

# 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 low, check for leakage and add oil up to the full level mark.

**NOTICE:**

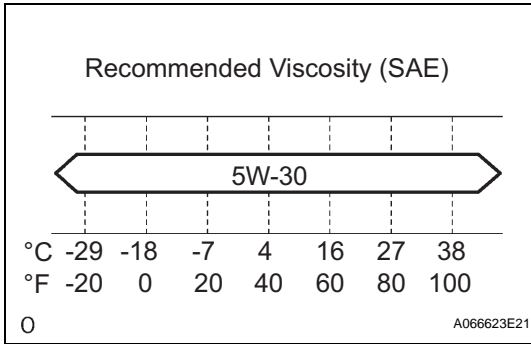
**Do not fill above the full level mark.**

### 2. CHECK ENGINE OIL QUALITY

- (a) Check the oil for deterioration, water contamination, discoloring or thinning. If the quality is visibly poor, replace the oil.

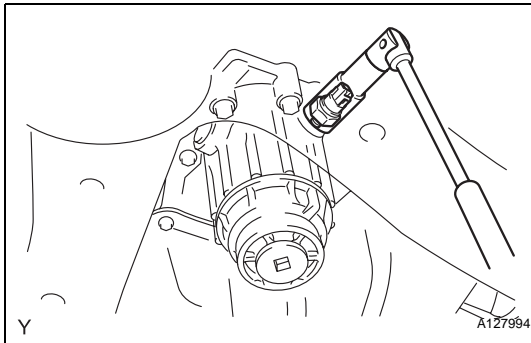
**Oil grade:**

**Use ILSAC multigrade engine oil. SAE 5W-30 engine oil may be used. However, SAE 5W-30 is the best choice for good fuel economy and good starting in cold weather.**



### 3. CHECK OIL PRESSURE

- (a) Remove the engine under cover LH.
- (b) Remove the engine under cover RH.
- (c) Disconnect the oil pressure switch connector.
- (d) Using a 24 mm deep socket wrench, remove the oil pressure switch.

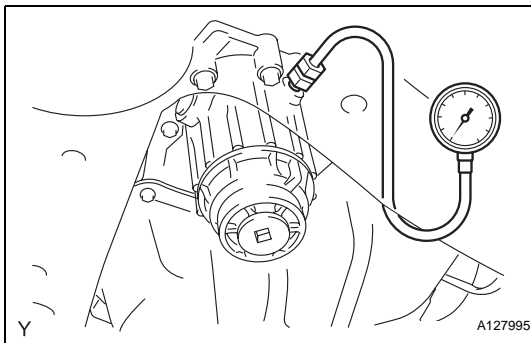


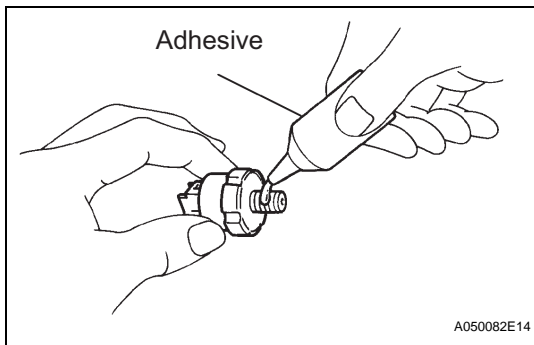
- (e) Install the oil pressure gauge with adapter.
- (f) Warm up the engine.
- (g) Measure the oil pressure.

**Standard oil pressure**

Engine Condition	Oil Pressure
Idle	80 kPa (0.8 kgf*cm <sup>2</sup> , 11.6 psi) or more
6,000 rpm	380 kPa (3.9 kgf*cm <sup>2</sup> , 55.5 psi) or more

If the oil pressure is not as specified, check the oil pump (See page [LU-13](#)).

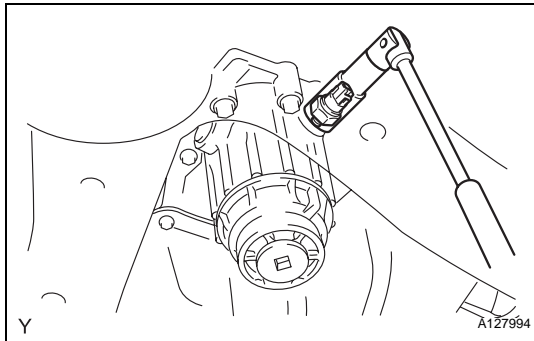




- (h) Remove the oil pressure gauge.
- (i) Apply adhesive to 2 or 3 threads of the oil pressure switch.

**Adhesive:**

**Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent**



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

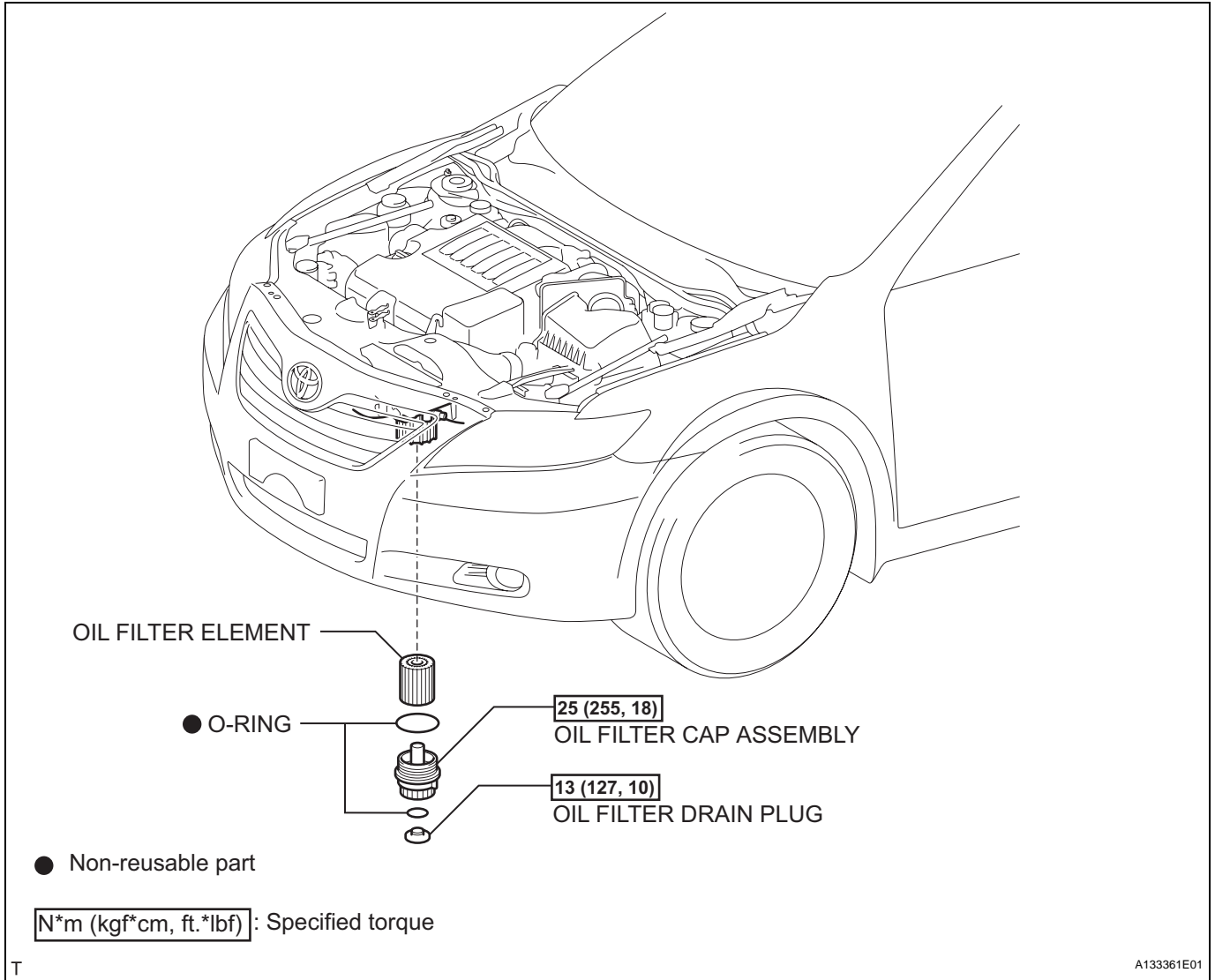
**Torque: 15 N\*m (153 kgf\*cm, 11 ft.\*lbf)**

**NOTICE:**

**Do not start the engine within 1 hour after installation.**

- (k) Connect the oil pressure switch connector.
- (l) Check for engine oil leaks.
- (m) Remove the engine under cover RH.
- (n) Remove the engine under cover LH.

# OIL FILTER COMPONENTS



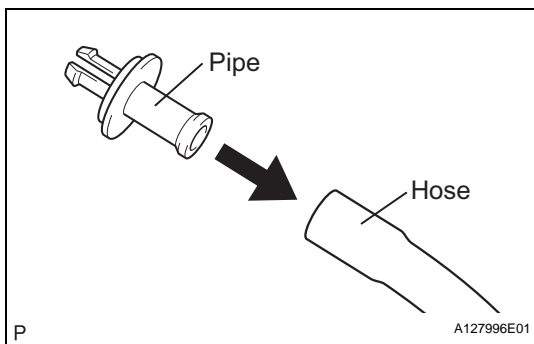
## REPLACEMENT

### 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 use water-less 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.

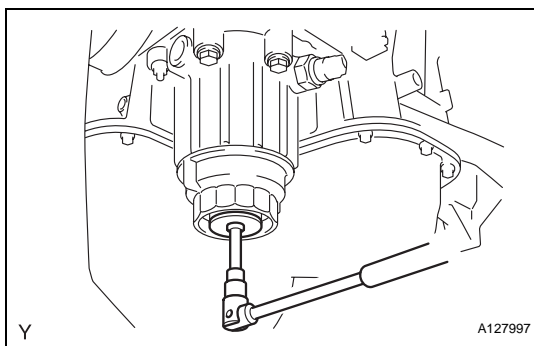
### 1. DRAIN ENGINE OIL

- (a) Remove the oil filler cap.
- (b) Remove the oil drain plug and drain the oil into a container.

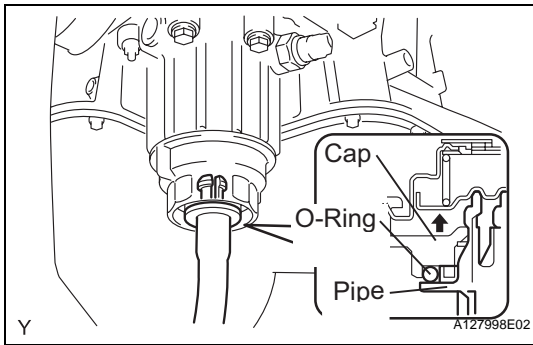


### 2. REMOVE OIL FILTER ELEMENT

- (a) Connect the hose with an inside diameter of 15 mm (0.59 in.) to the pipe.



- (b) Remove the oil filter drain plug from the oil filter cap.



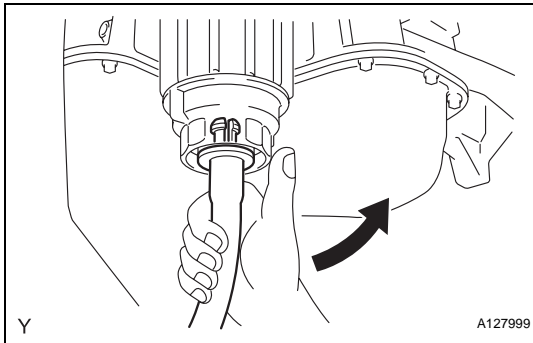
- (c) Insert the pipe with the hose into the oil filter cap.

**NOTICE:**

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

**HINT:**

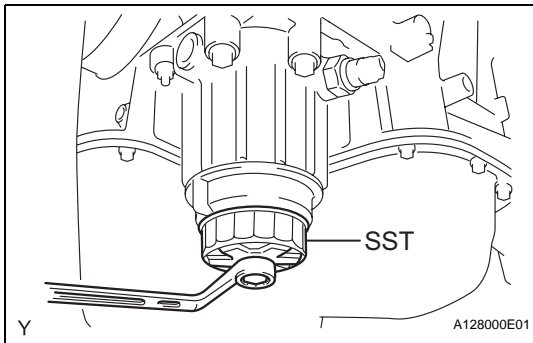
Place the hose end into a container before draining the oil from the hose.



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

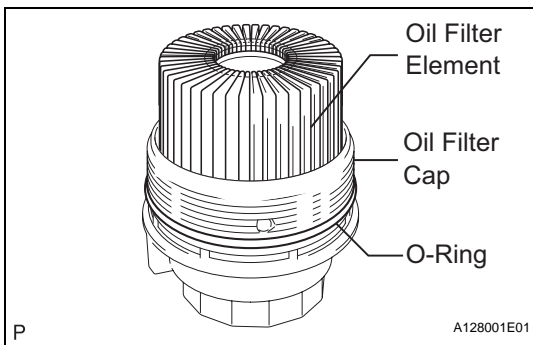
**HINT:**

Be sure to turn the pipe in the direction of the arrow to remove it.



- (e) Using SST, remove the oil filter cap.

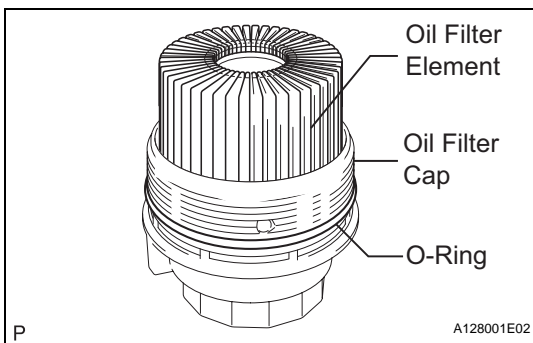
**SST 09228-06501**



- (f) Remove the oil filter element and O-ring from the oil filter cap.

**NOTICE:**

**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.**

**3. INSTALL OIL FILTER ELEMENT**

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

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

**NOTICE:**

**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 installation surface and the inside of the cap on the engine side.
- (e) Apply a light coat of engine oil to the O-ring again and install the oil filter cap.

**NOTICE:**

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

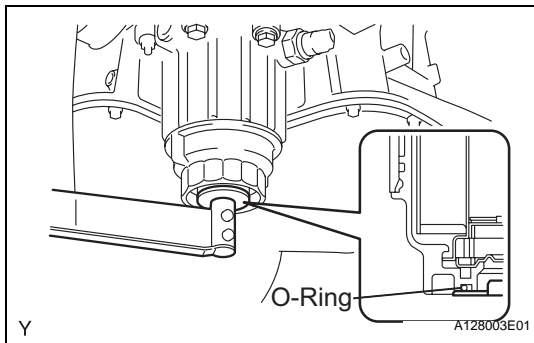
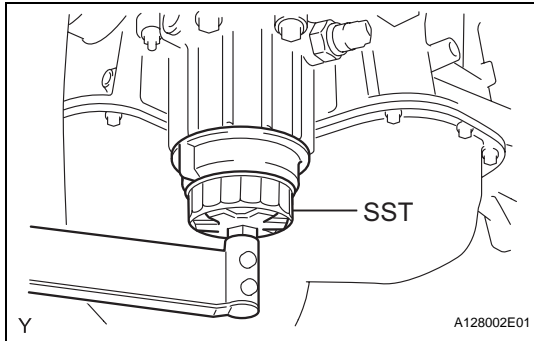
- (f) Using SST, install the oil filter cap.

**SST 09228-06501**

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

**NOTICE:**

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



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

**NOTICE:**

**Remove all dirt and foreign matter from the installation surface.**

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

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

**NOTICE:**

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

**4. ADD ENGINE OIL**

- (a) Clean and install the oil drain plug with a new gasket

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

- (b) Add new oil.

**Standard capacity**

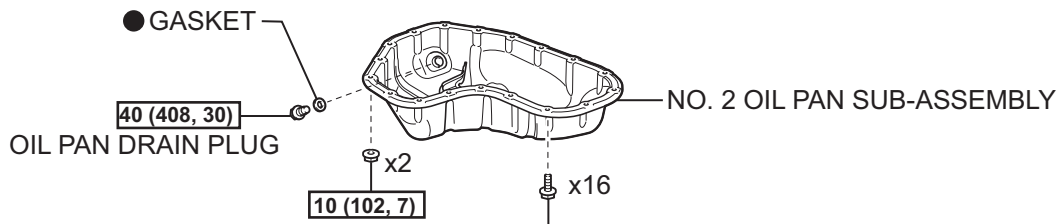
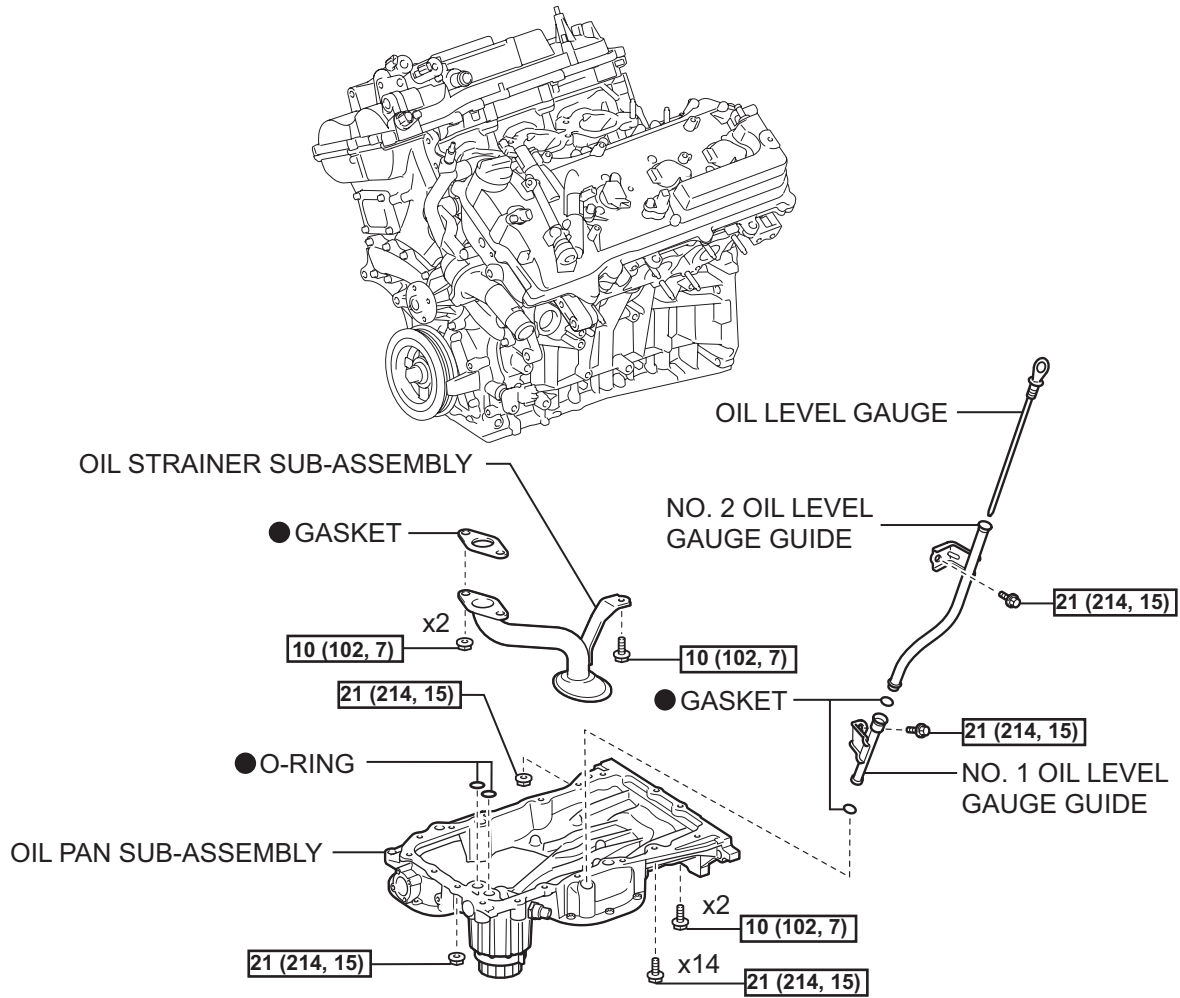
Item	Standard Condition
Drain and refill with oil filter change	6.1 liters (6.4 US qts, 5.4 Imp. qts)
Drain and refill without oil filter change	5.7 liters (6.0 US qts, 5.0 Imp. qts)
Dry fill	6.5 liters (6.9 US qts, 5.7 Imp. qts)

- (c) Install the oil filler cap.

**5. CHECK FOR ENGINE OIL LEAKS**

- (a) Start the engine. Check for engine oil leaks from the connected parts of the oil filter cap and oil filter drain plug.

# OIL PUMP COMPONENTS



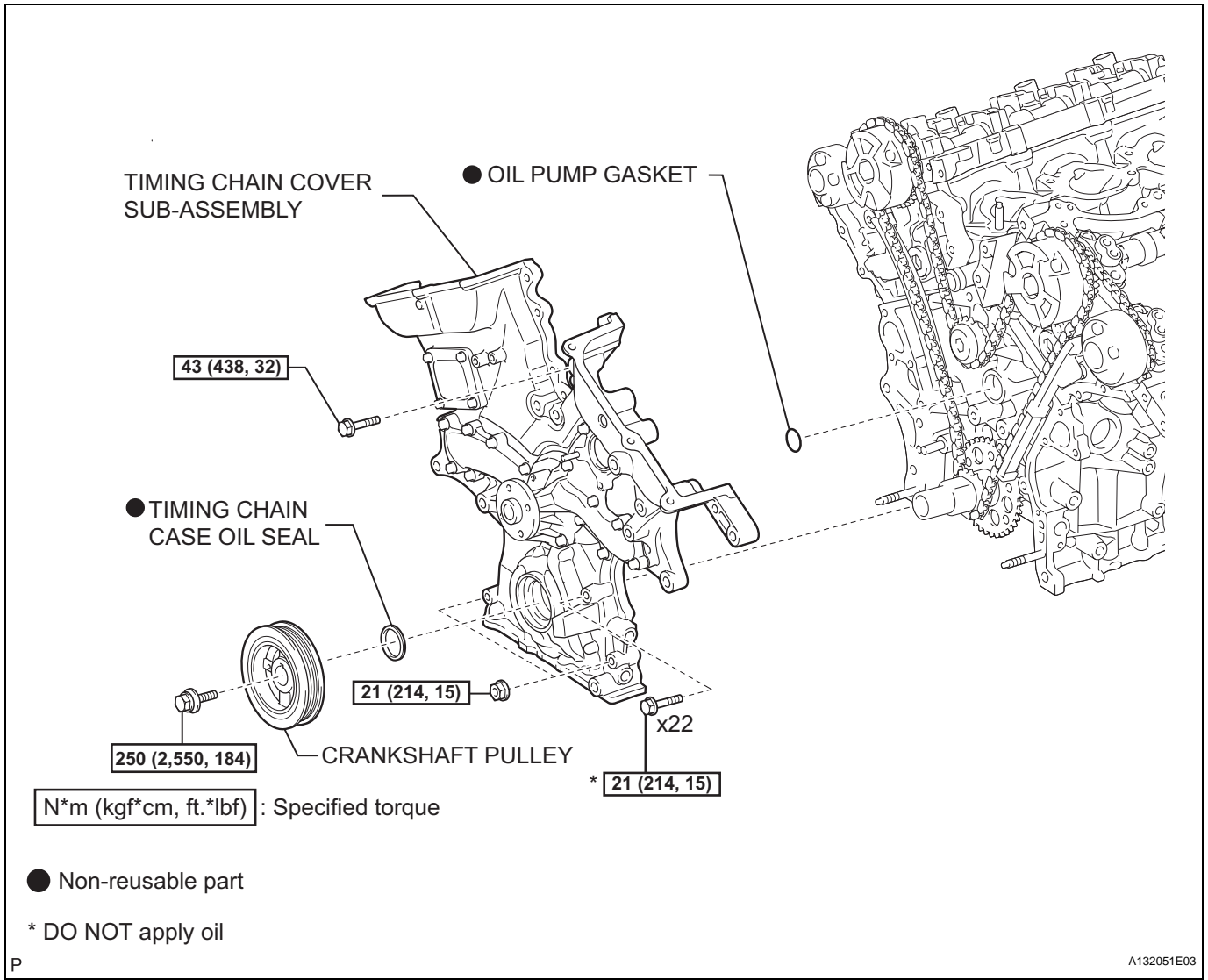
**N\*m (kgf\*cm, ft.\*lbf) : Specified torque**

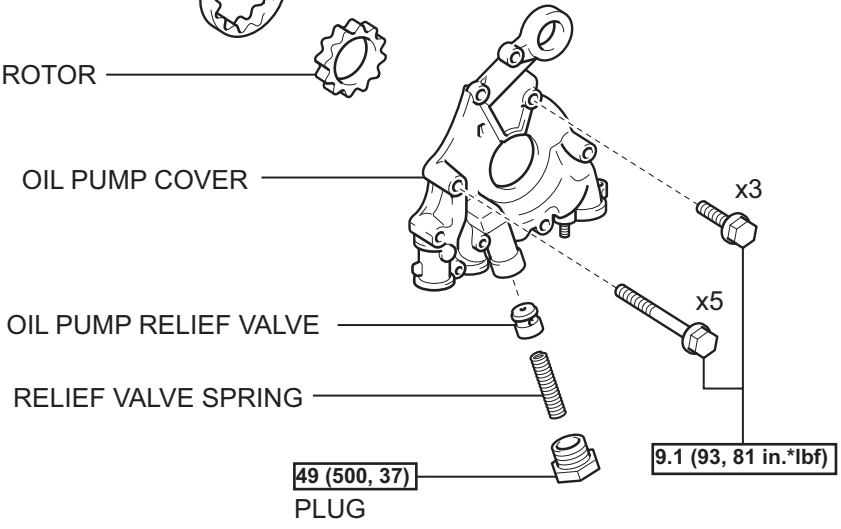
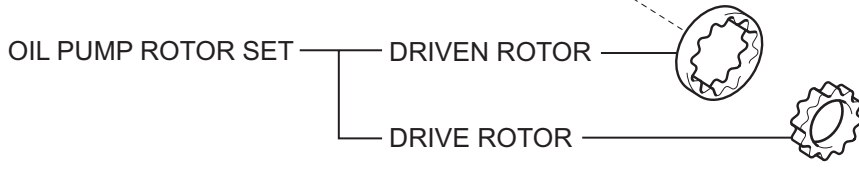
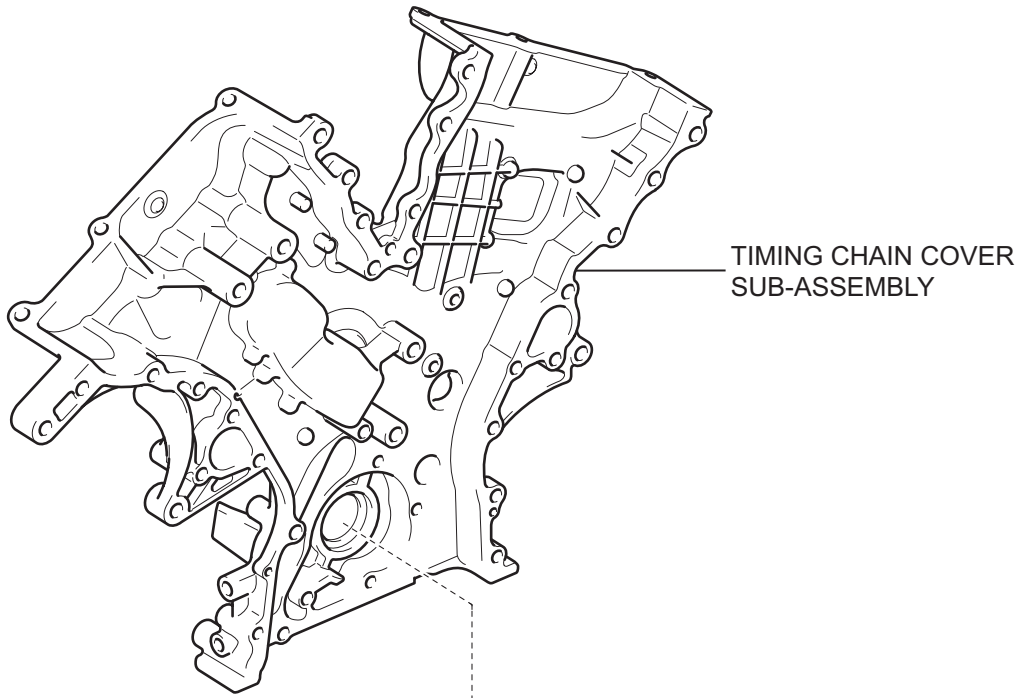
● Non-reusable part

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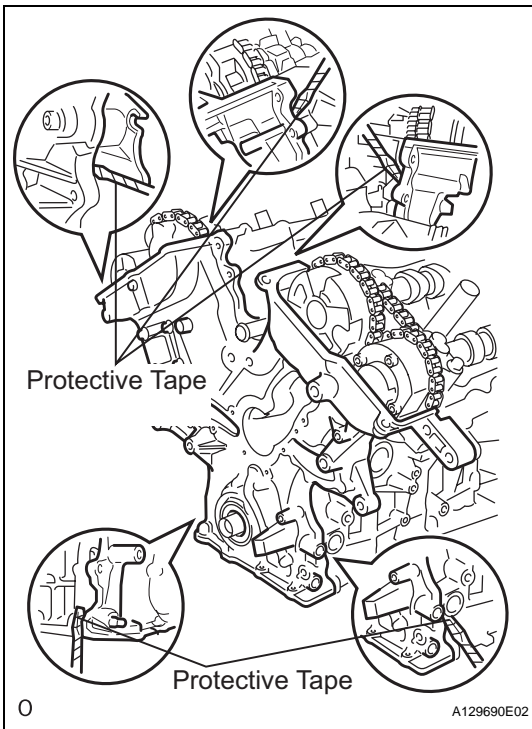
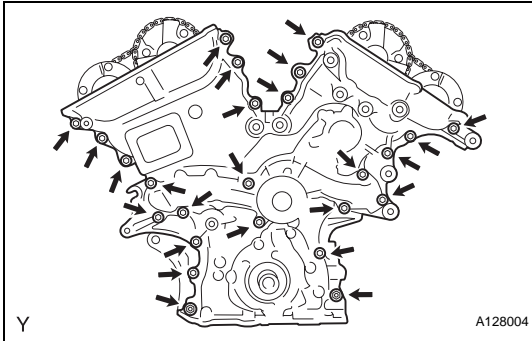
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N\*m (kgf\*cm, ft.\*lbf) : Specified torque

## REMOVAL

1. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE  
(See page [EM-29](#))
2. SECURE ENGINE  
(See page [EM-30](#))
3. REMOVE INTAKE AIR SURGE TANK ASSEMBLY  
(See page [FU-13](#))
4. REMOVE IGNITION COIL ASSEMBLY (See page [EM-32](#))
5. REMOVE NO. 2 ENGINE MOUNTING STAY RH (See page [EM-32](#))
6. REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH  
(See page [EM-32](#))
7. REMOVE OIL LEVEL GAUGE GUIDE SUB-ASSEMBLY (See page [EM-33](#))
8. REMOVE NO. 2 MANIFOLD STAY (See page [EM-33](#))
9. REMOVE NO. 2 EXHAUST MANIFOLD HEAT INSULATOR (See page [EM-33](#))
10. REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY LH  
(See page [EM-33](#))
11. REMOVE ENGINE MOUNTING BRACKET RH (See page [EM-33](#))
12. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY  
(See page [EM-34](#))
13. REMOVE NO. 2 TIMING GEAR COVER (See page [EM-34](#))
14. REMOVE NO. 2 IDLER PULLEY SUB-ASSEMBLY  
(See page [EM-34](#))
15. REMOVE WATER PUMP PULLEY (See page [CO-8](#))
16. REMOVE RADIO SETTING CONDENSER (See page [EM-35](#))
17. REMOVE NO. 1 VACUUM SWITCHING VALVE ASSEMBLY (See page [EM-35](#))
18. REMOVE NO. 1 OIL PIPE (See page [EM-65](#))
19. REMOVE OIL PIPE (See page [EM-65](#))
20. REMOVE CRANKSHAFT PULLEY (See page [EM-67](#))
21. REMOVE NO. 1 ENGINE MOUNTING BRACKET FRONT LH (See page [EM-68](#))
22. REMOVE WATER INLET HOUSING (See page [EM-68](#))
23. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 1) (See page [EM-69](#))
24. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 2) (See page [EM-69](#))

- 25. REMOVE NO. 2 OIL PAN SUB-ASSEMBLY (See page [EM-70](#))
- 26. REMOVE OIL STRAINER SUB-ASSEMBLY (See page [EM-70](#))
- 27. REMOVE OIL PAN SUB-ASSEMBLY (See page [EM-70](#))
- 28. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY
  - (a) Remove the 23 bolts and 2 nuts as shown in the illustration.



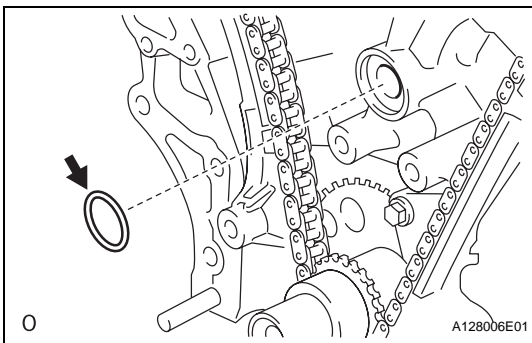
- (b) Remove the timing chain cover by prying between the timing chain cover and cylinder head or cylinder block with a screwdriver.

**NOTICE:**

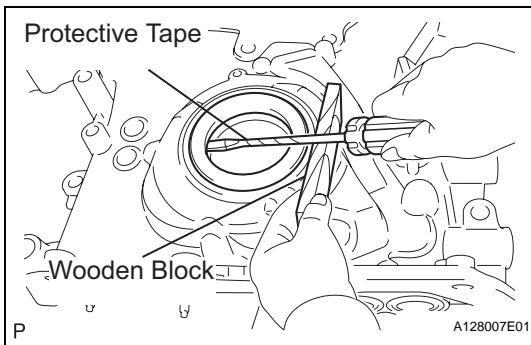
**Be careful not to damage the contact surfaces of the cylinder head, cylinder block and chain cover.**

**HINT:**

Tape the screwdriver tip before use.

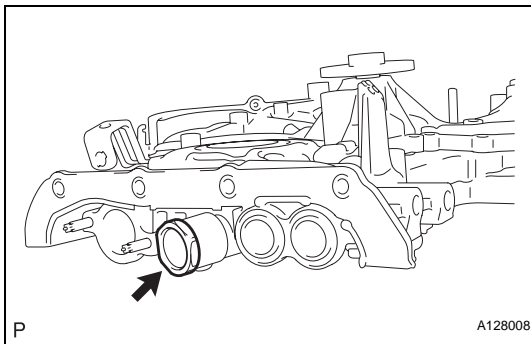


- (c) Remove the gasket.



## 29. REMOVE TIMING CHAIN CASE OIL SEAL

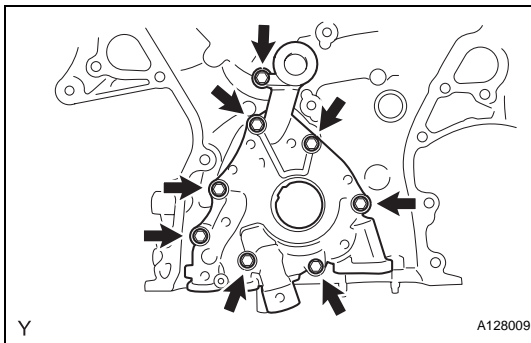
- (a) Using a screwdriver, pry out the oil seal.
- HINT:  
Tape the screwdriver tip before use.



## DISASSEMBLY

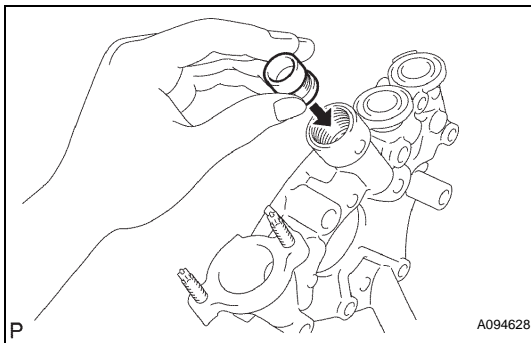
### 1. REMOVE OIL PUMP RELIEF VALVE

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



### 2. REMOVE OIL PUMP COVER

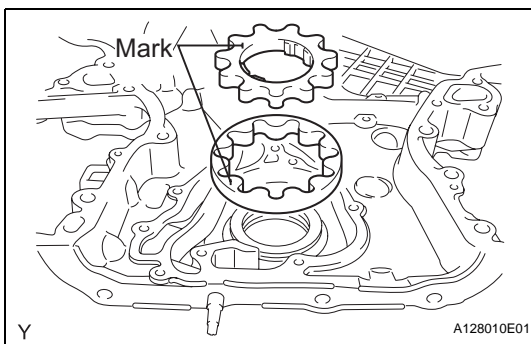
- (a) Remove the 8 bolts, oil pump cover and oil pump rotor set.



## INSPECTION

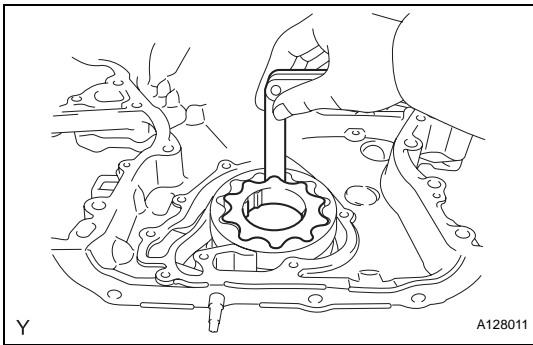
### 1. INSPECT OIL PUMP RELIEF VALVE

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



### 2. INSPECT OIL PUMP ROTOR SET

- (a) Install the rotors to the timing chain cover with the rotors' marks facing outward. Check that the rotors revolve smoothly.

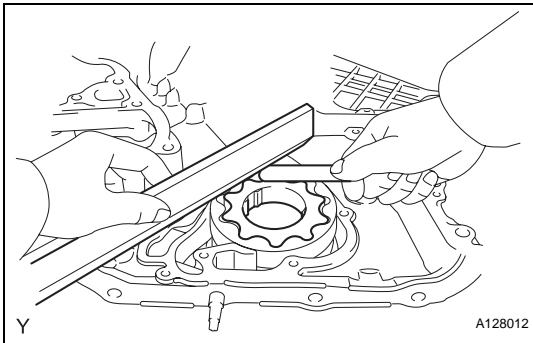


- (b) Check the tip clearance.
  - (1) Using a feeler gauge, measure the clearance between the drive and driven rotors, as shown in the illustration.

**Tip clearance**

Standard	Maximum
0.060 to 0.160 mm (0.0024 to 0.0063 in.)	0.16 mm (0.0063 in.)

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

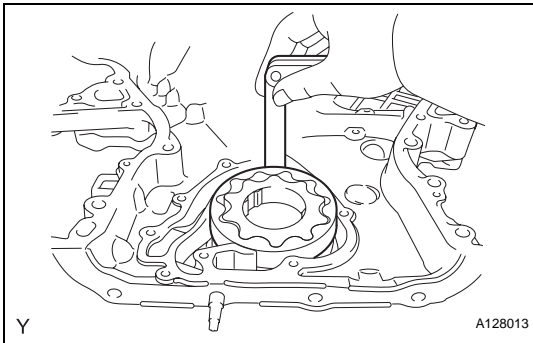


- (c) Check the side clearance.
  - (1) Using a feeler gauge and precision straightedge, measure the clearance between the rotors and precision straightedge, as shown in the illustration.

**Side clearance**

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

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



- (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**

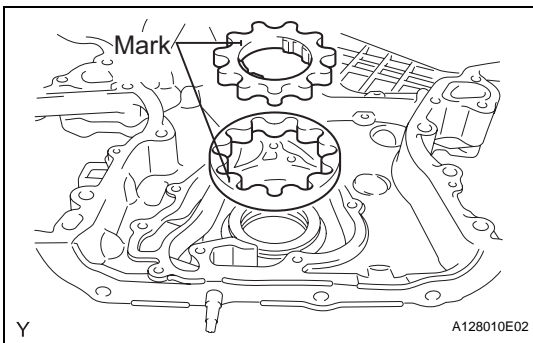
Standard	Maximum
0.250 to 0.325 mm (0.0098 to 0.0128 in.)	0.325 mm (0.0128 in.)

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

**REASSEMBLY**

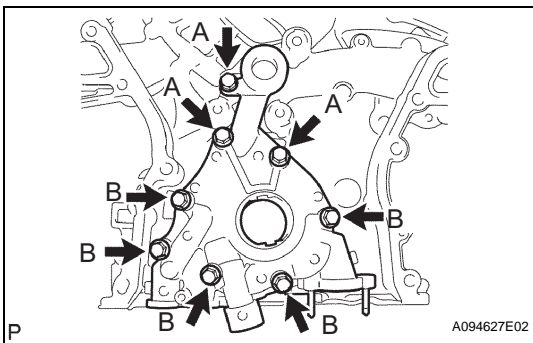
**1. INSTALL OIL PUMP COVER**

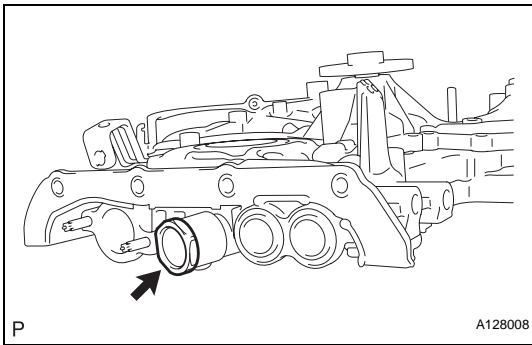
- (a) Coat the drive and driven rotors with engine oil and place them into the timing chain cover with the marks facing outward (oil pump cover side). Check that the rotors revolve smoothly.



- (b) Install the oil pump cover with the 8 bolts.
  - Torque: 9.1 N\*m (93 kgf\*cm, 81 in.\*lbf)**
  - Bolt length**

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

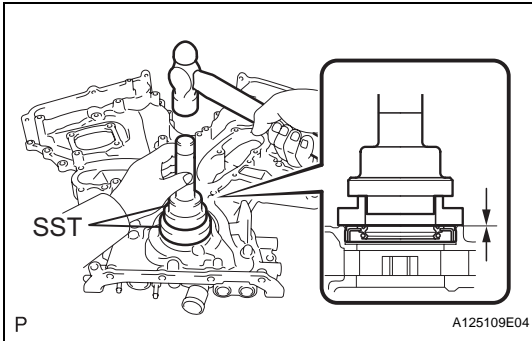




## 2. INSTALL OIL PUMP RELIEF VALVE

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

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



## INSTALLATION

### 1. INSTALL TIMING CHAIN CASE OIL SEAL

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

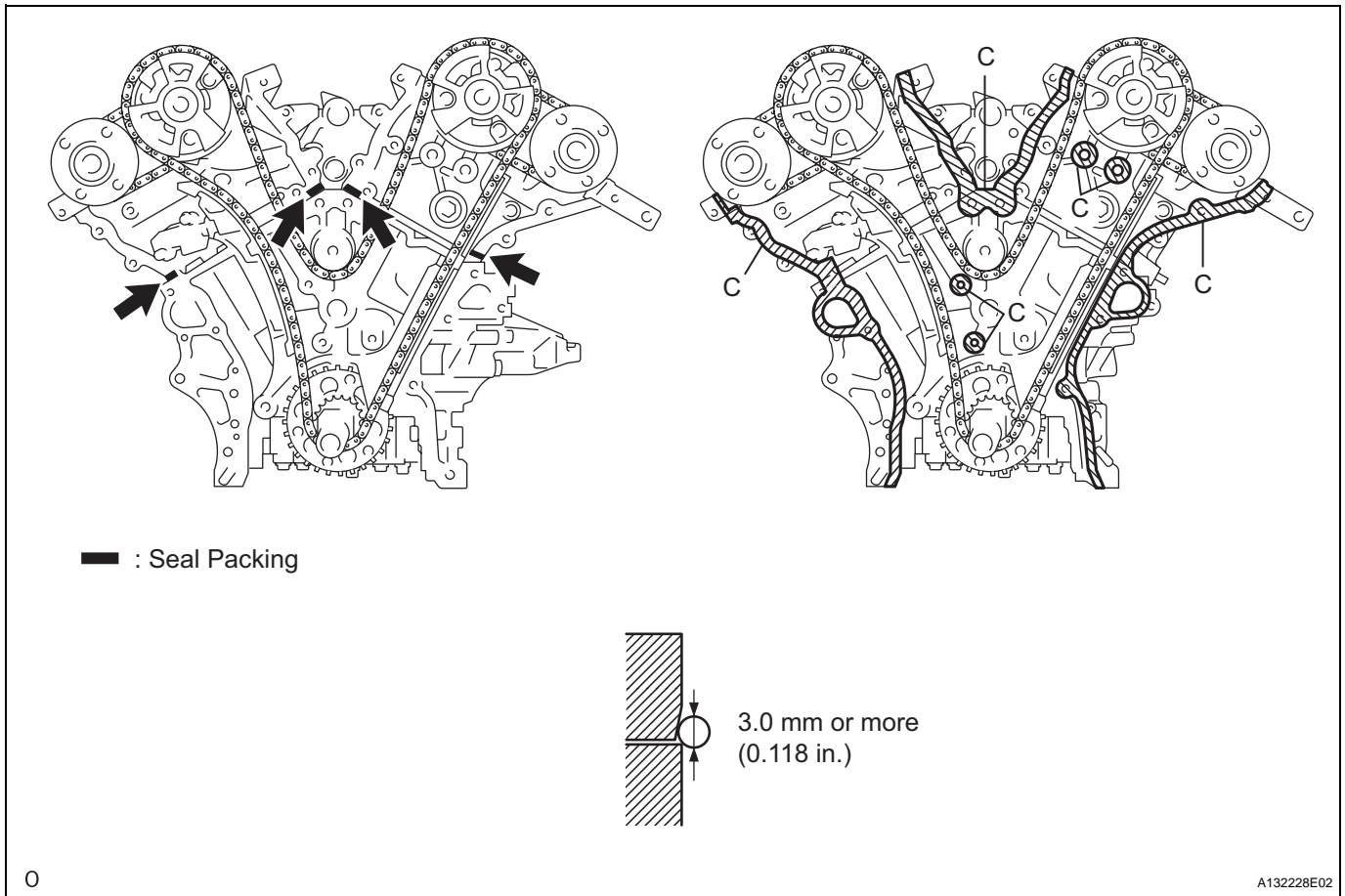
**SST 09223-22010, 09506-35010**

#### NOTICE:

- Keep the lip free from foreign matter.
- Do not tap on the oil seal at an angle.
- Make sure that the oil seal edge does not stick out of the timing chain case.

### 2. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY

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



**Seal packing:**

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

**Seal diameter:**

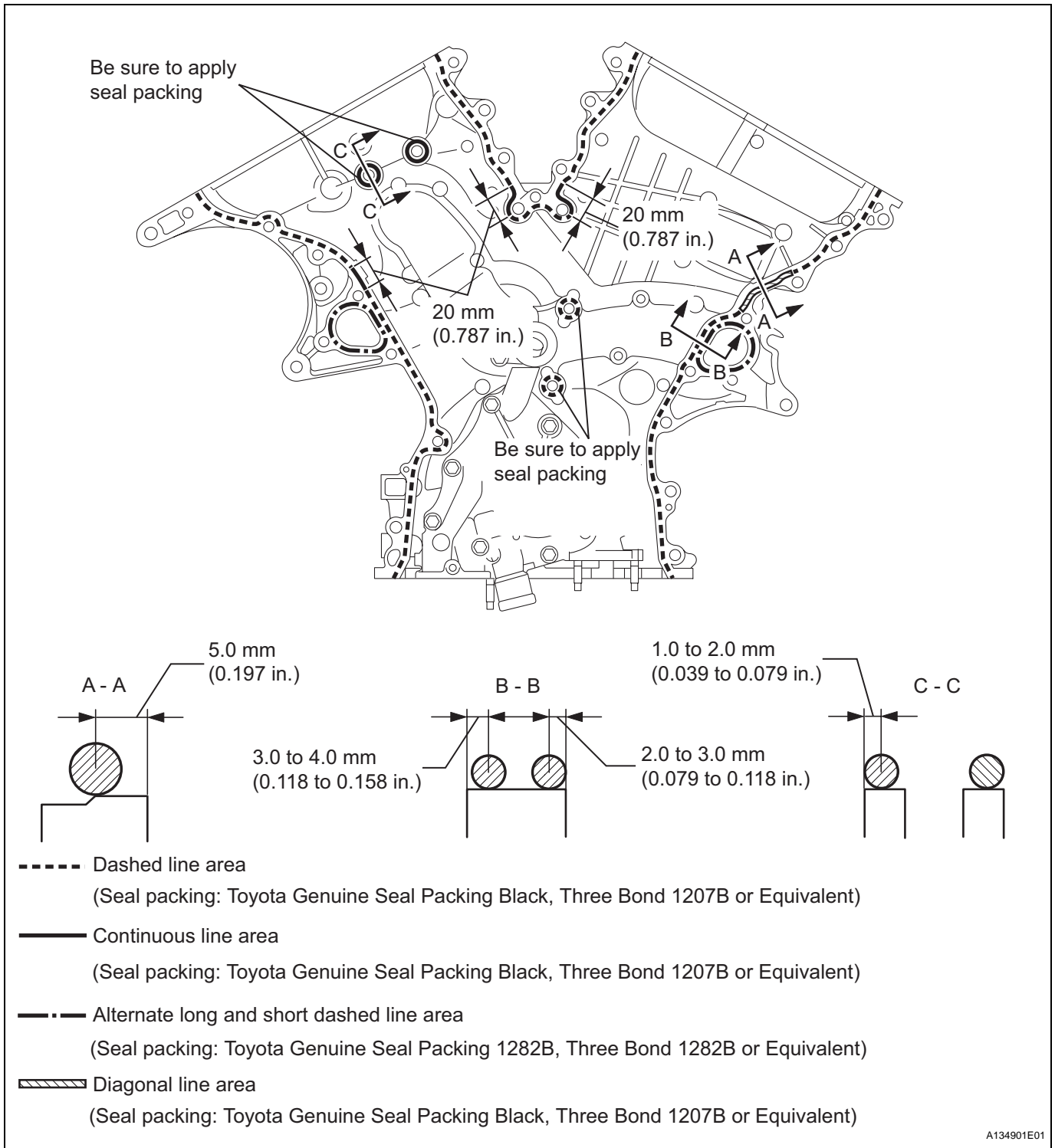
**3.0 mm (0.118 in.)**

**NOTICE:**

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



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



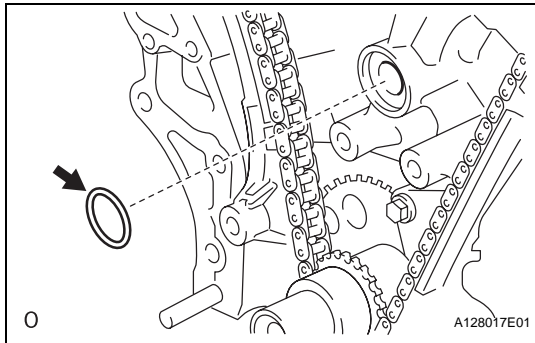
**Seal packing:**  
**Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent**  
**Toyota Genuine Seal Packing Black 1282B, Three Bond 1282B or equivalent**

**NOTICE:**

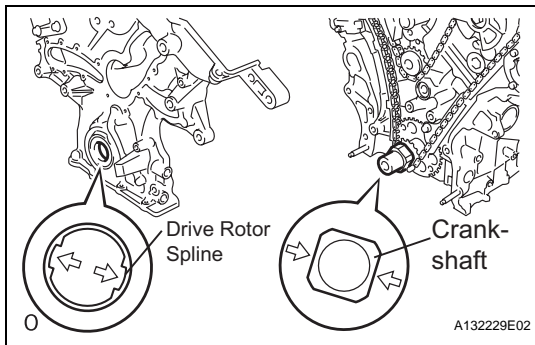
- When the contact surfaces are wet, wipe them with oil-free cloth before applying seal packing.
- Install the chain cover within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing.

Apply seal packing as follows

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

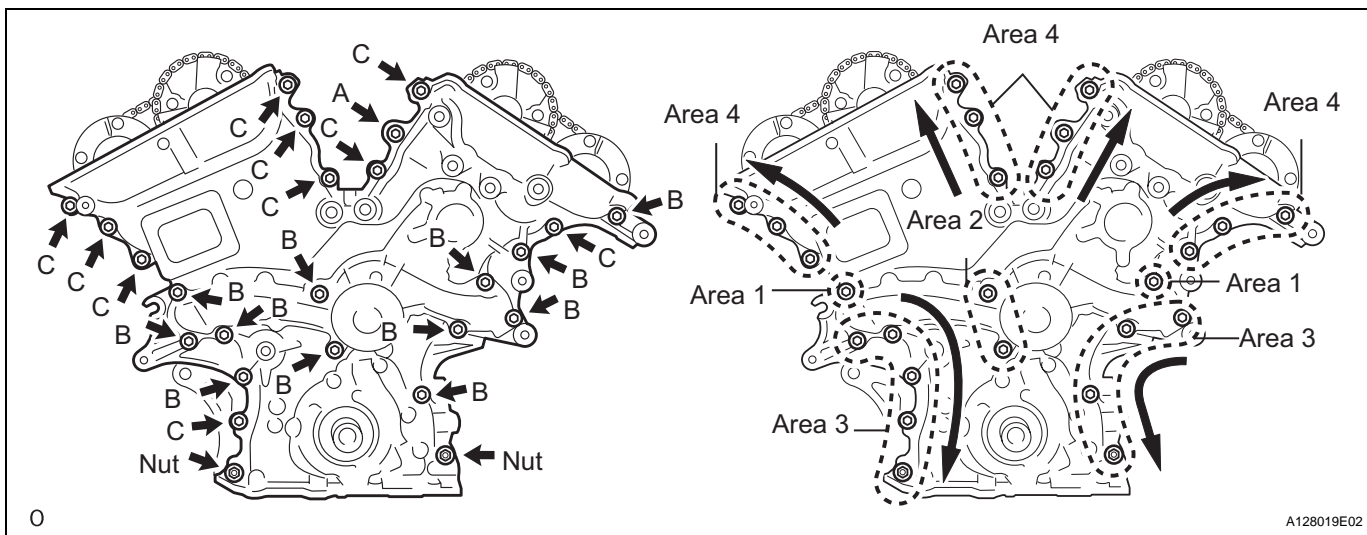


(c) Install a new gasket.



(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.

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



**Bolt length**

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

**NOTICE:**

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

- (f) Fully tighten the bolts in this order: Area 1 and Area 2.

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

- (g) Fully tighten the bolts and nuts in this order: Area 3.

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

HINT:

Tighten the bolts and nuts in the order of upper to lower as shown in the illustration.

- (h) Fully tighten the bolts in this order: 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 in the order of lower to upper as shown in the illustration.

3. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 2) (See page [EM-150](#))**
4. **INSTALL WATER INLET HOUSING (See page [EM-144](#))**
5. **REMOVE NO. 1 ENGINE MOUNTING BRACKET FRONT LH (See page [EM-38](#))**
6. **INSTALL OIL PAN SUB-ASSEMBLY (See page [EM-147](#))**
7. **INSTALL OIL STRAINER SUB-ASSEMBLY (See page [EM-148](#))**
8. **INSTALL NO. 2 OIL PAN SUB-ASSEMBLY (See page [EM-148](#))**
9. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 1) (See page [EM-149](#))**
10. **INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 2) (See page [EM-150](#))**
11. **INSTALL CRANKSHAFT PULLEY (See page [EM-151](#))**
12. **INSTALL NO. 1 OIL PIPE (See page [EM-153](#))**
13. **INSTALL OIL PIPE (See page [EM-153](#))**
14. **INSTALL NO. 1 VACUUM SWITCHING VALVE (See page [EC-14](#))**
15. **INSTALL RADIO SETTING CONDENSER (See page [EM-38](#))**
16. **INSTALL WATER PUMP PULLEY (See page [CO-10](#))**

17. INSTALL NO. 2 IDLER PULLEY SUB-ASSEMBLY (See page [EM-39](#))
18. INSTALL NO. 2 TIMING GEAR COVER (See page [EM-39](#))
19. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-39](#))
20. INSTALL ENGINE MOUNTING BRACKET RH (See page [EM-40](#))
21. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH (See page [EM-40](#))
22. INSTALL NO. 2 EXHAUST MANIFOLD HEAT INSULATOR (See page [EM-40](#))
23. INSTALL NO. 2 MANIFOLD STAY (See page [EM-41](#))
24. INSTALL OIL LEVEL GAUGE GUIDE SUB-ASSEMBLY (See page [EM-41](#))
25. REMOVE EXHAUST MANIFOLD SUB-ASSEMBLY RH (See page [EM-41](#))
26. INSTALL NO. 2 ENGINE MOUNTING STAY RH (See page [EM-42](#))
27. INSTALL IGNITION COIL ASSEMBLY (See page [EM-42](#))
28. INSTALL INTAKE AIR SURGE TANK ASSEMBLY (See page [FU-18](#))
29. REMOVE ENGINE STAND
30. INSTALL DRIVE PLATE AND RING GEAR SUB-ASSEMBLY (See page [EM-13](#))
31. INSTALL AUTOMATIC TRANSAXLE ASSEMBLY (See page [AX-214](#))
32. INSTALL STARTER ASSEMBLY (See page [ST-148](#))
33. INSTALL ENGINE WIRE
34. INSTALL FRONT DRIVE SHAFT ASSEMBLY LH (See page [DS-21](#))
35. INSTALL FRONT DRIVE SHAFT ASSEMBLY RH (See page [DS-20](#))
36. INSTALL FRONT FRAME ASSEMBLY (See page [EM-43](#))
37. INSTALL VANE PUMP ASSEMBLY (See page [EM-44](#))
38. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE (See page [EM-44](#))