

2009 ENGINE**Engine Mechanical (2ZR-FE) - Corolla Matrix****ENGINE****ON-VEHICLE INSPECTION****1. INSPECT ENGINE COOLANT**

HINT:

See COOLING SYSTEM .

2. INSPECT ENGINE OIL

HINT:

See LUBRICATION SYSTEM .

3. INSPECT BATTERY

HINT:

See CHARGING SYSTEM .

4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

- a. Remove the air cleaner cap.
- b. Remove the air filter element.
- c. Visually check that the air filter is not excessively damaged or oily. If necessary, replace the air filter.

5. INSPECT SPARK PLUG (See ON-VEHICLE INSPECTION)**6. INSPECT V-RIBBED BELT (See ON-VEHICLE INSPECTION)****7. INSPECT VALVE AND ADJUSTER 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).

8. INSPECT IGNITION TIMING

- a. When using the Techstream:
 1. Warm up and stop the engine.
 2. Connect the Techstream to the DLC3.
 3. Turn the ignition switch to ON.
 4. Enter Data List Mode on the Techstream.

HINT:

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

5. Inspect the ignition timing at idle.

Ignition timing:

8 to 12 degrees BTDC

NOTE:

- Turn all the electrical systems and the A/C off.
- Inspect the ignition timing with the cooling fans off.
- Check the ignition timing with the shift lever in N.

6. Enter the following menus: TC (TE1) / OFF.
 7. Turn the ignition switch off.
 8. Disconnect the Techstream from the DLC3.
- b. When not using the Techstream:
1. Remove the No. 2 cylinder head cover (See **REMOVAL**).
 2. Pull out the wire harness (brown) shown in the illustration.

NOTE:

After checking, wrap the wire harness with tape.

3. Warm up and stop the engine.
4. Connect the clip of the timing light to the wire harness.

NOTE:

Use a timing light that detects the primary signal.

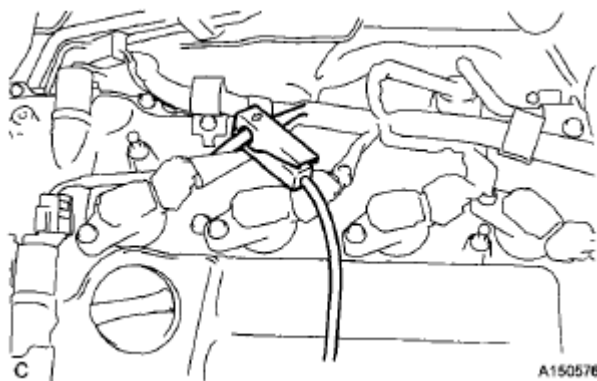


Fig. 1: Identifying Wire Harness

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

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

SST 09843-18040

NOTE: Examine the terminal numbers before connecting them.
Connecting the wrong terminals can damage the engine.

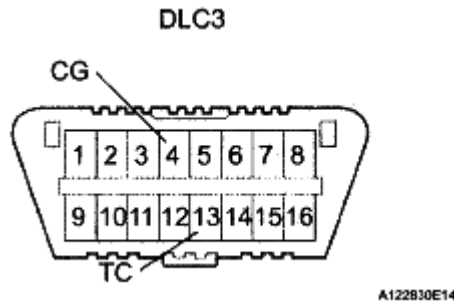


Fig. 2: Identifying DLC3 Connector Terminal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Inspect the ignition timing at idle.

Ignition timing:

8 to 12 degrees BTDC

NOTE:

- Turn all the electrical systems and the A/C off.
- Inspect the ignition timing with the cooling fans off.
- Check the ignition timing with the shift lever in N or P.

7. Disconnect SST from terminals 13 (TC) and 4 (CG) of the DLC3.
8. Turn the ignition switch off.
9. Remove the timing light.
10. Install the No. 2 cylinder head cover (See **INSTALLATION**).

9. INSPECT ENGINE IDLE SPEED

- a. Warm up and stop the engine.
- b. Connect the Techstream to the DLC3.
- c. Turn the ignition switch to ON.
- d. Enter Data List Mode on the Techstream.

HINT:

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

- e. Inspect the engine idle speed.

Idle speed:**600 to 700 rpm****NOTE:**

- Turn all the electrical systems and the A/C off.
- Inspect the idle speed with the cooling fans off.
- Check the idle speed with the shift lever in N or P.

- f. Turn the ignition switch off.
- g. Disconnect the Techstream from the DLC3.

10. INSPECT COMPRESSION

- a. Warm up and stop the engine.
- b. Remove the No. 2 cylinder head cover (See **REMOVAL**).
- c. Remove the 4 ignition coils.
- d. Remove the 4 spark plugs (See **IGNITION COIL AND SPARK PLUG**).
- e. Disconnect the 4 fuel injector connectors.
- f. Inspect the cylinder compression pressure.
 - 1. Insert a compression gauge into the spark plug hole.
 - 2. Fully open the throttle.
 - 3. While cranking the engine, measure the compression pressure.

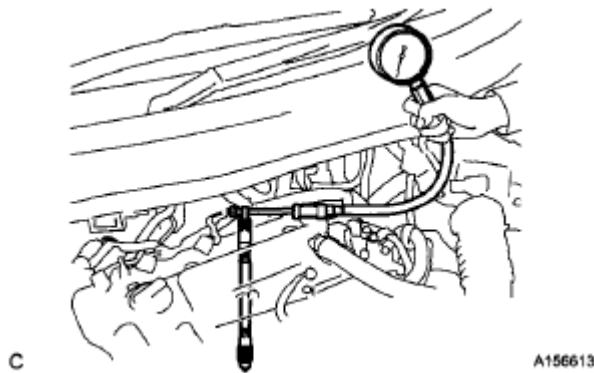


Fig. 3: Inspecting Cylinder Compression Pressure
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Compression:**1373 kPa (14.0 kgf/cm² , 199 psi)****Minimum pressure:****1079 kPa (11.0 kgf/cm² , 157 psi)**

Difference between each cylinder:**98 kPa (1.0 kgf/cm² , 14.2 psi) or less****NOTE:**

- **Use a fully-charged battery so that the engine speed can be increased to 250 rpm or more.**
- **Inspect the other cylinders in the same way.**
- **Measure the compression in as a short time as possible.**

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

HINT:

- If adding oil increases the compression, the piston rings and/or cylinder bore may be worn or damaged.
 - If the pressure stays low, the valve may be stuck or seated improperly, or there may be leakage from the gasket.
- g. Connect the 4 fuel injector connectors.
 - h. Install the 4 spark plugs (See **INSTALLATION**).
 - i. Install the 4 ignition coils.

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

- j. Install the No. 2 cylinder head cover (See **INSTALLATION**).

11. INSPECT CO/HC**HINT:**

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

- a. Start the engine.
- b. Run the engine at 2500 rpm for approximately 180 seconds.
- c. Insert the CO/HC meter testing probe at least 40 cm (1.3 ft.) into the tailpipe while idling.
- d. Check the CO/HC concentration during idle and when the engine is running at 2500 rpm.

HINT:

When doing the 2 mode (with the engine idling/ running at 2500 rpm) test, the measuring procedures are determined by applicable local regulations.

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

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

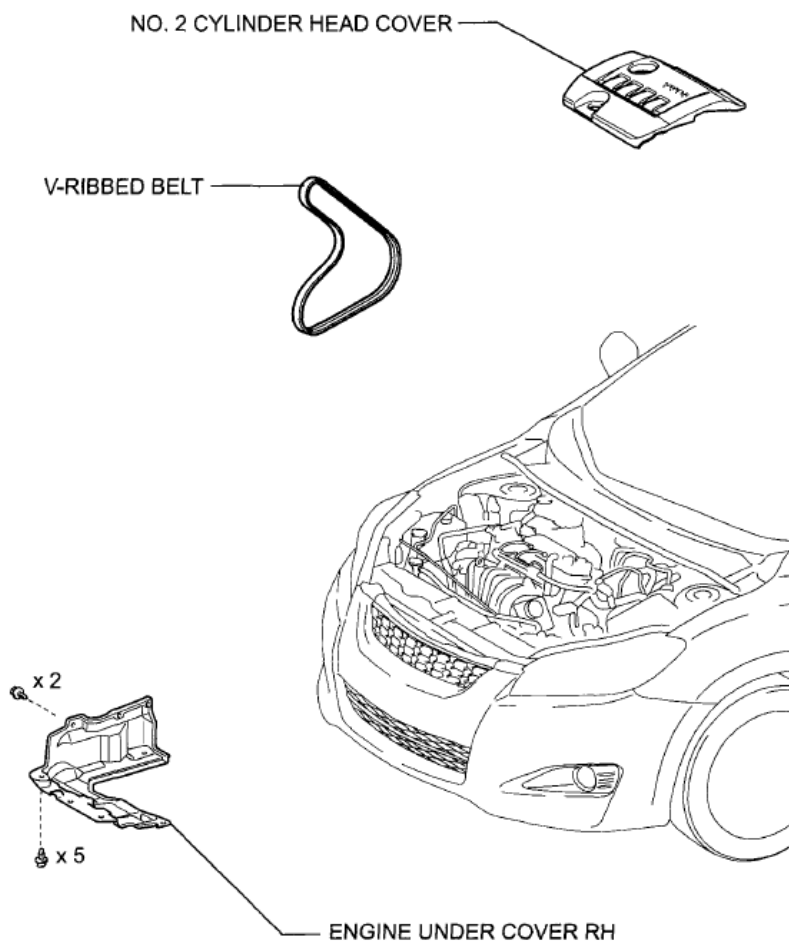
1. Check the A/F sensor and heated oxygen sensor operation.
2. See the table below for possible causes, then inspect the applicable parts and repair them if necessary.

POSSIBLE CAUSE CHART

CO	HC	Problem	Possible Cause
Normal	High	Rough idle	1. Faulty ignition: ○ Incorrect timing ○ Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leakage from intake and exhaust valves 4. Leakage from cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: ○ PCV hoses ○ Intake manifold ○ Throttle body ○ Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air cleaner filter element 2. Plugged PCV valve 3. Faulty EFI system: ○ Faulty pressure regulator ○ Faulty engine coolant temperature sensor ○ Faulty mass air flow meter ○ Faulty ECM ○ Faulty injectors ○ Throttle body

DRIVE BELT

COMPONENTS



C

A186538E01

Fig. 4: Identifying Drive Belt Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

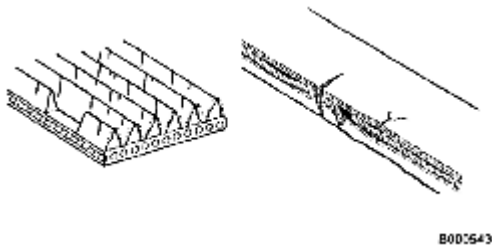
ON-VEHICLE INSPECTION

1. INSPECT V-RIBBED BELT

- Check the belt for wear, cracks or other signs of damage.

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

- The belt is cracked.
- The belt is worn out to the extent that wires are exposed.
- The belt has chunks missing from the ribbed grooves.



B002543

Fig. 5: Identifying V-Ribbed Belt For Wear And Cracks
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

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



CORRECT

INCORRECT

B075171E06

Fig. 6: Identifying V-Ribbed Belt Correct And Incorrect Position
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check the V-ribbed belt deflection and tension.

Deflection

ITEM SPECIFICATION

Item	Specified Condition
New belt	7.5 to 8.6 mm (0.296 to 0.338 in.)
Used belt	8.0 to 10.0 mm (0.315 to 0.394 in.)

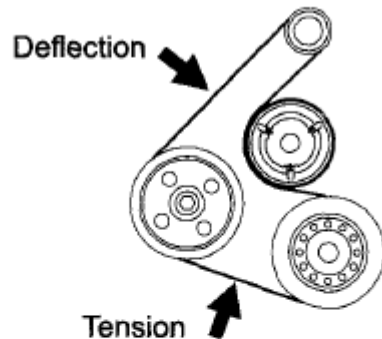
Tension

ITEM SPECIFICATION

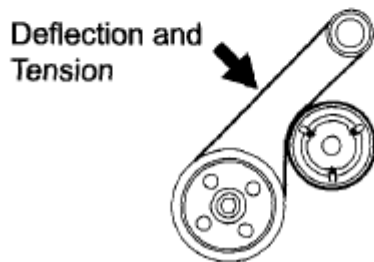
Item	Specified Condition
New belt	637 to 735 N (65 to 75 kg, 143 to 165 lb)
Used belt	392 to 588 N (40 to 60 kg, 88 to 132 lb)

If the belt deflection is not as specified, adjust it.

w/ Air Conditioning System:



w/o Air Conditioning System:



P

A147660E02

Fig. 7: Locating V-Ribbed Belt Deflection And Tension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

- When inspecting the V-ribbed belt deflection, apply 98 N (10 kgf) tensile force to it.
- After installing a new belt, run the engine for approximately 5 minutes and then readjust the tension to (new belt) specifications.
- Check the V-ribbed belt deflection and tension at the specified point.
- V-ribbed belt tension and deflection should be checked after 2 revolutions of the engine.
- V-ribbed belt tension and deflection should be checked at TDC crank angle and cold condition.
- When adjusting a belt, adjust its deflection and tension to the intermediate values of the specification.
- When reinstalling a belt which has been used for over 5 minutes, adjust its deflection and tension to the used belt specification.
- When using a belt tension gauge, confirm its accuracy by using a master gauge first.

If using a sonic tension meter:

Input data for sonic tension meter

Weight:**15 g/rib*m****Width:****6 ribs****Span:****188 mm (7.40 in.) (w/ air conditioning)****282 mm (11.1 in.) (w/o air conditioning)****REMOVAL**

1. **REMOVE NO. 2 CYLINDER HEAD COVER** (See **REMOVAL**)
2. **REMOVE ENGINE UNDER COVER RH**
3. **REMOVE V-RIBBED BELT**
 - a. Loosen bolts A and B.
 - b. Loosen bolt C, then remove the V-ribbed belt.

NOTE: **Do not loosen bolt D.**

INSTALLATION

1. **INSTALL V-RIBBED BELT**
 - a. Install the belt.

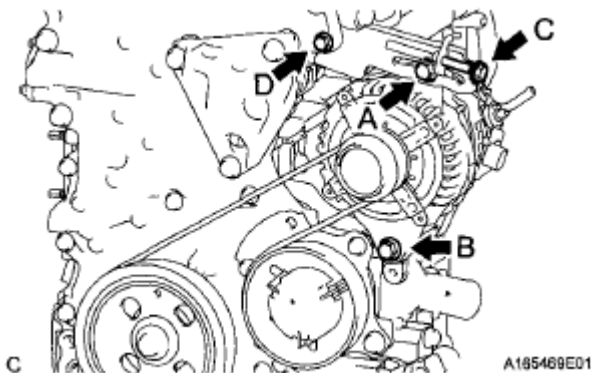


Fig. 8: Locating V-Ribbed Belt Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **ADJUST V-RIBBED BELT**
 - a. Turn bolt C to adjust the tension of the V-ribbed belt.

- b. Tighten bolts A and B.

Torque: Bolt A

19 N*m (190 kgf*cm, 14 ft.*lbf)

Bolt B

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

NOTE: Confirm that bolt D is not loosened.

3. INSPECT V-RIBBED BELT (See ON-VEHICLE INSPECTION)

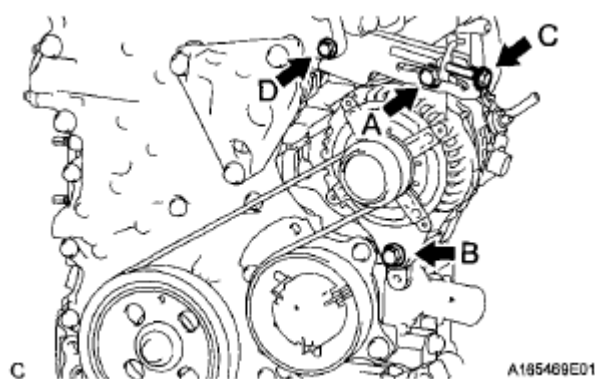


Fig. 9: Locating V-Ribbed Belt Bolt

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

4. INSTALL ENGINE UNDER COVER RH
5. INSTALL NO. 2 CYLINDER HEAD COVER

CAMSHAFT

COMPONENTS

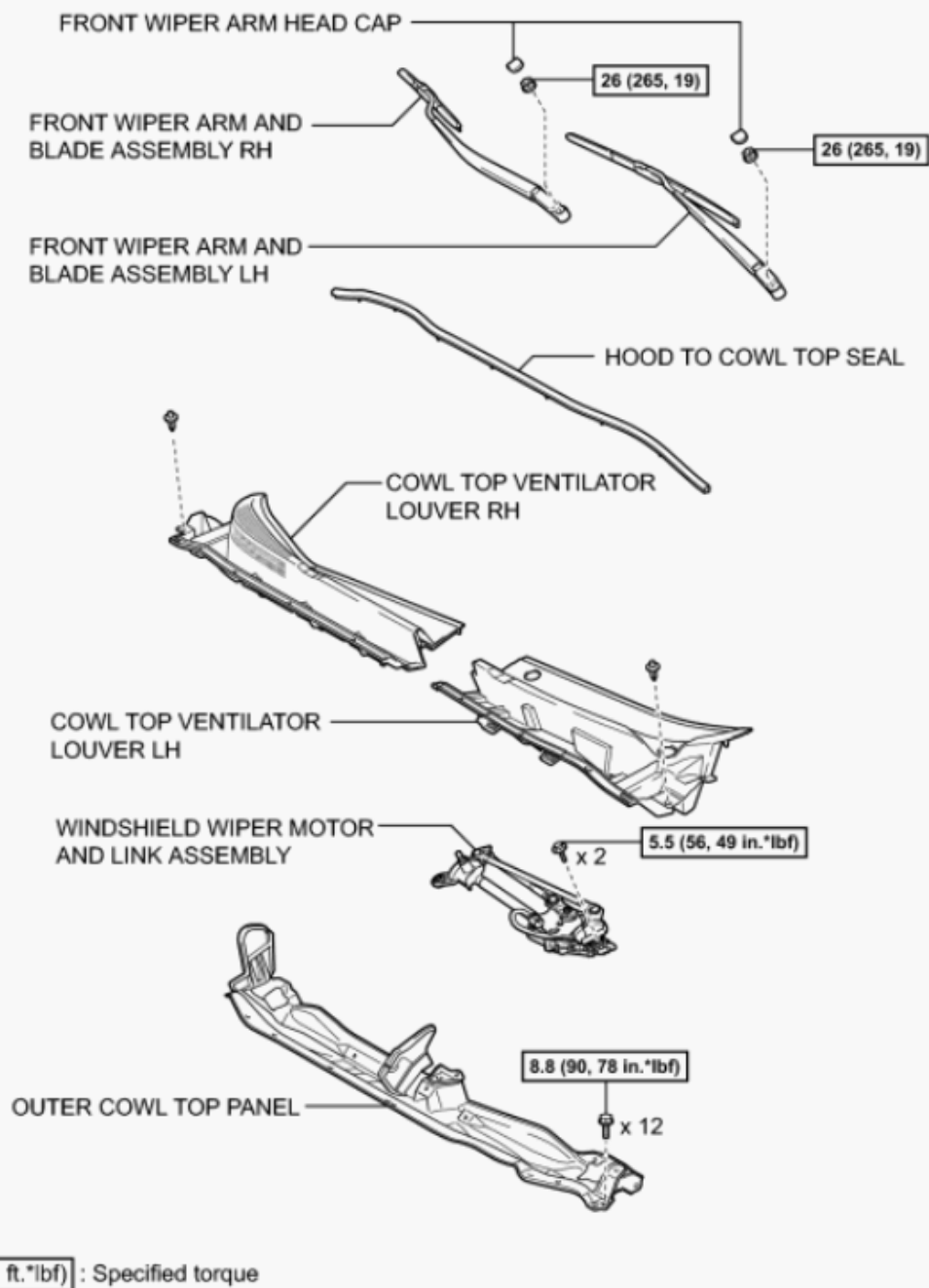


Fig. 10: Identifying Camshaft Components And Torque Specifications (1 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

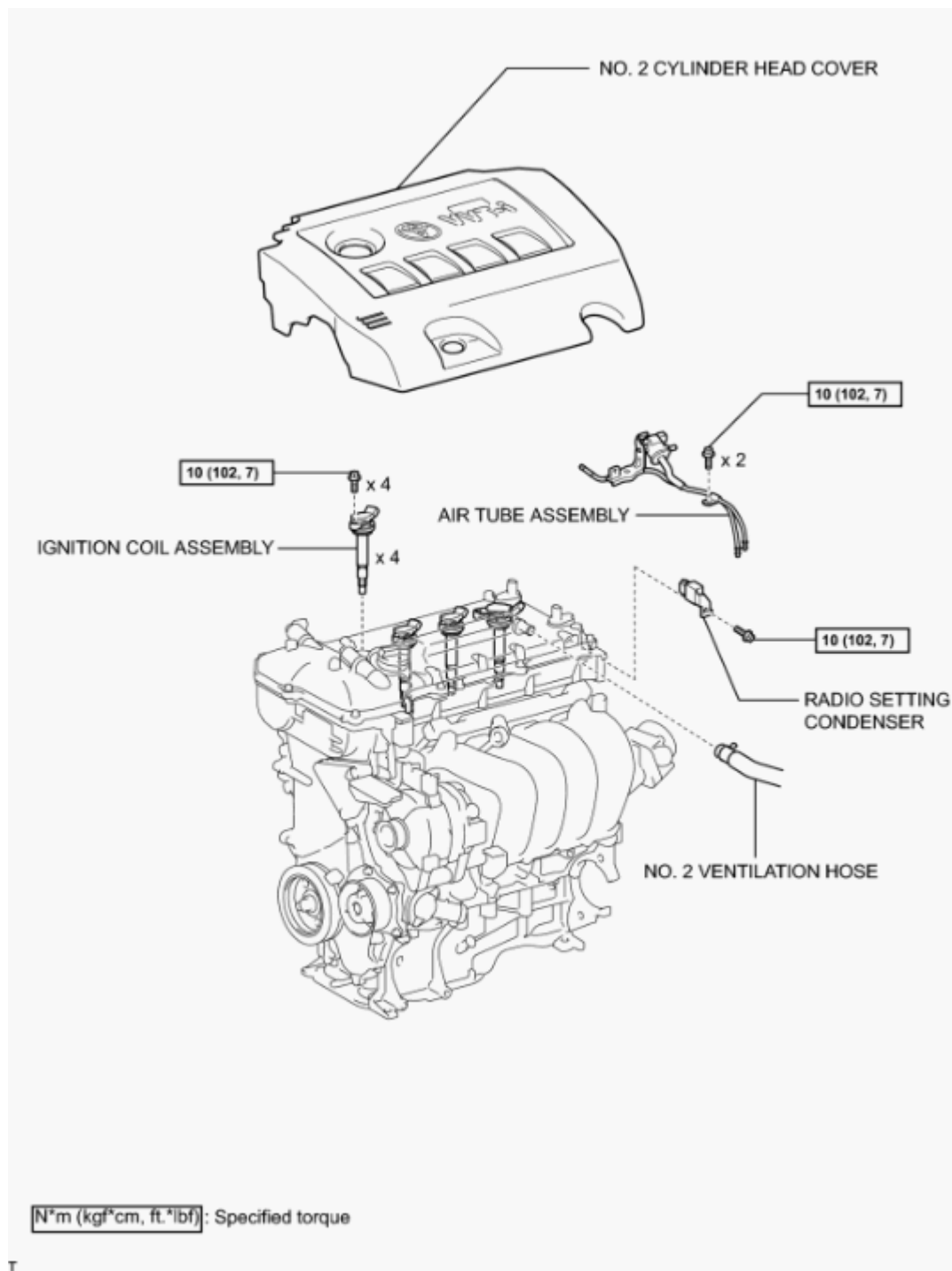


Fig. 11: Identifying Camshaft Components And Torque Specifications (2 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

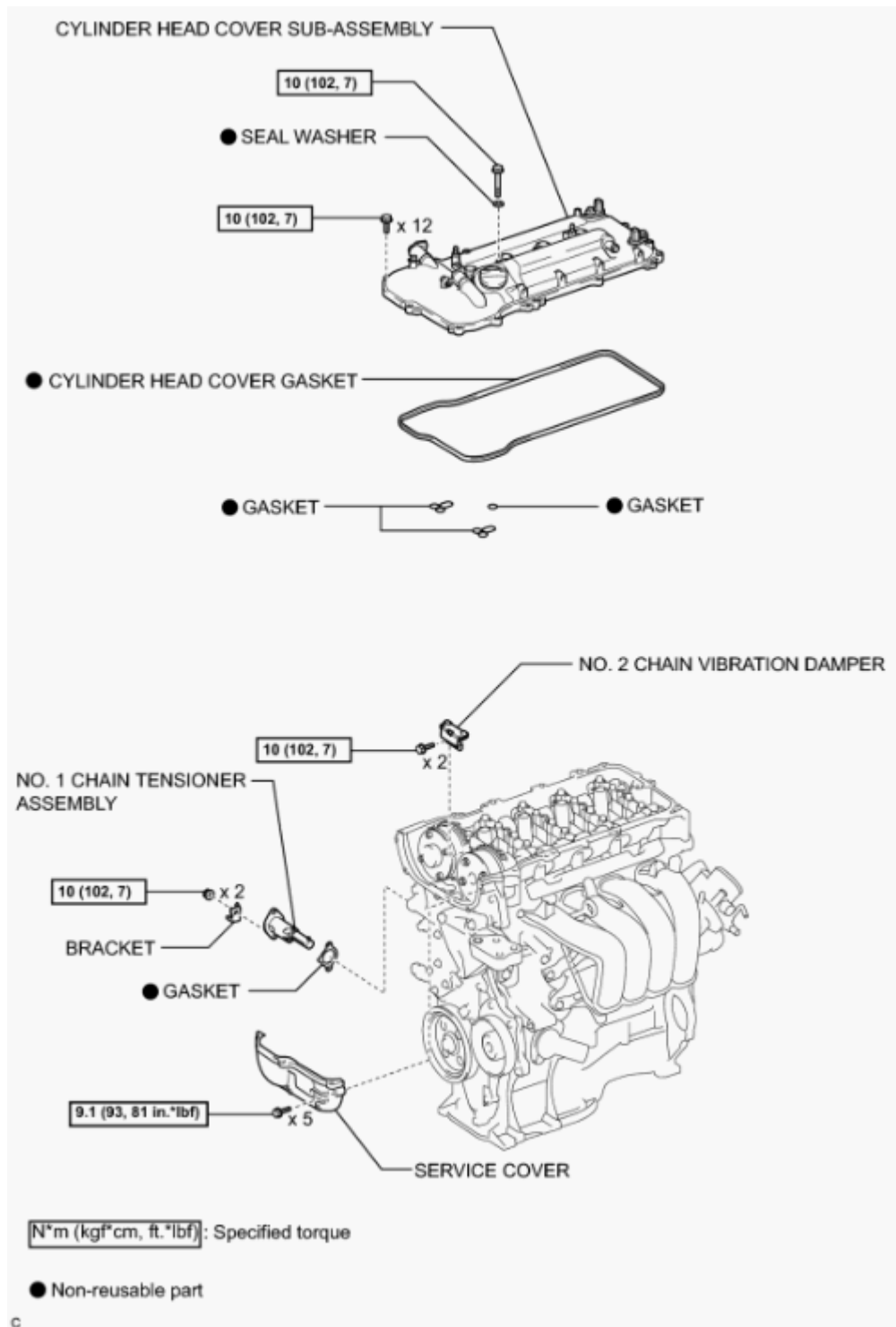


Fig. 12: Identifying Camshaft Components And Torque Specifications (3 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

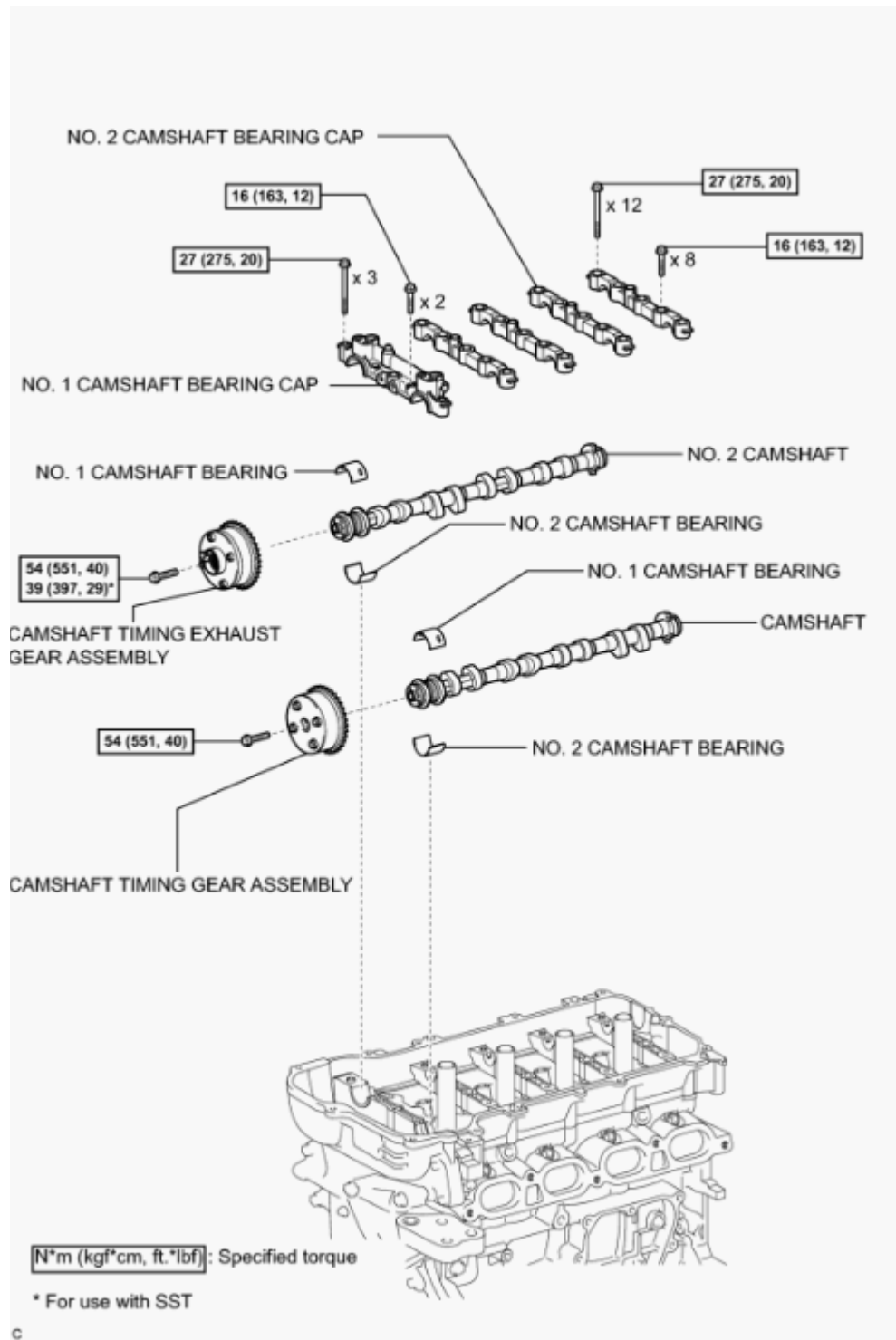


Fig. 13: Identifying Camshaft Components And Torque Specifications (4 Of 4)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. **REMOVE FRONT WIPER ARM HEAD CAP** . Refer to **REMOVAL** .

2. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY LH** . Refer to **REMOVAL** .
3. **REMOVE FRONT WIPER ARM AND BLADE ASSEMBLY RH** . Refer to **REMOVAL** .
4. **REMOVE HOOD TO COWL TOP SEAL** . Refer to **REMOVAL** .
5. **REMOVE COWL TOP VENTILATOR LOUVER RH** . Refer to **REMOVAL** .
6. **REMOVE COWL TOP VENTILATOR LOUVER LH** . Refer to **REMOVAL** .
7. **REMOVE WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** (See **REMOVAL**)
8. **REMOVE OUTER COWL TOP PANEL** . Refer to **REMOVAL** .
9. **REMOVE NO. 2 CYLINDER HEAD COVER** . Refer to **REMOVAL** .
10. **REMOVE IGNITION COIL ASSEMBLY** . Refer to **REMOVAL** .
11. **REMOVE RADIO SETTING CONDENSER** . Refer to **REMOVAL** .
12. **DISCONNECT NO. 2 VENTILATION HOSE**
 - a. Disconnect the No. 2 ventilation hose.

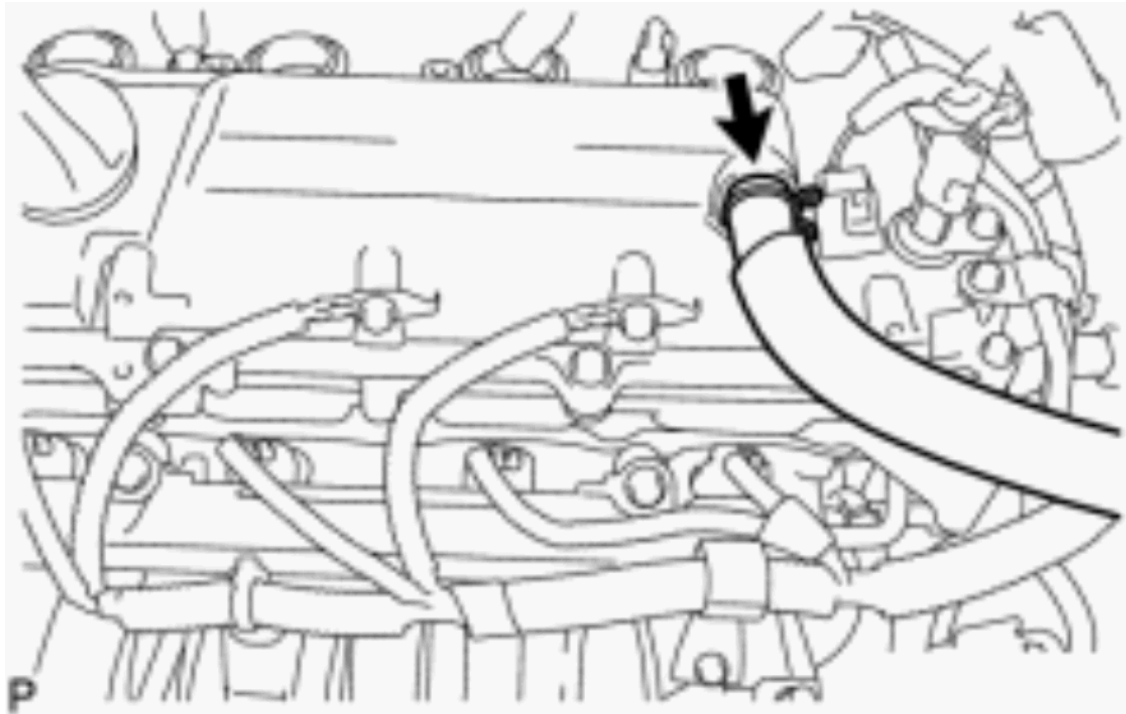


Fig. 14: Locating No. 2 Ventilation Hose

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

13. **DISCONNECT ENGINE WIRE**
 - a. Remove the 2 bolts, 5 connectors, 5 clamps and disconnect the engine wire.

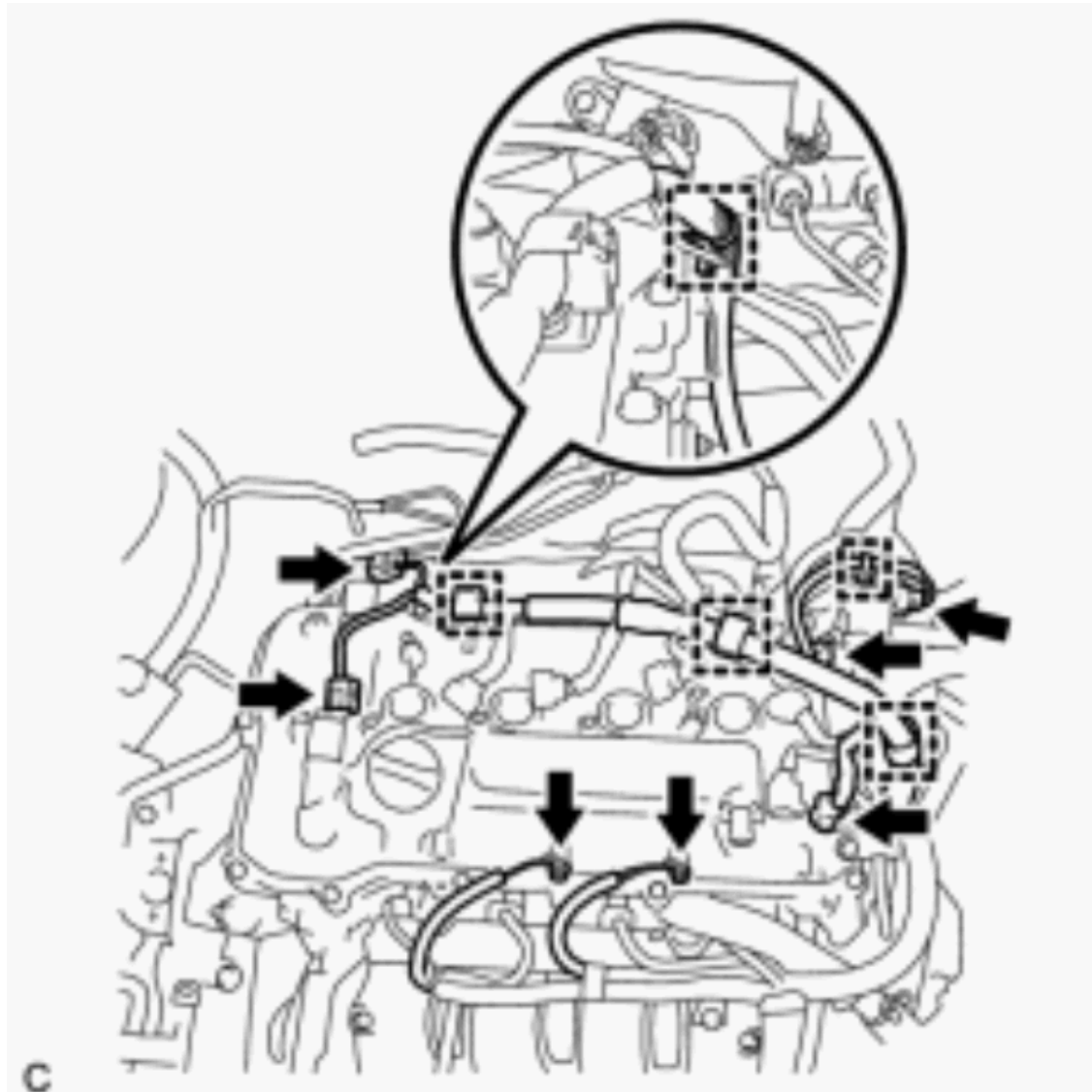


Fig. 15: Identifying Engine Wire

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

14. REMOVE AIR TUBE

- a. Remove the 2 bolts, 4 hoses and air tube assembly.

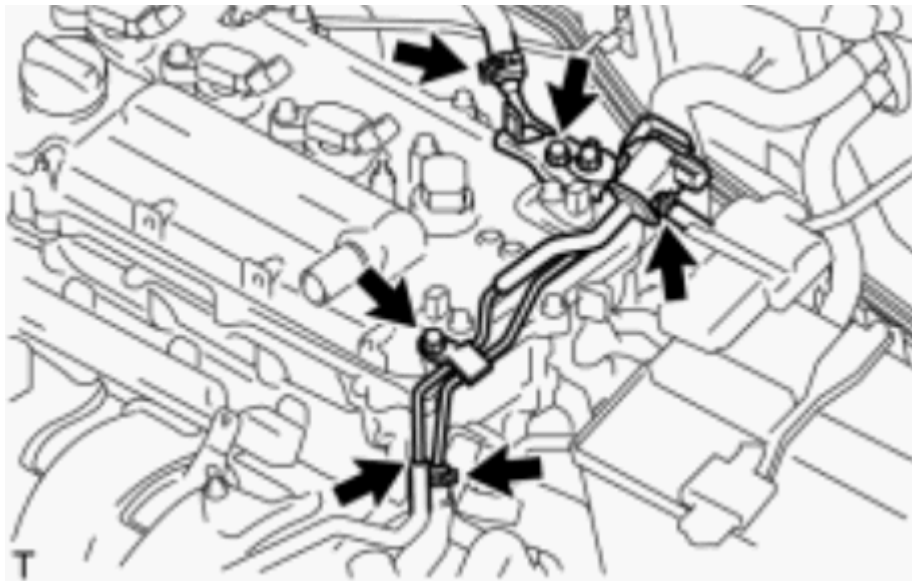


Fig. 16: Identifying Air Tube Assembly

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

15. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** . Refer to **DISASSEMBLY**.
16. **SET NO. 1 CYLINDER TO TDC / COMPRESSION**
 - a. Turn the crankshaft pulley until its timing notch (groove) and the timing mark "0" of the timing chain cover are aligned.

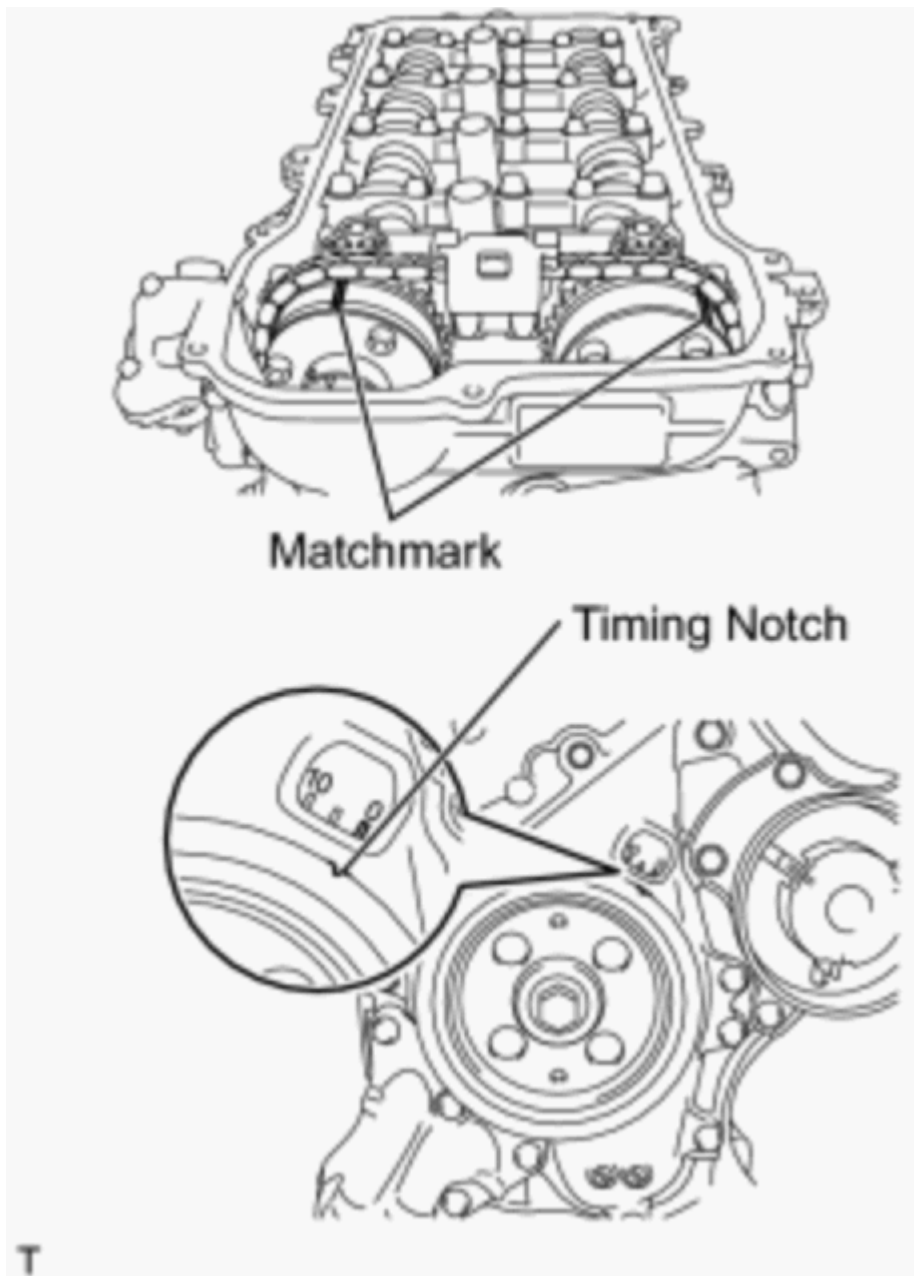


Fig. 17: Aligning Matchmarks

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

- b. Check that each matchmark of the camshaft timing gear and camshaft timing exhaust gear are aligned with each matchmark located as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing mark as shown in the illustration.
- c. Place paint marks on the chain in alignment with the timing marks on the camshaft timing gear and camshaft timing exhaust gear.

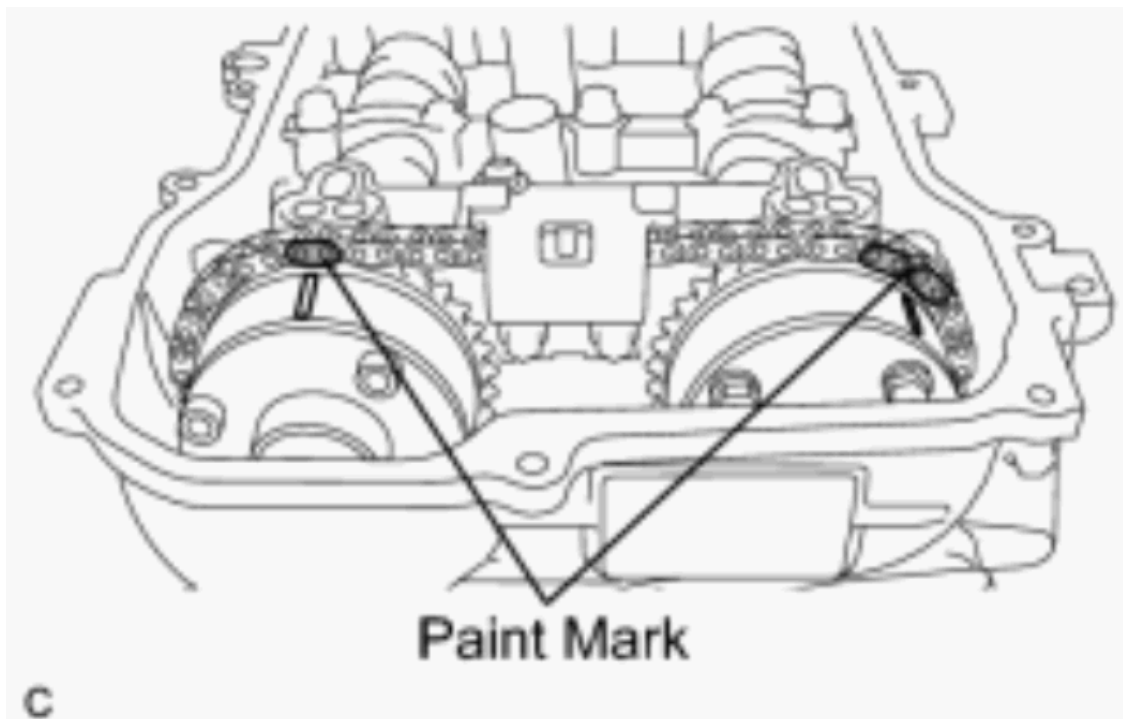


Fig. 18: Identifying Paint Marks

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

17. REMOVE NO. 2 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and No. 2 chain vibration damper from the camshaft bearing cap.



Fig. 19: Locating No. 2 Chain Vibration Damper

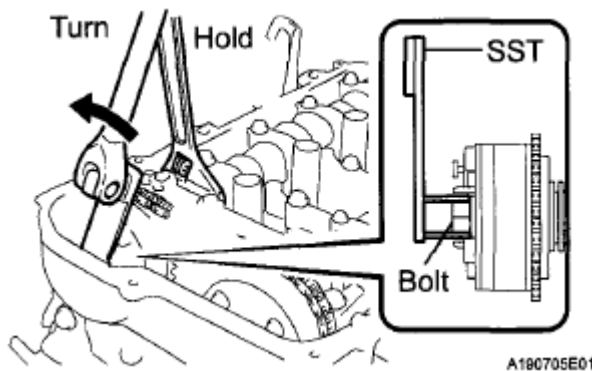
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY** . Refer to **DISASSEMBLY**.
19. **REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
 - a. While holding the hexagonal portion of the camshaft with a wrench, remove the camshaft timing exhaust gear bolt.

SST: 09249-37010

NOTE: Do not remove the other 4 bolts ("TORX" bolt). If any of them is removed, replace the camshaft timing exhaust gear assembly.

HINT: The bolt cannot be removed separately from the camshaft timing exhaust gear assembly due to lack of space.

**Fig. 20: Removing Camshaft Timing Exhaust Gear Assembly**

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

- b. Hold the hexagonal portion of the intake camshaft with a wrench and turn it slightly counterclockwise to release the chain.

NOTE: Do not turn the intake camshaft more than necessary.

HINT: Be sure to loosen the chain because the camshaft timing exhaust gear assembly cannot be removed with the chain tensioner.

- c. While removing the chain, pull out the camshaft timing exhaust gear assembly horizontally and then upward with the bolts installed.

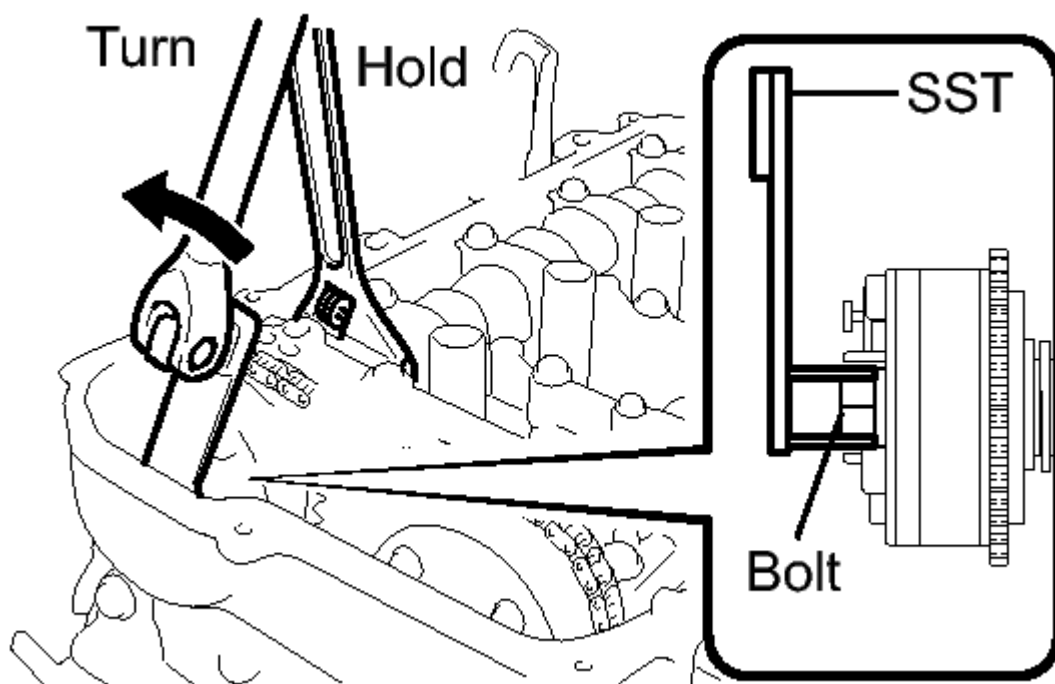
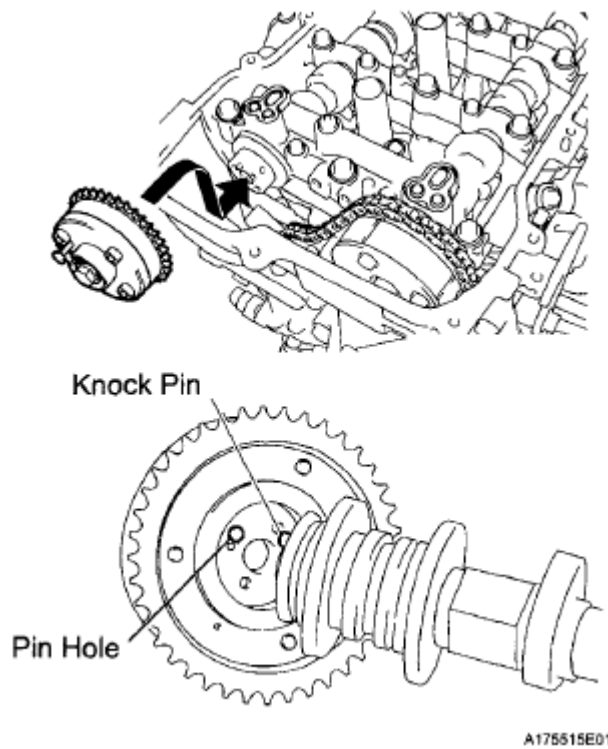


Fig. 21: Pulling Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Temporarily install the camshaft timing exhaust gear assembly.
 1. Install the bolt to the camshaft timing exhaust gear assembly.



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Fig. 22: Checking Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Align the knock pin on the No. 2 camshaft with the pin hole in the camshaft timing exhaust gear assembly and temporarily install the camshaft timing exhaust gear assembly to the No. 2 camshaft with the bolt.

NOTE:

- Do not install the chain onto the gear at this step.
- Do not allow the chain to interfere with the gear when installing the gear assembly.

- b. Inspect the camshaft timing exhaust gear lock.
 1. Check that the camshaft timing exhaust gear is locked.
- c. Inspect camshaft timing exhaust gear operation.
 1. After cleaning and degreasing the exhaust side VVT oil hole on the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.

NOTE:

Be sure to seal the oil hole completely because air leaks due to insufficient sealing will prevent the lock pin from being released.

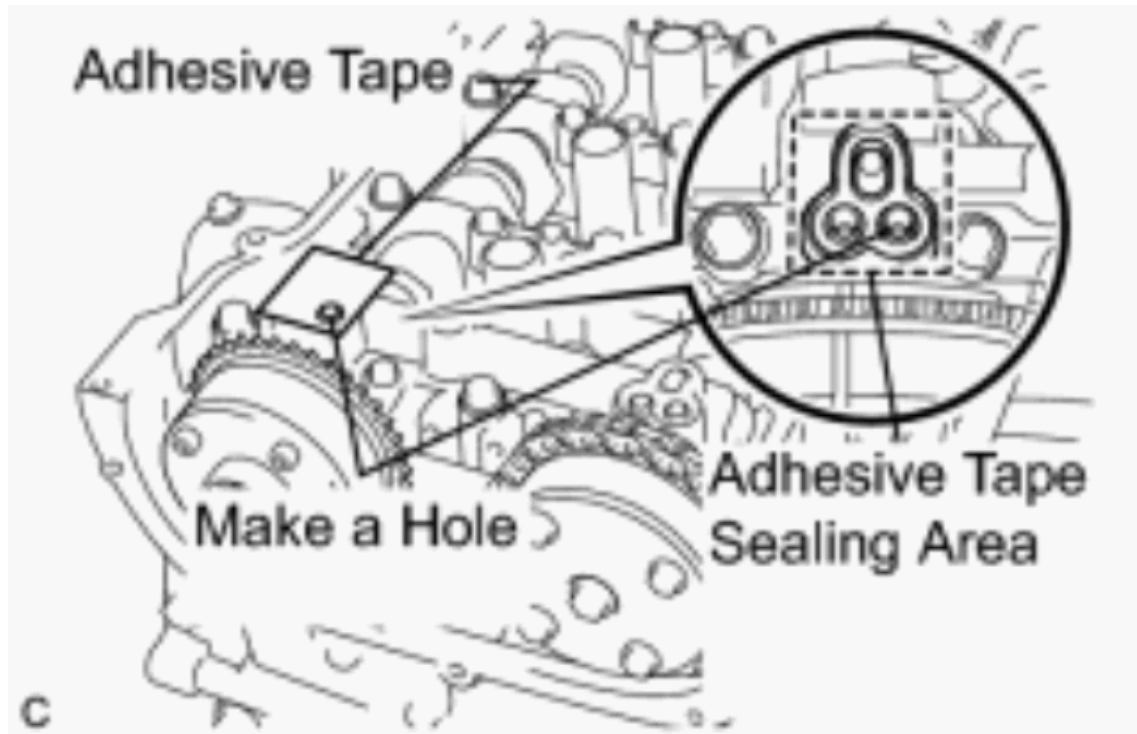


Fig. 23: Camshaft Timing Exhaust Gear Operation
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Make a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure B)
3. Apply approximately 200 kPa (2.0 kgf/cm², 28 psi.) of air pressure to the hole made in procedure B to release the lock pin.

NOTE:

- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.

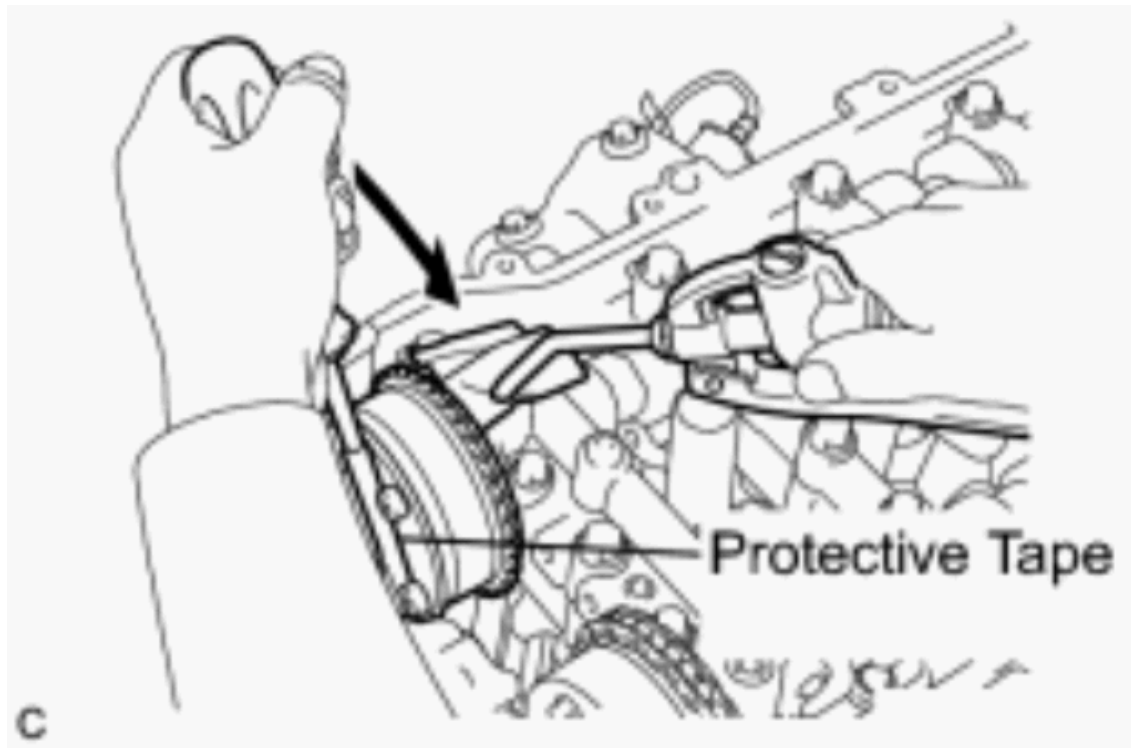


Fig. 24: Identifying Hole In Adhesive Tape

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

4. Using a screwdriver with its tip taped, forcibly turn the camshaft timing exhaust gear in the retard direction (clockwise).

NOTE:

- Be sure to keep the camshaft timing exhaust gear in the retard direction. If the gear is released, it will return to the advanced position automatically due to the force from the spring.
- Do not damage the camshaft timing exhaust gear.

HINT: Depending on the air pressure applied, the camshaft timing exhaust gear may turn in the retard direction without assistance by hand.

5. Using a screwdriver with its tip taped, turn the camshaft timing exhaust gear within its movable range (20°) 2 or 3 times without turning it to the most advanced position. Check that the camshaft timing gear turns smoothly.

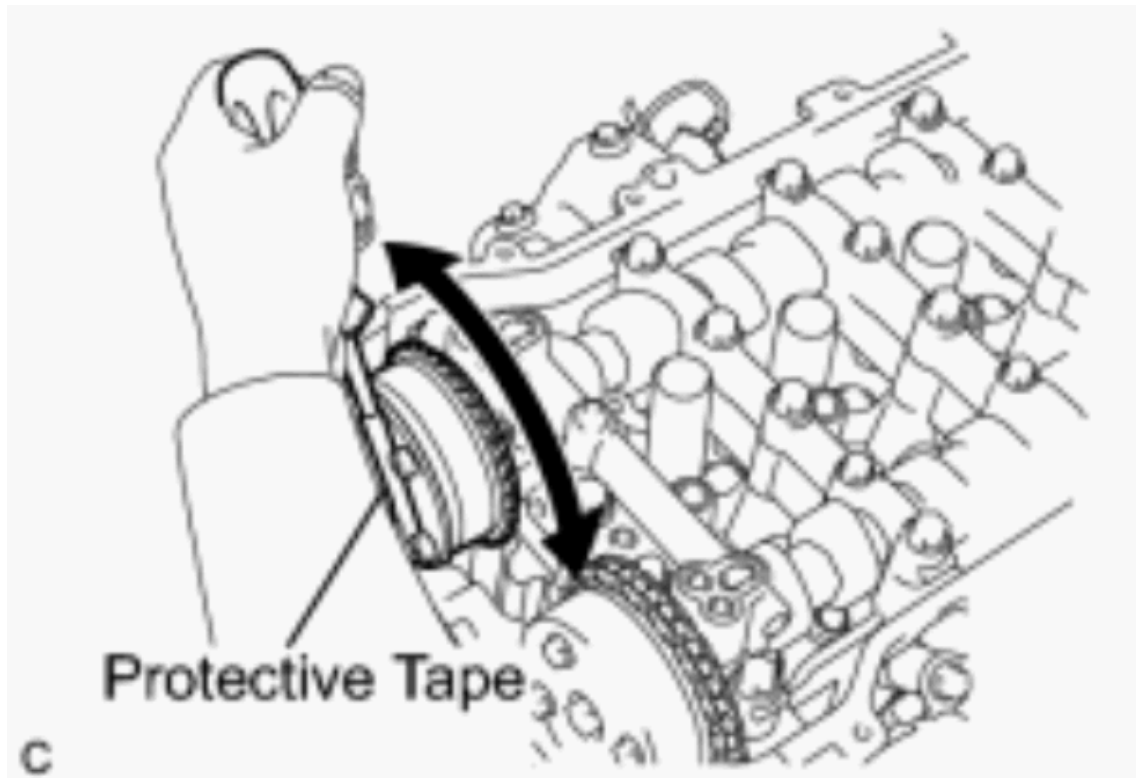


Fig. 25: Turning Camshaft Timing Gear Turns Smoothly With Screwdriver Tip Taped
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Lock the camshaft timing exhaust gear.

NOTE: Check that the camshaft timing exhaust gear assembly locks at the most advanced position (the most advanced position of its movable range) and cannot be rotated any further.

7. Remove the adhesive tape from the No. 1 camshaft bearing cap.
- d. Remove the camshaft timing exhaust gear assembly.
1. Remove the temporarily installed camshaft timing exhaust gear assembly.

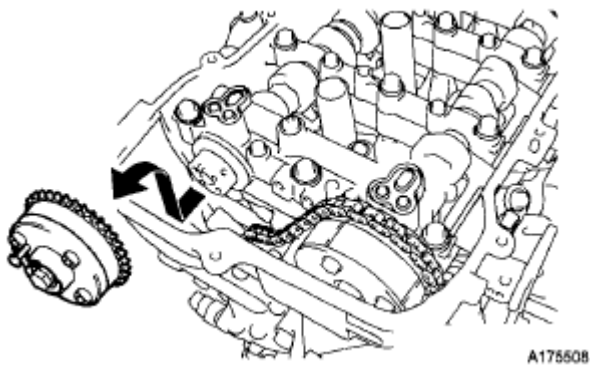


Fig. 26: Removing Camshaft Timing Exhaust Gear Assembly

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

21. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Inspect the camshaft timing gear lock.
 1. Check that the camshaft timing gear is locked.
- b. Inspect camshaft timing gear operation.
 1. After cleaning and degreasing the intake side VVT oil hole on the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.

NOTE: Be sure to seal the oil hole completely because air leaks due to insufficient sealing will prevent the lock pin from being released.

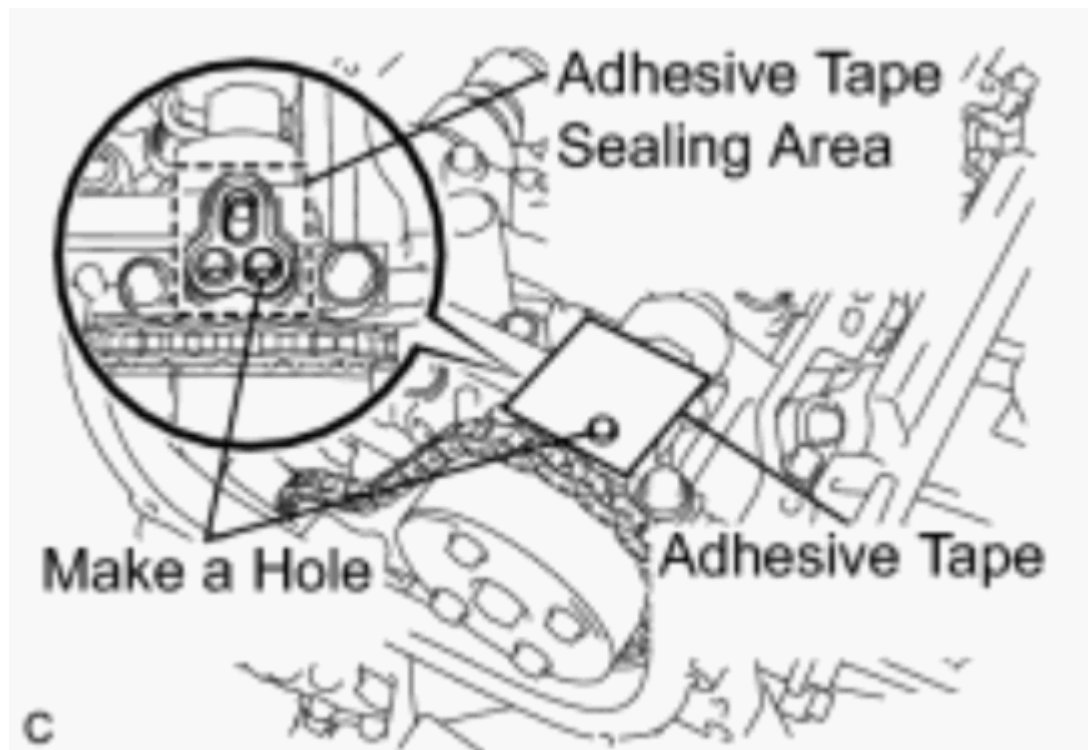


Fig. 27: Adhesive Tape Sealing Area

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

2. Make a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure A)
3. Apply approximately 150 kPa (1.5 kgf/cm², 22psi.) of air pressure to the hole made in procedure A to release the lock pin.

NOTE:

- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.

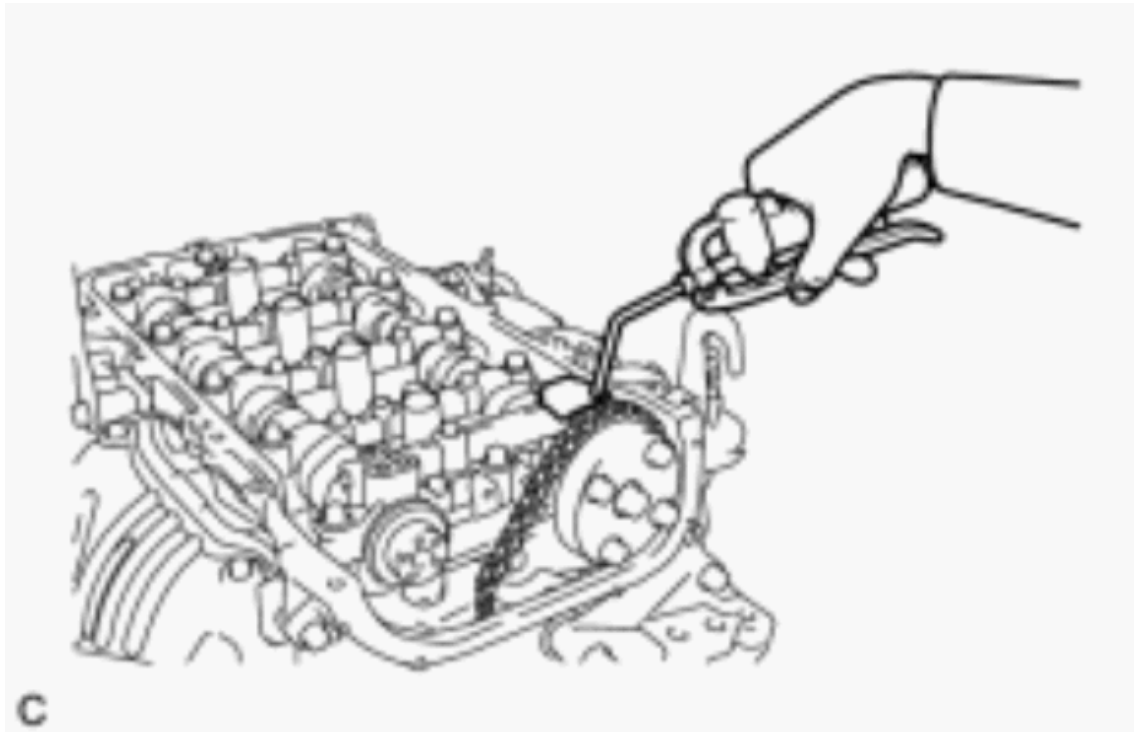


Fig. 28: Air Pressure

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

4. Forcibly turn the camshaft timing gear in the advance direction (counterclockwise).

HINT: Depending on the air pressure applied, the camshaft timing gear may turn in the advance direction without assistance by hand.

5. Turn the camshaft timing gear within its movable range (27.5°) 2 or 3 times without turning it to the most retarded position. Check that the camshaft timing gear turns smoothly.

NOTE:

- Do not lock the camshaft timing gear assembly.
- If camshaft timing gear assembly is locked, release the lock pin again.

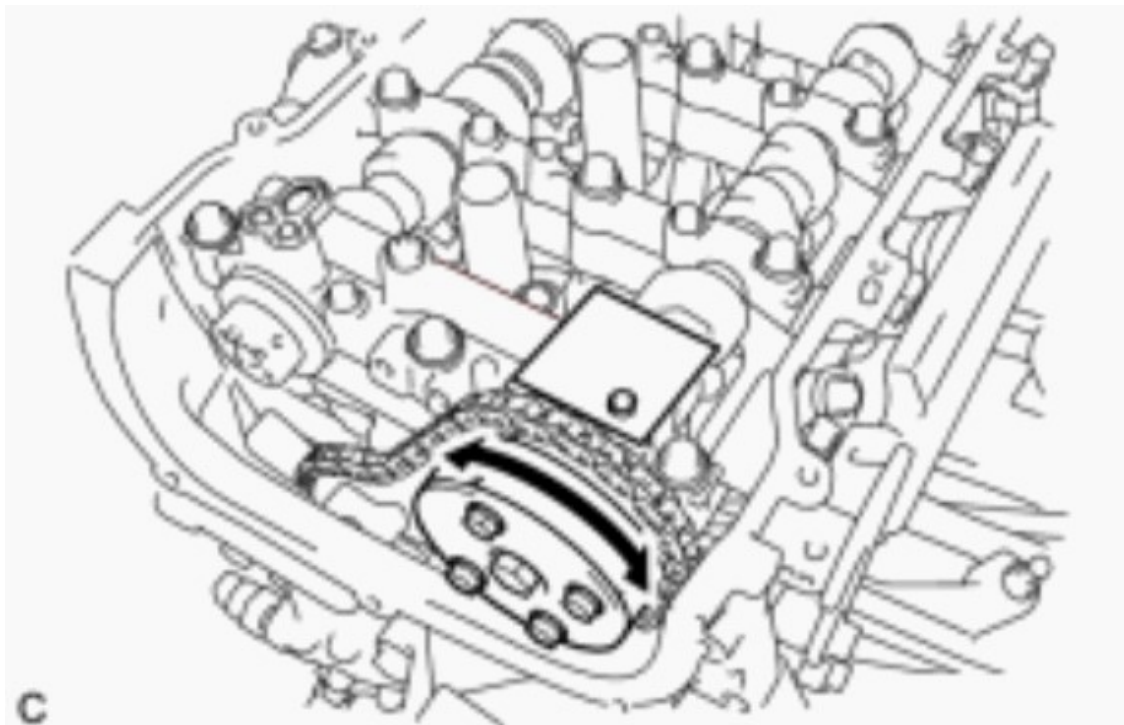


Fig. 29: Identifying Camshaft Timing Gear Turns Smoothly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Remove the adhesive tape from the No. 1 camshaft bearing cap.

22. REMOVE CAMSHAFT BEARING CAP

- a. Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

NOTE: Be sure not to loosen the other 15 bearing cap bolts in this step.

HINT: Arrange the removed parts in the correct order.

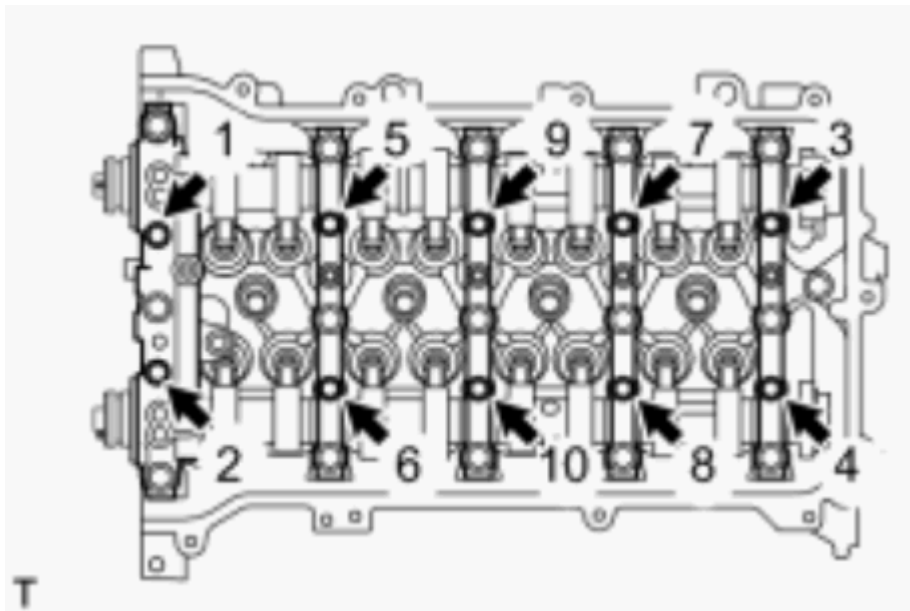


Fig. 30: Identifying Camshaft Bearing Cap In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 15 bolts and bearing caps in the order shown in the illustration. Immediately after removing bearing caps, install service bolts and spacers in the order shown in the illustration.

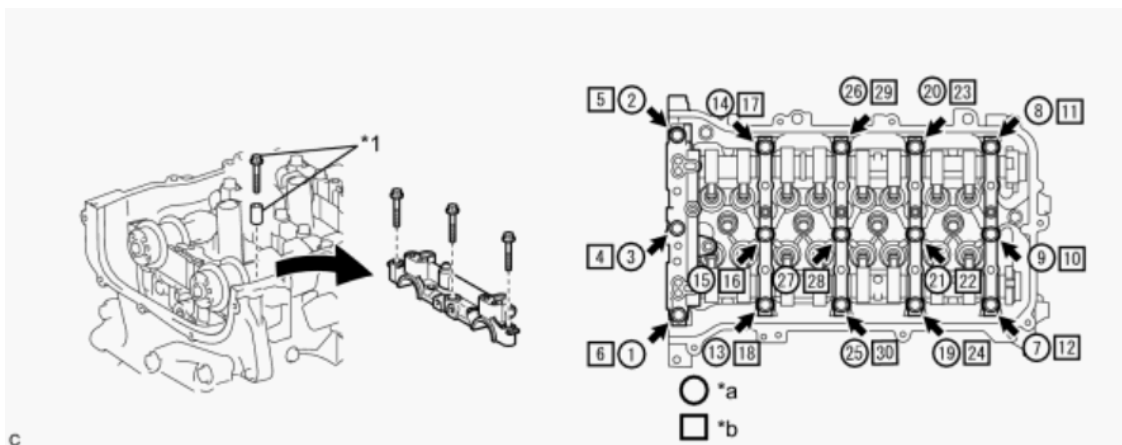


Fig. 31: Removing Camshaft Bearings In Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

*1	Service Bolt and Spacer (used to temporarily secure the camshaft housing)	-	-
*a	The removal order of the parts	*b	The installation order of the bolts and spacers for temporarily tightening the camshaft housing

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

NOTE:

- If the bolts are loosened all at once, FIPG on the camshaft housing and cylinder head may peel off, resulting in oil oozing. Therefore, be sure to install the service bolts and spacers to one bearing cap at a time.
- Do not install the bearing caps when installing the service bolts and spacers.

HINT:

- Arrange the removed parts in the correct order.
- Part number for the service bolts used to temporarily secure the camshaft housing: 91551-G0875 (15 bolts)
- Part number for the service spacers used to temporarily secure the camshaft housing: 90387-12048 (15 spacers)

23. REMOVE NO. 2 CAMSHAFT

- a. Remove the No. 2 camshaft from the camshaft housing.

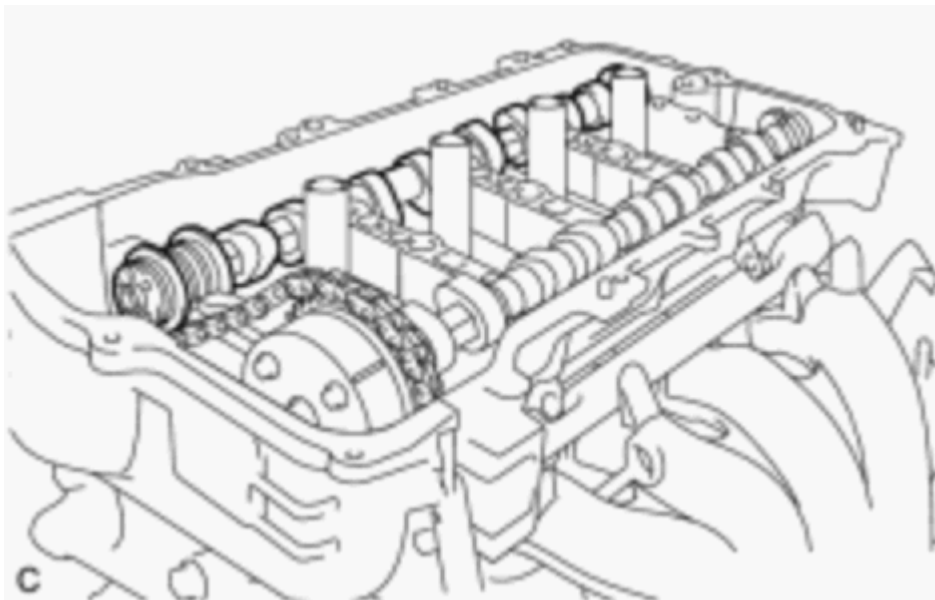


Fig. 32: Identifying No. 2 Camshaft Housing

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

24. REMOVE CAMSHAFT

- a. Hold up the chain and remove the camshaft from the camshaft housing.

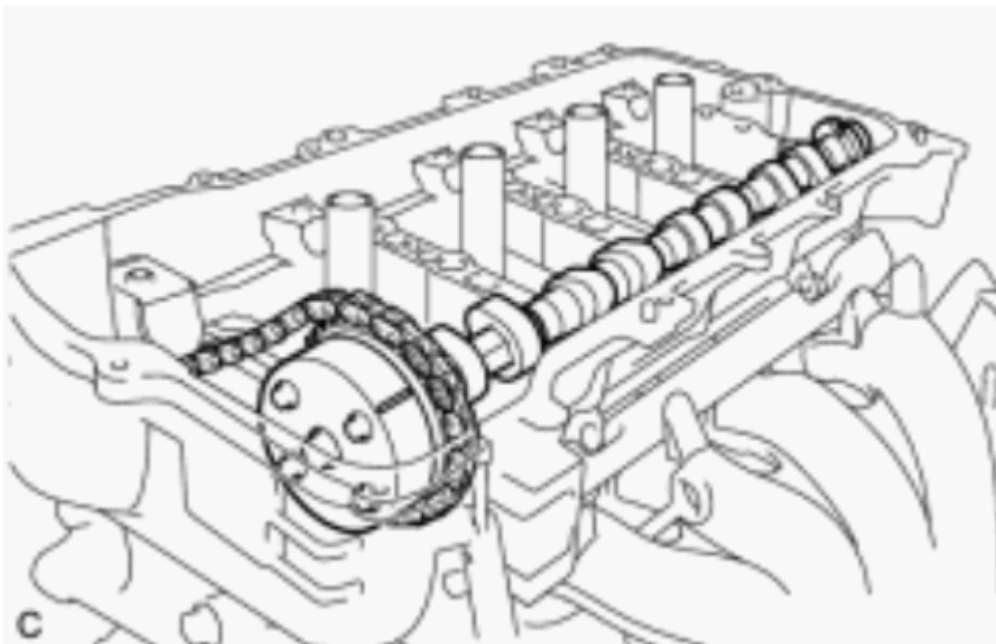


Fig. 33: Identifying Camshaft Housing

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

- b. Suspend the chain with a string or equivalent.

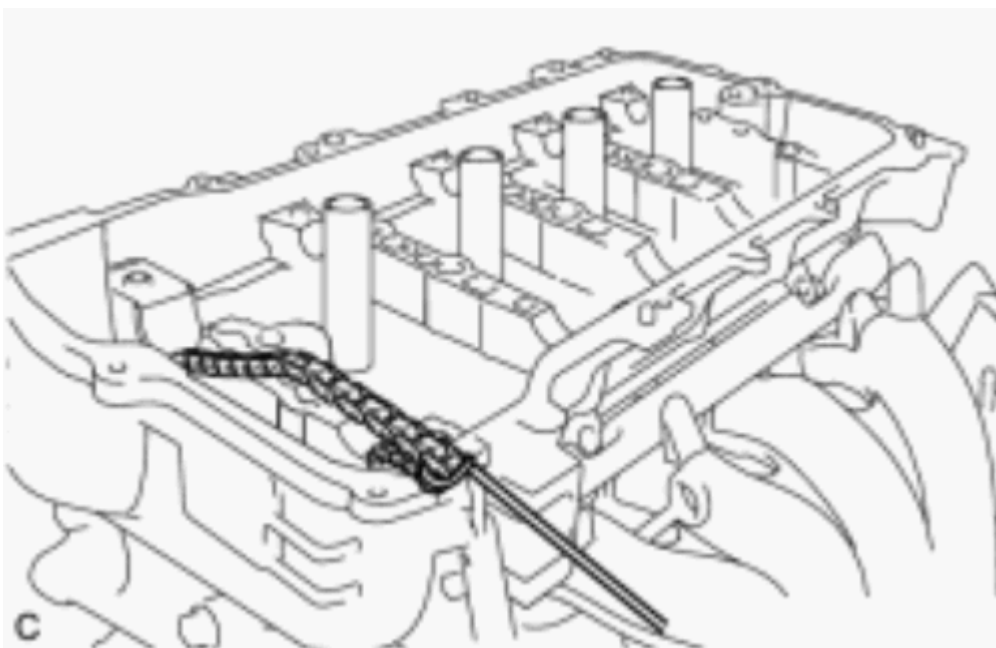


Fig. 34: Identifying Camshaft Housing

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

25. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY

- a. Secure the hexagonal portion of the camshaft in a soft jaw vise.
- b. Remove the flange bolt and the camshaft timing gear assembly.

NOTE:

- Before removing the camshaft timing gear, make sure that the lock pin has been released.
- Be sure not to remove the other 4 bolts.
- Keep the camshaft timing gear assembly is to be reused, be sure to use it with the lock pin released.

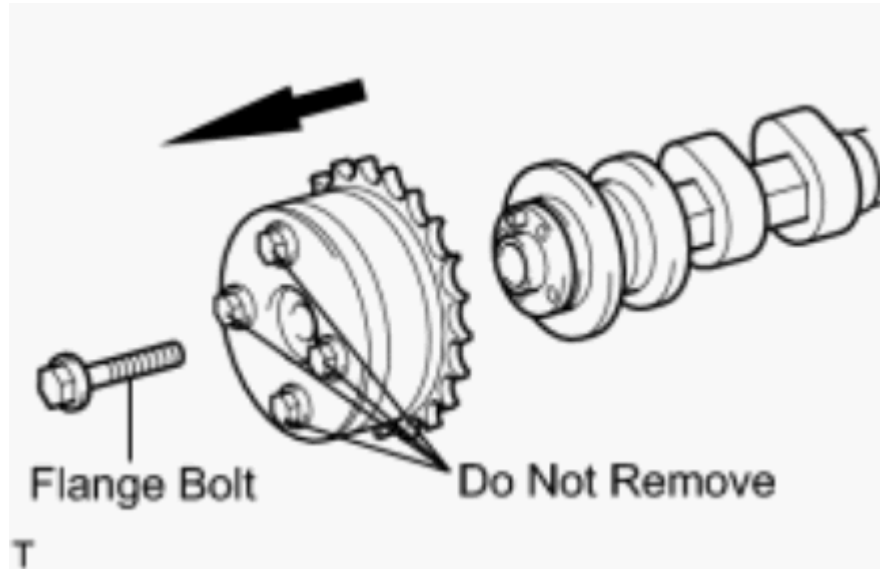


Fig. 35: Identifying Flange Bolt

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

26. REMOVE NO. 1 CAMSHAFT BEARING

- Remove the 2 No. 1 camshaft bearings from the No. 1 camshaft bearing cap.

HINT:

Arrange the removed parts in the correct order.

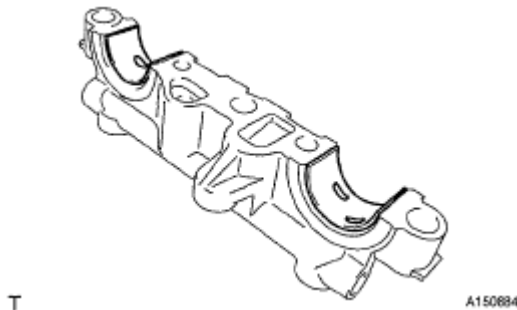


Fig. 36: Identifying No. 1 Camshaft Bearings

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

27. REMOVE NO. 2 CAMSHAFT BEARING

- a. Remove the 2 No. 2 camshaft bearings from the camshaft housing.

HINT:

Arrange the removed parts in the correct order.

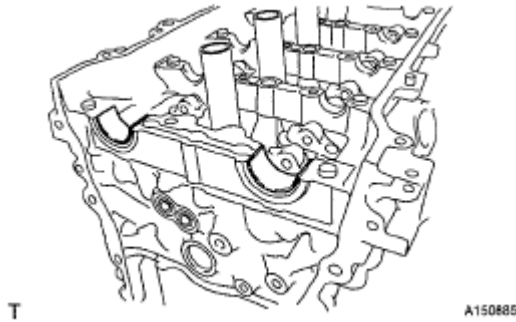


Fig. 37: Identifying No. 2 Camshaft Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL NO. 1 CAMSHAFT BEARING

- a. Clean both surfaces of the 2 No. 1 camshaft bearings.

NOTE: Do not apply engine oil to the bearings or the contact surfaces.

- b. Install the No. 1 camshaft bearings.
- c. Using a vernier caliper, measure the distance between the bearing cap edge and the camshaft bearing edge.

Dimension (A - B): 0.7 mm (0.0276 in.) or less

NOTE: Position the bearings to the center of the bearing cap by measuring dimensions A and B.

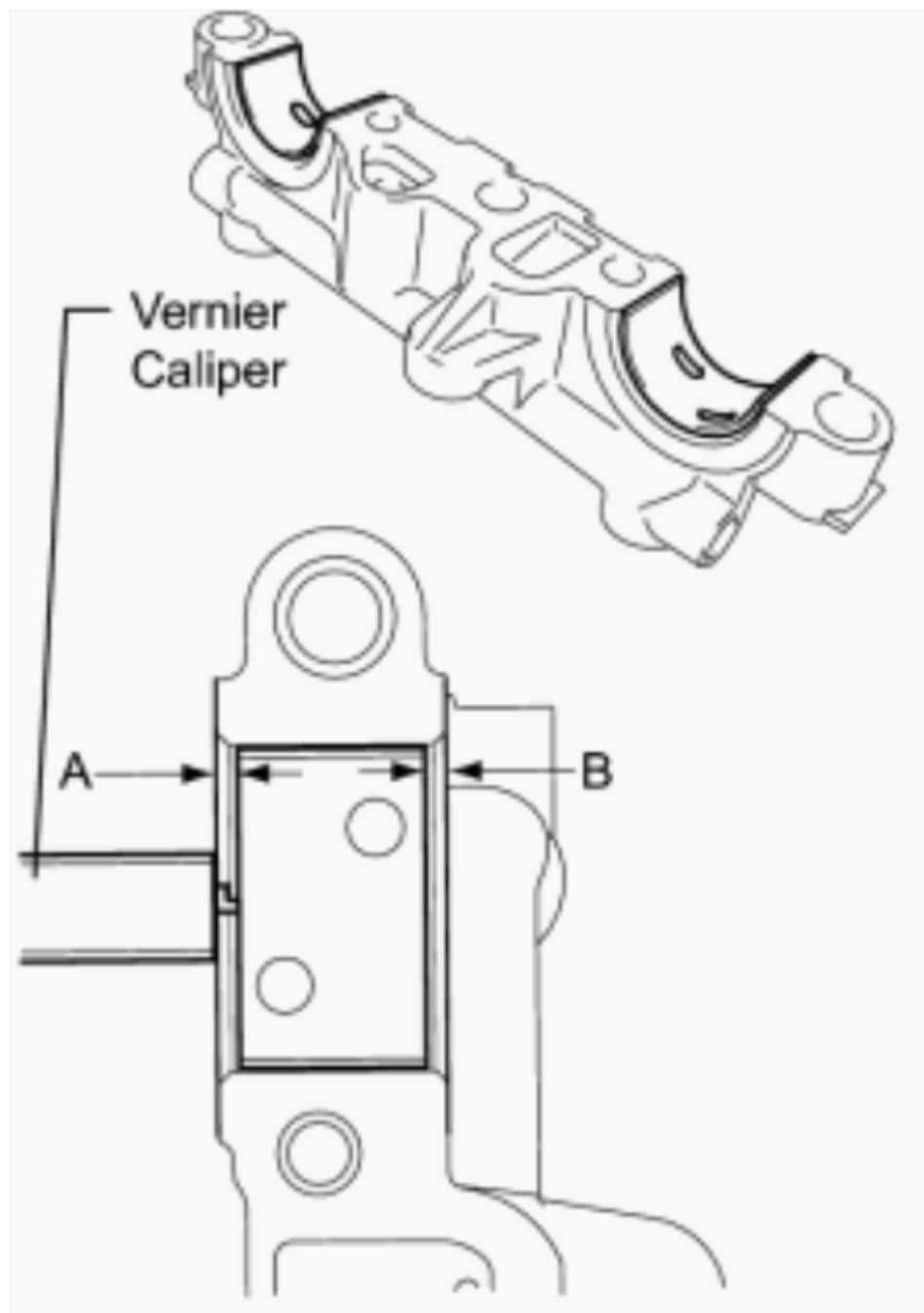


Fig. 38: Identifying No. 2 Camshaft Bearings
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL NO. 2 CAMSHAFT BEARING

- a. Clean both surfaces of the 2 No. 2 camshaft bearings.

NOTE: Do not apply engine oil to the bearings or the contact surfaces.

- b. Install the 2 No. 2 camshaft bearings.

- c. Using a vernier caliper, measure the distance between the bearing cap edge and the camshaft bearing edge.

Dimension (A):

1.05 to 1.75 mm (0.0413 to 0.0689 in.)

NOTE: Position the bearings to the center of the bearing cap by measuring dimension A.

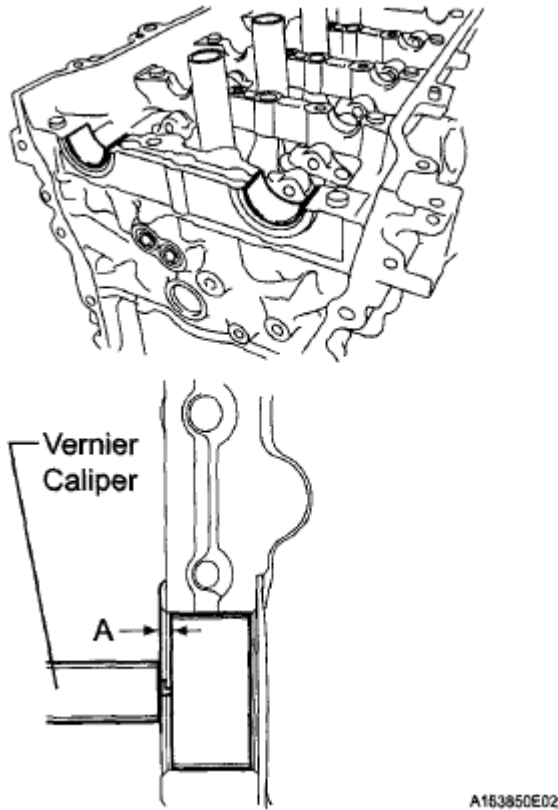


Fig. 39: Measuring Distance Between Bearing Cap Edge And Camshaft Bearing Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- a. Secure the hexagonal portion of the camshaft in a soft jaw vise.
- b. Check that the knock pin is installed on the camshaft.
- c. Put the camshaft timing gear and camshaft together with the knock pin and key groove misaligned, as shown in the illustration.

NOTE: Do not forcefully push in the camshaft timing gear assembly. This may cause the camshaft knock pin tip to damage the installation surface of the camshaft timing gear assembly.

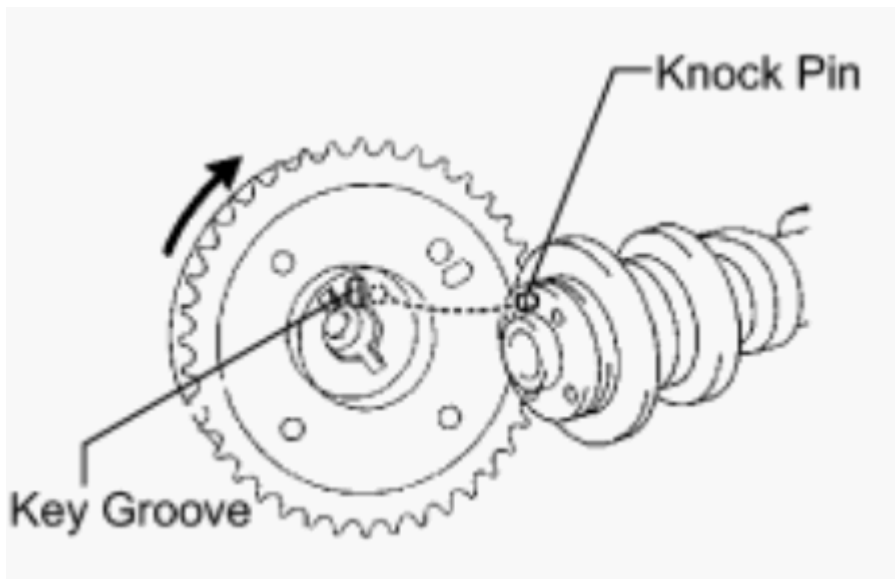


Fig. 40: Identifying Knock Pin And Key Groove

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

- d. Turn the camshaft timing gear as shown in the illustration while pushing it gently against the camshaft. Push further at the position where the pin fits into the groove.

NOTE: **Do not turn the camshaft timing gear in the retard direction (the right angle).**

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

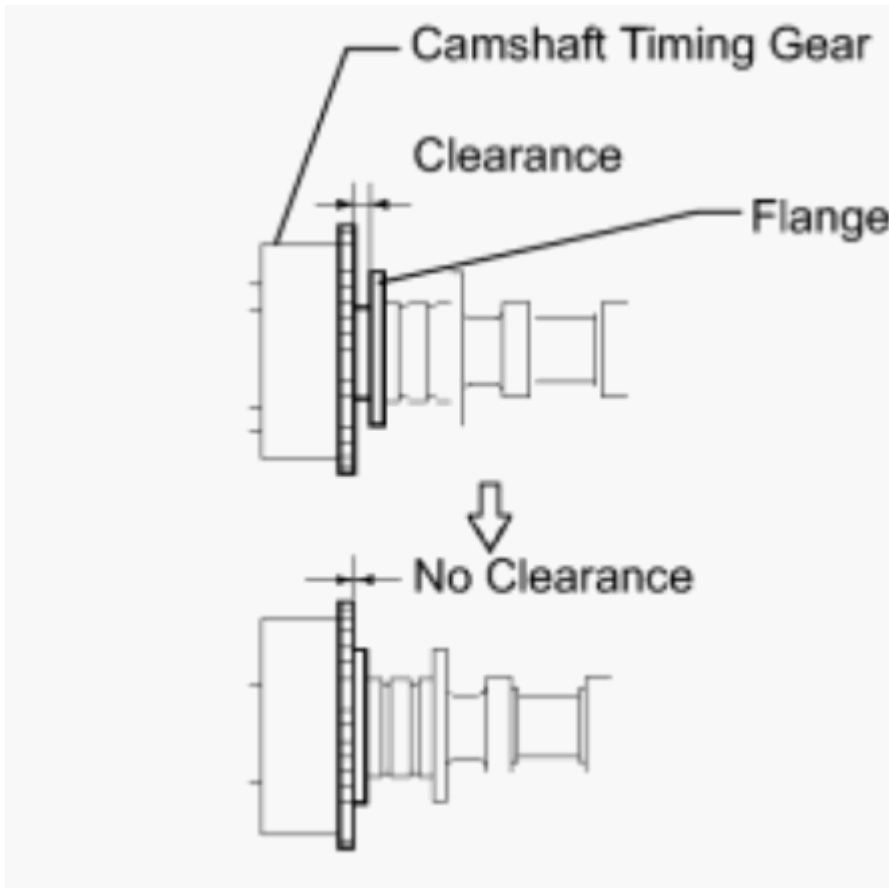


Fig. 41: Checking No Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Tighten the flange bolt with the camshaft timing gear fixed in place.

Torque: 54 N*m (551 kgf*cm, 40ft*lb)

NOTE: When tightening the bolts, do not allow the camshaft timing gear assembly to rotate.

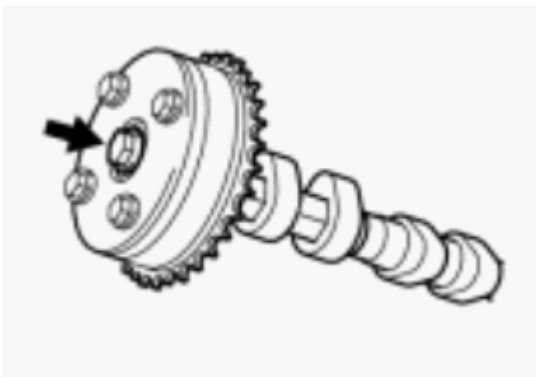


Fig. 42: Identifying Flange Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

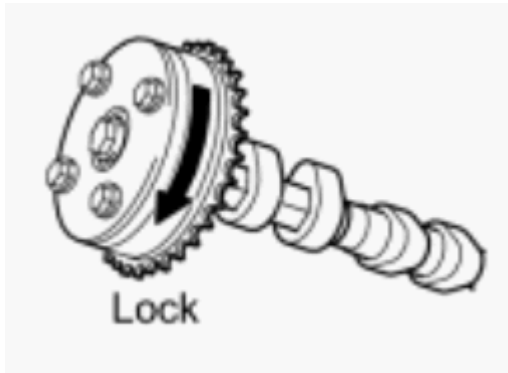
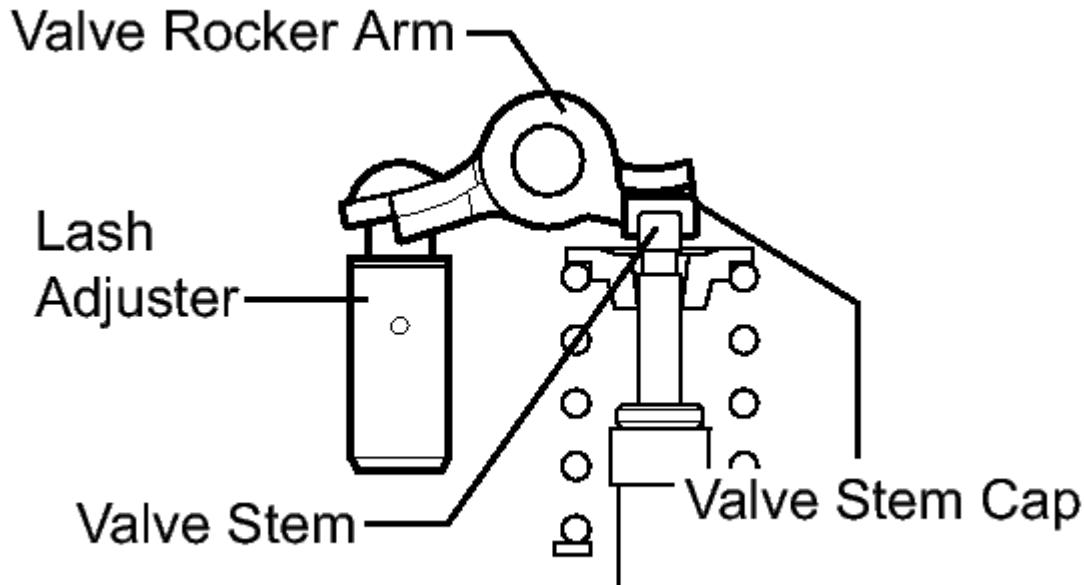


Fig. 43: Camshaft Timing Gear Lock Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

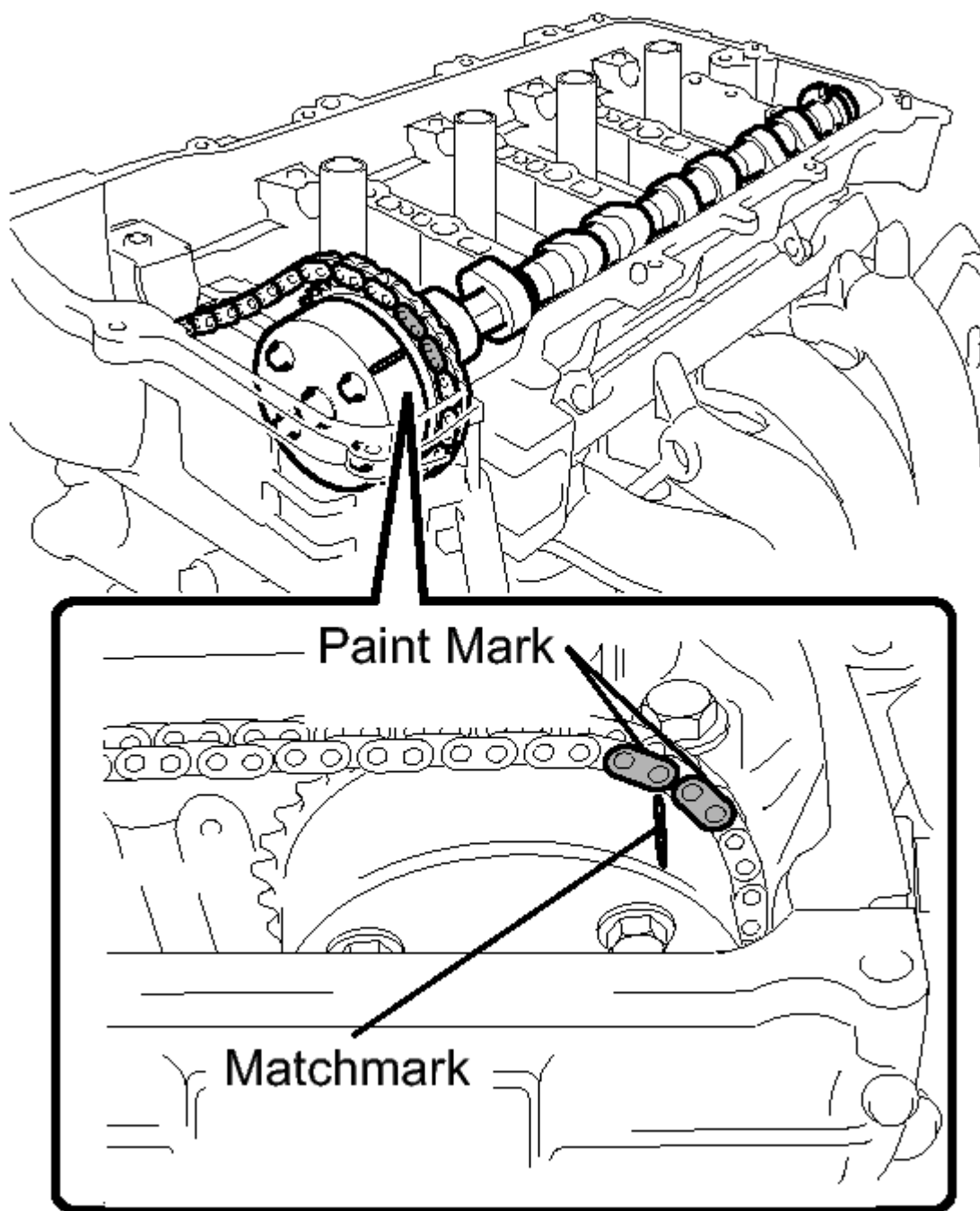
- a. Make sure that the valve rocker arm is installed as shown in the illustration.



P

Fig. 44: Applying Engine Oil To Lash Adjuster Tips And Valve Stem Cap Ends
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Clean the camshaft journals.
- c. Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.
- d. Hold up the chain and align the matchmark and the paint mark and install the camshaft.



C

Fig. 45: Aligning Camshaft Matchmark And Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL NO. 2 CAMSHAFT

- a. Make sure that the valve rocker arm is installed as shown in the illustration.

- b. Clean the camshaft journals.
- c. Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.
- d. Install the No. 2 camshaft to the camshaft housing.

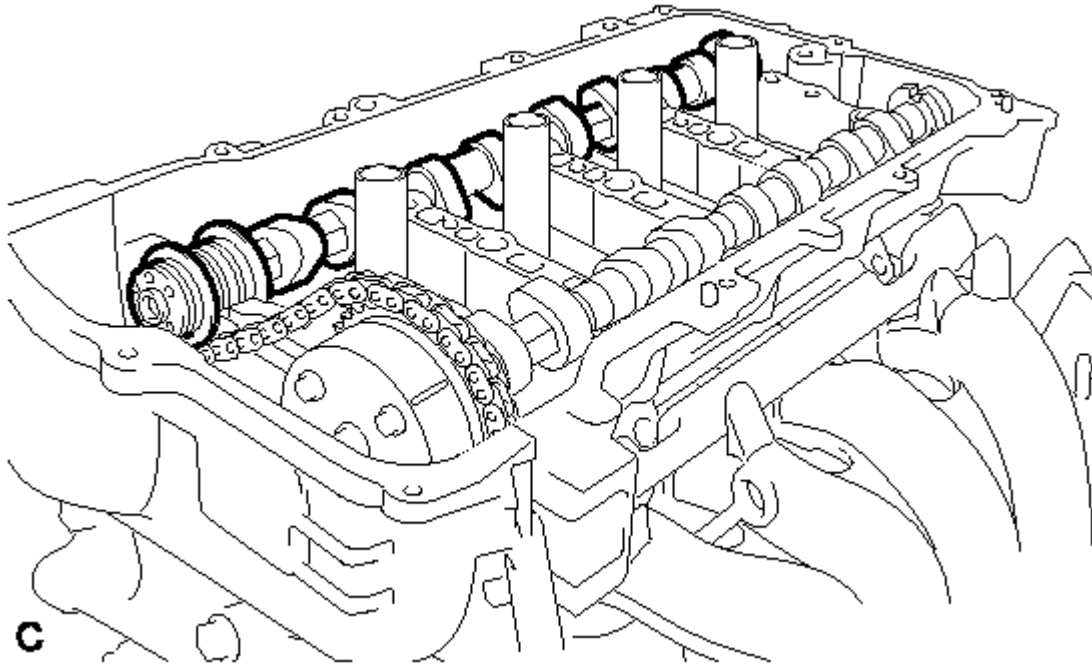


Fig. 46: View Of No. 2 Camshaft From Camshaft Housing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL CAMSHAFT BEARING CAP

- a. Check the marks and numbers on the camshaft bearing caps, and then remove the service bolts and spacers in the order shown in the illustration. Immediately after removing the service bolts and spacers in the location for bearing caps, install the bearing caps with the bolts in the order shown in the illustration.

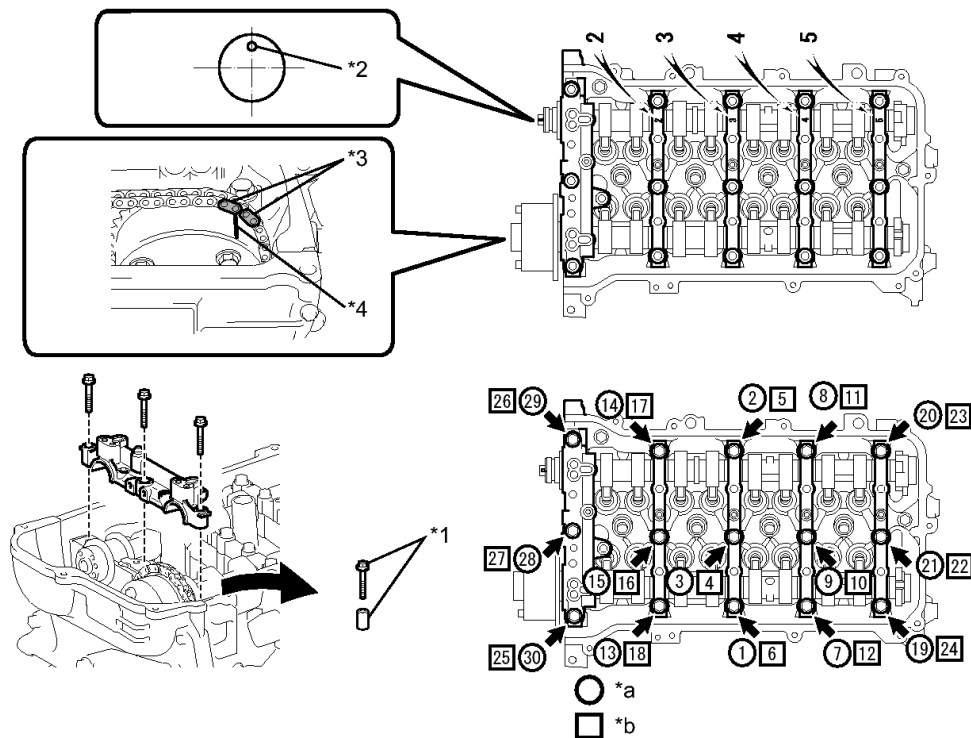


Fig. 47: Removing/Installing Bearing Caps And Bolts In Sequence

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

*1	Service Bolt and Spacer (used to temporarily secure the camshaft housing)	*2	Knock Pin
*3	Paint Mark	*4	Matchmark
*a	The removal order of the bolts and spacers for temporarily tightening the camshaft housing	*b	The installation order of the parts

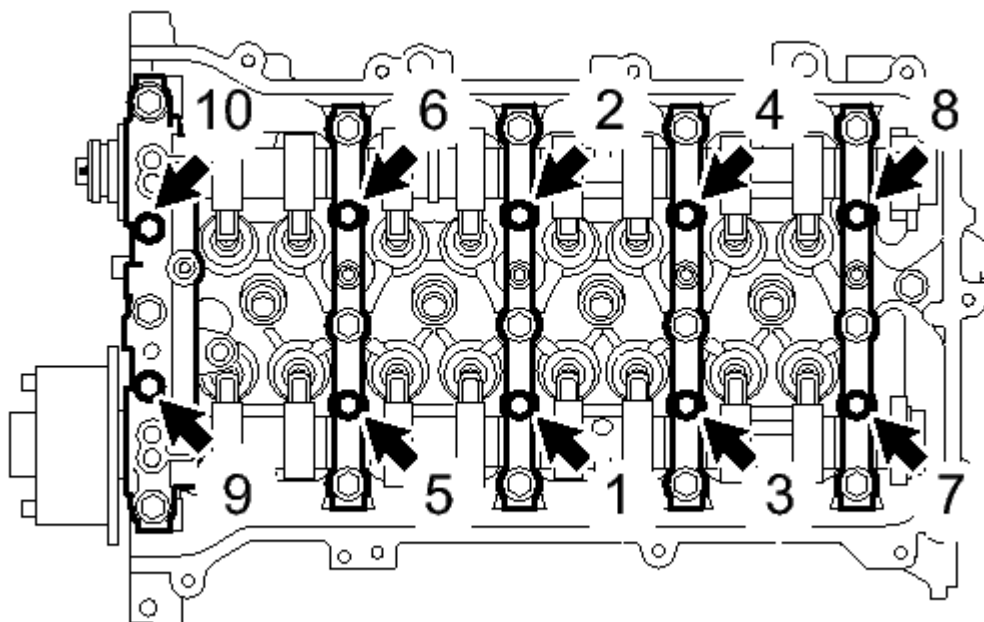
Torque: 27 N*m (275 kgf*cm, 20ft*lbf)

NOTE: If the bolts are loosened all at once, FIPG on the camshaft housing and cylinder head may peel off, resulting in oil oozing. Therefore, be sure to remove the service bolt and spacer from one bearing cap at a time.

HINT: Make sure that the orientation of the knock pin and matchmark on the camshaft is as shown in the illustration.

- b. Tighten the 10 bolts in the order shown in the illustration.

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



T

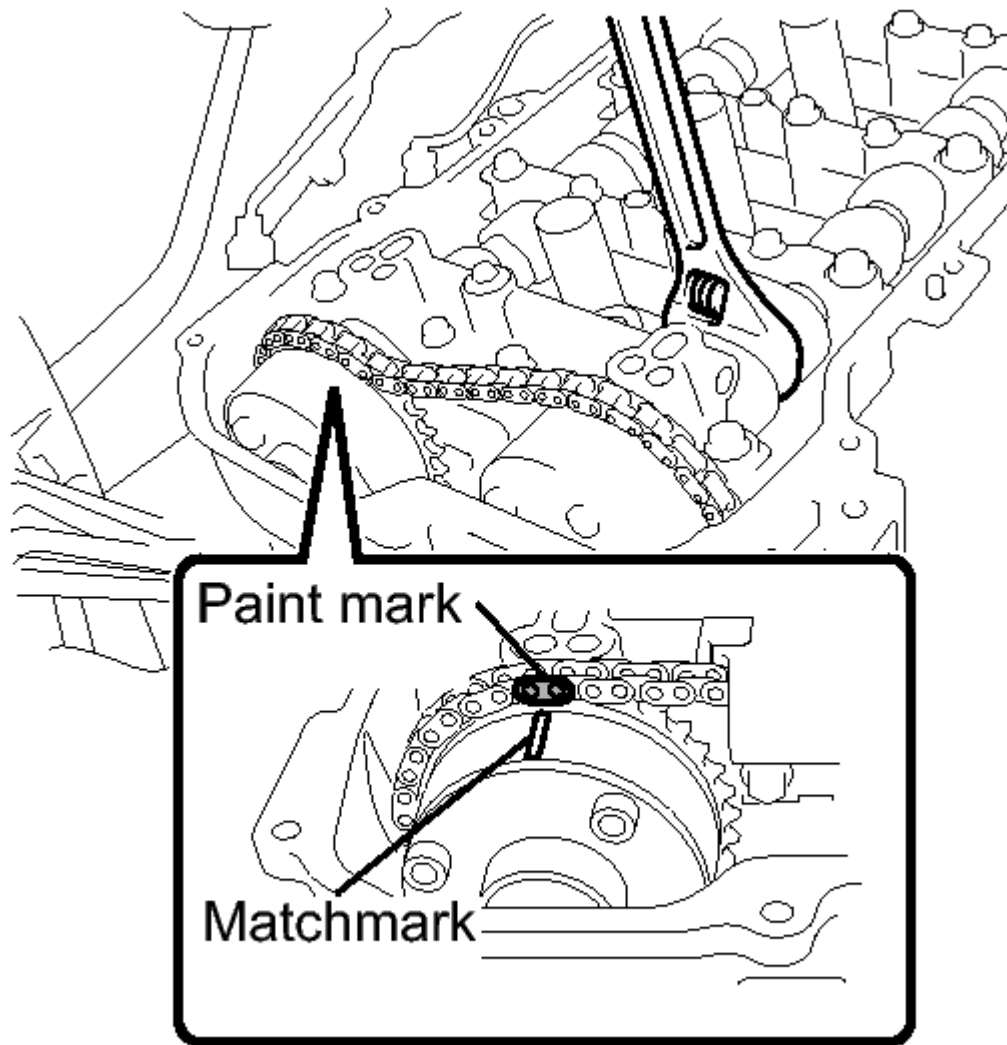
Fig. 48: Tightening Bolt Sequence

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

- c. Check the torque of each bolt again.

7. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Hold the hexagonal portion of the intake camshaft with a wrench and turn it slightly counterclockwise to release the chain.



C
Fig. 49: Installing/Removing Camshaft Timing Exhaust Gear Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the bolt to the camshaft timing exhaust gear assembly.
- c. Align the paint mark with the matchmark to install the chain.

NOTE:

- Do not turn the intake camshaft more than necessary.
- Align the paint mark with the matchmark to install the chain.

- d. Put the camshaft timing exhaust gear and camshaft together by aligning the key groove and knock pin.

NOTE:

- If the straight pin cannot be aligned with the pin hole, hold the hexagonal portion of the No. 2 camshaft with a wrench and turn

it slightly to install the gear.

- Do not turn the No. 2 camshaft more than necessary.
- Do not forcefully push in the camshaft timing exhaust gear assembly. This may cause the camshaft knock pin tip to damage the installation surface of the camshaft timing exhaust gear assembly.

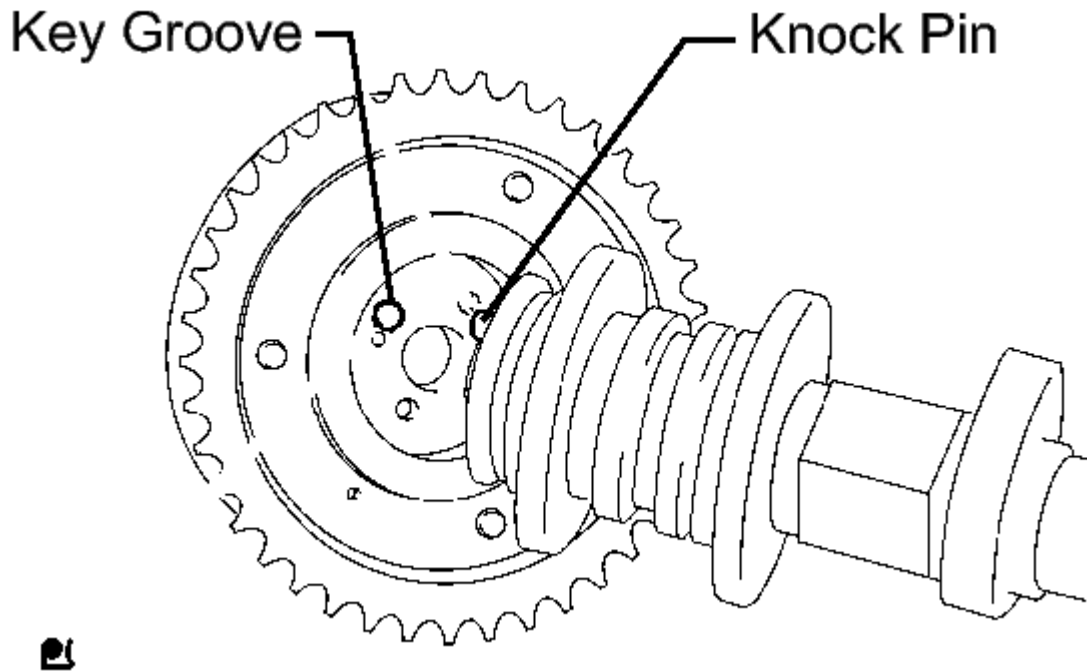


Fig. 50: Identifying Key Groove & Knock Pin

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

- e. Using SST and a wrench, hold the hexagonal portion of the No. 2 camshaft and install the camshaft timing exhaust gear assembly to the No. 2 camshaft.

SST: 09249-37010

without SST - Torque: 54 N*m (551 kgf*cm, 40ft*lbf)

with SST - Torque: 39 N*m (397 kgf*cm, 29ft*lbf)

NOTE:

- The "with SST" torque value can be obtained by using a torque wrench with a fulcrum length of 260 mm (10.24 in.) and SST of 100 mm (3.94 in.). Refer to **PRECAUTION** .
- This torque value is effective when SST is parallel to the torque wrench.

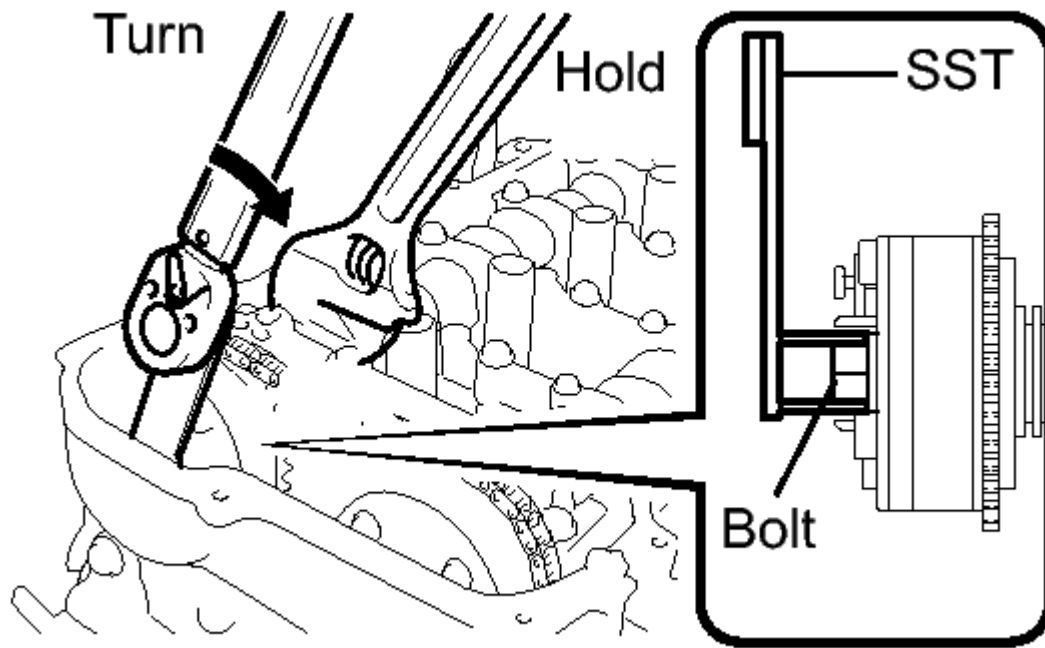


Fig. 51: Holding Hexagonal Portion Of No. 2 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL NO. 2 CHAIN VIBRATION DAMPER

- Using SST, install the No. 2 chain vibration damper with the 2 bolts.

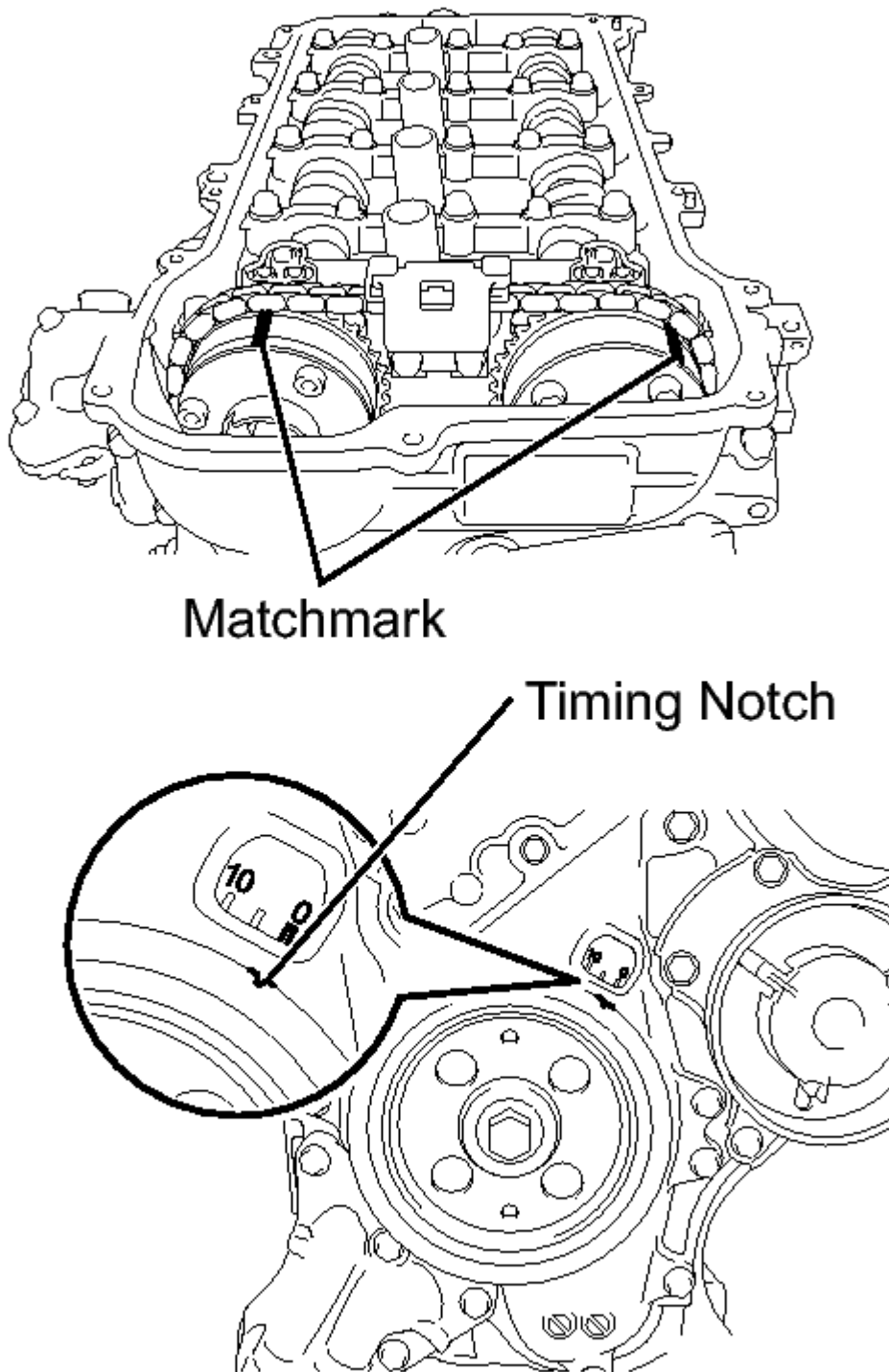
SST: 09961-00950

without SST - Torque: 10 N.m (102 kgf.cm, 7ft.lbf)

with SST - Torque: 5.5 N.m (56 kgf.cm, 48in.lbf)

NOTE:

- The "with SST" torque value can be obtained by using a torque wrench with a fulcrum length of 180 mm (7.09 in.) and SST of 150 mm (5.91 in.). Refer to PRECAUTION .
- This torque value is effective when SST is parallel to the torque wrench.

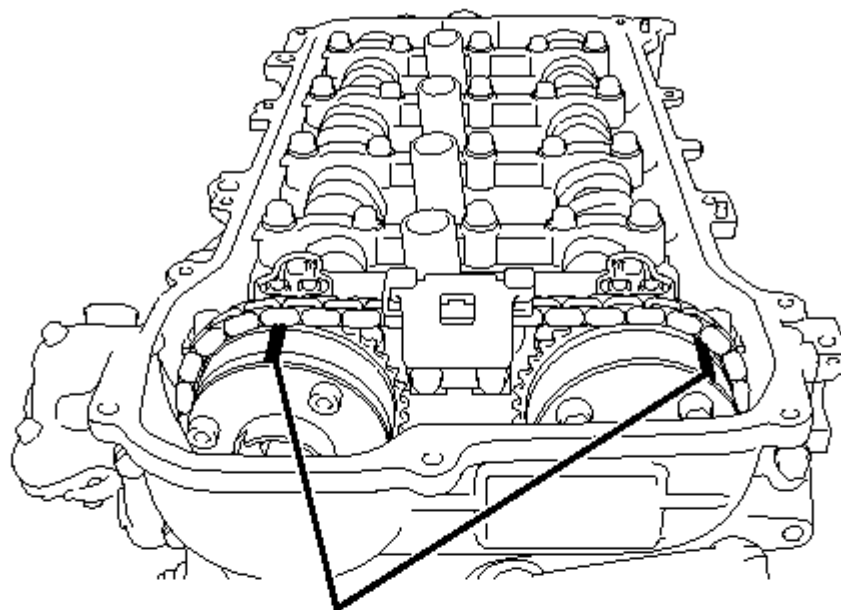


T

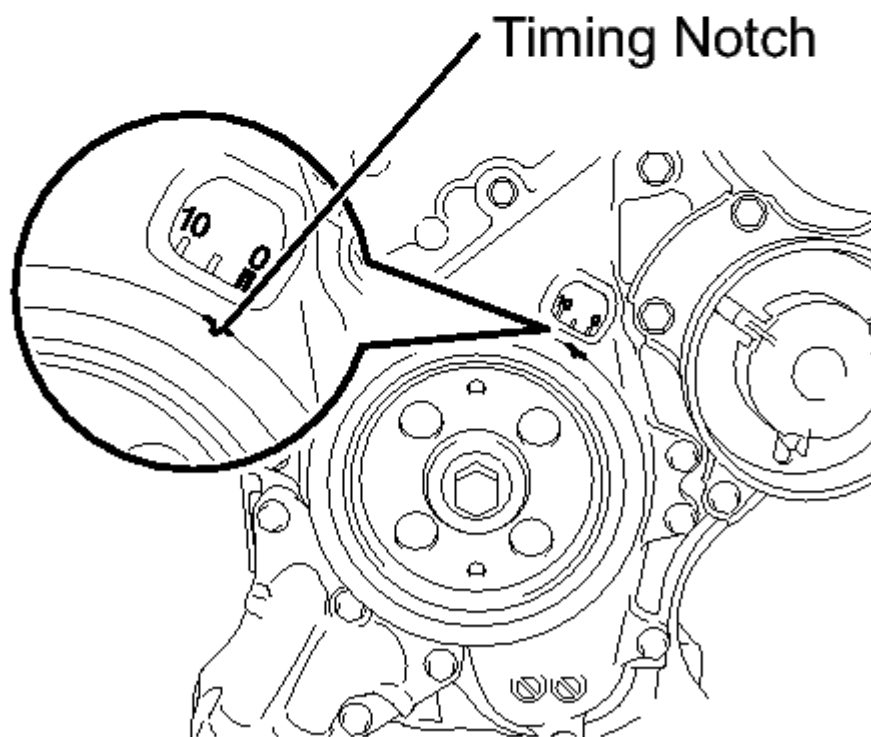
Fig. 52: Aligning Crankshaft Pulley & Timing Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY** . Refer to **REASSEMBLY**.
10. **SET NO. 1 CYLINDER TO TDC / COMPRESSION**

- a. Turn the crankshaft pulley until its timing notch (groove) and the timing mark "0" of the timing chain cover are aligned.



Matchmark



Timing Notch

T

Fig. 53: Aligning Crankshaft Pulley & Timing Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that each matchmark of the camshaft timing gear and camshaft timing exhaust gear are aligned with each matchmark located as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

11. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY . Refer to REASSEMBLY)

12. INSTALL AIR TUBE

- a. Install the air tube assembly with the 2 bolts.

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

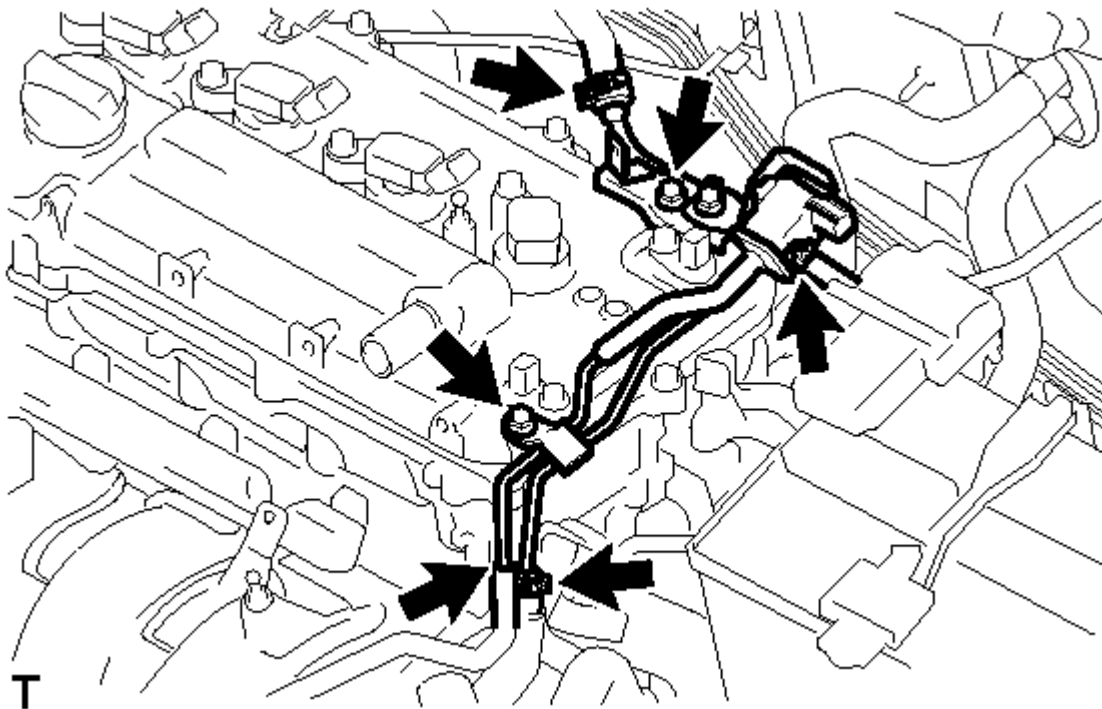


Fig. 54: Identifying Air Tube Assembly Bolts & Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Connect the 4 hoses.

13. CONNECT ENGINE WIRE

- a. Connect the 5 connectors and install the wire harness with the 2 bolts and 5 clamps.

Torque: 8.4 N.m (86 kgf.cm, 74in.lbf)

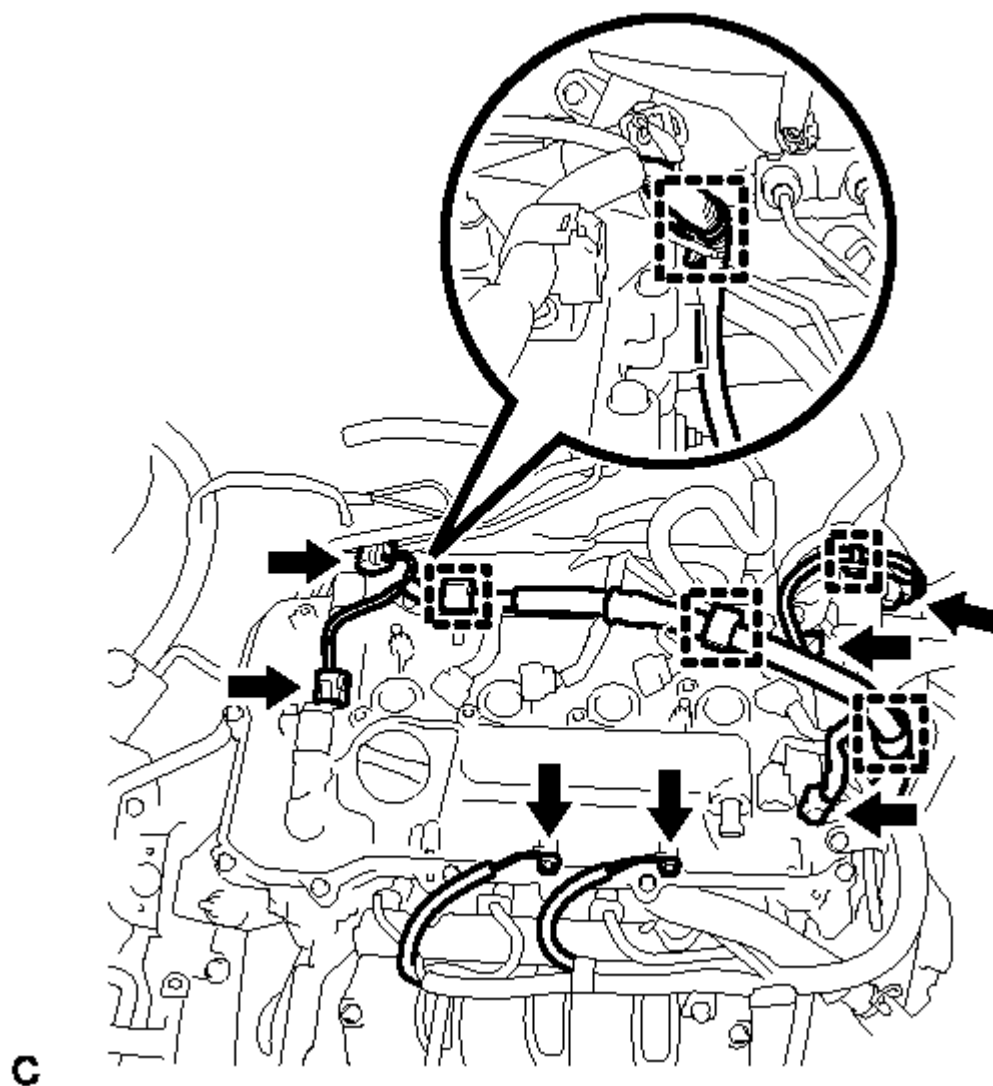


Fig. 55: Identifying Engine Wire Bolts, Connectors & Clamps
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. CONNECT NO. 2 VENTILATION HOSE

- a. Connect the No. 2 ventilation hose.

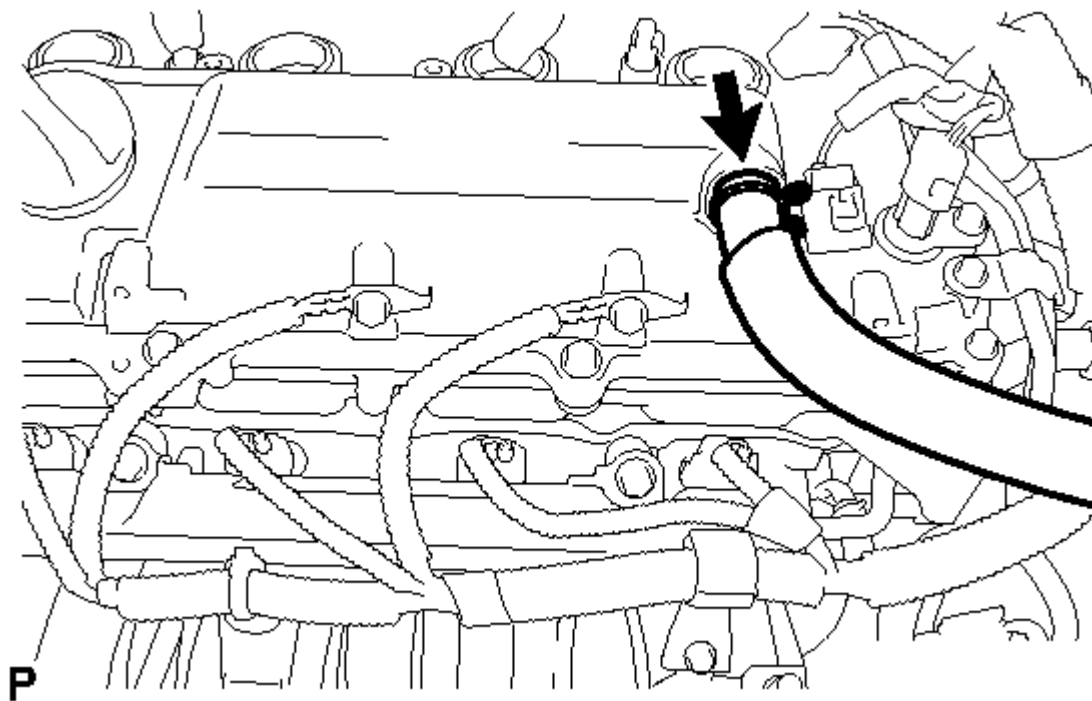


Fig. 56: Locating No. 2 Ventilation Hose

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

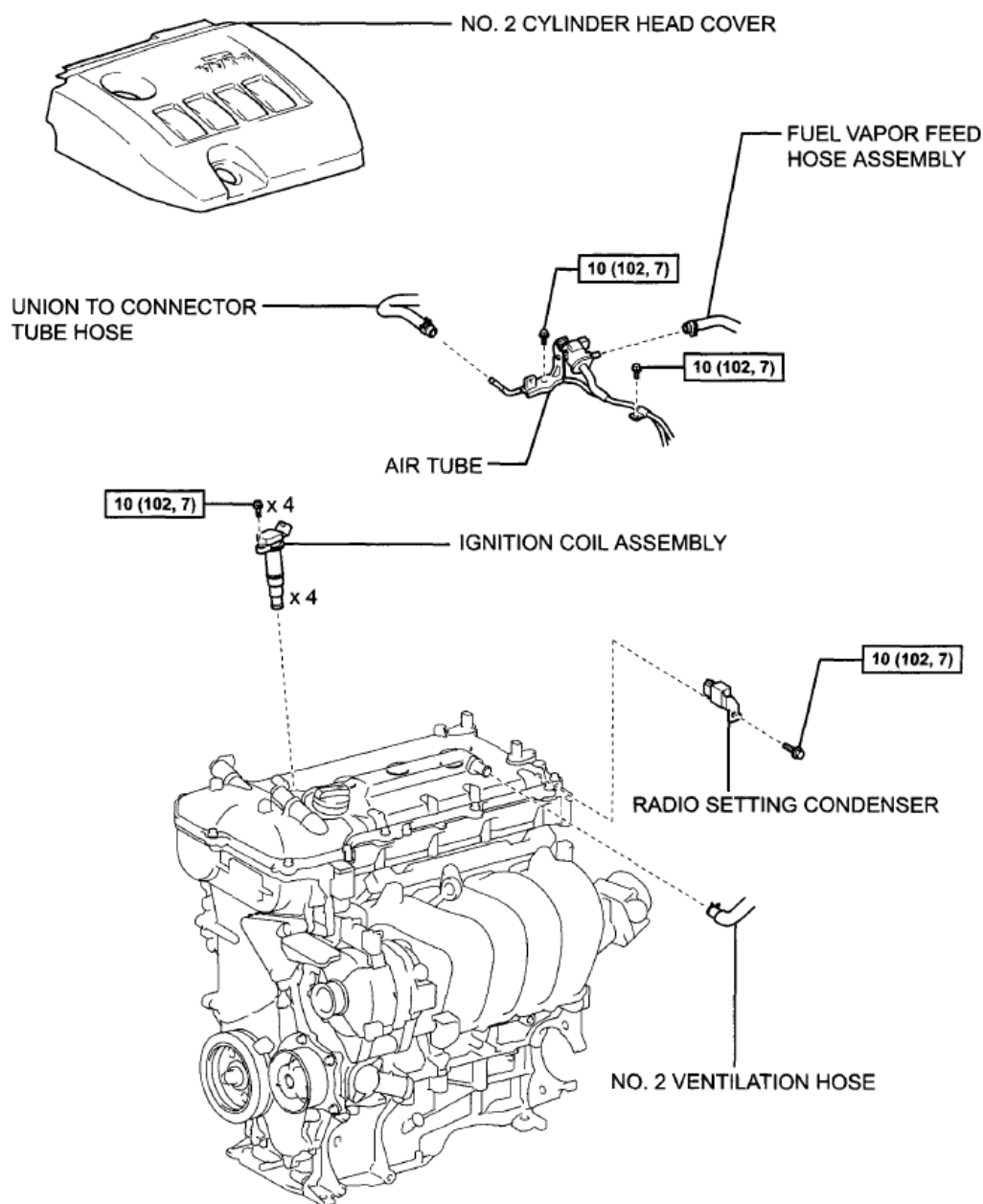
15. **INSTALL RADIO SETTING CONDENSER** . Refer to **INSTALLATION**.
16. **INSTALL IGNITION COIL ASSEMBLY** . Refer to **INSTALLATION** .
17. **INSPECT FOR ENGINE OIL LEAK**
18. **INSTALL NO. 2 CYLINDER HEAD COVER** . Refer to **INSTALLATION**.
19. **INSTALL OUTER COWL TOP PANEL** . Refer to **INSTALLATION** .
20. **INSTALL WINDSHIELD WIPER MOTOR AND LINK ASSEMBLY** . Refer to **INSTALLATION** .
21. **INSTALL COWL TOP VENTILATOR LOUVER LH** . Refer to **INSTALLATION** .
22. **INSTALL COWL TOP VENTILATOR LOUVER RH** . Refer to **INSTALLATION** .
23. **INSTALL HOOD TO COWL TOP SEAL** . Refer to **INSTALLATION** .
24. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY RH** . Refer to **INSTALLATION** .
25. **INSTALL FRONT WIPER ARM AND BLADE ASSEMBLY LH** . Refer to **INSTALLATION** .
26. **INSTALL FRONT WIPER ARM HEAD CAP** . Refer to **INSTALLATION** .
27. **INSPECT IGNITION TIMING** . Refer to **ON-VEHICLE INSPECTION**.
28. **INSPECT ENGINE IDLING SPEED** . Refer to **ON-VEHICLE INSPECTION**.

TIMING GEAR

COMPONENTS

2009 Toyota Matrix S

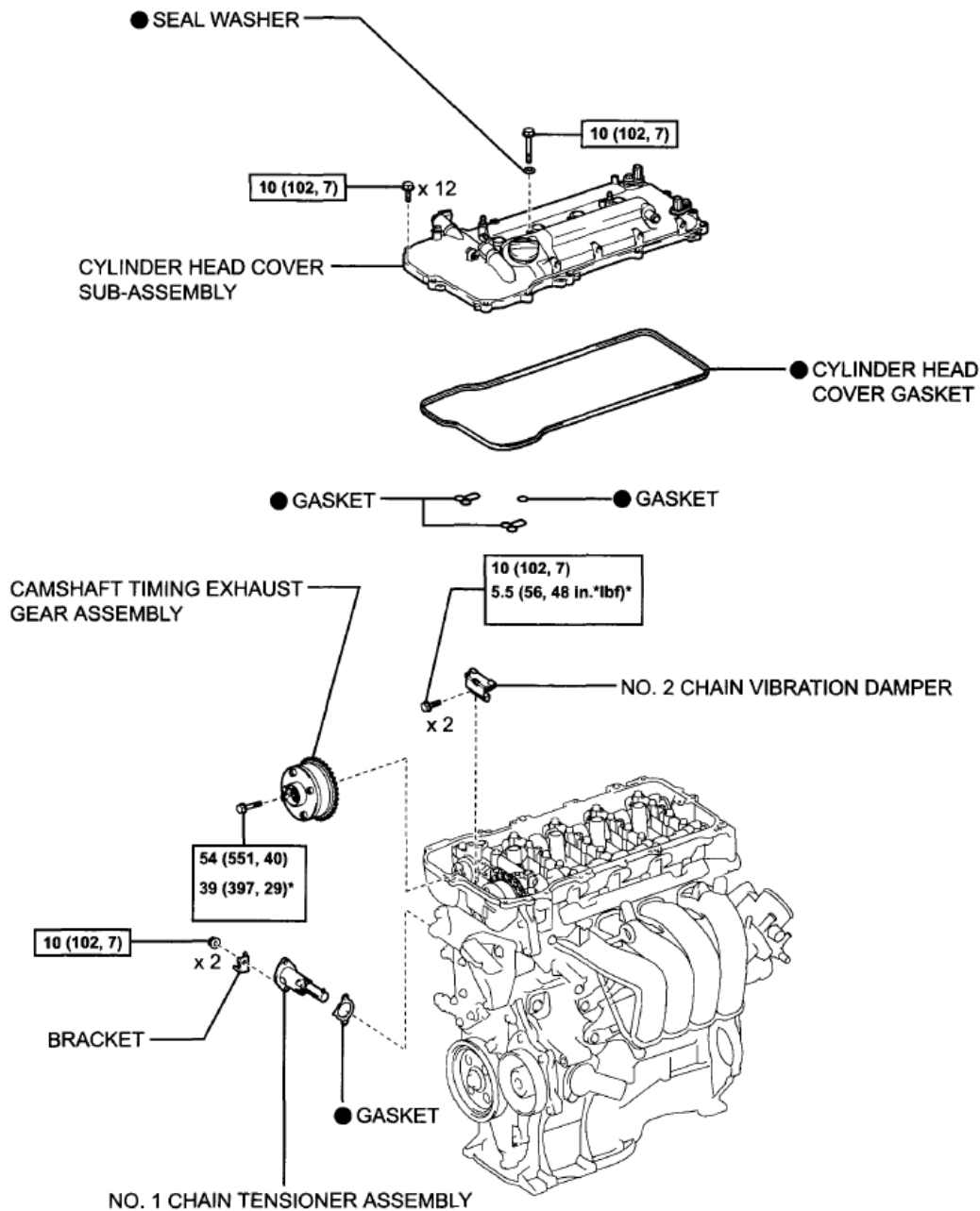
2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix



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

A183553E01

Fig. 57: Identifying Timing Gear Components With Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

* For use with SST

● Non-reusable part

A183664E01

Fig. 58: Identifying Timing Gear Components With Torque Specifications (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE NO. 2 CYLINDER HEAD COVER (See [REMOVAL](#))

2. **DISCONNECT FUEL VAPOR FEED HOSE ASSEMBLY** (See **REMOVAL**)
3. **DISCONNECT UNION TO CONNECTOR TUBE HOSE** (See **REMOVAL**)
4. **DISCONNECT NO. 2 VENTILATION HOSE**
5. **SEPARATE WIRE HARNESS**
 - a. Remove the 2 bolts (*1) and disconnect the 9 connectors and 2 clamps. Then disconnect the wire harness.
 - b. Remove the 2 bolts (*2) and disconnect the air tube.
6. **REMOVE RADIO SETTING CONDENSER** (See **DISASSEMBLY**)
7. **REMOVE IGNITION COIL ASSEMBLY** (See **REMOVAL**)

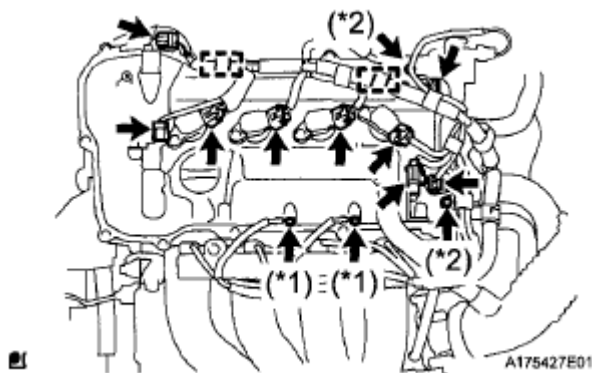


Fig. 59: Locating Wire Harness Bolt

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

8. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** (See **DISASSEMBLY**)
9. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**
 - a. Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.
 - b. Check that each timing mark of the camshaft timing gear and sprocket are aligned with each timing mark located as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

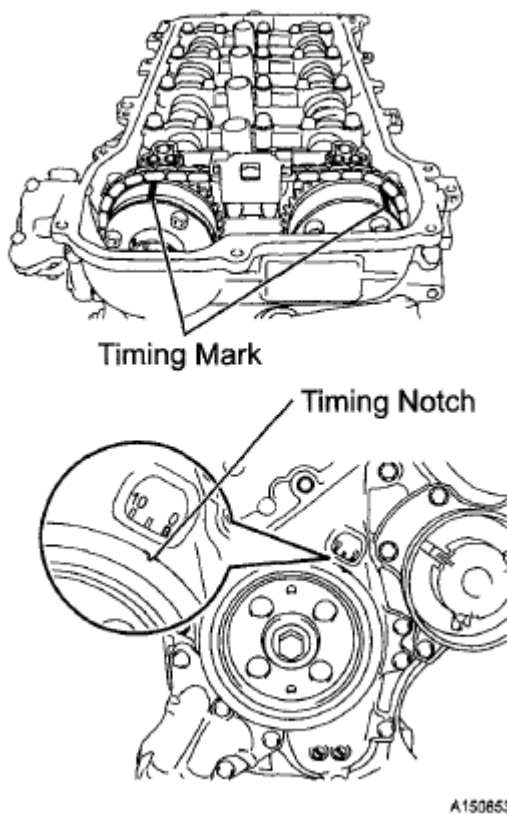


Fig. 60: Identifying Timing Mark Of Camshaft Timing Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place paint marks on the chain in alignment with the timing marks on the camshaft timing gear and camshaft timing exhaust gear.

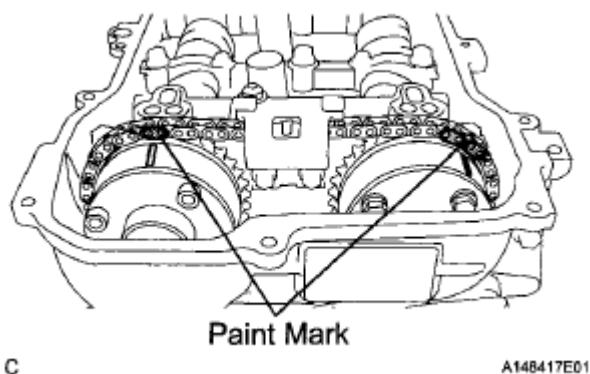


Fig. 61: Identifying Paint Marks On Camshaft Timing Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE NO. 2 CHAIN VIBRATION DAMPER

- a. Using SST, remove the 2 bolts and No. 2 chain vibration damper from the cam cap.

SST 09961-00950

11. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See DISASSEMBLY)

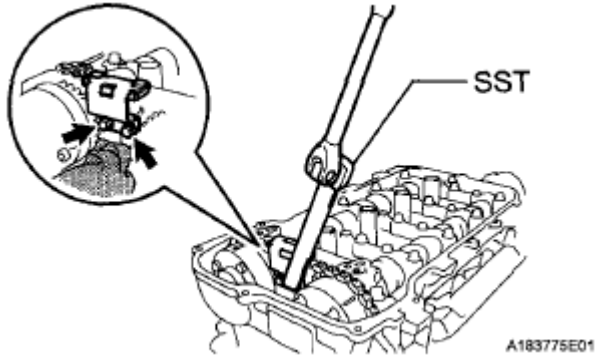


Fig. 62: Removing No. 2 Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. While holding the hexagonal portion of the No. 2 camshaft with a wrench, loosen the camshaft timing exhaust gear bolt with SST.

SST 09249-37010

NOTE: Do not remove the other 4 bolts ("TORX" bolt). If any of them is removed, replace the camshaft timing exhaust gear assembly.

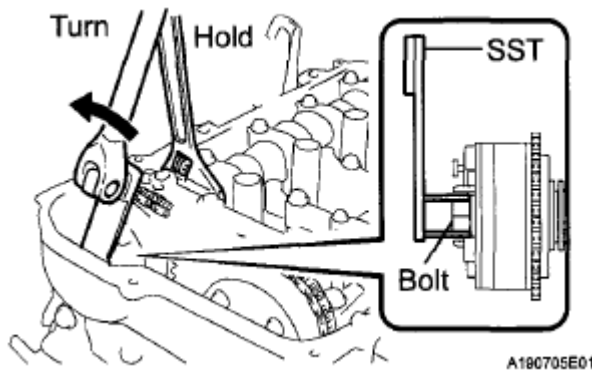


Fig. 63: Removing Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

The bolt cannot be removed separately from the camshaft timing exhaust gear assembly due to lack of space.

- b. Hold the hexagonal portion of the intake camshaft with a wrench and turn it slightly

counterclockwise to release the chain.

- c. While removing the chain, pull out the camshaft timing exhaust gear assembly horizontally and then upward with the bolts installed.

NOTE: **Do not turn the intake camshaft more than necessary.**

HINT:

Be sure to loosen the chain because the camshaft timing exhaust gear assembly cannot be removed with the chain tensioned.

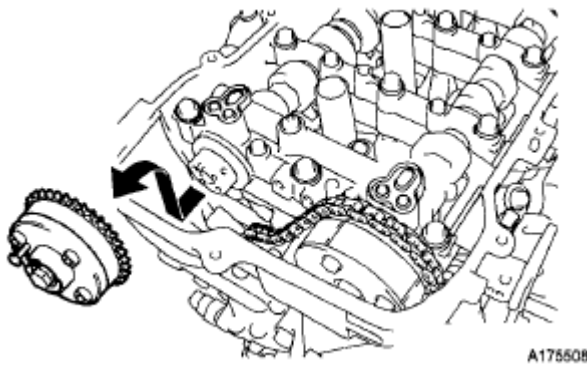


Fig. 64: Pulling Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Inspect the camshaft timing gear lock.
 1. Check that the camshaft timing gear is locked.
- b. Inspect camshaft timing gear operation.
 1. After cleaning and degreasing the intake side WT oil hole on the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.

NOTE: **Be sure to seal the oil hole completely because air leaks due to insufficient sealing will prevent the lock pin from being released.**

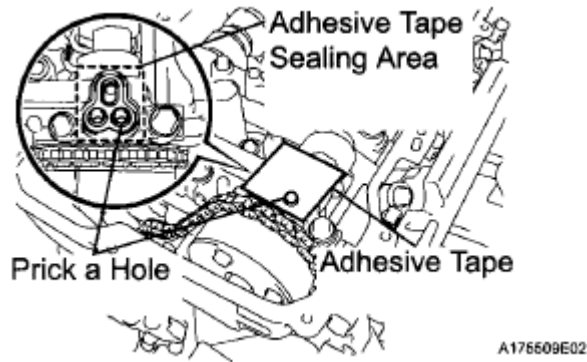


Fig. 65: Identifying Camshaft Timing Gear Sealing Area
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Prick a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure A)
3. Apply approximately 100 kPa (1.0 kgf/cm² , 14.5 psi.) of air pressure to the hole pricked in procedure A to release the lock pin.

NOTE:

- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.

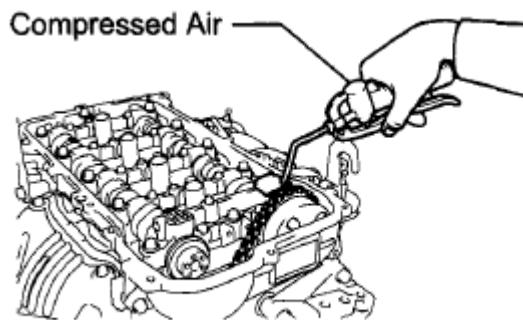


Fig. 66: Applying Compressed Air To Lock Pin
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Forcibly turn the camshaft timing gear in the advance direction (counterclockwise).

HINT:

Depending on the air pressure applied, the camshaft timing gear may turn in the advance direction without assistance by hand.

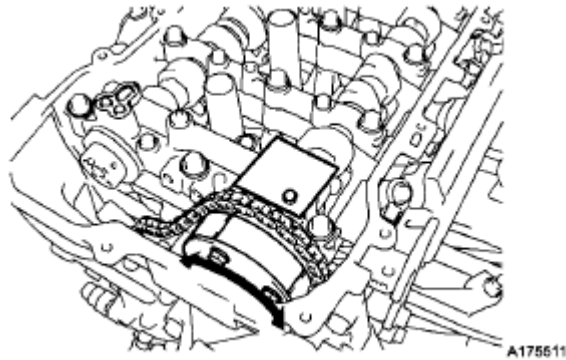


Fig. 67: Turning Camshaft Timing Gear

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

5. Turn the camshaft timing gear within its movable range (27.5°) 2 or 3 times without turning it to the most retarded position. Check that the camshaft timing gear turns smoothly.
6. Lock the camshaft timing gear.

NOTE: **Be sure to turn the camshaft timing gear to the locked position and then confirm that it is securely locked again to prevent the valve timing from being affected.**

7. Remove the adhesive tape from the No. 1 camshaft bearing cap.

14. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Temporarily install the camshaft timing exhaust gear assembly.
 1. Install the bolt to the camshaft timing exhaust gear assembly.
 2. Align the knock pin on the No. 2 camshaft with the pin hole in the camshaft timing exhaust gear assembly and temporarily install the camshaft timing exhaust gear assembly to the No. 2 camshaft with the bolt.

NOTE:

- **Do not install the chain onto the gear at this step.**
- **Do not allow the chain to interfere with the gear when installing the gear assembly.**

- b. Inspect the camshaft timing exhaust gear lock.
 1. Check that the camshaft timing exhaust gear is locked.

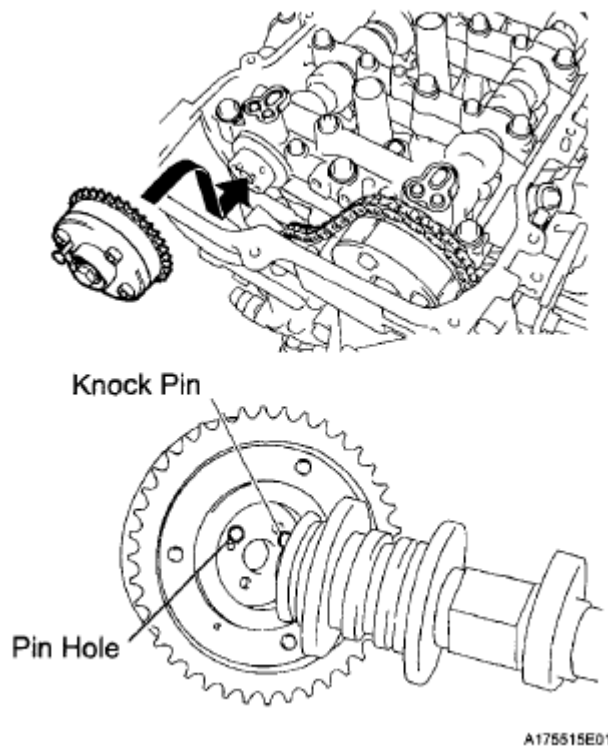


Fig. 68: Checking Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Inspect camshaft timing exhaust gear operation.
 - 1. After cleaning and degreasing the exhaust side WT oil hole on the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.

NOTE: Be sure to seal the oil hole completely because air leaks due to insufficient sealing will prevent the lock pin from being released.

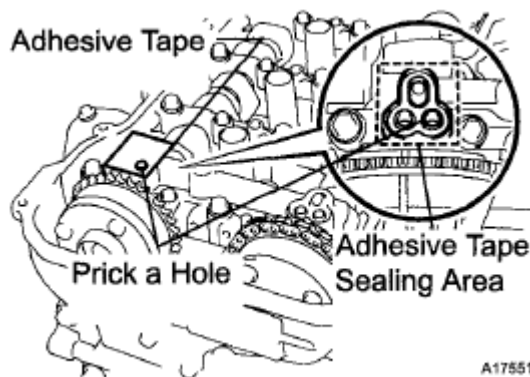
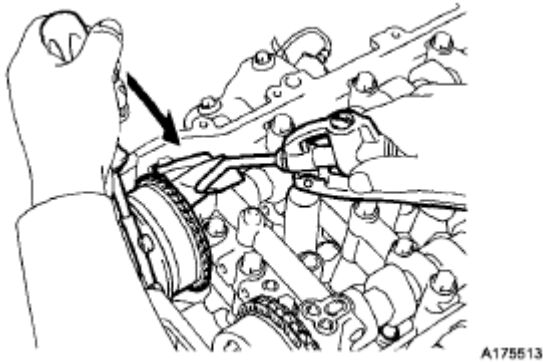


Fig. 69: Identifying Camshaft Timing Exhaust Gear Sealing Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Prick a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure B)
3. Apply approximately 100 kPa (1.0 kgf/cm² , 14.5 psi.) of air pressure to the hole pricked in procedure B to release the lock pin.

NOTE:

- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.

**Fig. 70: Releasing Lock Pin**

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

4. Using a screwdriver with its tip wrapped with tape, forcibly turn the camshaft timing exhaust gear in the retard direction (clockwise).

NOTE:

- Be sure to keep the camshaft timing exhaust gear in the retard direction. If the gear is released, it will return to the advanced position automatically due to the force from the spring.
 - Do not damage the camshaft timing exhaust gear.
5. Using a screwdriver with its tip wrapped with tape, turn the camshaft timing exhaust gear within its movable range (20°) 2 or 3 times without turning it to the most advanced position. Check that the camshaft timing gear turns smoothly.

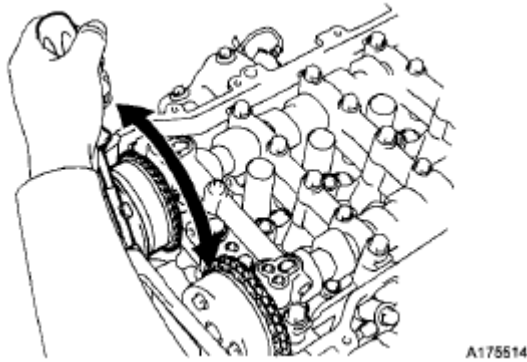


Fig. 71: Turning Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. Lock the camshaft timing exhaust gear.
7. Remove the adhesive tape from the No. 1 camshaft bearing cap.
- d. Remove the camshaft timing exhaust gear assembly.
 1. Remove the temporarily installed camshaft timing exhaust gear assembly.

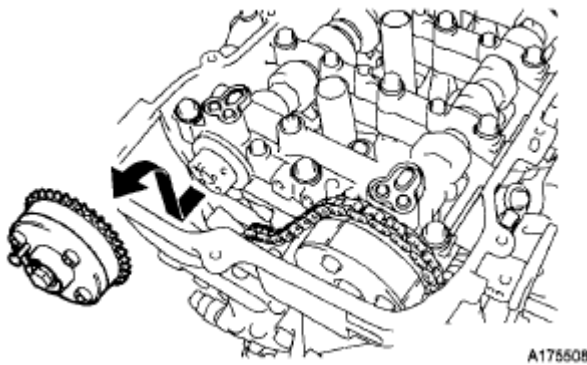


Fig. 72: Removing Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Raise the chain.
- b. Hold the hexagonal portion of the intake camshaft with a wrench and turn it slightly counterclockwise to release the chain.
- c. Align the paint mark with the matchmark to install the chain.

NOTE: **Do not turn the intake camshaft more than necessary.**

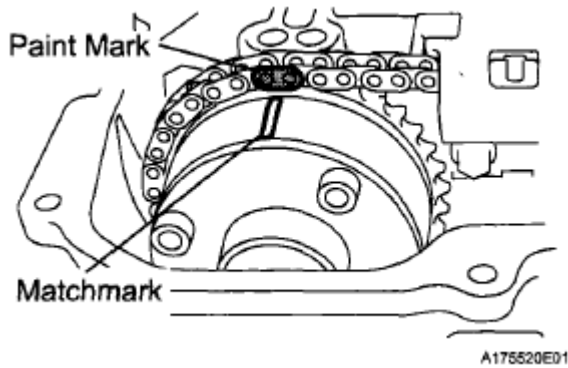


Fig. 73: Identifying Matchmark To Chain

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

- d. Align the straight pin on the No. 2 camshaft with the pin hole in the camshaft timing exhaust gear assembly and install the camshaft timing exhaust gear assembly to the No. 2 camshaft.

NOTE:

- If the straight pin cannot be aligned with the pin hole, hold the hexagonal portion of the No. 2 camshaft with a wrench and turn it slightly to install the gear.
- Do not turn the No. 2 camshaft more than necessary.
- Do not forcibly push on the tip of the straight pin with the camshaft timing exhaust gear assembly.

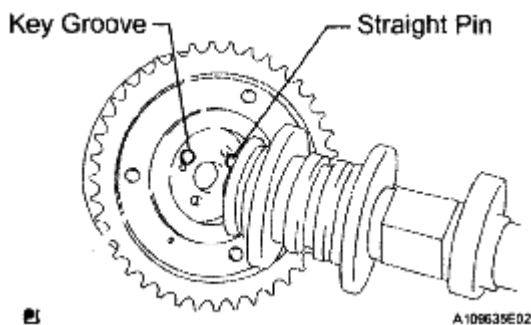


Fig. 74: Identifying Straight Pin And Key Groove

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

- e. Using SST and a wrench, hold the hexagonal portion of the No. 2 camshaft and install the camshaft timing exhaust gear assembly to the No. 2 camshaft.

SST 09249-37010

Torque: without SST

54 N*m (551 kgf*cm, 40 ft.*lbf)

with SST

39 N*m (397 kgf*cm, 29 ft.*lbf)

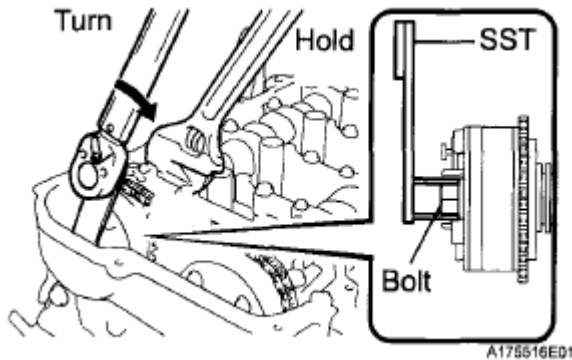


Fig. 75: Installing Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- This torque value can be obtained by using a torque wrench with a fulcrum length of 260 mm (10.24 in.) and SST of 100 mm (3.94 in.) (See REPAIR INSTRUCTION).
- This torque value is effective when SST is parallel to the torque wrench.

2. INSTALL NO. 2 CHAIN VIBRATION DAMPER

- Using SST, install the No. 2 chain vibration damper with the 2 bolts.

SST 09961-00950

Torque: without SST

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

with SST

5.5 N*m (56 kgf*cm, 48 in.*lbf)

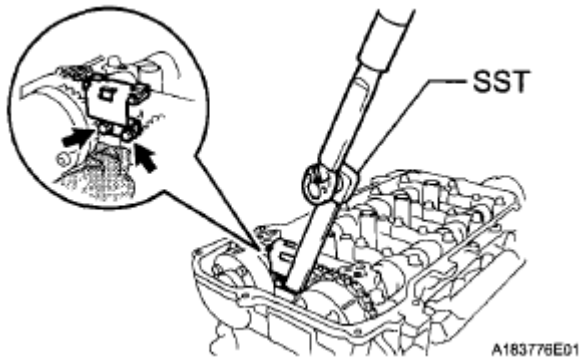


Fig. 76: Installing No. 2 Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- This torque value can be obtained by using a torque wrench with a fulcrum length of 180 mm (7.09 in.) and SST of 150 mm (5.91 in.) (See REPAIR INSTRUCTION).
- This torque value is effective when SST is parallel to the torque wrench.

3. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY** (See REASSEMBLY)
4. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**
 - a. Turn the crankshaft clockwise 360° to set the No. 1 cylinder to TDC/compression and align the matchmark (cutout) with the "0" mark on the timing chain (belt) cover.
 - b. Check that the matchmark on each camshaft timing gear is positioned as shown in the illustration.
5. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** (See REASSEMBLY)
6. **INSTALL IGNITION COIL ASSEMBLY** (See INSTALLATION)
7. **INSTALL RADIO SETTING CONDENSER** (See INSTALLATION)

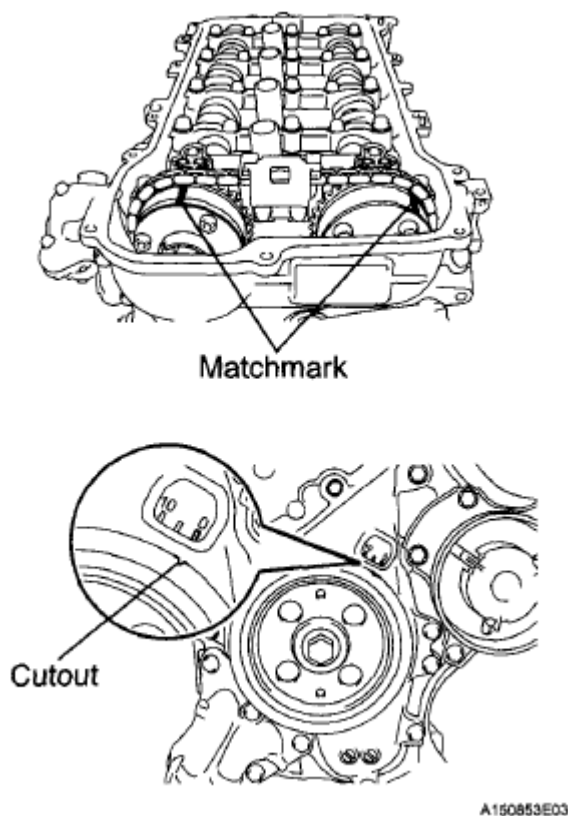


Fig. 77: Identifying Matchmark On Timing Chain Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL WIRE HARNESS

- a. Install the air tube with the 2 bolts (*2).

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

- b. Connect the 9 connectors and install the wire harness with the 2 bolts (*1) and 2 clamps.

Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)

9. INSTALL NO. 2 VENTILATION HOSE

10. CONNECT FUEL VAPOR FEED HOSE ASSEMBLY (See INSTALLATION)

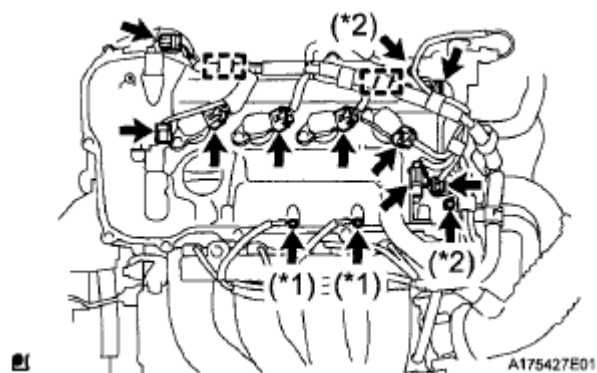


Fig. 78: Locating Air Tube With Bolts

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

11. **CONNECT UNION TO CONNECTOR TUBE HOSE** (See INSTALLATION)
12. **INSTALL NO. 2 CYLINDER HEAD COVER** (See INSTALLATION)

CYLINDER HEAD GASKET

COMPONENTS

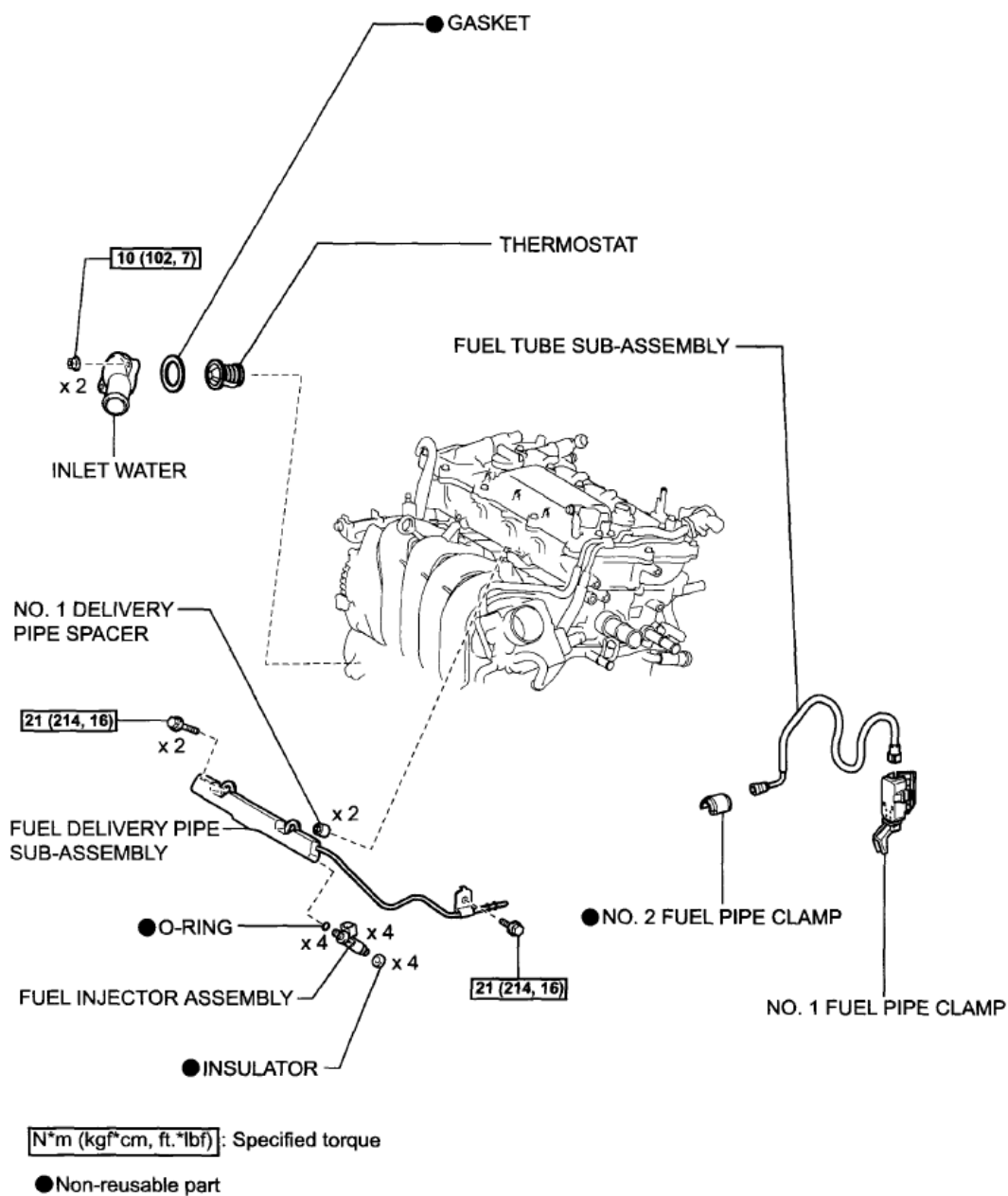


Fig. 79: Identifying Cylinder Head Components With Torque Specifications (1 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

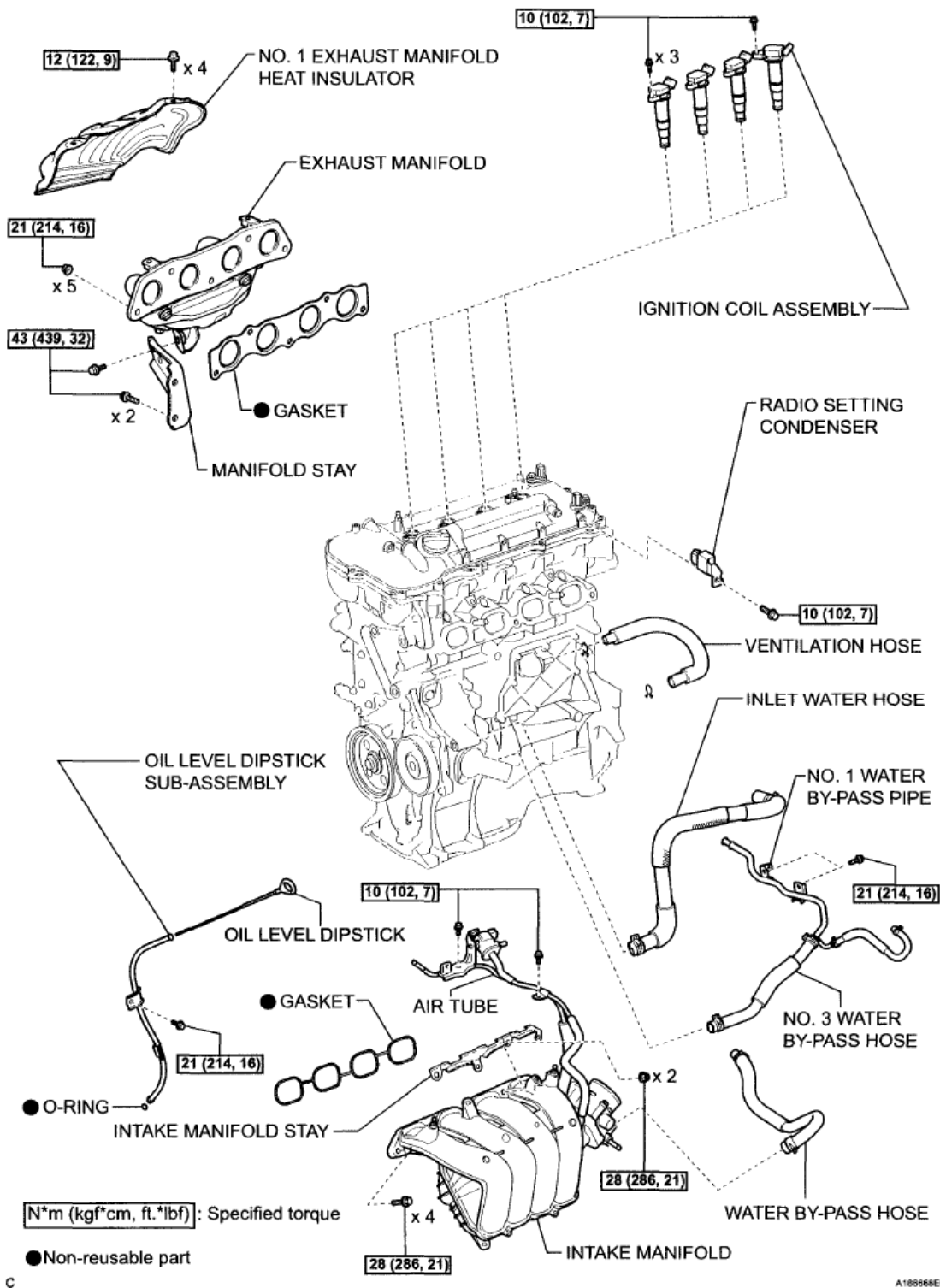
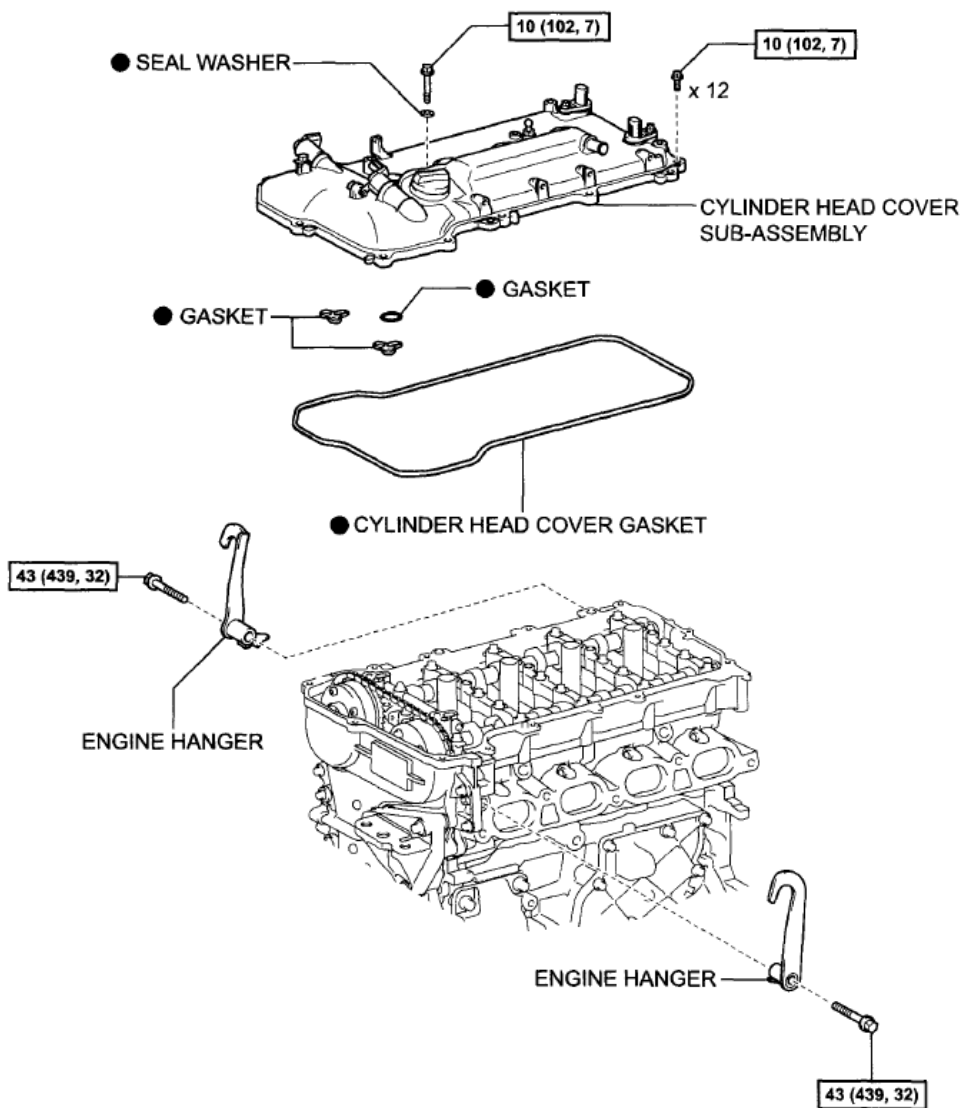


Fig. 80: Identifying Cylinder Head Components With Torque Specifications (2 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

● Non-reusable part

T

A156288E07

Fig. 81: Identifying Cylinder Head Components With Torque Specifications (3 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

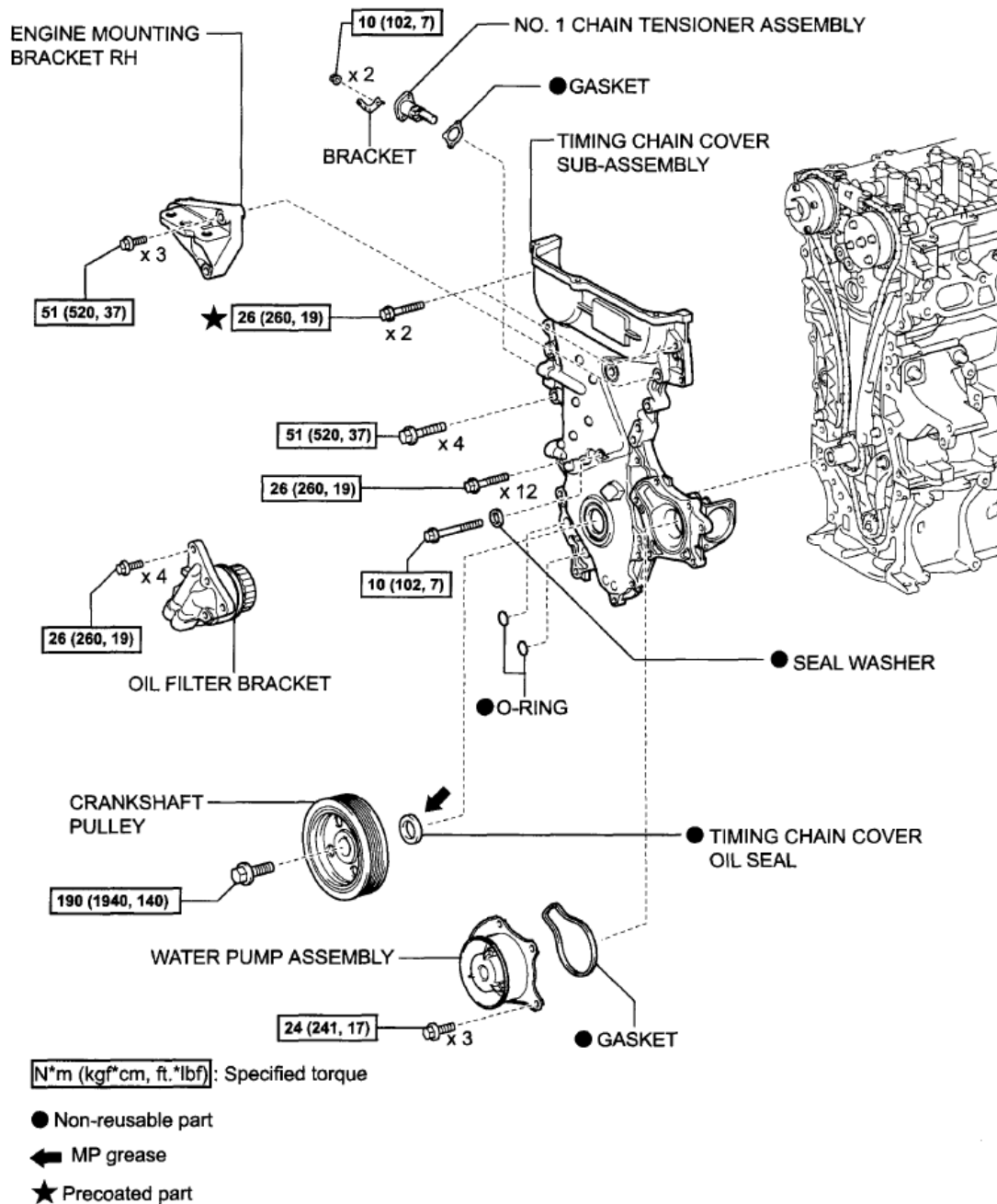
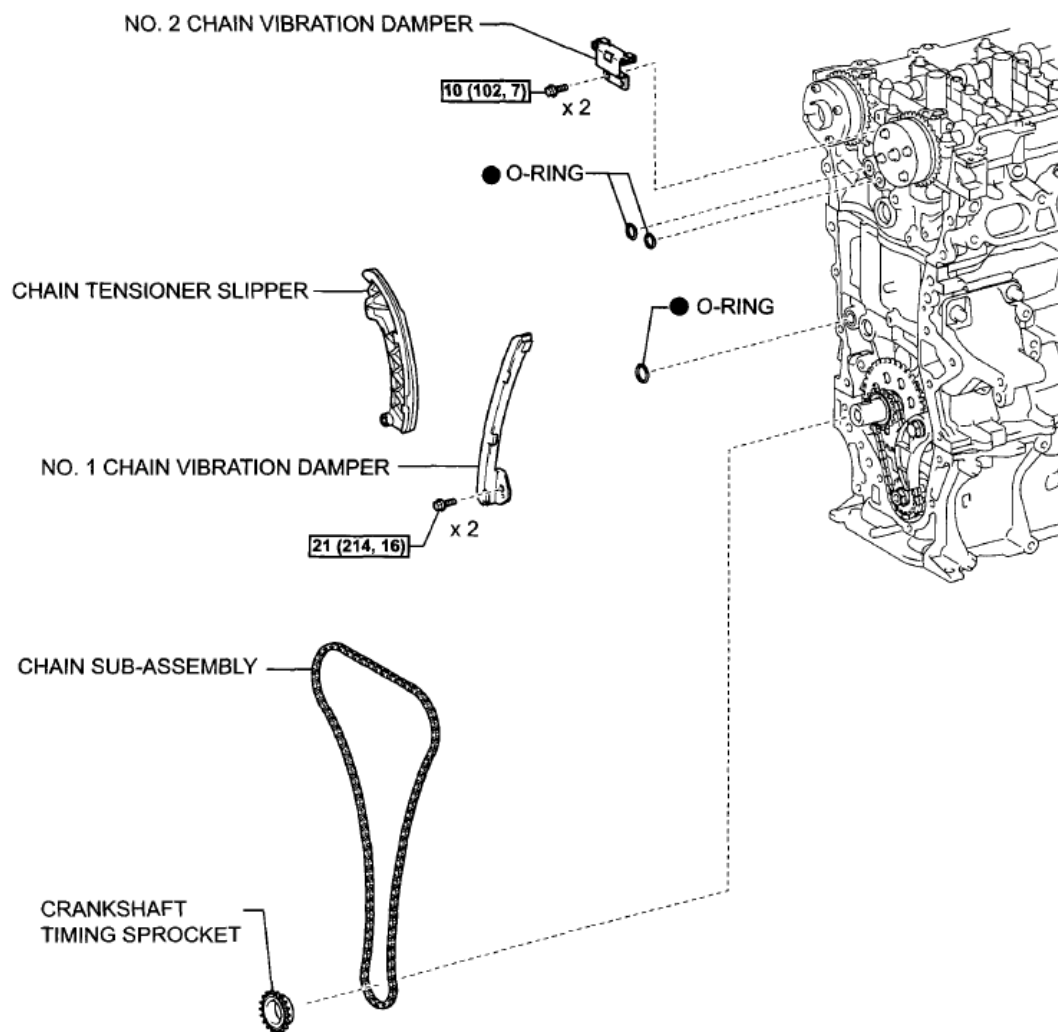


Fig. 82: Identifying Cylinder Head Components With Torque Specifications (4 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

● Non-reusable part

T

A160820E01

Fig. 83: Identifying Cylinder Head Components With Torque Specifications (5 Of 6)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

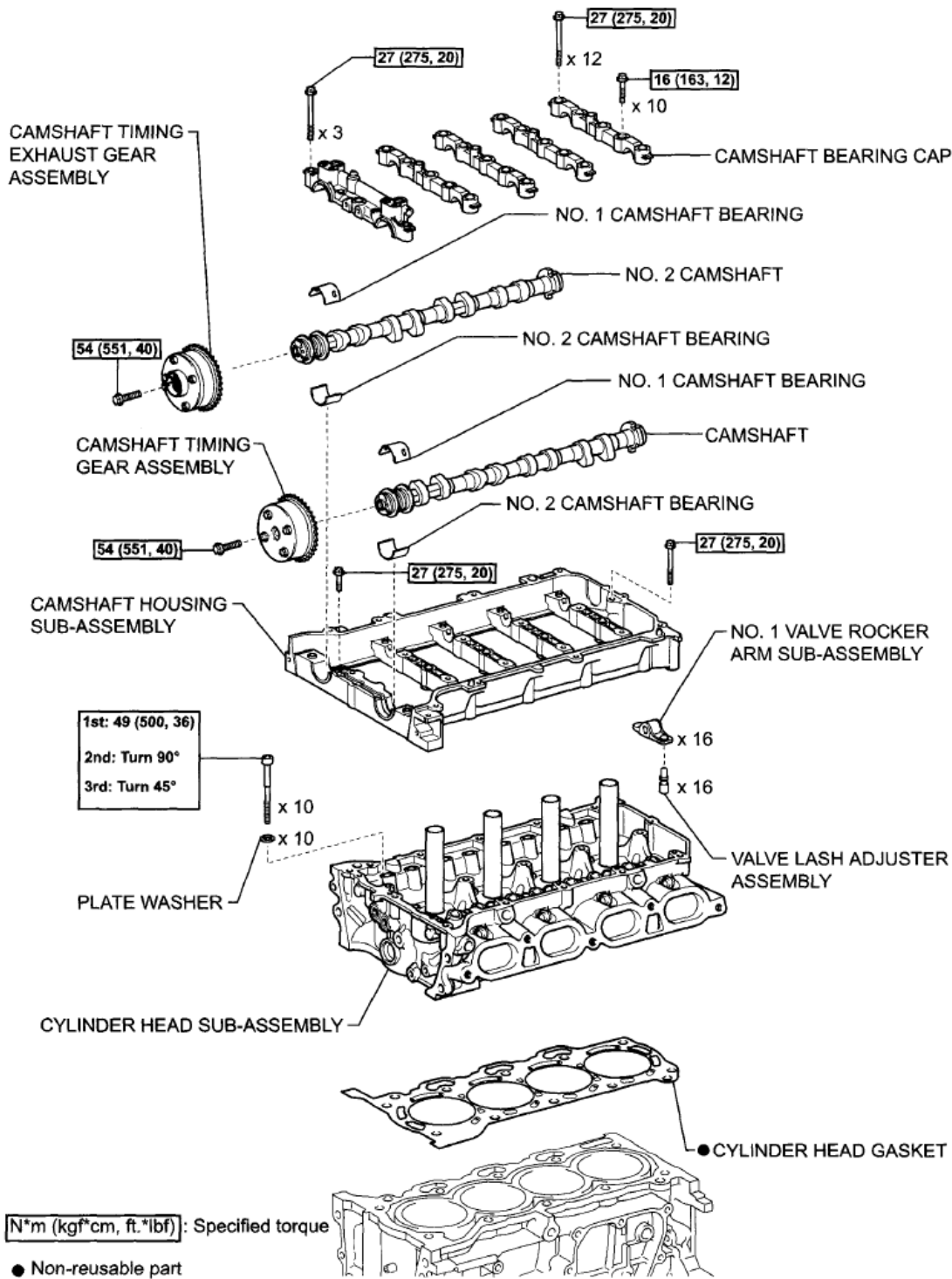


Fig. 84: Identifying Cylinder Head Components With Torque Specifications (6 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

See **REMOVAL**.

2. **INSTALL ENGINE STAND** (See **REMOVAL**)
3. **REMOVE INTAKE MANIFOLD** (See **REMOVAL**)
4. **DISCONNECT FUEL TUBE SUB-ASSEMBLY** (See **REMOVAL**)
5. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** (See **REMOVAL**)
6. **REMOVE FUEL INJECTOR ASSEMBLY** (See **REMOVAL**)
7. **REMOVE IGNITION COIL ASSEMBLY** (See **REMOVAL**)
8. **REMOVE OIL LEVEL DIPSTICK SUB-ASSEMBLY** (See **REMOVAL**)
9. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR** (See **REMOVAL**)
10. **REMOVE MANIFOLD STAY** (See **REMOVAL**)
11. **REMOVE EXHAUST MANIFOLD** (See **REMOVAL**)
12. **REMOVE VENTILATION HOSE** (See **REMOVAL**)
13. **DISCONNECT NO. 3 WATER BY-PASS HOSE** (See **REMOVAL**)
14. **REMOVE NO. 1 WATER BY-PASS PIPE** (See **REMOVAL**)
15. **REMOVE WATER BY-PASS HOSE** (See **REMOVAL**)
16. **REMOVE WATER INLET HOSE** (See **DISASSEMBLY**)
17. **REMOVE WATER INLET** (See **THERMOSTAT**)
18. **REMOVE THERMOSTAT** (See **THERMOSTAT**)
19. **REMOVE RADIO SETTING CONDENSER** (See **DISASSEMBLY**)
20. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** (See **DISASSEMBLY**)
21. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**
 - a. Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.
 - b. Check that each timing mark of the camshaft timing gear and sprocket are aligned with each timing mark located as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

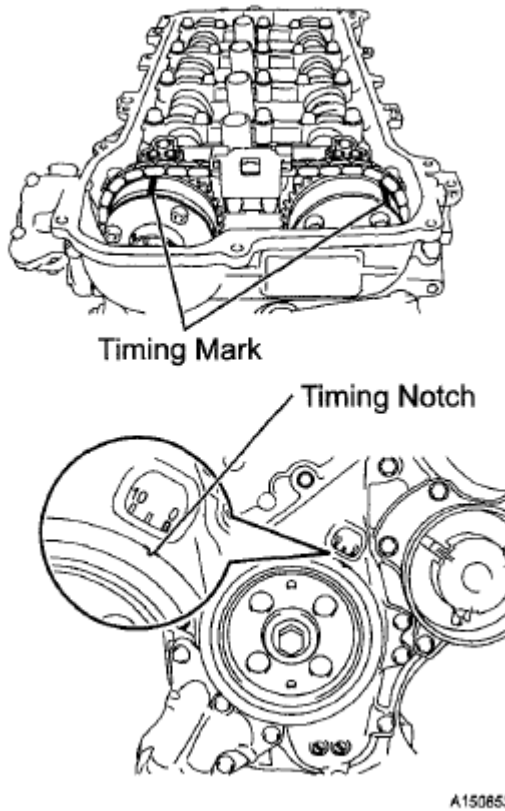


Fig. 85: Identifying Timing Mark Of Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. REMOVE CRANKSHAFT PULLEY (See REMOVAL)
23. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See DISASSEMBLY)
24. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (See REMOVAL)
25. REMOVE TIMING CHAIN COVER OIL SEAL (See DISASSEMBLY)
26. REMOVE CHAIN TENSIONER SLIPPER
 - a. Remove the chain tensioner slipper.

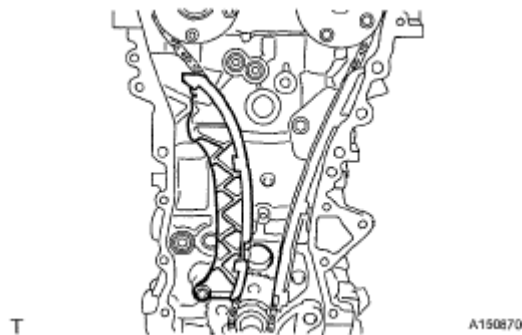


Fig. 86: Identifying Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. REMOVE NO. 1 CHAIN VIBRATION DAMPER

- a. Remove the 2 bolts and No. 1 chain vibration damper.



Fig. 87: Locating No. 1 Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. REMOVE CHAIN SUB-ASSEMBLY

- a. Hold the hexagonal portion of the camshaft with a wrench and turn the camshaft timing gear assembly counterclockwise to loosen the chain between the camshaft timing gears.
- b. With the chain loosened, release the chain from the camshaft timing gear assembly and place it on the camshaft timing gear assembly.

HINT:

Be sure to release the chain from the sprocket completely.

- c. Turn the camshaft clockwise to return it to the original position and remove the chain.

29. REMOVE NO. 2 CHAIN VIBRATION DAMPER (See REMOVAL)**30. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY (See REMOVAL)****31. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY (See REMOVAL)****32. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY (See REMOVAL)**

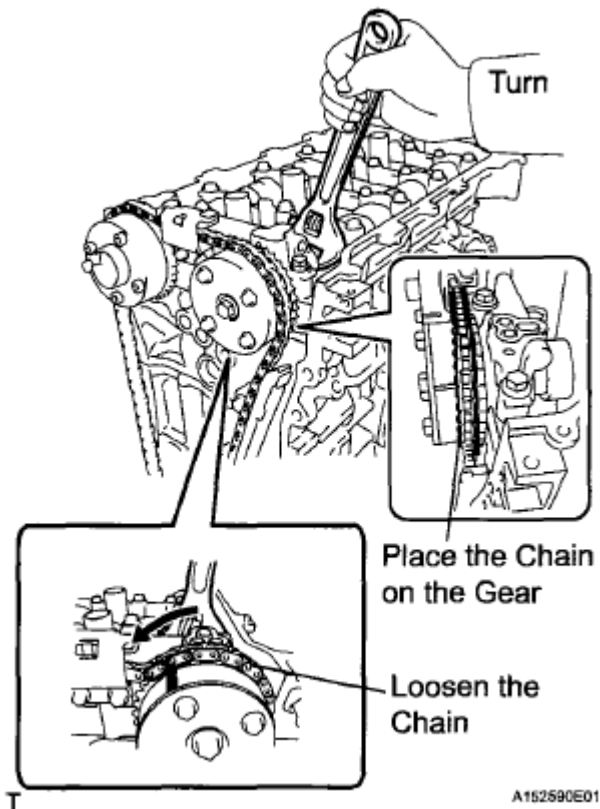


Fig. 88: Removing Chain Sub-Assembly

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

33. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY (See REMOVAL)
34. REMOVE CAMSHAFT BEARING CAP (See REMOVAL)
35. REMOVE CAMSHAFT (See REMOVAL)
36. REMOVE NO. 2 CAMSHAFT (See REMOVAL)
37. REMOVE NO. 1 CAMSHAFT BEARING (See REMOVAL)
38. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY (See DISASSEMBLY)
39. REMOVE VALVE LASH ADJUSTER ASSEMBLY (See DISASSEMBLY)
40. REMOVE NO. 2 CAMSHAFT BEARING (See REMOVAL)
41. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY (See DISASSEMBLY)
42. REMOVE CYLINDER HEAD SUB-ASSEMBLY
 - a. Using several steps, uniformly loosen and remove the 10 cylinder head bolts and 10 plate washers with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

NOTE: Head warpage or cracking could result from removing the bolts in the wrong order.

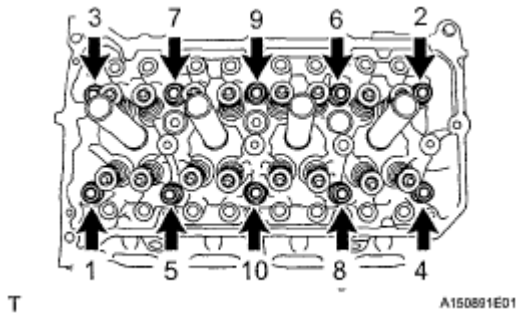


Fig. 89: Locating Cylinder Head Bolt Loosen Sequence

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

- b. Using a screwdriver with its tip wrapped with tape, pry between the cylinder head and cylinder block, and remove the cylinder head.

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

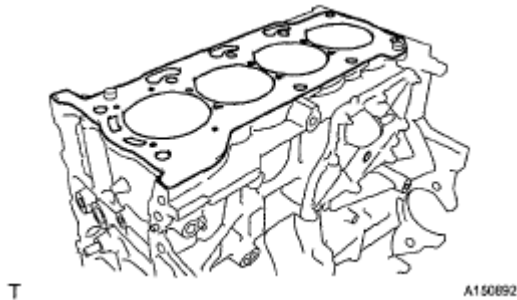


Fig. 90: Identifying Cylinder Head

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

43. REMOVE CYLINDER HEAD GASKET

- a. Remove the cylinder head gasket.

44. INSPECT NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY (See INSPECTION)

45. INSPECT VALVE LASH ADJUSTER ASSEMBLY (See INSPECTION)

46. INSPECT CYLINDER HEAD SET BOLT (See INSPECTION)

INSTALLATION

1. INSTALL CYLINDER HEAD GASKET

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

NOTE:

- Remove any oil from the contact surface.
- Make sure that the gasket is installed in the correct direction.

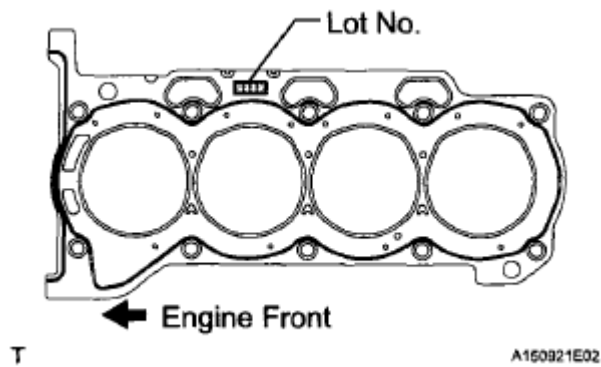


Fig. 91: Identifying Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

HINT:

The cylinder head bolts are tightened in 2 progressive steps.

- Apply a light coat of engine oil to the bolt threads and the area beneath the bolt heads that come in contact with the washers.
- Install the bolts and plate washers to the cylinder head.

NOTE: Do not drop the washers into the cylinder head.

- Using several steps, uniformly install and tighten the 10 cylinder head bolts and 10 plate washers with a 10 mm bi-hexagon wrench in the order shown in the illustration.

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

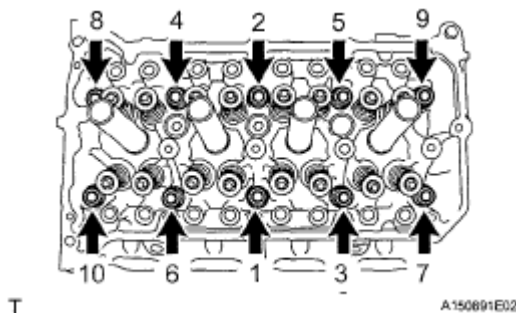


Fig. 92: Identifying Cylinder Head Bolt Tighten Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Mark the front side of the cylinder head bolts with paint.
- Retighten the cylinder head bolts an additional 90°, then once more 45° as shown in the illustration.
- Check that the paint mark is now at a 135° angle to the front.

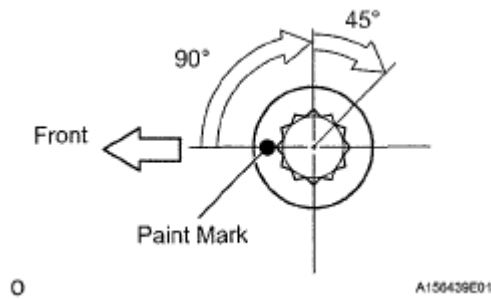


Fig. 93: Identifying Cylinder Head Bolts Tighten Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL VALVE LASH ADJUSTER ASSEMBLY (See REASSEMBLY)
4. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY (See REASSEMBLY)
5. INSTALL NO. 1 CAMSHAFT BEARING (See INSTALLATION)
6. INSTALL NO. 2 CAMSHAFT BEARING (See INSTALLATION)
7. INSTALL NO. 2 CAMSHAFT (See INSTALLATION)
8. INSTALL CAMSHAFT (See INSTALLATION)
9. INSTALL CAMSHAFT BEARING CAP (See INSTALLATION)
10. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY (See INSTALLATION)
11. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY (See INSTALLATION)
12. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY (See INSTALLATION)
13. INSTALL NO. 1 CHAIN VIBRATION DAMPER
 - a. Install the No. 1 chain vibration damper with the 2 bolts.

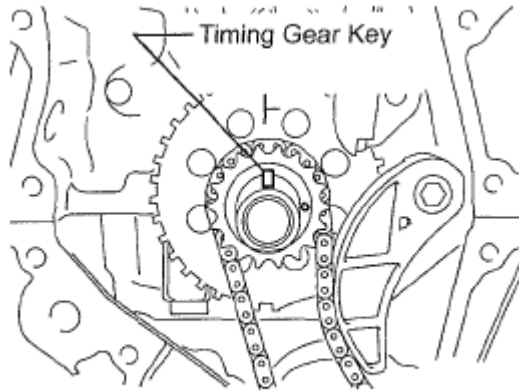
Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)



Fig. 94: Locating No. 1 Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSTALL NO. 2 CHAIN VIBRATION DAMPER (See INSTALLATION)
15. INSTALL CHAIN SUB-ASSEMBLY
 - a. Check the No. 1 cylinder TDC/compression.

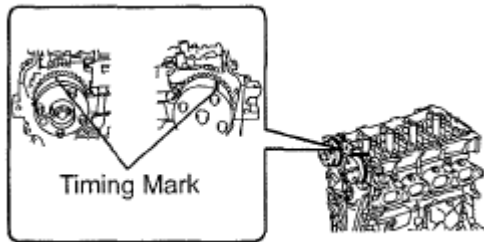
1. Temporarily tighten the crankshaft pulley bolt.
2. Turn the crankshaft counterclockwise to position the timing gear key to the top.
3. Remove the crankshaft pulley bolt.



A153028E01

Fig. 95: Identifying Timing Gear Key**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

4. Check the timing marks on each camshaft timing gear.



A153030E01

Fig. 96: Identifying Timing Marks On Camshaft Timing Gear**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Align the mark plate (orange) with the timing mark of the No. 2 camshaft as shown in the illustration and install the chain.

HINT:

- Be sure to position the mark plate at the front of the engine.
- The mark plate on the camshaft side is colored orange.
- Do not pass the chain around the sprocket of the camshaft timing gear assembly. Only place it on the sprocket.
- Pass the chain through the No. 1 vibration damper.

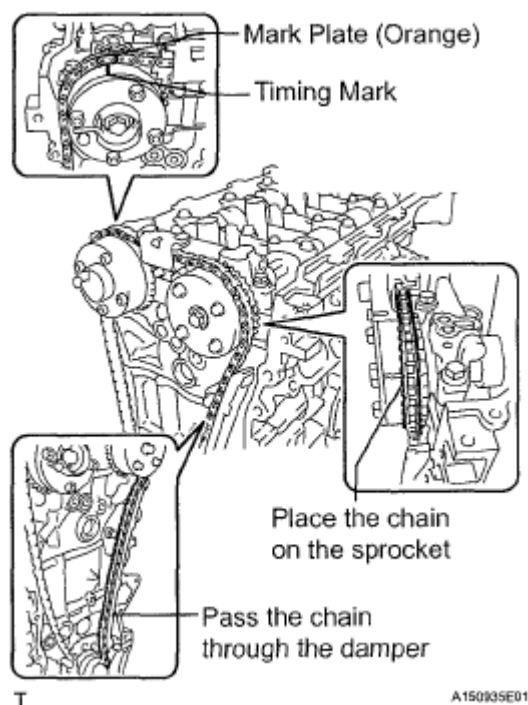


Fig. 97: Identifying Timing Mark Of No. 2 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Place the chain on the crankshaft without passing it around the shaft.

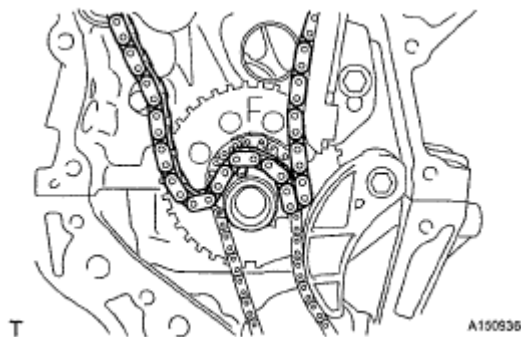


Fig. 98: Identifying Chain On Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Hold the hexagonal portion of the camshaft with a wrench and turn the camshaft timing gear assembly counterclockwise to align the mark plate (orange) and timing mark.

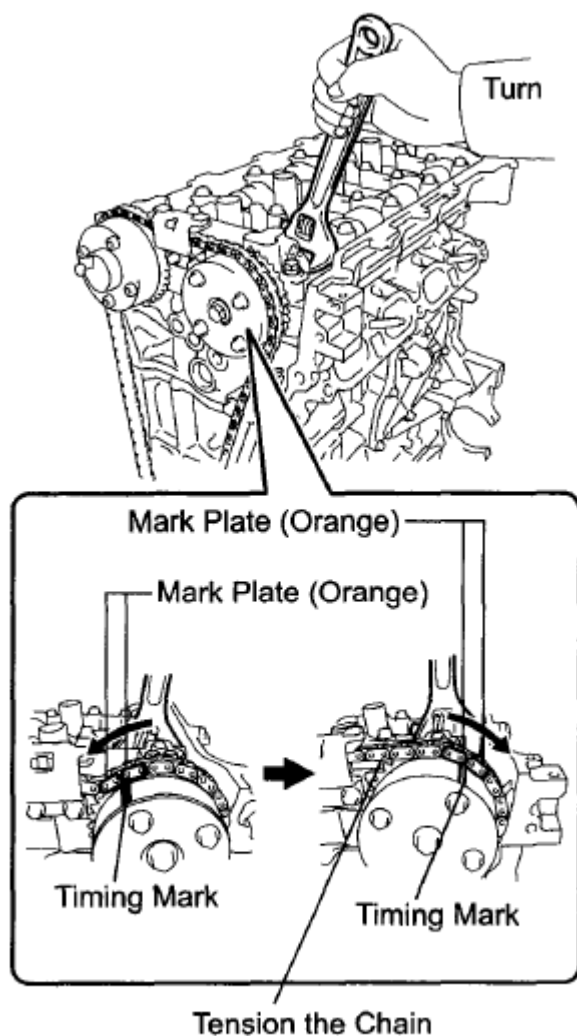
HINT:

- Be sure to position the mark plate at the front of the engine.
 - The mark plate on the camshaft side is colored orange.
- e. Hold the hexagonal portion of the camshaft with a wrench and turn the camshaft timing gear

assembly clockwise.

HINT:

To tension the chain, slowly turn the camshaft timing gear assembly clockwise to prevent the chain from being misaligned.



T

A167423E01

Fig. 99: Holding Hexagonal Portion Of Camshaft
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Align the mark plate (yellow) and timing mark and install the chain to the crankshaft timing gear.

HINT:

The mark plate on the crankshaft side is colored yellow.

- g. Recheck each timing mark at TDC/compression.

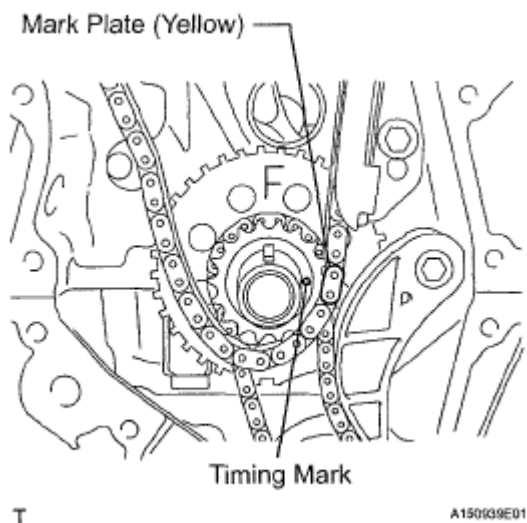


Fig. 100: Identifying Timing Mark On Crankshaft Timing Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

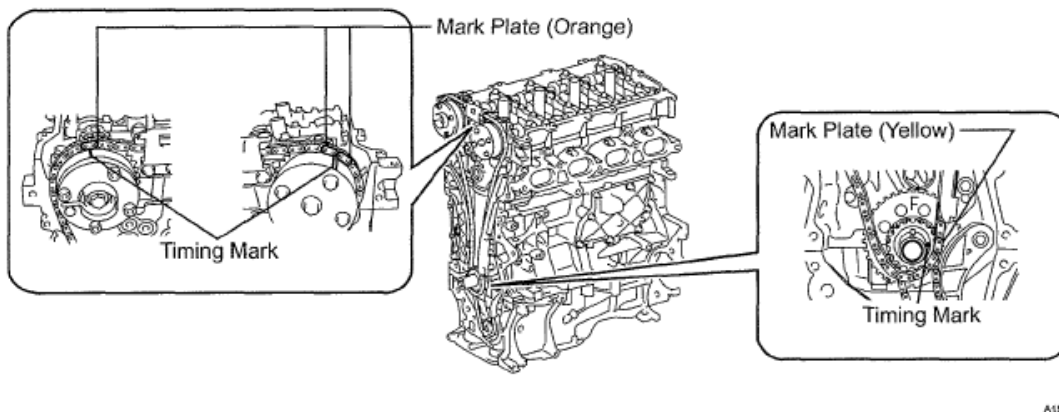
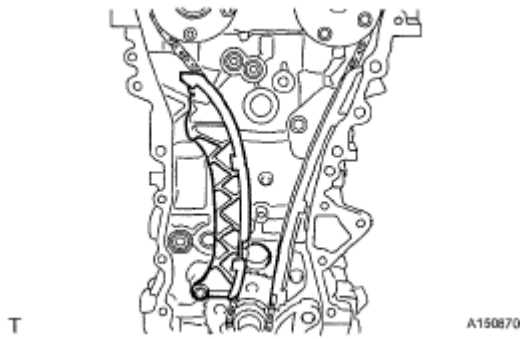


Fig. 101: Identifying Crankshaft Timing Mark Location
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSTALL CHAIN TENSIONER SLIPPER

- a. Install the chain tensioner slipper.

**Fig. 102: Identifying Chain Tensioner Slipper**

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

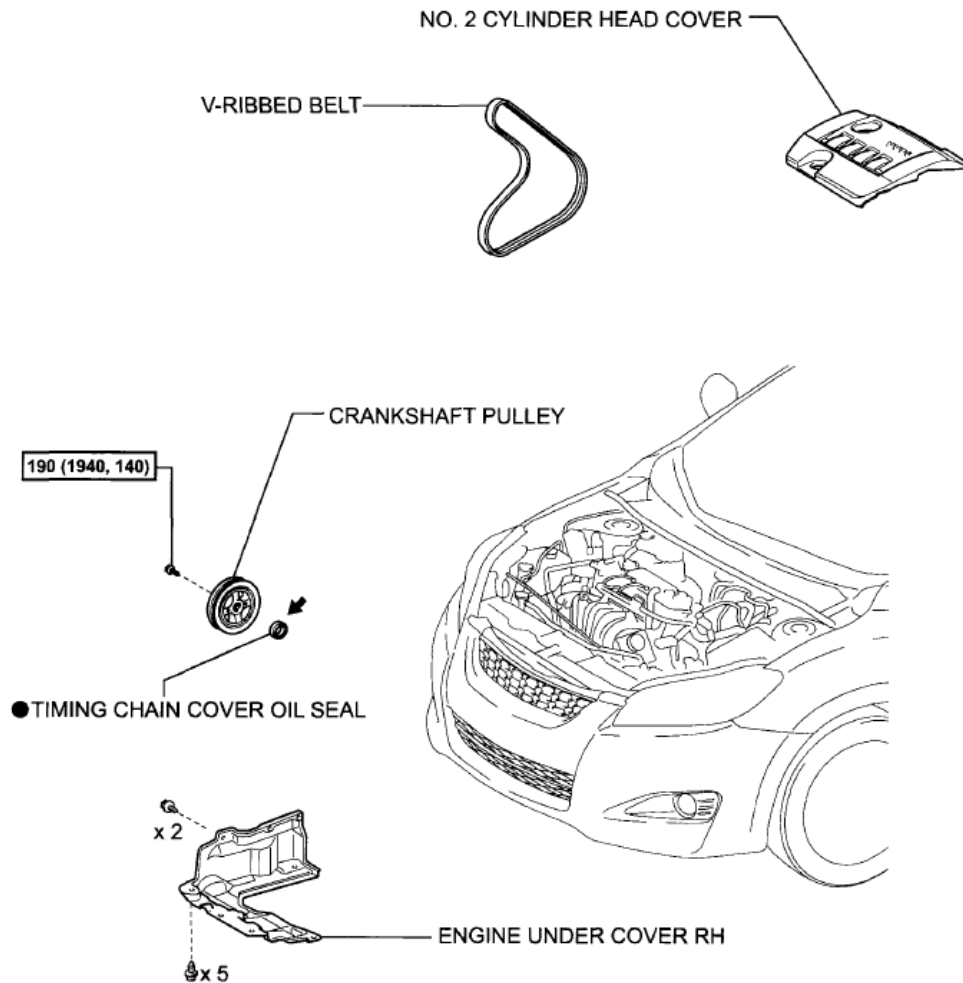
17. INSTALL TIMING CHAIN COVER OIL SEAL (See REASSEMBLY)
18. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See INSTALLATION)
19. INSTALL CRANKSHAFT PULLEY (See INSTALLATION)
20. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See REASSEMBLY)
21. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See REASSEMBLY)
22. INSTALL RADIO SETTING CONDENSER (See INSTALLATION)
23. INSTALL THERMOSTAT (See INSTALLATION)
24. INSTALL WATER INLET (See INSTALLATION)
25. INSTALL WATER INLET HOSE (See INSTALLATION)
26. INSTALL WATER BY-PASS HOSE (See INSTALLATION)
27. INSTALL NO. 1 WATER BY-PASS PIPE (See INSTALLATION)
28. CONNECT NO. 3 WATER BY-PASS HOSE (See INSTALLATION)
29. INSTALL VENTILATION HOSE (See INSTALLATION)
30. INSPECT EXHAUST MANIFOLD (See INSPECTION)
31. INSTALL EXHAUST MANIFOLD (See INSTALLATION)
32. INSTALL MANIFOLD STAY (See INSTALLATION)
33. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See INSTALLATION)
34. INSTALL OIL LEVEL DIPSTICK SUB-ASSEMBLY (See INSTALLATION)
35. INSTALL IGNITION COIL ASSEMBLY (See INSTALLATION)
36. INSTALL FUEL INJECTOR ASSEMBLY (See INSTALLATION)
37. INSTALL NO. 1 DELIVERY PIPE SPACER (See INSTALLATION)
38. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY (See INSTALLATION)
39. INSTALL FUEL TUBE SUB-ASSEMBLY (See INSTALLATION)
40. INSTALL INTAKE MANIFOLD (See INSTALLATION)
41. REMOVE ENGINE STAND (See INSTALLATION)
42. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

See INSTALLATION.

FRONT CRANKSHAFT OIL SEAL

COMPONENTS



A186538E01

Fig. 103: Identifying Front Crankshaft Oil Seal Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FRONT WHEEL RH
2. REMOVE ENGINE UNDER COVER RH

3. **REMOVE NO. 2 CYLINDER HEAD COVER** (See **REMOVAL**)
4. **REMOVE V-RIBBED BELT** (See **REMOVAL**)
5. **REMOVE CRANKSHAFT PULLEY**
 - a. Using SST, hold the pulley in place and loosen the pulley bolt.

SST 09213-58013, 09330-00021

NOTE: Check the SST installation positions when installing them to prevent the SST fixing bolts from coming into contact with the timing chain cover sub-assembly.

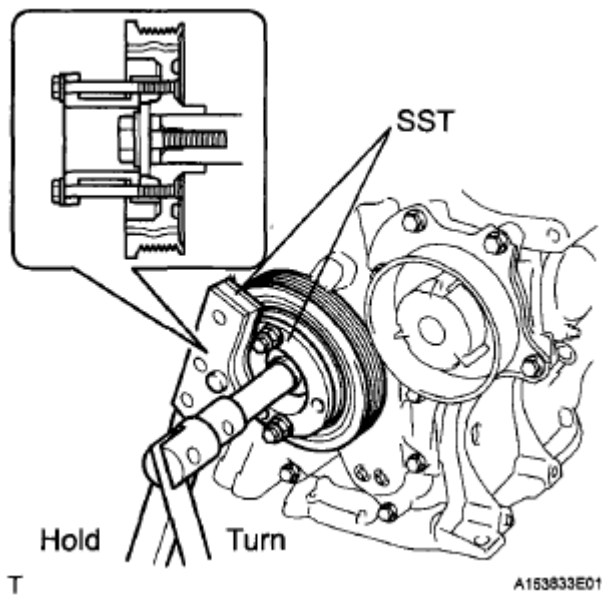


Fig. 104: Removing Crankshaft Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

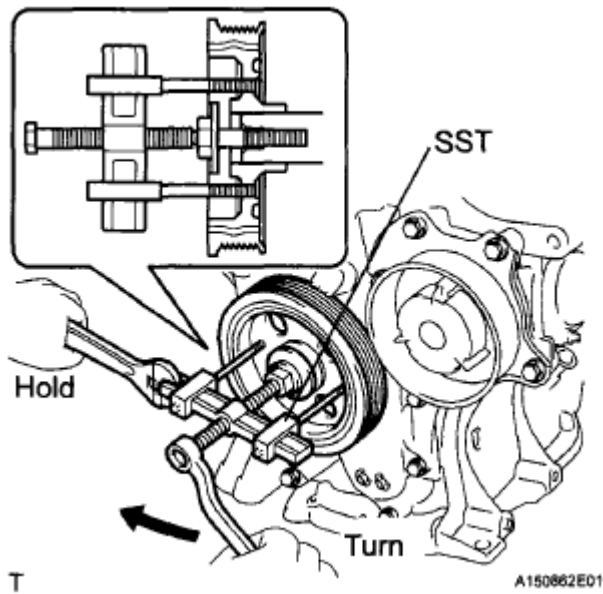


Fig. 105: Removing Crankshaft Pulley And Pulley Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE TIMING CHAIN COVER OIL SEAL

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

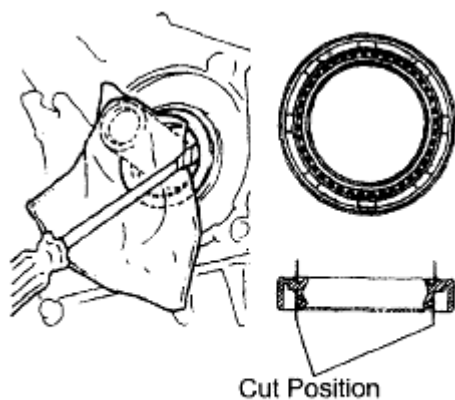
NOTE: After removing, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.

INSTALLATION

1. INSTALL TIMING CHAIN COVER OIL SEAL

- a. Apply MP grease to the lip of a new oil seal.

NOTE: Keep the lip free of foreign matter.



A112628E02

Fig. 106: Identifying Timing Chain Cover Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09223-22010

NOTE: Wipe off extra grease from the crankshaft.

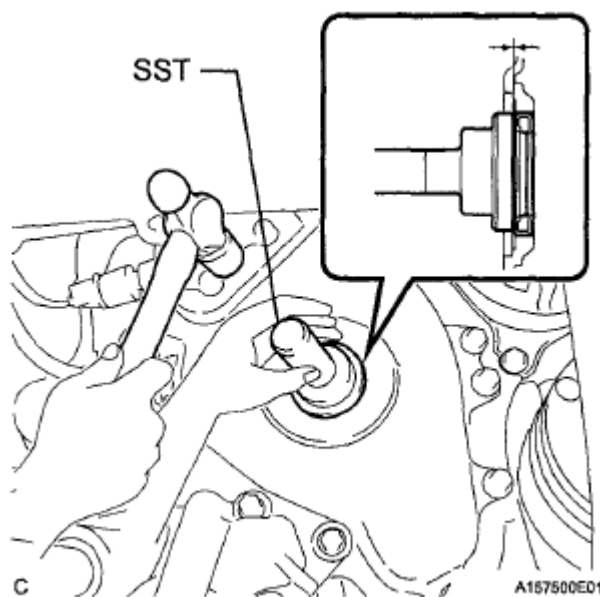


Fig. 107: Tapping Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL CRANKSHAFT PULLEY

- a. Align the pulley set key with the key groove of the pulley.

- b. Using SST, hold the pulley in place and tighten the bolt.

SST 09213-58013, 09330-00021

Torque: 190 N*m (1940 kgf*cm, 140 ft.*lbf)

NOTE: Check the SST installation positions when installing them to prevent the SST fixing bolts from coming into contact with the timing chain cover sub-assembly.

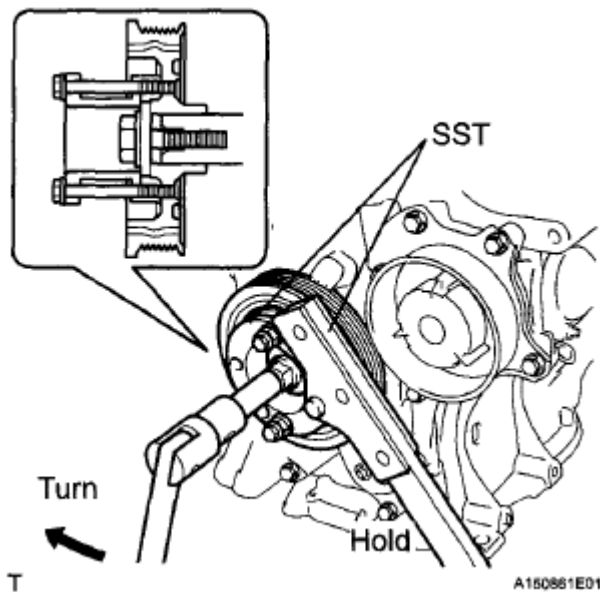


Fig. 108: Tightening Pulley Bolt

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

3. INSTALL V-RIBBED BELT (See INSTALLATION)
4. ADJUST V-RIBBED BELT (See INSTALLATION)
5. INSPECT V-RIBBED BELT (See ON-VEHICLE INSPECTION)
6. ADD ENGINE OIL (See REPLACEMENT)
7. INSPECT FOR ENGINE OIL LEAK
8. INSTALL NO. 2 CYLINDER HEAD COVER (See INSTALLATION)
9. INSTALL ENGINE UNDER COVER RH
10. INSTALL FRONT WHEEL RH

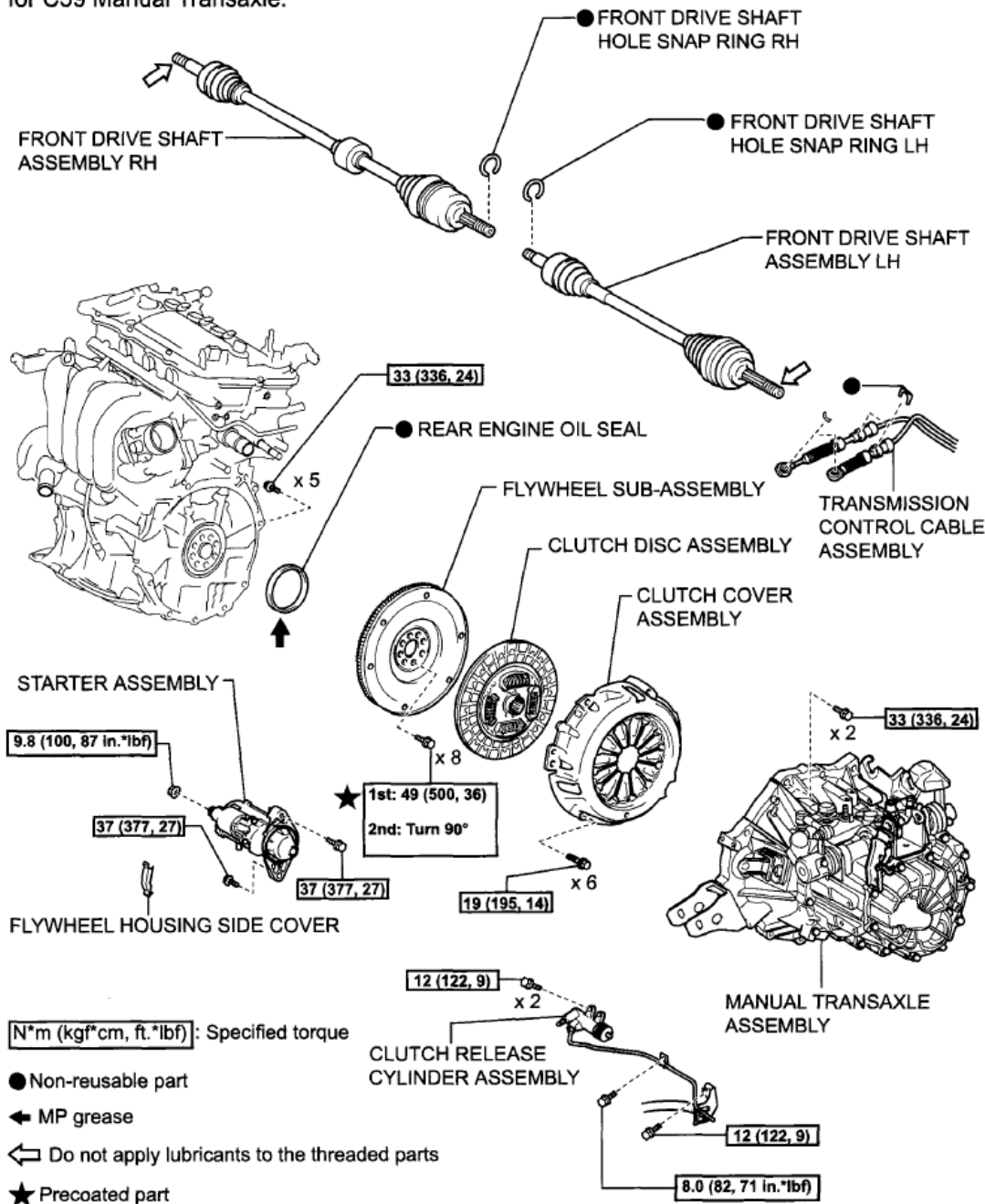
REAR CRANKSHAFT OIL SEAL

COMPONENTS

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

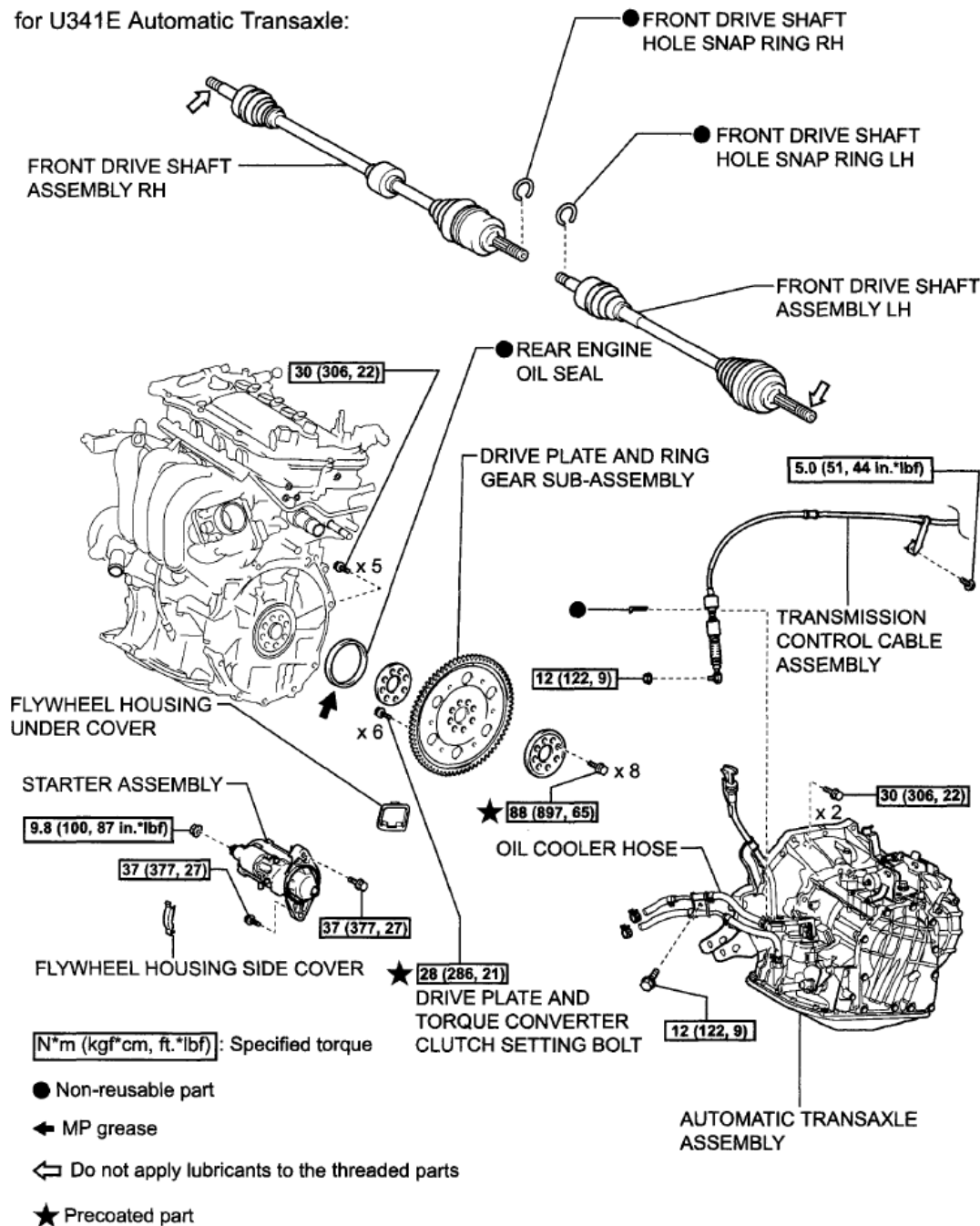
for C59 Manual Transaxle:



A106554E01

Fig. 109: Identifying Rear Crankshaft Oil Seal Components With Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for U341E Automatic Transaxle:



c

A188547E02

Fig. 110: Identifying Rear Crankshaft Oil Seal Components With Torque Specifications (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

See **REMOVAL**.

2. REMOVE MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)

HINT:

See **REMOVAL** for C59.

3. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)

HINT:

See **REMOVAL** for U341E.

4. REMOVE CLUTCH COVER ASSEMBLY (for Manual Transaxle) (See **REMOVAL)**

5. REMOVE CLUTCH DISC ASSEMBLY (for Manual Transaxle) (See **REMOVAL)**

6. REMOVE FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)

- a. Using SST, hold the crankshaft.

SST 09213-58013, 09330-00021

NOTE: Check the SST installation positions when installing them to prevent the SST fixing bolts from coming into contact with the timing chain cover sub-assembly.

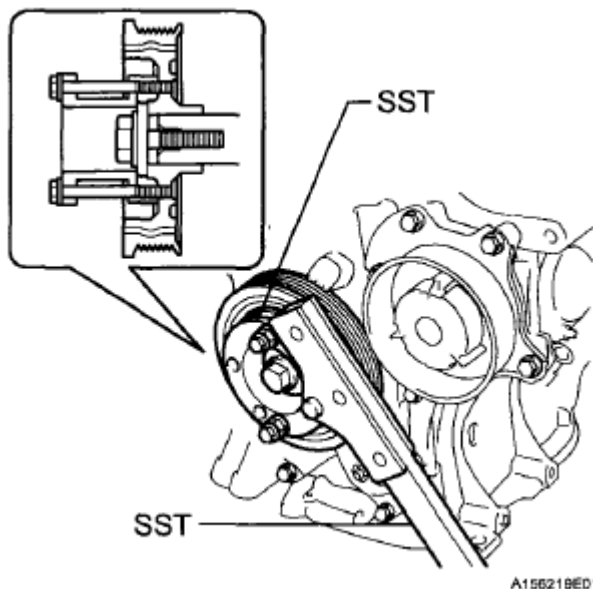


Fig. 111: Removing Flywheel Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 8 bolts and flywheel.

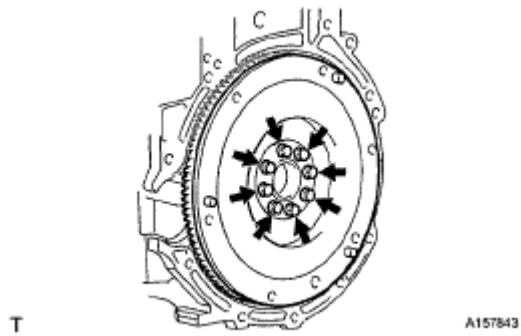


Fig. 112: Locating Flywheel Bolts

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

7. REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)

- a. Using SST, hold the crankshaft.

SST 09213-58013, 09330-00021

NOTE: Check the SST installation positions when installing them to prevent the SST fixing bolts from coming into contact with the timing chain cover sub-assembly.

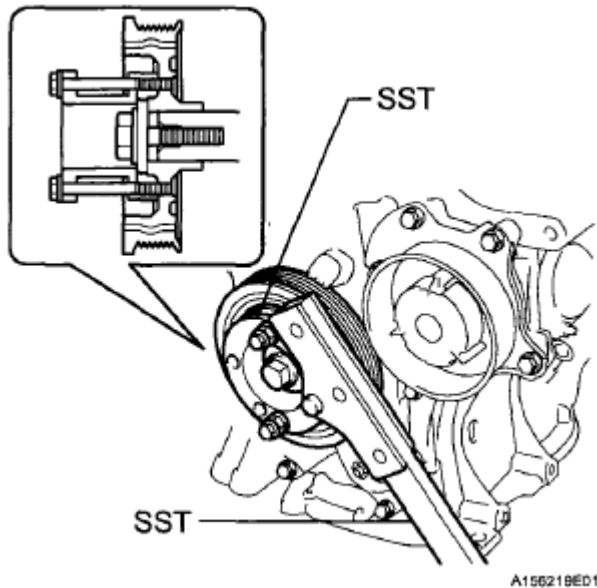


Fig. 113: Removing Flywheel Sub-Assembly

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

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

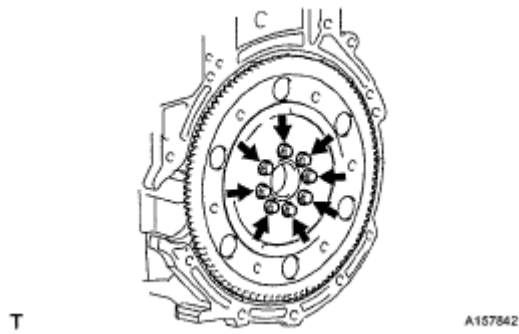


Fig. 114: Locating Drive Plate Bolts

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

8. REMOVE REAR ENGINE OIL SEAL

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

NOTE: After removing, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.

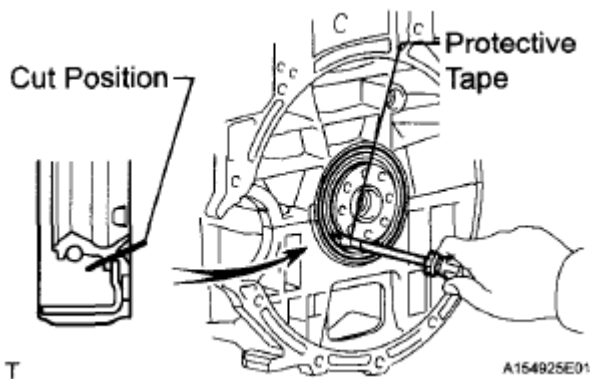


Fig. 115: Removing Rear Engine Oil Seal

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: Keep the lip free from foreign matter.

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

SST 09223-15030, 09950-70010 (09951 -07100)

NOTE:

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

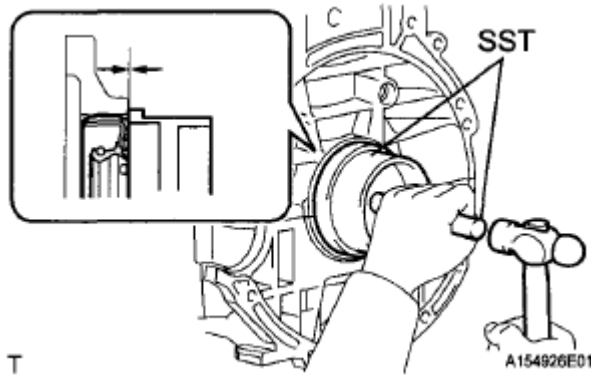


Fig. 116: Installing Rear Engine Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL FLYWHEEL SUB-ASSEMBLY (for Manual Transaxle)

- a. Using SST, hold the crankshaft.

SST 09213-58013, 09330-00021

NOTE:

Check the SST installation positions when installing them to prevent the SST fixing bolts from coming into contact with the timing chain cover sub-assembly.

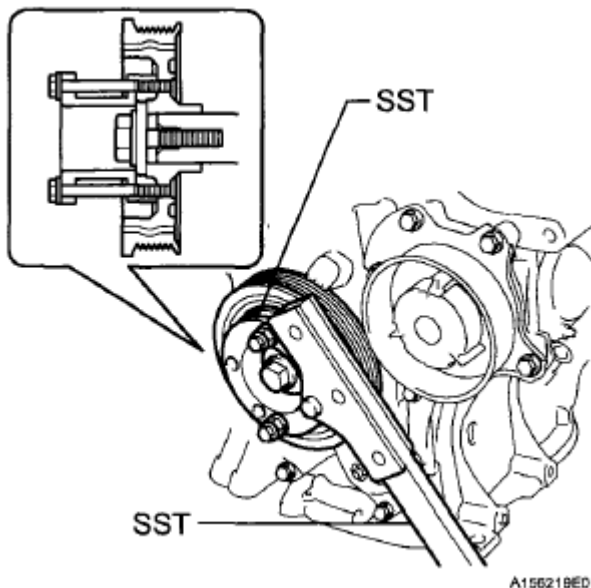


Fig. 117: Installing Flywheel Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

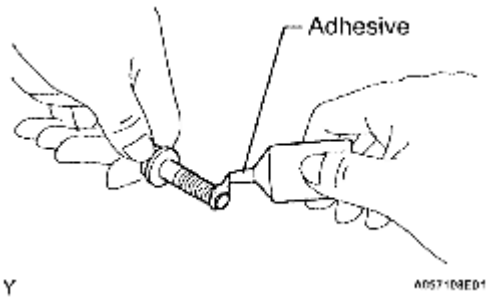


Fig. 118: Applying Adhesive To Threads Of Bolt Ends
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.

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

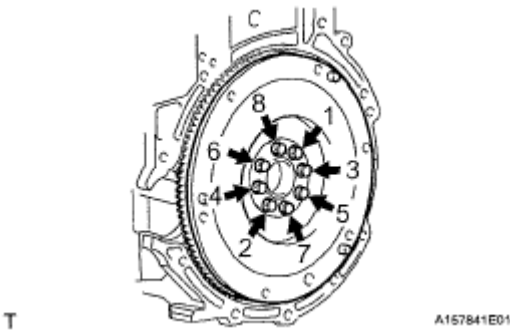


Fig. 119: Locating Drive Plate Bolts Tighten Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Mark the top of the bolts with paint.
e. Retighten the 8 bolts an additional 90° in the same sequence.
f. Check that the paint marks are now at a 90° angle to the top.
g. Check that the crankshaft turns smoothly.

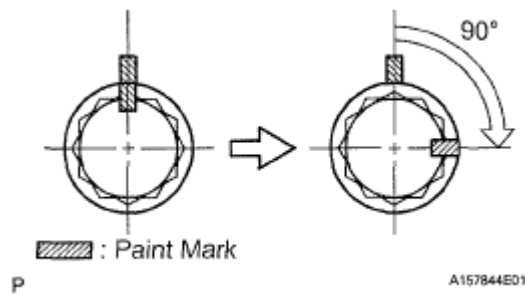


Fig. 120: Identifying Crankshaft Bolt Tighten Angle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (for Automatic Transaxle)

- a. Using SST, hold the crankshaft.

SST 09213-58013, 09330-00021

NOTE: Check the SST installation positions when installing them to prevent the SST fixing bolts from coming into contact with the timing chain cover sub-assembly.

- b. Clean the bolts and the bolt holes.

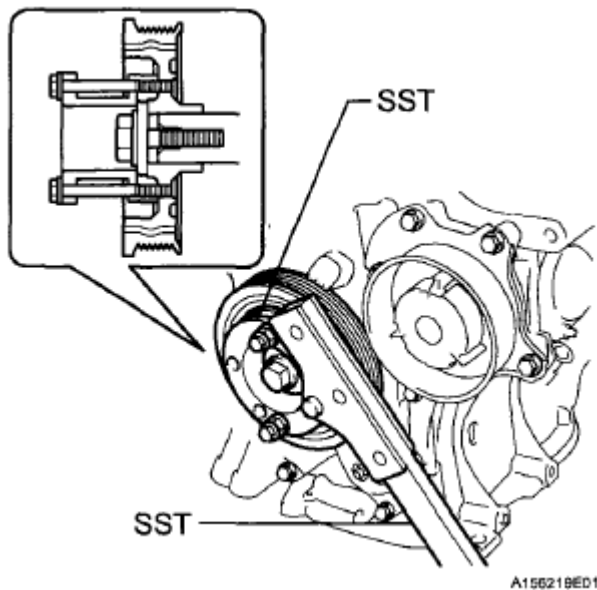


Fig. 121: Holding Crankshaft Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply a few drops of adhesive to 2 or 3 threads of the 8 bolts tip.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

- d. Install the front drive plate spacer.

HINT:

Front spacer is reversible.

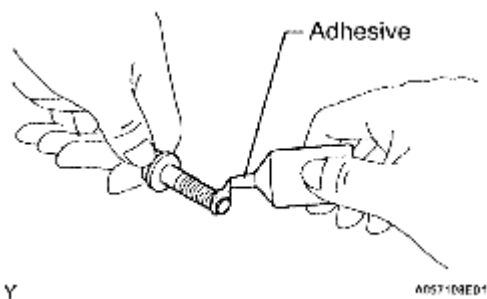


Fig. 122: Applying Adhesive To Threads Of Bolt Ends
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Install the drive plate and rear drive plate spacer onto the crankshaft.

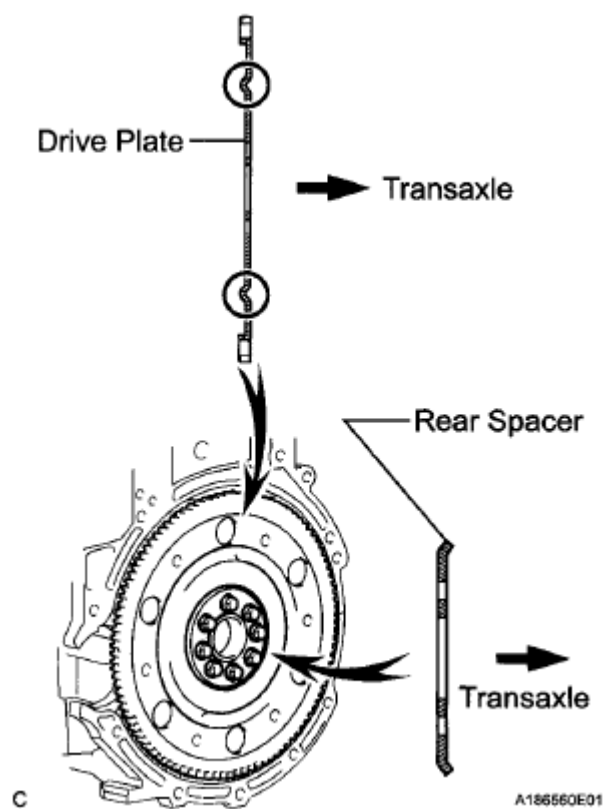


Fig. 123: Installing Drive Plate And Rear Drive Plate Spacer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. In several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.

Torque: 88 N*m (897 kgf*cm, 65 ft.*lbf)

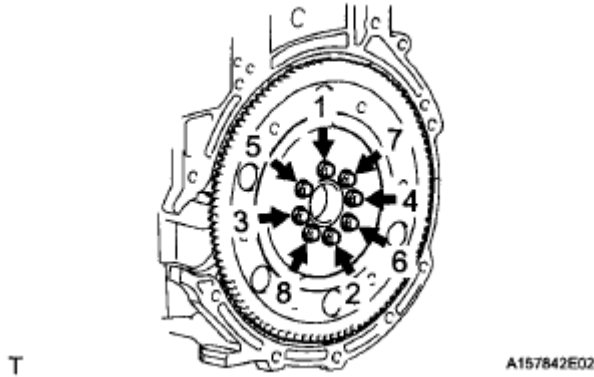


Fig. 124: Locating Drive Plate Bolt Tighten Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. **INSTALL CLUTCH DISC ASSEMBLY (for Manual Transaxle) (See INSTALLATION)**
5. **INSTALL CLUTCH COVER ASSEMBLY (for Manual Transaxle) (See INSTALLATION)**
6. **INSPECT AND ADJUST CLUTCH COVER ASSEMBLY (for Manual Transaxle) (See INSTALLATION)**
7. **INSTALL MANUAL TRANSAXLE ASSEMBLY (for Manual Transaxle)**

HINT:

See INSTALLATION for C59.

8. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)**

HINT:

See INSTALLATION for U341E.

9. **INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**

HINT:

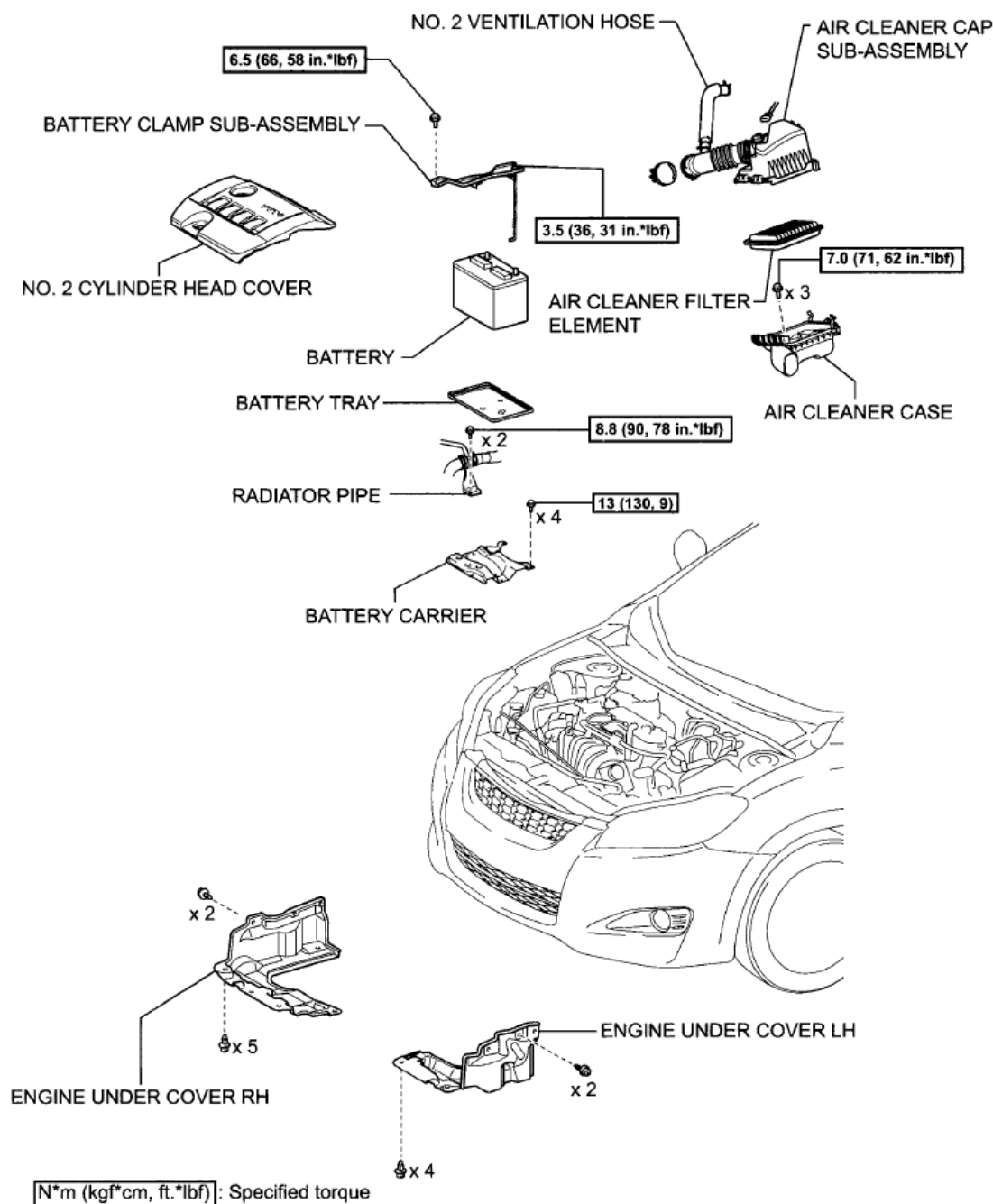
See INSTALLATION.

ENGINE ASSEMBLY

COMPONENTS

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

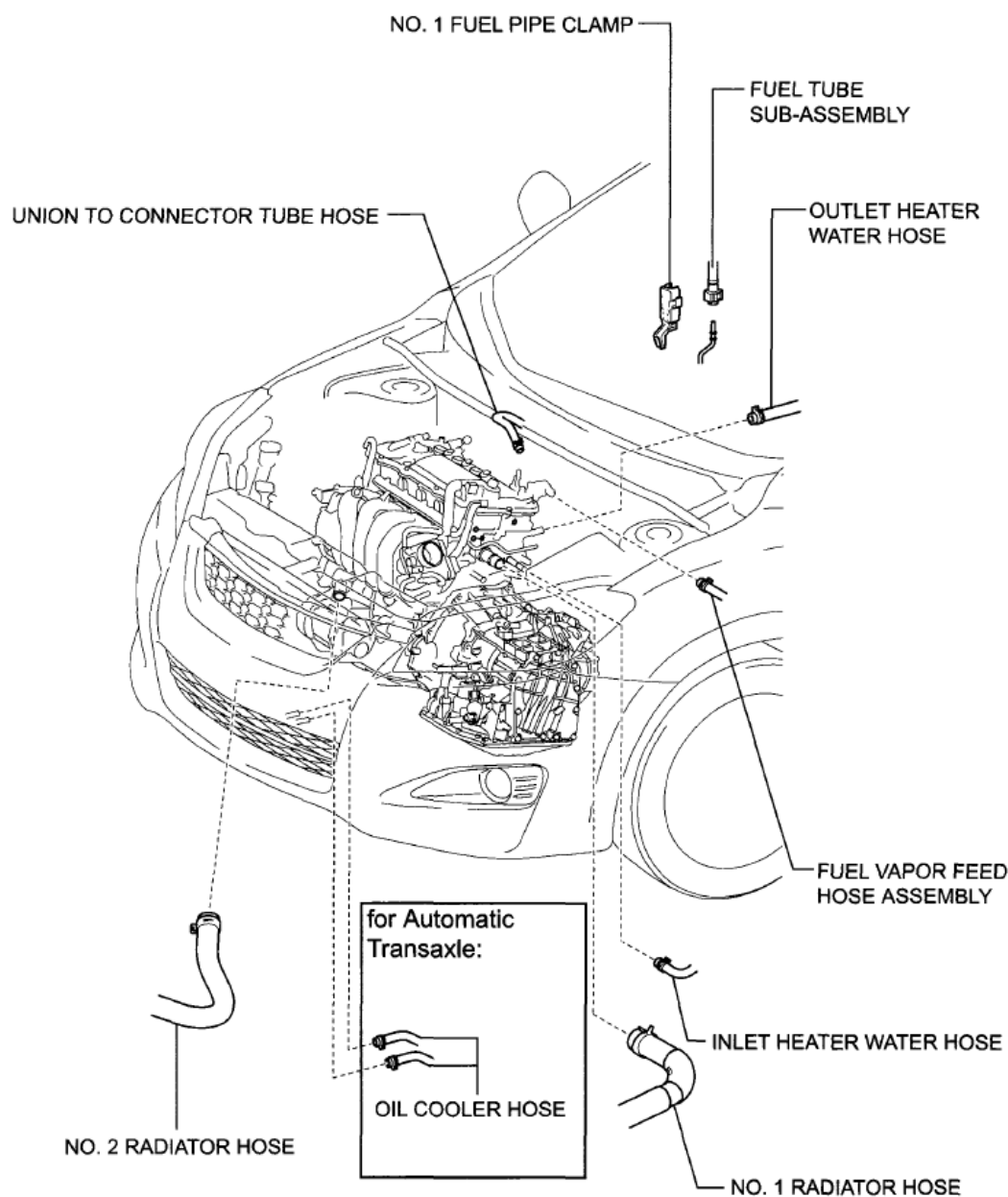


A195541E01

Fig. 125: Identifying Engine Assembly Components With Torque Specifications (1 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

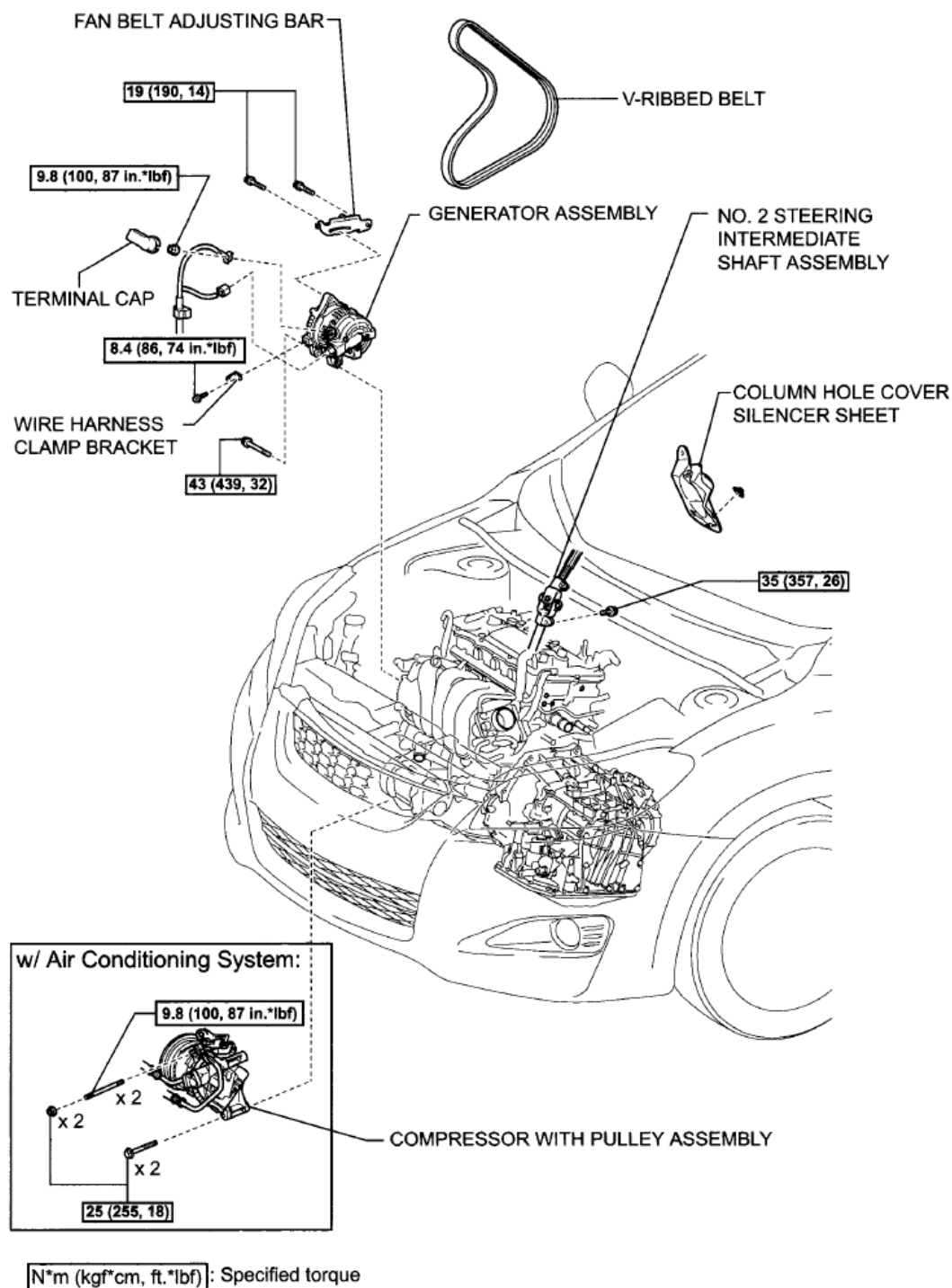
2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix



C

A180542E01

Fig. 126: Identifying Engine Assembly Components With (2 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



C

A186543E01

Fig. 127: Identifying Engine Assembly Components With Torque Specifications (3 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

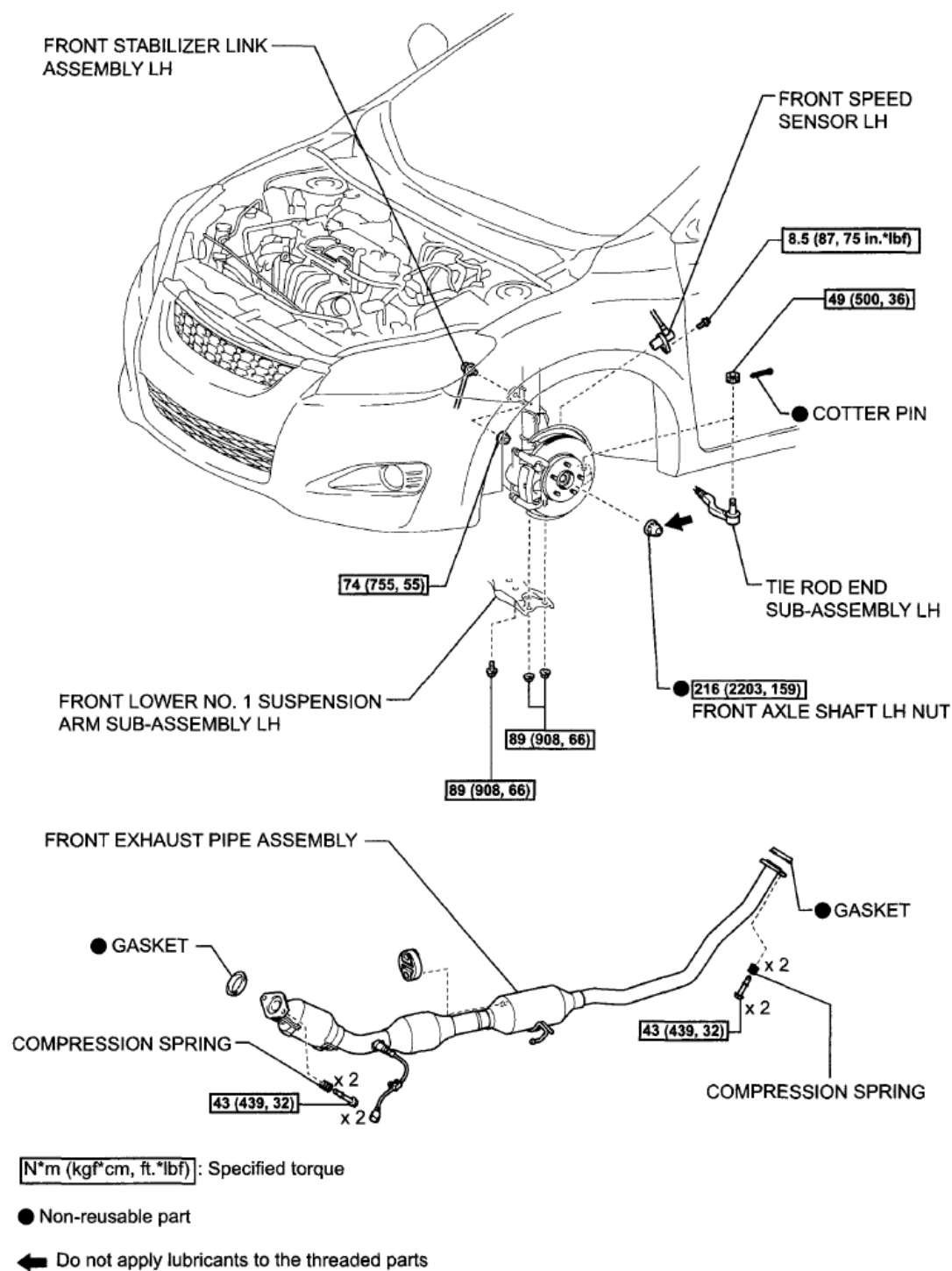
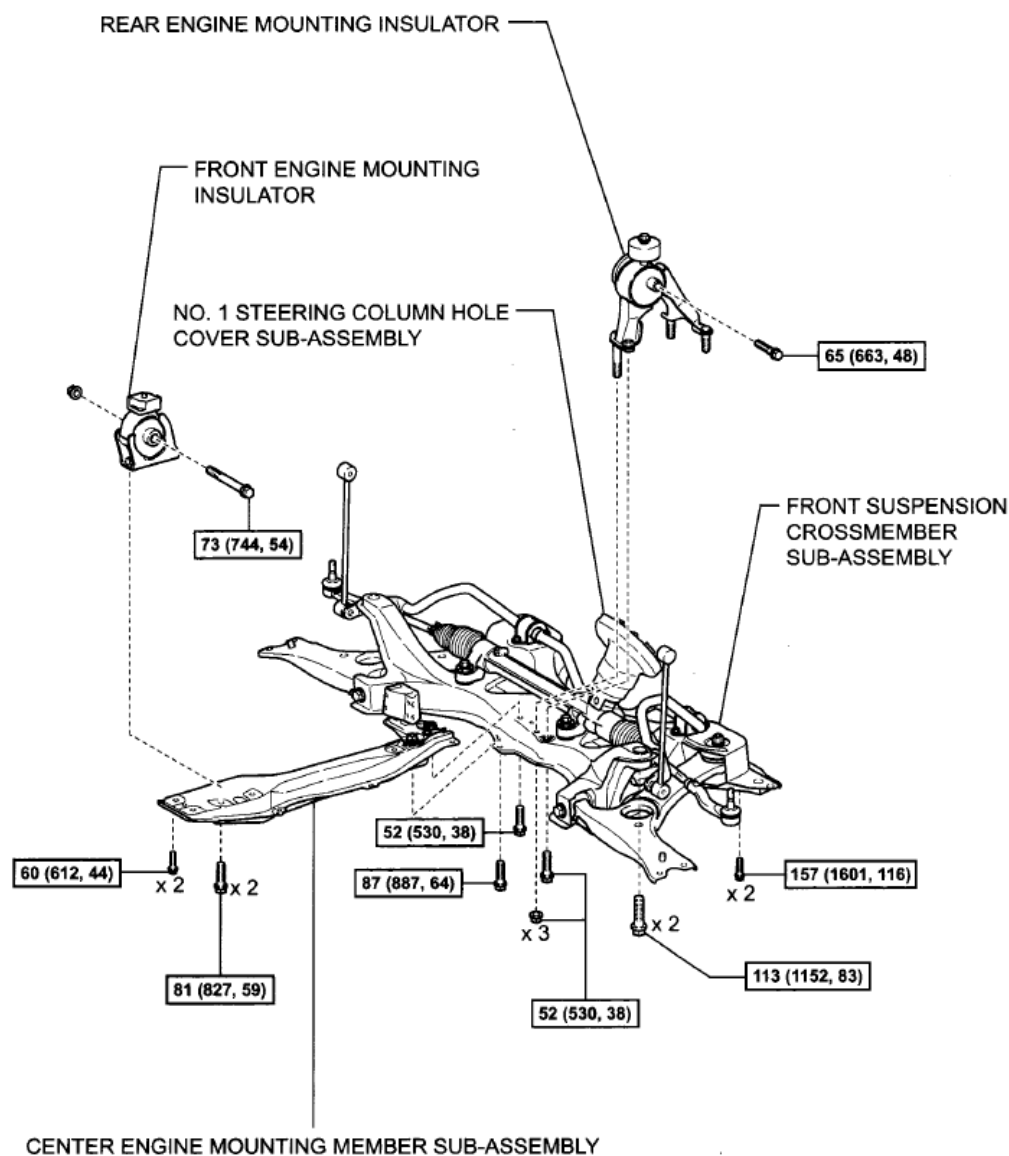


Fig. 128: Identifying Engine Assembly Components With Torque Specifications (4 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

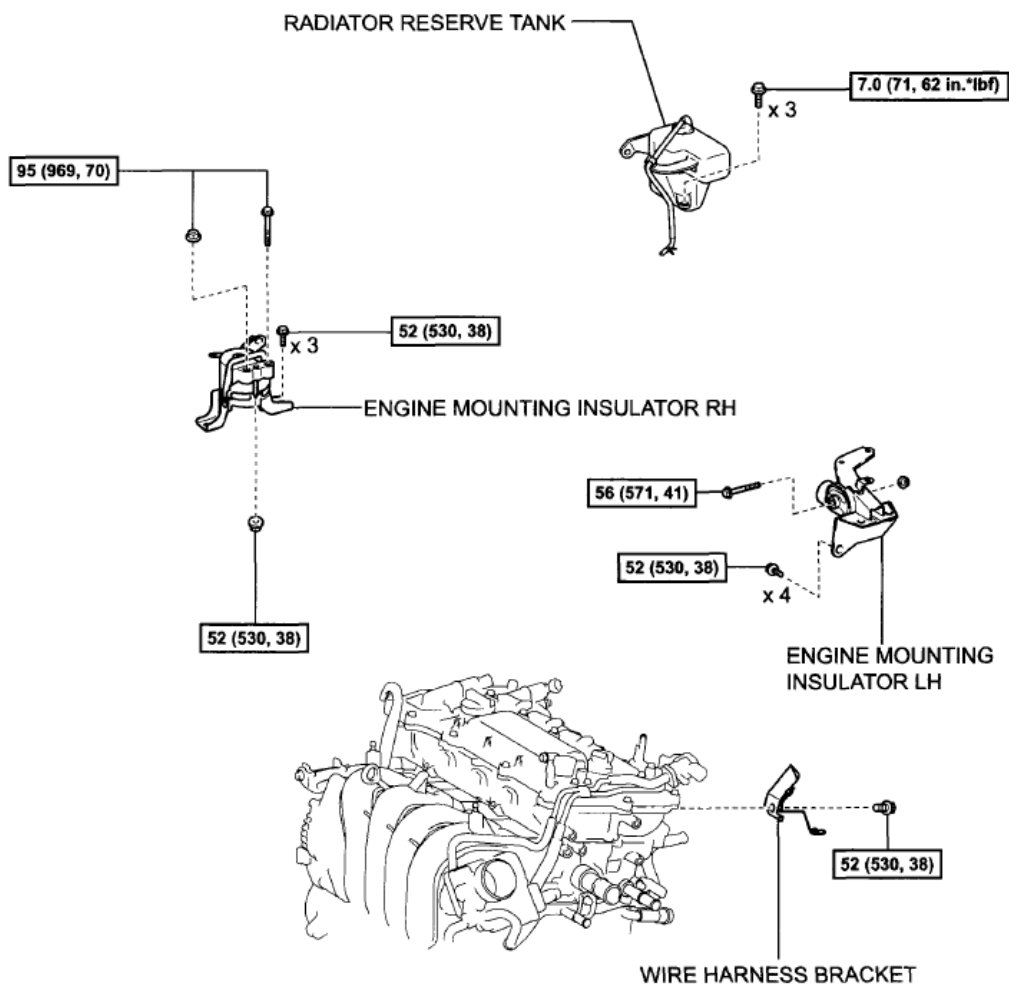


N°m (kgf $^{\circ}\text{cm}$, ft. $^{\circ}\text{lb}$): Specified torque

C

A186550E01

Fig. 129: Identifying Engine Assembly Components With Torque Specifications (5 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

C

A183914E01

Fig. 130: Identifying Engine Assembly Components With Torque Specifications (6 Of 8)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

for C59 Manual Transaxle:

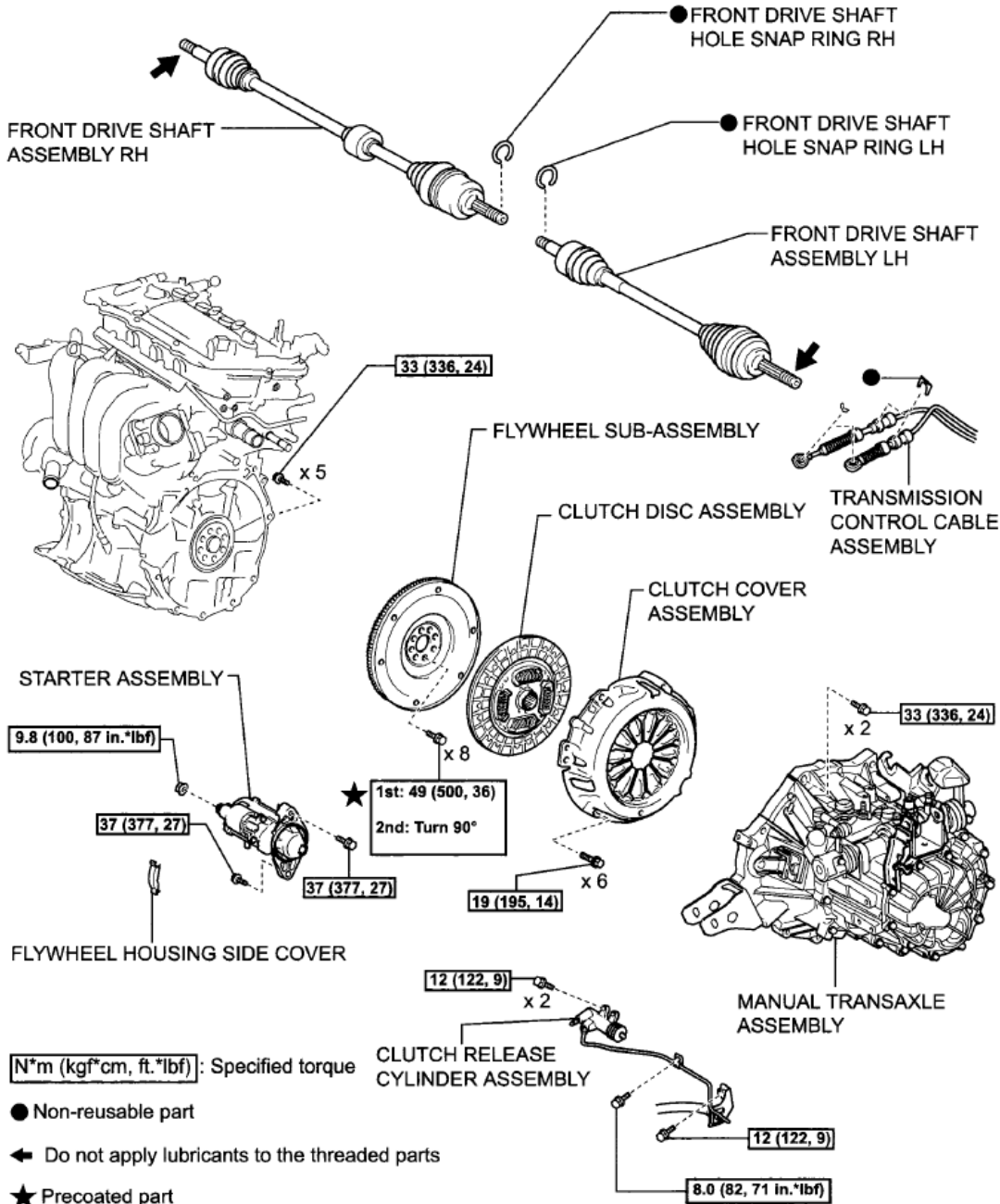
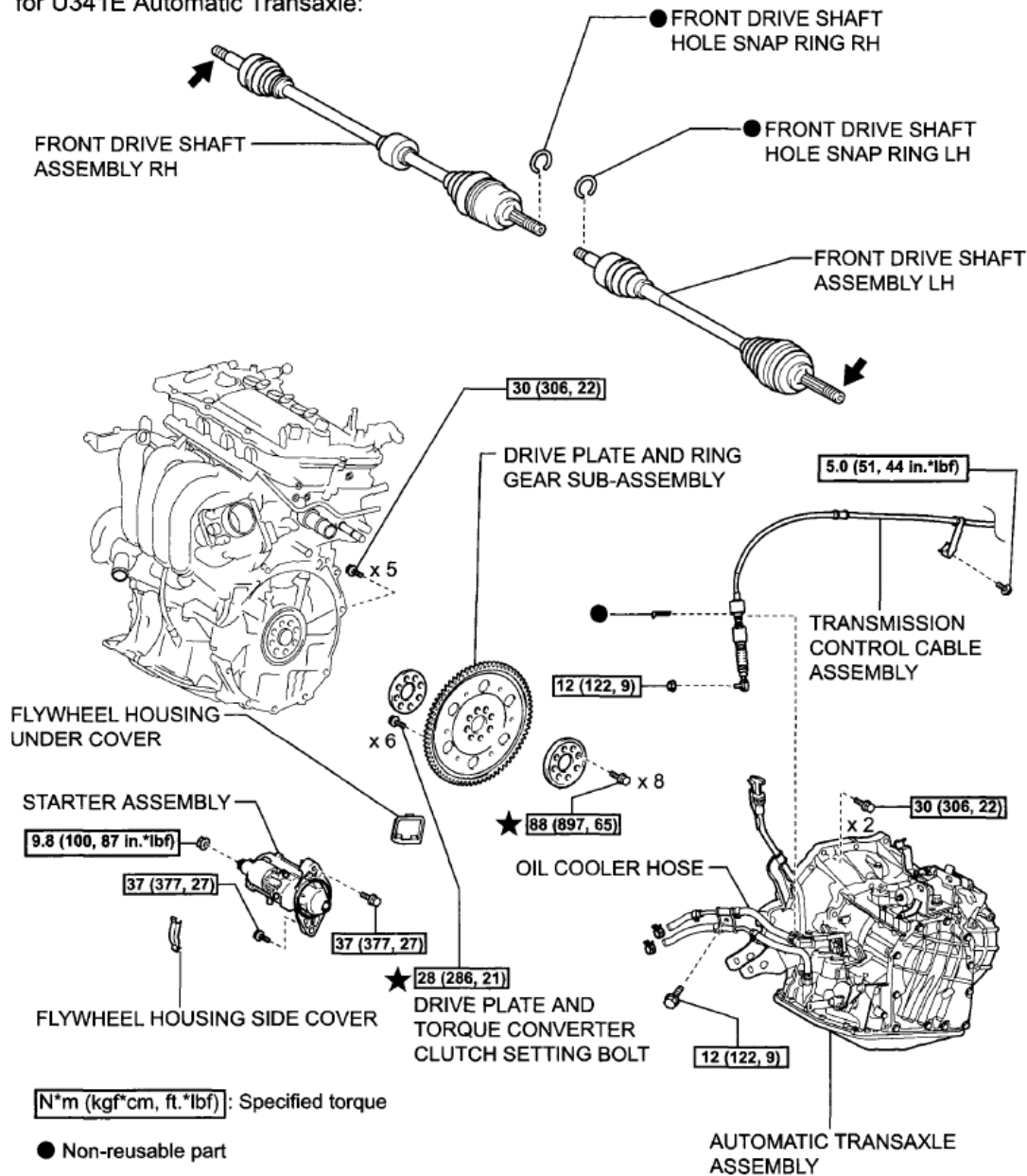


Fig. 131: Identifying Engine Assembly Components With Torque Specifications (7 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for U341E Automatic Transaxle:



C

A189548E02

Fig. 132: Identifying Engine Assembly Components With Torque Specifications (8 Of 8)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE

HINT:

See **FUEL SYSTEM** .

2. **ALIGN FRONT WHEELS FACING STRAIGHT AHEAD**
3. **REMOVE FRONT WHEEL**
4. **REMOVE ENGINE UNDER COVER LH**
5. **REMOVE ENGINE UNDER COVER RH**
6. **DRAIN ENGINE COOLANT** (See **COOLANT**)
7. **DRAIN ENGINE OIL** (See **REPLACEMENT**)
8. **DRAIN MANUAL TRANSAXLE OIL** (for Manual Transaxle)

HINT:

See **MANUAL TRANSAXLE OIL** for C59.

9. **DRAIN AUTOMATIC TRANSAXLE FLUID** (for Automatic Transaxle)

HINT:

See **AUTOMATIC TRANSAXLE FLUID** for U341E.

10. **REMOVE NO. 2 CYLINDER HEAD COVER**

- a. Hold the rear of the cover and raise it to disengage the 2 clips on the rear of the cover. Continue to raise the cover to disengage the 2 clips on the front of the cover to remove the cover.

NOTE: **Attempting to disengage both front and rear clips at the same time may cause the cover to break.**

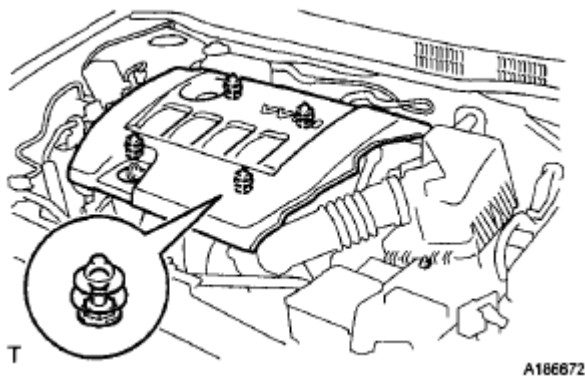


Fig. 133: Identifying No. 2 Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** (See **REMOVAL**)
12. **REMOVE AIR CLEANER CASE**
 - a. Separate the air cleaner filter element from the air cleaner.

- b. Disconnect the engine wire harness clamp from air cleaner case.
- c. Remove the 3 bolts and the air cleaner case.

13. REMOVE BATTERY

- a. Disconnect the battery cables.
- b. Remove the bolt and loosen the nut.
- c. Remove the battery.

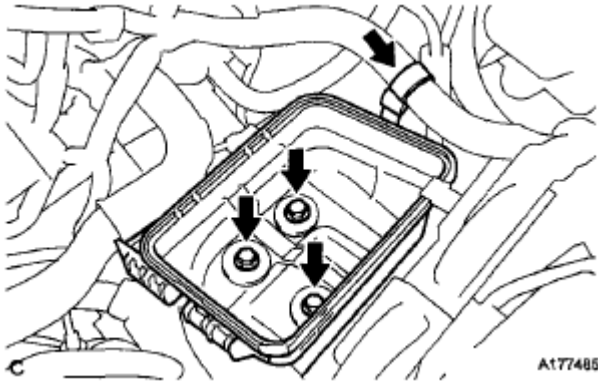


Fig. 134: Locating Battery Bolts

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

14. REMOVE BATTERY CARRIER

- a. Separate the 2 wire harness clamps from the battery carrier.

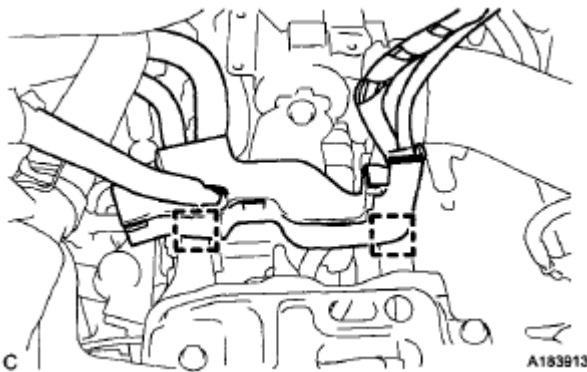


Fig. 135: Removing Battery Carrier

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

- b. Remove the 2 bolts.
- c. Separate the radiator pipe from the battery carrier.
- d. Remove the 4 bolts and battery carrier.

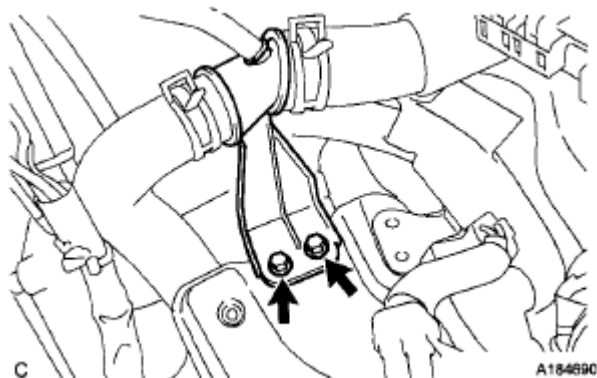


Fig. 136: Locating Battery Carrier Bolts

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

15. DISCONNECT NO. 1 RADIATOR HOSE

- a. Disengage the clamp*1.
- b. Disconnect the No. 1 radiator hose from the cylinder head with the clamp*2.

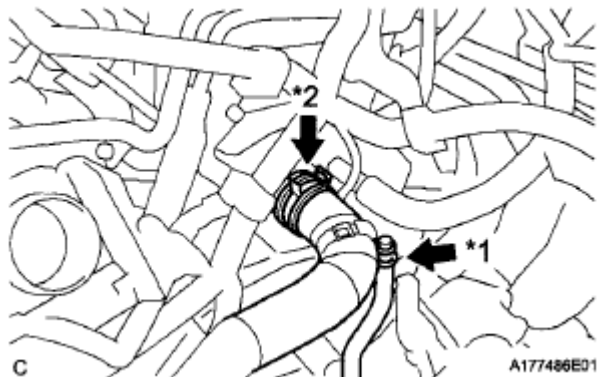
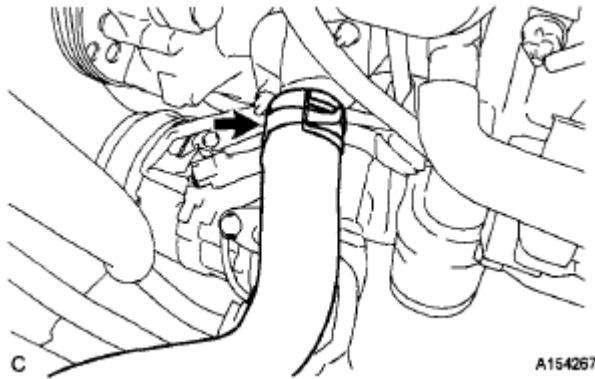


Fig. 137: Locating No. 1 Radiator Hose

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

16. DISCONNECT NO. 2 RADIATOR HOSE

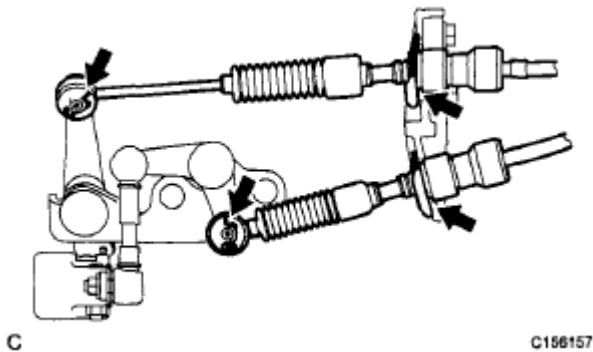
- a. Disconnect the No. 2 radiator hose from the water inlet hose.

**Fig. 138: Locating No. 2 Radiator Hose**

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

17. DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle)

- a. Remove the 2 clips and disconnect the 2 cables from the transaxle.
- b. Remove the 2 clips and disconnect the 2 cables from the control cable bracket.

**Fig. 139: Locating Transmission Control Cable Assembly Bolts**

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

18. DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle)

- a. Disconnect the control cable from the control cable support.
- b. Remove the nut and disconnect the control cable from the control shaft lever.
- c. Remove the clip and disconnect the control cable from the control cable bracket.
- d. Remove the bolt and disconnect the clamp of the control cable.

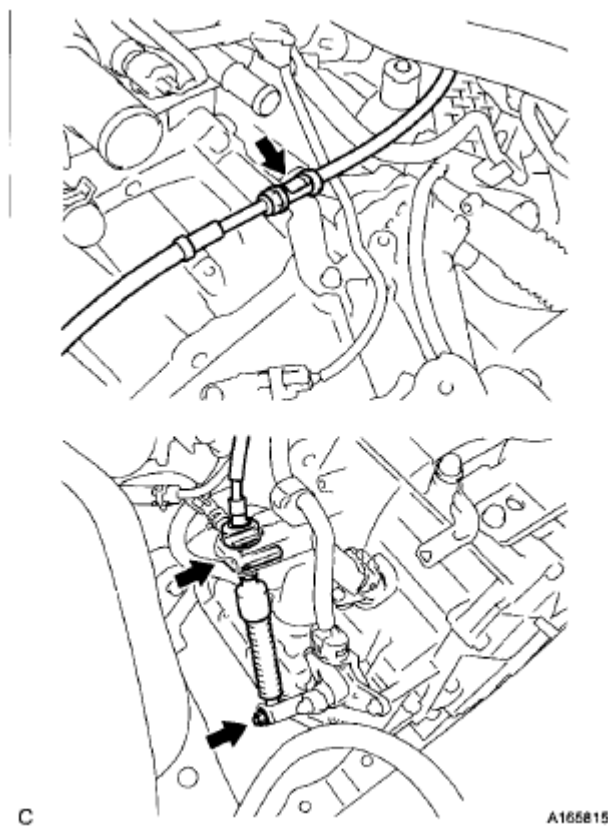


Fig. 140: Locating Transmission Control Cable Assembly (For Automatic Transaxle)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. DISCONNECT FUEL VAPOR FEED HOSE ASSEMBLY

- a. Disconnect the fuel vapor feed hose.

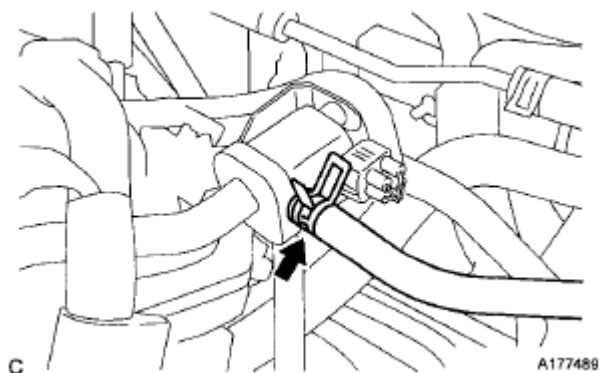


Fig. 141: Locating Fuel Vapor Feed Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. DISCONNECT UNION TO CONNECTOR TUBE HOSE

- a. Disconnect the union to connector tube hose.

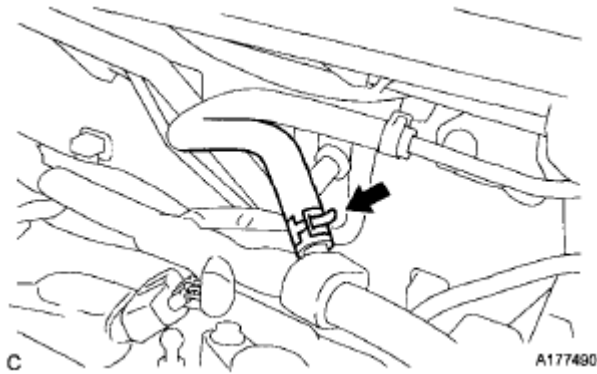


Fig. 142: Locating Union To Connector Tube Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. **DISCONNECT OIL COOLER HOSE (for Automatic Transaxle)**
- a. Disconnect the 2 oil cooler hoses from the oil cooler tube.

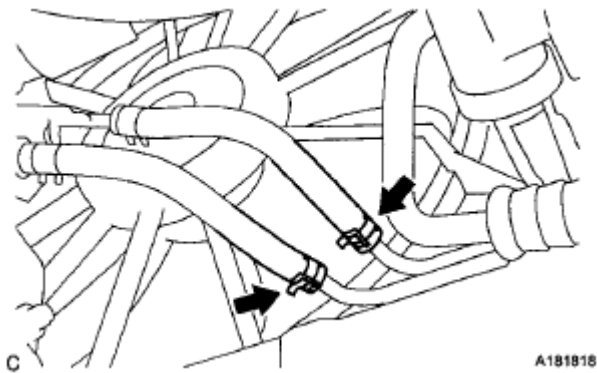


Fig. 143: Locating Oil Cooler Hoses To Oil Cooler Tube
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **DISCONNECT OUTLET HEATER WATER HOSE**
- a. Disconnect the outlet heater water hose from the engine.

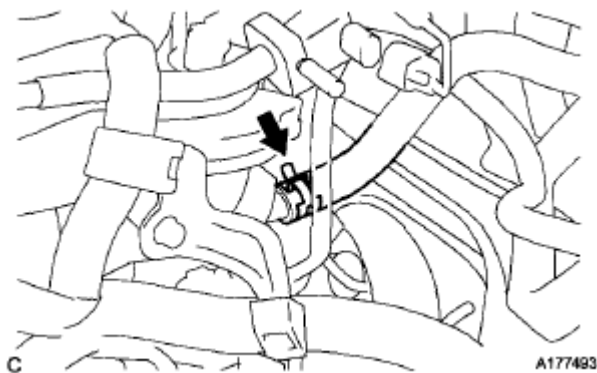


Fig. 144: Locating Outlet Heater Water Hose

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

23. DISCONNECT INLET HEATER WATER HOSE

- a. Disconnect the inlet heater water hose from the engine.

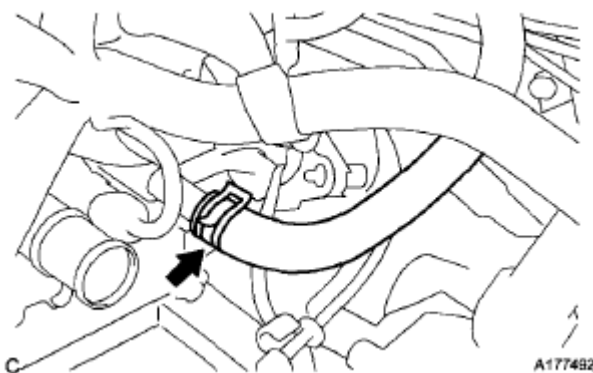


Fig. 145: Locating Inlet Heater Water Hose

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

24. DISCONNECT FUEL TUBE SUB-ASSEMBLY

- a. Release the claw to remove the No. 1 fuel pipe clamp.

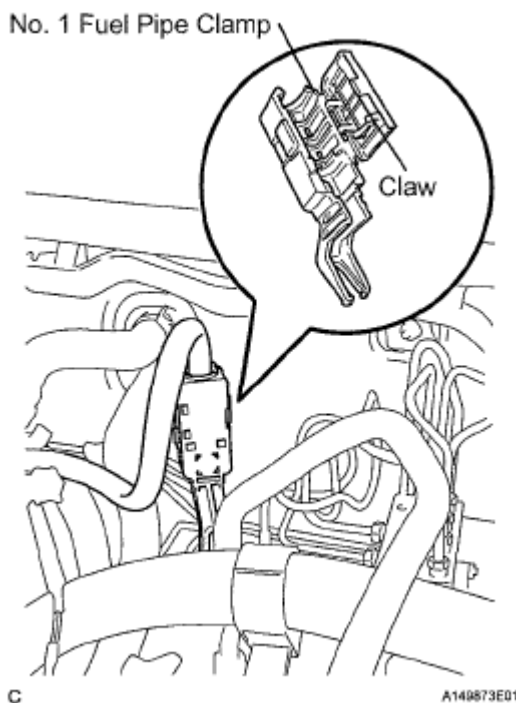


Fig. 146: Identifying No. 1 Fuel Pipe Clamp

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

- b. Pinch the retainer as illustrated, then pull the fuel tube connector out of the pipe.

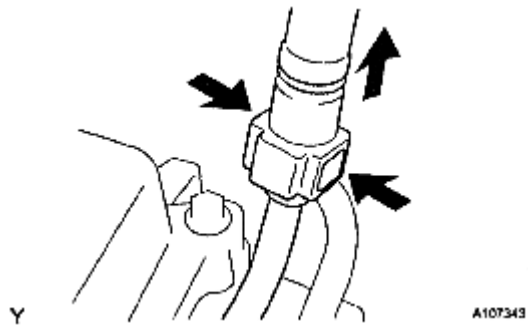


Fig. 147: Pulling Fuel Tube Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Remove any dirt and foreign matter from the fuel tube connector before performing this work.
- Do not allow any scratches or foreign matter on the parts when disconnecting, as the fuel tube connector has the O-rings that seal the pipe.
- Perform this work by hand. Do not use any tools.
- Do not forcibly bend, kink or twist the nylon tube.
- Protect the disconnected parts by covering them with vinyl bags after disconnecting the fuel tube.
- If the fuel tube connector and pipe are stuck, push and pull to release them.

25. **REMOVE V-RIBBED BELT** (See REMOVAL)
26. **REMOVE GENERATOR ASSEMBLY** (See DISASSEMBLY)
27. **REMOVE FAN BELT ADJUSTING BAR**
 - a. Remove the bolt and fan belt adjusting bar.
28. **SEPARATE COMPRESSOR WITH PULLEY ASSEMBLY (w/ Air Conditioning System)**
 - a. Disconnect the connector.
 - b. Remove the 2 bolts and 2 nuts.

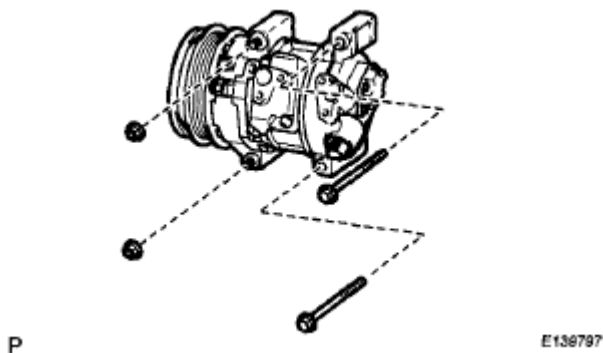
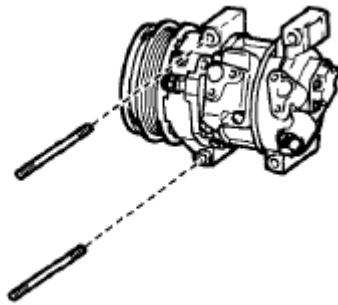


Fig. 148: Identifying Compressor With Pulley Assembly, Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a "TORX" socket wrench (E8), remove the 2 stud bolts and compressor with pulley assembly.

HINT:

Secure the compressor and hoses off to the side instead of discharging the A/C system.



P

E139796

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

29. SEPARATE CLUTCH RELEASE CYLINDER ASSEMBLY (for Manual Transaxle)

- a. Remove the 4 bolts and clutch tube bracket, and separate the clutch release cylinder assembly.



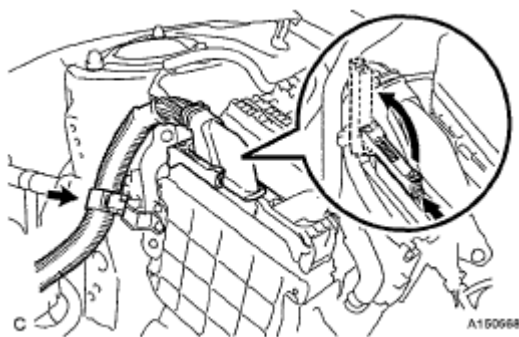
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Fig. 150: Locating Cylinder Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

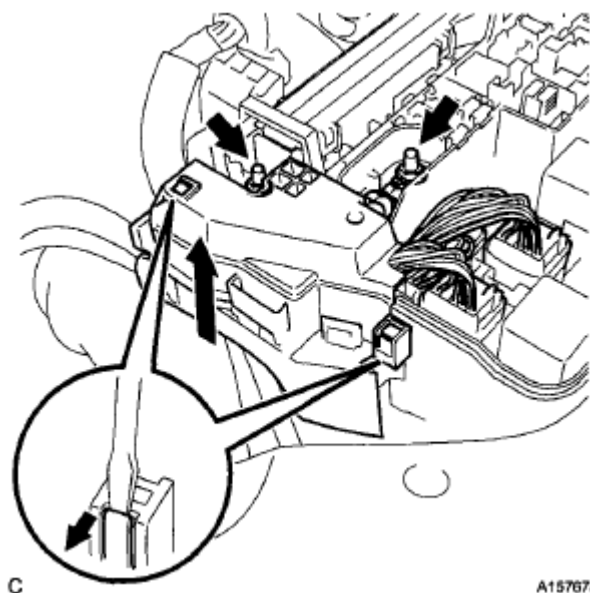
30. DISCONNECT WIRE HARNESS

- a. Pull up the lever to disconnect the ECM connector and release the clamp.

**Fig. 151: Identifying ECM Connector**

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

- b. Remove the 2 nuts.
- c. Remove the 3 connectors and 2 clamps from the engine room junction block and disconnect the wire harness.

**Fig. 152: Removing Engine Room Junction Block**

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

- d. Remove the bolt and clamp (for Manual Transaxle).

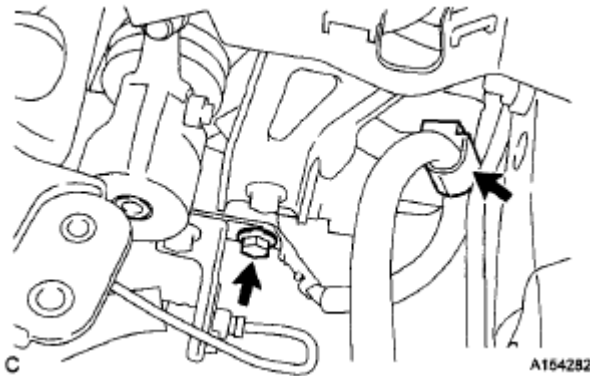


Fig. 153: Locating Bolt And Clamp (For Manual Transaxle)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Remove the bolt and clamp (for Automatic Transaxle).

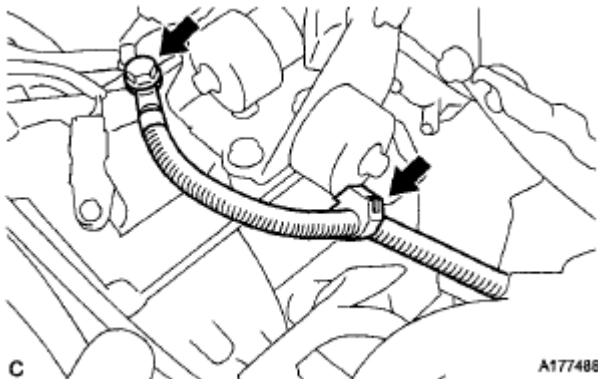


Fig. 154: Locating Bolt And Clamp (For Automatic Transaxle)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Disconnect all the wire harnesses and connectors. Make sure that no wire harness is connected between the body and engine.
31. **SECURE STEERING WHEEL** (See **REMOVAL**)
 32. **REMOVE COLUMN HOLE COVER SILENCER SHEET** (See **REMOVAL**)
 33. **SEPARATE NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY** (See **REMOVAL**)
 34. **DISCONNECT NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY** (See **REMOVAL**)
 35. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** (See **REMOVAL**)
 36. **REMOVE FRONT AXLE SHAFT LH NUT** (See **REMOVAL**)
 37. **REMOVE FRONT AXLE SHAFT RH NUT**

HINT:

Perform the same procedure for the LH side.

38. DISCONNECT FRONT SPEED SENSOR LH (See REMOVAL)**39. DISCONNECT FRONT SPEED SENSOR RH**

HINT:

Perform the same procedure for the LH side.

40. SEPARATE TIE ROD END SUB-ASSEMBLY LH (See REMOVAL)**41. SEPARATE TIE ROD END SUB-ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

42. SEPARATE FRONT STABILIZER LINK ASSEMBLY LH (See REMOVAL)**43. SEPARATE FRONT STABILIZER LINK ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

44. SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH (See REMOVAL)**45. SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

HINT:

Perform the same procedure for the LH side.

46. SEPARATE STEERING KNUCKLE WITH AXLE HUB LH

- a. Put matchmarks on the drive shaft and axle hub.

NOTE: Do not punch the marks.

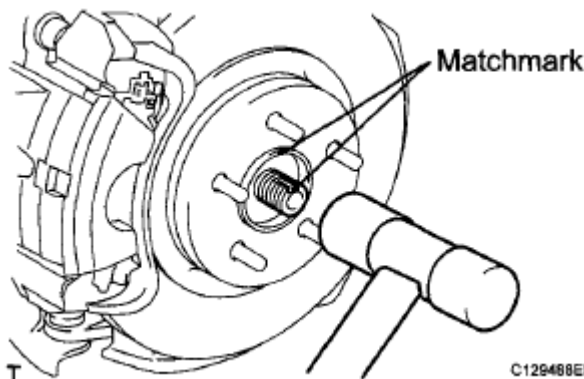


Fig. 155: Putting Matchmarks On Drive Shaft And Axle Hub
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a plastic-faced hammer, disconnect the front axle assembly LH.

NOTE:

- Be careful not to damage the boot and speed sensor rotor.
- Do not excessively push out the drive shaft from the axle assembly.

47. SEPARATE STEERING KNUCKLE WITH AXLE HUB RH

HINT:

Perform the same procedure for the LH side.

48. **REMOVE FRONT DRIVE SHAFT ASSEMBLY LH** (See REMOVAL)
49. **REMOVE FRONT DRIVE SHAFT ASSEMBLY RH** (See REMOVAL)
50. **REMOVE FRONT DRIVE SHAFT HOLE SNAP RING LH** (See DISASSEMBLY)
51. **REMOVE FRONT DRIVE SHAFT HOLE SNAP RING RH** (See DISASSEMBLY)
52. **REMOVE FLYWHEEL HOUSING UNDER COVER (for Automatic Transaxle)** (See REMOVAL)
53. **REMOVE DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT (for Automatic Transaxle)** (See REMOVAL)
54. **REMOVE FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY** (See REMOVAL)
55. **REMOVE CENTER ENGINE MOUNTING MEMBER SUB-ASSEMBLY** (See REMOVAL)
56. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**
- a. Set the engine lifter.

NOTE: Place the engine on wooden blocks or equivalent so that the engine is level.

- b. Remove the bolt and 2 nuts, and separate the engine mounting insulator RH.

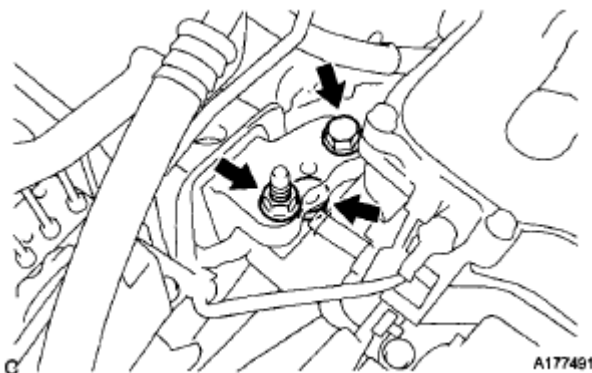


Fig. 156: Locating Engine Mounting Insulator Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the through bolt and nut, and separate the engine mounting insulator LH.
- d. Carefully remove the engine with transaxle from the vehicle.

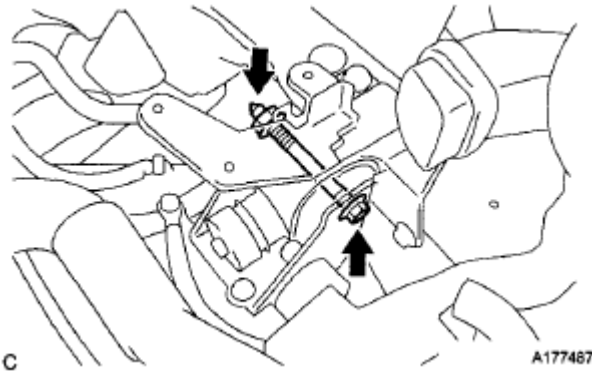


Fig. 157: Locating Engine Mounting Insulator Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. REMOVE FRONT ENGINE MOUNTING INSULATOR

- a. Remove the bolt, nut and front engine mounting insulator.

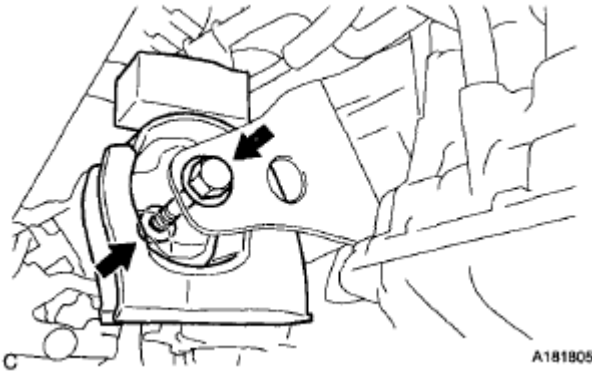


Fig. 158: Locating Front Engine Mounting Insulator Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. REMOVE REAR ENGINE MOUNTING INSULATOR

- a. Remove the through bolt and rear engine mounting insulator.



Fig. 159: Locating Rear Engine Mounting Insulator
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

59. REMOVE ENGINE MOUNTING INSULATOR LH

- a. Remove the 4 bolts and engine mounting insulator LH.

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

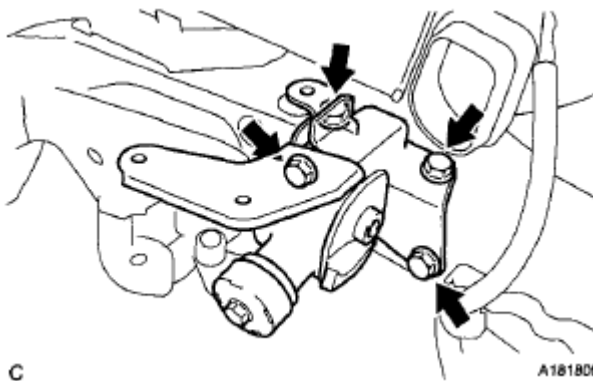


Fig. 160: Locating Engine Mounting Insulator Bolt
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

60. REMOVE ENGINE MOUNTING INSULATOR RH

- a. Disconnect the clamp, and release the relay block assembly.

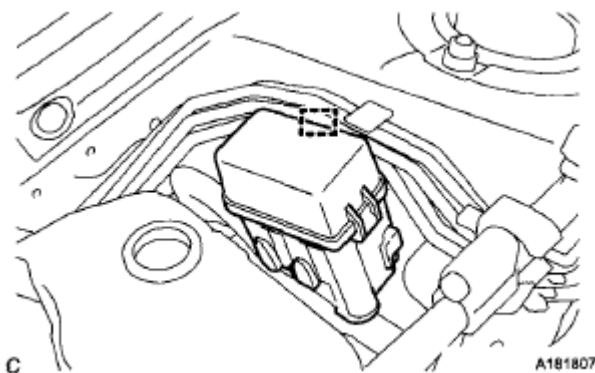


Fig. 161: Identifying Relay Block Assembly And Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the 3 bolts and radiator reserve tank.

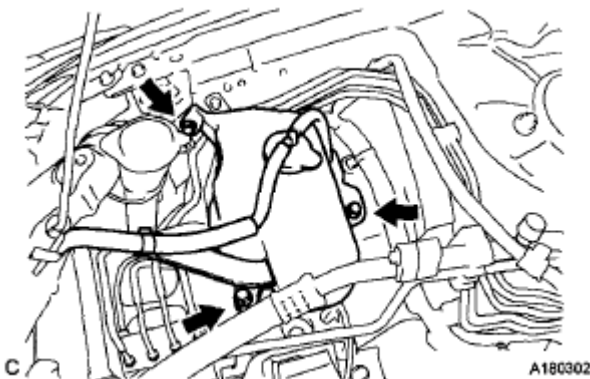


Fig. 162: Locating Radiator Reserve Tank Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 3 bolts and engine mounting insulator RH.

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

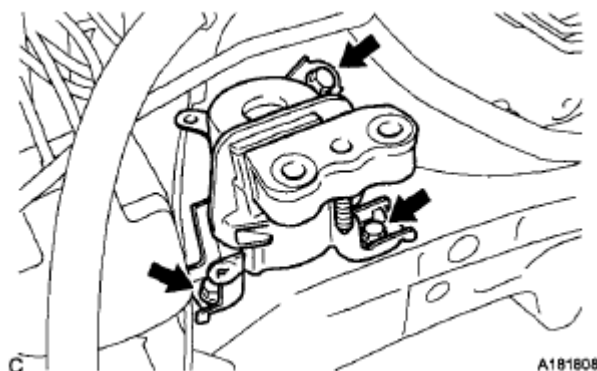


Fig. 163: Locating Engine Mounting Insulator RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

61. INSTALL ENGINE HANGER

- a. Remove the bolt and wire harness bracket.

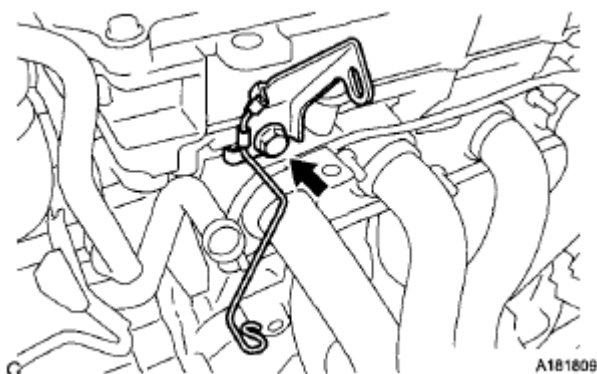


Fig. 164: Locating Wire Harness Bracket Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 engine hangers with the 2 bolts.

Torque: 43 N*m (439 kgf*cm, 32 ft.*lbf)

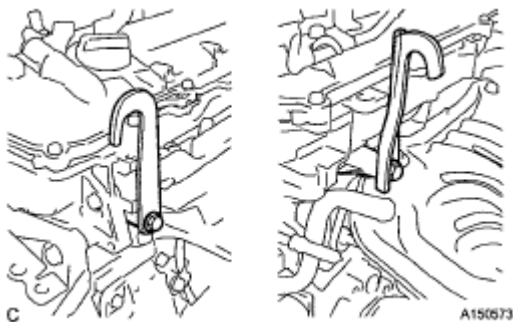


Fig. 165: Locating Engine Hangers Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TORQUE SPECIFICATION

Part Name	Part No.
No. 1 engine hanger	12281-37021
No. 2 engine hanger	12282-37011
Bolt	91552-81050

- 62. **REMOVE FLYWHEEL HOUSING SIDE COVER**
- 63. **REMOVE STARTER ASSEMBLY** (See **DISASSEMBLY**)
- 64. **REMOVE MANUAL TRANSAXLE ASSEMBLY** (for Manual Transaxle)

HINT:

See **REMOVAL** for C59.

- 65. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY** (for Automatic Transaxle)

HINT:

See **REMOVAL** for U341E.

- 66. **REMOVE CLUTCH COVER ASSEMBLY** (for Manual Transaxle) (See **REMOVAL**)
- 67. **REMOVE CLUTCH DISC ASSEMBLY** (for Manual Transaxle) (See **REMOVAL**)
- 68. **REMOVE FLYWHEEL SUB-ASSEMBLY** (for Manual Transaxle) (See **REMOVAL**)
- 69. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** (for Automatic Transaxle) (See **REMOVAL**)
- 70. **REMOVE ENGINE WIRE**

INSTALLATION

- 1. **INSTALL ENGINE WIRE**
- 2. **INSTALL FLYWHEEL SUB-ASSEMBLY** (for Manual Transaxle) (See **INSTALLATION**)
- 3. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** (for Automatic Transaxle) (See **INSTALLATION**)
- 4. **INSTALL CLUTCH DISC ASSEMBLY** (for Manual Transaxle) (See **INSTALLATION**)
- 5. **INSTALL CLUTCH COVER ASSEMBLY** (for Manual Transaxle) (See **INSTALLATION**)
- 6. **INSPECT AND ADJUST CLUTCH COVER ASSEMBLY** (for Manual Transaxle) (See **INSTALLATION**)
- 7. **INSTALL MANUAL TRANSAXLE ASSEMBLY** (for Manual Transaxle)

HINT:

See **INSTALLATION** for C59.

8. INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (for Automatic Transaxle)

HINT:

See **INSTALLATION** for U341E.

9. INSTALL STARTER ASSEMBLY (See **INSTALLATION)****10. INSTALL FLYWHEEL HOUSING SIDE COVER****11. INSTALL FRONT ENGINE MOUNTING INSULATOR**

- a. Install the front engine mounting insulator with the nut and bolt.

Torque: 73 N*m (744 kgf*cm, 54 ft.*lbf)

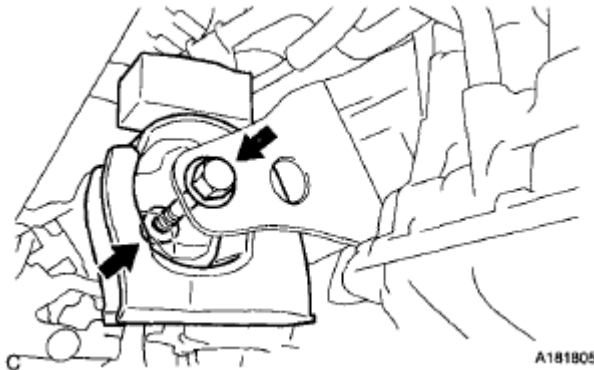


Fig. 166: Locating Front Engine Mounting Insulator With Nut And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSTALL REAR ENGINE MOUNTING INSULATOR

- a. Install the rear engine mounting insulator to the engine mounting bracket with the through bolt.

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

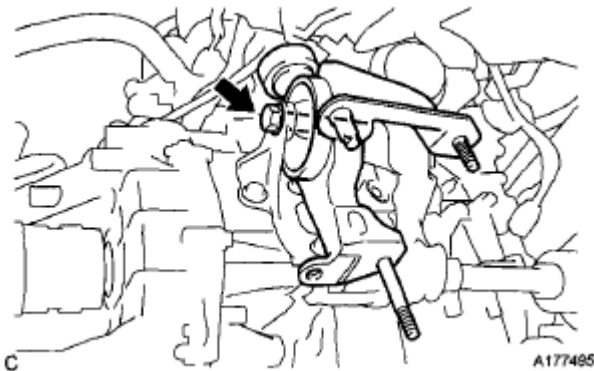


Fig. 167: Locating Rear Engine Mounting Insulator To Engine Mounting Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSTALL ENGINE MOUNTING INSULATOR LH

- a. Temporarily install the engine mounting insulator LH with the 4 bolts.
- b. Tighten the 4 bolts.

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

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

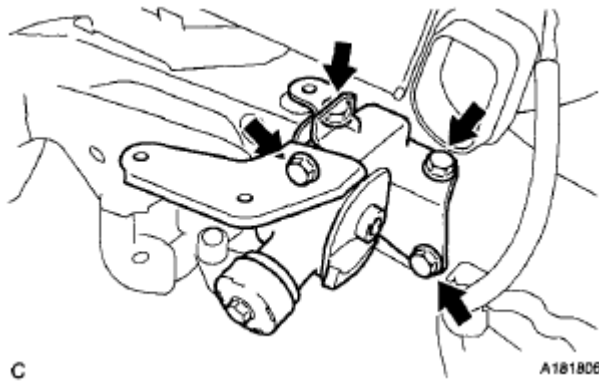


Fig. 168: Locating Engine Mounting Insulator LH With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSTALL ENGINE MOUNTING INSULATOR RH

- a. Install the engine mounting insulator RH with the 3 bolts.

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

HINT:

Perform this procedure only when replacement of the engine mounting insulator is necessary.

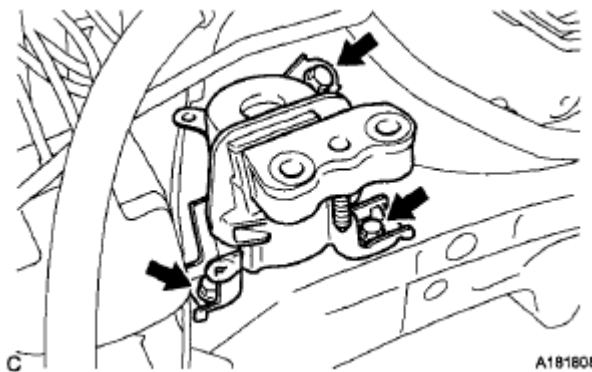


Fig. 169: Locating Engine Mounting Insulator RH With Bolts

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

- b. Install the radiator reserve tank with the 3 bolts.

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

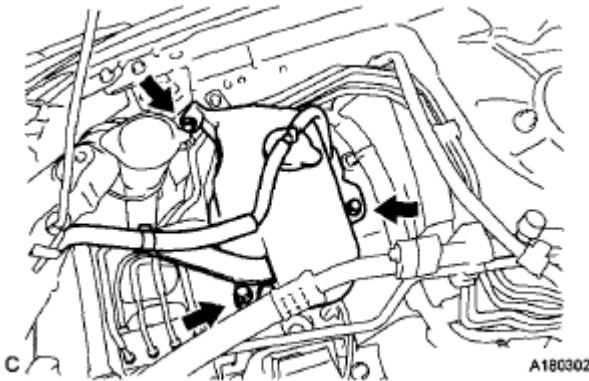


Fig. 170: Locating Radiator Reserve Tank With Bolts

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

- c. Install the relay block assembly.

15. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

- a. Set the engine assembly with transaxle and front suspension crossmember on the engine lifter.
- b. Operate the engine lifter and lift the engine assembly with transaxle and front suspension crossmember to the position where the engine mounting insulators RH and LH can be installed.

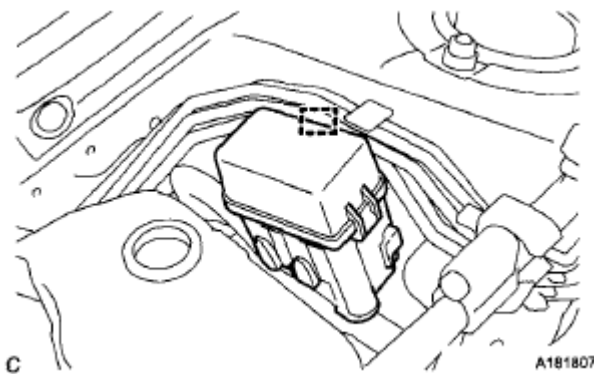


Fig. 171: Identifying Engine Assembly With Transaxle

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

CAUTION: Do not raise the engine more than necessary. If the engine is raised excessively, the vehicle may also be lifted up.

NOTE:

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

- While raising the engine into the vehicle, do not allow it to contact the vehicle.

- c. Install the engine mounting insulator LH with the through bolt and nut.

Torque: 56 N*m (571 kgf*cm, 41 ft.*lbf)

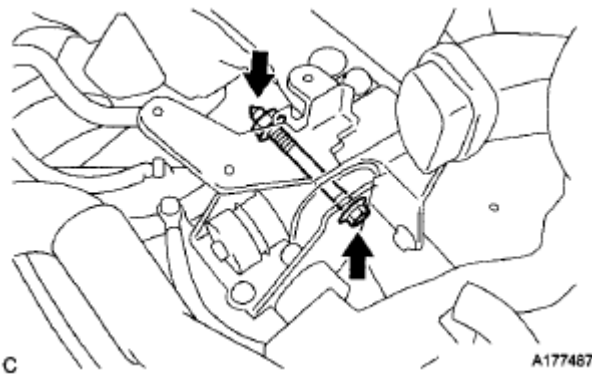


Fig. 172: Locating Engine Mounting Insulator LH, Bolt And Nut
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the engine mounting insulator RH with the bolt and 2 nuts.

Torque: Nut A

95 N*m (969 kgf*cm, 70 ft.*lbf)

Nut B

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

Bolt

95 N*m (969 kgf*cm, 70 ft.*lbf)

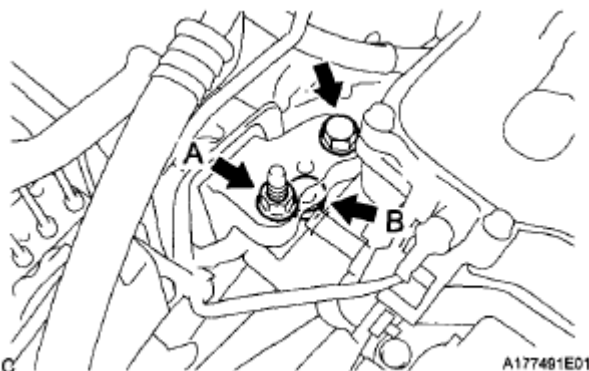


Fig. 173: Locating Engine Mounting Insulator RH, Bolt And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **TEMPORARILY INSTALL CENTER ENGINE MOUNTING MEMBER SUB-ASSEMBLY** (See **INSTALLATION**)
17. **INSTALL FRONT SUSPENSION CROSSMEMBER SUB-ASSEMBLY** (See **INSTALLATION**)
18. **FULLY TIGHTEN CENTER ENGINE MOUNTING MEMBER SUB-ASSEMBLY** (See **INSTALLATION**)
19. **REMOVE ENGINE HANGER**
 - a. Remove the 2 bolts and 2 engine hangers.
 - b. Install the wire harness bracket with the bolt.

Torque: 60 N*m (612 kgf*cm, 44 ft.*lbf)

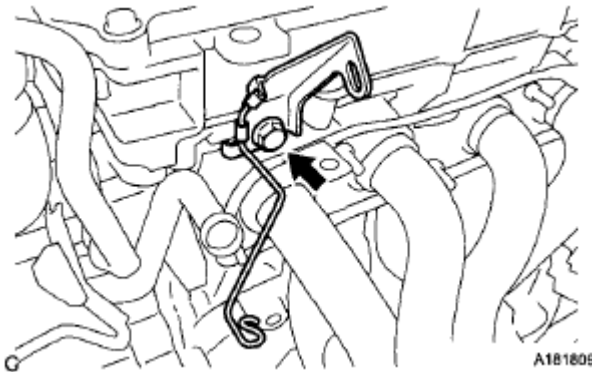


Fig. 174: Locating Wire Harness Bracket With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **INSTALL DRIVE PLATE AND TORQUE CONVERTER CLUTCH SETTING BOLT** (for Automatic Transaxle) (See **INSTALLATION**)
21. **INSTALL FLYWHEEL HOUSING UNDER COVER** (for Automatic Transaxle) (See **AUTOMATIC TRANSAXLE UNIT**)
22. **INSTALL FRONT DRIVE SHAFT HOLE SNAP RING LH** (See **INSTALLATION**)
23. **INSTALL FRONT DRIVE SHAFT HOLE SNAP RING RH** (See **INSTALLATION**)
24. **INSTALL FRONT DRIVE SHAFT ASSEMBLY LH** (See **INSTALLATION**)
25. **INSTALL FRONT DRIVE SHAFT ASSEMBLY RH** (See **INSTALLATION**)
26. **INSTALL STEERING KNUCKLE WITH AXLE HUB LH**
 - a. Align the matchmarks and connect the front drive shaft assembly to the front axle assembly LH.

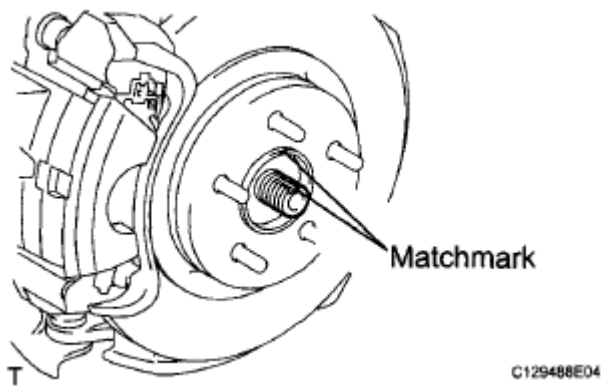


Fig. 175: Identifying Matchmarks On Front Drive Shaft Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. INSTALL STEERING KNUCKLE WITH AXLE HUB RH

HINT:

Perform the same procedure for the LH side.

28. INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH (See INSTALLATION)

29. INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH

HINT:

Perform the same procedure for the LH side.

30. INSTALL FRONT STABILIZER LINK ASSEMBLY LH (See INSTALLATION)

31. INSTALL FRONT STABILIZER LINK ASSEMBLY RH

HINT:

Perform the same procedure for the LH side.

32. CONNECT TIE ROD END SUB-ASSEMBLY LH (See INSTALLATION)

33. CONNECT TIE ROD END SUB-ASSEMBLY RH

HINT:

Perform the same procedure for the LH side.

34. INSTALL FRONT SPEED SENSOR LH (See INSTALLATION)

35. INSTALL FRONT SPEED SENSOR RH

HINT:

Perform the same procedure for the LH side.

- 36. **INSTALL FRONT AXLE SHAFT LH NUT** (See INSTALLATION)
- 37. **INSTALL FRONT AXLE SHAFT RH NUT**

HINT:

Perform the same procedure for the LH side.

- 38. **INSTALL FRONT EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
- 39. **INSTALL NO. 1 STEERING COLUMN HOLE COVER SUB-ASSEMBLY** (See INSTALLATION)
- 40. **INSTALL NO. 2 STEERING INTERMEDIATE SHAFT ASSEMBLY** (See INSTALLATION)
- 41. **INSTALL COLUMN HOLE COVER SILENCER SHEET** (See INSTALLATION)
- 42. **INSTALL WIRE HARNESS**
 - a. Install the earth wire to the engine compartment with the bolt and clamp (for Manual Transaxle).

Torque: 13 N*m (130 kgf*cm, 10 ft.*lbf)

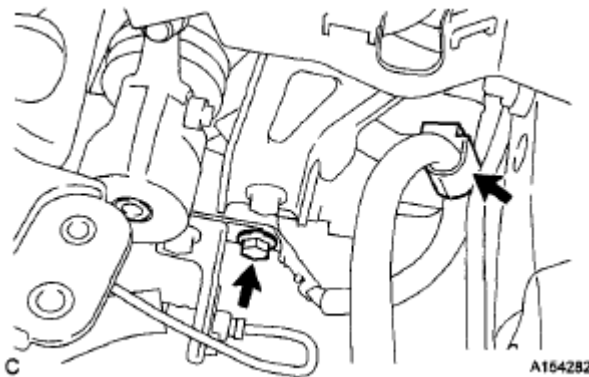


Fig. 176: Locating Bolt And Clamp (For Manual Transaxle)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the earth wire to the engine compartment with the bolt and clamp (for Automatic Transaxle).

Torque: 26 N*m (260 kgf*cm, 19 ft.*lbf)

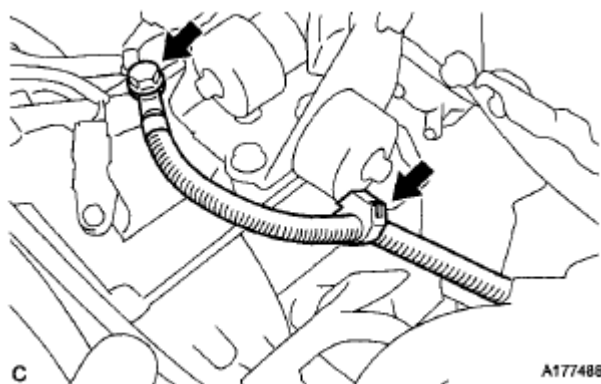


Fig. 177: Locating Bolt And Clamp (For Automatic Transaxle)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the wire harness with the 2 nuts.

Torque: 8.4 N*m (85 kgf*cm, 74 in.*lbf)

- d. Connect the 3 connectors and 2 wire harness clamps to the engine room junction block.

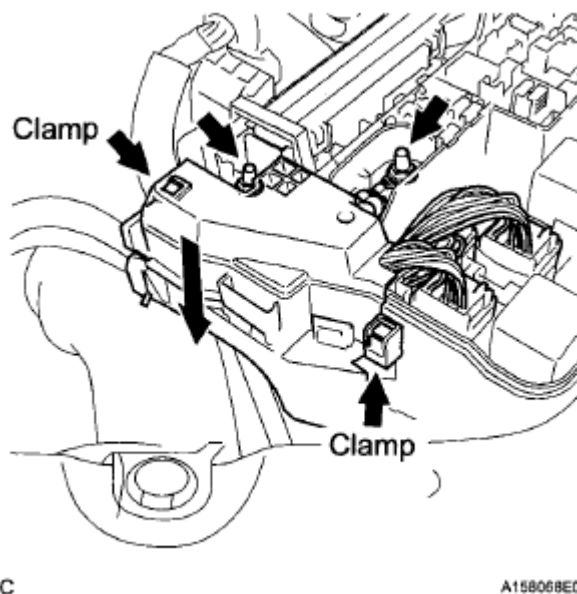


Fig. 178: Locating Wire Harness With Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Connect the connector to the ECU with the lock lever and connect the clamp.

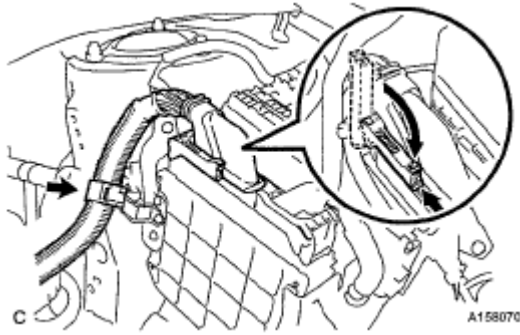


Fig. 179: Identifying ECU With Lock Lever

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

43. **INSTALL CLUTCH RELEASE CYLINDER ASSEMBLY (for Manual Transaxle)**
 - a. Install the clutch release cylinder assembly with the 4 bolts and clutch tube bracket.

Torque: Bolt A

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

Bolt B

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

Bolt C

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

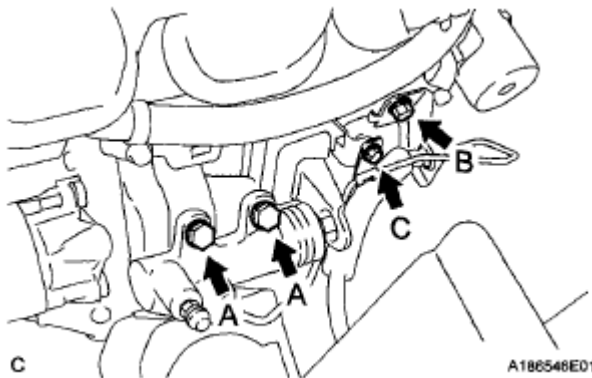


Fig. 180: Locating Clutch Release Cylinder Assembly Bolts (For Manual Transaxle)

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

44. **INSTALL COMPRESSOR WITH PULLEY ASSEMBLY (w/ Air Conditioning System) (See INSTALLATION)**
45. **INSTALL FAN BELT ADJUSTING BAR**
 - a. Install the bolt and fan belt adjusting bar.

Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)

46. **INSTALL GENERATOR ASSEMBLY** (See INSTALLATION)
47. **INSTALL V-RIBBED BELT** (See INSTALLATION)
48. **ADJUST V-RIBBED BELT** (See INSTALLATION)
49. **INSPECT V-RIBBED BELT** (See ON-VEHICLE INSPECTION)
50. **CONNECT FUEL TUBE SUB-ASSEMBLY**

- a. Connect the fuel tube connector and fuel pipe.

CAUTION: Align the fuel tube connector with the pipe, then push the fuel tube connector in until the retainer makes a "click" sound. If the connection is tight, apply a small amount of engine oil to the tip of the pipe. After connecting, pull on the pipe and connector to make sure that they are securely connected.

- b. Engage the claw and install the No. 1 fuel pipe clamp.

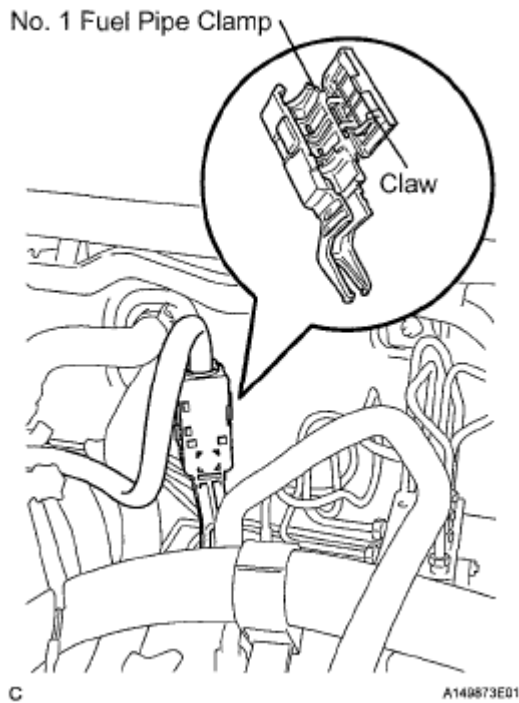
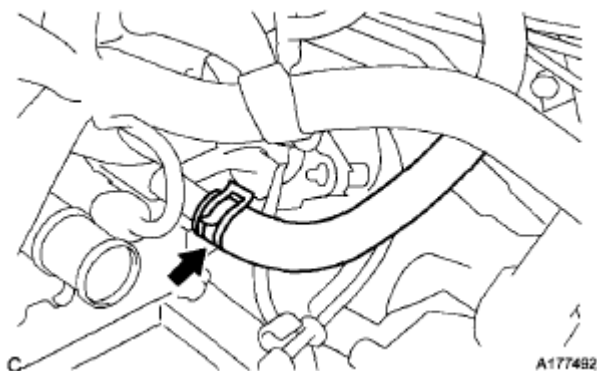


Fig. 181: Identifying No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

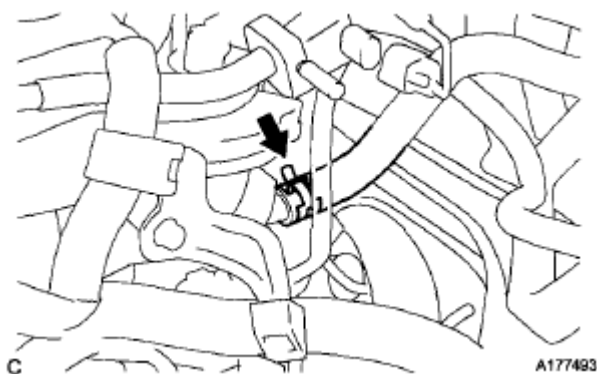
51. **CONNECT INLET HEATER WATER HOSE**
 - a. Connect the inlet heater water hose with the clamp.

**Fig. 182: Locating Inlet Heater Water Hose**

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

52. CONNECT OUTLET HEATER WATER HOSE

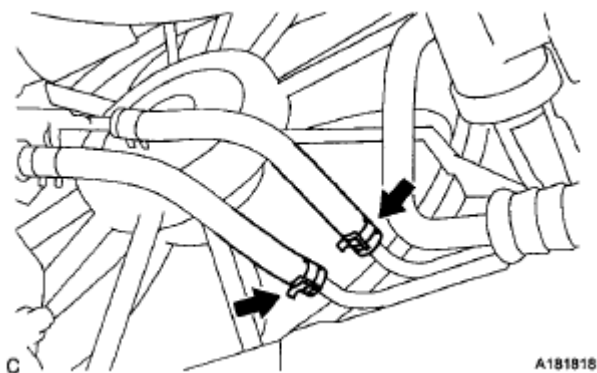
- a. Connect the outlet heater water hose with the clamp.

**Fig. 183: Locating Outlet Heater Water Hose And Clamp**

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

53. CONNECT OIL COOLER HOSE (for Automatic Transaxle)

- a. Connect the 2 oil cooler hoses with the clamps.

**Fig. 184: Locating Oil Cooler Hoses To Oil Cooler Tube**

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

54. CONNECT UNION TO CONNECTOR TUBE HOSE

- a. Connect the union to connector tube hose.

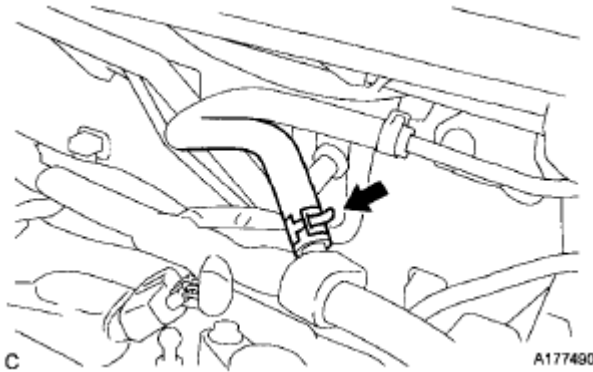


Fig. 185: Locating Union To Connector Tube Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

55. CONNECT FUEL VAPOR FEED HOSE ASSEMBLY

- a. Connect the fuel vapor feed hose assembly.

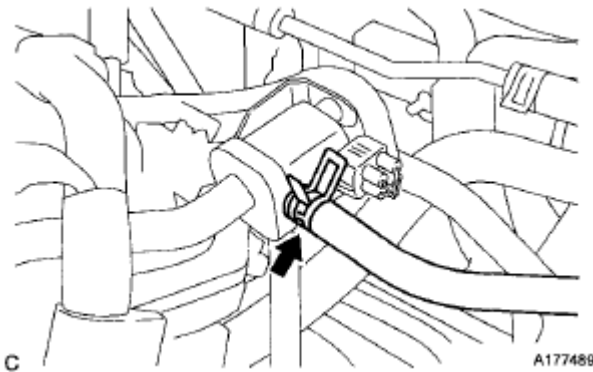


Fig. 186: Locating Fuel Vapor Feed Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY (for Manual Transaxle)

- a. Install the transmission control cable to the control cable bracket with 2 new clips.
- b. Install the transmission control cable to the transaxle with the 2 clips.

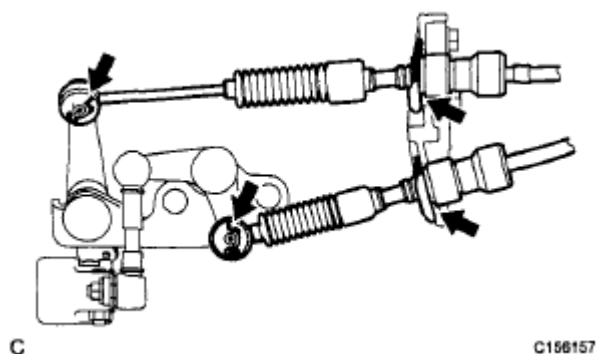


Fig. 187: Locating Transmission Control Cable Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. INSTALL TRANSMISSION CONTROL CABLE ASSEMBLY (for Automatic Transaxle)

- a. Secure the control cable onto the control cable bracket with a new clip.
- b. Connect the control cable onto the control shaft lever with the nut.

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

- c. Connect the control cable to the cable support.
- d. Connect the clamp of the control cable with the bolt.

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

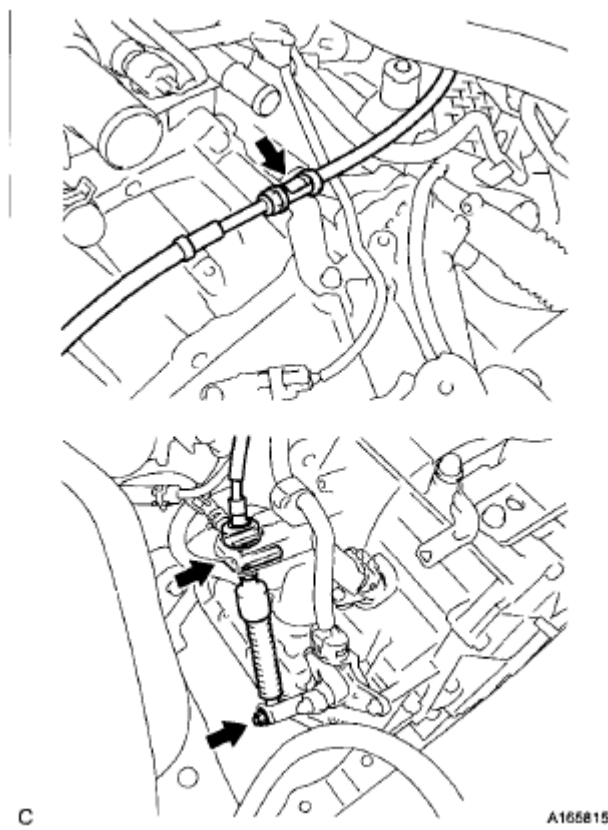


Fig. 188: Locating Transmission Control Cable Assembly (For Automatic Transaxle)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

58. CONNECT NO. 2 RADIATOR HOSE

- a. Connect the No. 2 radiator hose with the clamp.

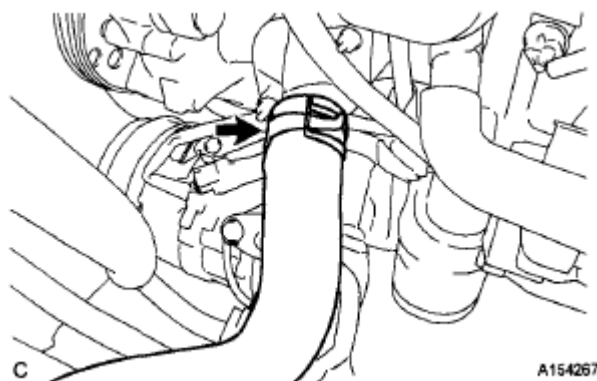


Fig. 189: Locating No. 2 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

59. CONNECT NO. 1 RADIATOR HOSE

- a. Connect the No. 1 radiator hose with the clamp.

- b. Connect the clamp.

60. INSTALL BATTERY CARRIER

- a. Install the battery carrier with the 4 bolts.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

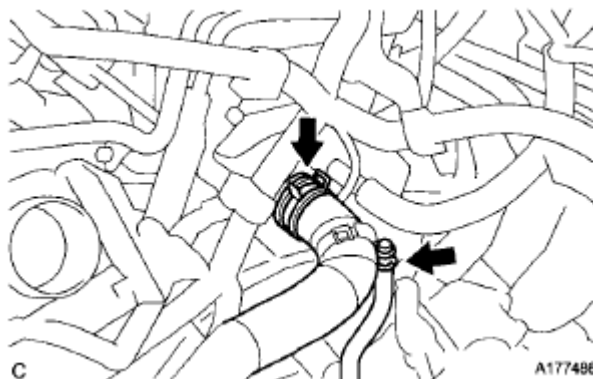


Fig. 190: Locating Battery Carrier With Bolts

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

- b. Connect the radiator pipe with the 2 bolts.

Torque: 8.8 N*m (90 kgf*cm, 78 in.*lbf)

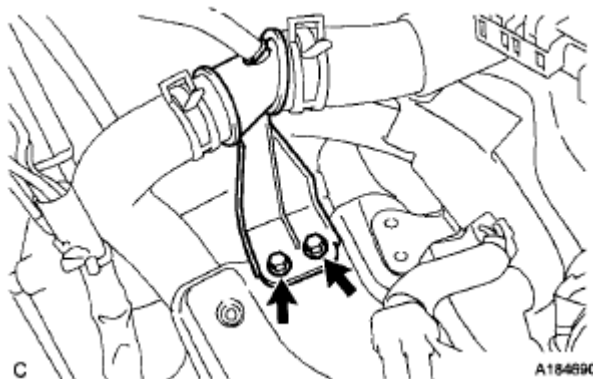


Fig. 191: Locating Radiator Pipe With Bolts

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

- c. Connect the 2 wire harness clamps.

61. INSTALL BATTERY

- a. Install the battery clamp with the bolt and nut.

Torque: for bolt

6.5 N*m (66 kgf*cm, 58 in.*lbf)

for nut

3.5 N*m (36 kgf*cm, 31 in.*lbf)

- b. Connect the battery cables.

Torque: 5.4 N*m (55 kgf*cm, 48 in.*lbf)

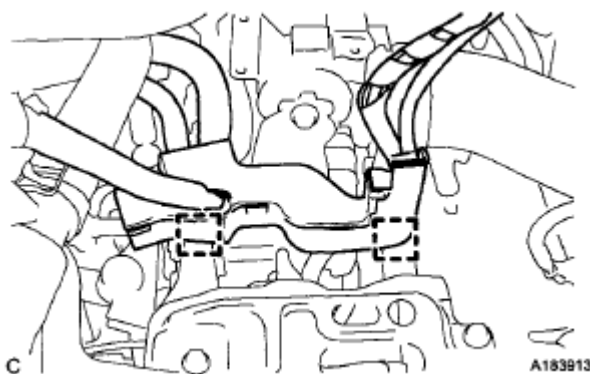


Fig. 192: Removing Battery Carrier

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

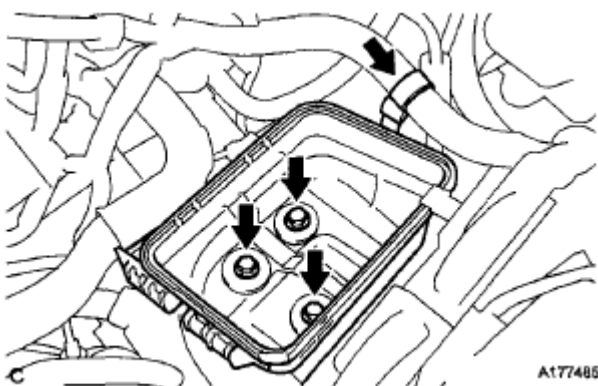


Fig. 193: Locating Battery Bolts

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

62. INSTALL AIR CLEANER CASE

- a. Install the air cleaner case with the 3 bolts.

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

- b. Install the wire harness clamp to the air cleaner case.
- c. Install the air cleaner filter element.

63. INSTALL AIR CLEANER CAP SUB-ASSEMBLY (See INSTALLATION)

64. ADD TRANSAXLE OIL (for Manual Transaxle)

HINT:

See MANUAL TRANSAXLE OIL for C59.

65. INSPECT AND ADJUST TRANSAXLE OIL (for Manual Transaxle)

HINT:

See MANUAL TRANSAXLE OIL for C59.

66. ADD AUTOMATIC TRANSAXLE FLUID (for Automatic Transaxle)

67. INSPECT TRANSAXLE FLUID LEVEL (for Automatic Transaxle)

HINT:

See AUTOMATIC TRANSAXLE FLUID for U341E.

68. INSPECT FOR AUTOMATIC TRANSAXLE FLUID LEAK (for Automatic Transaxle)

69. INSPECT SHIFT LEVER POSITION (for Automatic Transaxle)

HINT:

See INSPECTION for U341E.

70. ADJUST SHIFT LEVER POSITION (for Automatic Transaxle)

HINT:

See INSPECTION for U341E.

71. ADD ENGINE COOLANT (See COOLANT)

72. ADD ENGINE OIL (See REPLACEMENT)

73. INSPECT ENGINE OIL LEVEL (See LUBRICATION SYSTEM)

74. INSPECT FOR FUEL LEAK (See ON-VEHICLE INSPECTION)

75. INSPECT FOR ENGINE COOLANT LEAK (See COOLING SYSTEM)

76. INSPECT FOR OIL LEAK

77. INSPECT FOR EXHAUST GAS LEAK

78. INSTALL ENGINE UNDER COVER LH

79. INSTALL ENGINE UNDER COVER RH

80. INSTALL FRONT WHEELS

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

81. INSPECT IGNITION TIMING (See ON-VEHICLE INSPECTION)

- 82. **INSPECT ENGINE IDLE SPEED** (See ON-VEHICLE INSPECTION)
- 83. **INSPECT CO/HC** (See ON-VEHICLE INSPECTION)
- 84. **ADJUST FRONT WHEEL ALIGNMENT**

HINT:

See FRONT WHEEL ALIGNMENT .

- 85. **INSTALL NO. 2 CYLINDER HEAD COVER**
 - a. Engage the 4 clips to install the No. 2 cylinder head cover.

NOTE:

- Be sure to engage the clips securely.
- Do not apply excessive force or do not hit the cover to engage the clips. This may cause the cover to break.

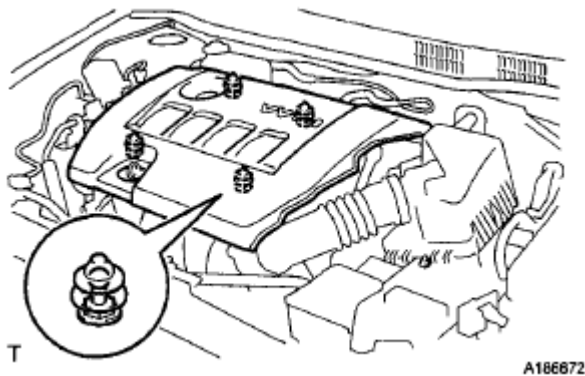


Fig. 194: Identifying No. 2 Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 86. **CHECK SPEED SENSOR SIGNAL**

HINT:

See TEST MODE PROCEDURE w/o VSC.

See TEST MODE PROCEDURE w/ VSC.

ENGINE UNIT

COMPONENTS

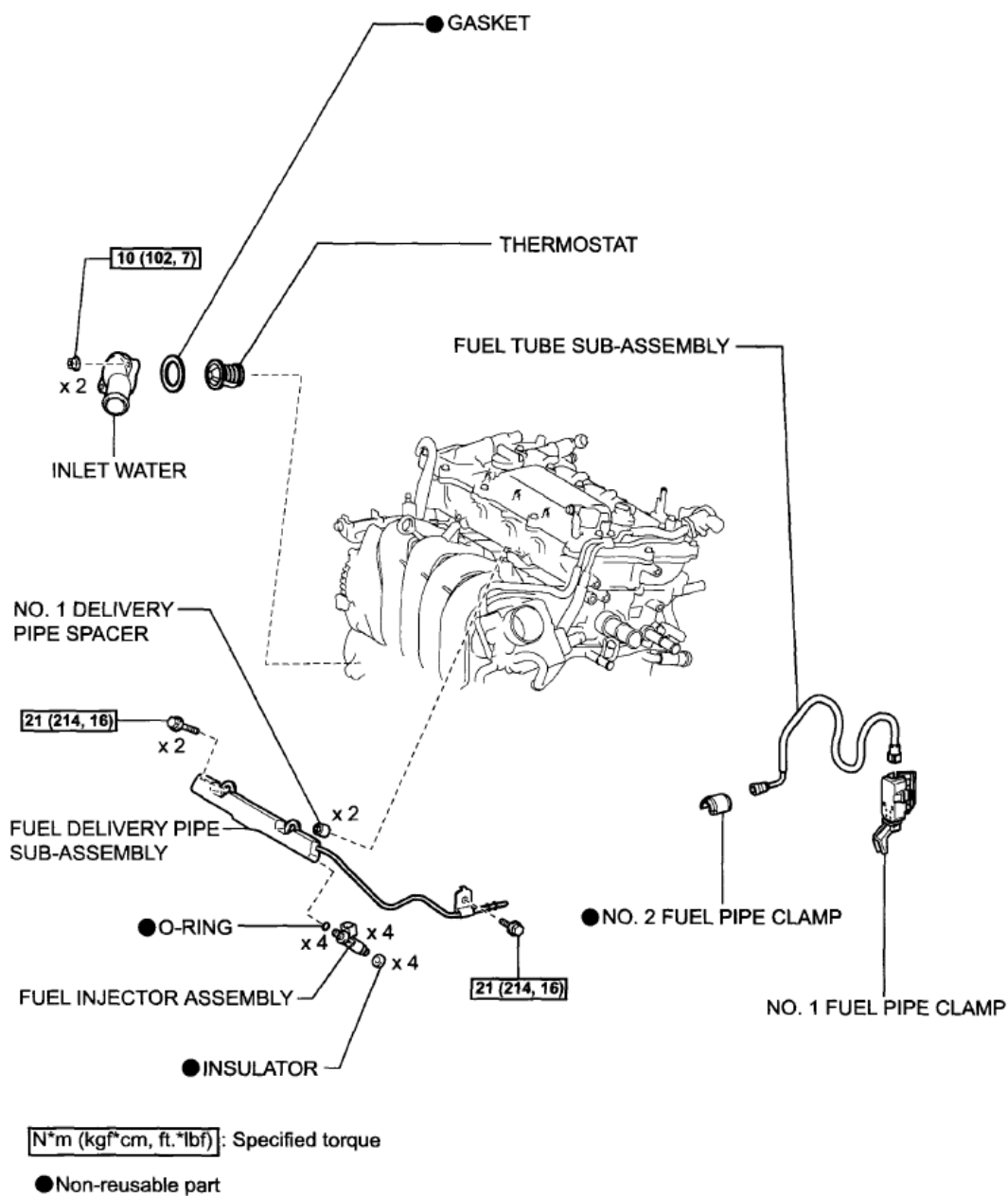


Fig. 195: Identifying Engine Unit Components With Torque Specifications (1 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

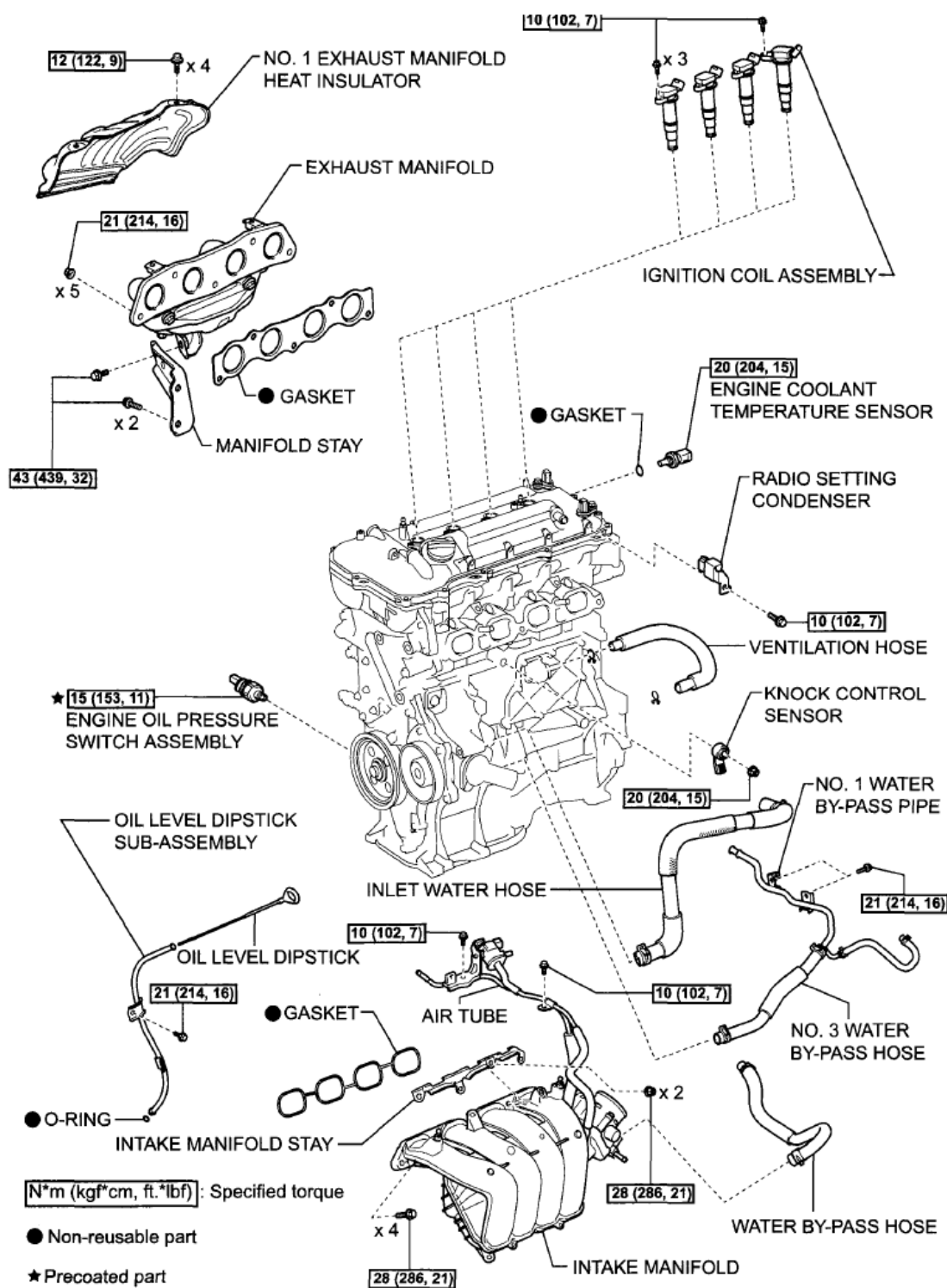


Fig. 196: Identifying Engine Unit Components With Torque Specifications (2 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

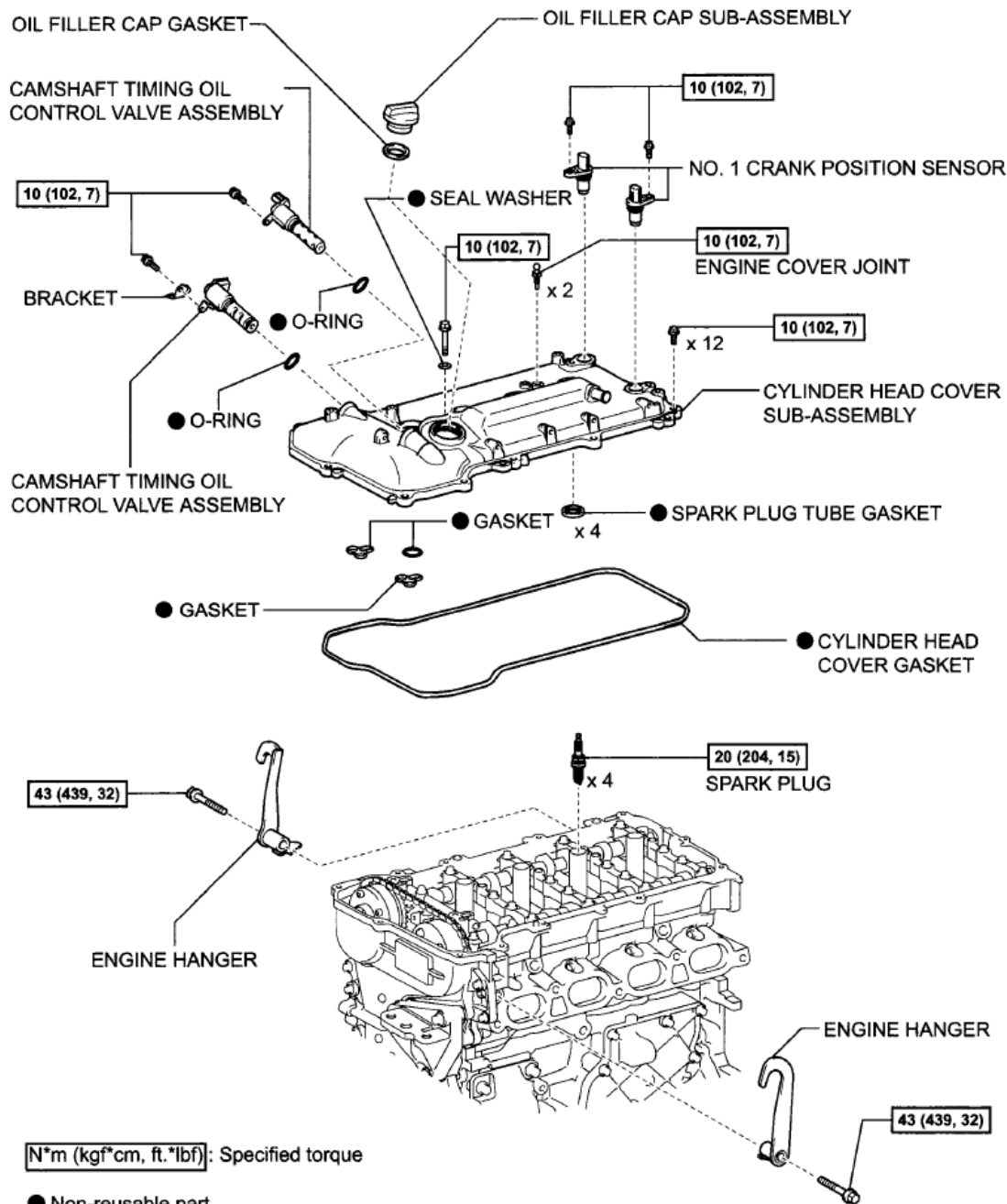
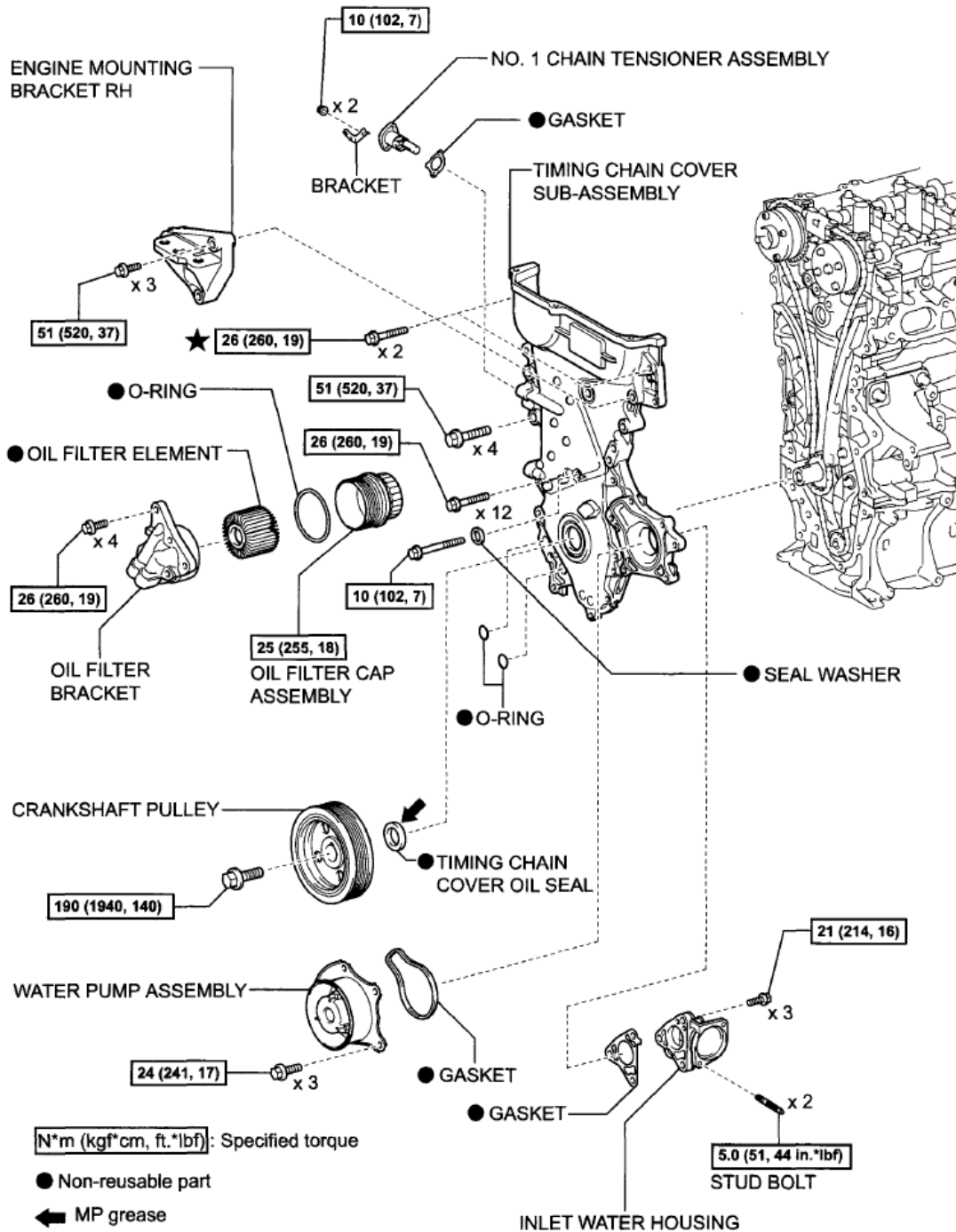
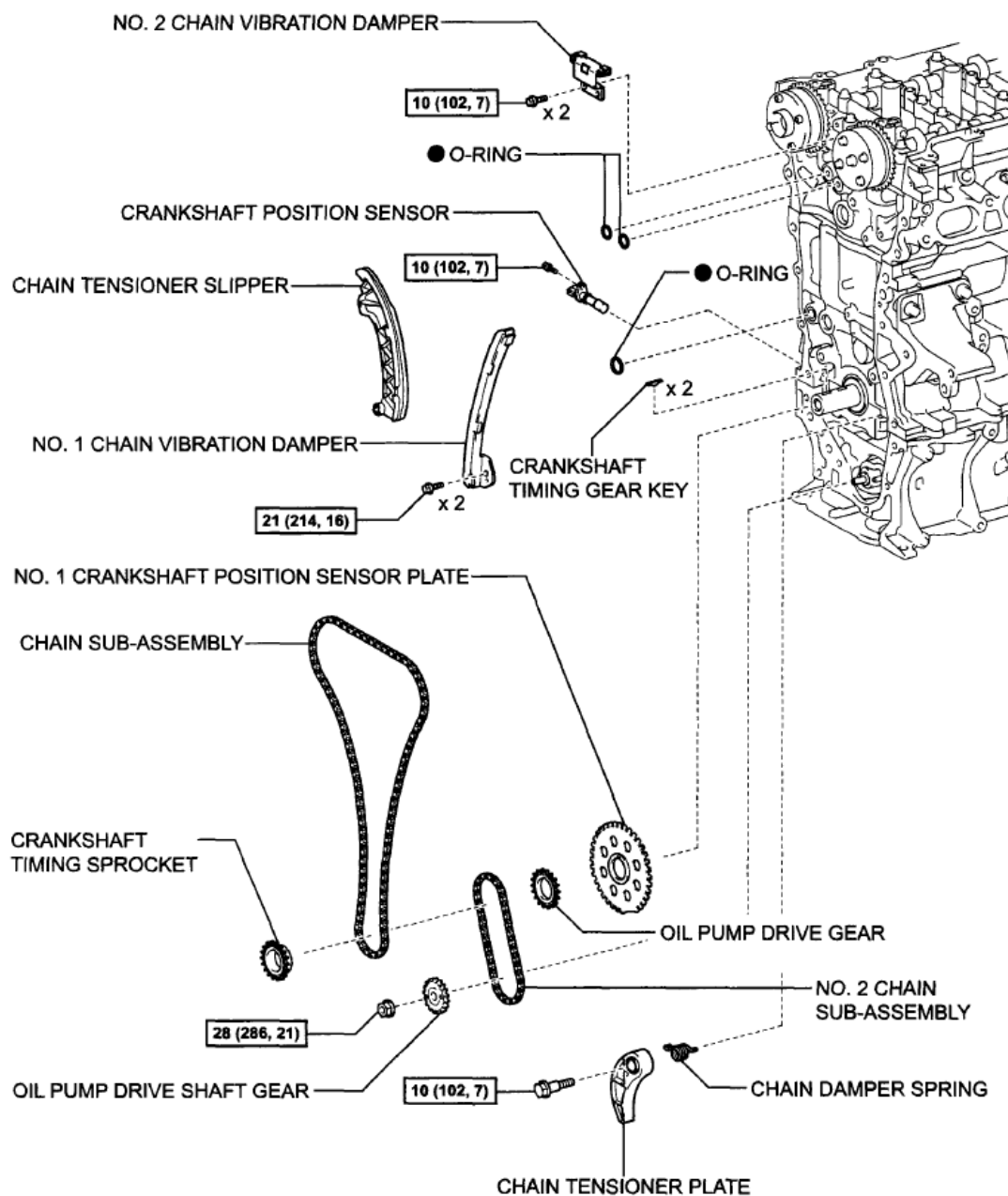


Fig. 197: Identifying Engine Unit Components With Torque Specifications (3 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A183766E01

Fig. 198: Identifying Engine Unit Components With Torque Specifications (4 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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

● Non-reusable part

A150362E03

Fig. 199: Identifying Engine Unit Components With Torque Specifications (5 Of 7)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2009 Toyota Matrix S

2009 ENGINE Engine Mechanical (2ZR-FE) - Corolla Matrix

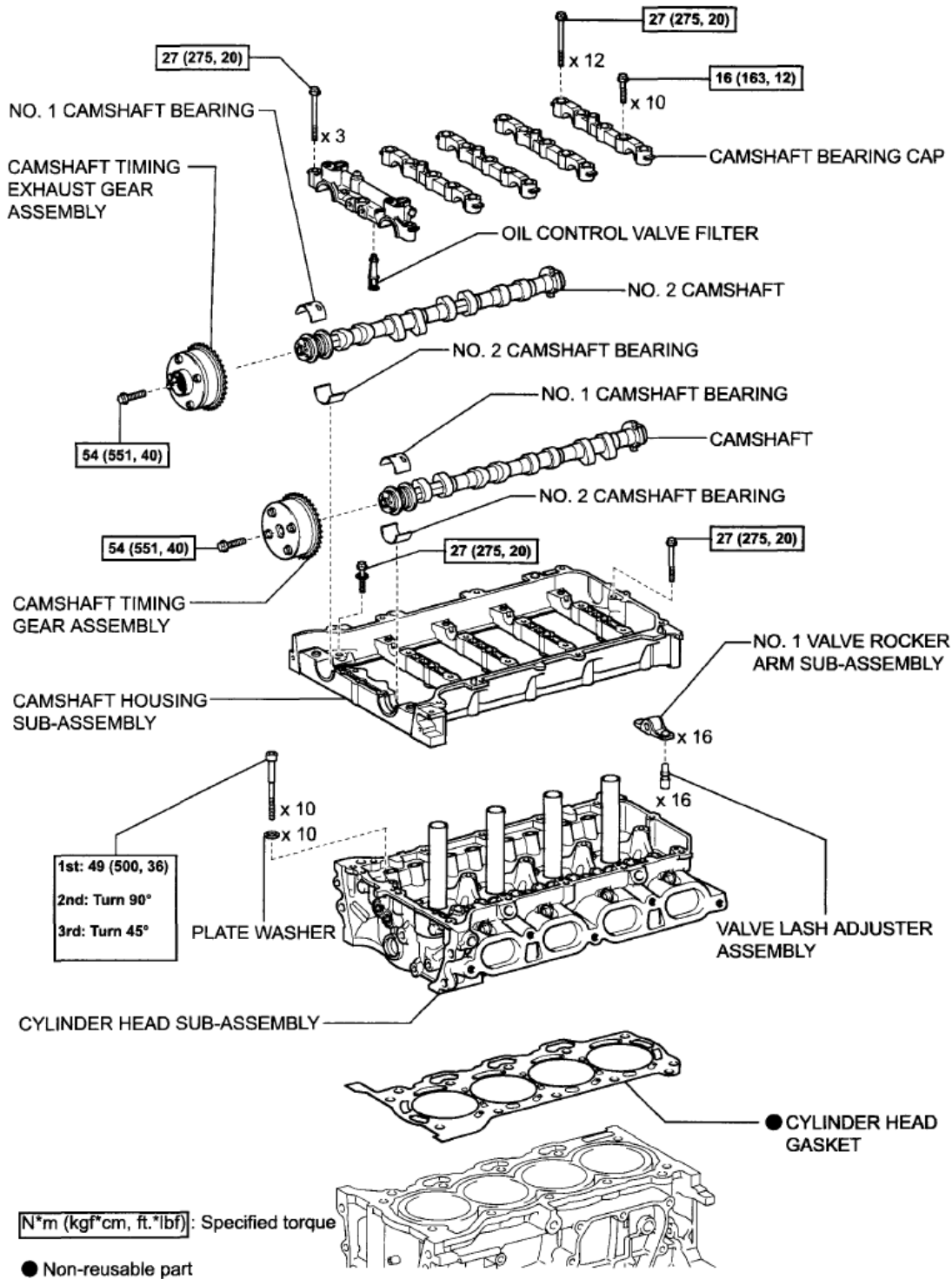


Fig. 200: Identifying Engine Unit Components With Torque Specifications (6 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

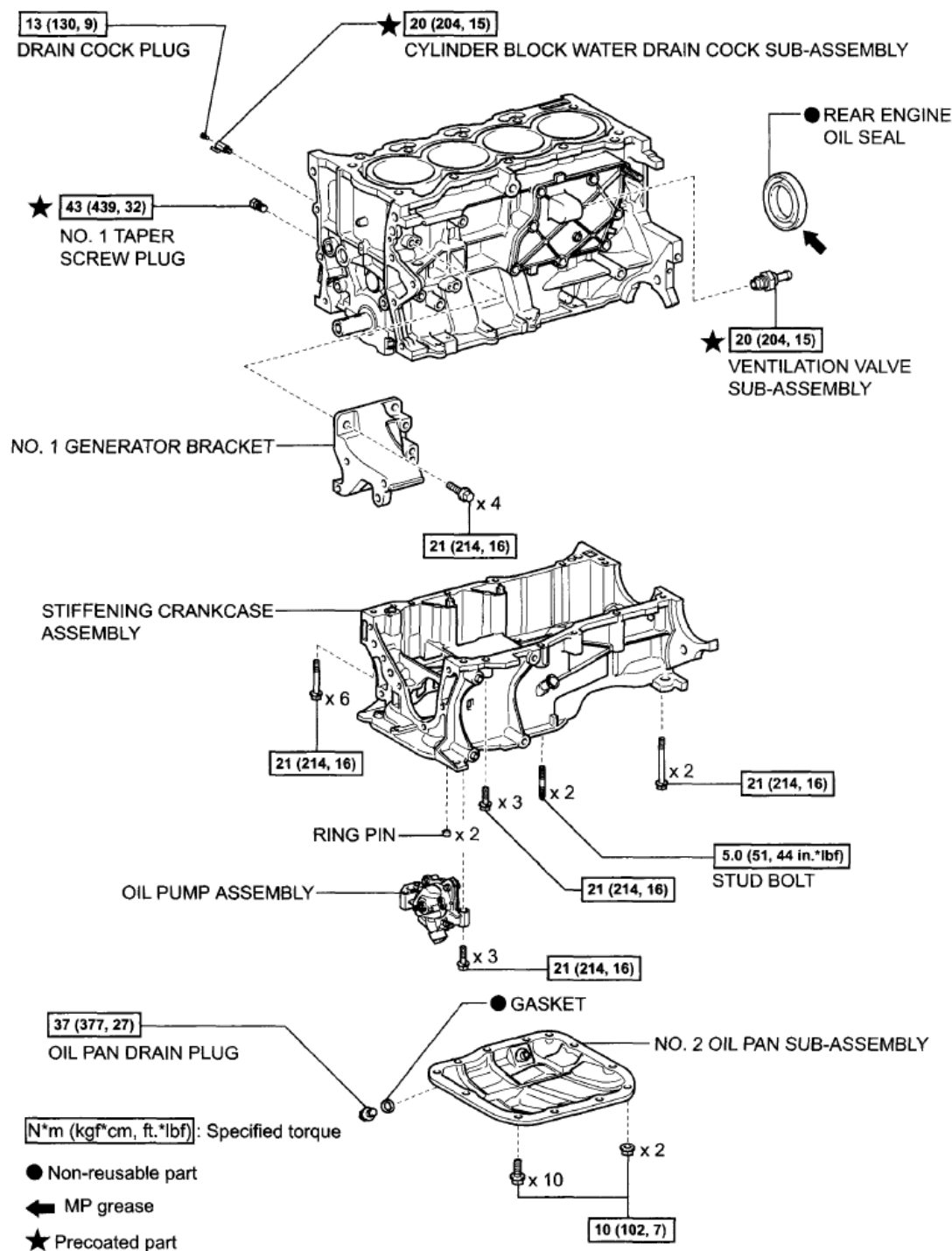


Fig. 201: Identifying Engine Unit Components With Torque Specifications (7 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. INSTALL ENGINE STAND

- a. Set the engine on an engine stand.

2. REMOVE ENGINE HANGER

3. REMOVE INTAKE MANIFOLD

- a. Remove the wire harness clamp bracket.
- b. Remove the 2 bolts and disconnect the air tube.
- c. Disconnect the ventilation hose from the intake manifold.
- d. Disconnect the 2 water by-pass hoses.

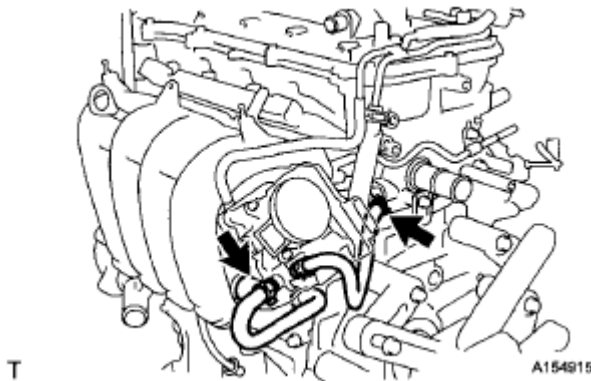


Fig. 202: Locating Water By-Pass Hoses

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

- e. Remove the 4 bolts, 2 nuts and intake manifold and intake manifold stay.
- f. Remove the gasket from the intake manifold.

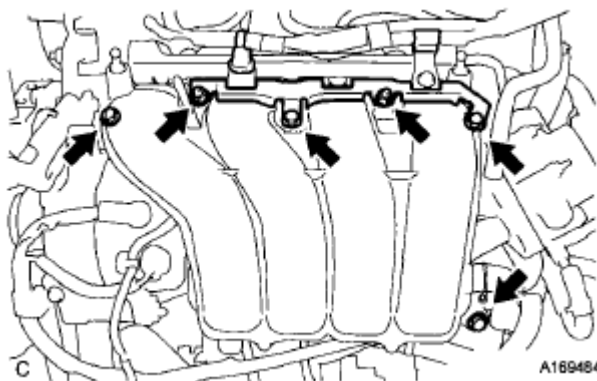


Fig. 203: Locating Intake Manifold Bolt And Nuts

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

- 4. **DISCONNECT FUEL TUBE SUB-ASSEMBLY** (See **REMOVAL**)
- 5. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** (See **REMOVAL**)
- 6. **REMOVE FUEL INJECTOR ASSEMBLY** (See **REMOVAL**)

7. REMOVE IGNITION COIL ASSEMBLY

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

8. REMOVE OIL LEVEL DIPSTICK SUB-ASSEMBLY

- a. Remove the bolt and oil level dipstick.
- b. Remove the O-ring from the oil level dipstick.

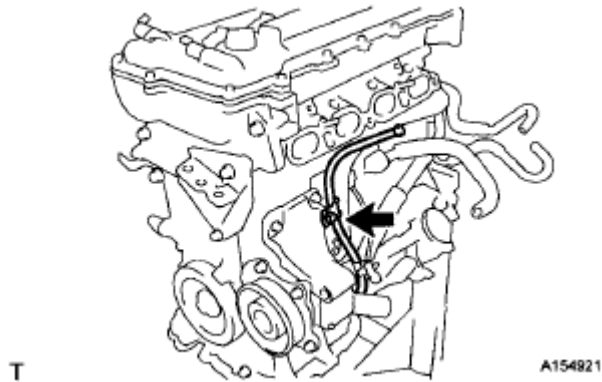


Fig. 204: Locating Oil Level Dipstick Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

- a. Remove the 4 bolts and exhaust manifold heat insulator.

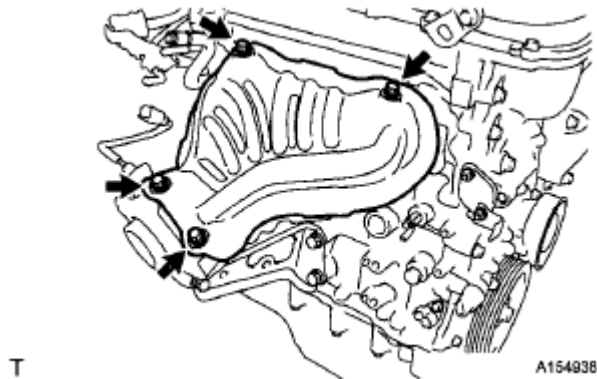


Fig. 205: Locating No. 1 Exhaust Manifold Heat Insulator Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. REMOVE MANIFOLD STAY

- a. Remove the 3 bolts and manifold stay.

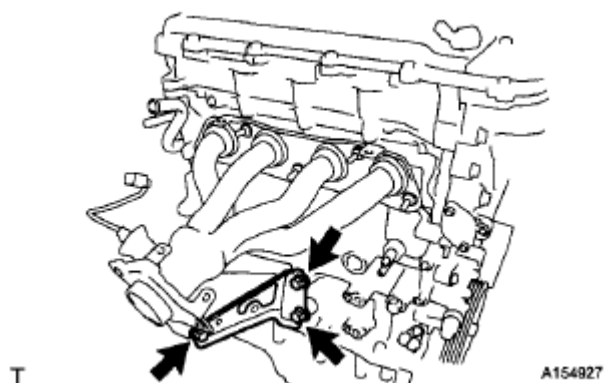


Fig. 206: Locating Manifold Stay Bolts

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

11. REMOVE EXHAUST MANIFOLD

- a. Remove the 5 nuts and exhaust manifold.

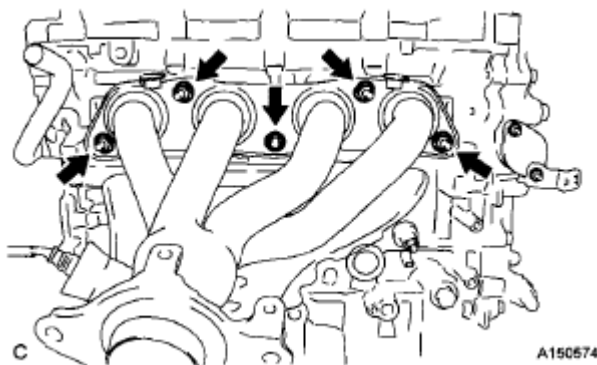


Fig. 207: Locating Exhaust Manifold Nuts

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

12. REMOVE VENTILATION HOSE

- a. Remove the ventilation hose.

13. DISCONNECT NO. 3 WATER BY-PASS HOSE

- a. Disconnect the No. 3 water by-pass hose from the water inlet housing.

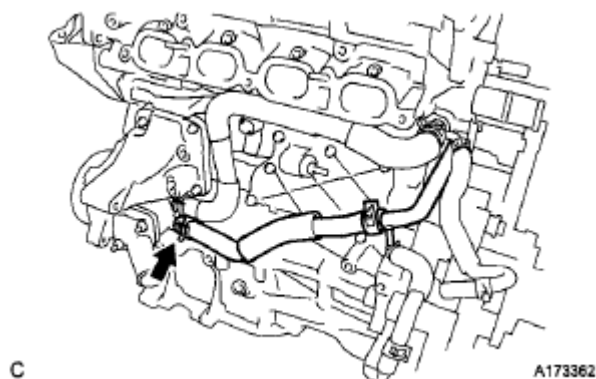


Fig. 208: Locating No. 3 Water By-Pass Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **REMOVE NO. 1 WATER BY-PASS PIPE**
 - a. Remove the 2 bolts and No. 1 water by-pass pipe.
15. **REMOVE WATER BY-PASS HOSE**
 - a. Remove the clamp and water by-pass hose.

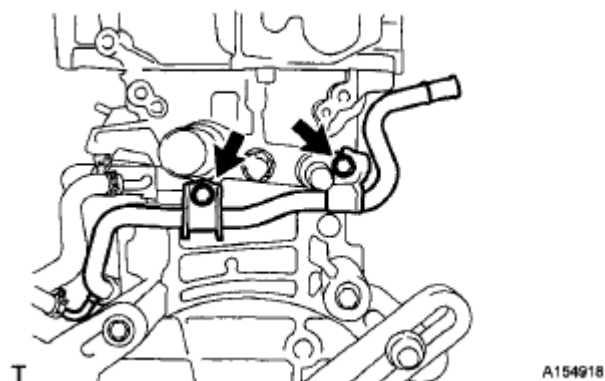


Fig. 209: Locating No. 1 Water By-Pass Pipe Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **REMOVE WATER INLET HOSE**
 - a. Remove the 2 clamps and water inlet hose.

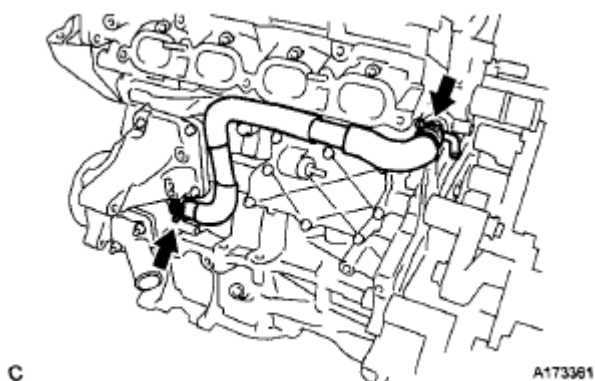


Fig. 210: Locating Water Inlet Hose Clamps

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

17. **REMOVE WATER INLET** (See **THERMOSTAT**)
18. **REMOVE THERMOSTAT** (See **THERMOSTAT**)
19. **REMOVE RADIO SETTING CONDENSER**
 - a. Remove the bolt and radio setting condenser.

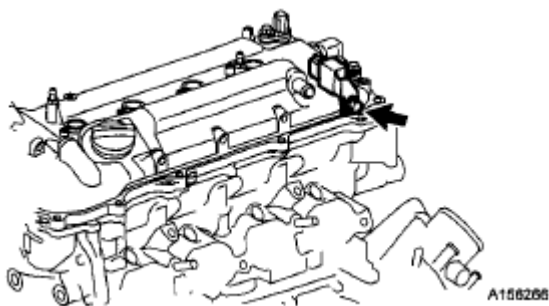


Fig. 211: Locating Radio Setting Condenser Bolt

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

DISASSEMBLY

1. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
 - a. Remove the oil filler cap.

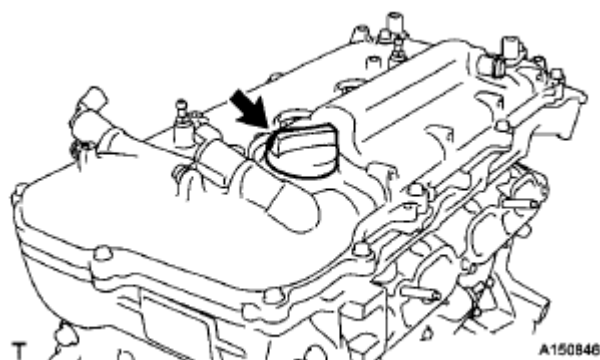


Fig. 212: Locating Oil Filler Cap

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

2. REMOVE OIL FILLER CAP GASKET

- a. Remove the gasket from the oil filler cap.

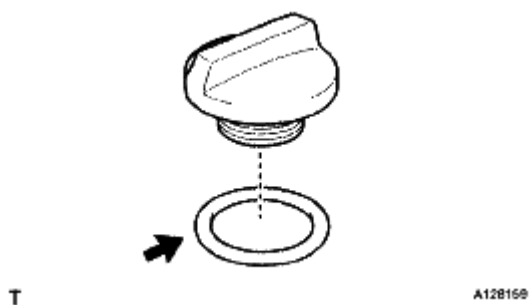


Fig. 213: Locating Oil Filler Cap Gasket

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

3. REMOVE ENGINE COVER JOINT

- a. Remove the 2 engine cover joints.

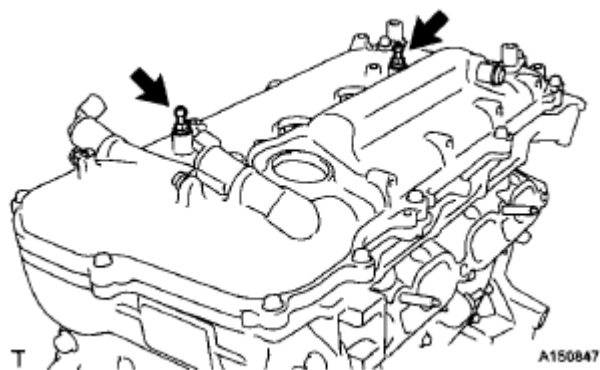
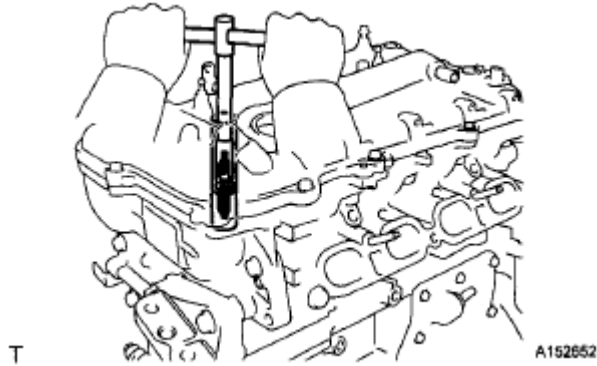


Fig. 214: Locating Engine Cover Joints

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

4. REMOVE SPARK PLUG

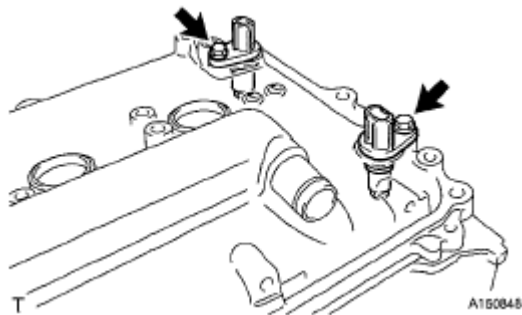
- a. Using a 14 mm spark plug wrench, remove the 4 spark plugs.

**Fig. 215: Removing Spark Plug**

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

5. REMOVE NO. 1 CRANK POSITION SENSOR

- a. Remove the 2 bolts and 2 sensors.

**Fig. 216: Locating No. 1 Crank Position Sensor Bolt**

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

6. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Remove the 2 bolts, O-rings, bracket and 2 oil control valves.

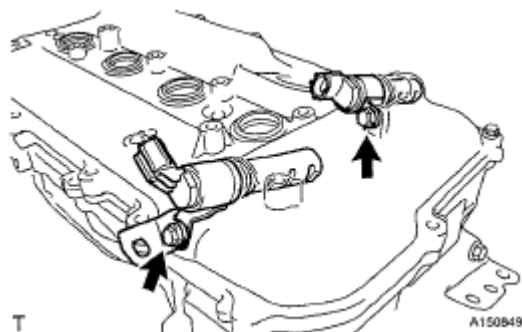


Fig. 217: Locating Camshaft Timing Oil Control Valve Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

- a. Remove the 13 bolts, seal washer and cylinder head cover.

NOTE: Be careful not to drop any of the gaskets into the engine when removing the cylinder head cover because the gaskets may stick to the cylinder head cover.

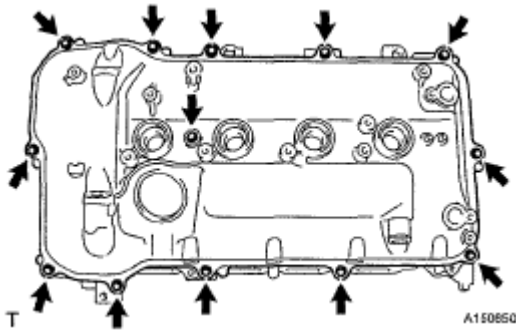


Fig. 218: Locating Cylinder Head Cover Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the cylinder head cover gasket.

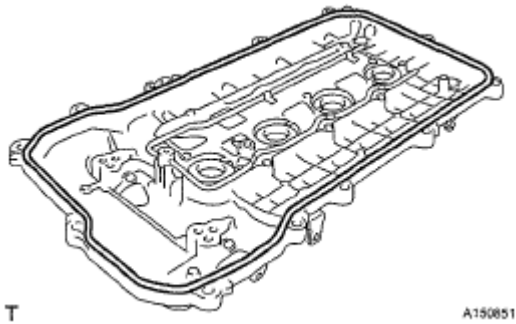


Fig. 219: Identifying Cylinder Head Cover Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the 3 gaskets from the camshaft bearing cap.

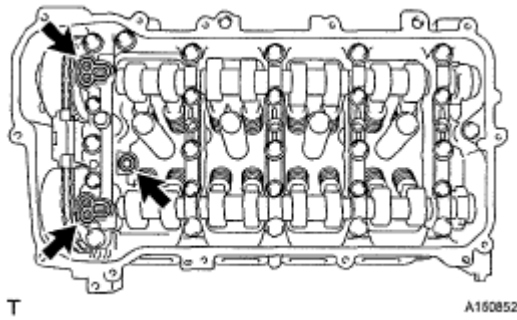


Fig. 220: Locating Camshaft Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See REMOVAL)
9. REMOVE CRANKSHAFT PULLEY (See REMOVAL)
10. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY
 - a. Remove the 2 nuts, bracket, tensioner and gasket.

NOTE: Do not turn the crankshaft without the chain tensioner installed.

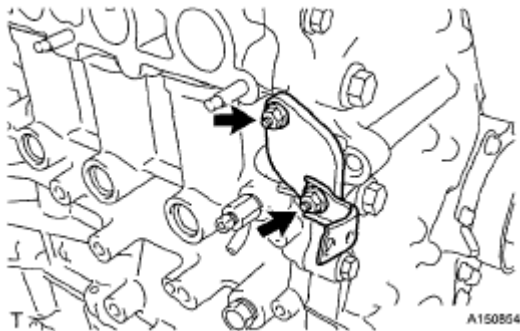


Fig. 221: Locating No. 1 Chain Tensioner Assembly And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. REMOVE CRANKSHAFT POSITION SENSOR
 - a. Remove the bolt and sensor.

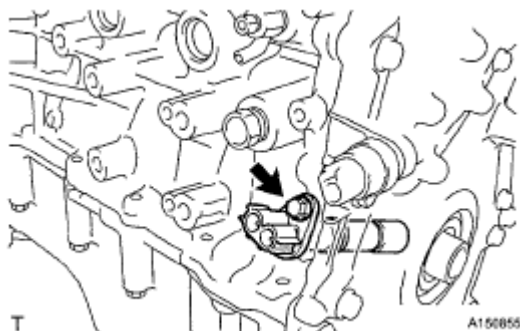


Fig. 222: Locating Crankshaft Position Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY

- a. Using a 24 mm deep socket wrench, remove the engine oil pressure switch assembly.

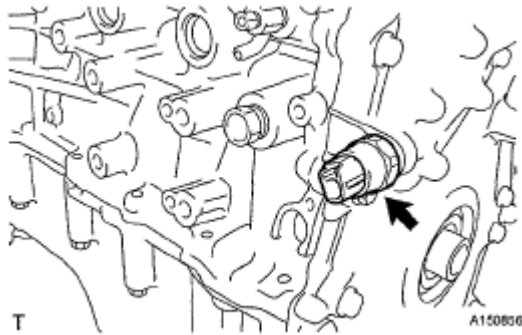


Fig. 223: Locating Engine Oil Pressure Switch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. REMOVE NO. 1 TAPER SCREW PLUG

- a. Remove the taper screw plug.

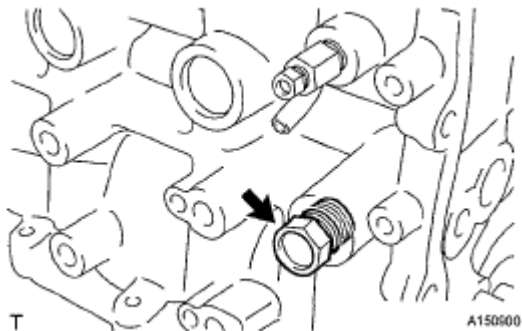


Fig. 224: Locating No. 1 Taper Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE KNOCK CONTROL SENSOR

- a. Remove the bolt and sensor.

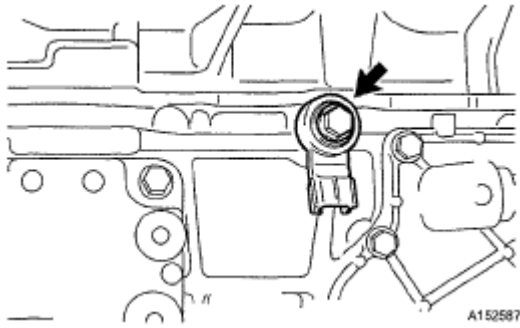


Fig. 225: Locating Knock Control Sensor Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

- a. Using a 19 mm deep socket wrench, remove the sensor.
- b. Remove the gasket from the engine coolant temperature sensor.

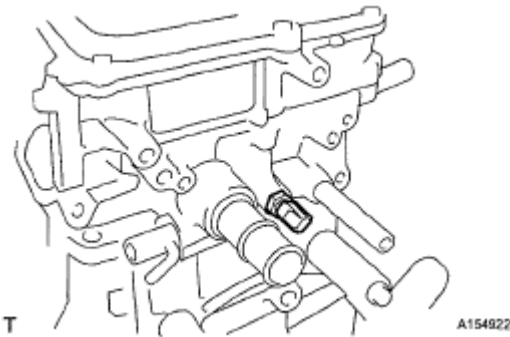


Fig. 226: Identifying Engine Coolant Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 16. REMOVE OIL FILTER CAP ASSEMBLY (See REPLACEMENT)**
- 17. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (See REMOVAL)**
- 18. REMOVE TIMING CHAIN COVER OIL SEAL**
 - a. Using a screwdriver and hammer, remove the oil seal.

NOTE: Be careful not to damage the timing chain cover.

HINT:

Tape the screwdriver tip before use.

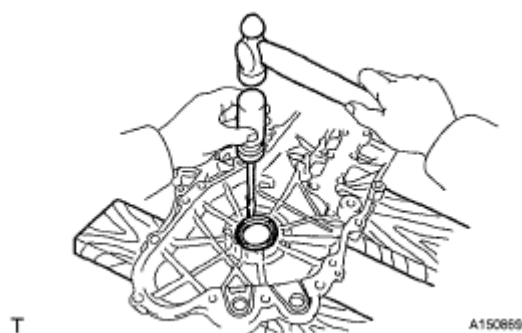


Fig. 227: Removing Timing Chain Cover Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. REMOVE WATER INLET HOUSING

- a. Remove the 3 bolts, gasket and water inlet housing.

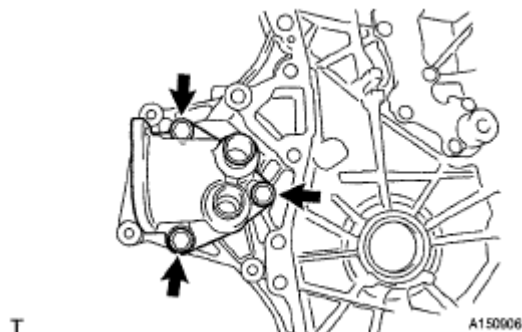


Fig. 228: Locating Water Inlet Housing Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. REMOVE NO. 1 GENERATOR BRACKET

- a. Remove the 4 bolts and No. 1 generator bracket.

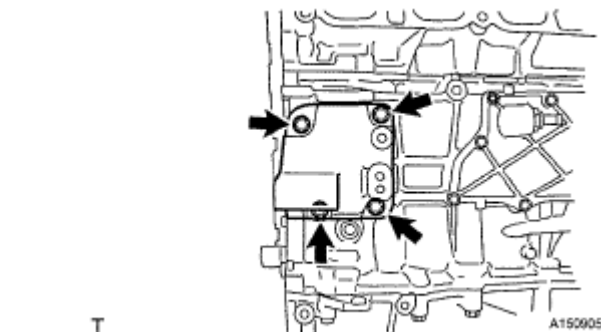


Fig. 229: Locating No. 1 Generator Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. REMOVE CHAIN TENSIONER SLIPPER (See REMOVAL)

22. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See REMOVAL)
23. REMOVE CHAIN SUB-ASSEMBLY (See REMOVAL)
24. REMOVE NO. 2 CHAIN VIBRATION DAMPER (See REMOVAL)
25. REMOVE CRANKSHAFT TIMING SPROCKET (See REMOVAL)
26. REMOVE NO. 2 CHAIN SUB-ASSEMBLY (See REMOVAL)
27. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE
 - a. Remove the No. 1 crankshaft position sensor plate.

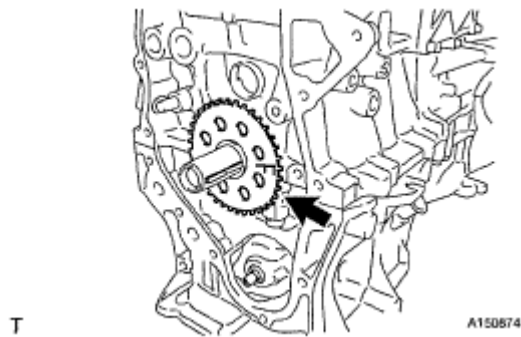


Fig. 230: Locating No. 1 Crankshaft Position Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. REMOVE CRANKSHAFT TIMING GEAR KEY
 - a. Using a screwdriver, remove the 2 crankshaft timing gear keys.

HINT:

Tape the screwdriver tip before use.

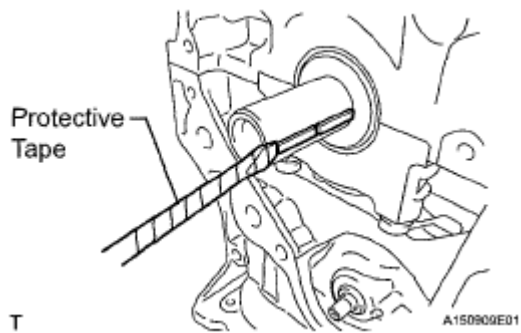


Fig. 231: Removing Crankshaft Timing Gear Keys
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY
 - a. Check the lock of the camshaft timing gear.
 - b. Release the lock pin.

NOTE: Before removing the camshaft timing gear assembly, make sure that the lock pin has been released.

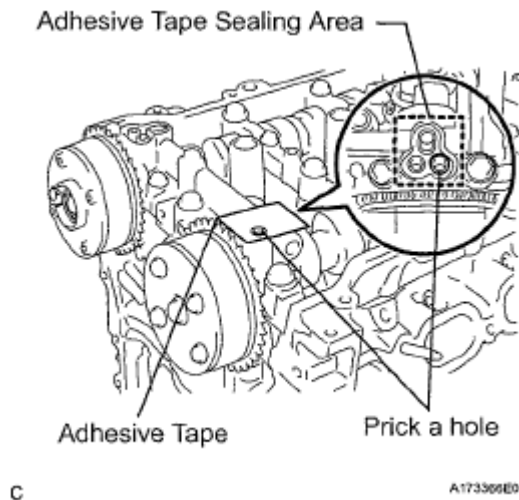


Fig. 232: Identifying Camshaft Timing Gear Sealing Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. After cleaning and degreasing the WT oil hole on the intake side of the No. 1 camshaft bearing cap, completely seal the oil hole with adhesive tape or equivalent as shown in the illustration to prevent air from leaking.

NOTE: Be sure to cover the oil hole completely because air leaks due to insufficient sealing will prevent the lock pin from being released.

2. Prick a hole in the tape covering the oil hole as shown in the illustration. (Procedure A)
3. Apply approximately 150 kPa (1.5 kgf/cm², psi) of air pressure to the hole pricked in procedure A to release the lock pin.

NOTE:

- If air leaks out, reattach the adhesive tape.
- Cover the oil hole with a piece of cloth when applying air pressure to prevent oil from spraying.
- Do not lock the camshaft timing gear assembly. If it is locked, release the lock pin again.

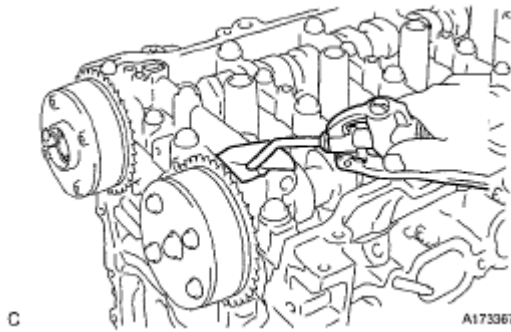


Fig. 233: Applying Air Pressure To Lock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.
4. Remove the adhesive tape from the No. 1 camshaft bearing cap.
 - c. Remove the flange bolt while holding the hexagonal portion of the camshaft, then remove the camshaft timing gear assembly.

NOTE:

- Before removing the camshaft timing gear, make sure that the lock pin has been released.
- Be sure not to remove the other 4 bolts.
- Keep the camshaft timing gear assembly horizontal while removing it from the camshaft.

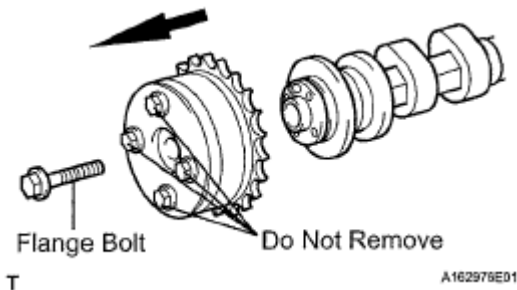


Fig. 234: Identifying Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Remove the flange bolt while holding the hexagonal portion of the camshaft, then remove the camshaft timing exhaust gear assembly.

NOTE:

- Be sure not to remove the other 4 bolts.
- Keep the camshaft timing exhaust gear assembly horizontal while removing it from the camshaft.

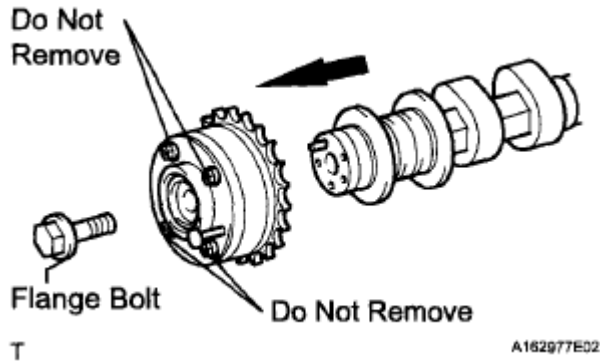


Fig. 235: Identifying Flange Bolt

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

31. REMOVE CAMSHAFT BEARING CAP

- Uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

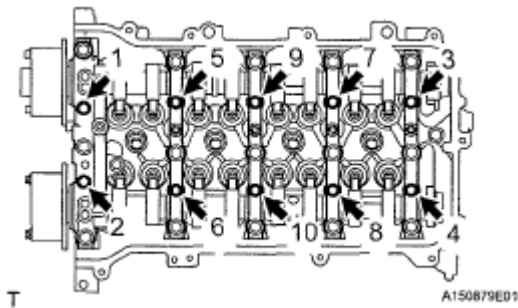


Fig. 236: Locating Camshaft Bearing Cap Bolts Loosen Sequence

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

- Uniformly loosen and remove the 15 bearing cap bolts in the sequence shown in the illustration.

NOTE: Uniformly loosen the bolts while keeping the camshaft level.

- Remove the 5 bearing caps.

HINT:

Arrange the removed parts in the correct order.

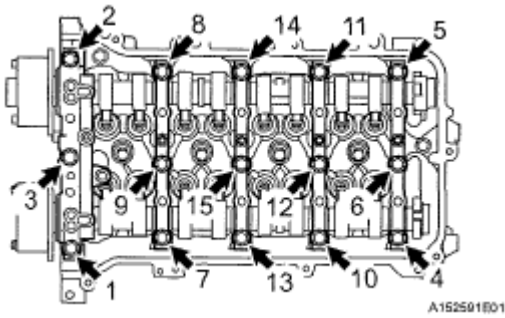


Fig. 237: Locating Camshaft Bearing Cap Bolts Loosen Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. REMOVE CAMSHAFT

- a. Remove the camshaft.

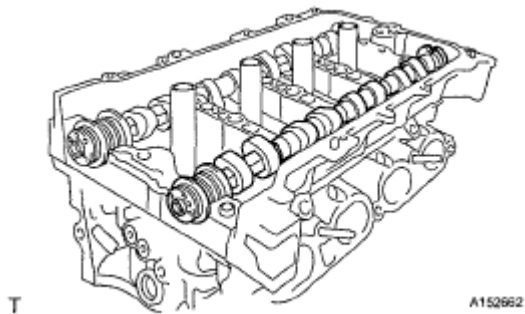


Fig. 238: Identifying Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. REMOVE NO. 2 CAMSHAFT

- a. Remove the No. 2 camshaft.

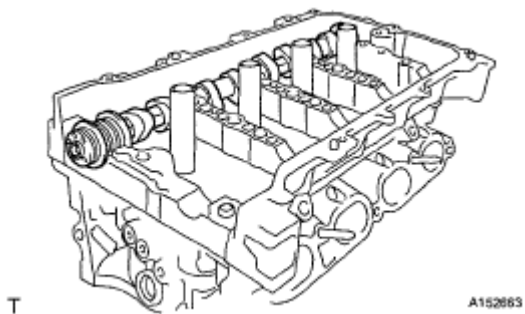


Fig. 239: Identifying No. 2 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

34. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

- a. Remove the 16 valve rocker arms.

HINT:

Arrange the removed parts in the correct order.

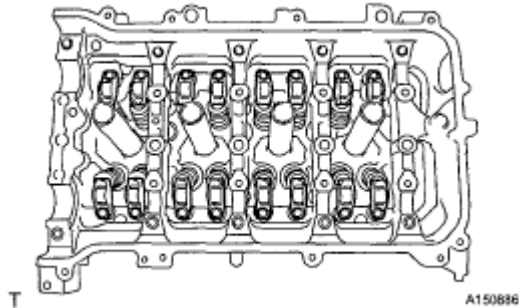


Fig. 240: Locating Valve Rocker Arms
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. 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.

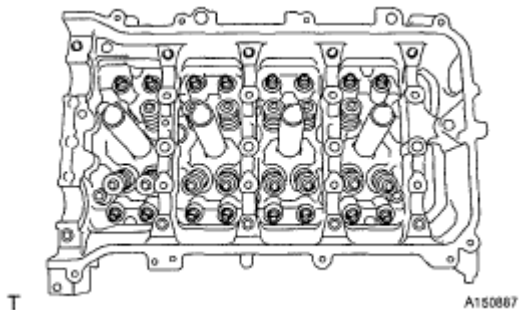


Fig. 241: Identifying Valve Lash Adjuster Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. REMOVE OIL CONTROL VALVE FILTER

- a. Remove the oil control valve filter.

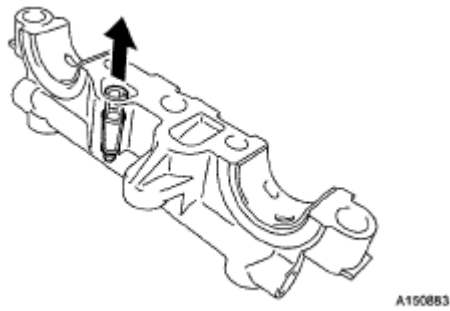


Fig. 242: Removing Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. REMOVE NO. 1 CAMSHAFT BEARING

- a. Remove the 2 No. 1 camshaft bearings.

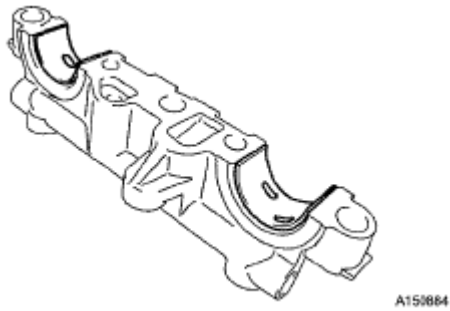


Fig. 243: Identifying No. 1 Camshaft Bearings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. REMOVE NO. 2 CAMSHAFT BEARING

- a. Remove the 2 No. 2 camshaft bearings.

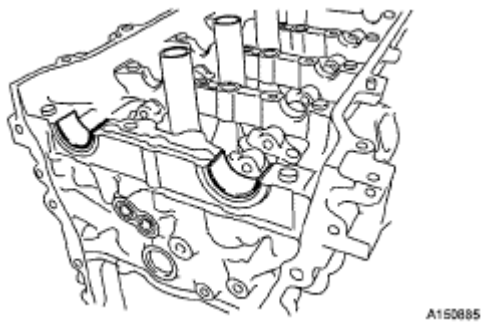


Fig. 244: Identifying No. 2 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY

- a. Remove the 2 bolts.

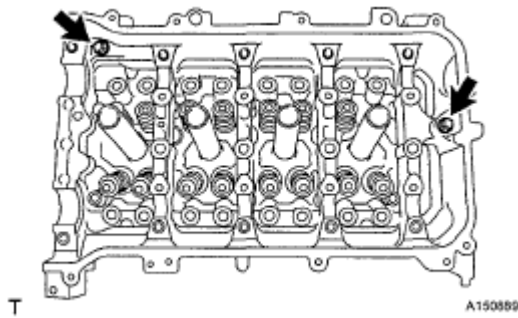


Fig. 245: Locating Camshaft Housing Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

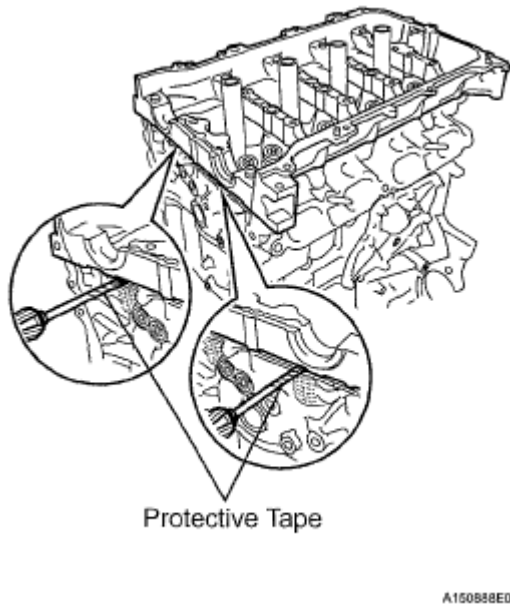


Fig. 246: Prying Between Cylinder Head And Camshaft Housing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

Tape the screwdriver tip before use.

40. **REMOVE CYLINDER HEAD SUB-ASSEMBLY** (See **REMOVAL**)
41. **REMOVE CYLINDER HEAD GASKET** (See **REMOVAL**)
42. **REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY**

- a. Remove the water drain cock plug from the water drain cock sub-assembly.
- b. Remove the cylinder block water drain cock sub-assembly from the cylinder block.

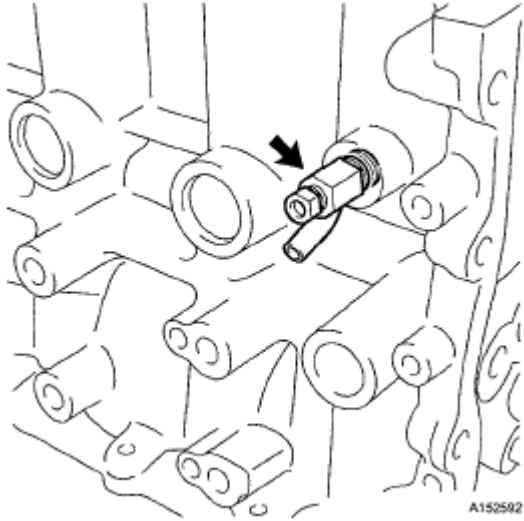


Fig. 247: Removing Cylinder Block Water Drain Cock Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. **REMOVE VENTILATION VALVE SUB-ASSEMBLY**
- a. Remove the ventilation valve.

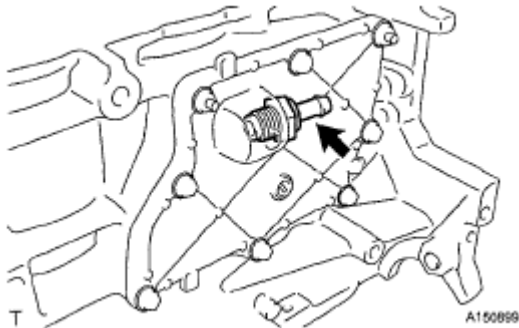


Fig. 248: Locating Ventilation Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

44. **REMOVE OIL PAN DRAIN PLUG**
- a. Remove the oil pan drain plug and gasket.

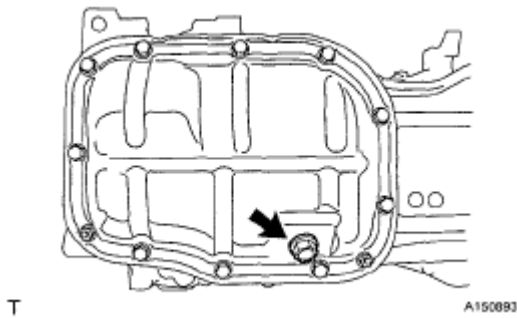


Fig. 249: Locating Oil Pan Drain Plug

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

45. **REMOVE NO. 2 OIL PAN SUB-ASSEMBLY** (See REMOVAL)
46. **REMOVE OIL PUMP ASSEMBLY** (See DISASSEMBLY)
47. **REMOVE REAR ENGINE OIL SEAL**
 - a. Using a knife, cut off the oil seal lip.
 - b. Using a screwdriver with its tip taped, pry out the oil seal.

NOTE: After removing the oil seal, check the crankshaft for damage. If it is damaged, smooth the surface with 400-grit sandpaper.

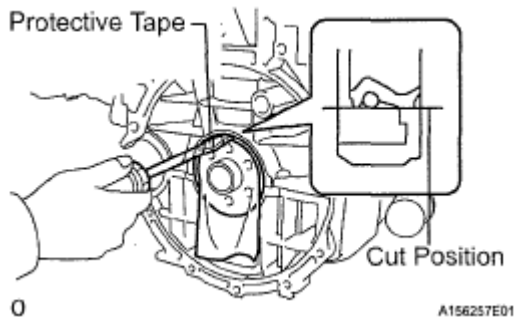


Fig. 250: Removing Rear Engine Oil Seal

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

48. **REMOVE STIFFENING CRANKCASE ASSEMBLY**
 - a. Uniformly loosen and remove the 11 bolts.

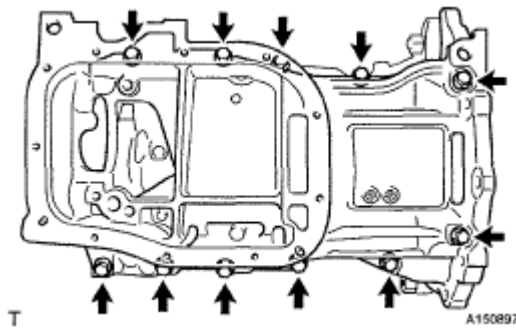


Fig. 251: Locating Stiffening Crankcase Assembly Bolts Loosen Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a screwdriver, remove the crankcase by prying between the crankcase and cylinder block.

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

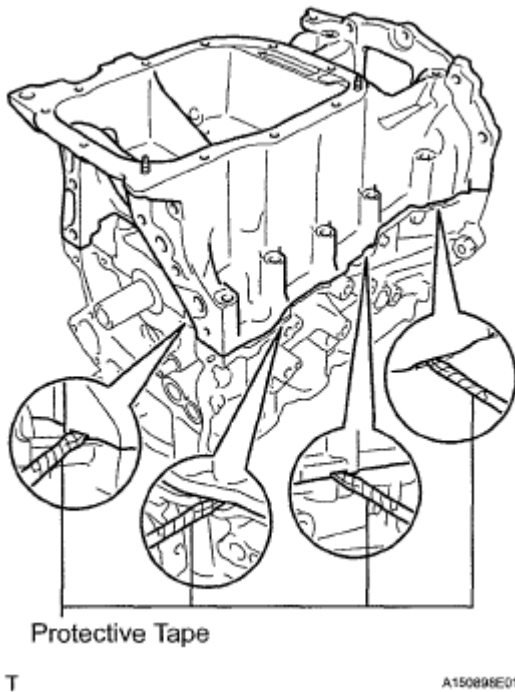


Fig. 252: Prying Between Crankcase And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

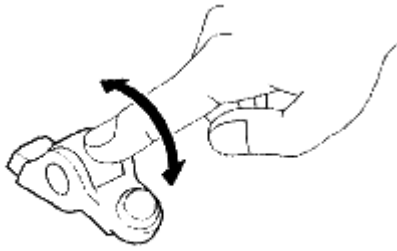
INSPECTION

1. INSPECT NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

- a. Turn the roller by hand to check that it turns smoothly.

HINT:

If the roller does not turn smoothly, replace the valve rocker arm sub-assembly.



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Fig. 253: Inspecting 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 lash adjuster free of dirt and foreign matter.
- Only use clean engine oil.

- a. Place the lash adjuster into a container filled with 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 it.

OK:

Plunger moves up and down .

NOTE:

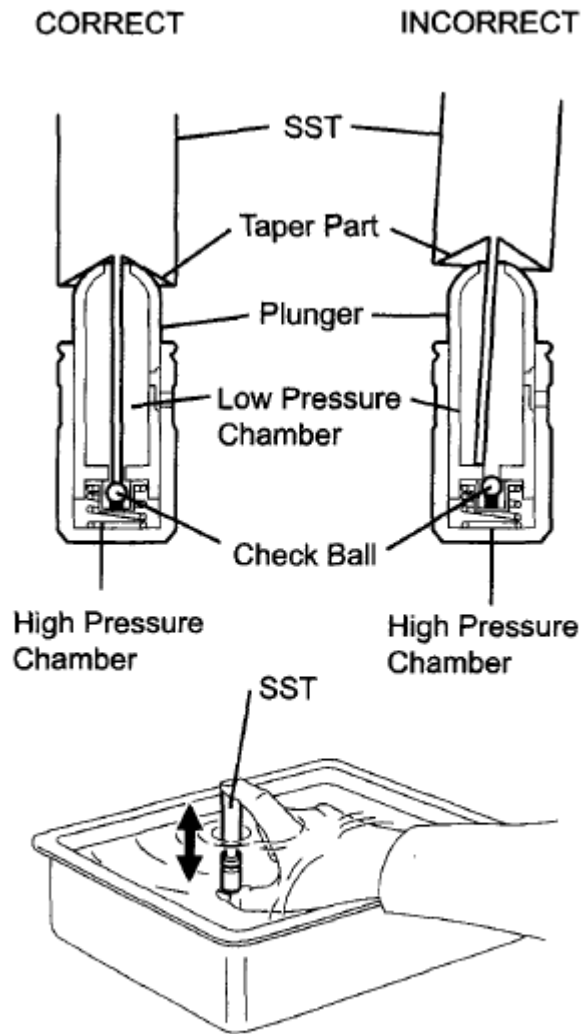
When bleeding the high-pressure chamber, make sure that the tip of SST is actually pressing the check ball as shown in the illustration. If the check ball is not pressed, the high-pressure chamber will not be bled.

- e. After bleeding, remove SST. Then, try to quickly and firmly press the plunger by hand.

OK:

Plunger is very difficult to move .

If the result is not as specified, replace the lash adjuster.



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Fig. 254: Identifying Plunger Correct And Incorrect Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- Install the camshaft timing gear (See **INSTALLATION**).
- Check the lock of the camshaft timing gear.
 - Confirm that the camshaft timing gear is locked.
- Release the lock pin.
 - 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 groove of the camshaft. Plug three of the paths with pieces of

rubber.

2. 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.

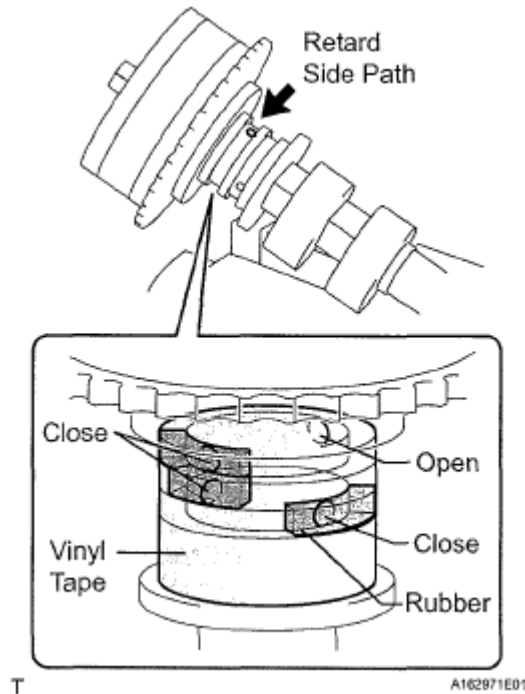


Fig. 255: Releasing Lock Pin

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

3. While applying approximately 150 kPa (1.5 kgf/cm², 22 psi) of air pressure to the oil paths, 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 lock the camshaft timing gear assembly. If it is locked, 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 leaks from the port, releasing the lock pin may be difficult.

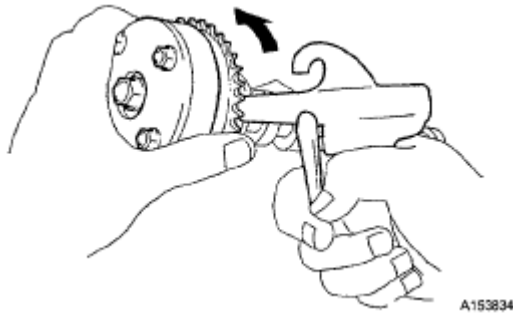


Fig. 256: Applying Air Pressure To Oil Paths

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

d. 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 lock the camshaft timing gear assembly. If it is locked, release the lock pin again.

4. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Install the camshaft timing exhaust gear (See **INSTALLATION**).
- b. Check the camshaft timing exhaust gear lock.
 1. Make sure that the camshaft timing exhaust gear is locked.
- c. Release the lock pin.
 1. Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

The 4 oil paths are provided in the grooves. Plug 2 paths with rubber pieces.

2. 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.

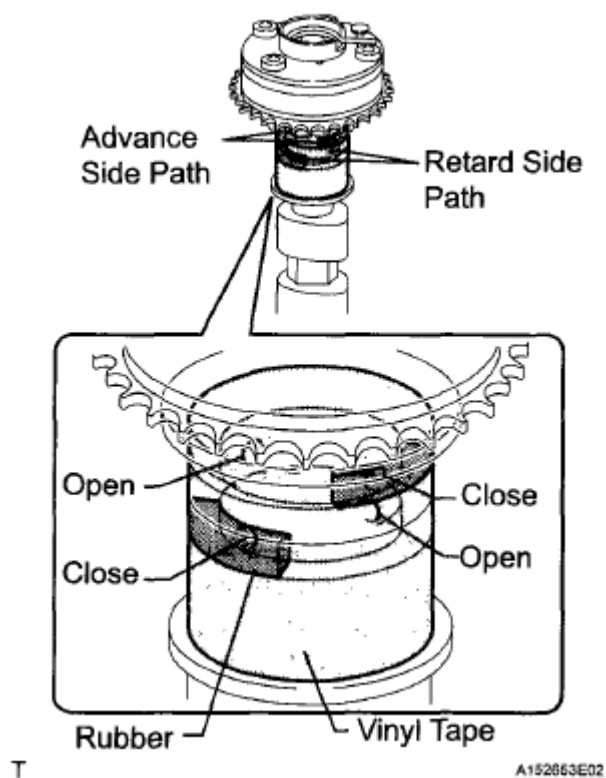


Fig. 257: Releasing Lock Pin

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

3. Apply approximately 200 kPa (2.0 kgf/cm², 28 psi) of air pressure to the 2 paths (the advance side path and the retard side path).

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

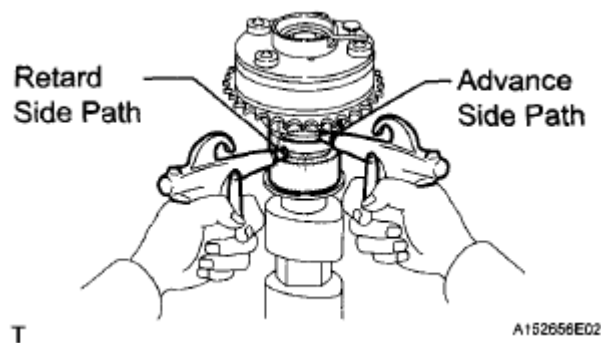


Fig. 258: Applying Air Pressure To Paths

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

4. Make sure 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.

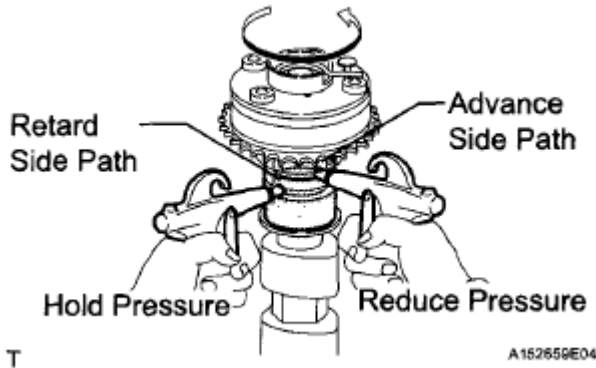


Fig. 259: Applying Air Pressure To Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. When the camshaft timing exhaust gear moves to the most retarded position, release the air pressure from the advance side path, 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.

- d. Check for smooth rotation.

1. Turn the camshaft timing exhaust gear within its movable range (19 to 21°) 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, 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.

- e. Check the lock at the most advanced position.

1. Make sure that the camshaft timing exhaust gear is locked at the most advanced position.

5. INSPECT CHAIN SUB-ASSEMBLY

- a. Pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.
- b. Using a vernier caliper, measure the length of 15 links.

Maximum chain elongation:

115.2 mm (4.535 in.)

NOTE: Perform the measurement at 3 random places. Use the average of the measurements.

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

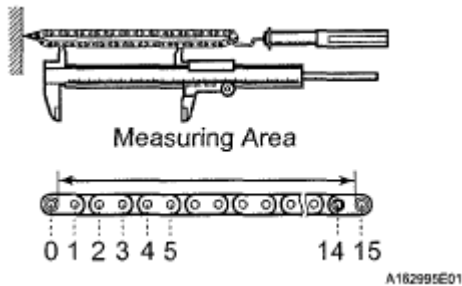


Fig. 260: Identifying Chain Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSPECT NO. 2 CHAIN SUB-ASSEMBLY

- Pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.
- Using a vernier caliper, measure the length of 15 links.

Maximum chain elongation:

102.1 mm (4.019 in.)

NOTE: Perform the measurement at 3 random places. Use the average of the measurements.

If the average elongation is greater than the maximum, replace the No. 2 chain.

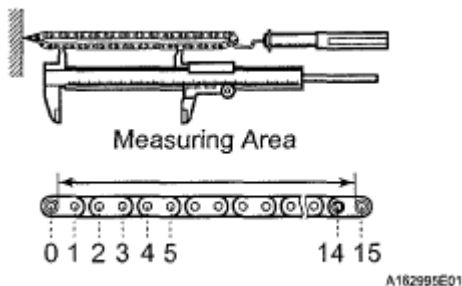


Fig. 261: Identifying No. 2 Chain Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT OIL PUMP DRIVE GEAR

- Place the chain around the gear.
- Using a vernier caliper, measure the diameter of the gear and chain.

Minimum gear diameter (with chain):

48.2 mm (1.898 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

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

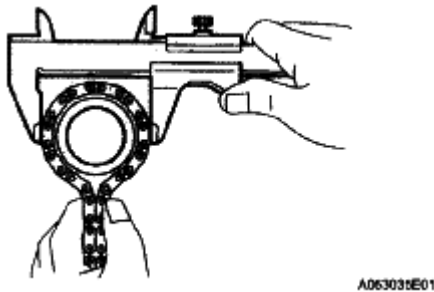


Fig. 262: Measuring Diameter Of Gear And Chain
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSPECT OIL PUMP DRIVE SHAFT GEAR

- a. Place the chain around the gear.
- b. Using a vernier caliper, measure the diameter of the gear and chain.

Minimum gear diameter (with chain):

48.8 mm (1.921 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

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

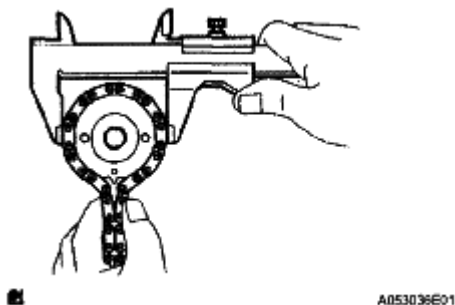


Fig. 263: Inspecting Oil Pump Drive Shaft Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- a. Place the chain around the gear.
- b. Using a vernier caliper, measure the diameter of the gear and chain.

Minimum gear diameter (with chain):

96.8 mm (3.811 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

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

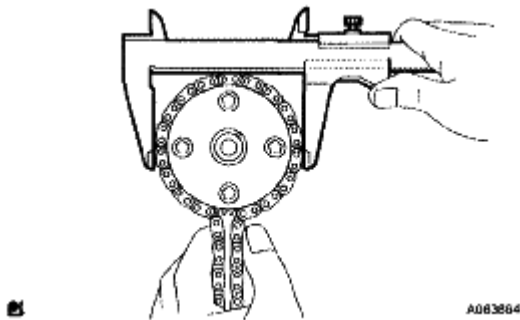


Fig. 264: Inspecting Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Place the chain around the sprocket.
- b. Using a vernier caliper, measure the diameter of the sprocket and chain.

Minimum sprocket diameter (with chain):

96.8 mm (3.811 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

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

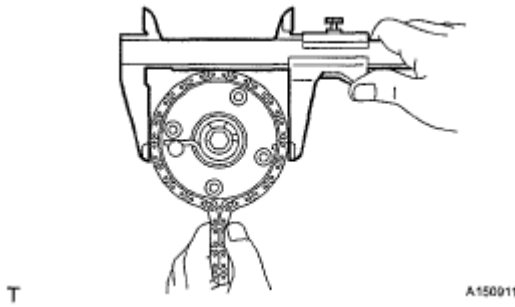


Fig. 265: Inspecting Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. INSPECT CRANKSHAFT TIMING GEAR

- a. Place the chain around the gear.
- b. Using a vernier caliper, measure the diameter of the gear and chain.

Minimum gear diameter (with chain):

51.1 mm (2.012 in.)

NOTE: The vernier caliper must be in contact with the chain rollers when measuring.

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

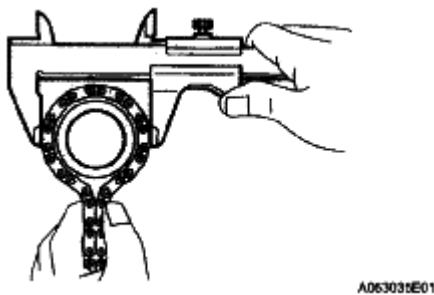


Fig. 266: Inspecting Crankshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSPECT CHAIN TENSIONER SLIPPER

- a. Using a vernier caliper, measure the tensioner slipper wear.

Maximum wear:

1.0 mm (0.039 in.)

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

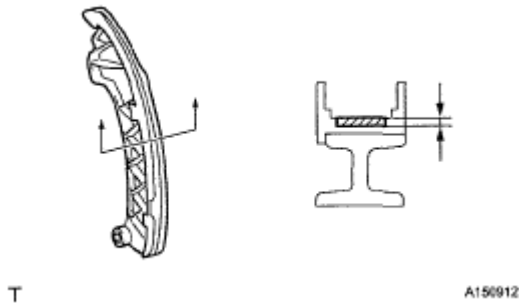


Fig. 267: Identifying Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSPECT NO. 1 CHAIN VIBRATION DAMPER

- a. Using a vernier caliper, measure the vibration damper wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the No. 1 chain vibration damper.

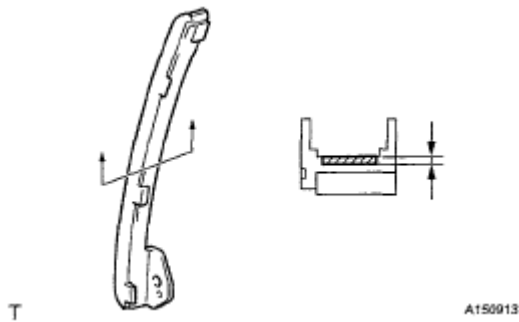


Fig. 268: Identifying No. 1 Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT NO. 2 CHAIN VIBRATION DAMPER

- a. Using a vernier caliper, measure the vibration damper wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the No. 2 chain vibration damper.

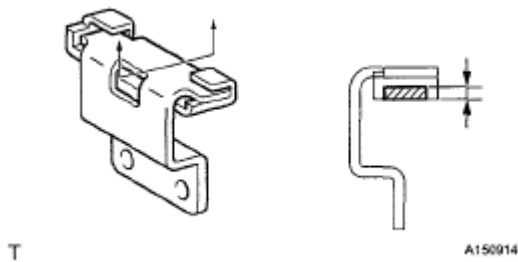


Fig. 269: Identifying No. 2 Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSPECT CHAIN TENSIONER PLATE

- Using a vernier caliper, measure the chain tensioner plate wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the chain tensioner plate.

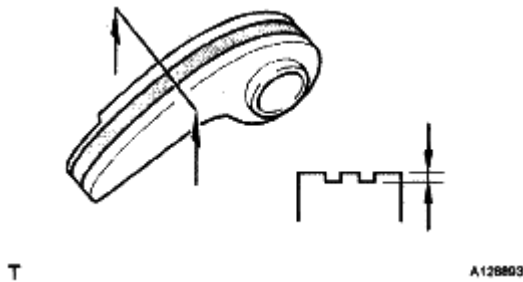


Fig. 270: Identifying Chain Tensioner Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. INSPECT NO. 1 CHAIN TENSIONER

- Check that the plunger moves smoothly when the ratchet pawl is raised by hand.
- Release the ratchet pawl, then check that the plunger is locked in place by the ratchet pawl and does not move when pushed by hand.

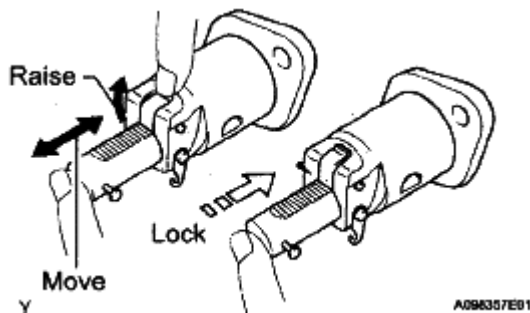
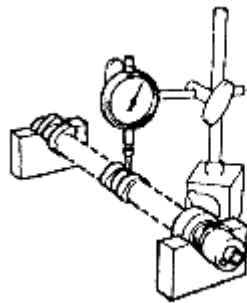


Fig. 271: Inspecting No. 1 Chain Tensioner**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.****17. INSPECT CAMSHAFT**

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

Maximum circle runout:**0.04 mm (0.0016 in.)**

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



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Fig. 272: Inspecting Camshaft**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:**42.816 to 42.916 mm (1.6857 to 1.6896 in.)****Minimum cam lobe height:****42.666 mm (1.6798 in.)**

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

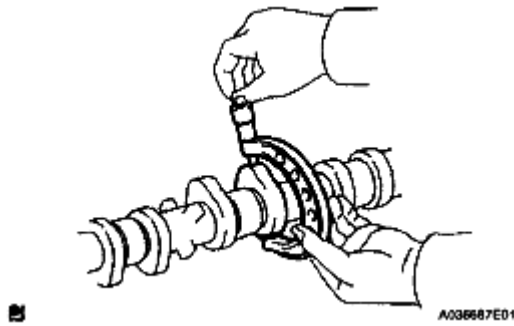


Fig. 273: Measuring Cam Lobe Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard Journal Diameter

STANDARD JOURNAL DIAMETER SPECIFICATION

Journal Position	Specified Condition
No. 1	34.449 to 34.465 mm (1.3563 to 1.3569 in.)
Other	22.949 to 22.965 mm (0.9035 to 0.9041 in.)

If the journal diameter is not as specified, check the oil clearance (See **INSPECTION**).

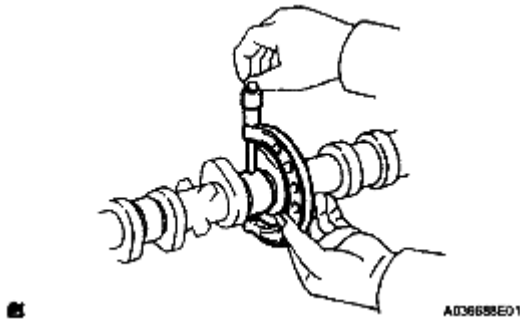


Fig. 274: Measuring Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

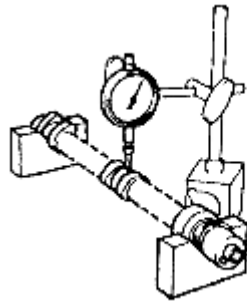
18. INSPECT NO. 2 CAMSHAFT

- a. Inspect the No. 2 camshaft for runout.
 - 1. Place the No. 2 camshaft on V-blocks.
 - 2. Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

0.04 mm (0.0016 in.)

If the circle runout is greater than the maximum, replace the No. 2 camshaft.



EM01628D01

Fig. 275: Measuring Circle Runout 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.

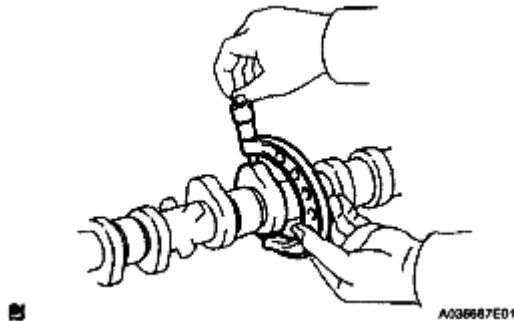
Standard cam lobe height:

44.336 to 44.436 mm (1.7455 to 1.7494 in.)

Minimum cam lobe height:

44.186 mm (1.7396 in.)

If the cam lobe height is less than the minimum, replace the No. 2 camshaft.



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Fig. 276: Measuring Cam Lobe Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard Journal Diameter

STANDARD JOURNAL DIAMETER SPECIFICATION

Journal Position	Specified Condition
No. 1	34.449 to 34.465 mm (1.3563 to 1.3569 in.)
Other	22.949 to 22.965 mm (0.9035 to 0.9041 in.)

If the journal diameter is not as specified, check the oil clearance (See **INSPECTION**).

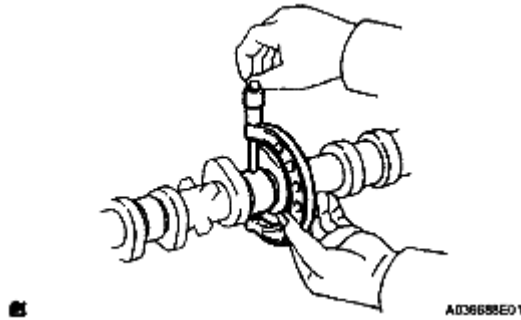


Fig. 277: Measuring Journal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSPECT CYLINDER HEAD SET BOLT

- Using a vernier caliper, measure the length of the cylinder head set bolt from the seat to the end.

Standard bolt length:

146.8 to 148.2 mm (5.7795 to 5.8346 in.)

Maximum bolt length:

149.2 mm (5.874 in.)

If the bolt length is greater than the maximum, replace the cylinder head set bolt.

- Using a vernier caliper, measure the minimum diameter of the elongated thread at the measuring point.

Standard outside diameter:

9.77 to 9.96 mm (0.3846 to 0.3921 in.)

Minimum outside diameter:

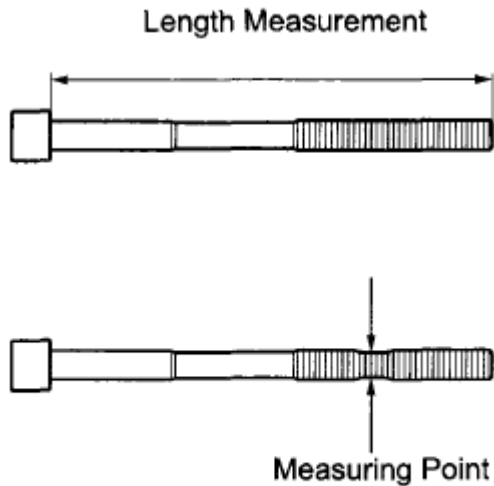
9.4 mm (0.3701 in.)

HINT:

Using a straightedge, visually check for thinner areas of the threaded part of the cylinder head set

bolt.

If the diameter is less than the minimum, replace the cylinder head set bolt.



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Fig. 278: Identifying Cylinder Head Set Bolt Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. INSPECT EXHAUST MANIFOLD

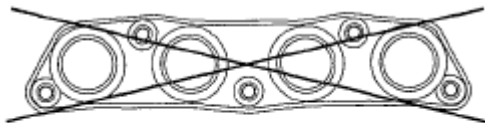
- Using a precision straightedge and feeler gauge, measure the warpage on the contact surface of the cylinder head.

Maximum warpage:

0.7 mm (0.028 in.)

HINT:

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



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Fig. 279: Inspecting Exhaust Manifold
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

1. REPLACE RING PIN

- a. Remove the 2 ring pins.
- b. Install 2 new ring pins to the crankcase.

Standard protrusion:

3 mm (0.118 in.)

2. REPLACE STUD BOLT

- a. For crankcase:
 1. Remove the 2 stud bolts.

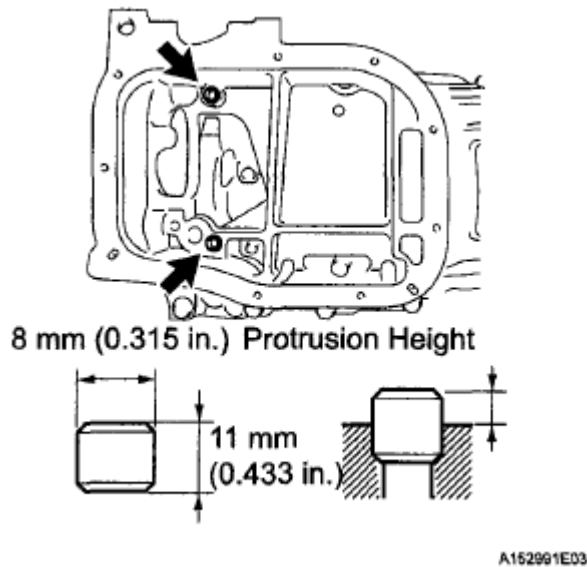


Fig. 280: Locating Stud Bolt

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

2. Using a "TORX" socket E5, install the 2 stud bolts as shown in the illustration.

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

- b. For water inlet housing:
 1. Remove the 2 stud bolts.

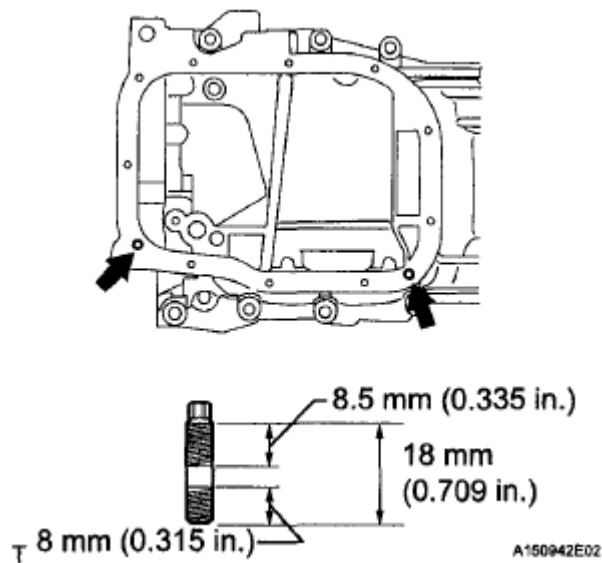


Fig. 281: Locating Stud Bolt

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

2. Using a "TORX" socket E5, install the 2 stud bolts as shown in the illustration.

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

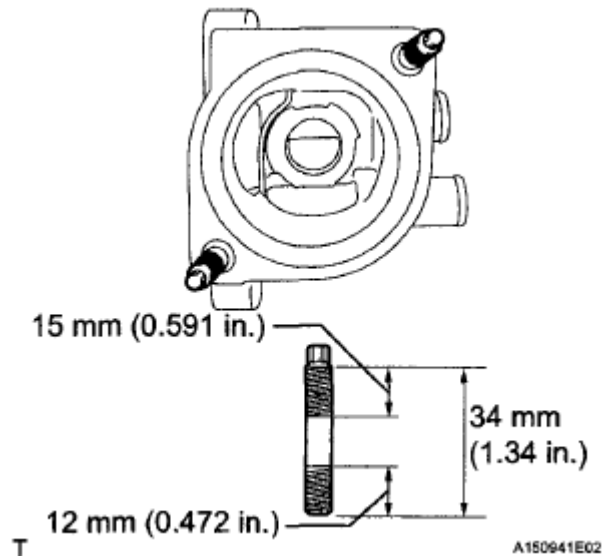


Fig. 282: Identifying Stud Bolt Dimension

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

3. REPLACE SPARK PLUG TUBE GASKET

- a. Pry up the claws of the ventilation baffle plate.

NOTE: Do not deform the claws of the baffle plate more than necessary.

- b. Remove the 4 gaskets from the cylinder head covers.

NOTE:

- Prevent the plug tube gaskets from being deformed as much as possible. The removed gaskets will be used when reinstalling the gaskets.
- Do not damage the connection of the cylinder head cover.



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Fig. 283: Identifying Spark Plug Tube Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Using a cutter, cut off the sealing part of the removed plug tube gasket.

Before Cutting Off After Cutting Off



T  : Area to be Cut Off

A126763E02

Fig. 284: Identifying Plug Tube Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. Using the plug tube gasket which has had the sealing part cut off, uniformly press in a new plug tube gasket all the way.

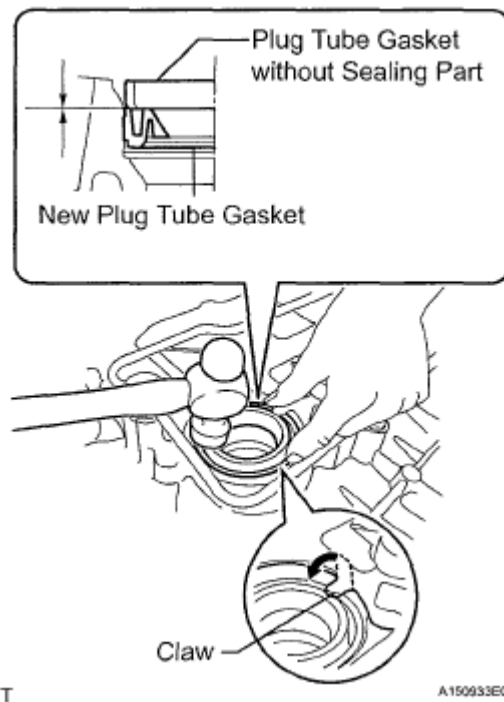


Fig. 285: Pressing Plug Tube Gasket
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- Keep the lip free of foreign matter.
- Do not tap on the oil seal at an angle.

HINT:

If a plug tube gasket that will be used to install a new gasket is deformed, and cannot be positioned on a new gasket, correct the deformation using pliers.

- c. Return the claws of the ventilation baffle plate to their original positions.

4. REPLACE TIMING CHAIN COVER OIL SEAL

- a. Using a screwdriver and hammer, remove the oil seal.

NOTE:

Be careful not to damage the timing chain cover oil seal.

HINT:

Tape the screwdriver tip before use.

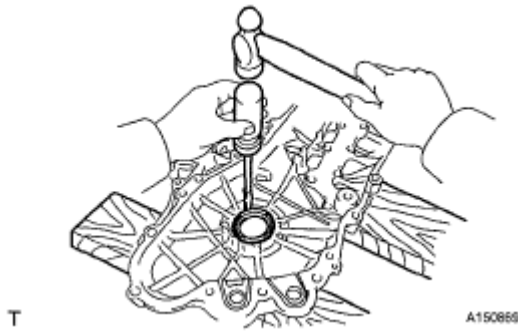


Fig. 286: Removing Timing Chain Cover Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, tap in a new oil seal until its surface is flush with the timing gear case edge.

SST 09223-22010

- c. Apply a light coat of MP grease to the lip of the oil seal.

NOTE:

- Keep the lip free of foreign matter.
- Do not tap on the oil seal at an angle.
- Make sure that the oil seal edge does not stick out of the timing chain cover.

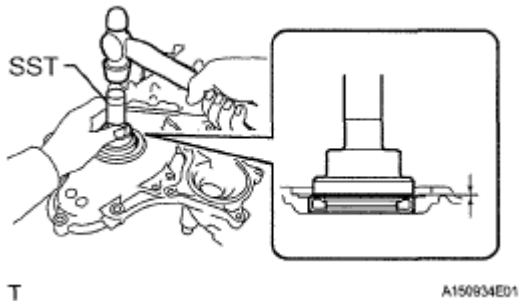


Fig. 287: Tapping Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REPLACE REAR ENGINE OIL SEAL

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

NOTE:

After removing the oil seal, check the crankshaft for damage. If it is damaged, smooth the surface with 400-grit sandpaper.

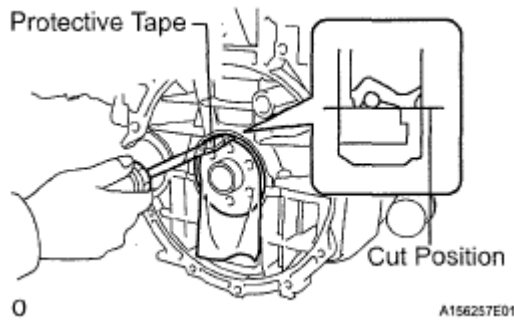


Fig. 288: Removing Rear Engine Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

SST 09223-15030, 09950-70010 (09951 -07100)

NOTE:

- Keep the lip free of foreign matter.
- Do not tap on the oil seal at an angle.

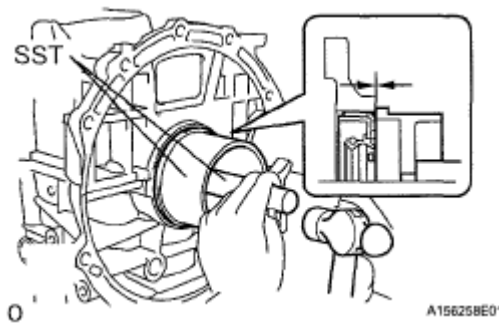


Fig. 289: Tapping Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Apply MP grease to a new oil seal lip.

NOTE: Wipe off extra grease on the crankshaft.

REASSEMBLY

1. INSTALL STIFFENING CRANKCASE ASSEMBLY

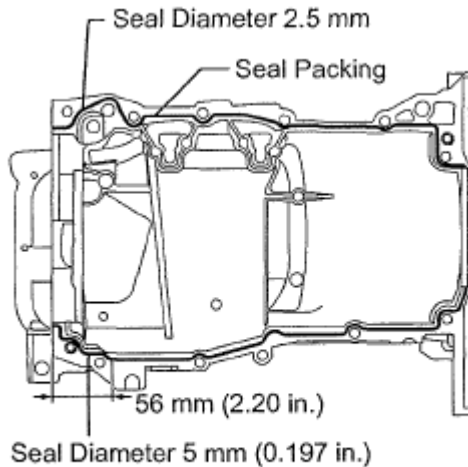
- a. Apply seal packing in a continuous bead (diameter: 2.5 mm (0.0984 in.)) to the places shown in the illustration.

Seal packing:

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

NOTE:

- Remove any oil from the contact surfaces.
- Install the crankcase within 3 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing the stiffening crankcase.



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Fig. 290: Identifying Stiffening Crankcase Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the stiffening crankcase with the 11 bolts.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

Bolt Length

BOLT LENGTH CHART

Item	Length
Bolt A	138 mm (5.43 in.)
Bolt B	35 mm (1.38 in.)
Bolt C	70 mm (2.76 in.)

- c. Recheck the torque for bolts 1 and 2.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

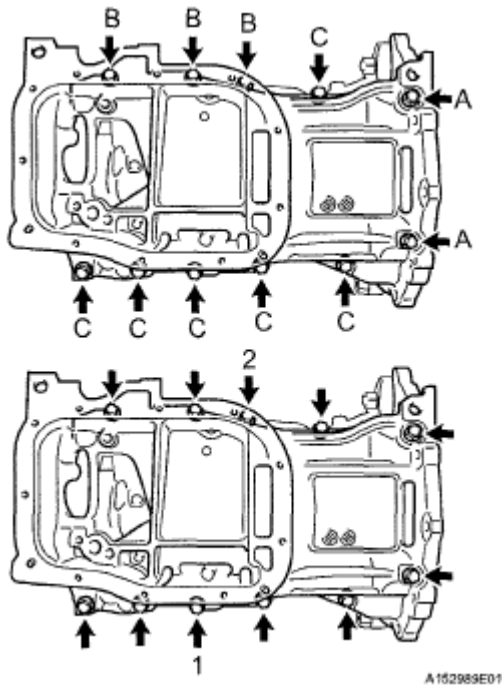


Fig. 291: Locating Stiffening Crankcase With Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Wipe off any excess seal packing with a clean piece of cloth.

2. INSTALL REAR ENGINE OIL SEAL

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

SST 09223-15030, 09950-70010 (09951 -07100)

NOTE:

- Keep the lip free of foreign matter.
- Do not tap on the oil seal at an angle.

- b. Apply MP grease to a new oil seal lip.

NOTE: Wipe off extra grease on the crankshaft.

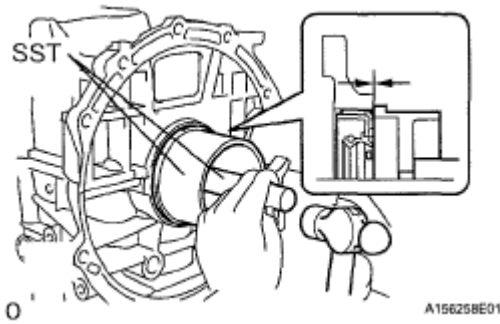


Fig. 292: Installing Rear Engine Oil Seal

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

3. INSTALL OIL PUMP ASSEMBLY (See INSTALLATION)
4. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY (See INSTALLATION)
5. INSTALL OIL PAN DRAIN PLUG
 - a. Install a new gasket and the oil pan drain plug.

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

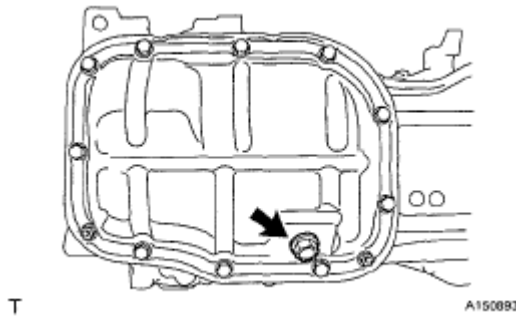


Fig. 293: Locating Oil Pan Drain Plug

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

6. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY
 - a. Apply adhesive to the threads of the drain cock.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

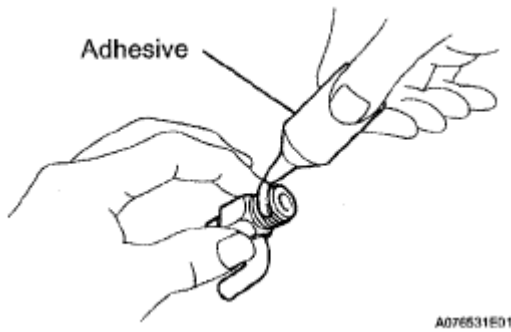


Fig. 294: Applying Adhesive To Threads Of Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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 it to the specified torque.
- Install the water drain cock within 3 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing the water drain cock.

- c. Install the water drain cock plug to the water drain cock.

Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)

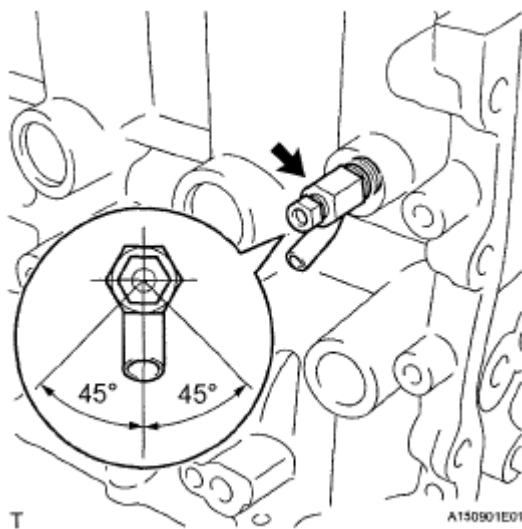


Fig. 295: Locating Water Drain Cock Plug To Water Drain Cock
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL VENTILATION VALVE SUB-ASSEMBLY

- a. Apply adhesive to the threads of the ventilation valve.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

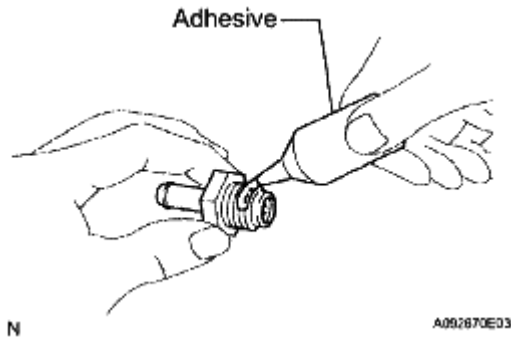


Fig. 296: Applying Adhesive To Threads Of Ventilation Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the ventilation valve.

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

NOTE:

- Install the crankcase within 3 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing the ventilation valve.

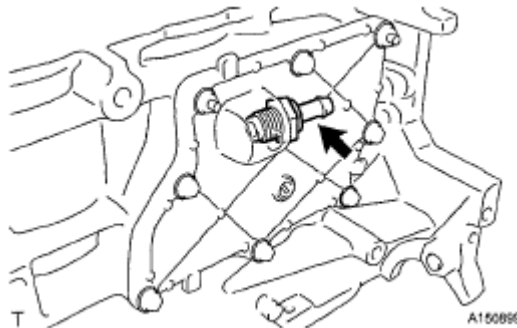


Fig. 297: Locating Ventilation Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL CYLINDER HEAD GASKET (See INSTALLATION)
9. INSTALL CYLINDER HEAD SUB-ASSEMBLY (See INSTALLATION)
10. INSTALL VALVE LASH ADJUSTER ASSEMBLY

NOTE:

- **Keep the lash adjuster free of dirt and foreign matter.**
- **Only use clean engine oil.**

- a. Place the lash adjuster into a container filled with 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 it.

OK:

Plunger moves up and down .

NOTE:

When bleeding the high-pressure 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, the high-pressure chamber will not be bled.

- e. After bleeding, remove SST. Then, try to press the plunger quickly and firmly by hand.

OK:

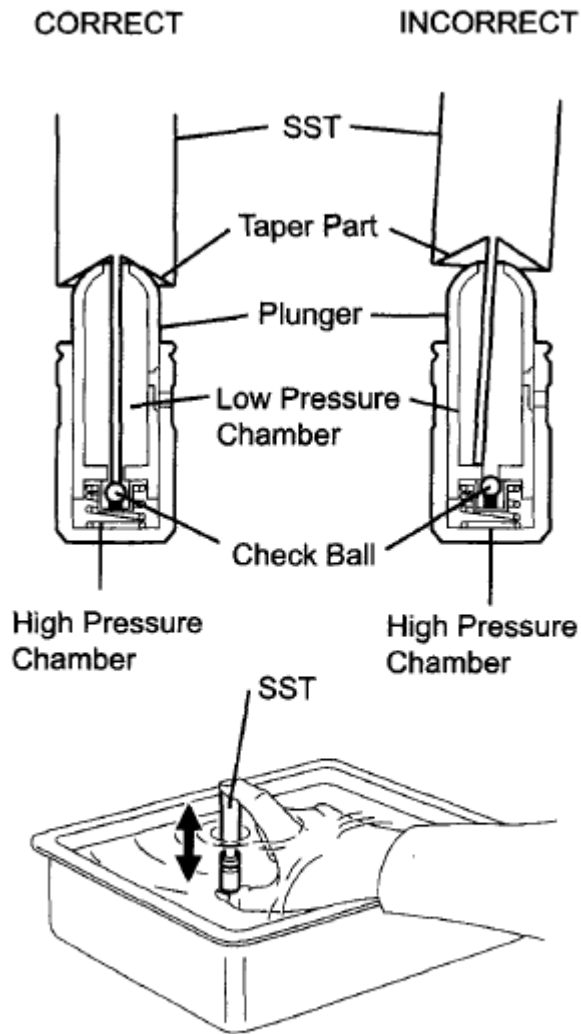
Plunger is very difficult to move .

If the result is not as specified, replace the lash adjuster.

- f. Install the lash adjusters.

NOTE:

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



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Fig. 298: Identifying Plunger Correct And Incorrect Position

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

11. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

- a. Apply engine oil to the lash adjuster tip and valve stem cap end.
- b. Make sure that the valve rocker arms are installed as shown in the illustration.

12. INSTALL NO. 1 CAMSHAFT BEARING

- a. Clean the both surfaces of the bearings.
- b. Install the 2 No. 1 camshaft bearings.

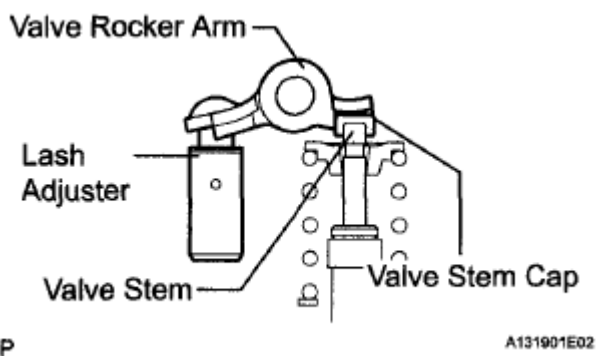


Fig. 299: Installing Camshaft Housing Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a vernier caliper, measure the distance between the bearing cap edge and the camshaft bearing edge.

Dimension (A - B):

0.7 mm (0.0276 in.) or less

NOTE: Position the bearings to the center of the bearing cap by measuring dimensions A and B.

13. INSTALL OIL CONTROL VALVE FILTER

- a. Check that no foreign matter is on the mesh part of the filter.

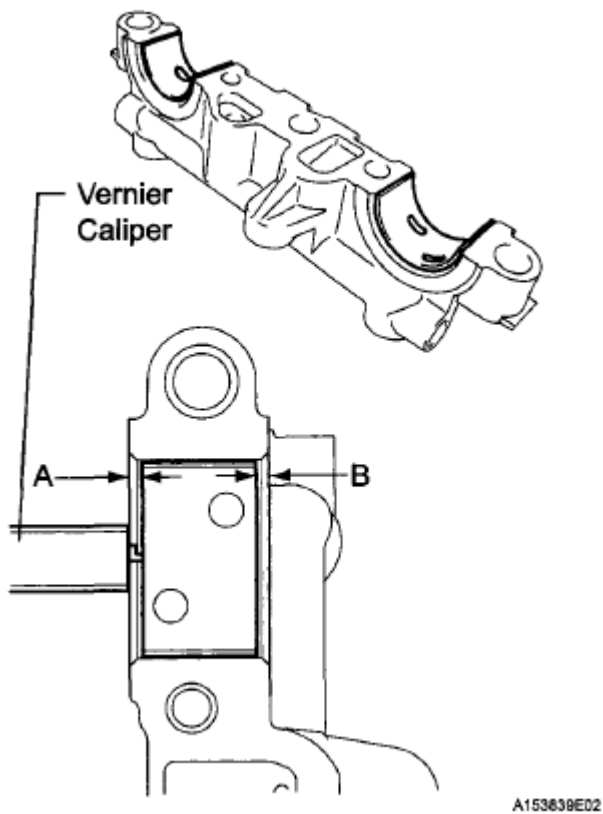


Fig. 300: Measuring Distance Between Bearing Cap Edge And Camshaft Bearing Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the oil control valve filter.

NOTE: Do not touch the mesh when installing the oil control valve filter.

14. INSTALL NO. 2 CAMSHAFT BEARING

- a. Clean both surfaces of the bearings.
- b. Install the 2 No. 2 camshaft bearings.

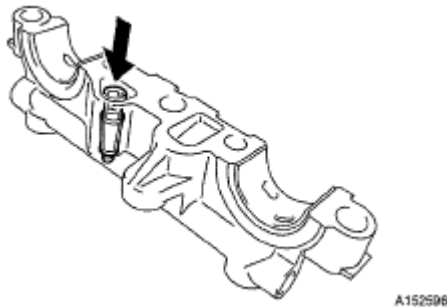


Fig. 301: Locating Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a vernier caliper, measure the distance between the bearing cap edge and the camshaft bearing edge.

Dimension (A):

1.05 to 1.75 mm (0.041 to 0.069 in.)

NOTE: Position the bearings to the center of the bearing cap by measuring dimension A.

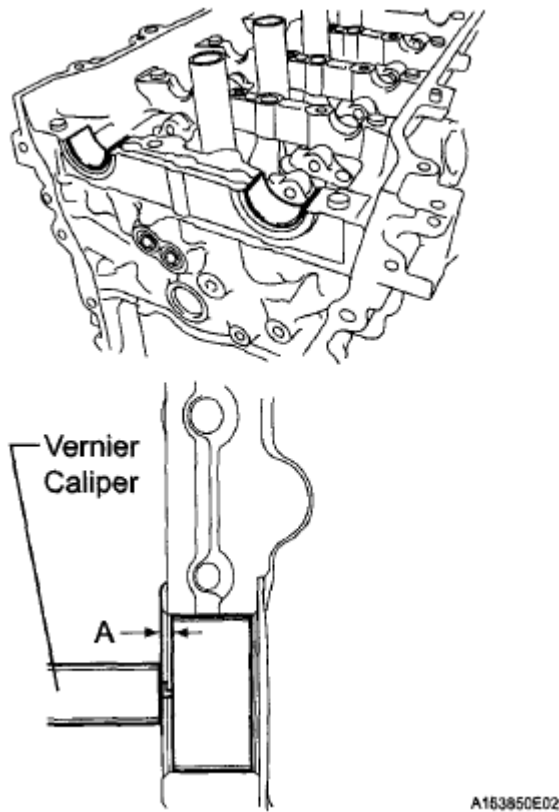


Fig. 302: Measuring Distance Between Bearing Cap Edge And Camshaft Bearing Edge
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. INSTALL NO. 2 CAMSHAFT

- a. Clean the camshaft journals.
- b. Apply a light coat of engine oil to the camshaft journals, camshaft housings and bearing caps.
- c. Install the No. 2 camshaft to the camshaft housing.

16. INSTALL CAMSHAFT

- a. Clean the camshaft journals.
- b. Apply a light coat of engine oil to the camshaft journals and camshaft housing.

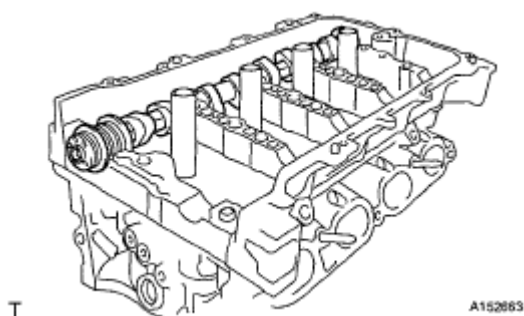


Fig. 303: Identifying No. 2 Camshaft

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

- c. Install the camshaft to the camshaft housing.

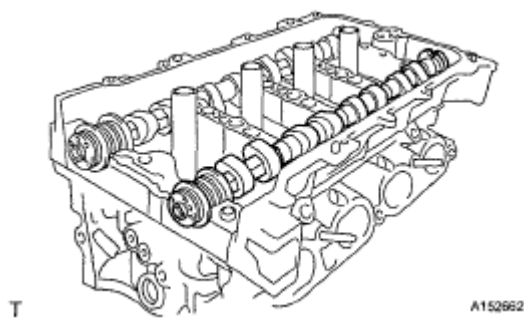


Fig. 304: Identifying Camshaft

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

17. INSTALL CAMSHAFT BEARING CAP

- a. Apply engine oil to the bearing caps.

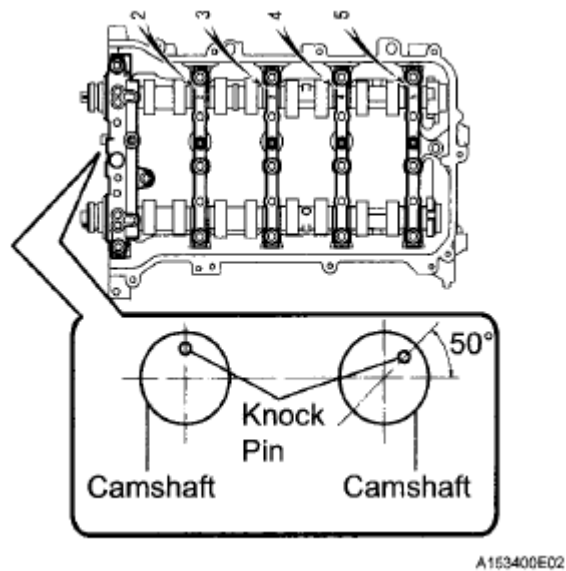


Fig. 305: Identifying Numbers On Camshaft Bearing Caps

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

- b. Make sure of the marks and numbers on the camshaft bearing caps and place them in each proper position and direction.

HINT:

Make sure that the knock pin of the camshaft is positioned as shown in the illustration.

- c. Tighten the 10 bolts in the order shown in the illustration.

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

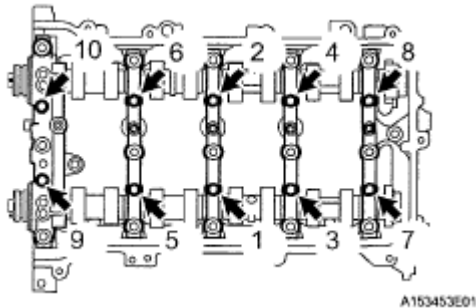


Fig. 306: Identifying Camshaft Bearing Bolt Tighten Sequence

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

18. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY

- a. Make sure that the valve rocker arms are installed as shown in the illustration.

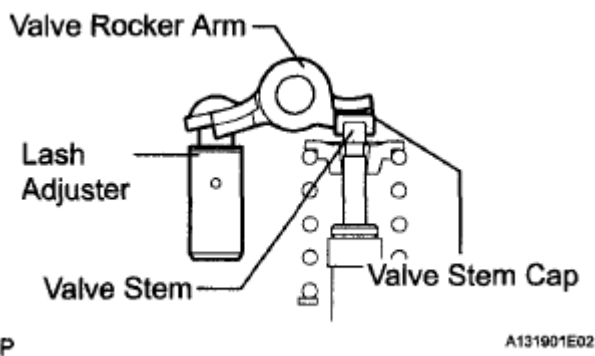


Fig. 307: Installing Camshaft Housing Sub-Assembly

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

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

Seal packing:

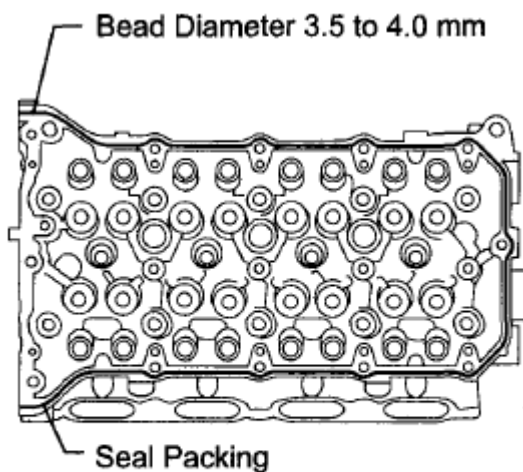
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Bead diameter:

3.5 to 4.0 mm (0.138 to 0.158 in.)

NOTE:

- Remove any oil from the contact surfaces.
- Install the camshaft housing sub-assembly within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing.



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Fig. 308: Identifying Camshaft Housing Seal Packing Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

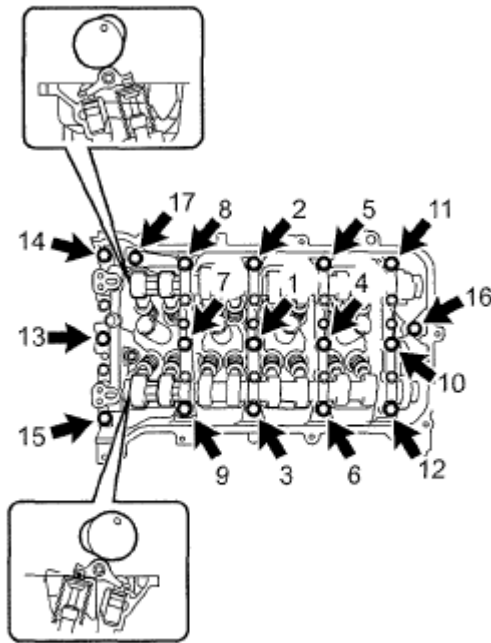
- Set the camshaft and No. 2 camshaft as shown in the illustration.
- Install the camshaft housing and tighten the 17 bolts in the order shown in the illustration.

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

NOTE:

- After installing the camshaft housing, make sure that the cam lobes are positioned as shown in the illustration.
- If any of the bolts are loosened during installation, remove the camshaft housing, clean the installation surfaces, and reapply seal packing.
- If the camshaft housing is removed because any of the bolts are loosened during installation, make sure that the previously applied seal packing does not enter any oil passages.
- After installing the camshaft housing, wipe off any seal packing

that seeped out from between the housing and the cylinder head.



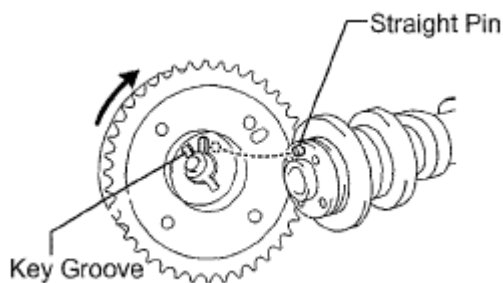
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Fig. 309: Locating No. 2 Camshaft Bolt Tighten Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- Check that the knock pin is installed on the camshaft.
- Put the camshaft timing gear and camshaft together with the straight pin and key groove misaligned, as shown in the illustration.

NOTE: Do not forcefully push in the camshaft timing gear assembly. This may cause the camshaft knock pin tip to damage the installation surface of the camshaft timing gear assembly.



A146265E01

Fig. 310: Identifying Straight Pin And Key Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Turn the camshaft timing gear as shown in the illustration while pushing it gently against the camshaft. Push further at the position where the pin fits into the groove.

NOTE: Do not turn the camshaft timing gear in the retard direction (clockwise).

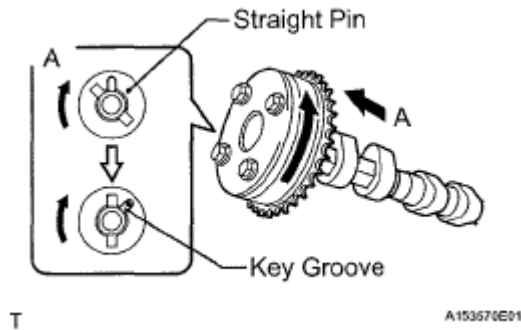
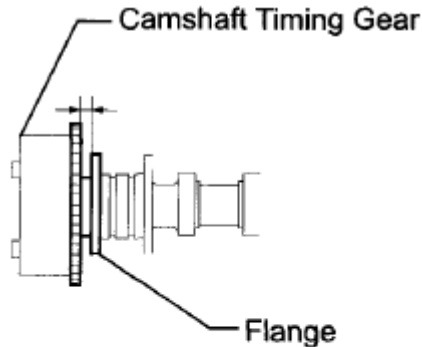


Fig. 311: Turning Camshaft Timing Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Measure the clearance between the gear and the camshaft flange.

Clearance:

0.1 to 0.4 mm (0.004 to 0.016 in.)



Clearance: 0.1 to 0.4 mm

A173381E01

Fig. 312: Measuring Clearance Between Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Tighten the flange bolt with the camshaft timing gear secured in place.

Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

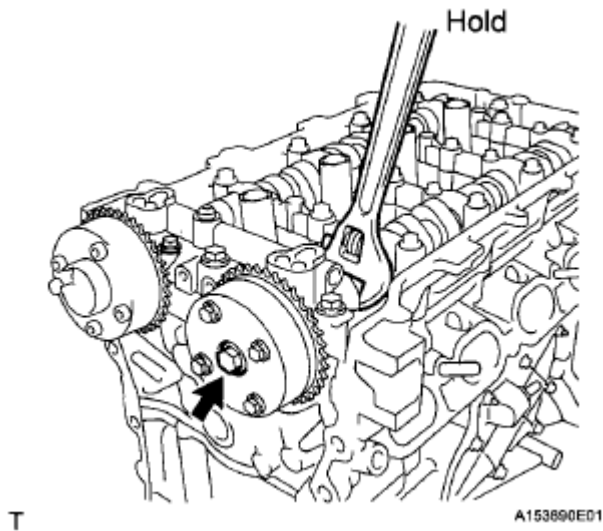


Fig. 313: Tightening Flange Bolt

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

- f. Check that the camshaft timing gear can move in the retard direction (clockwise) and locks in the most retarded position.

20. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

- a. Check that the knock pin is installed on the camshaft.

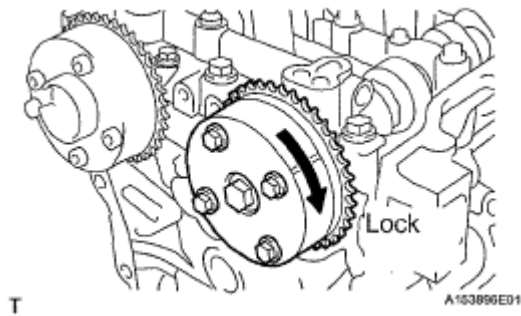


Fig. 314: Checking Camshaft Timing Gear

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

- b. Put the camshaft timing exhaust gear and camshaft together by aligning the key groove and straight pin.

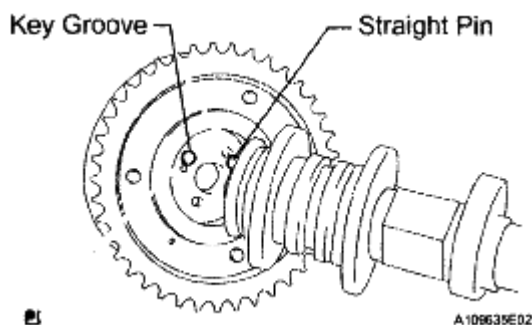


Fig. 315: Identifying Straight Pin And Key Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Lightly press the gear against the camshaft, and turn the gear. Push further at the position where the pin enters the groove.

NOTE: Be sure not to turn the camshaft timing exhaust gear in the retard direction (clockwise).

- d. Check that there is no clearance between the gear and the camshaft flange.
- e. Tighten the flange bolt with the camshaft timing exhaust gear fixed.

Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

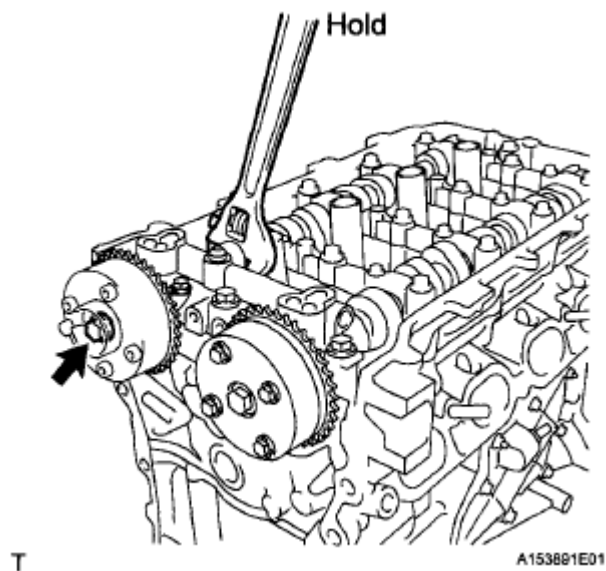


Fig. 316: Tightening Flange Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

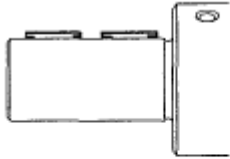
- f. Check the camshaft timing exhaust gear lock.
 - 1. Make sure that the camshaft timing exhaust gear is locked.

21. INSTALL CRANKSHAFT TIMING GEAR KEY

- a. Using a plastic-faced hammer, tap in the 2 crankshaft timing gear keys.

HINT:

Tap in the crankshaft timing gear keys until they contact the crankshaft as shown in the illustration.



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Fig. 317: Identifying Crankshaft Timing Gear Key
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE

- a. Install the sensor plate with the "F" mark facing forward.

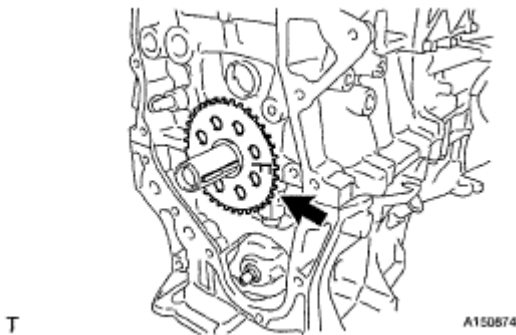


Fig. 318: Locating No. 1 Crankshaft Position Sensor Plate
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. INSTALL NO. 2 CHAIN SUB-ASSEMBLY (See INSTALLATION)
24. INSTALL CRANKSHAFT TIMING SPROCKET (See INSTALLATION)
25. INSTALL NO. 1 CHAIN VIBRATION DAMPER (See INSTALLATION)
26. INSTALL NO. 2 CHAIN VIBRATION DAMPER (See INSTALLATION)
27. INSTALL CHAIN SUB-ASSEMBLY (See INSTALLATION)
28. INSTALL CHAIN TENSIONER SLIPPER (See INSTALLATION)
29. INSTALL NO. 1 GENERATOR BRACKET
 - a. Install the No. 1 generator bracket with the 4 bolts.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

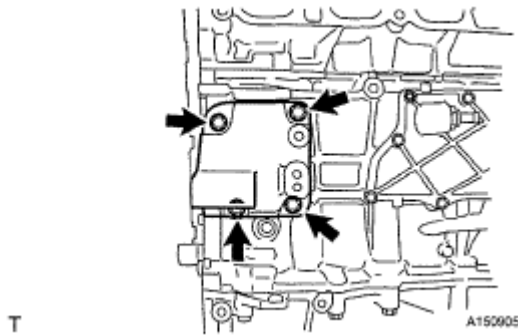


Fig. 319: Locating No. 1 Generator Bracket Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

30. INSTALL WATER INLET HOUSING

- a. Install the gasket.
- b. Install the water inlet housing with the 3 bolts.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

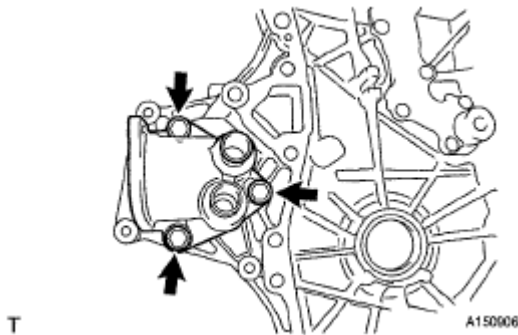


Fig. 320: Locating Water Inlet Housing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. INSTALL TIMING CHAIN COVER OIL SEAL

- a. Using SST, tap in a new oil seal until its surface is flush with the timing gear case edge.

SST 09223-22010

- b. Apply a light coat of MP grease to the lip of the oil seal.

NOTE:

- **Keep the lip free of foreign matter.**
- **Do not tap on the oil seal at an angle.**
- **Make sure that the oil seal edge does not stick out of the timing chain cover.**

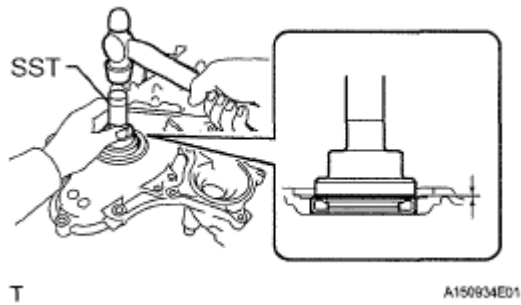


Fig. 321: Installing Timing Chain Cover Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

32. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See INSTALLATION)
33. INSTALL CRANKSHAFT PULLEY (See INSTALLATION)
34. INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY
 - a. Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

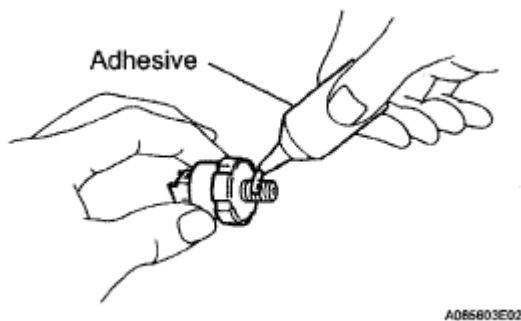


Fig. 322: Applying Adhesive To Threads Of Oil Pressure Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 24 mm deep socket wrench, install the oil pressure switch.

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

NOTE:

- Install the oil pressure switch within 3 minutes after applying adhesive.
- Do not start the engine within 1 hour after installation.

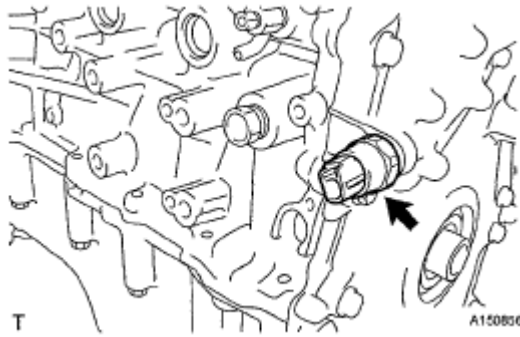


Fig. 323: Locating Engine Oil Pressure Switch Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

- a. Install a new gasket to the engine coolant temperature sensor.
- b. Using a 19 mm deep socket wrench, install the temperature sensor.

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

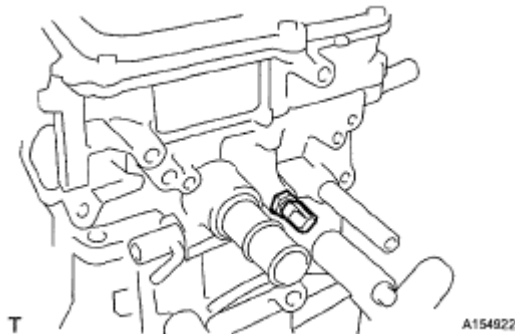


Fig. 324: Identifying Engine Coolant Temperature Sensor
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. INSTALL KNOCK CONTROL SENSOR

- a. Install the knock control sensor with the bolt.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

NOTE: Make sure that the knock control sensor is in the correct position.

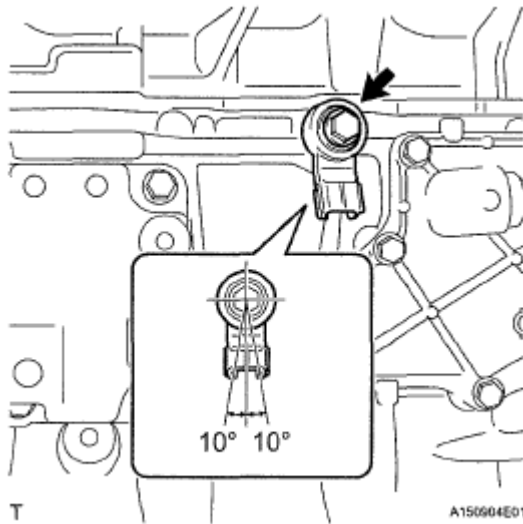


Fig. 325: Locating Knock Control Sensor With Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. INSTALL NO. 1 TAPER SCREW PLUG

- a. Apply adhesive to 2 or 3 threads of the plug, and install the plug.

Torque: 43 N*m (439 kgf*cm, 32 ft.*lbf)

NOTE:

- Install the plug within 3 minutes after applying adhesive.
- Do not start the engine within 1 hour after installation.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

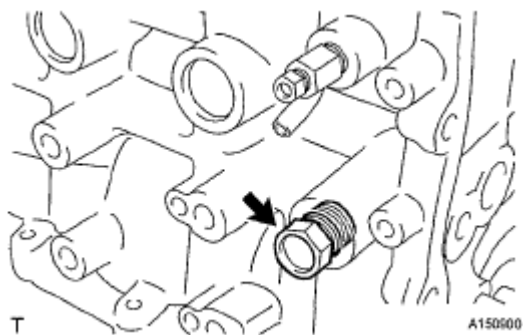
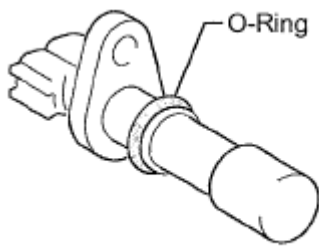


Fig. 326: Locating No. 1 Taper Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. INSTALL CRANKSHAFT POSITION SENSOR

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

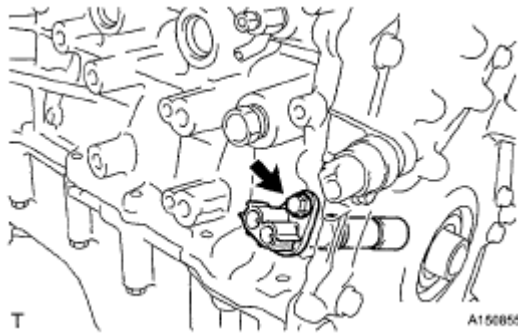


A157503E01

Fig. 327: Identifying O-ring Of Sensor

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

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

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

A156855

Fig. 328: Locating Crankshaft Position Sensor

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

39. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

- a. Release the ratchet pawl, then fully push in the plunger and engage the hook to the pin so that the plunger is in the position shown in the illustration.

NOTE: **Make sure that the cam engages the first tooth of the plunger to allow the hook to pass over the pin.**

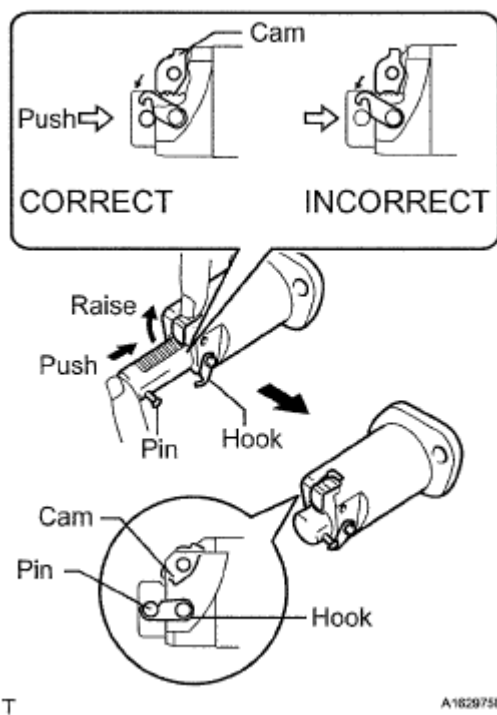


Fig. 329: Installing No. 1 Chain Tensioner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install a new gasket, bracket and No. 1 chain tensioner with the 2 nuts.

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

NOTE: If the hook releases the plunger while the chain tensioner is being installed, engage the hook again.

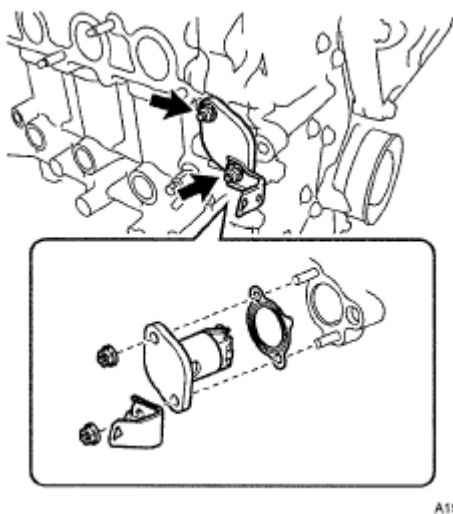


Fig. 330: Locating No. 1 Chain Tensioner With Nuts

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

- c. Turn the crankshaft counterclockwise, then disconnect the hook from the plunger knock pin.

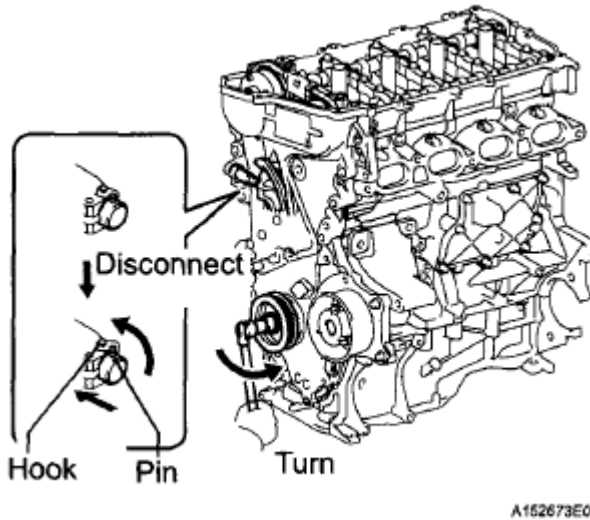


Fig. 331: Turning Crankshaft Of Plunger Knock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Turn the crankshaft clockwise, then check that the plunger is extended.

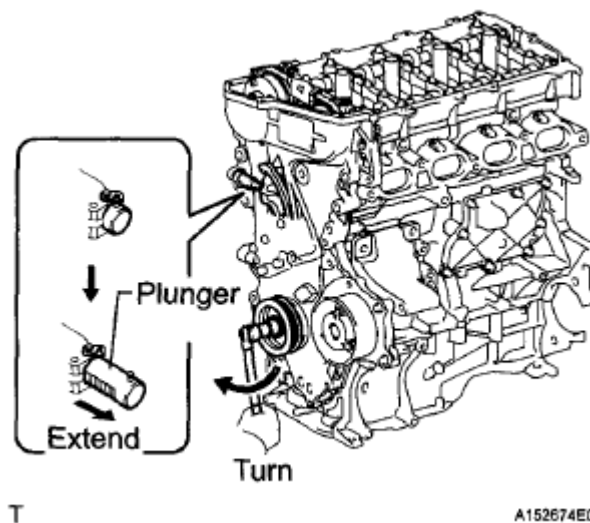


Fig. 332: Turning Crankshaft Of Plunger
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

40. **INSTALL OIL FILTER CAP ASSEMBLY** (See **REPLACEMENT**)
41. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**
a. Install a new gasket to the cylinder head cover.

NOTE: Remove any oil from the contact surfaces.

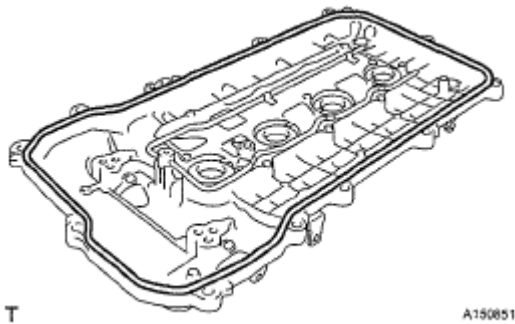


Fig. 333: Identifying Cylinder Head Cover Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install 3 new gaskets to the No. 1 camshaft bearing cap.

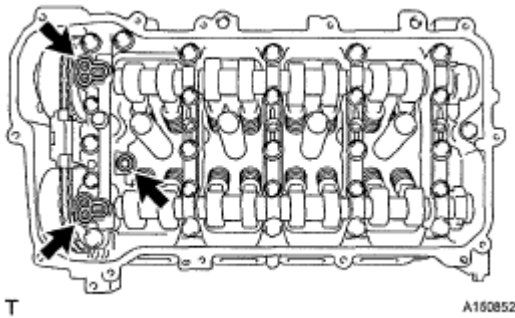


Fig. 334: Locating Camshaft Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Apply seal packing as shown the illustration.

Seal packing:

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

NOTE:

- Remove any oil from the contact surfaces.
- Install the cylinder head cover within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after the installation.

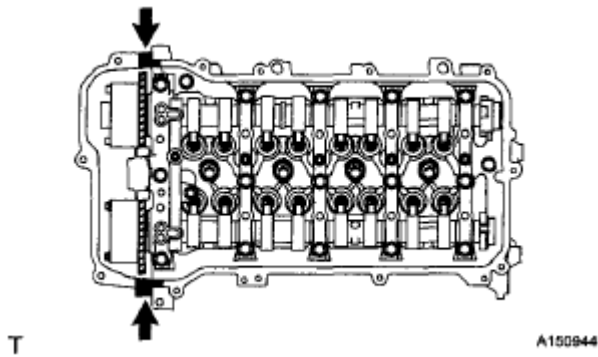


Fig. 335: Locating Cylinder Head Sealing Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Install the cylinder head cover with a new seal washer and the 13 bolts.

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

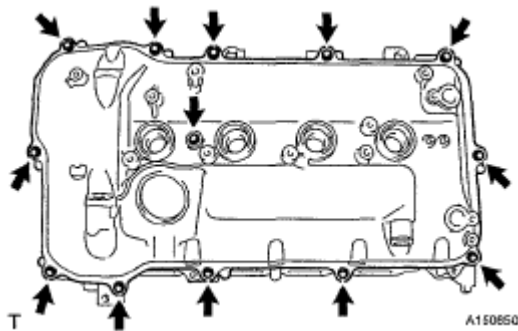


Fig. 336: Locating Cylinder Head Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

42. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- a. Apply a light coat of engine oil to 2 new O-rings, then install them onto the camshaft timing oil control valves.

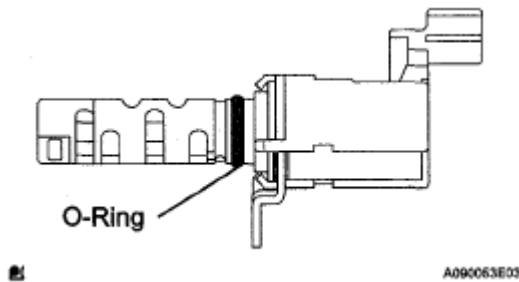


Fig. 337: Identifying O-rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 camshaft timing oil control valves and bracket with the 2 bolts.

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

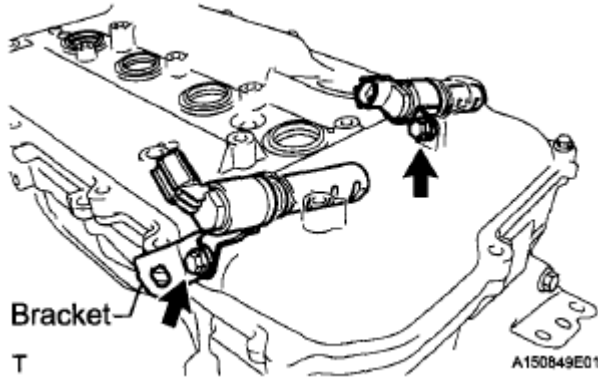


Fig. 338: Locating Camshaft Timing Oil Control Valves And Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

43. INSTALL NO. 1 CRANK POSITION SENSOR

- a. Apply a light coat of engine oil to the O-rings of the sensors.

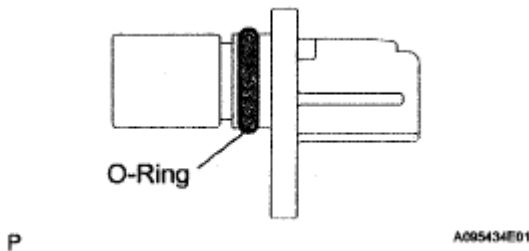


Fig. 339: Identifying O-ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the 2 sensors with the 2 bolts.

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

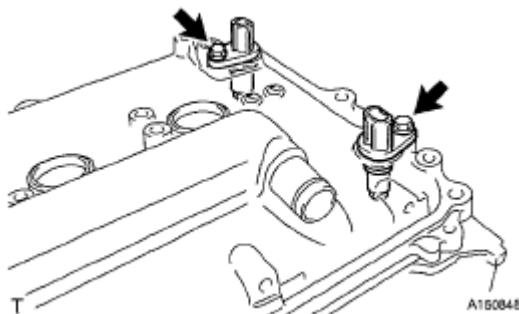


Fig. 340: Locating No. 1 Crank Position Sensor Bolt

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

44. INSTALL SPARK PLUG

- a. Using a 14 mm spark plug wrench, install the 4 spark plugs.

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

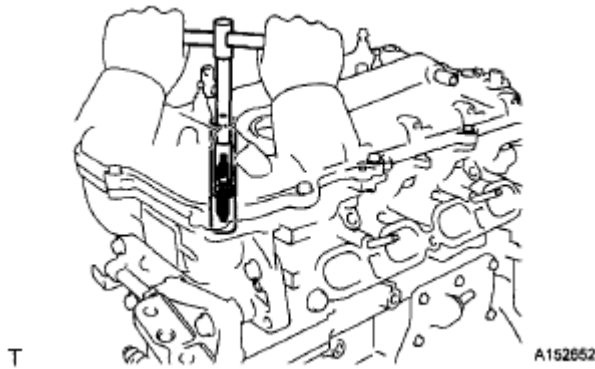


Fig. 341: Installing Spark Plug

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

45. INSTALL ENGINE COVER JOINT

- a. Install the 2 engine cover joints.

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

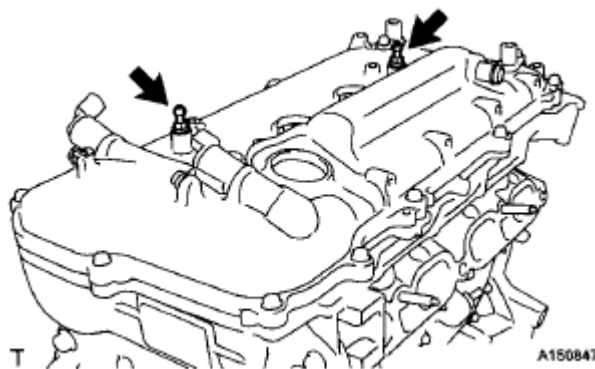
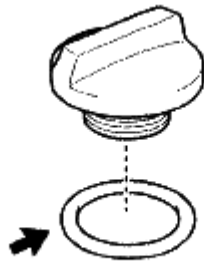


Fig. 342: Locating Engine Cover Joints

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

46. INSTALL OIL FILLER CAP GASKET

- a. Install the gasket to the cap.



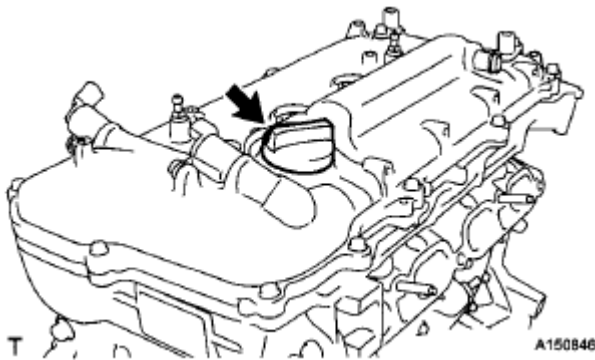
A128158

Fig. 343: Locating Oil Filler Cap Gasket

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

47. INSTALL OIL FILLER CAP SUB-ASSEMBLY

- a. Install the oil filler cap.



A150846

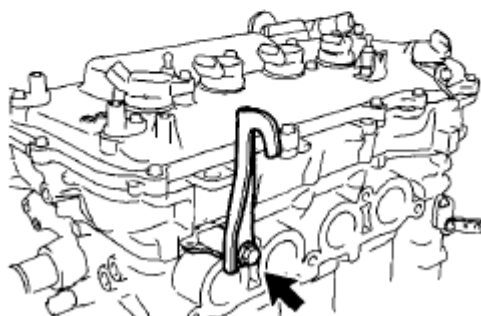
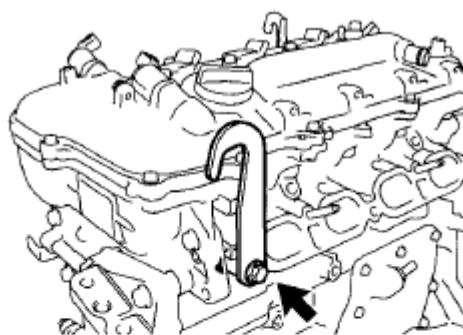
Fig. 344: Locating Oil Filler Cap

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

48. INSTALL ENGINE HANGER

- a. Install the 2 engine hangers with the 2 bolts.

Torque: 43 N*m (439 kgf*cm, 32 ft.*lbf)



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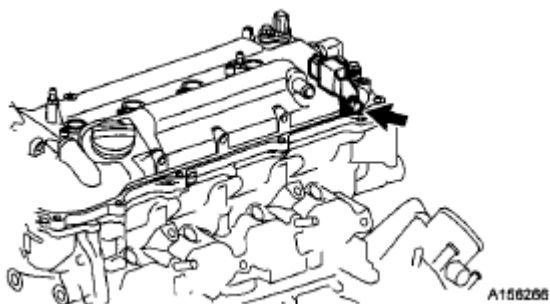
A150845

Fig. 345: Locating Engine Hangers With Bolts

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

INSTALLATION**1. INSTALL RADIO SETTING CONDENSER**

- a. Install the radio setting condenser with the bolt.

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

A156266

Fig. 346: Locating Radio Setting Condenser Bolt

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

2. **INSTALL THERMOSTAT** (See **INSTALLATION**)
3. **INSTALL WATER INLET** (See **INSTALLATION**)

4. INSTALL WATER INLET HOSE

- a. Install the water inlet hose with the 2 clamps.

5. INSTALL WATER BY-PASS HOSE

- a. Install the water by-pass hose with the clamp.

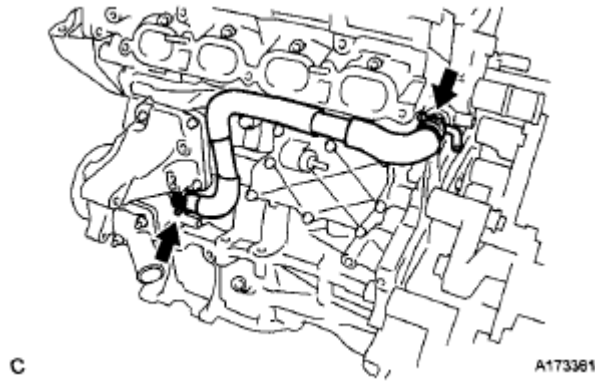


Fig. 347: Locating Water Inlet Hose Clamp

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

6. INSTALL NO. 1 WATER BY-PASS PIPE

- a. Install the No. 1 water by-pass pipe with the 2 bolts.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

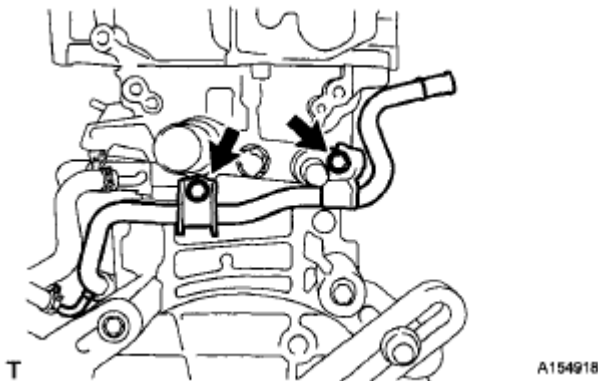


Fig. 348: Locating No. 1 Water By-Pass Pipe Bolts

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

7. CONNECT NO. 3 WATER BY-PASS HOSE

- a. Connect the No. 3 water by-pass hose to the water inlet housing.

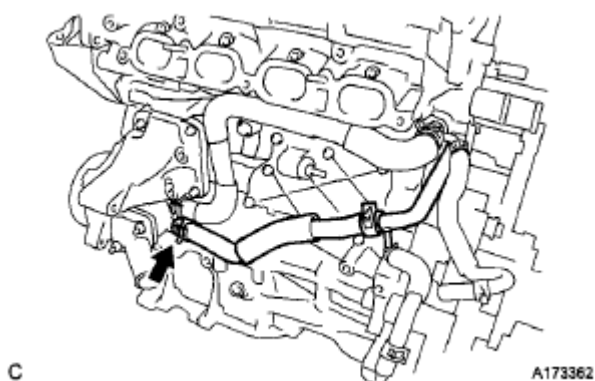


Fig. 349: Locating No. 3 Water By-Pass Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL VENTILATION HOSE

- a. Install the ventilation hose.

9. INSTALL EXHAUST MANIFOLD

- a. Install a new gasket onto the exhaust manifold.
- b. Install the exhaust manifold with the 5 nuts.

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

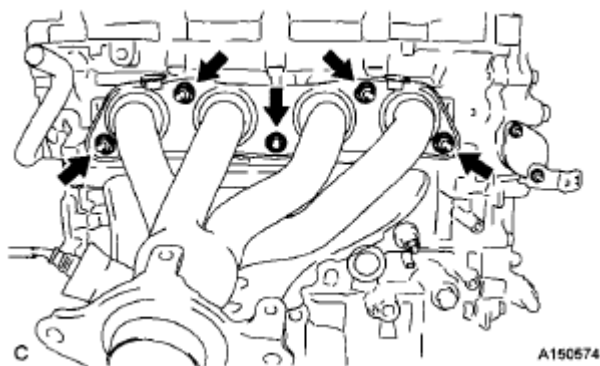


Fig. 350: Locating Exhaust Manifold Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSTALL MANIFOLD STAY

- a. Install the manifold stay with the 3 bolts.

Torque: 43 N*m (439 kgf*cm, 32 ft.*lbf)

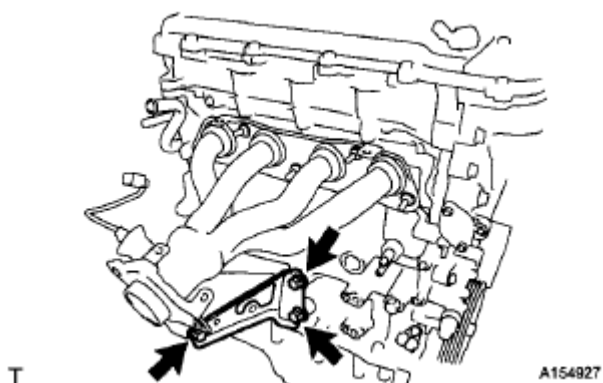


Fig. 351: Locating Manifold Stay Bolts

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

11. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

- a. Install the exhaust manifold heat insulator with the 4 bolts.

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

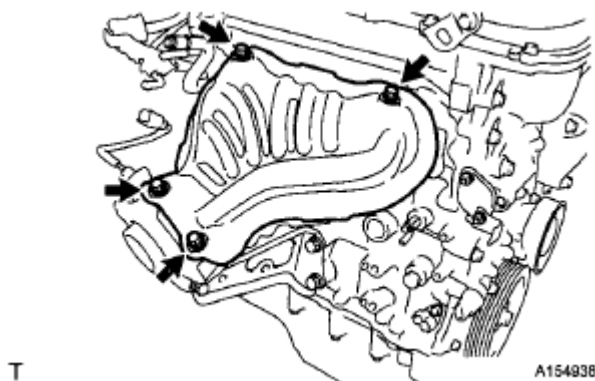


Fig. 352: Locating No. 1 Exhaust Manifold Heat Insulator Bolts

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

12. INSTALL OIL LEVEL DIPSTICK SUB-ASSEMBLY

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

Torque: 21 N*m (214 kgf*cm, 16 ft.*lbf)

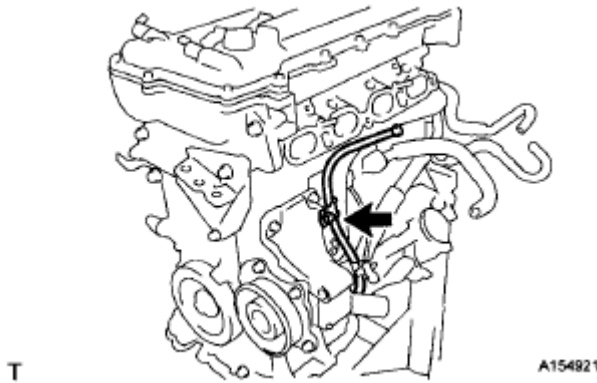


Fig. 353: Locating Oil Level Dipstick Sub-Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. INSTALL IGNITION COIL ASSEMBLY

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

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

14. INSTALL FUEL INJECTOR ASSEMBLY (See INSTALLATION)

15. INSTALL NO. 1 DELIVERY PIPE SPACER (See INSTALLATION)

16. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY (See INSTALLATION)

17. CONNECT FUEL TUBE SUB-ASSEMBLY (See INSTALLATION)

18. INSTALL INTAKE MANIFOLD

- a. Install a new gasket to the intake manifold.
- b. Install the intake manifold and intake manifold stay with the 4 bolts and 2 nuts.

Torque: 28 N*m (286 kgf*cm, 21 ft.*lbf)

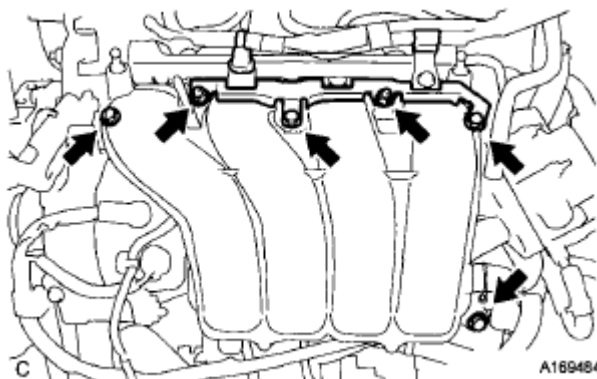


Fig. 354: Locating Intake Manifold Bolt And Nuts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Connect the 2 water by-pass hoses.

- d. Connect the ventilation hose to the intake manifold.
- e. Install the air tube with the 2 bolts.

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

- f. Install the wire harness bracket.

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

19. INSTALL FAN BELT ADJUSTING BAR

- a. Install the bolt and fan belt adjusting bar.

Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)

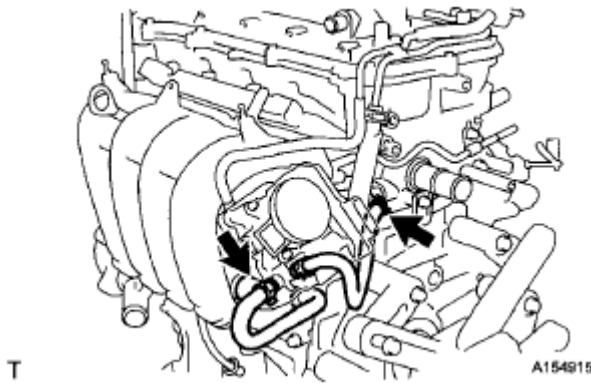


Fig. 355: Locating Water By-Pass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

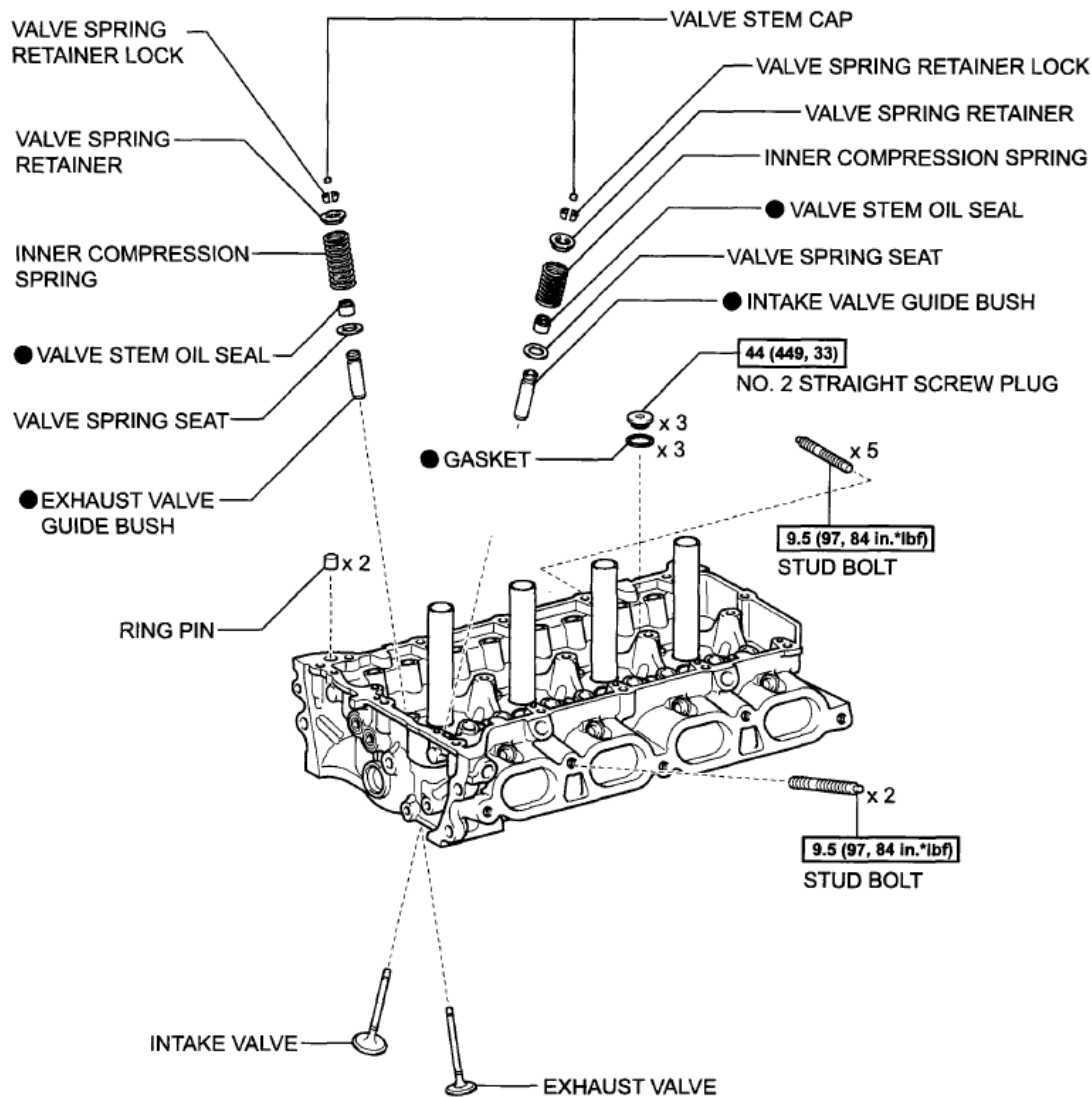
20. INSTALL ENGINE HANGER (See INSTALLATION)

21. REMOVE ENGINE STAND

- a. Attach the engine to the sling device with the chain block.
- b. Remove the engine from the engine stand.

CYLINDER HEAD

COMPONENTS



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

● Non-reusable part

A150355E04

Fig. 356: Identifying Cylinder Head Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. REMOVE VALVE STEM CAP

- Remove the valve stem caps from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

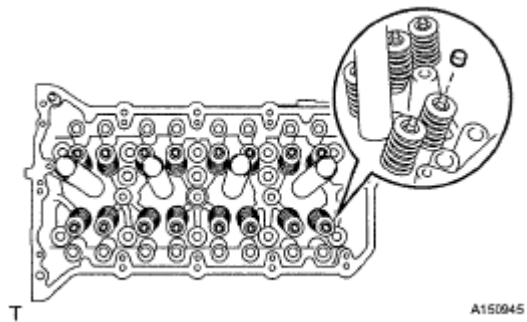


Fig. 357: Identifying Valve Stem Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. REMOVE INTAKE VALVE

- Using SST and wooden blocks, compress and remove the valve retainer locks.

SST 09202-70020 (09202-00010)

HINT:

Arrange the removed parts in the correct order.

- Remove the retainer, valve spring and valve.

HINT:

Arrange the removed parts in the correct order.

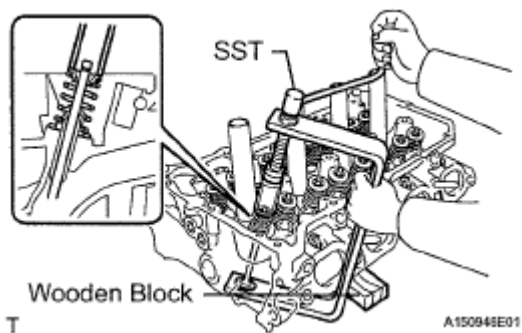


Fig. 358: Identifying Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. REMOVE EXHAUST VALVE

- Using SST and wooden blocks, compress and remove the valve retainer locks.

SST 09202-70020 (09202-00010)

HINT:

Arrange the removed parts in the correct order.

- b. Remove the retainer, valve spring and valve.

HINT:

Arrange the removed parts in the correct order.

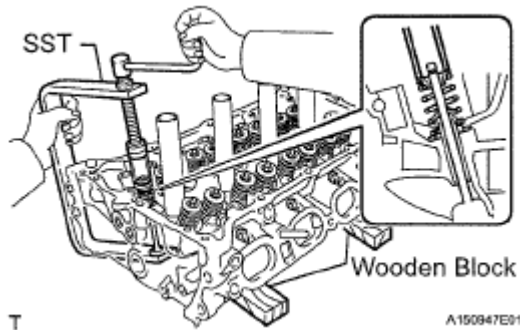


Fig. 359: Removing Exhaust Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. REMOVE VALVE STEM OIL SEAL

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

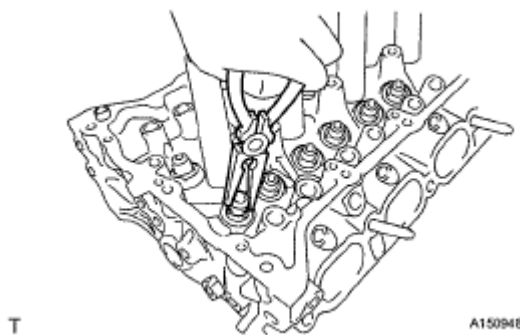


Fig. 360: Removing Valve Stem Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE VALVE SPRING SEAT

- a. Using compressed air and a magnetic pick-up tool, remove the valve spring seats by blowing air onto them.

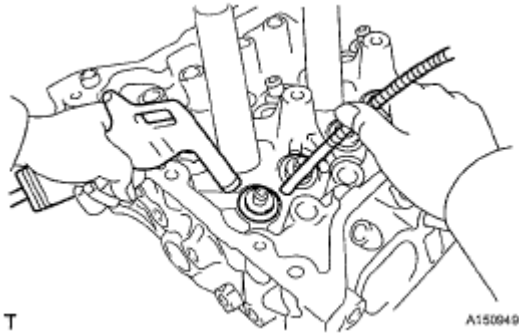


Fig. 361: Removing Valve Spring Seat
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. REMOVE NO. 2 STRAIGHT SCREW PLUG

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

NOTE: If water leaks from any of the straight screw plugs or if a plug is corroded, replace it.

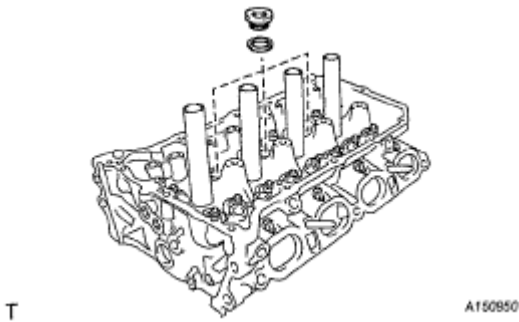


Fig. 362: Identifying No. 2 Straight Screw Plug
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT CYLINDER HEAD FOR FLATNESS

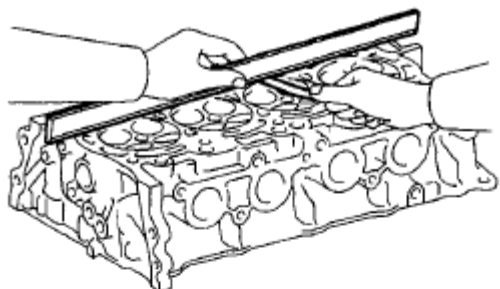
- a. Using a precision straightedge and a feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

Maximum Warpage

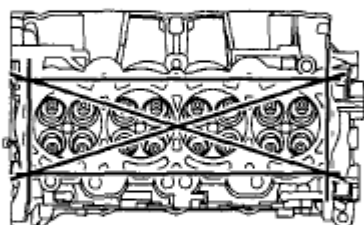
ITEM SPECIFICATION

Item	Specified Condition
Cylinder block side	0.05 mm (0.0020 in.)
Intake manifold side	0.10 mm (0.0039 in.)
Exhaust manifold side	0.10 mm (0.0039 in.)

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



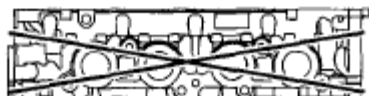
Cylinder Block Side:



Intake Side:



Exhaust Side:



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Fig. 363: Inspecting Cylinder Head For Flatness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT CYLINDER HEAD FOR CRACKS

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



Fig. 364: Inspecting Cylinder Head For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSPECT VALVE SEATS

- a. Apply a light coat of Prussian blue to the valve face.
- b. Lightly press the valve face against the valve seat.
- c. Check the valve face and valve seat according to the following procedure:

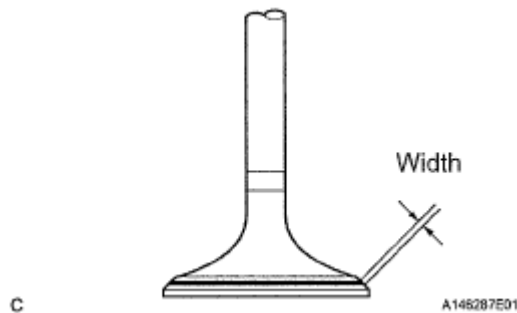


Fig. 365: Identifying Valve Seats Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. If Prussian blue appears 360° around the valve face, the valve face is concentric. If not, replace the valve.
2. If Prussian blue appears 360° around the valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
3. Check that the valve seat contact is in the middle of the valve face with the valve seat width between 1.0 and 1.4 mm (Intake side (0.039 to 0.055 in.)).
4. Check that the valve seat contact is in the middle of the valve face with the valve seat width between 1.0 and 1.4 mm (Exhaust side (0.039 to 0.055 in.)).

4. INSPECT CAMSHAFT THRUST CLEARANCE

- a. Install the camshafts (See **INSTALLATION**).
- b. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard Thrust Clearance

STANDARD THRUST CLEARANCE CHART

Item	Specified Condition
Intake	0.06 to 0.155 mm (0.0024 to 0.0061 in.)
Exhaust	0.06 to 0.155 mm (0.0024 to 0.0061 in.)

Maximum Thrust Clearance

THRUST CLEARANCE CHART

Item	Specified Condition
Intake	0.17 mm (0.0067 in.)
Exhaust	0.17 mm (0.0067 in.)

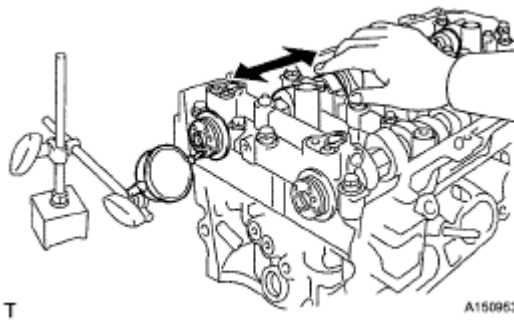


Fig. 366: Measuring Thrust Clearance Of Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

5. INSPECT CAMSHAFT OIL CLEARANCE

- Clean the bearing caps and camshaft journals.
- Place the camshafts on the camshaft housing.
- Lay a strip of Plastigage across each of the camshaft journals.
- Install the bearing caps (See **INSTALLATION**).

NOTE: Do not turn the camshaft.

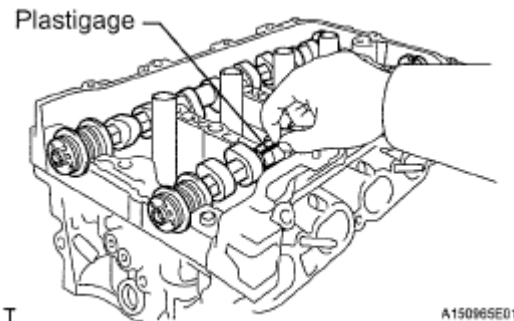


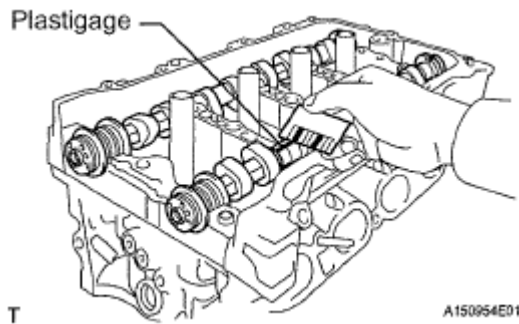
Fig. 367: Inspecting Camshaft Oil Clearance

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

- e. Remove the bearing caps (See **REMOVAL**).
- f. Measure the Plastigage at its widest point.

Standard Oil Clearance**ITEM SPECIFICATION**

Item	Specified Condition
Camshaft No. 1 journal	0.030 to 0.063 mm (0.0012 to 0.0025 in.)
Camshaft other journals	0.035 to 0.072 mm (0.0014 to 0.0028 in.)

**Fig. 368: Measuring Plastigage Widest Point**

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

Maximum Oil Clearance**ITEM SPECIFICATION**

Item	Specified Condition
Camshaft No. 1 journal	0.085 mm (0.0033 in.)
Camshaft other journals	0.09 mm (0.0035 in.)

NOTE: Completely remove the Plastigage after the inspection.

If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the cylinder head.

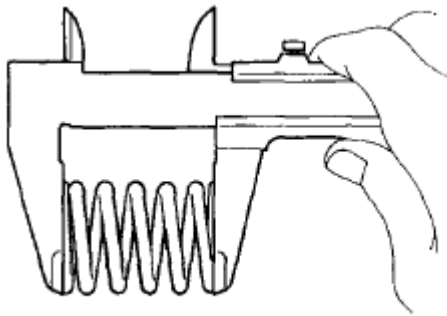
6. INSPECT COMPRESSION SPRING

- a. Using a vernier caliper, measure the free length of the valve spring.

Free length:

53.36 mm (2.1008 in.)

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



EM00801

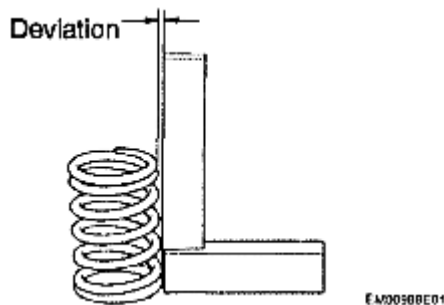
Fig. 369: Measuring Free Length Of Valve Spring
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a steel square, measure the deviation of the valve spring.

Maximum deviation:

1.0 mm (0.0394 in.)

If the deviation is greater than the maximum, replace the valve spring.

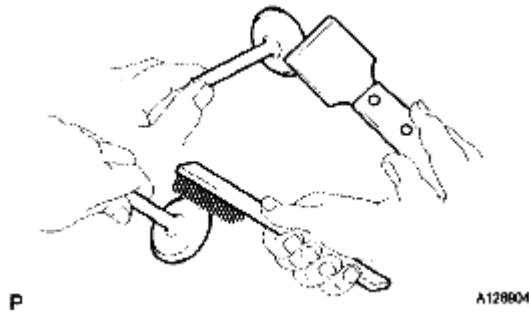


EM00908E01

Fig. 370: Identifying Deviation Of Valve Spring
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSPECT INTAKE VALVE

- a. Using a gasket scraper and wire brush, scrape off any carbon on the valve head.

**Fig. 371: Inspecting Intake Valve**

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

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

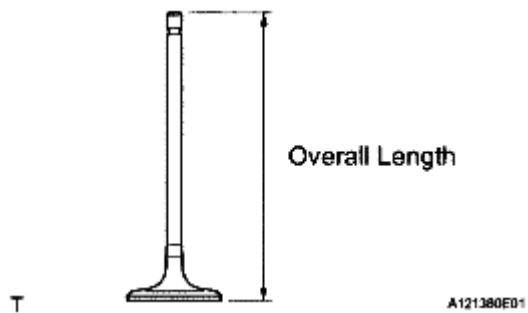
Standard overall length:

109.34 mm (4.3047 in.)

Minimum overall length:

108.84 mm (4.2850 in.)

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

**Fig. 372: Identifying Valve Length**

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

- c. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

5.470 to 5.485 mm (0.2154 to 0.2159 in.)

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

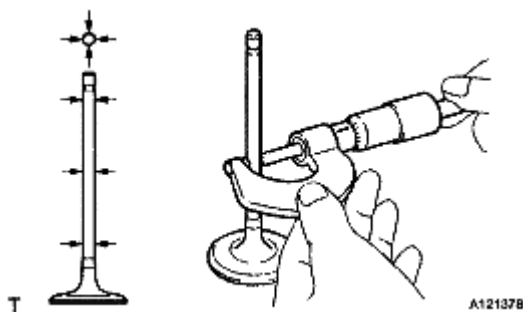


Fig. 373: Measuring Diameter Of Valve Stem

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

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

Standard margin thickness:

1.0 mm (0.0394 in.)

Minimum margin thickness:

0.5 mm (0.0197 in.)

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

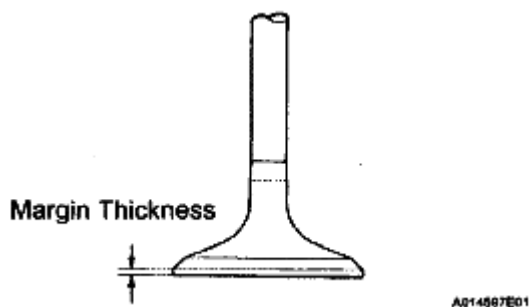


Fig. 374: Measuring Valve Head Margin Thickness

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

8. INSPECT EXHAUST VALVE

- a. Using a gasket scraper and wire brush, scrape off any carbon on the valve head.

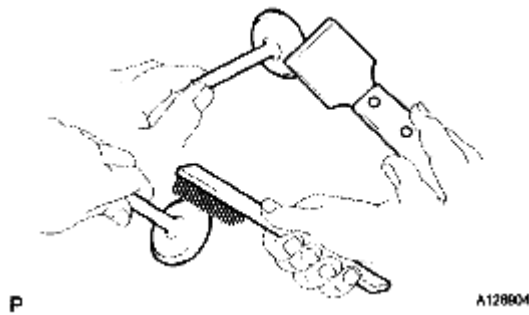


Fig. 375: Inspecting Intake Valve

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

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

Standard overall length:

108.25 mm (4.2618 in.)

Minimum overall length:

107.75 mm (4.2421 in.)

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

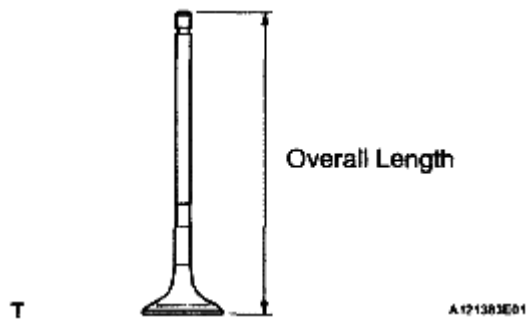


Fig. 376: Identifying Overall Length Of Valve

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

- c. Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

5.465 to 5.480 mm (0.2152 to 0.2157 in.)

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

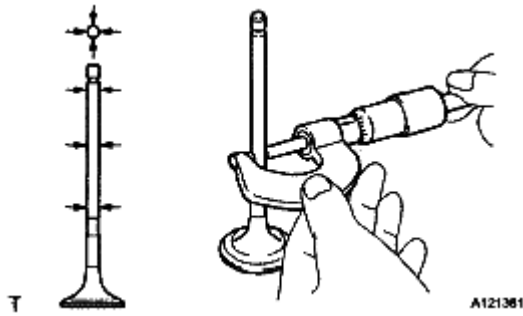


Fig. 377: Measuring Diameter Of Valve Stem

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

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

Standard margin thickness:

1.01 mm (0.0398 in.)

Minimum margin thickness:

0.5 mm (0.0197 in.)

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

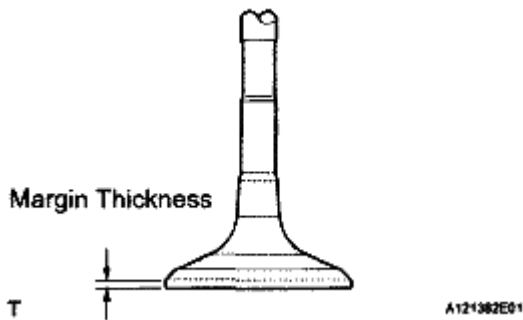


Fig. 378: Measuring Valve Head Margin Thickness

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

9. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

- a. Using a caliper gauge, measure the inside diameter of the guide bush.

Bushing 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.

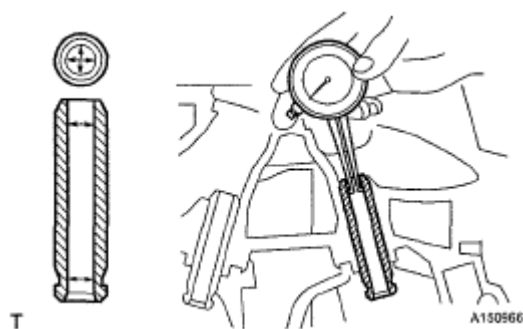


Fig. 379: Measuring Inside Diameter Of Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Oil Clearance

ITEM SPECIFICATION

Item	Specified Condition
Intake	0.025 to 0.060 mm (0.0010 to 0.0024 in.)
Exhaust	0.030 to 0.065 mm (0.0012 to 0.0026 in.)

Maximum Oil Clearance

ITEM SPECIFICATION

Item	Specified Condition
Intake	0.080 mm (0.0031 in.)
Exhaust	0.085 mm (0.0033 in.)

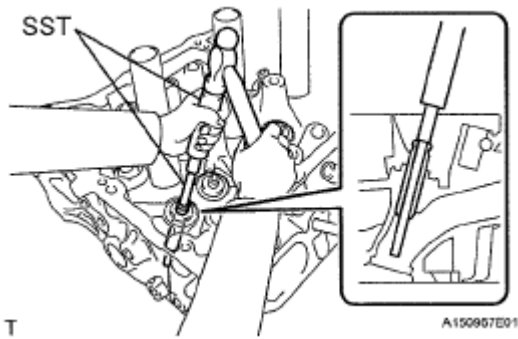
If the clearance is greater than the maximum, replace the valve and guide bush.

REPLACEMENT

1. REPLACE INTAKE VALVE GUIDE BUSH

- Heat the cylinder head to 80 to 100°C (176 to 212°F).
- Place the cylinder head on wooden blocks.
- Using SST and a hammer, tap out the guide bush.

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

**Fig. 380: Tapping 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.

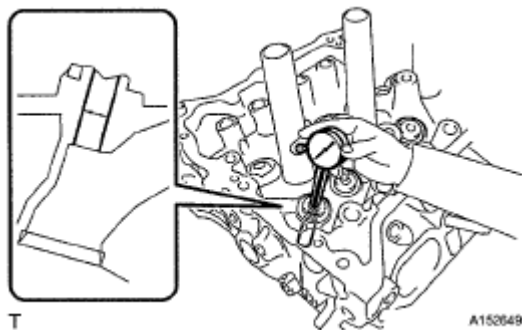
Cylinder bore diameter:

10.285 to 10.306 mm (0.4049 to 0.4057 in.)

Select a New Guide Bush (STD or O/S 0.05)

BUSH DIAMETER CHART

Bush Size	Bush Bore Diameter
STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

**Fig. 381: Identifying Bush Bore Diameter Of Cylinder Head**

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

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install an O/S 0.05 valve guide bush. If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

- e. Heat the cylinder head to 80 to 100°C (176 to 212°F).
f. Place the cylinder head on wooden blocks.

- g. Using SST and a hammer, tap a new guide bush into the specified protrusion height.

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

Protrusion height:

9.9 to 10.3 mm (0.3898 to 0.4055 in.)

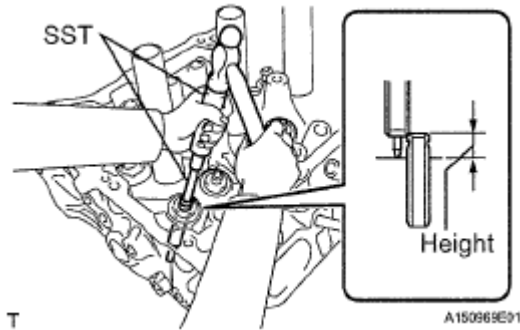


Fig. 382: Tapping Guide Bush

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

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

Standard oil clearance:

0.025 to 0.060 mm (0.0010 to 0.0024 in.)

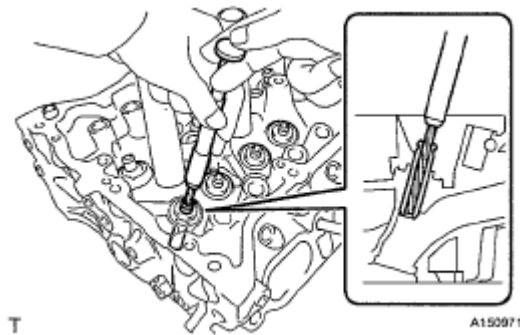


Fig. 383: Identifying Standard Clearance Between Guide Bush And Valve Stem

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

2. REPLACE EXHAUST VALVE GUIDE BUSH

- Heat the cylinder head to 80 to 100°C (176 to 212°F).
- Place the cylinder head on wooden blocks.
- Using SST and a hammer, tap out the guide bush.

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

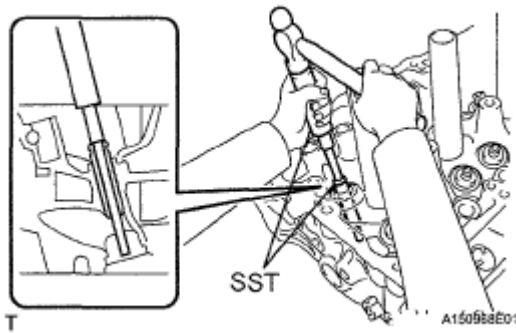


Fig. 384: Tapping Guide Bush

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

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

Diameter:

10.285 to 10.306 mm (0.4049 to 0.4057 in.)

Select a New Guide Bush (STD or O/S 0.05)

BUSH DIAMETER CHART

Bush Size	Bush Bore Diameter
STD	10.285 to 10.306 mm (0.4049 to 0.4057 in.)
O/S 0.05	10.335 to 10.356 mm (0.4069 to 0.4077 in.)

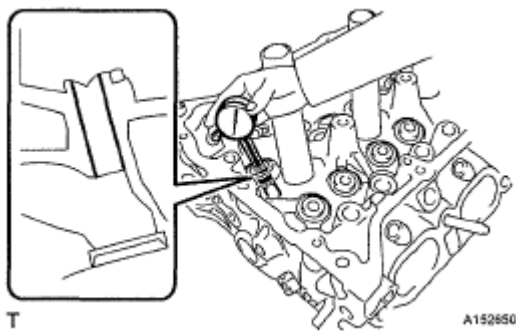


Fig. 385: Measuring Bush Bore Diameter Of Cylinder Head

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

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4057 in.), machine the bush bore to the dimension of 10.335 to 10.356 mm (0.4069 to 0.4077 in.) to install an O/S 0.05 valve guide bush. If the bush bore diameter of the cylinder head is greater than 10.356 mm (0.4077 in.), replace the cylinder head.

- e. Heat the cylinder head to 80 to 100°C (176 to 212°F).
- f. Place the cylinder head on wooden blocks.
- g. Using SST and a hammer, tap a new guide bush into the specified protrusion height.

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

Protrusion height:

11.15 to 11.55 mm (0.4390 to 0.4547 in.)

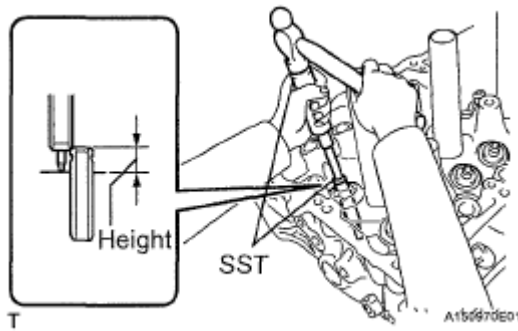


Fig. 386: Tapping Guide Bush

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

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

Standard oil clearance:

0.030 to 0.065 mm (0.0012 to 0.0026 in.)

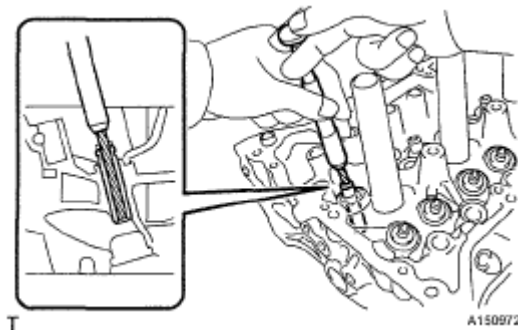


Fig. 387: Identifying Standard Clearance Between Guide Bush And Valve Stem

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

3. REPLACE RING PIN

NOTE: It is not necessary to remove the ring pins unless they are being replaced.

- a. Remove the ring pins.
- b. Using a plastic-faced hammer, tap in new ring pins to the specified protrusion height.

Protrusion height:

6.5 to 7.5 mm (0.26 to 0.30 in.)

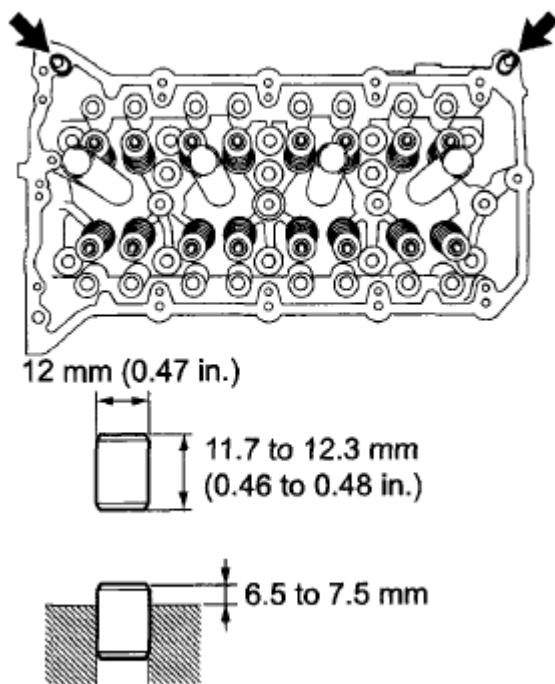
4. REPLACE STUD BOLT

NOTE: If any of the stud bolts is deformed or the threads are damaged, replace it.

- a. Remove the stud bolts.
- b. Using an E8 "TORX" socket, install the stud bolts.

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

Upper Side:

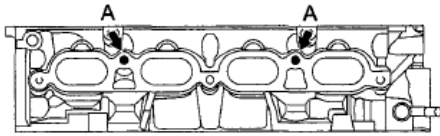


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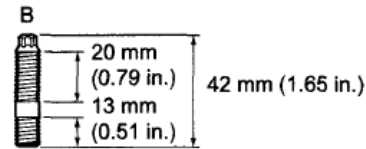
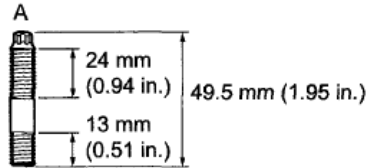
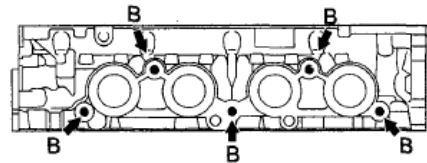
Fig. 388: Locating Stud Bolt

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

Intake Side:



Exhaust Side:



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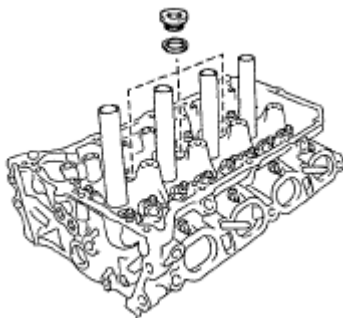
Fig. 389: Stud Bolt Dimension Chart
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. INSTALL NO. 2 STRAIGHT SCREW PLUG

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

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



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Fig. 390: Identifying No. 2 Straight Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL VALVE SPRING SEAT

- Install the valve spring seats to the cylinder head.

3. INSTALL VALVE STEM OIL SEAL

- Apply a light coat of engine oil to new oil seals.

NOTE: Pay close attention when installing the intake and exhaust oil seals. Installing the intake oil seal into the exhaust side or installing the

exhaust oil seal to the intake side may cause installation problems later.

HINT:

The intake valve oil seal is gray and the exhaust valve oil seal is black.

Intake Side:

Exhaust Side:

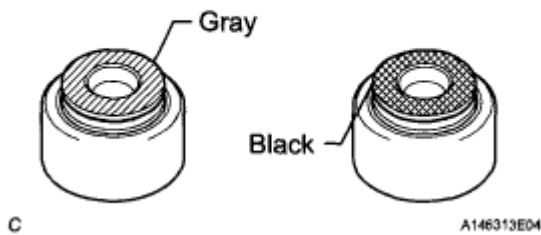


Fig. 391: Identifying Valve Stem Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using SST, push in the oil seals.

SST 09201-41020

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

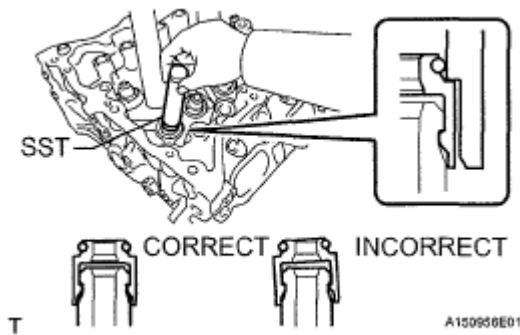


Fig. 392: Pushing Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL INTAKE VALVE

- a. Sufficiently apply 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 to their original positions.

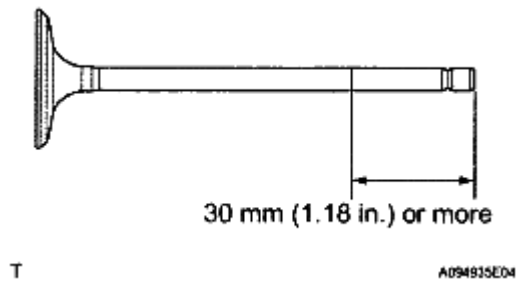


Fig. 393: Identifying Intake Valve Dimension

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

- c. Using SST and wooden blocks, compress the spring and install the 2 retainer locks.

SST 09202-70020(09202-00010)

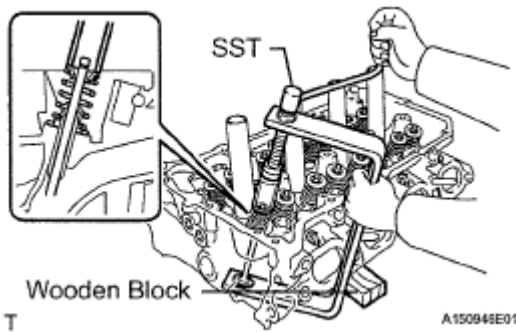


Fig. 394: Identifying Intake Valve

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 valve stem tip.
- Be careful not to damage the retainer.

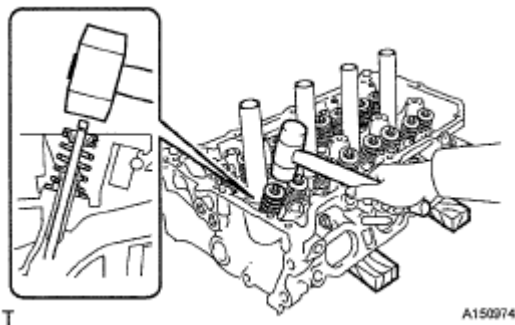


Fig. 395: Tapping Valve Stem

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

5. INSTALL EXHAUST VALVE

- Sufficiently apply engine oil to the tip area of the exhaust valve shown in the illustration.
- Install the valve, compression spring and spring retainer to the cylinder head.

NOTE: Install the same parts to their original positions.

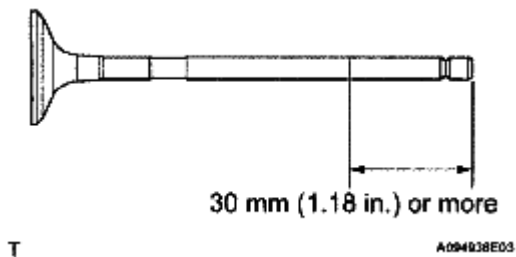


Fig. 396: Identifying Exhaust Valve Length
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using SST and wooden blocks, compress the spring and install the 2 retainer locks.

SST 09202-70020 (09202-00010)

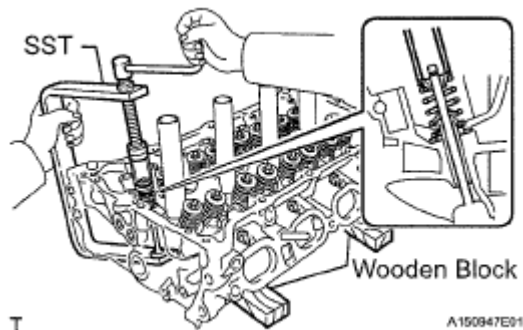


Fig. 397: Compressing Spring And Retainer Locks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

- Be careful not to damage the valve stem tip.
- Be careful not to damage the retainer.

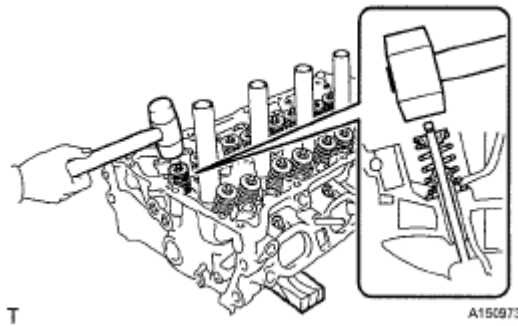


Fig. 398: Tapping Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL VALVE STEM CAP

- Apply a light coat of engine oil to the valve stem caps.
- Install the valve stem caps to the cylinder head.

REPAIR

1. REPAIR VALVE SEATS

NOTE:

- Repair the seat while checking the seating position.
- Keep the lip free of foreign matter.

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

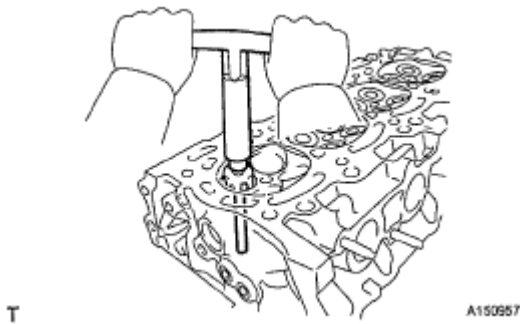


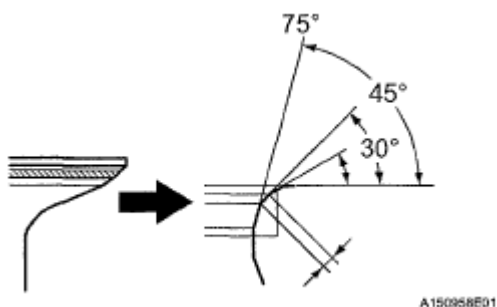
Fig. 399: Repairing Valve Seats
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- 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.

Valve Seat Width

ITEM SPECIFICATION

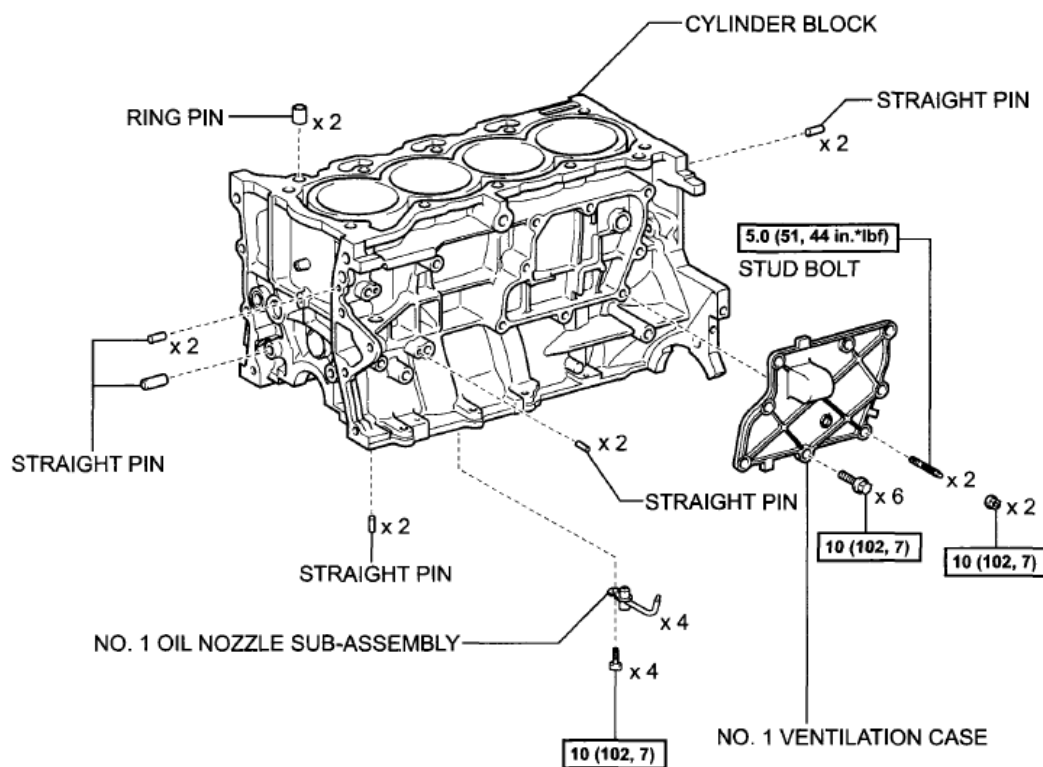
Item	Specified Condition
Intake Side	1.0 to 1.4 mm (0.039 to 0.055 in.)
Exhaust Side	1.0 to 1.4 mm (0.039 to 0.055 in.)

**Fig. 400: Identifying Valve Seat Angle**

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

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

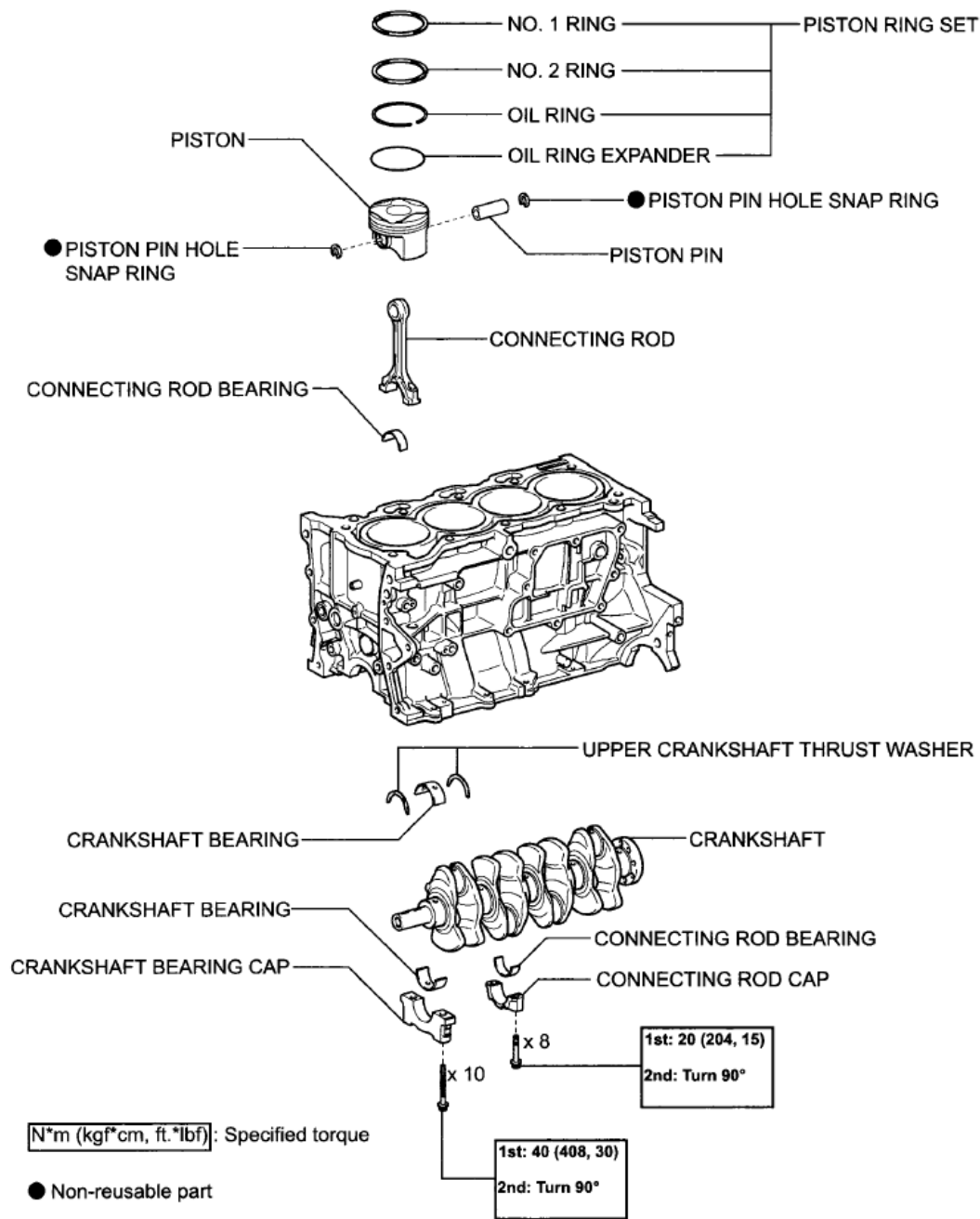
CYLINDER BLOCK**COMPONENTS**



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

A150356E05

Fig. 401: Identifying Cylinder Block Components With Torque Specifications (1 Of 2)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



A173362E01

Fig. 402: Identifying Cylinder Block Components With Torque Specifications (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY

1. REMOVE NO. 1 VENTILATION CASE

- Remove the 6 bolts and 2 nuts.

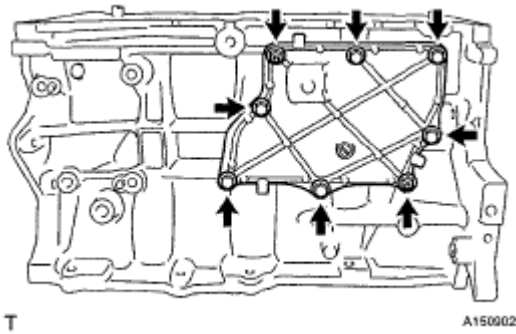


Fig. 403: Locating No. 1 Ventilation Case Bolt

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

- b. Remove the No. 1 ventilation case by prying between the No. 1 ventilation case and cylinder block with a screwdriver as shown in the illustration.

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

HINT:

Tape the screwdriver tip before use.

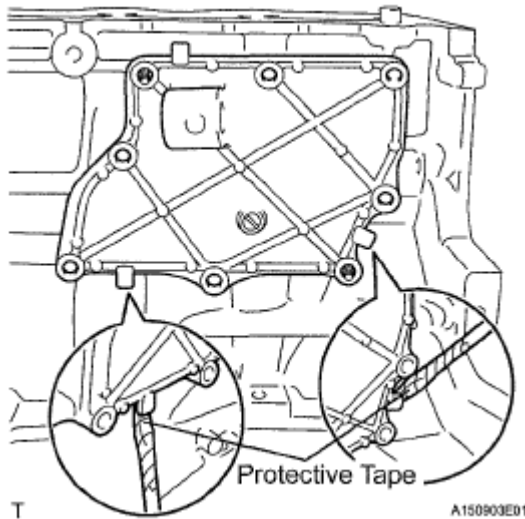


Fig. 404: Identifying No. 1 Ventilation Case

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

2. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- a. Using a ridge reamer, remove all the carbon from the top of the cylinder.

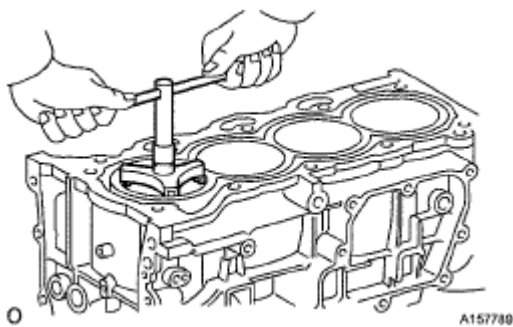


Fig. 405: Removing Piston Sub-Assembly With Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check that the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.

HINT:

The matchmarks on the connecting rods and caps are provided to ensure correct reassembly.

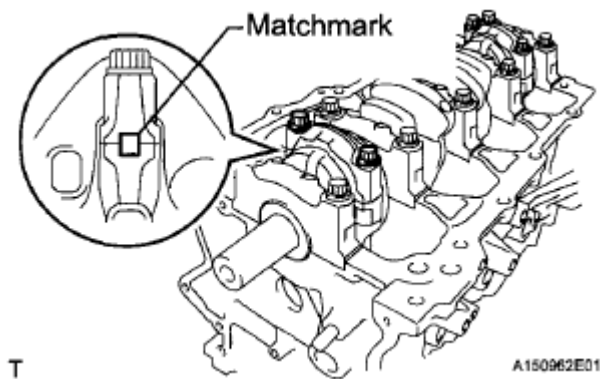


Fig. 406: Identifying Matchmarks On Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using SST, uniformly loosen the 2 bolts.

SST 09205-16010

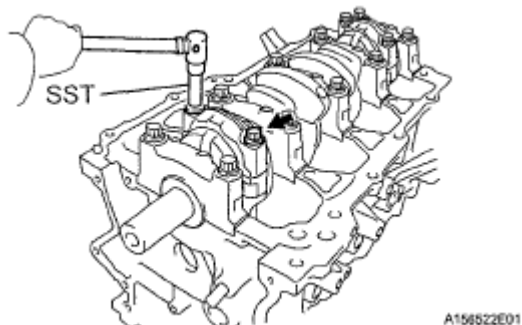


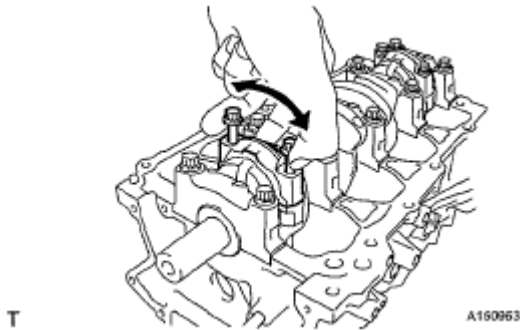
Fig. 407: Tightening Connecting Rods Bolts

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

- d. Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.

HINT:

Keep the lower bearing inserted in the connecting rod cap.

**Fig. 408: Removing Connecting Rod Cap**

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

- e. Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

- Keep the bearing, connecting rod and cap as a set.
- Arrange the piston and connecting rod assemblies in the correct order.

3. REMOVE CONNECTING ROD BEARING

- a. Remove the connecting rod bearings.

HINT:

Arrange the removed parts in the correct order.

4. REMOVE PISTON RING SET

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

HINT:

Arrange the removed parts in the correct order.

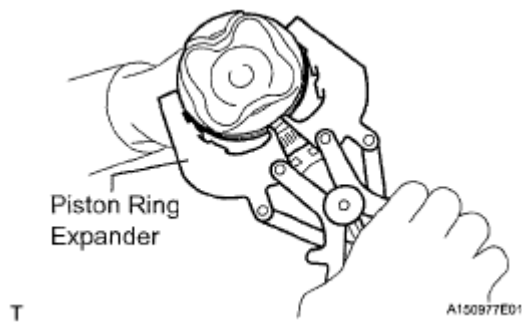


Fig. 409: Removing Piston Ring Set
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. REMOVE PISTON

- a. Using a screwdriver, pry out the 2 snap rings.

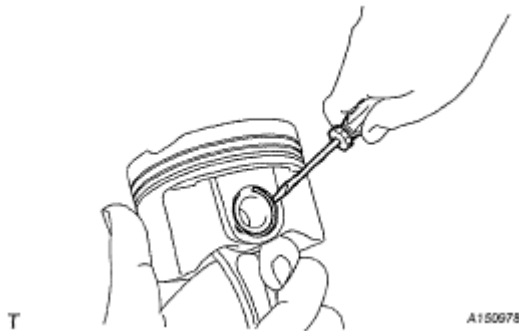


Fig. 410: Prying Snap Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Gradually heat each piston to approximately 80 to 90°C (176 to 194°F).

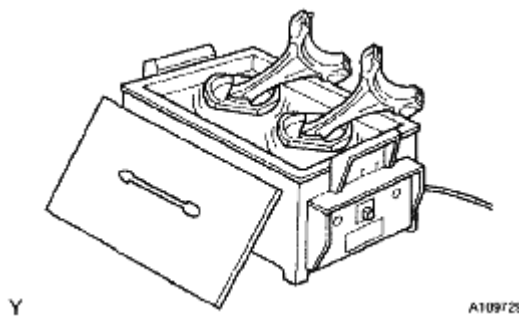


Fig. 411: Heating Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

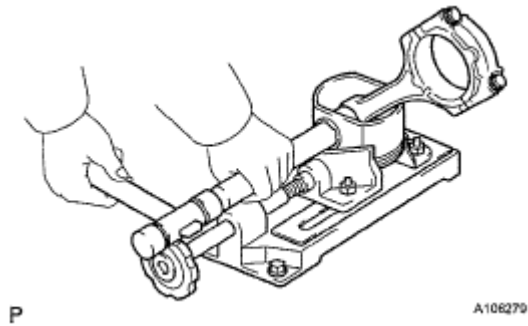


Fig. 412: Tapping Piston Pin

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

6. REMOVE CRANKSHAFT

- Uniformly loosen and remove the 10 main bearing cap bolts in the sequence shown in the illustration.

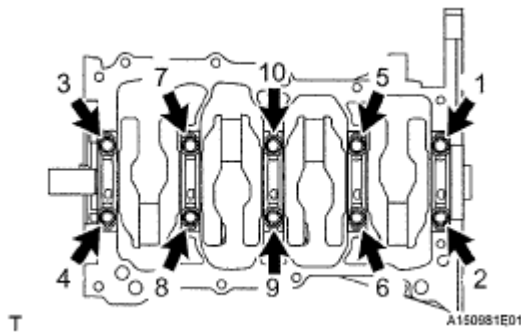


Fig. 413: Locating Crankshaft Bolt Loosen Sequence

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

- Use 2 removed main bearing cap bolts to remove the 5 main bearing caps and 5 lower bearings.

NOTE:

Insert the bolts into the caps in turn. Ease the cap out by gently pulling up and applying force toward the front and back sides of the cylinder block, as shown in the illustration. Be careful to damage the contact surfaces of the cap and cylinder block.

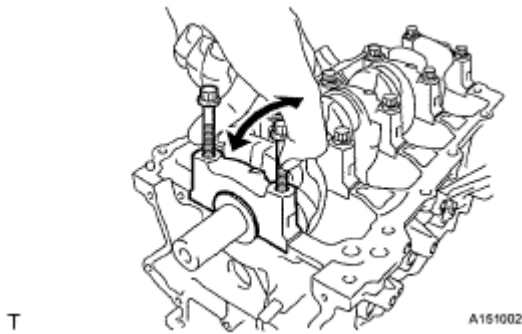


Fig. 414: Removing Main Bearing Cap Bolts

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

HINT:

- Keep the lower bearing and main bearing cap as a set.
 - Arrange the main bearing caps in the correct order.
- c. Lift out the crankshaft.

7. REMOVE UPPER CRANKSHAFT THRUST WASHER

- a. Remove the upper crankshaft thrust washers from the cylinder block.

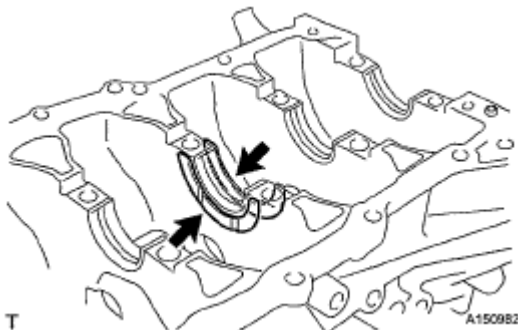


Fig. 415: Locating Upper Crankshaft Thrust Washers

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

8. REMOVE CRANKSHAFT BEARING

- a. Remove the 5 upper main bearings from the cylinder block.

HINT:

Arrange the bearings in the correct order.

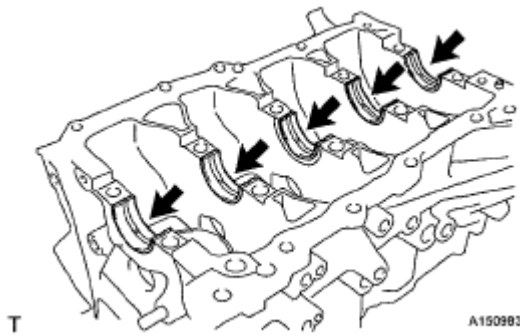


Fig. 416: Locating Crankshaft Bearing

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

- b. Remove the 5 lower main bearings from the 5 main bearing caps.

HINT:

Arrange the bearings in the correct order.

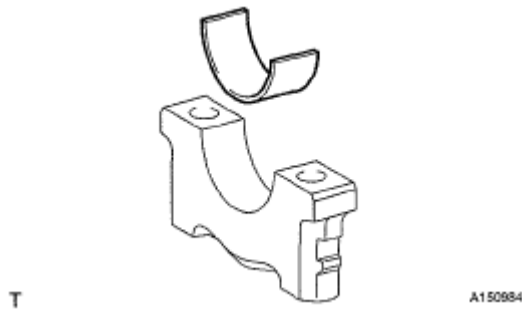


Fig. 417: Identifying Lower Main Bearings

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

9. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY

- a. Using a 5 mm socket hexagon wrench, remove the bolts and oil nozzles.

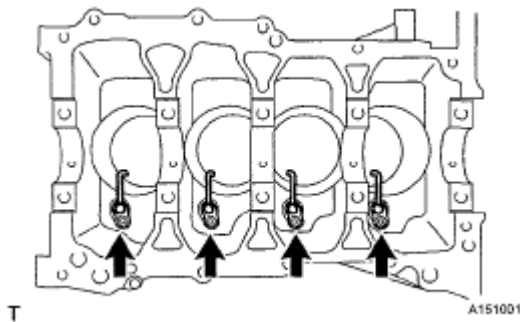


Fig. 418: Locating No. 1 Oil Nozzle Sub-Assembly

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

10. CLEAN CYLINDER BLOCK

NOTE: If the cylinder is washed at high temperature, the cylinder liner will stick out beyond the cylinder block. Always wash the cylinder block at a temperature of 45°C (113°F) or less.

INSPECTION

1. INSPECT CONNECTING ROD THRUST CLEARANCE

- Install the connecting rod cap (See **REASSEMBLY**).
- Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:

0.160 to 0.342 mm (0.0063 to 0.0135 in.)

Maximum thrust clearance:

0.342 mm (0.0135 in.)

If the thrust clearance is greater than the maximum, replace the connecting rod assemblies as necessary. If necessary, replace the crankshaft.

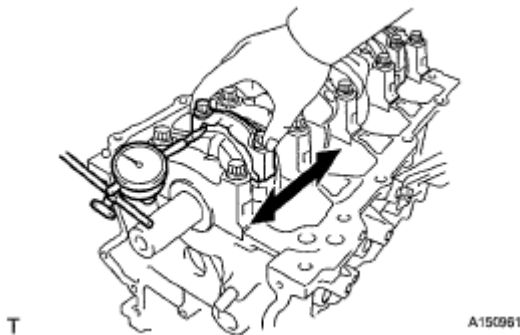


Fig. 419: Measuring Thrust Clearance Connecting Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT CONNECTING ROD OIL CLEARANCE

- Clean the crank pin and bearing.
- Check the crank pin and bearing for pitting end scratches.
- Lay a strip of Plastigage on the crank pin.

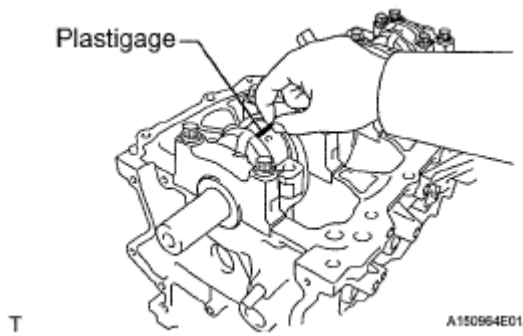


Fig. 420: Laying Strip Of Plastigage On Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Check that the front mark of the connecting rod cap is facing forward.
- e. Install the connecting rod cap (See **REASSEMBLY**).

NOTE: Do not turn the crankshaft.

- f. Remove the 2 bolts and connecting rod cap (See **DISASSEMBLY**).

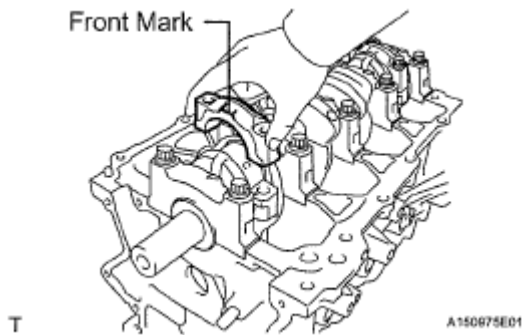


Fig. 421: Checking Front Mark Of Connecting Rod Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Measure the Plastigage at its widest point.

Standard oil clearance:

0.030 to 0.062 mm (0.0012 to 0.0024 in.)

Maximum oil clearance:

0.07 mm (0.0028 in.)

If the oil clearance is greater than the maximum, replace the connecting rod bearings. If necessary, inspect the crankshaft.

NOTE: Completely remove the Plastigage after the measurement.

HINT:

If replacing a bearing, replace it with one that has the same number as its respective connecting rod cap. Each standard bearing thickness is indicated by a 1, 2, or 3 mark on its surface.

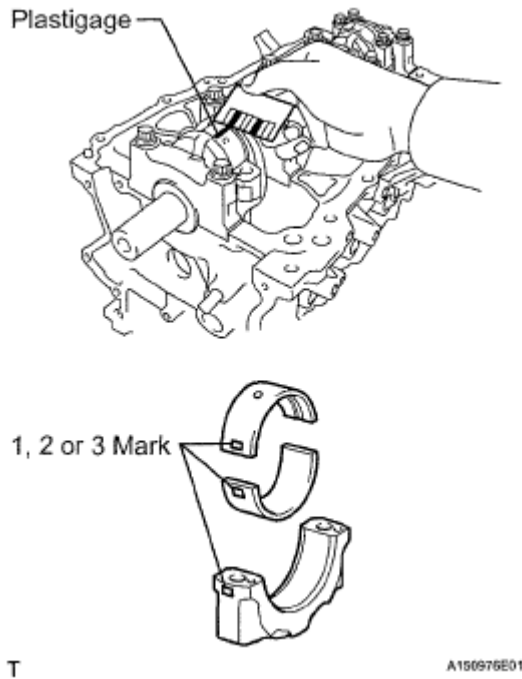


Fig. 422: Measuring Plastigage Of Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Connecting Rod Large End Bore Diameter

MARK SPECIFICATION

Mark	Specified Condition
Mark 1	47.000 to 47.008 mm (1.8504 to 1.8507 in.)
Mark 2	47.009 to 47.016 mm (1.8507 to 1.8510 in.)
Mark 3	47.017 to 47.024 mm (1.8511 to 1.8513 in.)

Standard Connecting Rod Bearing Thickness

MARK SPECIFICATION

Mark	Specified Condition
Mark 1	1.489 to 1.493 mm (0.0586 to 0.0588 in.)
Mark 2	1.494 to 1.497 mm (0.0588 to 0.0589 in.)
Mark 3	1.498 to 1.501 mm (0.0590 to 0.0591 in.)

Standard Crankshaft Pin Diameter**MARK SPECIFICATION**

Mark	Specified Condition
Mark 1, 2, 3	43.992 to 44.000 mm (1.7320 to 1.7323 in.)

3. 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 (0.0020 in.)

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

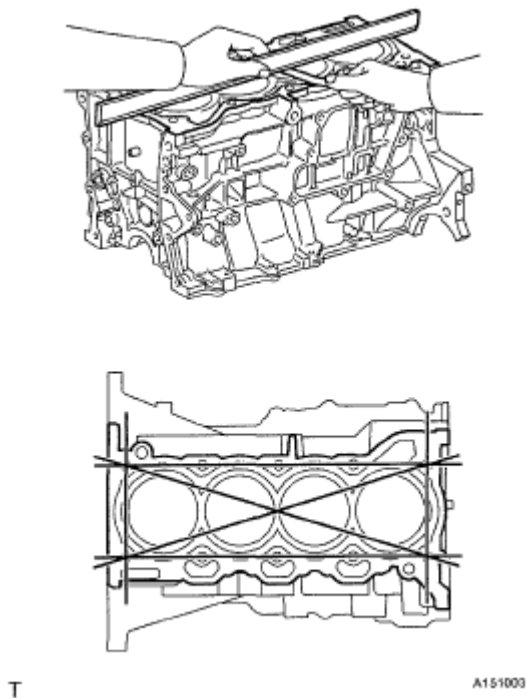


Fig. 423: Inspecting Cylinder Block For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSPECT CYLINDER BORE

- a. Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in both thrust and axial directions.

Standard diameter:

80.500 to 80.513 mm (3.1693 to 3.1698 in.)

Maximum diameter:

80.633 mm (3.1745 in.)

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

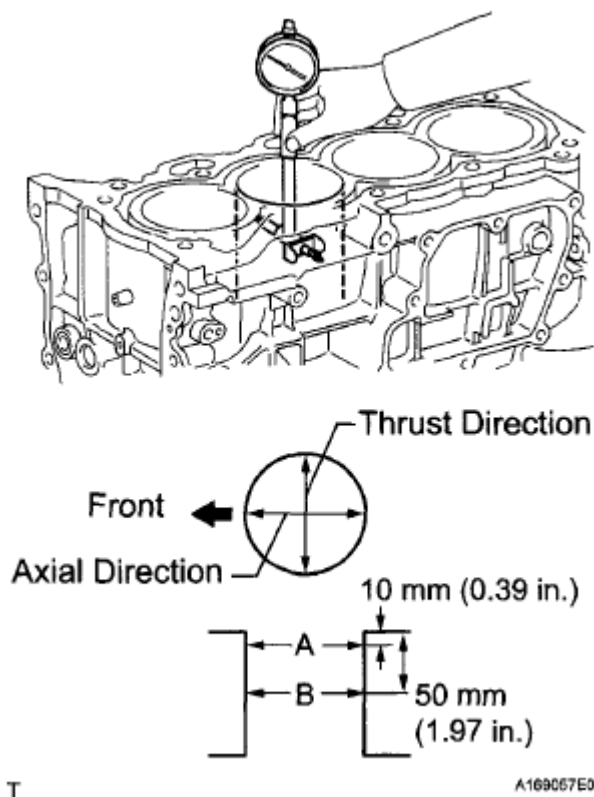
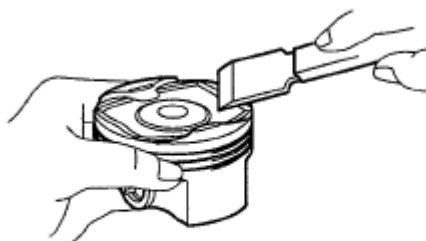


Fig. 424: Inspecting Cylinder Bore

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

5. INSPECT PISTON

- Using a gasket scraper, remove the carbon from the top of the piston.



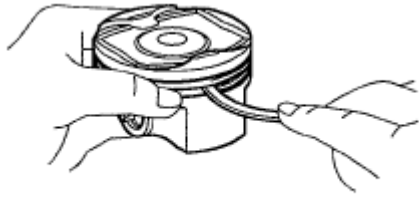
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Fig. 425: Removing Carbon Top Of Piston

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

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



0

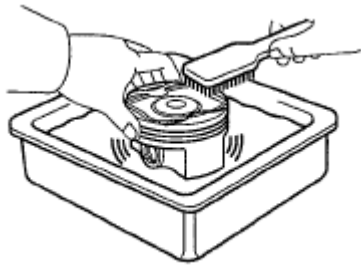
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Fig. 426: Cleaning Piston Ring Grooves

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.



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Fig. 427: Cleaning Piston Head

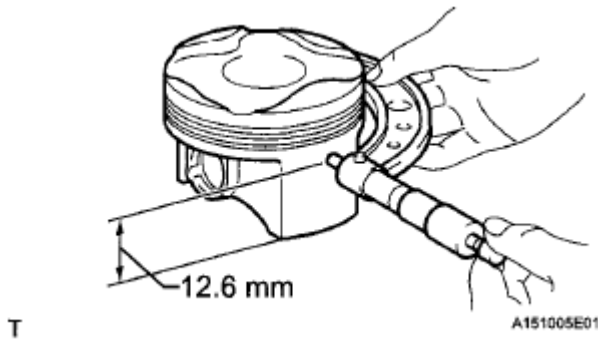
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a micrometer, measure the piston diameter at right angles to the piston pin hole, and at a point 12.6 mm (0.4961 in.) from the piston head.

Standard piston diameter:

80.461 to 80.471 mm (3.1677 to 3.1681 in.)

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

**Fig. 428: Measuring Piston Diameter**

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

6. INSPECT PISTON OIL CLEARANCE

- a. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:**0.029 to 0.052 mm (0.0011 to 0.0020 in.)****Maximum oil clearance:****0.09 mm (0.0035 in.)**

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

7. INSPECT RING GROOVE CLEARANCE

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

Standard Ring Groove Clearance**ITEM SPECIFICATION**

Item	Specified Condition
No. 1 Ring	0.02 to 0.07 mm (0.0008 to 0.0028 in.)
No. 2 Ring	0.02 to 0.06 mm (0.0008 to 0.0024 in.)
Oil Ring	0.02 to 0.065 mm (0.0008 to 0.0026 in.)

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

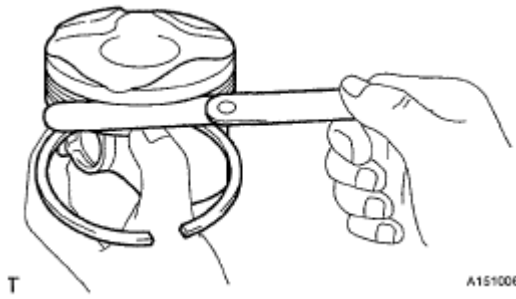


Fig. 429: Measuring Clearance Between Piston Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSPECT PISTON RING END GAP

- Using a piston, push the piston ring a little beyond the bottom of the ring travel, 50 mm (1.97 in.) from the top of the cylinder block.

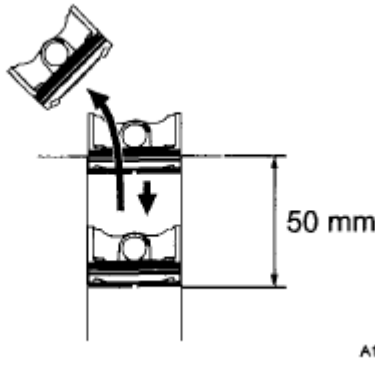


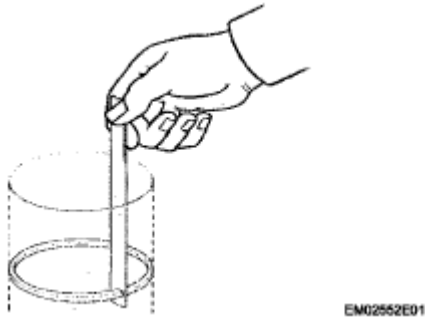
Fig. 430: Identifying Piston Ring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Using a feeler gauge, measure the end gap.

Standard End Gap

ITEM SPECIFICATION

Item	Specified Condition
No. 1 Ring	0.2 to 0.3 mm (0.0079 to 0.0118 in.)
No. 2 Ring	0.3 to 0.5 mm (0.0118 to 0.0197 in.)
Oil Ring	0.1 to 0.4 mm (0.0039 to 0.0157 in.)

**Fig. 431: Measuring End Gap**

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

Maximum End Gap

ITEM SPECIFICATION

Item	Specified Condition
No. 1 Ring	0.5 mm (0.0197 in.)
No. 2 Ring	0.7 mm (0.0276 in.)
Oil Ring	0.7 mm (0.0276 in.)

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

9. INSPECT PISTON PIN OIL CLEARANCE

- Using a caliper gauge, measure the piston pin bore diameter.

Standard piston pin bore diameter:

20.006 to 20.015 mm (0.7876 to 0.7880 in.)

ITEM SPECIFICATION

Item	Specified Condition
A	20.006 to 20.009 mm (0.7876 to 0.7878 in.)
B	20.010 to 20.012 mm (0.7878 to 0.7879 in.)
C	20.013 to 20.015 mm (0.7879 to 0.7880 in.)

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

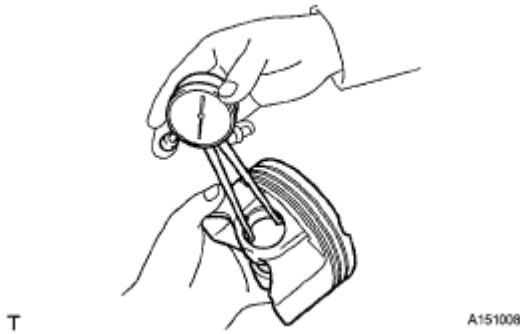


Fig. 432: Measuring Piston Pin Bore Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

Standard piston pin diameter:

20.004 to 20.013 mm (0.7876 to 0.7879 in.)

ITEM SPECIFICATION

Item	Specified Condition
A	20.004 to 20.007 mm (0.7876 to 0.7877 in.)
B	20.008 to 20.010 mm (0.7877 to 0.7878 in.)
C	20.011 to 20.013 mm (0.7878 to 0.7879 in.)

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

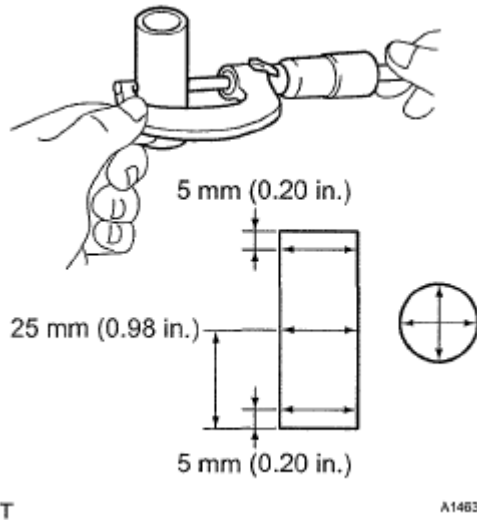


Fig. 433: Measuring Piston Pin Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a caliper gauge, measure the connecting rod small end bore diameter.

Standard connecting rod small end bore diameter:

20.012 to 20.021 mm (0.7879 to 0.7882 in.)

ITEM SPECIFICATION

Item	Specified Condition
A	20.012 to 20.015 mm (0.7879 to 0.7880 in.)
B	20.016 to 20.018 mm (0.7880 to 0.7881 in.)
C	20.019 to 20.021 mm (0.7881 to 0.7882 in.)

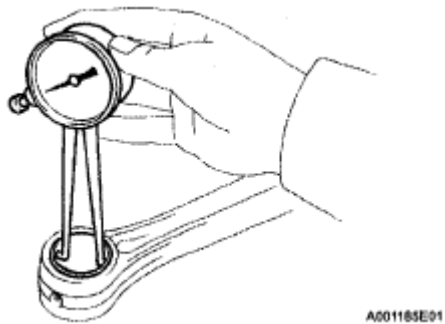


Fig. 434: Measuring Connecting Rod Small End Bore Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

Standard oil clearance:

-0.001 to 0.005 mm (-0.00004 to 0.0002 in.)

Maximum oil clearance:

0.010 mm (0.0004 in.)

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

- e. Subtract the piston pin diameter measurement from the connecting rod small end bore diameter measurement.

Standard oil clearance:

0.005 to 0.011 mm (0.0002 to 0.0004 in.)

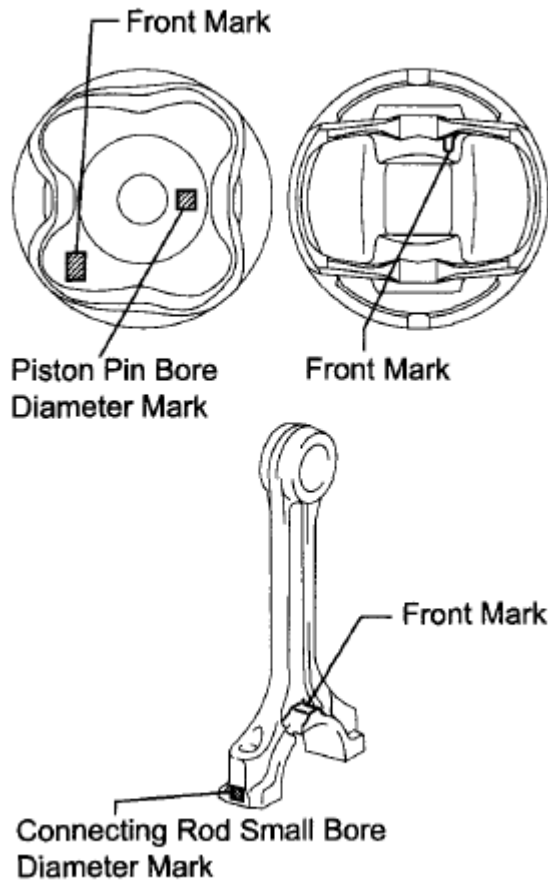
Maximum oil clearance:

0.014 mm (0.0006 in.)

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

Upper Side:

Lower Side:



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Fig. 435: Identifying Connecting Rod Small Bore Diameter Mark
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. INSPECT CONNECTING ROD BOLT

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

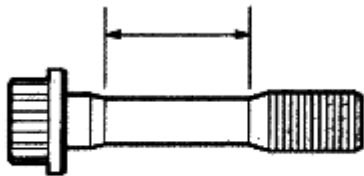
Standard diameter:

6.6 to 6.7 mm (0.2598 to 0.2638 in.)

Minimum diameter:

6.4 mm (0.2520 in.)

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



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Fig. 436: Identifying Connecting Rod Bolt

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

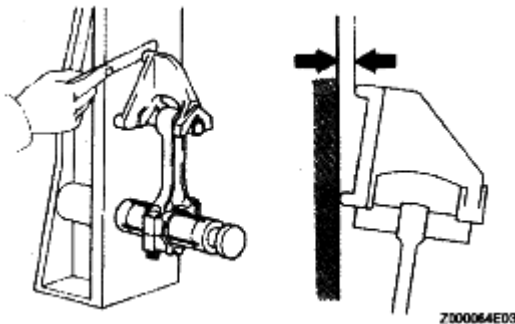
11. INSPECT CONNECTING ROD SUB-ASSEMBLY

- a. Using a connecting rod aligner and a feeler gauge, check the connecting rod alignment.
 1. Check for misalignment.

Maximum misalignment:

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

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



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Fig. 437: Inspecting Connecting Rod Sub-Assembly

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

2. Check for twist.

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

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

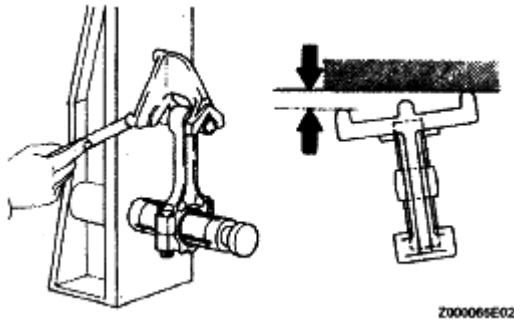


Fig. 438: Checking Connecting Rod Twist
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. INSPECT CRANKSHAFT

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

Maximum circle runout:

0.03 mm (0.0012 in.)

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

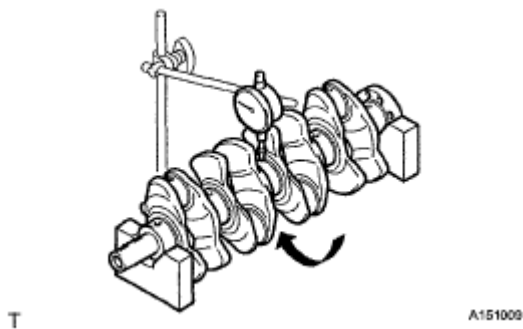


Fig. 439: Measuring Circle Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a micrometer, measure the diameter of each main journal.

Standard diameter:

47.988 to 48.000 mm (1.8893 to 1.8898 in.)

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

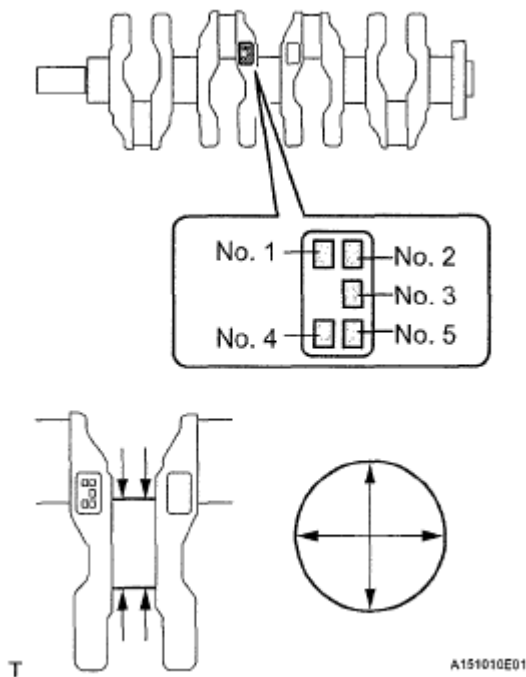


Fig. 440: Identifying Diameter Of Main Journal
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check each main journal for taper and distortion as shown in the illustration.

Maximum taper and distortion:

0.004 mm (0.0002 in.)

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

Standard Diameter (Reference)

MARK SPECIFICATION

Mark	Specified Condition
0	47.999 to 48.000 mm (1.8897 to 1.8898 in.)
1	47.997 to 47.998 mm (1.8896 to 1.8897 in.)
2	47.995 to 47.996 mm (1.8896 to 1.8896 in.)
3	47.993 to 47.994 mm (1.8895 to 1.8895 in.)
4	47.991 to 47.992 mm (1.8894 to 1.8894 in.)
5	47.988 to 47.990 mm (1.8893 to 1.8894 in.)

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

Standard diameter:

43.992 to 44.000 mm (1.7320 to 1.7323 in.)

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

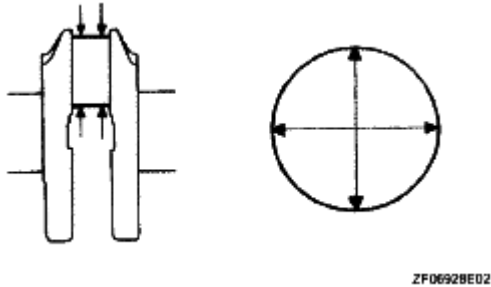


Fig. 441: Identifying Diameter Of Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Inspect each crank pin for taper and distortion as shown in the illustration.

Maximum taper and distortion:

0.004 mm (0.0002 in.)

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

13. INSPECT CRANKSHAFT THRUST CLEARANCE

- a. Install the main bearing cap (See **REASSEMBLY**).
- b. Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.04 to 0.14 mm (0.0016 to 0.0055 in.)

Maximum thrust clearance:

0.18 mm (0.0071 in.)

If the thrust clearance is greater than the maximum, replace the thrust washers as a set.

HINT:

The thrust washer thickness is 2.43 to 2.48 mm (0.0957 to 0.0976 in.).

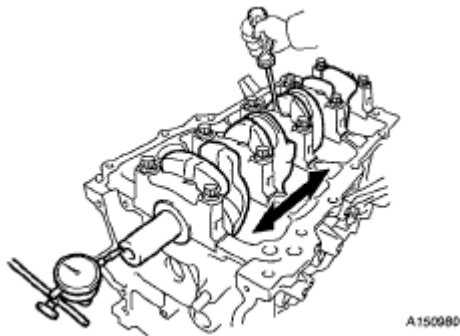


Fig. 442: Measuring Thrust Clearance Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. INSPECT CRANKSHAFT OIL CLEARANCE

- a. Check the crank journal and bearing for pitting and scratches.
- b. Install the crankshaft bearing (See **REASSEMBLY**).
- c. Place the crankshaft on the cylinder block.
- d. Lay a strip of Plastigage across each journal.
- e. Examine the front marks and numbers and install the bearing caps on the cylinder block.

HINT:

A number is marked on each main bearing cap to indicate the installation position.

- f. Install the main bearing cap (See **REASSEMBLY**).

NOTE: Do not turn the crankshaft.

- g. Remove the main bearing caps (See **DISASSEMBLY**).

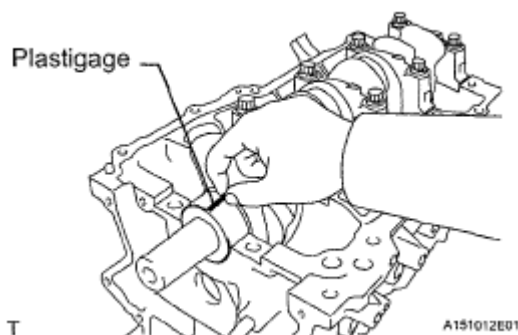


Fig. 443: Inspecting Crankshaft Oil Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Measure the Plastigage at its widest point.

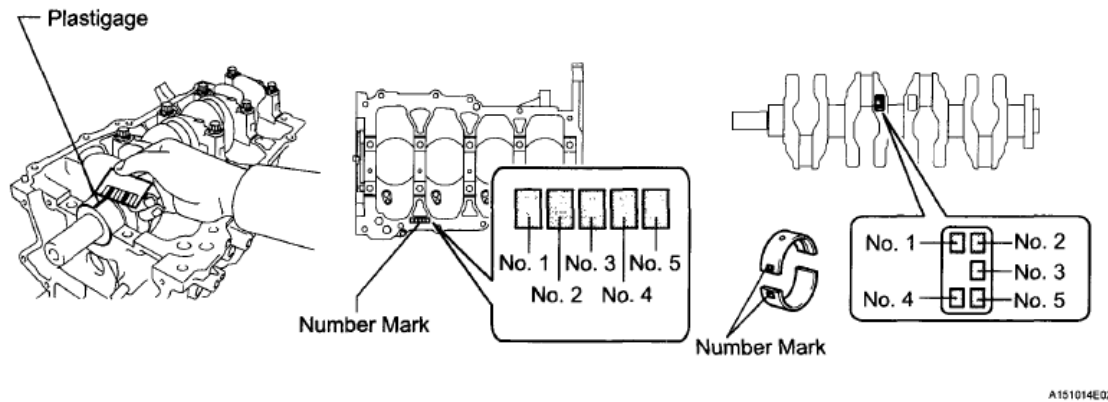


Fig. 444: Measuring Plastigage Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard oil clearance:

0.016 to 0.039 mm (0.0006 to 0.0015 in.)

Maximum oil clearance:

0.050 mm (0.0020 in.)

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

NOTE: Remove the Plastigage completely after the measurement.

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 according to the chart below. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.
- EXAMPLE: Cylinder block "3" + Crankshaft "5" = Total number 8 (Use bearing "3")

CYLINDER BLOCK REFERENCE

Cylinder block + Crankshaft	0 to 2	3 to 5	6 to 8	9 to 11
Bearing to be used	"1"	"2"	"3"	"4"

Standard Cylinder Block Journal Bore Diameter

MARK SPECIFICATION

Mark	Specified Condition
0	52.000 to 52.003 mm (2.0472 to 2.0474 in.)
1	52.003 to 52.005 mm (2.04736 to 2.04744 in.)

2	52.005 to 52.007 mm (2.0474 to 2.0475 in.)
3	52.007 to 52.010 mm (2.0475 to 2.0476 in.)
4	52.010 to 52.012 mm (2.0476 to 2.0477 in.)
5	52.012 to 52.014 mm (2.0477 to 2.0478 in.)
6	52.014 to 52.016 mm (2.0478 to 2.0479 in.)

Standard Crankshaft Journal Diameter**MARK SPECIFICATION**

Mark	Specified Condition
0	47.999 to 48.000 mm (1.8897 to 1.8898 in.)
1	47.997 to 47.998 mm (1.8896 to 1.8897 in.)
2	47.995 to 47.996 mm (1.88956 to 1.88960 in.)
3	47.993 to 47.994 mm (1.8895 to 1.8895 in.)
4	47.991 to 47.992 mm (1.8894 to 1.8894 in.)
5	47.988 to 47.990 mm (1.8893 to 1.8894 in.)

Standard Bearing Center Wall Thickness**MARK SPECIFICATION**

Mark	Specified Condition
1	1.994 to 1.997 mm (0.0785 to 0.0786 in.)
2	1.998 to 2.000 mm (0.07866 to 0.07874 in.)
3	2.001 to 2.003 mm (0.0788 to 0.0789 in.)
4	2.004 to 2.006 mm (0.0789 to 0.0790 in.)

15. INSPECT CYLINDER HEAD SET BOLT

- a. Using a vernier caliper, measure the tension portion diameter of the bolts.

Standard bolt length:

84.3 to 85.7 mm (3.3189 to 3.3740 in.)

Maximum bolt length:

86.7 mm (3.4134 in.)

If the bolt length is greater than the maximum, replace the bolt.

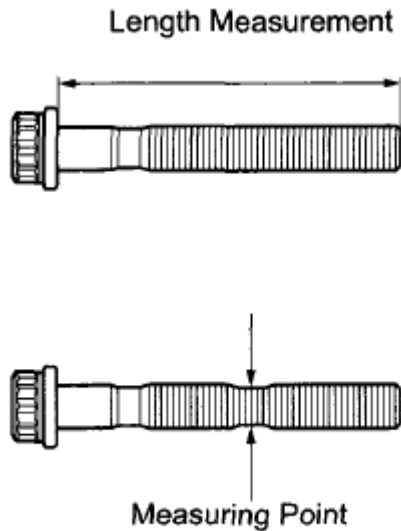
- b. Using a vernier caliper, measure the minimum diameter of the elongated thread at the measuring point.

Standard outside diameter:

9.77 to 9.96 mm (0.3846 to 0.3921 in.)

Minimum outside diameter:

9.1 mm (0.3583 in.)



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Fig. 445: Identifying Cylinder Head Set Bolt Dimension
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Using a straightedge, visually check for thinner areas of the threaded part of the crankshaft bearing cap bolt.

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

16. INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY

- a. Check the oil nozzles for damage or clogging.

HINT:

If there is damage or clogging, replace the oil nozzle.

REPLACEMENT

1. REPLACE RING PIN

NOTE: It is not necessary to remove the ring pins unless they are being replaced.

- a. Remove the ring pins.
- b. Using a plastic hammer, tap in the ring pins.

Standard protrusion:

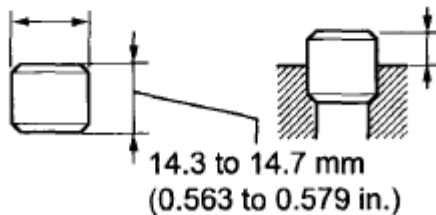
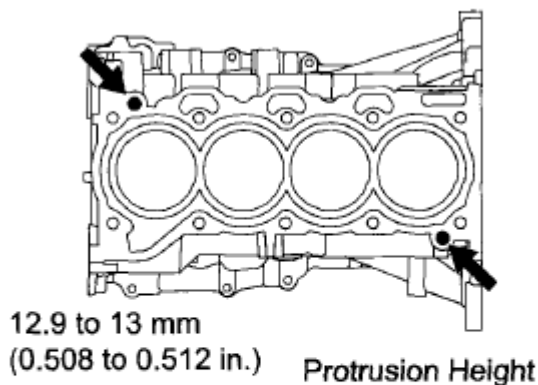
7.5 to 8.5 mm (0.295 to 0.335 in.)

2. REPLACE STUD BOLT

NOTE: If any of the stud bolts is deformed or the threads are damaged, replace it.

- a. Remove the stud bolts.

Upper Side:



T

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Fig. 446: Locating Stud Bolts

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

- b. Using a "TORX" socket E6, install the stud bolts as shown in the illustration.

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

3. REPLACE STRAIGHT PIN

NOTE: It is not necessary to remove the straight pins unless they are being

replaced.

- a. Remove the straight pins.

LH Side:

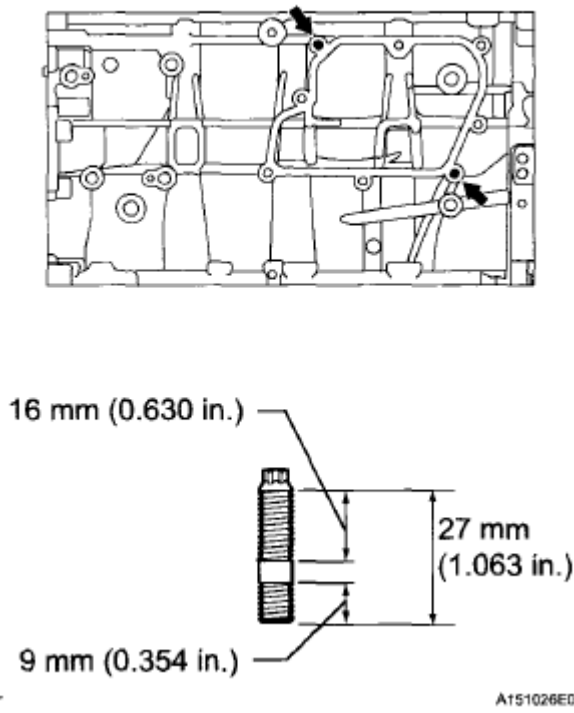
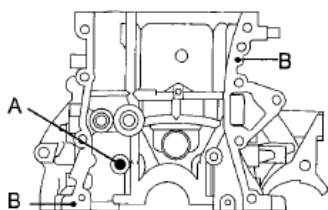


Fig. 447: Locating Straight Pins

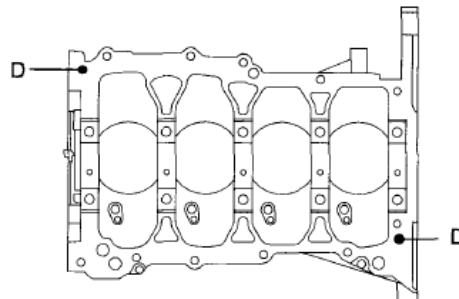
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a plastic hammer, tap in the straight pins.

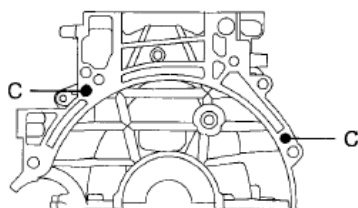
Front Side:



Lower Side:



Rear Side:



LH Side:

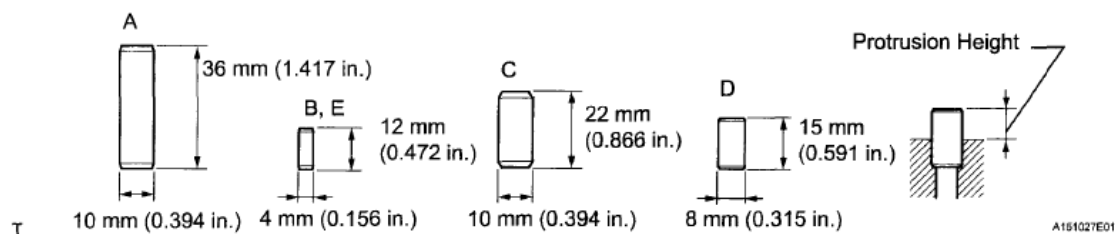
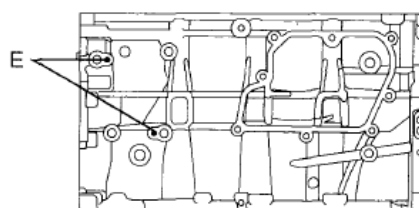


Fig. 448: Straight Pins Dimension Chart
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Protrusion

STANDARD PROTRUSION CHART

Item	Protrusion
Pin A	18.5 to 19.5 mm (0.729 to 0.768 in.)
Pin B	5.0 to 7.0 mm (0.197 to 0.276 in.)
Pin C	11 to 13 mm (0.433 to 0.512 in.)
Pin D	5.0 to 7.0 mm (0.197 to 0.276 in.)
Pin E	5.0 to 6.0 mm (0.197 to 0.236 in.)

REASSEMBLY

1. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

- Using a 5 mm socket hexagon wrench, install the oil nozzles with the bolts.

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

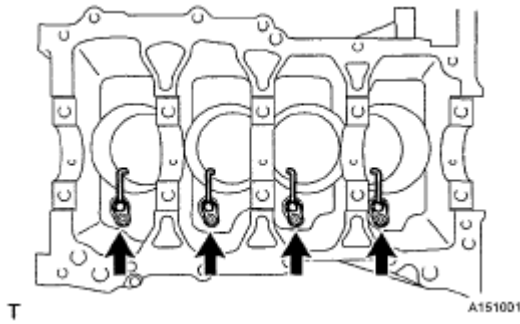


Fig. 449: Locating No. 1 Oil Nozzle Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL PISTON

- a. Using a screwdriver, install a new snap ring at one end of the piston pin hole.

HINT:

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

- b. Gradually heat the piston to approximately 80 to 90°C (176 to 194°F).

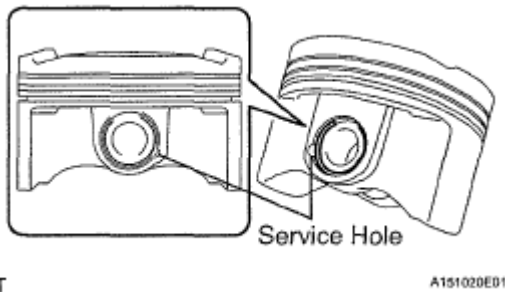


Fig. 450: Identifying Piston Service Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Align the front marks of the piston and connecting rod, and push in the piston by hand.

HINT:

The piston and pin are a matched set.

- d. Using a screwdriver, install a new snap ring on the other end of the piston pin hole.

HINT:

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

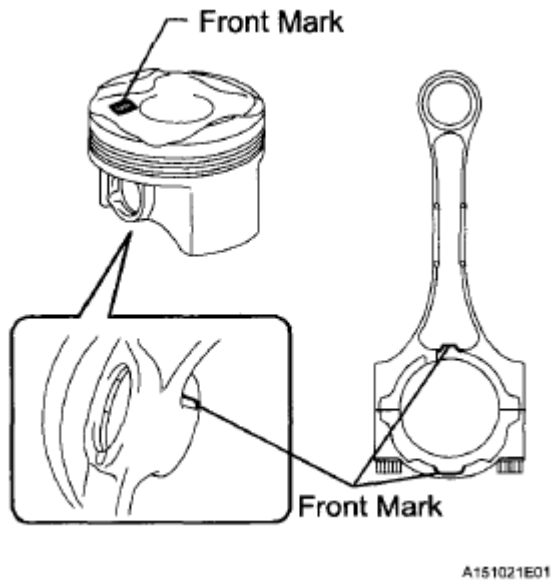


Fig. 451: Identifying Piston And Connecting Rod Front Mark Location
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Check the fitting condition between the piston and piston pin by trying to move the piston back and forth on the piston pin.



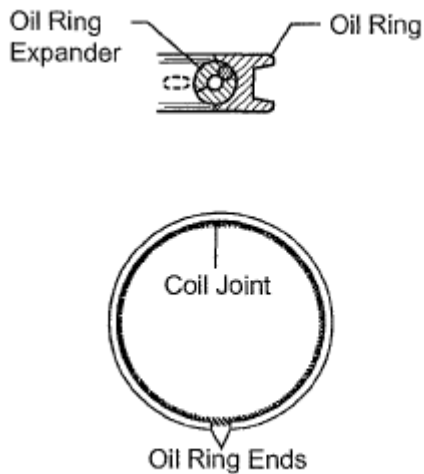
Fig. 452: Checking Fitting Condition Between Piston And Piston Pin
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL PISTON RING SET

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

NOTE:

- Install the expander and oil ring so that their ring ends are at opposite sides.
- Securely install the expander to the inner groove of the oil ring.



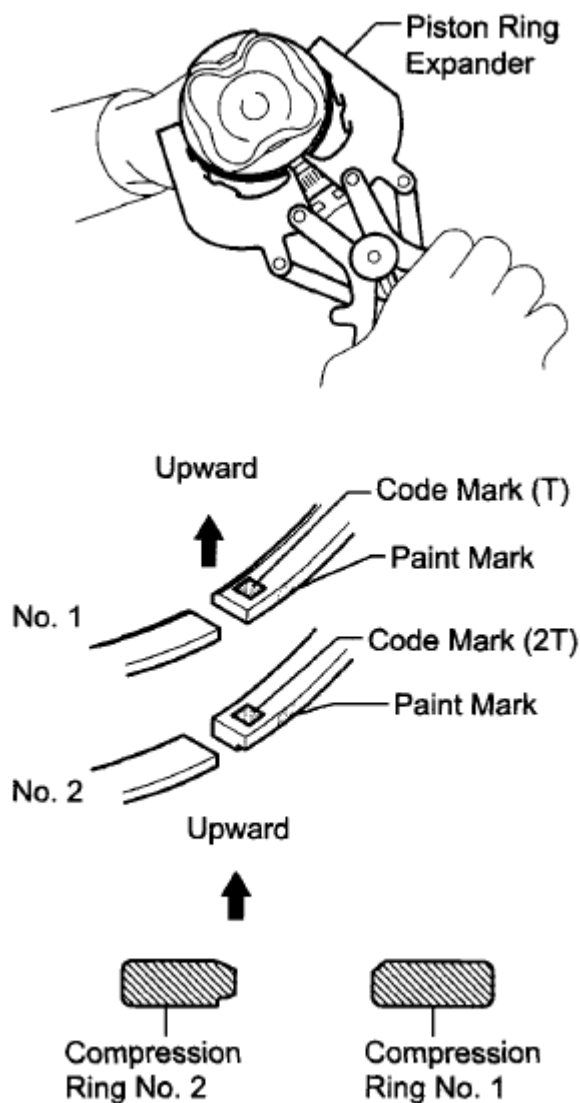
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Fig. 453: Identifying Expander And Oil Ring**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

- b. Using a piston ring expander, install the 2 compression rings so that the paint marks are positioned as shown in the illustration.

NOTE:

- Install the compression ring No. 1 with the code mark (T) facing upward.
- Install the compression ring No. 2 with the code mark (2T) facing upward.
- Paint marks can only be checked on new piston rings. When reusing piston rings, check each piston ring profile in order to install them into the correct positions.

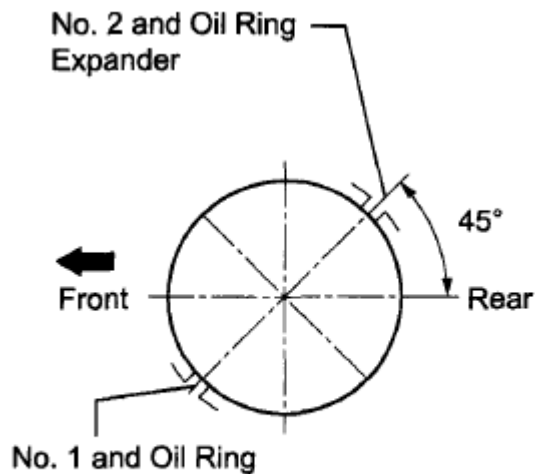


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Fig. 454: Identifying Compression Ring No. 2 With Code Mark
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Position the piston rings so that the ring ends are as shown in the illustration.



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Fig. 455: Identifying Piston Rings Position
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. INSTALL CRANKSHAFT BEARING

- a. Install the upper bearing (for except No. 3 journal).
 1. Install the upper bearing with an oil groove on the cylinder block.
 2. Using a scale, measure the distance between the cylinder block edge and the upper bearing edge.

NOTE: Do not apply engine oil to the bearing inner surface or journal contact surfaces.

Dimension (A):

0.5 to 1.0 mm (0.020 to 0.039 in.)

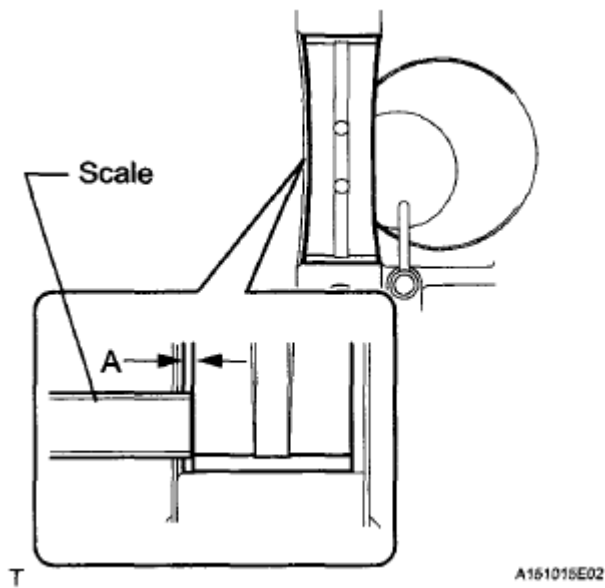


Fig. 456: Installing Upper Bearing Oil Groove On Cylinder Block
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the upper bearing (for No. 3 journal).
 1. Install the upper bearing with an oil groove on the cylinder block.
 2. Using a vernier caliper, measure the distance between the cylinder block edge and the upper bearing edge.

NOTE: Do not apply engine oil to the bearing inner surface or journal contact surfaces.

Dimension (A - B):

0.5 mm (0.0197 in.) or less

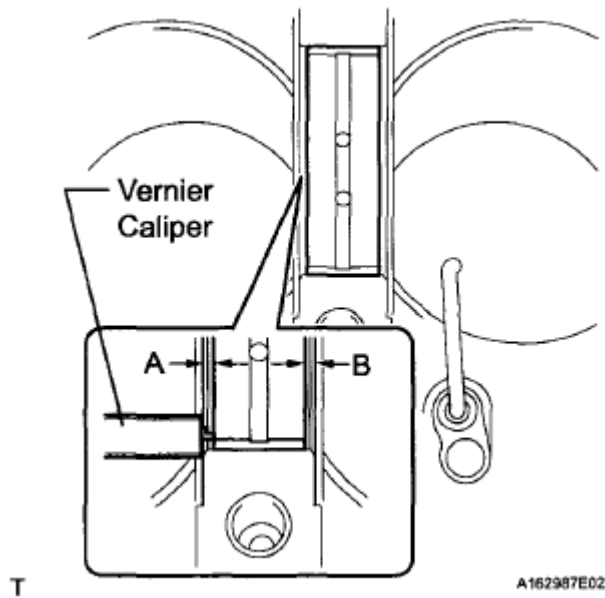


Fig. 457: Measuring Distance Between Cylinder Block Edge And Upper Bearing Edge
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the lower bearing.
 - 1. Install the lower bearing onto the bearing cap.
 - 2. Using a vernier caliper, measure the distance between the bearing cap edge and the lower bearing edge.

Dimension (A - B):

0.5 mm (0.0197 in.) or less

NOTE: Do not apply engine oil to the bearing inner surface or bearing cap contact surfaces.

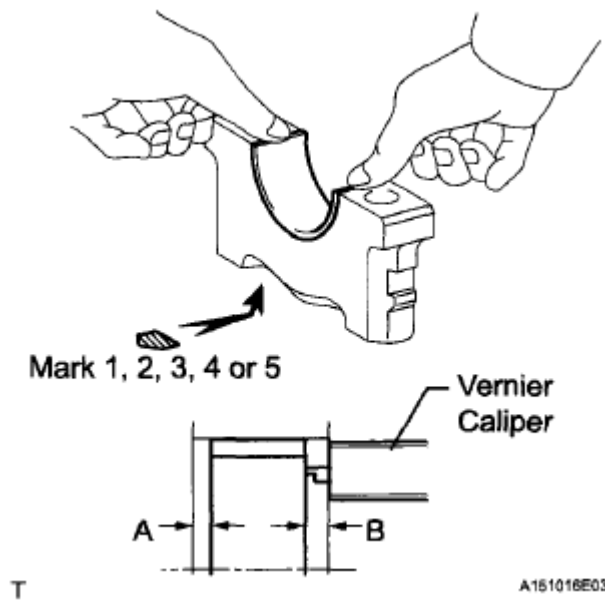


Fig. 458: Measuring Distance Between Bearing Cap Edge And Lower Bearing Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

5. INSTALL UPPER CRANKSHAFT THRUST WASHER

- Install the 2 thrust washers under the No. 3 journal of the cylinder block with the oil grooves facing outward.
- Apply engine oil to the crankshaft thrust washer.

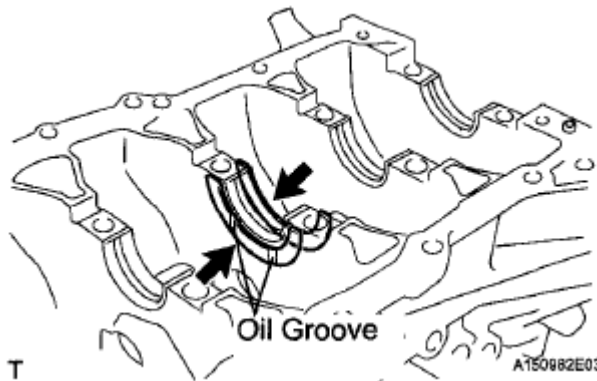


Fig. 459: Locating Upper Crankshaft Thrust Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. INSTALL CRANKSHAFT

- Apply engine oil to the upper bearing and install the crankshaft on the cylinder block.
- Apply engine oil to the lower bearing.
- Examine the number marks and install the bearing caps on the cylinder block.
- Apply a light coat of engine oil to the threads and under the bearing cap bolts.

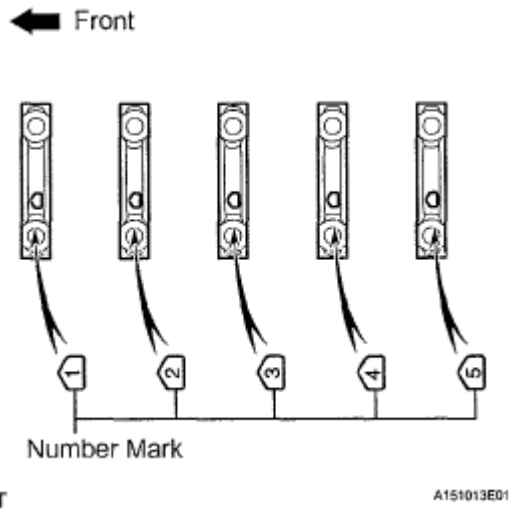


Fig. 460: Identifying Number Marks On Cylinder Block
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Temporarily install the 10 main bearing cap bolts.

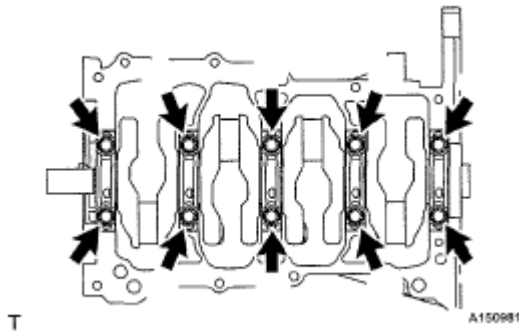


Fig. 461: Locating Main Bearing Cap Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Insert the main bearing cap by hand until the clearance between the main bearing cap and the cylinder block is less than 5 mm (0.20 in.) using the 2 internal bearing cap bolts as guides.

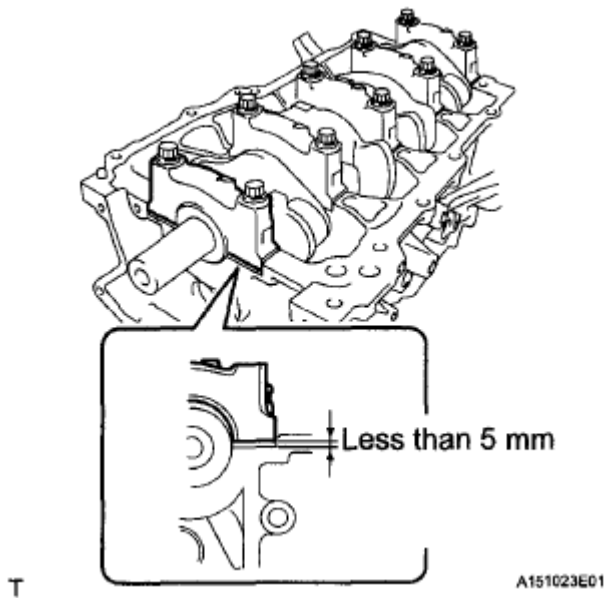


Fig. 462: Identifying Clearance Between Main Bearing Cap And Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- g. Using a plastic hammer, lightly tap the bearing cap to ensure a proper fit.
- h. Install the crankshaft bearing cap bolts.

NOTE: Tighten the main bearing cap bolts in 2 progressive steps.

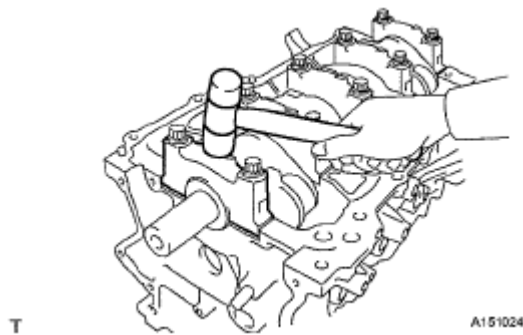


Fig. 463: Tapping Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- i. Step 1
 - 1. Install and uniformly tighten the 10 main bearing cap bolts in the sequence shown in the illustration.

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

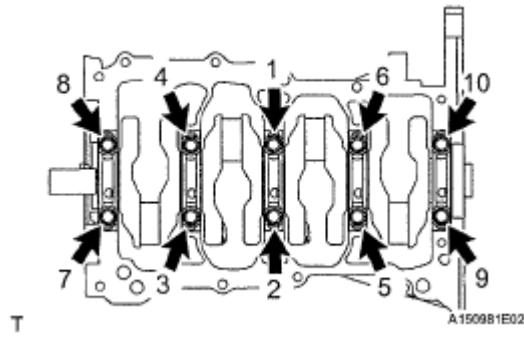


Fig. 464: Locating Bearing Cap Bolts Location
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

j. Step 2

1. Mark the front of the bearing cap bolts with paint.
2. Further tighten the bearing cap bolts an additional 90° in the numerical order shown in the previous illustration.

k. Check that the paint mark is now at a 90° angle to the front.

- l. Check that the crankshaft turns smoothly.
- m. Check the crankshaft thrust clearance (See **INSPECTION**).

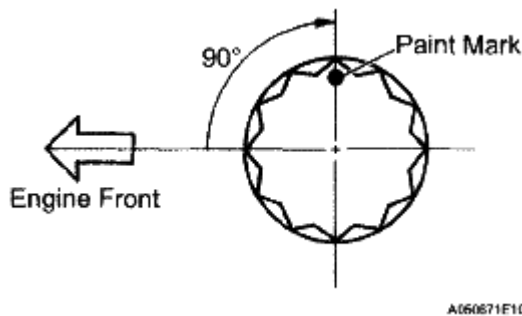


Fig. 465: Identifying Bearing Cap Bolt Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. INSTALL CONNECTING ROD BEARING

- a. Install the connecting rod bearing to the connecting rod and bearing cap.
- b. Using a vernier caliper, measure the distance between the connecting rod and bearing cap edges and the connecting rod bearing edge.

Dimension (A - B):

0.7 mm (0.0276 in.) or less

NOTE: Do not apply engine oil to the bearing inner surface or connecting rod contact surfaces.

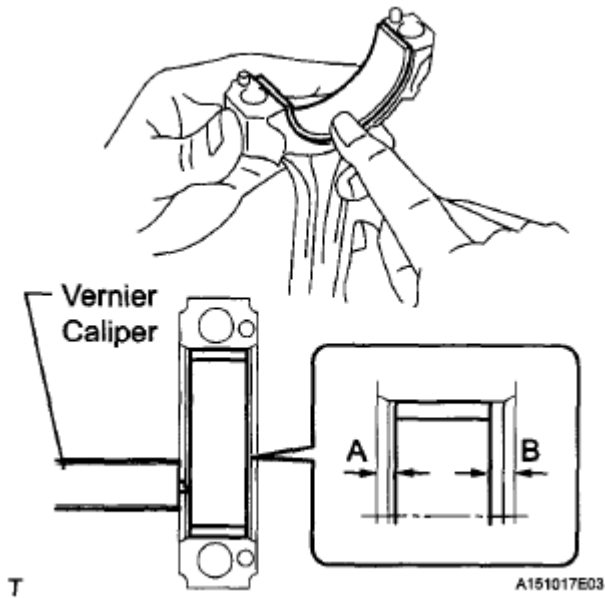


Fig. 466: Installing Connecting Rod Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

- Apply engine oil to the cylinder walls, the pistons, and the surfaces of the connecting rod bearings.
- Position the piston rings so that the ring ends are as shown in the illustration.

NOTE: Do not align the ring ends.

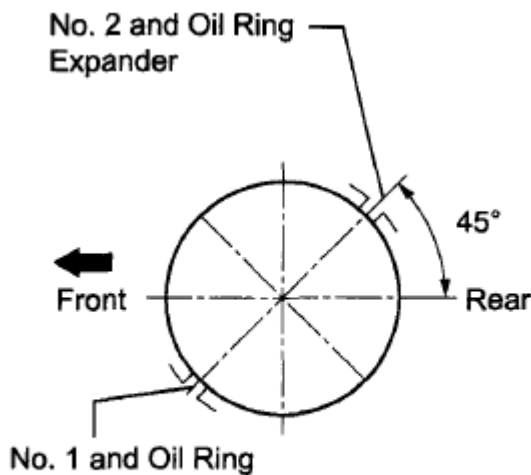


Fig. 467: Positioning Piston Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a piston ring compressor, push the correctly numbered piston and connecting rod assembly into the cylinder with the front mark of the piston facing forward.

NOTE:

- When inserting the piston with connecting rod, do not allow it to make contact with the oil nozzle.
- Match the numbered connecting rod cap with the connecting rod.

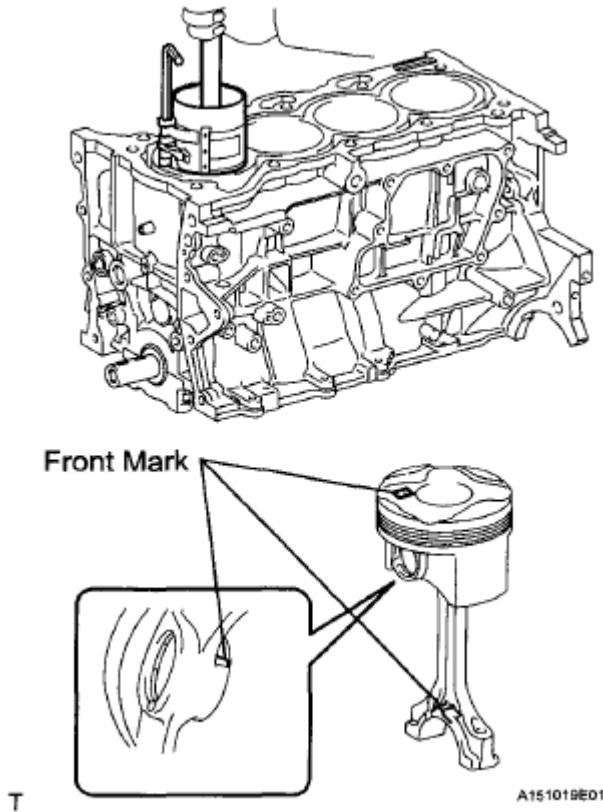


Fig. 468: Identifying Piston Front Mark Location

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

- d. Check that the protrusion of the connecting rod cap is facing in the correct direction.
 e. Apply a light coat of engine oil to the threads and under the heads of the connecting rod cap bolts.
 f. Install the connecting rod cap bolts.

NOTE:

Tighten the connecting rod cap bolts in 2 progressive steps.

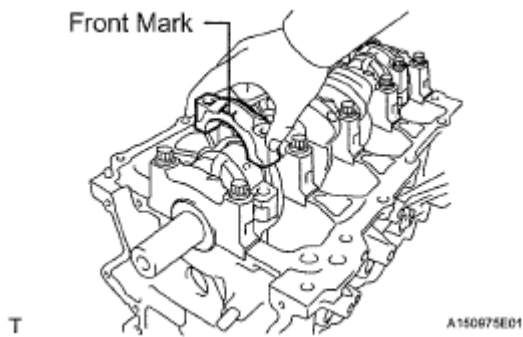


Fig. 469: Installing Connecting Rod Cap Correct Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Step 1

1. Using SST, install and alternately tighten the bolts of the connecting rod cap in several steps.

SST 09205-16010

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

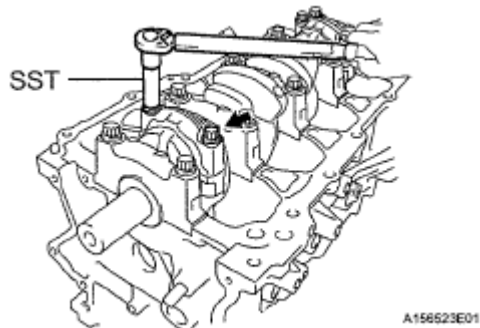


Fig. 470: Installing Connecting Rod Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Step 2

1. Mark the front of the connecting rod cap bolts with paint.
 2. Further tighten the cap bolts an additional 90° as shown in the illustration.
- i. Check that the crankshaft turns smoothly.
 - j. Check the connecting rod thrust clearance (See **INSPECTION**).

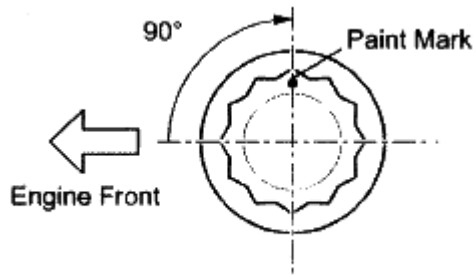


Fig. 471: Identifying Connecting Rod Cap Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL NO. 1 VENTILATION CASE

- a. Apply seal packing in a continuous bead as shown in the illustration.

Seal packing:

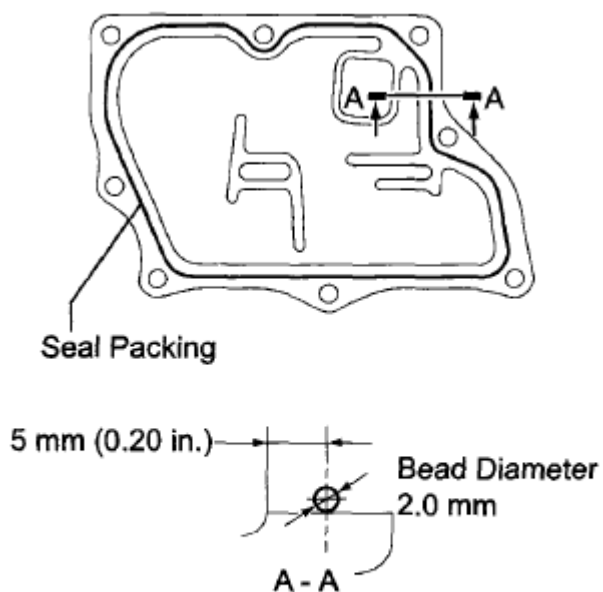
Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent

Bead diameter:

2.0 mm (0.0787 in.)

NOTE:

- Remove any oil from the contact surface.
- Install the No. 1 ventilation case within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing.



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Fig. 472: Identifying No. 1 Ventilation Case

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

- b. Install the No. 1 ventilation case with the 6 bolts and 2 nuts.

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

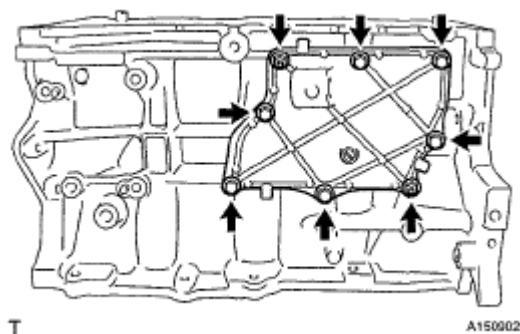


Fig. 473: Locating No. 1 Ventilation Case Bolts

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