2009 ENGINE

Engine Mechanical (1AR-FE) - Highlander

ENGINE

ON-VEHICLE INSPECTION

1. **INSPECT ENGINE COOLANT** (See **COOLING SYSTEM**)
2. **INSPECT ENGINE OIL** (See **LUBRICATION SYSTEM**)
3. **INSPECT BATTERY** (See **ON-VEHICLE INSPECTION**)
4. **INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
5. **INSPECT SPARK PLUG** (See **ON-VEHICLE INSPECTION**)
6. **INSPECT VALVE LASH ADJUSTER ASSEMBLY NOISE**
   a. Rev up the engine several times. Check that the engine does not emit unusual noises. If unusual noises occur, warm up the engine and idle it for over 30 minutes. Then perform the inspection above again. If any defects or problems are found during the inspection above, perform a lash adjuster inspection (See **INSPECTION**).
7. **INSPECT IGNITION TIMING**
   a. Warm up and stop the engine.
   b. When using the Techstream:
      1. Connect the Techstream to the DLC3.
      2. Start the engine and idle it.
      3. Turn the Techstream main switch on.
      4. Enter the following menus: Powertrain/Engine/Data List/IGN Advance.

         Standard ignition timing:

         BTDC 5 to 15deg. at idle

         HINT:

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

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

      5. Check that the ignition timing advances immediately when the engine speed is increased.
      6. Enter the following menus: Powertrain/Engine/Active Test/Connect the TC and TE1/ON.
      7. Monitor IGN Advance of the Data List.

         Standard ignition timing:

         BTDC 8 to 12deg. at idle

HINT:

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

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

8. Enter the following menus: Connect the TC and TE1/OFF.
9. Turn the ignition switch off.
10. Disconnect the Techstream from the DLC3.

c. When not using the Techstream:

1. Remove the No. 1 engine cover sub-assembly.
2. Pull out the wire harness as shown in the illustration.
3. Connect the clip of the timing light to the wire harness.

NOTE: Use a timing light that detects primary signals.

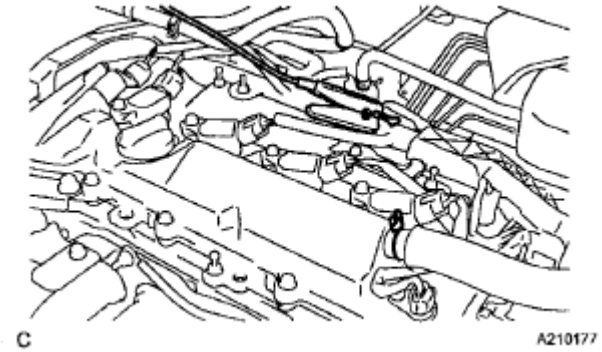


Fig. 1: Connecting Clip Of Timing Light To Wire Harness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09843-18040

NOTE:

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

Front view of DLC3:

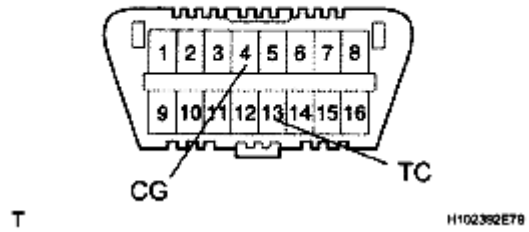


Fig. 2: Identifying DLC3 Connector Terminals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

   Standard ignition timing:

   8 to 12 BTDC at idle

6. Remove SST from the DLC3.
7. Check the ignition timing.

   Standard ignition timing:

   5 to 15° BTDC at idle

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

8. Check that the ignition timing advances immediately when the engine speed is increased.
9. Disconnect the timing light from the engine.
10. Install the No. 1 engine cover sub-assembly.

8. **INSPECT ENGINE IDLE SPEED**
   a. Warm up and stop the engine.
   b. When using the Techstream:
      1. Connect the Techstream to the DLC3.

         NOTE: Switch off all accessories and the A/C before connecting the Techstream.

      2. Race the engine at 2500 rpm for approximately 90 seconds.
      3. Turn the Techstream main switch on.
      4. Enter the following menus: Powertrain/Engine/Data List/Engine Speed.

         Standard idle speed:

600 to 700 rpm

HINT:

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

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

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

5. Disconnect the Techstream from the DLC3.

c. When not using the Techstream:

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

SST 09843-18030

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

2. Race the engine at 2500 rpm for approximately 90 seconds.
3. Check the idle speed.

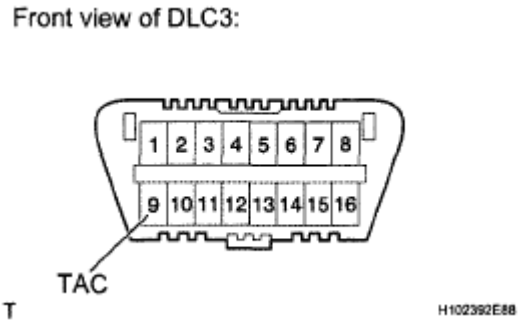


Fig. 3: Identifying DLC3 Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard idle speed:

600 to 700 rpm

NOTE:

- **Turn all electrical systems and the A/C off.**
- **Inspect the idle speed with the cooling fans off.**
- **When checking the idle speed, the transaxle should be in neutral.**

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

4. Disconnect the tachometer probe from the DLC3.

9. **INSPECT COMPRESSION**
   a. Warm up and stop the engine.
   b. Check for DTCs (See **DTC CHECK/CLEAR**).
   c. Remove the No. 1 engine cover sub-assembly.
   d. Disconnect the 4 fuel injector connectors.
   e. Remove the 4 bolts and 4 ignition coils.
   f. Remove the 4 spark plugs.
   g. Insert a compression gauge into the spark plug hole.
   h. Fully open the throttle.
   i. While cranking the engine, measure the compression pressure.

Standard compression pressure:

1450 kPa (14.7 kgf/cm^2 , 210 psi) or higher

Minimum pressure:

980 kPa (9.9 kgf/cm^2 , 142 psi)

Difference between each cylinder:

200 kPa (2.0 kgf/cm^2 , 29 psi) or less

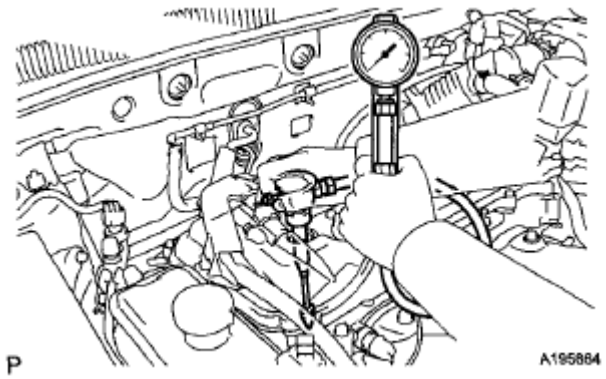


Fig. 4: Measuring Compression Pressure
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

j. If the cylinder compression is low in one or more cylinders, pour a small amount of engine oil into the cylinder with low compression through its spark plug hole. Then inspect the cylinder compression pressure again.

HINT:

- If adding oil helps boost the compression, it is likely that the piston rings and/or cylinder bore is worn or damaged.
- If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage in the gasket.

k. Install the 4 spark plugs.

Torque: 25 N*m (254 kgf*cm, 18 ft.*lbf)

l. Install the 4 ignition coils with the 4 bolts.

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

m. Connect the 4 fuel injector connectors.
n. Install the No. 1 engine cover sub-assembly.
o. Clear the DTCs (See **DTC CHECK/CLEAR**).

10. **INSPECT CO/HC**

HINT:

This check determines whether or not the idle CO/HC complies with regulations.

a. Start the engine.
b. Keep the engine speed at 2500 rpm for approximately 180 seconds.
c. Insert the CO/HC meter testing probe at least 40 cm (1.31 ft.) into the tailpipe during idling.
d. Immediately check CO/HC concentration at idle and 2500 rpm.

HINT:

- When performing the 2 mode (2500 rpm and idle) test, follow the measurement order prescribed by the applicable local regulations.
- If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.

1. Check the A/F sensor (See **REMOVAL**) and heated oxygen sensor (See **REMOVAL**) operation.
2. See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

SYMPTOM CHART

CO	HC	Symptom	Causes
Normal	High	Rough idle	1. Faulty ignitions o Incorrect timing o Plugs are contaminated or shorted, or gaps are defective o Leaky intake and exhaust valves o Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks o PCV hose o Intake manifold o Throttle body o Brake booster line o Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty SFI system o Faulty pressure o Defective ECT sensor o Faulty ECM o Faulty injector o Faulty throttle position sensor o Faulty MAF sensor

DRIVE BELT

COMPONENTS

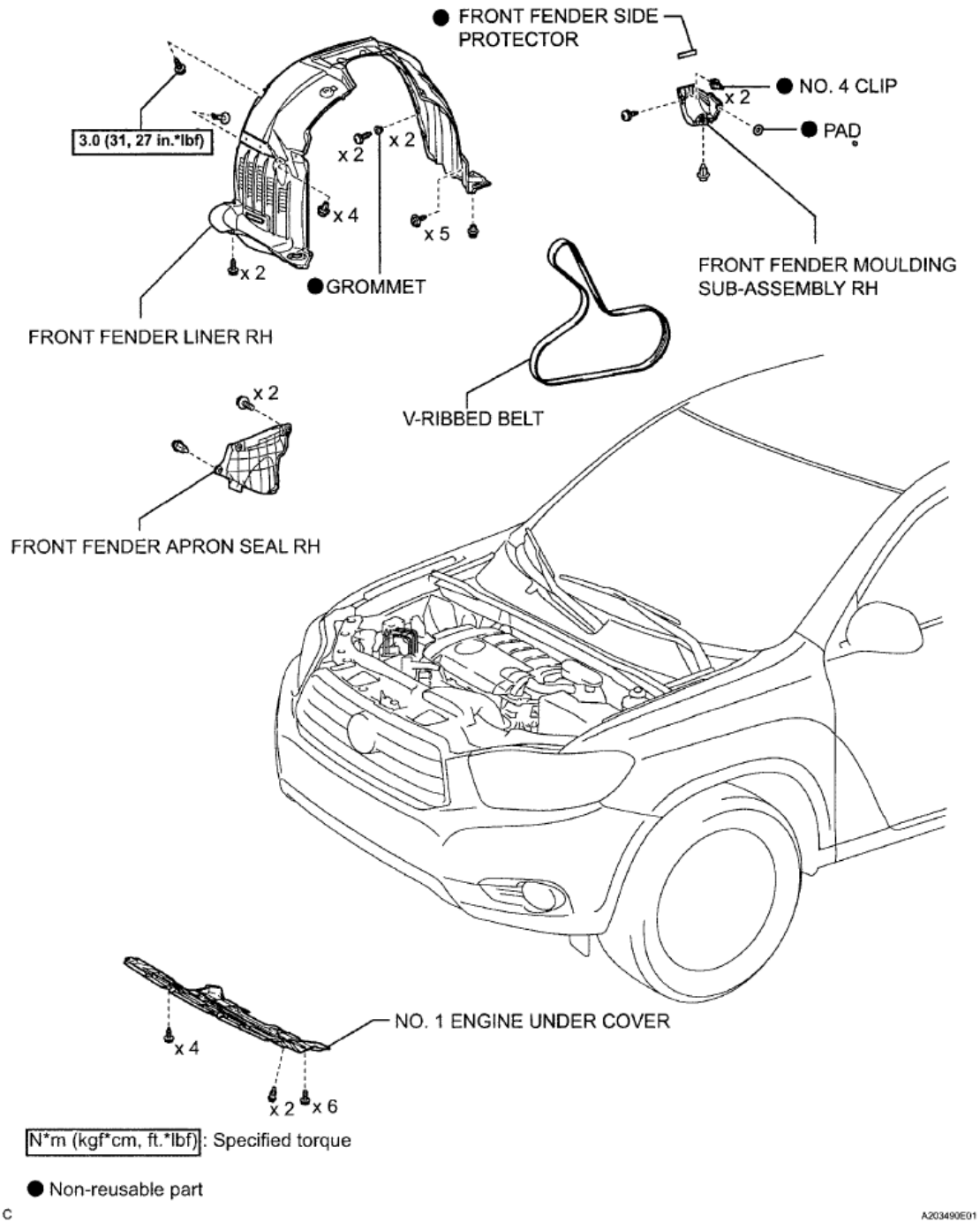


Fig. 5: Identifying Drive Belt Components With Torque Specification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ON-VEHICLE INSPECTION

1. **INSPECT V-RIBBED BELT**
   a. Check the belt for wear, cracks or other signs of damage.

If any of the following defects is found, replace the V-ribbed belt.

- The belt is cracked.
- The belt is worn out to the extent that the cords are exposed.
- The belt has chunks missing from the ribs.

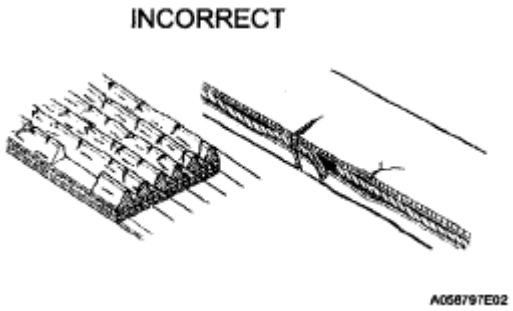


Fig. 6: Checking Drive Belt For Wear, Cracks Or Other Signs Of Damage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Check that the belt fits properly in the ribbed grooves.

HINT:

Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley. If it has slipped out, replace the V-ribbed belt. Install a new V-ribbed belt correctly.

2. **INSPECT V-RIBBED BELT TENSIONER ASSEMBLY**
   a. Check that nothing gets caught in the tensioner by turning it clockwise and counterclockwise. If a malfunction exists, replace the V-ribbed belt tensioner.

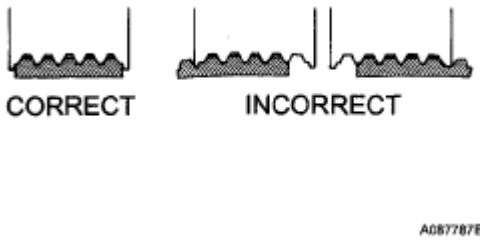


Fig. 7: Identifying Correct And Incorrect Ribbed Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE FRONT WHEEL RH**
2. **REMOVE NO. 1 ENGINE UNDER COVER**
3. **REMOVE FRONT FENDER MOULDING SUB-ASSEMBLY RH**
   a. Remove the clip.

b. Using a 4 mm hexagon wrench, remove the screw.

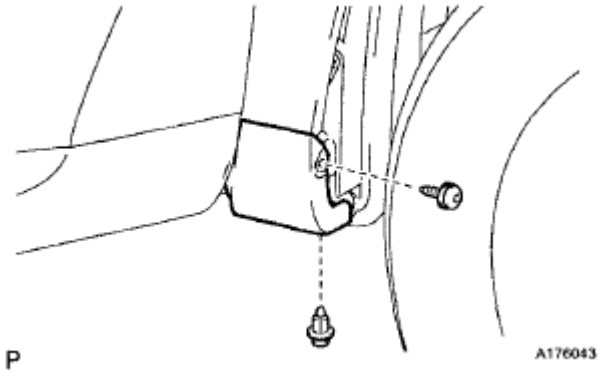


Fig. 8: Identifying Front Fender Moulding Sub-Assembly With Screw And Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Peel off the front fender side protector, disengage the 3 clips, and then remove the front fender moulding sub-assembly RH.
d. Remove the pad from the front fender moulding sub-assembly RH. o
e. Remove the 2 No. 4 clips from the front fender moulding sub-assembly RH.

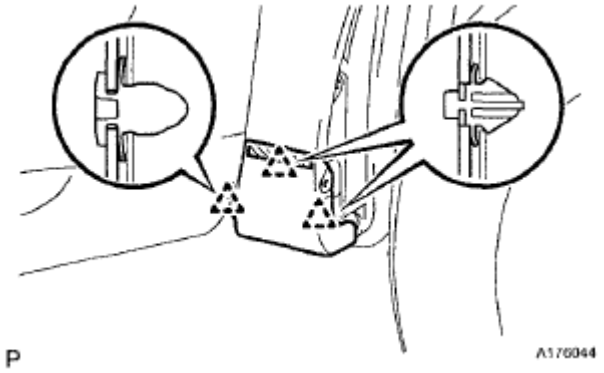


Fig. 9: Identifying Clips Of Front Fender Moulding Sub-Assembly RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Remove the front fender side protector from the front fender moulding sub-assembly RH.

4. **REMOVE FRONT FENDER LINER RH** (See **REMOVAL**)
5. **REMOVE FRONT FENDER APRON SEAL RH** (See **REMOVAL**)

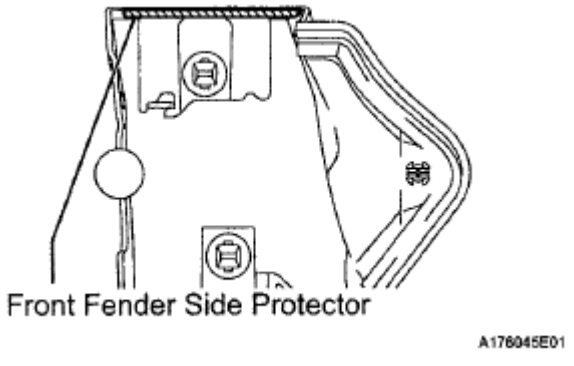


Fig. 10: Identifying Front Fender Side Protector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE V-RIBBED BELT**
   a. Attach a wrench to the hexagonal portion of the belt tensioner as shown in the illustration, rotate the belt tensioner clockwise, and remove the V-ribbed belt.

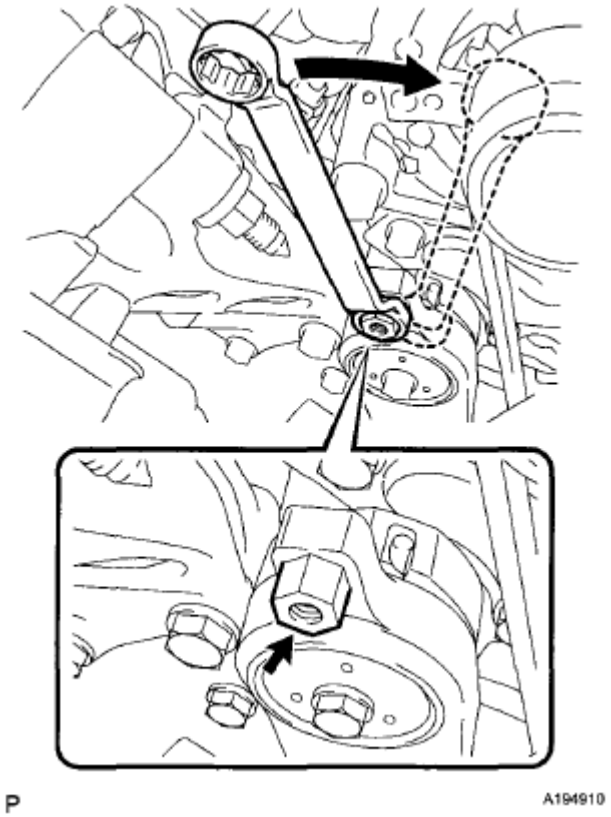


Fig. 11: Removing V-Ribbed Belt Using Wrench
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL V-RIBBED BELT**
   a. Set the V-ribbed belt onto each part as shown in the illustration except the water pump pulley.
   b. Loosen the V-ribbed belt by turning the belt tensioner clockwise.
   c. Set the V-ribbed belt onto the water pump pulley.

NOTE: Make sure that the belt is attached to each pulley. In particular, make sure that the belt is securely fitted into the grooves of the crankshaft pulley.

2. **INSTALL FRONT FENDER APRON SEAL RH** (See **ENGINE UNIT**)
3. **INSTALL FRONT FENDER LINER RH** (See **INSTALLATION**)

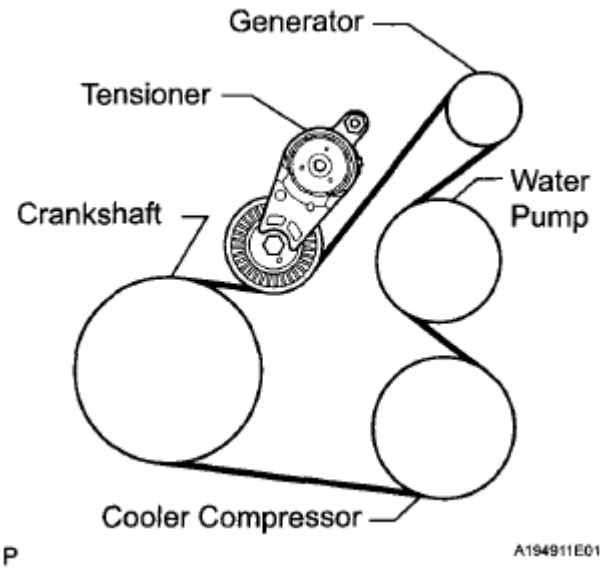


Fig. 12: Identifying V-Ribbed Belt Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL FRONT FENDER MOULDING SUB-ASSEMBLY RH**
   a. Clean the vehicle body surface.
      1. Using a heat light, heat the vehicle body surface.
      2. Remove the front fender side protector from the vehicle body.
      3. Wipe off any tape adhesive residue with cleaner.
   b. Clean the front fender moulding sub-assembly RH. (If reusing the front fender moulding sub-assembly RH)
      1. Using a heat light, heat the front fender moulding sub-assembly RH.
      2. Remove the front fender side protector from the front fender moulding sub-assembly RH.
      3. Wipe off any tape adhesive residue with cleaner.
      4. Install a new front fender side protector to the the front fender moulding sub-assembly RH.

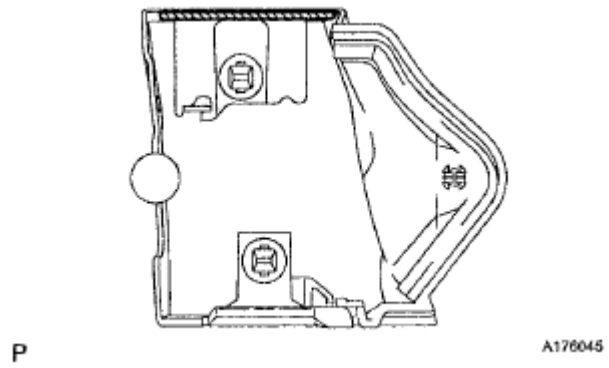


Fig. 13: Identifying Front Fender Moulding Sub-Assembly RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the front fender moulding sub-assembly RH.
   1. Using a heat light, heat the vehicle body and the front fender moulding sub-assembly.
   2. Remove the release paper from the front fender moulding sub-assembly.

      HINT:

      After removing the release paper, keep the exposed adhesive free from foreign matter.

   3. Engage the 3 clips and install the front fender moulding sub-assembly RH.

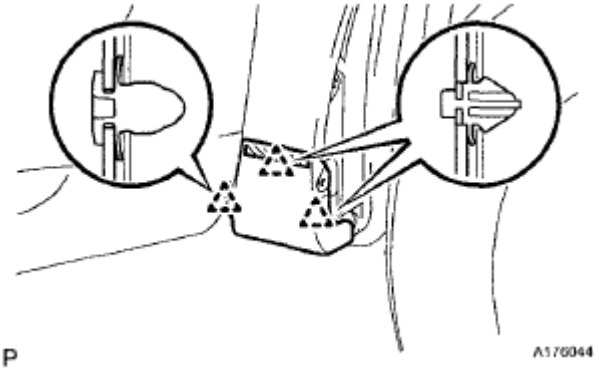


Fig. 14: Identifying Clips Of Front Fender Moulding Sub-Assembly RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   d. Using a 4 mm hexagon wrench, install the screw.
   e. Install the clip.

5. **INSTALL NO. 1 ENGINE UNDER COVER**
6. **INSTALL FRONT WHEEL RH**

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

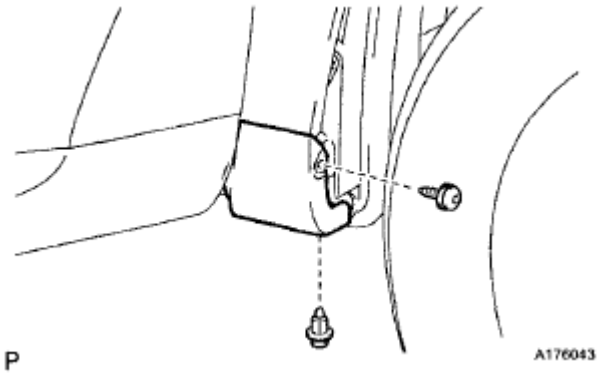


Fig. 15: Identifying Front Fender Moulding Sub-Assembly With Screw And Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CAMSHAFT

COMPONENTS

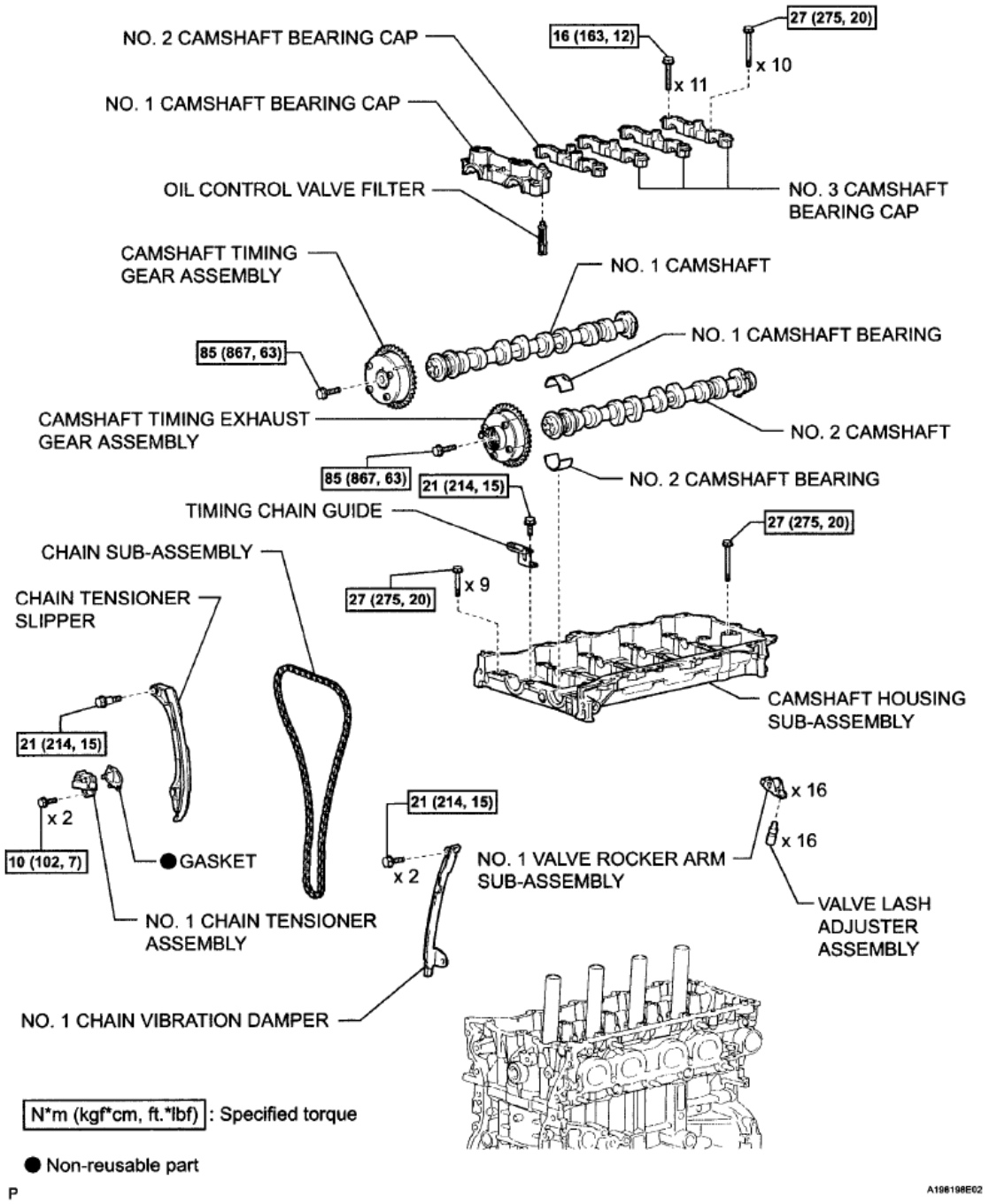


Fig. 16: Identifying Camshaft Components With Torque Specification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY**
   a. Remove the timing chain cover (See **REMOVAL**).
2. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**

a. Temporarily install the crankshaft pulley bolt.

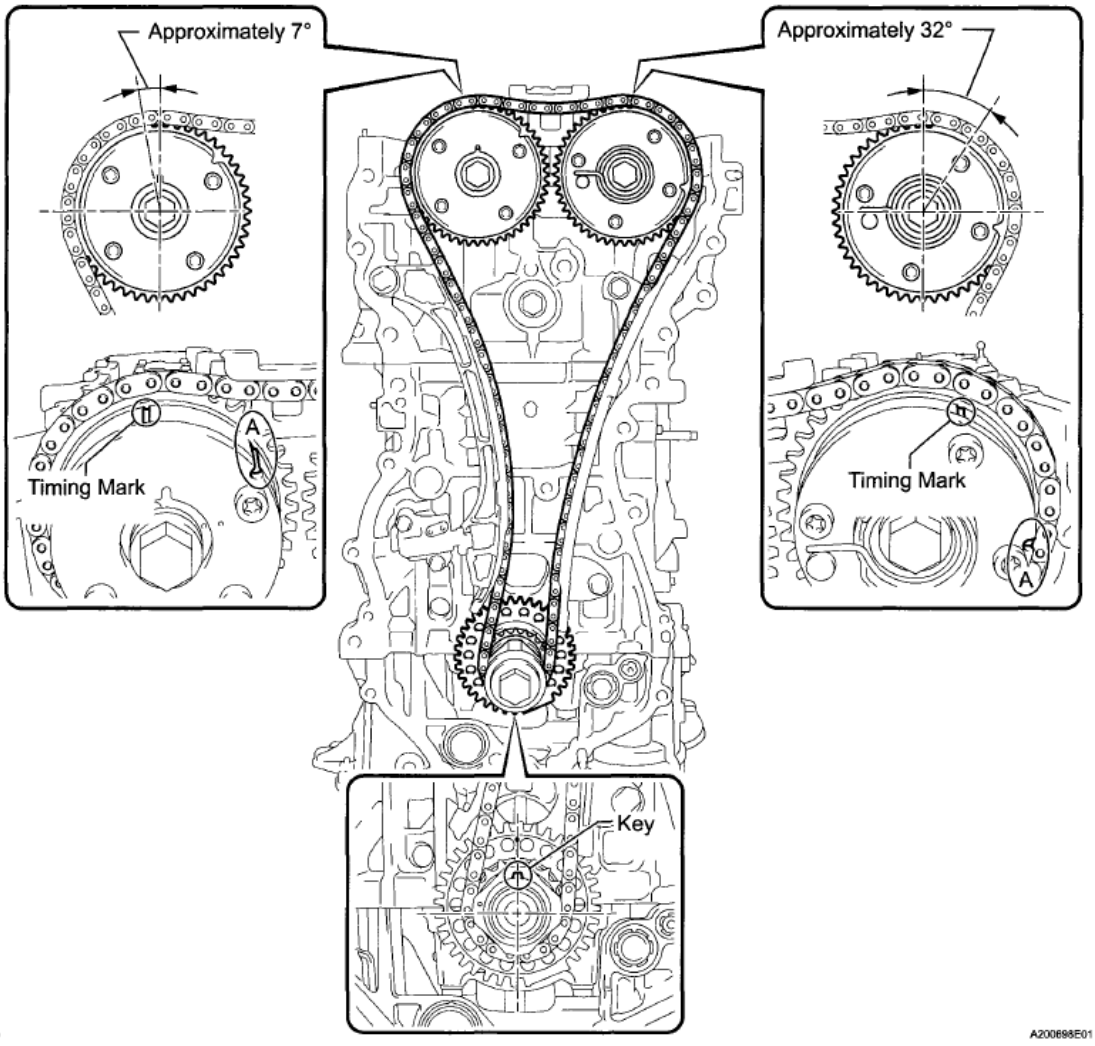


Fig. 17: Identifying Timing Marks On Crankshaft Timing Gear And Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

"A" is not a timing mark.

b. Rotate the crankshaft clockwise so that the timing marks on the crankshaft timing gear and camshaft timing gears are as shown in the illustration.

HINT:

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

c. Remove the crankshaft pulley bolt.

3. **REMOVE TIMING CHAIN GUIDE**
   a. Remove the bolt and timing chain guide.

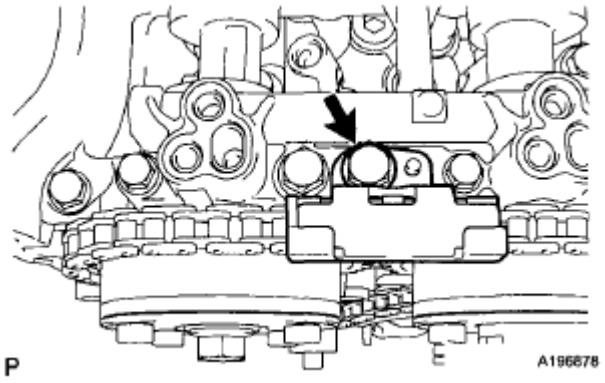


Fig. 18: Locating Timing Chain Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY**
   a. Allow the plunger to extend slightly, and then rotate the stopper plate counterclockwise to release the lock. Once the lock is released, push the plunger into the tensioner.

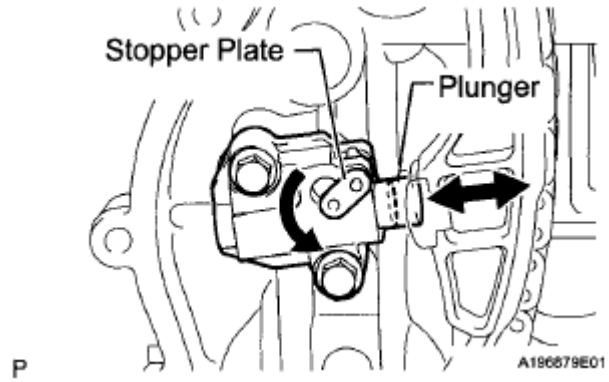


Fig. 19: Pushing Plunger Into Tensioner
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

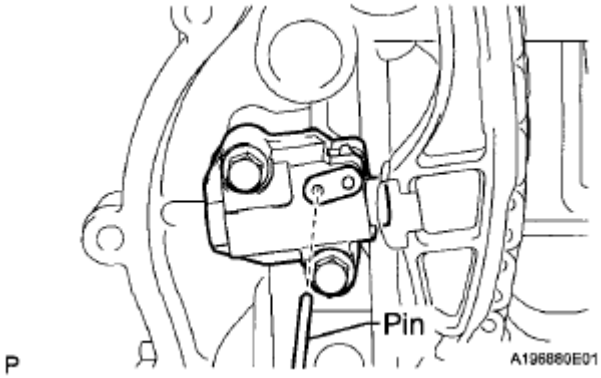


Fig. 20: Inserting Pin Into Stopper Plate Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

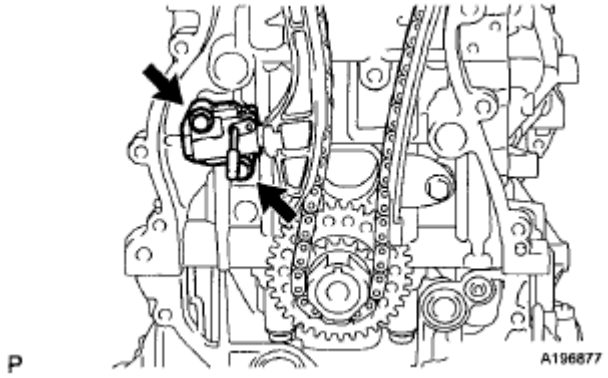


Fig. 21: Locating Chain Tensioner Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE CHAIN TENSIONER SLIPPER**
   a. Remove the bolt and chain tensioner slipper.
6. **REMOVE CHAIN SUB-ASSEMBLY**

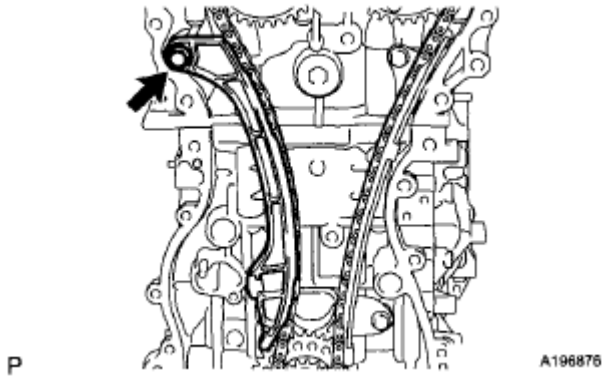


Fig. 22: Locating Chain Tensioner Slipper Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **REMOVE NO. 1 CHAIN VIBRATION DAMPER**
   a. Remove the 2 bolts and chain vibration damper.

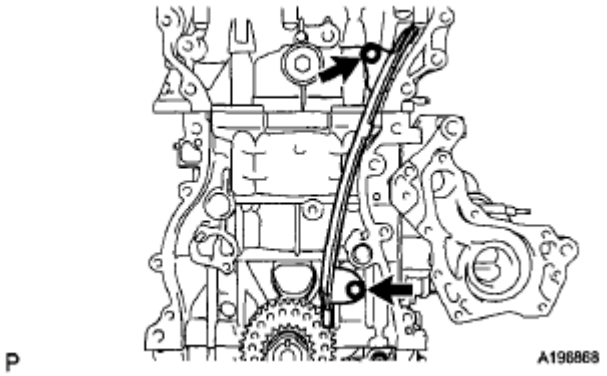


Fig. 23: Locating Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY**
   a. Hold the hexagonal portion of the camshaft with a wrench and remove the bolt and camshaft timing gear.

NOTE:

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

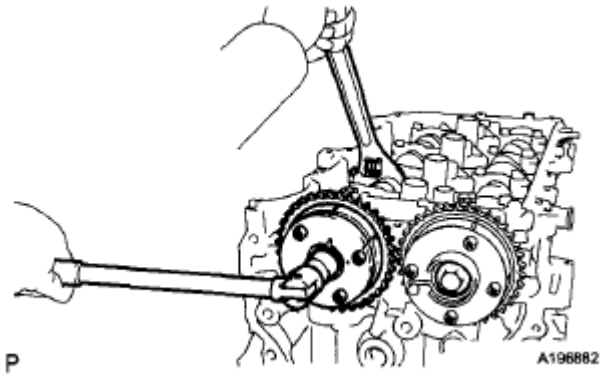


Fig. 24: Removing Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
   a. Hold the hexagonal portion of the camshaft with a wrench and remove the bolt and camshaft timing exhaust gear.

NOTE:

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

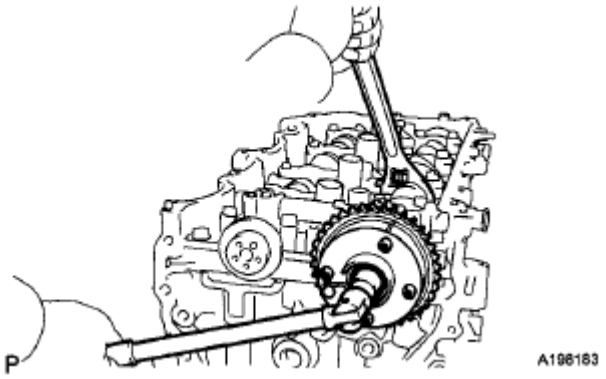


Fig. 25: Removing Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY**
    a. Uniformly loosen and remove the 20 bearing cap bolts in the sequence shown in the illustration.

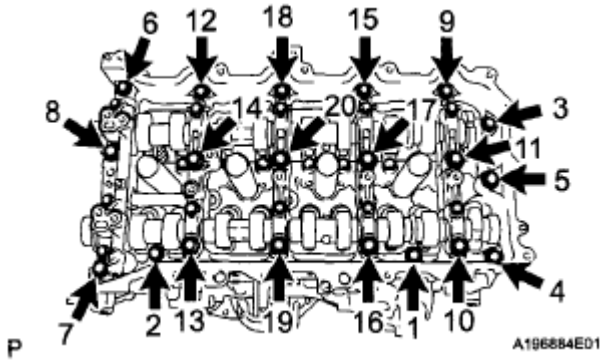


Fig. 26: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

    HINT:

    Tape the screwdriver tip before use.

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

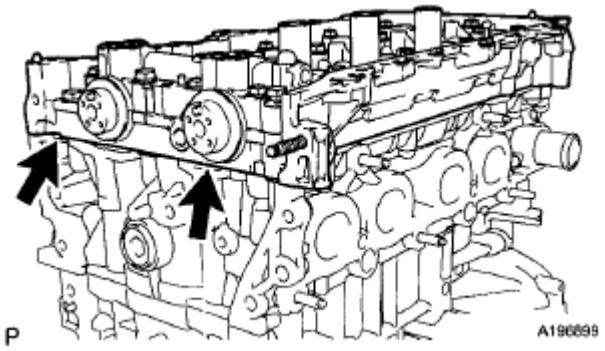


Fig. 27: Locating Contact Surfaces Of Cylinder Head And Camshaft Housing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE CAMSHAFT BEARING CAP**
    a. Remove the 11 bearing cap bolts in the sequence shown in the illustration.
    b. Remove the 5 bearing caps.

    HINT:

    Arrange the removed parts in the correct order.

12. **REMOVE OIL CONTROL VALVE FILTER** (See **INSPECTION**)
13. **REMOVE NO. 1 CAMSHAFT BEARING** (See **INSPECTION**)

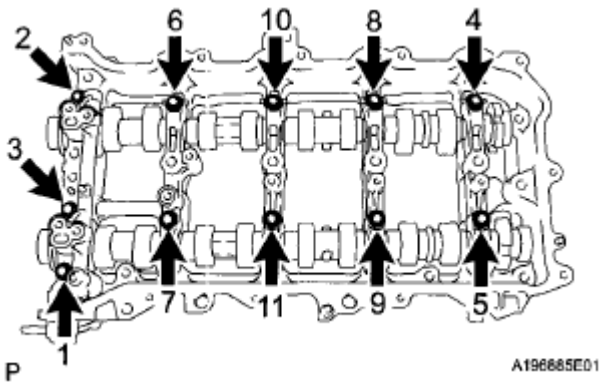


Fig. 28: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **REMOVE CAMSHAFT**
    a. Remove the No. 1 and No. 2 camshafts.
15. **REMOVE NO. 2 CAMSHAFT BEARING** (See **INSPECTION**)
16. **REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
    a. Remove the 16 valve rocker arms from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

17. **REMOVE VALVE LASH ADJUSTER ASSEMBLY**
    a. Remove the 16 valve lash adjusters from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

INSTALLATION

1. **SET CAMSHAFT TIMING GEAR ASSEMBLY**

HINT:

When installing the camshaft timing gear, release the lock pin and set the camshaft timing gear to the advanced position before installation.

a. Check the camshaft timing gear position.

NOTE: If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during installation. If the camshaft timing gear rotates to the retarded position, release the lock pin and set the camshaft timing gear to the advanced position.

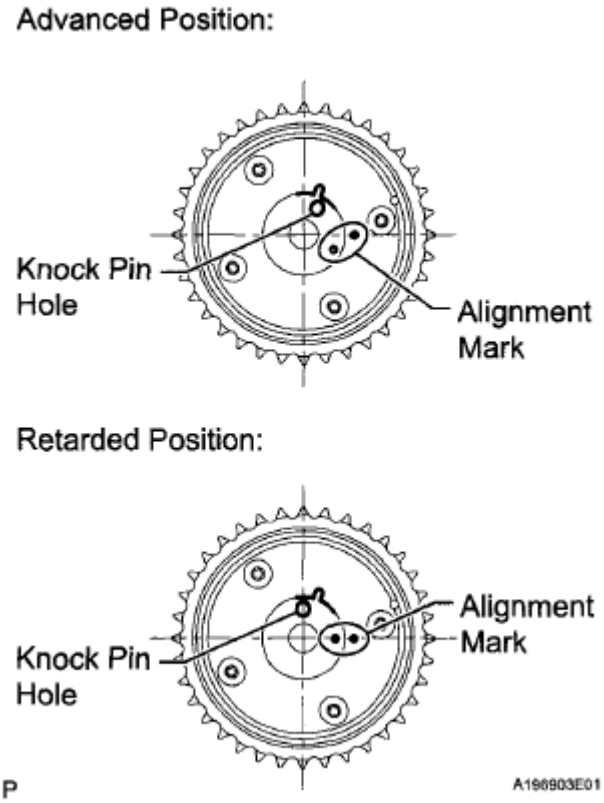


Fig. 29: Identifying Camshaft Timing Gear Advanced Position And Retarded Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

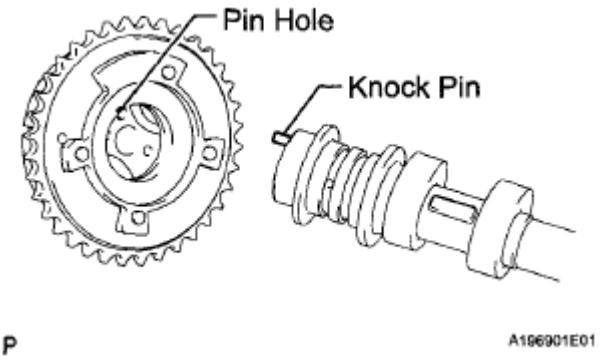


Fig. 30: Identifying Knock Pin And Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Check that there is no clearance between the camshaft timing gear and camshaft flange.
d. Hold the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

NOTE: Do not use any tools to install the bolt. If the bolt is installed using a

tool, the lock pin will be damaged.

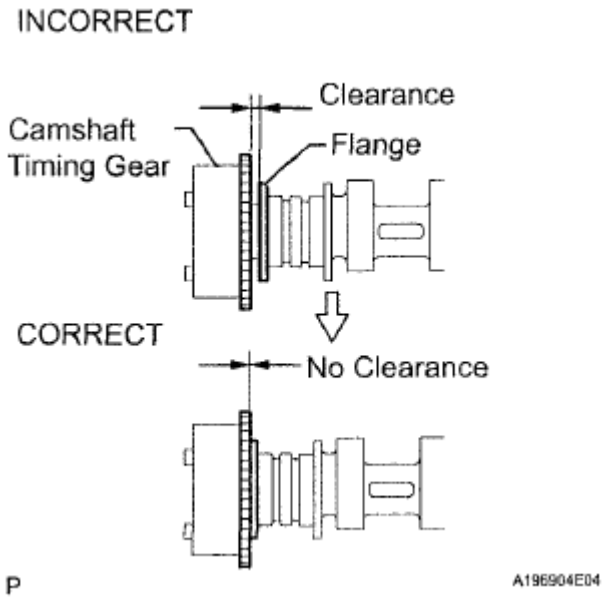


Fig. 31: Identifying Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

      HINT:

      There are 4 oil paths in the grooves of the camshaft. Plug 3 of the paths with pieces of rubber.

   3. Open a hole at port A shown in the illustration.

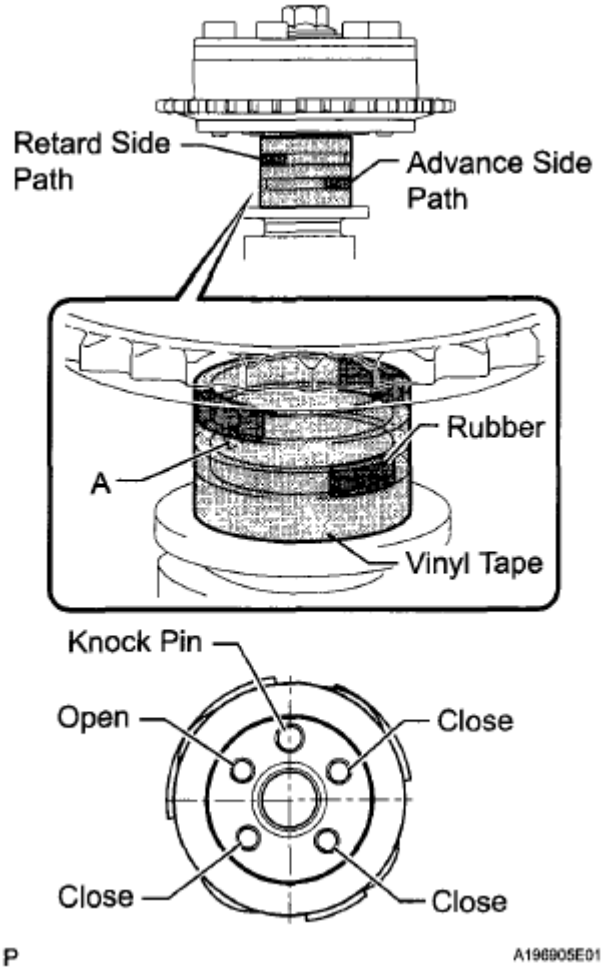


Fig. 32: Covering Oil Paths Of Cam Journal With Vinyl Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. While applying approximately 200 kPa (2.0 kgf/cm^2 , 29 psi) of air pressure to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).

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

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

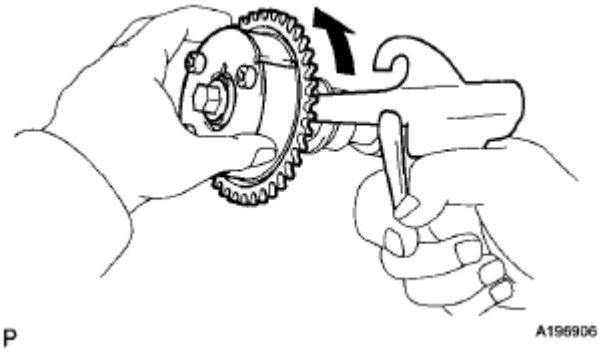


Fig. 33: Applying Air Pressure To Oil Path
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- The camshaft timing gear assembly may be turned in the advance direction without applying any force.
- If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.

5. Remove the vinyl tape and rubber pieces from the camshaft.

f. Remove the bolt and camshaft timing gear.

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

2. **INSTALL VALVE LASH ADJUSTER ASSEMBLY**
   a. Inspect the valve lash adjuster before installing it (See **INSPECTION**).
   b. Install the 16 lash adjusters to the cylinder head.

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

3. **INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
   a. Apply engine oil to the lash adjuster tips and valve stem caps.
   b. Install the 16 valve rocker arms as shown in the illustration.
4. **INSTALL NO. 2 CAMSHAFT BEARING** (See **INSTALLATION**)

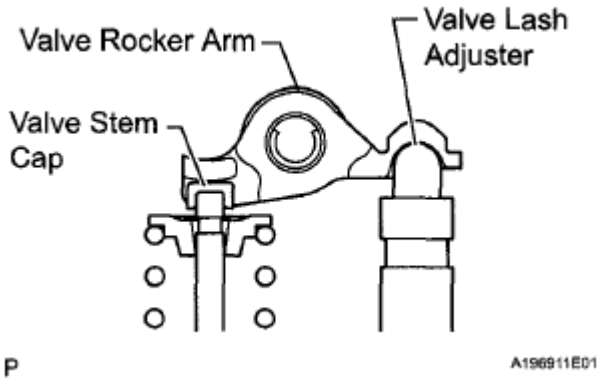


Fig. 34: Identifying Valve Lash Adjuster, Valve Stem Cap And Valve Rocker Arm
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL NO. 1 CAMSHAFT BEARING** (See **INSTALLATION**)
6. **INSTALL OIL CONTROL VALVE FILTER** (See **INSTALLATION**)
7. **INSTALL CAMSHAFT**
   a. Clean the camshaft journals, camshaft housing and bearing caps.
   b. Apply a light coat of engine oil to the camshaft journal, camshaft housing and bearing caps.
   c. Install the No. 1 and No. 2 camshafts to the camshaft housing.
8. **INSTALL CAMSHAFT BEARING CAP**
   a. Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.

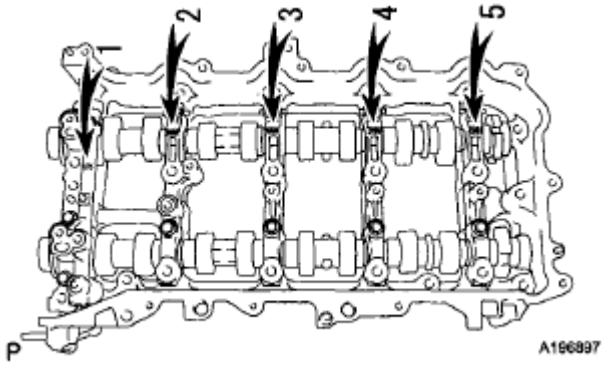


Fig. 35: Identifying Marks And Numbers On Camshaft Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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

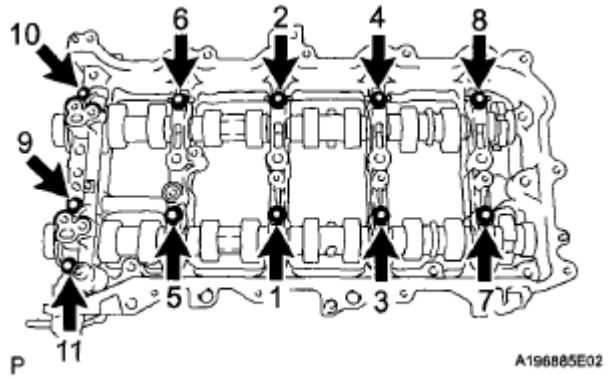


Fig. 36: Identifying Camshaft Bearing Caps Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY**
   a. Check that the valve rocker arms are installed as shown in the illustration.

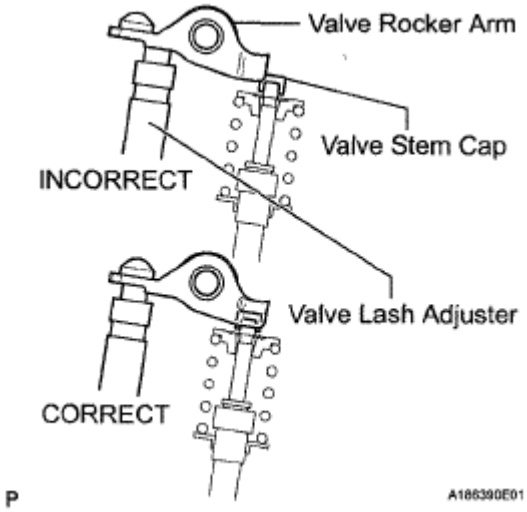


Fig. 37: Identifying Valve Rocker Arms Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Seal packing:

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

Standard seal diameter:

3.0 to 4.0 mm (0.118 to 0.157 in.)

NOTE:

- **Remove any oil from the contact surface.**

- **Install the camshaft housing within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.**

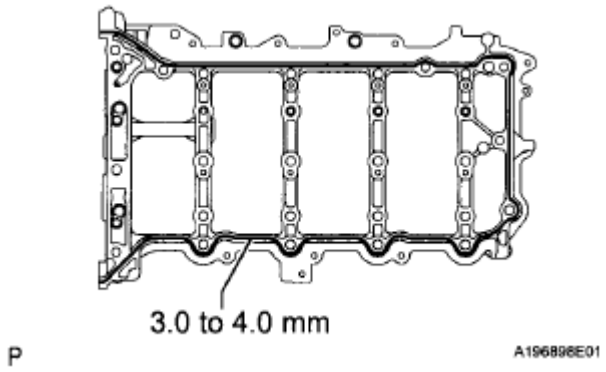


Fig. 38: Identifying Seal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

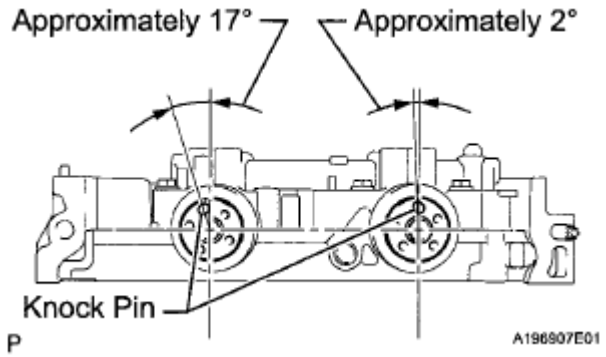


Fig. 39: Identifying No. 1 And No. 2 Camshafts Knock Pin Positioning
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

NOTE:

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

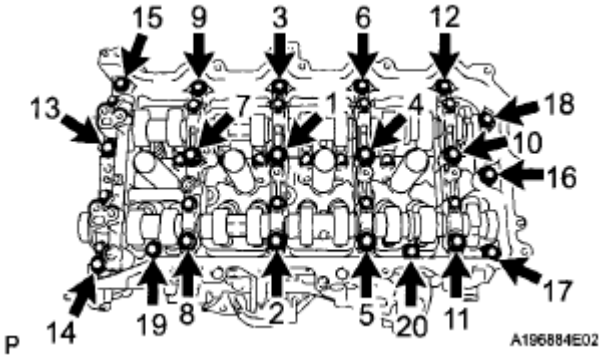


Fig. 40: Identifying Camshaft Housing Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY**
    a. Check the camshaft timing gear position. If the camshaft timing gear is not set to the advanced position, release the lock pin and reset the camshaft timing gear (Refer to the "SET CAMSHAFT TIMING GEAR ASSEMBLY" procedures).

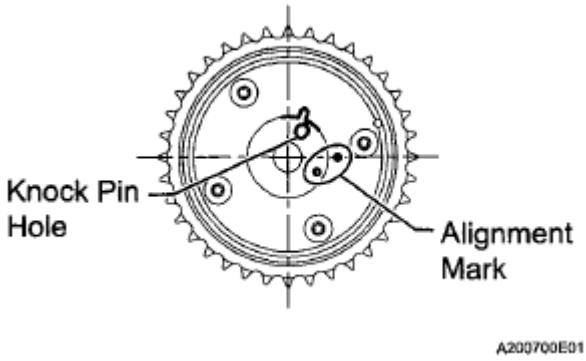


Fig. 41: Identifying Camshaft Timing Gear Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

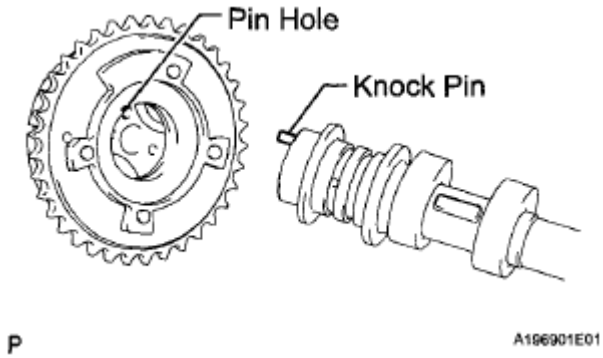


Fig. 42: Identifying Knock Pin And Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

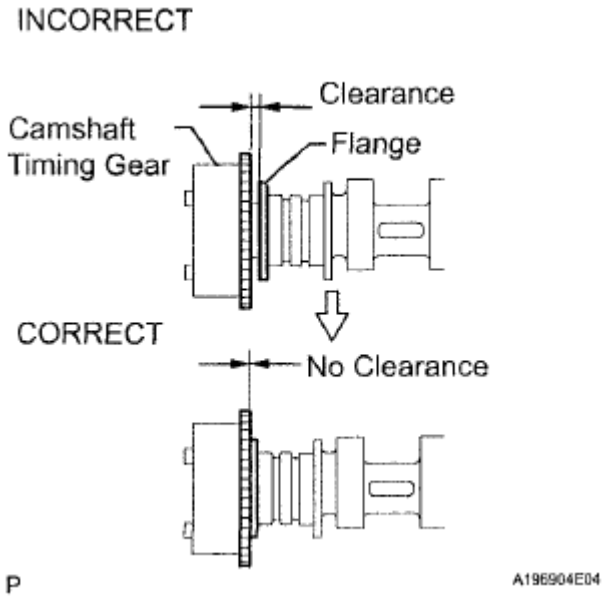


Fig. 43: Identifying Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

NOTE:

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

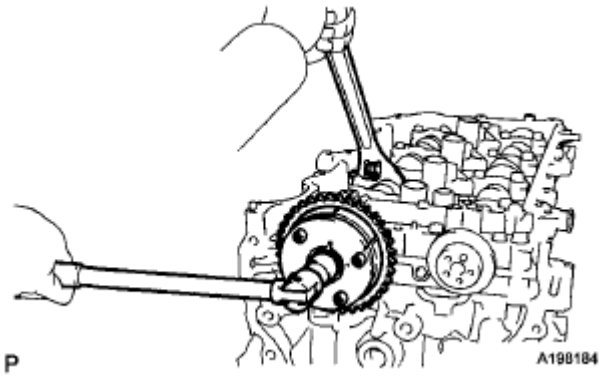


Fig. 44: Installing No. 1 Camshaft Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

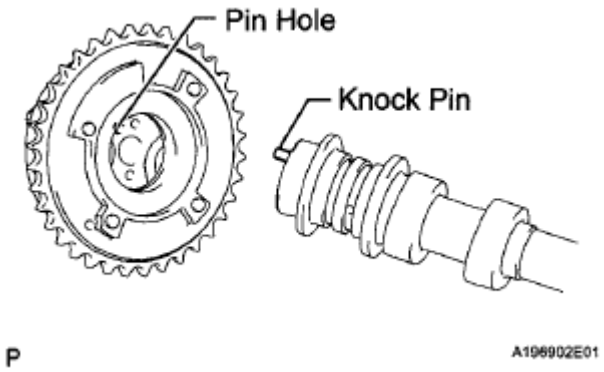


Fig. 45: Identifying No. 2 Camshaft Knock Pin And Camshaft Timing Exhaust Gear Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

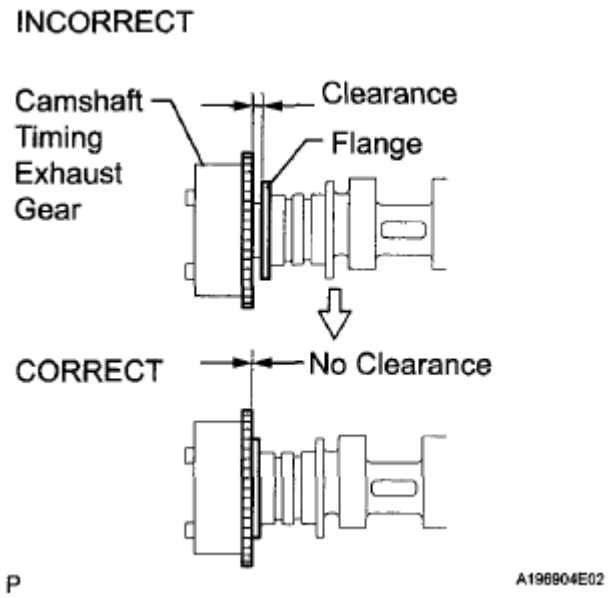


Fig. 46: Identifying Clearance Between Camshaft Timing Exhaust Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

NOTE:

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

- **Do not disassemble the camshaft timing exhaust gear.**

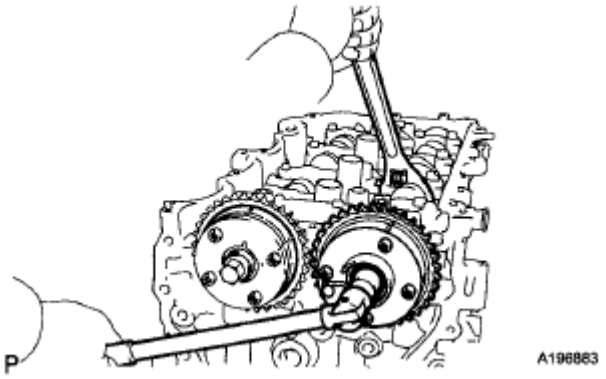


Fig. 47: Installing No. 2 Camshaft Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **ADD ENGINE OIL**
    a. Add 50 cc (3.1 cu. in) of engine oil into the oil hole shown in the illustration.

NOTE:

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

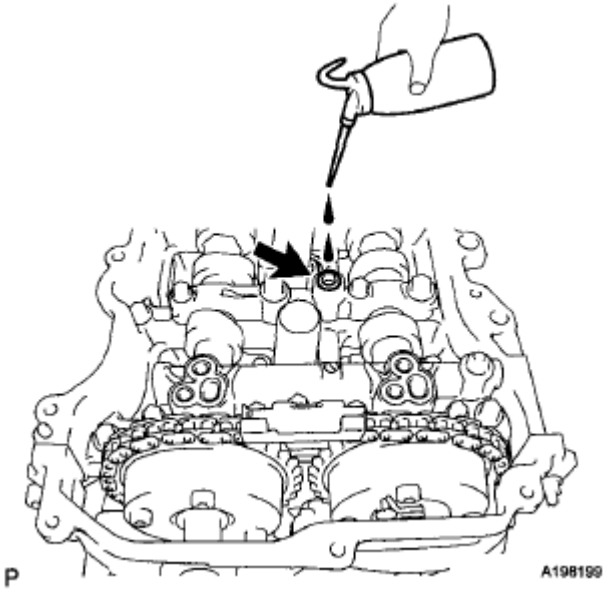


Fig. 48: Adding Of Engine Oil Into Oil Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

a. Temporarily install the crankshaft pulley bolt.
b. Rotate the crankshaft 40° counterclockwise to position the crankshaft pulley key as shown in the illustration.

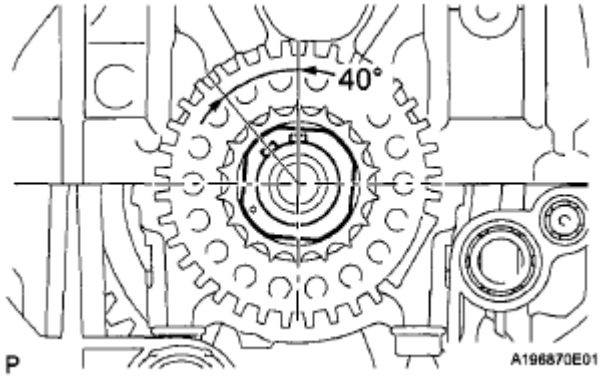


Fig. 49: Positioning Of Crankshaft Pulley Key
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Check that the timing marks of the camshaft timing gears are as shown in the illustration.

HINT:

"A" is not a timing mark.

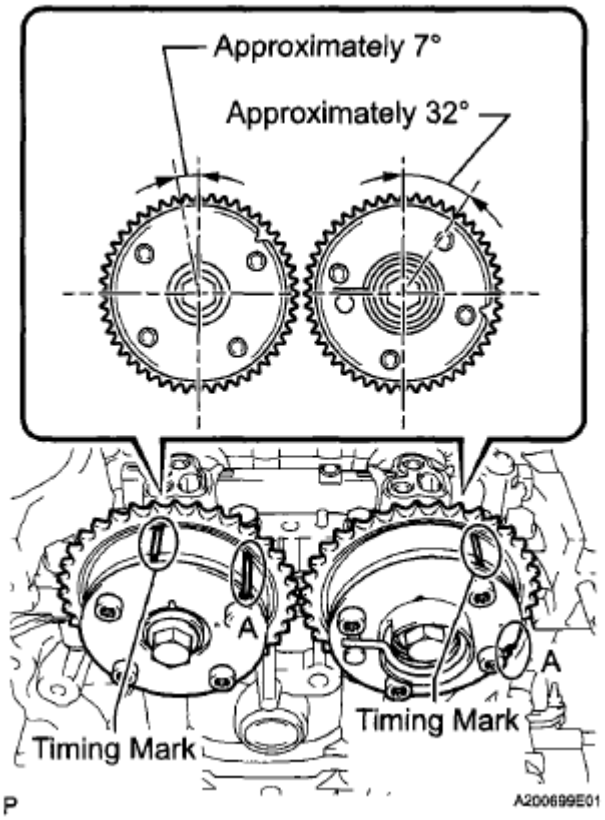


Fig. 50: Identifying Timing Marks Of Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSTALL NO. 1 CHAIN VIBRATION DAMPER**
    a. Install the chain vibration damper with the 2 bolts.

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

15. **INSTALL CHAIN SUB-ASSEMBLY**
    a. Place the chain onto the camshaft timing gears and crankshaft timing sprocket.

       HINT:

       - Make sure the mark plate of the chain faces away from the engine.
       - It is not necessary to install the chain to the teeth of the gears and sprocket.

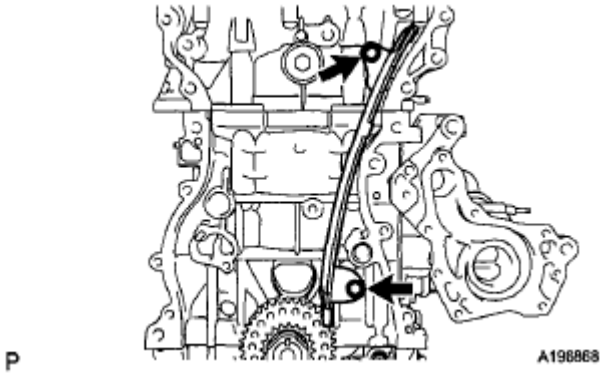


Fig. 51: Locating Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Align the mark plate (yellow or gold) of the chain with the timing mark of the camshaft timing exhaust gear and install the chain to the camshaft timing exhaust gear.

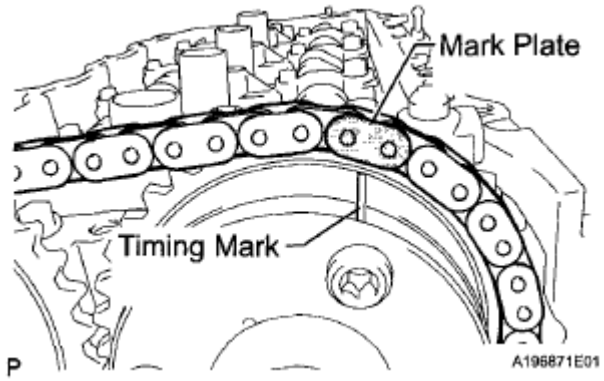


Fig. 52: Identifying Mark Plate (Yellow Or Gold) Of Chain And Timing Mark Of Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

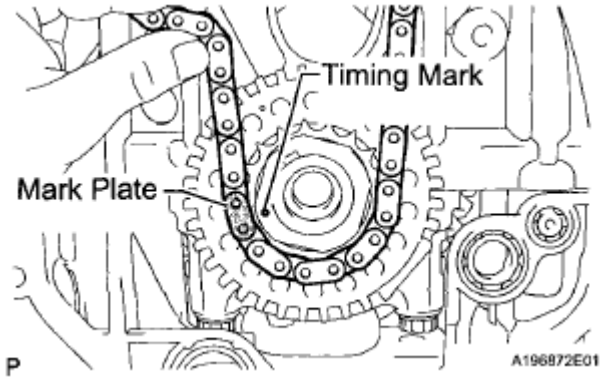


Fig. 53: Identifying Mark Plate (Pink Or Gold) Of Chain And Timing Mark Of Crankshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

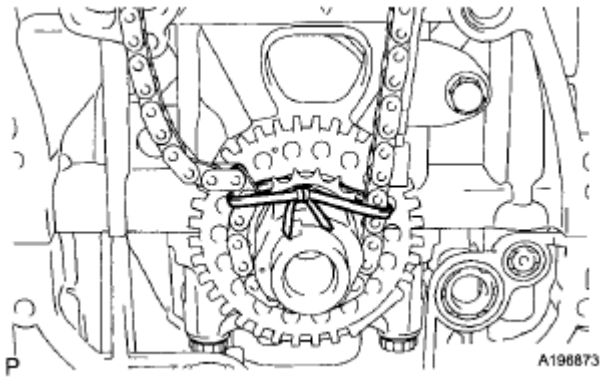


Fig. 54: Tying String Above Crankshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

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

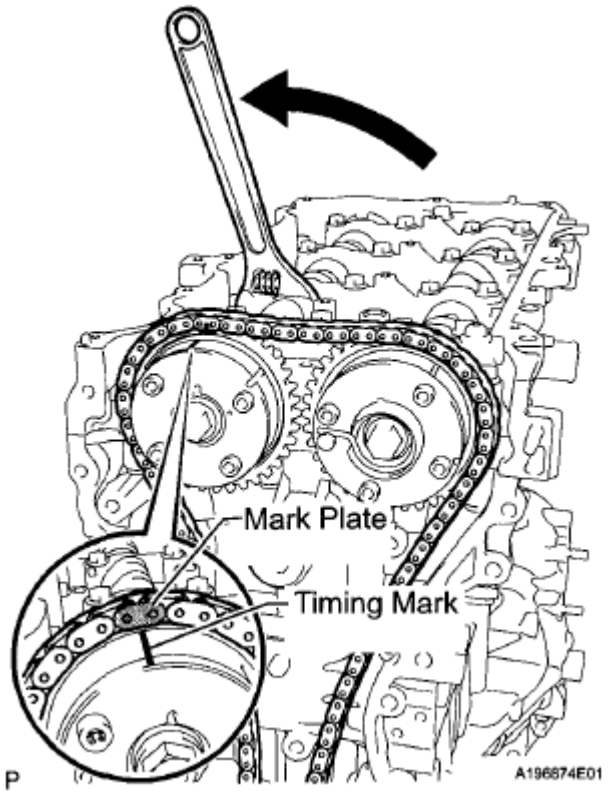


Fig. 55: Aligning Timing Mark Of Camshaft Timing Gear With Mark Plate (Yellow Or Gold) Of Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Make sure the chain is secure.

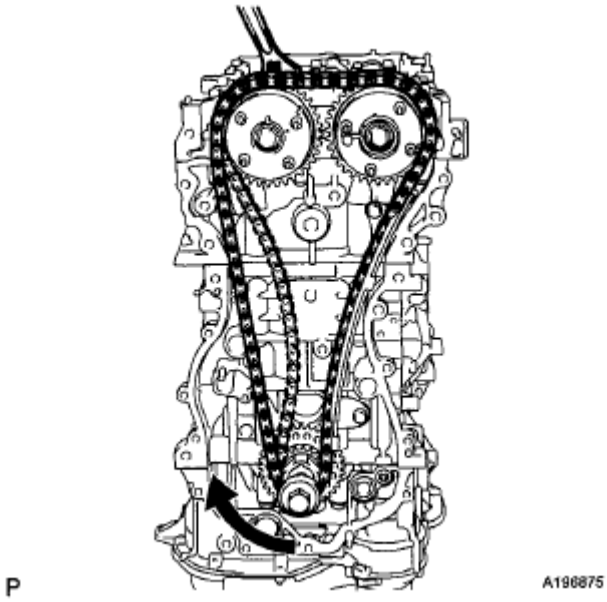


Fig. 56: Loosening Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **INSTALL CHAIN TENSIONER SLIPPER**
    a. Install the chain tensioner slipper with the bolt.

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

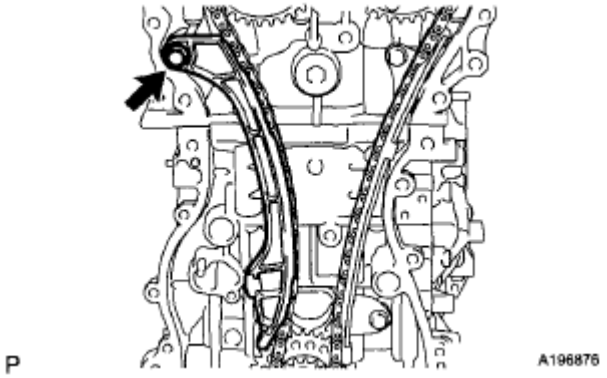


Fig. 57: Locating Chain Tensioner Slipper Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY**
    a. Install a new gasket and the chain tensioner with the 2 bolts.

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

    b. Remove the pin from the stopper plate.

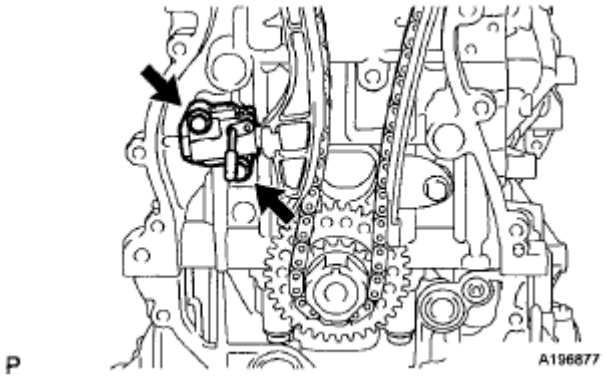


Fig. 58: Locating Chain Tensioner Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **INSTALL TIMING CHAIN GUIDE**
    a. Install the timing chain guide with the bolt

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

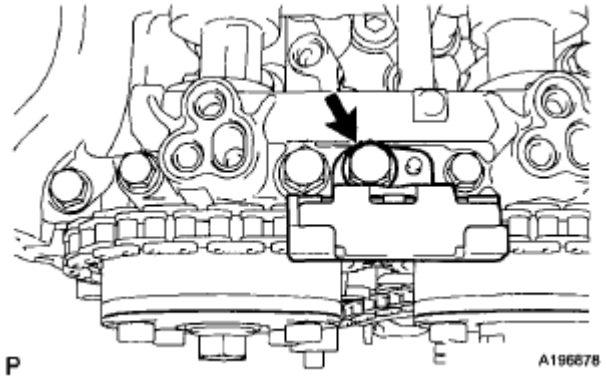


Fig. 59: Locating Timing Chain Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **CHECK NO. 1 CYLINDER TDC/COMPRESSION**
    a. Temporarily install the crankshaft pulley bolt.

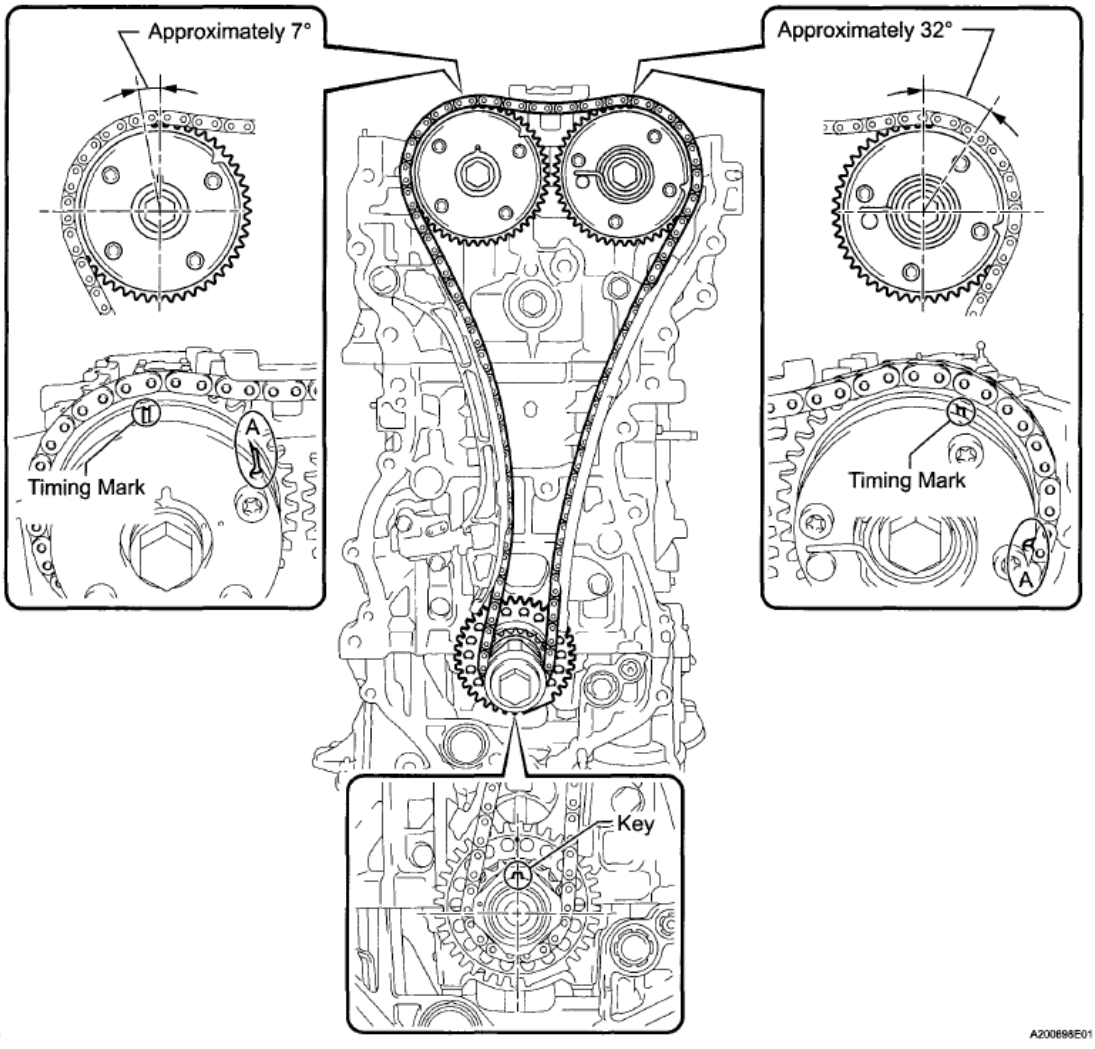


Fig. 60: Identifying Timing Marks On Crankshaft Timing Gear And Camshaft Timing Gears
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

"A" is not a timing mark.

c. Remove the crankshaft pulley bolt.

20. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY**
    a. Install the timing chain cover (See **INSTALLATION**).

CYLINDER HEAD GASKET

COMPONENTS

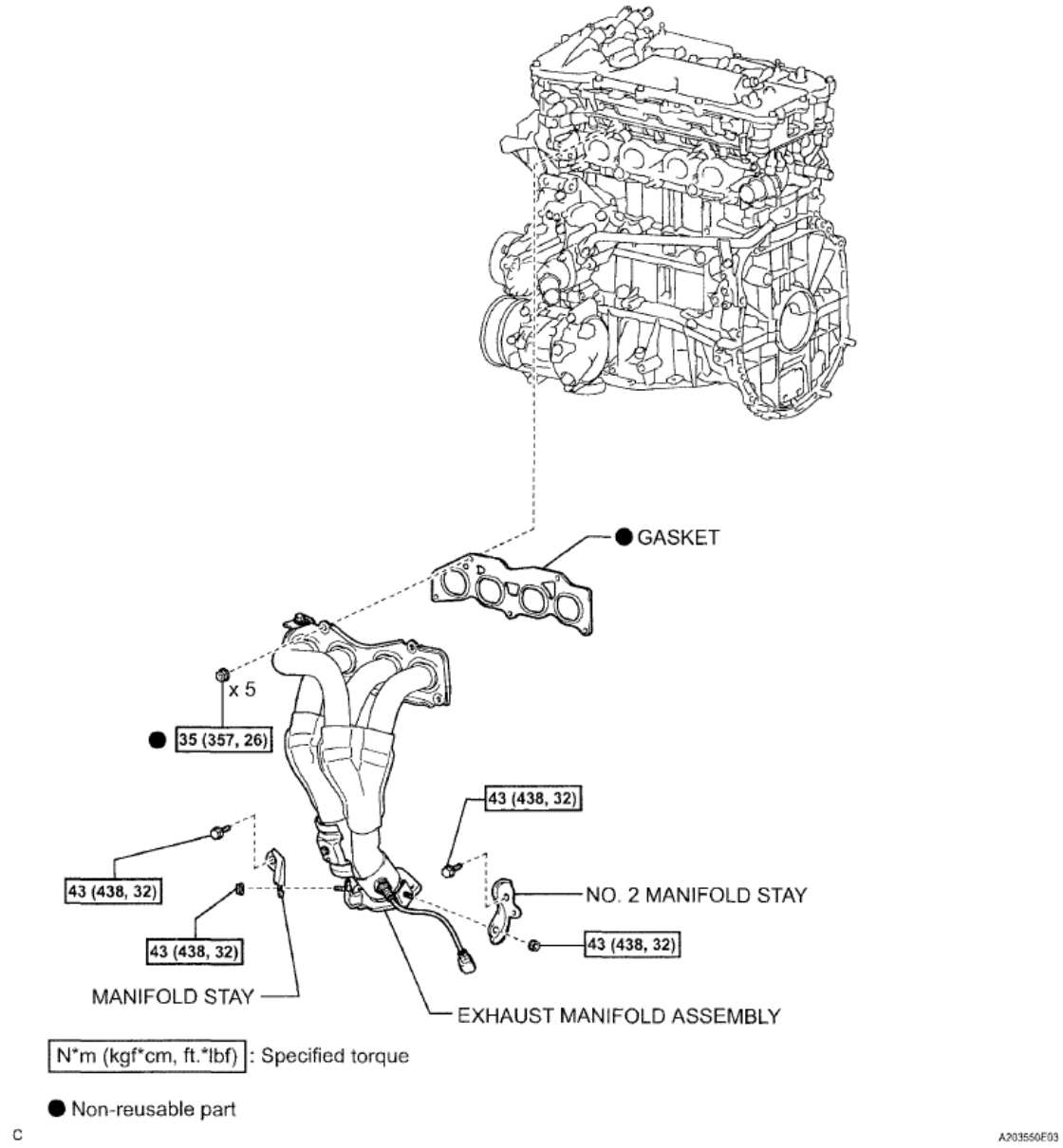


Fig. 61: Identifying Cylinder Head Gasket Components With Torque Specification (1 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

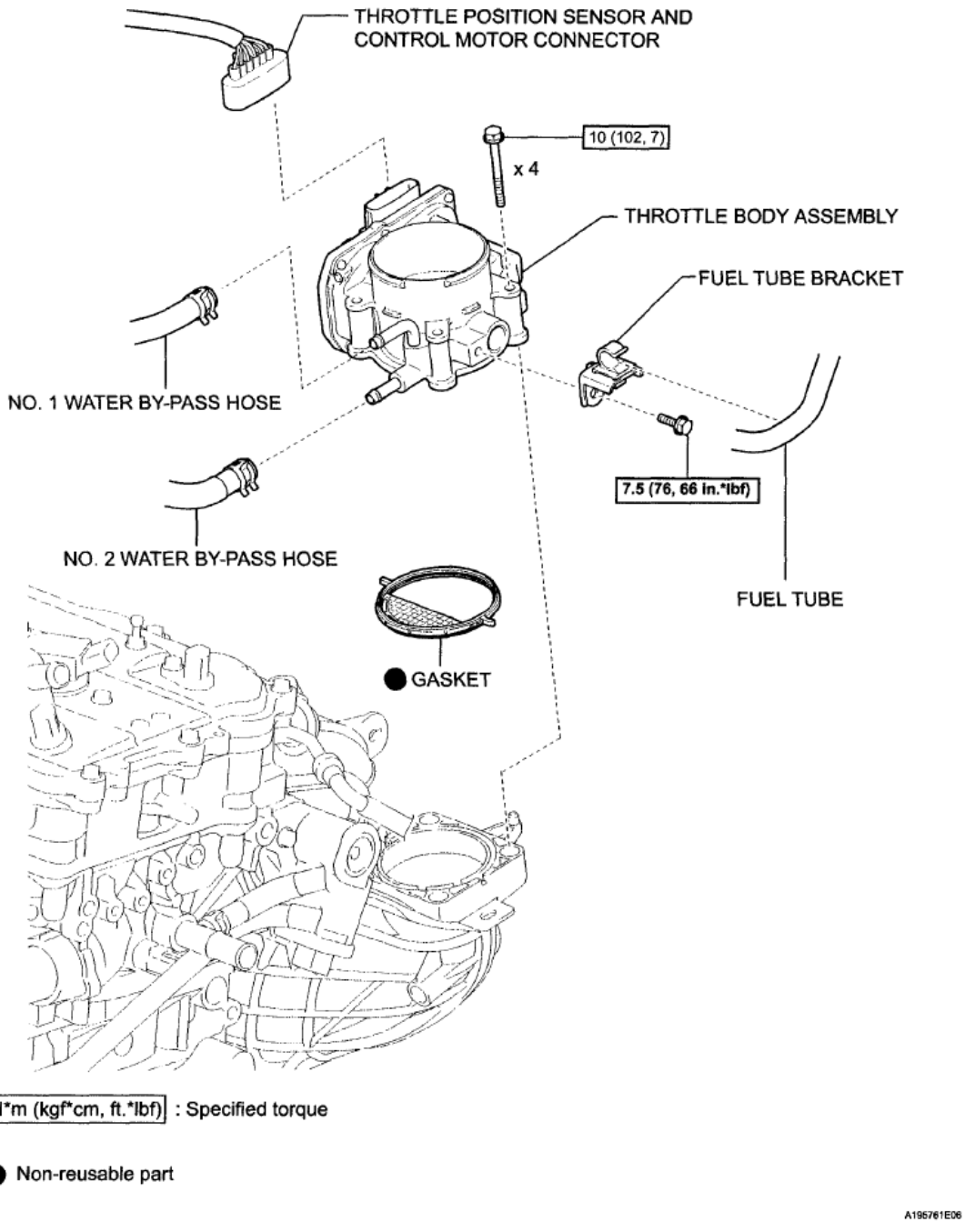


Fig. 62: Identifying Cylinder Head Gasket Components With Torque Specification (2 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

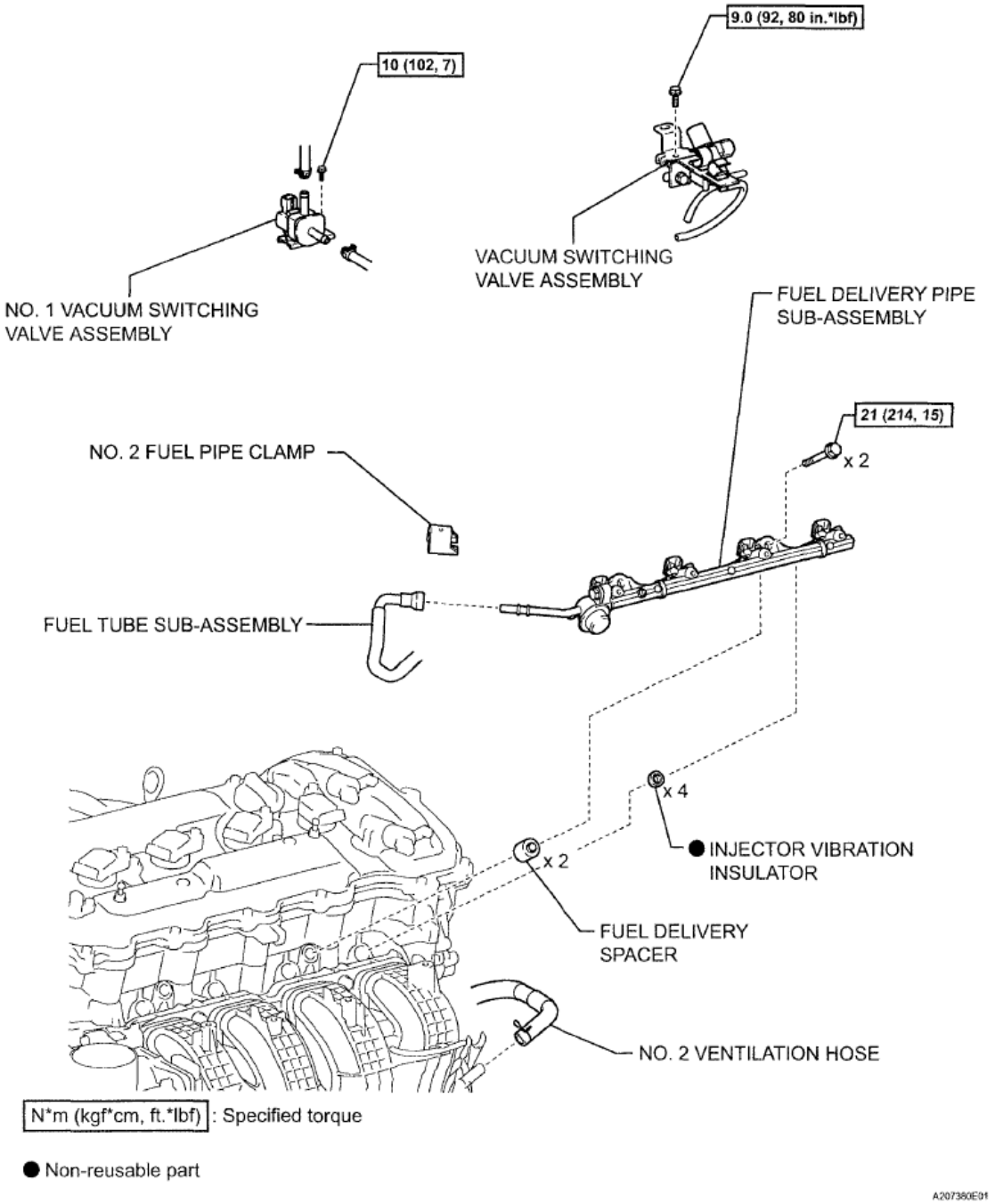


Fig. 63: Identifying Cylinder Head Gasket Components With Torque Specification (3 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

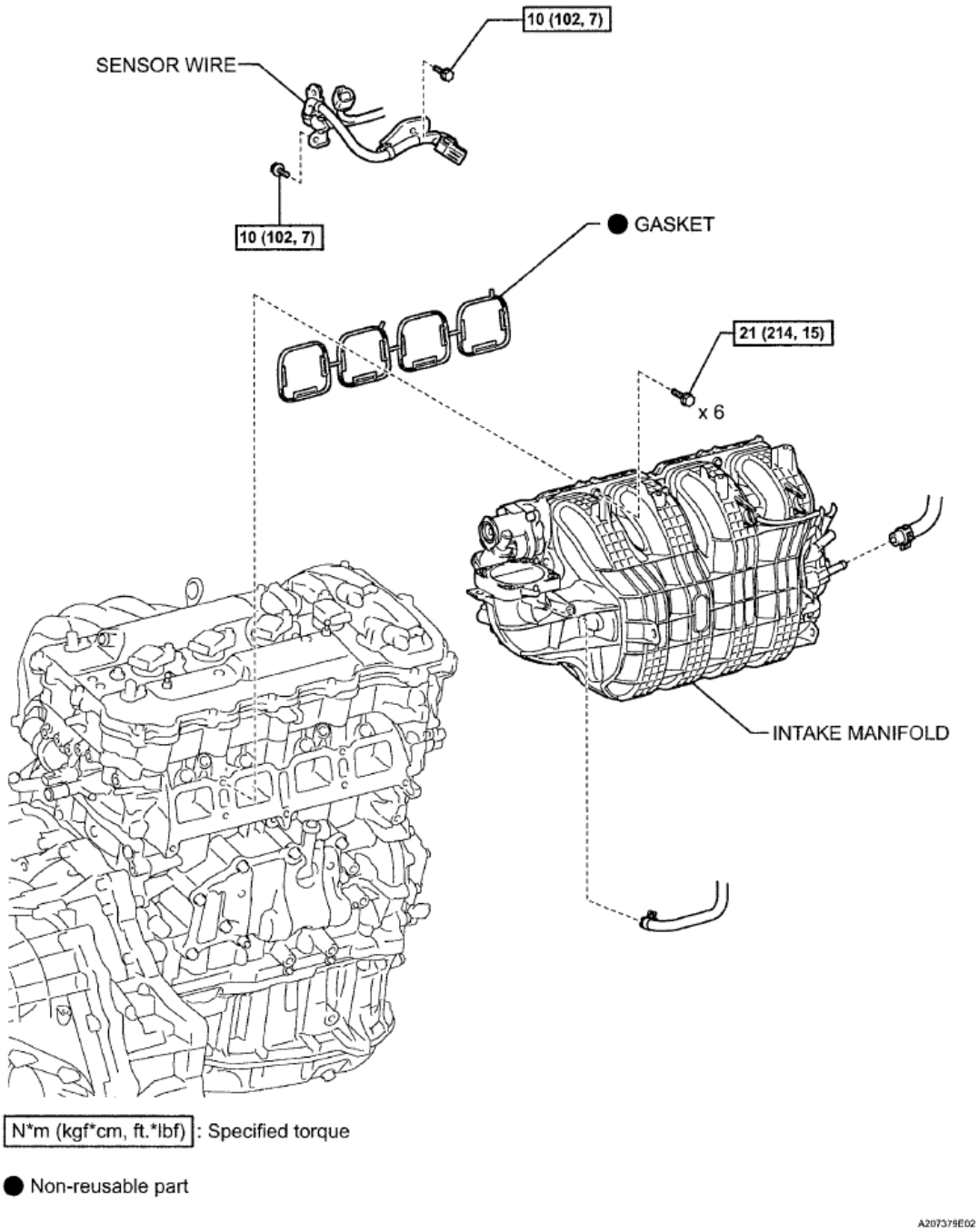


Fig. 64: Identifying Cylinder Head Gasket Components With Torque Specification (4 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

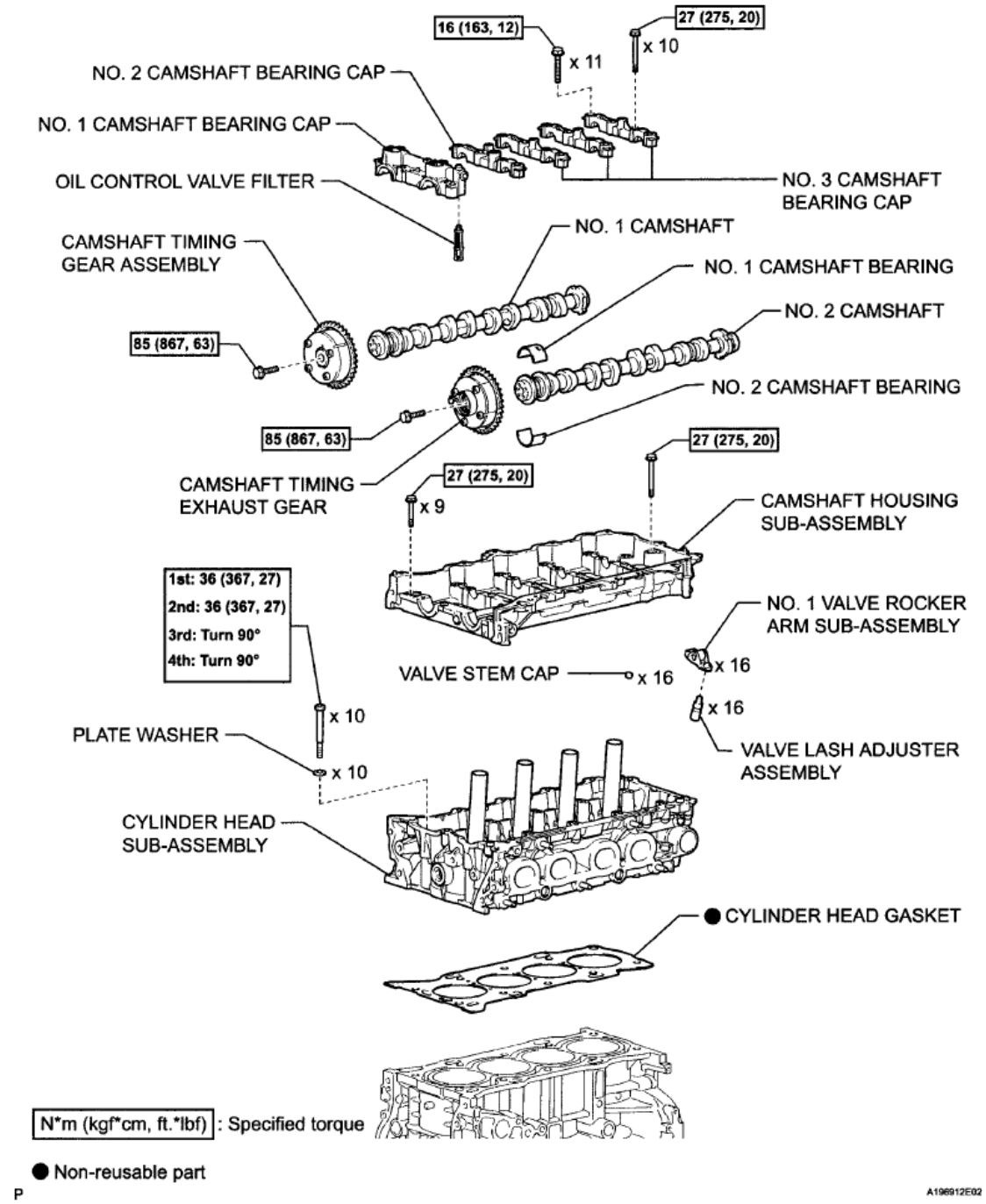


Fig. 65: Identifying Cylinder Head Gasket Components With Torque Specification (5 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE ENGINE AND TRANSAXLE**
   a. Remove the engine and transaxle (See **REMOVAL**).
2. **REMOVE EXHAUST MANIFOLD ASSEMBLY**

a. Remove the exhaust manifold assembly (See **REMOVAL**).

3. **REMOVE THROTTLE BODY ASSEMBLY** (See **REMOVAL**)
4. **REMOVE VACUUM SWITCHING VALVE ASSEMBLY** (See **INSPECTION**)
5. **REMOVE NO. 1 VACUUM SWITCHING VALVE ASSEMBLY** (See **REMOVAL**)
6. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** (See **INSPECTION**)
7. **DISCONNECT NO. 2 VENTILATION HOSE** (See **REMOVAL**)
8. **REMOVE INTAKE MANIFOLD** (See **REMOVAL**)
9. **REMOVE CAMSHAFT**
   a. Remove the camshafts (See **REMOVAL**).
10. **REMOVE VALVE STEM CAP**
    a. Remove the 16 valve stem caps from the cylinder head.

       HINT:

       Arrange the removed parts in the correct order.

11. **REMOVE CYLINDER HEAD SUB-ASSEMBLY**
    a. Using a 10 mm bi-hexagon wrench, uniformly loosen the 10 bolts in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

       HINT:

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

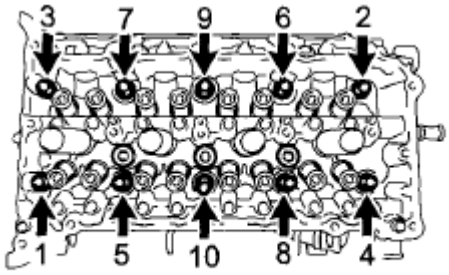


Fig. 66: Identifying Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

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

    b. Remove the cylinder head.
12. **REMOVE CYLINDER HEAD GASKET**

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

INSTALLATION

1. **INSPECT CYLINDER HEAD BOLT** (See **REASSEMBLY**)
2. **INSPECT CYLINDER HEAD SUB-ASSEMBLY** (See **INSPECTION**)
3. **INSTALL CYLINDER HEAD GASKET**
   a. Clean the cylinder block and cylinder head with solvent.
   b. Apply a continuous line of seal packing to a new cylinder head gasket as shown in the illustration.

      Seal packing:

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

      Standard seal dimension:

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

      mm (0.118 in.) thick

      HINT:

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

      NOTE:

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

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

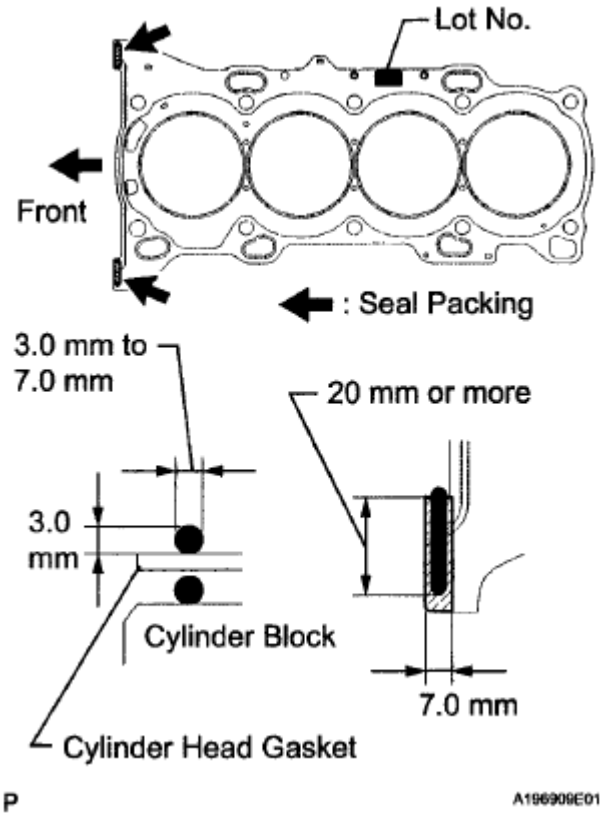


Fig. 67: Applying Continuous Line Of Seal Packing To Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Pay attention to the installation direction.

4. **INSTALL CYLINDER HEAD SUB-ASSEMBLY**

HINT:

The cylinder head bolts are tightened in 4 progressive steps.

a. Place the cylinder head on the cylinder block.

NOTE:

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

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

in several steps, in the sequence shown in the illustration.

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

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

e. Step 2:
   1. Tighten the cylinder head bolts again in the sequence shown in the illustration to make sure that they are tightened to the specified torque.

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

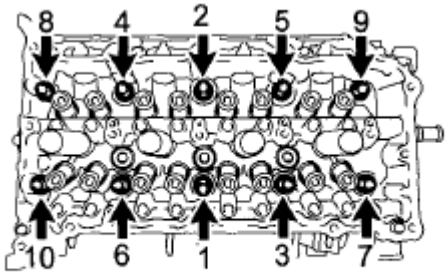


Fig. 68: Identifying Cylinder Head Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Step 3:
   1. Mark each cylinder head bolt head with paint as shown in the illustration.
   2. Tighten the cylinder head bolts 90° in the sequence shown in step 1.

g. Step 4:
   1. Tighten the cylinder head bolts another 90° in the sequence shown in step 1.
   2. Check that the painted marks are now facing rearward.

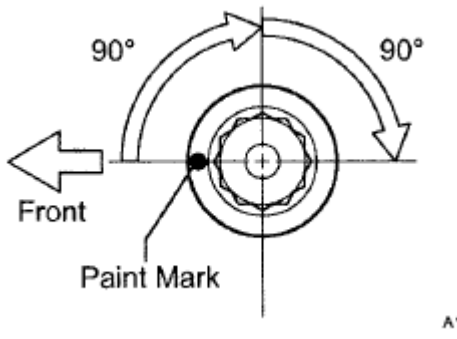


Fig. 69: Identifying Cylinder Head Bolts Installation Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

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

5. **INSTALL VALVE STEM CAP**
   a. Apply a light coat of engine oil to the valve stem ends.
   b. Install the 16 valve stem caps to the cylinder head.

NOTE: Do not drop the valve stem caps into the cylinder head.

6. **INSTALL CAMSHAFT**
   a. Install the camshafts (See **INSTALLATION**).
7. **INSTALL INTAKE MANIFOLD** (See **INSTALLATION**)
8. **CONNECT NO. 2 VENTILATION HOSE** (See **INSTALLATION**)
9. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** (See **INSTALLATION**)
10. **INSTALL NO. 1 VACUUM SWITCHING VALVE ASSEMBLY** (See **INSTALLATION**)
11. **INSTALL VACUUM SWITCHING VALVE ASSEMBLY** (See **INSTALLATION**)
12. **INSTALL THROTTLE BODY ASSEMBLY** (See **INSPECTION**)
13. **INSTALL EXHAUST MANIFOLD ASSEMBLY**
    a. Install the exhaust manifold assembly (See **INSTALLATION**).
14. **INSTALL ENGINE AND TRANSAXLE**
    a. Install the engine and transaxle (See **INSTALLATION**).

CYLINDER HEAD

COMPONENTS

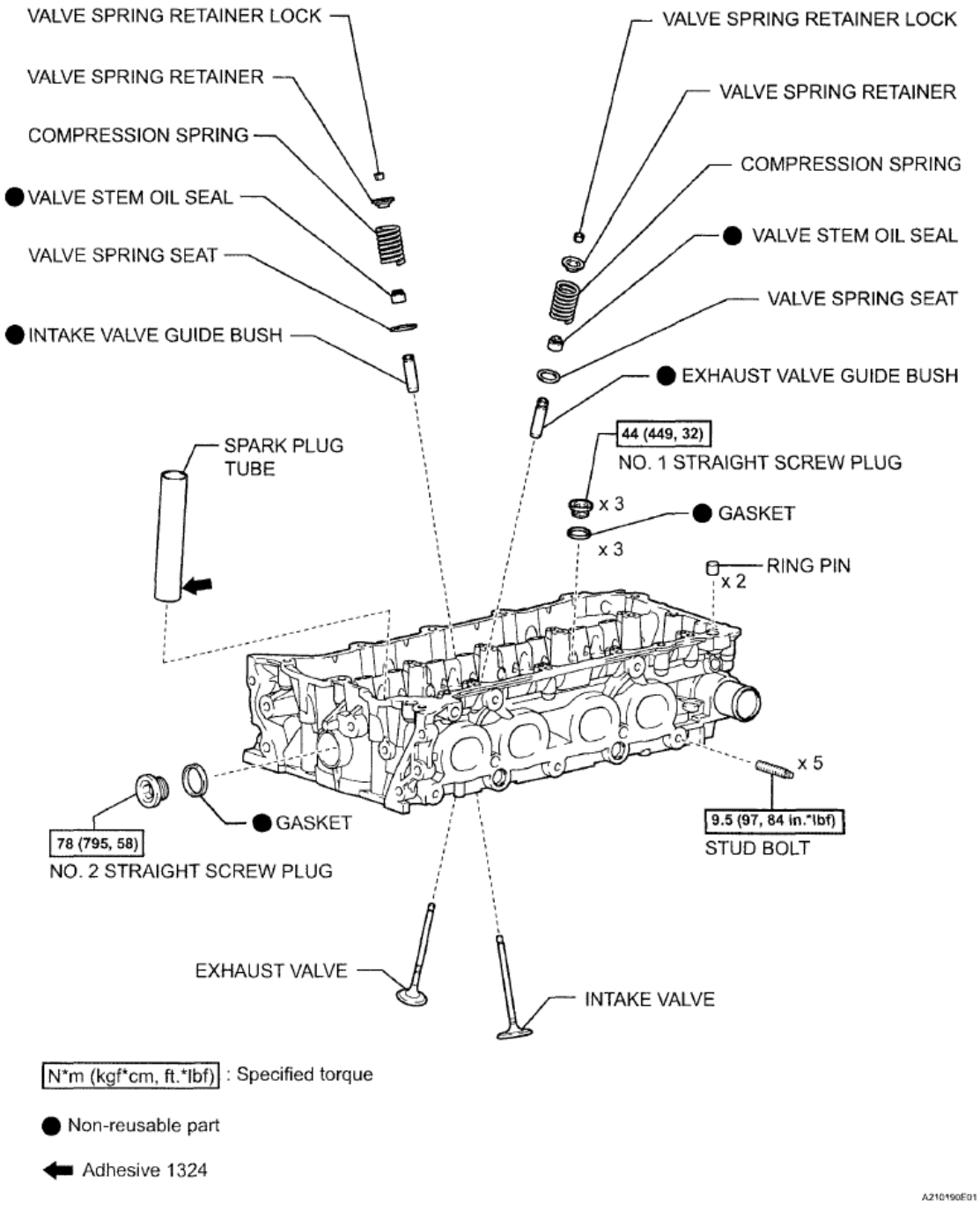


Fig. 70: Identifying Cylinder Head Components With Torque Specification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **REMOVE INTAKE VALVE**
    a. Using SST and wooden blocks, compress the compression spring and remove the valve spring retainer locks.

SST 09202-70020(09202-00010)

b. Remove the retainer, compression spring and valve.

HINT:

Arrange the removed parts in the correct order.

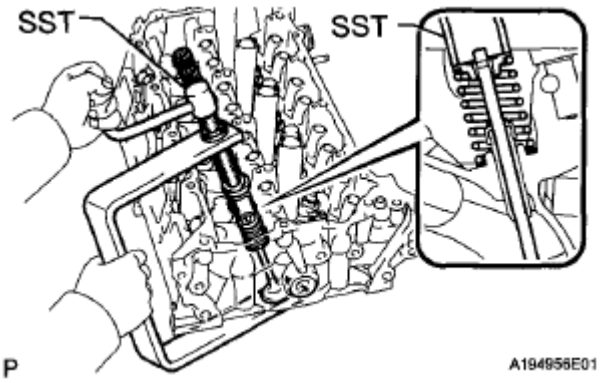


Fig. 71: Removing Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE EXHAUST VALVE**

a. Using SST and wooden blocks, compress the compression spring and remove the valve spring retainer locks.

SST 09202-70020(09202-00010)

b. Remove the retainer, compression spring and valve.

HINT:

Arrange the removed parts in the correct order.

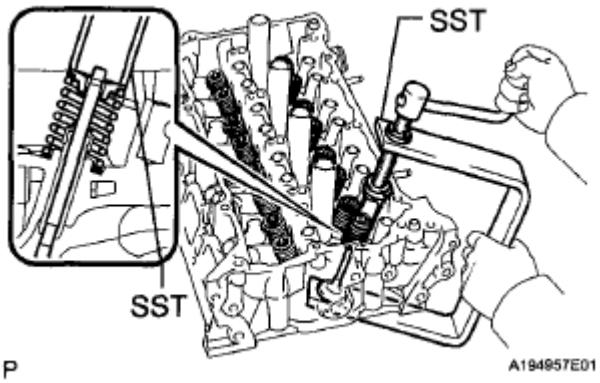


Fig. 72: Removing Exhaust Valve

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

3. **REMOVE VALVE STEM OIL SEAL**
   a. Using needle-nose pliers, remove the oil seals.

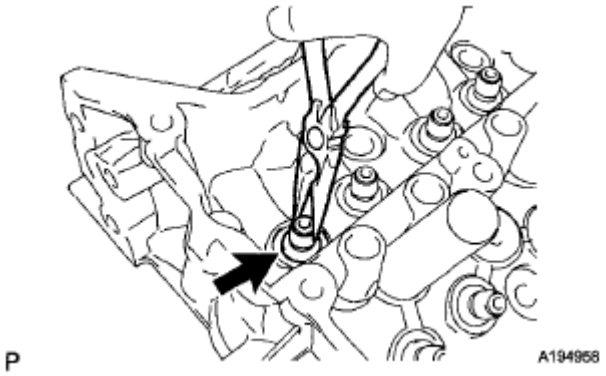


Fig. 73: Removing Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE VALVE SPRING SEAT**
   a. Using compressed air and a Magnet Hand, remove the valve spring seat by blowing air onto it.

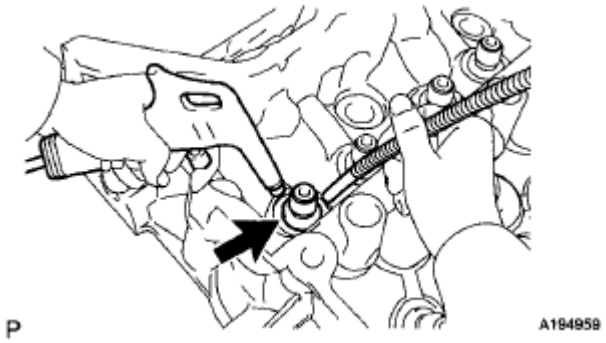


Fig. 74: Removing Valve Spring Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE NO. 1 STRAIGHT SCREW PLUG**

NOTE: If water leaks from the No. 1 screw plug or the plug is corroded, replace it.

   a. Using a 10 mm hexagon wrench, remove the 3 screw plugs and 3 gaskets.

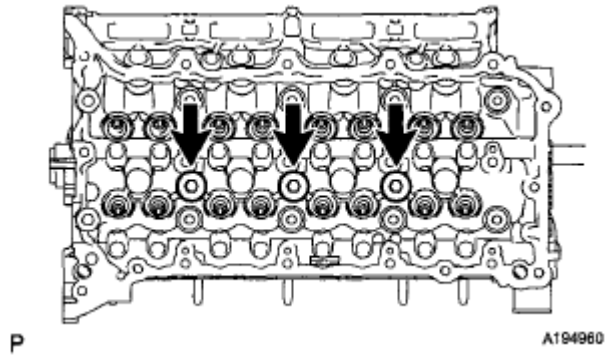


Fig. 75: Locating No. 1 Straight Screw Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **REMOVE NO. 2 STRAIGHT SCREW PLUG**

NOTE: If water leaks from the No. 2 screw plug or the plug is corroded, replace it.

a. Using a 14 mm hexagon wrench, remove the screw plug and gasket.

7. **REMOVE STUD BOLT**

NOTE: If a stud bolt is deformed or its threads are damaged, replace it.

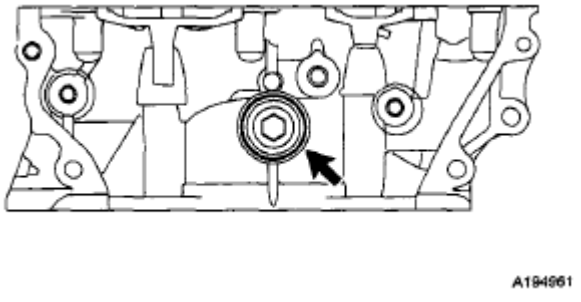


Fig. 76: Locating No. 2 Straight Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT CYLINDER HEAD SUB-ASSEMBLY**
   a. Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces where the cylinder head contacts the cylinder block and manifold.

Maximum Warpage

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition

Cylinder head lower side	0.05 mm (0.00197 in.)
Intake manifold side	0.10 mm (0.00394 in.)
Exhaust manifold side	0.10 mm (0.00394 in.)

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

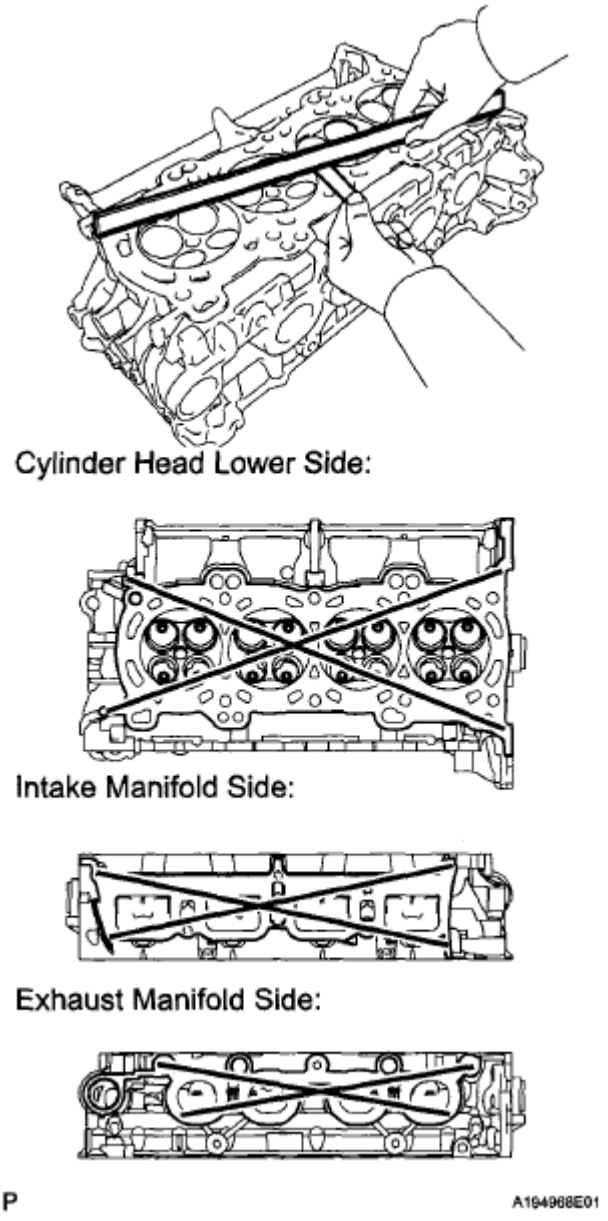


Fig. 77: Measuring Warpage Of Cylinder Head Contact Surfaces
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a dye penetrant, check the intake ports, exhaust ports and cylinder surface for cracks. If cracked, replace the cylinder head.

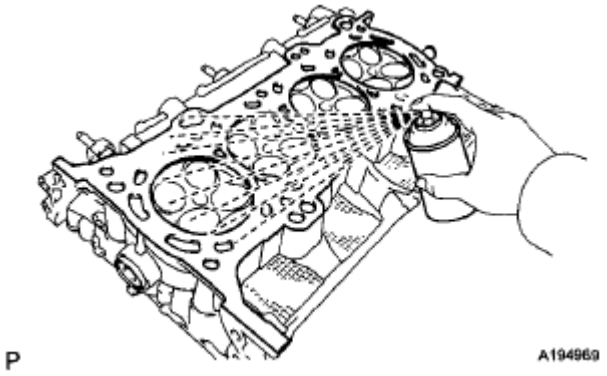


Fig. 78: Checking Intake Ports, Exhaust Ports And Cylinder Surface For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT COMPRESSION SPRING**
   a. Using a vernier caliper, measure the free length of the inner compression spring.

      Standard free length:

      50.0 mm (1.97 in.)

      If the free length is not as specified, replace the spring.

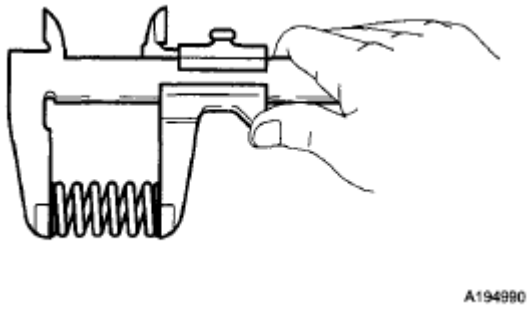


Fig. 79: Measuring Free Length Of Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a steel square, measure the deviation of the inner compression spring.

      Maximum deviation:

      1.0 mm (0.0394 in.)

      Maximum angle:

      2°

      If the deviation is more than the maximum, replace the spring.

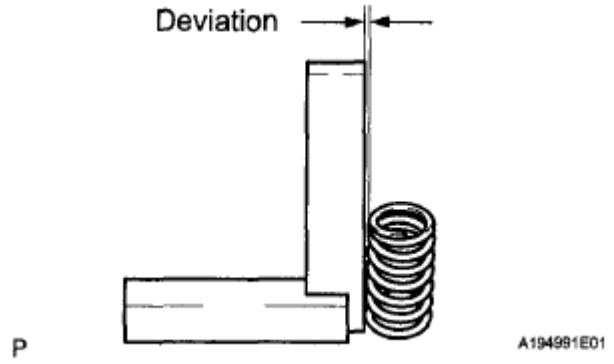


Fig. 80: Measuring Deviation Of Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSPECT INTAKE VALVE**
   a. Using a micrometer, measure the diameter of the valve stem.

      Standard valve stem diameter:

      5.470 mm to 5.485 mm (0,2154 to 0.2159 in.)

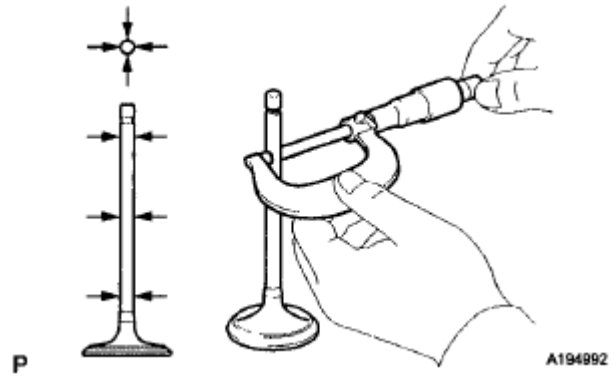


Fig. 81: Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a vernier caliper, measure the valve head margin thickness.

      Standard margin thickness:

      1.0 mm (0.0394 in.)

      Minimum margin thickness:

      0.50 mm (0.0197 in.)

      If the margin thickness is less than the minimum, replace the valve.

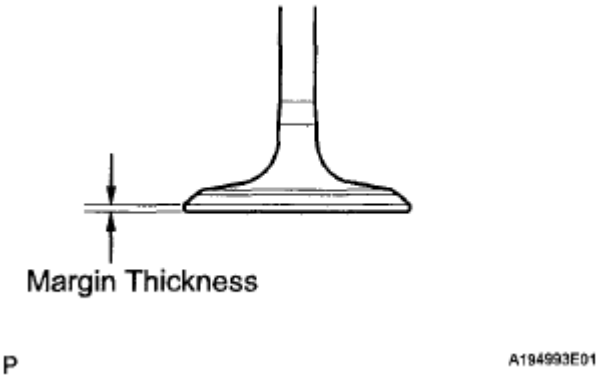


Fig. 82: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a vernier caliper, measure the overall length of the valve.

Standard overall length:

103.92 mm (4.09 in.)

Minimum overall length:

103.42 mm (4.07 in.)

If the overall length is less than the minimum, replace the intake valve.

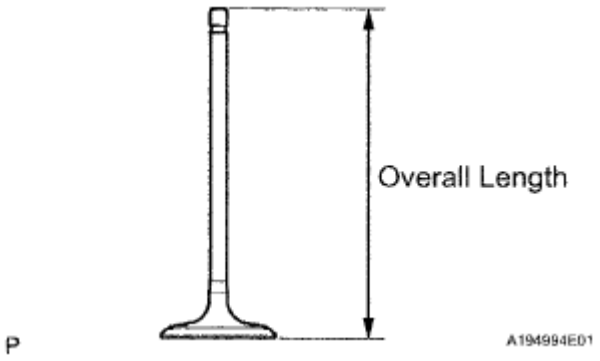


Fig. 83: Measuring Overall Length Of Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSPECT EXHAUST VALVE**
   a. Using a micrometer, measure the diameter of the valve stem.

   Standard valve stem diameter:

   5.465 mm to 5.480 mm (0.2152 to 0.2157 in.)

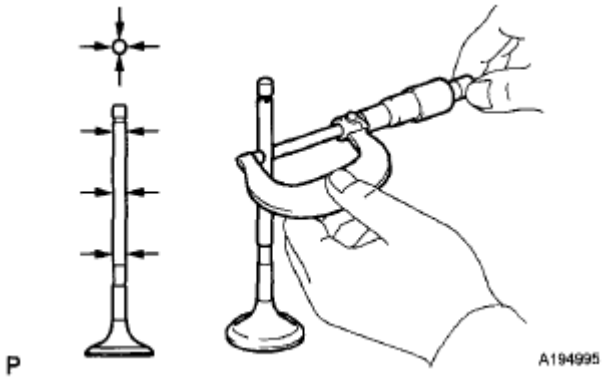


Fig. 84: Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a vernier caliper, measure the valve head margin thickness.

Standard margin thickness:

1.0 mm (0.0394 in.)

Minimum margin thickness:

0.50 mm (0.0197 in.)

If the margin thickness is less than the minimum, replace the exhaust valve.

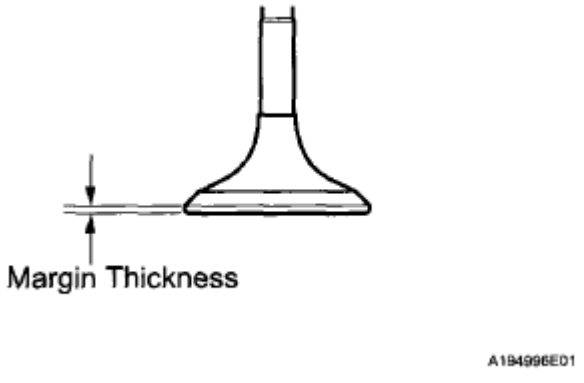


Fig. 85: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a vernier caliper, measure the overall length of the valve.

Standard overall length:

112.91 mm (4.44 in.)

Minimum overall length:

112.41 mm (4.43 in.)

If the overall length is less than the minimum, replace the exhaust valve.

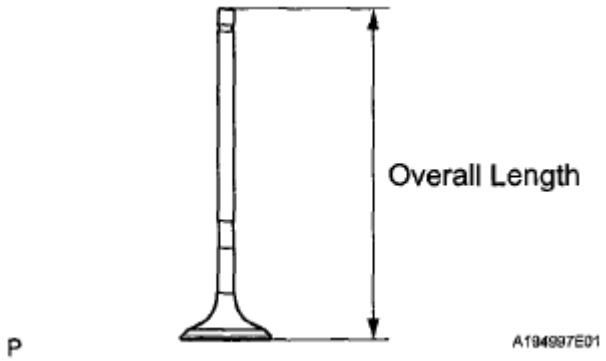


Fig. 86: Measuring Overall Length Of Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSPECT VALVE GUIDE BUSH OIL CLEARANCE**
   a. Using a caliper gauge, measure the inside diameter of the guide bush.

      Standard bush inside diameter: 5.510 to 5.530 mm (0.2169 to 0.2177 in.)

   b. Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

      Standard Oil Clearance

      ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake	0.025 to 0.060 mm (0.000984 to 0.00236 in.)
Exhaust	0.030 to 0.065 mm (0.00118 to 0.00256 in.)

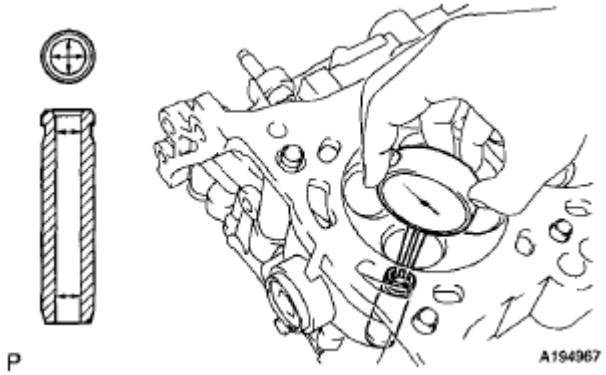


Fig. 87: Measuring Inside Diameter Of Guide Bush

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

Maximum Oil Clearance

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake	0.08 mm (0.00315 in.)
Exhaust	0.10 mm (0.00394 in.)

If the oil clearance is more than the maximum, replace the valve and guide bush.

6. **INSPECT INTAKE VALVE SEAT**
   a. Apply a light coat of Prussian blue to the valve face.
   b. Lightly press the valve face against the valve seat.

      HINT:

      Do not rotate the valve while pressing the valve.

   c. Check the valve face and valve seat.
      1. Check that the contact surfaces of the valve seat and valve face are in the middle area of their respective surfaces, with the width between 1.1 and 1.5 mm (0.0433 and 0.0591 in.).

         If not, correct the valve seat.

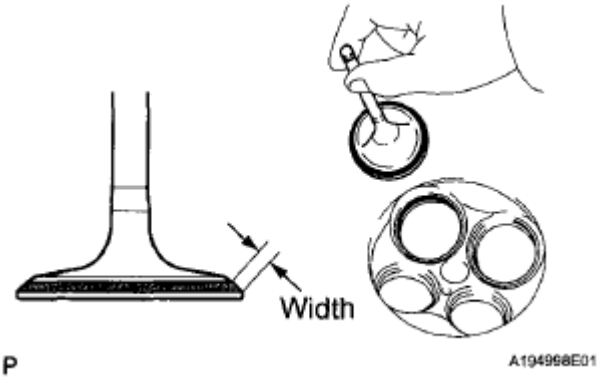


Fig. 88: Inspecting Intake Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

      2. Check that the contact surfaces of the valve seat and valve face are even around the entire valve seat.

         If not, correct the valve seat.

7. **INSPECT EXHAUST VALVE SEAT**

a. Apply a light coat of Prussian blue to the valve face.
b. Lightly press the valve face against the valve seat.

HINT:

Do not rotate the valve while pressing the valve.

c. Check the valve face and valve seat.
   1. Check that the contact surfaces of the valve seat and valve face are in the middle area of their respective surfaces, with the width between 1.1 and 1.5 mm (0.0433 and 0.0591 in.).

      If not, correct the valve seat.

   2. Check that the contact surfaces of the valve seat and valve face are even around the entire valve seat.

      If not, correct the valve seat.

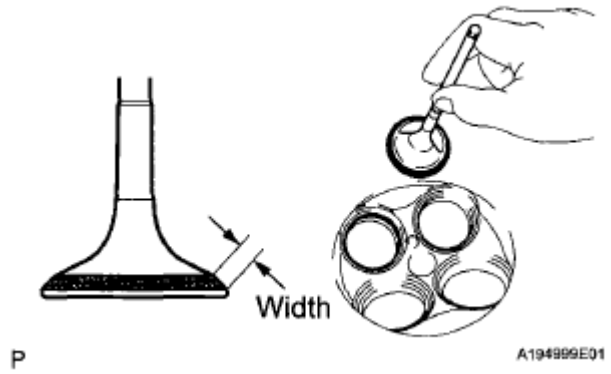


Fig. 89: Inspecting Exhaust Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSPECT CAMSHAFT OIL CLEARANCE**

NOTE: Do not turn the camshafts.

a. Clean the bearing caps, camshaft housing and camshaft journals.
b. Place the camshafts on the camshaft housing.
c. Lay a strip of Plastigage across each of the camshaft journals.
d. Install the camshaft bearing caps (See **CYLINDER HEAD GASKET**).
e. Install the camshaft housing sub-assembly (See **CYLINDER HEAD GASKET**).
f. Remove the camshaft bearing caps (See **INSTALLATION**).

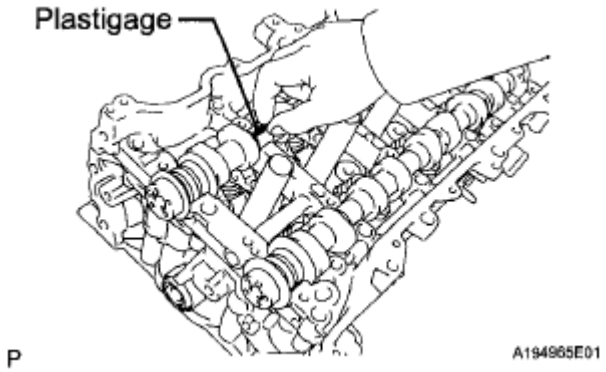


Fig. 90: Inspecting Camshaft Oil Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Measure the Plastigage at its widest point.

Standard Oil Clearance

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake No. 1 journal	0.035 to 0.072 mm (0.00137 to 0.00283 in.)
Exhaust No. 1 journal	0.049 to 0.086 mm (0.00193 to 0.00339 in.)
Other journal	0.025 to 0.062 mm (0.000984 to 0.00244 in.)

Maximum Oil Clearance

ITEM SPECIFIED CONDITION CHART

Item	Specified Condition
Intake No. 1 journal	0.085 mm (0.00335 in.)
Exhaust No. 1 journal	0.095 mm (0.00374 in.)
Other journal	0.085 mm (0.00335 in.)

If the oil clearance is more than the maximum, replace the camshaft. If necessary, replace the camshaft housing.

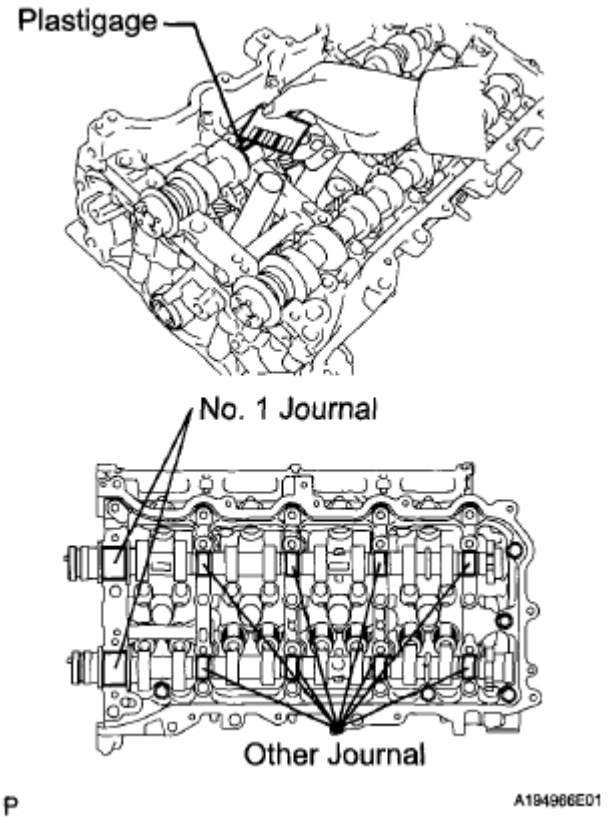


Fig. 91: Measuring Oil Clearance Using Plastigage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSPECT CAMSHAFT THRUST CLEARANCE**
   a. Inspect the intake camshaft.
      1. Install the intake camshaft.
      2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

         If the thrust clearance is more than the maximum, replace the camshaft housing. If the thrust surface is damaged, replace the camshaft.

   b. Inspect the intake and exhaust camshafts.
      1. Install the intake and exhaust camshafts.
      2. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

         Standard Thrust Clearance:

         0.060 to 0.155 mm (0.00236 to 0.00610 in.)

         Maximum Thrust Clearance:

0.170 mm (0.00669 in.)

If the thrust clearance is more than the maximum, replace the camshaft housing. If the thrust surface is damaged, replace the camshaft.

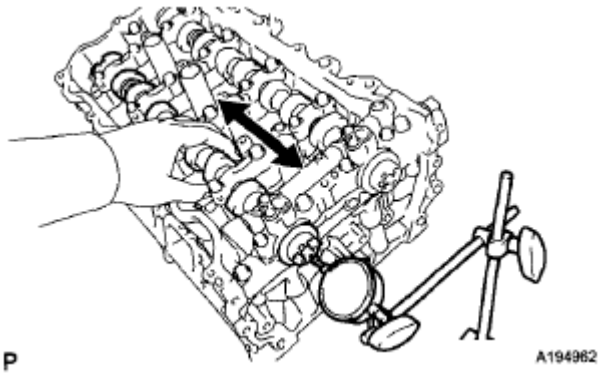


Fig. 92: Measuring Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

1. **REPLACE INTAKE VALVE GUIDE BUSH**
   a. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
   b. Place the cylinder head on wooden blocks.
   c. Using SST and a hammer, tap out the valve guide bush.

      SST 09201 -01055, 09950-70010 (09951 -07100)

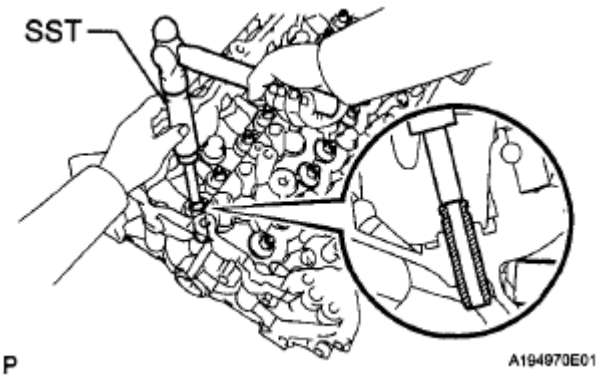


Fig. 93: Tapping Out Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   d. Using a caliper gauge, measure the bush bore diameter of the cylinder head.

      Standard bush bore diameter: 10.285 to 10.306 mm (0.405 to 0.406 in.)

If the bush bore diameter of the cylinder head is between 10.285 and 10.306 mm (0.405 and 0.406 in.), proceed to the next step.

If the bush bore diameter of the cylinder head is 10.356 mm (0.408 in.) or more, replace the cylinder head.

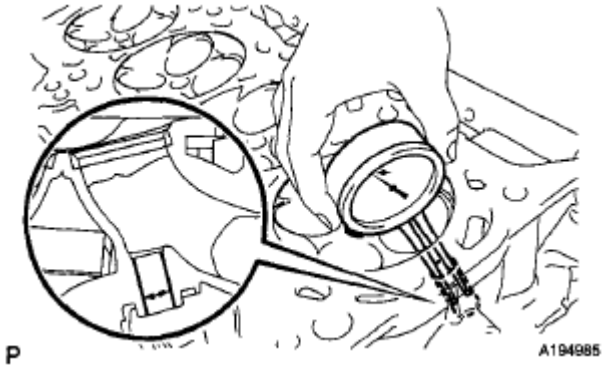


Fig. 94: Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Select a new guide bush (STD or O/S 0.05), and measure its diameter.
f. Machine the bush bore of the cylinder head to the diameter of the selected guide bush.

Bush Bore Diameter

BUSH BORE DIAMETER SPECIFICATION

Bush Size	Specified Condition
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

Standard bush length: 41.3 to 41.7 mm (1.626 to 1.642 in.)

g. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
h. Using SST and a hammer, tap in the selected guide bush to the standard protrusion height.

SST 09201 -10000 (09201 -01050), 09950-70010 (09951-07100)

Standard protrusion height: 14.8 to 15.2 mm (0.582 to 0.598 in.)

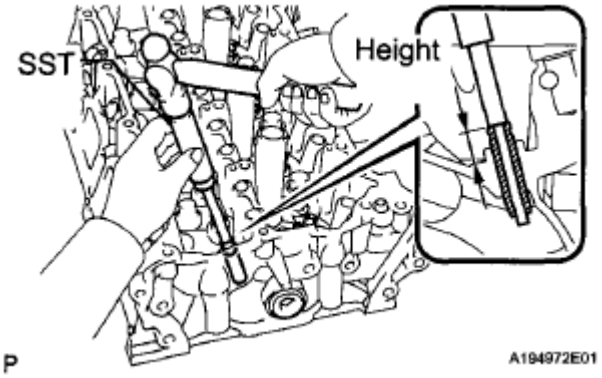


Fig. 95: Measuring Protrusion Height Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard oil clearance between the guide bush and valve stem.

Standard oil clearance: 0.025 to 0.060 mm (0.000984 to 0.00236 in.)

2. **REPLACE EXHAUST VALVE GUIDE BUSH**
   a. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
   b. Place the cylinder head on wooden blocks.

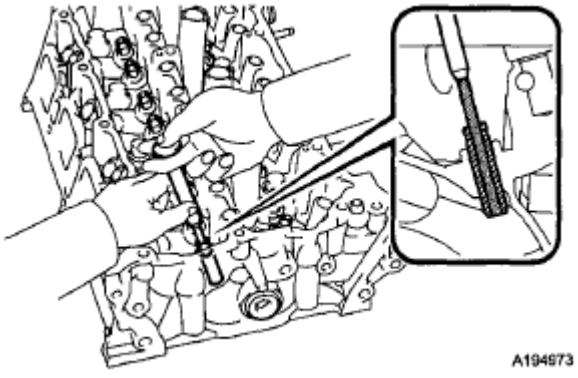


Fig. 96: Reaming Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using SST and a hammer, tap out the valve guide bush.

SST 09201-01055, 09950-70010 (09951-07100)

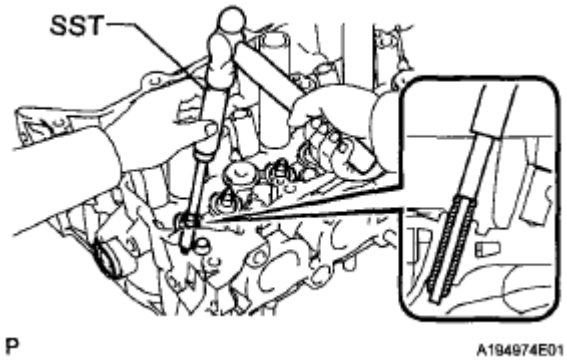


Fig. 97: Tapping Out Valve Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard bush bore diameter: 10.285 to 10.306 mm (0.405 to 0.406 in.)

If the bush diameter of the cylinder head is between 10.285 and 10.306 mm (0.405 and 0.406 in.), proceed to the next step.

If the bush bore diameter of the cylinder head is 10.356 mm (0.408 in.) or more, replace the cylinder head.

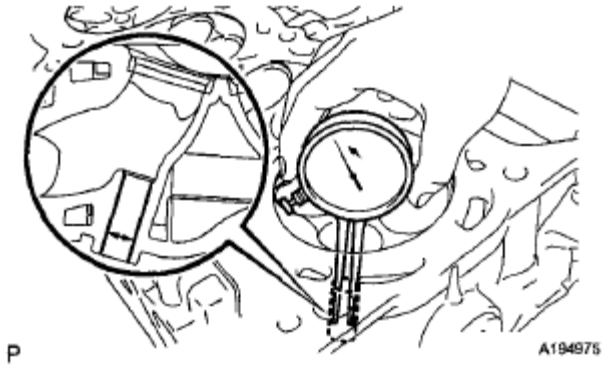


Fig. 98: Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Select a new guide bush (STD or O/S 0.05), and measure its diameter.
f. Machine the bush bore of the cylinder head to the diameter of the selected guide bush.

Bush Bore Diameter

BUSH BORE DIAMETER SPECIFICATION

Bush Size	Specified Condition
STD	10.333 to 10.344 mm (0.4068 in 0.4072 in.)

O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

Standard bush length: 46.8 to 47.2 mm (1.843 to 1.858 in.)

g. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
h. Using SST and a hammer, tap in the selected guide bush to the standard protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Standard protrusion height: 14.2 to 14.6 mm (0.559 to 0.575 in.)

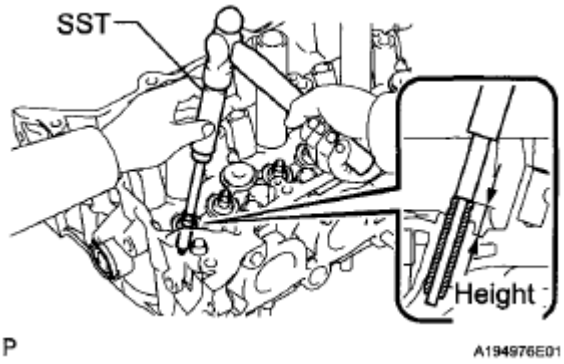


Fig. 99: Tapping In Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard oil clearance between the guide bush and valve stem.

Standard oil clearance: 0.030 to 0.065 mm (0.00118 to 0.00256 in.)

3. **REPLACE SPARK PLUG TUBE**

HINT:

When using a new cylinder head, the spark plug tubes must be replaced.

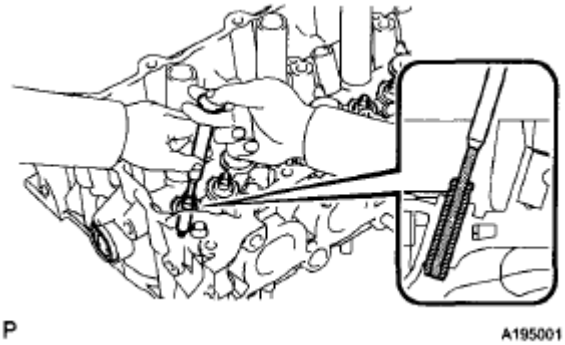


Fig. 100: Reaming Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Remove the spark plug tube.
b. Apply adhesive onto the shaded area of a new spark plug tube.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent.

Standard application width:

2.0 mm (0.0787 in.)

NOTE:

- **Install the spark plug tube within 3 minutes after applying adhesive.**
- **Be careful not to deform the spark plug tube.**
- **Be careful not to expose the seal to coolant for at least 1 hour after installing it.**

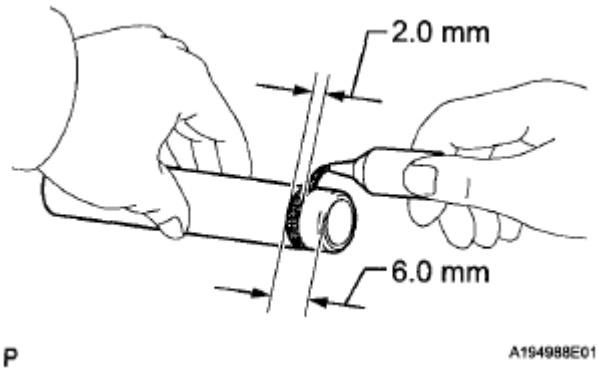


Fig. 101: Applying Adhesive Onto Shaded Area Of Spark Plug Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a wooden block and hammer, tap in the spark plug tube to the specified protrusion height.

Standard protrusion height:

112 mm (4.41 in.)

NOTE: **To avoid tapping in the spark plug tube too far, measure the protrusion height while tapping it.**

4. **REPLACE RING PIN**

NOTE: It is not necessary to remove the ring pin unless it is being replaced.

a. Remove the ring pins.

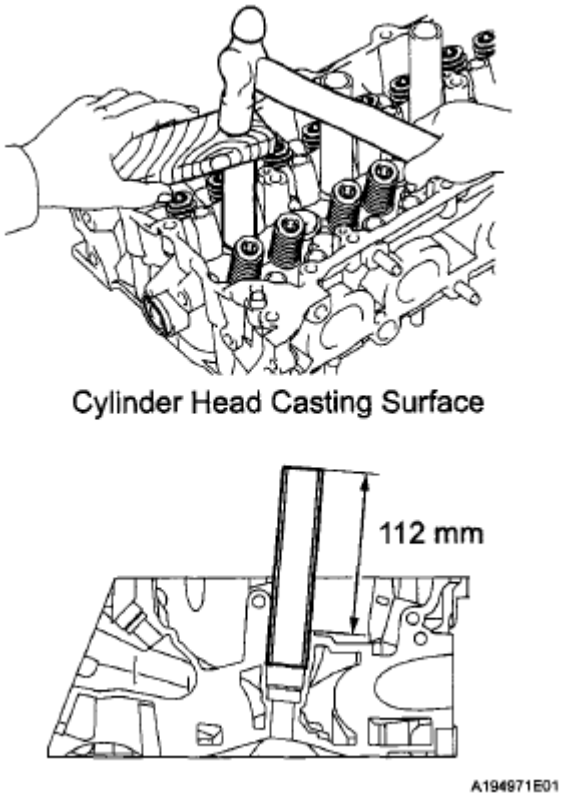


Fig. 102: Measuring Protrusion Height Of Spark Plug Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a plastic-faced hammer, tap in new ring pins to the cylinder head.

Standard protrusion height: 6.5 to 7.5 mm (0.256 to 0.295 in.)

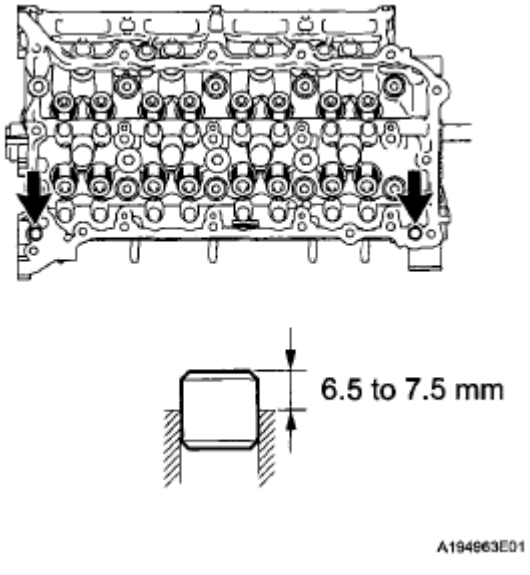


Fig. 103: Identifying Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. **INSTALL CYLINDER HEAD STUD BOLT**
   a. Using an E7 "TORX" socket wrench, install the cylinder head stud bolts.

      Torque: 9.5 N*m (97 kgf*cm, 84 in.*lbf)

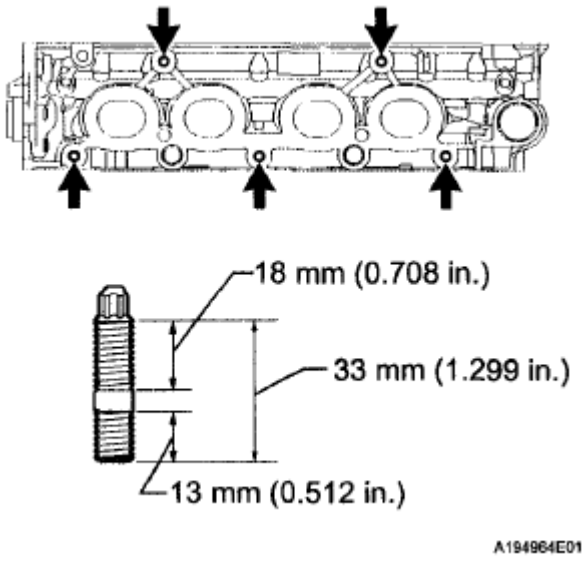


Fig. 104: Locating Cylinder Head Stud Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL NO. 1 STRAIGHT SCREW PLUG**

a. Using a 10 mm hexagon wrench, install 3 new gaskets and the 3 straight screw plugs.

Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)

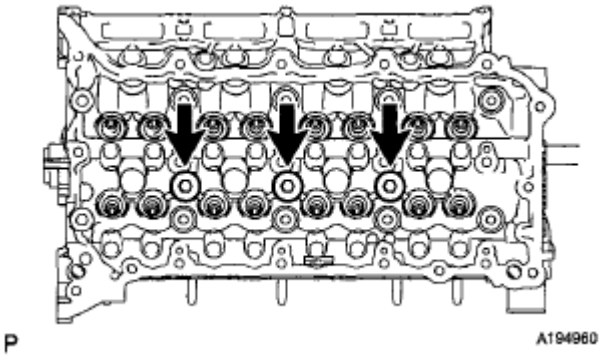


Fig. 105: Locating No. 1 Straight Screw Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL NO. 2 STRAIGHT SCREW PLUG**
   a. Using a 14 mm hexagon wrench, install a new gasket and the straight screw plug.

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

4. **INSTALL VALVE SPRING SEAT**
   a. Install the valve spring seats to the cylinder head.

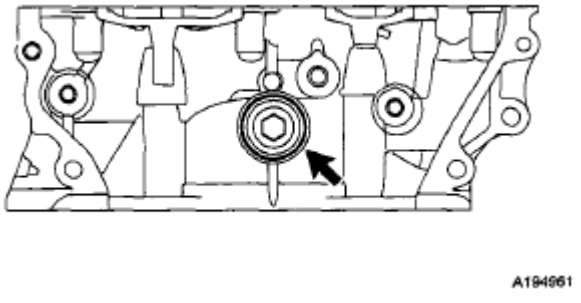


Fig. 106: Locating No. 2 Straight Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL VALVE STEM OIL SEAL**
   a. Apply a light coat of engine oil to new oil seals.

NOTE: Pay attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal onto the exhaust side or installing the exhaust oil seal onto the intake side can cause installation problems later.

HINT:

The intake valve oil seals are gray and the exhaust valve oil seals are black.

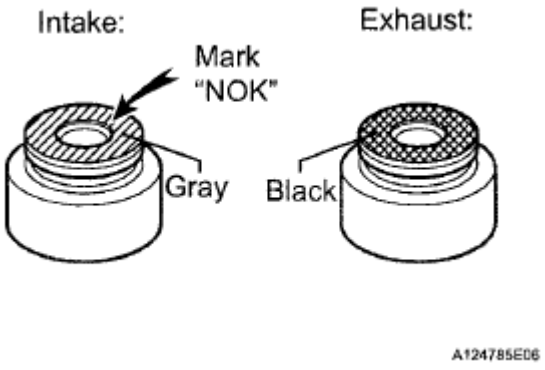


Fig. 107: Identifying Intake And Exhaust Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using SST, push in the intake and exhaust valve oil seals.

SST 09201-41020

NOTE: Failure to use SST will cause the seal to be damaged or improperly seated.

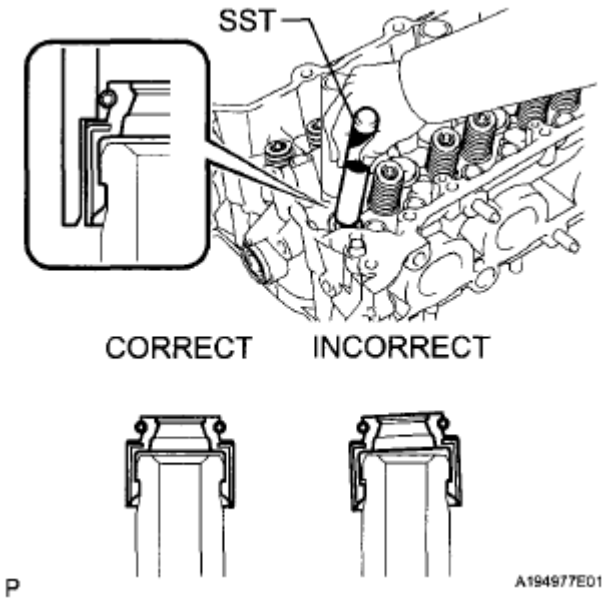


Fig. 108: Pushing Intake And Exhaust Valve Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL INTAKE VALVE**

a. Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.
b. Install the valve, compression spring and spring retainer to the cylinder head.

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

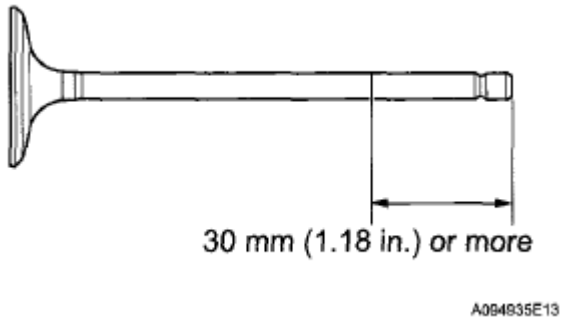


Fig. 109: Identifying Tip Area Of Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using SST and wooden blocks, compress the spring and install the retainer locks.

SST 09202-70020 (09202-00010)

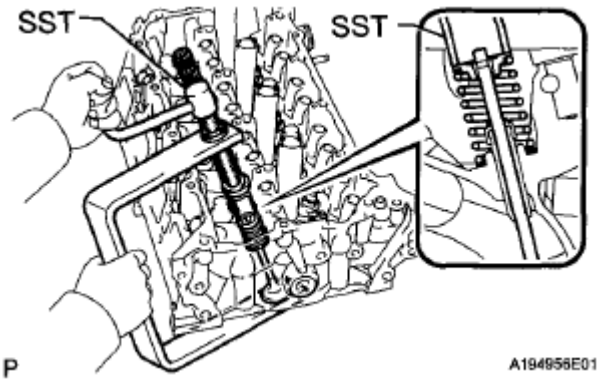


Fig. 110: Compressing Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTE: Be careful not to damage the retainer.

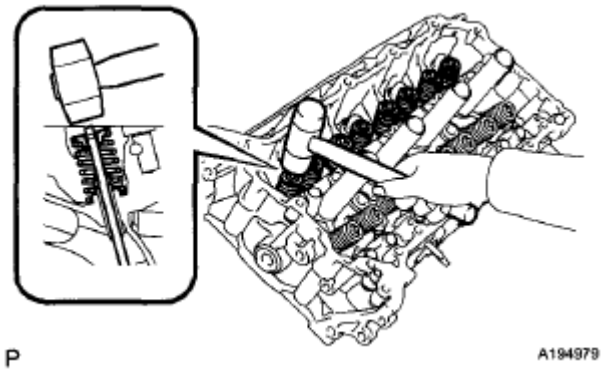


Fig. 111: Tapping Valve Stem Tip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL EXHAUST VALVE**
   a. Apply plenty of engine oil to the tip area of the exhaust valve shown in the illustration.
   b. Install the valve, compression spring and spring retainer to the cylinder head.

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

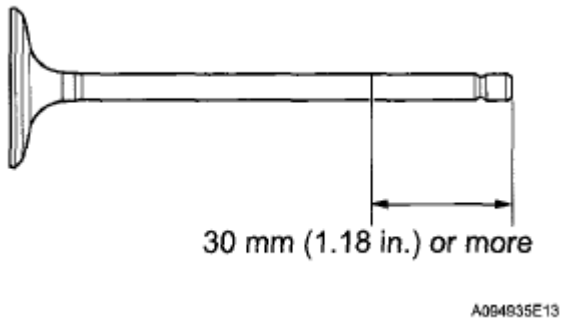


Fig. 112: Identifying Tip Area Of Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Using SST and wooden blocks, compress the spring and install the retainer locks.

SST 09202-70020 (09202-00010)

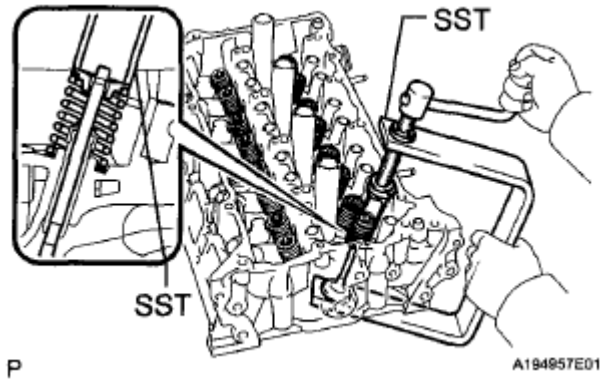


Fig. 113: Compressing Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.

NOTE: Be careful not to damage the retainer.

REPAIR

1. **REPAIR INTAKE VALVE SEAT**

NOTE:

- **Repair the seat while checking the seating position.**
- **Keep the lip free of foreign matter.**
- **Take off the cutter gradually to make the intake valve seat smooth.**

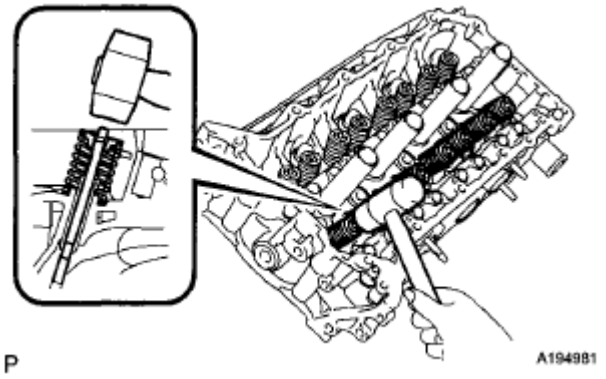


Fig. 114: Tapping Valve Stem Tip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Using a 45° cutter, resurface the valve seat so that the valve seat width is more than the specification.

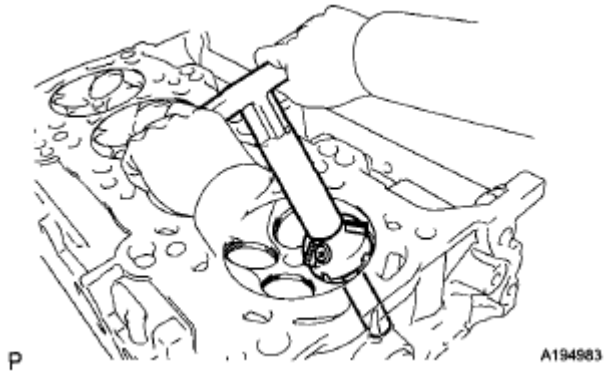


Fig. 115: Cutting Intake Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using 30° and 60° cutters, correct the valve seat so that the valve contacts the entire circumference of the seat. The contact should be in the center of the valve seat, and the valve seat width should be maintained within the specified range around the entire circumference of the seat.

Standard width: 1.0 to 1.4 mm (0.0394 to 0.0551 in.)

c. Hand-lap the valve and valve seat with an abrasive compound.
d. Check the valve seating position.

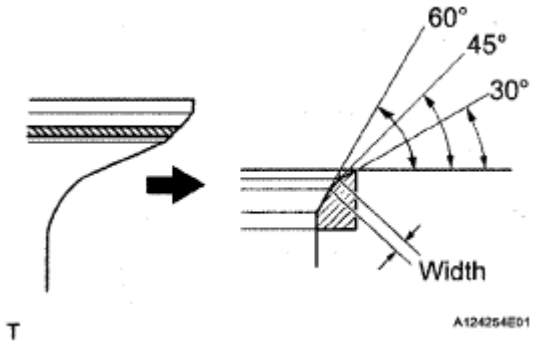


Fig. 116: Identifying Intake Valve Seat Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REPAIR EXHAUST VALVE SEAT**

NOTE:

- **Repair the seat while checking the seating position.**
- **Keep the lip free of foreign matter.**
- **Take off the cutter gradually to make the exhaust valve seat smooth.**

a. Using a 45° cutter, resurface the valve seat so that the valve seat width is more than the specification.

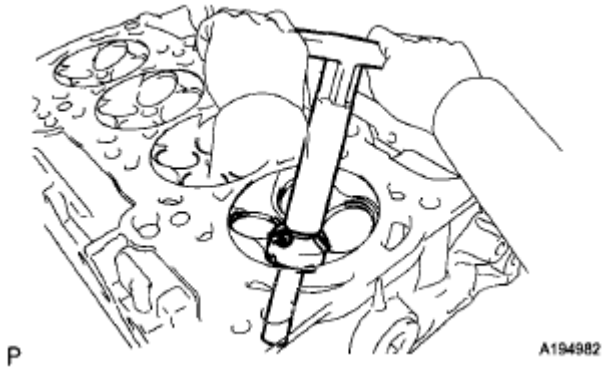


Fig. 117: Cutting Exhaust Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using 30° and 75° cutters, correct the valve seat so that the valve contacts the entire circumference of the seat. The contact should be in the center of the valve seat, and the valve seat width should be maintained within the specified range around the entire circumference of the seat.

   Standard width: 1.2 to 1.6 mm (0.0472 to 0.0630 in.)

c. Hand-lap the valve and valve seat with an abrasive compound.
d. Check the valve seating position.

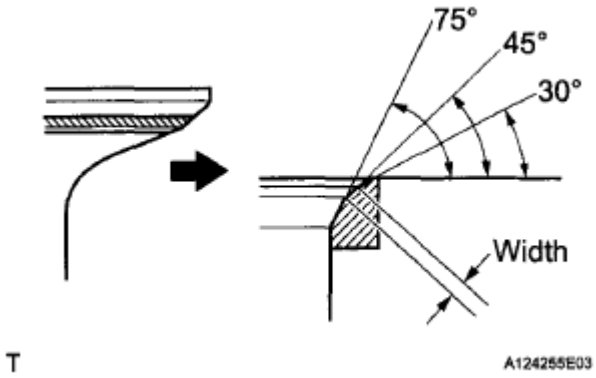


Fig. 118: Identifying Intake Valve Seat Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER BLOCK

COMPONENTS

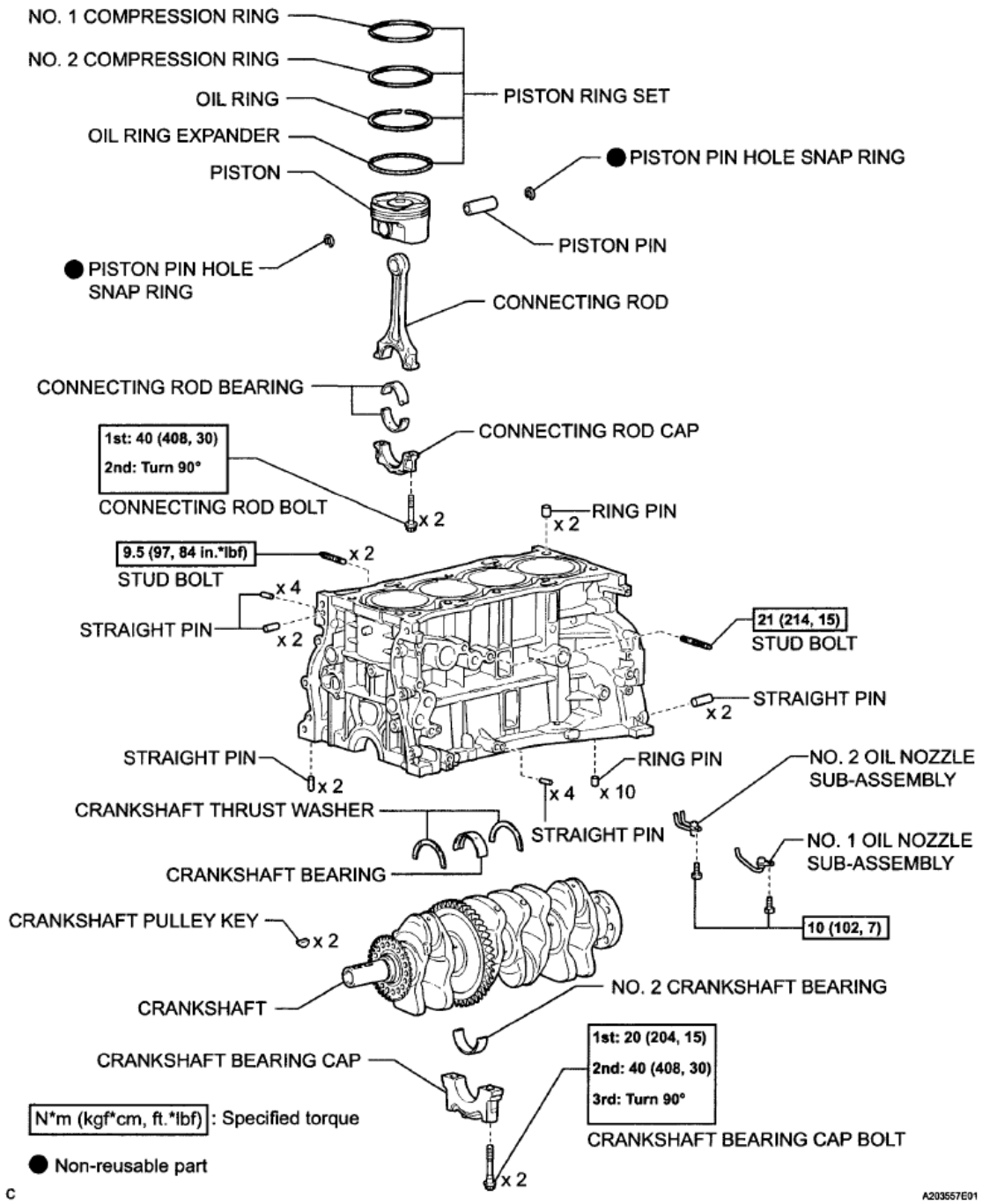


Fig. 119: Identifying Cylinder Block Components With Torque Specification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **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 0.512 mm (0.00630 to 0.0202 in.)

Maximum thrust clearance:

0.512 mm (0.0202 in.)

If the thrust clearance is more than the maximum, replace the connecting rod. If necessary, replace the crankshaft.

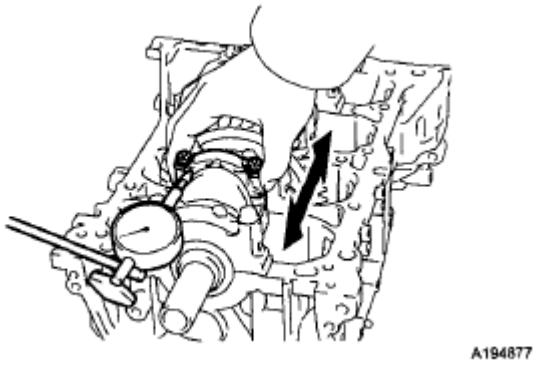


Fig. 120: Measuring Connecting Rod Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT CONNECTING ROD OIL CLEARANCE**
   a. Check the alignment marks on the connecting rod and cap to ensure correct reassembly.

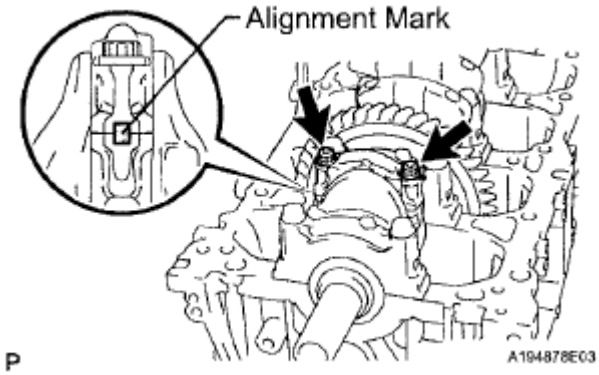


Fig. 121: Identifying Alignment Marks On Connecting Rod And Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Remove the 2 bolts and connecting rod cap.

      HINT:

Keep the lower bearing and connecting rod cap together.

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

If the crank pin or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

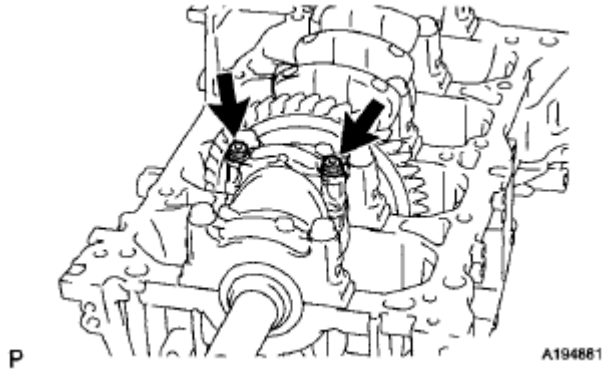


Fig. 122: Locating Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Lay a strip of Plastigage on the crank pin.

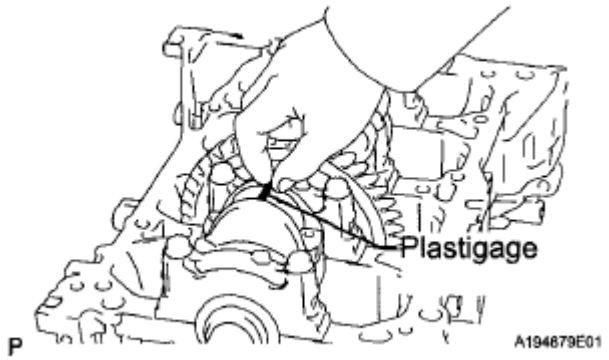


Fig. 123: Laying Strip Of Plastigage On Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Check that the front mark of the connecting rod cap is facing in the correct direction.

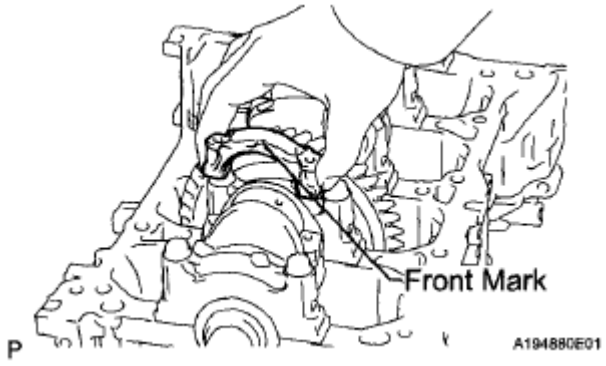


Fig. 124: Identifying Front Mark Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
h. Install and alternately tighten the bolts of the connecting rod cap in several steps.

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

NOTE: Do not turn the crankshaft during the measurement.

If any one of the connecting rod bolts does not meet the torque specification, replace the connecting rod bolts.

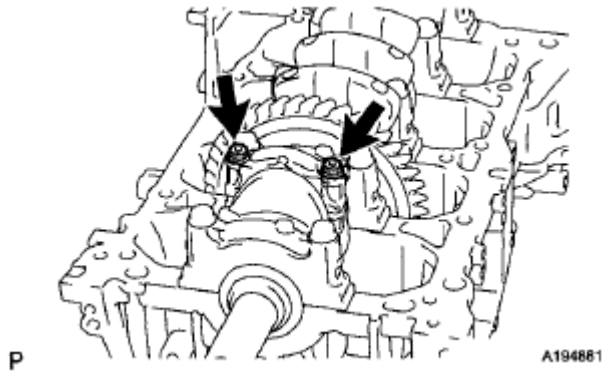


Fig. 125: Locating Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Mark the front of each connecting rod bolt with paint.
j. Tighten the bolts 90° as shown in the illustration.

NOTE: Do not turn the crankshaft during the measurement.

k. Remove the 2 bolts and connecting rod cap.

HINT:

Keep the lower bearing and connecting rod cap together.

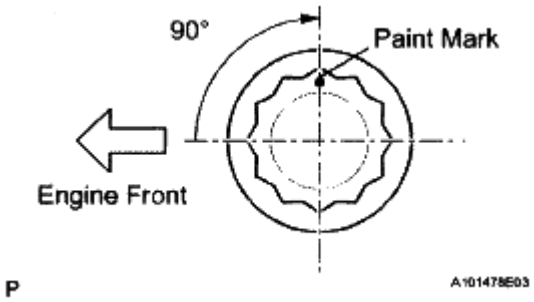


Fig. 126: Identifying Connecting Rod Bolt Angle With Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

l. Measure the Plastigage at its widest point.

Standard oil clearance:

0.030 to 0.063 mm (0.00118 to 0.00248 in.)

Maximum oil clearance:

0.07 mm (0.00276 in.)

NOTE: Remove the Plastigage completely after the measurement.

If the oil clearance is more than the maximum, replace the connecting rod bearing. If necessary, grind or replace the crankshaft.

HINT:

If replacing a bearing, select a new one with the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Standard crank pin diameter:

51.492 to 51.500 mm (2.0272 to 2.0276 in.)

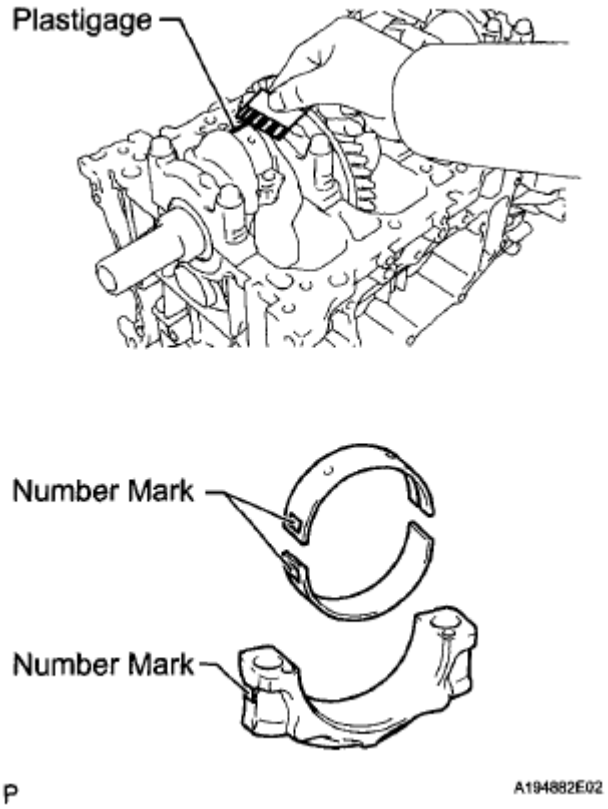


Fig. 127: Measuring Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Connecting Rod Big End Inside Diameter

CONNECTING ROD BIG END INSIDE DIAMETER SPECIFICATION

Item	Specified Condition
Mark 1	54.500 to 54.508 mm (2.1457 to 2.1460 in.)
Mark 2	54.509 to 54.516 mm (2.1460 to 2.1463 in.)
Mark 3	54.517 to 54.524 mm (2.1463 to 2.1466 in.)

Standard Size Bearing Center Wall Thickness

SIZE BEARING CENTER WALL THICKNESS SPECIFICATION

Item	Specified Condition
Mark 1	1.483 to 1.487 mm (0.0584 to 0.0585 in.)
Mark 2	1.488 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.492 to 1.495 mm (0.0587 to 0.0589 in.)

m. Perform the inspection above for each cylinder.

3. **REMOVE PISTON WITH CONNECTING ROD**
   a. Using a ridge reamer, remove all the carbon from the top of the cylinder.

b. Remove the 8 bolts, 4 connecting rod caps and 4 lower bearings.
c. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

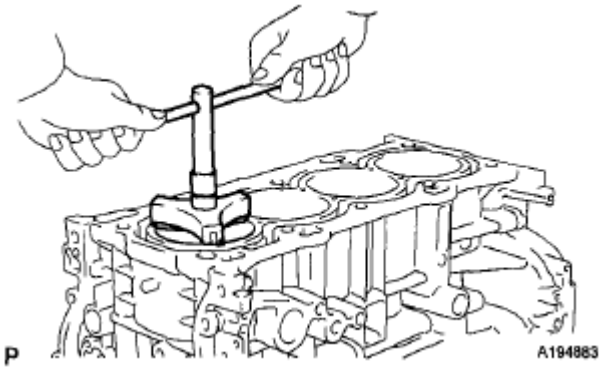


Fig. 128: Removing Carbon From Top Of Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.
- Be sure to arrange the removed piston and connecting rod assemblies in such a way that they can be reinstalled exactly as before.

4. **REMOVE CONNECTING ROD BEARING**
   a. Remove the connecting rod bearings from the connecting rods and connecting rod caps.

      HINT:

      Arrange the removed parts in the correct order.

5. **INSPECT CRANKSHAFT THRUST CLEARANCE**
   a. Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

      Standard thrust clearance:

      0.04 to 0.24 mm (0.00157 to 0.00945 in.)

      Maximum thrust clearance:

      0.30 mm (0.0118 in.)

      If the thrust clearance is more than the maximum, replace the thrust washers as a set. If necessary, replace the crankshaft.

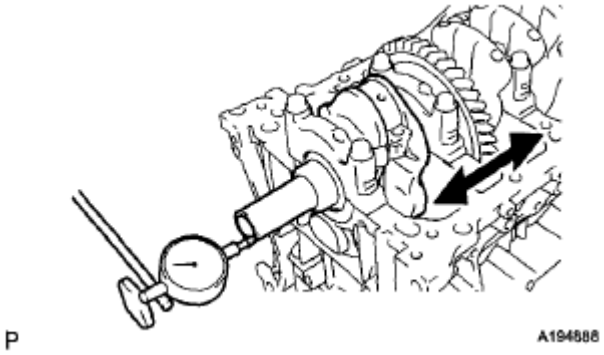


Fig. 129: Measuring Crankshaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust washer thickness:

1.93 to 1.98 mm (0.0760 to 0.0780 in.)

6. **REMOVE CRANKSHAFT**
   a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
   b. Remove the 5 bearing caps from the cylinder block.

      HINT:

      - Keep the No. 2 crankshaft bearings and crankshaft bearing caps together.
      - Arrange the bearing caps in the correct order.

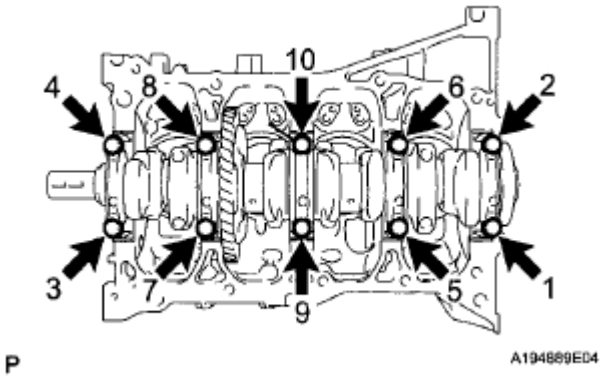


Fig. 130: Identifying Bearing Cap Bolts Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Remove the crankshaft from the cylinder block.

      HINT:

Keep the crankshaft bearings and crankshaft thrust washers together with the cylinder block.

d. Check each crankshaft journal and bearing for pitting and scratches.

If the journal or bearing is damaged, replace the bearings. If necessary, replace the crankshaft.

7. **REMOVE CRANKSHAFT THRUST WASHER**
   a. Remove the thrust washers from the cylinder block.
8. **REMOVE CRANKSHAFT BEARING**
   a. Remove the crankshaft bearings from the cylinder block and bearing caps.

HINT:

Arrange the bearings in the correct order.

9. **REMOVE CRANKSHAFT PULLEY KEY**
   a. Using a screwdriver, remove the 2 pulley keys from the crankshaft.

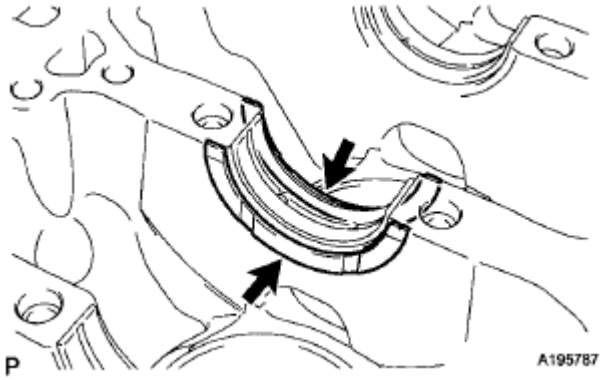


Fig. 131: Locating Crankshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **REMOVE PISTON RING SET**
    a. Using a piston ring expander, remove the 2 compression rings.
    b. Remove the oil ring and expander by hand.

HINT:

Arrange the removed parts in the correct order.

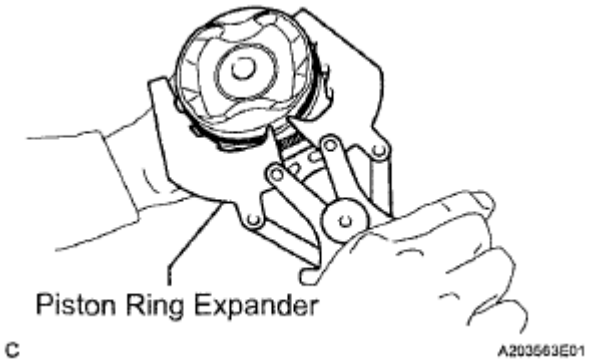


Fig. 132: Removing Compression Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE PISTON PIN HOLE SNAP RING**
    a. Insert a small screwdriver into the service hole, pry out the snap ring on the front side.

NOTE: Do not remove the snap ring on the rear side unless it is necessary. When the snap ring heeds to be removed, be careful not to damage the piston.

Fig. 133: Prying Out Snap Ring On Front Side
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **REMOVE PISTON**
    a. Gradually heat the piston up to 80 to 90°C (176 to 194°F).

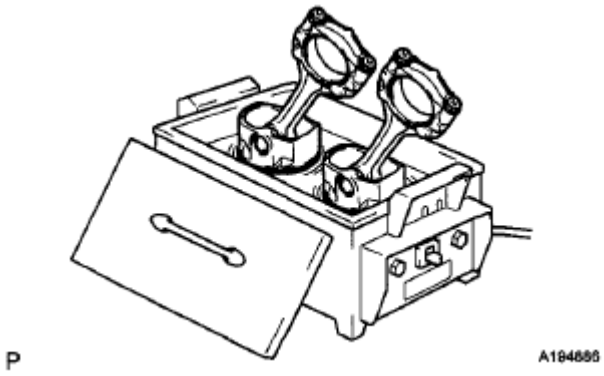


Fig. 134: Heating Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a plastic-faced hammer and brass bar, lightly tap out the piston pin. Then remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Be sure to arrange the removed pistons, pins, rings, connecting rods and bearings in such a way that the parts can be reinstalled exactly as before.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

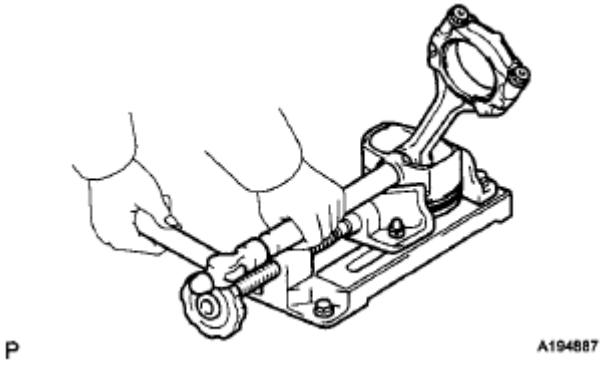


Fig. 135: Tapping Out Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY**
    a. Using a 5 mm hexagon wrench, remove the 2 bolts and 2 oil nozzles.

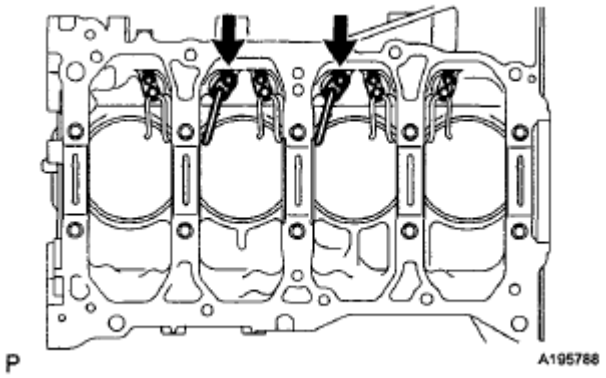


Fig. 136: Locating Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **REMOVE NO. 2 OIL NOZZLE SUB-ASSEMBLY**
    a. Using a 5 mm hexagon wrench, remove the 4 bolts and 4 oil nozzles.
15. **REMOVE STUD BOLT**

NOTE: If a stud bolt is deformed or its threads are damaged, replace it.

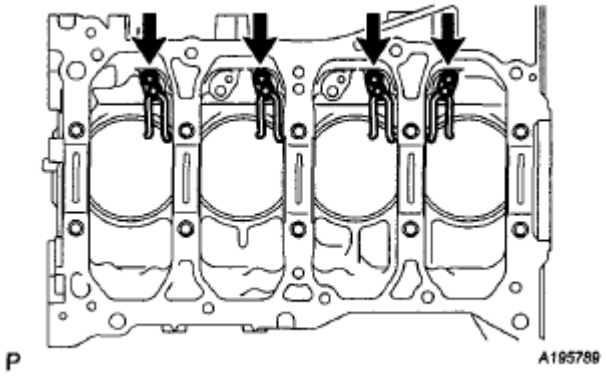


Fig. 137: Locating No. 2 Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. **INSPECT CYLINDER BLOCK FOR WARPAGE**
    a. Using a precision straightedge and feeler gauge, measure the warpage of the surface that is in contact with the cylinder head gasket.

    Maximum warpage:

    0.05 mm (0.00197 in.)

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

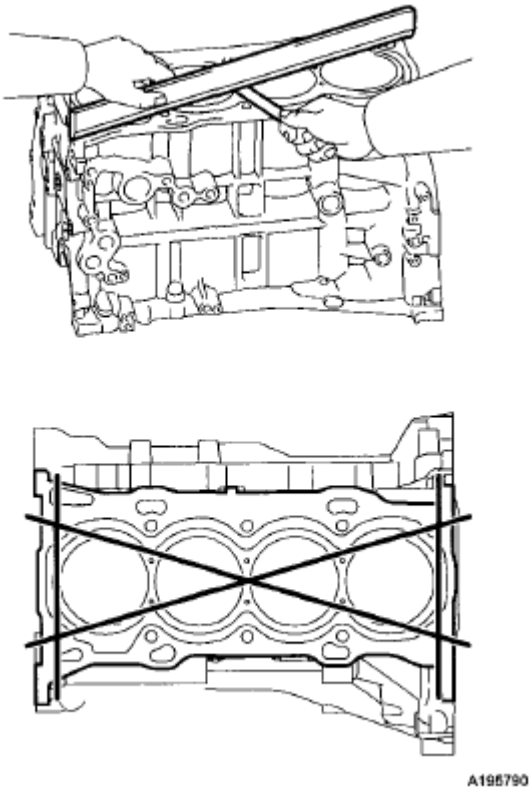


Fig. 138: Inspecting Cylinder Block For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT CYLINDER BORE**
   a. Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

      Standard diameter:

      90.000 to 90.013 mm (3.543 to 3.544 in.)

      Maximum diameter:

      90.133 mm (3.549 in.)

      If the average diameter of the 4 positions is more than the maximum, replace the cylinder block.

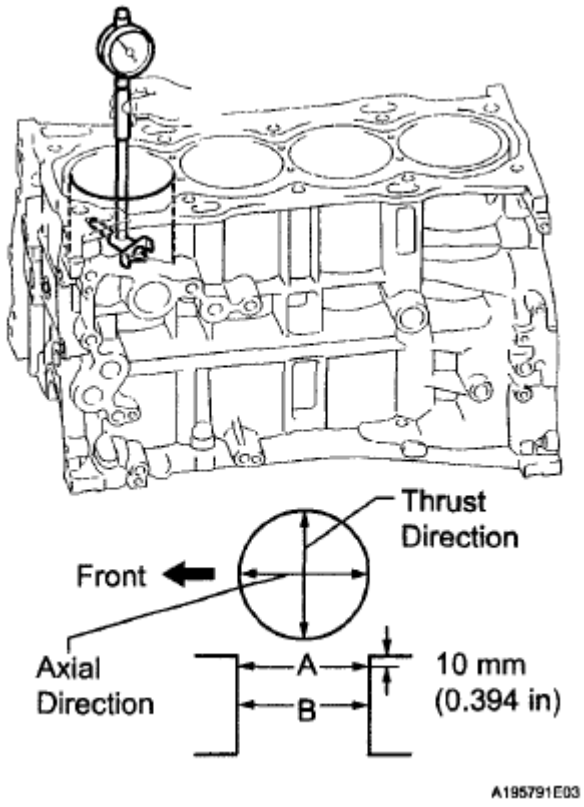


Fig. 139: Measuring Cylinder Bore Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSPECT PISTON**
   a. Using a gasket scraper, remove the carbon from the piston top.

Fig. 140: Removing Carbon From Piston Top
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using a groove cleaning tool or a broken ring, clean the piston ring grooves.

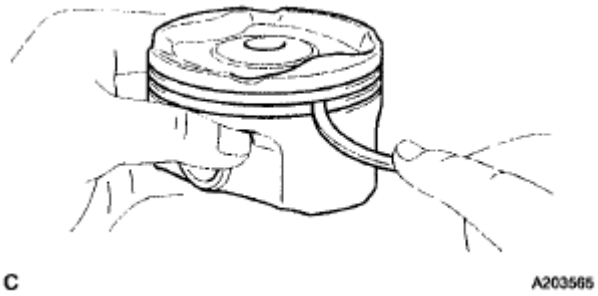


Fig. 141: Cleaning Piston Ring Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a brush and solvent, thoroughly clean the piston.

NOTE: Do not use a wire brush.

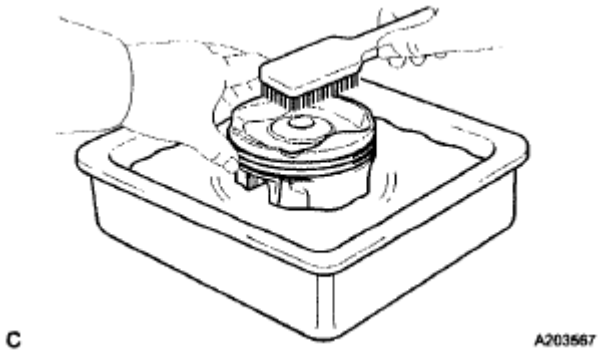


Fig. 142: Cleaning Piston Using Brush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using a micrometer, measure the piston diameter at a position that is 10.5 mm (0.413 in.) from the bottom of the piston (refer to the illustration).

Standard piston diameter:

89.980 to 89.990 mm (3.5425 to 3.5429 in.)

If the diameter is less than the minimum, replace the piston with pin.

4. **INSPECT PISTON OIL CLEARANCE**
   a. Measure the cylinder bore diameter in the thrust direction.

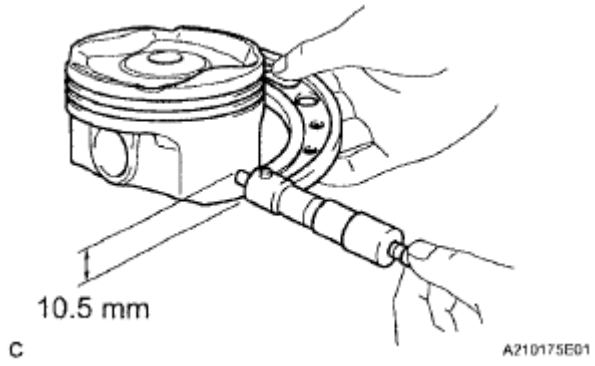


Fig. 143: Measuring Piston Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:

0.010 to 0.033 mm (0.000394 to 0.00130 in.)

Maximum oil clearance:

0.10 mm (0.00394 in.)

If the oil clearance is more than the maximum, replace all the pistons. If necessary, replace the cylinder block.

5. **INSPECT RING GROOVE CLEARANCE**

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

Standard Ring Groove Clearance

RING GROOVE CLEARANCE SPECIFICATION

Item	Specified Condition
No. 1 ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)
No. 2 ring	0.020 to 0.060 mm (0.000787 to 0.00236 in.)
Oil ring	0.020 to 0.070 mm (0.000787 to 0.00276 in.)

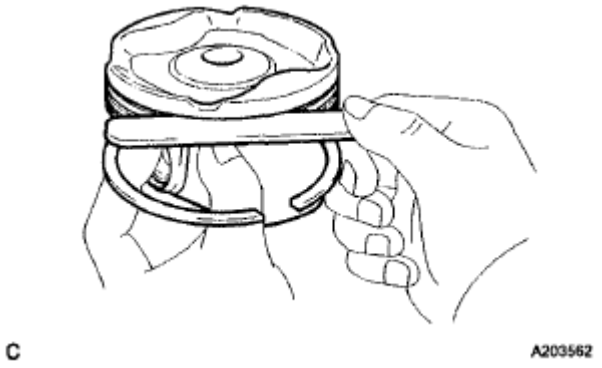


Fig. 144: Measuring Clearance Between Piston Ring And Wall Of Ring Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the groove clearance is not as specified, replace the piston with pin.

6. **INSPECT PISTON RING END GAP**
   a. Insert the piston ring into the cylinder bore.
   b. Using a piston, push the piston ring a little beyond the bottom of the ring travel, 120 mm (4.72 in.) from the top of the cylinder block.

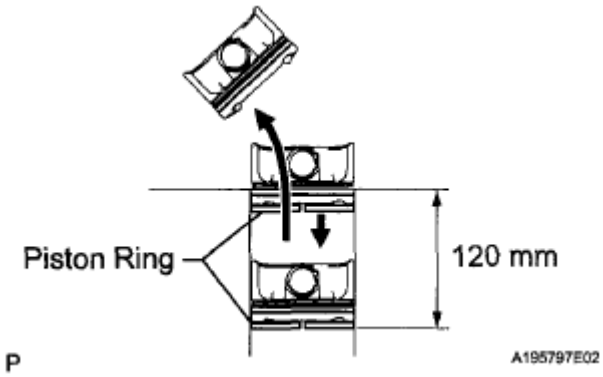


Fig. 145: Inserting Piston Ring Into Cylinder Bore
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Using a feeler gauge, measure the end gap.

Standard End Gap

END GAP SPECIFICATION

Item	Specified Condition
No. 1 ring	0.22 to 0.27 mm (0.00866 to 0.0106 in.)
No. 2 ring	0.37 to 0.42 mm (0.0146 to 0.0165 in.)
Oil ring	0.10 to 0.20 mm (0.00394 to 0.00787 in.)

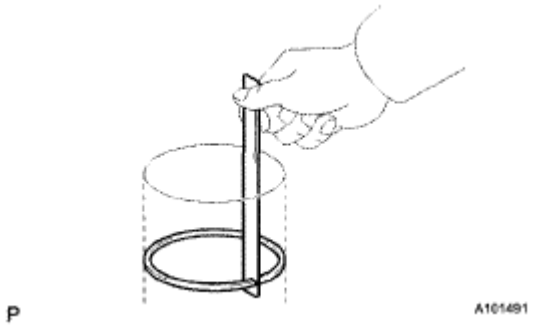


Fig. 146: Measuring Piston Ring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum End Gap

END GAP SPECIFICATION

Item	Specified Condition
No. 1 ring	0.87 mm (0.0342 in.)
No. 2 ring	1.02 mm (0.0402 in.)
Oil ring	0.80 mm (0.0315 in.)

If the end gap is more than the maximum, replace the piston ring. If the end gap is more than the maximum, even with a new piston ring, replace the cylinder block.

7. **INSPECT PISTON PIN OIL CLEARANCE**
   a. Check each mark on the piston, piston pin and connecting rod.

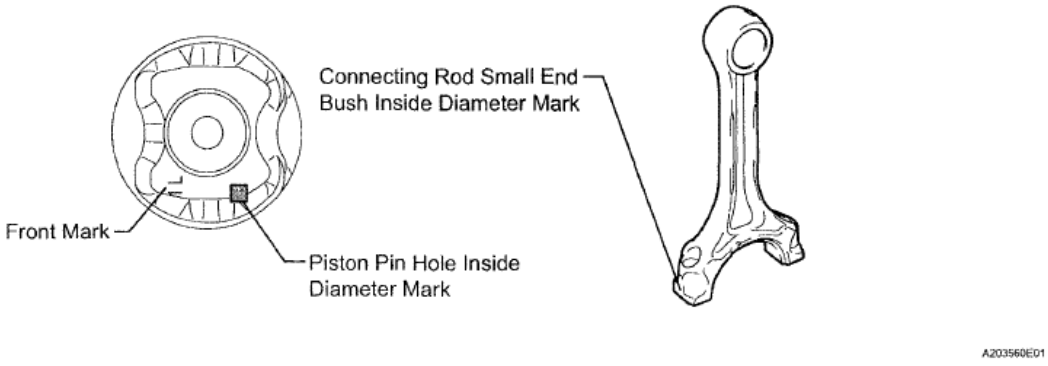


Fig. 147: Identifying Mark On Piston, Piston Pin And Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

The front mark is "1L" printed in raised letters.

   b. Using a caliper gauge, measure the inside diameter of the piston pin hole.

Standard Piston Pin Hole Inside Diameter

PISTON PIN HOLE INSIDE DIAMETER SPECIFICATION

Item	Specified Condition
Mark A	22.001 to 22.004 mm (0.86618 to 0.86630 in.)
Mark B	22.005 to 22.007 mm (0.86634 to 0.86642 in.)
Mark C	22.008 to 22.010 mm (0.86645 to 0.86653 in.)

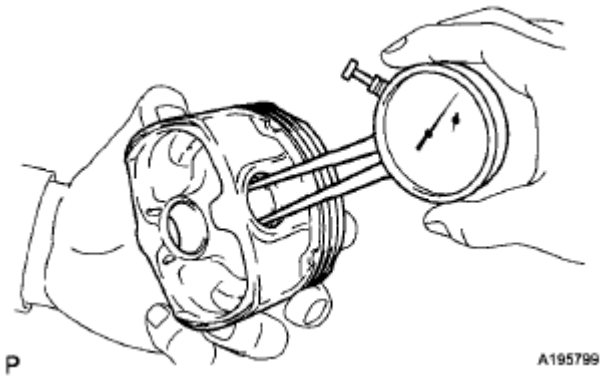


Fig. 148: Measuring Inside Diameter Of Piston Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard Piston Pin Diameter

PISTON PIN DIAMETER SPECIFICATION

Item	Specified Condition
Mark A	21.997 to 22.000 mm (0.86602 to 0.86614 in.)
Mark B	22.001 to 22.003 mm (0.86617 to 0.86626 in.)
Mark C	22.004 to 22.006 mm (0.86630 to 0.86638 in.)

If the diameter is not as specified, replace the piston pin.

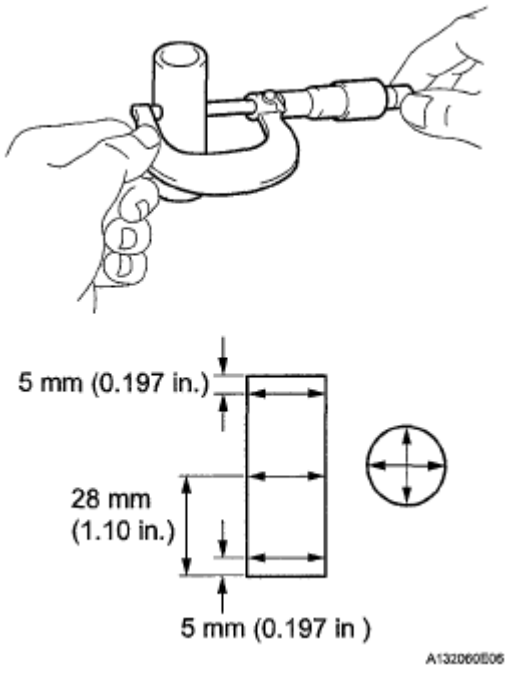


Fig. 149: Measuring Piston Pin Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Using a caliper gauge, measure the connecting rod small end bush inside diameter.

Standard Connecting Rod Small End Bush Inside Diameter

CONNECTING ROD SMALL END BUSH INSIDE DIAMETER SPECIFICATION

Item	Specified Condition
Mark A	22.005 to 22.008 mm (0.86634 to 0.86645 in.)
Mark B	22.009 to 22.011 mm (0.86649 to 0.86657 in.)
Mark C	22.012 to 22.014 mm (0.86661 to 0.86669 in.)

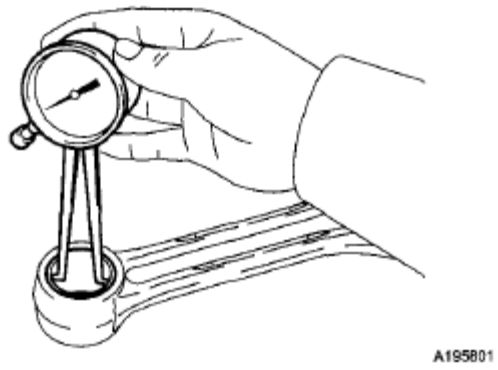


Fig. 150: Measuring Connecting Rod Small End Bush Inside Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the diameter is not as specified, replace the connecting rod.

e. Subtract the piston pin diameter measurement from the piston pin hole inside diameter measurement.

Standard oil clearance:

0.001 to 0.007 mm (0.0000394 to 0.000276 in.)

Maximum oil clearance:

0.013 mm (0.000512 in.)

If the oil clearance is more than the maximum, replace the piston and piston pin as a set.

f. Subtract the piston pin diameter measurement from the connecting rod small end bush inside diameter measurement.

Standard oil clearance:

0.005 to 0.011 mm (0.000197 to 0.000433 in.)

Maximum oil clearance:

0.017 mm (0.000669 in.)

If the oil clearance is more than the maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.

8. **INSPECT CONNECTING ROD SUB-ASSEMBLY**

a. Using a connecting rod aligner and feeler gauge, check the connecting rod alignment.

1. Check for bend.

Maximum bend:

0.05 mm (0.00197 in.) per 100 mm (3.94 in.)

If the bend is more than the maximum, replace the connecting rod.

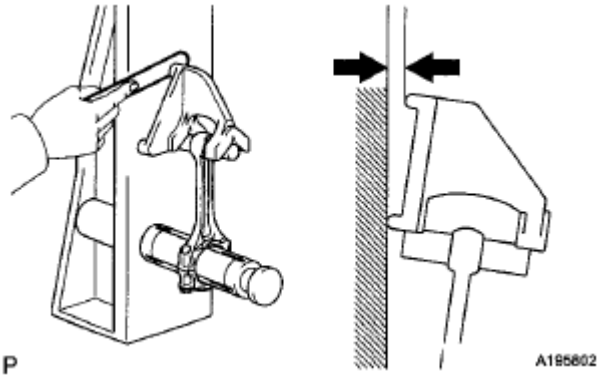


Fig. 151: Checking Connecting Rod Alignment For Bend
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Check for twist.

   Maximum twist: 0.15 mm (0.00591 in.) per 100 mm (3.94 in.)

   If the twist is more than the maximum, replace the connecting rod.

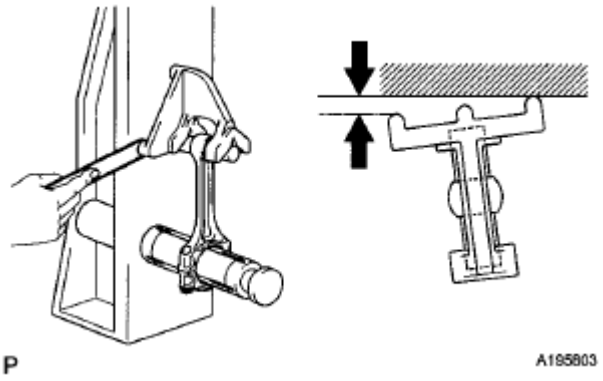


Fig. 152: Checking Connecting Rod Alignment For Twist
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSPECT CRANKSHAFT**
   a. Inspect for circle runout.
      1. Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.

         Maximum circle runout:

         0.003 mm (0.000118 in.)

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

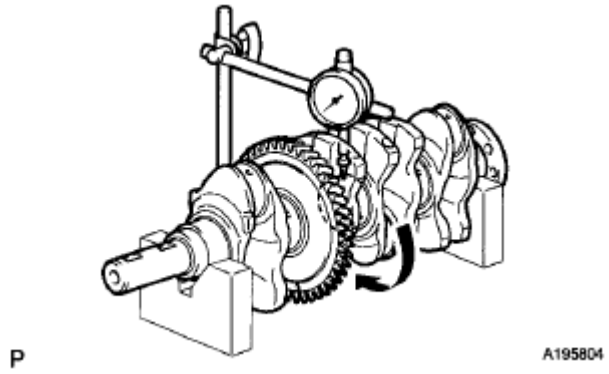


Fig. 153: Measuring Circle Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Inspect the main journals.
   1. Using a micrometer, measure the diameter of each main journal.

      Standard main journal diameter:

      54.988 to 55.000 mm (2.1649 to 2.1654 in.)

      If the diameter is not as specified, check the crankshaft oil clearance. If necessary, replace the crankshaft.

   2. Check each main journal for taper and out-of-round as shown in the illustration.

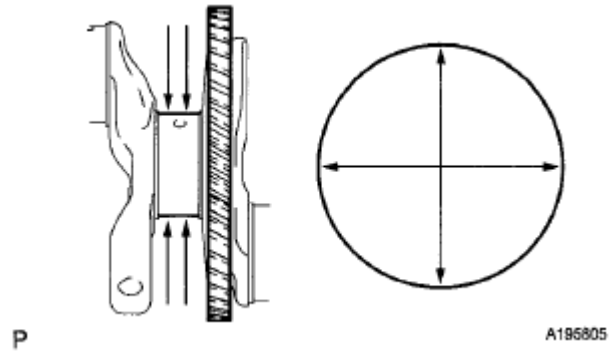


Fig. 154: Measuring Diameter Of Main Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum taper and out-of-round:

0.003 mm (0.000118 in.)

If the taper and out-of-round are more than the maximum, replace the crankshaft.

c. Inspect the crank pin.

1. Using a micrometer, measure the diameter of each crank pin.

   Standard crank pin diameter:

   51.492 to 51.500 mm (2.027 to 2.028 in.)

   If the diameter is not as specified, check the connecting rod oil clearance. If necessary, replace the crankshaft.

2. Inspect each crank pin for taper and out-of-round as shown in the illustration.

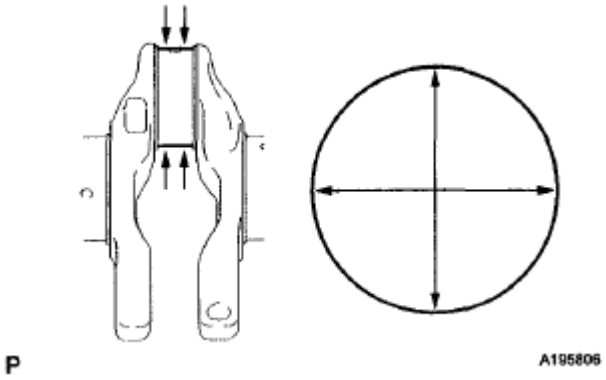


Fig. 155: Measuring Diameter Of Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum taper and out-of-round:

0.003 mm (0.000118 in.)

If the taper and out-of-round are more than the maximum, replace the crankshaft.

10. **INSPECT CRANKSHAFT OIL CLEARANCE**
    a. Install the crankshaft bearings (See **FRONT CRANKSHAFT OIL SEAL**).
    b. Install the crankshaft thrust washers (See **FRONT CRANKSHAFT OIL SEAL**).
    c. Clean each main journal and bearing.
    d. Place the crankshaft onto the cylinder block.
    e. Lay a strip of Plastigage across each journal.
    f. Install the crankshaft bearing caps (See **FRONT CRANKSHAFT OIL SEAL**).

       NOTE: Do not turn the crankshaft.

    g. Remove the crankshaft bearing caps (See **INSPECTION**).

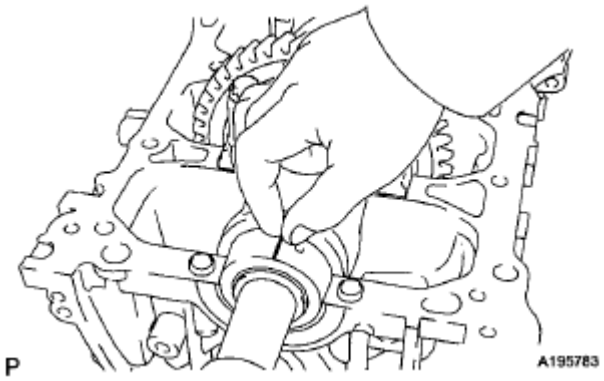


Fig. 156: Laying Strip Of Plastigage Across Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Measure the Plastigage at its widest point.

Standard oil clearance:

0.016 to 0.039 mm (0.000630 to 0.00154 in.)

Maximum oil clearance:

0.05 mm (0.00197 in.)

NOTE: Remove the Plastigage completely after the measurement.

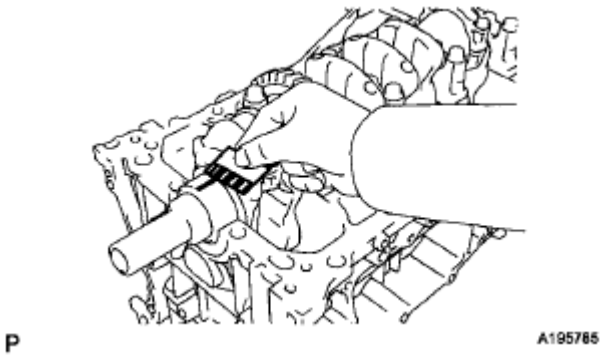


Fig. 157: Measuring Plastigage At Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the oil clearance is more than the maximum, replace the crankshaft bearing. If necessary, replace the crankshaft.

HINT:

If replacing a bearing, select a new one with the same number. If the number of the bearing cannot be determined, calculate the correct bearing number by adding together the numbers imprinted on

the cylinder block and crankshaft. Then select a new bearing with the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

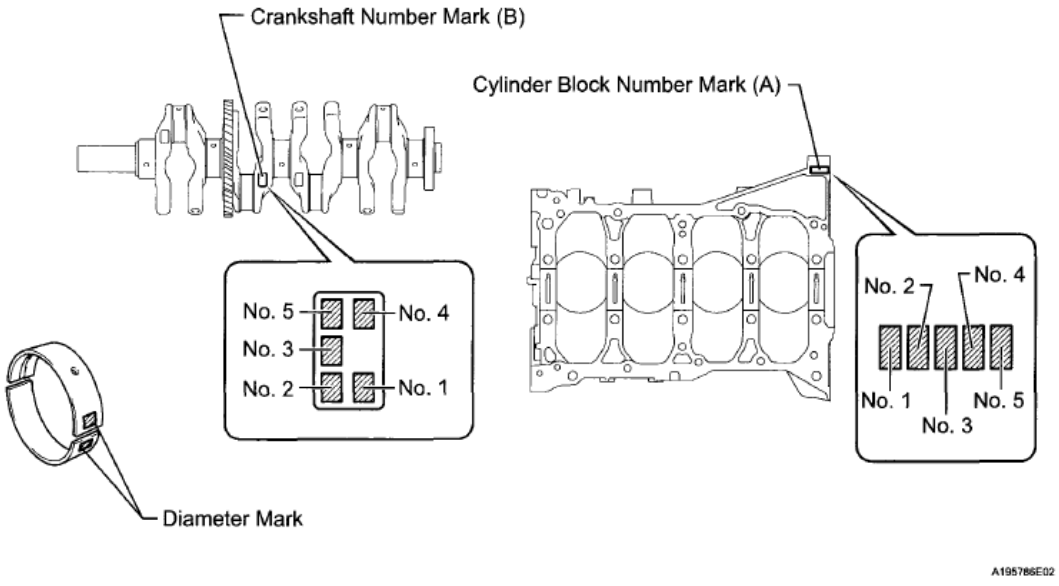


Fig. 158: Identifying Crankshaft Bearing Number Mark And Cylinder Block Number Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

EXAMPLE

Cylinder block (A) "3" + Crankshaft (B) "4" = Total "7"

Select the bearing marked "3".

Bearing Chart

BEARING CHART

(A) + (B)	Use Bearing
0 to 2	1
3 to 5	2
6 to 8	3
9 to 11	4

Standard Cylinder Block Journal Inside Diameter (A)

CYLINDER BLOCK JOURNAL INSIDE DIAMETER SPECIFICATION

Item	Specified Condition
Mark 0	59.000 to 59.002 mm (2.32283 to 2.32291 in.)
Mark 1	59.003 to 59.004 mm (2.32295 to 2.32299 in.)
Mark 2	59.005 to 59.006 mm (2.32303 to 2.32307 in.)
Mark 3	59.007 to 59.009 mm (2.32311 to 2.32318 in.)

Mark 4	59.010 to 59.011 mm (2.32322 to 2.32326 in.)
Mark 5	59.012 to 59.013 mm (2.32330 to 2.32334 in.)
Mark 6	59.014 to 59.016 mm (2.32338 to 2.32346 in.)

Standard Crankshaft Main Journal Diameter (B)

CRANKSHAFT MAIN JOURNAL DIAMETER SPECIFICATION

Item	Specified Condition
Mark 0	54.999 to 55.000 mm (2.16531 to 2.16535 in.)
Mark 1	54.997 to 54.998 mm (2.16523 to 2.16527 in.)
Mark 2	54.995 to 54.996 mm (2.16515 to 2.16519 in.)
Mark 3	54.993 to 54.994 mm (2.16507 to 2.16511 in.)
Mark 4	54.991 to 54.992 mm (2.16500 to 2.16504 in.)
Mark 5	54.988 to 54.990 mm (2.16488 to 2.16496 in.)

Standard Bearing Center Wall Thickness

BEARING CENTER WALL THICKNESS SPECIFICATION

Item	Specified Condition
Mark 1	1.991 to 1.994 mm (0.07839 to 0.07850 in.)
Mark 2	1.995 to 1.997 mm (0.07854 to 0.07862 in.)
Mark 3	1.998 to 2.000 mm (0.07866 to 0.07874 in.)
Mark 4	2.001 to 2.003 mm (0.07878 to 0.07886 in.)

i. Perform the inspection above for each journal.

11. **INSPECT CRANKSHAFT BEARING CAP BOLT**

a. Using a vernier caliper, measure the diameter of the threads at the measurement point.

Standard diameter:

9.77 to 9.96 mm (0.385 to 0.392 in.)

Minimum diameter:

9.1 mm (0.358 in.)

Measuring point (distance from the seat):

58.5 mm (2.30 in.)

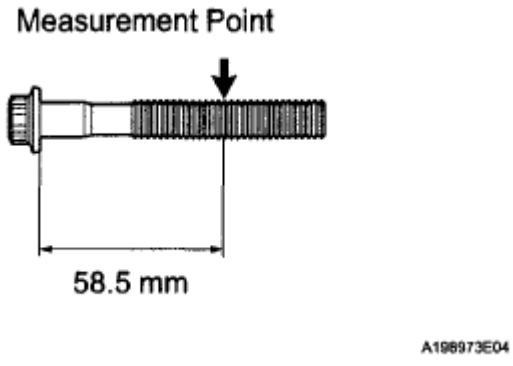


Fig. 159: Identifying Measurement Point On Crankshaft Bearing Cap Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- If the diameter is less than the minimum, replace the crankshaft bearing cap bolt. Failure to do so may lead to engine damage.
- If there is any thread deformation, replace the crankshaft bearing cap bolt with a new one.

12. **INSPECT CONNECTING ROD BOLT**
    a. Using a vernier caliper, measure the diameter of the bolt in the area show in the illustration.

Standard diameter:

8.5 to 8.6 mm (0.335 to 0.339 in.)

Minimum diameter:

8.3 mm (0.327 in.)

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

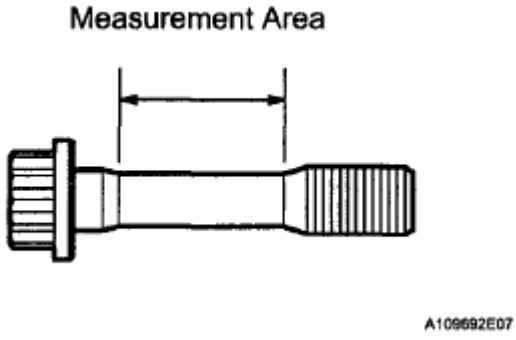


Fig. 160: Identifying Connecting Rod Bolt Measurement Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- Diameter measurements should be done at several points.
- If the diameter is less than the minimum, replace the connecting rod bolt with a new one. Failure to do so may lead to engine damage.
- If there is any thread deformation, replace the connecting rod bolt with a new one.

13. **INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY**

a. Push the check valve with a pin to check if it is stuck.

If stuck, replace the No. 1 oil nozzle.

b. Push the check valve with a pin to check if it moves smoothly.

If it does not move smoothly, clean or replace the No. 1 oil nozzle.

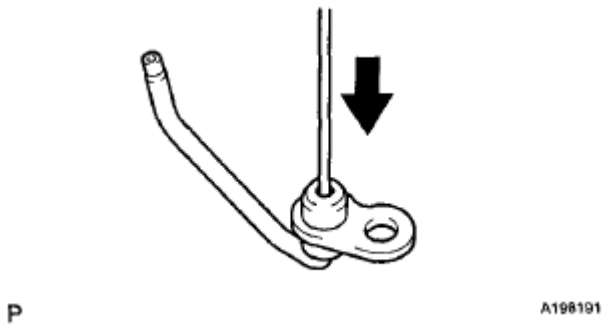


Fig. 161: Pushing Check Valve With Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Apply air into A. Check that air does not leak through B.

If air leaks, clean or replace the No. 1 oil nozzle.

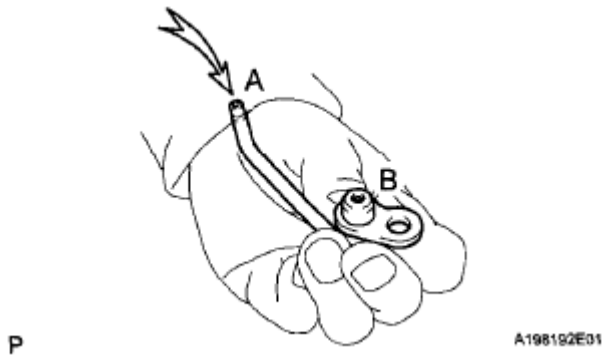


Fig. 162: Checking Air Leak Through B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Push the check valve while applying air into A.

Check that air passes through B.

If air does not pass through B, clean or replace the No. 1 oil nozzle.

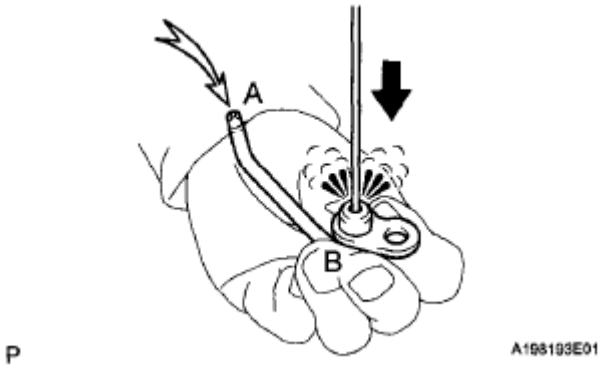


Fig. 163: Pushing Check Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSPECT NO. 2 OIL NOZZLE SUB-ASSEMBLY**
    a. Push the check valve with a pin to check if it is stuck.

       If stuck, replace the No. 2 oil nozzle.

    b. Push the check valve with a pin to check if it moves smoothly.

       If it does not move smoothly, clean or replace the No. 2 oil nozzle.

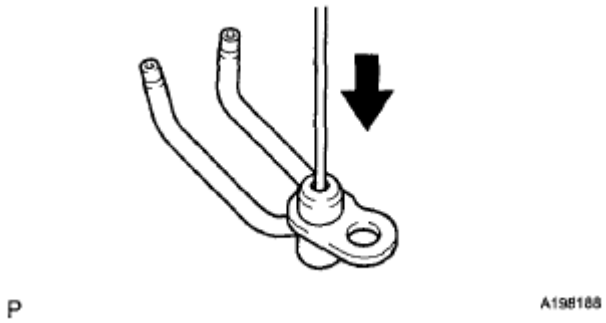


Fig. 164: Pushing Check Valve With Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    c. While covering A, apply air into B. Check that air does not leak through C. Perform the check again while covering B and applying air into A.

       If air leaks, clean or replace the No. 2 oil nozzle.

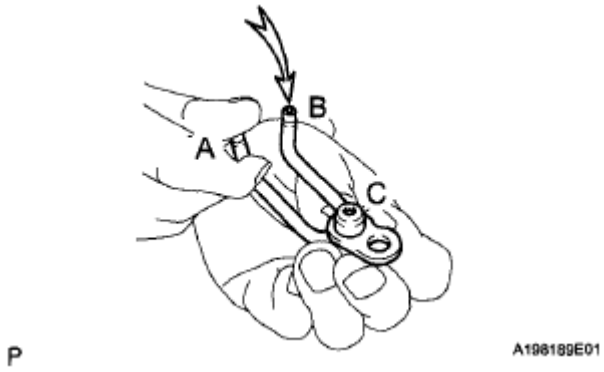


Fig. 165: Checking Air Through C
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Push the check valve while covering A, and apply air into B. Check that air passes through C. Perform the check again while covering B, pushing the check valve and applying air into A.

   If air does not pass through C, clean or replace the No. 2 oil nozzle.

REPLACEMENT

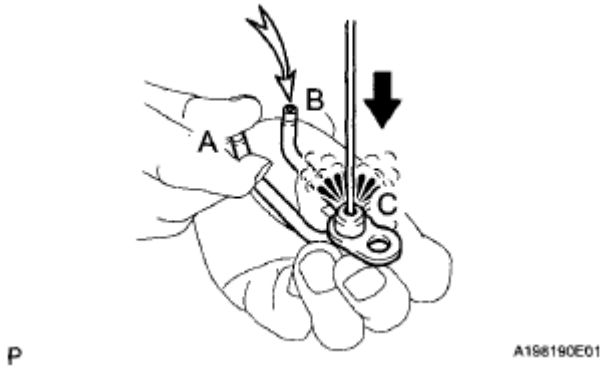


Fig. 166: Pushing Check Valve A And Applying Air Into B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. **REPLACE RING PIN**

NOTE: It is not necessary to remove the ring pin unless it is being replaced.

   a. Remove the 12 ring pins.
   b. Using a plastic-faced hammer, install 12 new ring pins.

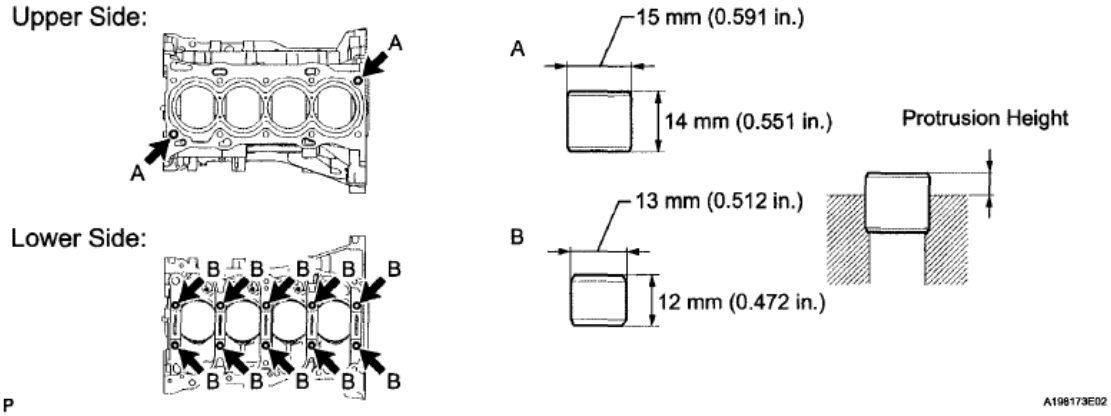


Fig. 167: Identifying Ring Pin Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Protrusion Height

PROTRUSION HEIGHT SPECIFICATION

Item	Specified Condition
A	5.0 to 7.0 mm (0.197 to 0.276 in.)
B	4.0 to 7.0 mm (0.157 to 0.276 in.)

2. **REPLACE STRAIGHT PIN**

NOTE: It is not necessary to remove the straight pin unless it is being replaced.

a. Remove the 14 straight pins.
b. Using a plastic-faced hammer, install 14 new straight pins.

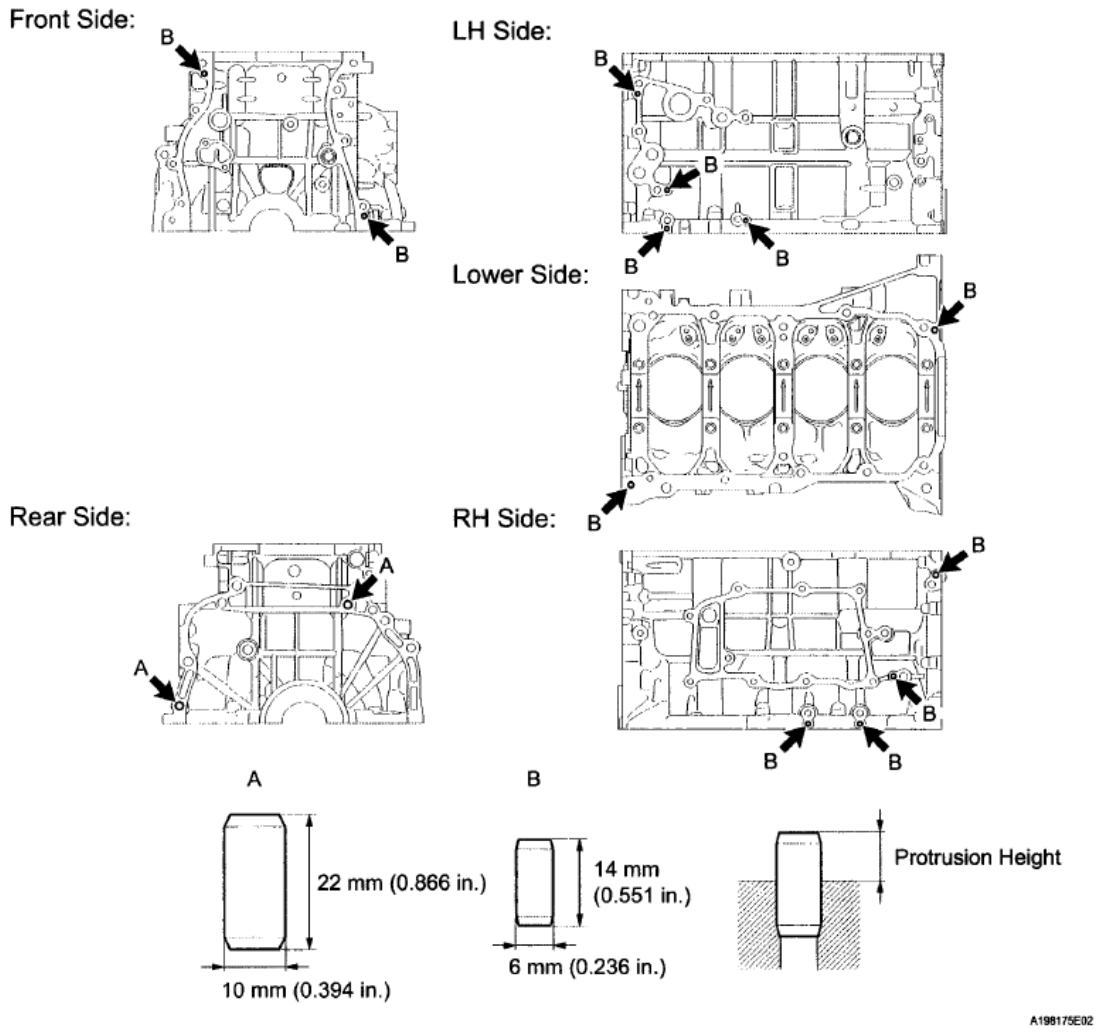


Fig. 168: Locating Straight Pins With Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Protrusion Height

PROTRUSION HEIGHT SPECIFICATION

Item	Specified Condition
A	11.0 to 13.0 mm (0.433 to 0.512 in.)
B	5.0 to 7.0 mm (0.197 to 0.276 in.)

REASSEMBLY

1. **INSTALL STUD BOLT**

NOTE: If a stud bolt is deformed or the threads are damaged, replace it.

a. Using E8 and E10 "TORX" socket wrenches, install the stud bolts.

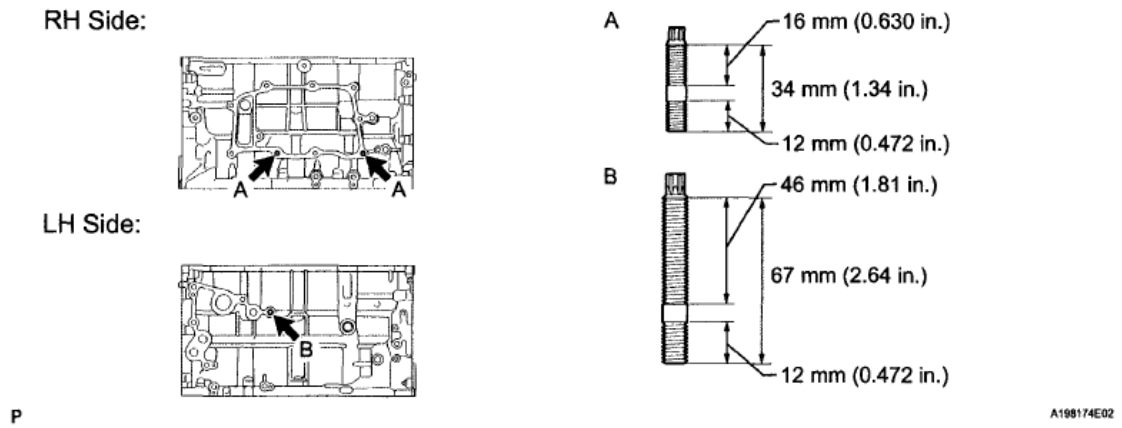


Fig. 169: Locating Stud Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: for stud bolt A

9.5 N*m (97 kgf*cm, 84 in.*lbf)

for stud bolt B

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

2. **INSTALL NO. 2 OIL NOZZLE SUB-ASSEMBLY**
   a. Using a 5 mm hexagon wrench, install the 4 oil nozzles with the 4 bolts.

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

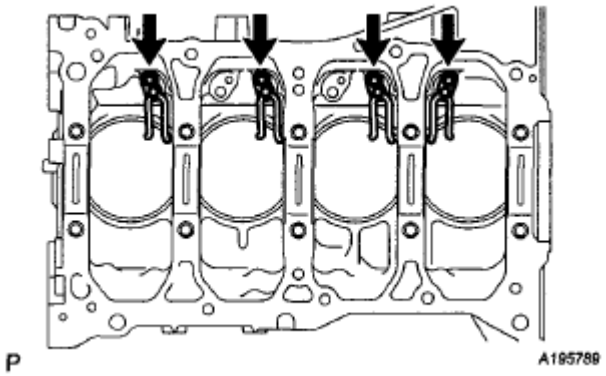


Fig. 170: Locating No. 2 Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY**
   a. Using a 5 mm hexagon wrench, install the 2 oil nozzles with the 2 bolts.

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

4. **INSTALL PISTON**
   a. Using a small screwdriver, install a new snap ring at one end of the piston pin hole.
   b. Gradually heat the piston up to 80 to 90°C (176 to 194°F).
   c. Coat the piston, piston pin and connecting rod with engine oil.

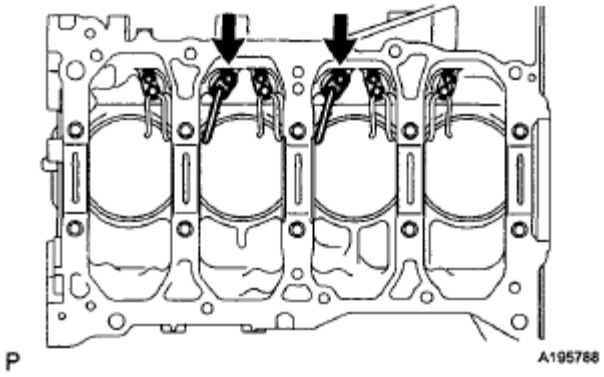


Fig. 171: Locating Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   d. Align the front marks of the piston and connecting rod, insert the connecting rod into the piston, and then push in the piston pin with your thumb until the pin comes into contact with the snap ring.

      HINT:

      The piston and pin are a matched set.

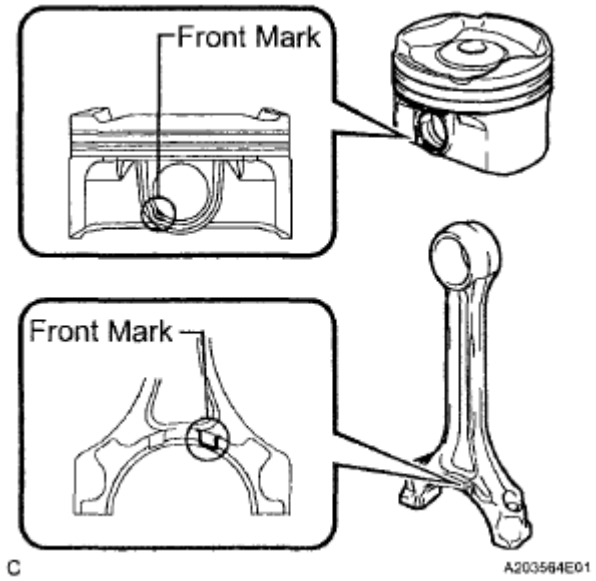


Fig. 172: Identifying Front Marks Of Piston And Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Using a small screwdriver, install a new snap ring on the other side of the piston pin hole.

HINT:

Be sure that the end gap of the snap ring is not aligned with the service hole cutout portion of the piston.

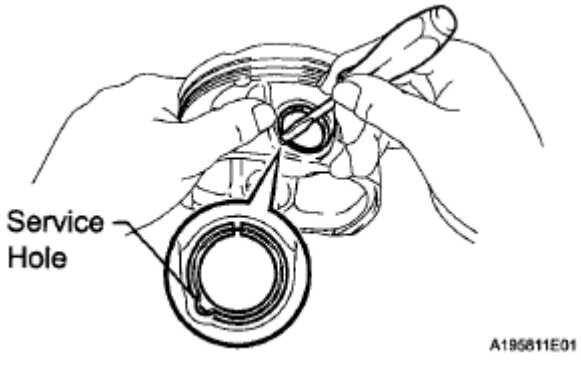


Fig. 173: Installing Snap Ring On Other Side Of Piston Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Check the fitting condition between the piston and piston pin.

1. Move the connecting rod back and forth on the piston pin. Check the fitting condition.

   If abnormal movement is felt, replace the piston and pin as a set.

2. Rotate the piston back and forth on the piston pin. Check the fitting condition.

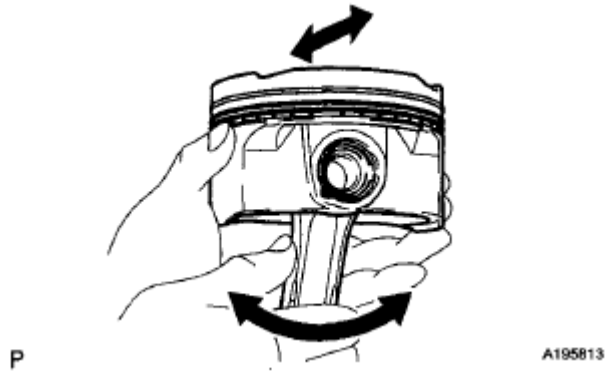


Fig. 174: Checking Fitting Condition Between Piston And Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If abnormal movement is felt, replace the piston and pin as a set.

5. **INSTALL PISTON RING SET**

a. Install the oil ring expander and oil ring by hand.

HINT:

Arrange the oil ring ends and coil joint as shown in the illustration.

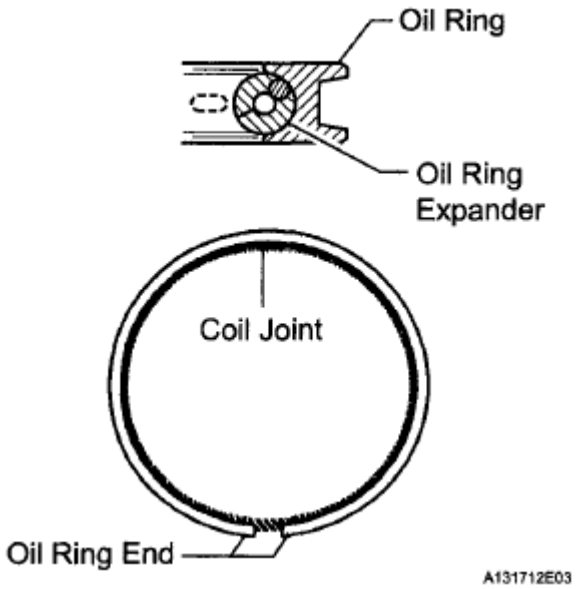


Fig. 175: Identifying Oil Ring Ends And Coil Joint
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a piston ring expander, install the 2 compression rings with the code mark positioned as shown in the illustration.

Piston Ring Mark

PISTON RING MARK REFERENCE

Item	Code Mark	Paint Mark
No. 1	1N	Blue
No. 2	2N	Orange

NOTE: Install the compression ring with the code mark facing upward.

6. **INSTALL CRANKSHAFT PULLEY KEY**
   a. Install the 2 crankshaft pulley keys to the crankshaft.

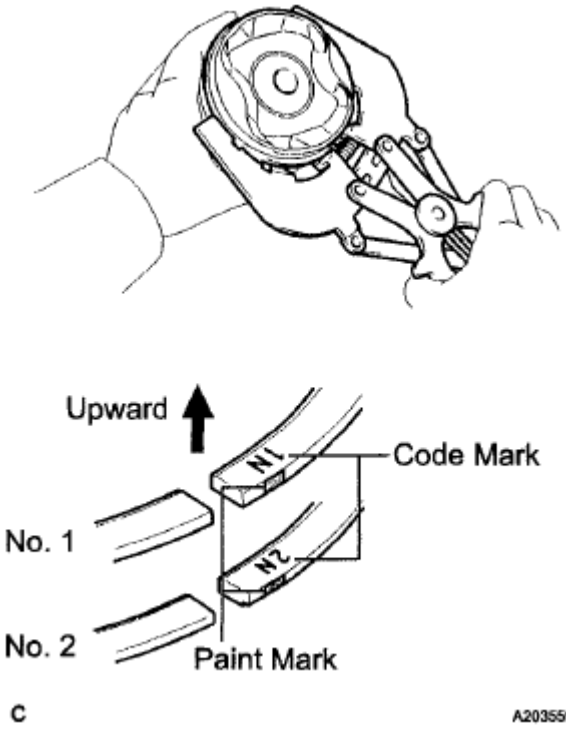


Fig. 176: Installing Compression Rings With Code Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL CRANKSHAFT BEARING**
   a. Clean the main journal and both surfaces of the bearing.
   b. Install the upper bearing to the cylinder block as shown in the illustration.

NOTE:

- **Do not apply engine oil to the bearings or their contact surfaces.**
- **Both sides of the oil groove in the cylinder block should be visible through the oil feed holes in the bearing. The amount visible on each side of the holes should be equal.**
- **Do not allow coolant to come into contact with the bearing inner surface.**
- **If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.**

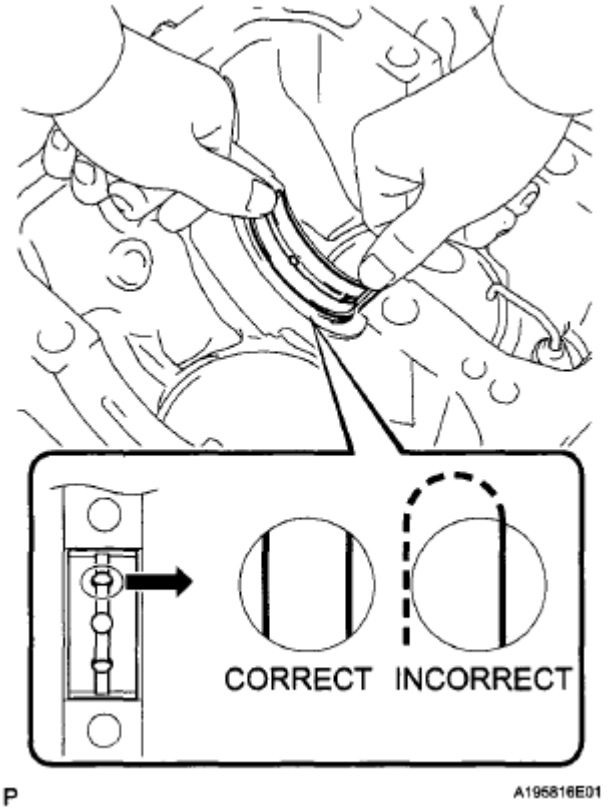


Fig. 177: Installing Upper Bearing To Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the lower bearing onto the bearing cap.
d. Using a vernier caliper, measure the distance between the crankshaft bearing cap's edge and the lower bearing's edge.

Dimension A - B or B - A:

0 to 0.7 mm (0 to 0.0276 in.)

NOTE:

- **Do not apply engine oil to the bearings and the contact surfaces.**
- **Do not allow coolant to come into contact with the bearing inner surface.**
- **If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.**

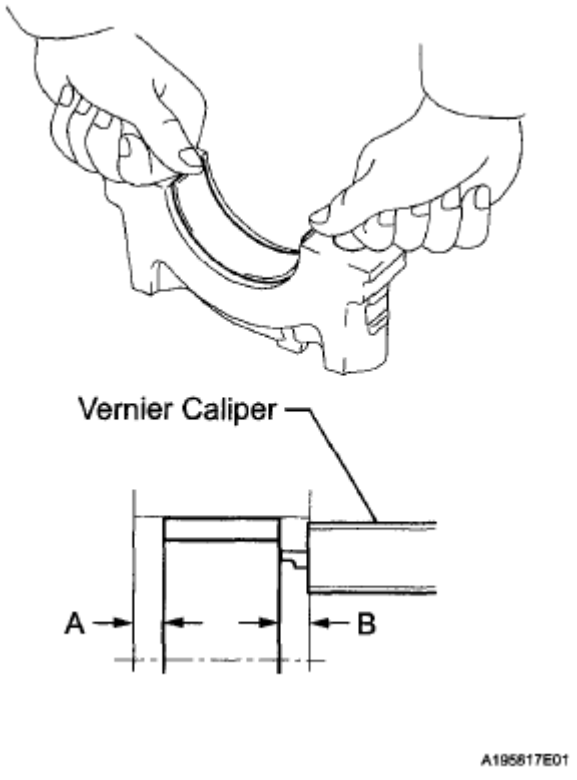


Fig. 178: Installing Lower Bearing Onto Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSTALL CRANKSHAFT THRUST WASHER**
   a. Apply engine oil to the thrust washers.
   b. Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil grooves facing outward.

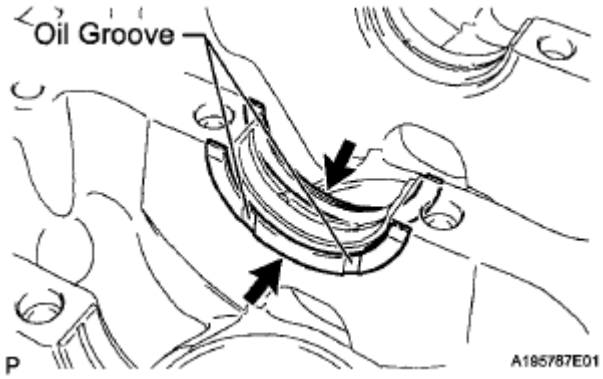


Fig. 179: Locating Thrust Washers Onto No. 3 Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL CRANKSHAFT**
   a. Apply engine oil to the upper bearing, and install the crankshaft onto the cylinder block.

b. Examine the front marks and numbers, and install the bearing caps onto the cylinder block with the front marks as shown in the illustration.

HINT:

The crankshaft bearing cap bolts are tightened in 3 progressive steps.

c. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

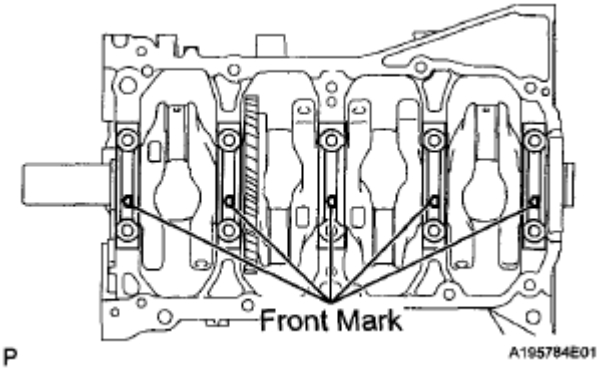


Fig. 180: Identifying Bearing Caps Front Marks And Numbers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Step 1:
   1. Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

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

e. Step 2:
   1. Tighten the 10 bearing cap bolts again in the sequence shown in the illustration.

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

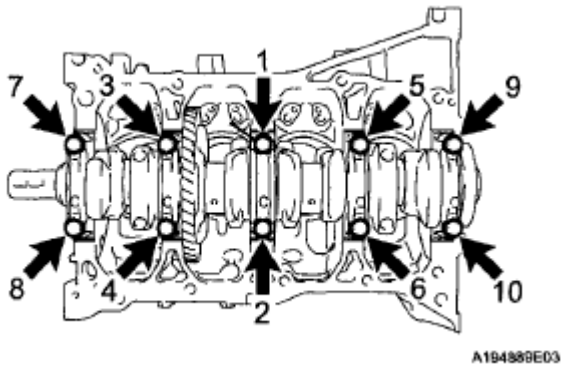


Fig. 181: Identifying Bearing Cap Bolts Tightening Sequence

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

If a crankshaft bearing cap bolt does not meet the specified torque, replace it.

f. Step 3:
   1. Mark the front of the bearing cap bolts with paint.
   2. Tighten the 10 bearing cap bolts 90° in the same sequence.
   3. Check that the paint marks are now at a 90° angle to the front.

g. Check that the crankshaft turns smoothly.

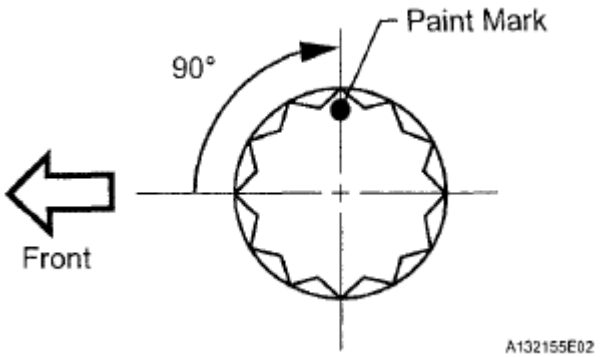


Fig. 182: Identifying Bearing Cap Bolts Installation Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **INSTALL CONNECTING ROD BEARING**
    a. Clean the bearing contact surface of the connecting rod and cap, and both surfaces of both bearings.
    b. Install the connecting rod bearings to the connecting rods and connecting rod caps.
    c. Using a vernier caliper, measure the distance between the edges of the connecting rod and connecting rod bearing, and the edges of the connecting rod cap and connecting rod bearing.

Dimension A - B or B - A:

0 to 0.7 mm (0 to 0.0276 in.)

NOTE:

- **Do not apply engine oil to the bearings and the contact surfaces.**
- **Do not allow coolant to come into contact with the bearing inner surface.**
- **If any coolant comes into contact with the bearing inner surface, replace the bearing with a new one.**

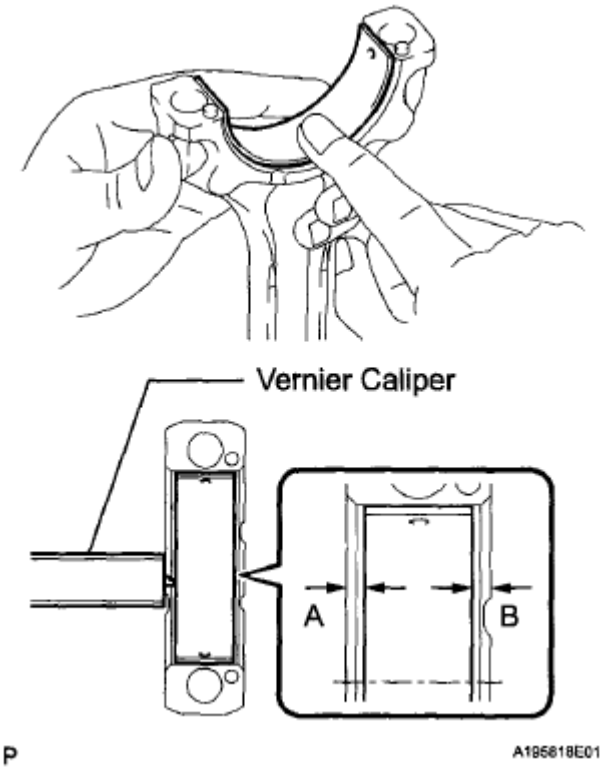


Fig. 183: Installing Connecting Rod Bearings To Connecting Rods And Connecting Rod Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **INSTALL PISTON WITH CONNECTING ROD**
    a. Apply engine oil to the cylinder walls, pistons, and surfaces of the connecting rod bearings.
    b. Position the piston rings so that the ring ends are as shown in the illustration.

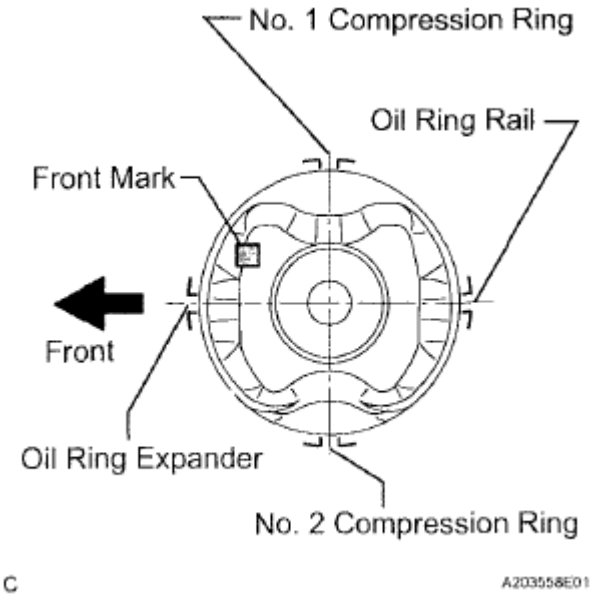


Fig. 184: [Positioning Piston Rings With Ring Ends]
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a hammer handle and piston ring compressor, press a piston with connecting rod into each cylinder with the front mark of the piston facing forward.

NOTE: When inserting the piston with connecting rod into the cylinder block, make sure the oil nozzle does not interfere with the connecting rod.

HINT:

The front mark is "1L" printed in raised letters.

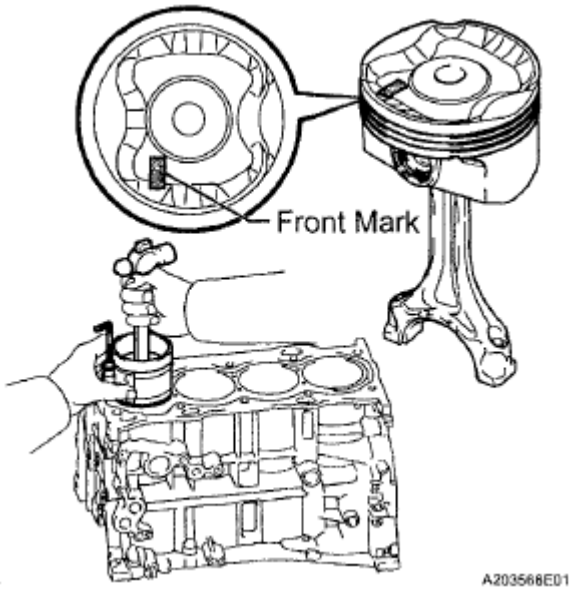


Fig. 185: Pressing Piston With Connecting Rod Into Cylinder With Front Mark Of Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Check that the front mark of the connecting rod cap is facing in the correct direction.

NOTE: Match the numbered connecting rod cap with the connecting rod.

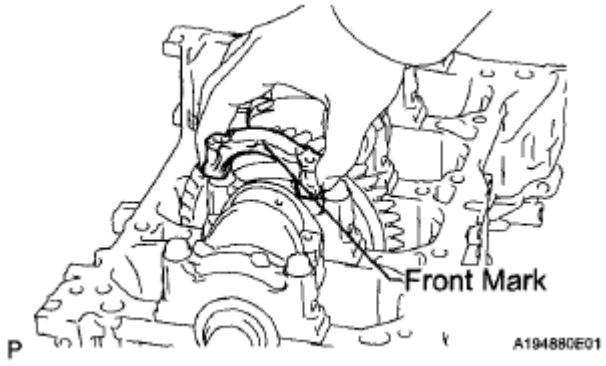


Fig. 186: Checking Front Mark Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
f. Temporarily install the connecting rod bolts.

HINT:

The connecting rod bolts are tightened in 2 progressive steps.

g. Step 1:
    1. Alternately tighten the connecting rod bolts in several steps.

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

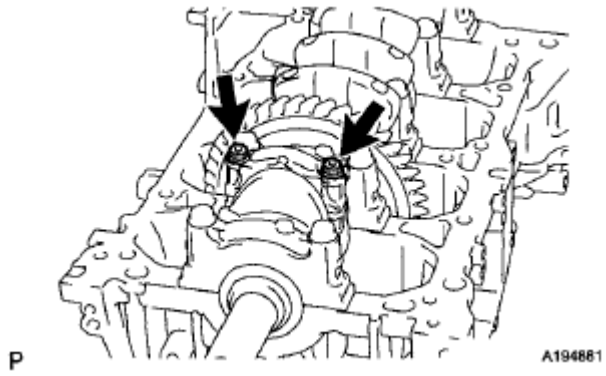


Fig. 187: Locating Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Step 2:
    1. Mark the front of the connecting rod bolts with paint.
    2. Tighten the bolts 90° as shown in the illustration.
    3. Check that the painted marks are now at a 90° angle to the front.
i. Check that the crankshaft turns smoothly.

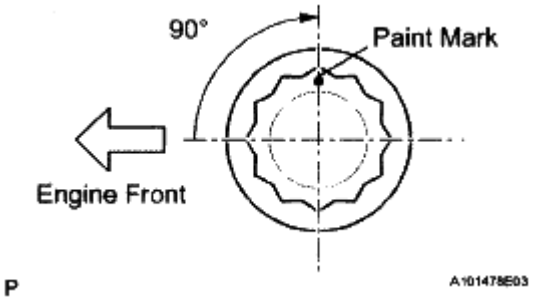


Fig. 188: Identifying Connecting Rod Bolts With Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

FRONT CRANKSHAFT OIL SEAL

COMPONENTS

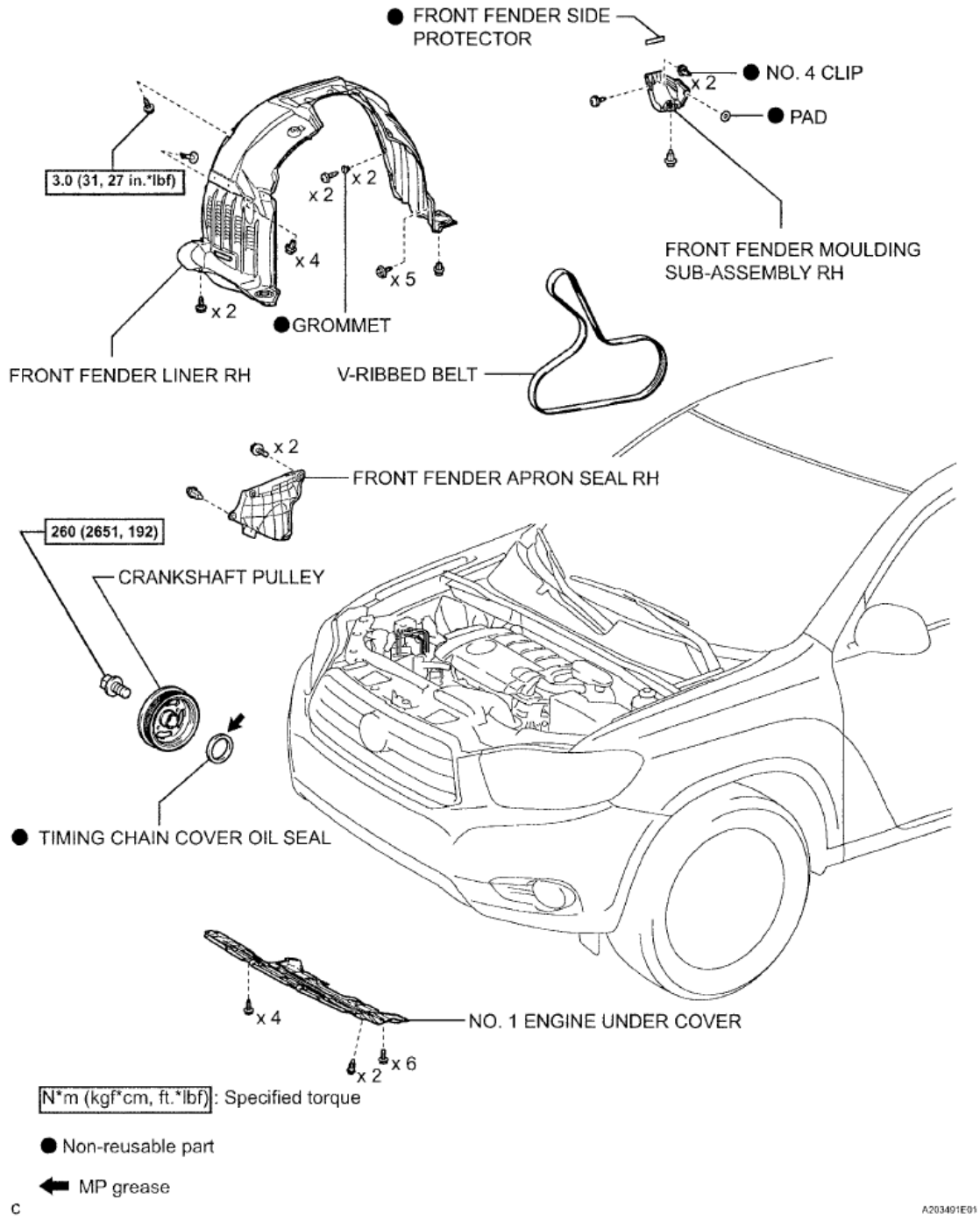


Fig. 189: Identifying Front Crankshaft Oil Seal Components With Torque Specification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE FRONT WHEEL RH**
2. **REMOVE NO. 1 ENGINE UNDER COVER**
3. **REMOVE FRONT FENDER MOULDING SUB-ASSEMBLY RH** (See **ON-VEHICLE**

INSPECTION)

4. **REMOVE FRONT FENDER LINER RH** (See **REMOVAL**)
5. **REMOVE FRONT FENDER APRON SEAL RH** (See **REMOVAL**)
6. **REMOVE V-RIBBED BELT** (See **INSTALLATION**)
7. **REMOVE CRANKSHAFT PULLEY**
   a. Using SST, hold the crankshaft pulley and loosen the pulley bolt. Further loosen the bolt until 2 or 3 threads are screwed into the crankshaft.

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

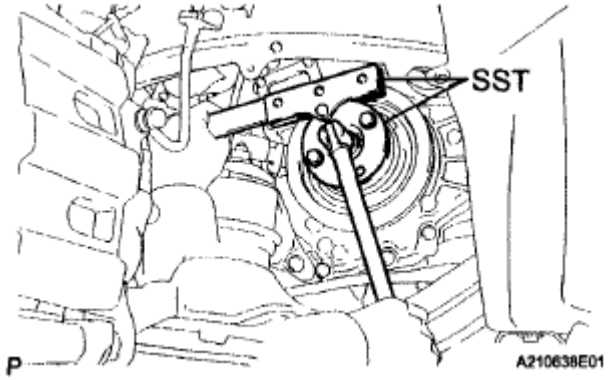


Fig. 190: Loosening Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using SST and the pulley bolt, remove the crankshaft pulley.

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

      HINT:

      Apply a lubricant to the threads and end of SST.

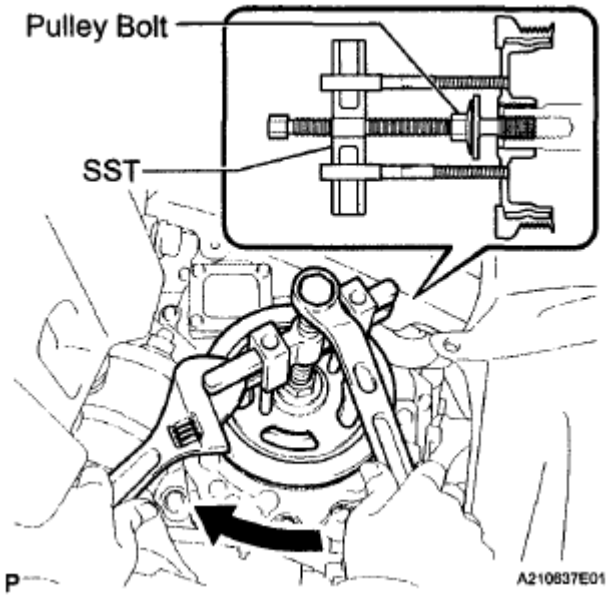


Fig. 191: Removing Crankshaft Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE TIMING CHAIN COVER OIL SEAL**
   a. Using a screwdriver, pry out the oil seal.

      HINT:

      Tape the screwdriver tip before use.

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

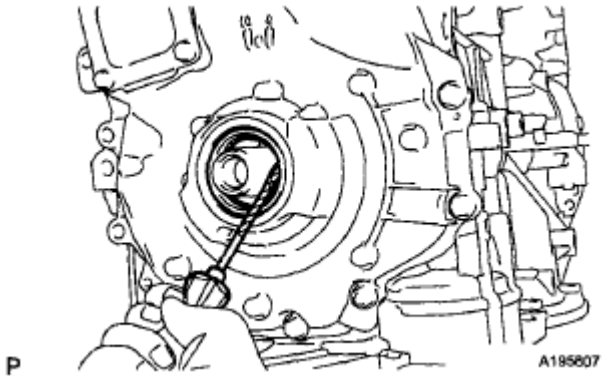


Fig. 192: Prying Out Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL TIMING CHAIN COVER OIL SEAL**
   a. Apply MP grease to the lip of a new oil seal.

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

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

SST 09223-22010

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

2. **INSTALL CRANKSHAFT PULLEY**
   a. Align the pulley set key with the key groove of the crankshaft pulley.

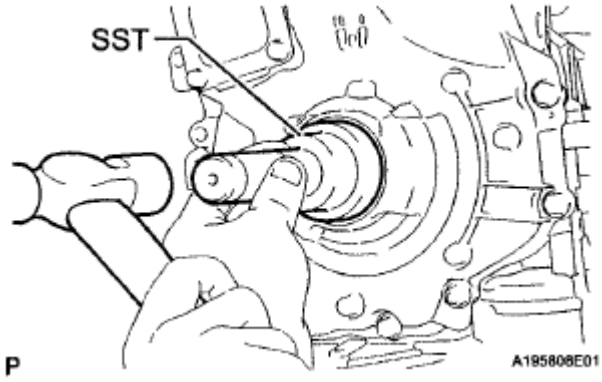


Fig. 193: Tapping Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Using SST, hold the crankshaft pulley and install the pulley bolt.

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

Torque: 260 N*m (2651 kgf*cm, 192 ft.*lbf)

3. **INSTALL V-RIBBED BELT** (See **INSTALLATION**)
4. **INSTALL FRONT FENDER APRON SEAL RH** (See **ENGINE UNIT**)
5. **INSTALL FRONT FENDER LINER RH** (See **INSTALLATION**)

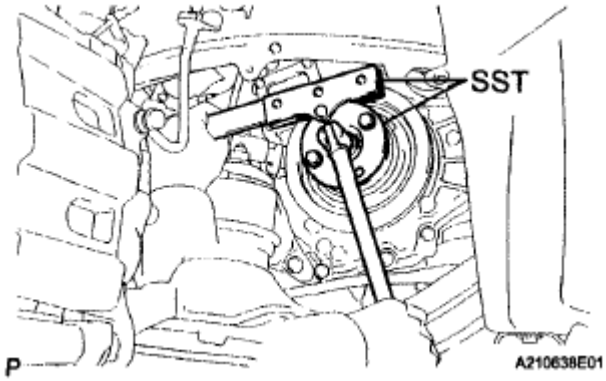


Fig. 194: Installing Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **INSTALL FRONT FENDER MOULDING SUB-ASSEMBLY RH** (See **CAMSHAFT**)
7. **INSTALL NO. 1 ENGINE UNDER COVER**
8. **INSTALL FRONT WHEEL RH**

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

REAR CRANKSHAFT OIL SEAL

COMPONENTS

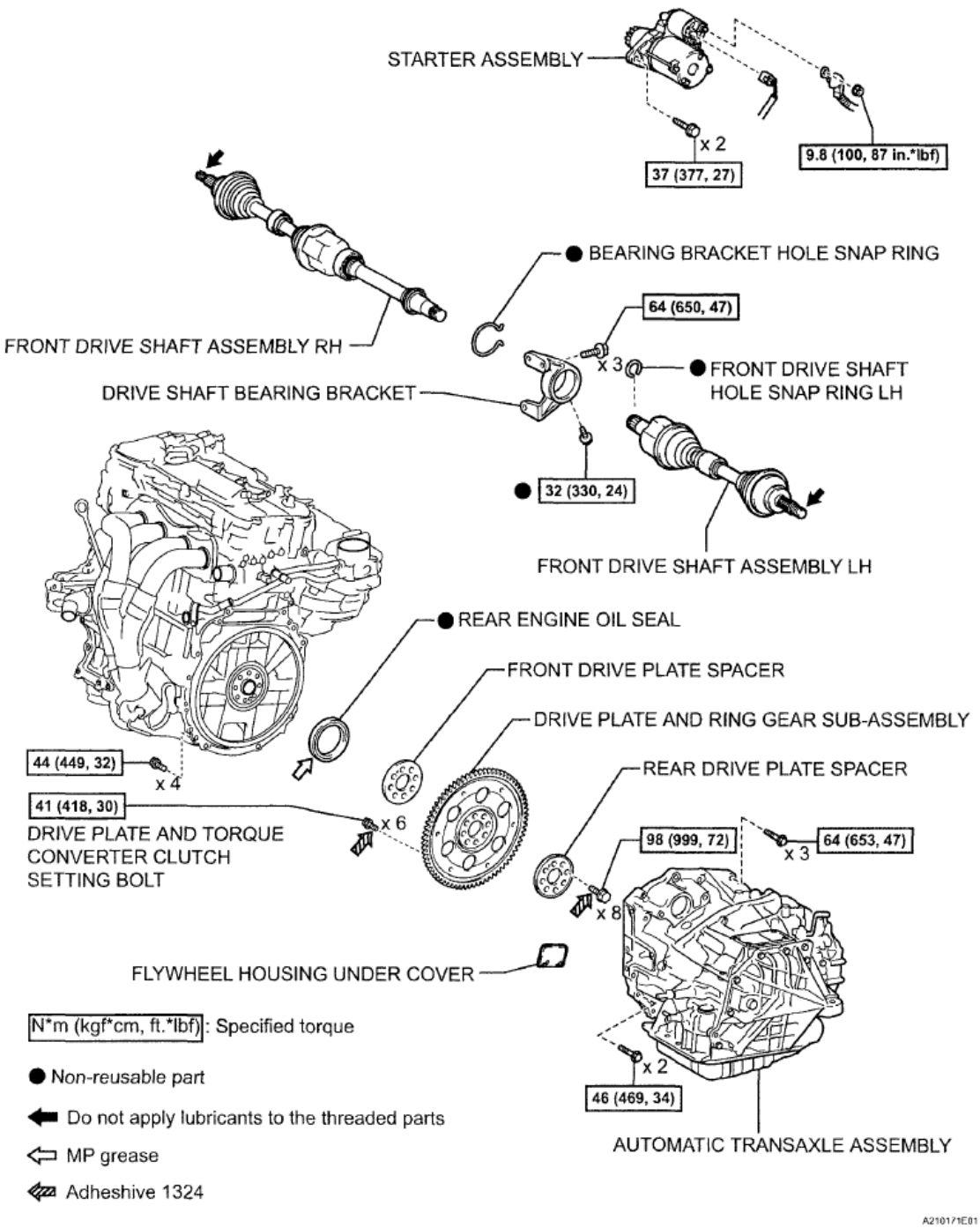


Fig. 195: Identifying Rear Crankshaft Oil Seal Components With Torque Specification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE ENGINE AND TRANSAXLE**
   a. Remove the engine and transaxle (See **REMOVAL**).
2. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY**

a. Remove the automatic transaxle (See **DISASSEMBLY**).

3. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY**
   a. Using SST, hold the crankshaft pulley.

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

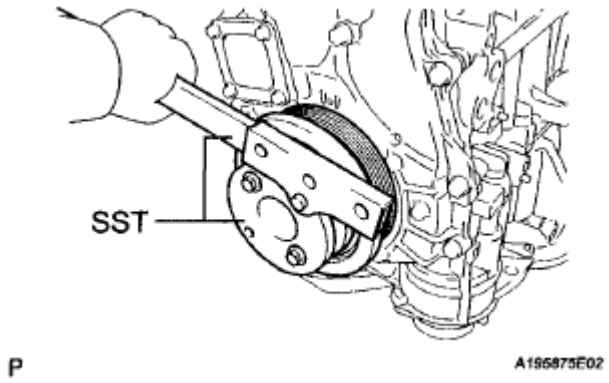


Fig. 196: Holding Crankshaft Pulley Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Remove the 8 bolts, front drive plate spacer, drive plate and ring gear sub-assembly, and rear drive plate spacer.

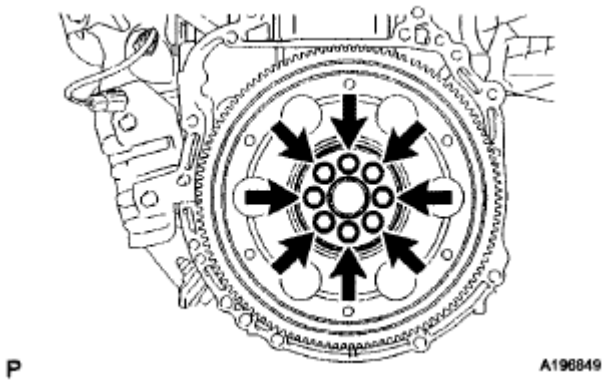


Fig. 197: Locating Drive Plate And Ring Gear Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE REAR ENGINE OIL SEAL**
   a. Using a knife, cut off the lip of the oil seal.
   b. Using a screwdriver, pry out the oil seal.

      HINT:

      Tape the screwdriver tip before use.

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

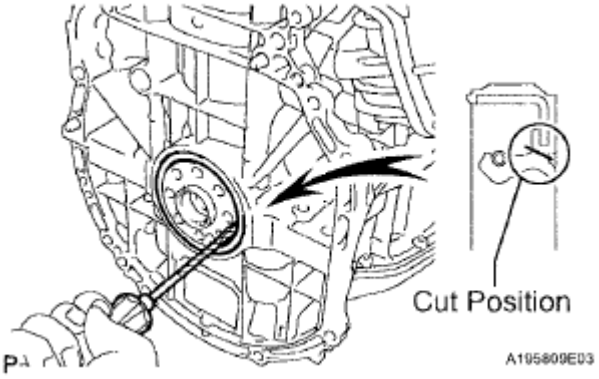


Fig. 198: Cutting Off Lip Of Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. **INSTALL REAR ENGINE OIL SEAL**
   a. Apply MP grease to the lip of a new oil seal.

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

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

SST 09223-15030, 09950-70010 (09951 -07150)

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

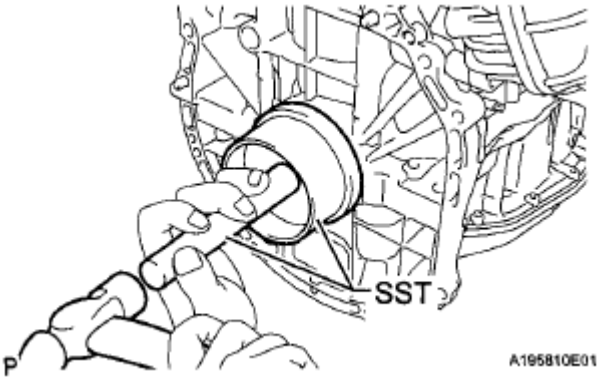


Fig. 199: Tapping Oil Seal Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY**
   a. Using SST, hold the crankshaft.

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

   b. Clean the bolts and their installation holes.

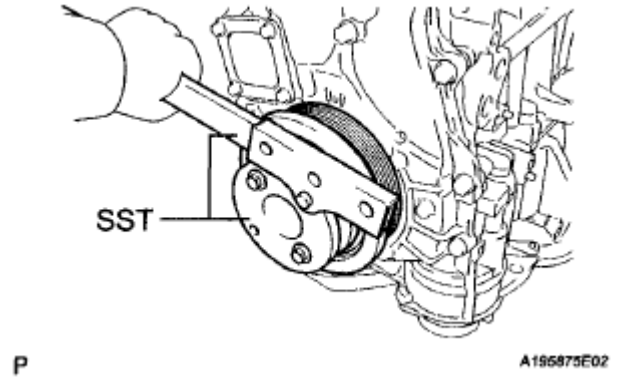


Fig. 200: Holding Crankshaft Pulley Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   c. Install the front drive plate spacer.

      HINT:

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

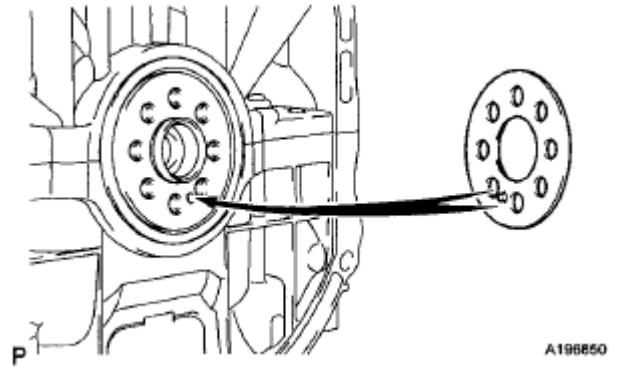


Fig. 201: Identifying Front Drive Plate Spacer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   d. Install the drive plate and rear drive plate spacer onto the crankshaft.

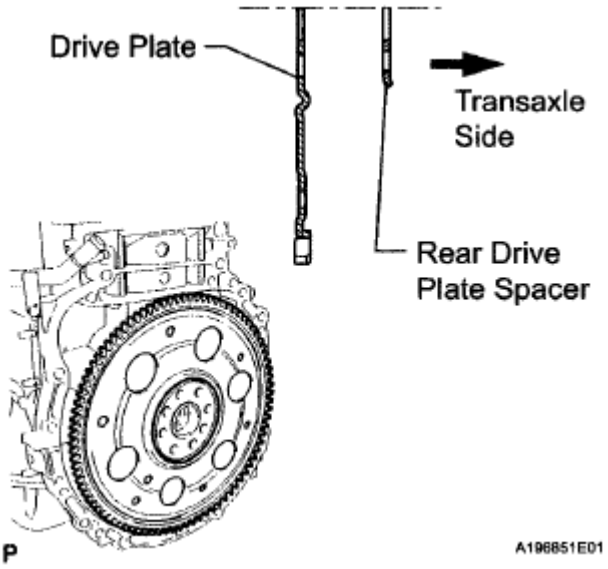


Fig. 202: Installing Drive Plate And Rear Drive Plate Spacer Onto Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Apply a few drops of adhesive to 2 or 3 threads of the 8 bolts.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

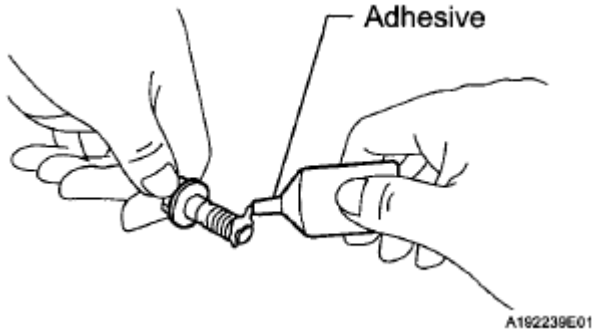


Fig. 203: Applying Drops Of Adhesive To Threads Of Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

NOTE: Do not strike or damage the drive plate installation bolts. Be sure to handle them carefully.

3. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY**

a. Install the automatic transaxle (See **DISASSEMBLY**).

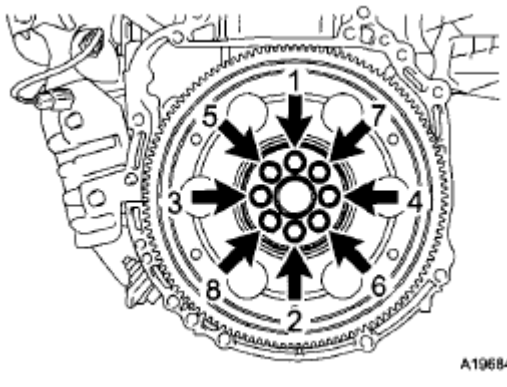


Fig. 204: Identifying Drive Plate Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL ENGINE AND TRANSAXLE**
   a. Install the engine and transaxle (See **INSTALLATION**).

ENGINE ASSEMBLY

COMPONENTS

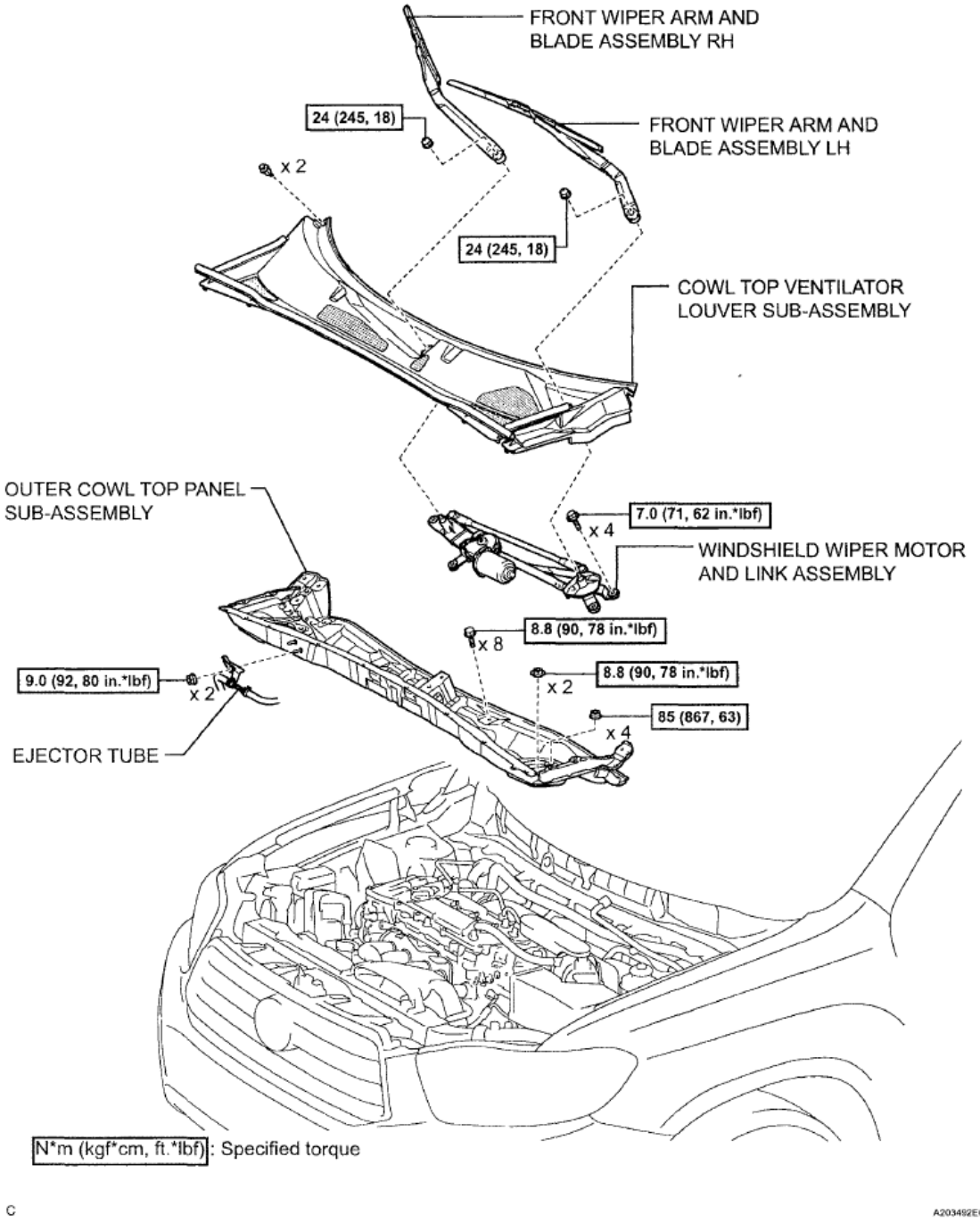


Fig. 205: Identifying Engine Assembly Components With Torque Specification (1 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

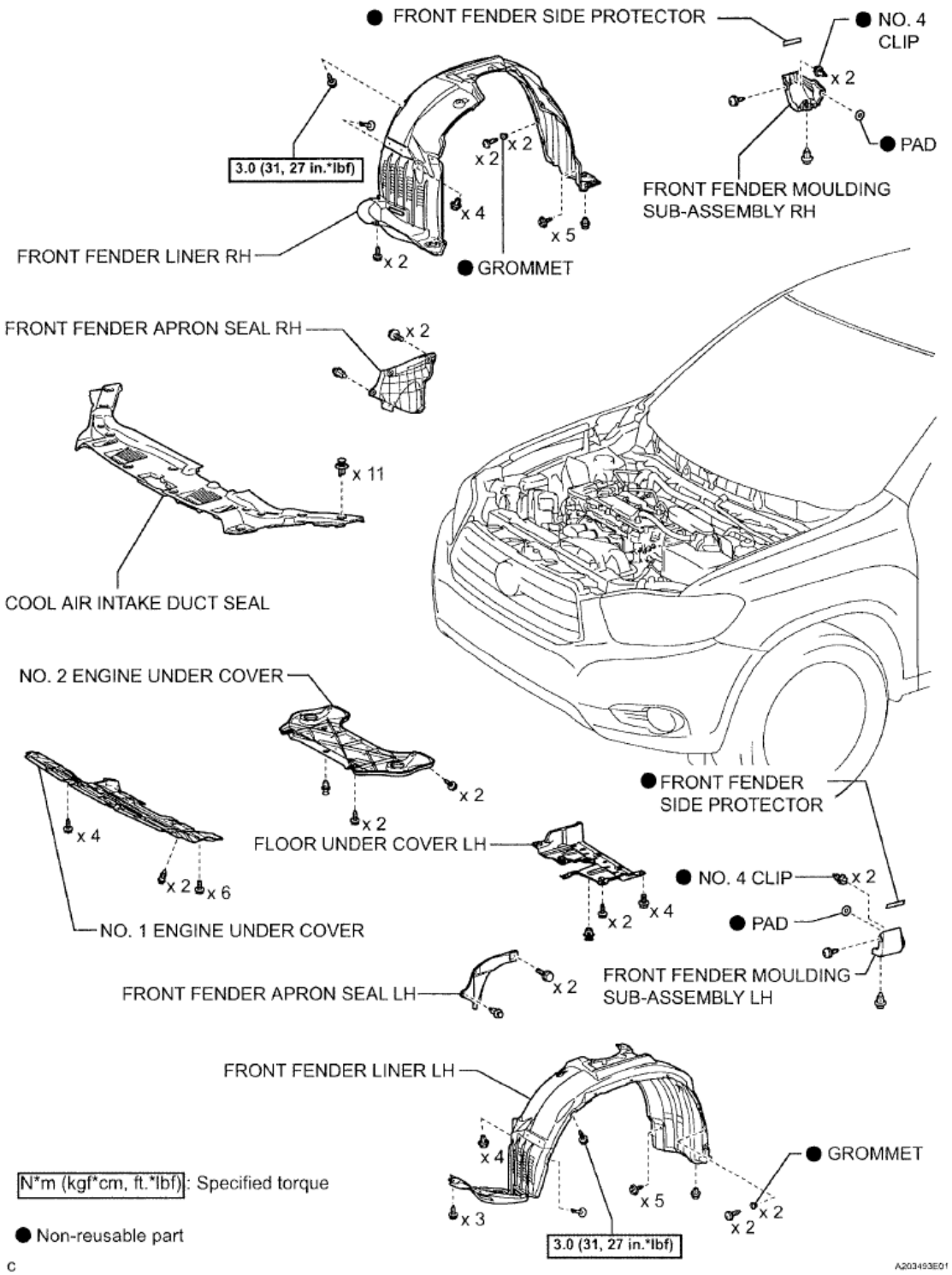


Fig. 206: Identifying Engine Assembly Components With Torque Specification (2 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

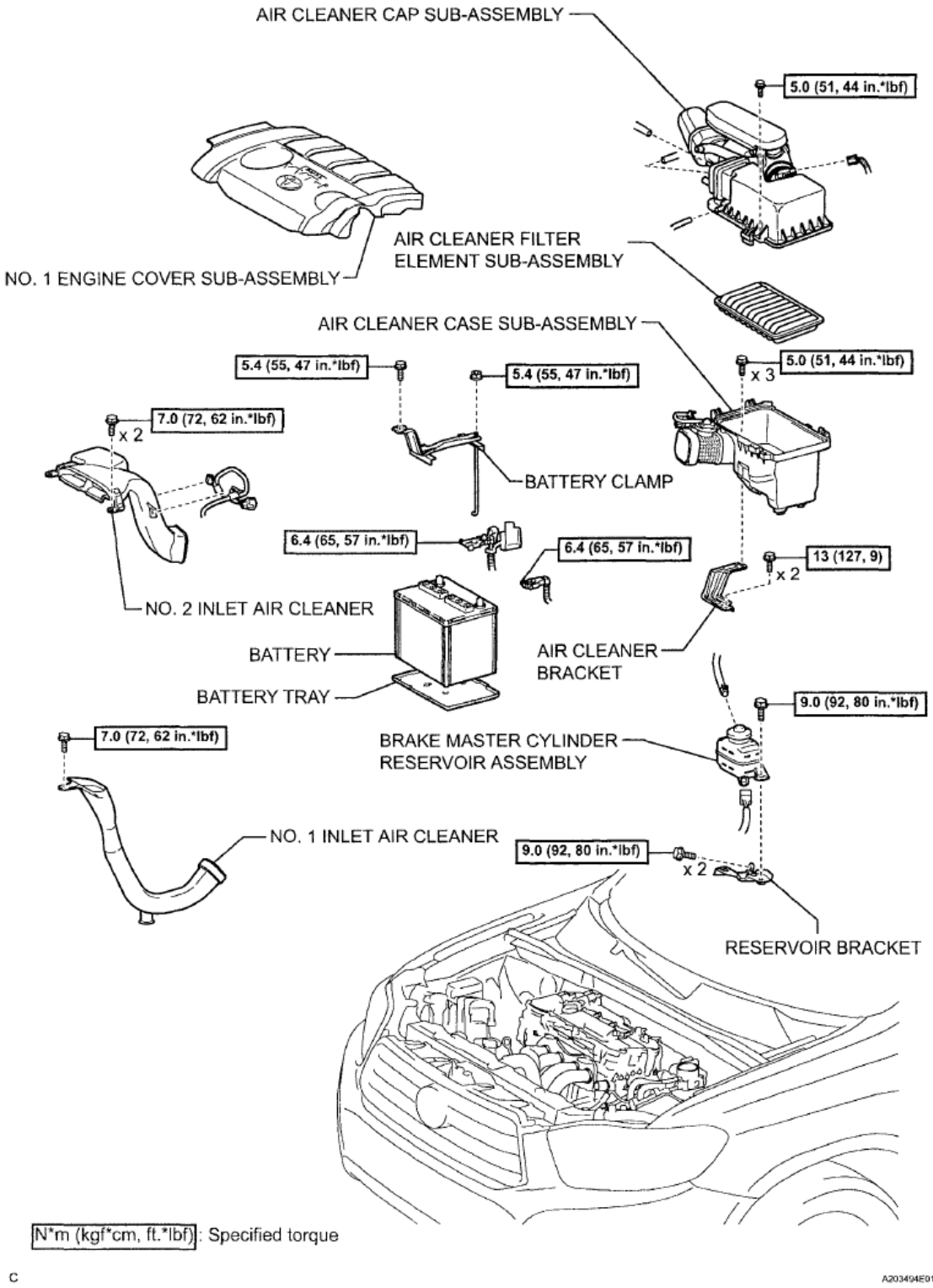


Fig. 207: Identifying Engine Assembly Components With Torque Specification (3 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

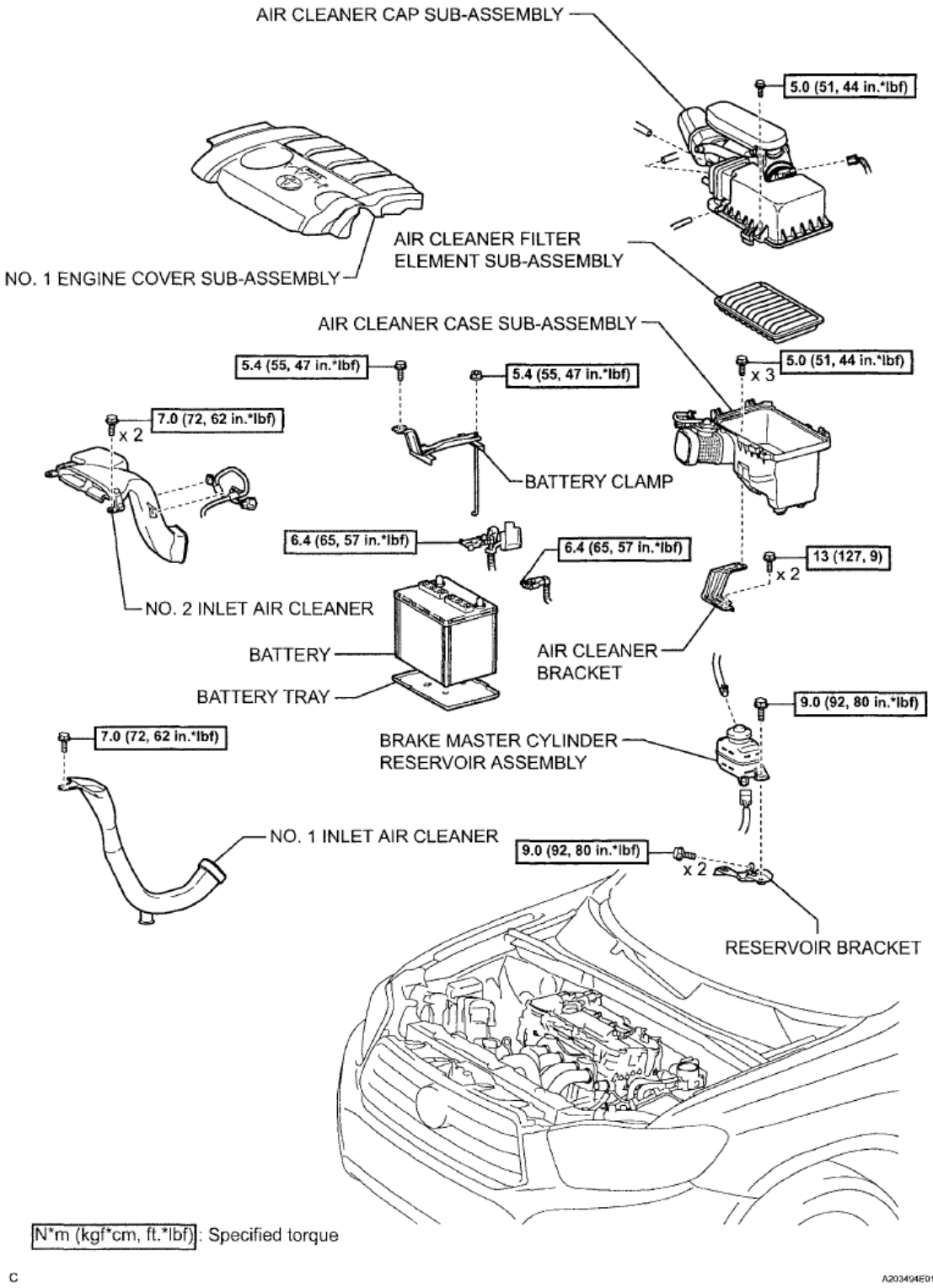


Fig. 208: Identifying Engine Assembly Components With Torque Specification (4 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

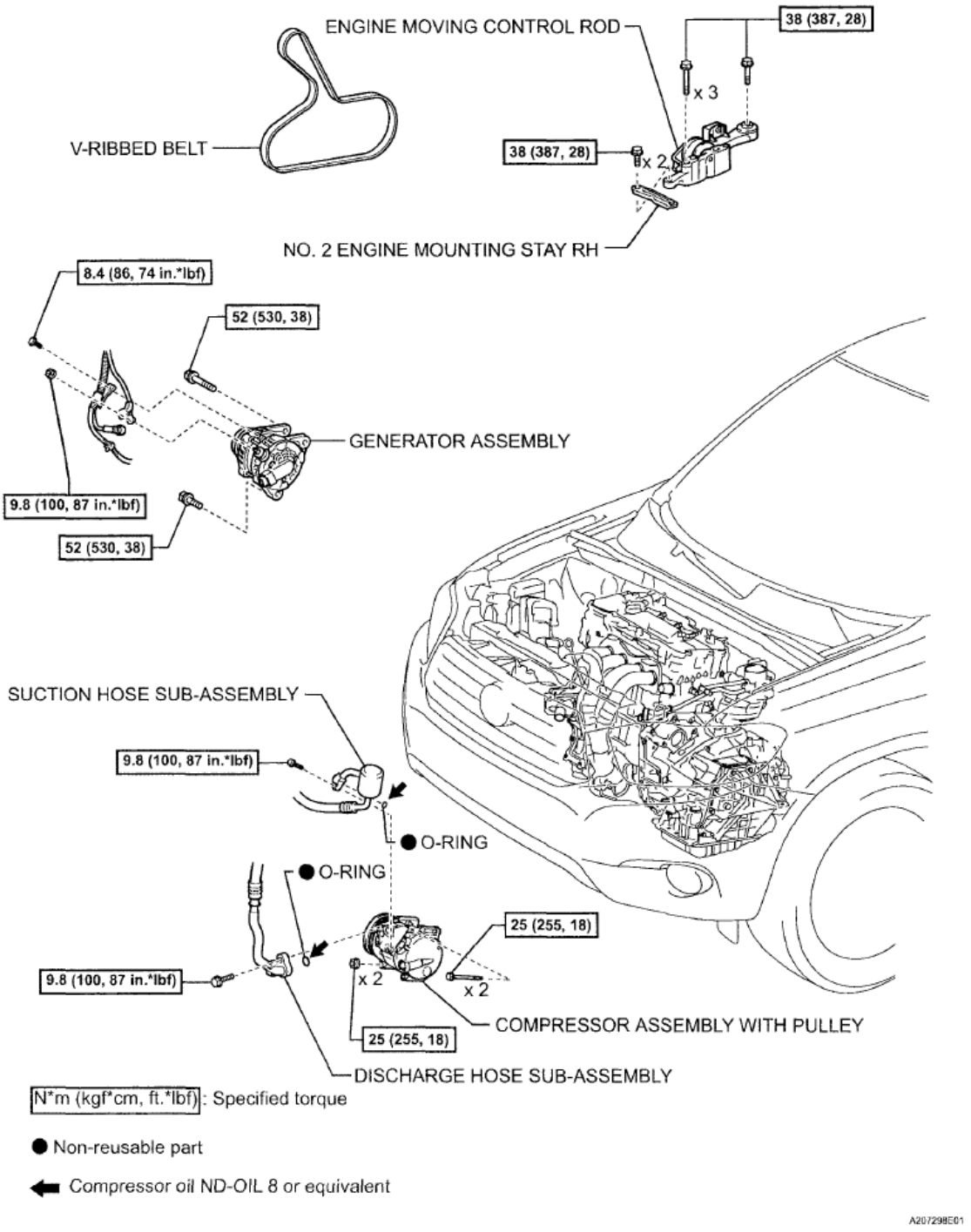


Fig. 209: Identifying Engine Assembly Components With Torque Specification (5 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

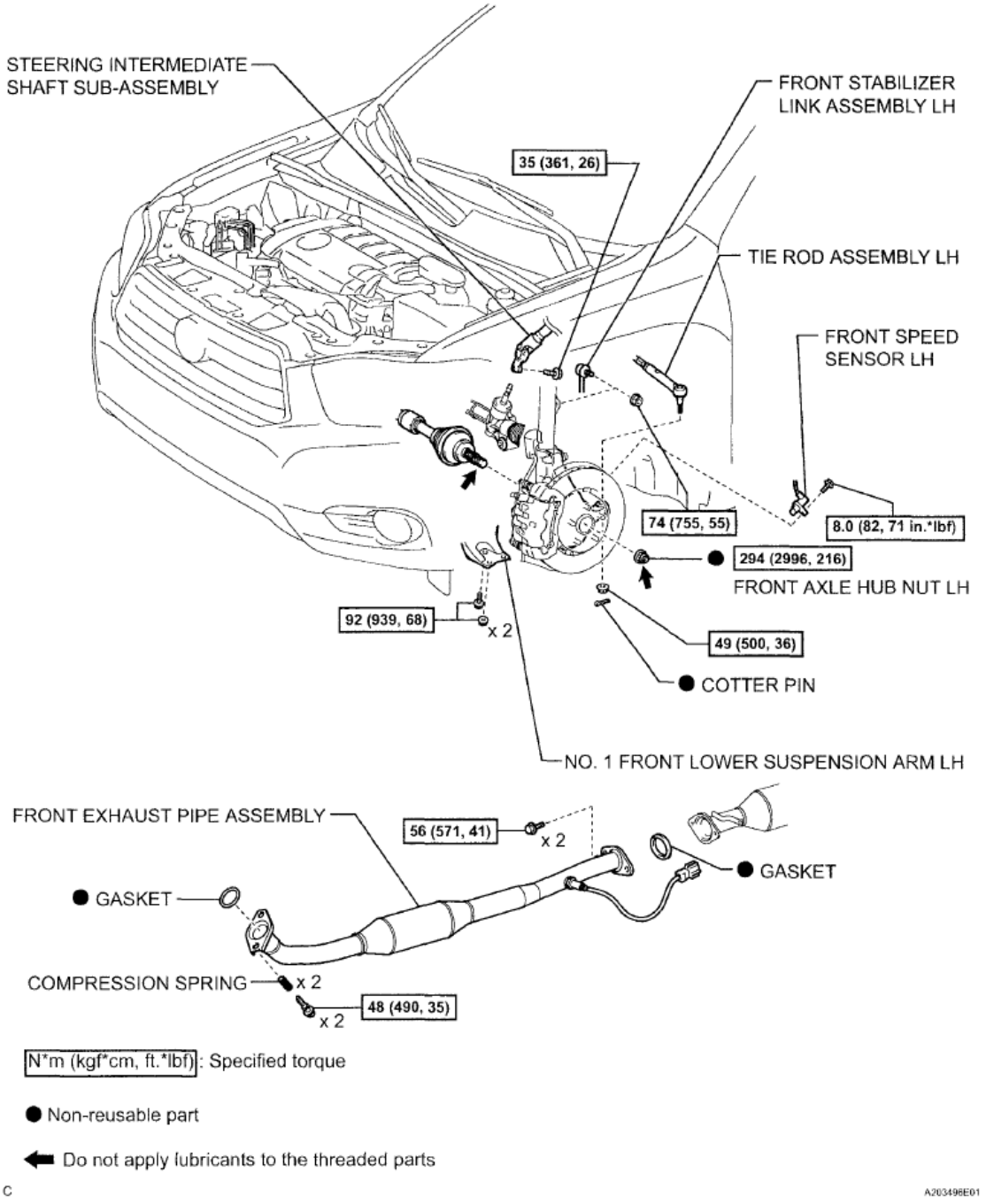


Fig. 210: Identifying Engine Assembly Components With Torque Specification (6 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

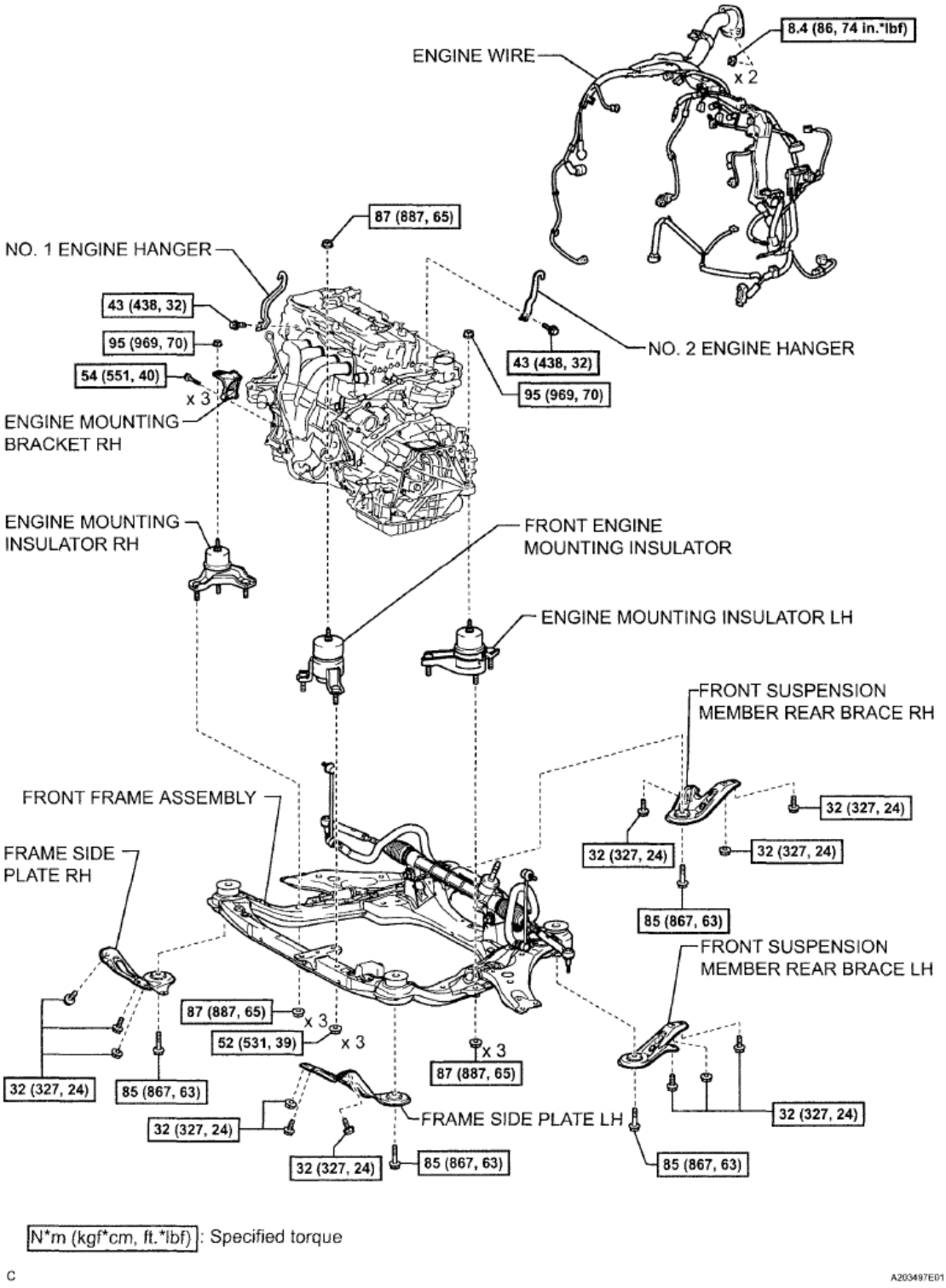


Fig. 211: Identifying Engine Assembly Components With Torque Specification (7 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

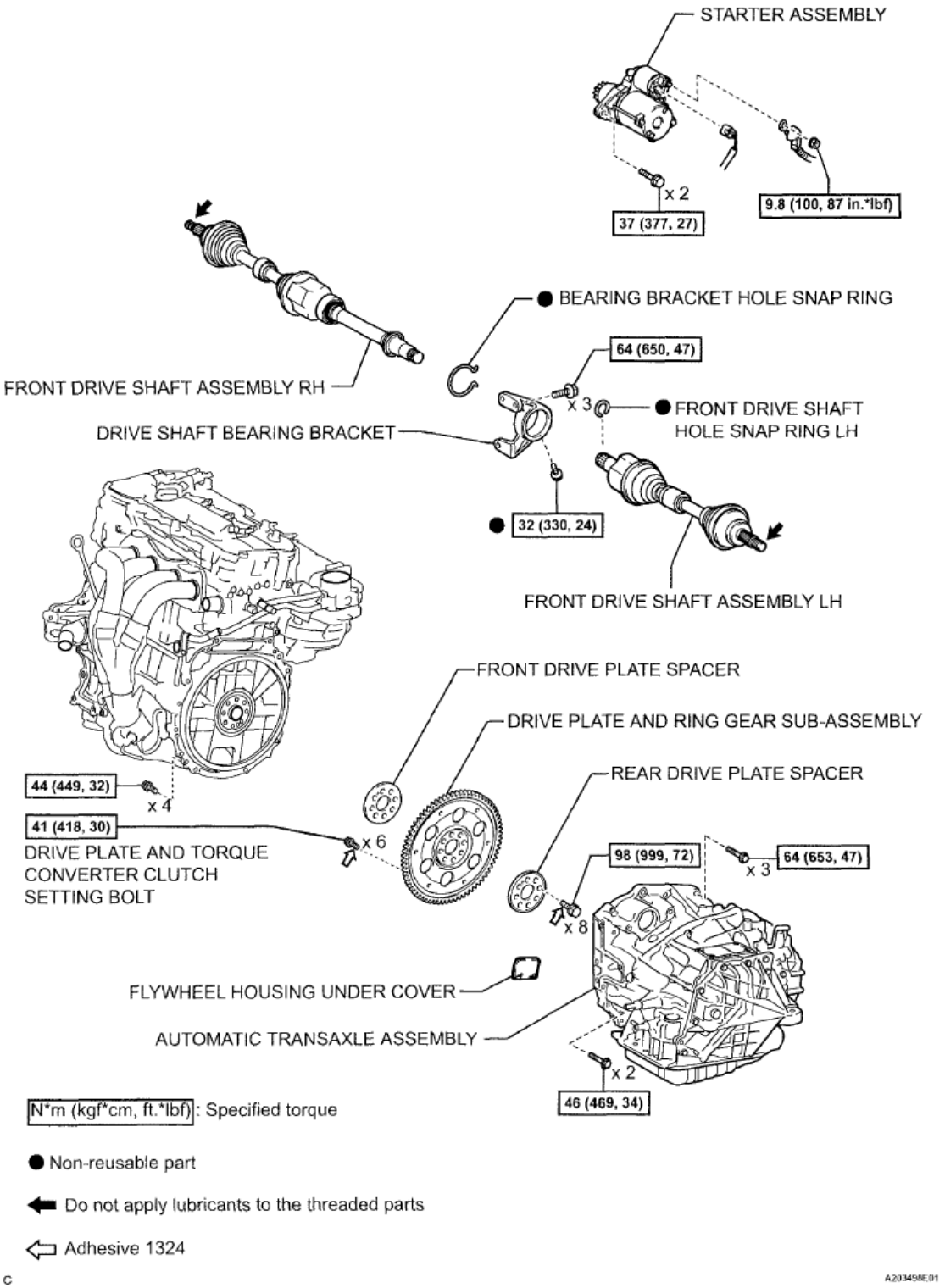


Fig. 212: Identifying Engine Assembly Components With Torque Specification (8 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **RECOVER REFRIGERANT FROM REFRIGERATION SYSTEM** (See **REPLACEMENT**)
2. **DISCHARGE FUEL SYSTEM PRESSURE**

   HINT:

   See **FUEL SYSTEM** .

3. **PLACE FRONT WHEELS FACING STRAIGHT AHEAD**
4. **REMOVE FRONT WHEELS**
5. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

   NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected (See INITIALIZATION).

6. **REMOVE COOL AIR INTAKE DUCT SEAL**
   a. Remove the 11 clips and cool air intake duct seal.
7. **REMOVE NO. 1 ENGINE UNDER COVER**
8. **REMOVE NO. 2 ENGINE UNDER COVER**
9. **REMOVE FLOOR UNDER COVER LH**
10. **REMOVE FRONT FENDER MOULDING SUB-ASSEMBLY LH** (See **REMOVAL**)
11. **REMOVE FRONT FENDER MOULDING SUB-ASSEMBLY RH** (See **ON-VEHICLE INSPECTION**)

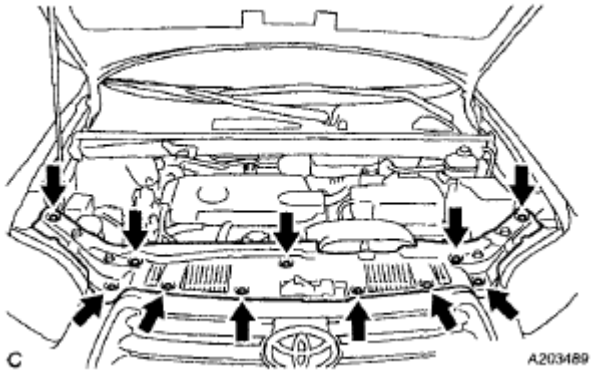


Fig. 213: Locating Cool Air Intake Duct Seal Clips
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **REMOVE FRONT FENDER LINER LH** (See **REMOVAL**)
13. **REMOVE FRONT FENDER LINER RH** (See **REMOVAL**)
14. **REMOVE FRONT FENDER APRON SEAL LH**
    a. Remove the 2 bolts, clip and front fender apron seal LH.

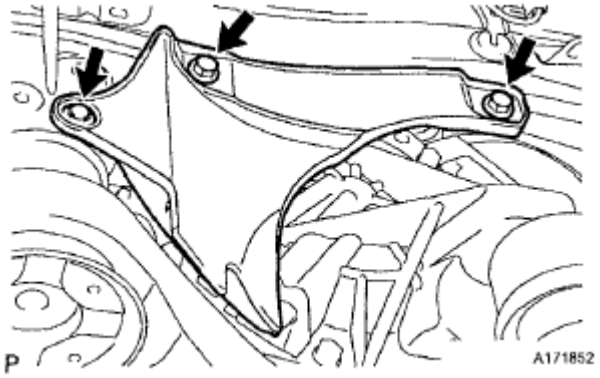


Fig. 214: Locating Front Fender Apron Seal LH Bolts And Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **REMOVE FRONT FENDER APRON SEAL RH**
    a. Remove the 2 bolts, clip and front fender apron seal RH.
16. **DRAIN ENGINE OIL** (See **REPLACEMENT**)
17. **DRAIN ENGINE COOLANT** (See **COOLANT**)
18. **DRAIN AUTOMATIC TRANSAXLE FLUID** (See **COMPONENTS**)

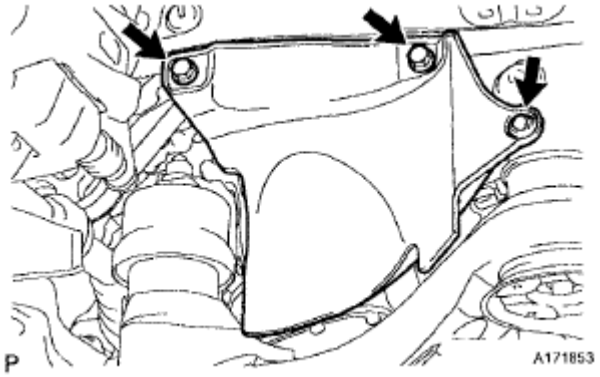


Fig. 215: Locating Front Fender Apron Seal RH Bolts And Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See **REMOVAL**)
20. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See **REMOVAL**)
21. **REMOVE COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY** (See **REMOVAL**)
22. **REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See **REMOVAL**)
23. **SEPARATE EJECTOR TUBE** (See **REMOVAL**)
24. **REMOVE OUTER COWL TOP PANEL SUB-ASSEMBLY** (See **REMOVAL**)
25. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY**
    a. Lift the rear of the No. 1 engine cover sub-assembly to detach the cover from the 2 pins, and then lift the front of the No. 1 engine cover sub-assembly to detach the cover from the pin and remove the No. 1 engine cover sub-assembly.

NOTE: Attempting to disengage both front and rear clips at the same time may cause the No. 1 engine cover sub-assembly to break.

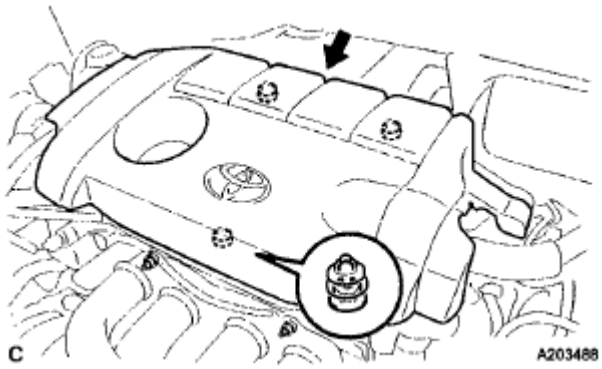


Fig. 216: Locating No. 1 Engine Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. **REMOVE BATTERY**
    a. Remove the nut, and separate the positive (+) battery terminal.
    b. Loosen the nut, and remove the bolt and battery clamp.
    c. Remove the battery and battery tray.

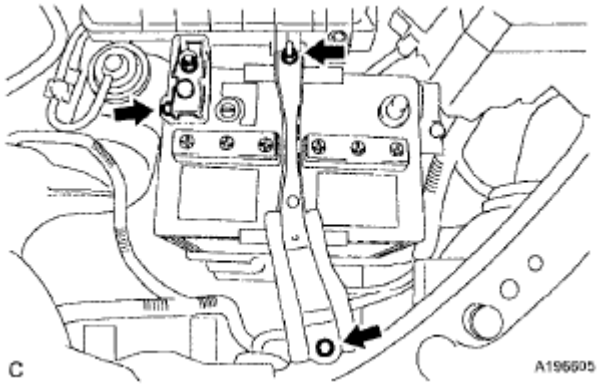


Fig. 217: Locating Positive (+) Battery Terminal And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. **REMOVE NO. 2 INLET AIR CLEANER**
    a. Disconnect the 2 clamps and vacuum hose.
    b. Remove the 2 bolts and No. 2 inlet air cleaner.
28. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** (See **REMOVAL**)
29. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
    a. Remove the air cleaner filter element sub-assembly.

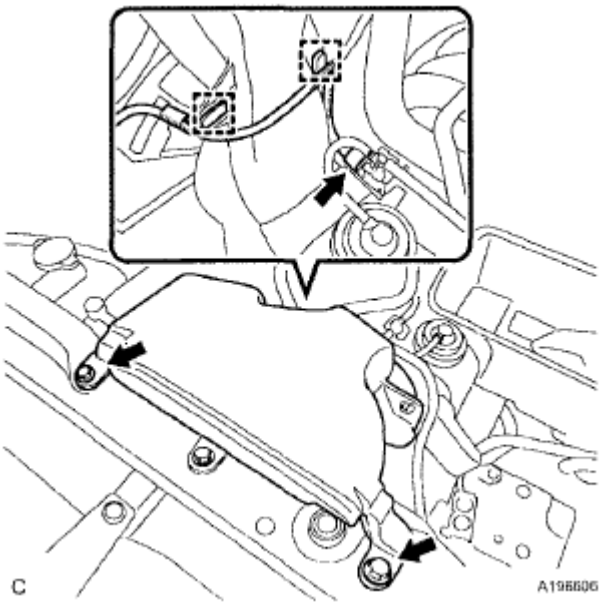


Fig. 218: Locating No. 2 Inlet Air Cleaner Bolts And Vacuum Hose With Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY**
    a. Disconnect the 2 clamps.
    b. Remove the 3 bolts and air cleaner case sub-assembly.

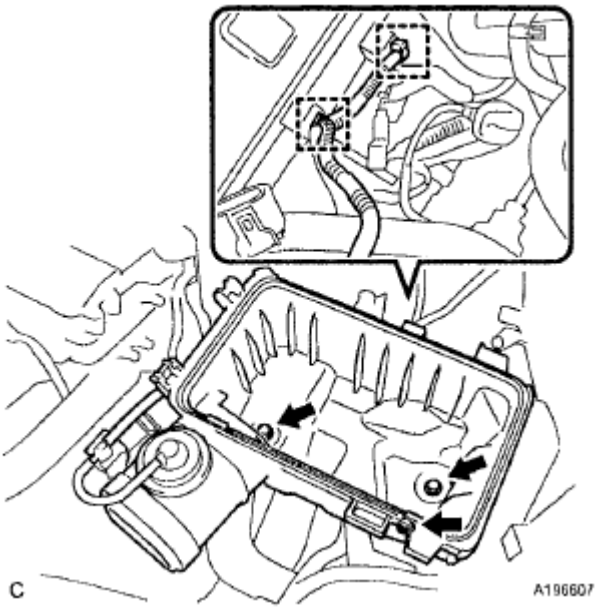


Fig. 219: Locating Air Cleaner Case Sub-Assembly Bolts With Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. **REMOVE AIR CLEANER BRACKET**

a. Remove the 2 bolts and air cleaner bracket.

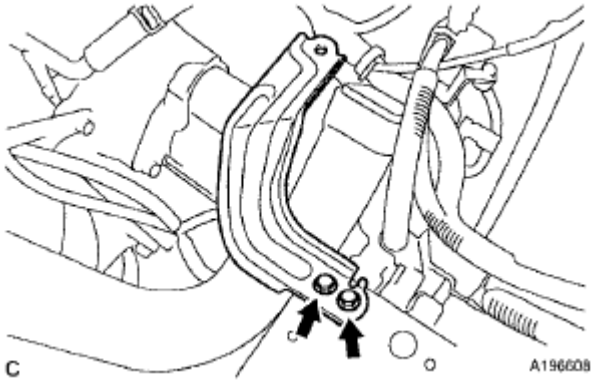


Fig. 220: Locating Air Cleaner Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. **REMOVE NO. 1 INLET AIR CLEANER**
    a. Remove the bolt and No. 1 inlet air cleaner.

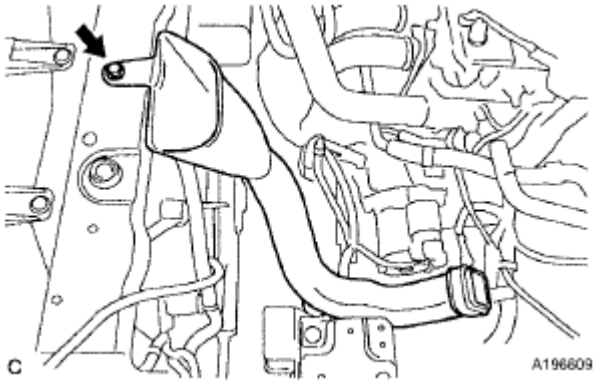


Fig. 221: Locating No. 1 Inlet Air Cleaner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **SEPARATE BRAKE MASTER CYLINDER RESERVOIR ASSEMBLY**
    a. Disconnect the level warning switch connector.
    b. Remove the bolt, and separate the brake master cylinder reservoir assembly.

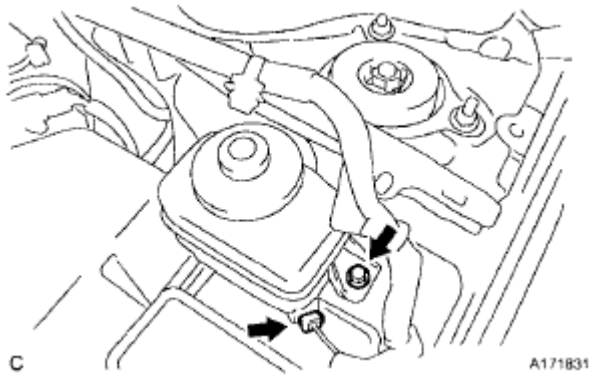


Fig. 222: Locating Level Warning Switch Connector And Brake Master Cylinder Reservoir Assembly Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. **REMOVE RESERVOIR BRACKET**
    a. Remove the 2 bolts and reservoir bracket.

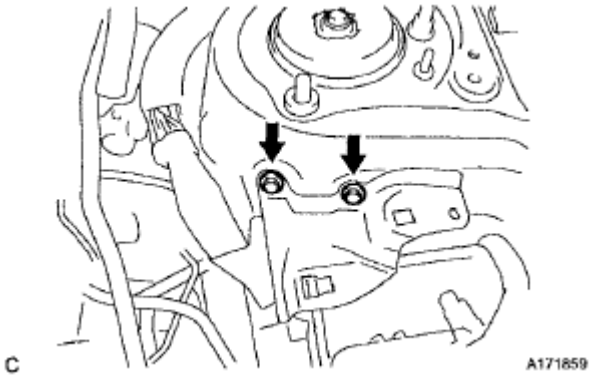


Fig. 223: Locating Reservoir Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. **DISCONNECT NO. 1 RADIATOR HOSE**
    a. Disconnect the No. 1 radiator hose.

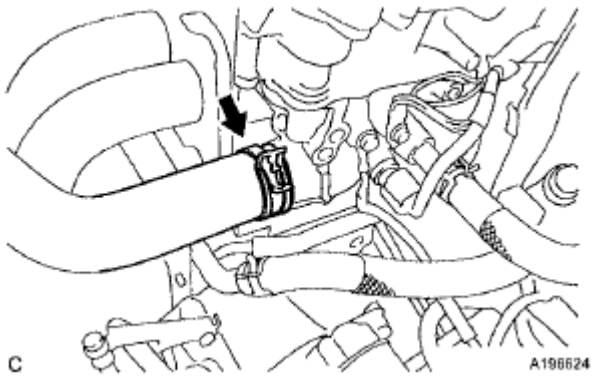


Fig. 224: Locating No. 1 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. **DISCONNECT NO. 2 RADIATOR HOSE**
    a. Disconnect the No. 2 radiator hose.

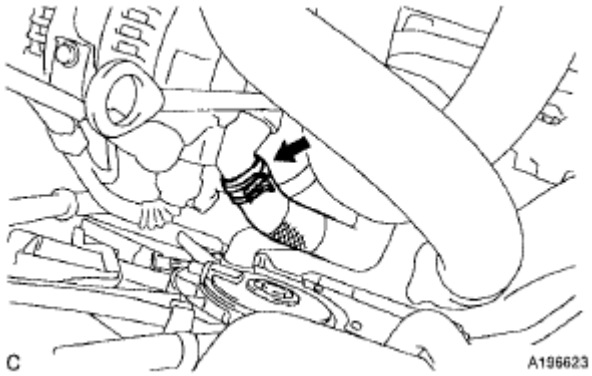


Fig. 225: Locating No. 2 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. **DISCONNECT INLET HEATER WATER HOSE**
    a. Disconnect the inlet heater water hose.

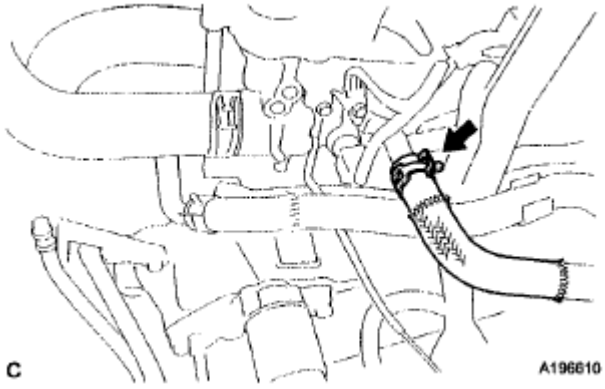


Fig. 226: Locating Inlet Heater Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. **DISCONNECT OUTLET HEATER WATER HOSE**
    a. Disconnect the outlet heater water hose.

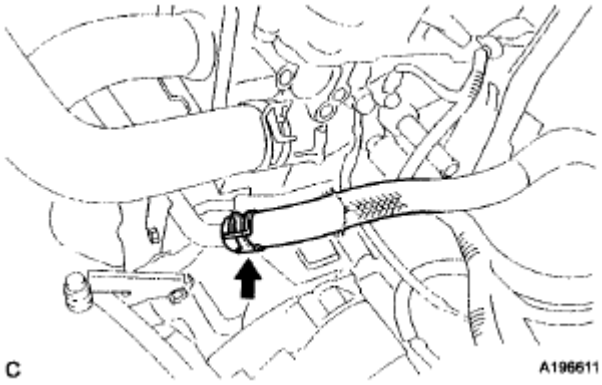


Fig. 227: Locating Outlet Heater Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. **DISCONNECT FUEL TUBE SUB-ASSEMBLY**
    a. Remove the No. 1 fuel pipe clamp.
    b. Pinch the fuel tube connector and then pull out the fuel main tube.

NOTE:

- **Check for dirt and foreign objects on the pipe and around the connector. Clean if necessary and then disconnect the connector.**
- **Disconnect the connector by hand.**
- **Do not bend, fold or rotate the nylon tube.**
- **If the pipe and connector are stuck together, push and pull the connector until it becomes free.**
- **Put the pipe and connector ends in vinyl bags to prevent damage and contamination.**

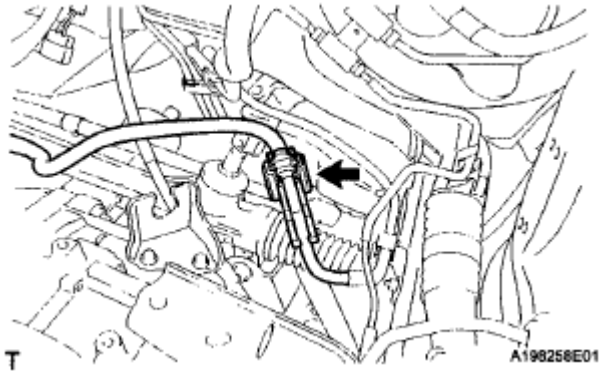


Fig. 228: Locating No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **DISCONNECT INLET OIL COOLER HOSE**
    a. Disconnect the inlet oil cooler hose.
41. **DISCONNECT OUTLET OIL COOLER HOSE**

a. Disconnect the outlet oil cooler hose.

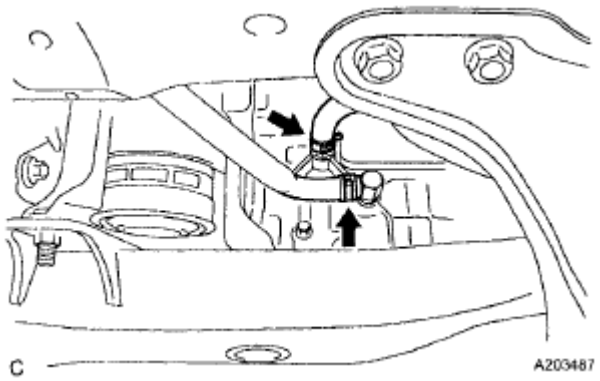


Fig. 229: Locating Inlet Oil Cooler Hose And Outlet Oil Cooler Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
    a. Remove the nut from the control shaft lever.
    b. Using a screwdriver, disengage the 4 claws, and disconnect the control cable with clip from the control cable bracket.
    c. Remove the clip.

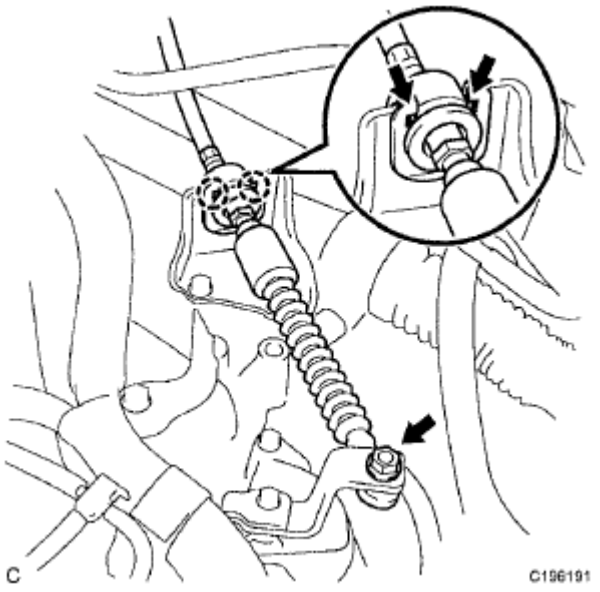


Fig. 230: Locating Control Shaft Lever Nut And Control Cable Bracket Clip With Claws
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **DISCONNECT ENGINE WIRE**
    a. Remove the No. 1 relay block cover.

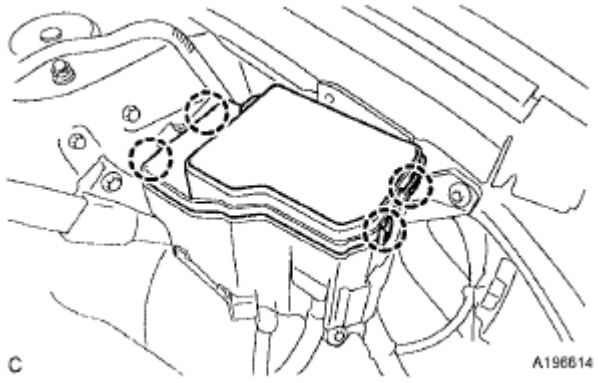


Fig. 231: Identifying No. 1 Relay Block Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the nut, and disconnect the engine wire connector from the engine room relay block.

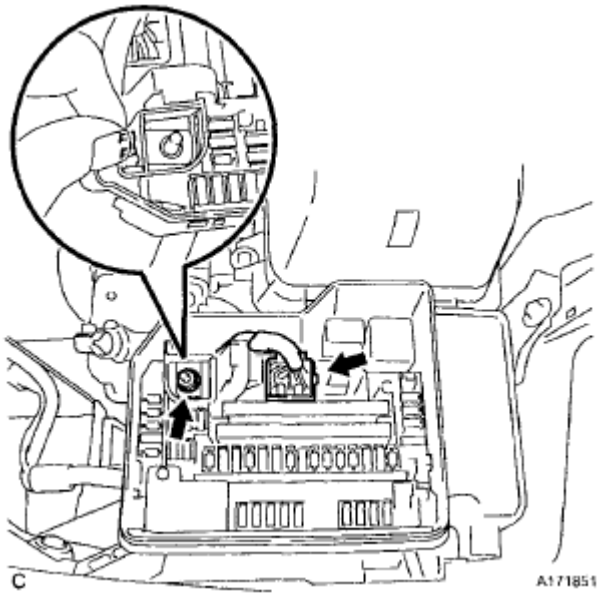


Fig. 232: Locating Nut And Engine Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a screwdriver, unlock the claw and separate the engine wire from the engine room relay block.

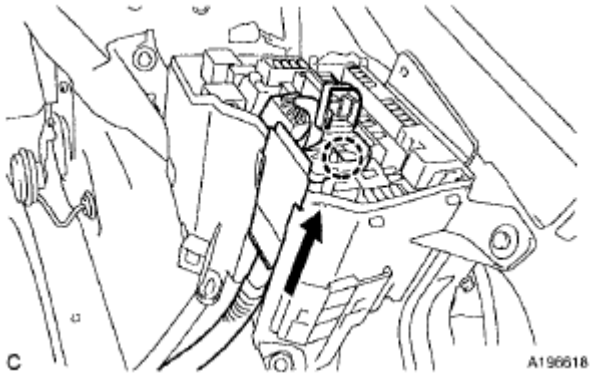


Fig. 233: Separating Engine Wire From Engine Room Relay Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Disconnect the engine wire clamp.

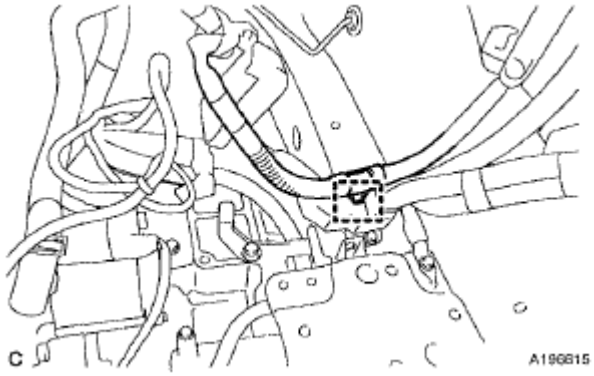


Fig. 234: Identifying Engine Wire Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Disconnect the engine wire clamp.
f. Remove the bolt, and separate the ground cables.

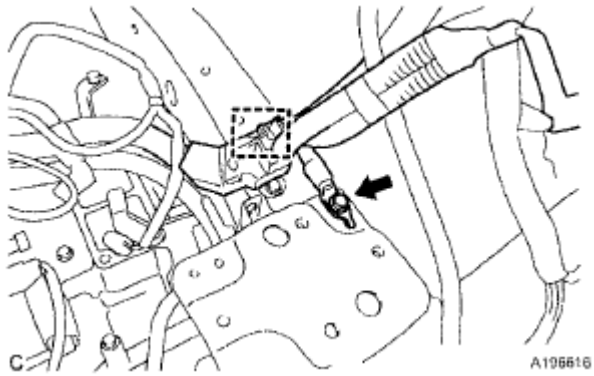


Fig. 235: Locating Ground Cables Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Remove the 2 bolts, and separate the ground cable.

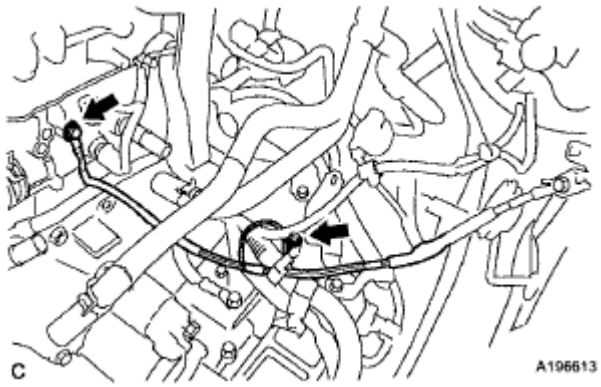


Fig. 236: Locating Ground Cable Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Remove the bolt, and separate the ground cable.

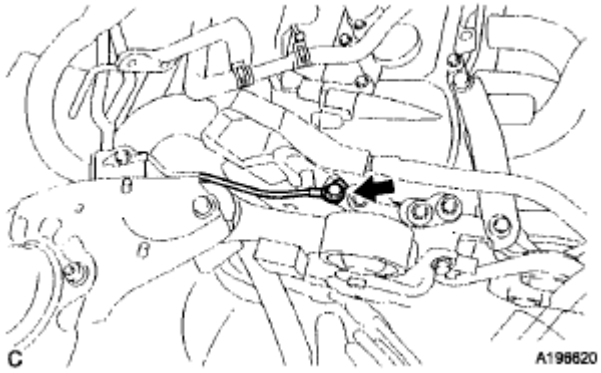


Fig. 237: Locating Ground Cable Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Disconnect the 2 clamps, remove the nut and separate the positive (+) cable.

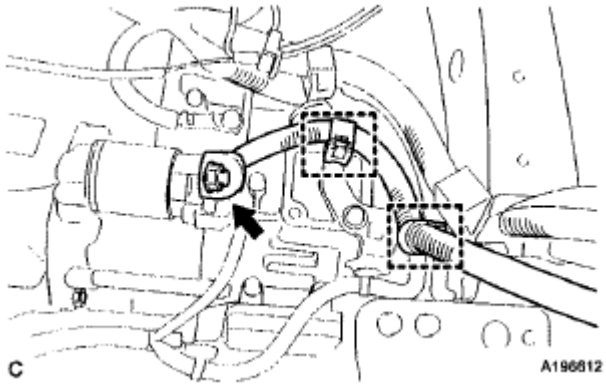


Fig. 238: Locating Positive (+) Cable Nut With Clamps

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

j. Disconnect the 4 ECM connectors, 2 junction block connectors and clamp.

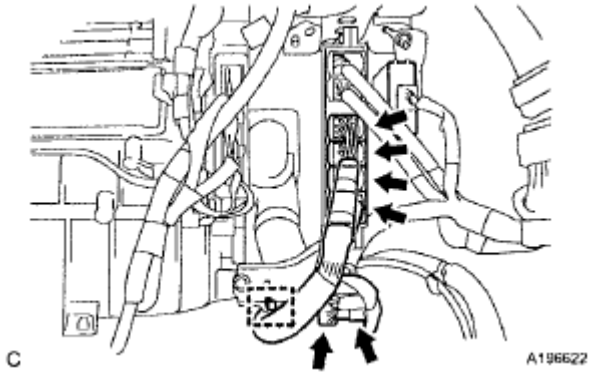


Fig. 239: Locating ECM Connectors, Junction Block Connectors With Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

k. Remove the 2 nuts and clamp, and separate the engine wire.

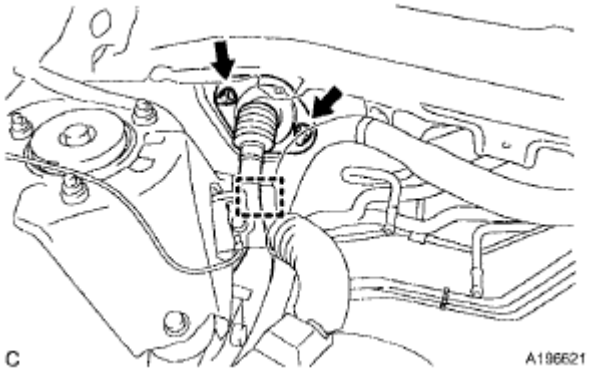


Fig. 240: Locating Engine Wire Nuts With Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. **REMOVE NO. 2 ENGINE MOUNTING STAY RH**
    a. Remove the 2 bolts and No. 2 engine mounting stay RH.

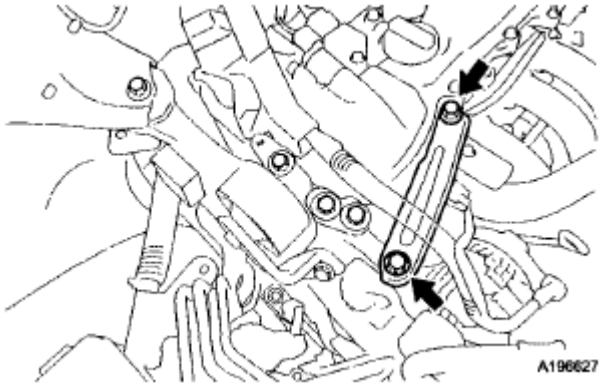


Fig. 241: Locating No. 2 Engine Mounting Stay RH Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. **REMOVE ENGINE MOVING CONTROL ROD**
    a. Remove the 4 bolts and engine moving control rod.

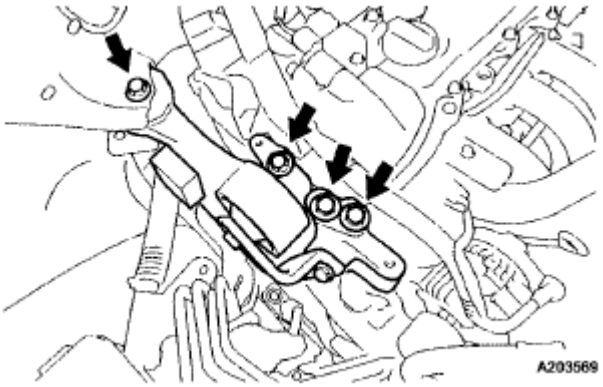


Fig. 242: Locating Engine Moving Control Rod Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. **DISCONNECT UNION TO CHECK VALVE HOSE**
    a. Disconnect the 2 union to check valve hoses.
47. **DISCONNECT SUCTION HOSE SUB-ASSEMBLY** (See **REMOVAL**)
48. **DISCONNECT DISCHARGE HOSE SUB-ASSEMBLY** (See **REMOVAL**)
49. **SECURE STEERING WHEEL** (See **REMOVAL**)
50. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** (See **REMOVAL**)

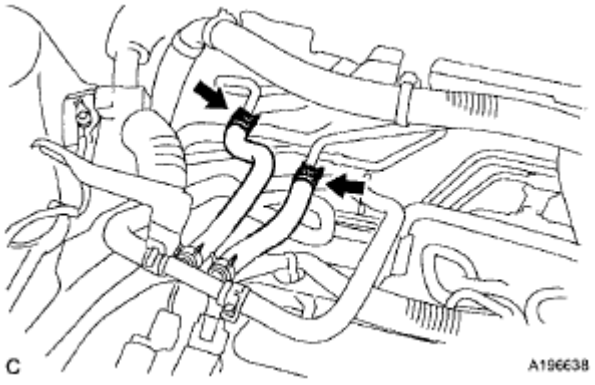


Fig. 243: Locating Union To Check Valve Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **SEPARATE FRONT STABILIZER LINK ASSEMBLY LH** (See **REMOVAL**)
52. **SEPARATE FRONT STABILIZER LINK ASSEMBLY RH**

    HINT:

    Perform the same procedure as for the LH side.

53. **REMOVE FRONT AXLE HUB NUT LH** (See **REMOVAL**)
54. **REMOVE FRONT AXLE HUB NUT RH**

    HINT:

    Perform the same procedure as for the LH side.

55. **SEPARATE FRONT SPEED SENSOR LH** (See **REMOVAL**)
56. **SEPARATE FRONT SPEED SENSOR RH**

    HINT:

    Perform the same procedure as for the LH side.

57. **SEPARATE TIE ROD ASSEMBLY LH** (See **REMOVAL**)
58. **SEPARATE TIE ROD ASSEMBLY RH**

    HINT:

    Perform the same procedure as for the LH side.

59. **SEPARATE NO. 1 FRONT LOWER SUSPENSION ARM LH** (See **REMOVAL**)
60. **SEPARATE NO. 1 FRONT LOWER SUSPENSION ARM RH**

HINT:

Perform the same procedure as for the LH side.

61. **SEPARATE FRONT AXLE ASSEMBLY LH** (See **REMOVAL**)
62. **SEPARATE FRONT AXLE ASSEMBLY RH**

HINT:

Perform the same procedure as for the LH side.

63. **SEPARATE STEERING INTERMEDIATE SHAFT SUB-ASSEMBLY** (See **REMOVAL**)
64. **REMOVE FLYWHEEL HOUSING UNDER COVER**
    a. Remove the flywheel housing under cover.

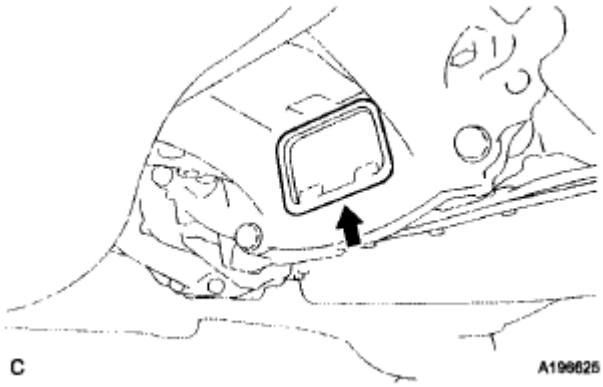


Fig. 244: Locating Flywheel Housing Under Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

65. **REMOVE DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT**
    a. Using SST, hold the crankshaft pulley.

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

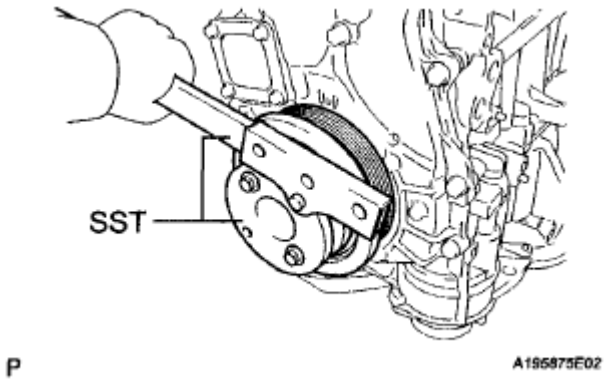


Fig. 245: Holding Crankshaft Pulley Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 6 drive plate and torque converter clutch setting bolts.

HINT:

There is one black colored bolt.

66. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**

a. Set the engine lifter.

Fig. 246: Locating Torque Converter Clutch Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 6 bolts, 2 nuts, and frame side rail plates RH and LH.

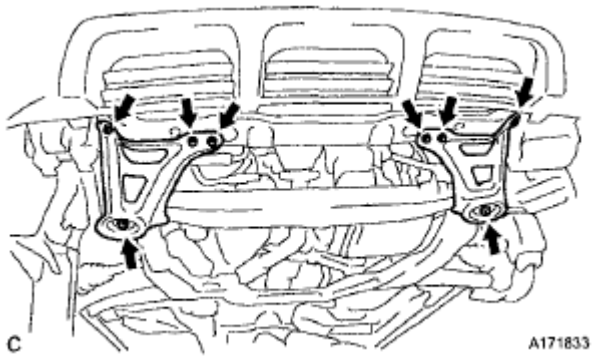


Fig. 247: Locating Frame Side Rail Plates Bolts And Nuts (RH And LH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 6 bolts, 2 nuts, and front suspension member rear braces RH and LH.
d. Operate the engine lifter, then remove the engine assembly with transaxle from the vehicle.

NOTE: Make sure that the engine is clear of all wiring and hoses.

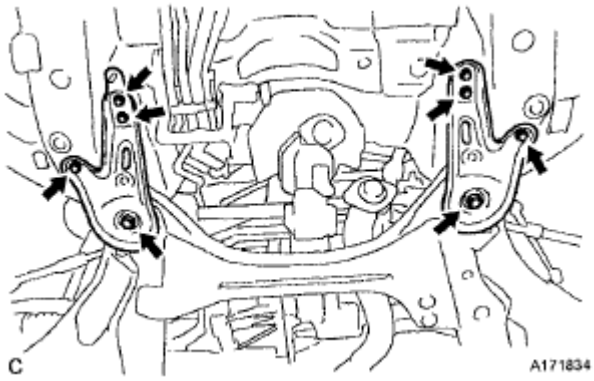


Fig. 248: Locating Front Suspension Member Rear Braces Bolts And Nuts (RH And LH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

67. **INSTALL ENGINE HANGERS**
    a. Install the 2 engine hangers with the 2 bolts as shown in the illustration.

PART REFERENCE

Item	Part No.
No. 1 engine hanger	12281-36020
No. 2 engine hanger	12282-36020
Bolt	91552-81040, 91552-81025

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

HINT:

Fit the fork part of the No. 2 engine hanger onto the rib of the cylinder head.

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

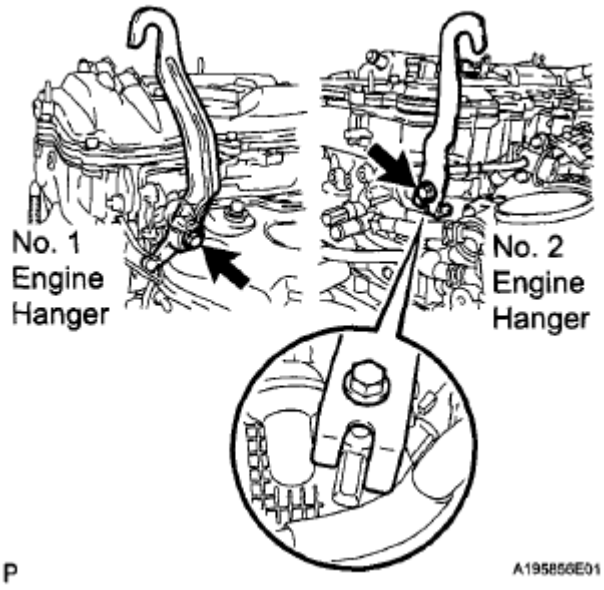


Fig. 249: Locating Engine Hangers Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

68. **REMOVE ENGINE WIRE**
69. **REMOVE V-RIBBED BELT** (See **INSTALLATION**)
70. **REMOVE GENERATOR ASSEMBLY** (See **REMOVAL**)
71. **REMOVE COMPRESSOR ASSEMBLY WITH PULLEY** (See **REMOVAL**)
72. **REMOVE STARTER ASSEMBLY** (See **REMOVAL**)
73. **REMOVE FRONT DRIVE SHAFT ASSEMBLY LH** (See **REMOVAL**)
74. **REMOVE FRONT DRIVE SHAFT HOLE SNAP RING LH** (See **DISASSEMBLY**)
75. **REMOVE FRONT DRIVE SHAFT ASSEMBLY RH** (See **DISASSEMBLY**)
76. **REMOVE DRIVE SHAFT BEARING BRACKET**
    a. Remove the 3 bolts and drive shaft bearing bracket.
77. **REMOVE FRONT FRAME ASSEMBLY**
    a. Loosen the 3 nuts.

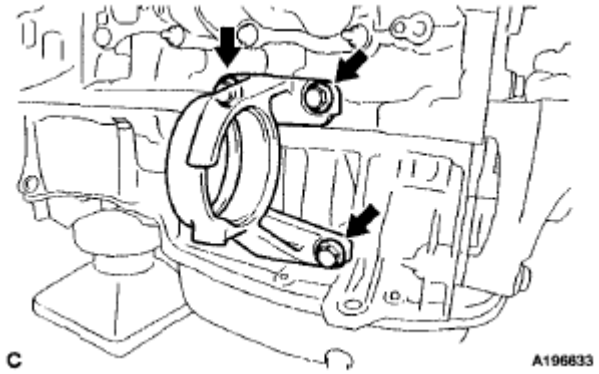


Fig. 250: Locating Drive Shaft Bearing Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

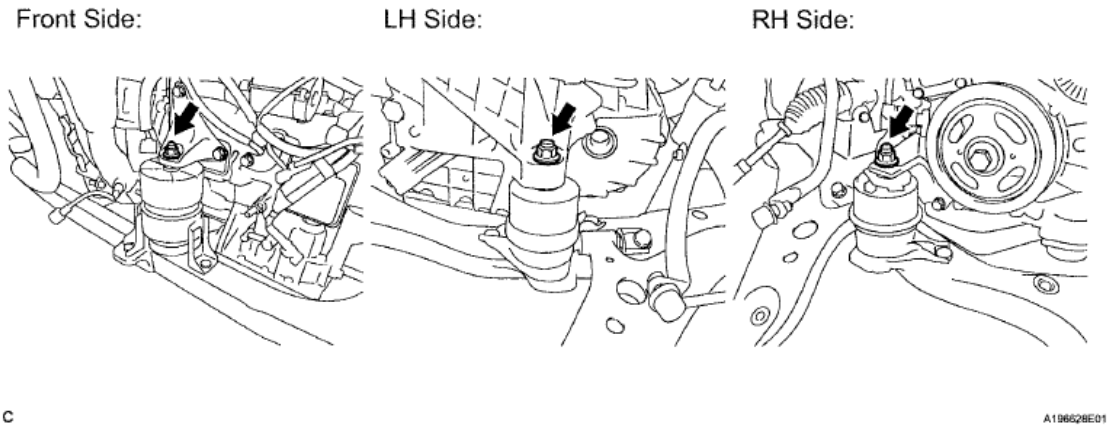


Fig. 251: Locating Front Frame Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 5 hole plugs.

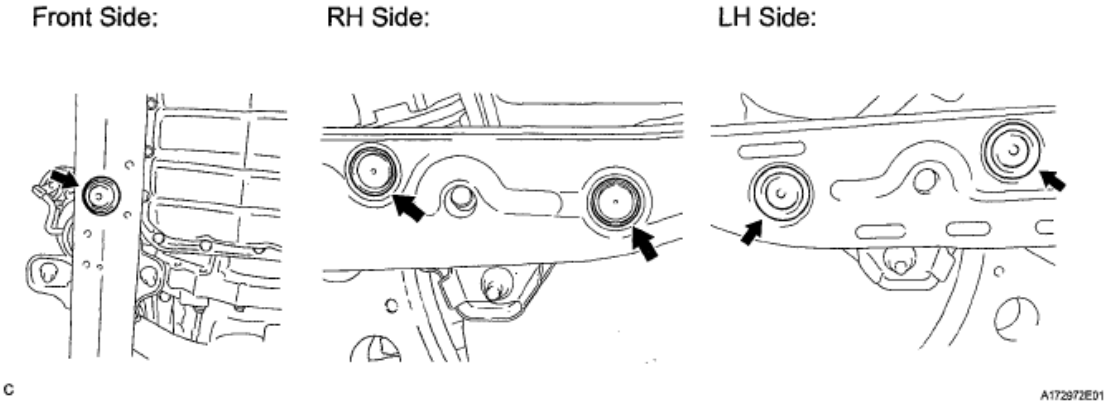


Fig. 252: Locating Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 9 nuts, and separate the front frame assembly.

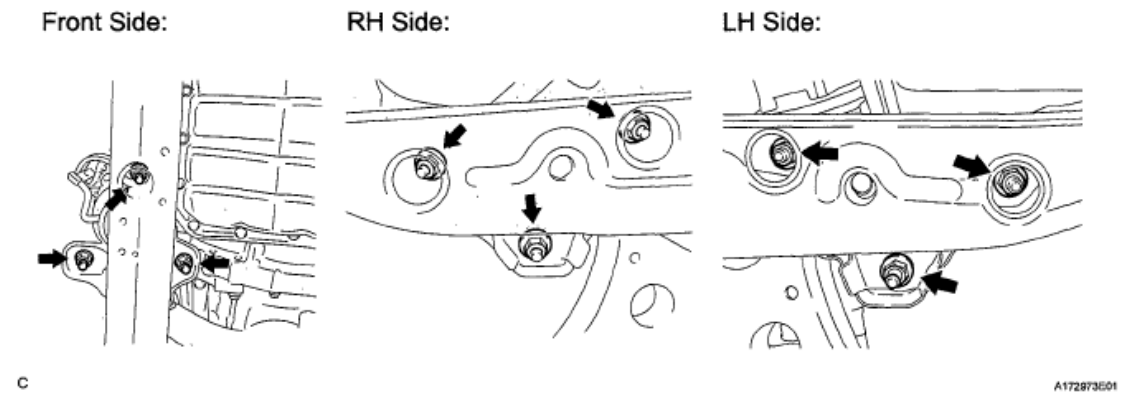


Fig. 253: Locating Front Frame Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

78. **REMOVE FRONT ENGINE MOUNTING INSULATOR**
    a. Remove the nut and front engine mounting insulator.

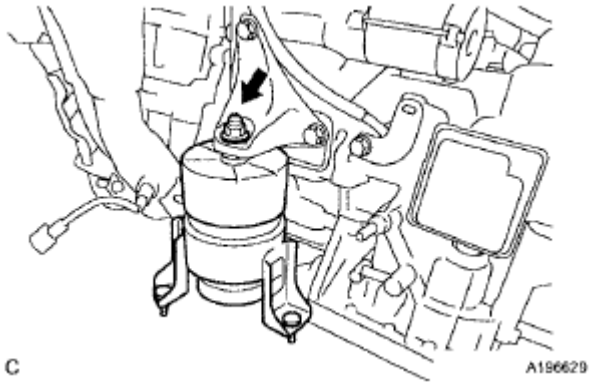


Fig. 254: Locating Front Engine Mounting Insulator Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

79. **REMOVE ENGINE MOUNTING INSULATOR LH**
    a. Remove the nut and engine mounting insulator LH.

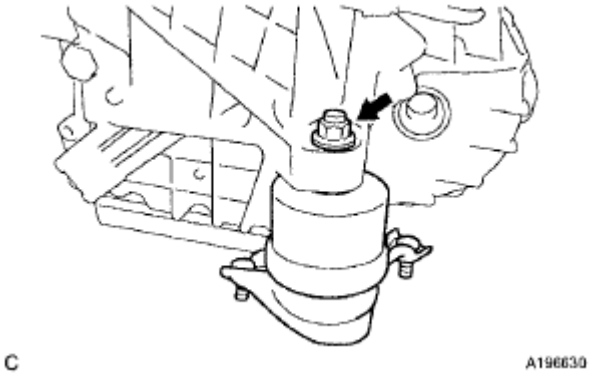


Fig. 255: Locating Engine Mounting Insulator LH Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

80. **REMOVE ENGINE MOUNTING INSULATOR RH**
    a. Remove the nut and engine mounting insulator RH.

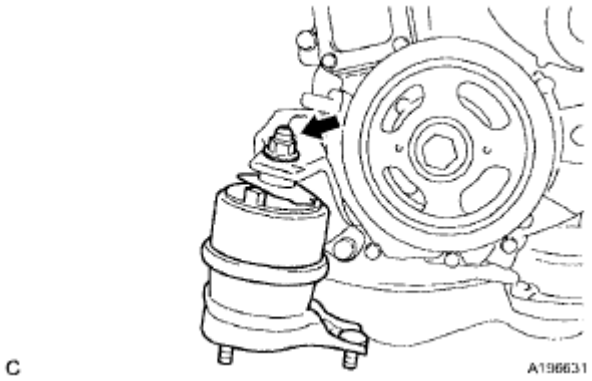


Fig. 256: Locating Engine Mounting Insulator RH Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

81. **REMOVE ENGINE MOUNTING BRACKET RH**
    a. Remove the 3 bolts and engine mounting bracket RH.
82. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY** (See **DISASSEMBLY**)
83. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** (See **REMOVAL**)
84. **INSTALL ENGINE ON ENGINE STAND**
    a. Install the engine onto an engine stand with the bolts.

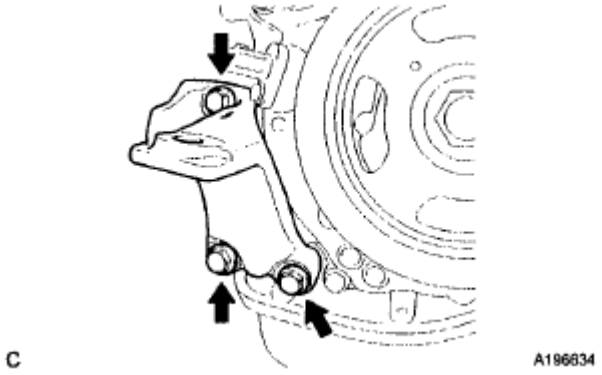


Fig. 257: Locating Engine Mounting Bracket RH Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

85. **REMOVE ENGINE HANGERS**
    a. Remove the 2 bolts and No. 1 and No. 2 engine hangers.

INSTALLATION

1. **INSTALL ENGINE HANGERS** (See **INSTALLATION**)
2. **REMOVE ENGINE STAND**
3. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** (See **ENGINE ASSEMBLY**)
4. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY** (See **DISASSEMBLY**)

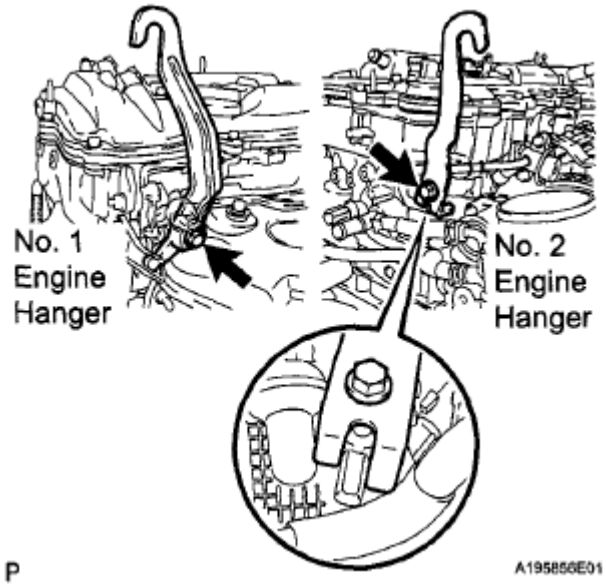


Fig. 258: Locating Engine Hangers Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL ENGINE MOUNTING BRACKET RH**
   a. Install the engine mounting bracket RH with the 3 bolts.

      Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

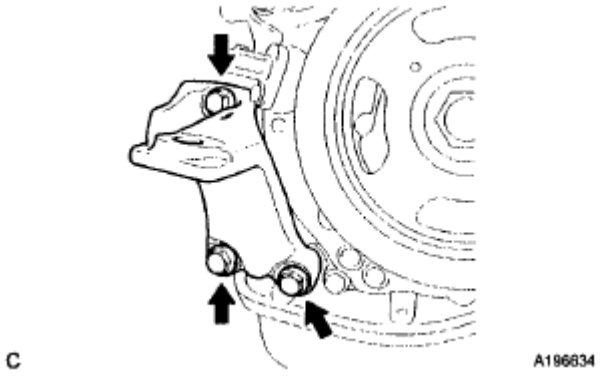


Fig. 259: Locating Engine Mounting Bracket RH Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. **TEMPORARILY INSTALL FRONT ENGINE MOUNTING INSULATOR**

a. Temporarily install the front engine mounting insulator with the nut.

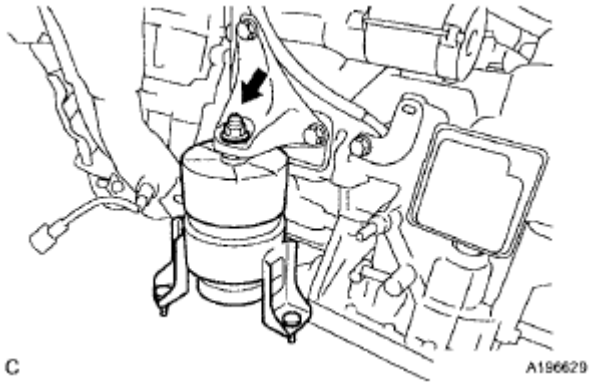


Fig. 260: Locating Front Engine Mounting Insulator Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **TEMPORARILY INSTALL ENGINE MOUNTING INSULATOR LH**
   a. Temporarily install the engine mounting insulator LH with the nut.

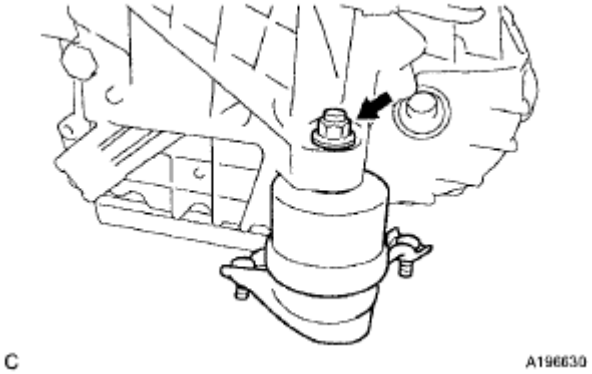


Fig. 261: Locating Engine Mounting Insulator LH Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **TEMPORARILY INSTALL ENGINE MOUNTING INSULATOR RH**
   a. Temporarily install the engine mounting insulator RH with the nut.
9. **INSTALL FRONT FRAME ASSEMBLY**
   a. Install the engine assembly with transaxle with the 9 nuts.

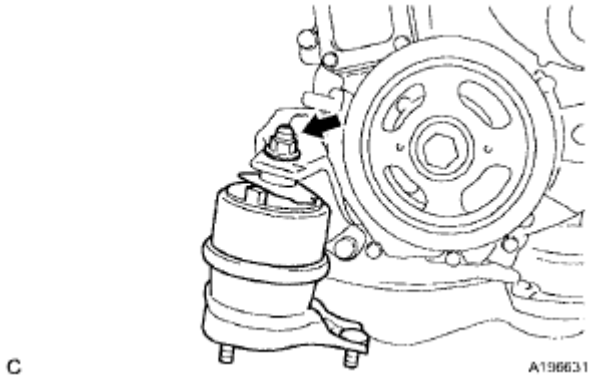


Fig. 262: Locating Engine Mounting Insulator RH Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

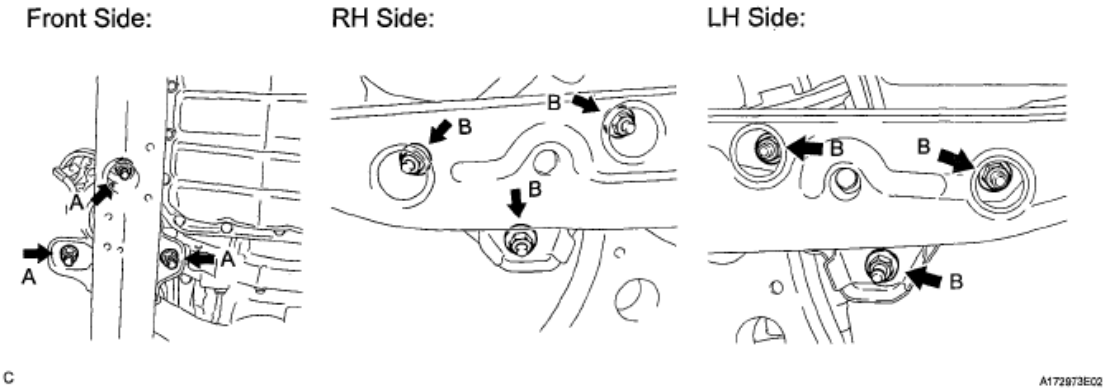


Fig. 263: Locating Engine Assembly With Transaxle Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: A

52 N*m (531 kgf*cm, 39 ft.*lbf)

B

87 N*m (887 kgf*cm, 64 ft.*lbf)

b. Tighten the 3 nuts.

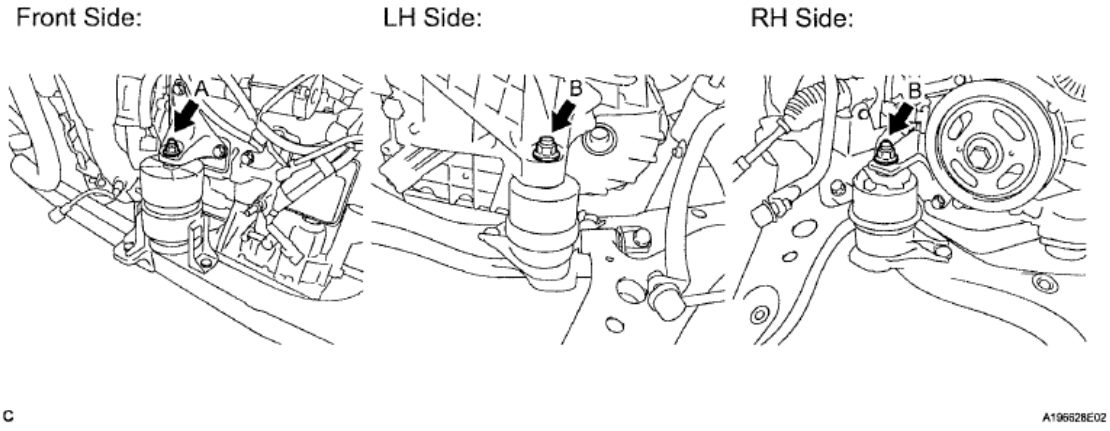


Fig. 264: Locating Front Frame Assembly Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: A

87 N*m (887 kgf*cm, 64 ft.*lbf)

B

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

c. Install the 5 hole plugs.

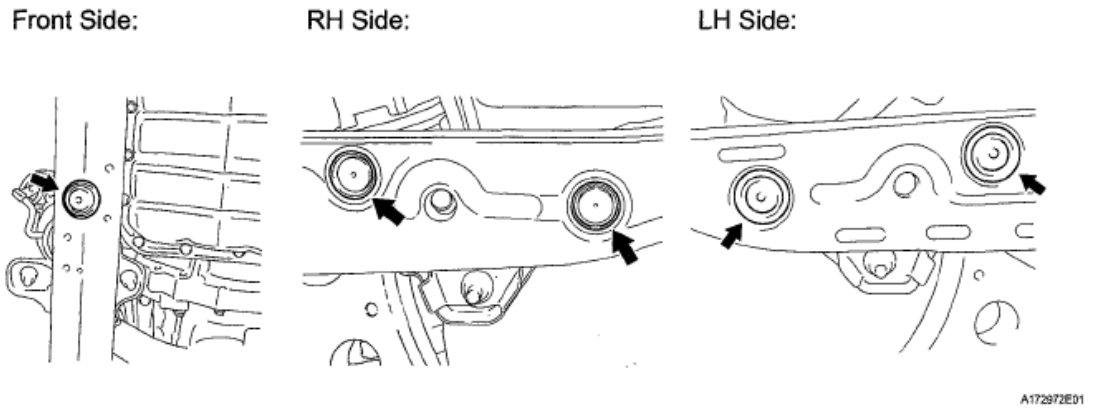


Fig. 265: Locating Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **INSTALL DRIVE SHAFT BEARING BRACKET**
    a. Install the drive shaft bearing bracket with the 3 bolts.

       Torque: 64 N*m (650 kgf*cm, 47 ft.*lbf)

11. **INSTALL FRONT DRIVE SHAFT HOLE SNAP RING LH** (See **REASSEMBLY**)

12. **INSTALL FRONT DRIVE SHAFT ASSEMBLY LH** (See **INSTALLATION**)
13. **INSTALL FRONT DRIVE SHAFT ASSEMBLY RH** (See **INSTALLATION**)
14. **INSTALL STARTER ASSEMBLY** (See **INSTALLATION**)
15. **INSTALL COMPRESSOR AND MAGNETIC CLUTCH** (See **INSTALLATION**)

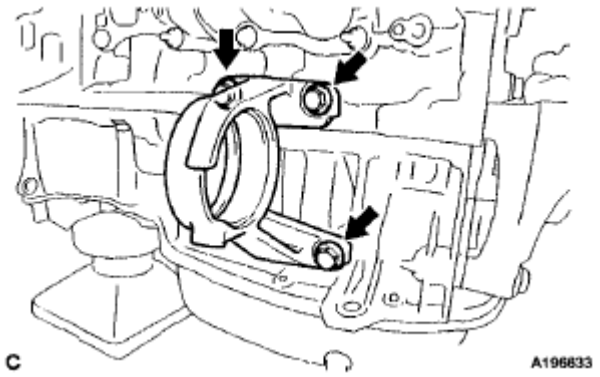


Fig. 266: Locating Drive Shaft Bearing Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **INSTALL GENERATOR ASSEMBLY** (See **INSTALLATION**)
17. **INSTALL V-RIBBED BELT** (See **INSTALLATION**)
18. **INSTALL ENGINE WIRE**
19. **INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**
    a. Set the engine assembly with transaxle on the engine lifter.
    b. Remove engine hangers (See **INSTALLATION**).
    c. Install the engine assembly to the vehicle.
    d. Install the frame side rail plates RH and LH with the 6 bolts and 2 nuts.

    Torque: Bolt A

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

    Bolt B

    32 N*m (327 kgf*cm, 24 ft.*lbf)

    Nut C

    32 N*m (327 kgf*cm, 24 ft.*lbf)

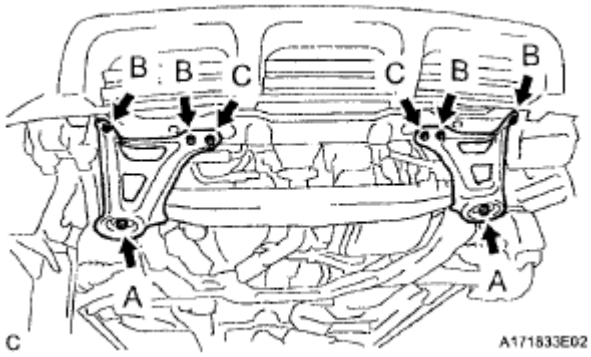


Fig. 267: Locating Frame Side Rail Plates Bolts And Nuts (RH And LH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Install the front suspension member rear braces RH and LH with the 6 bolts and 2 nuts.

Torque: Bolt A

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

Bolt B

32 N*m (327 kgf*cm, 24 ft.*lbf)

Nut C

32 N*m (327 kgf*cm, 24 ft.*lbf)

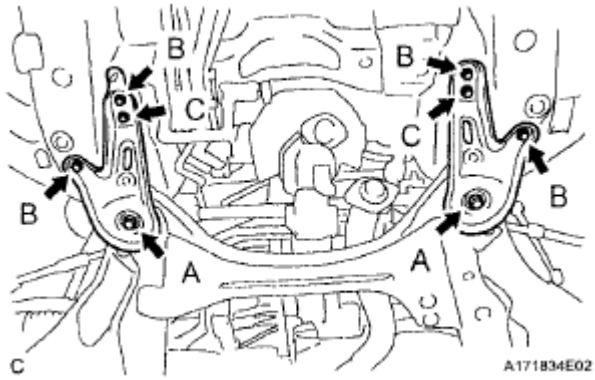


Fig. 268: Locating Front Suspension Member Rear Braces Bolts And Nuts (RH And LH)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **INSTALL DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT**

a. Using SST, hold the crankshaft pulley.

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

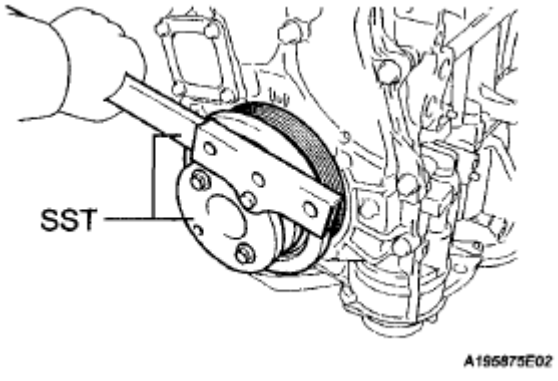


Fig. 269: Holding Crankshaft Pulley Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Apply a few drops of adhesive to the 2 or 3 end threads of the 6 drive plate and torque converter clutch setting bolts.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

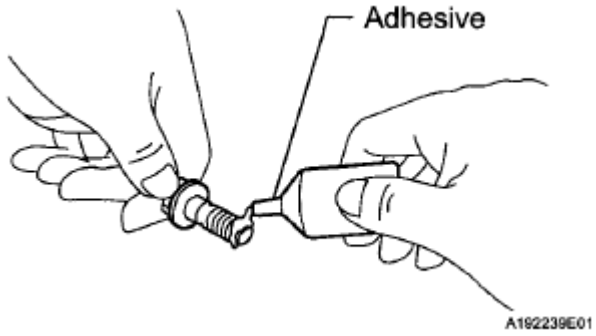


Fig. 270: Applying Drops Of Adhesive To End Threads Of Drive Plate And Torque Converter Clutch Setting Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the 6 drive plate and torque converter clutch setting bolts.

Torque: 41 N*m (418 kgf*cm, 30 ft.*lbf)

NOTE: Install the black colored bolt first, and then the 5 silver colored bolts.

Fig. 271: Locating Torque Converter Clutch Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. **INSTALL FLYWHEEL HOUSING UNDER COVER**
    a. Install the flywheel housing under cover.
22. **CONNECT STEERING INTERMEDIATE SHAFT SUB-ASSEMBLY** (See **INSTALLATION**)
23. **INSTALL FRONT AXLE ASSEMBLY LH** (See **INSTALLATION**)
24. **INSTALL FRONT AXLE ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

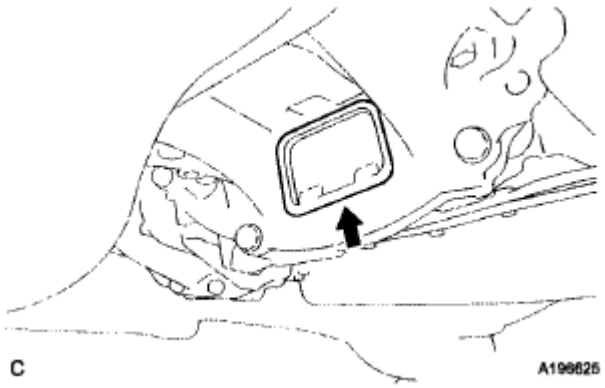


Fig. 272: Locating Flywheel Housing Under Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. **INSTALL NO. 1 FRONT LOWER SUSPENSION ARM LH** (See **INSTALLATION**)
26. **INSTALL NO. 1 FRONT LOWER SUSPENSION ARM RH**

    HINT:

    Use the same procedure described for the LH side.

27. **CONNECT TIE ROD ASSEMBLY LH** (See **INSTALLATION**)
28. **CONNECT TIE ROD ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

29. **INSTALL FRONT SPEED SENSOR LH** (See **INSTALLATION**)
30. **INSTALL FRONT SPEED SENSOR RH**

    HINT:

    Use the same procedure described for the LH side.

31. **INSTALL FRONT AXLE HUB NUT LH** (See **INSTALLATION**)
32. **INSTALL FRONT AXLE HUB NUT RH**

    HINT:

    Use the same procedure described for the LH side.

33. **INSTALL FRONT STABILIZER LINK ASSEMBLY LH** (See **INSTALLATION**)
34. **INSTALL FRONT STABILIZER LINK ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

35. **INSTALL FRONT EXHAUST PIPE ASSEMBLY** (See **INSTALLATION**)
36. **CONNECT DISCHARGE HOSE SUB-ASSEMBLY** (See **INSTALLATION**)
37. **CONNECT SUCTION HOSE SUB-ASSEMBLY** (See **INSTALLATION**)
38. **CONNECT UNION TO CHECK VALVE HOSE**
    a. Connect the 2 union to check valve hoses.

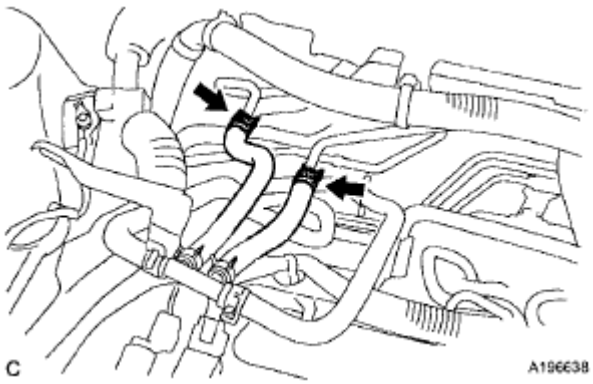


Fig. 273: Locating Union To Check Valve Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. **INSTALL ENGINE MOVING CONTROL ROD**
    a. Temporarily install the engine moving control rod with the 4 bolts.

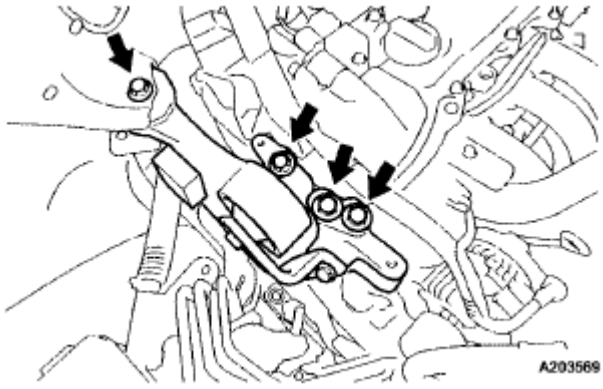


Fig. 274: Locating Engine Moving Control Rod Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Temporarily install the No. 2 engine mounting stay with the 2 bolts.
    c. Tighten the 6 bolts.

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

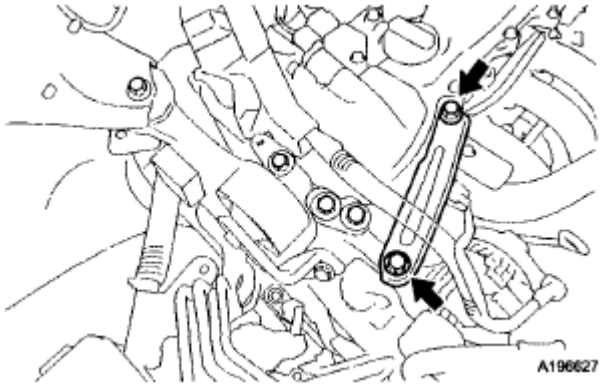


Fig. 275: Locating No. 2 Engine Mounting Stay RH Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **CONNECT ENGINE WIRE**
    a. Connect the 4 ECM connectors, 2 junction block connectors and clamp.

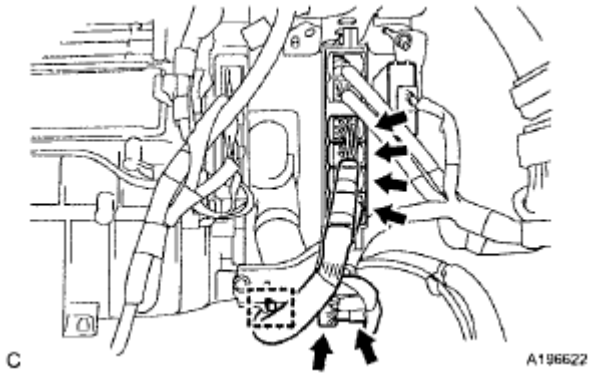


Fig. 276: Locating ECM Connectors, Junction Block Connectors With Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the engine wire with the 2 nuts and clamp.

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

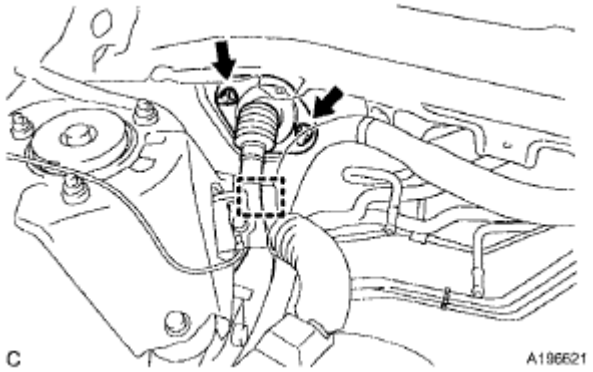


Fig. 277: Locating Engine Wire Nuts With Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the ground cable with the bolt.

Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)

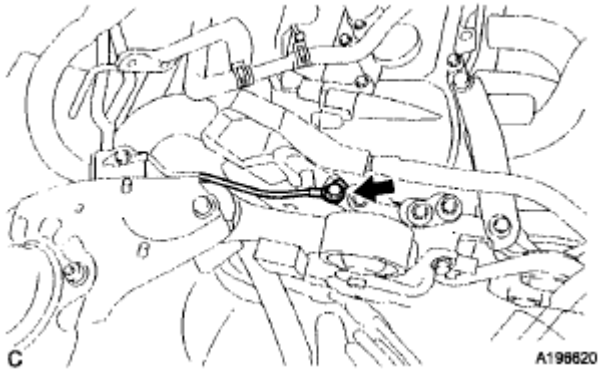


Fig. 278: Locating Ground Cable Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

d. Install the ground cable with the 2 bolts.

Torque: A

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

B

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

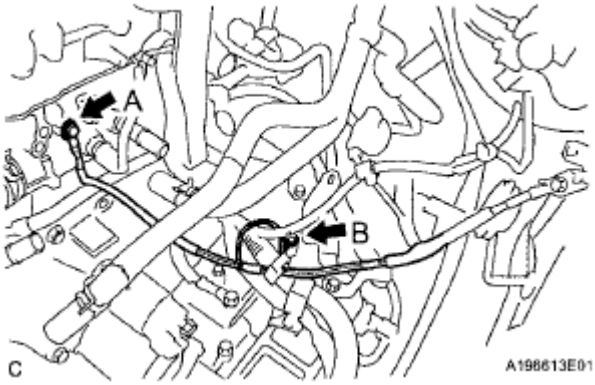


Fig. 279: Locating Ground Cable Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Install the positive (+) cable with the nut and 2 clamps.

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

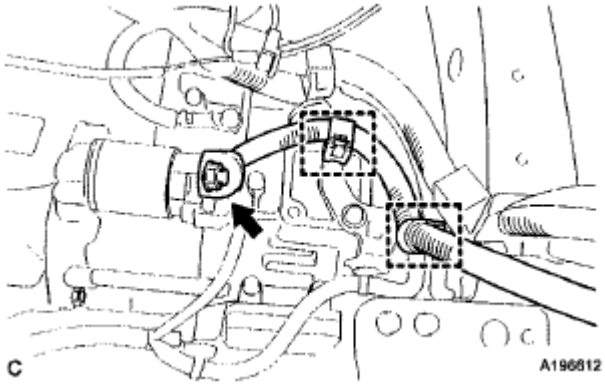


Fig. 280: Locating Positive (+) Cable Nut With Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Install the ground cable with the bolt.

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

g. Connect the engine wire clamp.

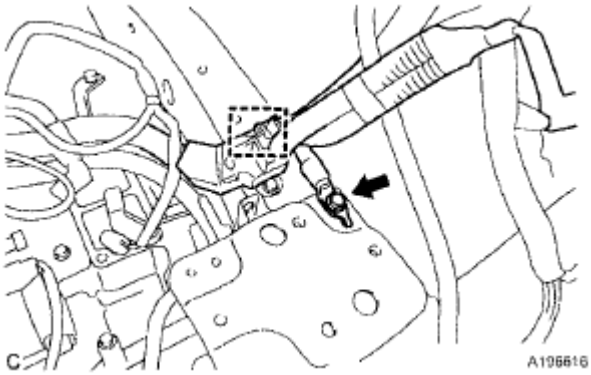


Fig. 281: Locating Ground Cables Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Connect the engine wire clamp.

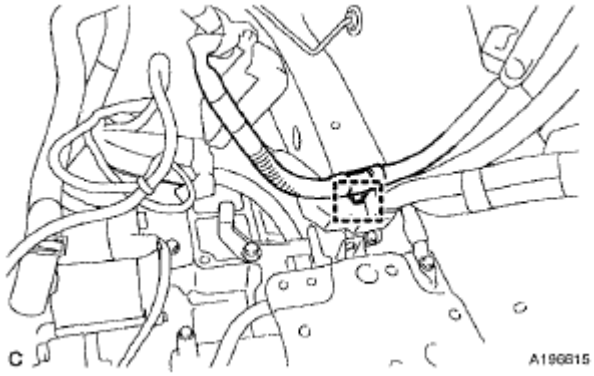


Fig. 282: Identifying Engine Wire Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

i. Connect the engine wire to the engine room relay block.

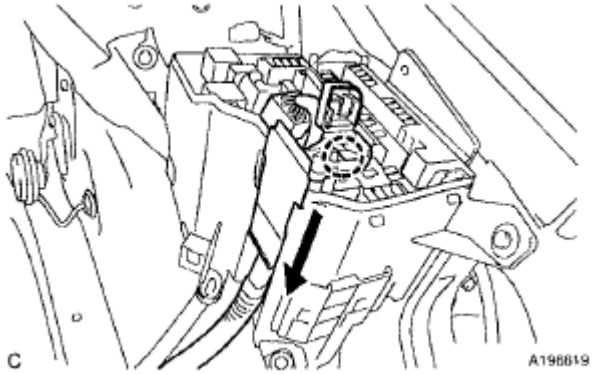


Fig. 283: Connecting Engine Wire To Engine Room Relay Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

j. Install the nut, and connect the engine wire connector.

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

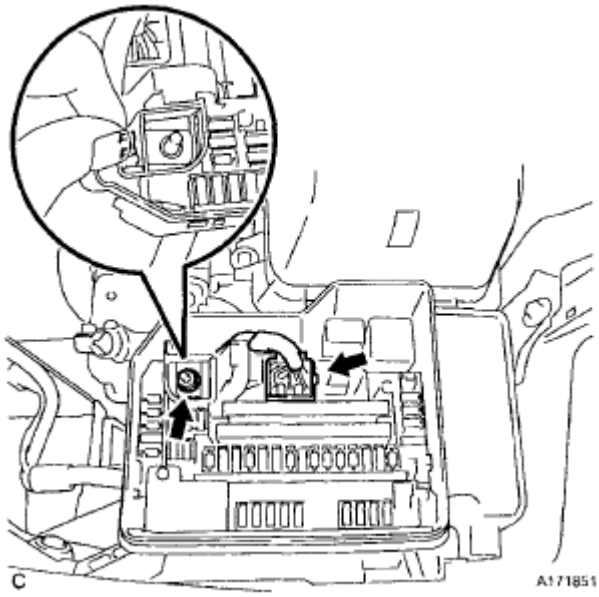


Fig. 284: Locating Nut And Engine Wire Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

k. Install the No. 1 relay block cover.

41. **CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**

a. Install a new clip to the control cable bracket.

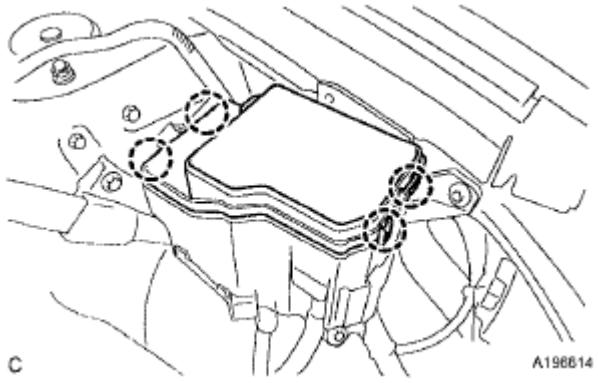


Fig. 285: Identifying No. 1 Relay Block Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the control cable to the control cable bracket.

NOTE:

- **Make sure that the A claws on the clip are securely fit into the bracket holes.**
- **Make sure that the cable is securely installed inside the B claws of the clip.**

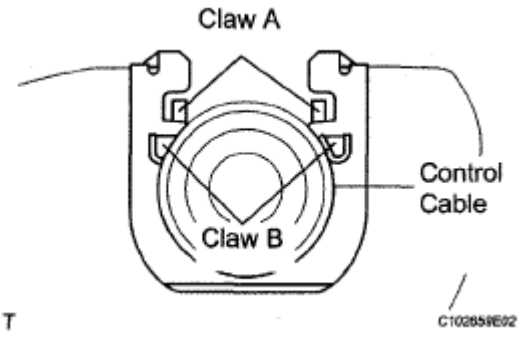


Fig. 286: Identifying Control Cable With Claw
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Torque: 12 N*m (120 kgf*cm, 9 ft.*lbf)

NOTE: **Before connecting the transmission control cable assembly, check that the park/neutral position switch and the shift lever are in N.**

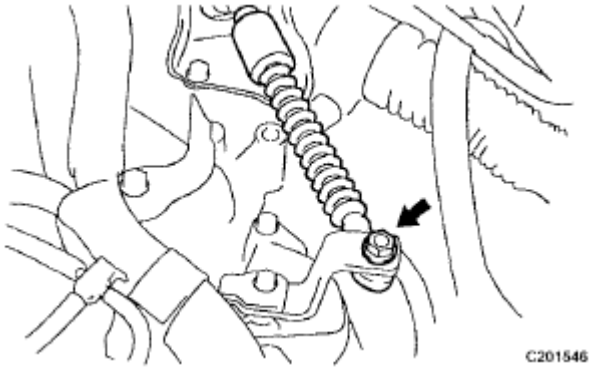


Fig. 287: Locating Control Shaft Lever Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. **CONNECT OUTLET OIL COOLER HOSE**
    a. Connect the outlet oil cooler hose.
43. **CONNECT INLET OIL COOLER HOSE**
    a. Connect the inlet oil cooler hose.

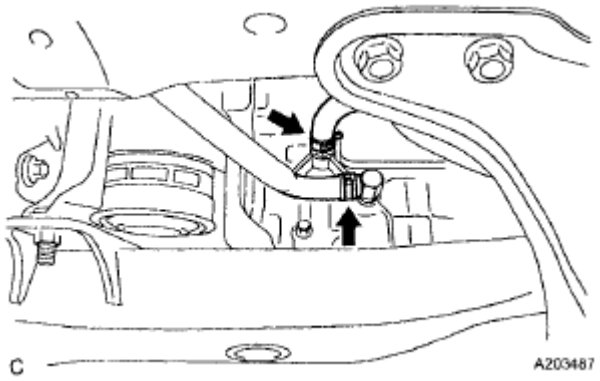


Fig. 288: Locating Inlet Oil Cooler Hose And Outlet Oil Cooler Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. **CONNECT FUEL TUBE SUB-ASSEMBLY**
    a. Push in the fuel tube connector to the fuel pipe until the fuel tube makes a "click" sound.

NOTE:

- **Check for damage or dirt and foreign objects on the connected part of the pipe.**
- **Check if the pipe and the connector are securely connected by trying to pull them apart.**

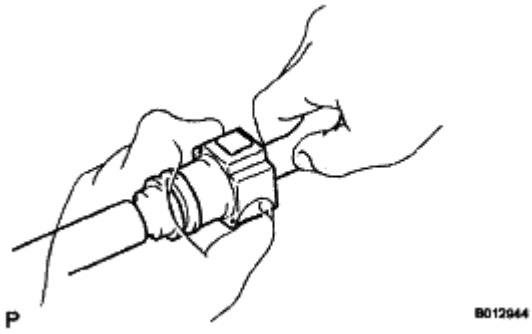


Fig. 289: Pushing Fuel Tube Connector To Fuel Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the No. 1 fuel pipe clamp.

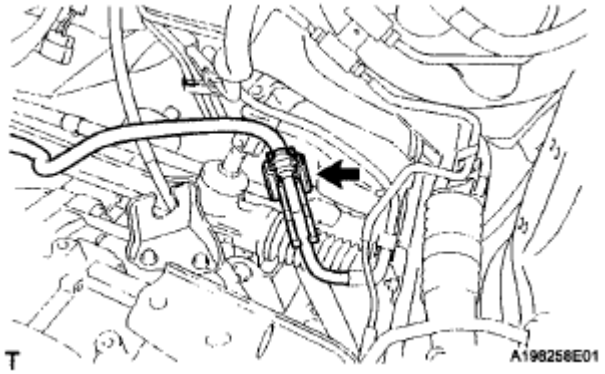


Fig. 290: Locating No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. **CONNECT OUTLET HEATER WATER HOSE**
    a. Connect the outlet heater water hose.

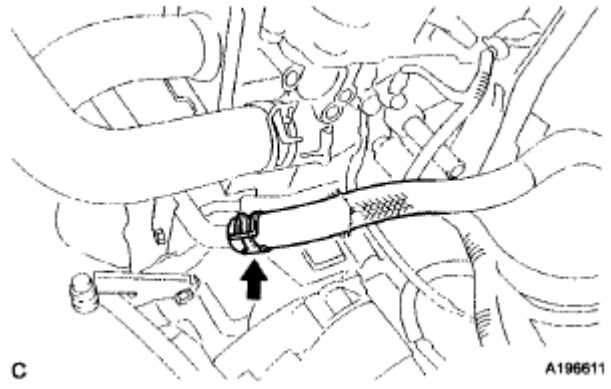


Fig. 291: Locating Outlet Heater Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

46. **CONNECT INLET HEATER WATER HOSE**
    a. Connect the inlet heater water hose.

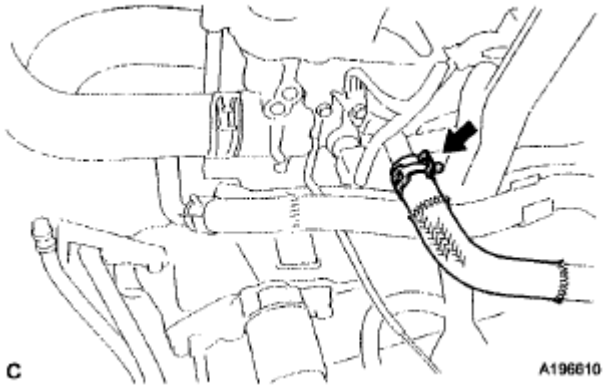


Fig. 292: Locating Inlet Heater Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

47. **CONNECT NO. 1 RADIATOR HOSE**
    a. Connect the No. 1 radiator hose.

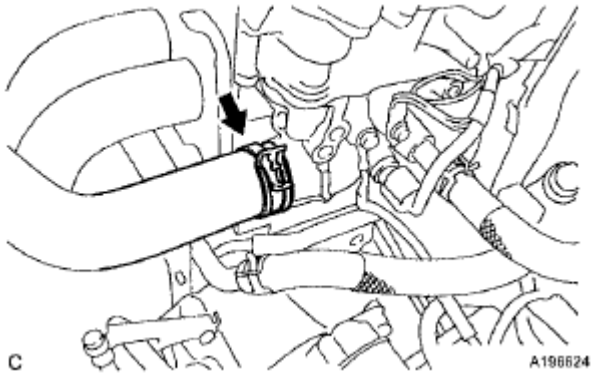


Fig. 293: Locating No. 1 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. **CONNECT NO. 2 RADIATOR HOSE**
    a. Connect the No. 2 radiator hose.

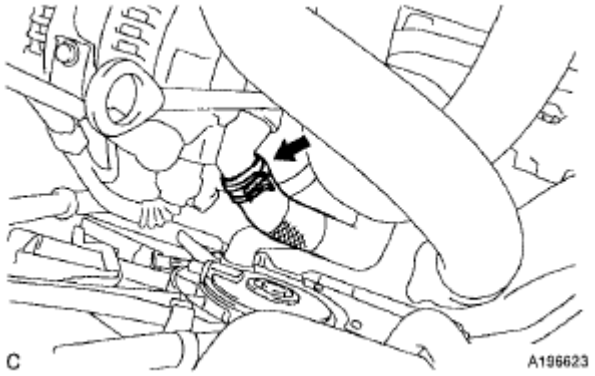


Fig. 294: Locating No. 2 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

49. **INSTALL RESERVOIR BRACKET**
    a. Install the reservoir bracket with the 2 bolts.

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

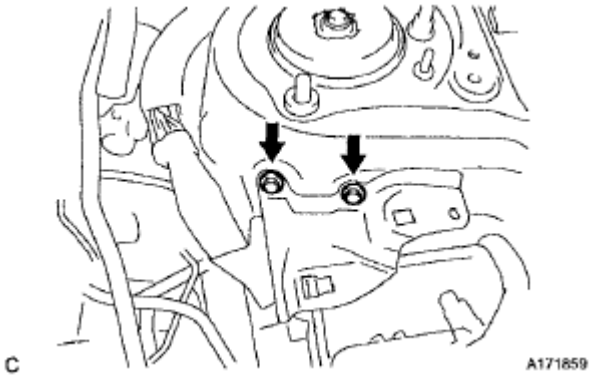


Fig. 295: Locating Reservoir Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

50. **INSTALL BRAKE MASTER CYLINDER RESERVOIR ASSEMBLY**
    a. Install the brake master cylinder reservoir assembly with the bolt.

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

    b. Connect the level warning switch connector.

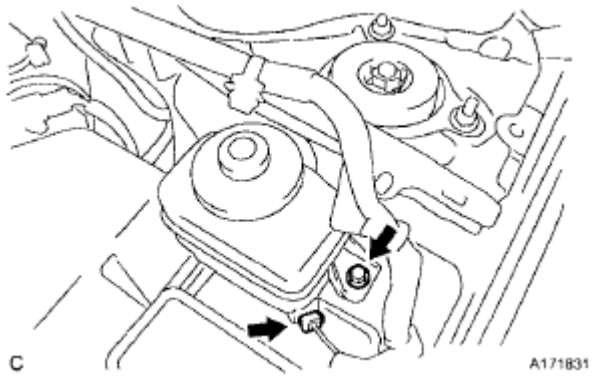


Fig. 296: Locating Level Warning Switch Connector And Brake Master Cylinder Reservoir Assembly Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **INSTALL NO. 1 INLET AIR CLEANER**
    a. Install the No. 1 inlet air cleaner with the bolt.

       Torque: 7.0 N*m (72 kgf*cm, 62 in.*lbf)

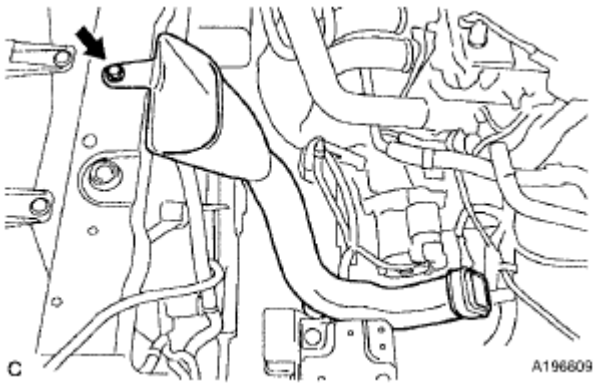


Fig. 297: Locating No. 1 Inlet Air Cleaner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

52. **INSTALL AIR CLEANER BRACKET**
    a. Install the air cleaner bracket with the 2 bolts.

       Torque: 13 N*m (127 kgf*cm, 9 ft.*lbf)

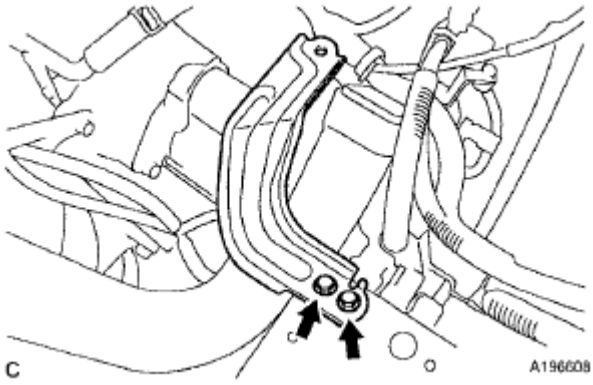


Fig. 298: Locating Air Cleaner Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY**
    a. Install the air cleaner case sub-assembly with the 3 bolts and 2 clamps.

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

54. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
    a. Install the air cleaner filter element sub-assembly.
55. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** (See **INSTALLATION**)

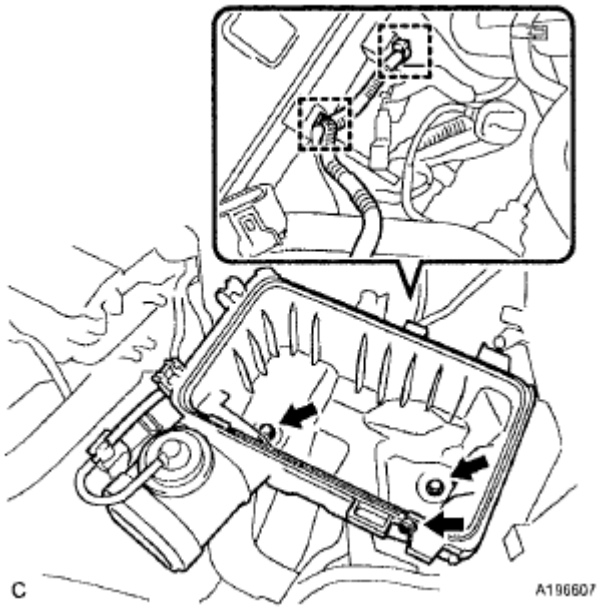


Fig. 299: Locating Air Cleaner Case Sub-Assembly Bolts With Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. **INSTALL NO. 2 INLET AIR CLEANER**
    a. Install the No. 2 inlet air cleaner with the 2 bolts.

Torque: 7.0 N*m (72 kgf*cm, 62 in.*lbf)

b. Connect the 2 clamps and vacuum hose.

57. **INSTALL BATTERY**
    a. Install the battery tray and battery.

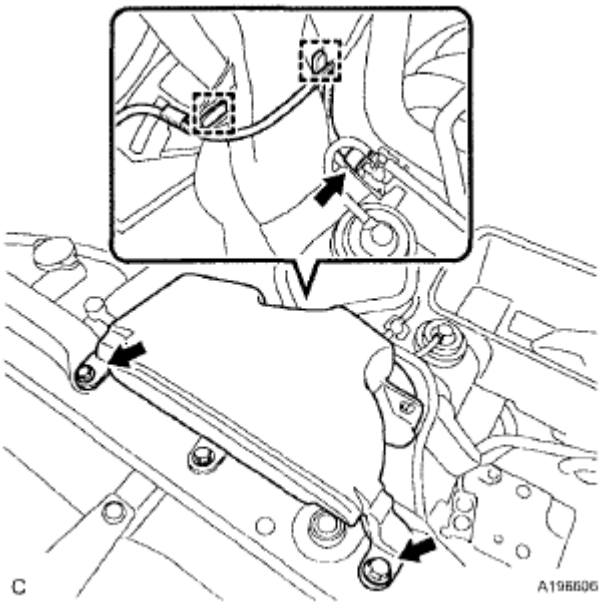


Fig. 300: Locating No. 2 Inlet Air Cleaner Bolts And Vacuum Hose With Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Install the battery clamp with the bolt and nut.

Torque: 5.4 N*m (55 kgf*cm, 47 in.*lbf)

    c. Install the positive (+) battery terminal with the nut.

Torque: 6.4 N*m (65 kgf*cm, 57 in.*lbf)

58. **INSTALL OUTER COWL TOP PANEL SUB-ASSEMBLY** (See **INSTALLATION**)
59. **INSTALL EJECTOR TUBE** (See **INSTALLATION**)
60. **INSTALL WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See **INSTALLATION**)

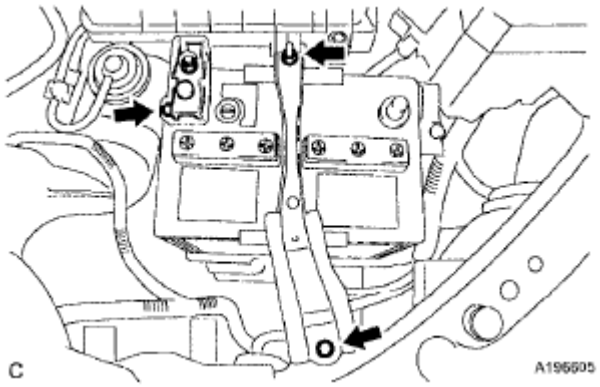


Fig. 301: Locating Positive (+) Battery Terminal And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. **INSTALL COWL TOP VENTILATOR LOUVER SUB-ASSEMBLY** (See **INSTALLATION**)
62. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY LH** (See **INSTALLATION**)
63. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY RH** (See **INSTALLATION**)
64. **INSTALL FRONT WHEELS**

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

65. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

    NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected (See INITIALIZATION).

66. **ADD ENGINE OIL** (See **REPLACEMENT**)
67. **ADD ENGINE COOLANT** (See **COOLANT**)
68. **ADD AUTOMATIC TRANSAXLE FLUID**

    HINT:

    See **DISASSEMBLY** .

69. **CHARGE WITH REFRIGERANT** (See **REPLACEMENT**)
70. **INSPECT FOR FUEL LEAK** (See **ON-VEHICLE INSPECTION**)
71. **INSPECT FOR OIL LEAK**
72. **INSPECT FOR COOLANT LEAK** (See **COOLING SYSTEM**)
73. **INSPECT FOR EXHAUST GAS LEAK**
74. **INSPECT FOR REFRIGERANT LEAK** (See **REPLACEMENT**)
75. **INSPECT AND ADJUST SHIFT LEVER POSITION**

    HINT:

See **INSPECTION** .

76. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT**

    HINT:

    See **FRONT WHEEL ALIGNMENT** .

77. **INSPECT IGNITION TIMING** (See **ENGINE**)
78. **INSPECT ENGINE IDLE SPEED** (See **DRIVE BELT**)
79. **INSPECT CO/HC** (See **DRIVE BELT**)
80. **INSTALL FRONT FENDER APRON SEAL RH**
    a. Install the front fender apron seal RH with the 2 bolts and clip.

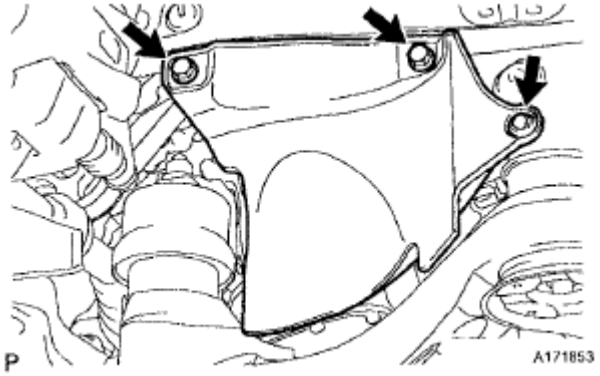


Fig. 302: Locating Front Fender Apron Seal RH Bolts And Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

81. **INSTALL FRONT FENDER APRON SEAL LH**
    a. Install the front fender apron seal LH with the 2 bolts and clip.
82. **INSTALL FRONT FENDER LINER LH** (See **INSTALLATION**)
83. **INSTALL FRONT FENDER LINER RH** (See **INSTALLATION**)
84. **INSTALL FRONT FENDER MOULDING SUB-ASSEMBLY LH** (See **INSTALLATION**)

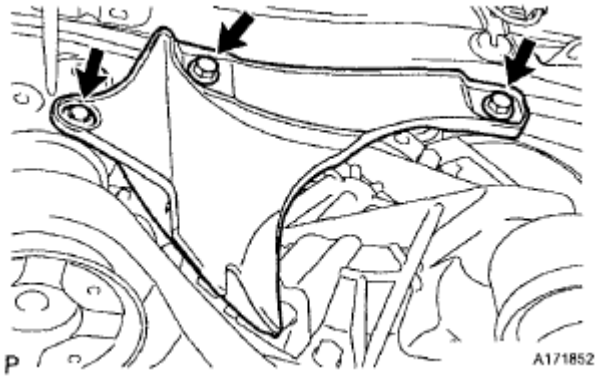


Fig. 303: Locating Front Fender Apron Seal LH Bolts And Clip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

85. **INSTALL FRONT FENDER MOULDING SUB-ASSEMBLY RH** (See **CAMSHAFT**)
86. **INSTALL FLOOR UNDER COVER LH**
87. **INSTALL NO. 2 ENGINE UNDER COVER**
88. **INSTALL NO. 1 ENGINE UNDER COVER**
89. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY**
    a. Fit the 3 retainers and install the No. 1 engine cover sub-assembly.

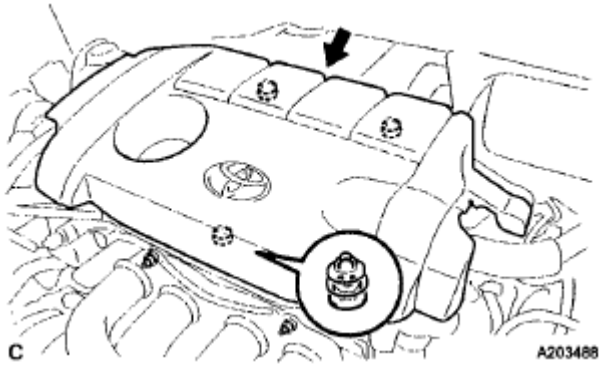


Fig. 304: Locating No. 1 Engine Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

90. **INSTALL COOL AIR INTAKE DUCT SEAL**
    a. Install the cool air intake duct seal with the 11 clips.
91. **CHECK ABS SPEED SENSOR SIGNAL**

    HINT:

    See **TEST MODE PROCEDURE** .

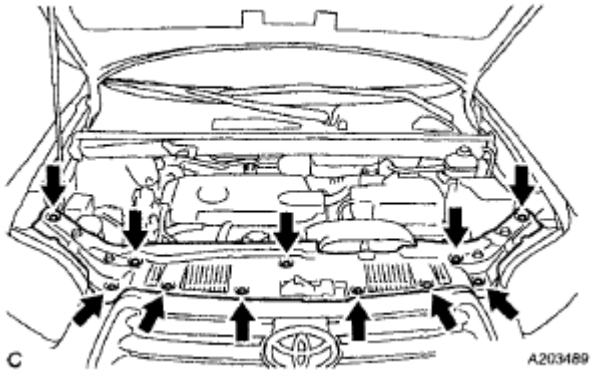


Fig. 305: Locating Cool Air Intake Duct Seal Clips
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ENGINE UNIT

COMPONENTS

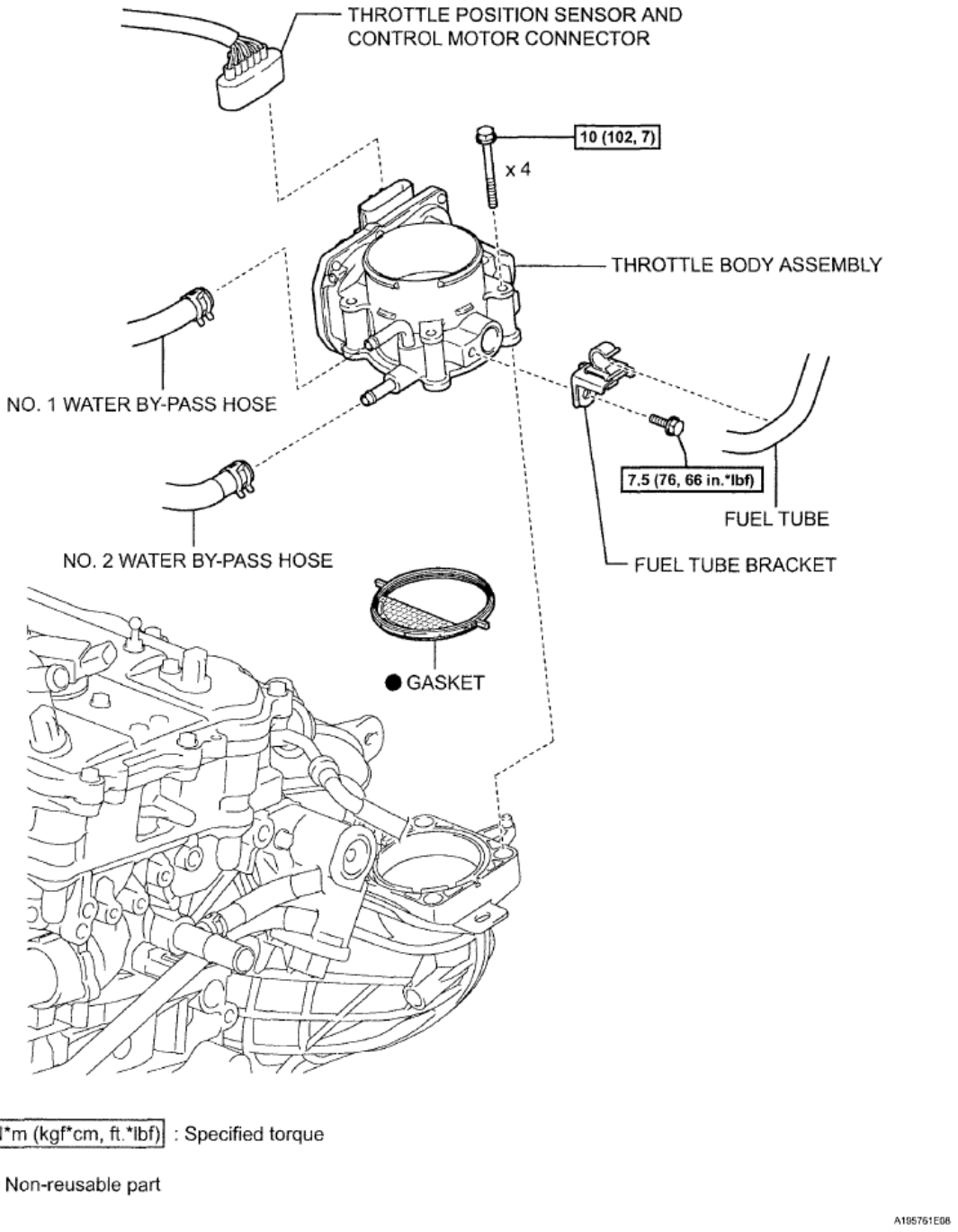


Fig. 306: Identifying Engine Unit Components With Torque Specification (1 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

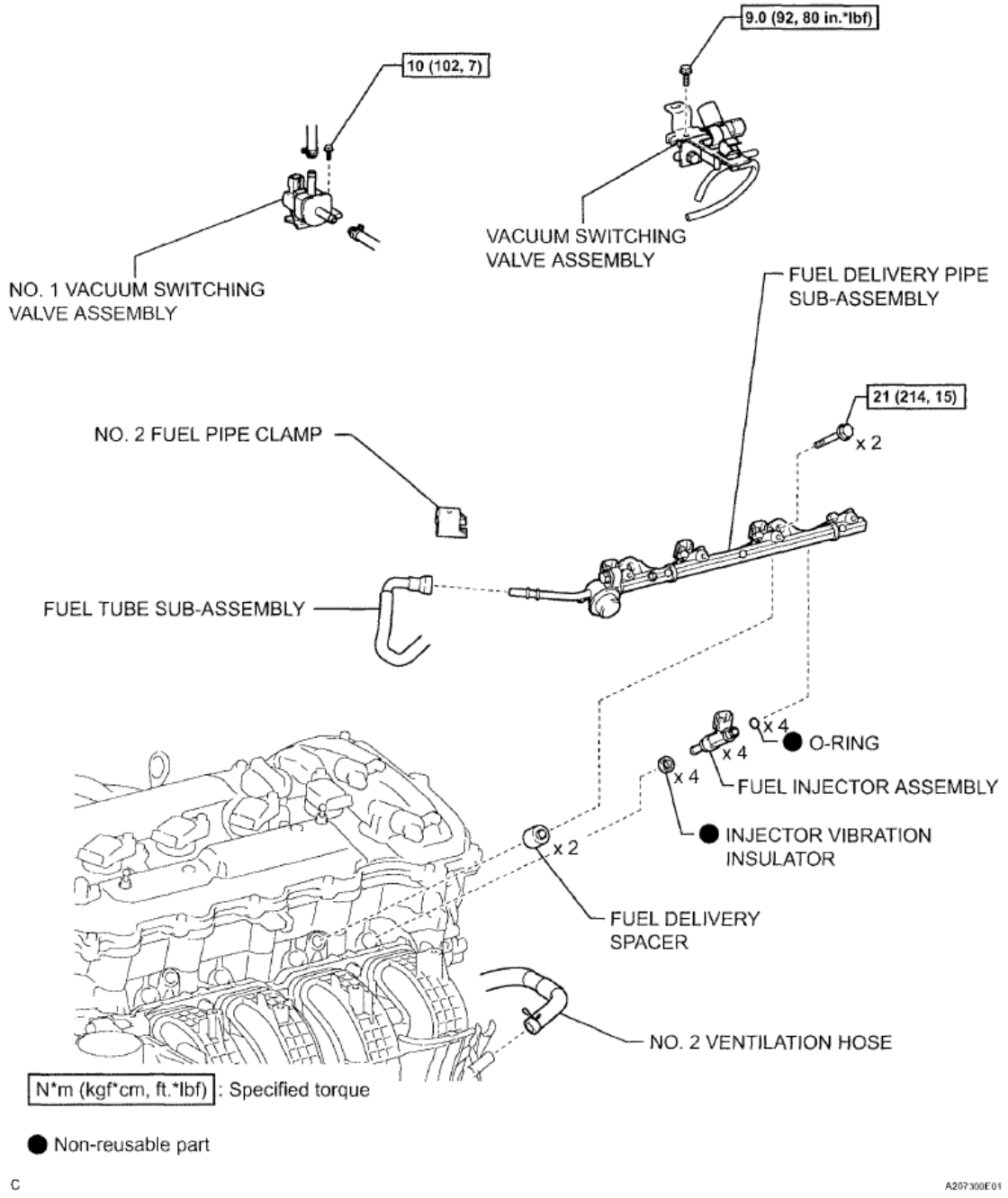


Fig. 307: Identifying Engine Unit Components With Torque Specification (2 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

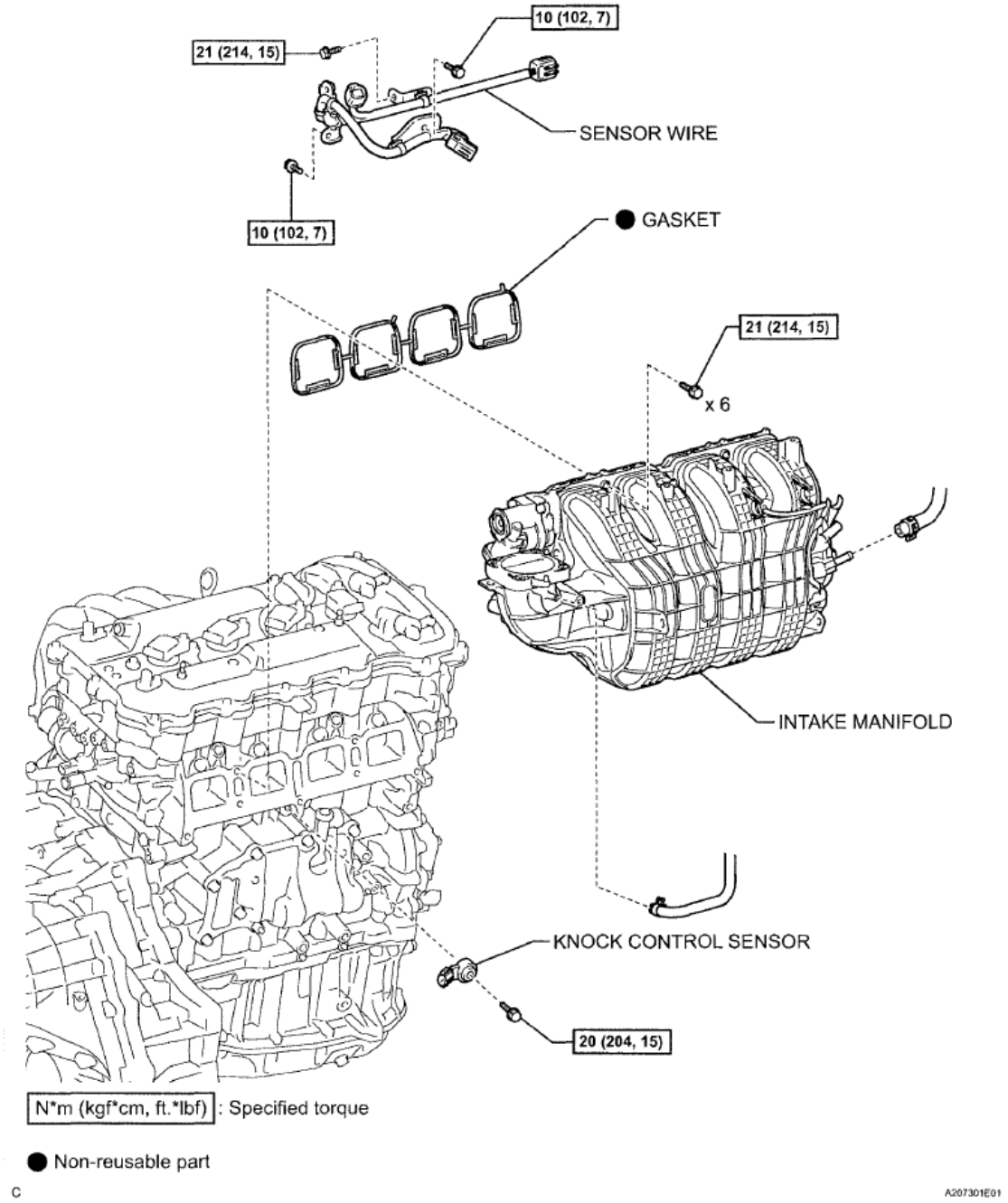


Fig. 308: Identifying Engine Unit Components With Torque Specification (3 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

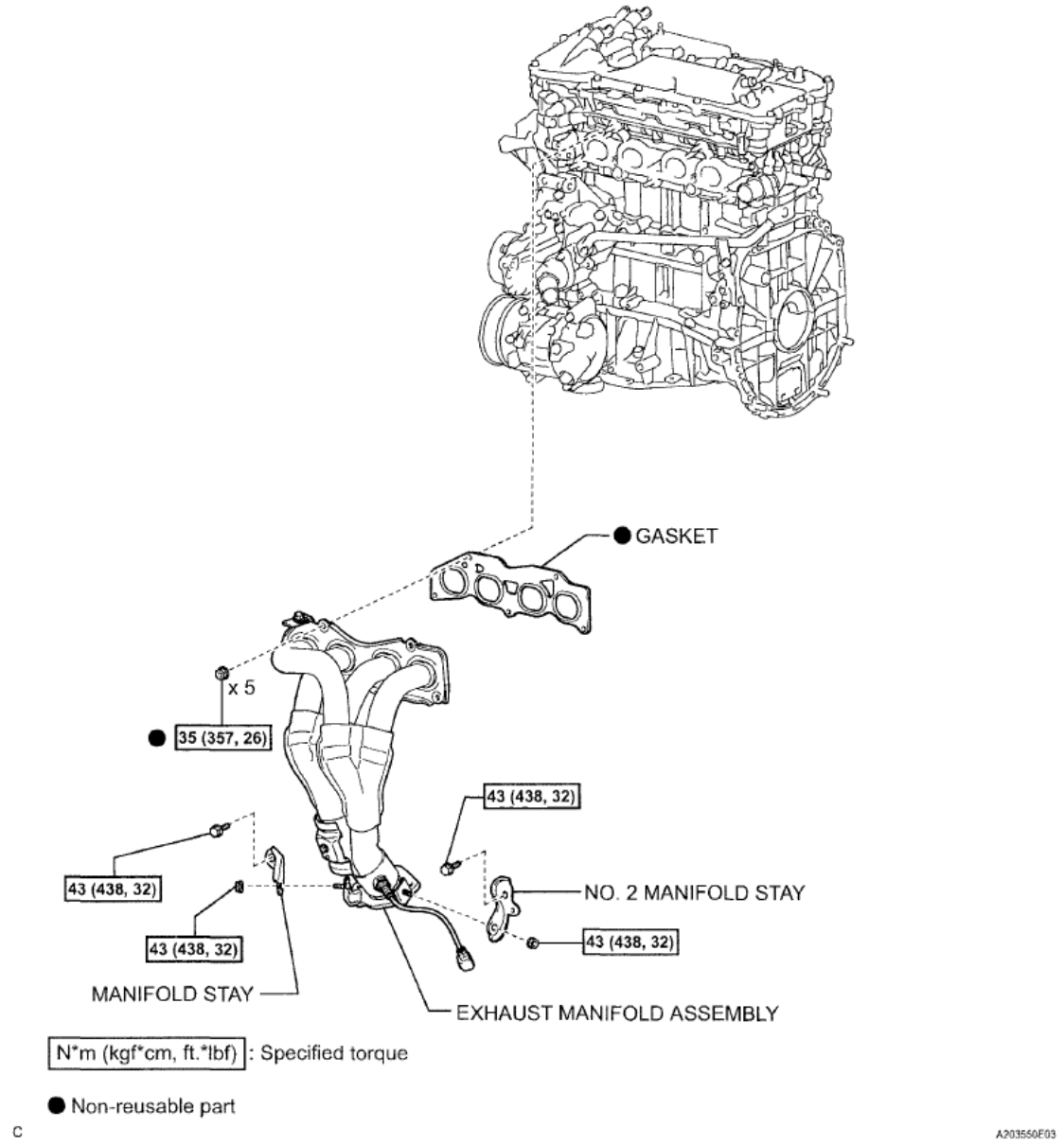


Fig. 309: Identifying Engine Unit Components With Torque Specification (4 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

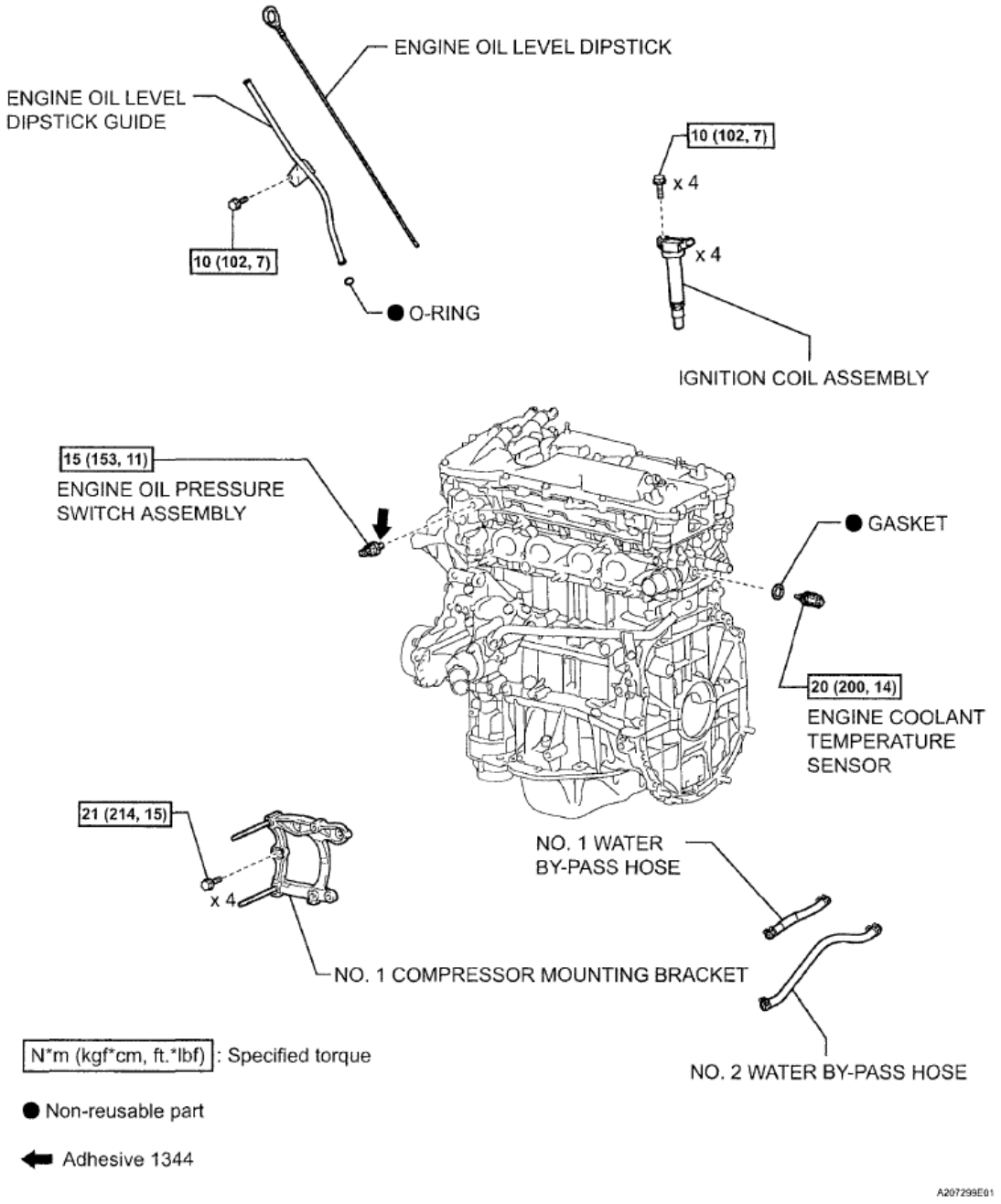


Fig. 310: Identifying Engine Unit Components With Torque Specification (5 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

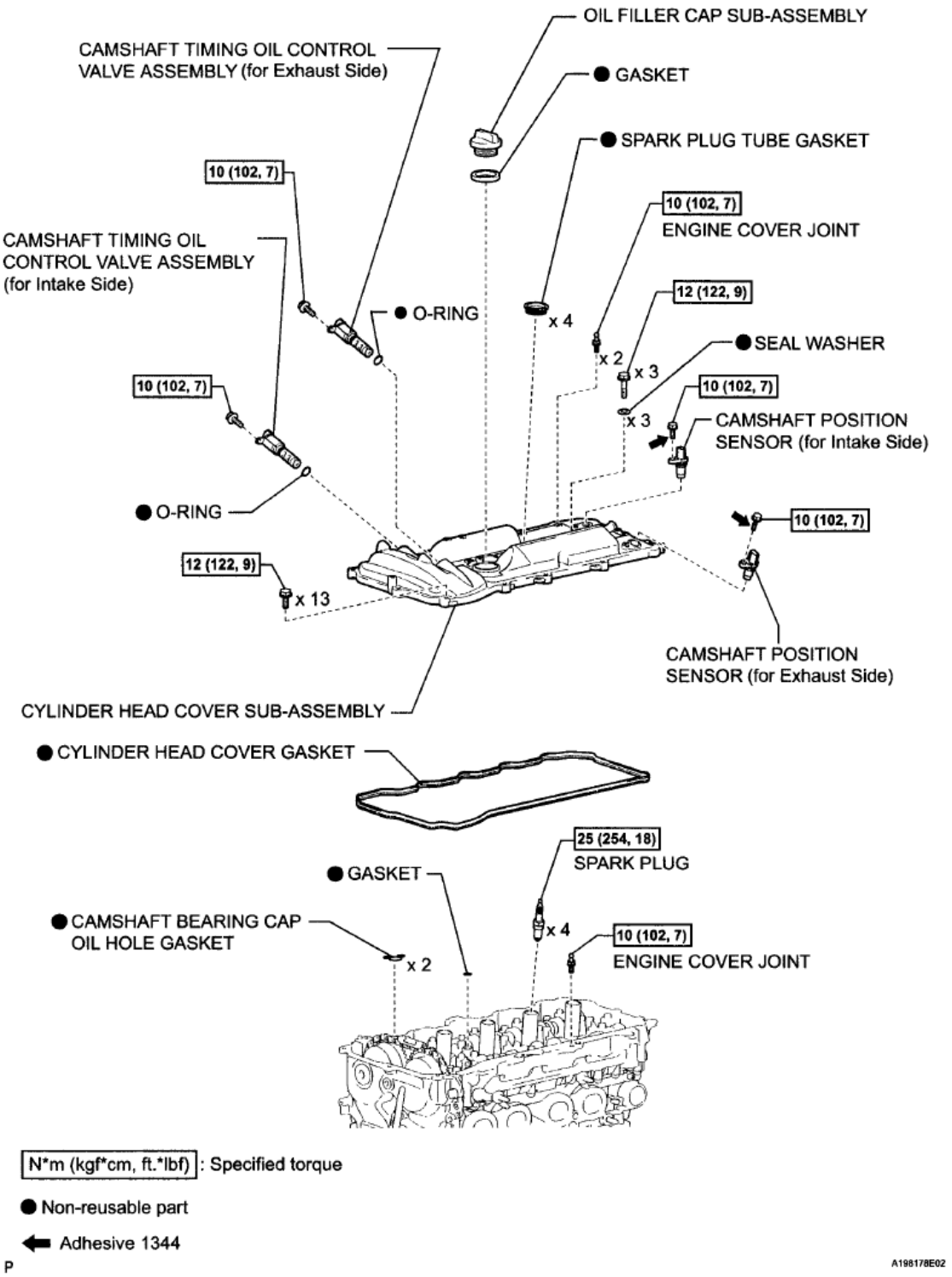


Fig. 311: Identifying Engine Unit Components With Torque Specification (6 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

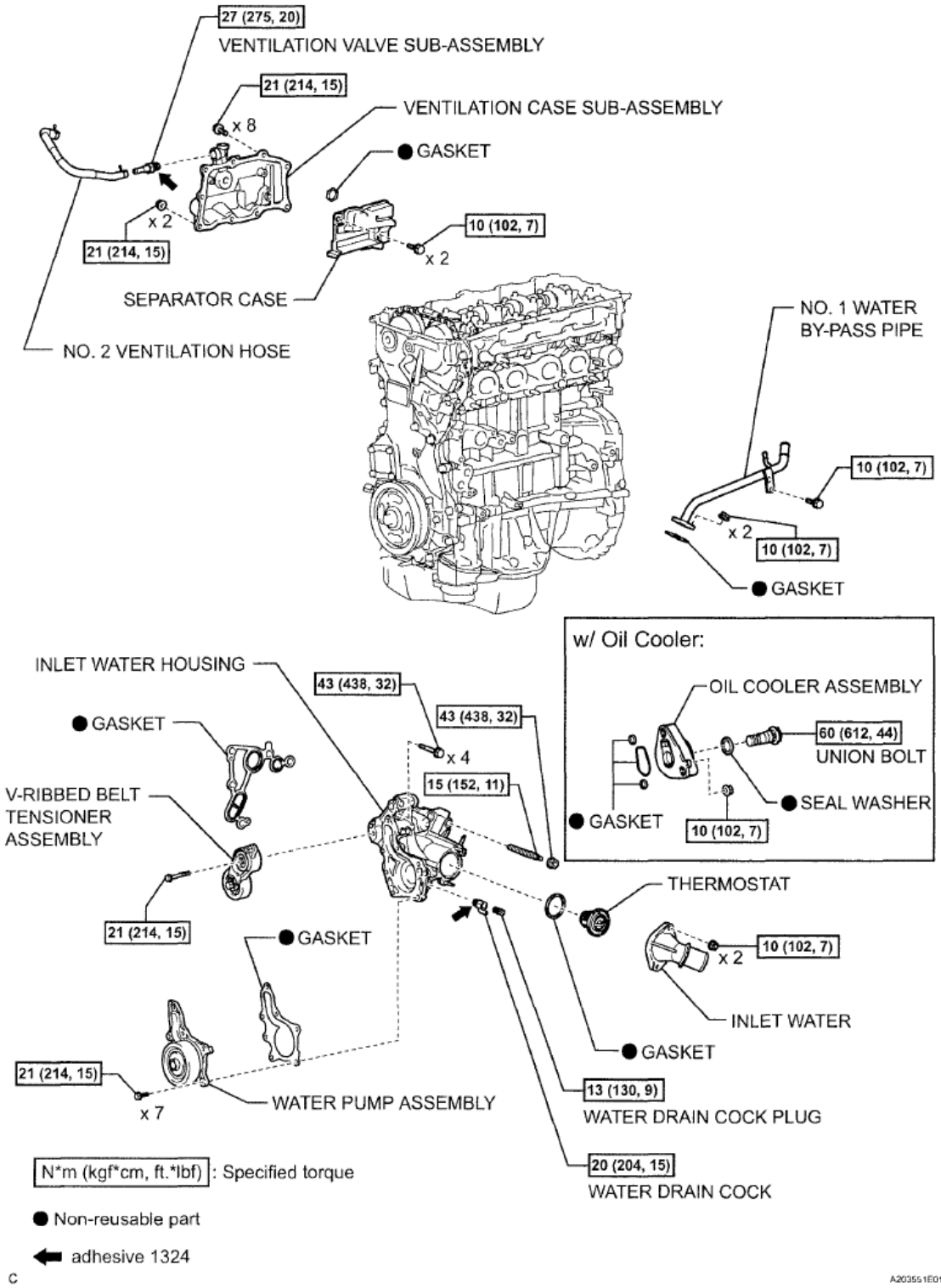


Fig. 312: Identifying Engine Unit Components With Torque Specification (7 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

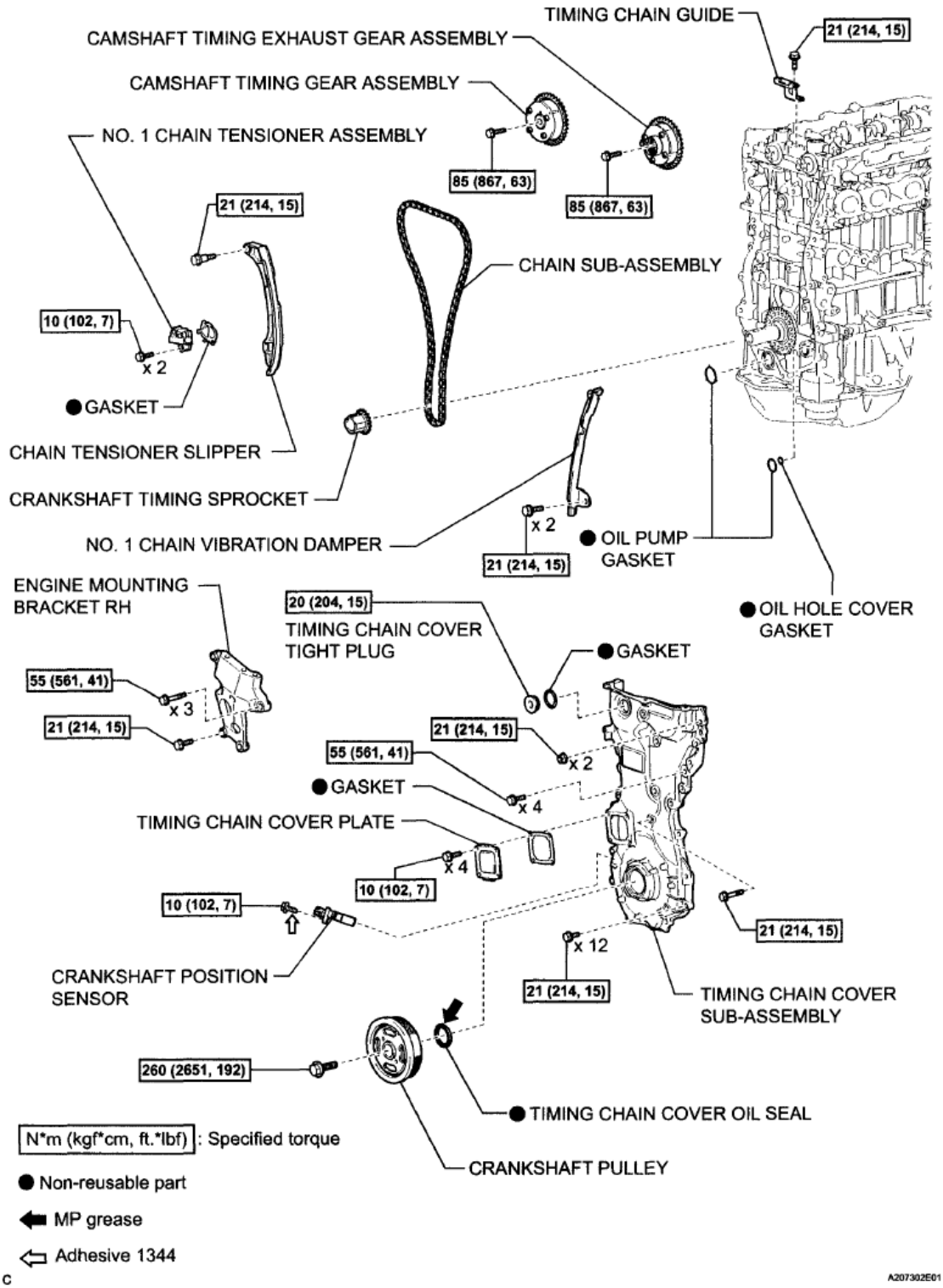


Fig. 313: Identifying Engine Unit Components With Torque Specification (8 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

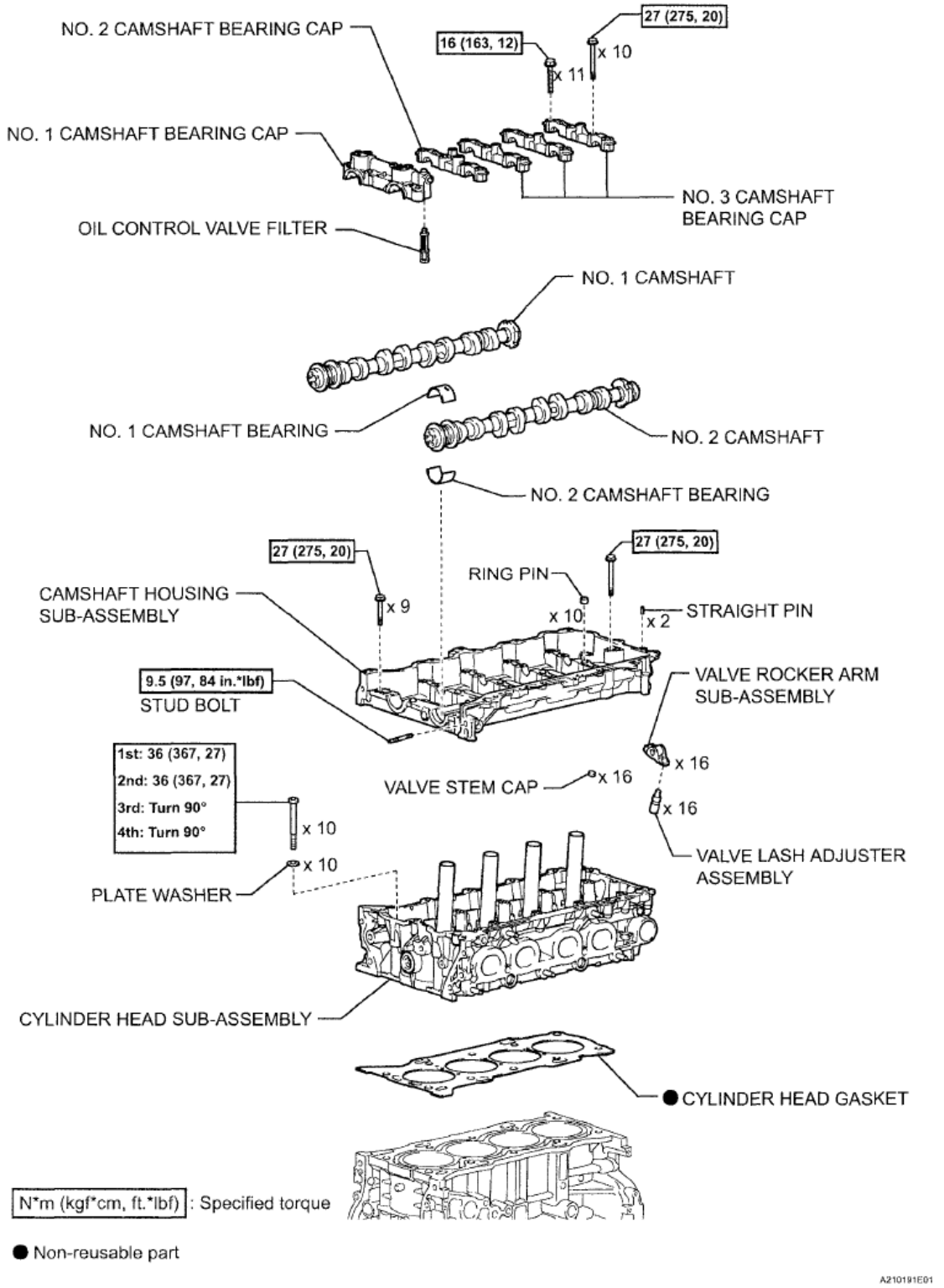


Fig. 314: Identifying Engine Unit Components With Torque Specification (9 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

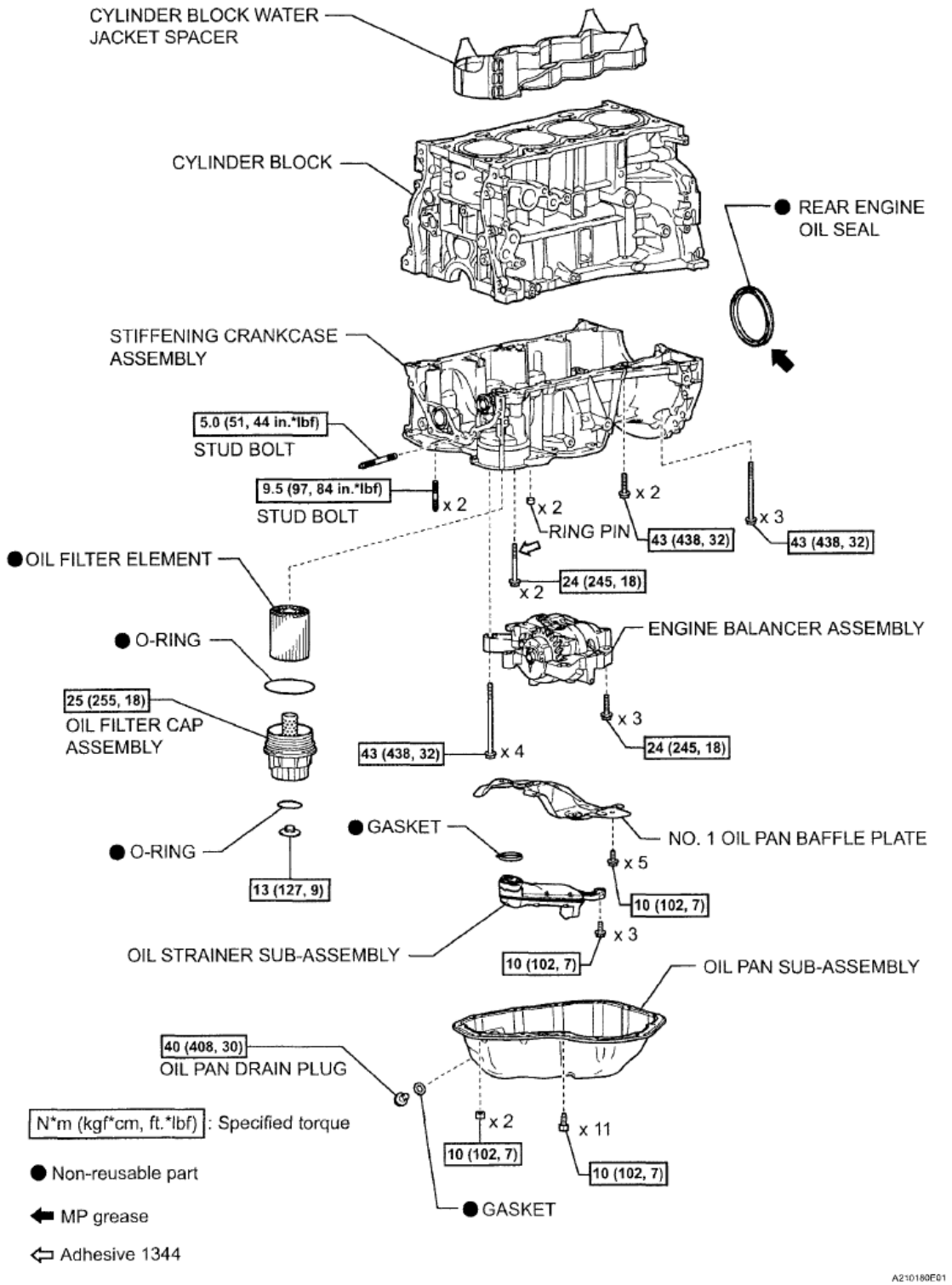


Fig. 315: Identifying Engine Unit Components With Torque Specification (10 Of 10)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE ENGINE OIL LEVEL DIPSTICK GUIDE**
   a. Remove the engine oil level dipstick.
   b. Remove the bolt and engine oil level dipstick guide.
   c. Remove the O-ring from the engine oil level dipstick guide.
2. **REMOVE MANIFOLD STAY** (See **REMOVAL**)
3. **REMOVE NO. 2 MANIFOLD STAY** (See **REMOVAL**)

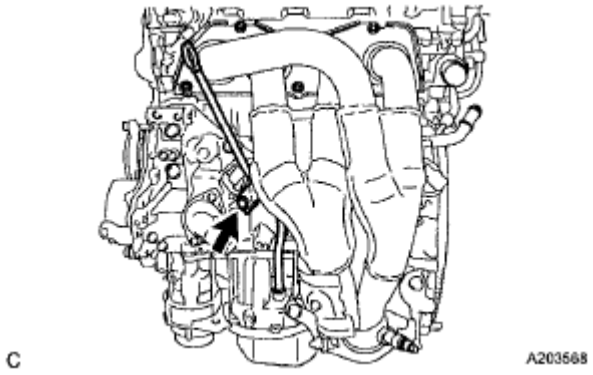


Fig. 316: Locating Engine Oil Level Dipstick Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **REMOVE EXHAUST MANIFOLD ASSEMBLY** (See **INSTALLATION**)
5. **REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET**
   a. Remove the 4 bolts and bracket.
6. **REMOVE THROTTLE BODY ASSEMBLY** (See **REMOVAL**)

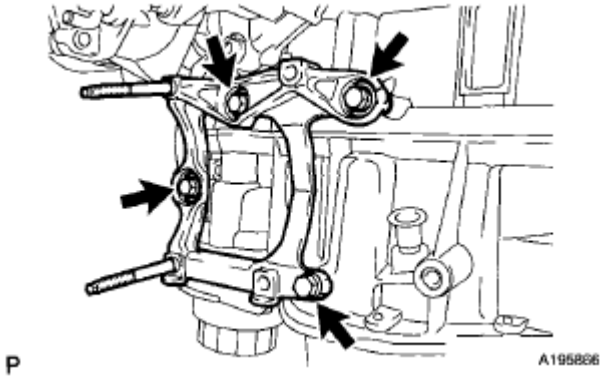


Fig. 317: Locating No. 1 Compressor Mounting Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **REMOVE WATER BY-PASS HOSE**
   a. Remove the No. 1 and No. 2 water by-pass hoses.
8. **REMOVE VACUUM SWITCHING VALVE ASSEMBLY** (See **INSPECTION**)
9. **REMOVE NO. 1 VACUUM SWITCHING VALVE ASSEMBLY** (See **REMOVAL**)

10. **DISCONNECT NO. 2 VENTILATION HOSE** (See **REMOVAL**)

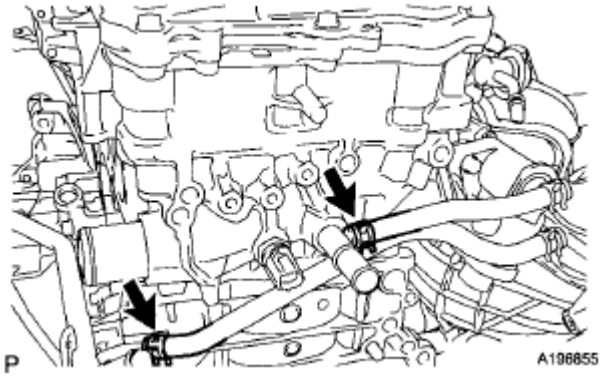


Fig. 318: Locating No. 1 And No. 2 Water By-Pass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE INTAKE MANIFOLD** (See **REMOVAL**)
12. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** (See **INSPECTION**)
13. **REMOVE SENSOR WIRE**
    a. Disconnect the knock control sensor wire.
    b. Remove the bolt and knock control sensor wire.
14. **REMOVE KNOCK CONTROL SENSOR** (See **REMOVAL**)
15. **REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY** (See **OIL PRESSURE SWITCH**)
16. **REMOVE ENGINE COOLANT TEMPERATURE SENSOR** (See **INSPECTION**)
17. **REMOVE IGNITION COIL ASSEMBLY** (See **REMOVAL**)

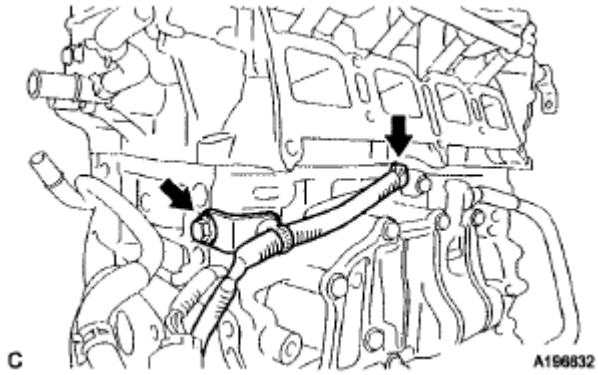


Fig. 319: Locating Knock Control Sensor Wire And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. **REMOVE ENGINE COVER JOINT**
    a. Remove the 3 joints.

2. **REMOVE SPARK PLUG** (See **REMOVAL**)
3. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)** (See **INSPECTION**)
4. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)** (See **INSPECTION**)

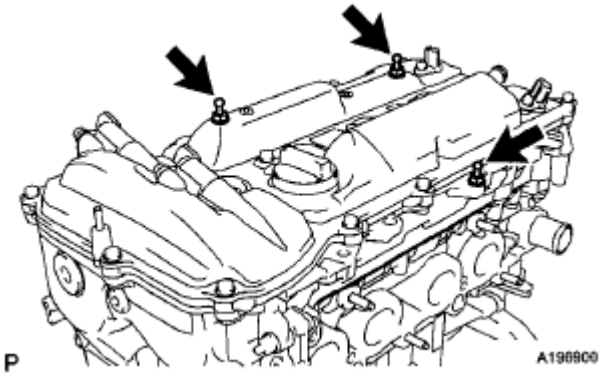


Fig. 320: Locating Engine Cover Joint
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **REMOVE CAMSHAFT POSITION SENSOR (for Intake Side)** (See **REMOVAL**)
6. **REMOVE CAMSHAFT POSITION SENSOR (for Exhaust Side)** (See **REMOVAL**)
7. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
   a. Remove the oil filler cap from the cylinder head.
   b. Remove the gasket from the oil filler cap.
8. **REMOVE CRANKSHAFT POSITION SENSOR** (See **REMOVAL**)
9. **REMOVE VENTILATION VALVE SUB-ASSEMBLY** (See **PCV VALVE**)
10. **REMOVE VENTILATION CASE SUB-ASSEMBLY**
    a. Remove the 8 bolts and 2 nuts.

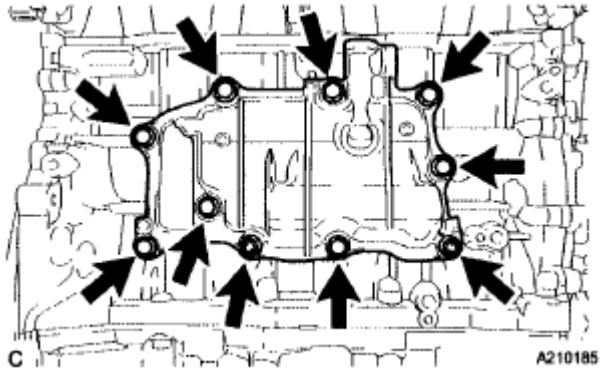


Fig. 321: Locating Ventilation Case Sub-Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

Tape the screwdriver tip before use.

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

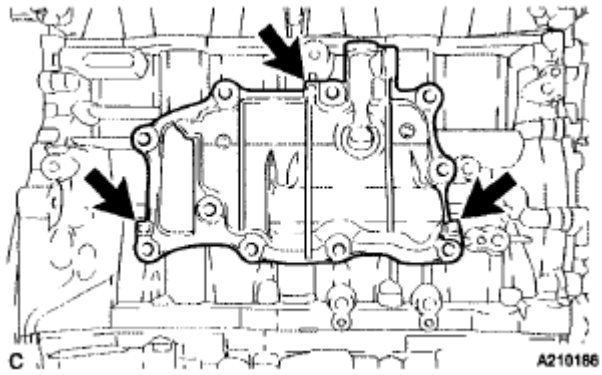


Fig. 322: Locating Contact Surfaces Of Cylinder Block And Ventilation Case
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE SEPARATOR CASE**
    a. Remove the 2 bolts, separator case and gasket.

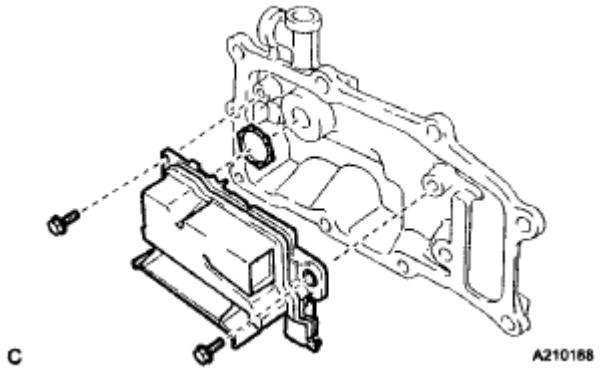


Fig. 323: Identifying Separator Case Bolts And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **REMOVE NO. 1 WATER BY-PASS PIPE**
    a. Remove the bolt, 2 nuts, water by-pass pipe and gasket.
13. **REMOVE INLET WATER** (See **REMOVAL**)
14. **REMOVE THERMOSTAT** (See **REMOVAL**)

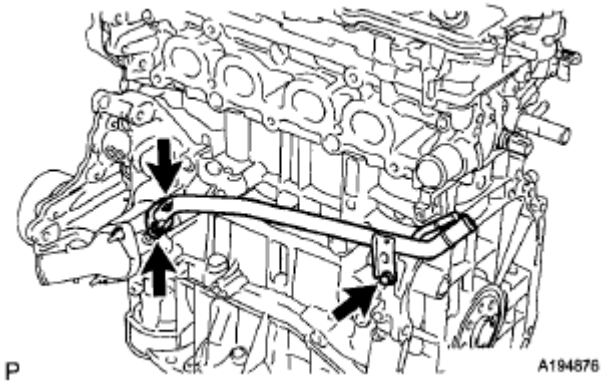


Fig. 324: Locating Water By-Pass Pipe Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY**
    a. Remove the bolt and V-ribbed belt tensioner.
16. **REMOVE WATER PUMP ASSEMBLY** (See **REMOVAL**)

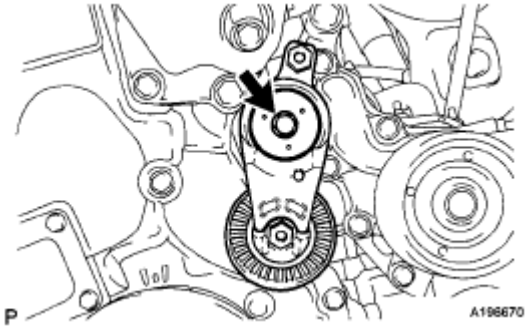


Fig. 325: Locating V-Ribbed Belt Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **REMOVE WATER DRAIN COCK**
    a. Remove the water drain cock plug from the water drain cock.
    b. Remove the water drain cock from the cylinder block.
18. **REMOVE OIL COOLER ASSEMBLY (w/ Oil Cooler)** (See **INSPECTION**)

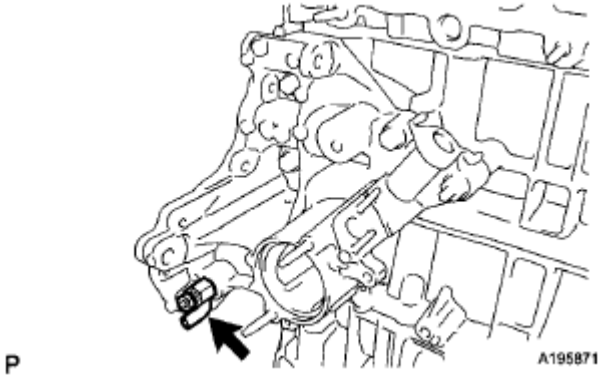


Fig. 326: Locating Water Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE INLET WATER HOUSING**
    a. Remove the 4 bolts, nut, inlet water housing and gasket.

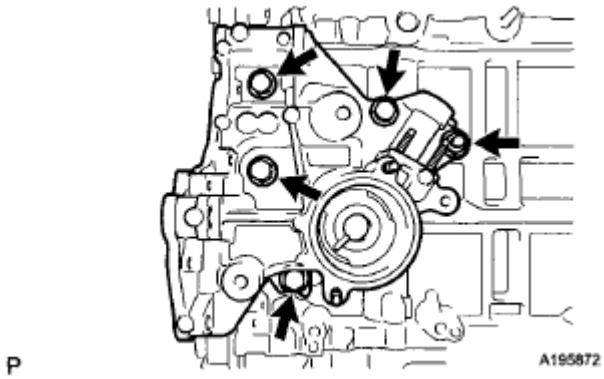


Fig. 327: Locating Inlet Water Housing Bolts And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

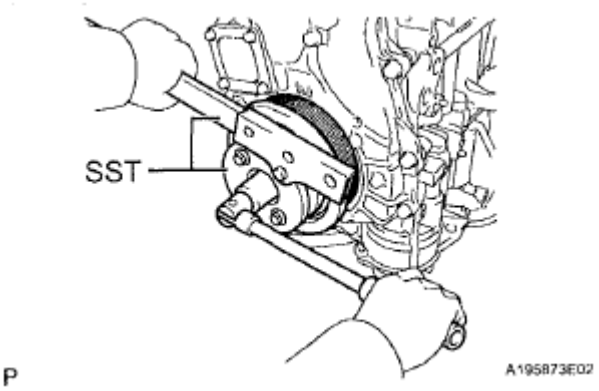


Fig. 328: Loosening Crankshaft Pulley Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using SST and the pulley bolt, remove the crankshaft pulley.

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

HINT:

Apply a lubricant to the threads and end of SST.

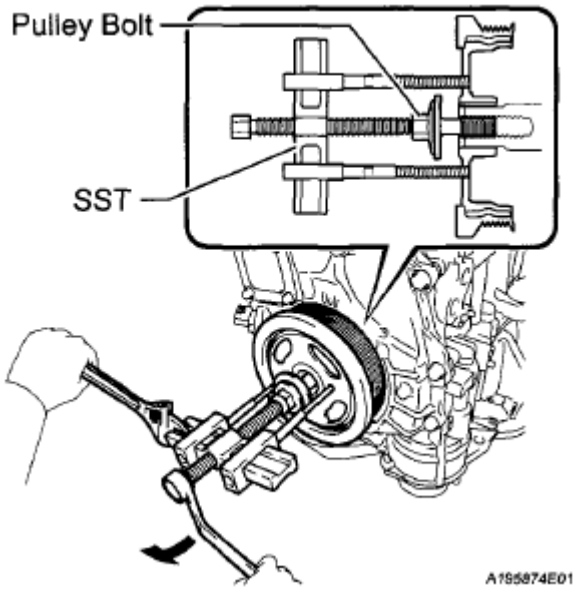


Fig. 329: Removing Crankshaft Pulley Using SST And Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
    a. Remove the 16 bolts, 3 seal washers, cylinder head cover and gasket.

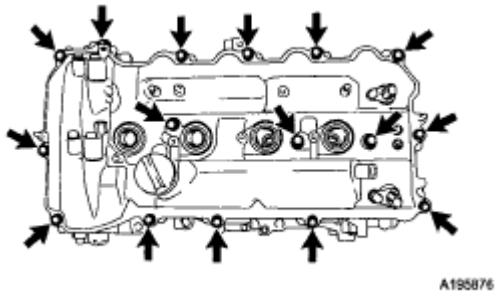


Fig. 330: Locating Cylinder Head Cover Bolts And Seal Washers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 3 gaskets from the camshaft bearing caps.

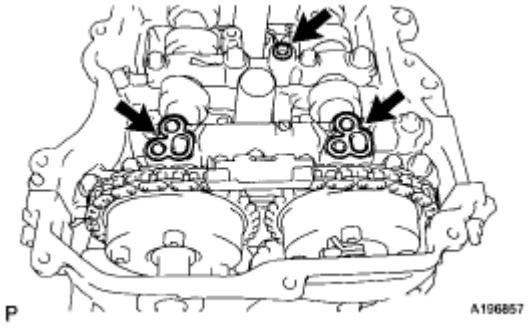


Fig. 331: Locating Camshaft Bearing Caps Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **REMOVE SPARK PLUG TUBE GASKET**
    a. Using a screwdriver, pry out the 4 plug tube gaskets.

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

HINT:

Tape the screwdriver tip before use.

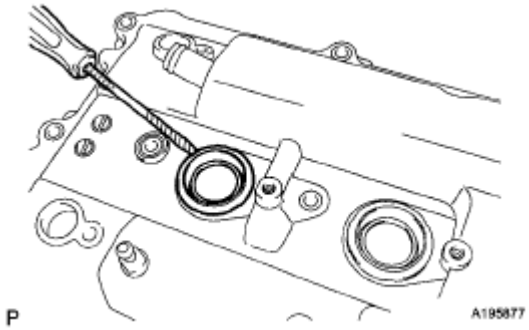


Fig. 332: Prying Out Plug Tube Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. **REMOVE ENGINE MOUNTING BRACKET RH** (See **REMOVAL**)
24. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY** (See **REMOVAL**)
25. **REMOVE TIMING CHAIN COVER TIGHT PLUG**
    a. Using a 14 mm hexagon wrench, remove the plug and gasket.

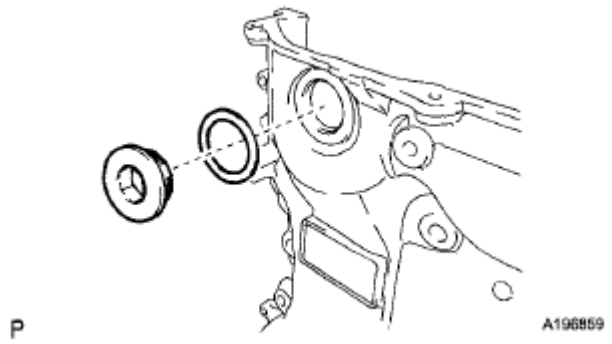


Fig. 333: Identifying Timing Chain Cover Tight Plug And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

26. **REMOVE TIMING CHAIN COVER PLATE**
    a. Remove the 4 bolts, timing chain cover plate and gasket.
27. **REMOVE TIMING CHAIN COVER OIL SEAL** (See **REMOVAL**)
28. **SET NO. 1 CYLINDER TO TDC/COMPRESSION** (See **REMOVAL**)
29. **REMOVE TIMING CHAIN GUIDE** (See **INSTALLATION**)

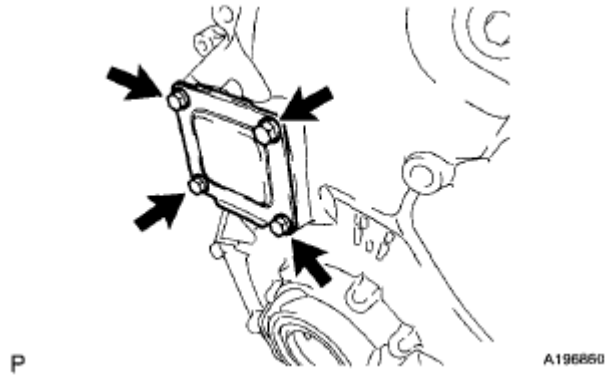


Fig. 334: Locating Timing Chain Cover Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY** (See **INSTALLATION**)
31. **REMOVE CHAIN TENSIONER SLIPPER** (See **INSTALLATION**)
32. **REMOVE CHAIN SUB-ASSEMBLY**

33. **REMOVE NO. 1 CHAIN VIBRATION DAMPER** (See **INSTALLATION**)
34. **REMOVE CRANKSHAFT TIMING SPROCKET**
    a. Remove the crankshaft timing sprocket from the crankshaft.
35. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY** (See **INSTALLATION**)
36. **REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY** (See **INSTALLATION**)
37. **REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY** (See **INSTALLATION**)

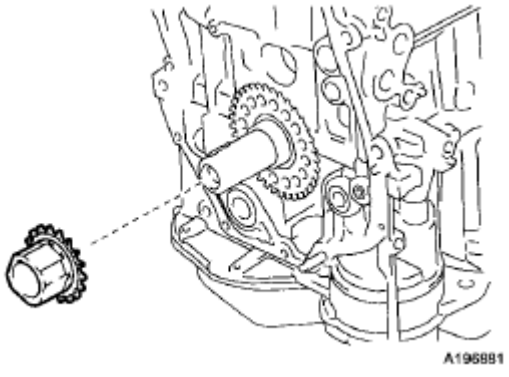


Fig. 335: Identifying Crankshaft Timing Sprocket And Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. **REMOVE CAMSHAFT BEARING CAP** (See **INSTALLATION**)
39. **REMOVE OIL CONTROL VALVE FILTER**
    a. Remove the oil control valve filter from the No. 1 camshaft bearing cap.
40. **REMOVE CAMSHAFT** (See **INSTALLATION**)

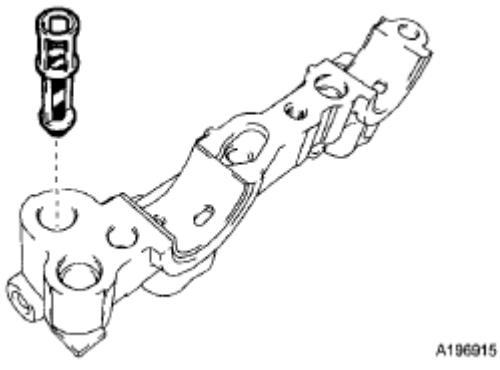


Fig. 336: Identifying Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

41. **REMOVE NO. 1 CAMSHAFT BEARING**
    a. Remove the No. 1 camshaft bearing.

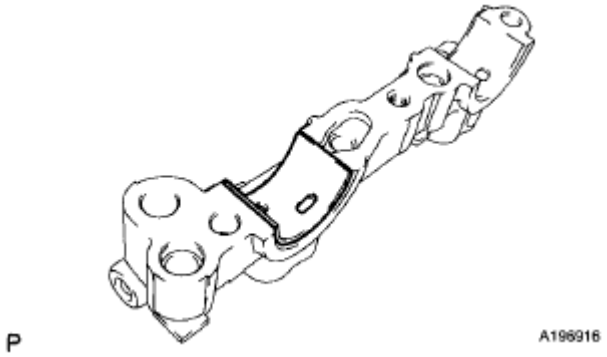


Fig. 337: Identifying No. 1 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. **REMOVE NO. 2 CAMSHAFT BEARING**
    a. Remove the No. 2 camshaft bearing.
43. **REMOVE CAMSHAFT HOUSING STUD BOLT**

NOTE: If a stud bolt is deformed or its threads are damaged, replace it.

44. **REMOVE CAMSHAFT BEARING CAP SETTING RING PIN**

NOTE: It is not necessary to remove the ring pin unless it is being replaced.

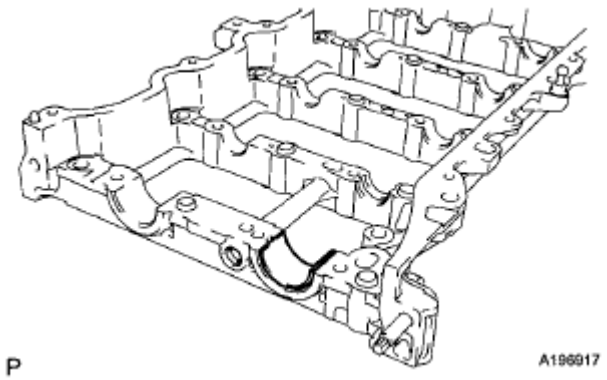


Fig. 338: Identifying No. 2 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. **REMOVE CAMSHAFT HOUSING STRAIGHT PIN**

NOTE: It is not necessary to remove the straight pin unless it is being replaced.

46. **REMOVE VALVE ROCKER ARM SUB-ASSEMBLY** (See **INSTALLATION**)
47. **REMOVE VALVE LASH ADJUSTER ASSEMBLY** (See **INSTALLATION**)
48. **REMOVE VALVE STEM CAP** (See **REMOVAL**)

49. **REMOVE CYLINDER HEAD SUB-ASSEMBLY** (See **REMOVAL**)
50. **REMOVE CYLINDER HEAD GASKET** (See **REMOVAL**)
51. **REMOVE CYLINDER BLOCK WATER JACKET SPACER**
    a. Remove the cylinder block water jacket spacer from the cylinder block.

NOTE: **Be sure to remove the water jacket spacer. If it is not removed, it may fall and become damaged when the cylinder block is inverted.**

52. **REMOVE OIL FILTER CAP ASSEMBLY** (See **REPLACEMENT**)

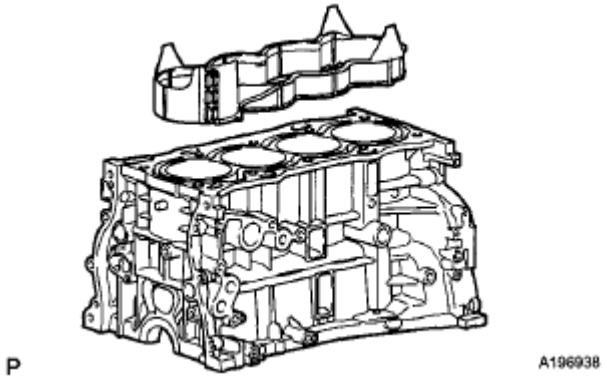


Fig. 339: Identifying Cylinder Block Water Jacket Spacer And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. **REMOVE OIL PAN SUB-ASSEMBLY**
    a. Remove the 11 bolts and 2 nuts.

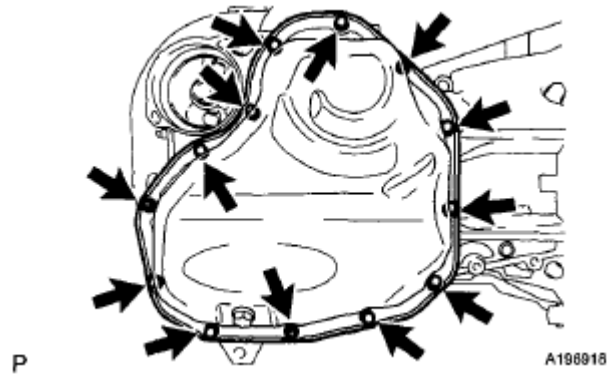


Fig. 340: Locating Oil Pan Sub-Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Insert the blade of an oil pan seal cutter between the oil pan and stiffening crankcase, cut off the applied sealer and remove the oil pan.

NOTE:

- **Be careful not to damage the stiffening crankcase contact surface of the oil pan.**
- **Be careful not to damage the stiffening crankcase flange.**

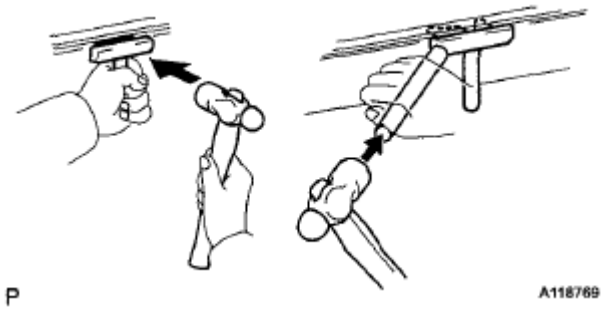


Fig. 341: Inserting Blade Of Oil Pan Seal Cutter Between Oil Pan And Stiffening Crankcase
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. **REMOVE OIL STRAINER SUB-ASSEMBLY**
    a. Remove the 3 bolts, oil strainer and gasket.

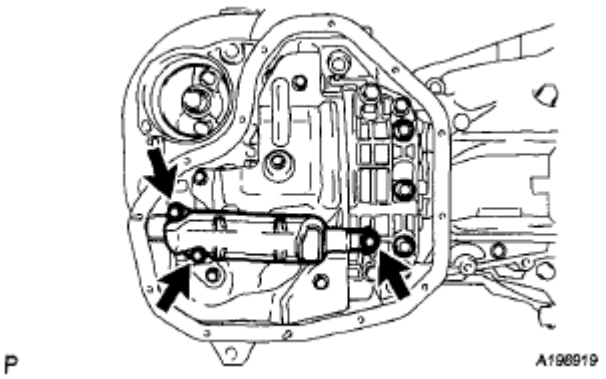


Fig. 342: Locating Oil Strainer Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. **REMOVE NO. 1 OIL PAN BAFFLE PLATE**
    a. Remove the 5 bolts and oil pan baffle plate.

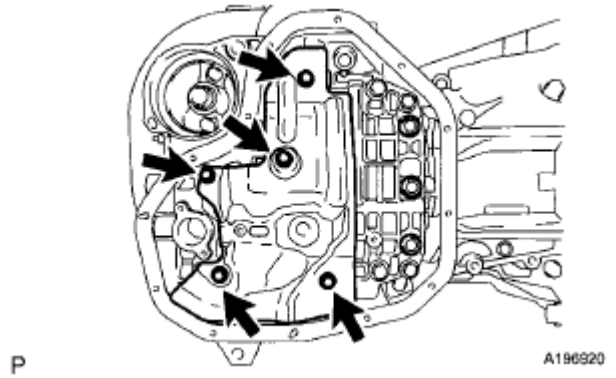


Fig. 343: Locating No. 1 Oil Pan Baffle Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. **INSPECT CRANKSHAFT BACKLASH**
    a. Using a dial indicator, measure the backlash of the crankshaft and balance shaft as shown in the illustration.

    Standard backlash:

    0.005 to 0.020 mm (0.000197 to 0.000787 in.)

    Maximum backlash:

    0.020 mm (0.000787 in.)

    If the backlash is more than the maximum, replace the engine balancer assembly.

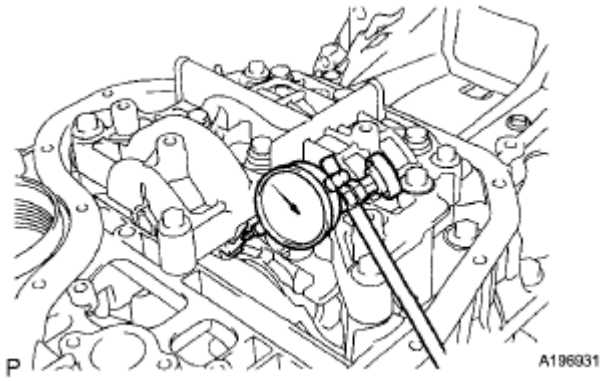


Fig. 344: Measuring Backlash Of Crankshaft And Balance Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **REMOVE ENGINE BALANCER ASSEMBLY**
    a. Remove the 7 bolts and engine balancer.

NOTE: Do not disassemble the engine balancer.

58. **INSPECT BALANCE SHAFT THRUST CLEARANCE** (See **REASSEMBLY**)

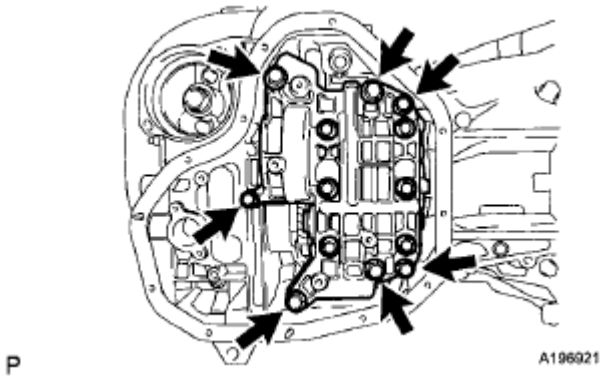


Fig. 345: Locating Engine Balancer Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

59. **REMOVE STIFFENING CRANKCASE ASSEMBLY**
    a. Remove the 7 bolts.

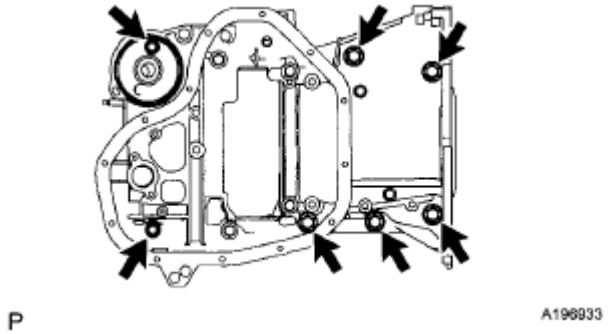


Fig. 346: Locating Stiffening Crankcase Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Using a screwdriver, remove the stiffening crankcase by prying between the stiffening crankcase and cylinder block at the places shown in the illustration.

    HINT:

    Tape the screwdriver tip before use.

    NOTE: Be careful not to damage the contact surfaces of the cylinder block and stiffening crankcase.

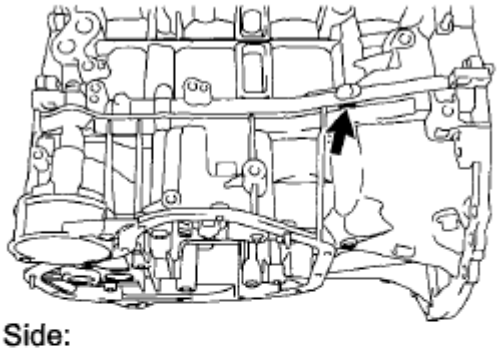
60. **REMOVE STIFFENING CRANKCASE STUD BOLT**

    NOTE: If a stud bolt is deformed or its threads are damaged, replace it.

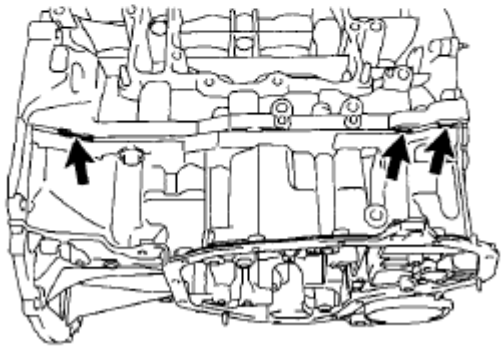
61. **REMOVE STIFFENING CRANKCASE RING PIN**

NOTE: It is not necessary to remove the ring pin unless it is being replaced.

LH Side:



RH Side:

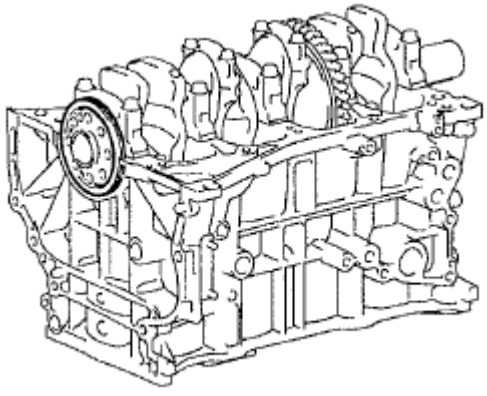


P A196934E01

Fig. 347: Locating Contact Surfaces Of Cylinder Block And Stiffening Crankcase
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

62. **REMOVE REAR ENGINE OIL SEAL**

a. Remove the rear engine oil seal from the cylinder block.



P A196937

Fig. 348: Identifying Rear Engine Oil Seal

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

INSPECTION

1. **INSPECT NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
   a. Turn the roller by hand to check that it turns smoothly.

      If the roller does not turn smoothly, replace the valve rocker arm sub-assembly.

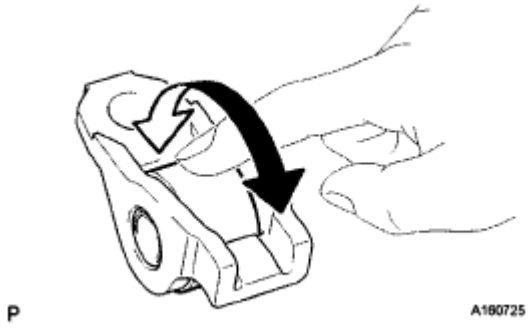


Fig. 349: Checking No. 1 Valve Rocker Arm Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **INSPECT VALVE LASH ADJUSTER ASSEMBLY**

NOTE:
- **Keep the adjuster free from dirt and foreign matter.**
- **Use only clean engine oil.**

   a. Place the lash adjuster into a container full of new engine oil.
   b. Insert the tip of SST into the lash adjuster plunger and use the tip to press down on the check ball inside the plunger.

      SST 09276-75010

   c. Squeeze SST and the lash adjuster together to move the plunger up and down 5 to 6 times.
   d. Check the movement of the plunger and bleed air.

      OK: Plunger moves up and down.

      NOTE: When bleeding high-pressure air from the compression chamber, make sure that the tip of SST is actually pressing the check ball as shown in the illustration. If the check ball is not pressed, air will not bleed.

   e. After bleeding the air, remove SST. Then try to quickly and firmly press the plunger with your fingers.

OK: Plunger can be pressed 3 times.

If the plunger can still be compressed after pressing it 3 times, replace the valve lash adjuster with a new one.

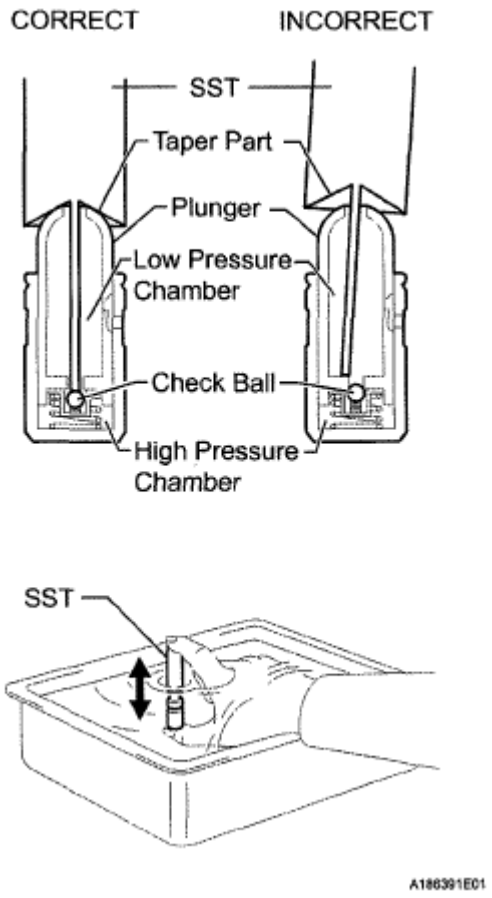


Fig. 350: Inspecting Valve Lash Adjuster Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSPECT CAMSHAFT OIL CLEARANCE** (See **REPLACEMENT**)
4. **INSPECT CAMSHAFT THRUST CLEARANCE** (See **REPLACEMENT**)
5. **INSPECT CAMSHAFT**
   a. Inspect the camshaft runout.
      1. Place the camshaft on V-blocks.
      2. Using a dial indicator, measure the circle runout at the center journal.

         Maximum circle runout: 0.03 mm (0.00118 in.)

         If the circle runout is more than the maximum, replace the camshaft sub-assembly.

         HINT:

Check the oil clearance after replacing the camshaft.

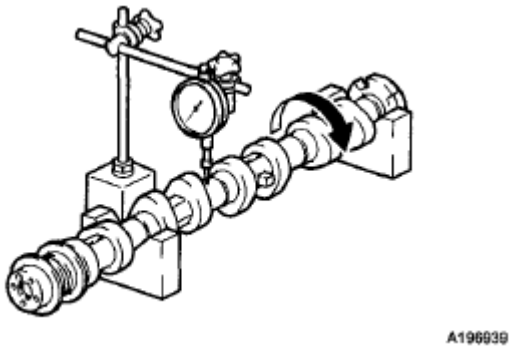


Fig. 351: Measuring Circle Runout At Center Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard Cam Lobe Height

CAM LOBE HEIGHT SPECIFICATION

Item	Specified Condition
Intake	44.163 to 44.305 mm (1.73870 to 1.74429 in.)
Exhaust	44.144 to 44.286 mm (1.73795 to 1.74354 in.)

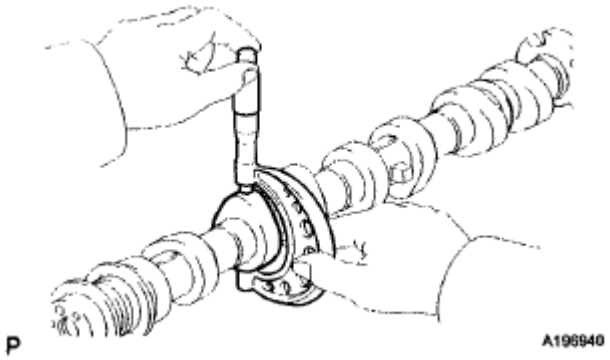


Fig. 352: Measuring Cam Lobe Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Minimum Cam Lobe Height

CAM LOBE HEIGHT SPECIFICATION

Item	Specified Condition
Intake	44.013 mm (1.73279 in.)
Exhaust	43.996 mm (1.73212 in.)

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

c. Inspect the camshaft journals.

1. Using a micrometer, measure the journal diameter.

Standard Journal Diameter

JOURNAL DIAMETER SPECIFICATION

Item	Specified Condition
No. 1 journal	34.449 to 34.465 mm (1.35626 to 1.35689 in.)
Other journals	22.959 to 22.975 mm (0.90390 to 0.90453 in.)

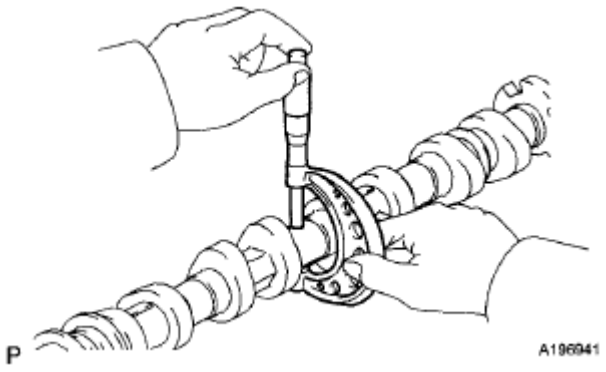


Fig. 353: Measuring Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the journal diameter is not as specified, check the oil clearance (See **REPLACEMENT**).

6. **INSPECT CAMSHAFT TIMING GEAR ASSEMBLY**

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

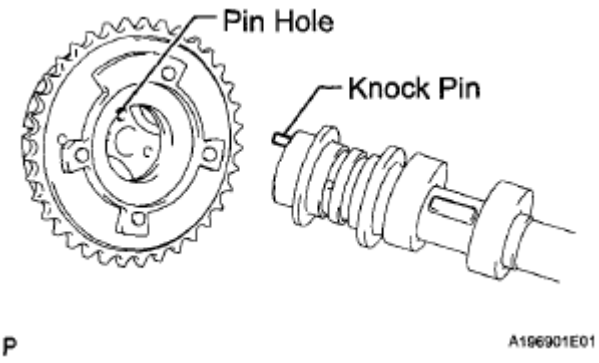


Fig. 354: Identifying Knock Pin And Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

c. Hold the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

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

d. Check the lock of the camshaft timing gear.
   1. Make sure that the camshaft timing gear is locked.

NOTE: Be careful not to damage the camshaft.

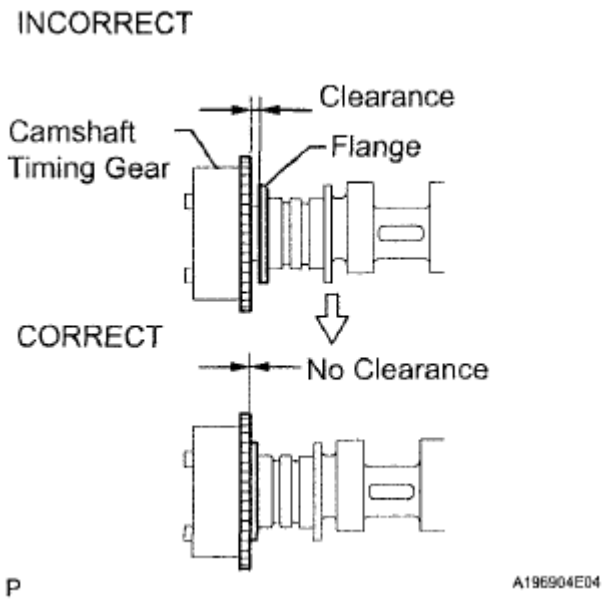


Fig. 355: Identifying Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

      HINT:

      There are 4 oil paths in the grooves of the camshaft. Plug 3 of the paths with pieces of rubber.

   3. Open a hole at port A shown in the illustration.

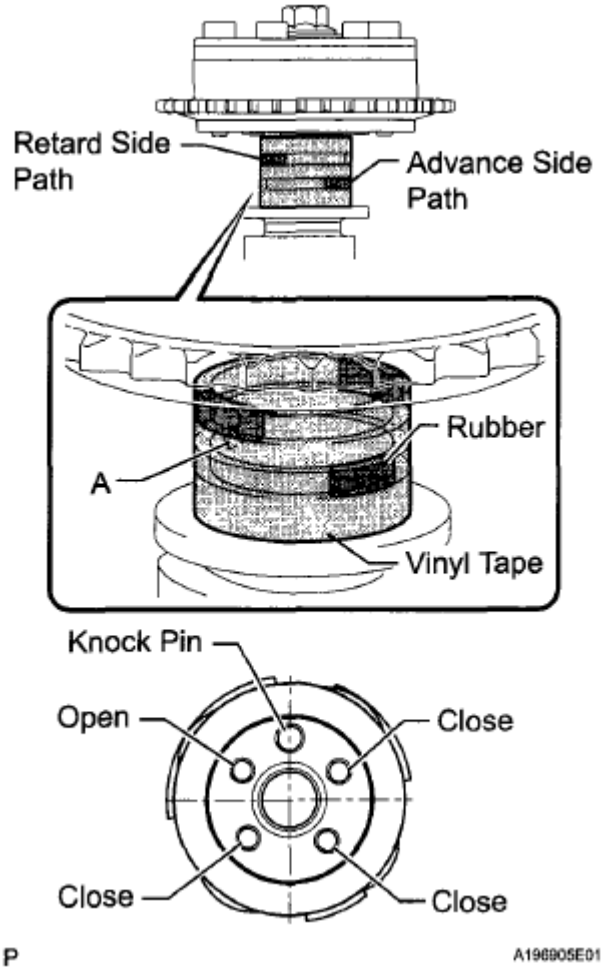


Fig. 356: Covering Oil Paths Of Cam Journal With Vinyl Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. While applying approximately 200 kPa (2.0 kgf/cm^2 , 29 psi) of air pressure to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).

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

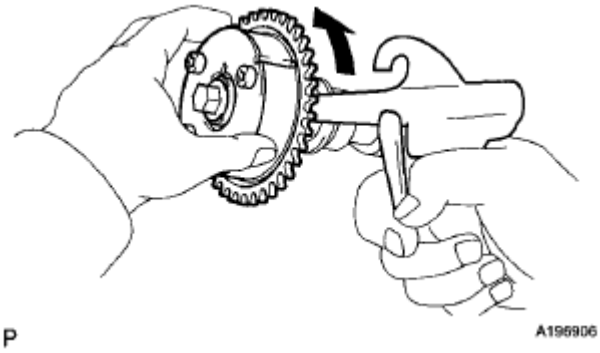


Fig. 357: Applying Air Pressure To Oil Path
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

- The camshaft timing gear assembly may be turned in the advance direction without applying any force.
- If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.

f. Check for smooth rotation.

1. Turn the camshaft timing gear within its movable range (26.5 to 28.5°) 2 or 3 times, but do not turn it to the most retarded position. Make sure that the gear turns smoothly.

NOTE: Do not allow the camshaft timing gear assembly to lock.

If it locks, release the lock pin again.

g. Remove the vinyl tape and rubber pieces from the camshaft.

h. Remove the bolt and camshaft timing gear.

7. **INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

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

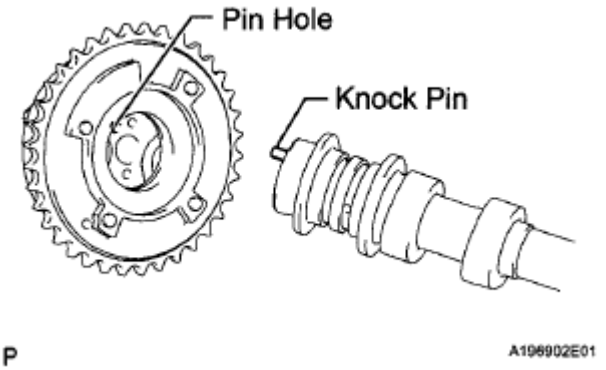


Fig. 358: Identifying No. 2 Camshaft Knock Pin And Camshaft Timing Exhaust Gear Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Check that there is no clearance between the camshaft timing exhaust gear and camshaft flange.
c. Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing exhaust gear by hand.
d. Check the lock of the camshaft timing exhaust gear.
    1. Make sure that the camshaft timing exhaust gear is locked.

NOTE: Be careful not to damage the camshaft.

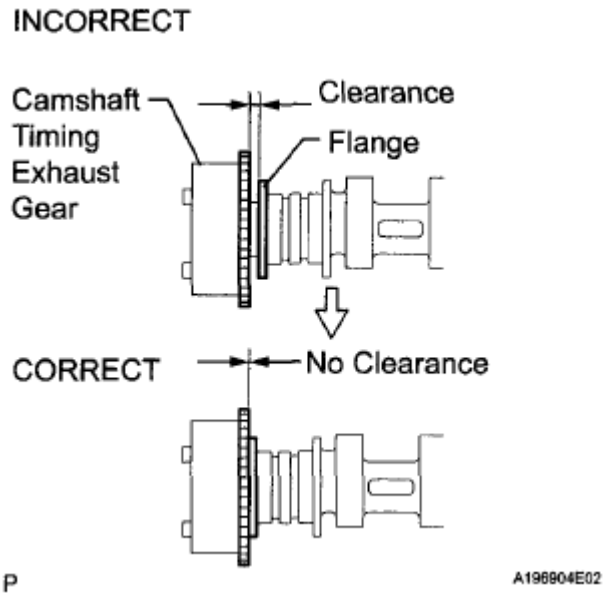


Fig. 359: Identifying Clearance Between Camshaft Timing Exhaust Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Release the lock pin.
    1. Clean the camshaft journal with non-residue solvent.

2. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

   HINT:

   There are 4 oil paths in the grooves of the camshaft. Plug 2 paths with rubber pieces.

3. Prick a hole in the tape placed on the advance side path. Prick a hole in the tape placed on the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.

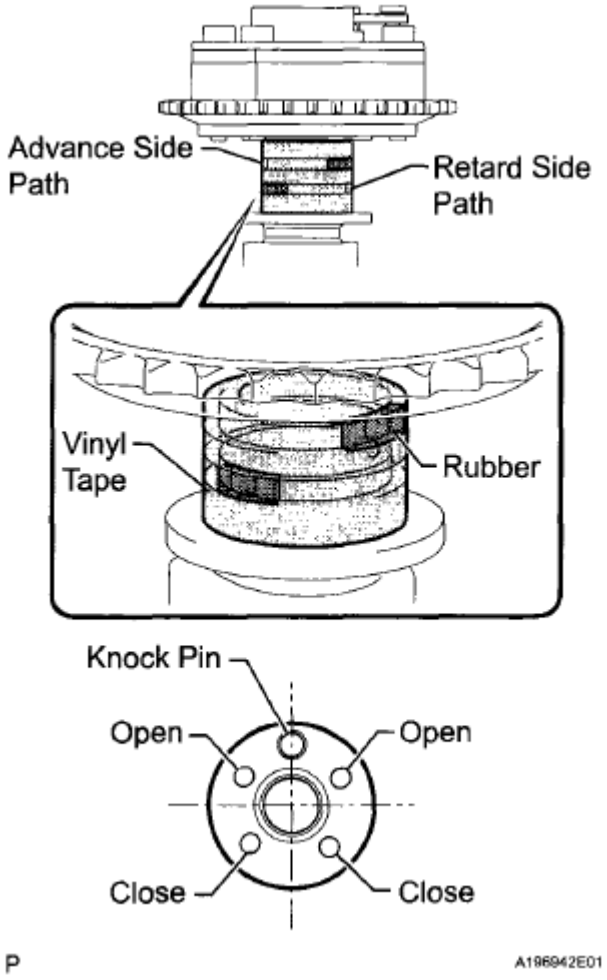


Fig. 360: Covering Oil Paths Of Cam Journal With Vinyl Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Apply approximately 200 kPa (2.0 kgf/cm^2 , 29 psi) of air pressure to the two open paths (the advance side path and retard side path).

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

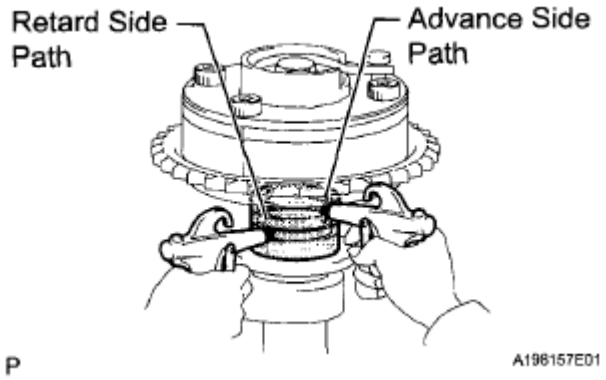


Fig. 361: Applying Air Pressure To Two Open Paths Advance (Side Path And Retard Side Path)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. Check that the camshaft timing exhaust gear turns in the retard direction when reducing the air pressure applied to the advance side path.

   HINT:

   The lock pin is released and the camshaft timing exhaust gear turns in the retard direction.

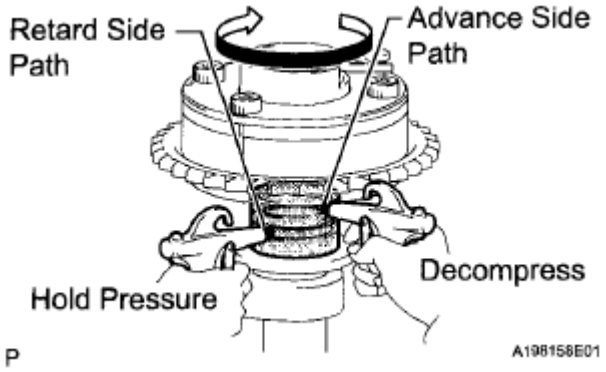


Fig. 362: Checking Camshaft Timing Exhaust Gear Turns In Retard Direction
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. When the camshaft timing exhaust gear moves to the most retarded position, release the air pressure from the advance side path, and then release the air pressure from the retard side path.

NOTE: Be sure to release the air pressure from the advance side path first. If the air pressure of the retard side path is released first, the camshaft timing exhaust gear may abruptly shift in the advance direction and break the lock pin or other parts.

f. Check for smooth rotation.

1. Turn the camshaft timing exhaust gear within its movable range (21.5 to 23.5°) 2 or 3 times, but do not turn it to the most advanced position. Make sure that the gear turns smoothly.

NOTE: When the air pressure is released from the advance side path and then from the retard side path, the gear automatically returns to the most advanced position due to the advance assist spring operation, and locks. Gradually release the air pressure from the retard side path before performing the smooth rotation check.

g. Check the lock at the most advanced position.
   1. Make sure that the camshaft timing exhaust gear locks at the most advanced position.
h. Remove the vinyl tape and rubber pieces from the camshaft.
i. Remove the bolt and camshaft timing gear.

8. **INSPECT CHAIN SUB-ASSEMBLY**
   a. Using a spring scale, pull the chain with a force of 147 N (15 kgf, 33.0 lbf) as shown in the illustration.
   b. Using a vernier caliper, measure the length of 15 pins.

Maximum chain elongation:

137.7 mm (5.42 in.)

HINT:

Perform the measurement at 3 random places. If the elongation is more than the maximum, replace the chain sub-assembly.

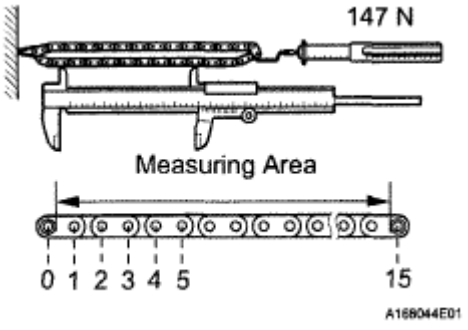


Fig. 363: Measuring Length Of Chain Pins
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSPECT CRANKSHAFT TIMING SPROCKET**
   a. Place the chain around the sprocket.
   b. Using a vernier caliper, measure the sprocket diameter with the chain.

Minimum sprocket diameter (with chain):

59.94 mm (2.36 in.)

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

HINT:

The vernier caliper must contact the chain rollers for the measurement.

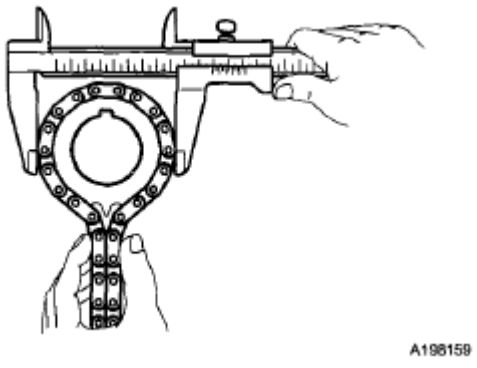


Fig. 364: Measuring Chain Elongation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY**
    a. Move the stopper plate counterclockwise to release the lock. Push the plunger and check that it moves smoothly.

    If necessary, replace the No. 1 chain tensioner assembly.

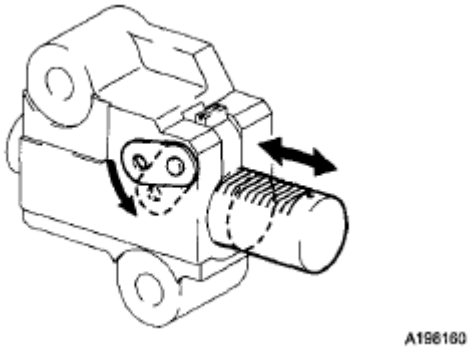


Fig. 365: Inspecting No. 1 Chain Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **INSPECT CHAIN TENSIONER SLIPPER**
    a. Measure the worn depth of the chain tensioner slipper.

    Maximum depth: 1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the chain tensioner slipper.

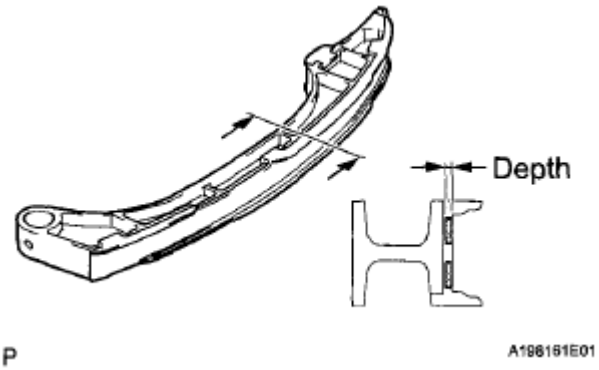


Fig. 366: Identifying Worn Depth Of Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **INSPECT NO. 1 CHAIN VIBRATION DAMPER**
    a. Measure the worn depth of the chain vibration damper.

    Maximum depth: 1.0 mm (0.0394 in.)

    If the depth is more than the maximum, replace the No. 1 chain vibration damper.

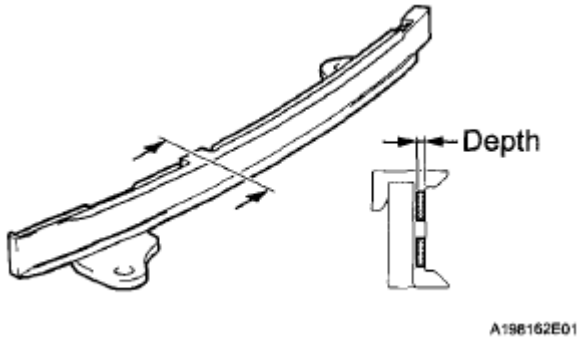


Fig. 367: Identifying Worn Depth Of Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **INSPECT TIMING CHAIN GUIDE**
    a. Measure the worn depth of the timing chain guide.

    Maximum depth: 1.0 mm (0.0394 in.)

    If the depth is more than the maximum, replace the timing chain guide.

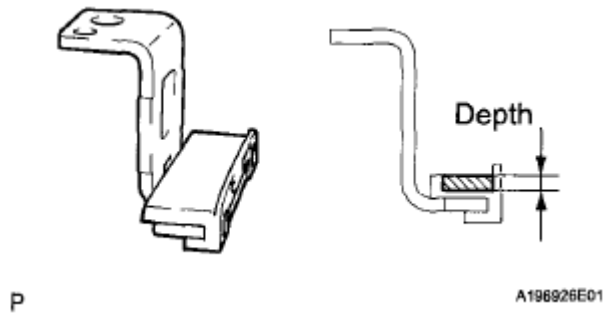


Fig. 368: Identifying Worn Depth Of Timing Chain Guide
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSPECT NO. 1 BALANCE SHAFT THRUST CLEARANCE**
    a. Using a dial indicator, measure the thrust clearance while moving the No. 1 balance shaft back and forth.

    Standard thrust clearance:

    0.05 to 0.09 mm (0.00197 to 0.00354 in.)

    Maximum thrust clearance:

    0.09 mm (0.00354 in.)

    If the thrust clearance is more than the maximum, replace the engine balancer assembly.

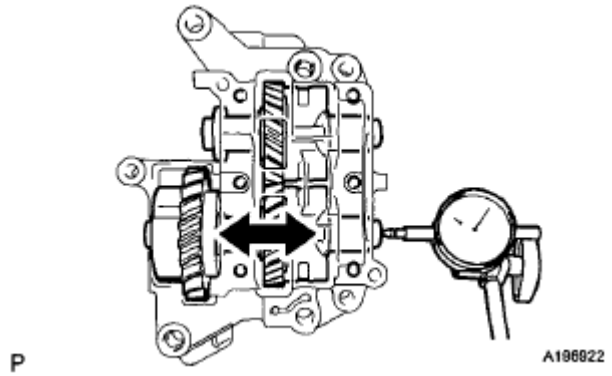


Fig. 369: Measuring No. 1 Balance Shaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **INSPECT NO. 2 BALANCE SHAFT THRUST CLEARANCE**
    a. Using a dial indicator, measure the thrust clearance while moving the No. 2 balance shaft back and forth.

    Standard thrust clearance:

0.05 to 0.09 mm (0.00197 to 0.00354 in.)

Maximum thrust clearance:

0.09 mm (0.00354 in.)

If the thrust clearance is more than the maximum, replace the engine balancer assembly.

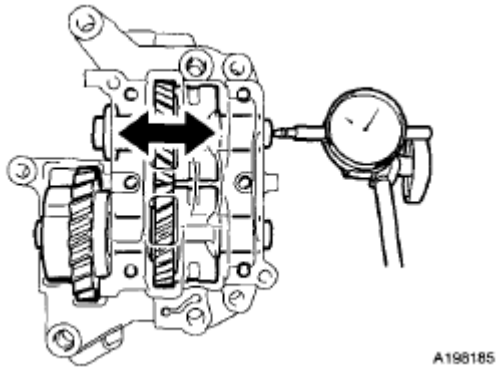


Fig. 370: Measuring No. 2 Balance Shaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **INSPECT BALANCE SHAFT BACKLASH**
    a. Hold the No. 2 balance shaft in place, and then using a dial indicator, measure the backlash of the No. 1 and No. 2 balance shafts as shown in the illustration.

    Standard backlash:

    0.04 to 0.17 mm (0.00157 to 0.00669 in.)

    Maximum backlash:

    0.17 m (0.00669 in.)

    NOTE: Measure at 3 or more areas around the circumference of the No. 1 and No. 2 balance shafts.

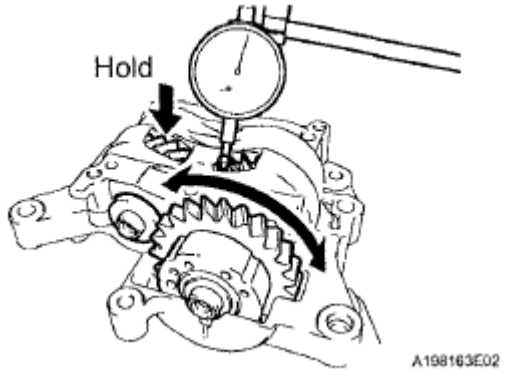


Fig. 371: Measuring Backlash Of No. 1 And No. 2 Balance Shafts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the backlash is more than the maximum, replace the engine balancer assembly.

17. **INSPECT CYLINDER HEAD BOLT**
    a. Using a vernier caliper, measure the diameter of the threads at the measurement point.

Standard diameter:

10.85 to 11.00 mm (0.427 to 0.433 in.)

Minimum diameter:

10.6 mm (0.417 in.)

Measurement point (distance from the seat):

106 mm (4.17 in.)

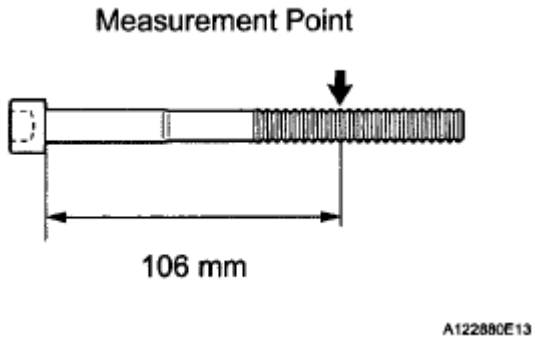


Fig. 372: Identifying Measurement Point Of Cylinder Head Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- If the diameter is less than the minimum, replace the cylinder head bolt. Failure to do so may lead to engine damage.
- If there is any thread deformation, replace the cylinder head bolt with a new one.

18. **INSPECT EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**
    a. Using a precision straightedge and feeler gauge, measure the warpage of the surface that contacts the cylinder head.

    Maximum warpage: 0.7 mm (0.0276 in.)

    If the warpage is more than the maximum, replace the exhaust manifold.

Fig. 373: Measuring Warpage Of Exhaust Manifold Converter Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. **INSTALL ENGINE BALANCER ASSEMBLY**
    a. Check that the alignment marks of the balance shaft damper cover and balance shaft driven gear are aligned. If the alignment marks are not aligned, realign them.

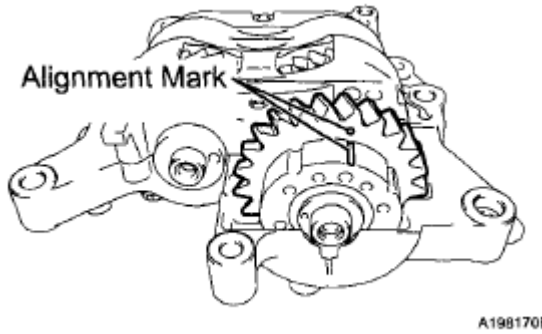


Fig. 374: Identifying Alignment Marks Of Balance Shaft Damper Cover And Balance Shaft Driven Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Place a wrench on the rear cutout part of the No. 2 balance shaft and hold the shaft in place.
2. Rotate the balance shaft driven gear of the No. 1 balance shaft counterclockwise to align the alignment mark of the balance shaft driven gear with the alignment mark of the balance shaft

damper cover.

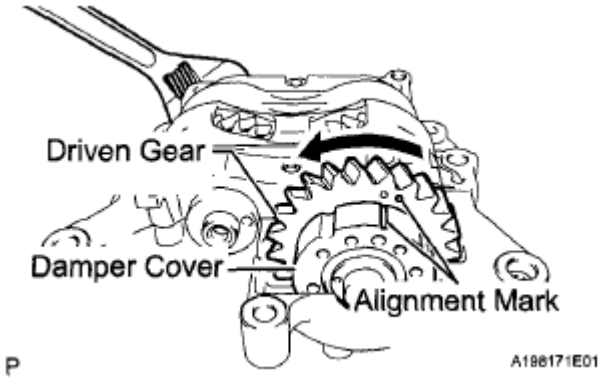


Fig. 375: Rotating Balance Shaft Driven Gear Of No. 1 Balance Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the engine balancer to the stiffening crankcase with the 3 bolts, and tighten the bolts in the sequence shown in the illustration.

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

2. **INSTALL STIFFENING CRANKCASE STUD BOLT**

NOTE: If a stud bolt is deformed or the threads are damaged, replace it.

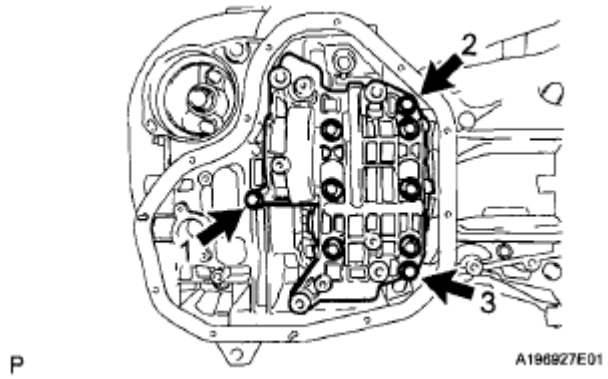


Fig. 376: Identifying Engine Balancer Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

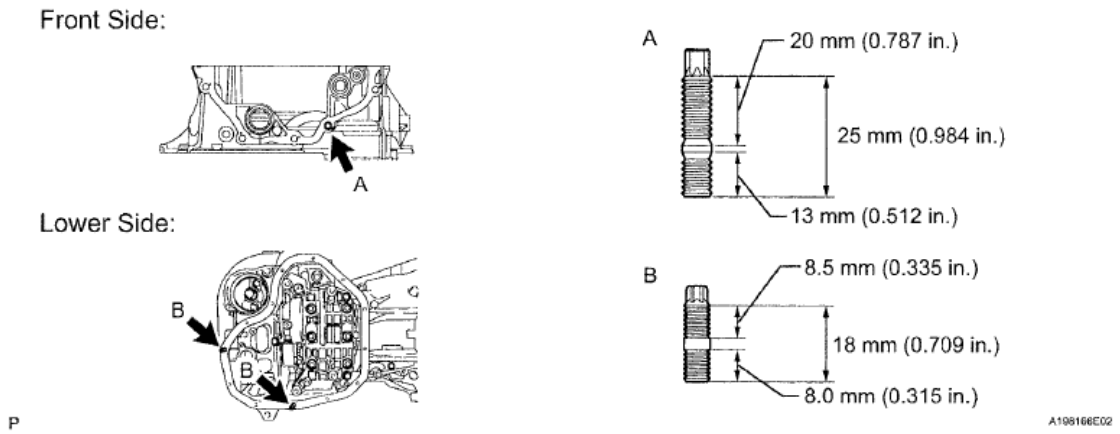


Fig. 377: Locating Stud Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Using E5 and E8 "TORX" socket wrenches, install the stud bolts.

Torque: for stud bolt A

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

for stud bolt B

9.5 N*m (97 kgf*cm, 84 in.*lbf)

3. **INSTALL STIFFENING CRANKCASE RING PIN**

NOTE: It is not necessary to remove the ring pin unless it is being replaced.

a. Using a plastic-faced hammer, tap in 2 new ring pins until they stop.

Standard protrusion height: 4.3 to 5.3 mm (0.169 to 0.209 in.)

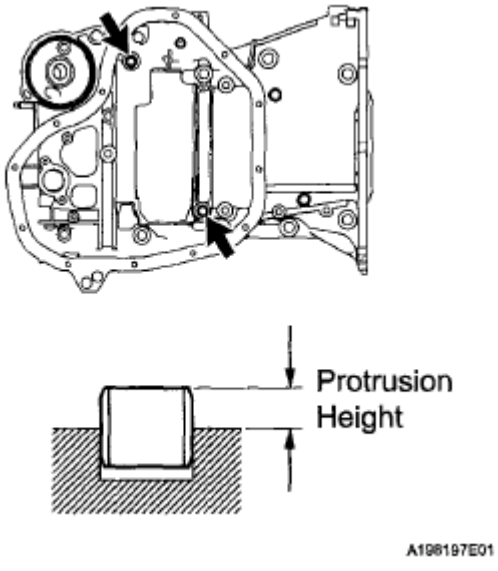


Fig. 378: Locating Ring Pins With Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL STIFFENING CRANKCASE ASSEMBLY**
   a. Rotate the crankshaft clockwise so that the crankshaft key is at the position 90° from the bottom as shown in the illustration.

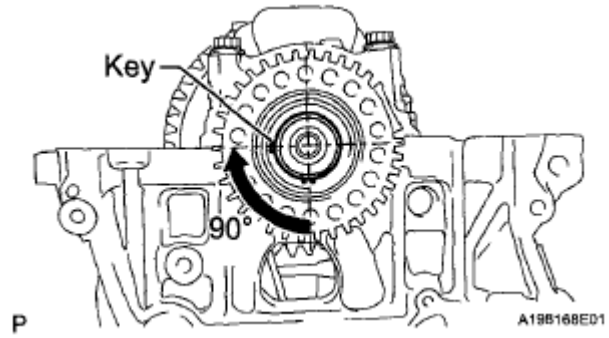


Fig. 379: Rotating Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Seal packing:

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

Standard Seal Dimension

SEAL DIMENSION SPECIFICATION

Area	Specified Condition

Continuous Line	2.5 to 3.5 mm (0.0984 to 0.138 in.)
Dashed Line	7.0 to 9.0 mm (0.276 to 0.354 in.) wide and 2.5 to 3.5 mm (0.0984 to 0.138 in.) thick

Application Length A:

28 mm (1.10 in.)

NOTE:

- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.**
- **Do not apply oil for at least 4 hours after the installation.**

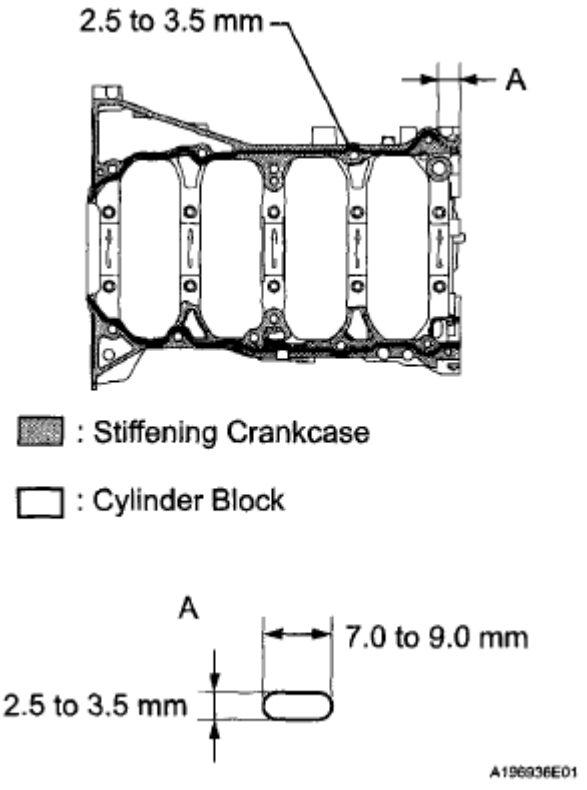


Fig. 380: Applying Seal Packing In Continuous Line
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Check that the rear cutouts are as shown in the illustration.
d. Clean the bolts and their installation holes.

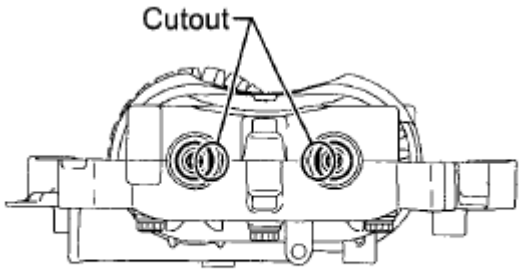


Fig. 381: Checking Rear Cutouts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Apply adhesive to 3 threads or more of the end of bolt A.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

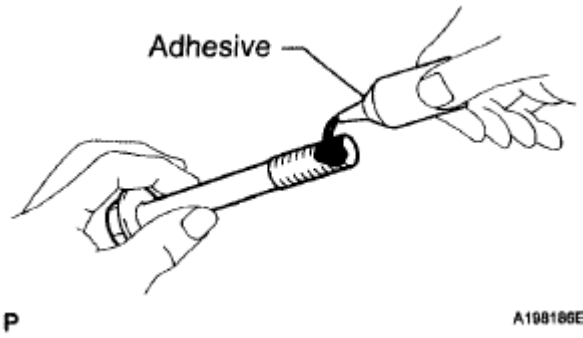


Fig. 382: Applying Adhesive To Threads Of End Of Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Temporarily install the stiffening crankcase with the 11 bolts.

Bolt Length

BOLT LENGTH REFERENCE

Item	Length
Bolt A	65 mm (2.56 in.)
Bolt B	35 mm (1.38 in.)
Bolt C	125 mm (4.92 in.)
Bolt D	165 mm (6.50 in.)

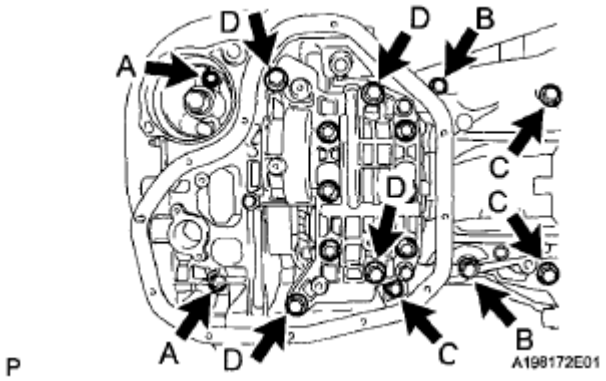


Fig. 383: Locating Stiffening Crankcase Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Apply adhesive to bolt A before installing it.

g. Tighten the 11 bolts in the sequence shown in the illustration to install the stiffening crankcase.

Torque: for Bolt A

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

except Bolt A

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

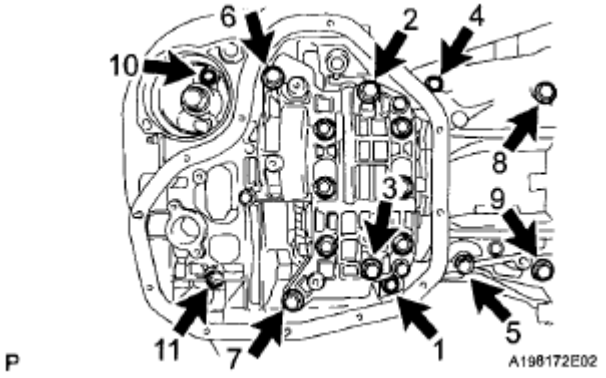


Fig. 384: Identifying Stiffening Crankcase Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. **INSTALL NO. 1 OIL PAN BAFFLE PLATE**
   a. Install the oil pan baffle plate and uniformly tighten the 5 bolts in several steps, in the sequence shown in the illustration.

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

6. **INSTALL OIL STRAINER SUB-ASSEMBLY**
   a. Apply a light coat of engine oil to a new gasket.

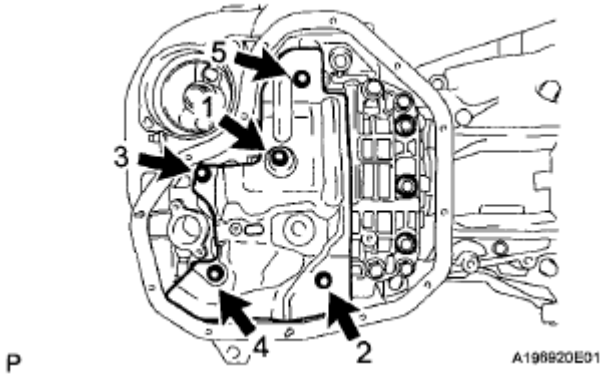


Fig. 385: Identifying No. 1 Oil Pan Baffle Plate Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   b. Align the protrusion of the gasket with the cutout of the oil strainer, and install the gasket to the oil strainer.
   c. Install the oil strainer by tightening the 3 bolts in several steps, in the sequence shown in the illustration.

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

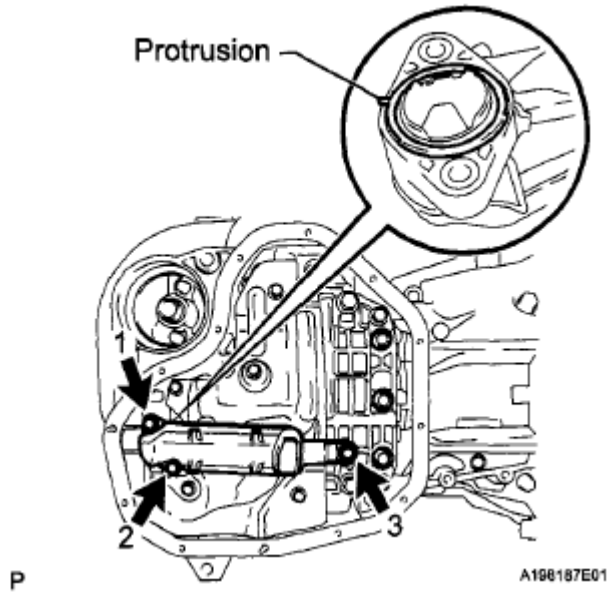


Fig. 386: Aligning Protrusion Of Gasket With Cutout Of Oil Strainer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. **INSTALL OIL PAN SUB-ASSEMBLY**
   a. Apply seal packing in a continuous line as shown in the illustration.

      Seal packing:

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

      Standard seal diameter:

      2.5 to 3.5 mm (0.0984 to 0.138 in.)

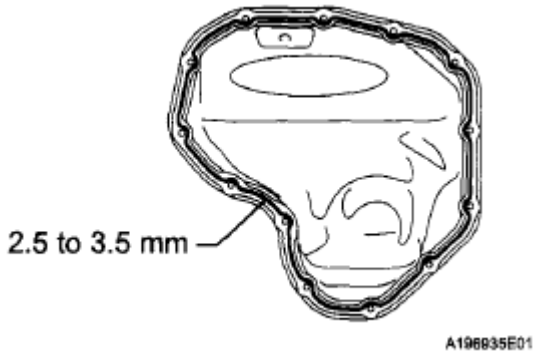


Fig. 387: Applying Seal Packing In Continuous Line
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes and tighten the bolts and nuts within 10 minutes after applying seal packing.**
- **Do not apply oil for at least 4 hours after the installation.**

   b. Install the oil pan by tightening the 11 bolts and 2 nuts in several steps, in the sequence shown in the illustration.

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

      HINT:

      Bolt A and nut A should be tightened twice.

8. **INSTALL OIL FILTER CAP ASSEMBLY** (See **REPLACEMENT**)
9. **INSTALL REAR ENGINE OIL SEAL** (See **REMOVAL**)

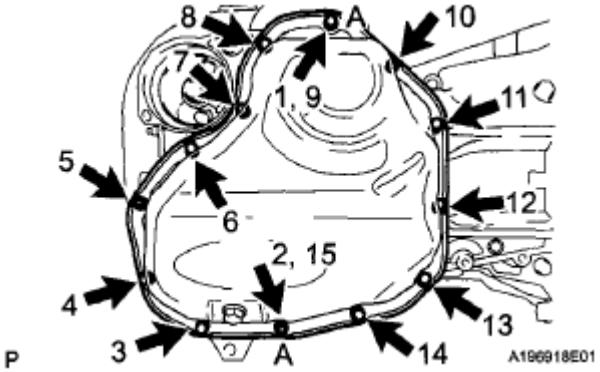


Fig. 388: Identifying Oil Pan Bolts And Nuts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **INSTALL CYLINDER BLOCK WATER JACKET SPACER**
    a. Install the water jacket spacer to the cylinder block.
11. **INSTALL CYLINDER HEAD GASKET** (See **CYLINDER HEAD**)
12. **INSTALL CYLINDER HEAD SUB-ASSEMBLY** (See **CYLINDER HEAD**)
13. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY** (See **INSTALLATION**)

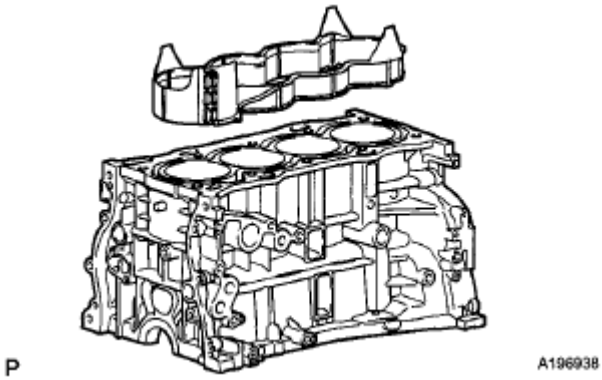


Fig. 389: Identifying Cylinder Block Water Jacket Spacer And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **INSTALL CAMSHAFT BEARING CAP SETTING RING PIN**

NOTE: It is not necessary to remove the ring pin unless it is being replaced.

a. Using a plastic-faced hammer, tap in 10 new ring pins to the camshaft housing.

Standard protrusion height: 2.7 to 3.3 mm (0.106 to 0.130 in.)

15. **INSTALL CAMSHAFT HOUSING STRAIGHT PIN**

NOTE: It is not necessary to remove the straight pin unless it is being replaced.

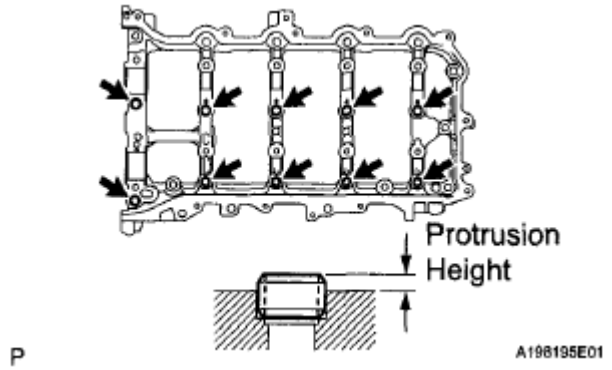


Fig. 390: Locating Camshaft Housing Ring Pins With Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Using a plastic-faced hammer, tap in 2 new straight pins to the camshaft housing.

Standard protrusion height: 5.0 to 7.0 mm (0.197 to 0.276 in.)

16. **INSTALL CAMSHAFT HOUSING STUD BOLT**

NOTE: If a stud bolt is deformed or the threads are damaged, replace it.

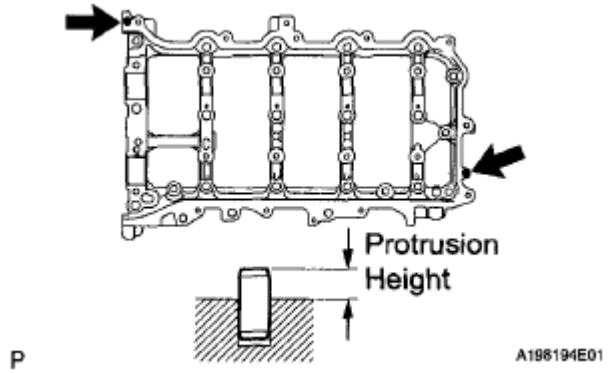


Fig. 391: Locating Camshaft Housing Straight Pins With Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

a. Using an E8 "TORX" socket wrench, install the stud bolt.

Torque: 9.5 N*m (97 kgf*cm, 84 in.*lbf)

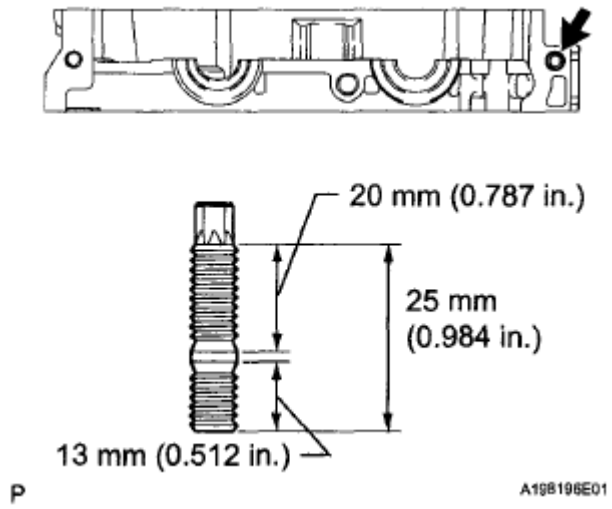


Fig. 392: Locating Stud Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **INSTALL NO. 1 CAMSHAFT BEARING**
    a. Clean the No. 1 camshaft bearing.
    b. Install the camshaft bearing to the No. 1 camshaft bearing cap.
    c. Using a vernier caliper, measure the distance between the camshaft bearing cap edge and the camshaft bearing edge.

       Dimension A - B or B - A:

       0 to 0.7 mm (0 to 0.0276 in.)

18. **REMOVE NO. 2 CAMSHAFT BEARING**
    a. Clean the No. 2 camshaft bearing.
    b. Install the camshaft bearing to the camshaft housing.

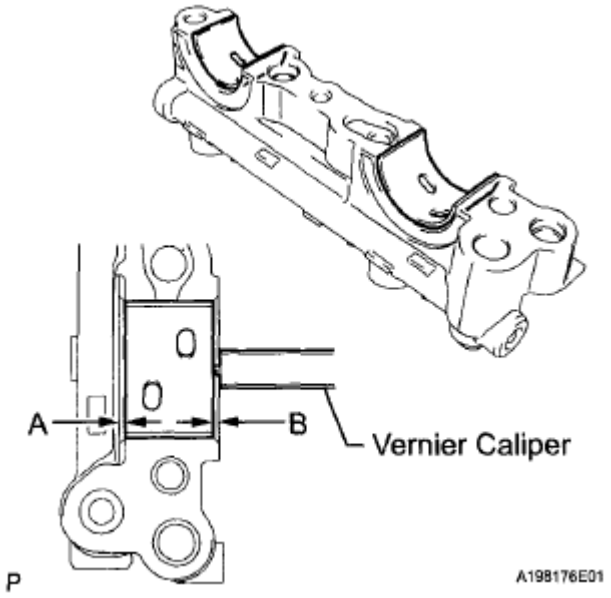


Fig. 393: Measuring Distance Between Camshaft Bearing Cap Edge And Camshaft Bearing Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Using a vernier caliper, measure the distance between the camshaft housing edge and the camshaft bearing edge.

Standard distance: 1.15 to 1.85 mm (0.0453 to 0.0728 in.)

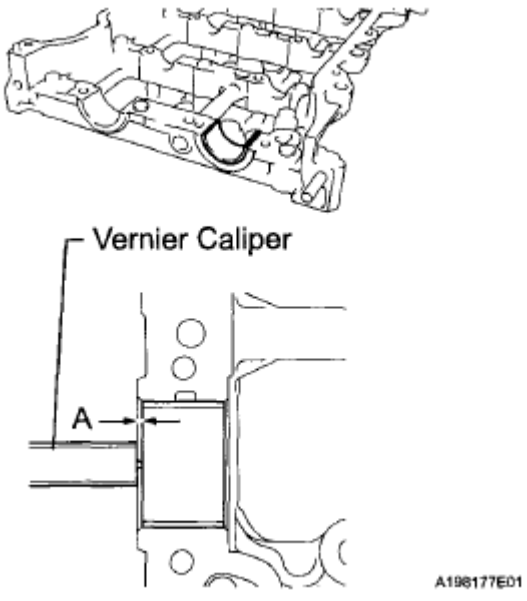


Fig. 394: Measuring Distance Between Camshaft Housing Edge And Camshaft Bearing Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **INSTALL OIL CONTROL VALVE FILTER**
    a. Install the oil control valve filter to the No. 1 camshaft bearing cap.
20. **INSTALL CAMSHAFT** (See **CYLINDER HEAD GASKET**)
21. **INSTALL CAMSHAFT BEARING CAP** (See **CYLINDER HEAD GASKET**)
22. **INSTALL VALVE STEM CAP** (See **CYLINDER HEAD**)

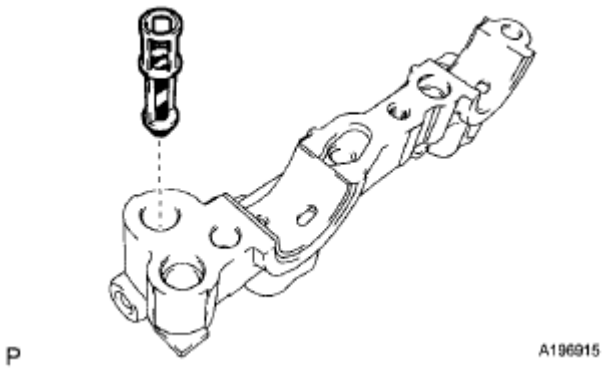


Fig. 395: Identifying Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. **INSTALL VALVE LASH ADJUSTER ASSEMBLY** (See **CYLINDER HEAD GASKET**)
24. **INSTALL VALVE ROCKER ARM SUB-ASSEMBLY** (See **CYLINDER HEAD GASKET**)
25. **INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY** (See **CYLINDER HEAD GASKET**)
26. **INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY** (See **CYLINDER HEAD GASKET**)
27. **INSTALL CRANKSHAFT TIMING SPROCKET**
    a. Install the crankshaft timing sprocket to the crankshaft.
28. **ADD ENGINE OIL** (See **CYLINDER HEAD GASKET**)
29. **SET NO. 1 CYLINDER TO TDC/COMPRESSION** (See **CYLINDER HEAD GASKET**)
30. **INSTALL NO. 1 CHAIN VIBRATION DAMPER** (See **CYLINDER HEAD GASKET**)

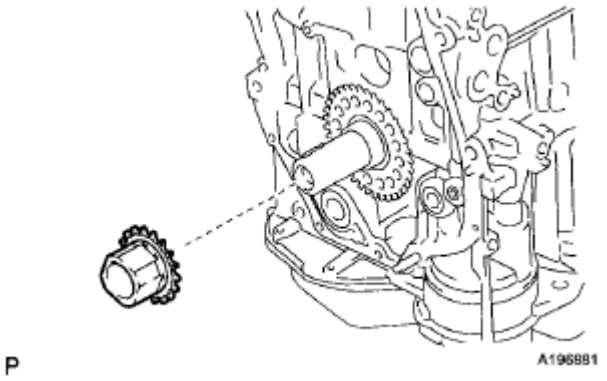


Fig. 396: Identifying Crankshaft Timing Sprocket And Crankshaft

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

31. **INSTALL CHAIN SUB-ASSEMBLY**
32. **INSTALL CHAIN TENSIONER SLIPPER** (See **CYLINDER HEAD GASKET**)
33. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY** (See **CYLINDER HEAD GASKET**)
34. **INSTALL TIMING CHAIN GUIDE** (See **CYLINDER HEAD GASKET**)
35. **CHECK NO. 1 CYLINDER TDC/COMPRESSION** (See **CYLINDER HEAD GASKET**)
36. **INSTALL TIMING CHAIN COVER PLATE**
    a. Install a new gasket and the timing chain cover plate with the 4 bolts.

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

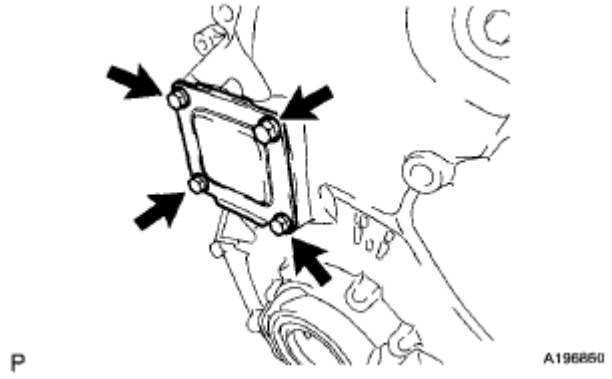


Fig. 397: Locating Timing Chain Cover Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. **INSTALL TIMING CHAIN COVER TIGHT PLUG**
    a. Using a 14 mm hexagon wrench, install a new gasket and the plug.

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

38. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY** (See **INSTALLATION**)
39. **INSTALL ENGINE MOUNTING BRACKET RH** (See **INSTALLATION**)

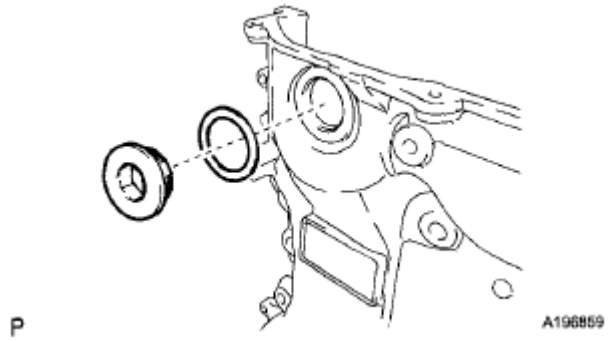


Fig. 398: Identifying Timing Chain Cover Tight Plug And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **INSTALL TIMING CHAIN COVER OIL SEAL** (See **INSTALLATION**)
41. **INSTALL SPARK PLUG TUBE GASKET**
    a. Visually check the spark plug tube gasket.

    OK

    SPECIFIED CONDITION REFERENCE

Area	Specified Condition
Upper surface	No scratches or deformation
Outer lip	No scratches or deformation
Inner lip	No scratches

    If the result is not as specified, replace the spark plug tube gasket.

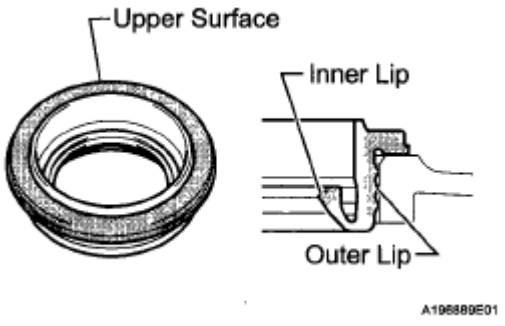


Fig. 399: Checking Spark Plug Tube Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Install the 4 plug tube gaskets to the cylinder head cover.

NOTE: After pressing in the spark plug tube gasket, make sure the gasket protrudes 1.0 mm (0.0394 in.) or less from the cylinder head cover.

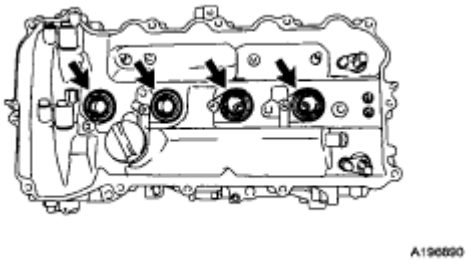


Fig. 400: Locating Spark Plug Tube Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**
    a. Apply a light coat of engine oil to 3 new gaskets.
    b. Install the 3 gaskets to the camshaft bearing caps.
    c. Install a new gasket to the cylinder head cover.

NOTE: Remove any oil from the contact surface.

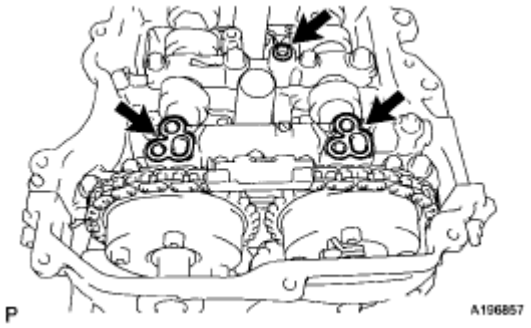


Fig. 401: Locating Camshaft Bearing Caps Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    d. Apply seal packing as shown in the illustration.

Seal packing:

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

Standard seal diameter:

3.0 to 6.0 mm (0.118 to 0.236 in.)

Application width A:

5.0 mm (0.197 in.)

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

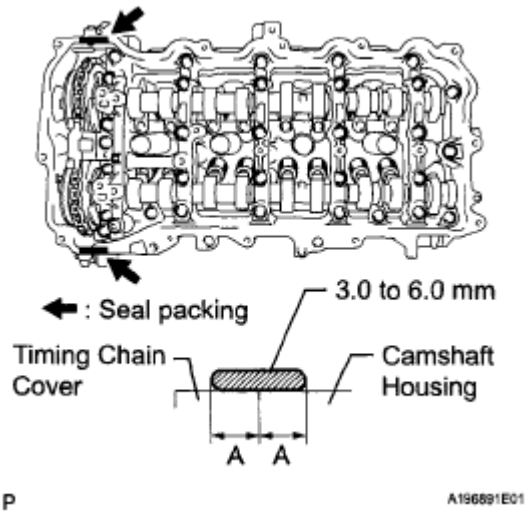


Fig. 402: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

e. Align the cylinder head cover with pin A. Then align the cylinder head cover with pin B and install the cylinder head cover.
f. Install 3 new seal washers and the 16 bolts, and then tighten the bolts in the order shown in the illustration.

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

NOTE: Do not apply oil for at least 4 hours after the installation.

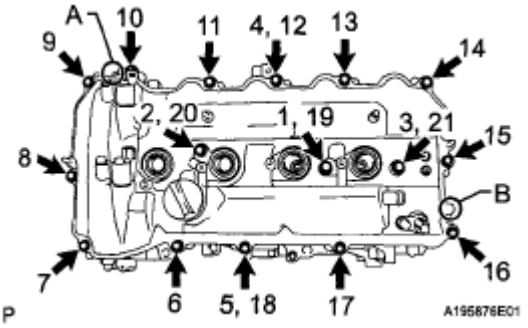


Fig. 403: Identifying Cylinder Head Cover Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **INSTALL CRANKSHAFT PULLEY**
    a. Align the pulley set key with the key groove of the crankshaft pulley.
    b. Using SST, hold the crankshaft pulley and install the pulley bolt.

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

Torque: 260 N*m (2651 kgf*cm, 192 ft.*lbf)

44. **INSTALL CRANKSHAFT POSITION SENSOR** (See **REMOVAL**)

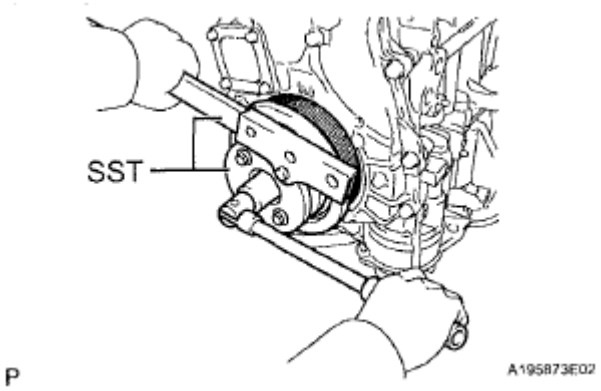


Fig. 404: Loosening Crankshaft Pulley Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

45. **INSTALL INLET WATER HOUSING**
    a. Install a new gasket and the inlet water housing with the 4 bolts and nut.

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

46. **INSTALL OIL COOLER ASSEMBLY (w/ Oil Cooler)** (See **INSPECTION**)
47. **INSTALL WATER PUMP ASSEMBLY** (See **REMOVAL**)

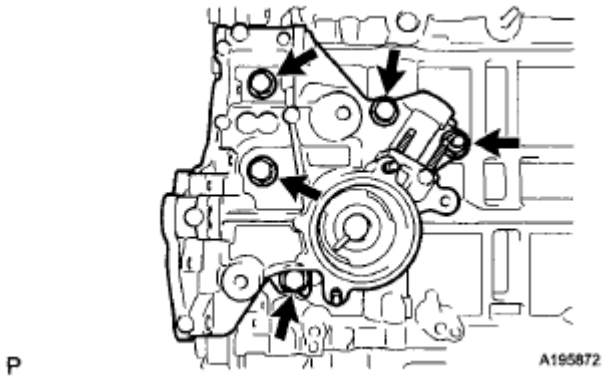


Fig. 405: Locating Inlet Water Housing Bolts And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

48. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY**
    a. Install the V-ribbed belt tensioner with the bolt.

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

49. **INSTALL THERMOSTAT** (See **INSTALLATION**)
50. **INSTALL INLET WATER** (See **INSTALLATION**)

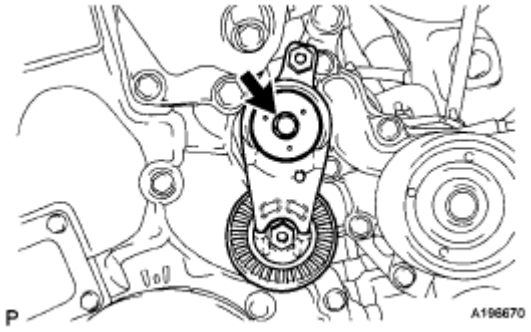


Fig. 406: Locating V-Ribbed Belt Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **INSTALL WATER DRAIN COCK**
    a. Apply adhesive to 2 or 3 threads of the drain cock.

       Adhesive:

       Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

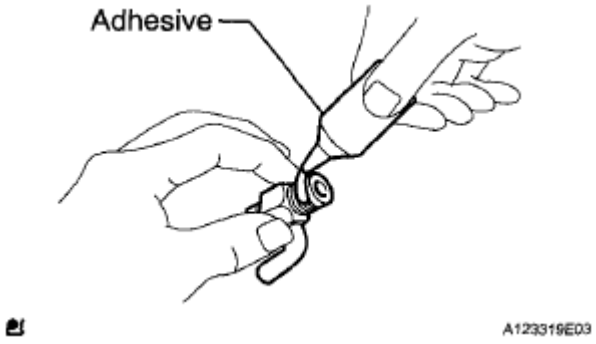


Fig. 407: Applying Adhesive To Threads Of Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Install the water drain cock as shown in the illustration.

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

NOTE:

- **Do not rotate the drain cock more than 1 revolution (360°) after tightening the drain cock to the specified torque.**
- **Do not loosen the drain cock to adjust it. If an adjustment is necessary, remove the drain cock and reinstall it.**

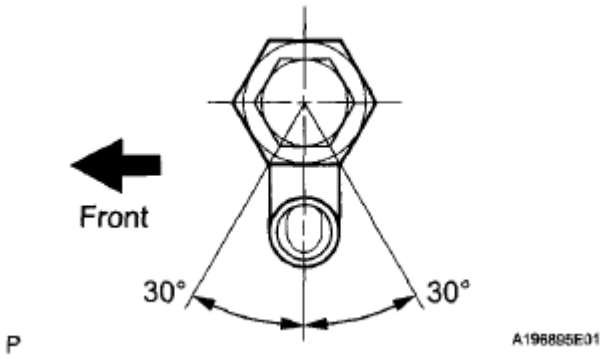


Fig. 408: Identifying Water Drain Cock Installation Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Install the water drain cock plug to the water drain cock.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

52. **INSTALL NO. 1 WATER BY-PASS PIPE**
    a. Install a new gasket and the water by-pass pipe with the 2 nuts and bolt.

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

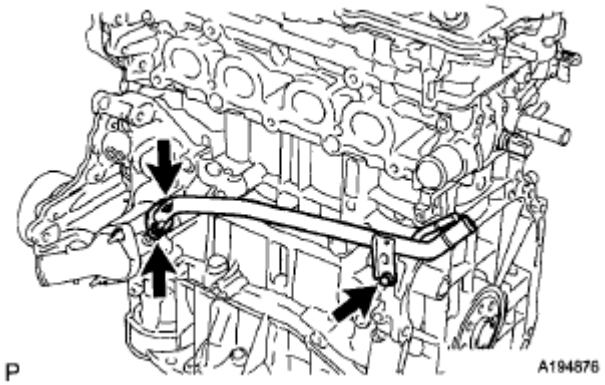


Fig. 409: Locating Water By-Pass Pipe Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

53. **INSTALL SEPARATOR CASE**
    a. Apply a light coat of engine oil to a new gasket.
    b. Install the gasket to the separator case.
    c. Install the separator case with the 2 bolts.

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

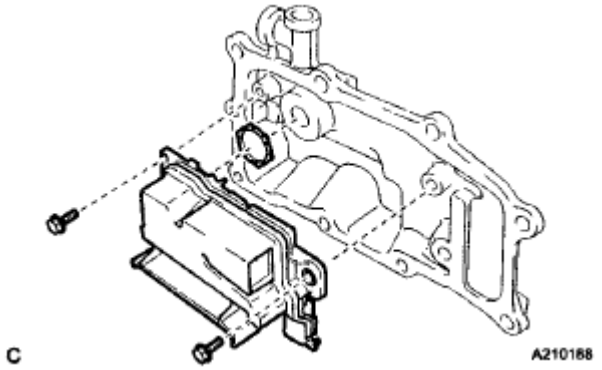


Fig. 410: Identifying Separator Case Bolts And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

54. **INSTALL VENTILATION CASE SUB-ASSEMBLY**
    a. Apply seal packing in a continuous line as shown in the illustration.

       Seal packing:

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

       Standard seal diameter:

       2.5 to 3.5 mm (0.0984 to 0.138 in.)

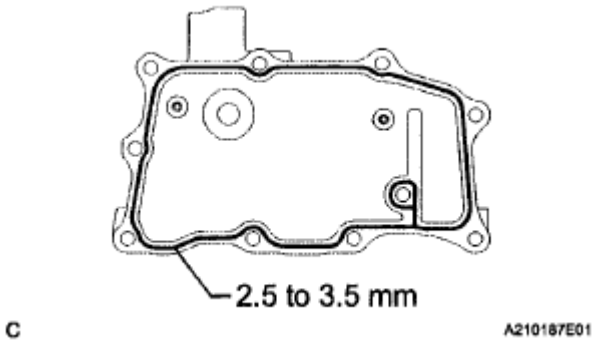


Fig. 411: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:
- **Remove any oil from the contact surface.**
- **Install the ventilation case within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.**

    b. Install the ventilation case, and install the 8 bolts and 2 nuts in the order shown in the illustration.

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

HINT:

Bolt A should be tightened twice.

55. **INSTALL VENTILATION VALVE SUB-ASSEMBLY** (See **INSPECTION**)
56. **INSTALL CAMSHAFT POSITION SENSOR (for Intake Side)** (See **REMOVAL**)

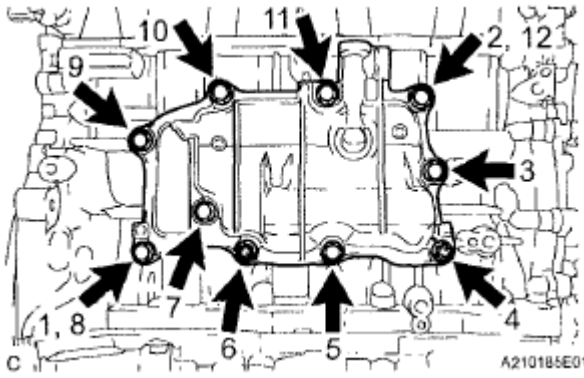


Fig. 412: Identifying Ventilation Case Bolts And Nuts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **INSTALL CAMSHAFT POSITION SENSOR (for Exhaust Side)** (See **REMOVAL**)
58. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Intake Side)** (See **INSTALLATION**)
59. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (for Exhaust Side)** (See **INSTALLATION**)
60. **INSTALL OIL FILLER CAP SUB-ASSEMBLY**
    a. Install a new gasket to the oil filler cap.
    b. Install the oil filler cap to the cylinder head.
61. **INSTALL SPARK PLUG** (See **REMOVAL**)
62. **INSTALL ENGINE COVER JOINT**
    a. Install the 3 joints.

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

INSTALLATION

1. **INSTALL IGNITION COIL ASSEMBLY** (See **REMOVAL**)
2. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR** (See **INSTALLATION**)

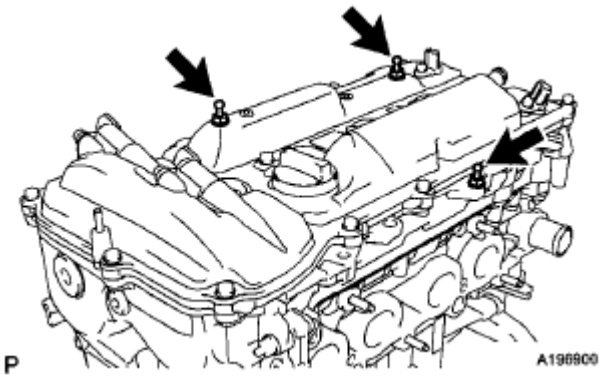


Fig. 413: Locating Engine Cover Joint
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY** (See **INSTALLATION**)
4. **INSTALL KNOCK CONTROL SENSOR** (See **REMOVAL**)
5. **INSTALL SENSOR WIRE**
   a. Install the sensor wire with the bolt.

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

   b. Connect the knock control sensor connector.
6. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** (See **INSTALLATION**)
7. **INSTALL INTAKE MANIFOLD** (See **INSTALLATION**)
8. **CONNECT NO. 2 VENTILATION HOSE** (See **INSTALLATION**)

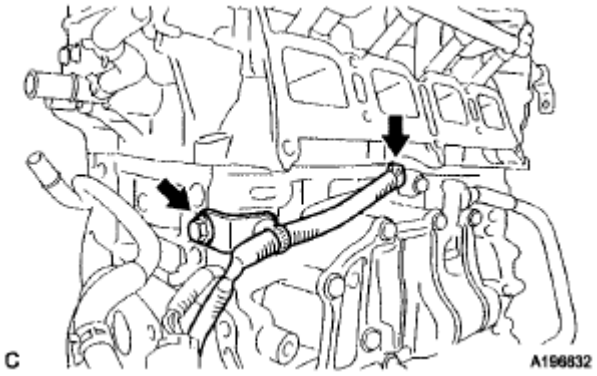


Fig. 414: Locating Knock Control Sensor Wire And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL NO. 1 VACUUM SWITCHING VALVE ASSEMBLY** (See **INSTALLATION**)
10. **INSTALL VACUUM SWITCHING VALVE ASSEMBLY** (See **INSTALLATION**)
11. **INSTALL WATER BY-PASS HOSE**
    a. Install the No. 1 and No. 2 water by-pass hoses.

12. **INSTALL THROTTLE BODY ASSEMBLY** (See **INSPECTION**)

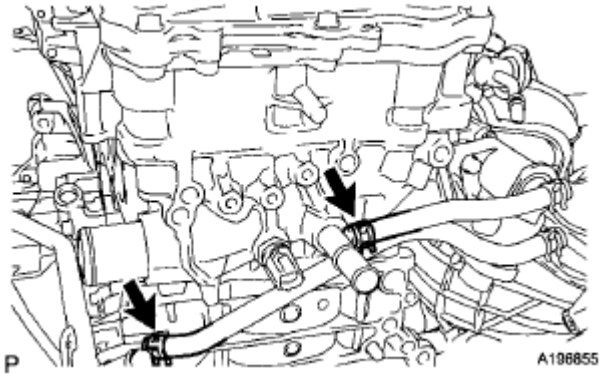


Fig. 415: Locating No. 1 And No. 2 Water By-Pass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET**
    a. Install the bracket with the 4 bolts.

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

14. **INSTALL EXHAUST MANIFOLD ASSEMBLY** (See **INSTALLATION**)
15. **INSTALL NO. 2 MANIFOLD STAY** (See **INSTALLATION**)
16. **INSTALL MANIFOLD STAY** (See **INSTALLATION**)

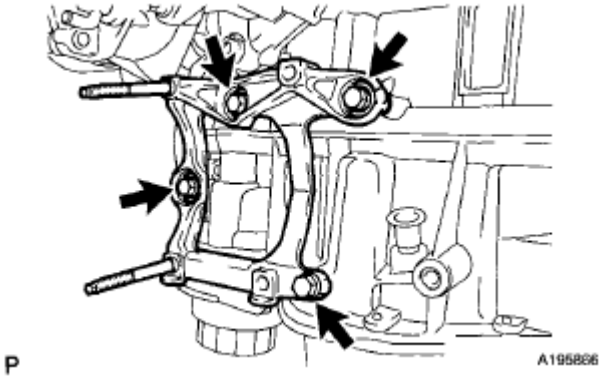


Fig. 416: Locating No. 1 Compressor Mounting Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **INSTALL ENGINE OIL LEVEL DIPSTICK GUIDE**
    a. Apply a light coat of engine oil to a new O-ring.
    b. Install the O-ring to the engine oil level dipstick guide.
    c. Install the engine oil level dipstick guide with the bolt.

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

d. Install the engine oil level dipstick.

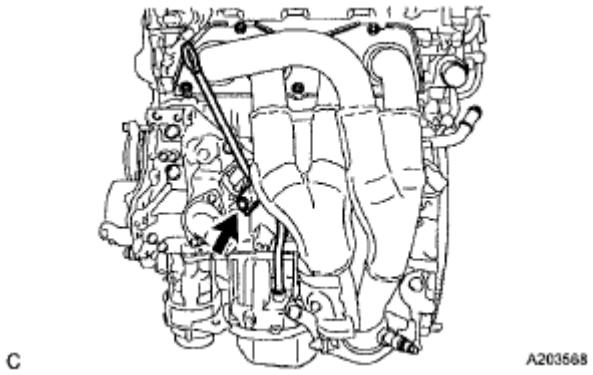


Fig. 417: Locating Engine Oil Level Dipstick Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

