

LUBRICATION SYSTEM

ON-VEHICLE INSPECTION

1. CHECK ENGINE OIL LEVEL

- Warm up the engine, stop the engine and wait for 5 minutes.
- 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.

NOTICE:

Do not add engine oil above the F mark.

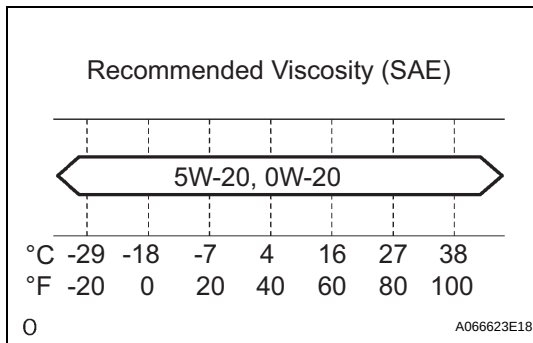
2. CHECK ENGINE OIL QUALITY

- Check the oil for deterioration, water intrusion, discoloration or thinning.
If the quality is visibly poor, replace the oil.

Oil grade:

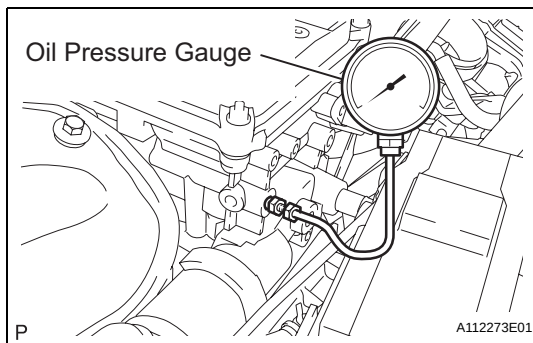
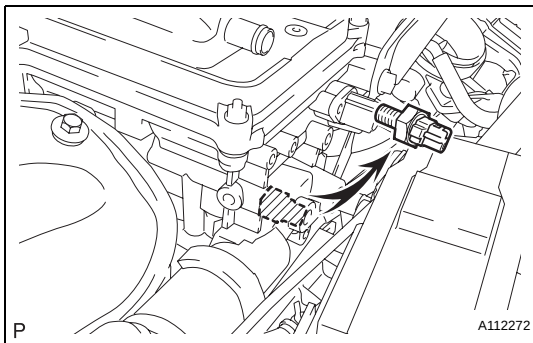
Use ILSAC multigrade engine oil. SAE 5W-20 and SAE 0W-20 engine oil may be used.

However, SAE 0W-20 is the best choice for good fuel economy and good starting in cold weather.



3. CHECK OIL PRESSURE

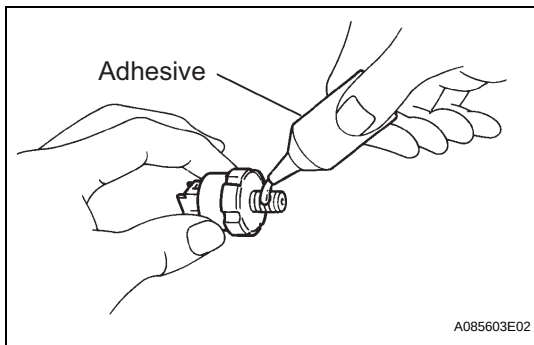
- Disconnect the oil pressure switch connector.
- Using a 24 mm deep socket wrench, remove the oil pressure switch.



- Install the oil pressure gauge.
- Warm up the engine.
- Measure the oil pressure.

Standard oil pressure

Condition	Specified Condition
Idle	29 kPa (0.3 kgf/cm ² , 4.3 psi) or more
3,000 rpm	170 to 300 kPa (1.7 to 3.1 kgf/cm ² , 24 to 44 psi)



- (f) Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or Equivalent

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

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

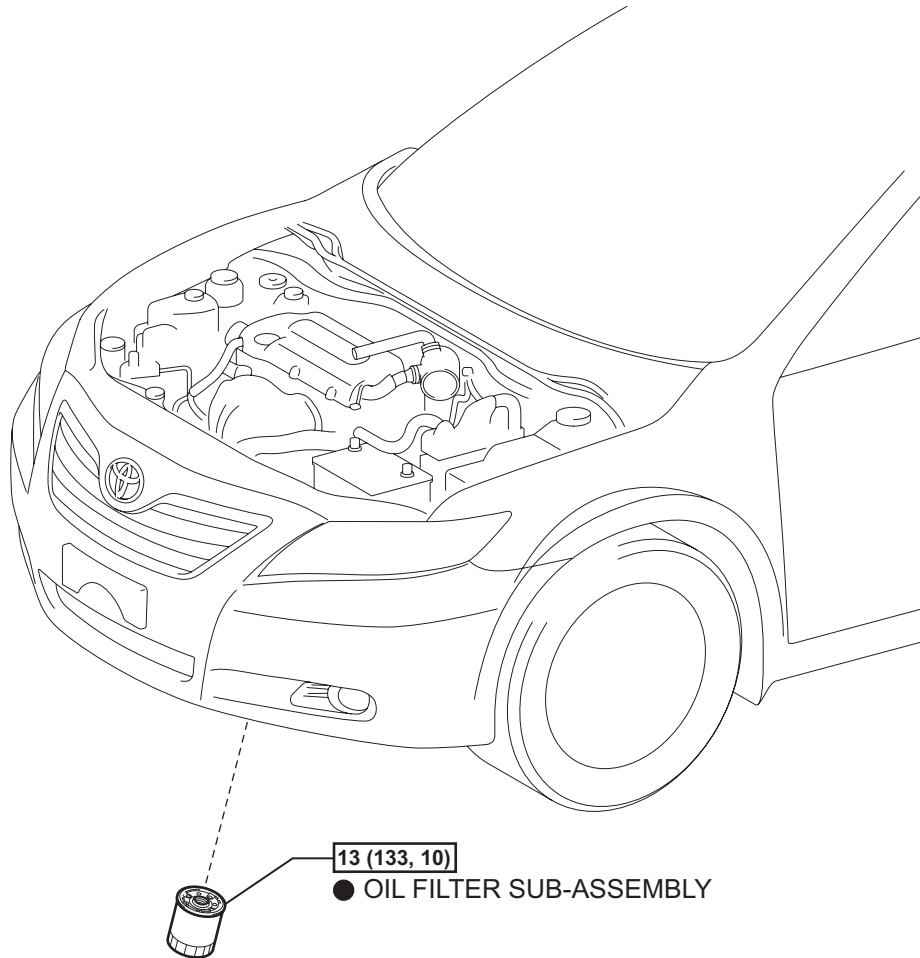
NOTICE:

Do not start the engine within 1 hour of installation.

- (h) Connect the oil pressure switch connector.
(i) Check for engine oil leaks.

OIL FILTER

COMPONENTS



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

● Non-reusable part

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REPLACEMENT

CAUTION:

- Prolonged and repeated contact with engine oil will cause the loss 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. Wear protective clothing and gloves. Wash your skin thoroughly with soap and water, or use a waterless hand cleaner to remove any used engine oil. Do not use gasoline, thinners or solvents.
- For environmental protection, 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 SUB-ASSEMBLY

- (a) Using SST, remove the oil filter.
SST 09228-06501

3. INSTALL OIL FILTER SUB-ASSEMBLY

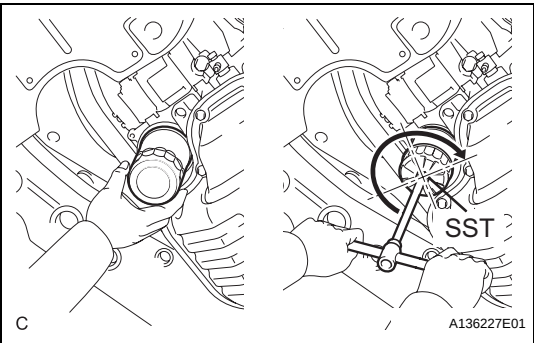
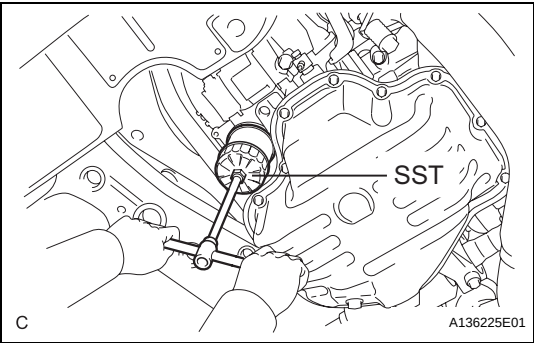
- (a) Check and clean the oil filter installation surface.
- (b) Apply clean engine oil to the gasket of a new oil filter.

- (c) Lightly screw the oil filter into place by hand. Tighten it until the gasket contacts the seat.
- (d) Using SST, tighten the oil filter.
SST 09228-06501

- (1) Depending on the work space available, choose from the following.
 - 1. If enough space is available, use a torque wrench to tighten the oil filter.
Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)
 - 2. If enough space is not available to use a torque wrench, tighten the oil filter a 3/4 turn by hand or use a common wrench.

4. ADD ENGINE OIL

- (a) Clean and install the oil drain plug with a new gasket.
Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)
- (b) Add new oil.
Standard capacity



Item	Standard Condition
Drain and refill with oil filter change	4.3 liters (4.5 US qts, 3.8 Imp. qts)

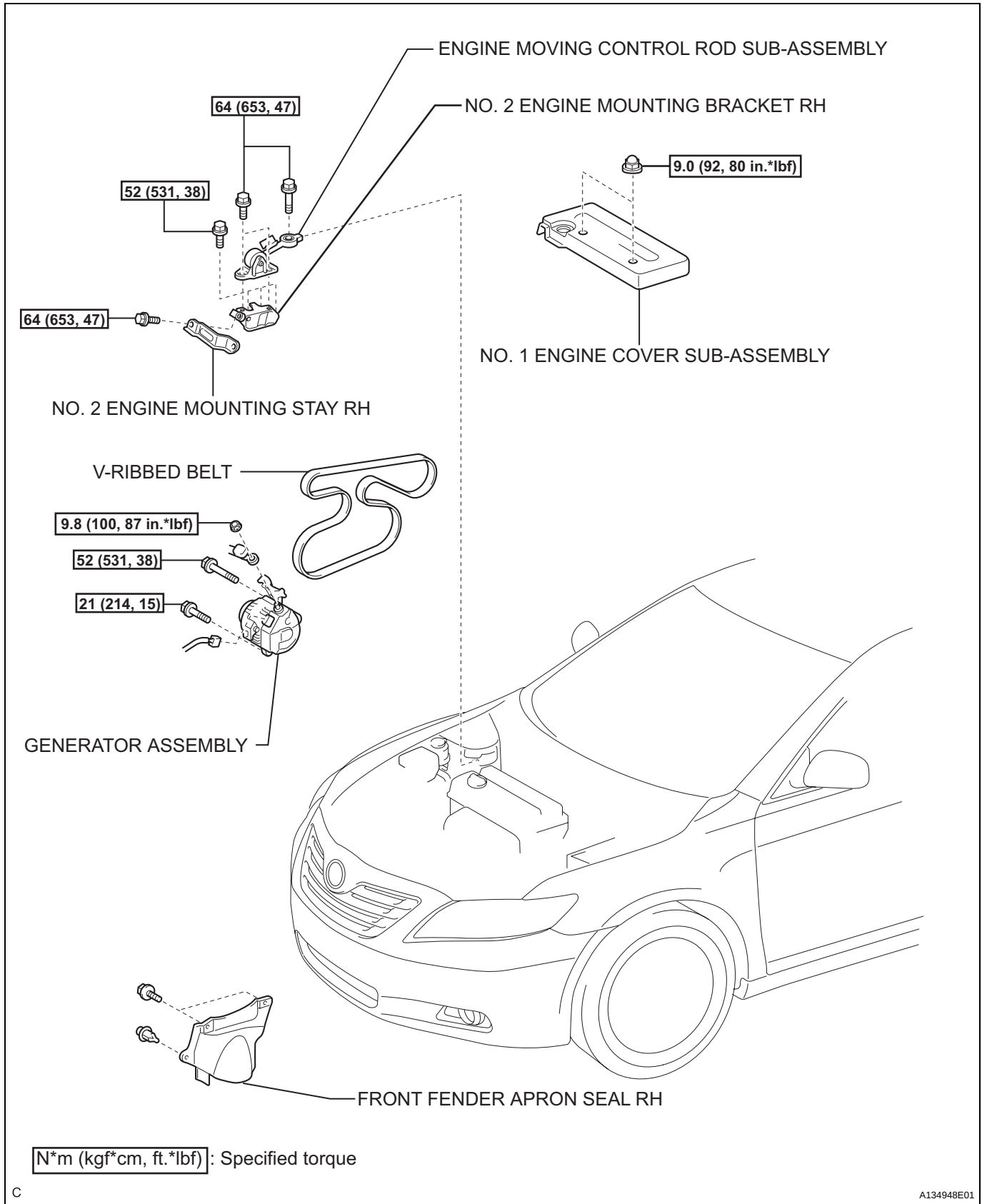
Item	Standard Condition
Drain and refill without oil filter change	4.1 liters (4.3 US qts, 3.6 Imp. qts)
Dry fill	5.0 liters (5.3 US qts, 4.4 Imp. qts)

(c) Install the oil filler cap.

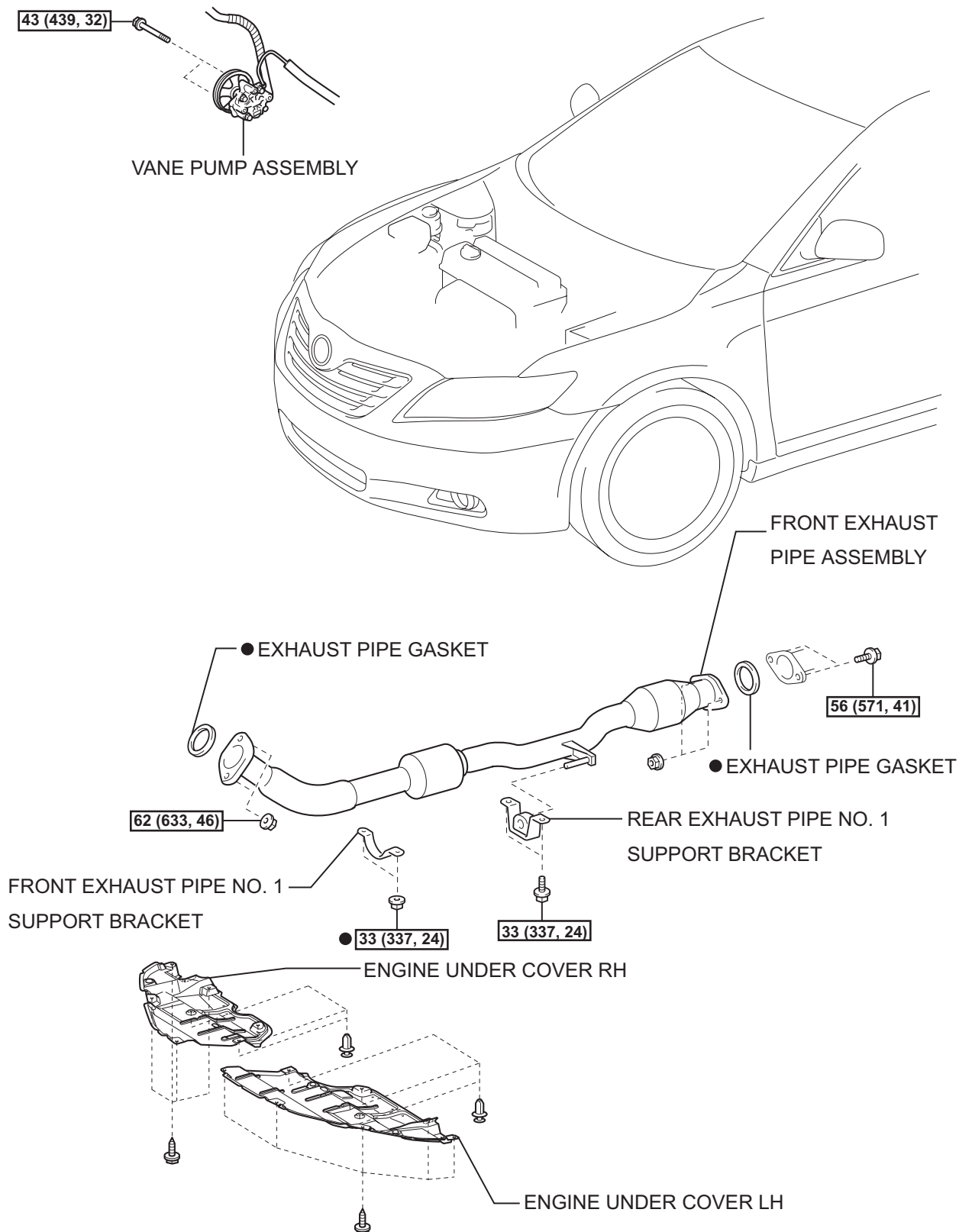
5. CHECK FOR ENGINE OIL LEAKS

OIL PUMP

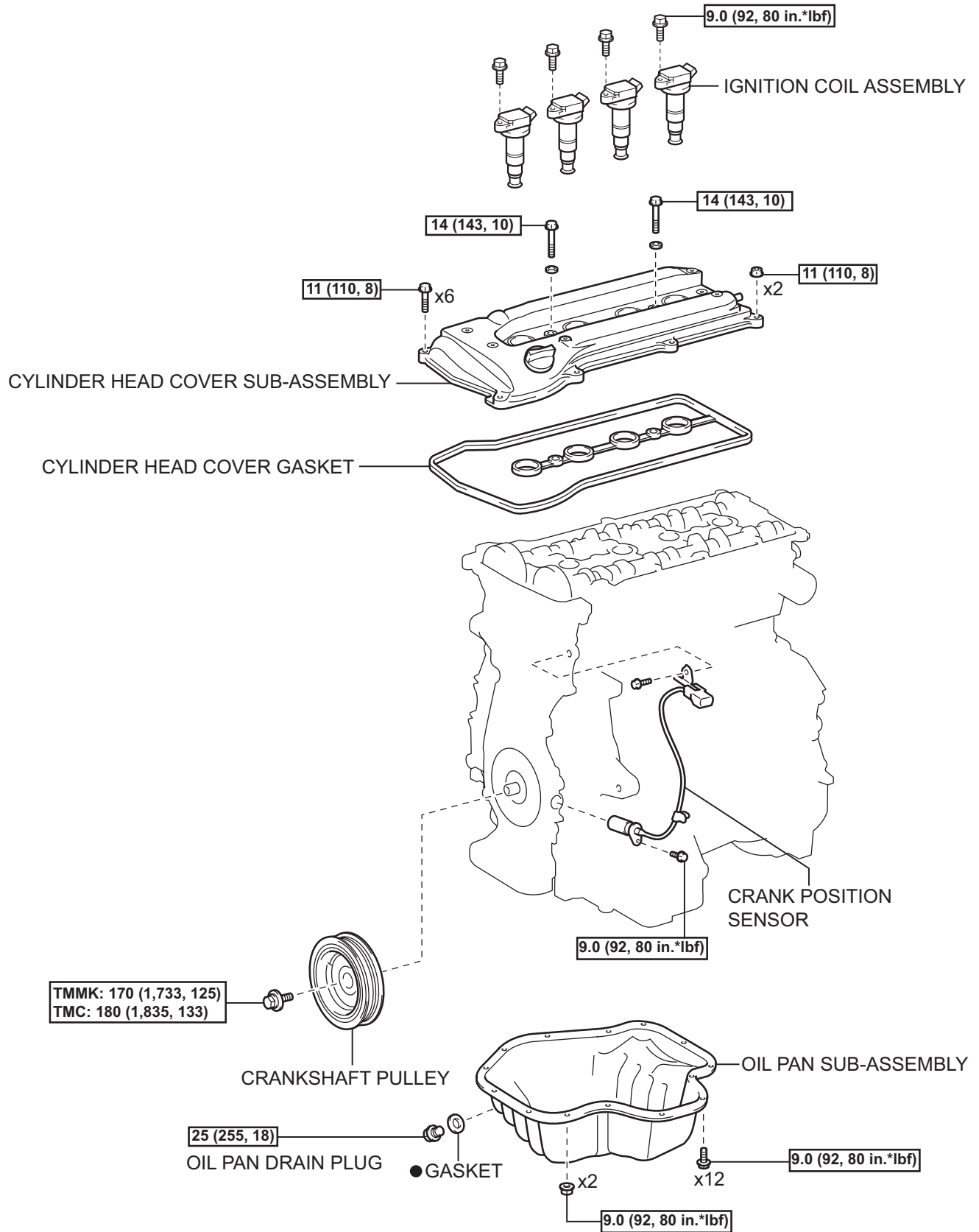
COMPONENTS



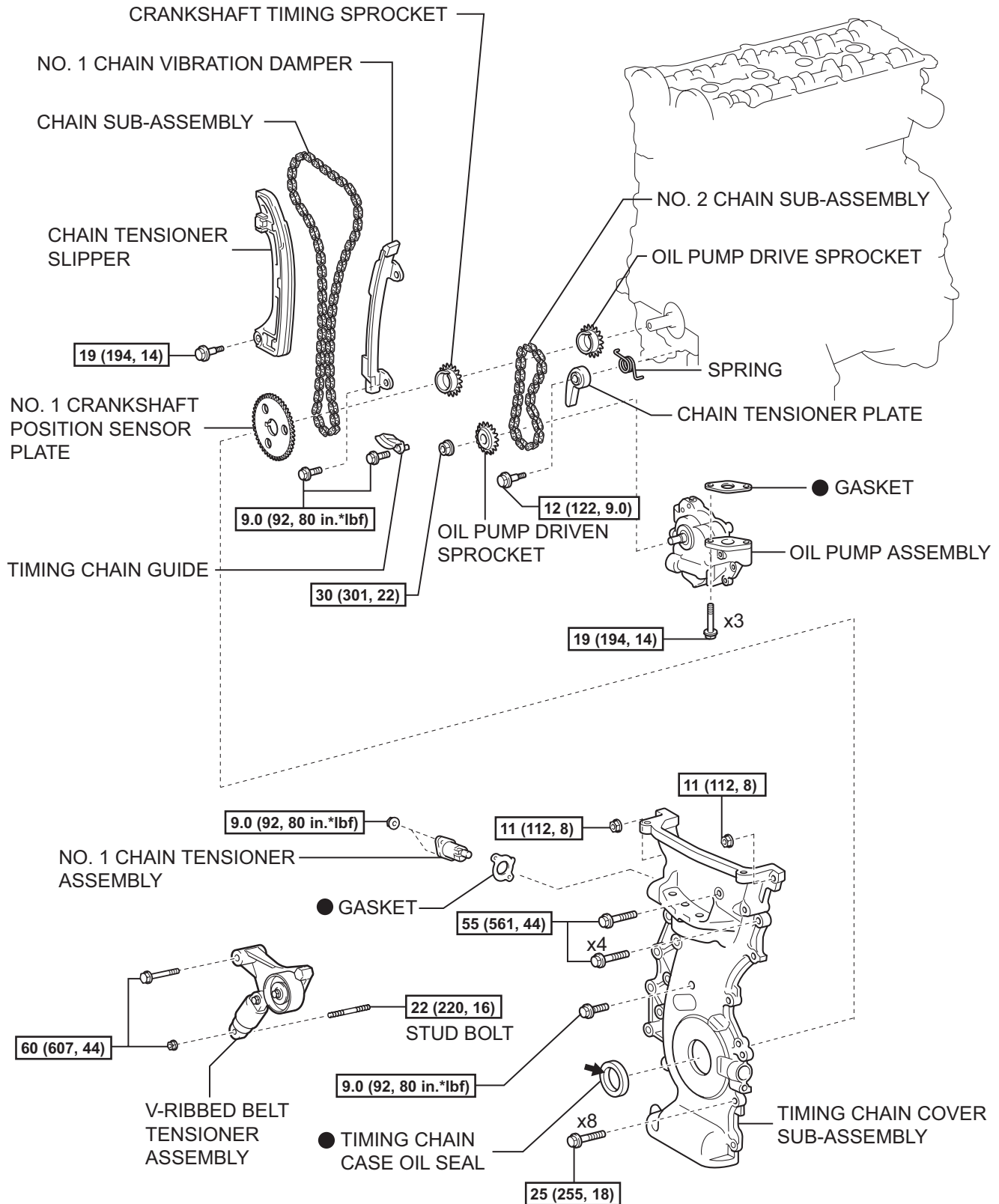
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N*m (kgf*cm, ft.*lbf): Specified torque ● Non-reusable part



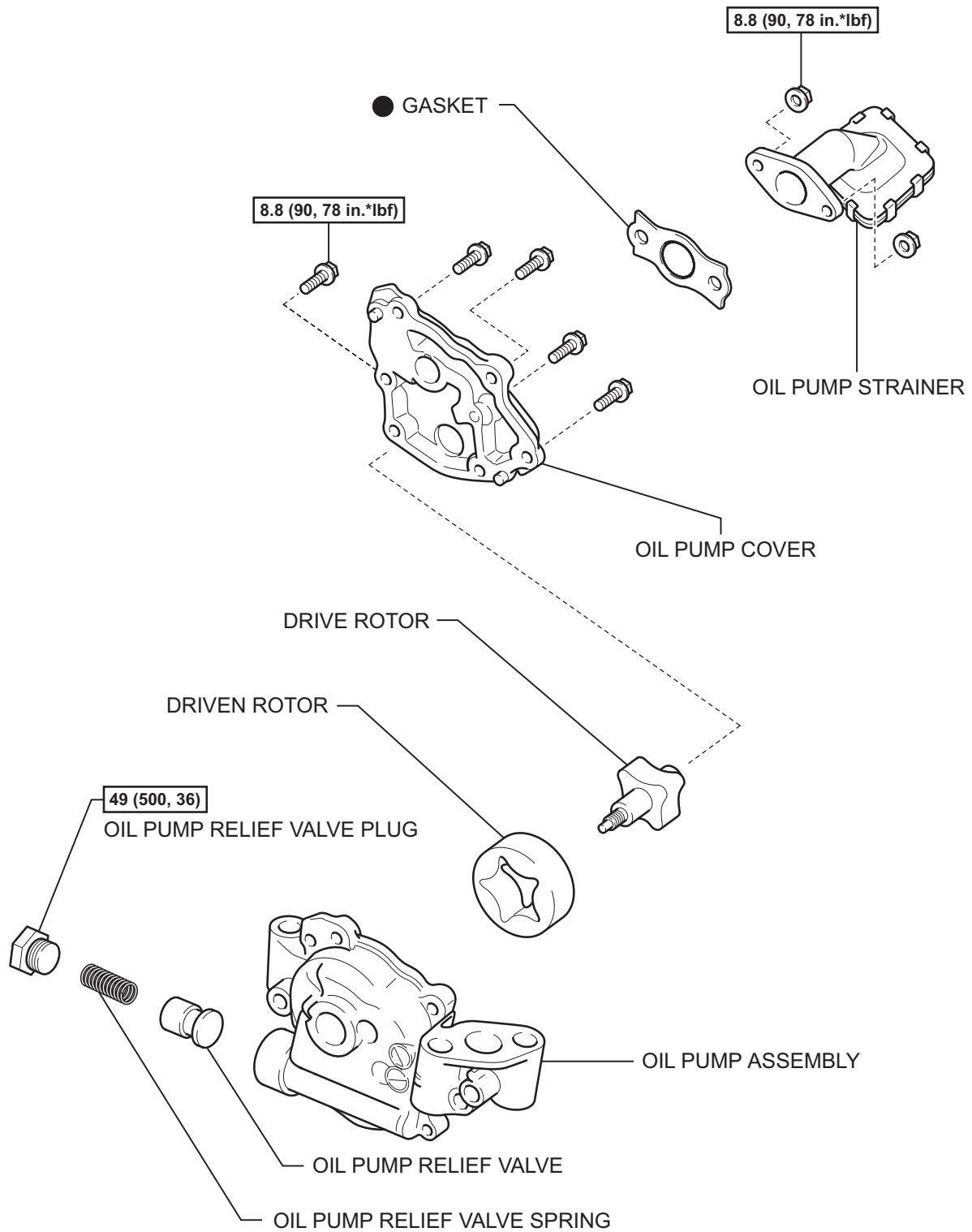
N*m (kgf*cm, ft.*lbf): Specified torque ● Non-reusable part



● Non-reusable part

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

← Apply MP grease



● Non-reusable part

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

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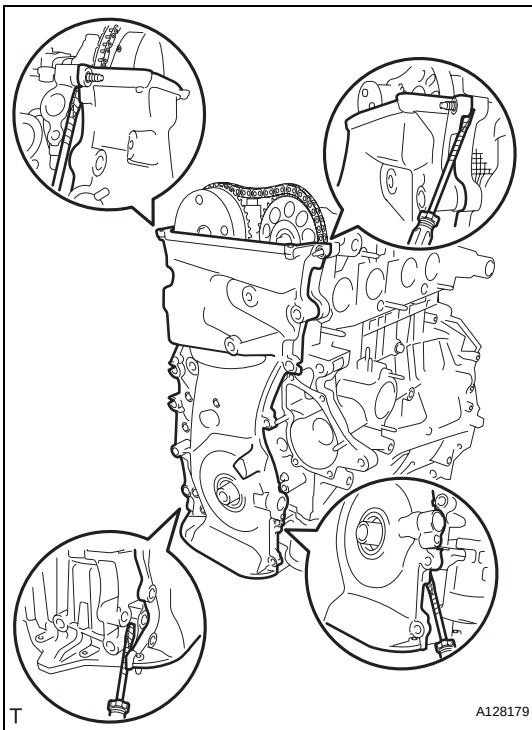
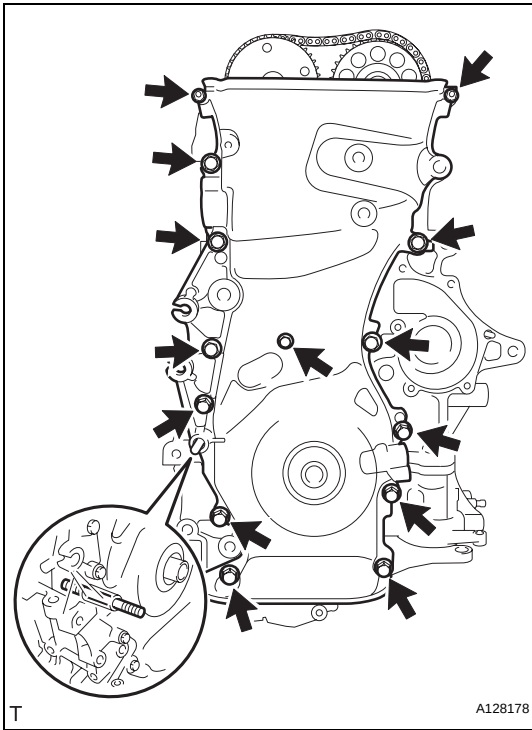
REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
2. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY (See page [EM-94](#))
3. REMOVE FRONT WHEEL RH
4. REMOVE ENGINE UNDER COVER LH
5. REMOVE ENGINE UNDER COVER RH
6. REMOVE FRONT FENDER APRON SEAL RH
7. DRAIN ENGINE OIL (See page [LU-4](#))
8. REMOVE FRONT EXHAUST PIPE ASSEMBLY (See page [EX-2](#))
9. REMOVE NO. 2 ENGINE MOUNTING STAY RH (See page [EM-95](#))
10. REMOVE ENGINE MOVING CONTROL ROD SUB-ASSEMBLY (See page [EM-95](#))
11. REMOVE NO. 2 ENGINE MOUNTING BRACKET RH (See page [EM-96](#))
12. REMOVE V-RIBBED BELT (See page [EM-6](#))
13. REMOVE GENERATOR ASSEMBLY (See page [CH-11](#))
14. REMOVE VANE PUMP ASSEMBLY (See page [EM-101](#))
15. REMOVE IGNITION COIL ASSEMBLY (See page [EM-106](#))
16. DISCONNECT VENTILATION HOSE
17. DISCONNECT NO. 2 VENTILATION HOSE
18. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See page [EM-21](#))
19. SET SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page [EM-8](#))
20. REMOVE CRANKSHAFT PULLEY (See page [EM-75](#))
21. REMOVE CRANK POSITION SENSOR (See page [ES-411](#))
22. REMOVE OIL PAN SUB-ASSEMBLY (See page [EM-22](#))
23. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-22](#))
24. INSTALL ENGINE HANGERS (See page [EM-22](#))
25. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-23](#))
26. REMOVE ENGINE MOUNTING INSULATOR (See page [EM-23](#))

27. REMOVE ENGINE MOUNTING BRACKET RH (See page [EM-24](#))

28. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY

- (a) Using a E10 "torx" socket, remove the stud bolt for the drive belt tensioner from the cylinder block.
- (b) Remove the 12 bolts and 2 nuts.



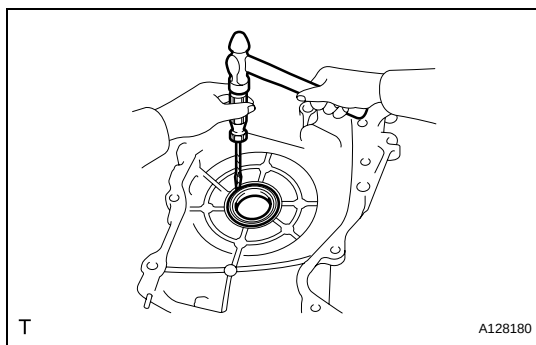
- (c) Remove the timing chain cover by prying between the timing chain cover and cylinder head or cylinder block with a screwdriver.

NOTICE:

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

HINT:

Tape the screwdriver tip before use.



29. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

- (a) Using a screwdriver and a hammer, tap out the oil seal.

HINT:

Tape the screwdriver tip before use.

30. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See page EM-24)

31. REMOVE CHAIN TENSIONER SLIPPER (See page EM-24)

32. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See page EM-24)

33. REMOVE TIMING CHAIN GUIDE (See page EM-25)

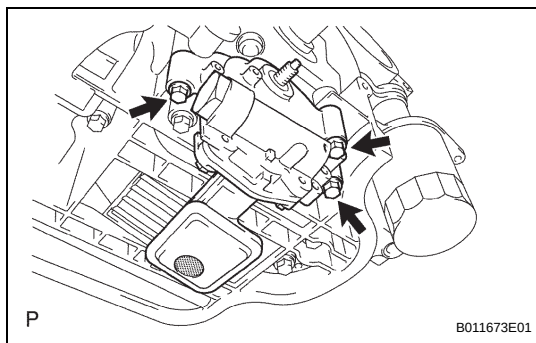
34. REMOVE CHAIN SUB-ASSEMBLY (See page EM-25)

35. REMOVE CRANKSHAFT TIMING SPROCKET (See page EM-25)

36. REMOVE NO. 2 CHAIN SUB-ASSEMBLY (See page EM-25)

37. REMOVE OIL PUMP ASSEMBLY

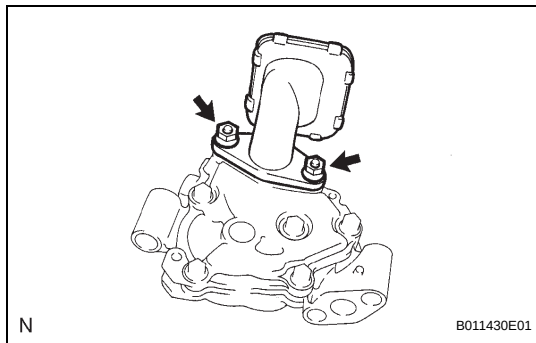
- (a) Remove the 3 bolts, oil pump and gasket.



DISASSEMBLY

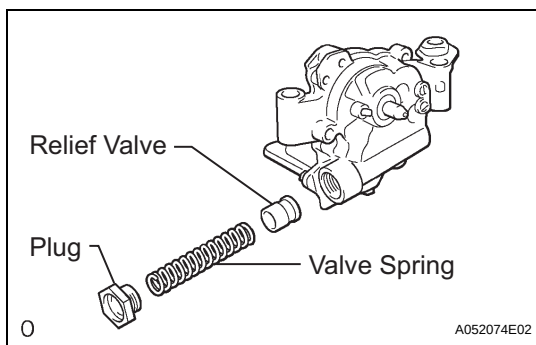
1. REMOVE OIL PUMP STRAINER

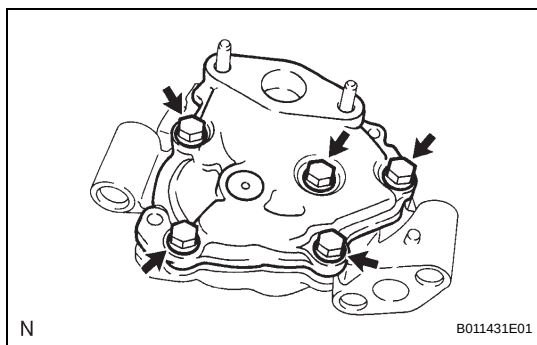
- (a) Remove the 2 nuts, oil pump strainer and gasket.



2. REMOVE OIL PUMP RELIEF VALVE

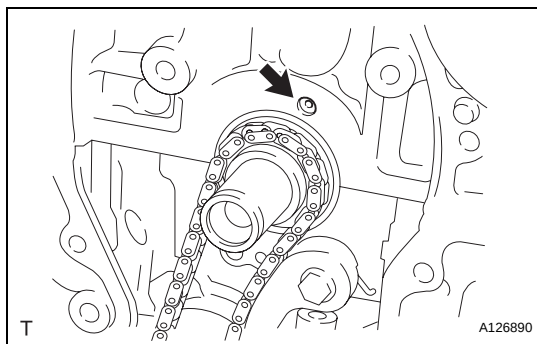
- (a) Using a 27 mm socket wrench, remove the plug.
(b) Remove the valve spring and relief valve.





3. REMOVE OIL PUMP COVER

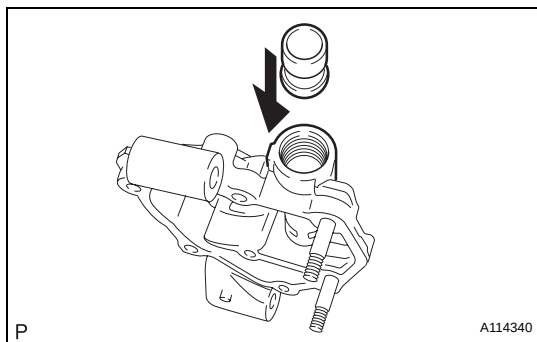
- (a) Remove the 5 bolts and oil pump cover.
- (b) Remove the oil pump rotor.



INSPECTION

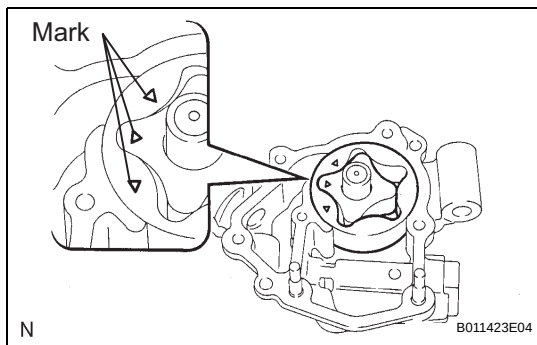
1. INSPECT OIL JET

- (a) Check the oil jet for damage or clogging.
If necessary, repair the cylinder block.



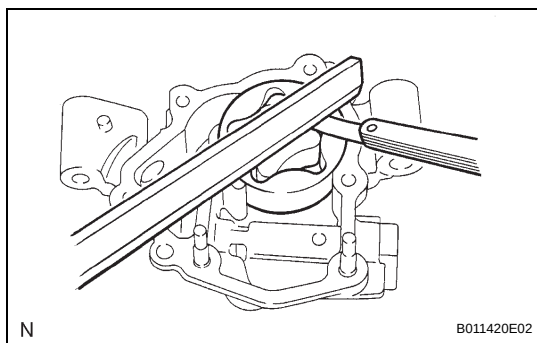
2. INSPECT OIL PUMP RELIEF VALVE

- (a) Check the relief valve.
 - (1) Coat the valve with engine oil, and then check that the valve 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.

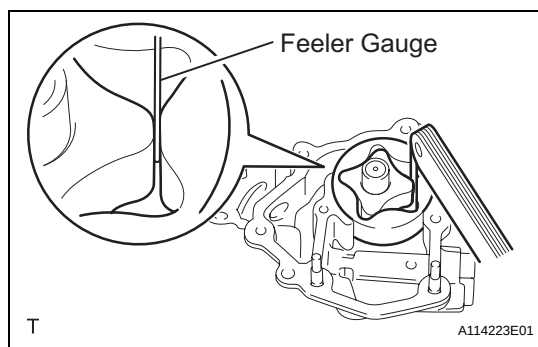


3. INSPECT OIL PUMP ROTOR

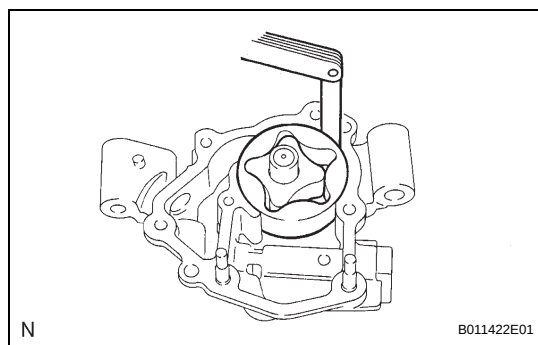
- (a) Install the oil pump rotor.
 - (1) Coat the drive rotor and driven rotor with engine oil.
 - (2) Place the drive and driven rotors into the oil pump with the marks facing the pump cover side.



- (b) Check the side clearance.
 - (1) Using a feeler gauge and precision straightedge, measure the clearance between the rotors and precision straightedge.
Standard clearance:
 0.030 to 0.085 mm (0.0012 to 0.0033 in.)
Maximum clearance:
 0.16 mm (0.0063 in.)
 If the side clearance is greater than the maximum, replace the oil pump assembly.



- (c) Check the tip clearance.
- (1) Using a feeler gauge, measure the clearance between the drive and driven rotor tips.
Standard clearance:
 0.080 to 0.160 mm (0.0031 to 0.0063 in.)
Maximum clearance:
 0.35 mm (0.0138 in.)
 If the tip clearance is greater than the maximum, replace the oil pump assembly.

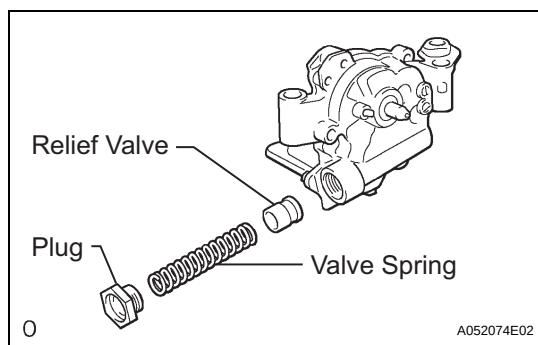
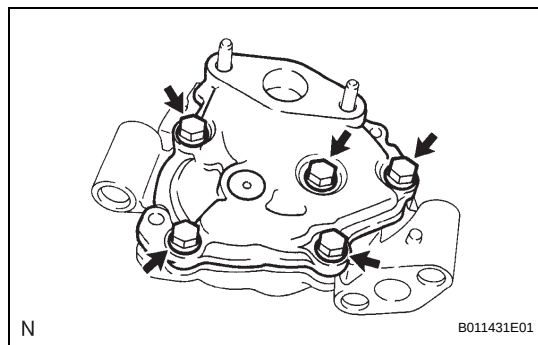


- (d) Check the body clearance.
- (1) Using a feeler gauge, measure the clearance between the driven rotor and pump body.
Standard clearance:
 0.100 to 0.170 mm (0.0039 to 0.0067 in.)
Maximum clearance:
 0.325 mm (0.0128 in.)
 If the body clearance is greater than the maximum, replace the oil pump assembly.

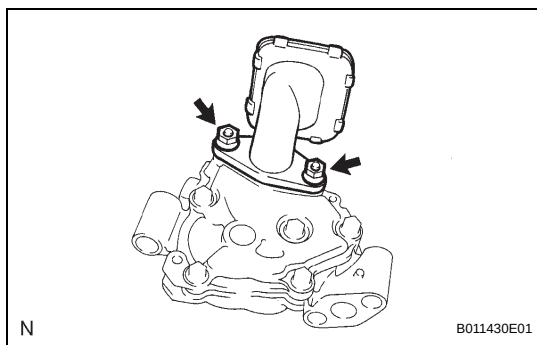
4. **INSPECT NO. 2 CHAIN SUB-ASSEMBLY** (See page [EM-138](#))
5. **INSPECT OIL PUMP DRIVE SPROCKET** (See page [EM-138](#))
6. **INSPECT OIL PUMP DRIVEN SPROCKET** (See page [EM-139](#))
7. **INSPECT CHAIN TENSIONER PLATE** (See page [EM-140](#))

REASSEMBLY

1. **INSTALL OIL PUMP COVER**
 - (a) Install the oil pump cover with the 5 bolts.
Torque: 8.8 N*m (90 kgf*cm, 78 in.*lbf)
2. **INSTALL OIL PUMP RELIEF VALVE**
 - (a) Coat the relief valve with engine oil.



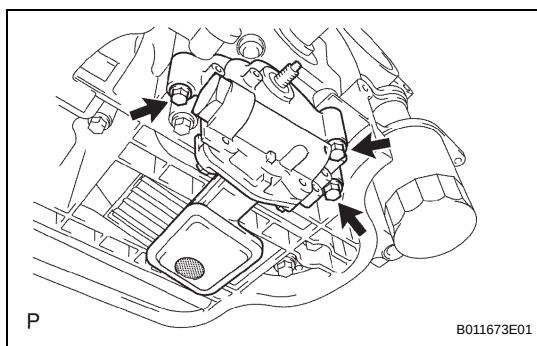
- (b) Insert the relief valve and spring into the pump body hole.
- (c) Using a 27 mm socket wrench, install the plug.
Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)



3. INSTALL OIL PUMP STRAINER

- (a) Install a new gasket and the oil strainer with the 2 nuts.

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



INSTALLATION

1. INSTALL OIL PUMP ASSEMBLY

- (a) Install a new gasket and the oil pump with the 3 bolts.

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

2. INSTALL NO. 2 CHAIN SUB-ASSEMBLY (See page [EM-27](#))

3. INSTALL CRANKSHAFT TIMING SPROCKET (See page [EM-28](#))

4. INSTALL NO. 1 CHAIN VIBRATION DAMPER (See page [EM-28](#))

5. INSTALL CHAIN SUB-ASSEMBLY (See page [EM-28](#))

6. INSTALL CHAIN TENSIONER SLIPPER (See page [EM-29](#))

7. INSTALL TIMING CHAIN GUIDE (See page [EM-30](#))

8. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See page [EM-30](#))

9. INSTALL TIMING CHAIN CASE OIL SEAL

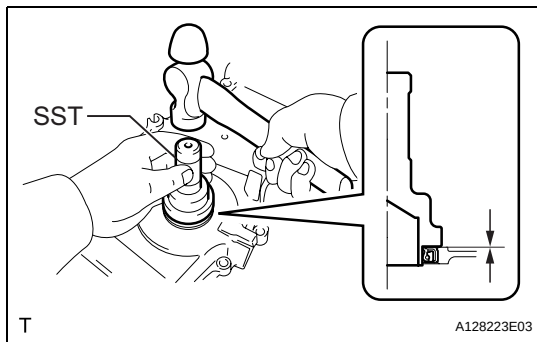
- (a) Using SST, tap in a new oil seal until its surface is flush with the timing chain cover edge.

SST 09223-22010

- (b) Apply a light coat of MP grease to the lip of the oil seal.

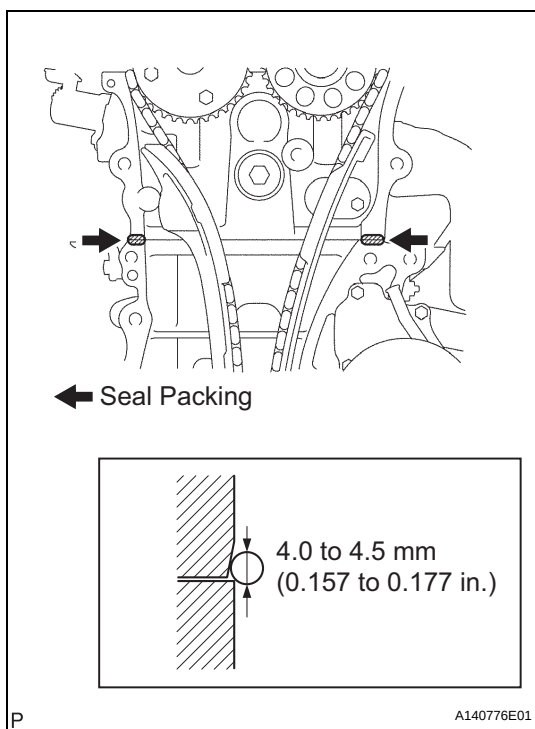
NOTICE:

Keep the gap between the timing chain cover edge and the oil seal free of foreign matter.



10. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY

- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.

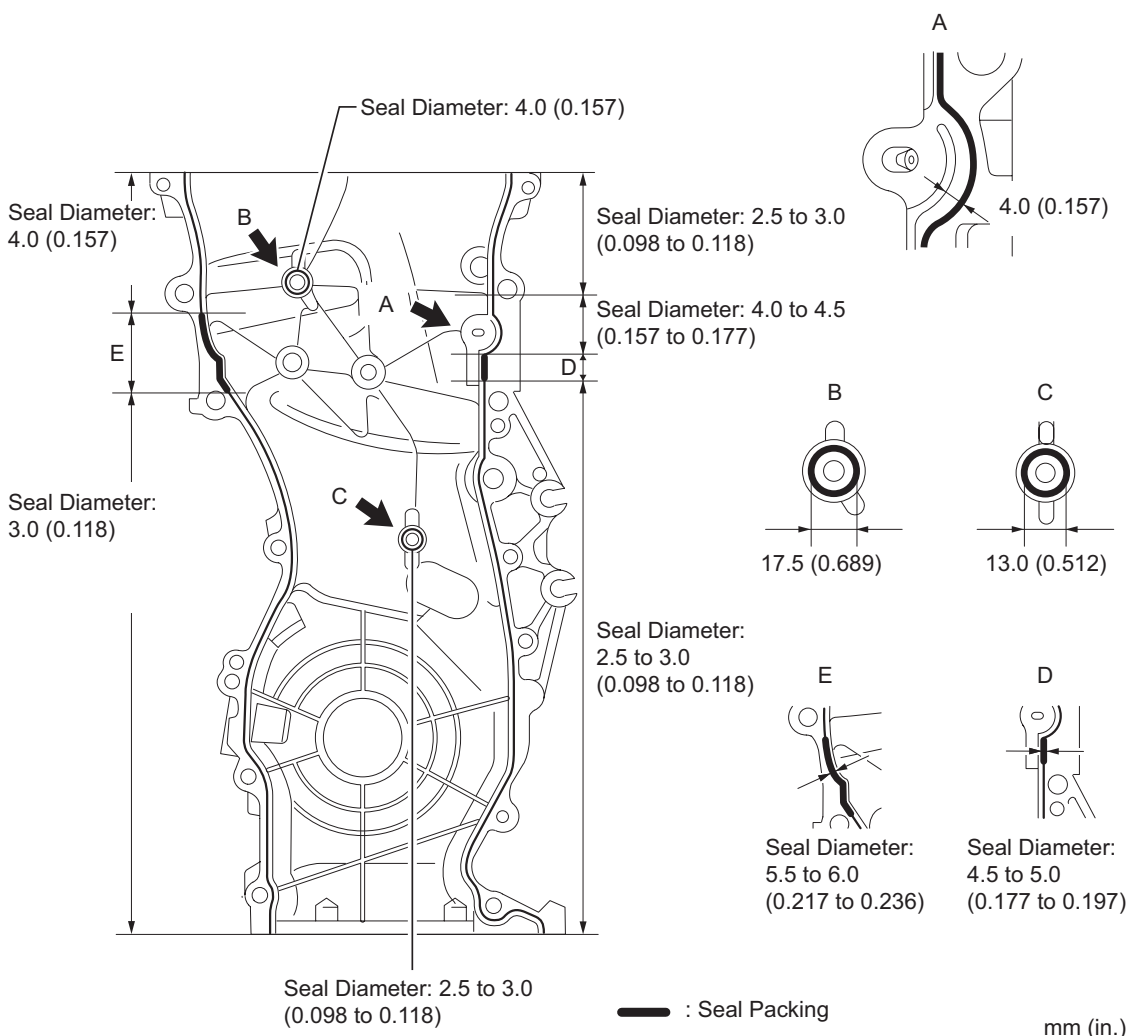


- (b) Apply seal packing (diameter: 4.0 to 4.5 mm (0.157 to 0.177 in.)) as shown in the illustration.

Seal packing:

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

- (c) Apply seal packing in a continuous bead as shown in the illustration.



Seal packing:

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

NOTICE:

- Remove any oil from the contact surface.
- Install the chain cover within 3 minutes after applying seal packing.
- Do not start the engine for at least 2 hours after installing.

- (d) Install the timing chain cover with the 12 bolts and 2 nuts.

Torque: Bolt A

9.0 N*m (92 kgf*cm, 80 in.*lbf)

Bolt B

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

Bolt C

55 N*m (561 kgf*cm, 41 ft.*lbf)

Nut

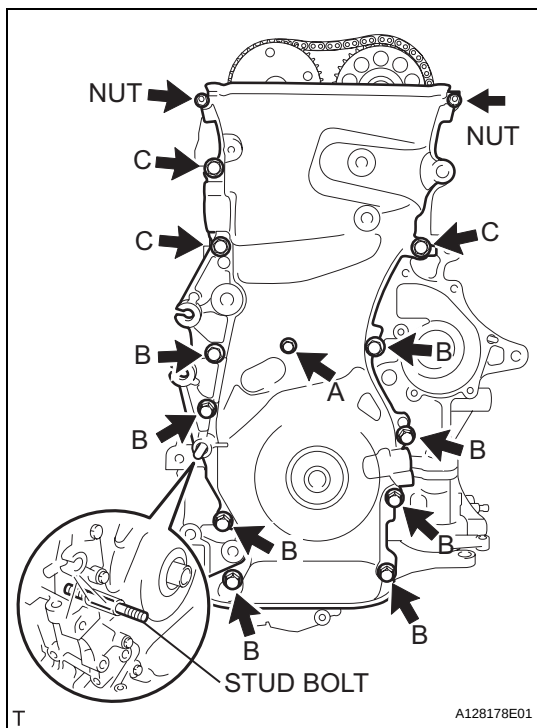
11 N*m (112 kgf*cm, 8 ft.*lbf)

Bolt length

Item	Length
Bolt A	30 mm (1.18 in.) length for 10 mm head
Bolt B	30 mm (1.18 in.) length for 12 mm head
Bolt C	40 mm (1.57 in.) length for 14 mm head

- (e) Using a E10 "torx" socket, install the stud bolt to the drive belt tensioner.

Torque: 22 N*m (220 kgf*cm, 16 ft.*lbf)



11. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY
(See page [EM-30](#))

12. INSTALL ENGINE MOUNTING BRACKET RH (See page [EM-30](#))

13. INSTALL ENGINE MOUNTING INSULATOR (See page [EM-30](#))

14. INSTALL OIL PAN SUB-ASSEMBLY (See page [EM-31](#))

15. INSTALL CRANK POSITION SENSOR (See page [ES-411](#))

16. INSTALL CRANKSHAFT PULLEY (See page [EM-76](#))

17. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-32](#))

18. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY
(See page [EM-33](#))

19. INSTALL NO. 2 VENTILATION HOSE

20. INSTALL VENTILATION HOSE

21. INSTALL IGNITION COIL ASSEMBLY (See page [EM-33](#))

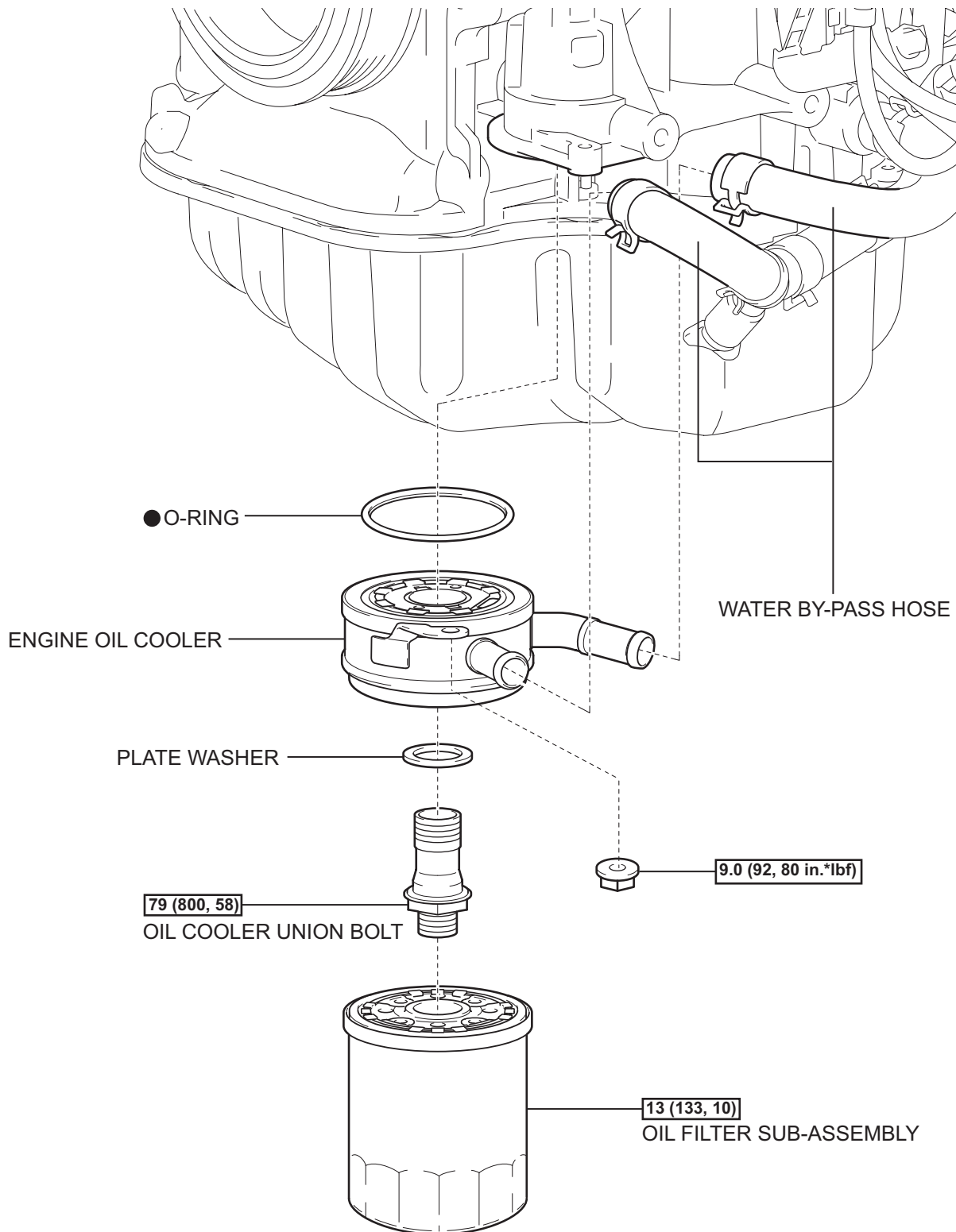
22. INSTALL VANE PUMP ASSEMBLY (See page [EM-113](#))

23. INSTALL GENERATOR ASSEMBLY (See page [CH-19](#))

24. INSTALL V-RIBBED BELT (See page [EM-6](#))
25. INSTALL NO. 2 ENGINE MOUNTING BRACKET RH (See page [EM-118](#))
26. INSTALL ENGINE MOVING CONTROL ROD SUB-ASSEMBLY (See page [EM-119](#))
27. INSTALL NO. 2 ENGINE MOUNTING STAY RH (See page [EM-119](#))
28. INSTALL FRONT EXHAUST PIPE ASSEMBLY (See page [EX-3](#))
29. ADD ENGINE OIL
30. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL (See page [EM-120](#))
31. CHECK ENGINE OIL LEAKS
32. CHECK CHECK EXHAUST GAS LEAKS
33. CHECK IGNITION TIMING (See page [EM-1](#))
34. INSTALL FRONT FENDER APRON SEAL RH
35. INSTALL ENGINE UNDER COVER LH
36. INSTALL ENGINE UNDER COVER RH
37. INSTALL FRONT WHEEL RH
38. INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY (See page [EM-121](#))

ENGINE OIL COOLER (w/ Oil Cooler)

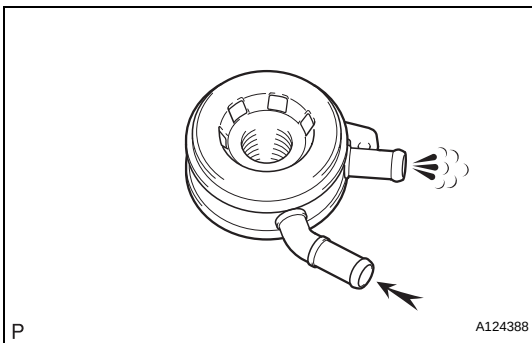
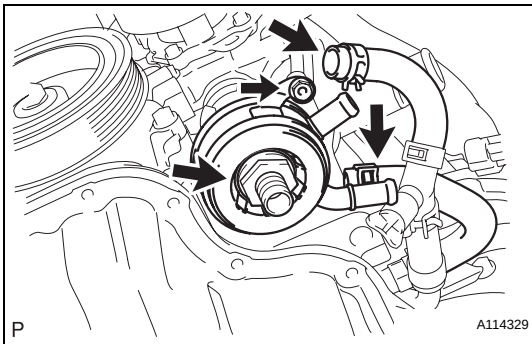
COMPONENTS



N*m (kgf*cm, ft.*lbf): Specified torque ● Non-reusable part

REMOVAL

1. REMOVE FRONT WHEEL OPENING EXTENSION PAD RH
2. REMOVE FRONT WHEEL OPENING EXTENSION PAD LH
3. REMOVE ENGINE UNDER COVER RH
4. REMOVE ENGINE UNDER COVER LH
5. DRAIN ENGINE COOLANT (See page [CO-5](#))
6. DRAIN ENGINE OIL (See page [LU-4](#))
7. REMOVE OIL FILTER SUB-ASSEMBLY (See page [LU-4](#))
8. REMOVE ENGINE OIL COOLER
 - (a) Disconnect the 2 oil cooler hoses from the oil cooler.
 - (b) Remove the oil cooler union bolt, plate washer, nut, oil cooler and O-ring.



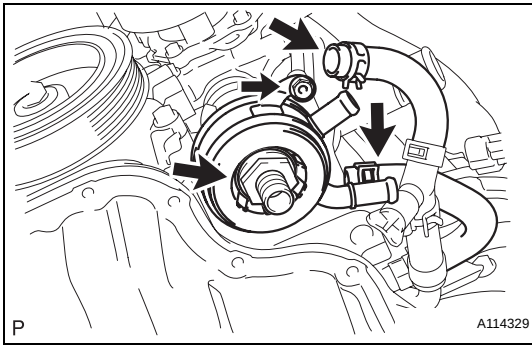
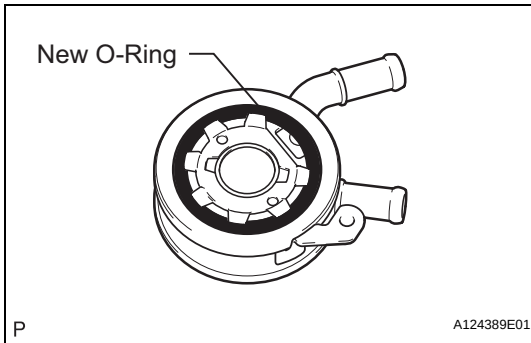
INSPECTION

1. INSPECT ENGINE OIL COOLER
 - (a) Check the engine oil cooler for damage or clogging. If necessary, replace the oil cooler.

INSTALLATION

1. INSTALL ENGINE OIL COOLER

- (a) Clean the oil cooler contact surface.
- (b) Install a new O-ring to the oil cooler.



- (c) Apply a light coat of engine oil to the threads and under the head of the oil cooler union bolt.
- (d) Install the oil cooler with the plate washer, oil cooler union bolt and nut.

Torque: for union bolt

79 N*m (800 kgf*cm, 58 ft.*lbf)

for nut

9.0 N*m (92 kgf*cm, 80 in.*lbf)

- (e) Connect the 2 oil cooler hoses.

- 2. **INSTALL OIL FILTER SUB-ASSEMBLY** (See page [LU-4](#))
- 3. **ADD ENGINE OIL** (See page [LU-4](#))
- 4. **ADD ENGINE COOLANT** (See page [CO-5](#))
- 5. **CHECK FOR ENGINE OIL LEAKS**
- 6. **CHECK FOR ENGINE COOLANT LEAKS** (See page [CO-1](#))
- 7. **CHECK ENGINE OIL LEVEL** (See page [LU-1](#))
- 8. **INSTALL ENGINE UNDER COVER RH**
- 9. **INSTALL ENGINE UNDER COVER LH**
- 10. **INSTALL FRONT WHEEL OPENING EXTENSION PAD LH**
- 11. **INSTALL FRONT WHEEL OPENING EXTENSION PAD RH**