55 mm (2.17 in.) for D

40 mm (1.57 in.) for E

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

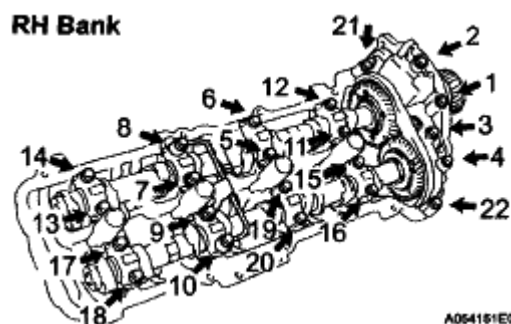


Fig. 481: Identifying Bearing Cap Bolts Location

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

13. Uniformly tighten the 22 bearing cap bolts in several steps, in the order shown in the illustration.

Torque:

For bolt C

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

For others

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

14. Bring the service bolt installed in the driven sub-gear upward by turning the hexagonal portion of the camshaft with a wrench.
15. Remove the service bolt.

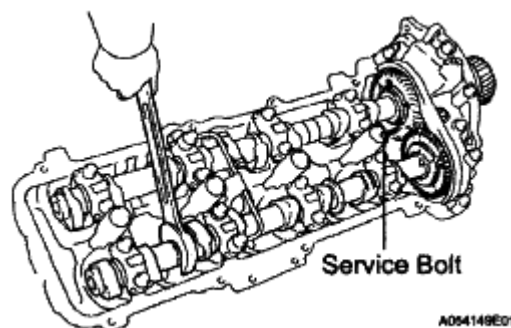


Fig. 482: Identifying Service Bolt

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

- c. Install the camshafts of the LH bank.

1. Apply MP grease to the thrust portion of the camshafts.

2. Align the timing marks (2-dot marks) of the camshaft drive and driven main gears, and place the 2 camshafts.

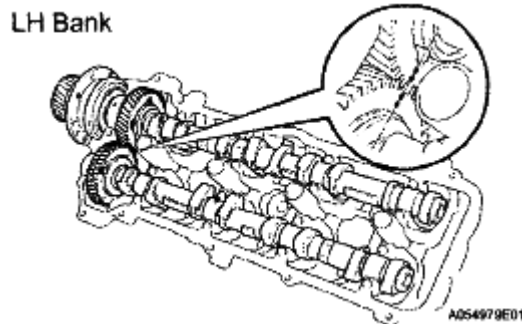


Fig. 483: Identifying Timing Marks Of Camshaft Drive And Driven Main Gears
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

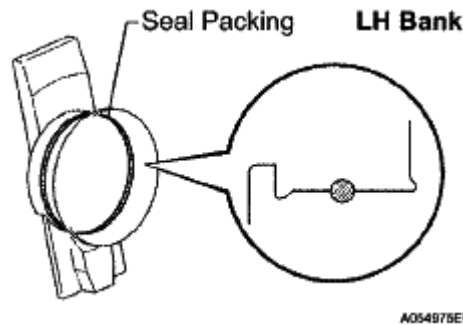


Fig. 484: Identifying Seal Packing To Housing Plug
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

CAUTION: Be careful of the installation direction.

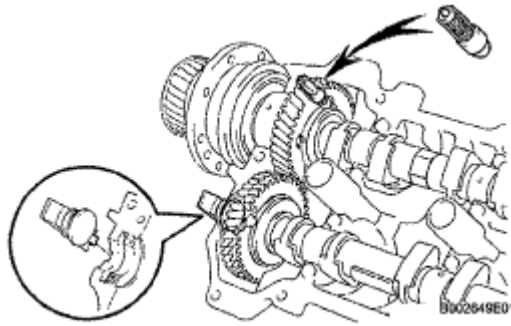


Fig. 485: Identifying Camshaft Housing Plug And Oil Control Valve Filter To Cylinder Head

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

5. Apply seal packing to the front bearing cap.

- Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the bearing cap and cylinder head.

Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and groove. Thoroughly clean all components to remove all the loose material. Using a non-residue solvent, clean both sealing surfaces.

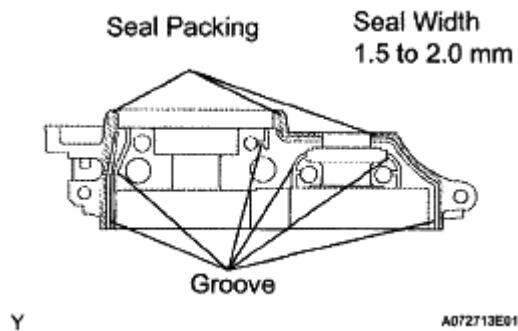


Fig. 486: Identifying Seal Packing And Bearing Cap

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

- Apply seal packing to the bearing cap as shown in the illustration.

Use a nozzle that has been cut to 1.5 to 2.0 mm (0.059 to 0.079 in.) opening. Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied. Immediately remove the nozzle from the tube and reinstall the cap.

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

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

6. Install the front bearing cap.

HINT:

The thrust position of the camshaft will be determined after installing the front bearing cap.

7. Install the other bearing cap in the order shown with the arrow mark facing forward.

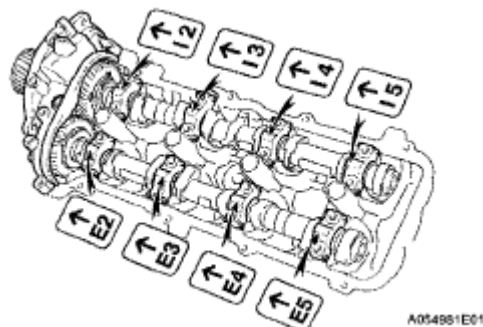


Fig. 487: Identifying Front Bearing Cap

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

8. Push in the camshaft setting oil seal.

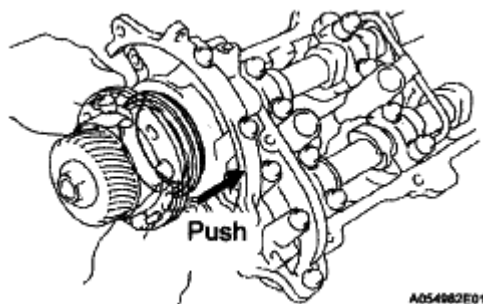


Fig. 488: Identifying Camshaft Setting Oil Seal

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

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

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

HINT:

Each bolt length is as follows:

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

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

25 mm (0.98 in.) for C

55 mm (2.17 in.) for D

40 mm (1.57 in.) for E

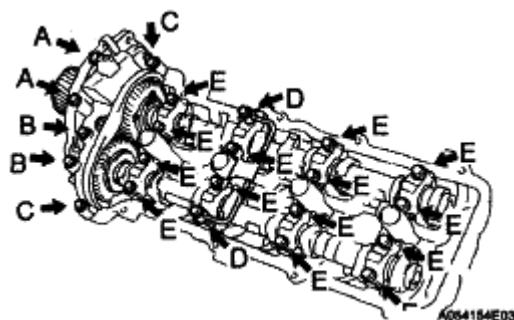


Fig. 489: Identifying Bearing Cap Bolt

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

11. Install the oil feed pipe and the 22 bearing cap bolts as shown in the illustration.
12. Uniformly tighten the 22 bearing cap bolts in several steps, in the order shown in the illustration.

Torque:

For bolt C

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

For others

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

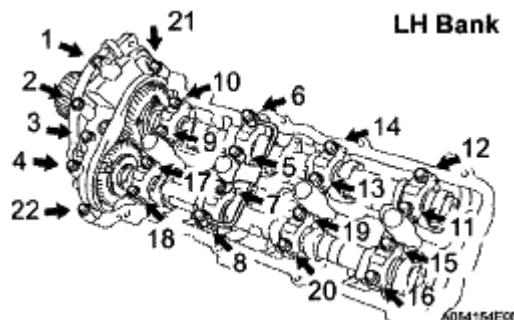


Fig. 490: Identifying Bearing Cap Bolts In Several Steps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. Bring the service bolt installed in the driven sub-gear upward by turning the hexagonal portion of the camshaft with a wrench.
14. Remove the service bolt.

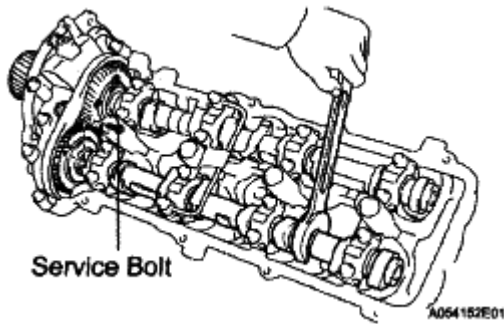


Fig. 491: Identifying Service Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. INSTALL REAR TIMING BELT PLATE RH

- a. Install the rear timing belt plate with the bolt and stud bolt.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

36. INSTALL NO. 2 REAR TIMING BELT PLATE RH

- a. Install the rear timing belt plate with the 2 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

37. INSTALL REAR TIMING BELT PLATE LH

- a. Install the rear timing belt plate with the bolt.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

38. INSTALL NO. 2 REAR TIMING BELT PLATE LH

- a. Install the rear timing belt plate with the 2 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

39. INSTALL CRANKSHAFT TIMING PULLEY

- a. Fit the timing pulley set key to the key groove of the pulley.
- b. Using SST and a hammer, tap in the timing pulley with the flange side facing inward.

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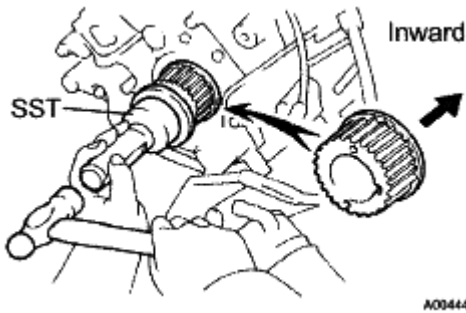


Fig. 492: Identifying Tapping Timing Pulley With Flange Side Facing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. INSTALL NO. 2 TIMING BELT IDLER SUB-ASSEMBLY

- a. Install the idler with the bolt.

Torque: 35 N*m (352 kgf*cm, 25 ft.*lbf)

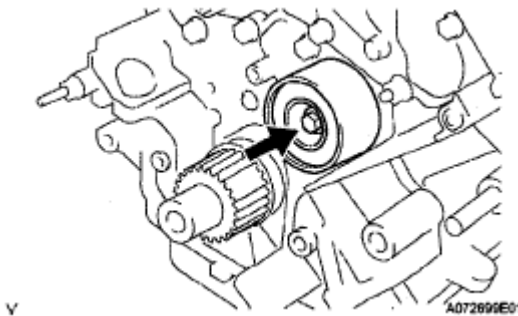


Fig. 493: Identifying Idler With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the idler moves smoothly.

41. INSTALL NO. 1 TIMING BELT IDLER SUB-ASSEMBLY

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

Adhesive: Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

- b. Using a 10 mm hexagon wrench, install the plate washer and idler with the pivot bolt.

Torque: 35 N*m (352 kgf*cm, 25 ft.*lbf)

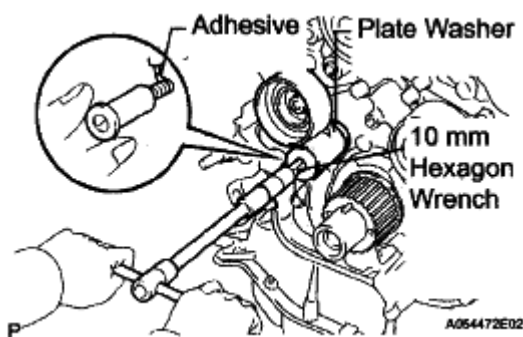


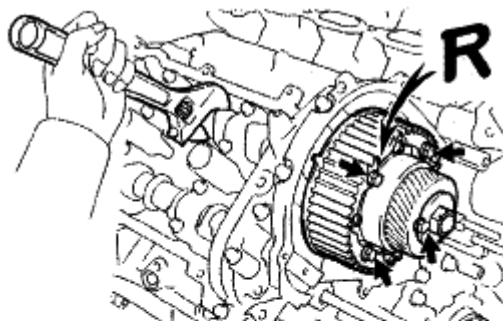
Fig. 494: Identifying Timing Belt Idler Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check that the idler bracket moves smoothly.

42. INSTALL CAMSHAFT TIMING PULLEYS

- a. Align the camshaft timing tube knock pin with the knock pin groove of the timing pulley.

RH Bank:



LH Bank:

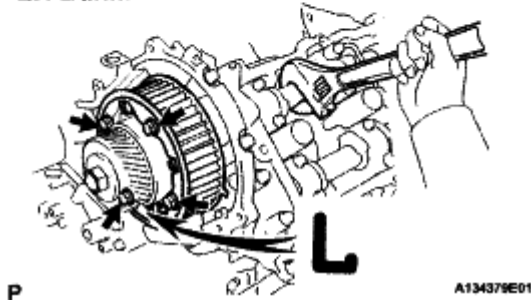


Fig. 495: Identifying Camshaft Timing Pulleys
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Attach the timing pulley to the camshaft timing tube. Face the timing pulley's "R" and "L" marks forward.
- c. Hold the hexagonal portion of the camshaft,
- d. Using a 5 mm hexagon wrench, install the 8 bolts.

Torque: 8.1 N*m (83 kgf*cm, 72 in.*lbf)

43. INSTALL TIMING BELT

NOTE: The engine should be cold.

a. Set the No. 1 cylinder to TDC/compression.

1. Turn the hexagonal portion of the camshaft to align the timing marks of the camshaft timing pulleys and timing belt plates.

HINT:

By turning the camshaft timing pulleys clockwise as follows, installation of the timing pulleys will be easy:

1/2 teeth turn for the left bank camshaft timing pulley

1 tooth turn for the right bank camshaft timing pulley

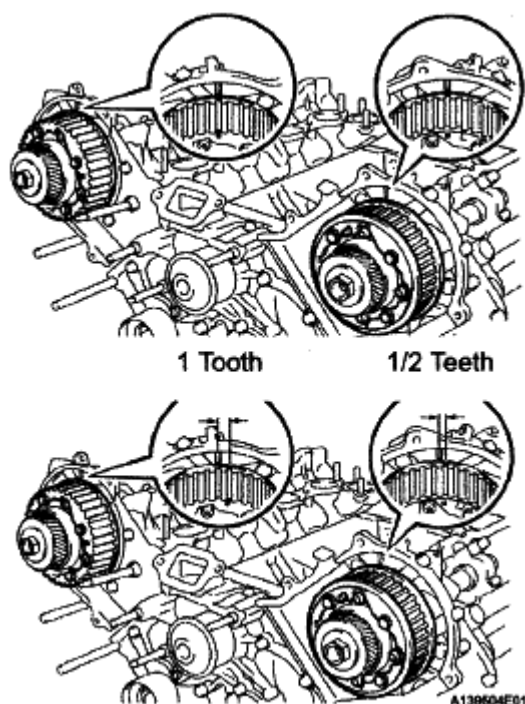


Fig. 496: Identifying Camshaft Timing Pulleys And Timing Belt Plates
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

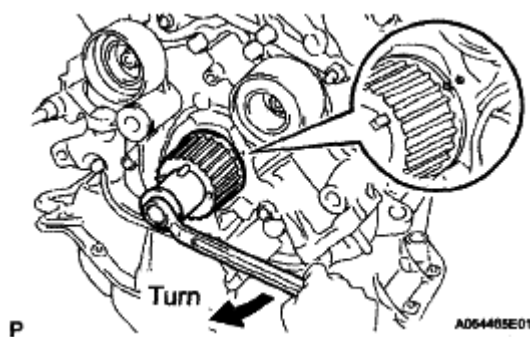


Fig. 497: Identifying Crankshaft Of Crankshaft Timing Pulley And Oil Pump Body
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the timing belt.

1. Remove any oil or water on each pulley. Keep them clean after removal.

NOTE: Only wipe the pulleys; do not use any cleansing agent.

2. Face the front mark (arrow) on the timing belt forward.
3. Connect the timing belt to the crankshaft timing pulley.
 - Align the installation mark on the timing belt with the timing mark of the crankshaft timing pulley.

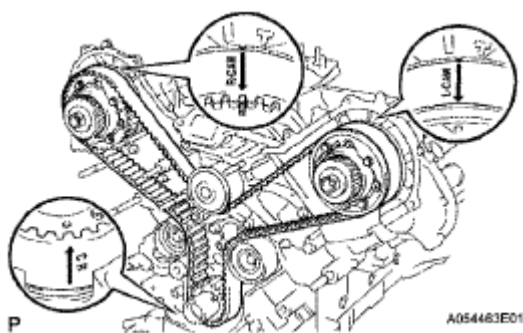


Fig. 498: Identifying Installation Mark On Belt With Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Connect the No. 2 timing belt to the idler.
5. Connect the timing belt to the camshaft timing pulley LH.
 - Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.
6. Connect the timing belt to the water pump pulley.
7. Connect the timing belt to the camshaft timing pulley (RH bank).
 - Align the installation mark on the timing belt with the timing mark of the camshaft timing pulley.

8. Connect the No. 1 timing belt to the idler.
- c. Set the belt tensioner.
 1. Using a press, slowly press in the push rod using 981 to 9,807 N (100 to 1,000 kgf, 220 to 2,205 lbf) of pressure.
 2. Align the holes of the push rod and housing, pass a 1.27 mm hexagon wrench through the holes to keep the setting position of the push rod.

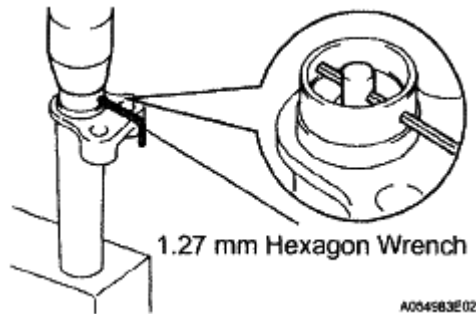


Fig. 499: Identifying Hexagon Wrench Holes Position Of Push Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Release the press.
4. Install the dust boot to the belt tensioner.
- d. Install the belt tensioner.
 1. Temporarily install the belt tensioner with the 2 bolts.

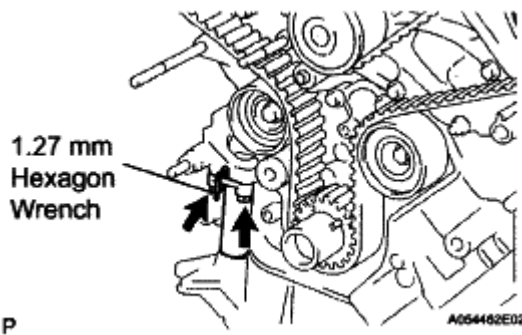


Fig. 500: Identifying Belt Tensioner With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Alternately tighten the 2 bolts.

Torque: 26 N*m (270 kgf*cm, 19 ft.*lbf)

3. Using pliers, remove the 1.27 mm hexagon wrench from the belt tensioner.
- e. Check the valve timing.
 1. Using the crankshaft damper bolt, slowly turn the crankshaft pulley 2 revolutions from the

TDC to TDC.

NOTE: Always turn the crankshaft pulley clockwise.

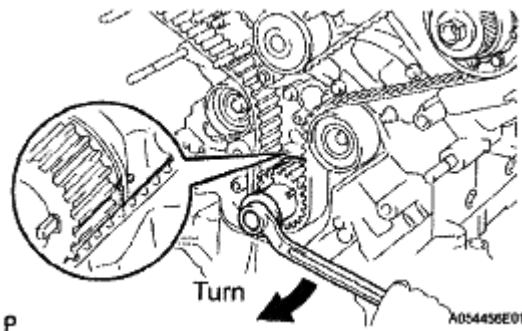


Fig. 501: Identifying Crankshaft Pulley

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

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

If the timing marks are not aligned, remove the timing belt and reinstall it.

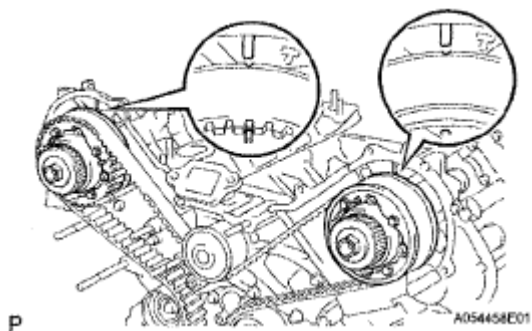


Fig. 502: Identifying Crankshaft

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

44. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE

- a. Install the sensor plate as shown in the illustration.

NOTE: Take care not to install it in a wrong direction.

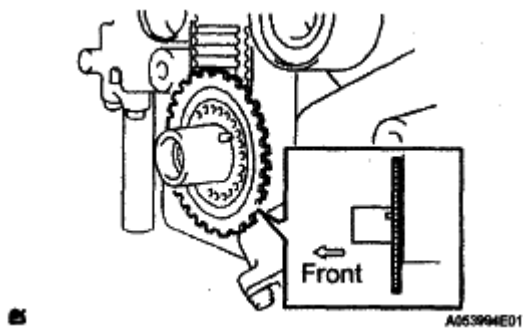


Fig. 503: Identifying Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. INSTALL TIMING GEAR COVER SPACER

- a. Install the gasket to the cover spacer.

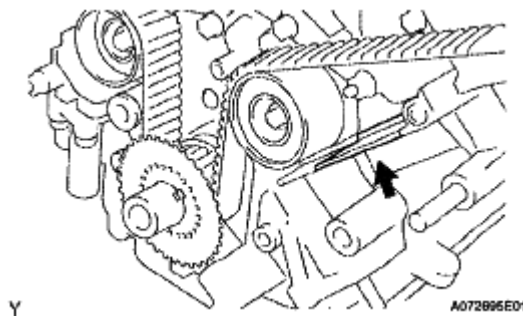


Fig. 504: Identifying Cover Spacer And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the cover spacer.

46. INSTALL NO. 1 TIMING BELT COVER

- a. Install the timing belt cover with the 4 bolts.

Torque: 7.5 N*m (80 kgf*cm, 66 in.*lbf)

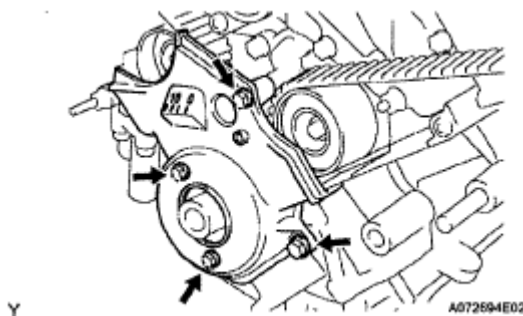


Fig. 505: Identifying Timing Belt Cover With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. INSTALL CRANKSHAFT DAMPER SUB-ASSEMBLY

- a. Align the pulley set key with the key groove of the crankshaft damper.
- b. Using SST and a hammer, tap in the crankshaft damper.

SST 09223-46011

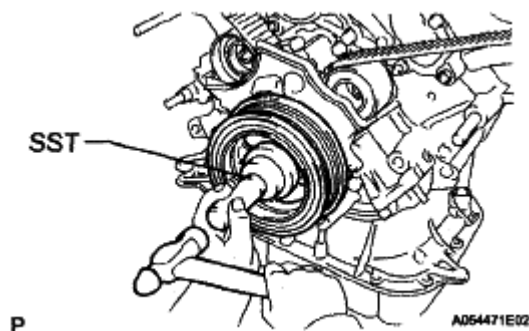


Fig. 506: Identifying Tapping Crankshaft Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST, install the damper bolt.

SST 09213-70011 (09213-70020), 09330-00021

Torque: 245 N*m (2,498 kgf*cm, 181 ft.*lbf)

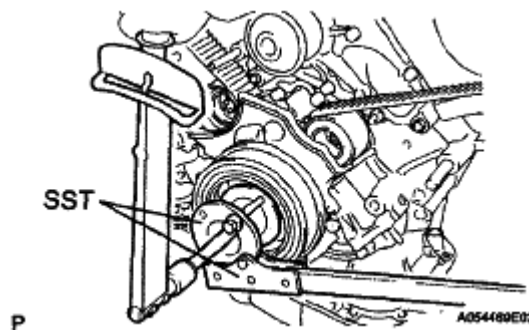


Fig. 507: Identifying Damper Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. INSPECT VALVE CLEARANCE (See ADJUSTMENT)
49. ADJUST VALVE CLEARANCE (See ADJUSTMENT)
50. INSTALL FAN BRACKET SUB-ASSEMBLY
 - a. Install the idler pulley with the 2 bolts and 2 nuts.

Torque:

For 12 mm head

16 N*m (160 kgf*cm, 12 ft.*lbf)

For 14 mm head

32 N*m (326 kgf*cm, 24 ft.*lbf)

HINT:

Each bolt length is as follows:

106 mm (4.17 in.) for 12 mm head [A]

114 mm (4.49 in.) for 14 mm head [B]

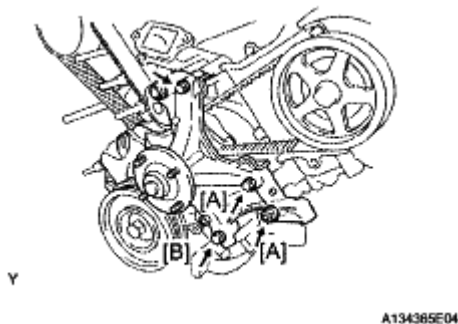


Fig. 508: Identifying Idler Pulley With Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- a. Install the belt tensioner with the bolt and 2 nuts.

Torque: 16 N*m (160 kgf*cm, 11 ft.*lbf)

HINT:

Use a bolt 106 mm (4.17 in.) in length.

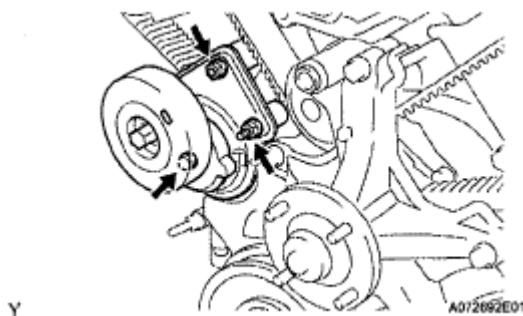


Fig. 509: Identifying Belt Tensioner With Bolt And Nuts

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

52. INSTALL NO. 2 TIMING BELT COVER SUB-ASSEMBLY

- a. Install the timing belt cover and fit the claws and pins into each part.
- b. Install the timing belt cover with the 2 bolts.

Torque: 16 N*m (160 kgf*cm, 12 ft.*lbf)

HINT:

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

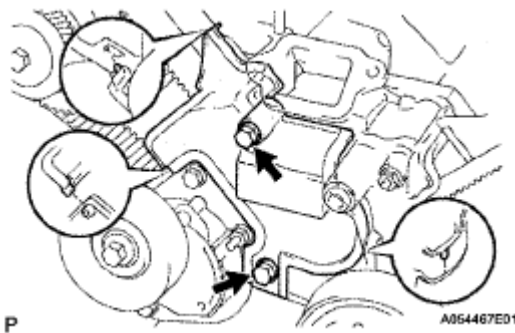


Fig. 510: Identifying Timing Belt Cover With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY

- a. Install the idler pulley and cover plate with the bolt.

Torque: 39 N*m (398 kgf*cm, 29 ft.*lbf)

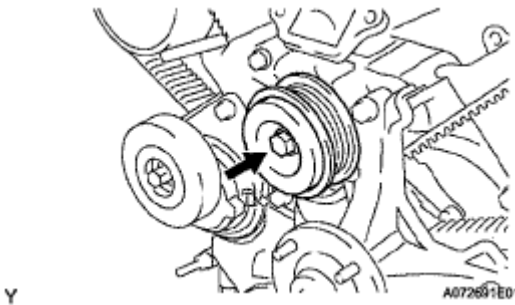


Fig. 511: Identifying Idler Pulley And Cover Plate With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. INSTALL SEMI-CIRCULAR PLUG

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

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

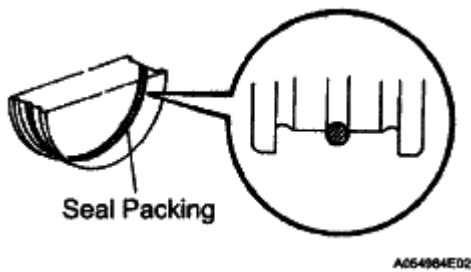
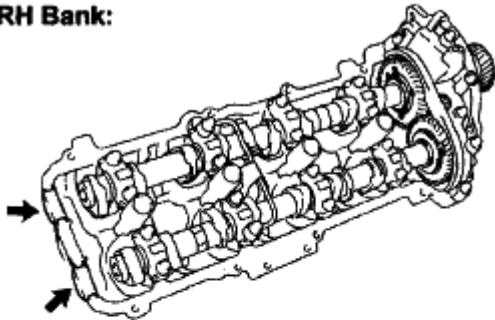


Fig. 512: Identifying Seal Packing To Semi-Circular Plug Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

RH Bank:



LH Bank:

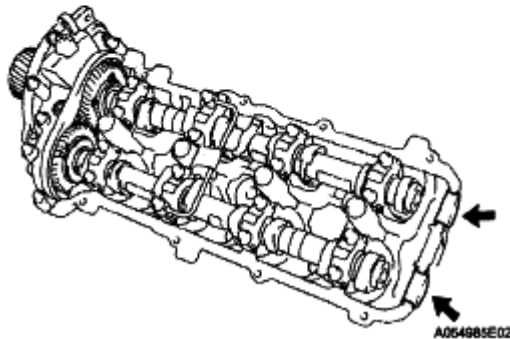


Fig. 513: Identifying Semi-Circular Plugs To Cylinder Heads
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. INSTALL CYLINDER HEAD COVER

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

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

- c. Install the gasket to the cylinder head cover.
- d. Install the seal washer to the bolt.

- e. Install the cylinder head cover with the 9 bolts. Uniformly tighten the bolts in several steps.

Torque: 6.0 N*m (60 kgf*cm, 53 in.*lbf)

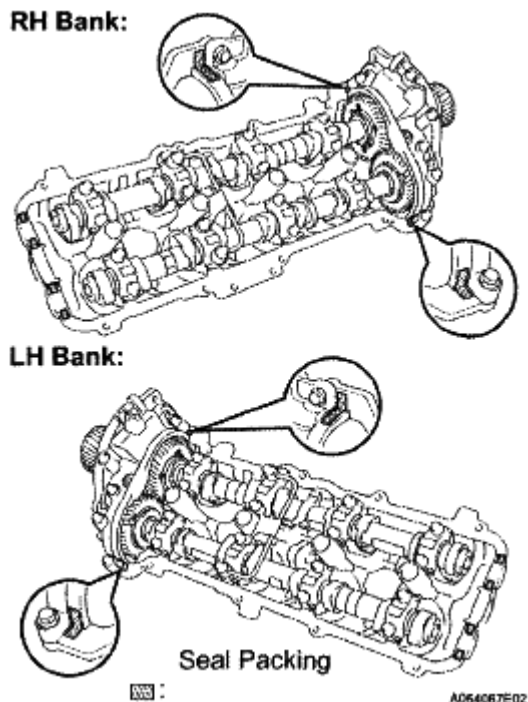


Fig. 514: Identifying Cylinder Head Cover Seal Packing Area
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. INSTALL OIL FILLER CAP HOUSING

- a. Install a new gasket and the oil filler cap housing with the 2 nuts.

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

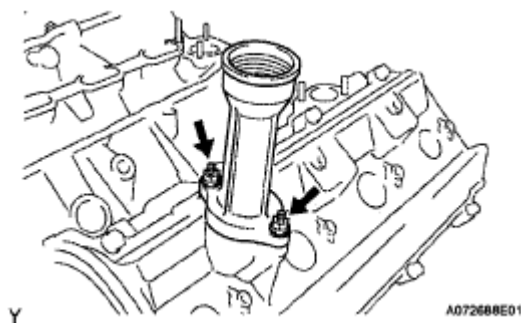


Fig. 515: Identifying Oil Filler Cap Housing Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. INSTALL OIL FILLER CAP SUB-ASSEMBLY

58. INSTALL SPARK PLUG

Torque: 18 N*m (178 kgf*cm, 13 ft.*lbf)

59. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- a. Apply seal packing to 2 or 3 threads.

Seal packing: Toyota Genuine Seal Packing 1282B, Three Bond 1282B or equivalent

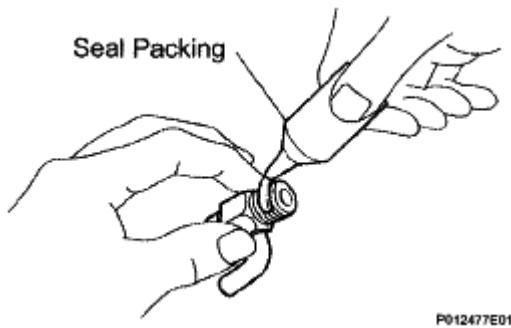


Fig. 516: Identifying Seal Packing To Threads
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 drain cocks.

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

HINT:

After tightening to the specified torque, rotate the drain union clockwise until its drain port is facing forward.

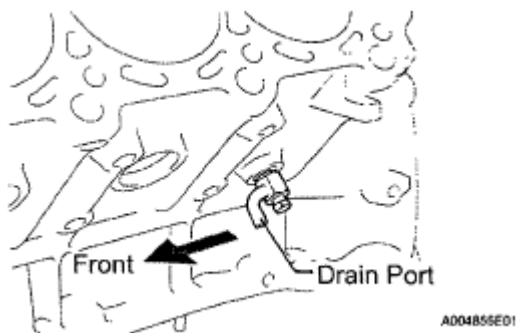


Fig. 517: Identifying Drain Port
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. INSTALL ENGINE HANGERS

- a. Install the 2 engine hangers with the 4 bolts.

Torque: 37 N*m (380 kgf*cm, 27 ft.*lbf)

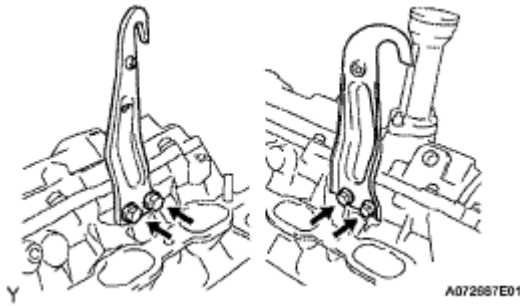


Fig. 518: Identifying Engine Hangers With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.