

2009 Toyota Highlander Limited

2009 ENGINE Lubrication (2GR-FE) - Highlander

2009 ENGINE**Lubrication (2GR-FE) - Highlander****LUBRICATION SYSTEM****ON-VEHICLE INSPECTION****1. CHECK ENGINE OIL LEVEL**

- a. Warm up the engine, stop it and wait 5 minutes. The oil level should be between the dipstick's low level mark and full level mark.

If the engine oil level is low, check for leakage and add oil up to the full level mark.

NOTE: Do not add engine oil to above the full level mark.

2. CHECK ENGINE OIL

- a. Check the engine oil for deterioration, water contamination, discoloring or thinning.

If the condition is visibly poor, replace the engine oil and engine oil filter.

3. REMOVE FRONT WHEEL RH (for 4WD)**4. REMOVE ENGINE UNDER COVER ASSEMBLY (for 2WD) (See REMOVAL)****5. DISCONNECT FRONT FENDER LINER RH (for 4WD)****6. REMOVE FRONT FENDER APRON SEAL RH (for 4WD) (See REMOVAL)****7. CHECK OIL PRESSURE**

- a. Disconnect the wiring harness protector, (w/ oil cooler)
- b. Disconnect the oil pressure switch assembly connector.

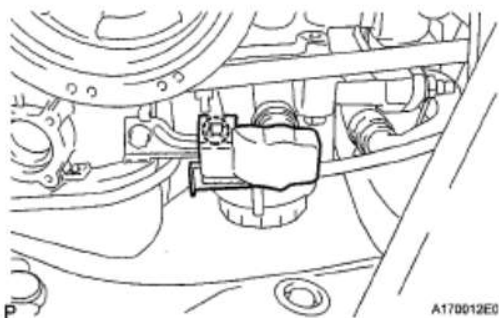
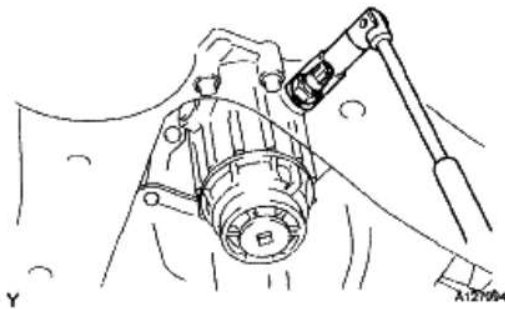


Fig. 1: Identifying Oil Pressure Switch Assembly Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a 24 mm deep socket wrench, remove the oil pressure switch, (w/o oil cooler)

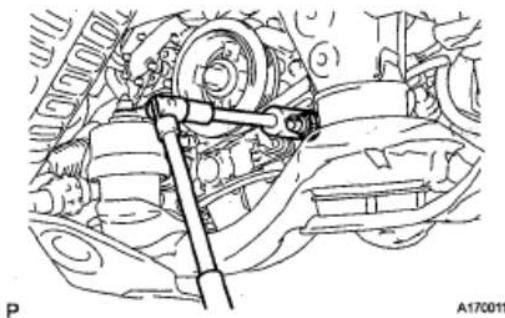
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**Fig. 2: Removing Oil Pressure Switch**

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

- d. Using a 24 mm deep socket wrench, remove the oil pressure switch, (w/ oil cooler)

**Fig. 3: Removing Oil Pressure Switch**

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

- e. Install the oil pressure gauge w/ adapter.
f. Warm up the engine.
g. Check the oil pressure.

Standard oil pressure**OIL PRESSURE CHART**

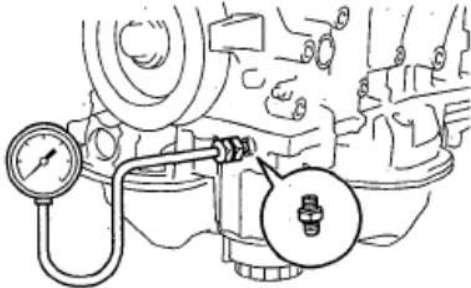
Engine Condition	Oil Pressure
Idle	80 kPa (0.8 kgf/cm ² , 11.6 psi) or more
3000 rpm	380 kPa (3.9 kgf/cm ² , 55.1 psi) or more

If the oil pressure is not as specified, check the oil pump (See **DISASSEMBLY**).

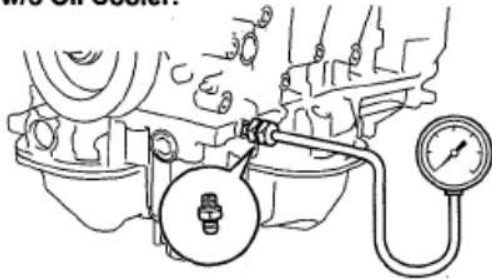
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w/ Oil Cooler:



w/o Oil Cooler:



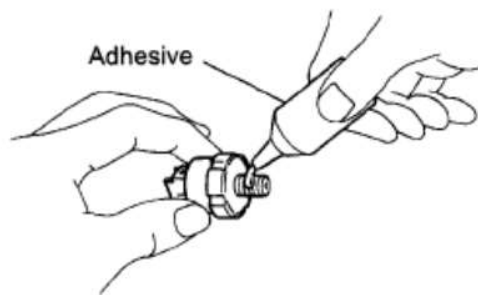
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Fig. 4: Installing Oil Pressure Gauge W/ Adapter
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- h. Remove the oil pressure gauge.
- i. Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent



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Fig. 5: Applying Adhesive To Threads Of Oil Pressure Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- j. Using a 24 mm deep socket wrench, install the oil pressure switch, (w/o oil cooler)

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

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NOTE: Do not start the engine w/in 1 hour after installation.

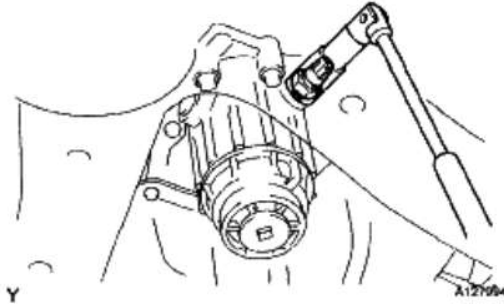


Fig. 6: Installing Oil Pressure Switch

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

- k. Using a 24 mm deep socket wrench, install the oil pressure switch, (w/ oil cooler)

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

NOTE: Do not start the engine w/in 1 hour after installation.

- l. Connect the oil pressure switch assembly connector.

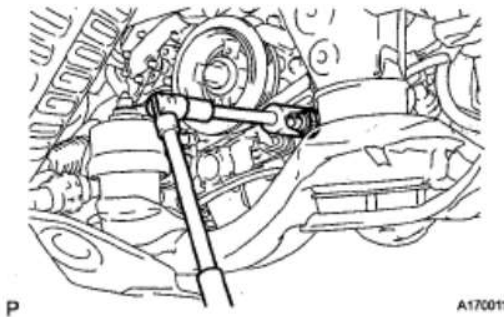


Fig. 7: Installing Oil Pressure Switch

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

- m. Connect the wiring harness protector, (w/ oil cooler)
n. Start the engine.
o. Check for engine oil leaks from the oil pressure switch assembly.

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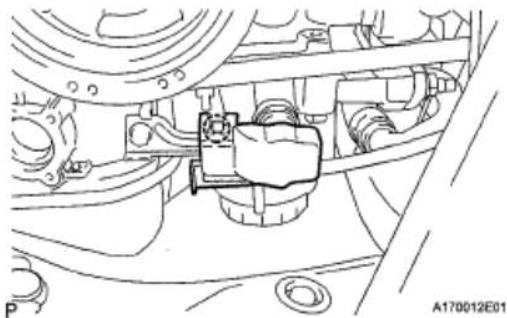


Fig. 8: Identifying Oil Pressure Switch Assembly Connector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. **INSTALL FRONT FENDER APRON SEAL RH (for 4WD)** (See **INSTALLATION**)
9. **INSTALL FRONT FENDER LINER RH (for 4WD)**
10. **INSTALL ENGINE UNDER COVER ASSEMBLY (for 2WD)** (See **INSTALLATION**)
11. **INSTALL FRONT WHEEL RH (for 4WD)**

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

OIL AND OIL FILTER

COMPONENTS

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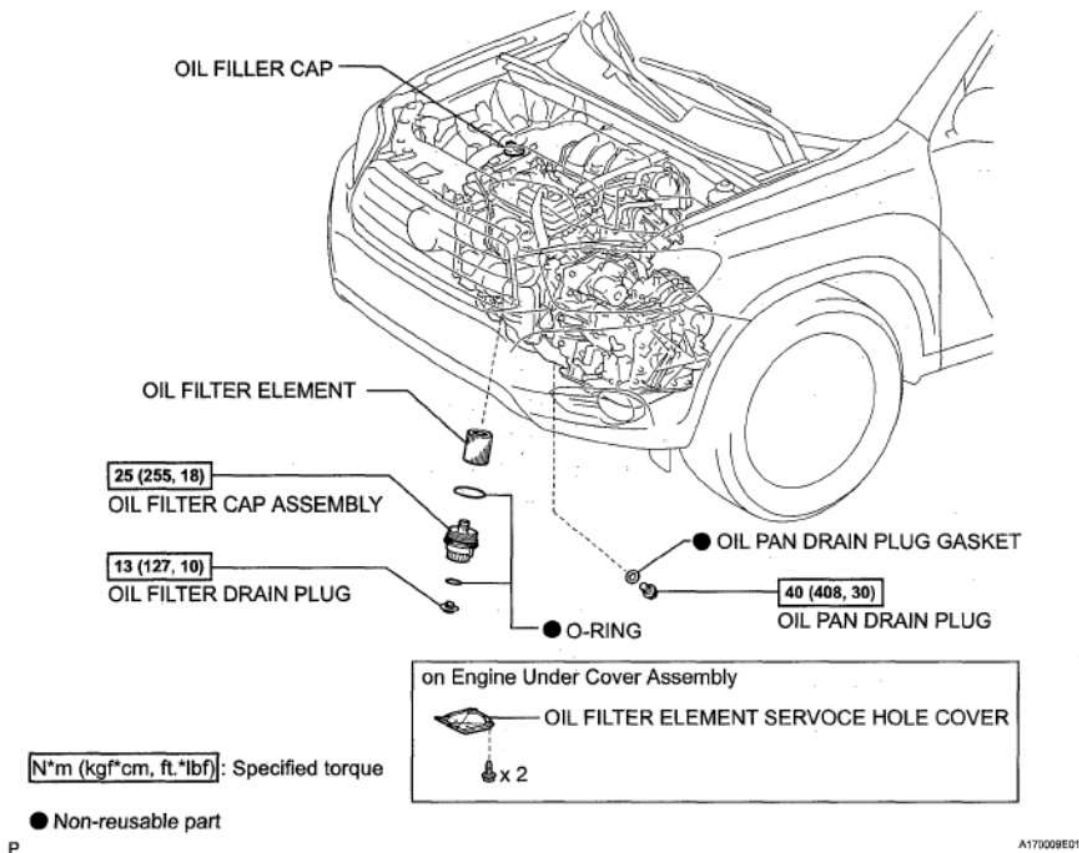


Fig. 9: Identifying Oil And Oil Filter Components And Torque Specifications
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REPLACEMENT

CAUTION:

- Prolonged and repeated contact with engine oil will result in the removal of natural oils from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer.
- Precautions should be taken when replacing engine oil to minimize the risk of your skin making contact with used engine oil. Protective clothing and gloves that cannot be penetrated by oil should be worn. The skin should be washed with soap and water, or waterless hand cleaner, to remove any used engine oil thoroughly. Do not use gasoline, thinners, or solvents.
- In order to preserve the environment, used oil and used oil filters must be disposed of at designated disposal sites.

1. DRAIN ENGINE OIL

- Remove the oil filler cap.
- Remove the oil drain plug and gasket, and drain the oil into a container.

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- c. Clean and install the oil drain plug with a new gasket.

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

2. REMOVE OIL FILTER ELEMENT

- a. Remove the oil filter element service hole cover.
b. Connect a hose with an inside diameter of 15 mm (0.59 in.) to the pipe.

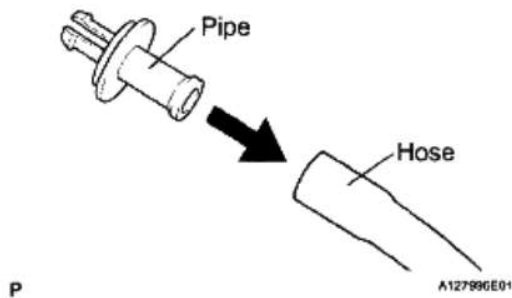


Fig. 10: Connecting Hose To Pipe

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

- c. Remove the oil filter drain plug from the oil filter cap.

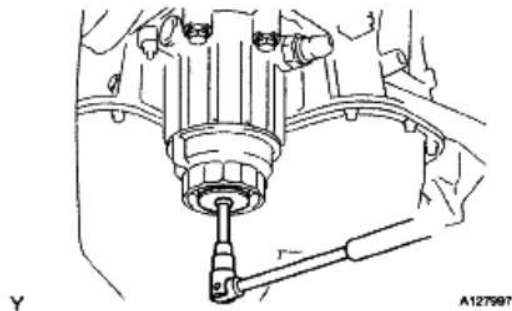


Fig. 11: Removing Oil Filter Drain Plug

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

- d. Insert the pipe with the hose into the oil filter cap.

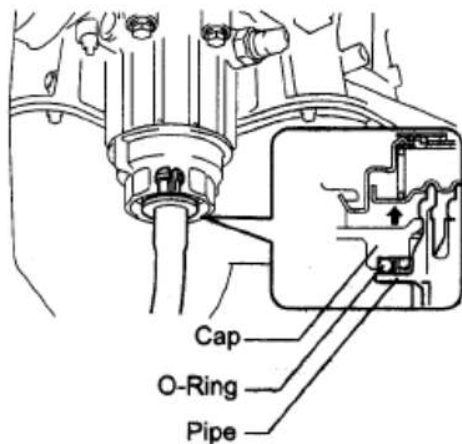
NOTE: Be sure to insert the pipe with the O-ring installed on the oil filter cap side.

HINT:

Place the hose end into a container before draining oil from the hose.

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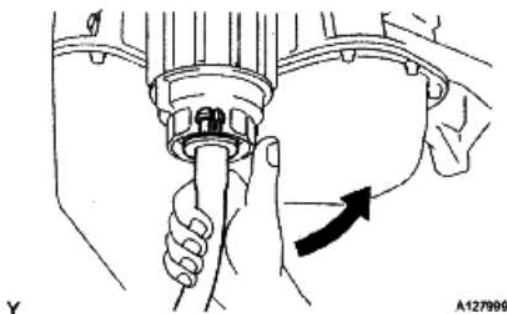
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Fig. 12: Inserting Pipe With Hose Into Oil Filter Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Make sure that oil is completely drained, and remove the pipe and O-ring.

HINT:

Be sure to angle the pipe in the direction of the arrow while removing it.



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Fig. 13: Removing Pipe And O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- f. Using SST, remove the oil filter cap.

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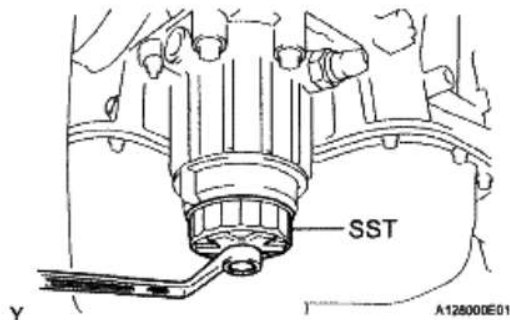


Fig. 14: Removing Oil Filter Cap

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

- g. Remove the oil filter element and O-ring from the oil filter cap.

NOTE: Do not use any tools to remove the O-ring in order to prevent the cap from being damaged. Be sure to remove it by hand.

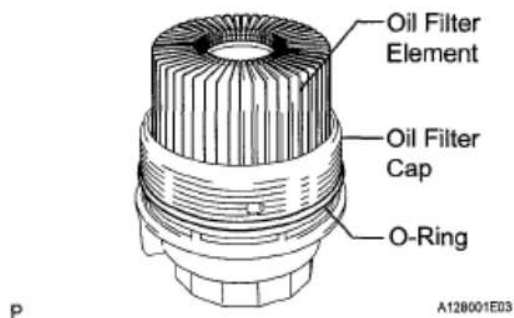


Fig. 15: Identifying Oil Filter Element, O-Ring And Oil Filter Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. INSTALL OIL FILTER ELEMENT

- a. Clean the inside of the oil filter cap, threads, and O-ring groove.

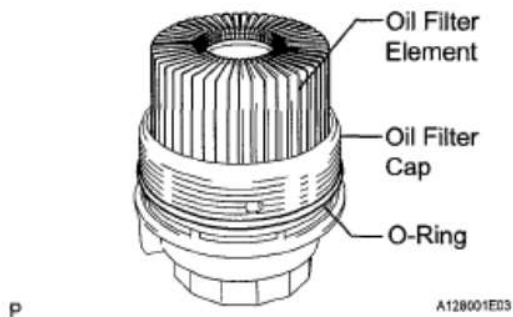


Fig. 16: Identifying Oil Filter Element, O-Ring And Oil Filter Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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- b. Apply a light coat of engine oil to a new O-ring and install it to the oil filter cap.

NOTE: Make sure that the O-ring does not get twisted on the groove.

- c. Install a new oil filter element to the oil filter cap.
d. Remove all dirt and foreign matter from the contact surfaces and the inside of the cap on the engine side.

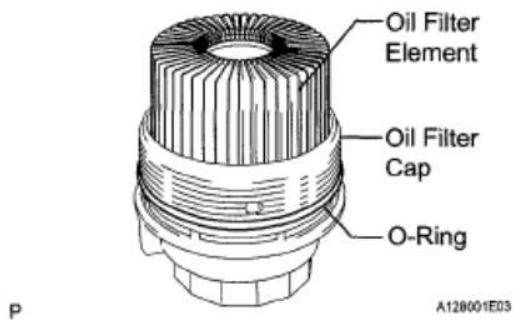


Fig. 17: Identifying Oil Filter Element, O-Ring And Oil Filter Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Apply a light coat of engine oil to the O-ring again and install the oil filter cap.

NOTE: Make sure that the O-ring does not get caught between the parts.

- f. Using SST, install the oil filter cap.

SST 09228-06501

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

NOTE: Make sure that there is no clearance between the parts after tightening the oil filter cap.

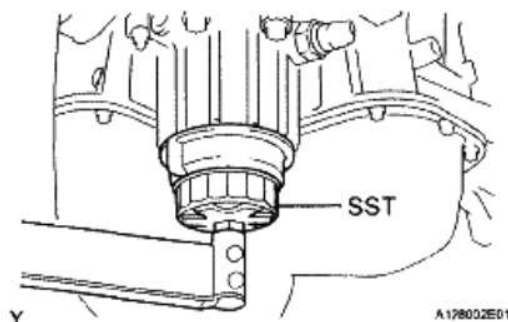


Fig. 18: Installing Oil Filter Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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- g. Apply a light coat of engine oil to a new O-ring and install it to the oil filter cap.

NOTE: Remove all dirt and foreign matter from the contact surfaces.

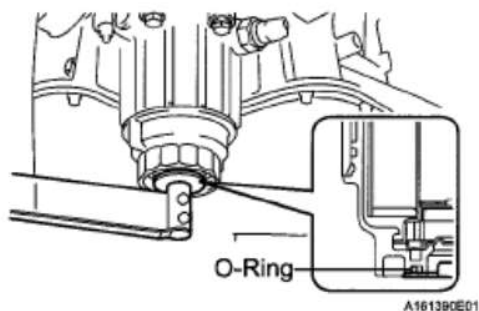


Fig. 19: Installing Oil Filter Cap

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

- h. Install the oil filter drain plug to the oil filter cap.

Torque: 13 N*m (127 kgf*cm, 10 ft.*lbf)

NOTE: Make sure that the O-ring does not get caught between the parts.

- i. Install the oil filter element service hole cover.

4. ADD ENGINE OIL

- a. Add clean engine oil and install the oil filler cap.

Engine oil

ENGINE OIL SPECIFICATIONS

Oil Grade	Oil Viscosity (SAE)
ILSAC multigrade engine oil	5W-30

Standard capacity (w/ Oil Cooler):

ITEM SPECIFICATIONS

Item	Standard Condition
Drain and refill with oil filter change	6.1 liters (6.4 US qts, 5.4 imp. qts)
Drain and refill without oil filter change	5.7 liters (6.0 US qts, 5.0 imp. qts)
Dry fill	7.1 liters (7.5 US qts, 6.2 imp. qts)

Standard capacity (w/o Oil Cooler):

ITEM SPECIFICATIONS

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Item	Standard Condition
Drain and refill with oil filter change	6.1 liters (6.4 US qts, 5.4 imp. qts)
Drain and refill without oil filter change	5.7 liters (6.0 US qts, 5.0 imp. qts)
Dry fill	6.8 liters (7.2 US qts, 6.0 imp. qts)

5. INSPECT FOR OIL LEAK

- a. Start the engine. Check for engine oil leaks from the oil filter cap and oil filter drain plug.
- b. Install the oil filter element service hole cover.

OIL PRESSURE SWITCH**COMPONENTS**

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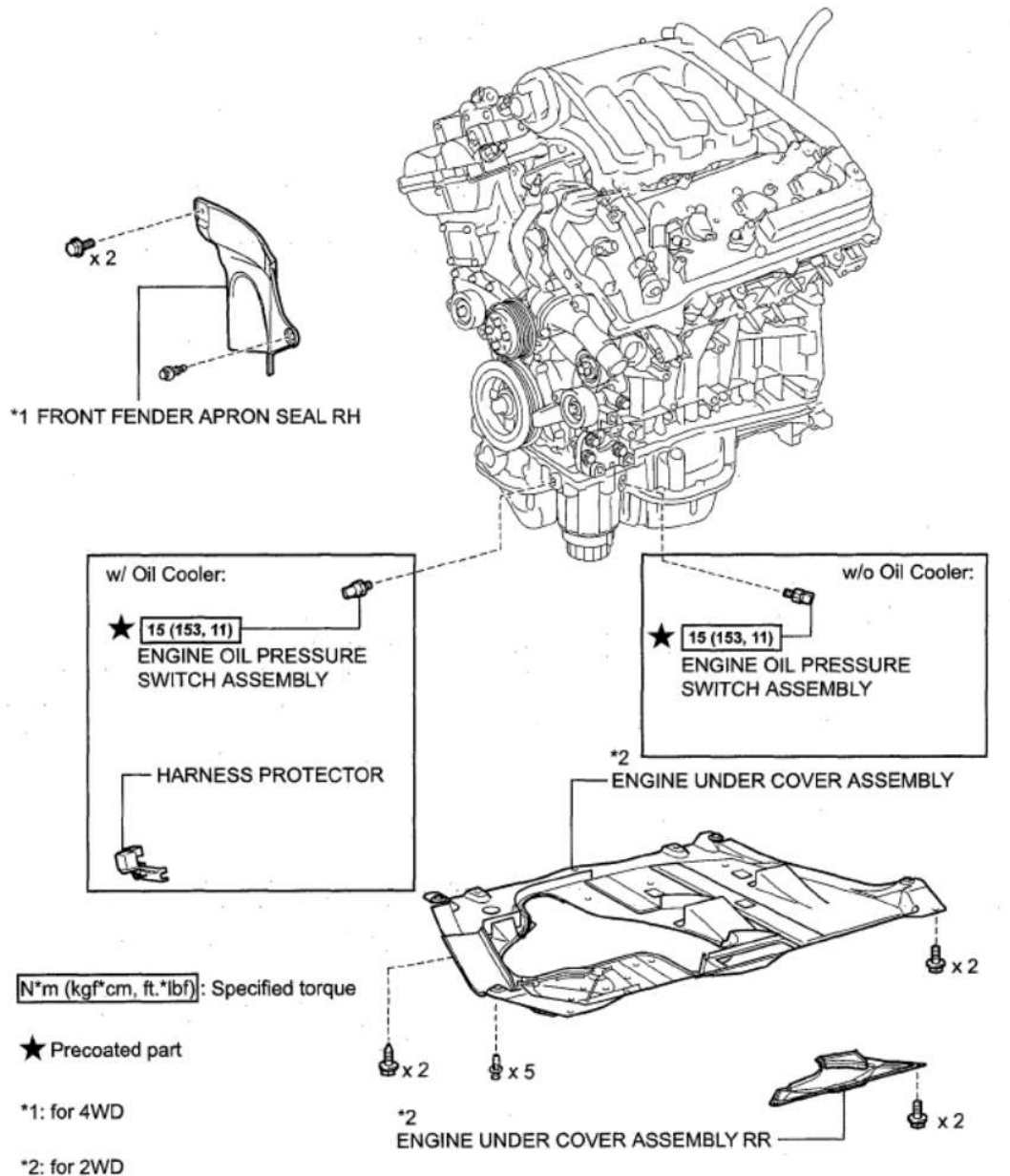


Fig. 20: Identifying Oil Pressure Switch Components And Torque Specifications
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE FRONT WHEEL RH (for 4WD)
2. REMOVE ENGINE UNDER COVER ASSEMBLY (for 2WD) (See [REMOVAL](#))
3. DISCONNECT FRONT FENDER LINER RH (for 4WD)
4. REMOVE FRONT FENDER APRON SEAL RH (for 4WD) (See [REMOVAL](#))
5. REMOVE ENGINE OIL PRESSURE SWITCH ASSEMBLY

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- a. Disconnect the wiring harness protector, (w/ oil cooler)
- b. Disconnect the oil pressure switch assembly connector.

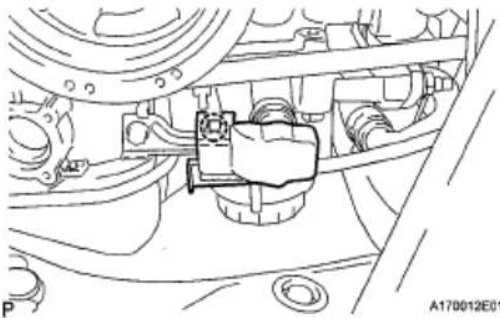


Fig. 21: Identifying Wiring Harness Protector
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a 24 mm deep socket wrench, remove the oil pressure switch, (w/o oil cooler)

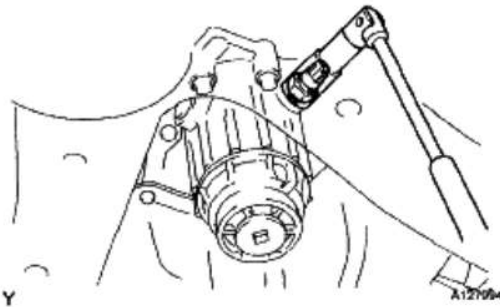


Fig. 22: Removing Oil Pressure Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- d. Using a 24 mm deep socket wrench, remove the oil pressure switch, (w/ oil cooler)

INSPECTION**1. INSPECT ENGINE OIL PRESSURE SWITCH ASSEMBLY**

- a. Disconnect the oil pressure switch connector.
- b. Start the engine.

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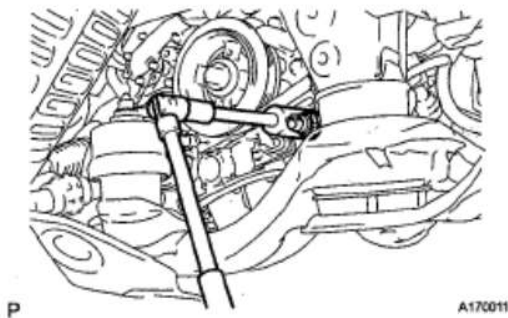


Fig. 23: Removing Oil Pressure Switch

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

- c. Measure the resistance according to the value(s) in the table below.

Standard resistance

TESTER CONNECTION SPECIFIED CONDITION CHART

Tester Connection	Condition	Specified Condition
B26-1 - Switch body	Idling	10 kohms or higher
B26-1 - Switch body	Engine stopped	Below 1 ohms

- d. Reconnect the oil pressure switch connector. If the result is not as specified, replace the oil pressure switch assembly.

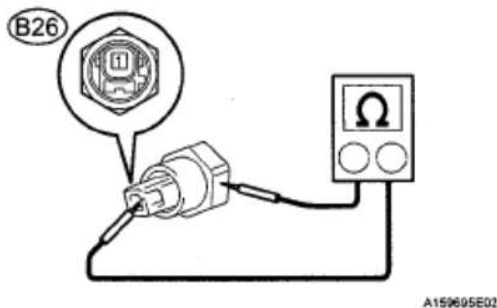


Fig. 24: Inspecting Engine Oil Pressure Switch Assembly

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

INSTALLATION

1. INSTALL ENGINE OIL PRESSURE SWITCH ASSEMBLY

- a. Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

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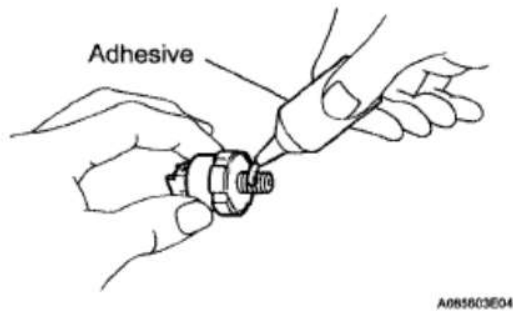


Fig. 25: Applying Adhesive To Threads Of Oil Pressure Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Using a 24 mm deep socket wrench, install the oil pressure switch, (w/o oil cooler)

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

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

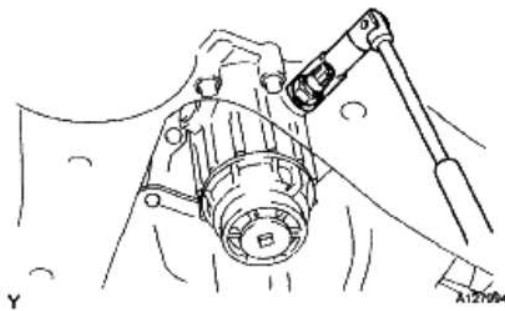


Fig. 26: Installing Oil Pressure Switch
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Using a 24 mm deep socket wrench, install the oil pressure switch, (w/ oil cooler)

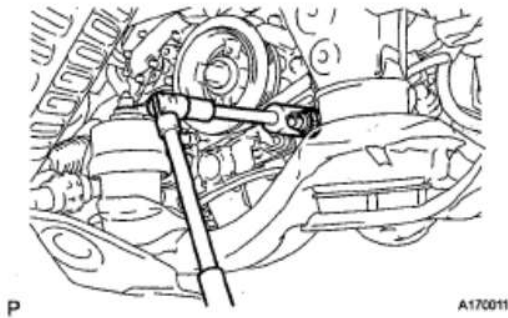
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)

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

- d. Connect the oil pressure switch assembly connector.

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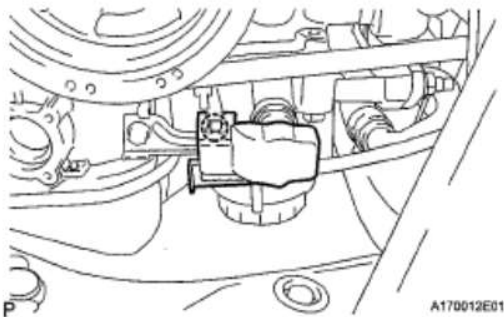
**Fig. 27: Installing Oil Pressure Switch**

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

- e. Connect the wiring harness protector, (w/ oil cooler)

2. INSPECT FOR OIL LEAK

- a. Start the engine.
- b. Check for engine oil leaks from the oil pressure switch assembly.

**Fig. 28: Identifying Wiring Harness Protector**

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

- 3. **INSTALL FRONT FENDER APRON SEAL RH (for 4WD)** (See **INSTALLATION**)
- 4. **INSTALL FRONT FENDER LINER RH (for 4WD)**
- 5. **INSTALL ENGINE UNDER COVER ASSEMBLY (for 2WD)** (See **INSTALLATION**)
- 6. **INSTALL FRONT WHEEL RH (for 4WD)**

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

OIL PUMP**COMPONENTS**

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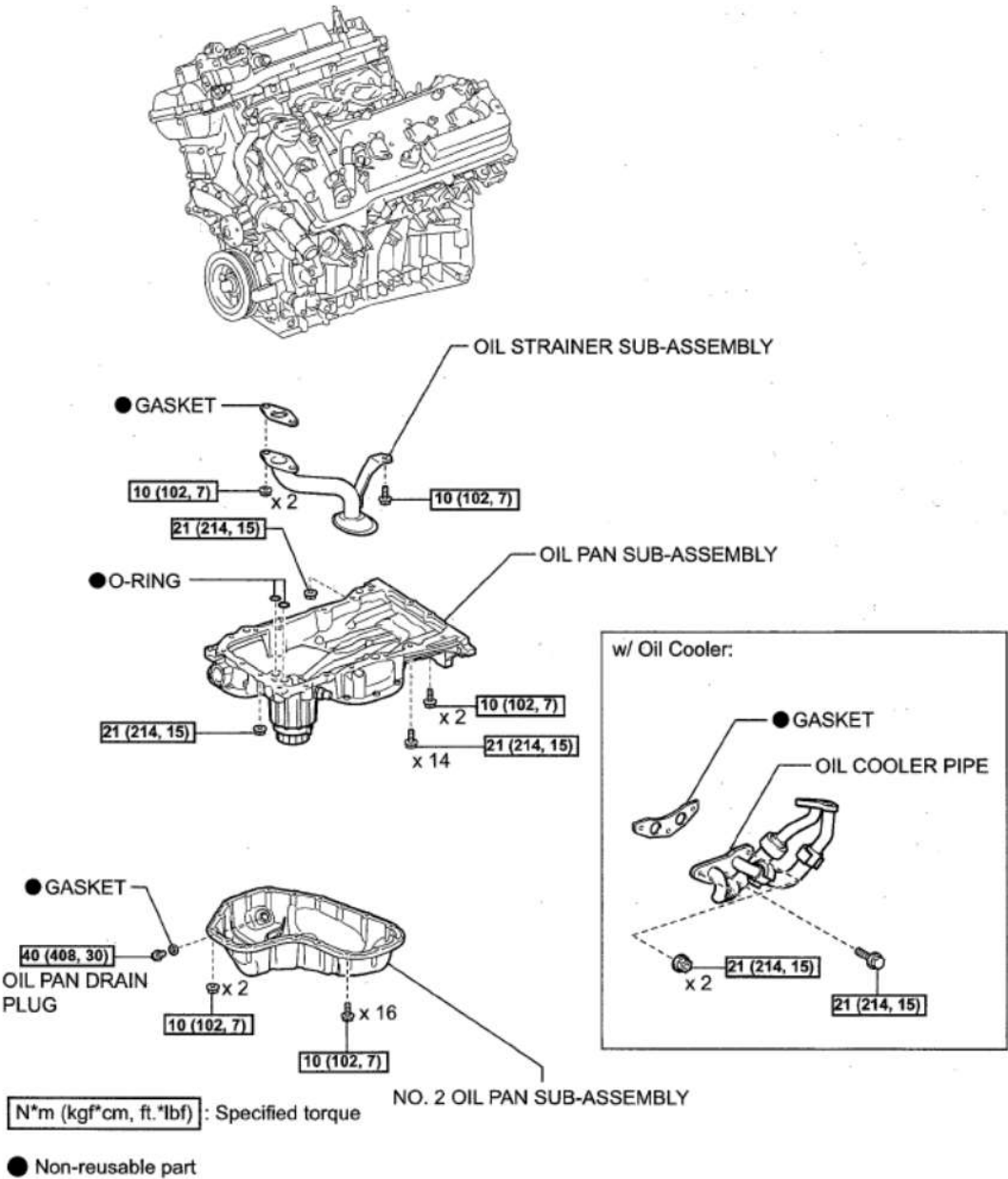
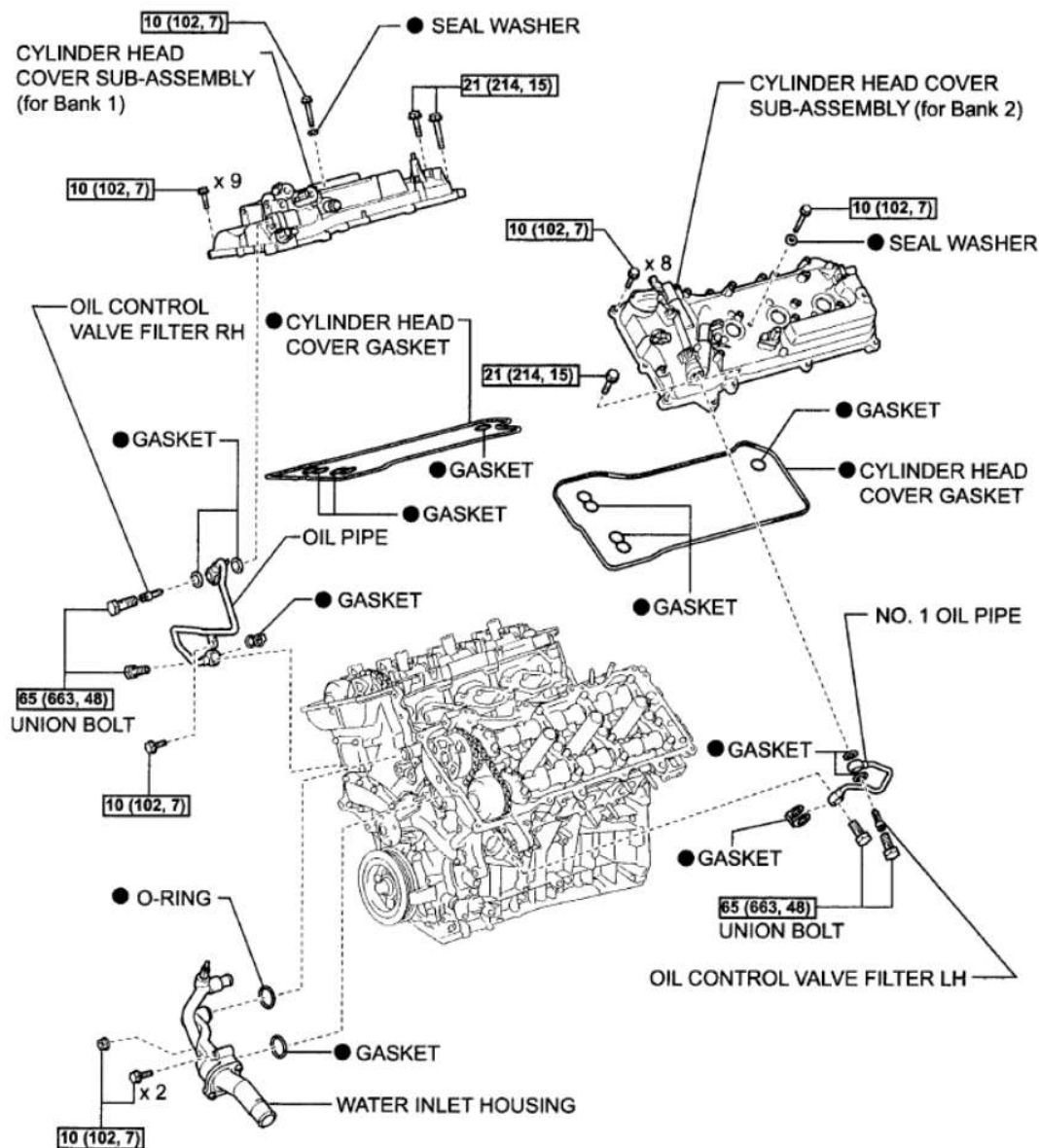


Fig. 29: Identifying Oil Pump Components And Torque Specifications (1 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

● Non-reusable part

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Fig. 30: Identifying Oil Pump Components And Torque Specifications (2 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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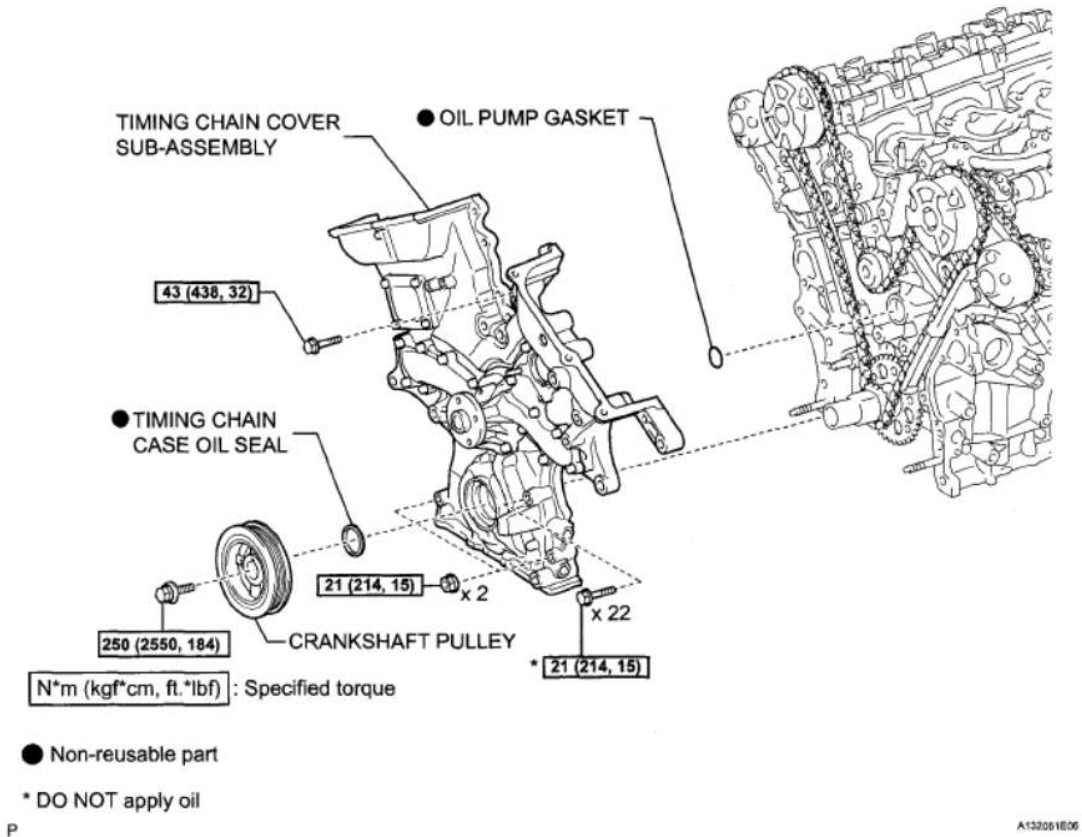
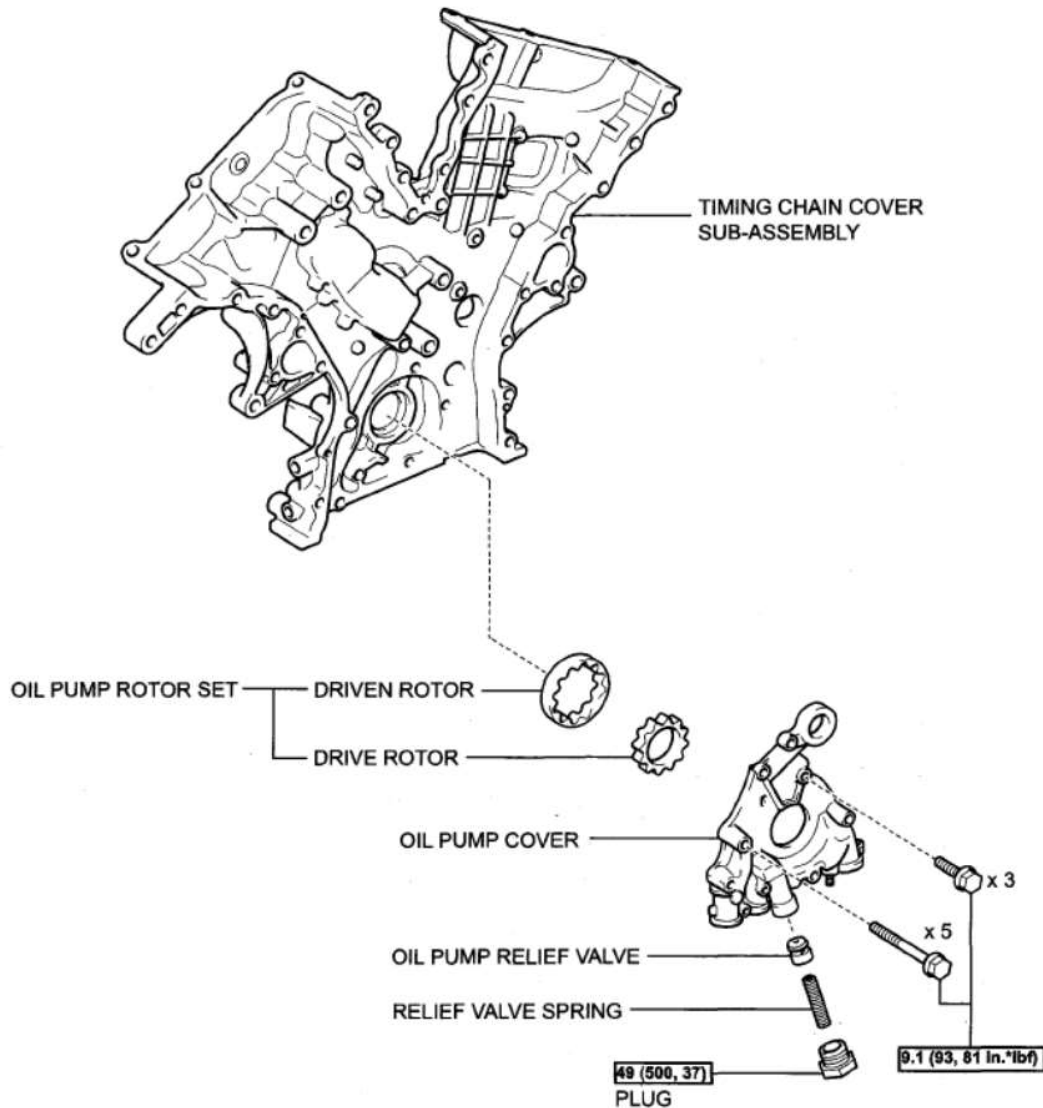


Fig. 31: Identifying Oil Pump Components And Torque Specifications (3 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

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Fig. 32: Identifying Oil Pump Components And Torque Specifications (4 Of 4)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL

1. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

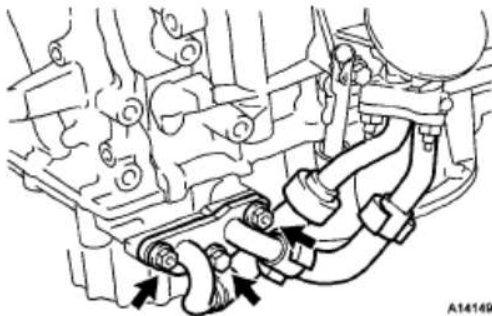
See **REMOVAL** .

2. SECURE ENGINE (See **REMOVAL**)

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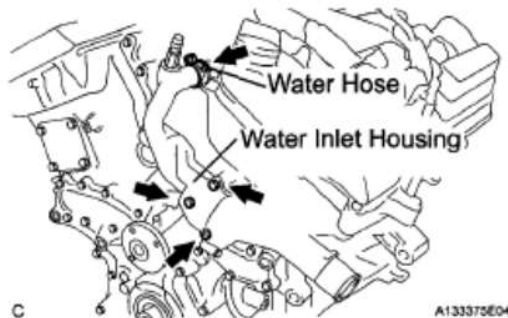
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3. **REMOVE NO. 1 OIL PIPE** (See **DISASSEMBLY**)
4. **REMOVE OIL PIPE** (See **DISASSEMBLY**)
5. **REMOVE CRANKSHAFT PULLEY** (See **DISASSEMBLY**)
6. **SEPARATE OIL COOLER PIPE (w/ oil cooler)**
 - a. Remove the bolt and 2 nuts, and disconnect the oil cooler pipe from the oil pan sub-assembly.
 - b. Remove the gasket from the oil pan sub-assembly.

**Fig. 33: Locating Nuts**

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

7. **REMOVE WATER INLET HOUSING**
 - a. Disconnect the water hose.
 - b. Remove the 2 bolts, nut and water inlet housing.

**Fig. 34: Locating Bolts, Nut And Water Inlet Housing**

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

- c. Remove the water inlet housing gasket and water outlet pipe O-ring.

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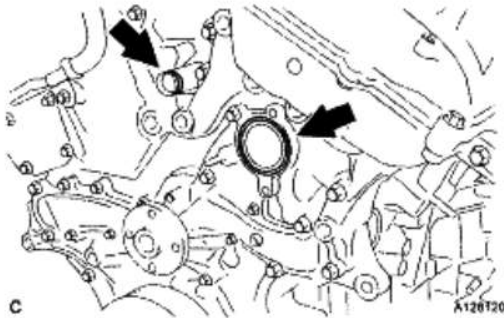


Fig. 35: Locating Water Inlet Housing Gasket And O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 1) (See DISASSEMBLY)
9. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 2) (See DISASSEMBLY)
10. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY (See DISASSEMBLY)
11. REMOVE OIL STRAINER SUB-ASSEMBLY (See DISASSEMBLY)
12. REMOVE OIL PAN SUB-ASSEMBLY (See DISASSEMBLY)
13. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY
 - a. Remove the 23 bolts and 2 nuts as shown in the illustration.

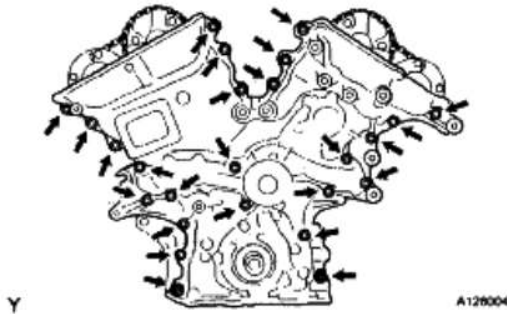


Fig. 36: Locating Belt Cover Sub-Assembly Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the timing chain cover by prying between the timing chain cover and cylinder head or cylinder block with a screwdriver.

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

HINT:

Tape the screwdriver tip before use.

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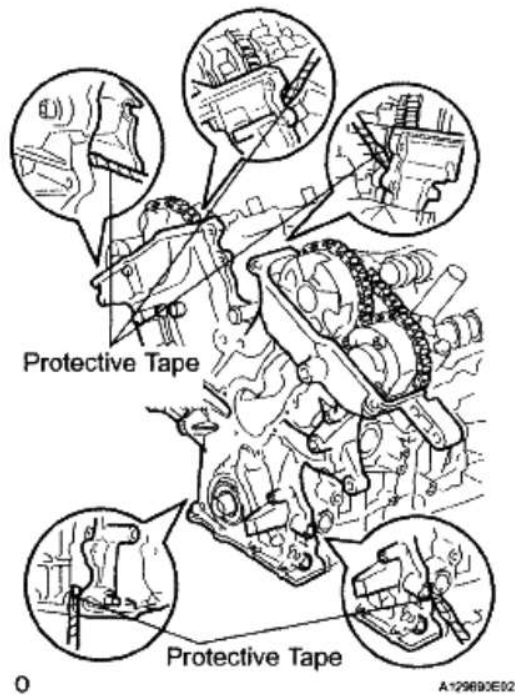


Fig. 37: Removing Bolts, Chain Cover Plate And Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Remove the gasket.

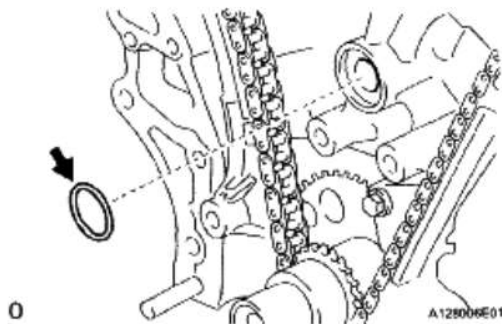


Fig. 38: Locating Gasket
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

14. REMOVE TIMING CHAIN CASE OIL SEAL

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

HINT:

Tape the screwdriver tip before use.

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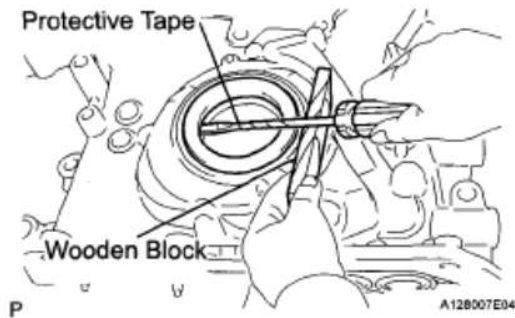


Fig. 39: Prying Out Oil Seal

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

DISASSEMBLY

1. REMOVE OIL PUMP RELIEF VALVE

- Using a 27 mm socket wrench, remove the relief valve plug.
- Remove the valve spring and oil pump relief valve.

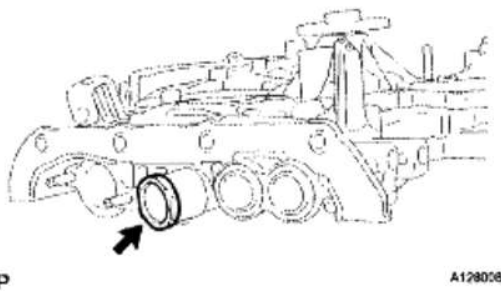


Fig. 40: Locating Oil Pump Relief Valve Plug

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

2. REMOVE OIL PUMP COVER

- Remove the 8 bolts, oil pump cover and oil pump rotor set.

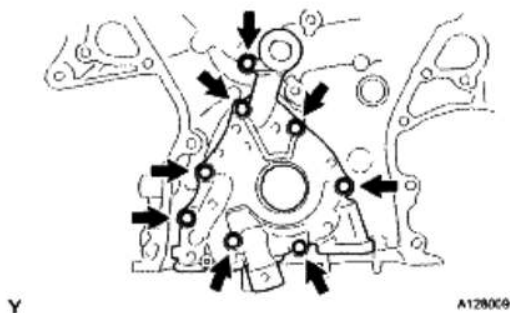


Fig. 41: Locating Oil Pump Cover Bolts

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

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INSPECTION

1. INSPECT OIL PUMP RELIEF VALVE

- a. Coat the relief valve with engine oil and check that it falls smoothly into the valve hole by its own weight. If the valve does not fall smoothly, replace the relief valve. If necessary, replace the oil pump assembly.

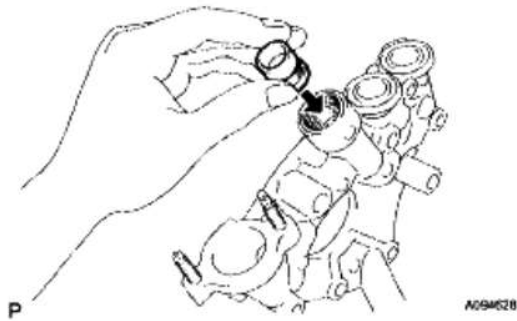


Fig. 42: Inspecting Oil Pump Relief Valve
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSPECT OIL PUMP ROTOR SET

- a. Install the rotors to the timing chain cover with the rotors' marks facing up. Check that the rotors rotate smoothly.

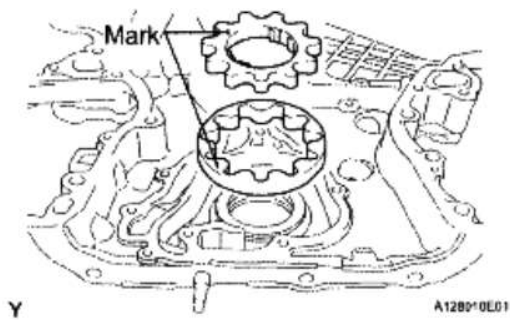


Fig. 43: Identifying Rotors Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Check the tip clearance.
 - 1. Using a feeler gauge, measure the clearance between the drive and driven rotor tips, as shown in the illustration.

Tip clearance

TIP CLEARANCE CHART

Standard	Maximum
0.060 to 0.160 mm (0.0024 to 0.0063 in.)	0.160 mm (0.0063 in.)

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If the clearance is greater than the maximum, replace the drive and driven rotors.

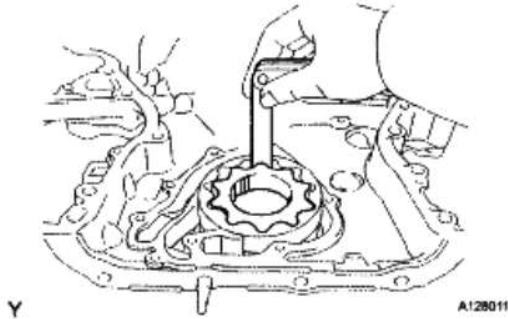


Fig. 44: Measuring Clearance Between Drive Rotor And Driven Rotor Tips
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Check the side clearance.
1. Using a feeler gauge and precision straightedge, measure the clearance between the rotors and precision straightedge, as shown in the illustration.

Side clearance**SIDE CLEARANCE CHART**

Standard	Maximum
0.030 to 0.090 mm (0.0012 to 0.0035 in.)	0.090 mm (0.0035 in.)

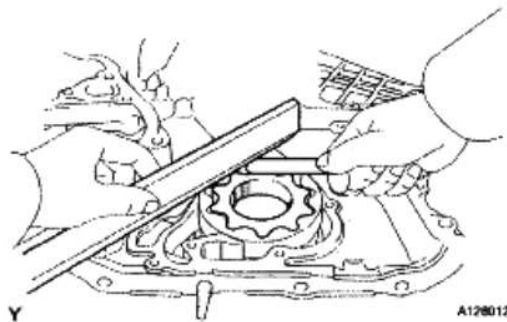


Fig. 45: Checking Side Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

If the side clearance is greater than the maximum, replace the timing chain cover sub-assembly.

- d. Check the body clearance.
1. Using a feeler gauge, measure the clearance between the timing chain cover and driven rotor, as shown in the illustration.

Body clearance

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BODY CLEARANCE CHART

Standard	Maximum
0.250 to 0.325 mm (0.0098 to 0.0128 in.)	0.325 mm (0.0128 in.)

If the body clearance is greater than the maximum, replace the timing chain cover sub-assembly.

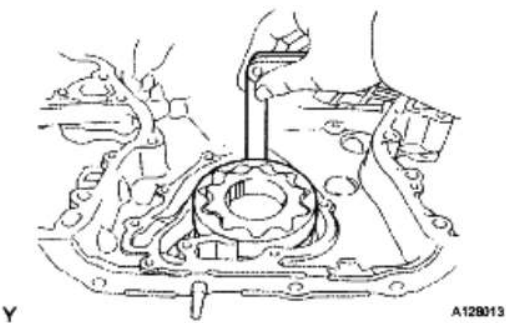


Fig. 46: Checking Body Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REASSEMBLY

1. INSTALL OIL PUMP COVER

- a. Coat the drive and driven rotors with engine oil and place them into the timing chain cover with the marks facing up (oil pump cover side). Check that the rotors rotate smoothly.

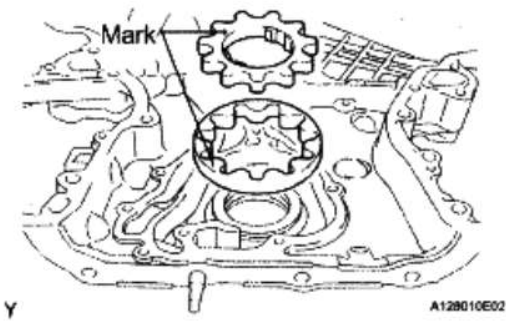


Fig. 47: Identifying Mark On Drive And Driven Rotors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Install the oil pump cover with the 8 bolts.

Torque: 9.1 N*m (93 kgf*cm, 81 in.*lbf)

Bolt length

BOLT LENGTH CHART

Item	Length
------	--------

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Bolt A	22 mm (0.87 in.)
Bolt B	40 mm (1.58 in.)

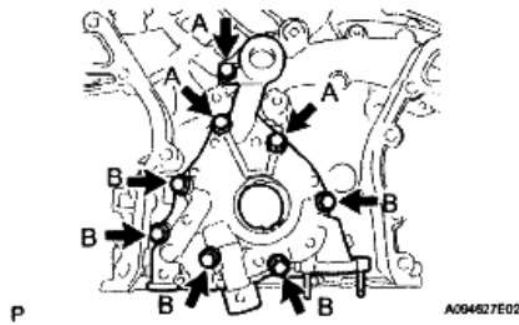


Fig. 48: Locating Oil Pump Cover Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL OIL PUMP RELIEF VALVE

- Coat the oil pump relief valve with engine oil.
- Insert the relief valve and relief valve spring into the oil pump cover hole.
- Using a 27 mm socket wrench, install the plug.

Torque: 49 N*m (500 kgf*cm, 37 ft.*lbf)

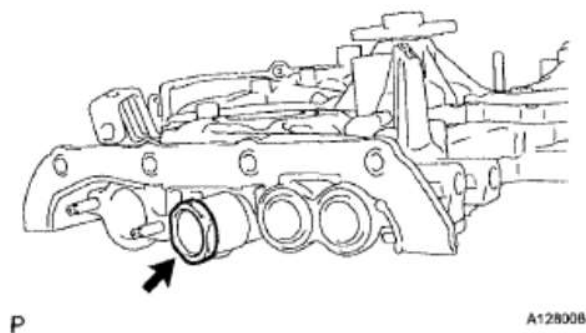


Fig. 49: Locating Timing Chain Case Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSTALLATION

1. INSTALL TIMING CHAIN CASE OIL SEAL

- Using SST, tap in a new oil seal until its surface is flush with the timing chain case edge.

SST 09223-22010, 09506-35010

NOTE:

- Keep the lip free from foreign matter.

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- Do not tap on the oil seal at an angle.
- Make sure that the oil seal edge does not stick out of the timing chain case.

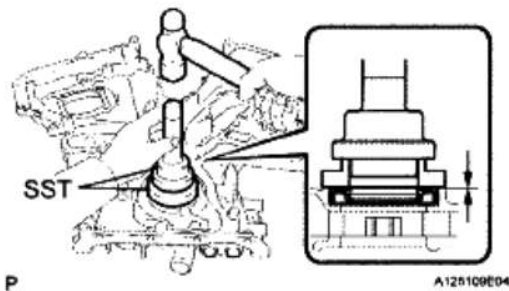


Fig. 50: Installing Timing Chain Case Oil Seal
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY

- Apply seal packing in a continuous line to the engine unit as shown in the following illustration.

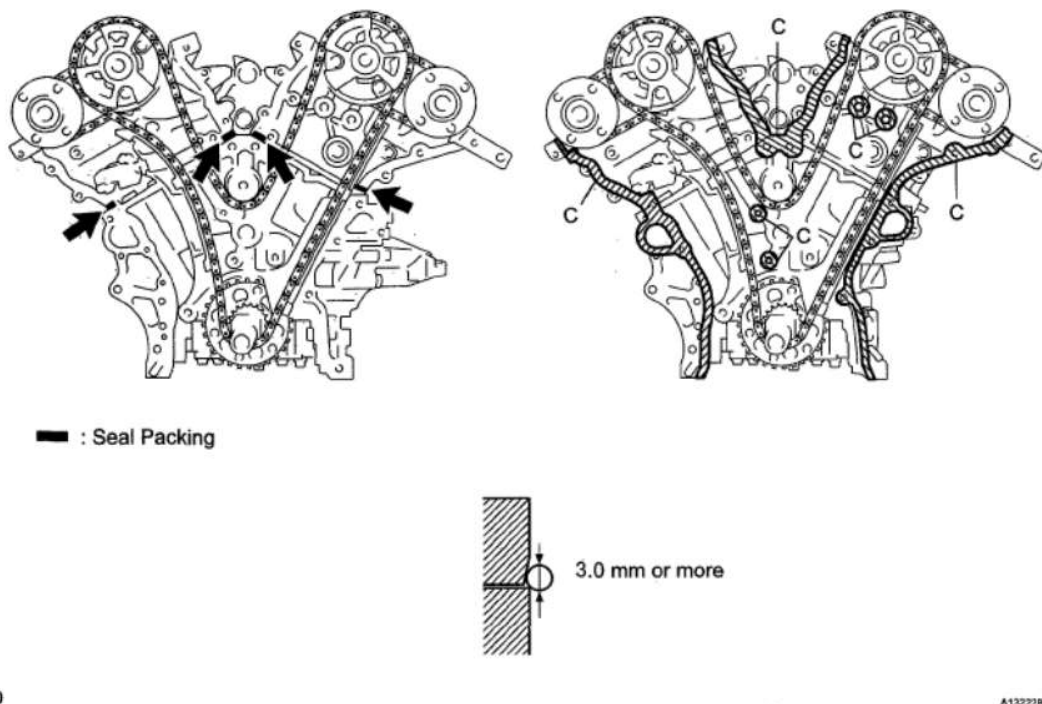


Fig. 51: Locating Seal Packing
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Seal packing:

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

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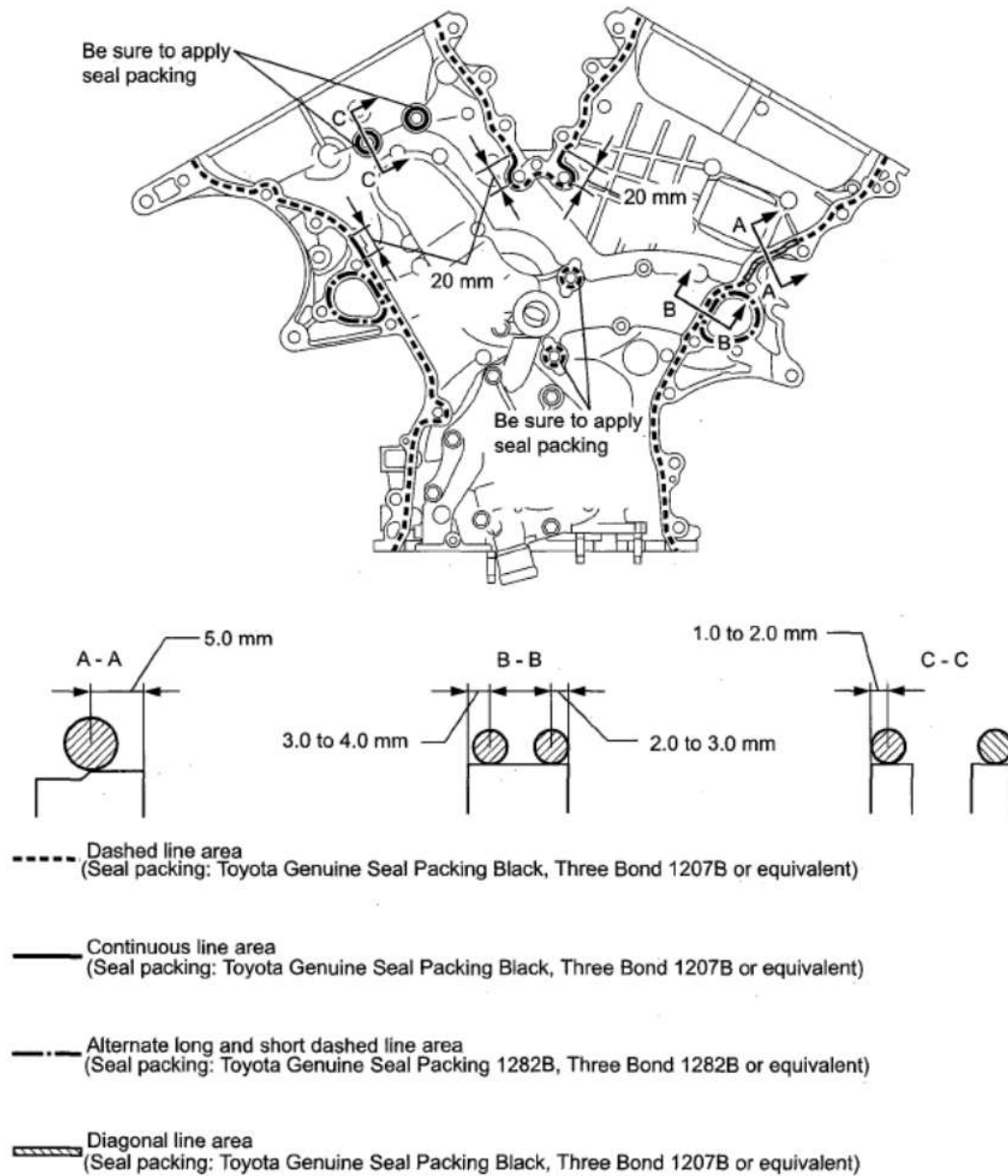
Seal diameter:**3.0 mm (0.118 in.)****NOTE:**

- Be sure to clean and degrease the contact surfaces, especially the surfaces indicated by C in the illustration.
- If the contact surfaces are wet, wipe them with an oil-free cloth before applying seal packing.
- Install the chain cover sub-assembly within 3 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing the chain cover sub-assembly.

- b. Apply seal packing in a continuous line to the timing chain cover as shown in the following illustration.

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Fig. 52: Identifying Seal Packing

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

Seal packing:

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

Toyota Genuine Seal Packing 1282B, Three Bond 1282B or equivalent

NOTE:

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- If the contact surfaces are wet, wipe them with an oil-free cloth before applying seal packing.
- Install the chain cover sub-assembly within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing the chain cover sub-assembly.

Apply seal packing as follows

SEAL PACKING SPECIFICATIONS

Area	Seal Packing Diameter	Application Position from Inside Seal Line
Continuous Line Area	4.5 mm (0.177 in.) or more	3.0 to 4.0 mm (0.118 to 0.158 in.)
Alternate Long and Short Dashed Line Area	3.5 mm (0.138 in.) or more	2.0 to 3.0 mm (0.079 to 0.118 in.)
Dashed Line Area	3.5 mm (0.138 in.) or more	3.0 to 4.0 mm (0.118 to 0.158 in.)
Diagonal Line Area	6.0 mm (0.236 in.) or more	5.0 mm (0.197 in.)

- c. Install a new gasket.

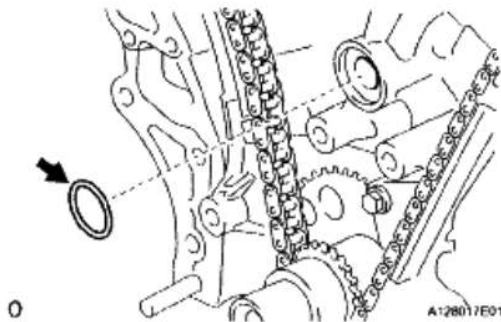


Fig. 53: Locating Gasket

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

- d. Align the oil pump's drive rotor spline and the crankshaft as shown in the illustration. Install the spline and chain cover to the crankshaft.

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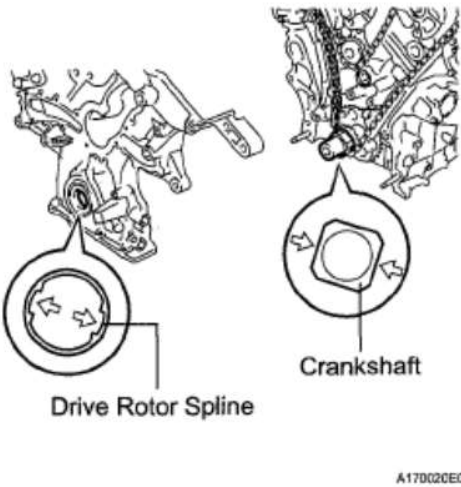


Fig. 54: Identifying Drive Rotor Spline And Crankshaft
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- e. Temporarily tighten the timing chain cover with the 23 bolts and 2 nuts.

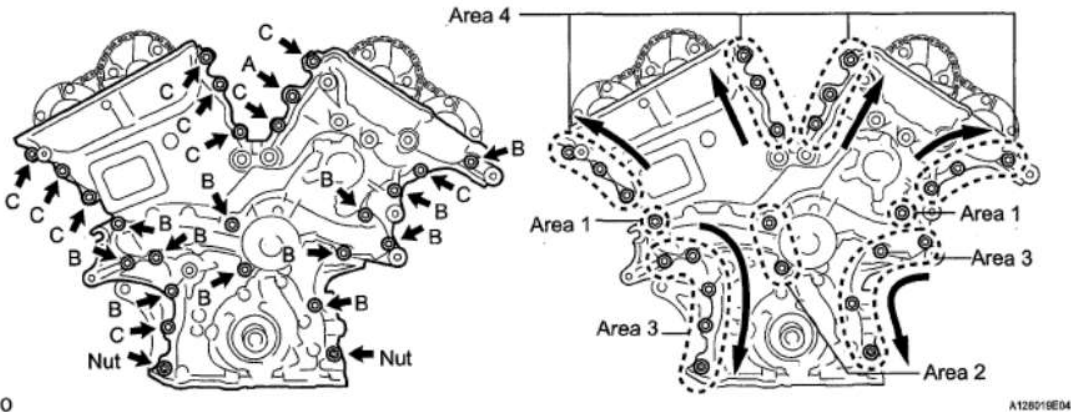


Fig. 55: Locating Timing Chain Cover Bolts And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Bolt length

BOLT LENGTH CHART

Item	Length
Bolt A	40 mm (1.57 in.)
Bolt B	55 mm (2.17 in.)
Bolt C	25 mm (0.98 in.)

NOTE: Make sure that there is no oil on the bolt threads.

- f. Fully tighten the bolts in area 1 and area 2.

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

- g. Fully tighten the bolts and nuts in area 3.

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

HINT:

Tighten the bolts and nuts from top to bottom as shown in the illustration.

- h. Fully tighten the bolts in area 4.

Torque: Bolt A

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

Except bolt A

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

HINT:

Tighten the bolts from bottom to top as shown in the illustration.

3. **INSTALL OIL PAN SUB-ASSEMBLY** (See REASSEMBLY)
4. **INSTALL OIL STRAINER SUB-ASSEMBLY** (See REASSEMBLY)
5. **INSTALL NO. 2 OIL PAN SUB-ASSEMBLY** (See REASSEMBLY)
6. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 2)** (See REASSEMBLY)
7. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 1)** (See REASSEMBLY)
8. **INSTALL WATER INLET HOUSING**
 - a. Install a new water inlet housing No. 1 gasket and water outlet pipe O-ring.

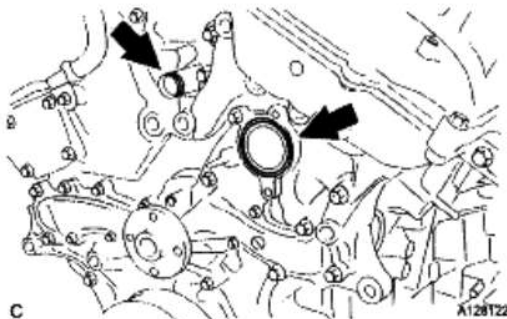


Fig. 56: Locating Water Inlet Housing No. 1 Gasket And Water Outlet Pipe O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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- b. Install the water inlet housing with the 2 bolts and nut.

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

NOTE: Be careful not to allow the O-ring to get caught between the parts.

- c. Connect the water hose.

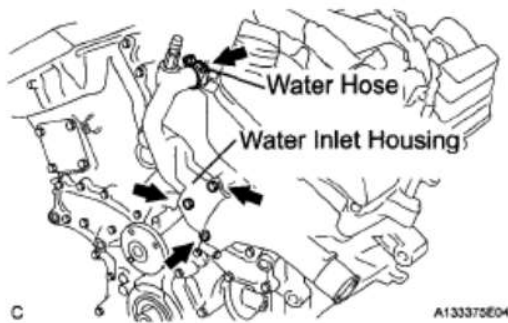


Fig. 57: Locating Water Inlet Housing And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. INSTALL OIL COOLER PIPE (w/ oil cooler)

- Install a new gasket to the oil pan sub-assembly.
- Install the oil cooler pipe with the bolt and 2 nuts.

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

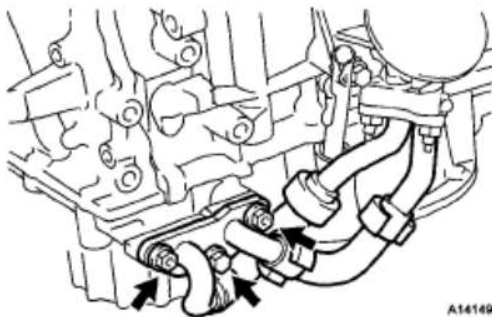


Fig. 58: Locating Oil Cooler Pipe With Bolt And 2 Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- INSTALL CRANKSHAFT PULLEY (See REASSEMBLY)
- INSTALL OIL PIPE (See REASSEMBLY)
- INSTALL NO. 1 OIL PIPE (See REASSEMBLY)
- INSTALL ENGINE HANGERS (See INSTALLATION)
- REMOVE ENGINE STAND

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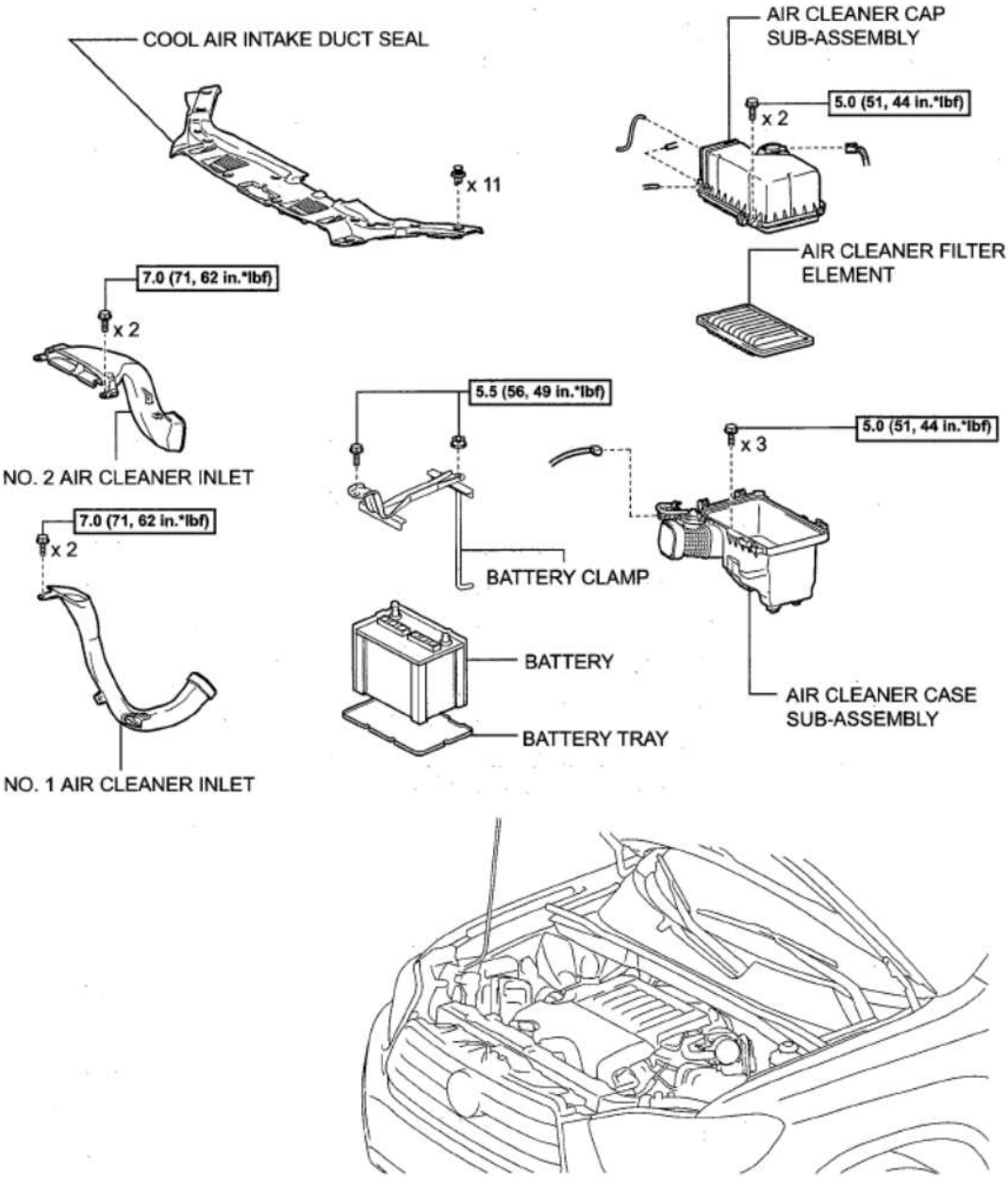
15. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

HINT:

See INSTALLATION .**ENGINE OIL COOLER****COMPONENTS**

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

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Fig. 59: Identifying Engine Oil Cooler Components And Torque Specifications (1 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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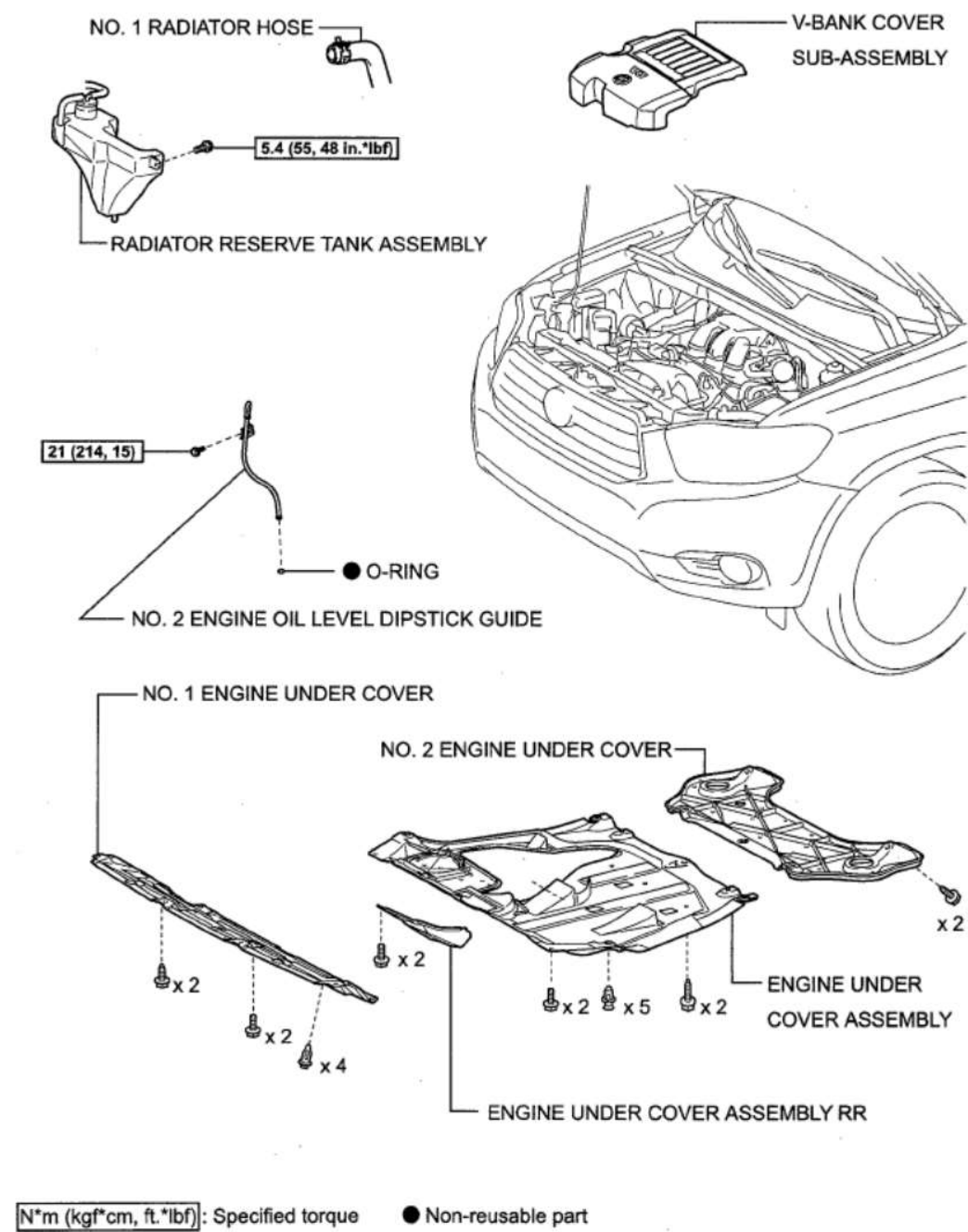


Fig. 60: Identifying Engine Oil Cooler Components And Torque Specifications (2 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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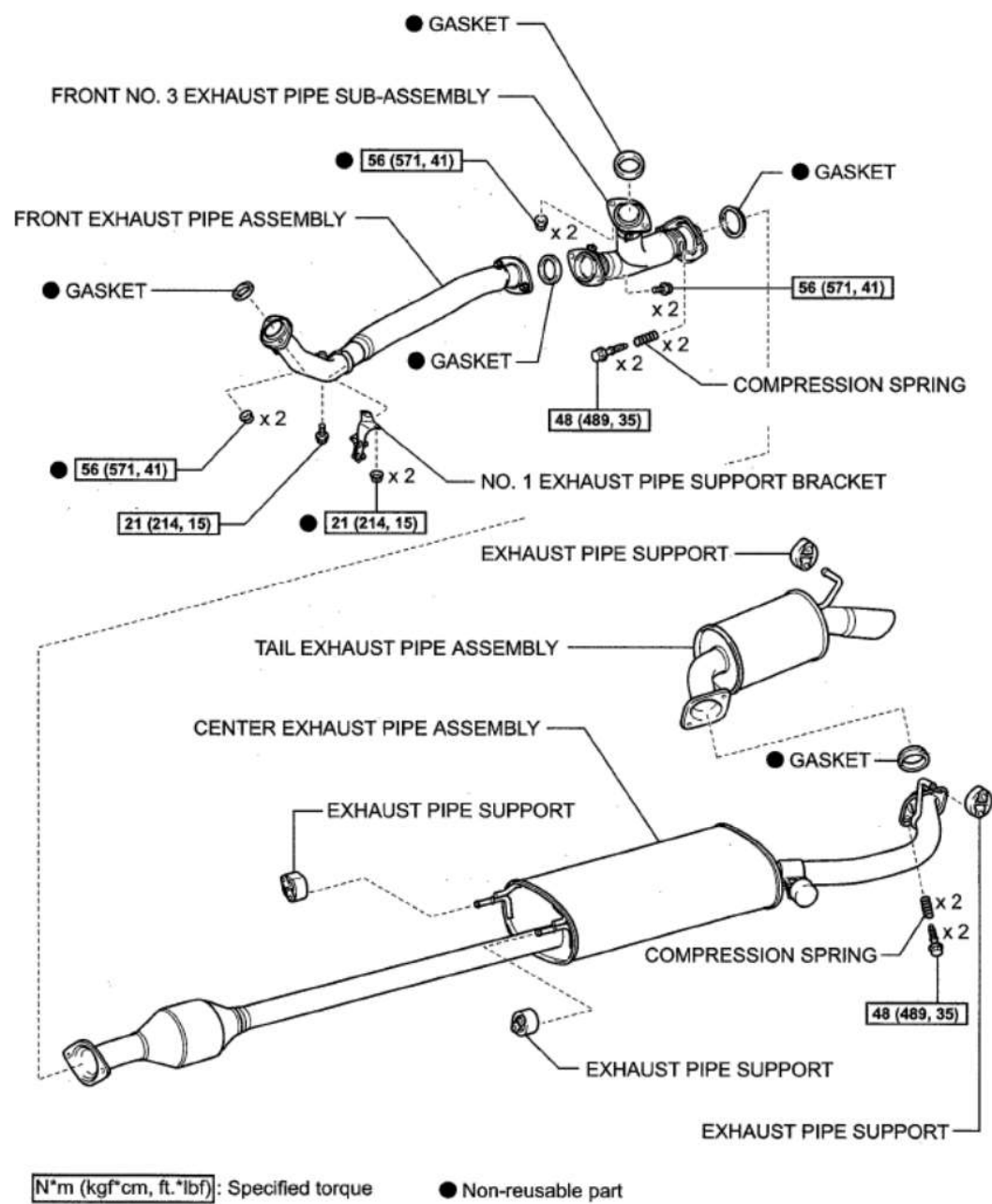


Fig. 61: Identifying Engine Oil Cooler Components And Torque Specifications (3 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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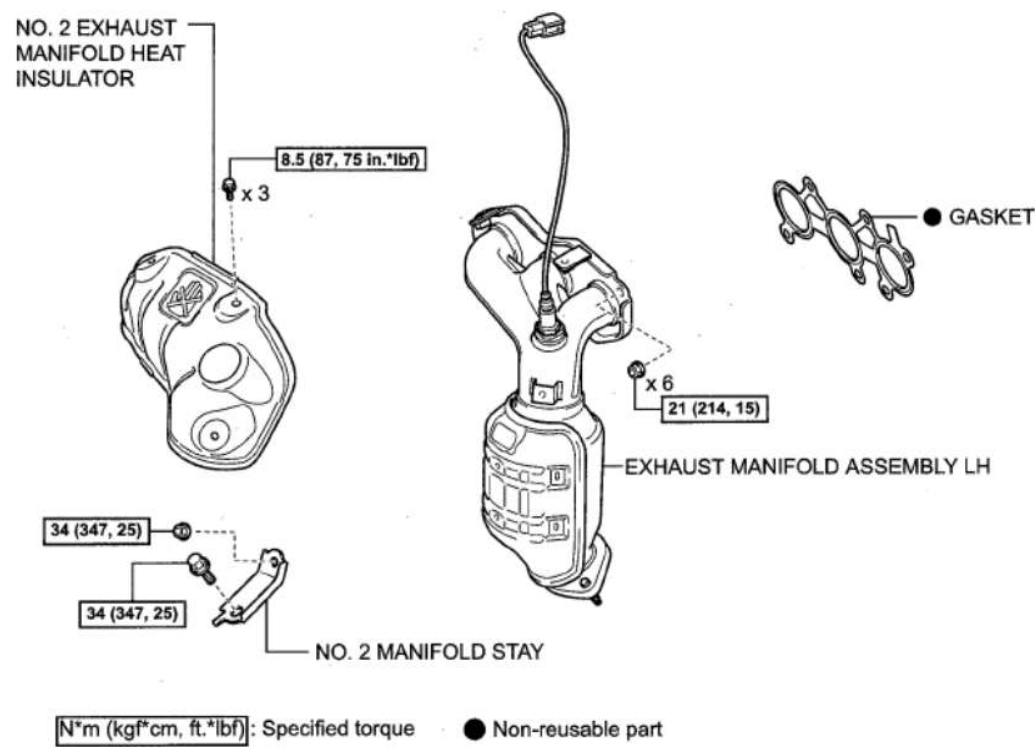
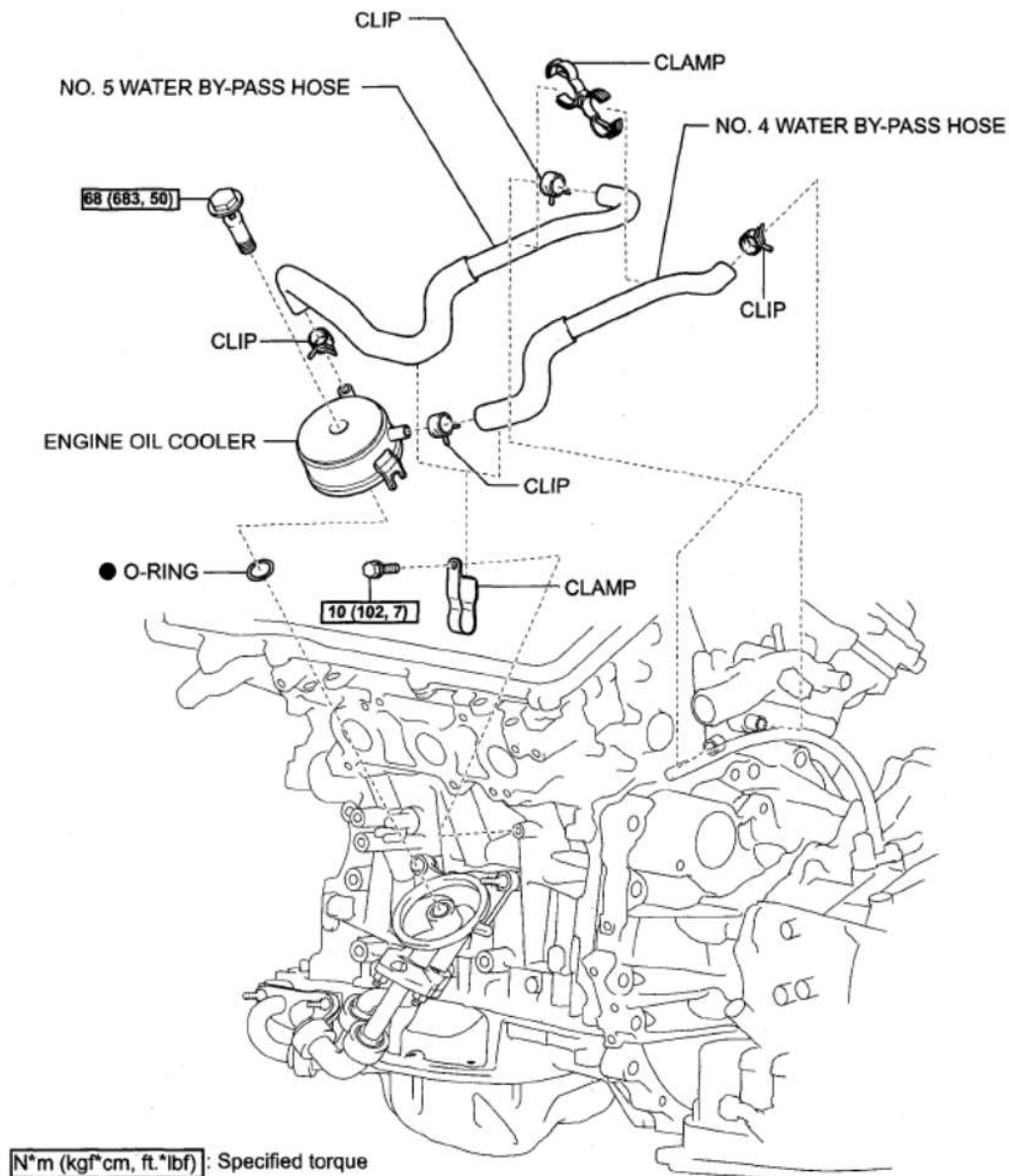


Fig. 62: Identifying Engine Oil Cooler Components And Torque Specifications (4 Of 5)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Fig. 63: Identifying Engine Oil Cooler Components And Torque Specifications (5 Of 5)
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

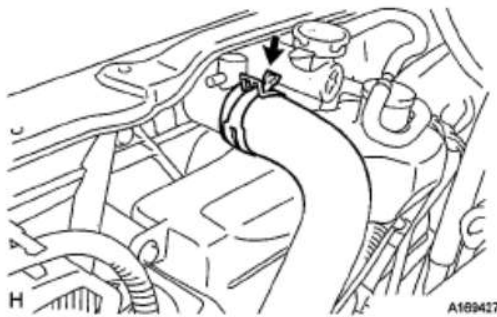
REMOVAL

1. **REMOVE BATTERY** (See REMOVAL)
2. **REMOVE COOL AIR INTAKE DUCT SEAL** (See REMOVAL)
3. **REMOVE NO. 2 AIR CLEANER INLET** (See REMOVAL)
4. **REMOVE NO. 1 AIR CLEANER INLET** (See REMOVAL)

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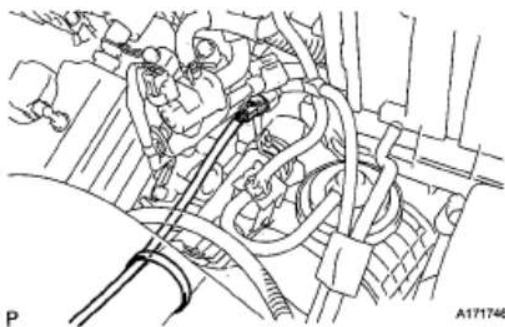
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5. **REMOVE AIR CLEANER CAP SUB-ASSEMBLY** (See REMOVAL)
6. **REMOVE AIR CLEANER CASE SUB-ASSEMBLY** (See REMOVAL)
7. **REMOVE V-BANK COVER SUB-ASSEMBLY** (See REMOVAL)
8. **DRAIN ENGINE COOLANT** (See COOLANT)
9. **DRAIN ENGINE OIL** (See OIL PRESSURE SWITCH)
10. **DISCONNECT NO. 1 RADIATOR HOSE**
 - a. Disconnect the No. 1 radiator hose from the radiator.
11. **REMOVE RADIATOR RESERVE TANK ASSEMBLY** (See REMOVAL)
12. **REMOVE NO. 2 ENGINE OIL LEVEL DIPSTICK GUIDE** (See REMOVAL)

**Fig. 64: Locating No. 1 Radiator Hose**

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

13. **REMOVE NO. 2 EXHAUST MANIFOLD HEAT INSULATOR**
 - a. Disconnect the air fuel ratio sensor connector and remove the clamp.

**Fig. 65: Locating Air Fuel Ratio Sensor Connector And Clamp**

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

- b. Remove the 3 bolts and No. 2 exhaust manifold heat insulator.
14. **REMOVE NO. 1 ENGINE UNDER COVER** (See REMOVAL)
15. **REMOVE ENGINE UNDER COVER ASSEMBLY** (See REMOVAL)
16. **REMOVE NO. 2 ENGINE UNDER COVER** (See REMOVAL)

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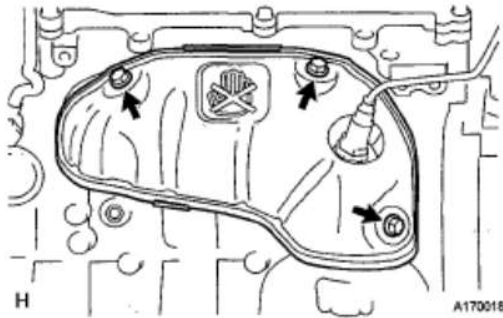


Fig. 66: Locating Bolts And No. 2 Exhaust Manifold Heat Insulator
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

17. **REMOVE PROPELLER WITH CENTER BEARING SHAFT (for 4WD)** (See REMOVAL)
18. **REMOVE TAIL EXHAUST PIPE ASSEMBLY** (See REMOVAL)
19. **REMOVE CENTER EXHAUST PIPE ASSEMBLY** (See REMOVAL)
20. **REMOVE FRONT NO. 3 EXHAUST PIPE SUB-ASSEMBLY** (See REMOVAL)
21. **REMOVE FRONT EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
22. **REMOVE NO. 2 MANIFOLD STAY** (See REMOVAL)
23. **REMOVE EXHAUST MANIFOLD ASSEMBLY LH**
 - a. Remove the 6 nuts and exhaust manifold assembly LH.
 - b. Remove the gasket.

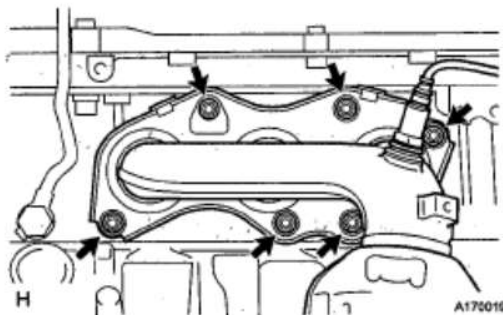


Fig. 67: Locating Nuts And Exhaust Manifold Assembly LH
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

24. **REMOVE ENGINE OIL COOLER**
 - a. Remove the bolt, 2 clamps, and 4 clips, and disconnect the 2 water by-pass hoses.

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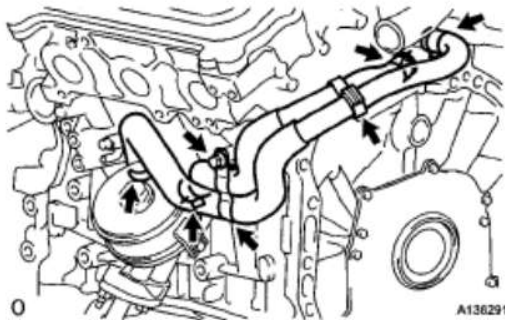


Fig. 68: Locating Bolt, Clamps, Clips And Water By-Pass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Remove the oil cooler union bolt, oil cooler assembly, and O-ring.

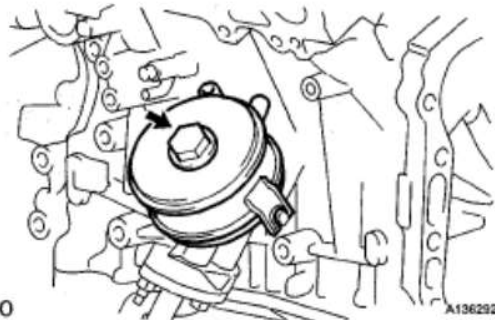


Fig. 69: Locating Oil Cooler Union Bolt, Oil Cooler Assembly And O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

INSPECTION

1. INSPECT ENGINE OIL COOLER

- a. Check the engine oil cooler for damage or clogging. If necessary, replace the oil cooler.

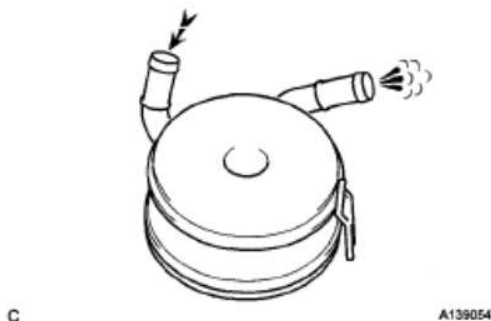


Fig. 70: Inspecting Engine Oil Cooler
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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INSTALLATION**1. INSTALL ENGINE OIL COOLER**

- a. Clean the oil cooler contact surface on the cooler mounting.
- b. Install a new O-ring to the oil cooler.

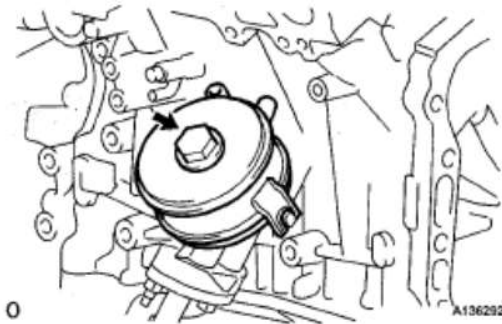


Fig. 71: Locating Oil Cooler Union Bolt, Oil Cooler Assembly And O-Ring
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- c. Install the oil cooler assembly with the union bolt.

Torque: 68 N*m (683 kgf*cm, 50 ft.*lbf)

- d. Install the 2 water by-pass hoses with the bolt, 2 clamps, and 4 clips.

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

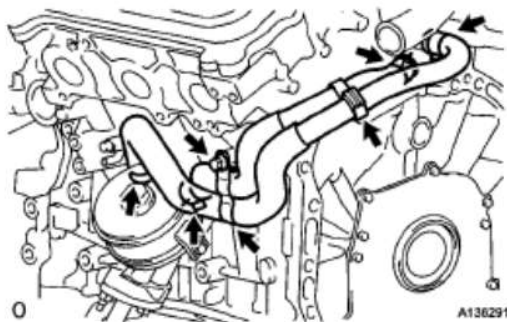


Fig. 72: Locating Bolt, Clamps, Clips And Water By-Pass Hoses
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2. INSTALL EXHAUST MANIFOLD ASSEMBLY LH

- a. Install a new gasket.
- b. Install the exhaust manifold assembly LH by tightening the 6 nuts in the order shown in the illustration.

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

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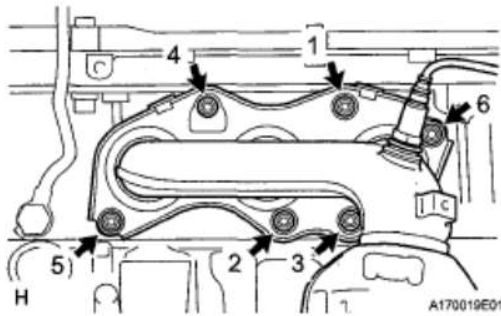


Fig. 73: Locating Exhaust Manifold Assembly LH And Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. **INSTALL NO. 2 MANIFOLD STAY** (See INSTALLATION)
4. **INSTALL FRONT EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
5. **INSTALL CENTER EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
6. **INSTALL TAIL EXHAUST PIPE ASSEMBLY** (See INSTALLATION)
7. **INSTALL FRONT NO. 3 EXHAUST PIPE SUB-ASSEMBLY** (See INSTALLATION)
8. **TEMPORARILY TIGHTEN PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY** (for 4WD) (See INSTALLATION)
9. **FULLY TIGHTEN PROPELLER WITH CENTER BEARING SHAFT ASSEMBLY** (for 4WD) (See INSTALLATION)
10. **INSTALL NO. 2 EXHAUST MANIFOLD HEAT INSULATOR**
 - a. Install the No. 2 exhaust manifold heat insulator by tightening the 3 bolts in the order shown in the illustration.

Torque: 8.5 N*m (87 kgf*cm, 75 in.*lbf)

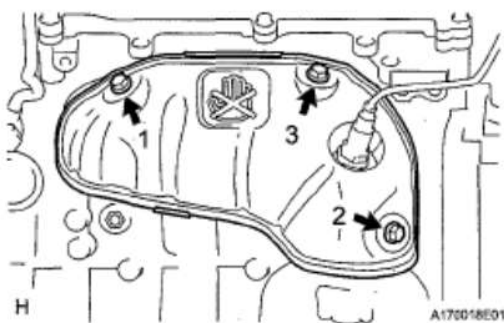


Fig. 74: Locating No. 2 Exhaust Manifold Heat Insulator And Bolts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- b. Connect the air fuel ratio sensor connector and install the clamp.
11. **INSTALL NO. 2 ENGINE OIL LEVEL DIPSTICK GUIDE** (See INSTALLATION)
12. **INSTALL RADIATOR RESERVE TANK ASSEMBLY** (See INSTALLATION)

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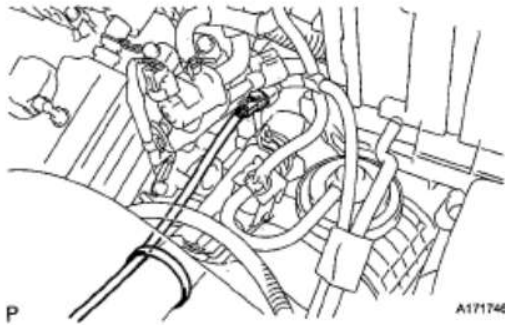


Fig. 75: Locating Air Fuel Ratio Sensor Connector And Clamp
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. **CONNECT NO. 1 RADIATOR HOSE**
 - a. Connect the No. 1 radiator hose to the radiator.
14. **INSTALL AIR CLEANER CASE SUB-ASSEMBLY** (See INSTALLATION)
15. **INSTALL AIR CLEANER CAP SUB-ASSEMBLY** (See INSTALLATION)

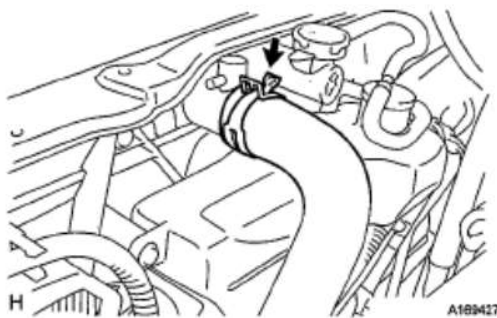


Fig. 76: Locating No. 1 Radiator Hose
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

16. **INSTALL NO. 1 AIR CLEANER INLET** (See INSTALLATION)
17. **INSTALL NO. 2 AIR CLEANER INLET** (See INSTALLATION)
18. **INSTALL COOL AIR INTAKE DUCT SEAL** (See INSTALLATION)
19. **INSTALL BATTERY** (See INSTALLATION)
20. **ADD ENGINE COOLANT** (See REPLACEMENT)
21. **ADD ENGINE OIL** (See OIL PRESSURE SWITCH)
22. **INSPECT FOR COOLANT LEAK** (See COOLING SYSTEM)
23. **INSPECT FOR OIL LEAK**
 - a. Start the engine.
 - b. Check for engine oil leaks from the oil cooler assembly and the union bolt.
24. **INSPECT FOR EXHAUST GAS LEAK** (See INSTALLATION)
25. **INSTALL NO. 2 ENGINE UNDER COVER** (See INSTALLATION)

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26. **INSTALL ENGINE UNDER COVER ASSEMBLY** (See INSTALLATION)
27. **INSTALL NO. 1 ENGINE UNDER COVER** (See INSTALLATION)
28. **INSTALL V-BANK COVER SUB-ASSEMBLY** (See INSTALLATION)
29. **CHECK ENGINE OIL LEVEL**
 - a. Warm up the engine, stop the engine and wait for 5 minutes.
 - b. Check that the engine oil level is between the L and F marks of the oil dipstick. If low, check for leakage and add oil up to the F mark.

NOTE: **Do not add engine oil above the F mark.**