2014 ENGINE

Engine Mechanical (Service Information) (Except Hybrid)- Camry (2AR-FE)

ENGINE

ON-VEHICLE INSPECTION [08/2013 -]

ON-VEHICLE INSPECTION [08/2013 -]

1. **INSPECT ENGINE COOLANT**

   Refer to **ON-VEHICLE INSPECTION [08/2013 -]**

2. **INSPECT ENGINE OIL**

   Refer to **ON-VEHICLE INSPECTION [08/2013 -]**

3. **INSPECT BATTERY**

   Refer to **ON-VEHICLE INSPECTION [08/2013 -]**

4. **INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
   a. Remove the air cleaner filter element sub-assembly.
   b. Visually check that the air cleaner filter element sub-assembly is not excessively damaged or oily. If necessary, replace the air cleaner filter element sub-assembly.

      HINT:

      - If there is any dirt or a blockage in the air cleaner filter element sub-assembly, clean it with compressed air.
      - If any dirt or a blockage remains even after cleaning the air cleaner filter element sub-assembly with compressed air, replace it.

   c. Install the air cleaner filter element sub-assembly.
5. **INSPECT SPARK PLUG**

   Refer to **ON-VEHICLE INSPECTION [08/2013 -]**

6. **INSPECT VALVE LASH ADJUSTER ASSEMBLY NOISE**
   a. Rev up the engine several times. Check that the engine does not emit unusual noises.

      If unusual noises occur, warm up the engine and idle it for over 30 minutes. Then perform the inspection above again.

      If any defects or problems are found during the inspection above, perform a lash adjuster inspection See step 2.

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7. **INSPECT IGNITION TIMING**
   a. Warm up and stop the engine.
   b. When using the Techstream:
      1. Connect the Techstream to the DLC3.

         NOTE: When checking the ignition timing, the transmission should be in neutral.

      2. Start the engine and idle it.
      3. Turn the Techstream main switch on.
      4. Enter the following menus: Powertrain / Engine / Data List / IGN Advance.

         Standard ignition timing

         BTDC 5 to 15 deg. at idle

         HINT:

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

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

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

         Standard ignition timing

         BTDC 8 to 12 deg. at idle

         HINT:

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

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

      8. Enter the following menus: Connect the TC and TE1 / OFF.
      9. Turn the ignition switch off.
      10. Disconnect the Techstream from the DLC3.
   c. When not using the Techstream:
      1. Remove the No. 1 engine cover sub-assembly.
      2. Pull out the wire harness as shown in the illustration.

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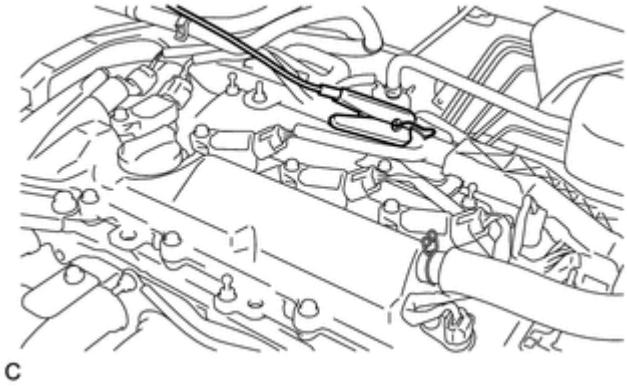


Fig. 1: Identifying Timing Light Clip At Wire Harness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Connect the clip of a timing light to the wire harness.

NOTE: Use a timing light that detects primary signals.

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

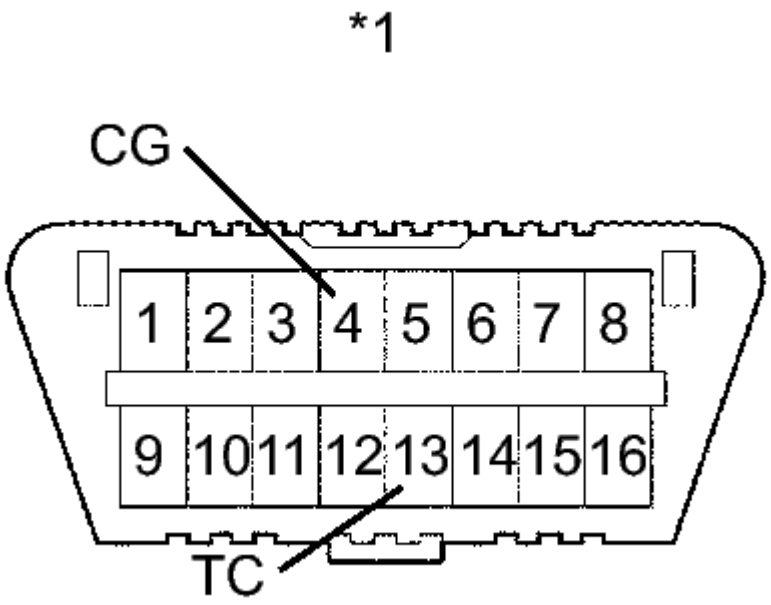


Fig. 2: Identifying DLC3 Connector Terminals Identification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	DLC3

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- **SST: 09843-18040**

NOTE:

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

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

   Standard ignition timing

   8 to 12° BTDC at idle

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

   Standard ignition timing

   5 to 15° BTDC at idle

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

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

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

NOTE:

- **Switch off all accessories and the A/C before connecting the Techstream.**
- **When checking the idle speed, the transmission should be in neutral.**

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

         Standard idle speed

         610 to 710 rpm

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HINT:

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

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

5. Disconnect the Techstream from the DLC3.

c. When not using the Techstream:

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

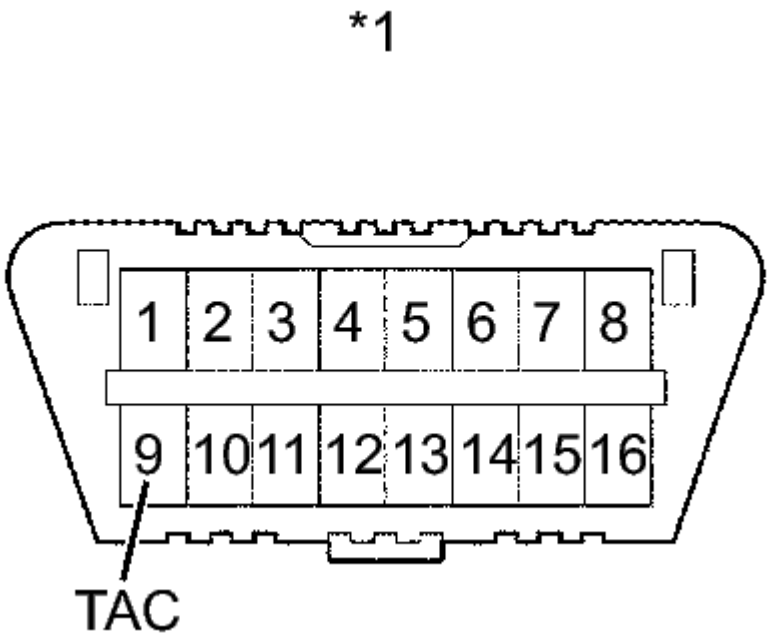


Fig. 3: Identifying DLC3 Connector Terminals Identification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	DLC3

- **SST: 09843-18030**

NOTE:

- **Confirm the terminals before connecting them. Connecting the wrong terminals may result in damage to electrical components.**
- **Turn all electrical systems and the A/C off.**
- **Inspect the idle speed with the cooling fans off.**
- **When checking the idle speed, the transaxle should be in neutral.**

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

   Standard idle speed

   610 to 710 rpm

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

4. Disconnect the tachometer probe from the DLC3.

9. **INSPECT COMPRESSION**
   a. Warm up and stop the engine.
   b. Check for DTCs. Refer to **DTC CHECK / CLEAR [08/2013 - 12/2013]** .
   c. Remove the 4 spark plugs. Refer to **REMOVAL [08/2013 -] - Step 3** .
   d. Disconnect the 4 fuel injector connectors.
   e. Insert a compression gauge into the spark plug hole.

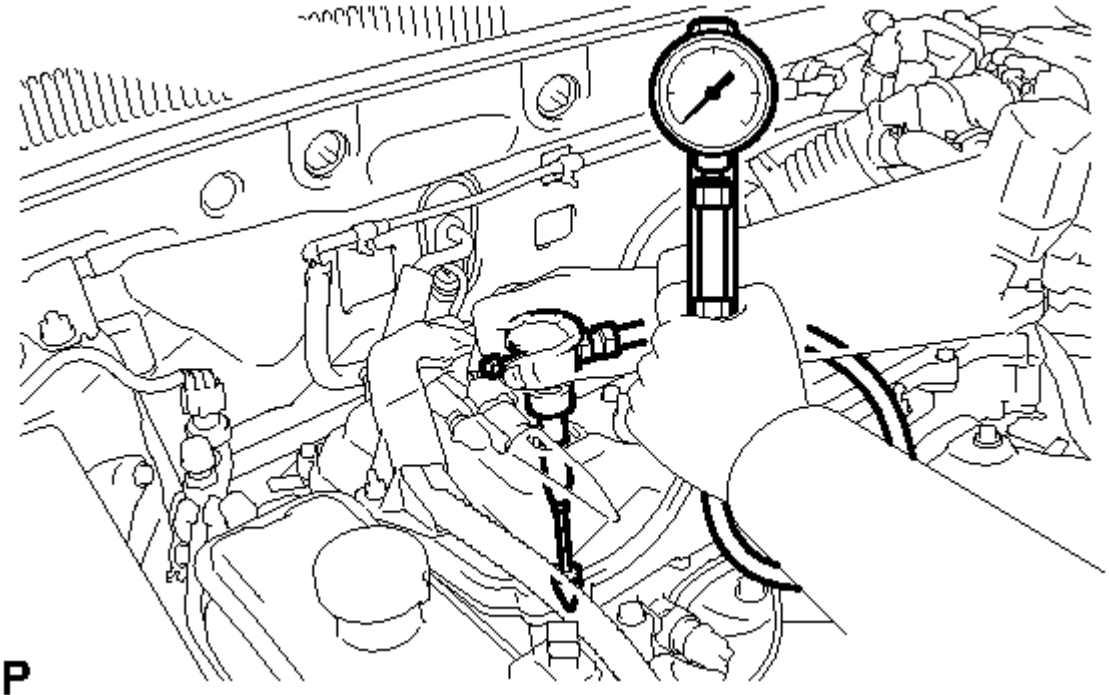


Fig. 4: View Of Measuring Compression Pressure
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   f. Fully open the throttle.
   g. While cranking the engine, measure the compression pressure.

   Standard compression pressure

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1450 kPa (14.8 kgf/cm^2 , 210 psi)

Minimum pressure

980 kPa (10.0 kgf/cm^2 , 142 psi)

Difference between each cylinder

100 kPa (1.0 kgf/cm^2 , 15 psi)

HINT:

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

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

HINT:

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

i. Connect the 4 fuel injector connectors.

j. Install the 4 spark plugs. Refer to **INSTALLATION [08/2013 -] - Step 1** .

k. Clear the DTCs. Refer to **DTC CHECK / CLEAR [08/2013 - 12/2013]** .

10. **INSPECT CO/HC**

HINT:

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

a. Start the engine.

b. Keep the engine speed at 2500 rpm for approximately 180 seconds.

c. Insert the CO/HC meter testing probe at least 40 cm (1.31 ft.) into the tailpipe during idling.

d. Immediately check CO/HC concentration at idle and 2500 rpm.

HINT:

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

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1. Check the DTCs. Refer to **DTC CHECK / CLEAR [08/2013 - 12/2013]** .
2. See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

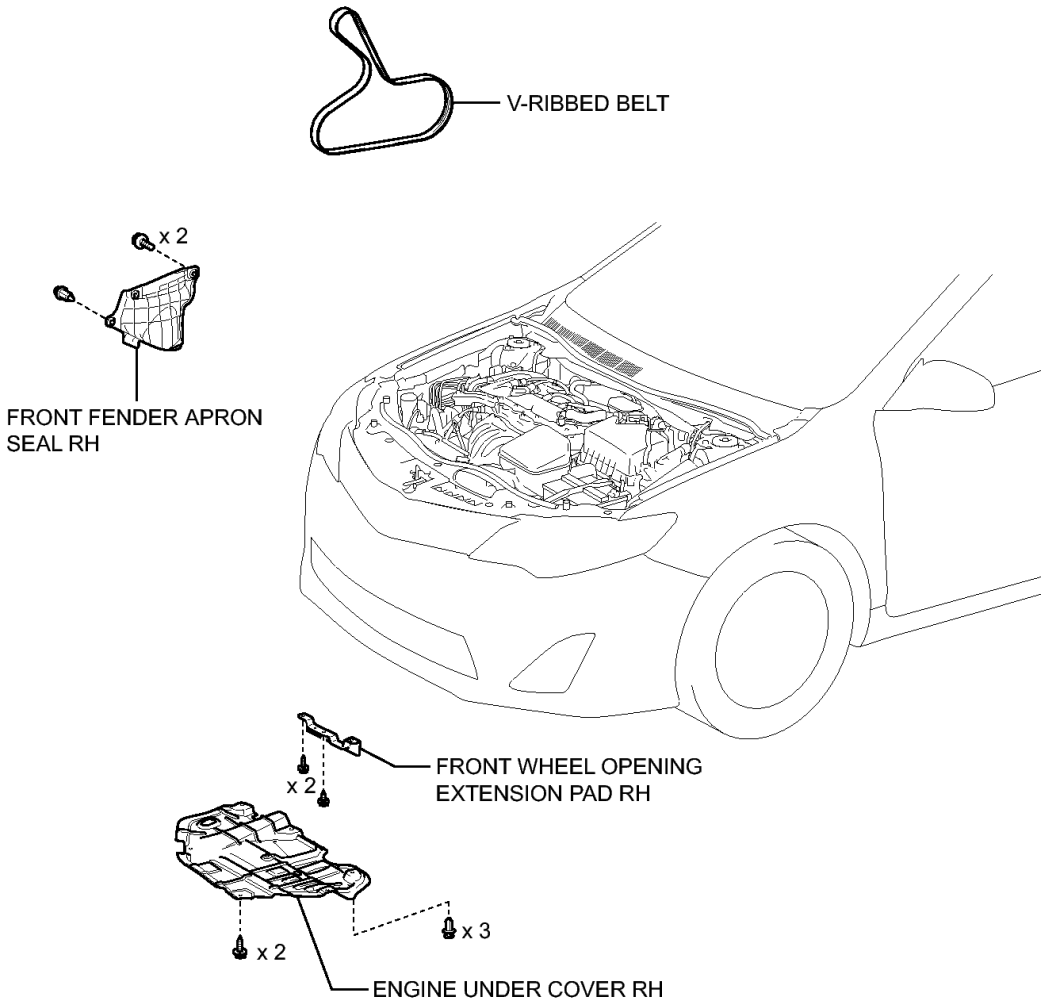
CO	HC	Symptom	Causes
Normal	High	Rough idle	1. Faulty ignition • Incorrect timing • Plugs are contaminated or shorted, or gaps are defective 2. Leaky intake and exhaust valves 3. Leaky cylinder
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks • PCV hose • Intake manifold • Throttle body • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty SFI system • Faulty pressure • Defective ECT sensor • Faulty ECM • Faulty injector • Faulty throttle position sensor • Faulty MAF sensor

DRIVE BELT

COMPONENTS [08/2013 -]

ILLUSTRATION

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c

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

ON-VEHICLE INSPECTION [08/2013 -]

ON-VEHICLE INSPECTION [08/2013 -]

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

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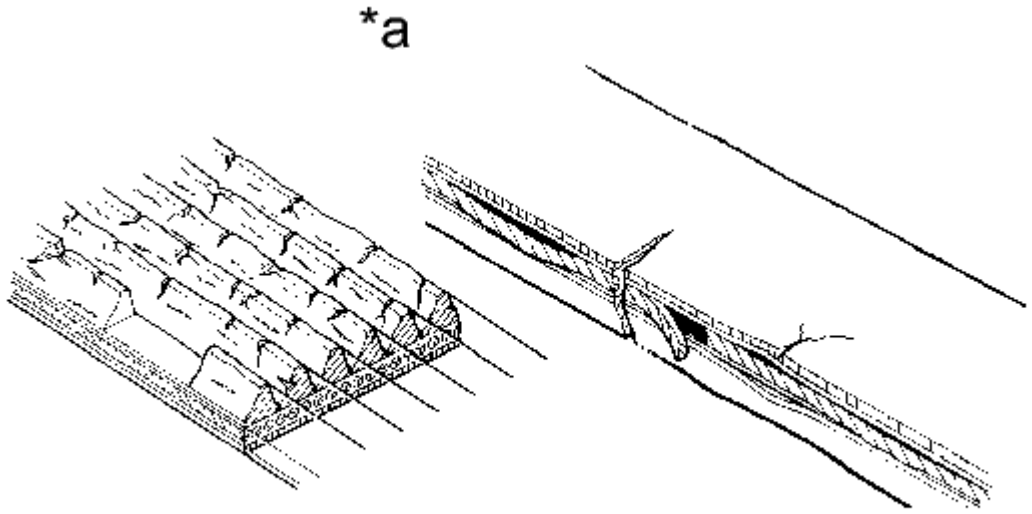


Fig. 6: Inspecting V-Ribbed Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	INCORRECT

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

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

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

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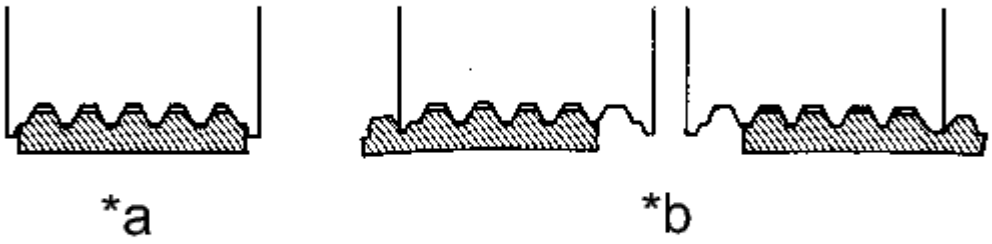


Fig. 7: Checking V Belt For Proper Installation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	CORRECT
*b	INCORRECT

HINT:

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

2. **INSPECT V-RIBBED BELT TENSIONER ASSEMBLY**
   a. Check that nothing gets caught in the tensioner by turning it clockwise and counterclockwise.

      If a malfunction exists, replace the V-ribbed belt tensioner.

REMOVAL [08/2013 -]

REMOVAL [08/2013 -]

REMOVAL [08/2013 -]

1. **REMOVE FRONT WHEEL RH**
2. **REMOVE FRONT WHEEL OPENING EXTENSION PAD RH**
3. **REMOVE ENGINE UNDER COVER RH**
4. **REMOVE FRONT FENDER APRON SEAL RH**

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

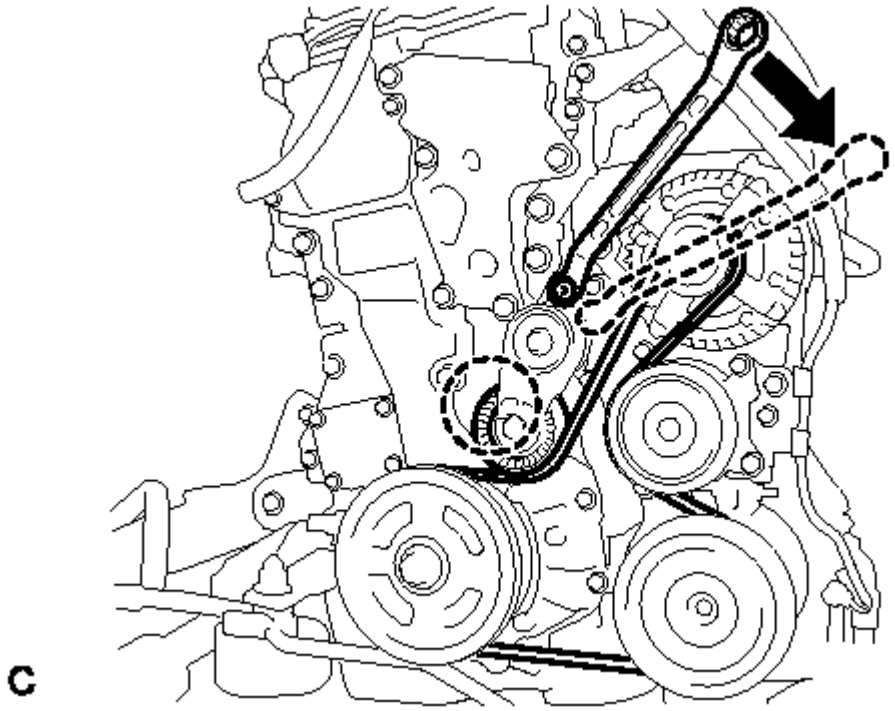


Fig. 8: Removing V-Ribbed Belt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION [08/2013 -]

INSTALLATION [08/2013 -]

INSTALLATION [08/2013 -]

1. **INSTALL V-RIBBED BELT**
   a. Set the V-ribbed belt onto each part as shown in the illustration except the water pump pulley.

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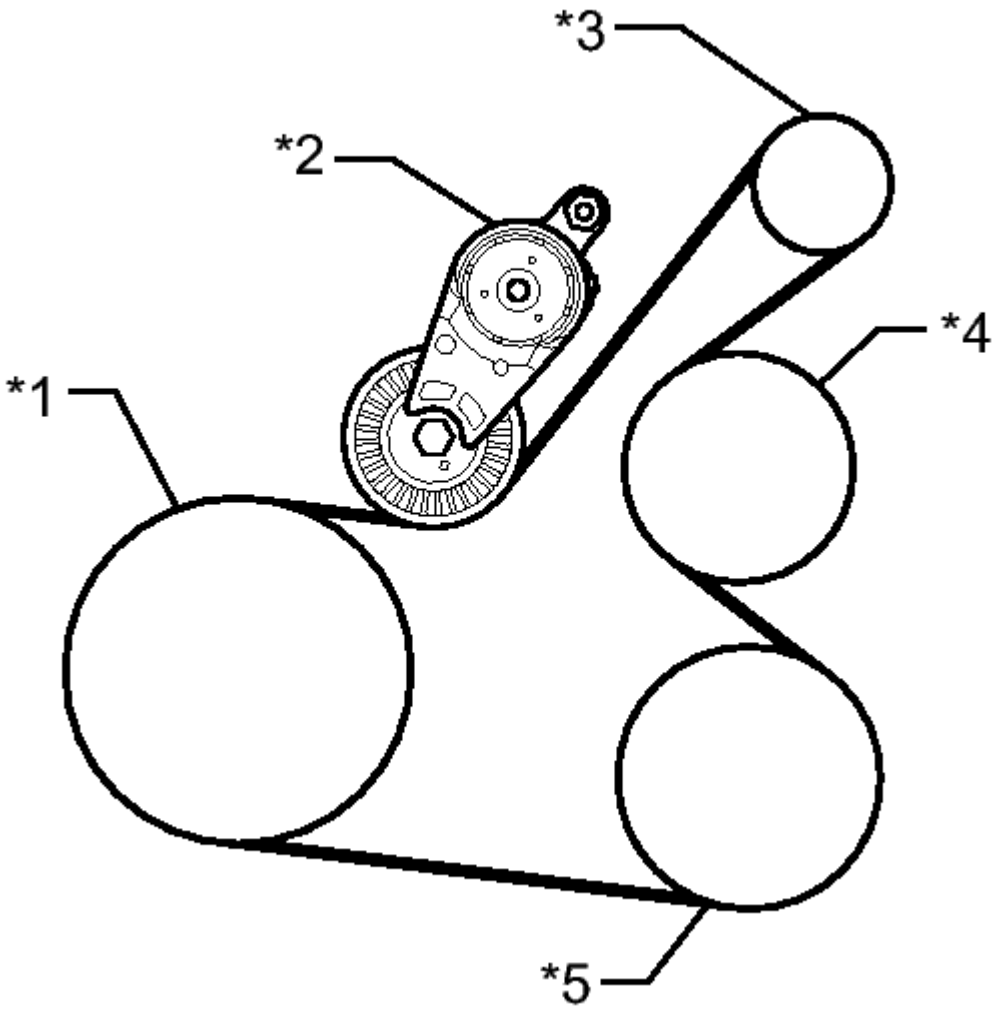


Fig. 9: Identifying V-Ribbed Belt Routing Diagram
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Crankshaft
*2	Tensioner
*3	Generator
*4	Water Pump
*5	Cooler Compressor

b. Loosen the V-ribbed belt by turning the belt tensioner clockwise.
c. Set the V-ribbed belt onto the water pump pulley.

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

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pulley.

2. **INSTALL FRONT FENDER APRON SEAL RH**
3. **INSTALL ENGINE UNDER COVER RH**
4. **INSTALL FRONT WHEEL OPENING EXTENSION PAD RH**
5. **INSTALL FRONT WHEEL RH**

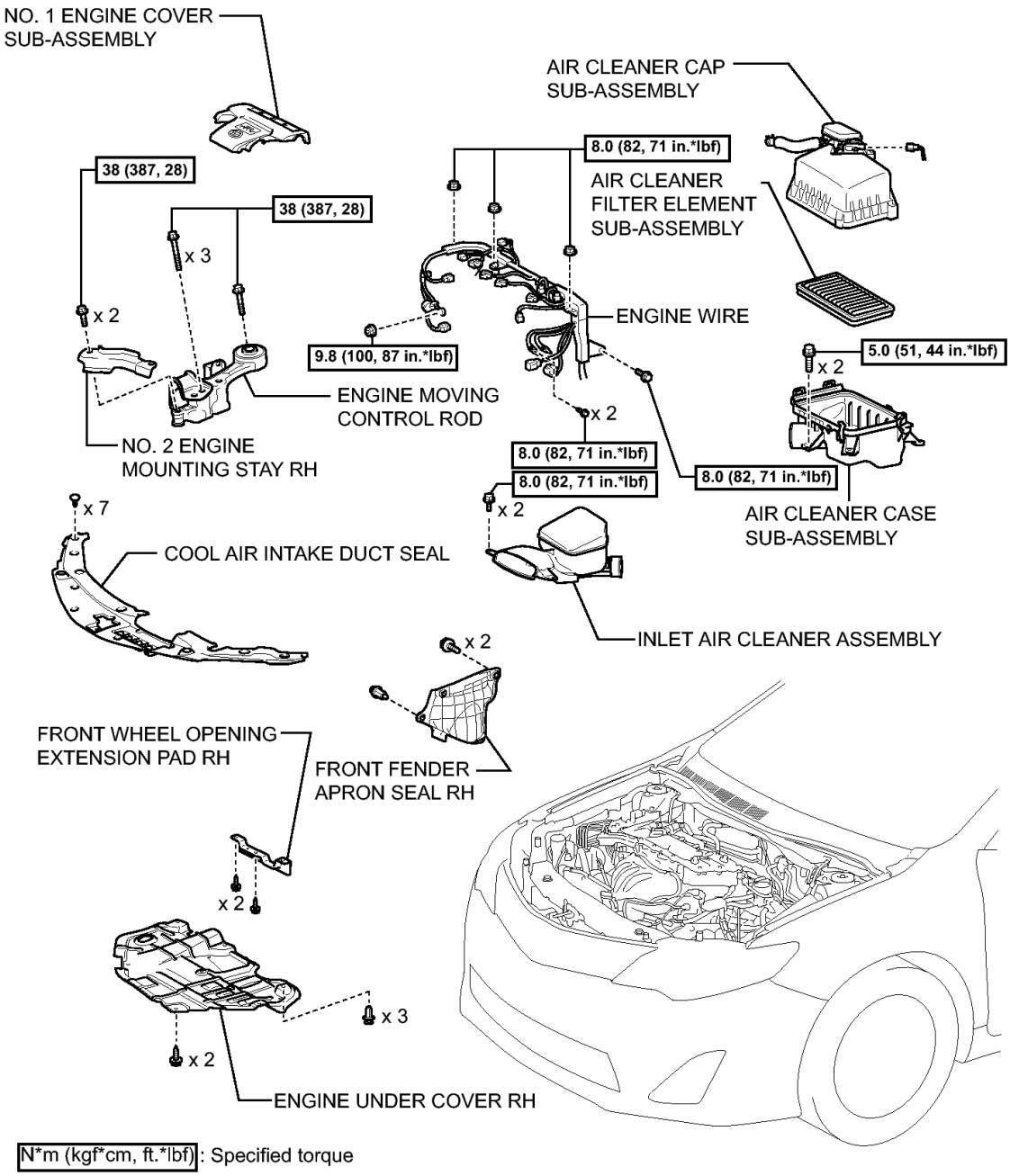
Torque: 103 N*m (1049 kgf*cm, 76 ft.*lbf)

CAMSHAFT

COMPONENTS [08/2013 -]

ILLUSTRATION

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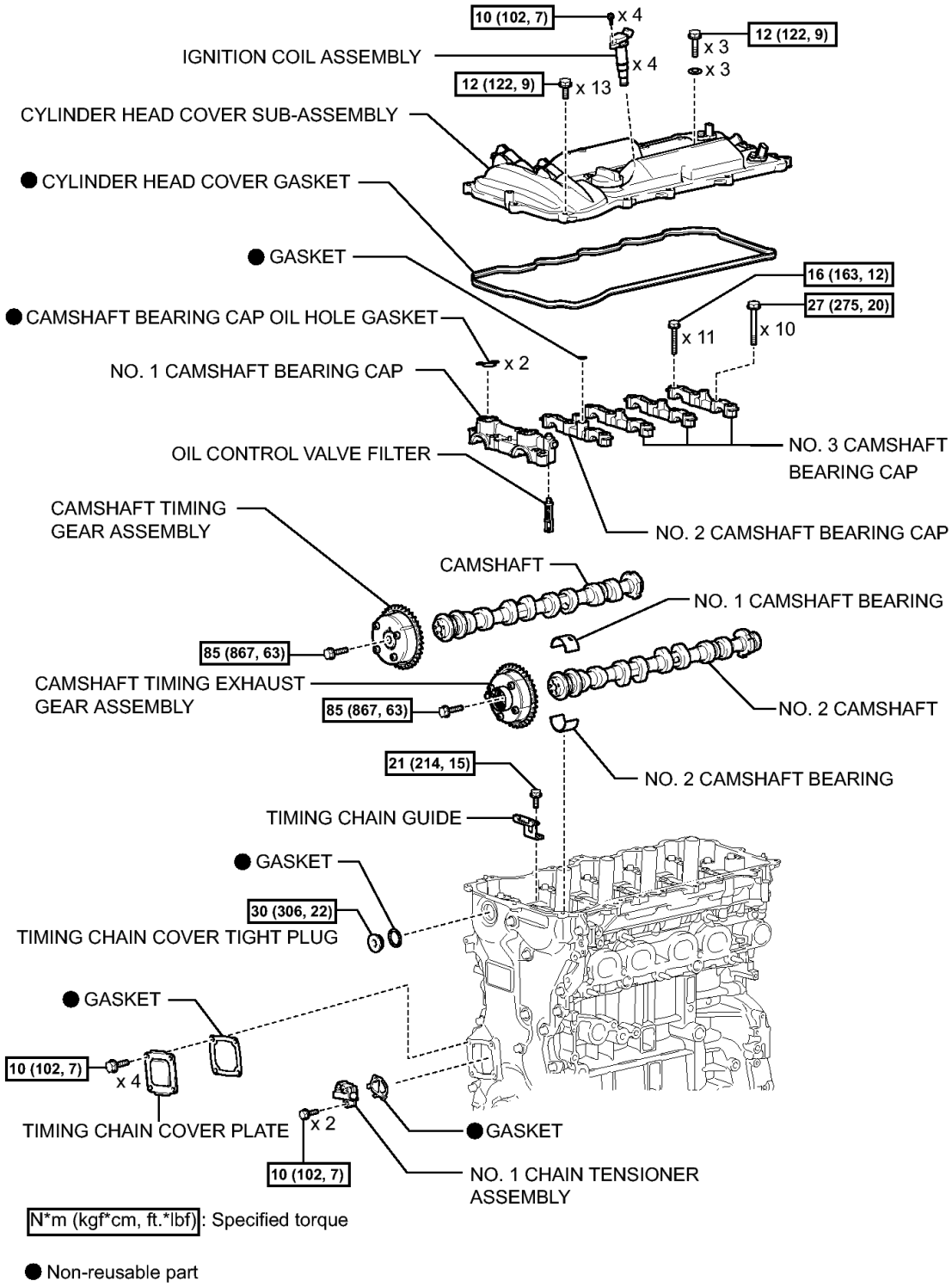


c

Fig. 10: Identifying Camshaft Replacement Components With Torque Specifications (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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c

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

REMOVAL [08/2013 - 12/2013]

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REMOVAL [08/2013 - 12/2013]

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

   NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [08/2013 - 12/2013] .

2. **REMOVE FRONT WHEEL RH**
3. **REMOVE FRONT WHEEL OPENING EXTENSION PAD RH**
4. **REMOVE ENGINE UNDER COVER RH**
5. **REMOVE FRONT FENDER APRON SEAL RH**
6. **REMOVE COOL AIR INTAKE DUCT SEAL** . Refer to **REMOVAL [08/2013 -] - Step 1**
7. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY** See step 18
8. **REMOVE INLET AIR CLEANER ASSEMBLY** See step 19
9. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 7**
10. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY** See step 21
11. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY** See step 22
12. **REMOVE NO. 2 ENGINE MOUNTING STAY RH** See step 32
13. **REMOVE ENGINE MOVING CONTROL ROD** See step 34
14. **DISCONNECT ENGINE WIRE**
    a. Disconnect the connectors and clamps.

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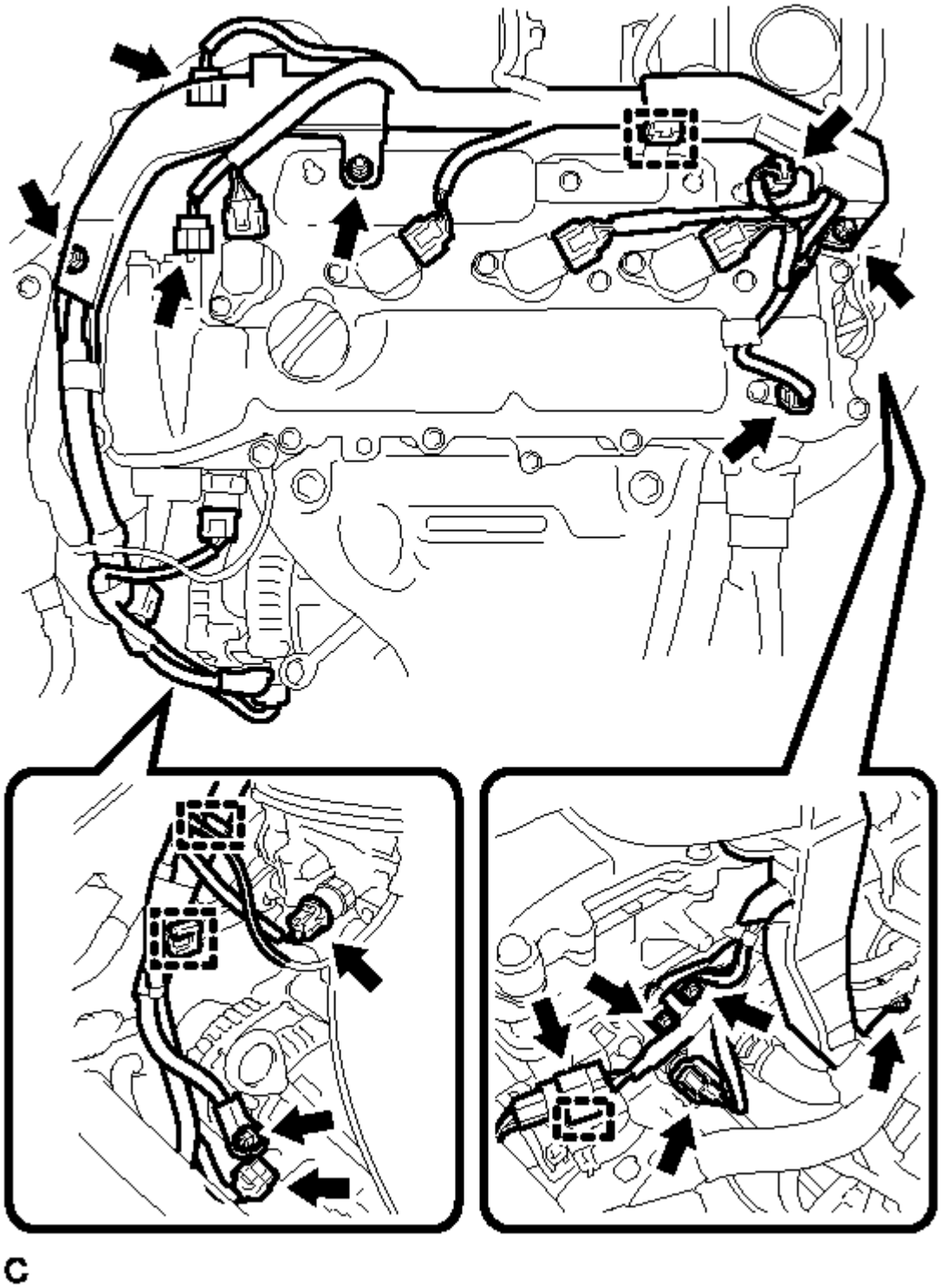


Fig. 12: Identifying Connectors, Clamp, Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

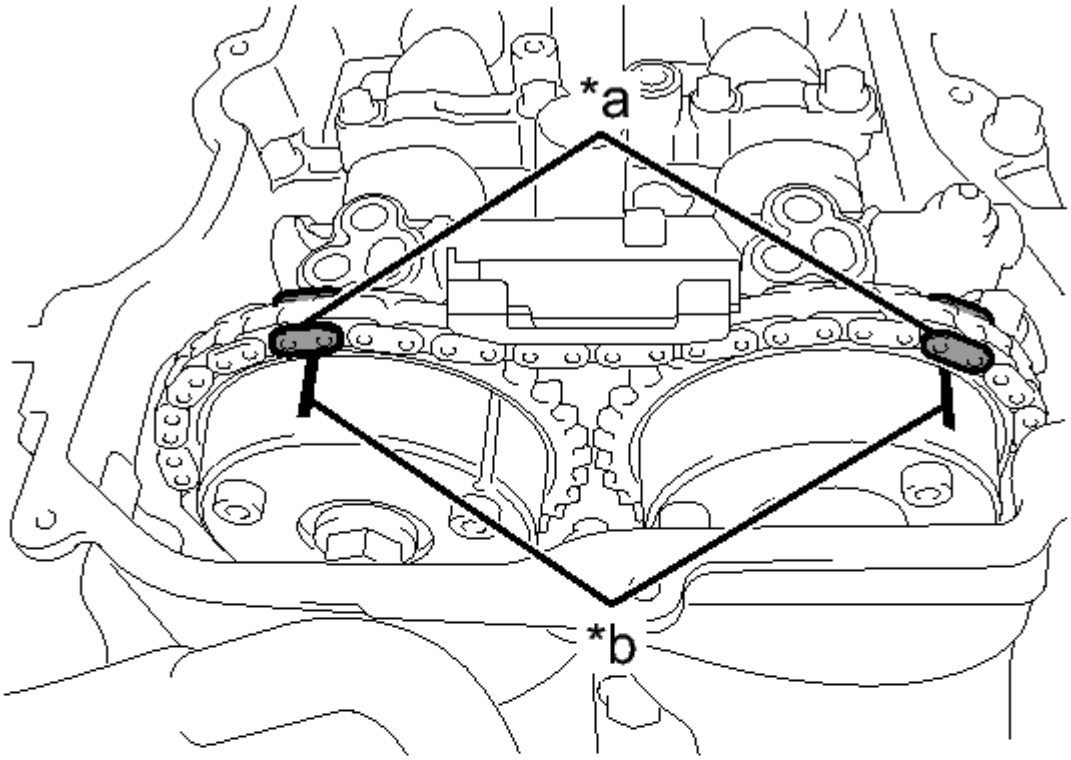
b. Remove the bolts and nuts and disconnect the engine wire from the engine.

15. **REMOVE IGNITION COIL ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 2**

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16. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 4**
17. **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.

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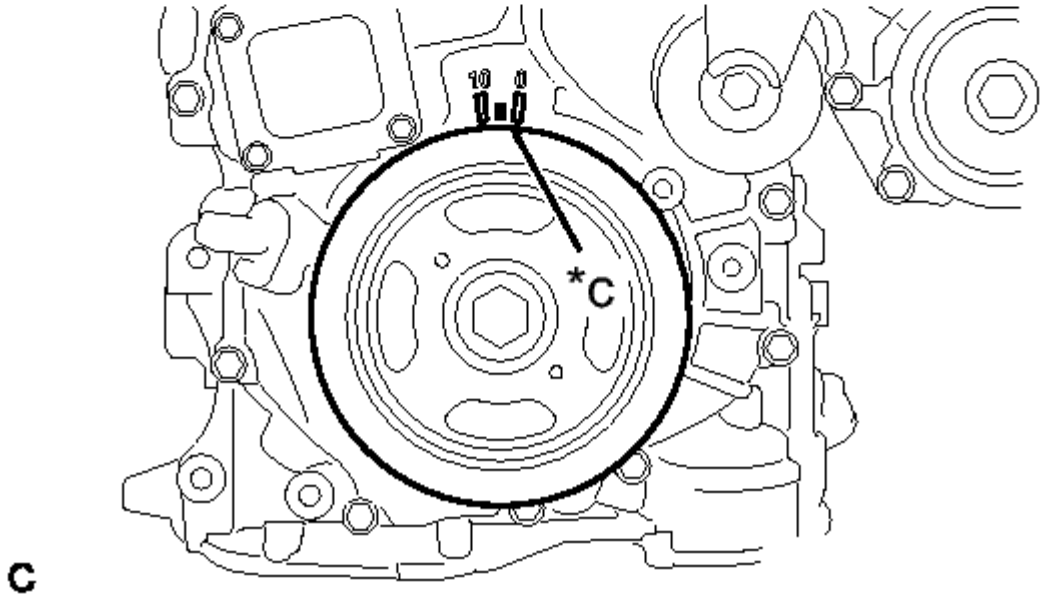


Fig. 13: Setting No. 1 Cylinder To TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark

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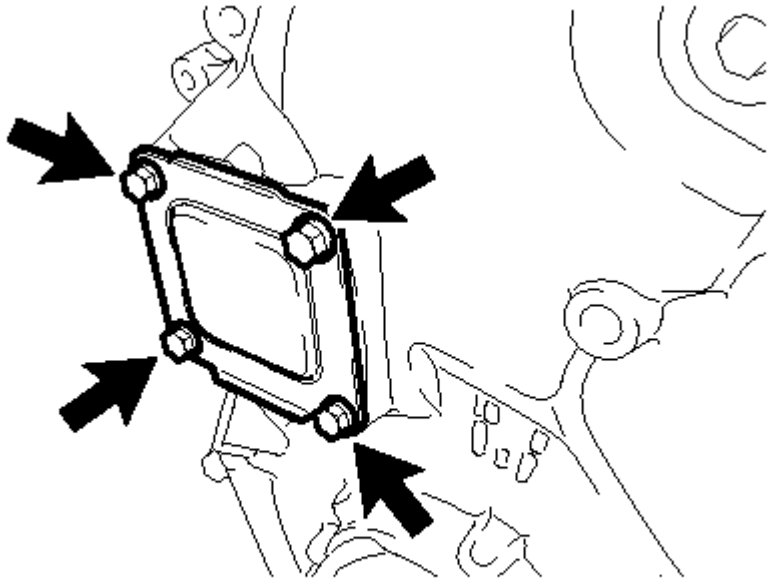
*b	Timing Mark
*c	Timing Notch

b. Check that each timing mark of the camshaft timing gear assembly and camshaft timing exhaust gear assembly 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.

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

18. **REMOVE TIMING CHAIN COVER PLATE**

a. Remove the 4 bolts, timing chain cover plate and gasket.



P

Fig. 14: Locating Timing Chain Cover Plate, Gasket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY**

a. Turn the crankshaft approximately 10° clockwise.

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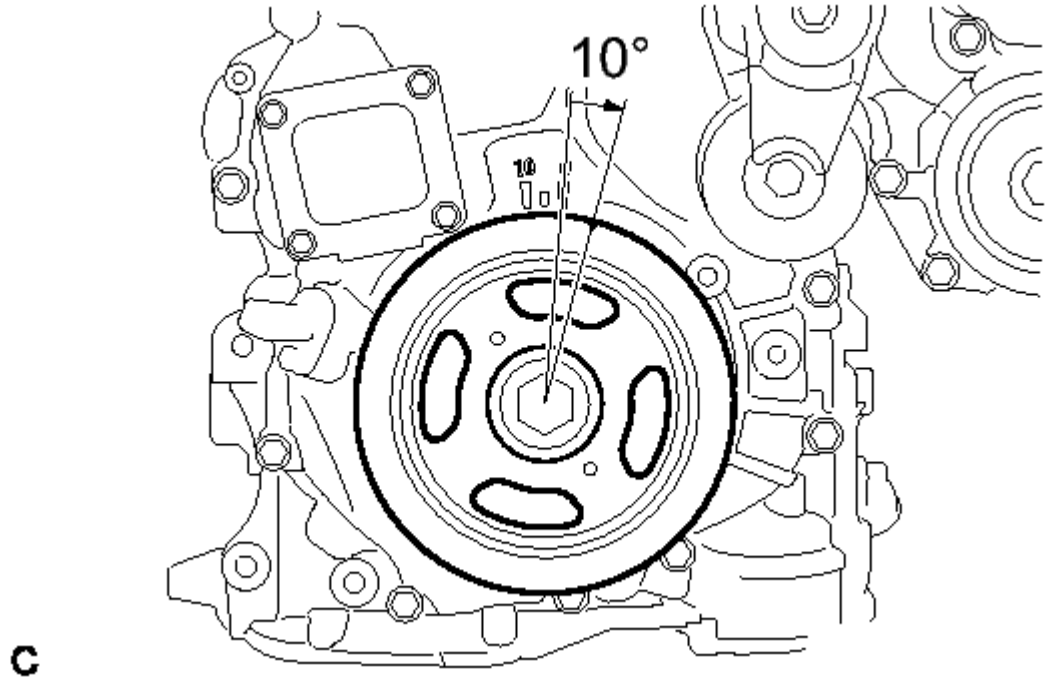


Fig. 15: View Of Turning Crankshaft 10Degrees Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Turn the crankshaft approximately 10° counterclockwise.

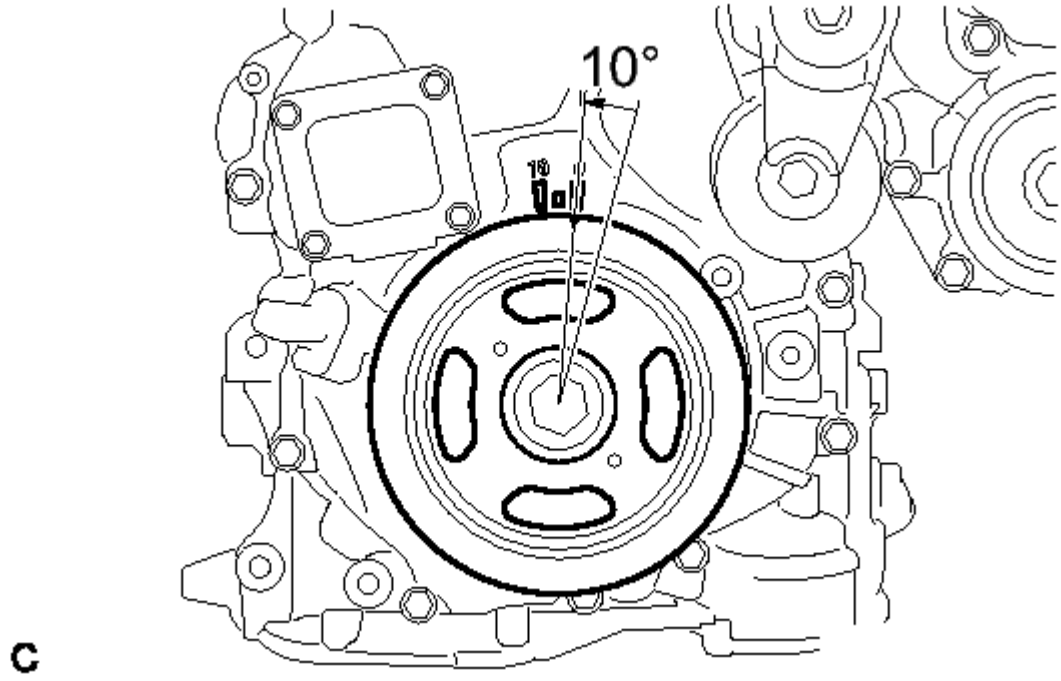


Fig. 16: Turning Crankshaft 10Degrees Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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c. Align the holes of the stopper plate and tensioner, and insert a pin into the stopper plate hole to lock the tensioner.

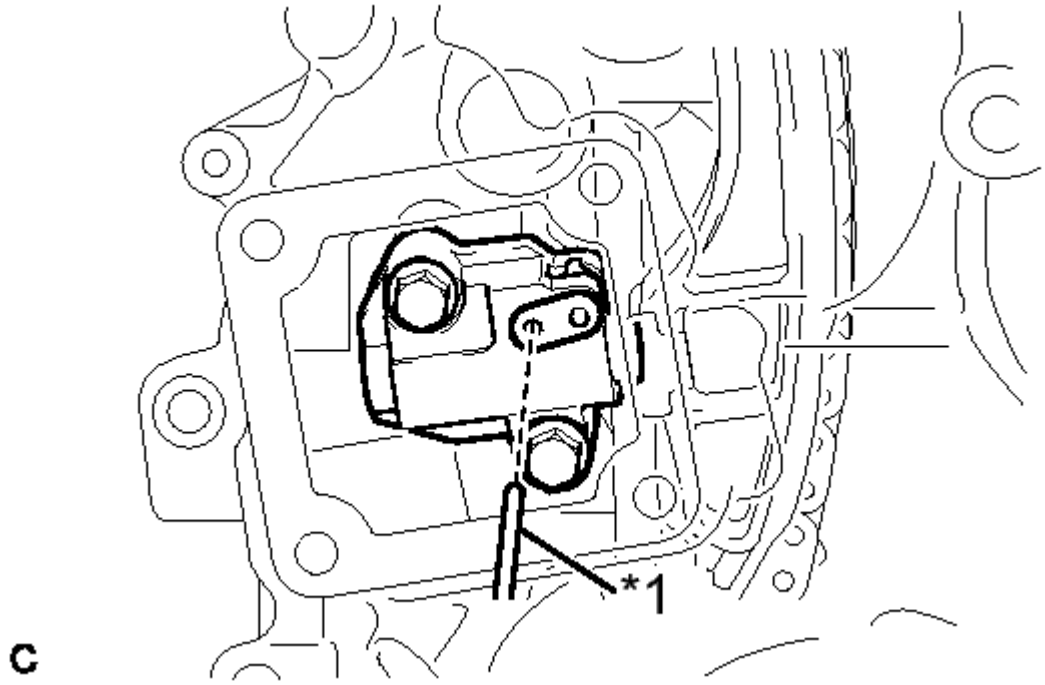


Fig. 17: Inserting Pin Into Stopper Plate Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Pin

d. Turn the crankshaft approximately 10° clockwise.

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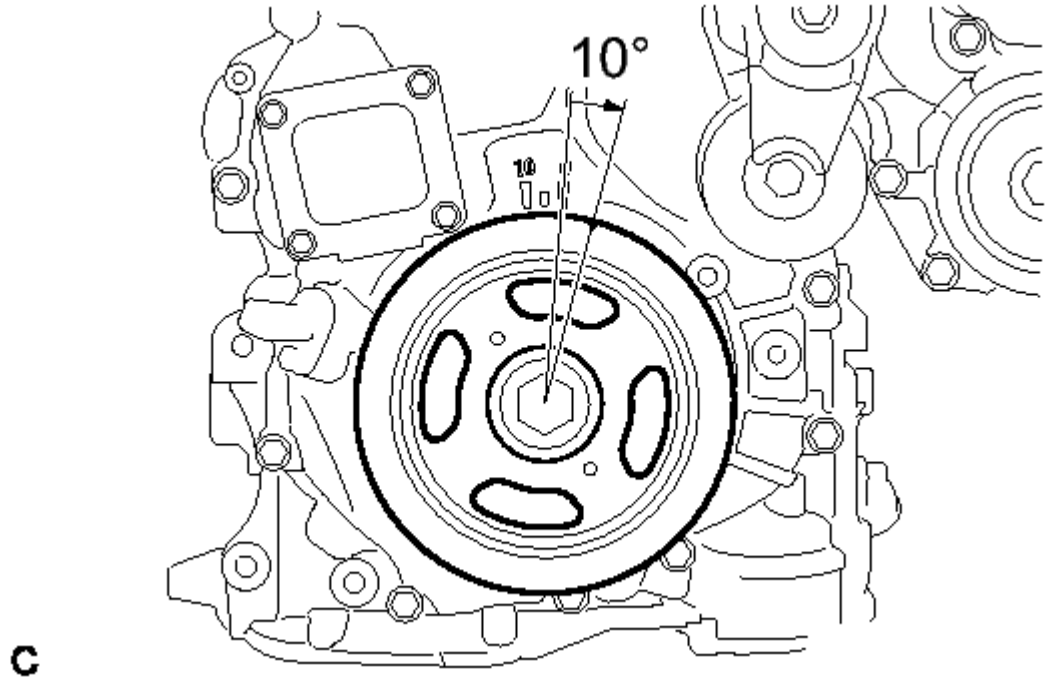


Fig. 18: View Of Turning Crankshaft 10Degrees Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

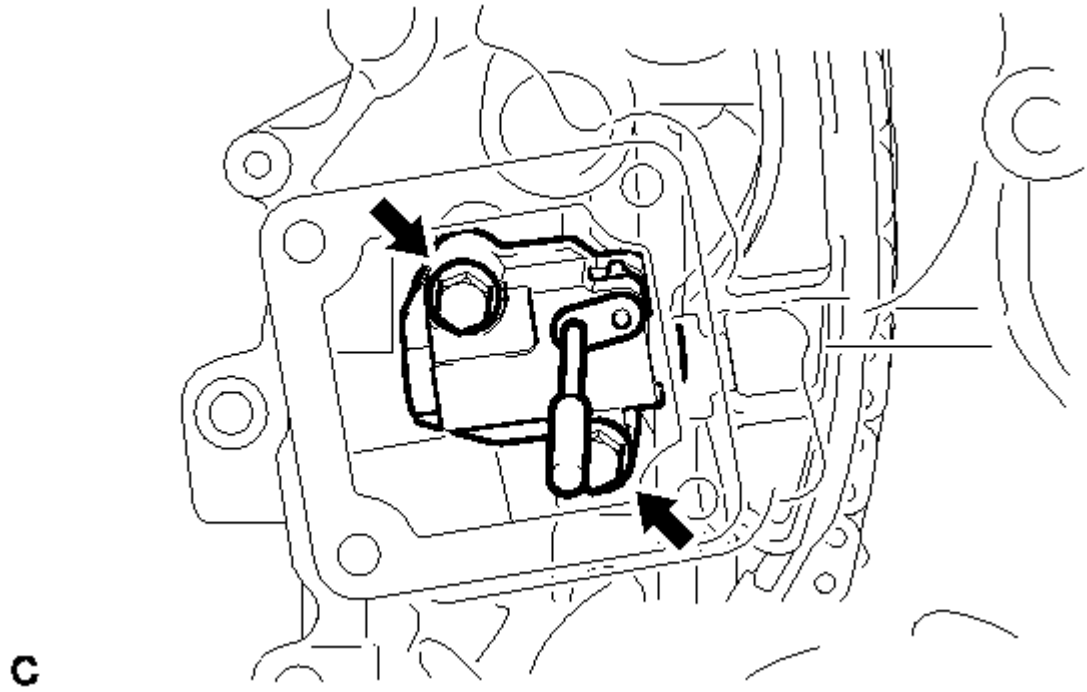


Fig. 19: No. 1 Chain Tensioner Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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NOTE: Make sure not to drop the gasket inside the timing chain cover.

f. Turn the crankshaft approximately 10° counterclockwise.

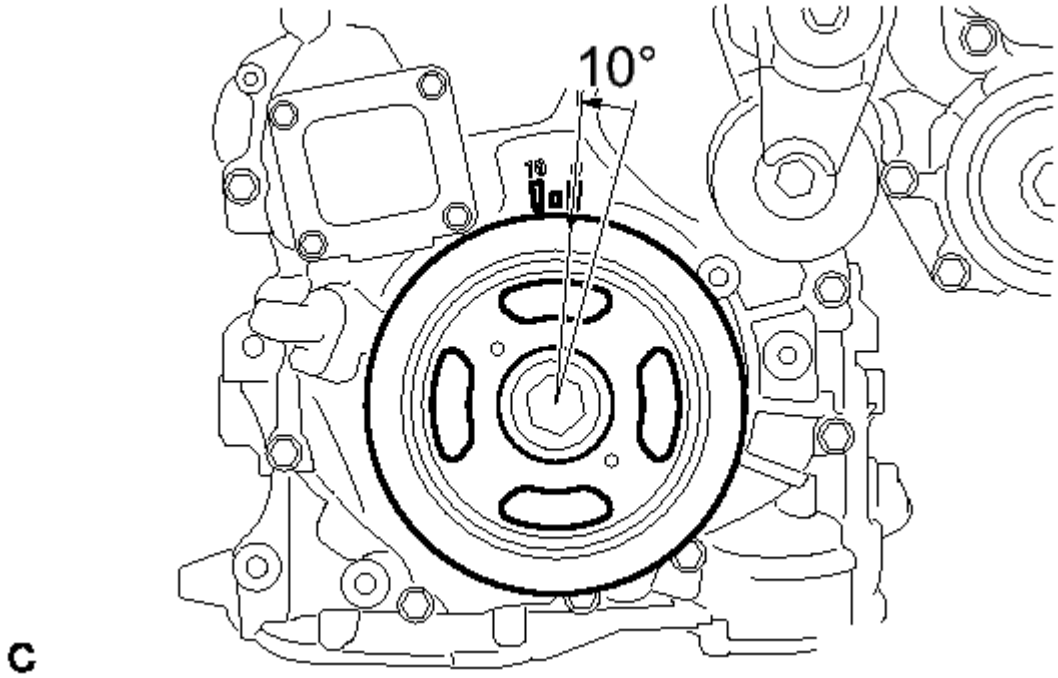


Fig. 20: Turning Crankshaft 10Degrees Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE TIMING CHAIN GUIDE** See step 13
21. **REMOVE TIMING CHAIN COVER TIGHT PLUG** See step 21
22. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY**
    a. Hold the hexagonal portion of the camshaft with a wrench and remove the bolt from the camshaft.

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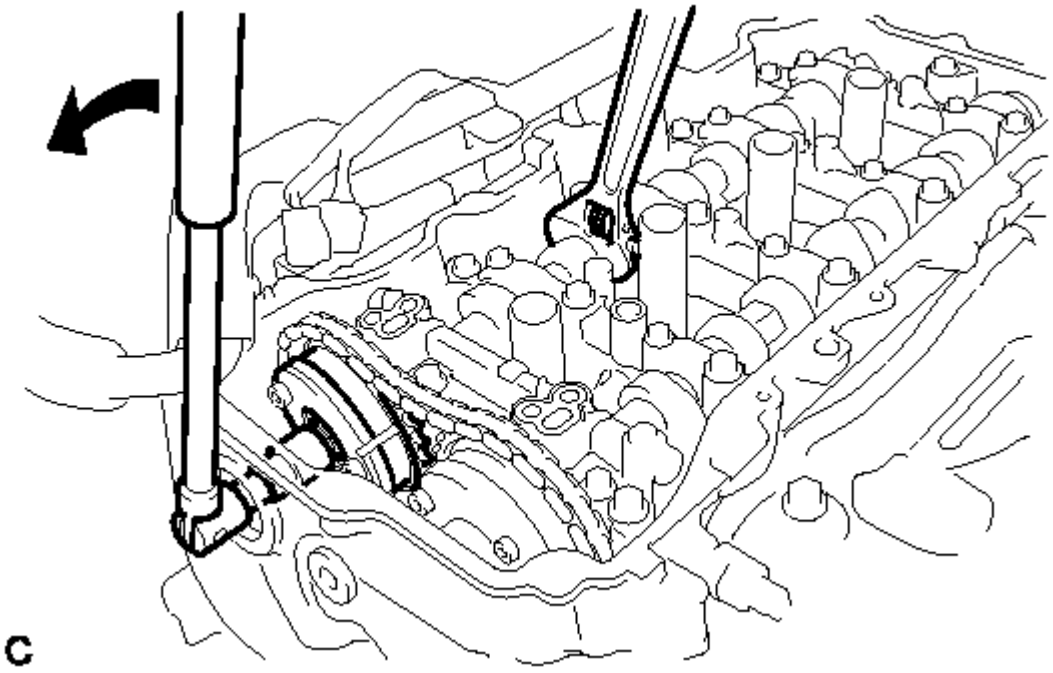


Fig. 21: Removing Camshaft Timing Gear Using A Wrench
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful not to damage the cylinder head or spark plug tube with the wrench.

b. Separate the camshaft timing gear assembly from the camshaft.

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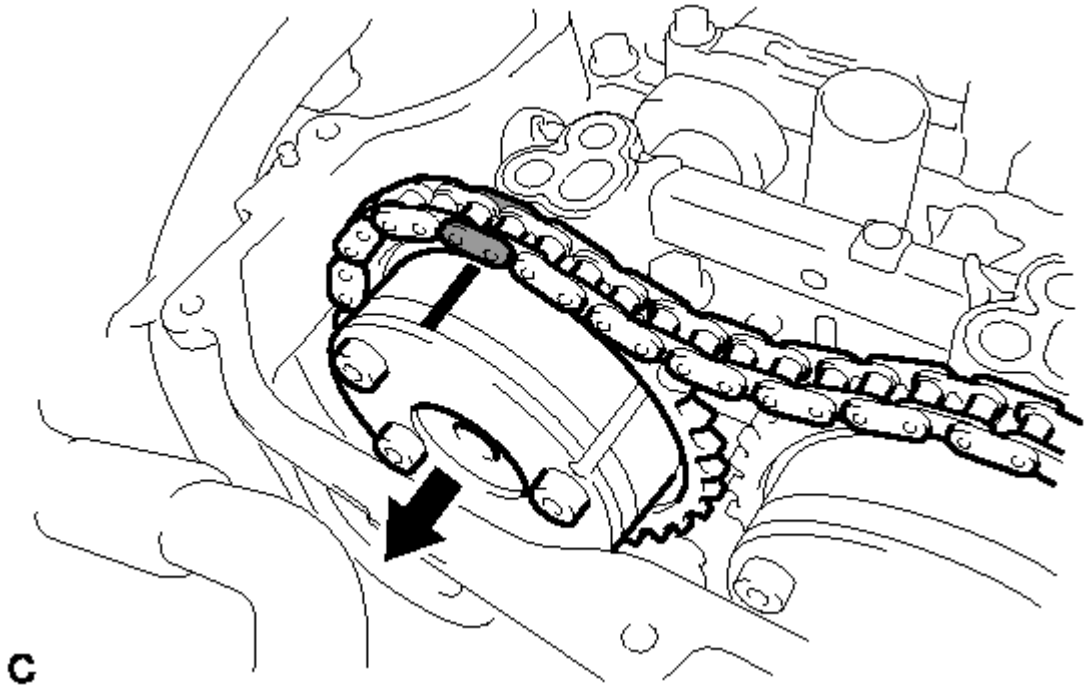


Fig. 22: Separating Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the timing chain from the camshaft timing gear assembly, and turn the camshaft timing gear assembly approximately 180°.

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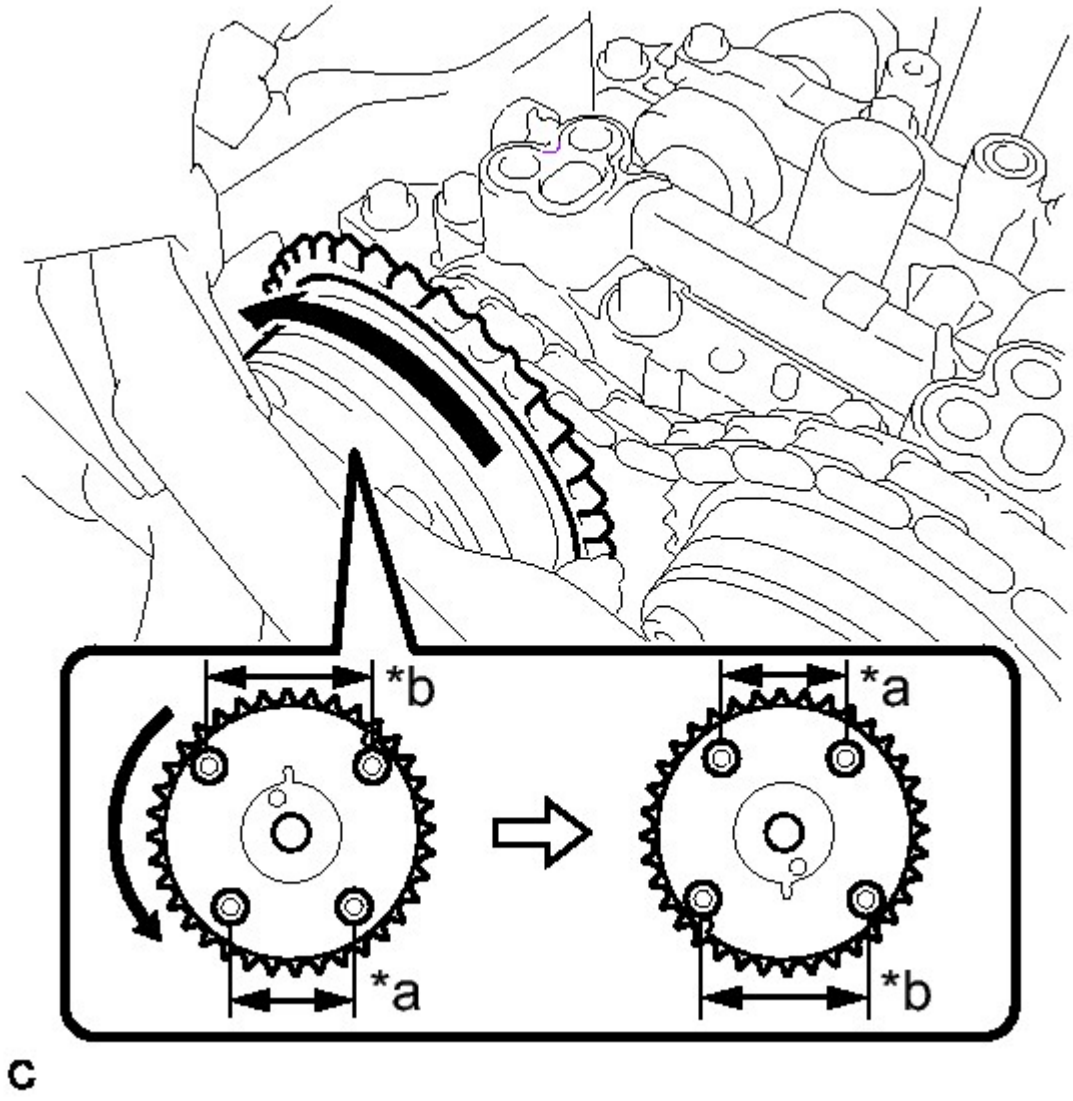


Fig. 23: Rotating Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Narrow
*b	Wide

d. Remove the camshaft timing gear assembly.

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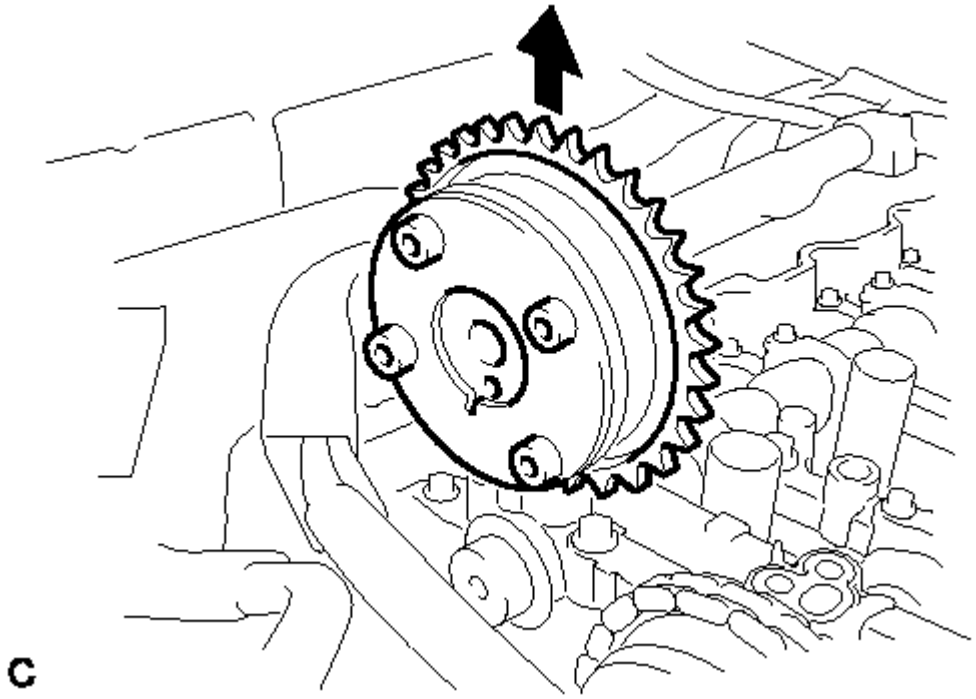


Fig. 24: Removing Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Do not disassemble the camshaft timing gear assembly.

23. **REMOVE CAMSHAFT BEARING CAP**
    a. Using several steps, remove the 11 bearing cap bolts in the sequence shown in the illustration.

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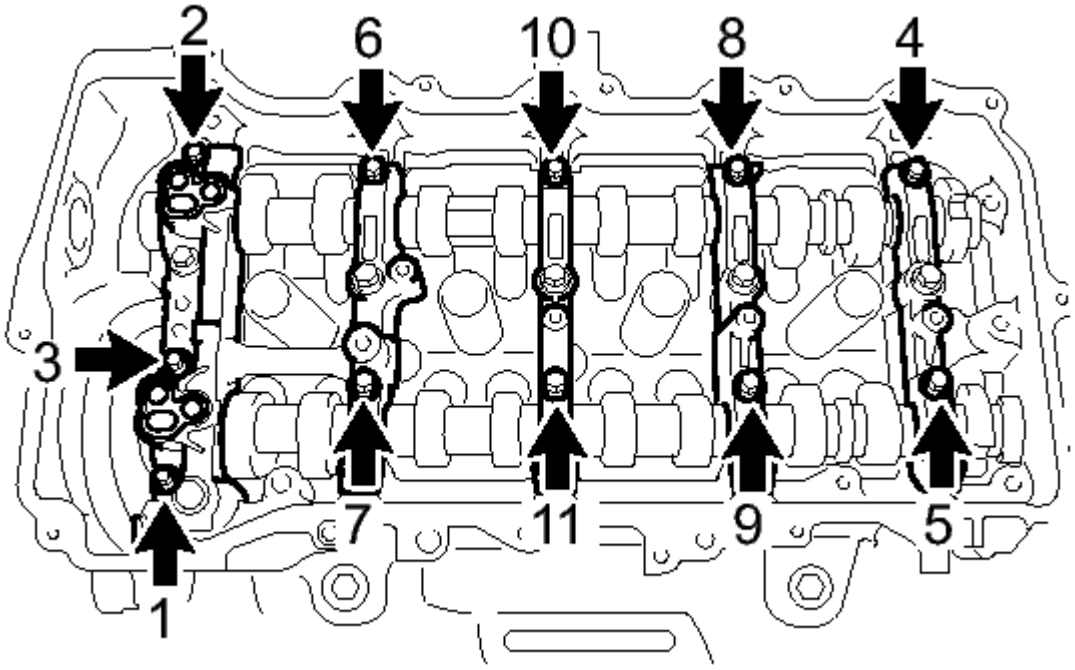


Fig. 25: Removal Sequence For Bearing Cap Bolts (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using several steps, remove the 10 bearing cap bolts in the sequence shown in the illustration.

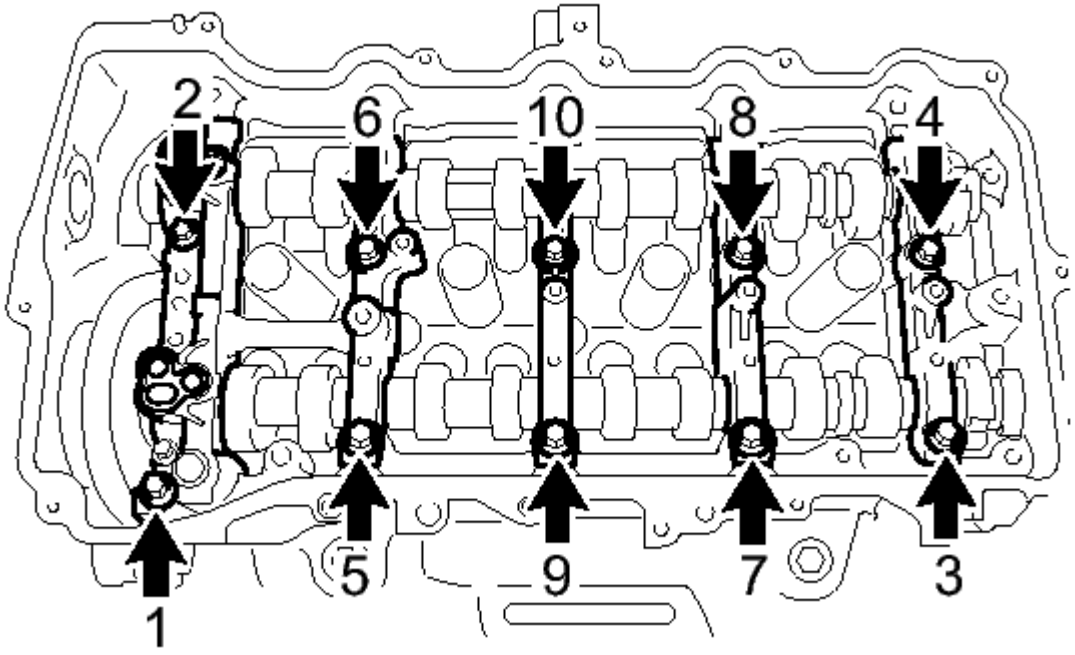


Fig. 26: Removal Sequence For Bearing Cap Bolts (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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c. Remove the 5 bearing caps.

HINT:

Arrange the removed parts in the correct order.

24. **REMOVE CAMSHAFT**

a. Remove the camshaft from the camshaft housing sub-assembly.

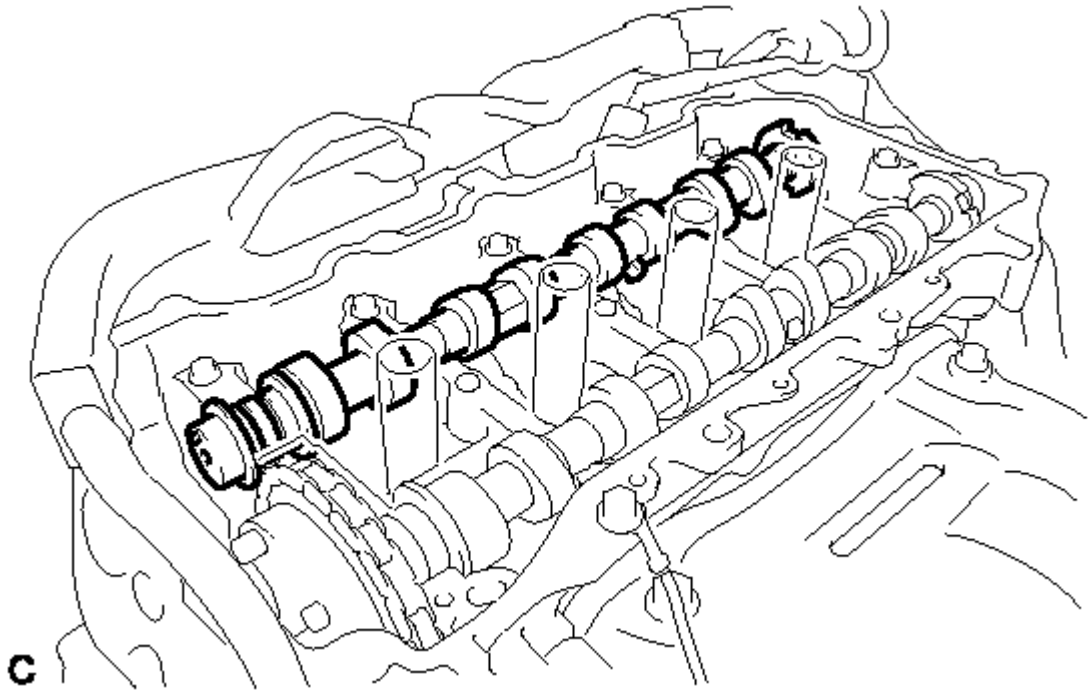


Fig. 27: Removing No. 1 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. **REMOVE NO. 2 CAMSHAFT**

a. Hold up the chain and remove the No. 2 camshaft from the camshaft housing sub-assembly.

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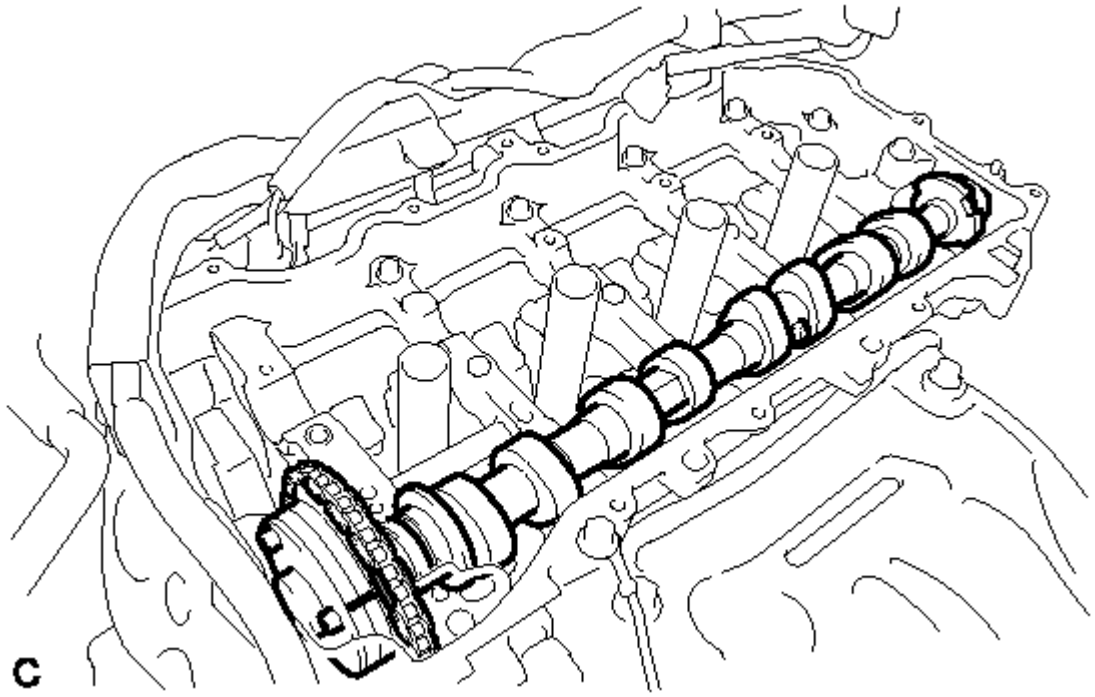


Fig. 28: Removing No. 2 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Suspend the chain with a string or equivalent as shown in the illustration.

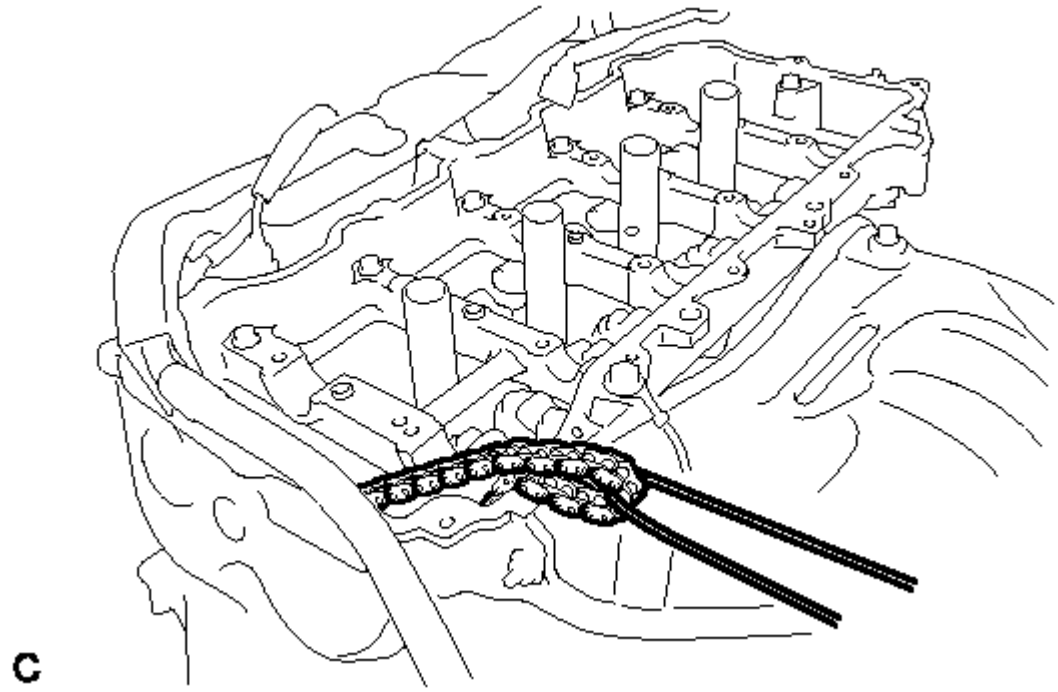


Fig. 29: View Of Suspending Chain With String Or Equivalent
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

26. **REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
    a. Remove the flange bolt and camshaft timing exhaust gear assembly.

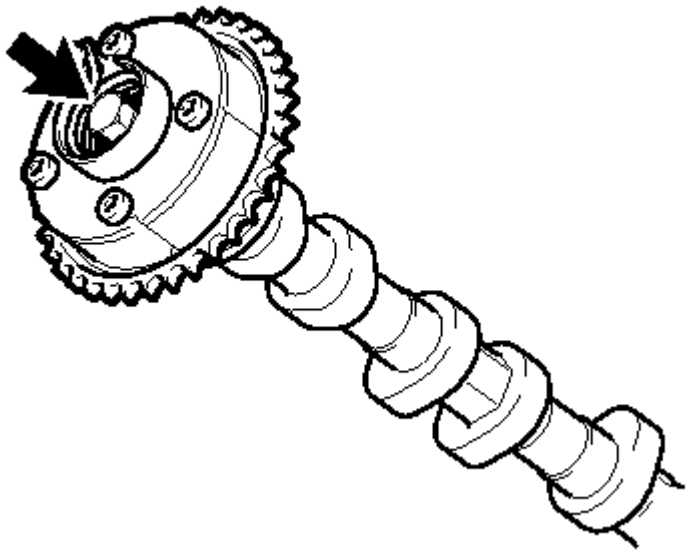


Fig. 30: Location of Camshaft Timing Exhaust Gear Flange Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Do not disassemble the camshaft timing exhaust gear assembly.

27. **REMOVE OIL CONTROL VALVE FILTER** See step 35
28. **REMOVE NO. 1 CAMSHAFT BEARING** See step 37
29. **REMOVE NO. 2 CAMSHAFT BEARING** See step 38

REMOVAL [12/2013 -]

REMOVAL [12/2013 -]

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [12/2013 -] .

2. **REMOVE FRONT WHEEL RH**
3. **REMOVE FRONT WHEEL OPENING EXTENSION PAD RH**

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4. **REMOVE ENGINE UNDER COVER RH**
5. **REMOVE FRONT FENDER APRON SEAL RH**
6. **REMOVE COOL AIR INTAKE DUCT SEAL** . Refer to **REMOVAL [08/2013 -] - Step 1**
7. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY** See step 18
8. **REMOVE INLET AIR CLEANER ASSEMBLY** See step 19
9. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 7**
10. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY** See step 21
11. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY** See step 22
12. **REMOVE NO. 2 ENGINE MOUNTING STAY RH** See step 32
13. **REMOVE ENGINE MOVING CONTROL ROD** See step 34
14. **DISCONNECT ENGINE WIRE**
    a. Disconnect the connectors and clamps.

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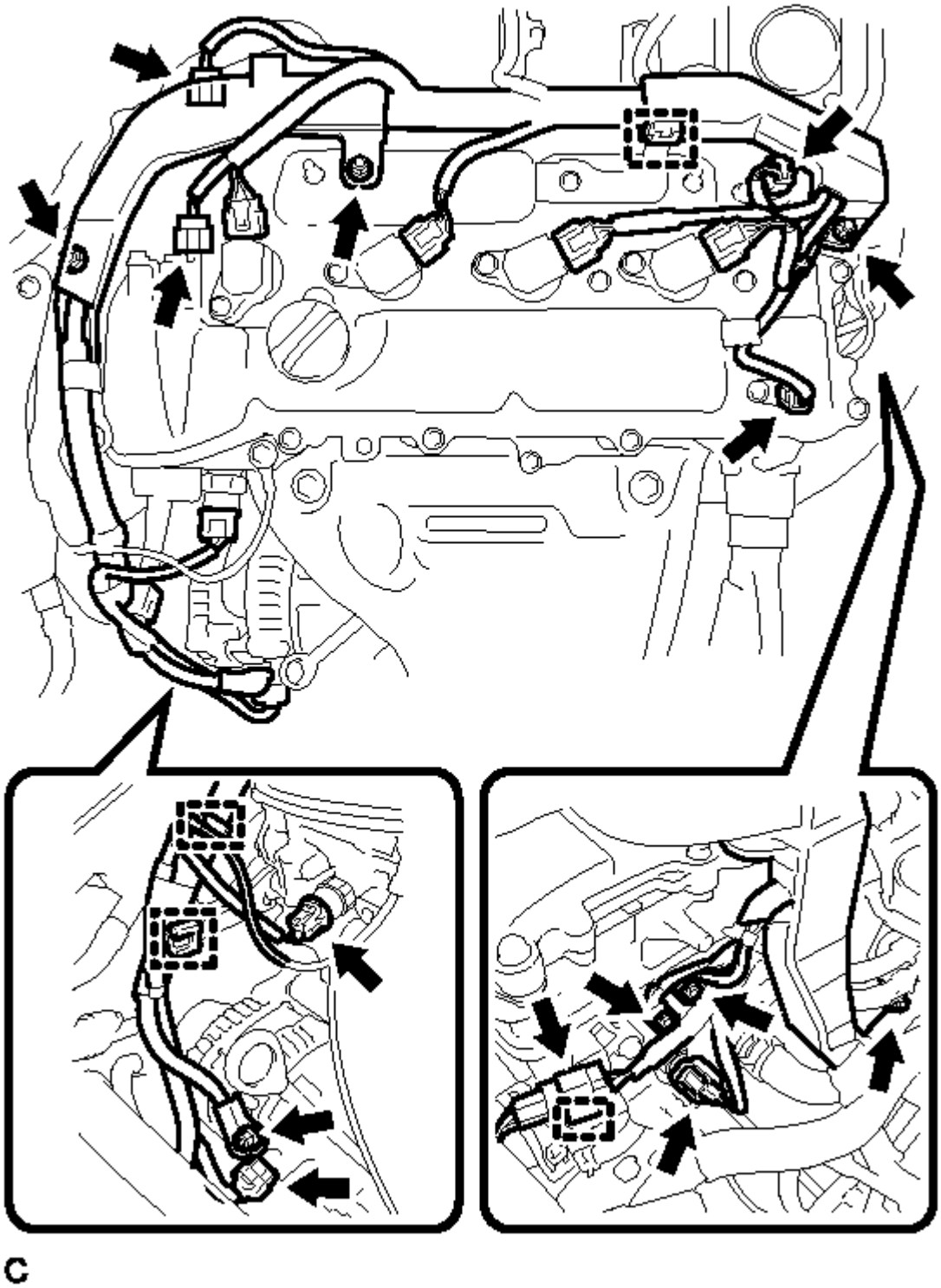


Fig. 31: Identifying Connectors, Clamp, Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the bolts and nuts and disconnect the engine wire from the engine.

15. **REMOVE IGNITION COIL ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 2**

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16. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 4**
17. **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.

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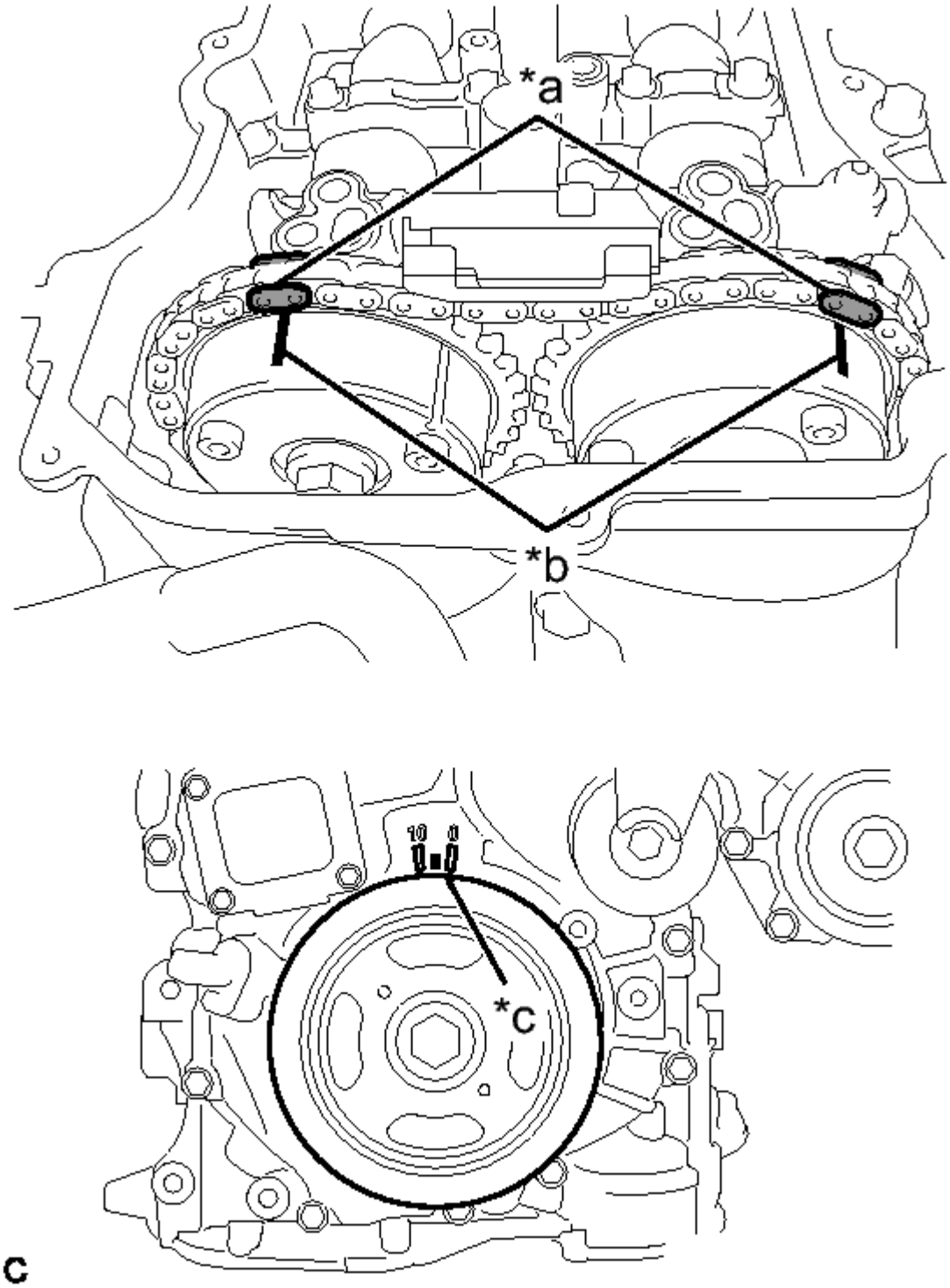


Fig. 32: Setting No. 1 Cylinder To TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark

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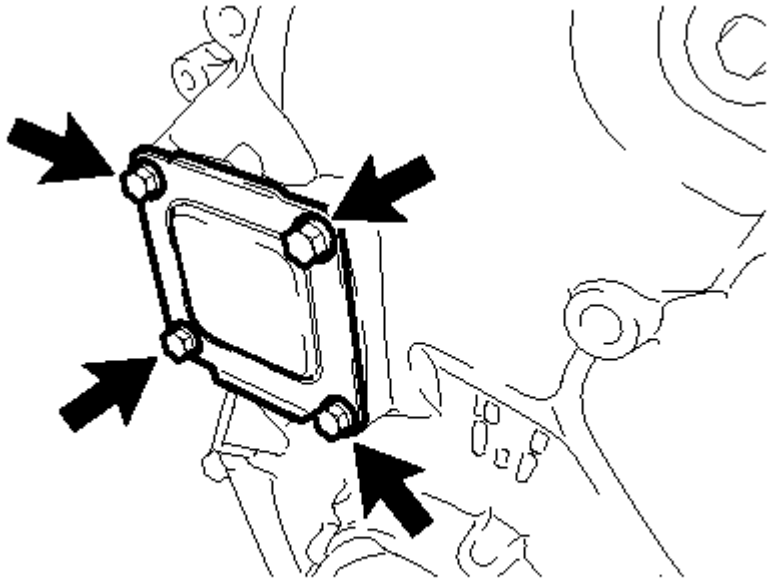
*b	Timing Mark
*c	Timing Notch

b. Check that each timing mark of the camshaft timing gear assembly and camshaft timing exhaust gear assembly 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.

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

18. **REMOVE TIMING CHAIN COVER PLATE**

a. Remove the 4 bolts, timing chain cover plate and gasket.



P

Fig. 33: Locating Timing Chain Cover Plate, Gasket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

19. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY**

a. Turn the crankshaft approximately 10° clockwise.

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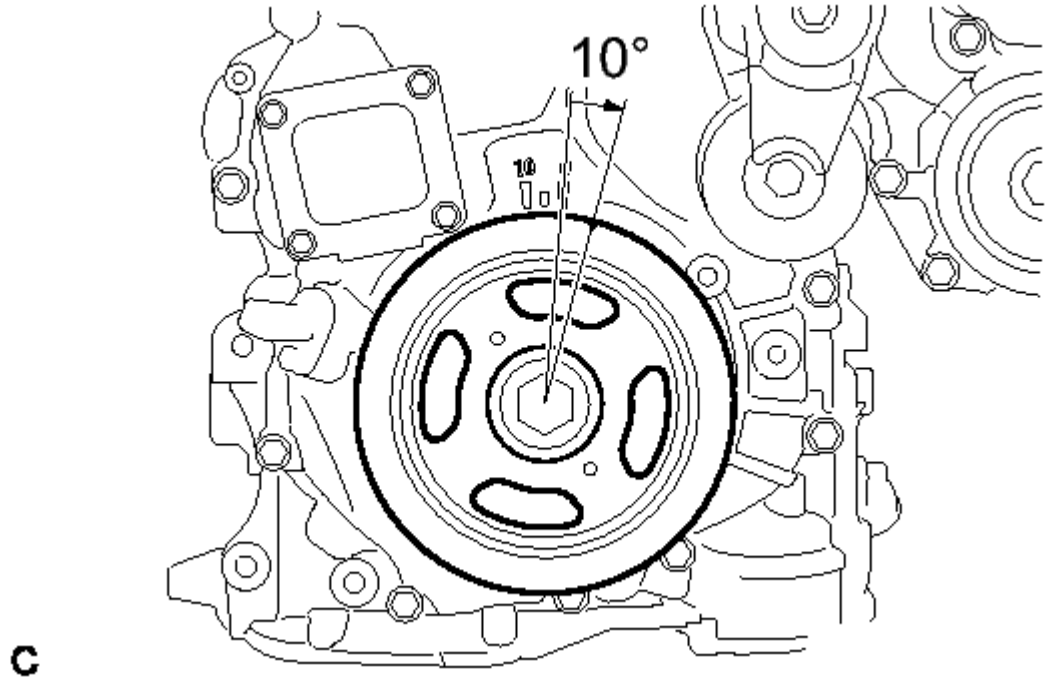


Fig. 34: View Of Turning Crankshaft 10Degrees Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Turn the crankshaft approximately 10° counterclockwise.

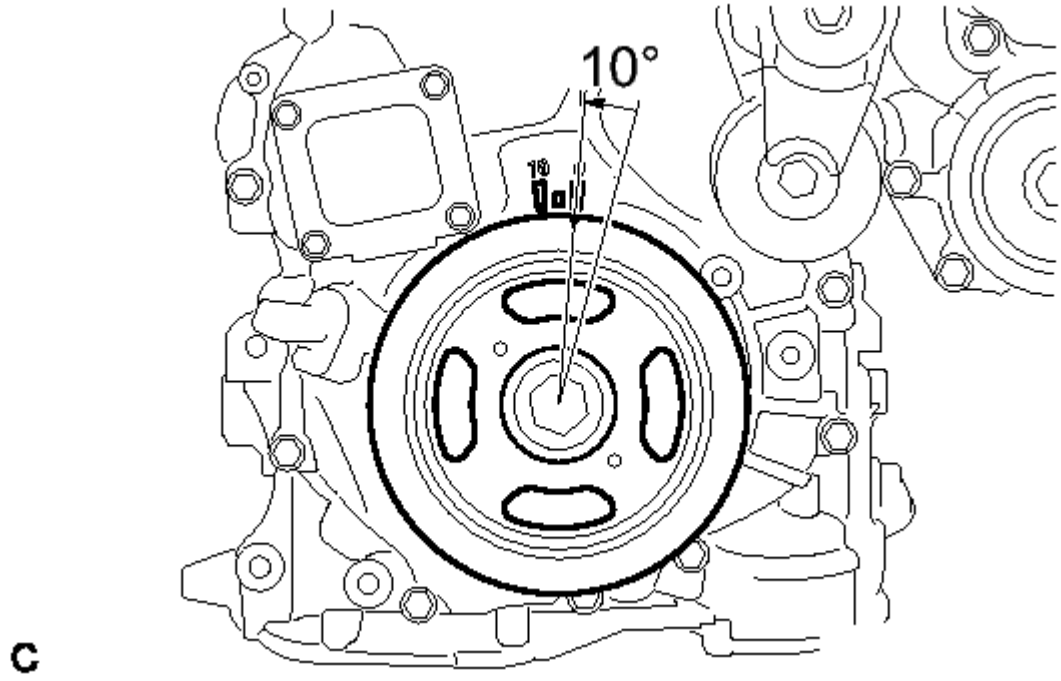


Fig. 35: Turning Crankshaft 10Degrees Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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c. Align the holes of the stopper plate and tensioner, and insert a pin into the stopper plate hole to lock the tensioner.

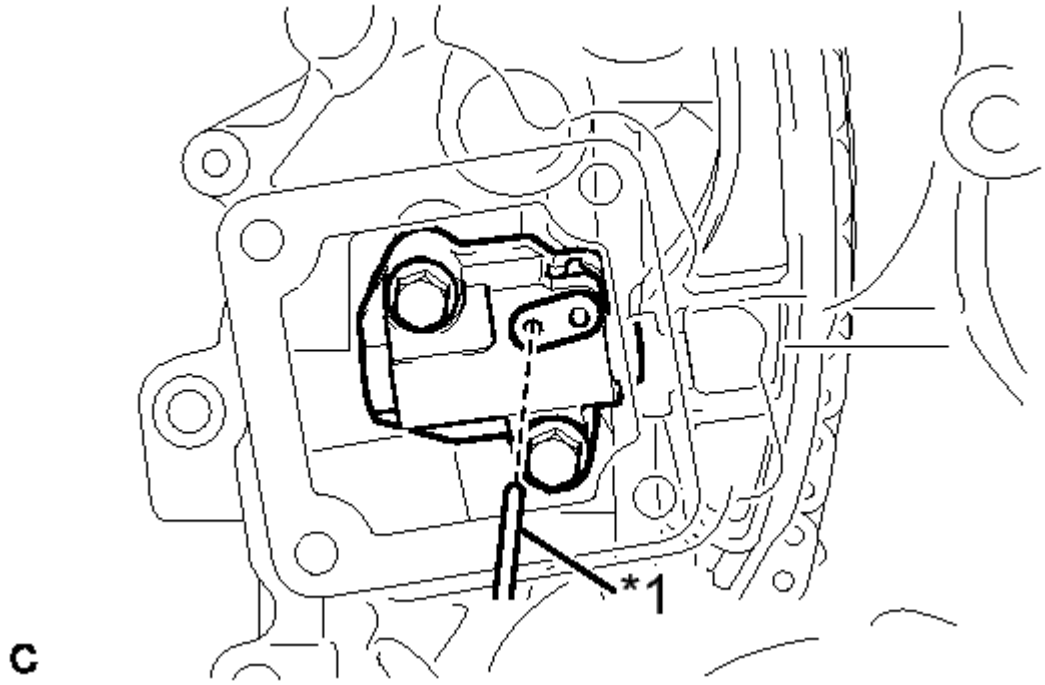


Fig. 36: Inserting Pin Into Stopper Plate Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Pin

d. Turn the crankshaft approximately 10° clockwise.

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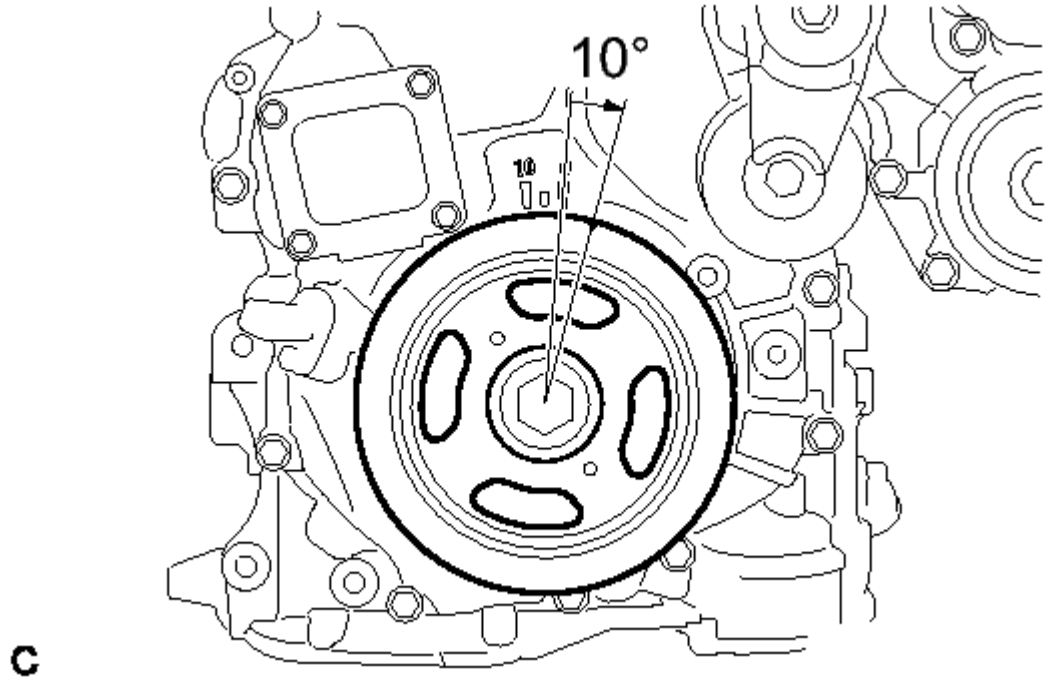


Fig. 37: View Of Turning Crankshaft 10Degrees Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

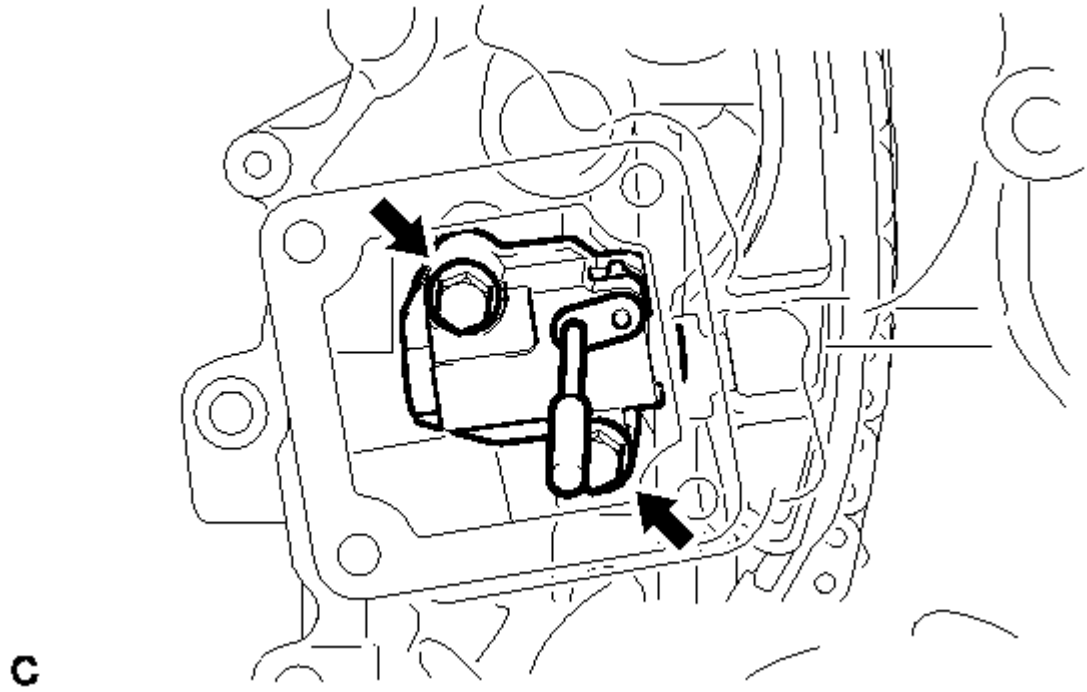


Fig. 38: No. 1 Chain Tensioner Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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NOTE: Make sure not to drop the gasket inside the timing chain cover.

f. Turn the crankshaft approximately 10° counterclockwise.

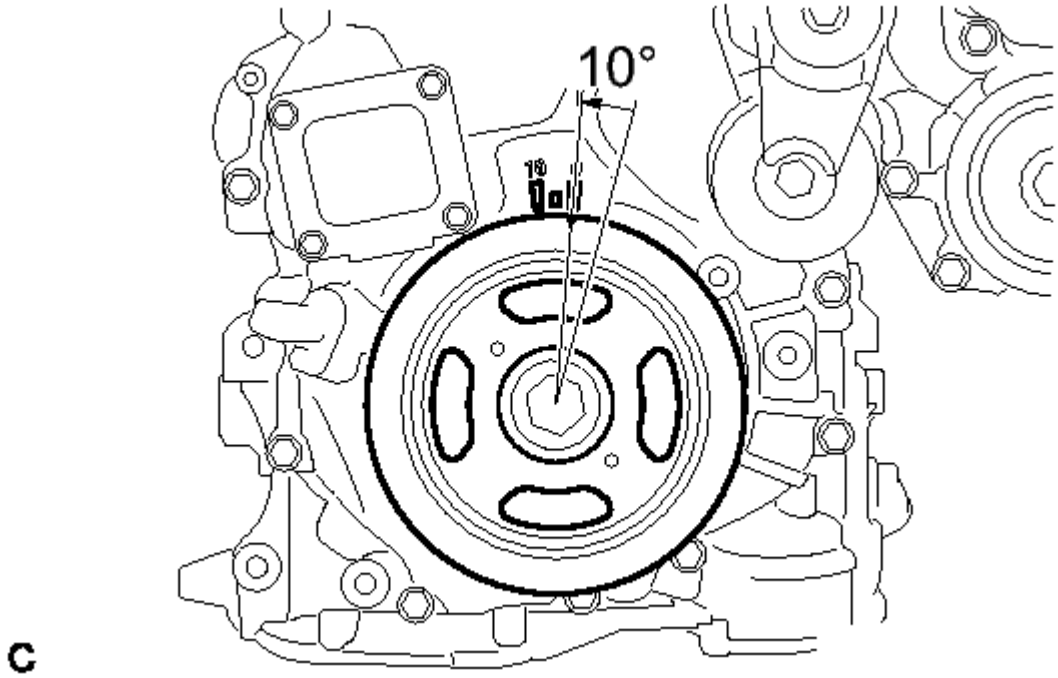


Fig. 39: Turning Crankshaft 10Degrees Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE TIMING CHAIN GUIDE** See step 13
21. **REMOVE TIMING CHAIN COVER TIGHT PLUG** See step 21
22. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY**
    a. Hold the hexagonal portion of the camshaft with a wrench and remove the bolt from the camshaft.

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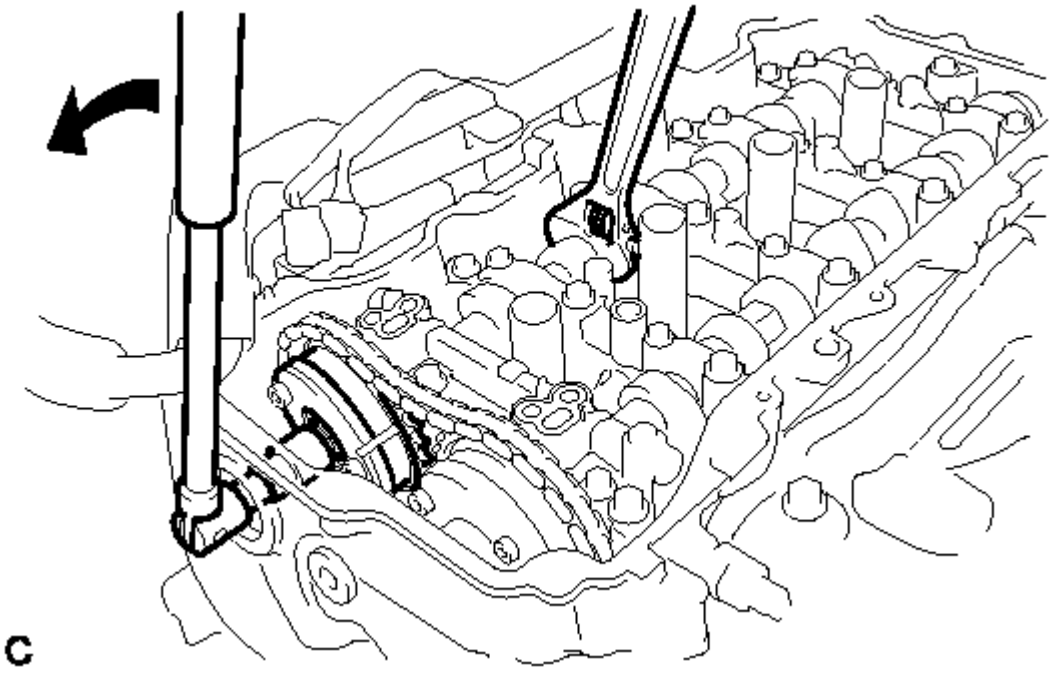


Fig. 40: Removing Camshaft Timing Gear Using A Wrench
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful not to damage the cylinder head or spark plug tube with the wrench.

b. Separate the camshaft timing gear assembly from the camshaft.

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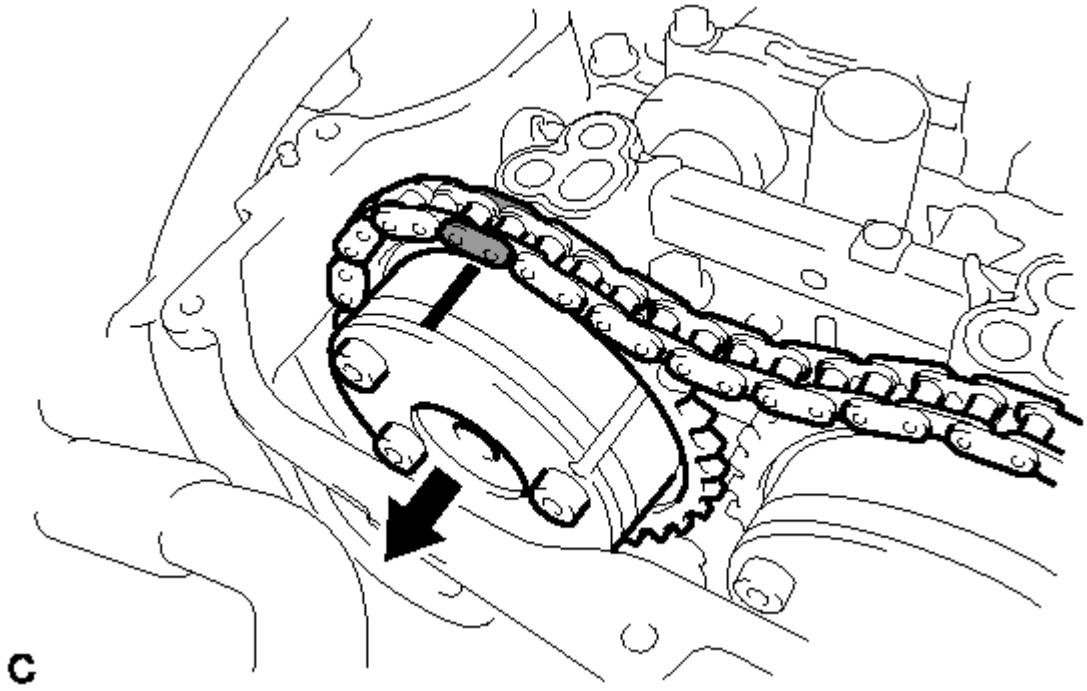


Fig. 41: Separating Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the timing chain from the camshaft timing gear assembly, and turn the camshaft timing gear assembly approximately 180°.

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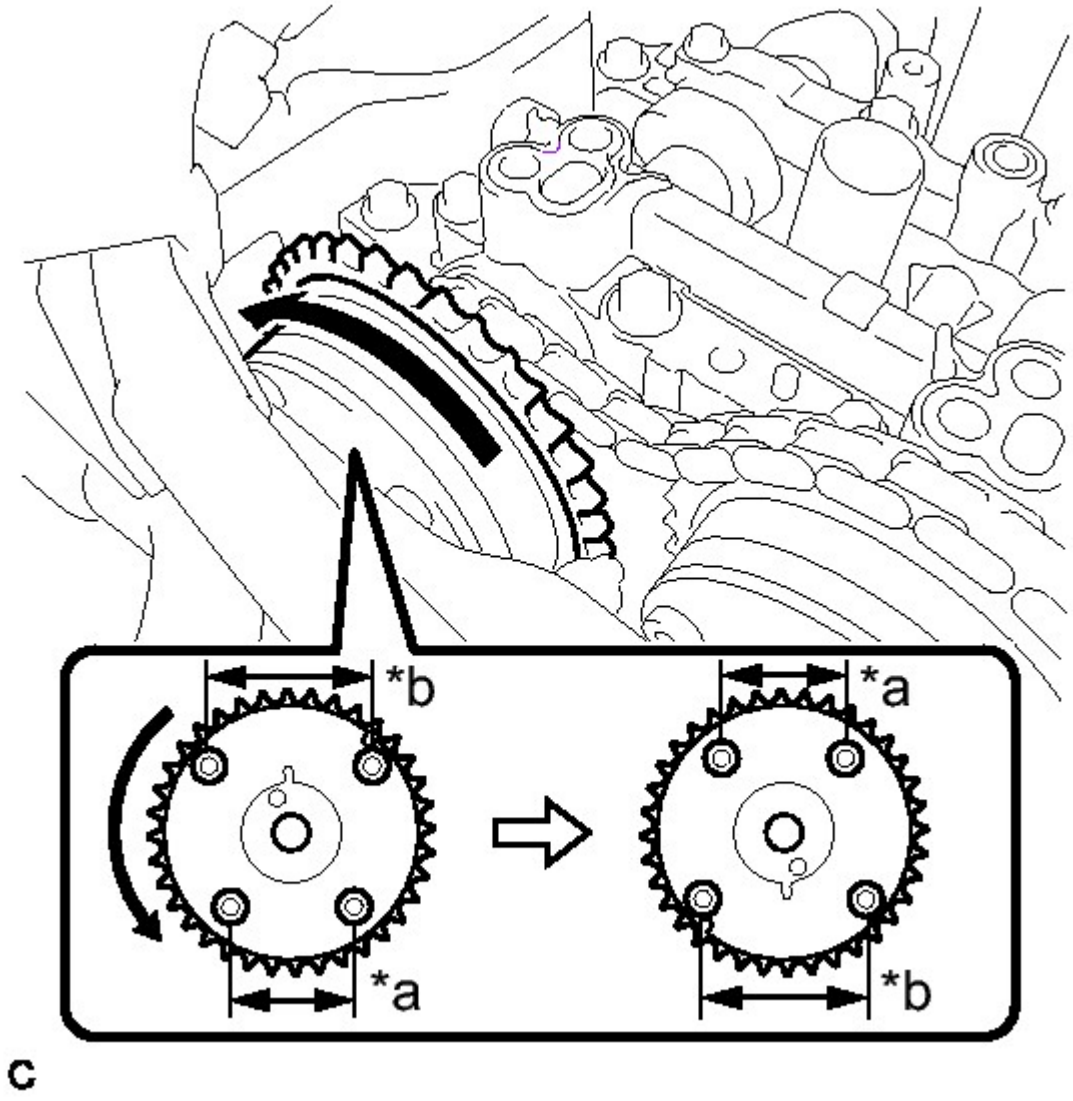


Fig. 42: Rotating Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Narrow
*b	Wide

d. Remove the camshaft timing gear assembly.

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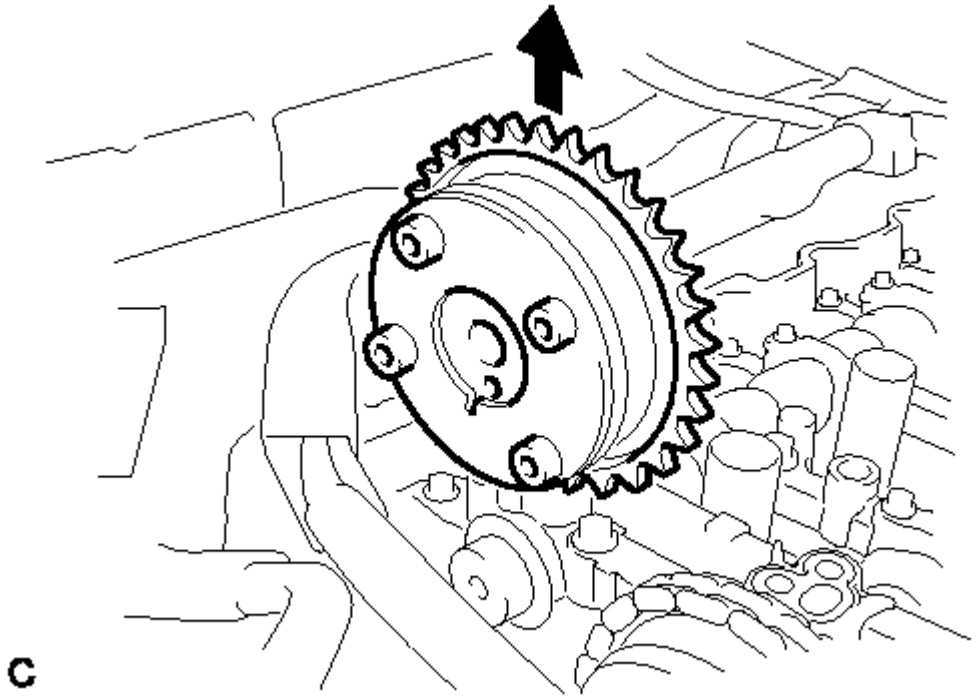


Fig. 43: Removing Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Do not disassemble the camshaft timing gear assembly.

23. **REMOVE CAMSHAFT BEARING CAP**
    a. Using several steps, remove the 11 bearing cap bolts in the sequence shown in the illustration.

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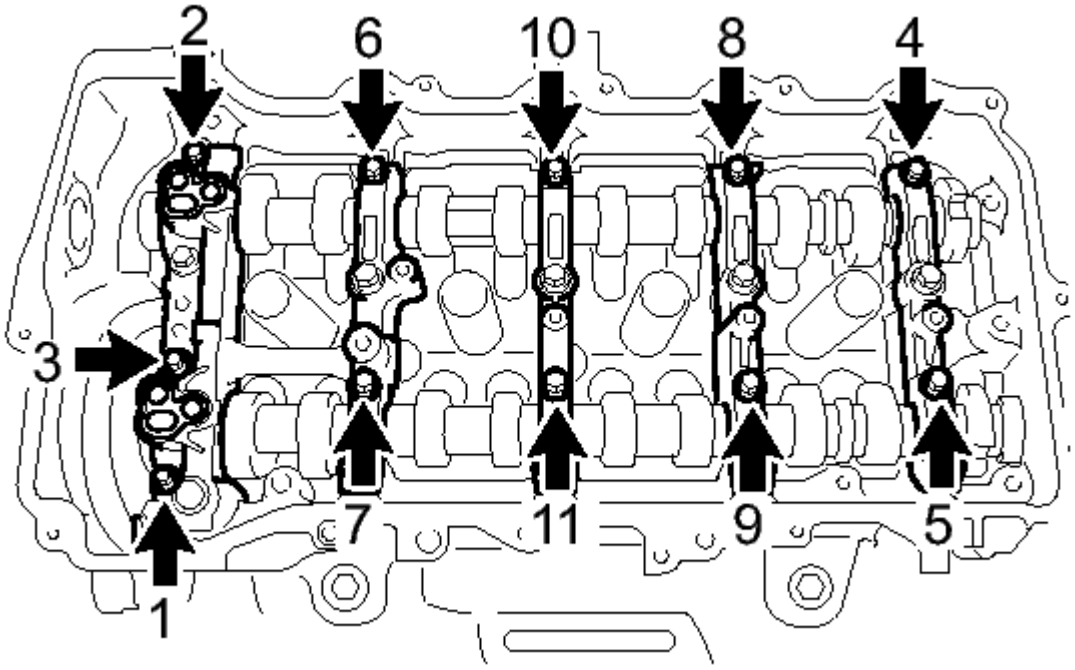


Fig. 44: Removal Sequence For Bearing Cap Bolts (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using several steps, remove the 10 bearing cap bolts in the sequence shown in the illustration.

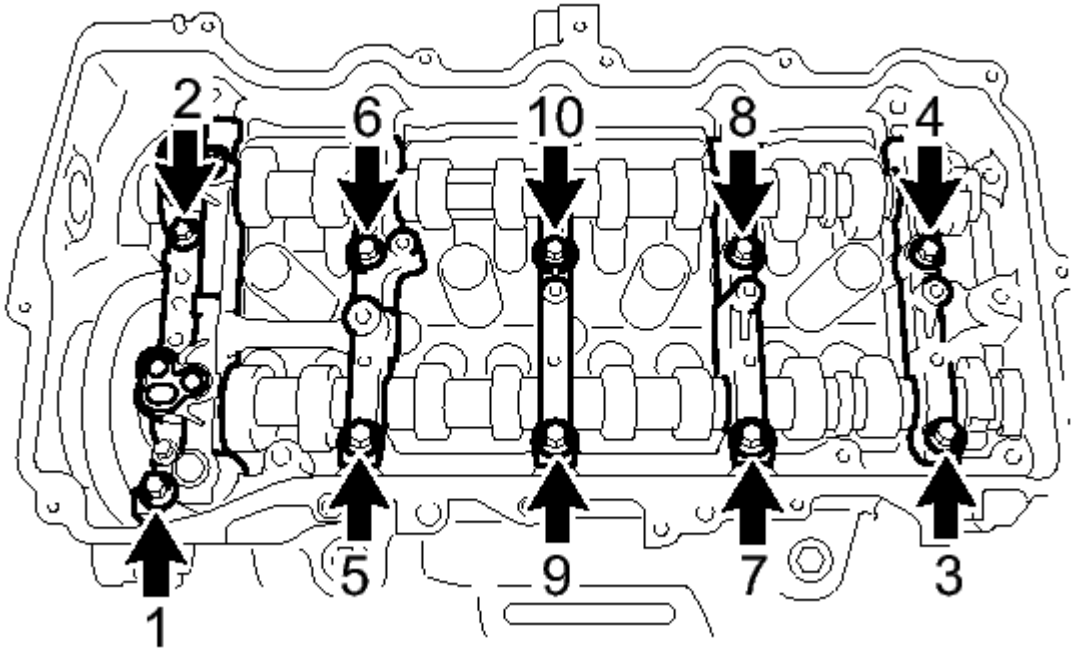


Fig. 45: Removal Sequence For Bearing Cap Bolts (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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c. Remove the 5 bearing caps.

HINT:

Arrange the removed parts in the correct order.

24. **REMOVE CAMSHAFT**

a. Remove the camshaft from the camshaft housing sub-assembly.

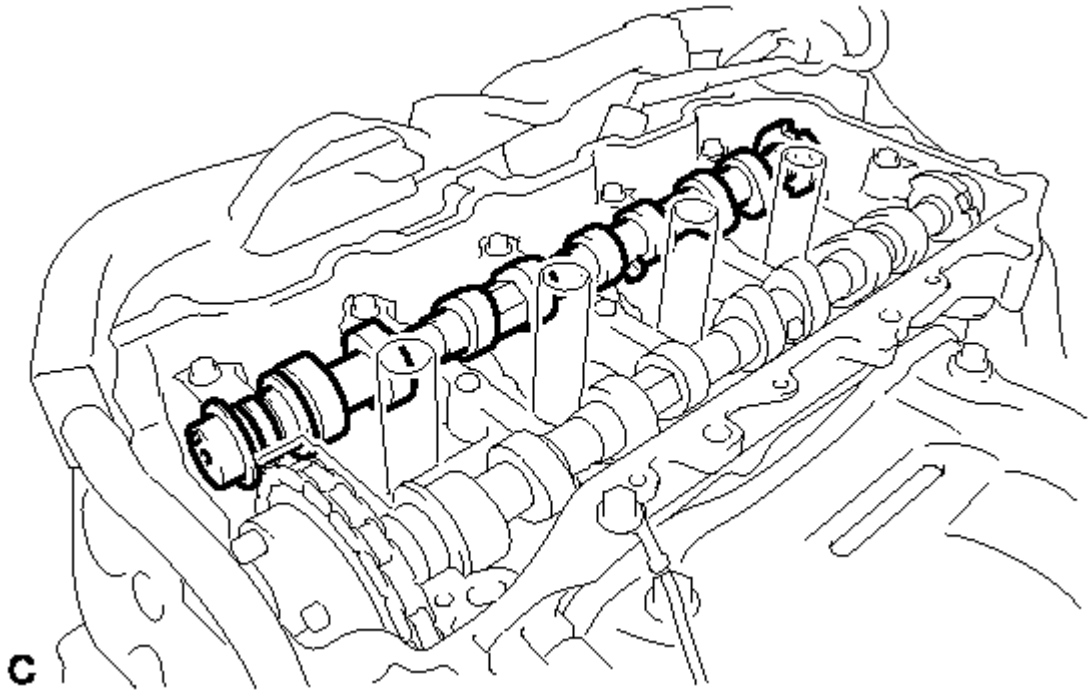


Fig. 46: Removing No. 1 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

25. **REMOVE NO. 2 CAMSHAFT**

a. Hold up the chain and remove the No. 2 camshaft from the camshaft housing sub-assembly.

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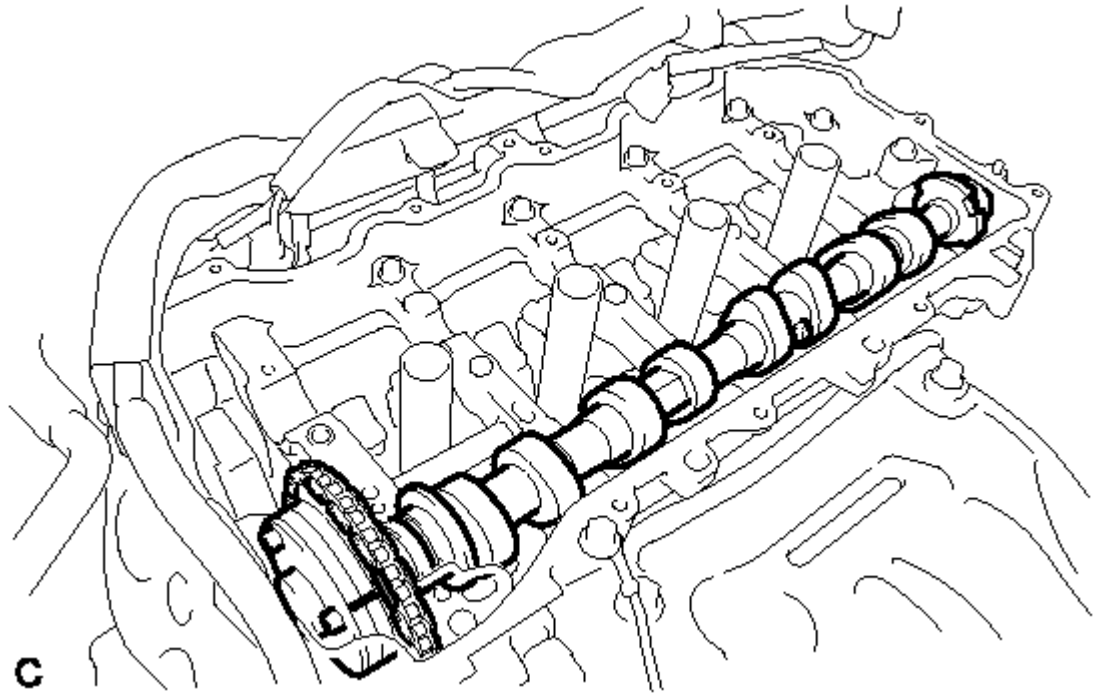


Fig. 47: Removing No. 2 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Suspend the chain with a string or equivalent as shown in the illustration.

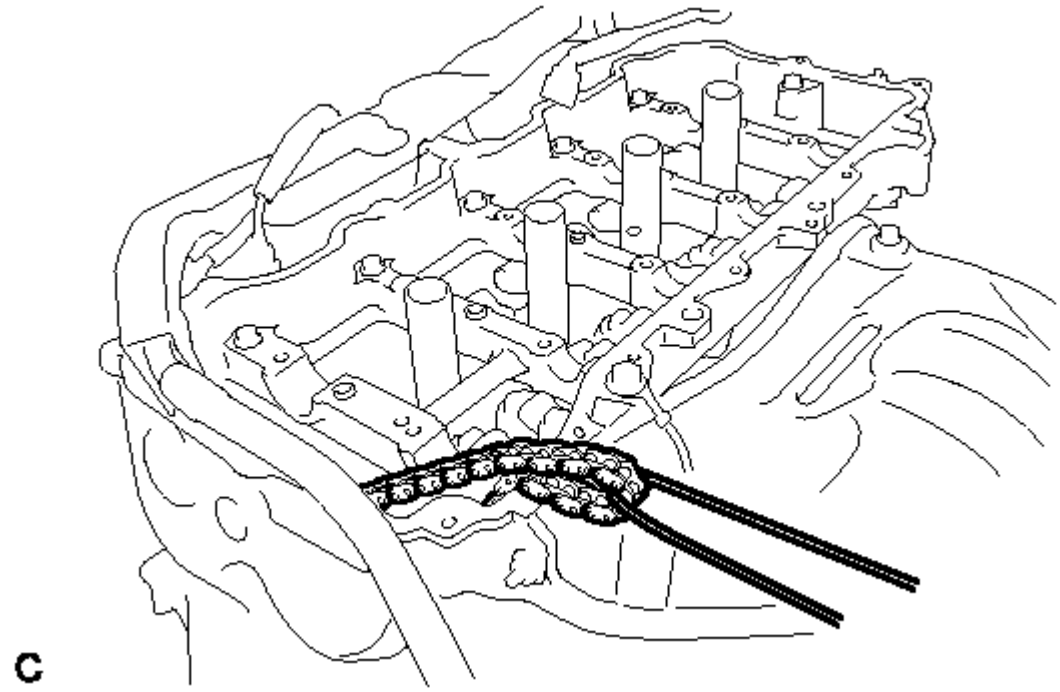


Fig. 48: View Of Suspending Chain With String Or Equivalent
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

26. **REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
    a. Remove the flange bolt and camshaft timing exhaust gear assembly.

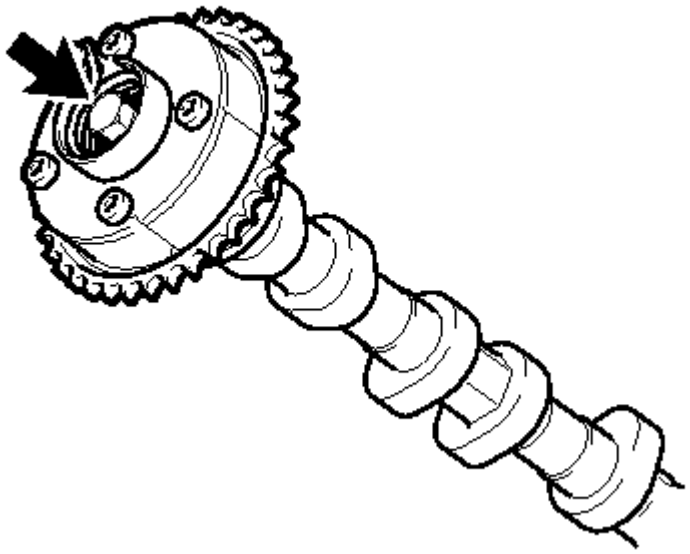


Fig. 49: Location of Camshaft Timing Exhaust Gear Flange Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Do not disassemble the camshaft timing exhaust gear assembly.

27. **REMOVE OIL CONTROL VALVE FILTER** See step 35
28. **REMOVE NO. 1 CAMSHAFT BEARING** See step 37
29. **REMOVE NO. 2 CAMSHAFT BEARING** See step 38

INSTALLATION [08/2013 - 12/2013]

INSTALLATION [08/2013 - 12/2013]

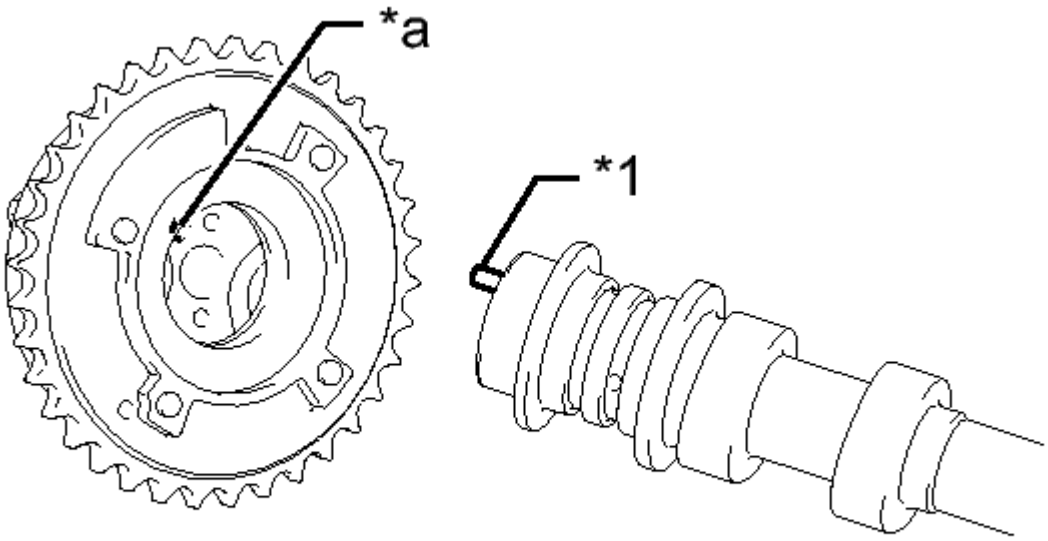
HINT:

Perform "Inspection After Repair" after replacing the camshaft, No. 2 camshaft, camshaft timing gear assembly or camshaft timing exhaust gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

1. **INSTALL NO. 2 CAMSHAFT BEARING** See step 18
2. **INSTALL NO. 1 CAMSHAFT BEARING** See step 17

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3. **INSTALL OIL CONTROL VALVE FILTER** See step 19
4. **INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
   a. Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear assembly.



P

Fig. 50: Identifying Knock Pin And Knock Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Knock Pin Hole

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

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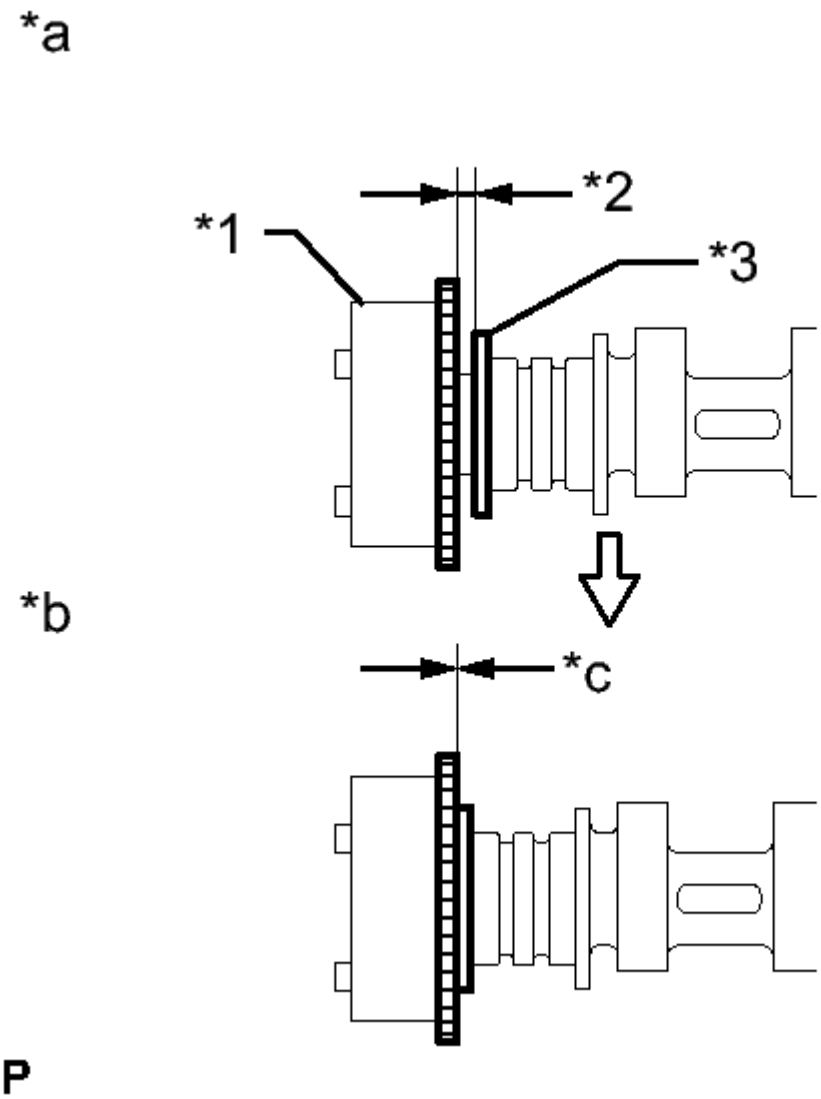


Fig. 51: Checking Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Exhaust Gear Assembly
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance

c. Fix the camshaft timing exhaust gear assembly with the bolt.

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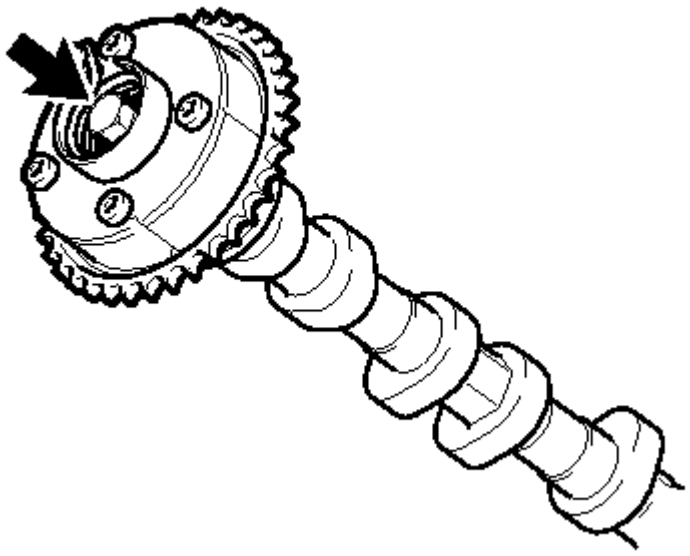


Fig. 52: Location of Camshaft Timing Exhaust Gear Flange Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Do not disassemble the camshaft timing exhaust gear assembly.

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing exhaust gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

5. **SET TDC/COMPRESSION**
   a. Turn the crankshaft pulley until its timing notch (groove) and the timing mark "0" of the timing chain cover are aligned.

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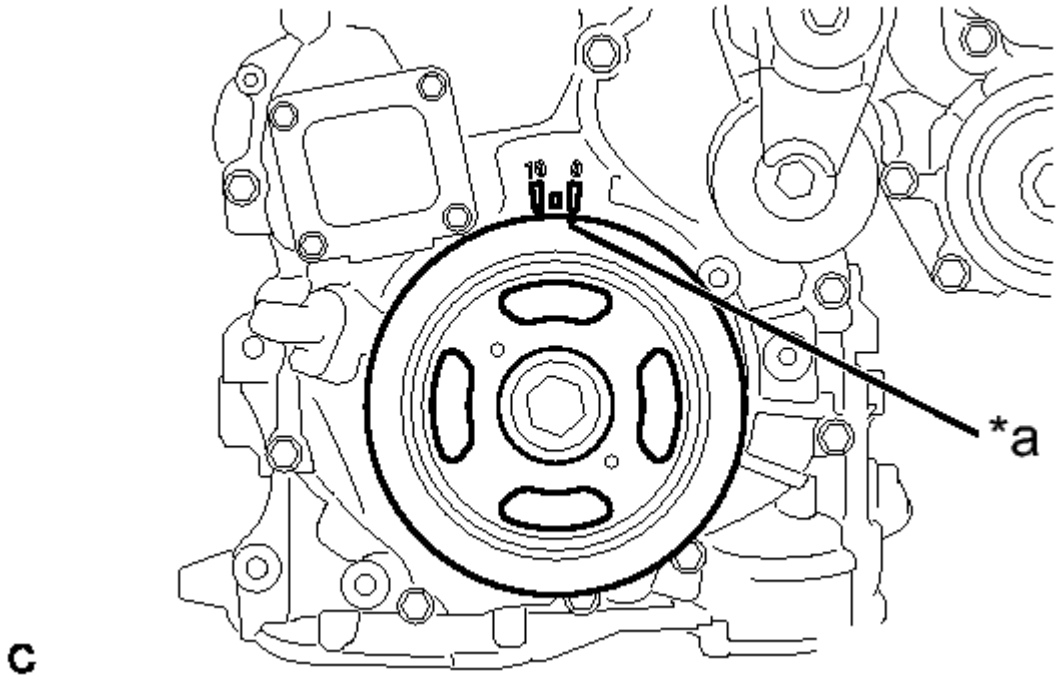


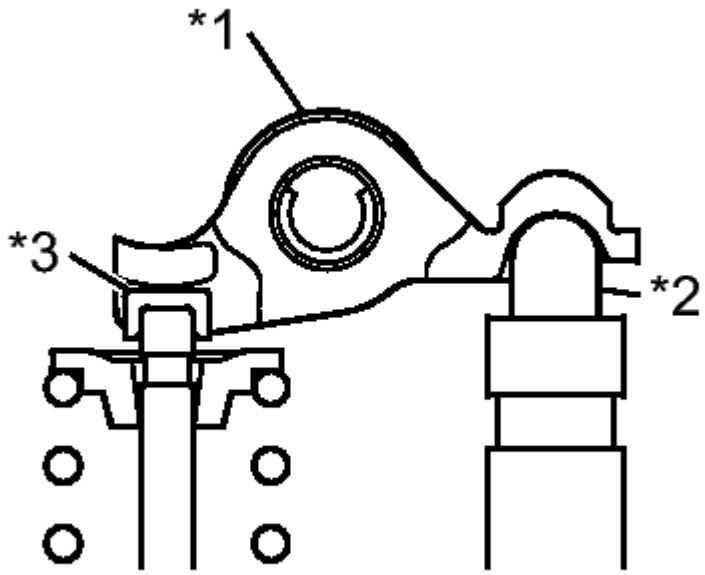
Fig. 53: Setting TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Timing Notch

6. **INSTALL NO. 2 CAMSHAFT**
   a. Make sure that the valve rocker arms are installed as shown in the illustration.

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Fig. 54: Identifying Valve Rocker Arms
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Valve Rocker Arm
*2	Valve Lash Adjuster
*3	Valve Stem Cap

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 timing mark and the paint mark, and install the camshaft.

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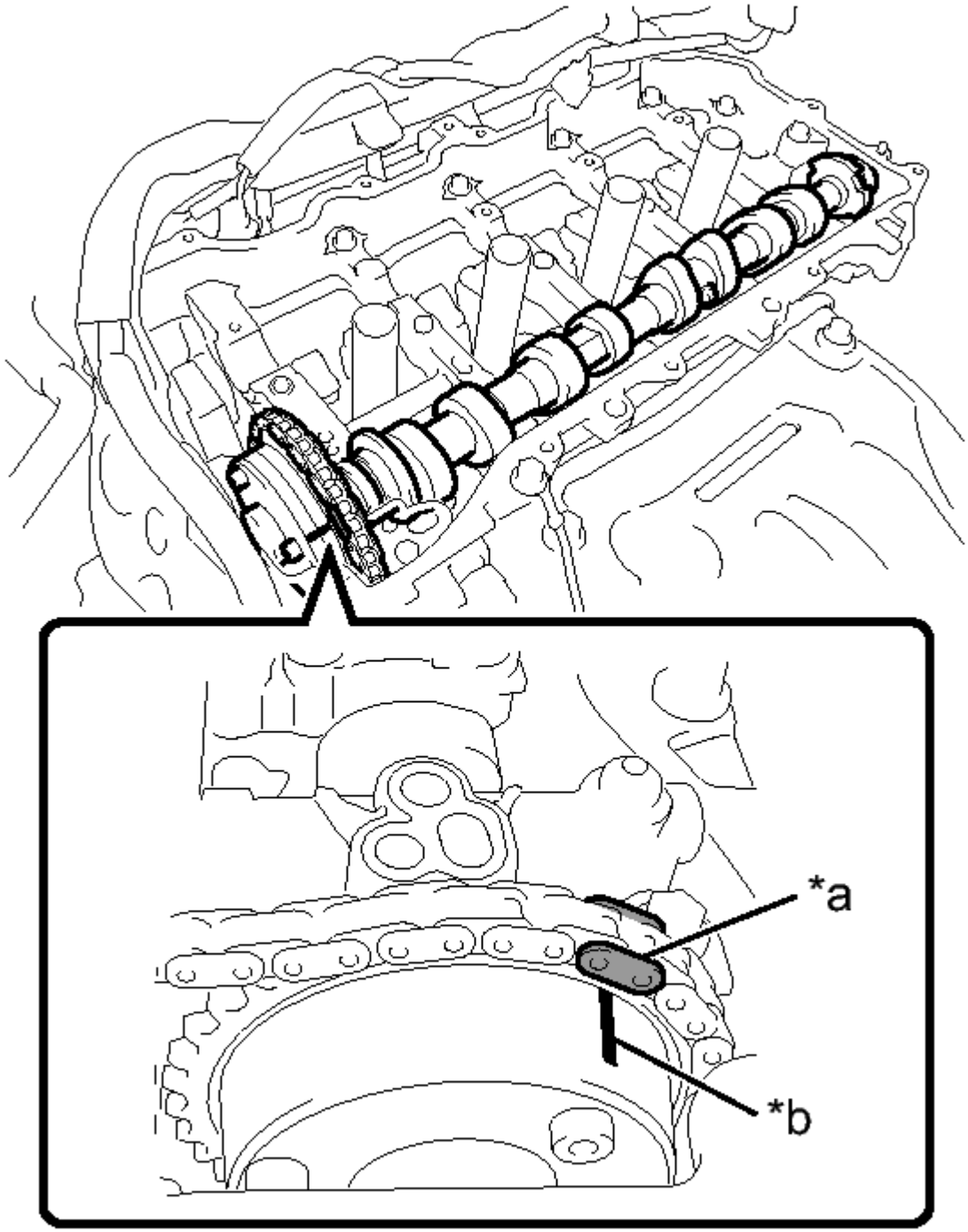


Fig. 55: Aligning Timing Mark And Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark

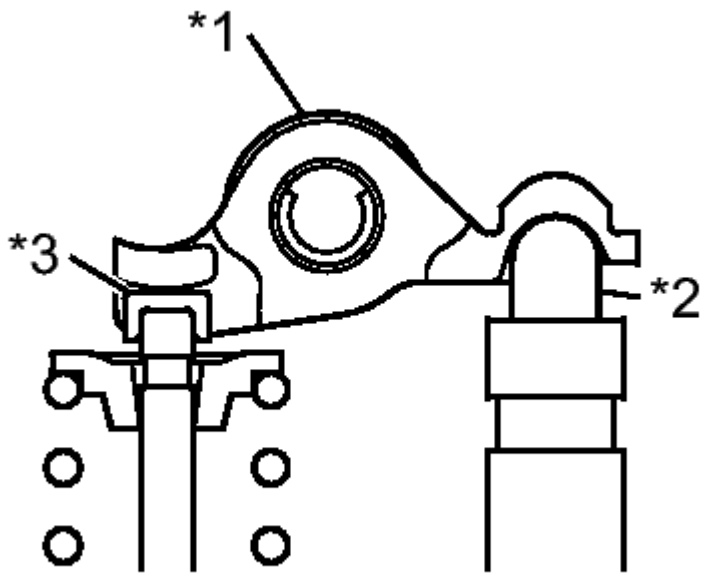
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*b	Timing Mark

HINT:

Perform "Inspection After Repair" after replacing the No. 2 camshaft. Refer to **INITIALIZATION [08/2013 -]** .

7. **INSTALL CAMSHAFT**
   a. Make sure that the valve rocker arms are installed as shown in the illustration.



P

Fig. 56: Identifying Valve Rocker Arms
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Valve Rocker Arm
*2	Valve Lash Adjuster
*3	Valve Stem Cap

   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 camshaft to the camshaft housing as shown in the illustration.

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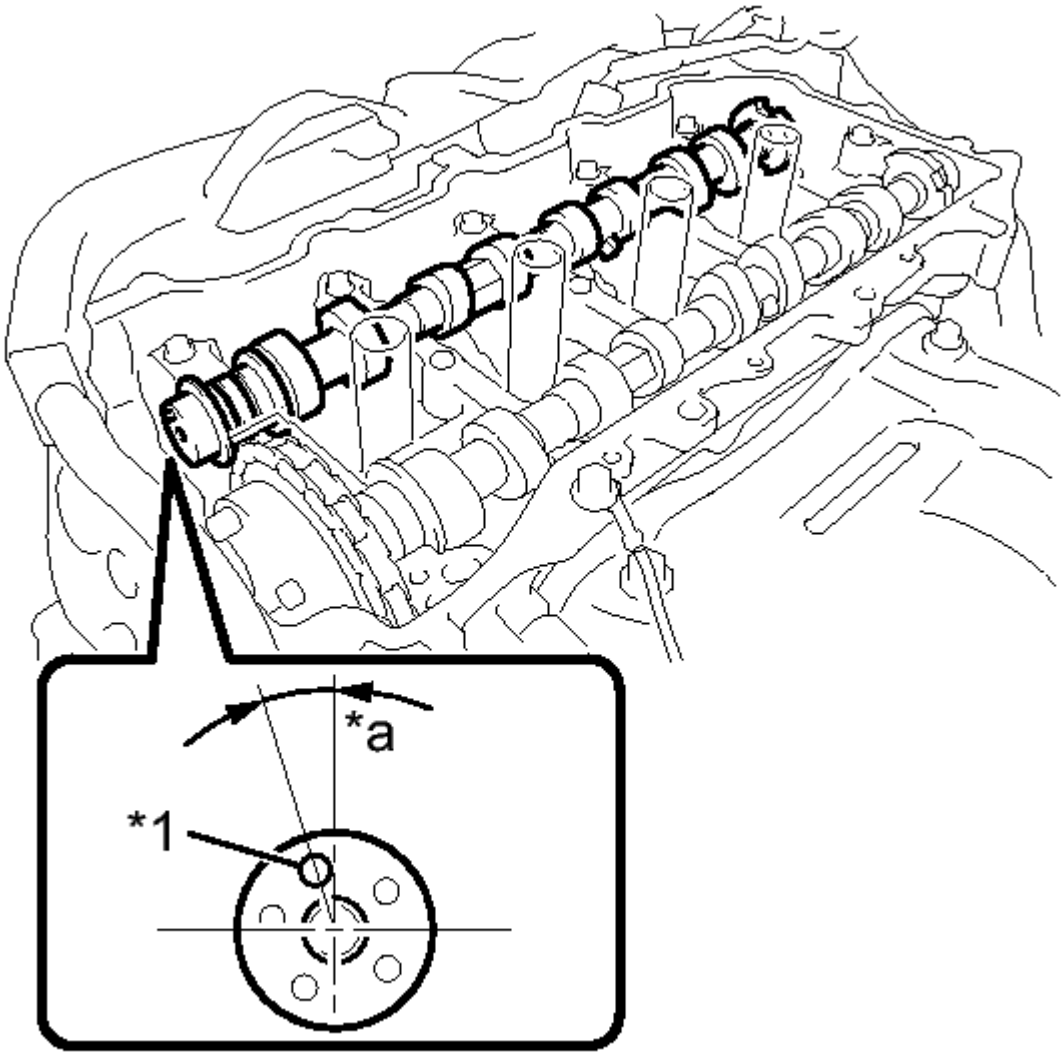


Fig. 57: Identifying Camshaft Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Approximately 17°

HINT:

Perform "Inspection After Repair" after replacing the camshaft. Refer to **INITIALIZATION [08/2013 -]** .

8. **INSTALL CAMSHAFT BEARING CAP**
   a. Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.

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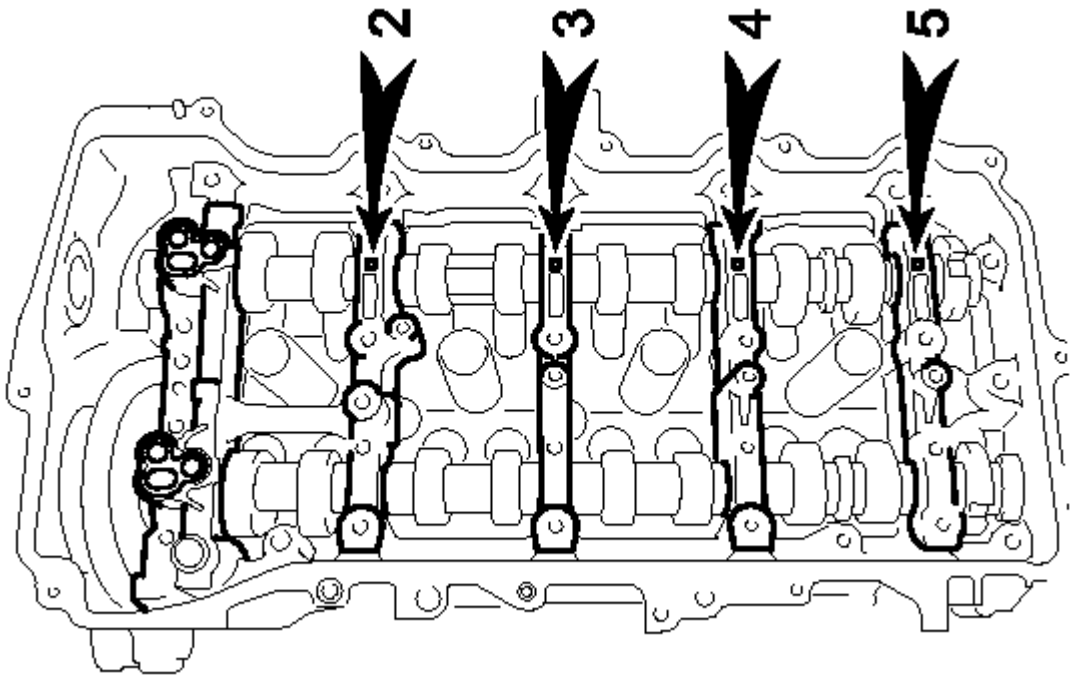


Fig. 58: Identifying Camshaft Bearing Cap Marks And Numbers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using several steps, uniformly tighten the 10 bolts in the sequence shown in the illustration.

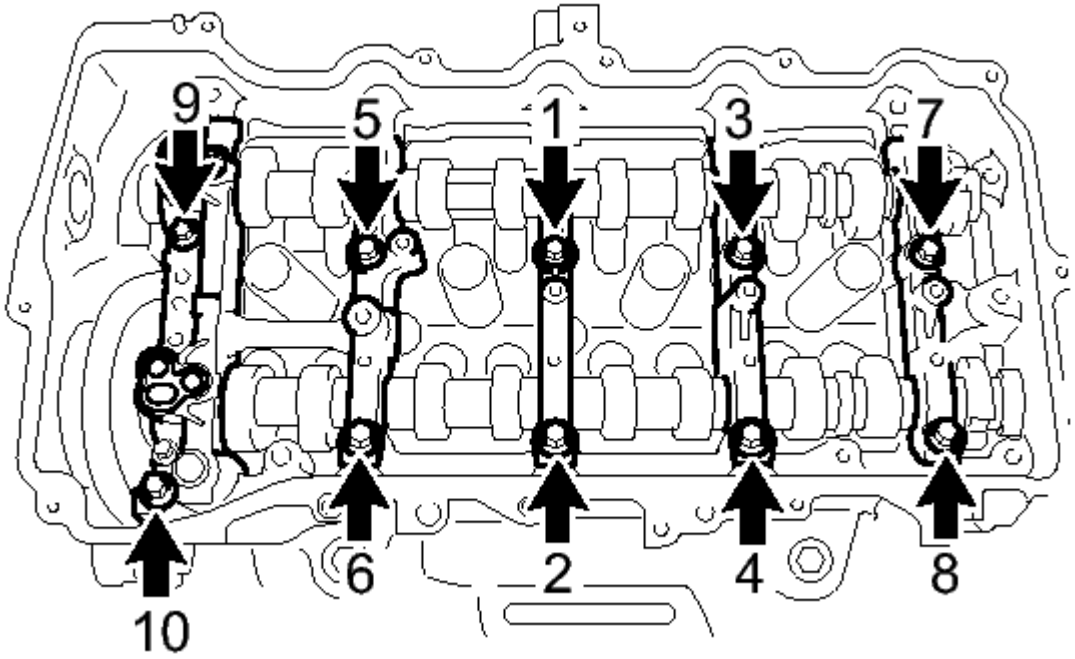


Fig. 59: Tightening Sequence Of Camshaft Bearing Cap Bolts (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

c. Using several steps, uniformly tighten the 11 bolts in the sequence shown in the illustration.

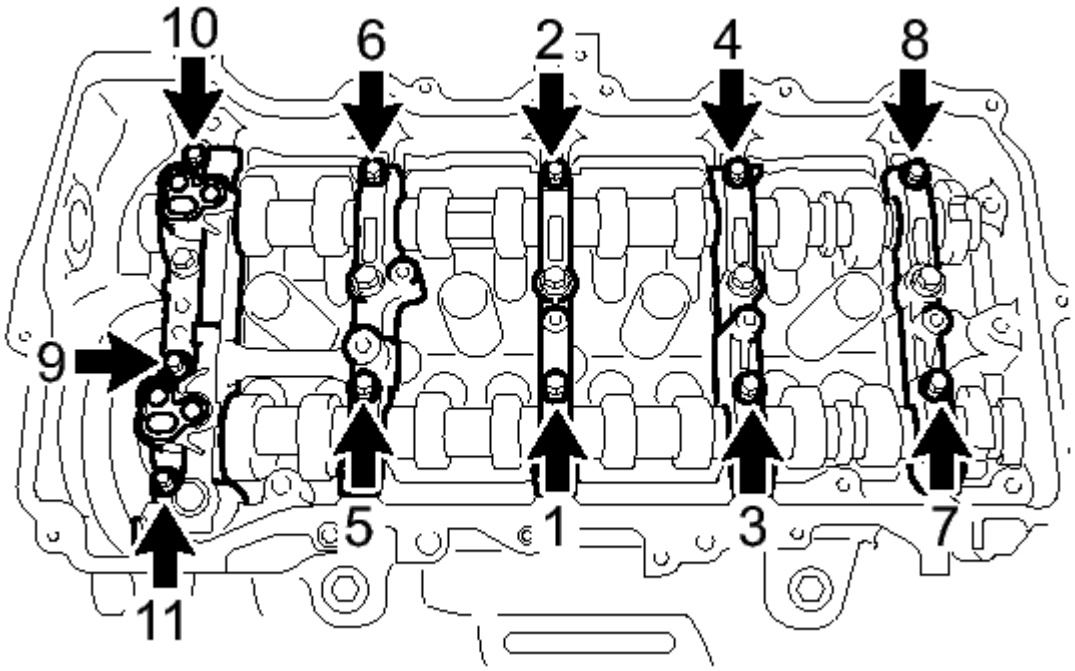


Fig. 60: Tightening Sequence Of Camshaft Bearing Cap Bolts (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

d. Check the torque of each bolt again.

9. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY**
   a. Check the camshaft timing gear position.

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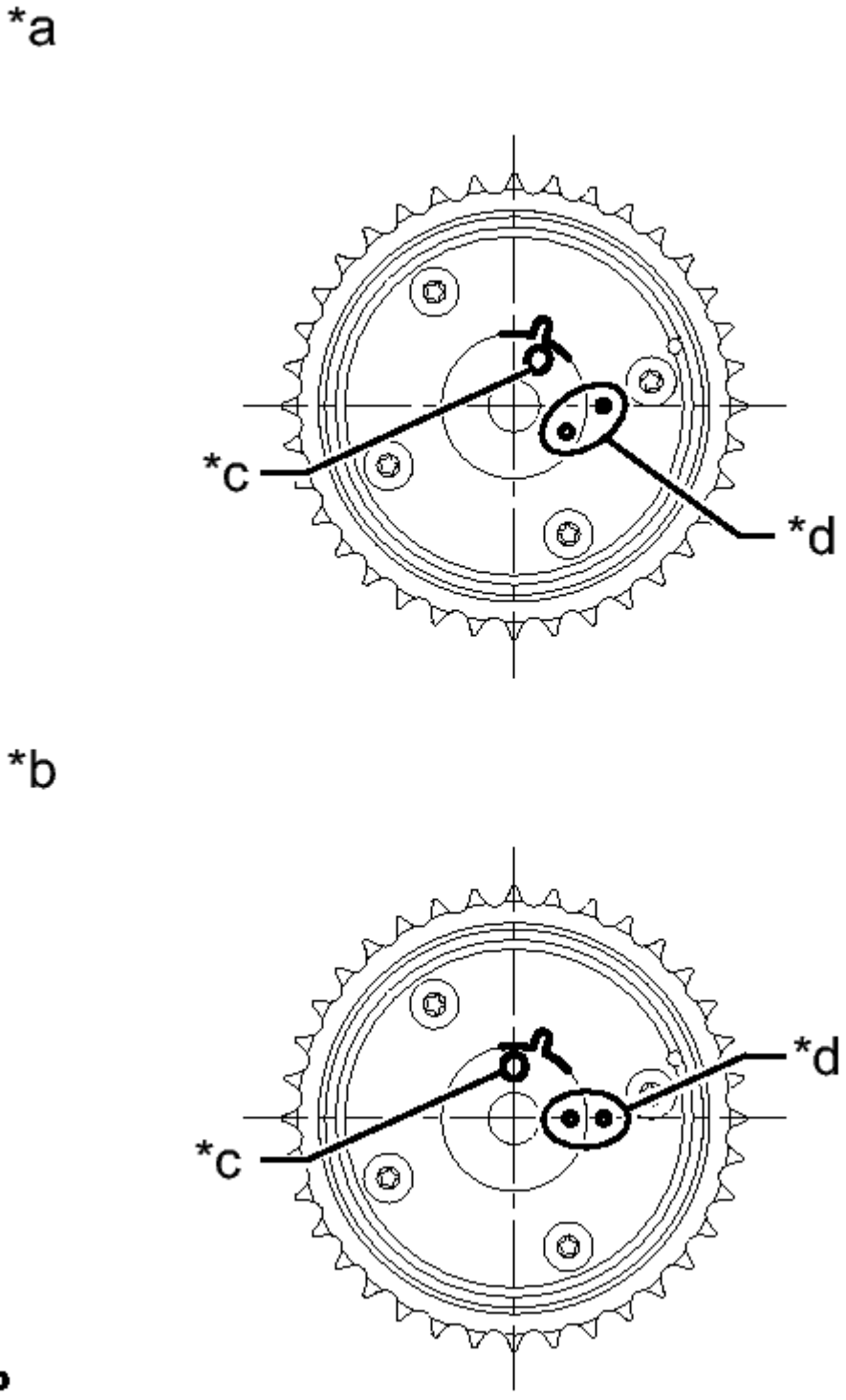


Fig. 61: Identifying Camshaft Timing Gear Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Advanced Position

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*b	Retarded Position
*c	Knock Pin Hole
*d	Alignment Mark

NOTE:

- **If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during installation.**
- **If the camshaft timing gear has rotated to the most retarded position, make sure to release the lock pin and set the camshaft timing gear to the most advanced position before tightening the camshaft timing gear.**

b. Install the camshaft timing gear assembly as shown in the illustration.

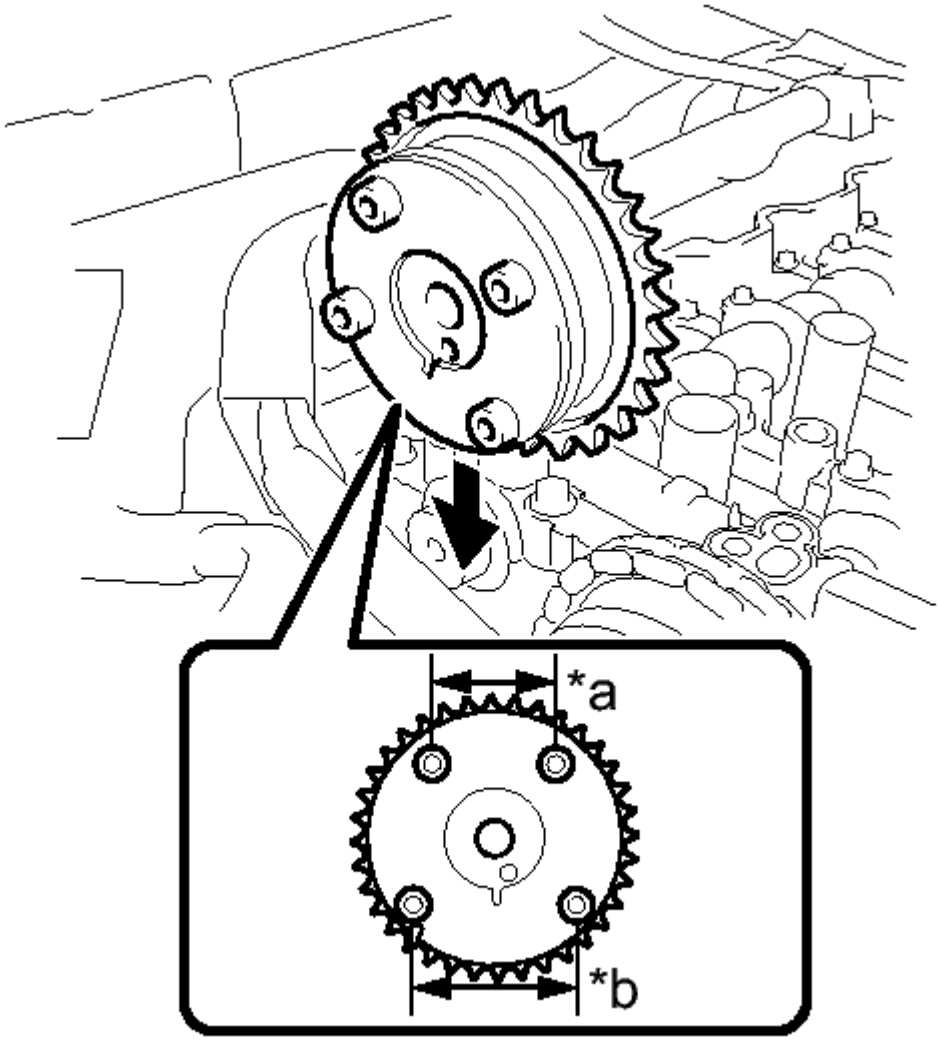


Fig. 62: Installing Camshaft Timing Gear Assembly

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

TEXT IN ILLUSTRATION

*a	Narrow
*b	Wide

c. Turn the camshaft timing gear assembly approximately 180° counterclockwise.

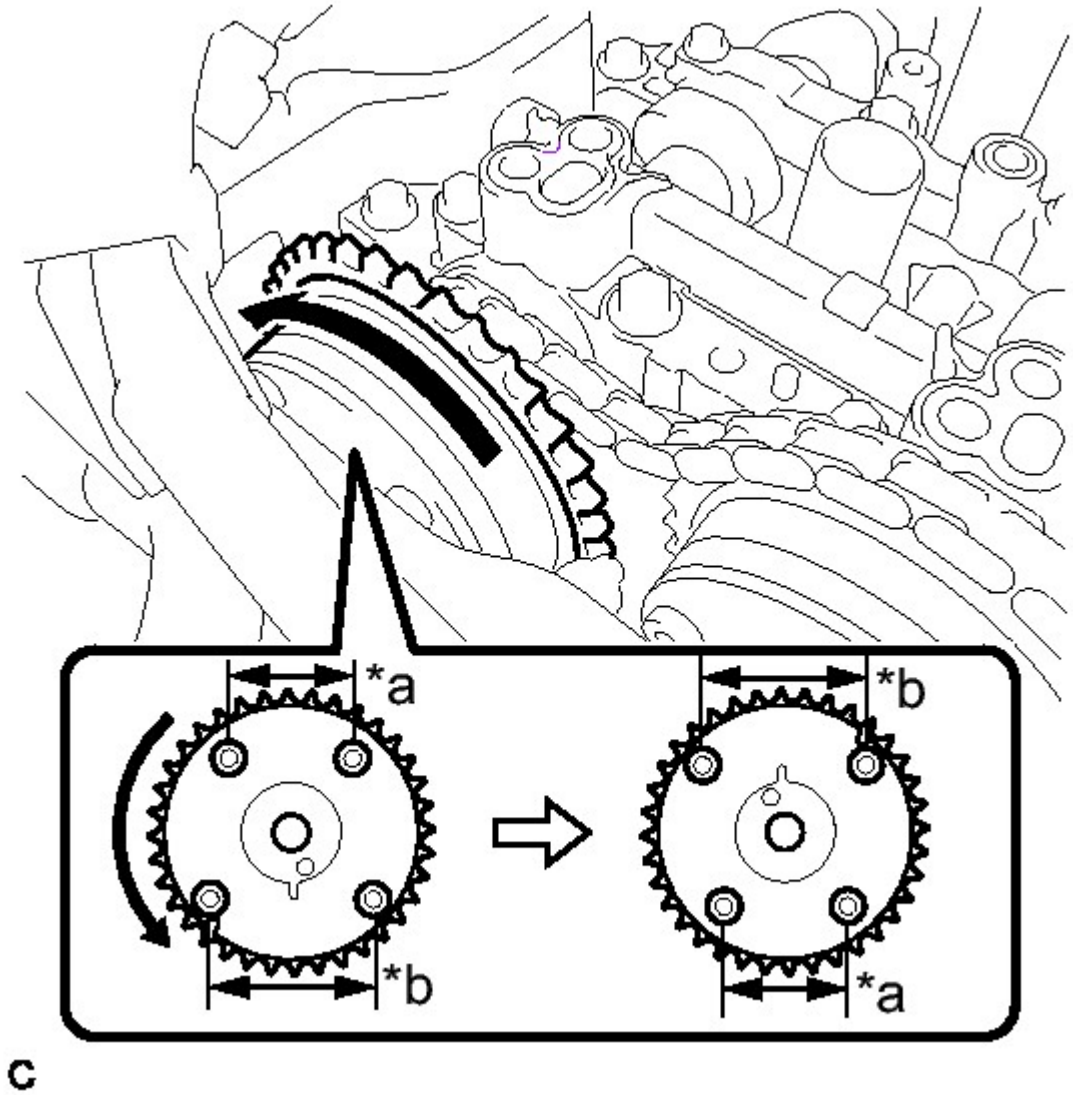


Fig. 63: Turn Camshaft Timing Gear Approximately 180Degrees Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Narrow
*b	Wide

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d. Align the paint mark with the timing mark to install the chain.

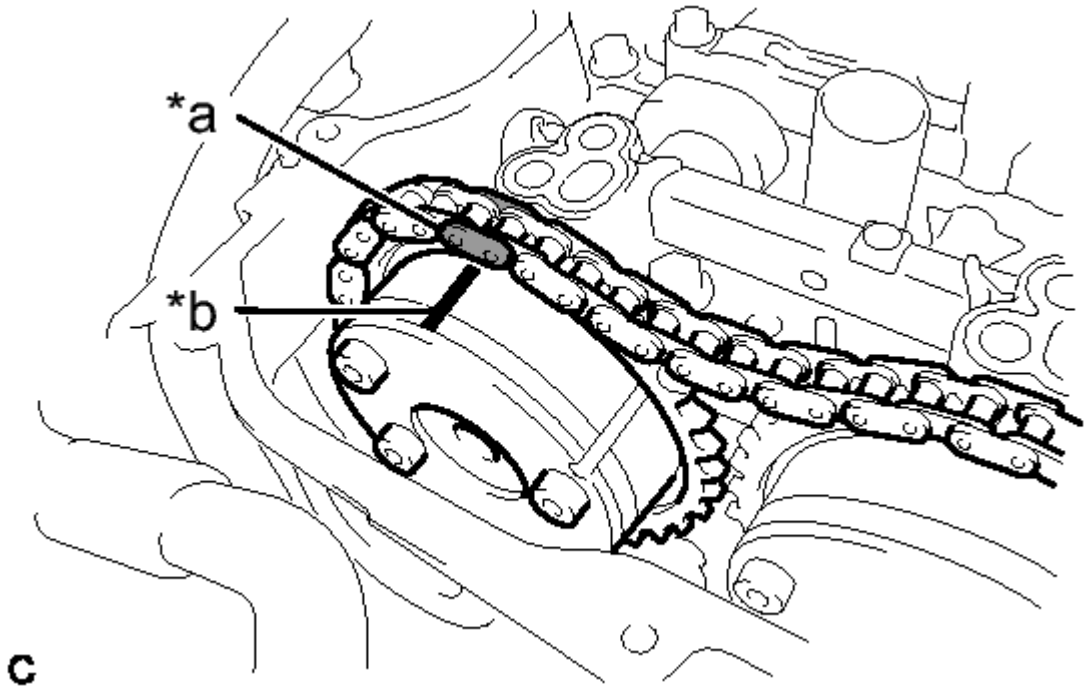


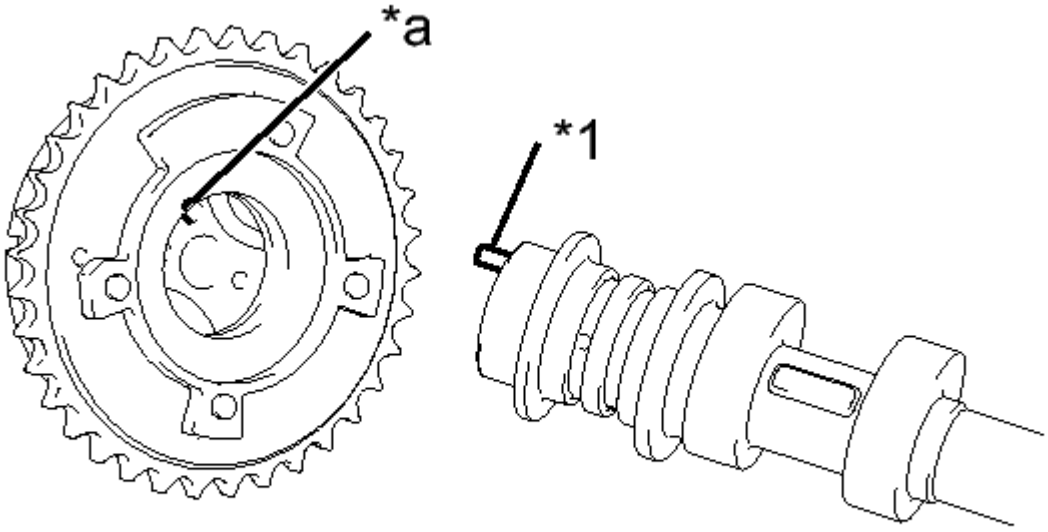
Fig. 64: Aligning Paint Mark And Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark
*b	Timing Mark

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

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Fig. 65: Identifying No. 1 Camshaft Knock Pin & Camshaft Timing Gear Knock Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Knock Pin Hole

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

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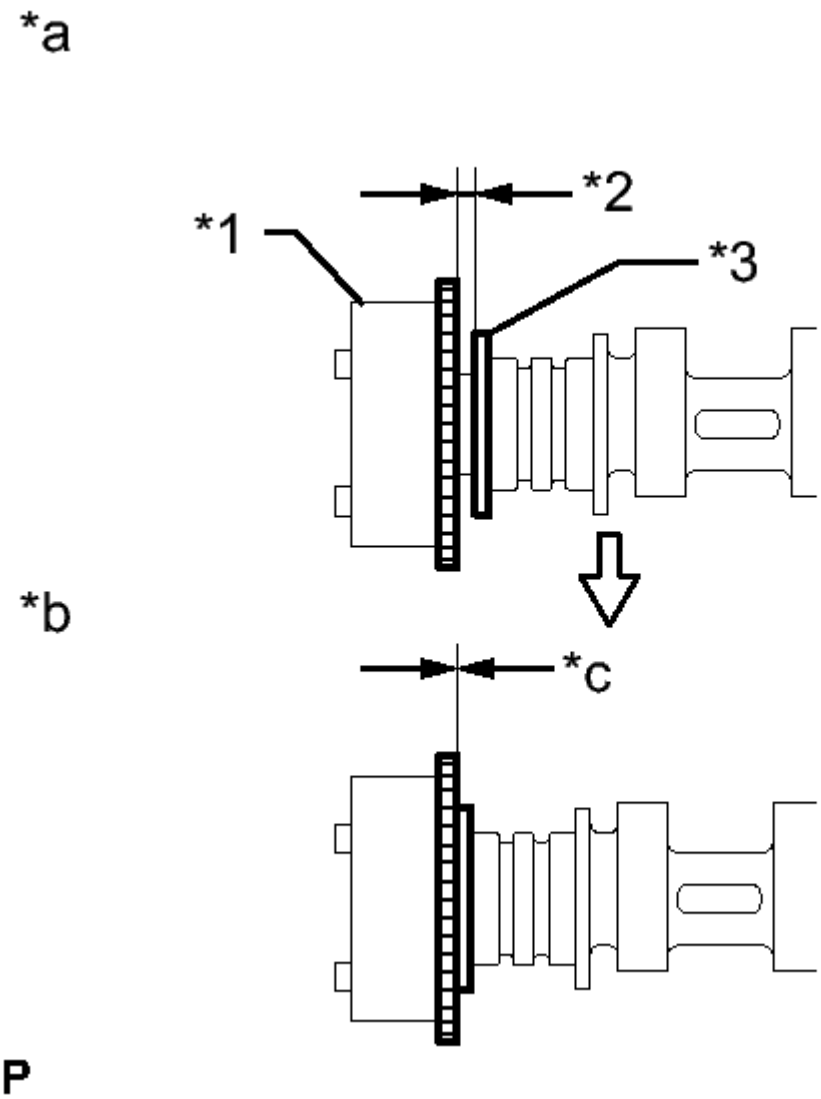


Fig. 66: Checking Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Gear
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance

g. Secure the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear assembly by hand.

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

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tool, the lock pin will be damaged.

h. If the lock pin has not been released, release it.

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.

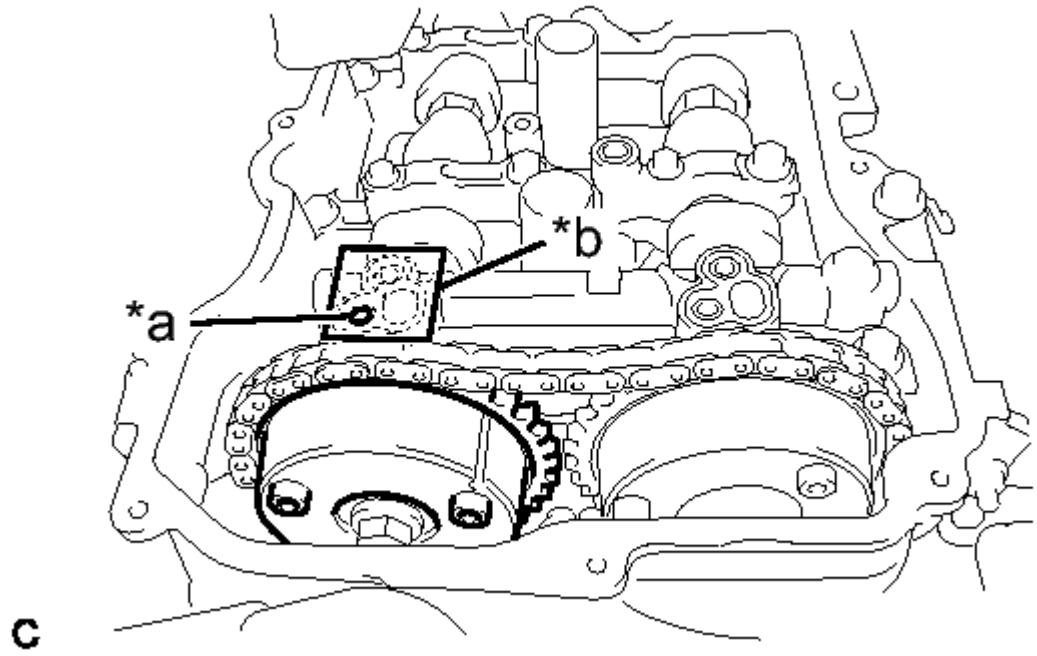


Fig. 67: Sealing Oil Hole With Adhesive Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Make a Hole
*b	Adhesive Tape Sealing Area

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

2. Make a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure A)
3. Apply approximately 200 kPa (2.0 kgf/ cm^2 , 29 psi) of air pressure to the hole made in procedure A to release the lock pin.

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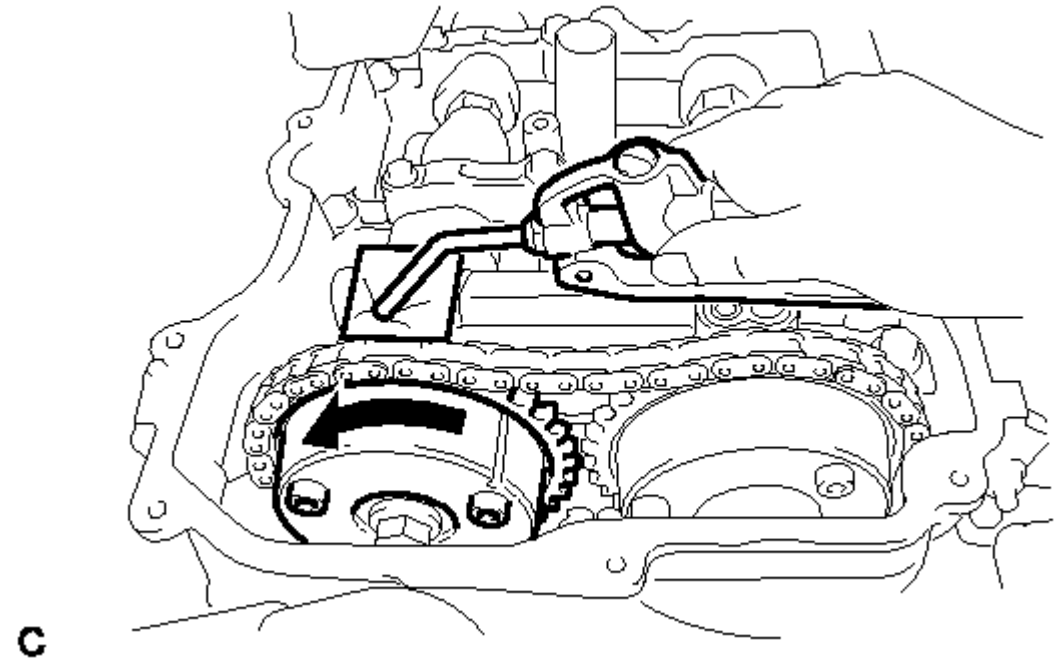


Fig. 68: Applying Air Pressure To Release Lock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.**

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

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

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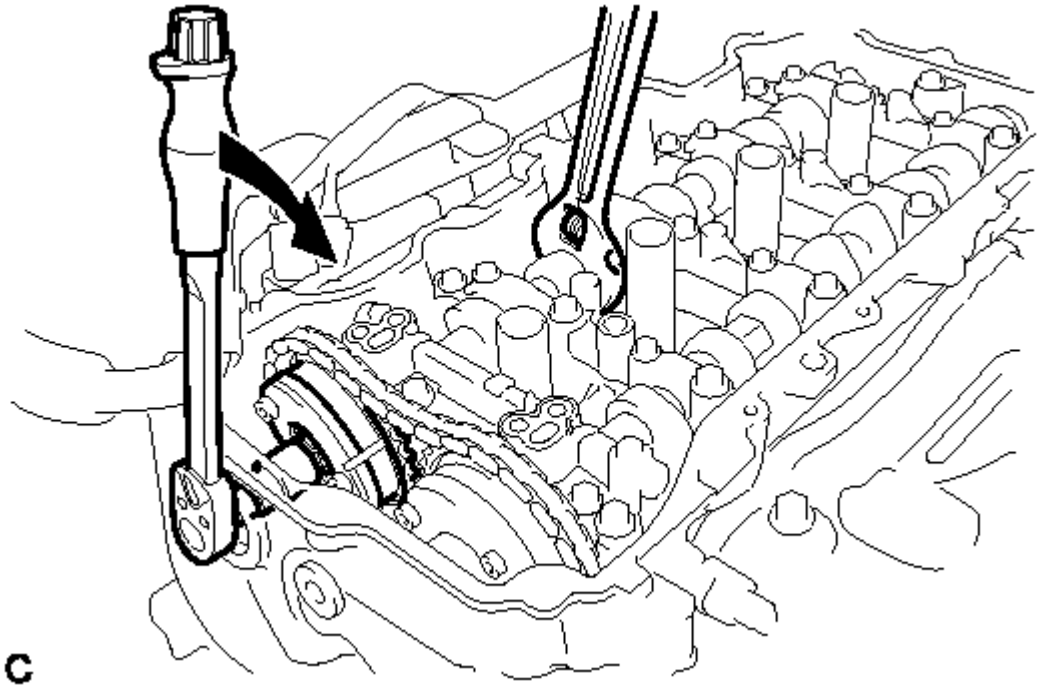


Fig. 69: Installing No. 1 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Be careful not to damage the cylinder head or spark plug tube with the wrench.

j. 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.

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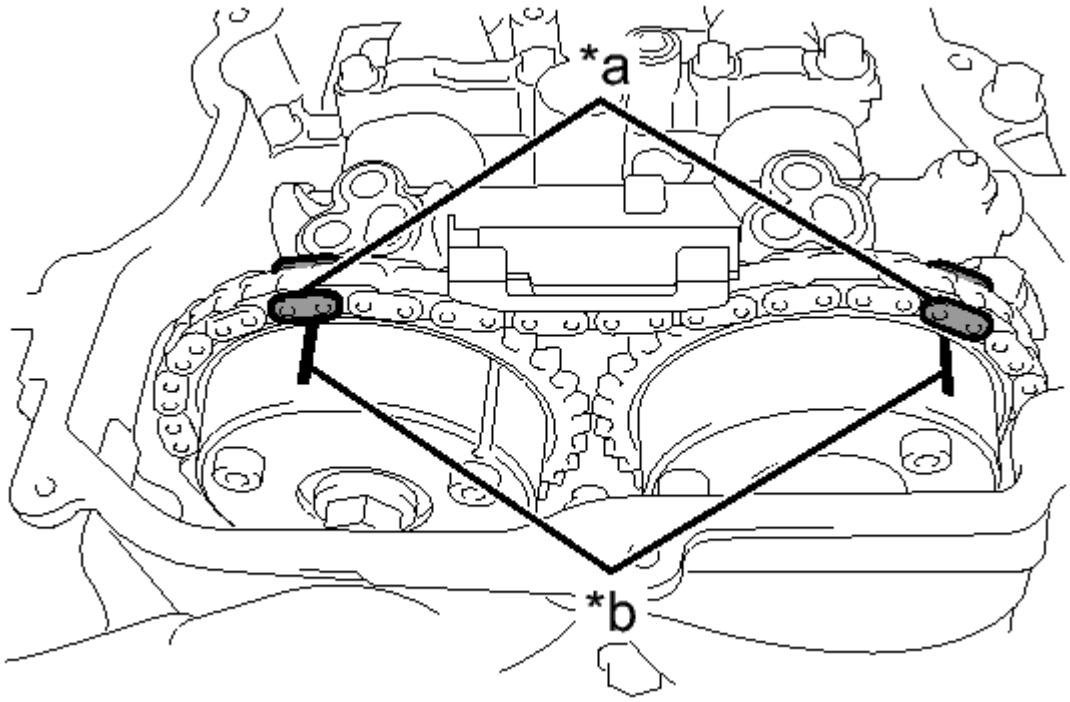


Fig. 70: Aligning Paint Mark And Timing Mark With Camshaft Timing Gear And Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark
*b	Timing Mark

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

10. **ADD ENGINE OIL** See step 17
11. **INSTALL TIMING CHAIN GUIDE** See step 23
12. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY**
    a. Turn the crankshaft approximately 10° clockwise.

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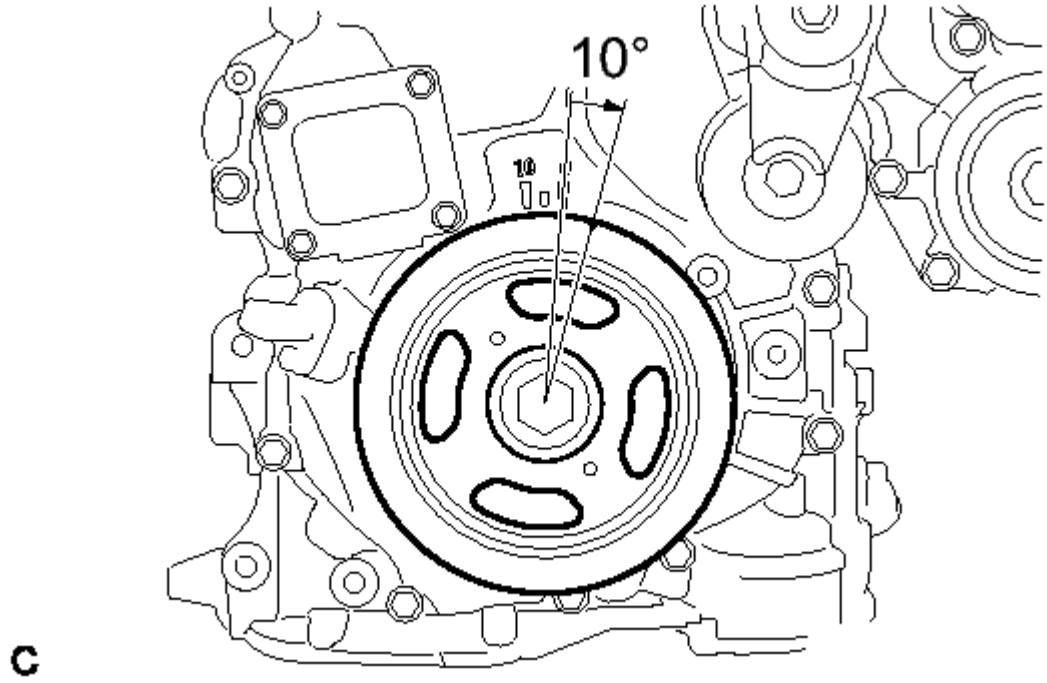


Fig. 71: View Of Turning Crankshaft 10Degrees Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install a new gasket and the chain tensioner with the 2 bolts.

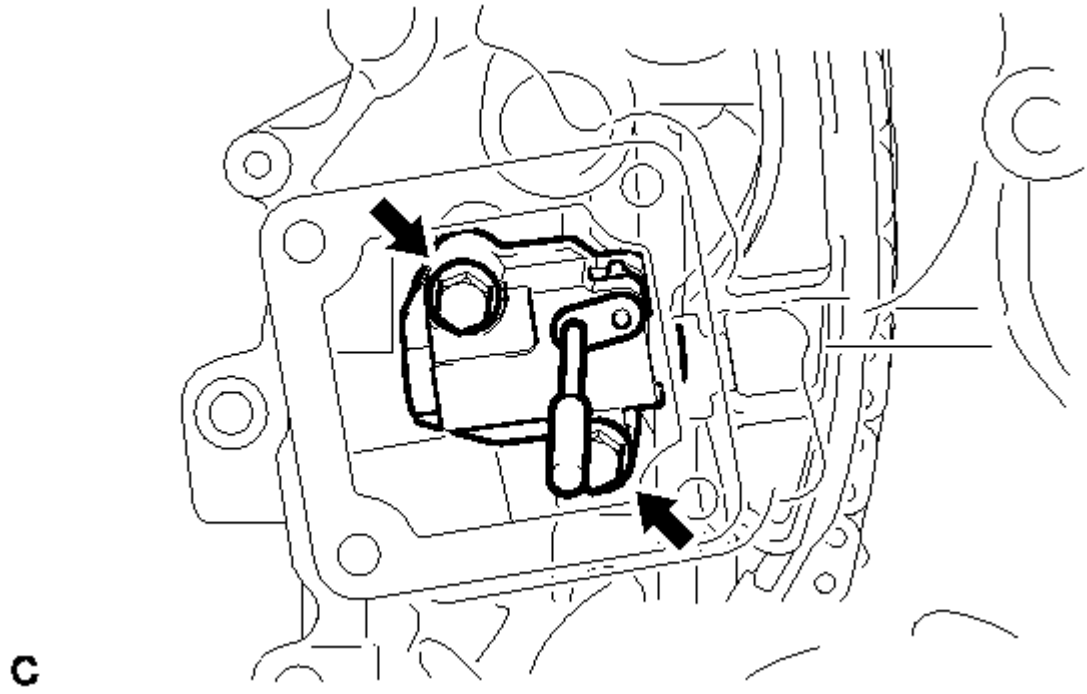


Fig. 72: No. 1 Chain Tensioner Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Make sure not to drop the gasket inside the timing chain cover.

c. Remove the pin from the stopper plate.

13. **CHECK 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.

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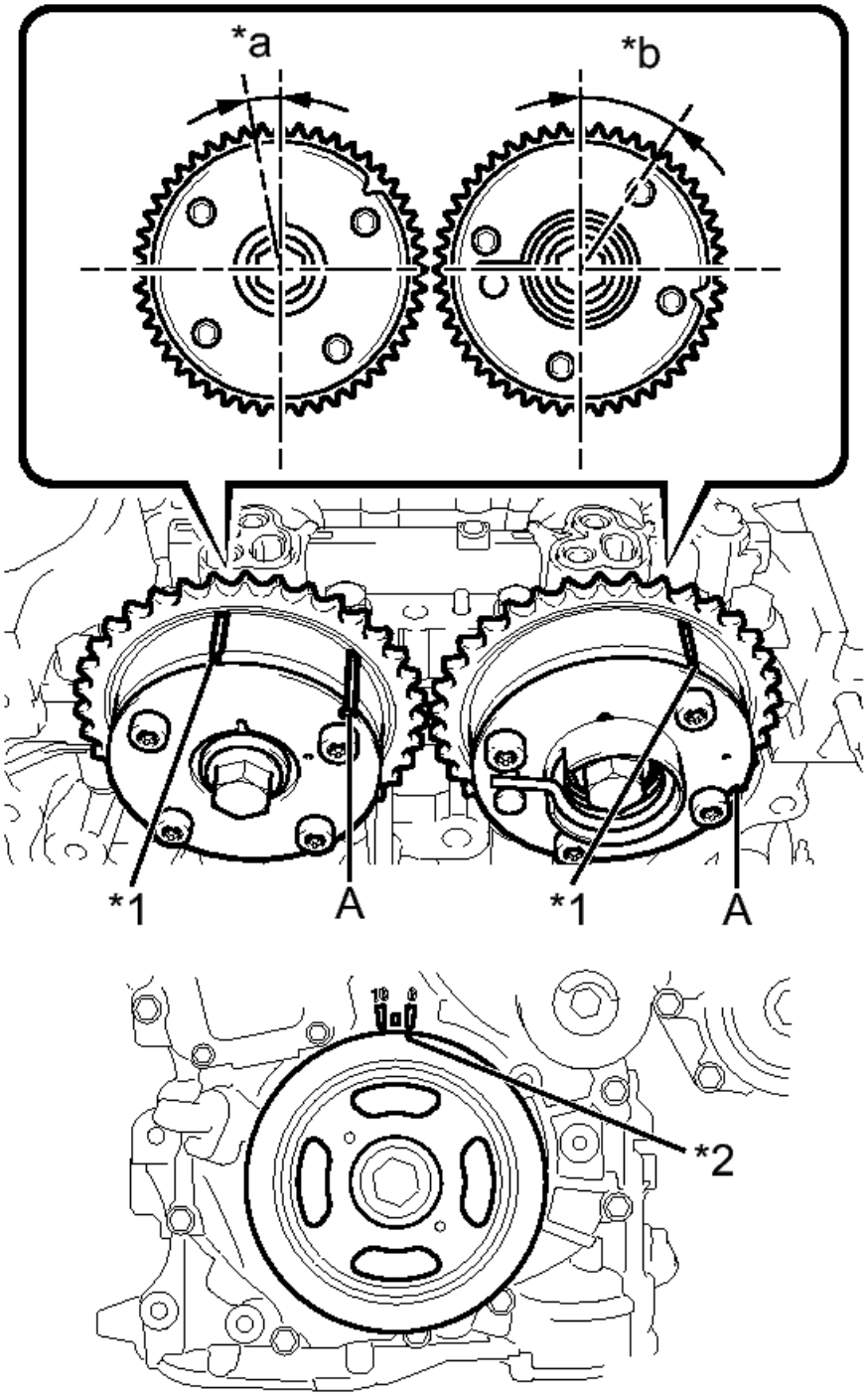


Fig. 73: Setting No. 1 Cylinder To TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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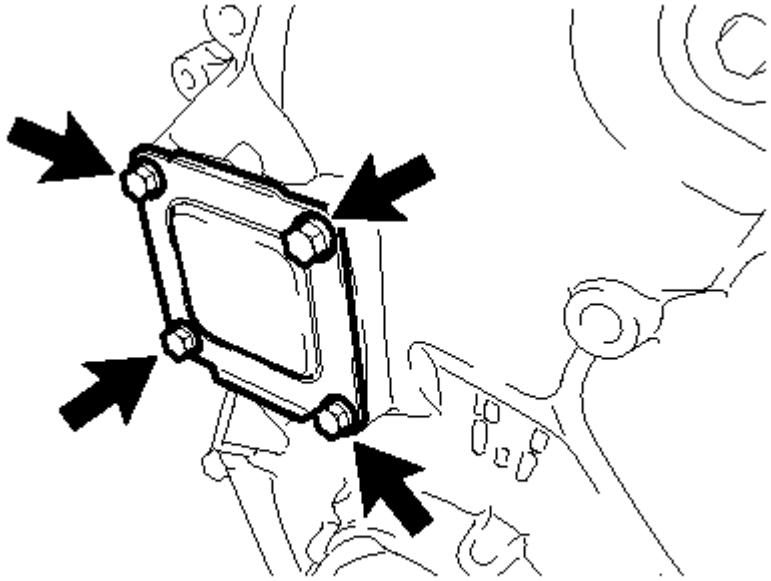
*1	Timing Mark
*2	Timing Notch
*a	Approximately 7°
*b	Approximately 32°

b. Check that the timing marks of the camshaft timing gears are as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

HINT:

"A" is not a timing mark.

14. **INSTALL TIMING CHAIN COVER PLATE**
    a. Install a new gasket and the timing chain cover plate with the 4 bolts.



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Fig. 74: Locating Timing Chain Cover Plate, Gasket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

15. **INSTALL TIMING CHAIN COVER TIGHT PLUG** See step 38
16. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** See step 43
17. **INSTALL IGNITION COIL ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
18. **CONNECT ENGINE WIRE**
    a. Install the engine wire to the engine with the bolts and nuts.

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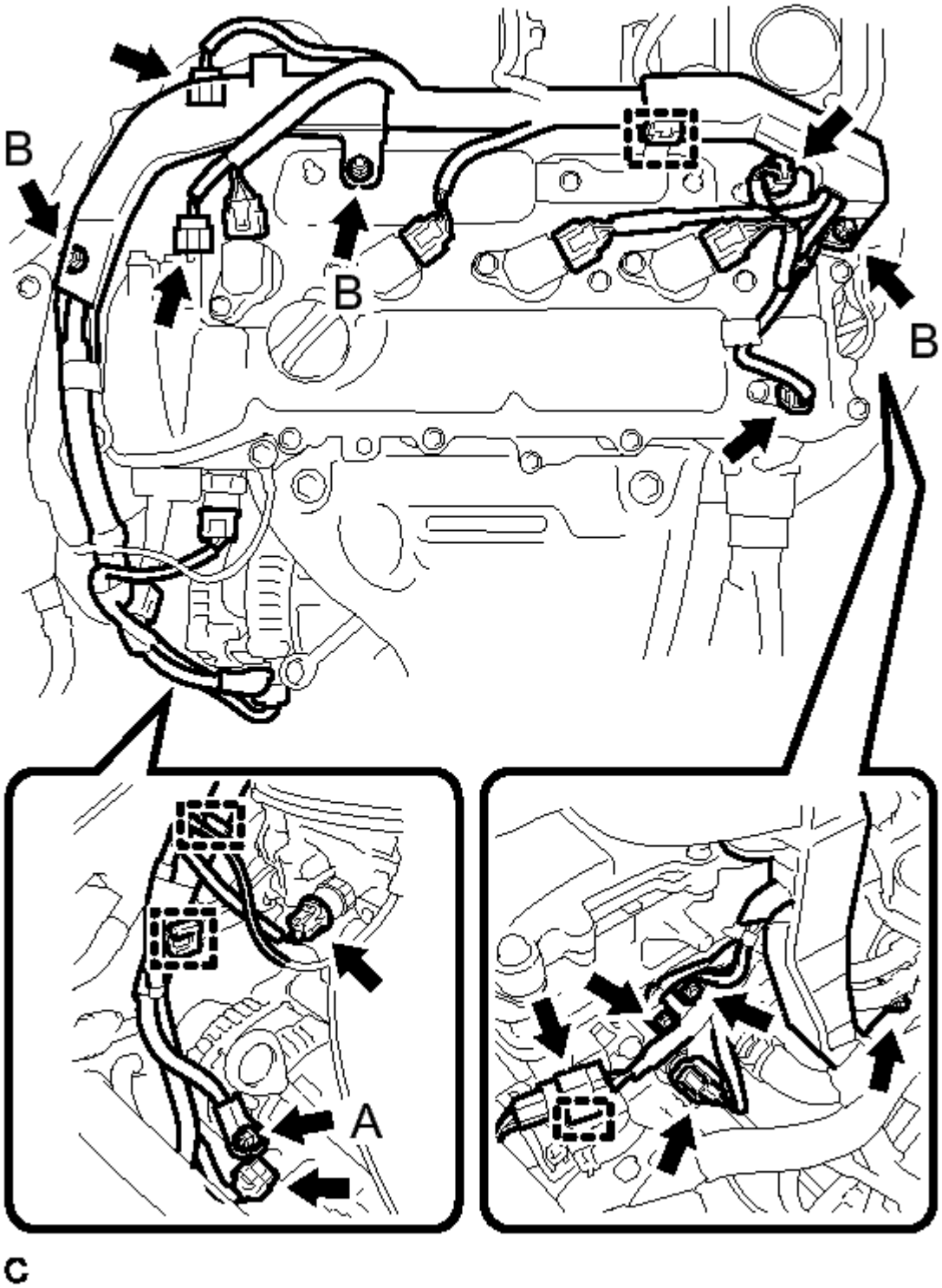


Fig. 75: Identifying Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Nut A

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Torque: 9.8 N*m (100 kgf*cm, 87 in.*lbf)

Nut B

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

Bolt

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

b. Connect the connectors and clamps.

19. **INSTALL ENGINE MOVING CONTROL ROD** See step 38
20. **INSTALL NO. 2 ENGINE MOUNTING STAY RH** See step 40
21. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY** See step 50
22. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY** See step 51
23. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
24. **INSTALL INLET AIR CLEANER ASSEMBLY** See step 53
25. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
    a. Connect the negative (-) battery terminal.

    Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

    NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [08/2013 - 12/2013] .

26. **INSPECT FOR OIL LEAK**
27. **INSTALL FRONT FENDER APRON SEAL RH**
28. **INSTALL ENGINE UNDER COVER RH**
29. **INSTALL FRONT WHEEL OPENING EXTENSION PAD RH**
30. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY** See step 68
31. **INSTALL COOL AIR INTAKE DUCT SEAL** . Refer to **INSTALLATION [08/2013 -] - Step 4**
32. **INSTALL FRONT WHEEL RH**

INSTALLATION [12/2013 -]

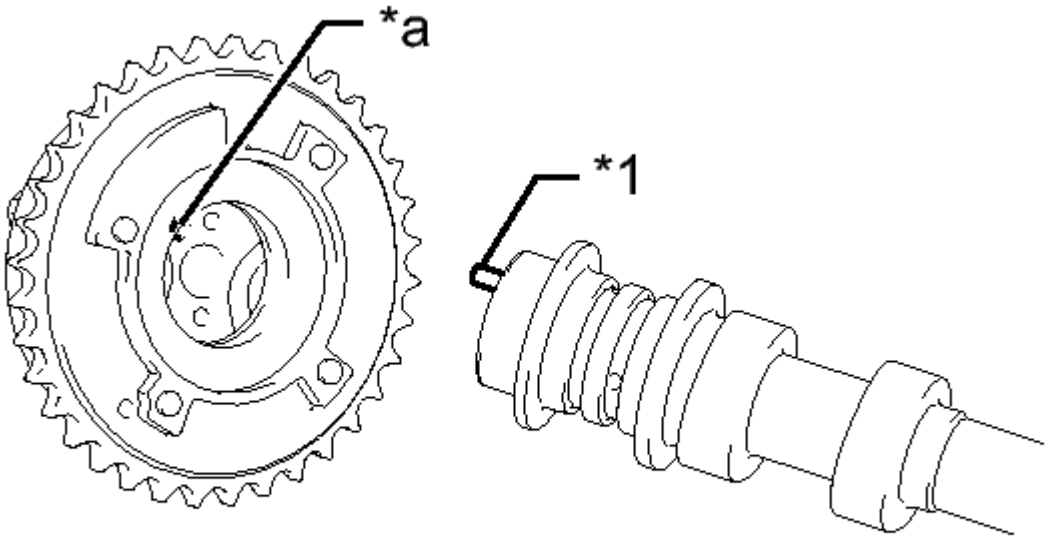
INSTALLATION [12/2013 -]

HINT:

Perform "Inspection After Repair" after replacing the camshaft, No. 2 camshaft, camshaft timing gear assembly or camshaft timing exhaust gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

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1. **INSTALL NO. 2 CAMSHAFT BEARING** See step 18
2. **INSTALL NO. 1 CAMSHAFT BEARING** See step 17
3. **INSTALL OIL CONTROL VALVE FILTER** See step 19
4. **INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
   a. Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear assembly.



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Fig. 76: Identifying Knock Pin And Knock Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Knock Pin Hole

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

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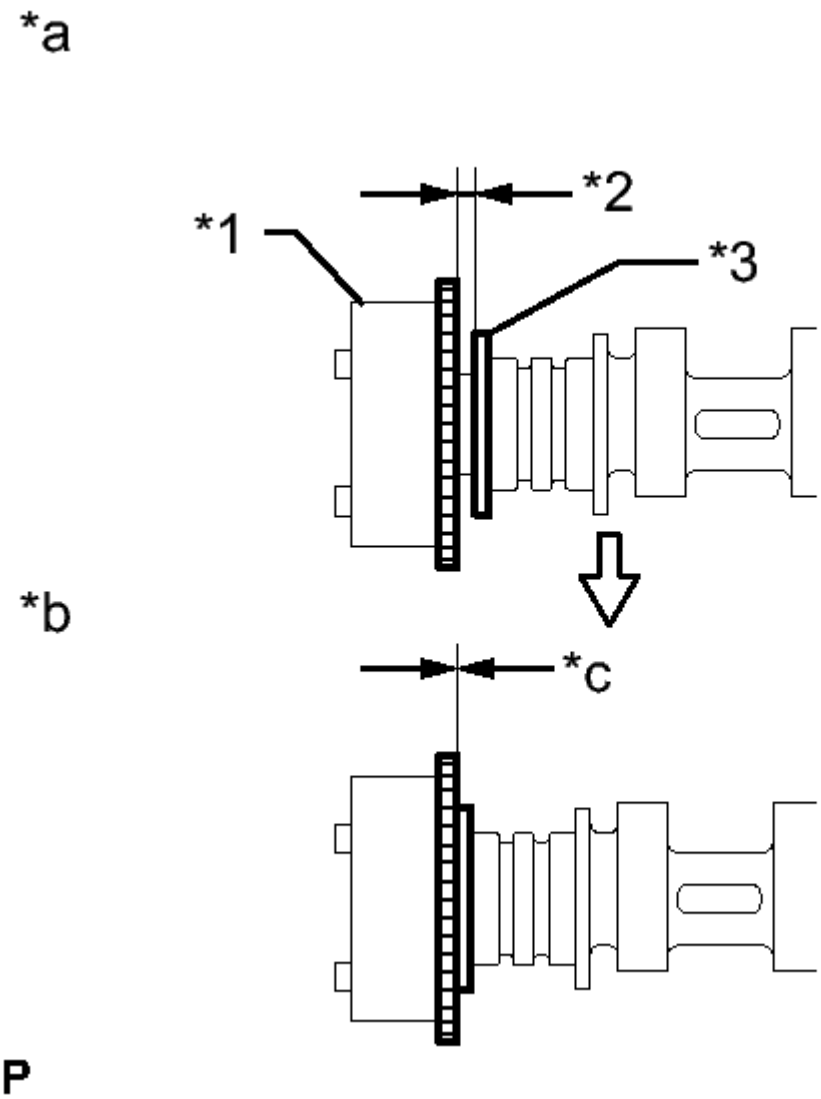


Fig. 77: Checking Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Exhaust Gear Assembly
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance

c. Fix the camshaft timing exhaust gear assembly with the bolt.

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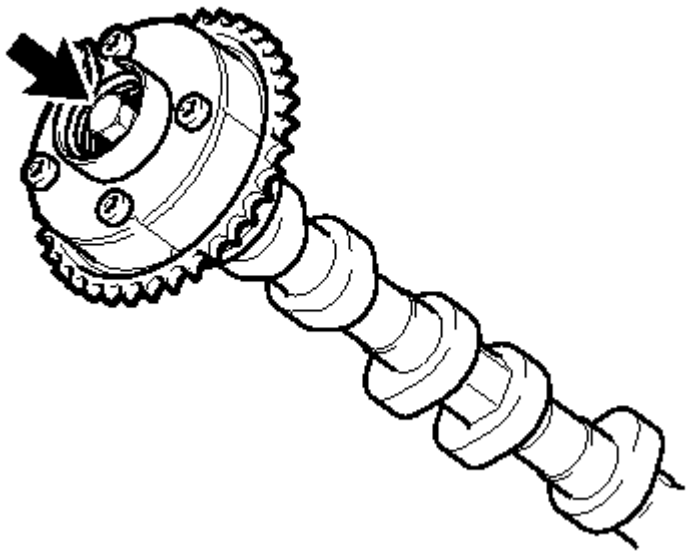


Fig. 78: Location of Camshaft Timing Exhaust Gear Flange Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Do not disassemble the camshaft timing exhaust gear assembly.

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing exhaust gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

5. **SET TDC/COMPRESSION**
   a. Turn the crankshaft pulley until its timing notch (groove) and the timing mark "0" of the timing chain cover are aligned.

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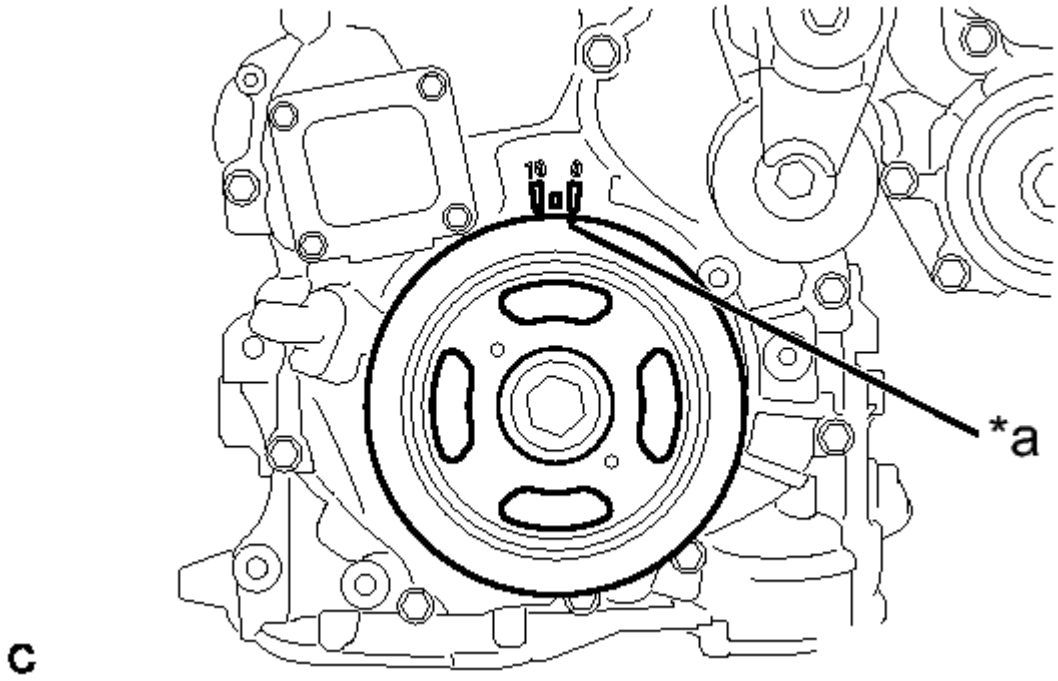


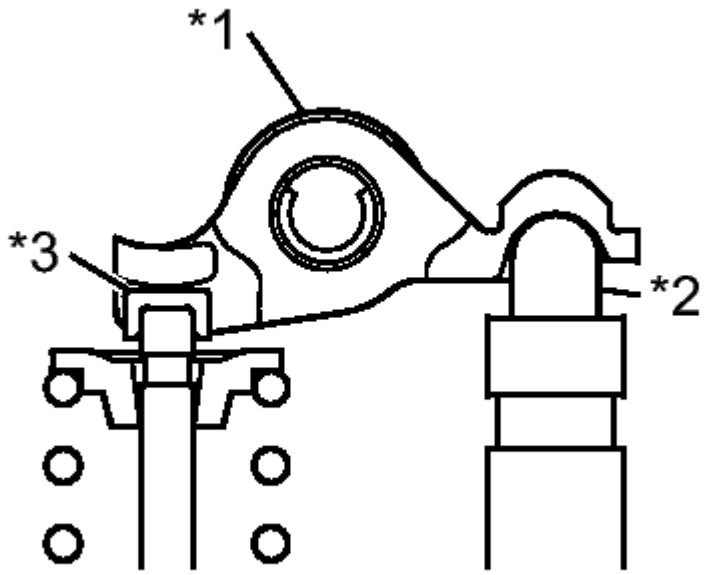
Fig. 79: Setting TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Timing Notch

6. **INSTALL NO. 2 CAMSHAFT**
   a. Make sure that the valve rocker arms are installed as shown in the illustration.

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Fig. 80: Identifying Valve Rocker Arms
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Valve Rocker Arm
*2	Valve Lash Adjuster
*3	Valve Stem Cap

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 timing mark and the paint mark, and install the camshaft.

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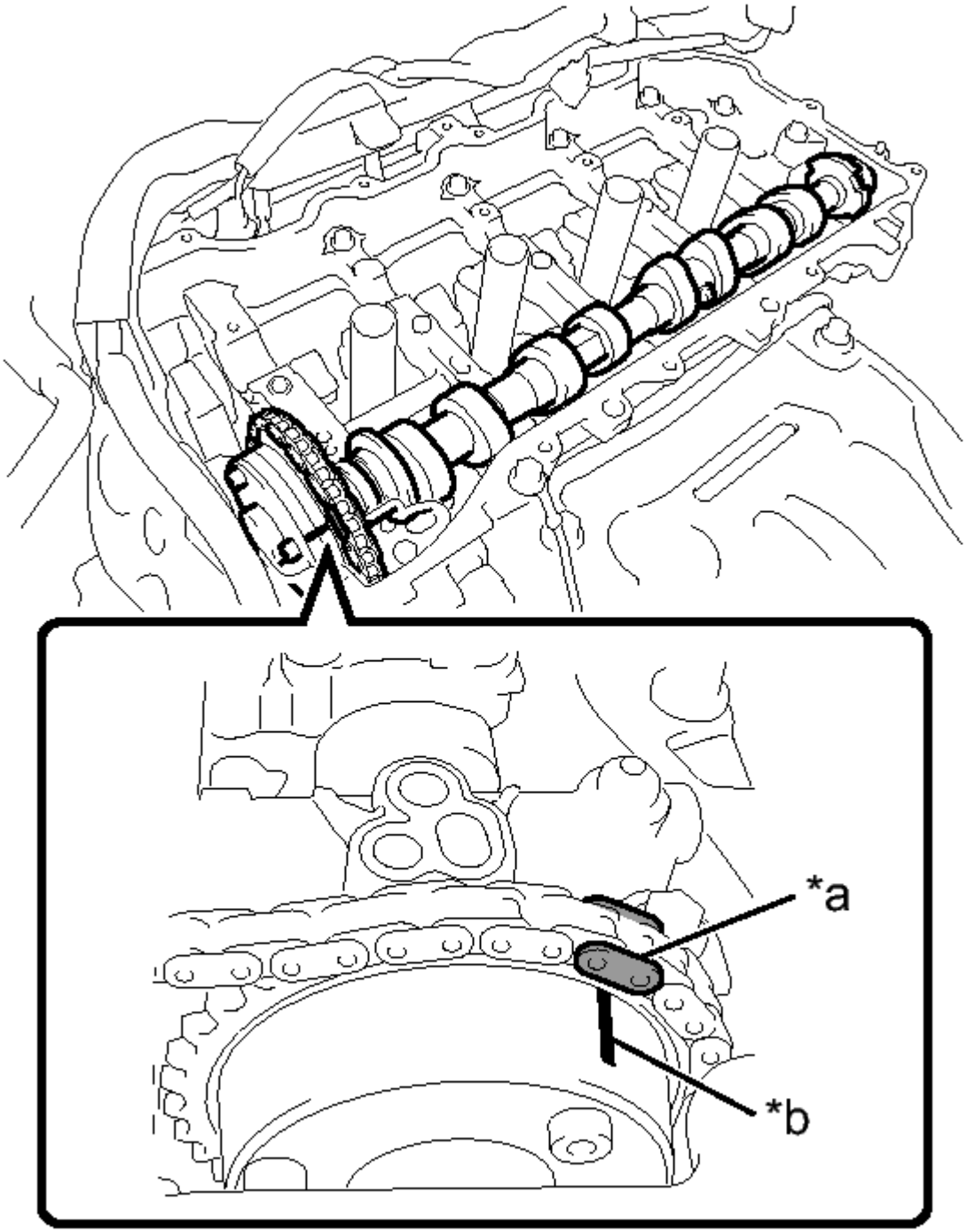


Fig. 81: Aligning Timing Mark And Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark

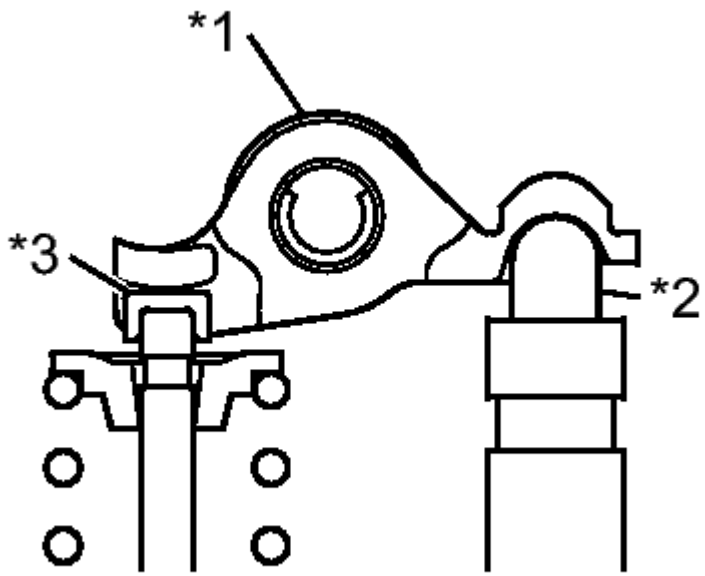
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*b	Timing Mark

HINT:

Perform "Inspection After Repair" after replacing the No. 2 camshaft. Refer to **INITIALIZATION [08/2013 -]** .

7. **INSTALL CAMSHAFT**
   a. Make sure that the valve rocker arms are installed as shown in the illustration.



P

Fig. 82: Identifying Valve Rocker Arms
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Valve Rocker Arm
*2	Valve Lash Adjuster
*3	Valve Stem Cap

   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 camshaft to the camshaft housing as shown in the illustration.

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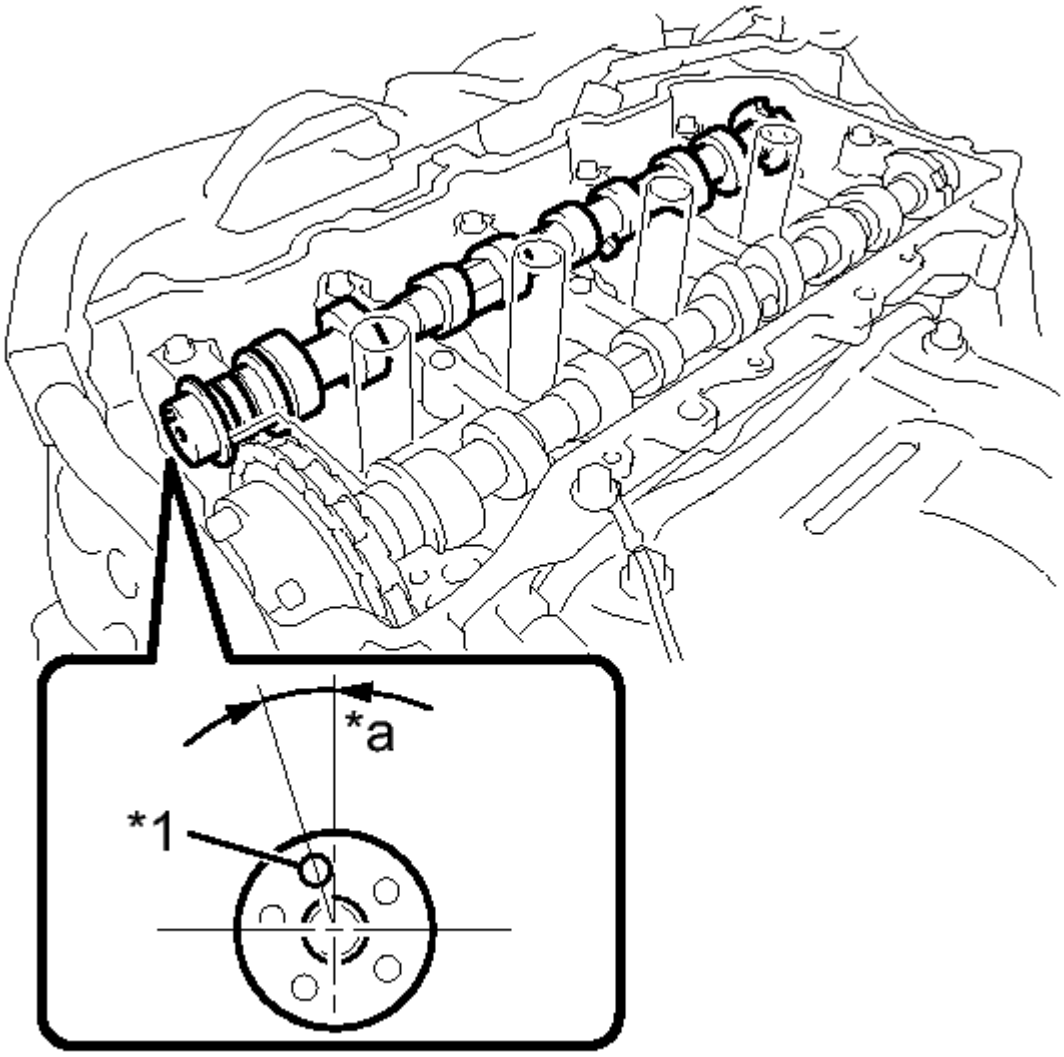


Fig. 83: Identifying Camshaft Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Approximately 17°

HINT:

Perform "Inspection After Repair" after replacing the camshaft. Refer to **INITIALIZATION [08/2013 -]** .

8. **INSTALL CAMSHAFT BEARING CAP**
   a. Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.

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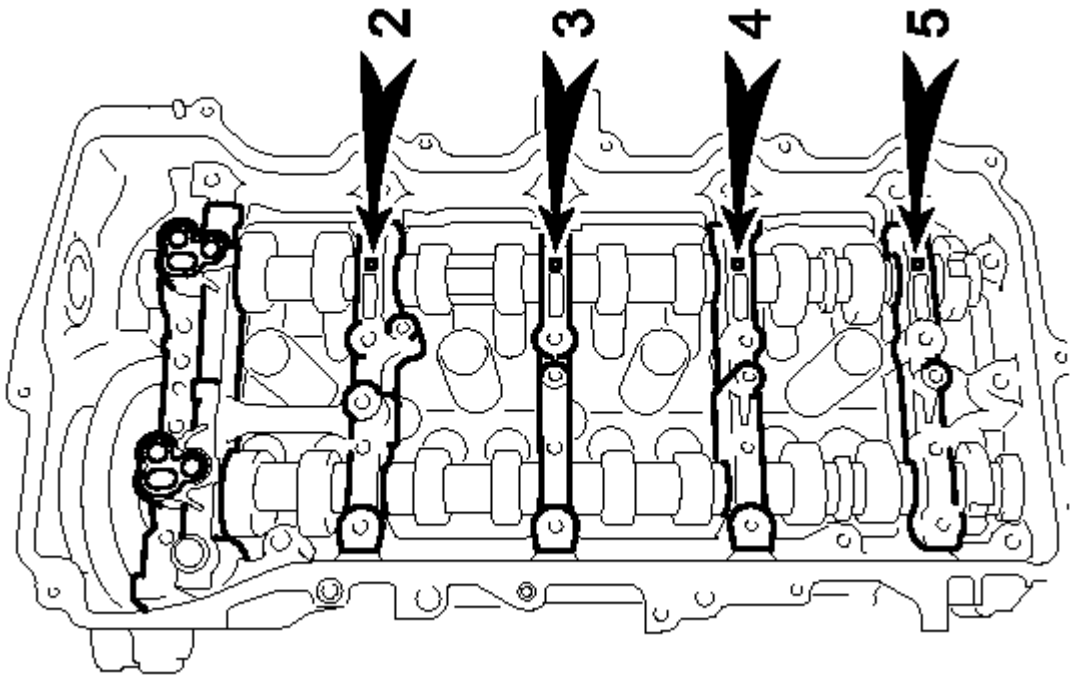


Fig. 84: Identifying Camshaft Bearing Cap Marks And Numbers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using several steps, uniformly tighten the 10 bolts in the sequence shown in the illustration.

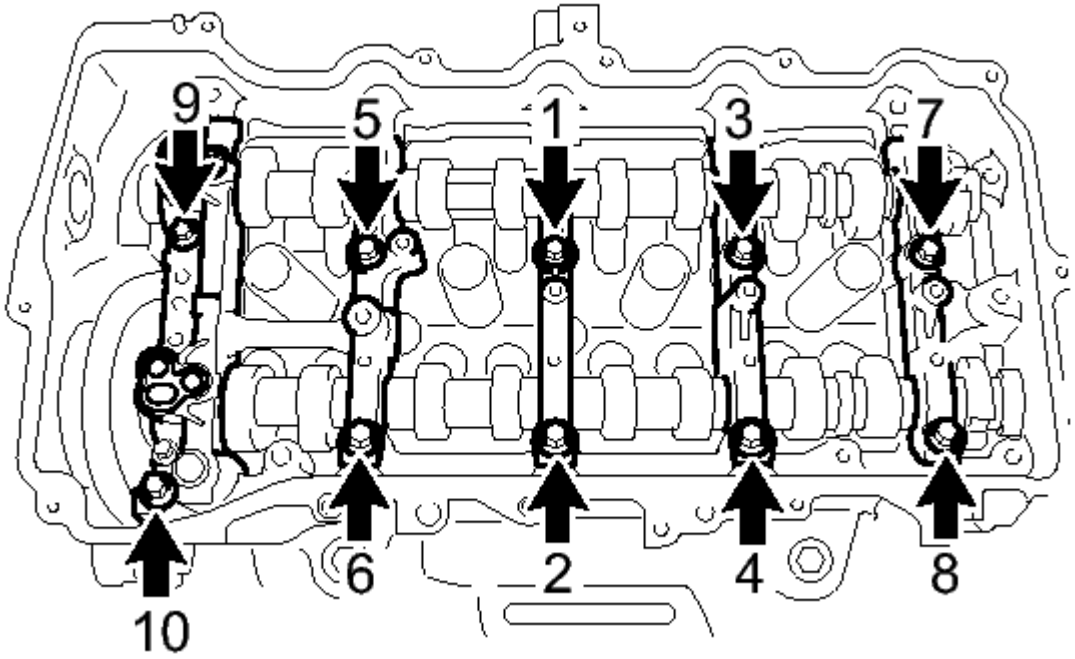


Fig. 85: Tightening Sequence Of Camshaft Bearing Cap Bolts (1 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

c. Using several steps, uniformly tighten the 11 bolts in the sequence shown in the illustration.

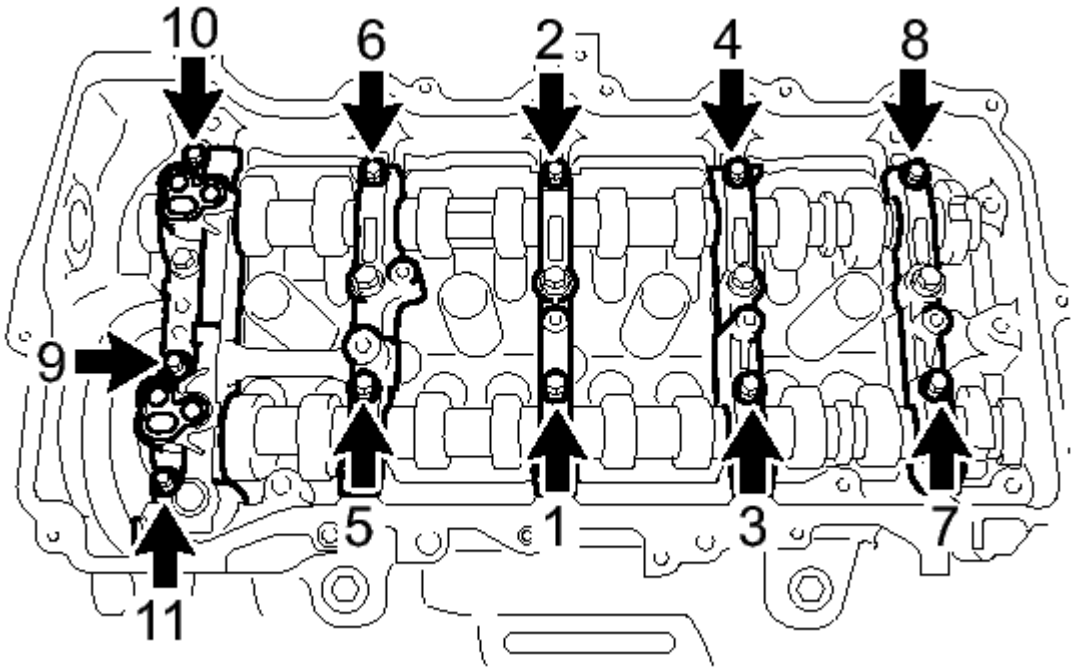


Fig. 86: Tightening Sequence Of Camshaft Bearing Cap Bolts (2 Of 2)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

d. Check the torque of each bolt again.

9. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY**
   a. Check the camshaft timing gear position.

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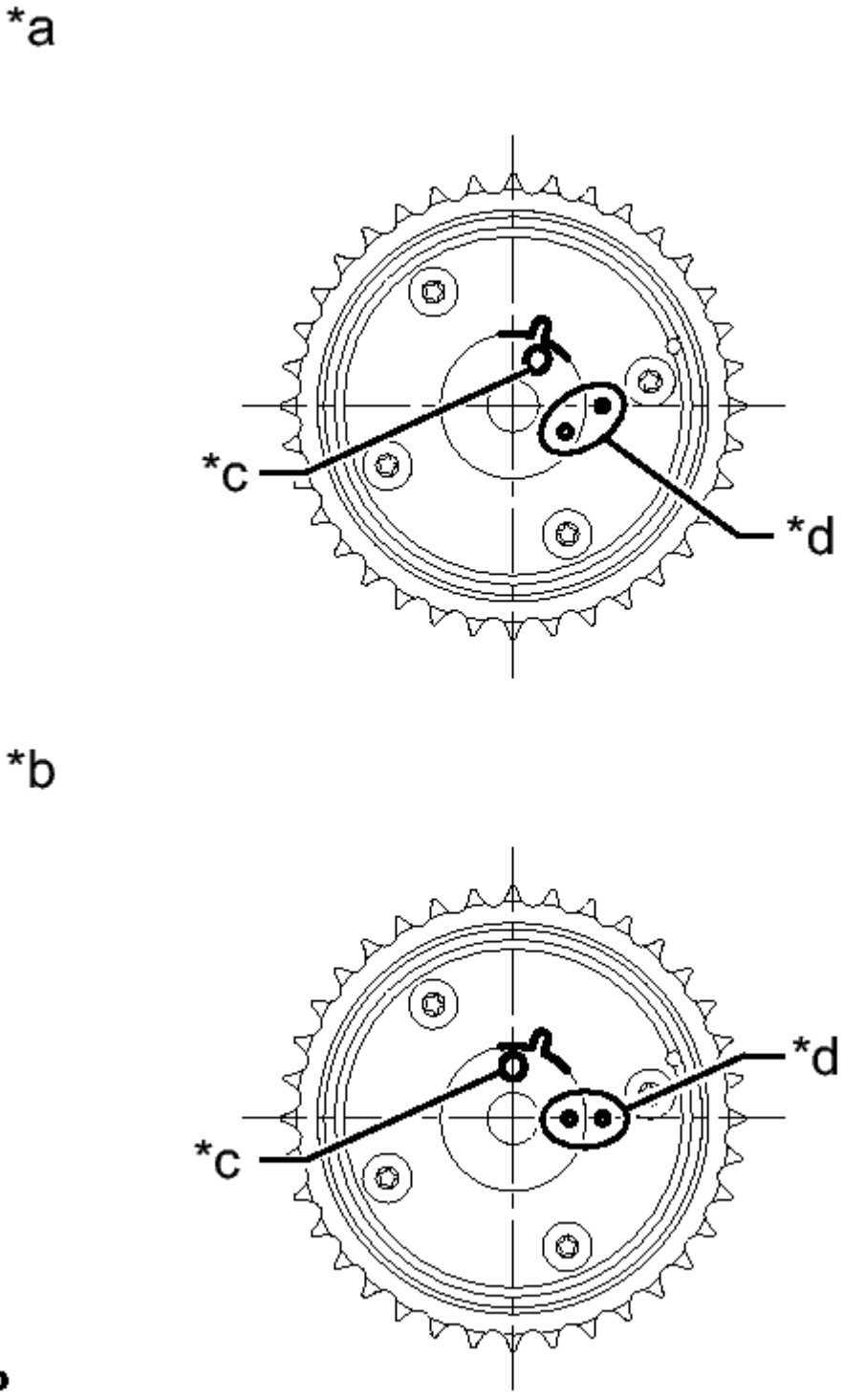


Fig. 87: Identifying Camshaft Timing Gear Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Advanced Position

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*b	Retarded Position
*c	Knock Pin Hole
*d	Alignment Mark

NOTE:

- **If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during installation.**
- **If the camshaft timing gear has rotated to the most retarded position, make sure to release the lock pin and set the camshaft timing gear to the most advanced position before tightening the camshaft timing gear.**

b. Install the camshaft timing gear assembly as shown in the illustration.

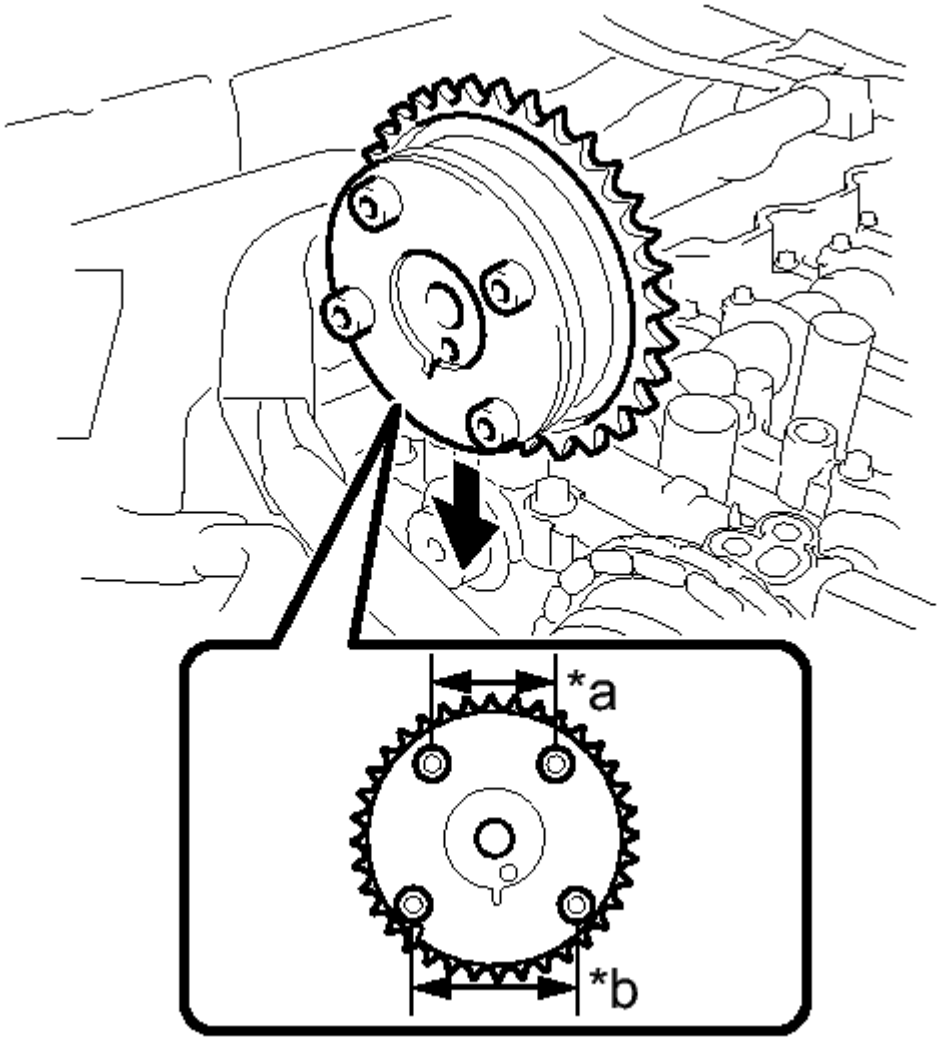


Fig. 88: Installing Camshaft Timing Gear Assembly

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

TEXT IN ILLUSTRATION

*a	Narrow
*b	Wide

c. Turn the camshaft timing gear assembly approximately 180° counterclockwise.

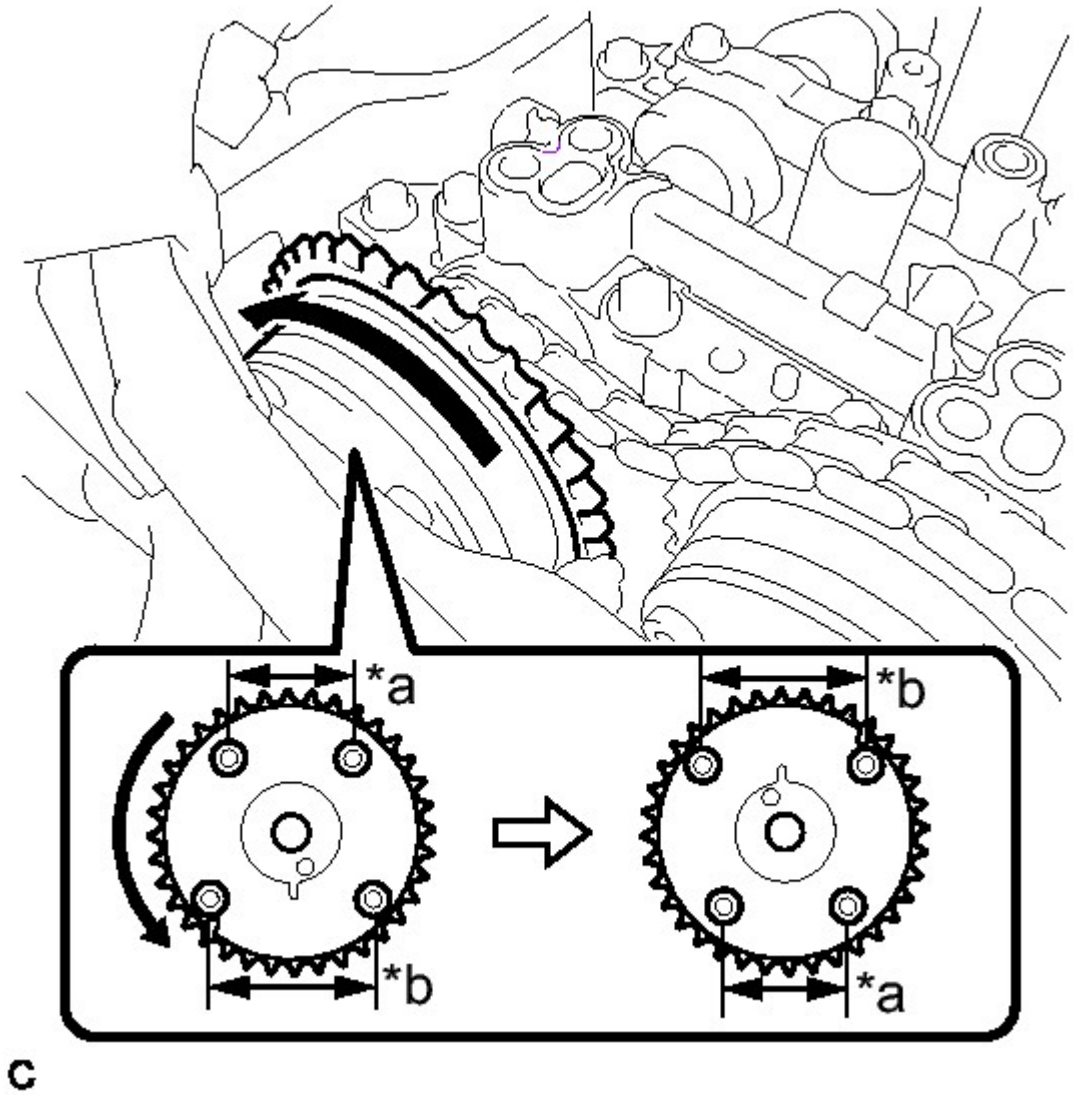


Fig. 89: Turn Camshaft Timing Gear Approximately 180Degrees Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Narrow
*b	Wide

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d. Align the paint mark with the timing mark to install the chain.

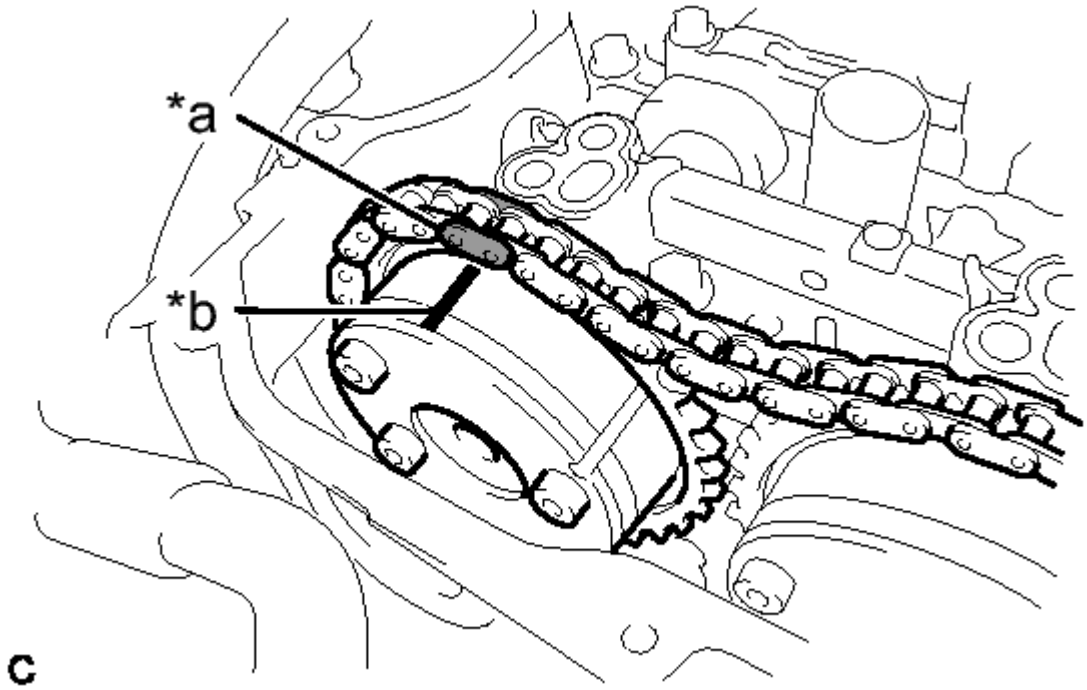


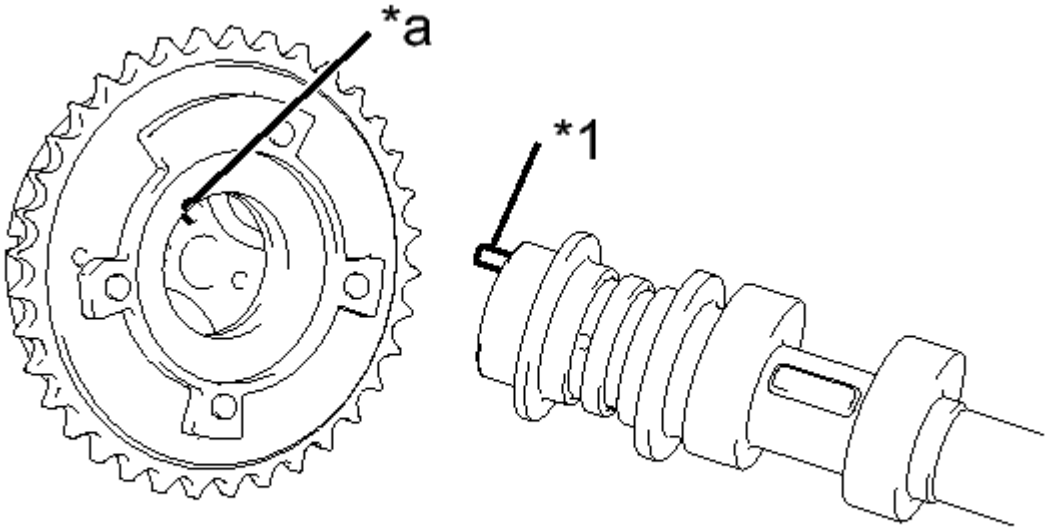
Fig. 90: Aligning Paint Mark And Timing Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark
*b	Timing Mark

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

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Fig. 91: Identifying No. 1 Camshaft Knock Pin & Camshaft Timing Gear Knock Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Knock Pin Hole

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

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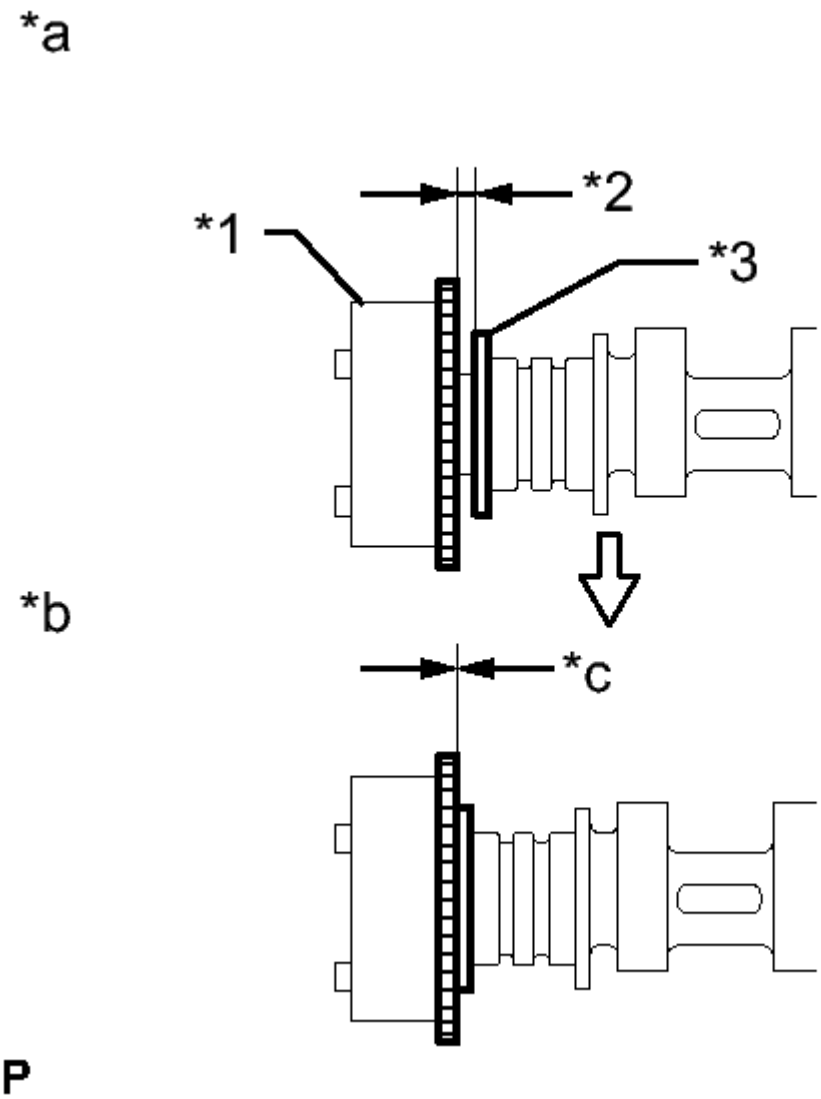


Fig. 92: Checking Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Gear
*2	Clearance
*3	Camshaft Flange
*a	INCORRECT
*b	CORRECT
*c	No Clearance

g. Secure the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear assembly by hand.

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

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tool, the lock pin will be damaged.

h. If the lock pin has not been released, release it.

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.

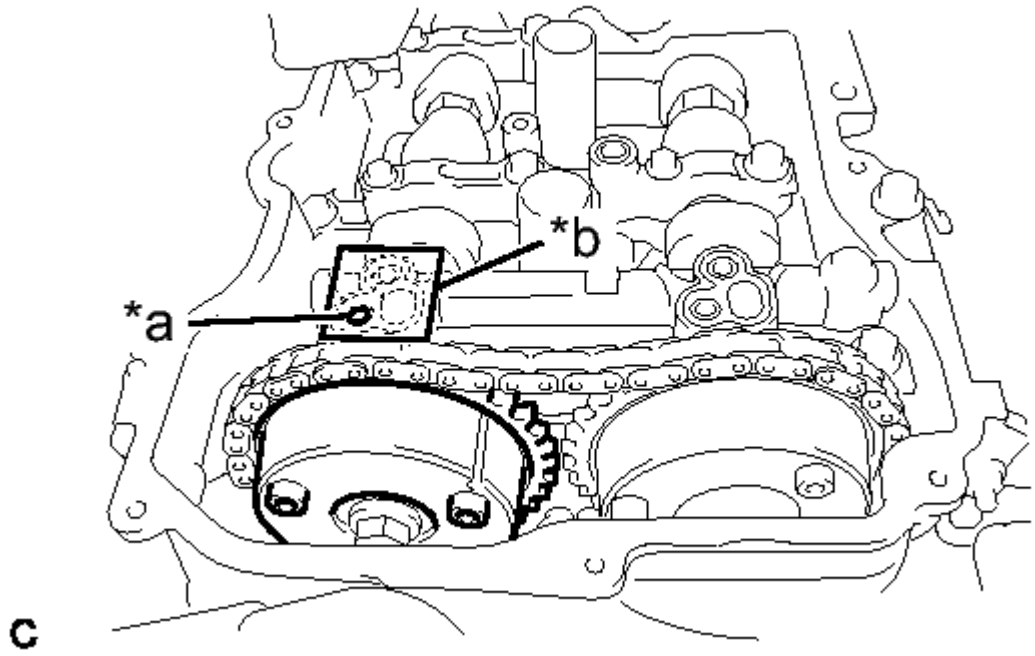


Fig. 93: Sealing Oil Hole With Adhesive Tape
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Make a Hole
*b	Adhesive Tape Sealing Area

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

2. Make a hole in the adhesive tape covering the oil hole as shown in the illustration. (Procedure A)
3. Apply approximately 200 kPa (2.0 kgf/ cm^2 , 29 psi) of air pressure to the hole made in procedure A to release the lock pin.

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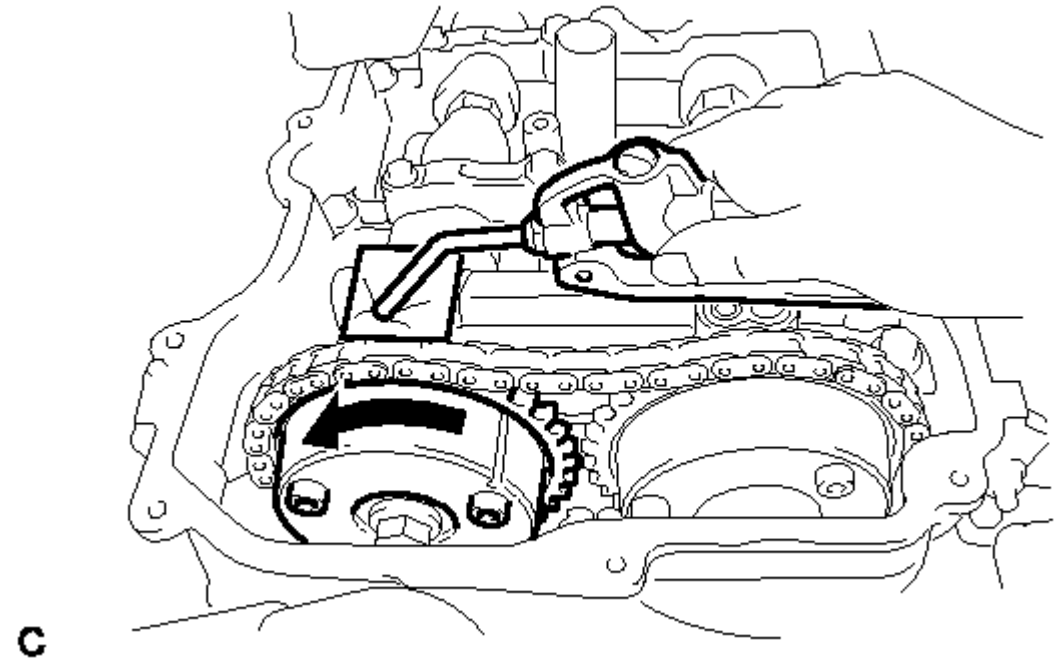


Fig. 94: Applying Air Pressure To Release Lock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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.**

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

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

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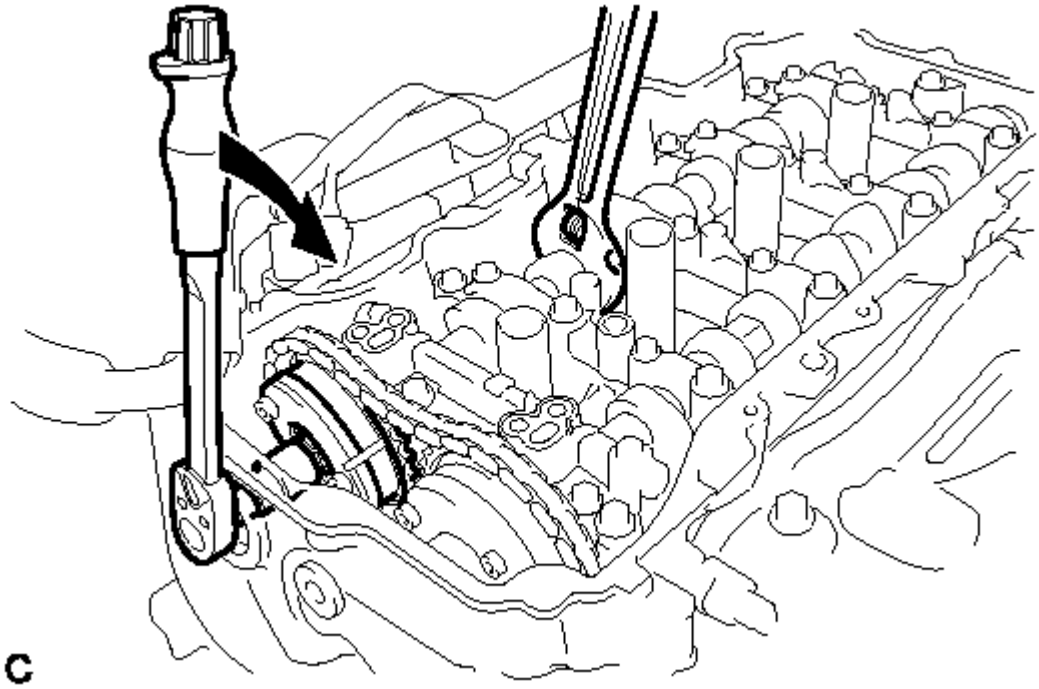


Fig. 95: Installing No. 1 Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Be careful not to damage the cylinder head or spark plug tube with the wrench.

j. 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.

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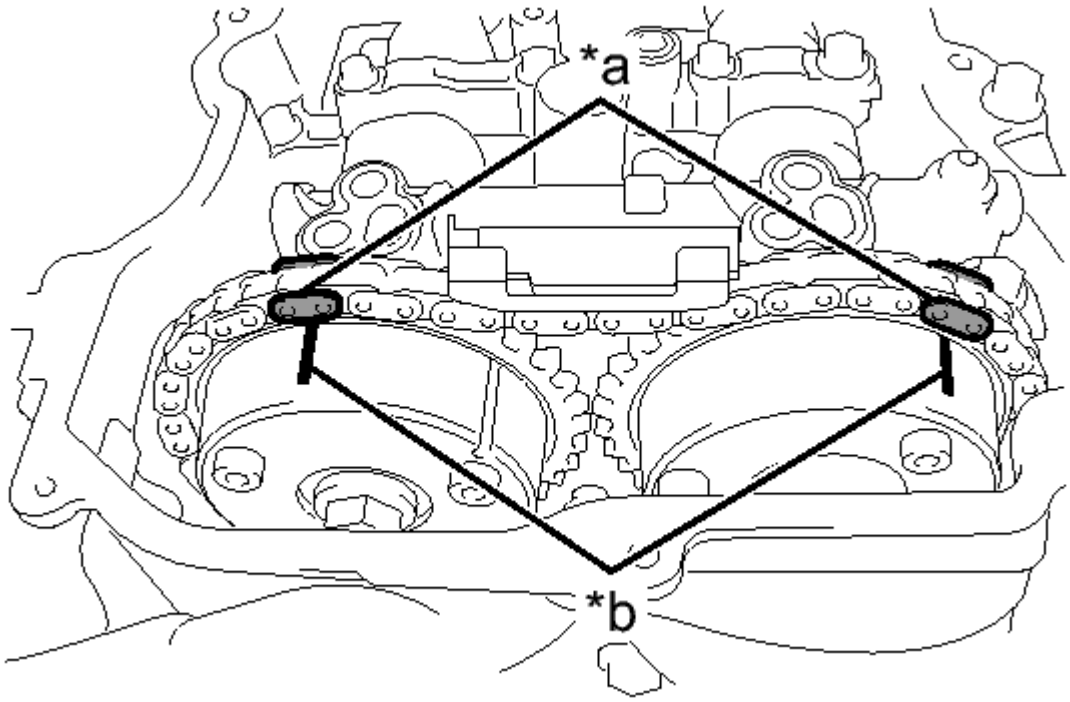


Fig. 96: Aligning Paint Mark And Timing Mark With Camshaft Timing Gear And Camshaft Timing Exhaust Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark
*b	Timing Mark

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

10. **ADD ENGINE OIL** See step 17
11. **INSTALL TIMING CHAIN GUIDE** See step 23
12. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY**
    a. Turn the crankshaft approximately 10° clockwise.

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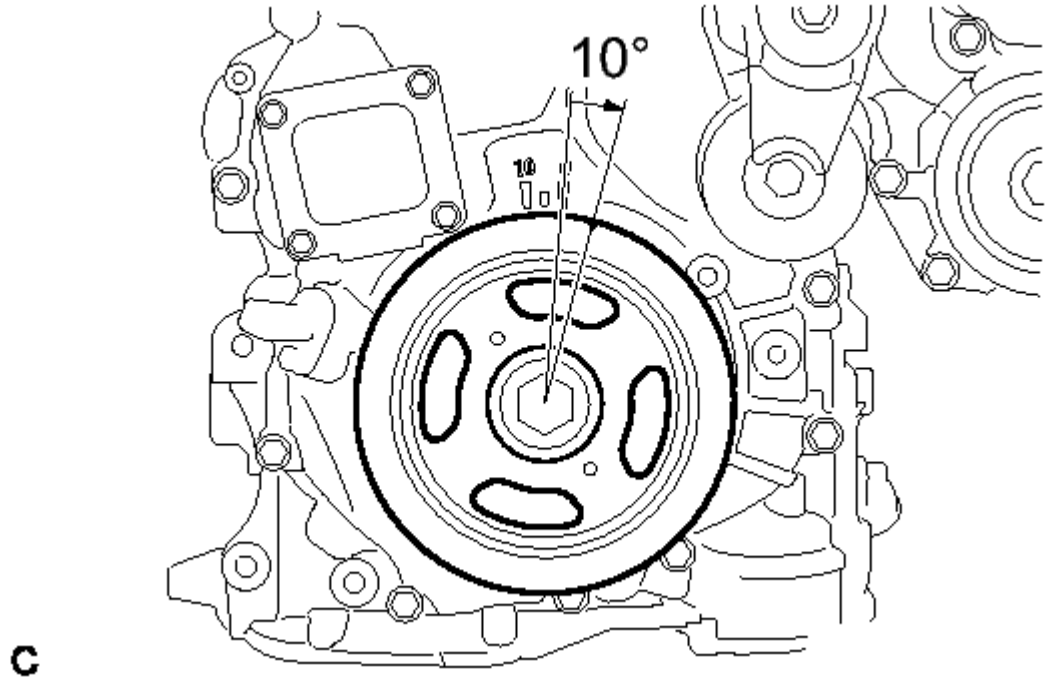


Fig. 97: View Of Turning Crankshaft 10Degrees Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install a new gasket and the chain tensioner with the 2 bolts.

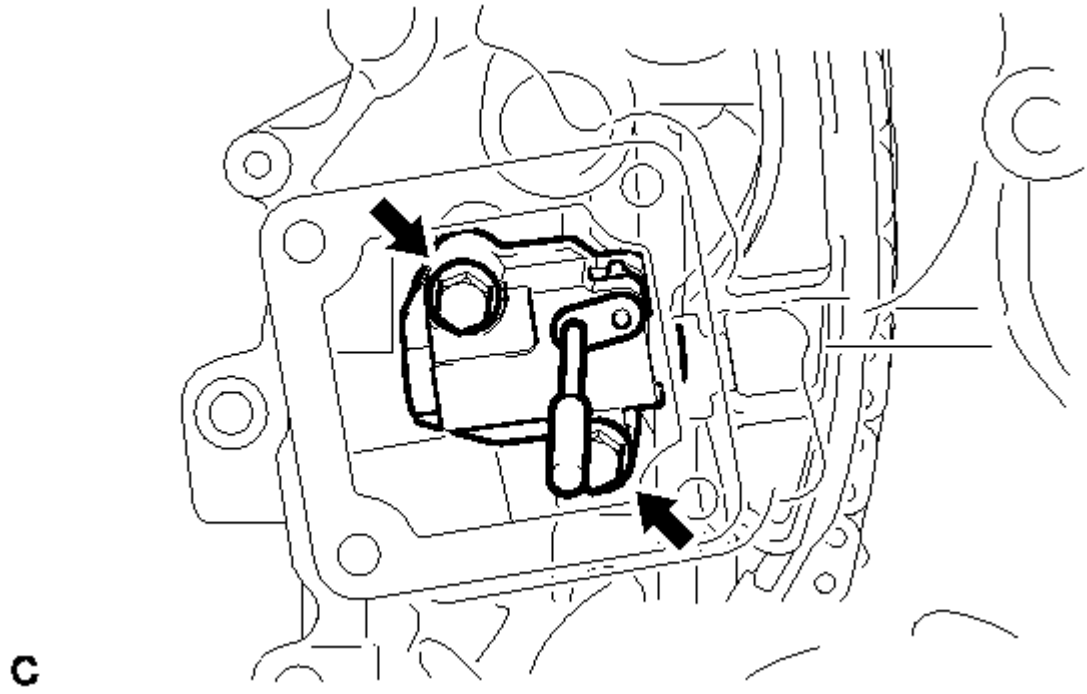


Fig. 98: No. 1 Chain Tensioner Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Make sure not to drop the gasket inside the timing chain cover.

c. Remove the pin from the stopper plate.

13. **CHECK 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.

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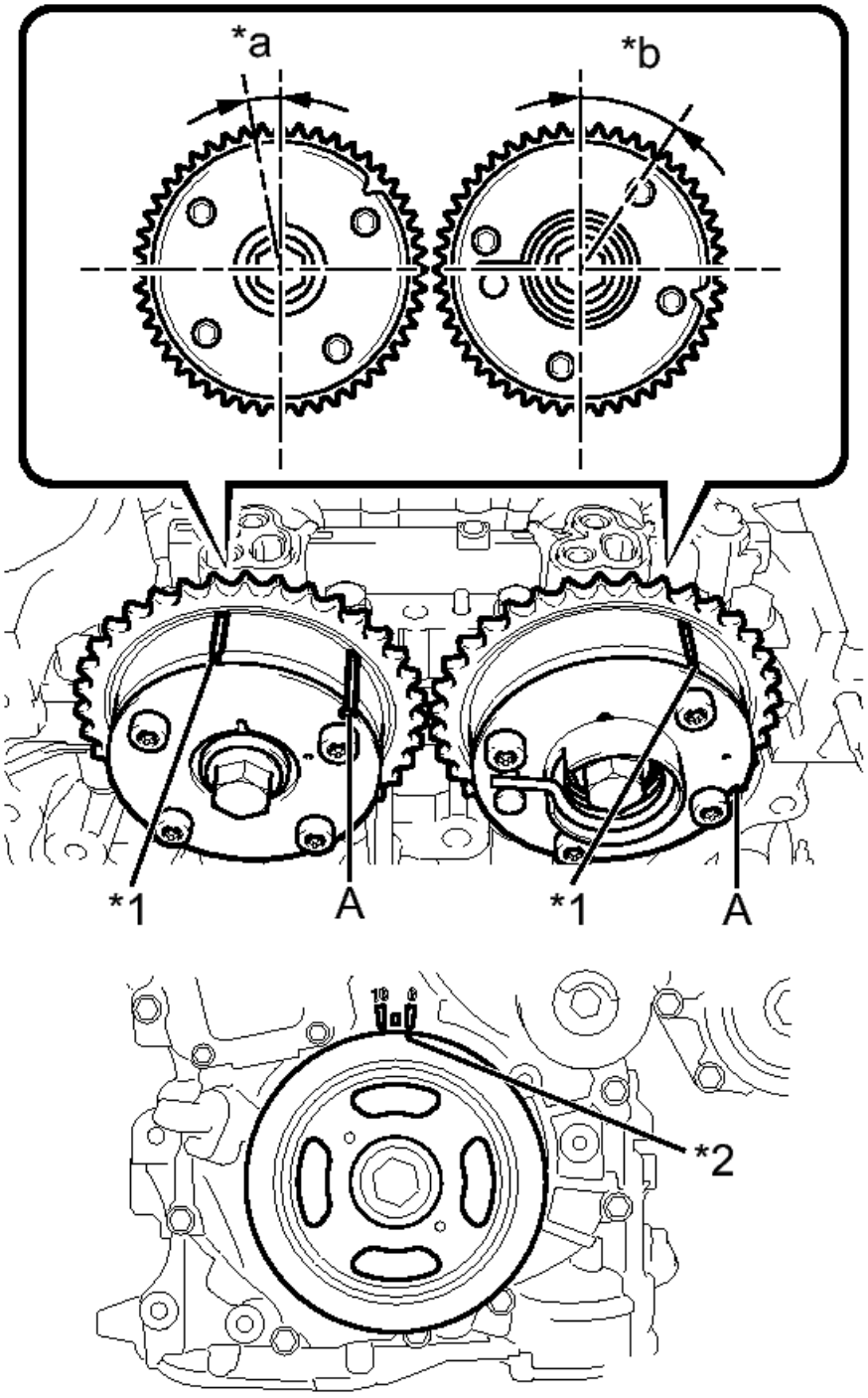


Fig. 99: Setting No. 1 Cylinder To TDC/Compression
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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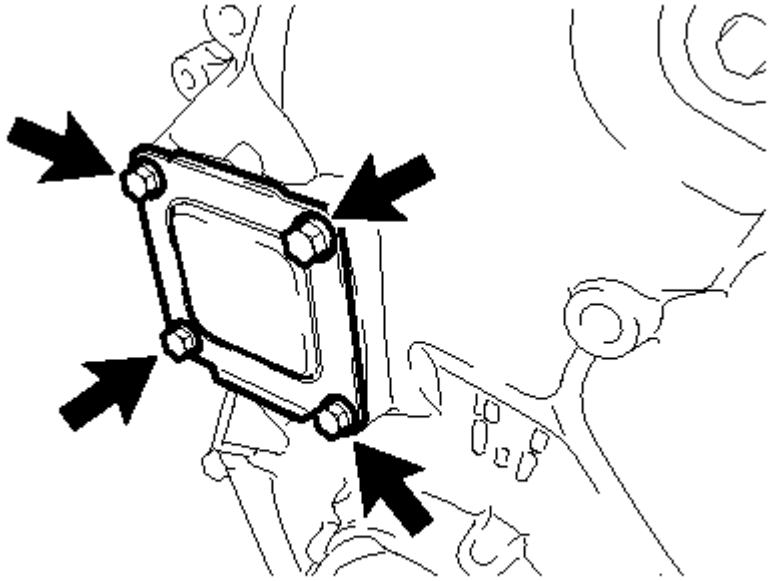
*1	Timing Mark
*2	Timing Notch
*a	Approximately 7°
*b	Approximately 32°

b. Check that the timing marks of the camshaft timing gears are as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) to align the timing marks as shown in the illustration.

HINT:

"A" is not a timing mark.

14. **INSTALL TIMING CHAIN COVER PLATE**
    a. Install a new gasket and the timing chain cover plate with the 4 bolts.



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Fig. 100: Locating Timing Chain Cover Plate, Gasket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

15. **INSTALL TIMING CHAIN COVER TIGHT PLUG** See step 38
16. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY** See step 43
17. **INSTALL IGNITION COIL ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
18. **CONNECT ENGINE WIRE**
    a. Install the engine wire to the engine with the bolts and nuts.

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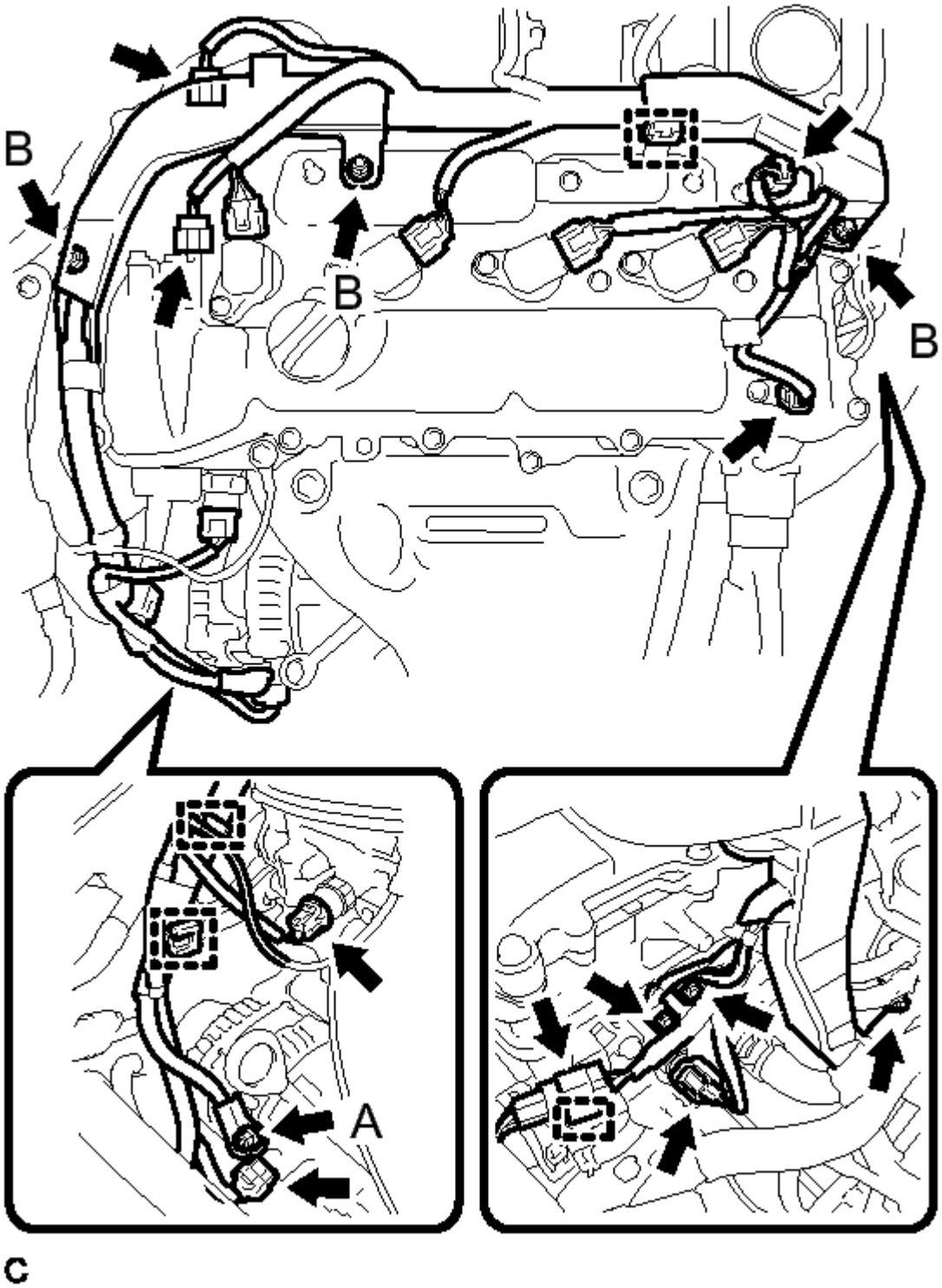


Fig. 101: Identifying Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Nut A

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Torque: 9.8 N*m (100 kgf*cm, 87 in.*lbf)

Nut B

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

Bolt

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

b. Connect the connectors and clamps.

19. **INSTALL ENGINE MOVING CONTROL ROD** See step 38
20. **INSTALL NO. 2 ENGINE MOUNTING STAY RH** See step 40
21. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY** See step 50
22. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY** See step 51
23. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
24. **INSTALL INLET AIR CLEANER ASSEMBLY** See step 53
25. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
    a. Connect the negative (-) battery terminal.

    Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

    NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [12/2013 -] .

26. **INSPECT FOR OIL LEAK**
27. **INSTALL FRONT FENDER APRON SEAL RH**
28. **INSTALL ENGINE UNDER COVER RH**
29. **INSTALL FRONT WHEEL OPENING EXTENSION PAD RH**
30. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY** See step 68
31. **INSTALL COOL AIR INTAKE DUCT SEAL** . Refer to **INSTALLATION [08/2013 -] - Step 4**
32. **INSTALL FRONT WHEEL RH**

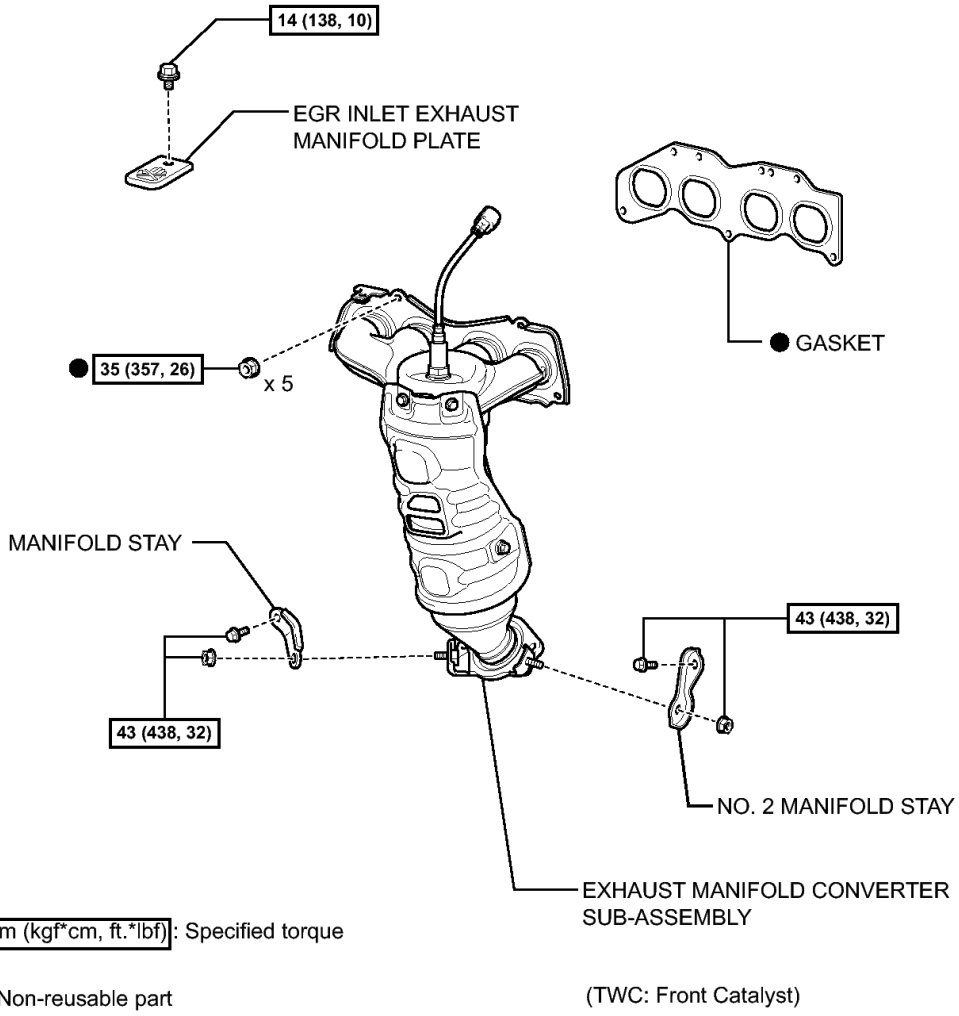
CYLINDER HEAD GASKET

COMPONENTS [08/2013 -]

ILLUSTRATION

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for PZEV:



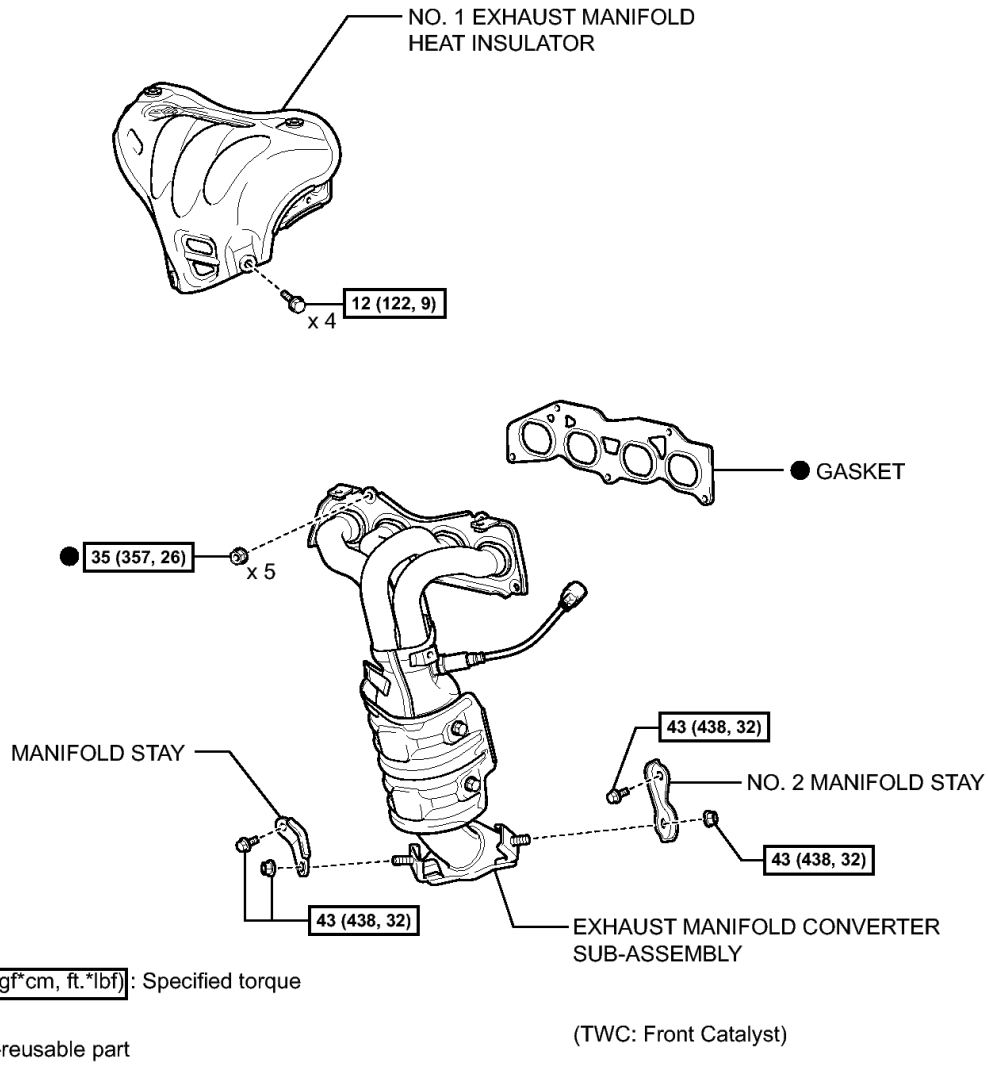
c

Fig. 102: Identifying Engine Unit Replacement Components With Torque Specifications (4 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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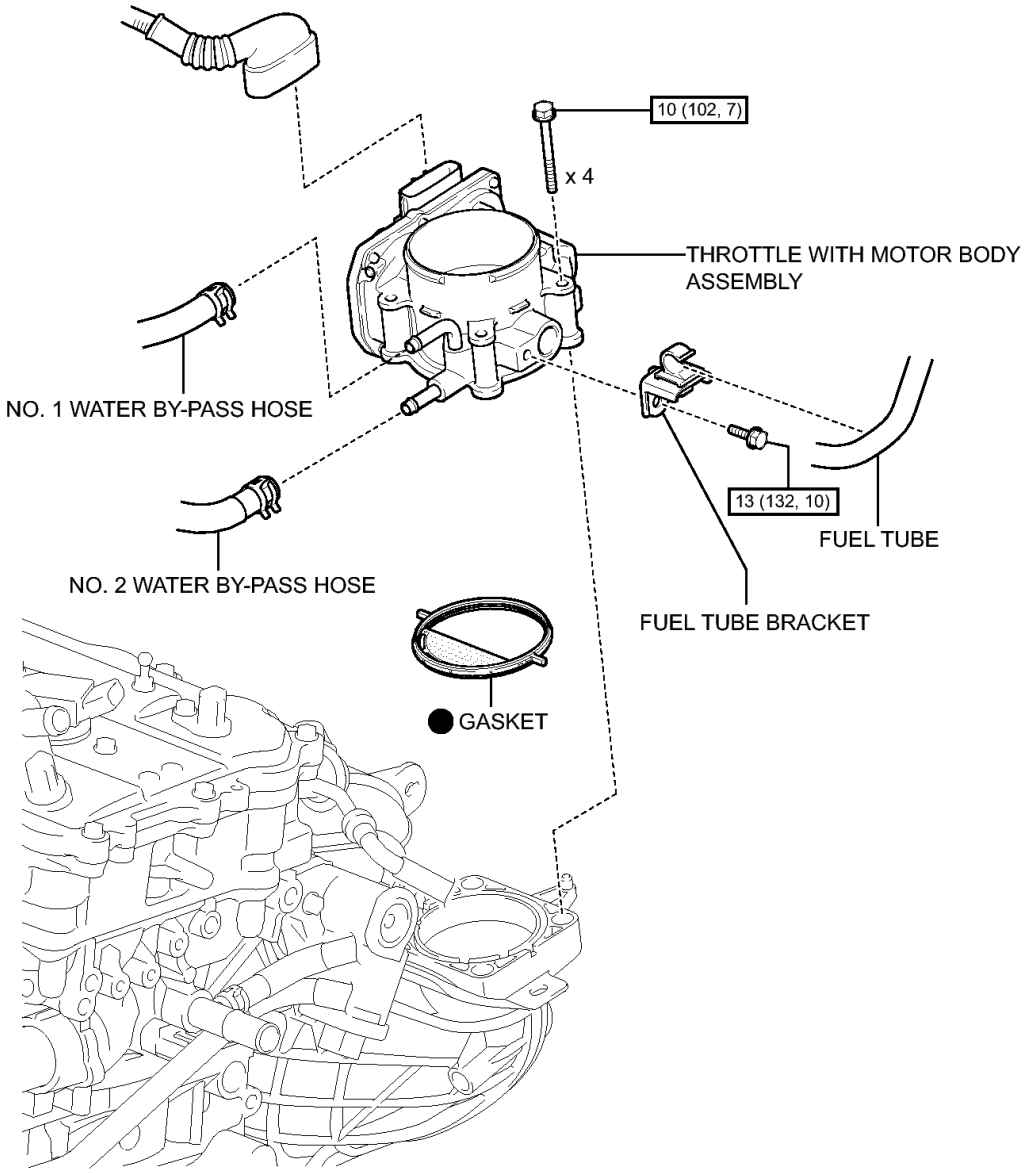


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Fig. 103: Identifying Engine Unit Replacement Components With Torque Specifications (5 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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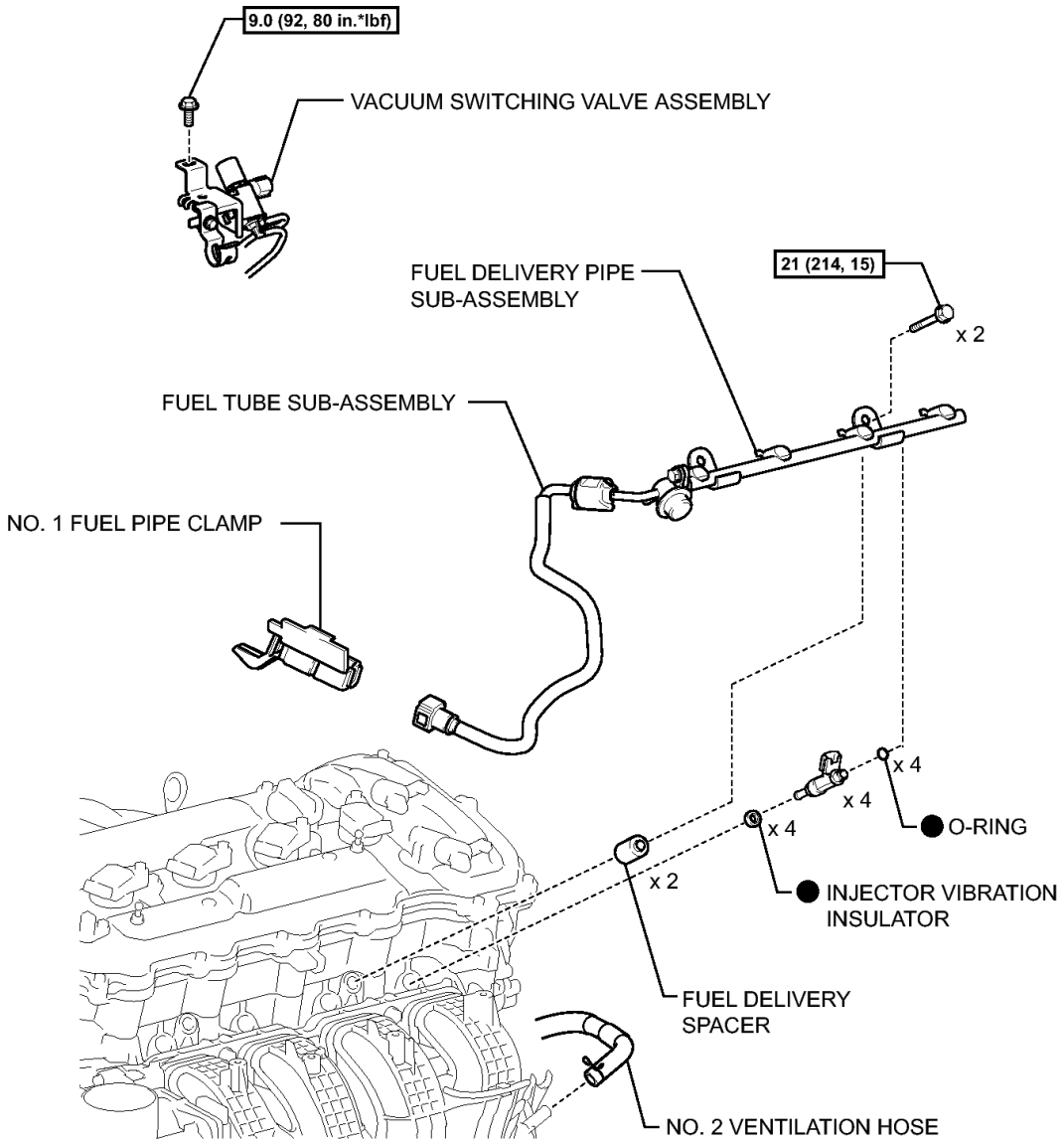


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Fig. 104: Identifying Intake Manifold Replacement Components With Torque Specifications (2 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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

● Non-reusable part

c

Fig. 105: Identifying Engine Unit Replacement Components With Torque Specifications (2 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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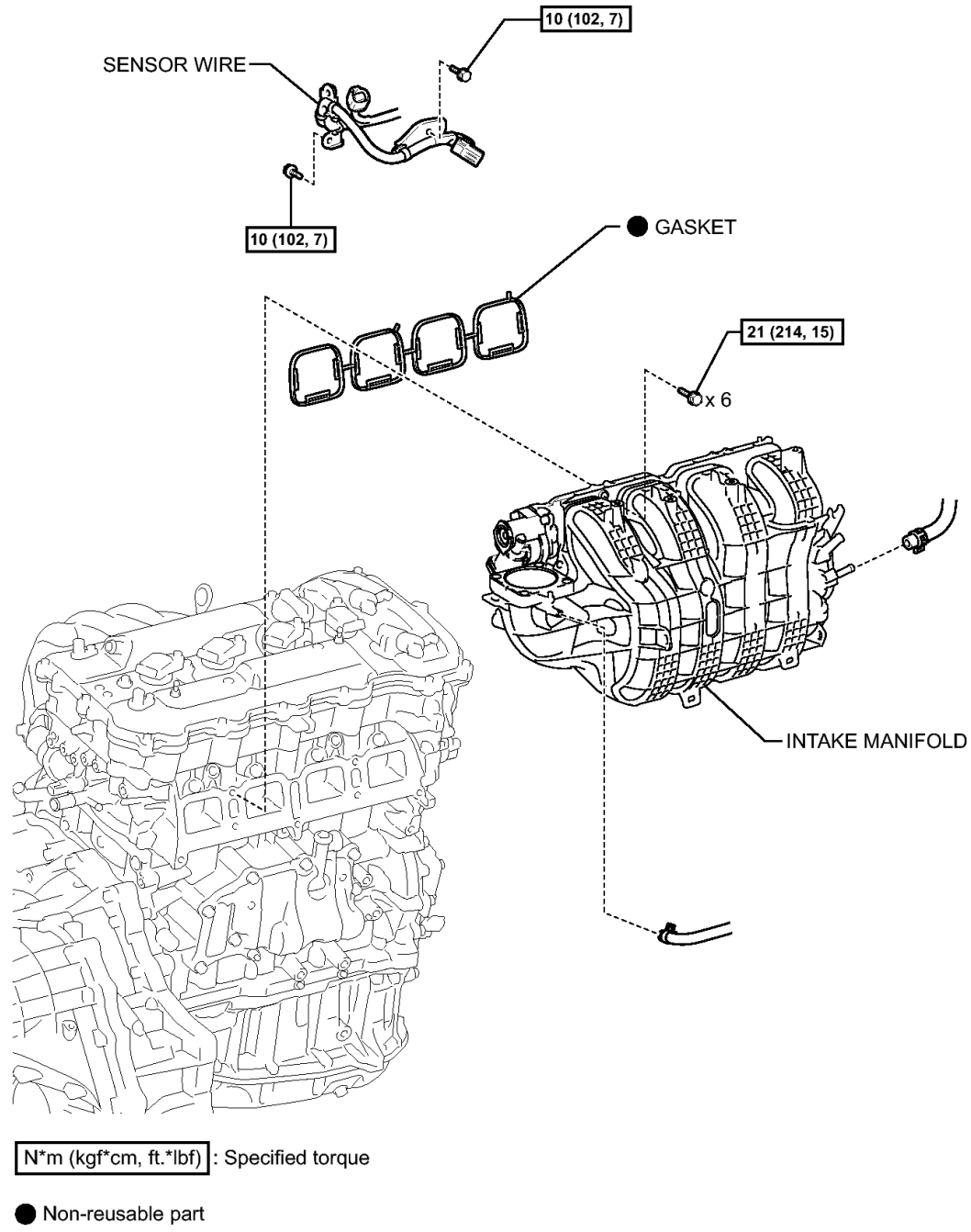
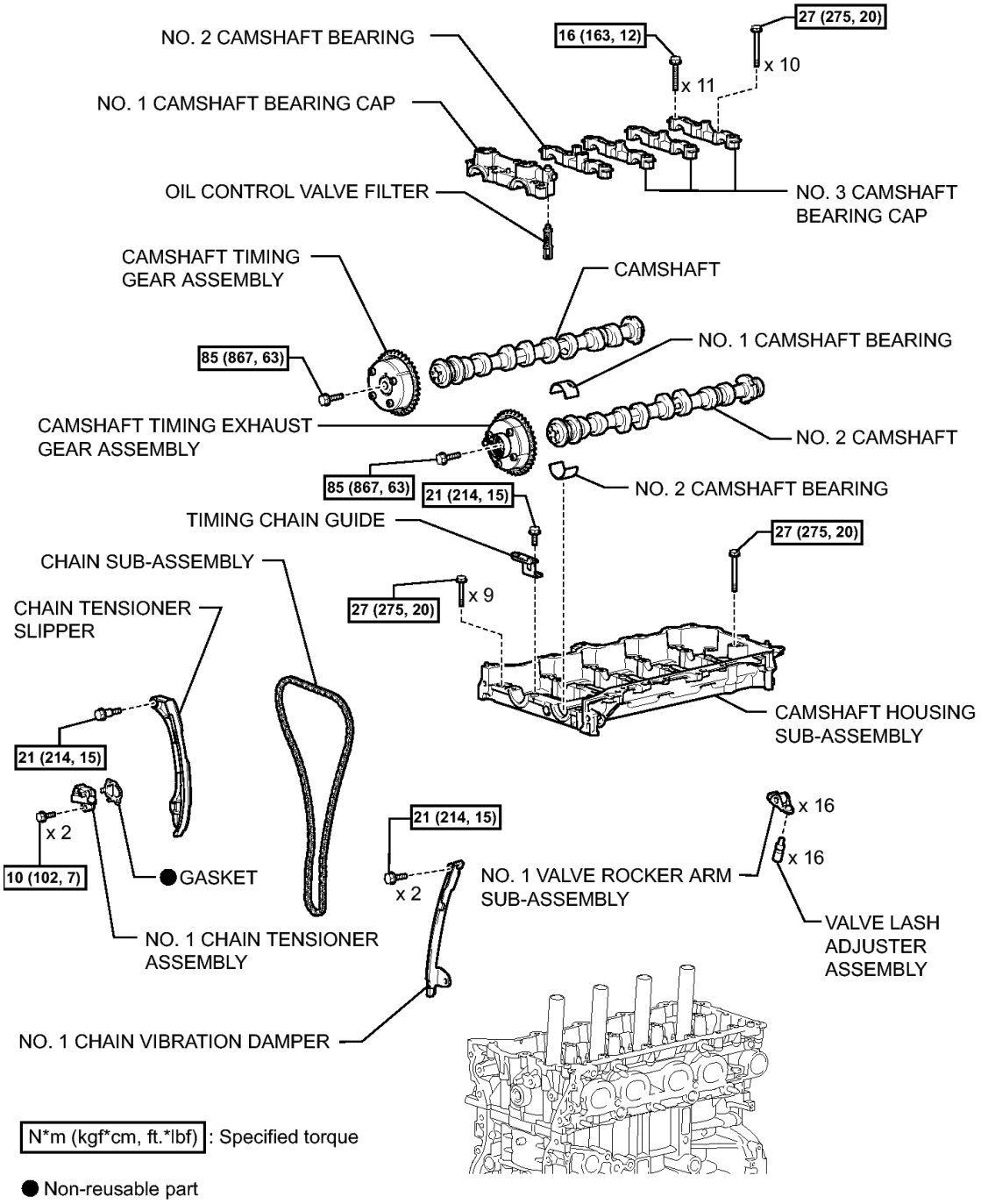


Fig. 106: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (5 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Fig. 107: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (6 Of 7)

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ILLUSTRATION

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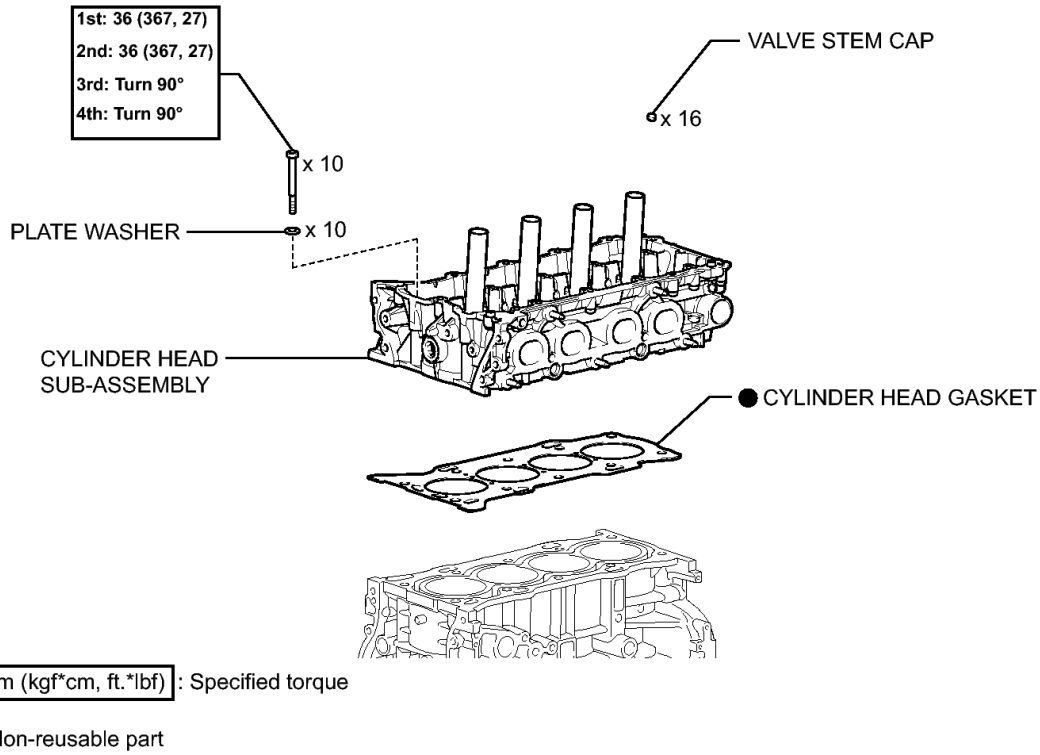


Fig. 108: Identifying Cylinder Head Gasket Replacement Components With Torque Specifications (7 Of 7)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL [08/2013 -]

REMOVAL [08/2013 -]

1. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY**

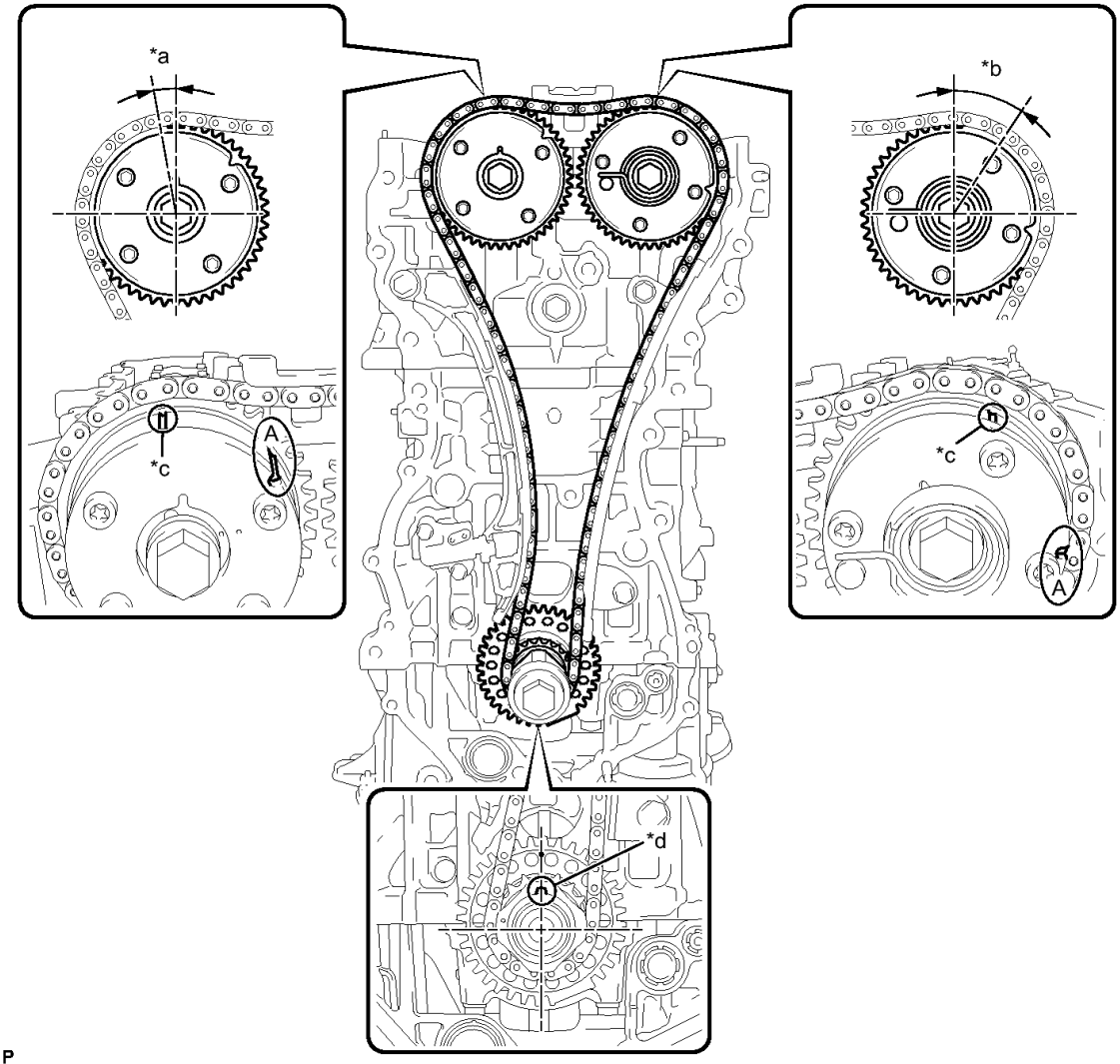
   Refer to **REMOVAL [08/2013 -] - Step 9**

2. **REMOVE MANIFOLD STAY** . Refer to **REMOVAL [08/2013 -] - Step 6**
3. **REMOVE NO. 2 MANIFOLD STAY** . Refer to **REMOVAL [08/2013 -] - Step 7**
4. **REMOVE EGR INLET EXHAUST MANIFOLD PLATE (for PZEV)** . Refer to **REMOVAL [08/2013 -] - Step 9**
5. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (except PZEV)** . Refer to **REMOVAL [08/2013 -] - Step 8**
6. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 11**
7. **REMOVE THROTTLE WITH MOTOR BODY ASSEMBLY** . Refer to **REMOVAL [08/2013 -**

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12/2013] - Step 6

8. **REMOVE VACUUM SWITCHING VALVE ASSEMBLY (for ACIS)** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 7**
9. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 9**
10. **DISCONNECT NO. 2 VENTILATION HOSE** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 8**
11. **REMOVE INTAKE MANIFOLD** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 12**
12. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**
    a. Temporarily install the crankshaft pulley bolt.



P

Fig. 109: Identifying Crankshaft & Camshaft Timing Gear Timing Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Approximately 7°	*b	Approximately 32°

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*c	Timing Mark	*d	Key

HINT:

"A" is not a timing mark.

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

HINT:

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

c. Remove the crankshaft pulley bolt.

13. **REMOVE TIMING CHAIN GUIDE**

a. Remove the bolt and timing chain guide.

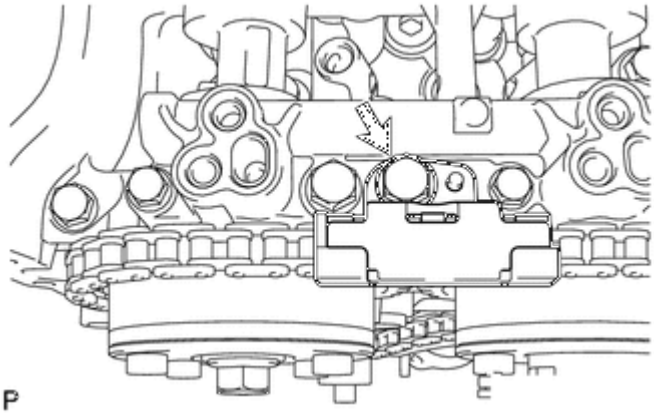


Fig. 110: Timing Chain Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY**

a. Allow the plunger to extend slightly, and then rotate the stopper plate counterclockwise to release the lock. Once the lock is released, push the plunger into the tensioner.

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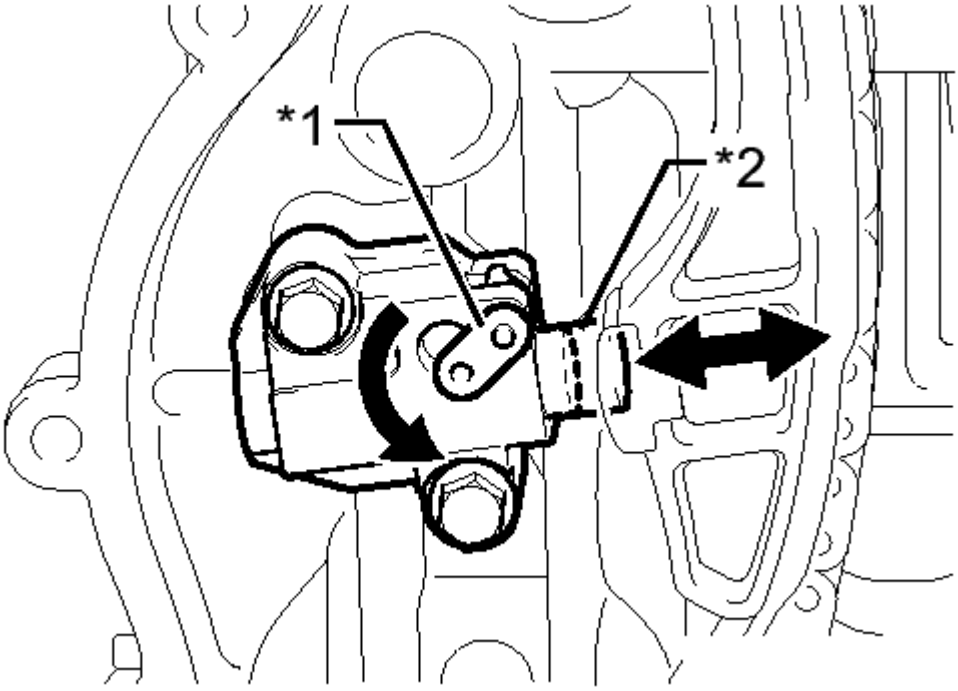


Fig. 111: Identifying Stopper Plate And Plunger
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Stopper Plate
*2	Plunger

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

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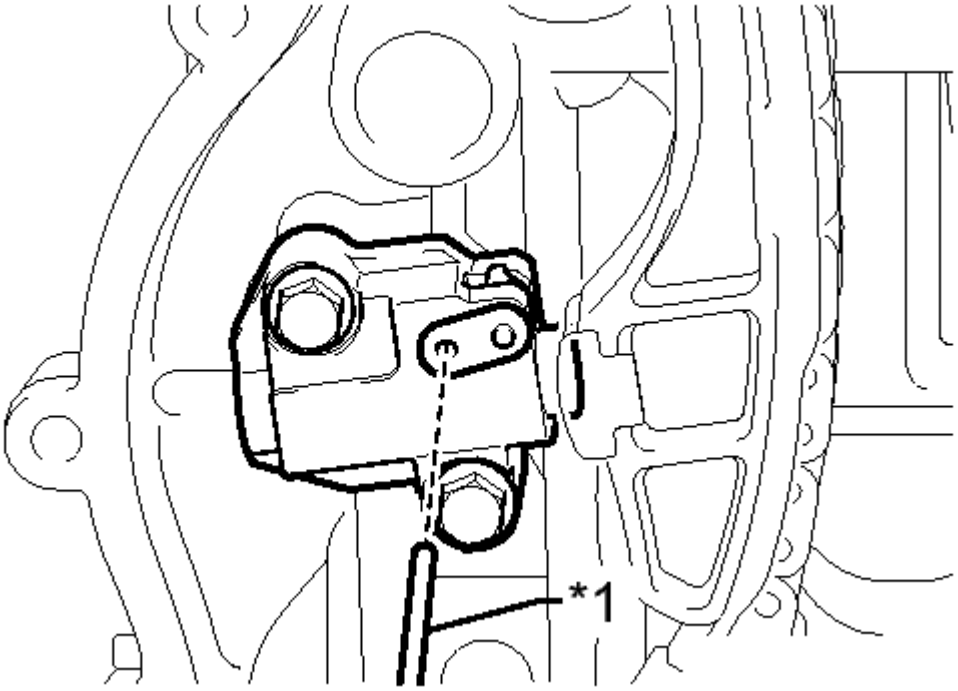


Fig. 112: Insert Pin Into Stopper Plate Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Pin

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

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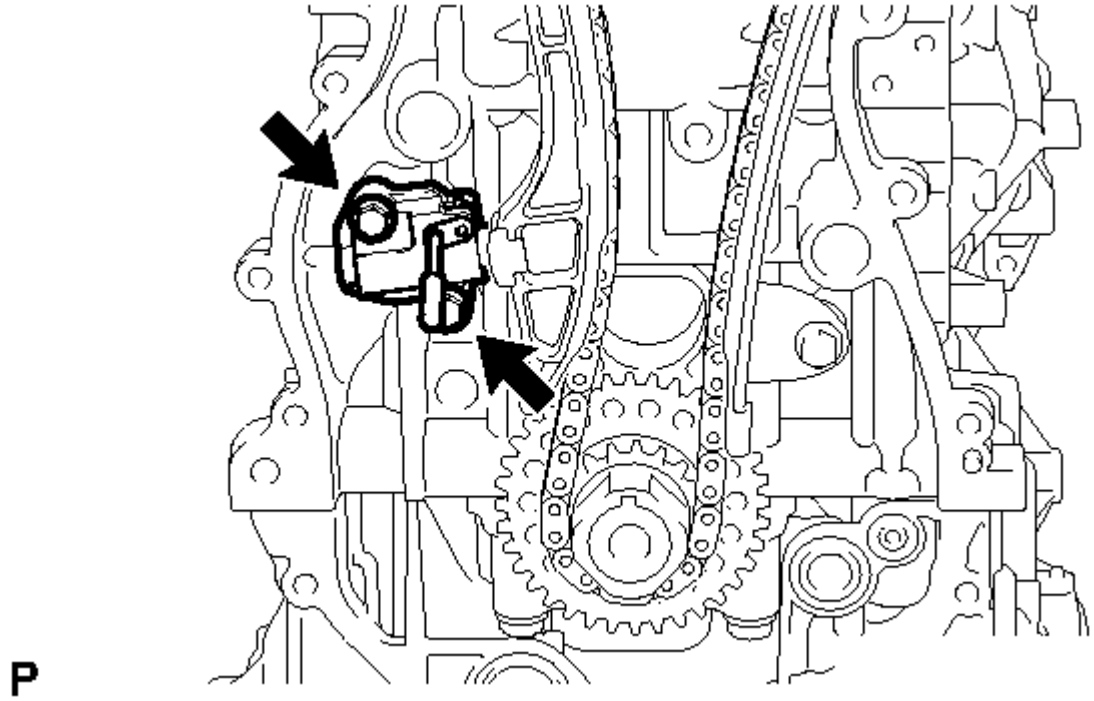


Fig. 113: Location of Chain Tensioner Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **REMOVE CHAIN TENSIONER SLIPPER**
    a. Remove the bolt and chain tensioner slipper.

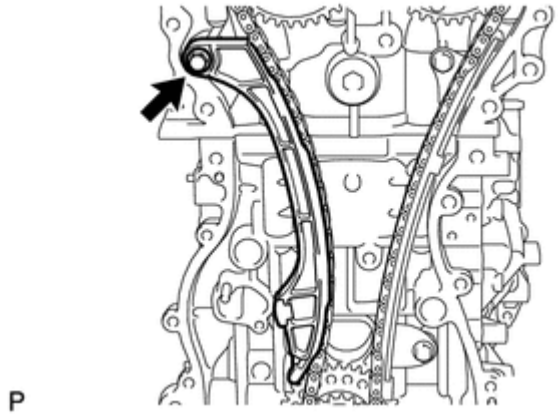


Fig. 114: Location of Bolt And Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **REMOVE CHAIN SUB-ASSEMBLY**
    a. Remove the chain sub-assembly.
17. **REMOVE NO. 1 CHAIN VIBRATION DAMPER**
    a. Remove the 2 bolts and chain vibration damper.

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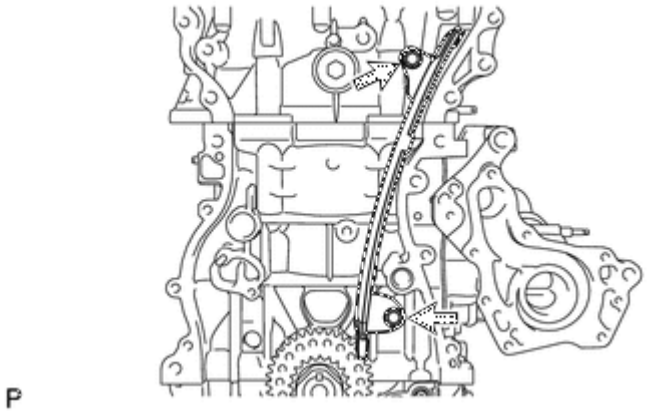


Fig. 115: Location of Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

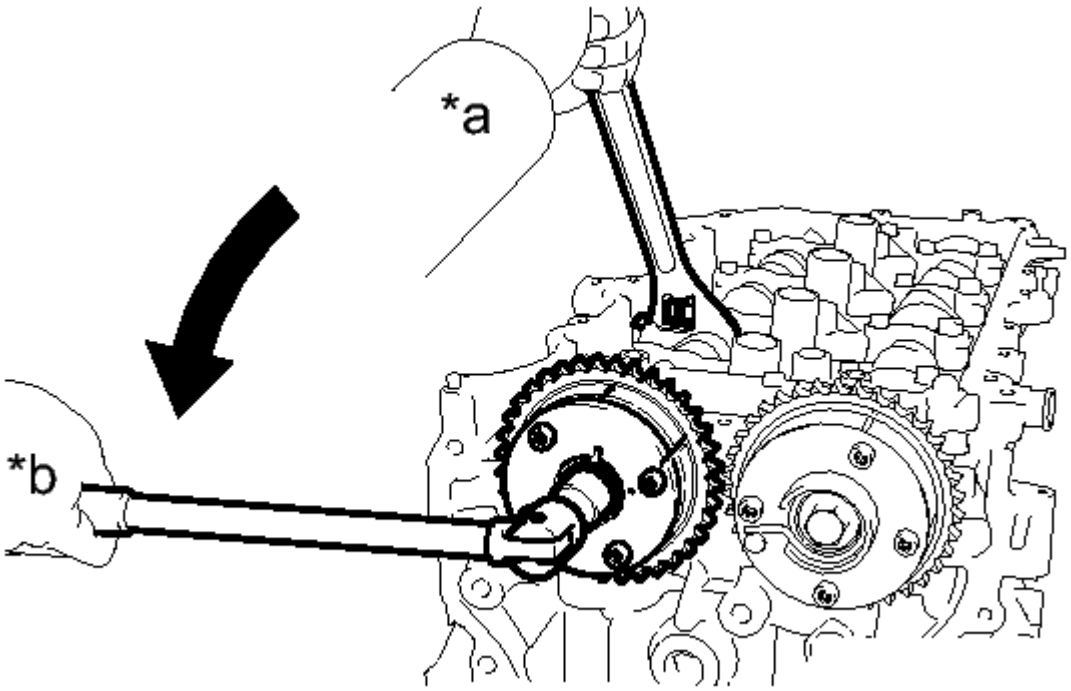


Fig. 116: Removing Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

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NOTE:

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

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

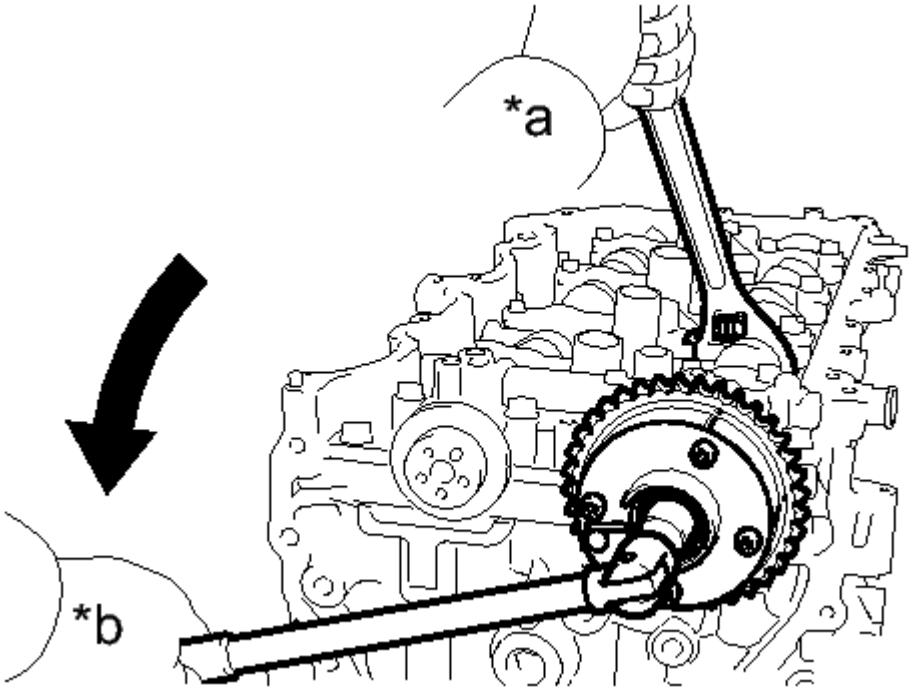


Fig. 117: Removing Camshaft Timing Exhaust Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

NOTE:

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

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

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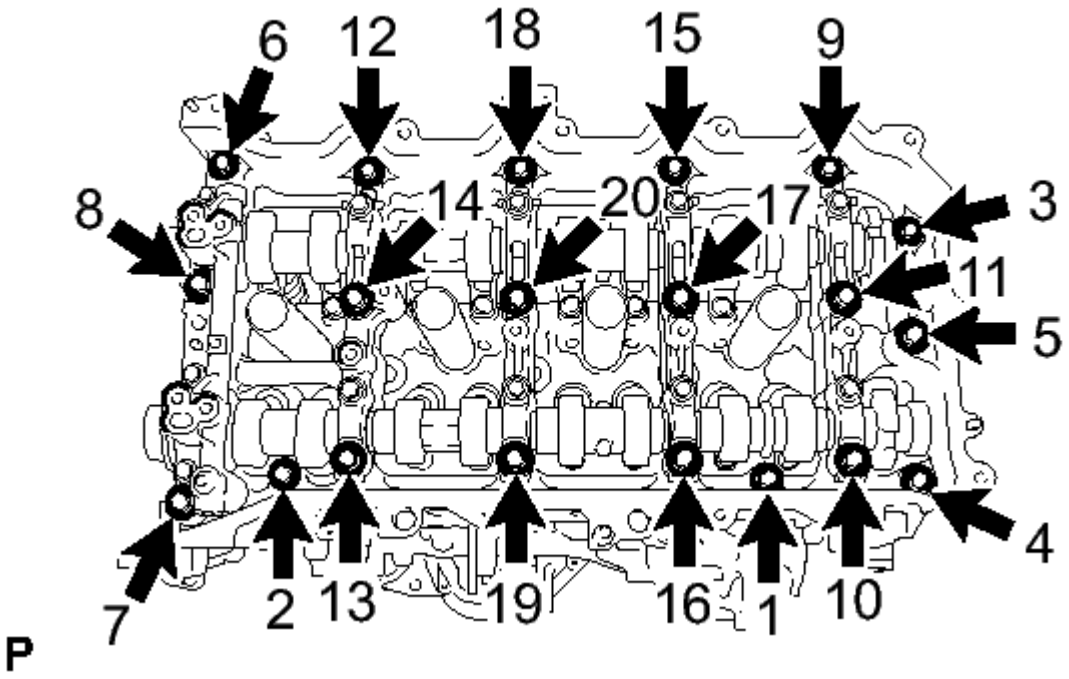


Fig. 118: Identifying Bearing Cap Bolts With Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

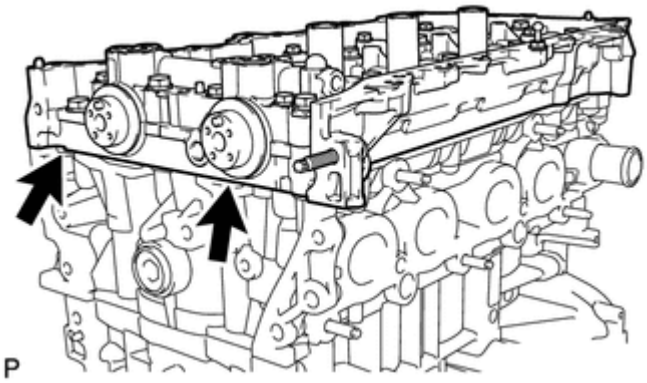


Fig. 119: Location of Contact Surfaces Of Cylinder Head And Camshaft Housing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Tape the screwdriver tip before use.

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

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

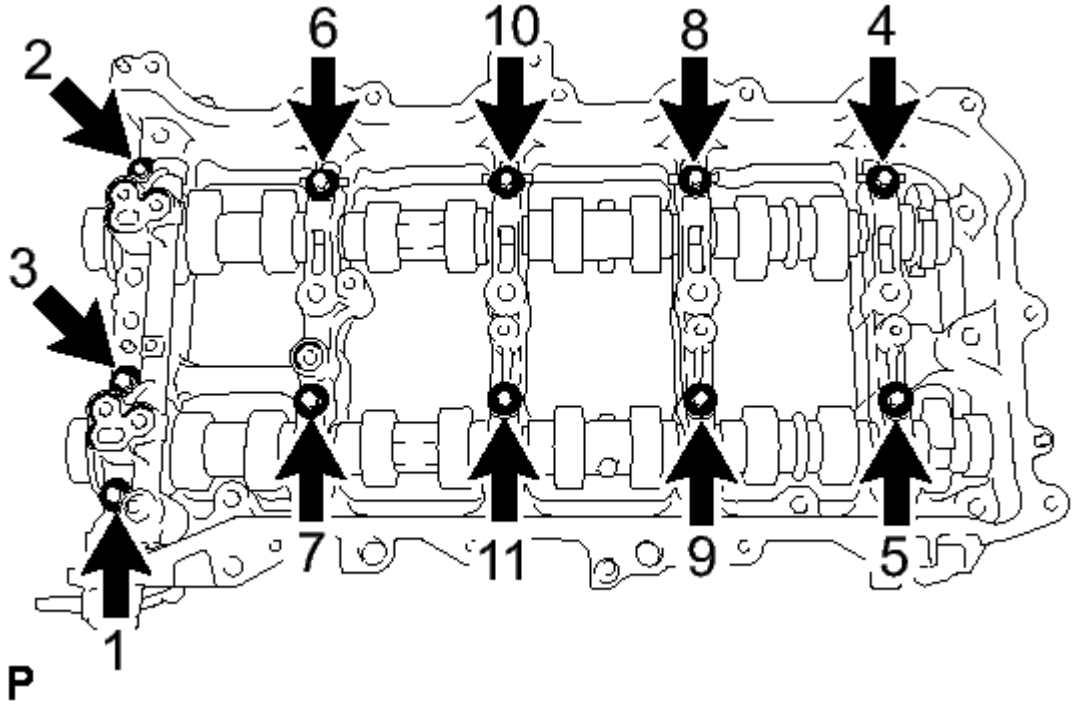


Fig. 120: Identifying Bearing Cap Bolts With Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the 5 bearing caps.

    HINT:

    Arrange the removed parts in the correct order.

22. **REMOVE OIL CONTROL VALVE FILTER** See step 35
23. **REMOVE NO. 1 CAMSHAFT BEARING** See step 37
24. **REMOVE CAMSHAFT**
    a. Remove the camshaft and No. 2 camshaft.
25. **REMOVE NO. 2 CAMSHAFT BEARING** See step 38
26. **REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
    a. Remove the 16 valve rocker arms from the cylinder head sub-assembly.

    HINT:

    Arrange the removed parts in the correct order.

27. **REMOVE VALVE LASH ADJUSTER ASSEMBLY**

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a. Remove the 16 valve lash adjusters from the cylinder head sub-assembly.

HINT:

Arrange the removed parts in the correct order.

28. **REMOVE VALVE STEM CAP**

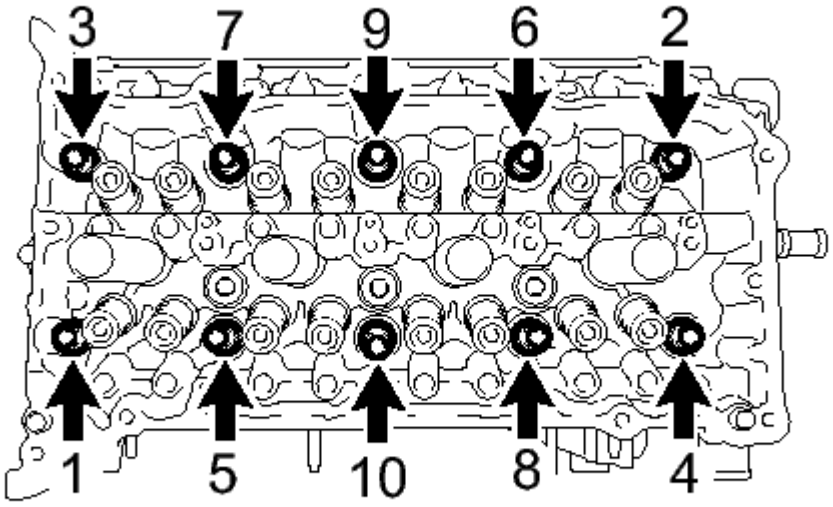
a. Remove the 16 valve stem caps from the cylinder head sub-assembly.

HINT:

Arrange the removed parts in the correct order.

29. **REMOVE CYLINDER HEAD SUB-ASSEMBLY**

a. Using a 10 mm bi-hexagon wrench, uniformly loosen the 10 bolts in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.



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Fig. 121: Identifying Head Bolts With Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

NOTE:

- **Be careful not to drop washers into the cylinder head sub-assembly.**

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- **Head warpage or cracking could result from removing bolts in the incorrect order.**

b. Remove the cylinder head sub-assembly.

30. **REMOVE CYLINDER HEAD GASKET**
    a. Remove the cylinder head gasket from the cylinder block.

INSTALLATION [08/2013 -]

INSTALLATION [08/2013 -]

HINT:

Perform "Inspection After Repair" after replacing the cylinder head sub-assembly. Refer to **INITIALIZATION [08/2013 -]** .

1. **INSPECT CYLINDER HEAD BOLT** See step 17
2. **INSPECT CYLINDER HEAD SUB-ASSEMBLY** See step 1
3. **INSTALL CYLINDER HEAD GASKET**
    a. Clean the cylinder block sub-assembly and cylinder head sub-assembly with solvent.

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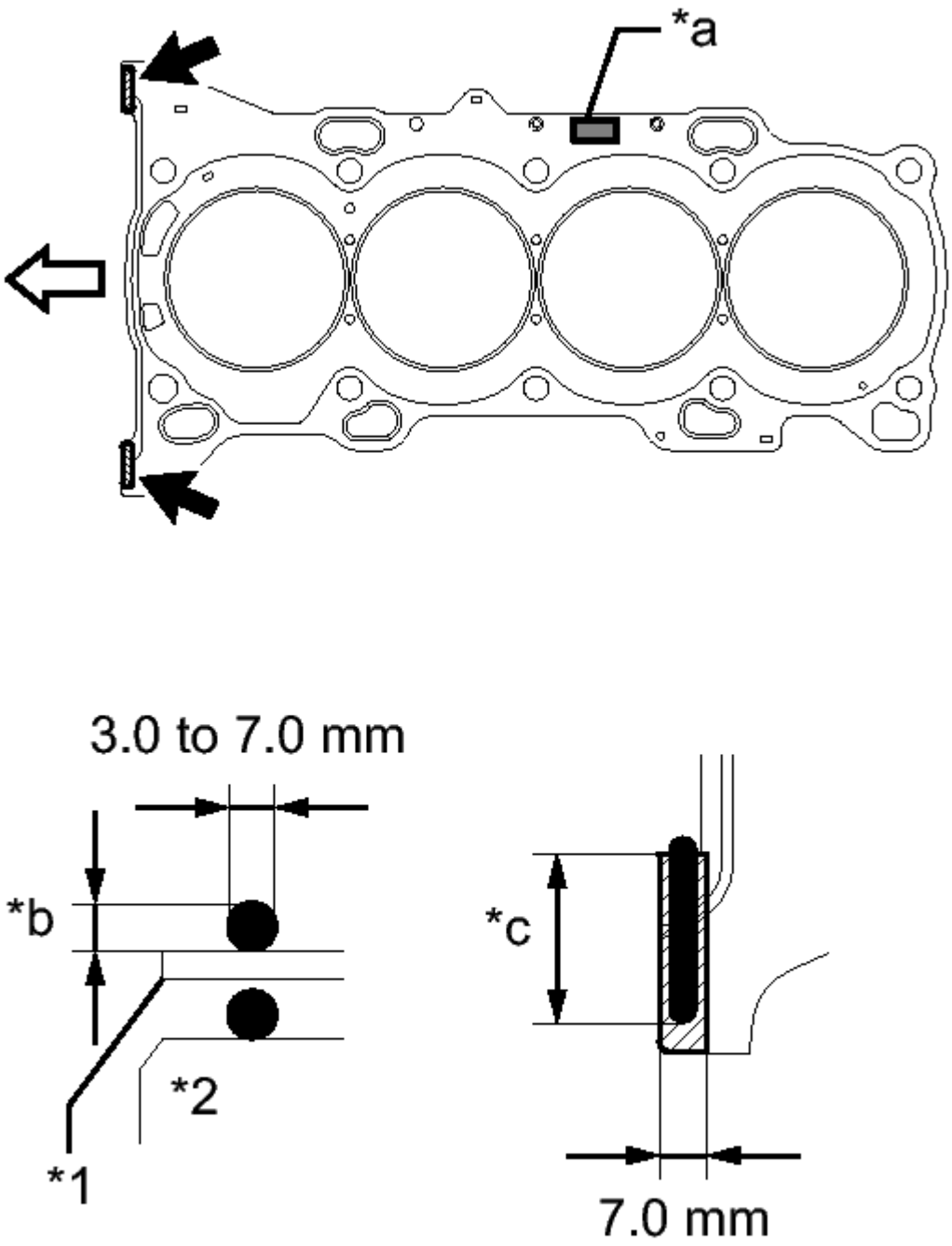
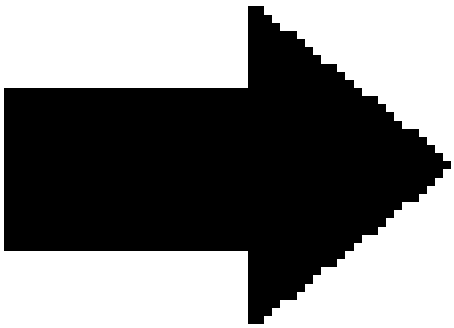
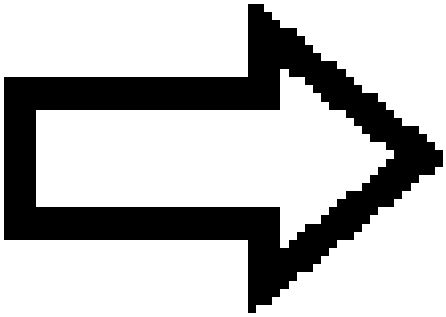


Fig. 122: Identifying Cylinder Block And Cylinder Head Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Cylinder Head Gasket

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*2	Cylinder Block Sub-assembly
*a	Lot No.
*b	3.0 mm or more
*c	20 mm or more
	Seal Packing
	Front

b. Apply a continuous line of seal packing to a new cylinder head gasket as shown in the illustration.

Seal Packing

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

Standard Seal Dimension

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

HINT:

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

NOTE:

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

c. Place the new cylinder head gasket on the cylinder block sub-assembly surface with the Lot No. stamp facing upward.

NOTE: Pay attention to the installation direction.

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

HINT:

The cylinder head bolts are tightened in 4 progressive steps.

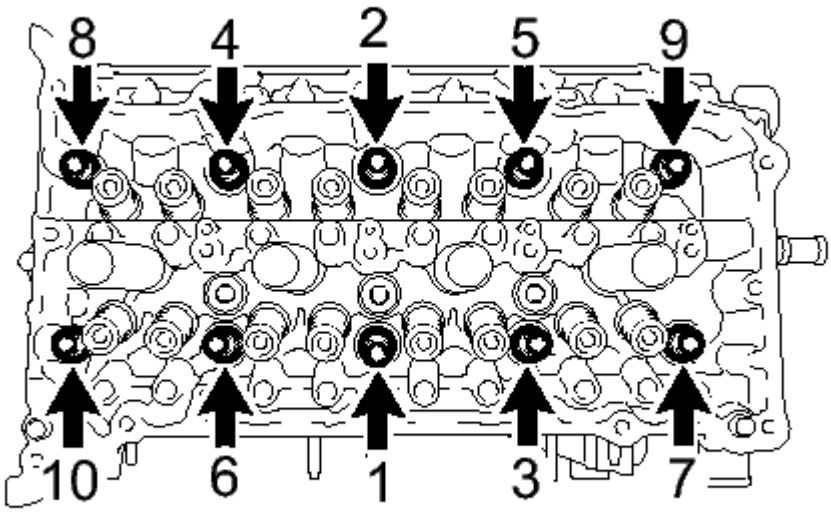
a. Place the cylinder head sub-assembly on the cylinder block sub-assembly.

NOTE:

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

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

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Fig. 123: Identifying Cylinder Head Bolts With Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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

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

f. Step 3:
   1. Mark each cylinder head bolt head with paint as shown in the illustration.

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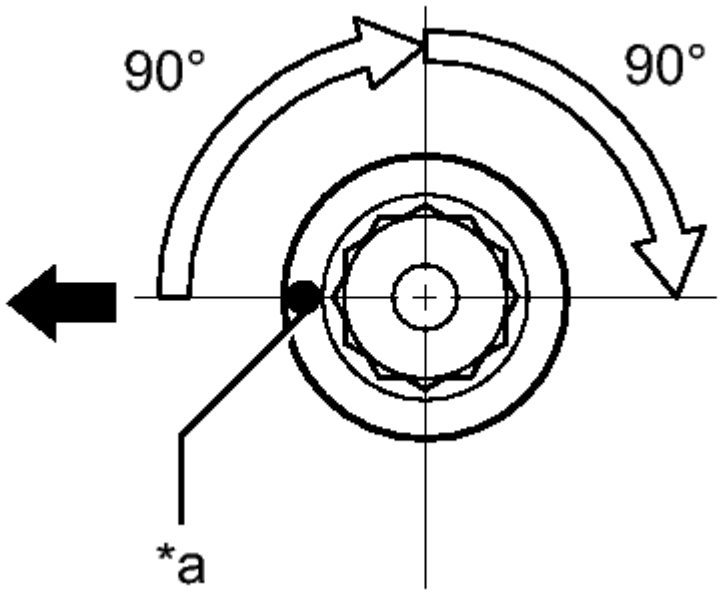
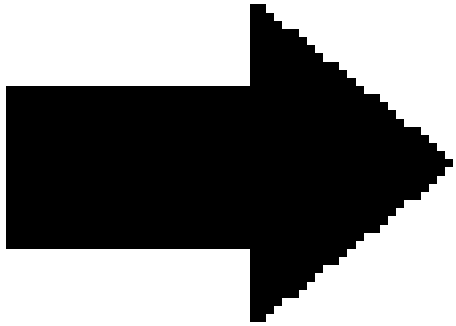


Fig. 124: Identifying Paint Mark On Cylinder Head Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Painted Mark
	Front

2. Tighten the cylinder head bolts 90° in the sequence shown in step 1.

g. Step 4:

1. Tighten the cylinder head bolts another 90° in the sequence shown in step 1.
2. Check that the paint marks are now facing rearward.

NOTE:

- **Do not add engine oil for at least 2 hours after installation.**
- **Do not start the engine for at least 2 hours after installation.**
- **After installation, if the seal packing has seeped out, wipe**

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it off.

HINT:

Perform "Inspection After Repair" after replacing the cylinder head sub-assembly. Refer to **INITIALIZATION [08/2013 -]** .

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

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

6. **SET CAMSHAFT TIMING GEAR ASSEMBLY**

HINT:

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

a. Check the camshaft timing gear assembly position.

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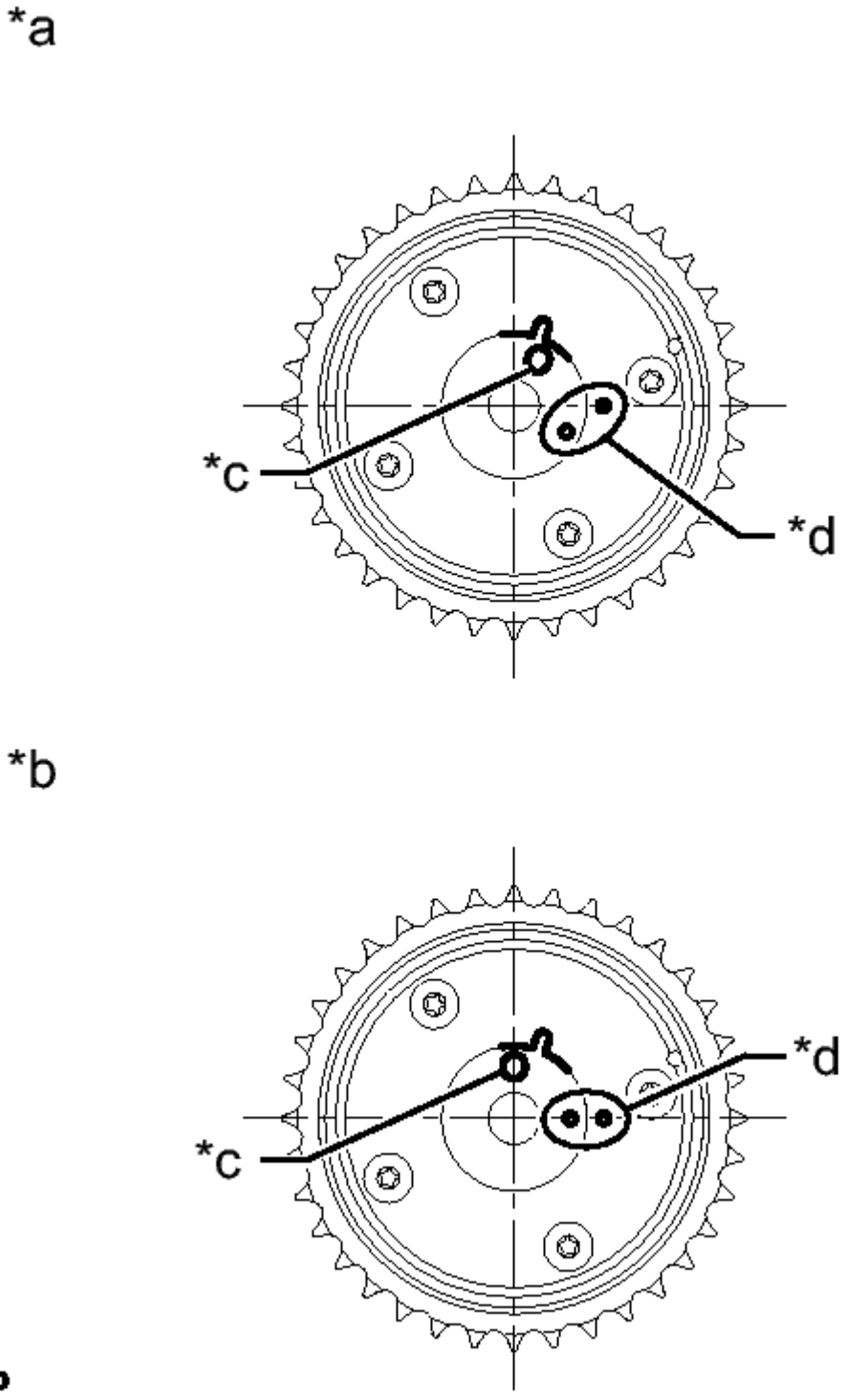


Fig. 125: Identifying Camshaft Timing Gear Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Advanced Position

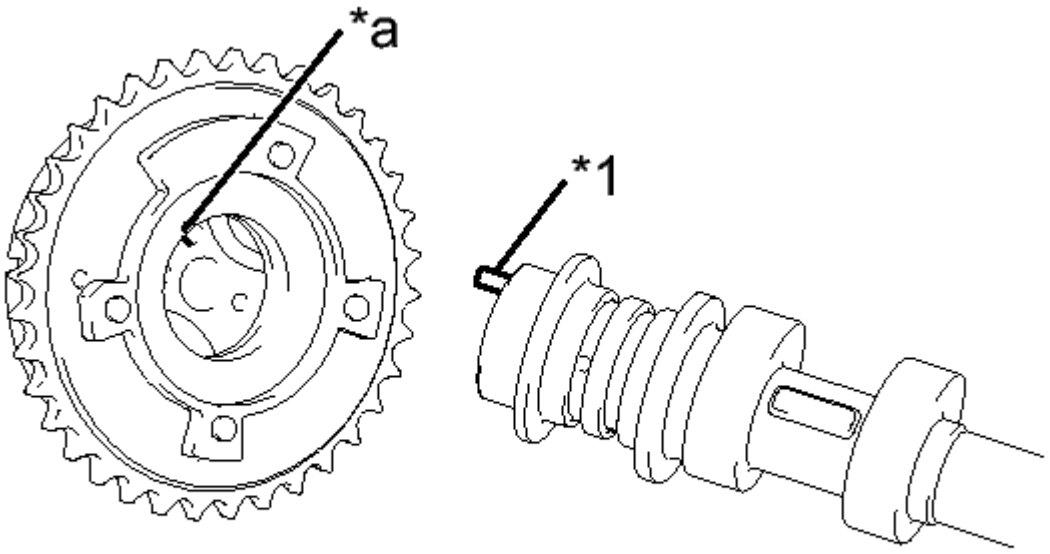
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*b	Retarded Position
*c	Knock Pin Hole
*d	Alignment Mark

NOTE: **If the camshaft timing gear assembly is set to the advanced position, do not let the camshaft timing gear assembly rotate clockwise during installation.**

If the camshaft timing gear assembly rotates to the retarded position, release the lock pin and set the camshaft timing gear assembly to the advanced position.

b. Align and attach the knock pin of the camshaft with the pin hole of the camshaft timing gear assembly.



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Fig. 126: Insert Knock Pin Of Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Pin Hole

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

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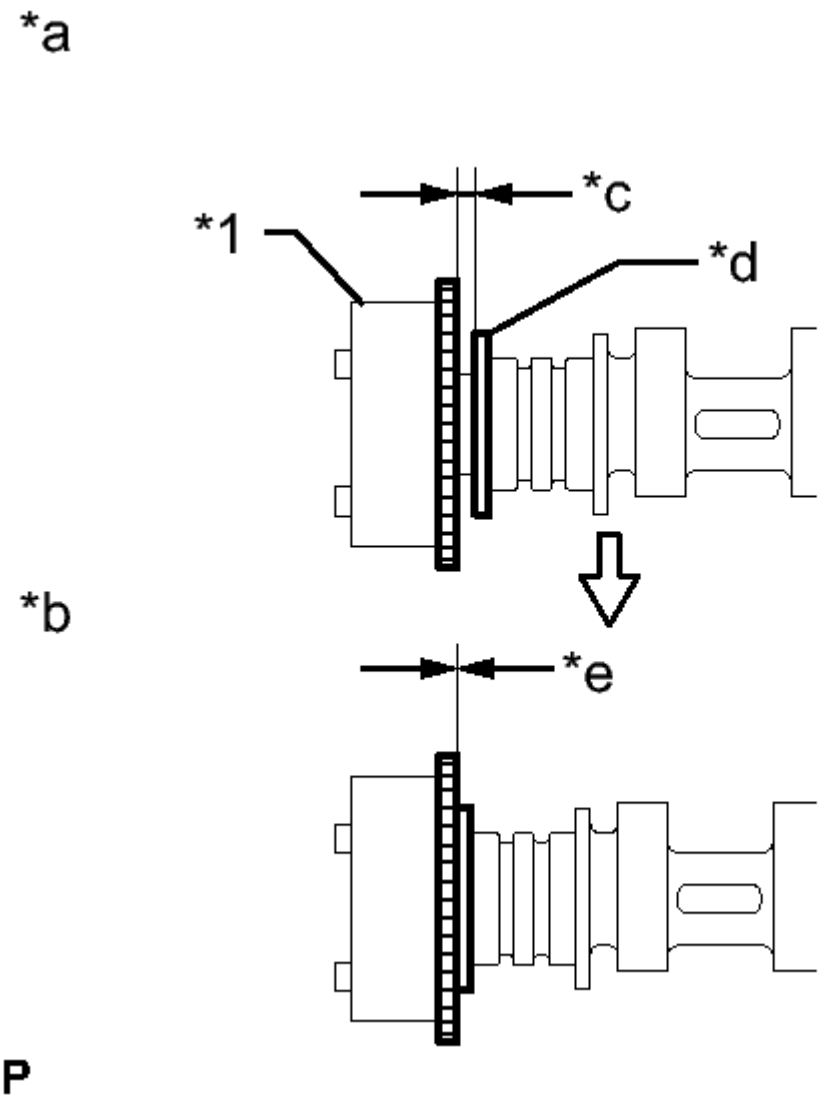


Fig. 127: Identifying No Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Gear Assembly
*a	Incorrect
*b	Correct
*c	Clearance
*d	Camshaft Flange
*e	No Clearance

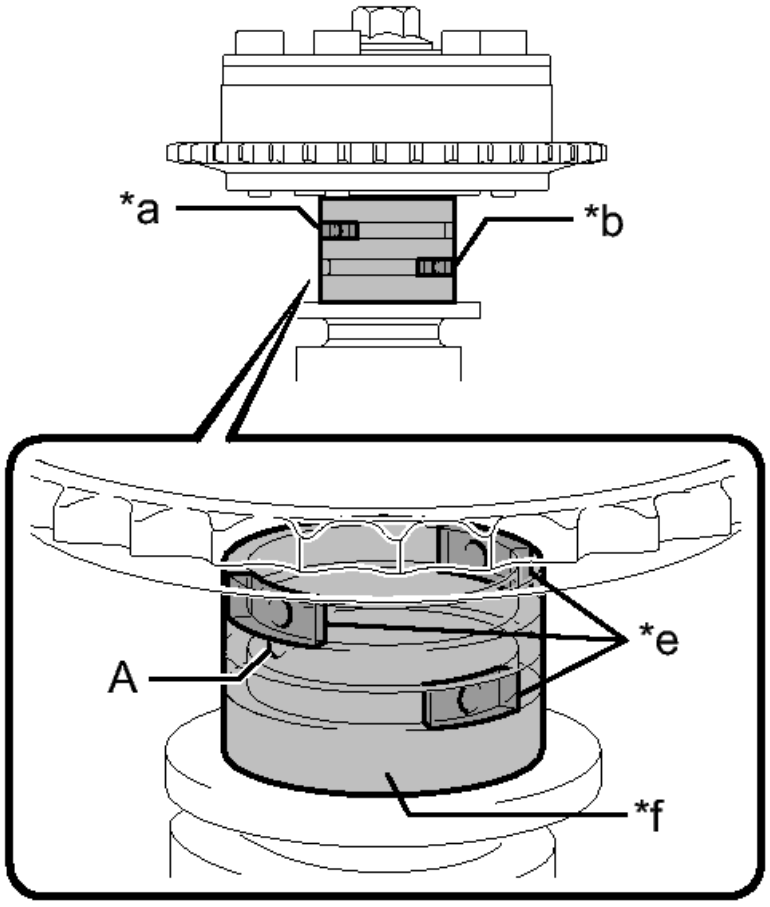
d. Secure the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear assembly by hand.

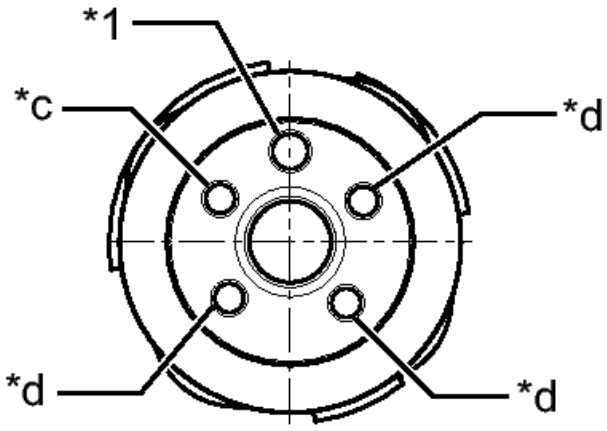
NOTE: Do not use any tools to install the bolt. If the bolt is installed using a

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tool, the lock pin will be damaged.

e. Release the lock pin.





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Fig. 128: Identifying Rubber, Vinyl Tape, Knock Pin, Retard Side Path And Advance Side Path
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

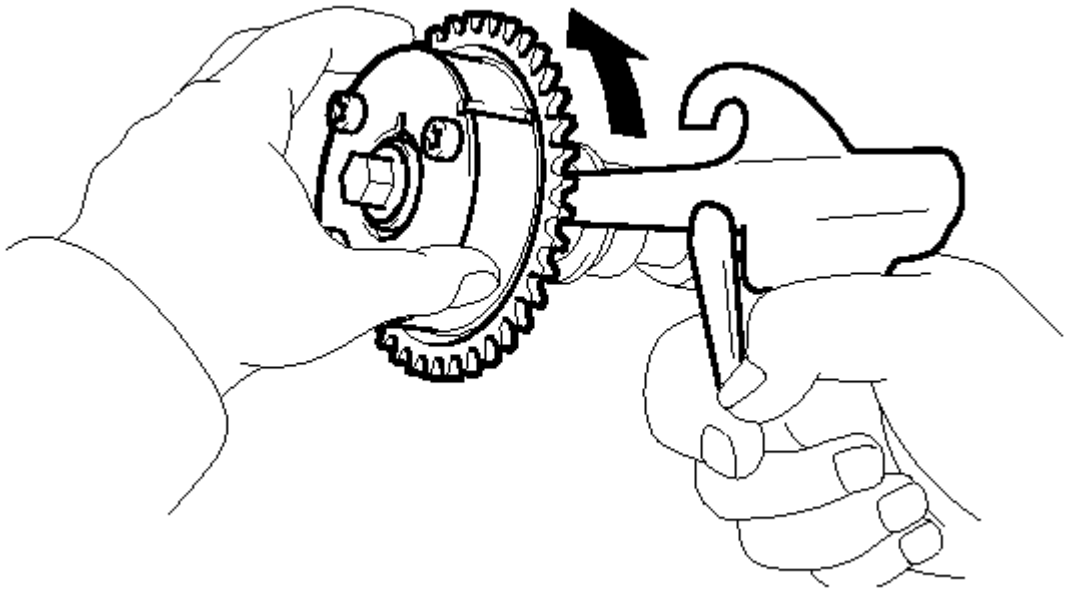
*1	Knock Pin
*a	Retard Side Path
*b	Advance Side Path
*c	Open
*d	Close
*e	Rubber
*f	Vinyl Tape

1. Clean the camshaft journal with non-residue solvent.
2. Cover the 4 oil paths of the camshaft journal with vinyl tape as shown in the illustration.

   HINT:

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

3. Open a hole at port (A) shown in the illustration.
4. While applying approximately 200 kPa (2.0 kgf/ cm^2 , 29 psi) of air pressure to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).



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Fig. 129: View Of Using Air Pressure To Turn Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

HINT:

- The camshaft timing gear assembly may turn in the advance direction without assistance by hand.
- If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.

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

f. Remove the bolt and camshaft timing gear assembly.

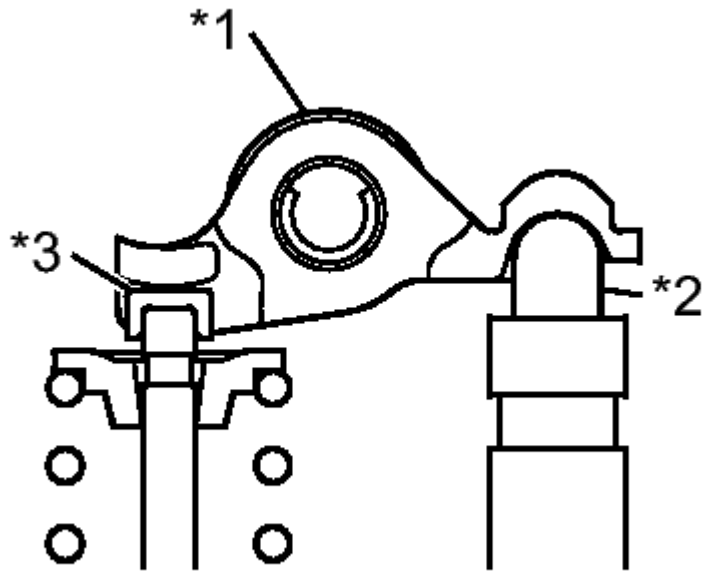
NOTE: Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

7. **INSTALL VALVE LASH ADJUSTER ASSEMBLY**
   a. Inspect the valve lash adjuster assemblies before installing them See step 2.
   b. Install the 16 valve lash adjuster assemblies to the cylinder head sub-assembly.

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

8. **INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
   a. Apply engine oil to the valve lash adjuster assembly tips and valve stem caps.

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Fig. 130: Identifying Valve Rocker Arms
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	No. 1 Valve Rocker Arm Sub-assembly
*2	Valve Lash Adjuster Assembly
*3	Valve Stem Cap

b. Install the 16 No. 1 valve rocker arm sub-assemblies as shown in the illustration.

9. **INSTALL NO. 2 CAMSHAFT BEARING** See step 18
10. **INSTALL NO. 1 CAMSHAFT BEARING** See step 17
11. **INSTALL OIL CONTROL VALVE FILTER** See step 19
12. **INSTALL CAMSHAFT**
    a. Clean the camshaft journals, camshaft housing sub-assembly and camshaft bearing caps.
    b. Apply a light coat of engine oil to the camshaft journals, camshaft housing sub-assembly and camshaft bearing caps.
    c. Install the camshaft and No. 2 camshaft to the camshaft housing sub-assembly.

    HINT:

    Perform "Inspection After Repair" after replacing the camshaft or No. 2 camshaft. Refer to **INITIALIZATION [08/2013 -]** .

13. **INSTALL CAMSHAFT BEARING CAP**
    a. Confirm the marks and numbers on the No. 1 camshaft bearing cap, No. 2 camshaft bearing cap

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and 3 No. 3 camshaft bearing caps and place them in their proper positions and directions.

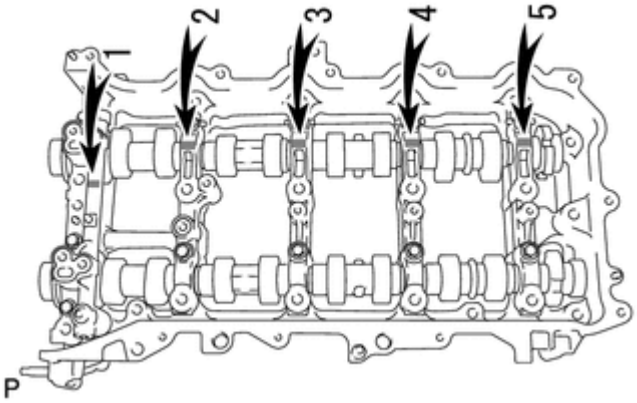


Fig. 131: Identifying Camshaft Bearing Caps Positions
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

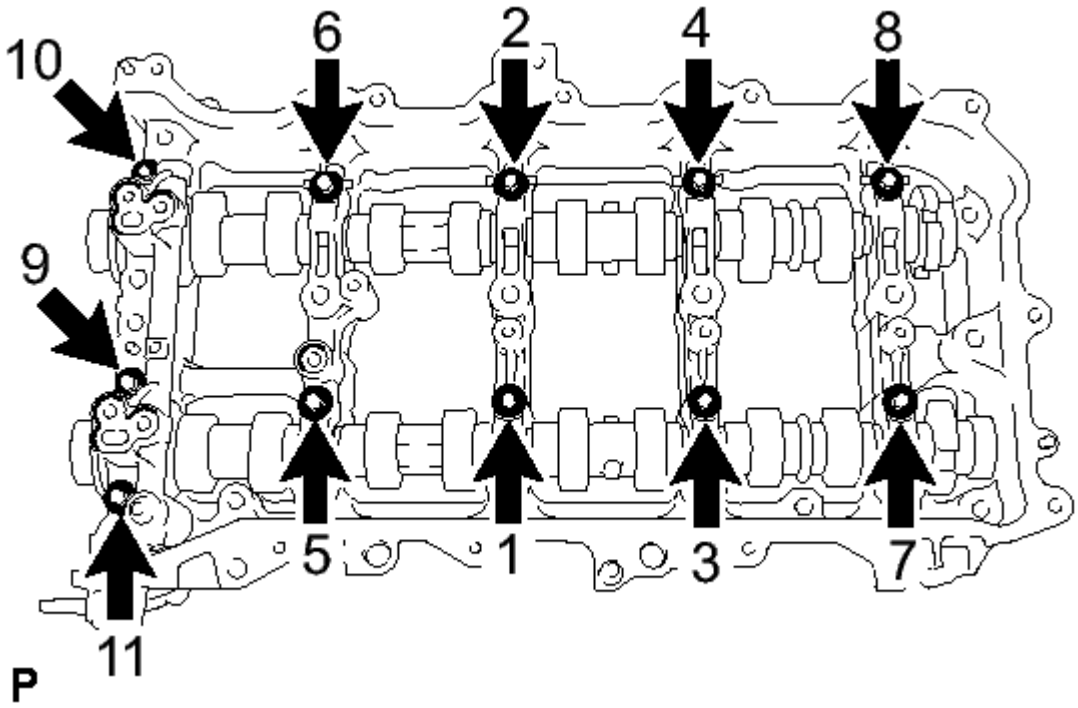


Fig. 132: Identifying Camshaft Bearing Caps Bolts With Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Make sure that the camshaft and No. 2 camshaft rotate smoothly after installing the No. 1 camshaft bearing cap, No. 2 camshaft bearing cap and No. 3 camshaft bearing caps.

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14. **INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY**

a. Check that the No. 1 valve rocker arm sub-assemblies are installed as shown in the illustration.

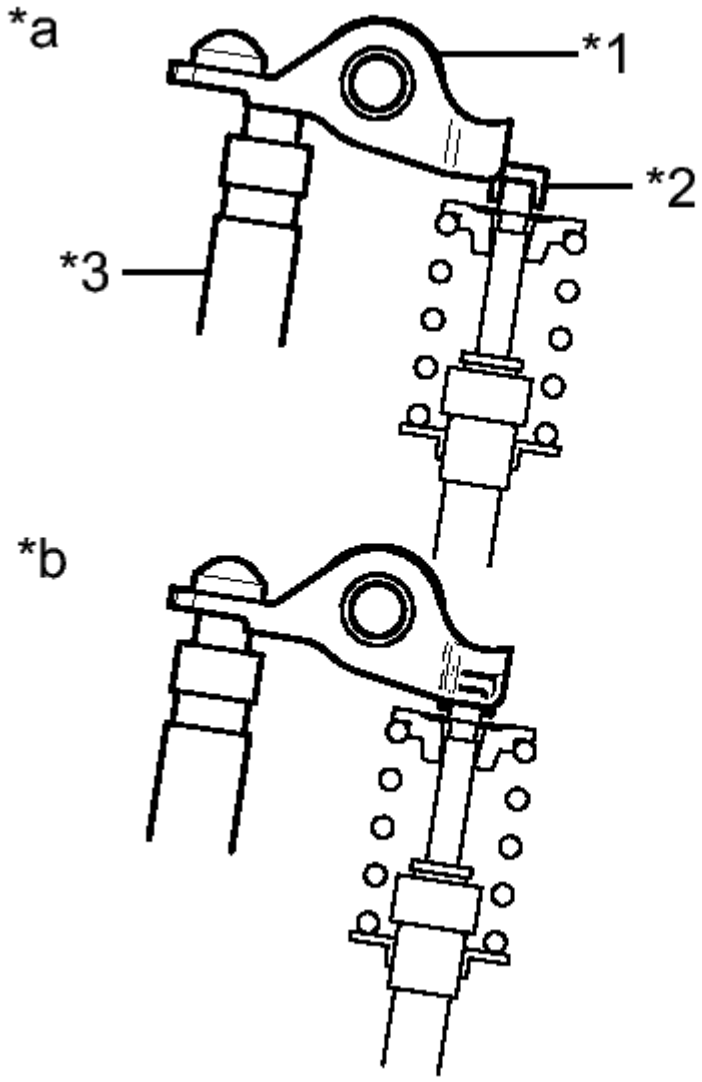


Fig. 133: Identifying Valve Rocker Arm Installation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	No. 1 Valve Rocker Arm Sub-assembly
*2	Valve Stem Cap
*3	Valve Lash Adjuster Assembly
*a	Incorrect
*b	Correct

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

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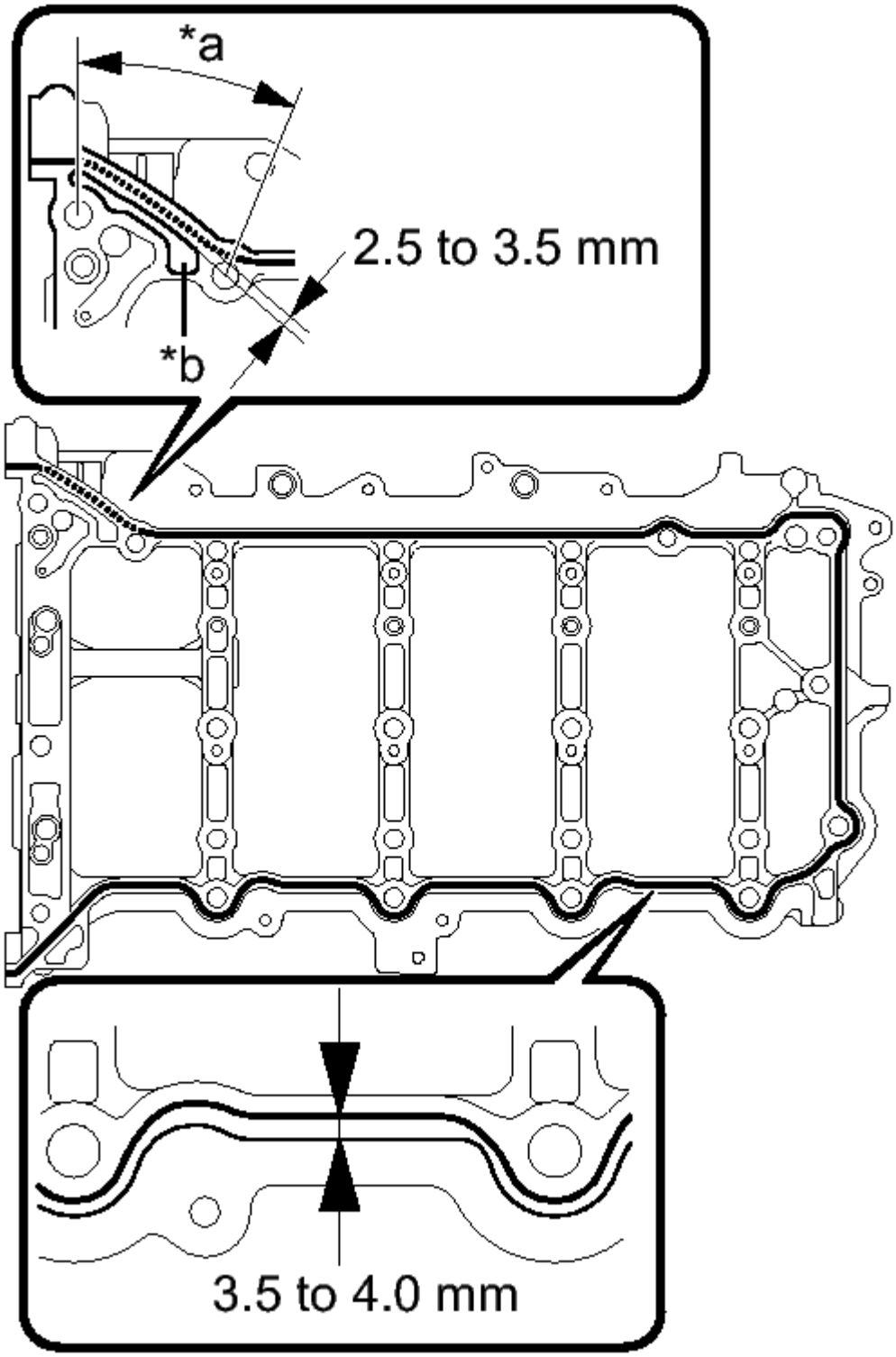


Fig. 134: Identifying Seal Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Dashed Line

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*b	Groove

Seal Packing

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

Apply Seal Packing as Follows

Area	Seal Packing Diameter	Application Position
Continuous Line	3.0 to 4.0 mm (0.118 to 0.157 in.)	Distance from edge of camshaft housing sub-assembly to center of seal packing: 3.5 to 4.0 mm (0.138 to 0.157 in.)
Dashed Line		Distance from outside edge of groove to center of seal packing: 2.5 to 3.5 mm (0.0984 to 0.138 in.)

NOTE:

- **Remove any oil from the contact surface.**
- **Install the camshaft housing sub-assembly within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.**

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

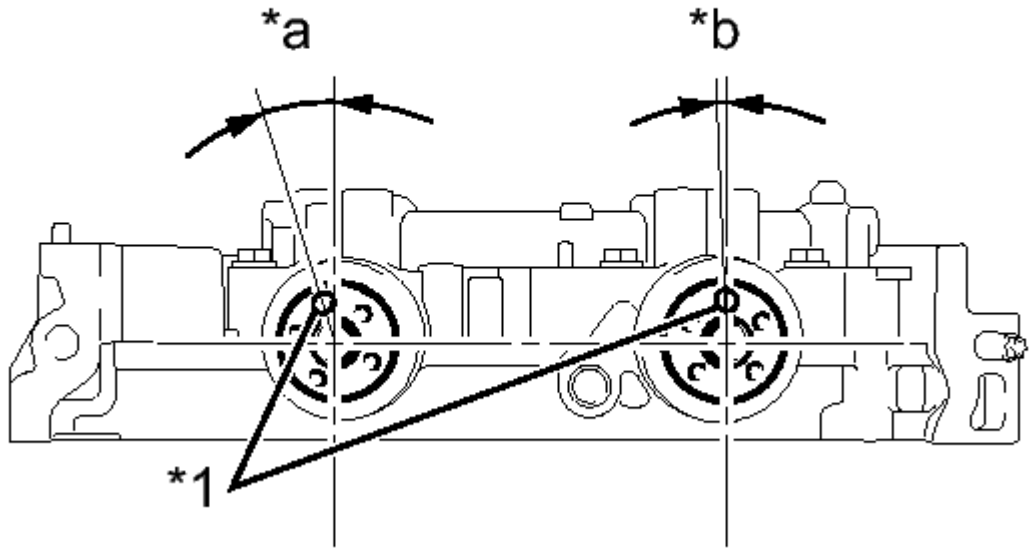


Fig. 135: Identifying No. 1 & No. 2 Camshaft Knock Pin Positions
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Approximately 17°
*b	Approximately 2°

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

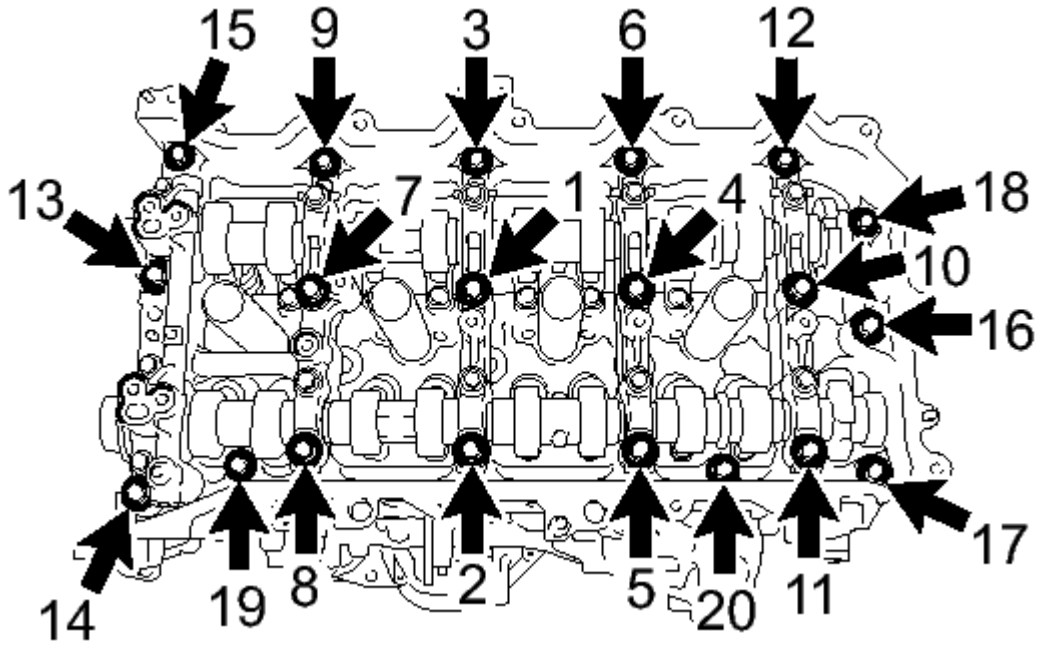


Fig. 136: Identifying Camshaft Housing Bolts With Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE:

- **Do not add engine oil for at least 2 hours after the installation.**
- **Do not start the engine for at least 2 hours after the installation.**
- **After installation, if the seal packing has seeped out, wipe it off.**

15. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY**
    a. Check the camshaft timing gear assembly position.

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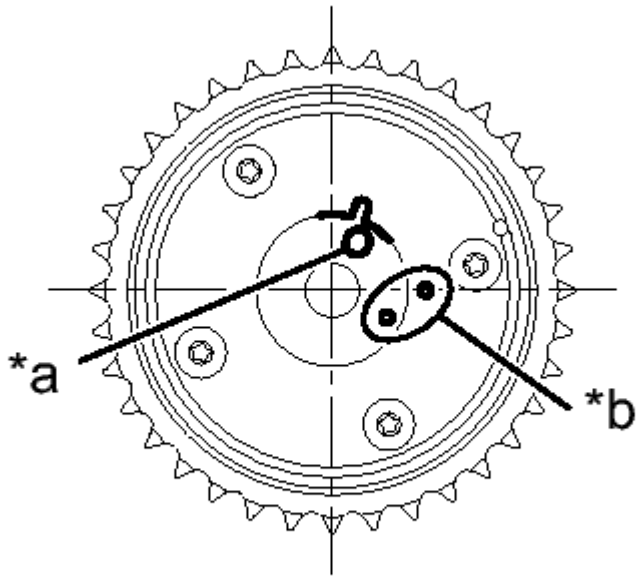


Fig. 137: Identifying Camshaft Timing Gear Knock Pin Hole & Alignment Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

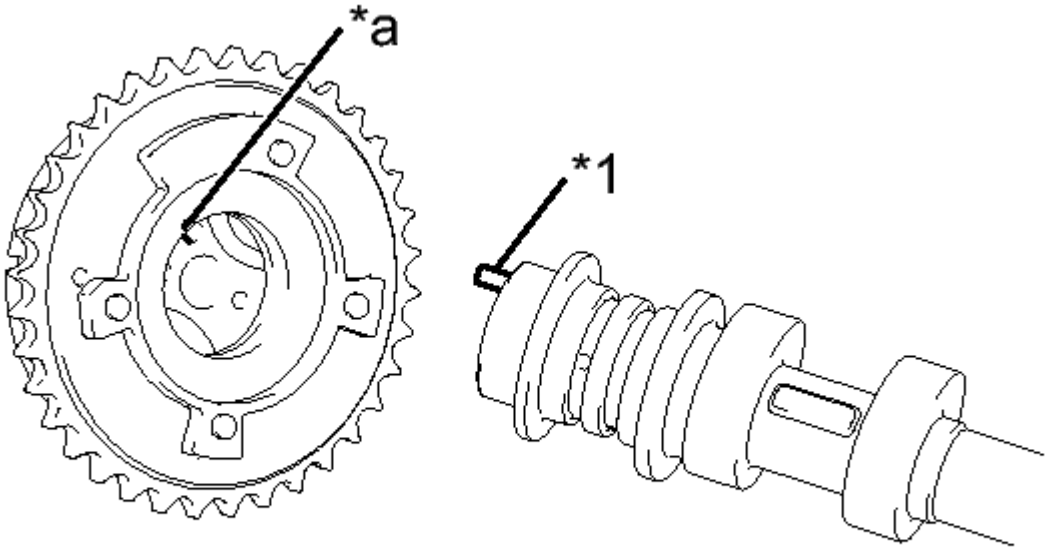
TEXT IN ILLUSTRATION

*a	Knock Pin Hole
*b	Alignment Mark

If the camshaft timing gear assembly is not set to the advanced position, release the lock pin and reset the camshaft timing gear assembly (Refer to the "Set Camshaft Timing Gear Assembly" procedures).

b. Align and fit the knock pin of the camshaft with the pin hole of the camshaft timing gear assembly.

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Fig. 138: Insert Knock Pin Of Camshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Pin Hole

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

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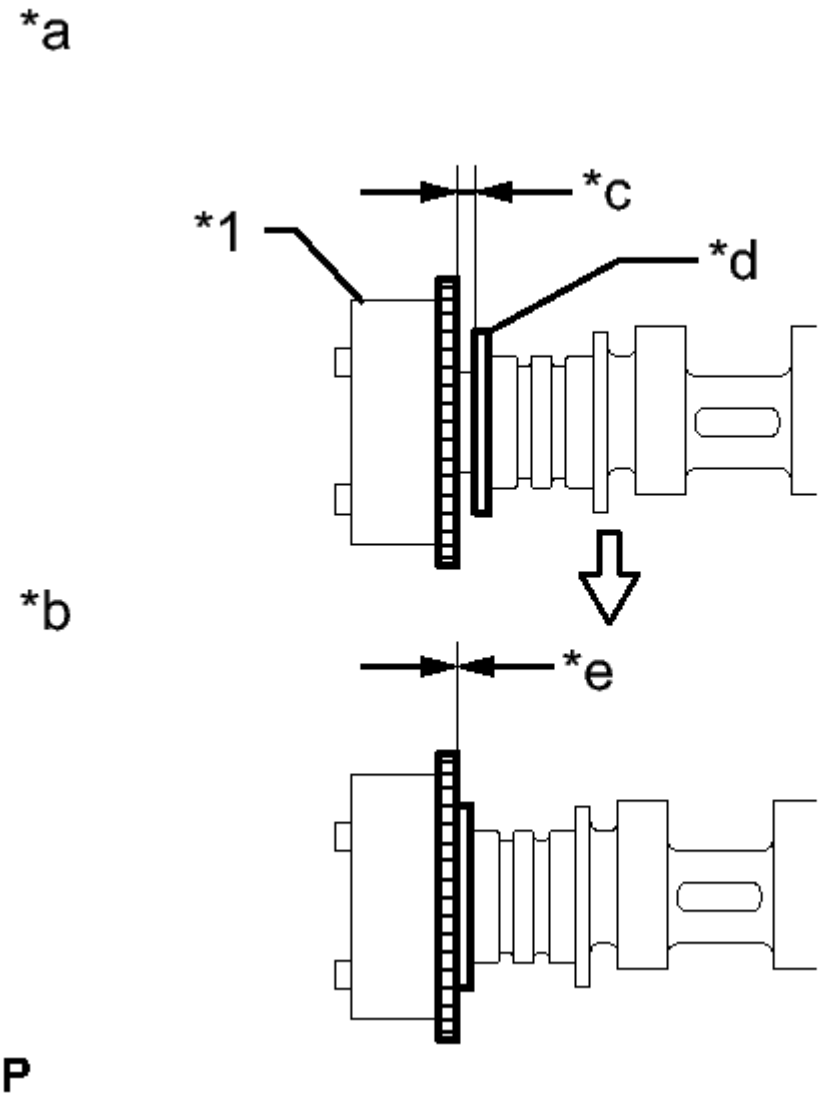


Fig. 139: Identifying No Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Gear Assembly
*a	Incorrect
*b	Correct
*c	Clearance
*d	Camshaft Flange
*e	No Clearance

d. Using a wrench to hold the hexagonal portion of the camshaft, install the bolt.

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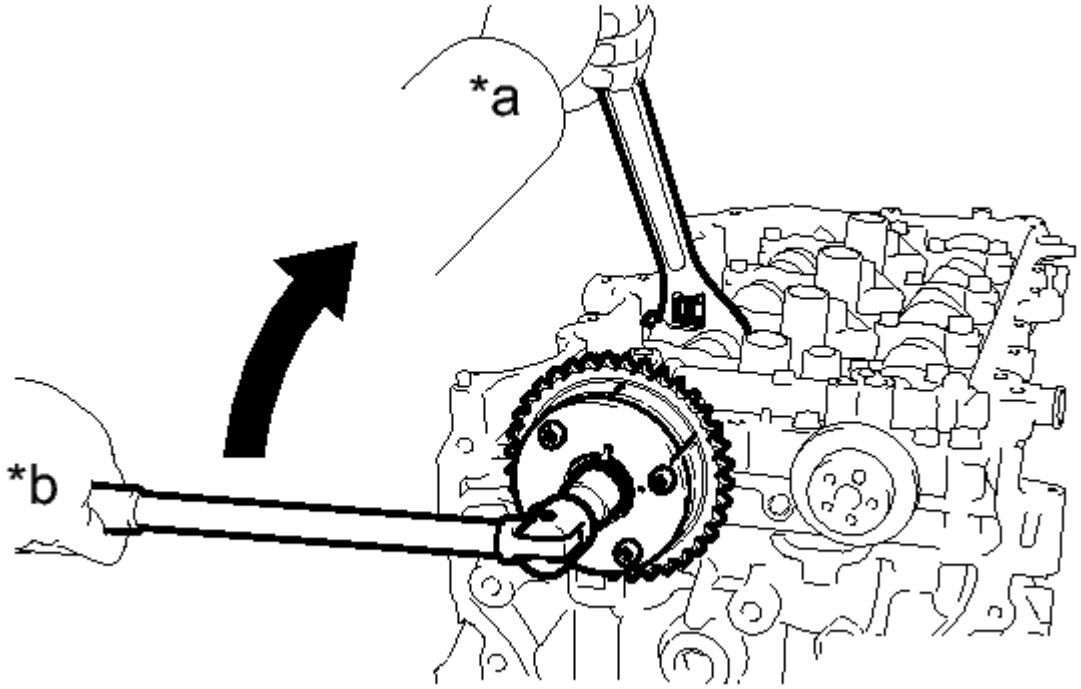


Fig. 140: Installing Camshaft Bolt Using Hexagonal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

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

NOTE:

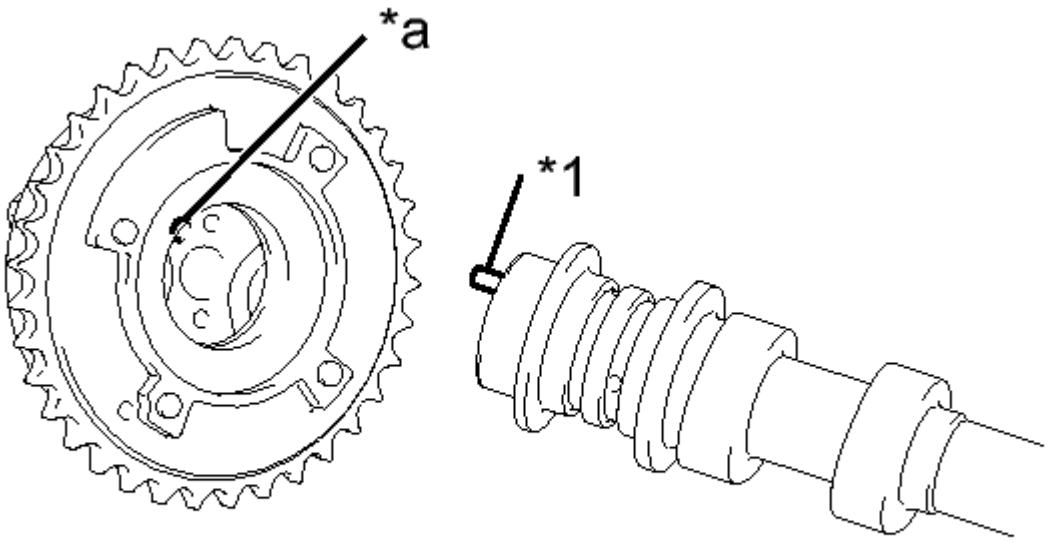
- **Be careful not to damage the cylinder head sub-assembly or spark plug tube with the wrench.**
- **Do not disassemble the camshaft timing gear assembly.**

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

16. **INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**
    a. Align and fit the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear assembly.

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Fig. 141: Identifying No. 2 Camshaft Knock Pin & Camshaft Timing Exhaust Gear Knock Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Knock Pin
*a	Pin Hole

b. Check that there is no clearance between the camshaft timing exhaust gear assembly and No. 2 camshaft flange.

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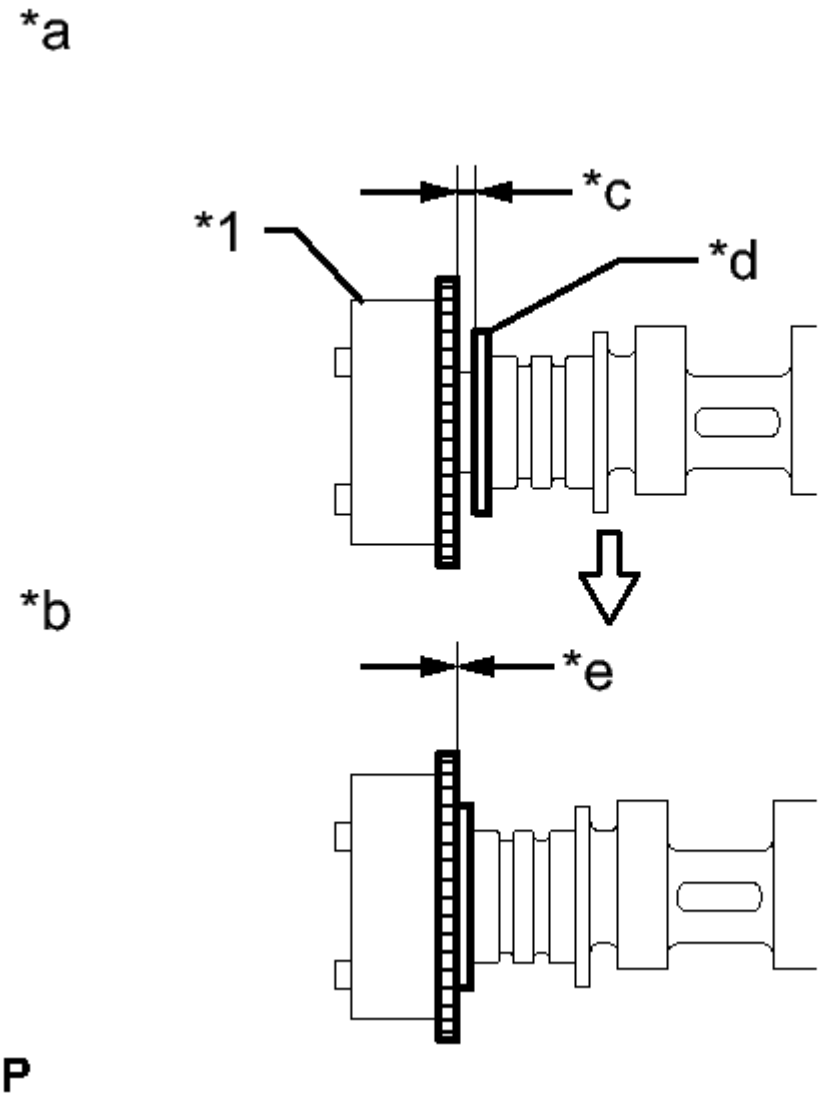


Fig. 142: Identifying No Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Exhaust Gear Assembly
*a	Incorrect
*b	Correct
*c	Clearance
*d	No. 2 Camshaft Flange
*e	No Clearance

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

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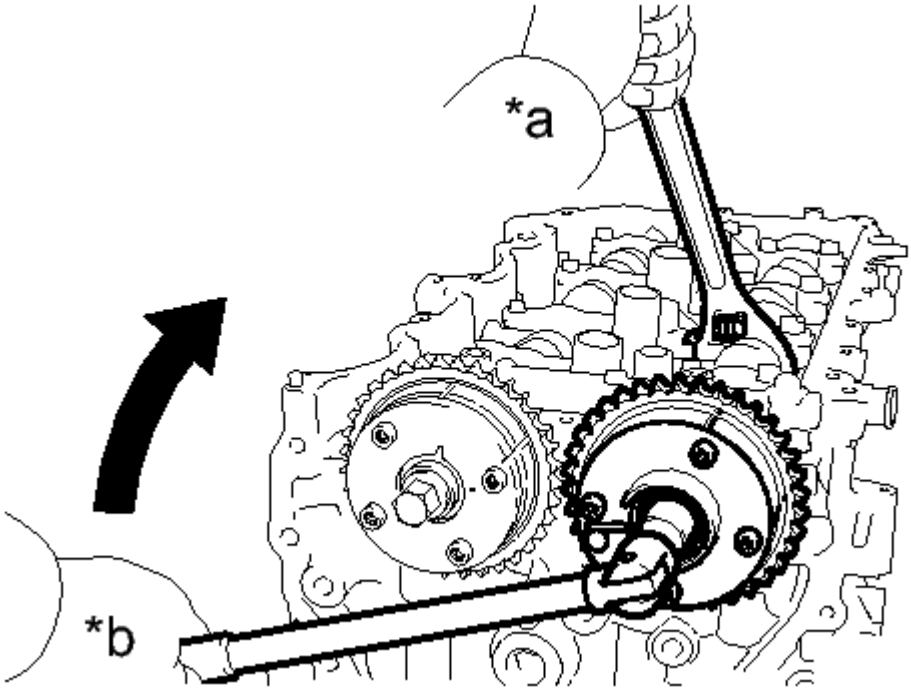


Fig. 143: Installing No. 2 Camshaft Bolt Using Hexagonal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

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

NOTE:

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

HINT:

Perform "Inspection After Repair" after replacing the camshaft timing exhaust gear assembly. Refer to **INITIALIZATION [08/2013 -]** .

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

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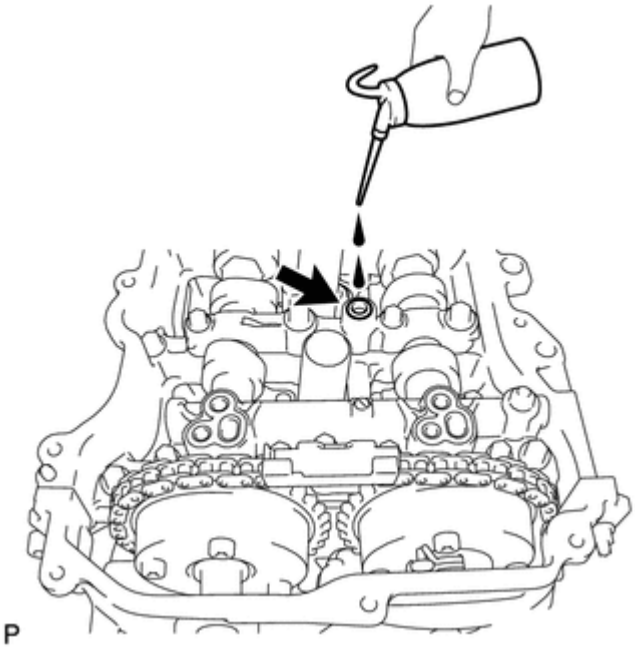


Fig. 144: View Of Adding Engine Oil Into Oil Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

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

18. **SET NO. 1 CYLINDER TO TDC/COMPRESSION**
    a. Temporarily install the crankshaft pulley bolt.

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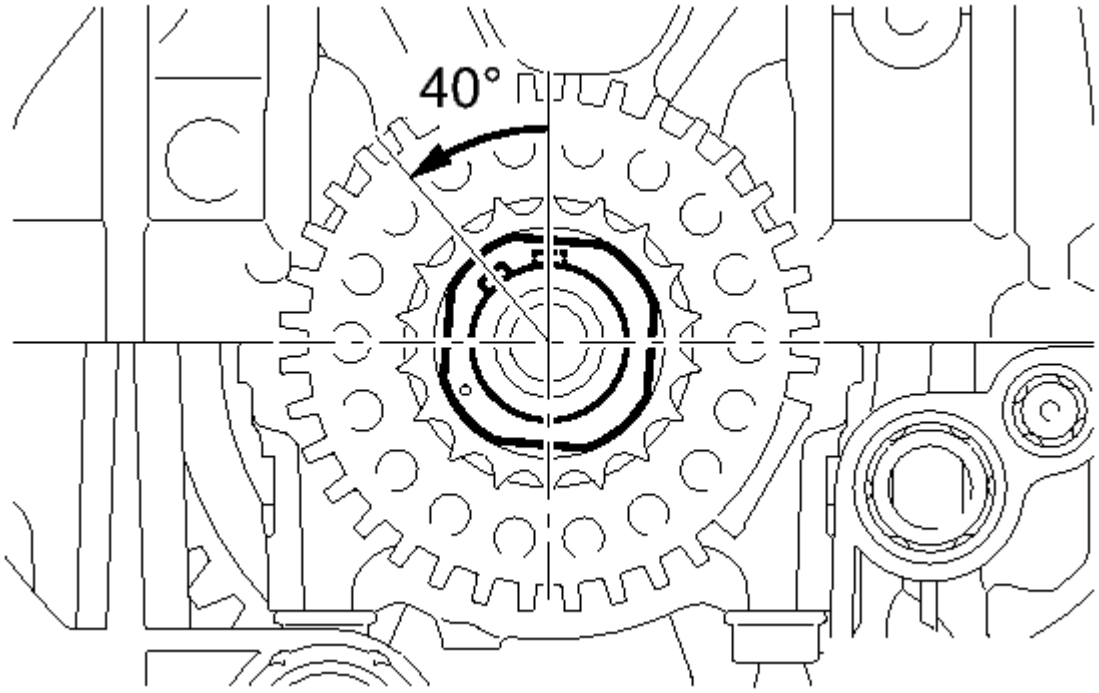


Fig. 145: Rotating Crankshaft 40Degrees Counterclockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Rotate the crankshaft 40° counterclockwise to position the crankshaft pulley key as shown in the illustration.
c. Check that the timing marks of the camshaft timing exhaust gear assembly and camshaft timing gear assembly are as shown in the illustration.

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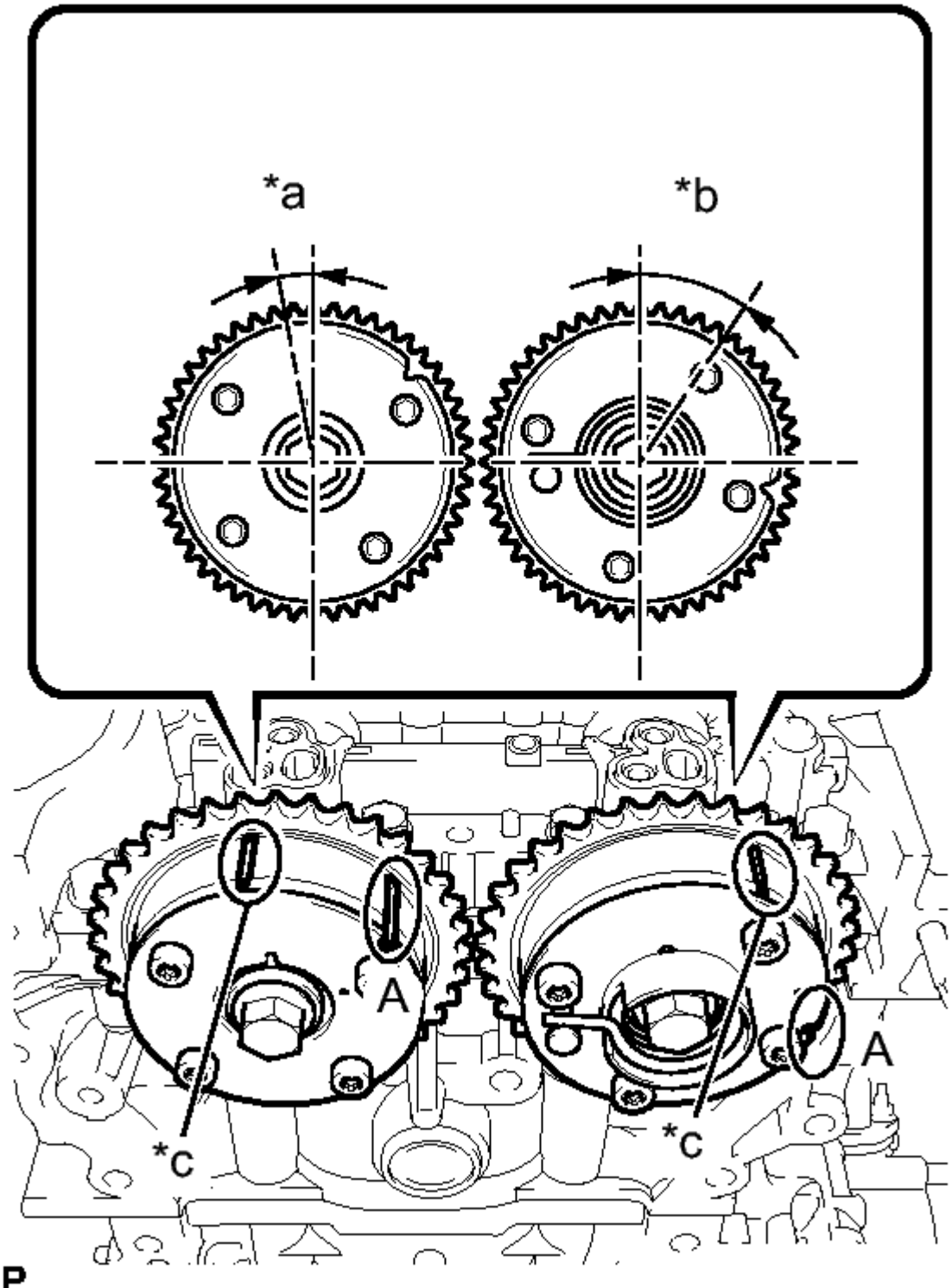


Fig. 146: Identifying Camshaft Timing Gears Timing Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Approximately 7°

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*b	Approximately 32°
*c	Timing Mark

HINT:

"A" is not a timing mark.

19. **INSTALL NO. 1 CHAIN VIBRATION DAMPER**
    a. Install the No. 1 chain vibration damper with the 2 bolts in the order shown in the illustration.

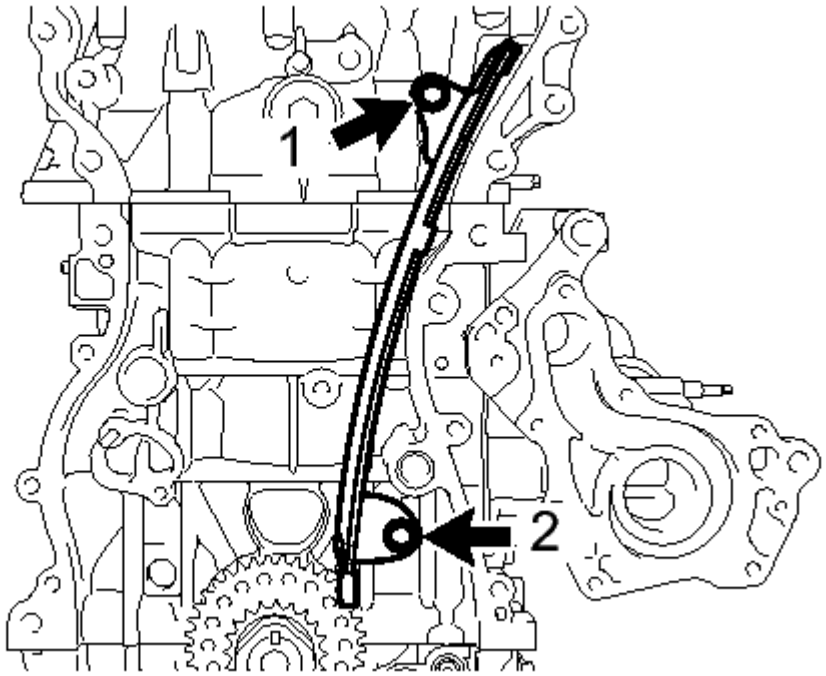


Fig. 147: Locating Chain Vibration Damper Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

20. **INSTALL CHAIN SUB-ASSEMBLY**
    a. Place the chain sub-assembly onto the camshaft timing exhaust gear assembly, camshaft timing gear assembly and crankshaft timing sprocket.

HINT:

- Make sure the mark plate of the chain sub-assembly faces away from the engine.
- It is not necessary to install the chain sub-assembly to the teeth of the camshaft timing exhaust gear assembly, camshaft timing gear assembly and crankshaft timing sprocket.

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

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exhaust gear assembly.

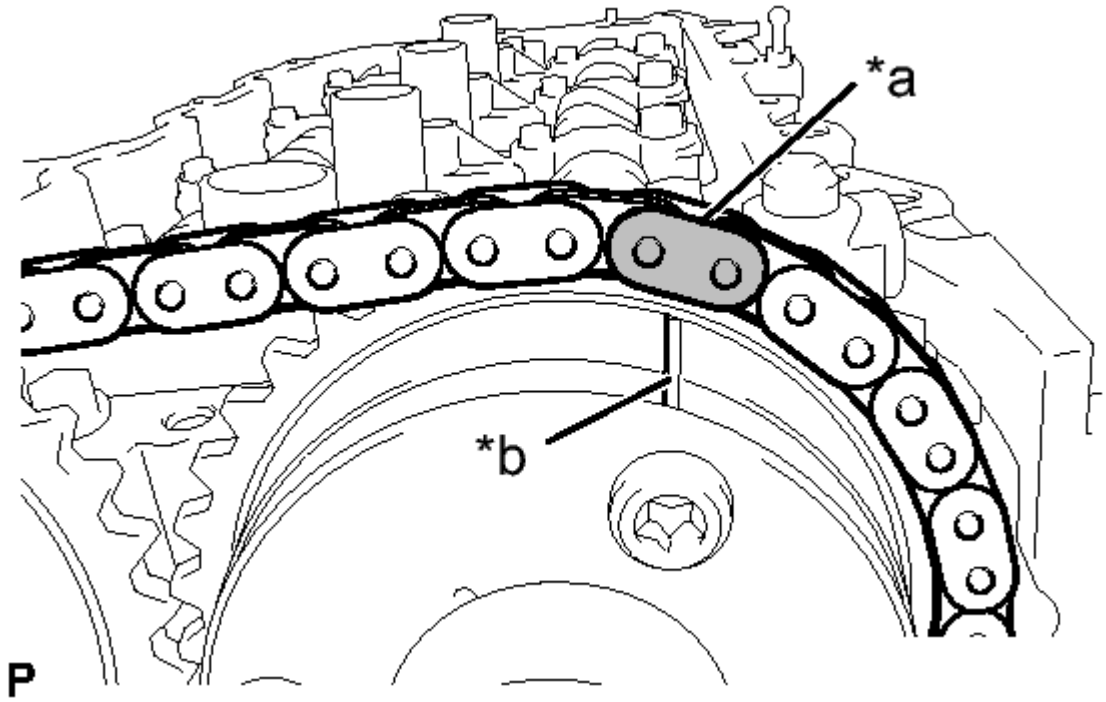


Fig. 148: Identifying Timing Chain & Camshaft Timing Exhaust Gear Matchmarks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Mark Plate
*b	Timing Mark

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

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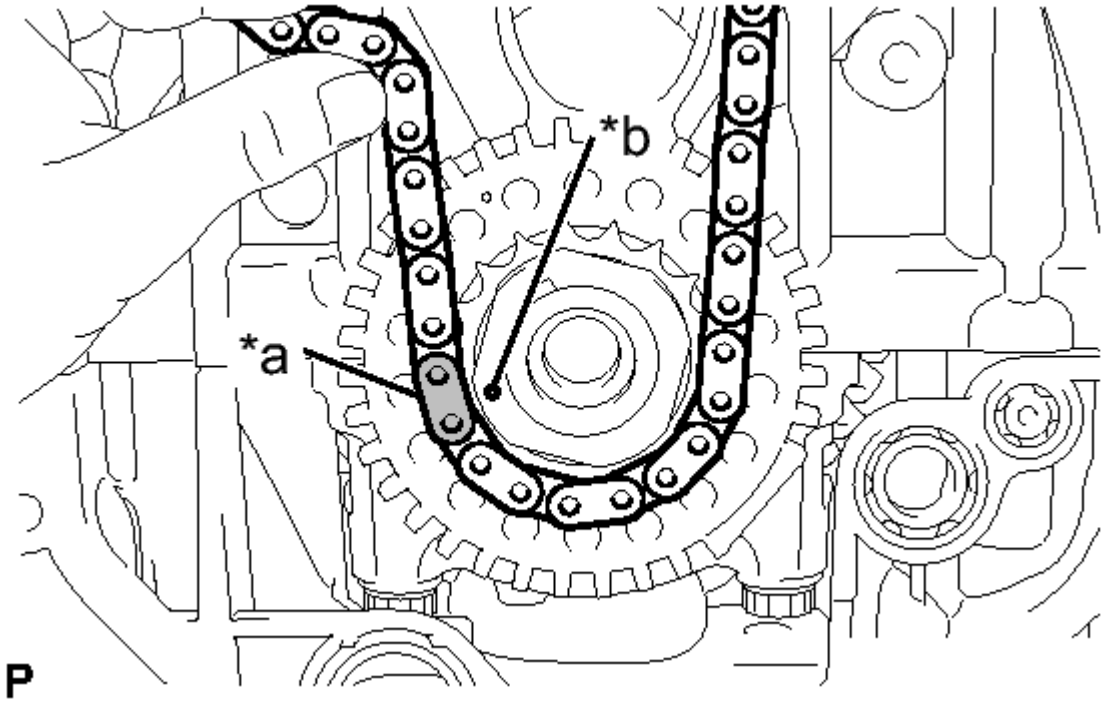


Fig. 149: Identifying Timing Chain & Crankshaft Timing Sprocket Matchmarks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Mark Plate
*b	Timing Mark

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

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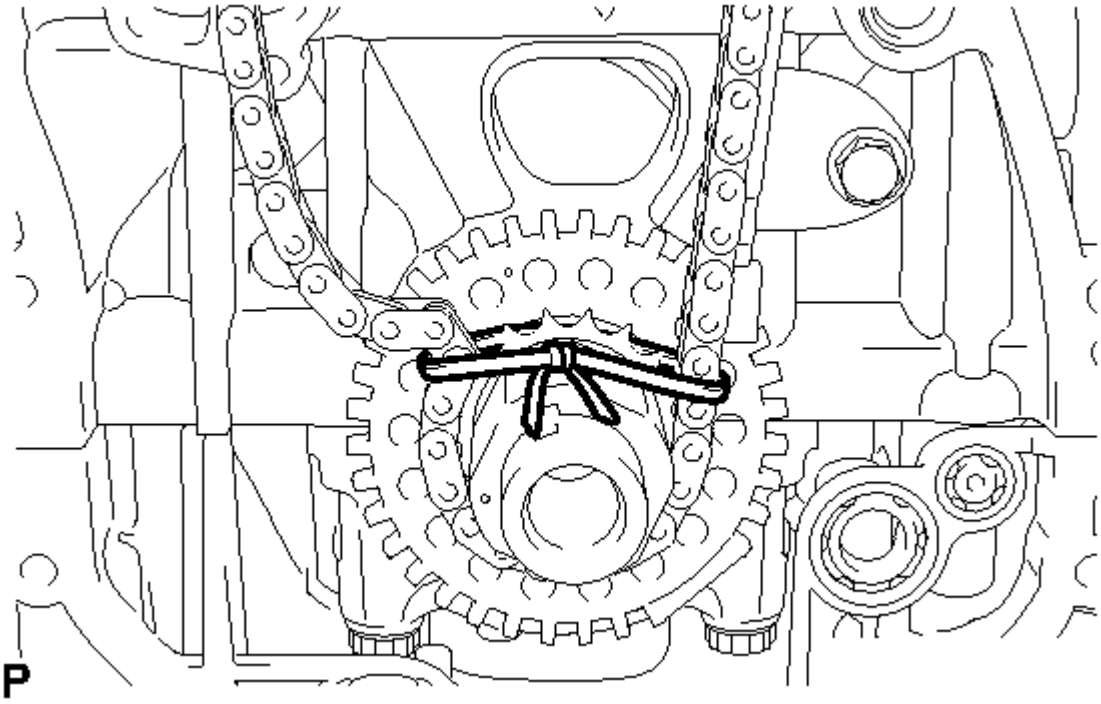


Fig. 150: Tying String Above Crankshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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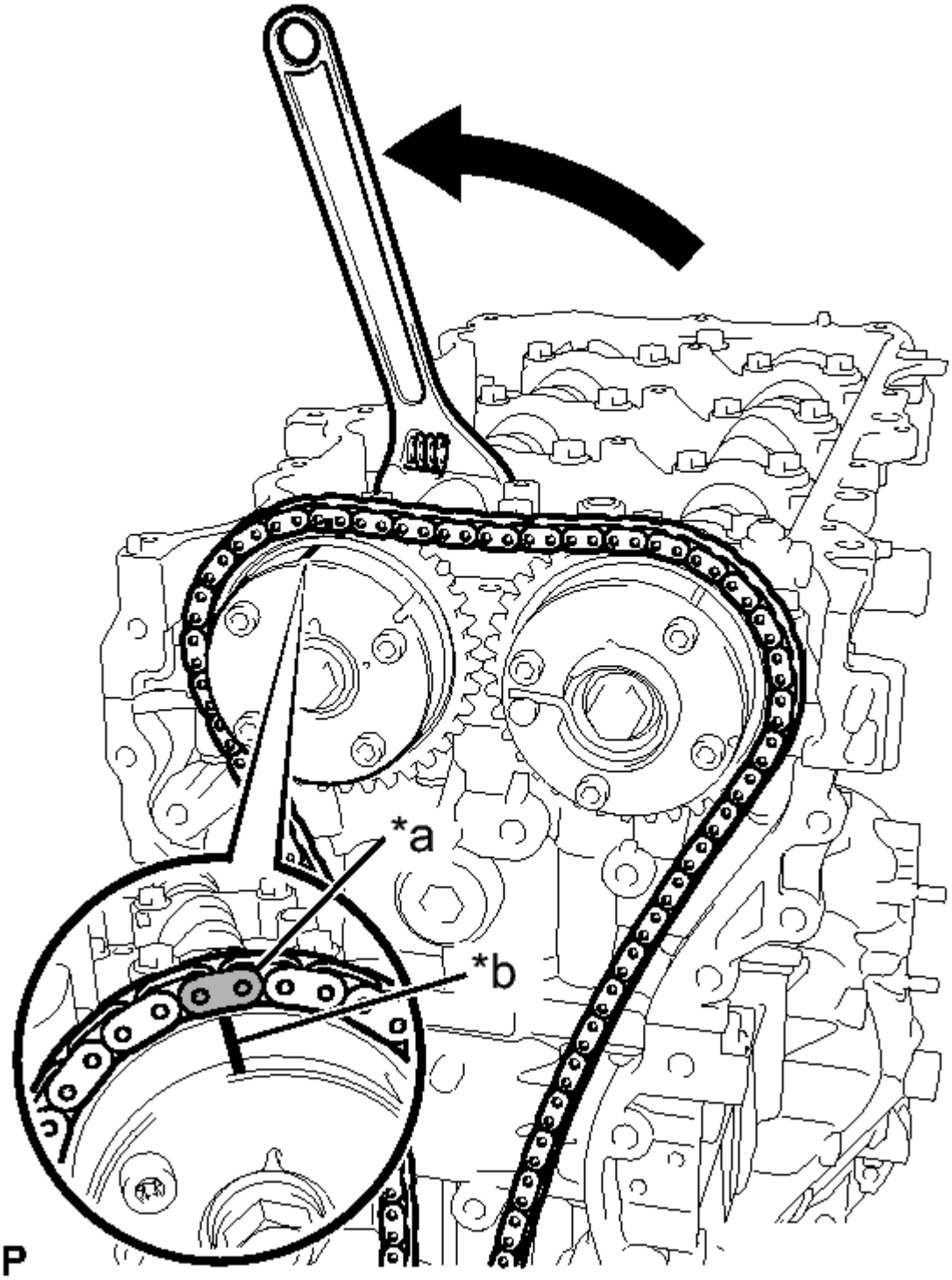


Fig. 151: Turning Intake Camshaft Counterclockwise & Aligning Camshaft Gear To Chain Matchmarks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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*a	Mark Plate
*b	Timing Mark

HINT:

Hold the camshaft in place with a wrench until the No. 1 chain tensioner assembly is installed.

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

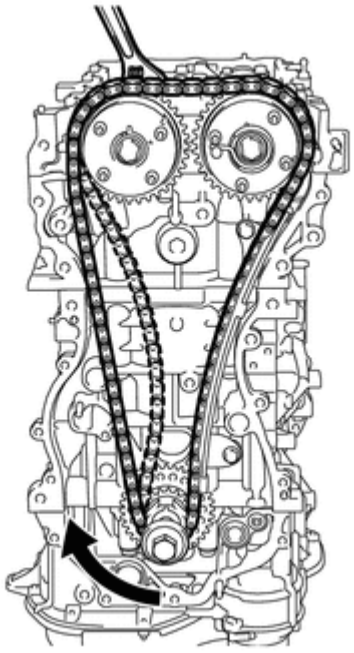


Fig. 152: View Of Rotating Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Make sure the chain sub-assembly is secure.

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

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

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

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

    b. Remove the pin from the stopper plate.
23. **INSTALL TIMING CHAIN GUIDE**

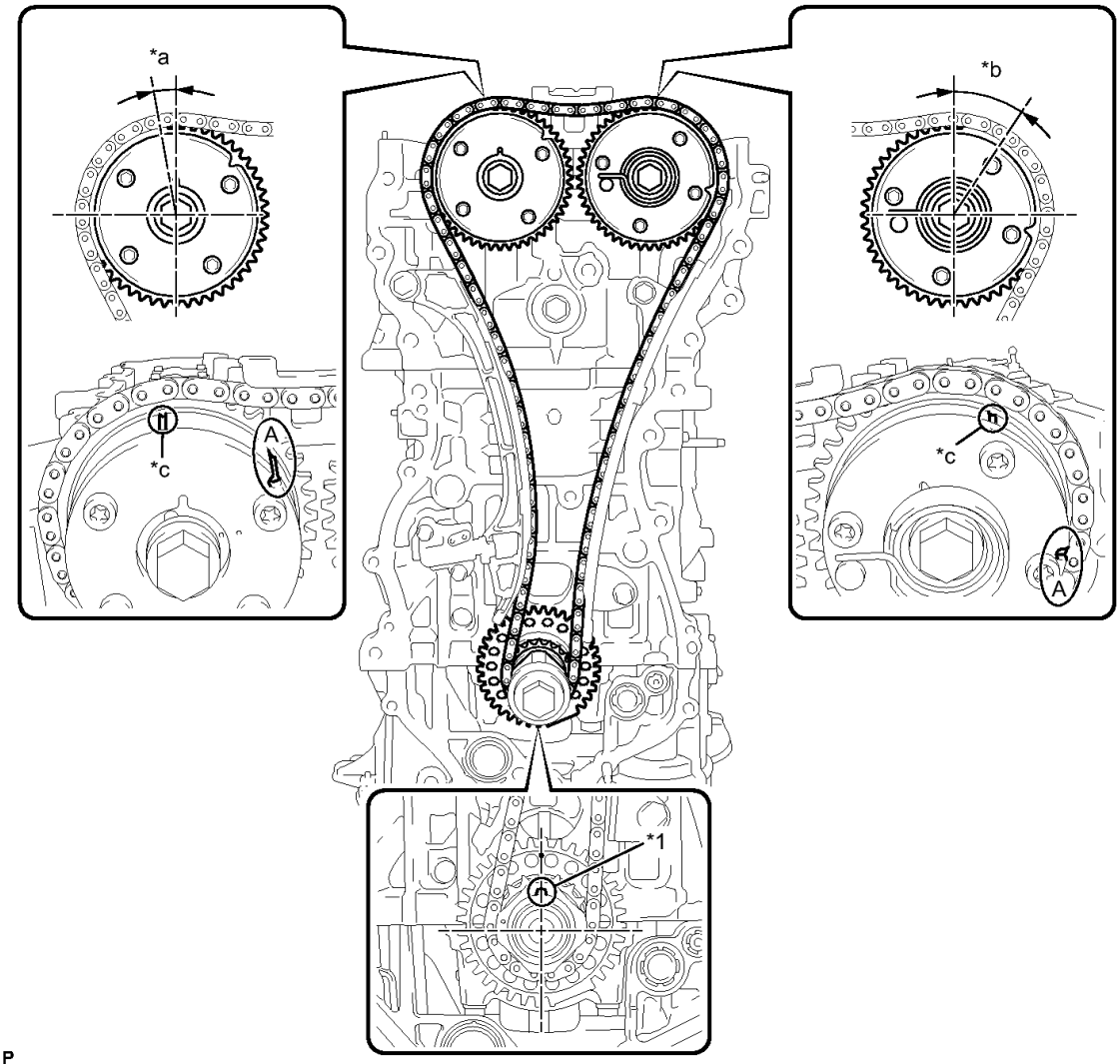
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a. Install the timing chain guide with the bolt.

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

24. **CHECK NO. 1 CYLINDER AT TDC/COMPRESSION**

a. Temporarily install the crankshaft pulley bolt.



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Fig. 153: Identifying Crankshaft & Camshaft Timing Gear Timing Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Crankshaft Pulley Key	-	-
*a	Approximately 7°	*b	Approximately 32°
*c	Timing Mark	-	-

b. Rotate the crankshaft clockwise and align the crankshaft pulley key as shown in the illustration.

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c. Check that the timing marks on the camshaft timing exhaust gear assembly and camshaft timing gear assembly are as shown in the illustration.

HINT:

"A" is not a timing mark.

d. Remove the crankshaft pulley bolt.

25. **INSTALL INTAKE MANIFOLD** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 1**
26. **CONNECT NO. 2 VENTILATION HOSE** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 5**
27. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 2**
28. **INSTALL VACUUM SWITCHING VALVE ASSEMBLY (for ACIS)** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 6**
29. **INSTALL THROTTLE WITH MOTOR BODY ASSEMBLY** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 7**
30. **INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 3**
31. **INSTALL EGR INLET EXHAUST MANIFOLD PLATE (for PZEV)** . Refer to **INSTALLATION [08/2013 -] - Step 6**
32. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (except PZEV)** . Refer to **INSTALLATION [08/2013 -] - Step 5**
33. **INSTALL NO. 2 MANIFOLD STAY** . Refer to **INSTALLATION [08/2013 -] - Step 7**
34. **INSTALL MANIFOLD STAY** . Refer to **INSTALLATION [08/2013 -] - Step 8**
35. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY**

    Refer to **INSTALLATION [08/2013 -] - Step 1**

FRONT CRANKSHAFT OIL SEAL

COMPONENTS [08/2013 -]

ILLUSTRATION

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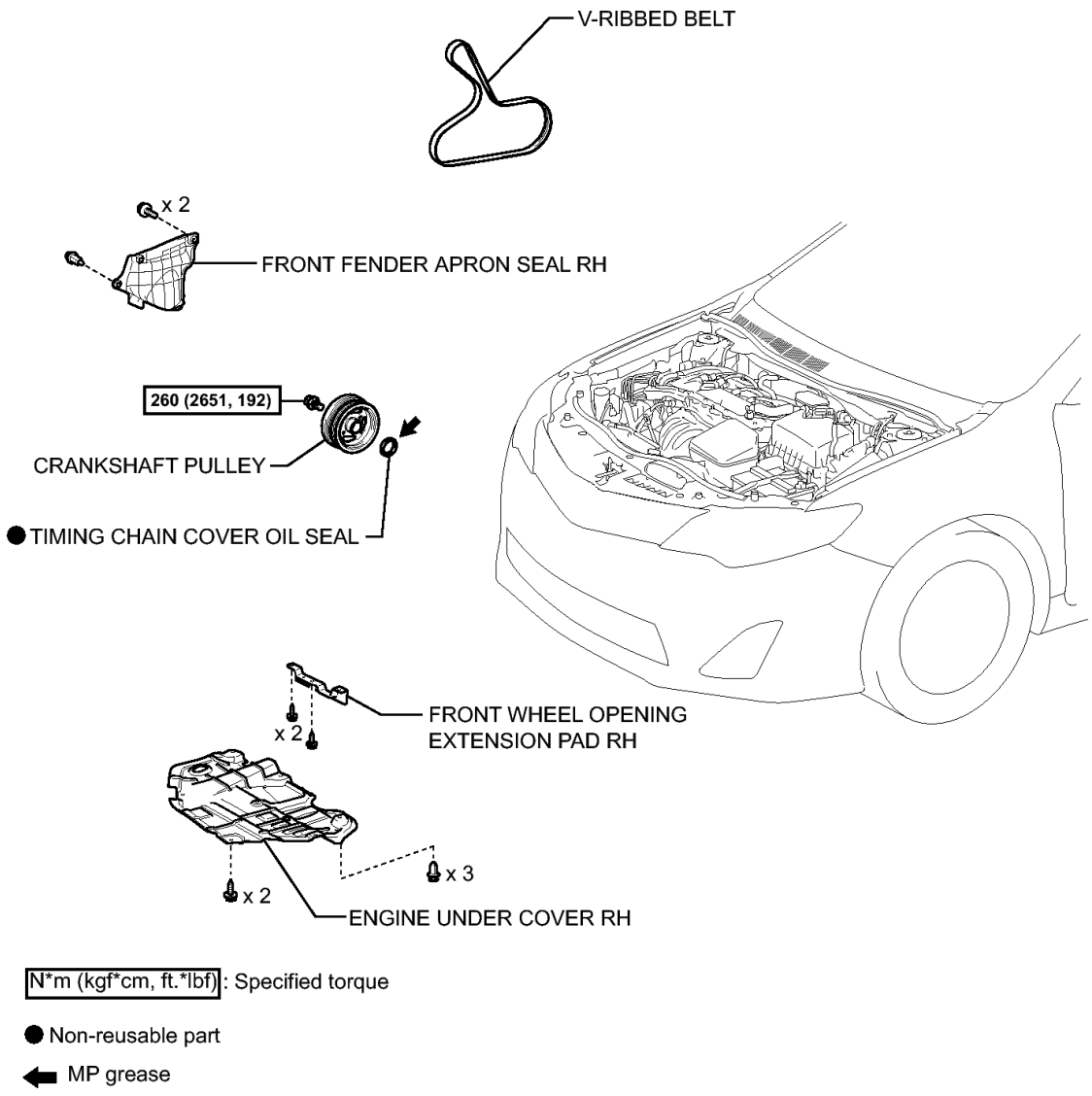


Fig. 154: Identifying Front Crankshaft Oil Seal Replacement Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL [08/2013 -]

REMOVAL [08/2013 -]

1. **REMOVE FRONT WHEEL RH**
2. **REMOVE FRONT WHEEL OPENING EXTENSION PAD RH**
3. **REMOVE ENGINE UNDER COVER RH**
4. **REMOVE FRONT FENDER APRON SEAL RH**
5. **REMOVE V-RIBBED BELT** See step 5

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6. **REMOVE CRANKSHAFT PULLEY**
   a. Using SST, hold the crankshaft pulley and loosen the pulley bolt. Further loosen the bolt until 2 or 3 threads are screwed into the crankshaft.

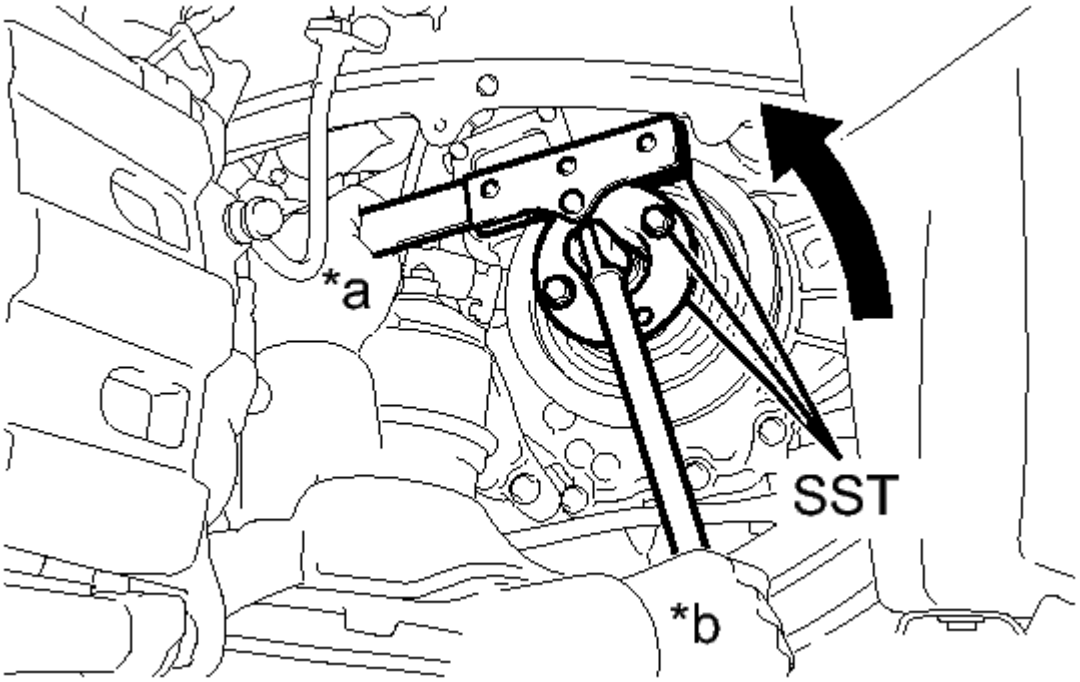


Fig. 155: Removing Crankshaft Pulley Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

- **SST: 09213-54015**
- **SST: 09330-00021**
- **SST: 91551-80650**

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

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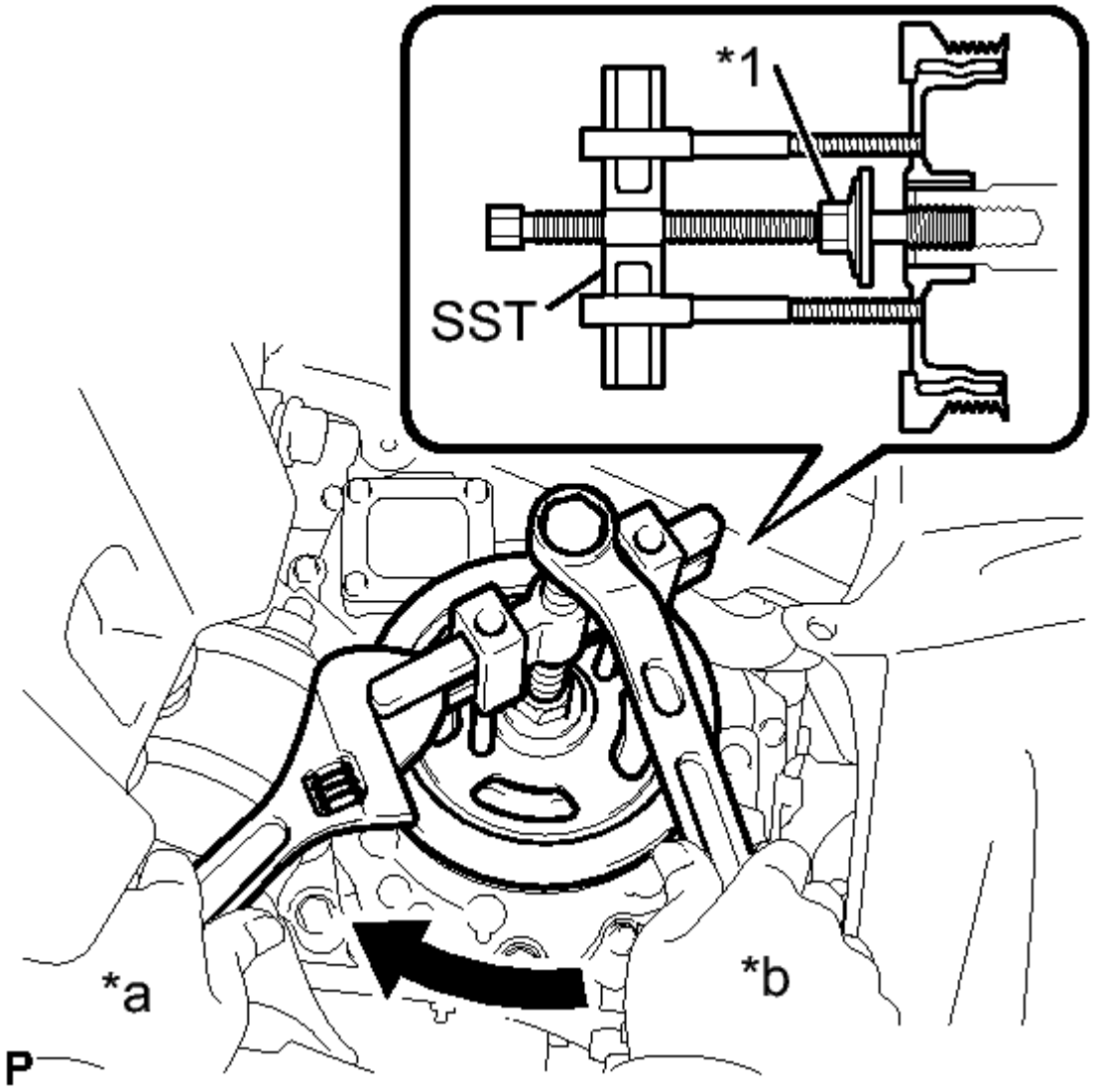


Fig. 156: Removing Crankshaft Pulley Using SST & Pulley Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Pulley Bolt
*a	Hold
*b	Turn

- **SST: 09950-50013**
  09951-05010
  09952-05010
  09953-05020
  09954-05011

HINT:

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Apply a lubricant to the threads and end of SST.

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

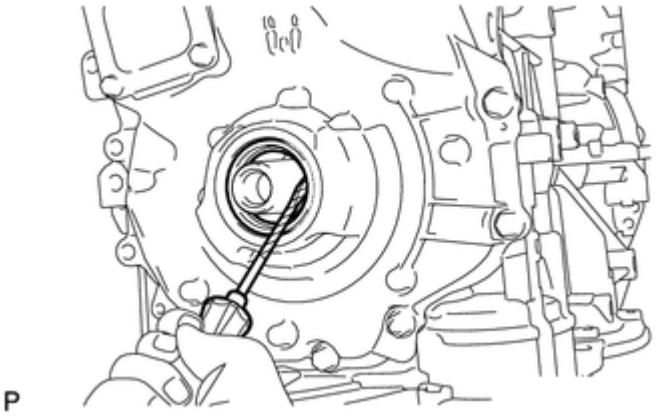


Fig. 157: View Of Prying Out Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Tape the screwdriver tip before use.

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

INSTALLATION [08/2013 -]

INSTALLATION [08/2013 -]

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

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

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

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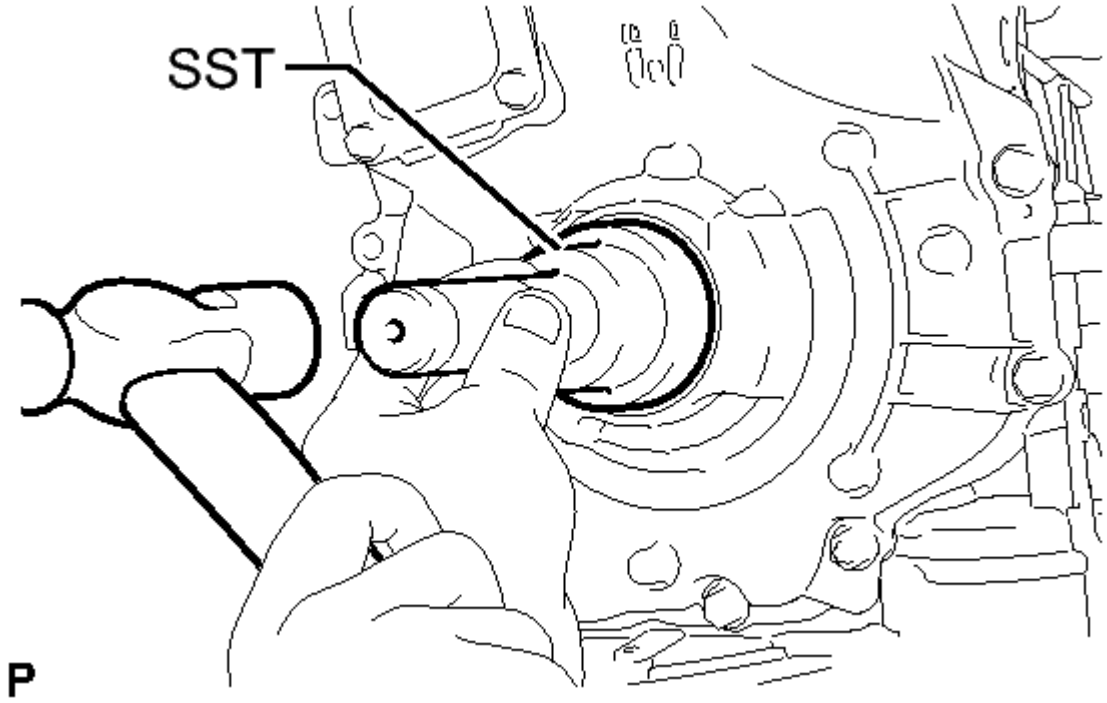


Fig. 158: View Of Installing Oil Seal Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09223-22010**

NOTE:

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

2. **INSTALL CRANKSHAFT PULLEY**
   a. Align the pulley set key with the key groove of the crankshaft pulley.
   b. Using SST, hold the crankshaft pulley and install the pulley bolt.

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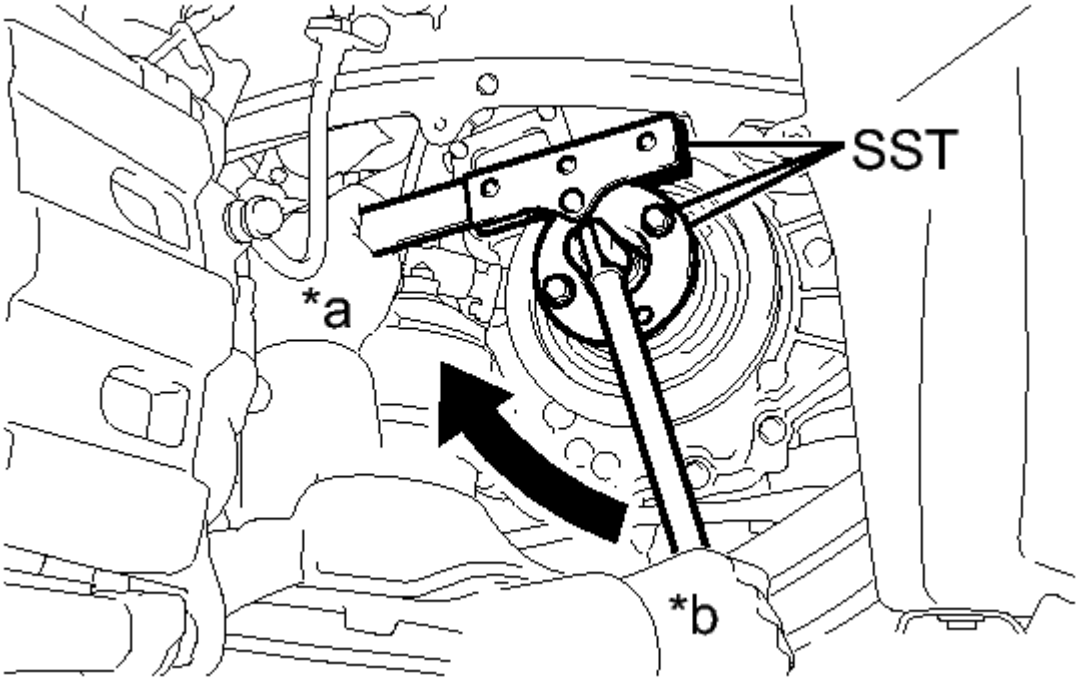


Fig. 159: Installing Crankshaft Pulley Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

- **SST: 09213-54015**
- **SST: 09330-00021**
- **SST: 91551-80650**

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

3. **INSTALL V-RIBBED BELT** See step 1
4. **INSTALL FRONT FENDER APRON SEAL RH**
5. **INSTALL ENGINE UNDER COVER RH**
6. **INSTALL FRONT WHEEL OPENING EXTENSION PAD RH**
7. **INSTALL FRONT WHEEL RH**

Torque: 103 N*m (1049 kgf*cm, 76 ft.*lbf)

REAR CRANKSHAFT OIL SEAL

COMPONENTS [08/2013 -]

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ILLUSTRATION

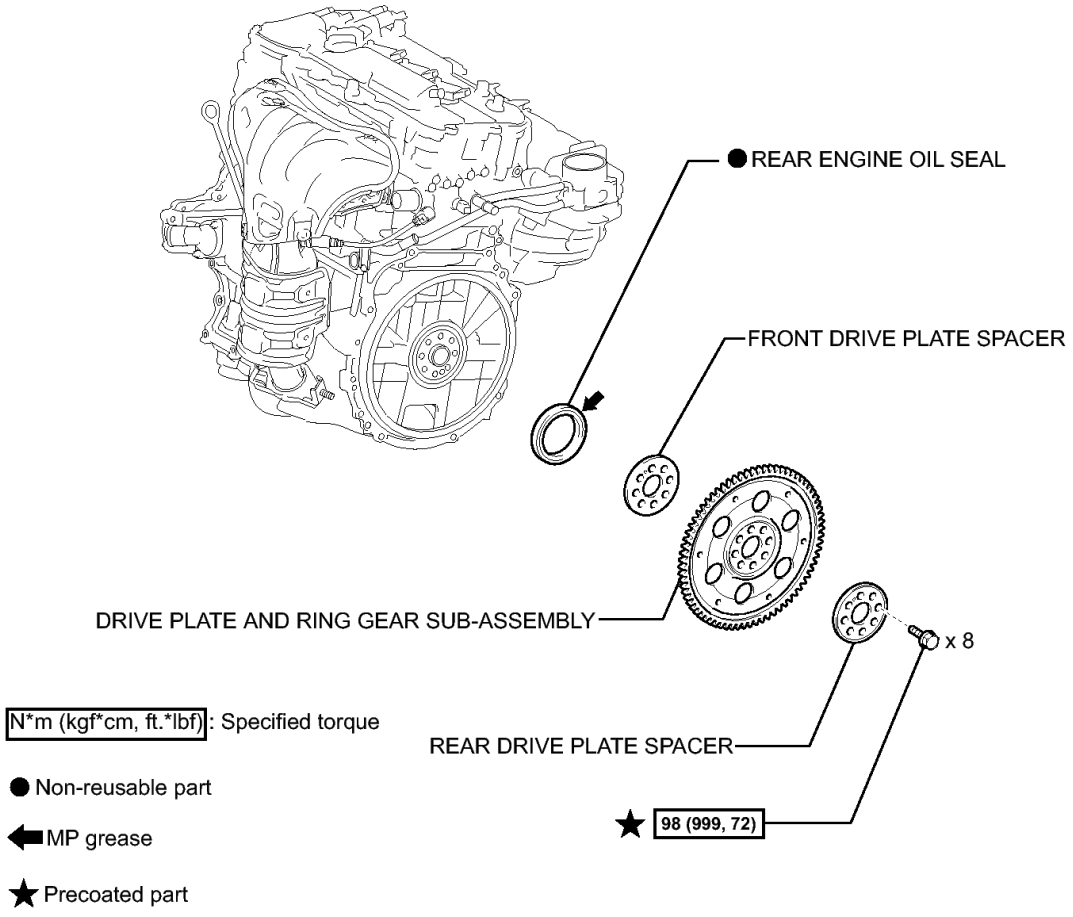


Fig. 160: Identifying Rear Crankshaft Oil Seal Replacement Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL [08/2013 -]

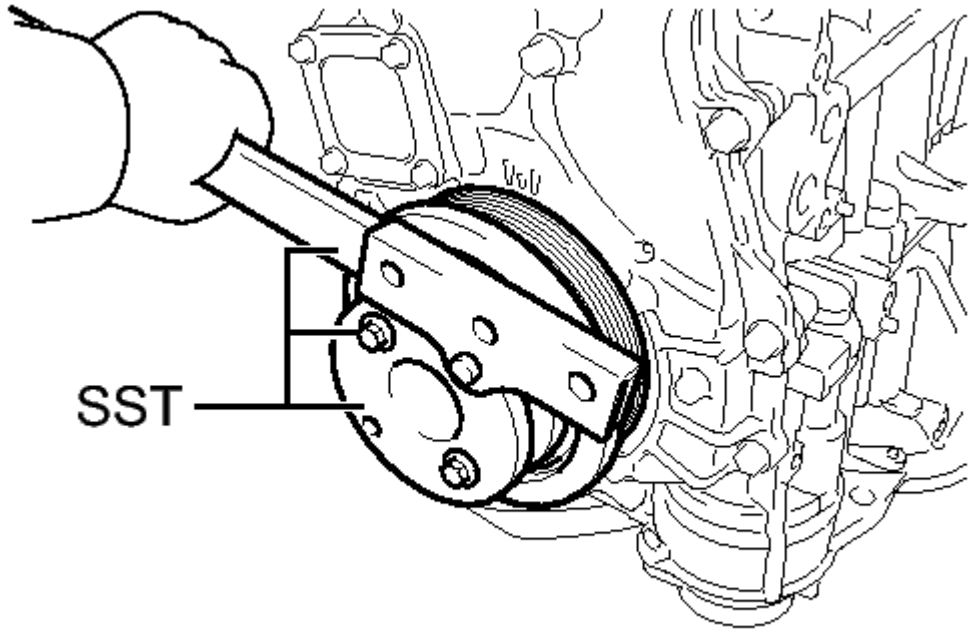
REMOVAL [08/2013 -]

1. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY**

   Refer to **REMOVAL [08/2013 -]**

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

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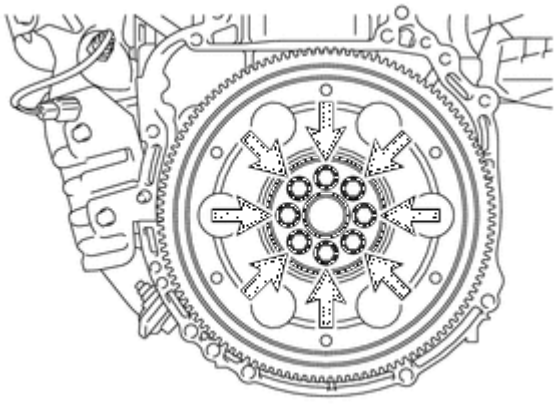


P

Fig. 161: Identifying SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09213-54015**
- **SST: 09330-00021**
- **SST: 91551-80650**

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



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Fig. 162: Locating Drive Plate Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **REMOVE REAR ENGINE OIL SEAL**
   a. Using a knife, cut off the lip of the oil seal.

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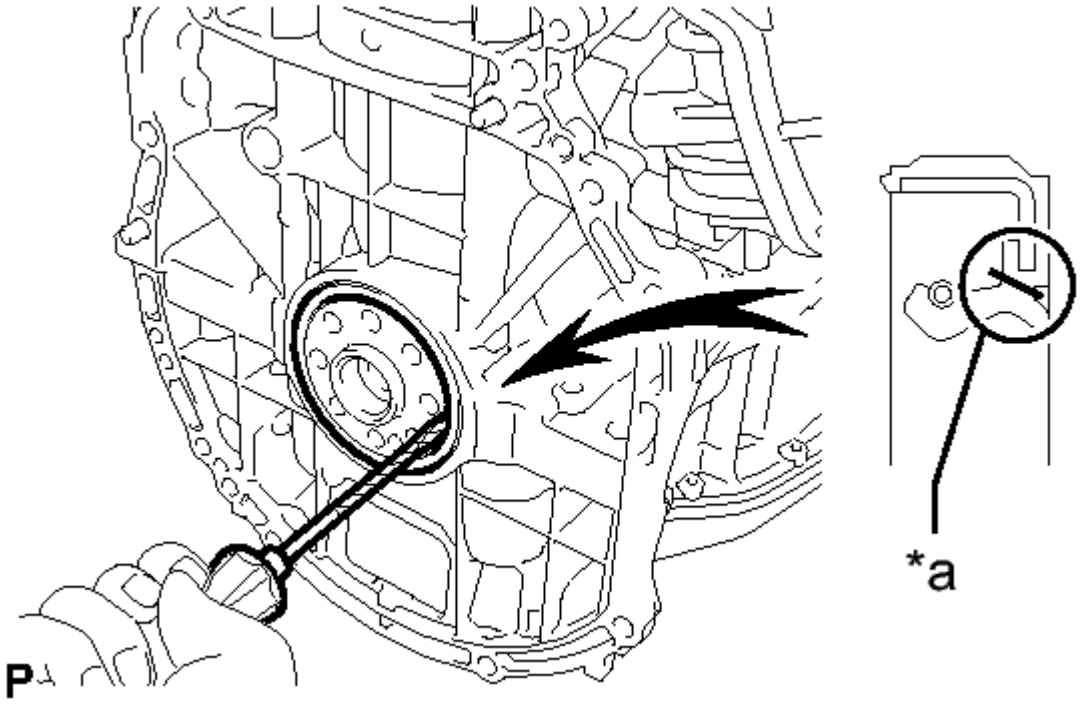


Fig. 163: Removing Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Cut Position

b. Using a screwdriver, pry out the oil seal.

HINT:

Tape the screwdriver tip before use.

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

INSTALLATION [08/2013 -]

INSTALLATION [08/2013 -]

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

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

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

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block and crankcase.

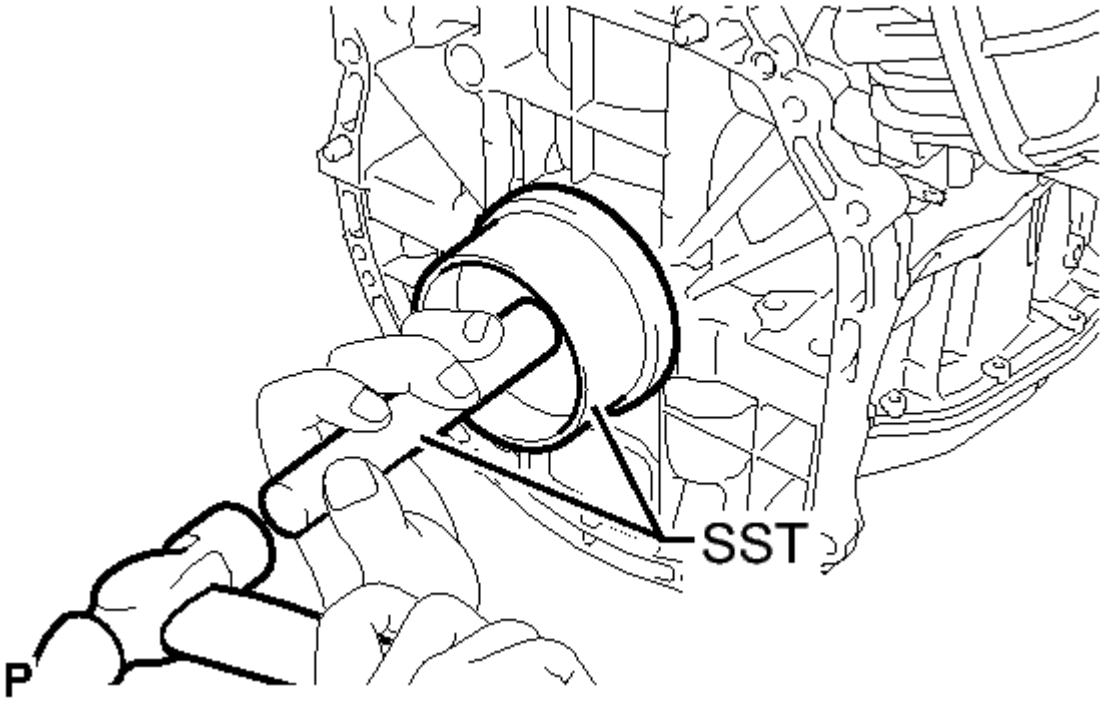


Fig. 164: View Of Installing Rear Engine Oil Seal Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

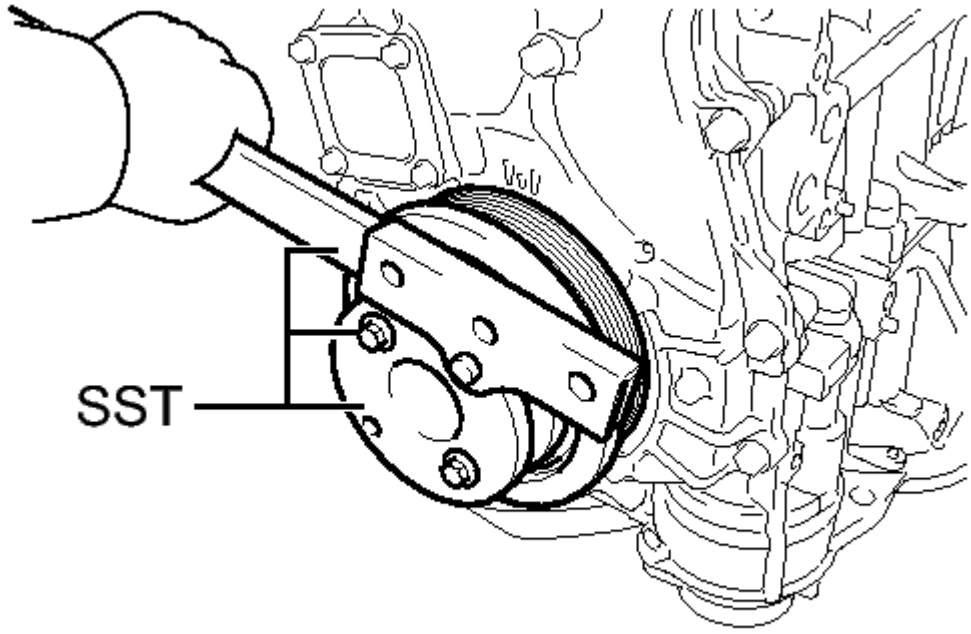
- **SST: 09223-15030**
- **SST: 09950-70010**
  09951-07150

NOTE:

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

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

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Fig. 165: Identifying SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09213-54015**
- **SST: 91551-80650**
- **SST: 09330-00021**

b. Clean the bolts and their installation holes.
c. Install the front drive plate spacer.

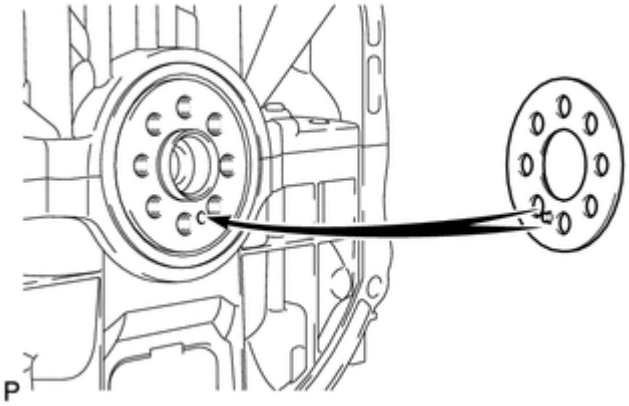


Fig. 166: View Of Aligning Pin Of Front Drive Plate Spacer With Pin Hole Of Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

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

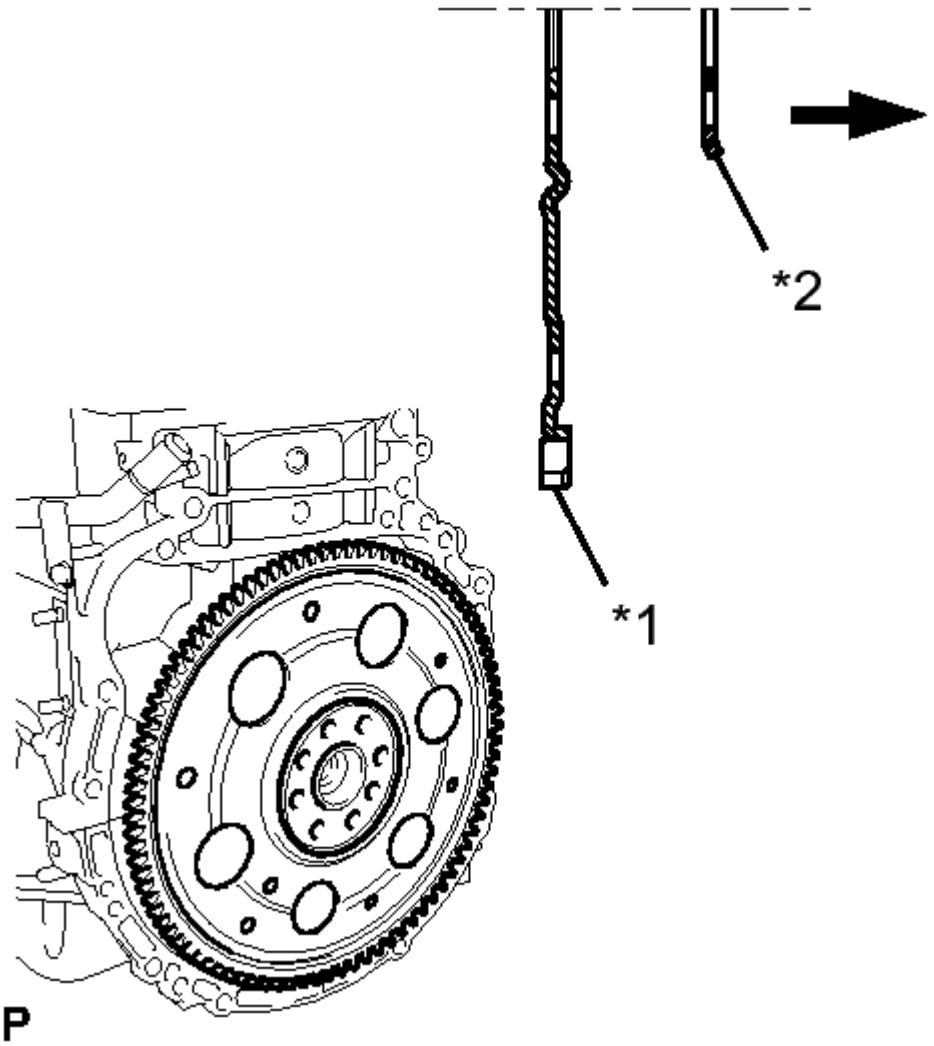
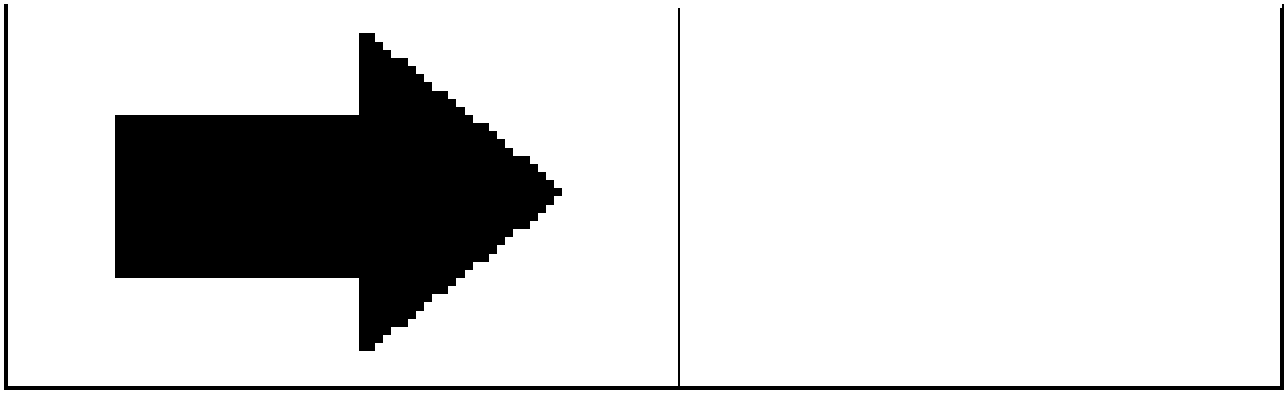


Fig. 167: Identifying Drive Plate And Rear Drive Plate Spacer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Drive Plate
*2	Rear Drive Plate Spacer
	Transaxle Side

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

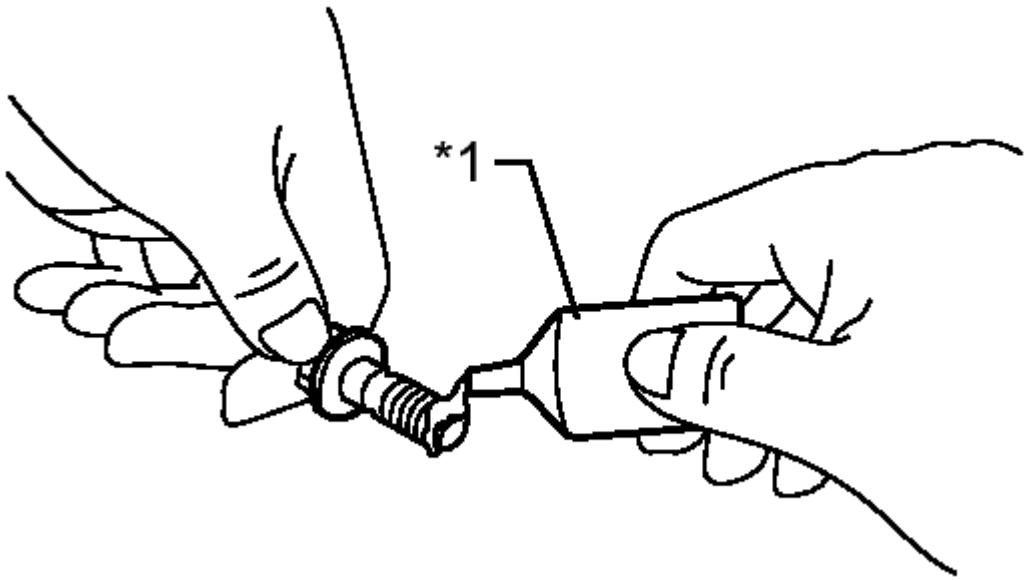


Fig. 168: View Of Applying Adhesive To Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

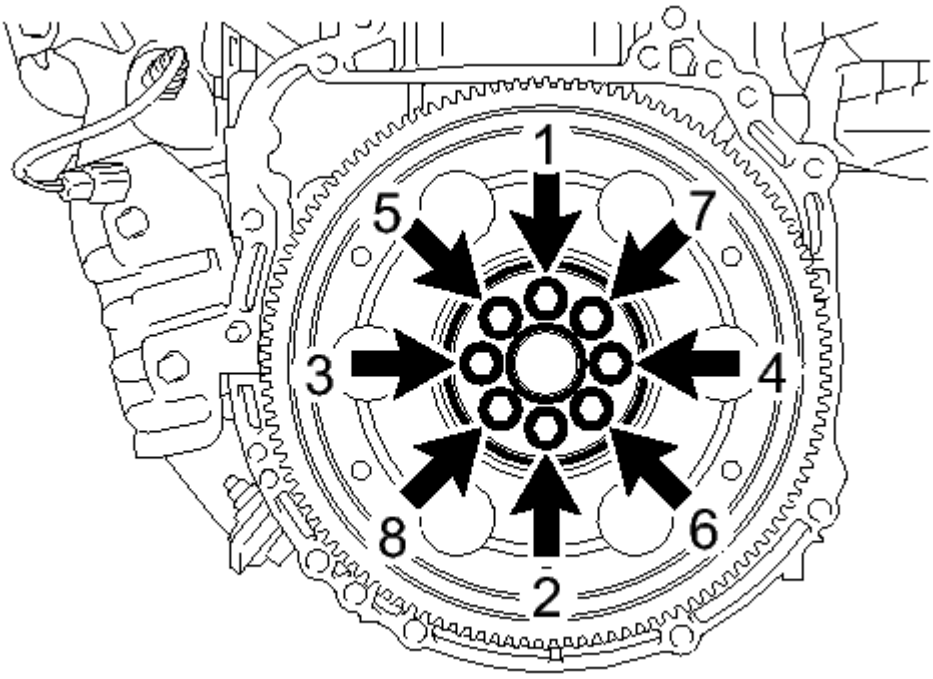
*1	Adhesive

Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

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

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Fig. 169: Identifying Drive Plate Bolt Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

NOTE: Do not start the engine for at least an hour after installing the drive plate.

3. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY**

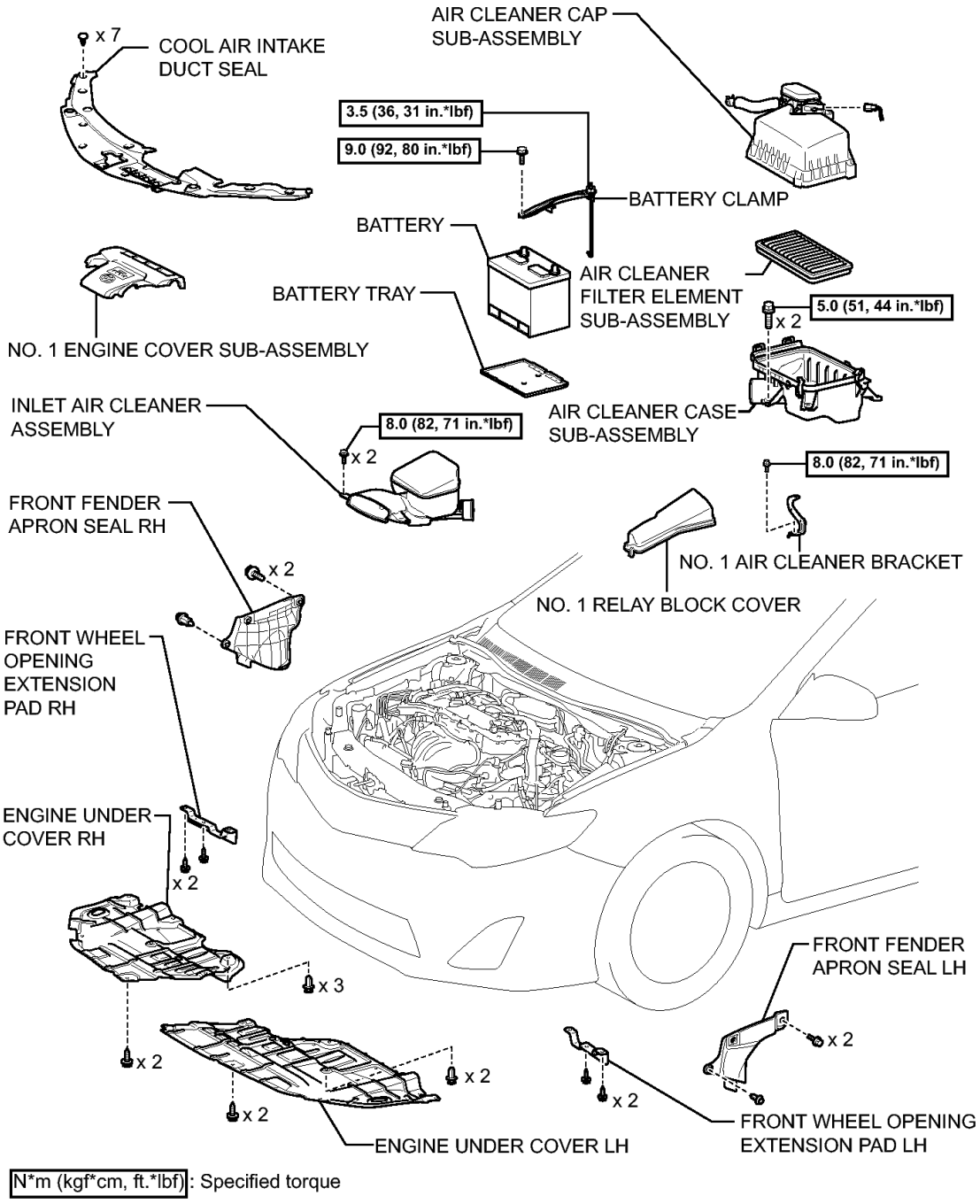
Refer to **INSTALLATION [08/2013 -]**

ENGINE ASSEMBLY

COMPONENTS [08/2013 -]

ILLUSTRATION

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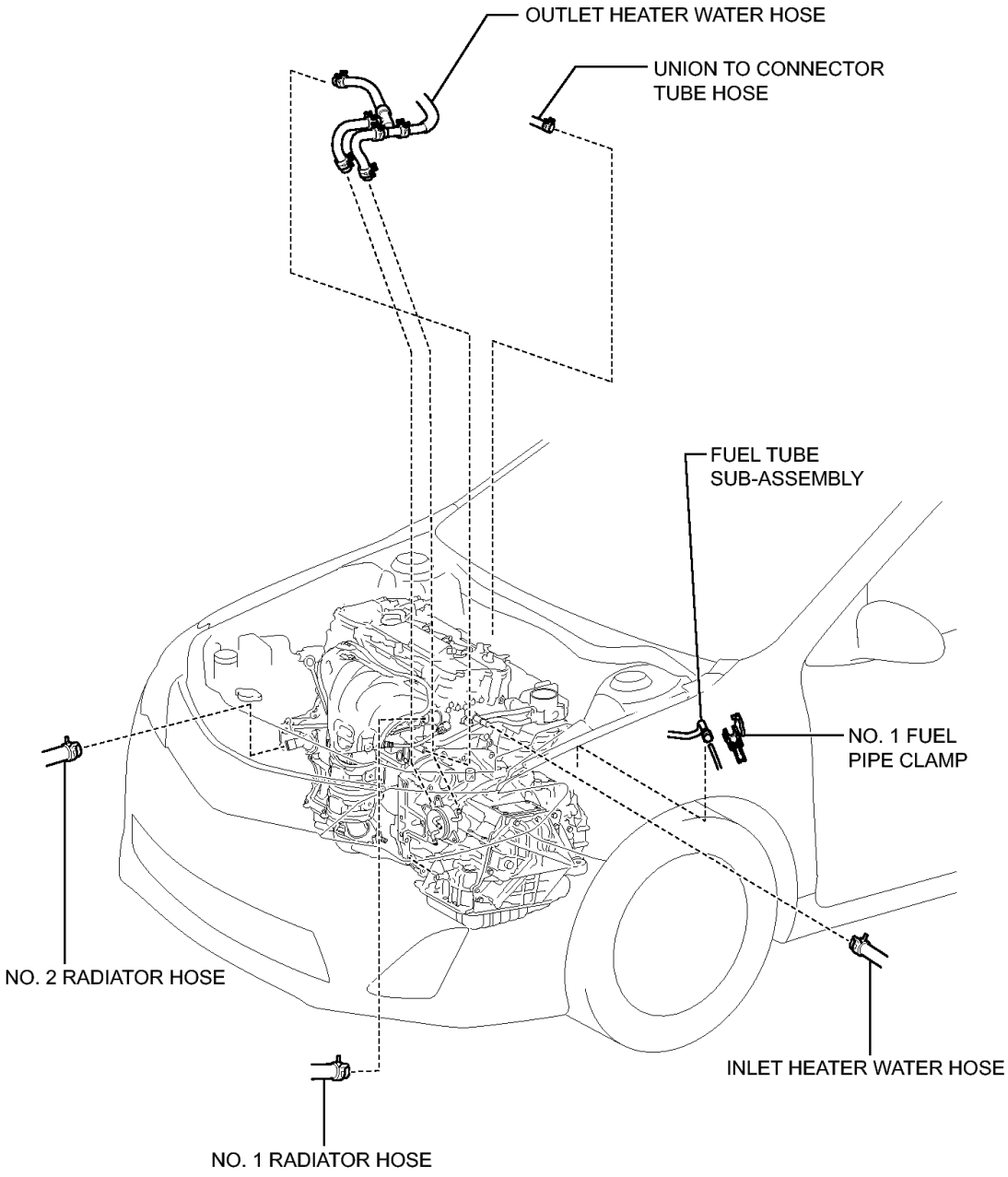


c

Fig. 170: Identifying Engine Assembly Replacement Components With Torque Specifications (1 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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c

Fig. 171: Identifying Engine Assembly Replacement Components With Torque Specifications (2 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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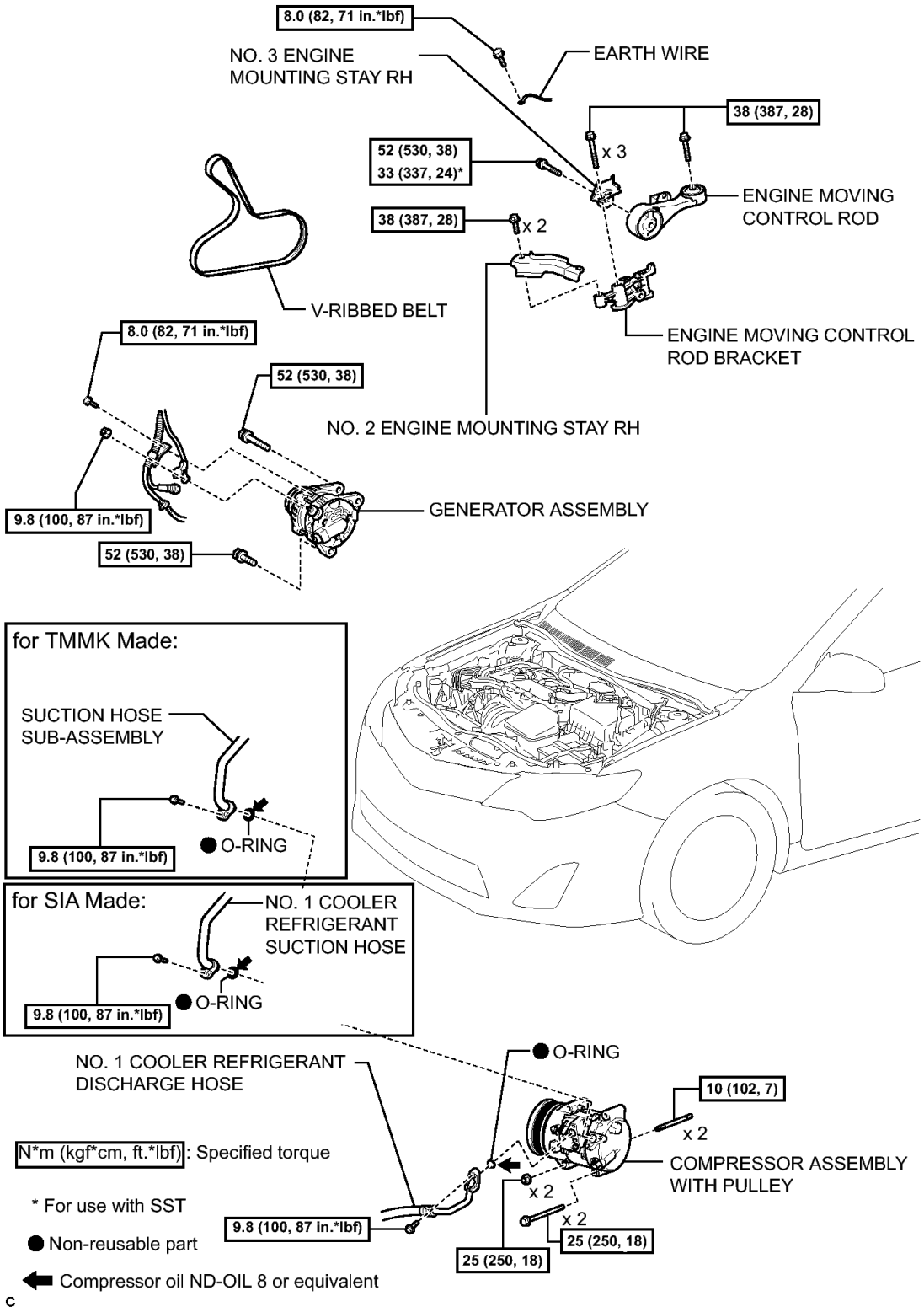


Fig. 172: Identifying Engine Assembly Replacement Components With Torque Specifications (3 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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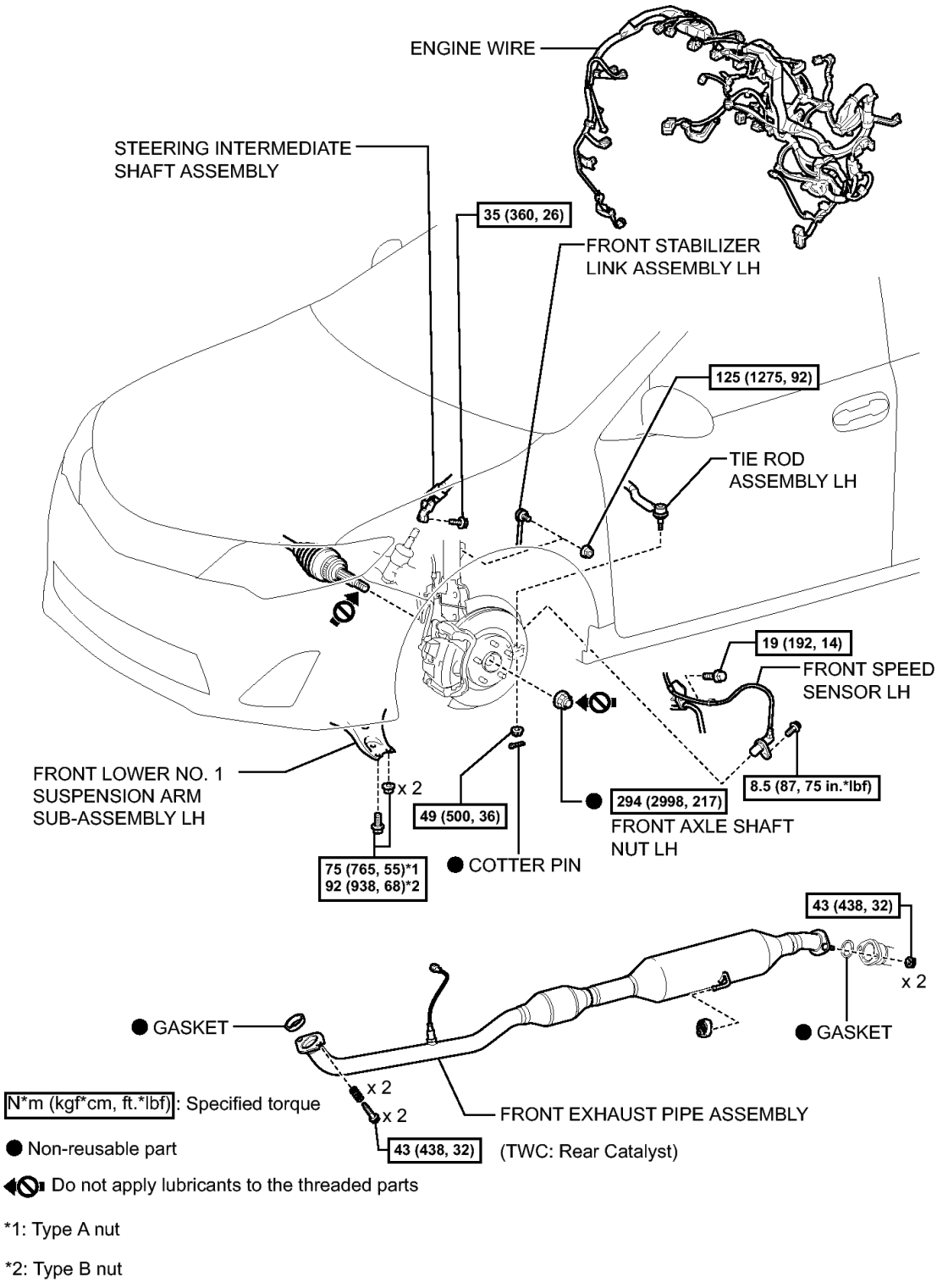


Fig. 173: Identifying Engine Assembly Replacement Components With Torque Specifications (4 of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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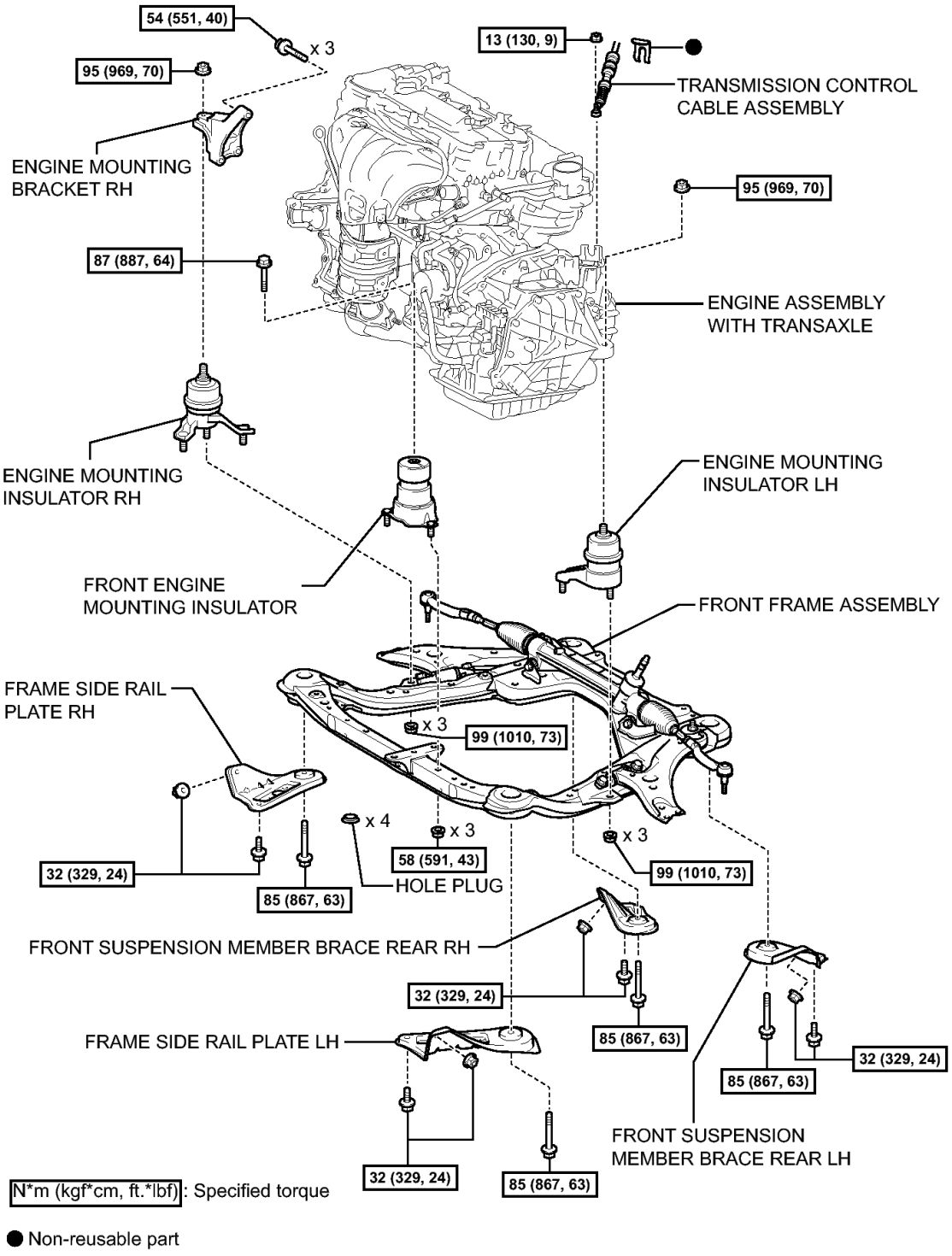


Fig. 174: Identifying Engine Assembly Replacement Components With Torque Specifications (5 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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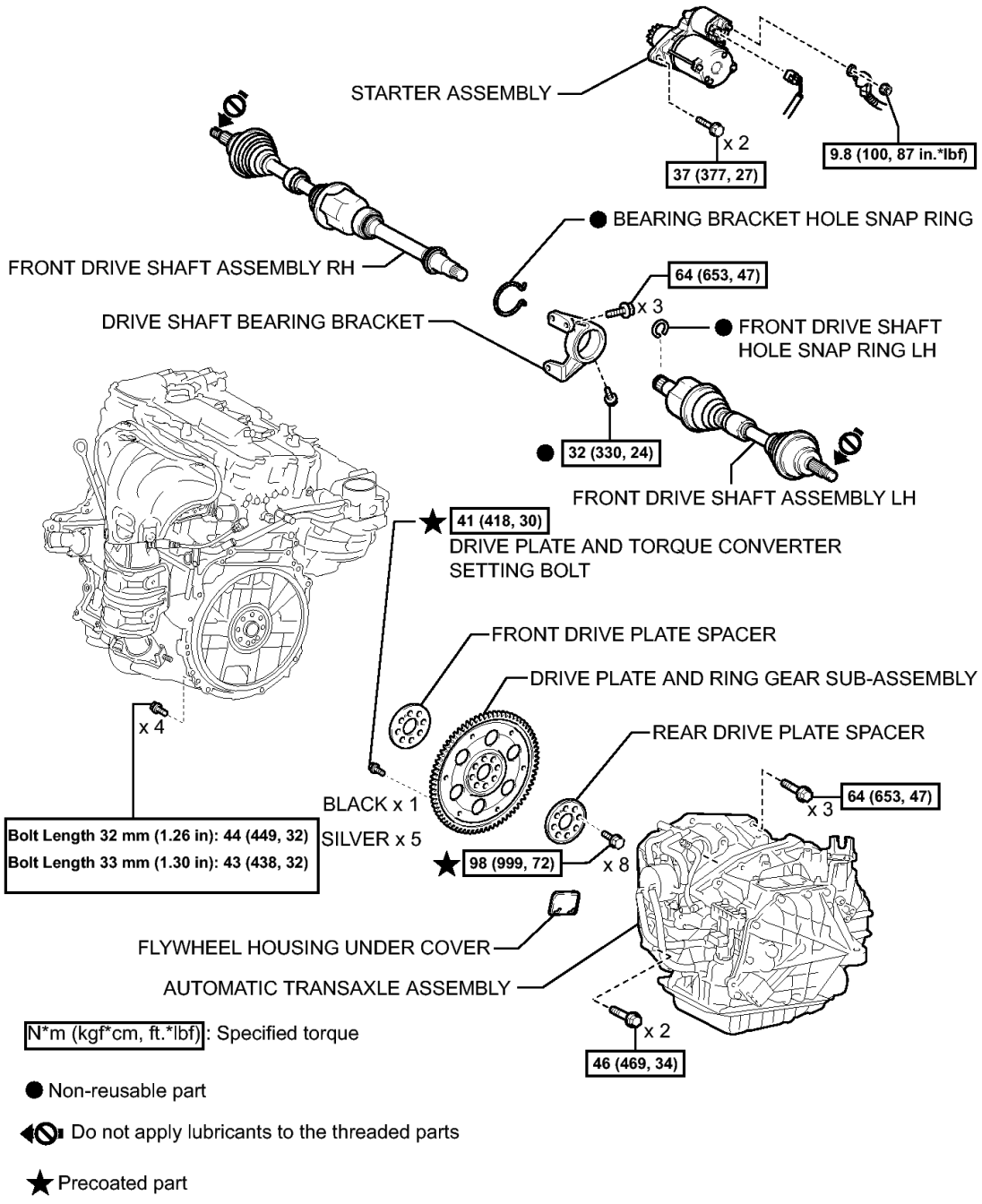


Fig. 175: Identifying Engine Assembly Replacement Components With Torque Specifications (6 Of 6)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL [08/2013 - 12/2013]

REMOVAL [08/2013 - 12/2013]

1. **PRECAUTION**

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WARNING: The engine assembly with transmission is very heavy. Be sure to follow the procedure described in the removal procedure, or the engine lifter may suddenly drop.

NOTE: After turning the ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work. Refer to PRECAUTION [08/2013 - 12/2013] .

2. **RECOVER REFRIGERANT FROM REFRIGERATION SYSTEM** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
3. **DISCHARGE FUEL SYSTEM PRESSURE**

   Refer to **PRECAUTION [08/2013 - 12/2013]**

4. **PLACE FRONT WHEELS FACING STRAIGHT AHEAD**
5. **SECURE STEERING WHEEL**
6. **REMOVE FRONT WHEELS**
7. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [08/2013 - 12/2013] .

8. **REMOVE FRONT WHEEL OPENING EXTENSION PAD LH**
9. **REMOVE ENGINE UNDER COVER LH**
10. **REMOVE FRONT WHEEL OPENING EXTENSION PAD RH**
11. **REMOVE ENGINE UNDER COVER RH**
12. **REMOVE FRONT FENDER APRON SEAL LH**
13. **REMOVE FRONT FENDER APRON SEAL RH**
14. **DRAIN ENGINE OIL** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
15. **DRAIN ENGINE COOLANT** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
16. **DRAIN AUTOMATIC TRANSAXLE FLUID** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
17. **REMOVE COOL AIR INTAKE DUCT SEAL** . Refer to **REMOVAL [08/2013 -] - Step 1**
18. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY**
    a. Lift the rear of the engine cover to detach the cover from the 2 pins, and then lift the front of the engine cover to detach the cover from the pin and remove the engine cover.

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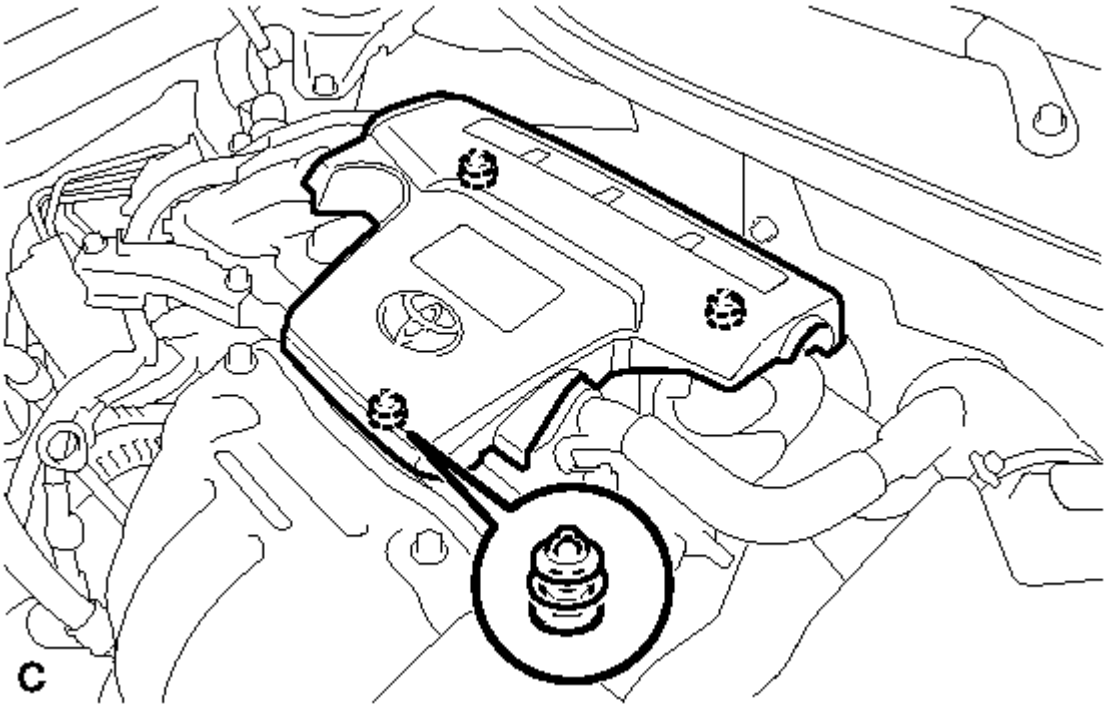


Fig. 176: Identifying No. 1 Engine Cover Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

19. **REMOVE INLET AIR CLEANER ASSEMBLY**
    a. Remove the 2 bolts and inlet air cleaner assembly.

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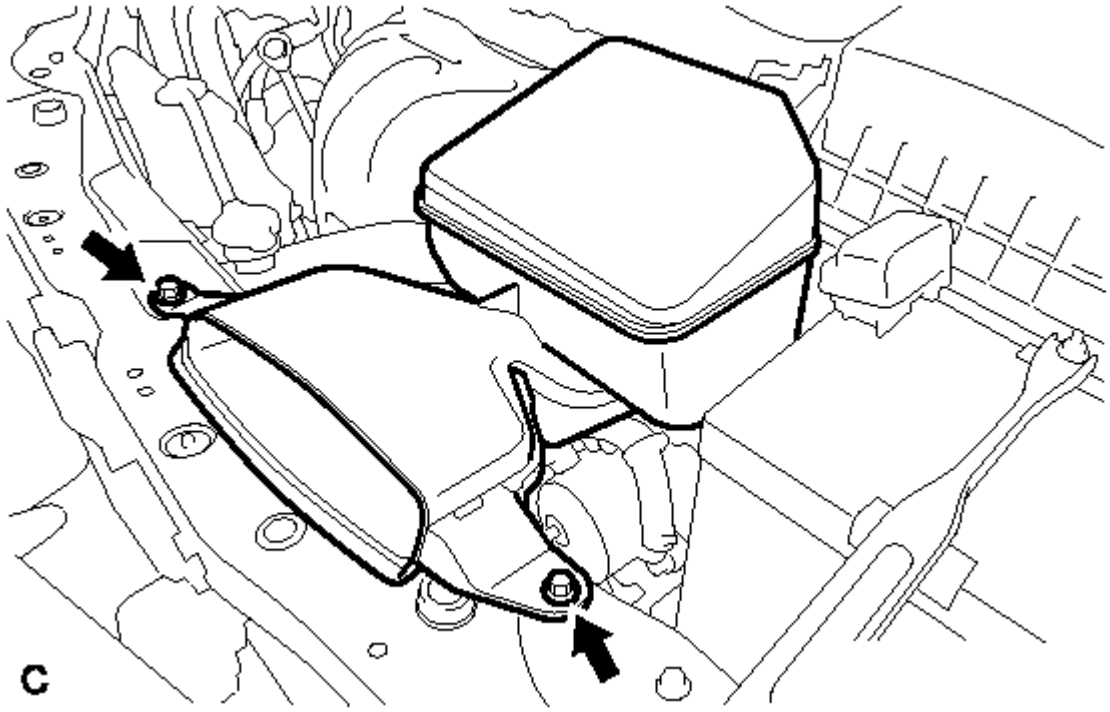


Fig. 177: Identifying Inlet Air Cleaner Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 7**
21. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
    a. Remove the air cleaner filter element sub-assembly.
22. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY**
    a. Disconnect the wire harness clamp.

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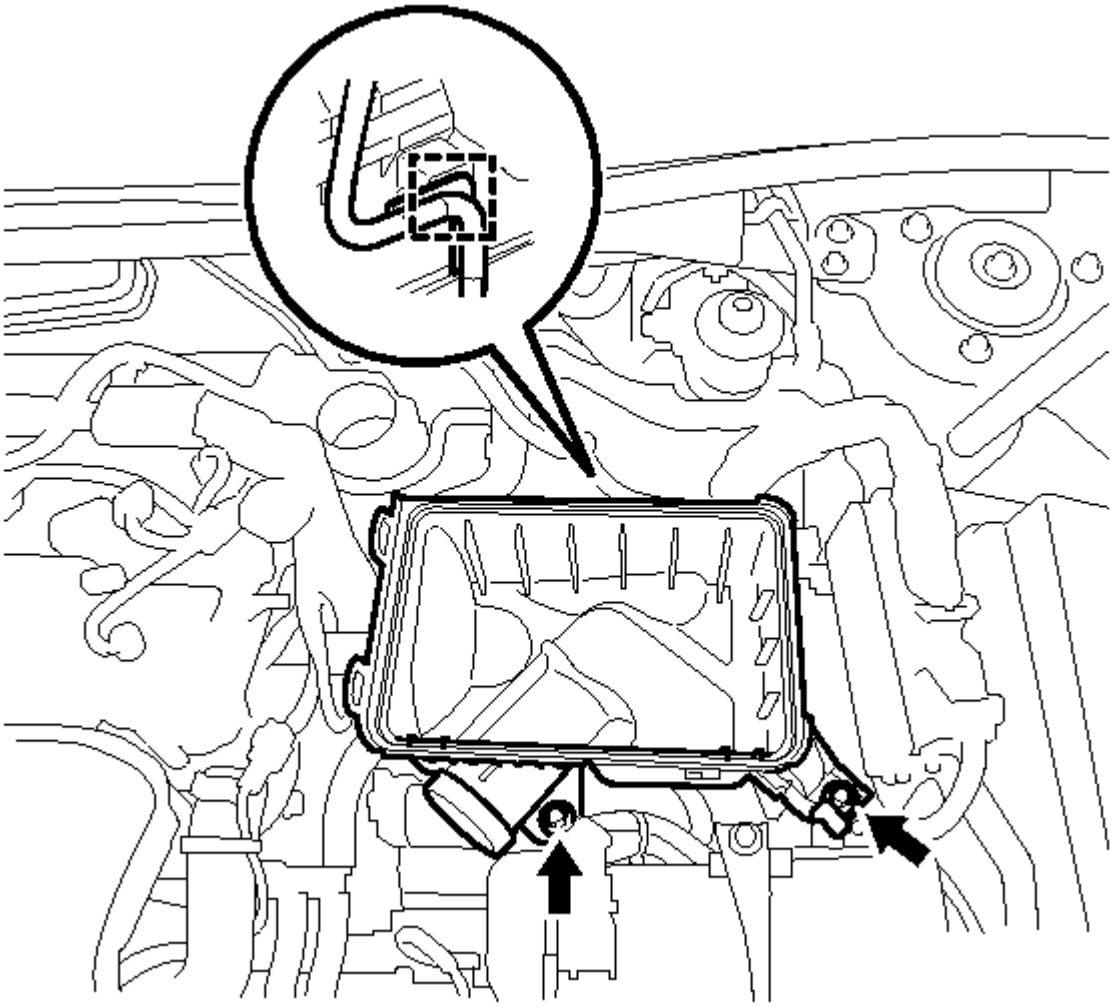


Fig. 178: Identifying Air Cleaner Case Sub-Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 2 bolts and air cleaner case sub-assembly.

23. **REMOVE BATTERY**

a. Loosen the nut, and separate the positive (+) battery terminal.

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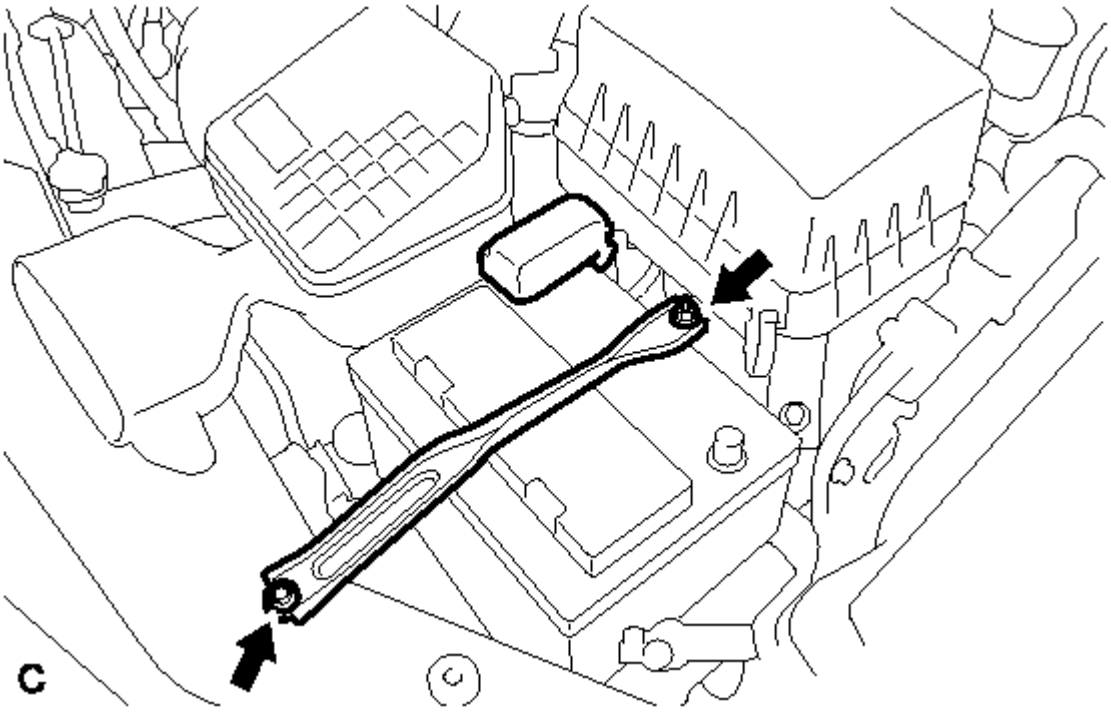


Fig. 179: Identifying Battery Clamp, Bolt And Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Loosen the nut, and remove the bolt and battery clamp.
c. Remove the battery and battery tray.

24. **DISCONNECT NO. 1 RADIATOR HOSE**
    a. Remove the hose clamp to separate the air fuel ratio sensor wire from the No. 1 radiator hose.

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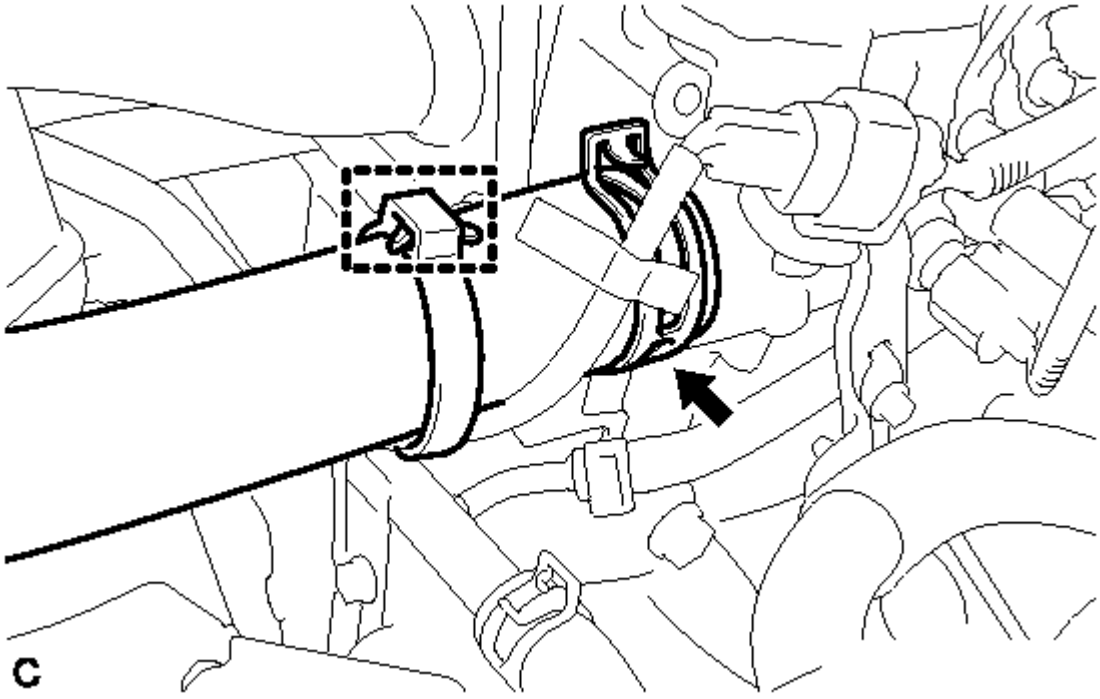
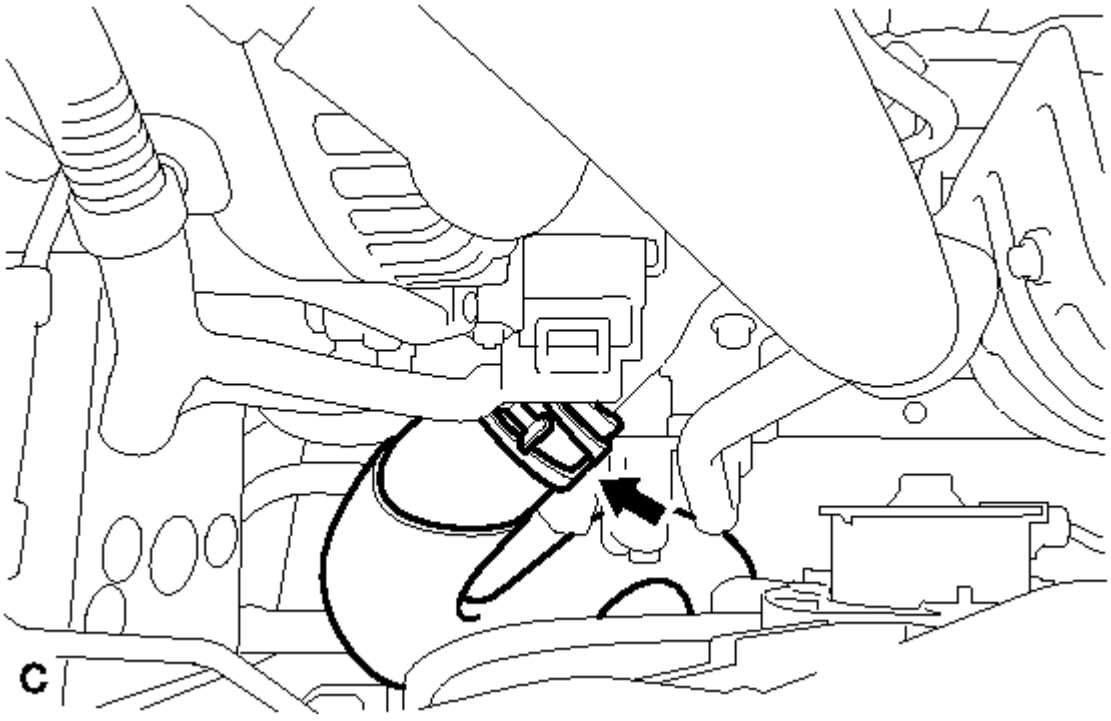


Fig. 180: Identifying Inlet Radiator Hose & Wire Harness Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Disconnect the No. 1 radiator hose.

25. **DISCONNECT NO. 2 RADIATOR HOSE**

a. Disconnect the No. 2 radiator hose.



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Fig. 181: Identifying No. 2 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

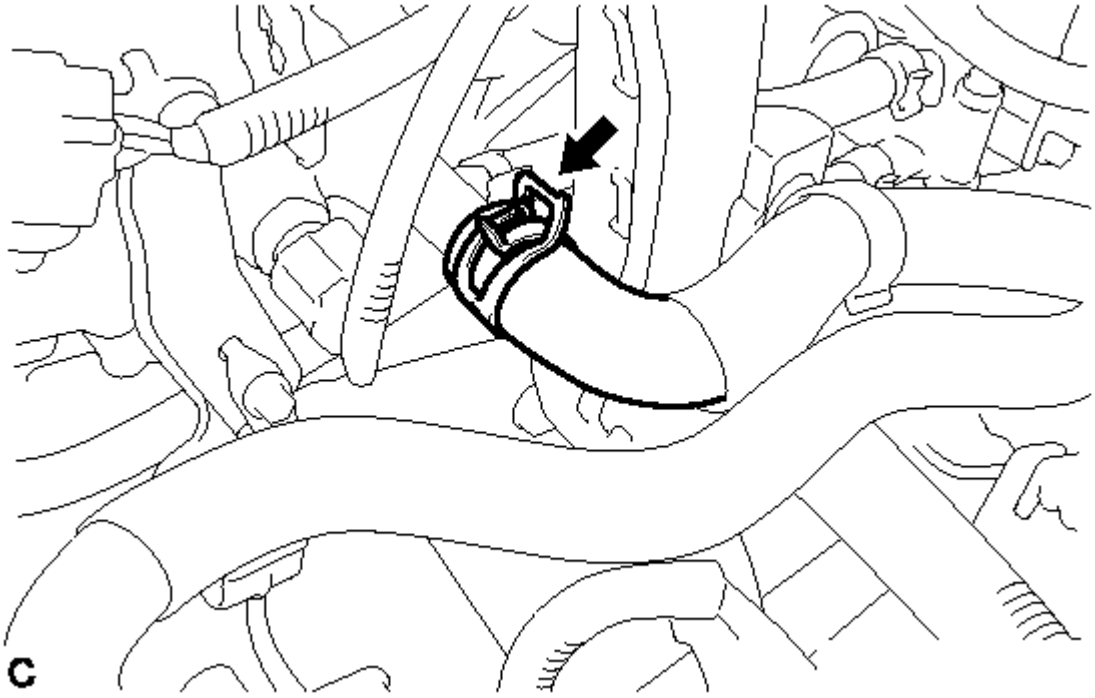


Fig. 182: Identifying Outlet Heater Water Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. **DISCONNECT OUTLET HEATER WATER HOSE**
    a. Disconnect the 3 outlet heater water hoses.

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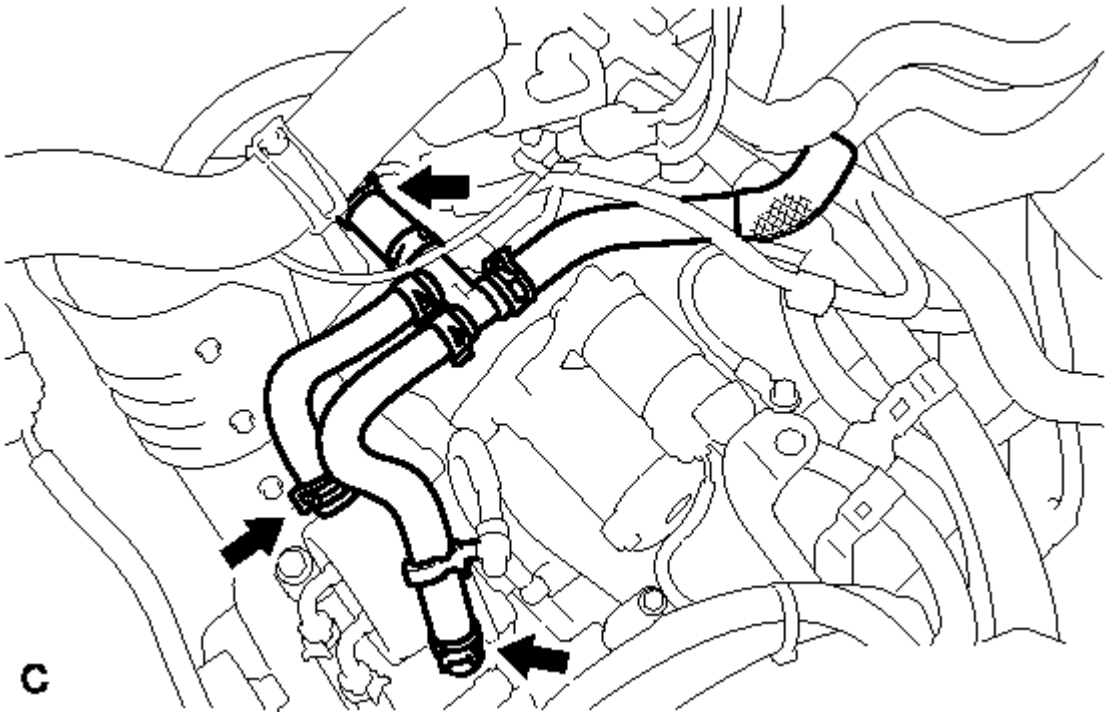


Fig. 183: Identifying Outlet Heater Water Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. **REMOVE STARTER ASSEMBLY** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 10**
29. **DISCONNECT ENGINE WIRE**
    a. Remove the No. 1 relay block cover.
    b. Remove the 2 nuts and disconnect the wire clamp.

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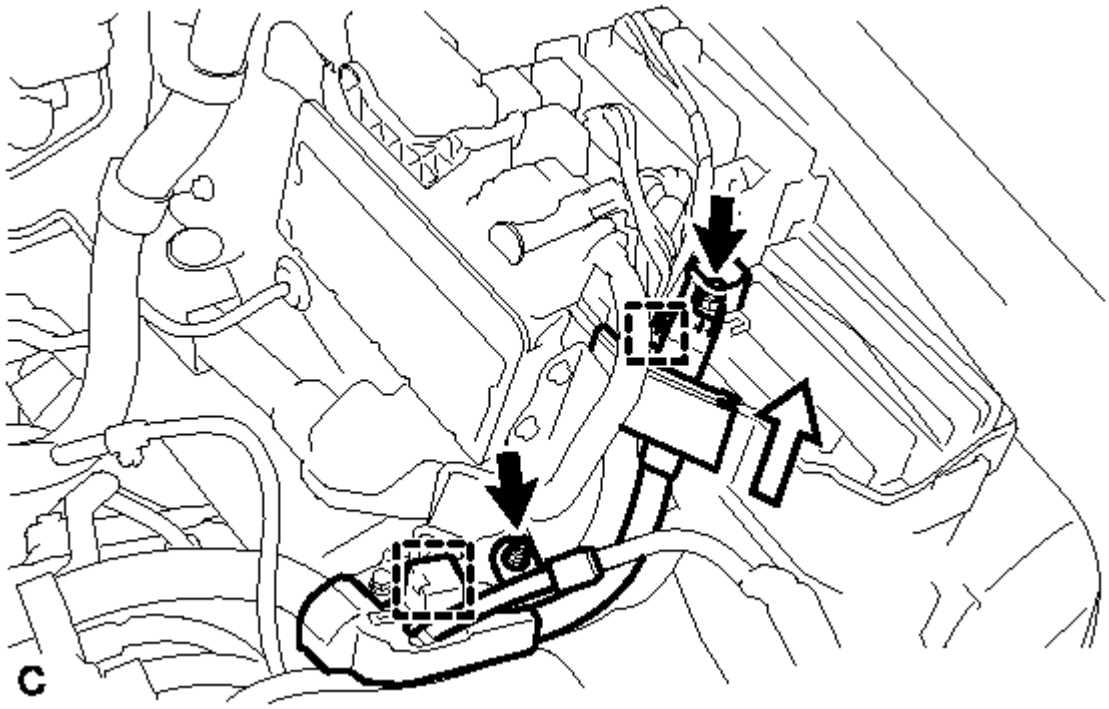
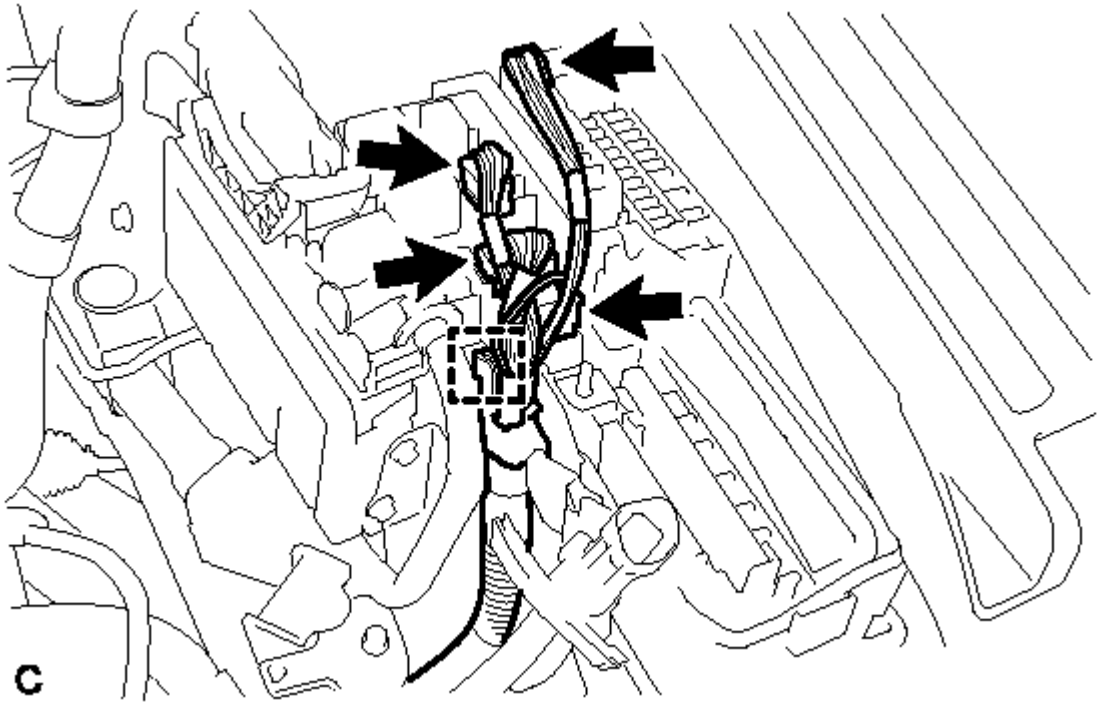


Fig. 184: Identifying Engine Wire Nuts And Wire Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

d. Disconnect the 4 connectors.



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Fig. 185: Identifying Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

f. Pull up the lever to disconnect the ECM connector.

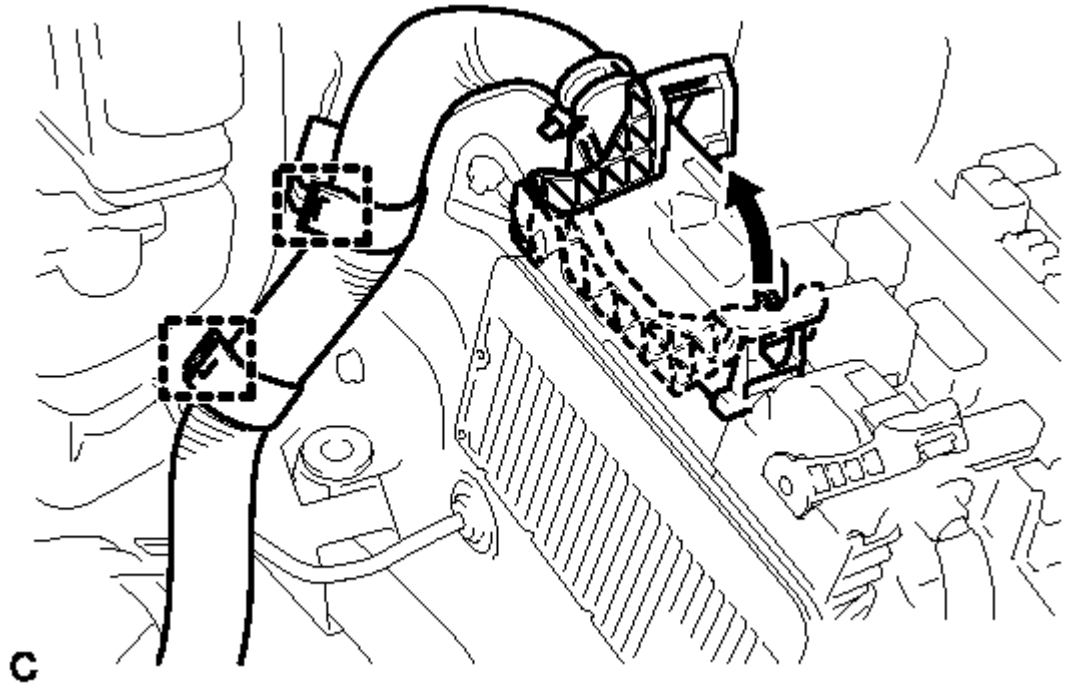


Fig. 186: Identifying ECM Connector And Wire Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Disconnect the 2 wire clamps.

30. **DISCONNECT NO. 1 AIR CLEANER BRACKET**

a. Disconnect the 2 wire clamps.

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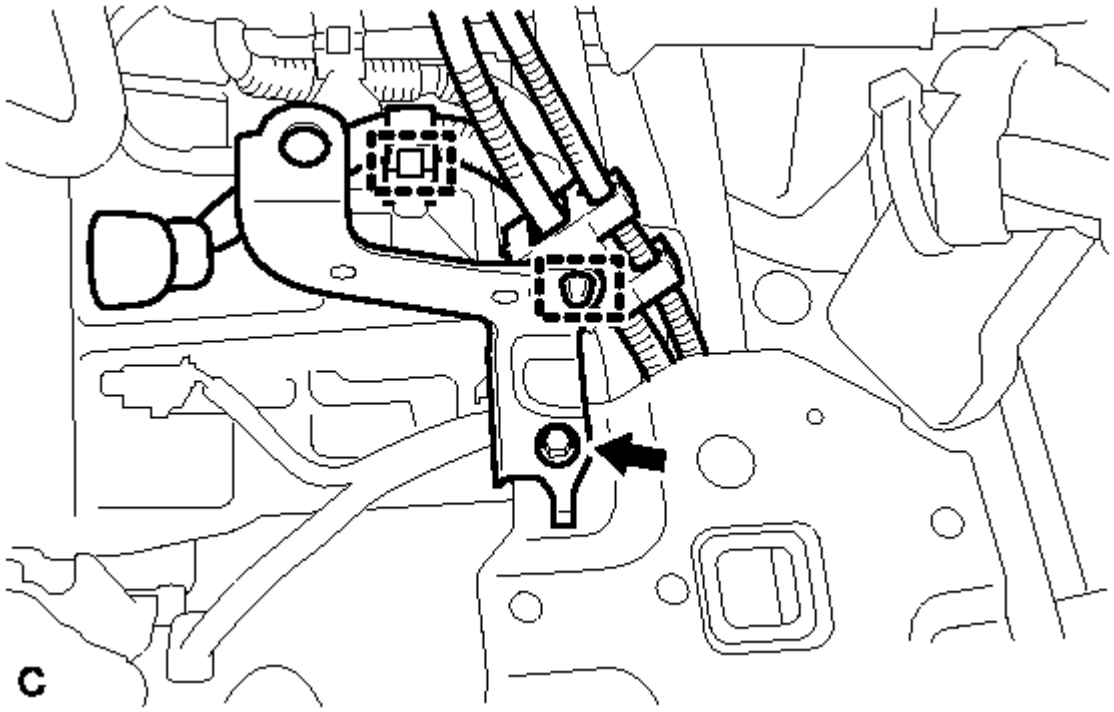
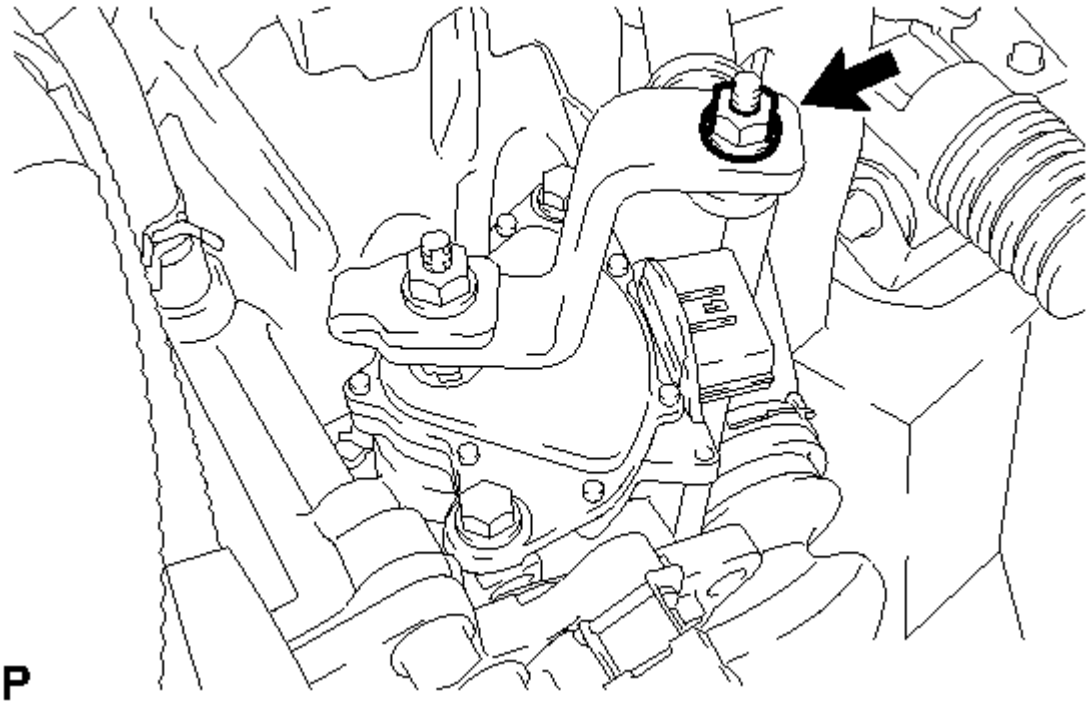


Fig. 187: Identifying No. 1 Air Cleaner Bracket And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the bolt and No. 1 air cleaner bracket.

31. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**

a. Remove the nut and disconnect the transmission control cable from the control shaft lever.



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Fig. 188: Locating Transmission Control Shaft Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the clip and disconnect the transmission control cable assembly from the No. 1 control cable bracket.

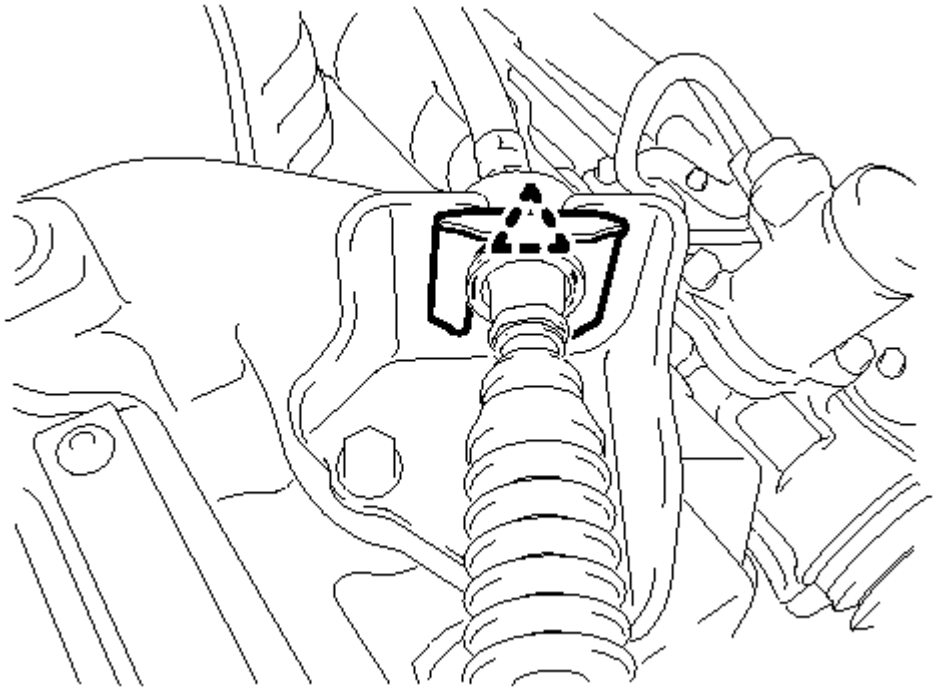


Fig. 189: Remove The Clip From The Transmission Cable Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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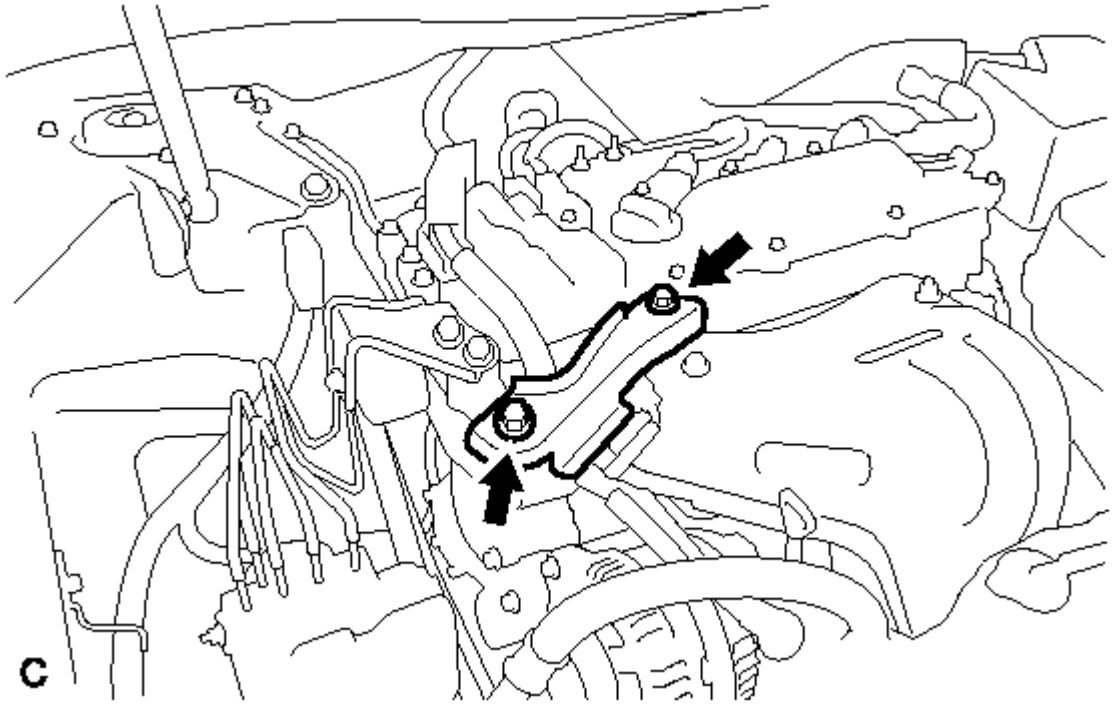


Fig. 190: Identifying No. 2 Engine Mounting Stay Bolts RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **SEPARATE EARTH WIRE**
    a. Remove the bolt and separate the earth wire from the engine moving control rod bracket.

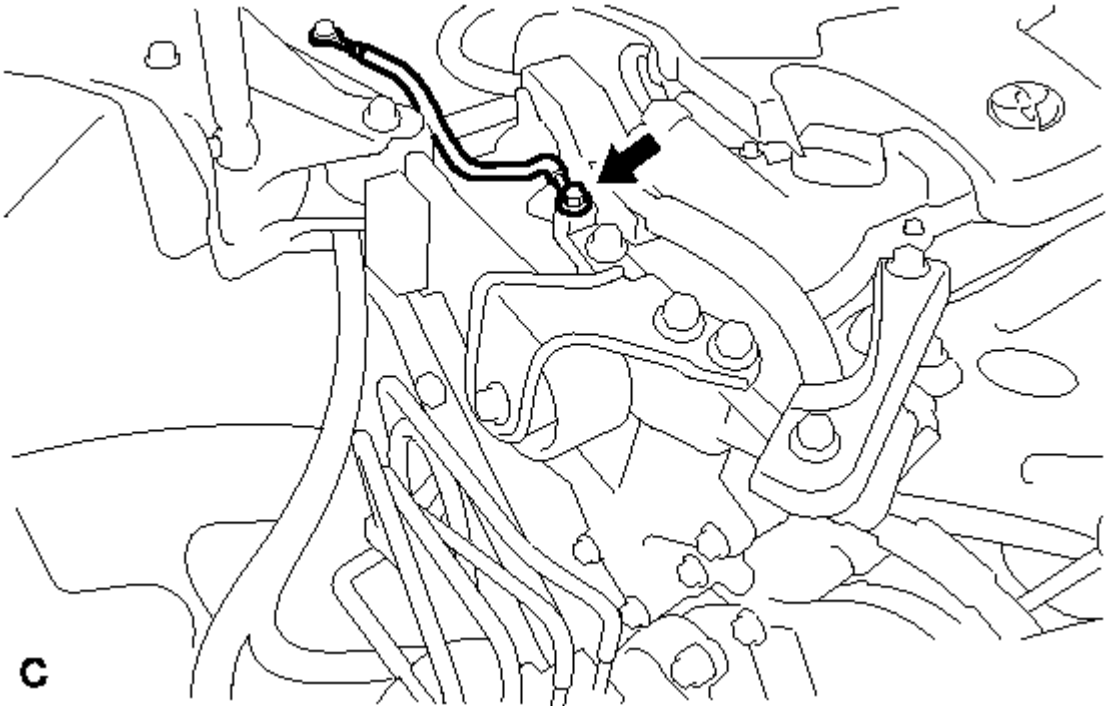


Fig. 191: Identifying Earth Wire

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

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

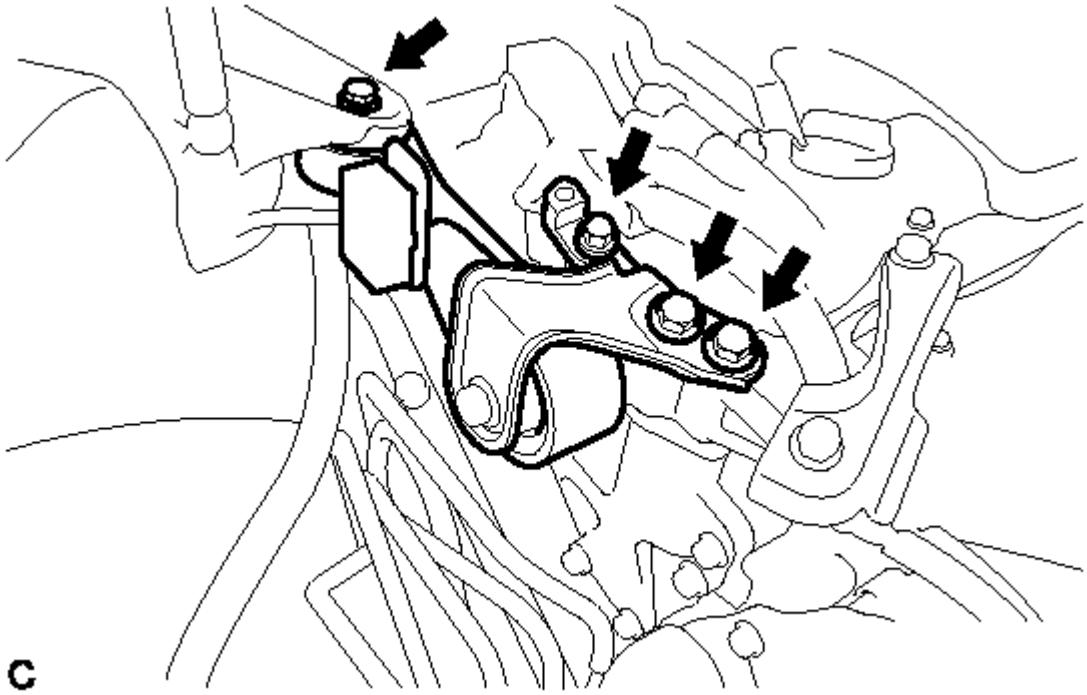
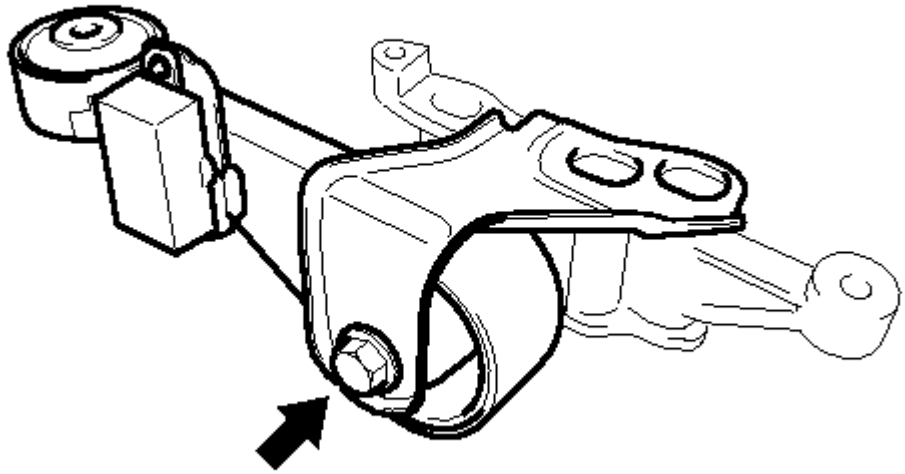


Fig. 192: Identifying Engine Moving Control Rod Bracket And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. **REMOVE ENGINE MOVING CONTROL ROD**
    a. Remove the bolt, No. 3 engine mounting stay RH and engine moving control rod from the engine moving control rod bracket.

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C

Fig. 193: Identifying Engine Moving Control Rod Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Perform this procedure only when replacement of the engine moving control rod is necessary.

36. **DISCONNECT UNION TO CONNECTOR TUBE HOSE**
    a. Disconnect the union to connector tube hose.

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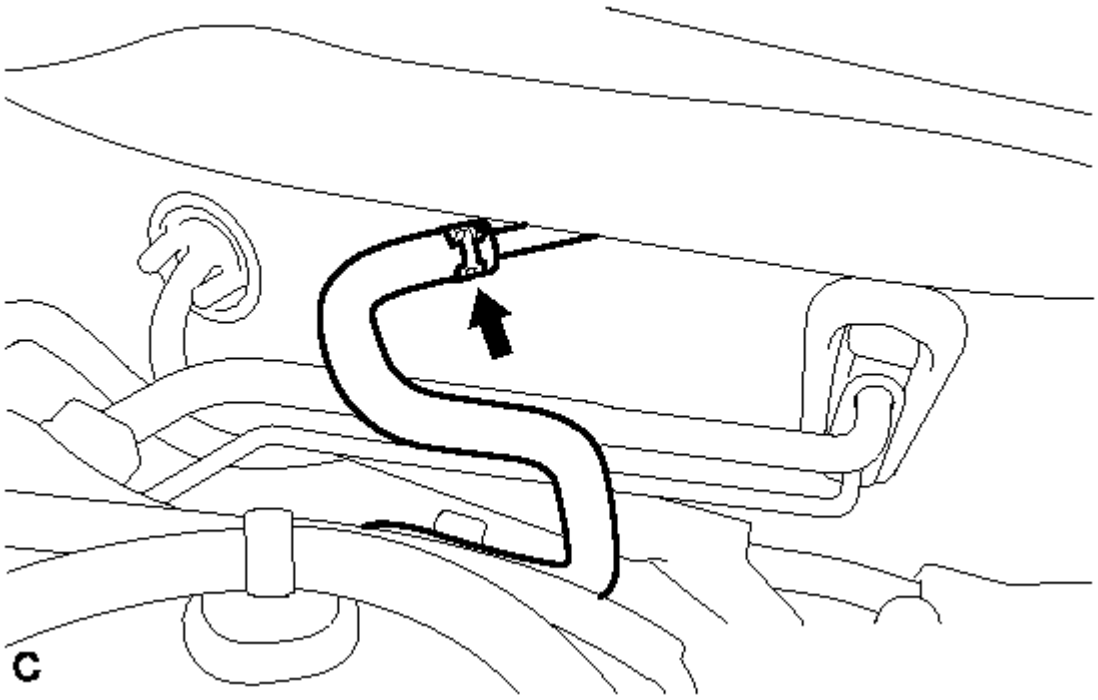


Fig. 194: Identifying Union And Connector Tube Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. **DISCONNECT NO. 1 COOLER REFRIGERANT DISCHARGE HOSE** . Refer to **REMOVAL [08/2013 -] - Step 5**
38. **DISCONNECT SUCTION HOSE SUB-ASSEMBLY (for TMMK Made)** . Refer to **REMOVAL [08/2013 -] - Step 6**
39. **DISCONNECT NO. 1 COOLER REFRIGERANT SUCTION HOSE (for SIA Made)** . Refer to **REMOVAL [08/2013 -] - Step 7**
40. **DISCONNECT FUEL TUBE SUB-ASSEMBLY**
    a. Release the claw and remove the No. 1 fuel pipe clamp.

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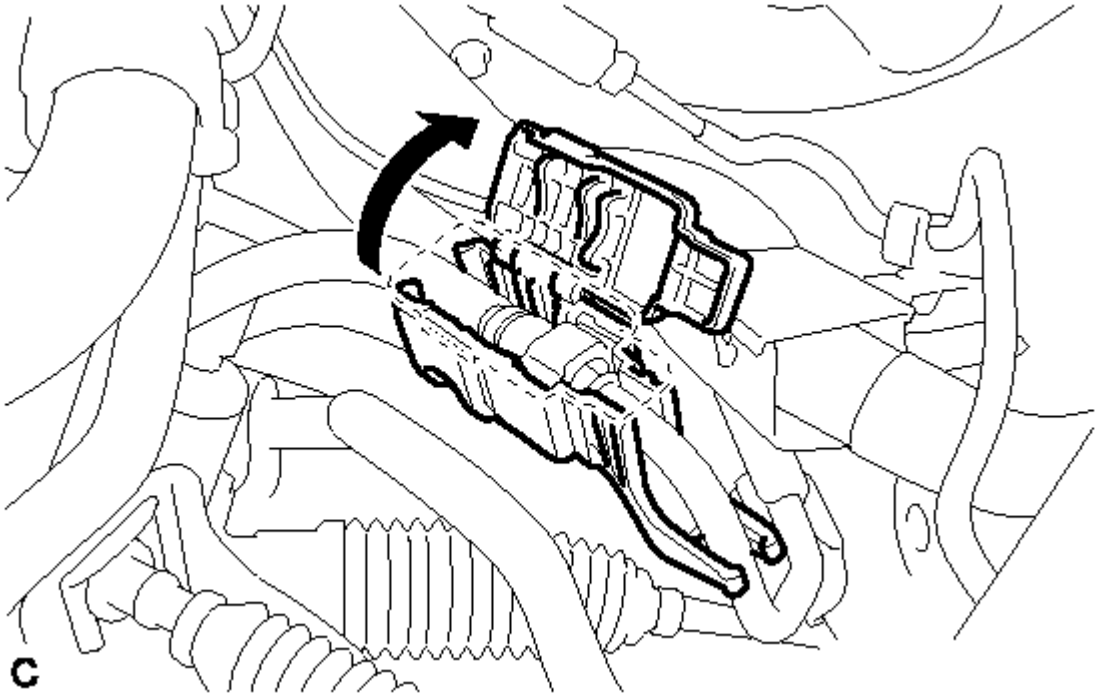


Fig. 195: Identifying No. 1 Fuel Pipe Component Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Pinch the fuel tube connector and then pull out the fuel main tube.

NOTE:

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

41. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 4**
42. **REMOVE FRONT AXLE SHAFT NUT LH** . Refer to **REMOVAL [08/2013 -] - Step 9**
43. **REMOVE FRONT AXLE SHAFT NUT RH**

HINT:

Use the same procedure described for the LH side.

44. **SEPARATE FRONT STABILIZER LINK ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 4**

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45. **SEPARATE FRONT STABILIZER LINK ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

46. **SEPARATE FRONT SPEED SENSOR LH** . Refer to **REMOVAL [08/2013 -] - Step 3**
47. **SEPARATE FRONT SPEED SENSOR RH**

    HINT:

    Use the same procedure described for the LH side.

48. **SEPARATE TIE ROD ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 5**
49. **SEPARATE TIE ROD ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

50. **SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 8**
51. **SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

52. **SEPARATE FRONT AXLE ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 7**
53. **SEPARATE FRONT AXLE ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

54. **SEPARATE STEERING INTERMEDIATE SHAFT ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 4**
55. **REMOVE FLYWHEEL HOUSING UNDER COVER**
    a. Remove the flywheel housing under cover.

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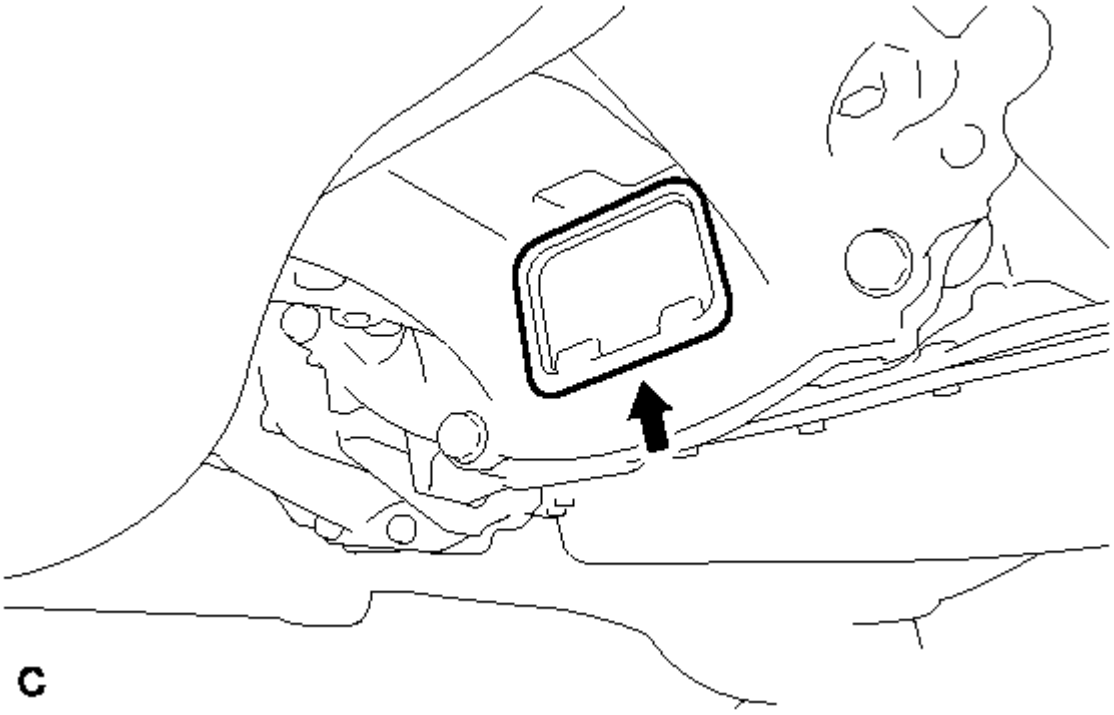
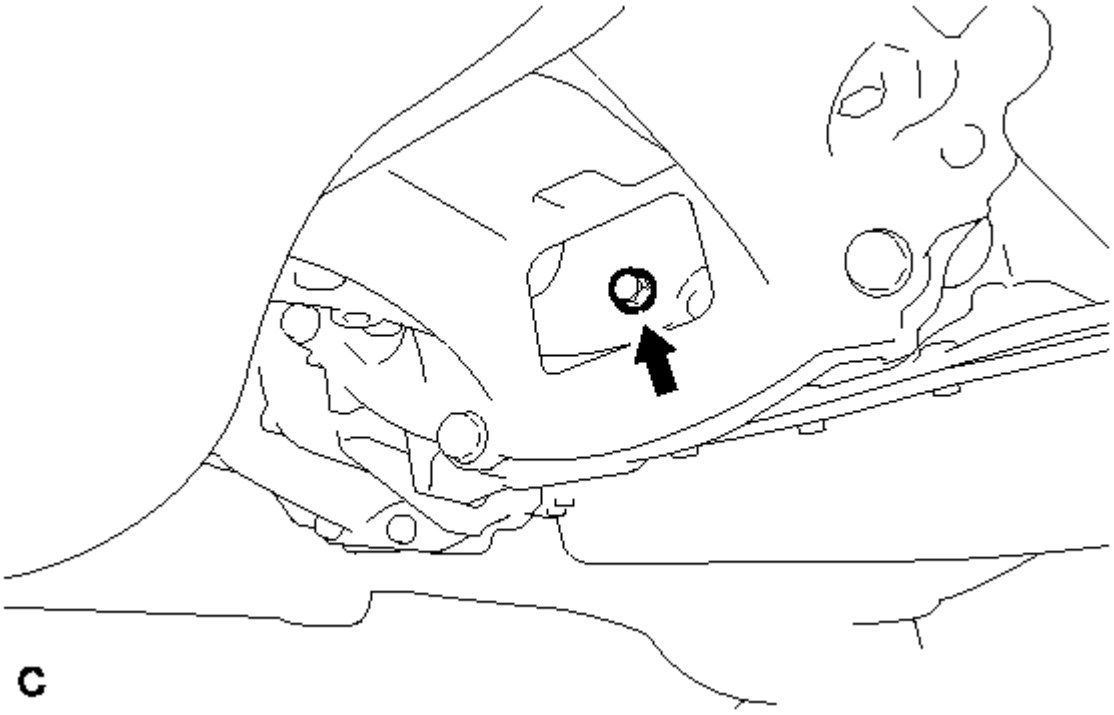


Fig. 196: Locating Flywheel Housing Under Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. **REMOVE DRIVE PLATE AND TORQUE CONVERTER SETTING BOLT**

a. Turn the crankshaft to gain access to the removal locations of the 6 torque converter setting bolts and remove each bolt while holding the crankshaft pulley bolt with a wrench.



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Fig. 197: Locating Torque Converter Clutch Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**
    a. Set the engine lifter.

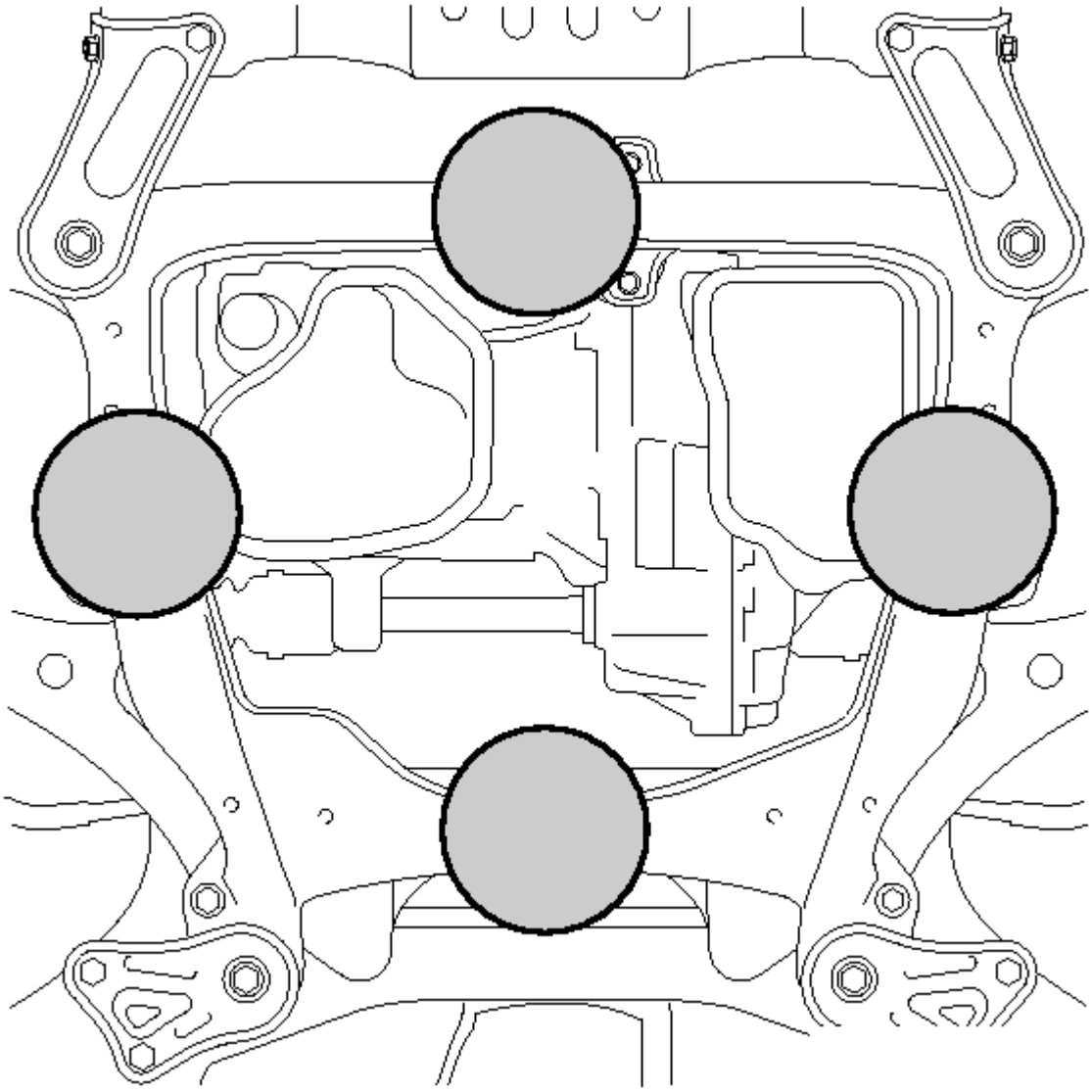


Fig. 198: Identifying Engine Lifter Points
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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	Attachment Installation Position

NOTE:

- **Install a height adjustment attachment and plate lift attachment onto the engine assembly with transaxle.**
- **Securely support the engine assembly to prevent it from turning upside down until it is secured to an engine stand.**
- **To prevent the oil pan from deforming, do not place any attachments onto the oil pan of the engine assembly with transaxle.**
- **Servicing an engine assembly while it is hanging is dangerous. This can be done only when installing/removing the engine assembly to/from an engine stand.**
- **Do not perform any procedure while the engine assembly is suspended because doing so may cause the engine assembly to drop, resulting in injury. However, the engine assembly needs to be suspended when it is installed or removed from an engine stand.**

b. Remove the 4 bolts, 2 nuts, and frame side rail plate RH and LH.

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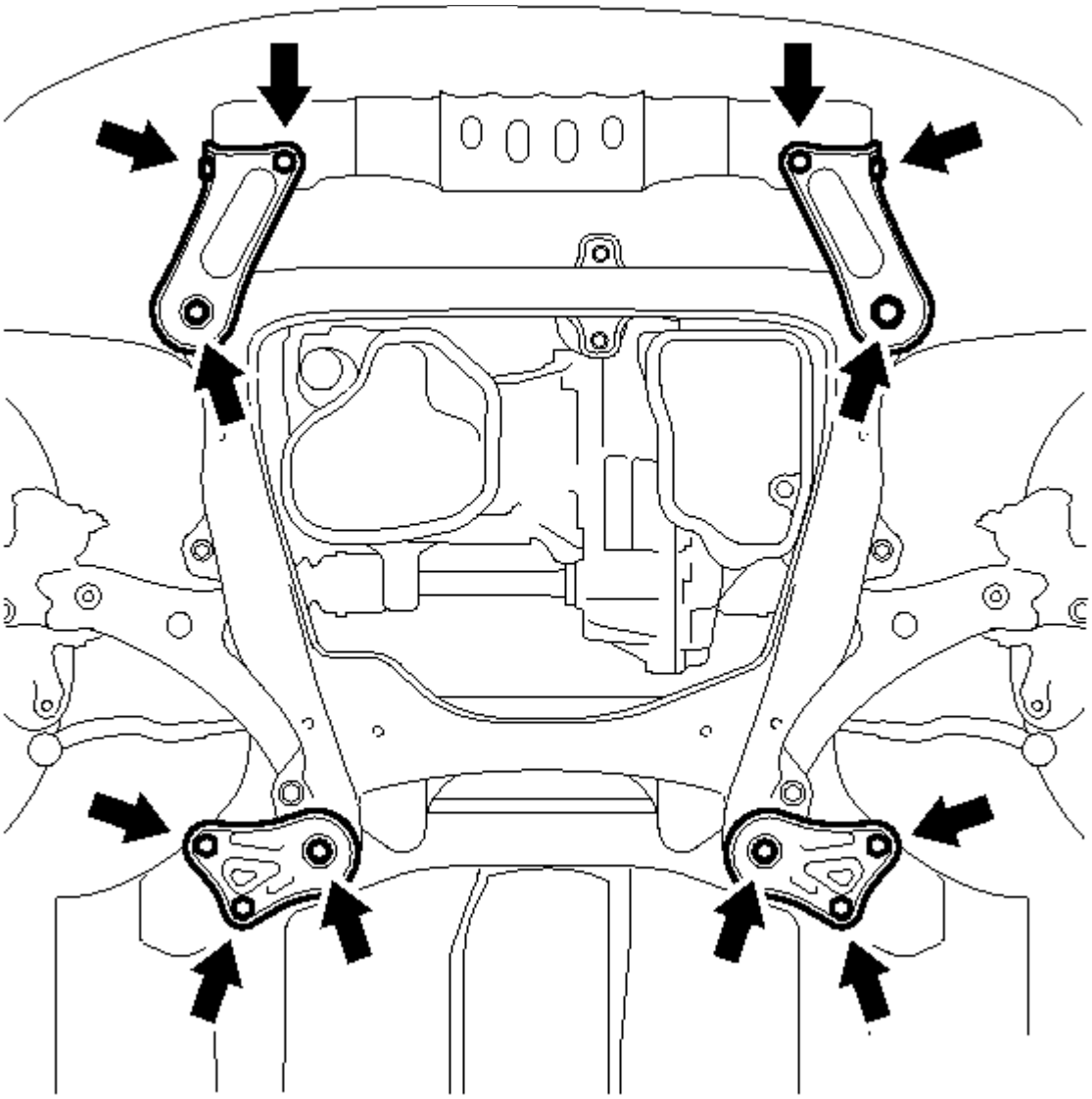


Fig. 199: Identifying Frame Side Rail Plate Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 4 bolts, 2 nuts, and front suspension member brace rear RH and LH.
d. Operate the engine lifter and remove the engine assembly from the vehicle.

NOTE:

- **Make sure that the engine is clear of all wiring and hoses.**
- **While lowering the engine from the vehicle, do not allow it to contact the vehicle.**

e. Install engine hangers See step 20.

58. **REMOVE ENGINE WIRE**
    a. Remove the engine wire from the engine with transaxle.
59. **REMOVE V-RIBBED BELT** See step 5

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60. **REMOVE COMPRESSOR ASSEMBLY WITH PULLEY** . Refer to **REMOVAL [08/2013 -] - Step 8**
61. **REMOVE GENERATOR ASSEMBLY** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 4**
62. **REMOVE FRONT DRIVE SHAFT ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 15**
63. **REMOVE FRONT DRIVE SHAFT HOLE SNAP RING LH** . Refer to **REMOVAL [08/2013 -] - Step 17**
64. **REMOVE FRONT DRIVE SHAFT ASSEMBLY RH** . Refer to **REMOVAL [08/2013 -] - Step 16**
65. **REMOVE FRONT FRAME ASSEMBLY**
    a. Remove the nut and separate the engine mounting insulator LH.

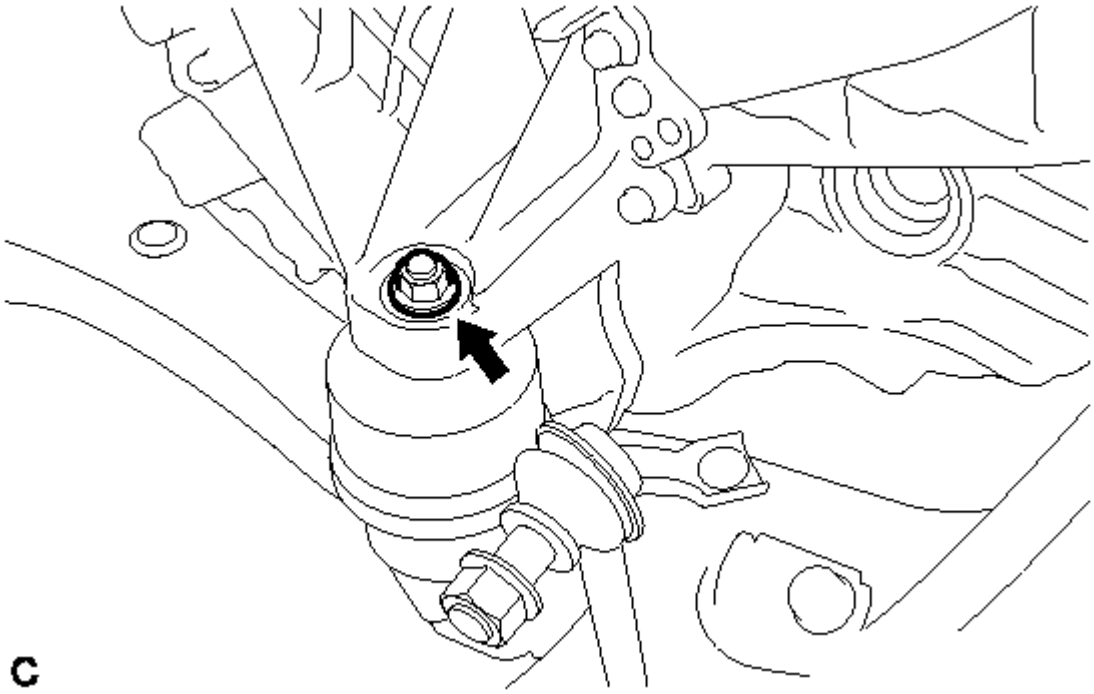


Fig. 200: Identifying Engine Mounting Insulator Nut LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the bolt and separate the front engine mounting insulator.

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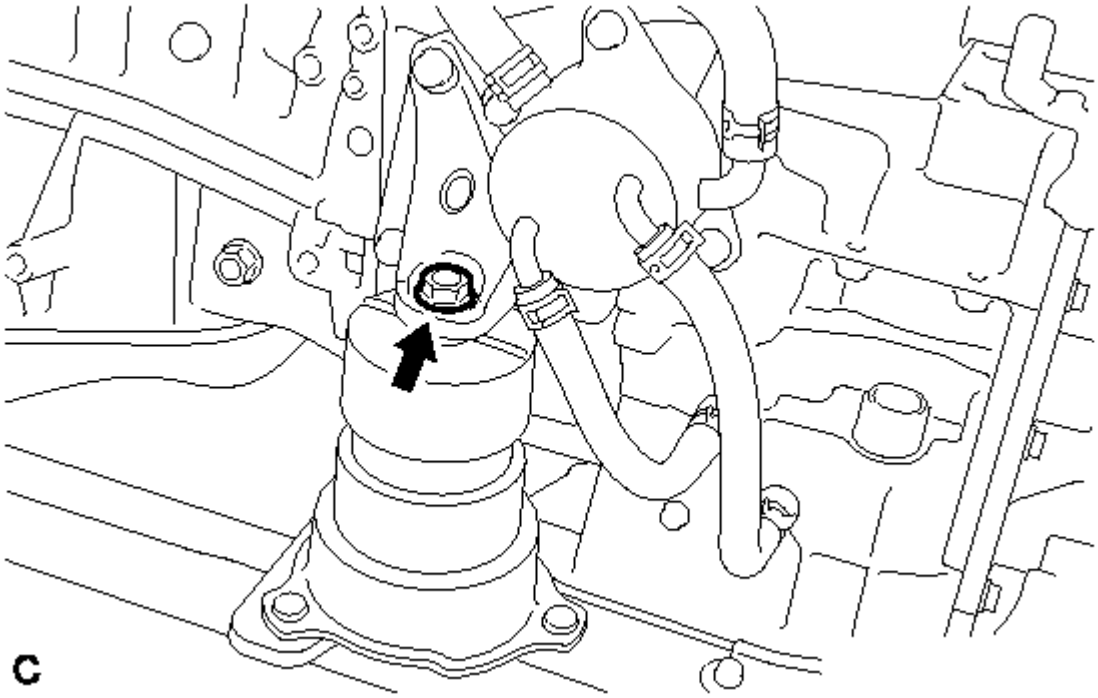


Fig. 201: Identifying Front Engine Mounting Insulator Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the nut and separate the engine mounting insulator RH.

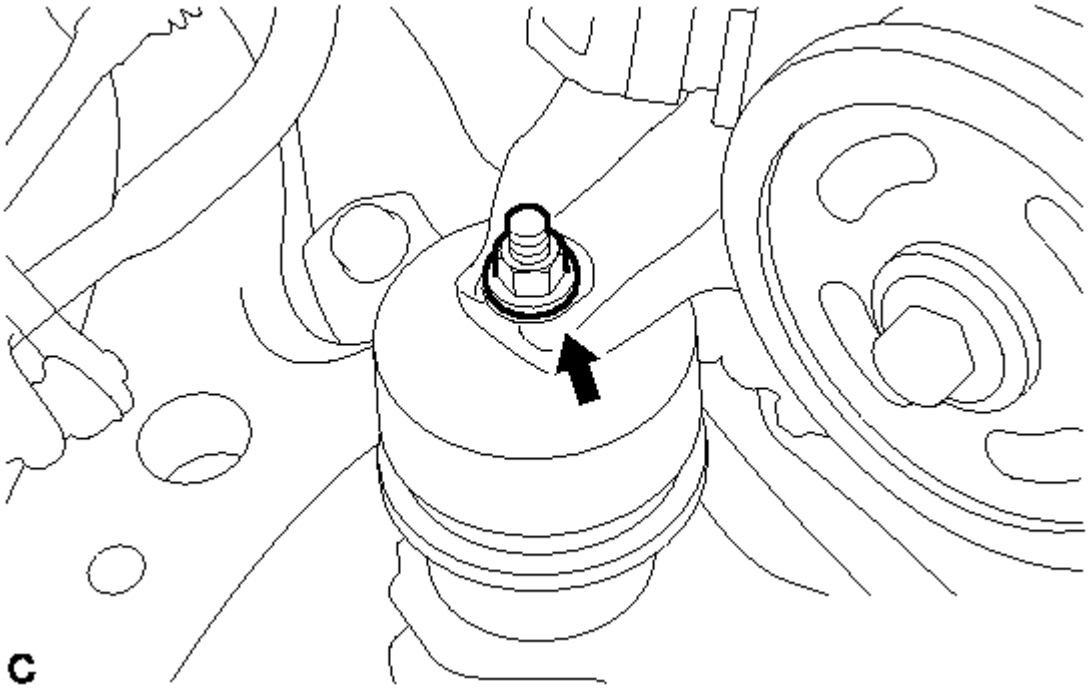


Fig. 202: Identifying Engine Mounting Insulator Nut RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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d. Remove the front frame assembly.

e. Using a height adjustable attachment and plate lift attachment, place the engine assembly on a flat level surface.

NOTE:

- **Using a height adjustable attachment and plate lift attachment, place the engine assembly with transaxle horizontally.**
- **To prevent the oil pan from deforming, do not place any attachments onto the oil pan of the engine assembly with transaxle.**
- **Using an engine sling device and engine lift, secure the engine assembly before service.**

66. **REMOVE FRONT ENGINE MOUNTING INSULATOR**

a. Remove the 3 nuts and front engine mounting insulator.

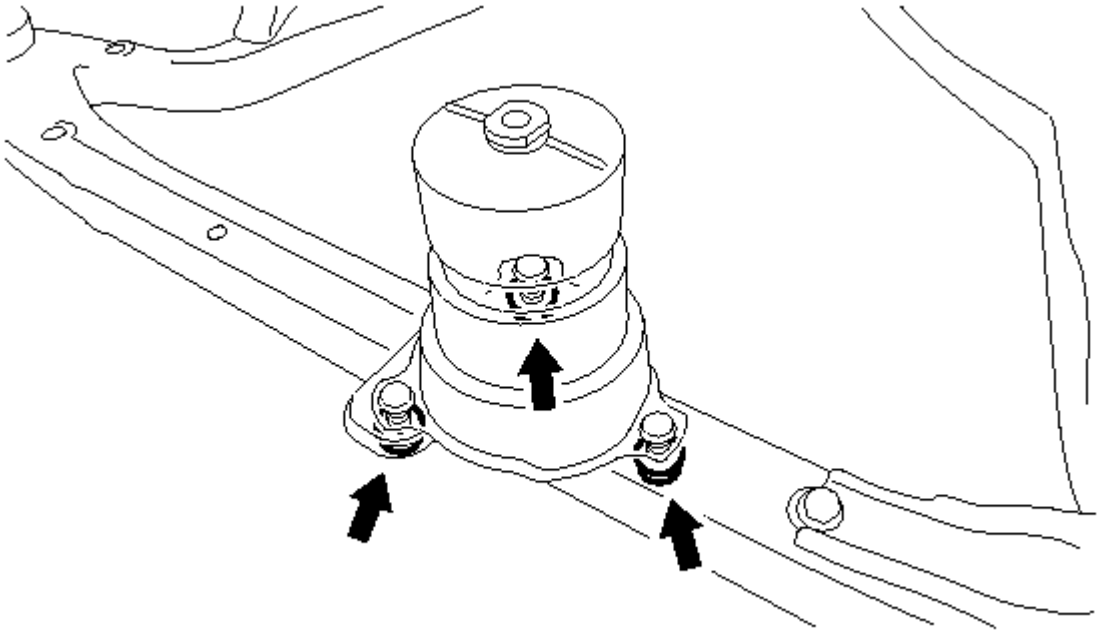


Fig. 203: Identifying Engine Mounting Insulator Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

67. **REMOVE ENGINE MOUNTING INSULATOR LH**

a. Remove the 2 hole plugs from the front frame assembly.

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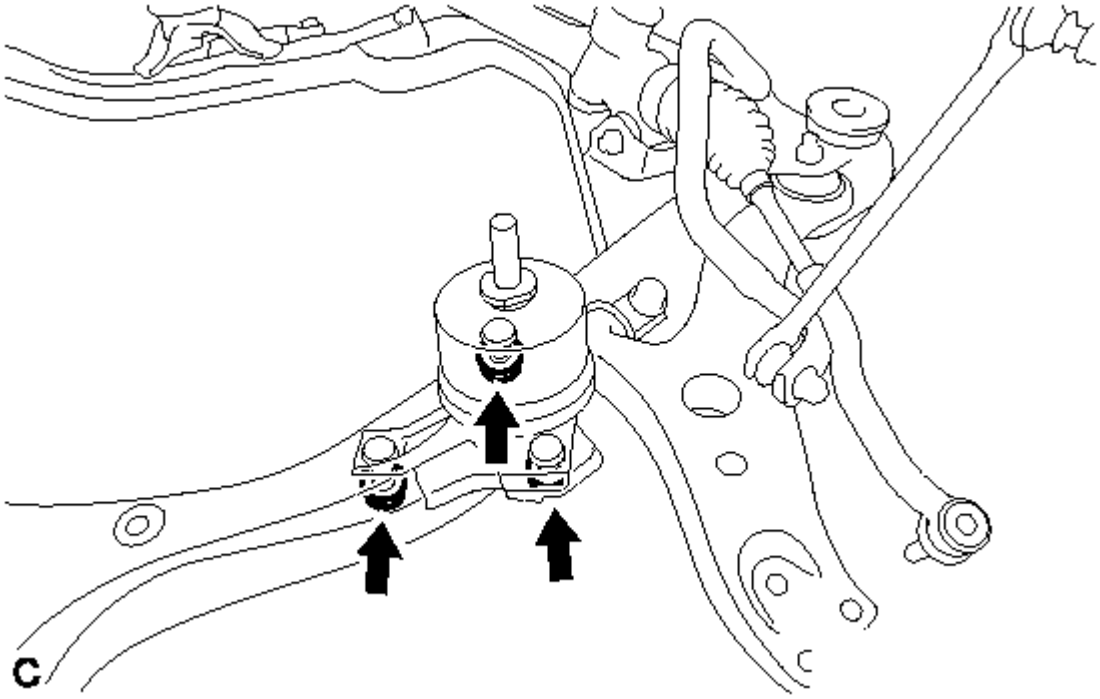


Fig. 204: Identifying Front Frame Assembly Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 3 nuts and engine mounting insulator LH.

HINT:

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

68. **REMOVE ENGINE MOUNTING INSULATOR RH**

a. Remove the 2 hole plugs from the front frame assembly.

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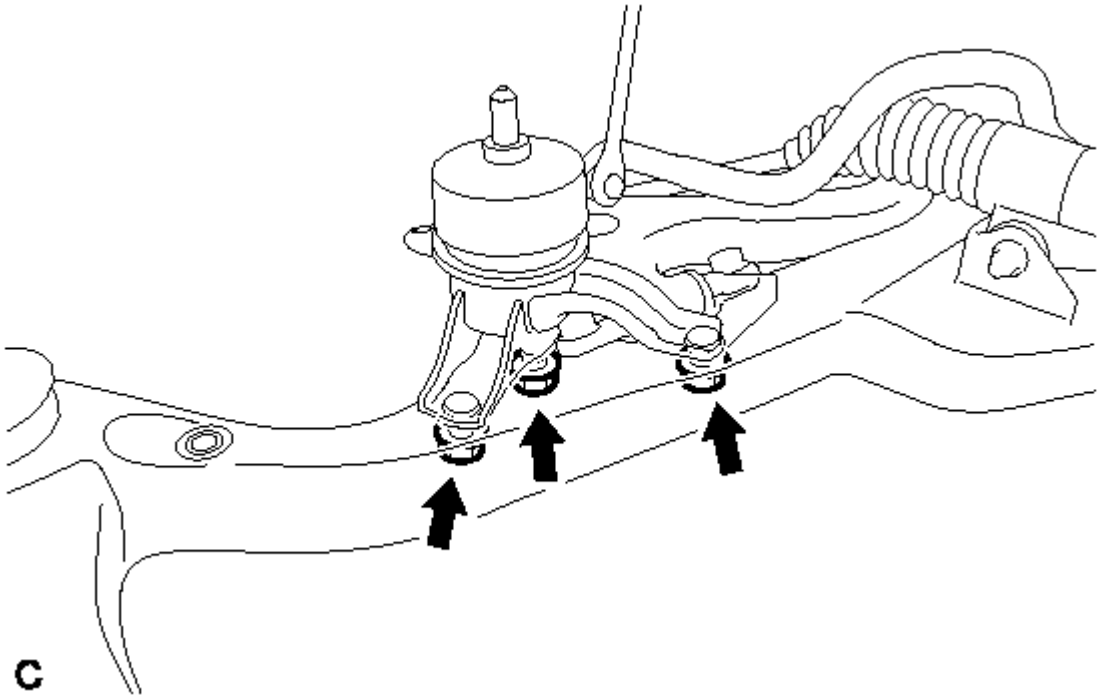


Fig. 205: Identifying Front Frame Assembly Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 3 nuts and engine mounting insulator RH.

HINT:

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

69. **REMOVE DRIVE SHAFT BEARING BRACKET**

a. Remove the 3 bolts and drive shaft bearing bracket.

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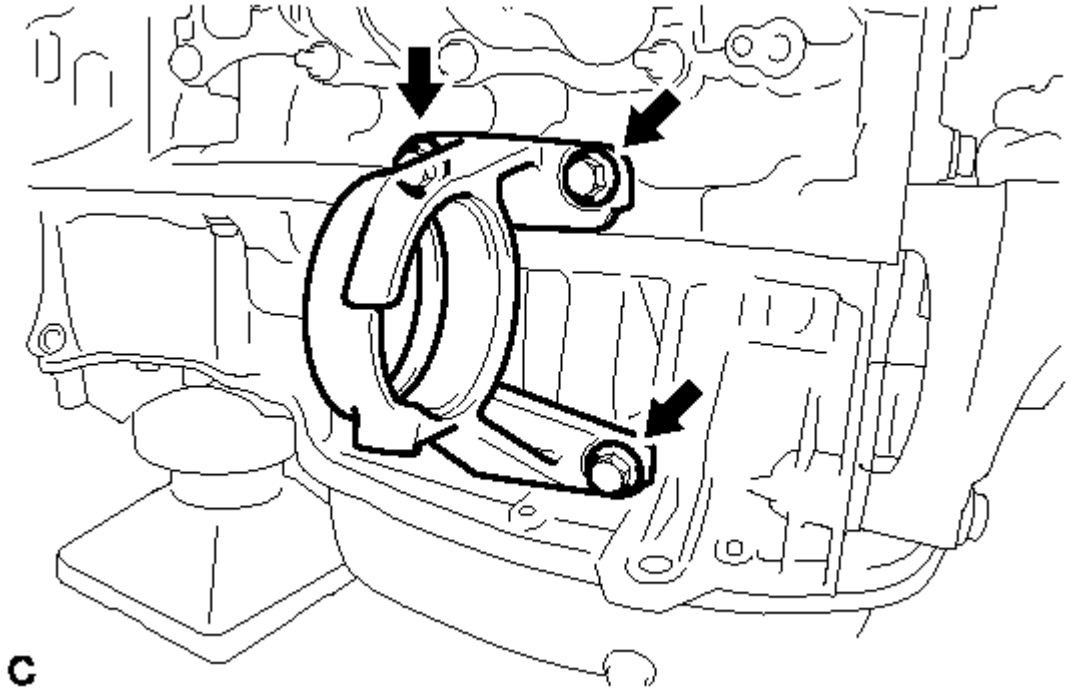


Fig. 206: Locating Drive Shaft Bearing Bracket Component Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

70. **REMOVE ENGINE MOUNTING BRACKET RH**
    a. Remove the 3 bolts and engine mounting bracket RH.

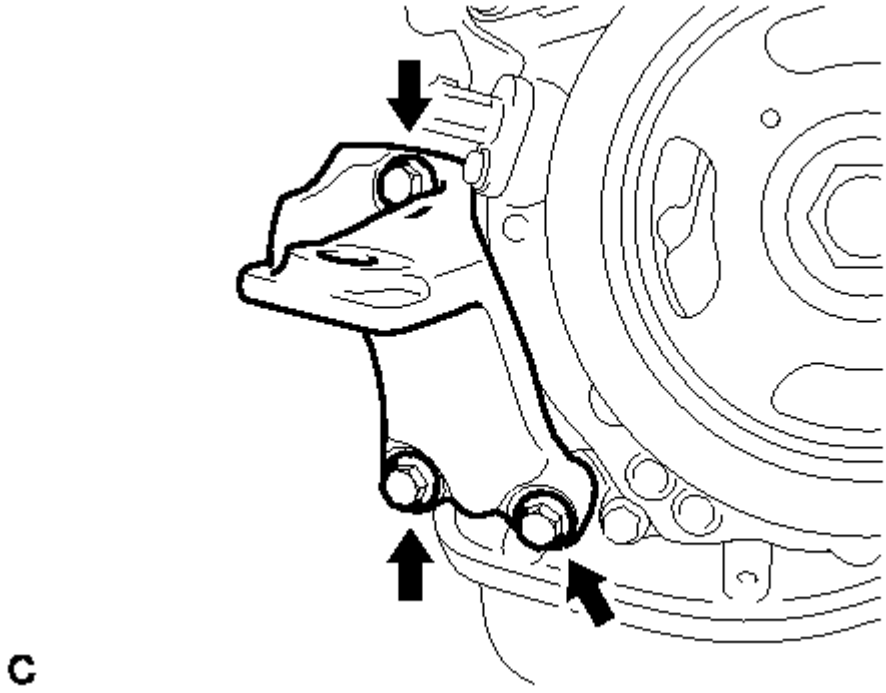


Fig. 207: Locating Engine Mounting Bracket RH Bolts

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

71. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 8**
72. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** See step 2
73. **INSTALL ENGINE STAND**
    a. Install the engine onto an engine stand with the bolts.

REMOVAL [12/2013 -]

REMOVAL [12/2013 -]

1. **PRECAUTION**

WARNING: The engine assembly with transmission is very heavy. Be sure to follow the procedure described in the removal procedure, or the engine lifter may suddenly drop.

NOTE: After turning the ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work. Refer to PRECAUTION [12/2013 -] .

2. **RECOVER REFRIGERANT FROM REFRIGERATION SYSTEM** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
3. **DISCHARGE FUEL SYSTEM PRESSURE**

   Refer to **PRECAUTION [12/2013 -]**

4. **PLACE FRONT WHEELS FACING STRAIGHT AHEAD**
5. **SECURE STEERING WHEEL**
6. **REMOVE FRONT WHEELS**
7. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**

NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [12/2013 -] .

8. **REMOVE FRONT WHEEL OPENING EXTENSION PAD LH**
9. **REMOVE ENGINE UNDER COVER LH**
10. **REMOVE FRONT WHEEL OPENING EXTENSION PAD RH**
11. **REMOVE ENGINE UNDER COVER RH**
12. **REMOVE FRONT FENDER APRON SEAL LH**
13. **REMOVE FRONT FENDER APRON SEAL RH**

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14. **DRAIN ENGINE OIL** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
15. **DRAIN ENGINE COOLANT** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
16. **DRAIN AUTOMATIC TRANSAXLE FLUID** . Refer to **REPLACEMENT [08/2013 -] - Step 1**
17. **REMOVE COOL AIR INTAKE DUCT SEAL** . Refer to **REMOVAL [08/2013 -] - Step 1**
18. **REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY**
    a. Lift the rear of the engine cover to detach the cover from the 2 pins, and then lift the front of the engine cover to detach the cover from the pin and remove the engine cover.

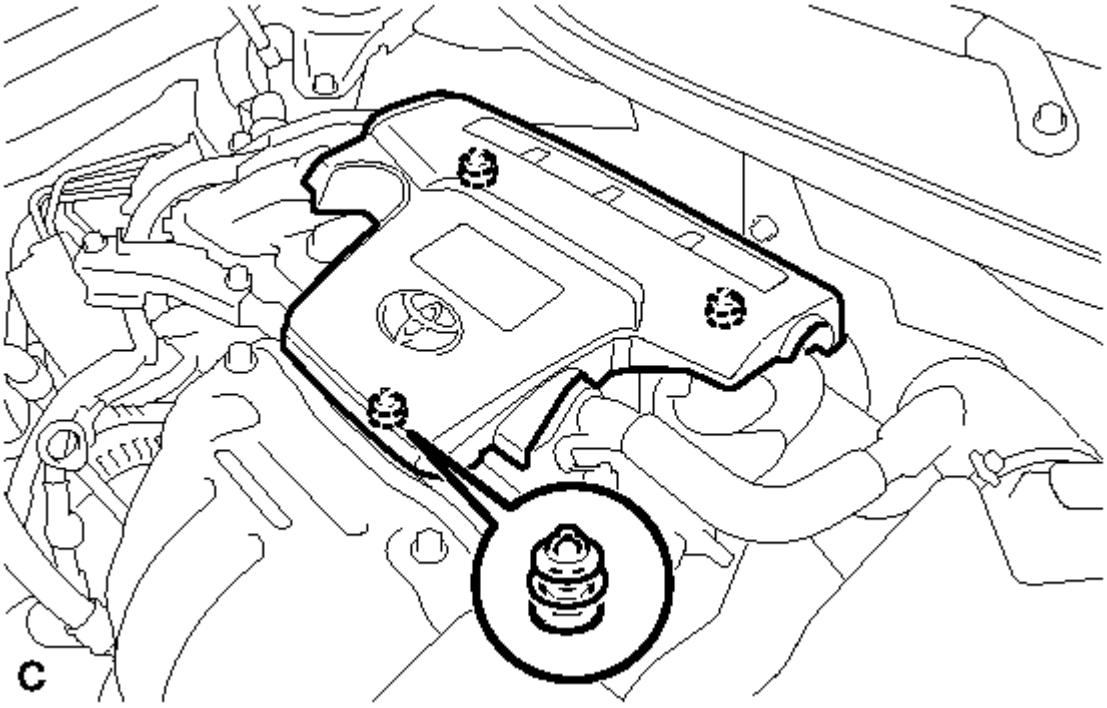


Fig. 208: Identifying No. 1 Engine Cover Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

19. **REMOVE INLET AIR CLEANER ASSEMBLY**
    a. Remove the 2 bolts and inlet air cleaner assembly.

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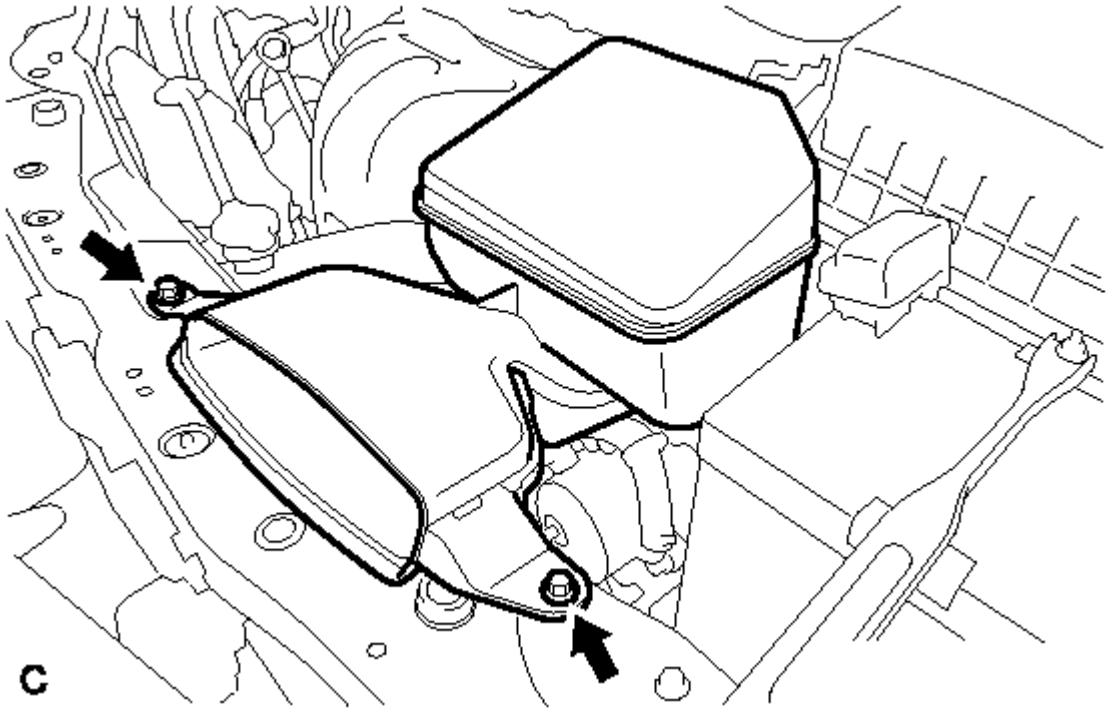


Fig. 209: Identifying Inlet Air Cleaner Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 7**
21. **REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**
    a. Remove the air cleaner filter element sub-assembly.
22. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY**
    a. Disconnect the wire harness clamp.

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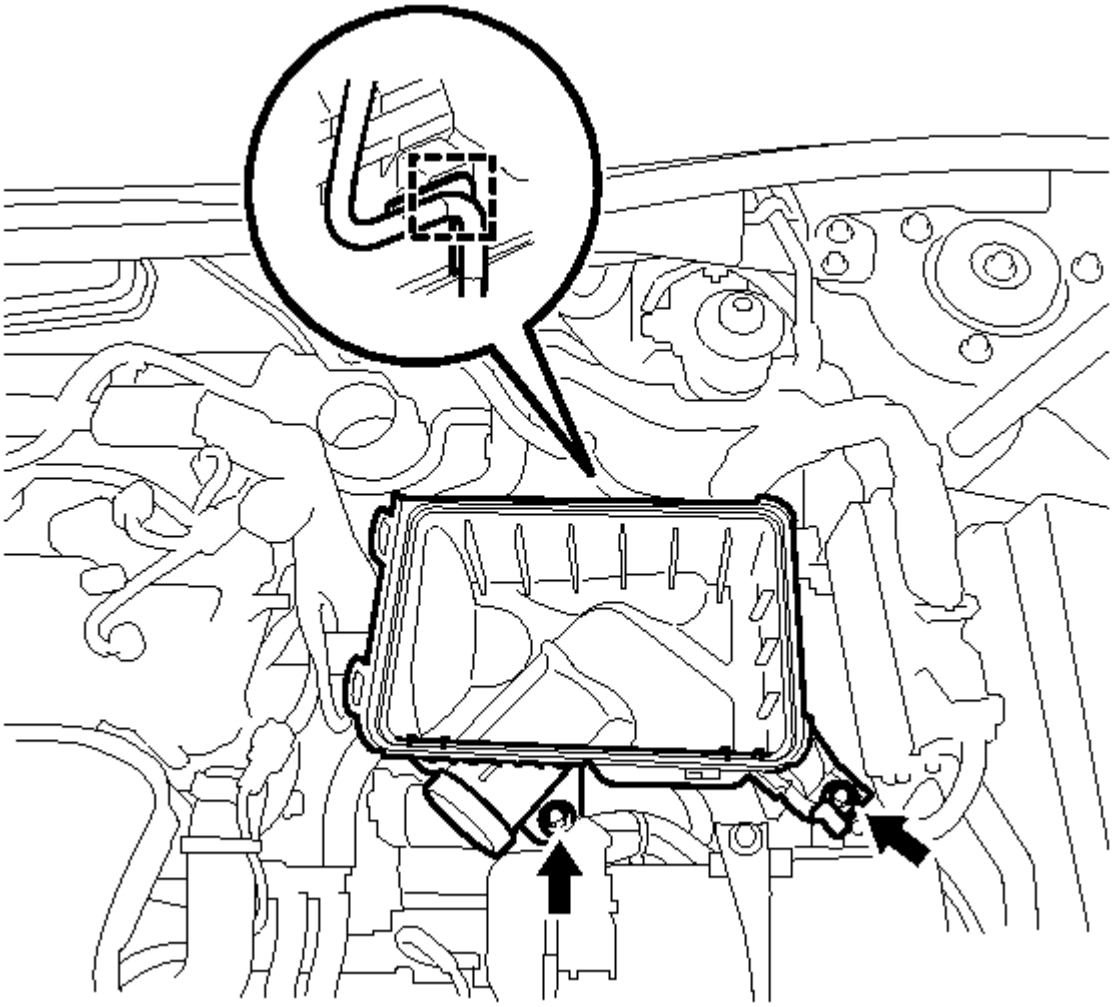


Fig. 210: Identifying Air Cleaner Case Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 2 bolts and air cleaner case sub-assembly.

23. **REMOVE BATTERY**

a. Loosen the nut, and separate the positive (+) battery terminal.

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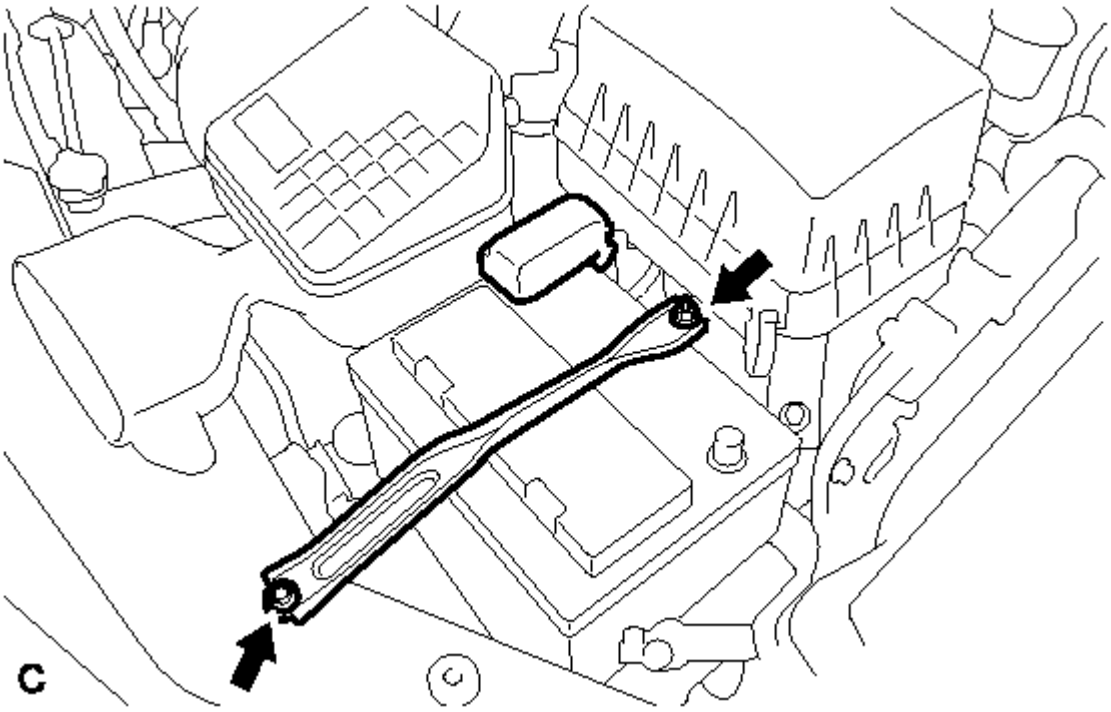


Fig. 211: Identifying Battery/Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Loosen the nut, and remove the bolt and battery clamp.
c. Remove the battery and battery tray.

24. **DISCONNECT NO. 1 RADIATOR HOSE**
    a. Remove the hose clamp to separate the air fuel ratio sensor wire from the No. 1 radiator hose.

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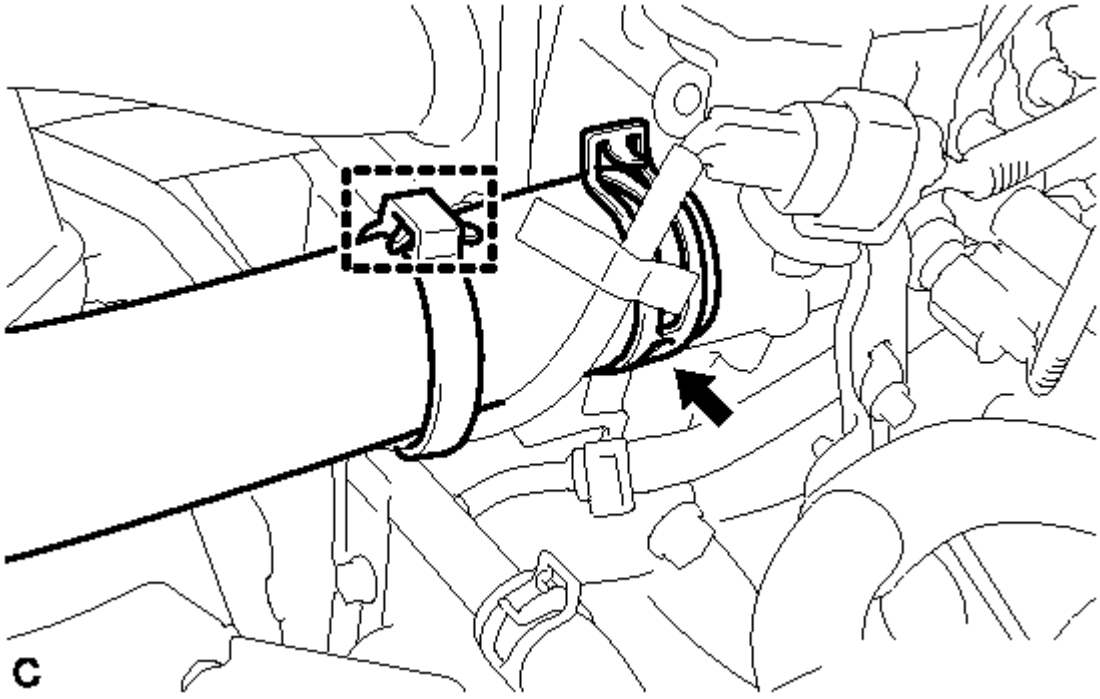
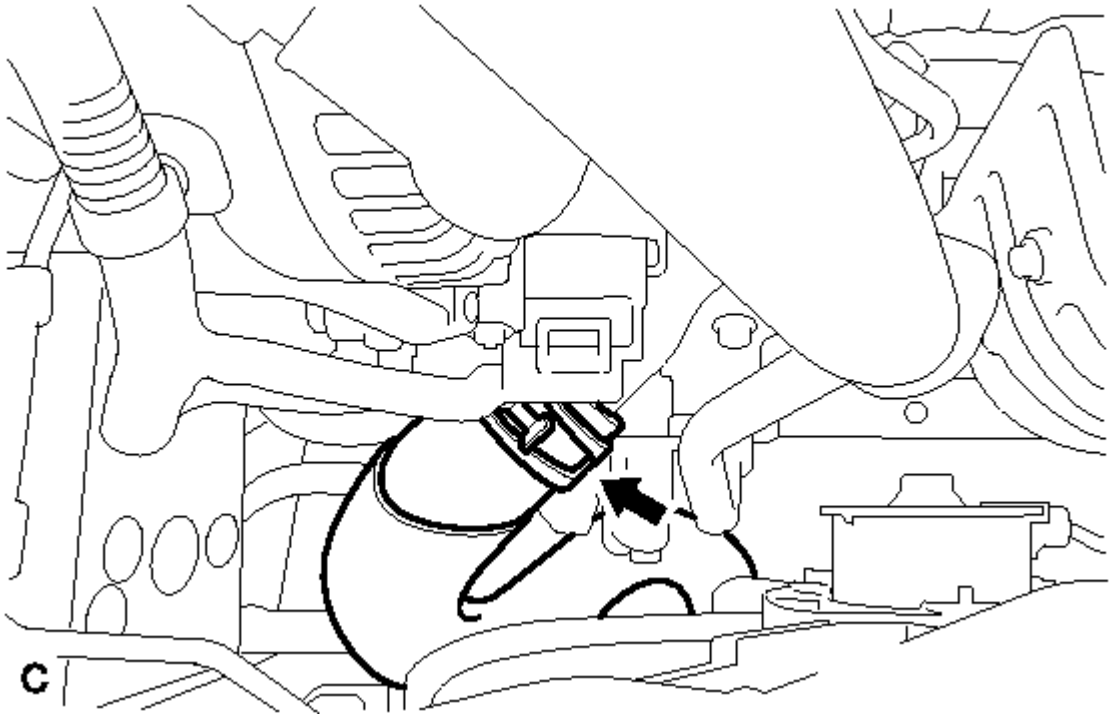


Fig. 212: Identifying Inlet Radiator Hose & Wire Harness Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Disconnect the No. 1 radiator hose.

25. **DISCONNECT NO. 2 RADIATOR HOSE**

a. Disconnect the No. 2 radiator hose.



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Fig. 213: Identifying No. 2 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

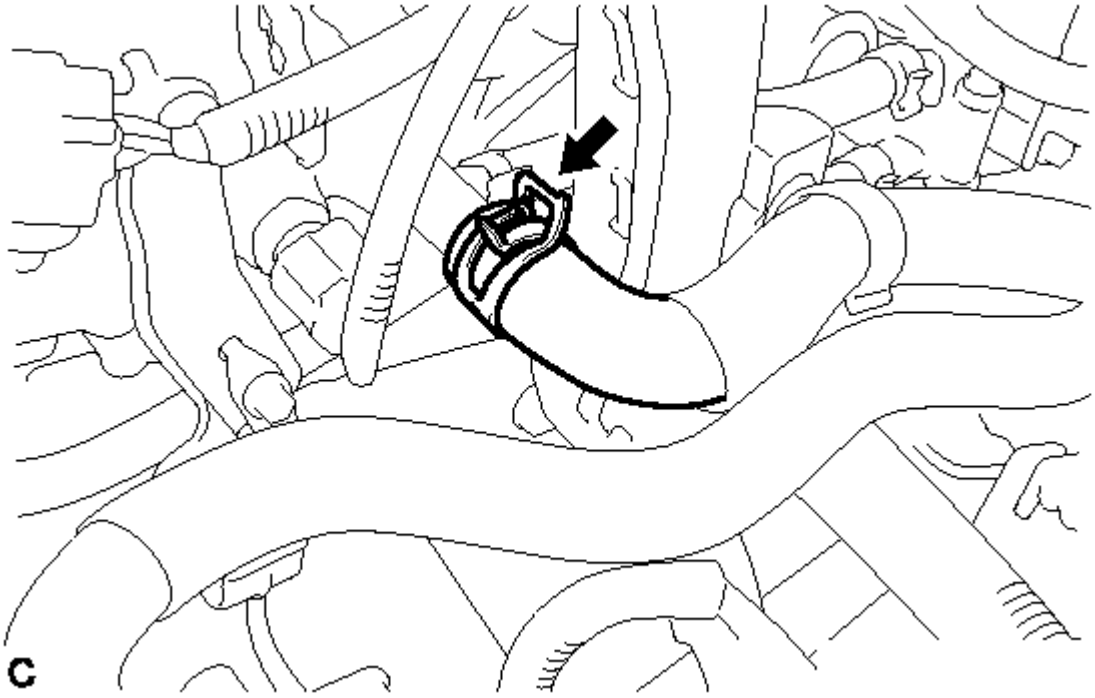


Fig. 214: View Of Inlet Heater Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

27. **DISCONNECT OUTLET HEATER WATER HOSE**
    a. Disconnect the 3 outlet heater water hoses.

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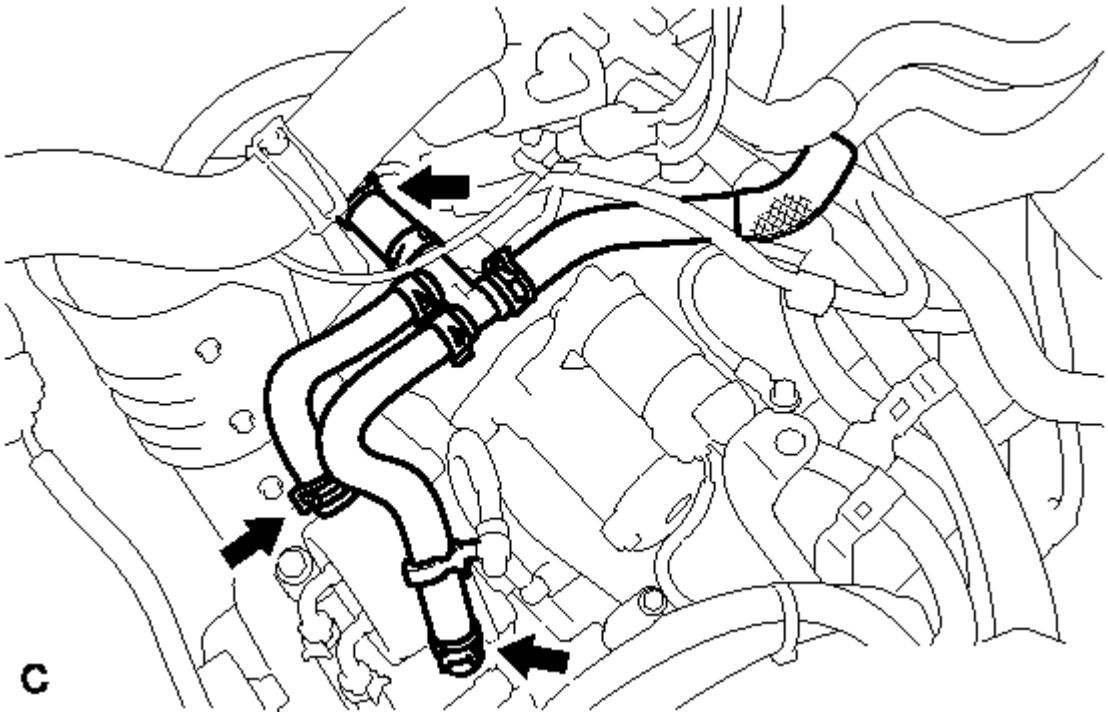


Fig. 215: Identifying Outlet Heater Water Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

28. **REMOVE STARTER ASSEMBLY** . Refer to **REMOVAL [12/2013 -] - Step 10**
29. **DISCONNECT ENGINE WIRE**
    a. Remove the No. 1 relay block cover.
    b. Remove the 2 nuts and disconnect the wire clamp.

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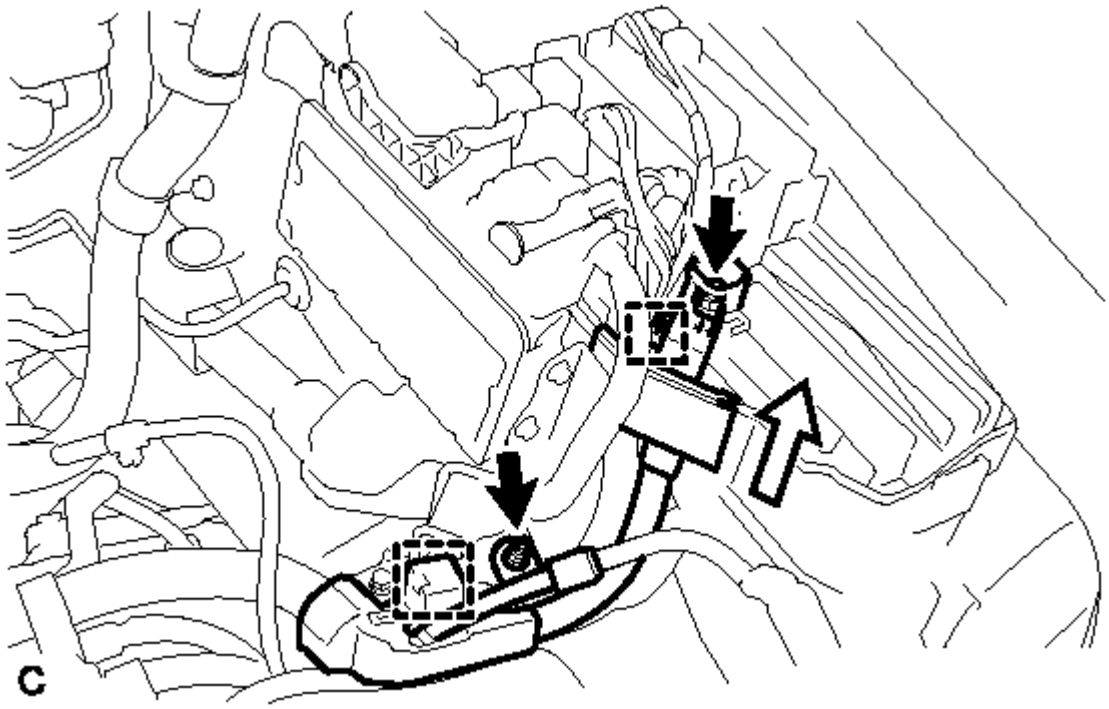
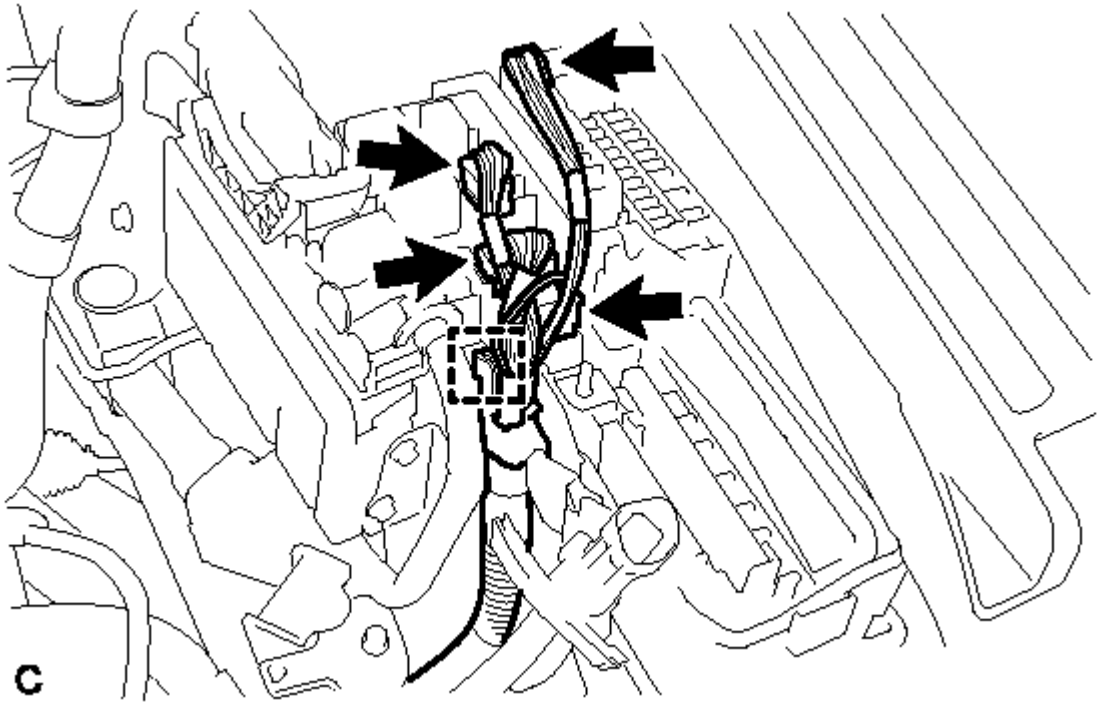


Fig. 216: Identifying Engine Wire Nuts And Wire Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

d. Disconnect the 4 connectors.



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Fig. 217: Identifying Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

f. Pull up the lever to disconnect the ECM connector.

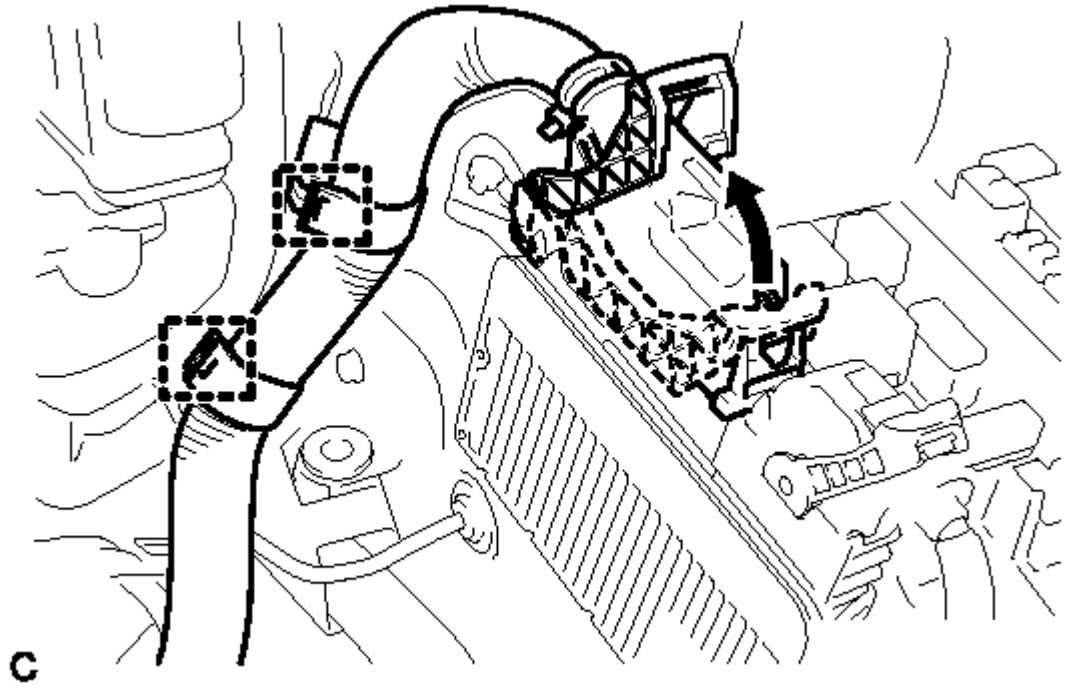


Fig. 218: Identifying ECM Connector And Wire Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

g. Disconnect the 2 wire clamps.

30. **DISCONNECT NO. 1 AIR CLEANER BRACKET**

a. Disconnect the 2 wire clamps.

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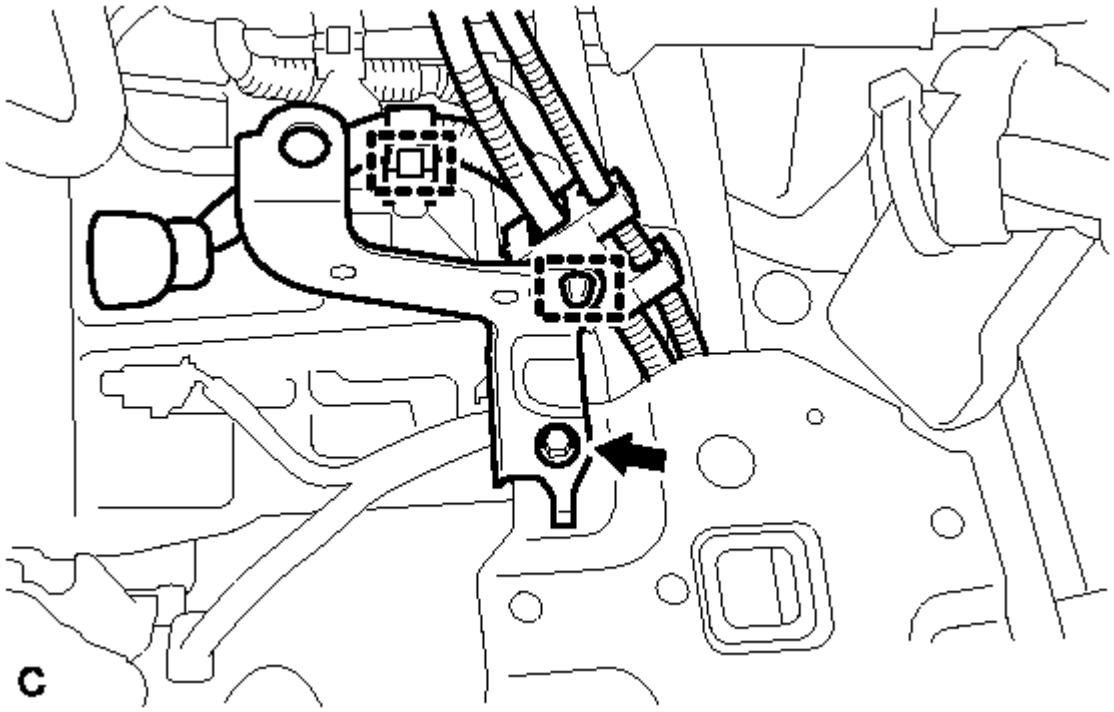
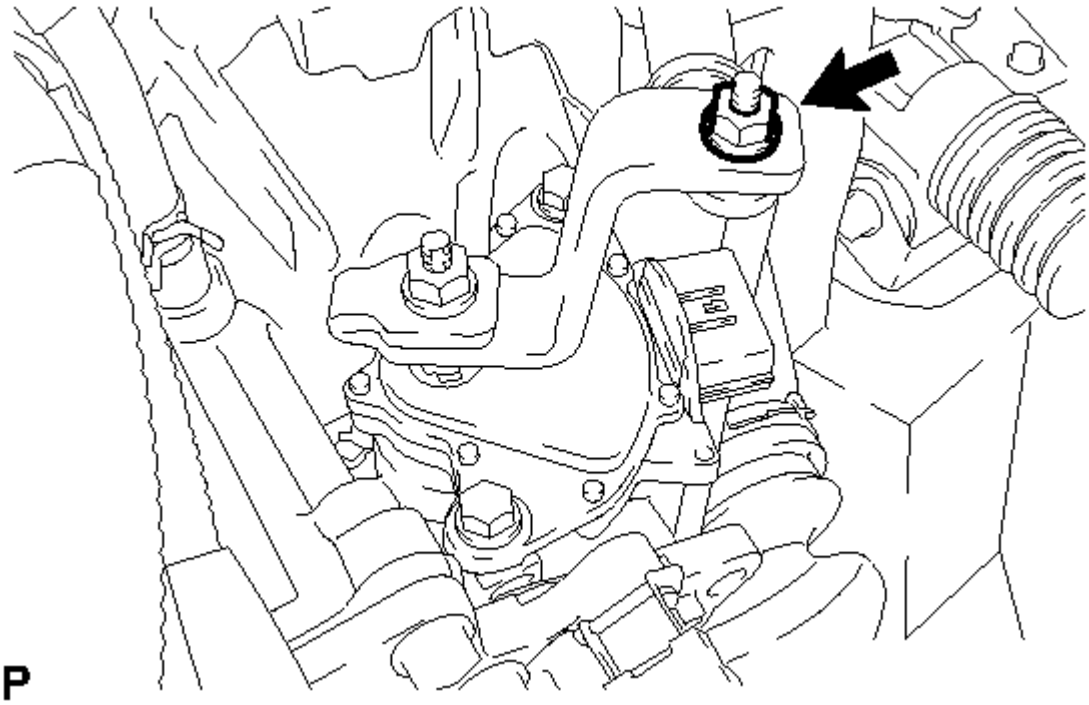


Fig. 219: Identifying No. 1 Air Cleaner Bracket And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the bolt and No. 1 air cleaner bracket.

31. **DISCONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**

a. Remove the nut and disconnect the transmission control cable from the control shaft lever.



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Fig. 220: Locating Transmission Control Shaft Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the clip and disconnect the transmission control cable assembly from the No. 1 control cable bracket.

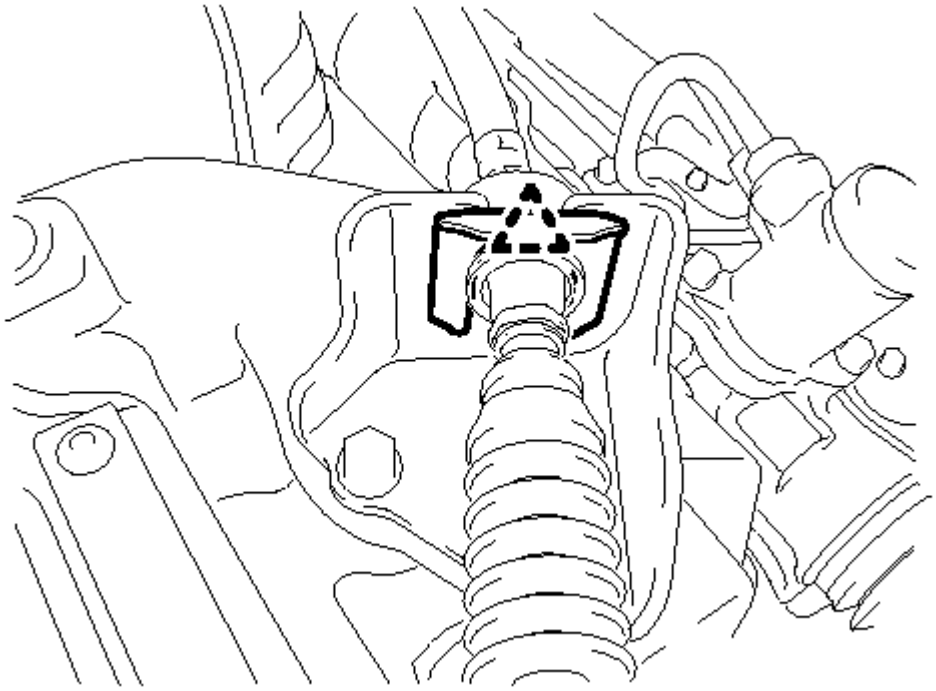


Fig. 221: Remove The Clip From The Transmission Cable Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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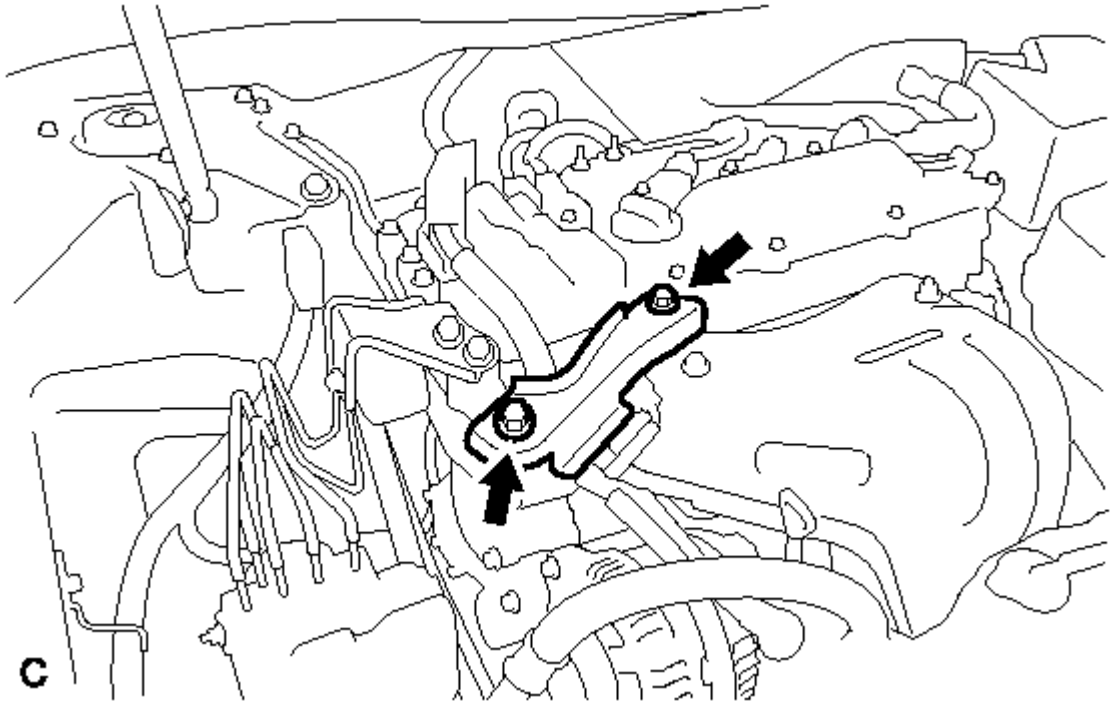


Fig. 222: Identifying No. 2 Endgine Mounting Stay RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **SEPARATE EARTH WIRE**
    a. Remove the bolt and separate the earth wire from the engine moving control rod bracket.

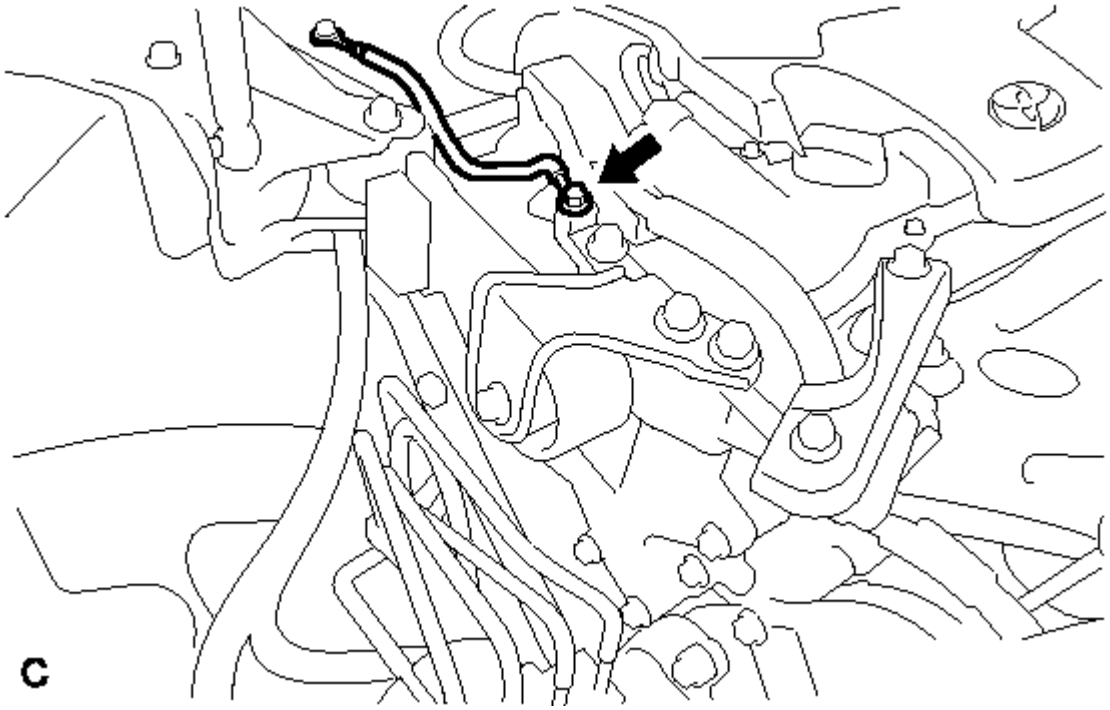


Fig. 223: Identifying Earth Wire

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

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

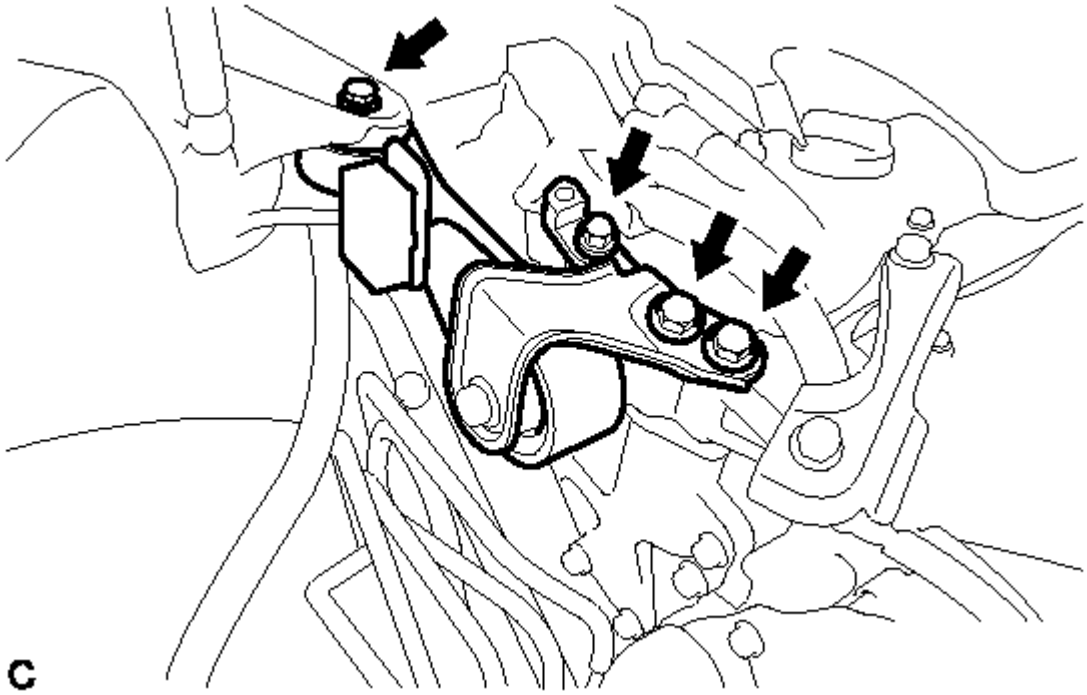
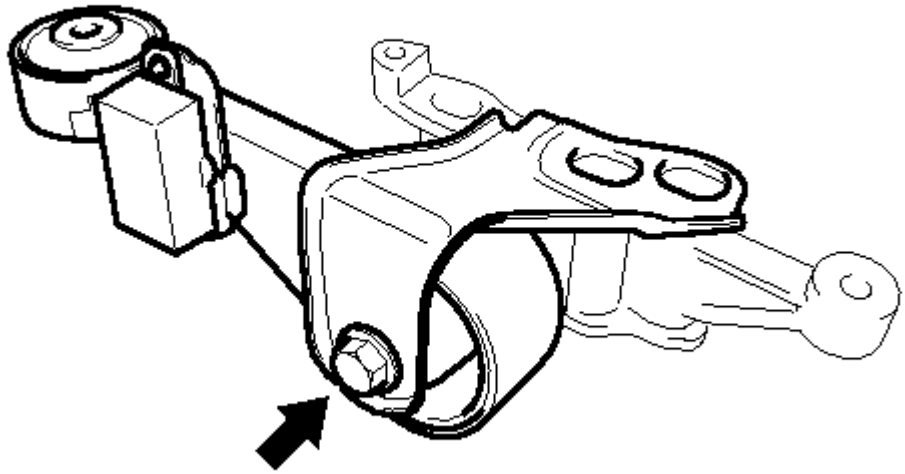


Fig. 224: Identifying Engine Moving Control Rod Bracket And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

35. **REMOVE ENGINE MOVING CONTROL ROD**
    a. Remove the bolt, No. 3 engine mounting stay RH and engine moving control rod from the engine moving control rod bracket.

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C

Fig. 225: Identifying Engine Moving Control Rod
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Perform this procedure only when replacement of the engine moving control rod is necessary.

36. **DISCONNECT UNION TO CONNECTOR TUBE HOSE**
    a. Disconnect the union to connector tube hose.

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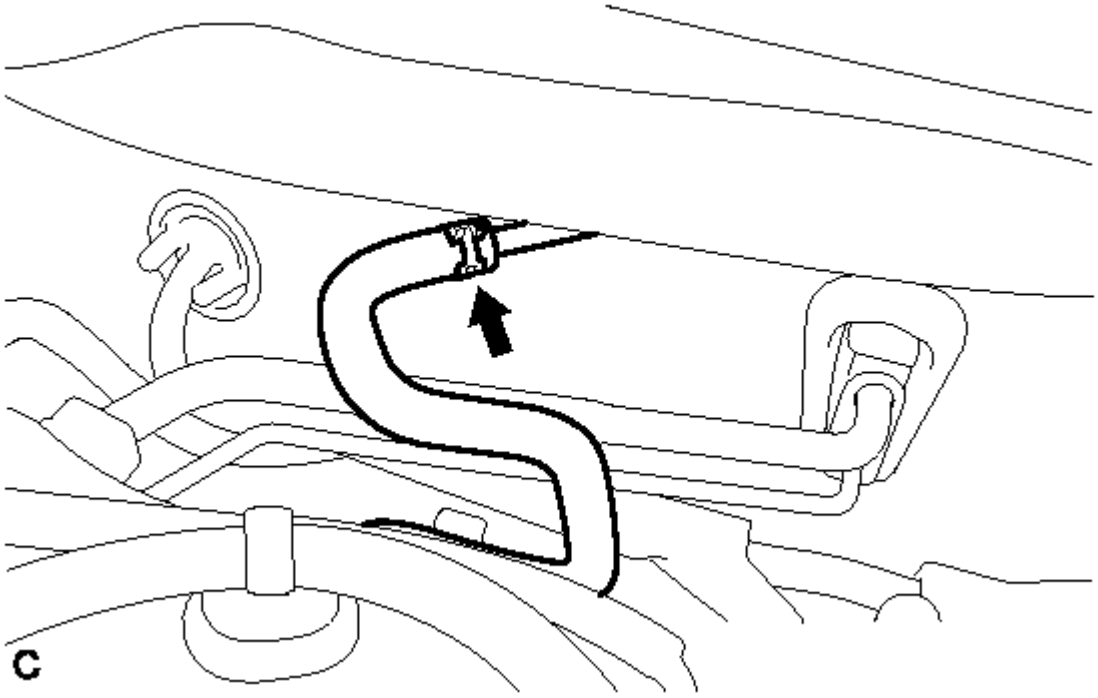


Fig. 226: Identifying Union to Connector Tube Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

37. **DISCONNECT NO. 1 COOLER REFRIGERANT DISCHARGE HOSE** . Refer to **REMOVAL [08/2013 -] - Step 5**
38. **DISCONNECT SUCTION HOSE SUB-ASSEMBLY (for TMMK Made)** . Refer to **REMOVAL [08/2013 -] - Step 6**
39. **DISCONNECT NO. 1 COOLER REFRIGERANT SUCTION HOSE (for SIA Made)** . Refer to **REMOVAL [08/2013 -] - Step 7**
40. **DISCONNECT FUEL TUBE SUB-ASSEMBLY**
    a. Release the claw and remove the No. 1 fuel pipe clamp.

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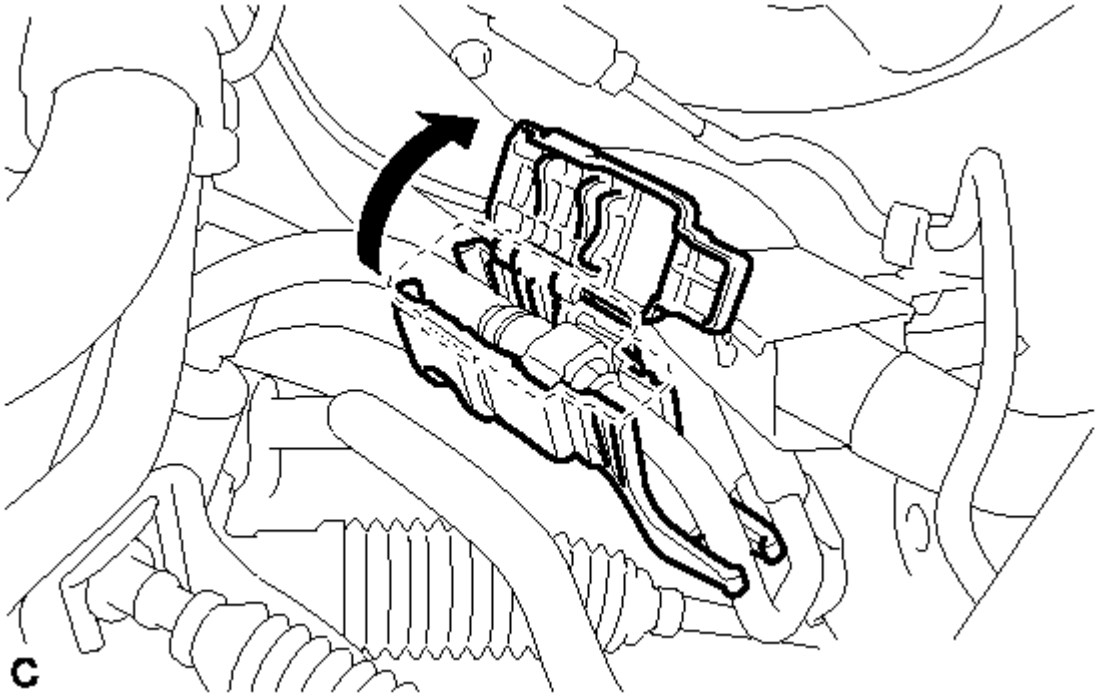


Fig. 227: Identifying Fuel Tube Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Pinch the fuel tube connector and then pull out the fuel main tube.

NOTE:

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

41. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 4**
42. **REMOVE FRONT AXLE SHAFT NUT LH** . Refer to **REMOVAL [08/2013 -] - Step 9**
43. **REMOVE FRONT AXLE SHAFT NUT RH**

HINT:

Use the same procedure described for the LH side.

44. **SEPARATE FRONT STABILIZER LINK ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 4**

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45. **SEPARATE FRONT STABILIZER LINK ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

46. **SEPARATE FRONT SPEED SENSOR LH** . Refer to **REMOVAL [08/2013 -] - Step 3**
47. **SEPARATE FRONT SPEED SENSOR RH**

    HINT:

    Use the same procedure described for the LH side.

48. **SEPARATE TIE ROD ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 5**
49. **SEPARATE TIE ROD ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

50. **SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 8**
51. **SEPARATE FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

52. **SEPARATE FRONT AXLE ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 7**
53. **SEPARATE FRONT AXLE ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

54. **SEPARATE STEERING INTERMEDIATE SHAFT ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 4**
55. **REMOVE FLYWHEEL HOUSING UNDER COVER**
    a. Remove the flywheel housing under cover.

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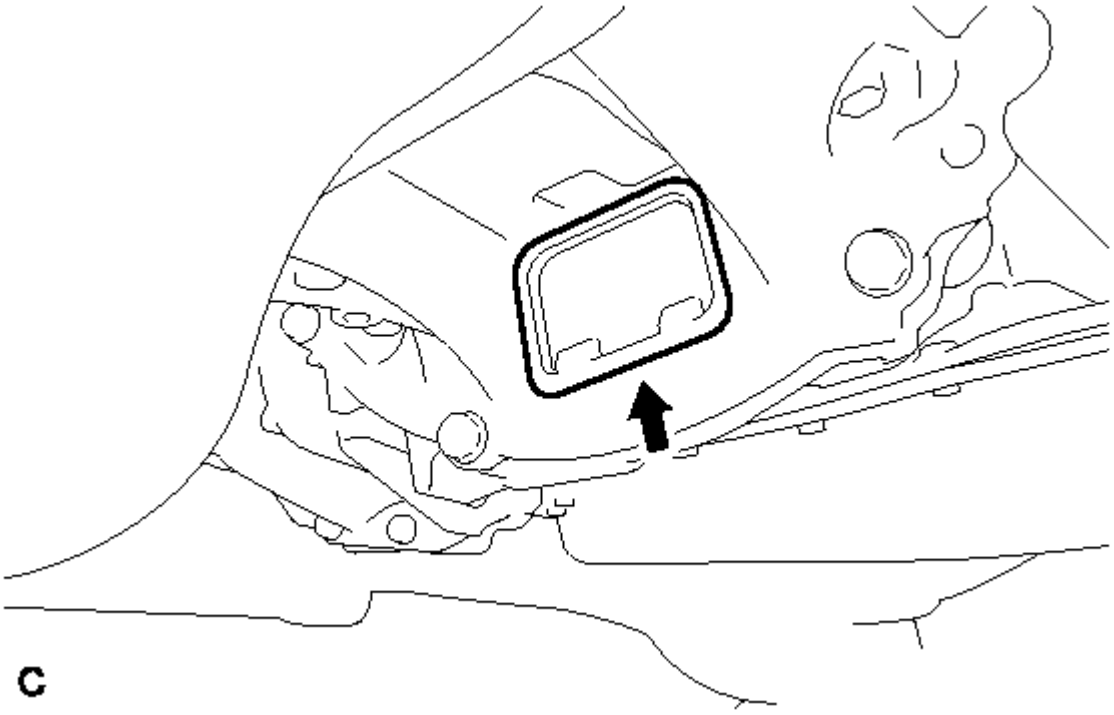
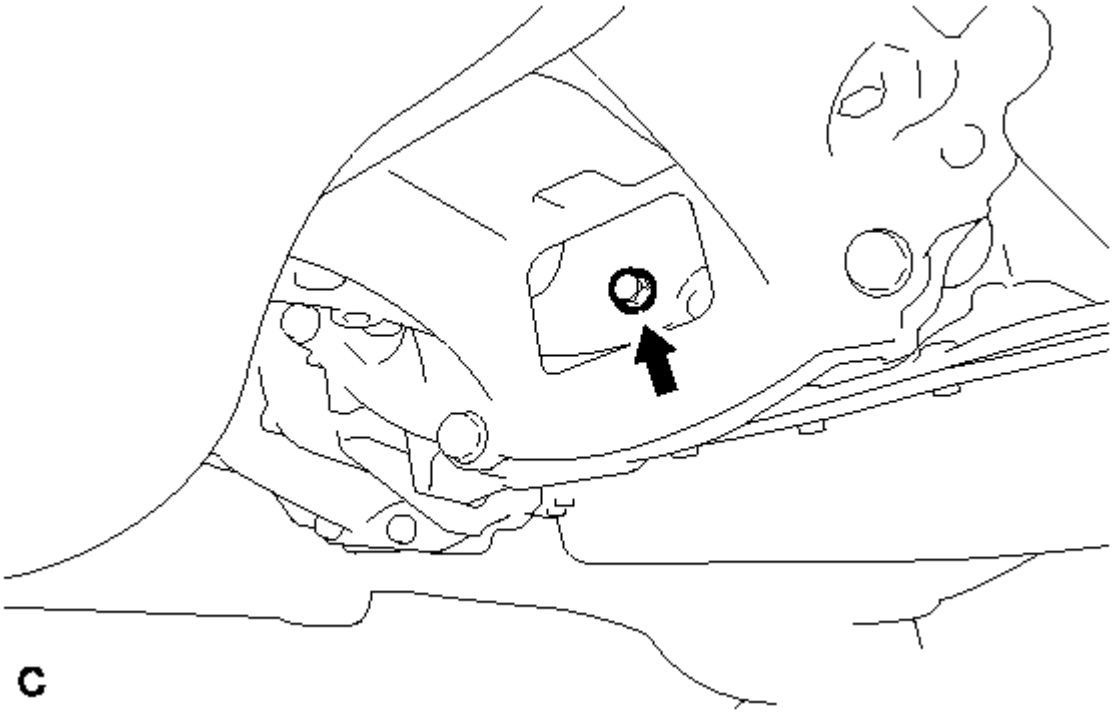


Fig. 228: Locating Flywheel Housing Under Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

56. **REMOVE DRIVE PLATE AND TORQUE CONVERTER SETTING BOLT**

a. Turn the crankshaft to gain access to the removal locations of the 6 torque converter setting bolts and remove each bolt while holding the crankshaft pulley bolt with a wrench.



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Fig. 229: Locating Torque Converter Clutch Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

57. **REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**
    a. Set the engine lifter.

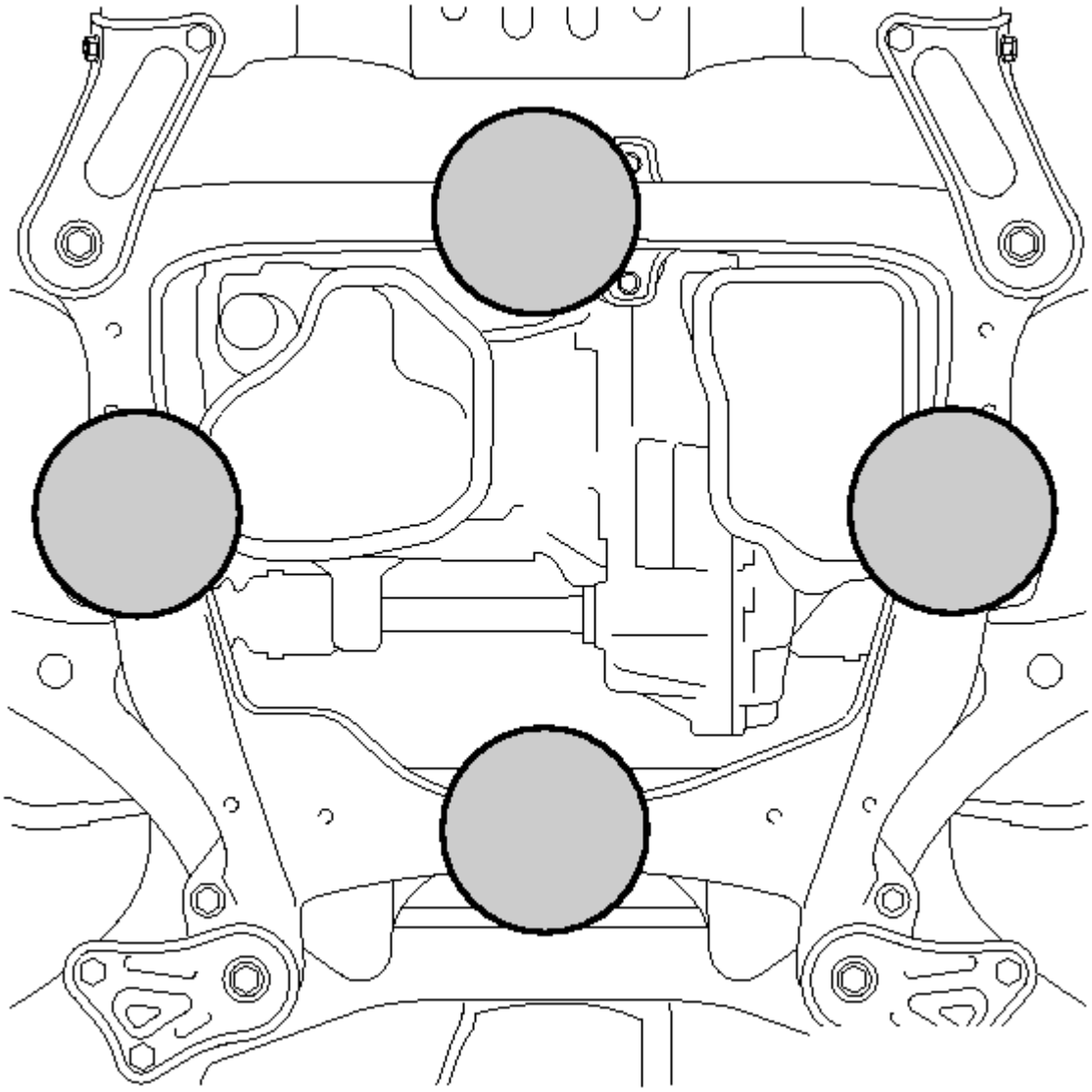


Fig. 230: Identifying Engine Assembly Removal Locations with Transaxle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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	Attachment Installation Position

NOTE:

- **Install a height adjustment attachment and plate lift attachment onto the engine assembly with transaxle.**
- **Securely support the engine assembly to prevent it from turning upside down until it is secured to an engine stand.**
- **To prevent the oil pan from deforming, do not place any attachments onto the oil pan of the engine assembly with transaxle.**
- **Servicing an engine assembly while it is hanging is dangerous. This can be done only when installing/removing the engine assembly to/from an engine stand.**
- **Do not perform any procedure while the engine assembly is suspended because doing so may cause the engine assembly to drop, resulting in injury. However, the engine assembly needs to be suspended when it is installed or removed from an engine stand.**

b. Remove the 4 bolts, 2 nuts, and frame side rail plate RH and LH.

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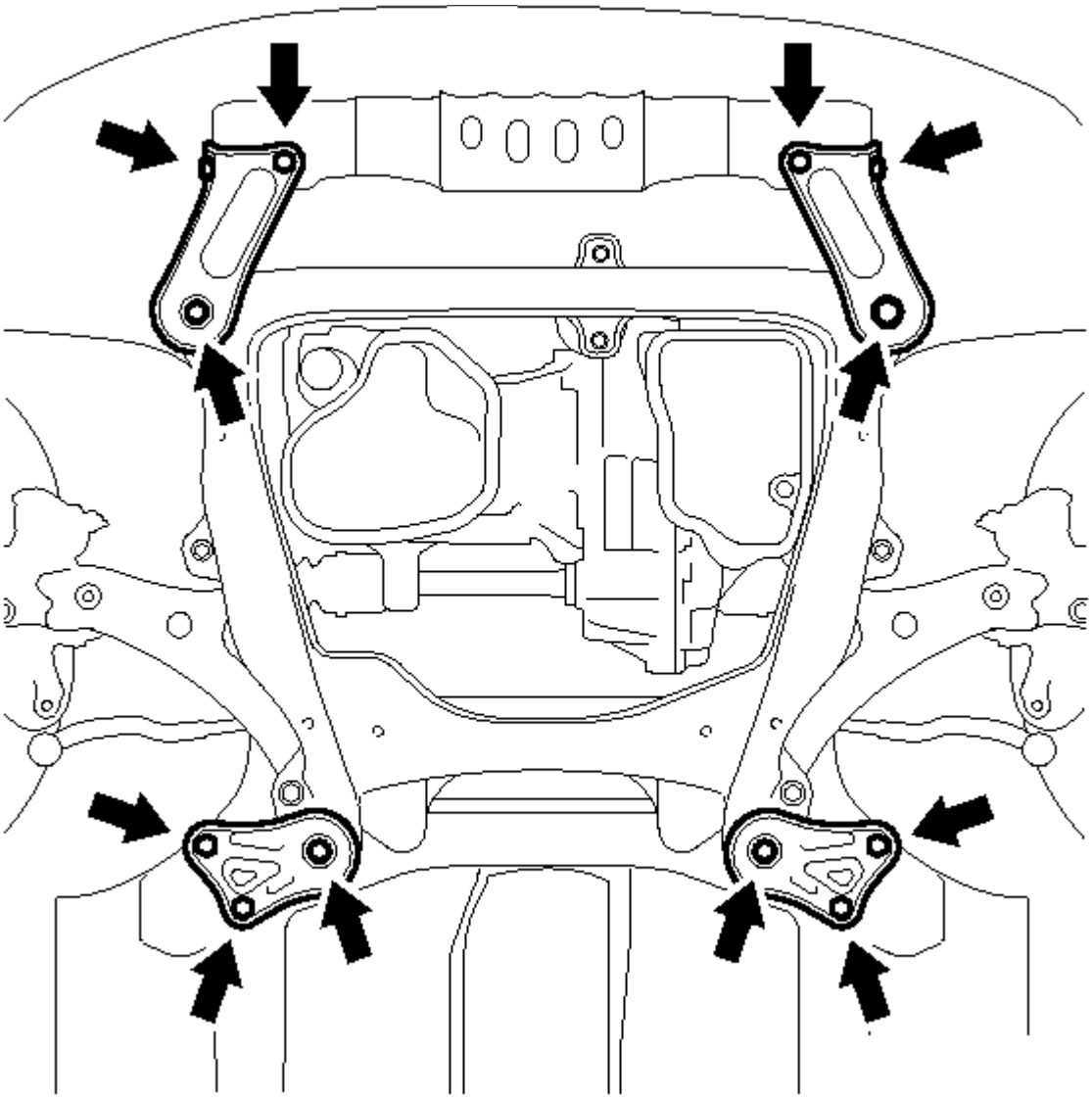


Fig. 231: Identifying Engine Removal Bolts, Nuts And Frame Side Plate RH And LH.
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the 4 bolts, 2 nuts, and front suspension member brace rear RH and LH.
d. Operate the engine lifter and remove the engine assembly from the vehicle.

NOTE:

- **Make sure that the engine is clear of all wiring and hoses.**
- **While lowering the engine from the vehicle, do not allow it to contact the vehicle.**

e. Install engine hangers See step 20.

58. **REMOVE ENGINE WIRE**
    a. Remove the engine wire from the engine with transaxle.
59. **REMOVE V-RIBBED BELT** See step 5

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60. **REMOVE COMPRESSOR ASSEMBLY WITH PULLEY** . Refer to **REMOVAL [08/2013 -] - Step 8**
61. **REMOVE GENERATOR ASSEMBLY** . Refer to **REMOVAL [12/2013 -] - Step 4**
62. **REMOVE FRONT DRIVE SHAFT ASSEMBLY LH** . Refer to **REMOVAL [08/2013 -] - Step 15**
63. **REMOVE FRONT DRIVE SHAFT HOLE SNAP RING LH** . Refer to **REMOVAL [08/2013 -] - Step 17**
64. **REMOVE FRONT DRIVE SHAFT ASSEMBLY RH** . Refer to **REMOVAL [08/2013 -] - Step 16**
65. **REMOVE FRONT FRAME ASSEMBLY**
    a. Remove the nut and separate the engine mounting insulator LH.

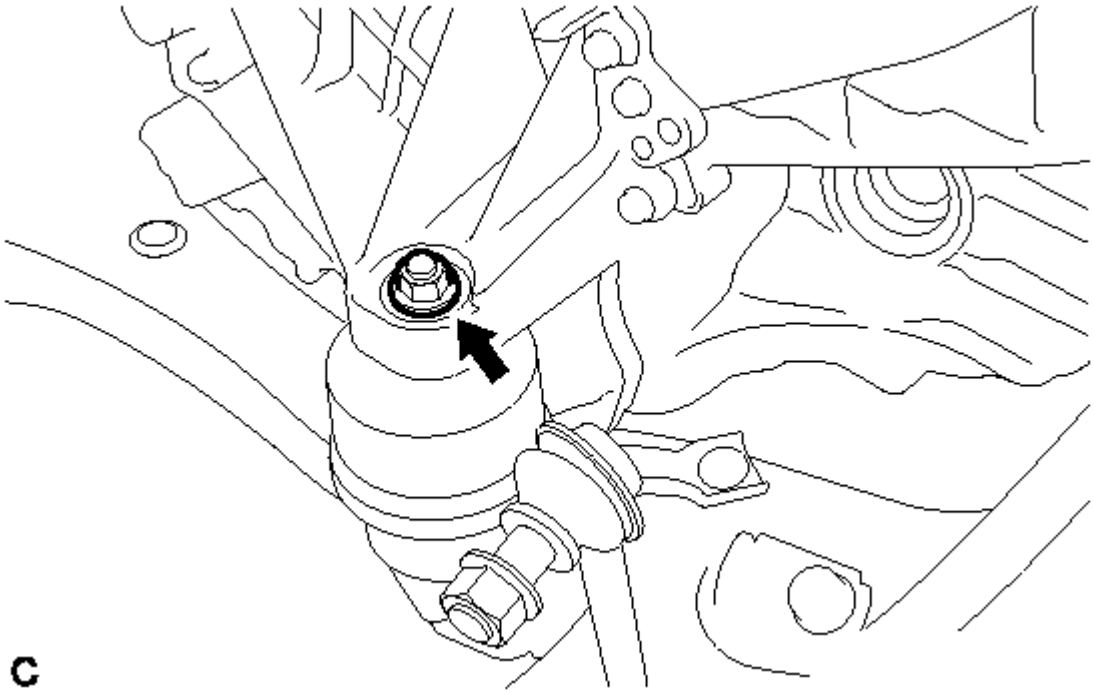


Fig. 232: Identifying Engine Mounting Insulator Nut LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the bolt and separate the front engine mounting insulator.

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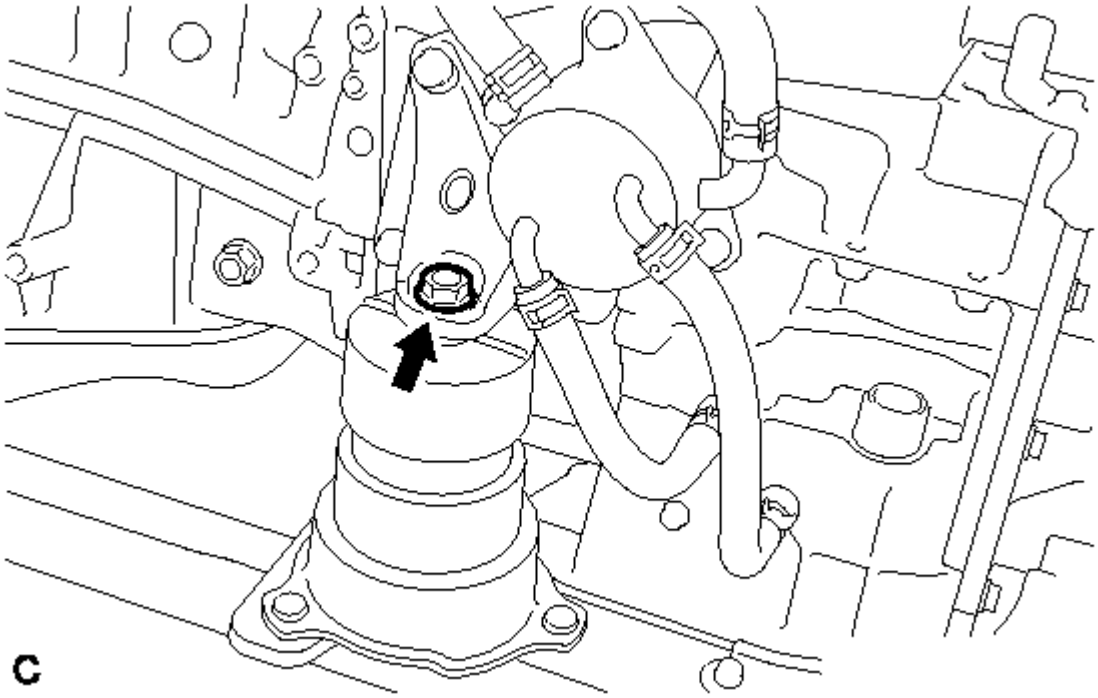


Fig. 233: Identifying Front Engine Mounting Insulator Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

c. Remove the nut and separate the engine mounting insulator RH.

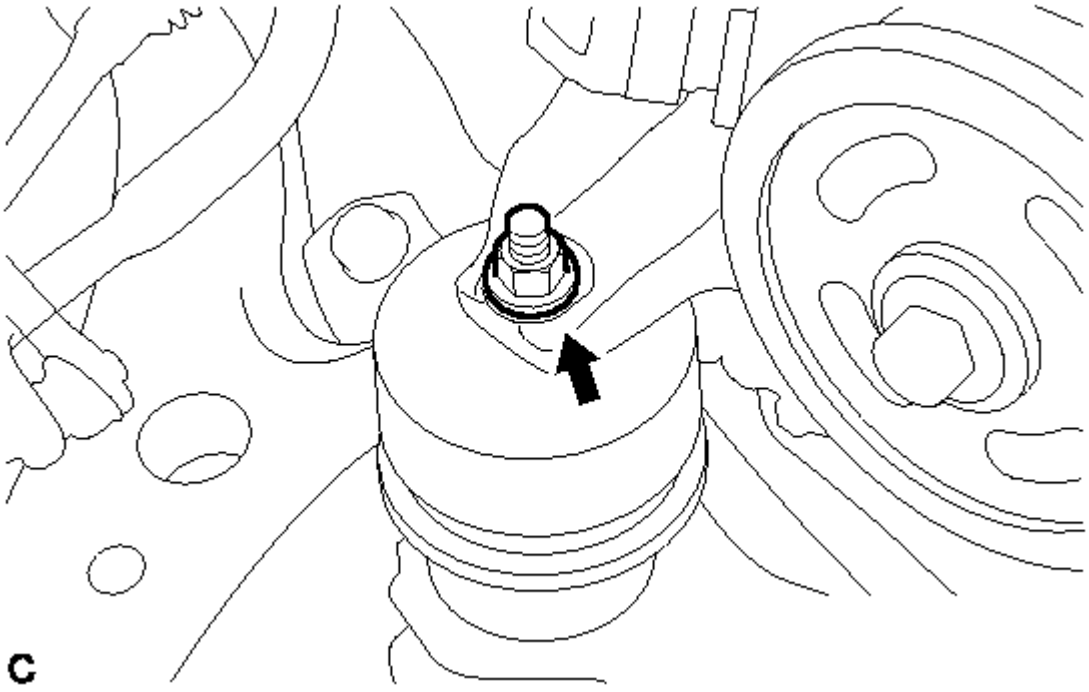


Fig. 234: Identifying Engine Mounting Insulator Nut RH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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d. Remove the front frame assembly.

e. Using a height adjustable attachment and plate lift attachment, place the engine assembly on a flat level surface.

NOTE:

- **Using a height adjustable attachment and plate lift attachment, place the engine assembly with transaxle horizontally.**
- **To prevent the oil pan from deforming, do not place any attachments onto the oil pan of the engine assembly with transaxle.**
- **Using an engine sling device and engine lift, secure the engine assembly before service.**

66. **REMOVE FRONT ENGINE MOUNTING INSULATOR**

a. Remove the 3 nuts and front engine mounting insulator.

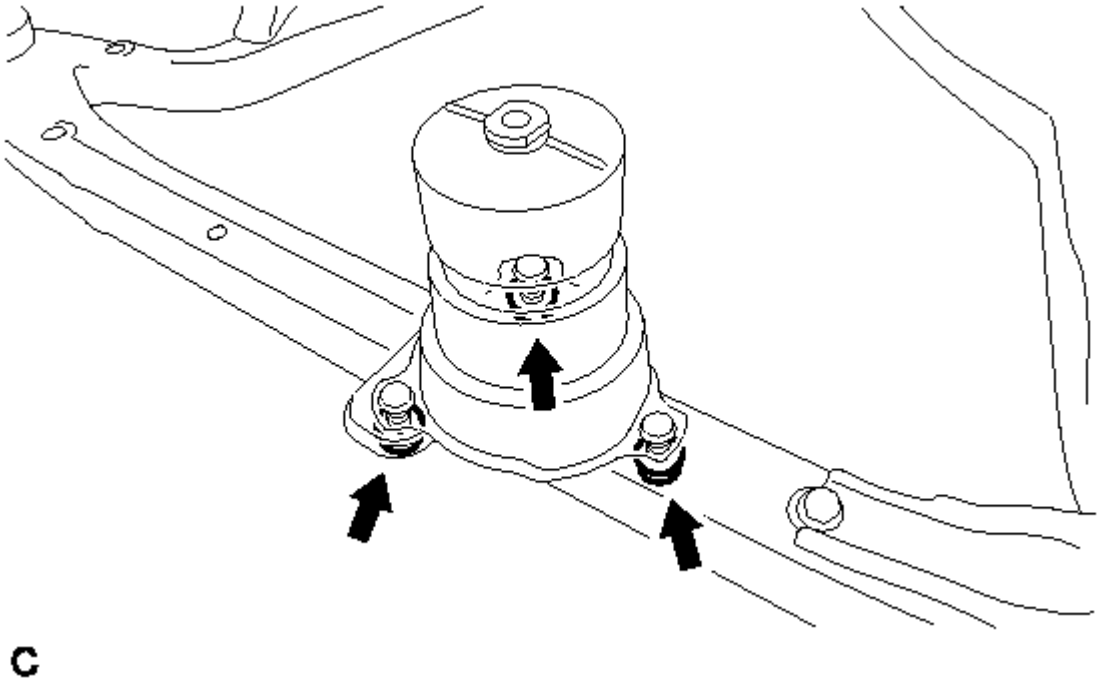


Fig. 235: Identifying Engine Mounting Insulator Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

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

67. **REMOVE ENGINE MOUNTING INSULATOR LH**

a. Remove the 2 hole plugs from the front frame assembly.

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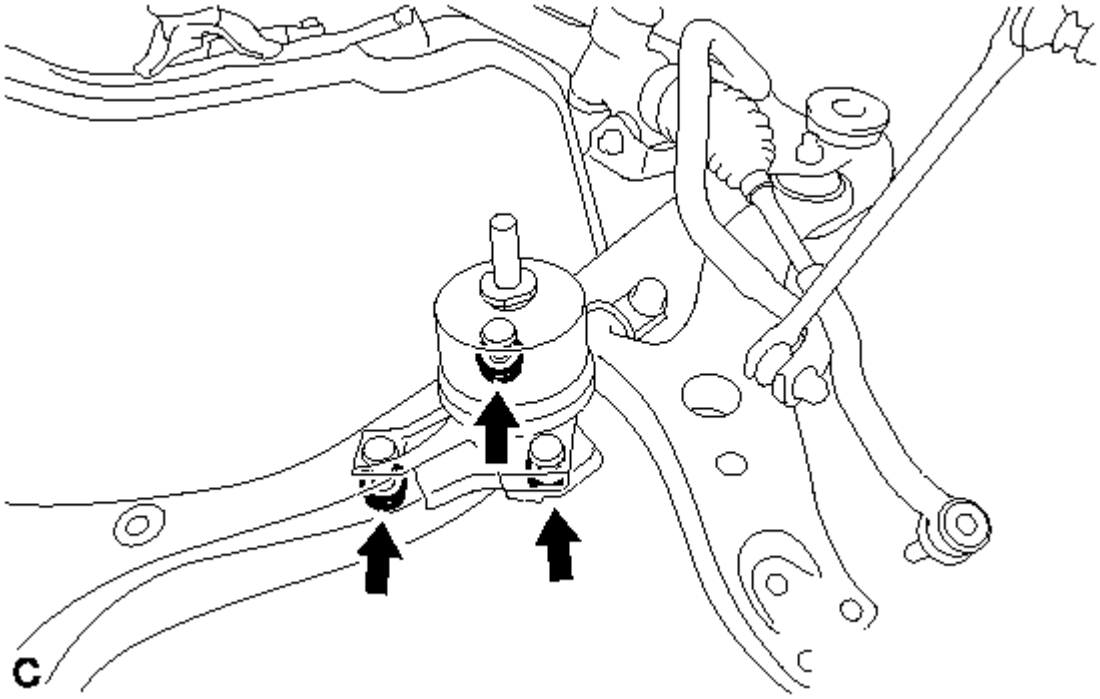


Fig. 236: Identifying Front Frame Assembly Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 3 nuts and engine mounting insulator LH.

HINT:

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

68. **REMOVE ENGINE MOUNTING INSULATOR RH**

a. Remove the 2 hole plugs from the front frame assembly.

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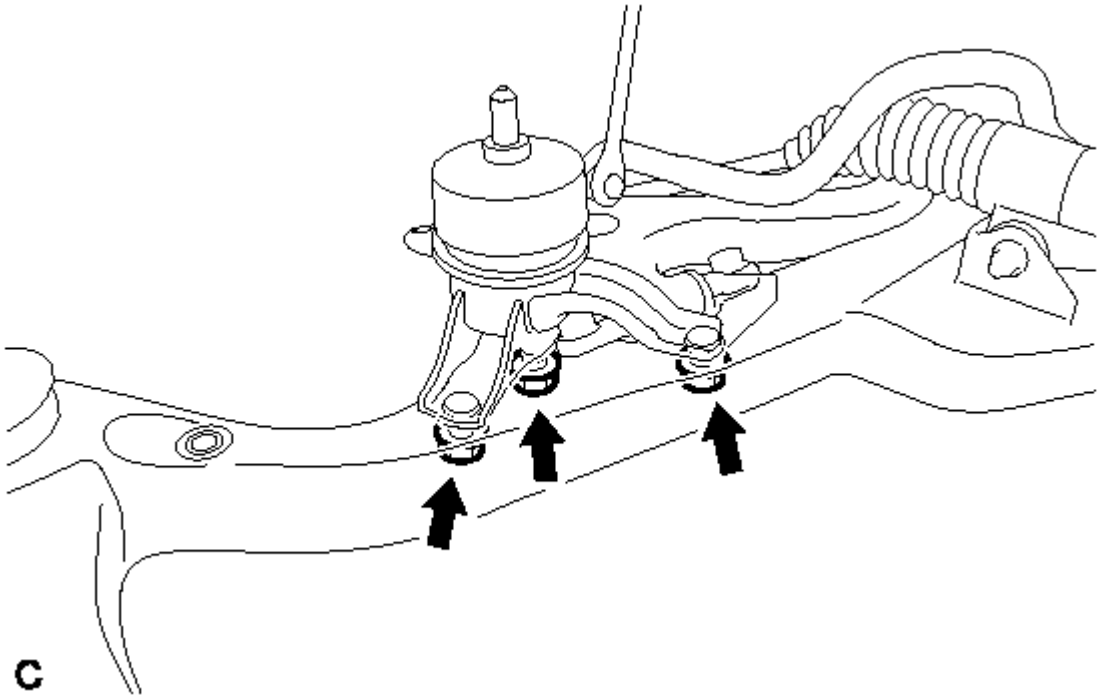


Fig. 237: Identifying Front Frame Assembly Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 3 nuts and engine mounting insulator RH.

HINT:

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

69. **REMOVE DRIVE SHAFT BEARING BRACKET**

a. Remove the 3 bolts and drive shaft bearing bracket.

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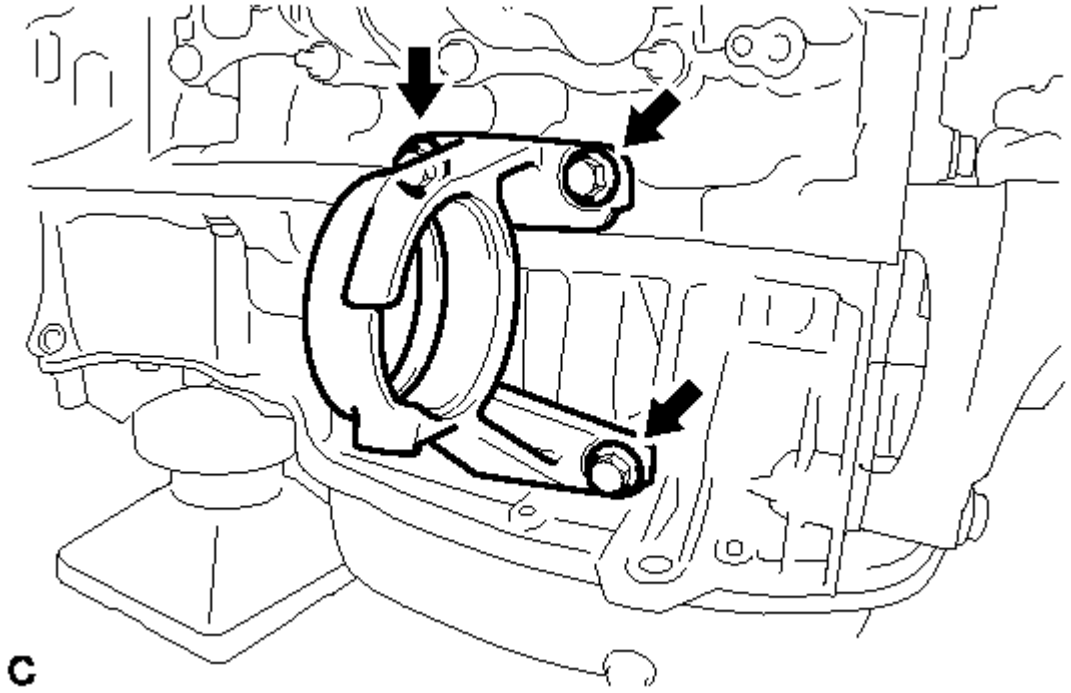


Fig. 238: Locating Drive Shaft Bearing Bracket Component Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

70. **REMOVE ENGINE MOUNTING BRACKET RH**
    a. Remove the 3 bolts and engine mounting bracket RH.

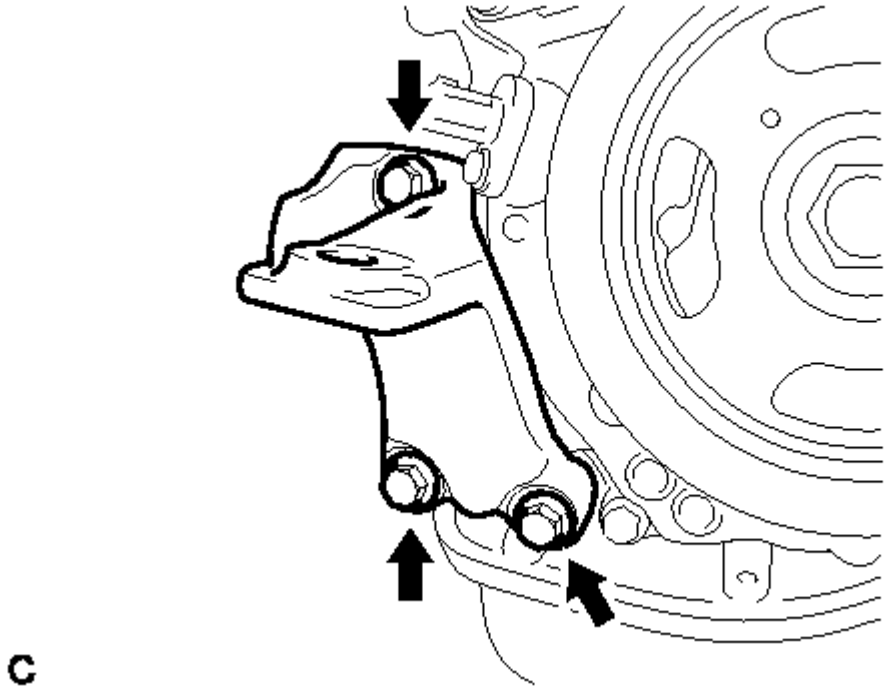


Fig. 239: Locating Engine Mounting Bracket RH Bolts

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

71. **REMOVE AUTOMATIC TRANSAXLE ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 8**
72. **REMOVE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** See step 2
73. **INSTALL ENGINE STAND**
    a. Install the engine onto an engine stand with the bolts.

INSTALLATION [08/2013 - 12/2013]

INSTALLATION [08/2013 - 12/2013]

HINT:

Perform "Inspection After Repair" after replacing the engine assembly. Refer to **INITIALIZATION [08/2013 -]** .

1. **REMOVE ENGINE STAND**
    a. Using a chain block and engine sling device, secure the engine assembly.

NOTE:

- **Adjust the angle of the sling device carefully to prevent the engine assembly or engine hanger from deforming or becoming damaged.**
- **Servicing an engine assembly while it is hanging is dangerous. This can be done only when installing/removing the engine assembly to/from an engine stand.**

    b. Remove the engine assembly from the engine stand.
2. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** See step 2
3. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 8**
4. **INSTALL ENGINE MOUNTING BRACKET RH**
    a. Install the engine mounting bracket RH with the 3 bolts.

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

5. **INSTALL DRIVE SHAFT BEARING BRACKET**
    a. Install the drive shaft bearing bracket with the 3 bolts.

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

6. **TEMPORARILY INSTALL FRONT ENGINE MOUNTING INSULATOR**
    a. Temporarily install the front engine mounting insulator with the 3 nuts.

    HINT:

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

7. **TEMPORARILY INSTALL ENGINE MOUNTING INSULATOR LH**
   a. Temporarily install the engine mounting insulator LH with the 3 nuts.

      HINT:

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

8. **TEMPORARILY INSTALL ENGINE MOUNTING INSULATOR RH**
   a. Temporarily install the engine mounting insulator RH with the 3 nuts.

      HINT:

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

9. **INSTALL FRONT FRAME ASSEMBLY**
   a. Install the engine mounting insulator LH with the nut.

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

   b. Install the engine mounting insulator RH with the nut.

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

   c. Install the front engine mounting insulator with the bolt.

      Torque: 87 N*m (887 kgf*cm, 64 ft.*lbf)

   d. Fully tighten the 9 temporarily installed nuts of the engine mounting insulators to the specified torque.

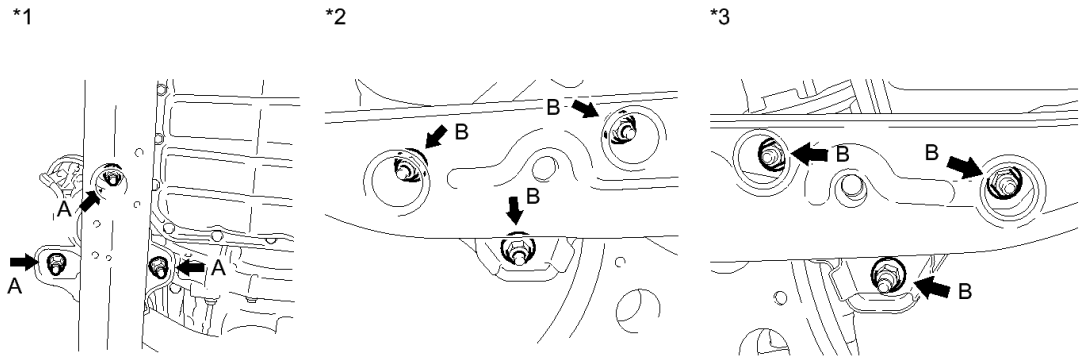


Fig. 240: Identifying Front Engine Mounting Insulator Assembly Bolts\ And Engine Mounting Insulator Bolts

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

TEXT IN ILLUSTRATION

*1	Front Engine Mounting Insulator	*2	Engine Mounting Insulator RH
*3	Engine Mounting Insulator LH	-	-

A

Torque: 58 N*m (591 kgf*cm, 43 ft.*lbf)

B

Torque: 99 N*m (1010 kgf*cm, 73 ft.*lbf)

HINT:

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

e. Install the 4 hole plugs.

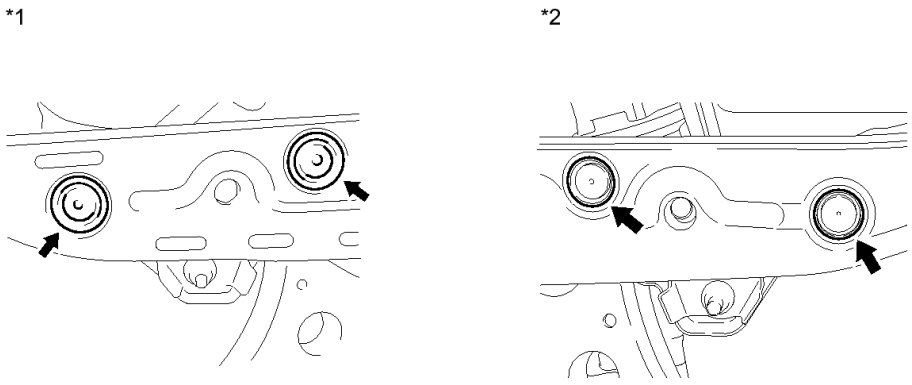


Fig. 241: Identifying Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Engine Mounting Insulator RH	*2	Engine Mounting Insulator LH

HINT:

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

10. **INSTALL FRONT DRIVE SHAFT HOLE SNAP RING LH** . Refer to **REASSEMBLY [08/2013 -] - Step 13**
11. **INSTALL FRONT DRIVE SHAFT ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 1**

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12. **INSTALL FRONT DRIVE SHAFT ASSEMBLY RH** . Refer to **INSTALLATION [08/2013 -] - Step 2**
13. **INSTALL GENERATOR ASSEMBLY** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 1**
14. **INSTALL COMPRESSOR ASSEMBLY WITH PULLEY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
15. **INSTALL V-RIBBED BELT** See step 1
16. **INSTALL ENGINE WIRE**
    a. Install the engine wire to the engine assembly with transaxle.
17. **INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**
    a. Set the engine assembly with transaxle on an engine lifter.

NOTE:

- **Install height adjustment attachments and plate lift attachments under the engine assembly with transaxle.**
- **To prevent the oil pan sub-assembly from deforming, do not place any attachments under the oil pan sub-assembly of the engine assembly with transaxle.**
- **Make sure to support the engine assembly with transaxle securely to prevent it from falling.**

    b. Remove the engine hangers See step 1.
    c. Install the engine assembly with transaxle to the vehicle.

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

HINT:

- Make sure that the engine assembly is clear of all wiring and hoses.
- While raising the engine assembly into the vehicle, do not allow it to contact the vehicle.

    d. Install the frame side rail plate RH and frame side rail plate LH with the 4 bolts and 2 nuts.

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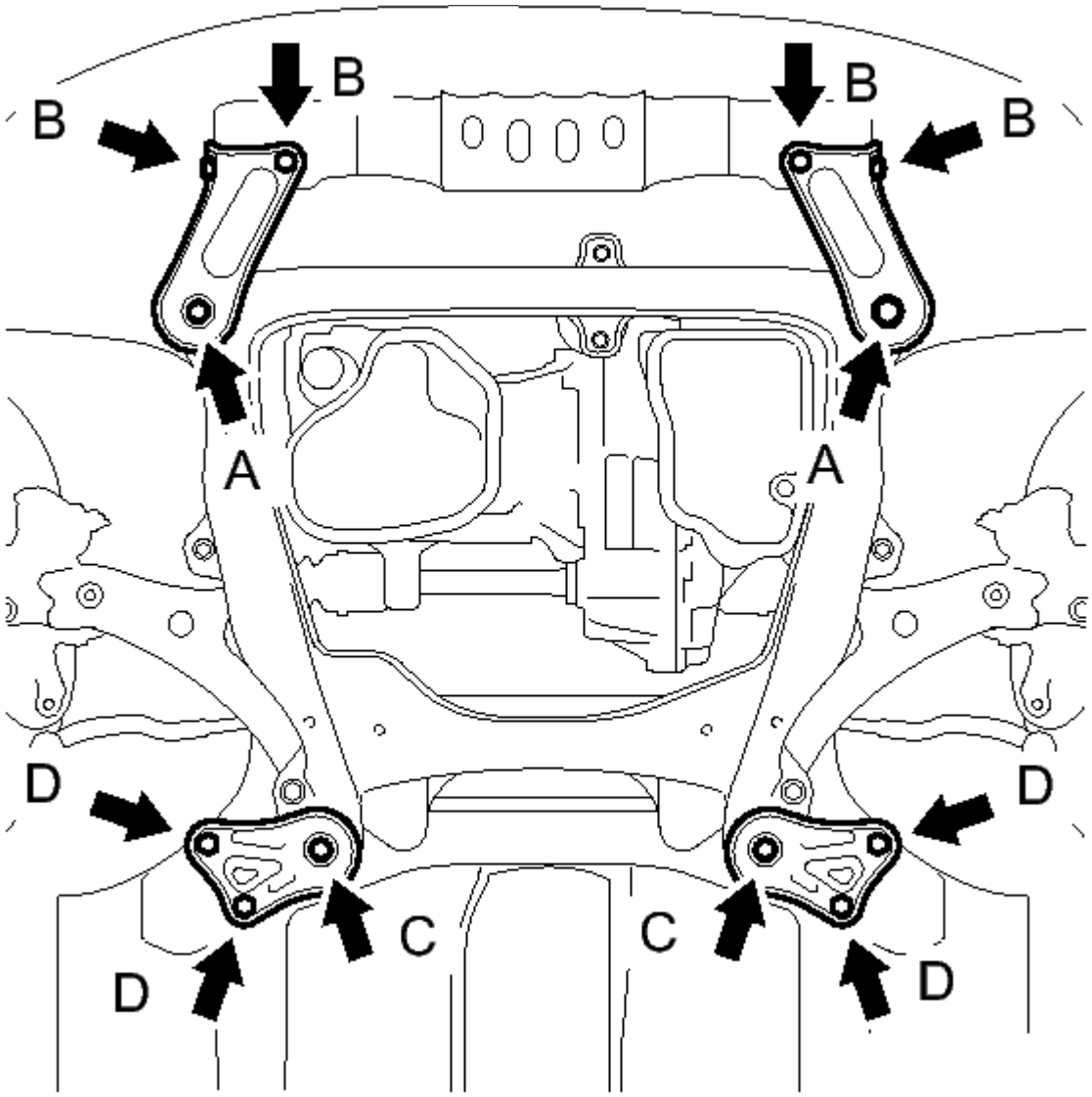


Fig. 242: Identifying Frame Side Rail Plate Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

A

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

B

Torque: 32 N*m (329 kgf*cm, 24 ft.*lbf)

e. Install the front suspension member brace rear RH and front suspension member brace rear LH with the 4 bolts and 2 nuts.

C

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

D

Torque: 32 N*m (329 kgf*cm, 24 ft.*lbf)

HINT:

Perform "Inspection After Repair" after replacing the engine assembly. Refer to **INITIALIZATION [08/2013 -]** .

18. **INSTALL DRIVE PLATE AND TORQUE CONVERTER SETTING BOLT**
    a. Apply adhesive to 2 or 3 threads at the tip of each of the 6 drive plate and torque converter setting bolts.

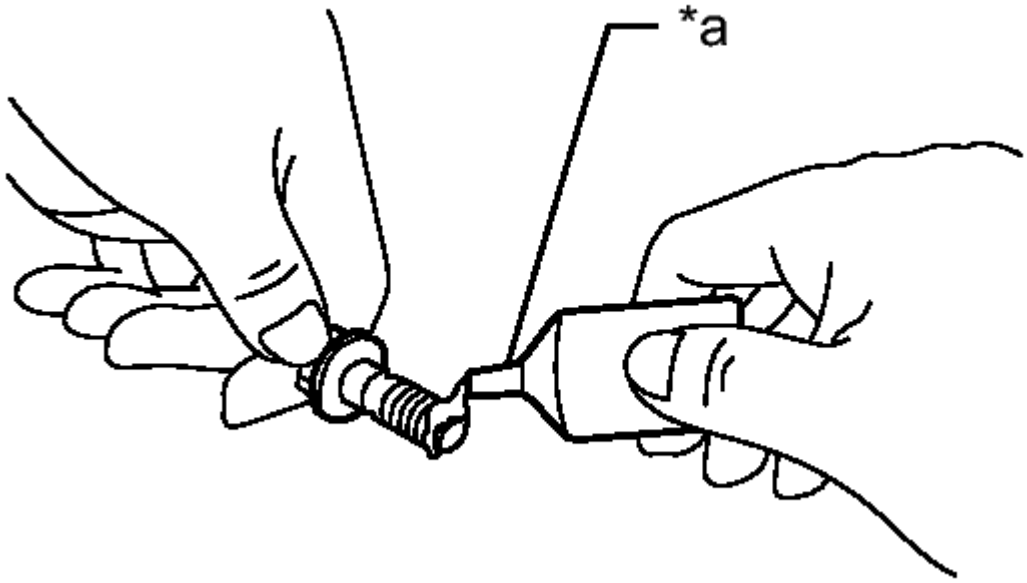


Fig. 243: Apply Adhesive To End Threads Of Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Adhesive

Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

    b. Turn the crankshaft to gain access to the installation locations of the 6 drive plate and torque converter setting bolts and install each bolt while holding the crankshaft pulley bolt with a wrench.

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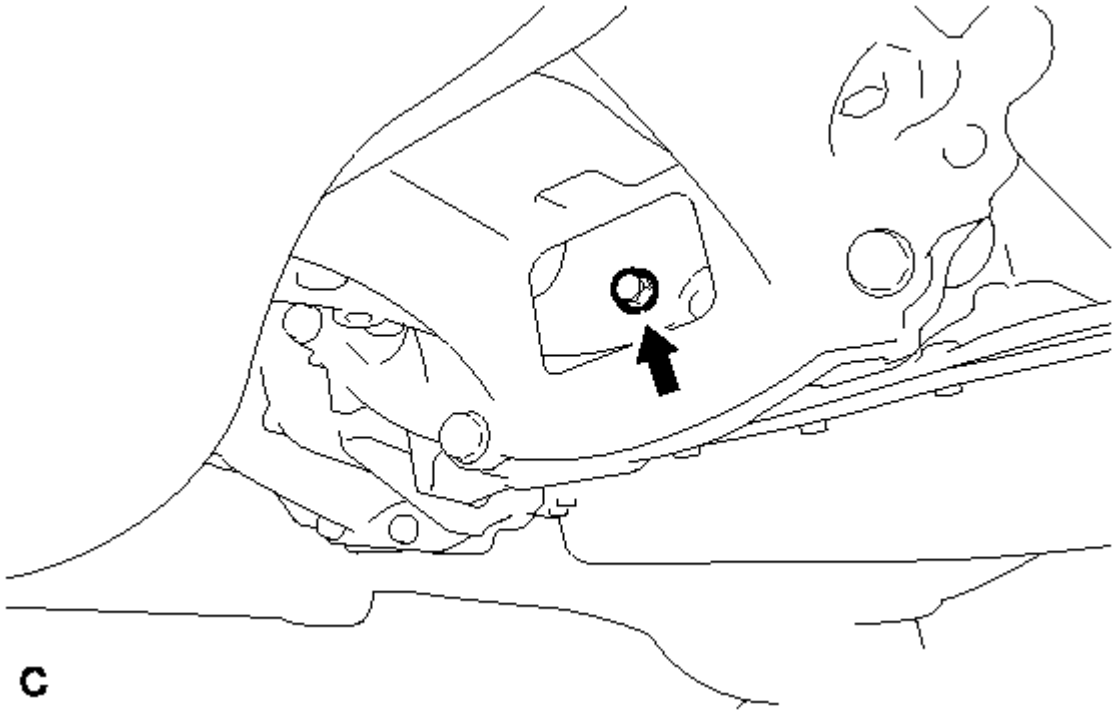


Fig. 244: Locating Torque Converter Clutch Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 41 N*m (418 kgf*cm, 30 ft.*lbf)

NOTE: Install the black colored bolt first, and then the 5 silver colored bolts.

19. **INSTALL FLYWHEEL HOUSING UNDER COVER**
    a. Install the flywheel housing under cover.
20. **CONNECT STEERING INTERMEDIATE SHAFT ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 10**
21. **INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 8**
22. **INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

23. **INSTALL TIE ROD ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 8**
24. **INSTALL TIE ROD ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

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25. **INSTALL FRONT SPEED SENSOR LH** . Refer to **INSTALLATION [08/2013 -] - Step 19**
26. **INSTALL FRONT SPEED SENSOR RH**

    HINT:

    Use the same procedure described for the LH side.

27. **INSTALL FRONT STABILIZER LINK ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 10**
28. **INSTALL FRONT STABILIZER LINK ASSEMBLY RH**

    HINT:

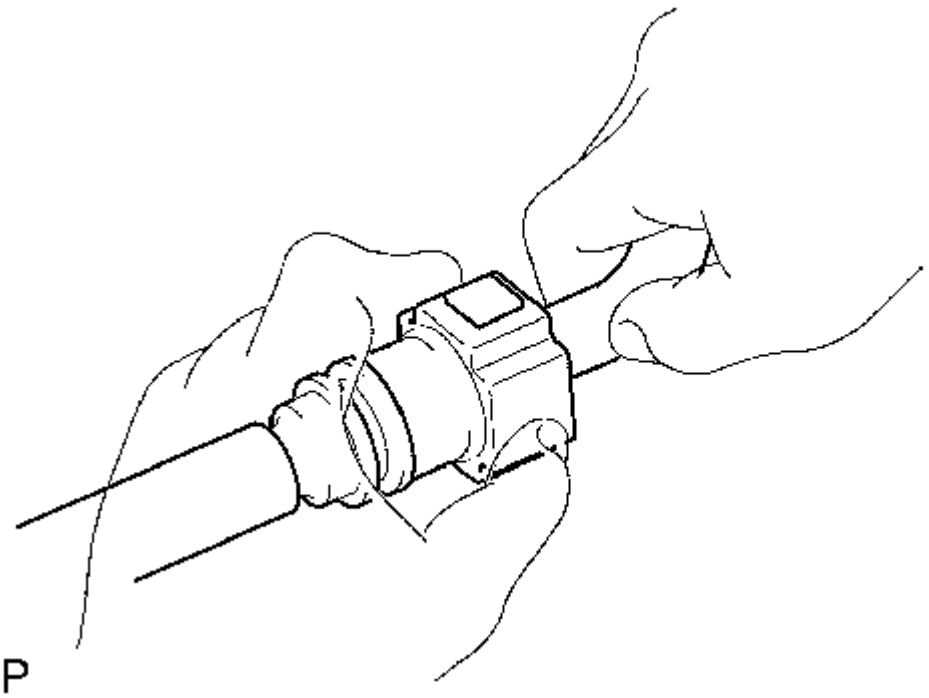
    Use the same procedure described for the LH side.

29. **INSTALL FRONT AXLE SHAFT NUT LH** . Refer to **INSTALLATION [08/2013 -] - Step 7**
30. **INSTALL FRONT AXLE SHAFT NUT RH**

    HINT:

    Use the same procedure described for the LH side.

31. **INSTALL FRONT EXHAUST PIPE ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
32. **CONNECT FUEL TUBE SUB-ASSEMBLY**
    a. Push the fuel tube connector onto the fuel pipe until the connector makes a "click" sound.



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Fig. 245: Pushing Fuel Tube Connector To Fuel Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- **Check for damage or contamination on the connecting part of the fuel pipe.**
- **Check if the fuel pipe and the fuel tube connector are securely connected by trying to pull them apart.**

b. Install the No. 1 fuel pipe clamp.

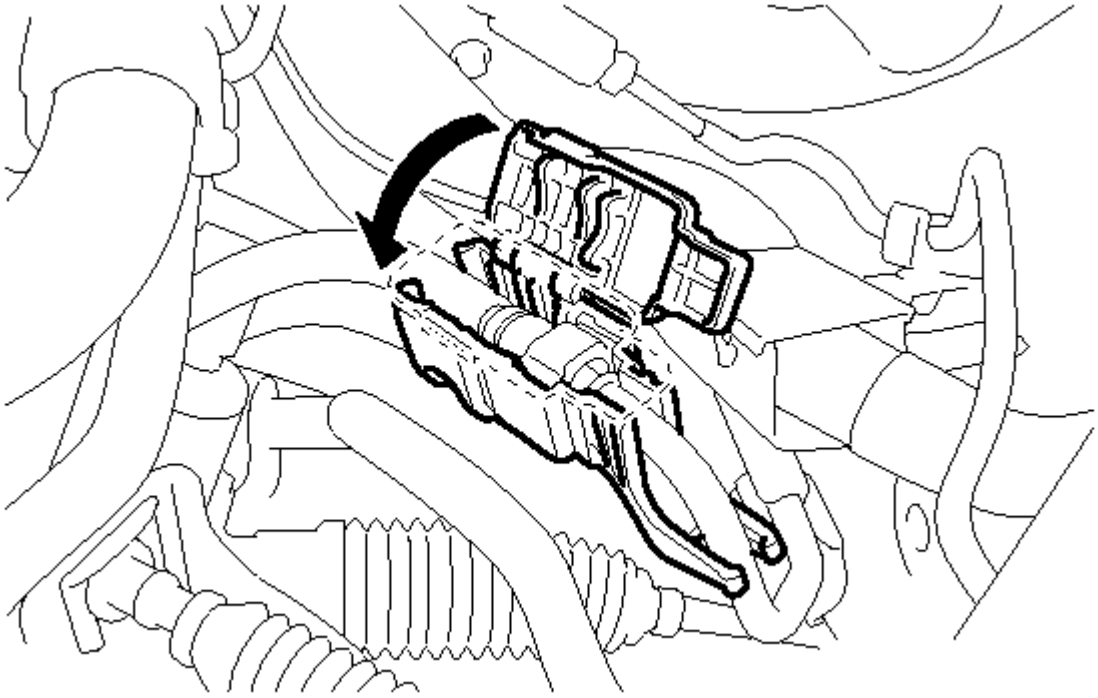


Fig. 246: Identifying No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **INSTALL NO. 1 COOLER REFRIGERANT DISCHARGE HOSE** . Refer to **INSTALLATION [08/2013 -] - Step 3**
34. **INSTALL SUCTION HOSE SUB-ASSEMBLY (for TMMK Made)** . Refer to **INSTALLATION [08/2013 -] - Step 4**
35. **INSTALL NO. 1 COOLER REFRIGERANT SUCTION HOSE (for SIA Made)** . Refer to **INSTALLATION [08/2013 -] - Step 5**
36. **CONNECT UNION TO CONNECTOR TUBE HOSE**
    a. Connect the union to connector tube hose and slide the clip to secure it.
37. **INSTALL ENGINE MOVING CONTROL ROD**
    a. Temporarily install the engine moving control rod and No. 3 engine mounting stay RH to the engine moving control rod bracket with the bolt.

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HINT:

Perform this procedure only when replacement of the engine moving control rod is necessary.

38. **INSTALL ENGINE MOVING CONTROL ROD BRACKET**
    a. When the engine moving control rod has been replaced.
        1. Temporarily install the engine moving control rod bracket with the 4 bolts.

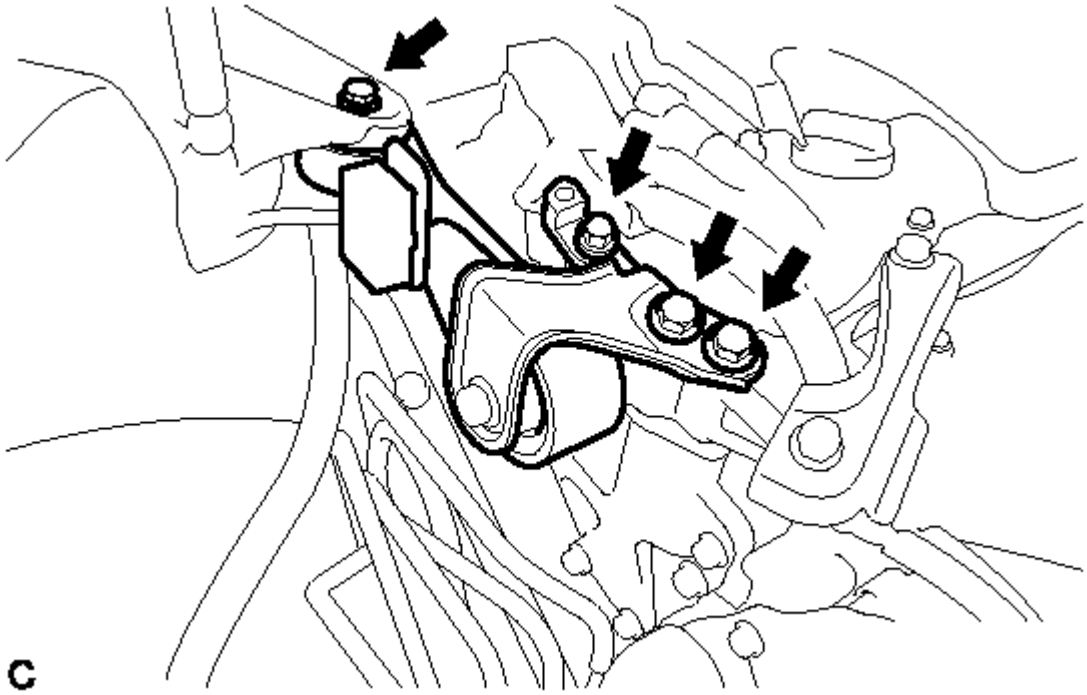


Fig. 247: Identifying Engine Moving Control Rod Bracket And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

        2. Fully tighten the 4 bolts.

           Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

        3. Fully tighten the bolt.

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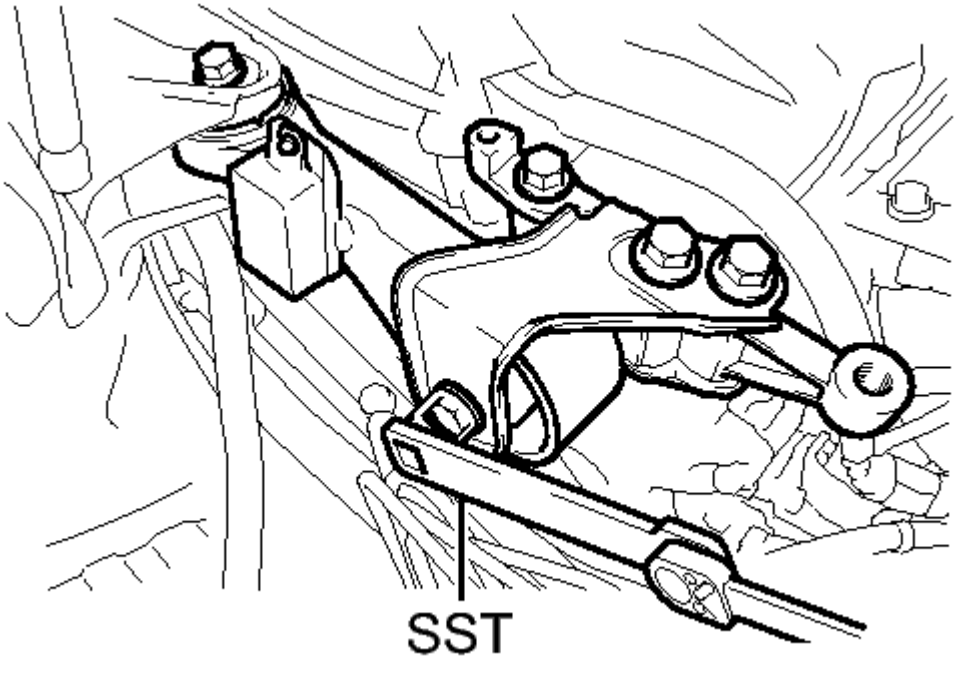


Fig. 248: Tightening Engine Moving Control Rod Bracket Bolt A
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09961-00950**

without SST

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

with SST

Torque: 33 N*m (337 kgf*cm, 24 ft.*lbf)

NOTE:

- **The "with SST" torque value is effective when using SST with a fulcrum length of 150 mm (5.91 in.) and a torque wrench with a fulcrum length of 260 mm (10.24 in.). Refer to PRECAUTION [08/2013 - 12/2013] .**
- **The "with SST" torque value is effective when SST is parallel to the torque wrench.**

b. When the engine moving control rod has been reused.

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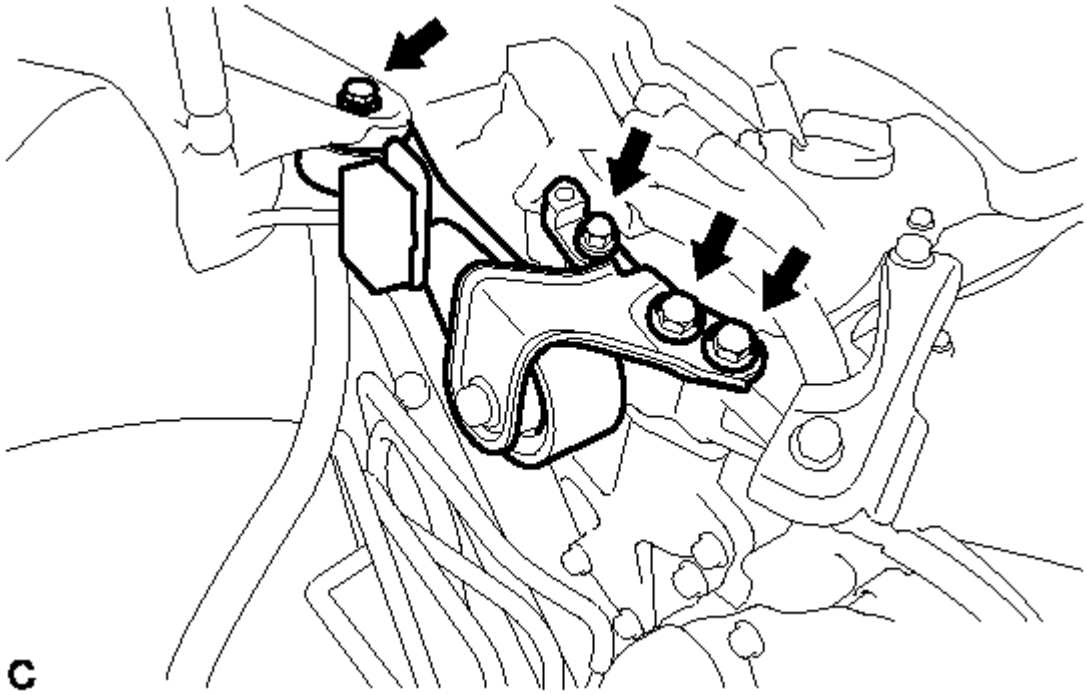


Fig. 249: Identifying Engine Moving Control Rod Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Temporarily install the engine moving control rod bracket with the 4 bolts.
2. Fully tighten the 4 bolts.

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

39. **INSTALL EARTH WIRE**
    a. Install the earth wire with the bolt.

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

40. **INSTALL NO. 2 ENGINE MOUNTING STAY RH**
    a. Install the No. 2 engine mounting stay RH with the 2 bolts.

    Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

41. **CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
    a. Connect the transmission control cable assembly to the No. 1 control cable bracket with a new clip.

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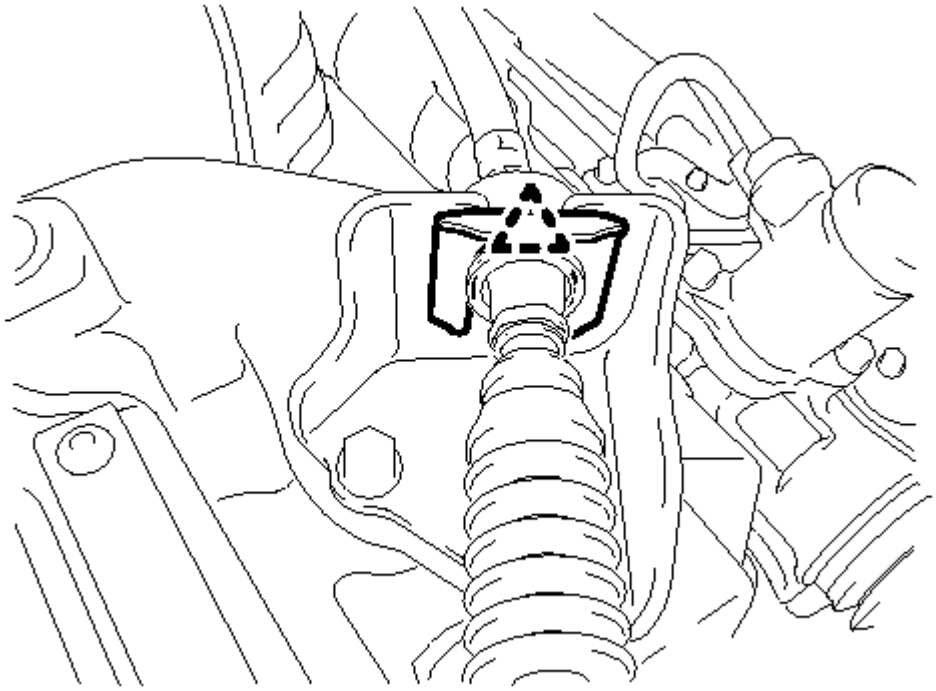


Fig. 250: Remove The Clip From The Transmission Cable Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the transmission control cable assembly to the control shaft lever with the nut.

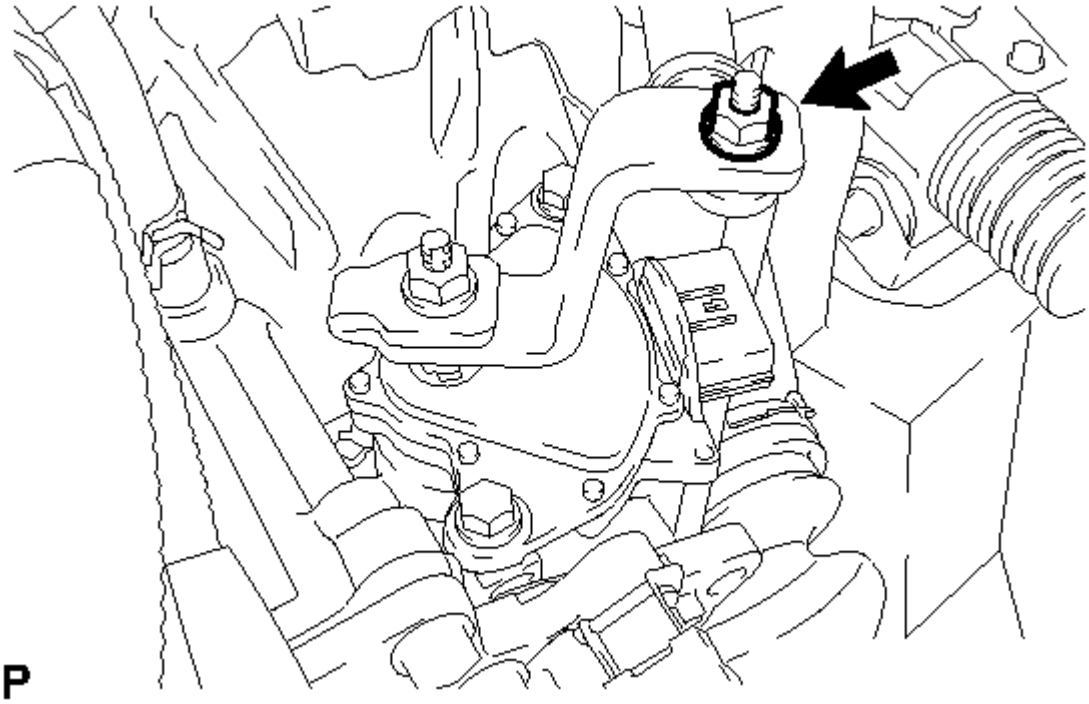


Fig. 251: Locating Transmission Control Shaft Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

42. **INSTALL NO. 1 AIR CLEANER BRACKET**
    a. Install the No. 1 air cleaner bracket to the battery carrier with the bolt.

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

    b. Connect the 2 wire clamps.
43. **CONNECT ENGINE WIRE**
    a. Connect the 2 wire clamps.

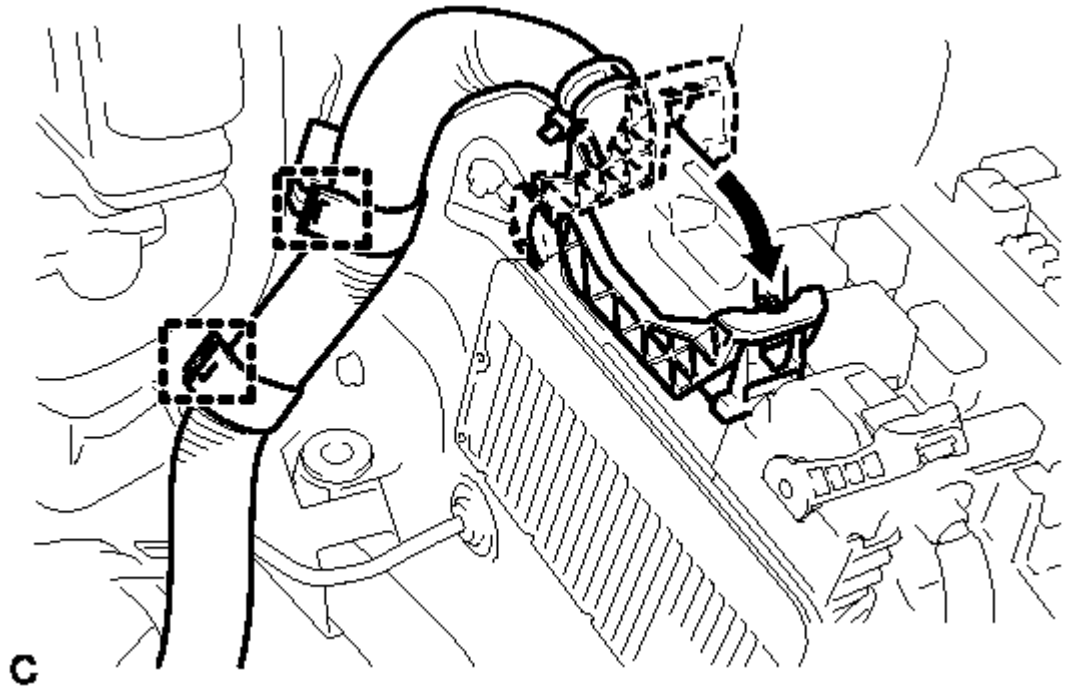


Fig. 252: Identifying Wire Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Connect the ECM connector with the lock lever.
    c. Connect the engine wire to the engine room relay block.
    d. Connect the 4 connectors.
    e. Connect the engine wire to the engine room relay block with the clamp.

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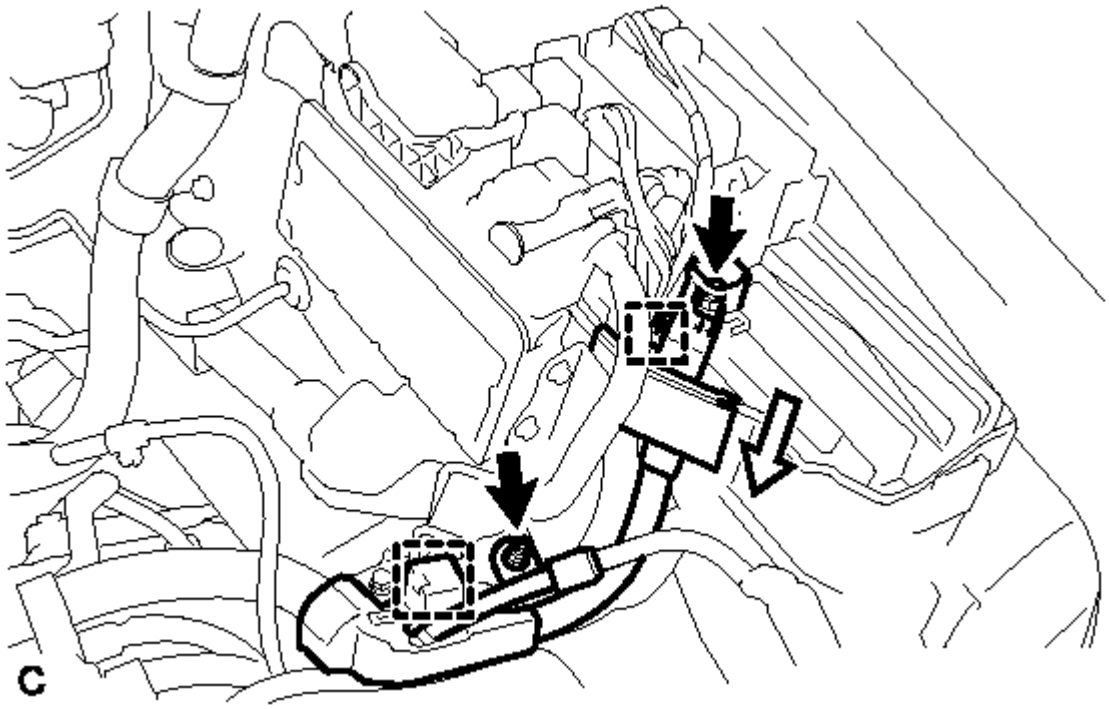


Fig. 253: Identifying Wire Clamp And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Connect the wire clamp and install the 2 nuts.

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

g. Install the No. 1 relay block cover.

44. **INSTALL STARTER ASSEMBLY** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 1**
45. **CONNECT INLET HEATER WATER HOSE**
    a. Connect the inlet heater water hose and slide the clip to secure it.
46. **CONNECT OUTLET HEATER WATER HOSE**
    a. Connect the 3 outlet heater water hoses and slide the 3 clips to secure them.
47. **CONNECT NO. 1 RADIATOR HOSE**
    a. Connect the No. 1 radiator hose and slide the clip to secure it.
    b. Connect the air fuel ratio sensor wire to the No. 1 radiator hose with the hose clamp.
48. **CONNECT NO. 2 RADIATOR HOSE**
    a. Connect the No. 2 radiator hose and slide the clip to secure it.
49. **INSTALL BATTERY**
    a. Install the battery and battery tray.
    b. Install the battery clamp with the bolt and nut.

Bolt

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

Nut

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

c. Connect the cable to the positive (+) battery terminal.

Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

50. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY**

a. Insert the projection of the air cleaner case sub-assembly to the hole of the No. 2 air cleaner bracket as shown in the illustration.

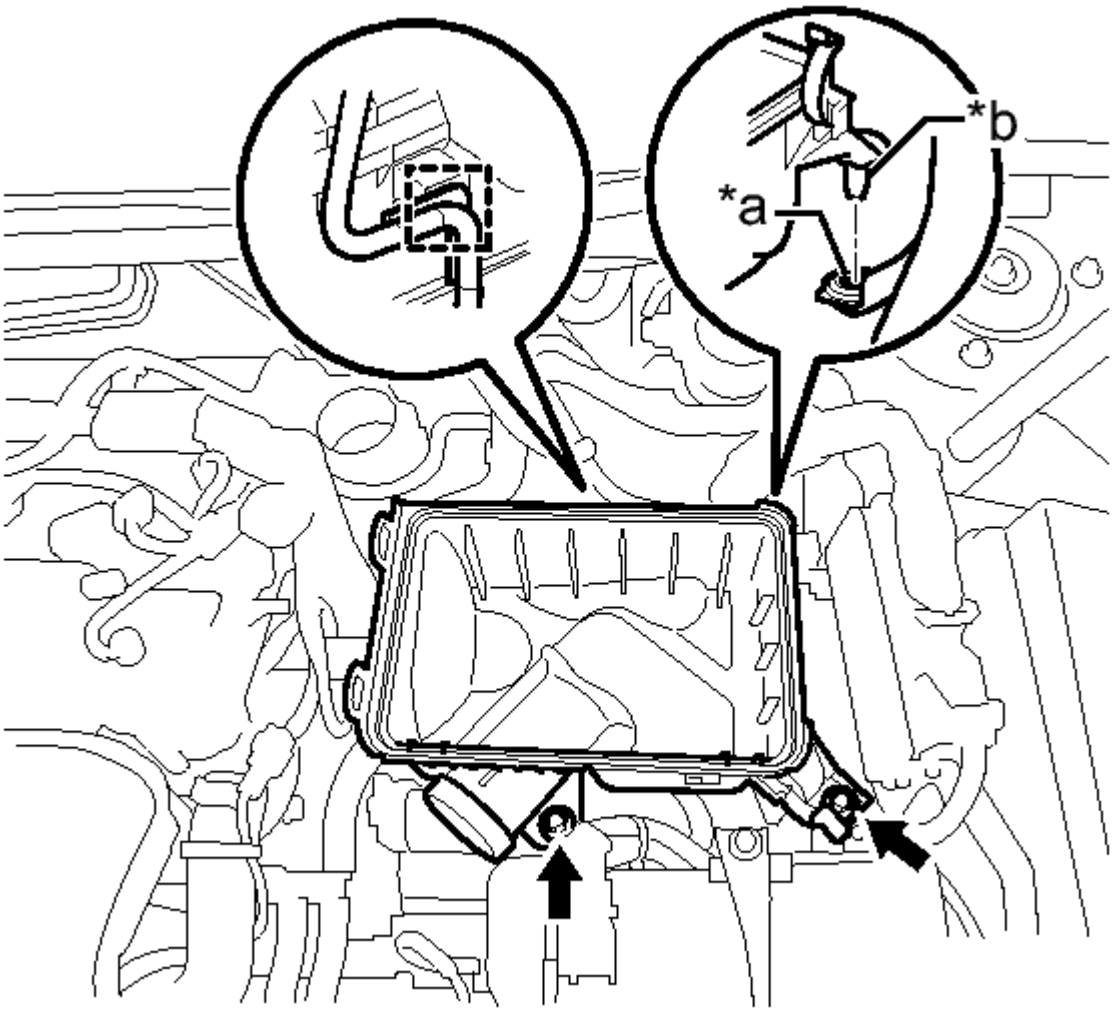


Fig. 254: Identifying Air Cleaner Case Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

 © 2011 Mitchell Repair Information Company, LLC.

*a	Hole
*b	Projection

b. Tighten the 2 bolts.

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

c. Connect the wire harness clamp.

51. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

a. Install the air cleaner filter element sub-assembly.

NOTE: Install the air cleaner filter element sub-assembly with the printed side facing the vehicle front.

52. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
53. **INSTALL INLET AIR CLEANER ASSEMBLY**

a. Install the inlet air cleaner assembly with the 2 bolts.

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

54. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

a. Connect the cable to the negative (-) battery terminal.

Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [08/2013 - 12/2013] .

55. **ADD ENGINE OIL**
56. **ADD ENGINE COOLANT** . Refer to **REPLACEMENT [08/2013 -] - Step 2**
57. **ADD AUTOMATIC TRANSAXLE FLUID**

Refer to **ADJUSTMENT [08/2013 -]**

58. **CHARGE WITH REFRIGERANT** . Refer to **REPLACEMENT [08/2013 -] - Step 2**
59. **WARM UP ENGINE**
60. **INSPECT FOR FUEL LEAK** . Refer to **ON-VEHICLE INSPECTION [08/2013 - 12/2013] - Step 1**
61. **INSPECT FOR OIL LEAK**
62. **INSPECT FOR COOLANT LEAK** . Refer to **ON-VEHICLE INSPECTION [08/2013 -] - Step 1**
63. **INSPECT FOR EXHAUST GAS LEAK**
64. **INSPECT REFRIGERANT LEAK** . Refer to **REPLACEMENT [08/2013 -] - Step 4**

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65. **INSPECT IGNITION TIMING** See step 7
66. **INSPECT ENGINE IDLE SPEED** See step 8
67. **INSPECT CO/HC** See step 10
68. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY**
    a. Fit the 3 retainers and install the No. 1 engine cover sub-assembly.
69. **INSTALL COOL AIR INTAKE DUCT SEAL** . Refer to **INSTALLATION [08/2013 -] - Step 4**
70. **INSPECT SHIFT LEVER POSITION**

    Refer to **ADJUSTMENT [08/2013 -] - Step 1**

71. **ADJUST SHIFT LEVER POSITION**

    Refer to **ADJUSTMENT [08/2013 -] - Step 2**

72. **INSTALL FRONT FENDER APRON SEAL LH**
73. **INSTALL FRONT FENDER APRON SEAL RH**
74. **INSTALL ENGINE UNDER COVER LH**
75. **INSTALL FRONT WHEEL OPENING EXTENSION PAD LH**
76. **INSTALL ENGINE UNDER COVER RH**
77. **INSTALL FRONT WHEEL OPENING EXTENSION PAD RH**
78. **INSTALL FRONT WHEEL**

    Torque: 103 N*m (1049 kgf*cm, 76 ft.*lbf)

79. **ADJUST FRONT WHEEL ALIGNMENT**

    Refer to **ADJUSTMENT [08/2013 -]**

80. **CHECK ABS SPEED SENSOR SIGNAL**

    Refer to **TEST MODE PROCEDURE [08/2013 -]**

INSTALLATION [12/2013 -]

INSTALLATION [12/2013 -]

HINT:

Perform "Inspection After Repair" after replacing the engine assembly. Refer to **INITIALIZATION [08/2013 -]** .

1. **REMOVE ENGINE STAND**
    a. Using a chain block and engine sling device, secure the engine assembly.

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NOTE:

- **Adjust the angle of the sling device carefully to prevent the engine assembly or engine hanger from deforming or becoming damaged.**
- **Servicing an engine assembly while it is hanging is dangerous. This can be done only when installing/removing the engine assembly to/from an engine stand.**

b. Remove the engine assembly from the engine stand.

2. **INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY** See step 2
3. **INSTALL AUTOMATIC TRANSAXLE ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 8**
4. **INSTALL ENGINE MOUNTING BRACKET RH**
   a. Install the engine mounting bracket RH with the 3 bolts.

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

5. **INSTALL DRIVE SHAFT BEARING BRACKET**
   a. Install the drive shaft bearing bracket with the 3 bolts.

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

6. **TEMPORARILY INSTALL FRONT ENGINE MOUNTING INSULATOR**
   a. Temporarily install the front engine mounting insulator with the 3 nuts.

      HINT:

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

7. **TEMPORARILY INSTALL ENGINE MOUNTING INSULATOR LH**
   a. Temporarily install the engine mounting insulator LH with the 3 nuts.

      HINT:

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

8. **TEMPORARILY INSTALL ENGINE MOUNTING INSULATOR RH**
   a. Temporarily install the engine mounting insulator RH with the 3 nuts.

      HINT:

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

9. **INSTALL FRONT FRAME ASSEMBLY**
   a. Install the engine mounting insulator LH with the nut.

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

b. Install the engine mounting insulator RH with the nut.

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

c. Install the front engine mounting insulator with the bolt.

Torque: 87 N*m (887 kgf*cm, 64 ft.*lbf)

d. Fully tighten the 9 temporarily installed nuts of the engine mounting insulators to the specified torque.

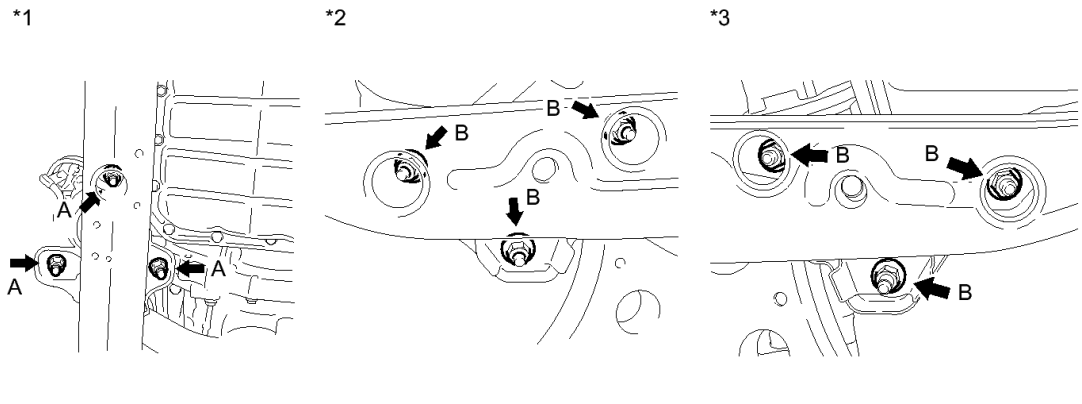


Fig. 255: Identifying Front Engine Mounting Insulator Assembly Bolts\ And Engine Mounting Insulator Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Front Engine Mounting Insulator	*2	Engine Mounting Insulator RH
*3	Engine Mounting Insulator LH	-	-

A

Torque: 58 N*m (591 kgf*cm, 43 ft.*lbf)

B

Torque: 99 N*m (1010 kgf*cm, 73 ft.*lbf)

HINT:

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

e. Install the 4 hole plugs.

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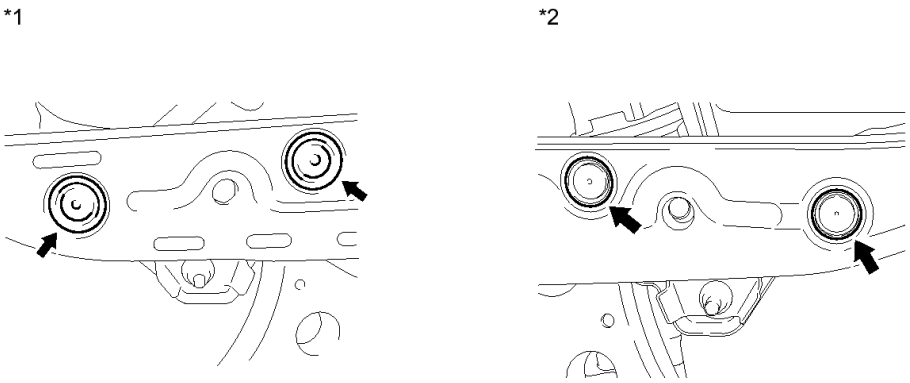


Fig. 256: Identifying Hole Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Engine Mounting Insulator RH	*2	Engine Mounting Insulator LH

HINT:

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

10. **INSTALL FRONT DRIVE SHAFT HOLE SNAP RING LH** . Refer to **REASSEMBLY [08/2013 -] - Step 13**
11. **INSTALL FRONT DRIVE SHAFT ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 1**
12. **INSTALL FRONT DRIVE SHAFT ASSEMBLY RH** . Refer to **INSTALLATION [08/2013 -] - Step 2**
13. **INSTALL GENERATOR ASSEMBLY** . Refer to **INSTALLATION [12/2013 -] - Step 1**
14. **INSTALL COMPRESSOR ASSEMBLY WITH PULLEY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
15. **INSTALL V-RIBBED BELT** See step 1
16. **INSTALL ENGINE WIRE**
    a. Install the engine wire to the engine assembly with transaxle.
17. **INSTALL ENGINE ASSEMBLY WITH TRANSAXLE**
    a. Set the engine assembly with transaxle on an engine lifter.

NOTE:

- **Install height adjustment attachments and plate lift attachments under the engine assembly with transaxle.**
- **To prevent the oil pan sub-assembly from deforming, do not place any attachments under the oil pan sub-assembly of the engine assembly with transaxle.**
- **Make sure to support the engine assembly with transaxle**

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securely to prevent it from falling.

b. Remove the engine hangers See step 1.
c. Install the engine assembly with transaxle to the vehicle.

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

HINT:

- Make sure that the engine assembly is clear of all wiring and hoses.
- While raising the engine assembly into the vehicle, do not allow it to contact the vehicle.

d. Install the frame side rail plate RH and frame side rail plate LH with the 4 bolts and 2 nuts.

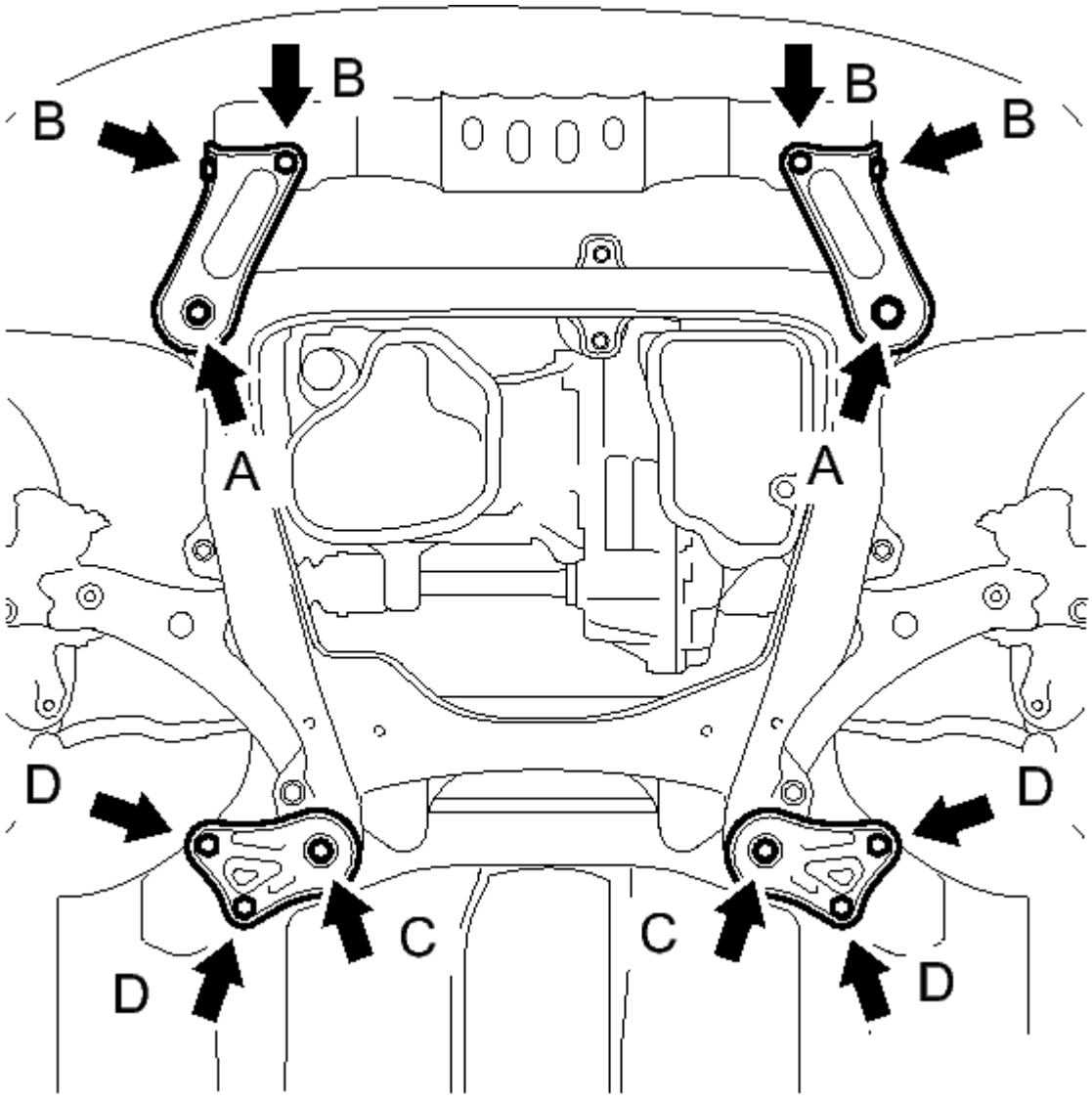


Fig. 257: Identifying Frame Side Rail Plate Bolts And Nuts

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

A

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

B

Torque: 32 N*m (329 kgf*cm, 24 ft.*lbf)

e. Install the front suspension member brace rear RH and front suspension member brace rear LH with the 4 bolts and 2 nuts.

C

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

D

Torque: 32 N*m (329 kgf*cm, 24 ft.*lbf)

HINT:

Perform "Inspection After Repair" after replacing the engine assembly. Refer to **INITIALIZATION [08/2013 -]** .

18. **INSTALL DRIVE PLATE AND TORQUE CONVERTER SETTING BOLT**

a. Apply adhesive to 2 or 3 threads at the tip of each of the 6 drive plate and torque converter setting bolts.

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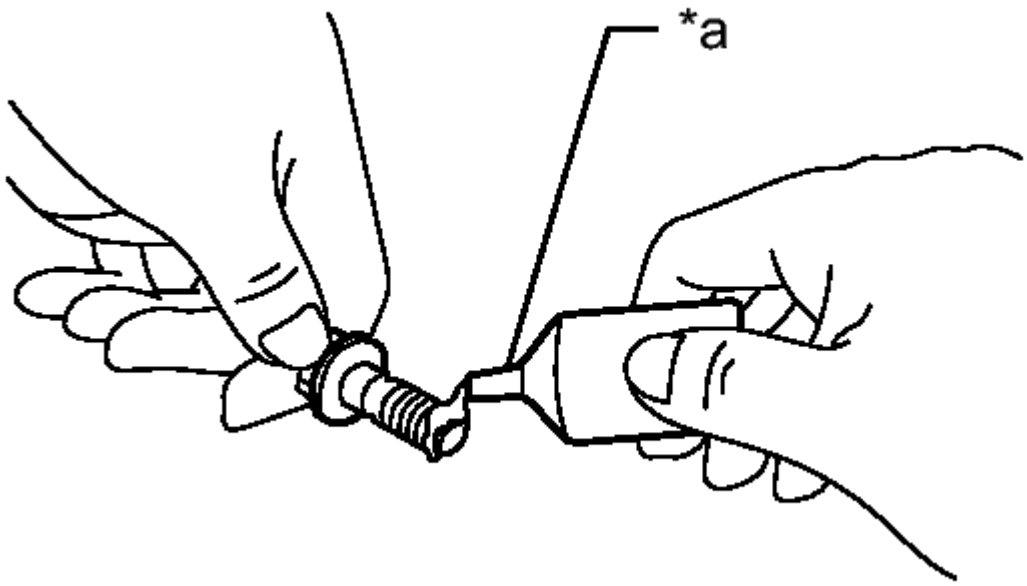


Fig. 258: Apply Adhesive To End Threads Of Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Adhesive

Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent

b. Turn the crankshaft to gain access to the installation locations of the 6 drive plate and torque converter setting bolts and install each bolt while holding the crankshaft pulley bolt with a wrench.

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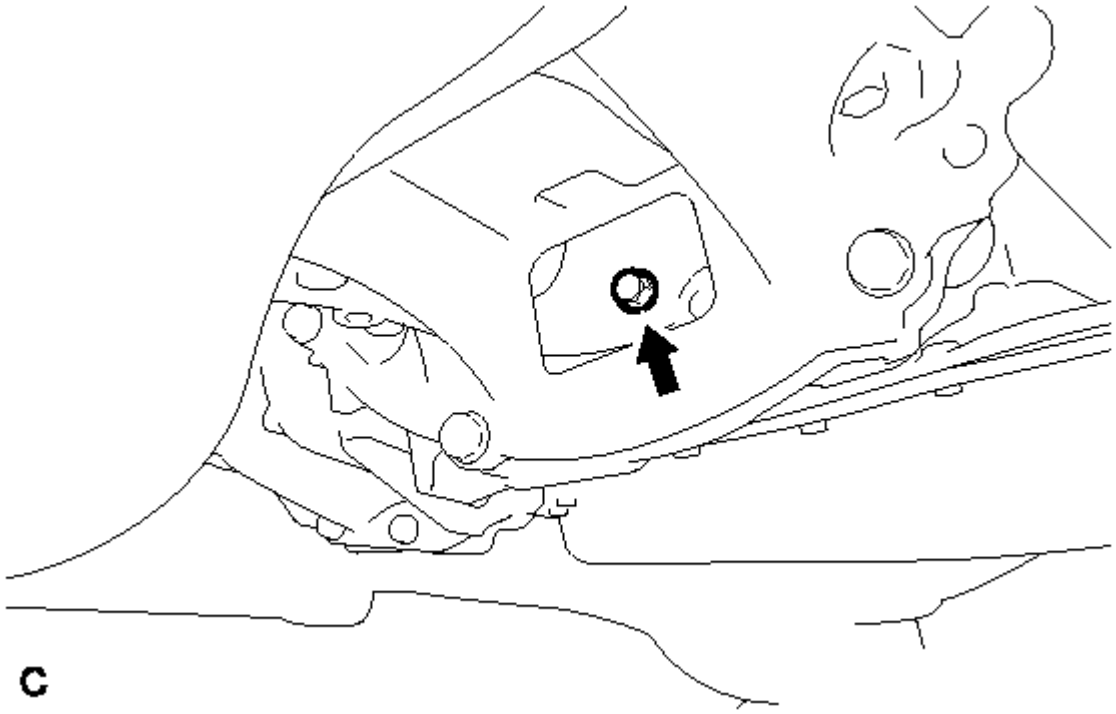


Fig. 259: Locating Torque Converter Clutch Setting Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Torque: 41 N*m (418 kgf*cm, 30 ft.*lbf)

NOTE: Install the black colored bolt first, and then the 5 silver colored bolts.

19. **INSTALL FLYWHEEL HOUSING UNDER COVER**
    a. Install the flywheel housing under cover.
20. **CONNECT STEERING INTERMEDIATE SHAFT ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 10**
21. **INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 8**
22. **INSTALL FRONT LOWER NO. 1 SUSPENSION ARM SUB-ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

23. **INSTALL TIE ROD ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 8**
24. **INSTALL TIE ROD ASSEMBLY RH**

    HINT:

    Use the same procedure described for the LH side.

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25. **INSTALL FRONT SPEED SENSOR LH** . Refer to **INSTALLATION [08/2013 -] - Step 19**
26. **INSTALL FRONT SPEED SENSOR RH**

    HINT:

    Use the same procedure described for the LH side.

27. **INSTALL FRONT STABILIZER LINK ASSEMBLY LH** . Refer to **INSTALLATION [08/2013 -] - Step 10**
28. **INSTALL FRONT STABILIZER LINK ASSEMBLY RH**

    HINT:

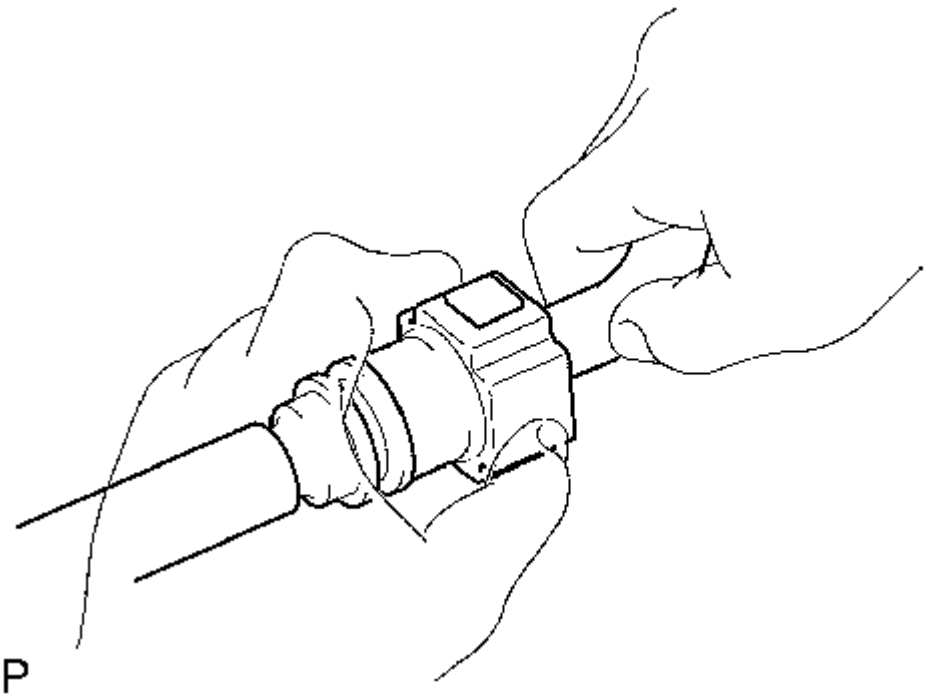
    Use the same procedure described for the LH side.

29. **INSTALL FRONT AXLE SHAFT NUT LH** . Refer to **INSTALLATION [08/2013 -] - Step 7**
30. **INSTALL FRONT AXLE SHAFT NUT RH**

    HINT:

    Use the same procedure described for the LH side.

31. **INSTALL FRONT EXHAUST PIPE ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
32. **CONNECT FUEL TUBE SUB-ASSEMBLY**
    a. Push the fuel tube connector onto the fuel pipe until the connector makes a "click" sound.



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Fig. 260: Pushing Fuel Tube Connector To Fuel Pipe
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- **Check for damage or contamination on the connecting part of the fuel pipe.**
- **Check if the fuel pipe and the fuel tube connector are securely connected by trying to pull them apart.**

b. Install the No. 1 fuel pipe clamp.

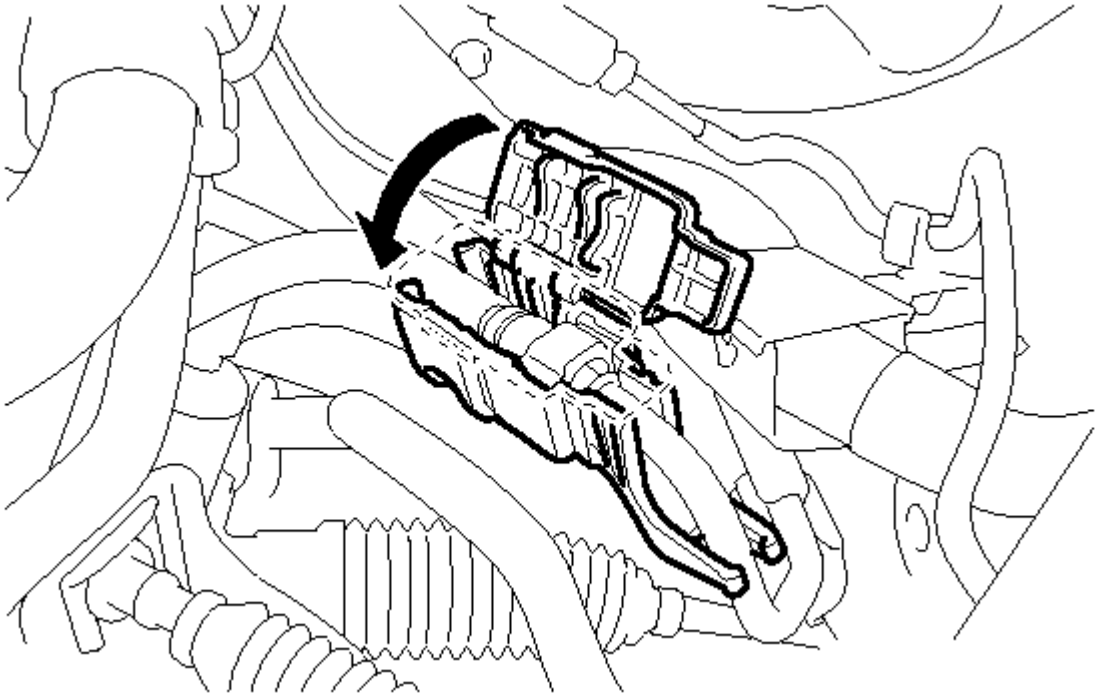


Fig. 261: Identifying No. 1 Fuel Pipe Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

33. **INSTALL NO. 1 COOLER REFRIGERANT DISCHARGE HOSE** . Refer to **INSTALLATION [08/2013 -] - Step 3**
34. **INSTALL SUCTION HOSE SUB-ASSEMBLY (for TMMK Made)** . Refer to **INSTALLATION [08/2013 -] - Step 4**
35. **INSTALL NO. 1 COOLER REFRIGERANT SUCTION HOSE (for SIA Made)** . Refer to **INSTALLATION [08/2013 -] - Step 5**
36. **CONNECT UNION TO CONNECTOR TUBE HOSE**
    a. Connect the union to connector tube hose and slide the clip to secure it.
37. **INSTALL ENGINE MOVING CONTROL ROD**
    a. Temporarily install the engine moving control rod and No. 3 engine mounting stay RH to the engine moving control rod bracket with the bolt.

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HINT:

Perform this procedure only when replacement of the engine moving control rod is necessary.

38. **INSTALL ENGINE MOVING CONTROL ROD BRACKET**
    a. When the engine moving control rod has been replaced.
        1. Temporarily install the engine moving control rod bracket with the 4 bolts.

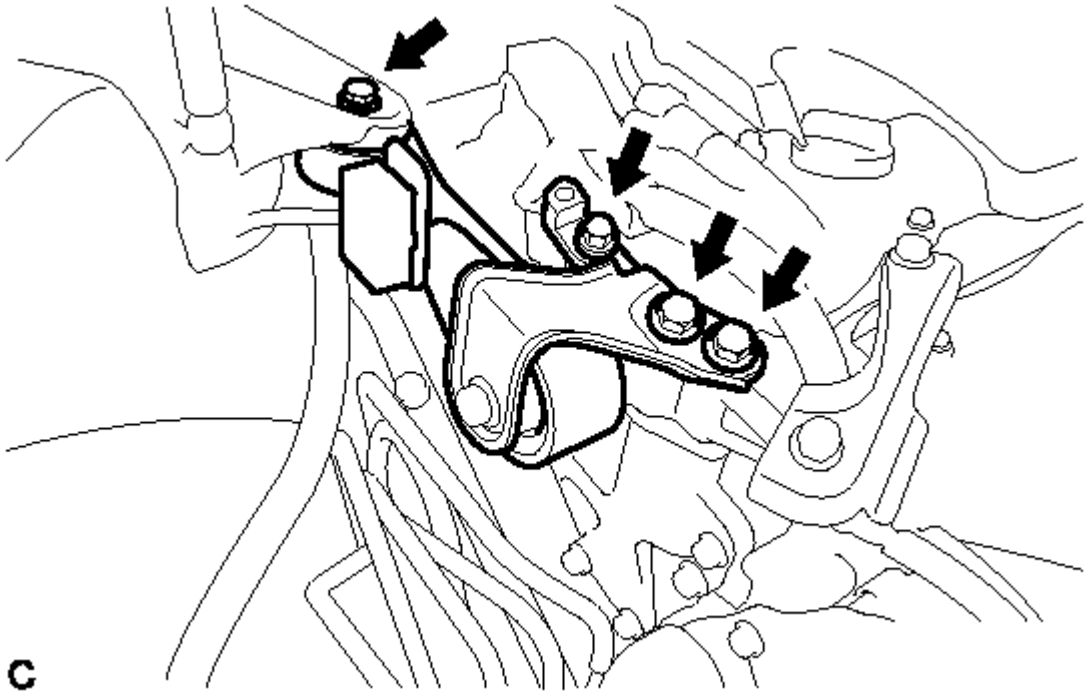


Fig. 262: Identifying Engine Moving Control Rod Bracket And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

        2. Fully tighten the 4 bolts.

           Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

        3. Fully tighten the bolt.

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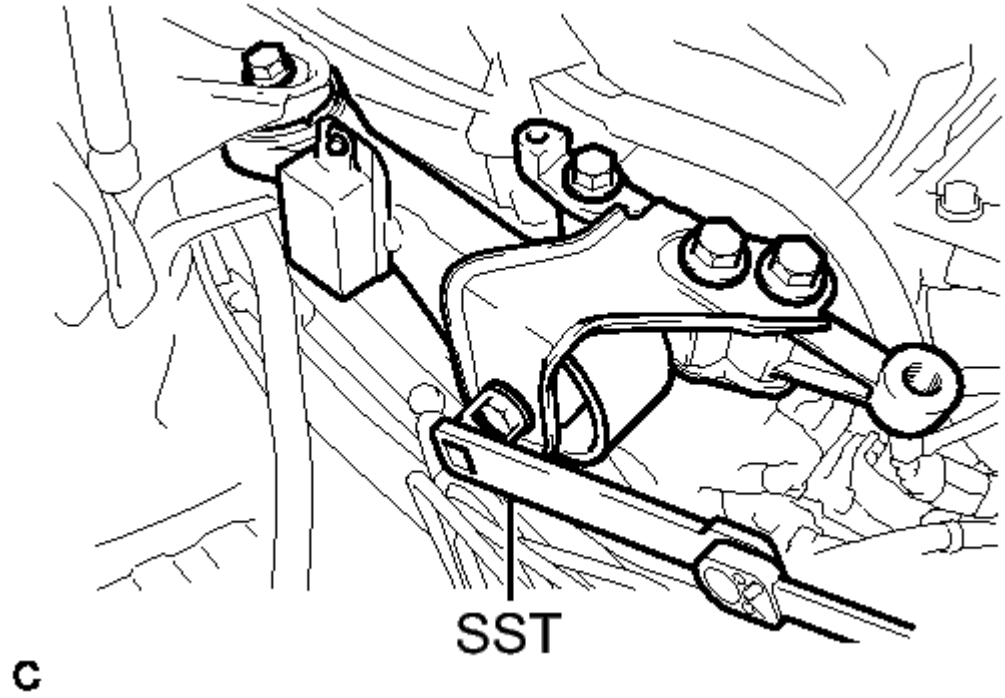


Fig. 263: Tightening Engine Moving Control Rod Bracket Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09961-00950**

without SST

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

with SST

Torque: 33 N*m (337 kgf*cm, 24 ft.*lbf)

NOTE:

- **The "with SST" torque value is effective when using SST with a fulcrum length of 150 mm (5.91 in.) and a torque wrench with a fulcrum length of 260 mm (10.24 in.). Refer to PRECAUTION [12/2013 -] .**
- **The "with SST" torque value is effective when SST is parallel to the torque wrench.**

b. When the engine moving control rod has been reused.

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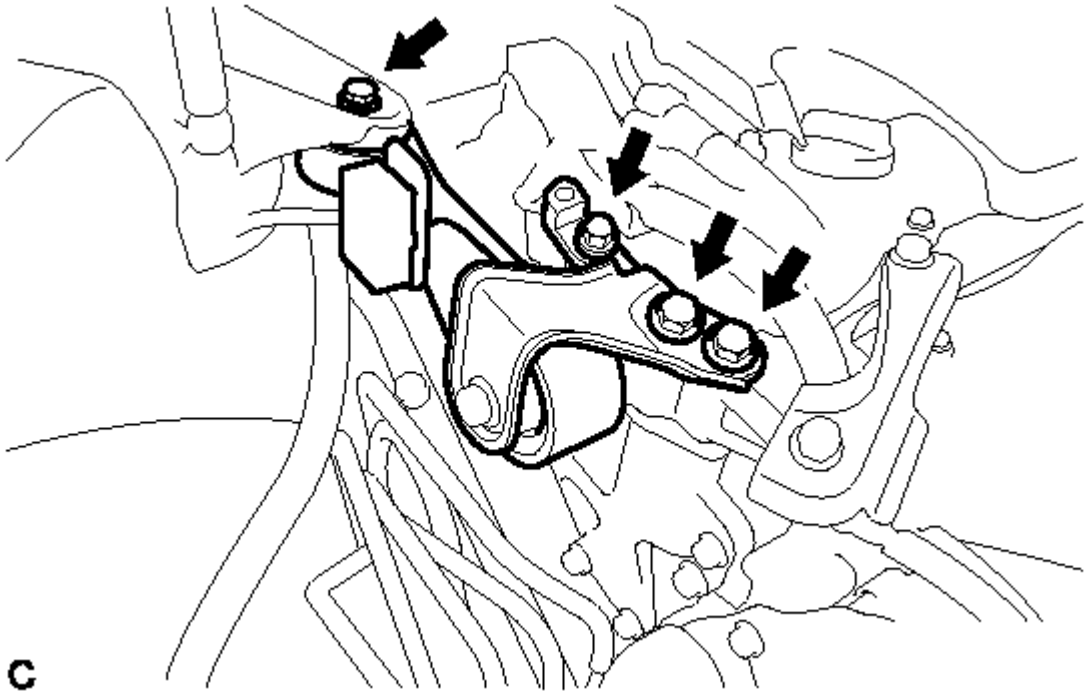


Fig. 264: Identifying Engine Moving Control Rod Bracket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Temporarily install the engine moving control rod bracket with the 4 bolts.
2. Fully tighten the 4 bolts.

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

39. **INSTALL EARTH WIRE**
    a. Install the earth wire with the bolt.

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

40. **INSTALL NO. 2 ENGINE MOUNTING STAY RH**
    a. Install the No. 2 engine mounting stay RH with the 2 bolts.

    Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

41. **CONNECT TRANSMISSION CONTROL CABLE ASSEMBLY**
    a. Connect the transmission control cable assembly to the No. 1 control cable bracket with a new clip.

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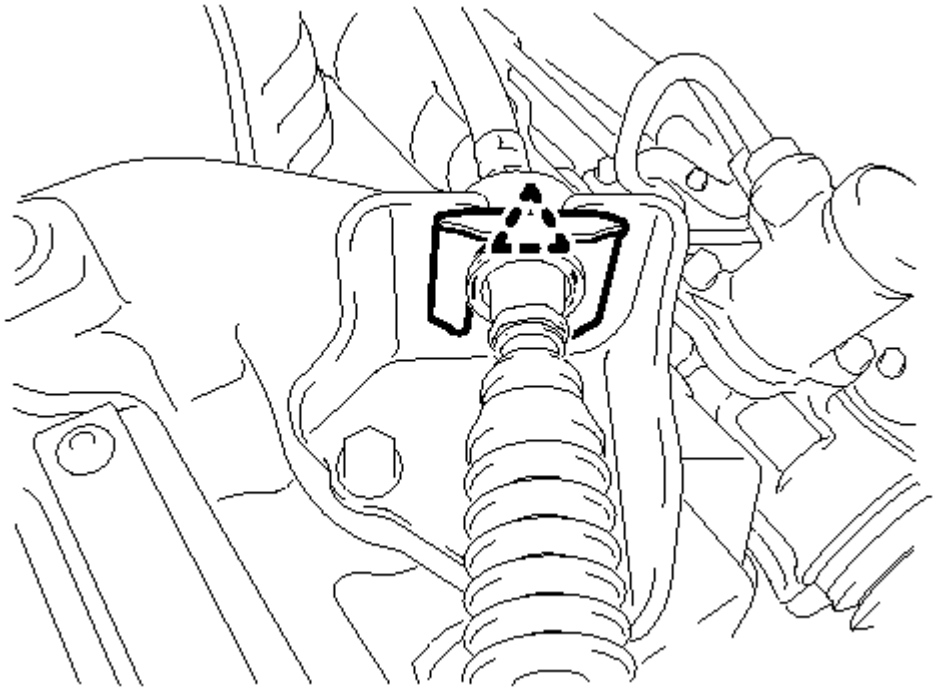


Fig. 265: Remove The Clip From The Transmission Cable Bracket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the transmission control cable assembly to the control shaft lever with the nut.

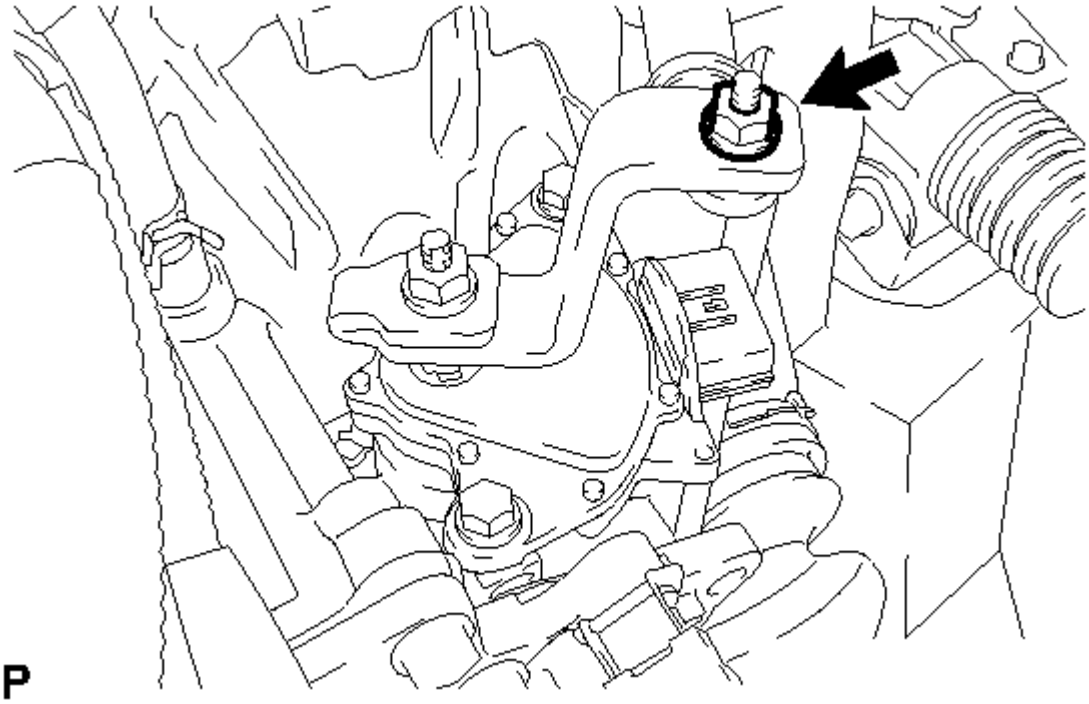


Fig. 266: Locating Transmission Control Shaft Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

42. **INSTALL NO. 1 AIR CLEANER BRACKET**
    a. Install the No. 1 air cleaner bracket to the battery carrier with the bolt.

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

    b. Connect the 2 wire clamps.
43. **CONNECT ENGINE WIRE**
    a. Connect the 2 wire clamps.

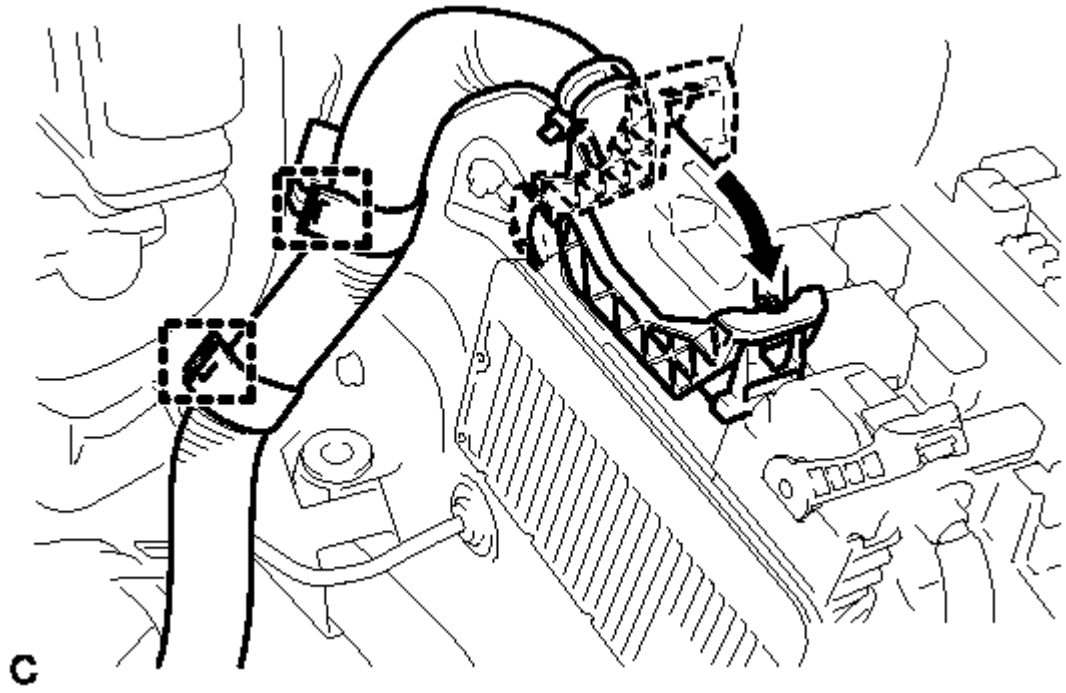


Fig. 267: Identifying Wire Clamps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Connect the ECM connector with the lock lever.
    c. Connect the engine wire to the engine room relay block.
    d. Connect the 4 connectors.
    e. Connect the engine wire to the engine room relay block with the clamp.

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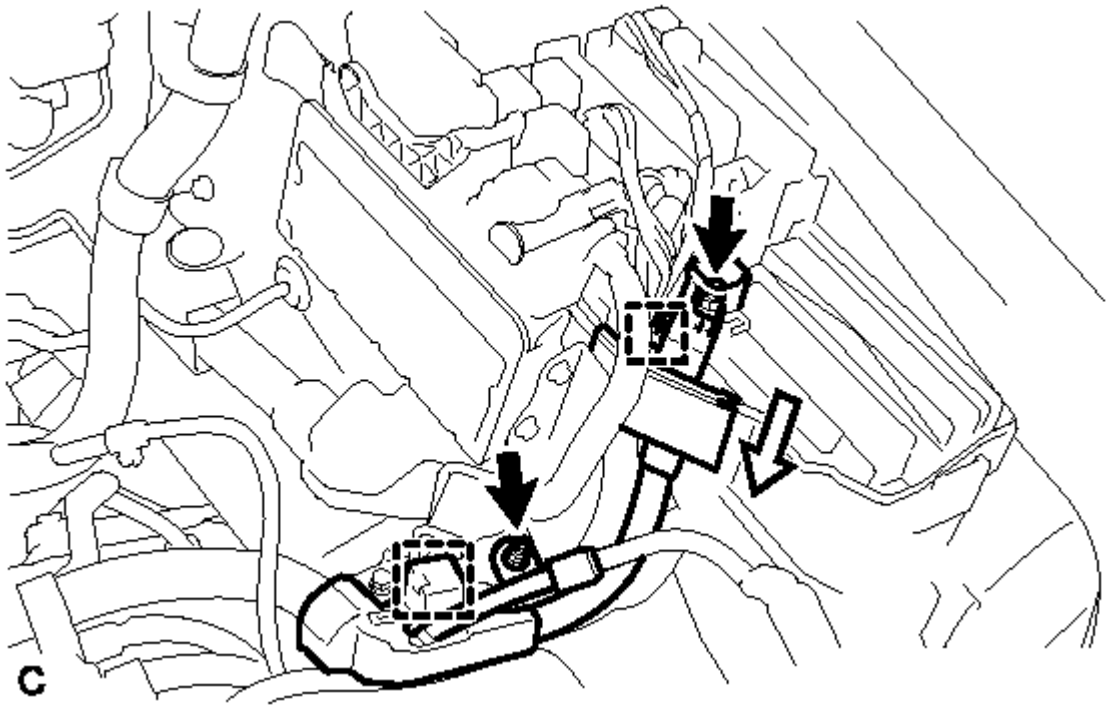


Fig. 268: Identifying Wire Clamp And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Connect the wire clamp and install the 2 nuts.

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

g. Install the No. 1 relay block cover.

44. **INSTALL STARTER ASSEMBLY** . Refer to **INSTALLATION [12/2013 -] - Step 1**
45. **CONNECT INLET HEATER WATER HOSE**
    a. Connect the inlet heater water hose and slide the clip to secure it.
46. **CONNECT OUTLET HEATER WATER HOSE**
    a. Connect the 3 outlet heater water hoses and slide the 3 clips to secure them.
47. **CONNECT NO. 1 RADIATOR HOSE**
    a. Connect the No. 1 radiator hose and slide the clip to secure it.
    b. Connect the air fuel ratio sensor wire to the No. 1 radiator hose with the hose clamp.
48. **CONNECT NO. 2 RADIATOR HOSE**
    a. Connect the No. 2 radiator hose and slide the clip to secure it.
49. **INSTALL BATTERY**
    a. Install the battery and battery tray.
    b. Install the battery clamp with the bolt and nut.

Bolt

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

Nut

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

c. Connect the cable to the positive (+) battery terminal.

Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

50. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY**

a. Insert the projection of the air cleaner case sub-assembly to the hole of the No. 2 air cleaner bracket as shown in the illustration.

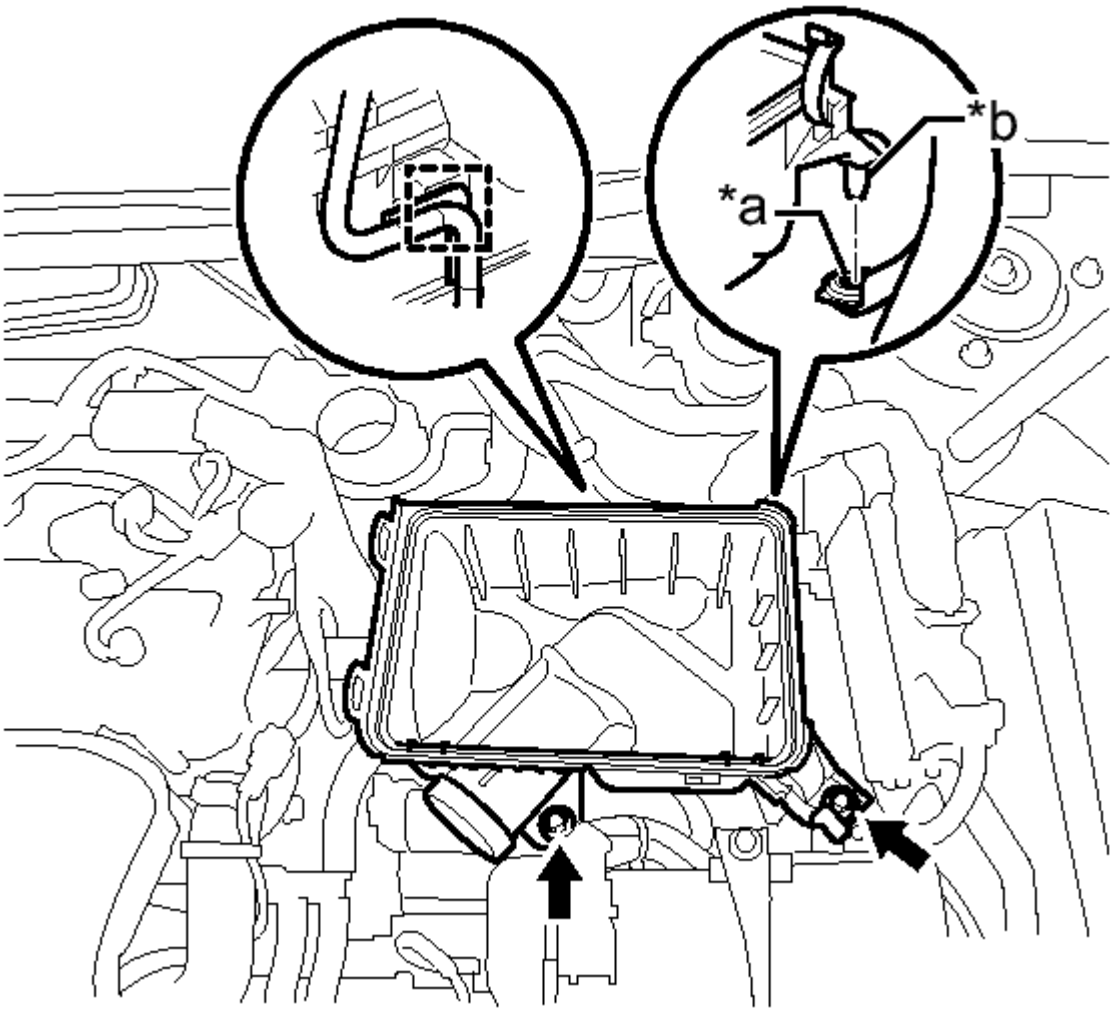


Fig. 269: Identifying Air Cleaner Case Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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*a	Hole
*b	Projection

b. Tighten the 2 bolts.

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

c. Connect the wire harness clamp.

51. **INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

a. Install the air cleaner filter element sub-assembly.

NOTE: Install the air cleaner filter element sub-assembly with the printed side facing the vehicle front.

52. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
53. **INSTALL INLET AIR CLEANER ASSEMBLY**

a. Install the inlet air cleaner assembly with the 2 bolts.

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

54. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

a. Connect the cable to the negative (-) battery terminal.

Torque: 6.9 N*m (70 kgf*cm, 61 in.*lbf)

NOTE: When disconnecting the cable, some systems need to be initialized after the cable is reconnected. Refer to INITIALIZATION [12/2013 -] .

55. **ADD ENGINE OIL**
56. **ADD ENGINE COOLANT** . Refer to **REPLACEMENT [08/2013 -] - Step 2**
57. **ADD AUTOMATIC TRANSAXLE FLUID**

Refer to **ADJUSTMENT [08/2013 -]**

58. **CHARGE WITH REFRIGERANT** . Refer to **REPLACEMENT [08/2013 -] - Step 2**
59. **WARM UP ENGINE**
60. **INSPECT FOR FUEL LEAK** . Refer to **ON-VEHICLE INSPECTION [12/2013 -] - Step 1**
61. **INSPECT FOR OIL LEAK**
62. **INSPECT FOR COOLANT LEAK** . Refer to **ON-VEHICLE INSPECTION [08/2013 -] - Step 1**
63. **INSPECT FOR EXHAUST GAS LEAK**
64. **INSPECT REFRIGERANT LEAK** . Refer to **REPLACEMENT [08/2013 -] - Step 4**
65. **INSPECT IGNITION TIMING** See step 7

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66. **INSPECT ENGINE IDLE SPEED** See step 8
67. **INSPECT CO/HC** See step 10
68. **INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY**
    a. Fit the 3 retainers and install the No. 1 engine cover sub-assembly.
69. **INSTALL COOL AIR INTAKE DUCT SEAL** . Refer to **INSTALLATION [08/2013 -] - Step 4**
70. **INSPECT SHIFT LEVER POSITION**

    Refer to **ADJUSTMENT [08/2013 -] - Step 1**

71. **ADJUST SHIFT LEVER POSITION**

    Refer to **ADJUSTMENT [08/2013 -] - Step 2**

72. **INSTALL FRONT FENDER APRON SEAL LH**
73. **INSTALL FRONT FENDER APRON SEAL RH**
74. **INSTALL ENGINE UNDER COVER LH**
75. **INSTALL FRONT WHEEL OPENING EXTENSION PAD LH**
76. **INSTALL ENGINE UNDER COVER RH**
77. **INSTALL FRONT WHEEL OPENING EXTENSION PAD RH**
78. **INSTALL FRONT WHEEL**

    Torque: 103 N*m (1049 kgf*cm, 76 ft.*lbf)

79. **ADJUST FRONT WHEEL ALIGNMENT**

    Refer to **ADJUSTMENT [08/2013 -]**

80. **CHECK ABS SPEED SENSOR SIGNAL**

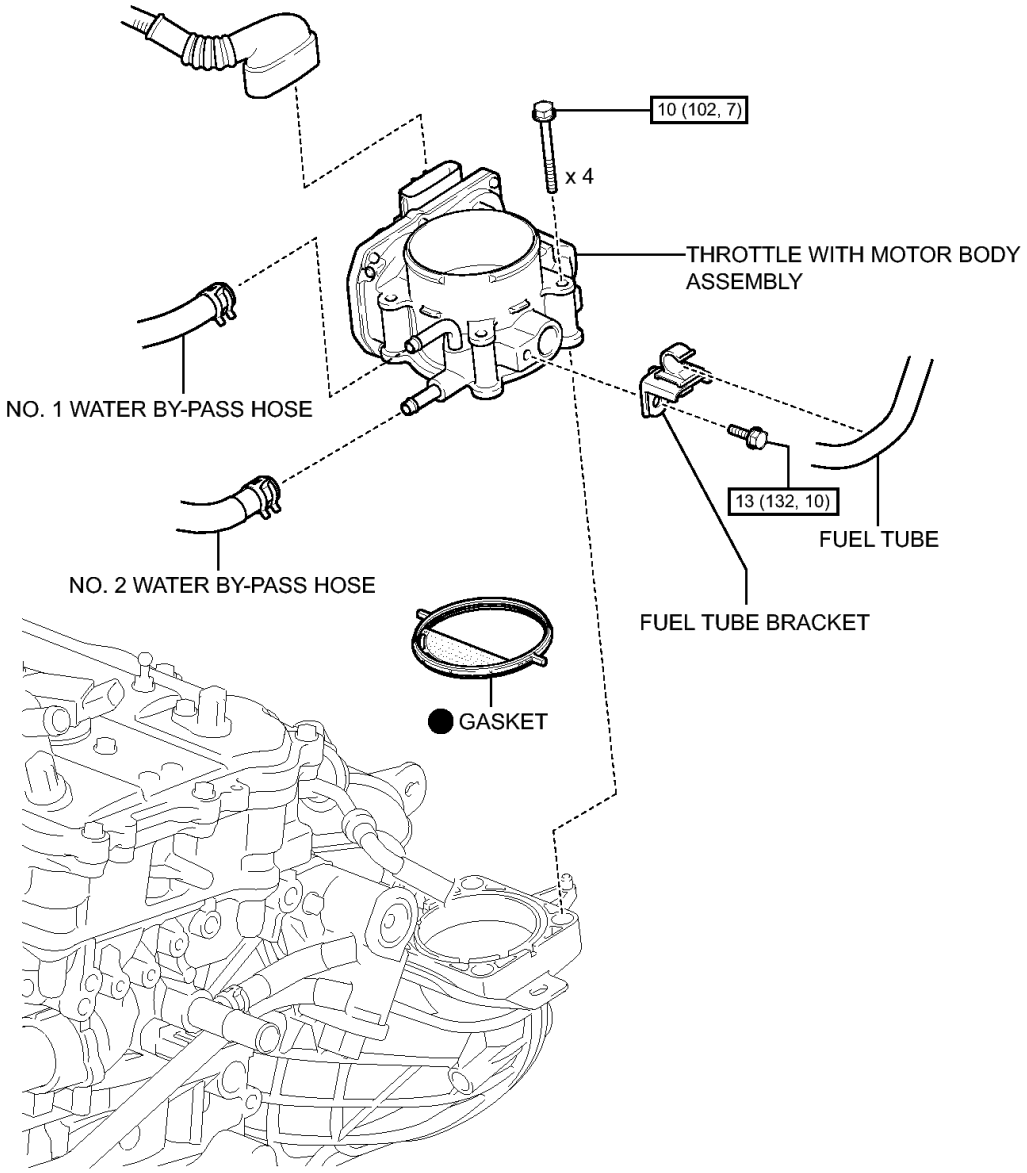
    Refer to **TEST MODE PROCEDURE [08/2013 -]**

ENGINE UNIT

COMPONENTS [08/2013 -]

ILLUSTRATION

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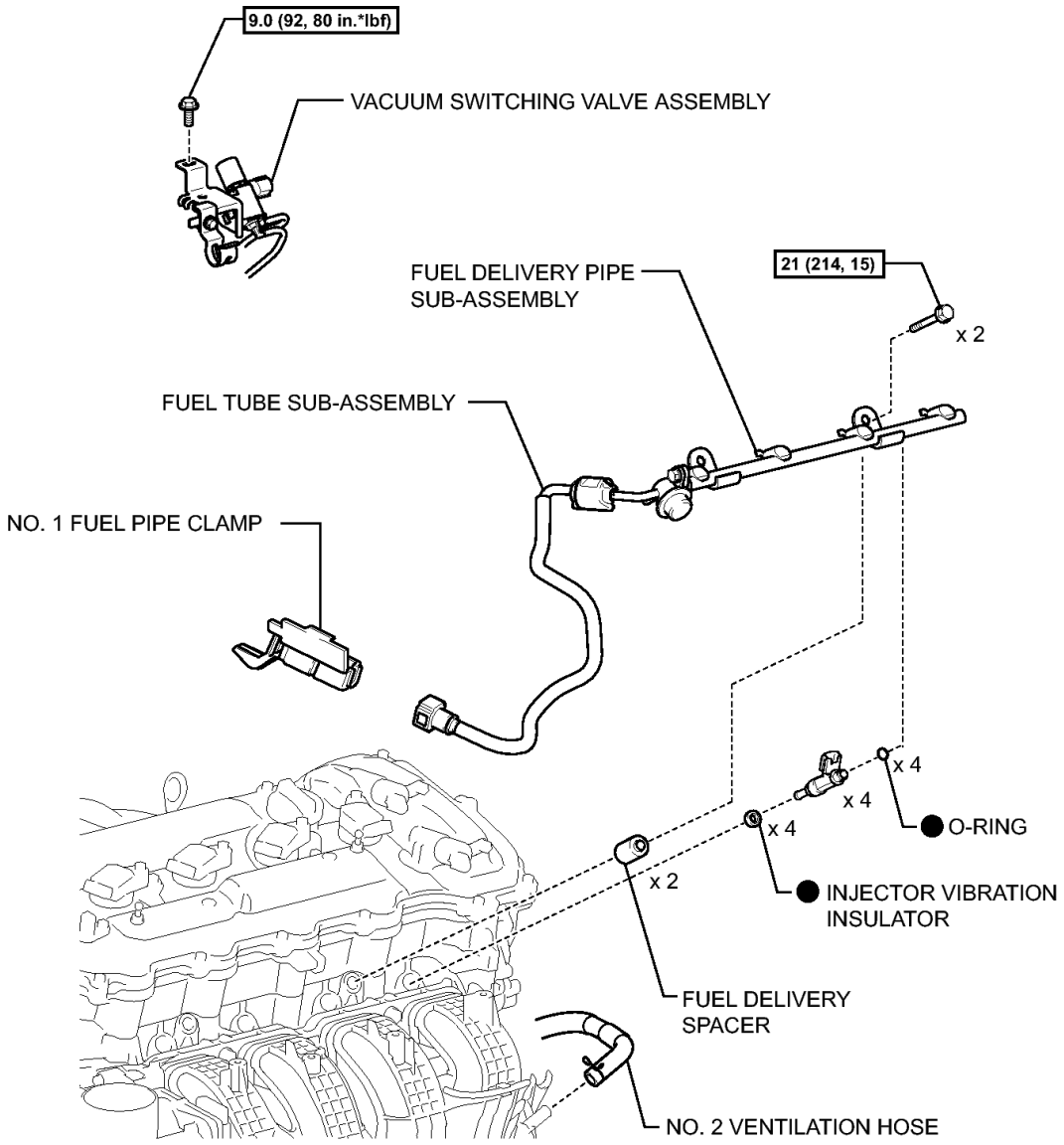


c

Fig. 270: Identifying Intake Manifold Replacement Components With Torque Specifications (2 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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

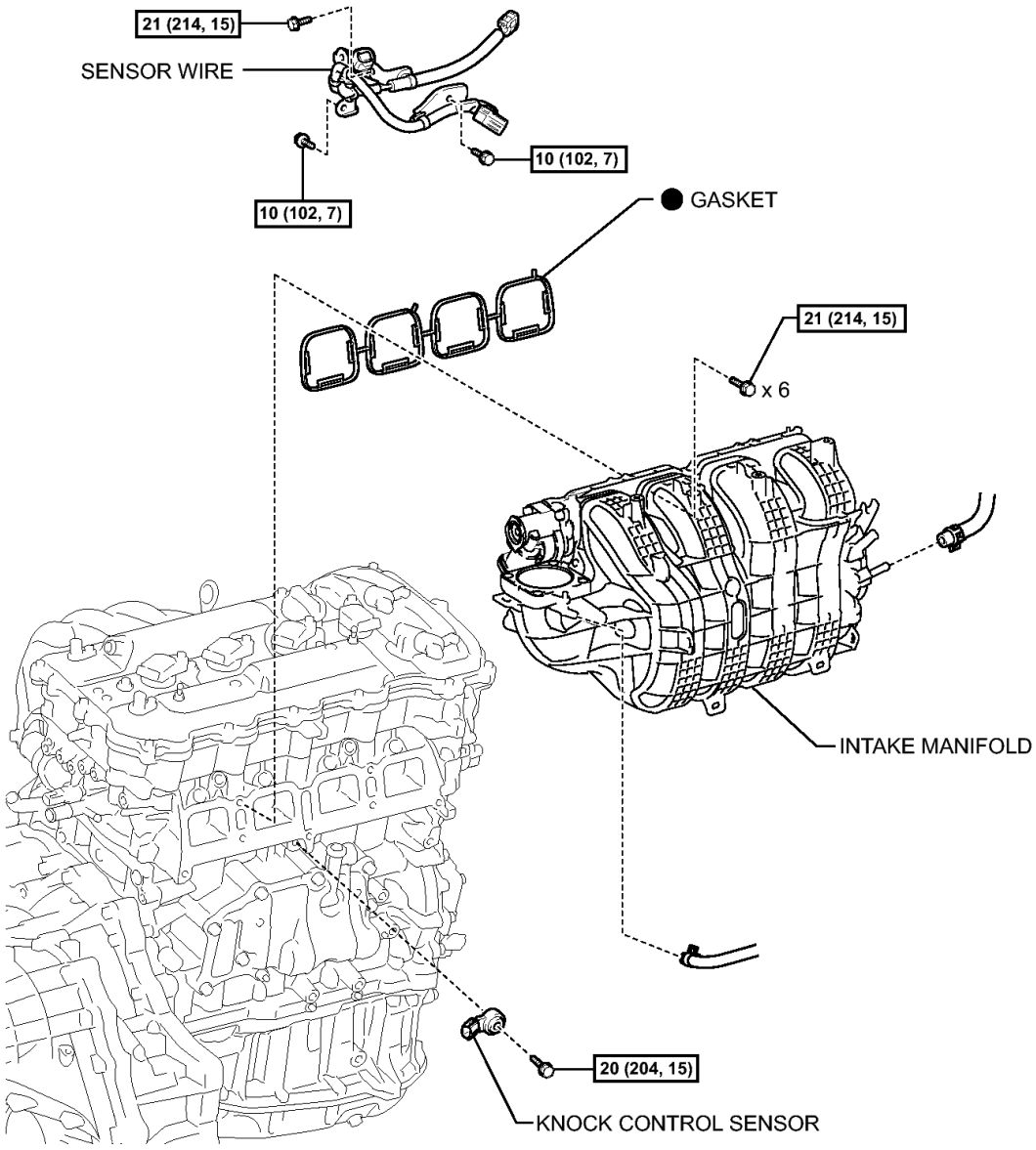
● Non-reusable part

c

Fig. 271: Identifying Engine Unit Replacement Components With Torque Specifications (2 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

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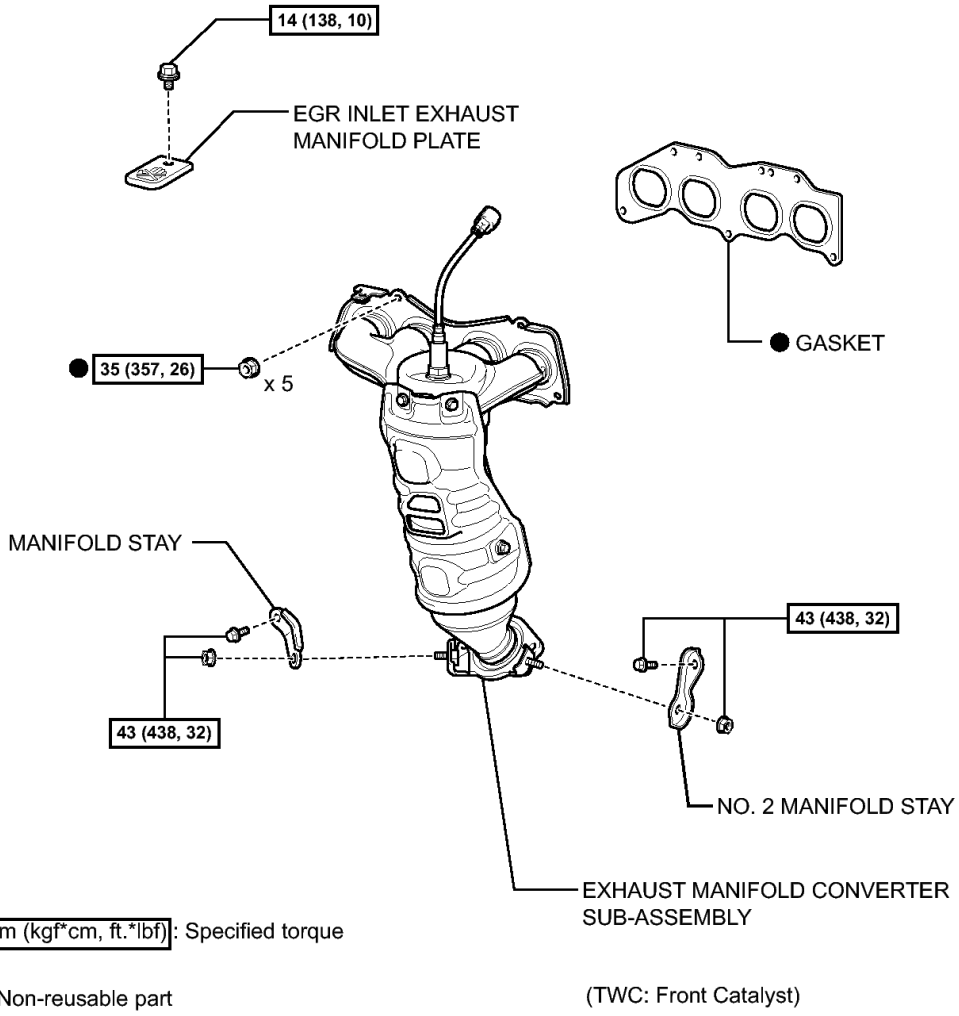
c

Fig. 272: Identifying Engine Unit Replacement Components With Torque Specifications (3 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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for PZEV:



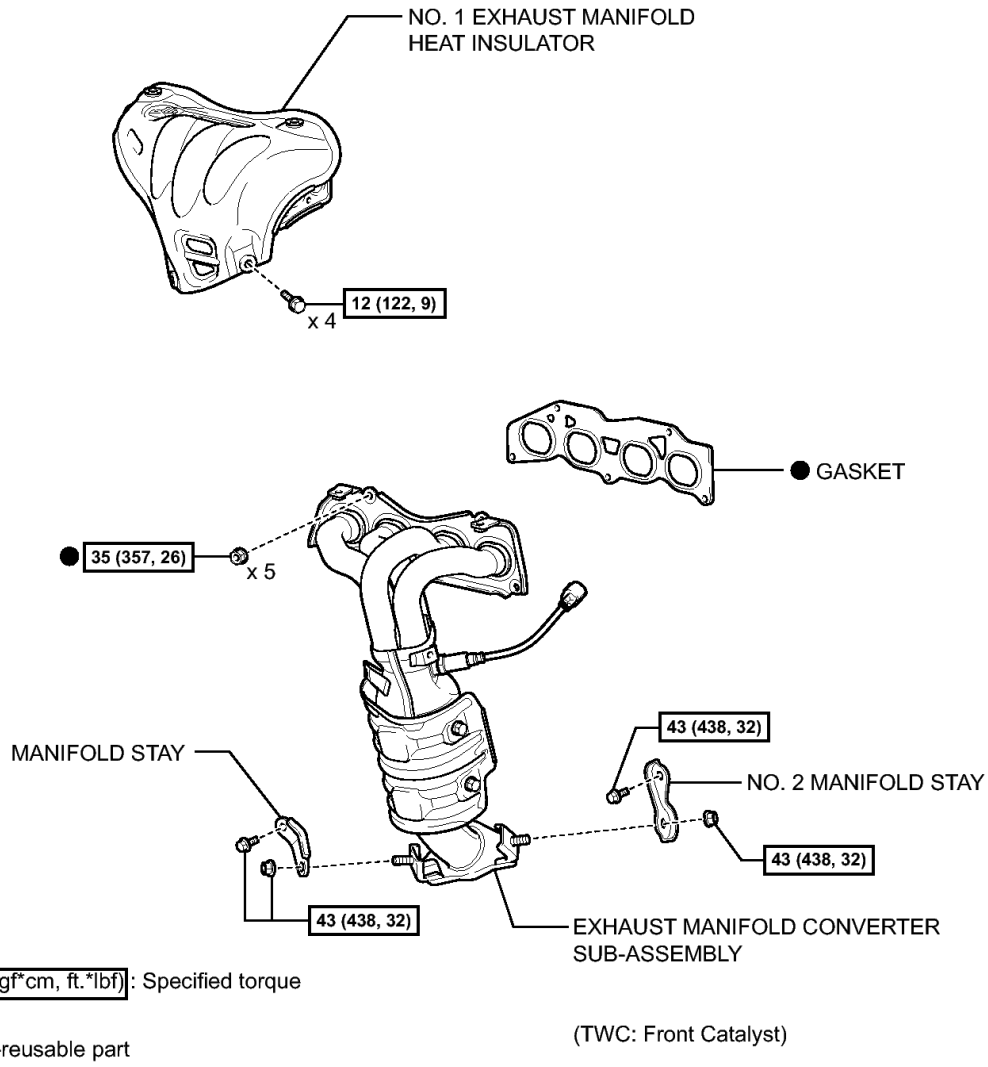
c

Fig. 273: Identifying Engine Unit Replacement Components With Torque Specifications (4 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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except PZEV:



c

Fig. 274: Identifying Engine Unit Replacement Components With Torque Specifications (5 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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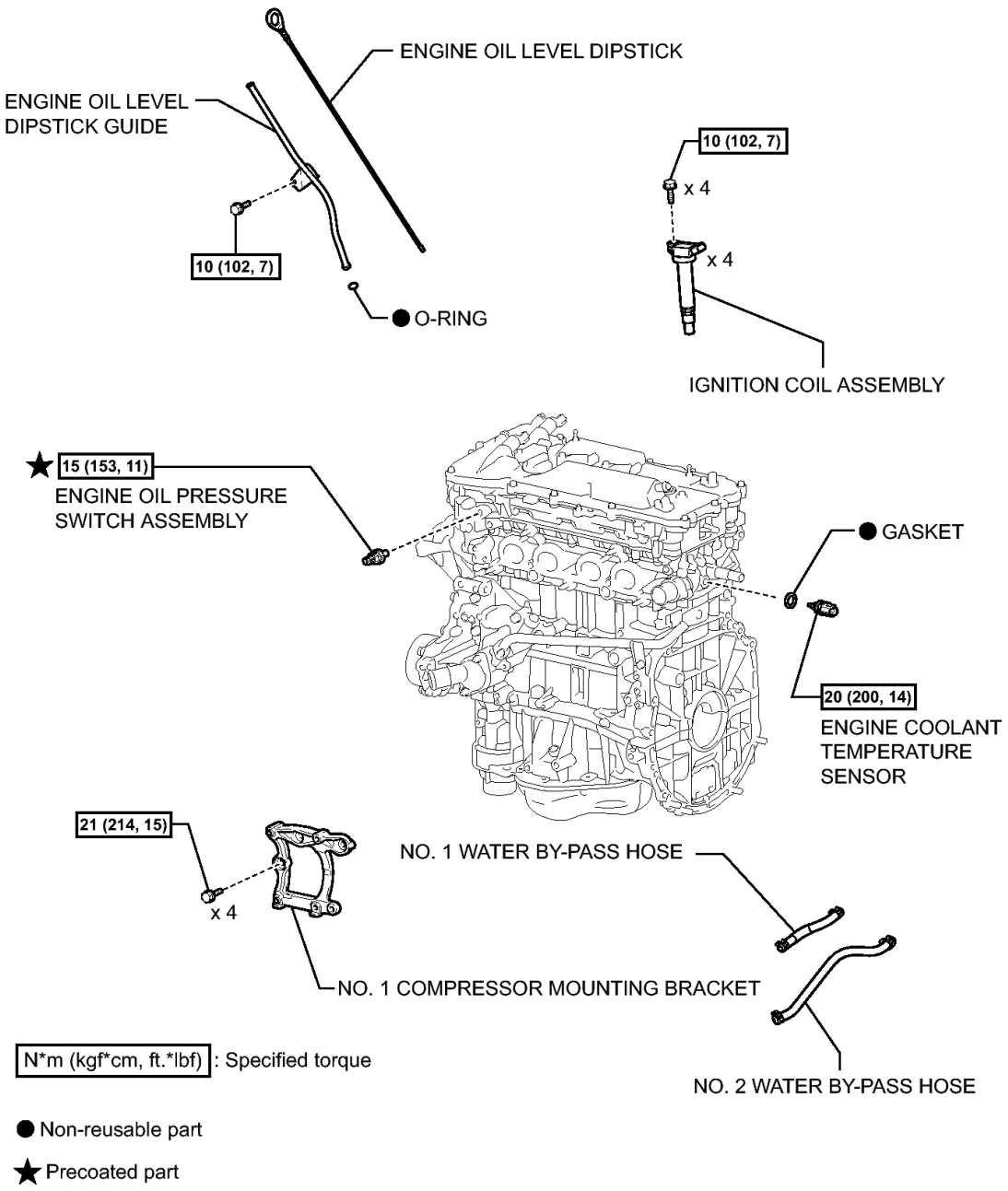
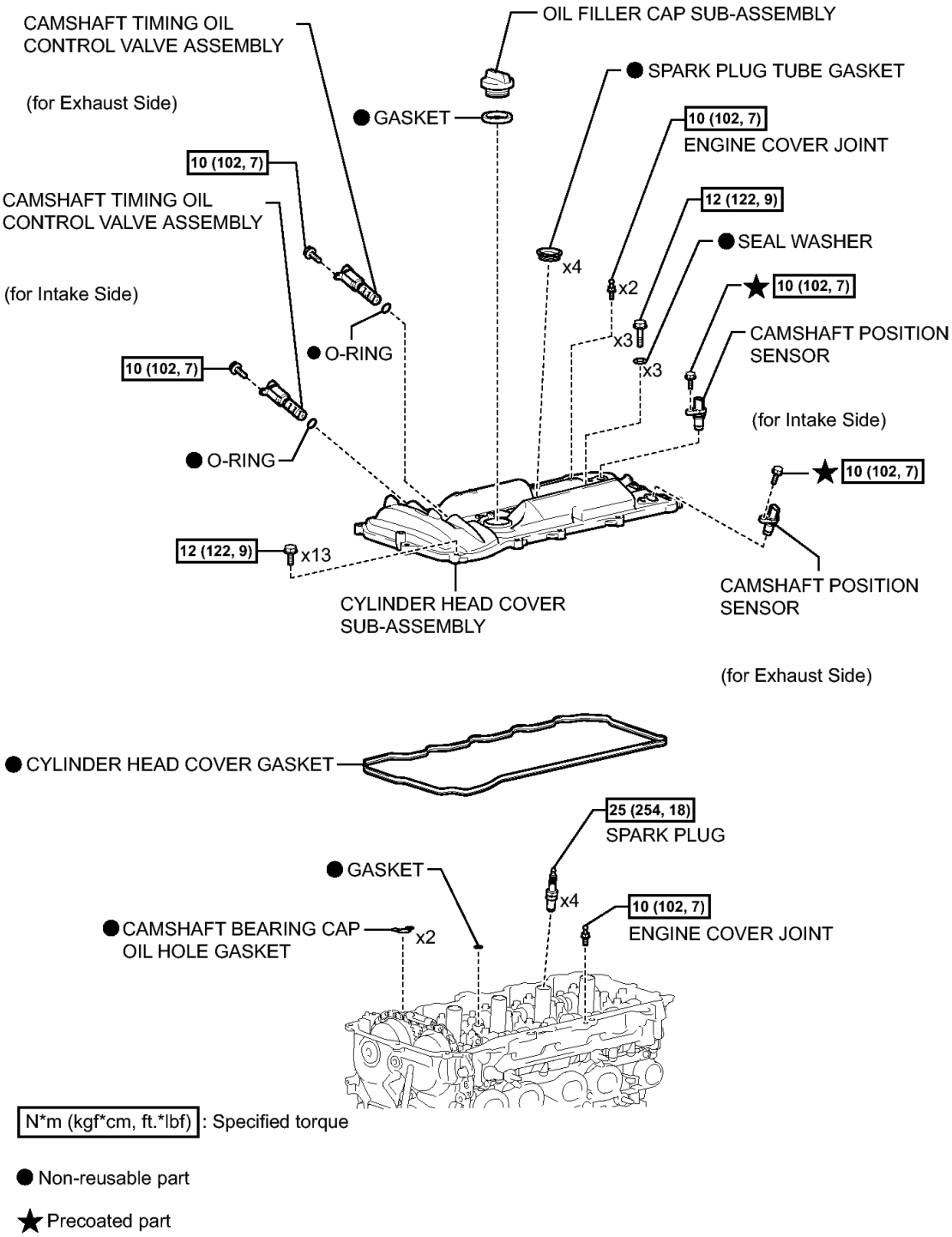


Fig. 275: Identifying Engine Unit Replacement Components With Torque Specifications (6 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Fig. 276: Identifying Engine Unit Replacement Components With Torque Specifications (7 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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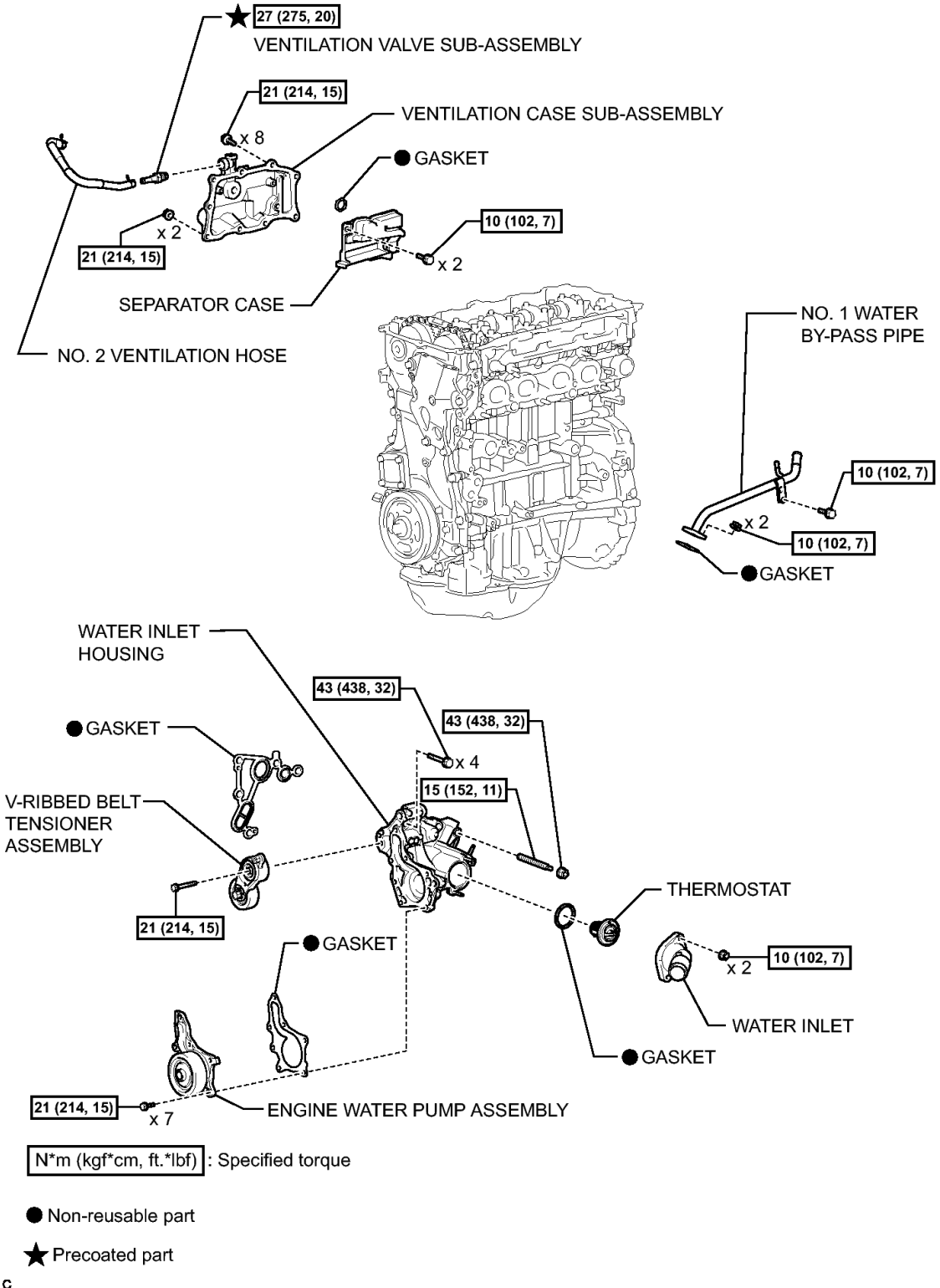


Fig. 277: Identifying Engine Unit Replacement Components With Torque Specifications (8 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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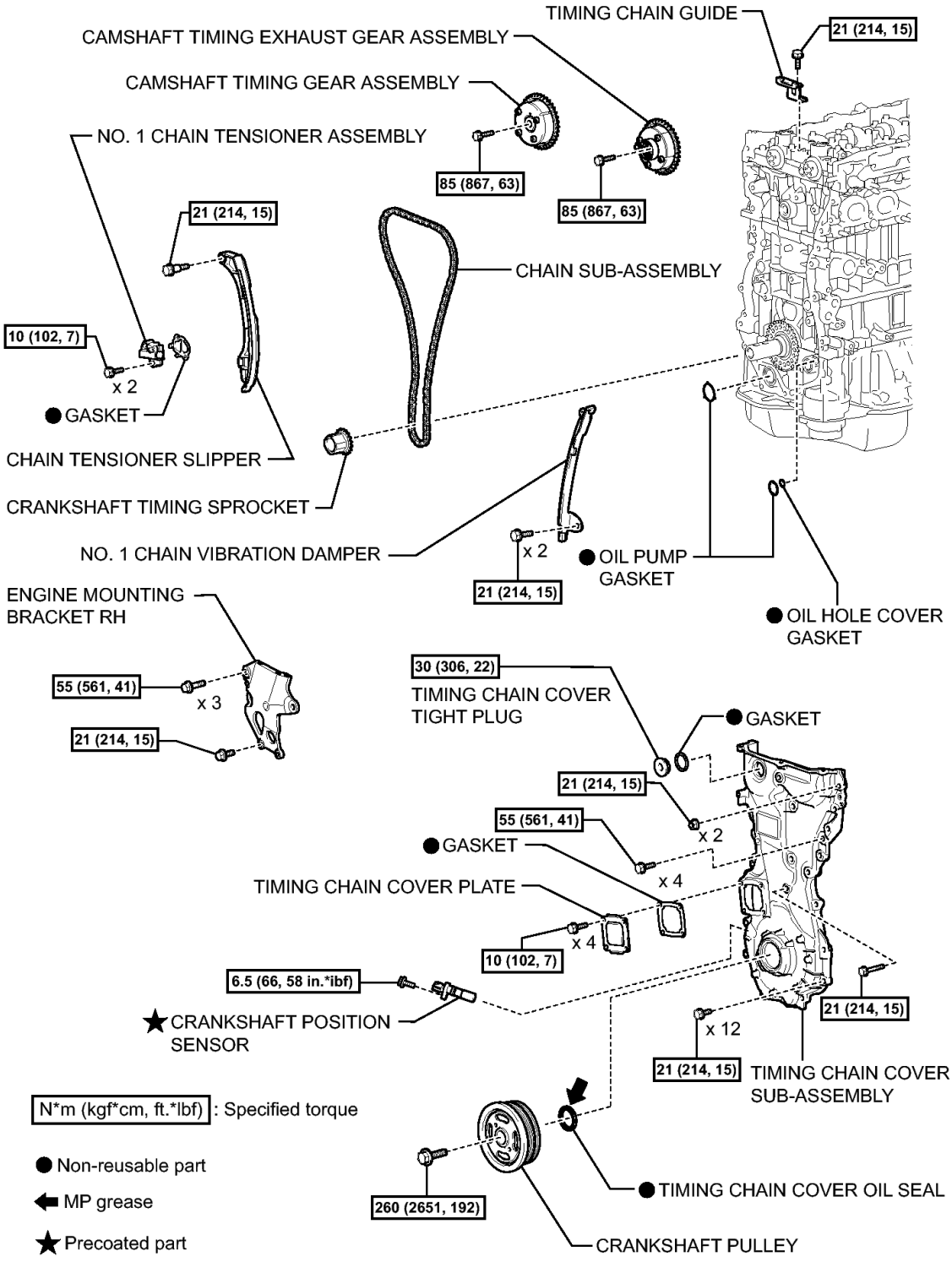


Fig. 278: Identifying Engine Unit Replacement Components With Torque Specifications (9 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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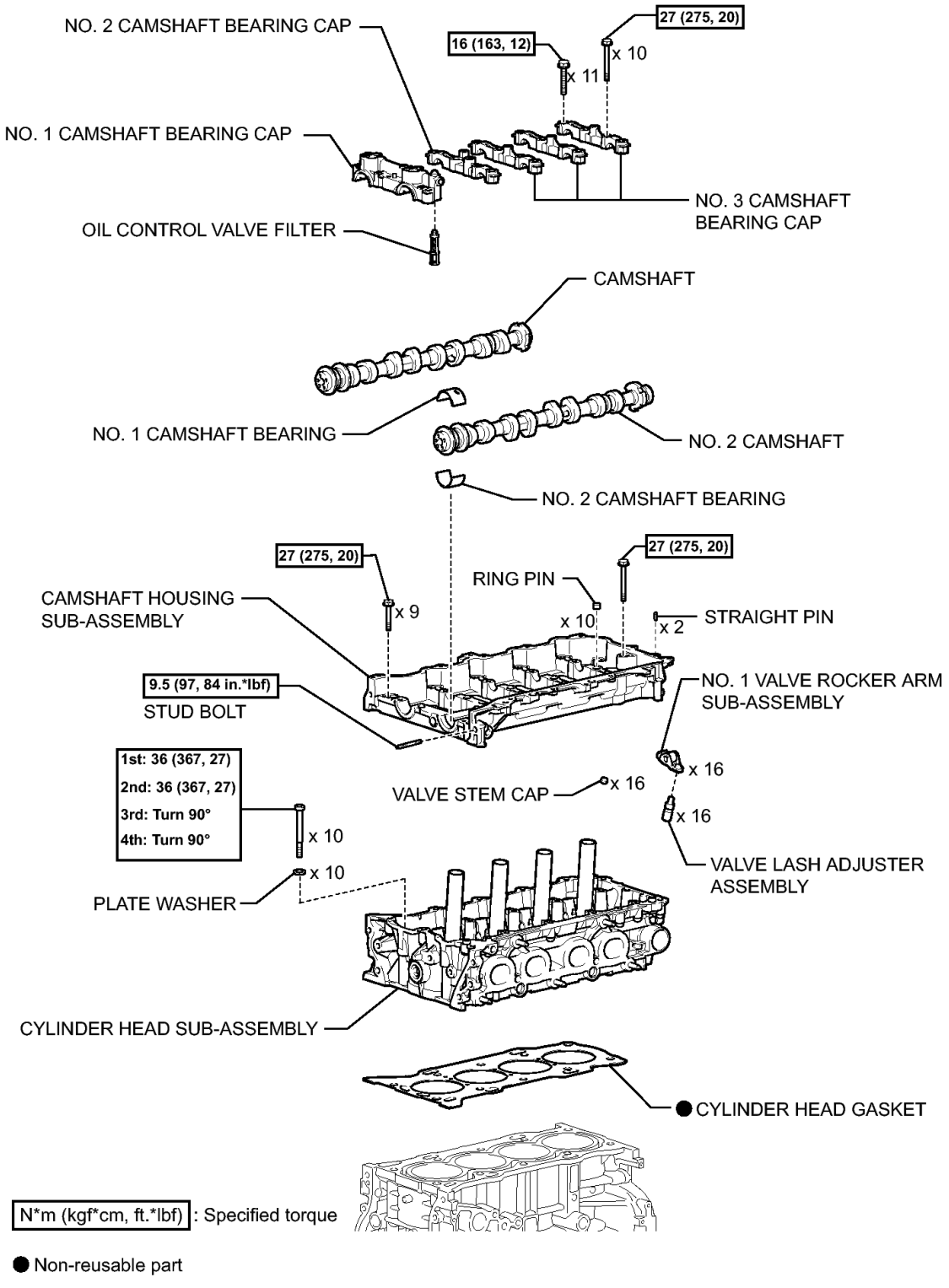


Fig. 279: Identifying Engine Unit Replacement Components With Torque Specifications (10 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ILLUSTRATION

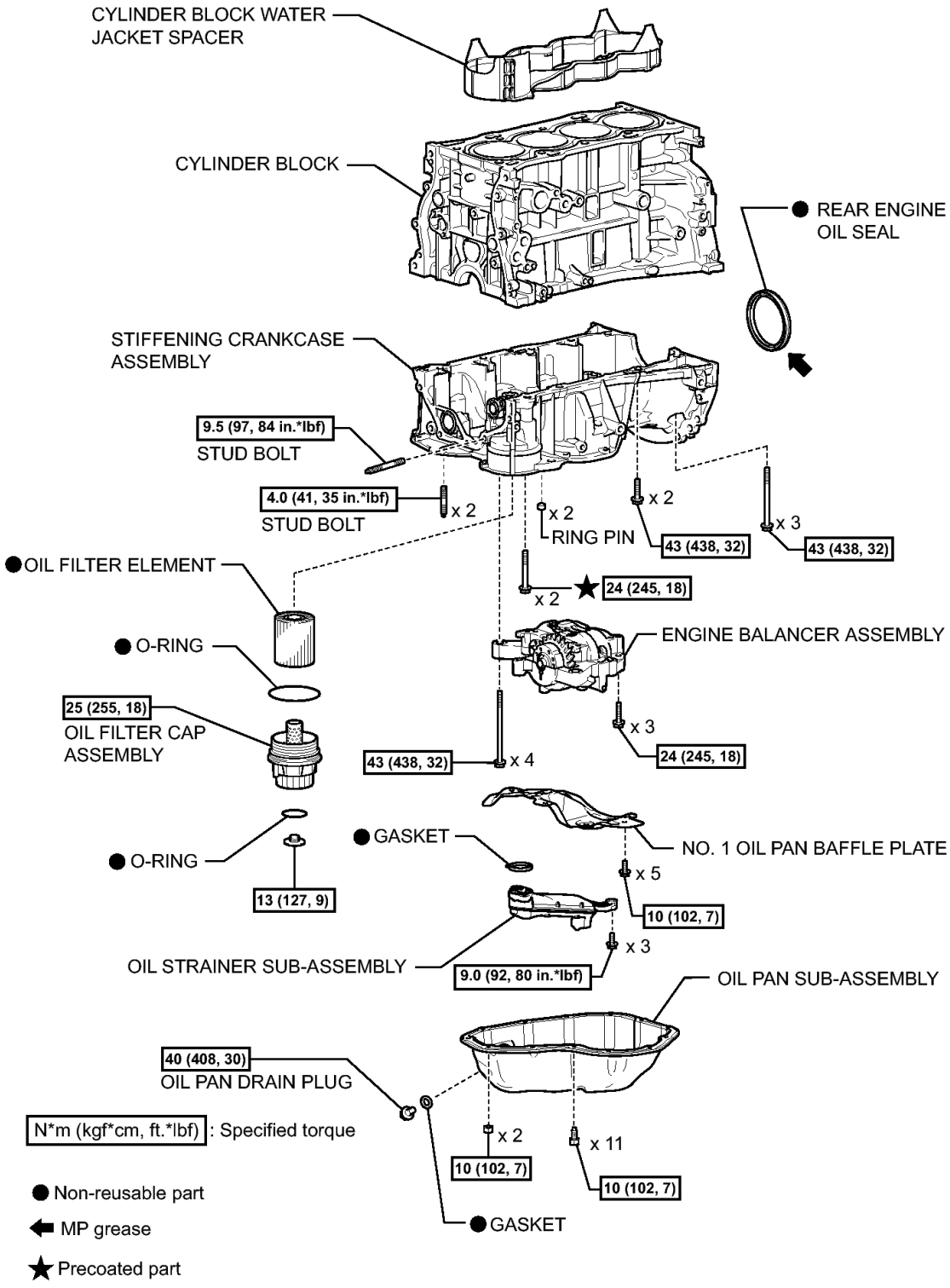


Fig. 280: Identifying Engine Unit Replacement Components With Torque Specifications (11 Of 11)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL [08/2013 -]

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REMOVAL [08/2013 -]

1. **REMOVE ENGINE HANGERS**
   a. Remove the 2 bolts and 2 engine hangers.

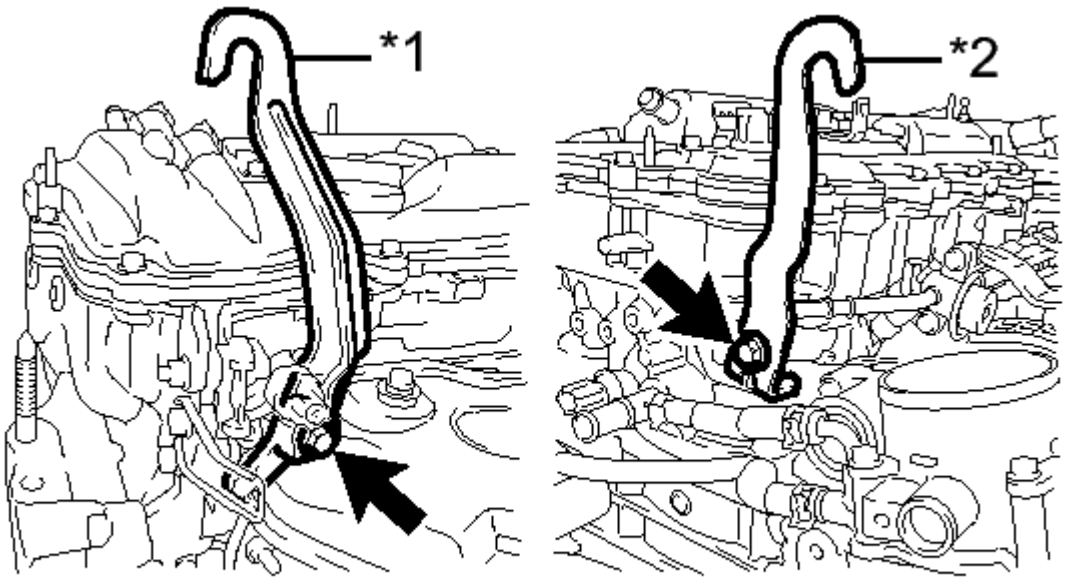


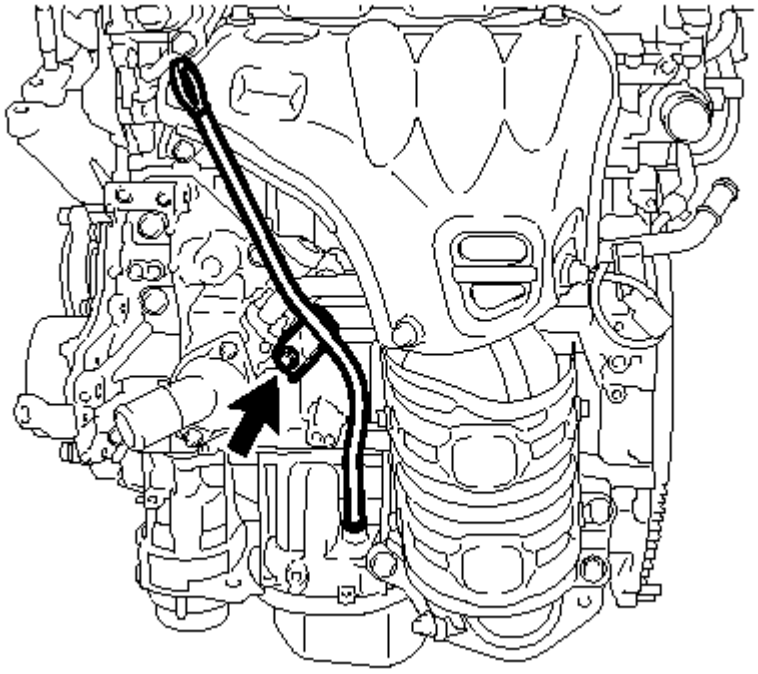
Fig. 281: Identifying Engine Hangers Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	No. 1 Engine Hanger
*2	No. 2 Engine Hanger

2. **REMOVE ENGINE OIL LEVEL DIPSTICK GUIDE**
   a. Remove the engine oil level dipstick.

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Fig. 282: Locating Dipstick Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the bolt and engine oil level dipstick guide.
c. Remove the O-ring from the engine oil level dipstick guide.

3. **REMOVE MANIFOLD STAY** . Refer to **REMOVAL [08/2013 -] - Step 6**
4. **REMOVE NO. 2 MANIFOLD STAY** . Refer to **REMOVAL [08/2013 -] - Step 7**
5. **REMOVE EGR INLET EXHAUST MANIFOLD PLATE (for PZEV)** . Refer to **REMOVAL [08/2013 -] - Step 9**
6. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (except PZEV)** . Refer to **REMOVAL [08/2013 -] - Step 8**
7. **REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 11**
8. **REMOVE NO. 1 COMPRESSOR MOUNTING BRACKET**
   a. Remove the 4 bolts and bracket.

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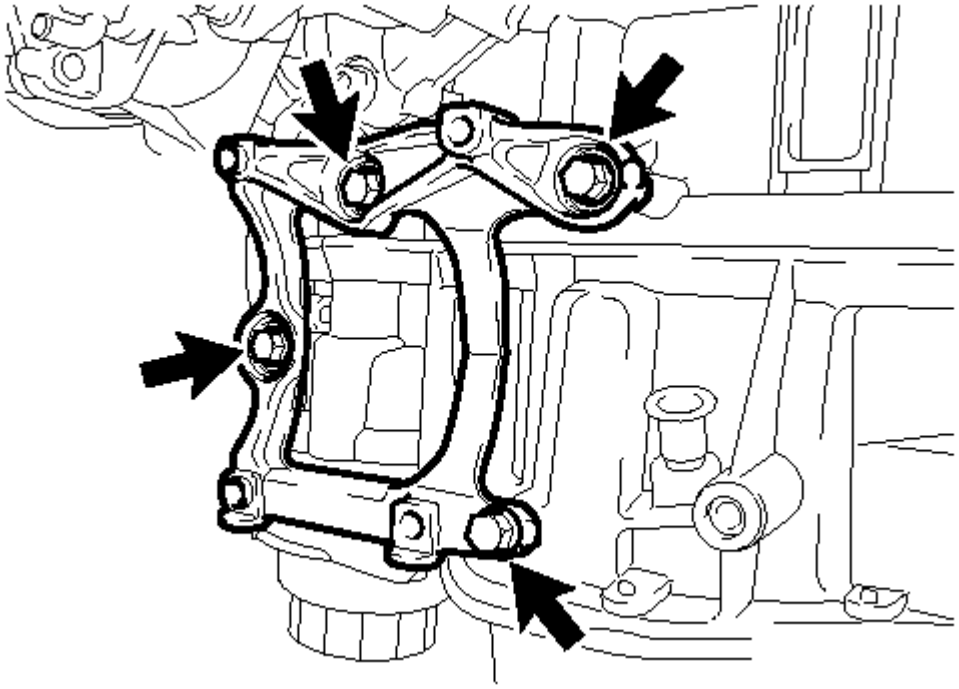


Fig. 283: Locating NO. 1 Compressor Mounting Bracket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. **REMOVE THROTTLE WITH MOTOR BODY ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 8**
10. **REMOVE WATER BY-PASS HOSE**
    a. Remove the No. 1 and No. 2 water by-pass hoses.

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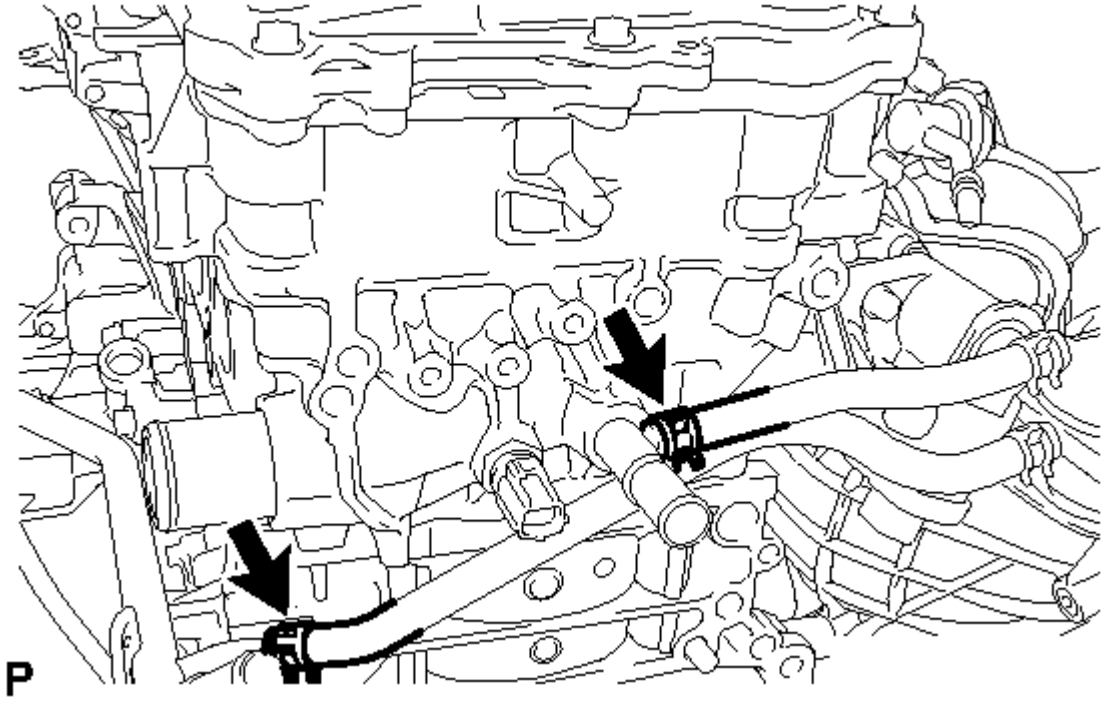


Fig. 284: Locating No. 1 And No. 2 Water Bypass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE VACUUM SWITCHING VALVE ASSEMBLY (for ACIS)** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 7**
12. **DISCONNECT NO. 2 VENTILATION HOSE** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 8**
13. **REMOVE UNION TO CONNECTOR TUBE HOSE** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 9**
14. **REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 9**
15. **REMOVE INTAKE MANIFOLD** . Refer to **REMOVAL [08/2013 - 12/2013] - Step 12**
16. **REMOVE SENSOR WIRE**
    a. Disconnect the knock control sensor connector.

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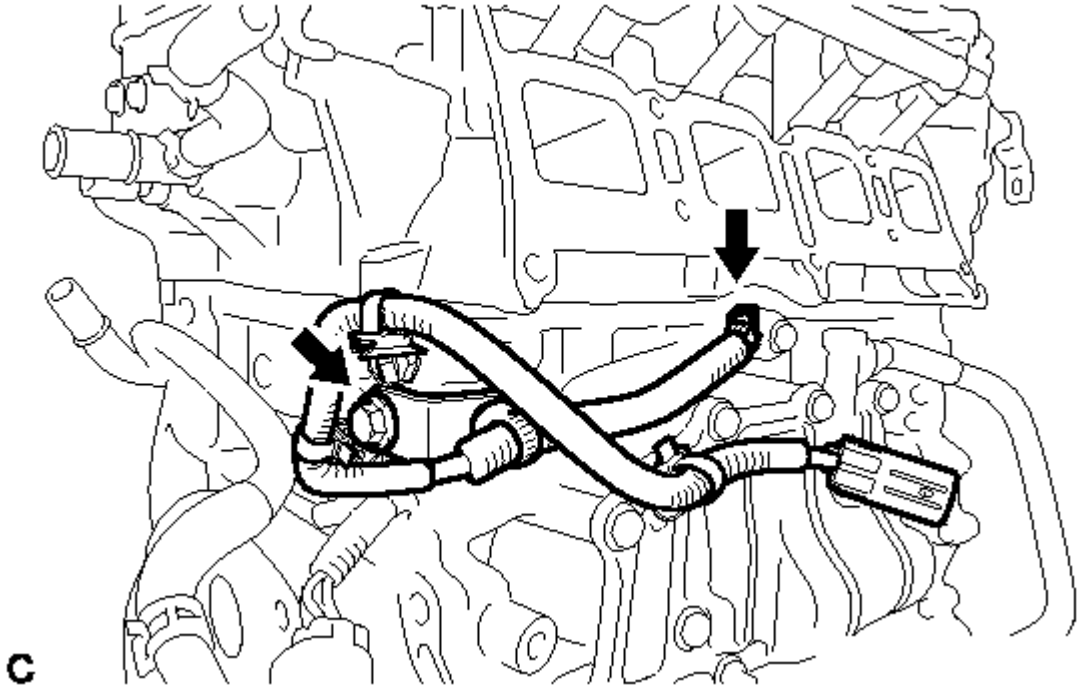


Fig. 285: Identifying Knock Control Sensor Connector, Wire And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the bolt and knock control sensor wire.

17. **REMOVE KNOCK CONTROL SENSOR** . Refer to **REMOVAL [08/2013 -] - Step 2**
18. **REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 1**
19. **REMOVE ENGINE COOLANT TEMPERATURE SENSOR** . Refer to **REMOVAL [08/2013 -] - Step 9**
20. **REMOVE IGNITION COIL ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 2**

DISASSEMBLY [08/2013 -]

DISASSEMBLY [08/2013 -]

1. **REMOVE ENGINE COVER JOINT**
   a. Remove the 3 joints.

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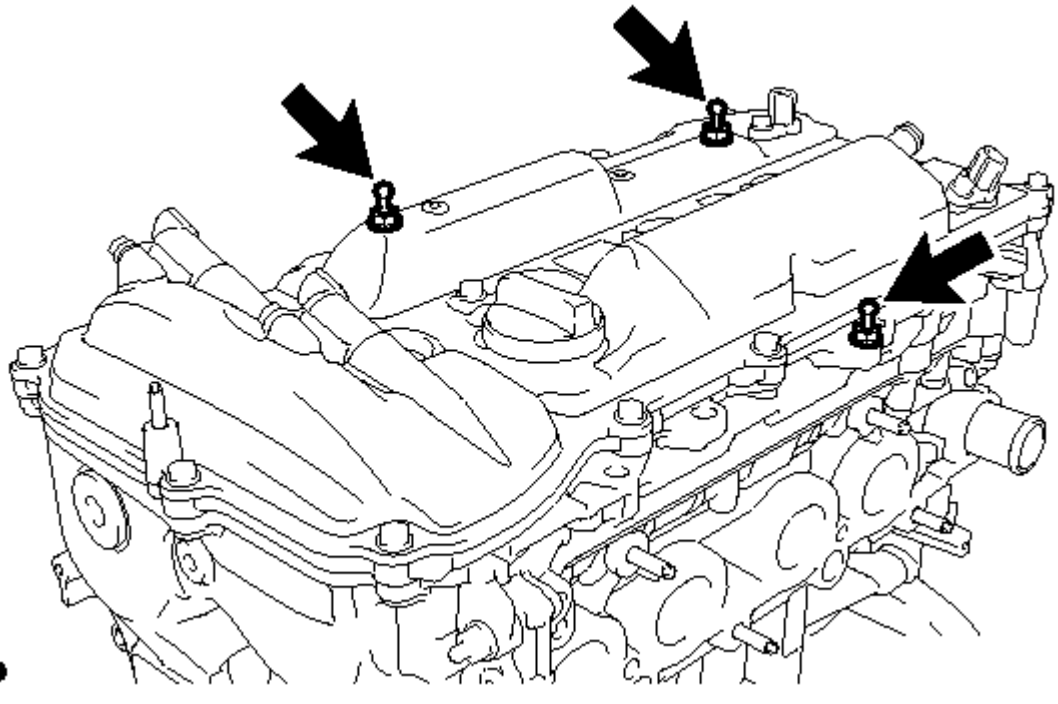


Fig. 286: Locating Engine Cover Joints
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. **REMOVE SPARK PLUG** . Refer to **REMOVAL [08/2013 -] - Step 3**
3. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 3**
4. **REMOVE CAMSHAFT POSITION SENSOR** . Refer to **REMOVAL [08/2013 -] - Step 2**
5. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
   a. Remove the oil filler cap from the cylinder head.
   b. Remove the gasket from the oil filler cap.
6. **REMOVE CRANKSHAFT POSITION SENSOR** . Refer to **REMOVAL [08/2013 -] - Step 1**
7. **REMOVE VENTILATION VALVE SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 2**
8. **REMOVE VENTILATION CASE SUB-ASSEMBLY**
   a. Remove the 8 bolts and 2 nuts.

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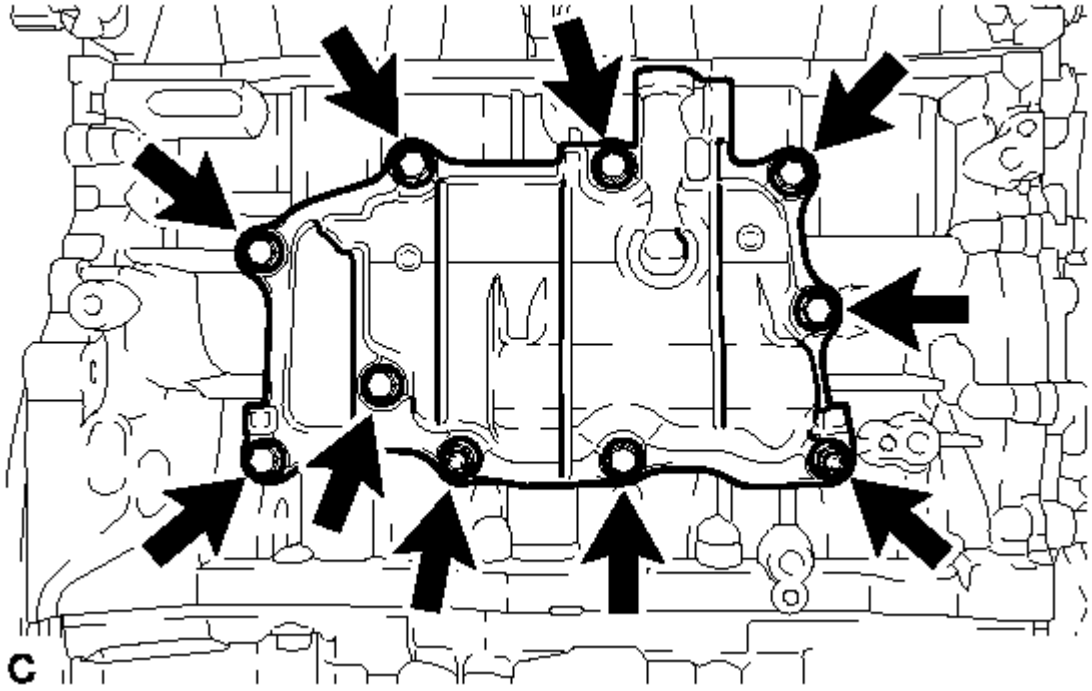


Fig. 287: Locating Ventilation Case Sub-Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the ventilation case by prying between the ventilation case and cylinder block with a screwdriver.

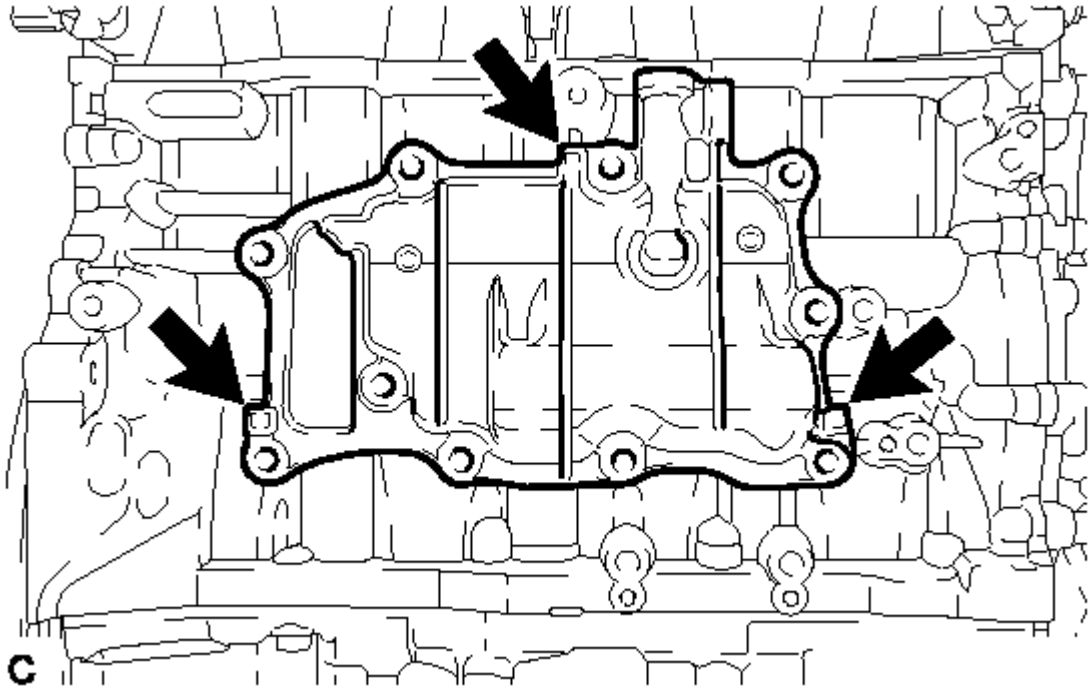


Fig. 288: Locating Contact Surfaces Of Cylinder Block And Ventilation Case

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

HINT:

Tape the screwdriver tip before use.

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

9. **REMOVE SEPARATOR CASE**
   a. Remove the 2 bolts, separator case and gasket.

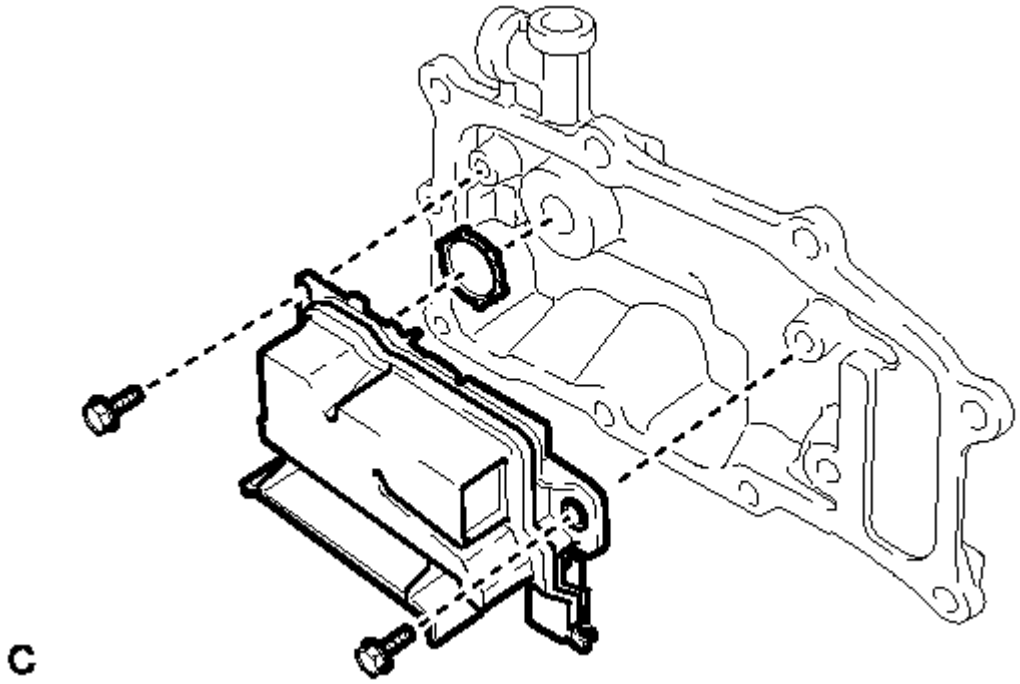


Fig. 289: Identifying Separator Case, Gasket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. **REMOVE NO. 1 WATER BY-PASS PIPE**
    a. Remove the bolt, 2 nuts, water by-pass pipe and gasket.

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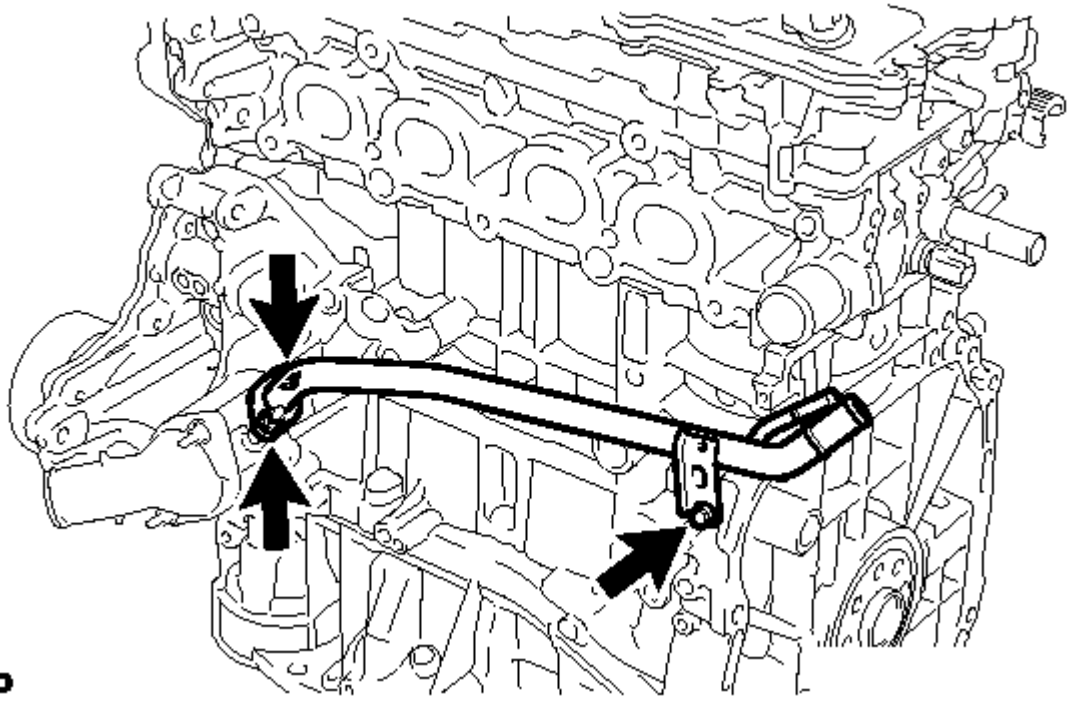


Fig. 290: Locating Water Bypass Pipe, Gasket, Bolt & Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **REMOVE WATER INLET** . Refer to **REMOVAL [08/2013 -] - Step 3**
12. **REMOVE THERMOSTAT** . Refer to **REMOVAL [08/2013 -] - Step 4**
13. **REMOVE V-RIBBED BELT TENSIONER ASSEMBLY**
    a. Remove the bolt and V-ribbed belt tensioner.

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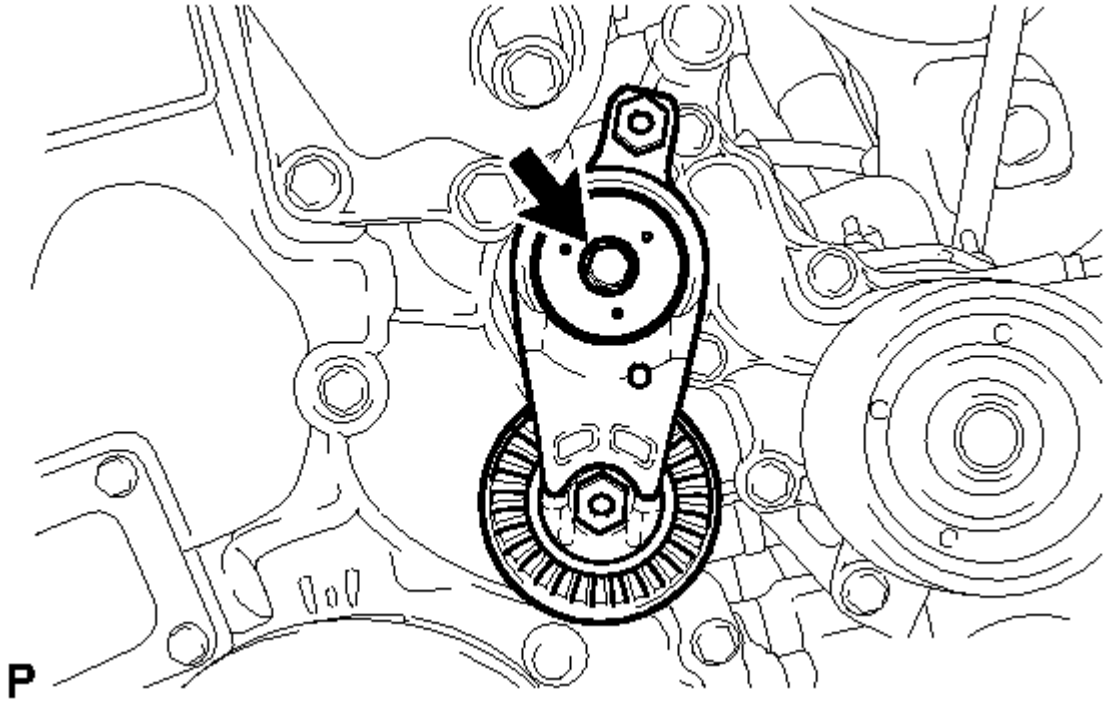
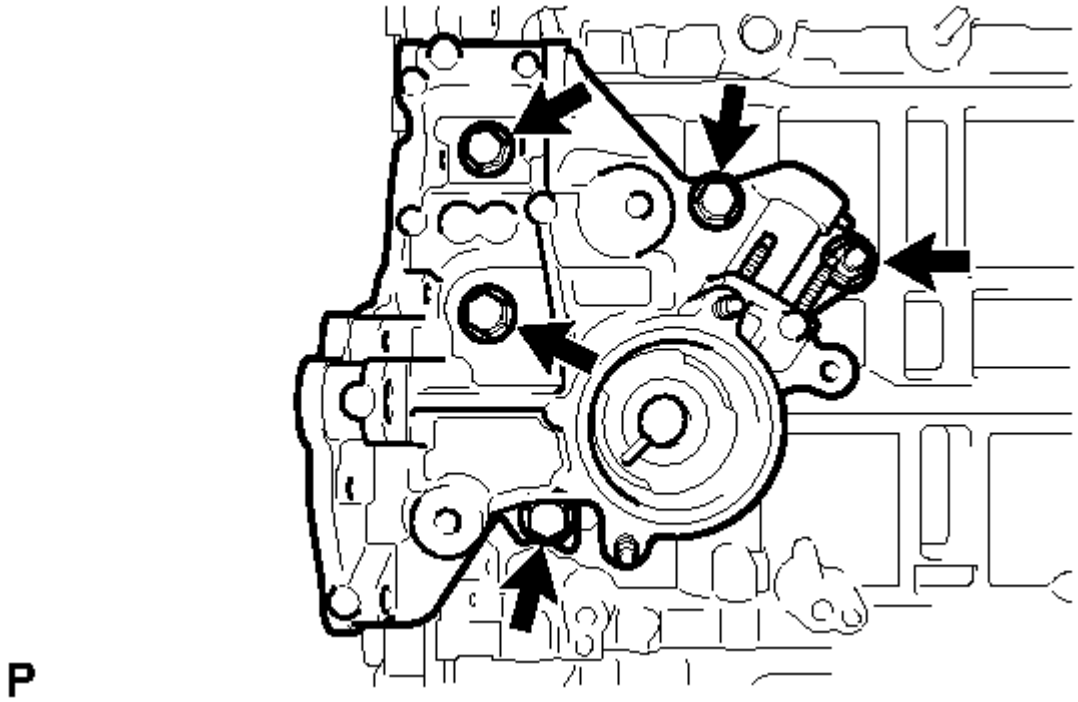


Fig. 291: Locating V-Ribbed Belt Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. **REMOVE ENGINE WATER PUMP ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 5**
15. **REMOVE WATER INLET HOUSING**
    a. Remove the 4 bolts, nut, inlet water housing and gasket.



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Fig. 292: Locating Inlet Water Housing, Gasket, Bolts & Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **REMOVE CRANKSHAFT PULLEY**
    a. Using SST, hold the crankshaft pulley and loosen the pulley bolt. Further loosen the bolt until 2 or 3 threads are screwed into the crankshaft.

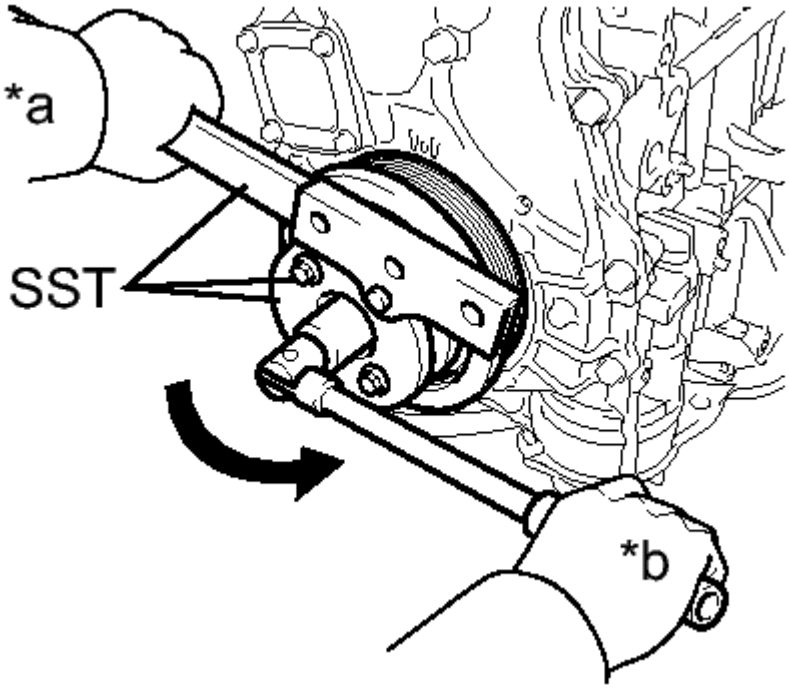


Fig. 293: Removing Crankshaft Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

- **SST: 09213-54015**
- **SST: 09330-00021**
- **SST: 91551-80650**

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

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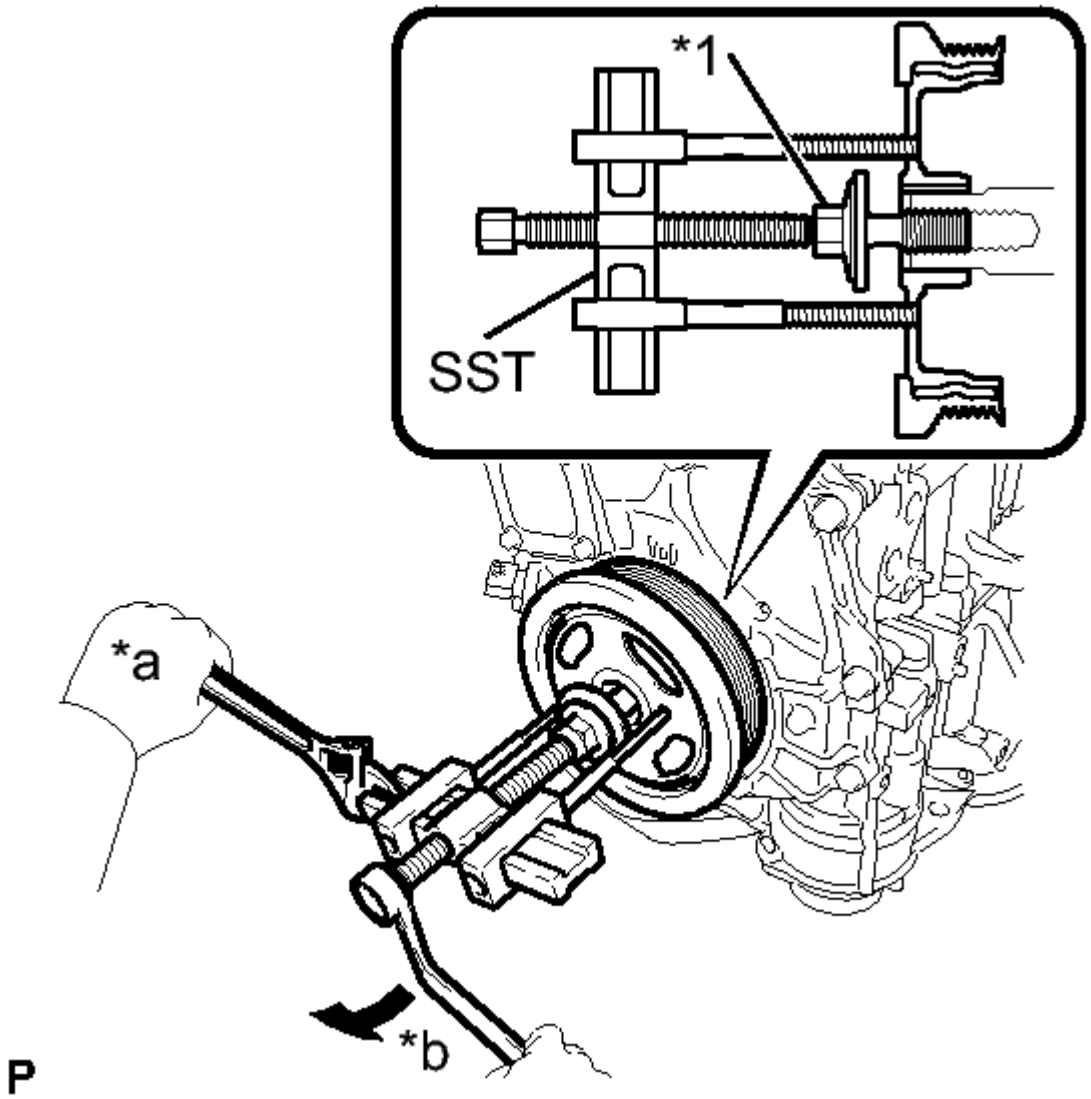


Fig. 294: Removing Crankshaft Pulley Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Pulley Bolt
*a	Hold
*b	Turn

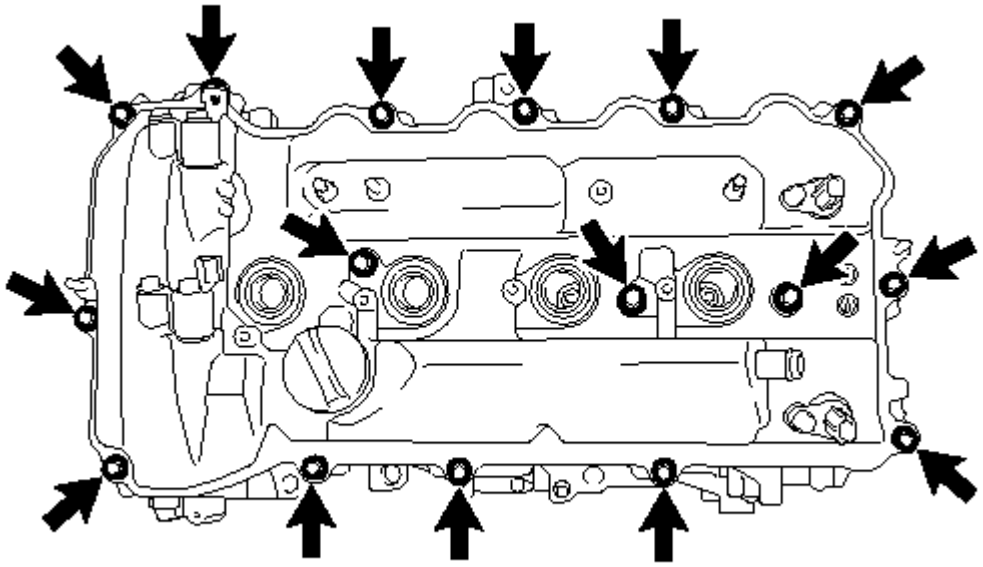
- **SST: 09950-50013**
  09951-05010
  09952-05010
  09953-05020
  09954-05011

HINT:

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Apply a lubricant to the threads and end of SST.

17. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
    a. Remove the 16 bolts, 3 seal washers, cylinder head cover and gasket.



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Fig. 295: Locating Cylinder Head Cover And Gasket Bolts And Seal Washers
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

    b. Remove the 3 gaskets from the camshaft bearing caps.

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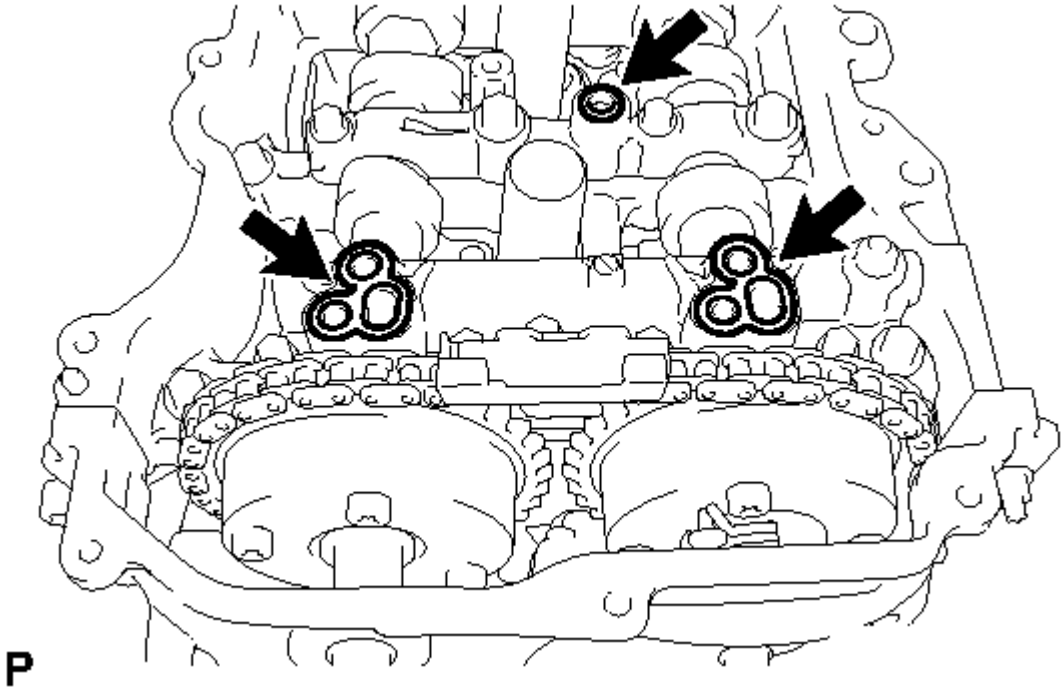


Fig. 296: Locating Camshaft Bearing Caps Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

18. **REMOVE SPARK PLUG TUBE GASKET**
    a. Using a screwdriver, pry out the 4 plug tube gaskets.

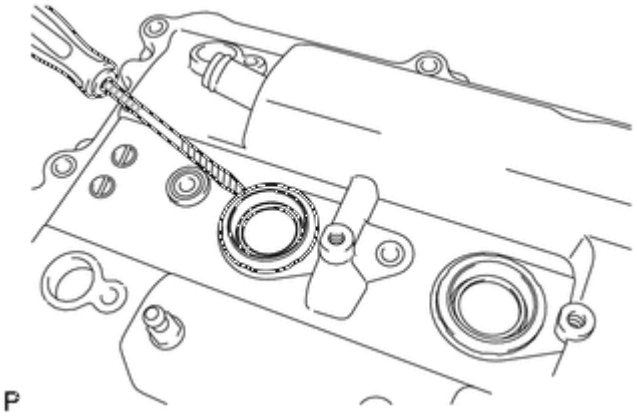


Fig. 297: Removing Spark Plug Tube Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful not to damage the cylinder head cover.

HINT:

Tape the screwdriver tip before use.

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19. **REMOVE ENGINE MOUNTING BRACKET RH** . Refer to **REMOVAL [08/2013 -] - Step 7**
20. **REMOVE TIMING CHAIN COVER SUB-ASSEMBLY** . Refer to **REMOVAL [08/2013 -] - Step 9**
21. **REMOVE TIMING CHAIN COVER TIGHT PLUG**
    a. Using a 14 mm hexagon wrench, remove the plug and gasket.

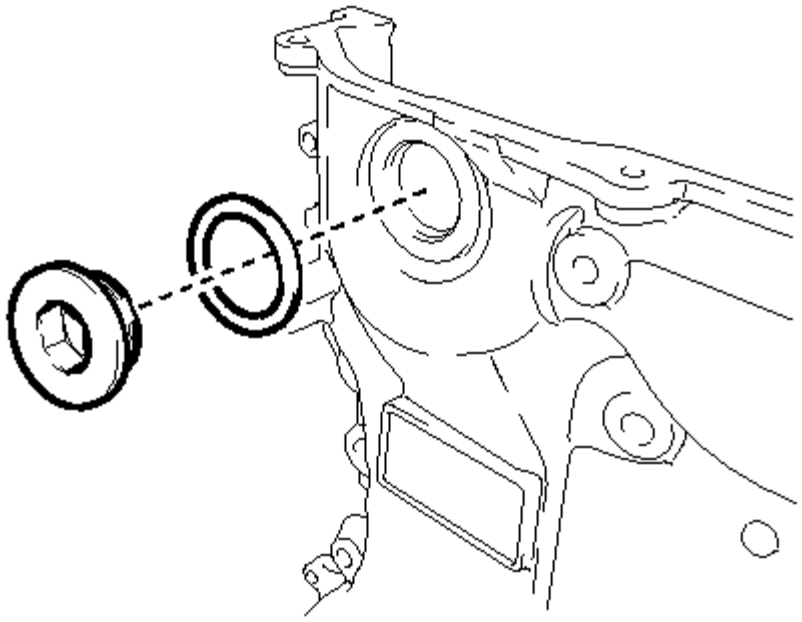


Fig. 298: Identifying Timing Chain Cover Tight Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. **REMOVE TIMING CHAIN COVER PLATE**
    a. Remove the 4 bolts, timing chain cover plate and gasket.

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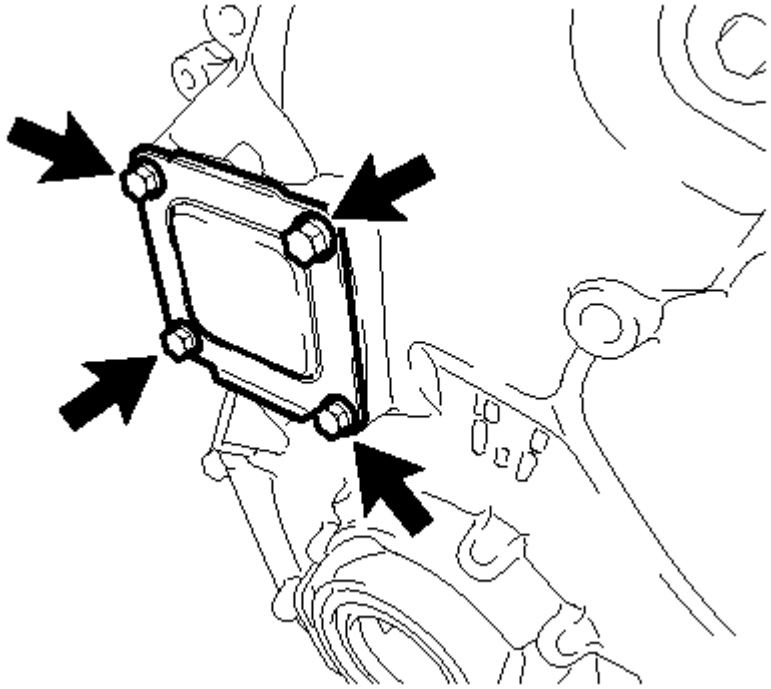
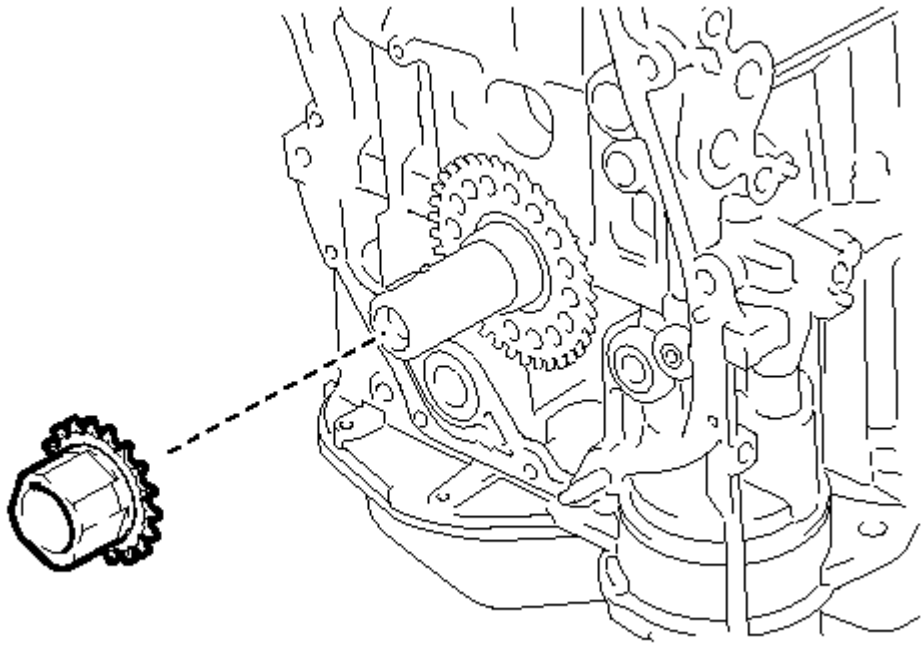


Fig. 299: Locating Timing Chain Cover Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

23. **REMOVE TIMING CHAIN COVER OIL SEAL** . Refer to **REMOVAL [08/2013 -] - Step 10**
24. **SET NO. 1 CYLINDER TO TDC/COMPRESSION** See step 12
25. **REMOVE TIMING CHAIN GUIDE** See step 13
26. **REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY** See step 14
27. **REMOVE CHAIN TENSIONER SLIPPER** See step 15
28. **REMOVE CHAIN SUB-ASSEMBLY**
    a. Remove the chain sub-assembly.
29. **REMOVE NO. 1 CHAIN VIBRATION DAMPER** See step 17
30. **REMOVE CRANKSHAFT TIMING SPROCKET**
    a. Remove the crankshaft timing sprocket from the crankshaft.

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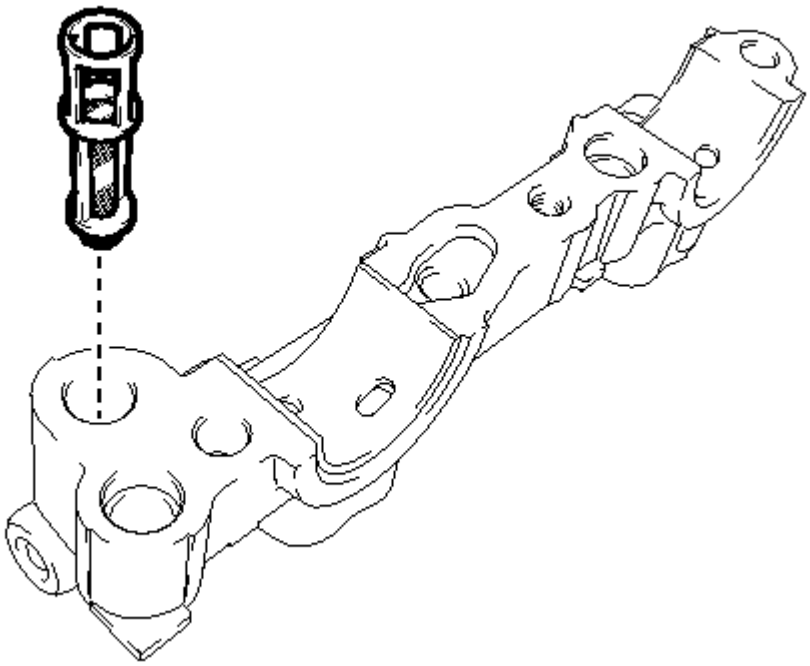


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Fig. 300: Identifying Crankshaft Timing Sprocket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

31. **REMOVE CAMSHAFT TIMING GEAR ASSEMBLY** See step 18
32. **REMOVE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY** See step 19
33. **REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY** See step 20
34. **REMOVE CAMSHAFT BEARING CAP** See step 21
35. **REMOVE OIL CONTROL VALVE FILTER**
    a. Remove the oil control valve filter from the No. 1 camshaft bearing cap.

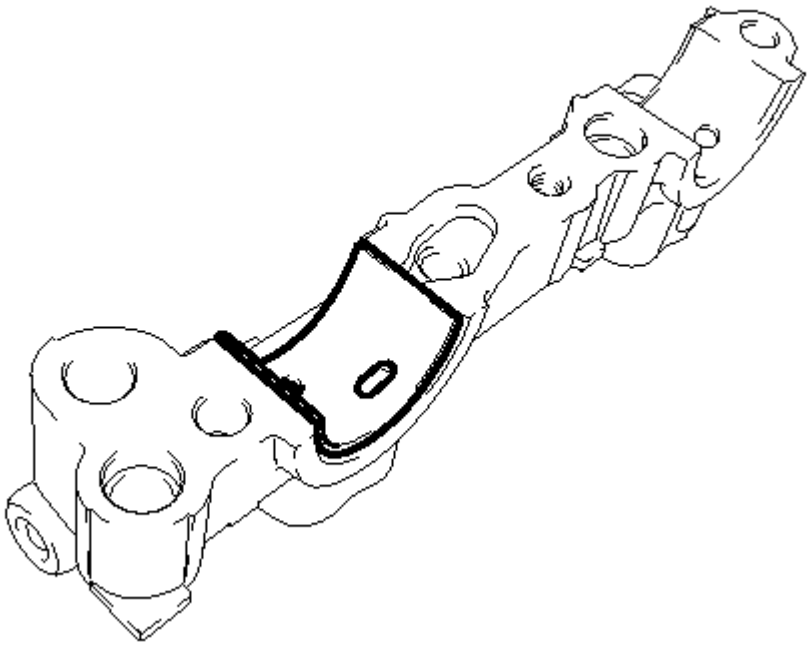
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Fig. 301: Identifying Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

36. **REMOVE CAMSHAFT** See step 24
37. **REMOVE NO. 1 CAMSHAFT BEARING**
    a. Remove the No. 1 camshaft bearing.

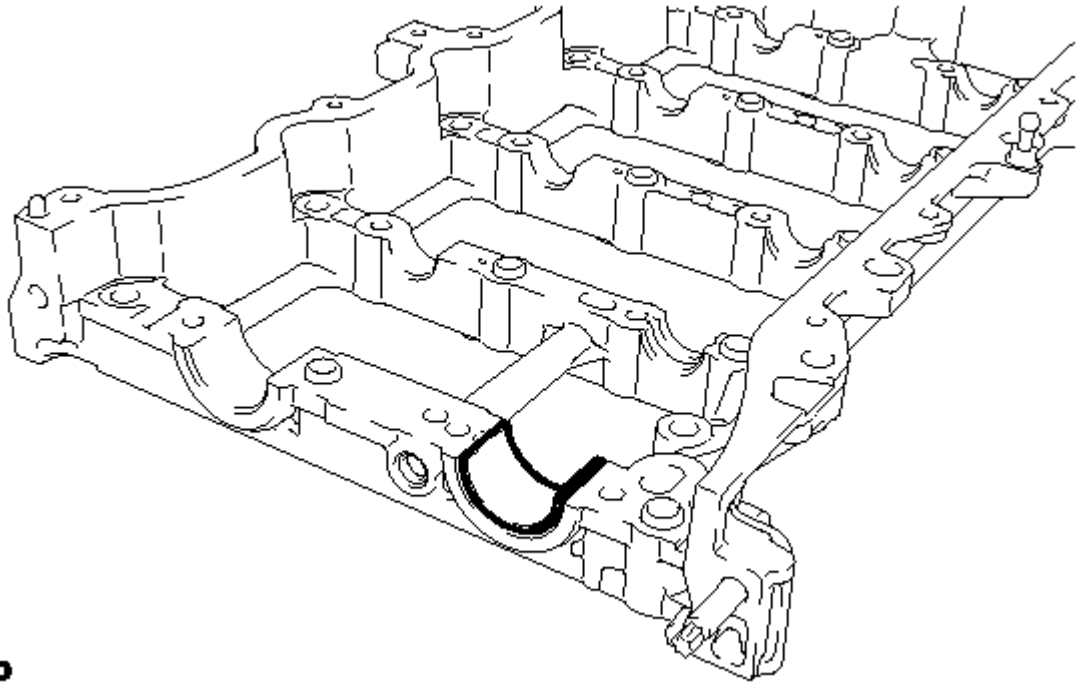


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Fig. 302: No. 1 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

38. **REMOVE NO. 2 CAMSHAFT BEARING**
    a. Remove the No. 2 camshaft bearing.



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Fig. 303: No. 2 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

39. **REMOVE CAMSHAFT HOUSING STUD BOLT**

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

40. **REMOVE CAMSHAFT BEARING CAP SETTING RING PIN**

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

41. **REMOVE CAMSHAFT HOUSING STRAIGHT PIN**

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

42. **REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY** See step 26
43. **REMOVE VALVE LASH ADJUSTER ASSEMBLY** See step 27
44. **REMOVE VALVE STEM CAP** See step 28
45. **REMOVE CYLINDER HEAD SUB-ASSEMBLY** See step 29

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46. **REMOVE CYLINDER HEAD GASKET** See step 30
47. **REMOVE CYLINDER BLOCK WATER JACKET SPACER**
    a. Remove the cylinder block water jacket spacer from the cylinder block.

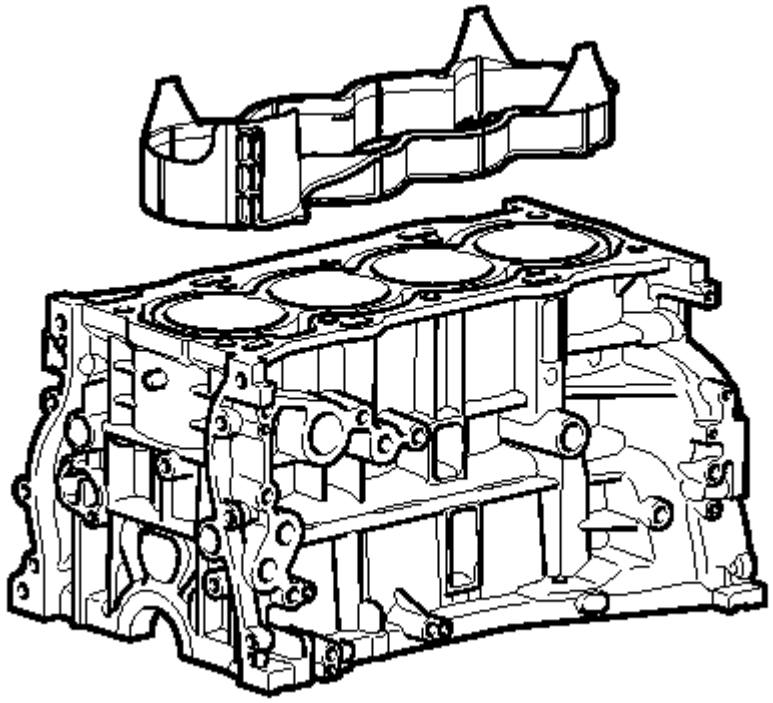


Fig. 304: Identifying Cylinder Block Water Jacket Spacer Component
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be sure to remove the water jacket spacer. If it is not removed, it may fall and become damaged when the cylinder block is inverted.

48. **REMOVE OIL FILTER CAP ASSEMBLY** . Refer to **REPLACEMENT [08/2013 -] - Step 2**
49. **REMOVE OIL PAN SUB-ASSEMBLY**
    a. Remove the 11 bolts and 2 nuts.

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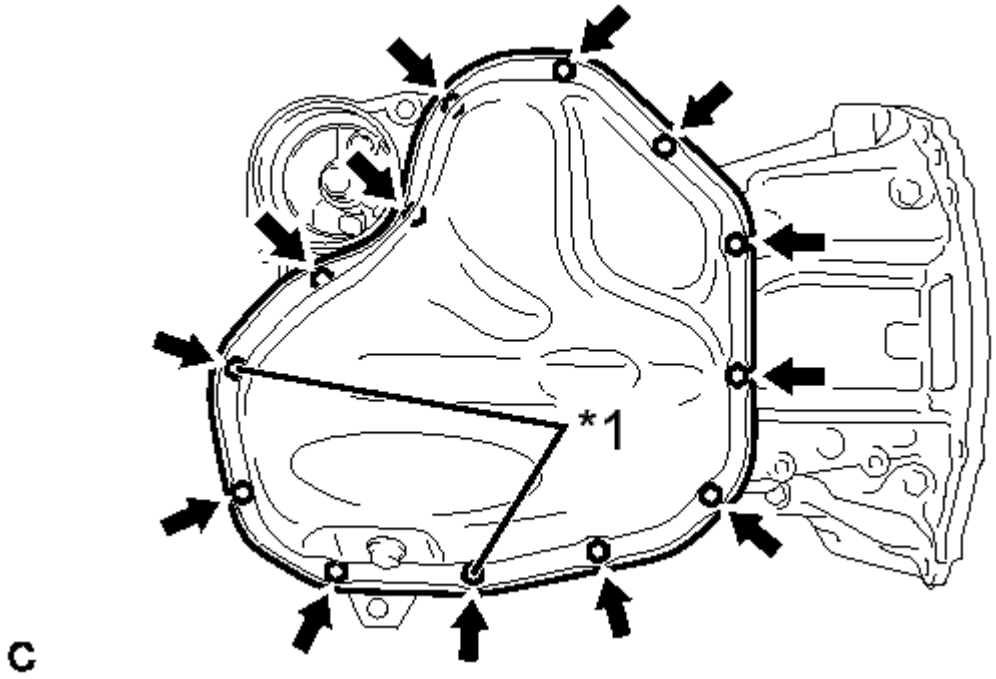


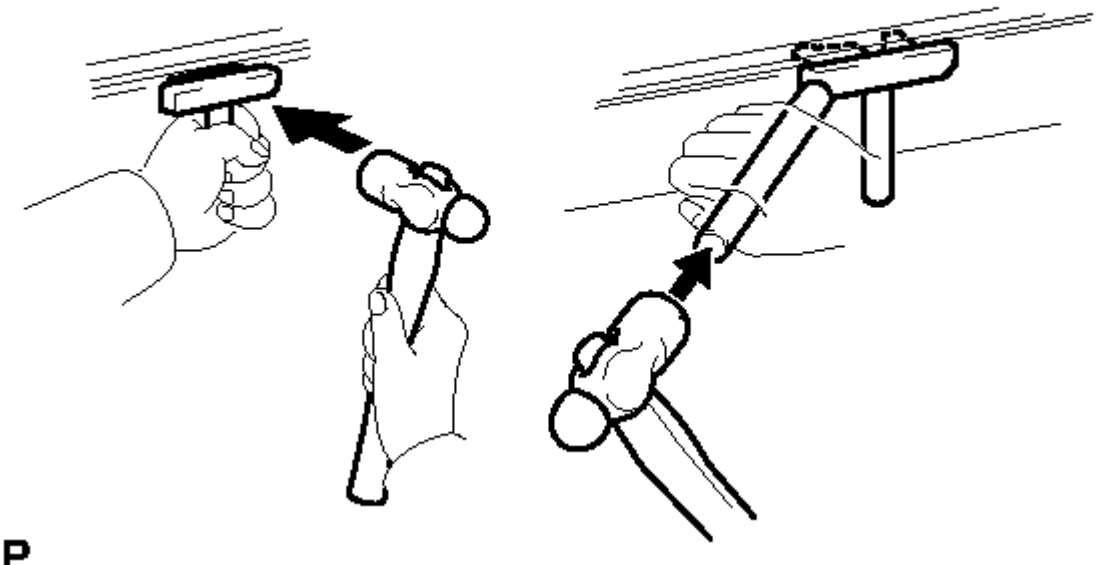
Fig. 305: Identifying Oil Pan Sub-Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Nut

b. Insert the blade of an oil pan seal cutter between the oil pan and stiffening crankcase, cut off the applied sealer and remove the oil pan.

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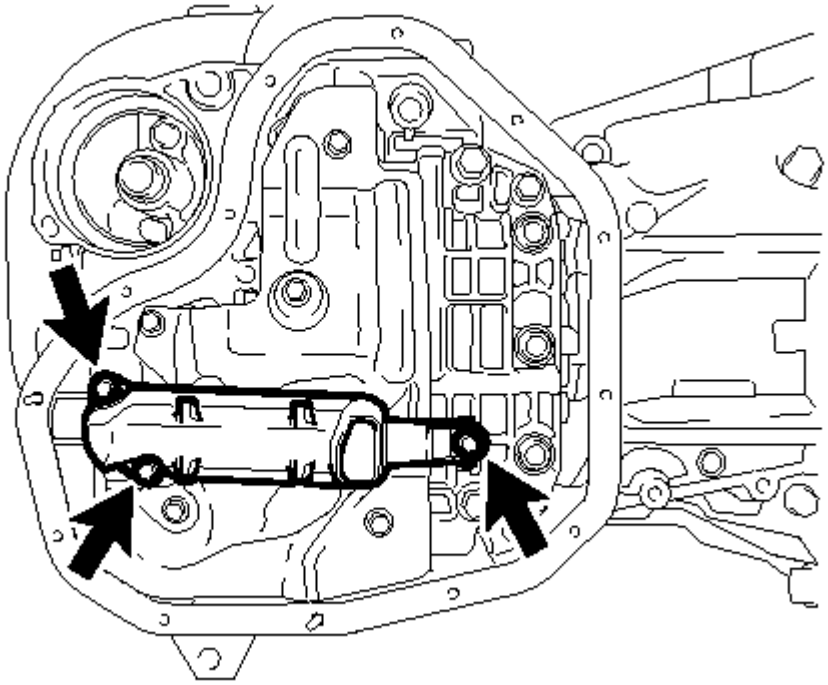
Fig. 306: View Of Inserting Blade Of SST Between No. 1 & No. 2 Oil Pans
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE:

- **Be careful not to damage the stiffening crankcase contact surface of the oil pan.**
- **Be careful not to damage the stiffening crankcase flange.**

50. **REMOVE OIL STRAINER SUB-ASSEMBLY**
    a. Remove the 3 bolts, oil strainer and gasket.

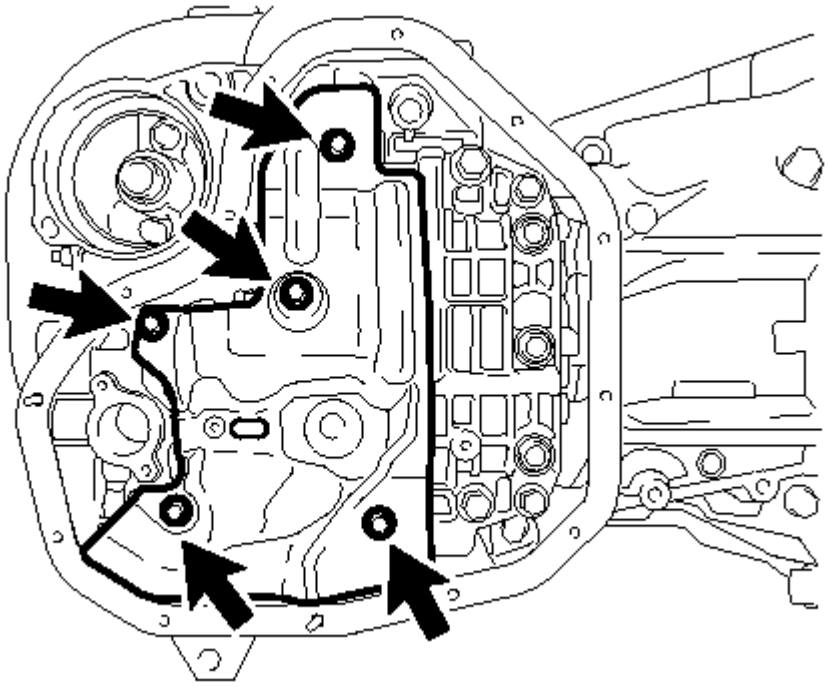
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Fig. 307: Oil Strainer And Gasket Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

51. **REMOVE NO. 1 OIL PAN BAFFLE PLATE**
    a. Remove the 5 bolts and oil pan baffle plate.



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Fig. 308: Oil Pan Baffle Plate Bolts

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

52. **INSPECT CRANKSHAFT BACKLASH**
    a. Using a dial indicator, measure the backlash of the crankshaft and balance shaft as shown in the illustration.

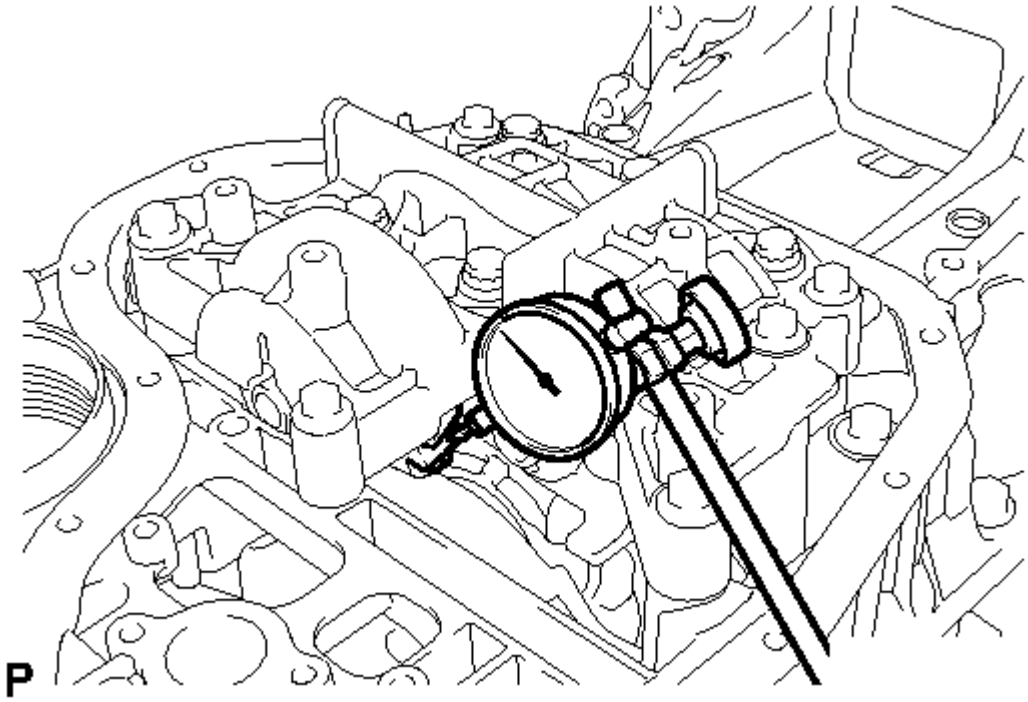


Fig. 309: View Of Measuring Backlash Of Crankshaft And Balance Shaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard backlash

0.05 to 0.20 mm (0.00197 to 0.00787 in.)

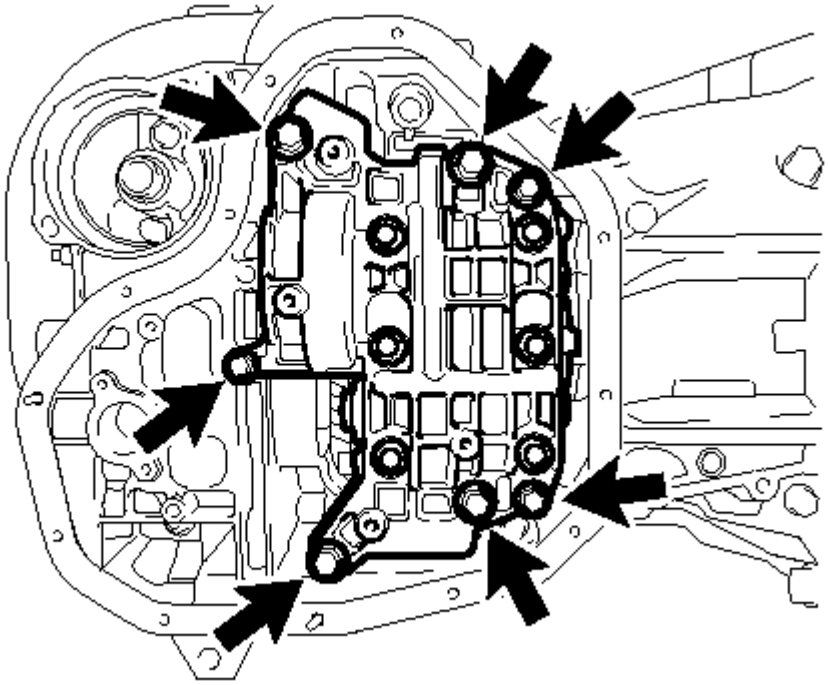
Maximum backlash

0.20 mm (0.00787 in.)

If the backlash is more than the maximum, replace the engine balancer assembly.

53. **REMOVE ENGINE BALANCER ASSEMBLY**
    a. Remove the 7 bolts and engine balancer.

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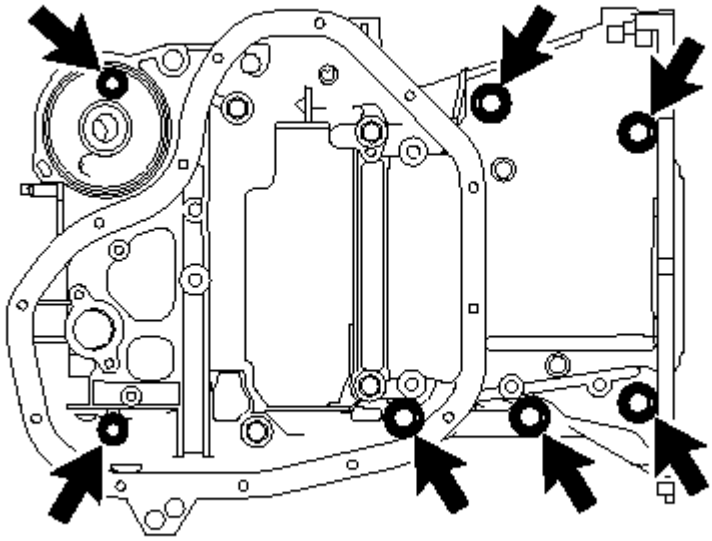
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Fig. 310: Location of Engine Balancer Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Do not disassemble the engine balancer.

54. **INSPECT BALANCE SHAFT THRUST CLEARANCE** See step 14
55. **REMOVE STIFFENING CRANKCASE ASSEMBLY**
    a. Remove the 7 bolts.

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Fig. 311: Stiffening Crankcase Assembly Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Using a screwdriver, remove the stiffening crankcase by prying between the stiffening crankcase and cylinder block at the places shown in the illustration.

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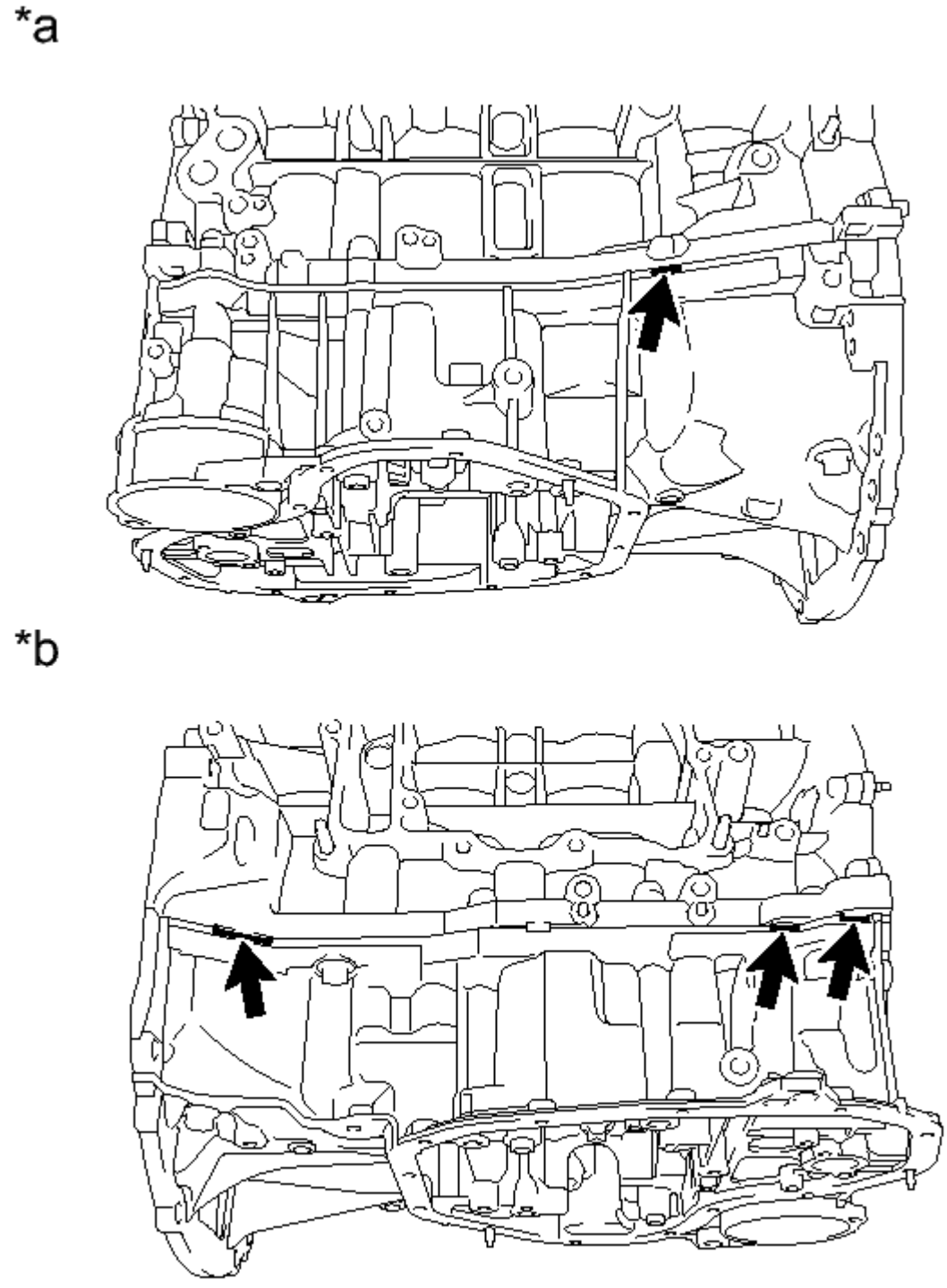


Fig. 312: Locating Stiffening Crankcase & Cylinder Block Prying Areas
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	LH Side:

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*b	RH Side:

HINT:

Tape the screwdriver tip before use.

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

56. **REMOVE STIFFENING CRANKCASE STUD BOLT**

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

57. **REMOVE STIFFENING CRANKCASE RING PIN**

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

58. **REMOVE REAR ENGINE OIL SEAL**
    a. Remove the rear engine oil seal from the cylinder block.

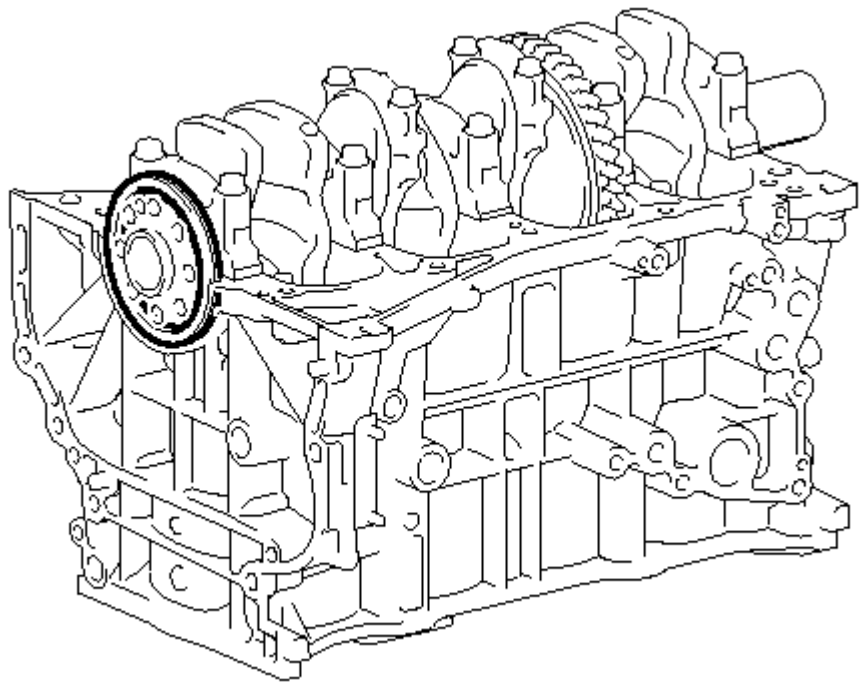


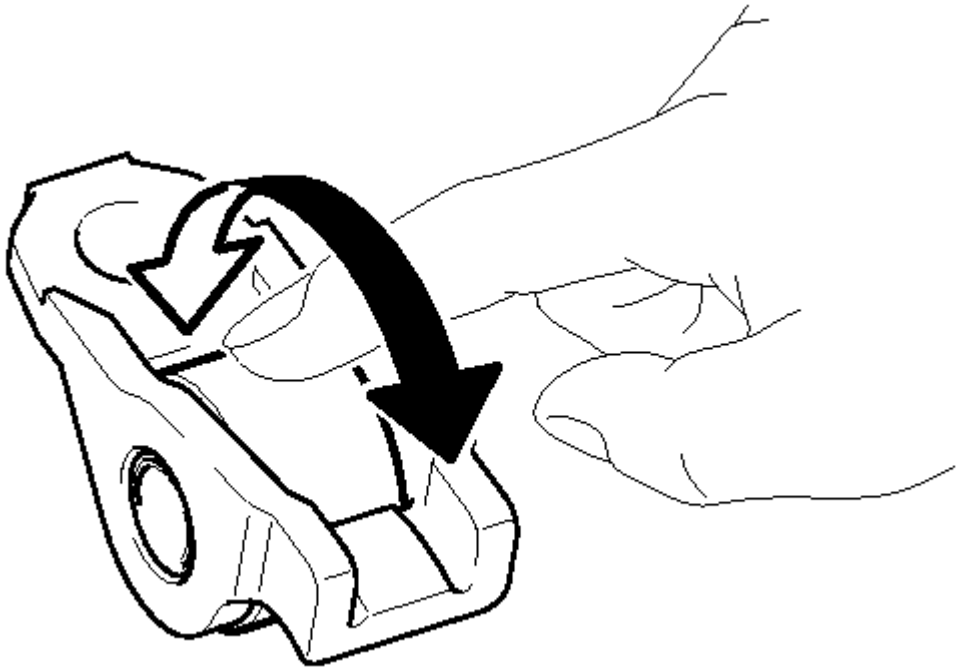
Fig. 313: Rear Engine Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION [08/2013 -]

INSPECTION [08/2013 -]

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1. **INSPECT NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY**
   a. Turn the roller by hand to check that it turns smoothly.



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Fig. 314: Turning No. 1 Valve Rocker Arm By Hand
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

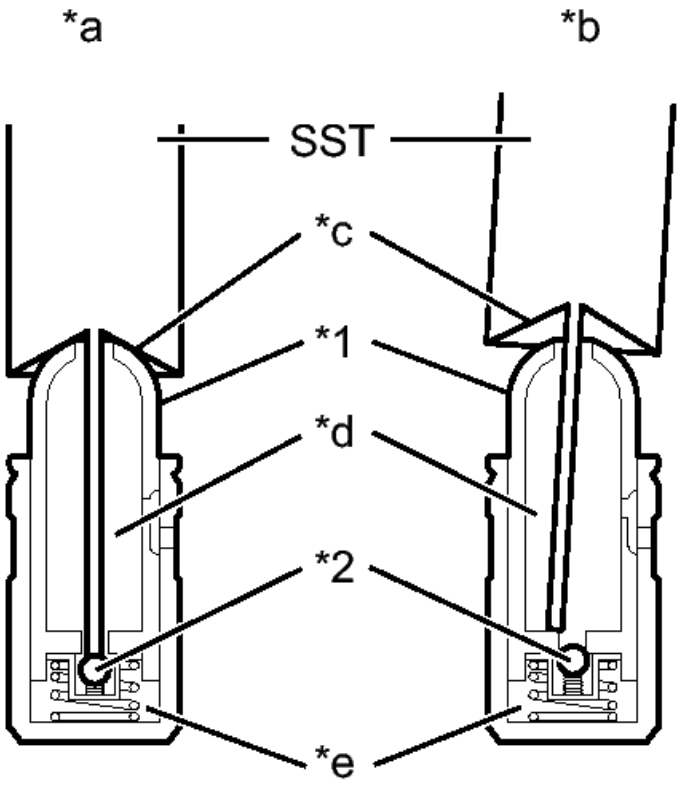
If the roller does not turn smoothly, replace the No. 1 valve rocker arm sub-assembly.

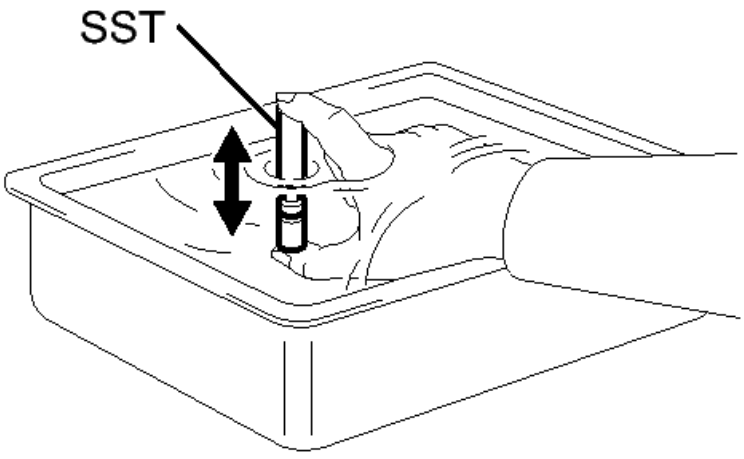
2. **INSPECT VALVE LASH ADJUSTER ASSEMBLY**

NOTE:

- **Keep the valve lash adjuster assembly free from dirt and foreign matter.**
- **Use only clean engine oil.**

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Fig. 315: Inspecting Valve Lash Adjuster Assembly Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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*1	Plunger
*2	Check Ball
*a	CORRECT
*b	INCORRECT
*c	Taper Part
*d	Low Pressure Chamber
*e	High Pressure Chamber

a. Place the valve lash adjuster assembly into a container full of new engine oil.
b. Insert the tip of SST into the valve lash adjuster assembly plunger and use the tip to press down on the check ball inside the plunger.
   - **SST: 09276-75010**
c. Squeeze SST and the valve lash adjuster assembly together to move the plunger up and down 5 to 6 times.
d. Check the movement of the plunger and bleed the air.

   OK

   Plunger moves up and down.

   NOTE: When bleeding high-pressure air from the compression chamber, make sure that the tip of SST is actually pressing the check ball as shown in the illustration. If the check ball is not pressed, air will not bleed.

e. After bleeding the air, remove SST. Then try to quickly and firmly press the plunger with your fingers.

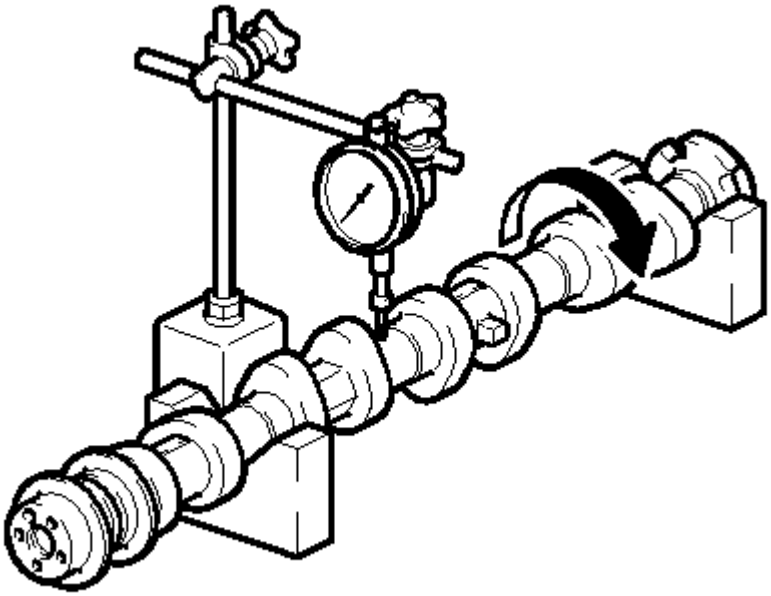
   OK

   Plunger is very difficult to move.

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

3. **INSPECT CAMSHAFT OIL CLEARANCE** See step 8
4. **INSPECT CAMSHAFT THRUST CLEARANCE** See step 9
5. **INSPECT CAMSHAFT**
   a. Inspect the camshaft runout.

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Fig. 316: Measuring Circle Runout At Center Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

   Maximum runout

   0.03 mm (0.00118 in.)

   If the runout is more than the maximum, replace the camshaft.

   HINT:

   Check the oil clearance after replacing the camshaft.

b. Inspect the cam lobes.

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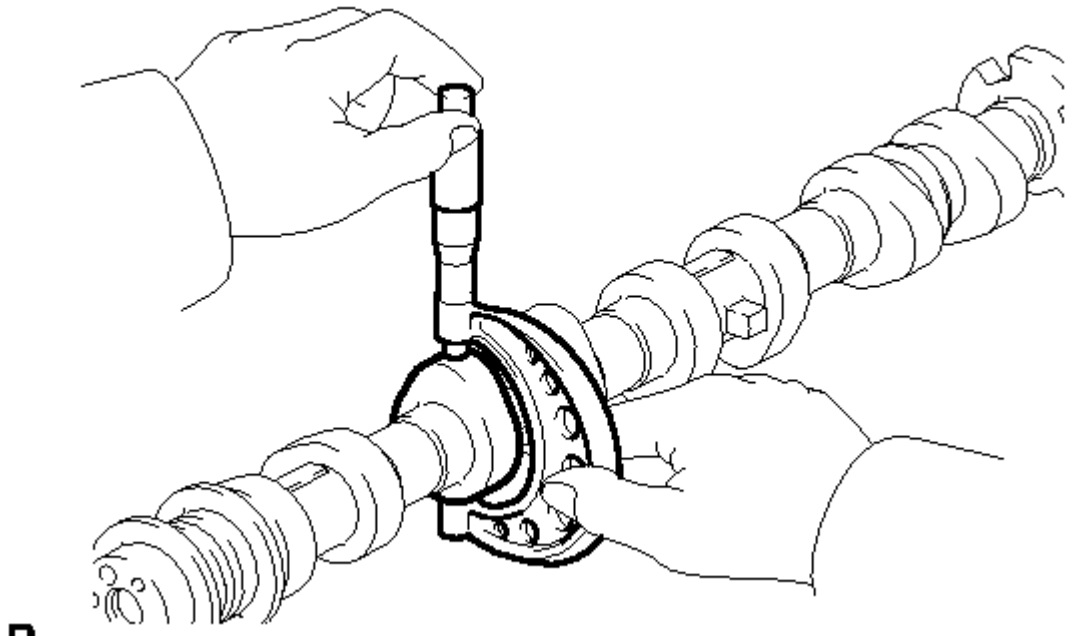


Fig. 317: View Of Checking Cam Lobes
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Using a micrometer, measure the cam lobe height.

   Standard Cam Lobe Height

Item	Specified Condition
Intake	44.163 to 44.305 mm (1.739 to 1.744 in.)
Exhaust	44.144 to 44.286 mm (1.738 to 1.744 in.)

   Minimum Cam Lobe Height

Item	Specified Condition
Intake	44.013 mm (1.733 in.)
Exhaust	43.996 mm (1.732 in.)

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

c. Inspect the camshaft journals.

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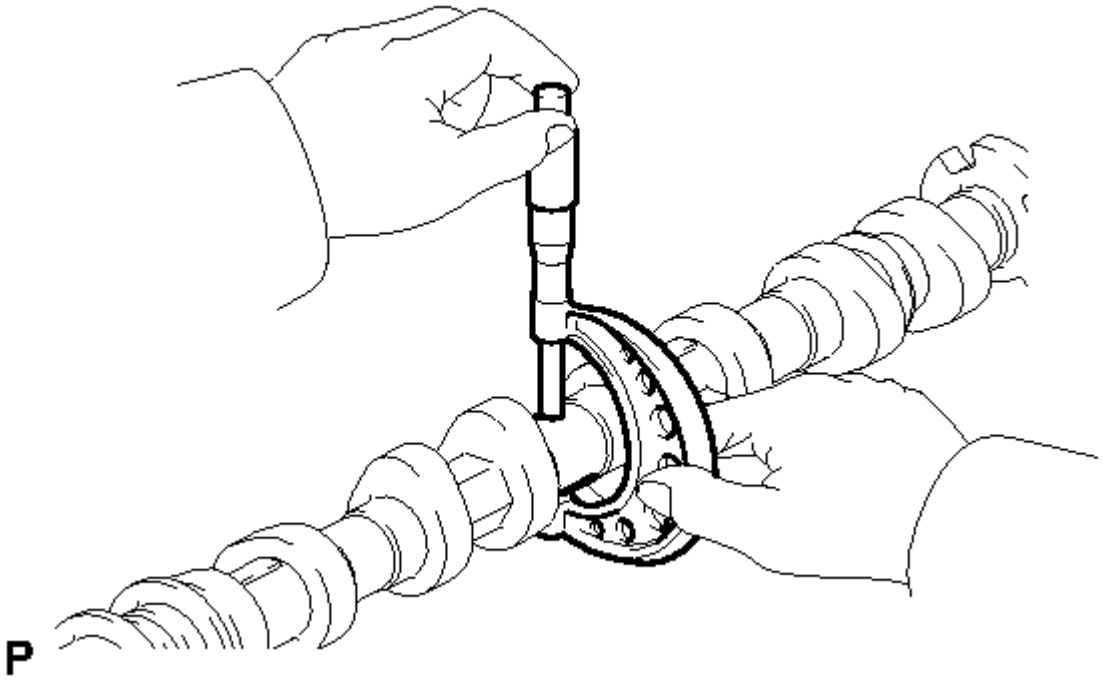


Fig. 318: View Of Checking Camshaft Journals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1. Using a micrometer, measure the journal diameter.

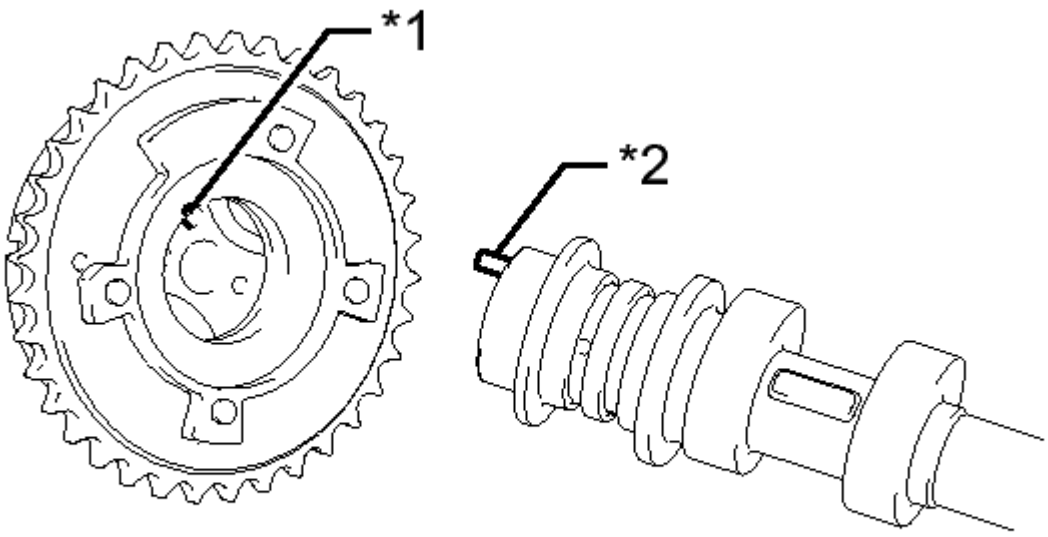
   Standard Journal Diameter

Item	Specified Condition
No. 1 journal	34.449 to 34.465 mm (1.356 to 1.357 in.)
Other journals	22.959 to 22.975 mm (0.904 to 0.905 in.)

   If the journal diameter is not as specified, check the oil clearance See step 8.

6. **INSPECT CAMSHAFT TIMING GEAR ASSEMBLY**
   a. Fit the camshaft and camshaft timing gear assembly by aligning the knock pin of the camshaft with the pin hole of the camshaft timing gear assembly.

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Fig. 319: Identifying Pin Hole And Knock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Pin Hole
*2	Knock Pin

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

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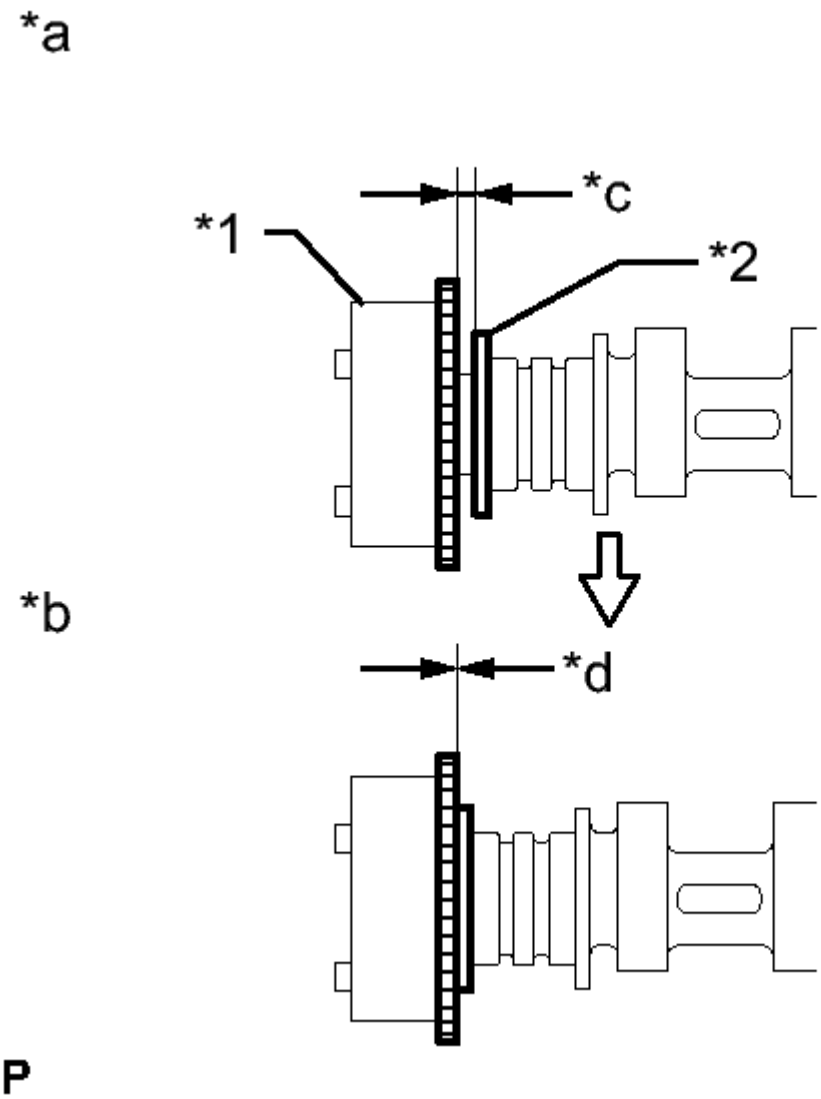


Fig. 320: Identifying No Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Gear Assembly
*2	Flange
*a	INCORRECT
*b	CORRECT
*c	Clearance
*d	No Clearance

c. While holding the camshaft, install the installation bolt of the camshaft timing gear assembly by hand.

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

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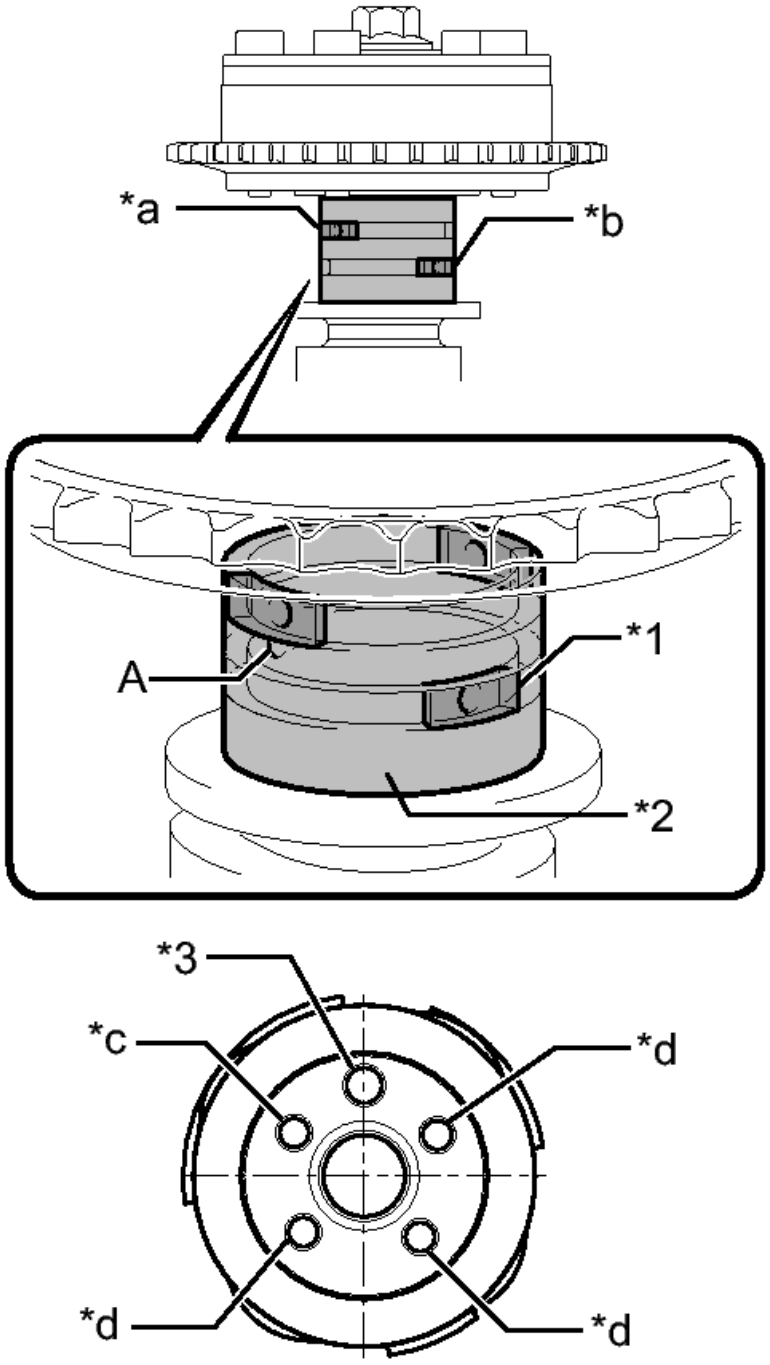
tool, the lock pin will be damaged.

d. Check the lock of the camshaft timing gear assembly.
   1. Make sure that the camshaft timing gear assembly is locked.

NOTE: Be careful not to damage the camshaft.

e. Release the lock pin.

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Fig. 321: Identifying Lock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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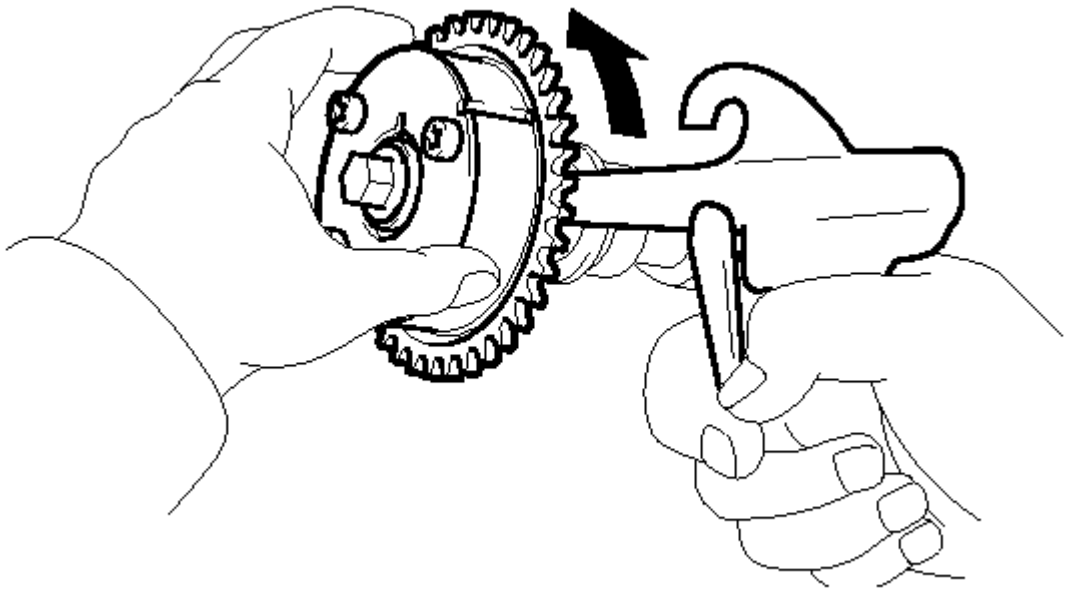
*1	Rubber Piece
*2	Vinyl Tape
*3	Knock Pin
*a	Retard Side Path
*b	Advance Side Path
*c	Open
*d	Close

1. Clean the camshaft journal with non-residue solvent.
2. Cover the 4 oil paths of the camshaft journal with vinyl tape as shown in the illustration.

   HINT:

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

3. Prick a hole at port A shown in the illustration.
4. While applying approximately 200 kPa (2.0 kgf/ cm^2 , 29 psi) of air pressure to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).



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Fig. 322: View Of Using Air Pressure To Turn Camshaft Timing Gear Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

HINT:

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

f. Check for smooth rotation.

1. Turn the camshaft timing gear assembly within its movable range (19 to 21°) 2 or 3 times, but do not turn it to the most retarded position. Make sure that the camshaft timing gear assembly turns smoothly.

NOTE: Do not allow the camshaft timing gear assembly to lock.

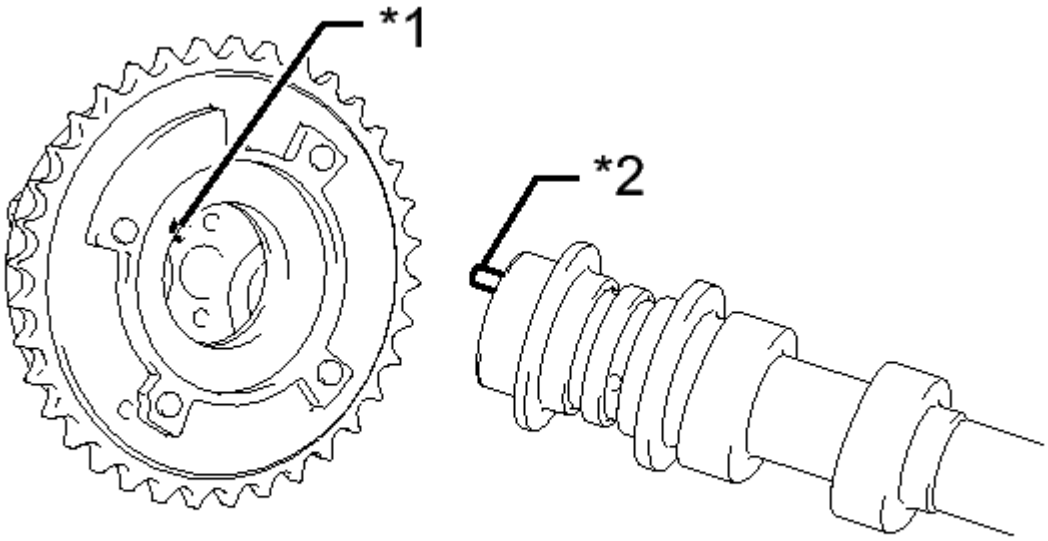
If it locks, release the lock pin again.

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

h. Remove the bolt and camshaft timing gear assembly.

7. **INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

a. Fit the No. 2 camshaft and camshaft timing exhaust gear assembly by aligning the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear assembly.



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Fig. 323: Identifying Pin Hole And Knock Pin

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

TEXT IN ILLUSTRATION

*1	Pin Hole
*2	Knock Pin

b. Check that there is no clearance between the camshaft timing exhaust gear assembly and No. 2 camshaft flange.

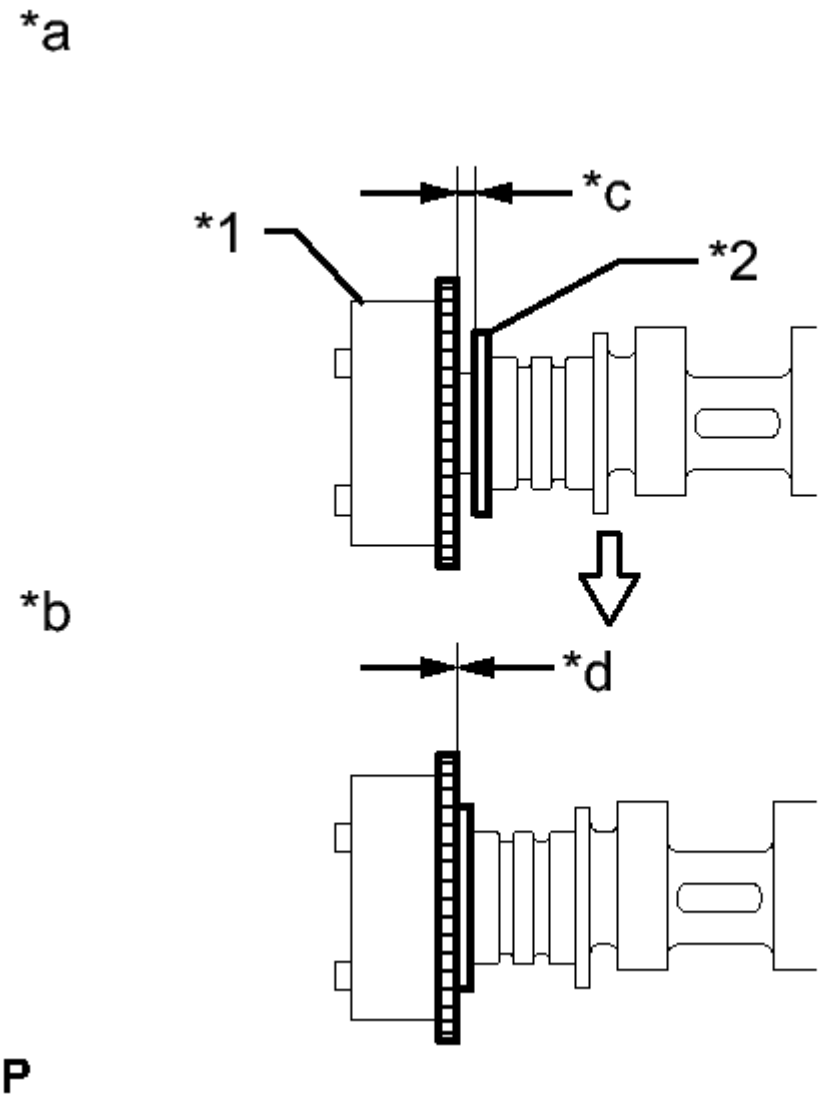


Fig. 324: Identifying No Clearance Between Camshaft Timing Gear And Camshaft Flange
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Camshaft Timing Exhaust Gear Assembly
*2	Flange

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*a	INCORRECT
*b	CORRECT
*c	Clearance
*d	No Clearance

c. While holding the No. 2 camshaft, install the installation bolt of the camshaft timing exhaust gear assembly by hand.

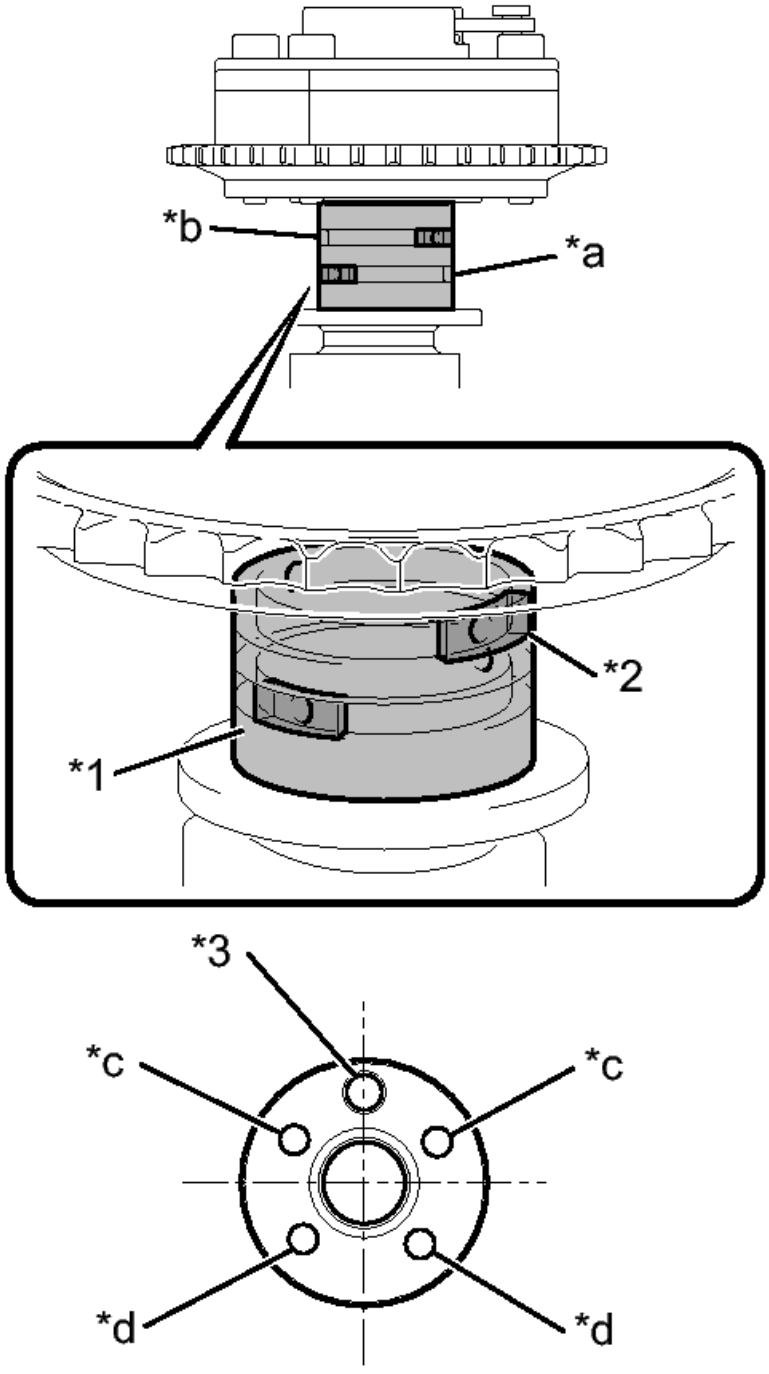
d. Check the lock of the camshaft timing exhaust gear assembly.

1. Make sure that the camshaft timing exhaust gear assembly is locked.

NOTE: Be careful not to damage the No. 2 camshaft.

e. Release the lock pin.

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Fig. 325: Identifying Lock Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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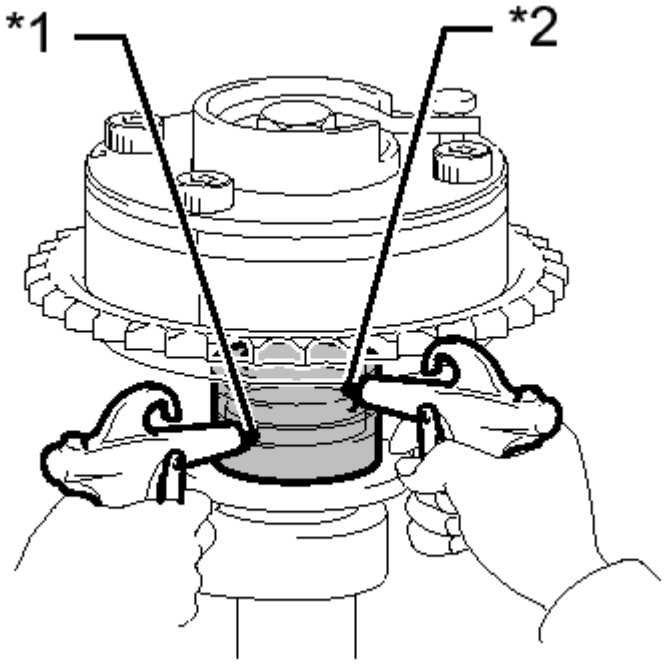
*1	Vinyl Tape
*2	Rubber Piece
*3	Knock Pin
*a	Retard Side Path
*b	Advance Side Path
*c	Open
*d	Close

1. Clean the No. 2 camshaft journal with non-residue solvent.
2. Cover the 4 oil paths of the No. 2 camshaft journal with vinyl tape as shown in the illustration.

   HINT:

   There are 4 oil paths in the grooves of the camshaft. Plug 2 paths with rubber pieces.

3. Prick a hole in the tape placed on the advance side path. Prick a hole in the tape placed on the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.
4. Apply approximately 200 kPa (2.0 kgf/cm^2 , 29 psi) of air pressure to the 2 open paths (the advance side path and retard side path).



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Fig. 326: Identifying Camshaft Side Oil Paths
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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TEXT IN ILLUSTRATION

*1	Retard Side Path
*2	Advance Side Path

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

5. Check that the camshaft timing exhaust gear assembly turns in the retard direction when reducing the air pressure applied to the advance side path.

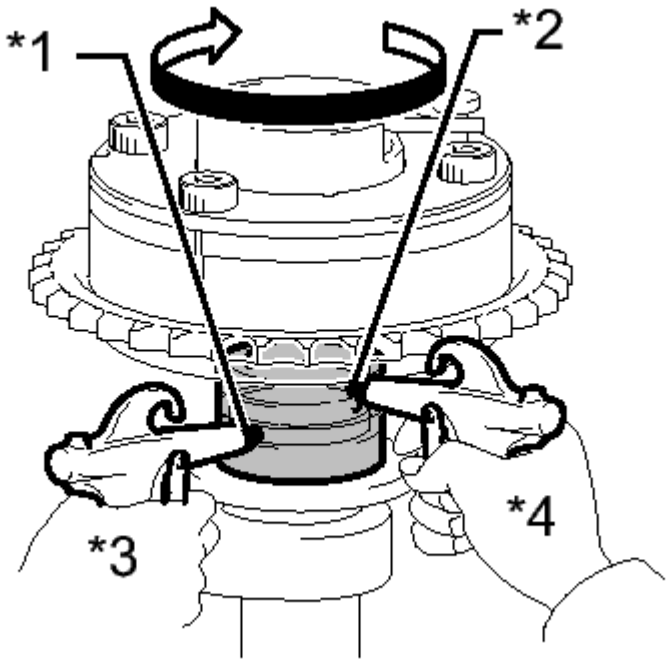


Fig. 327: Checking Camshaft Timing Exhaust Gear Turns In Retard Direction
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Retard Side Path
*2	Advance Side Path
*3	Hold Pressure
*4	Decompress

HINT:

The lock pin is released and the camshaft timing exhaust gear assembly turns in the retard direction.

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

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retard side path.

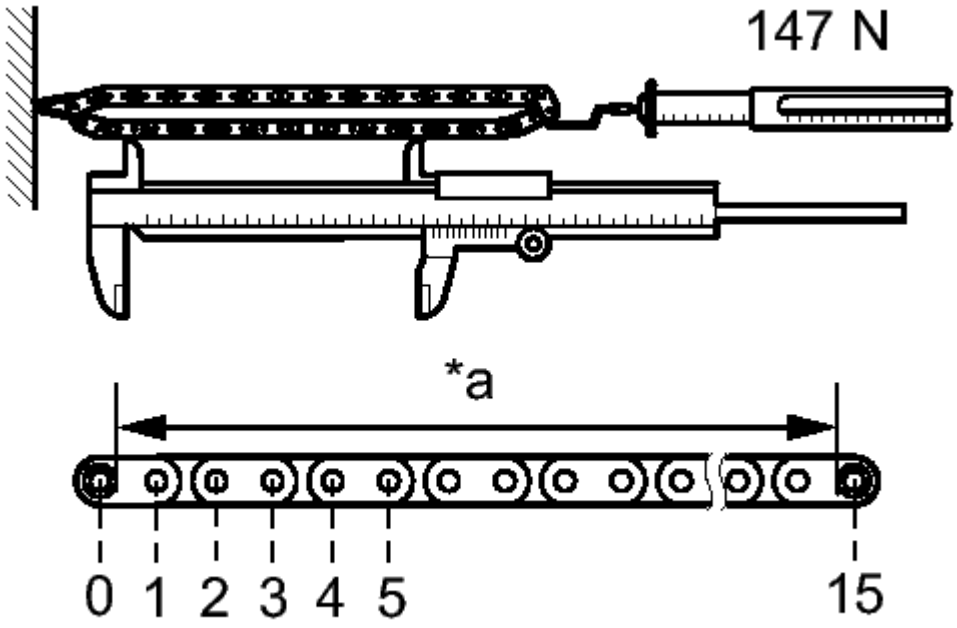
NOTE: Be sure to release the air pressure from the advance side path first. If the air pressure of the retard side path is released first, the camshaft timing exhaust gear assembly may abruptly shift in the advance direction and break the lock pin or other parts.

f. Check for smooth rotation.
   1. Turn the camshaft timing exhaust gear assembly 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 camshaft timing exhaust gear assembly turns smoothly.

NOTE: When the air pressure is released from the advance side path and then from the retard side path, the camshaft timing exhaust gear assembly automatically returns to the most advanced position due to the advance assist spring operation, and locks. Gradually release the air pressure from the retard side path before performing the smooth rotation check.

g. Check the lock at the most advanced position.
   1. Make sure that the camshaft timing exhaust gear assembly locks at the most advanced position.
h. Remove the vinyl tape and rubber pieces from the No. 2 camshaft.
i. Remove the bolt and camshaft timing exhaust gear assembly.

8. **INSPECT CHAIN SUB-ASSEMBLY**



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Fig. 328: Inspecting Chain Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Measurement Area

a. Using a spring scale, pull the chain sub-assembly with a force of 147 N (15 kgf, 33.0 lbf) as shown in the illustration.
b. Using a vernier caliper, measure the length of 15 pins.

   Maximum chain sub-assembly elongation

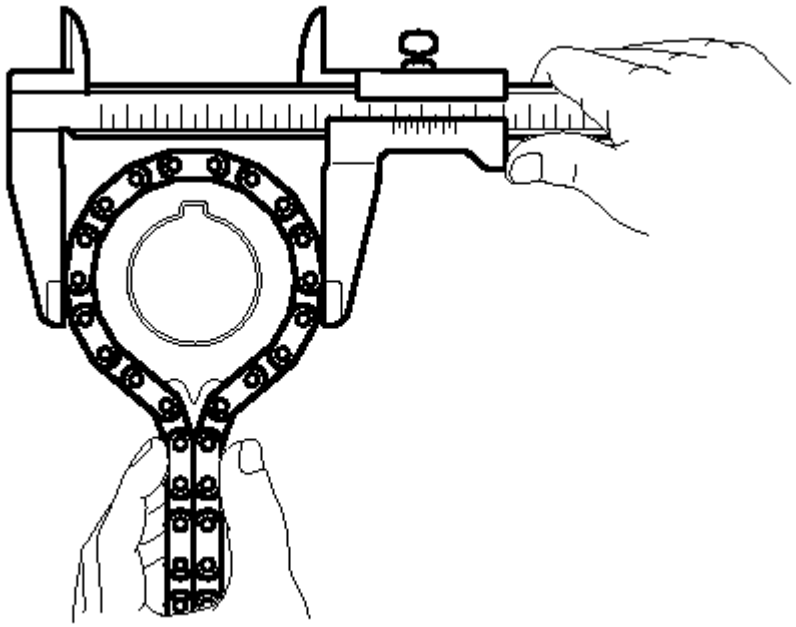
   137.7 mm (5.42 in.)

   HINT:

   Perform the measurement at 3 random places.

   If the elongation is more than the maximum, replace the chain sub-assembly.

9. **INSPECT CRANKSHAFT TIMING SPROCKET**
   a. Place the chain sub-assembly around the crankshaft timing sprocket.



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Fig. 329: View Of Measuring Chain Elongation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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b. Using a vernier caliper, measure the crankshaft timing sprocket diameter with the chain sub-assembly.

Minimum crankshaft timing sprocket diameter (with chain sub-assembly)

59.94 mm (2.36 in.)

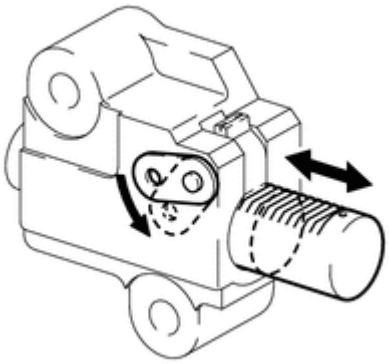
If the diameter is less than the minimum, replace the chain sub-assembly and crankshaft timing sprocket.

HINT:

The vernier caliper must contact the chain sub-assembly rollers for the measurement.

10. **INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY**

a. Move the stopper plate counterclockwise to release the lock. Push the plunger and check that it moves smoothly.



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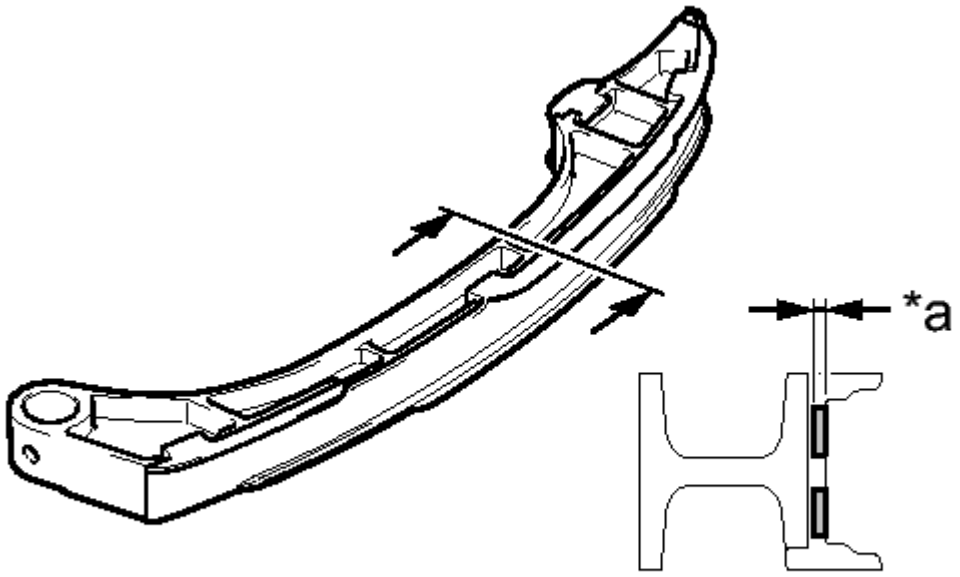
Fig. 330: Pushing No. 1 Chain Tensioner Plunger
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If necessary, replace the No. 1 chain tensioner assembly.

11. **INSPECT CHAIN TENSIONER SLIPPER**

a. Measure the wear depth of the chain tensioner slipper.

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Fig. 331: Measuring Wear Depth Of Chain Tensioner Slipper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Depth

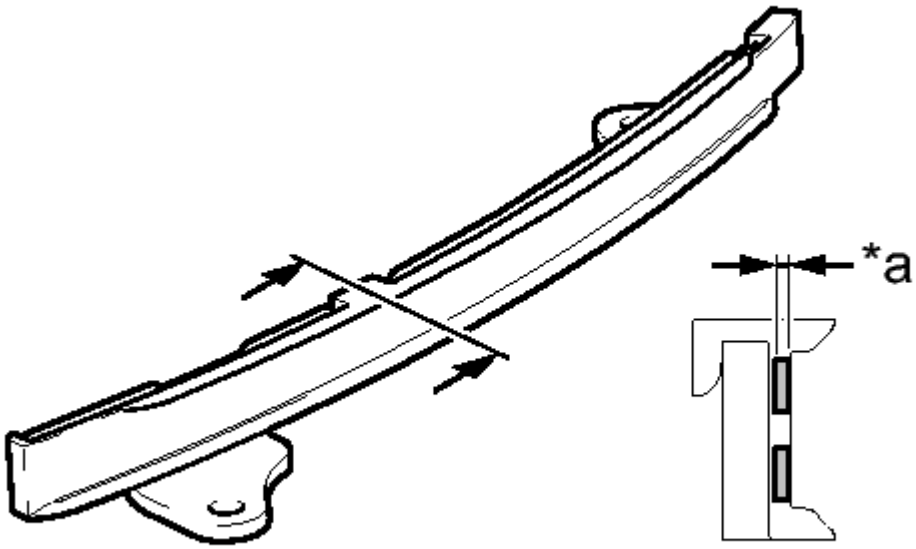
Maximum depth

1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the chain tensioner slipper.

12. **INSPECT NO. 1 CHAIN VIBRATION DAMPER**
    a. Measure the wear depth of the No. 1 chain vibration damper.

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Fig. 332: Measuring Wear Depth Of No. 1 Chain Vibration Damper
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Depth

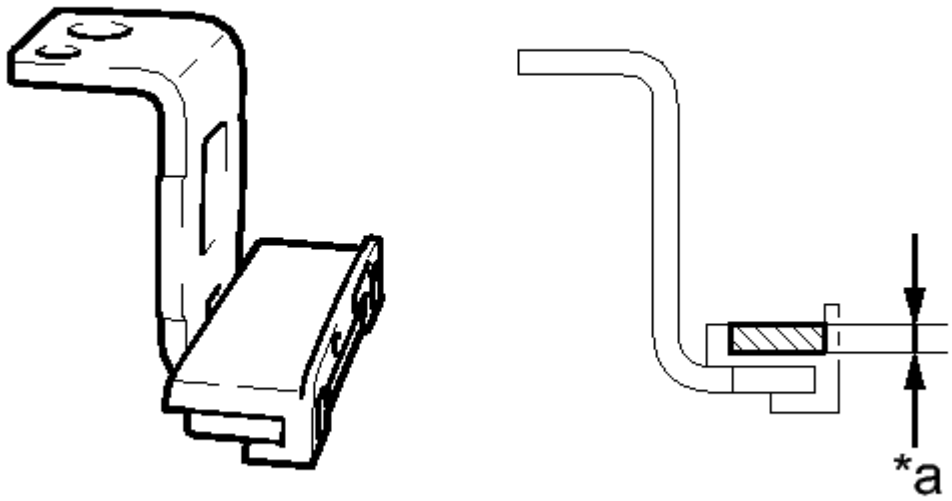
Maximum depth

1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the No. 1 chain vibration damper.

13. **INSPECT TIMING CHAIN GUIDE**
    a. Measure the wear depth of the timing chain guide.

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Fig. 333: Measuring Wear Depth Of Timing Chain Guide
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Depth

Maximum depth

1.0 mm (0.0394 in.)

If the depth is more than the maximum, replace the timing chain guide.

14. **INSPECT NO. 1 BALANCE SHAFT THRUST CLEARANCE**
    a. Using a dial indicator, measure the thrust clearance while moving the No. 1 balance shaft back and forth.

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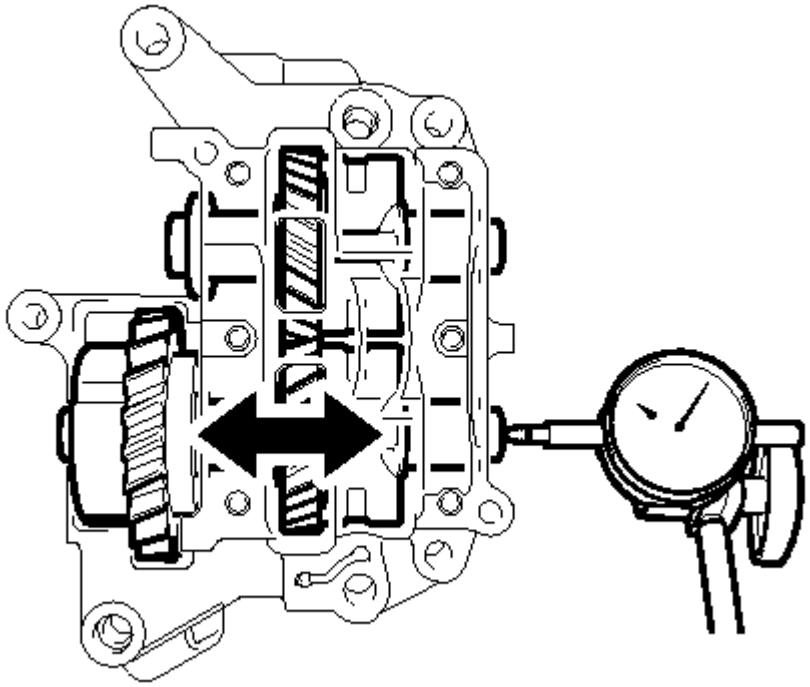


Fig. 334: Measuring No. 1 Balance Shaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.05 to 0.09 mm (0.00197 to 0.00354 in.)

Maximum thrust clearance

0.09 mm (0.00354 in.)

If the thrust clearance is more than the maximum, replace the engine balancer assembly.

15. **INSPECT NO. 2 BALANCE SHAFT THRUST CLEARANCE**
    a. Using a dial indicator, measure the thrust clearance while moving the No. 2 balance shaft back and forth.

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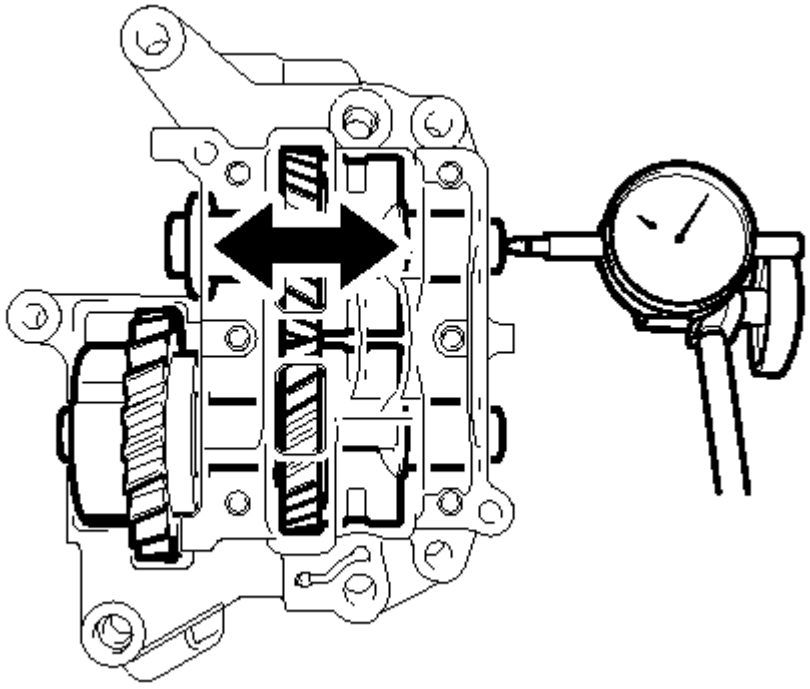


Fig. 335: Measuring No. 2 Balance Shaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.05 to 0.09 mm (0.00197 to 0.00354 in.)

Maximum thrust clearance

0.09 mm (0.00354 in.)

If the thrust clearance is more than the maximum, replace the engine balancer assembly.

16. **INSPECT BALANCE SHAFT BACKLASH**
    a. While holding the No. 2 balance shaft, measure the backlash of the No. 1 and No. 2 balance shafts using a dial indicator as shown in the illustration.

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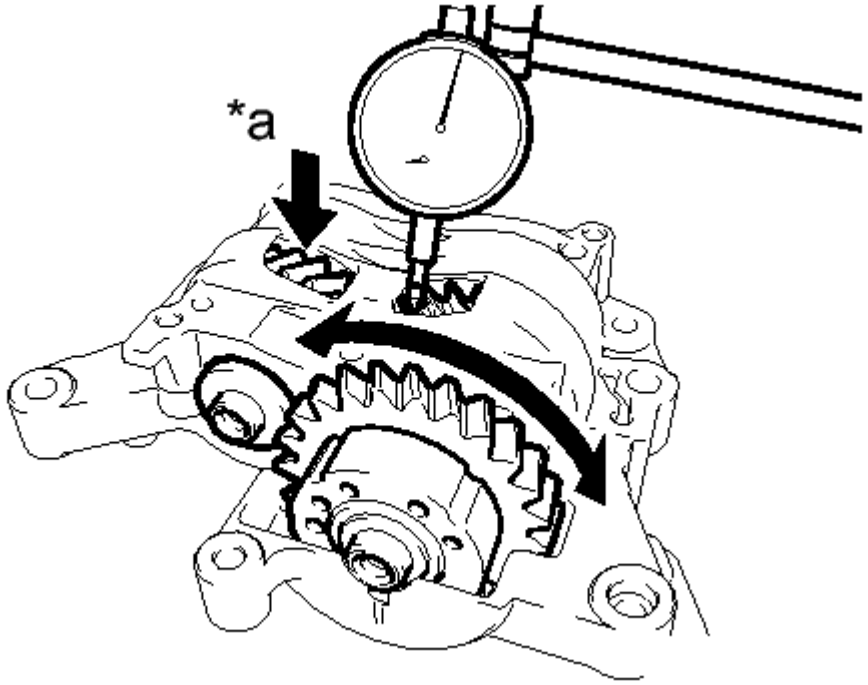


Fig. 336: Measuring No. 1 And No. 2 Balance Shafts Backlash
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold

Standard backlash

0.04 to 0.17 mm (0.00157 to 0.00669 in.)

Maximum backlash

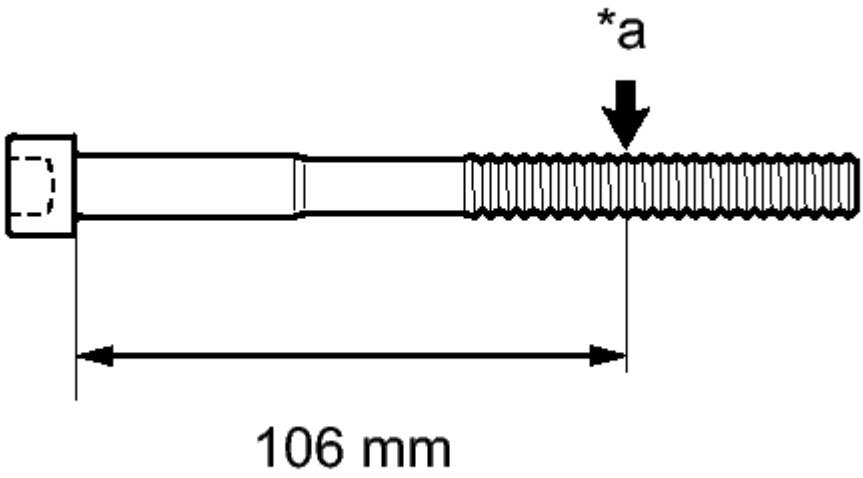
0.17 m (0.00669 in.)

NOTE: Measure at 3 or more points on the circumference of the No. 1 and No. 2 balance shafts.

If the backlash is more than the maximum, replace the engine balancer assembly.

17. **INSPECT CYLINDER HEAD BOLT**
    a. Using a vernier caliper, measure the diameter of the threads at the measurement point.

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Fig. 337: Inspecting Cylinder Head Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Measurement Point

Standard diameter

10.85 to 11.00 mm (0.427 to 0.433 in.)

Minimum diameter

10.6 mm (0.417 in.)

Measurement point (distance from the seat)

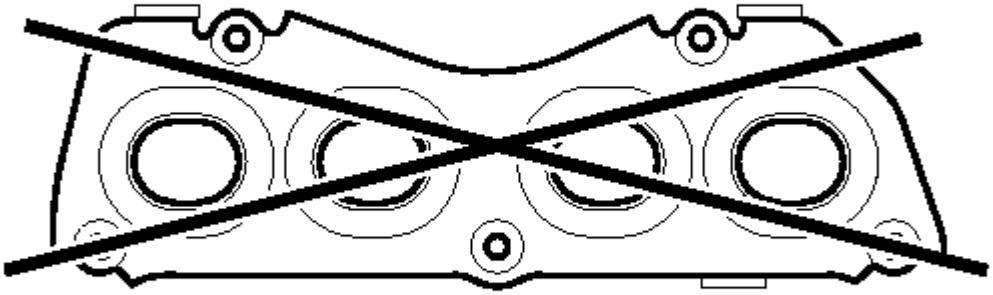
106 mm (4.17 in.)

HINT:

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

18. **INSPECT EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**
    a. Using a precision straightedge and feeler gauge, measure the warpage of the surface that contacts the cylinder head.

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Fig. 338: Measuring Warpage Of Exhaust Manifold Converter Surface
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum warpage

0.7 mm (0.0276 in.)

If the warpage is more than the maximum, replace the exhaust manifold converter sub-assembly.

REASSEMBLY [08/2013 -]

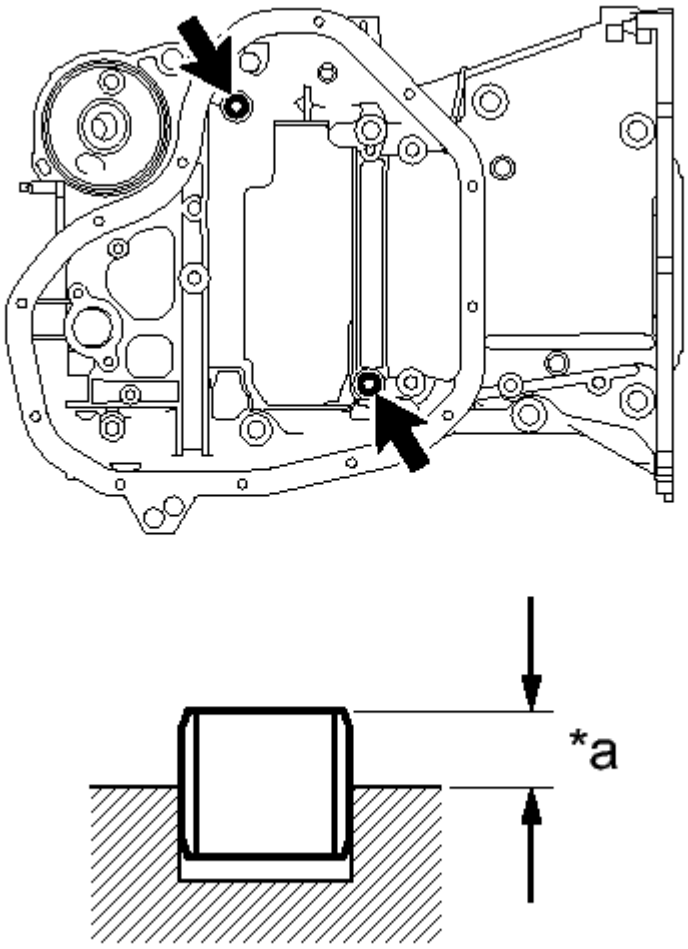
REASSEMBLY [08/2013 -]

1. **INSTALL STIFFENING CRANKCASE RING PIN**

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

a. Using a plastic-faced hammer, tap in 2 new ring pins until they stop.

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Fig. 339: Locating Stiffening Crankcase Ring Pins
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard protrusion height

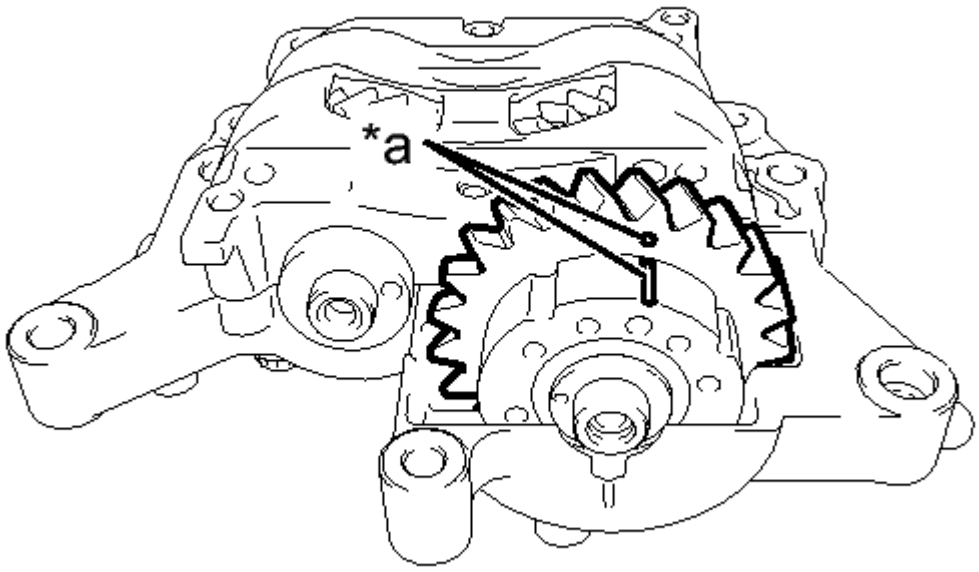
4.3 to 5.3 mm (0.169 to 0.209 in.)

TEXT IN ILLUSTRATION

*a	Protrusion Height

2. **INSTALL ENGINE BALANCER ASSEMBLY**
   a. Check that the alignment marks of the balance shaft damper cover and balance shaft driven gear are aligned.

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Fig. 340: Aligning Marks To Balance Shaft Damper And Balance Shaft Driven Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Alignment Mark

If the alignment marks are not aligned, realign them.

1. Place a wrench on the rear cutout part of the No. 2 balance shaft and secure the shaft in place.

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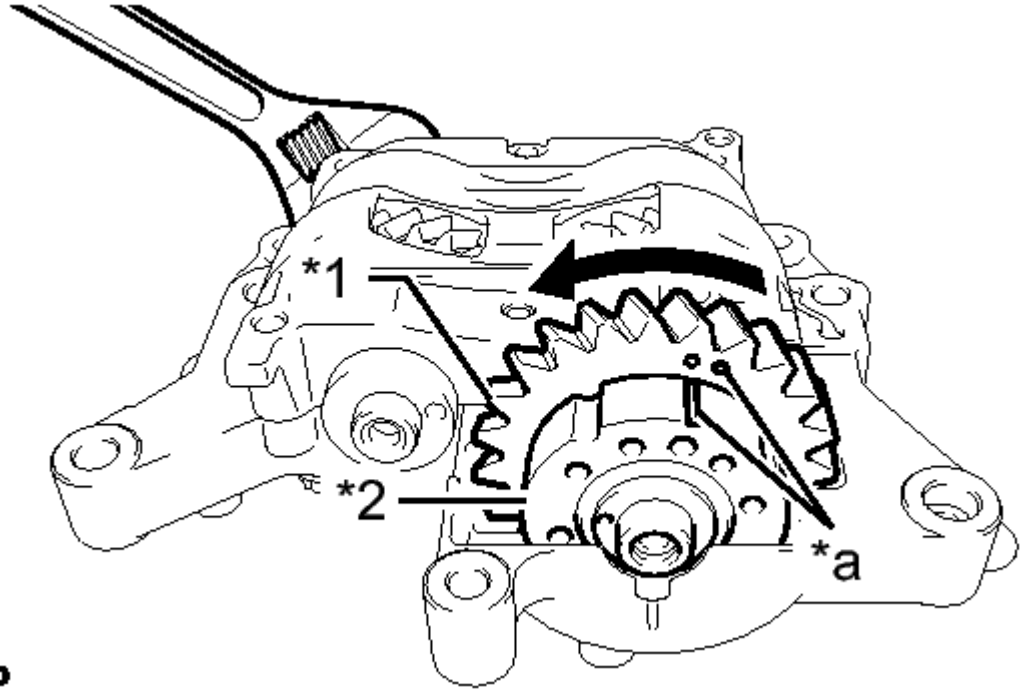


Fig. 341: Identifying Driven Gear And Damper Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Driven Gear
*2	Damper Cover
*a	Alignment Mark

2. Rotate the balance shaft driven gear of the No. 1 balance shaft counterclockwise to align the alignment mark of the balance shaft driven gear with the alignment mark of the balance shaft damper cover.

b. Install the engine balancer to the stiffening crankcase with the 3 bolts, and tighten the bolts in the sequence shown in the illustration.

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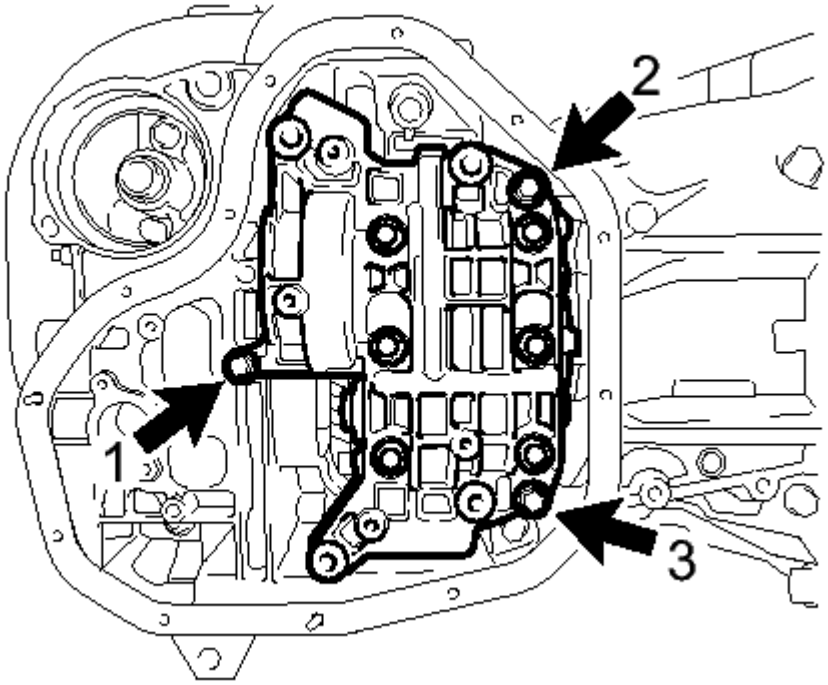


Fig. 342: Identifying Engine Balancer Bolts With Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

3. **INSTALL STIFFENING CRANKCASE STUD BOLT**

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

a. Using an E5 and E8 "TORX" socket wrench, install the stud bolts.

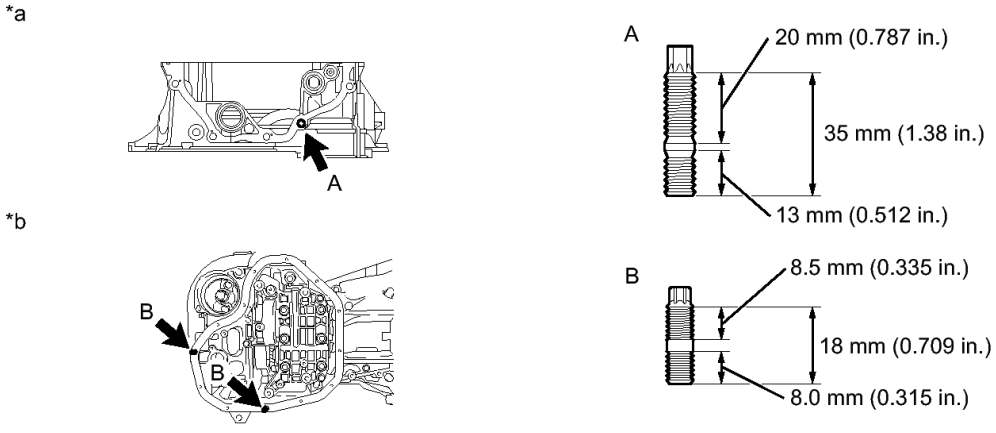


Fig. 343: Identifying Stud Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for stud bolt A

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

for stud bolt B

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

TEXT IN ILLUSTRATION

*a	Front Side	*b	Lower Side

4. **INSTALL STIFFENING CRANKCASE ASSEMBLY**
   a. Rotate the crankshaft clockwise so that the crankshaft key is at the position 90° from the bottom as shown in the illustration.

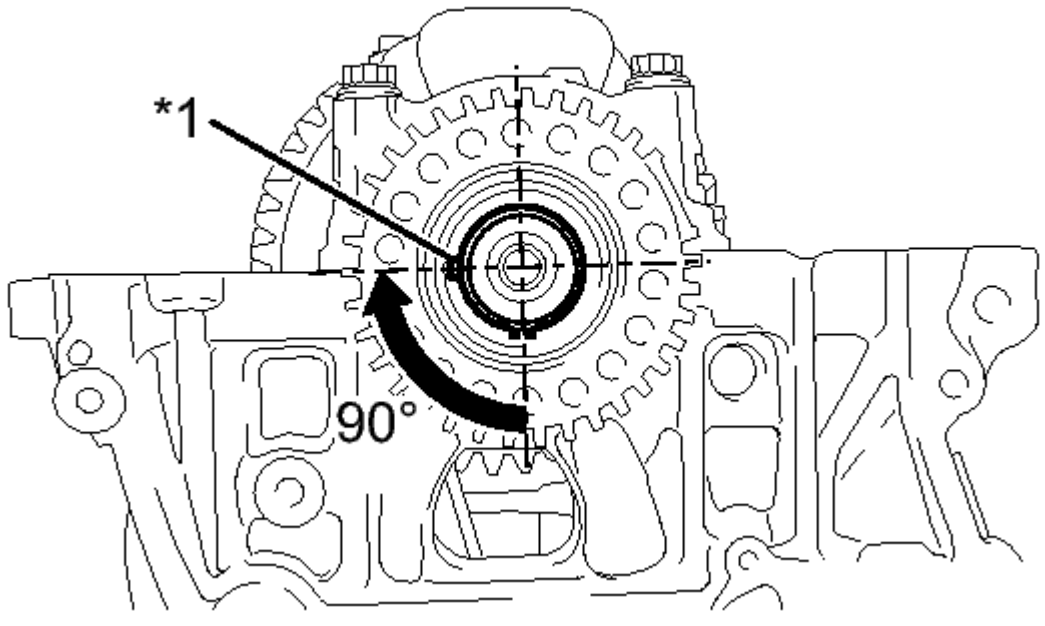


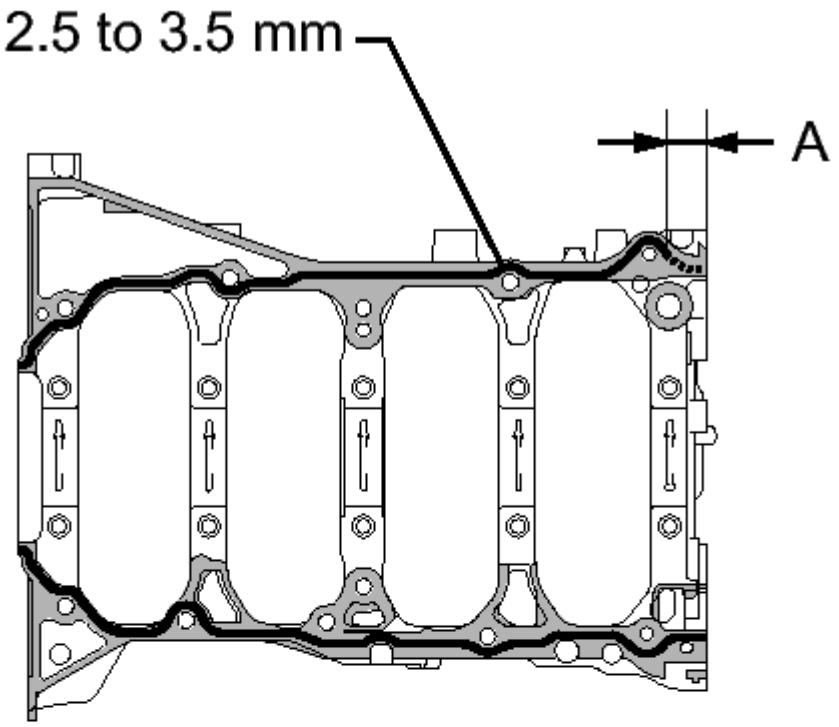
Fig. 344: Rotating Crankshaft Clockwise
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Key

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

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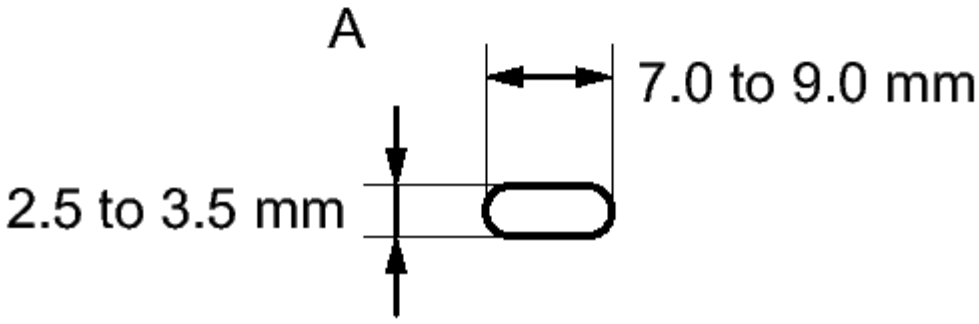


Fig. 345: Identifying Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing

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

Standard Seal Dimension

Area	Specified Condition
Continuous Line	2.5 to 3.5 mm (0.0984 to 0.138 in.)
Dashed Line	7.0 to 9.0 mm (0.276 to 0.354 in.) wide and 2.5 to 3.5 mm (0.0984 to 0.138 in.) thick

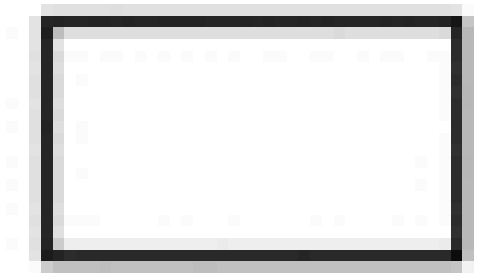
Application Length A

28 mm (1.10 in.)

TEXT IN ILLUSTRATION

	Stiffening Crankcase
	Cylinder Block

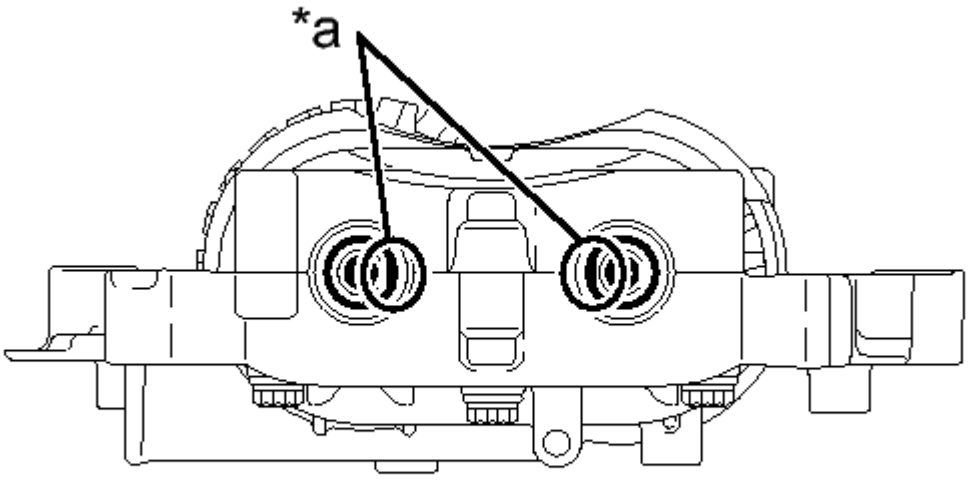
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NOTE:

- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.**
- **Do not apply oil for at least 2 hours after the installation.**

c. Check that the rear cutout parts are as shown in the illustration.



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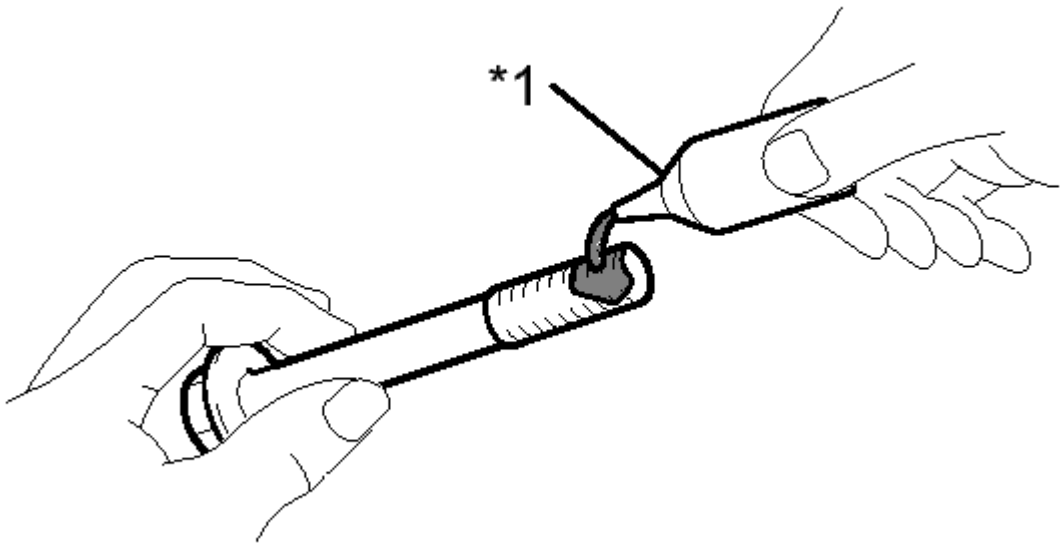
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Fig. 346: Identifying Stiffening Crankcase Rear Cutout Parts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Cutout

d. Clean the bolts and their installation holes.
e. Apply adhesive to 3 or more threads of the ends of bolts A.



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Fig. 347: Applying Adhesive To Bolt Threads
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Adhesive

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

TEXT IN ILLUSTRATION

*1	Adhesive

f. Temporarily install the stiffening crankcase with the 11 bolts.

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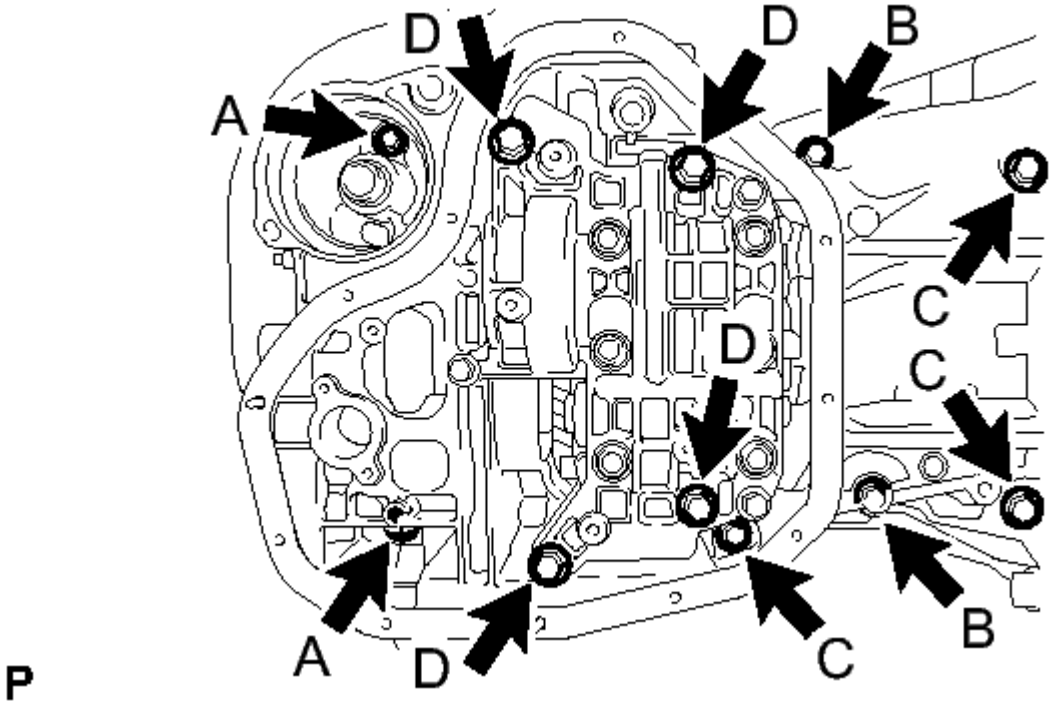


Fig. 348: Stiffening Crankcase Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bolt Length

Item	Length
Bolt A	65 mm (2.56 in.)
Bolt B	35 mm (1.38 in.)
Bolt C	125 mm (4.92 in.)
Bolt D	165 mm (6.50 in.)

HINT:

Apply adhesive to bolts A before installing them.

g. Tighten the 11 bolts in the sequence shown in the illustration to install the stiffening crankcase

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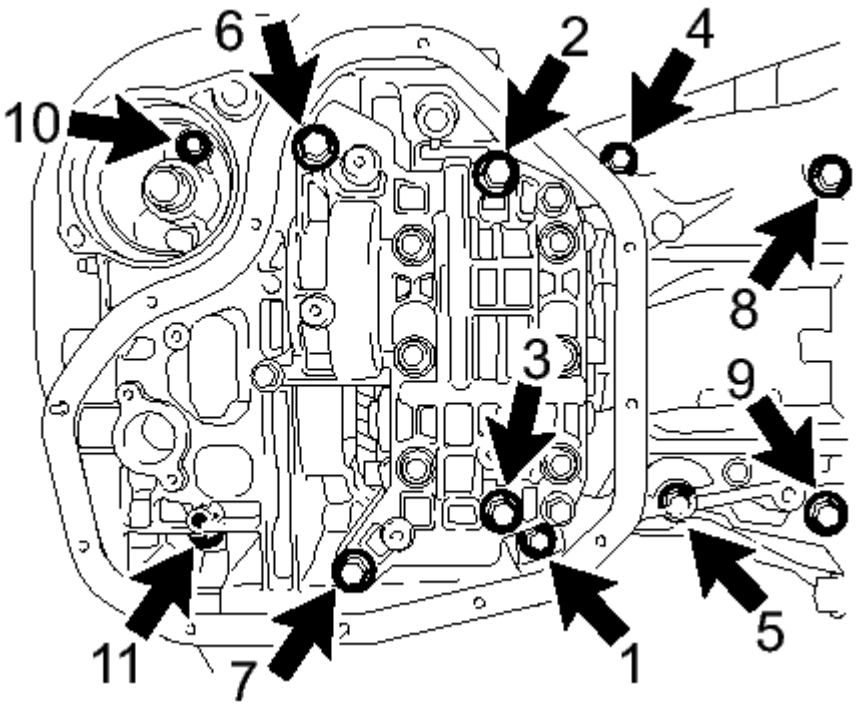


Fig. 349: Stiffening Crankcase Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

for Bolt A

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

except Bolt A

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

5. **INSTALL NO. 1 OIL PAN BAFFLE PLATE**
   a. Install the oil pan baffle plate and uniformly tighten the 5 bolts in several steps, in the sequence shown in the illustration.

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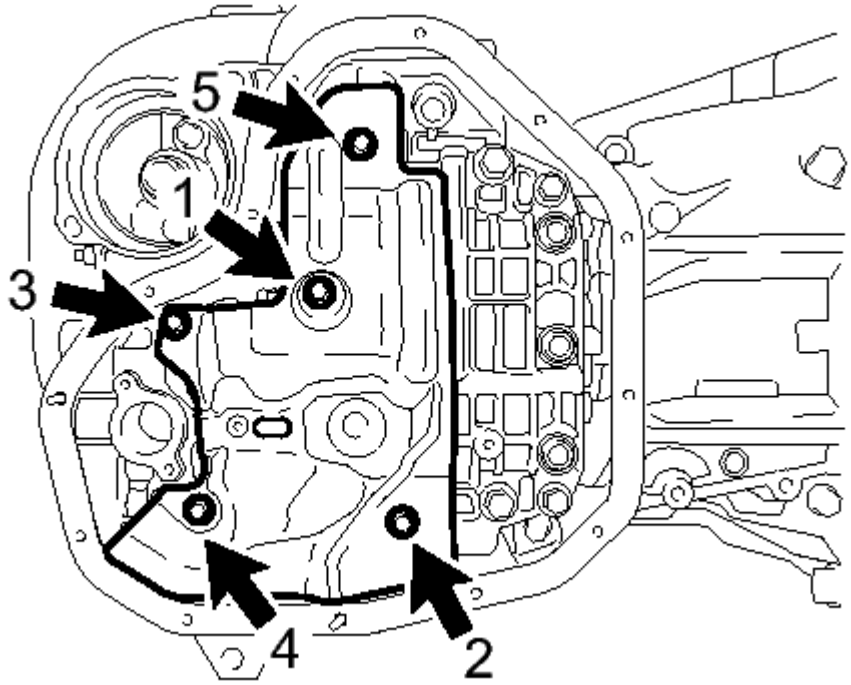


Fig. 350: No. 1 Oil Pan Baffle Plate Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

6. **INSTALL OIL STRAINER SUB-ASSEMBLY**
   a. Apply a light coat of engine oil to a new gasket.
   b. Align the protrusion of the gasket with the cutout of the oil strainer, and install the gasket to the oil strainer.

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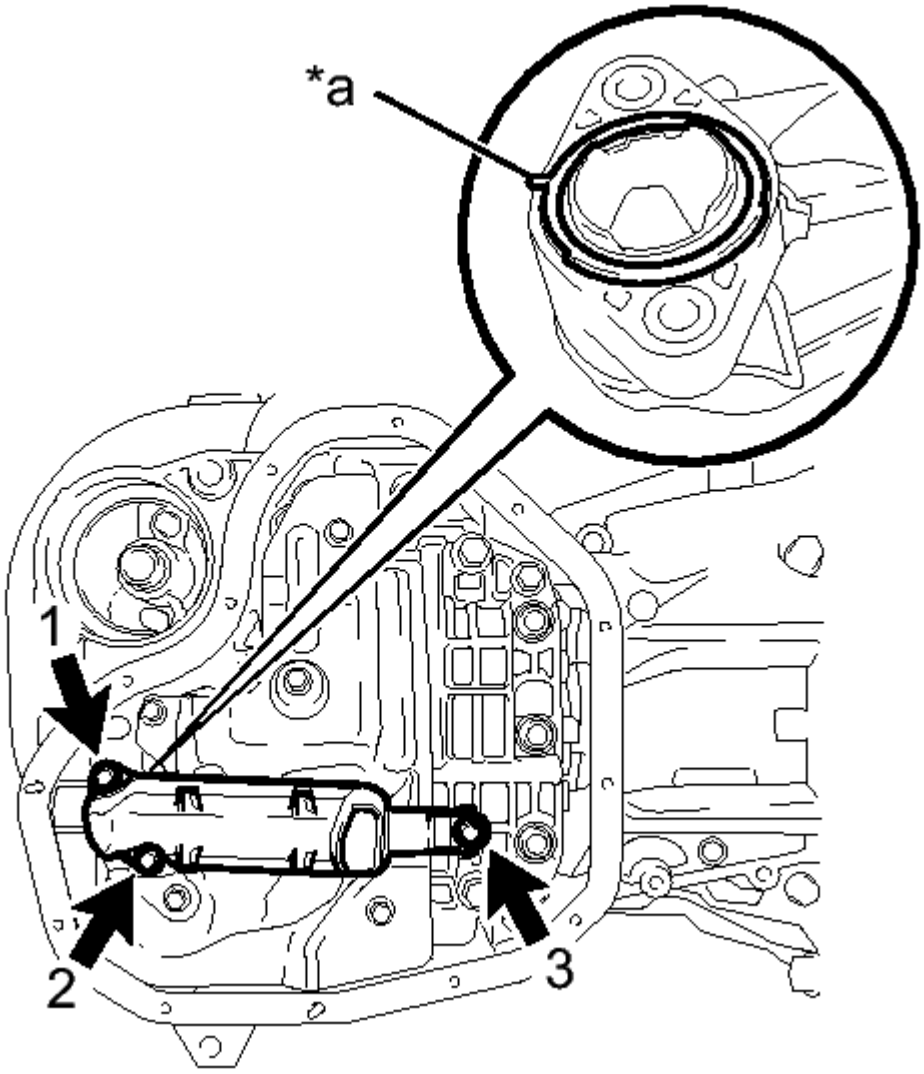


Fig. 351: Identifying 3 Oil Strainer Bolts With Tightening Sequence & Aligning Gasket Protrusion To Oil Strainer Cutout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Protrusion

c. Install the oil strainer with the 3 bolts in several steps, in the sequence shown in the illustration.

Torque: 9 N*m (92 kgf*cm, 80 in.*lbf)

7. **INSTALL OIL PAN SUB-ASSEMBLY**
   a. Apply seal packing in a continuous line as shown in the illustration.

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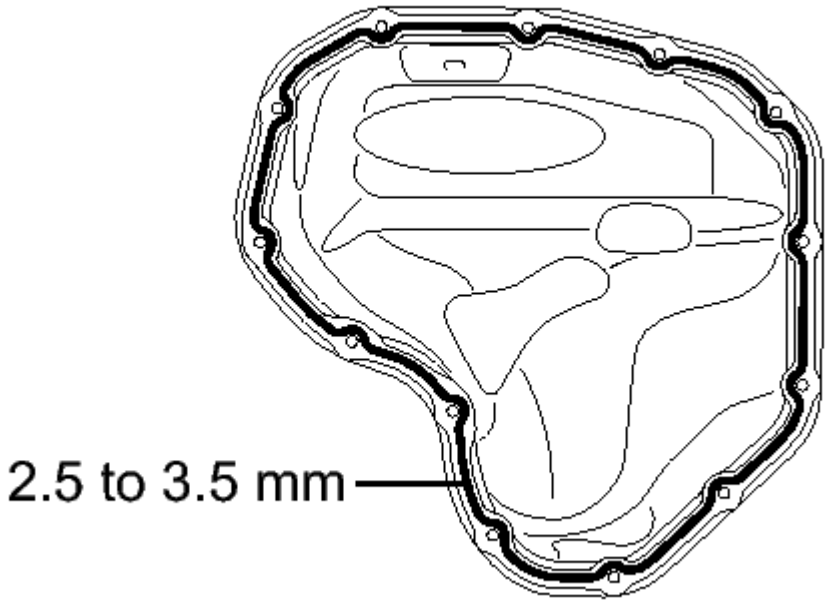


Fig. 352: Identifying Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing

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

Standard seal diameter

2.5 to 3.5 mm (0.0984 to 0.138 in.)

NOTE:

- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes and tighten the bolts and nuts within 10 minutes after applying seal packing.**
- **Do not apply oil for at least 2 hours after the installation.**

b. Install the oil pan with the 11 bolts and 2 nuts in several steps, in the sequence shown in the illustration.

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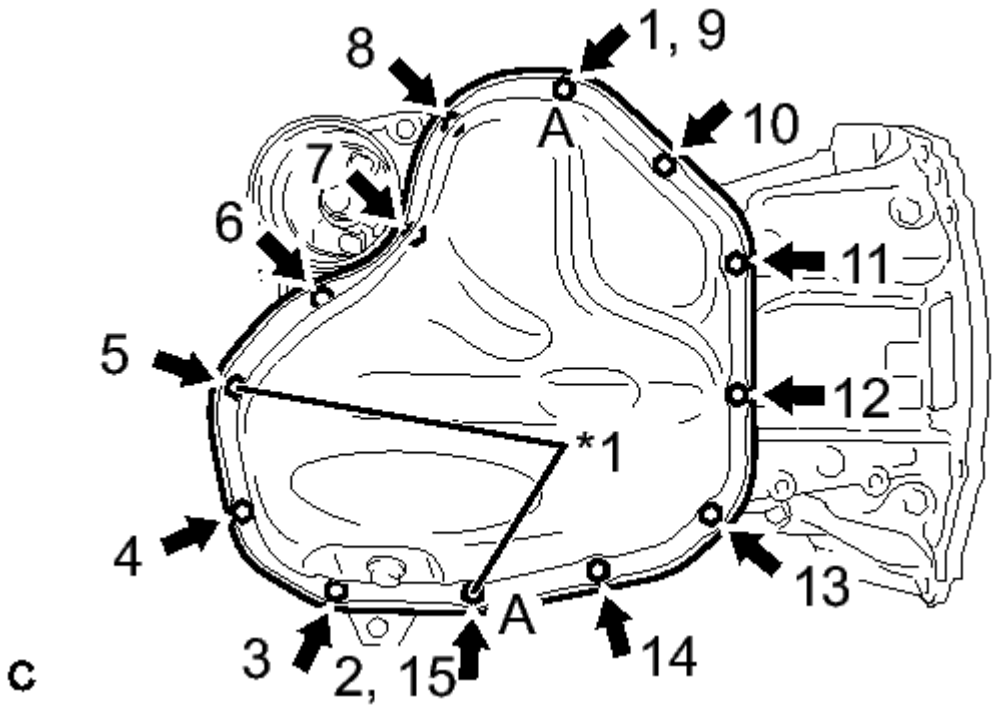


Fig. 353: Identifying Oil Pan Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

TEXT IN ILLUSTRATION

*1	Nut

HINT:

Bolt A and nut A are tightened twice.

8. **INSTALL OIL FILTER CAP ASSEMBLY** . Refer to **REPLACEMENT [08/2013 -] - Step 3**
9. **INSTALL REAR ENGINE OIL SEAL** See step 1
10. **INSTALL CYLINDER BLOCK WATER JACKET SPACER**
    a. Install the water jacket spacer to the cylinder block.

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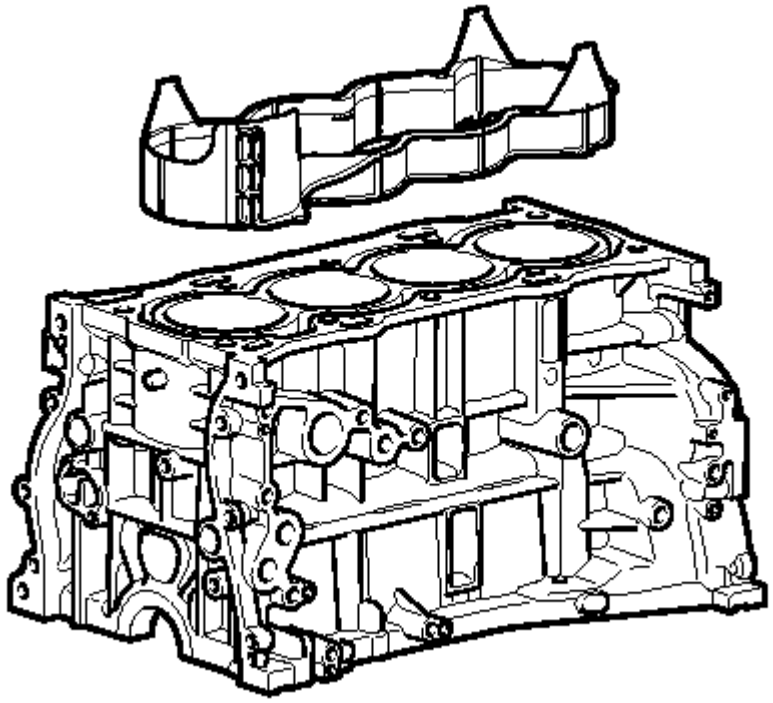


Fig. 354: Identifying Cylinder Block Water Jacket Spacer Component
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. **INSTALL CYLINDER HEAD GASKET** See step 3
12. **INSTALL CYLINDER HEAD SUB-ASSEMBLY** See step 4
13. **SET CAMSHAFT TIMING GEAR ASSEMBLY** See step 6
14. **INSTALL CAMSHAFT BEARING CAP SETTING RING PIN**

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

a. Using a plastic-faced hammer, tap in 10 new ring pins to the camshaft housing.

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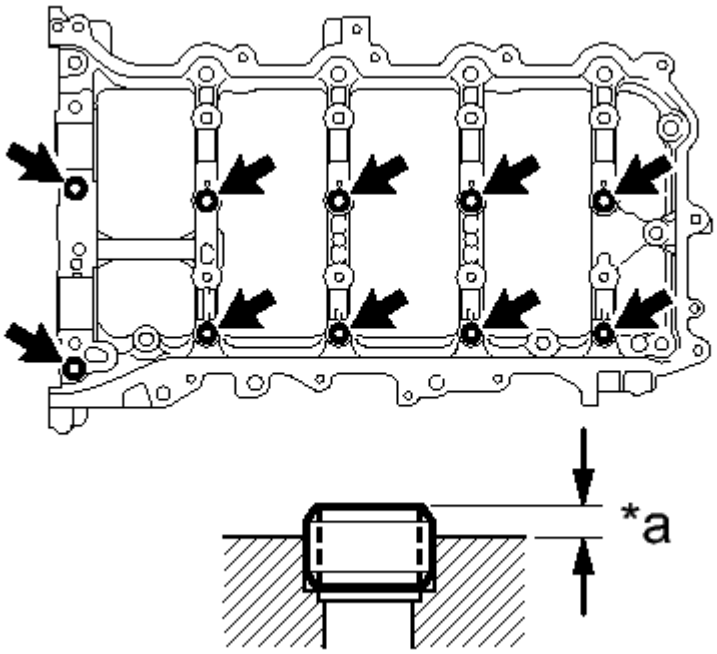


Fig. 355: Locating Camshaft Bearing Ring Pins
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard protrusion height

2.7 to 3.3 mm (0.106 to 0.130 in.)

TEXT IN ILLUSTRATION

*a	Protrusion Height

15. **INSTALL CAMSHAFT HOUSING STRAIGHT PIN**

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

a. Using a plastic-faced hammer, tap in 2 new straight pins to the camshaft housing.

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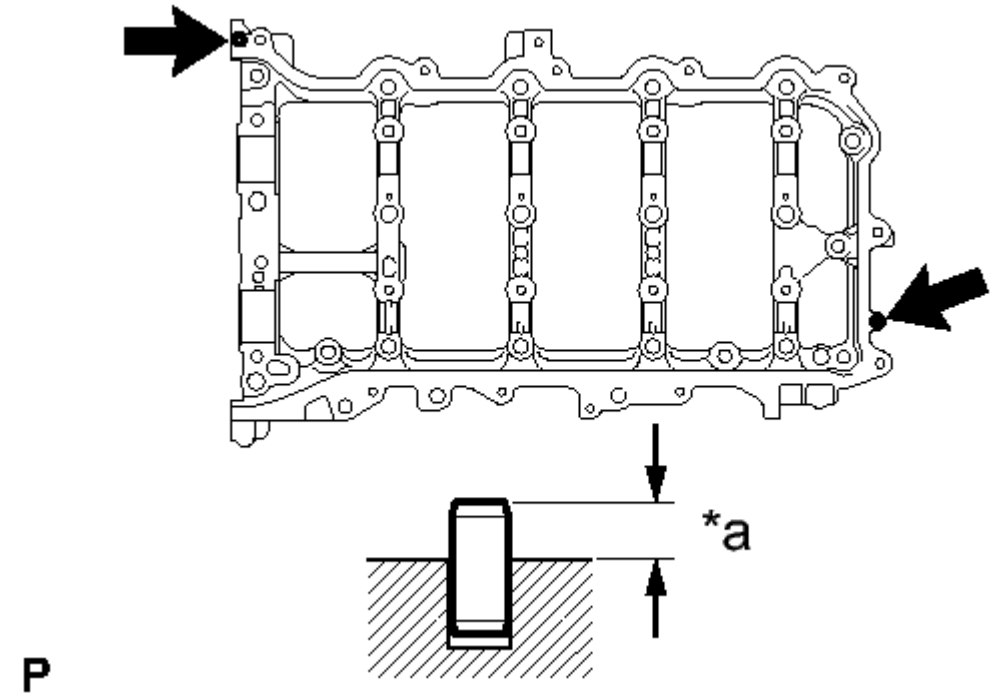


Fig. 356: Locating Camshaft Housing Straight Pins
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard protrusion height

5.0 to 7.0 mm (0.197 to 0.276 in.)

TEXT IN ILLUSTRATION

*a	Protrusion Height

16. **INSTALL CAMSHAFT HOUSING STUD BOLT**

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

a. Using an E8 "TORX" socket wrench, install the stud bolt.

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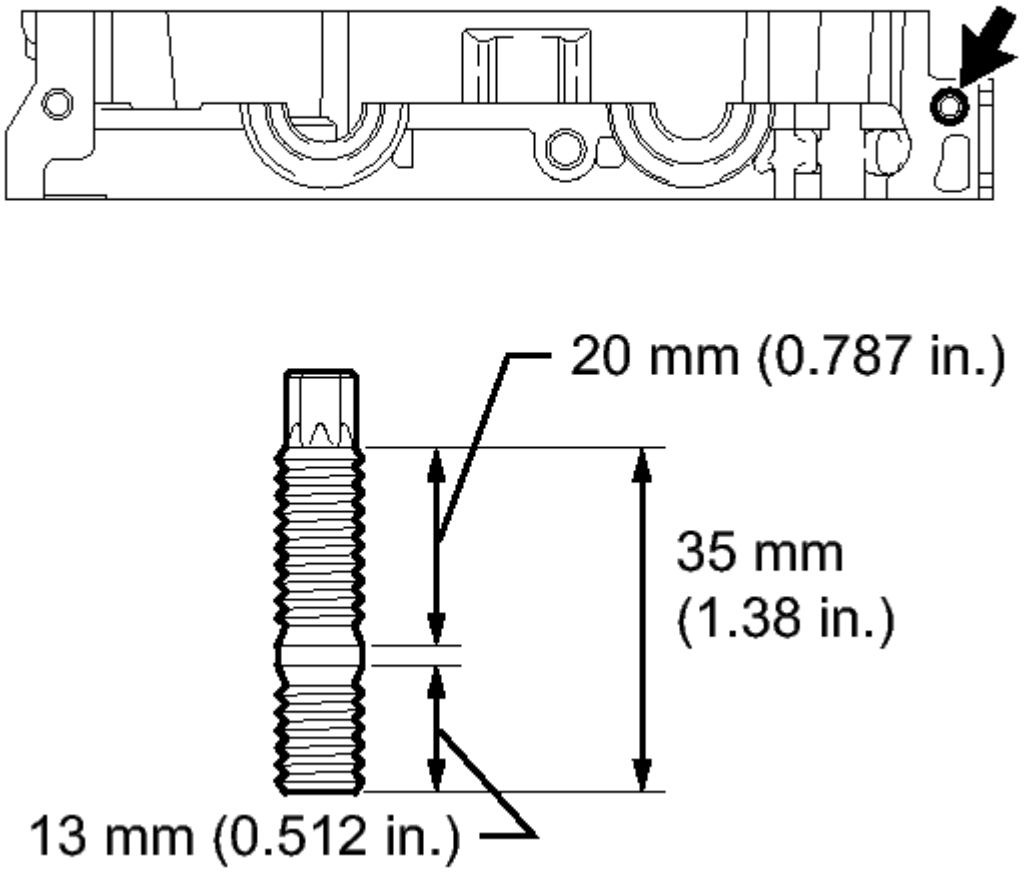


Fig. 357: Locating Camshaft Housing Stud Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

17. **INSTALL NO. 1 CAMSHAFT BEARING**
    a. Clean the No. 1 camshaft bearing.

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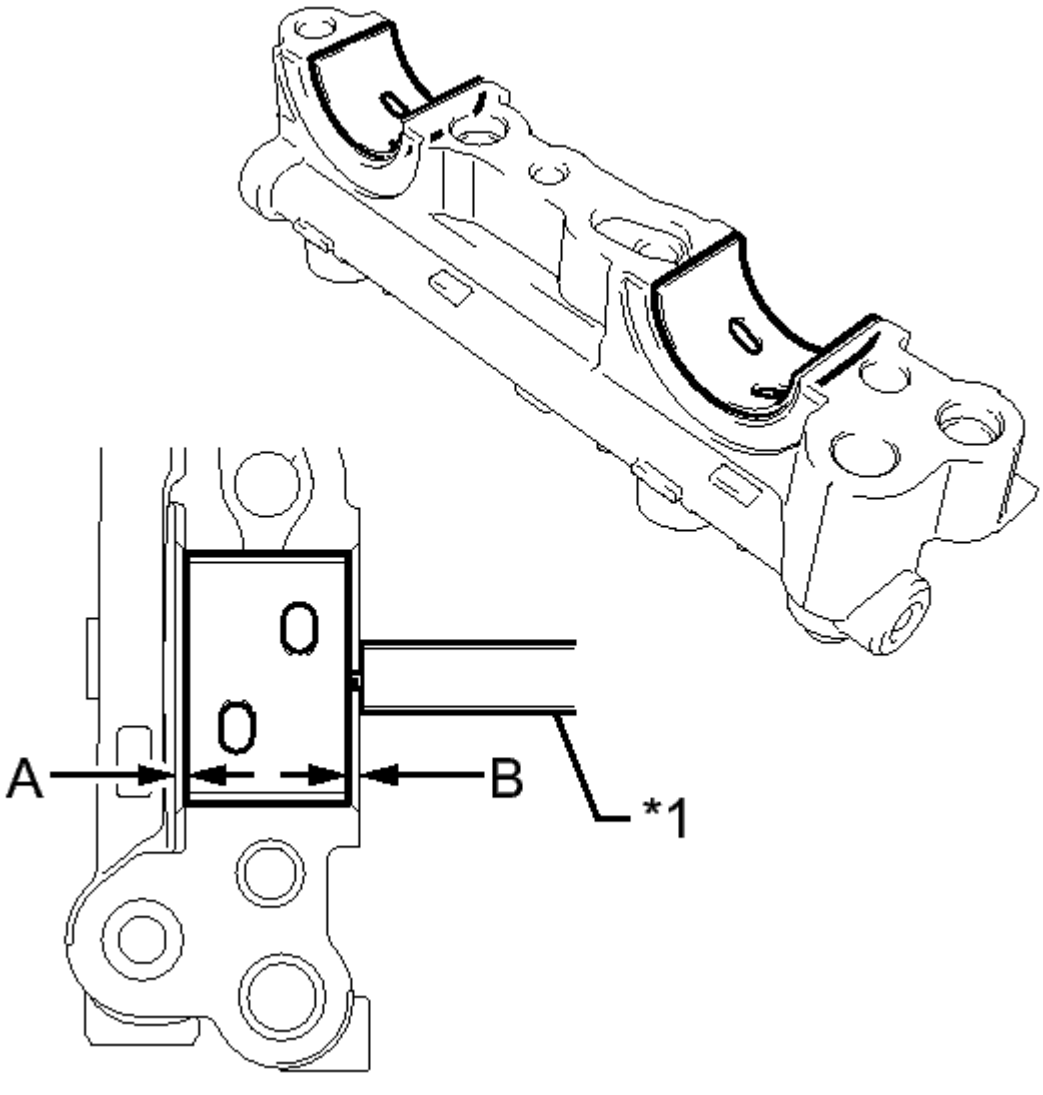


Fig. 358: Measuring No. 1 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Vernier Caliper

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

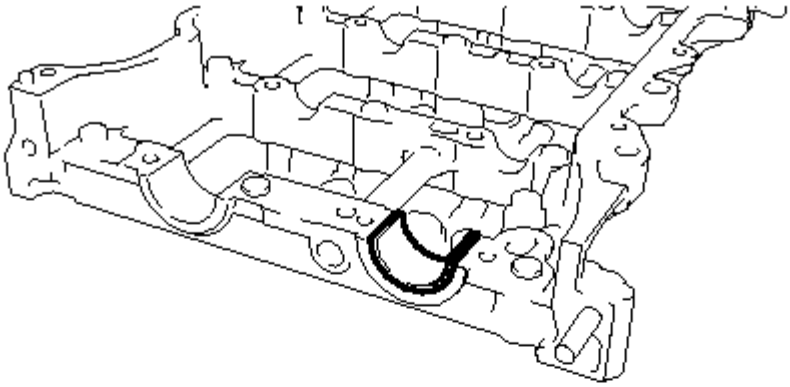
Standard dimension A - B or B - A

0 to 0.7 mm (0 to 0.0276 in.)

18. **INSTALL NO. 2 CAMSHAFT BEARING**

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a. Clean the No. 2 camshaft bearing.
b. Install the camshaft bearing to the camshaft housing.
c. Using a vernier caliper, measure the distance between the camshaft housing edge and the camshaft bearing edge.



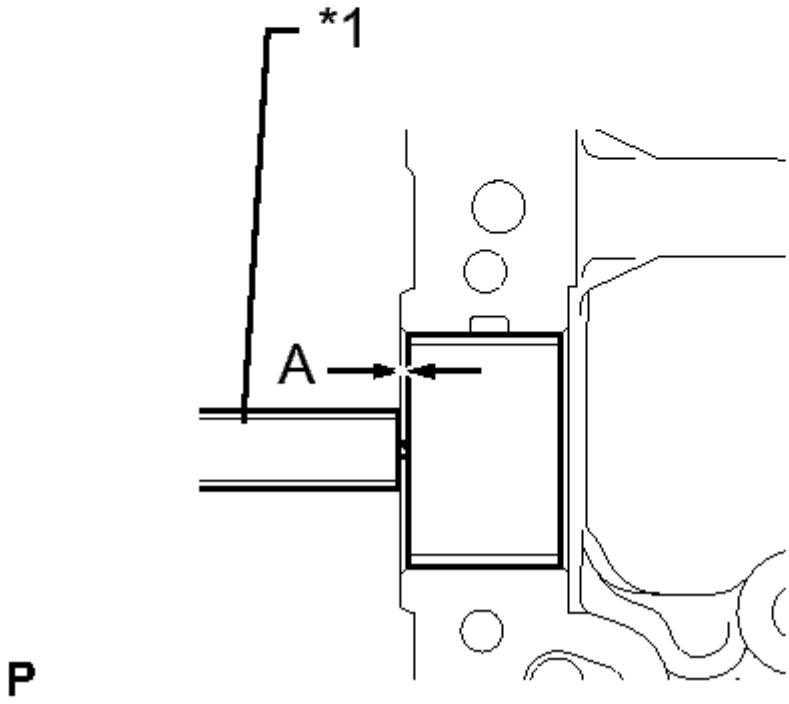


Fig. 359: Measuring No. 2 Camshaft Bearing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard distance

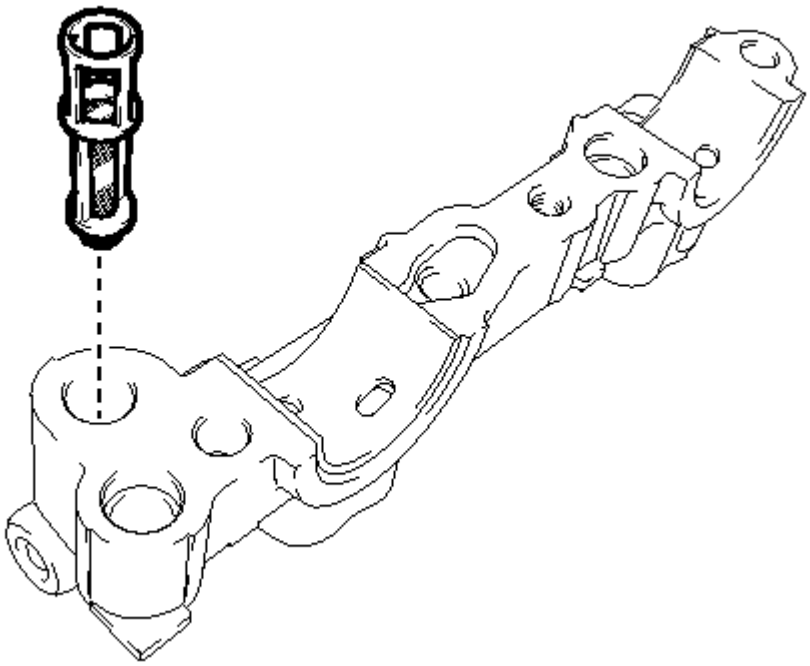
1.15 to 1.85 mm (0.0453 to 0.0728 in.)

TEXT IN ILLUSTRATION

*1	Vernier Caliper

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19. **INSTALL OIL CONTROL VALVE FILTER**
    a. Install the oil control valve filter to the No. 1 camshaft bearing cap.

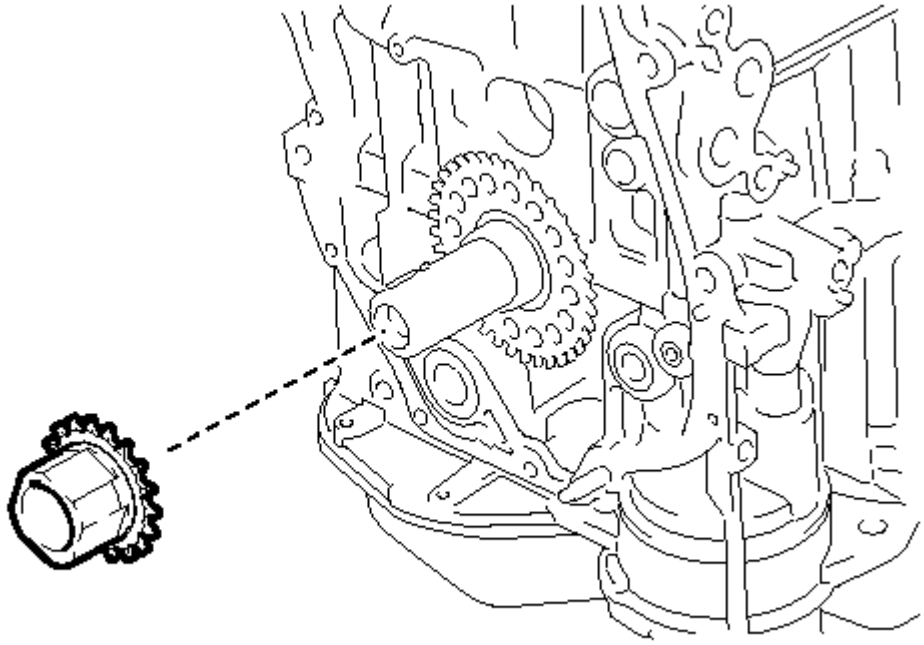


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Fig. 360: Identifying Oil Control Valve Filter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. **INSTALL CAMSHAFT** See step 12
21. **INSTALL CAMSHAFT BEARING CAP** See step 13
22. **INSTALL VALVE STEM CAP** See step 5
23. **INSTALL VALVE LASH ADJUSTER ASSEMBLY** See step 7
24. **INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY** See step 8
25. **INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY** See step 14
26. **INSTALL CAMSHAFT TIMING GEAR ASSEMBLY** See step 15
27. **INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY** See step 16
28. **INSTALL CRANKSHAFT TIMING SPROCKET**
    a. Install the crankshaft timing sprocket to the crankshaft.

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Fig. 361: Identifying Crankshaft Timing Sproket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. **ADD ENGINE OIL** See step 17
30. **SET NO. 1 CYLINDER TO TDC/COMPRESSION** See step 18
31. **INSTALL NO. 1 CHAIN VIBRATION DAMPER** See step 19
32. **INSTALL CHAIN SUB-ASSEMBLY** See step 20
33. **INSTALL CHAIN TENSIONER SLIPPER** See step 21
34. **INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY** See step 22
35. **INSTALL TIMING CHAIN GUIDE** See step 23
36. **CHECK NO. 1 CYLINDER TO TDC/COMPRESSION** See step 24
37. **INSTALL TIMING CHAIN COVER PLATE**
    a. Install a new gasket and the timing chain cover plate with the 4 bolts.

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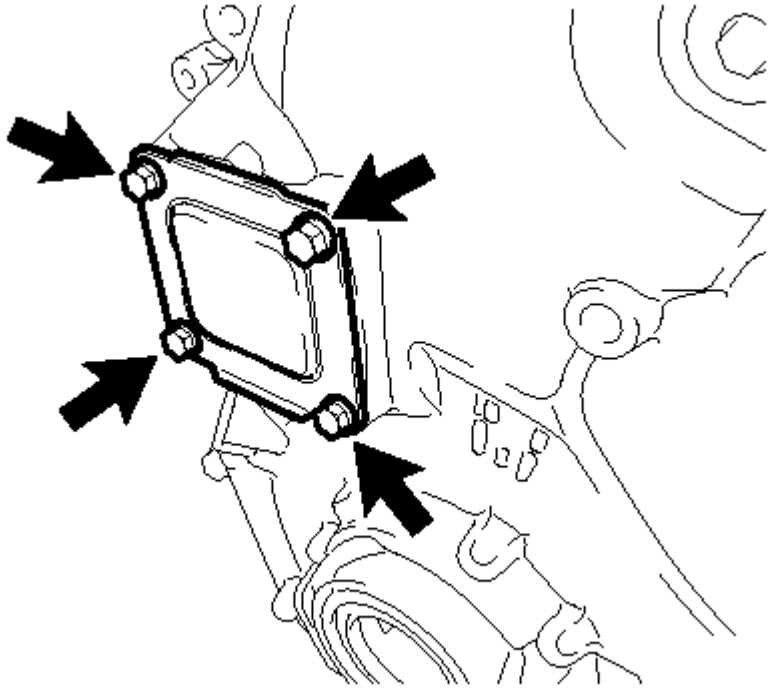
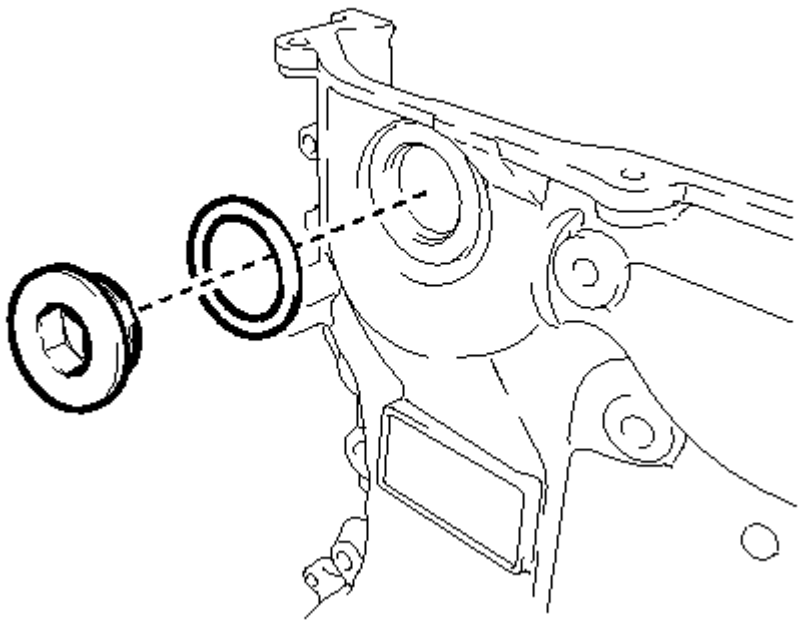


Fig. 362: Locating Timing Chain Cover Plate Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

38. **INSTALL TIMING CHAIN COVER TIGHT PLUG**
    a. Using a 14 mm hexagon wrench, install a new gasket and the plug.

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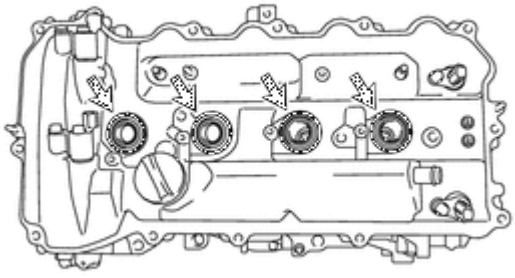


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Fig. 363: Identifying Timing Chain Cover Tight Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

39. **INSTALL TIMING CHAIN COVER SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 1**
40. **INSTALL ENGINE MOUNTING BRACKET RH** . Refer to **INSTALLATION [08/2013 -] - Step 2**
41. **INSTALL TIMING CHAIN COVER OIL SEAL** See step 1
42. **INSTALL SPARK PLUG TUBE GASKET**
    a. Install 4 new plug tube gaskets to the cylinder head cover.



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Fig. 364: Locating Plug Tube Gaskets At Cylinder Head Cover
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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NOTE: After pressing in the spark plug tube gasket, make sure the gasket protrudes 1.0 mm (0.0394 in.) or less from the cylinder head cover.

43. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY**

a. Apply a light coat of engine oil to 3 new gaskets.

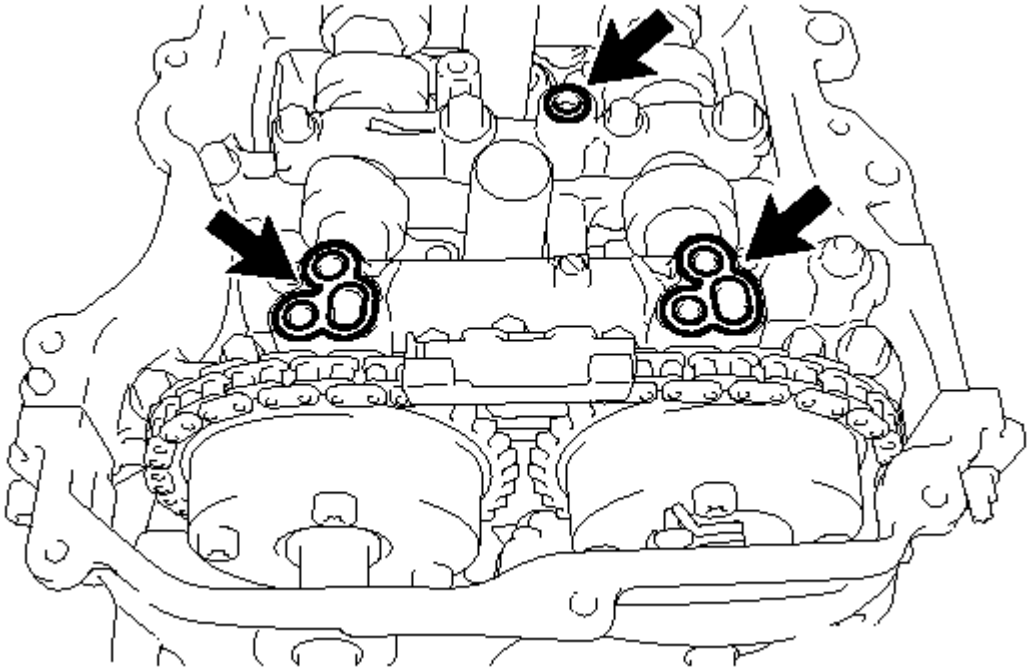


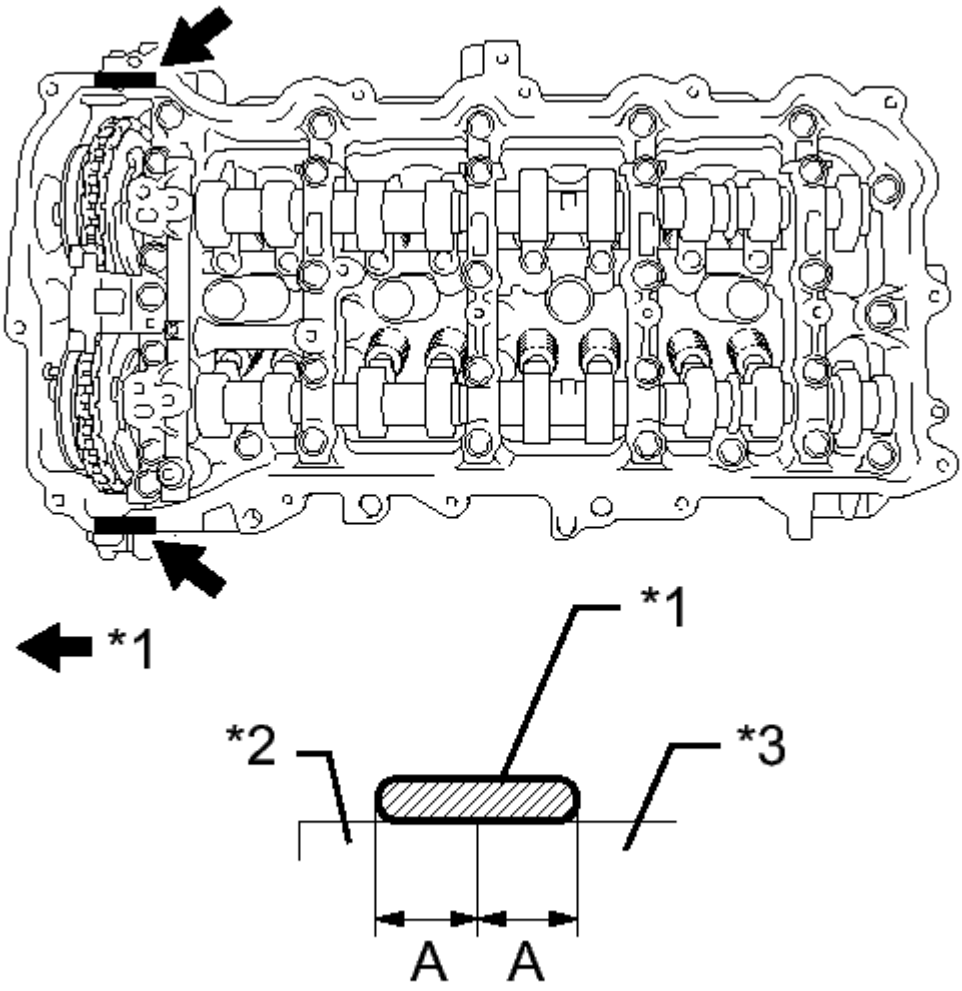
Fig. 365: Locating Camshaft Bearing Caps Gaskets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the 3 gaskets to the camshaft bearing caps.
c. Install a new gasket to the cylinder head cover.

NOTE: Remove any oil from the contact surface.

d. Apply seal packing as shown in the illustration.

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Fig. 366: Cylinder Head Cover Sub-Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing

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

Standard seal diameter

3.0 to 6.0 mm (0.118 to 0.236 in.)

Application width A

5.0 mm (0.197 in.)

TEXT IN ILLUSTRATION

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*1	Seal packing
*2	Timing Chain Cover
*3	Camshaft Housing

NOTE:

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

e. Align the cylinder head cover with pin A. Then align the cylinder head cover with pin B and install the cylinder head cover.

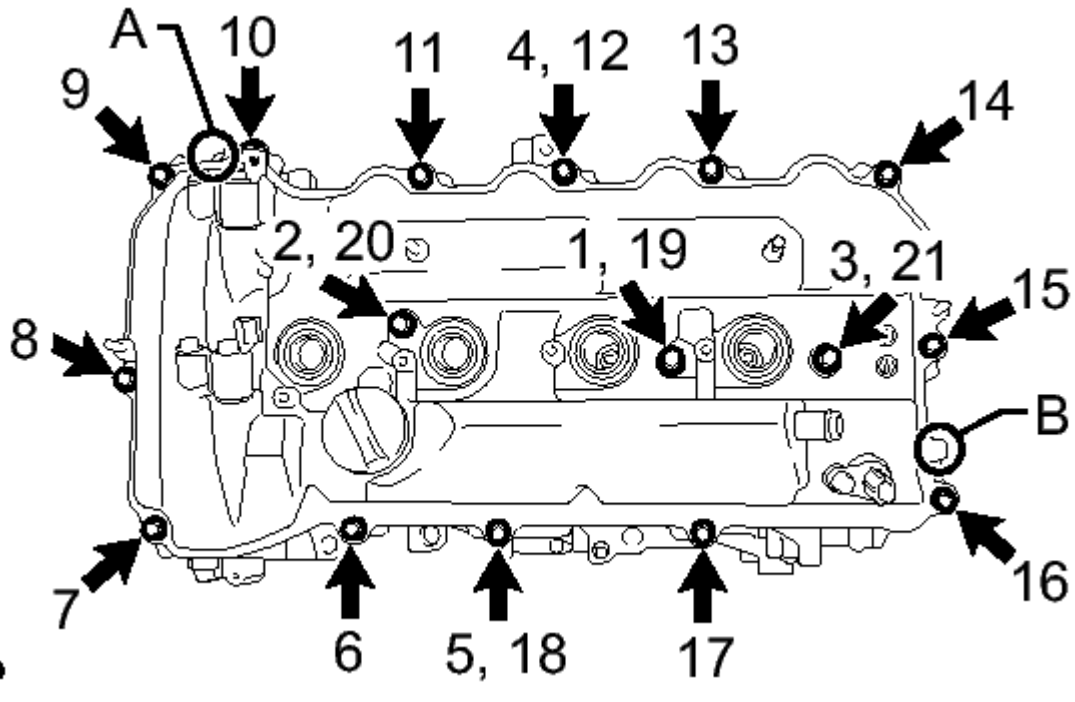


Fig. 367: Identifying Cylinder Head Cover Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Install 3 new seal washers and the 16 bolts, and then tighten the bolts in the order shown in the illustration.

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

NOTE: Do not apply oil for at least 2 hours after the installation.

44. **INSTALL CRANKSHAFT PULLEY**

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

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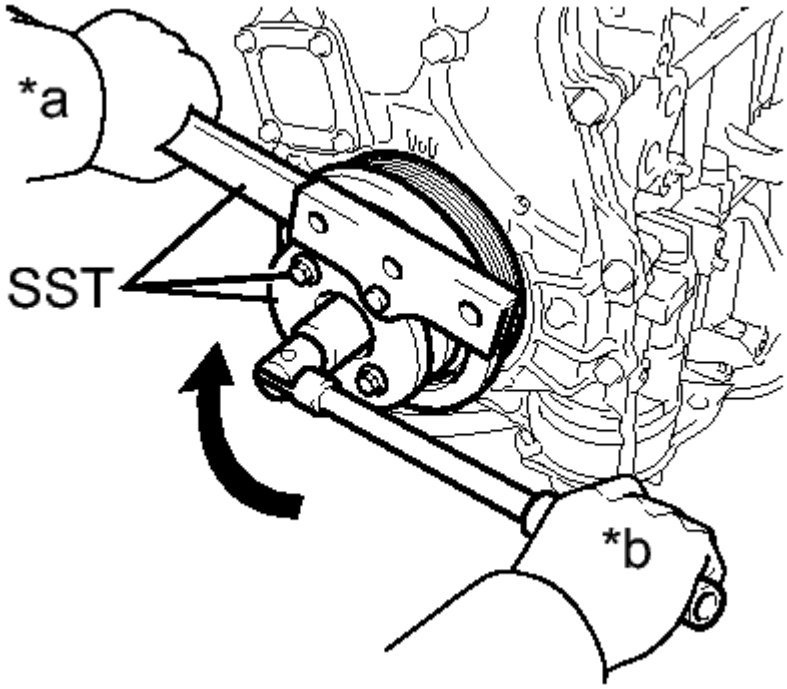


Fig. 368: Installing Crankshaft Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Hold
*b	Turn

b. Using SST, hold the crankshaft pulley and install the pulley bolt.
   - **SST: 09213-54015**
   - **SST: 09330-00021**
   - **SST: 91551-80650**

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

45. **INSTALL CRANKSHAFT POSITION SENSOR** . Refer to **INSTALLATION [08/2013 -] - Step 1**
46. **INSTALL WATER INLET HOUSING**
    a. Install a new gasket and the inlet water housing with the 4 bolts and nut.

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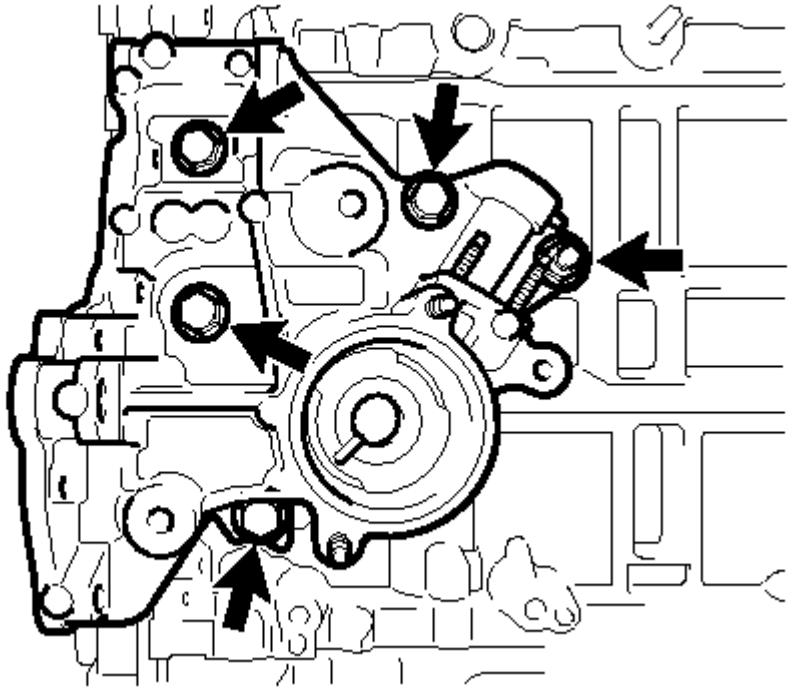


Fig. 369: Locating Inlet Water Housing, Gasket, Bolts & Nut
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

47. **INSTALL ENGINE WATER PUMP ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 1**
48. **INSTALL V-RIBBED BELT TENSIONER ASSEMBLY**
    a. Install the V-ribbed belt tensioner with the bolt.

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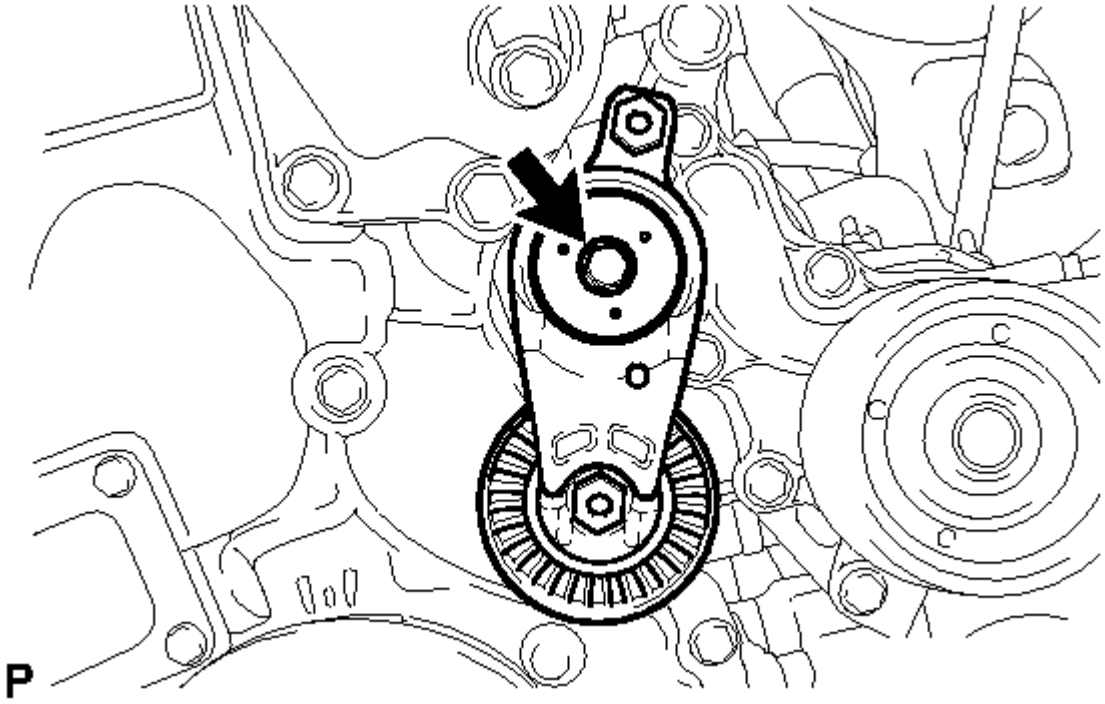


Fig. 370: Locating V-Ribbed Belt Tensioner Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

49. **INSTALL THERMOSTAT** . Refer to **INSTALLATION [08/2013 -] - Step 1**
50. **INSTALL WATER INLET** . Refer to **INSTALLATION [08/2013 -] - Step 2**
51. **INSTALL NO. 1 WATER BY-PASS PIPE**
    a. Install a new gasket and the water by-pass pipe with the 2 nuts and bolt.

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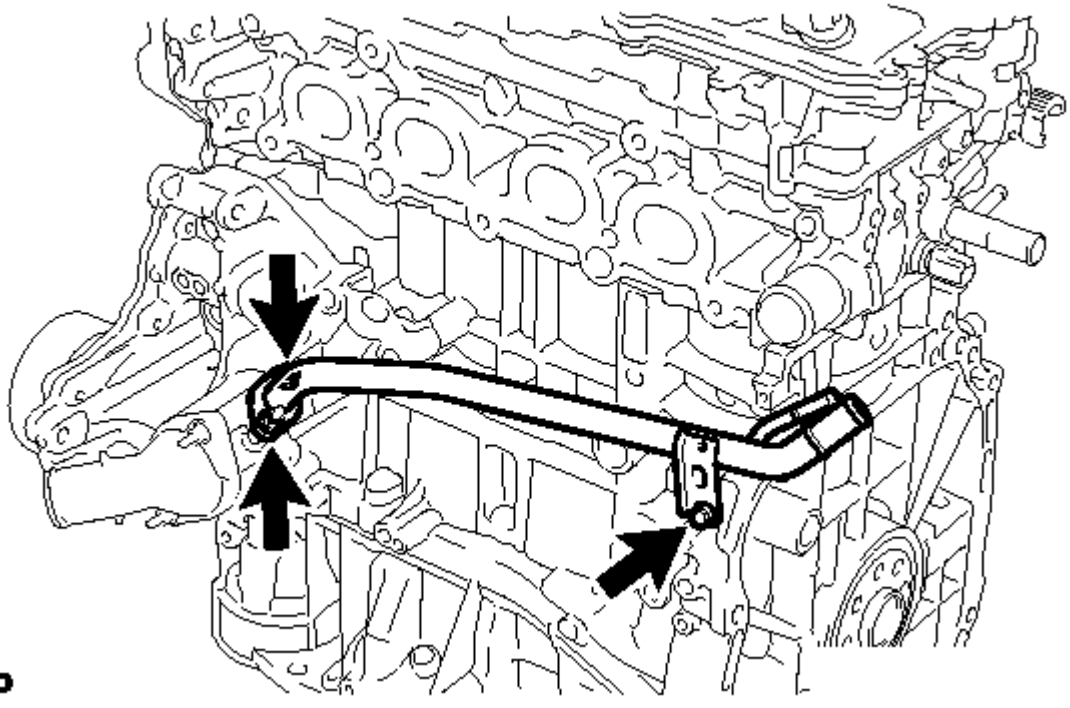


Fig. 371: Locating Water Bypass Pipe, Gasket, Bolt & Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

52. **INSTALL SEPARATOR CASE**
    a. Apply a light coat of engine oil to a new gasket.

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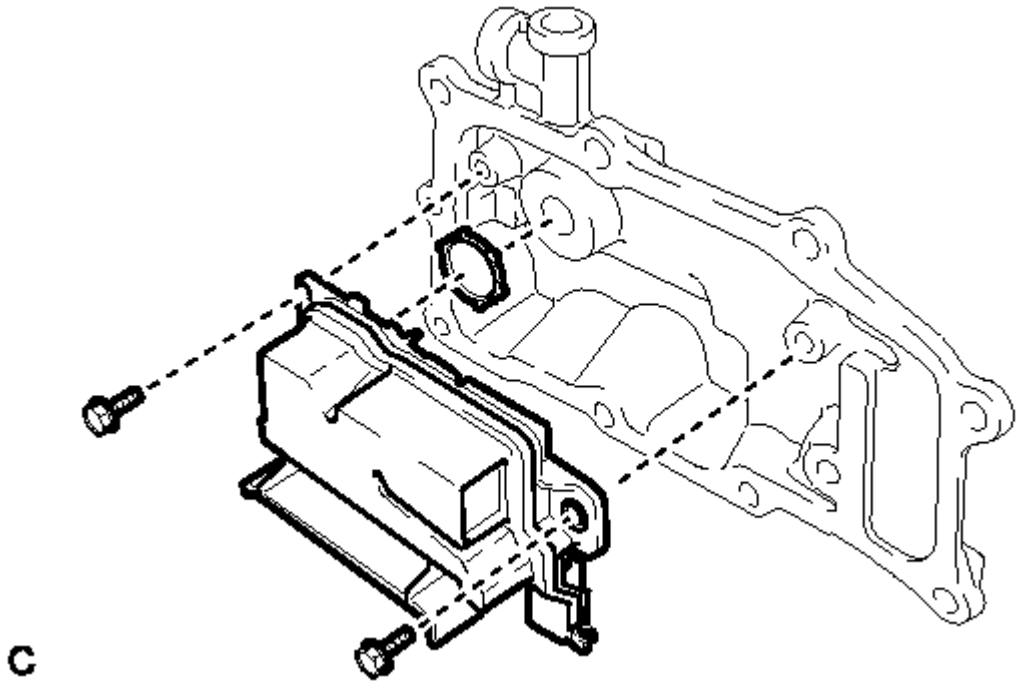


Fig. 372: Identifying Separator Case, Gasket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the gasket to the separator case.
c. Install the separator case with the 2 bolts.

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

53. **INSTALL VENTILATION CASE SUB-ASSEMBLY**
    a. Apply seal packing in a continuous line as shown in the illustration.

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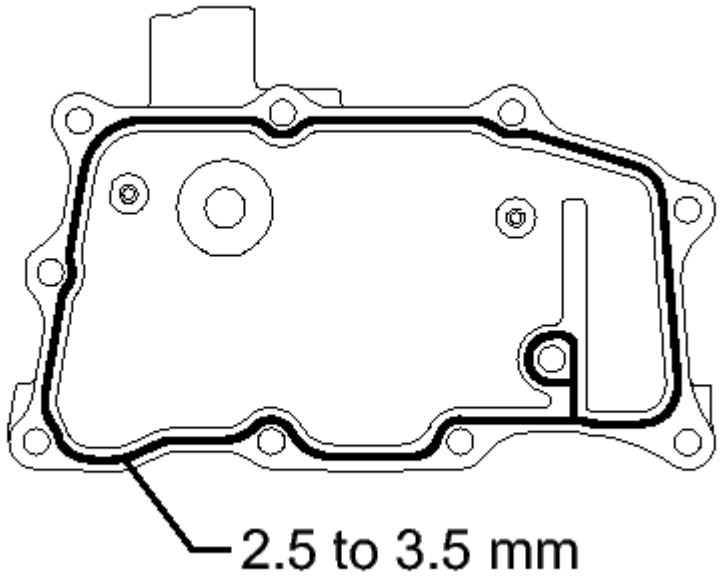


Fig. 373: Identifying Seal Packing Applying Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing

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

Standard seal diameter

2.5 to 3.5 mm (0.0984 to 0.138 in.)

NOTE:

- **Remove any oil from the contact surface.**
- **Install the ventilation case within 3 minutes and tighten the bolts and nuts within 15 minutes after applying seal packing.**

b. Install the ventilation case, and install the 8 bolts and 2 nuts in the order shown in the illustration.

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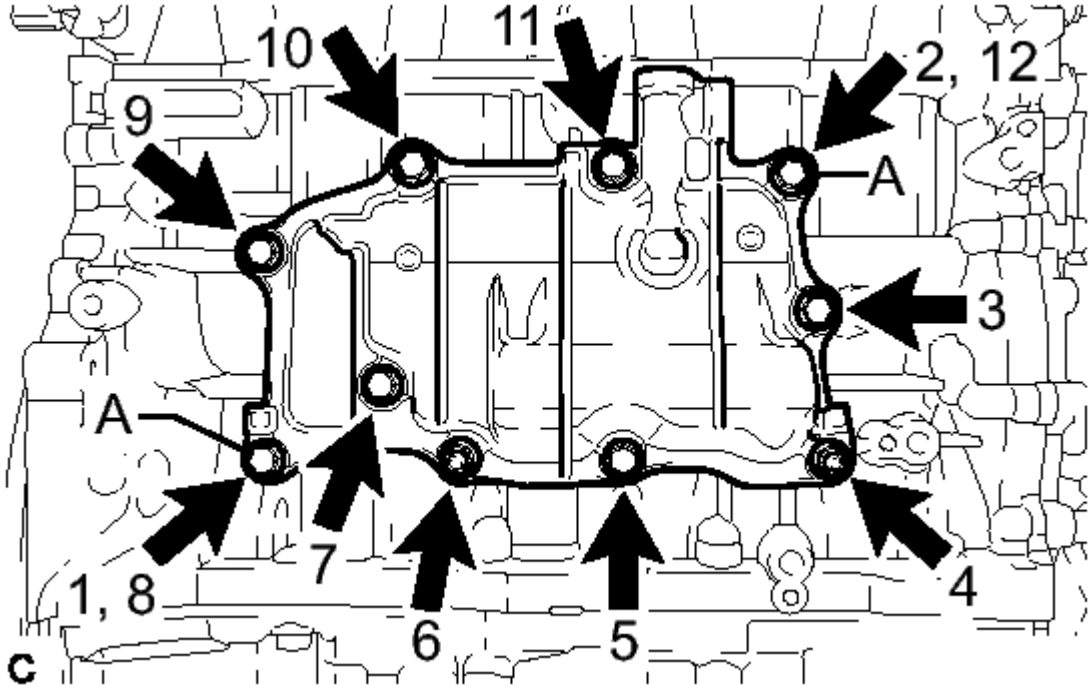


Fig. 374: Identifying Ventilation Case Sub-Assembly Fasteners With Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

Bolt A is tightened twice.

54. **INSTALL VENTILATION VALVE SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 1**
55. **INSTALL CAMSHAFT POSITION SENSOR** . Refer to **INSTALLATION [08/2013 -] - Step 1**
56. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 1**
57. **INSTALL OIL FILLER CAP SUB-ASSEMBLY**
    a. Install a new gasket to the oil filler cap.
    b. Install the oil filler cap to the cylinder head.
58. **INSTALL SPARK PLUG** . Refer to **INSTALLATION [08/2013 -] - Step 1**
59. **INSTALL ENGINE COVER JOINT**
    a. Install the 3 joints.

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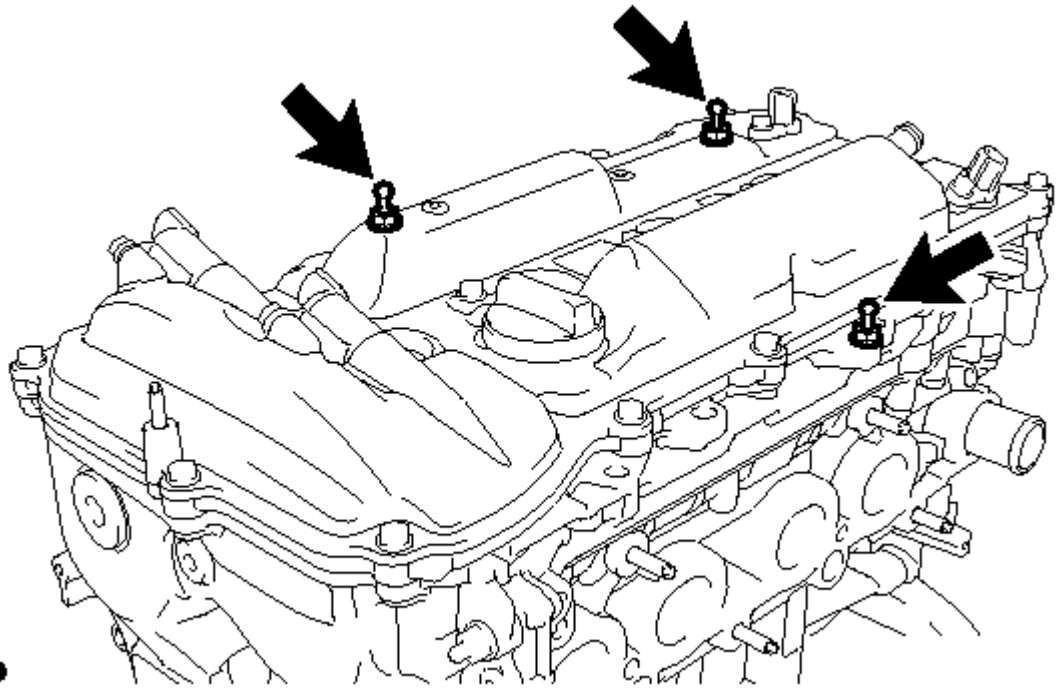


Fig. 375: Locating Engine Cover Joints
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

INSTALLATION [08/2013 -]

INSTALLATION [08/2013 -]

HINT:

Perform "Inspection After Repair" after replacing the engine assembly. Refer to **INITIALIZATION [08/2013 -]** .

1. **INSTALL IGNITION COIL ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 2**
2. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 1**
3. **INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 1**
4. **INSTALL KNOCK CONTROL SENSOR** . Refer to **INSTALLATION [08/2013 -] - Step 1**
5. **INSTALL SENSOR WIRE**
    a. Install the sensor wire with the bolt.

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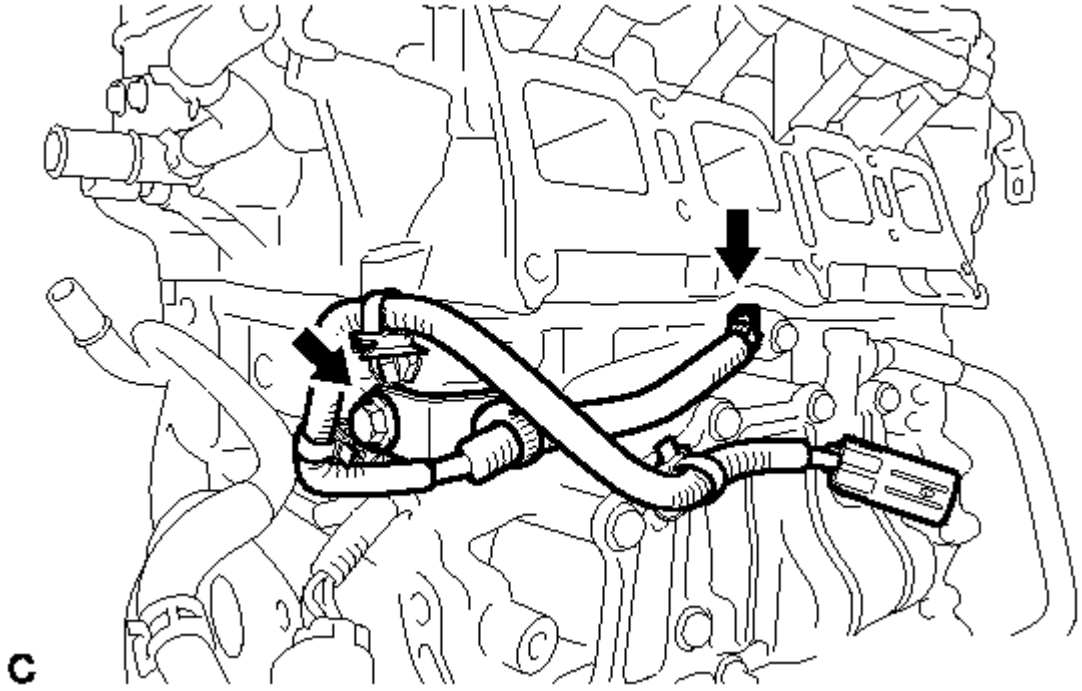


Fig. 376: Identifying Knock Control Sensor Connector, Wire And Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

b. Connect the knock control sensor connector.

6. **INSTALL INTAKE MANIFOLD** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 1**
7. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 2**
8. **INSTALL UNION TO CONNECTOR TUBE HOSE** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 4**
9. **CONNECT NO. 2 VENTILATION HOSE** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 5**
10. **INSTALL VACUUM SWITCHING VALVE ASSEMBLY (for ACIS)** . Refer to **INSTALLATION [08/2013 - 12/2013] - Step 6**
11. **INSTALL WATER BY-PASS HOSE**
    a. Install the No. 1 and No. 2 water by-pass hoses.

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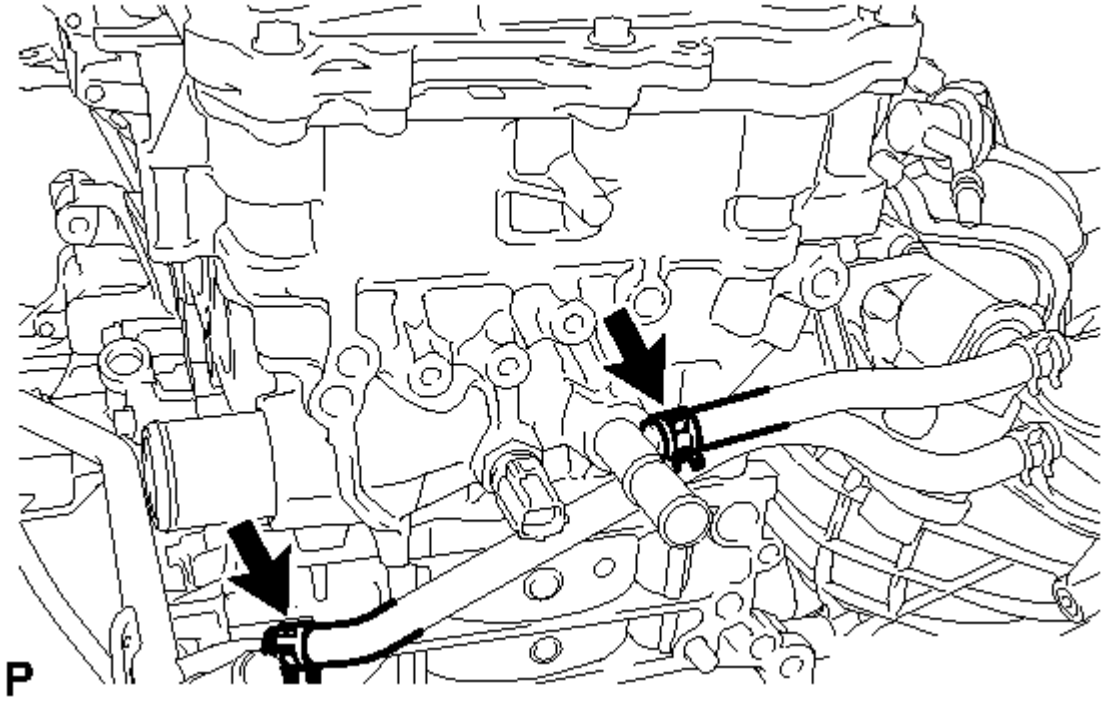


Fig. 377: Locating No. 1 And No. 2 Water Bypass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. **INSTALL THROTTLE WITH MOTOR BODY ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 1**
13. **INSTALL NO. 1 COMPRESSOR MOUNTING BRACKET**
    a. Install the bracket with the 4 bolts.

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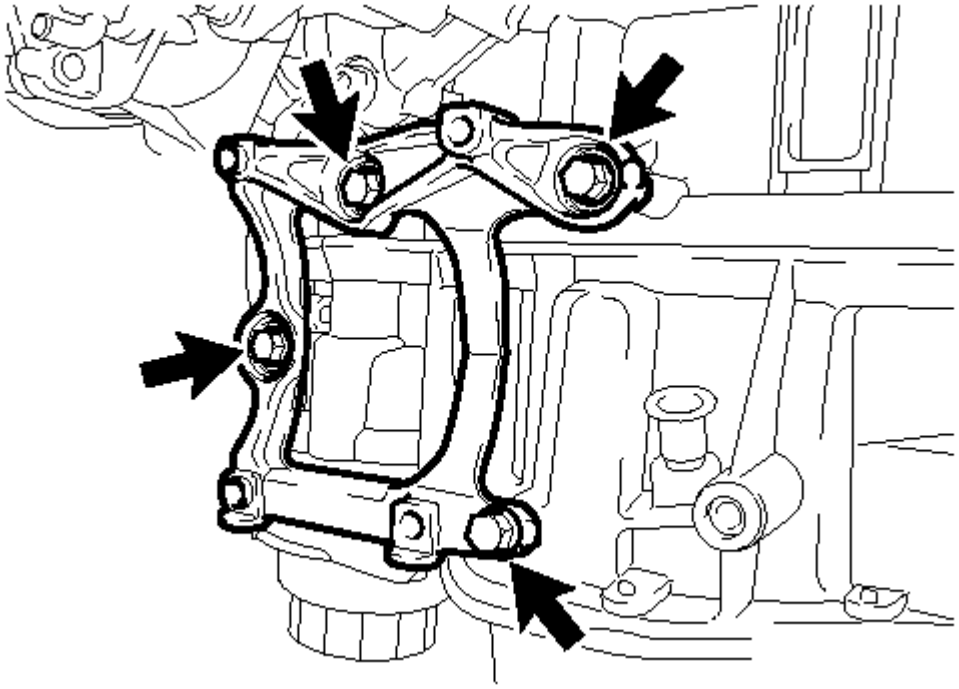


Fig. 378: Locating NO. 1 Compressor Mounting Bracket & Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

14. **INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY** . Refer to **INSTALLATION [08/2013 -] - Step 3**
15. **INSTALL EGR INLET EXHAUST MANIFOLD PLATE (for PZEV)** . Refer to **INSTALLATION [08/2013 -] - Step 6**
16. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (except PZEV)** . Refer to **INSTALLATION [08/2013 -] - Step 5**
17. **INSTALL NO. 2 MANIFOLD STAY** . Refer to **INSTALLATION [08/2013 -] - Step 7**
18. **INSTALL MANIFOLD STAY** . Refer to **INSTALLATION [08/2013 -] - Step 8**
19. **INSTALL ENGINE OIL LEVEL DIPSTICK GUIDE**
    a. Apply a light coat of engine oil to a new O-ring.

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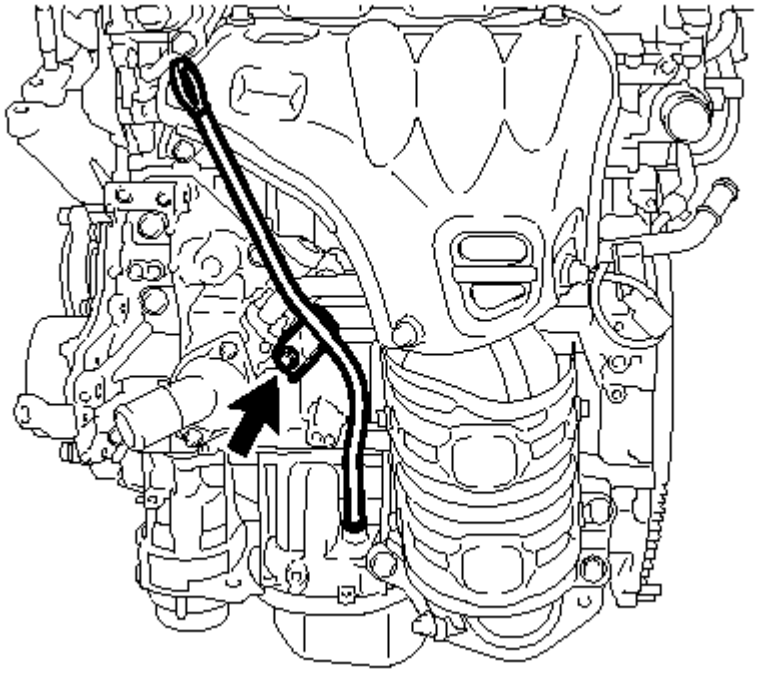


Fig. 379: Locating Dipstick Guide Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Install the O-ring to the engine oil level dipstick guide.
c. Install the engine oil level dipstick guide with the bolt.

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

d. Install the engine oil level dipstick.

20. **INSTALL ENGINE HANGERS**
    a. Install the 2 engine hangers with the 4 bolts as shown in the illustration.

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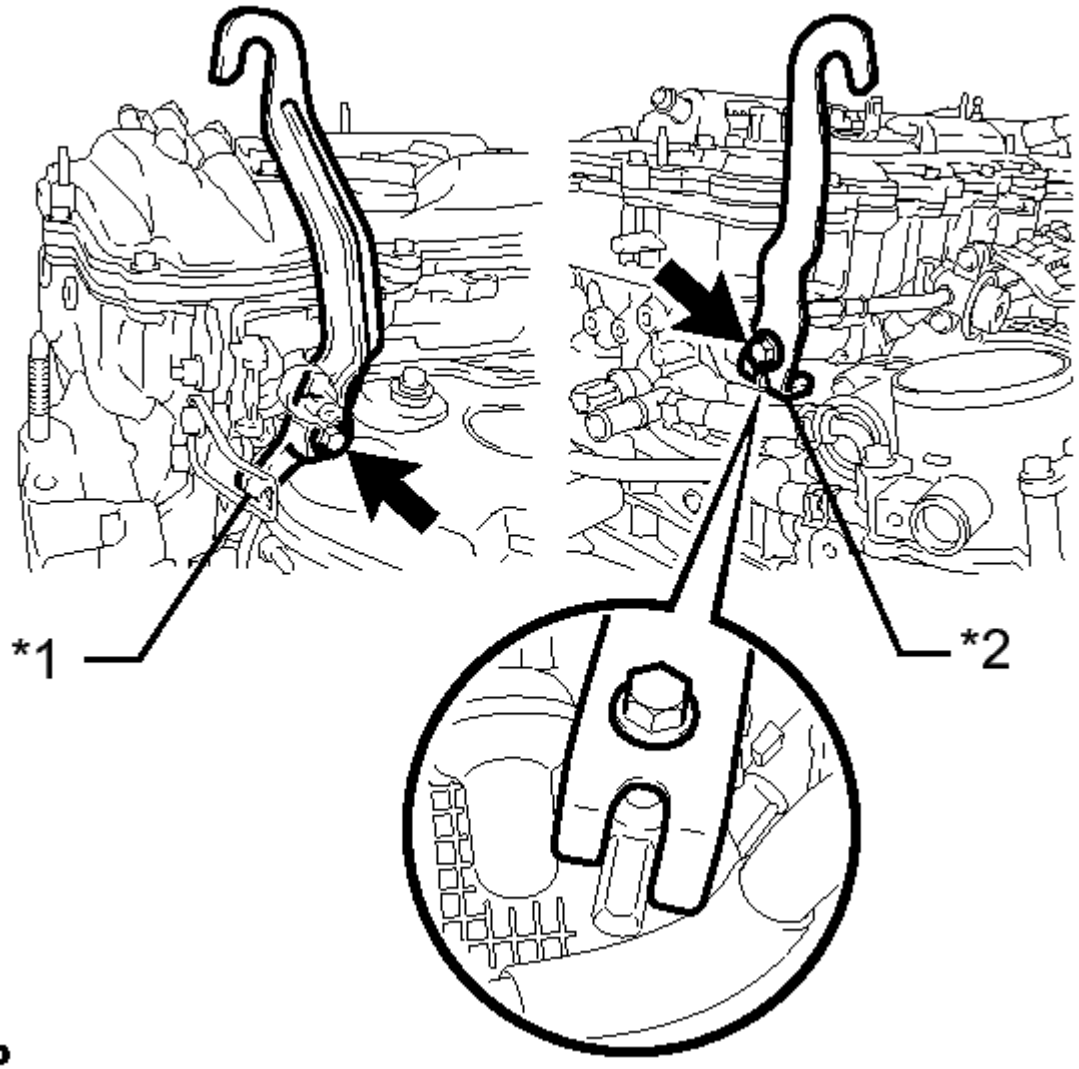


Fig. 380: Identifying Engine Hangers With Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PART NO.

Item	Part No.
No. 1 engine hanger	12281-36020
No. 2 engine hanger	12282-36021
Bolt	91552-81040 or 91552-81025

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

b. Attach an engine sling device and hang the engine with the chain block.

CYLINDER HEAD

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COMPONENTS [08/2013 -]

ILLUSTRATION

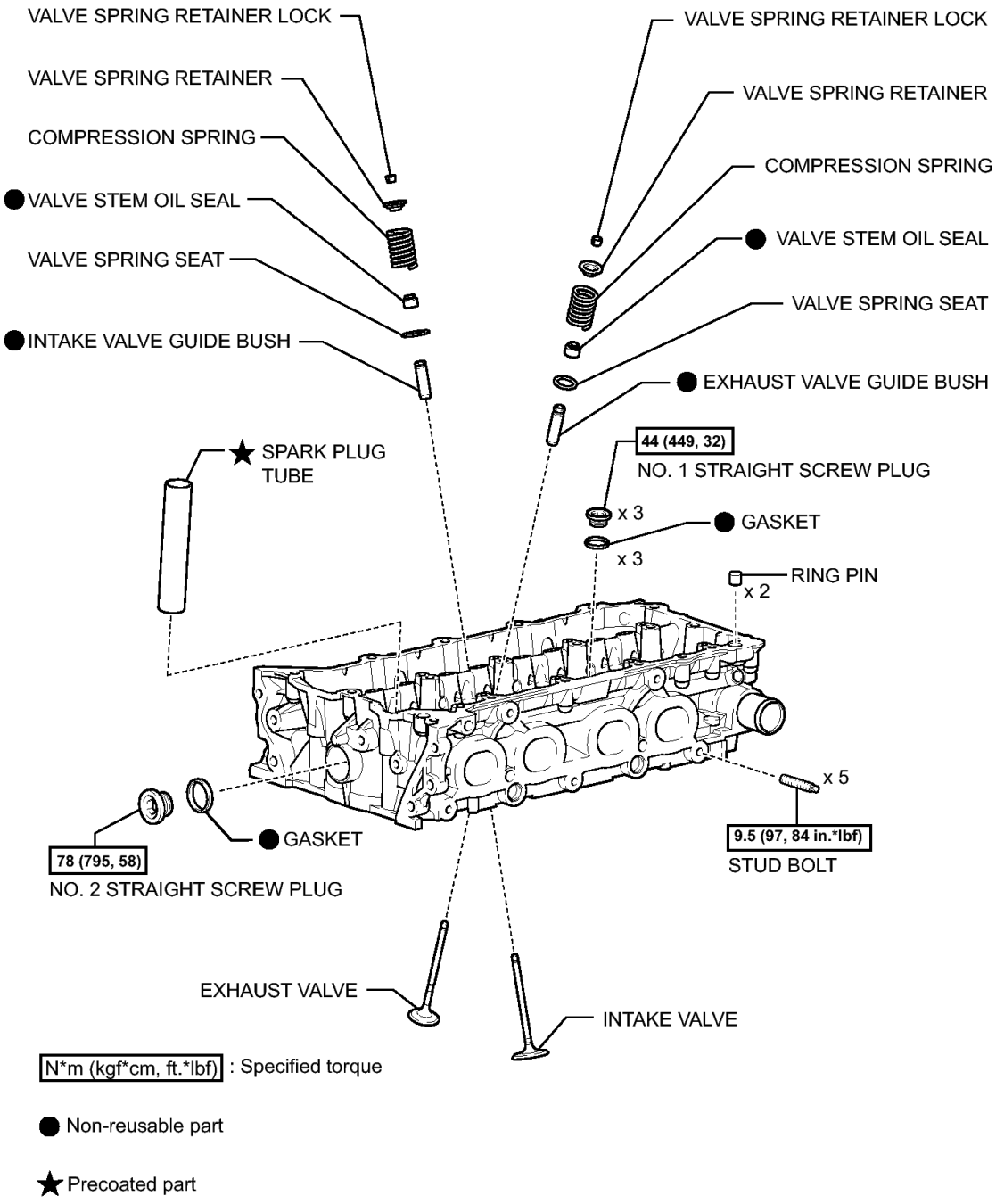


Fig. 381: Identifying Cylinder Head Replacement Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY [08/2013 -]

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DISASSEMBLY [08/2013 -]

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

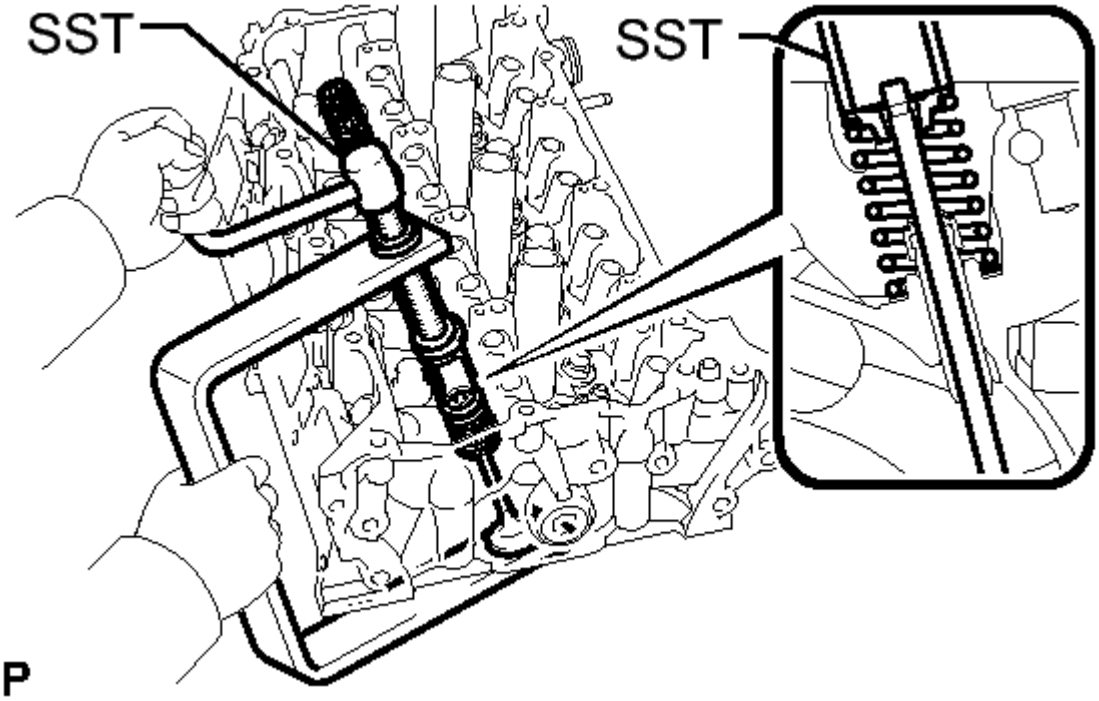


Fig. 382: View Of Compressing The Intake Valve Compression Spring Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09202-70020**
  09202-00010

   b. Remove the retainer, compression spring and valve.

   HINT:

   Arrange the removed parts in the correct order.

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

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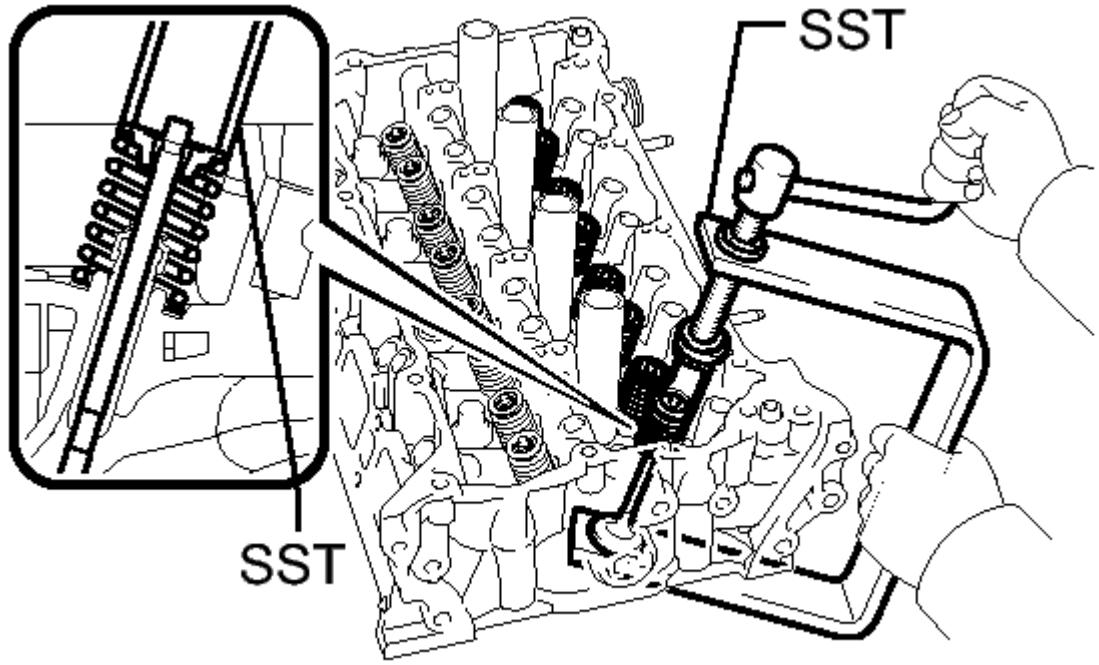


Fig. 383: View Of Compressing The Exhaust Valve Compression Spring Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09202-70020**
  09202-00010

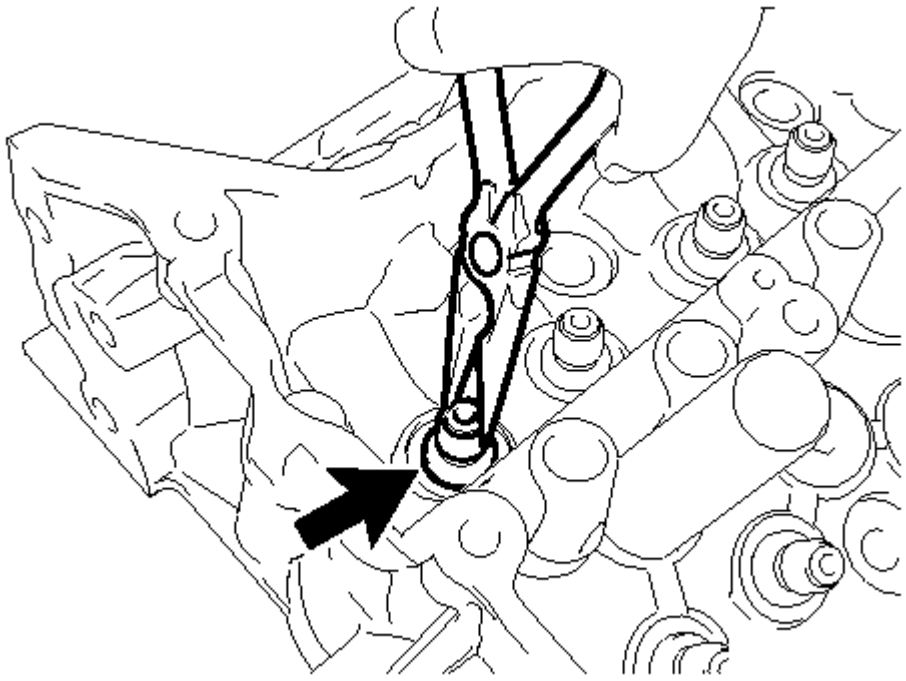
b. Remove the retainer, compression spring and valve.

HINT:

Arrange the removed parts in the correct order.

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

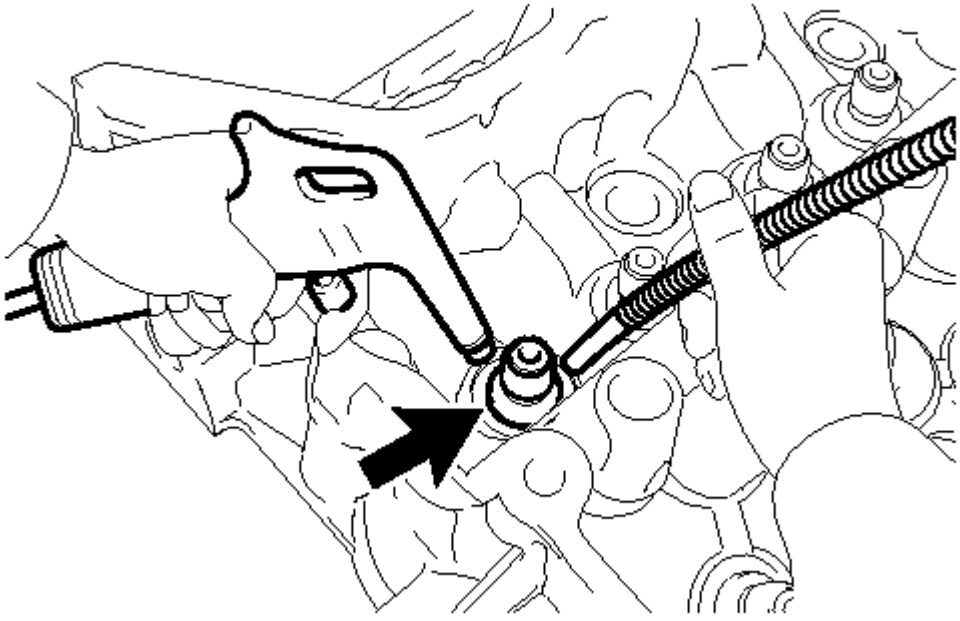
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Fig. 384: View Of Removing Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



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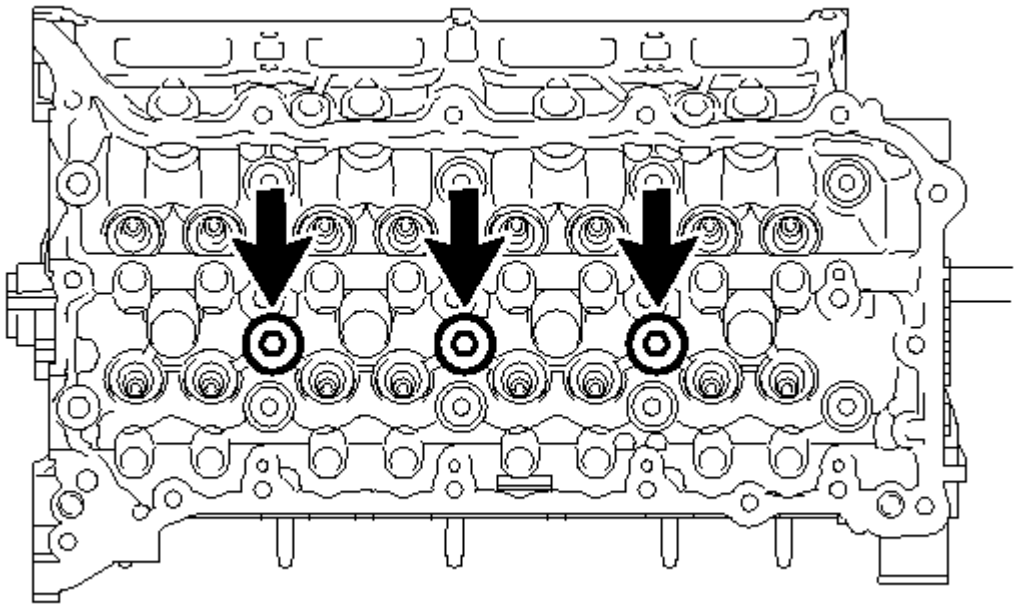
Fig. 385: View Of Removing Valve Spring Seat

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

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

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



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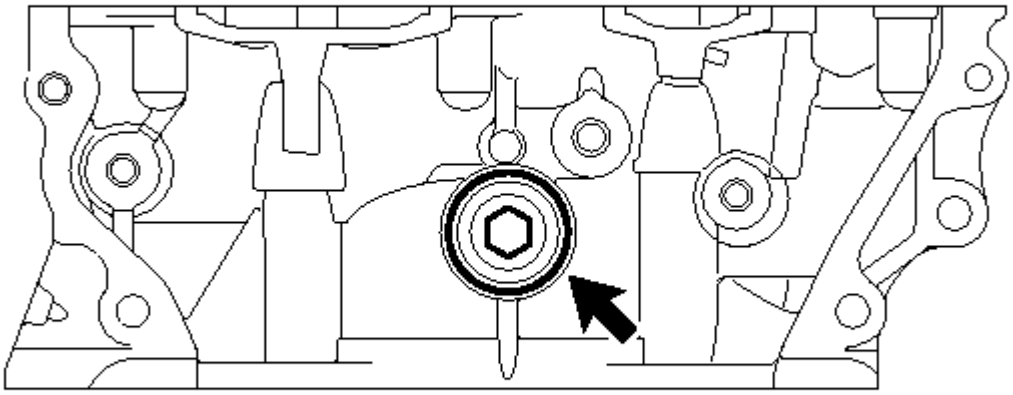
Fig. 386: Locating No. 1 Straight Screw Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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

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Fig. 387: Locating No. 2 Straight Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

7. **REMOVE STUD BOLT**

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

INSPECTION [08/2013 -]

INSPECTION [08/2013 -]

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

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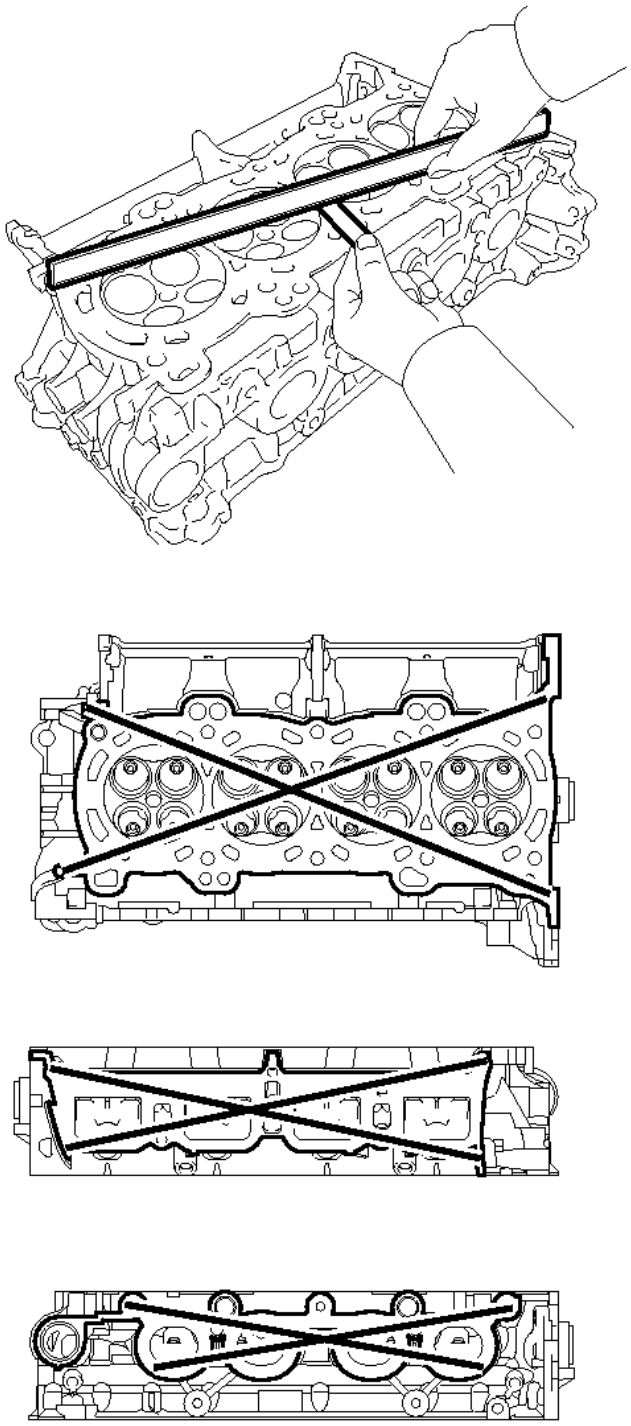


Fig. 388: Measuring Warpage Of Contact Surfaces
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum Warpage

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

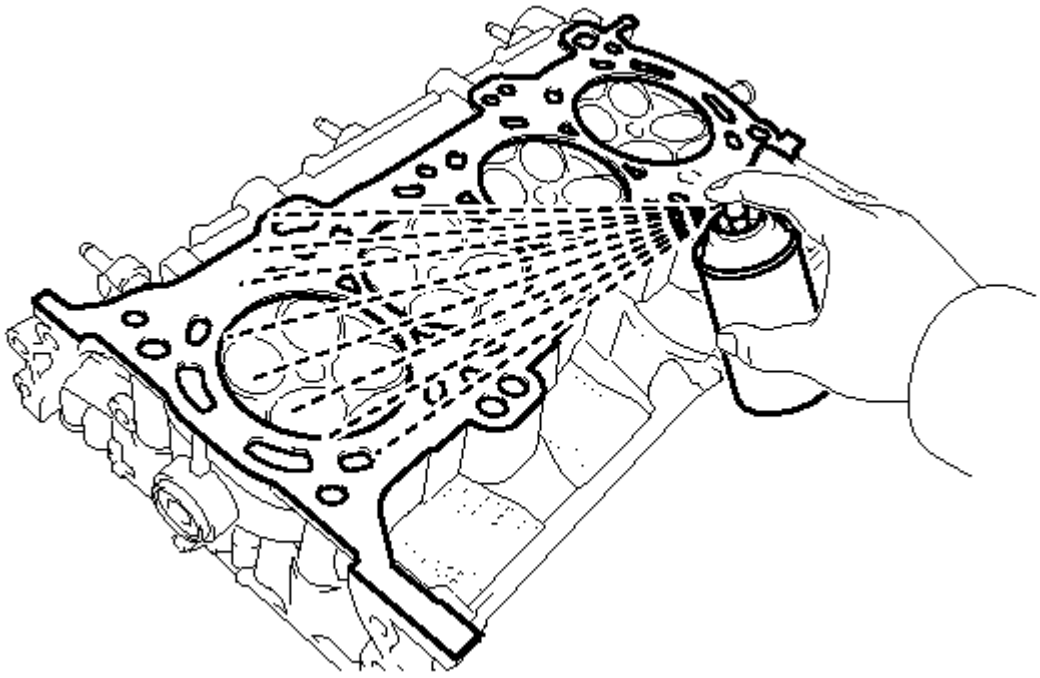
TEXT IN ILLUSTRATION

*a	Cylinder Head Lower Side
*b	Intake Manifold Side
*c	Exhaust Manifold Side

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

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

If cracked, replace the cylinder head.

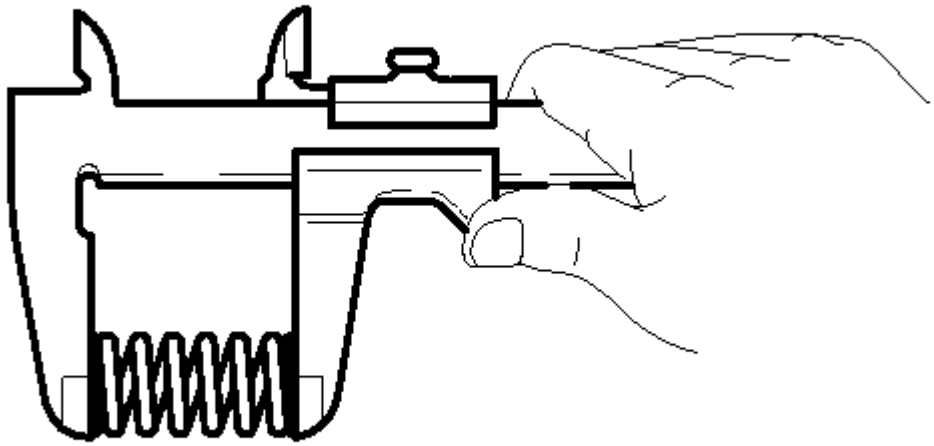


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Fig. 389: Inspecting Exhaust Ports And Cylinder Surface For Cracks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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Fig. 390: View Of Measuring Free Length Of Inner Compression Spring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard free length

47.2 to 49.2 mm (1.86 to 1.94 in.)

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

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

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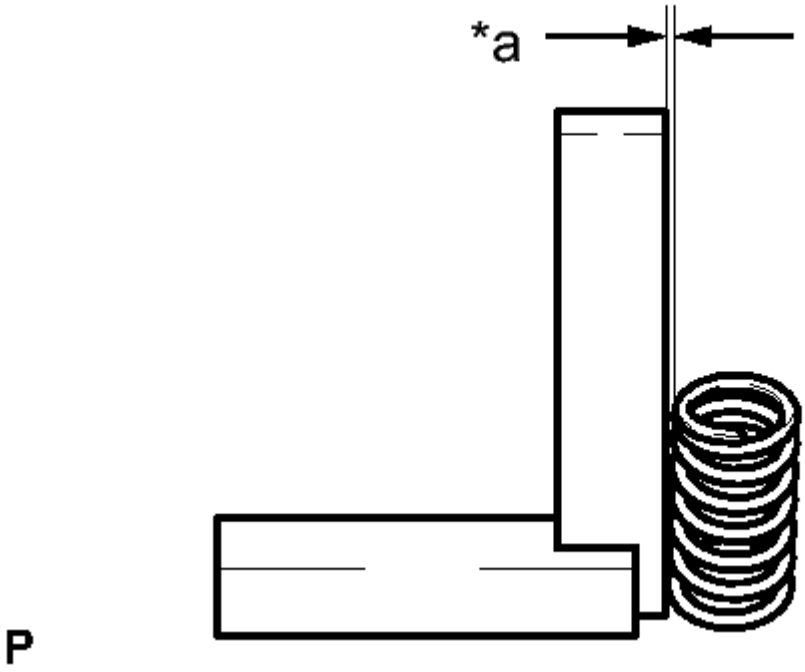


Fig. 391: Measuring Inner Compression Spring Deviation
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum deviation

1.0 mm (0.0394 in.)

Maximum angle

2°

TEXT IN ILLUSTRATION

*a	Deviation

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

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

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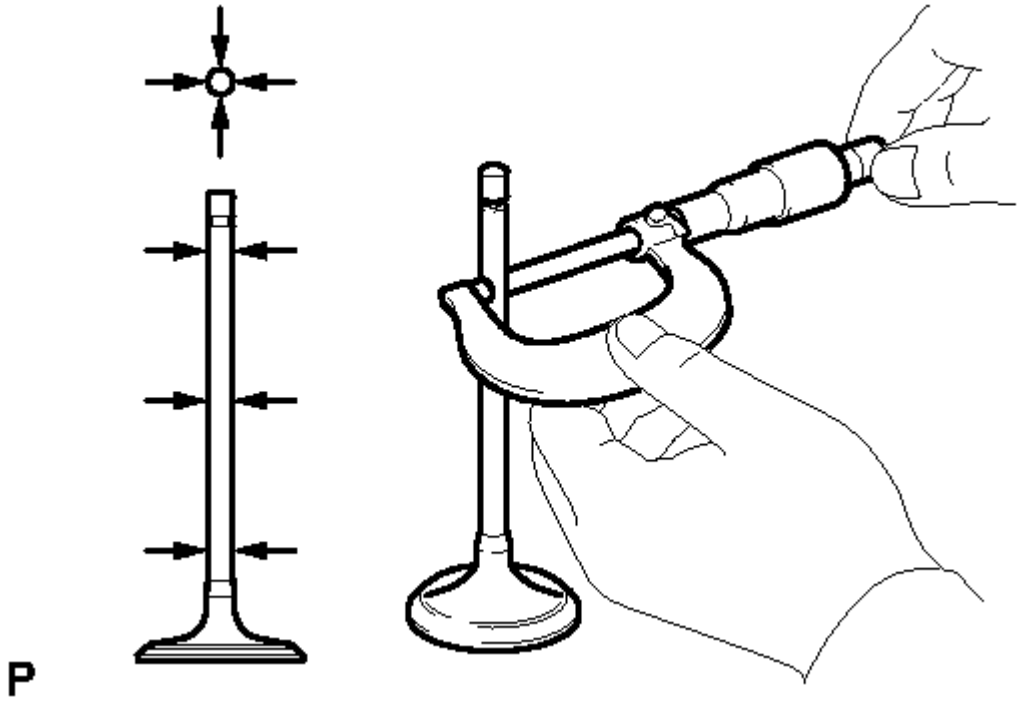


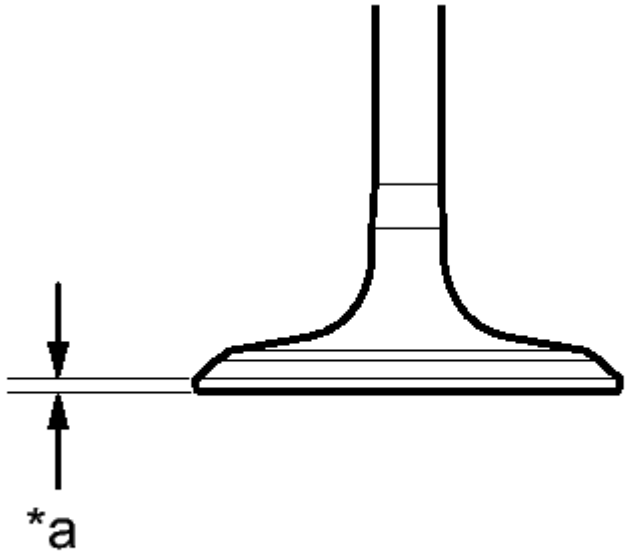
Fig. 392: View Of Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard valve stem diameter

5.470 mm to 5.485 mm (0.21535 to 0.21594 in.)

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

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Fig. 393: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard margin thickness

1.0 mm (0.0394 in.)

Minimum margin thickness

0.50 mm (0.0197 in.)

TEXT IN ILLUSTRATION

*a	Margin Thickness

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

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

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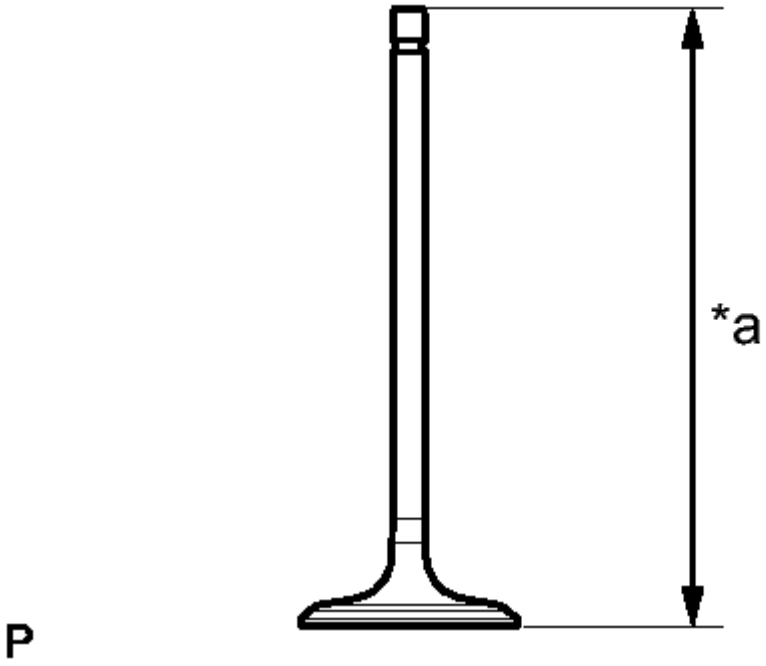


Fig. 394: Measuring Overall Length Of Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard overall length

103.92 mm (4.09 in.)

Minimum overall length

103.42 mm (4.07 in.)

TEXT IN ILLUSTRATION

*a	Overall Length

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

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

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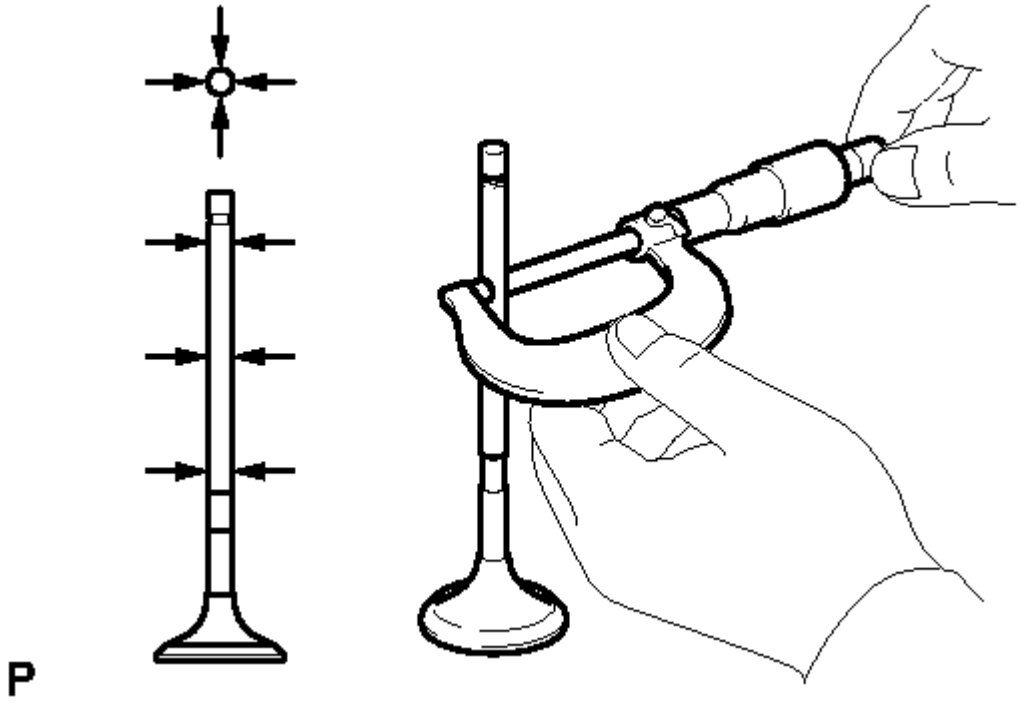


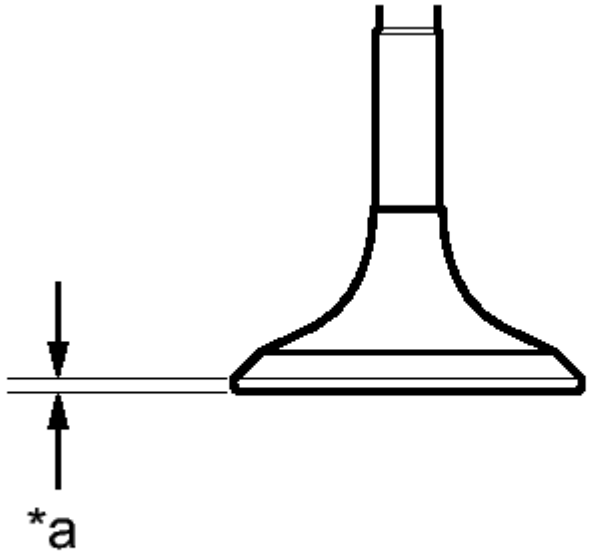
Fig. 395: View Of Measuring Diameter Of Valve Stem
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard valve stem diameter

5.465 mm to 5.480 mm (0.21516 to 0.21575 in.)

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

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Fig. 396: Measuring Valve Head Margin Thickness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard margin thickness

1.0 mm (0.0394 in.)

Minimum margin thickness

0.50 mm (0.0197 in.)

TEXT IN ILLUSTRATION

*a	Margin Thickness

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

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

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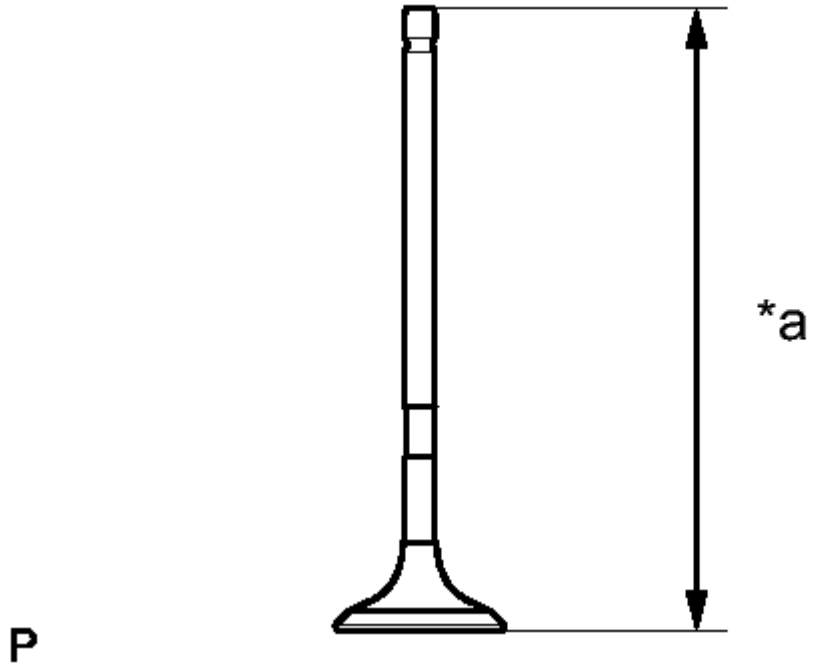


Fig. 397: Measuring Overall Length Of Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard overall length

112.91 mm (4.44 in.)

Minimum overall length

112.41 mm (4.43 in.)

TEXT IN ILLUSTRATION

*a	Overall Length

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

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

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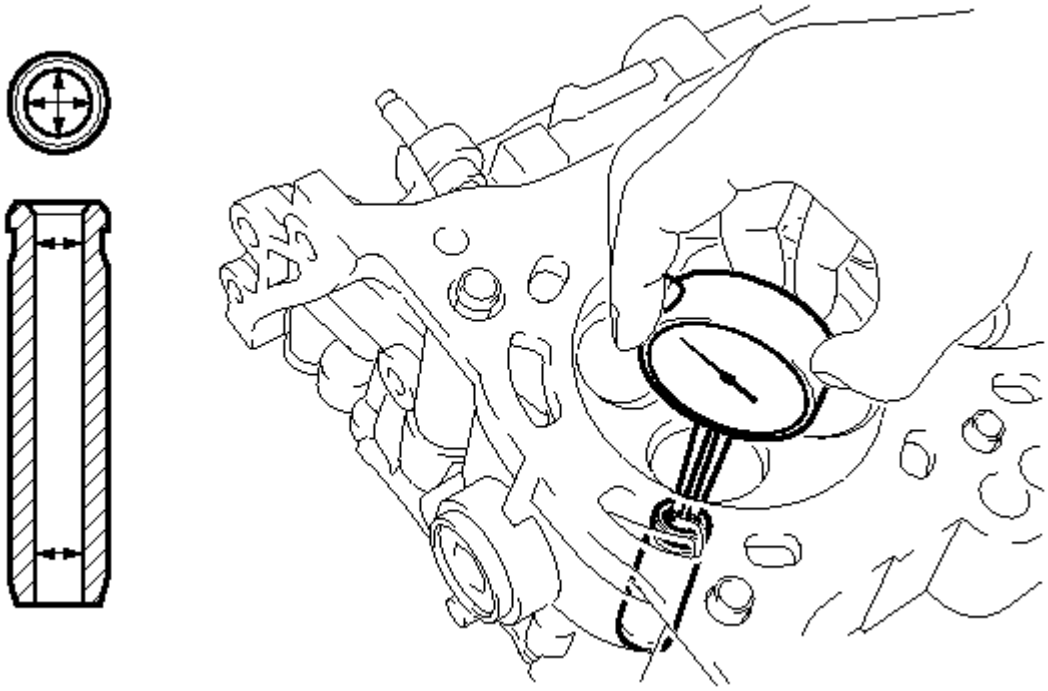


Fig. 398: View Of Measuring Inside Diameter Of Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard bush inside diameter

5.510 to 5.530 mm (0.2169 to 0.2177 in.)

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

Standard Oil Clearance

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

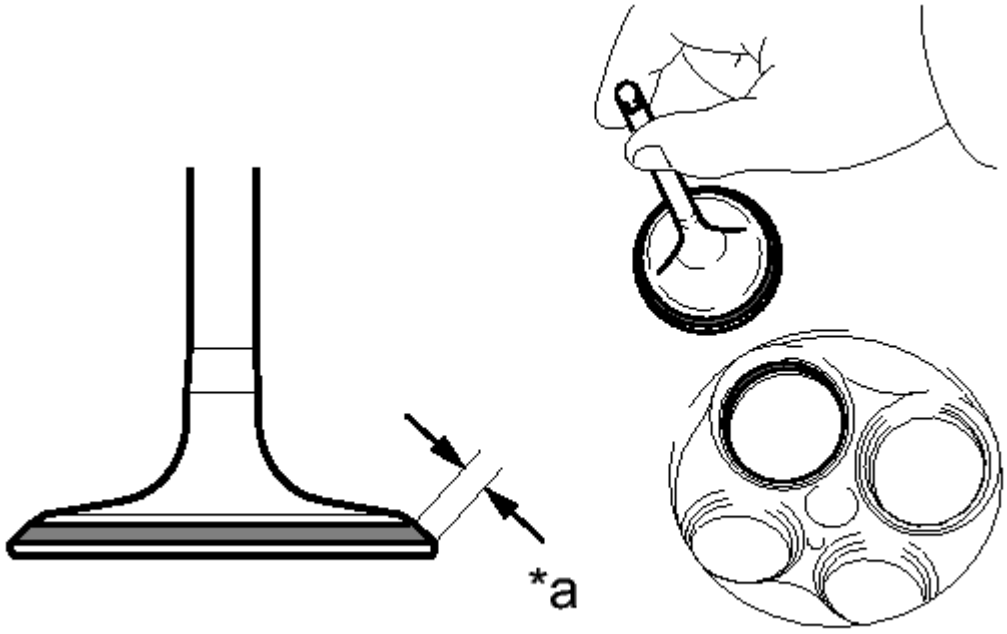
Maximum Oil Clearance

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

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

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

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Fig. 399: Inspecting Intake Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Width

HINT:

Do not rotate the valve while pressing the valve.

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

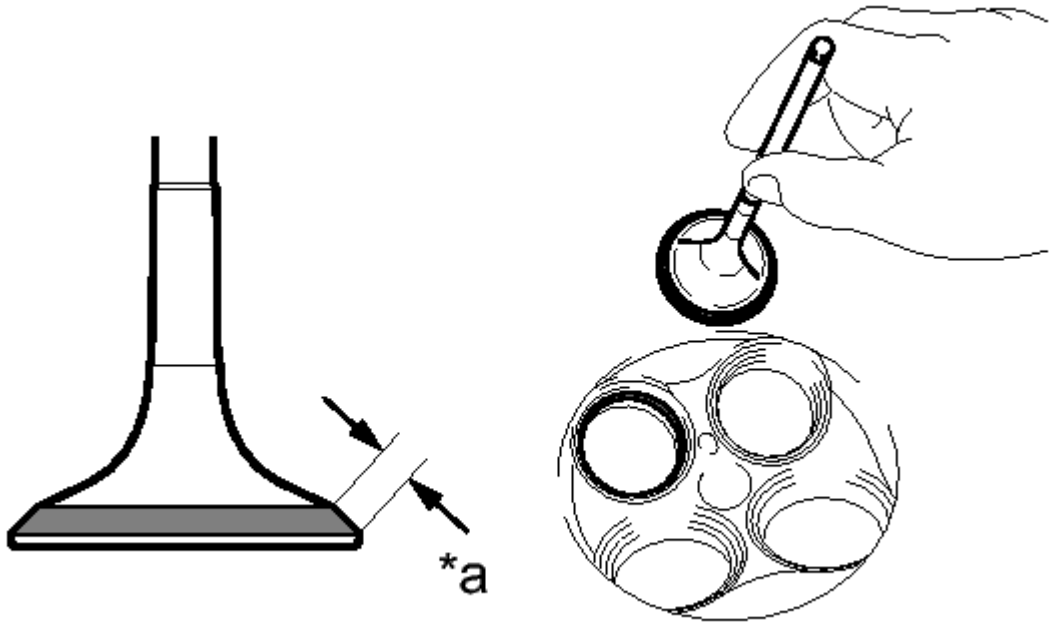
      If not, correct the valve seat.

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

      If not, correct the valve seat.

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

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Fig. 400: Inspecting Exhaust Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Width

HINT:

Do not rotate the valve while pressing the valve.

c. Check the valve face and valve seat.

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

   If not, correct the valve seat.

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

   If not, correct the valve seat.

8. **INSPECT CAMSHAFT OIL CLEARANCE**

NOTE: Do not turn the camshafts.

a. Clean the bearing caps, camshaft housing and camshaft journals.

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b. Place the camshafts on the camshaft housing.
c. Lay a strip of Plastigage across each of the camshaft journals.

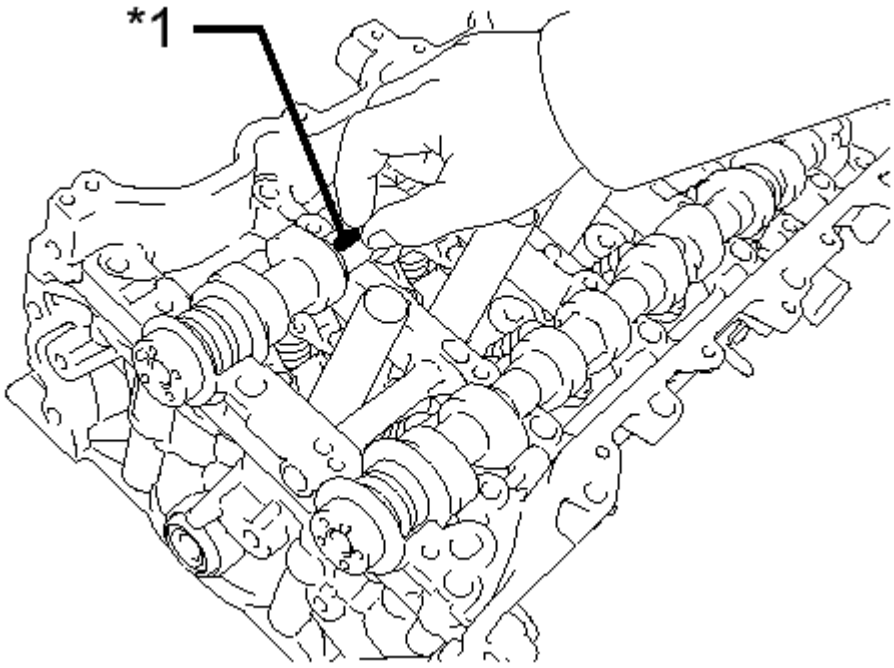


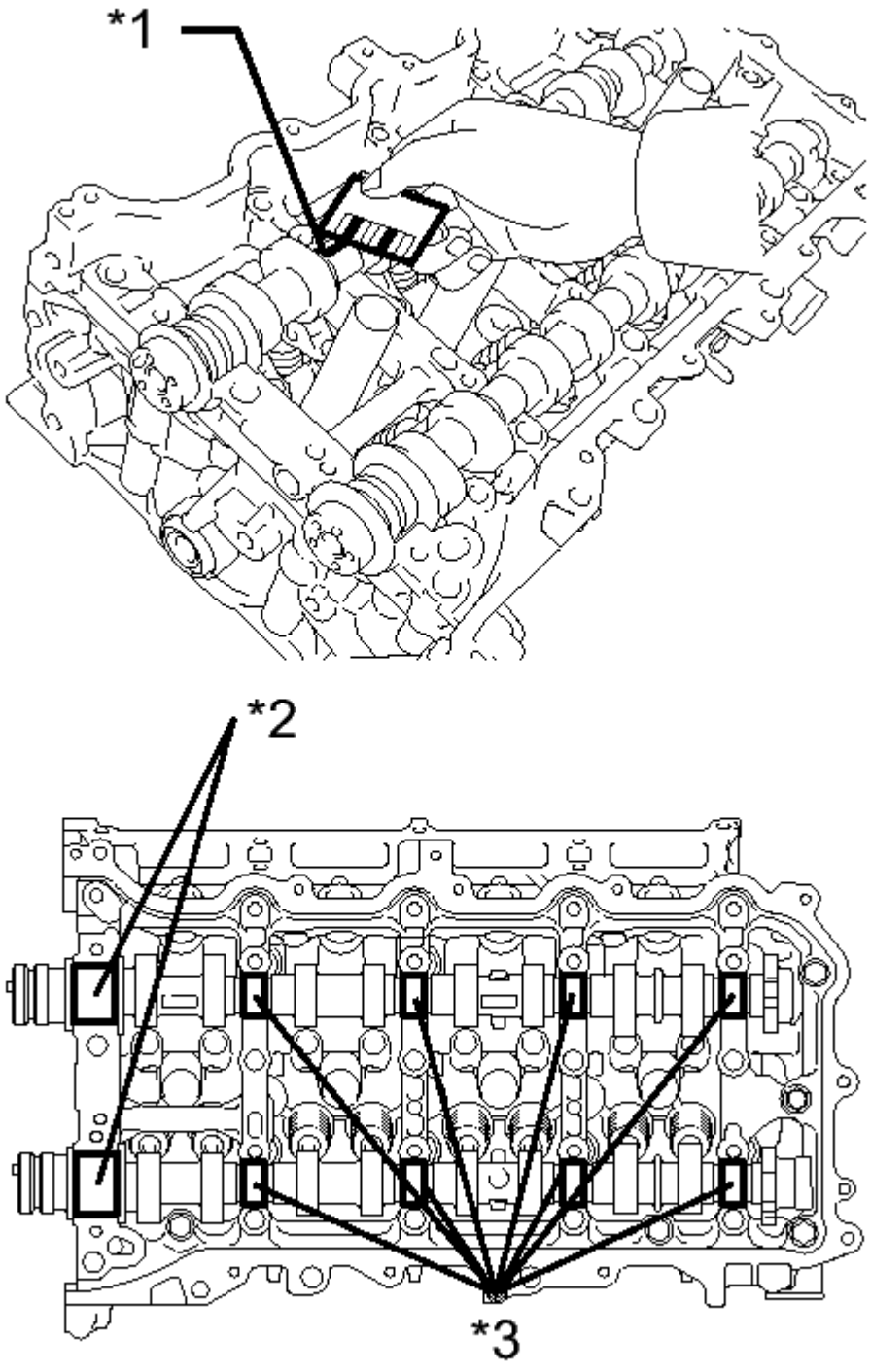
Fig. 401: Inspecting Camshaft Oil Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Plastigage

d. Install the camshaft bearing caps See step 13.
e. Install the camshaft housing sub-assembly See step 14.
f. Remove the camshaft bearing caps See step 21.
g. Measure the Plastigage at its widest point.

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Fig. 402: Measuring The Plastigage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Oil Clearance

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

Maximum Oil Clearance

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

TEXT IN ILLUSTRATION

*1	Plastigage
*2	No. 1 Journal
*3	Other Journal

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

9. **INSPECT CAMSHAFT THRUST CLEARANCE**
   a. Clean the bearing caps, camshaft housing and camshaft journals.
   b. Place the camshafts on the camshaft housing.
   c. Install the camshaft bearing caps See step 13.
   d. Install the camshaft housing sub-assembly See step 14.
   e. Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

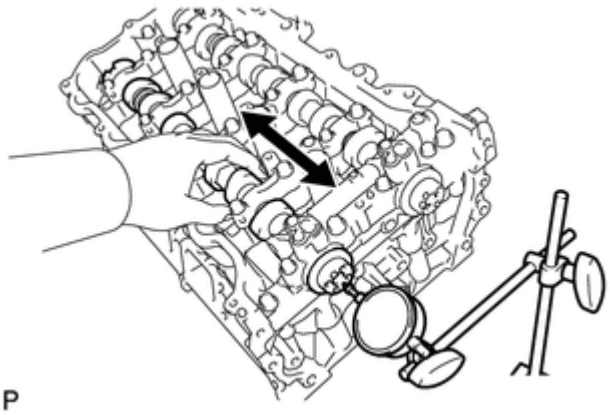


Fig. 403: View Of Measuring Camshaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Thrust Clearance

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Item	Specified Condition
Intake	0.060 to 0.155 mm (0.00236 to 0.00610 in.)
Exhaust	0.060 to 0.155 mm (0.00236 to 0.00610 in.)

Maximum Thrust Clearance

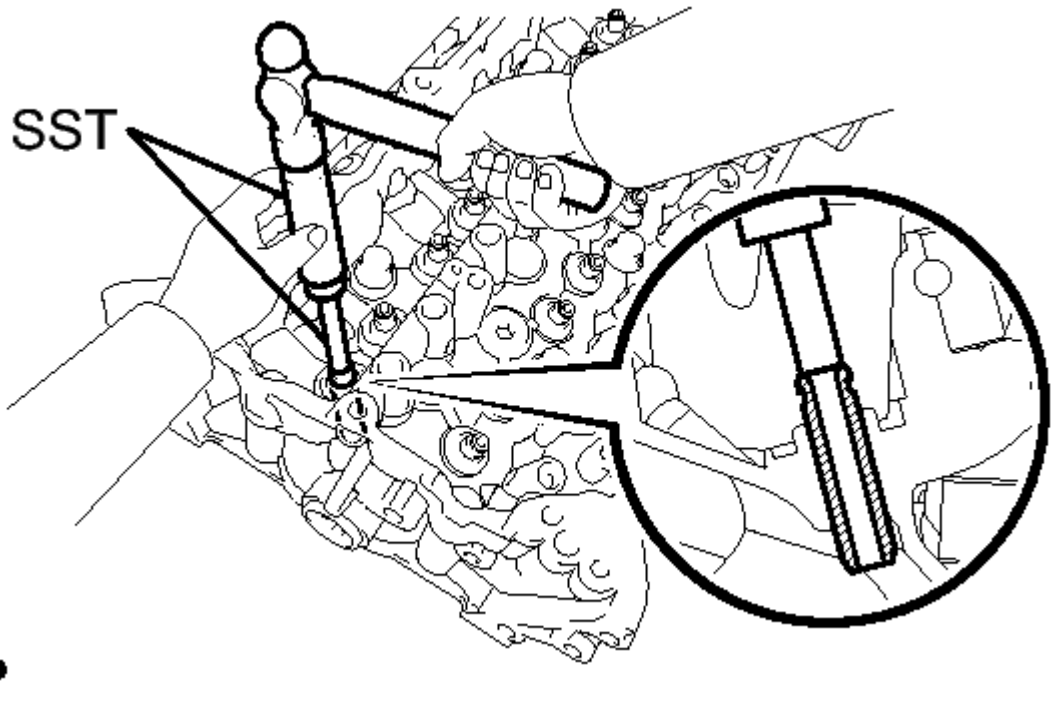
Item	Specified Condition
Intake	0.170 mm (0.00669 in.)
Exhaust	0.170 mm (0.00669 in.)

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

REPLACEMENT [08/2013 -]

REPLACEMENT [08/2013 -]

1. **REPLACE INTAKE VALVE GUIDE BUSH**
   a. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
   b. Place the cylinder head on wooden blocks.
   c. Using SST and a hammer, tap out the valve guide bush.
      - **SST: 09201-01055**
      - **SST: 09950-70010**
        09951-07100



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Fig. 404: Tapping Out Valve Guide Bush Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

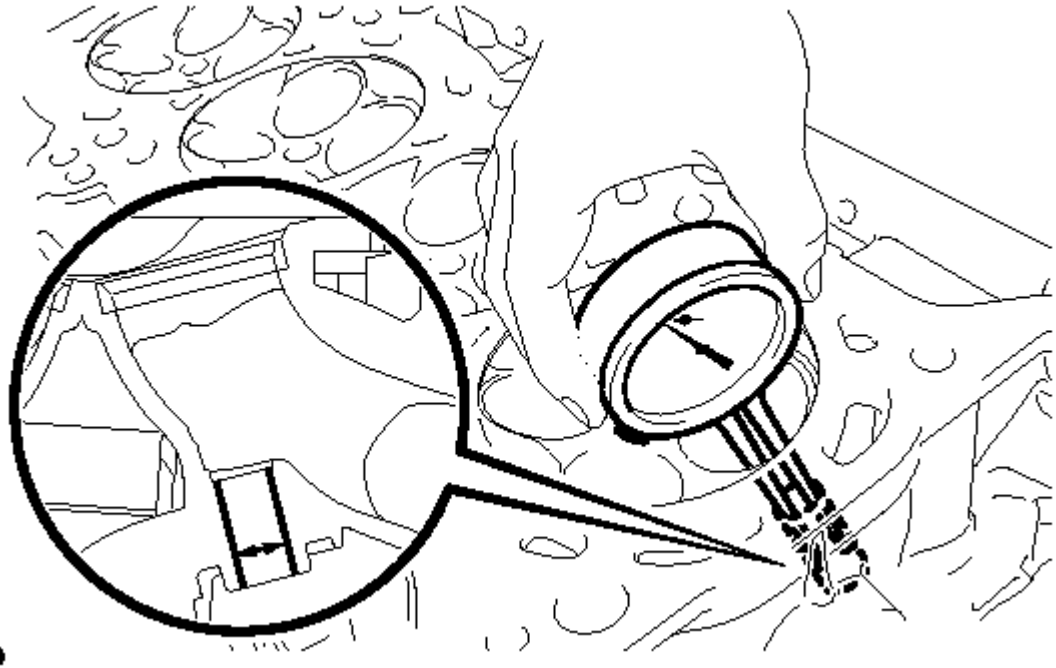


Fig. 405: View Of Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard bush bore diameter

10.285 to 10.306 mm (0.405 to 0.406 in.)

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

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

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

Bush Bore Diameter

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

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Standard bush length

41.3 to 41.7 mm (1.626 to 1.642 in.)

g. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
h. Using SST and a hammer, tap in the selected guide bush to the standard protrusion height.
   - **SST: 09201-10000**
     09201-01050
   - **SST: 09950-70010**
     09951-07100

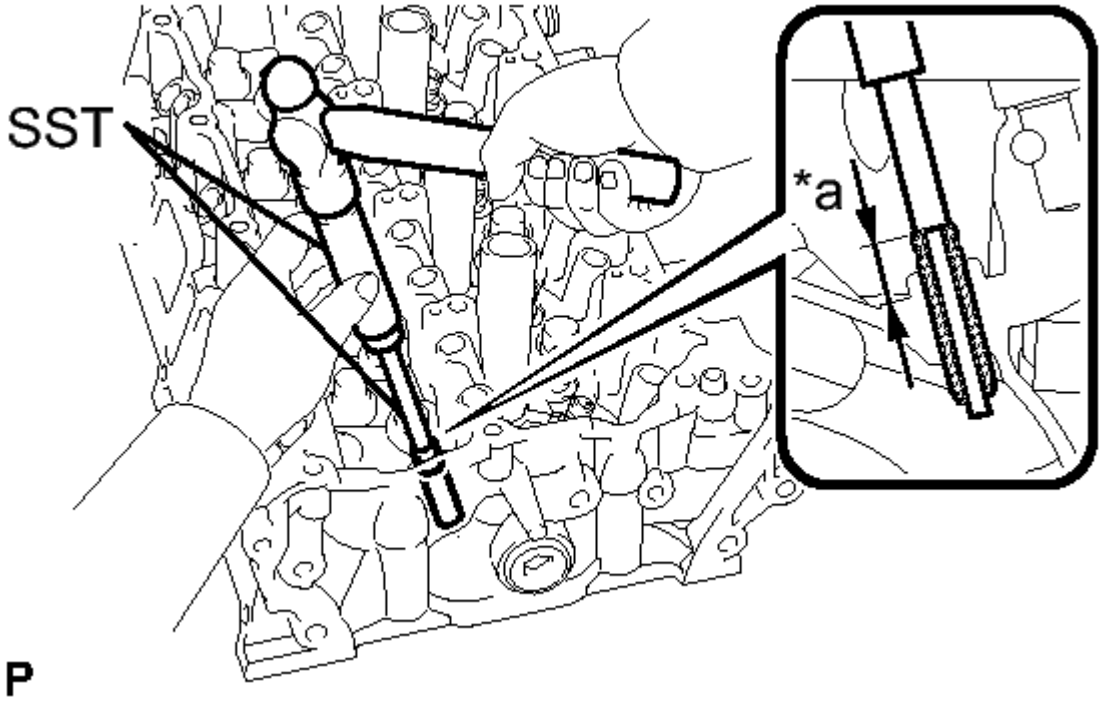


Fig. 406: Tapping Selected Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard protrusion height

14.8 to 15.2 mm (0.582 to 0.598 in.)

TEXT IN ILLUSTRATION

*a	Height

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

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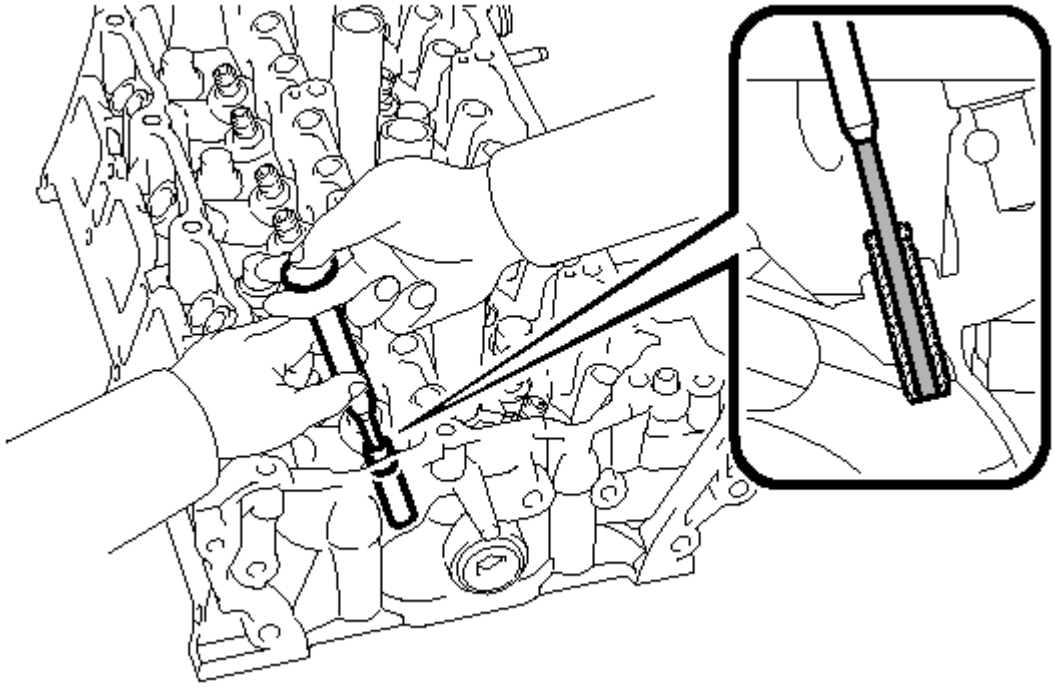


Fig. 407: View Of Reaming Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard oil clearance

0.025 to 0.060 mm (0.000984 to 0.00236 in.)

2. **REPLACE EXHAUST VALVE GUIDE BUSH**
   a. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
   b. Place the cylinder head on wooden blocks.
   c. Using SST and a hammer, tap out the valve guide bush.
      - **SST: 09201-01055**
      - **SST: 09950-70010**
        09951-07100

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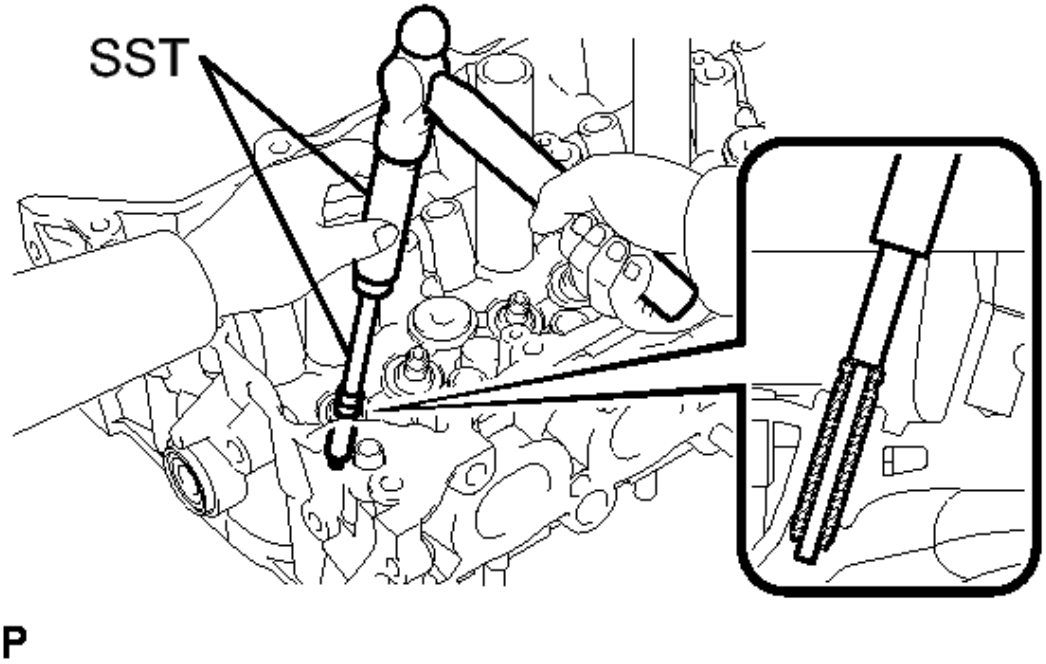


Fig. 408: Tapping Out Valve Guide Bush Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

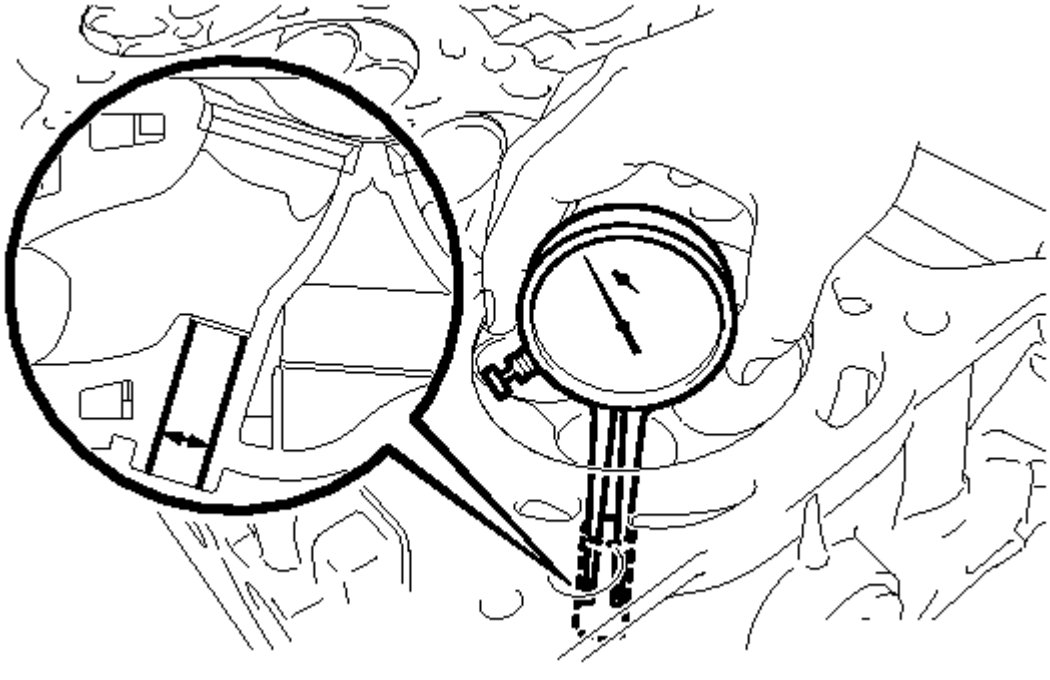


Fig. 409: View Of Measuring Bush Bore Diameter Of Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Standard bush bore diameter

10.285 to 10.306 mm (0.405 to 0.406 in.)

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

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

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

Bush Bore Diameter

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

Standard bush length

46.8 to 47.2 mm (1.843 to 1.858 in.)

g. Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
h. Using SST and a hammer, tap in the selected guide bush to the standard protrusion height.
   - **SST: 09201-10000**
     09201-01050
   - **SST: 09950-70010**
     09951-07100

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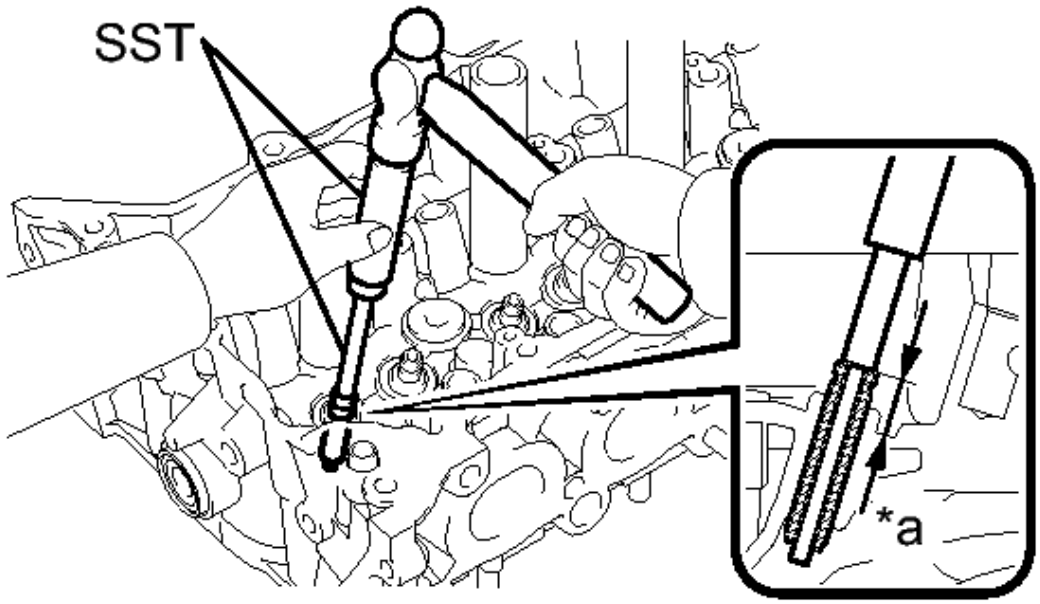


Fig. 410: Tapping Selected Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard protrusion height

14.2 to 14.6 mm (0.559 to 0.575 in.)

TEXT IN ILLUSTRATION

*a	Height

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

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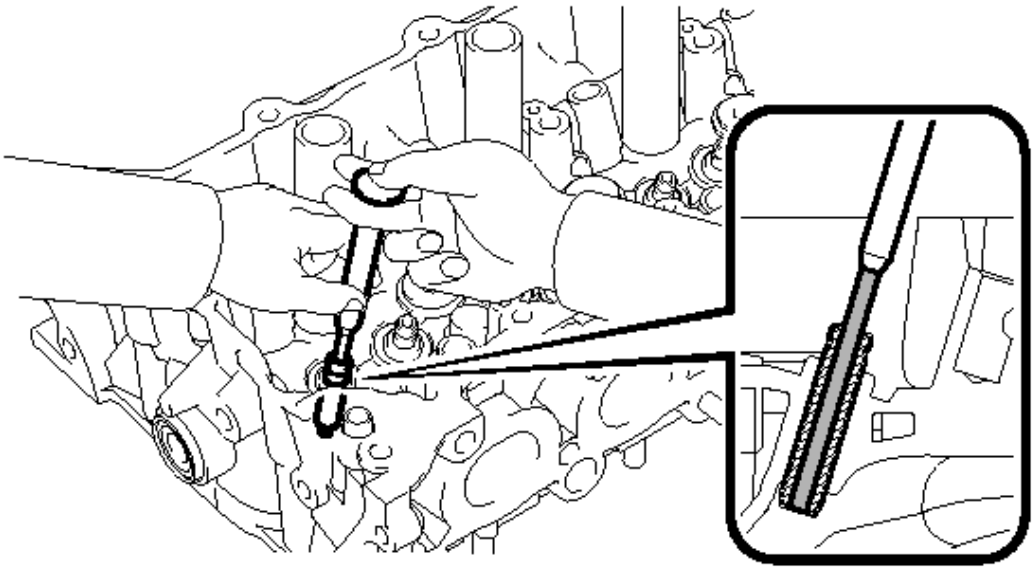


Fig. 411: View Of Reaming Guide Bush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard oil clearance

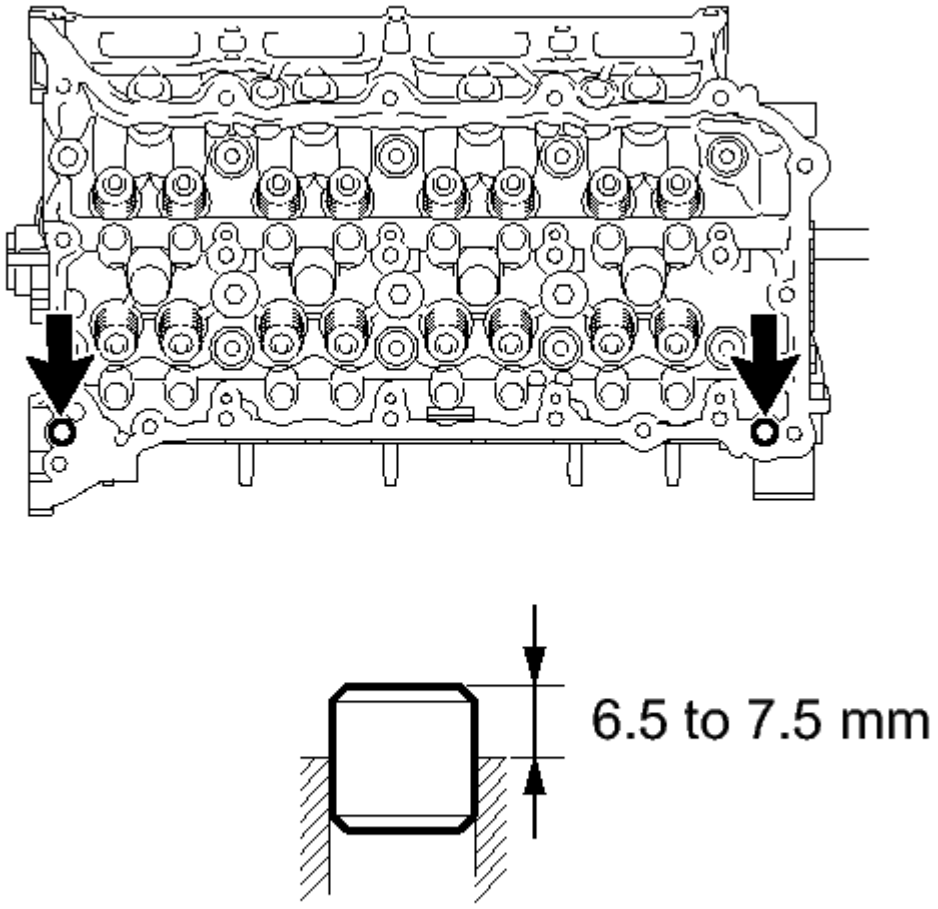
0.030 to 0.065 mm (0.00118 to 0.00256 in.)

3. **REPLACE RING PIN**

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

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

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Fig. 412: Identifying Ring Pins & Standard Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard protrusion height

6.5 to 7.5 mm (0.256 to 0.295 in.)

REASSEMBLY [08/2013 -]

REASSEMBLY [08/2013 -]

HINT:

Perform "Inspection After Repair" after replacing the cylinder head sub-assembly. Refer to **INITIALIZATION [08/2013 -]** .

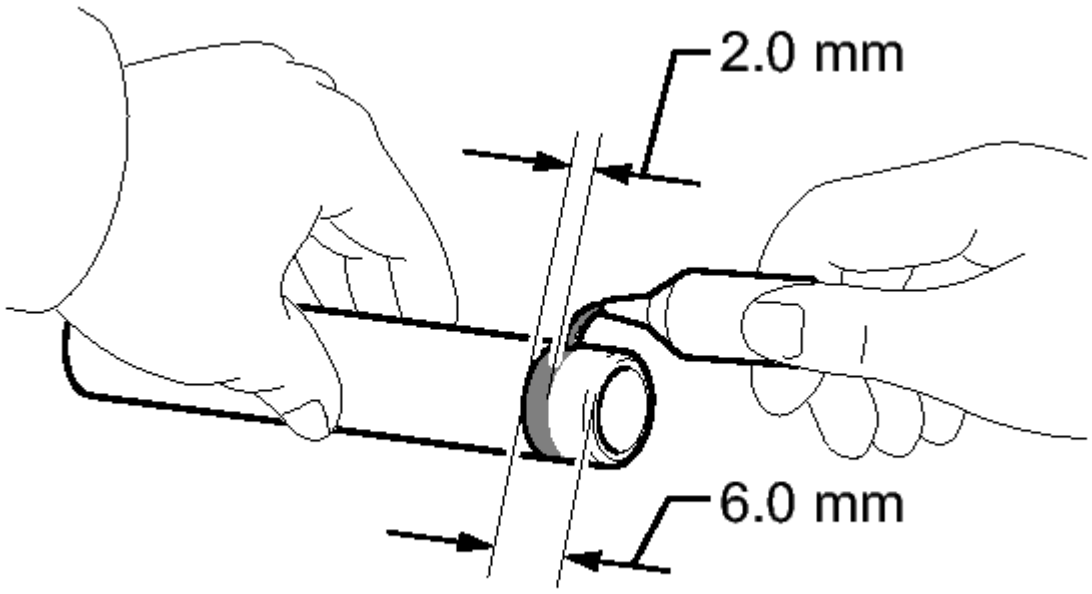
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1. **INSTALL SPARK PLUG TUBE**

HINT:

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

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



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Fig. 413: View Of Applying Adhesive Onto Shaded Area
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Adhesive

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent.

Standard application width

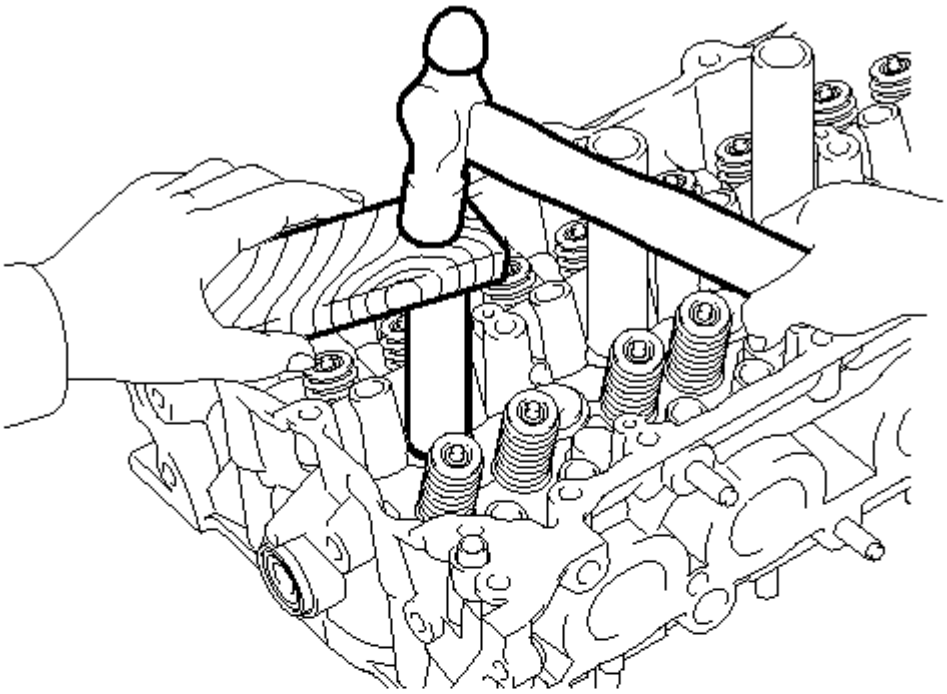
2.0 mm (0.0787 in.)

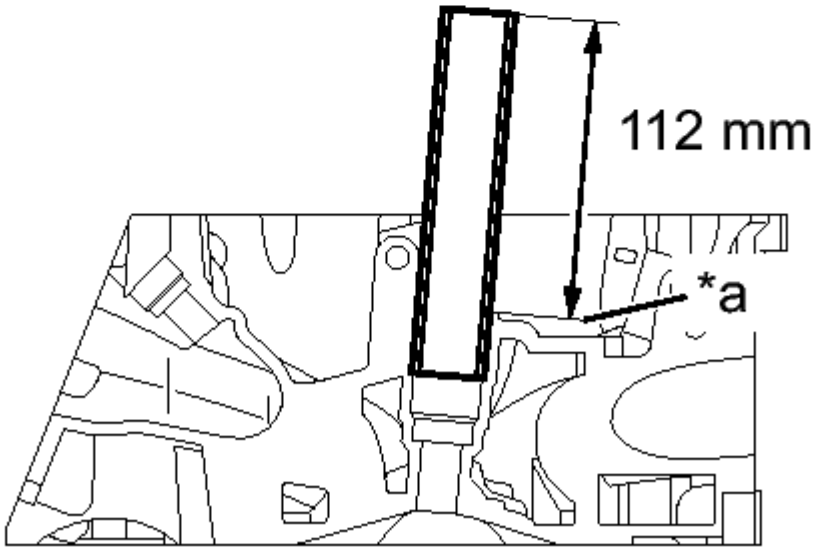
NOTE:

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

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

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Fig. 414: Tapping Spark Plug Tube To Specified Protrusion Height Using A Wooden Block & Hammer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

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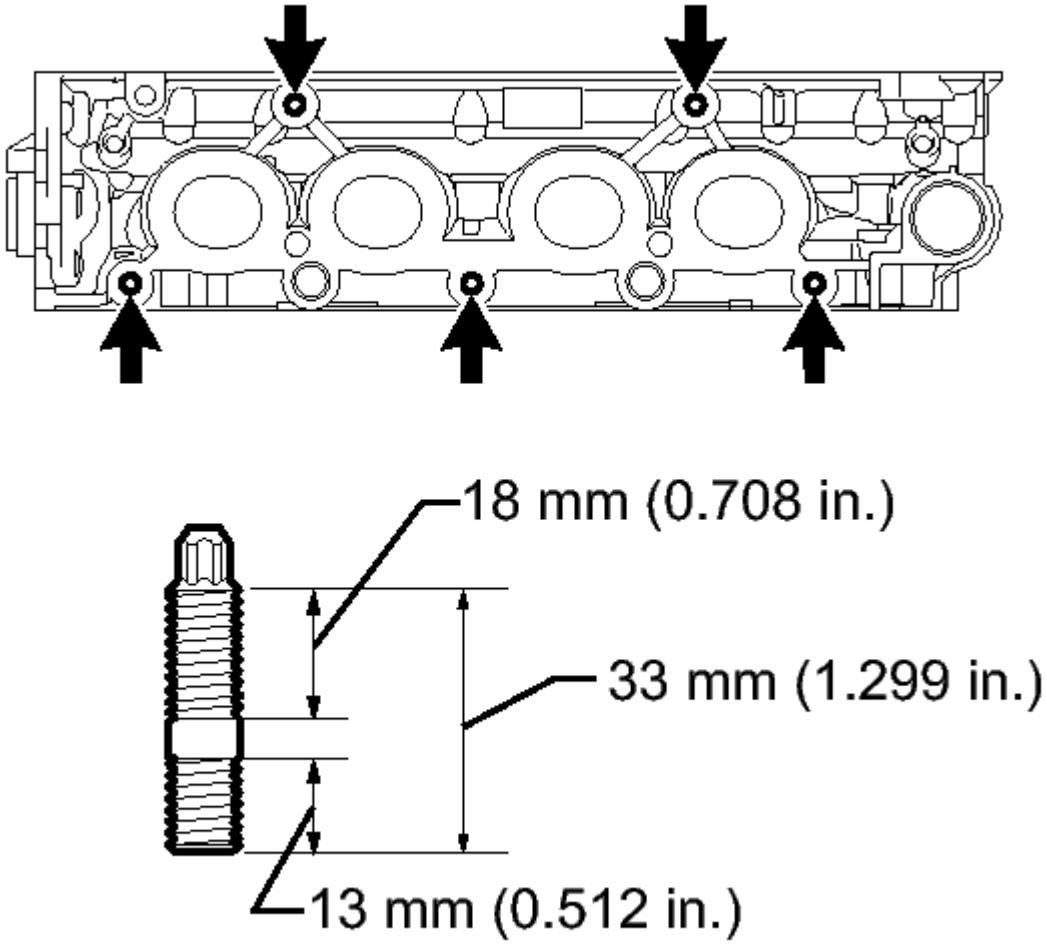
*a	Cylinder Head Casting Surface

Standard protrusion height

112 mm (4.41 in.)

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

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



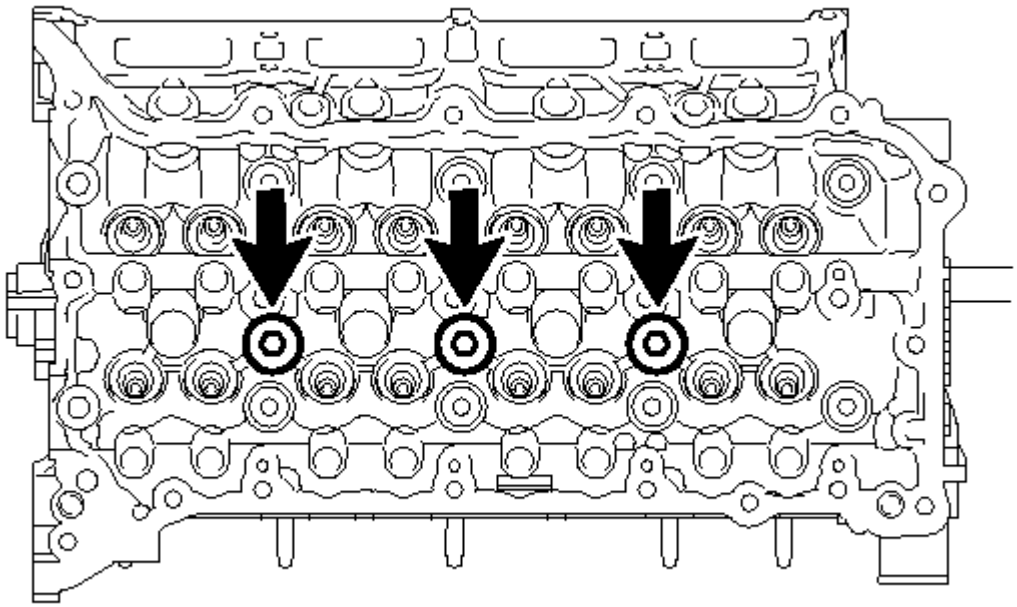
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Fig. 415: Identifying Cylinder Head Stud Bolt Dimensions
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

3. **INSTALL NO. 1 STRAIGHT SCREW PLUG**
   a. Using a 10 mm hexagon wrench, install 3 new gaskets and the 3 straight screw plugs.



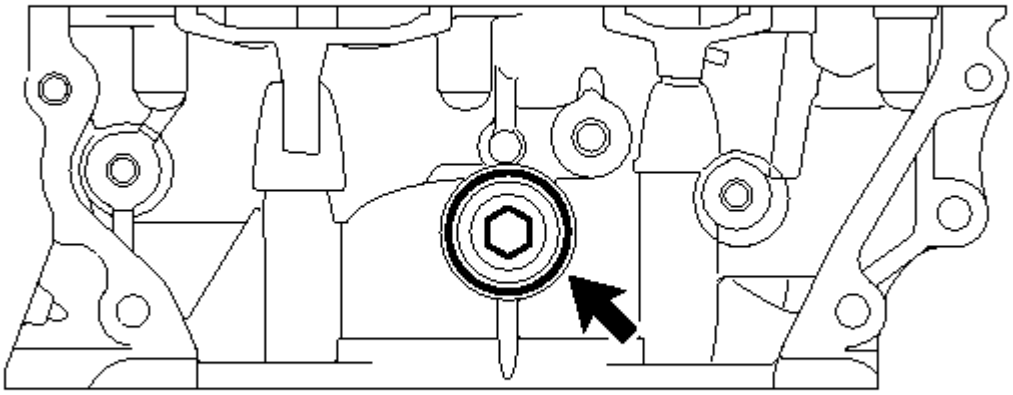
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Fig. 416: Locating No. 1 Straight Screw Plugs
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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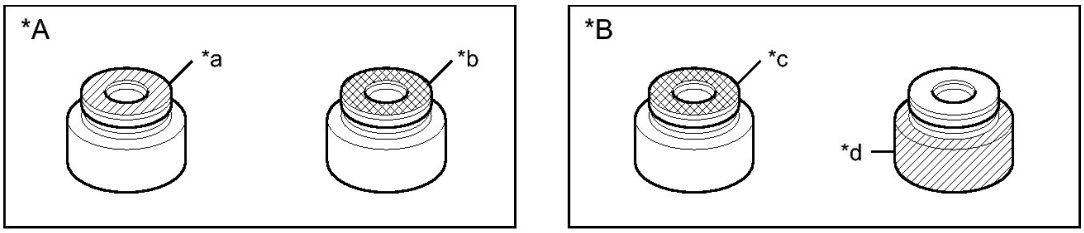


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Fig. 417: Locating No. 2 Straight Screw Plug
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

5. **INSTALL VALVE SPRING SEAT**
   a. Install the valve spring seats to the cylinder head.
6. **INSTALL VALVE STEM OIL SEAL**
   a. Apply a light coat of engine oil to new oil seals.



c

Fig. 418: Identifying Valve Stem Oil Seals
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*A	for Intake Side	*B	for Exhaust Side
*a	Gray (for Intake Side)	*b	Black (for Intake Side)
*c	Black (for Exhaust Side)	*d	Gray (for Exhaust Side)

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

HINT:

- for Intake Side

  The intake side valve stem oil seals is gray or black.

- for Exhaust Side

  The exhaust side valve stem oil seals is black or gray.

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

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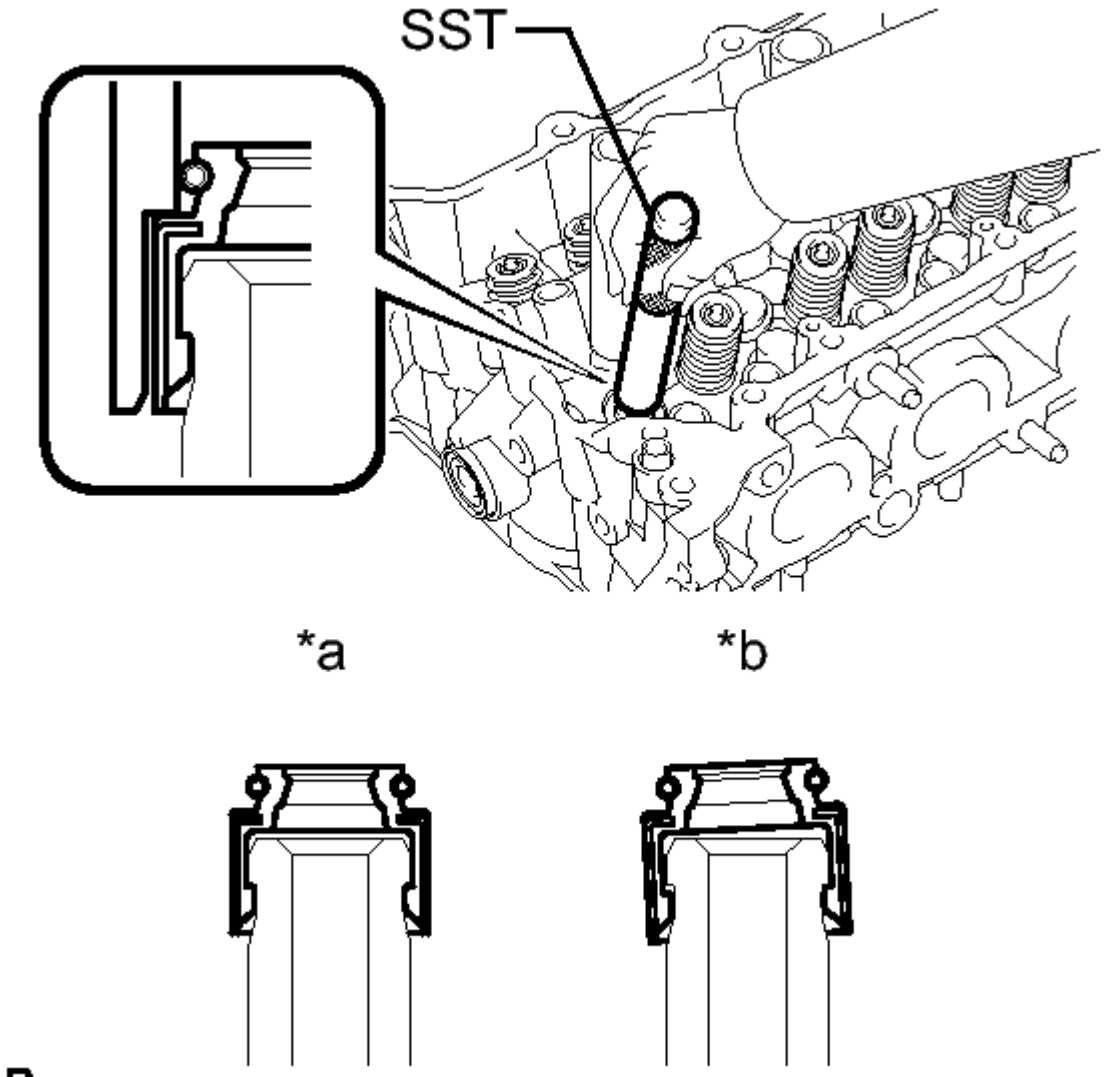


Fig. 419: Installing Valve Oil Seals using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

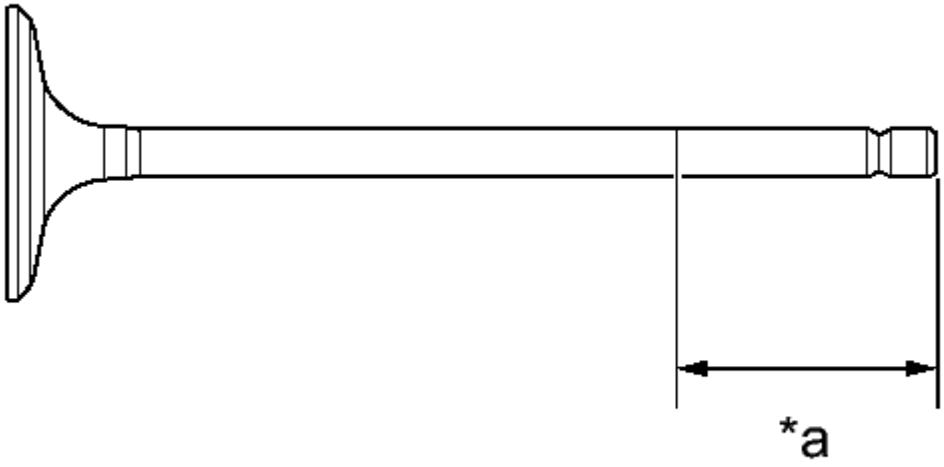
*a	CORRECT
*b	INCORRECT

- **SST: 09201-41020**

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

7. **INSTALL INTAKE VALVE**
   a. Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.

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Fig. 420: Measuring Exhaust Or Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	30 mm (1.18 in.) or more

b. Install the valve, compression spring and spring retainer to the cylinder head.

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

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

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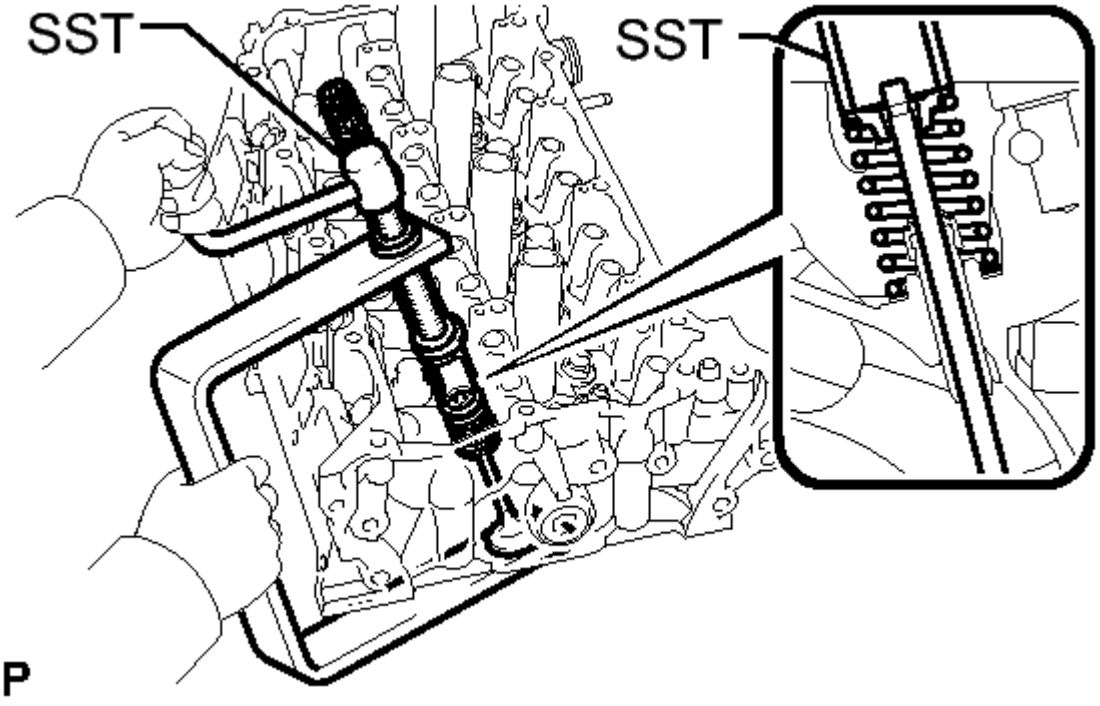
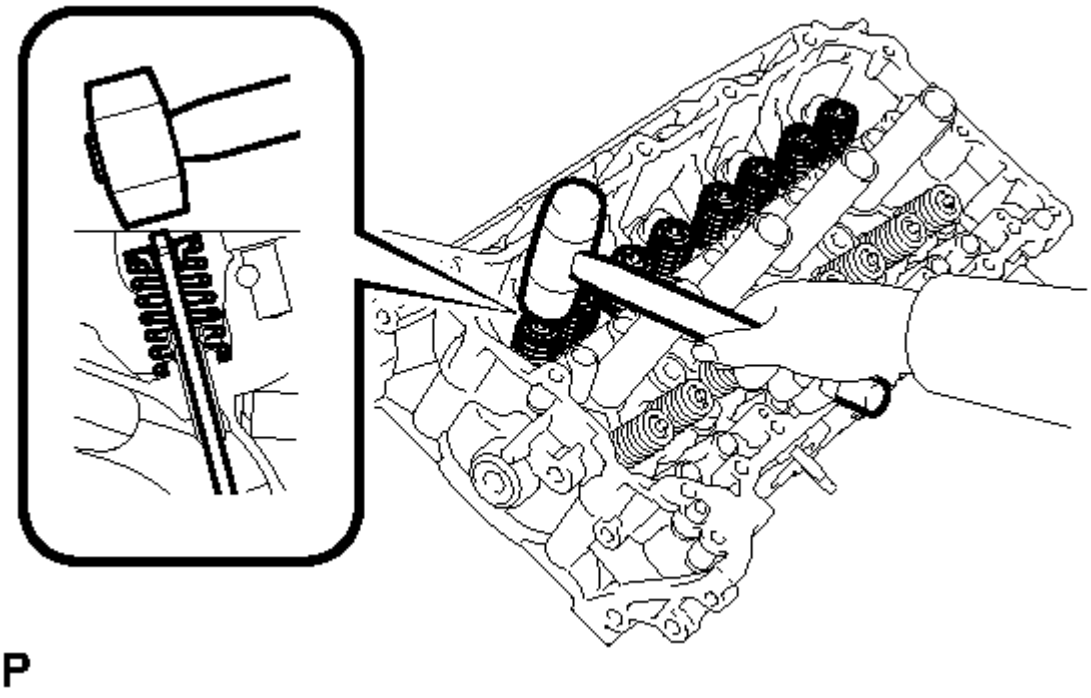


Fig. 421: View Of Compressing The Intake Valve Compression Spring Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09202-70020**
  09202-00010

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

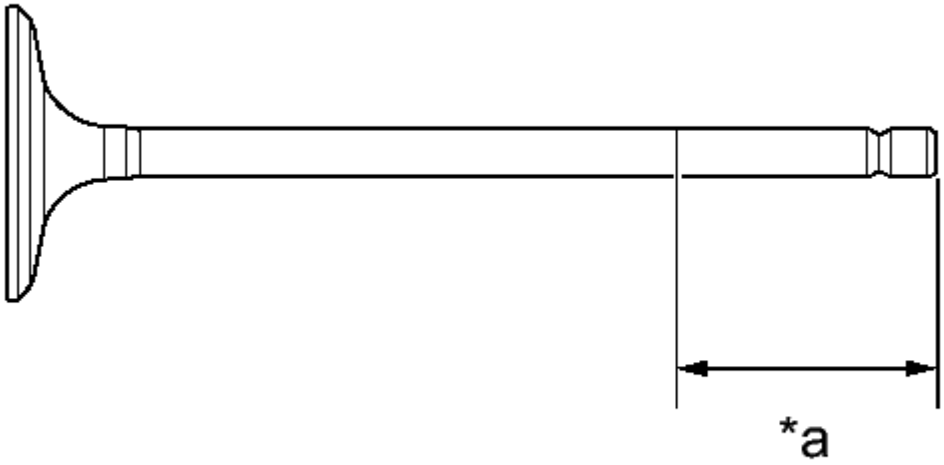


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Fig. 422: View Of Tapping Valve Stem Tip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful not to damage the retainer.

8. **INSTALL EXHAUST VALVE**
   a. Apply plenty of engine oil to the tip area of the exhaust valve shown in the illustration.



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Fig. 423: Measuring Exhaust Or Intake Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

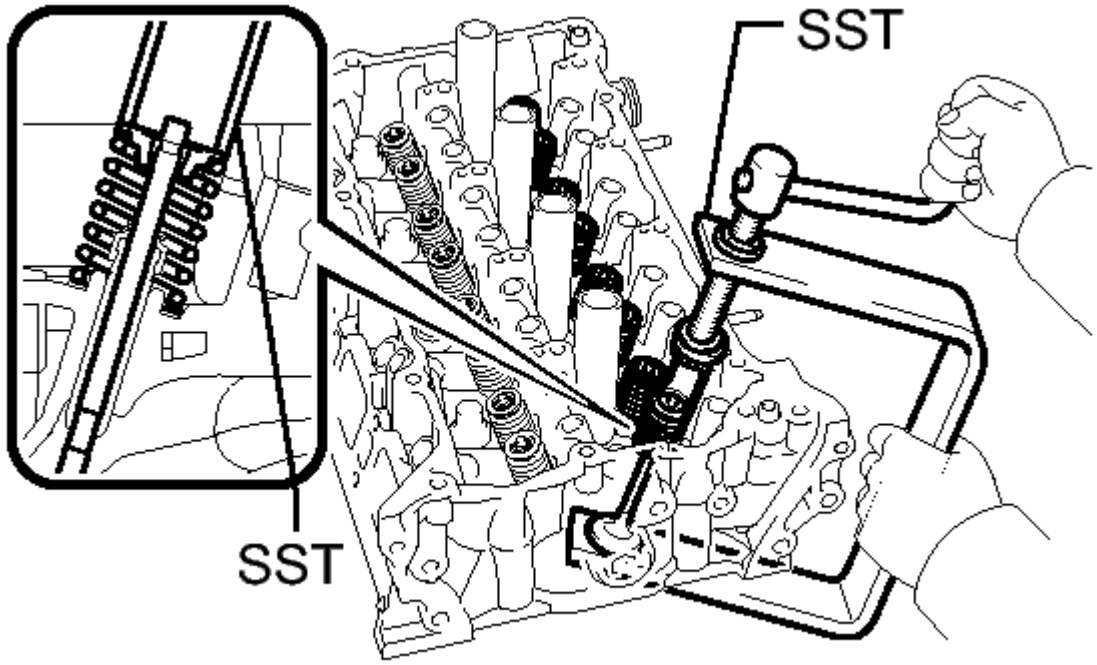
*a	30 mm (1.18 in.) or more

   b. Install the valve, compression spring and spring retainer to the cylinder head.

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

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

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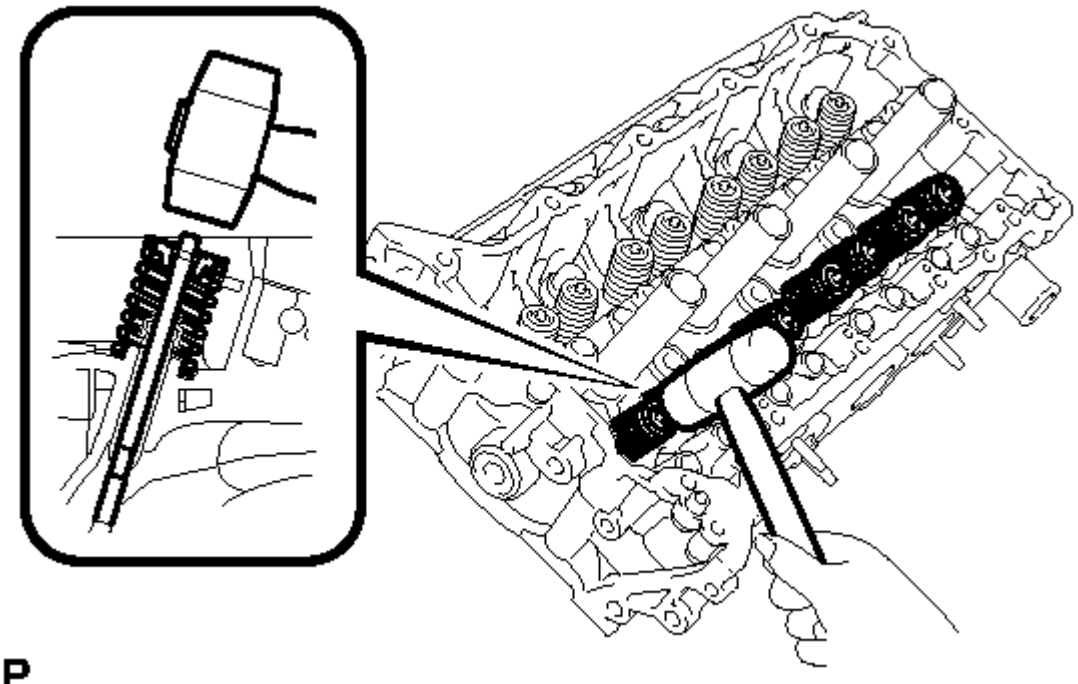


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Fig. 424: View Of Compressing The Exhaust Valve Compression Spring Using SST
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- **SST: 09202-70020**
  09202-00010

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



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Fig. 425: View Of Tapping Valve Stem Tip
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Be careful not to damage the retainer.

REPAIR [08/2013 -]

REPAIR [08/2013 -]

1. **REPAIR INTAKE VALVE SEAT**

NOTE:

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

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

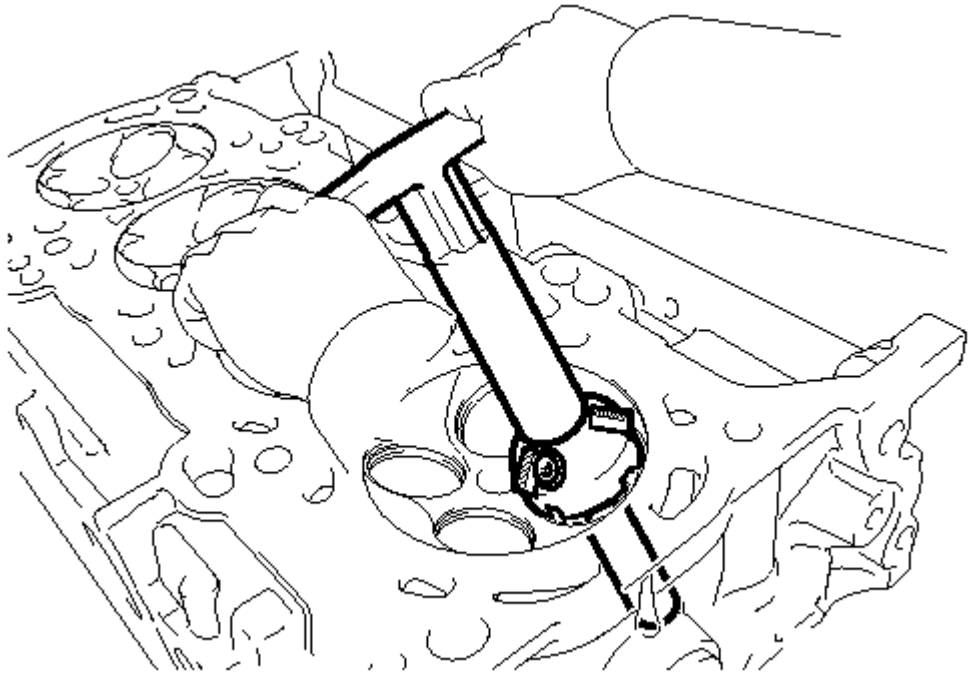
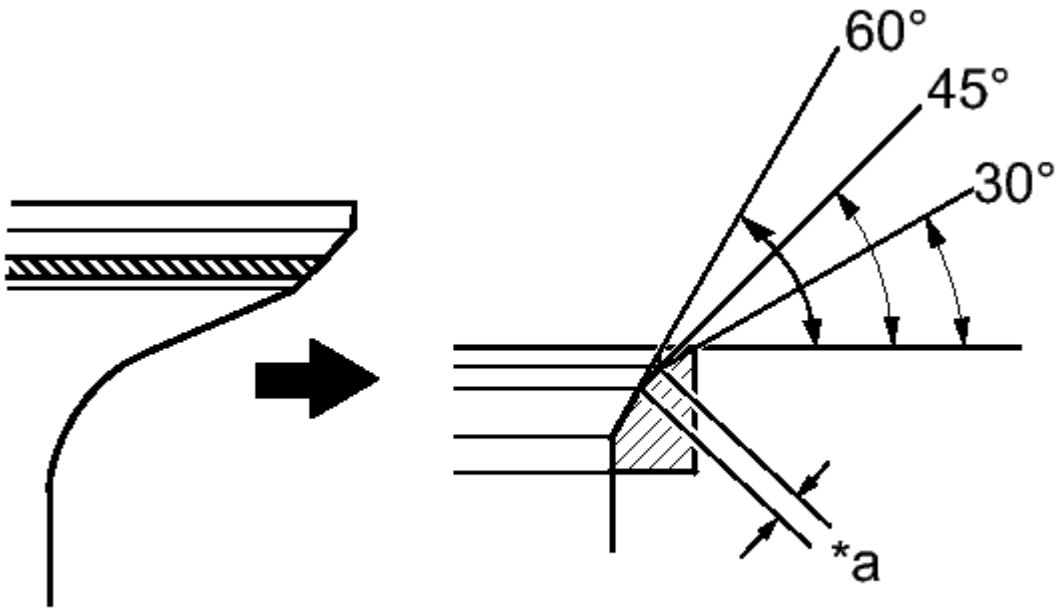


Fig. 426: View Of Cutting Intake Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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Fig. 427: Measuring Seat Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard width

1.0 to 1.4 mm (0.0394 to 0.0551 in.)

TEXT IN ILLUSTRATION

*a	Width

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

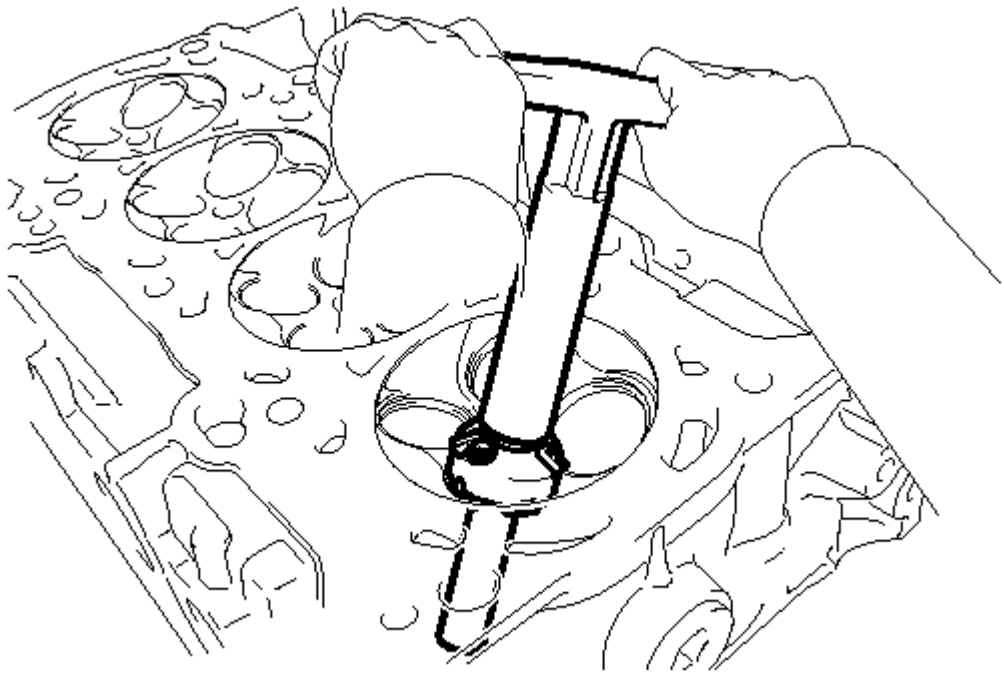
2. **REPAIR EXHAUST VALVE SEAT**

NOTE:

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

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

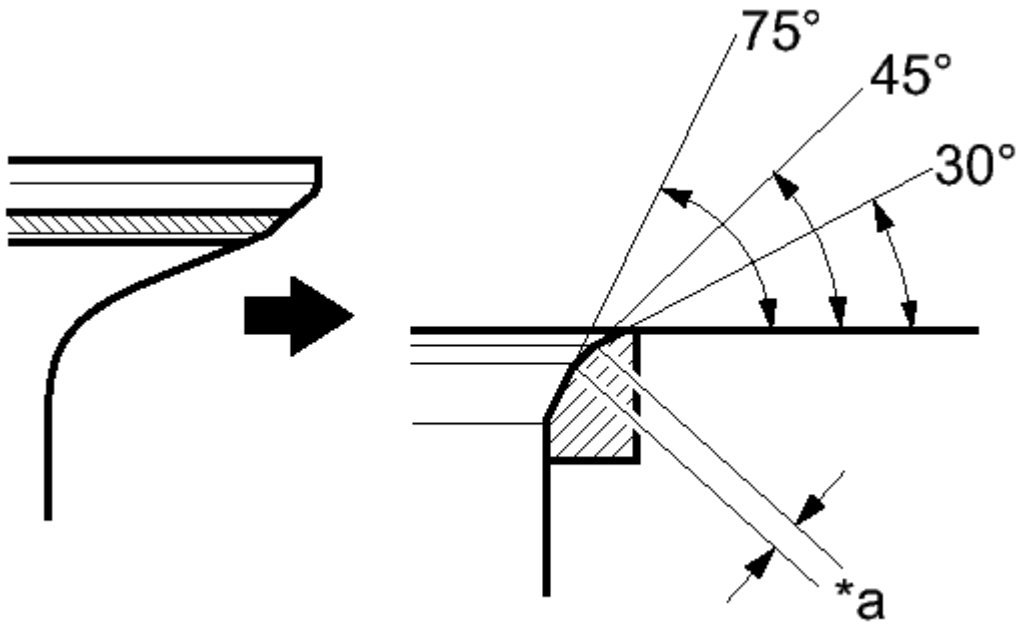
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Fig. 428: View Of Resurfacing Exhaust Valve Seat
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



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Fig. 429: Measuring Seat Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard width

1.2 to 1.6 mm (0.0472 to 0.0630 in.)

TEXT IN ILLUSTRATION

*a	Width

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

CYLINDER BLOCK

COMPONENTS [08/2013 -]

ILLUSTRATION

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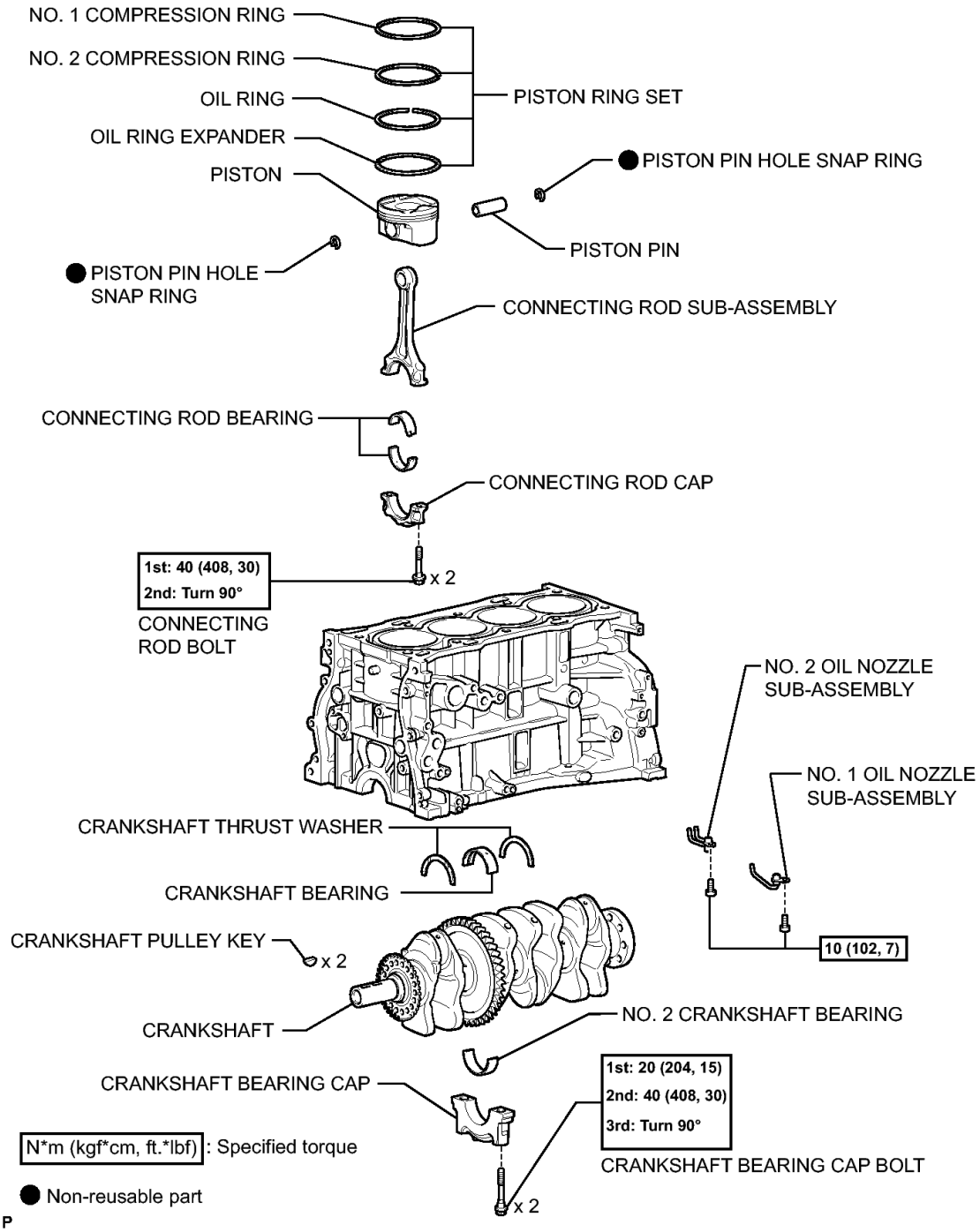


Fig. 430: Identifying Cylinder Block Replacement Components With Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

DISASSEMBLY [08/2013 -]

DISASSEMBLY [08/2013 -]

1. **INSPECT CONNECTING ROD THRUST CLEARANCE**

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



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Fig. 431: View Of Measuring Connecting Rod Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.160 to 0.512 mm (0.00630 to 0.0202 in.)

Maximum thrust clearance

0.512 mm (0.0202 in.)

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

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

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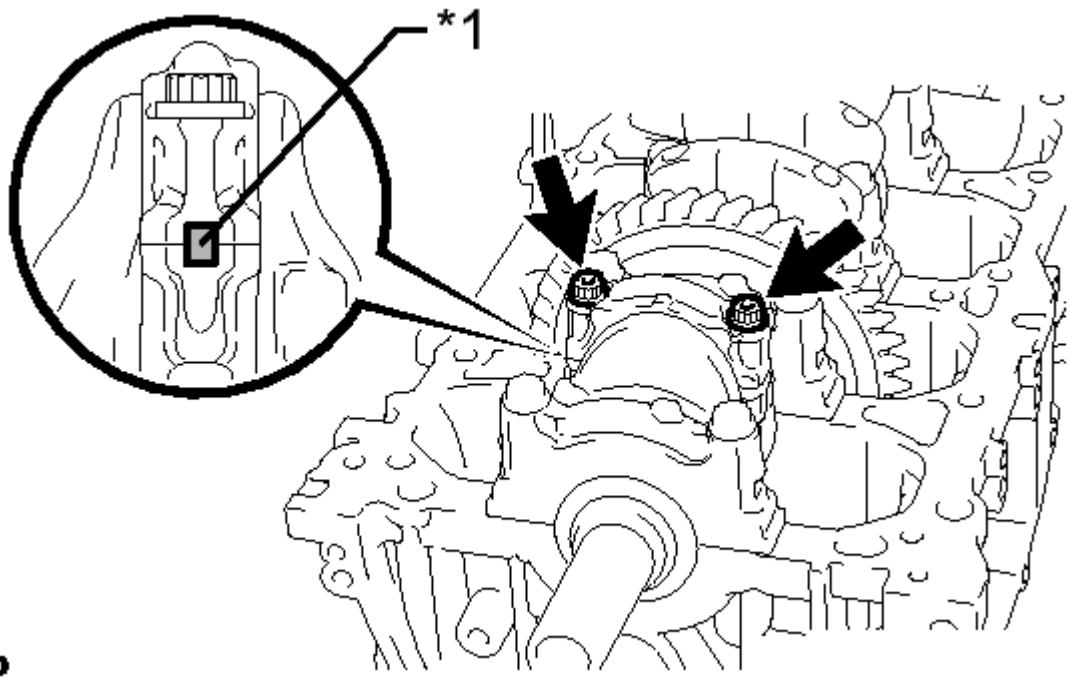


Fig. 432: Identifying Alignment Marks On Connecting Rod And Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Alignment Mark

b. Remove the 2 bolts and connecting rod cap.

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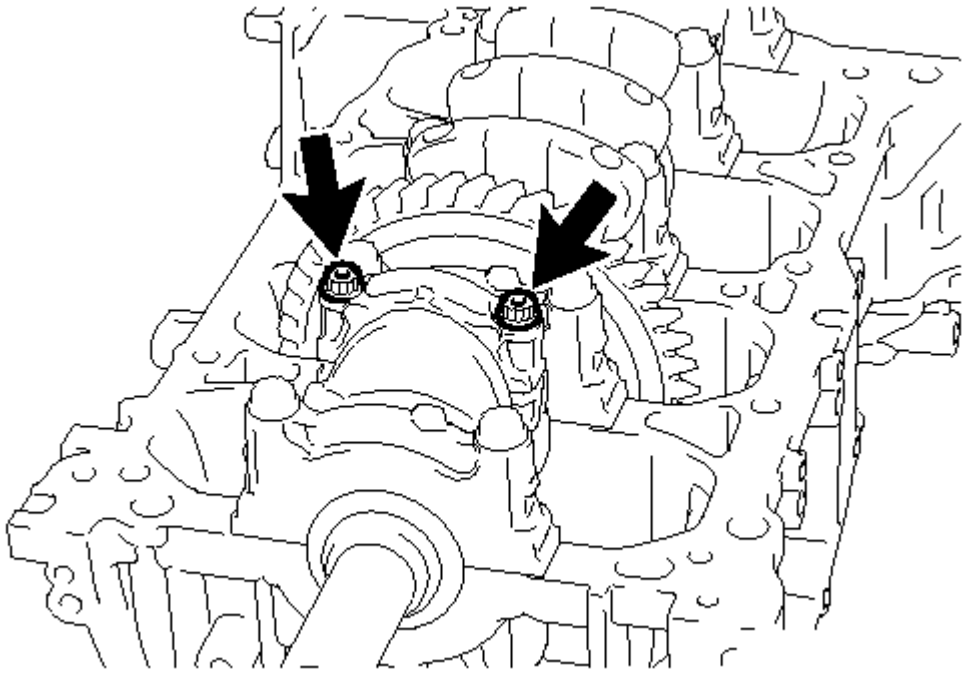


Fig. 433: Locating Connecting Rod Component Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

HINT:

Keep the lower bearing and connecting rod cap together.

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

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

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

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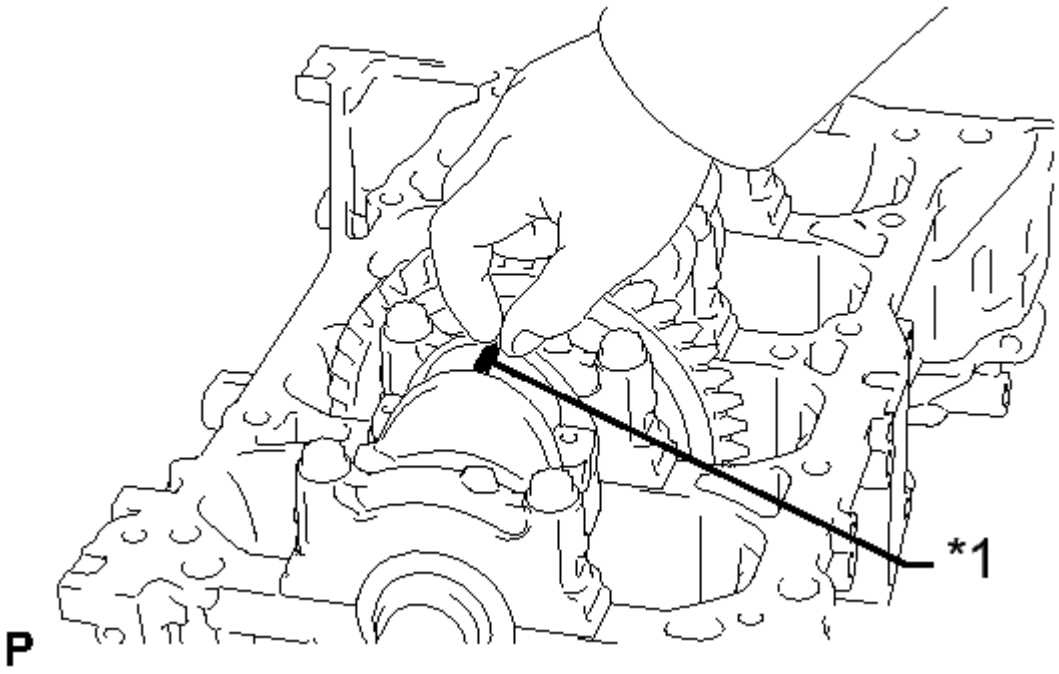


Fig. 434: Laying Plastigage On Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Plastigage

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

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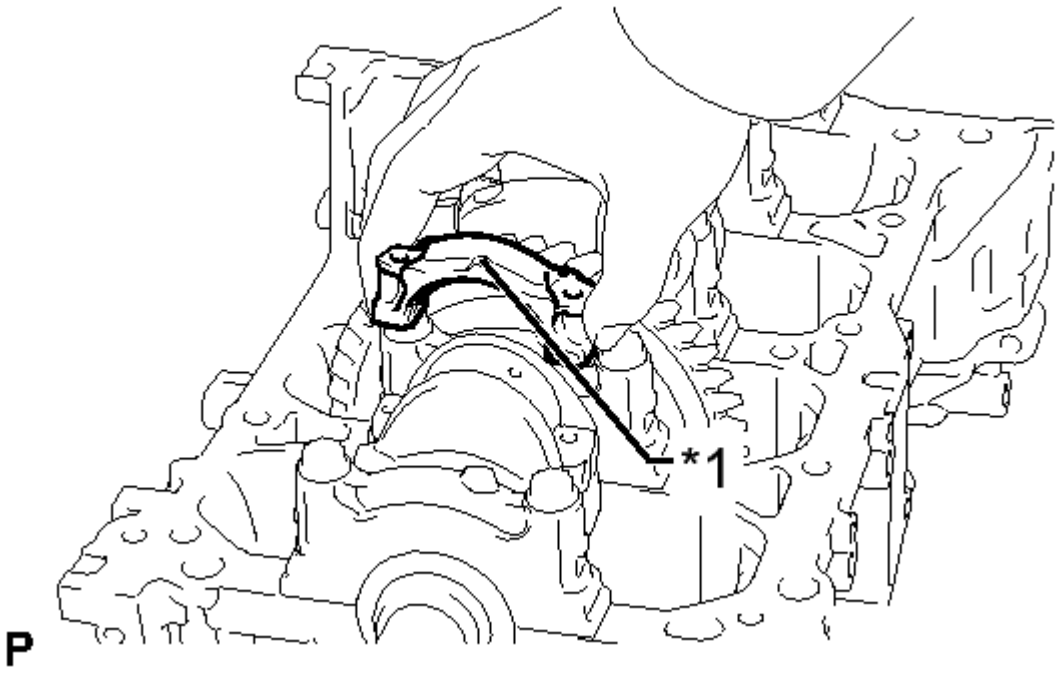


Fig. 435: Identifying Front Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Front Mark

g. Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.

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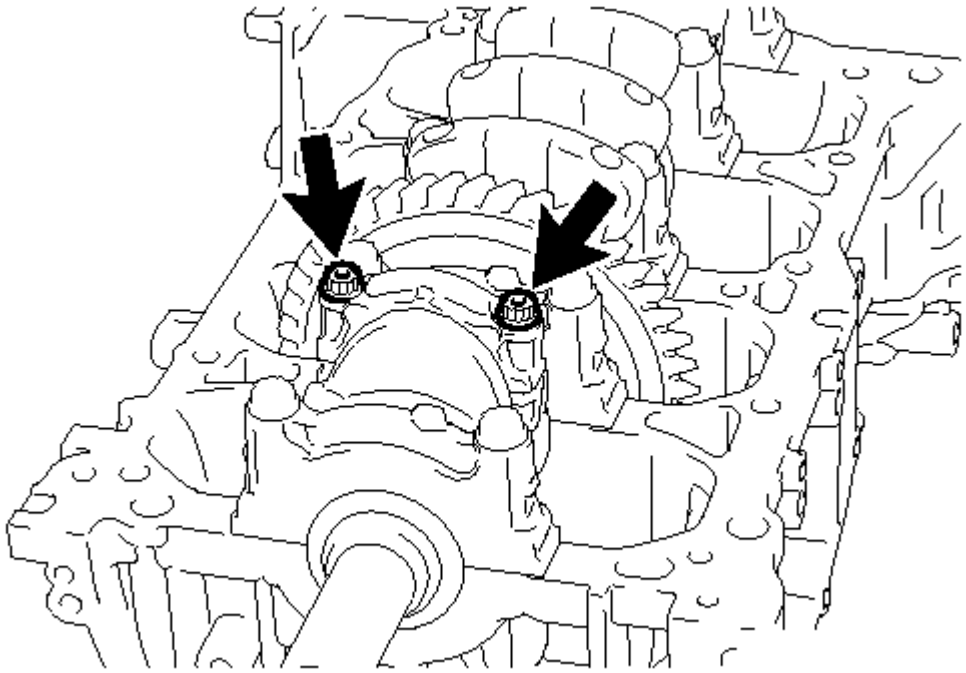


Fig. 436: Locating Connecting Rod Component Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

h. Install and alternately tighten the bolts of the connecting rod cap in several steps.

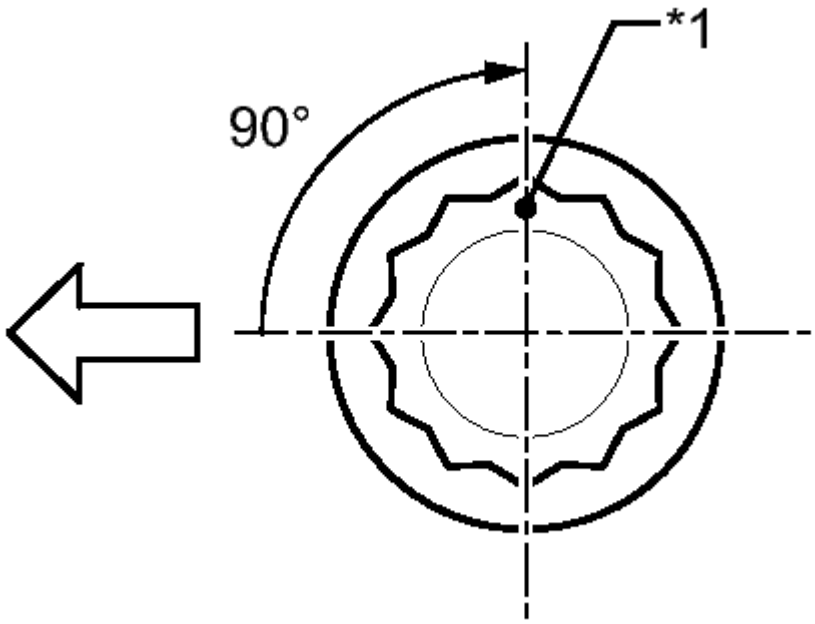
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)

NOTE: Do not turn the crankshaft during the measurement.

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

i. Mark the front of each connecting rod bolt with paint.

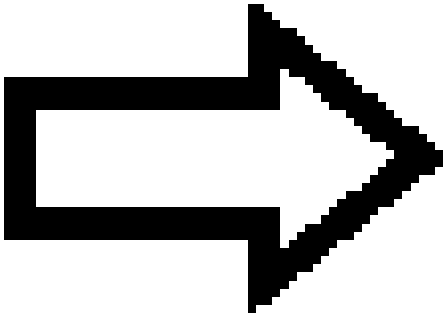
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Fig. 437: Identifying Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Paint Mark
	Engine Front

j. Tighten the bolts 90° as shown in the illustration.

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NOTE: Do not turn the crankshaft during the measurement.

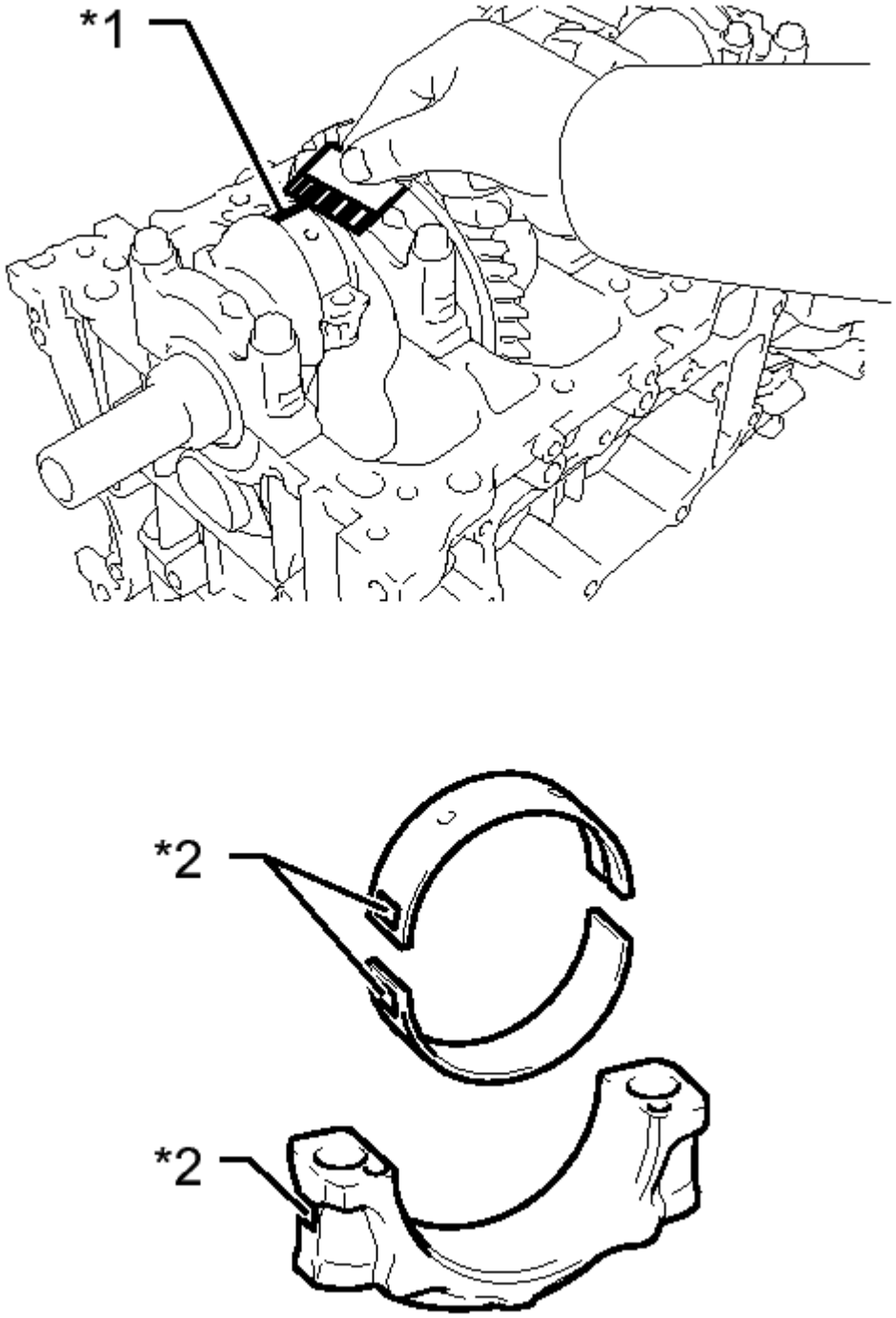
k. Remove the 2 bolts and connecting rod cap.

HINT:

Keep the lower bearing and connecting rod cap together.

l. Measure the Plastigage at its widest point.

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Fig. 438: Measuring Plastigage Widest Point
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Plastigage

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*2	Number Mark

Standard oil clearance

0.030 to 0.063 mm (0.00118 to 0.00248 in.)

Maximum oil clearance

0.07 mm (0.00276 in.)

NOTE: Remove the Plastigage completely after the measurement.

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

HINT:

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

Standard crank pin diameter

51.492 to 51.500 mm (2.0272 to 2.0276 in.)

Standard Connecting Rod Big End Inside Diameter

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

Standard Size Bearing Center Wall Thickness

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

m. Perform the inspection above for each cylinder.

3. **REMOVE PISTON WITH CONNECTING ROD**

a. Using a ridge reamer, remove all the carbon from the top of the cylinder.

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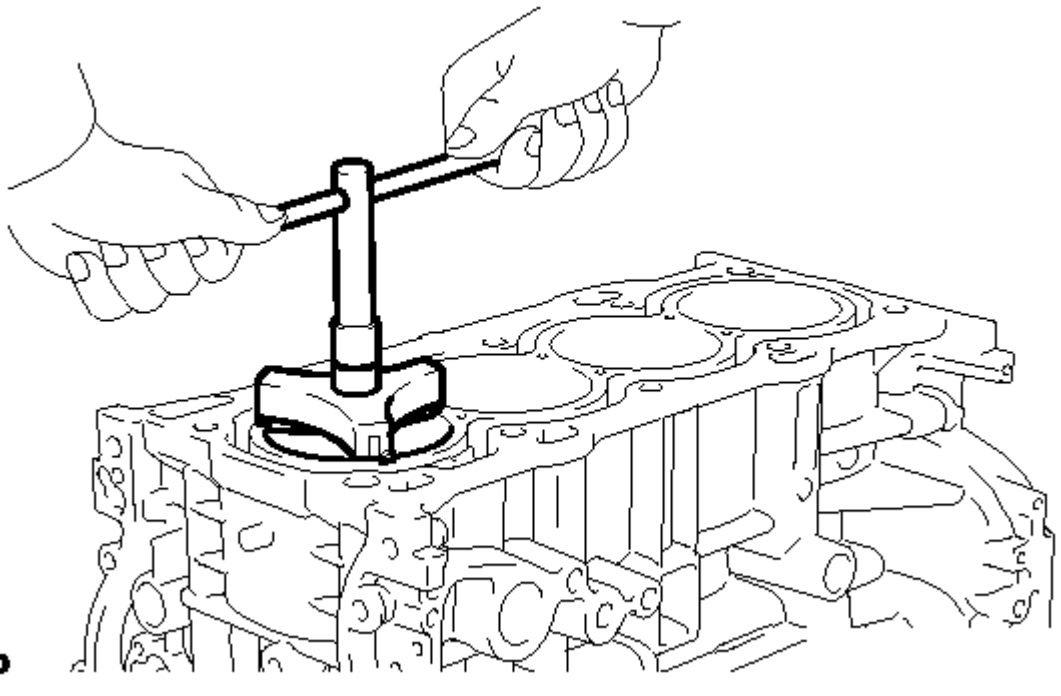


Fig. 439: View Of Removing Carbon From Top Of Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

HINT:

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

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

   HINT:

   Arrange the removed parts in the correct order.

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

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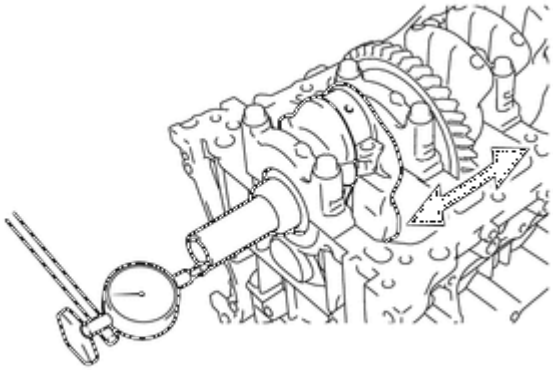


Fig. 440: View Of Measuring Crankshaft Thrust Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard thrust clearance

0.04 to 0.24 mm (0.00157 to 0.00945 in.)

Maximum thrust clearance

0.30 mm (0.0118 in.)

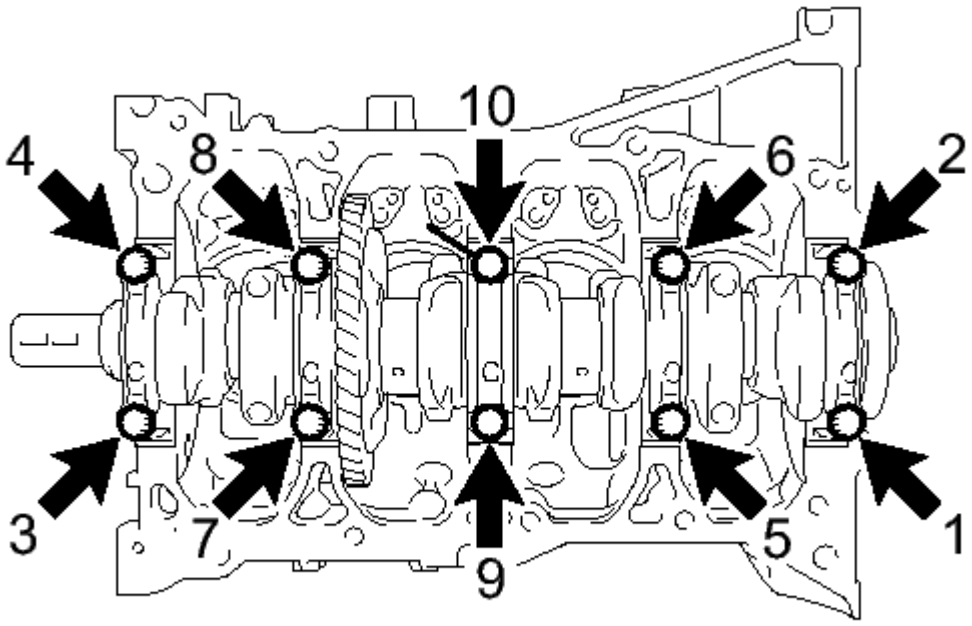
If the thrust clearance is more than the maximum, replace the thrust washers as a set. If necessary, replace the crankshaft.

Standard thrust washer thickness

1.93 to 1.98 mm (0.0760 to 0.0780 in.)

6. **REMOVE CRANKSHAFT**
   a. Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

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Fig. 441: Identifying Bearing Cap Bolts With Loosening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

b. Remove the 5 bearing caps from the cylinder block.

HINT:

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

c. Remove the crankshaft from the cylinder block.

HINT:

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

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

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

7. **REMOVE CRANKSHAFT THRUST WASHER**
   a. Remove the thrust washers from the cylinder block.

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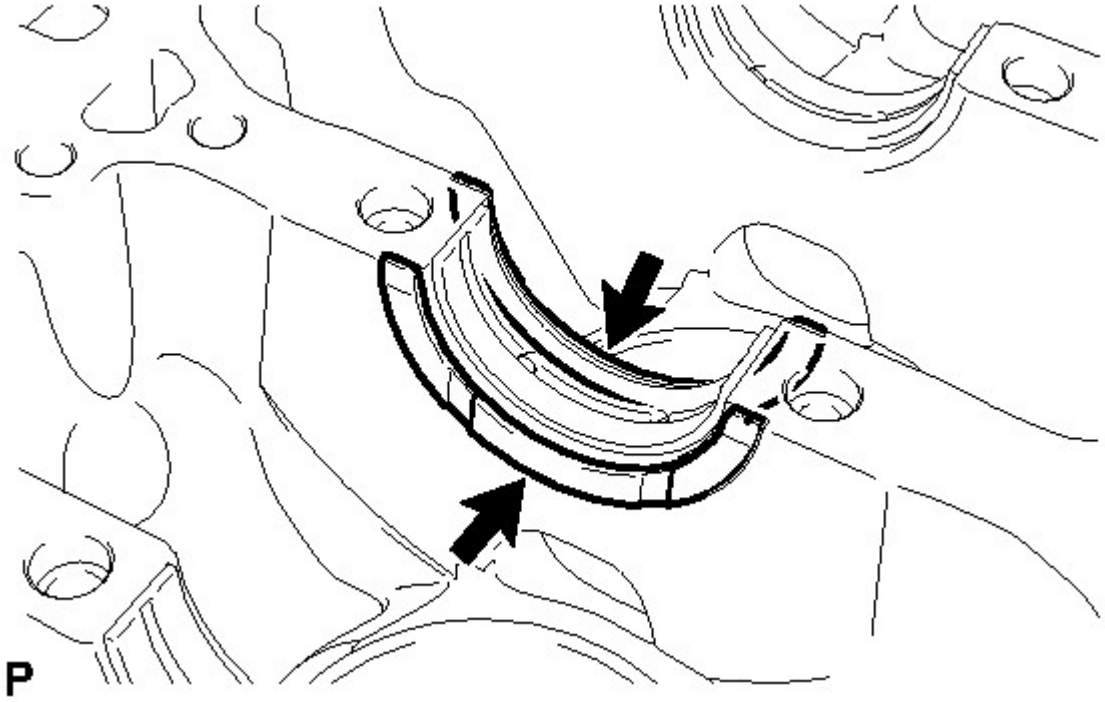


Fig. 442: Thrust Washer
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **REMOVE CRANKSHAFT BEARING**
   a. Remove the crankshaft bearings from the cylinder block and bearing caps.

      HINT:

      Arrange the bearings in the correct order.

9. **REMOVE CRANKSHAFT PULLEY KEY**
   a. Using a screwdriver, remove the 2 pulley keys from the crankshaft.
10. **REMOVE PISTON RING SET**
   a. Using a piston ring expander, remove the 2 compression rings.

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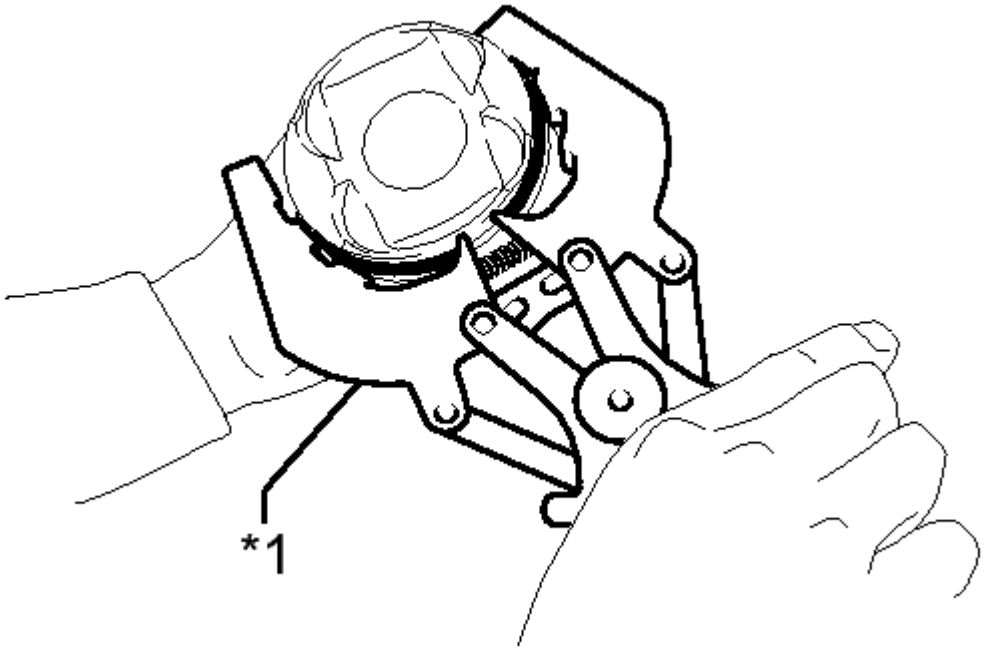


Fig. 443: Removing Piston Compression Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Piston Ring Expander

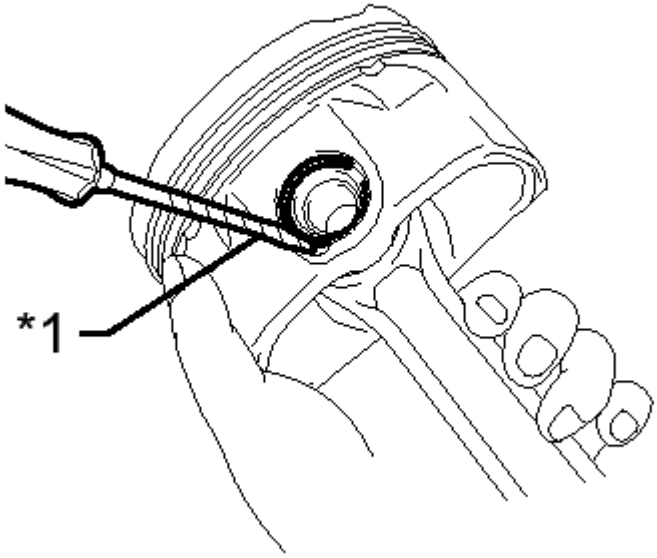
b. Remove the oil ring and expander by hand.

HINT:

Arrange the removed parts in the correct order.

11. **REMOVE PISTON PIN HOLE SNAP RING**
    a. Using a screwdriver, pry out the 2 snap rings.

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Fig. 444: Identifying Snap Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

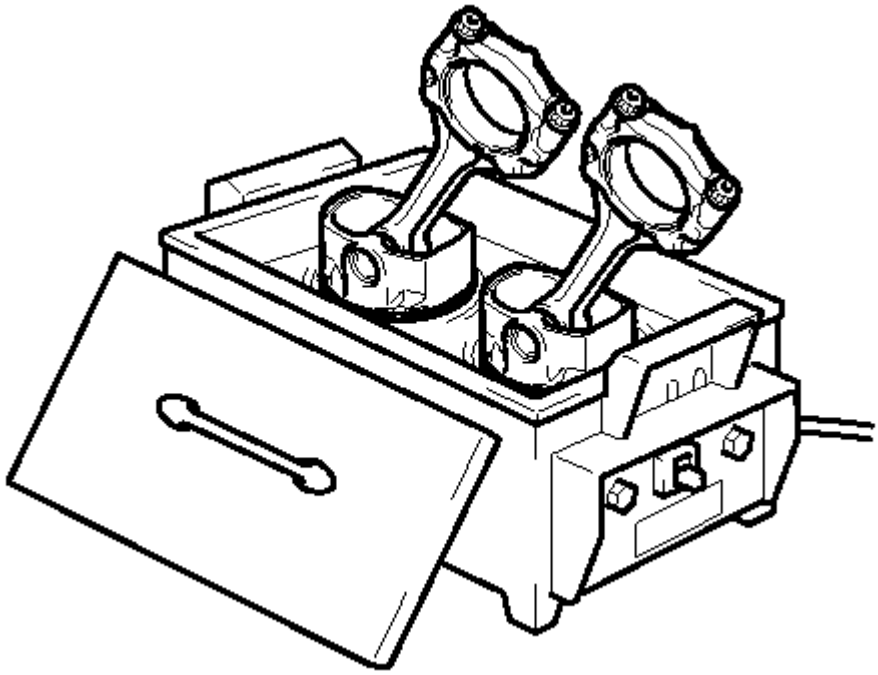
*1	Protective Tape

HINT:

Tape the screwdriver tip before use.

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

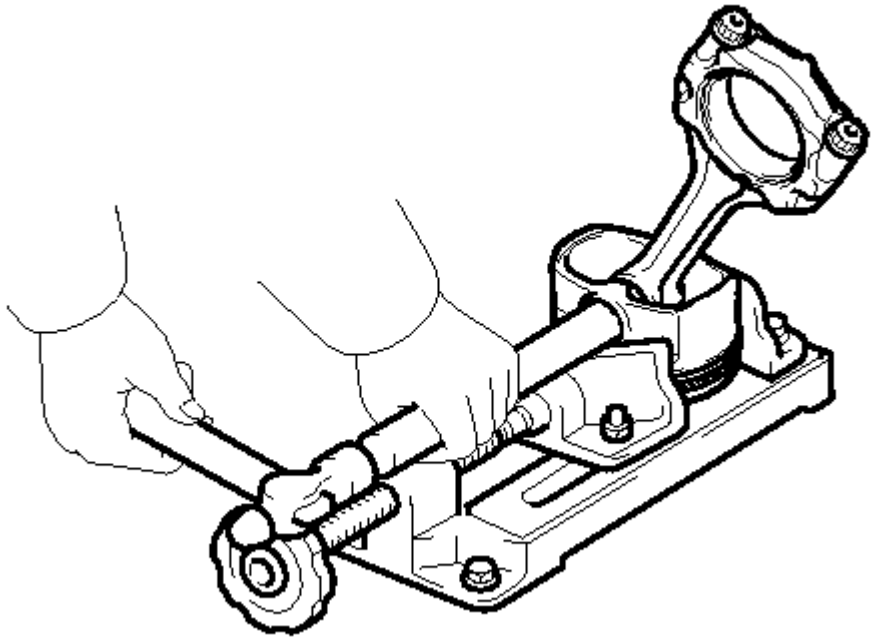
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Fig. 445: View Of Heating Piston
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



P

Fig. 446: View Of Tapping Out Piston Pin

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

HINT:

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

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

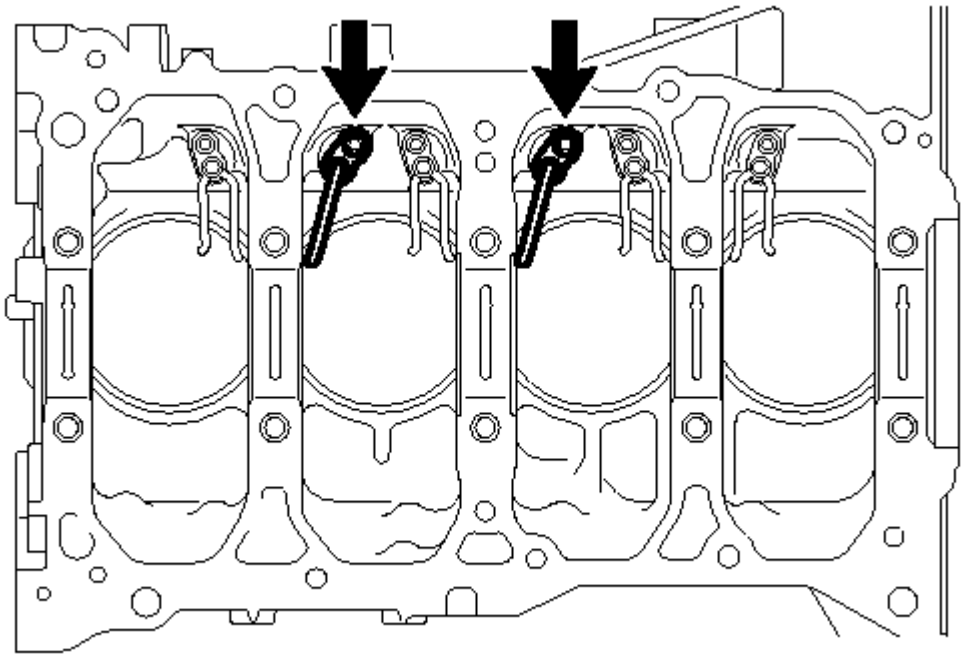


Fig. 447: Locating No. 1 Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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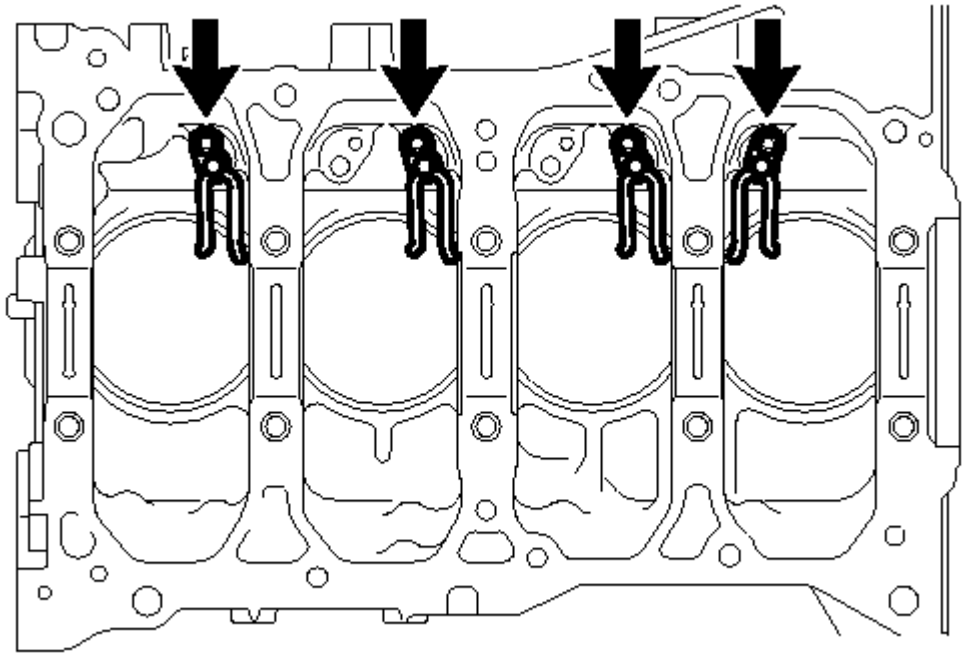


Fig. 448: Locating No. 2 Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. **REMOVE STUD BOLT**

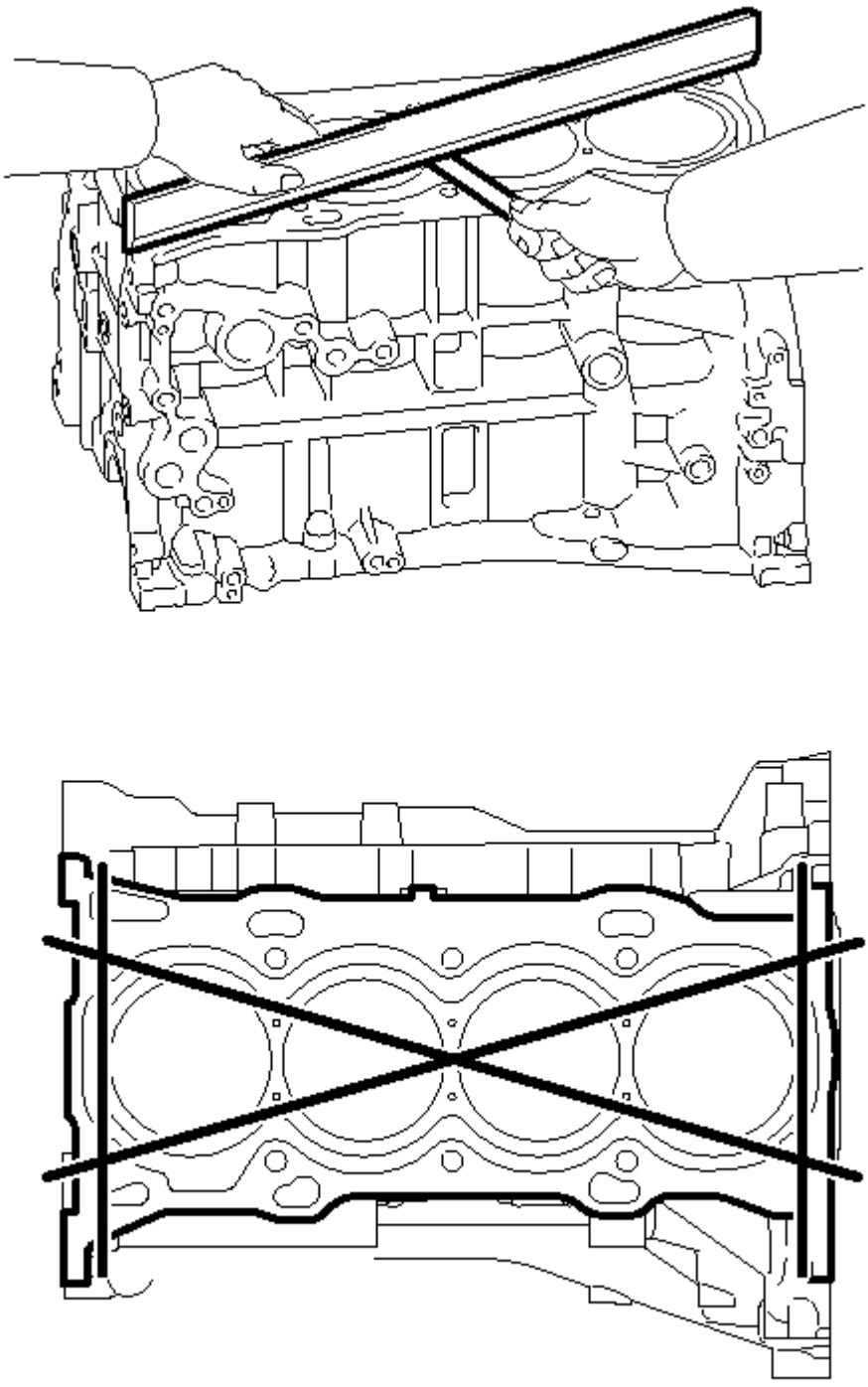
NOTE: If a stud bolt is deformed or its threads are damaged, replace it.

INSPECTION [08/2013 -]

INSPECTION [08/2013 -]

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

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Fig. 449: View Of Inspecting Cylinder Block For Warpage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Maximum Warpage

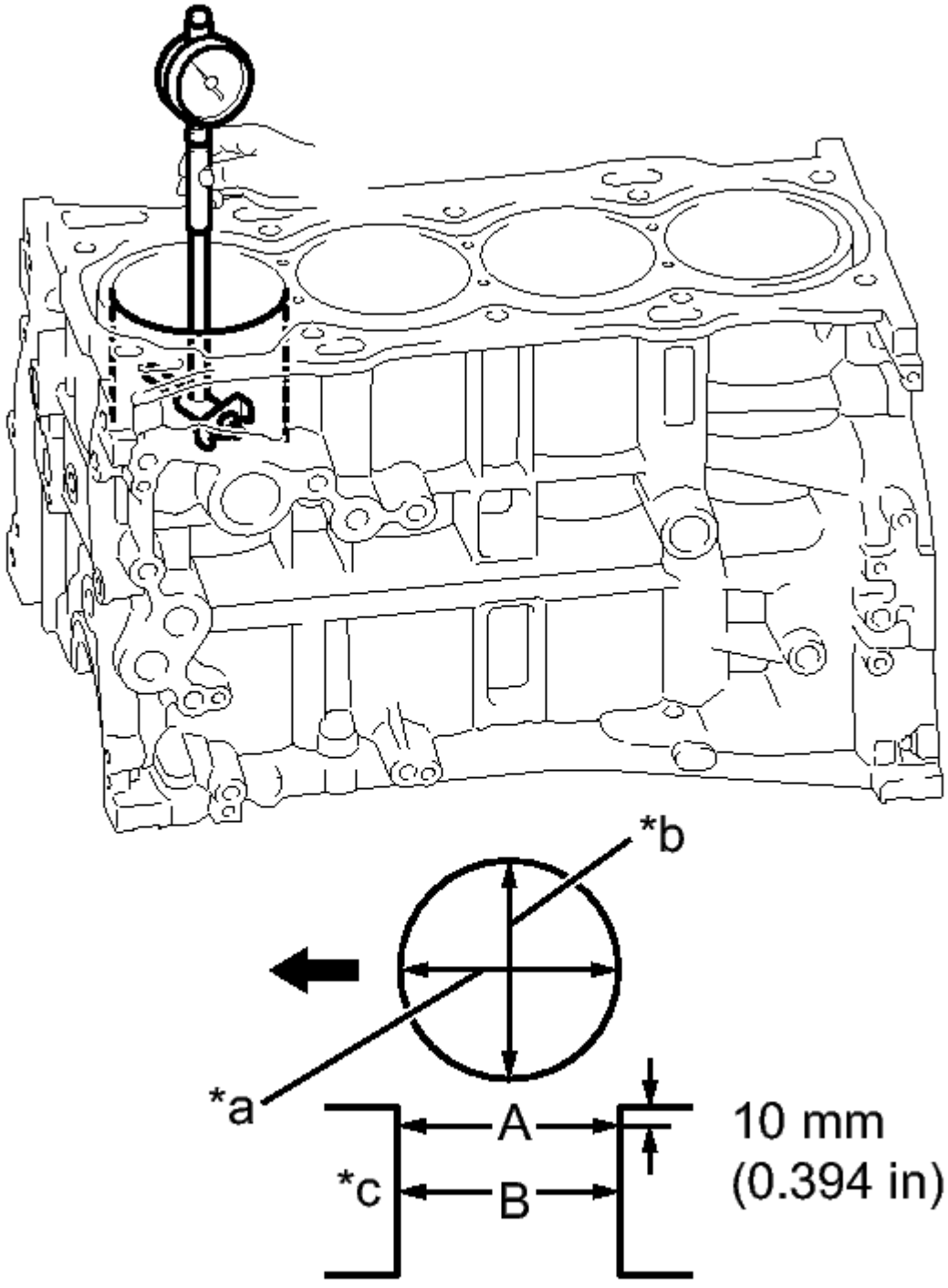
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0.05 mm (0.00197 in.)

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

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

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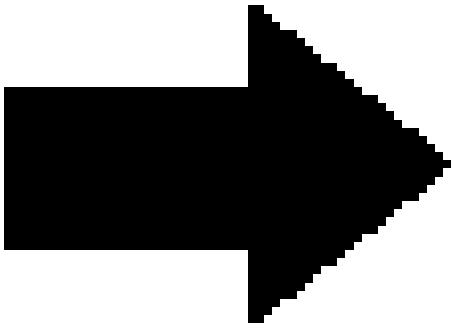
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Fig. 450: Measuring Cylinder Bore Diameter Using Cylinder Gauge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Axial Direction

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*b	Thrust Direction
*c	Center
	Front

Standard Diameter

90.000 to 90.013 mm (3.543 to 3.544 in.)

Maximum Diameter

90.13 mm (3.548 in.)

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

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

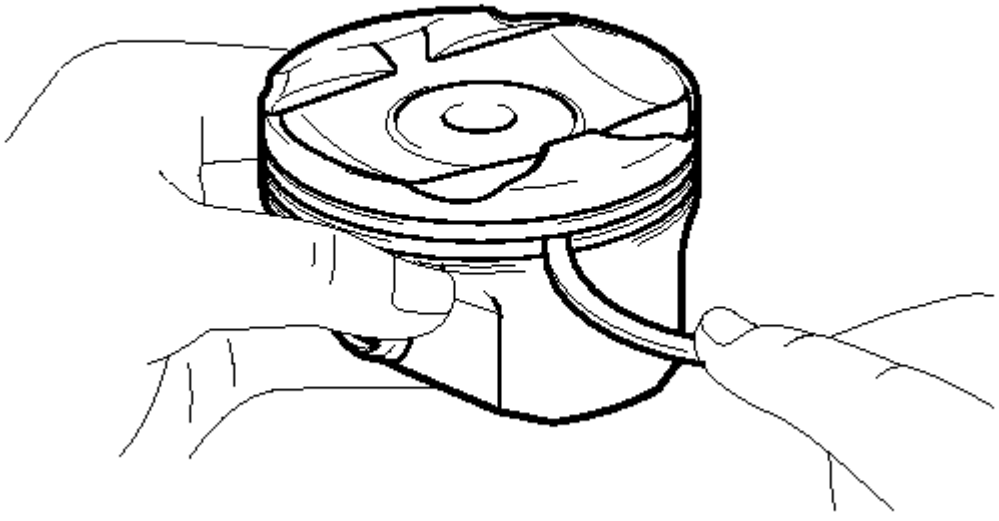
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Fig. 451: View Of Removing Carbon From Piston Top
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

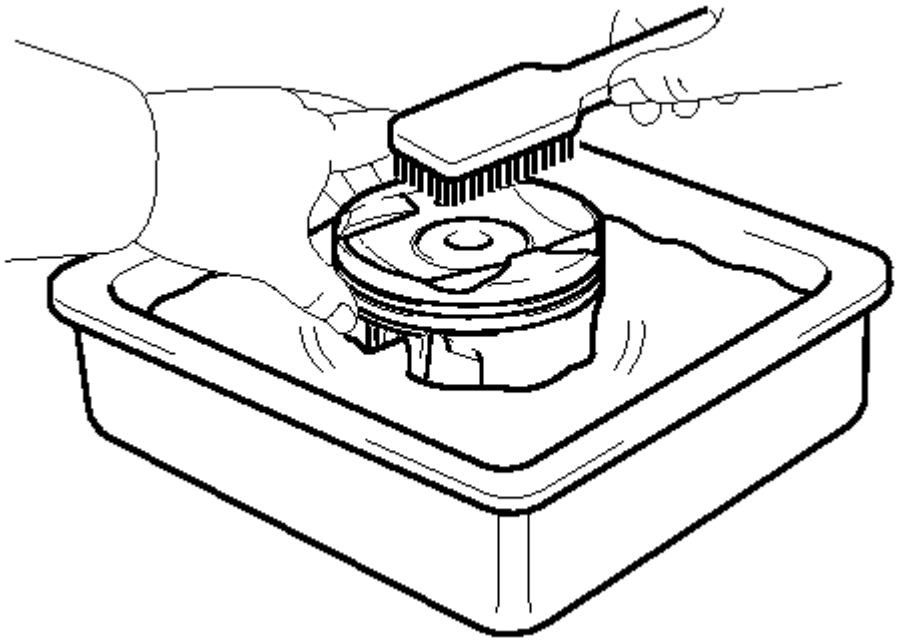


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Fig. 452: View Of Cleaning Piston Ring Grooves
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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



P

Fig. 453: View Of Cleaning Piston Using Brush
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Do not use a wire brush.

d. Using a micrometer, measure the piston diameter at a right angle to the piston center line, and at a position that is 10.5 mm (0.413 in.) from the bottom of the piston.

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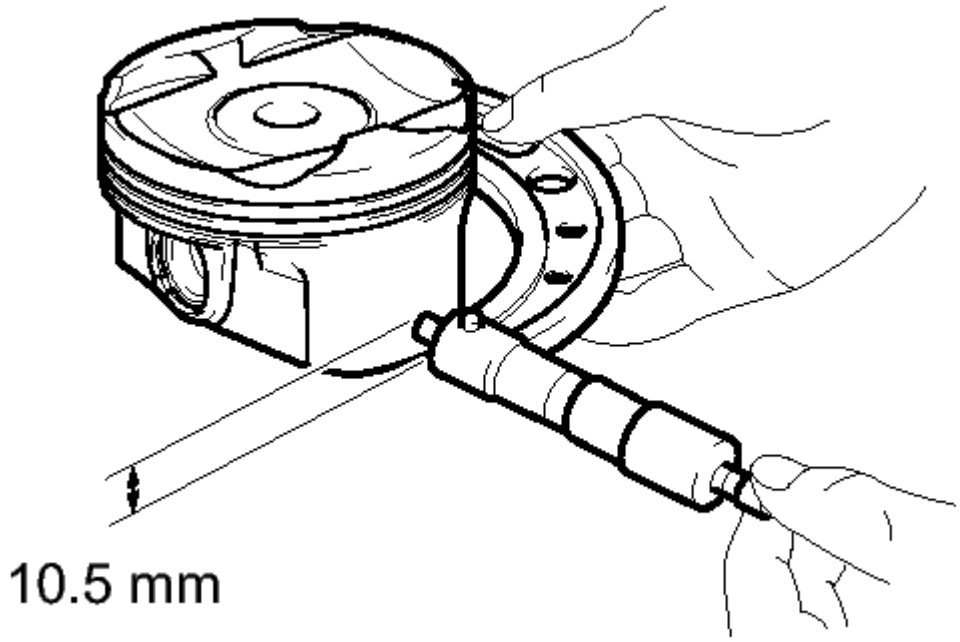


Fig. 454: Measuring Piston Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Piston Diameter

89.985 to 89.995mm (3.5427 to 3.5431 in.)

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

4. **INSPECT PISTON OIL CLEARANCE**
   a. Measure the cylinder bore diameter in the thrust direction.
   b. Subtract the piston diameter measurement from the cylinder bore diameter measurement.

   Standard Oil Clearance

   0.010 to 0.033 mm (0.000394 to 0.00130 in.)

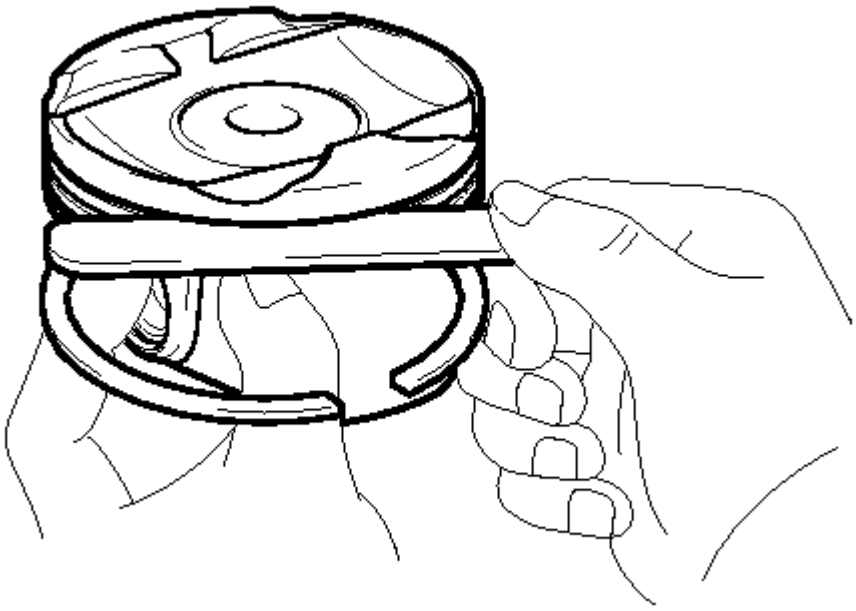
   Maximum Oil Clearance

   0.10 mm (0.00394 in.)

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

5. **INSPECT RING GROOVE CLEARANCE**
   a. Using a feeler gauge, measure the clearance between the new piston ring and the wall of the ring groove.

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Fig. 455: View Of Measuring Clearance Between Piston Ring And Wall Of Ring Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

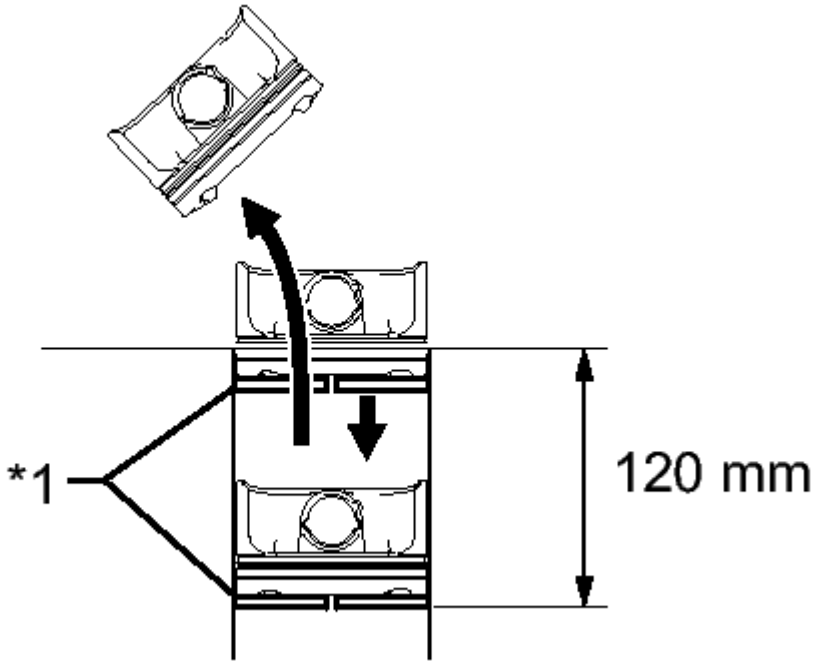
Standard Ring Groove Clearance

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

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

6. **INSPECT PISTON RING END GAP**
   a. Insert the piston ring into the cylinder bore.

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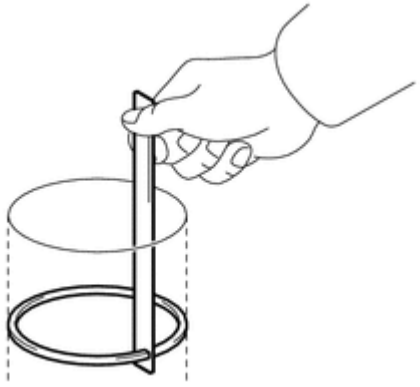
P

Fig. 456: Identifying Piston Ring End Gap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Piston Ring

b. Using a piston, push the piston ring a little beyond the bottom of the ring travel, 120 mm (4.72 in.) from the top of the cylinder block sub-assembly.
c. Using a feeler gauge, measure the end gap.



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Fig. 457: Measuring End Gap Using A Feeler Gauge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard End Gap

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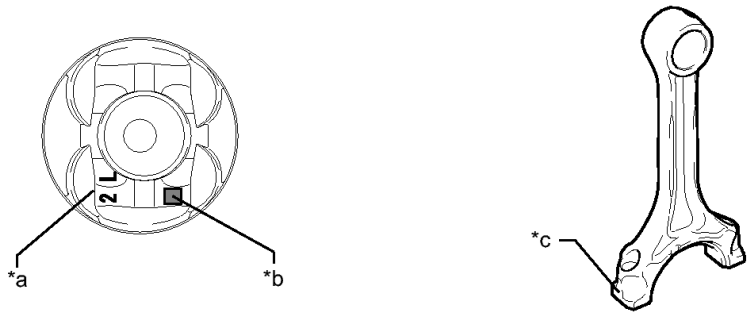
Item	Specified Condition
No. 1 ring	0.22 to 0.27 mm (0.00866 to 0.0106 in.)
No. 2 ring	0.37 to 0.42 mm (0.0146 to 0.0165 in.)
Oil ring	0.10 to 0.20 mm (0.00394 to 0.00787 in.)

Maximum End Gap

Item	Specified Condition
No. 1 ring	0.87 mm (0.0343 in.)
No. 2 ring	1.02 mm (0.0402 in.)
Oil ring	0.80 mm (0.0315 in.)

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

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



P
Fig. 458: Checking Piston, Pin & Connecting Rod Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Front Mark	*b	Piston Pin Hole Inside Diameter Mark
*c	Connecting Rod Small End Bush Inside Diameter Mark	-	-

HINT:

The front mark is "2L" printed in raised letters.

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

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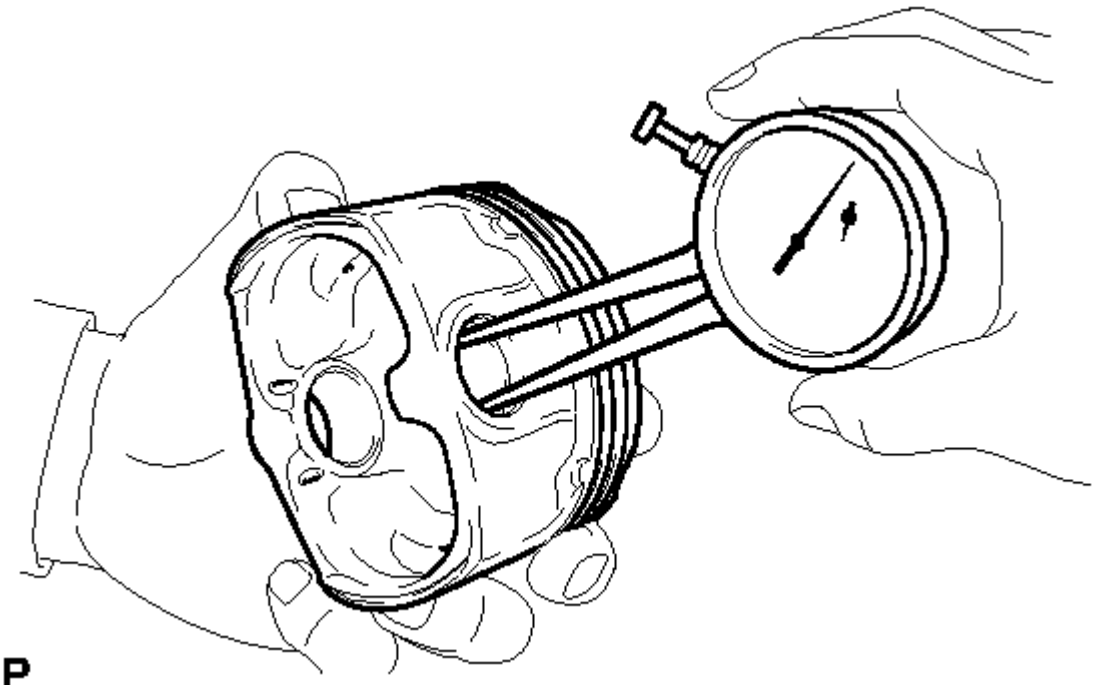


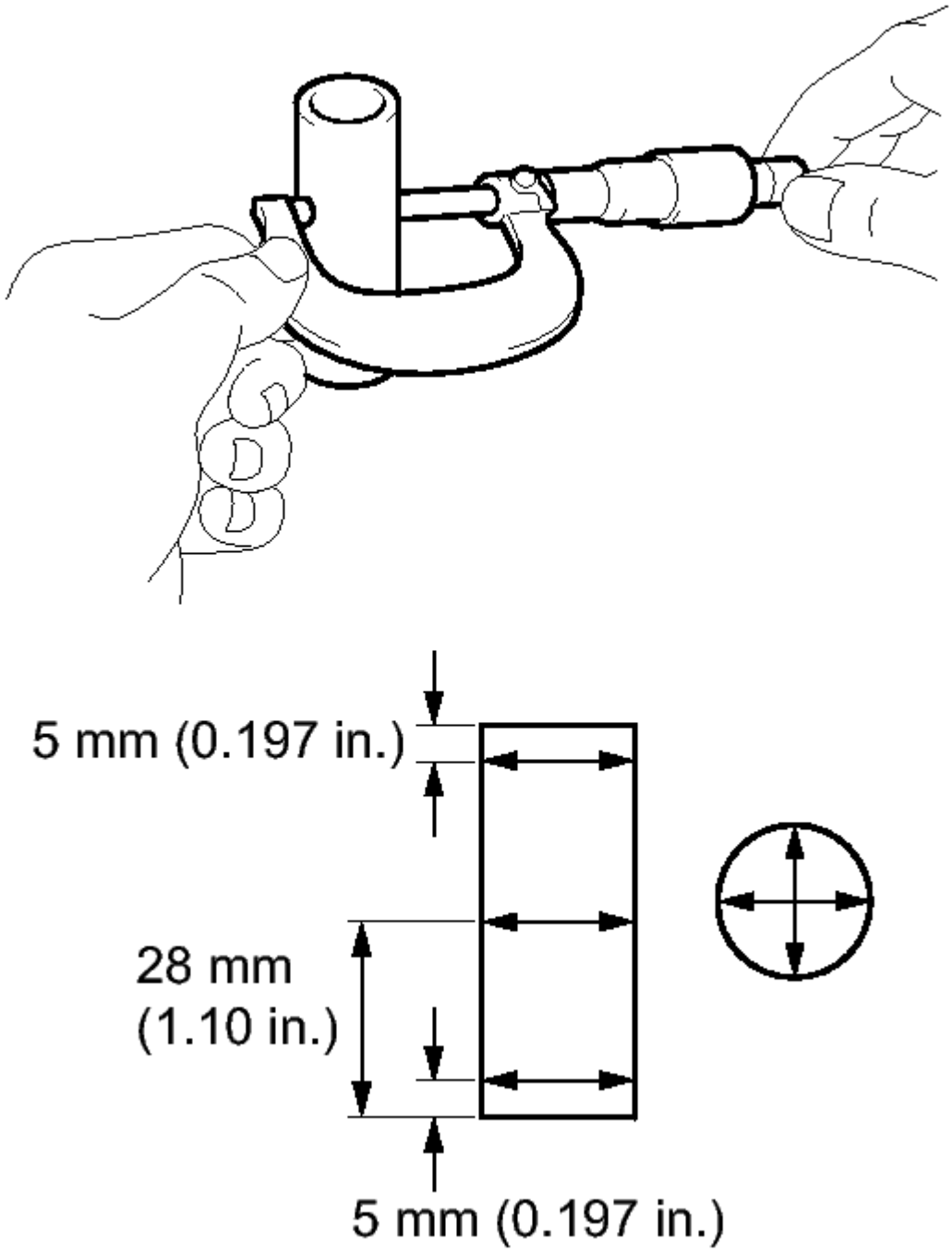
Fig. 459: View Of Measuring Inside Diameter Of Piston Pin Hole
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Piston Pin Hole Inside Diameter

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

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

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Fig. 460: View Of Measuring Piston Pin Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

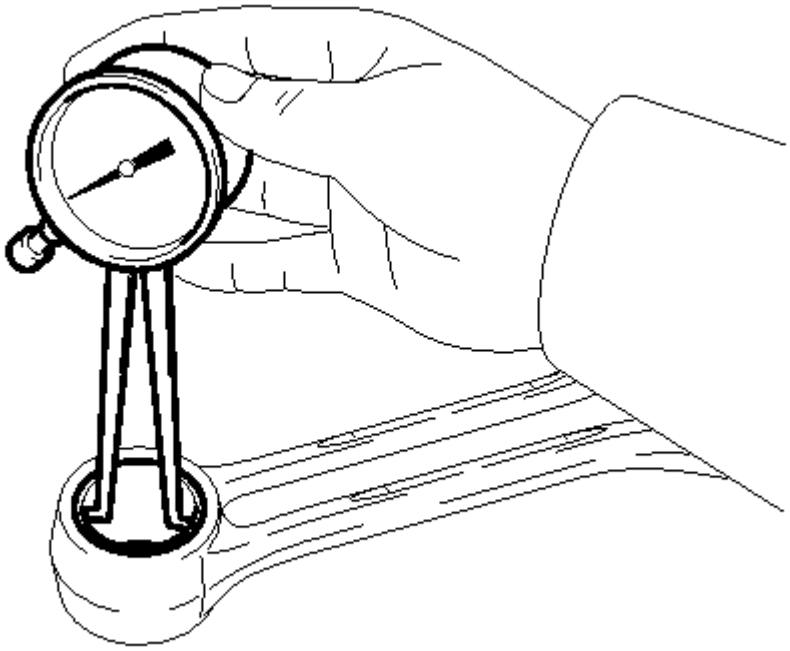
Standard Piston Pin Diameter

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Item	Specified Condition
Mark A	21.997 to 22.000 mm (0.86602 to 0.86614 in.)
Mark B	22.001 to 22.003 mm (0.86618 to 0.86626 in.)
Mark C	22.004 to 22.006 mm (0.86630 to 0.86638 in.)

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

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



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Fig. 461: View Of Measuring Connecting Rod Small End Bush Inside Diameter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Standard Connecting Rod Small End Bush Inside Diameter

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

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

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

Standard Oil Clearance

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0.001 to 0.007 mm (0.0000394 to 0.000276 in.)

Maximum Oil Clearance

0.013 mm (0.000512 in.)

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

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

Standard Oil Clearance

0.005 to 0.011 mm (0.000197 to 0.000433 in.)

Maximum Oil Clearance

0.017 mm (0.000669 in.)

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

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

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

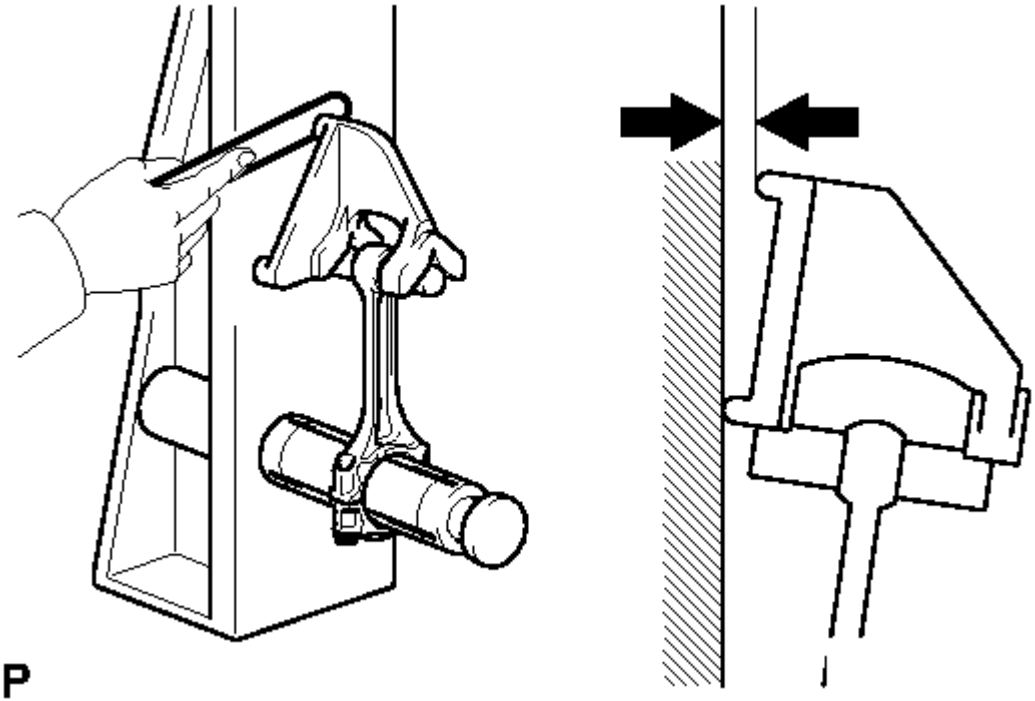


Fig. 462: View Of Checking Connecting Rod Alignment (For Bend)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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1. Check for bend.

   Maximum Bend

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

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

2. Check for twist.

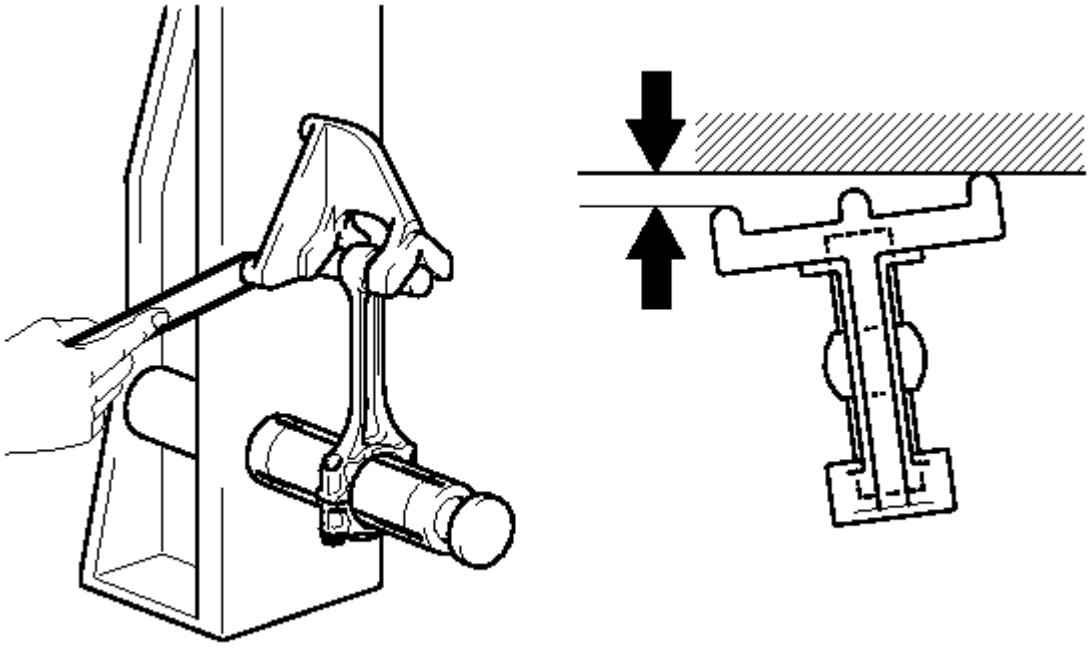


Fig. 463: View Of Checking Connecting Rod Alignment (For Twist)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

   Maximum Twist

   0.15 mm (0.00591 in.) per 100 mm (3.94 in.)

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

9. **INSPECT CRANKSHAFT**
   a. Inspect for circle runout.

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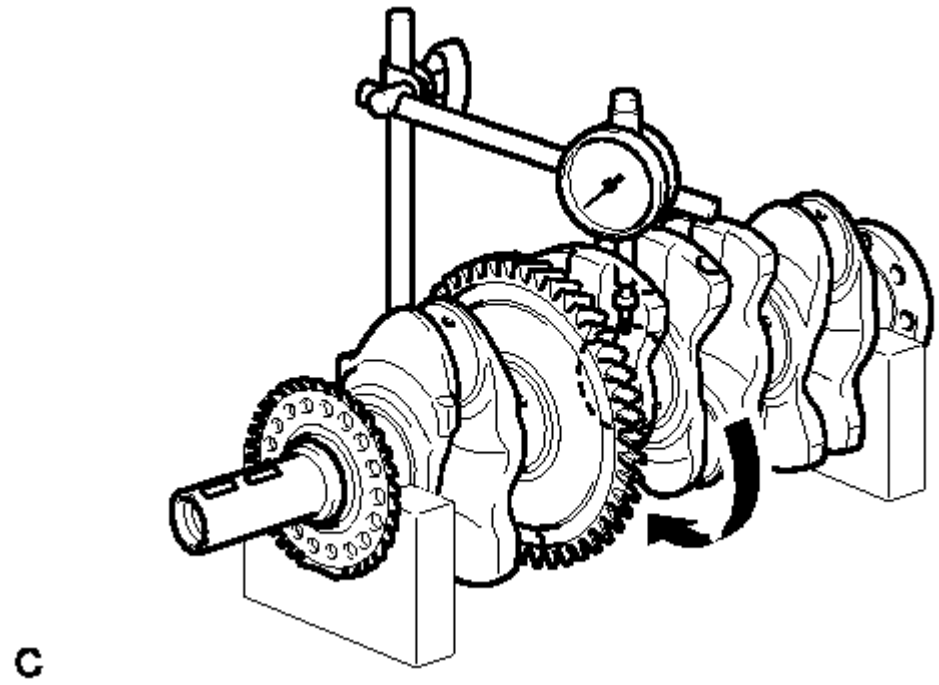


Fig. 464: Inspecting Crankshaft Circle Runout
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

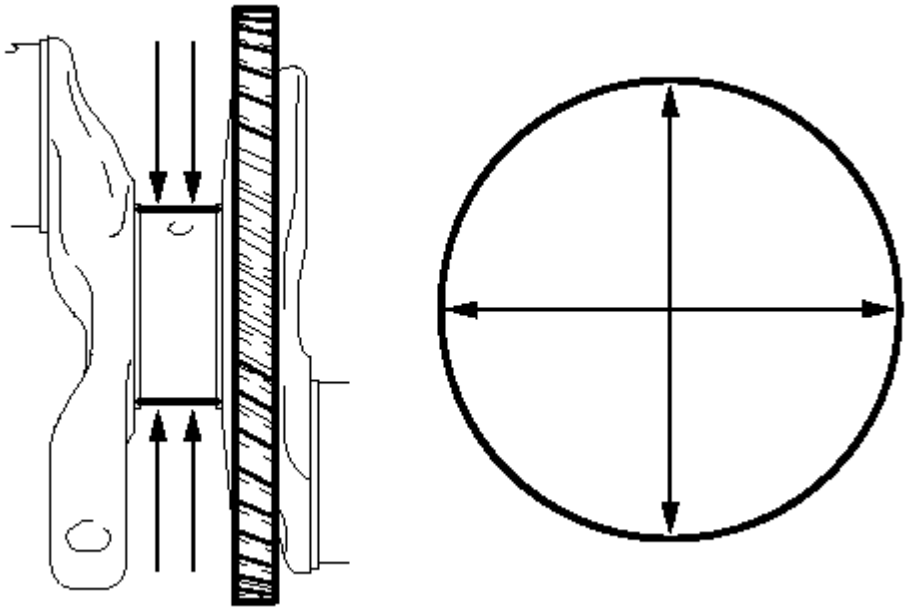
   Maximum Circle Runout

   0.003 mm (0.000118 in.)

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

b. Inspect the main journals.

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Fig. 465: View Of Checking Crankshaft Main Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

   Standard Main Journal Diameter

   54.988 to 55.000 mm (2.1649 to 2.1654 in.)

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

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

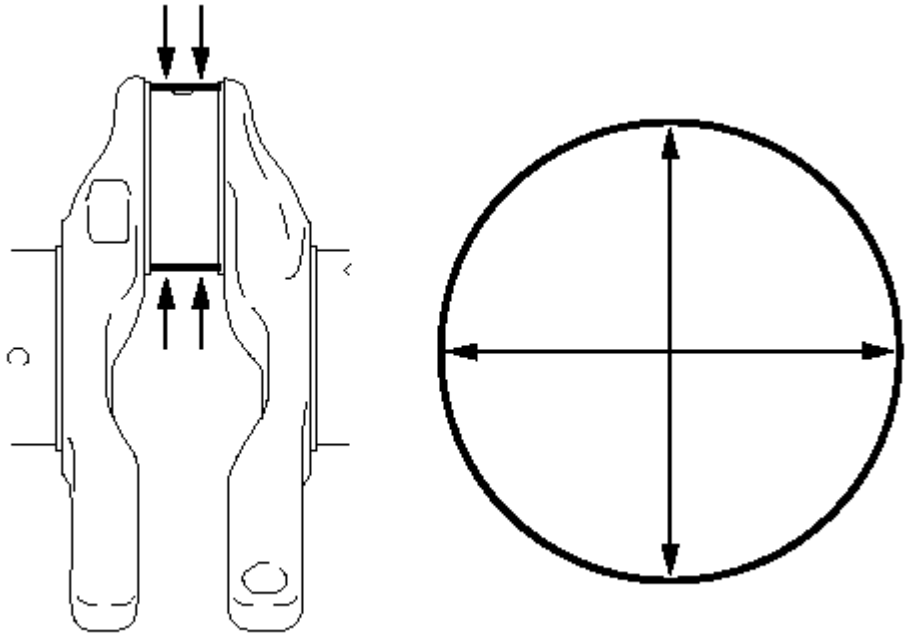
   Maximum Taper and Out-of-round

   0.003 mm (0.000118 in.)

   If the taper or out-of-round is more than the maximum, replace the crankshaft.

c. Inspect the crank pin.

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Fig. 466: View Of Measuring Diameter Of Crank Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

   Standard Crank Pin Diameter

   51.492 to 51.500 mm (2.027 to 2.028 in.)

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

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

   Maximum Taper and Out-of-round

   0.003 mm (0.000118 in.)

   If the taper or out-of-round is more than the maximum, replace the crankshaft.

10. **INSPECT CRANKSHAFT OIL CLEARANCE**
    a. Install the crankshaft bearings See step 7.
    b. Install the crankshaft thrust washers See step 8.
    c. Clean each main journal and crankshaft bearing.
    d. Place the crankshaft onto the cylinder block sub-assembly.
    e. Lay a strip of Plastigage across each journal.

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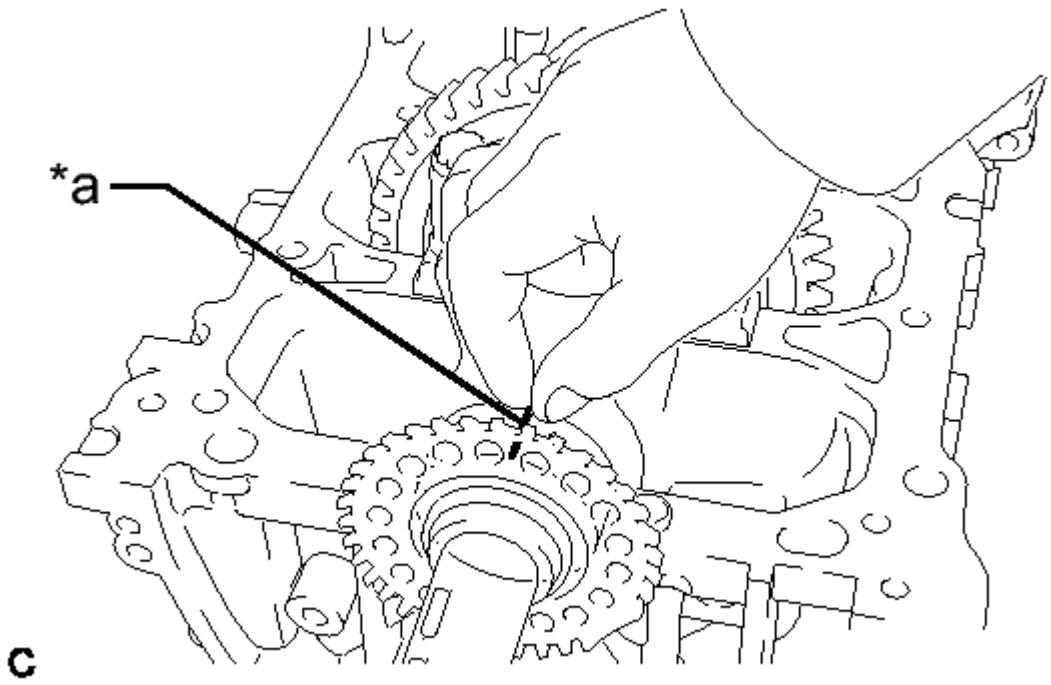


Fig. 467: Laying Strip Of Plastigage Across Journal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Plastigage

f. Install the crankshaft bearing caps See step 9.

NOTE: Do not turn the crankshaft.

g. Remove the crankshaft bearing caps See step 6.
h. Measure the Plastigage at its widest point.

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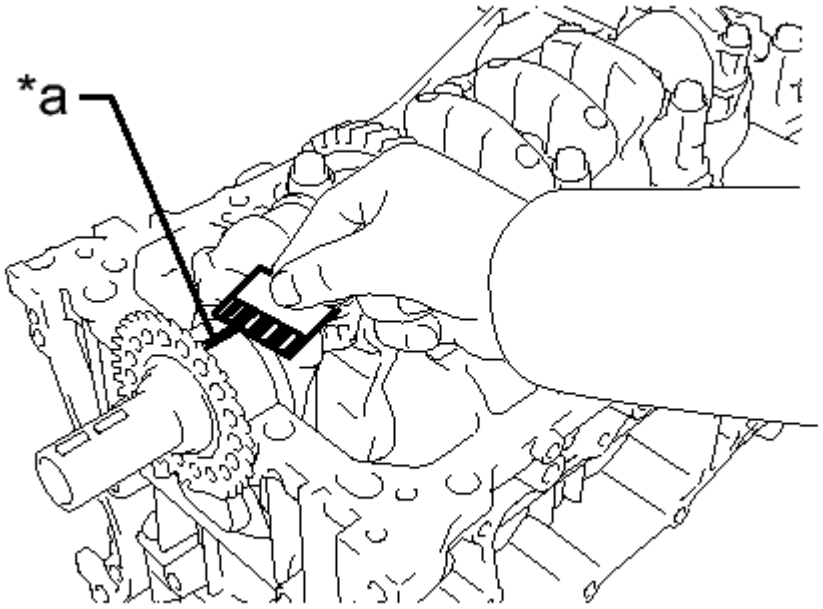


Fig. 468: Measuring Oil Clearance Using Plastigage
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Plastigage

Standard Oil Clearance

0.017 to 0.040 mm (0.000669 to 0.00157 in.)

Maximum Oil Clearance

0.05 mm (0.00197 in.)

NOTE: Remove the Plastigage completely after the measurement.

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

HINT:

If replacing a crankshaft bearing, select a new one with the same number. If the number of the crankshaft bearing cannot be determined, calculate the correct crankshaft bearing number by adding together the numbers imprinted on the cylinder block sub-assembly and crankshaft. Then select a new crankshaft bearing with the calculated number. There are 4 sizes of standard crankshaft bearings, marked "1", "2", "3" or "4" accordingly.

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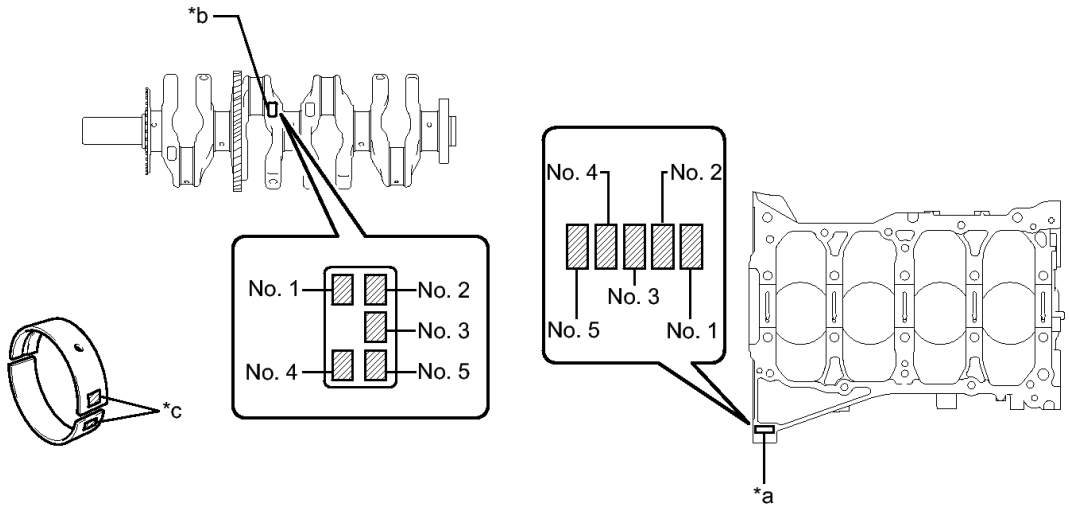


Fig. 469: Numbers Imprinted On The Cylinder Block And Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Cylinder Block Number Mark (A)	*b	Crankshaft Number Mark (B)
*c	Diameter Mark	-	-

EXAMPLE

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

Select the crankshaft bearing marked "3".

Bearing Chart

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

Standard Cylinder Block Journal Inside Diameter (A)

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

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

Standard Crankshaft Main Journal Diameter (B)

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

Standard Crankshaft Bearing Center Wall Thickness

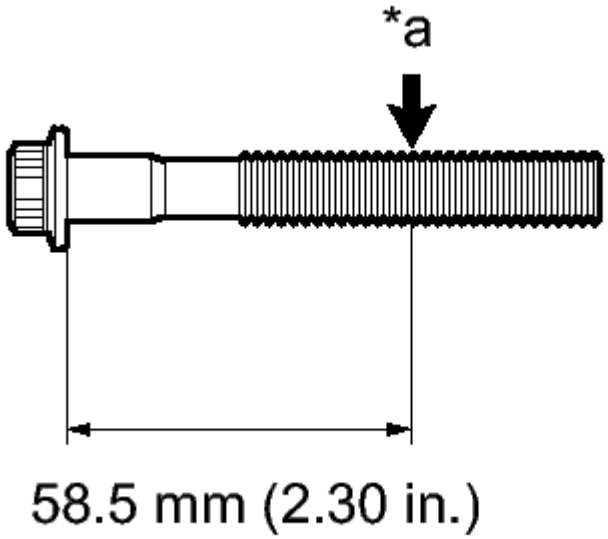
Item	Specified Condition
Mark 1	1.991 to 1.994 mm (0.07839 to 0.07850 in.)
Mark 2	1.995 to 1.997 mm (0.07854 to 0.07862 in.)
Mark 3	1.998 to 2.000 mm (0.07866 to 0.07874 in.)
Mark 4	2.001 to 2.003 mm (0.07878 to 0.07886 in.)

i. Perform the inspection above for each journal.

11. **INSPECT CRANKSHAFT BEARING CAP BOLT**

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

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Fig. 470: Measuring Crankshaft Bearing Cap Bolt Threads
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Measurement Point

Standard Diameter

9.77 to 9.96 mm (0.385 to 0.392 in.)

Minimum Diameter

9.1 mm (0.358 in.)

HINT:

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

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

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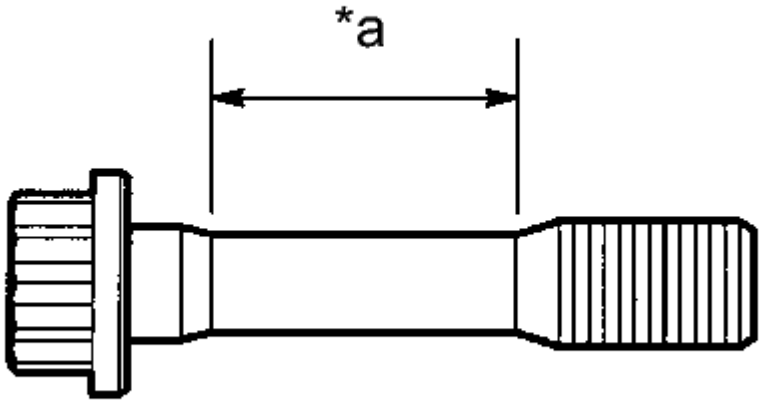


Fig. 471: Inspecting Connecting Rod Bolt
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Measurement Area

Standard Diameter

8.5 to 8.6 mm (0.335 to 0.339 in.)

Minimum Diameter

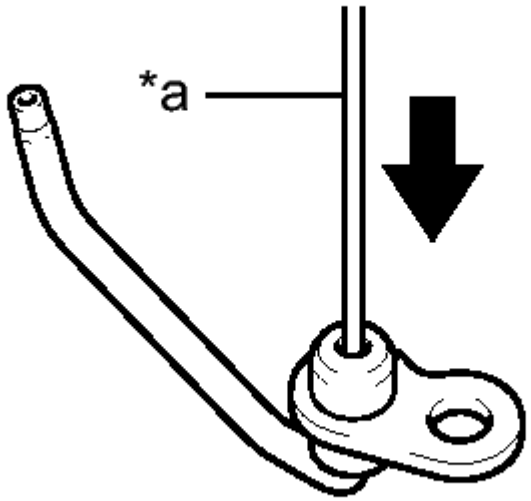
8.3 mm (0.327 in.)

HINT:

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

13. **INSPECT NO. 1 OIL NOZZLE SUB-ASSEMBLY**
    a. Push the check valve with a pin to check if it is stuck.

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Fig. 472: Pushing Check Valve With Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Pin

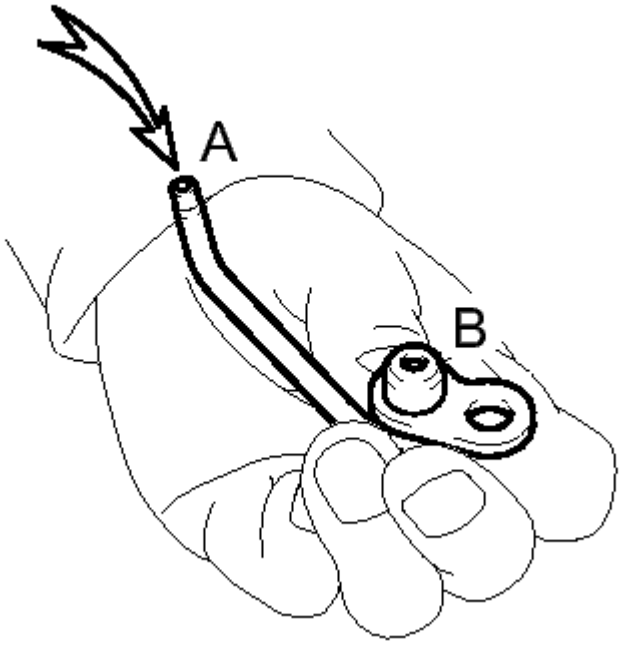
If stuck, replace the No. 1 oil nozzle sub-assembly.

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

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

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

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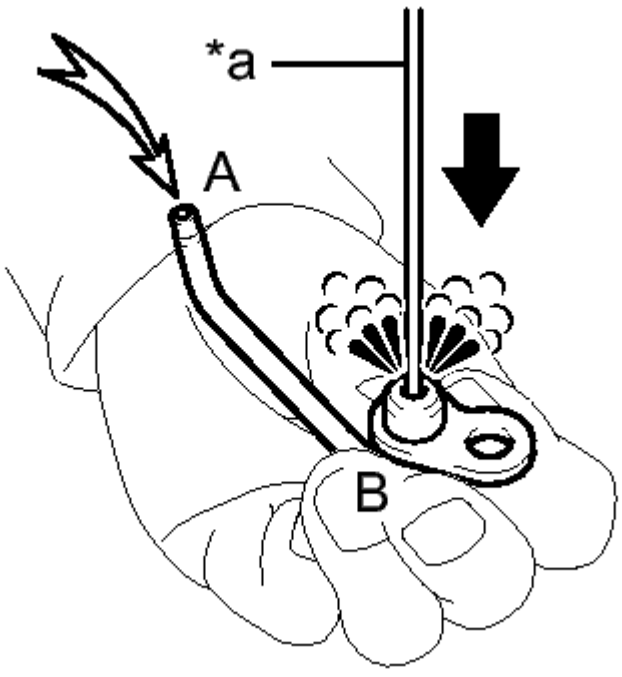


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Fig. 473: View Of Checking Air Leak Through B
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

d. Push the check valve with a pin while applying air into (A). Check that air passes through (B).



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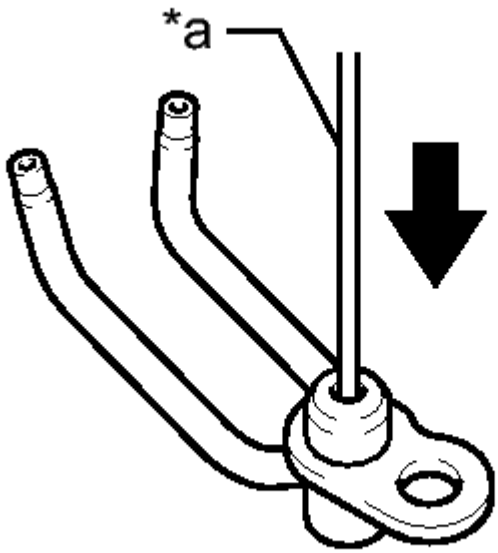
Fig. 474: Pushing Check Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Pin

If air does not pass through (B), clean or replace the No. 1 oil nozzle sub-assembly.

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



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Fig. 475: Pushing Check Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Pin

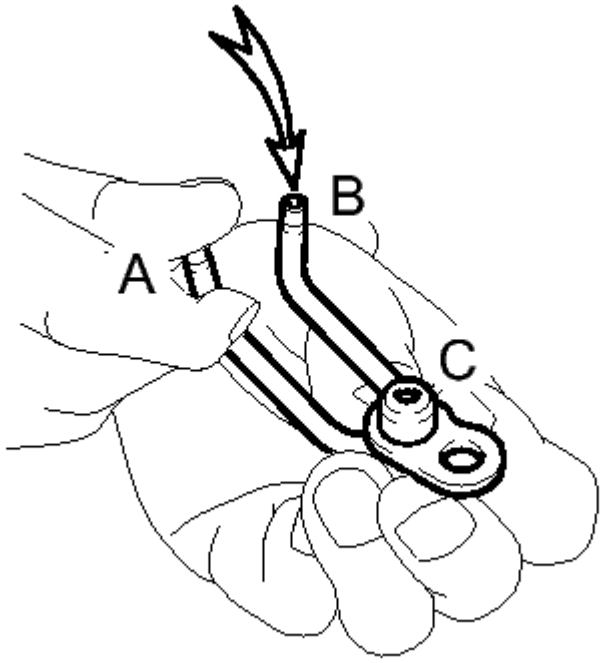
If stuck, replace the No. 2 oil nozzle sub-assembly.

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

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

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

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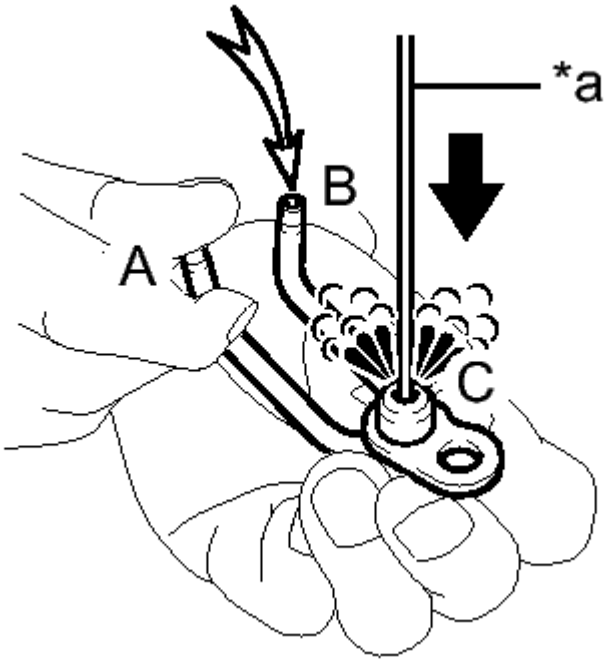
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Fig. 476: View Of Checking For Air Leak
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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Fig. 477: Pushing Check Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Pin

If air does not pass through (C), clean or replace the No. 2 oil nozzle sub-assembly.

REPLACEMENT [08/2013 -]

REPLACEMENT [08/2013 -]

1. **REPLACE RING PIN**

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

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

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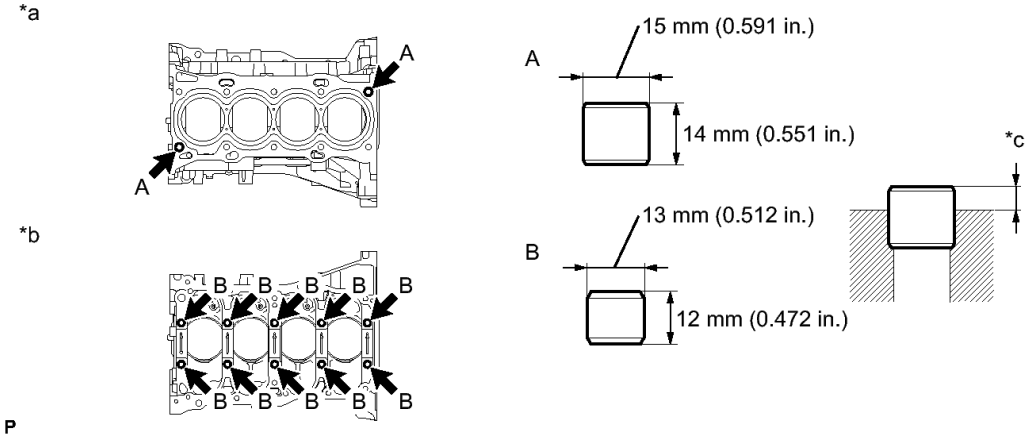


Fig. 478: Identifying Ring Pins & Standard Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Upper Side:	*b	Lower Side:
*c	Protrusion Height	-	-

Standard Protrusion Height

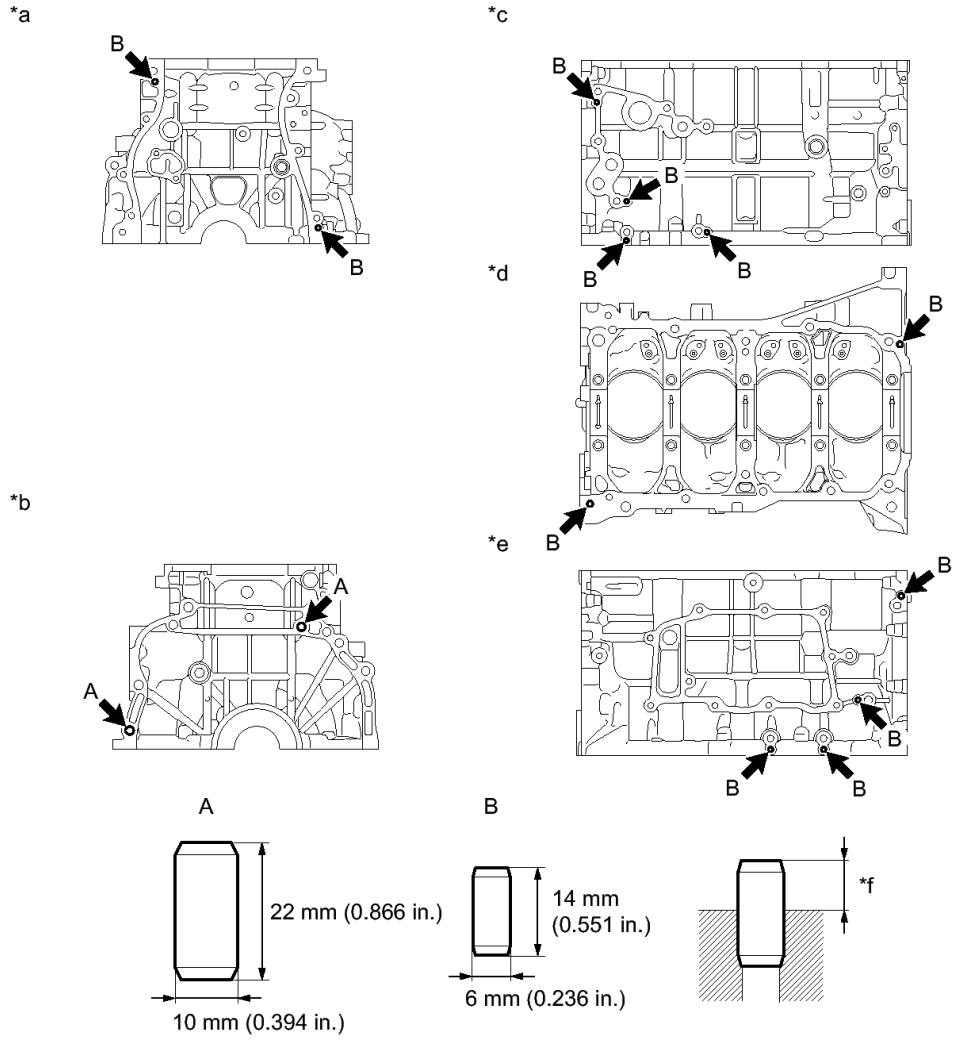
Item	Specified Condition
A	5.0 to 7.0 mm (0.197 to 0.276 in.)
B	4.0 to 7.0 mm (0.157 to 0.276 in.)

2. **REPLACE STRAIGHT PIN**

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

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

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Fig. 479: Identifying Straight Pins & Standard Protrusion Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Front Side:	*b	Rear Side:
*c	LH Side:	*d	Lower Side:
*e	RH Side:	*f	Protrusion Height

Standard Protrusion Height

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

REASSEMBLY [08/2013 -]

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REASSEMBLY [08/2013 -]

HINT:

Perform "Inspection After Repair" after replacing the piston or piston ring. Refer to **INITIALIZATION [08/2013 -]** .

1. **INSTALL STUD BOLT**

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

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

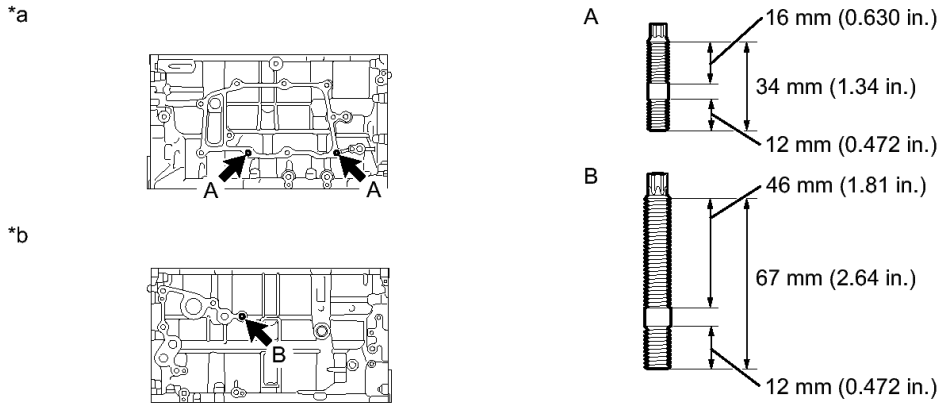


Fig. 480: Identifying Stud Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	RH Side:	*b	LH Side:

for stud bolt A

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

for stud bolt B

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

2. **INSTALL NO. 2 OIL NOZZLE SUB-ASSEMBLY**

a. Using a 5 mm hexagon wrench, install the 4 oil nozzles with the 4 bolts.

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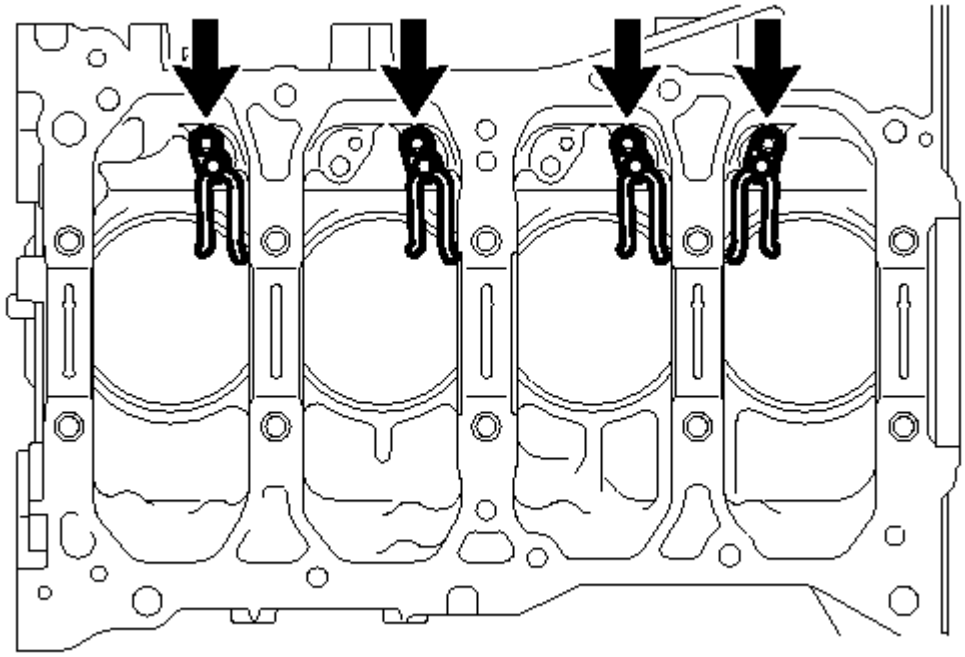
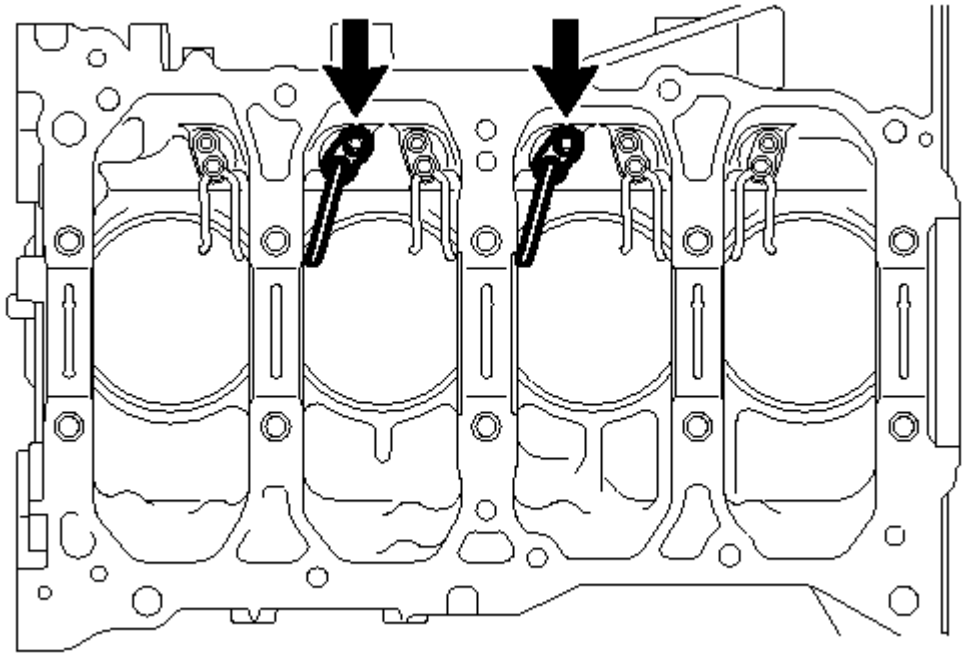


Fig. 481: Locating No. 2 Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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Fig. 482: Locating No. 1 Oil Nozzles Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

4. **INSTALL PISTON**
   a. Using a small screwdriver, install a new snap ring at one end of the piston pin hole.
   b. Gradually heat the piston up to 80 to 90°C (176 to 194°F).
   c. Coat the piston, piston pin and connecting rod with engine oil.
   d. Align the front marks of the piston and connecting rod, insert the connecting rod into the piston, and then push in the piston pin with your thumb until the pin comes into contact with the snap ring.

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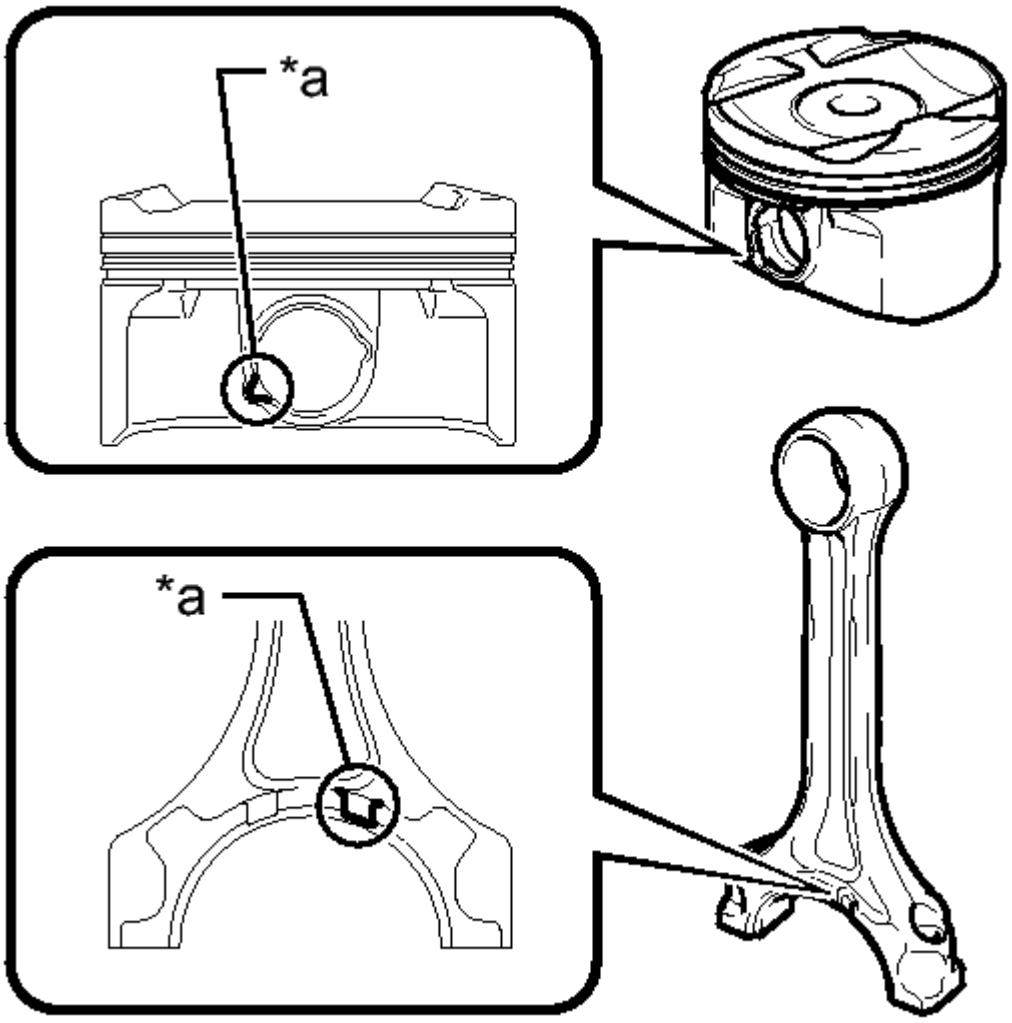


Fig. 483: Identifying Front Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Front Mark

HINT:

The piston and pin are a matched set.

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

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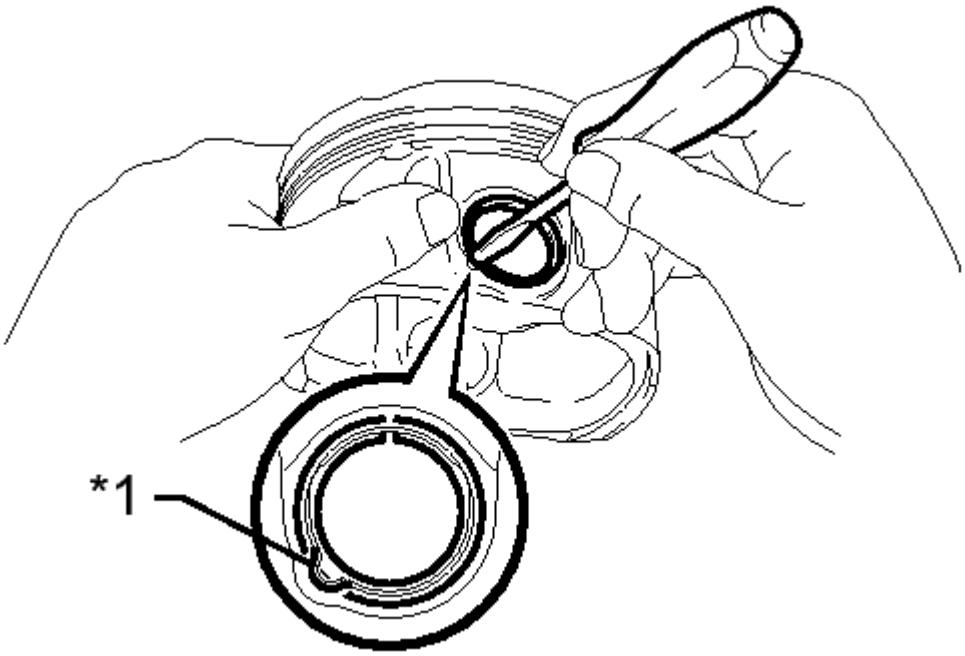


Fig. 484: Installing Snap Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Service Hole

HINT:

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

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

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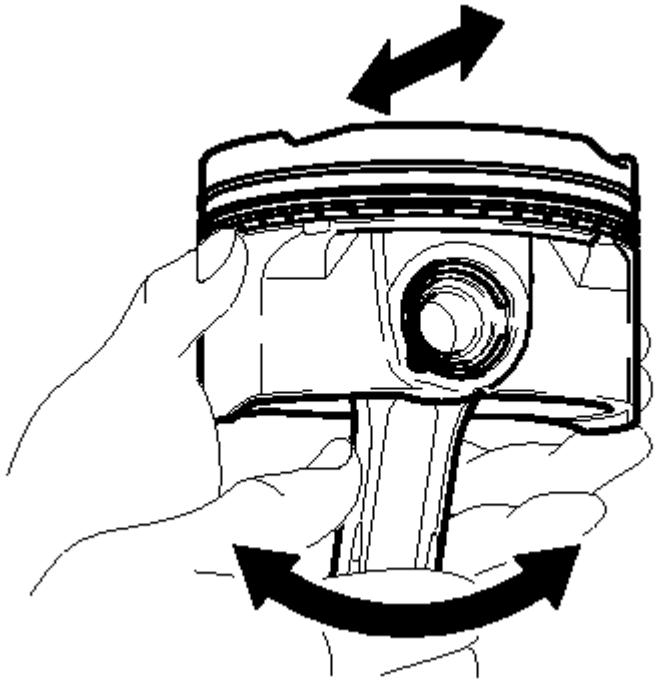


Fig. 485: View Of Checking Fitting Condition Between Piston And Piston Pin
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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

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

   HINT:

   Perform "Inspection After Repair" after replacing the piston. Refer to **INITIALIZATION [08/2013 -]** .

5. **INSTALL PISTON RING SET**
   a. Install the oil ring expander and oil ring by hand.

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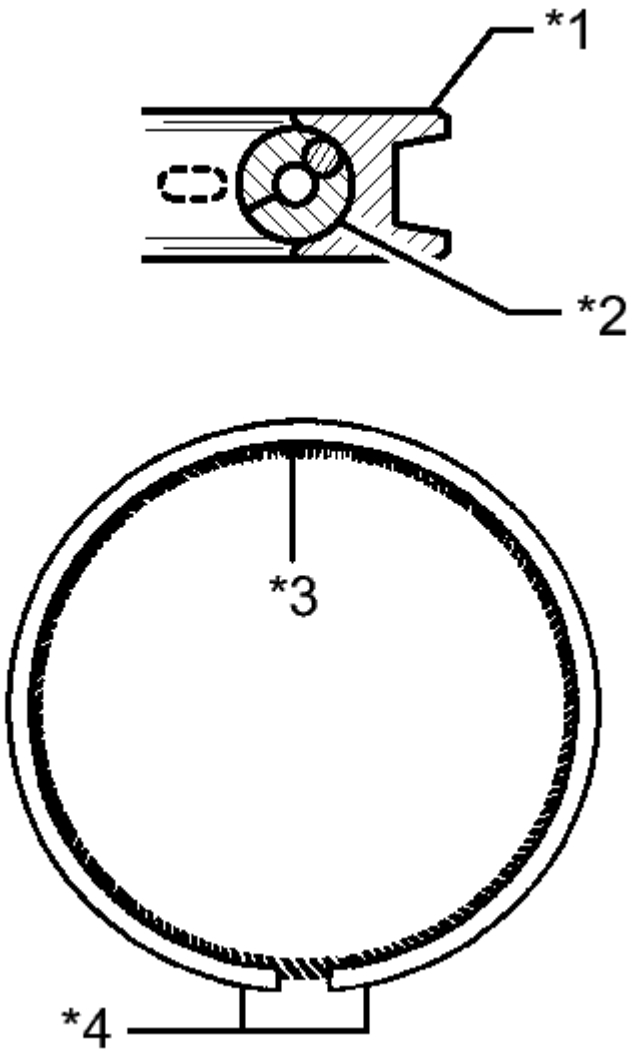


Fig. 486: Identifying Rings Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

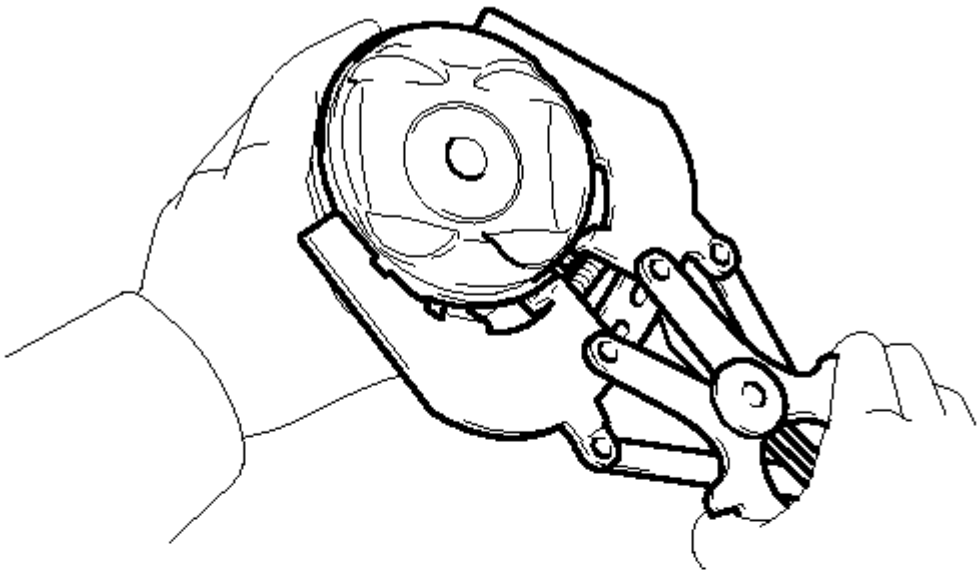
*1	Oil Ring
*2	Oil Ring Expander
*3	Coil Joint
*4	Oil Ring End

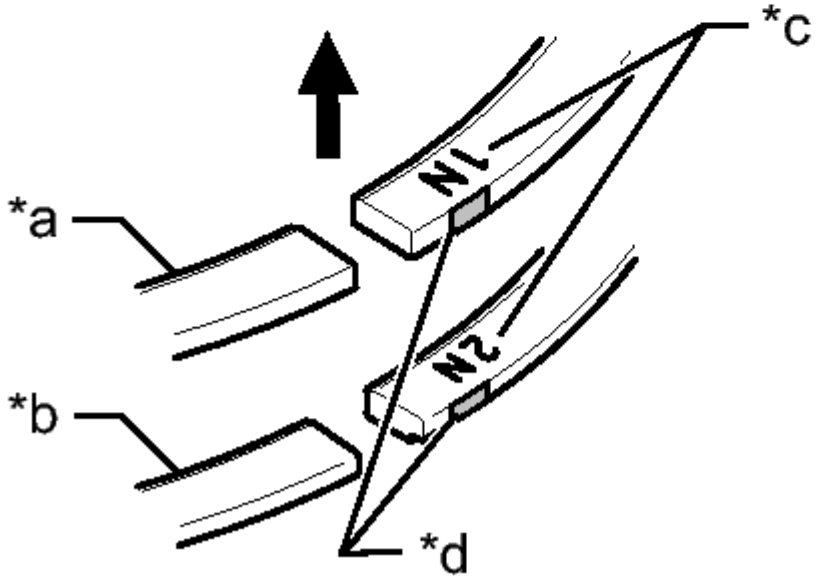
HINT:

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

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

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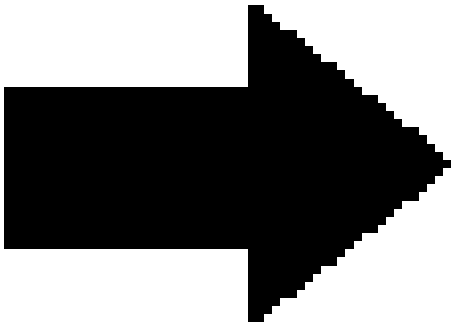
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Fig. 487: Identifying Compression Rings Using Piston Ring Expander
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	No. 1

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*b	No. 2
*c	Code Mark
*d	Paint Mark
	Paint Mark

Piston Ring Mark

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

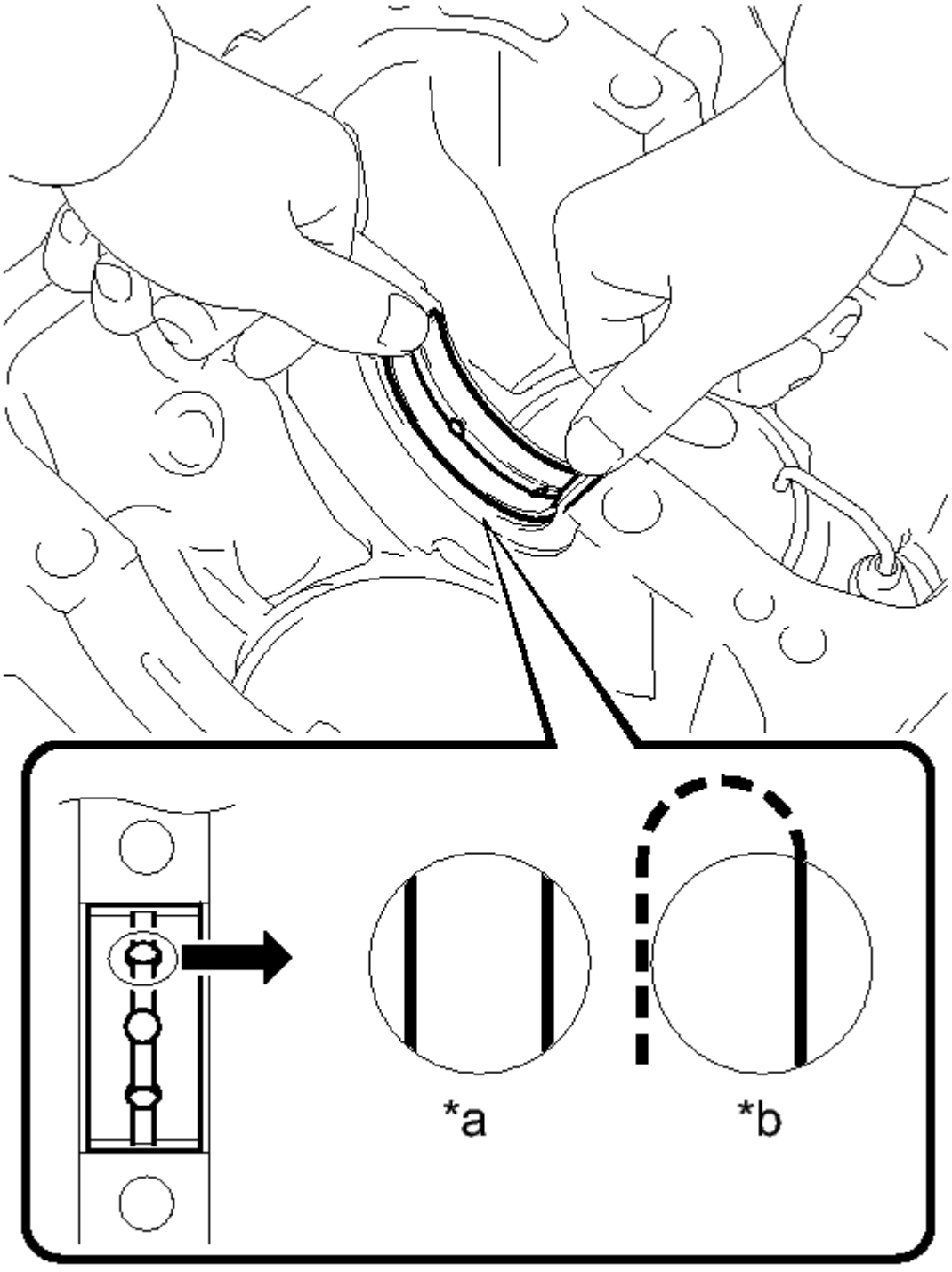
NOTE: Install the compression ring with the code mark facing upward.

HINT:

Perform "Inspection After Repair" after replacing the piston, piston ring. Refer to **INITIALIZATION [08/2013 -]** .

6. **INSTALL CRANKSHAFT PULLEY KEY**
   a. Install the 2 crankshaft pulley keys to the crankshaft.
7. **INSTALL CRANKSHAFT BEARING**
   a. Clean the main journal and both surfaces of the bearing.

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Fig. 488: Installing Upper Bearing At Cylinder Block
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	CORRECT

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*b	INCORRECT

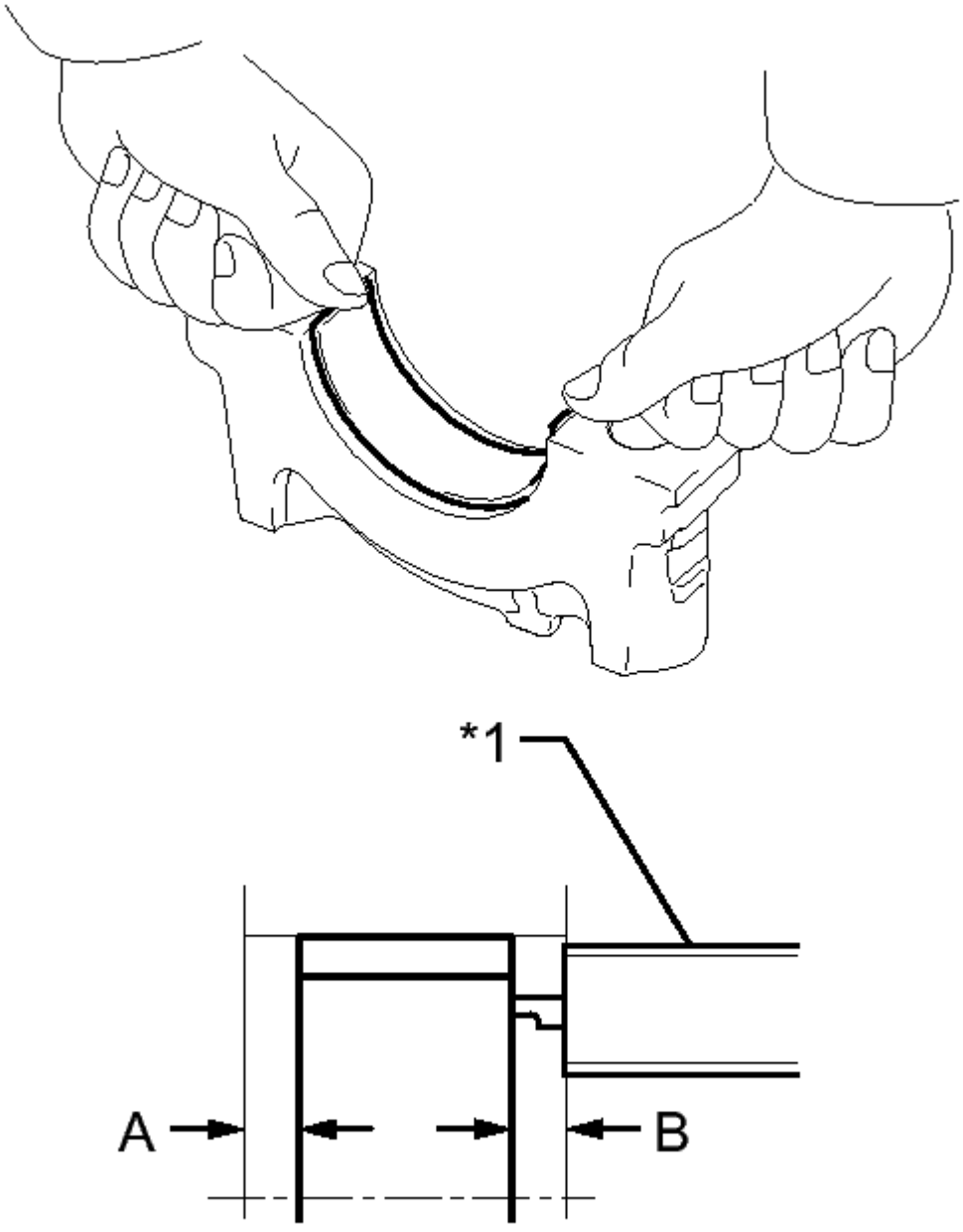
b. Install the upper bearing to the cylinder block as shown in the illustration.

NOTE:

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

c. Install the lower bearing onto the bearing cap.

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Fig. 489: Measuring Distance Between Crankshaft Cap Edge And Lower Bearing Edge
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Vernier Caliper

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d. Using a vernier caliper, measure the distance between the crankshaft bearing cap edge and the lower bearing edge.

Standard dimension A - B or B - A

0 to 0.7 mm (0 to 0.0276 in.)

NOTE:

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

8. **INSTALL CRANKSHAFT THRUST WASHER**

a. Apply engine oil to the thrust washers.

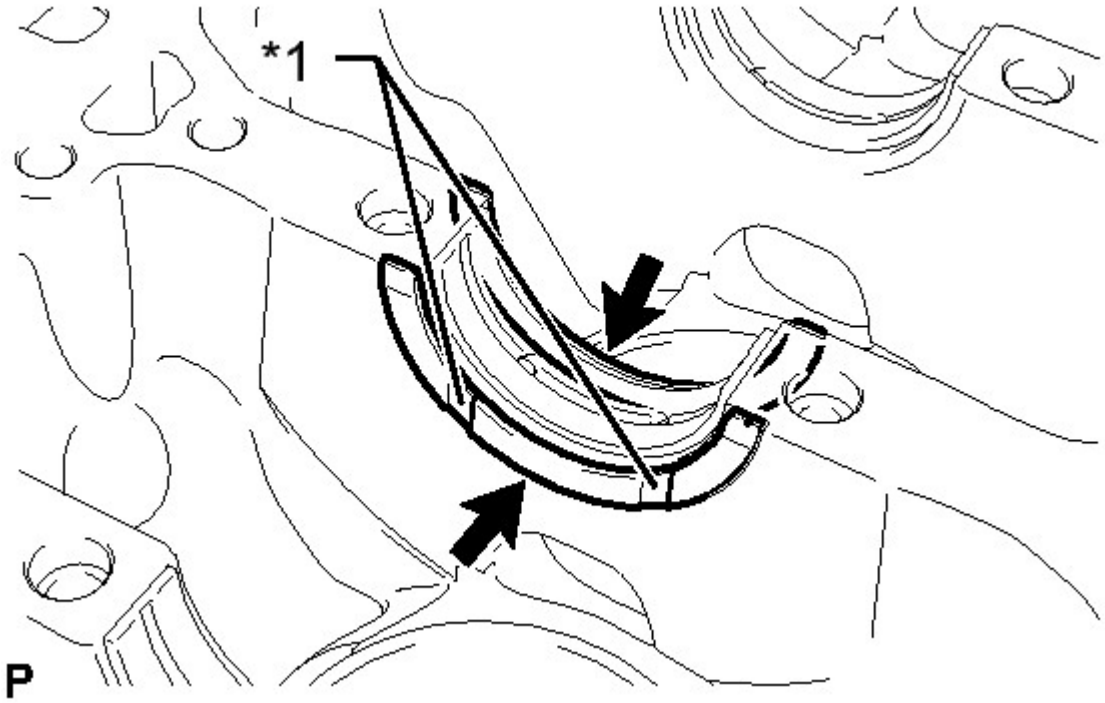


Fig. 490: Identifying Oil Groove
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Oil Groove

b. Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil grooves facing outward.

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

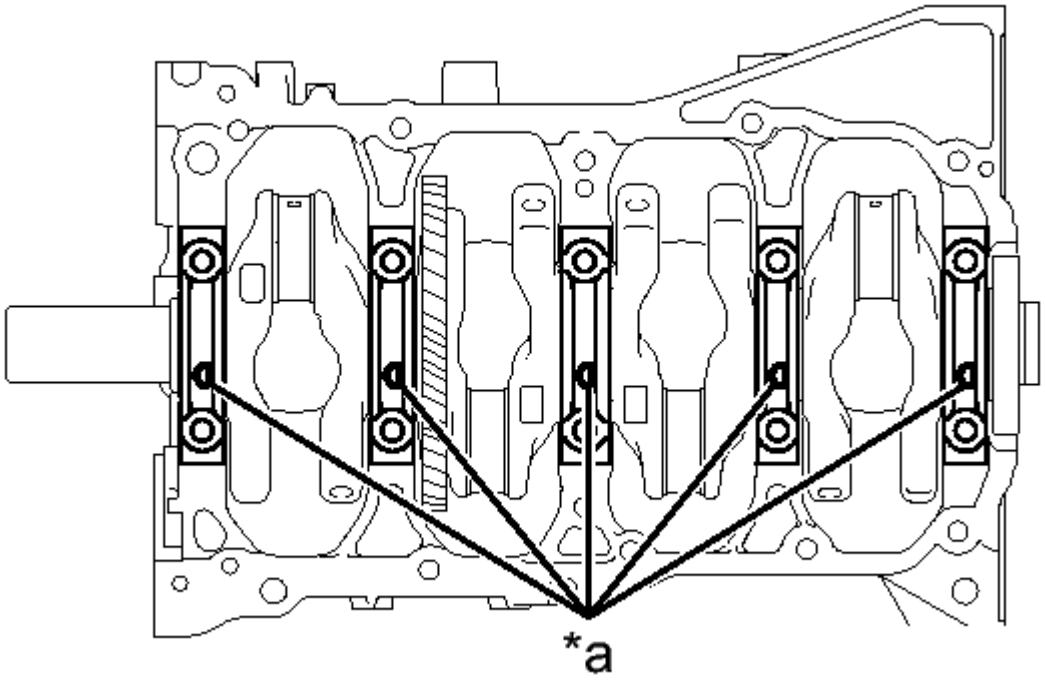


Fig. 491: Identifying Front Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Front Mark

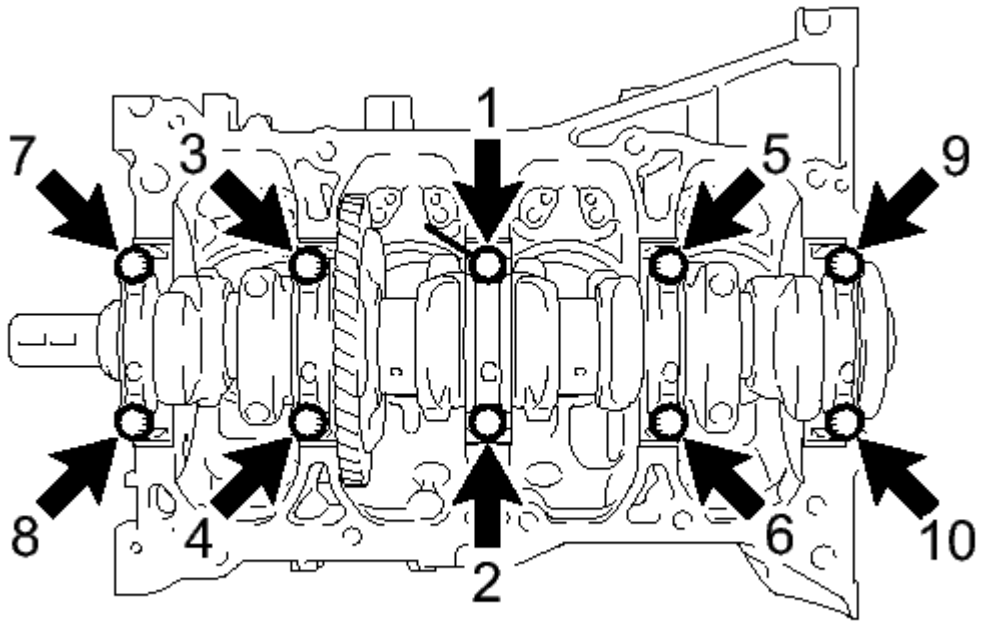
   b. Examine the front marks and numbers, and install the bearing caps onto the cylinder block with the front marks as shown in the illustration.

HINT:

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

   c. Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.
   d. Step 1:
      1. Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

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Fig. 492: Identifying Crankshaft Bearing Cap Bolts Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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

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

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

f. Step 3:
   1. Mark the front of the bearing cap bolts with paint.

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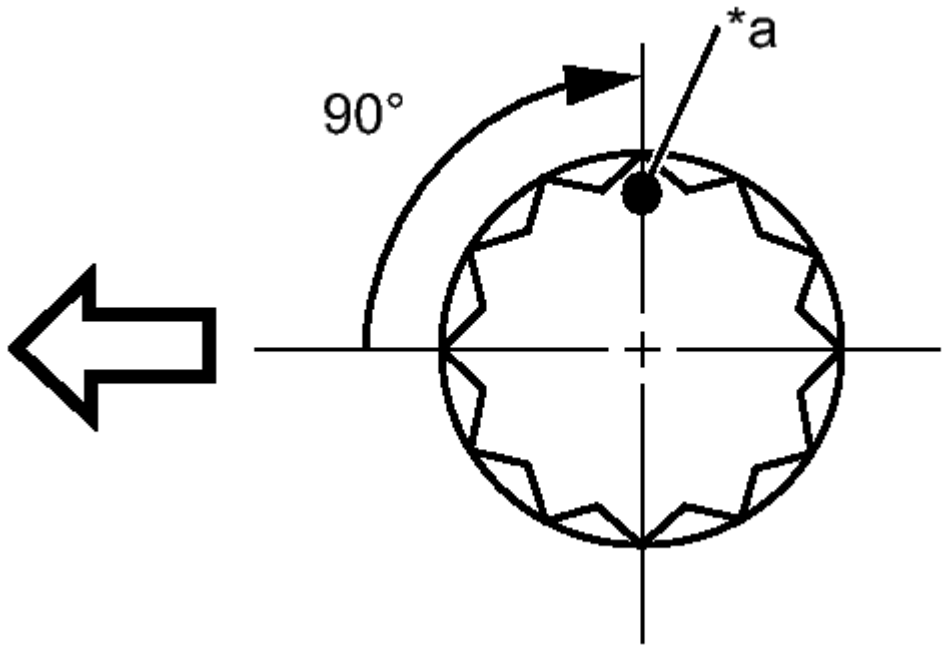
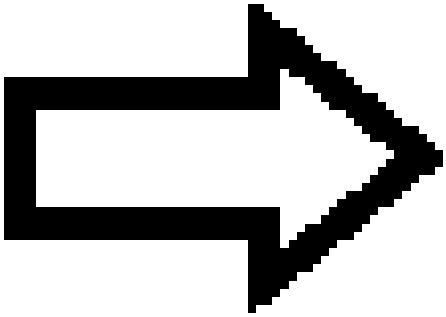


Fig. 493: Identifying Paint Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark
	Engine Front

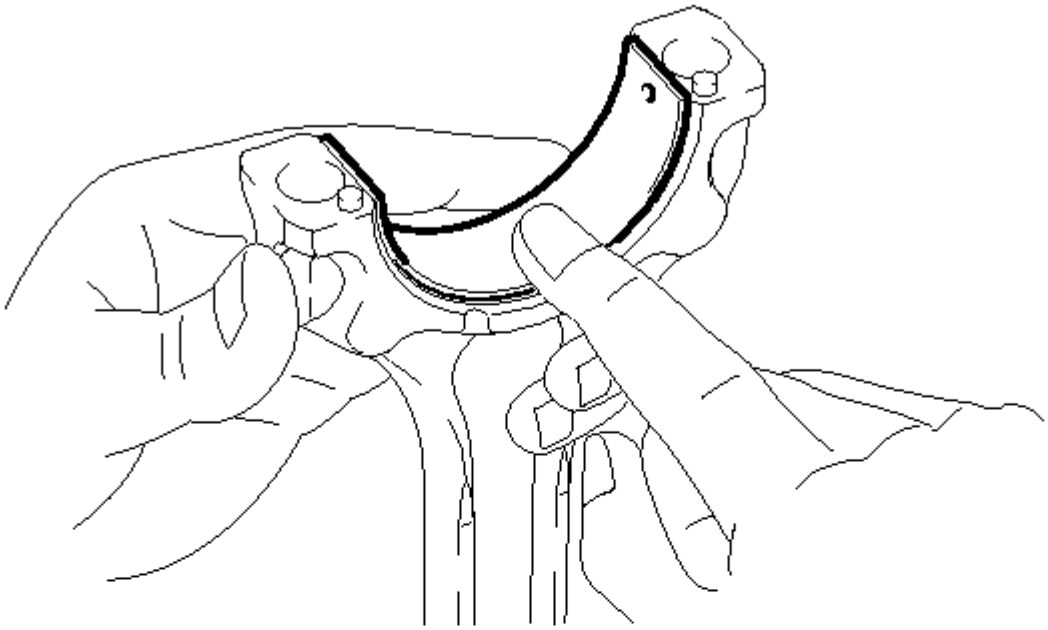
2. Tighten the 10 bearing cap bolts 90° in the same sequence.
3. Check that the paint marks are now at a 90° angle to the front.

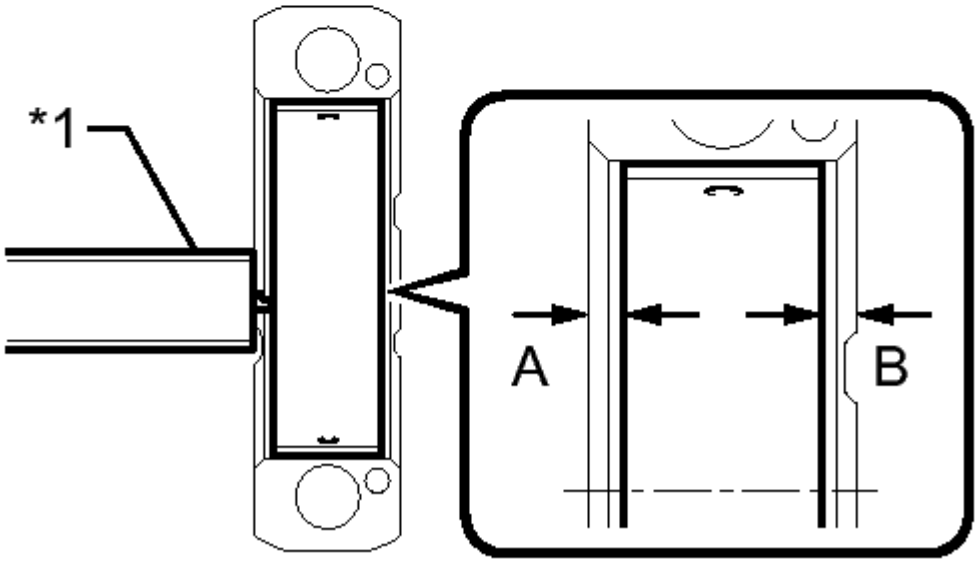
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g. Check that the crankshaft turns smoothly.

10. **INSTALL CONNECTING ROD BEARING**

a. Clean the bearing contact surface of the connecting rod and cap, and both surfaces of both bearings.





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Fig. 494: Cleaning Bearing Contact Surface Of Connector Rod And Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Vernier Caliper

b. Install the connecting rod bearings to the connecting rods and connecting rod caps.
c. Using a vernier caliper, measure the distance between the edges of the connecting rod and connecting rod bearing, and the edges of the bearing cap and connecting rod bearing.

Standard dimension A - B or B - A

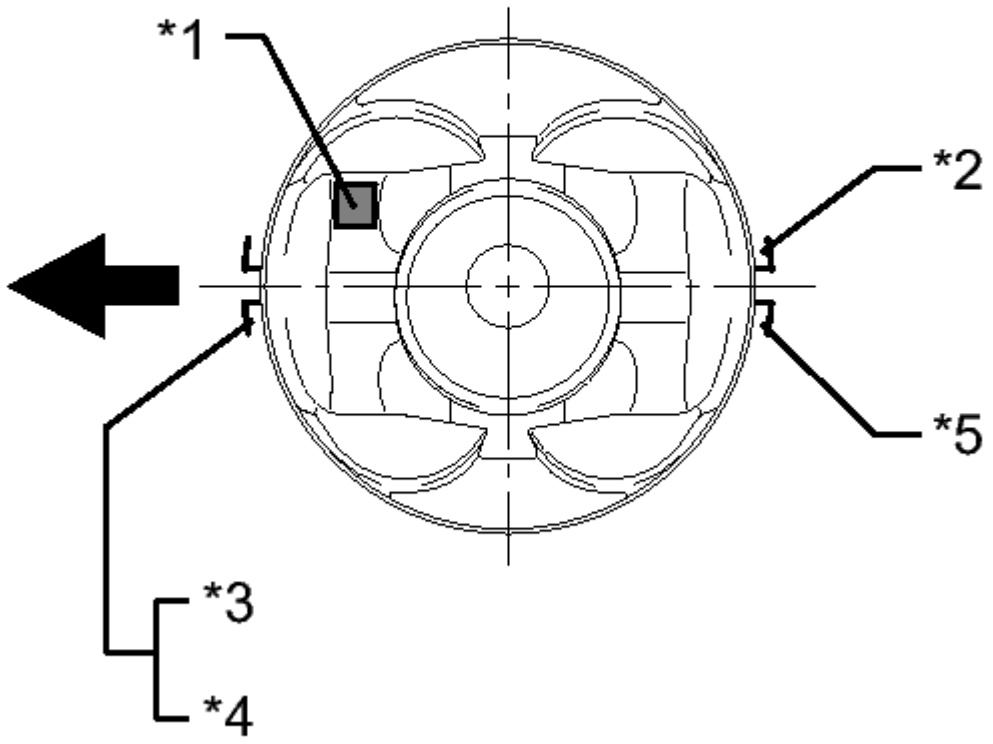
0 to 0.7 mm (0 to 0.0276 in.)

NOTE:

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

11. **INSTALL PISTON WITH CONNECTING ROD**
    a. Apply engine oil to the cylinder walls, pistons, and surfaces of the connecting rod bearings.

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Fig. 495: Piston Ring Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*1	Front Mark
*2	No. 2 Compression Ring
*3	No. 1 Compression Ring
*4	Oil Ring
*5	Oil Ring (Expander)

b. Position the piston rings so that the ring ends are as shown in the illustration.
c. Using a hammer handle and piston ring compressor, press a piston with connecting rod into each cylinder with the front mark of the piston facing forward.

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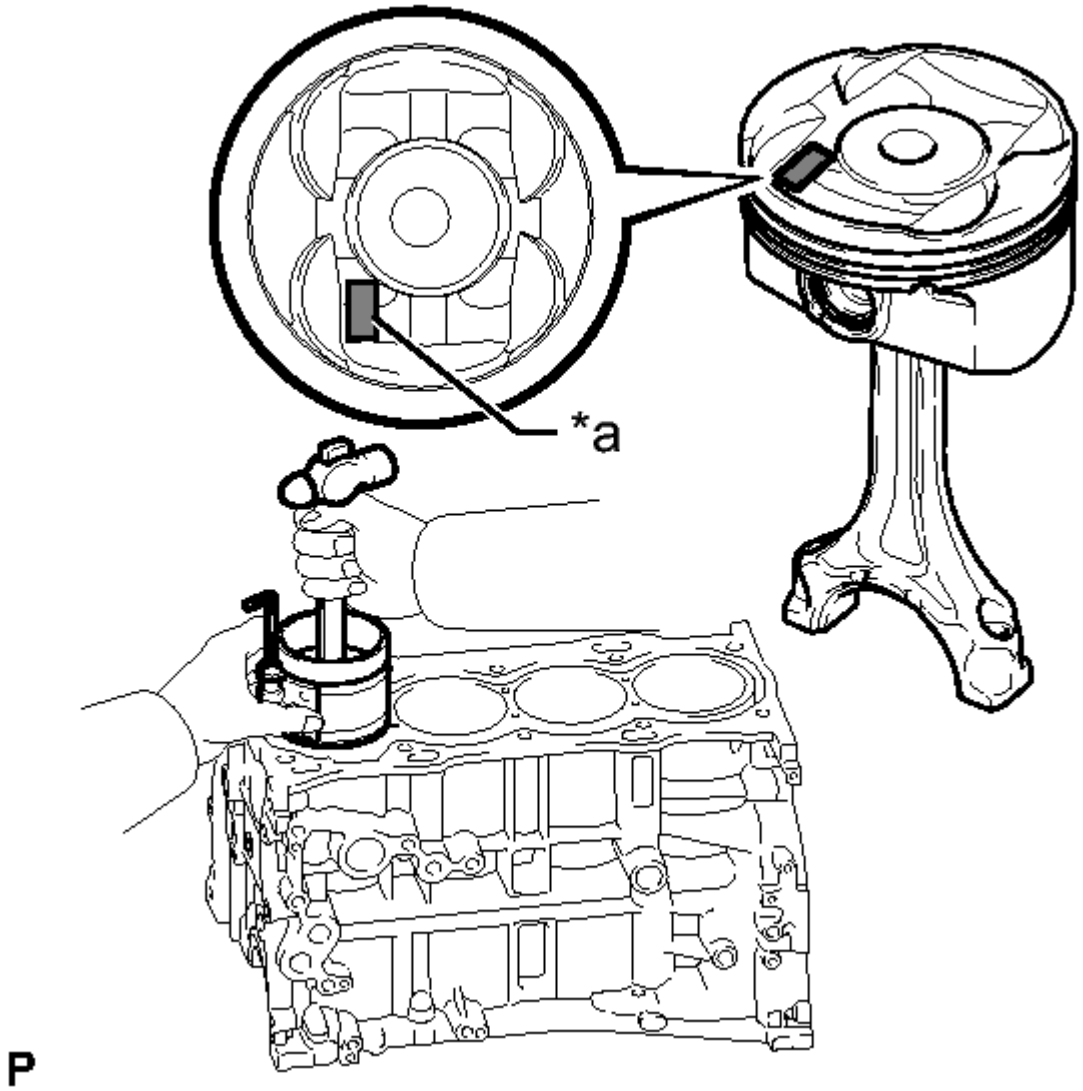


Fig. 496: Pressing Connecting Rod Into Cylinder
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Front Mark

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

HINT:

The front mark is "2L" printed in raised letters.

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

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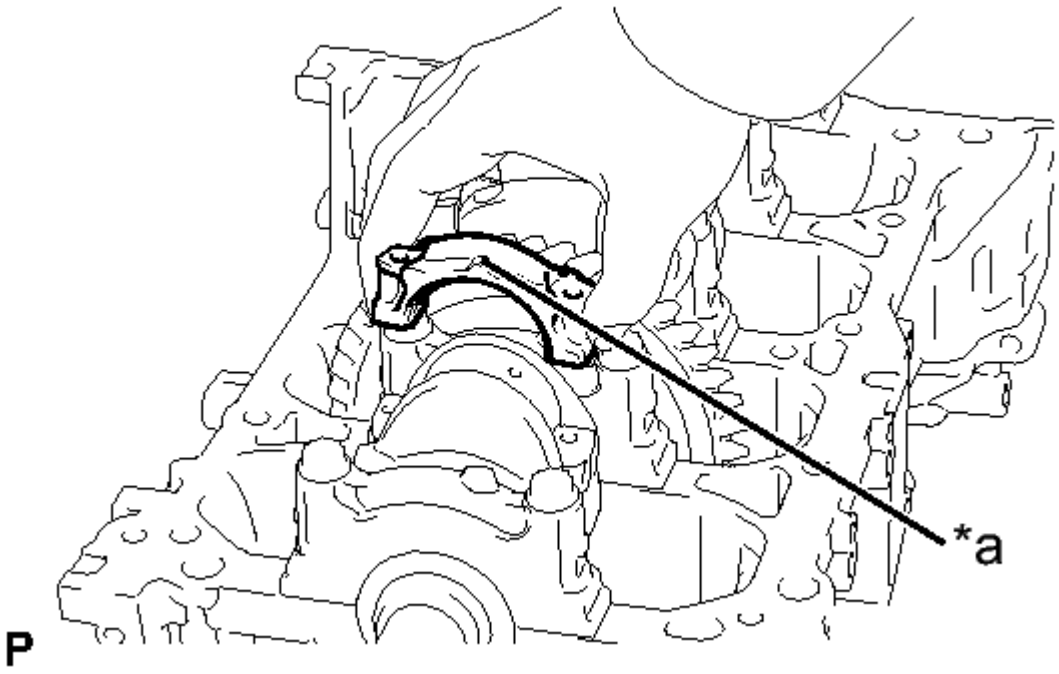


Fig. 497: Identifying Front Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Front Mark

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

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

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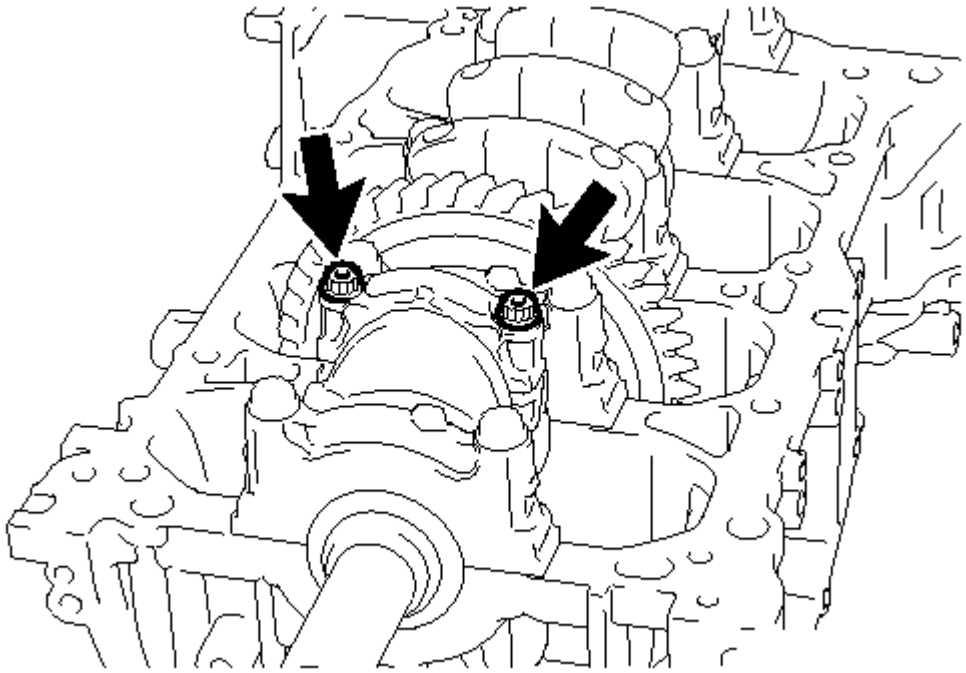


Fig. 498: Locating Connecting Rod Component Cap Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

f. Temporarily install the connecting rod bolts.

HINT:

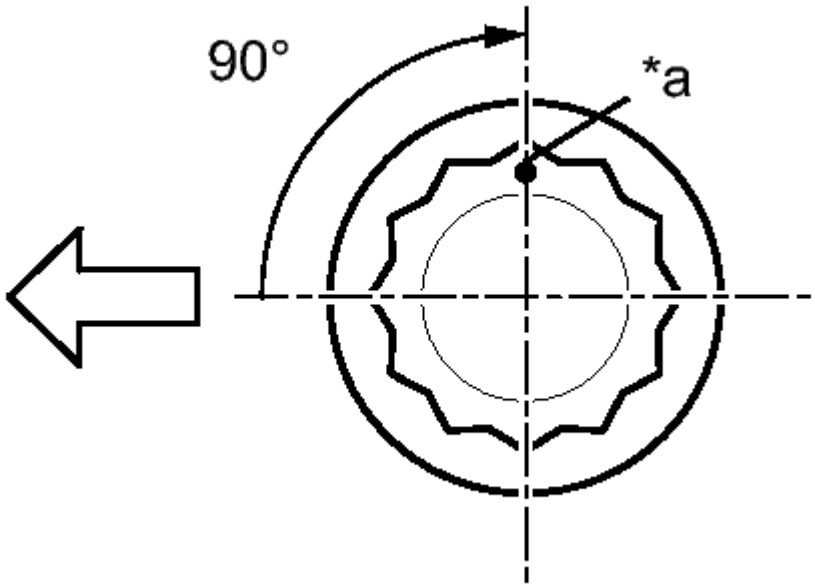
The connecting rod bolts are tightened in 2 progressive steps.

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

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

h. Step 2:

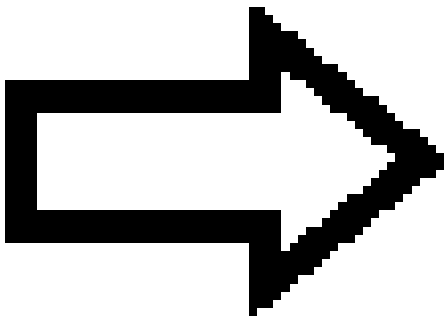
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Fig. 499: Identifying Connecting Rod Cap Bolts Final Torque Position
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TEXT IN ILLUSTRATION

*a	Paint Mark
	Engine Front

1. Mark the front of the connecting rod bolts with paint.
2. Tighten the bolts 90° as shown in the illustration.

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3. Check that the paint marks are now at a 90° angle to the front.

i. Check that the crankshaft turns smoothly.

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