

REMOVAL

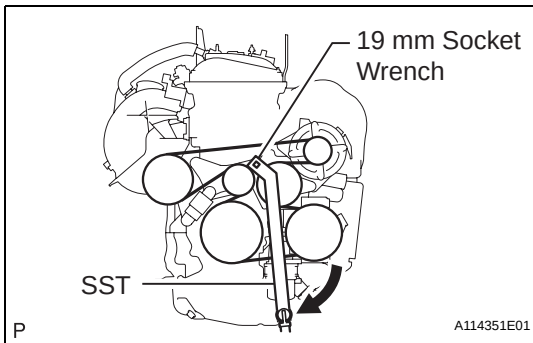
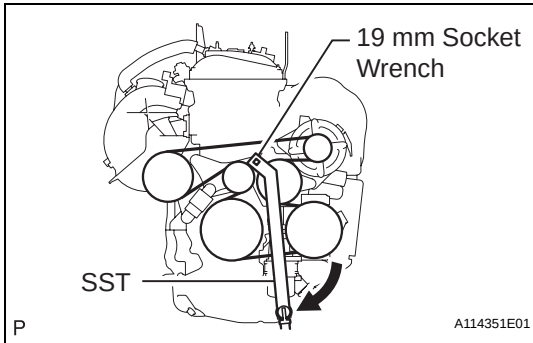
1. REMOVE RADIATOR SUPPORT OPENING COVER
2. REMOVE FRONT WHEEL RH
3. REMOVE FRONT FENDER APRON RH
4. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH
 - (a) Remove the 4 bolts and reinforcement RH.
5. REMOVE FAN AND GENERATOR V BELT
 - (a) Using SST and 19 mm socket wrench, loosen the V-ribbed belt tensioner arm clockwise, then remove the fan and generator V belt.

SST 09216-42010

NOTICE:

- Be sure to connect SST and the tools so that they are in line during use.
- When retracting the tensioner, turn it clockwise slowly for 3 seconds or more. Do not apply force rapidly.
- After the tensioner is fully retracted, do not apply force any more than necessary.

EM



INSTALLATION

1. INSTALL FAN AND GENERATOR V BELT
 - (a) Using SST and 19 mm socket wrench, loosen the V-ribbed belt tensioner arm clockwise, then install the fan and generator V belt.

SST 09216-42010

NOTICE:

 - Be sure to connect SST and the tools so that they are in line during use.
 - When retracting the tensioner, turn it clockwise slowly for 3 seconds or more. Do not apply force rapidly.
 - After the tensioner is fully retracted, do not apply force any more than necessary.
2. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH
 - (a) Install the reinforcement RH with the 4 bolts.
Torque: 96 N*m (979 kgf*cm, 71 ft.*lbf)
3. INSTALL FRONT FENDER APRON RH
4. INSTALL FRONT WHEEL RH
5. INSTALL RADIATOR SUPPORT OPENING COVER

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

CAUTION:

Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.

2. REMOVE RADIATOR SUPPORT OPENING COVER

3. REMOVE FRONT WHEEL RH

4. REMOVE NO. 1 ENGINE UNDER COVER

5. REMOVE FRONT FENDER APRON RH

6. REMOVE NO. 1 ENGINE COVER

(a) Remove the 2 nuts and cover.

7. DRAIN ENGINE OIL (See page [LU-4](#))

8. REMOVE FRONT EXHAUST PIPE (See page [EX-3](#))

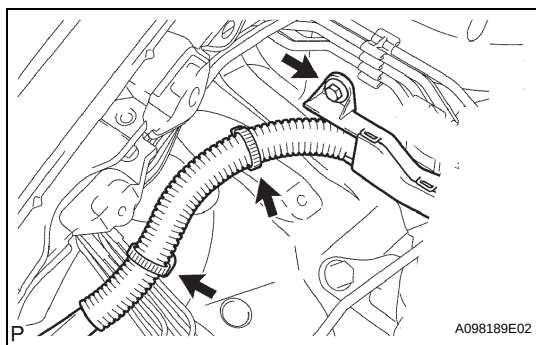
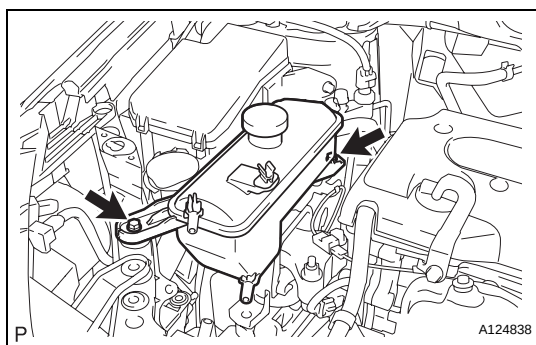
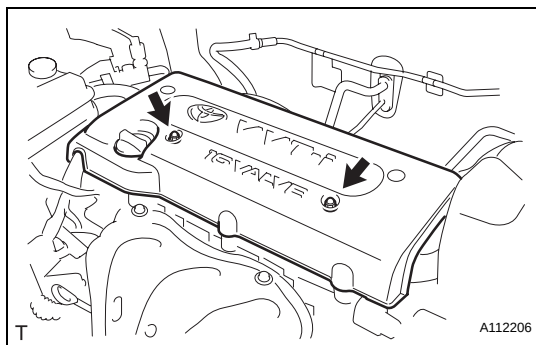
9. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page [EM-6](#))

10. REMOVE FAN AND GENERATOR V BELT (See page [EM-6](#))

11. REMOVE GENERATOR ASSEMBLY (See page [CH-9](#))

12. REMOVE RADIATOR RESERVOIR

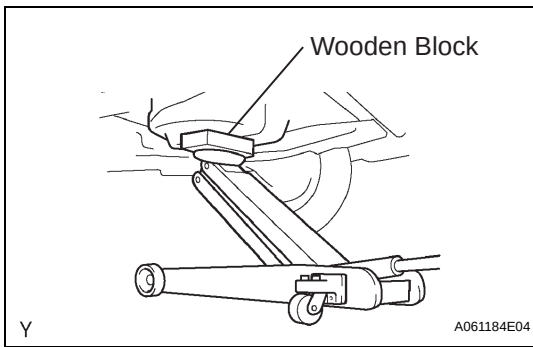
(a) Remove the 2 bolts and radiator reservoir.



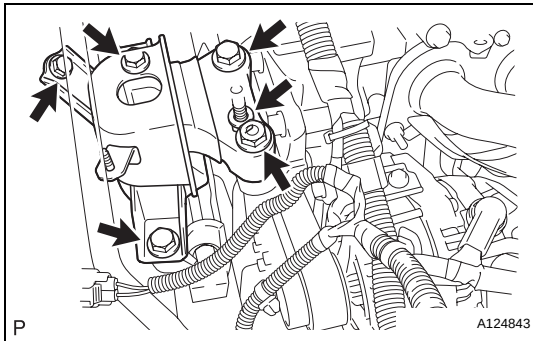
13. REMOVE ENGINE MOUNTING INSULATOR RH

(a) Remove the bolt of the wire harness protector.

(b) Disconnect the 2 clamps of the engine wire.



- (c) Place a transmission jack underneath the engine, then put a wooden block on the jack.



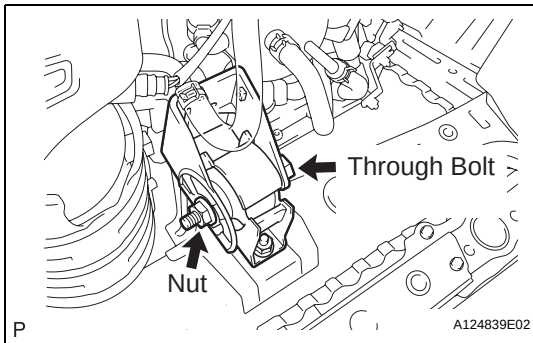
- (d) Remove the 4 bolts, 2 nuts and engine mounting insulator RH.

NOTICE:

Do not apply excessive force to the return tube when removing the engine mounting insulator RH.

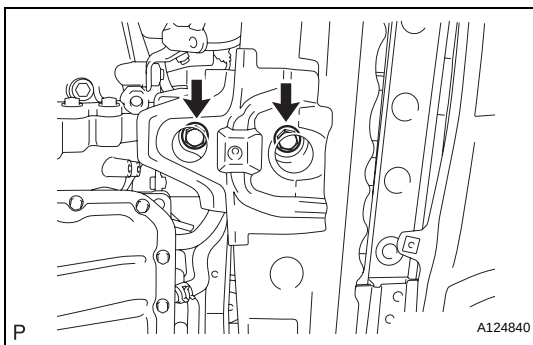
HINT:

Keep clearance by lowering the engine using the transmission jack when removing the engine mounting insulator FR.



14. REMOVE ENGINE MOUNTING INSULATOR FR

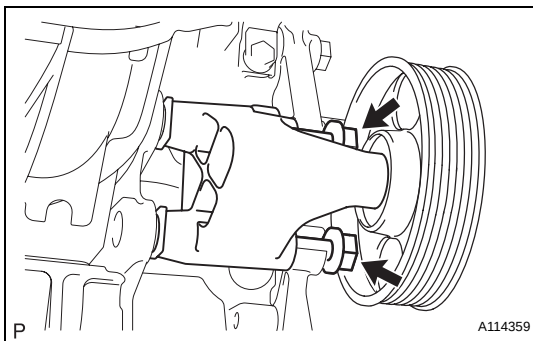
- (a) Remove the through bolt and nut.



- (b) Remove the 2 bolts and engine mounting insulator FR.

HINT:

Keep clearance by lowering the engine using the transmission jack when removing the engine mounting insulator FR.

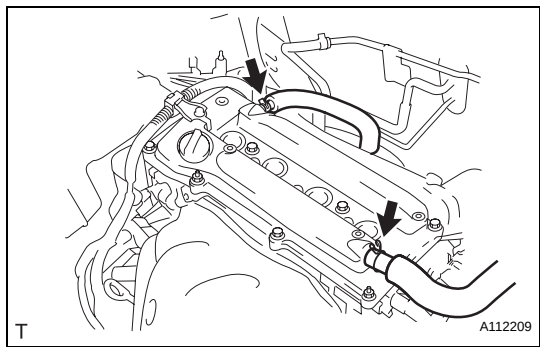


15. REMOVE IDLER PULLEY

- (a) Loosen the 2 bolts and remove the idler pulley with the 2 bolts.

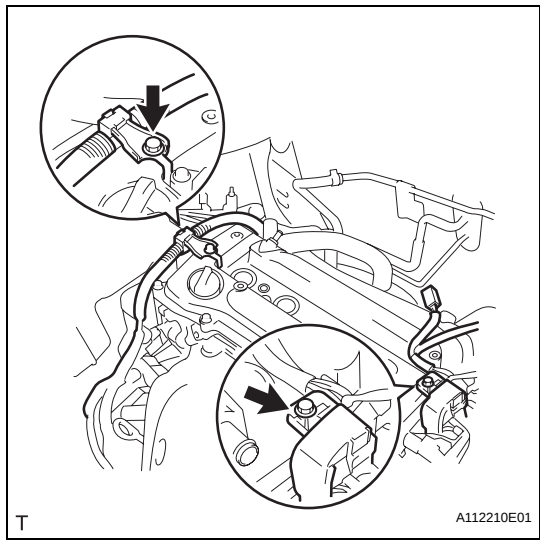
16. REMOVE IGNITION COIL ASSEMBLY (See page [IG-9](#))

17. REMOVE SPARK PLUG (See page [EM-8](#))

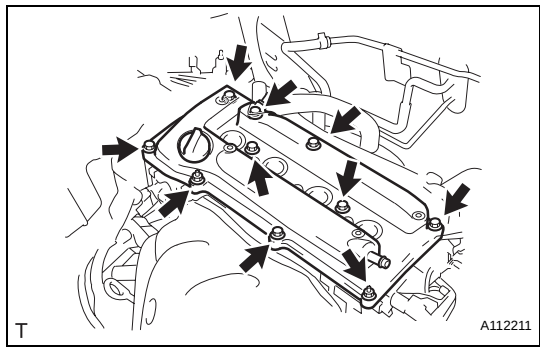


18. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY

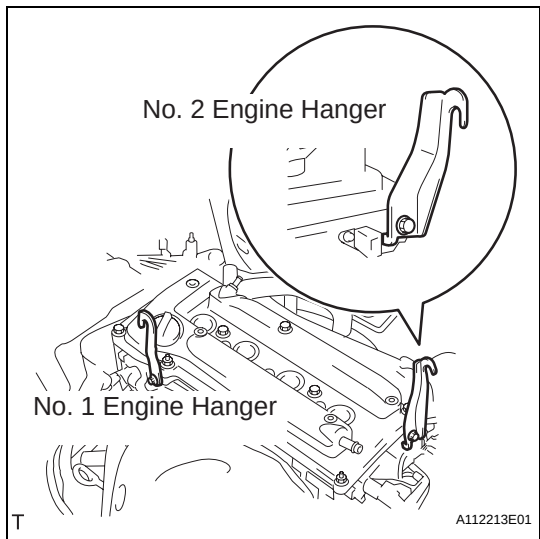
- (a) Disconnect the 2 ventilation hoses form the cylinder head cover.



- (b) Remove the 2 bolts and disconnect the 2 engine wires.



- (c) Remove the 8 bolts, 2 nuts and cylinder head cover.



19. REMOVE OIL PAN SUB-ASSEMBLY

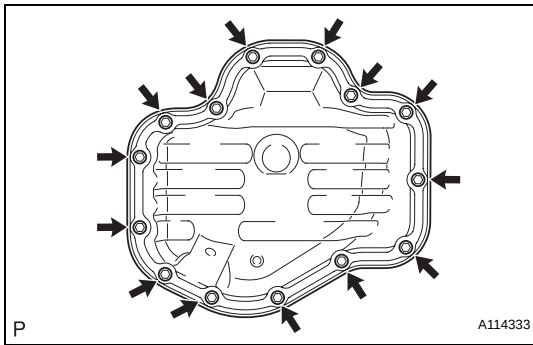
- (a) Install the No. 1 and No. 2 engine hangers with the bolts.

Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

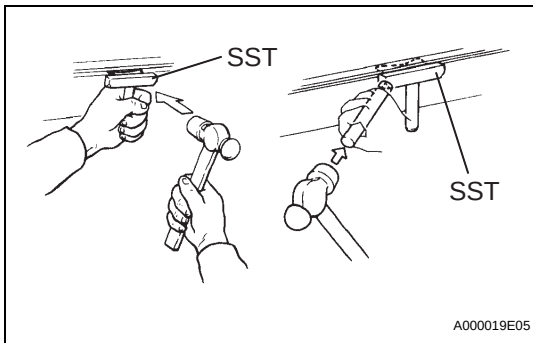
Part No.

Item	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020

- (b) Attach the sling device to the engine hangers and chain block.



- (c) Remove the 12 bolts and 2 nuts.

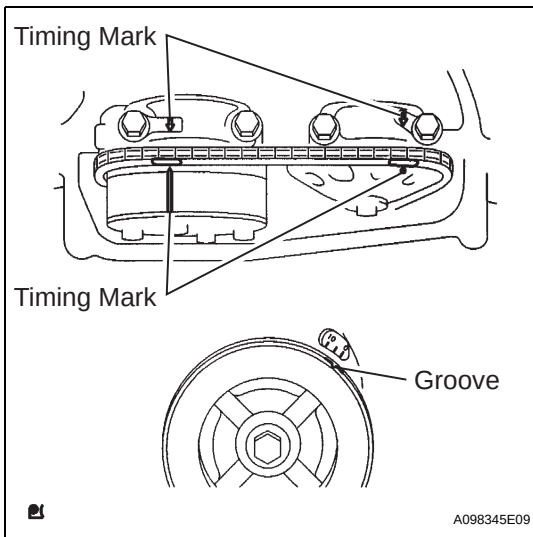


- (d) Insert the blade of SST between the crankcase, chain cover and oil pan, then cut off the applied sealer and remove the oil pan.

SST 09032-00100

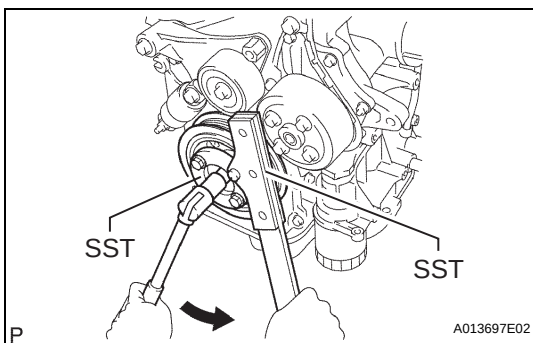
NOTICE:

Be careful not to damage the contact surface of the crankcase, chain cover and oil pan.



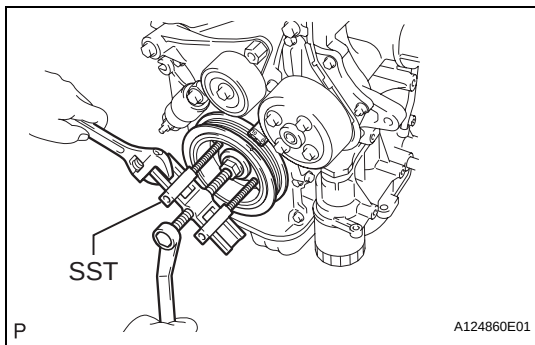
20. SET NO. 1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.
- (b) Check that each timing mark of the camshaft timing gear and sprocket is aligned with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.
If not, turn the crankshaft by 1 revolution (360°) to align the timing marks as above.



21. REMOVE CRANKSHAFT PULLEY

- (a) Using SST, fix the pulley in place and loosen the pulley bolt.
SST 09213-54015 (91651-60855), 09330-00021

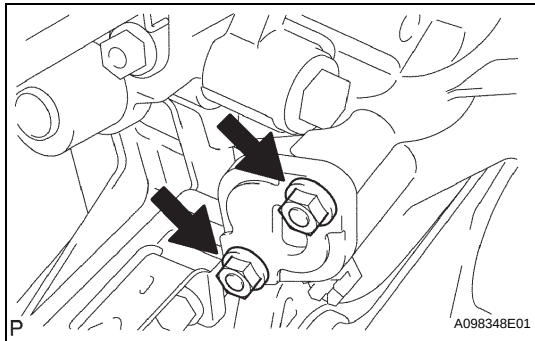


- (b) Remove the crankshaft pulley.

HINT:

If necessary, remove the pulley and pulley bolt using SST.

SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021), 09950-40011 (09957-04010)

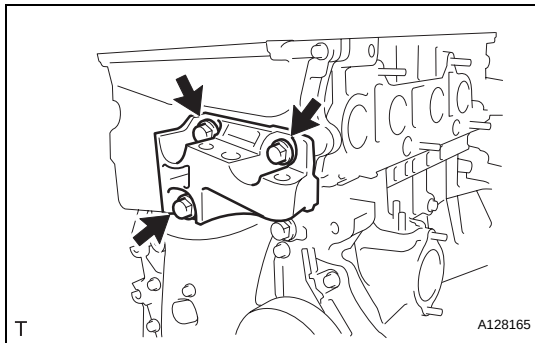


22. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

- (a) Remove the 2 nuts, chain tensioner and gasket.

NOTICE:

Do not turn the crankshaft without the chain tensioner.



23. REMOVE ENGINE MOUNTING BRACKET RH

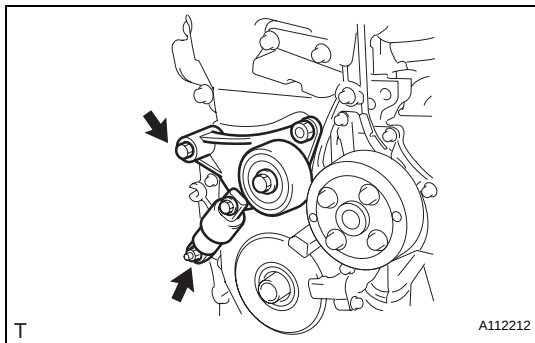
- (a) Remove the 3 bolts and engine mounting bracket RH.

24. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY

- (a) Lift the engine upward using the transmission jack.

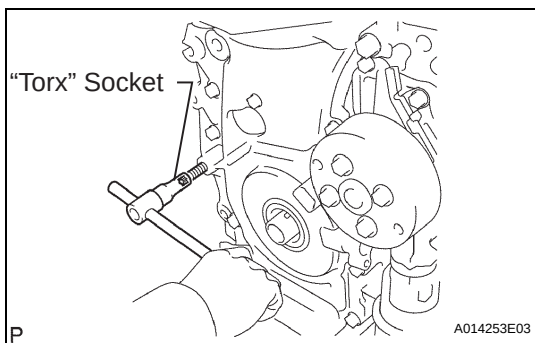
NOTICE:

Do not lift the engine more than necessary.



- (b) Remove the bolt, nut and V-ribbed belt tensioner.

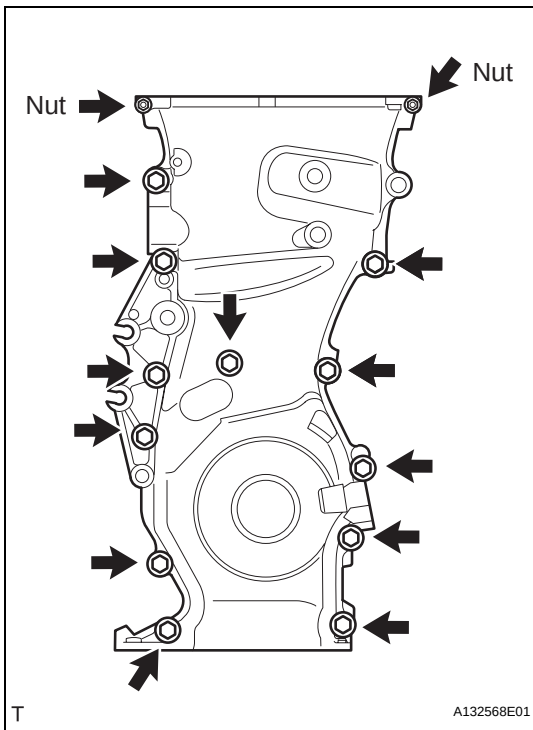
25. REMOVE CRANKSHAFT POSITION SENSOR (See page [ES-402](#))



26. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY

- (a) Using an E10 "torx" socket, remove the stud bolt for the V-ribbed belt tensioner.

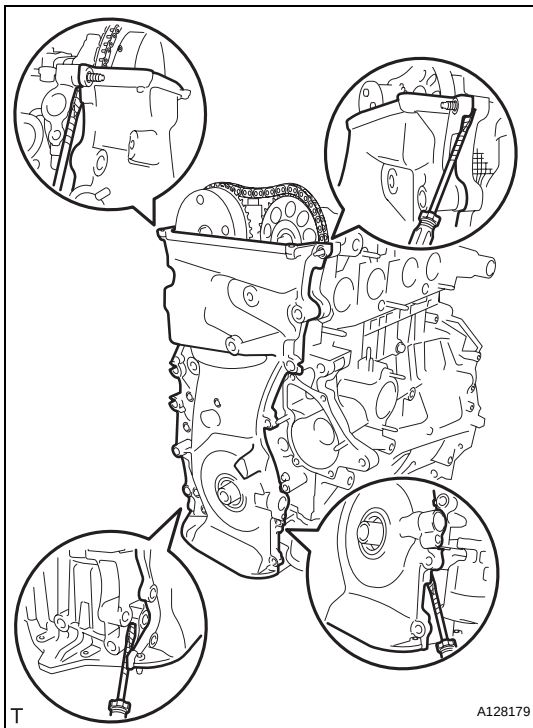
- (b) Remove the 12 bolts and 2 nuts.



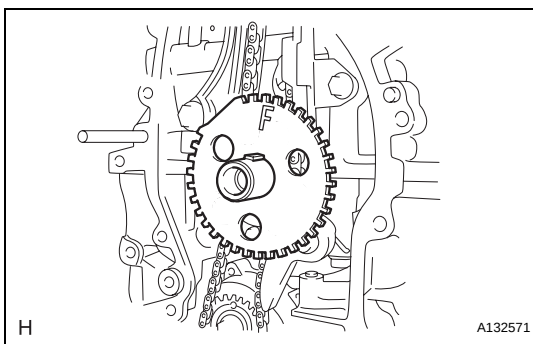
- (c) Remove the timing chain cover by prying the portions between the timing chain cover, cylinder head and cylinder block with a screwdriver.

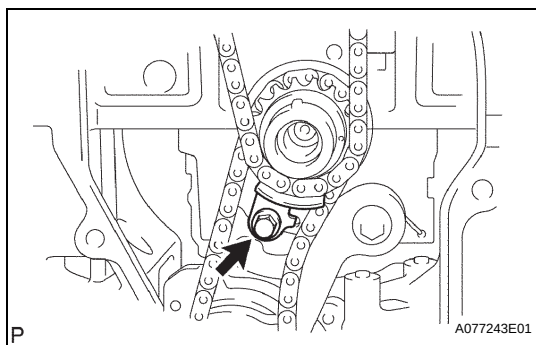
NOTICE:

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

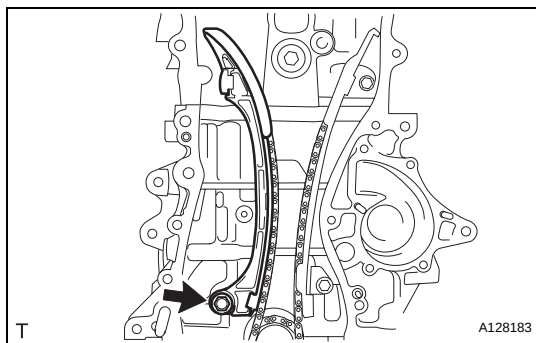


27. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE

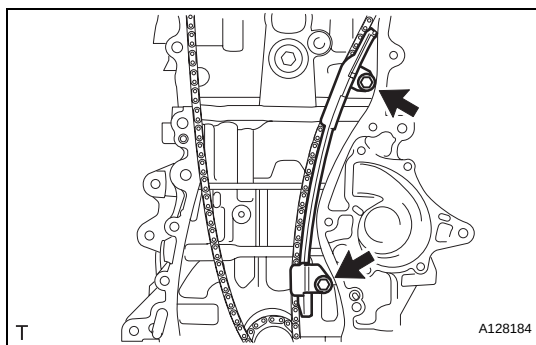


**28. REMOVE TIMING CHAIN GUIDE**

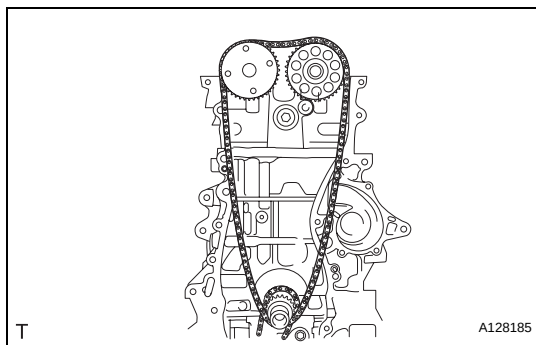
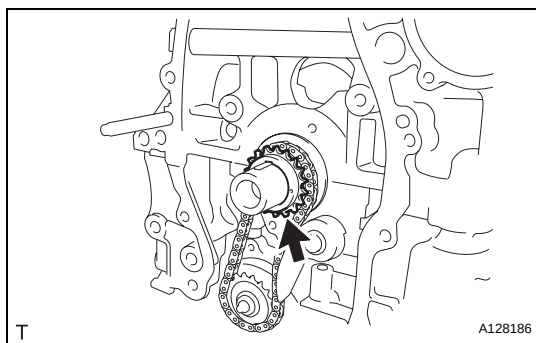
- (a) Remove the bolt and timing chain guide.

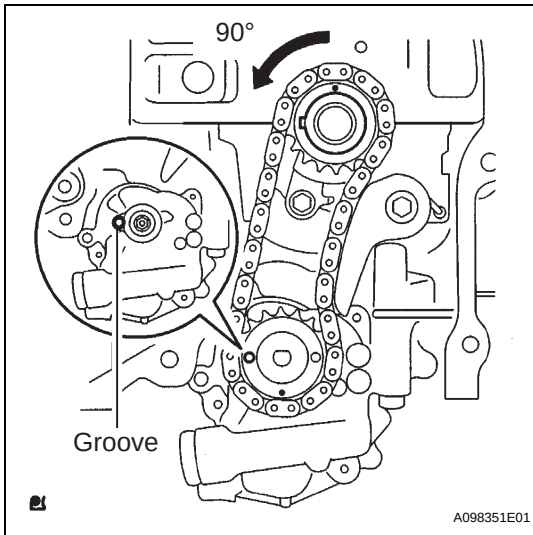
**29. REMOVE CHAIN TENSIONER SLIPPER**

- (a) Remove the bolt and chain tensioner slipper.

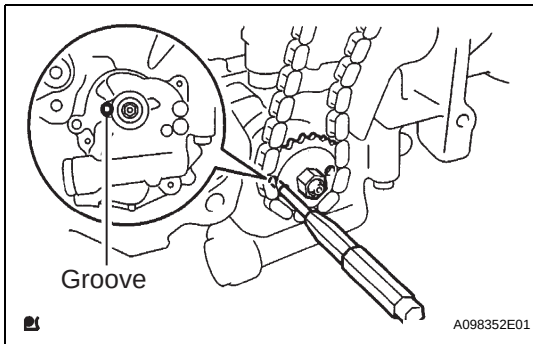
**30. REMOVE NO. 1 CHAIN VIBRATION DAMPER**

- (a) Remove the 2 bolts and chain vibration damper.

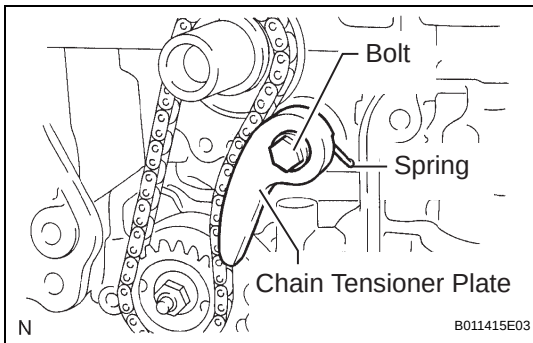
**31. REMOVE CHAIN SUB-ASSEMBLY****32. REMOVE CRANKSHAFT TIMING SPROCKET**

**33. REMOVE NO. 2 CHAIN SUB-ASSEMBLY**

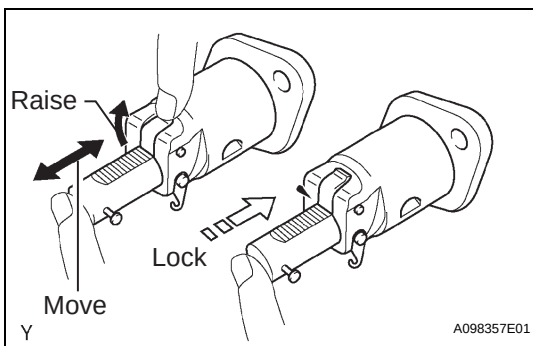
- (a) Turn the crankshaft by 90° counterclockwise to align the adjusting hole of the oil pump drive shaft sprocket with the groove of the oil pump.



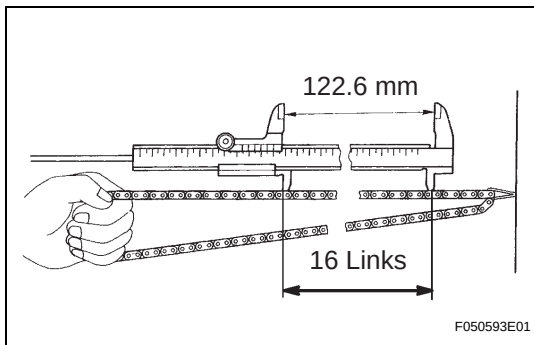
- (b) Insert a 4 mm diameter bar into the adjusting hole of the oil pump drive shaft sprocket to lock the gear in position, and then remove the nut.



- (c) Remove the bolt, chain tensioner plate and spring.
- (d) Remove the oil pump drive sprocket, oil pump drive shaft sprocket and No. 2 chain.

**INSPECTION****1. INSPECT NO. 1 CHAIN TENSIONER**

- (a) Check that the plunger moves smoothly when the ratchet pawl is raised with your finger.
- (b) Release the ratchet pawl, then check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



2. INSPECT CHAIN SUB-ASSEMBLY

- (a) Using a vernier caliper, measure the length of the 16 links with the chain fully stretched.

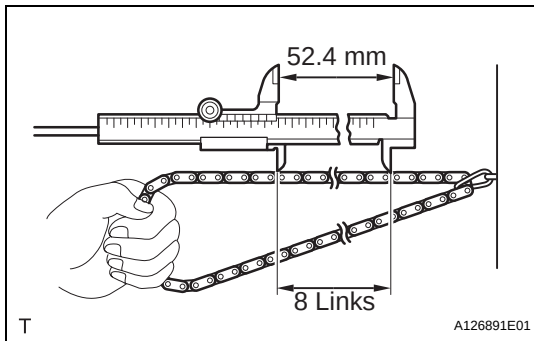
Maximum chain elongation:

122.6 mm (4.827 in.)

If the chain elongation is greater than the maximum, replace the chain sub-assembly.

HINT:

Take the measurements at 3 or more places selected at random.



3. INSPECT NO. 2 CHAIN SUB-ASSEMBLY

- (a) Using a vernier caliper, measure the length of the 8 links with the chain fully stretched.

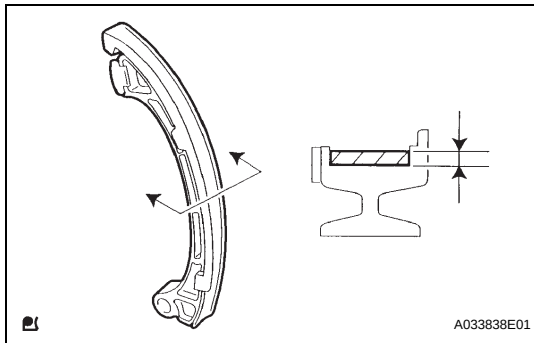
Maximum chain elongation:

52.4 mm (2.063 in.)

If the chain elongation is greater than the maximum, replace the No. 2 chain sub-assembly.

HINT:

Take the measurements at 3 or more places selected at random.



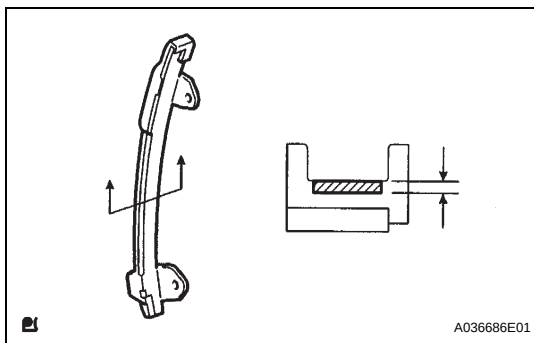
4. INSPECT CHAIN TENSIONER SLIPPER

- (a) Using a vernier caliper, measure the tensioner slipper wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the chain tensioner slipper.



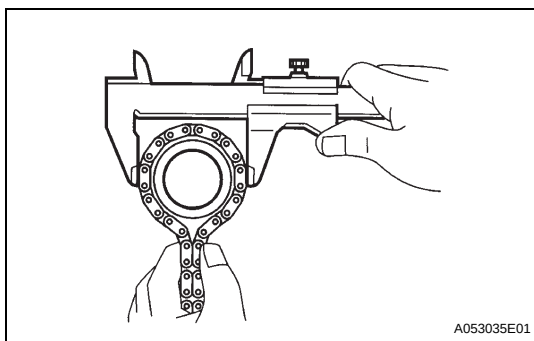
5. INSPECT NO. 1 CHAIN VIBRATION DAMPER

- (a) Using a vernier caliper, measure the vibration damper wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the No. 1 chain vibration damper.



6. INSPECT CRANKSHAFT TIMING SPROCKET

- (a) Wrap the chain around the timing sprocket.
(b) Using a vernier caliper, measure the timing gear diameter with the chain.

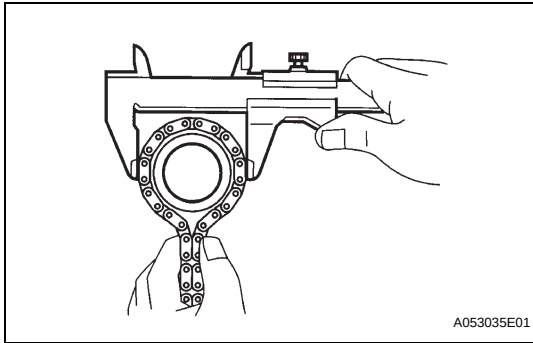
Minimum gear diameter (with chain):

51.6 mm (2.031 in.)

NOTICE:

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

If the gear diameter is less than the minimum, replace the chain sub-assembly and crankshaft timing sprocket.



7. INSPECT OIL PUMP DRIVE SPROCKET

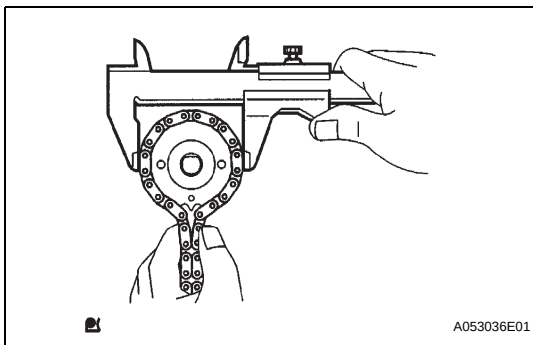
- Wrap the chain around the drive sprocket.
- Using a vernier caliper, measure the drive gear diameter with the chain.

Minimum gear diameter (with chain):
48.2 mm (1.898 in.)

NOTICE:

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

If the gear diameter is less than the minimum, replace the No. 2 chain sub-assembly and oil pump drive sprocket.



8. INSPECT OIL PUMP DRIVE SHAFT SPROCKET

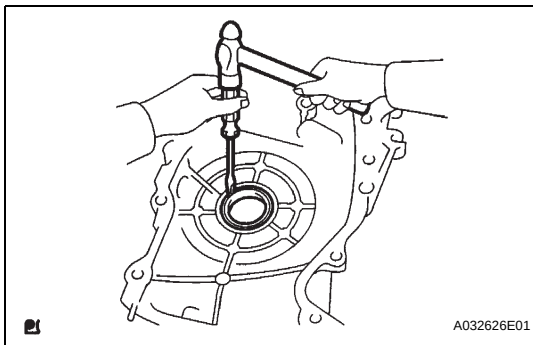
- Wrap the chain around the drive shaft sprocket.
- Using a vernier caliper, measure the drive shaft gear diameter with the chain.

Minimum gear diameter (with chain):
48.2 mm (1.898 in.)

NOTICE:

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

If the gear diameter is less than the minimum, replace the No. 2 chain sub-assembly and oil pump drive shaft sprocket.



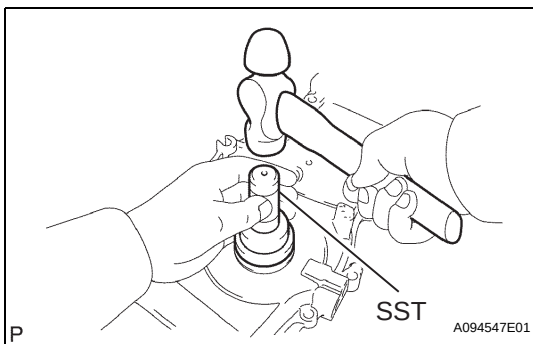
REPLACEMENT

1. REPLACE TIMING CHAIN COVER OIL SEAL

- Using a screwdriver and hammer, tap out the oil seal.
- Place the oil seal retainer on wooden blocks.
- Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign objects.



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

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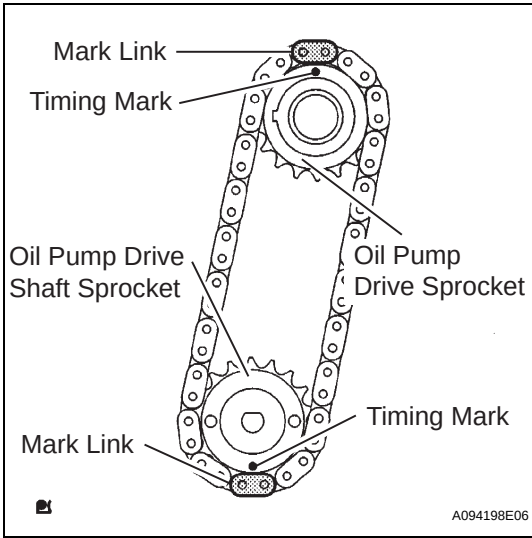
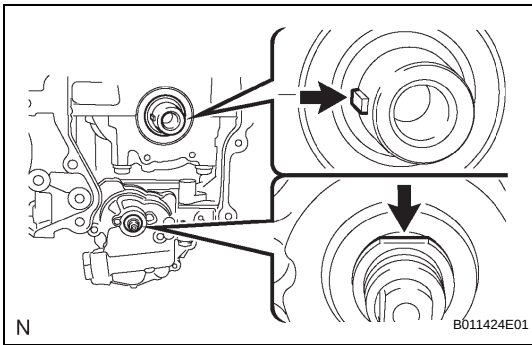
NOTICE:

Do not tap the oil seal at an angle.

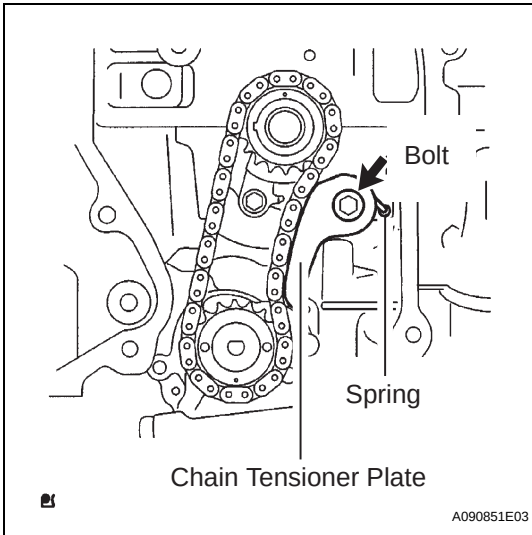
INSTALLATION

1. INSTALL NO. 2 CHAIN SUB-ASSEMBLY

- Set the crankshaft key in the left horizontal position.
- Turn the cutout of the drive shaft so that it faces upward.

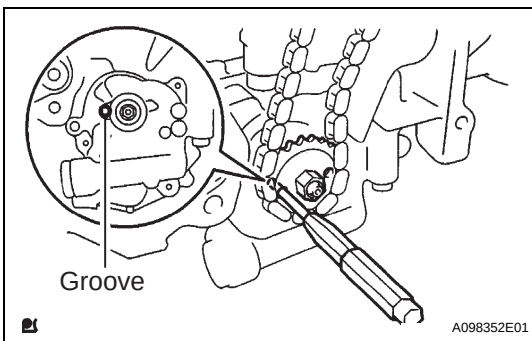


- Align the yellow mark links with the timing marks of each gear as shown in the illustration.
- Install the sprockets onto the crankshaft and oil pump shaft with the chain wrapped on the gears.
- Temporarily tighten the oil pump drive shaft sprocket with the nut.



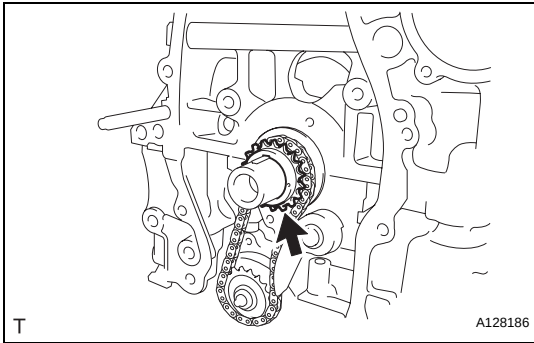
- Insert the damper spring into the adjusting hole, and then install the chain tensioner plate with the bolt.

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

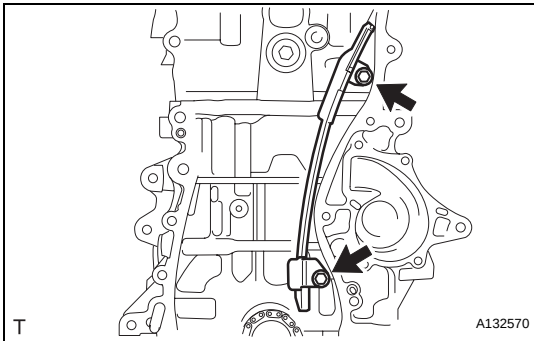


- Align the adjusting hole of the oil pump drive shaft sprocket with the groove of the oil pump.
- Insert a 4 mm diameter bar into the adjusting hole of the oil pump drive shaft gear to lock the gear in position, and then tighten the nut.

Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf)

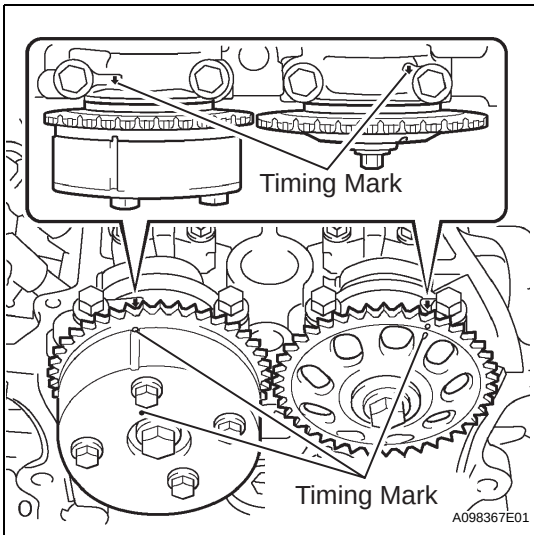


2. INSTALL CRANKSHAFT TIMING SPROCKET



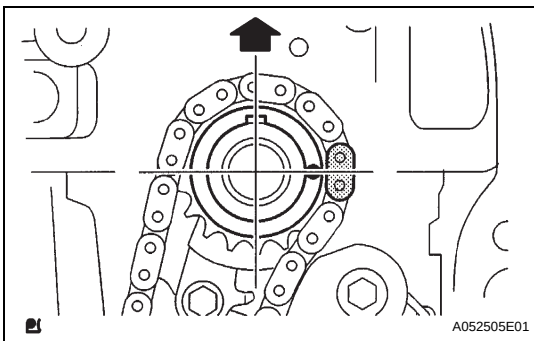
3. INSTALL NO. 1 CHAIN VIBRATION DAMPER

- (a) Install the chain vibration damper with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

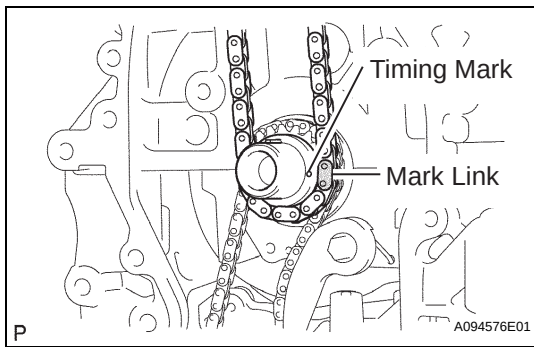


4. INSTALL CHAIN SUB-ASSEMBLY

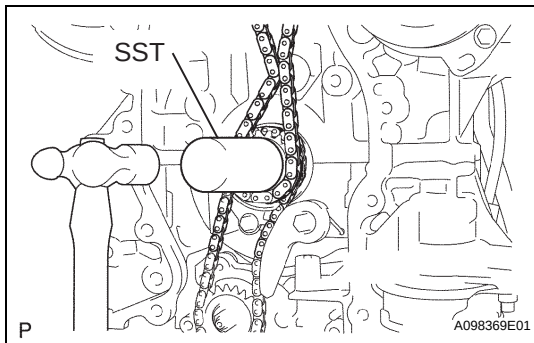
- (a) Set the No. 1 cylinder to TDC/compression.
(1) Turn the camshafts with a wrench (using the hexagonal lobe) to align the timing marks of the camshaft timing gear with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.



- (2) Using the crankshaft pulley bolt, turn the crankshaft to position the key on the crankshaft upward.

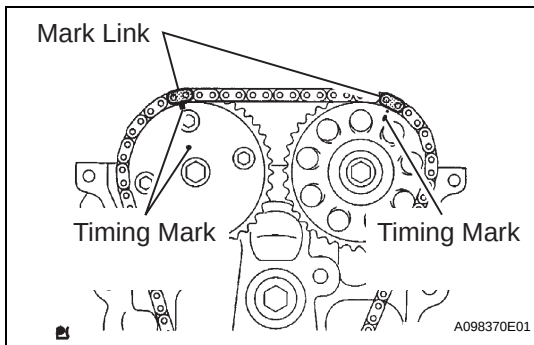


- (b) Install the chain onto the crankshaft timing sprocket with the gold or orange mark link aligned with the timing mark on the crankshaft.

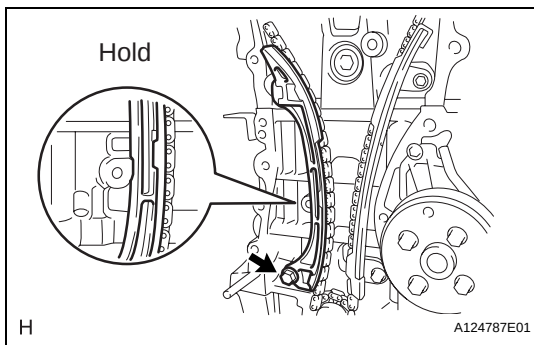


- (c) Using SST and a hammer, tap in the crankshaft timing sprocket.

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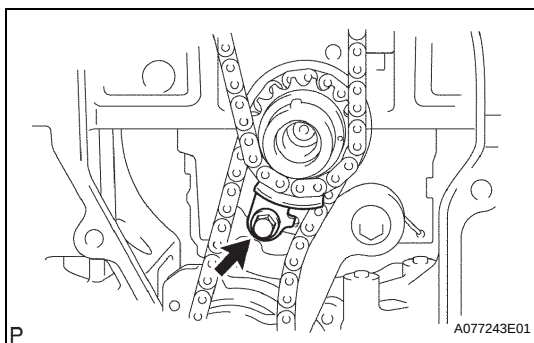


- (d) Align the gold or yellow links with each timing mark located on the camshaft timing gear and sprocket, then install the chain.



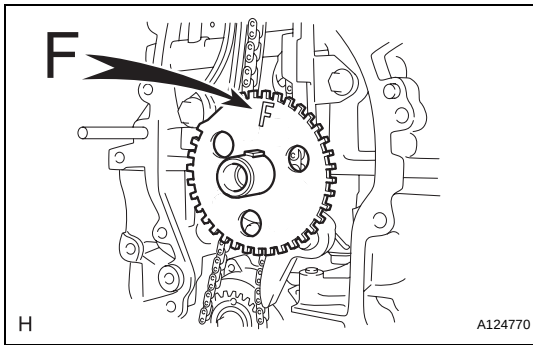
5. INSTALL CHAIN TENSIONER SLIPPER

- (a) Install the chain tensioner slipper with the bolt.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)



6. INSTALL TIMING CHAIN GUIDE

- (a) Install the timing chain guide with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

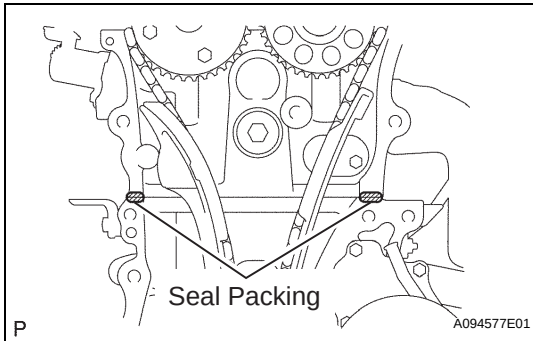


7. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE

- (a) Install the sensor plate with the "F" mark facing forward.

8. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY

- (a) Remove any old packing 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 Block, Three Bond 1207B or Equivalent

NOTICE:

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

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

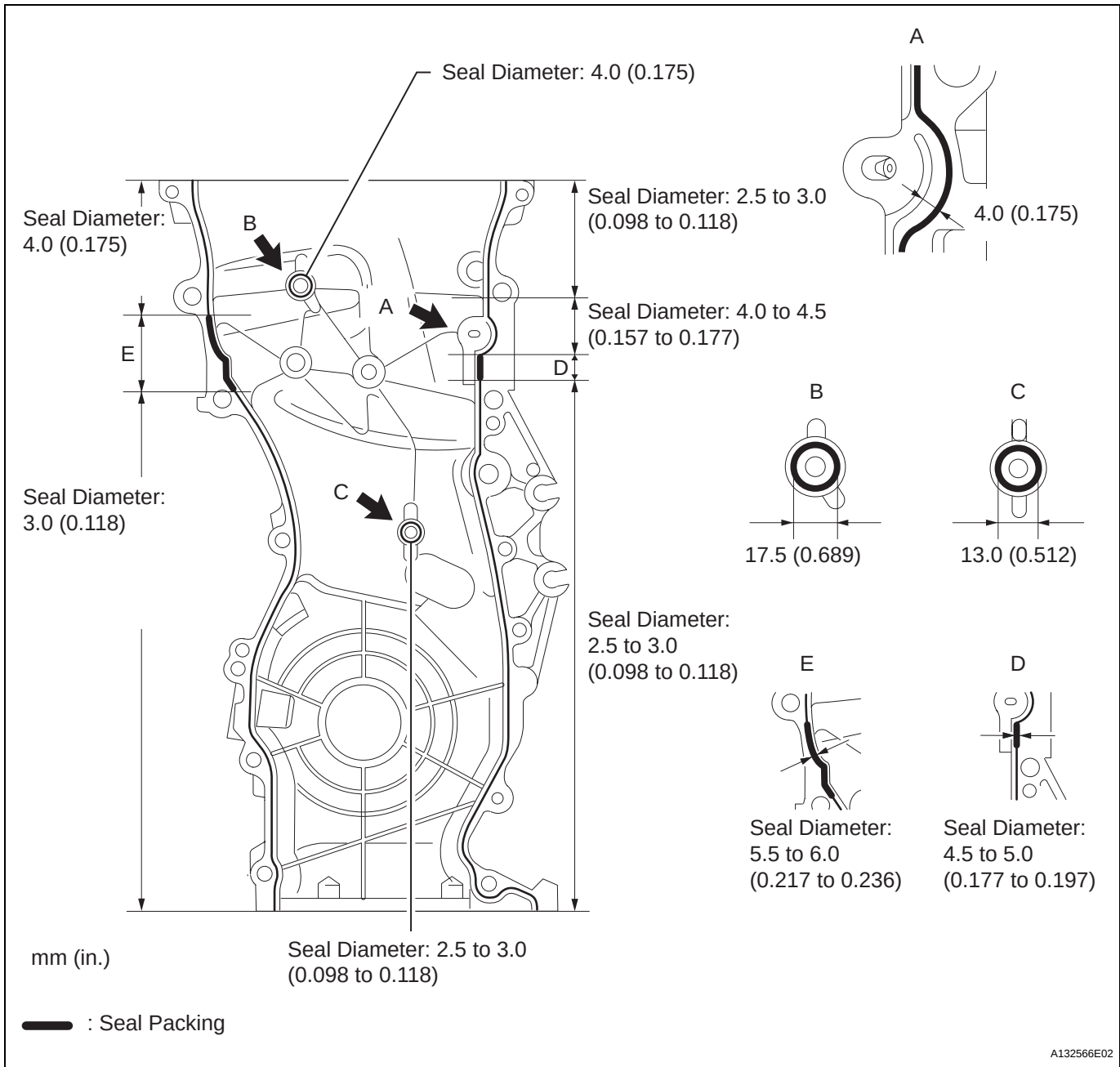
Seal packing:

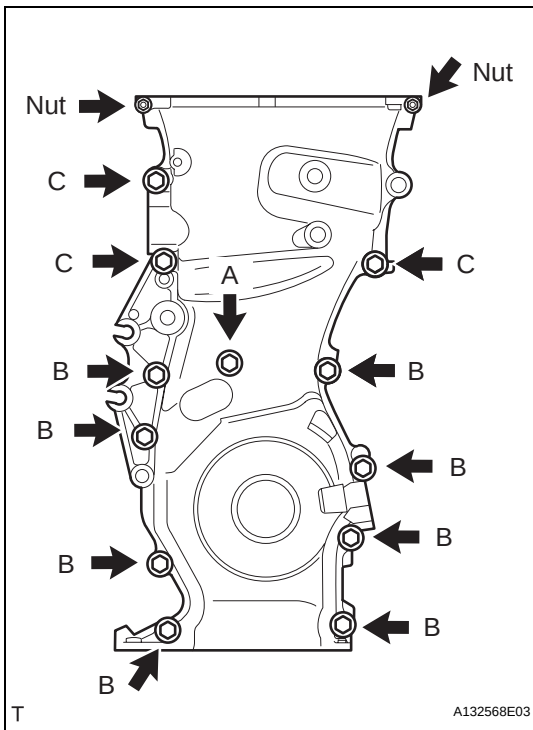
Toyota Genuine Seal Packing Block, Three Bond 1207B or Equivalent

NOTICE:

- Remove any oil from the contact surface.
- Install the chain cover within 3 minutes of applying seal packing.

- Do not add engine oil for at least 2 hours after installing the chain cover.





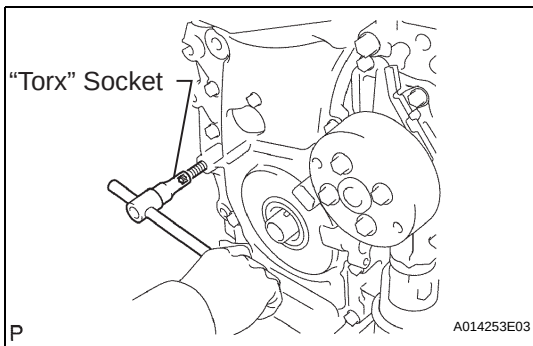
- (d) Install the timing chain cover with the 12 bolts and 2 nuts.

Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf) for bolt A
 25 N*m (255 kgf*cm, 18 ft.*lbf) for bolt B
 55 N*m (561 kgf*cm, 41 ft.*lbf) for bolt C
 11 N*m (112 kgf*cm, 8 ft.*lbf) for nut

HINT:

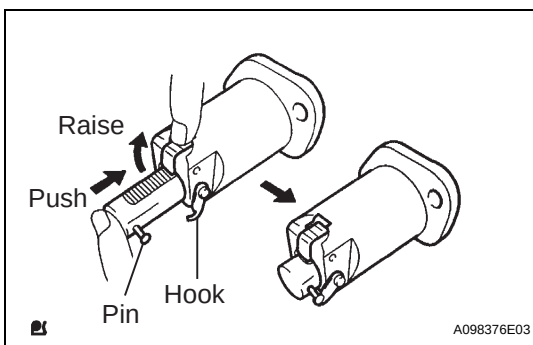
Bolt length:

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



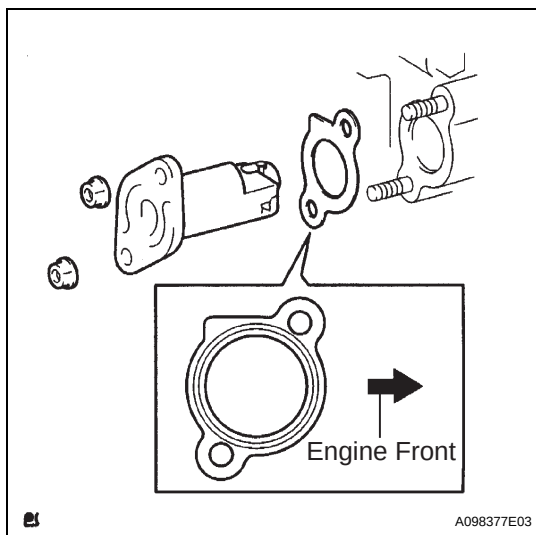
- (e) Using an E10 "torx" socket, install the stud bolt for the V-ribbed belt tensioner.

Torque: 21.5 N*m (219 kgf*cm, 16 ft.*lbf)



9. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

- (a) Release the ratchet pawl, then fully push in the plunger and hook the hook to the pin so that the plunger is in the position shown in the illustration.



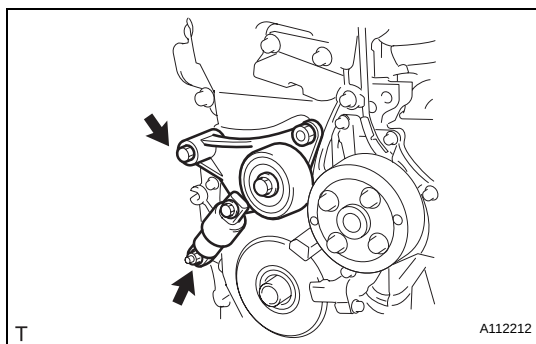
- (b) Install a new gasket and the chain tensioner with the 2 nuts.

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

NOTICE:

When installing the chain tensioner, set the hook again if the hook releases the plunger.

EM



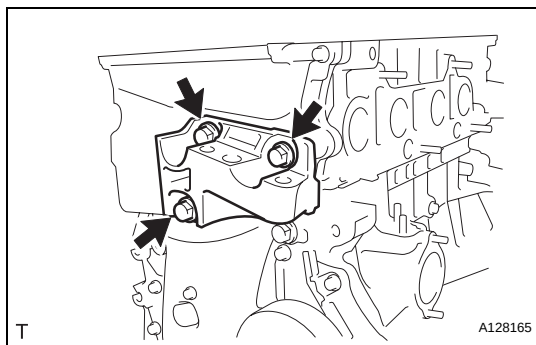
10. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY

- (a) Install the V-ribbed belt tensioner with the bolt and nut.

Torque: 59.5 N*m (607 kgf*cm, 44 ft.*lbf)

NOTICE:

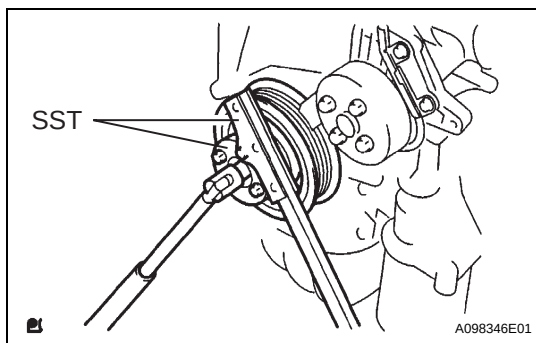
Do not lift the engine more than necessary.



11. INSTALL ENGINE MOUNTING BRACKET RH

- (a) Install the engine mounting bracket RH with the 3 bolts.

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

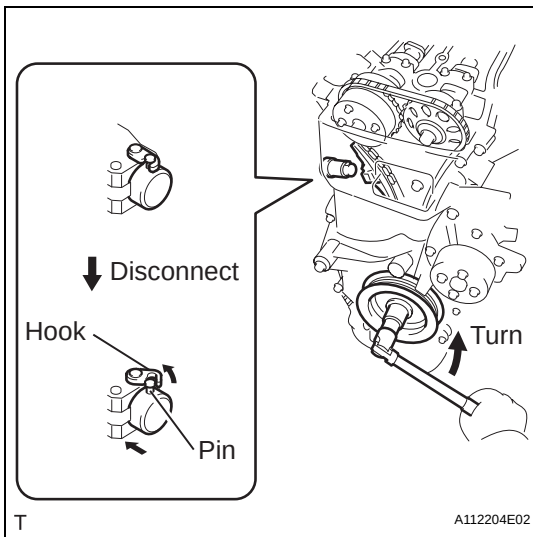


12. INSTALL CRANKSHAFT PULLEY

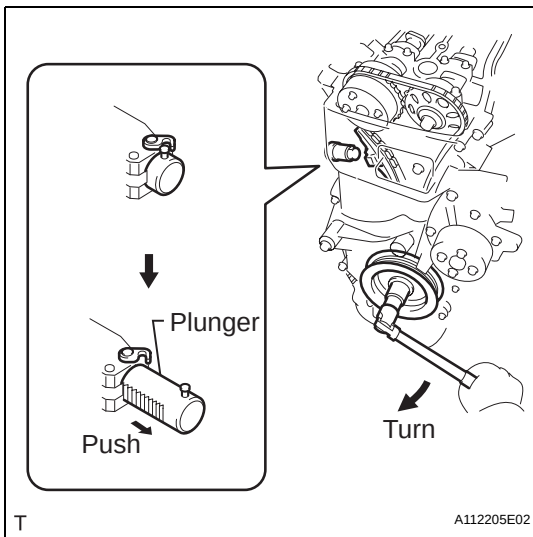
- (a) Using SST, fix the pulley in place and tighten the bolt.

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Torque: 180 N*m (1,835 kgf*cm, 133 ft.*lbf)



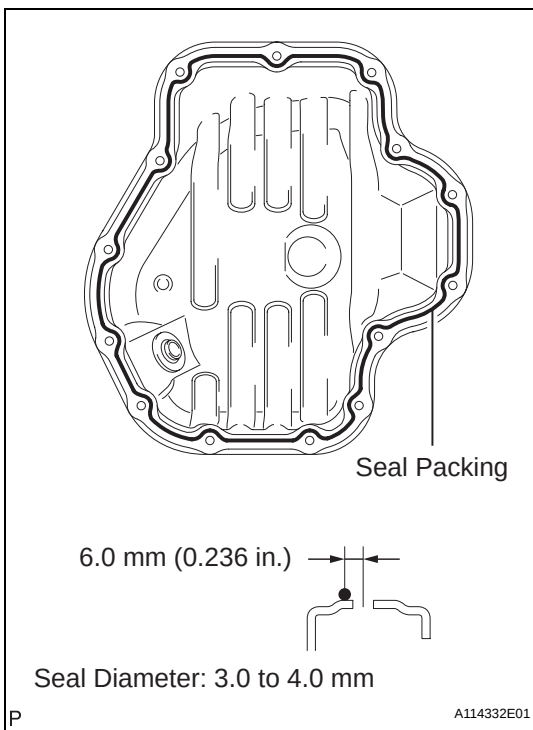
- (b) Turn the crankshaft counterclockwise, then disconnect the plunger knock pin from the hook.



- (c) Turn the crankshaft clockwise, then check that the plunger is extended.

13. INSTALL OIL PAN SUB-ASSEMBLY

- (a) Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder block and oil pan.



- (b) Apply a continuous bead of seal packing (Diameter 3.0 to 4.0 mm (0.118 to 0.157 in.)) as shown in the illustration.

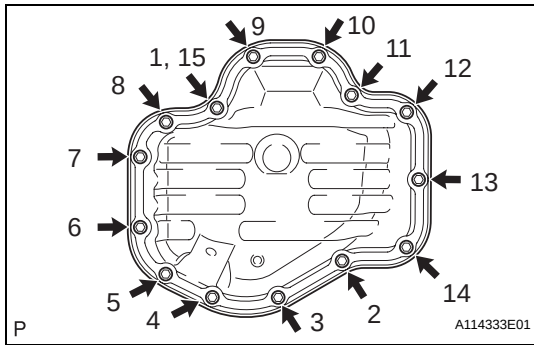
Seal packing:

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

NOTICE:

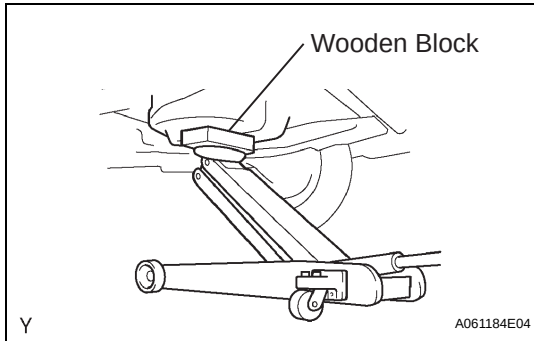
- Remove any oil from the contact surface.
- Install the oil pan within 3 minutes of applying seal packing.
- Do not add engine oil for at least 2 hours after installing the oil pan.

- (c) Install the oil pan to the cylinder block.



- (d) Uniformly tighten the 12 bolts and 2 nuts in the sequence shown in the illustration.

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



- (e) Place a transmission jack underneath the engine, then put a wooden block on the jack.

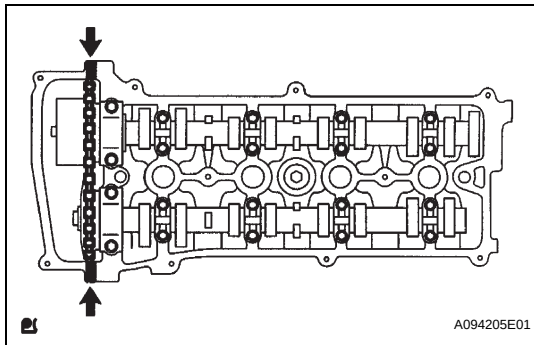
- (f) Remove the chain block and sling device.

- (g) Remove the No. 1 and No. 2 engine hangers.

14. INSTALL CRANKSHAFT POSITION SENSOR (See page [ES-402](#))

15. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY

- (a) Remove any old packing material from the contact surface.



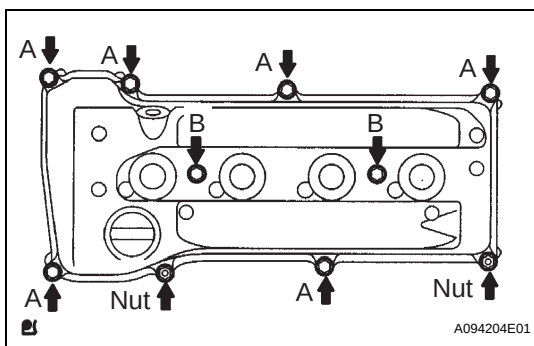
- (b) Apply seal packing to the 2 locations shown in the illustration.

Seal packing:

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

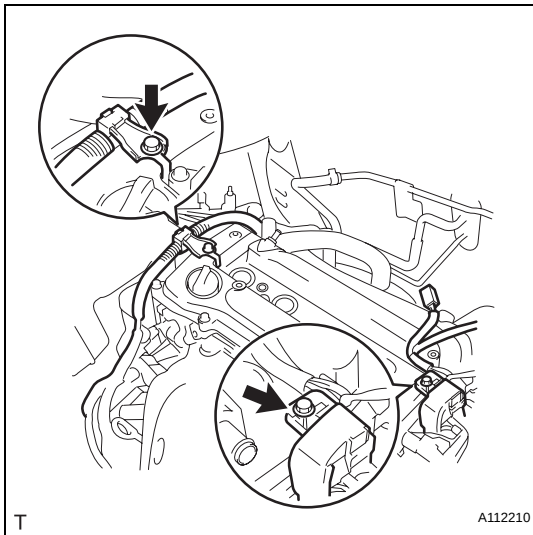
NOTICE:

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

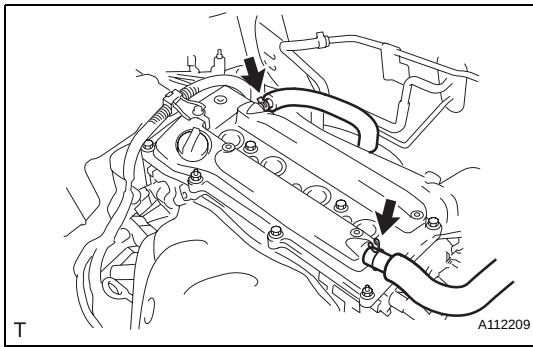


- (c) Install the cylinder head cover with the 8 bolts and 2 nuts.

Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf) for bolt A
14 N*m (143 kgf*cm, 10 ft.*lbf) for bolt B
11 N*m (112 kgf*cm, 8 ft.*lbf) for nut



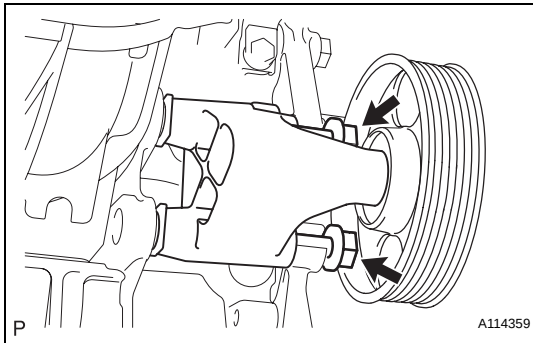
- (d) Install the 2 engine wires with the 2 bolts.
Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)



- (e) Connect the 2 ventilation hoses to the cylinder head cover.

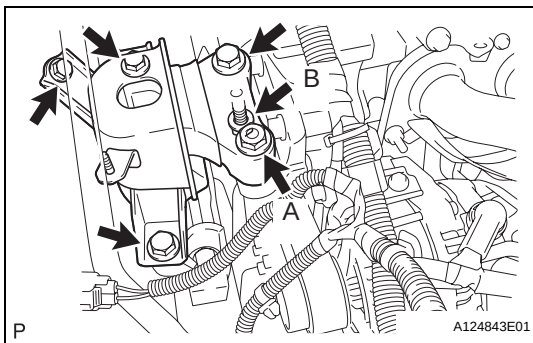
16. INSTALL SPARK PLUG (See page [EM-16](#))

17. INSTALL IGNITION COIL ASSEMBLY (See page [IG-9](#))



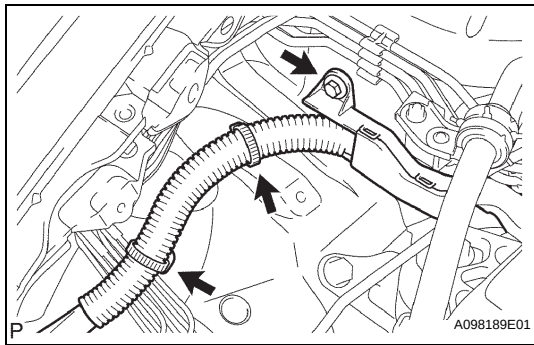
18. INSTALL IDLER PULLEY

- (a) Install the idler pulley with the 2 bolts.
Torque: 60 N*m (612 kgf*cm, 44 ft.*lbf)

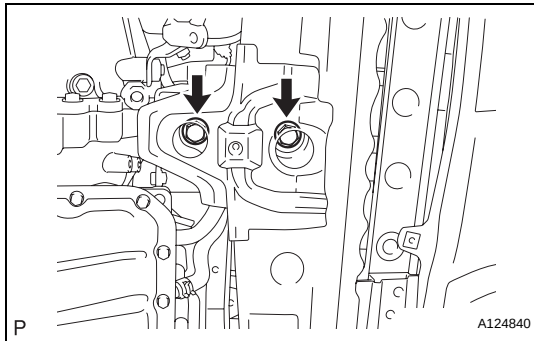


19. INSTALL ENGINE MOUNTING INSULATOR RH

- (a) Install the engine mounting insulator RH with the 4 bolts and 2 nuts.
Torque: 95 N*m (969 kgf*cm, 70 ft.*lbf) for bolt
95 N*m (969 kgf*cm, 70 ft.*lbf) for nut A
52 N*m (530 kgf*cm, 38 ft.*lbf) for nut B



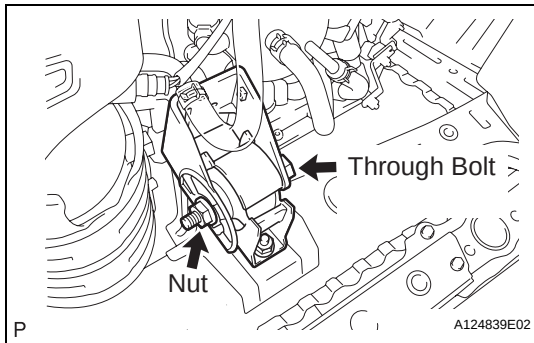
- (b) Connect the 2 clamps of the engine wire.
- (c) Install the wire harness protector with the bolt.



20. INSTALL ENGINE MOUNTING INSULATOR FR

- (a) Install the engine mounting insulator FR with the 2 bolts.

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

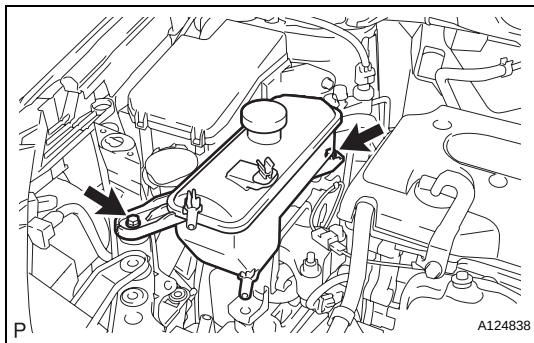


- (b) Install the through bolt and nut.

Torque: 145 N*m (1,479 kgf*cm, 107 ft.*lbf)

HINT:

Install the bolt which is used to secure the front engine mounting bracket FR.



21. INSTALL RADIATOR RESERVOIR

- (a) Install the radiator reservoir with the 2 bolts.

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

22. INSTALL GENERATOR ASSEMBLY (See page [CH-15](#))

23. INSTALL FAN AND GENERATOR V BELT (See page [EM-7](#))

24. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page [EM-7](#))

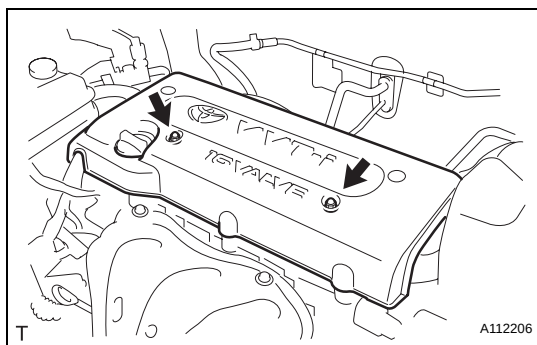
25. INSTALL FRONT EXHAUST PIPE (See page [EX-4](#))

26. ADD ENGINE OIL (See page [LU-4](#))

27. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

28. CHECK FOR ENGINE OIL LEAKS

29. CHECK FOR EXHAUST GAS LEAKS

**30. INSTALL NO. 1 ENGINE COVER**

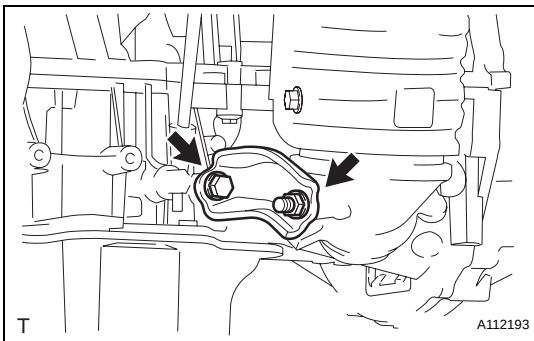
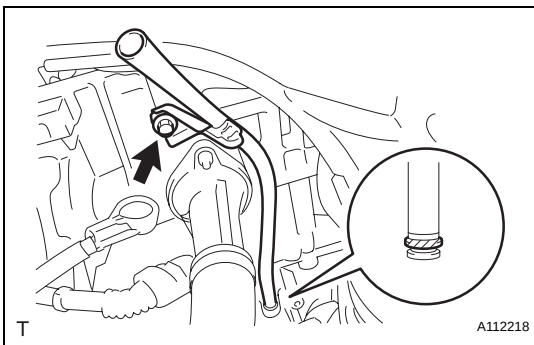
- (a) Install the engine cover with the 2 nuts.
Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)

31. INSTALL FRONT FENDER APRON RH**32. INSTALL NO. 1 ENGINE UNDER COVER****33. INSTALL FRONT WHEEL RH****34. INSTALL RADIATOR SUPPORT OPENING COVER**

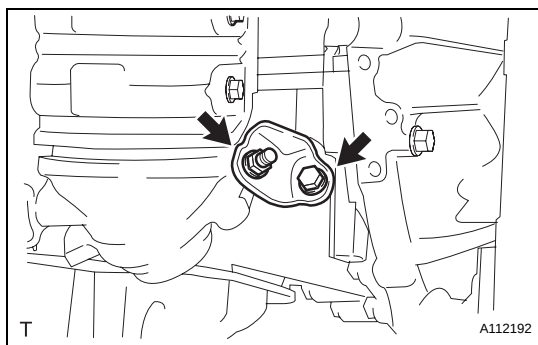
REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE (See page [FU-9](#))
2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
CAUTION:
Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
3. REMOVE RADIATOR SUPPORT OPENING COVER
4. REMOVE FRONT WHEEL RH
5. REMOVE NO. 1 ENGINE UNDER COVER
6. REMOVE FRONT FENDER APRON RH
7. REMOVE NO. 1 ENGINE COVER (See page [EM-22](#))
8. DRAIN ENGINE COOLANT (See page [CO-6](#))
9. DRAIN ENGINE OIL (See page [LU-4](#))
10. REMOVE AIR CLEANER CAP (See page [ES-411](#))
11. REMOVE THROTTLE BODY (See page [ES-412](#))
12. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY (See page [FU-10](#))
13. REMOVE INTAKE MANIFOLD (See page [ES-419](#))
14. REMOVE INTAKE MANIFOLD INSULATOR (See page [ES-420](#))
15. REMOVE FRONT EXHAUST PIPE (See page [EX-3](#))
16. REMOVE OIL DIPSTICK
17. REMOVE OIL DIPSTICK GUIDE
 - (a) Remove the bolt and guide.
 - (b) Remove the O-ring from the guide.

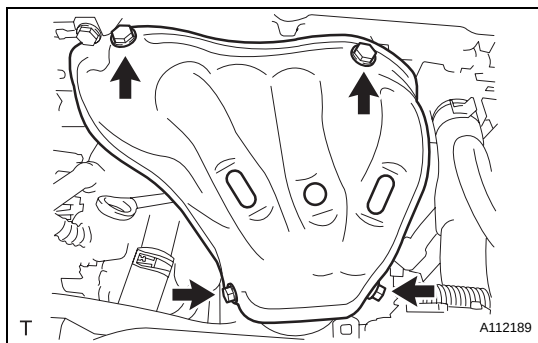
EM



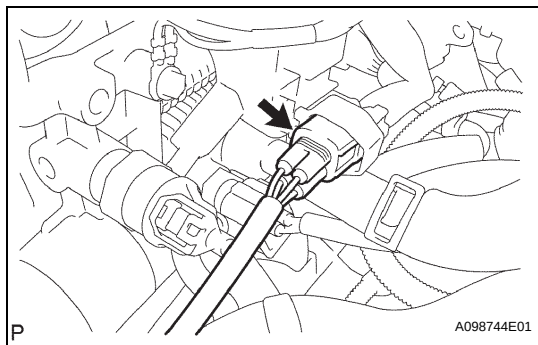
18. REMOVE MANIFOLD STAY
 - (a) Remove the bolt, nut and stay.

**19. REMOVE NO. 2 MANIFOLD STAY**

- (a) Remove the bolt, nut and stay.

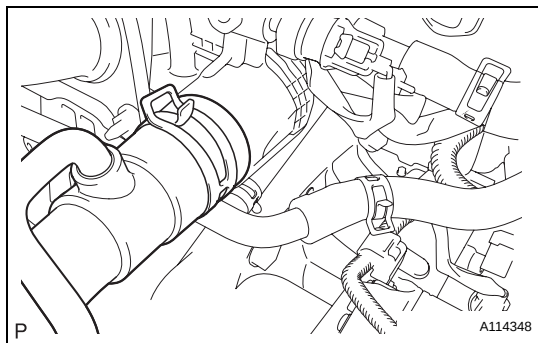
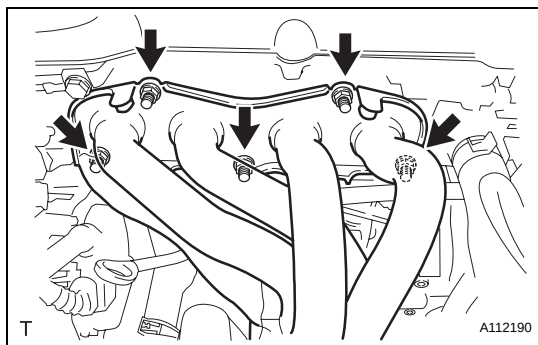
**20. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR**

- (a) Remove the 4 bolts and heat insulator.

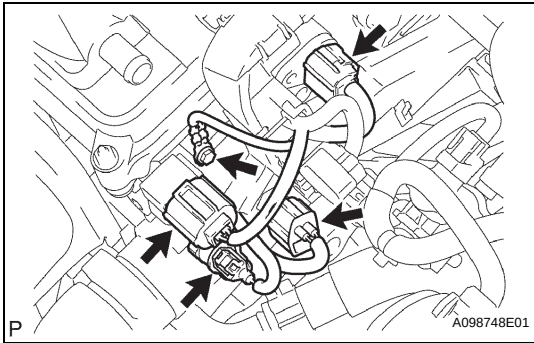
**21. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY**

- (a) Disconnect the air-fuel ratio sensor connector.

- (b) Remove the 5 nuts, manifold converter and gasket.

**22. DISCONNECT NO. 1 RADIATOR HOSE**

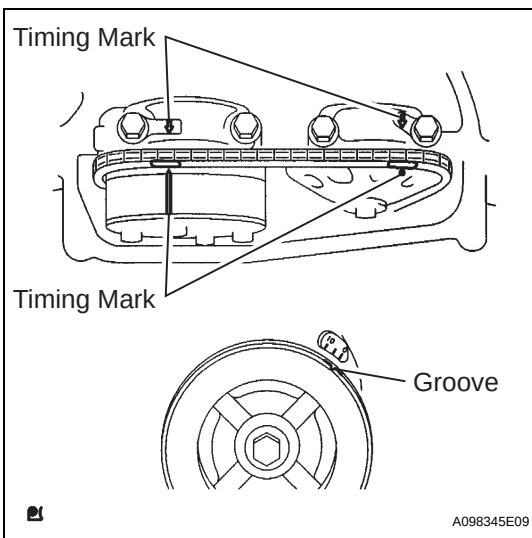
- (a) Disconnect the No. 1 radiator hose.

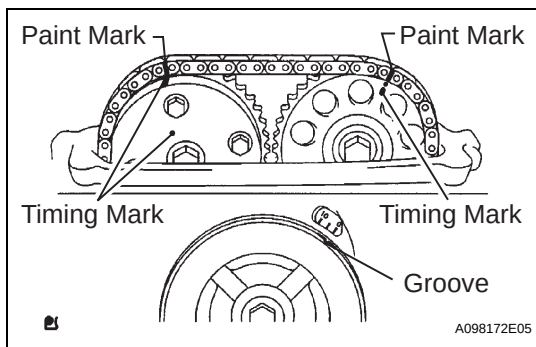
**23. DISCONNECT ENGINE WIRE**

- Disconnect the radio setting condenser connector.
- Disconnect the engine oil pressure switch connector.
- Disconnect the engine coolant temperature sensor connector.
- Disconnect the camshaft position sensor connector.
- Remove the bolt and ground cable.

24. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page EM-6)**25. REMOVE FAN AND GENERATOR V BELT (See page EM-6)****26. REMOVE GENERATOR ASSEMBLY (See page CH-9)****27. REMOVE ENGINE MOUNTING INSULATOR RH (See page EM-22)****28. REMOVE IDLER PULLEY (See page EM-23)****29. REMOVE IGNITION COIL ASSEMBLY (See page IG-9)****30. REMOVE SPARK PLUG (See page EM-8)****31. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (See page EM-24)****32. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See page EM-26)****33. REMOVE CRANKSHAFT POSITION SENSOR (See page ES-402)****34. REMOVE OIL PAN SUB-ASSEMBLY (See page EM-24)****35. SET NO. 1 CYLINDER TO TDC/COMPRESSION**

- Turn the crankshaft pulley until its groove and the timing mark "0" of the timing chain cover are aligned.
- Check that each timing mark of the camshaft timing gear and sprocket is aligned with each timing mark located on the No. 1 and No. 2 bearing caps as shown in the illustration.
If not, turn the crankshaft by 1 revolution (360°) to align the timing marks as above.

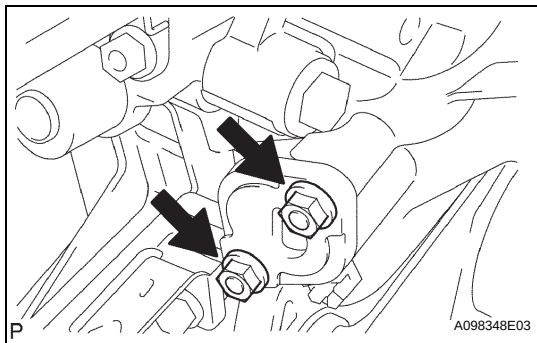




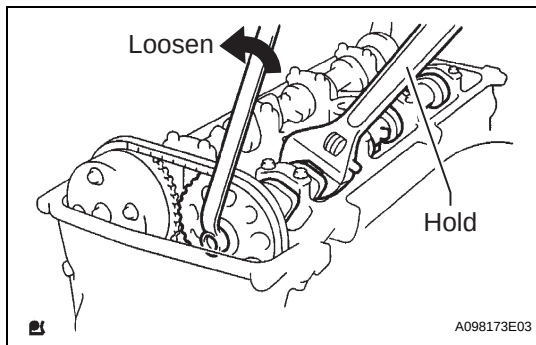
36. REMOVE NO. 2 CAMSHAFT

- (a) Place paint marks on the chain in alignment with the timing marks on the camshaft timing gear and camshaft timing sprocket.

- (b) Remove the 2 nuts, tensioner and gasket.

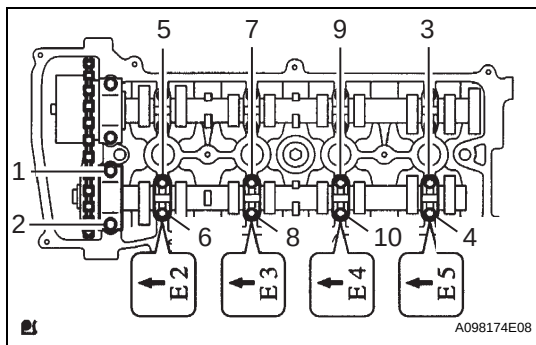


- (c) While holding the camshaft with a wrench, loosen the camshaft timing set bolt.

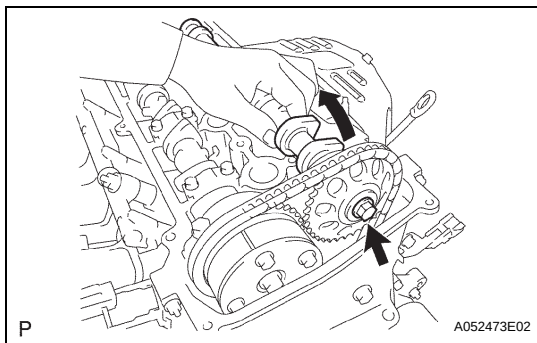


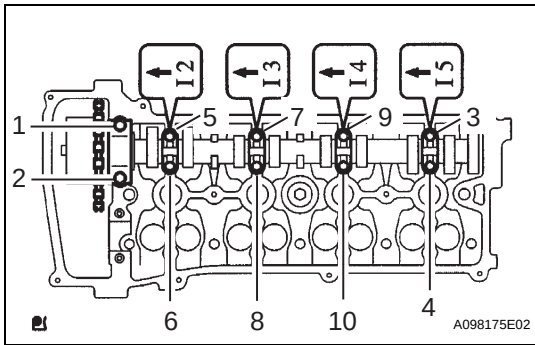
- (d) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

- (e) Remove the 5 bearing caps.

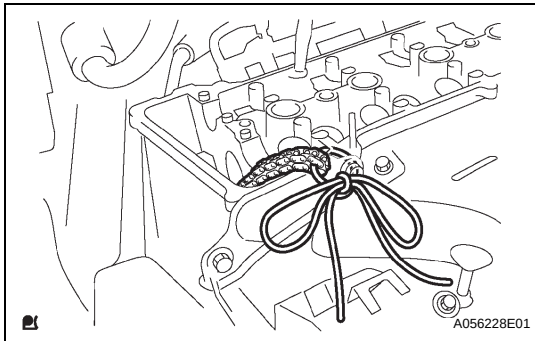


- (f) While holding the No. 2 camshaft by hand, remove the camshaft timing sprocket set bolt.
- (g) Remove the camshaft timing sprocket from the No. 2 camshaft with the timing chain wrapped on the sprocket.
- (h) Remove the camshaft timing sprocket from the timing chain.



**37. REMOVE CAMSHAFT**

- Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
- Remove the 5 bearing caps.
- Remove the camshaft and camshaft timing gear while holding the timing chain by hand.



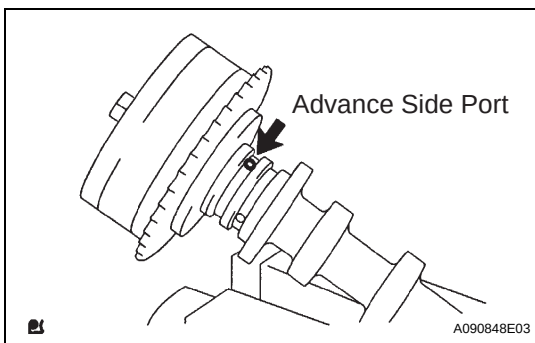
- Tie the timing chain with a string as shown in the illustration.

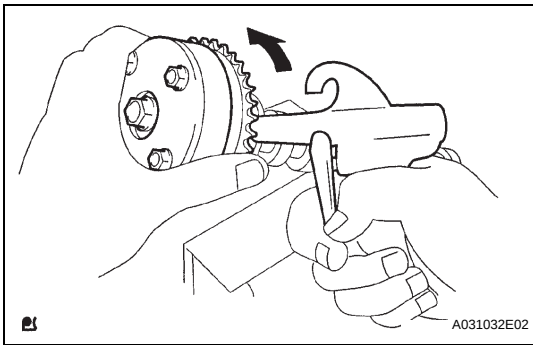
NOTICE:

Be careful not to drop anything inside the timing chain cover.

38. REMOVE CRANKSHAFT PULLEY (See page [EM-25](#))**39. REMOVE ENGINE MOUNTING BRACKET RH (See page [EM-26](#))****40. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (See page [EM-26](#))****41. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE****42. REMOVE TIMING CHAIN GUIDE (See page [EM-28](#))****43. REMOVE CHAIN TENSIONER SLIPPER (See page [EM-28](#))****44. REMOVE NO. 1 CHAIN VIBRATION DAMPER (See page [EM-28](#))****45. REMOVE CHAIN SUB-ASSEMBLY****46. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-395](#))****47. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY**

- Clamp the camshaft in a vise, and make sure that the camshaft timing gear does not rotate.
- Cover all the oil ports with vinyl tape except the advance side port shown in the illustration.





- (c) Apply air pressure of 100 kPa (1.0 kgf/cm², 14 psi) to the oil path, then turn the camshaft timing gear to the advance direction (counterclockwise) by hand.

CAUTION:

Cover the paths with a shop rag to avoid oil splashes.

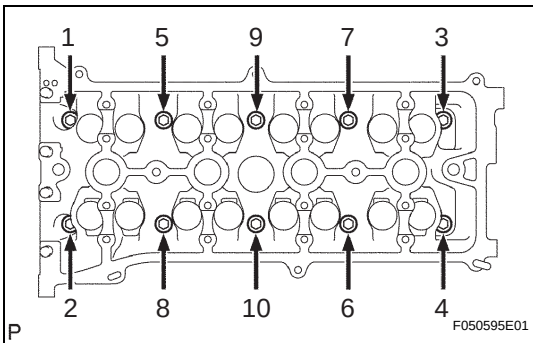
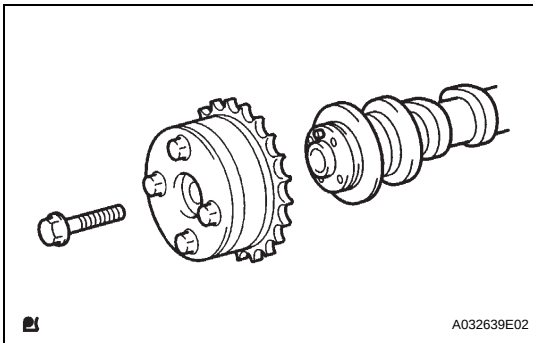
HINT:

Depending on the air pressure, the camshaft timing gear will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure is difficult to apply because of air leakage from the port, there may be the case that the lock pin is difficult to release.

- (d) Remove the flange bolt of the camshaft timing gear.

NOTICE:

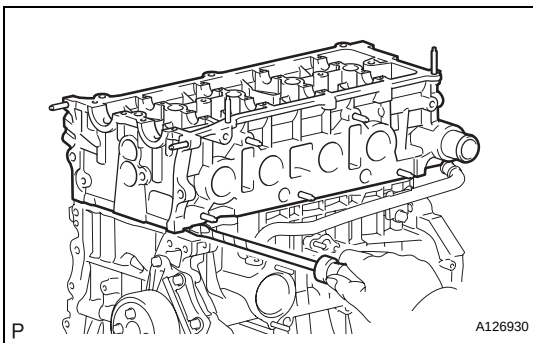
- Be sure not to remove the other 4 bolts.
- When reusing the camshaft timing gear, release the straight pin lock first, then install the gear.

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

- (a) Using several steps, uniformly loosen and remove the 10 cylinder head bolts and 10 plate washers with a 10 mm bi-hexagon wrench in the sequence shown in the illustration.

NOTICE:

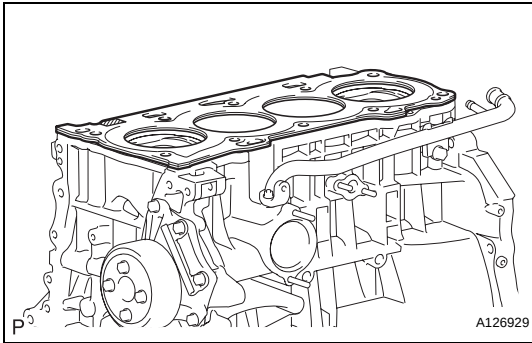
Head warp or cracking could result from removing the bolts in the wrong order.



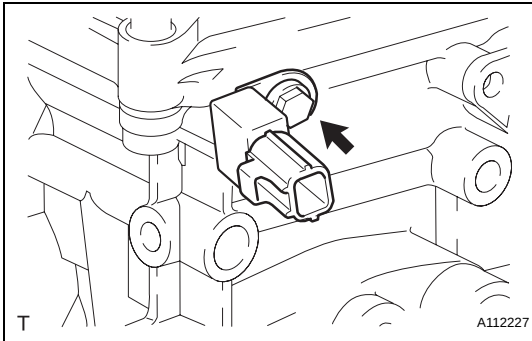
- (b) Using a screwdriver with its tip wrapped with tape, pry between the cylinder head and cylinder block, and remove the cylinder head.

NOTICE:

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



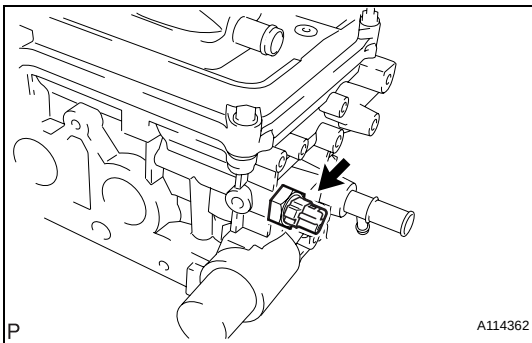
49. REMOVE CYLINDER HEAD GASKET



DISASSEMBLY

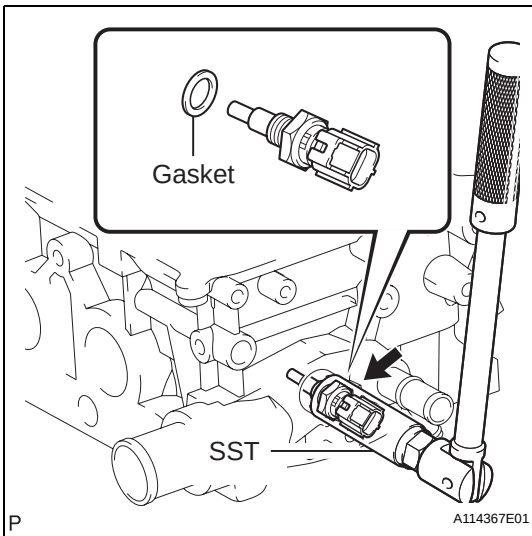
1. REMOVE RADIO SETTING CONDENSER

- (a) Remove the bolt and condenser.



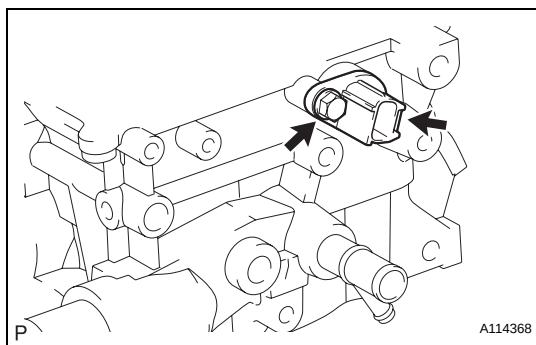
2. REMOVE OIL PRESSURE SWITCH

- (a) Using a 24 mm deep socket wrench, remove the sensor.



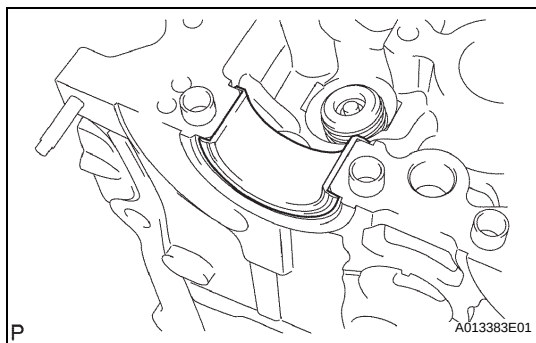
3. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

- (a) Using SST, remove the sensor and gasket.
SST 09817-33190



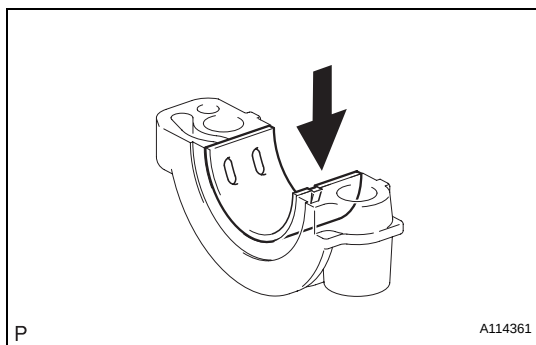
4. REMOVE CAMSHAFT POSITION SENSOR

- (a) Remove the bolt and sensor.



5. REMOVE NO. 2 CAMSHAFT BEARING

- (a) Remove the No. 2 camshaft bearing.



6. REMOVE NO. 1 CAMSHAFT BEARING

- (a) Remove the No. 1 camshaft bearing.

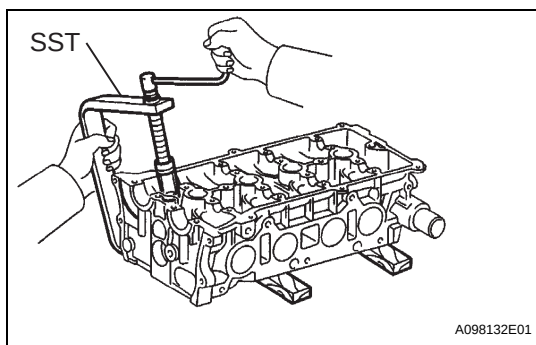
7. REMOVE VALVE LIFTER

HINT:

Arrange the valve lifters in the correct order.

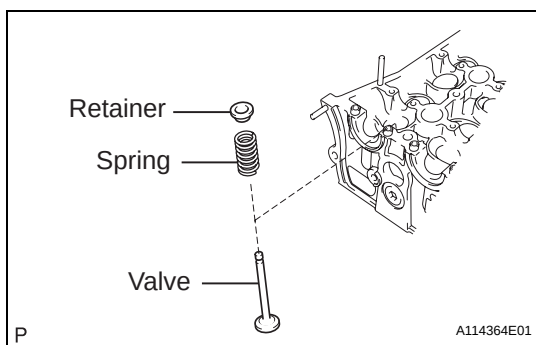
8. REMOVE INTAKE VALVE

- (a) Place the cylinder head on wooden blocks.



- (b) Using SST, compress the spring, then remove the 2 retainer locks.

SST 09202-70020 (09202-00010)



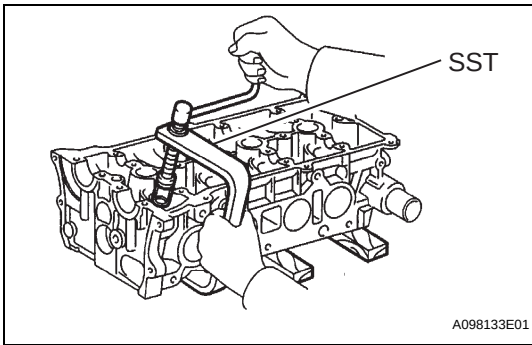
- (c) Remove the retainer, spring and valve from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

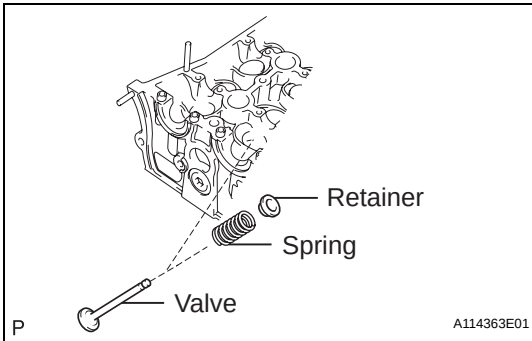
9. REMOVE EXHAUST VALVE

- (a) Place the cylinder head on wooden blocks.



- (b) Using SST, compress the spring, then remove the 2 retainer locks.

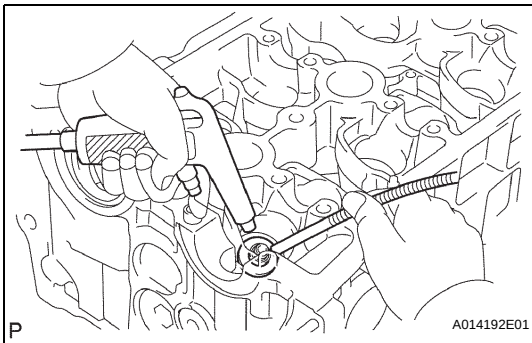
SST 09202-70020 (09202-00010)



- (c) Remove the retainer, spring and valve from the cylinder head.

HINT:

Arrange the removed parts in the correct order.

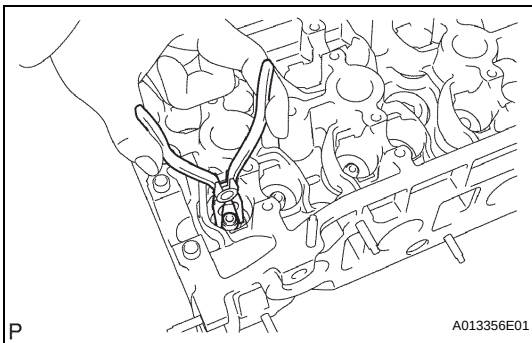


10. REMOVE VALVE SPRING SEAT

- (a) Using compressed air and a magnetic finger, remove the spring seat by blowing air.

HINT:

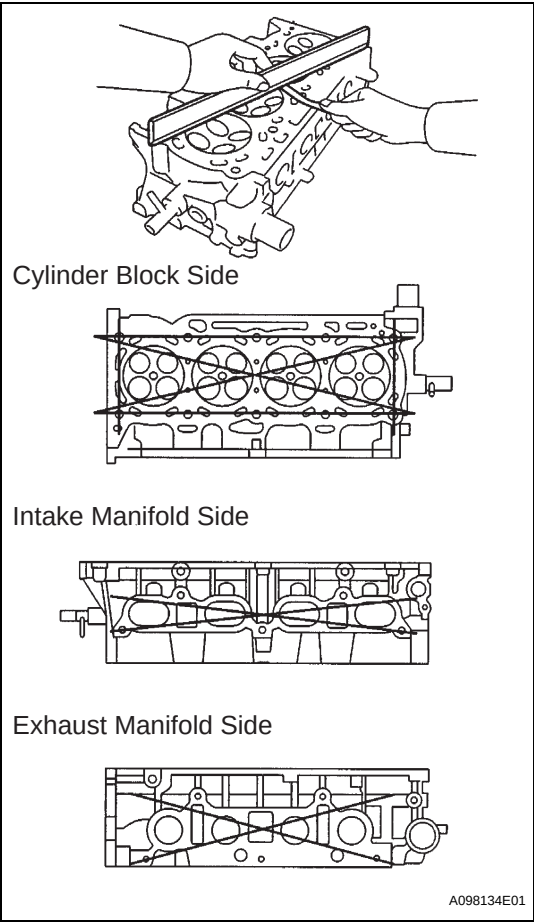
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.



11. REMOVE VALVE STEM OIL SEAL

- (a) Using needle-nose pliers, remove the 16 oil seals.

EM



INSPECTION

1. INSPECT CYLINDER HEAD FOR WARPAGE

- (a) Using a precision straightedge and feeler gauge, measure the warpage of the contact surfaces of the cylinder block and manifolds.

Maximum warpage:

0.08 mm (0.0032 in.)

If the warpage is greater than the maximum, replace the cylinder head sub-assembly.

2. INSPECT CYLINDER HEAD FOR CRACKS

- (a) Using a dye penetrant, inspect the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.
If cracked, replace the cylinder head.

3. INSPECT VALVE SEAT

- (a) Apply a light coat of Prussian blue to the valve face.
(b) Lightly press the valve against the seat.

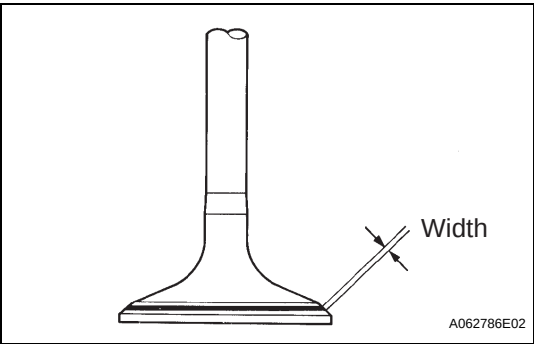
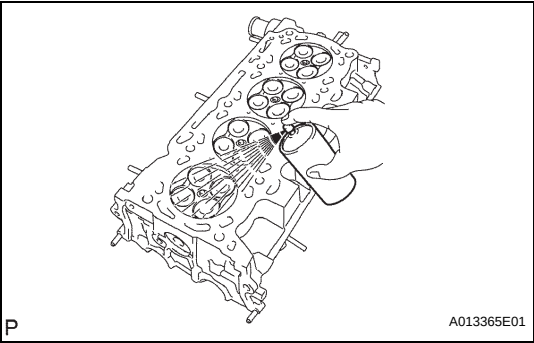
NOTICE:

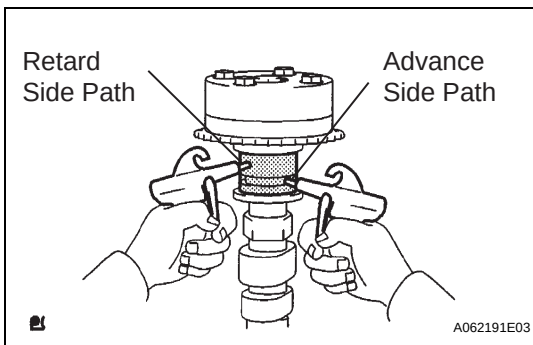
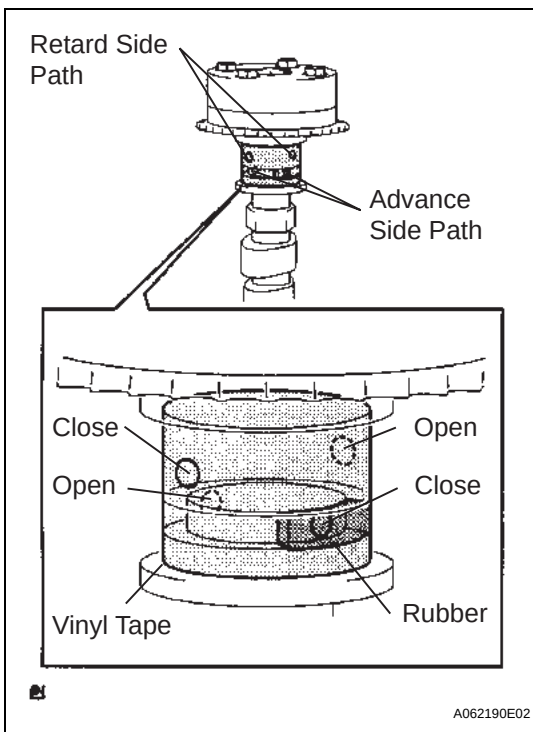
Do not turn the valve.

- (c) Check the valve face and seat in accordance with the following procedure.
- (1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
 - (2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the valve seat (see page [EM-87](#)).
 - (3) Check that the seat contact is in the middle of the valve face with a width.

Standard width

Item	Standard Condition
Intake	1.0 to 1.4 mm (0.0039 to 0.0551 in.)
Exhaust	1.2 to 1.6 mm (0.0472 to 0.0630 in.)





4. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

- (a) Check the lock of the camshaft timing gear.

- (1) Clamp the camshaft in a vise, and confirm that the camshaft timing gear is locked.

NOTICE:

Be careful not to damage the camshaft.

- (b) Release the lock pin.

- (1) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT:

The 2 advance side paths are provided in the groove of the camshaft. Plug one of the paths with a rubber piece.

- (2) Break through the tape of the advance side path and the retard side path on the opposite side of the groove.

- (3) Apply approximately 200 kPa (2.0 kgf/cm², 28 psi) of air pressure to the paths whose tape was broken in the procedure above.

CAUTION:

Some oil spraying will occur. Contain the spray with a shop rag.

- (4) Check that the camshaft timing gear revolves in the advance direction when weakening the air pressure of the retard side path.

OK:

Gear rotates in advance direction.

HINT:

This operation releases the lock pin for the extreme retard position.

- (5) When the camshaft timing gear reaches the extreme advance position, remove the air gun from the retard side path and advance side path, in that order.

NOTICE:

Do not remove the air gun from the advance side path first. The gear may abruptly shift in the retard direction and break the lock pin.

- (c) Check for smooth rotation.

- (1) Rotate the camshaft timing gear within its movable range several times, but do not turn it to the extreme retard position. Check that the gear rotates smoothly.

OK:

Gear rotates smoothly.

NOTICE:

Do not use an air gun to perform the smooth operation check.

- (d) Check the lock in the extreme retard position.
 (1) Confirm that the camshaft timing gear is locked at the extreme retard position.

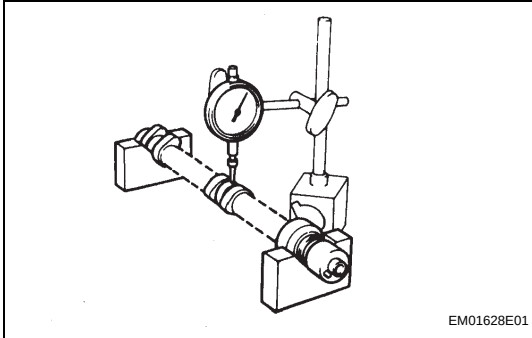
5. INSPECT CAMSHAFT

- (a) Inspect the camshaft for runout.
 (1) Place the camshaft on V-blocks.
 (2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

0.03 mm (0.0012 in.)

If the circle runout is greater than the maximum, replace the camshaft.



- (b) Inspect the cam lobes.

- (1) Using a micrometer, measure the cam lobe height.

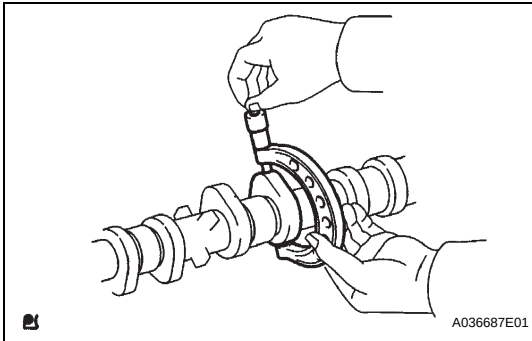
Standard cam lobe height:

47.306 to 47.406 mm (1.8624 to 1.8664 in.)

Minimum cam lobe height:

47.196 mm (1.8581 in.)

If the cam lobe height is less than the minimum, replace the camshaft.



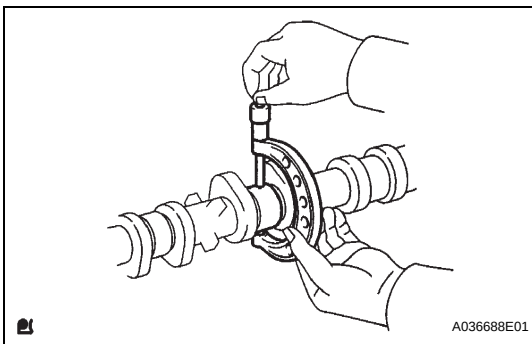
- (c) Inspect the camshaft journals.

- (1) Using a micrometer, measure the journal diameter.

Standard journal diameter

Journal Position	Specified Condition
No. 1	35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other	22.959 to 22.975 mm (0.9039 to 0.9045 in.)

If the journal diameter is not as specified, check the oil clearance.

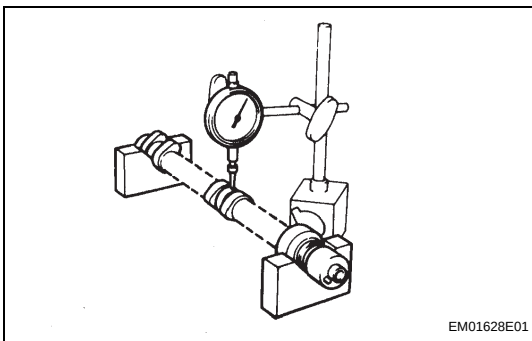
**6. INSPECT NO. 2 CAMSHAFT**

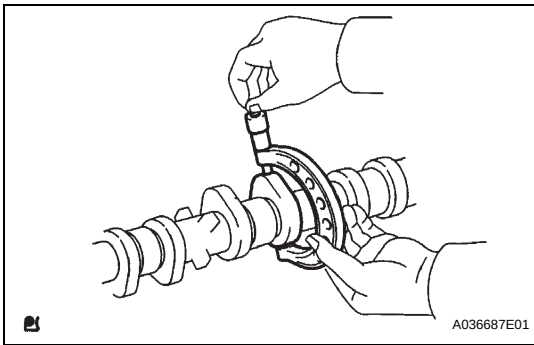
- (a) Inspect the camshaft for runout.
 (1) Place the camshaft on V-blocks.
 (2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout:

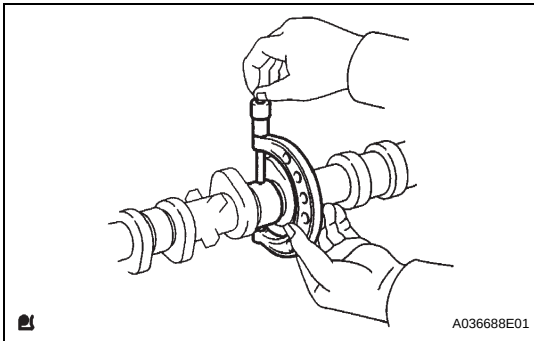
0.03 mm (0.0012 in.)

If the circle runout is greater than the maximum, replace the No. 2 camshaft.





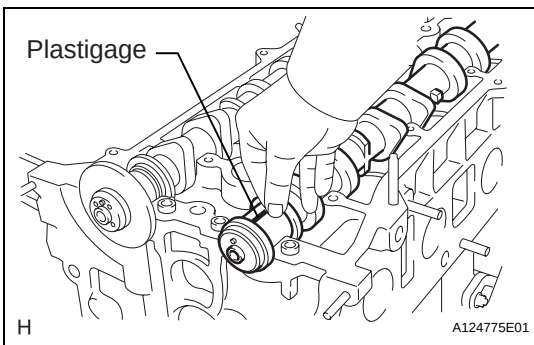
- (b) Inspect the cam lobes.
- (1) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
45.983 to 46.083 mm (1.8104 to 1.8143 in.)
Minimum cam lobe height:
45.873 mm (1.8060 in.)
 If the cam lobe height is less than the minimum, replace the No. 2 camshaft.



- (c) Inspect the camshaft journals.
- (1) Using a micrometer, measure the journal diameter.
Standard journal diameter

Journal Position	Specified Condition
No. 1	35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other	22.959 to 22.975 mm (0.9039 to 0.9045 in.)

If the journal diameter is not as specified, check the oil clearance.



7. INSPECT CAMSHAFT OIL CLEARANCE

- (a) Clean the 10 bearing caps and camshaft journals.
 - (b) Place the 2 camshafts on the cylinder head.
 - (c) Lay a strip of Plastigage across each of the camshaft journals.
 - (d) Install the 10 bearing caps (see page EM-84).
- NOTICE:**
Do not turn the camshaft.
- (e) Remove the 10 bearing caps for the No. 2 camshaft (see page EM-60) and camshaft (see page EM-61).

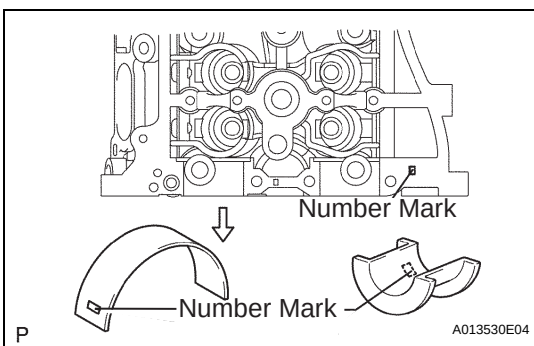
- (f) Measure the Plastigage at its widest point.
Standard oil clearance

Item	Standard Condition
Intake No. 1 journal	0.007 to 0.038 mm (0.0003 to 0.0015 in.)
Exhaust No. 1 journal	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Other journal	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

Maximum oil clearance

Item	Standard Condition
Intake No. 1 journal	0.07 mm (0.0028 in.)
Other journal	0.10 mm (0.0039 in.)

NOTICE:
Completely remove the Plastigage after the measurement.



If the oil clearance on the No. 1 journal is greater than the maximum, choose a new bearing and install it.

If the oil clearance on the other journals is greater than the maximum, replace the cylinder head sub-assembly or the camshaft.

Standard cylinder head journal bore diameter

Mark	Standard Condition
Mark 1	40.000 to 40.008 mm (1.5748 to 1.5751 in.)
Mark 2	40.009 to 40.017 mm (1.5752 to 1.5755 in.)
Mark 3	40.018 to 40.025 mm (1.5755 to 1.5758 in.)

Standard bearing center wall thickness

Mark	Standard Condition
Mark 1	2.000 to 2.004 mm (0.0787 to 0.0789 in.)
Mark 2	2.005 to 2.008 mm (0.0789 to 0.0791 in.)
Mark 3	2.009 to 2.012 mm (0.0791 to 0.0792 in.)

Standard camshaft journal diameter:

35.971 to 35.985 mm (1.4162 to 1.4167 in.)

8. INSPECT CAMSHAFT THRUST CLEARANCE

- Install the 2 camshafts (see page [EM-84](#)).
- Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance

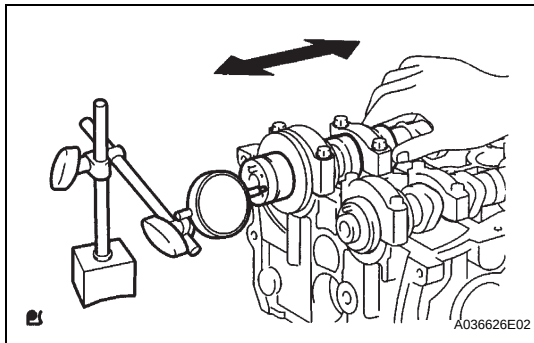
Item	Standard Condition
Intake	0.040 to 0.095 mm (0.0016 to 0.0037 in.)
Exhaust	0.080 to 0.135 mm (0.0032 to 0.0053 in.)

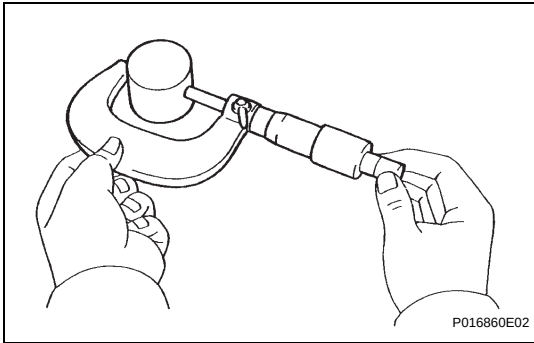
Maximum thrust clearance

Item	Standard Condition
Intake	0.11 mm (0.0043 in.)
Exhaust	0.15 mm (0.0059 in.)

If the thrust clearance is greater than the maximum, replace the cylinder head.

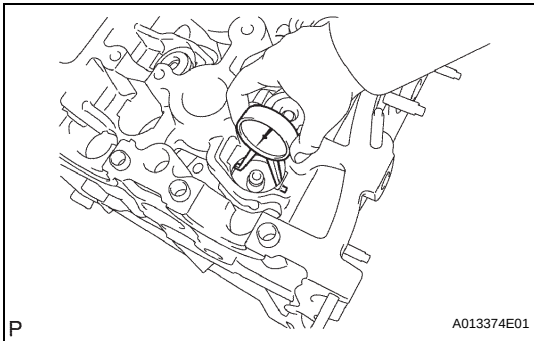
If damage is found on the camshaft thrust surfaces, replace the camshaft.





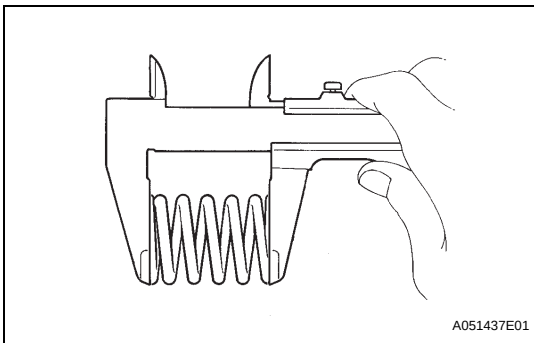
9. INSPECT VALVE LIFTER

- (a) Using a micrometer, measure the lifter diameter.
Standard lifter diameter:
30.966 to 30.976 mm (1.2191 to 1.2195 in.)
 If the diameter is not as specified, replace the valve lifter.



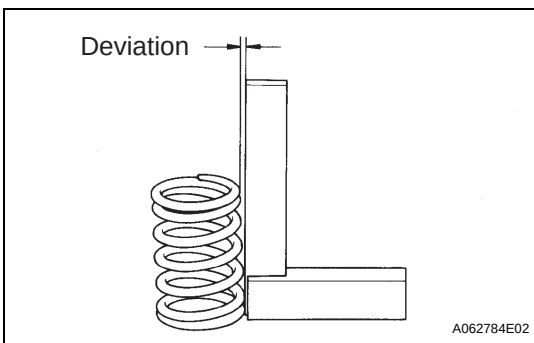
10. INSPECT VALVE LIFTER OIL CLEARANCE

- (a) Using a caliper gauge, measure the valve lifter bore diameter of the cylinder head.
Standard lifter bore diameter:
31.009 to 31.025 mm (1.2208 to 1.2215 in.)
 If the diameter is not as specified, replace the cylinder head sub-assembly.
- (b) Subtract the valve lifter diameter measurement from the valve lifter bore diameter measurement.
Standard oil clearance:
0.033 to 0.059 mm (0.0013 to 0.0023 in.)
Maximum oil clearance:
0.079 mm (0.0031 in.)
 If the oil clearance is greater than the maximum, replace the valve lifter. If necessary, replace the cylinder head sub-assembly.

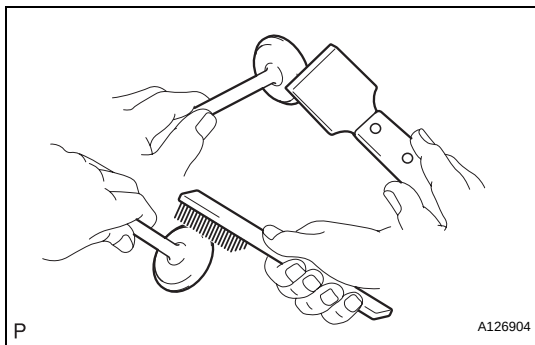


11. INSPECT INNER COMPRESSION SPRING

- (a) Using a vernier caliper, measure the free length of the valve spring.
Standard free length:
47.43 mm (1.8673 in.)
 If the length is not as specified, replace the inner compression spring.

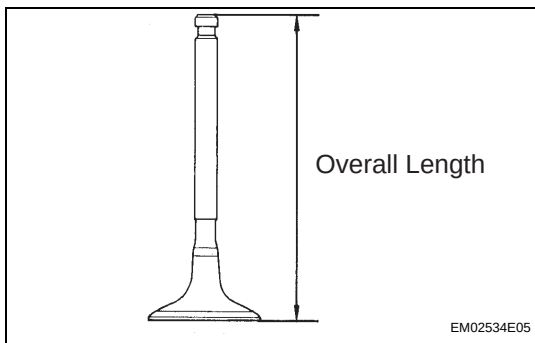


- (b) Using a steel square, measure the deviation of the inner compression spring.
Maximum deviation:
1.6 mm (0.063 in.)
Maximum angle (Reference):
2°
 If the deviation is greater than the maximum, replace the inner compression spring.



12. INSPECT INTAKE VALVE

- Using a gasket scraper, chip off any carbon on the valve head.
- Using a wire brush, thoroughly clean the valve.



- Using a vernier caliper, measure the valve overall length.

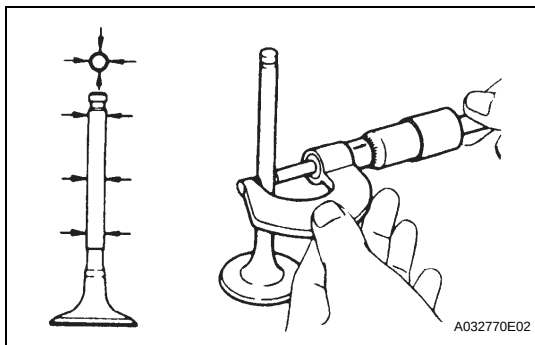
Standard overall length:

101.71 mm (4.0043 in.)

Minimum overall length:

101.21 mm (3.9846 in.)

If the overall length is less than the minimum, replace the intake valve.

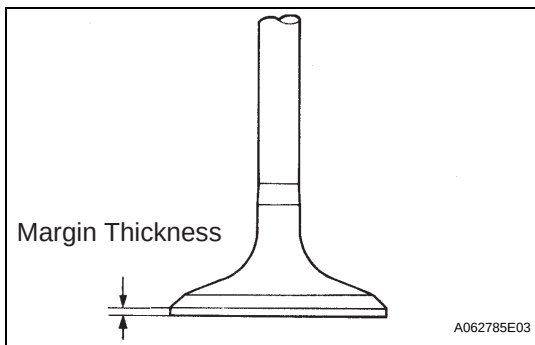


- Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter:

5.470 to 5.485 mm (0.2154 to 0.2159 in.)

If the diameter is not as specified, replace the intake valve.



- Using a vernier caliper, measure the valve head margin thickness.

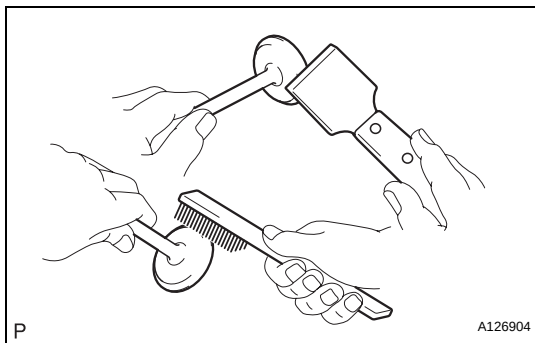
Standard margin thickness:

1.25 mm (0.0492 in.)

Minimum margin thickness:

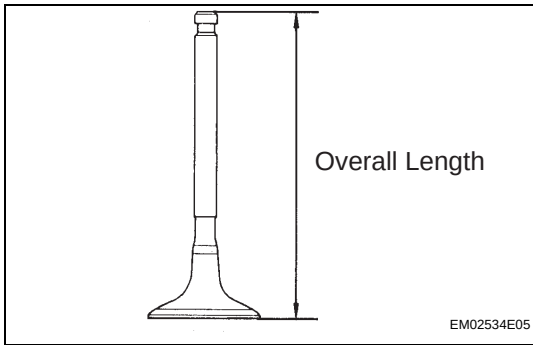
1.05 mm (0.0413 in.)

If the diameter is not as specified, replace the intake valve.



13. INSPECT EXHAUST VALVE

- Using a gasket scraper, chip off any carbon on the valve head.
- Using a wire brush, thoroughly clean the valve.



- (c) Using a vernier caliper, measure the valve overall length.

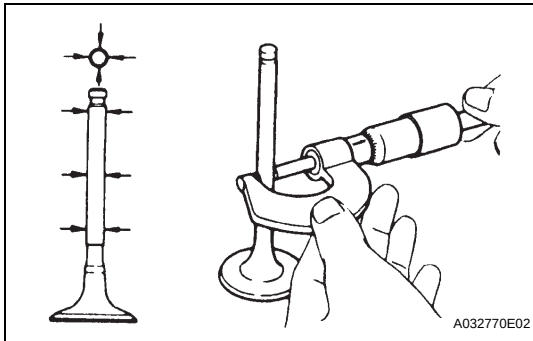
Standard overall length:

101.15 mm (3.9823 in.)

Minimum overall length:

100.70 mm (3.9646 in.)

If the overall length is less than the minimum, replace the exhaust valve.

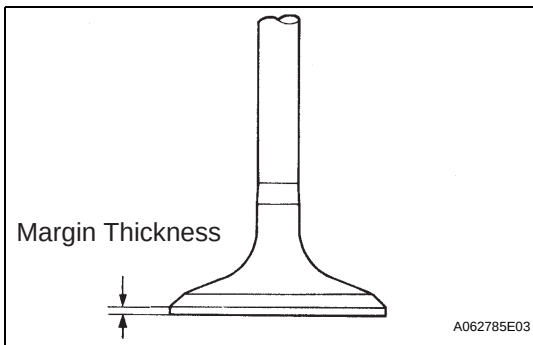


- (d) Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter:

5.465 to 5.480 mm (0.2152 to 0.2158 in.)

If the overall length is less than the minimum, replace the exhaust valve.



- (e) Using a vernier caliper, measure the valve head margin thickness.

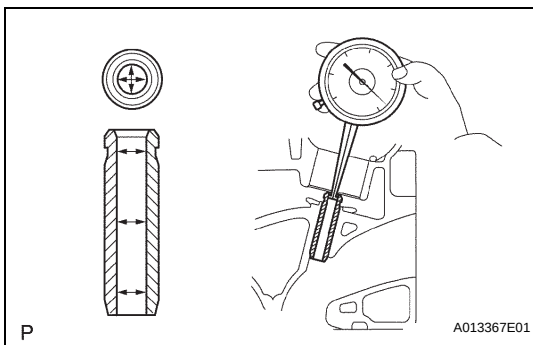
Standard margin thickness:

1.40 mm (0.0551 in.)

Minimum margin thickness:

1.20 mm (0.0472 in.)

If the overall length is less than the minimum, replace the exhaust valve.



14. INSPECT INTAKE VALVE GUIDE BUSH

- (a) Using a caliper gauge, measure the inside diameter of the guide bush.

Standard bush inside diameter:

5.510 to 5.530 mm (0.2169 to 0.2177 in.)

If the inside diameter is not as specified, replace the intake valve guide bush.

- (b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

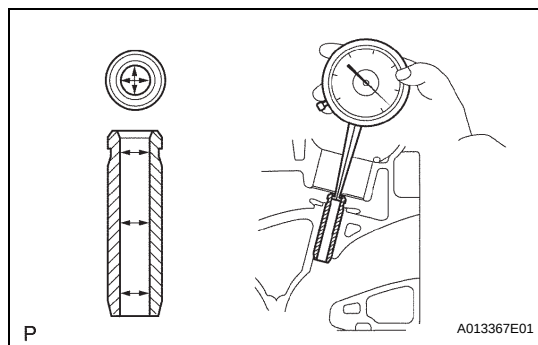
Standard oil clearance:

0.025 to 0.060 mm (0.0010 to 0.0024 in.)

Maximum oil clearance:

0.08 mm (0.0032 in.)

If the clearance is greater than the maximum, replace the valve and intake guide bush.



15. INSPECT EXHAUST VALVE GUIDE BUSH

- (a) Using a caliper gauge, measure the inside diameter of the guide bush.

Standard bush inside diameter:

5.510 to 5.530 mm (0.2169 to 0.2177 in.)

If the inside diameter is not as specified, replace the exhaust valve guide bush.

- (b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

Standard oil clearance:

0.030 to 0.065 mm (0.0012 to 0.0026 in.)

Maximum oil clearance:

0.10 mm (0.004 in.)

If the clearance is greater than the maximum, replace the valve and exhaust valve guide bush.

16. INSPECT CYLINDER HEAD SET BOLT

- (a) Using a vernier caliper, measure the length of the head bolts from the seat to the end.

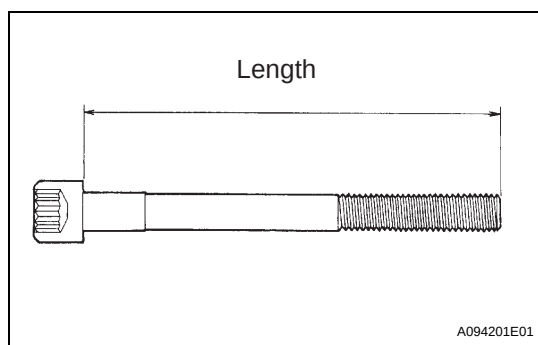
Standard bolt length:

141.3 to 142.7 mm (5.563 to 5.618 in.)

Maximum bolt length:

144.2 mm (5.677 in.)

If the bolt length is greater than the maximum, replace the cylinder head set bolt.



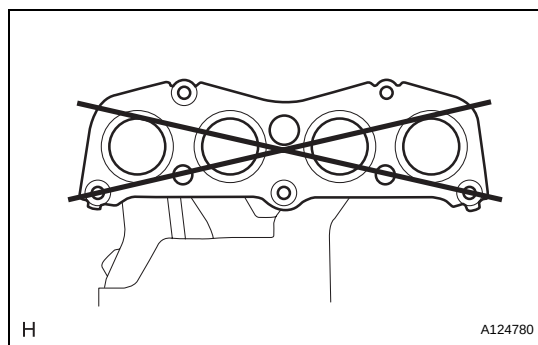
17. INSPECT EXHAUST MANIFOLD

- (a) Using a precision straightedge and a feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage:

0.70 mm (0.028 in.)

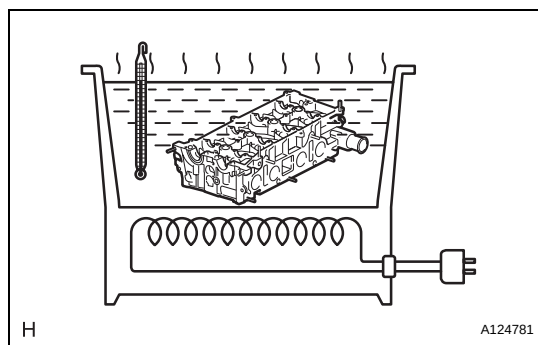
If the warpage is greater than the maximum, replace the exhaust manifold.

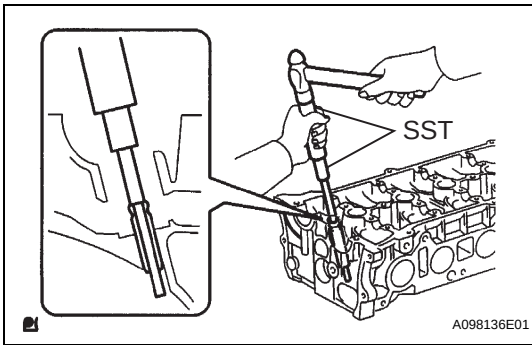


REPLACEMENT

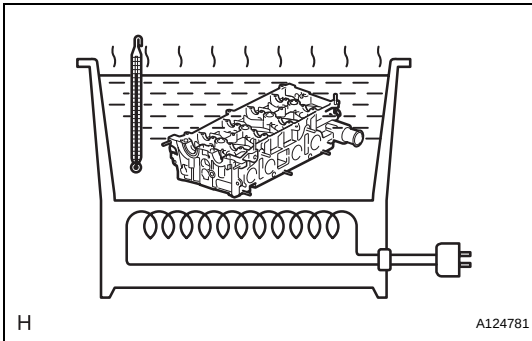
1. REPLACE INTAKE VALVE GUIDE BUSH

- (a) Heat the cylinder head to 80 to 100°C (176 to 212°F).
- (b) Place the cylinder head on wooden blocks.



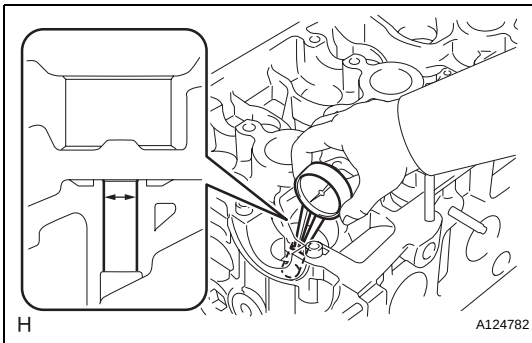


- (c) Using SST and a hammer, tap out the guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



- (d) Heat the cylinder head to 80 to 100°C (176 to 212°F).

- (e) Place the cylinder head on wooden blocks.



- (f) Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard diameter:

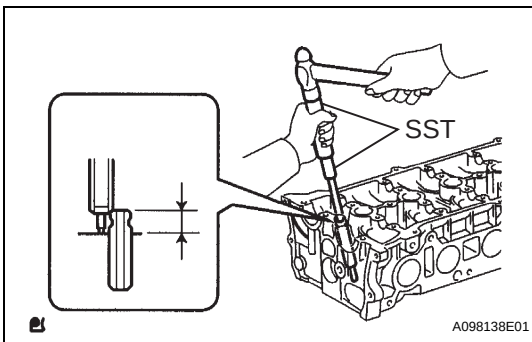
10.285 to 10.306 mm (0.4049 to 0.4058 in.)

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4058 in.), machine the bush bore to the dimension of 10.335 to 10.365 mm (0.4068 to 0.4077 in.).

Standard valve guide bush diameter

Condition	Specified Condition
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S (0.05 mm)	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

If the bushing bore diameter of the cylinder head is greater than 10.394 mm (0.4092 in.), replace the cylinder head.

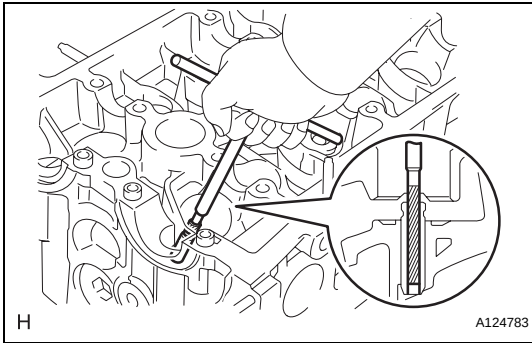


- (g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Standard protrusion height:

9.6 to 10.0 mm (0.378 to 0.394 in.)



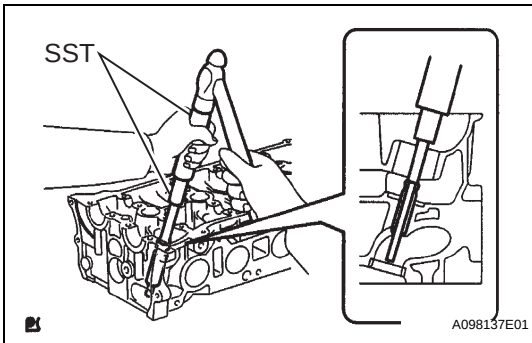
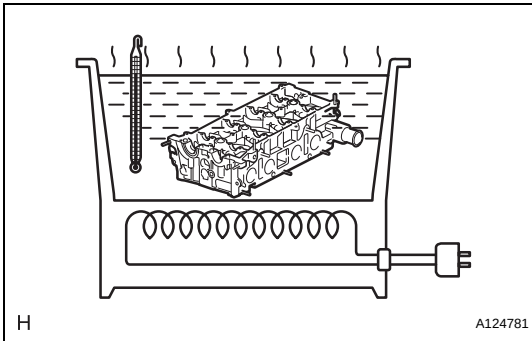
- (h) Using a sharp 5.5 mm reamer, ream the valve guide bush to the standard specified clearance between the valve guide bush and valve stem.

Standard oil clearance:

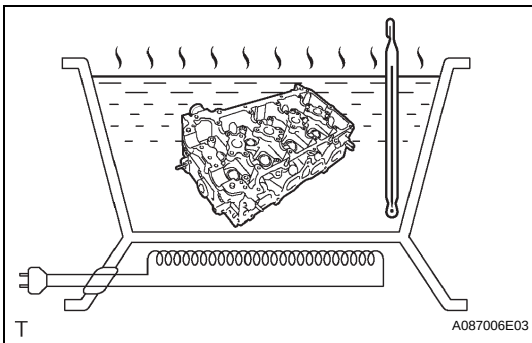
0.025 to 0.060 mm (0.0010 to 0.0024 in.)

2. REPLACE EXHAUST VALVE GUIDE BUSH

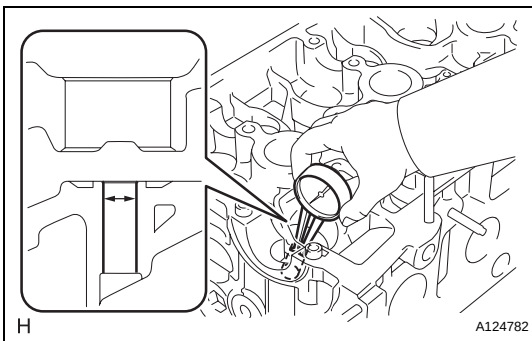
- (a) Heat the cylinder head to 80 to 100°C (176 to 212°F).
 (b) Place the cylinder head on wooden blocks.



- (c) Using SST and a hammer, tap out the guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



- (d) Heat the cylinder head to 80 to 100°C (176 to 212°F).
 (e) Place the cylinder head on wooden blocks.



- (f) Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard diameter:

10.285 to 10.306 mm (0.4049 to 0.4058 in.)

If the bush bore diameter of the cylinder head is greater than 10.306 mm (0.4058 in.), machine the bush bore to the dimension of 10.335 to 10.365 mm (0.4068 to 0.4077 in.).

Standard valve guide bush diameter

Condition	Specified Condition
STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
O/S (0.05 mm)	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

If the bushing bore diameter of the cylinder head is greater than 10.394 mm (0.4092 in.), replace the cylinder head.

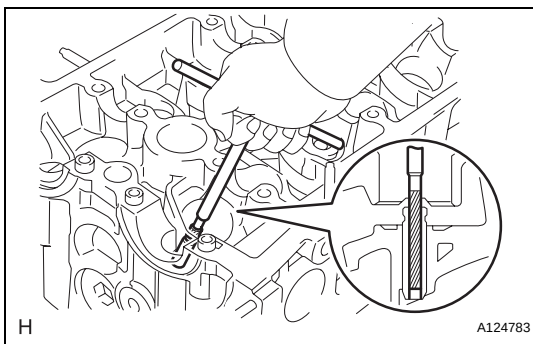
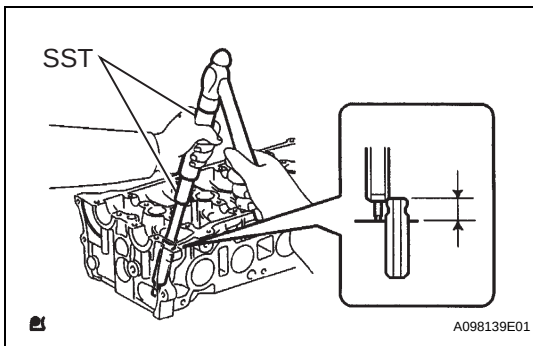
- (g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

Standard protrusion height:

9.6 to 10.0 mm (0.378 to 0.394 in.)

EM



- (h) Using a sharp 5.5 mm reamer, ream the valve guide bush to the standard specified clearance between the valve guide bush and valve stem.

Standard oil clearance:

0.030 to 0.065 mm (0.0012 to 0.0026 in.)

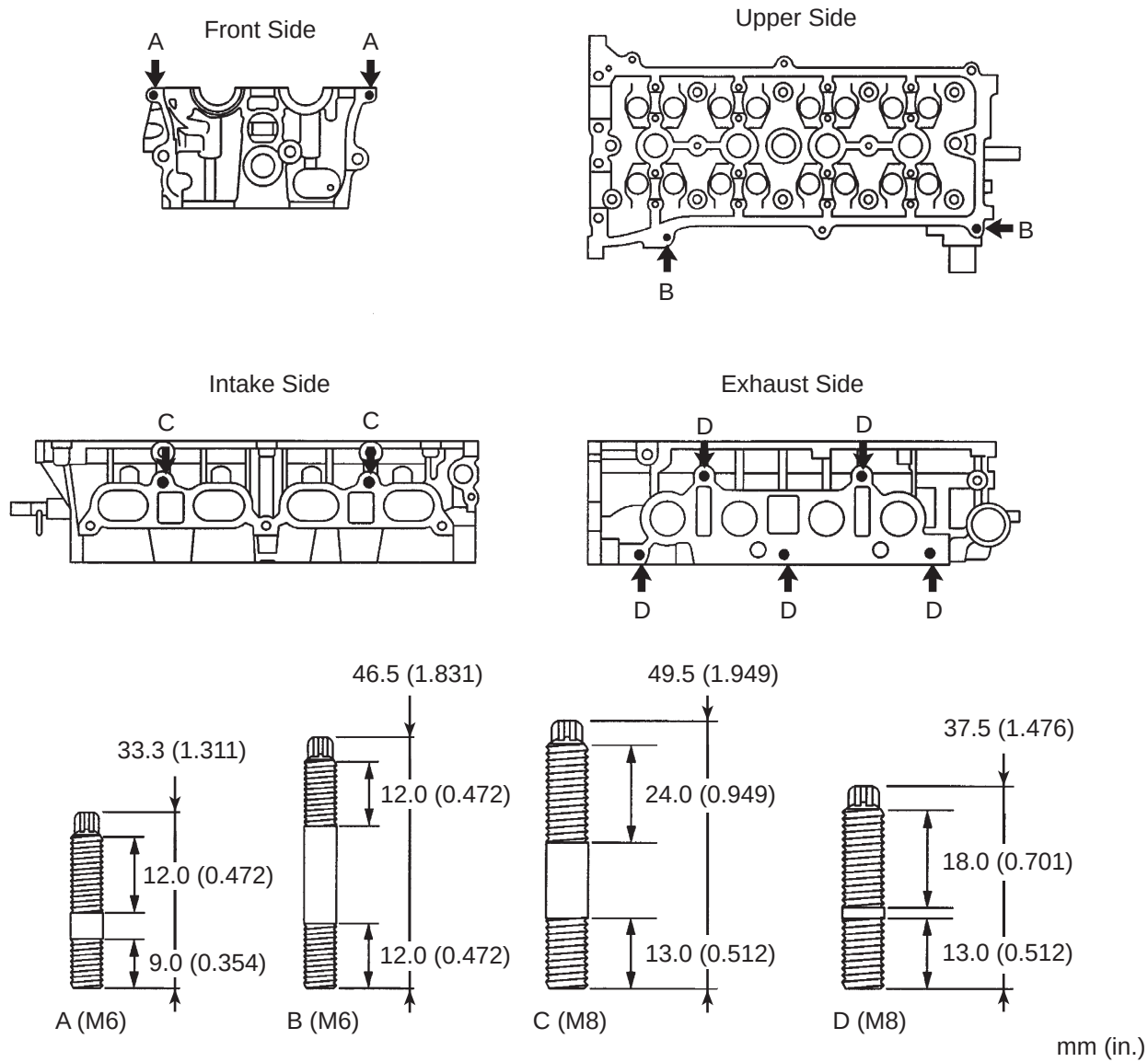
3. REPLACE STUD BOLT

NOTICE:

If the stud bolt is deformed or threads are damaged, replace it.

- (a) Using E5 and E7 "torx" socket wrenches, remove the 11 stud bolts.

- (b) Using E5 and E7 "torx" socket wrenches, install the 11 stud bolts.

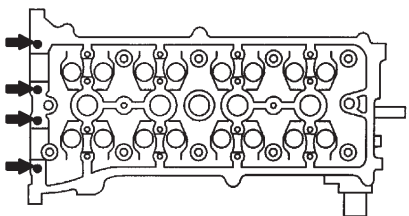


A098141E04

4. REPLACE RING PIN

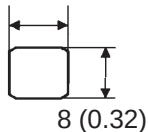
- (a) Remove the 4 ring pins.

Upper Side

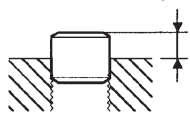


11 (0.43)

3 (0.12)



8 (0.32)



mm (in.)

A098140E04

- (b) Using a plastic-faced hammer, tap in 4 new ring pins to the specified protrusion height.

Protrusion height:**3.0 mm (0.12 in.)**

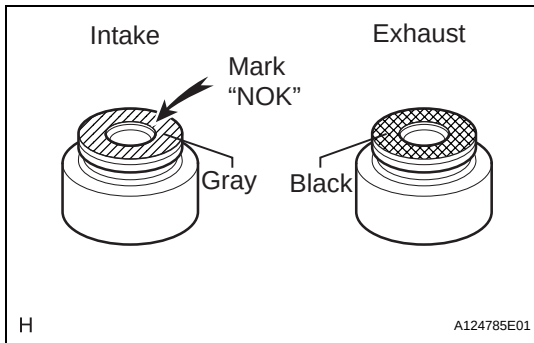
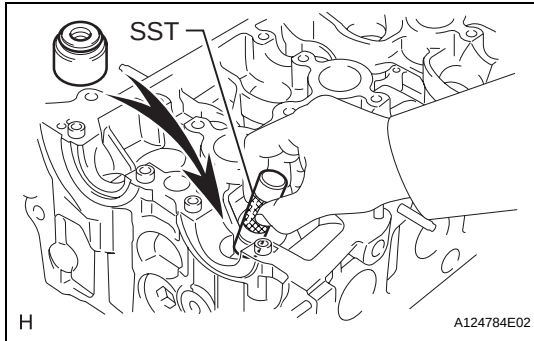
REASSEMBLY

HINT:

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace oil seals with new ones.

1. INSTALL VALVE STEM OIL SEAL

- (a) Using SST, push in a new oil seal.
SST 09201-41020



HINT:

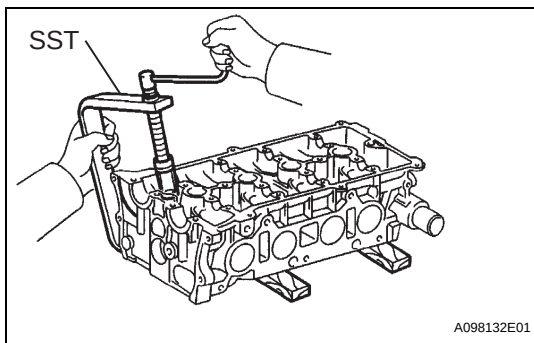
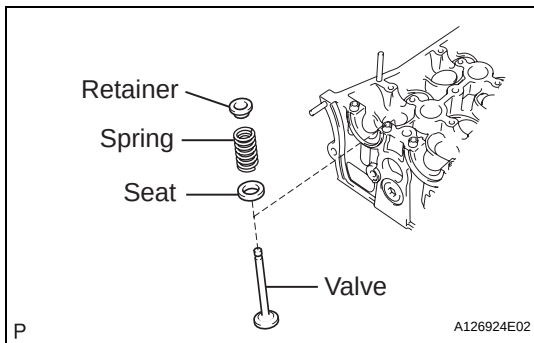
The intake valve oil seal is gray and the exhaust valve oil seal is black.

NOTICE:

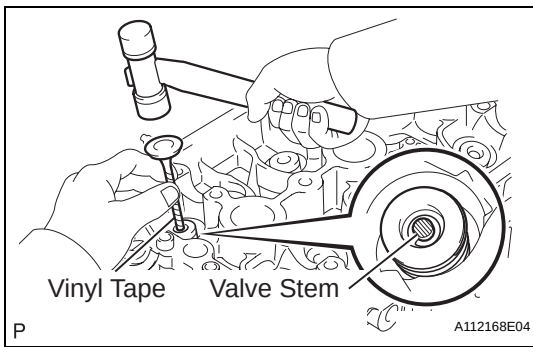
Pay close attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust or installing the exhaust oil seal to the intake can cause installation problems later.

2. INSTALL INTAKE VALVE

- (a) Place the cylinder head on wooden blocks.
 (b) Install the valve, seat, spring and retainer onto the cylinder head.



- (c) Using SST, compress the spring, and place the 2 retainer locks around the valve stem.
SST 09202-70020 (09202-00010)



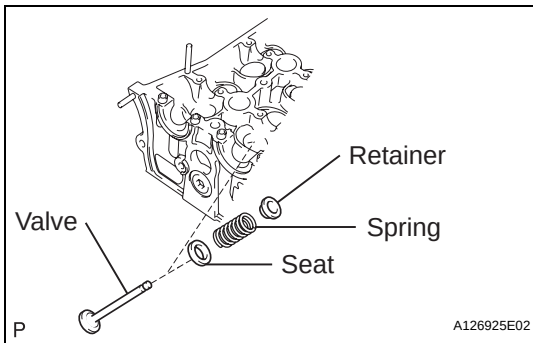
- (d) Using a plastic-faced hammer and discarded valve (with its tip wrapped with tape), lightly tap the installed valve to fit it into place.

NOTICE:

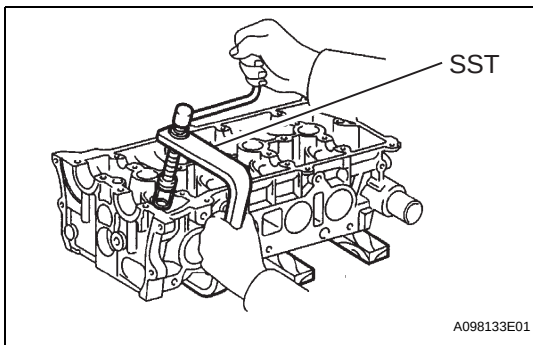
Be careful not to damage the valve stem tip.

3. INSTALL EXHAUST VALVE

- (a) Place the cylinder head on wooden blocks.

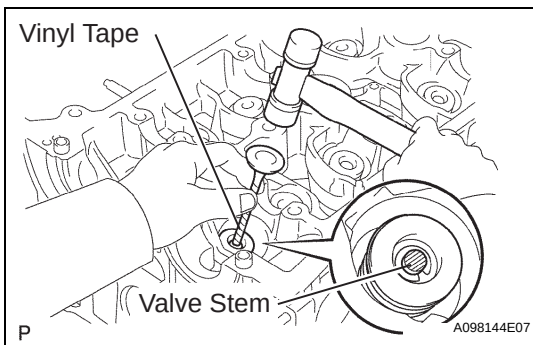


- (b) Install the valve, seat, spring and retainer onto the cylinder head.



- (c) Using SST, compress the spring, and place the 2 retainer locks around the valve stem.

SST 09202-70020 (09202-00010)



- (d) Using a plastic-faced hammer and discarded valve (with its tip wrapped with tape), lightly tap the installed valve to fit it into place.

NOTICE:

Be careful not to damage the valve stem tip.

4. INSTALL VALVE LIFTER

- (a) Assemble the valve lifter and the tip of the valve stem with a light coat of engine oil applied.

NOTICE:

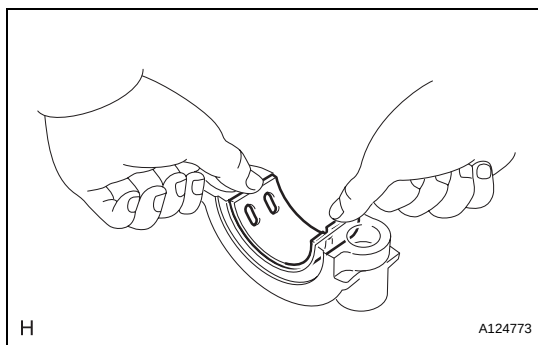
Install the valve lifters in their original places.

5. INSTALL NO. 1 CAMSHAFT BEARING

- (a) Clean the contact surface of the bearing and the bearing cap.

NOTICE:

Do not apply engine oil to the contact surfaces of the camshaft bearing and bearing cap.



- (b) Align the bearing claw with the claw groove of No. 1 and No. 2 bearing cap, and push in the No. 1 camshaft bearing.

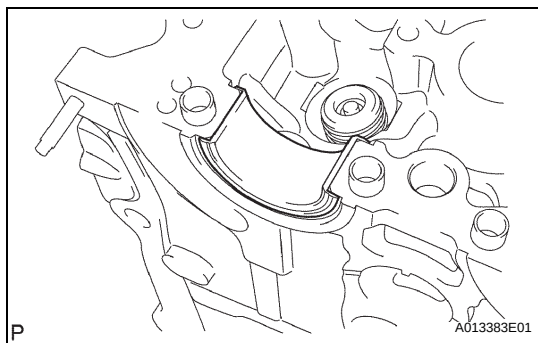
6. INSTALL NO. 2 CAMSHAFT BEARING

- (a) Clean the contact surface of the bearing and the bearing cap.

NOTICE:

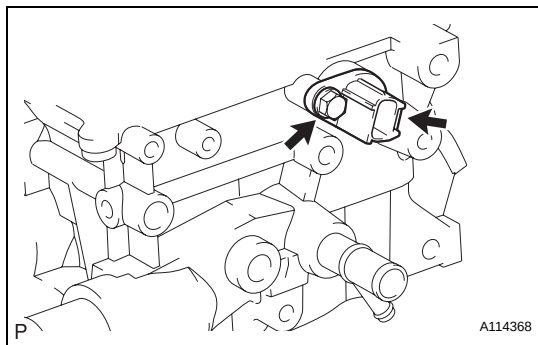
Do not apply engine oil to the contact surfaces of the camshaft bearing and cylinder block.

- (b) Install the No. 2 camshaft bearing onto the cylinder head.



7. INSTALL CAMSHAFT POSITION SENSOR

- (a) Install the camshaft position sensor with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

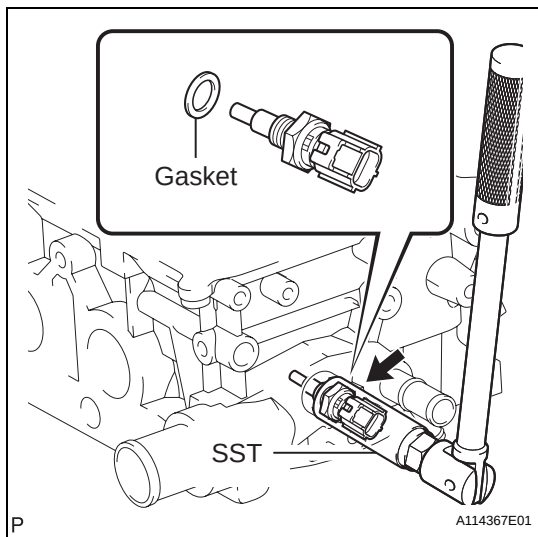


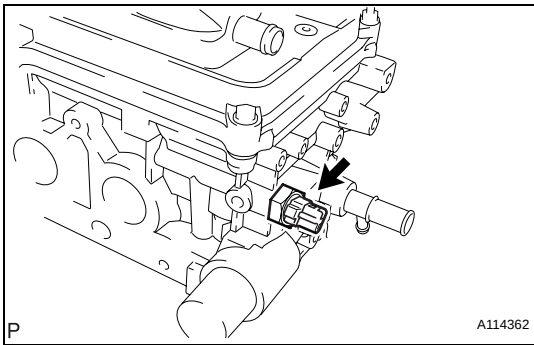
8. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

- (a) Using SST, install a new gasket and the ECT sensor.

SST 09817-33190

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)



**9. INSTALL OIL PRESSURE SWITCH**

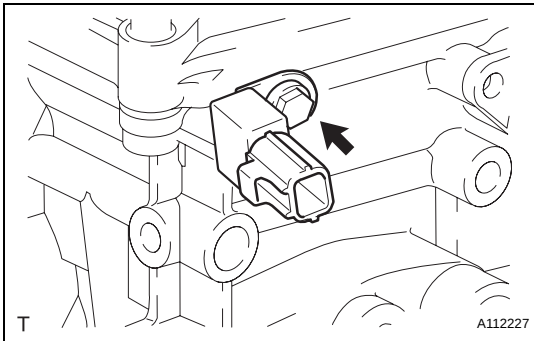
- (a) Apply adhesive to 2 or 3 threads of the oil pressure switch.

Adhesive:

Toyota Genuine Adhesive 1344, Three Bond 1344 or equivalent

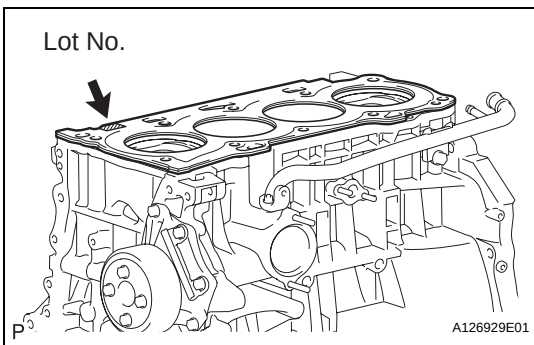
- (b) Using a 24 mm deep socket wrench, install the oil pressure switch.

Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

**10. INSTALL RADIO SETTING CONDENSER**

- (a) Install the condenser with the bolt.

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

**INSTALLATION****1. INSTALL CYLINDER HEAD GASKET**

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

NOTICE:

- Remove any oil from contact surface.
- Be careful of the installation direction.

2. INSTALL CYLINDER HEAD SUB-ASSEMBLY

- (a) Place the cylinder head on the head gasket.

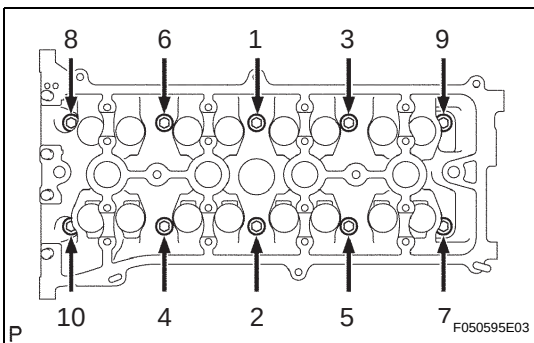
NOTICE:

Place the cylinder head gently in order to avoid damaging the gasket.

- (b) Install the cylinder head bolts.

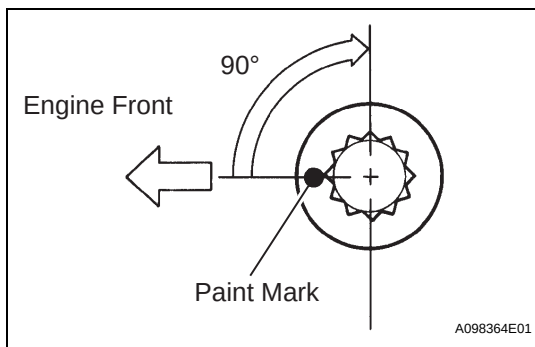
NOTICE:

The cylinder head bolts are tightened in 2 successive steps.

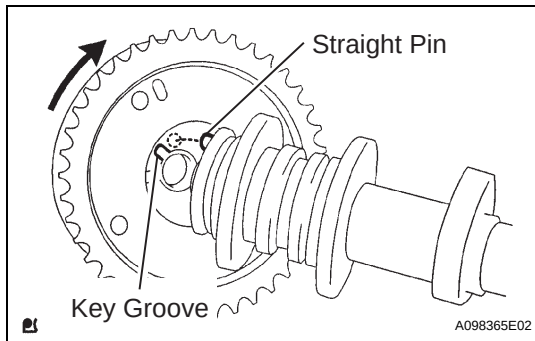


- (1) Apply a light coat of engine oil to the threads and under the heads of the cylinder head set bolts.
- (2) Using several steps, uniformly install and tighten the 10 cylinder head set bolts and plate washers with a 10 mm bi-hexagon wrench in the order shown in the illustration.

Torque: 70 N*m (714 kgf*cm, 52 ft.*lbf)



- (c) Mark the front of the cylinder head bolts with paint.
- (d) Retighten the cylinder head bolts by 90° as shown in the illustration.
- (e) Check that the paint mark is now at a 90° angle to the front.



3. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY

- (a) Put the camshaft timing gear and camshaft together with the straight pin and key groove misaligned, as shown in the illustration.
- (b) Turn the camshaft timing gear as shown in the illustration while pushing it gently against the camshaft. Push further at the position where the pin fits into the groove.

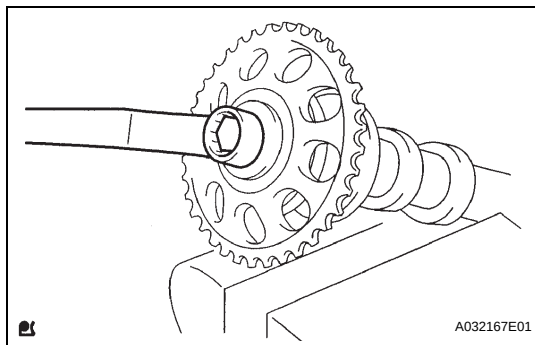
NOTICE:

Be sure not to turn the camshaft timing gear to the retard angle side (the right angle).

- (c) Check that there is no clearance between the gear fringe and camshaft.
- (d) Tighten the flange bolt with the camshaft timing gear fixed in place.

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

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



4. INSTALL NO. 2 CAMSHAFT TIMING SPROCKET

- (a) Clamp the camshaft in a vise, then install the camshaft timing sprocket with the bolt.

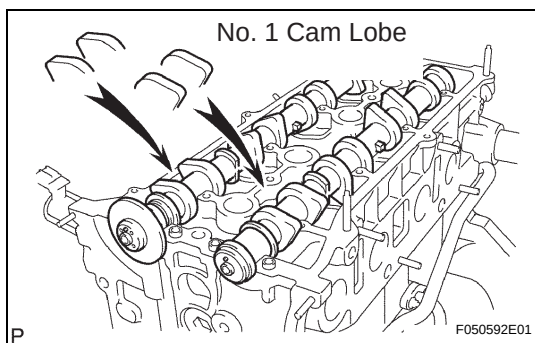
Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

NOTICE:

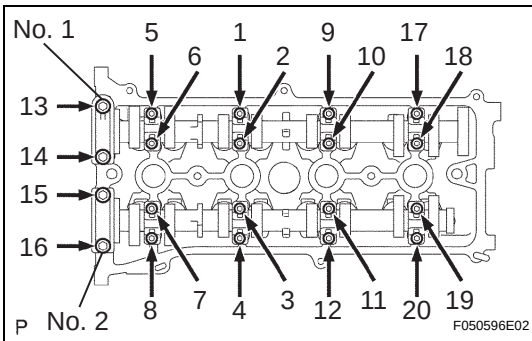
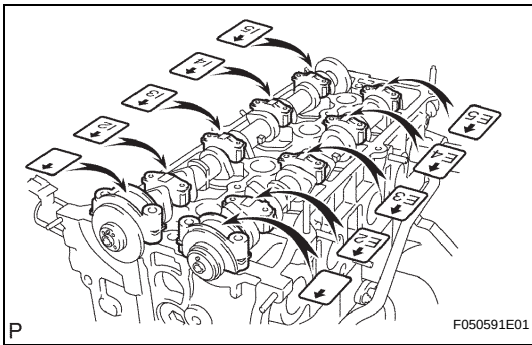
Do not damage the camshaft.

5. INSTALL CAMSHAFT

- (a) Apply a light coat of engine oil to the journal portion of the camshaft.



- (b) Place the 2 camshafts on the cylinder head with the No. 1 cam lobes facing the directions shown in the illustration.



- (c) Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.
- (d) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

- (e) Using several steps, uniformly tighten the 20 bearing cap bolts in the sequence shown in the illustration.

Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf) for No. 1 and No. 2 bearing cap
 9.0 N*m (92 kgf*cm, 80 in.*lbf) for No. 3 bearing cap

NOTICE:

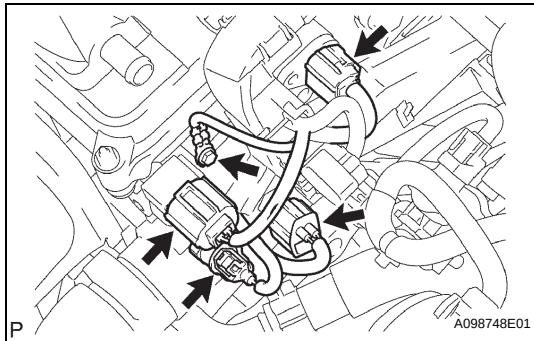
Install the camshaft with the timing mark of the camshaft timing gear on top.

6. INSTALL NO. 1 CHAIN VIBRATION DAMPER (See page [EM-33](#))
7. INSTALL CHAIN SUB-ASSEMBLY (See page [EM-33](#))
8. INSTALL CHAIN TENSIONER SLIPPER (See page [EM-34](#))
9. INSTALL TIMING CHAIN GUIDE (See page [EM-34](#))
10. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See page [EM-35](#))
11. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See page [EM-35](#))
12. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-37](#))
13. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-38](#))
14. INSTALL ENGINE MOUNTING BRACKET RH (See page [EM-38](#))
15. INSTALL CRANKSHAFT PULLEY (See page [EM-38](#))
16. INSTALL OIL PAN SUB-ASSEMBLY (See page [EM-39](#))
17. INSTALL CRANKSHAFT POSITION SENSOR (See page [ES-402](#))
18. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (See page [EM-40](#))
19. INSTALL SPARK PLUG (See page [EM-16](#))
20. INSTALL IGNITION COIL ASSEMBLY (See page [IG-9](#))
21. INSTALL IDLER PULLEY (See page [EM-41](#))

22. INSTALL ENGINE MOUNTING INSULATOR RH (See page [EM-41](#))
23. INSTALL RADIATOR RESERVOIR (See page [EM-112](#))
24. INSTALL GENERATOR ASSEMBLY (See page [CH-15](#))
25. INSTALL FAN AND GENERATOR V BELT (See page [EM-7](#))
26. INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page [EM-7](#))

27. CONNECT ENGINE WIRE

- (a) Connect the ground cable with the bolt.
Torque: 8.4 N*m (86 kgf*cm, 74 in.*lbf)
- (b) Connect the camshaft position sensor connector.
- (c) Connect the engine coolant temperature sensor connector.
- (d) Connect the engine oil pressure switch connector.
- (e) Connect the radio setting condenser connector.
- (f) Connect the heater water inlet hose.



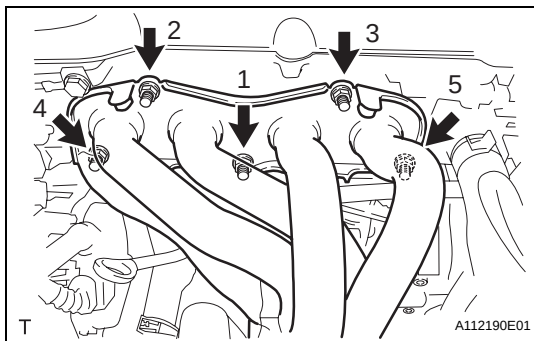
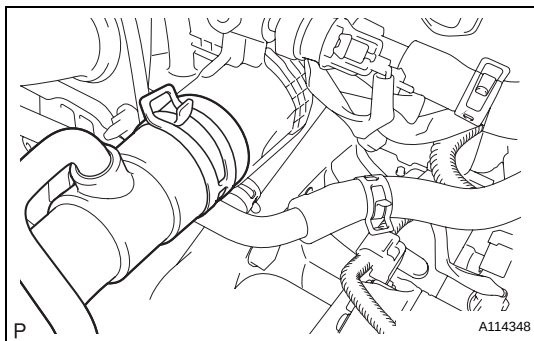
28. CONNECT NO. 1 RADIATOR HOSE

- (a) Connect the hose to the cylinder head.

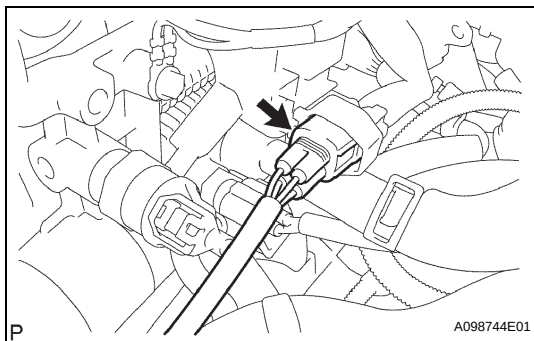
29. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-396](#))

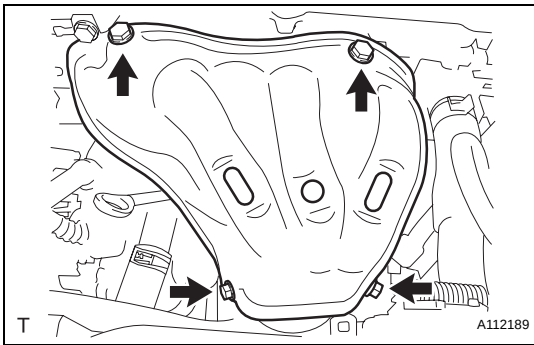
30. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY

- (a) Install a new gasket onto the cylinder head.
- (b) Temporarily tighten the exhaust manifold converter with the 5 nuts.
- (c) Tighten the 5 nuts in the sequence shown in the illustration.
Torque: 37 N*m (377 kgf*cm, 27 ft.*lbf)



- (d) Connect the air-fuel ratio sensor connector.

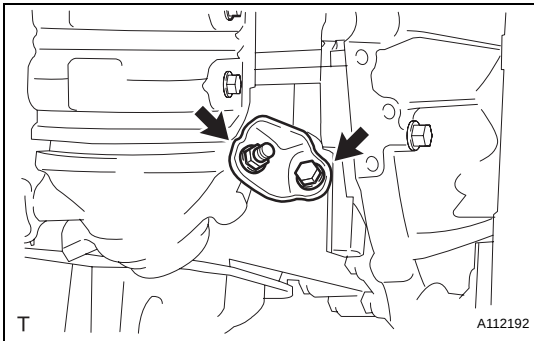




31. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

- (a) Install the exhaust manifold heat insulator with the 4 bolts.

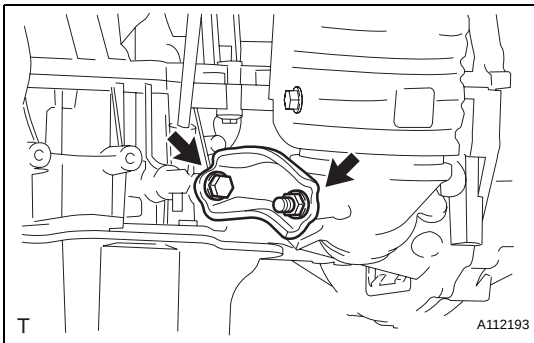
Torque: 12 N*m (122 kgf*cm, 9 ft.*lbf)



32. INSTALL NO. 2 MANIFOLD STAY

- (a) Install the stay with the bolt and nut.

Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)



33. INSTALL MANIFOLD STAY

- (a) Install the stay with the bolt and nut.

Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)

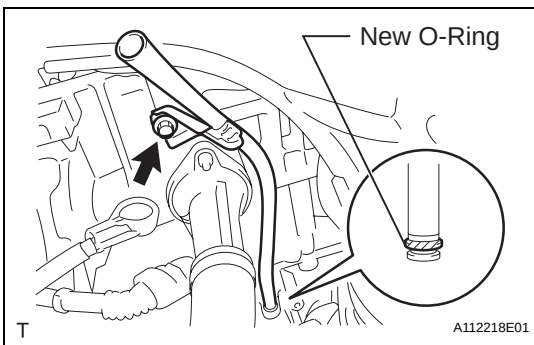
34. INSTALL FRONT EXHAUST PIPE (See page [EX-4](#))

35. INSTALL OIL DIPSTICK GUIDE

- (a) Apply a light coat of engine oil to a new O-ring and install it onto the guide.

- (b) Install the guide with the bolt.

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



36. INSTALL OIL DIPSTICK

37. INSTALL INTAKE MANIFOLD INSULATOR (See page [ES-421](#))

38. INSTALL INTAKE MANIFOLD (See page [ES-421](#))

39. INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY (See page [FU-13](#))

40. INSTALL THROTTLE BODY (See page [ES-413](#))

41. INSTALL AIR CLEANER CAP (See page [ES-413](#))

42. ADD ENGINE OIL (See page [LU-4](#))

43. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

44. CHECK FOR FUEL LEAKS

45. ADD ENGINE COOLANT (See page [CO-6](#))

46. CHECK FOR ENGINE COOLANT LEAKS

- (a) Check for engine coolant leaks (see page [CO-1](#)).

- 47. CHECK FOR ENGINE OIL LEAKS
- 48. CHECK FOR EXHAUST GAS LEAKS
- 49. INSPECT IGNITION TIMING (See page EM-1)
- 50. INSPECT ENGINE IDLING SPEED (See page EM-2)
- 51. INSPECT COMPRESSION (See page EM-3)
- 52. INSPECT CO/HC (See page EM-4)
- 53. INSTALL NO. 1 ENGINE COVER (See page EM-43)
- 54. INSTALL FRONT FENDER APRON RH
- 55. INSTALL NO. 1 ENGINE UNDER COVER
- 56. INSTALL FRONT WHEEL RH
- 57. INSTALL RADIATOR SUPPORT OPENING COVER

REPAIR

1. REPAIR VALVE SEATS

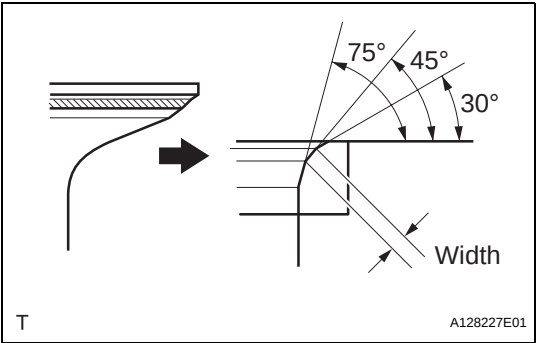
- (a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.
- (b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.

Standard width

Item	Standard Condition
Intake	1.0 to 1.4 mm (0.0394 to 0.0551 in.)
Exhaust	1.2 to 1.6 mm (0.0427 to 0.0630 in.)

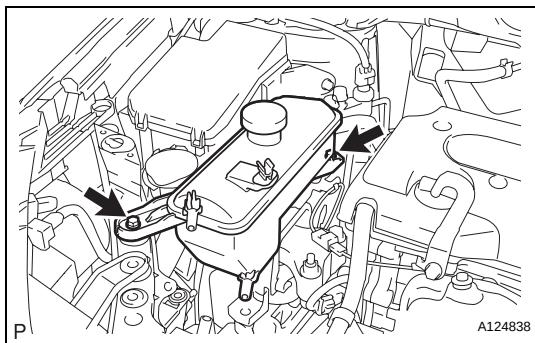
- (c) Lap the valve and valve seat by hand with an abrasive compound.
- (d) Recheck the valve seating position.

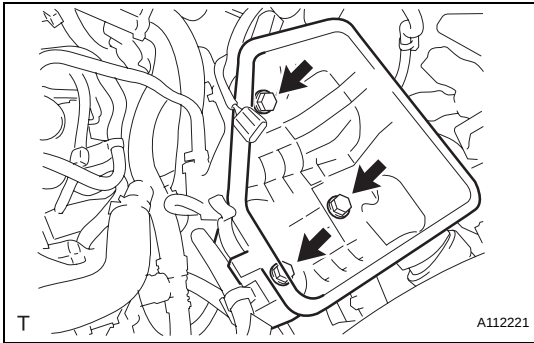
EM



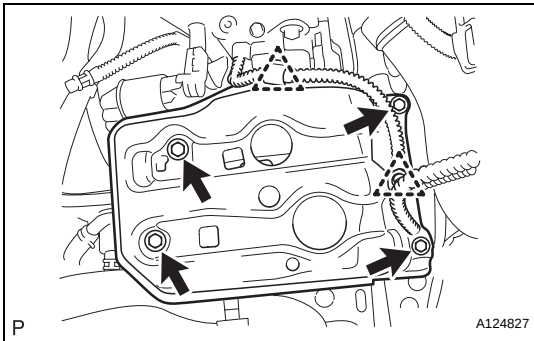
REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE (See page [FU-9](#))
2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
CAUTION:
Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
3. REMOVE HOOD SUB-ASSEMBLY (See page [ED-4](#))
4. REMOVE RADIATOR SUPPORT OPENING COVER
5. REMOVE BATTERY CLAMP SUB-ASSEMBLY
 - (a) Loosen the bolt and nut, and remove the battery clamp.
6. REMOVE BATTERY
7. REMOVE BATTERY TRAY
8. REMOVE FRONT WHEEL
9. REMOVE NO. 1 ENGINE UNDER COVER
10. REMOVE NO. 2 ENGINE UNDER COVER
11. REMOVE FRONT FENDER APRON RH
12. REMOVE NO. 1 ENGINE COVER (See page [EM-22](#))
13. DRAIN ENGINE COOLANT (See page [CO-6](#))
14. DRAIN AUTOMATIC TRANSAXLE FLUID
 - (a) Drain automatic transaxle fluid for U241E (2WD) (see page [AX-146](#)).
 - (b) Drain automatic transaxle fluid for U140F (4WD) (see page [AX-147](#)).
15. REMOVE RADIATOR ASSEMBLY
 - (a) Remove the radiator (see page [CO-29](#)).
16. REMOVE RADIATOR RESERVOIR
 - (a) Remove the 2 bolts and reservoir.
17. REMOVE PURGE VSV (See page [EC-15](#))
18. REMOVE AIR CLEANER CAP (See page [ES-411](#))
19. REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

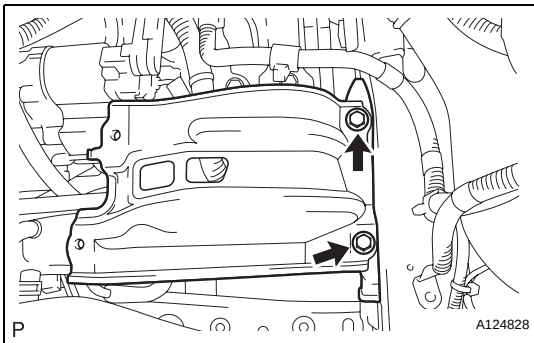


**20. REMOVE AIR CLEANER CASE SUB-ASSEMBLY**

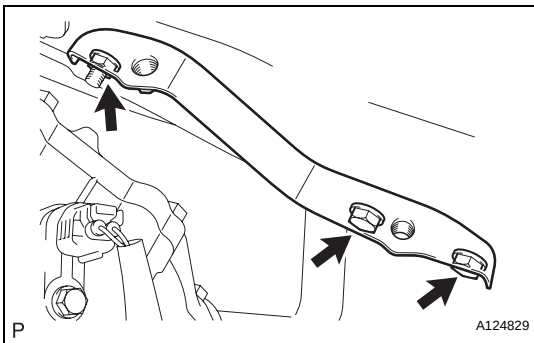
- (a) Remove the 3 bolts from the air cleaner case.
- (b) Disconnect the case from the NO. 1 air cleaner inlet.

**21. REMOVE FRONT BATTERY CARRIER**

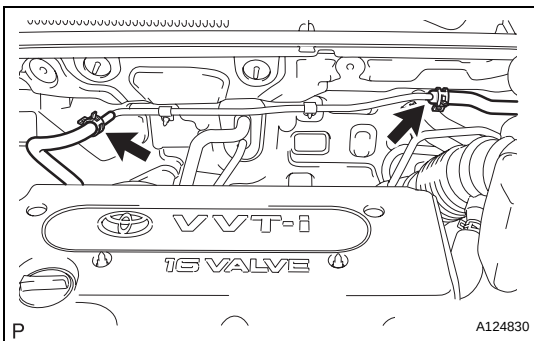
- (a) Disconnect the 2 clamps of the engine wire.
- (b) Remove the 4 bolts and front battery carrier.

**22. REMOVE BATTERY BRACKET REINFORCEMENT**

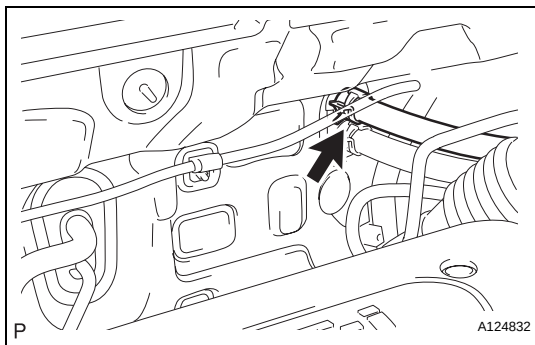
- (a) Remove the 2 bolts and battery bracket reinforcement.

**23. REMOVE BATTERY CARRIER BRACKET**

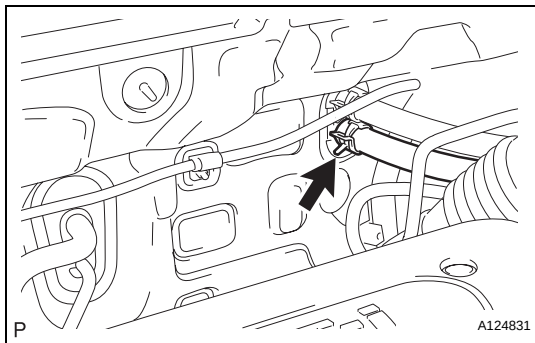
- (a) Remove the 2 bolts, nut and battery carrier bracket.

**24. DISCONNECT UNION TO CONNECTOR TUBE HOSE**

- (a) Disconnect the 2 union to connector tube hoses from the booster vacuum tube.

**25. DISCONNECT HEATER WATER INLET HOSE**

- (a) Disconnect the heater water inlet hose from the heater unit.

**26. DISCONNECT HEATER WATER OUTLET HOSE**

- (a) Disconnect the heater water outlet hose from the heater unit.

27. DISCONNECT FUEL TUBE (See page [FU-10](#))**28. REMOVE THROTTLE BODY (See page [ES-412](#))****29. DISCONNECT NO. 2 VENTILATION HOSE (See page [FU-10](#))****30. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY (See page [FU-10](#))****31. REMOVE INTAKE MANIFOLD (See page [ES-419](#))****32. REMOVE INTAKE MANIFOLD INSULATOR (See page [ES-420](#))****33. REMOVE TRANSAXLE CONTROL CABLE ASSEMBLY**

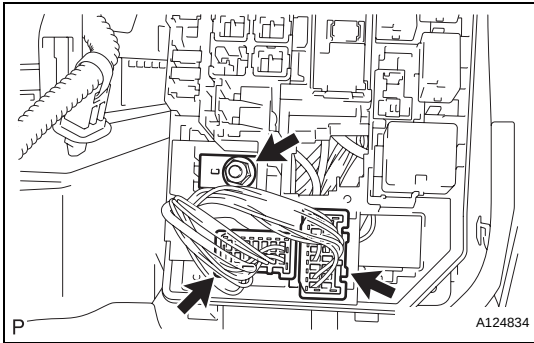
- (a) Remove the transaxle control cable for U241E (2WD) (see page [AX-129](#)).
(b) Remove the transaxle control cable for U140F (4WD) (see page [AX-129](#)).

34. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page [EM-6](#))**35. REMOVE FAN AND GENERATOR V BELT (See page [EM-6](#))****36. REMOVE GENERATOR ASSEMBLY (See page [CH-9](#))****37. REMOVE COOLER COMPRESSOR ASSEMBLY**

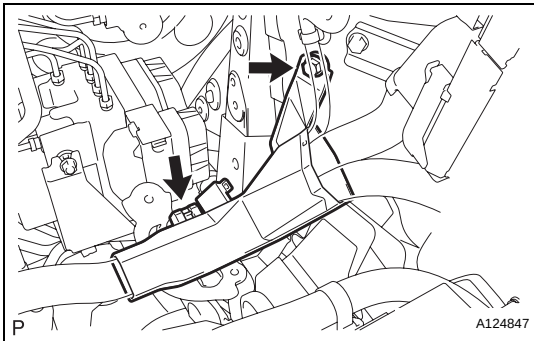
- (a) Remove the cooler compressor (see page [AC-216](#)).
HINT:
Disconnect the compressor together with the low-pressure and high-pressure hoses, then secure it to the vehicle side using rope.

38. REMOVE ECM (See page [ES-429](#))**39. DISCONNECT ENGINE WIRE**

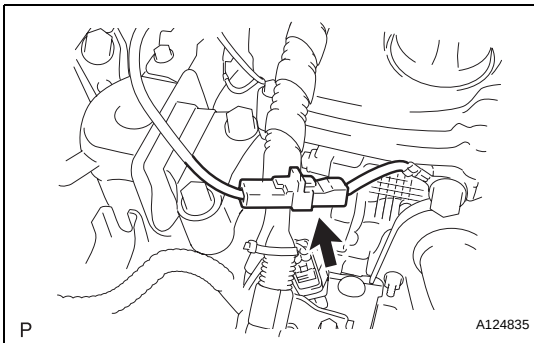
- (a) Remove the engine room relay block cover.



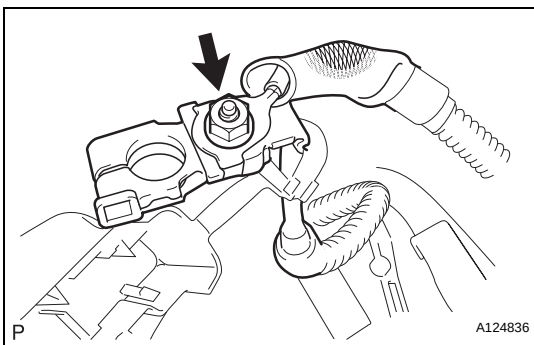
- (b) Remove the nut and disconnect the 2 engine wire connectors.



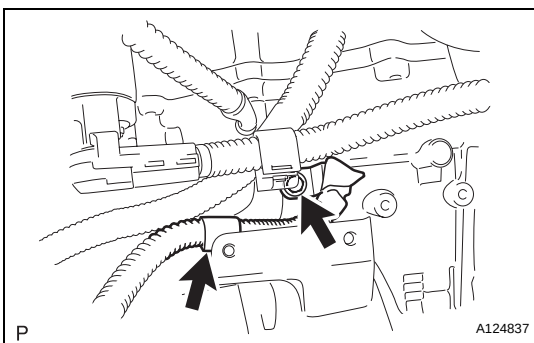
- (c) Remove the bolt and engine wire cover. Then disconnect the engine wire from the engine wire cover.



- (d) Disconnect the ground cable connector.



- (e) Remove the nut from the positive (+) battery terminal to disconnect the engine wire.



- (f) Disconnect the ground cable from the clamp located near the starter.
(g) Remove the bolt and ground cable located near the starter.

40. REMOVE FRONT EXHAUST PIPE ASSEMBLY (See page [EX-3](#))

41. REMOVE FRONT DRIVE SHAFT ASSEMBLY

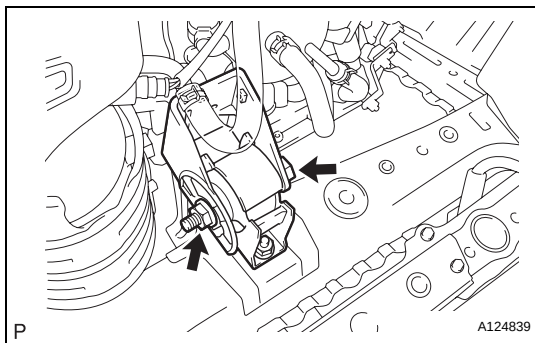
- (a) Remove the front drive shaft (for 2WD) (see page [DS-7](#)).

- (b) Remove the front drive shaft (for 4WD) (see page [DS-40](#)).

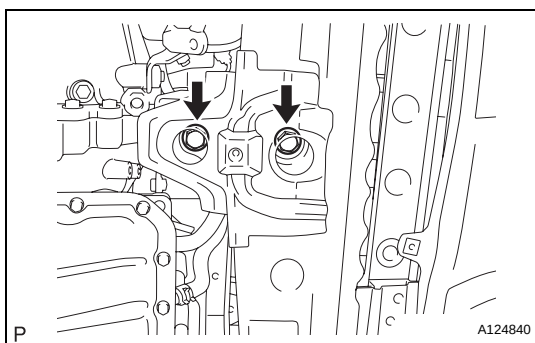
42. REMOVE PROPELLER SHAFT ASSEMBLY (for 4WD)
(See page [PR-3](#))

43. REMOVE ENGINE MOUNTING INSULATOR FR

- (a) Remove the through bolt and nut.

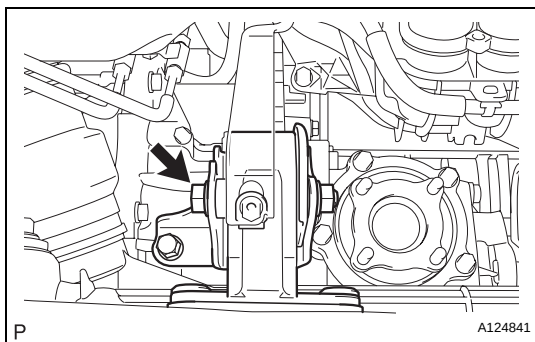


- (b) Remove the 2 bolts and engine mounting insulator FR.

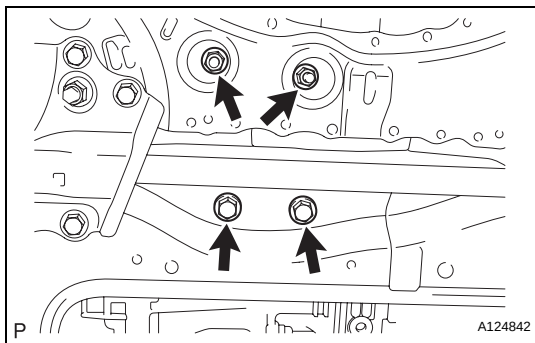


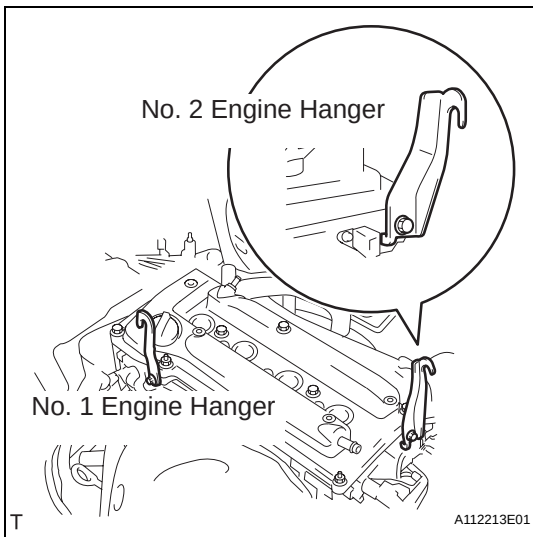
44. REMOVE ENGINE MOUNTING INSULATOR RR

- (a) Remove the through bolt.



- (b) Remove the 2 nuts, 2 bolts and engine mounting insulator RR.



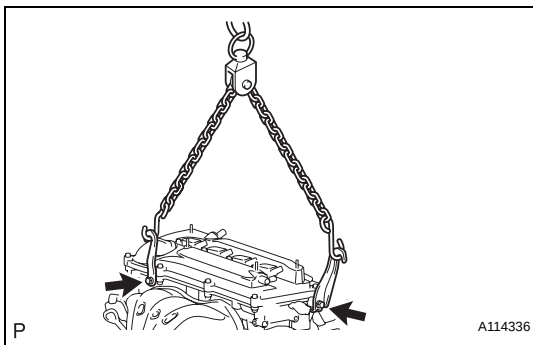
**45. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**

- (a) Install the No. 1 and No. 2 engine hangers with the bolts as shown in the illustration.

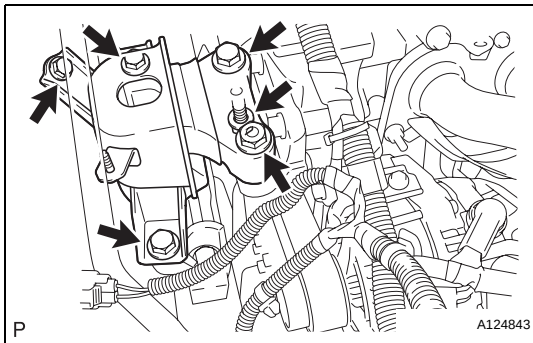
Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

Part No.

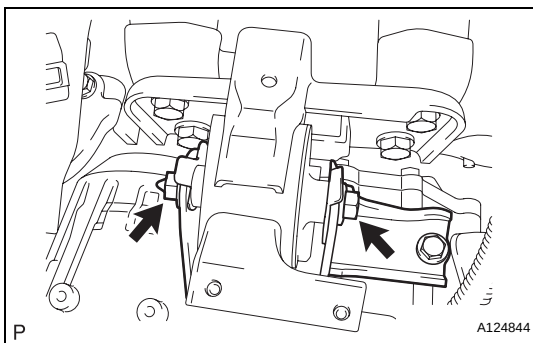
Item	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020



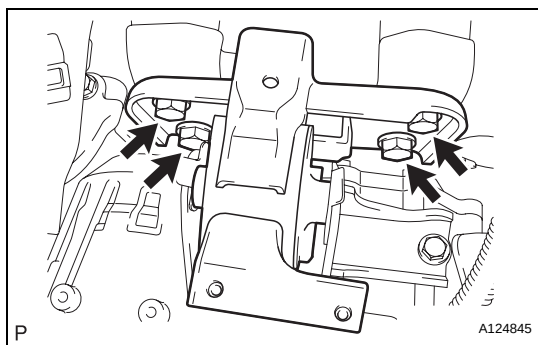
- (b) Attach the sling device to the engine hangers and chain block.
- (c) Carefully remove the engine with transaxle from the vehicle.

**46. REMOVE ENGINE MOUNTING INSULATOR RH**

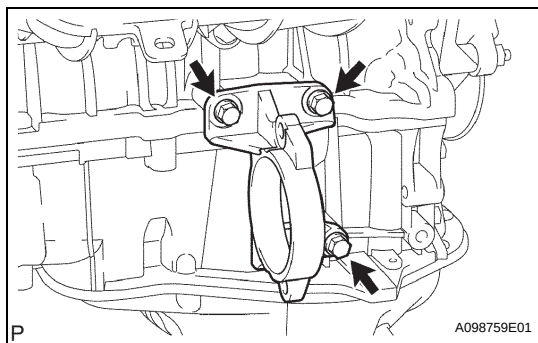
- (a) Remove the 2 nuts, 4 bolts and engine mounting insulator RH.

**47. REMOVE ENGINE MOUNTING INSULATOR LH**

- (a) Remove the through bolt and nut.

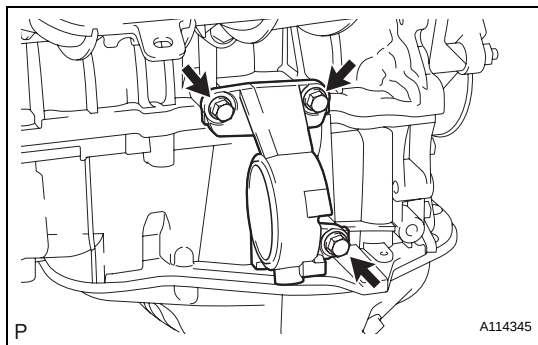


- (b) Remove the 4 bolts and engine mounting insulator LH.



48. REMOVE DRIVE SHAFT BEARING BRACKET (for 2WD)

- (a) Remove the 3 bolts and bracket.



49. REMOVE DRIVE SHAFT BEARING BRACKET (for 4WD)

- (a) Remove the 3 bolts and bracket.

50. REMOVE TRANSFER ASSEMBLY (for 4WD) (See page [TF-59](#))

51. REMOVE STARTER ASSEMBLY (See page [ST-7](#))

52. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY

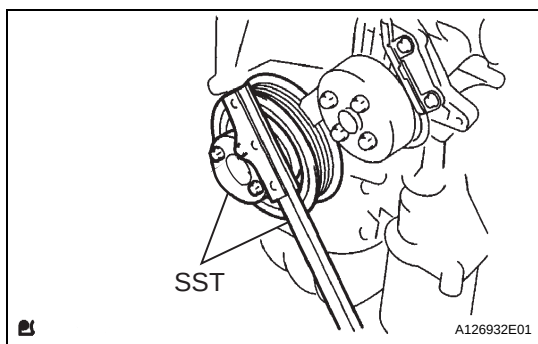
- (a) Remove the automatic transaxle for U241E (2WD) (see page [AX-147](#)).
 (b) Remove the automatic transaxle for U140F (4WD) (see page [AX-148](#)).

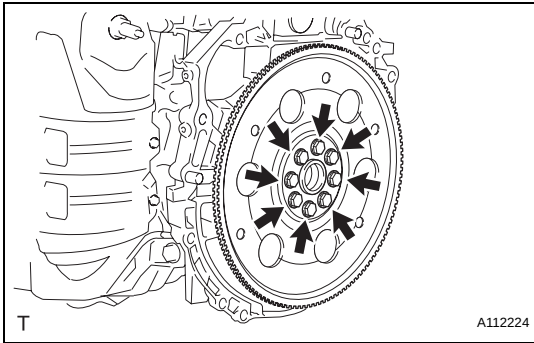
53. REMOVE TORQUE CONVERTER CLUTCH ASSEMBLY

- (a) Remove the torque converter clutch for U241E (2WD) (see page [AX-148](#)).
 (b) Remove the torque converter clutch for U140F (4WD) (see page [AX-149](#)).

54. REMOVE DRIVE PLATE SUB-ASSEMBLY

- (a) Using SST, hold the crankshaft.
SST 09213-54015 (91651-60855), 09330-00021

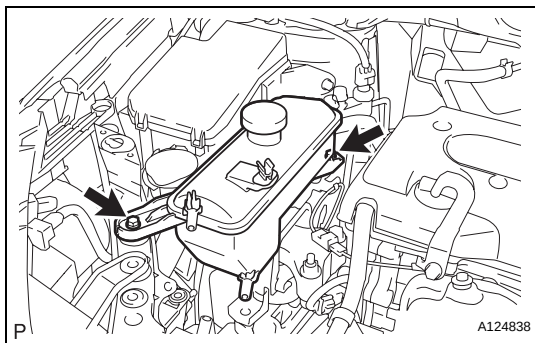


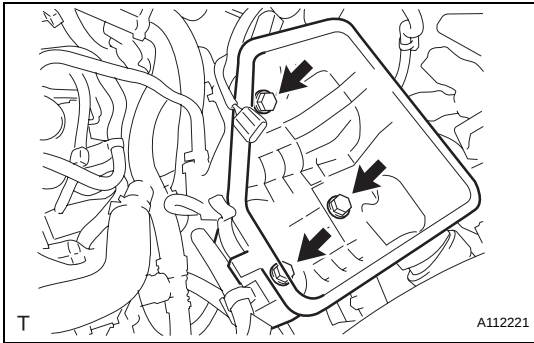


- (b) Remove the 8 bolts, rear spacer, drive plate and front spacer.

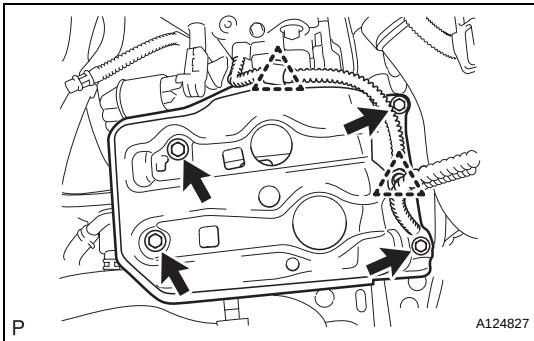
REMOVAL

1. DISCHARGE FUEL SYSTEM PRESSURE (See page [FU-9](#))
2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL
CAUTION:
Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
3. REMOVE HOOD SUB-ASSEMBLY (See page [ED-4](#))
4. REMOVE RADIATOR SUPPORT OPENING COVER
5. REMOVE BATTERY CLAMP SUB-ASSEMBLY
 - (a) Loosen the bolt and nut, and remove the battery clamp.
6. REMOVE BATTERY
7. REMOVE BATTERY TRAY
8. REMOVE FRONT WHEEL
9. REMOVE NO. 1 ENGINE UNDER COVER
10. REMOVE NO. 2 ENGINE UNDER COVER
11. REMOVE FRONT FENDER APRON RH
12. REMOVE NO. 1 ENGINE COVER (See page [EM-22](#))
13. DRAIN ENGINE COOLANT (See page [CO-6](#))
14. DRAIN AUTOMATIC TRANSAXLE FLUID
 - (a) Drain automatic transaxle fluid for U241E (2WD) (see page [AX-146](#)).
 - (b) Drain automatic transaxle fluid for U140F (4WD) (see page [AX-147](#)).
15. REMOVE RADIATOR ASSEMBLY
 - (a) Remove the radiator (see page [CO-29](#)).
16. REMOVE RADIATOR RESERVOIR
 - (a) Remove the 2 bolts and reservoir.
17. REMOVE PURGE VSV (See page [EC-15](#))
18. REMOVE AIR CLEANER CAP (See page [ES-411](#))
19. REMOVE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

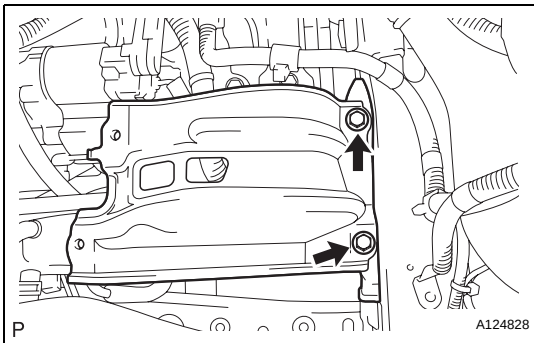


**20. REMOVE AIR CLEANER CASE SUB-ASSEMBLY**

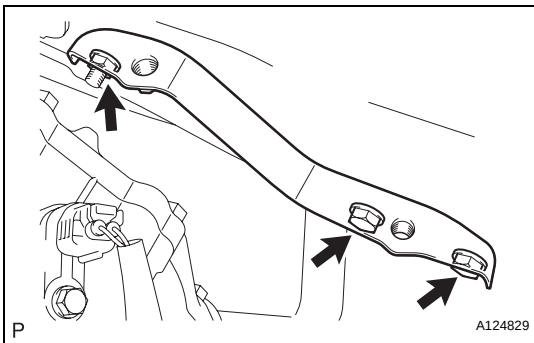
- (a) Remove the 3 bolts from the air cleaner case.
- (b) Disconnect the case from the NO. 1 air cleaner inlet.

**21. REMOVE FRONT BATTERY CARRIER**

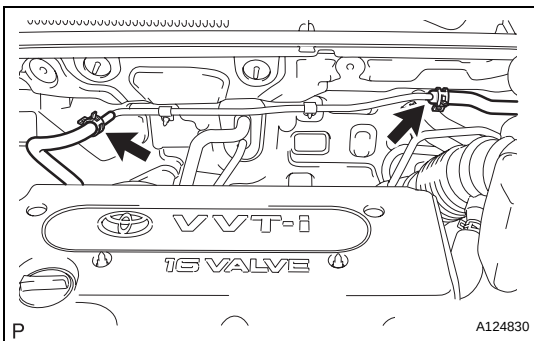
- (a) Disconnect the 2 clamps of the engine wire.
- (b) Remove the 4 bolts and front battery carrier.

**22. REMOVE BATTERY BRACKET REINFORCEMENT**

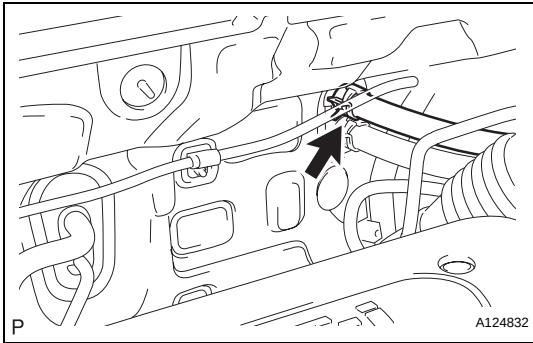
- (a) Remove the 2 bolts and battery bracket reinforcement.

**23. REMOVE BATTERY CARRIER BRACKET**

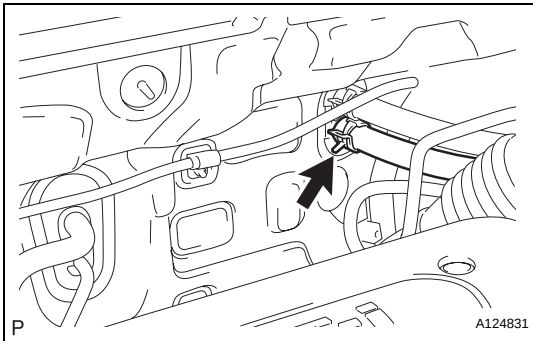
- (a) Remove the 2 bolts, nut and battery carrier bracket.

**24. DISCONNECT UNION TO CONNECTOR TUBE HOSE**

- (a) Disconnect the 2 union to connector tube hoses from the booster vacuum tube.

**25. DISCONNECT HEATER WATER INLET HOSE**

- (a) Disconnect the heater water inlet hose from the heater unit.

**26. DISCONNECT HEATER WATER OUTLET HOSE**

- (a) Disconnect the heater water outlet hose from the heater unit.

27. DISCONNECT FUEL TUBE (See page [FU-10](#))**28. REMOVE THROTTLE BODY (See page [ES-412](#))****29. DISCONNECT NO. 2 VENTILATION HOSE (See page [FU-10](#))****30. REMOVE FUEL DELIVERY PIPE SUB-ASSEMBLY (See page [FU-10](#))****31. REMOVE INTAKE MANIFOLD (See page [ES-419](#))****32. REMOVE INTAKE MANIFOLD INSULATOR (See page [ES-420](#))****33. REMOVE TRANSAXLE CONTROL CABLE ASSEMBLY**

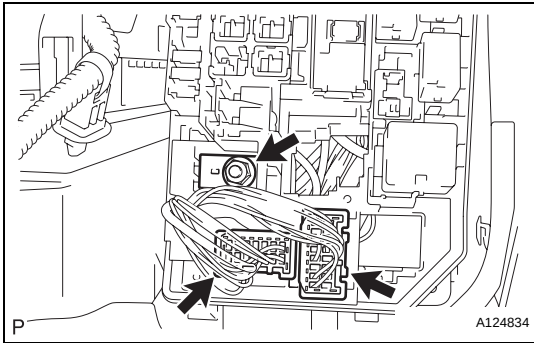
- (a) Remove the transaxle control cable for U241E (2WD) (see page [AX-129](#)).
(b) Remove the transaxle control cable for U140F (4WD) (see page [AX-129](#)).

34. REMOVE FRONT SUSPENSION MEMBER REINFORCEMENT RH (See page [EM-6](#))**35. REMOVE FAN AND GENERATOR V BELT (See page [EM-6](#))****36. REMOVE GENERATOR ASSEMBLY (See page [CH-9](#))****37. REMOVE COOLER COMPRESSOR ASSEMBLY**

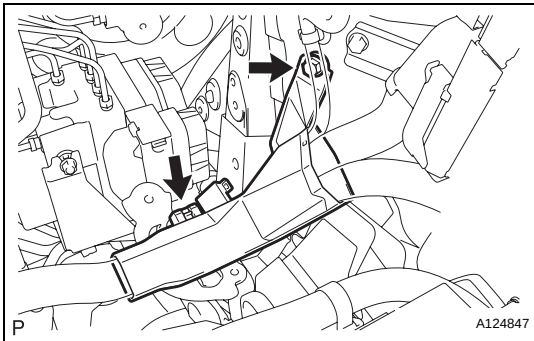
- (a) Remove the cooler compressor (see page [AC-216](#)).
HINT:
Disconnect the compressor together with the low-pressure and high-pressure hoses, then secure it to the vehicle side using rope.

38. REMOVE ECM (See page [ES-429](#))**39. DISCONNECT ENGINE WIRE**

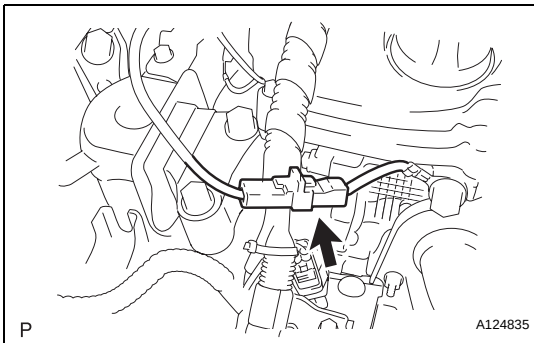
- (a) Remove the engine room relay block cover.



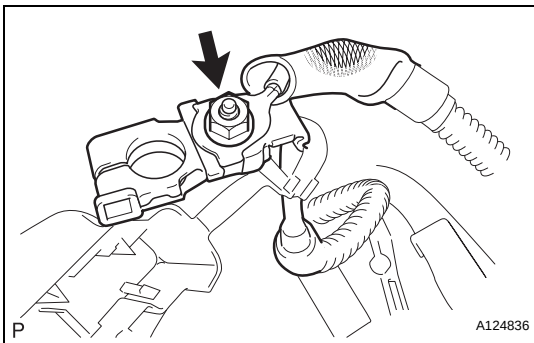
- (b) Remove the nut and disconnect the 2 engine wire connectors.



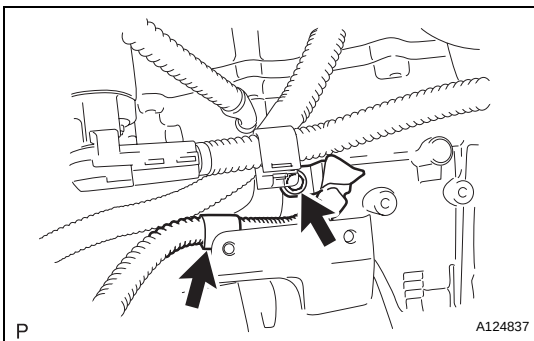
- (c) Remove the bolt and engine wire cover. Then disconnect the engine wire from the engine wire cover.



- (d) Disconnect the ground cable connector.



- (e) Remove the nut from the positive (+) battery terminal to disconnect the engine wire.



- (f) Disconnect the ground cable from the clamp located near the starter.
 (g) Remove the bolt and ground cable located near the starter.

40. REMOVE FRONT EXHAUST PIPE ASSEMBLY (See page [EX-3](#))

41. REMOVE FRONT DRIVE SHAFT ASSEMBLY

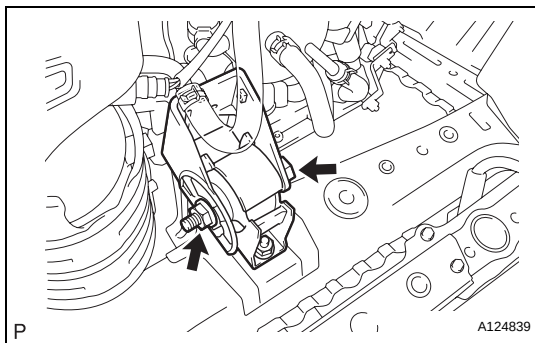
- (a) Remove the front drive shaft (for 2WD) (see page [DS-7](#)).

- (b) Remove the front drive shaft (for 4WD) (see page [DS-40](#)).

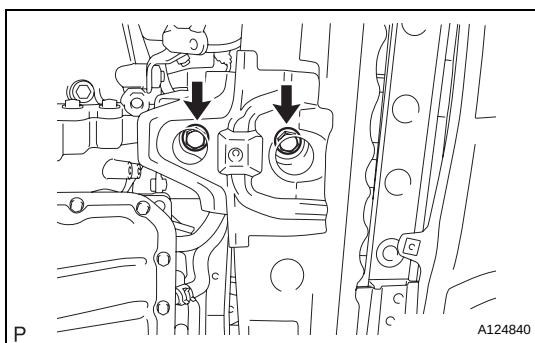
42. REMOVE PROPELLER SHAFT ASSEMBLY (for 4WD)
(See page [PR-3](#))

43. REMOVE ENGINE MOUNTING INSULATOR FR

- (a) Remove the through bolt and nut.

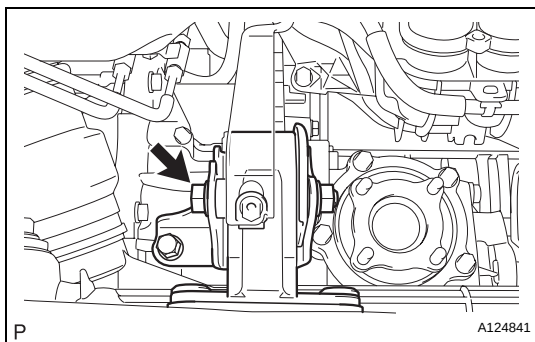


- (b) Remove the 2 bolts and engine mounting insulator FR.

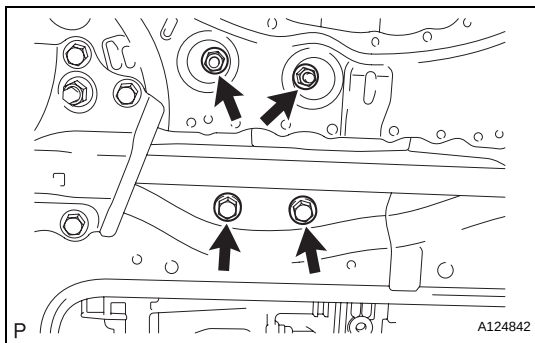


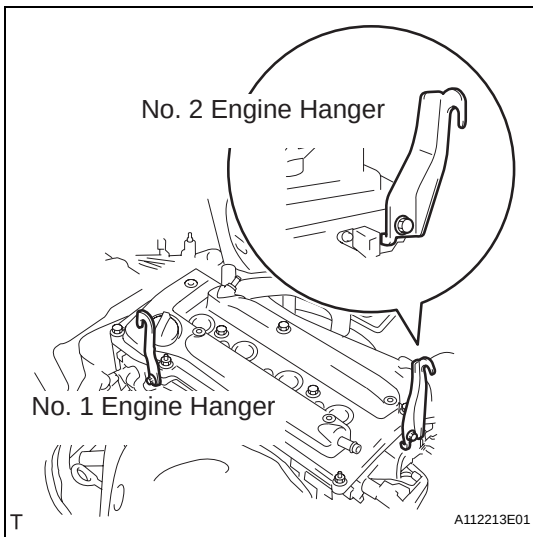
44. REMOVE ENGINE MOUNTING INSULATOR RR

- (a) Remove the through bolt.



- (b) Remove the 2 nuts, 2 bolts and engine mounting insulator RR.



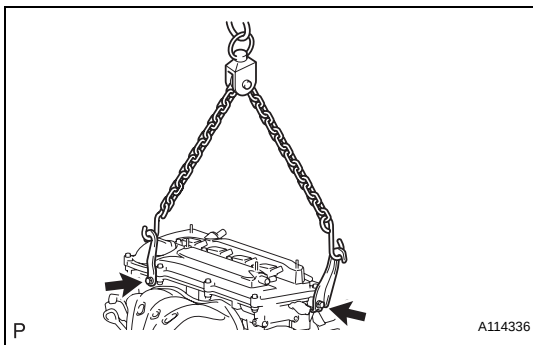
**45. REMOVE ENGINE ASSEMBLY WITH TRANSAXLE**

- (a) Install the No. 1 and No. 2 engine hangers with the bolts as shown in the illustration.

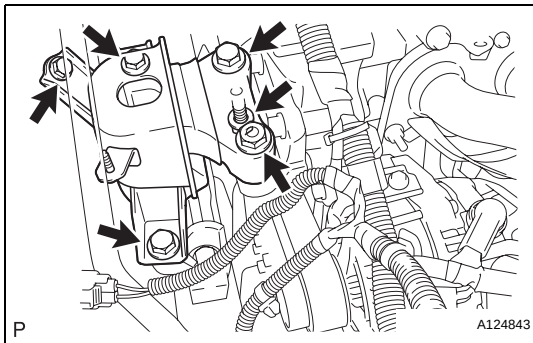
Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)

Part No.

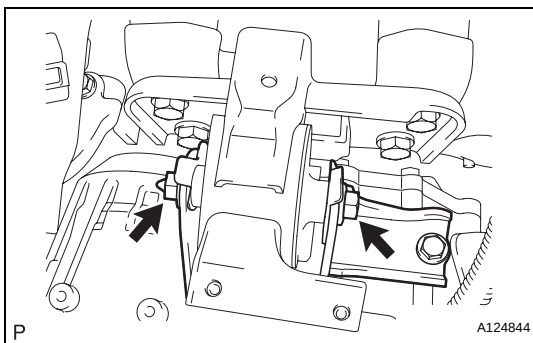
Item	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020



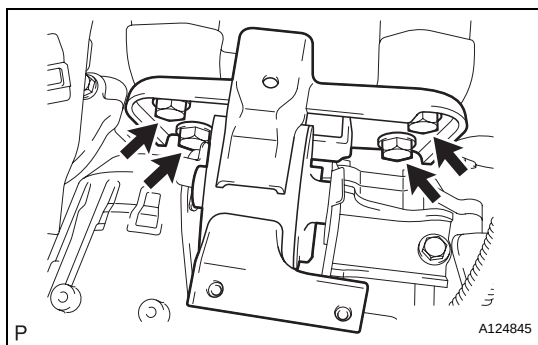
- (b) Attach the sling device to the engine hangers and chain block.
- (c) Carefully remove the engine with transaxle from the vehicle.

EM**46. REMOVE ENGINE MOUNTING INSULATOR RH**

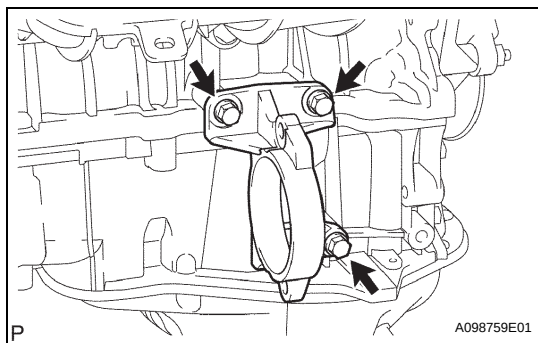
- (a) Remove the 2 nuts, 4 bolts and engine mounting insulator RH.

**47. REMOVE ENGINE MOUNTING INSULATOR LH**

- (a) Remove the through bolt and nut.

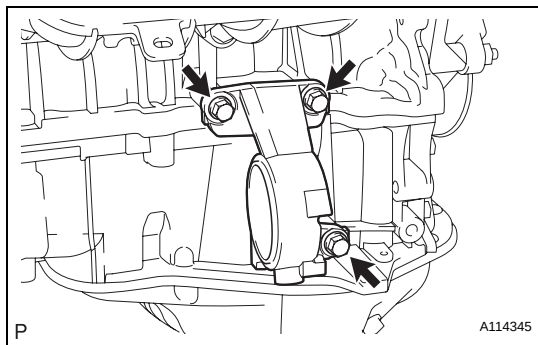


- (b) Remove the 4 bolts and engine mounting insulator LH.



48. REMOVE DRIVE SHAFT BEARING BRACKET (for 2WD)

- (a) Remove the 3 bolts and bracket.



49. REMOVE DRIVE SHAFT BEARING BRACKET (for 4WD)

- (a) Remove the 3 bolts and bracket.

50. REMOVE TRANSFER ASSEMBLY (for 4WD) (See page [TF-59](#))

51. REMOVE STARTER ASSEMBLY (See page [ST-7](#))

52. REMOVE AUTOMATIC TRANSAXLE ASSEMBLY

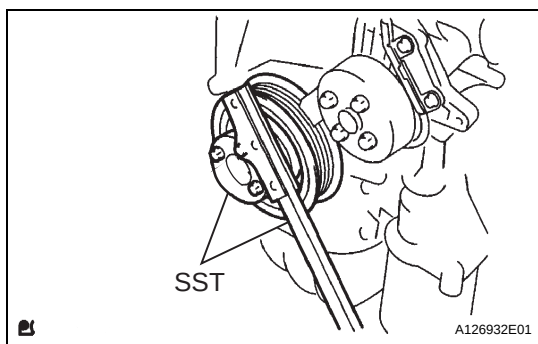
- (a) Remove the automatic transaxle for U241E (2WD) (see page [AX-147](#)).
 (b) Remove the automatic transaxle for U140F (4WD) (see page [AX-148](#)).

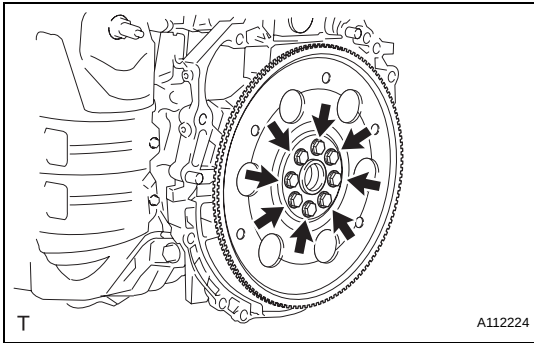
53. REMOVE TORQUE CONVERTER CLUTCH ASSEMBLY

- (a) Remove the torque converter clutch for U241E (2WD) (see page [AX-148](#)).
 (b) Remove the torque converter clutch for U140F (4WD) (see page [AX-149](#)).

54. REMOVE DRIVE PLATE SUB-ASSEMBLY

- (a) Using SST, hold the crankshaft.
SST 09213-54015 (91651-60855), 09330-00021





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

INSTALLATION

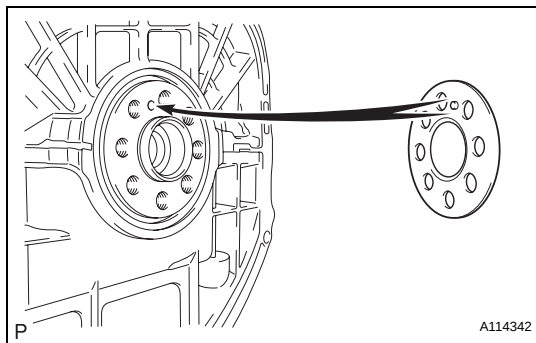
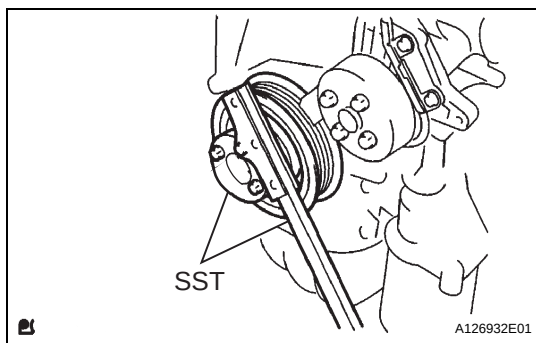
1. INSTALL DRIVE PLATE SUB-ASSEMBLY

- (a) Clean the 8 bolts and 8 bolt holes.
- (b) Apply adhesive to 2 or 3 threads of the 8 bolts.

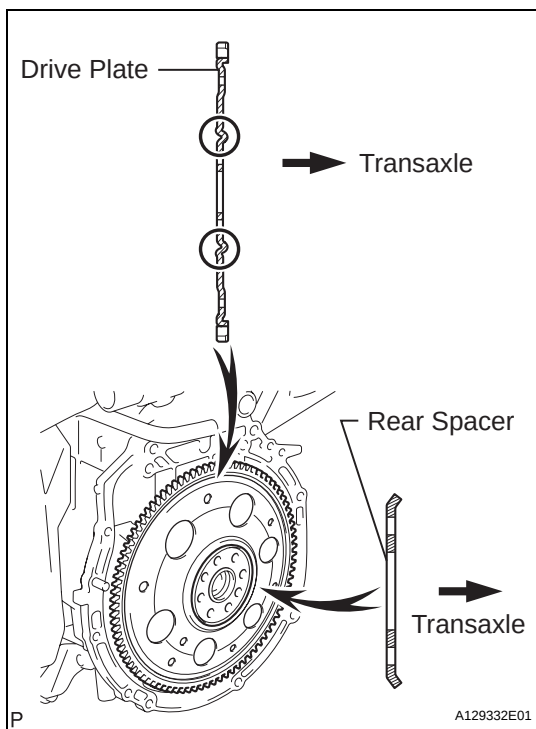
Adhesive:

Toyota Genuine Adhesive 1342, Three Bond 1342 or Equivalent

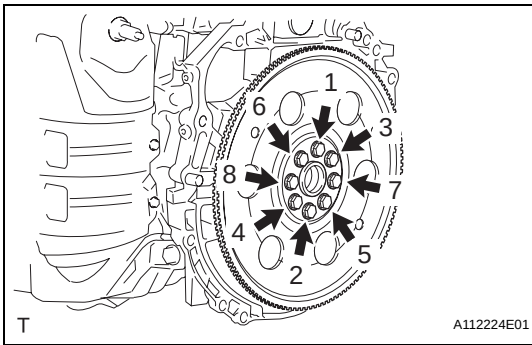
- (c) Using SST, hold the crankshaft.
SST 09213-54015 (91651-60855), 09330-00021



- (d) Install the front spacer.
HINT:
Align the pin of the front spacer with the pin hole of the crankshaft.



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



- (f) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 98 N*m (1,000 kgf*cm, 72 ft.*lbf)

2. INSTALL TORQUE CONVERTER CLUTCH ASSEMBLY

- (a) Install the torque converter clutch for U241E (2WD) (see page [AX-148](#)).
 (b) Install the torque converter clutch for U140F (4WD) (see page [AX-149](#)).

3. INSTALL AUTOMATIC TRANSAXLE ASSEMBLY

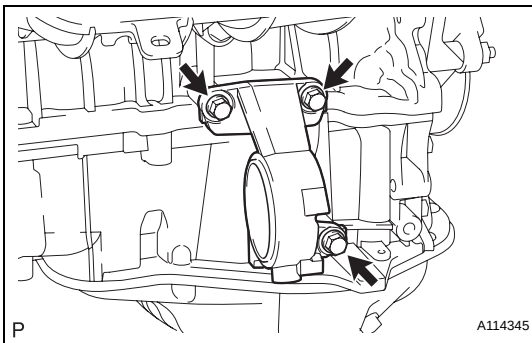
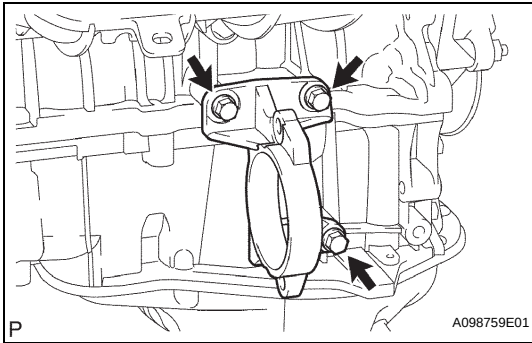
- (a) Install the automatic transaxle for U241E (2WD) (see page [AX-149](#)).
 (b) Install the automatic transaxle for U140F (4WD) (see page [AX-150](#)).

4. INSTALL STARTER ASSEMBLY (See page [ST-14](#))

5. INSTALL TRANSFER ASSEMBLY (for 4WD) (See page [TF-75](#))

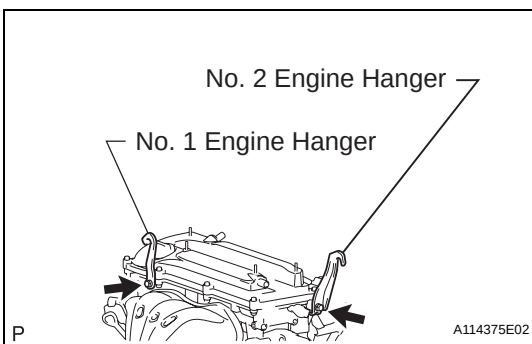
6. INSTALL DRIVE SHAFT BEARING BRACKET (for 2WD)

- (a) Install the bracket with the 3 bolts.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)



7. INSTALL DRIVE SHAFT BEARING BRACKET (for 4WD)

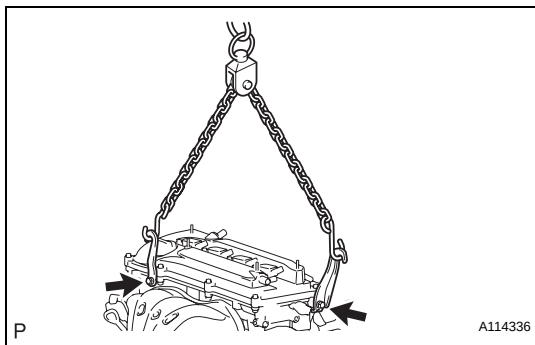
- (a) Install the bracket with the 3 bolts.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)



8. INSTALL ENGINE HANGER

- (a) Install the No. 1 and No. 2 engine hangers.
Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)
Part No.

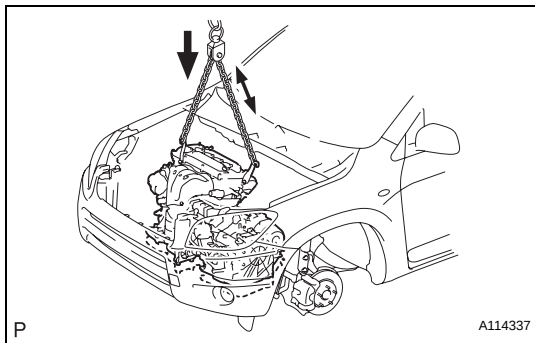
ITEM	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020



- (b) Attach the sling device and the engine with the chain block.

9. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

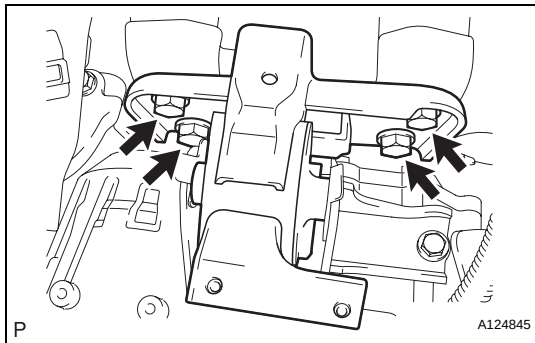
- (a) Lift the engine assembly (with transaxle) with the chain block.



- (b) Lower the engine out of the vehicle slowly and carefully.

NOTICE:

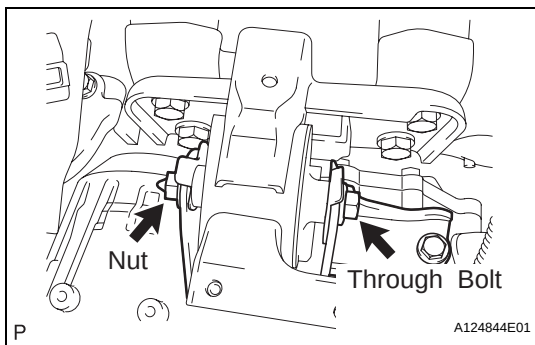
Make sure the engine is clear of all wiring, hoses and cables.



10. INSTALL ENGINE MOUNTING INSULATOR LH

- (a) Install the engine mounting insulator LH with the 4 bolts.

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

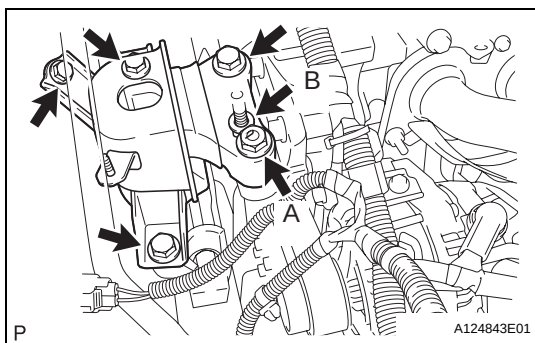


- (b) Install the engine mounting insulator LH with the through bolt and nut.

HINT:

Install the through bolt by tightening the nut.

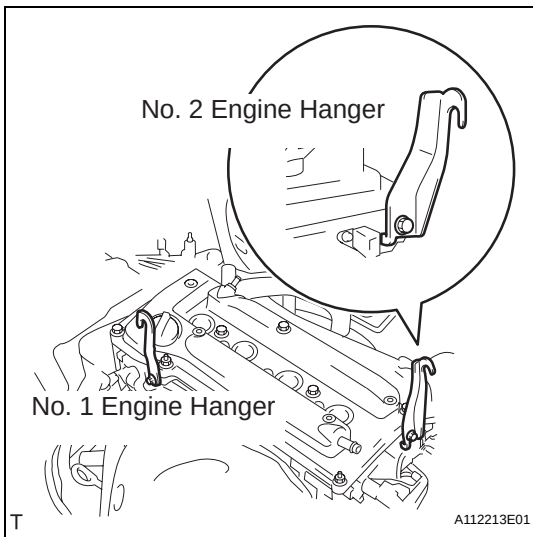
Torque: 56 N*m (571 kgf*cm, 41 ft.*lbf)



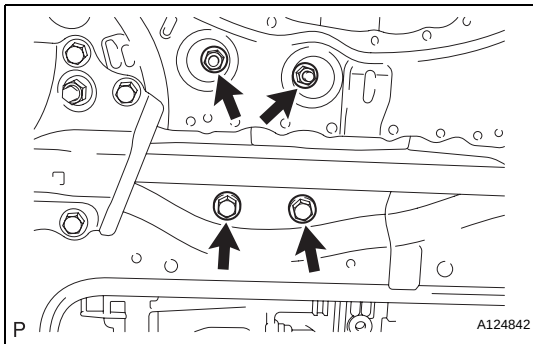
11. INSTALL ENGINE MOUNTING INSULATOR RH

- (a) Install the engine mounting insulator RH with the 2 bolts and 2 nuts.

Torque: 95 N*m (969 kgf*cm, 70 ft.*lbf) for bolt
95 N*m (969 kgf*cm, 70 ft.*lbf) for nut A
52 N*m (530 kgf*cm, 38 ft.*lbf) for nut B

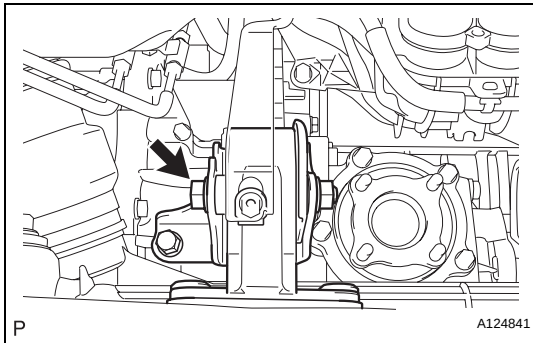
**12. REMOVE ENGINE HANGER**

- (a) Remove the No. 1 and No. 2 engine hangers.

**13. INSTALL ENGINE MOUNTING INSULATOR RR**

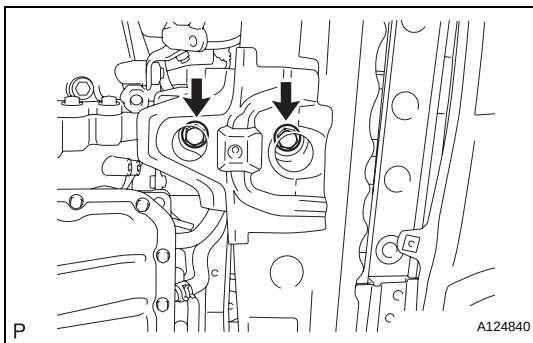
- (a) Install the engine mounting insulator RR with the 2 nuts and 2 bolts.

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



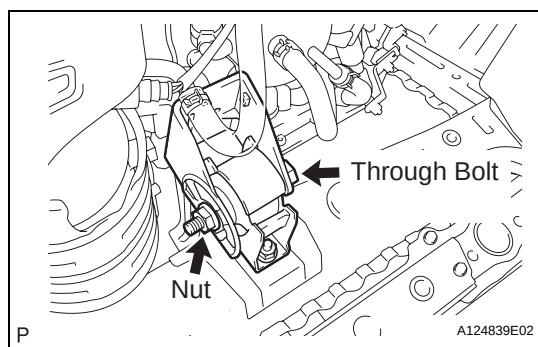
- (b) Install the through bolt which is used to secure the rear engine mounting insulator, into the rear engine mounting bracket.

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

**14. INSTALL ENGINE MOUNTING INSULATOR FR**

- (a) Install the engine mounting insulator FR with the 2 bolts.

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



- (b) Install the through bolt and nut which is used to secure the front engine mounting bracket FR.
HINT:
Install the through bolt by tightening the nut.
Torque: 145 N*m (1,479 kgf*cm, 107 ft.*lbf)

15. INSTALL PROPELLER SHAFT ASSEMBLY (for 4WD)

- (a) Install the propeller shaft (see page [PR-5](#)).

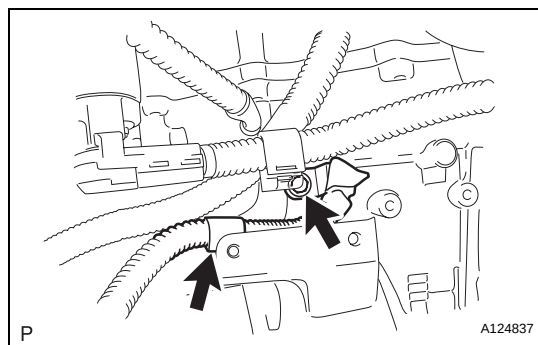
16. INSTALL FRONT DRIVE SHAFT ASSEMBLY

- (a) Install the front drive shaft RH (for 2WD) (see page [DS-32](#)).
(b) Install the front drive shaft RH (for 4WD) (see page [DS-65](#)).

17. INSTALL FRONT EXHAUST PIPE (See page [EX-4](#))

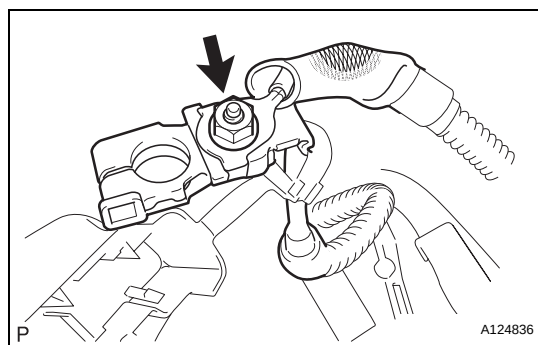
18. CONNECT ENGINE WIRE

- (a) Install the ground cable with the bolt located near the starter.
Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)
(b) Connect the ground cable to the clamp located near the starter.

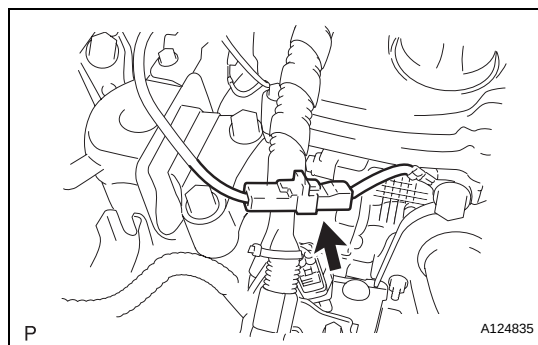


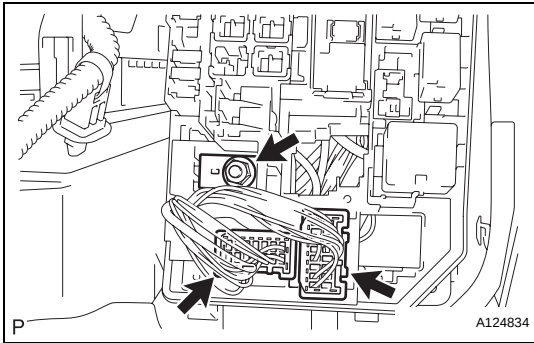
- (c) Connect the engine wire to the positive (+) battery terminal with the nut.

Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

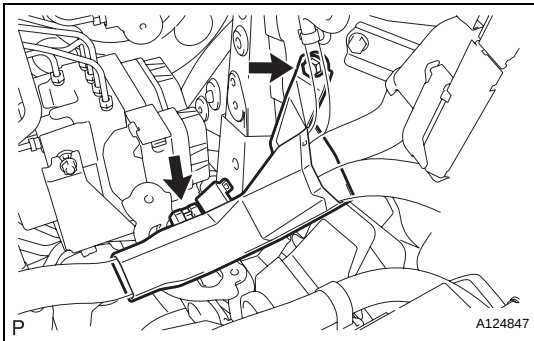


- (d) Connect the ground cable connector.



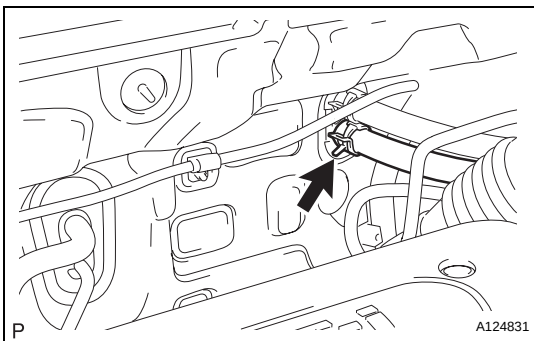


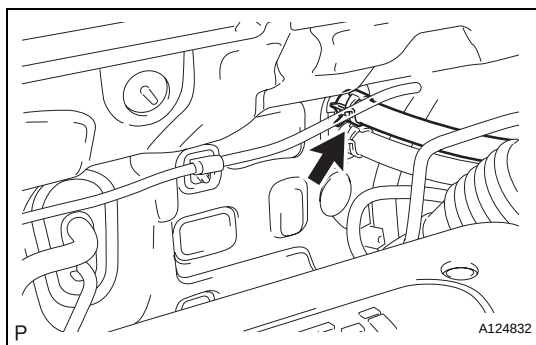
- (e) Connect the 2 engine wire connectors and install the nut.
- (f) Install the engine room relay block cover.



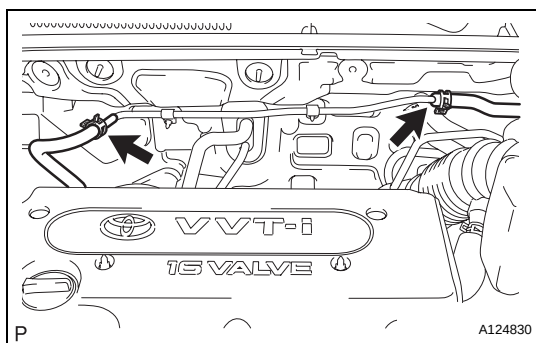
- (g) Attach the clamp of the engine wire cover.
- (h) Install the engine wire cover to with the bolt.

19. **INSTALL ECM** (See page [ES-430](#))
20. **INSTALL COOLER COMPRESSOR ASSEMBLY** (See page [AC-217](#))
21. **INSTALL GENERATOR ASSEMBLY** (See page [CH-15](#))
22. **INSTALL FAN AND GENERATOR V BELT** (See page [EM-7](#))
23. **INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH** (See page [EM-7](#))
24. **INSTALL TRANSAXLE CONTROL CABLE ASSEMBLY**
 - (a) Install the transaxle control cable for U241E (see page [AX-130](#)).
 - (b) Install the transaxle control cable for U140F (see page [AX-130](#)).
25. **INSTALL INTAKE MANIFOLD INSULATOR** (See page [ES-421](#))
26. **INSTALL INTAKE MANIFOLD** (See page [ES-421](#))
27. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** (See page [FU-13](#))
28. **CONNECT NO. 2 VENTILATION HOSE** (See page [FU-14](#))
29. **INSTALL THROTTLE BODY ASSEMBLY** (See page [ES-413](#))
30. **CONNECT FUEL TUBE** (See page [FU-14](#))
31. **CONNECT HEATER WATER OUTLET HOSE**
 - (a) Connect the heater water outlet hose to the air conditioner tube.

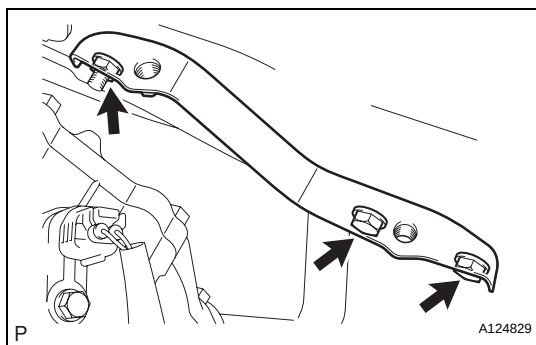


**32. CONNECT HEATER WATER INLET HOSE**

- (a) Connect the heater water inlet hose to the air conditioner tube.

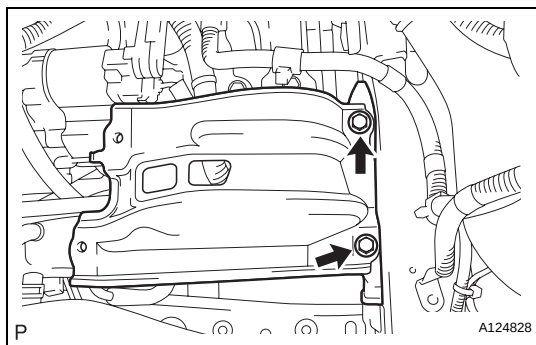
**33. CONNECT UNION TO CONNECTOR TUBE HOSE**

- (a) Connect the 2 union to connector tube hoses to the booster vacuum tube.

**34. INSTALL BATTERY CARRIER BRACKET**

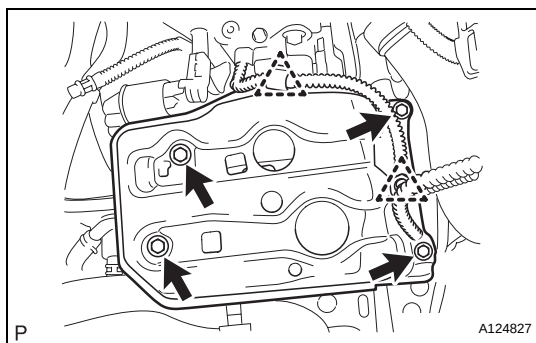
- (a) Install the battery carrier bracket with the nut and 2 bolts.

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

**35. INSTALL BATTERY BRACKET REINFORCEMENT**

- (a) Install the battery bracket reinforcement with the 2 bolts.

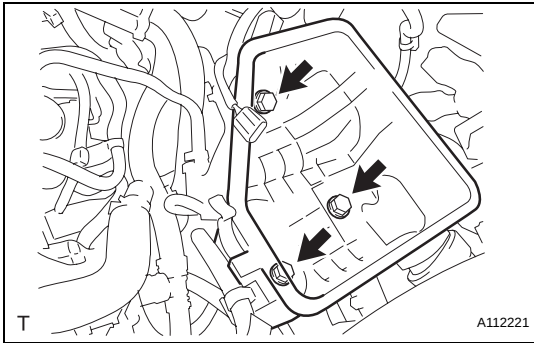
Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

**36. INSTALL FRONT BATTERY CARRIER**

- (a) Install the front battery carrier with the 4 bolts.
Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)
 (b) Connect the 2 clamps of the engine wire.

37. INSTALL AIR CLEANER CASE SUB-ASSEMBLY

- (a) Connect the air cleaner case to the No. 1 air cleaner inlet.

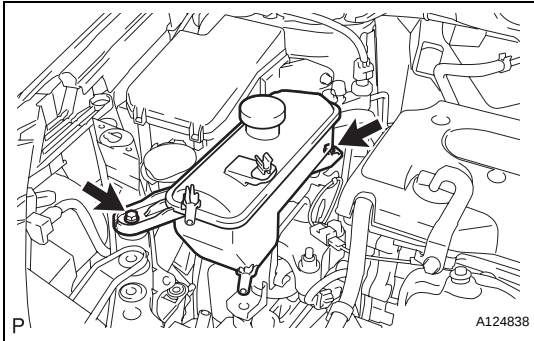


- (b) Install the air cleaner case with the 3 bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

38. INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

39. INSTALL AIR CLEANER CAP (See page [ES-413](#))

40. INSTALL PURGE VSV (See page [EC-16](#))



41. INSTALL RADIATOR RESERVOIR

- (a) Install the reservoir with the 2 bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

42. INSTALL RADIATOR ASSEMBLY

- (a) Install the radiator (see page [CO-32](#)).

43. INSTALL BATTERY TRAY

44. INSTALL BATTERY

- (a) Install the battery.
(b) Install the battery clamp with the bolt and nut.
Torque: 8.5 N*m (87 kgf*cm, 75 in.*lbf) for bolt
5.0 N*m (51 kgf*cm, 44 in.*lbf) for nut

45. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

46. ADD AUTOMATIC TRANSAXLE FLUID

- (a) Add automatic transaxle fluid for U241E (2WD) (see page [AX-151](#)).
(b) Add automatic transaxle fluid for U140F (4WD) (see page [AX-152](#)).

47. CHECK FOR FUEL LEAKS (See page [FU-14](#))

48. ADD ENGINE COOLANT (See page [CO-6](#))

49. CHECK FOR ENGINE COOLANT LEAKS

- (a) Check for engine coolant leaks (see page [CO-1](#)).

50. CHECK FOR AUTOMATIC TRANSAXLE FLUID LEAKS

51. ADJUST SHIFT LEVER POSITION

- (a) Adjust the shift lever position for U241E (2WD) (see page [AX-138](#)).
(b) Adjust the shift lever position for U140F (4WD) (see page [AX-138](#)).

52. INSTALL NO. 1 ENGINE COVER (See page [EM-43](#))

53. INSTALL FRONT FENDER APRON RH

54. INSTALL NO. 2 ENGINE UNDER COVER

55. INSTALL NO. 1 ENGINE UNDER COVER

56. INSTALL FRONT WHEEL

57. INSTALL RADIATOR SUPPORT OPENING COVER

58. INSTALL HOOD SUB-ASSEMBLY

- (a) Install the hood (see page [ED-7](#)).
- (b) Adjust the hood (see page [ED-5](#)).

59. INSPECT AND ADJUST FRONT WHEEL ALIGNMENT

- (a) Inspect and adjust the front wheel alignment (see page [SP-3](#)).

60. PERFORM REGISTRATION

- (a) When replacing the engine assembly, perform vehicle stability control system recognition in ECM (see page [CC-12](#)).

61. RESET MEMORY (for Automatic Transaxle)

- (a) When replacing the engine assembly, perform the RESET MEMORY procedure (A/T initialization) for U241E (2WD) (see page [AX-18](#)) and for U140F (4WD) (see page [AX-18](#)).

INSTALLATION

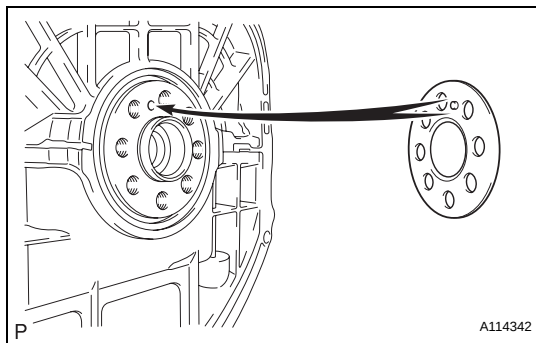
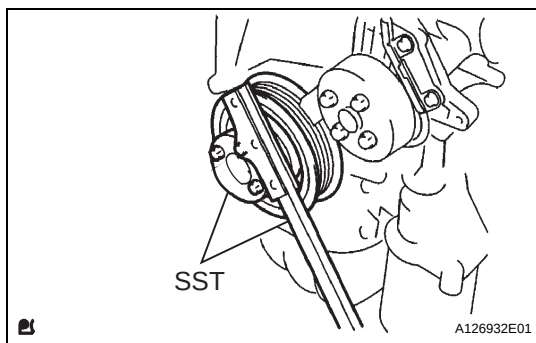
1. INSTALL DRIVE PLATE SUB-ASSEMBLY

- (a) Clean the 8 bolts and 8 bolt holes.
- (b) Apply adhesive to 2 or 3 threads of the 8 bolts.

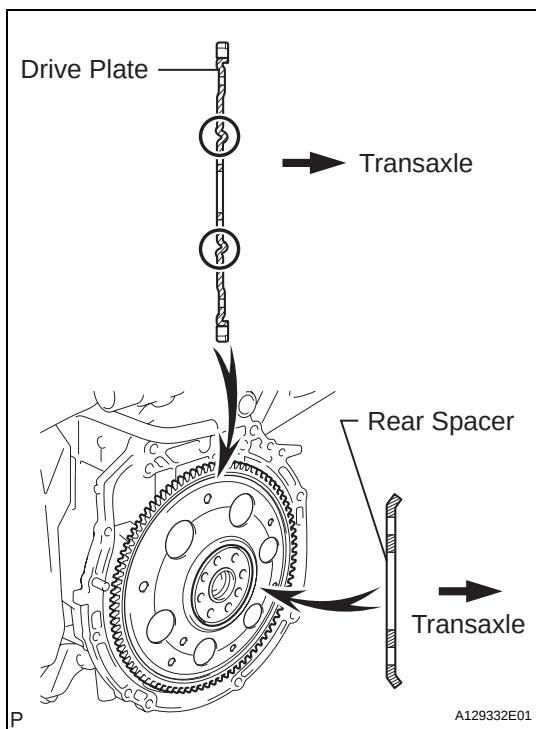
Adhesive:

Toyota Genuine Adhesive 1342, Three Bond 1342 or Equivalent

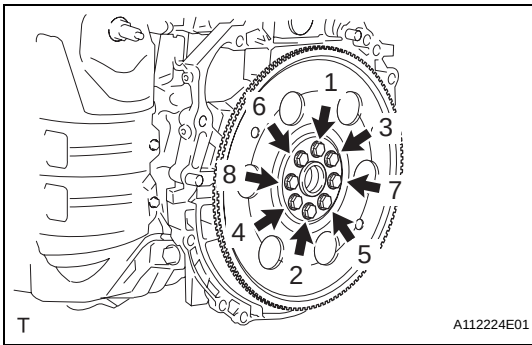
- (c) Using SST, hold the crankshaft.
SST 09213-54015 (91651-60855), 09330-00021



- (d) Install the front spacer.
HINT:
Align the pin of the front spacer with the pin hole of the crankshaft.



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



- (f) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 98 N*m (1,000 kgf*cm, 72 ft.*lbf)

2. INSTALL TORQUE CONVERTER CLUTCH ASSEMBLY

- (a) Install the torque converter clutch for U241E (2WD) (see page [AX-148](#)).
 (b) Install the torque converter clutch for U140F (4WD) (see page [AX-149](#)).

3. INSTALL AUTOMATIC TRANSAXLE ASSEMBLY

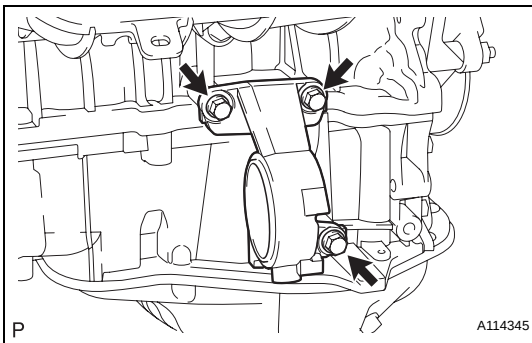
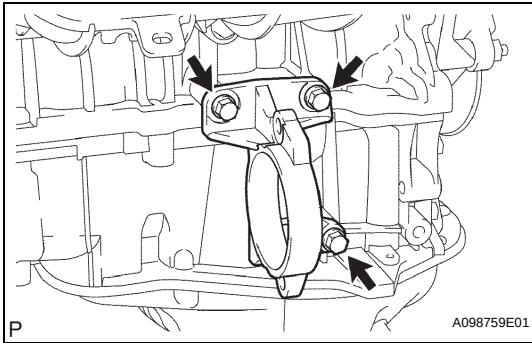
- (a) Install the automatic transaxle for U241E (2WD) (see page [AX-149](#)).
 (b) Install the automatic transaxle for U140F (4WD) (see page [AX-150](#)).

4. INSTALL STARTER ASSEMBLY (See page [ST-14](#))

5. INSTALL TRANSFER ASSEMBLY (for 4WD) (See page [TF-75](#))

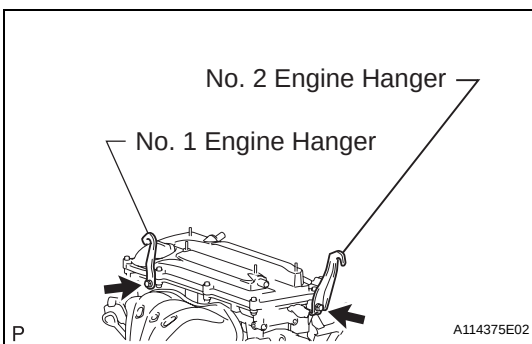
6. INSTALL DRIVE SHAFT BEARING BRACKET (for 2WD)

- (a) Install the bracket with the 3 bolts.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)



7. INSTALL DRIVE SHAFT BEARING BRACKET (for 4WD)

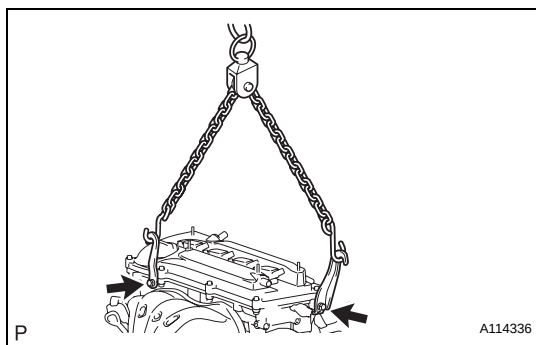
- (a) Install the bracket with the 3 bolts.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)



8. INSTALL ENGINE HANGER

- (a) Install the No. 1 and No. 2 engine hangers.
Torque: 38 N*m (387 kgf*cm, 28 ft.*lbf)
Part No.

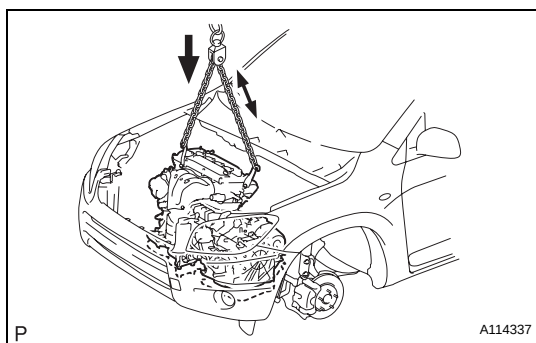
ITEM	Part No.
No. 1 engine hanger	12281-28010
No. 2 engine hanger	12282-28010
Bolt	91512-61020



- (b) Attach the sling device and the engine with the chain block.

9. INSTALL ENGINE ASSEMBLY WITH TRANSAXLE

- (a) Lift the engine assembly (with transaxle) with the chain block.



- (b) Lower the engine out of the vehicle slowly and carefully.

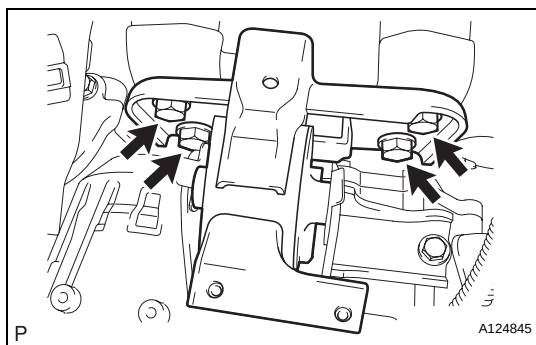
NOTICE:

Make sure the engine is clear of all wiring, hoses and cables.

10. INSTALL ENGINE MOUNTING INSULATOR LH

- (a) Install the engine mounting insulator LH with the 4 bolts.

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

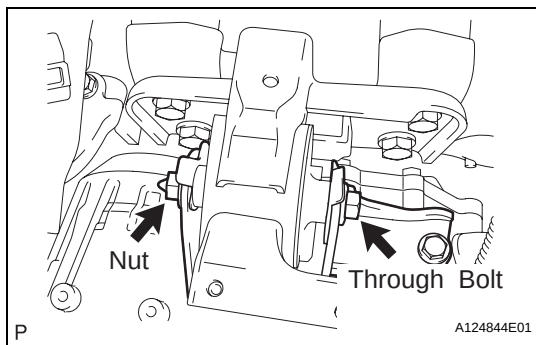


- (b) Install the engine mounting insulator LH with the through bolt and nut.

HINT:

Install the through bolt by tightening the nut.

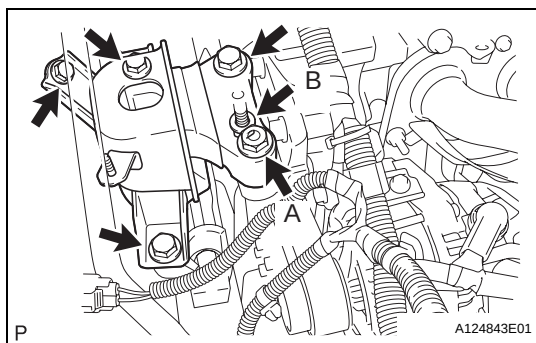
Torque: 56 N*m (571 kgf*cm, 41 ft.*lbf)

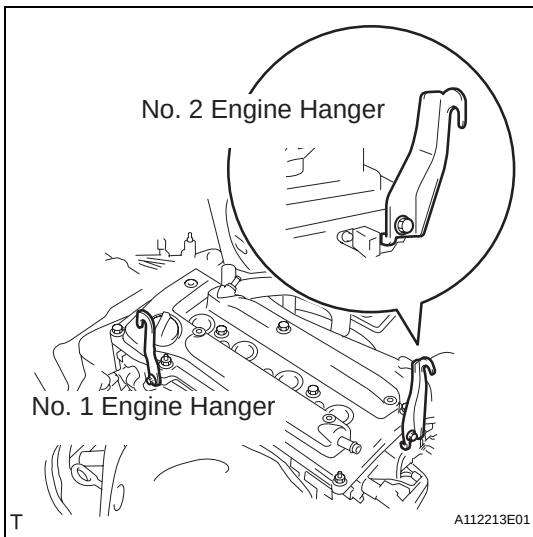


11. INSTALL ENGINE MOUNTING INSULATOR RH

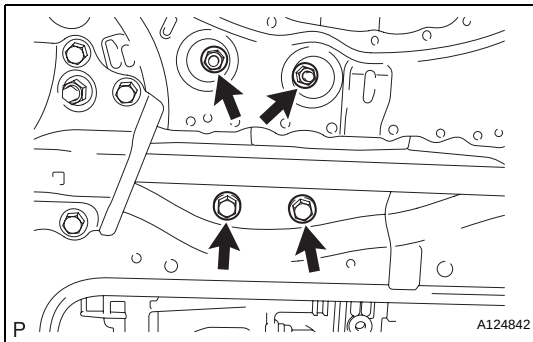
- (a) Install the engine mounting insulator RH with the 2 bolts and 2 nuts.

Torque: 95 N*m (969 kgf*cm, 70 ft.*lbf) for bolt
95 N*m (969 kgf*cm, 70 ft.*lbf) for nut A
52 N*m (530 kgf*cm, 38 ft.*lbf) for nut B



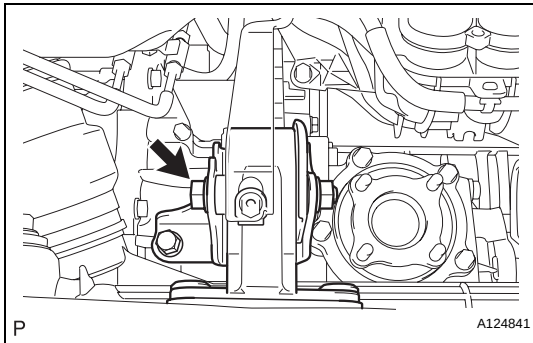
**12. REMOVE ENGINE HANGER**

- (a) Remove the No. 1 and No. 2 engine hangers.

**13. INSTALL ENGINE MOUNTING INSULATOR RR**

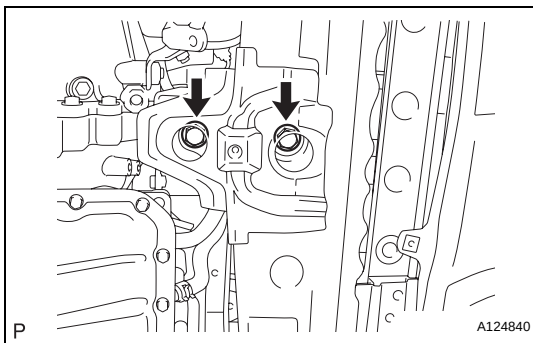
- (a) Install the engine mounting insulator RR with the 2 nuts and 2 bolts.

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



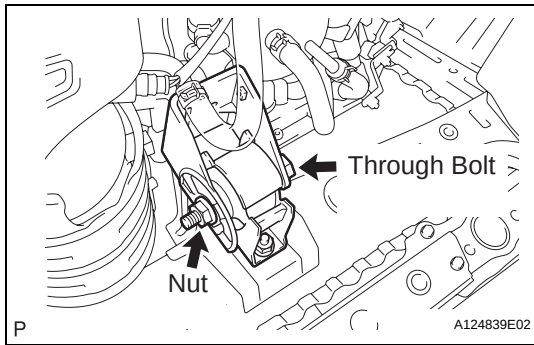
- (b) Install the through bolt which is used to secure the rear engine mounting insulator, into the rear engine mounting bracket.

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

**14. INSTALL ENGINE MOUNTING INSULATOR FR**

- (a) Install the engine mounting insulator FR with the 2 bolts.

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



- (b) Install the through bolt and nut which is used to secure the front engine mounting bracket FR.
HINT:
 Install the through bolt by tightening the nut.
Torque: 145 N*m (1,479 kgf*cm, 107 ft.*lbf)

15. INSTALL PROPELLER SHAFT ASSEMBLY (for 4WD)

- (a) Install the propeller shaft (see page [PR-5](#)).

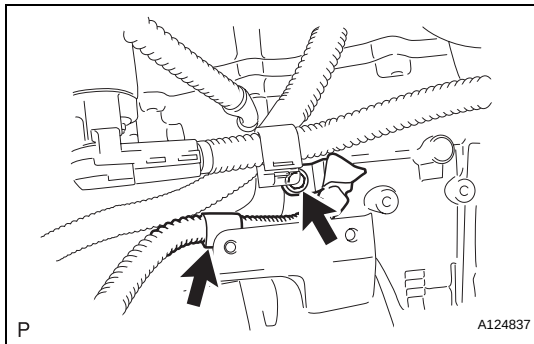
16. INSTALL FRONT DRIVE SHAFT ASSEMBLY

- (a) Install the front drive shaft RH (for 2WD) (see page [DS-32](#)).
 (b) Install the front drive shaft RH (for 4WD) (see page [DS-65](#)).

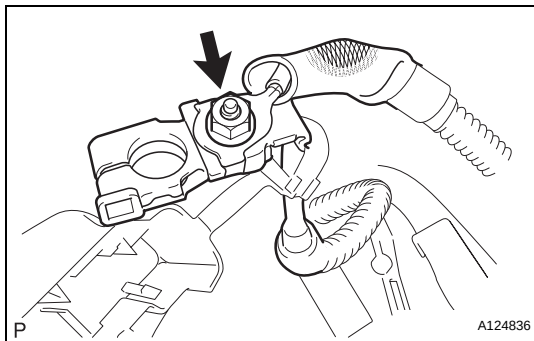
17. INSTALL FRONT EXHAUST PIPE (See page [EX-4](#))

18. CONNECT ENGINE WIRE

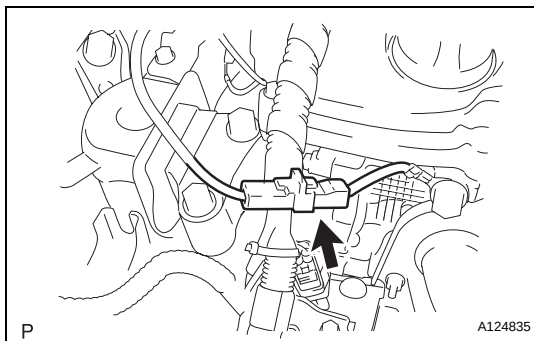
- (a) Install the ground cable with the bolt located near the starter.
Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)
 (b) Connect the ground cable to the clamp located near the starter.

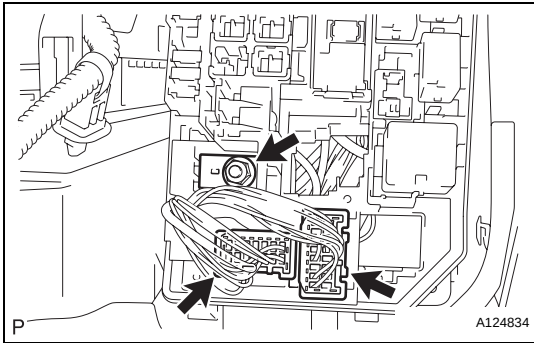


- (c) Connect the engine wire to the positive (+) battery terminal with the nut.
Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)

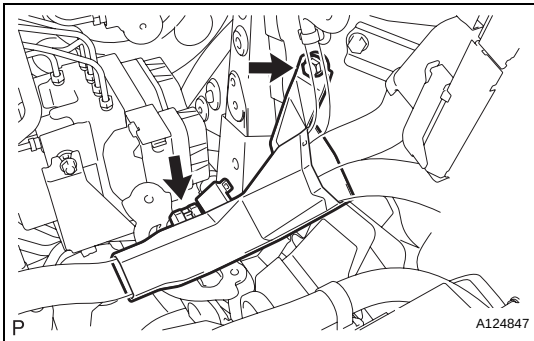


- (d) Connect the ground cable connector.



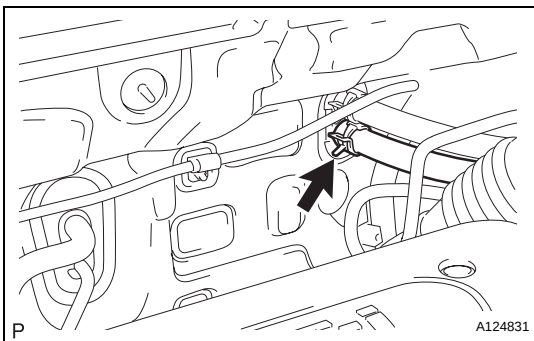


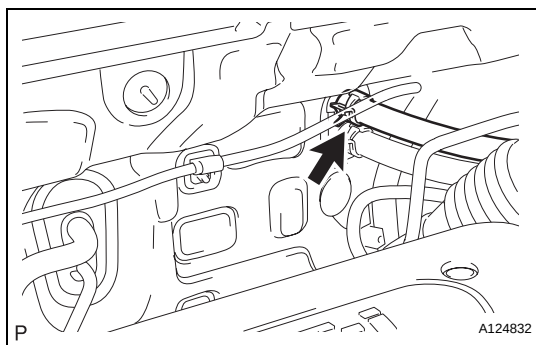
- (e) Connect the 2 engine wire connectors and install the nut.
- (f) Install the engine room relay block cover.



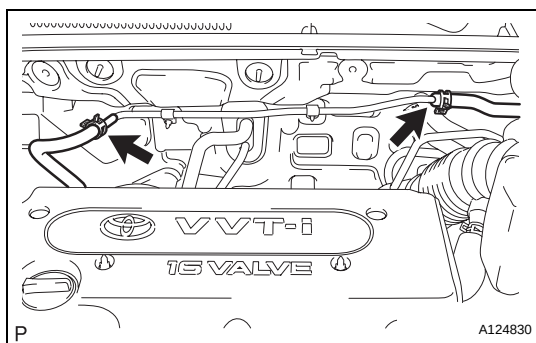
- (g) Attach the clamp of the engine wire cover.
- (h) Install the engine wire cover to with the bolt.

19. **INSTALL ECM** (See page [ES-430](#))
20. **INSTALL COOLER COMPRESSOR ASSEMBLY** (See page [AC-217](#))
21. **INSTALL GENERATOR ASSEMBLY** (See page [CH-15](#))
22. **INSTALL FAN AND GENERATOR V BELT** (See page [EM-7](#))
23. **INSTALL FRONT SUSPENSION MEMBER REINFORCEMENT RH** (See page [EM-7](#))
24. **INSTALL TRANSAXLE CONTROL CABLE ASSEMBLY**
 - (a) Install the transaxle control cable for U241E (see page [AX-130](#)).
 - (b) Install the transaxle control cable for U140F (see page [AX-130](#)).
25. **INSTALL INTAKE MANIFOLD INSULATOR** (See page [ES-421](#))
26. **INSTALL INTAKE MANIFOLD** (See page [ES-421](#))
27. **INSTALL FUEL DELIVERY PIPE SUB-ASSEMBLY** (See page [FU-13](#))
28. **CONNECT NO. 2 VENTILATION HOSE** (See page [FU-14](#))
29. **INSTALL THROTTLE BODY ASSEMBLY** (See page [ES-413](#))
30. **CONNECT FUEL TUBE** (See page [FU-14](#))
31. **CONNECT HEATER WATER OUTLET HOSE**
 - (a) Connect the heater water outlet hose to the air conditioner tube.

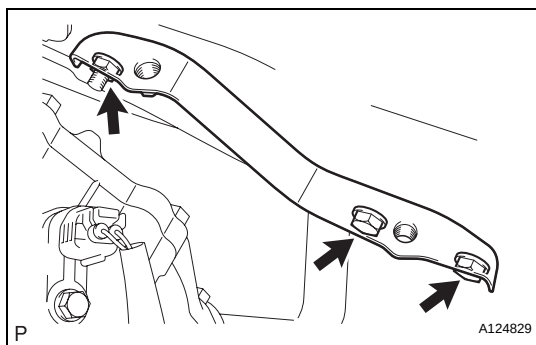


**32. CONNECT HEATER WATER INLET HOSE**

- (a) Connect the heater water inlet hose to the air conditioner tube.

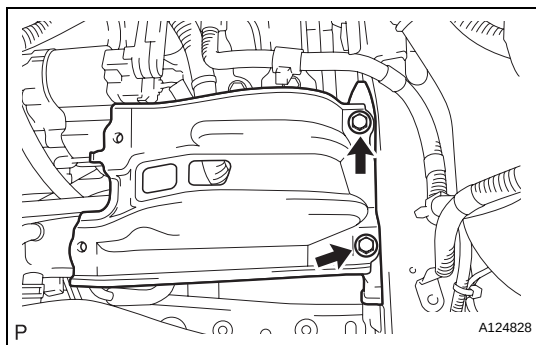
**33. CONNECT UNION TO CONNECTOR TUBE HOSE**

- (a) Connect the 2 union to connector tube hoses to the booster vacuum tube.

**34. INSTALL BATTERY CARRIER BRACKET**

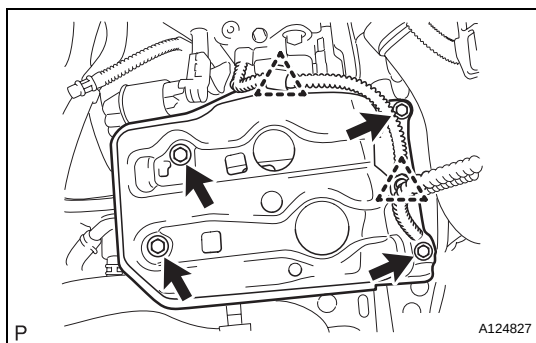
- (a) Install the battery carrier bracket with the nut and 2 bolts.

Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

**35. INSTALL BATTERY BRACKET REINFORCEMENT**

- (a) Install the battery bracket reinforcement with the 2 bolts.

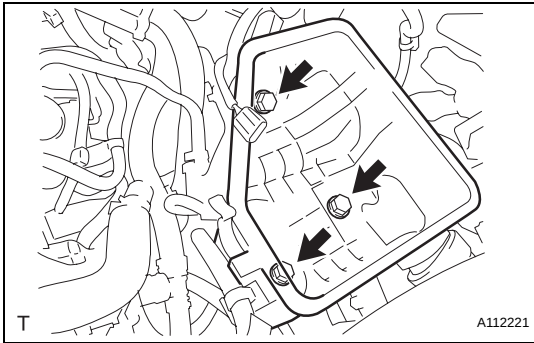
Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)

**36. INSTALL FRONT BATTERY CARRIER**

- (a) Install the front battery carrier with the 4 bolts.
Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)
(b) Connect the 2 clamps of the engine wire.

37. INSTALL AIR CLEANER CASE SUB-ASSEMBLY

- (a) Connect the air cleaner case to the No. 1 air cleaner inlet.

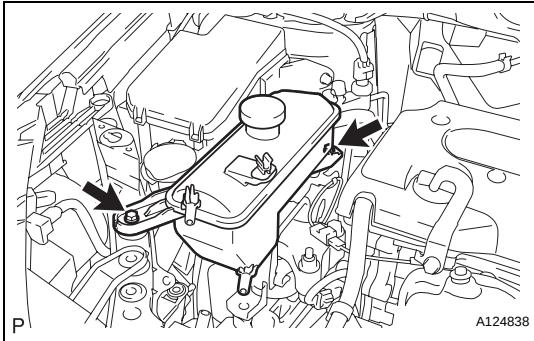


- (b) Install the air cleaner case with the 3 bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

38. INSTALL AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

39. INSTALL AIR CLEANER CAP (See page [ES-413](#))

40. INSTALL PURGE VSV (See page [EC-16](#))



41. INSTALL RADIATOR RESERVOIR

- (a) Install the reservoir with the 2 bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

42. INSTALL RADIATOR ASSEMBLY

- (a) Install the radiator (see page [CO-32](#)).

43. INSTALL BATTERY TRAY

44. INSTALL BATTERY

- (a) Install the battery.
(b) Install the battery clamp with the bolt and nut.
Torque: 8.5 N*m (87 kgf*cm, 75 in.*lbf) for bolt
5.0 N*m (51 kgf*cm, 44 in.*lbf) for nut

45. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

46. ADD AUTOMATIC TRANSAXLE FLUID

- (a) Add automatic transaxle fluid for U241E (2WD) (see page [AX-151](#)).
(b) Add automatic transaxle fluid for U140F (4WD) (see page [AX-152](#)).

47. CHECK FOR FUEL LEAKS (See page [FU-14](#))

48. ADD ENGINE COOLANT (See page [CO-6](#))

49. CHECK FOR ENGINE COOLANT LEAKS

- (a) Check for engine coolant leaks (see page [CO-1](#)).

50. CHECK FOR AUTOMATIC TRANSAXLE FLUID LEAKS

51. ADJUST SHIFT LEVER POSITION

- (a) Adjust the shift lever position for U241E (2WD) (see page [AX-138](#)).
(b) Adjust the shift lever position for U140F (4WD) (see page [AX-138](#)).

52. INSTALL NO. 1 ENGINE COVER (See page [EM-43](#))

53. INSTALL FRONT FENDER APRON RH

54. INSTALL NO. 2 ENGINE UNDER COVER

55. INSTALL NO. 1 ENGINE UNDER COVER

56. INSTALL FRONT WHEEL

57. INSTALL RADIATOR SUPPORT OPENING COVER

58. INSTALL HOOD SUB-ASSEMBLY

- (a) Install the hood (see page [ED-7](#)).
- (b) Adjust the hood (see page [ED-5](#)).

59. INSPECT AND ADJUST FRONT WHEEL ALIGNMENT

- (a) Inspect and adjust the front wheel alignment (see page [SP-3](#)).

60. PERFORM REGISTRATION

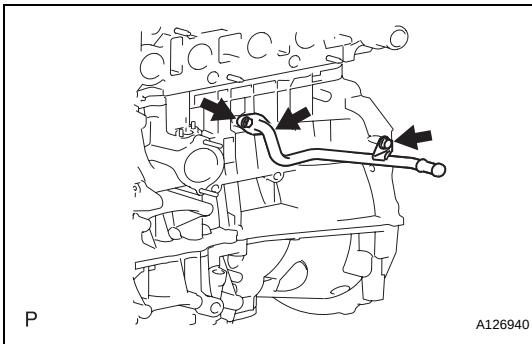
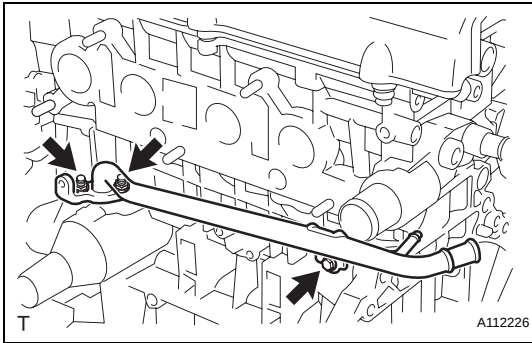
- (a) When replacing the engine assembly, perform vehicle stability control system recognition in ECM (see page [CC-12](#)).

61. RESET MEMORY (for Automatic Transaxle)

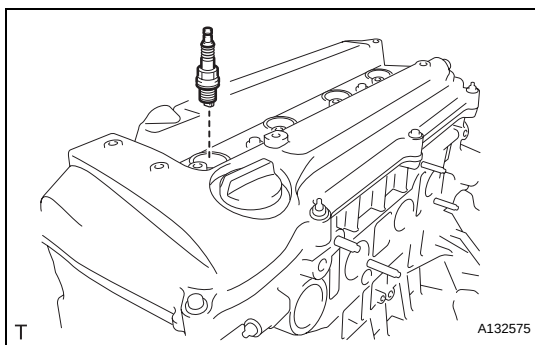
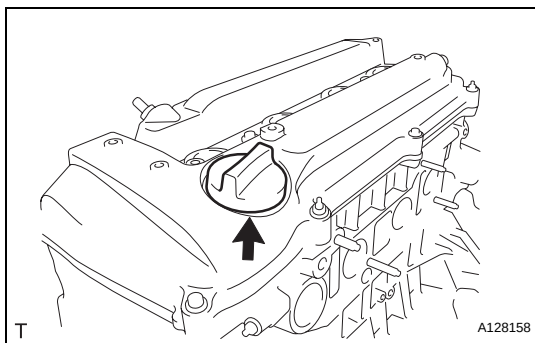
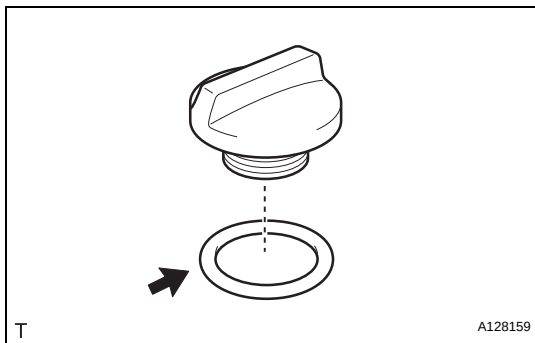
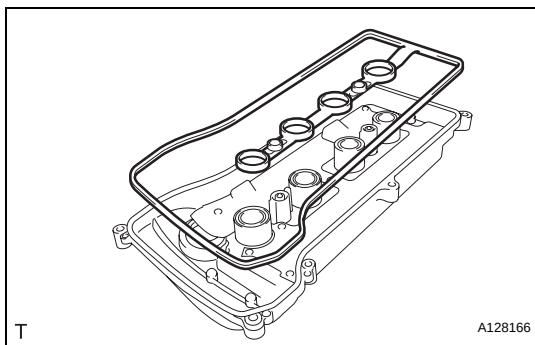
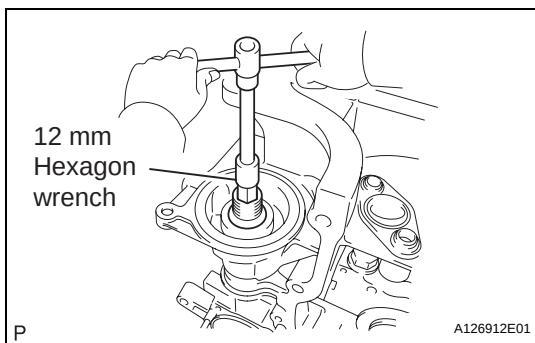
- (a) When replacing the engine assembly, perform the RESET MEMORY procedure (A/T initialization) for U241E (2WD) (see page [AX-18](#)) and for U140F (4WD) (see page [AX-18](#)).

DISASSEMBLY

1. REMOVE IDLER PULLEY (See page [EM-23](#))
2. REMOVE OIL DIPSTICK
3. REMOVE OIL DIPSTICK GUIDE (See page [EM-57](#))
4. REMOVE MANIFOLD STAY (See page [EM-57](#))
5. REMOVE NO. 2 MANIFOLD STAY (See page [EM-58](#))
6. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See page [EM-58](#))
7. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (See page [EM-58](#))
8. REMOVE WATER INLET (See page [CO-15](#))
9. REMOVE THERMOSTAT
10. REMOVE NO. 1 WATER BY-PASS PIPE
(a) Remove the bolt, 2 nuts, pipe and gasket.

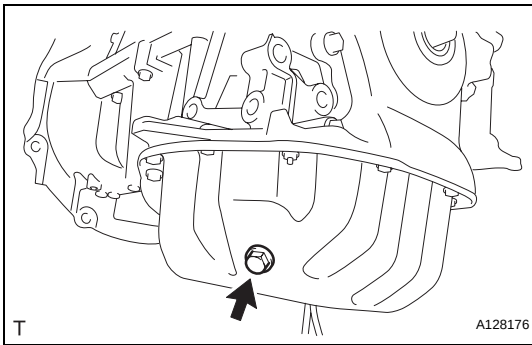
EM

11. REMOVE NO. 3 WATER BY-PASS PIPE
(a) Remove the bolt, 2 nuts, pipe and gasket.
12. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-26](#))
13. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-395](#))
14. REMOVE KNOCK SENSOR (See page [ES-420](#))
15. REMOVE RADIO SETTING CONDENSER (See page [EM-63](#))
16. REMOVE OIL PRESSURE SWITCH ASSEMBLY (See page [EM-63](#))
17. REMOVE ENGINE COOLANT TEMPERATURE SENSOR (See page [EM-63](#))
18. REMOVE CAMSHAFT POSITION SENSOR (See page [EM-64](#))
19. REMOVE IGNITION COIL ASSEMBLY (See page [IG-9](#))

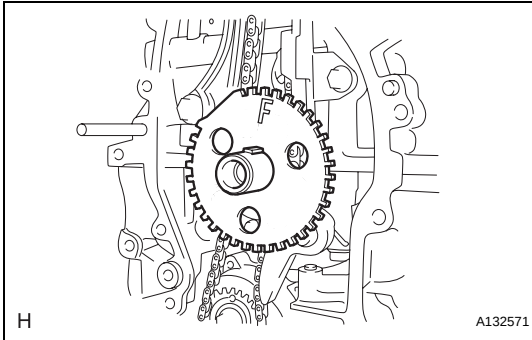
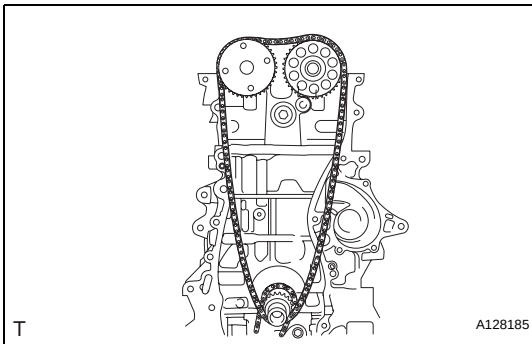
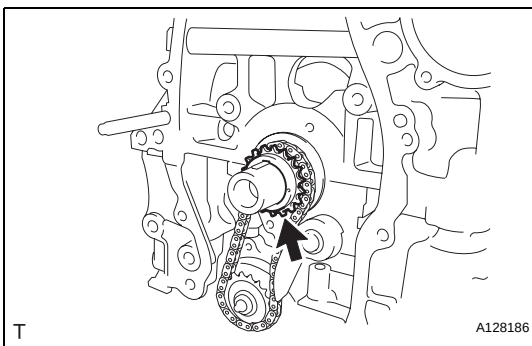
**20. REMOVE SPARK PLUG****21. REMOVE OIL FILLER CAP SUB-ASSEMBLY****22. REMOVE OIL FILLER CAP GASKET****23. REMOVE VENTILATION VALVE SUB-ASSEMBLY**
(See page [EC-18](#))**24. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
(See page [EM-24](#))**25. REMOVE CYLINDER HEAD COVER GASKET****26. REMOVE OIL FILTER SUB-ASSEMBLY** (See page [LU-4](#))**27. REMOVE OIL FILTER UNION**

- (a) Using a 12 mm hexagon wrench, remove the oil filter union.

28. REMOVE CRANKSHAFT POSITION SENSOR (See page [ES-402](#))**29. REMOVE WATER PUMP PULLEY** (See page [CO-11](#))**30. REMOVE WATER PUMP ASSEMBLY** (See page [CO-11](#))

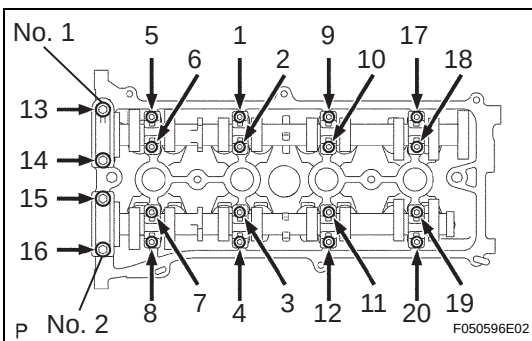
**31. REMOVE OIL PAN DRAIN PLUG**

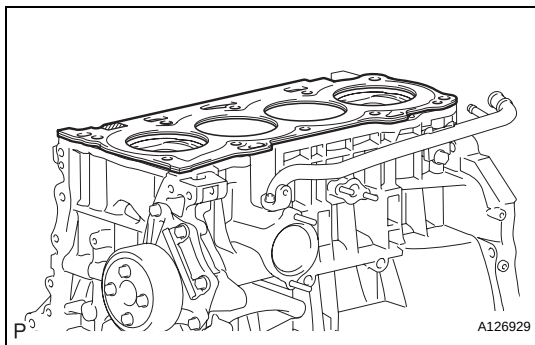
(a) Remove the oil pan drain plug and gasket.

32. REMOVE OIL PAN SUB-ASSEMBLY (See page [EM-24](#))**33. REMOVE CRANKSHAFT PULLEY** (See page [EM-25](#))**34. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY** (See page [EM-26](#))**35. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY** (See page [EM-26](#))**36. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE****37. REMOVE TIMING CHAIN GUIDE** (See page [EM-28](#))**38. REMOVE CHAIN TENSIONER SLIPPER** (See page [EM-28](#))**39. REMOVE NO. 1 CHAIN VIBRATION DAMPER** (See page [EM-28](#))**40. REMOVE CHAIN SUB-ASSEMBLY****41. REMOVE CRANKSHAFT TIMING SPROCKET****42. REMOVE NO. 2 CHAIN SUB-ASSEMBLY** (See page [EM-29](#))**43. REMOVE OIL PUMP DRIVE GEAR****44. REMOVE OIL PUMP ASSEMBLY** (See page [LU-12](#))**45. REMOVE CAMSHAFT**

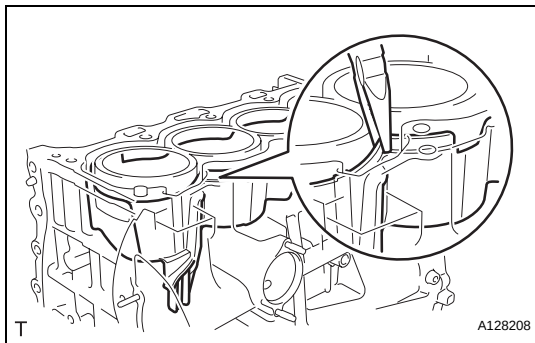
(a) Using several steps, uniformly loosen and remove the 20 bearing cap bolts in the sequence shown in the illustration.

(b) Remove the 10 bearing caps, then remove the camshaft and No. 2 camshaft.

46. REMOVE CYLINDER HEAD SUB-ASSEMBLY (See page [EM-62](#))



47. REMOVE CYLINDER HEAD GASKET

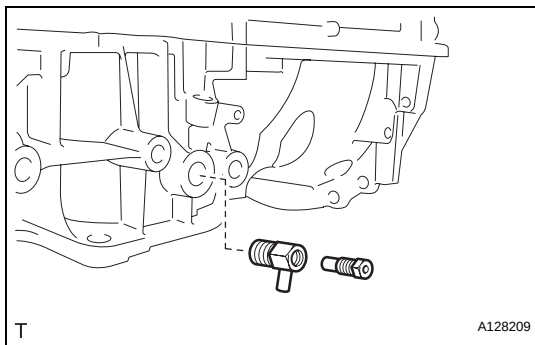


48. REMOVE CYLINDER BLOCK WATER JACKET SPACER

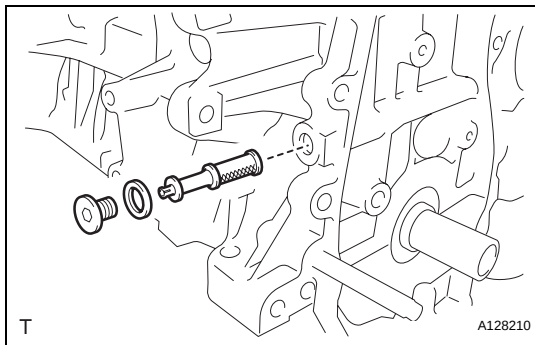
- (a) Using needle-nose pliers, remove the cylinder block water jacket spacer from the water jacket.

NOTICE:

Before turning the cylinder block upside down, make sure that the water jacket spacer is removed, as it will fall out.

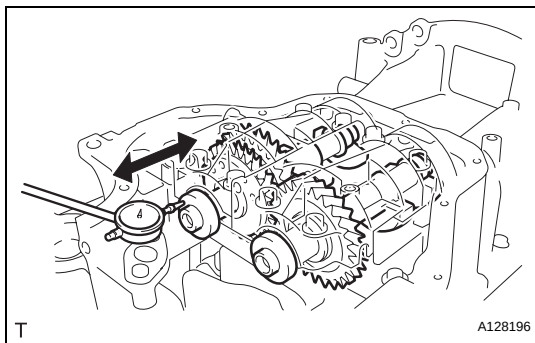


49. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY



50. REMOVE OIL CONTROL VALVE FILTER

- (a) Using a 6 mm socket hexagon wrench, remove the plug and gasket.
(b) Remove the oil control valve filter.



51. INSPECT BALANCE SHAFT THRUST CLEARANCE

- (a) Using a dial indicator, measure the thrust clearance while moving the balance shaft back and forth.

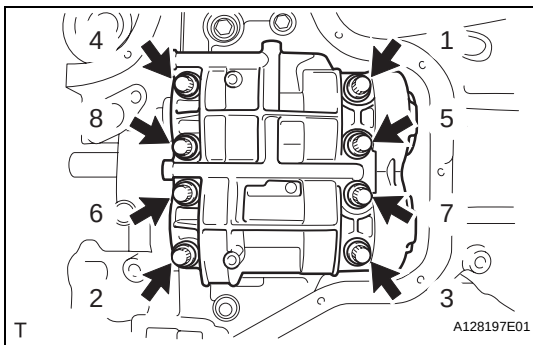
Standard thrust clearance:

0.05 to 0.09 mm (0.0020 to 0.0035 in.)

Maximum thrust clearance:

0.09 mm (0.0035 in.)

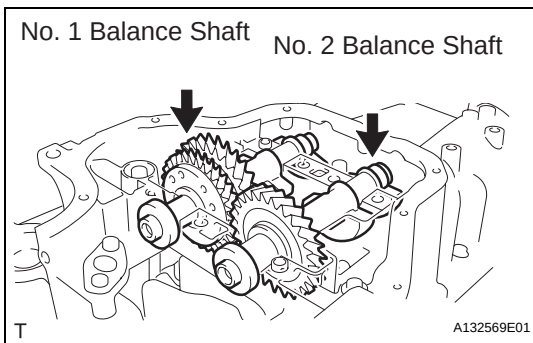
If the thrust clearance is greater than the maximum, replace the balance shaft housing and bearings. If necessary, replace the balance shaft.

**52. INSPECT BALANCE SHAFT OIL CLEARANCE**

- (a) Using several steps, uniformly loosen and remove the 8 bolts in the sequence shown in the illustration.
- (b) Remove the balance shaft housing from the crankcase.

HINT:

Keep the lower bearing and balance shaft housing together.



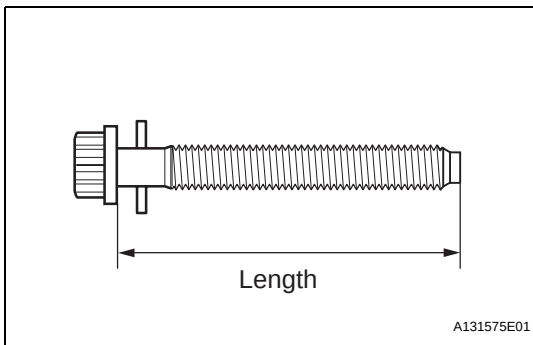
- (c) Lift out the No. 1 and No. 2 balance shafts.

HINT:

Keep the upper bearing with the crankcase.

- (d) Clean each bearing and journal.
- (e) Check each bearing and journal for pitting and scratches.

If a bearing or journal is damaged, replace the bearings. If necessary, replace the balance shaft.



- (f) Inspect the balance shaft housing bolt.

- (1) Using a vernier caliper, measure the length of the bolts from the seat to the end.

Standard bolt length:

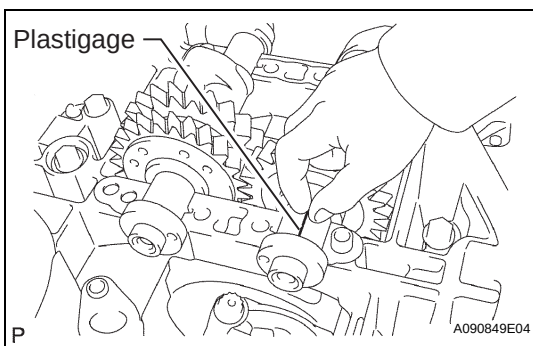
58.3 to 59.7 mm (2.295 to 2.350 in.)

Maximum bolt length:

60.3 mm (2.374 in.)

If the bolt length is greater than the maximum, replace the balance shaft bolt.

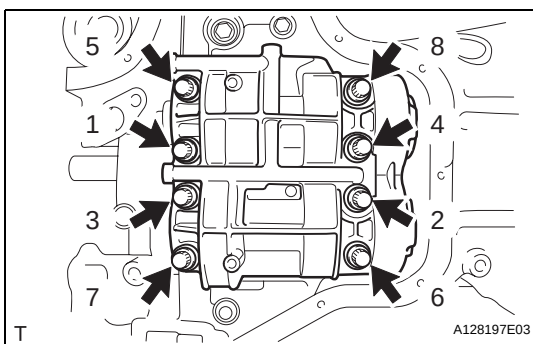
- (g) Place the No. 1 and No. 2 balance shafts onto the crankcase.



- (h) Lay a strip of Plastigage across each journal.

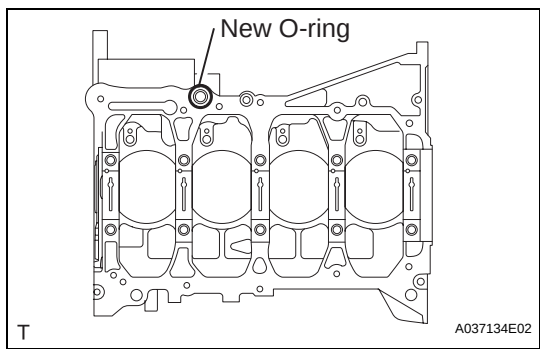
- (i) Install the balance shaft housing.

- (j) Apply a light coat of engine oil on the threads and under the heads of the bolts.



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

Torque: 21.6 N*m (220 kgf*cm, 16 ft.*lbf)



- (l) Mark the front of the bolts with paint.
- (m) Retighten the bolts 90° as shown in the illustration.
- (n) Check that the paint mark is now at a 90° angle to the front.
- (o) Remove the balance shaft housing from the crankcase.
- (p) Measure the Plastigage at its widest point.

Standard oil clearance:
0.004 to 0.049 mm (0.0002 to 0.0019 in.)
Maximum oil clearance:
0.049 mm (0.0019 in.)

NOTICE:
Remove the Plastigage completely after the measurement.
If the oil clearance is greater than the maximum, replace the bearing. If necessary, replace the balance shaft.

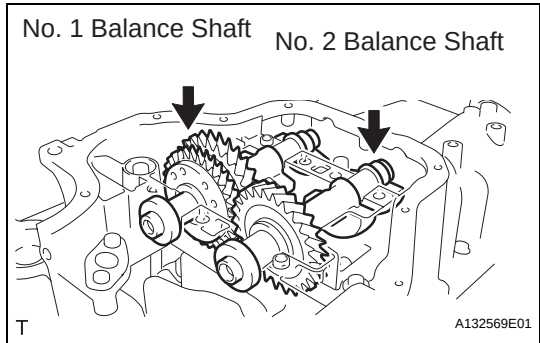
HINT:
If replacing a bearing, select a new one with the same number.

Standard balance shaft housing journal bore diameter

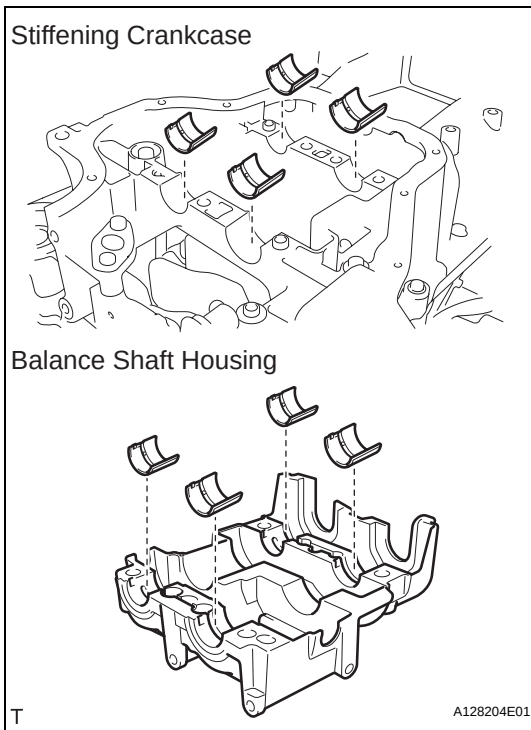
Item	Specified Condition
Mark 1	26.000 to 26.006 mm (1.0236 to 1.0239 in.)
Mark 2	26.007 to 26.012 mm (1.0239 to 1.0214 in.)
Mark 3	26.013 to 26.018 mm (1.0241 to 1.0243 in.)

Standard balance shaft journal diameter:
22.985 to 23.000 mm (0.9049 to 0.9055 in.)
Standard bearing center wall thickness

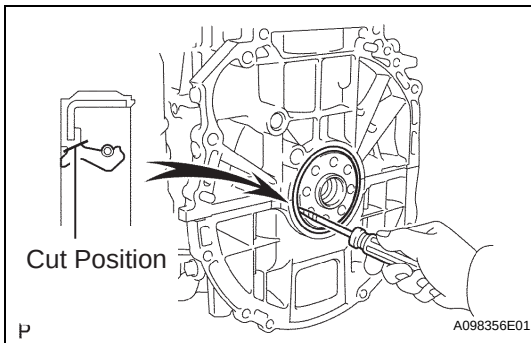
Item	Specified Condition
Mark 1	1.486 to 1.489 mm (0.05850 to 0.05862 in.)
Mark 2	1.490 to 1.492 mm (0.05866 to 0.05874 in.)
Mark 3	1.493 to 1.495 mm (0.0585 to 0.0586 in.)



53. REMOVE BALANCE SHAFT



54. REMOVE NO. 1 BALANCE SHAFT BEARING

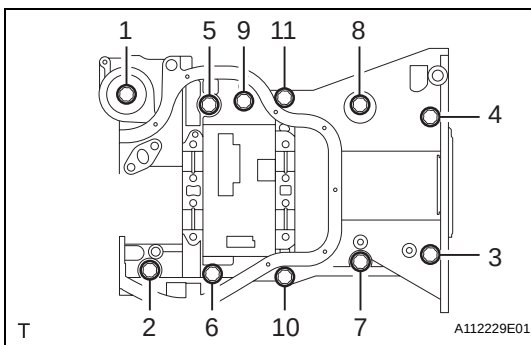


55. REMOVE ENGINE REAR OIL SEAL

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

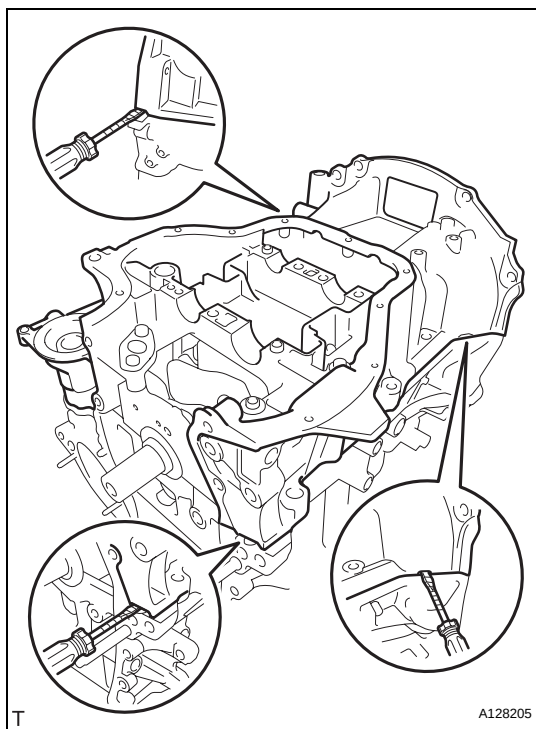
NOTICE:

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



56. REMOVE STIFFENING CRANKCASE ASSEMBLY

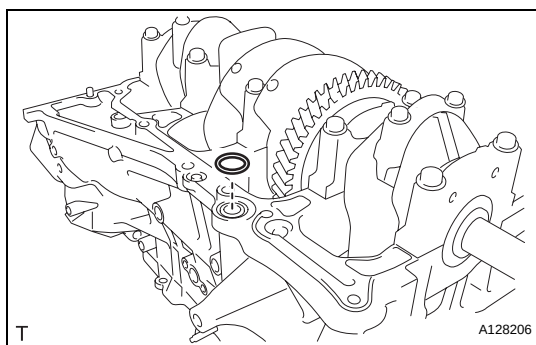
- Using several steps, uniformly loosen and remove the 11 bolts in the sequence shown in the illustration.



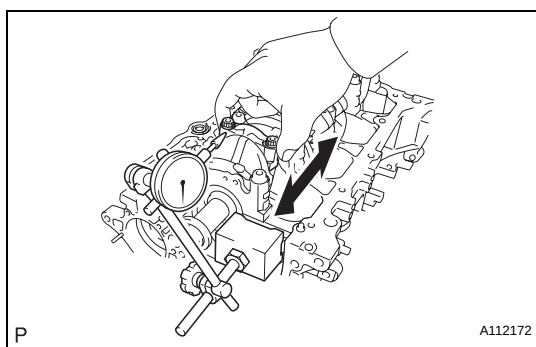
- (b) Remove the crankcase by prying the portions between the crankcase and cylinder block.

NOTICE:

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



- (c) Remove the O-ring from the cylinder block.



57. INSPECT CONNECTING ROD THRUST CLEARANCE

- (a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:

0.160 to 0.362 mm (0.0063 to 0.0143 in.)

Maximum thrust clearance:

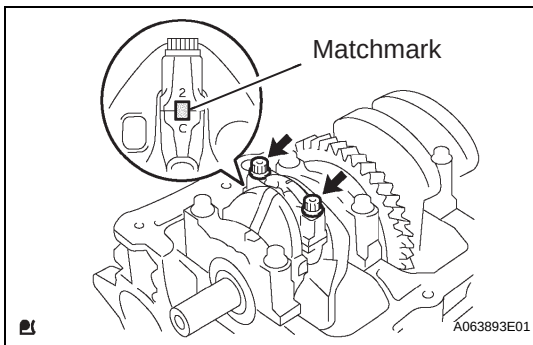
0.362 mm (0.0143 in.)

If the thrust clearance is greater than the maximum, replace the connecting rod. If necessary, replace the crankshaft.

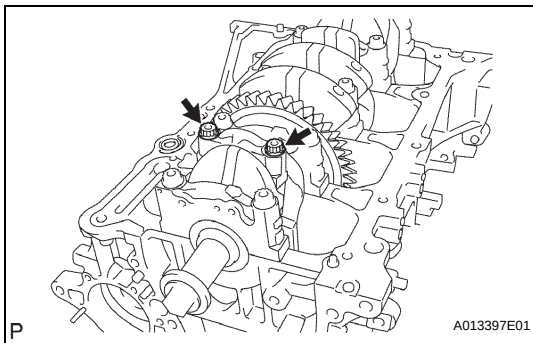
58. INSPECT CONNECTING ROD OIL CLEARANCE

NOTICE:

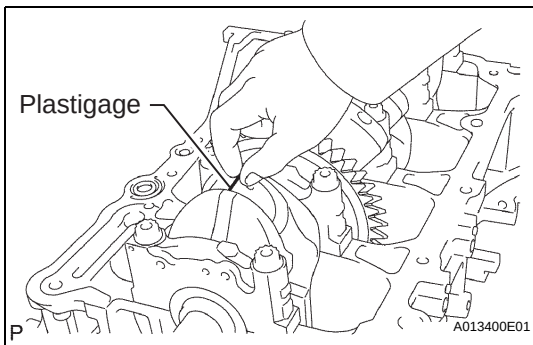
Do not turn the crankshaft during the measurement.



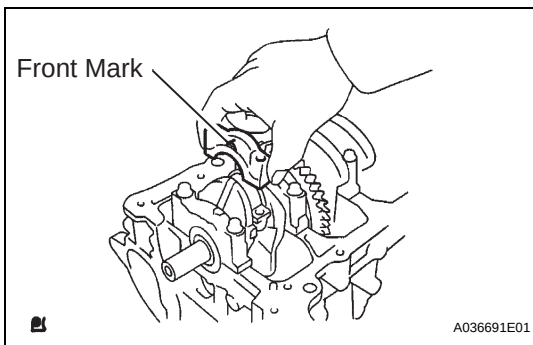
- (a) Using marking paint, write the matched cylinder number on each connecting rod and cap.
HINT:
The matchmarks in the connecting rods and caps are for ensuring correct reassembly.



- (b) Using a 12 mm socket wrench, remove the 2 bolts and connecting rod cap.
(c) Clean the crank pin and bearing.
(d) Check the crank pin and bearing for pitting and scratches.

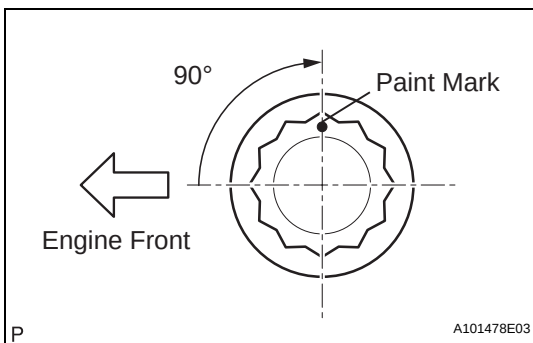


- (e) Lay a strip of Plastigage on the crank pin.

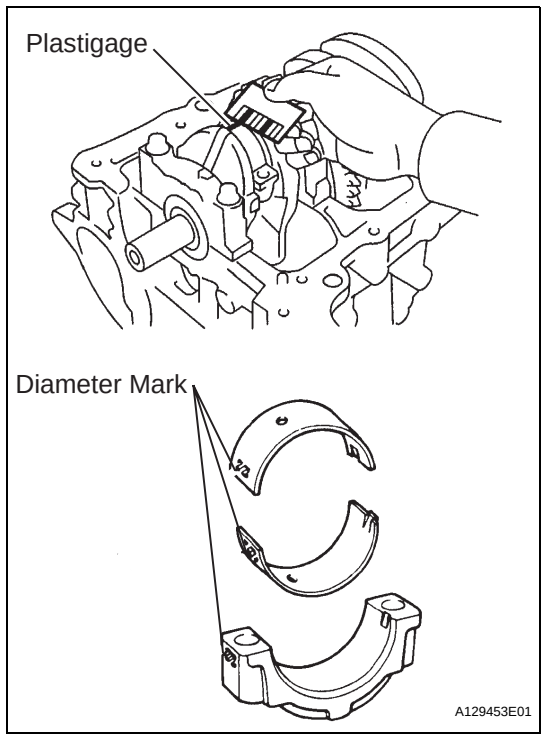


- (f) Check that the front mark of the connecting rod cap is facing in the correct direction.
(g) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
(h) Using a 12 mm socket wrench, tighten the bolts in several passes to the specified torque.

Torque: 24.5 N*m (250 kgf*cm, 18 ft.*lbf)



- (i) Mark the front of the connecting rod bolts with paint.
(j) Retighten the cap bolts 90° as shown in the illustration.
(k) Check that the crankshaft turns smoothly.
(l) Using a 12 mm socket wrench, remove the 2 bolts and connecting rod cap.



- (m) Measure the Plastigage at its widest point.
Standard oil clearance:
0.024 to 0.048 mm (0.0009 to 0.0019 in.)
Maximum oil clearance:
0.08 mm (0.0032 in.)

NOTICE:
Remove the Plastigage completely after the measurement.

If the oil clearance is greater than the maximum, replace the connecting rod bearing. If necessary, grind or replace the crankshaft.

HINT:
If replacing a bearing, select a new one with the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Standard connecting rod large end bore diameter

Mark	Specified Condition
Mark 1	51.000 to 51.007 mm (2.0079 to 2.0082 in.)
Mark 2	51.008 to 51.013 mm (2.0082 to 2.0084 in.)
Mark 3	51.014 to 51.020 mm (2.0084 to 2.0087 in.)

Standard connecting rod bearing thickness

Mark	Specified Condition
Mark 1	1.485 to 1.488 mm (0.0585 to 0.0586 in.)
Mark 2	1.489 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.492 to 1.494 mm (0.0587 to 0.0588 in.)

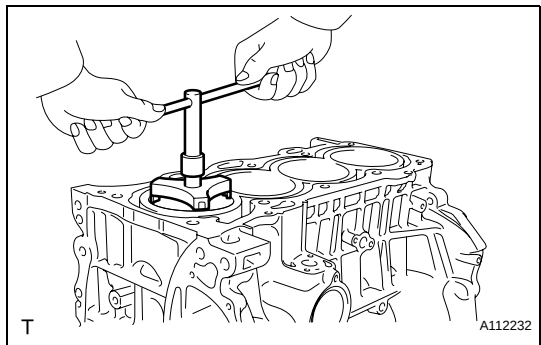
Standard crankshaft pin diameter:
47.990 to 48.000 (1.8894 to 1.8898 in.)

59. REMOVE PISTON WITH CONNECTING ROD

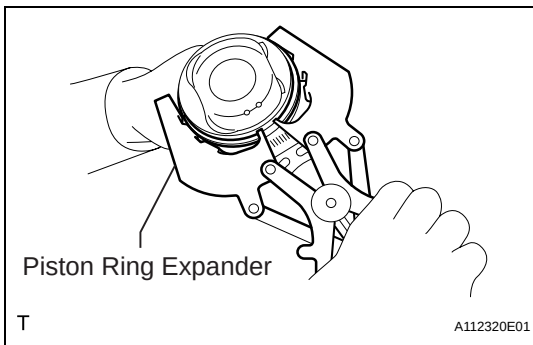
- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.
(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

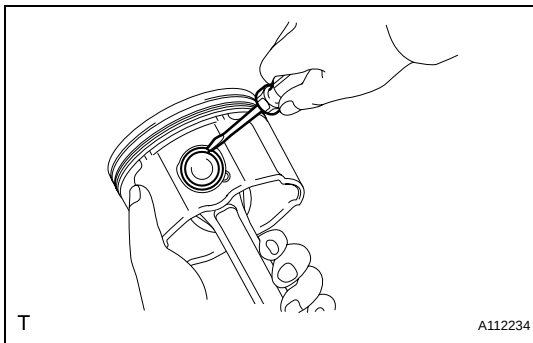
- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.



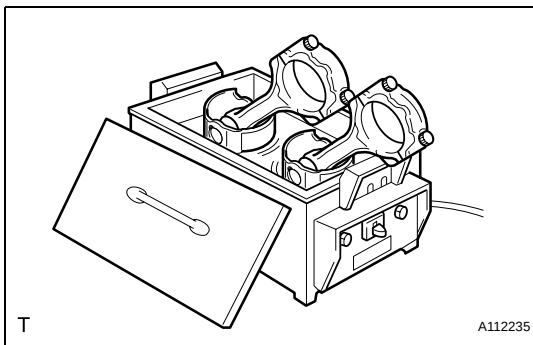
60. REMOVE CONNECTING ROD BEARING

**61. REMOVE PISTON RING SET**

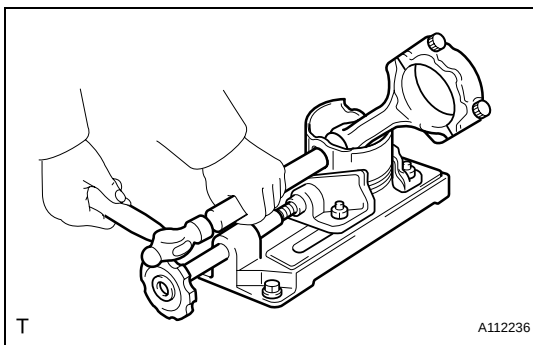
- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the oil ring and expander by hand.

**62. REMOVE PISTON PIN HOLE SNAP RING**

- (a) Using a small screwdriver, pry out the 2 snap rings.

**63. REMOVE PISTON**

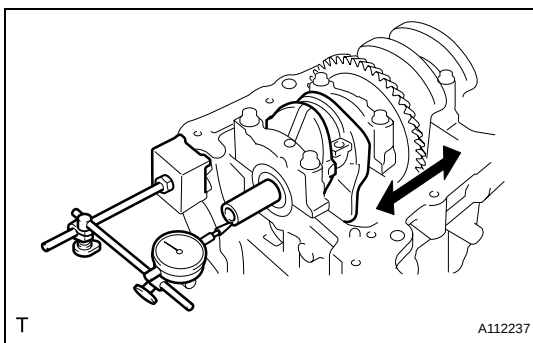
- (a) Gradually heat the piston up to 80 to 90°C (176 to 194°F).



- (b) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin, then remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Arrange the piston, pin, ring, connecting rod and bearings in the correct order.

**64. INSPECT CRANKSHAFT THRUST CLEARANCE**

- (a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.04 to 0.24 mm (0.0016 to 0.0095 in.)

Maximum thrust clearance:

0.30 mm (0.012 in.)

If the thrust clearance is greater than the maximum, replace the thrust washers as a set.

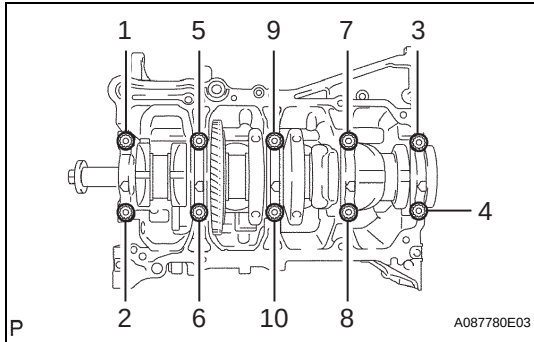
HINT:

The thrust washer thickness is 1.93 to 1.98 mm (0.0760 to 0.0780 in.).

65. INSPECT CRANKSHAFT OIL CLEARANCE

NOTICE:

Do not turn the crankshaft during the measurement.



- (a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
- (b) Remove the 5 bearing caps from the cylinder block.

HINT:

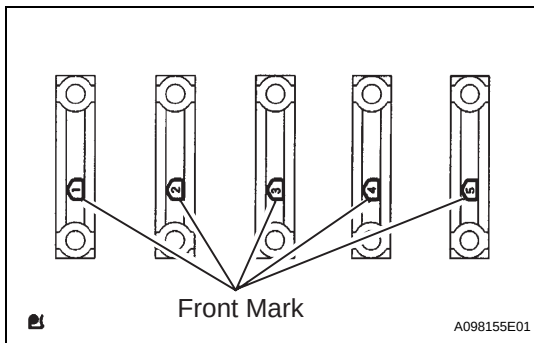
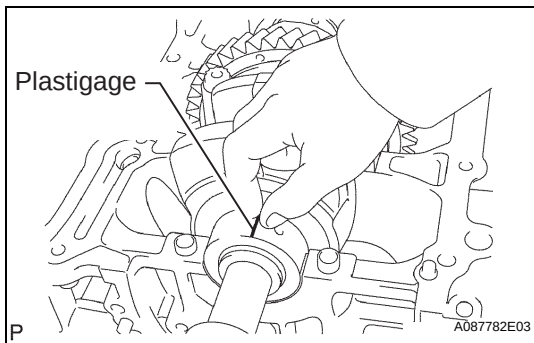
- Keep the No. 2 crankshaft bearings and crankshaft bearing caps together.
- Arrange the bearing caps in correct order.

- (c) Remove the crankshaft.

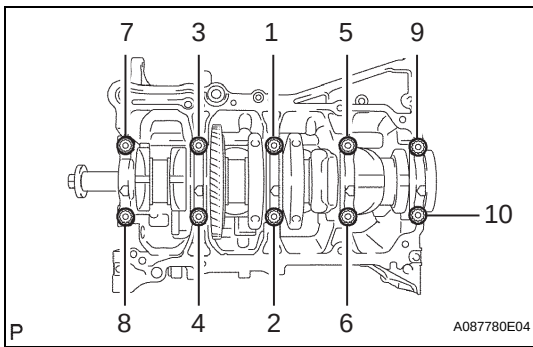
HINT:

Keep the crankshaft bearings and crankshaft thrust washer uppers together with the cylinder block.

- (d) Clean each main journal and bearing.
- (e) Check each main journal and bearing for pitting and scratches.
 - If the journal or bearing is damaged, replace the bearings.
 - If necessary, replace the crankshaft.
- (f) Place the crankshaft onto the cylinder block.
- (g) Lay a strip of Plastigage across each journal.

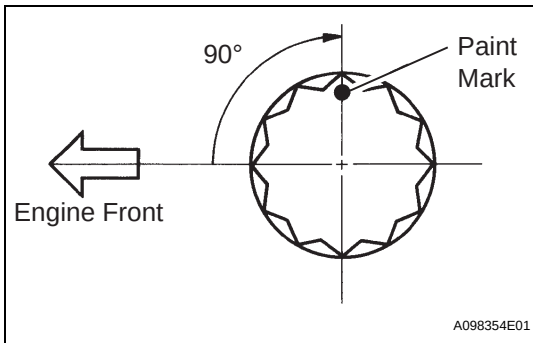


- (h) Examine the front marks and numbers, and install the bearing caps onto the cylinder block in the order shown in the illustration.
- (i) Apply a light coat of engine oil to the threads and under the heads of the crankshaft bearing cap set bolts.

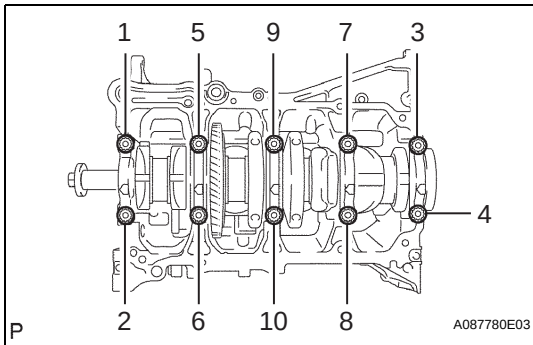


- (j) Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

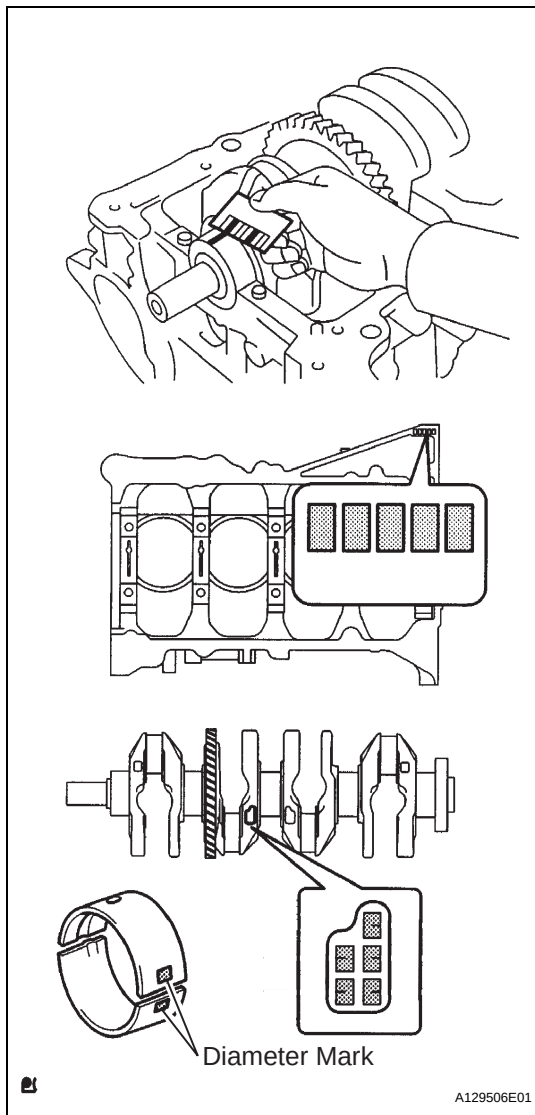
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)



- (k) Mark the front of the bearing cap bolts with paint.
 (l) Retighten the 10 bearing cap bolts by 90°.
 (m) Check that the paint marks are at a 90° angle to the front.



- (n) Remove the crankshaft bearing caps.



- (o) Measure the Plastigage at its widest point.

Standard oil clearance:

0.008 to 0.024 mm (0.0003 to 0.0010 in.)

Maximum oil clearance:

0.050 mm (0.0020 in.)

NOTICE:

Remove the Plastigage completely after the measurement.

If the oil clearance is greater than the maximum, replace the crankshaft bearing. If necessary, replace the crankshaft.

HINT:

If replacing a bearing, select a new one with the same number. If the number of the bearing cannot be determined, calculate the correct bearing number by adding together the numbers imprinted on the cylinder block and crankshaft. Then select a new bearing with the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

Cylinder block + Crankshaft	0 to 2	3 to 5	6 to 8	9 to 11
Use bearing	"1"	"2"	"3"	"4"

EXAMPLE

- Imprinted number on the cylinder block is 3.
- Imprinted number on the crankshaft is 4.

$$3 + 4 = 7$$

Select the bearing marked "3".

Standard cylinder block journal bore diameter

Mark	Specified Condition
0	59.000 to 59.002 mm (2.3228 to 2.3229 in.)
1	59.003 to 59.004 mm (2.3230 to 2.3230 in.)
2	59.005 to 59.006 mm (2.3230 to 2.3231 in.)
3	59.007 to 59.009 mm (2.3231 to 2.3232 in.)
4	59.010 to 59.011 mm (2.3232 to 2.3233 in.)
5	59.012 to 59.013 mm (2.3233 to 2.3234 in.)
6	59.014 to 59.016 mm (2.3234 to 2.3235 in.)

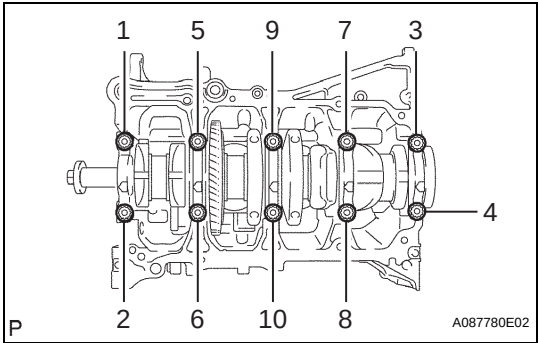
Standard crankshaft journal diameter

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)

Mark	Specified Condition
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.988 to 54.990 mm (2.1649 to 2.1650 in.)

Standard bearing center wall thickness

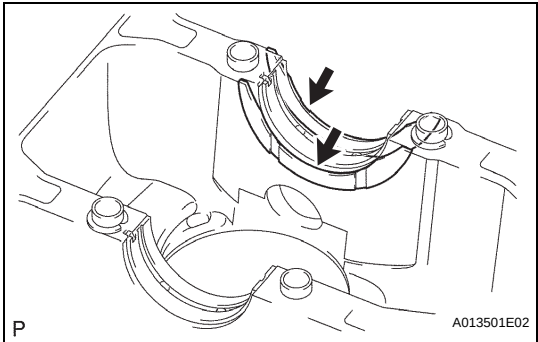
Mark	Specified Condition
1	1.993 to 1.996 mm (0.0785 to 0.0786 in.)
2	1.997 to 1.999 mm (0.0786 to 0.0787 in.)
3	2.000 to 2.002 mm (0.0787 to 0.0788 in.)
4	2.003 to 2.005 mm (0.0789 to 0.0789 in.)



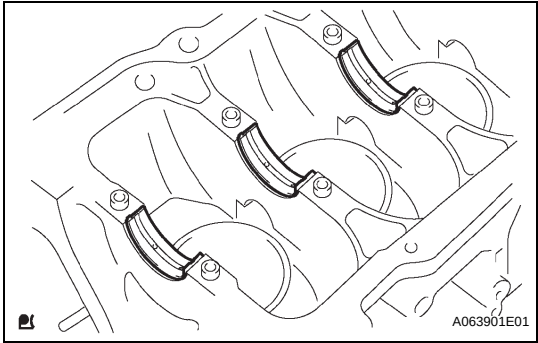
66. REMOVE CRANKSHAFT

- (a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
- (b) Remove the 5 bearing caps from the cylinder block.
- (c) Remove the crankshaft from the cylinder block.

EM

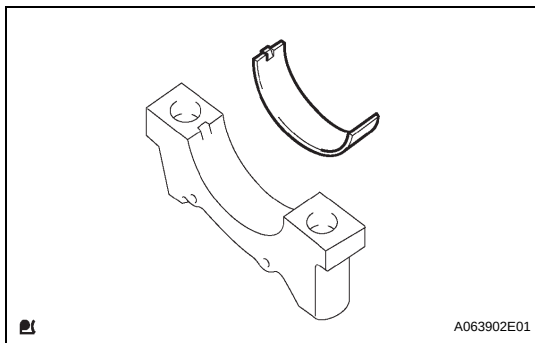


67. REMOVE CRANKSHAFT THRUST WASHER UPPER



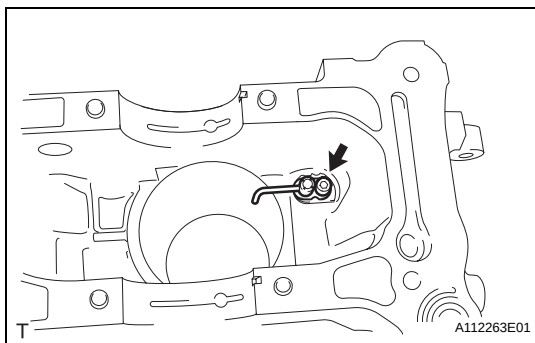
68. REMOVE CRANKSHAFT BEARING

- HINT:
- Arrange the bearings in the correct order.

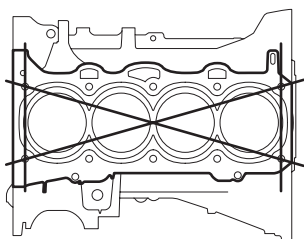
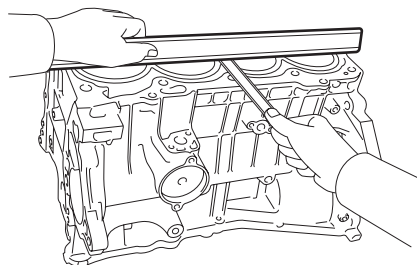
**69. REMOVE NO. 2 CRANKSHAFT BEARING**

HINT:

Arrange the bearings in the correct order.

**70. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY**

- (a) Remove the 4 bolts and 4 oil nozzles.



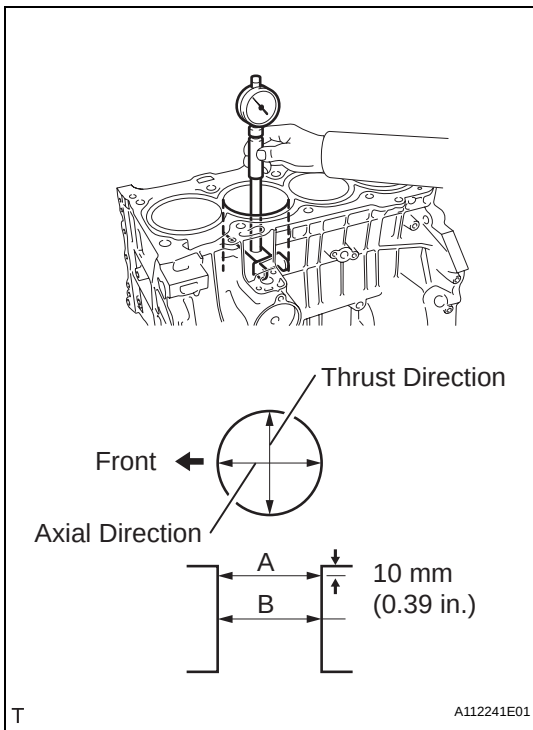
T A112240

INSPECTION**1. INSPECT CYLINDER BLOCK FOR WARPAGE**

- (a) Using a precision straightedge and feeler gauge, measure the warpage of the surface that is in contact with the cylinder head gasket.

Maximum warpage:**0.05 mm (0.0020 in.)**

If the warpage is greater than the maximum, replace the cylinder block.



2. INSPECT CYLINDER BORE

- (a) Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

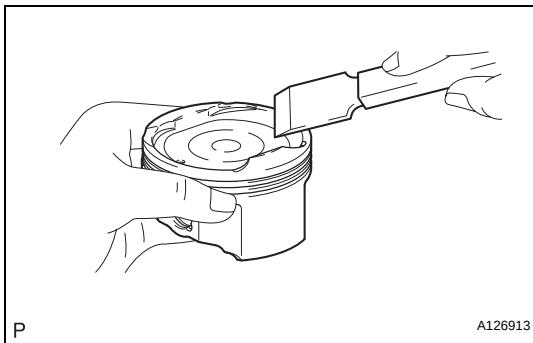
Standard diameter:

88.500 to 88.513 mm (3.4843 to 3.4847 in.)

Maximum diameter:

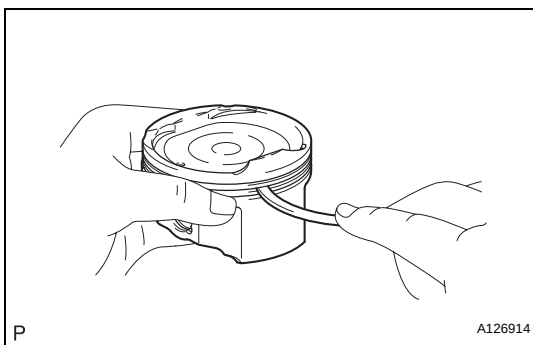
88.633 mm (3.4894 in.)

If the average diameter of the 4 positions is greater than the maximum, replace the cylinder block.

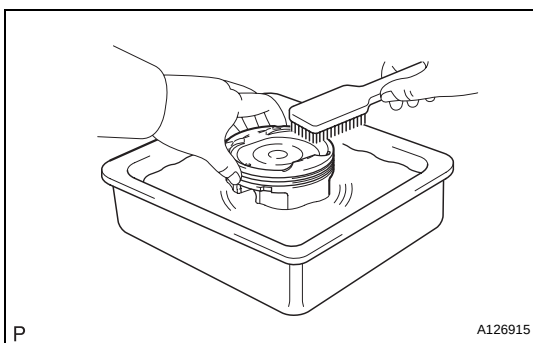


3. INSPECT PISTON

- (a) Using a gasket scraper, remove the carbon from the piston top.



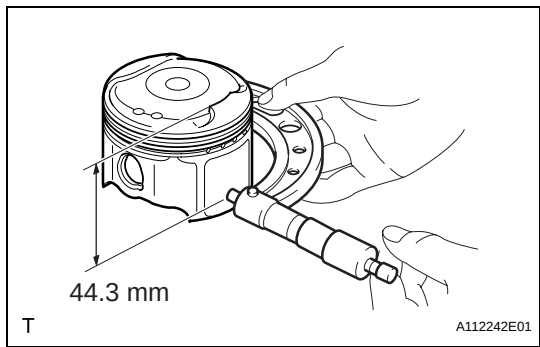
- (b) Using a groove cleaning tool or a broken ring, clean the piston ring grooves.



- (c) Using a brush and solvent, thoroughly clean the piston.

NOTICE:

Do not use a wire brush.



- (d) Using a micrometer, measure the piston diameter at right angles to the piston pin hole, and at the piston 44.3 mm (1.7587 in.) from the piston head.
Standard piston diameter:
88.477 to 88.487 mm (3.5125 to 3.5129 in.)
If the diameter is not as specified, replace the piston.

4. INSPECT PISTON OIL CLEARANCE

- (a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.
Standard oil clearance:
0.021 to 0.044 mm (0.0008 to 0.0017 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)
If the oil clearance is greater than the maximum, replace all the pistons. If necessary, replace the cylinder block.

5. INSPECT RING GROOVE CLEARANCE

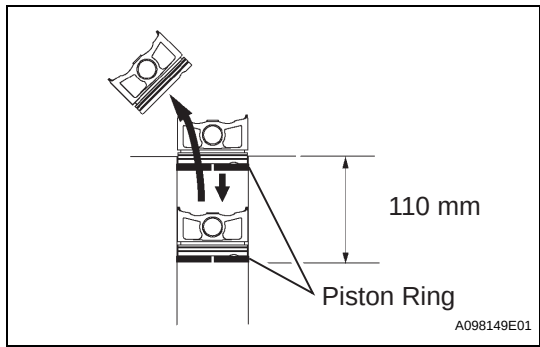
- (a) Using a feeler gauge, measure the clearance between the new piston ring and wall of the ring groove.
Standard ring groove clearance

Item	Specified Condition
No. 1 ring	0.020 to 0.070 mm (0.0008 to 0.0028 in.)
No. 2 ring	0.020 to 0.060 mm (0.0008 to 0.0024 in.)
Oil ring	0.020 to 0.070 mm (0.0008 to 0.0028 in.)

If the groove clearance is not as specified, replace the piston.

6. INSPECT PISTON RING END GAP

- (a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.

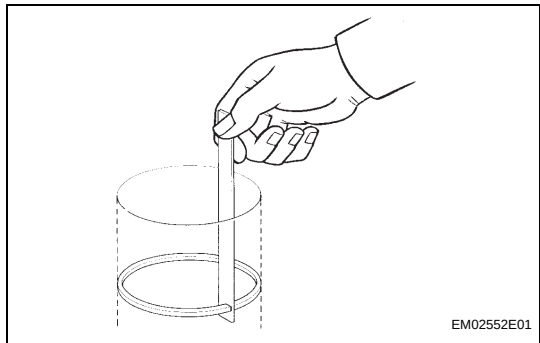


- (b) Using a feeler gauge, measure the end gap.
Standard end gap

Item	Specified Condition
No. 1 ring	0.24 to 0.31 mm (0.0094 to 0.0122 in.)
No. 2 ring	0.33 to 0.43 mm (0.0130 to 0.0169 in.)
Oil ring	0.10 to 0.30 mm (0.0040 to 0.0119 in.)

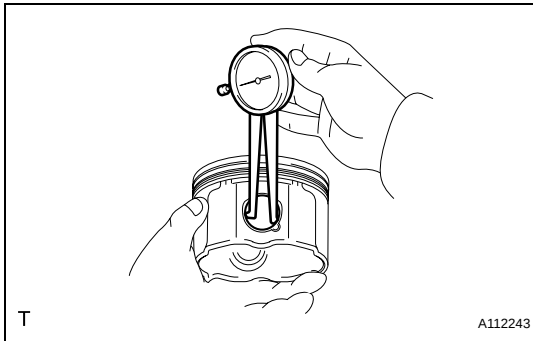
Maximum end gap

Item	Specified Condition
No. 1 ring	0.89 mm (0.0350 in.)



Item	Specified Condition
No. 2 ring	1.37 mm (0.0539 in.)
Oil ring	0.73 mm (0.0287 in.)

If the end gap is greater than the maximum, replace the piston ring. If the end gap is greater than the maximum, even with a new piston ring, replace the cylinder block.



7. INSPECT PISTON PIN OIL CLEARANCE

- (a) Using a caliper gauge, measure the piston pin bore diameter.

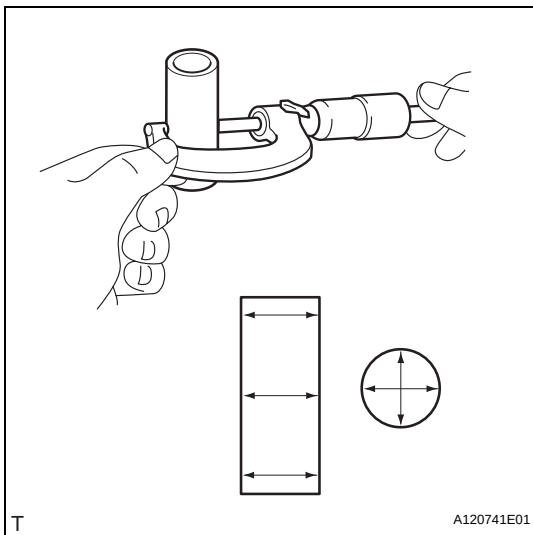
Standard piston pin bore diameter:
22.001 to 22.010 mm (0.8662 to 0.8665 in.)

Item	Specified Condition
A	22.001 to 22.004 mm (0.8662 to 0.8663 in.)
B	22.005 to 22.007 mm (0.8663 to 0.8664 in.)
C	22.008 to 22.010 mm (0.8665 to 0.8665 in.)

If the diameter is not as specified, replace the piston.

- (b) Using a micrometer, measure the piston pin diameter.

Standard piston pin diameter:
21.997 to 22.006 mm (0.8660 to 0.8664 in.)

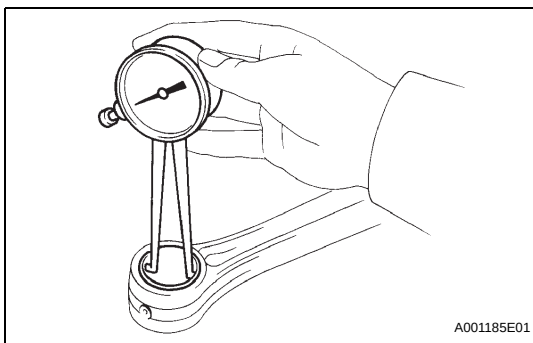


Item	Specified Condition
A	21.997 to 22.000 mm (0.8660 to 0.8661 in.)
B	22.001 to 22.003 mm (0.8662 to 0.8663 in.)
C	22.004 to 22.006 mm (0.8663 to 0.8664 in.)

If the diameter is not as specified, replace the piston pin.

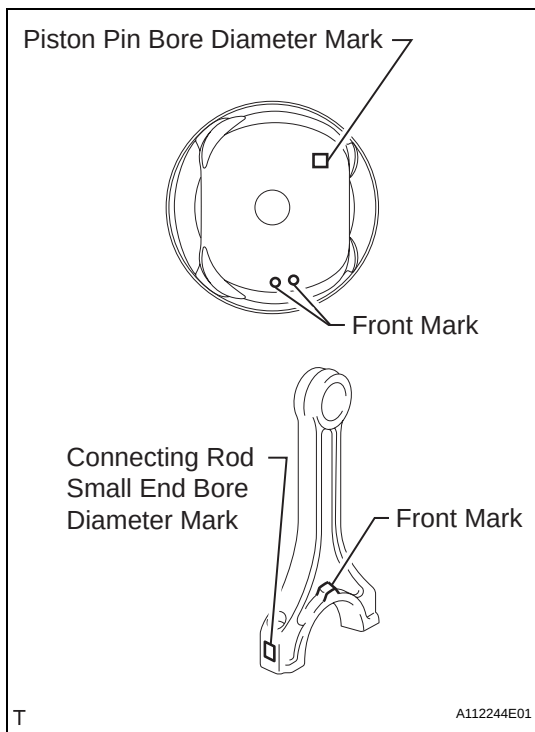
- (c) Using a caliper gauge, measure the connecting rod small end bore diameter.

Standard connecting rod small end bore diameter:
22.005 to 22.014 mm (0.8663 to 0.8667 in.)



Item	Specified Condition
A	22.005 to 22.008 mm (0.8663 to 0.8665 in.)
B	22.009 to 22.011 mm (0.8665 to 0.8666 in.)
C	22.012 to 22.014 mm (0.8666 to 0.8667 in.)

If the diameter is not as specified, replace the connecting rod.



- (d) Subtract the piston pin diameter measurement from the piston pin bore diameter measurement.

Standard oil clearance:

0.001 to 0.007 mm (0.00004 to 0.0003 in.)

Maximum oil clearance:

0.013 mm (0.0005 in.)

If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the piston and piston pin as a set.

- (e) Subtract the piston pin diameter measurement from the connecting rod small end bore diameter measurement.

Standard oil clearance:

0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance:

0.017 mm (0.0007 in.)

If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.

8. INSPECT CONNECTING ROD SUB-ASSEMBLY

- (a) Using a connecting rod aligner and feeler gauge, check the connecting rod alignment.

- (1) Check for misalignment.

Maximum misalignment:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

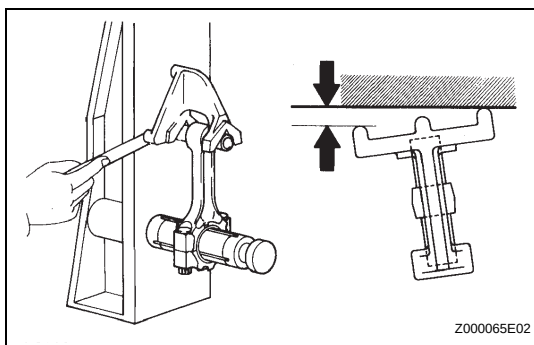
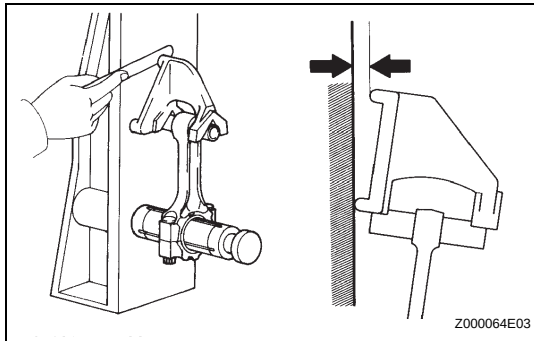
If the misalignment is greater than the maximum, replace the connecting rod.

- (2) Check for twist.

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If the twist is greater than the maximum, replace the connecting rod.



9. INSPECT CONNECTING ROD BOLT

- (a) Using a vernier caliper, measure the tension portion diameter of the bolt.

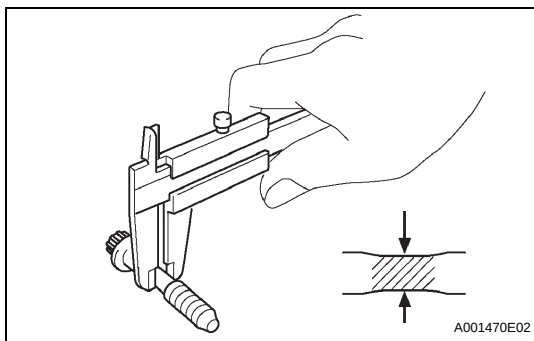
Standard diameter:

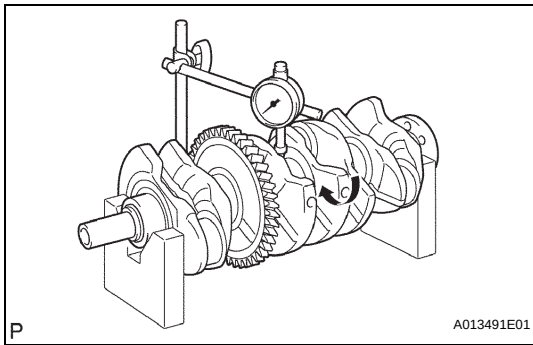
7.2 to 7.3 mm (0.283 to 0.287 in.)

Maximum diameter:

7.0 mm (0.276 in.)

If the diameter is less than the minimum, replace the connecting rod bolt.





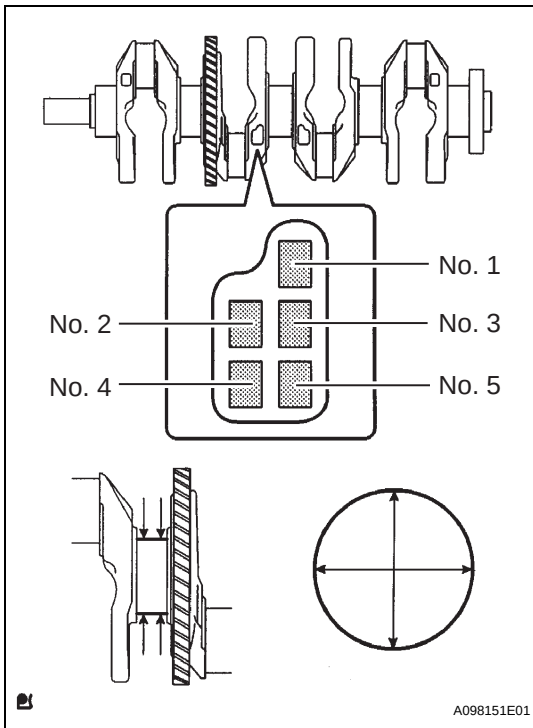
10. INSPECT CRANKSHAFT

- (a) Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.

Maximum taper and distortion:

0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.



- (b) Using a micrometer, measure the diameter of each main journal.

Standard diameter:

54.988 to 55.000 mm (2.1830 to 2.1654 in.)

If the diameter is not as specified, check the crankshaft oil clearance.

- (c) Check each main journal for taper and distortion as shown in the illustration.

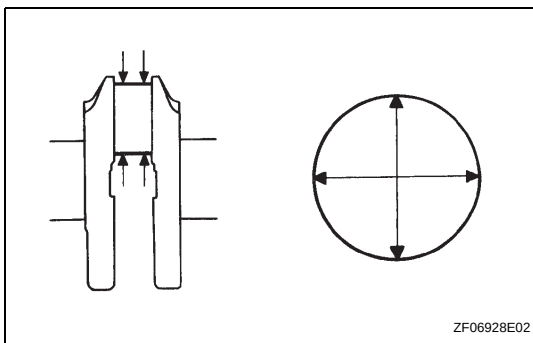
Maximum taper and distortion:

0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.

Standard diameter (Reference)

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.998 to 54.990 mm (2.1649 to 2.1650 in.)



- (d) Using a micrometer, measure the diameter of each crank pin.

Standard diameter:

47.990 to 48.000 mm (1.8894 to 1.8898 in.)

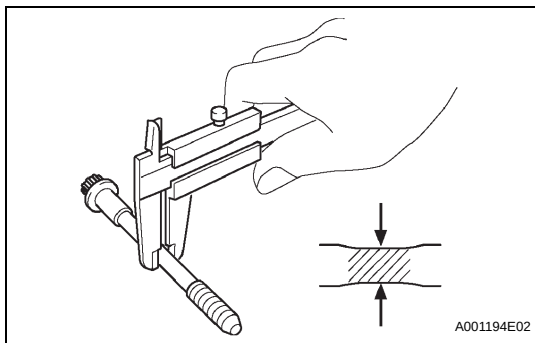
If the diameter is not as specified, check the connecting rod oil clearance.

- (e) Inspect each crank pin for taper and distortion as shown in the illustration.

Maximum taper and distortion:

0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.

**11. INSPECT CRANKSHAFT BEARING CAP SET BOLT**

- (a) Using a vernier caliper, measure the tension portion diameter of the bolts.

Standard diameter:

7.5 to 7.6 mm (0.295 to 0.299 in.)

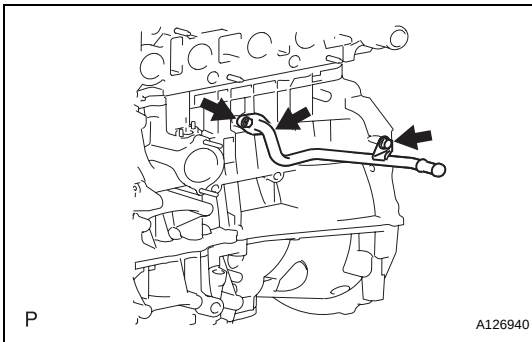
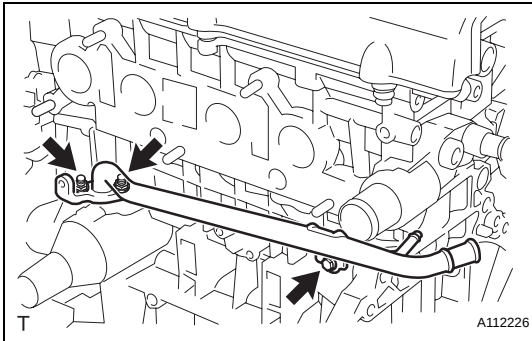
Minimum diameter:

7.5 mm (0.295 in.)

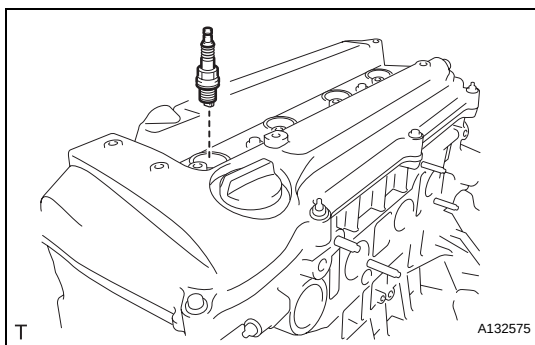
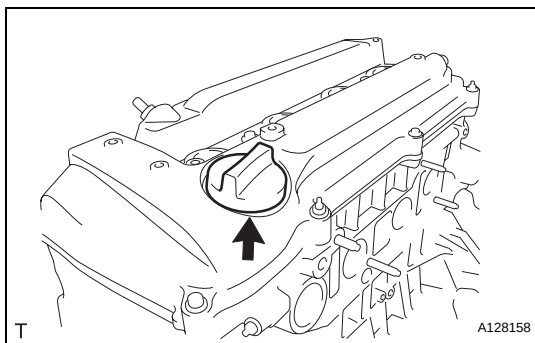
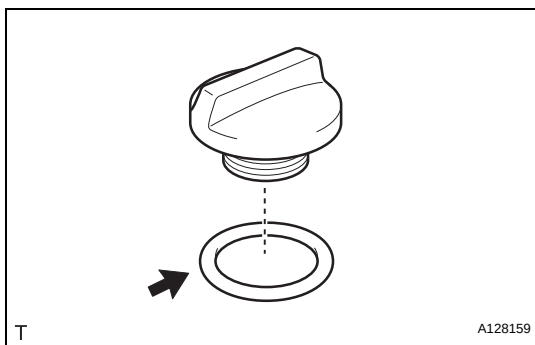
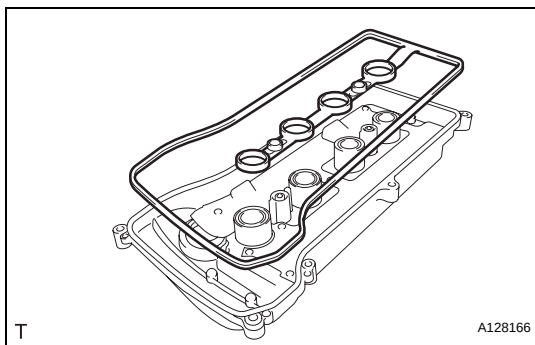
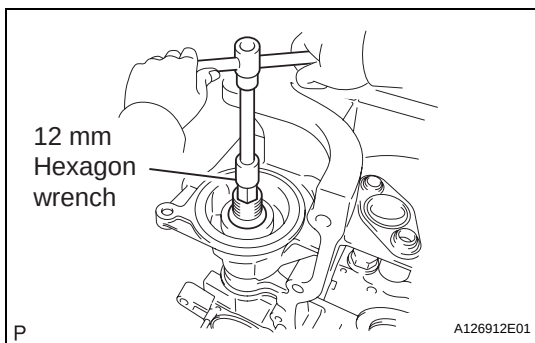
If the diameter is less than the minimum, replace the bolt.

DISASSEMBLY

1. REMOVE IDLER PULLEY (See page [EM-23](#))
2. REMOVE OIL DIPSTICK
3. REMOVE OIL DIPSTICK GUIDE (See page [EM-57](#))
4. REMOVE MANIFOLD STAY (See page [EM-57](#))
5. REMOVE NO. 2 MANIFOLD STAY (See page [EM-58](#))
6. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See page [EM-58](#))
7. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (See page [EM-58](#))
8. REMOVE WATER INLET (See page [CO-15](#))
9. REMOVE THERMOSTAT
10. REMOVE NO. 1 WATER BY-PASS PIPE
(a) Remove the bolt, 2 nuts, pipe and gasket.

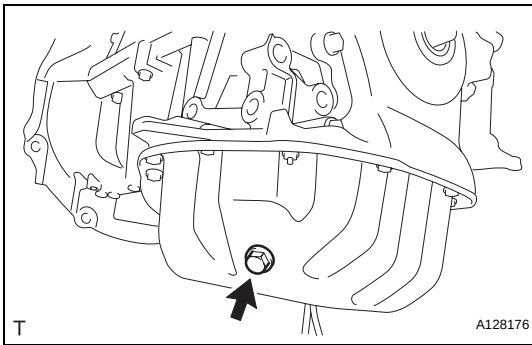
EM

11. REMOVE NO. 3 WATER BY-PASS PIPE
(a) Remove the bolt, 2 nuts, pipe and gasket.
12. REMOVE V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-26](#))
13. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-395](#))
14. REMOVE KNOCK SENSOR (See page [ES-420](#))
15. REMOVE RADIO SETTING CONDENSER (See page [EM-63](#))
16. REMOVE OIL PRESSURE SWITCH ASSEMBLY (See page [EM-63](#))
17. REMOVE ENGINE COOLANT TEMPERATURE SENSOR (See page [EM-63](#))
18. REMOVE CAMSHAFT POSITION SENSOR (See page [EM-64](#))
19. REMOVE IGNITION COIL ASSEMBLY (See page [IG-9](#))

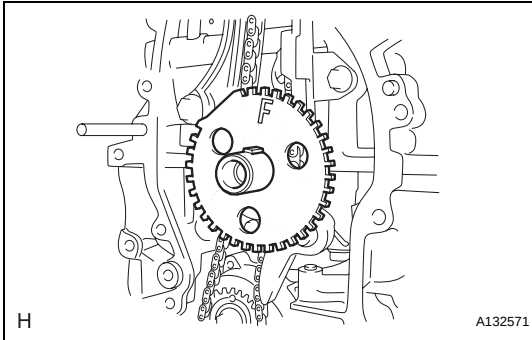
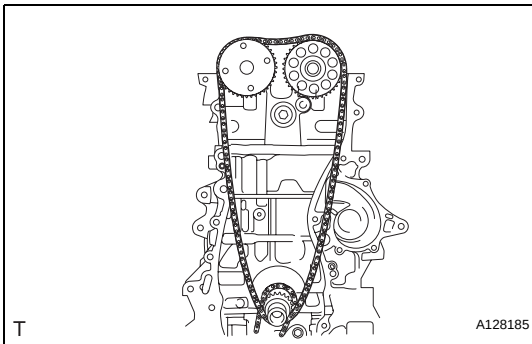
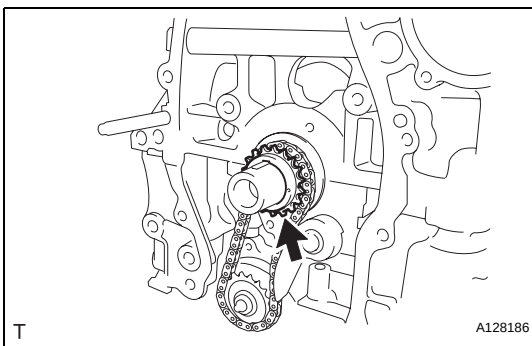
**20. REMOVE SPARK PLUG****21. REMOVE OIL FILLER CAP SUB-ASSEMBLY****22. REMOVE OIL FILLER CAP GASKET****23. REMOVE VENTILATION VALVE SUB-ASSEMBLY**
(See page [EC-18](#))**24. REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY**
(See page [EM-24](#))**25. REMOVE CYLINDER HEAD COVER GASKET****26. REMOVE OIL FILTER SUB-ASSEMBLY** (See page [LU-4](#))**27. REMOVE OIL FILTER UNION**

- (a) Using a 12 mm hexagon wrench, remove the oil filter union.

28. REMOVE CRANKSHAFT POSITION SENSOR (See page [ES-402](#))**29. REMOVE WATER PUMP PULLEY** (See page [CO-11](#))**30. REMOVE WATER PUMP ASSEMBLY** (See page [CO-11](#))

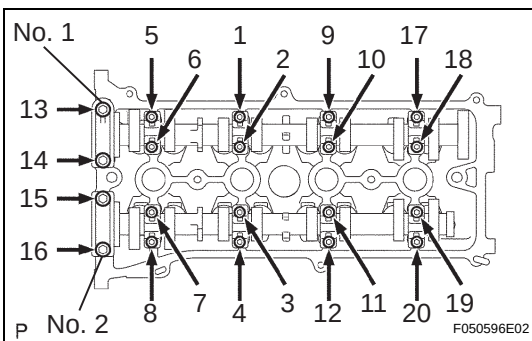
**31. REMOVE OIL PAN DRAIN PLUG**

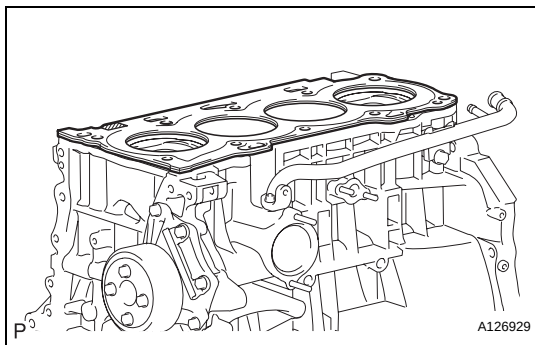
- (a) Remove the oil pan drain plug and gasket.

32. REMOVE OIL PAN SUB-ASSEMBLY (See page [EM-24](#))**33. REMOVE CRANKSHAFT PULLEY** (See page [EM-25](#))**34. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY** (See page [EM-26](#))**35. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY** (See page [EM-26](#))**36. REMOVE NO. 1 CRANKSHAFT POSITION SENSOR PLATE****37. REMOVE TIMING CHAIN GUIDE** (See page [EM-28](#))**38. REMOVE CHAIN TENSIONER SLIPPER** (See page [EM-28](#))**39. REMOVE NO. 1 CHAIN VIBRATION DAMPER** (See page [EM-28](#))**40. REMOVE CHAIN SUB-ASSEMBLY****41. REMOVE CRANKSHAFT TIMING SPROCKET****42. REMOVE NO. 2 CHAIN SUB-ASSEMBLY** (See page [EM-29](#))**43. REMOVE OIL PUMP DRIVE GEAR****44. REMOVE OIL PUMP ASSEMBLY** (See page [LU-12](#))**45. REMOVE CAMSHAFT**

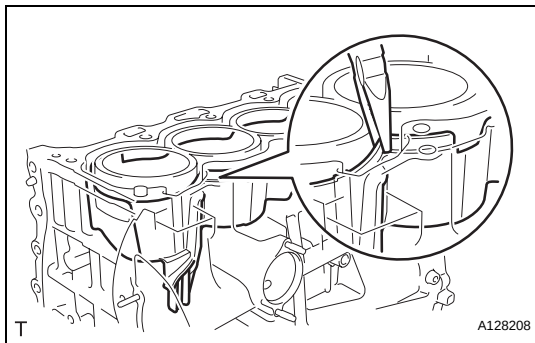
- (a) Using several steps, uniformly loosen and remove the 20 bearing cap bolts in the sequence shown in the illustration.

- (b) Remove the 10 bearing caps, then remove the camshaft and No. 2 camshaft.

46. REMOVE CYLINDER HEAD SUB-ASSEMBLY (See page [EM-62](#))



47. REMOVE CYLINDER HEAD GASKET

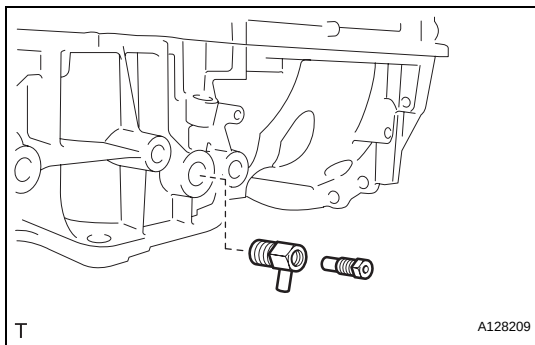


48. REMOVE CYLINDER BLOCK WATER JACKET SPACER

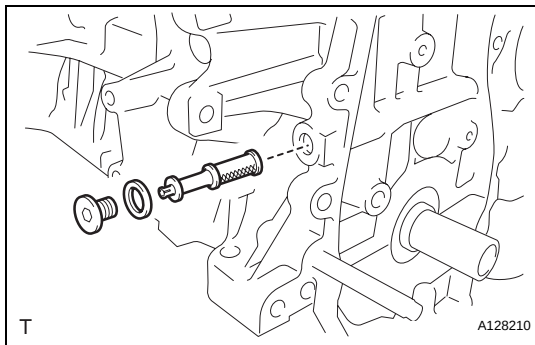
- (a) Using needle-nose pliers, remove the cylinder block water jacket spacer from the water jacket.

NOTICE:

Before turning the cylinder block upside down, make sure that the water jacket spacer is removed, as it will fall out.

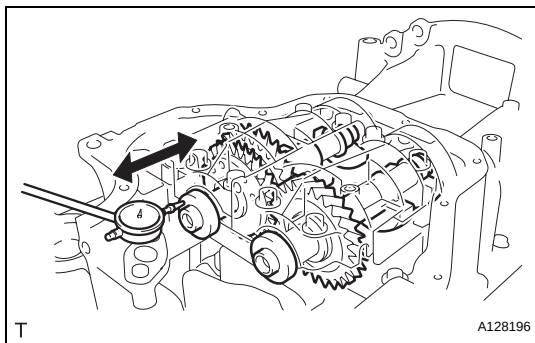


49. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY



50. REMOVE OIL CONTROL VALVE FILTER

- (a) Using a 6 mm socket hexagon wrench, remove the plug and gasket.
(b) Remove the oil control valve filter.



51. INSPECT BALANCE SHAFT THRUST CLEARANCE

- (a) Using a dial indicator, measure the thrust clearance while moving the balance shaft back and forth.

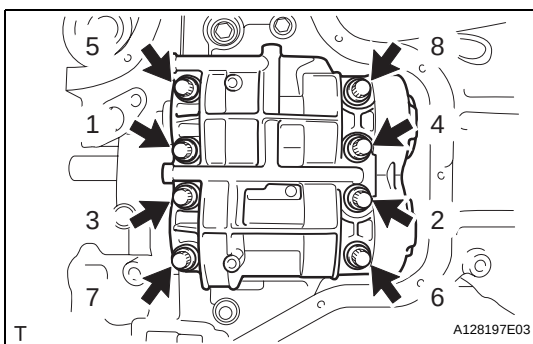
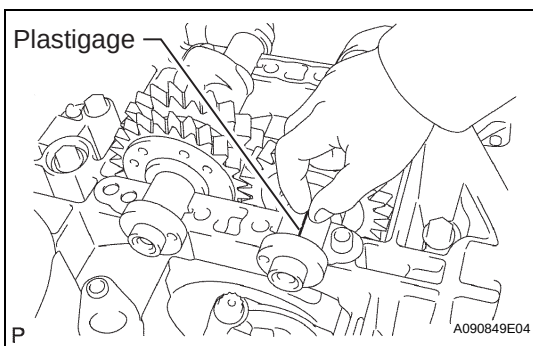
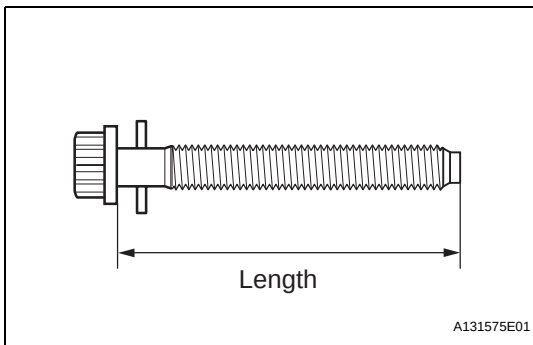
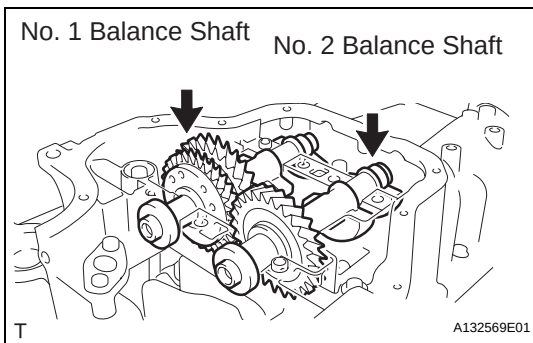
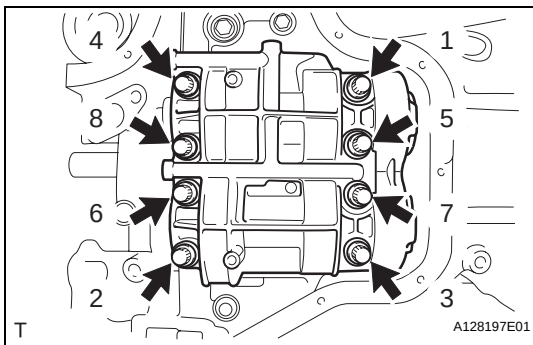
Standard thrust clearance:

0.05 to 0.09 mm (0.0020 to 0.0035 in.)

Maximum thrust clearance:

0.09 mm (0.0035 in.)

If the thrust clearance is greater than the maximum, replace the balance shaft housing and bearings. If necessary, replace the balance shaft.

**52. INSPECT BALANCE SHAFT OIL CLEARANCE**

- (a) Using several steps, uniformly loosen and remove the 8 bolts in the sequence shown in the illustration.
- (b) Remove the balance shaft housing from the crankcase.

HINT:

Keep the lower bearing and balance shaft housing together.

- (c) Lift out the No. 1 and No. 2 balance shafts.

HINT:

Keep the upper bearing with the crankcase.

- (d) Clean each bearing and journal.
- (e) Check each bearing and journal for pitting and scratches.

If a bearing or journal is damaged, replace the bearings. If necessary, replace the balance shaft.

- (f) Inspect the balance shaft housing bolt.

- (1) Using a vernier caliper, measure the length of the bolts from the seat to the end.

Standard bolt length:

58.3 to 59.7 mm (2.295 to 2.350 in.)

Maximum bolt length:

60.3 mm (2.374 in.)

If the bolt length is greater than the maximum, replace the balance shaft bolt.

- (g) Place the No. 1 and No. 2 balance shafts onto the crankcase.

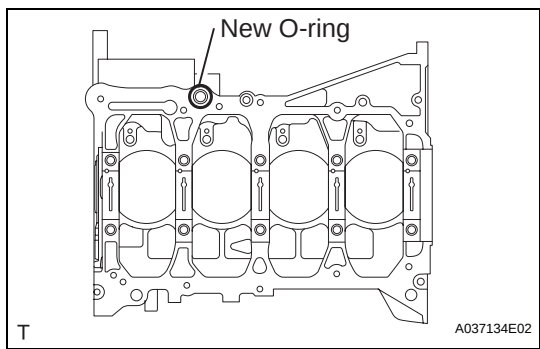
- (h) Lay a strip of Plastigage across each journal.

- (i) Install the balance shaft housing.

- (j) Apply a light coat of engine oil on the threads and under the heads of the bolts.

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

Torque: 21.6 N*m (220 kgf*cm, 16 ft.*lbf)



- (l) Mark the front of the bolts with paint.
- (m) Retighten the bolts 90° as shown in the illustration.
- (n) Check that the paint mark is now at a 90° angle to the front.
- (o) Remove the balance shaft housing from the crankcase.
- (p) Measure the Plastigage at its widest point.

Standard oil clearance:

0.004 to 0.049 mm (0.0002 to 0.0019 in.)

Maximum oil clearance:

0.049 mm (0.0019 in.)

NOTICE:

Remove the Plastigage completely after the measurement.

If the oil clearance is greater than the maximum, replace the bearing. If necessary, replace the balance shaft.

HINT:

If replacing a bearing, select a new one with the same number.

Standard balance shaft housing journal bore diameter

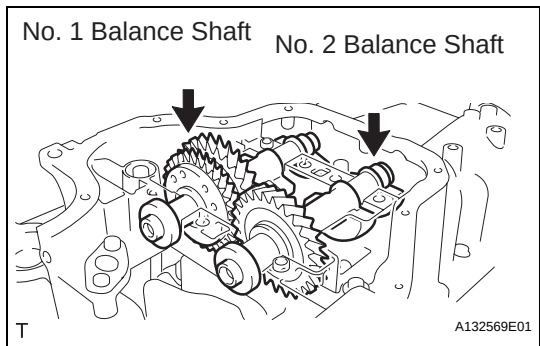
Item	Specified Condition
Mark 1	26.000 to 26.006 mm (1.0236 to 1.0239 in.)
Mark 2	26.007 to 26.012 mm (1.0239 to 1.0214 in.)
Mark 3	26.013 to 26.018 mm (1.0241 to 1.0243 in.)

Standard balance shaft journal diameter:

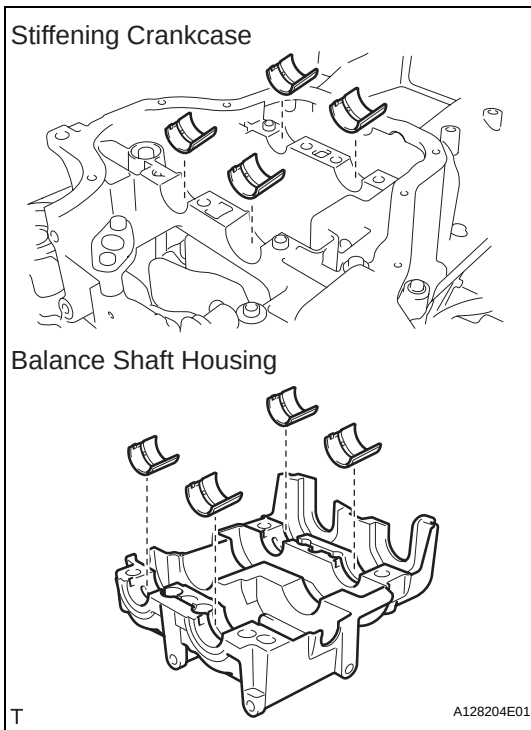
22.985 to 23.000 mm (0.9049 to 0.9055 in.)

Standard bearing center wall thickness

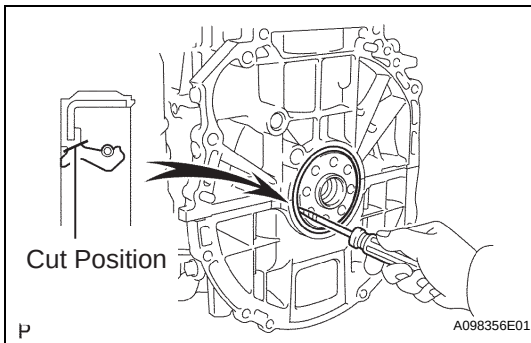
Item	Specified Condition
Mark 1	1.486 to 1.489 mm (0.05850 to 0.05862 in.)
Mark 2	1.490 to 1.492 mm (0.05866 to 0.05874 in.)
Mark 3	1.493 to 1.495 mm (0.0585 to 0.0586 in.)



53. REMOVE BALANCE SHAFT



54. REMOVE NO. 1 BALANCE SHAFT BEARING

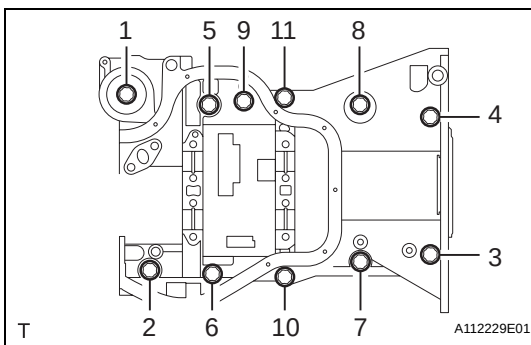


55. REMOVE ENGINE REAR OIL SEAL

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

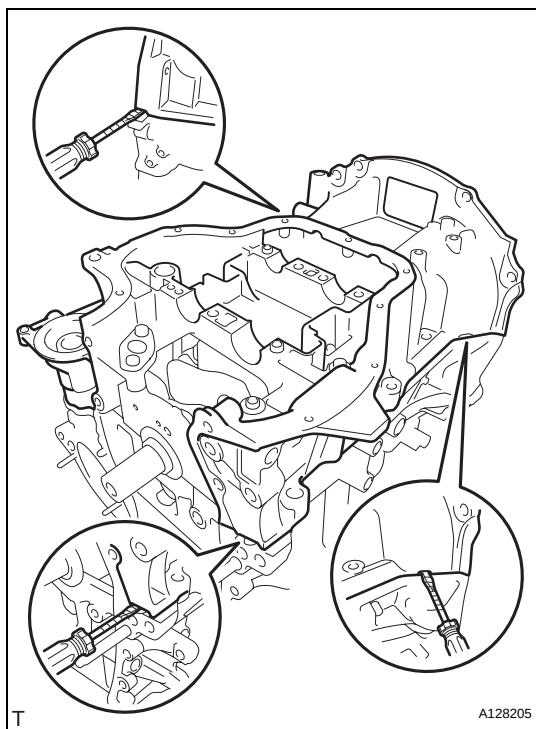
NOTICE:

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



56. REMOVE STIFFENING CRANKCASE ASSEMBLY

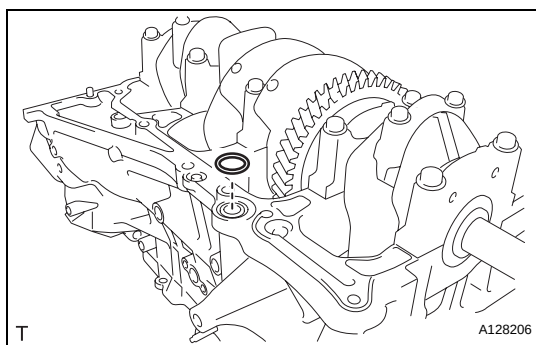
- Using several steps, uniformly loosen and remove the 11 bolts in the sequence shown in the illustration.



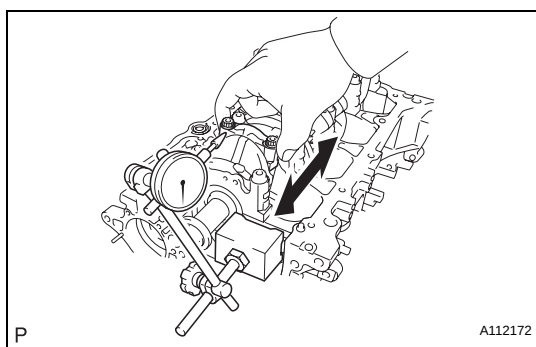
- (b) Remove the crankcase by prying the portions between the crankcase and cylinder block.

NOTICE:

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



- (c) Remove the O-ring from the cylinder block.



57. INSPECT CONNECTING ROD THRUST CLEARANCE

- (a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:

0.160 to 0.362 mm (0.0063 to 0.0143 in.)

Maximum thrust clearance:

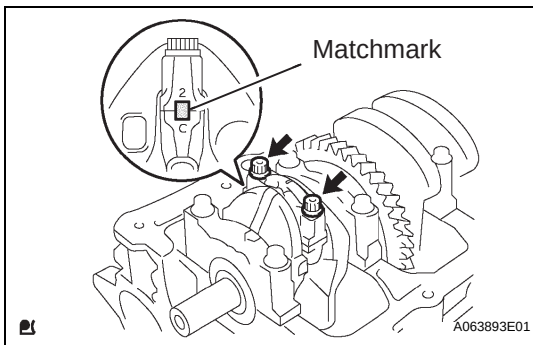
0.362 mm (0.0143 in.)

If the thrust clearance is greater than the maximum, replace the connecting rod. If necessary, replace the crankshaft.

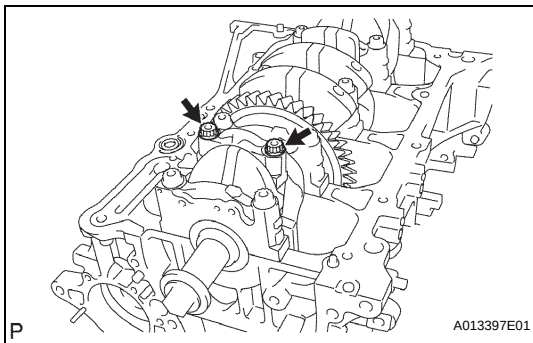
58. INSPECT CONNECTING ROD OIL CLEARANCE

NOTICE:

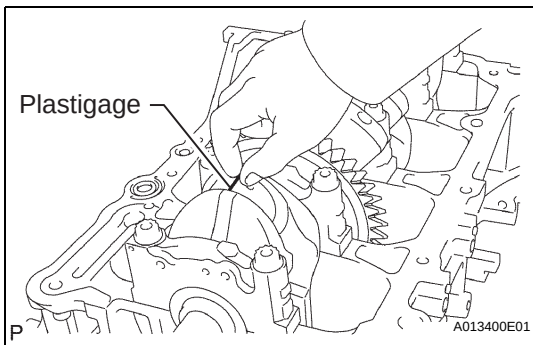
Do not turn the crankshaft during the measurement.



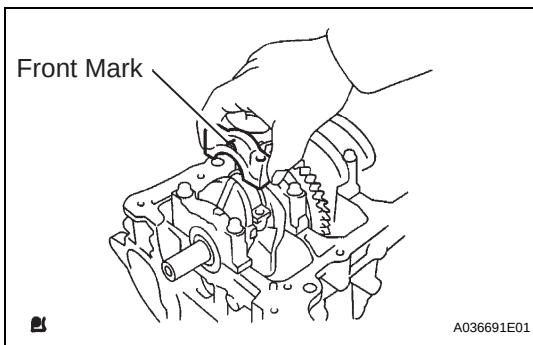
- (a) Using marking paint, write the matched cylinder number on each connecting rod and cap.
HINT:
The matchmarks in the connecting rods and caps are for ensuring correct reassembly.



- (b) Using a 12 mm socket wrench, remove the 2 bolts and connecting rod cap.
(c) Clean the crank pin and bearing.
(d) Check the crank pin and bearing for pitting and scratches.

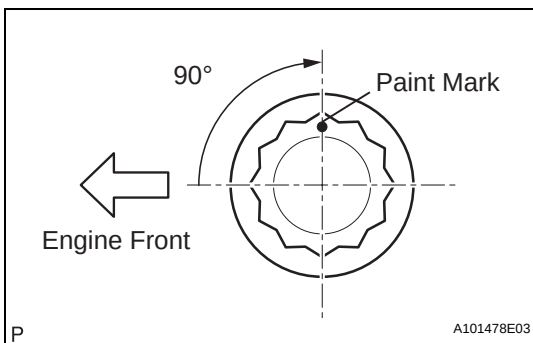


- (e) Lay a strip of Plastigage on the crank pin.

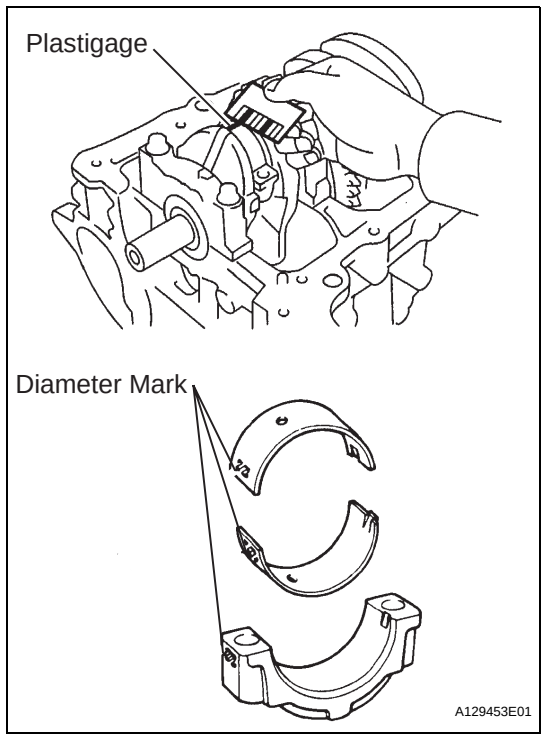


- (f) Check that the front mark of the connecting rod cap is facing in the correct direction.
(g) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
(h) Using a 12 mm socket wrench, tighten the bolts in several passes to the specified torque.

Torque: 24.5 N*m (250 kgf*cm, 18 ft.*lbf)



- (i) Mark the front of the connecting rod bolts with paint.
(j) Retighten the cap bolts 90° as shown in the illustration.
(k) Check that the crankshaft turns smoothly.
(l) Using a 12 mm socket wrench, remove the 2 bolts and connecting rod cap.



- (m) Measure the Plastigage at its widest point.
Standard oil clearance:
0.024 to 0.048 mm (0.0009 to 0.0019 in.)
Maximum oil clearance:
0.08 mm (0.0032 in.)

NOTICE:
Remove the Plastigage completely after the measurement.

If the oil clearance is greater than the maximum, replace the connecting rod bearing. If necessary, grind or replace the crankshaft.

HINT:
If replacing a bearing, select a new one with the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

Standard connecting rod large end bore diameter

Mark	Specified Condition
Mark 1	51.000 to 51.007 mm (2.0079 to 2.0082 in.)
Mark 2	51.008 to 51.013 mm (2.0082 to 2.0084 in.)
Mark 3	51.014 to 51.020 mm (2.0084 to 2.0087 in.)

Standard connecting rod bearing thickness

Mark	Specified Condition
Mark 1	1.485 to 1.488 mm (0.0585 to 0.0586 in.)
Mark 2	1.489 to 1.491 mm (0.0586 to 0.0587 in.)
Mark 3	1.492 to 1.494 mm (0.0587 to 0.0588 in.)

Standard crankshaft pin diameter:
47.990 to 48.000 (1.8894 to 1.8898 in.)

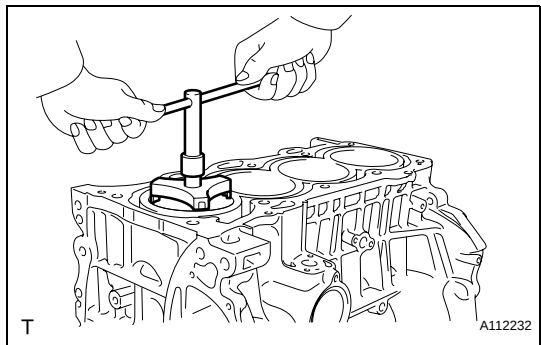
59. REMOVE PISTON WITH CONNECTING ROD

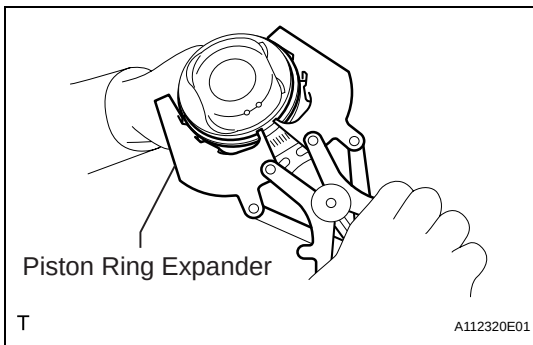
- (a) Using a ridge reamer, remove all the carbon from the top of the cylinder.
(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:

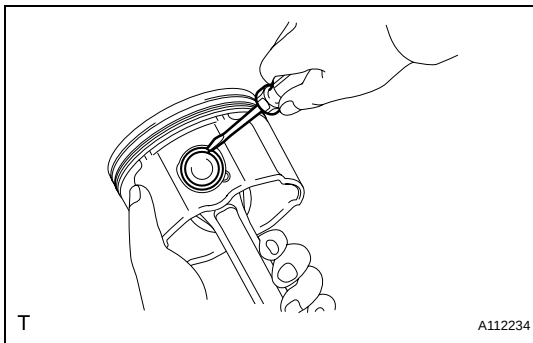
- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

60. REMOVE CONNECTING ROD BEARING

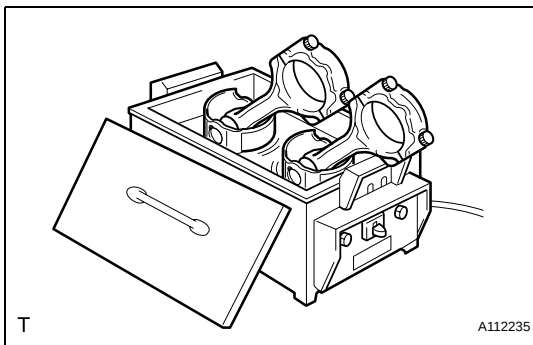


**61. REMOVE PISTON RING SET**

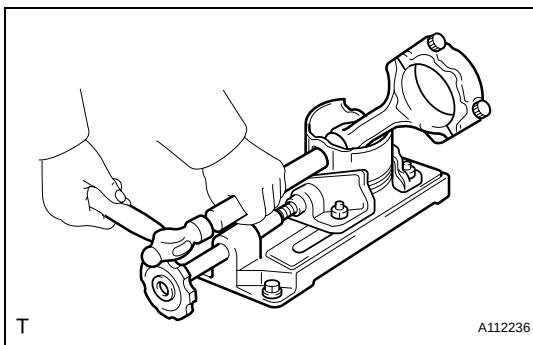
- (a) Using a piston ring expander, remove the 2 compression rings.
- (b) Remove the oil ring and expander by hand.

**62. REMOVE PISTON PIN HOLE SNAP RING**

- (a) Using a small screwdriver, pry out the 2 snap rings.

**63. REMOVE PISTON**

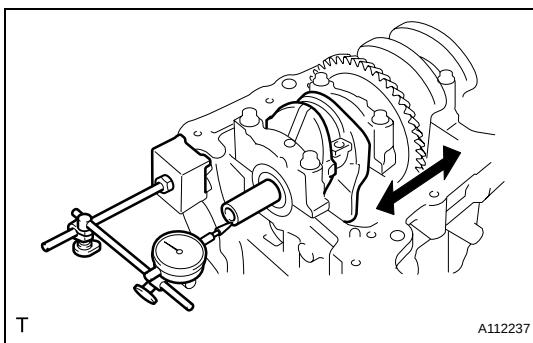
- (a) Gradually heat the piston up to 80 to 90°C (176 to 194°F).



- (b) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin, then remove the connecting rod.

HINT:

- The piston and pin are a matched set.
- Arrange the piston, pin, ring, connecting rod and bearings in the correct order.

**64. INSPECT CRANKSHAFT THRUST CLEARANCE**

- (a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.04 to 0.24 mm (0.0016 to 0.0095 in.)

Maximum thrust clearance:

0.30 mm (0.012 in.)

If the thrust clearance is greater than the maximum, replace the thrust washers as a set.

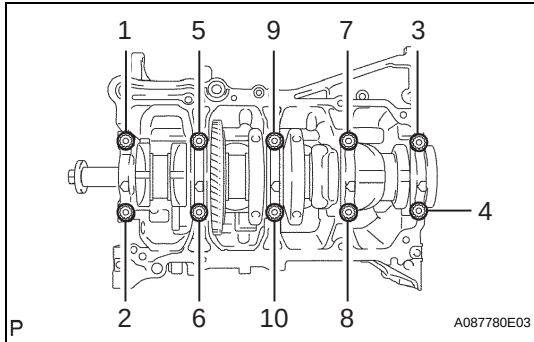
HINT:

The thrust washer thickness is 1.93 to 1.98 mm (0.0760 to 0.0780 in.).

65. INSPECT CRANKSHAFT OIL CLEARANCE

NOTICE:

Do not turn the crankshaft during the measurement.



- (a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.

- (b) Remove the 5 bearing caps from the cylinder block.

HINT:

- Keep the No. 2 crankshaft bearings and crankshaft bearing caps together.
- Arrange the bearing caps in correct order.

- (c) Remove the crankshaft.

HINT:

Keep the crankshaft bearings and crankshaft thrust washer uppers together with the cylinder block.

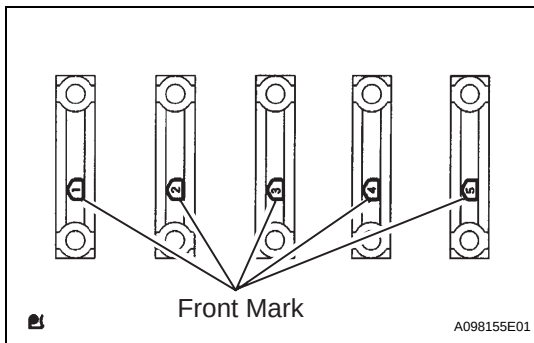
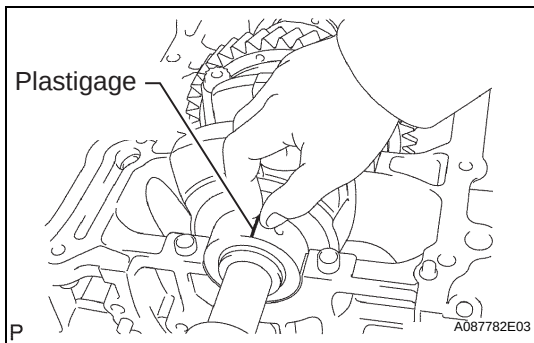
- (d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.

- If the journal or bearing is damaged, replace the bearings.

- If necessary, replace the crankshaft.

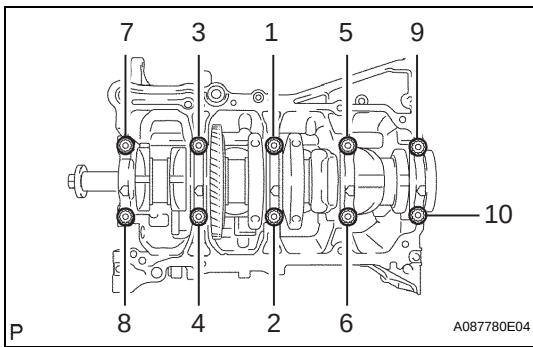
- (f) Place the crankshaft onto the cylinder block.

- (g) Lay a strip of Plastigage across each journal.



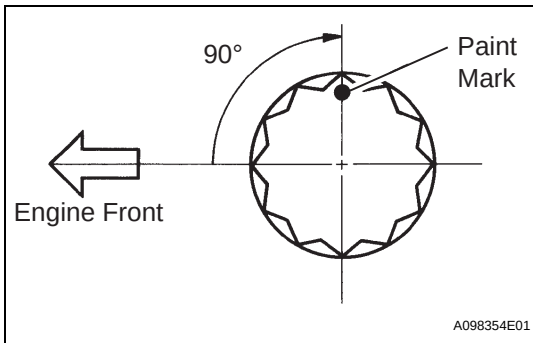
- (h) Examine the front marks and numbers, and install the bearing caps onto the cylinder block in the order shown in the illustration.

- (i) Apply a light coat of engine oil to the threads and under the heads of the crankshaft bearing cap set bolts.

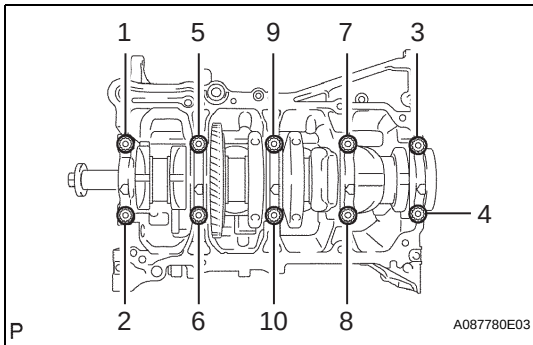


- (j) Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

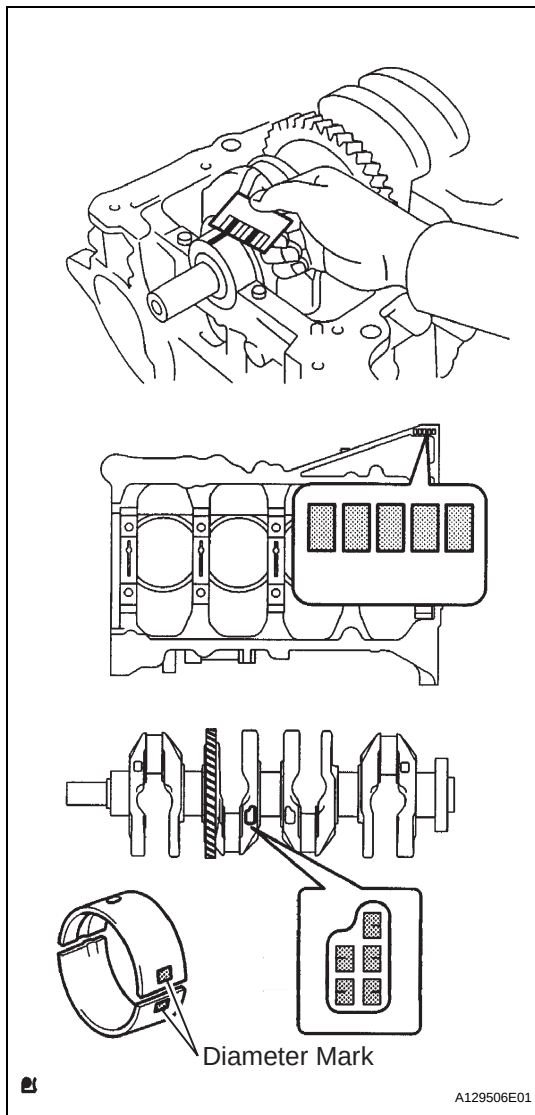
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)



- (k) Mark the front of the bearing cap bolts with paint.
 (l) Retighten the 10 bearing cap bolts by 90°.
 (m) Check that the paint marks are at a 90° angle to the front.



- (n) Remove the crankshaft bearing caps.



- (o) Measure the Plastigage at its widest point.

Standard oil clearance:

0.008 to 0.024 mm (0.0003 to 0.0010 in.)

Maximum oil clearance:

0.050 mm (0.0020 in.)

NOTICE:

Remove the Plastigage completely after the measurement.

If the oil clearance is greater than the maximum, replace the crankshaft bearing. If necessary, replace the crankshaft.

HINT:

If replacing a bearing, select a new one with the same number. If the number of the bearing cannot be determined, calculate the correct bearing number by adding together the numbers imprinted on the cylinder block and crankshaft. Then select a new bearing with the calculated number. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

Cylinder block + Crankshaft	0 to 2	3 to 5	6 to 8	9 to 11
Use bearing	"1"	"2"	"3"	"4"

EXAMPLE

- Imprinted number on the cylinder block is 3.
- Imprinted number on the crankshaft is 4.

$$3 + 4 = 7$$

Select the bearing marked "3".

Standard cylinder block journal bore diameter

Mark	Specified Condition
0	59.000 to 59.002 mm (2.3228 to 2.3229 in.)
1	59.003 to 59.004 mm (2.3230 to 2.3230 in.)
2	59.005 to 59.006 mm (2.3230 to 2.3231 in.)
3	59.007 to 59.009 mm (2.3231 to 2.3232 in.)
4	59.010 to 59.011 mm (2.3232 to 2.3233 in.)
5	59.012 to 59.013 mm (2.3233 to 2.3234 in.)
6	59.014 to 59.016 mm (2.3234 to 2.3235 in.)

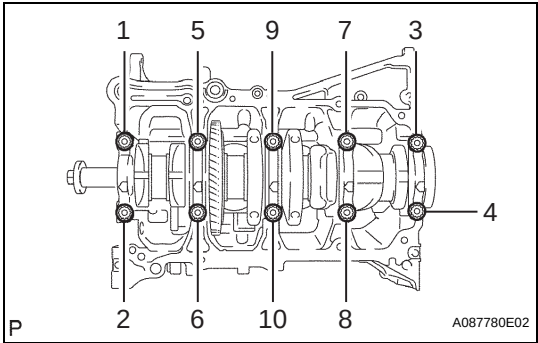
Standard crankshaft journal diameter

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)

Mark	Specified Condition
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.988 to 54.990 mm (2.1649 to 2.1650 in.)

Standard bearing center wall thickness

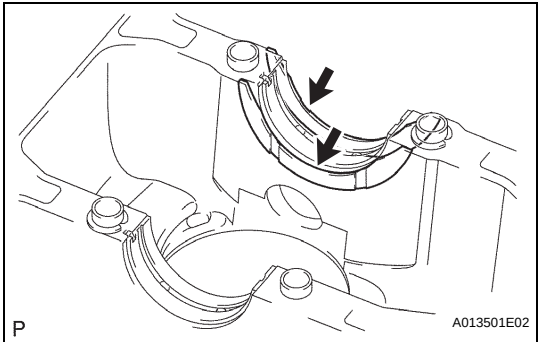
Mark	Specified Condition
1	1.993 to 1.996 mm (0.0785 to 0.0786 in.)
2	1.997 to 1.999 mm (0.0786 to 0.0787 in.)
3	2.000 to 2.002 mm (0.0787 to 0.0788 in.)
4	2.003 to 2.005 mm (0.0789 to 0.0789 in.)



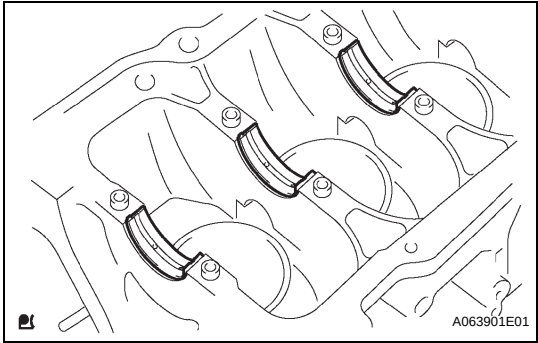
66. REMOVE CRANKSHAFT

- (a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts in the sequence shown in the illustration.
- (b) Remove the 5 bearing caps from the cylinder block.
- (c) Remove the crankshaft from the cylinder block.

EM

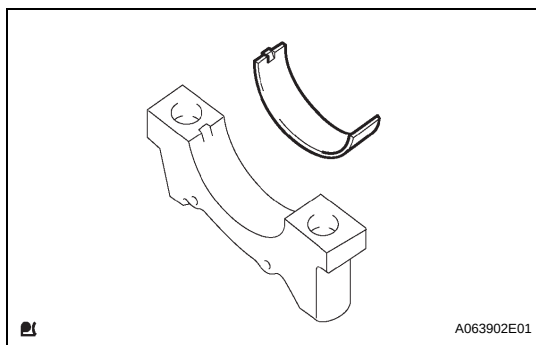


67. REMOVE CRANKSHAFT THRUST WASHER UPPER



68. REMOVE CRANKSHAFT BEARING

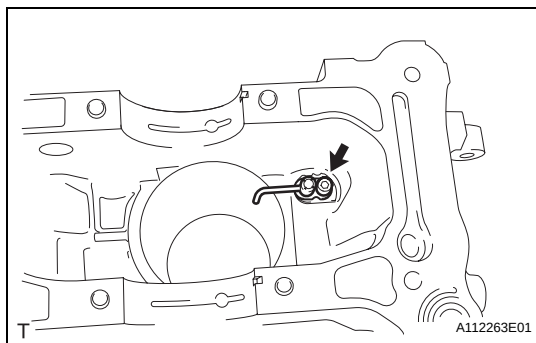
- HINT:
Arrange the bearings in the correct order.



69. REMOVE NO. 2 CRANKSHAFT BEARING

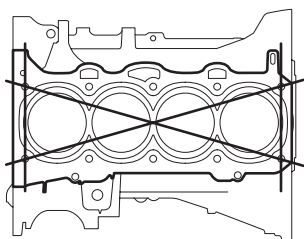
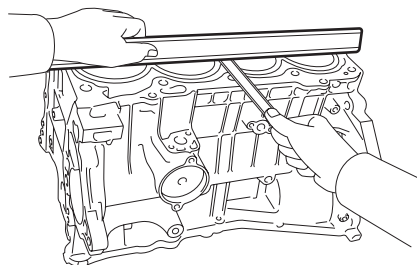
HINT:

Arrange the bearings in the correct order.



70. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY

- (a) Remove the 4 bolts and 4 oil nozzles.



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INSPECTION

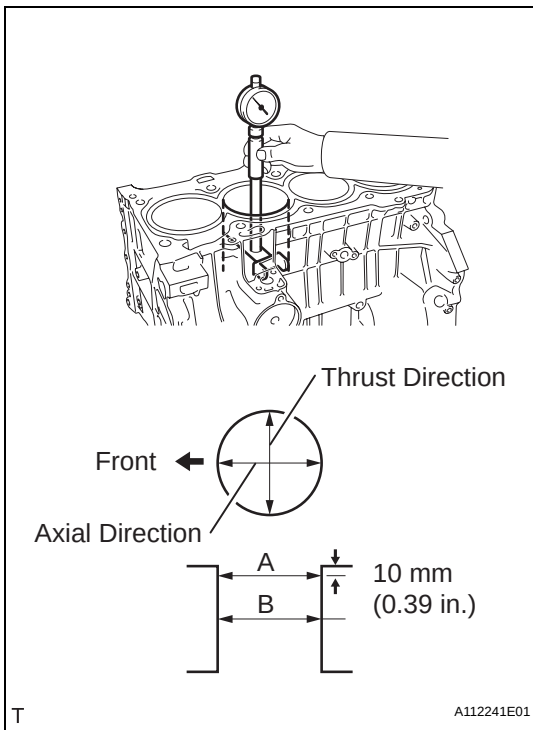
1. INSPECT CYLINDER BLOCK FOR WARPAGE

- (a) Using a precision straightedge and feeler gauge, measure the warpage of the surface that is in contact with the cylinder head gasket.

Maximum warpage:

0.05 mm (0.0020 in.)

If the warpage is greater than the maximum, replace the cylinder block.



2. INSPECT CYLINDER BORE

- (a) Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

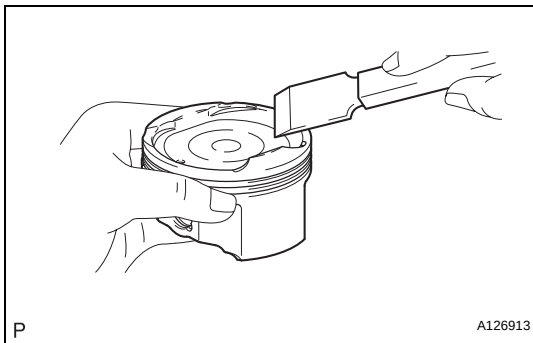
Standard diameter:

88.500 to 88.513 mm (3.4843 to 3.4847 in.)

Maximum diameter:

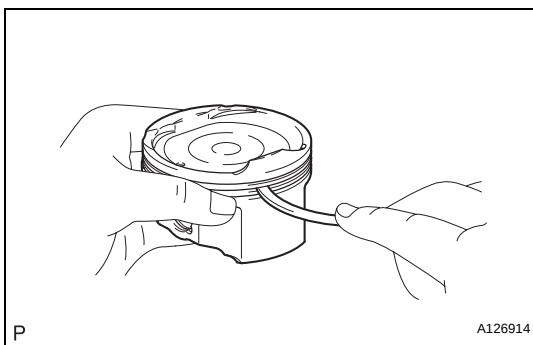
88.633 mm (3.4894 in.)

If the average diameter of the 4 positions is greater than the maximum, replace the cylinder block.

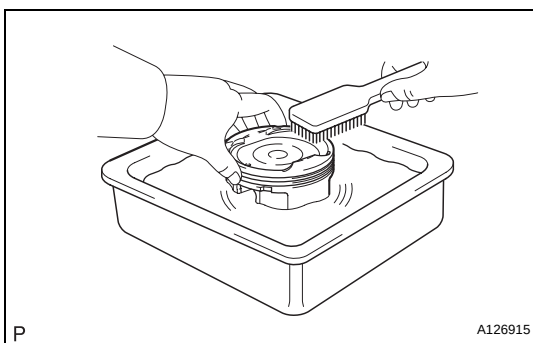


3. INSPECT PISTON

- (a) Using a gasket scraper, remove the carbon from the piston top.



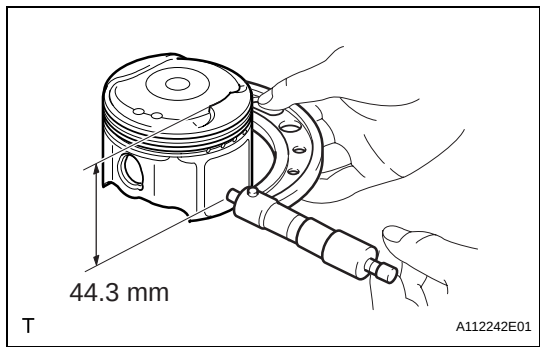
- (b) Using a groove cleaning tool or a broken ring, clean the piston ring grooves.



- (c) Using a brush and solvent, thoroughly clean the piston.

NOTICE:

Do not use a wire brush.



- (d) Using a micrometer, measure the piston diameter at right angles to the piston pin hole, and at the piston 44.3 mm (1.7587 in.) from the piston head.
Standard piston diameter:
88.477 to 88.487 mm (3.5125 to 3.5129 in.)
If the diameter is not as specified, replace the piston.

4. INSPECT PISTON OIL CLEARANCE

- (a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.
Standard oil clearance:
0.021 to 0.044 mm (0.0008 to 0.0017 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)
If the oil clearance is greater than the maximum, replace all the pistons. If necessary, replace the cylinder block.

5. INSPECT RING GROOVE CLEARANCE

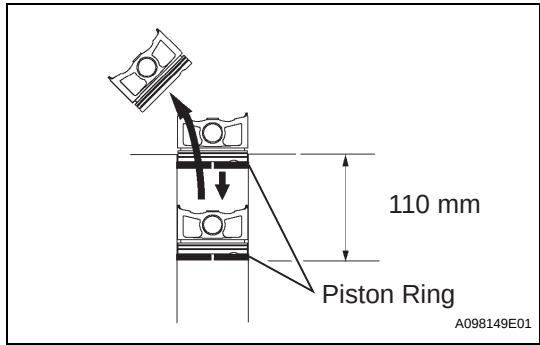
- (a) Using a feeler gauge, measure the clearance between the new piston ring and wall of the ring groove.
Standard ring groove clearance

Item	Specified Condition
No. 1 ring	0.020 to 0.070 mm (0.0008 to 0.0028 in.)
No. 2 ring	0.020 to 0.060 mm (0.0008 to 0.0024 in.)
Oil ring	0.020 to 0.070 mm (0.0008 to 0.0028 in.)

If the groove clearance is not as specified, replace the piston.

6. INSPECT PISTON RING END GAP

- (a) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.

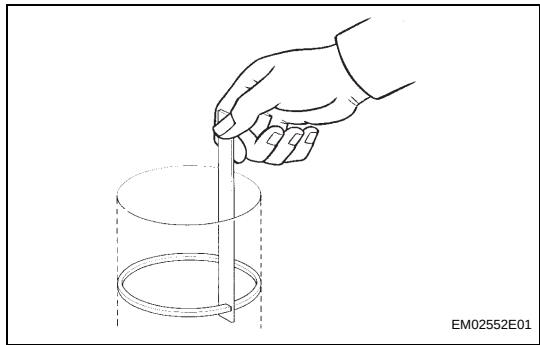


- (b) Using a feeler gauge, measure the end gap.
Standard end gap

Item	Specified Condition
No. 1 ring	0.24 to 0.31 mm (0.0094 to 0.0122 in.)
No. 2 ring	0.33 to 0.43 mm (0.0130 to 0.0169 in.)
Oil ring	0.10 to 0.30 mm (0.0040 to 0.0119 in.)

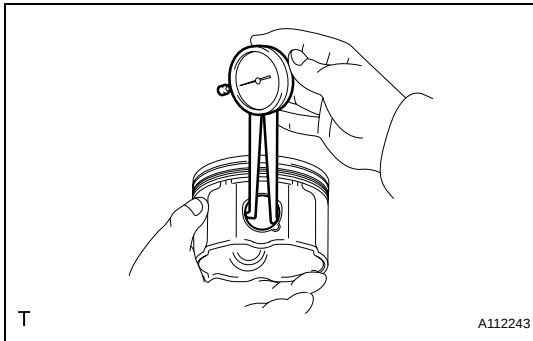
Maximum end gap

Item	Specified Condition
No. 1 ring	0.89 mm (0.0350 in.)



Item	Specified Condition
No. 2 ring	1.37 mm (0.0539 in.)
Oil ring	0.73 mm (0.0287 in.)

If the end gap is greater than the maximum, replace the piston ring. If the end gap is greater than the maximum, even with a new piston ring, replace the cylinder block.



7. INSPECT PISTON PIN OIL CLEARANCE

- (a) Using a caliper gauge, measure the piston pin bore diameter.

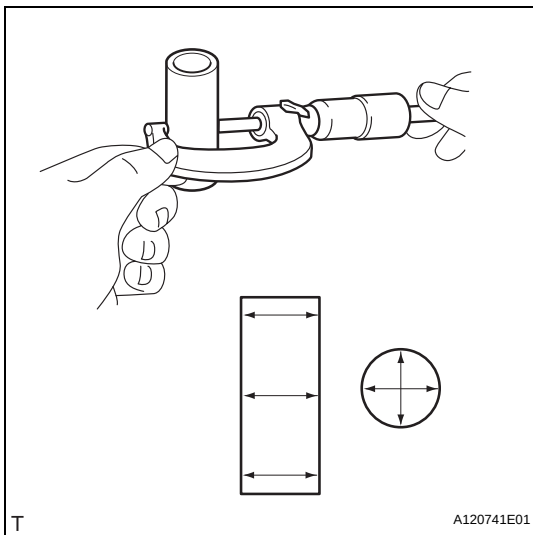
Standard piston pin bore diameter:
22.001 to 22.010 mm (0.8662 to 0.8665 in.)

Item	Specified Condition
A	22.001 to 22.004 mm (0.8662 to 0.8663 in.)
B	22.005 to 22.007 mm (0.8663 to 0.8664 in.)
C	22.008 to 22.010 mm (0.8665 to 0.8665 in.)

If the diameter is not as specified, replace the piston.

- (b) Using a micrometer, measure the piston pin diameter.

Standard piston pin diameter:
21.997 to 22.006 mm (0.8660 to 0.8664 in.)

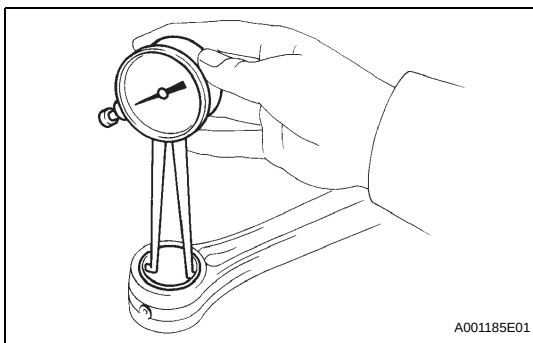


Item	Specified Condition
A	21.997 to 22.000 mm (0.8660 to 0.8661 in.)
B	22.001 to 22.003 mm (0.8662 to 0.8663 in.)
C	22.004 to 22.006 mm (0.8663 to 0.8664 in.)

If the diameter is not as specified, replace the piston pin.

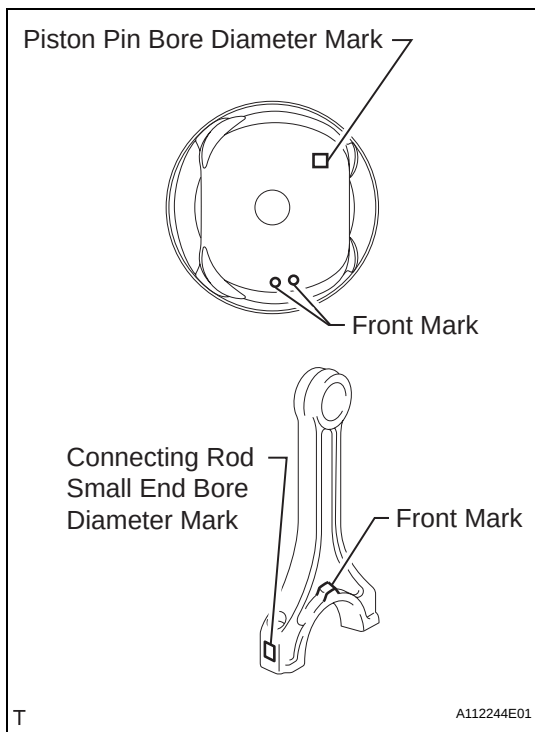
- (c) Using a caliper gauge, measure the connecting rod small end bore diameter.

Standard connecting rod small end bore diameter:
22.005 to 22.014 mm (0.8663 to 0.8667 in.)



Item	Specified Condition
A	22.005 to 22.008 mm (0.8663 to 0.8665 in.)
B	22.009 to 22.011 mm (0.8665 to 0.8666 in.)
C	22.012 to 22.014 mm (0.8666 to 0.8667 in.)

If the diameter is not as specified, replace the connecting rod.



- (d) Subtract the piston pin diameter measurement from the piston pin bore diameter measurement.

Standard oil clearance:

0.001 to 0.007 mm (0.00004 to 0.0003 in.)

Maximum oil clearance:

0.013 mm (0.0005 in.)

If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the piston and piston pin as a set.

- (e) Subtract the piston pin diameter measurement from the connecting rod small end bore diameter measurement.

Standard oil clearance:

0.005 to 0.011 mm (0.0002 to 0.0004 in.)

Maximum oil clearance:

0.017 mm (0.0007 in.)

If the oil clearance is greater than the maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.

8. INSPECT CONNECTING ROD SUB-ASSEMBLY

- (a) Using a connecting rod aligner and feeler gauge, check the connecting rod alignment.

- (1) Check for misalignment.

Maximum misalignment:

0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

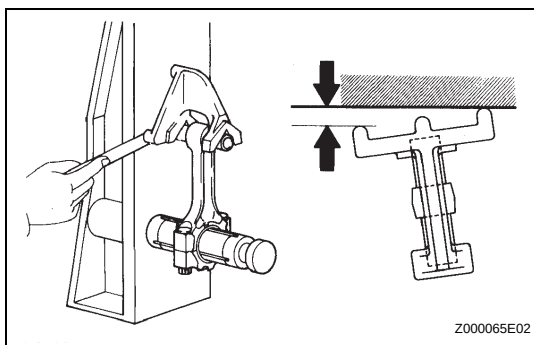
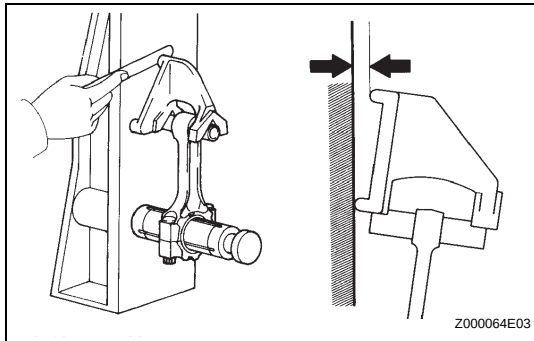
If the misalignment is greater than the maximum, replace the connecting rod.

- (2) Check for twist.

Maximum twist:

0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

If the twist is greater than the maximum, replace the connecting rod.



9. INSPECT CONNECTING ROD BOLT

- (a) Using a vernier caliper, measure the tension portion diameter of the bolt.

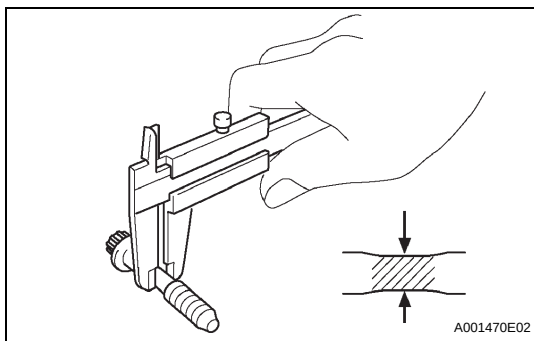
Standard diameter:

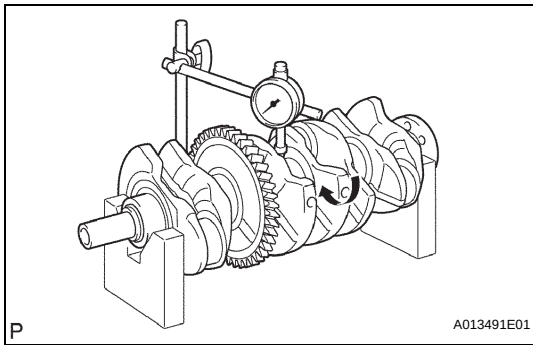
7.2 to 7.3 mm (0.283 to 0.287 in.)

Maximum diameter:

7.0 mm (0.276 in.)

If the diameter is less than the minimum, replace the connecting rod bolt.





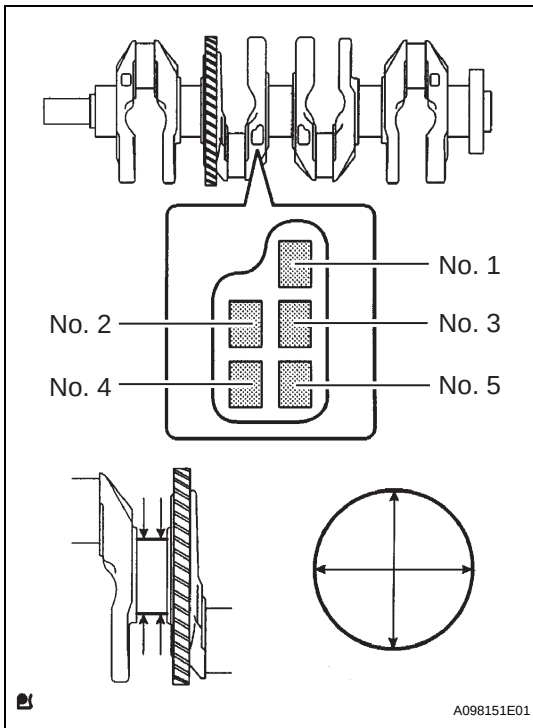
10. INSPECT CRANKSHAFT

- (a) Using a dial indicator and V-blocks, measure the circle runout as shown in the illustration.

Maximum taper and distortion:

0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.



- (b) Using a micrometer, measure the diameter of each main journal.

Standard diameter:

54.988 to 55.000 mm (2.1830 to 2.1654 in.)

If the diameter is not as specified, check the crankshaft oil clearance.

- (c) Check each main journal for taper and distortion as shown in the illustration.

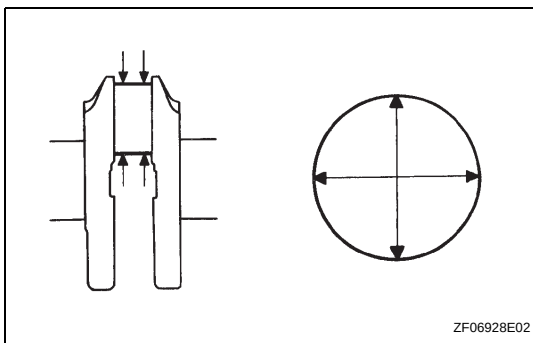
Maximum taper and distortion:

0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.

Standard diameter (Reference)

Mark	Specified Condition
0	54.999 to 55.000 mm (2.1653 to 2.1654 in.)
1	54.997 to 54.998 mm (2.1652 to 2.1653 in.)
2	54.995 to 54.996 mm (2.1652 to 2.1652 in.)
3	54.993 to 54.994 mm (2.1651 to 2.1651 in.)
4	54.991 to 54.992 mm (2.1650 to 2.1650 in.)
5	54.998 to 54.990 mm (2.1649 to 2.1650 in.)



- (d) Using a micrometer, measure the diameter of each crank pin.

Standard diameter:

47.990 to 48.000 mm (1.8894 to 1.8898 in.)

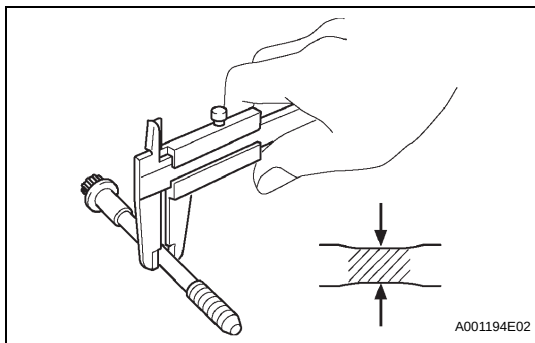
If the diameter is not as specified, check the connecting rod oil clearance.

- (e) Inspect each crank pin for taper and distortion as shown in the illustration.

Maximum taper and distortion:

0.003 mm (0.0001 in.)

If the taper and distortion are greater than the maximum, replace the crankshaft.

**11. INSPECT CRANKSHAFT BEARING CAP SET BOLT**

- (a) Using a vernier caliper, measure the tension portion diameter of the bolts.

Standard diameter:

7.5 to 7.6 mm (0.295 to 0.299 in.)

Minimum diameter:

7.5 mm (0.295 in.)

If the diameter is less than the minimum, replace the bolt.

REPLACEMENT

1. REPLACE TIMING CHAIN COVER OIL SEAL

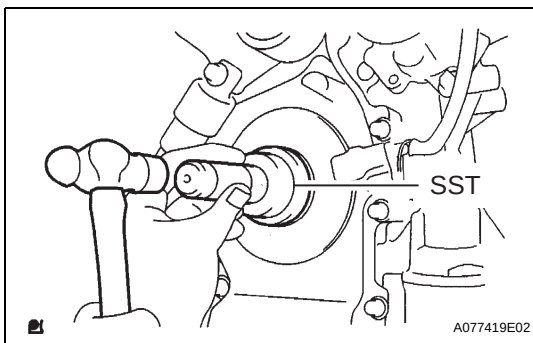
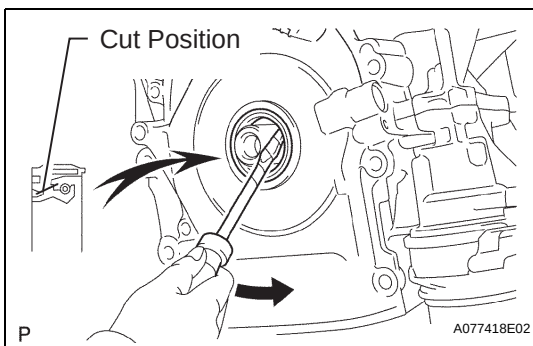
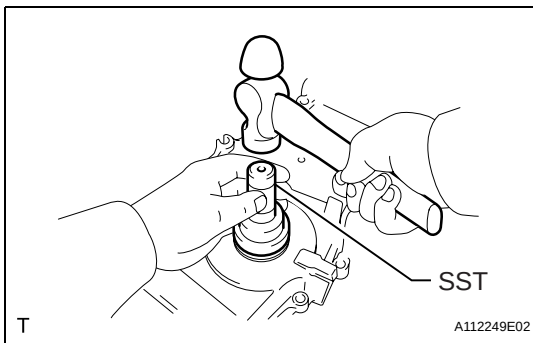
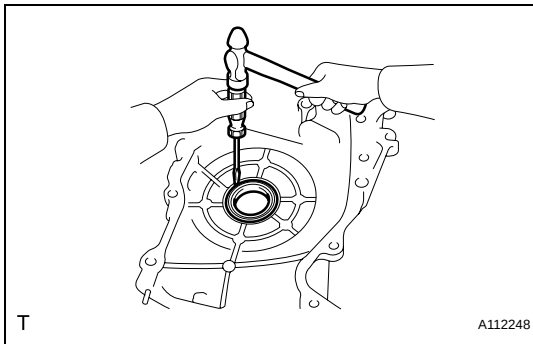
HINT:

There are 2 methods to replace the oil seal.

- (a) If the timing chain cover is removed from the cylinder block:
- (1) Using a screwdriver and hammer, tap out the oil seal.
 - (2) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign objects.



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

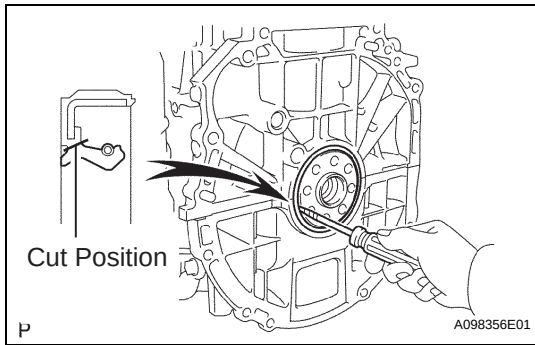
SST 09223-22010

NOTICE:

Do not tap the oil seal at an angle.

- (b) If the timing chain cover oil seal is installed to the cylinder block:
- (1) Remove the fan and generator V belt (see page [EM-6](#)).
 - (2) Remove the crankshaft pulley (see page [EM-25](#)).
 - (3) Using a knife, cut off the lip of the oil seal.
 - (4) Using a screwdriver with its tip wrapped with tape, pry out the oil seal.
- NOTICE:**
After removing, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.
- (5) Apply multi-purpose grease to the lip of a new oil seal.
- NOTICE:**
Keep the lip free of foreign objects.
- (6) Using SST and a hammer, tap in the new oil seal until its surface is flush with the timing chain cover edge.
- SST 09223-22010**
- NOTICE:**
Do not tap the oil seal at an angle.
- (7) Install the crankshaft pulley (see page [EM-38](#)).
 - (8) Install the fan and generator V belt (see page [EM-7](#)).

EM



2. REPLACE ENGINE REAR OIL SEAL

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

NOTICE:

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

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

NOTICE:

Keep the lip free of foreign objects.

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

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

NOTICE:

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

3. REPLACE STUD BOLT (for Cylinder Block)

NOTICE:

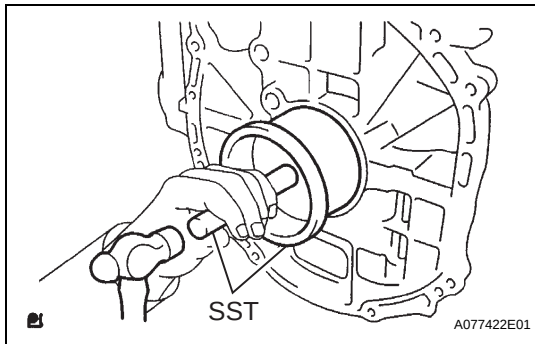
If the stud bolt is deformed or the threads are damaged, replace it.

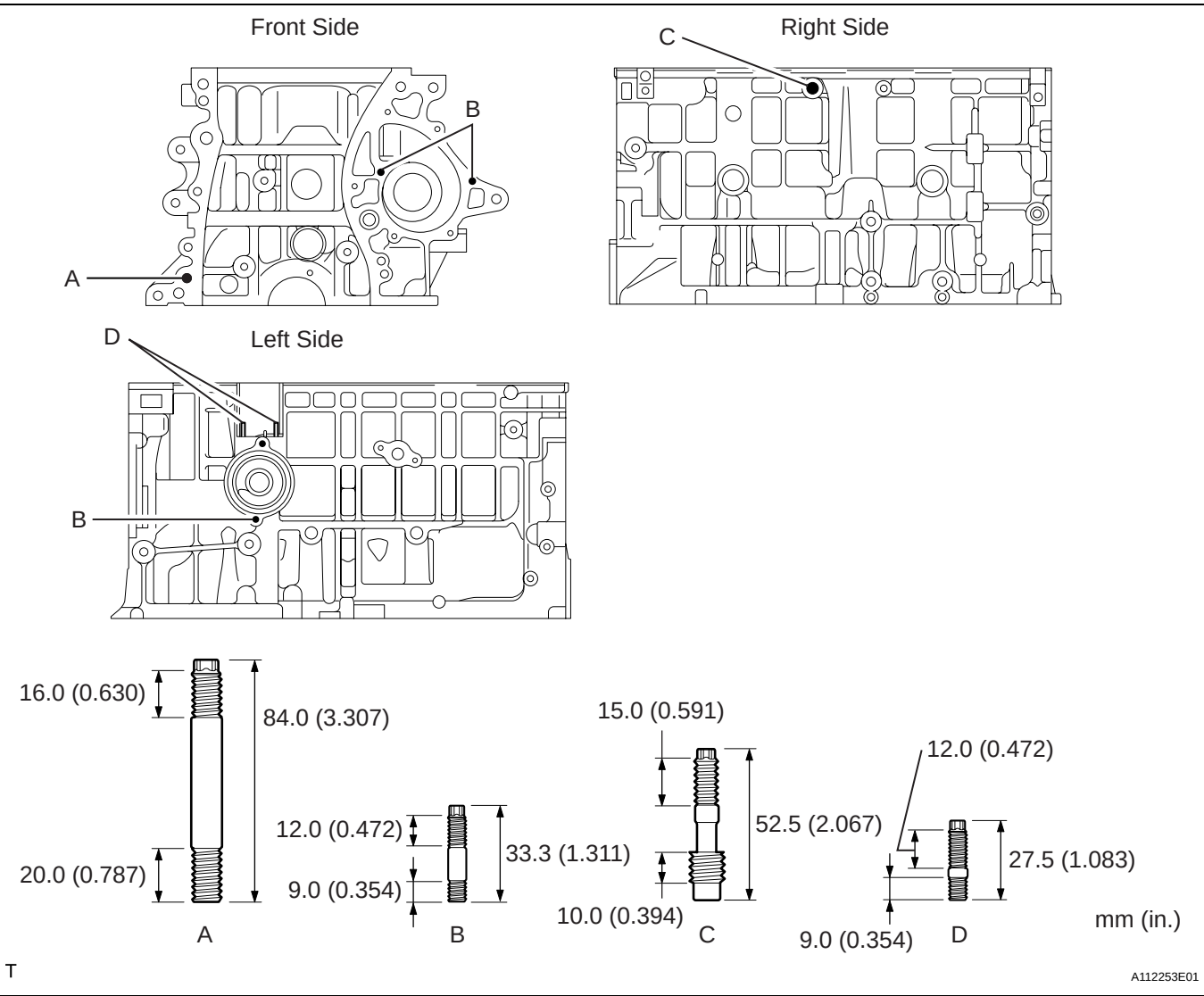
- Remove the 8 stud bolts.
- Install the 8 stud bolts into the cylinder block.

Torque

Item	Specified Condition
A	5.0 N*m (51 kgf*cm, 44 in.*lbf)
B	21.5 N*m (219 kgf*cm, 16 ft.*lbf)
C	5.0 N*m (51 kgf*cm, 44 in.*lbf)
D	5.0 N*m (51 kgf*cm, 44 in.*lbf)

EM





4. REPLACE TIGHT PLUG (for Cylinder Block)

NOTICE:

If water leaks from the tight plug or the plug corrodes, replace it.

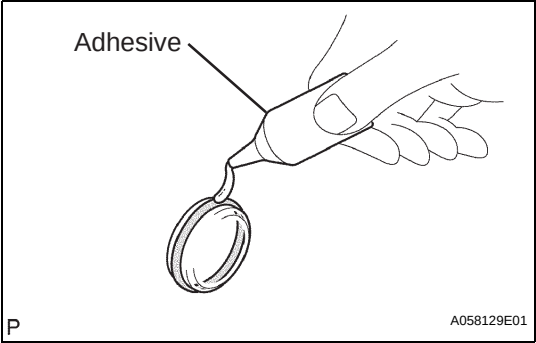
- (a) Remove the 2 tight plugs from the engine front and rear side.
- (b) Apply adhesive around new tight plugs.

Adhesive:

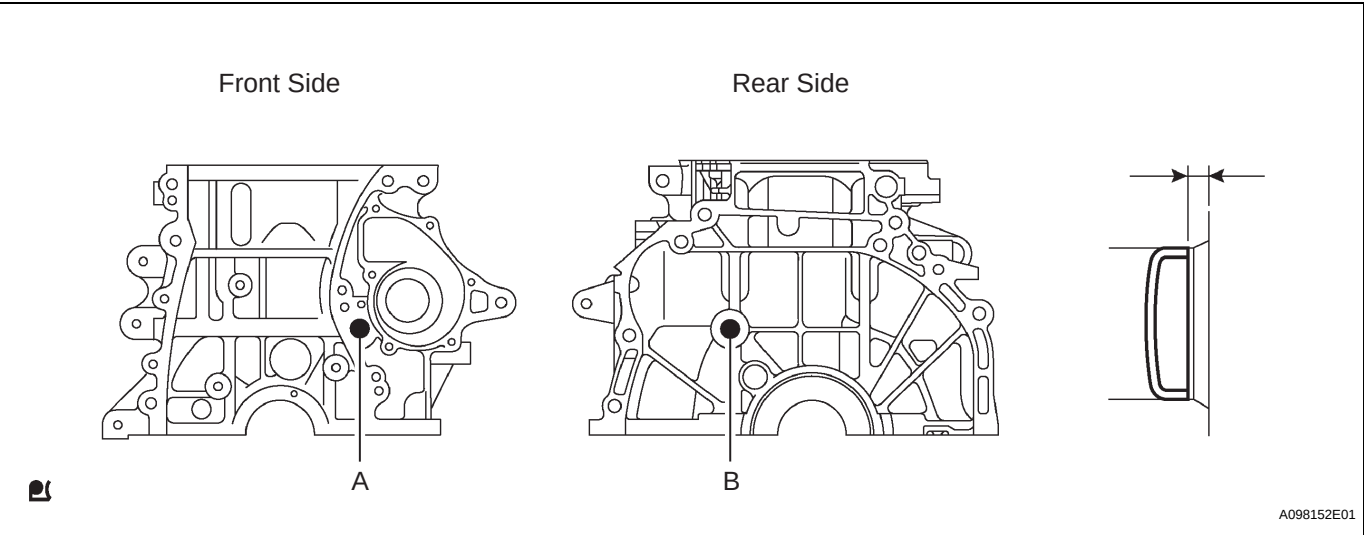
Toyota Genuine Adhesive 1342, Three Bond 1342 or Equivalent

- (c) Using SST, install the 2 tight plugs.
SST 09950-60010 (09951-00200), 09950-70010 (09951-07100)

Standard depth



Item	Specified Condition
A	1.7 to 2.7 mm (0.067 to 0.106 in.)
B	2.2 to 3.2 mm (0.087 to 0.126 in.)



EM

5. REPLACE RING PIN (for Cylinder Block)

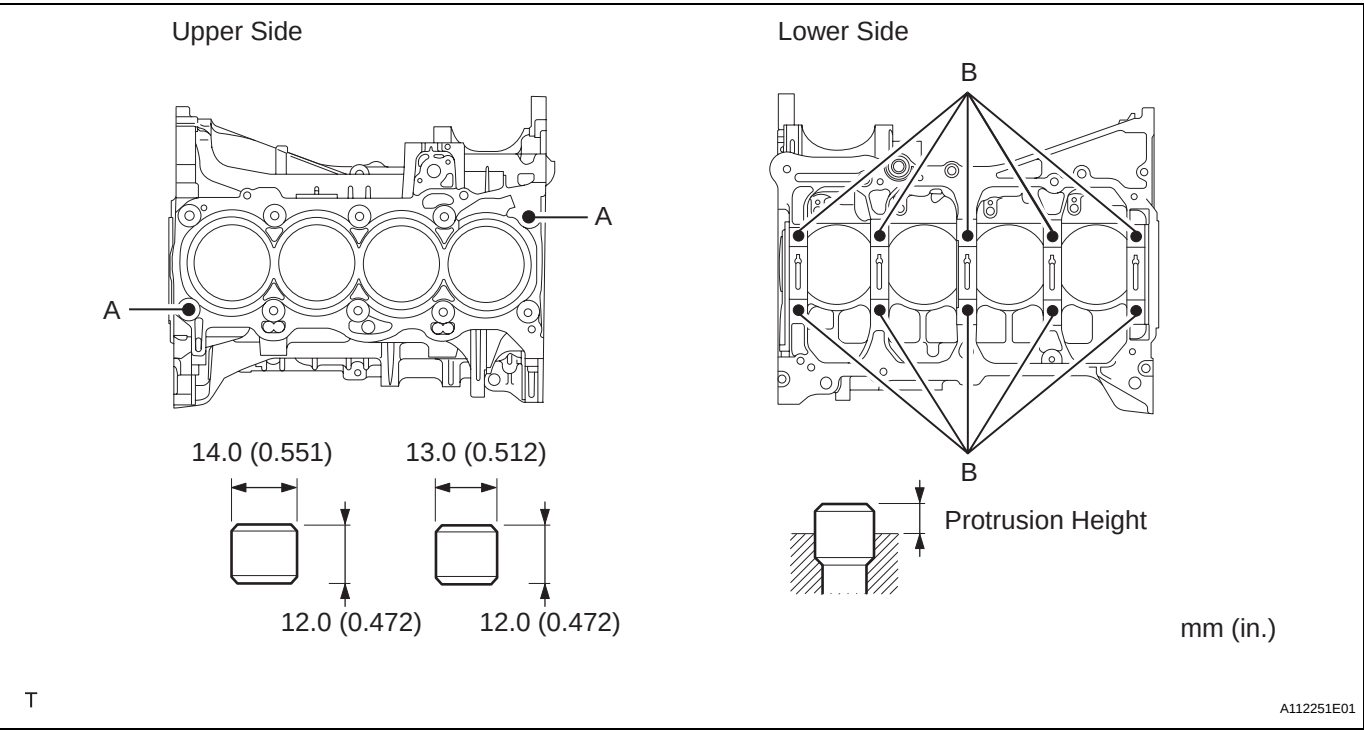
NOTICE:

It is not necessary to remove with head pin unless it is being replaced.

- (a) Remove the 12 ring pins.
- (b) Using a plastic-faced hammer, install 12 new ring pins.

Standard protrusion height

Item	Specified Condition
A	6.0 mm (0.236 in.)
B	5.0 mm (0.197 in.)



6. REPLACE STRAIGHT PIN (for Cylinder Block)

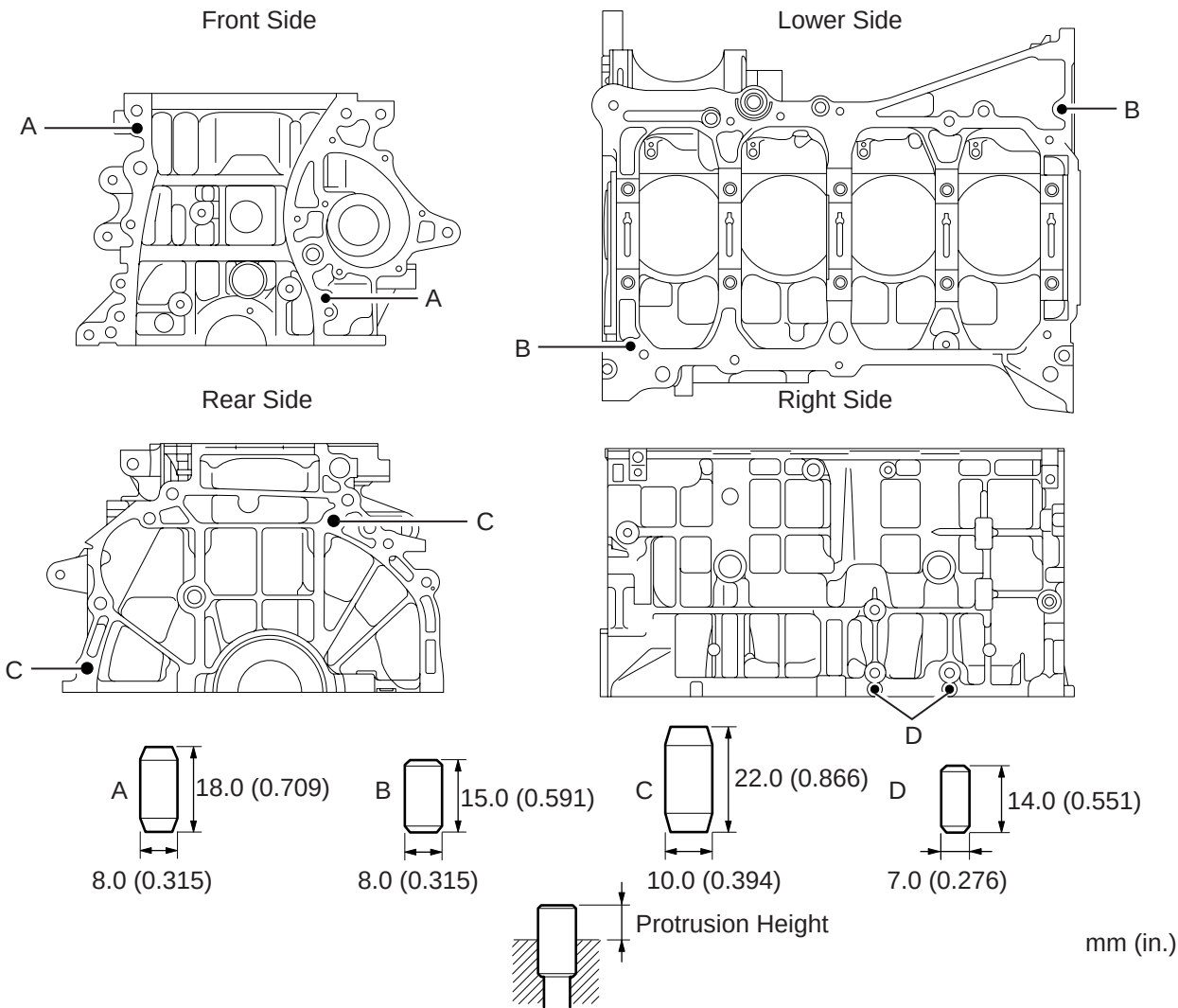
NOTICE:

It is not necessary to remove with straight pin unless it is being replaced.

- (a) Remove the 8 straight pins.
- (b) Using a plastic-faced hammer, install 8 new straight pins.

Standard protrusion height

Item	Specified Condition
A	8.0 mm (0.315 in.)
B	7.5 mm (0.295 in.)
C	12.0 mm (0.472 in.)
D	5.0 mm (0.197 in.)



EM

REPLACEMENT

1. REPLACE TIMING CHAIN COVER OIL SEAL

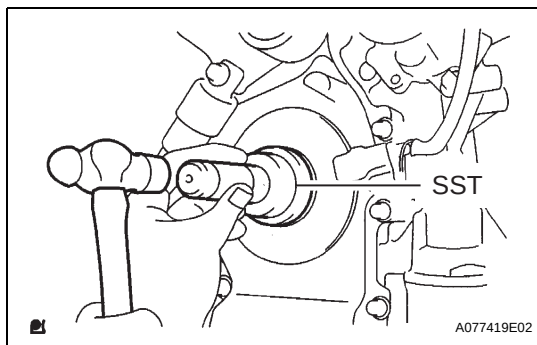
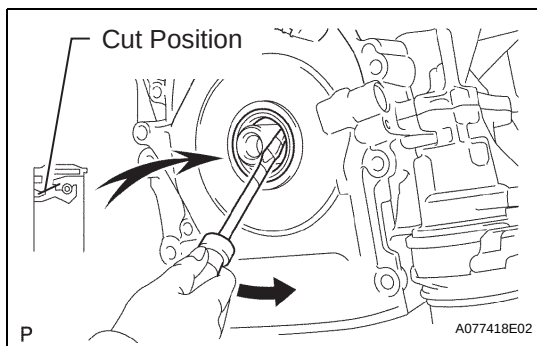
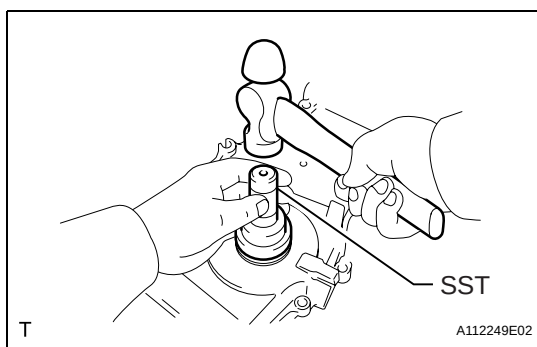
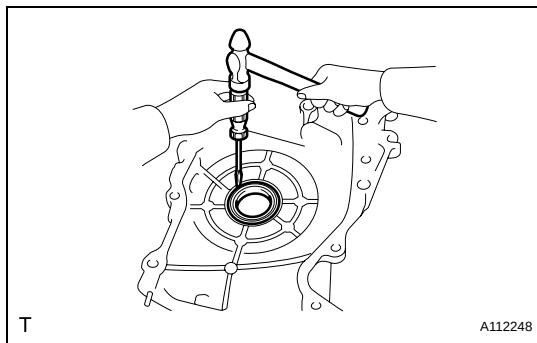
HINT:

There are 2 methods to replace the oil seal.

- (a) If the timing chain cover is removed from the cylinder block:
- (1) Using a screwdriver and hammer, tap out the oil seal.
 - (2) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign objects.



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

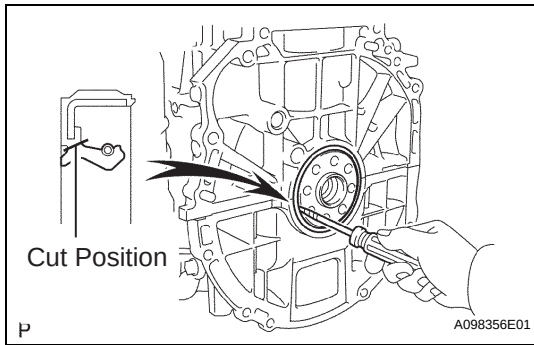
SST 09223-22010

NOTICE:

Do not tap the oil seal at an angle.

- (b) If the timing chain cover oil seal is installed to the cylinder block:
- (1) Remove the fan and generator V belt (see page [EM-6](#)).
 - (2) Remove the crankshaft pulley (see page [EM-25](#)).
 - (3) Using a knife, cut off the lip of the oil seal.
 - (4) Using a screwdriver with its tip wrapped with tape, pry out the oil seal.
- NOTICE:**
After removing, check the crankshaft for damage. If damaged, smooth the surface with 400-grit sandpaper.
- (5) Apply multi-purpose grease to the lip of a new oil seal.
- NOTICE:**
Keep the lip free of foreign objects.
- (6) Using SST and a hammer, tap in the new oil seal until its surface is flush with the timing chain cover edge.
- SST 09223-22010**
NOTICE:
Do not tap the oil seal at an angle.
- (7) Install the crankshaft pulley (see page [EM-38](#)).
 - (8) Install the fan and generator V belt (see page [EM-7](#)).

EM



2. REPLACE ENGINE REAR OIL SEAL

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

NOTICE:

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

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

NOTICE:

Keep the lip free of foreign objects.

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

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

NOTICE:

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

3. REPLACE STUD BOLT (for Cylinder Block)

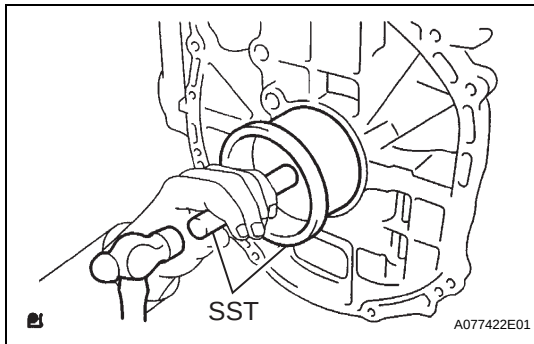
NOTICE:

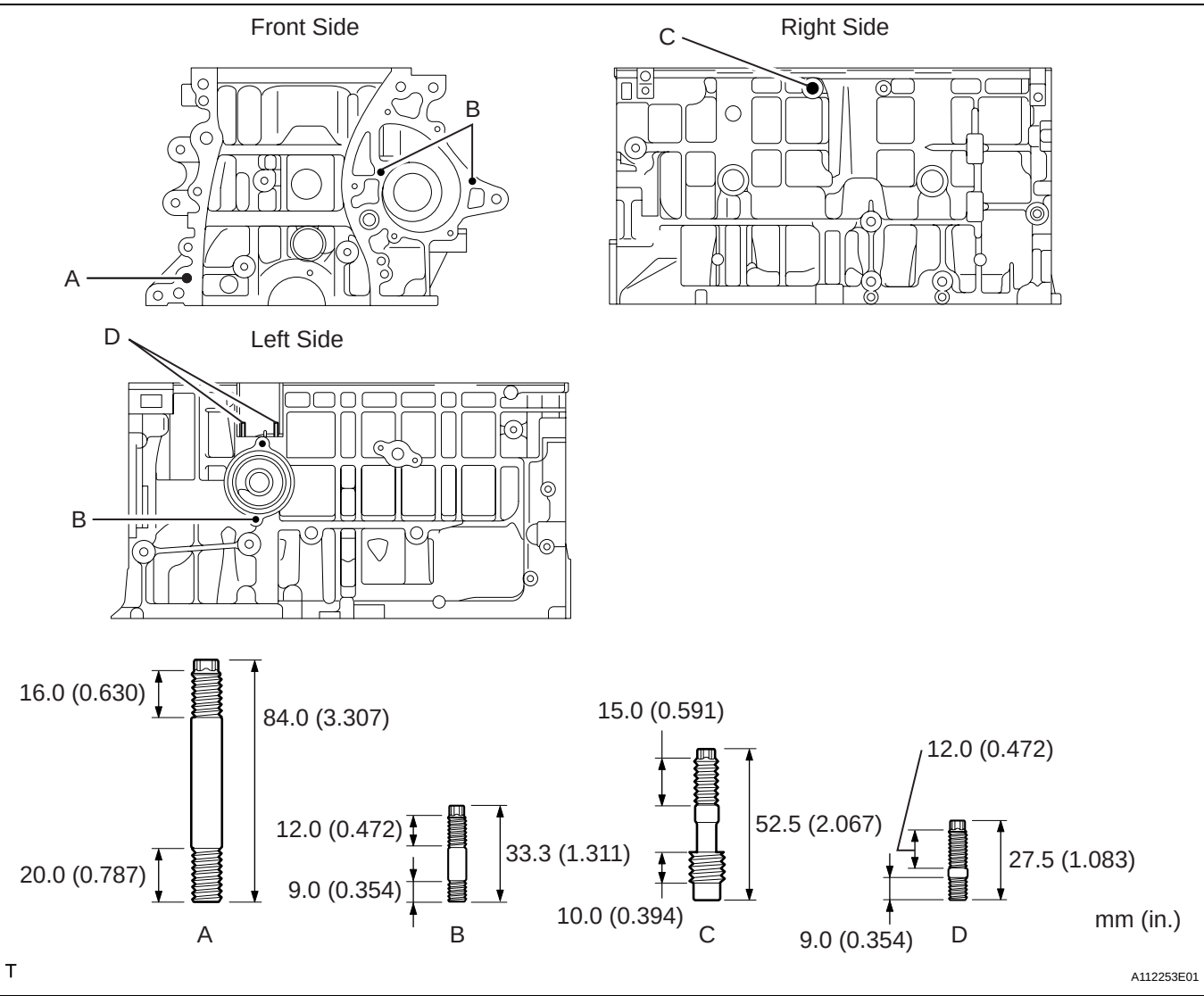
If the stud bolt is deformed or the threads are damaged, replace it.

- Remove the 8 stud bolts.
- Install the 8 stud bolts into the cylinder block.

Torque

Item	Specified Condition
A	5.0 N*m (51 kgf*cm, 44 in.*lbf)
B	21.5 N*m (219 kgf*cm, 16 ft.*lbf)
C	5.0 N*m (51 kgf*cm, 44 in.*lbf)
D	5.0 N*m (51 kgf*cm, 44 in.*lbf)





4. REPLACE TIGHT PLUG (for Cylinder Block)

NOTICE:

If water leaks from the tight plug or the plug corrodes, replace it.

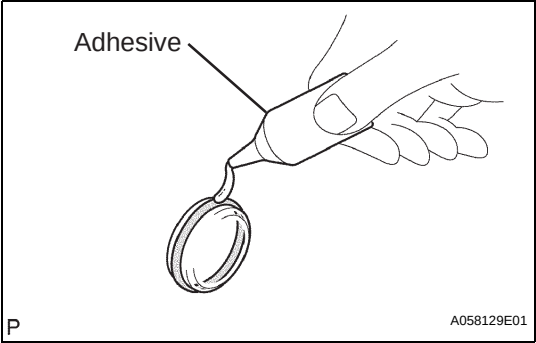
- (a) Remove the 2 tight plugs from the engine front and rear side.
- (b) Apply adhesive around new tight plugs.

Adhesive:

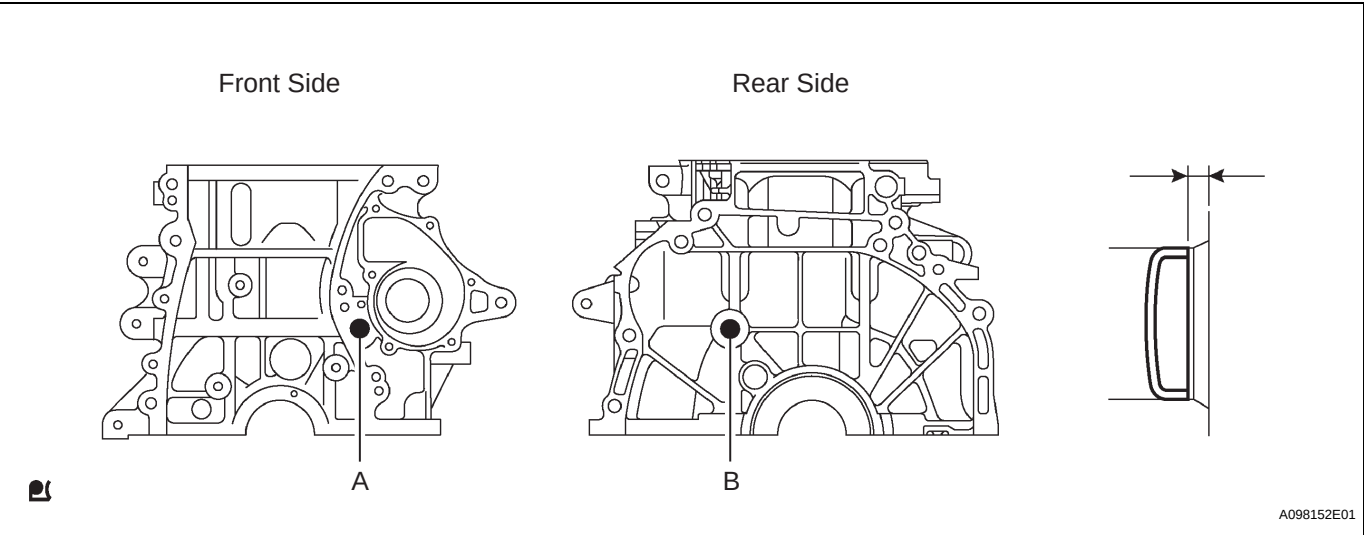
Toyota Genuine Adhesive 1342, Three Bond 1342 or Equivalent

- (c) Using SST, install the 2 tight plugs.
SST 09950-60010 (09951-00200), 09950-70010 (09951-07100)

Standard depth



Item	Specified Condition
A	1.7 to 2.7 mm (0.067 to 0.106 in.)
B	2.2 to 3.2 mm (0.087 to 0.126 in.)



EM

5. REPLACE RING PIN (for Cylinder Block)

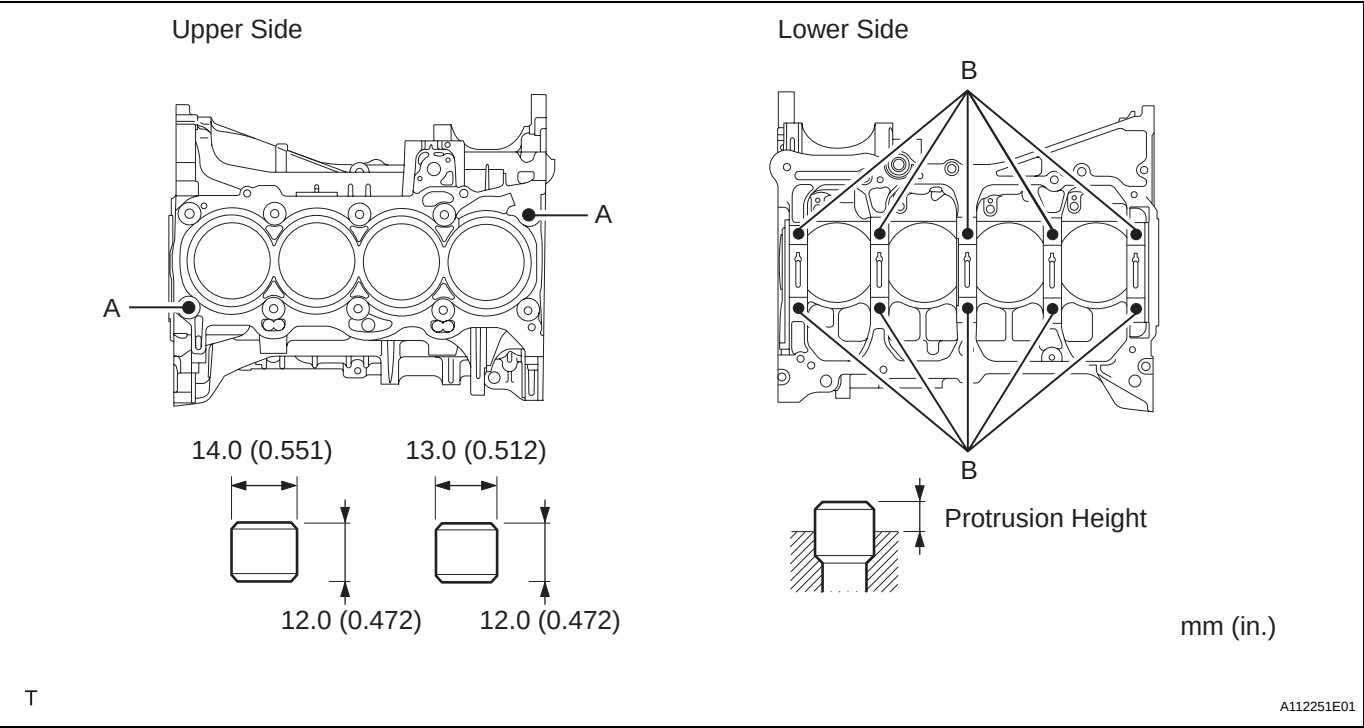
NOTICE:

It is not necessary to remove with head pin unless it is being replaced.

- (a) Remove the 12 ring pins.
- (b) Using a plastic-faced hammer, install 12 new ring pins.

Standard protrusion height

Item	Specified Condition
A	6.0 mm (0.236 in.)
B	5.0 mm (0.197 in.)



6. REPLACE STRAIGHT PIN (for Cylinder Block)

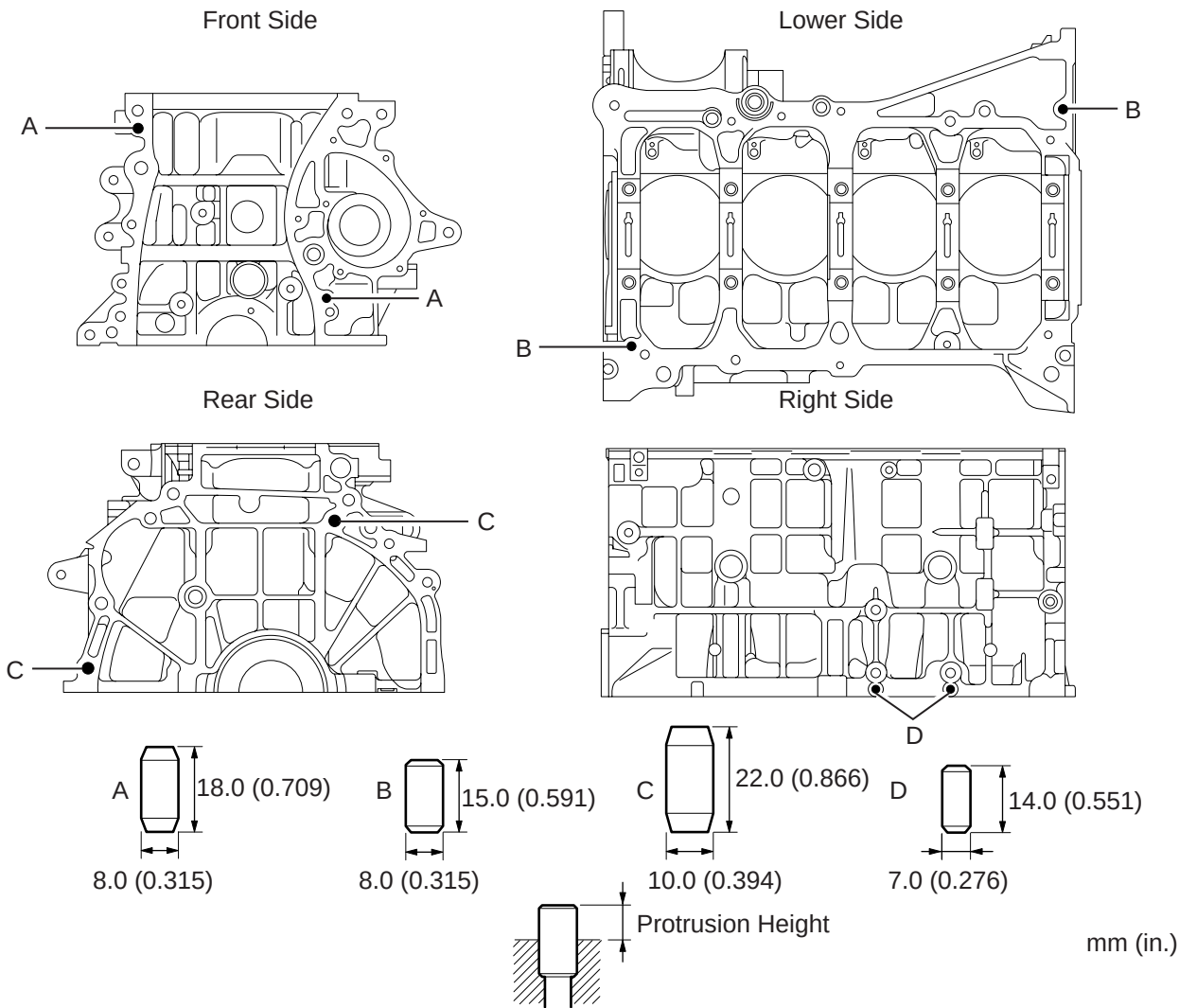
NOTICE:

It is not necessary to remove with straight pin unless it is being replaced.

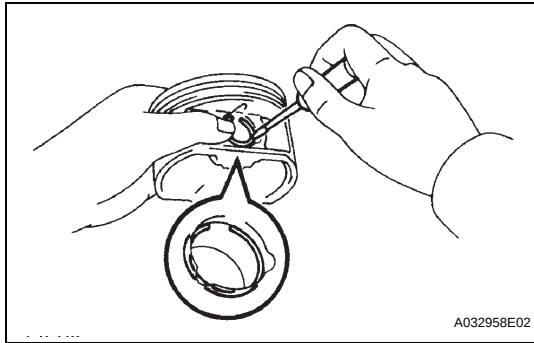
- (a) Remove the 8 straight pins.
- (b) Using a plastic-faced hammer, install 8 new straight pins.

Standard protrusion height

Item	Specified Condition
A	8.0 mm (0.315 in.)
B	7.5 mm (0.295 in.)
C	12.0 mm (0.472 in.)
D	5.0 mm (0.197 in.)



EM



REASSEMBLY

1. INSTALL PISTON

- (a) Using a small screwdriver, install a new snap ring onto one end of the piston pin hole.

HINT:

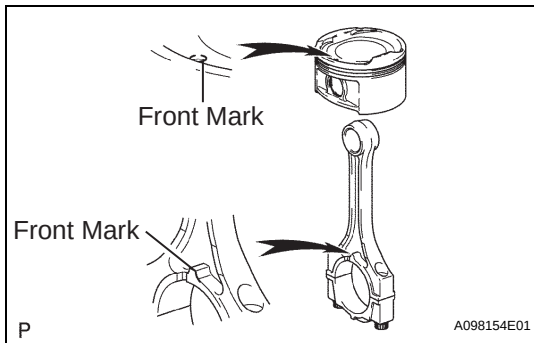
Make sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

- (b) Gradually heat the piston up to 80 to 90°C (176 to 194°F).

- (c) Align the front marks of the piston and connecting rod, then push in the piston pin with your thumb until the pin comes into contact with the snap pin hole.

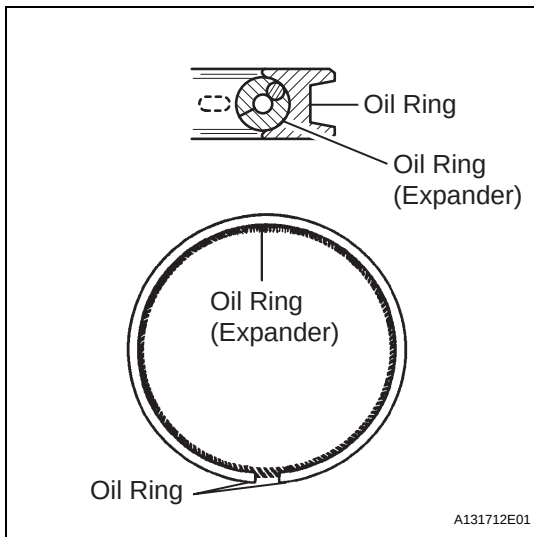
HINT:

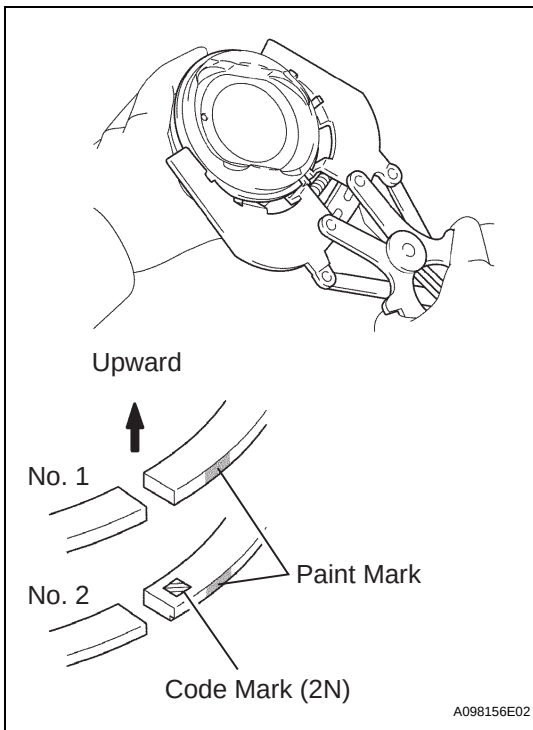
Make sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.



2. INSTALL PISTON RING SET

- (a) Install the expander and oil ring by hand.

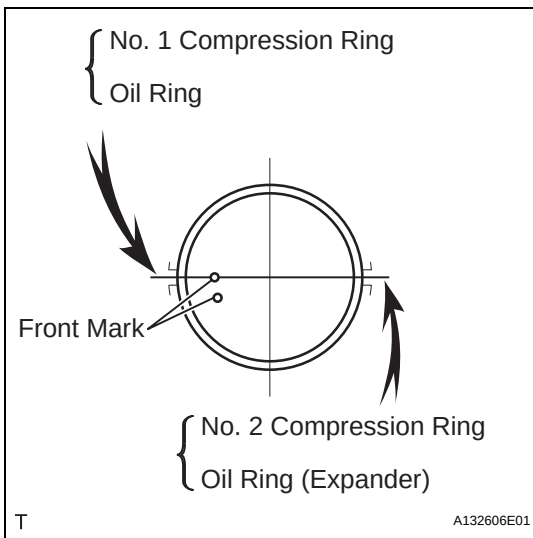




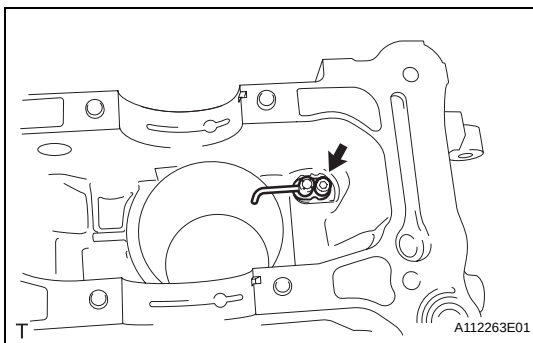
- (b) Using a piston ring expander, install the 2 compression rings with the paint mark as shown in the illustration.

NOTICE:

Install the No. 2 compression ring with the code mark (2N) facing upward.



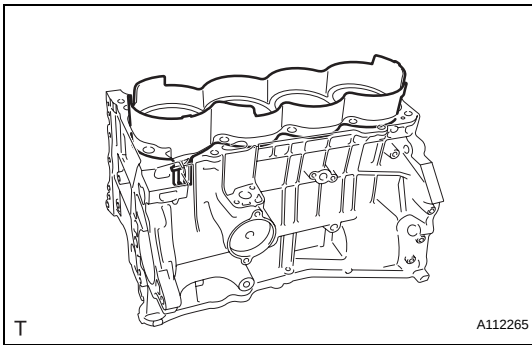
- (c) Position the piston rings so that the ring ends are as shown in the illustration.



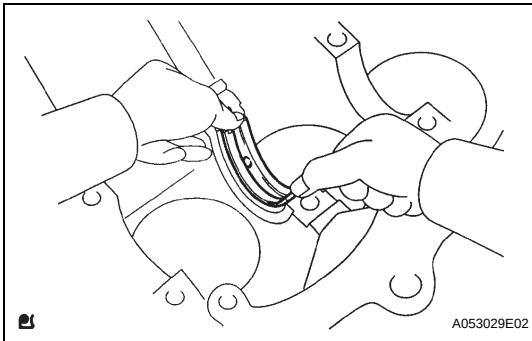
3. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

- (a) Install the 4 oil nozzles with the 4 bolts.

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



4. INSTALL CYLINDER BLOCK WATER JACKET SPACER

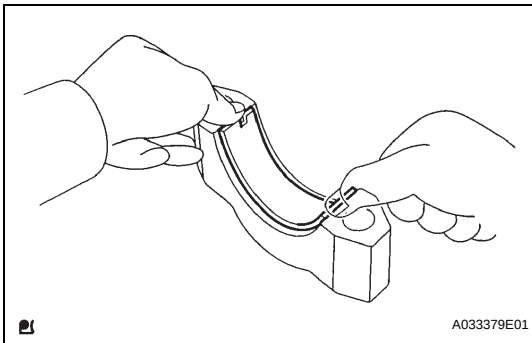


5. INSTALL CRANKSHAFT BEARING

- (a) Install the upper bearing with an oil groove onto the cylinder block.

NOTICE:

Do not apply engine oil to the contact surfaces of the cylinder block and crankshaft bearing.

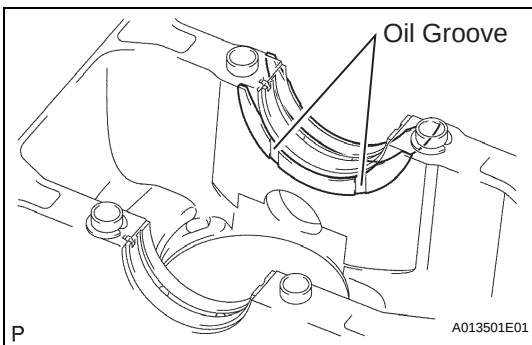


6. INSTALL NO. 2 CRANKSHAFT BEARING

- (a) Install the lower bearing onto the bearing cap.

NOTICE:

Do not apply engine oil to the contact surfaces of the cylinder block and crankshaft bearing cap..

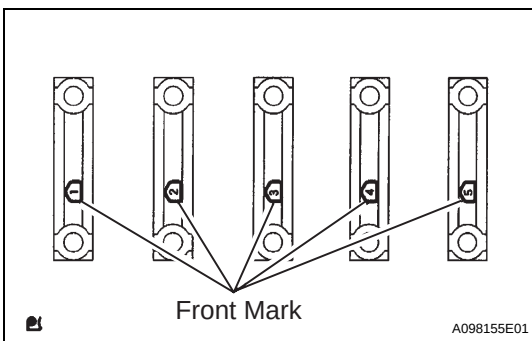


7. INSTALL CRANKSHAFT THRUST WASHER UPPER

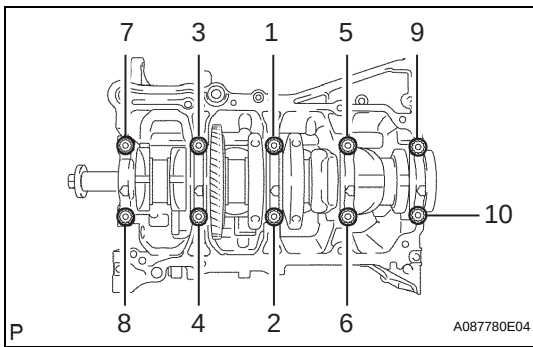
- (a) Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil groove facing outward.

8. INSTALL CRANKSHAFT

- (a) Apply engine oil to the upper bearing, and install the crankshaft onto the cylinder block.

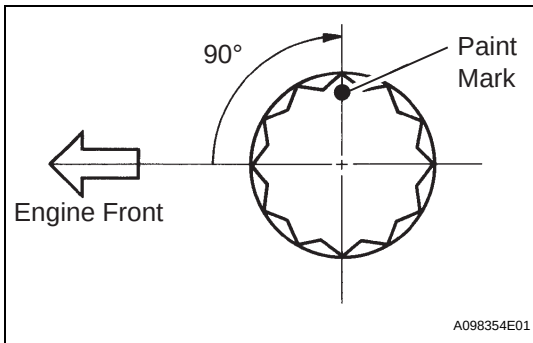


- (b) Examine the front marks and numbers, and install the bearing caps onto the cylinder block in the order shown in the illustration.
- (c) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

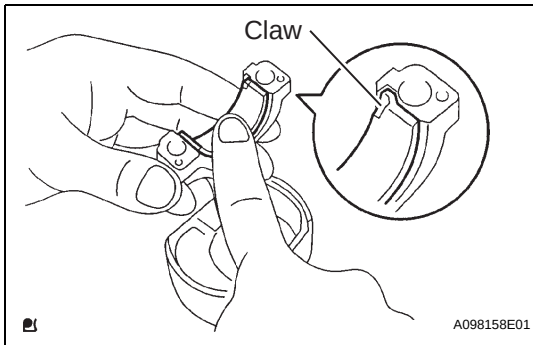


- (d) Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

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



- (e) Mark the front of the bearing cap bolts with paint.
 (f) Retighten the 10 bearing cap bolts by 90° in the same sequence.
 (g) Check that the paint marks are now at a 90° angle to the front.
 (h) Check that the crankshaft turns smoothly.



9. INSTALL CONNECTING ROD BEARING

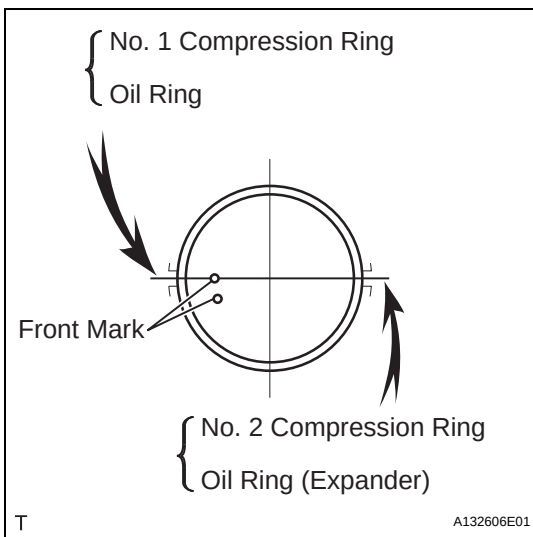
- (a) Align the bearing claw with the oil groove of the connecting rod or connecting rod cap.

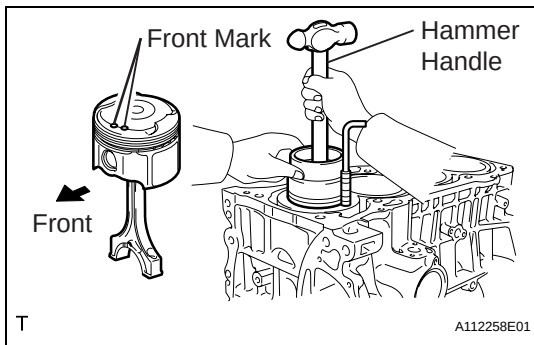
NOTICE:

- Do not apply engine oil to the contact surfaces of the connecting rod cap and bearing.
- Do not apply engine oil to the contact surfaces of the connecting rod and bearing.

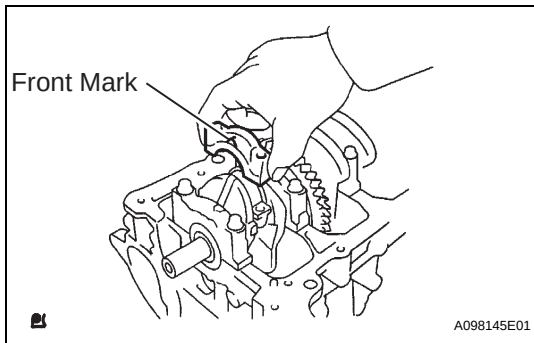
10. INSTALL PISTON WITH CONNECTING ROD

- (a) Apply engine oil to the cylinder walls, pistons, and surfaces of connecting rod bearings.
 (b) Check the position of the piston ring ends.





- (c) Using a hammer handle and piston ring compressor, press a piston and connecting rod into each cylinder with the front mark of the piston facing forward.



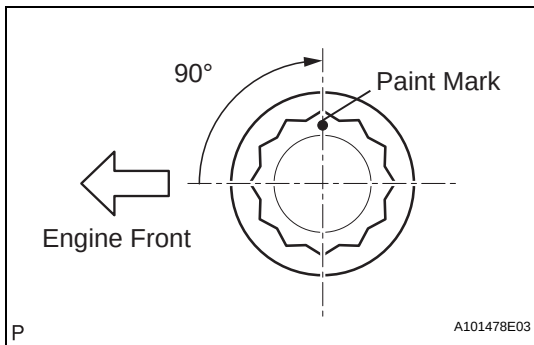
- (d) Check that the front mark of the connecting rod cap is facing in the correct direction.

NOTICE:

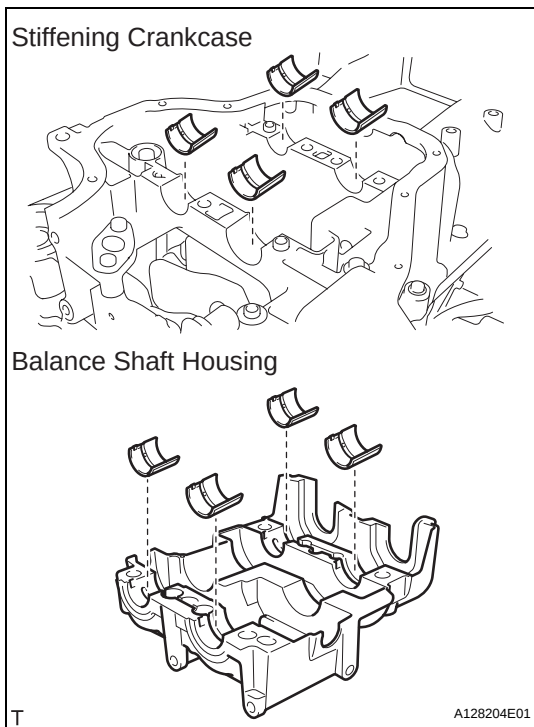
Match the numbered connecting rod cap with the connecting rod.

- (e) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
 (f) Using a 12 mm socket wrench, tighten the bolts in several passes to the specified torque.

Torque: 24.5 N*m (250 kgf*cm, 18 ft.*lbf)



- (g) Mark the front of the connecting rod bolts with paint.
 (h) Retighten the cap bolts 90° as shown in the illustration.
 (i) Check that the crankshaft turns smoothly.



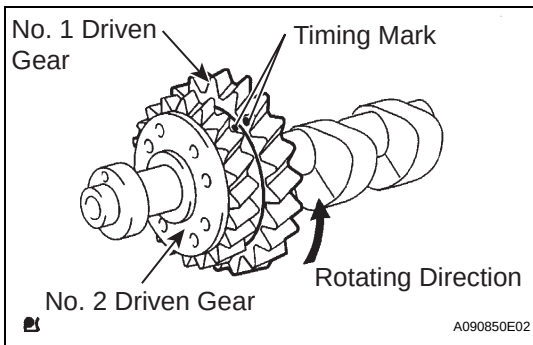
11. INSTALL NO. 1 BALANCE SHAFT BEARING

- (a) Align the bearing claw with the claw groove, and push in the 8 bearings.

NOTICE:

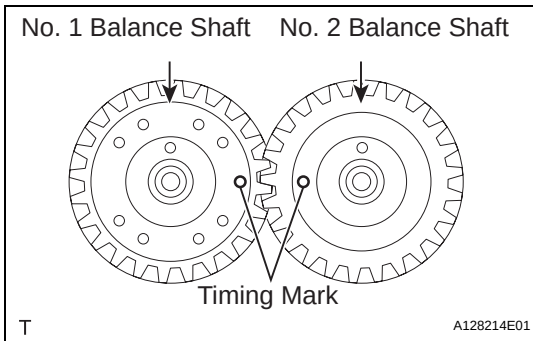
- Do not apply engine oil to the contact surfaces of the balance shaft bearing and balance shaft housing.
- Do not apply engine oil to the contact surfaces of the balance shaft bearing and stiffening crankcase.

- (b) Apply light coat of engine oil to the bearings.

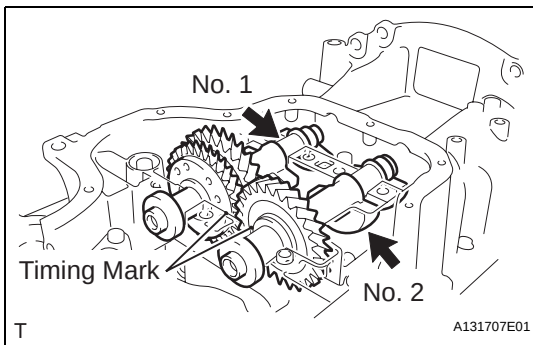


12. INSTALL BALANCE SHAFT

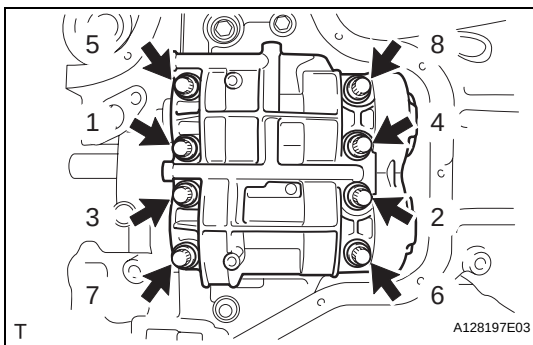
- (a) Rotate the No. 1 driven gear of the No. 1 balance shaft in the rotating direction until it hits the stopper.



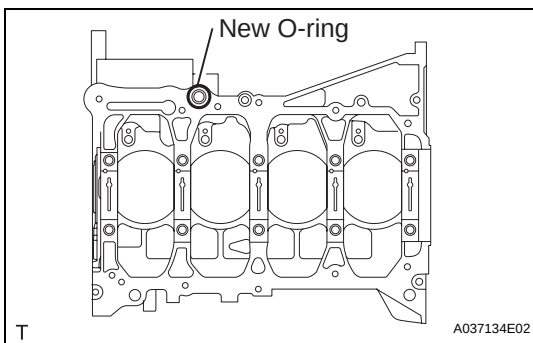
- (b) Confirm that the timing marks on the No. 1 and No. 2 driven gears are aligned.



- (c) Align the timing marks of the No. 1 and No. 2 balance shafts as shown in the illustration.
- (d) Place the No. 1 and No. 2 balance shafts onto the crankcase.
- (e) Apply a light coat of engine oil to the threads and under the heads of the bolts.



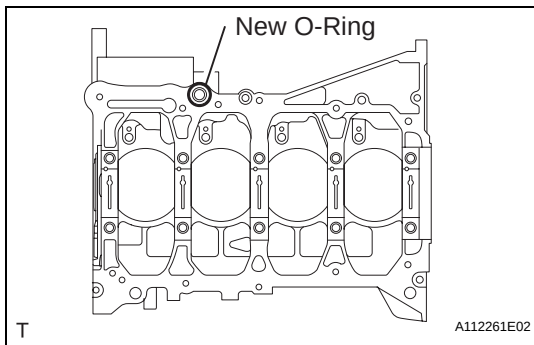
- (f) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 21.6 N*m (220 kgf*cm, 16 ft.*lbf)
- (g) Mark the front of the bolts with paint.
- (h) Retighten the bolts 90° as shown in the illustration.



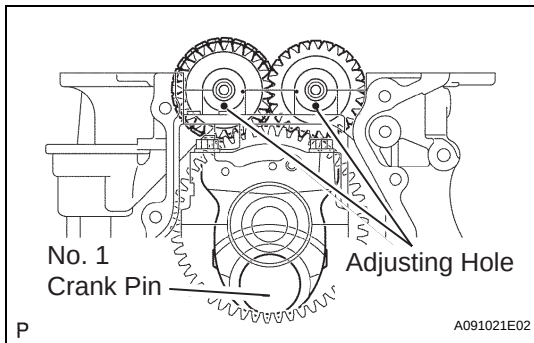
- (i) Check that the paint mark is now at a 90° angle to the front.

13. INSTALL STIFFENING CRANKCASE ASSEMBLY

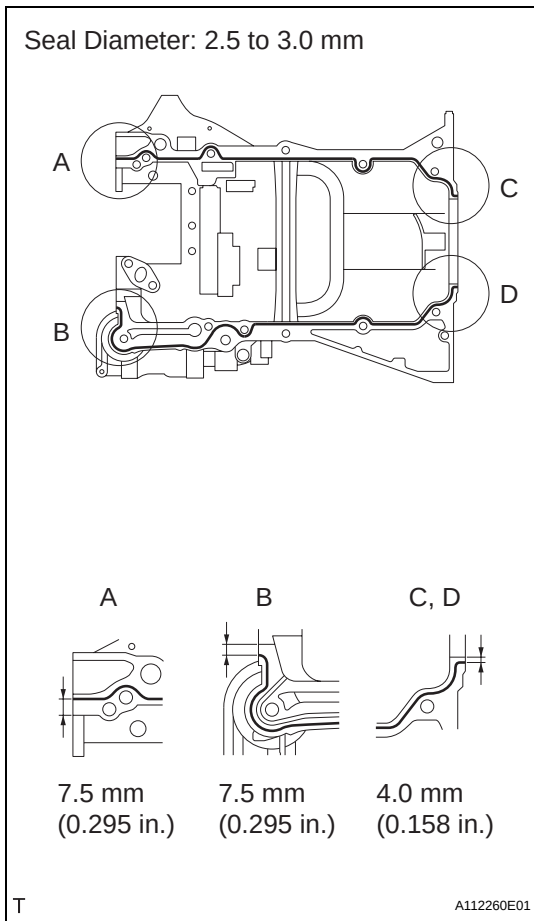
- (a) Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder block and crankcase.



- (b) Place a new O-ring on the cylinder block as shown in the illustration.



- (c) With the No. 1 crank pin of the crankshaft placed at the 6 o'clock position, install the No. 1 and No. 2 balance shafts and align the adjusting holes as shown in the illustration.



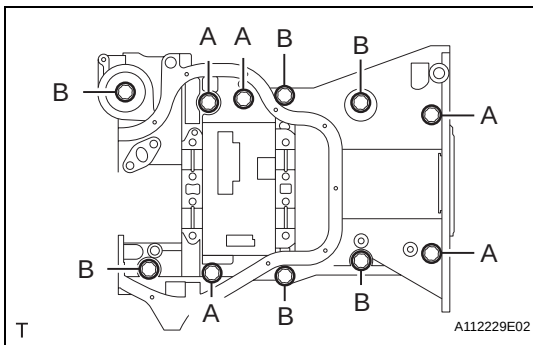
- (d) Apply a continuous bead of seal packing (Diameter 2.5 to 3.0 mm (0.098 to 0.118 in.)) as shown in the illustration.

Seal packing:

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

NOTICE:

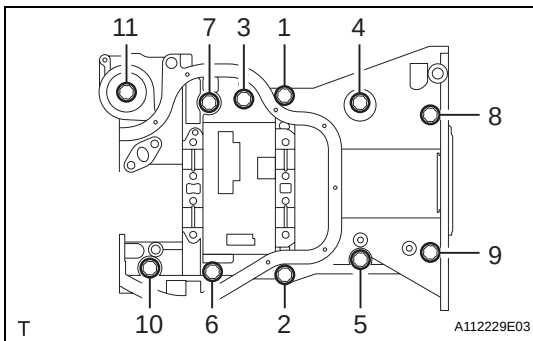
- Remove any oil from the contact surface.
- Install the crankcase within 3 minutes of applying seal packing.
- Do not add engine oil for at least 2 hours after installing the crankcase.



- (e) Temporarily install the crankcase with the 11 bolts.

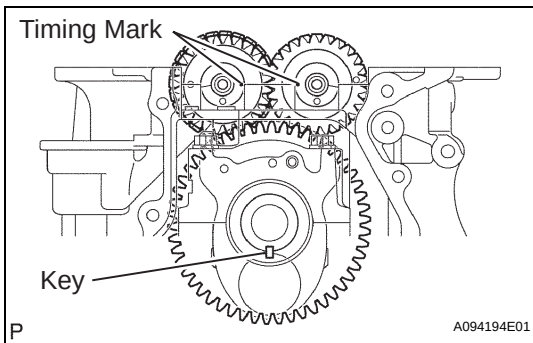
Standard bolt length

Item	Specified Condition
For bolt A (12 mm head)	112 mm (4.41 in.)
For bolt B (12 mm head)	35 mm (1.38 in.)



- (f) Uniformly tighten the bolts.

Torque: 24 N*m (245 kgf*cm, 18 ft.*lbf)



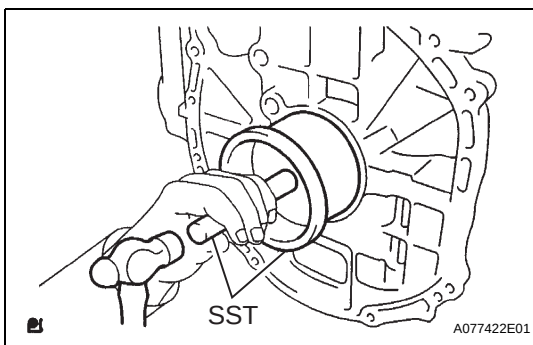
- (g) Confirm that the timing marks of the balance shafts are aligned when the key groove is placed at the 6 o'clock position, as shown in the illustration.

14. INSTALL ENGINE REAR OIL SEAL

- (a) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign object.

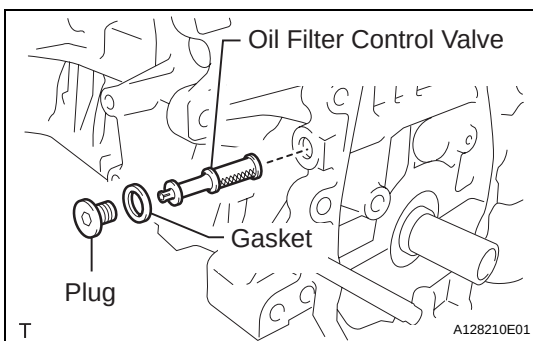


- (b) Using SST and hammer, tap in the new oil seal until its surface is flush with the rear oil seal retainer edge.

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

NOTICE:

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

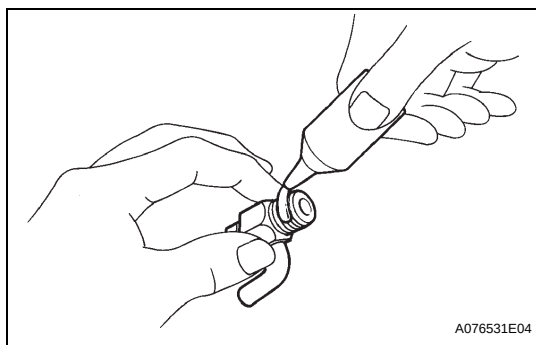


15. INSTALL OIL CONTROL VALVE FILTER

- (a) Check that there are no foreign objects on the mesh part of the oil control valve filter.

- (b) Using a 6 mm socket hexagon wrench, install a new gasket and the oil control valve filter with the plug.

Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

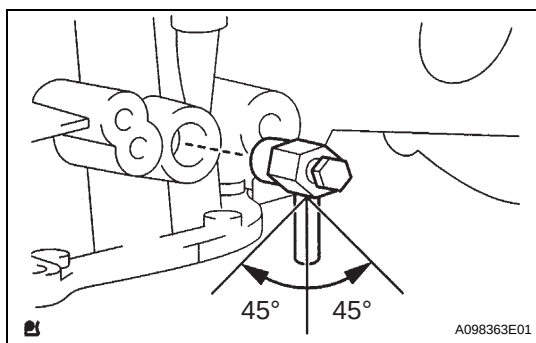


16. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- (a) Apply adhesive to 2 or 3 threads of the drain cock.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent



- (b) After tightening the drain cock to the specified torque, turn the drain cock clockwise as shown in the illustration.

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

NOTICE:

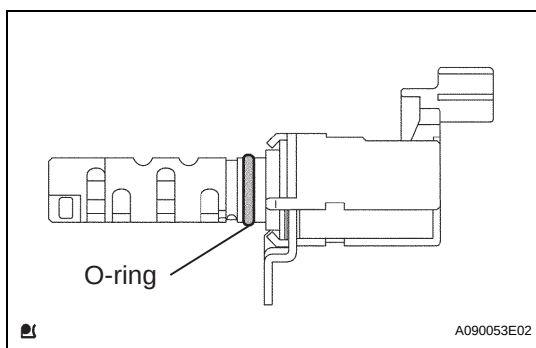
- Install the drain cock within 3 minutes of applying adhesive.
- Do not add coolant for at least an hour after installing the drain cock.
- Do not turn the drain cock by more than 1 revolution (360°) after tightening the drain cock to the specified torque.
- Do not loosen the drain cock after setting it correctly.

17. INSTALL CYLINDER HEAD GASKET (See page [EM-82](#))

18. INSTALL CYLINDER HEAD SUB-ASSEMBLY (See page [EM-82](#))

19. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- (a) Apply a light coat of engine oil to a new O-ring, then install it onto the camshaft timing oil control valve.



- (b) Install the camshaft timing oil control valve with the bolt.

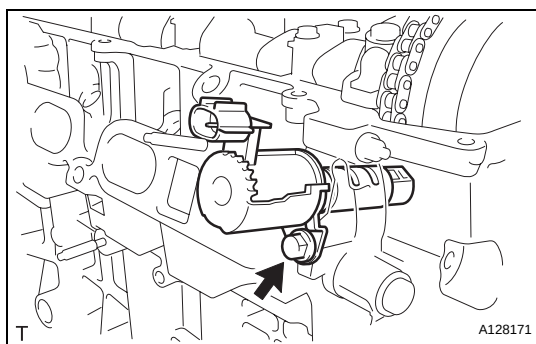
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

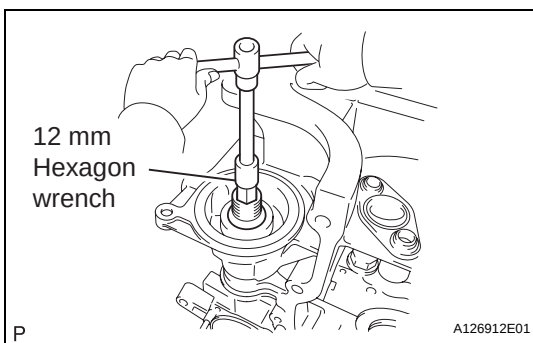
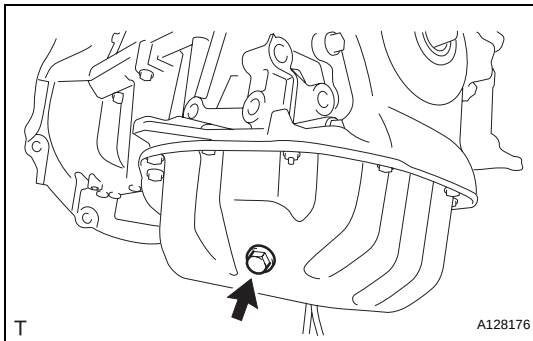
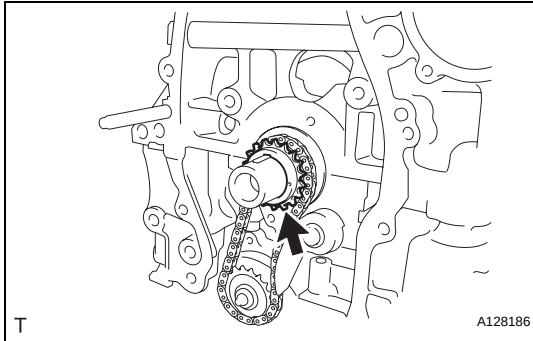
20. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY (See page [EM-83](#))

21. INSTALL NO. 2 CAMSHAFT TIMING SPROCKET (See page [EM-84](#))

22. INSTALL NO. 2 CAMSHAFT BEARING (See page [EM-81](#))

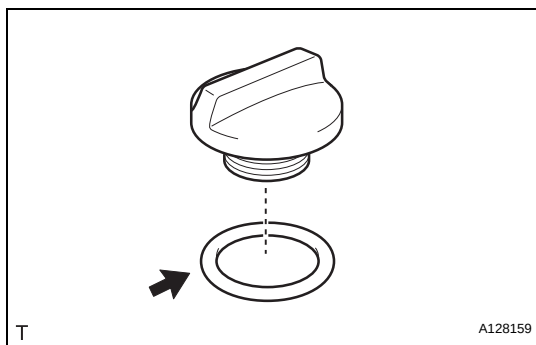
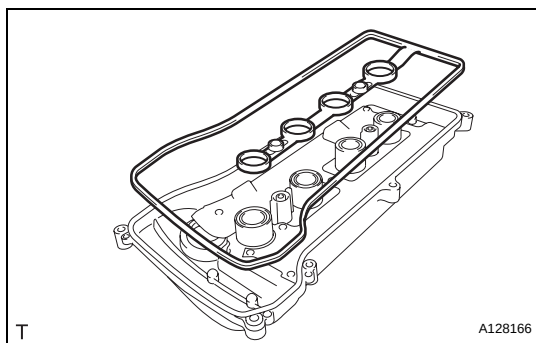
23. INSTALL NO. 1 CAMSHAFT BEARING (See page [EM-81](#))



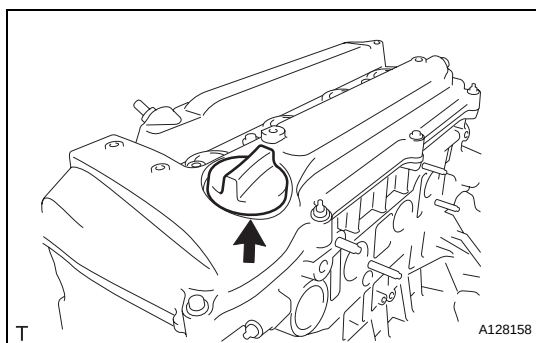


24. INSTALL CAMSHAFT (See page [EM-84](#))
25. INSTALL OIL PUMP ASSEMBLY (See page [LU-15](#))
26. INSTALL OIL PUMP DRIVE GEAR
27. INSTALL NO. 2 CHAIN SUB-ASSEMBLY (See page [EM-32](#))
28. INSTALL CRANKSHAFT TIMING SPROCKET
29. INSTALL NO. 1 CHAIN VIBRATION DAMPER (See page [EM-33](#))
30. INSTALL CHAIN SUB-ASSEMBLY (See page [EM-33](#))
31. INSTALL CHAIN TENSIONER SLIPPER (See page [EM-34](#))
32. INSTALL TIMING CHAIN GUIDE (See page [EM-34](#))
33. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See page [EM-35](#))
34. REPLACE TIMING CHAIN COVER OIL SEAL (See page [EM-144](#))
35. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See page [EM-35](#))
36. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-37](#))
37. INSTALL CRANKSHAFT PULLEY (See page [EM-38](#))
38. INSTALL OIL PAN SUB-ASSEMBLY (See page [EM-39](#))
39. INSTALL OIL PAN DRAIN PLUG
 - (a) Place a new gasket on the oil pan drain plug, then install it onto the oil pan.
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)
40. INSTALL WATER PUMP ASSEMBLY (See page [CO-12](#))
41. INSTALL WATER PUMP PULLEY (See page [CO-13](#))
42. INSTALL CRANKSHAFT POSITION SENSOR (See page [ES-402](#))
43. INSTALL OIL FILTER UNION
 - (a) Using a 12 mm hexagon wrench, install the oil filter union.
Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf)
44. INSTALL OIL FILTER SUB-ASSEMBLY (See page [LU-4](#))
45. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page [EM-25](#))
46. CHECK VALVE CLEARANCE (See page [EM-8](#))
47. ADJUST VALVE CLEARANCE (See page [EM-8](#))
48. INSTALL CAMSHAFT (See page [EM-13](#))

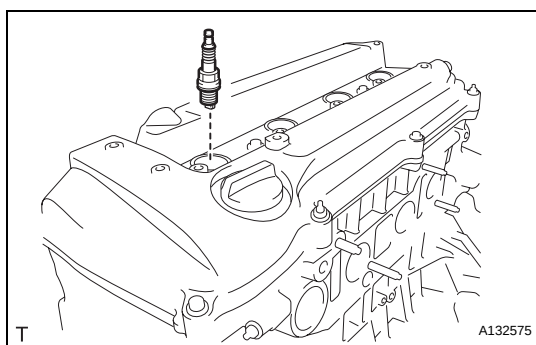
49. INSTALL NO. 2 CAMSHAFT (See page [EM-14](#))
50. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-37](#))
51. INSTALL CYLINDER HEAD COVER GASKET
(a) Install the gasket onto the cylinder head cover.
52. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY
(See page [EM-40](#))



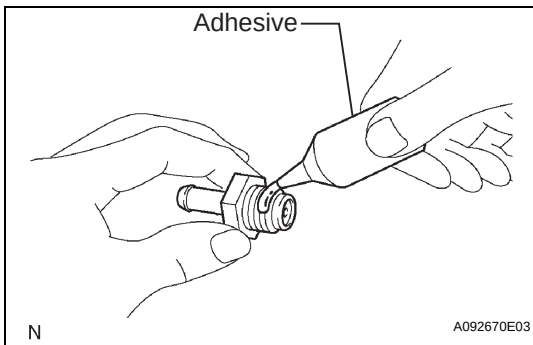
53. INSTALL OIL FILLER CAP SUB-ASSEMBLY
(a) Install the gasket to the cap.



- (b) Install the oil filler cap.
Torque: 3.0 N*m (31 kgf*cm, 26 in.*lbf)



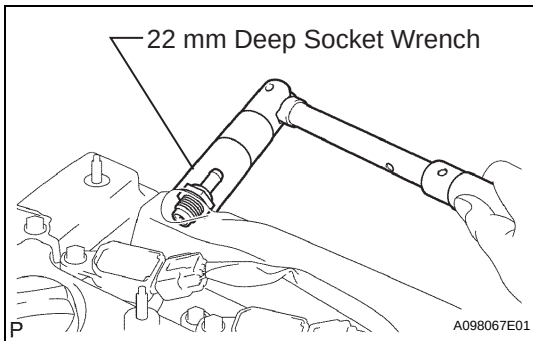
54. INSTALL SPARK PLUG
Torque: 25 N*m (254 kgf*cm, 18 ft.*lbf)
55. INSTALL IGNITION COIL ASSEMBLY (See page [IG-9](#))

**56. INSTALL VENTILATION VALVE SUB-ASSEMBLY**

- (a) Apply adhesive to the threads of the ventilation valve.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent



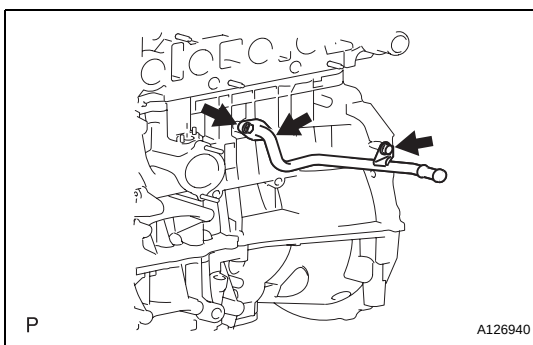
- (b) Using a 22 mm deep socket wrench, install the ventilation valve.

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

57. INSTALL OIL DIPSTICK GUIDE (See page [EM-86](#))**58. INSTALL OIL DIPSTICK****59. INSTALL CAMSHAFT POSITION SENSOR (See page [EM-81](#))****60. INSTALL ENGINE COOLANT TEMPERATURE SENSOR (See page [EM-82](#))****61. INSTALL OIL PRESSURE SWITCH ASSEMBLY (See page [EM-82](#))****62. INSTALL RADIO SETTING CONDENSER (See page [EM-82](#))****63. INSTALL KNOCK SENSOR (See page [ES-420](#))****64. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-396](#))****65. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-38](#))****66. INSTALL NO. 3 WATER BY-PASS PIPE**

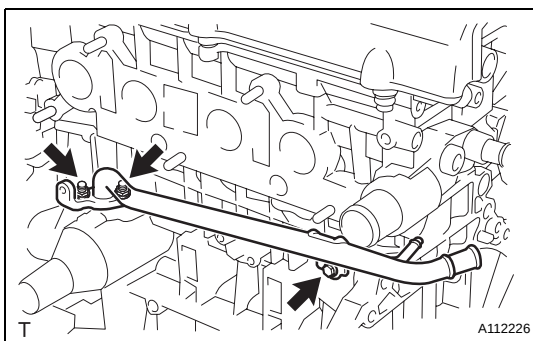
- (a) Install a new gasket and pipe with the bolt and 2 nuts.

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

**67. INSTALL NO. 1 WATER BY-PASS PIPE**

- (a) Install a new gasket and the pipe with the bolt and 2 nuts.

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

68. INSTALL THERMOSTAT (See page [CO-15](#))**69. INSTALL WATER INLET (See page [CO-16](#))****70. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (See page [EM-85](#))**

- 71. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See page [EM-86](#))
- 72. INSTALL NO. 2 MANIFOLD STAY (See page [EM-86](#))
- 73. INSTALL MANIFOLD STAY (See page [EM-86](#))
- 74. INSTALL IDLER PULLEY (See page [EM-41](#))

REASSEMBLY

1. INSTALL PISTON

- (a) Using a small screwdriver, install a new snap ring onto one end of the piston pin hole.

HINT:

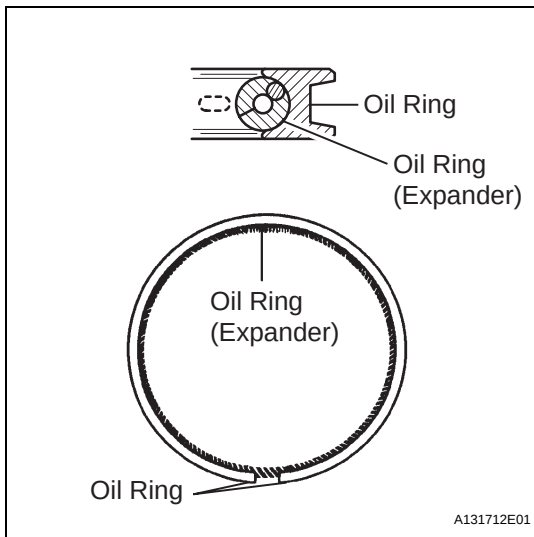
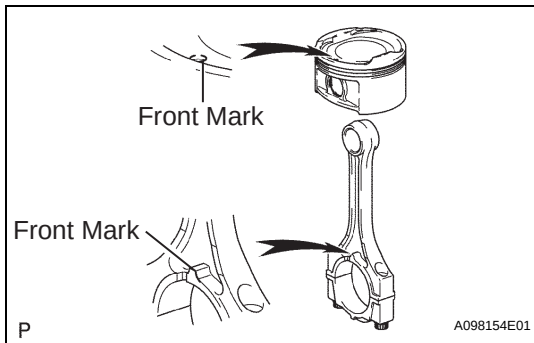
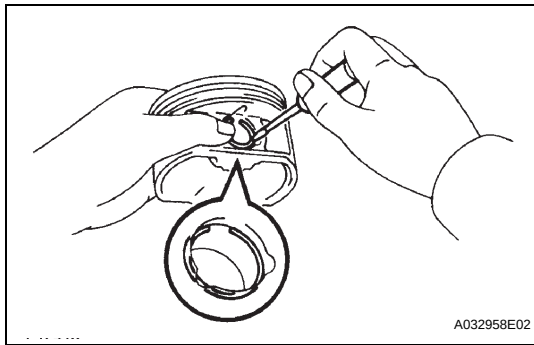
Make sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

- (b) Gradually heat the piston up to 80 to 90°C (176 to 194°F).

- (c) Align the front marks of the piston and connecting rod, then push in the piston pin with your thumb until the pin comes into contact with the snap pin hole.

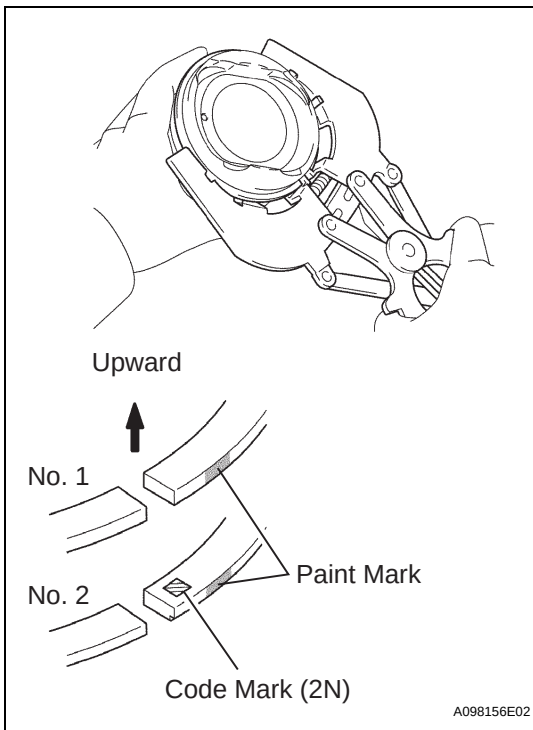
HINT:

Make sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.



2. INSTALL PISTON RING SET

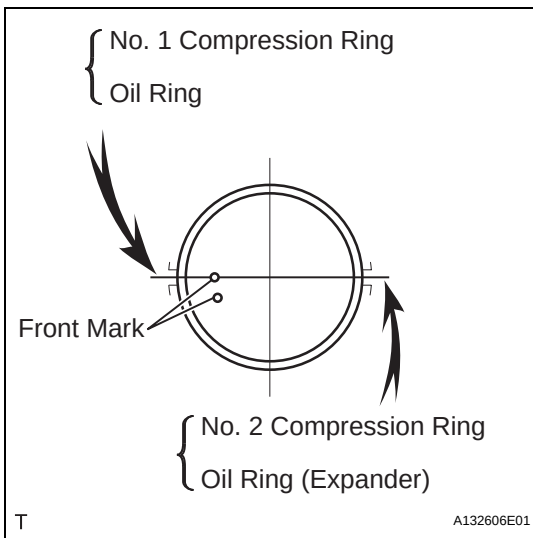
- (a) Install the expander and oil ring by hand.



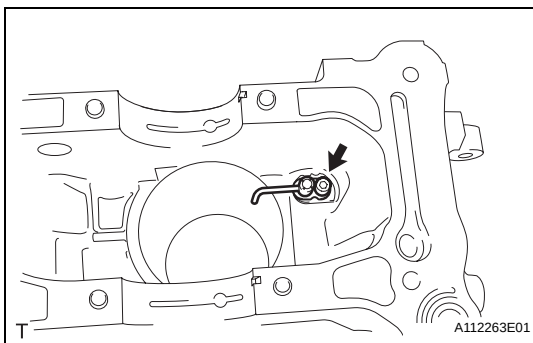
- (b) Using a piston ring expander, install the 2 compression rings with the paint mark as shown in the illustration.

NOTICE:

Install the No. 2 compression ring with the code mark (2N) facing upward.



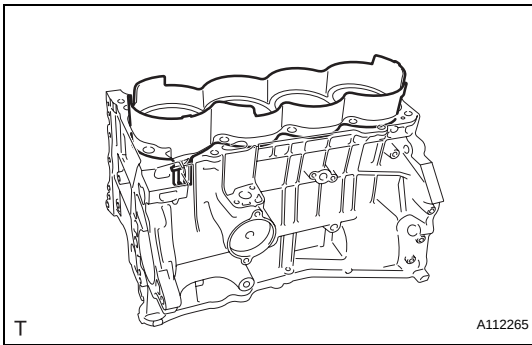
- (c) Position the piston rings so that the ring ends are as shown in the illustration.



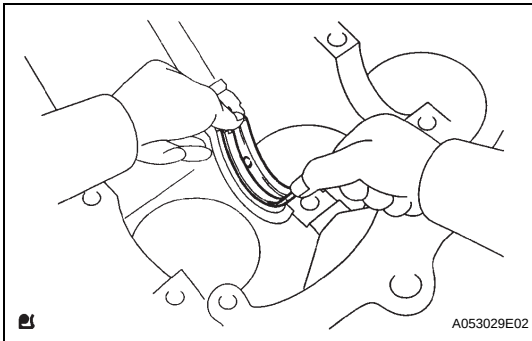
3. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

- (a) Install the 4 oil nozzles with the 4 bolts.

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



4. INSTALL CYLINDER BLOCK WATER JACKET SPACER

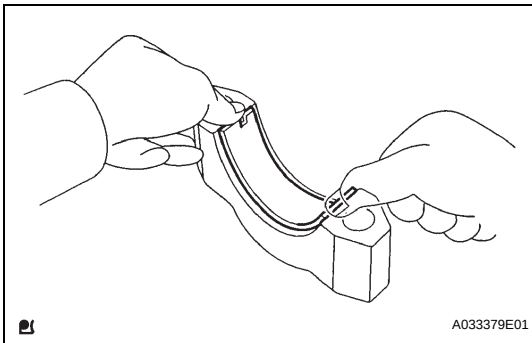


5. INSTALL CRANKSHAFT BEARING

- (a) Install the upper bearing with an oil groove onto the cylinder block.

NOTICE:

Do not apply engine oil to the contact surfaces of the cylinder block and crankshaft bearing.

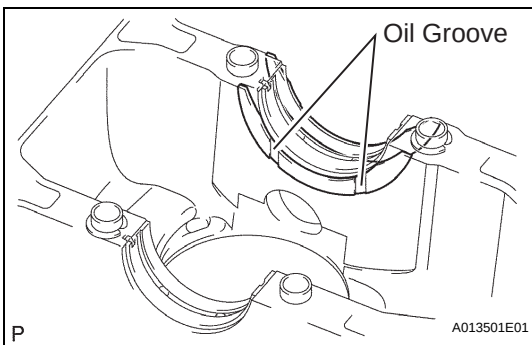


6. INSTALL NO. 2 CRANKSHAFT BEARING

- (a) Install the lower bearing onto the bearing cap.

NOTICE:

Do not apply engine oil to the contact surfaces of the cylinder block and crankshaft bearing cap..

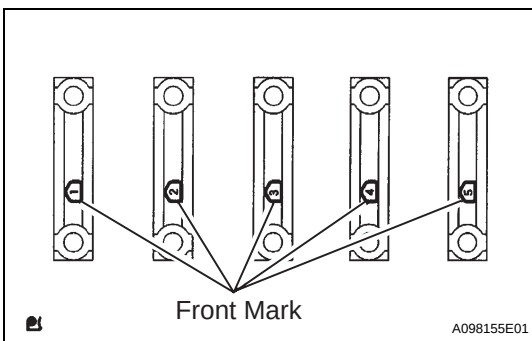


7. INSTALL CRANKSHAFT THRUST WASHER UPPER

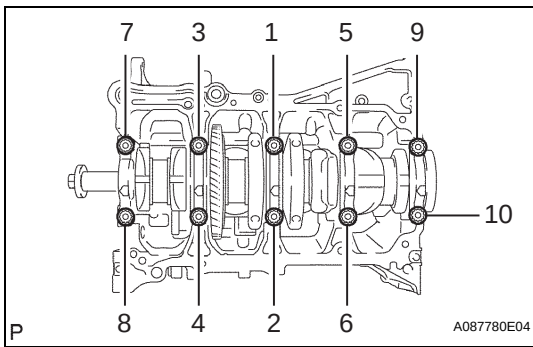
- (a) Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil groove facing outward.

8. INSTALL CRANKSHAFT

- (a) Apply engine oil to the upper bearing, and install the crankshaft onto the cylinder block.

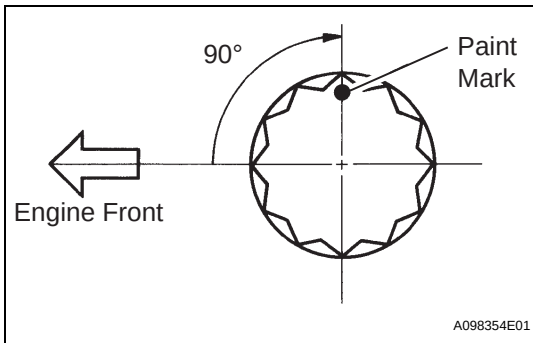


- (b) Examine the front marks and numbers, and install the bearing caps onto the cylinder block in the order shown in the illustration.
- (c) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.

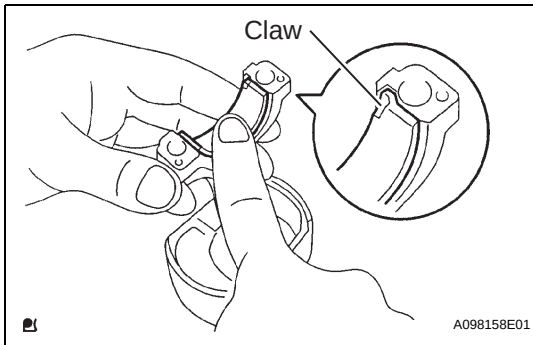


- (d) Using several steps, uniformly install and tighten the 10 bearing cap bolts in the sequence shown in the illustration.

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



- (e) Mark the front of the bearing cap bolts with paint.
 (f) Retighten the 10 bearing cap bolts by 90° in the same sequence.
 (g) Check that the paint marks are now at a 90° angle to the front.
 (h) Check that the crankshaft turns smoothly.



9. INSTALL CONNECTING ROD BEARING

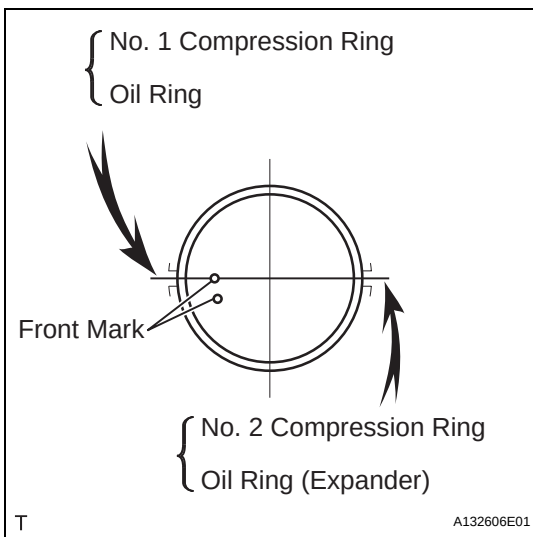
- (a) Align the bearing claw with the oil groove of the connecting rod or connecting rod cap.

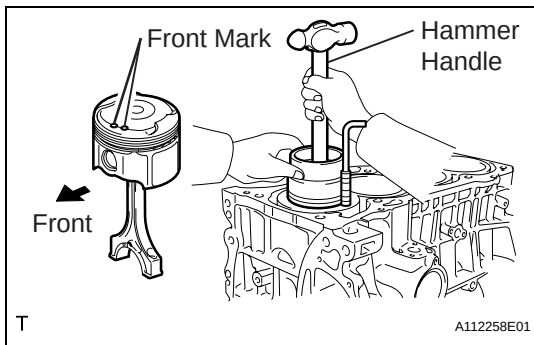
NOTICE:

- Do not apply engine oil to the contact surfaces of the connecting rod cap and bearing.
- Do not apply engine oil to the contact surfaces of the connecting rod and bearing.

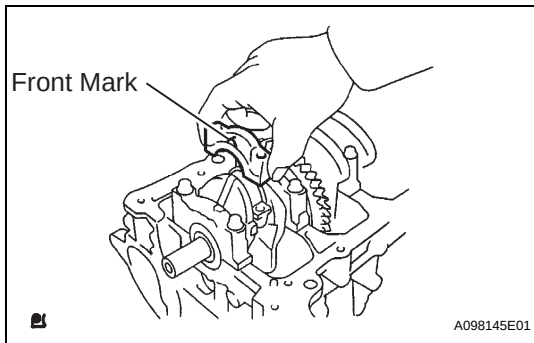
10. INSTALL PISTON WITH CONNECTING ROD

- (a) Apply engine oil to the cylinder walls, pistons, and surfaces of connecting rod bearings.
 (b) Check the position of the piston ring ends.





- (c) Using a hammer handle and piston ring compressor, press a piston and connecting rod into each cylinder with the front mark of the piston facing forward.



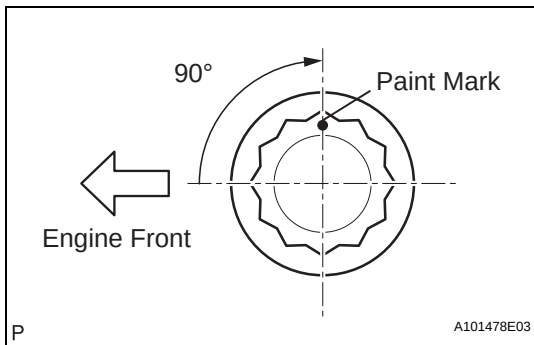
- (d) Check that the front mark of the connecting rod cap is facing in the correct direction.

NOTICE:

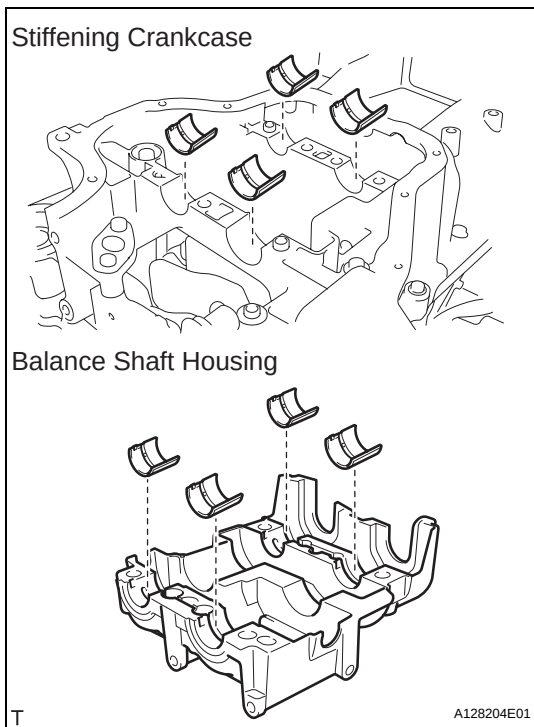
Match the numbered connecting rod cap with the connecting rod.

- (e) Apply a light coat of engine oil to the threads and under the heads of the connecting rod bolts.
 (f) Using a 12 mm socket wrench, tighten the bolts in several passes to the specified torque.

Torque: 24.5 N*m (250 kgf*cm, 18 ft.*lbf)



- (g) Mark the front of the connecting rod bolts with paint.
 (h) Retighten the cap bolts 90° as shown in the illustration.
 (i) Check that the crankshaft turns smoothly.

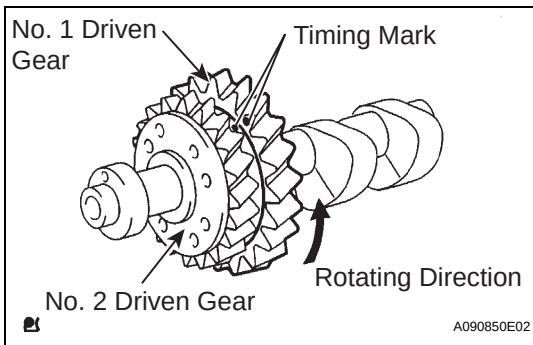
**11. INSTALL NO. 1 BALANCE SHAFT BEARING**

- (a) Align the bearing claw with the claw groove, and push in the 8 bearings.

NOTICE:

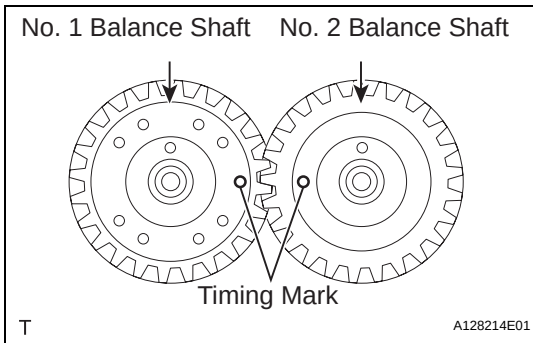
- Do not apply engine oil to the contact surfaces of the balance shaft bearing and balance shaft housing.
- Do not apply engine oil to the contact surfaces of the balance shaft bearing and stiffening crankcase.

- (b) Apply light coat of engine oil to the bearings.

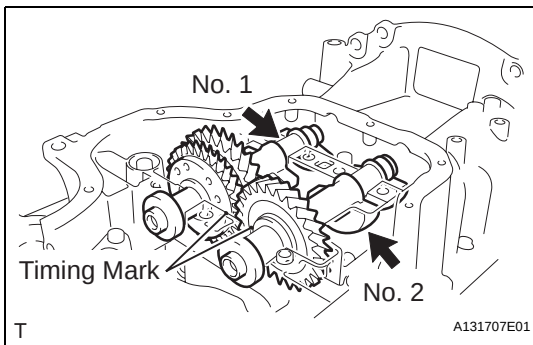


12. INSTALL BALANCE SHAFT

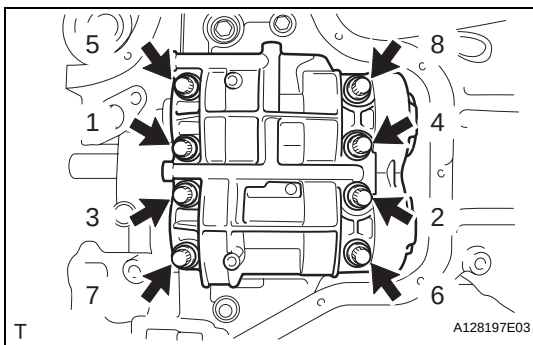
- (a) Rotate the No. 1 driven gear of the No. 1 balance shaft in the rotating direction until it hits the stopper.



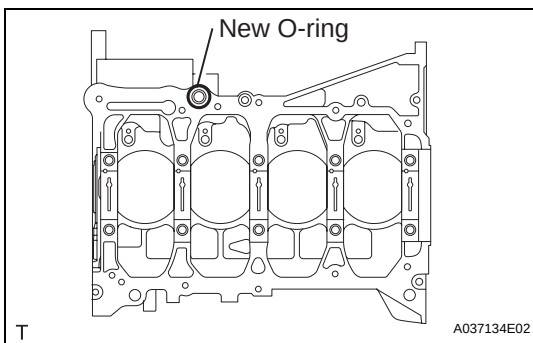
- (b) Confirm that the timing marks on the No. 1 and No. 2 driven gears are aligned.



- (c) Align the timing marks of the No. 1 and No. 2 balance shafts as shown in the illustration.
- (d) Place the No. 1 and No. 2 balance shafts onto the crankcase.
- (e) Apply a light coat of engine oil to the threads and under the heads of the bolts.



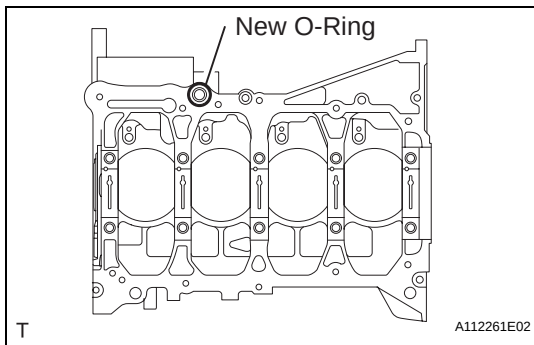
- (f) Using several steps, uniformly install and tighten the 8 bolts in the sequence shown in the illustration.
Torque: 21.6 N*m (220 kgf*cm, 16 ft.*lbf)
- (g) Mark the front of the bolts with paint.
- (h) Retighten the bolts 90° as shown in the illustration.



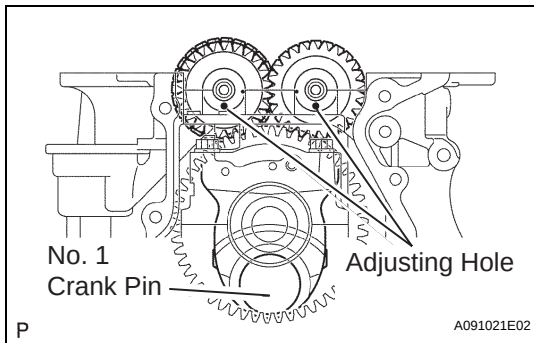
- (i) Check that the paint mark is now at a 90° angle to the front.

13. INSTALL STIFFENING CRANKCASE ASSEMBLY

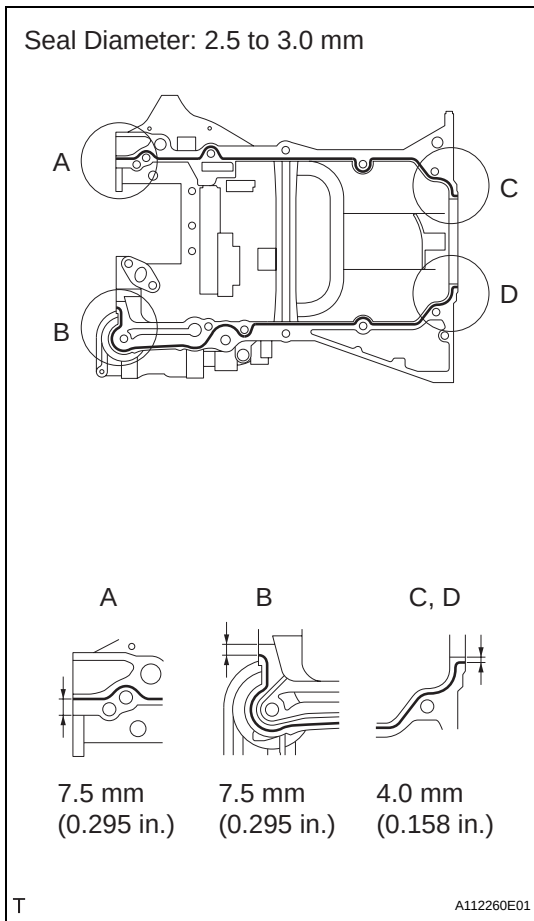
- (a) Remove any old packing material and be careful not to drop any oil on the contact surfaces of the cylinder block and crankcase.



- (b) Place a new O-ring on the cylinder block as shown in the illustration.



- (c) With the No. 1 crank pin of the crankshaft placed at the 6 o'clock position, install the No. 1 and No. 2 balance shafts and align the adjusting holes as shown in the illustration.



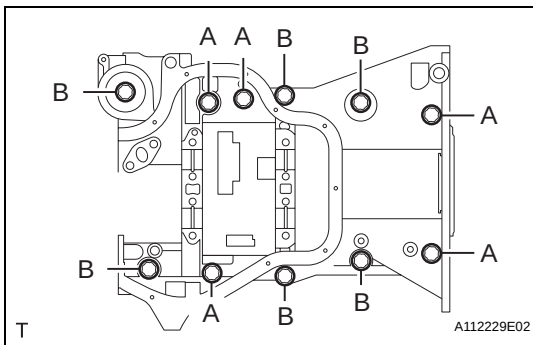
- (d) Apply a continuous bead of seal packing (Diameter 2.5 to 3.0 mm (0.098 to 0.118 in.)) as shown in the illustration.

Seal packing:

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

NOTICE:

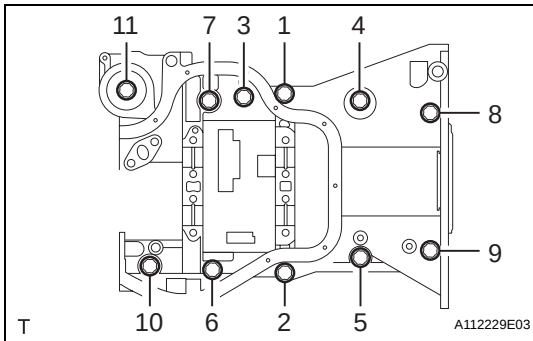
- Remove any oil from the contact surface.
- Install the crankcase within 3 minutes of applying seal packing.
- Do not add engine oil for at least 2 hours after installing the crankcase.



- (e) Temporarily install the crankcase with the 11 bolts.

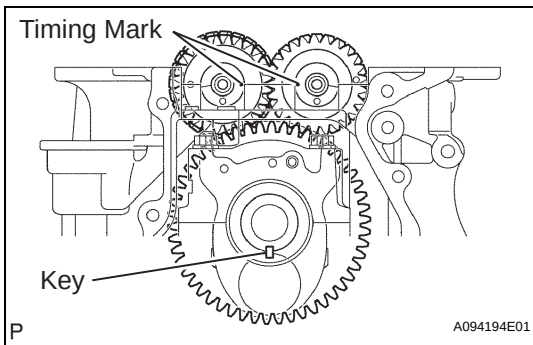
Standard bolt length

Item	Specified Condition
For bolt A (12 mm head)	112 mm (4.41 in.)
For bolt B (12 mm head)	35 mm (1.38 in.)



- (f) Uniformly tighten the bolts.

Torque: 24 N*m (245 kgf*cm, 18 ft.*lbf)



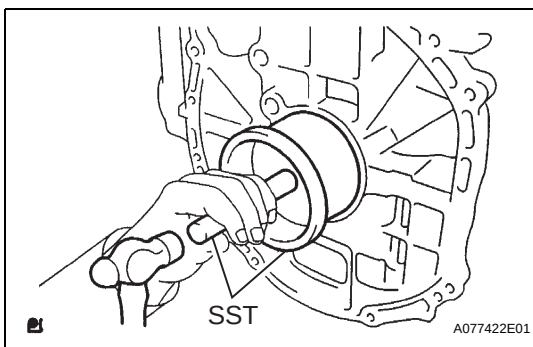
- (g) Confirm that the timing marks of the balance shafts are aligned when the key groove is placed at the 6 o'clock position, as shown in the illustration.

14. INSTALL ENGINE REAR OIL SEAL

- (a) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign object.

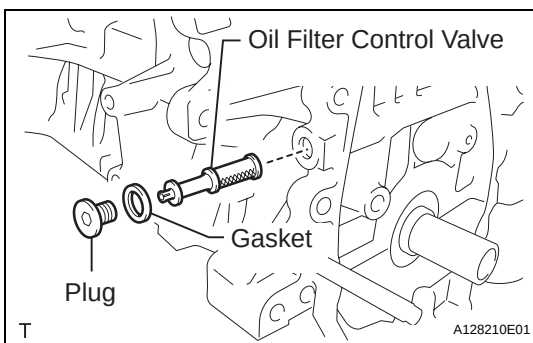


- (b) Using SST and hammer, tap in the new oil seal until its surface is flush with the rear oil seal retainer edge.

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

NOTICE:

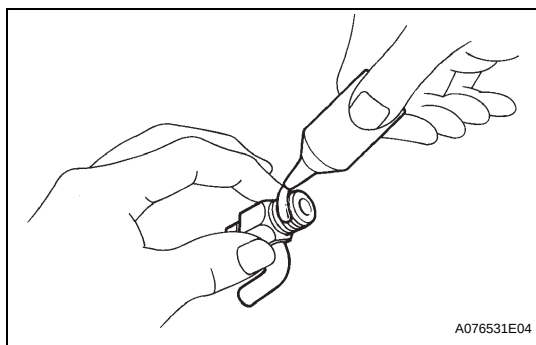
- Wipe any extra grease off the crankshaft.
- Do not tap the oil seal at an angle.



15. INSTALL OIL CONTROL VALVE FILTER

- (a) Check that there are no foreign objects on the mesh part of the oil control valve filter.
- (b) Using a 6 mm socket hexagon wrench, install a new gasket and the oil control valve filter with the plug.

Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

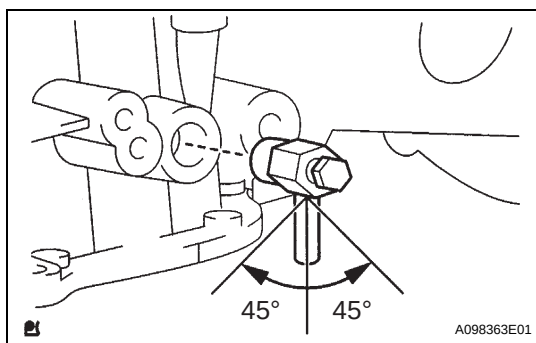


16. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

- (a) Apply adhesive to 2 or 3 threads of the drain cock.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent



- (b) After tightening the drain cock to the specified torque, turn the drain cock clockwise as shown in the illustration.

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

NOTICE:

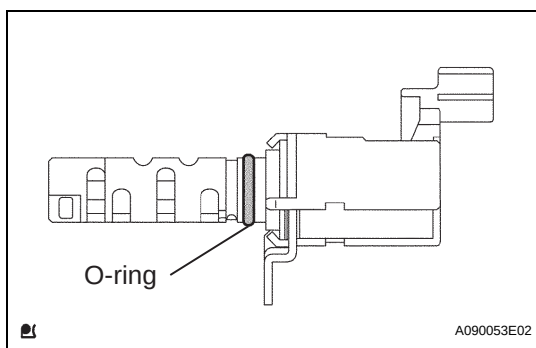
- Install the drain cock within 3 minutes of applying adhesive.
- Do not add coolant for at least an hour after installing the drain cock.
- Do not turn the drain cock by more than 1 revolution (360°) after tightening the drain cock to the specified torque.
- Do not loosen the drain cock after setting it correctly.

17. INSTALL CYLINDER HEAD GASKET (See page [EM-82](#))

18. INSTALL CYLINDER HEAD SUB-ASSEMBLY (See page [EM-82](#))

19. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

- (a) Apply a light coat of engine oil to a new O-ring, then install it onto the camshaft timing oil control valve.



- (b) Install the camshaft timing oil control valve with the bolt.

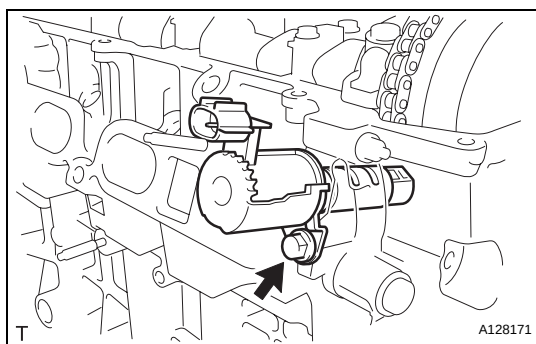
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

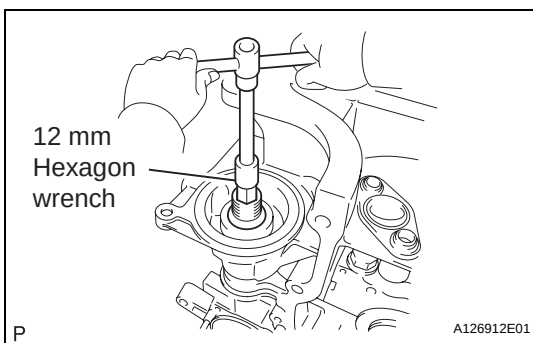
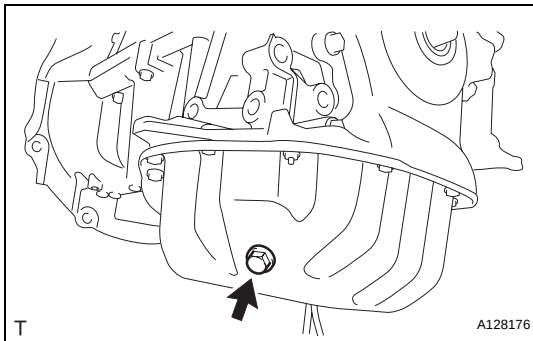
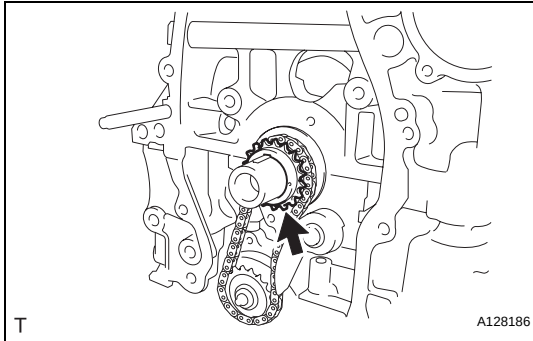
20. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY (See page [EM-83](#))

21. INSTALL NO. 2 CAMSHAFT TIMING SPROCKET (See page [EM-84](#))

22. INSTALL NO. 2 CAMSHAFT BEARING (See page [EM-81](#))

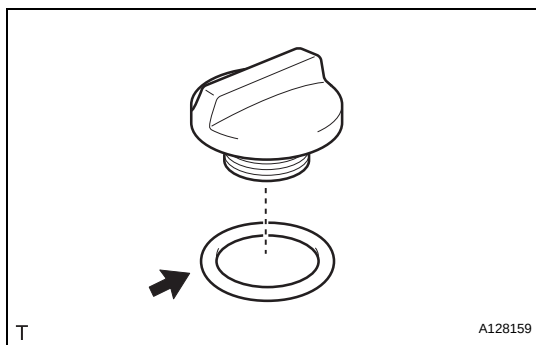
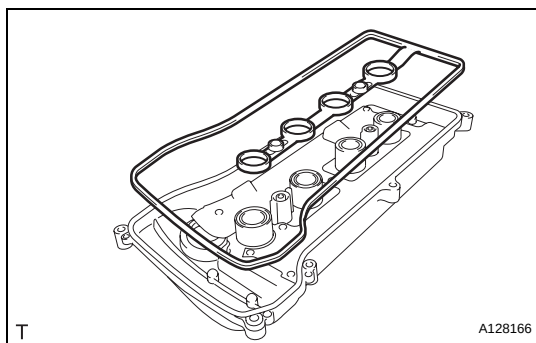
23. INSTALL NO. 1 CAMSHAFT BEARING (See page [EM-81](#))



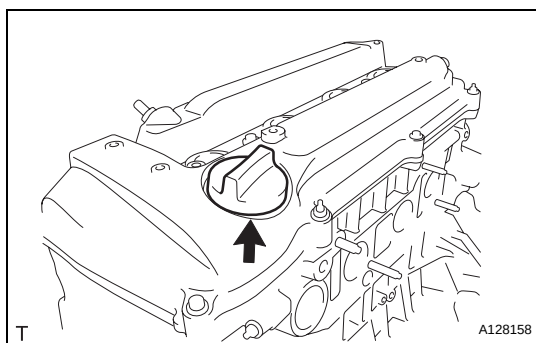


24. INSTALL CAMSHAFT (See page [EM-84](#))
25. INSTALL OIL PUMP ASSEMBLY (See page [LU-15](#))
26. INSTALL OIL PUMP DRIVE GEAR
27. INSTALL NO. 2 CHAIN SUB-ASSEMBLY (See page [EM-32](#))
28. INSTALL CRANKSHAFT TIMING SPROCKET
29. INSTALL NO. 1 CHAIN VIBRATION DAMPER (See page [EM-33](#))
30. INSTALL CHAIN SUB-ASSEMBLY (See page [EM-33](#))
31. INSTALL CHAIN TENSIONER SLIPPER (See page [EM-34](#))
32. INSTALL TIMING CHAIN GUIDE (See page [EM-34](#))
33. INSTALL NO. 1 CRANKSHAFT POSITION SENSOR PLATE (See page [EM-35](#))
34. REPLACE TIMING CHAIN COVER OIL SEAL (See page [EM-144](#))
35. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (See page [EM-35](#))
36. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-37](#))
37. INSTALL CRANKSHAFT PULLEY (See page [EM-38](#))
38. INSTALL OIL PAN SUB-ASSEMBLY (See page [EM-39](#))
39. INSTALL OIL PAN DRAIN PLUG
 - (a) Place a new gasket on the oil pan drain plug, then install it onto the oil pan.
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)
40. INSTALL WATER PUMP ASSEMBLY (See page [CO-12](#))
41. INSTALL WATER PUMP PULLEY (See page [CO-13](#))
42. INSTALL CRANKSHAFT POSITION SENSOR (See page [ES-402](#))
43. INSTALL OIL FILTER UNION
 - (a) Using a 12 mm hexagon wrench, install the oil filter union.
Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf)
44. INSTALL OIL FILTER SUB-ASSEMBLY (See page [LU-4](#))
45. SET NO. 1 CYLINDER TO TDC/COMPRESSION (See page [EM-25](#))
46. CHECK VALVE CLEARANCE (See page [EM-8](#))
47. ADJUST VALVE CLEARANCE (See page [EM-8](#))
48. INSTALL CAMSHAFT (See page [EM-13](#))

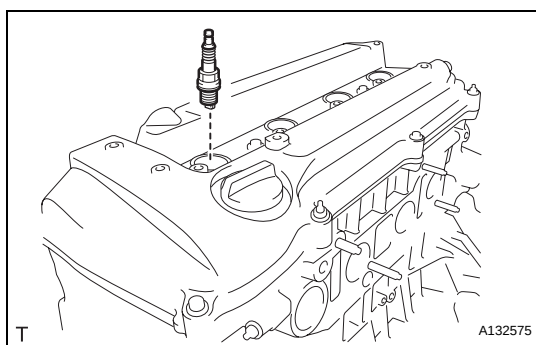
49. INSTALL NO. 2 CAMSHAFT (See page [EM-14](#))
50. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY (See page [EM-37](#))
51. INSTALL CYLINDER HEAD COVER GASKET
(a) Install the gasket onto the cylinder head cover.
52. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY
(See page [EM-40](#))



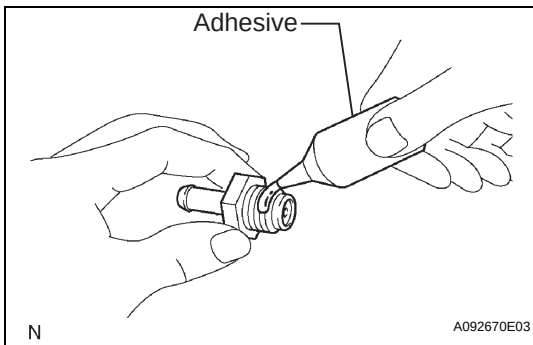
53. INSTALL OIL FILLER CAP SUB-ASSEMBLY
(a) Install the gasket to the cap.



- (b) Install the oil filler cap.
Torque: 3.0 N*m (31 kgf*cm, 26 in.*lbf)



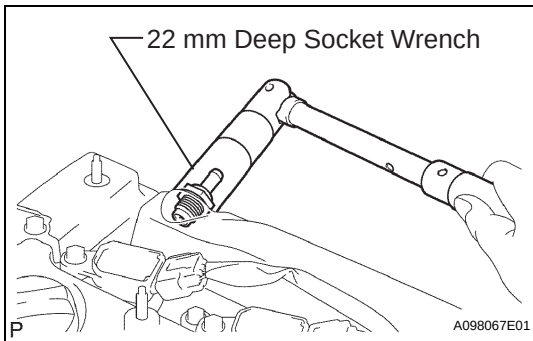
54. INSTALL SPARK PLUG
Torque: 25 N*m (254 kgf*cm, 18 ft.*lbf)
55. INSTALL IGNITION COIL ASSEMBLY (See page [IG-9](#))

**56. INSTALL VENTILATION VALVE SUB-ASSEMBLY**

- (a) Apply adhesive to the threads of the ventilation valve.

Adhesive:

Toyota Genuine Adhesive 1324, Three Bond 1324 or equivalent



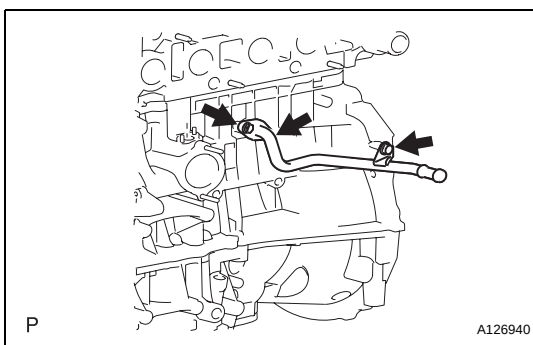
- (b) Using a 22 mm deep socket wrench, install the ventilation valve.

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

57. INSTALL OIL DIPSTICK GUIDE (See page [EM-86](#))**58. INSTALL OIL DIPSTICK****59. INSTALL CAMSHAFT POSITION SENSOR (See page [EM-81](#))****60. INSTALL ENGINE COOLANT TEMPERATURE SENSOR (See page [EM-82](#))****61. INSTALL OIL PRESSURE SWITCH ASSEMBLY (See page [EM-82](#))****62. INSTALL RADIO SETTING CONDENSER (See page [EM-82](#))****63. INSTALL KNOCK SENSOR (See page [ES-420](#))****64. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page [ES-396](#))****65. INSTALL V-RIBBED BELT TENSIONER ASSEMBLY (See page [EM-38](#))****66. INSTALL NO. 3 WATER BY-PASS PIPE**

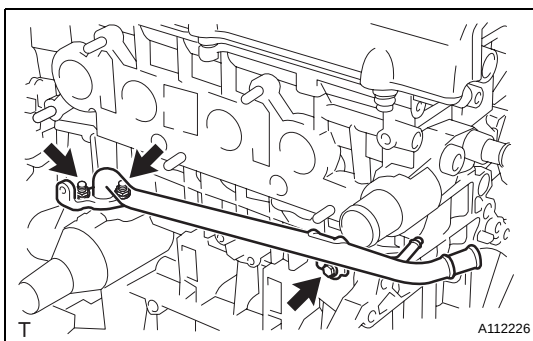
- (a) Install a new gasket and pipe with the bolt and 2 nuts.

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

**67. INSTALL NO. 1 WATER BY-PASS PIPE**

- (a) Install a new gasket and the pipe with the bolt and 2 nuts.

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

68. INSTALL THERMOSTAT (See page [CO-15](#))**69. INSTALL WATER INLET (See page [CO-16](#))****70. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSEMBLY (See page [EM-85](#))**

- 71. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR (See page [EM-86](#))
- 72. INSTALL NO. 2 MANIFOLD STAY (See page [EM-86](#))
- 73. INSTALL MANIFOLD STAY (See page [EM-86](#))
- 74. INSTALL IDLER PULLEY (See page [EM-41](#))

ENGINE

ON-VEHICLE INSPECTION

1. INSPECT ENGINE COOLANT
2. INSPECT ENGINE OIL
3. INSPECT BATTERY
4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY
 - (a) Remove the air cleaner cap.
 - (b) Remove the air filter element.
 - (c) Visually check that the air filter is not excessively damaged or oily.
If necessary, replace the air filter.

5. INSPECT SPARK PLUG

6. INSPECT FAN AND GENERATOR V BELT

HINT:

You do not need to check the belt deflection because the auto tensioner has been adopted.

7. INSPECT IGNITION TIMING

NOTICE:

- Turn all the electrical systems and the A/C OFF.
- Inspect the ignition timing with the cooling fan OFF.
- When checking the ignition timing, shift the transmission to the neutral position.

(a) Warm up and stop the engine.

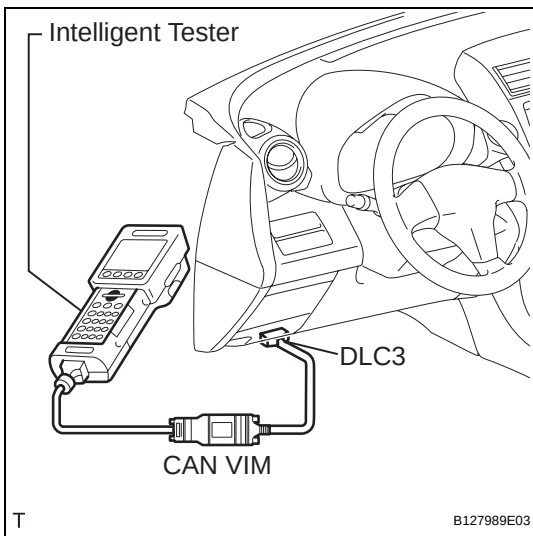
(b) When using intelligent tester:

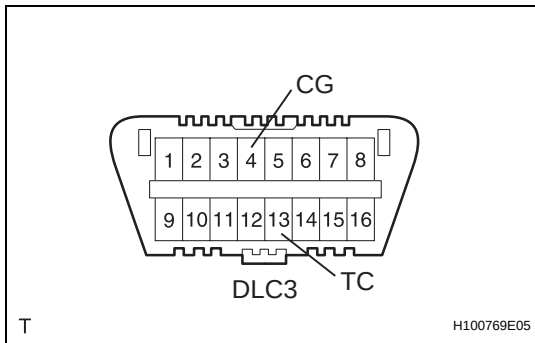
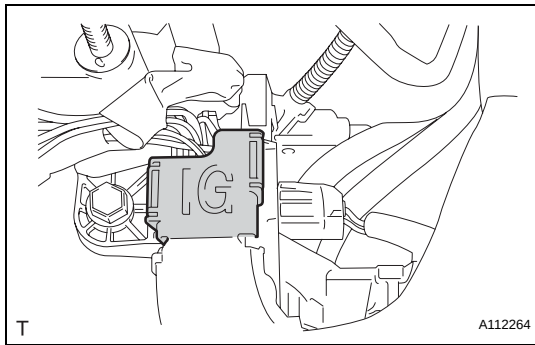
- (1) Connect the intelligent tester to the DLC3.
- (2) Allow the engine to idle.
- (3) Select the following menu items:
DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / IGN ADVANCE.
- (4) Read IGN ADVANCE to check the ignition timing.

Standard ignition timing:

5 to 15° BTDC @ idle

- (5) Check that the ignition timing advances immediately when the engine speed is increased.
 - (6) Turn the ignition switch OFF.
 - (7) Disconnect the intelligent tester from the DLC3.
- (c) When not using intelligent tester:
- (1) Remove the No. 1 engine cover (see page [EM-22](#)).





- (2) Open the ignition cover located to the right of the No. 4 ignition coil.
- (3) Pull out the wire harness from the IG cover.
- (4) Connect a timing light to the wire harness.

NOTICE:

Use a timing light that detects the first signal.

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

SST 09843-18040

- (6) Allow the engine to idle and check the ignition timing.

Standard ignition timing:

8 to 12° BTDC @ idle

HINT:

Run the engine at 1,000 to 1,300 rpm for 5 seconds, then check that the engine speed returns to the idling speed.

- (7) Remove SST from the DLC3.
- (8) Allow the engine to idle and check the ignition timing.

Standard ignition timing:

5 to 15° BTDC

- (9) Check that the ignition timing advances immediately when the engine speed is increased.

- (10) Turn the ignition switch OFF.

- (11) Remove the timing light.

- (12) Close the IG cover.

- (13) Install the No. 1 engine cover (see page [EM-43](#)).

8. INSPECT ENGINE IDLE SPEED

- (a) When using intelligent tester:

- (1) Turn OFF all the accessories and air conditioning.
- (2) Move the shift lever to P or neutral.
- (3) Connect the intelligent tester to the DLC3.
- (4) Warm up the engine.
- (5) Select the tester menus:
DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / ENGINE SPD.
- (6) Read ENGINE SPEED to check the idle speed while the radiator-cooling fan is not rotating.

Standard idle speed:

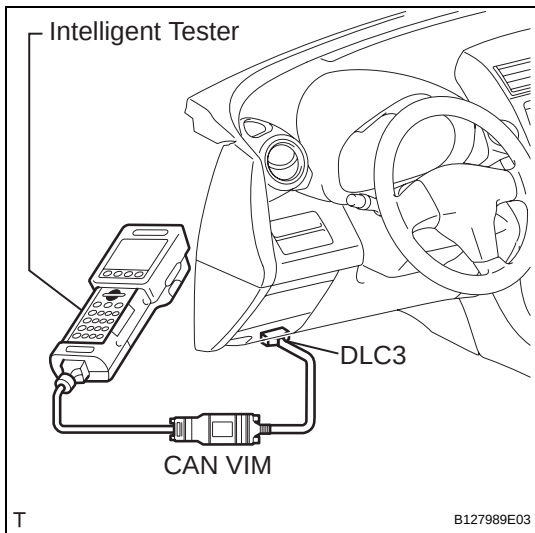
600 to 700 rpm

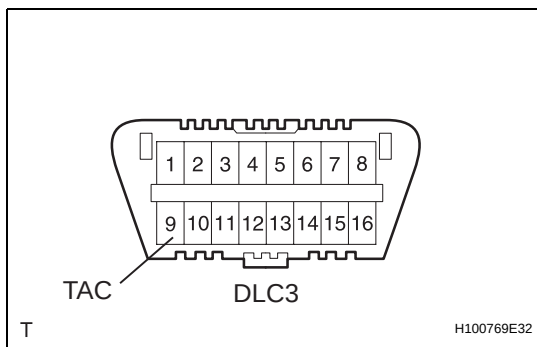
- (7) Turn the ignition switch OFF.

- (8) Disconnect the tester from the DLC3.

- (b) When not using intelligent tester:

- (1) Turn OFF all the accessories and air conditioning.





- (2) Move the shift lever to P or neutral.
- (3) Connect SST to 9 (TAC) of the DLC3 terminal, and then connect a tachometer to SST.
SST 09843-18030
- (4) Warm up the engine.
- (5) Check the idle speed while the radiator-cooling fan is not rotating.
Standard idle speed:
600 to 700 rpm
- (6) Turn the ignition switch OFF.
- (7) Remove the tachometer and disconnect SST from the DLC3.

9. INSPECT COMPRESSION

- (a) Warm up and stop the engine.
- (b) Remove the No. 1 engine under cover.
- (c) Remove the 4 ignition coils (see page IG-9).
- (d) Remove the 4 spark plugs.
- (e) Disconnect the 4 fuel injector connectors.
- (f) Set SST and a compression gauge.
- (g) Insert the compression gauge into the spark plug hole.
- (h) While cranking the engine, measure the compression pressure.

Standard compression pressure:

1,300 kPa (13.8 kgf/cm², 196 psi)

Minimum pressure:

1,000 kPa (10 kgf/cm², 142 psi)

Standard difference between each cylinder:

100 kPa (1.0 kgf/cm², 14 psi)

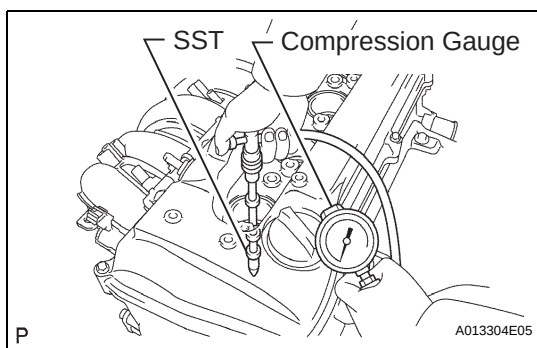
NOTICE:

- Always use a fully charged battery to obtain an engine speed of 250 rpm or more.
- Check the other cylinders' compression pressures in the same way.
- This measurement must be done as quickly as possible.

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

HINT:

- If adding oil increases the compression, the piston rings and/or cylinder bore may be worn or damaged.
 - If pressure stays low, a valve may be stuck or seated improperly, or there may be leakage in the gasket.
- (i) Connect the 4 fuel injector connectors.
 - (j) Install the 4 spark plugs.
Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)
 - (k) Install the 4 ignition coils (see page IG-9).
 - (l) Install the No. 1 engine under cover.



10. INSPECT CO/HC

HINT:

The ECM properly controls the CO/HC concentration in the emission gas.

- (a) Start and warm up the engine.
- (b) Run the engine at 2,500 rpm for approximately 180 seconds.
- (c) Insert the CO/HC meter testing probe at least 40 cm (1.3 ft.) into the tailpipe while idling.
- (d) Inspect the CO/HC concentration while idling and/or at 2,500 rpm.

If the CO/HC concentration is not as specified, perform troubleshooting.

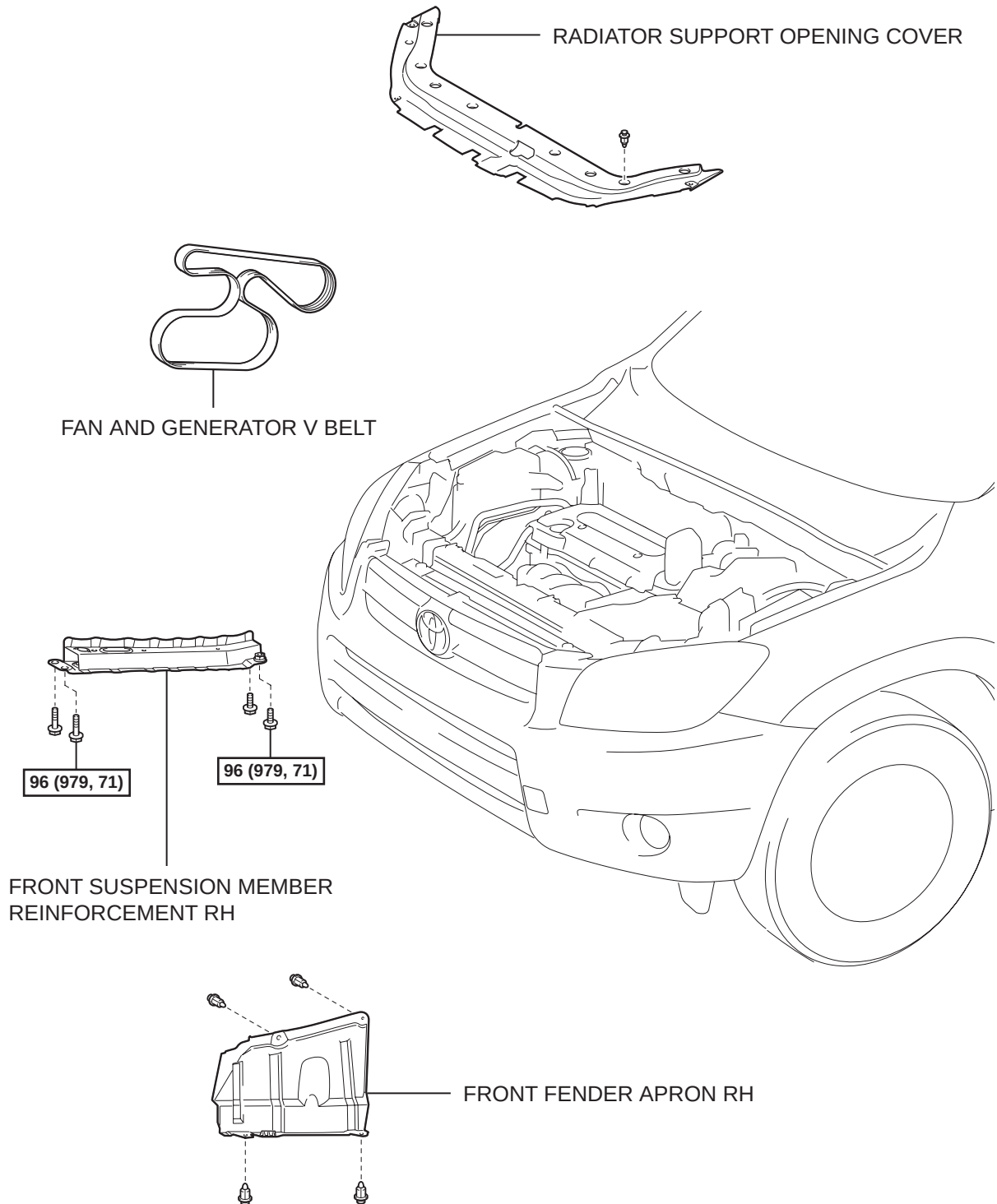
HINT:

See the table below for possible causes, and then inspect and repair the applicable causes if necessary.

CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignition: - Incorrect timing - Plugs are contaminated, shorted, or gaps are defective 2. Incorrect valve clearance 3. Leaks in intake and exhaust valve 4. Leaks in cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leakage: - Ventilation hoses - Intake manifold - Throttle body - Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty SFI system: - Faulty pressure regulator - Faulty engine coolant temperature sensor - Faulty mass air flow meter - Faulty ECM - Faulty injectors - Faulty throttle body

DRIVE BELT

COMPONENTS



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

EM

ON-VEHICLE INSPECTION

1. CHECK FAN AND GENERATOR V BELT

- (a) Visually check the drive belt for excessive wear, frayed cords, etc.

If any defect has been found, replace the drive belt.

HINT:

Cracks on the rib side of a drive belt are considered acceptable.

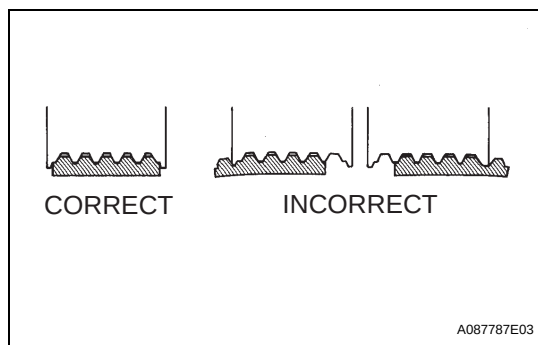
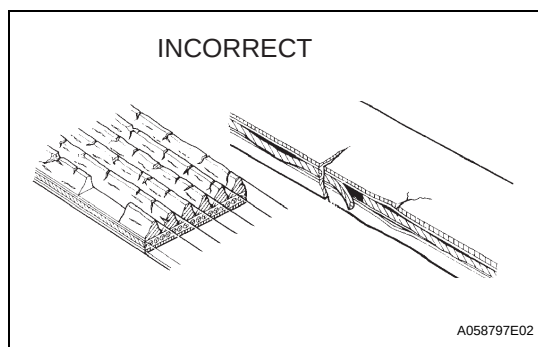
If the drive belt has chunks missing from the ribs, it should be replaced.

- (b) After installing the drive belt, check that it fits properly in the ribbed grooves.

Check with your hand to confirm that the belt has not slipped out of the grooves on the bottom of the crank pulley.

HINT:

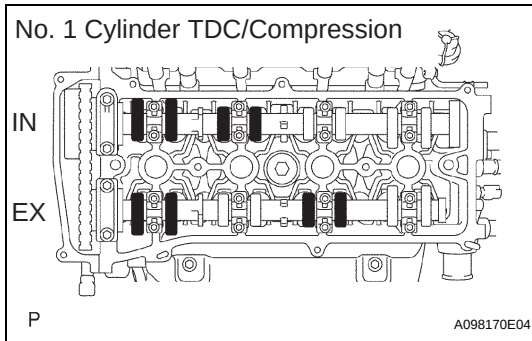
- A "new belt" is a belt which has been used for less than 5 minutes on a running engine.
- A "used belt" is a belt which has been used on a running engine for 5 minutes or more.
- After installing a new belt, run the engine for approximately 5 minutes and then recheck the tension.



VALVE CLEARANCE

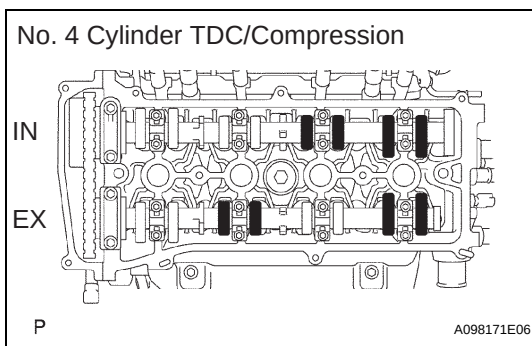
ADJUSTMENT

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
CAUTION:
 Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE FRONT WHEEL RH**
3. **REMOVE NO. 1 ENGINE UNDER COVER**
4. **REMOVE FRONT FENDER APRON RH**
5. **REMOVE NO. 1 ENGINE COVER** (See page [EM-22](#))
6. **REMOVE IGNITION COIL ASSEMBLY** (See page [IG-9](#))
7. **REMOVE SPARK PLUG**
 (a) Remove the 4 spark plugs.
8. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY** (See page [EM-24](#))
9. **SET NO. 1 CYLINDER TO TDC/COMPRESSION** (See page [EM-25](#))
10. **CHECK VALVE CLEARANCE**
 (a) Check only the valves indicated.
 (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
Standard valve clearance (cold)



Item	Standard Condition
Intake	0.19 to 0.29 mm (0.0075 to 0.0114 in.)
Exhaust	0.38 to 0.48 mm (0.0150 to 0.0189 in.)

- (2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve clearance lifters.
- (b) Turn the crankshaft 1 revolution (360°) and set the No. 4 cylinder to the TDC/compression.
- (c) Check only the valves indicated.
 (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
Standard valve clearance (cold)

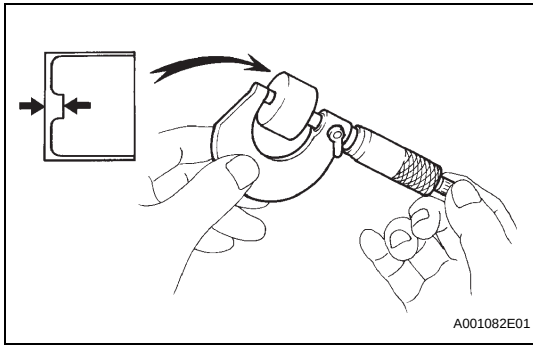


Item	Standard Condition
Intake	0.19 to 0.29 mm (0.0075 to 0.0114 in.)
Exhaust	0.38 to 0.48 mm (0.0150 to 0.0189 in.)

- (2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement valve lifters.

11. ADJUST VALVE CLEARANCE

- (a) Remove the No. 2 camshaft (see page [EM-60](#)).



- (b) Remove the camshaft (see page [EM-61](#)).
- (c) Remove the valve lifters.
- (d) Using a micrometer, measure the thickness of the removed valve lifters.
- (e) Calculate the thickness of a new lifter so that the valve clearance comes within the specified values.

New lifter thickness

Item	Specification
Intake	$A = B + (C - 0.24 \text{ mm (0.0095 in.)})$
Exhaust	$A = B + (C - 0.43 \text{ mm (0.0169 in.)})$

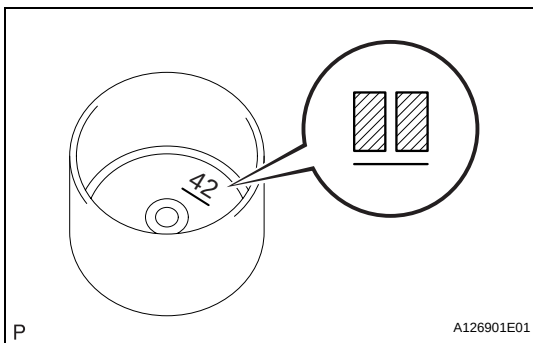
A	New lifter thickness
B	Used lifter thickness
C	Measured valve clearance

CALCULATION EXAMPLE (Intake):

1. Measured intake valve clearance = 0.40 mm (0.0158 in.)
(Measured - Specification = Excess clearance)
(a) 0.40 mm (0.0158 in.) - 0.24 mm (0.0095 in.) = 0.16 mm (0.0063 in.)
 2. Measured used lifter thickness = 5.250 mm (0.2067 in.)
 3. New lifter thickness = 5.410 mm (0.2130 in.)
(Excess clearance + Used lifter thickness = Ideal new lifter)
(a) 0.16 mm (0.0063 in.) + 5.250 mm (0.2067 in.) = 5.410 mm (0.2130 in.)
 4. Closest new lifter = 5.420 mm (0.2134 in.)
– Select No. 42 lifter
- (f) Select a new lifter with a thickness as close as possible to the calculated values.

HINT:

- Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 to 5.740 mm (0.1992 to 0.2260 in.).
- The identification number inside the valve lifters shows the value to 2 decimal places. (The illustration shows 5.420 mm (0.2134 in.).)



Installed lifter thickness	Measured clearance	
	mm (in.)	mm (in.)
	0.000 - 0.030 (0.0000 - 0.0012)	0.031 - 0.060 (0.0012 - 0.0020)
5.060 (0.1992)		0.051 - 0.070 (0.0020 - 0.0028)
5.080 (0.2000)		0.071 - 0.090 (0.0028 - 0.0035)
5.100 (0.2008)		0.091 - 0.110 (0.0036 - 0.0043)
5.120 (0.2016)		0.111 - 0.130 (0.0044 - 0.0051)
5.140 (0.2024)		0.131 - 0.150 (0.0052 - 0.0059)
5.160 (0.2031)		0.151 - 0.170 (0.0059 - 0.0067)
5.180 (0.2039)		0.171 - 0.189 (0.0067 - 0.0074)
5.200 (0.2047)		0.190 - 0.209 (0.0075 - 0.0114)
5.210 (0.2051)		0.291 - 0.310 (0.0115 - 0.0122)
5.220 (0.2055)		0.311 - 0.330 (0.0122 - 0.0130)
5.230 (0.2059)		0.331 - 0.350 (0.0130 - 0.0138)
5.240 (0.2063)		0.351 - 0.370 (0.0138 - 0.0146)
5.250 (0.2067)		0.371 - 0.390 (0.0146 - 0.0154)
5.260 (0.2071)		0.391 - 0.410 (0.0154 - 0.0161)
5.270 (0.2075)		0.411 - 0.430 (0.0162 - 0.0169)
5.280 (0.2079)		0.431 - 0.450 (0.0170 - 0.0177)
5.290 (0.2083)		0.451 - 0.470 (0.0178 - 0.0185)
5.300 (0.2087)		0.471 - 0.490 (0.0185 - 0.0193)
5.310 (0.2091)		0.491 - 0.510 (0.0193 - 0.0201)
5.320 (0.2094)		0.511 - 0.530 (0.0201 - 0.0209)
5.330 (0.2098)		0.531 - 0.550 (0.0209 - 0.0217)
5.340 (0.2102)		0.551 - 0.570 (0.0217 - 0.0224)
5.350 (0.2106)		0.571 - 0.590 (0.0225 - 0.0232)
5.360 (0.2110)		0.591 - 0.610 (0.0233 - 0.0240)
5.370 (0.2114)		0.611 - 0.630 (0.0241 - 0.0248)
5.380 (0.2118)		0.631 - 0.650 (0.0248 - 0.0256)
5.390 (0.2122)		0.651 - 0.670 (0.0256 - 0.0264)
5.400 (0.2126)		0.671 - 0.690 (0.0264 - 0.0272)
5.410 (0.2130)		0.691 - 0.710 (0.0272 - 0.0280)
5.420 (0.2134)		0.711 - 0.730 (0.0280 - 0.0287)
5.430 (0.2138)		0.731 - 0.750 (0.0288 - 0.0296)
5.440 (0.2142)		0.751 - 0.770 (0.0296 - 0.0303)
5.450 (0.2146)		0.771 - 0.790 (0.0304 - 0.0311)
5.460 (0.2150)		0.791 - 0.810 (0.0311 - 0.0319)
5.470 (0.2154)		0.811 - 0.830 (0.0319 - 0.0327)
5.480 (0.2157)		0.831 - 0.850 (0.0327 - 0.0335)
5.490 (0.2161)		0.851 - 0.870 (0.0335 - 0.0343)
5.500 (0.2165)		0.871 - 0.890 (0.0343 - 0.0350)
5.510 (0.2169)		0.891 - 0.910 (0.0351 - 0.0358)
5.520 (0.2173)		0.911 - 0.930 (0.0359 - 0.0366)
5.530 (0.2177)		
5.540 (0.2181)		
5.550 (0.2185)		
5.560 (0.2189)		
5.570 (0.2193)		
5.580 (0.2197)		
5.590 (0.2201)		
5.600 (0.2205)		
5.620 (0.2213)		
5.640 (0.2220)		
5.660 (0.2228)		
5.680 (0.2236)		
5.700 (0.2244)		
5.720 (0.2252)		
5.740 (0.2260)		

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New lifter thickness

Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)

Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)
10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)
12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)	-	-

Standard intake valve clearance (cold):**0.19 to 0.29 mm (0.0075 to 0.0114 in.)****EXAMPLE:**

The 5.250 mm (0.2067 in.) lifter is installed, and the measured clearance is 0.400 mm (0.0157 in.).

Replace the 5.250 mm (0.2067 in.) lifter with a new No. 42 lifter.

(h) Valve lifter selection chart (exhaust).

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A114356F01

New lifter thickness

Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)
06	5.060 (0.1992)	30	5.300 (0.2087)	54	5.540 (0.2181)

Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)	Lifter No.	Thickness mm (in.)
08	5.080 (0.2000)	32	5.320 (0.2094)	56	5.560 (0.2189)
10	5.100 (0.2008)	34	5.340 (0.2102)	58	5.580 (0.2197)
12	5.120 (0.2016)	36	5.360 (0.2110)	60	5.600 (0.2205)
14	5.140 (0.2024)	38	5.380 (0.2118)	62	5.620 (0.2213)
16	5.160 (0.2031)	40	5.400 (0.2126)	64	5.640 (0.2220)
18	5.180 (0.2039)	42	5.420 (0.2134)	66	5.660 (0.2228)
20	5.200 (0.2047)	44	5.440 (0.2142)	68	5.680 (0.2236)
22	5.220 (0.2055)	46	5.460 (0.2150)	70	5.700 (0.2244)
24	5.240 (0.2063)	48	5.480 (0.2157)	72	5.720 (0.2252)
26	5.260 (0.2071)	50	5.500 (0.2165)	74	5.740 (0.2260)
28	5.280 (0.2079)	52	5.520 (0.2173)	-	-

Standard exhaust valve clearance (cold):
0.38 to 0.48 mm (0.0150 to 0.0189 in.)

EXAMPLE:

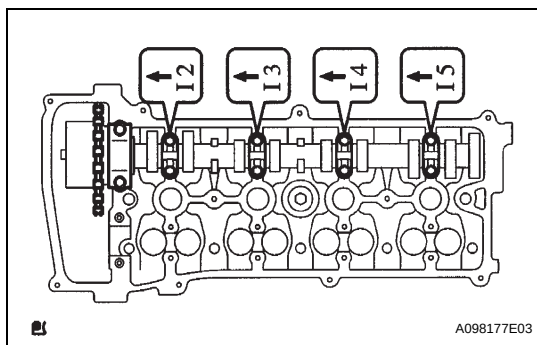
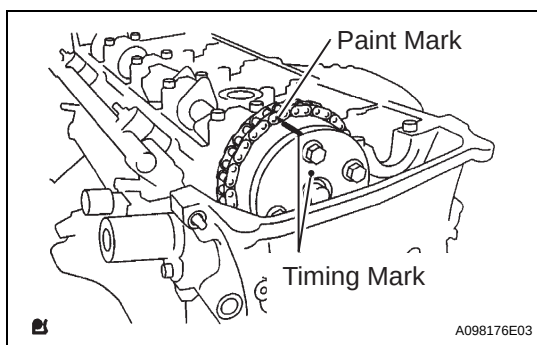
The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.430 mm (0.0169 in.).

Replace the 5.340 mm (0.2102 in.) lifter with a new No. 42 lifter.

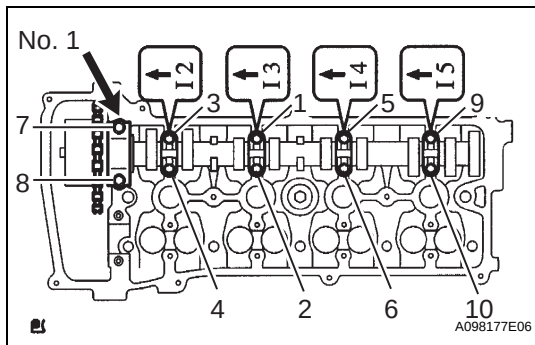
- (i) Install the selected valve lifter.

12. INSTALL CAMSHAFT

- (a) Apply a light coat of engine oil to the journal portion of the camshaft.
- (b) Install the timing chain onto the camshaft timing gear with the paint mark aligned with the timing mark in the camshaft timing gear as shown in the illustration.



- (c) Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps into the cylinder head.
- (d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.



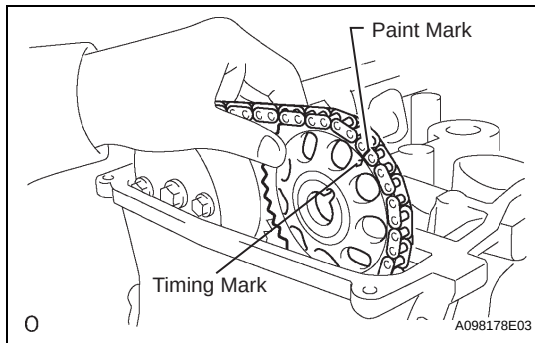
- (e) Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf) for No. 1 bearing cap
9.0 N*m (92 kgf*cm, 80 in.*lbf) for No. 3 bearing cap

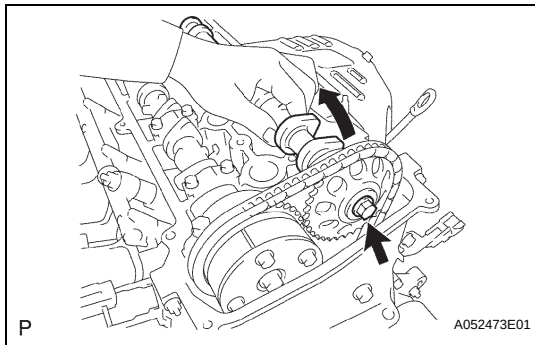
13. INSTALL NO. 2 CAMSHAFT

- (a) Apply a light coat of engine oil to the journal portion of the No. 2 camshaft.

- (b) Put the No. 2 camshaft on the cylinder head with the paint mark of the chain aligned with the timing mark on the camshaft timing sprocket.

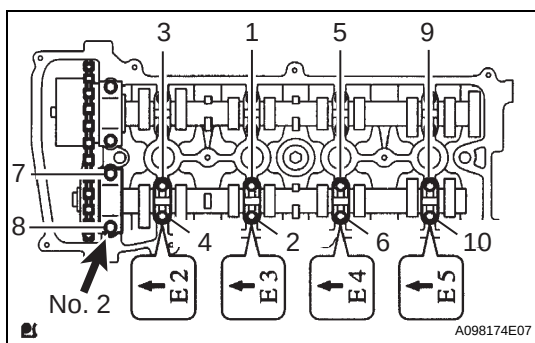
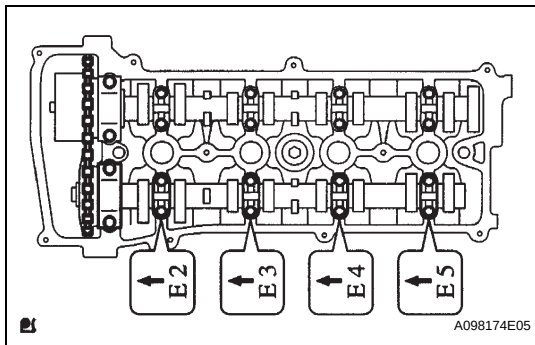


- (c) While holding the No. 2 camshaft by hand, temporarily tighten the camshaft timing sprocket set bolt.



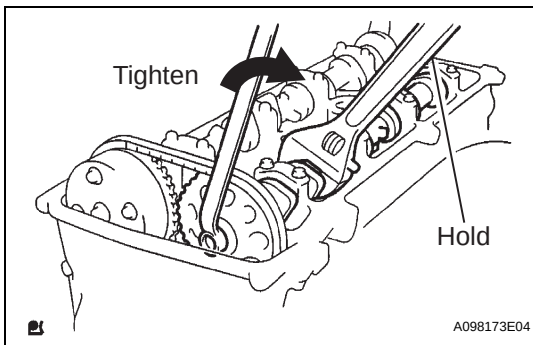
- (d) Examine the front marks and numbers, and check that the order is as shown in the illustration. Then install the bearing caps onto the cylinder head.

- (e) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



- (f) Using several steps, uniformly tighten the 10 bearing cap bolts in the sequence shown in the illustration.

Torque: 29.5 N*m (301 kgf*cm, 22 ft.*lbf) for No. 2 bearing cap
9.0 N*m (92 kgf*cm, 80 in.*lbf) for No. 3 bearing cap

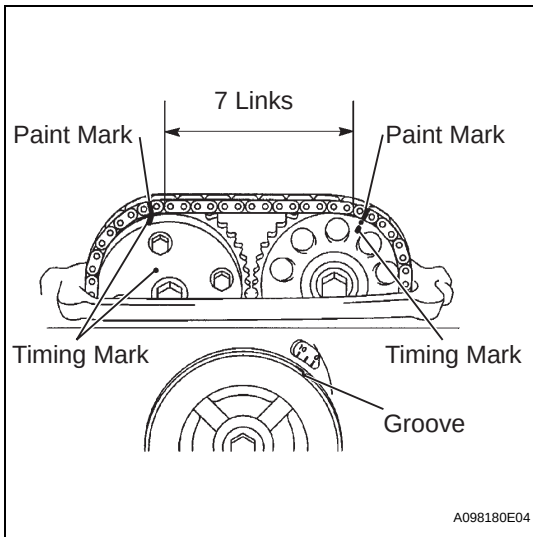


- (g) While holding the camshaft with a wrench, tighten the camshaft timing sprocket set bolt.

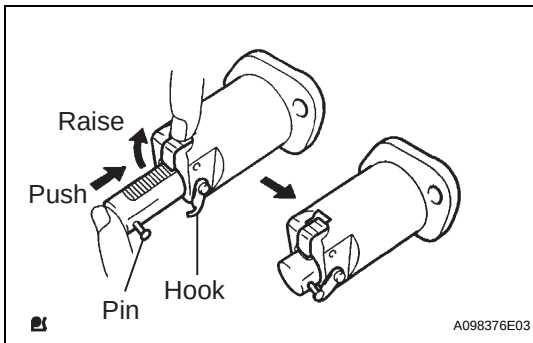
Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)

NOTICE:

Be careful not to damage the valve lifter.

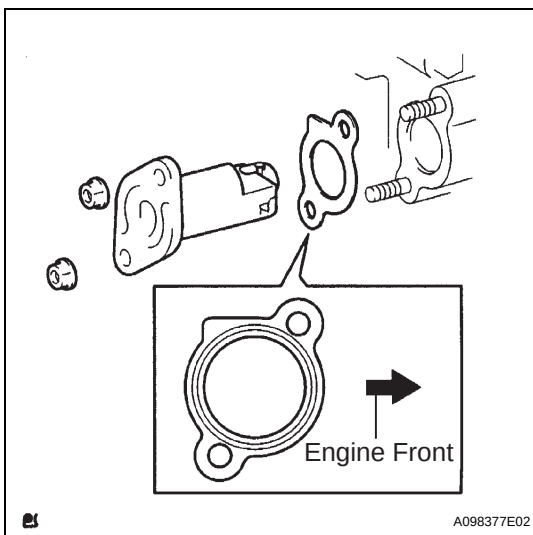


- (h) Check that the paint marks on the chain are aligned with the timing marks on the camshaft timing gear and camshaft timing sprocket. Also, check that the crankshaft pulley groove is aligned with the timing mark "0" of the timing chain cover.



14. INSTALL NO. 1 CHAIN TENSIONER

- (a) Release the ratchet pawl, then fully push in the plunger and hook the hook to the pin so that the plunger is in the position shown in the illustration.

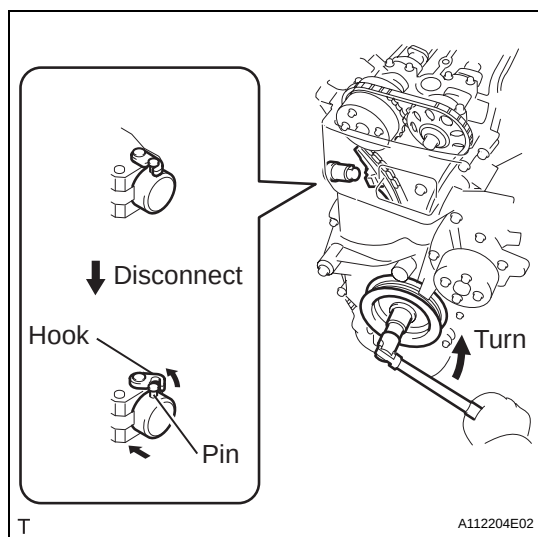


- (b) Install a new gasket and the chain tensioner with the 2 nuts.

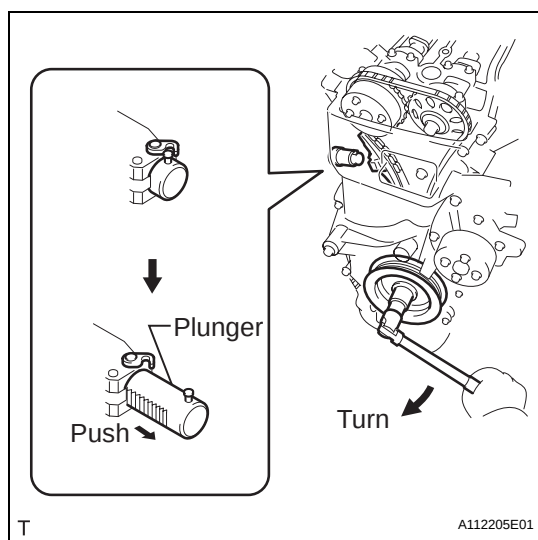
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

NOTICE:

When installing the chain tensioner, set the hook again if the hook releases the plunger.



- (c) Turn the crankshaft counterclockwise, then disconnect the plunger knock pin from the hook.



- (d) Turn the crankshaft clockwise, then check that the plunger is extended.

15. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY
(See page [EM-40](#))

16. INSTALL SPARK PLUG

- (a) Install the 4 spark plugs.

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

17. INSTALL IGNITION COIL ASSEMBLY (See page [IG-9](#))

18. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

19. CHECK FOR ENGINE OIL LEAKS

20. INSTALL NO. 1 ENGINE COVER (See page [EM-43](#))

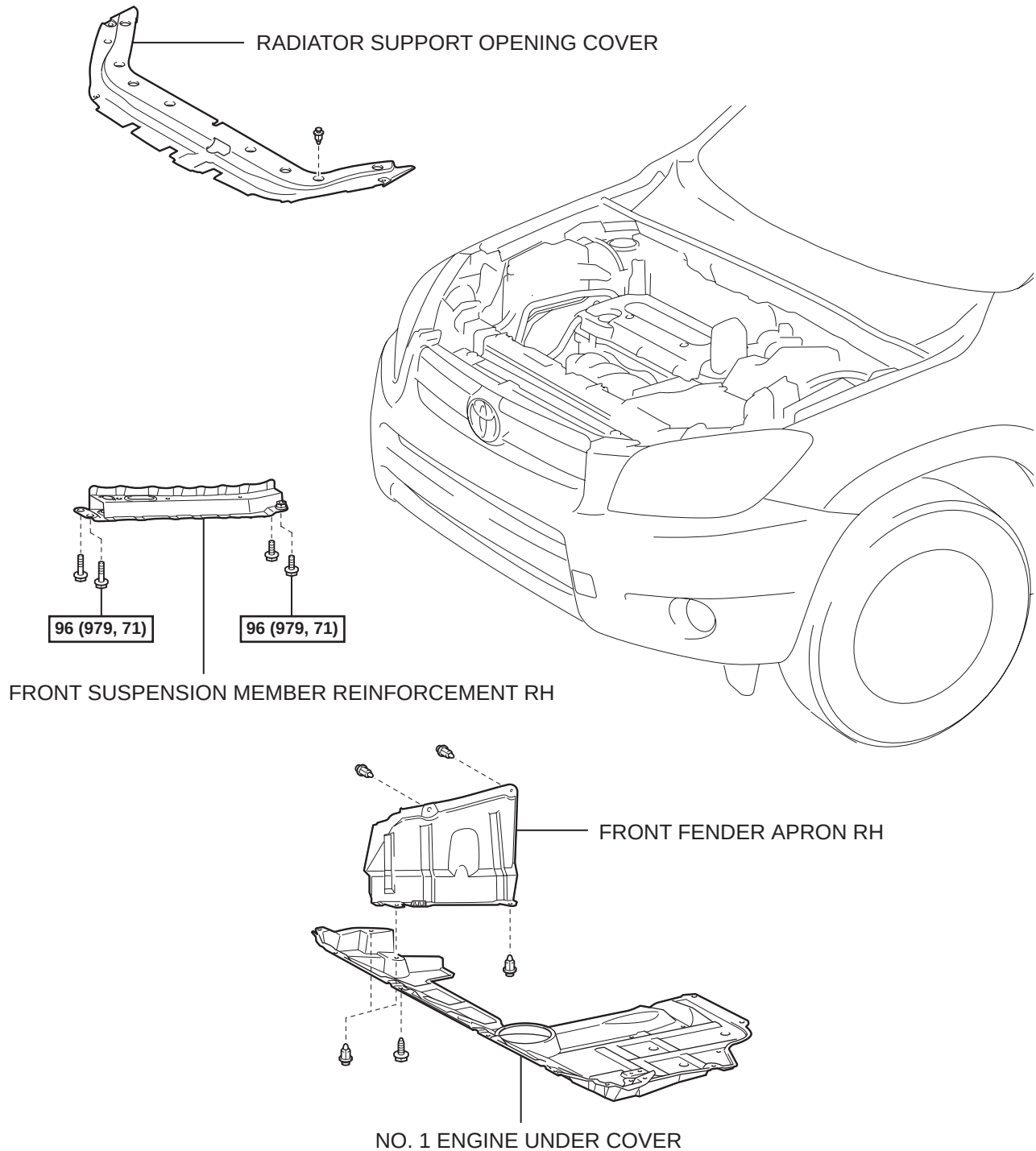
21. INSTALL FRONT FENDER APRON RH

22. INSTALL NO. 1 ENGINE UNDER COVER

23. INSTALL FRONT WHEEL RH

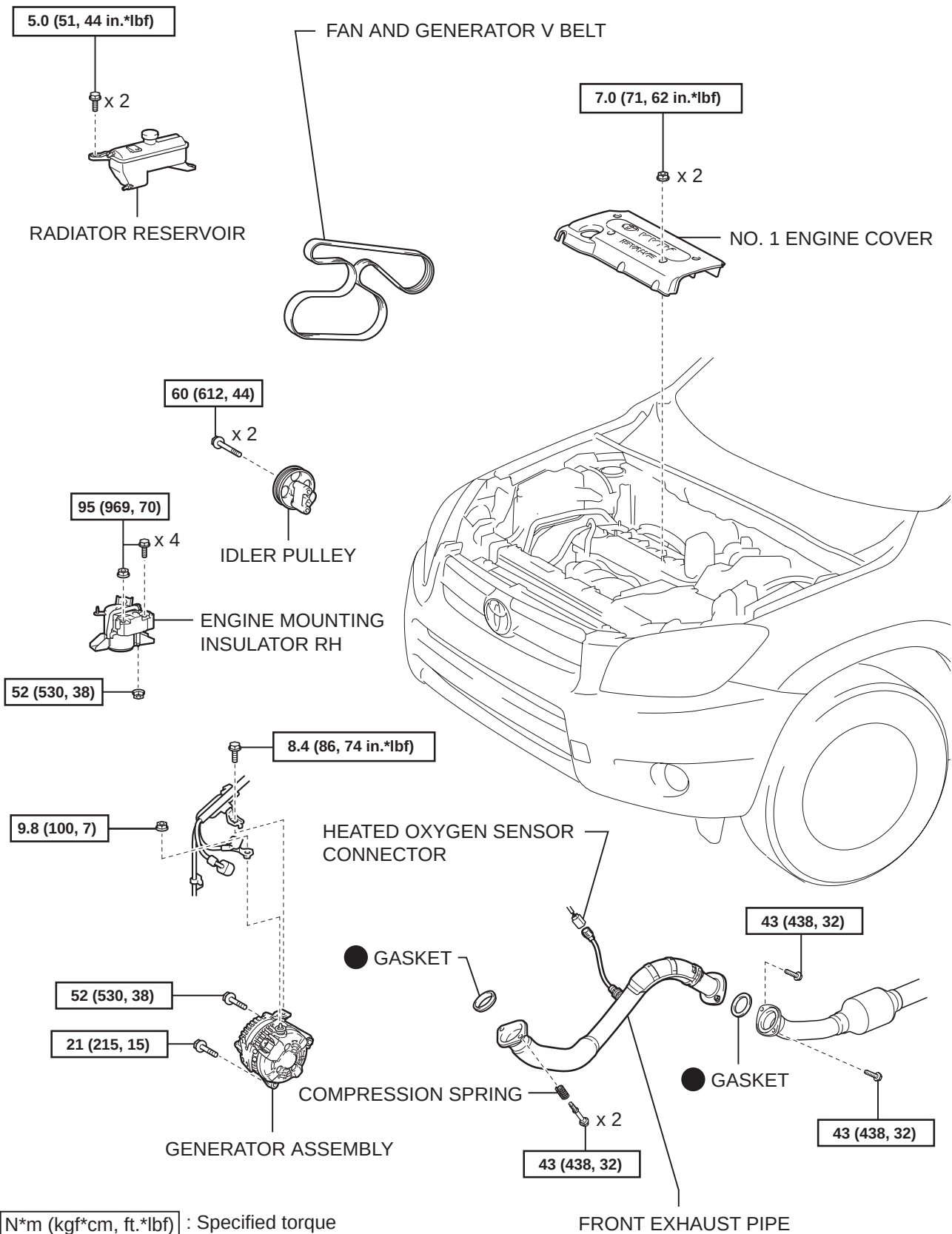
TIMING CHAIN

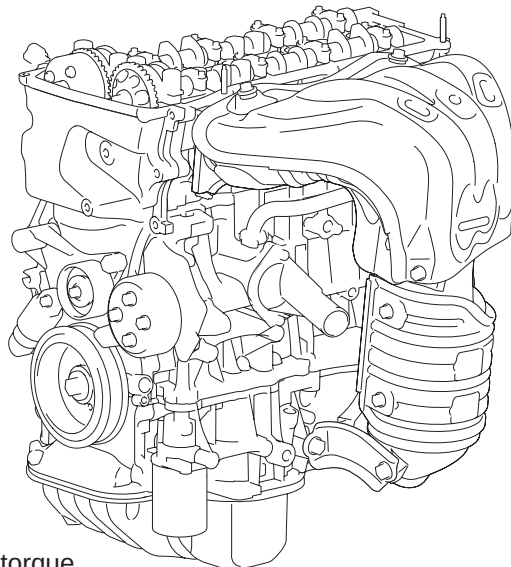
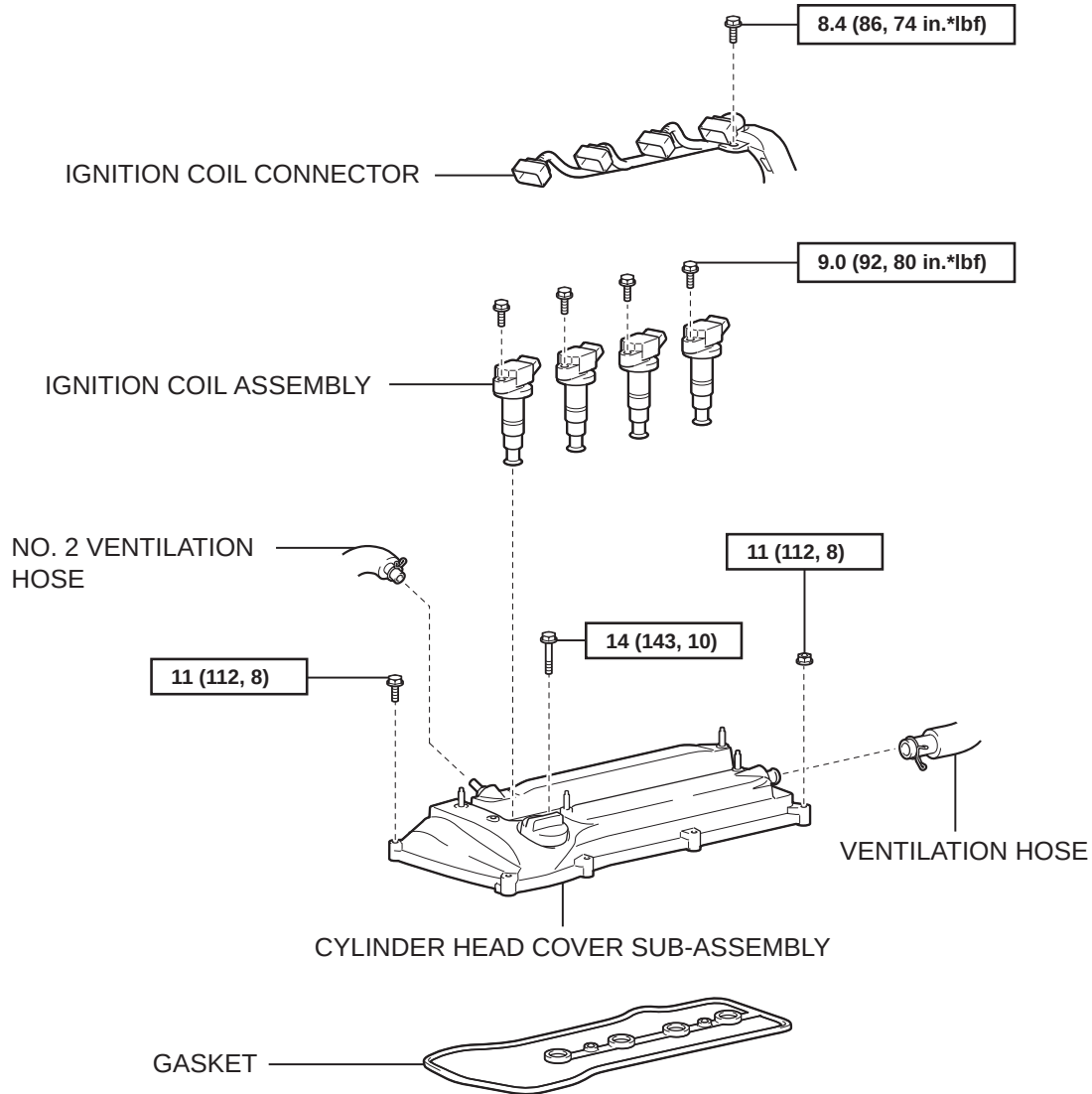
COMPONENTS



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

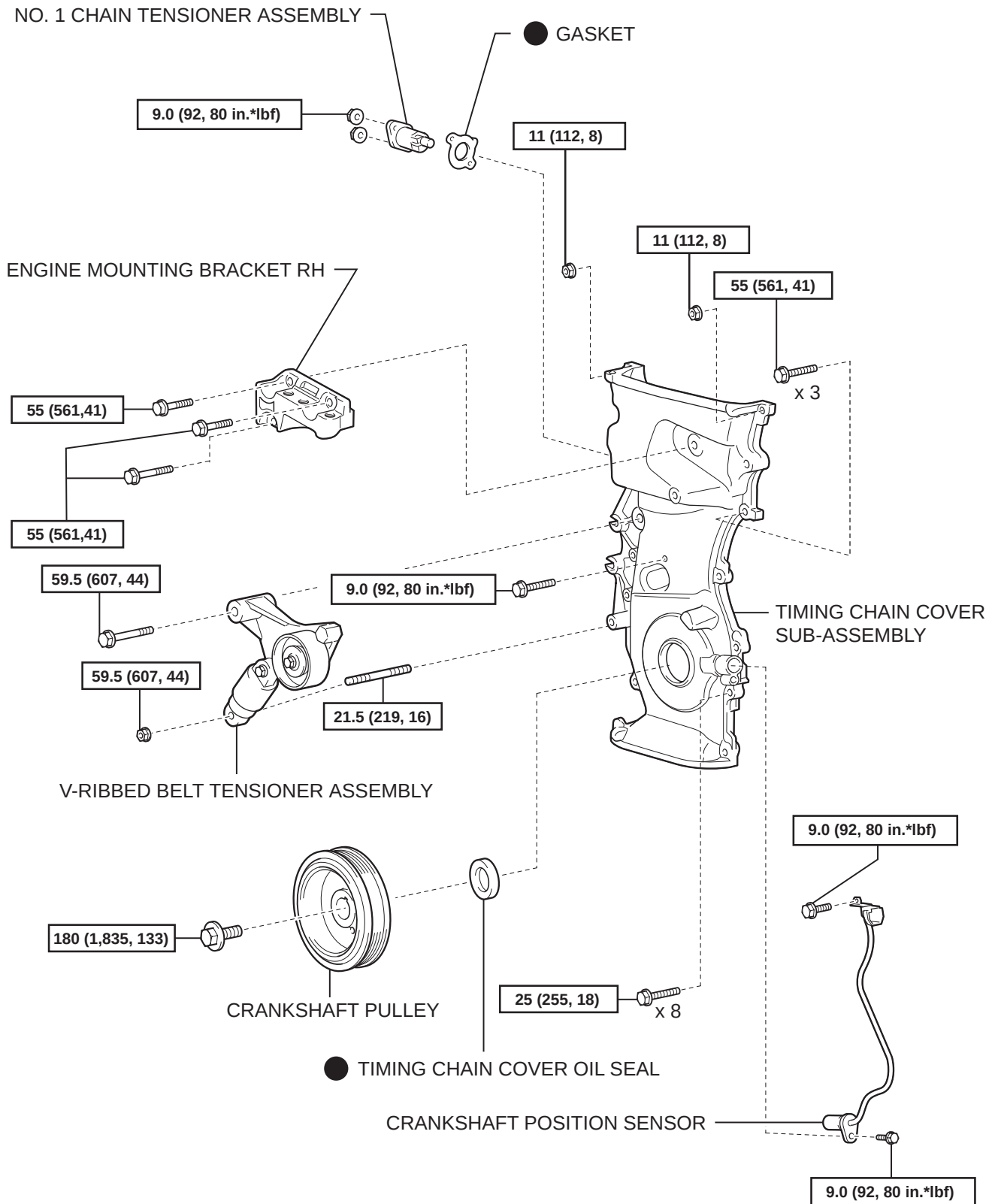
EM





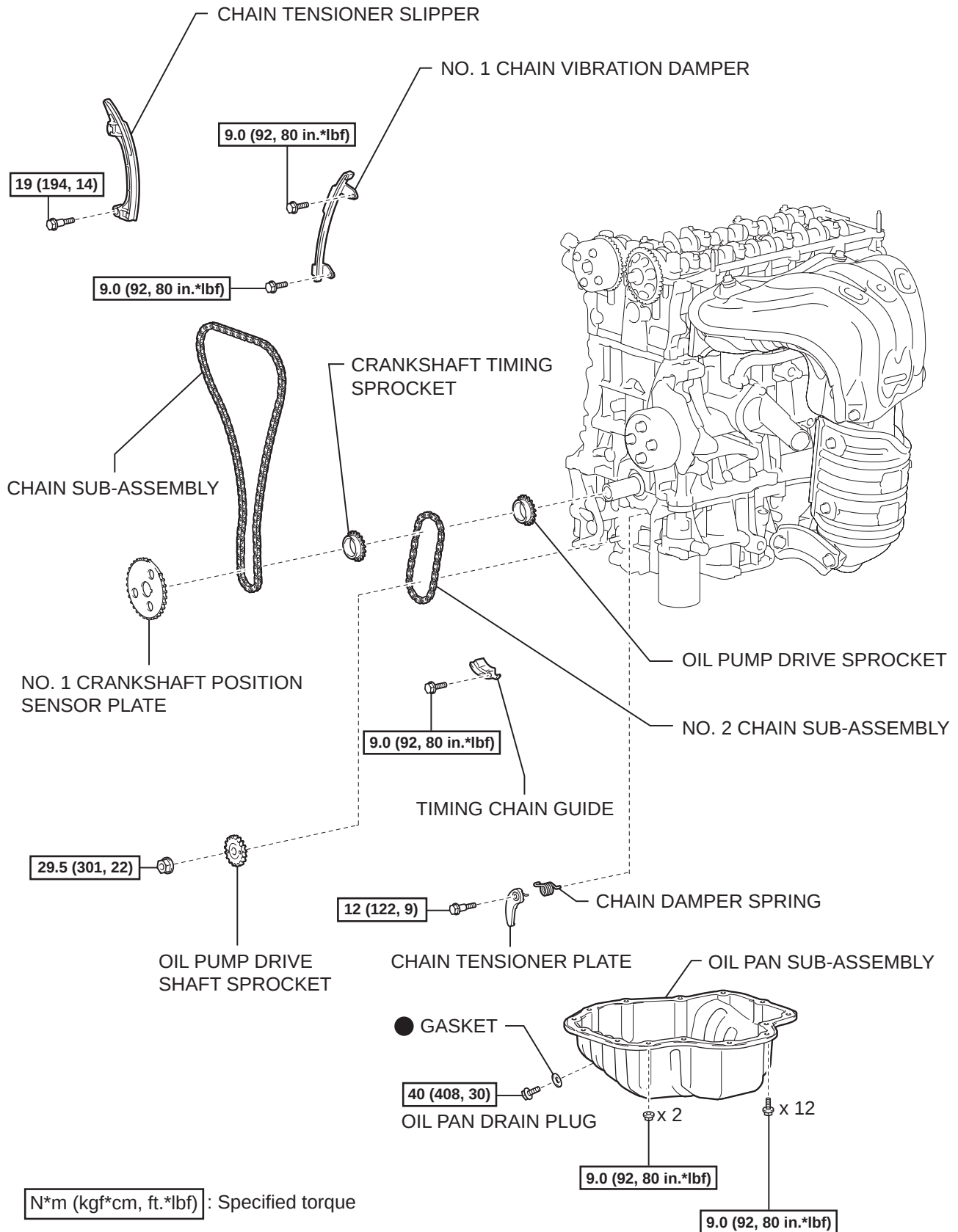
N*m (kgf*cm, ft.*lbf) : Specified torque

EM



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

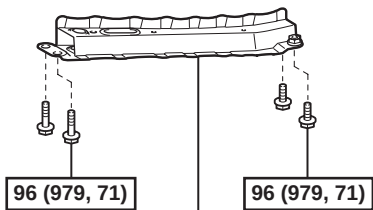
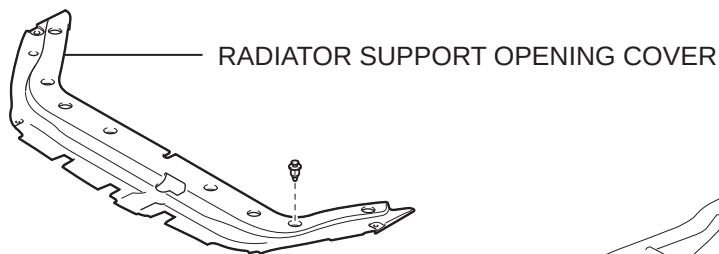
● Non-reusable part



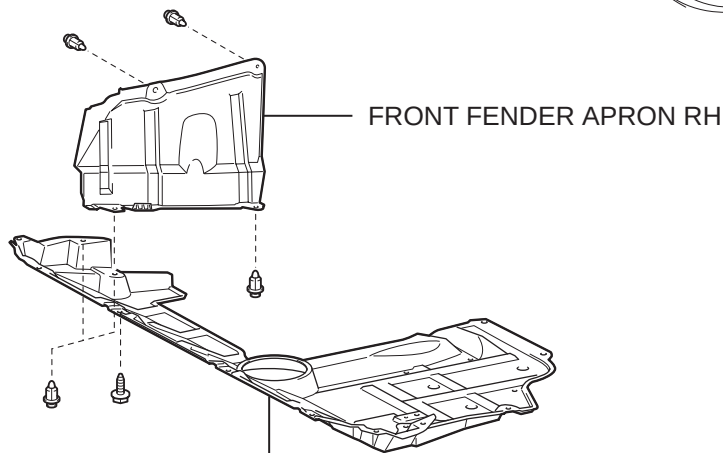
CYLINDER HEAD

COMPONENTS

EM



FRONT SUSPENSION MEMBER REINFORCEMENT RH

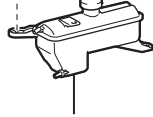


NO. 1 ENGINE UNDER COVER

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

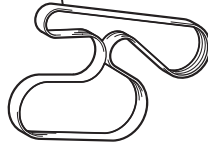
5.0 (51, 44 in.*lbf)

x 2



RADIATOR RESERVOIR

FAN AND GENERATOR V BELT



NO. 1 ENGINE COVER

7.0 (71, 62 in.*lbf)

x 2



60 (612, 44)

x 2



IDLER PULLEY

95 (969, 70)

x 4

ENGINE MOUNTING
INSULATOR RH

52 (530, 38)



8.4 (86, 74 in.*lbf)



9.8 (100, 7)

HEATED OXYGEN SENSOR
CONNECTOR

52 (530, 38)



21 (215, 15)



COMPRESSION SPRING

GENERATOR ASSEMBLY

GASKET



43 (438, 32)



GASKET



x 2

43 (438, 32)

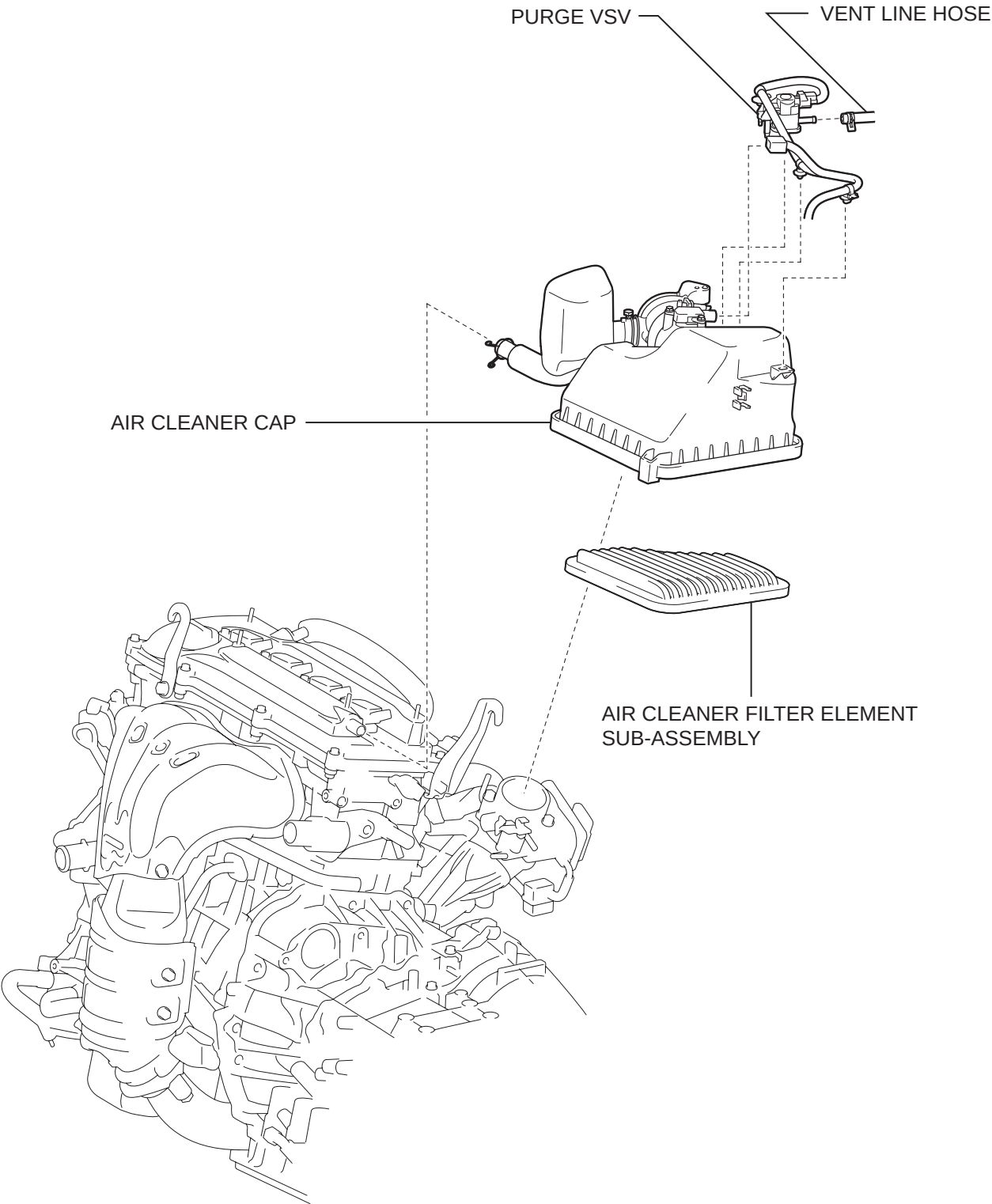
FRONT EXHAUST PIPE

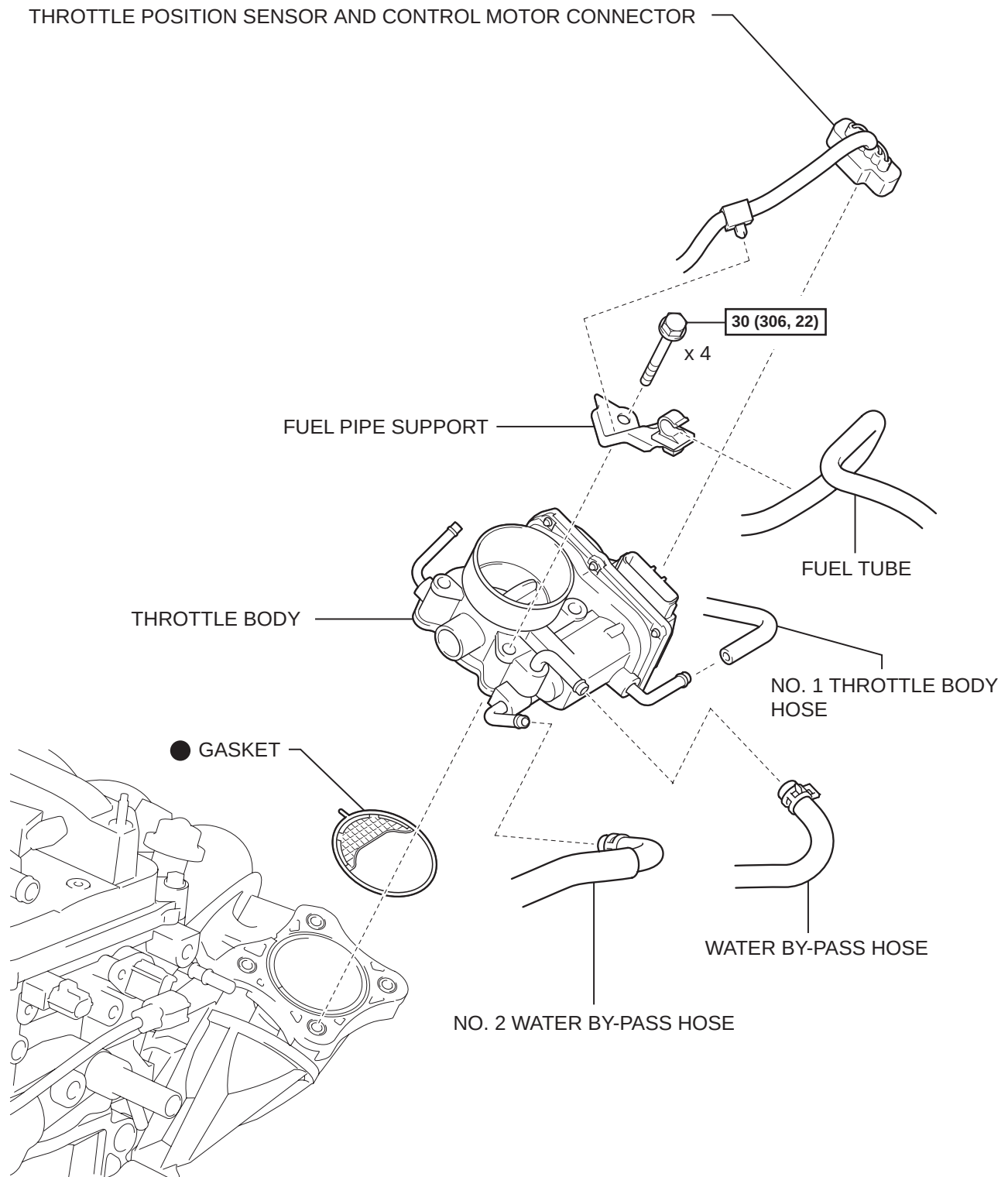
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

EM

EM



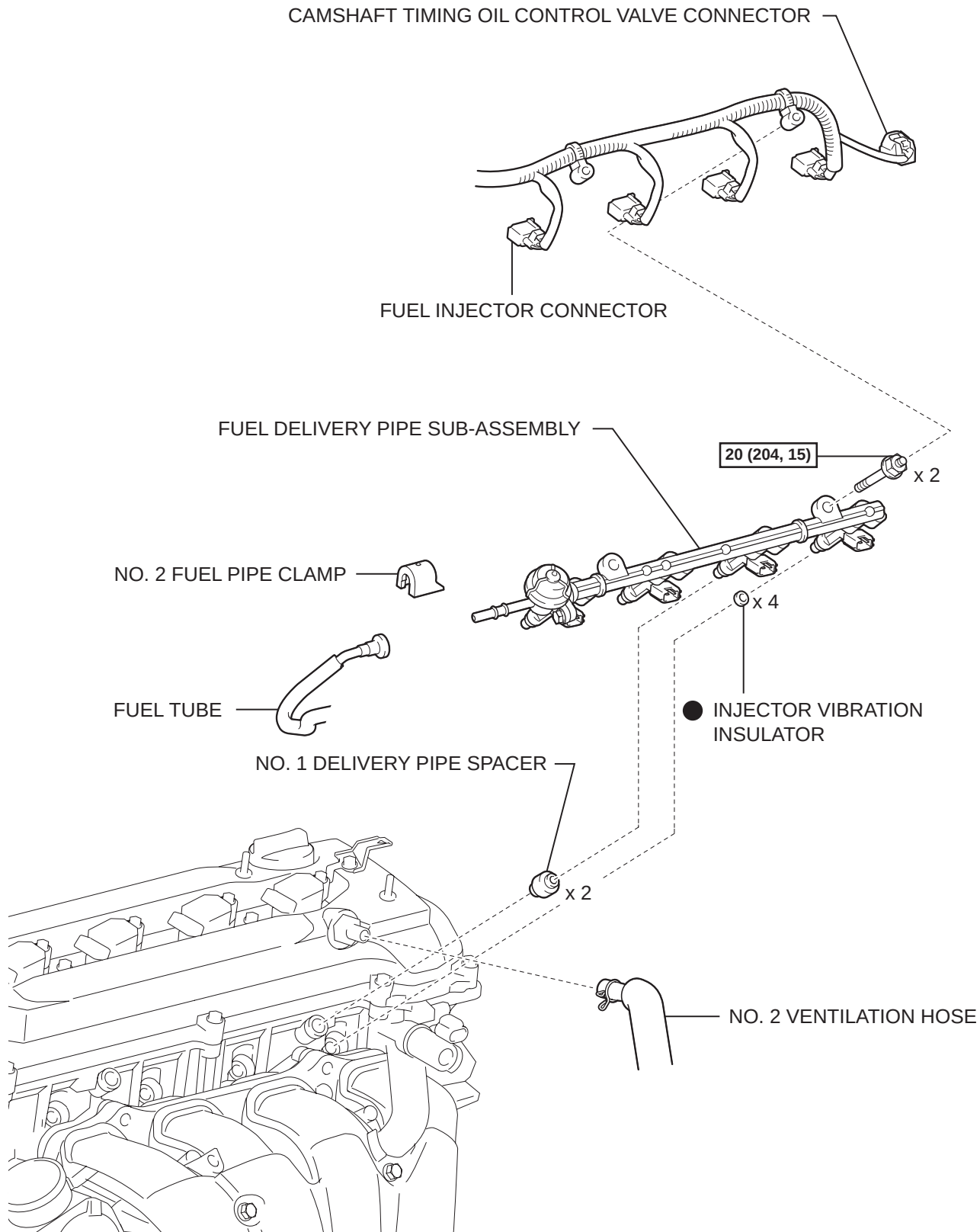


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

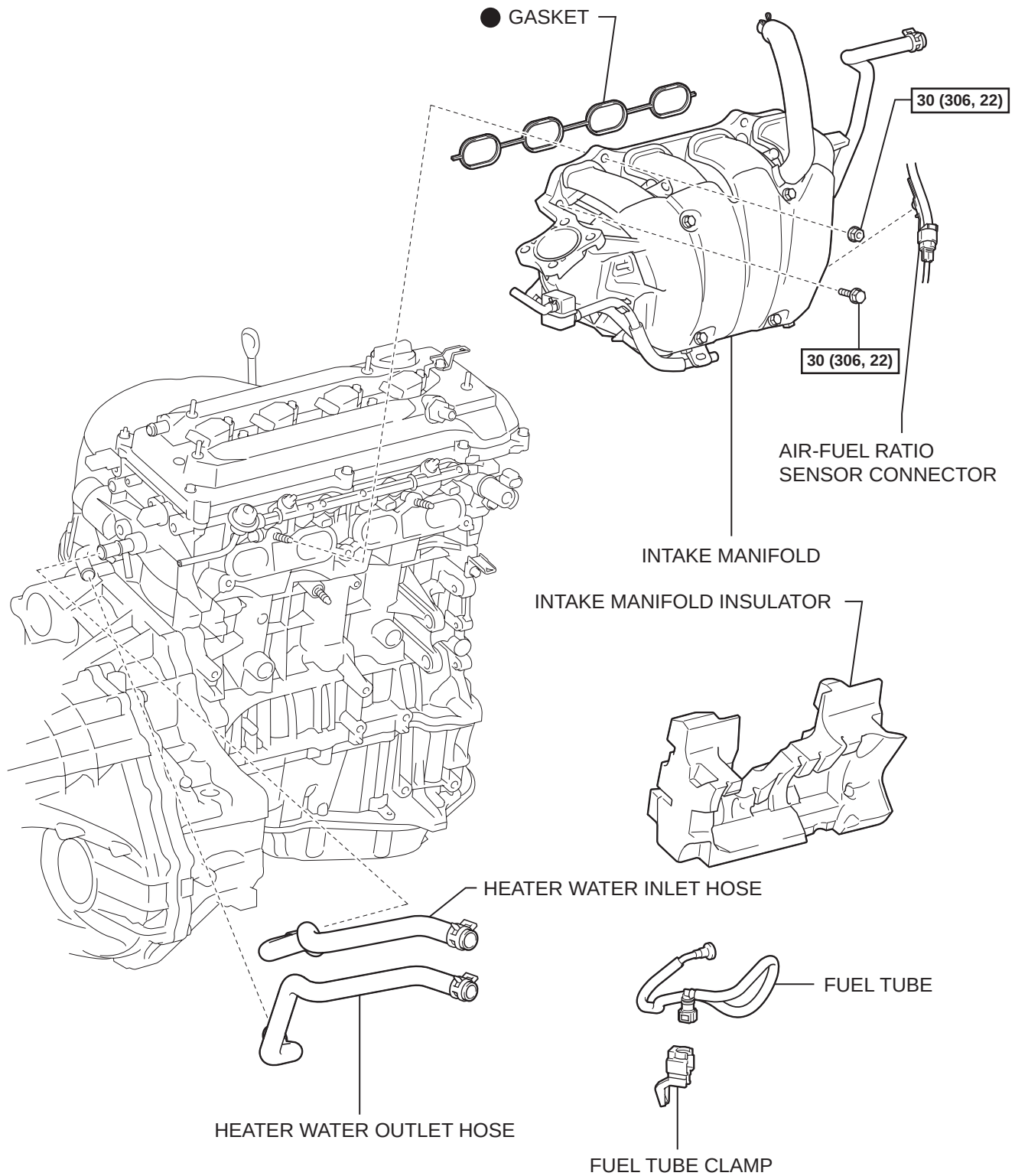
EM

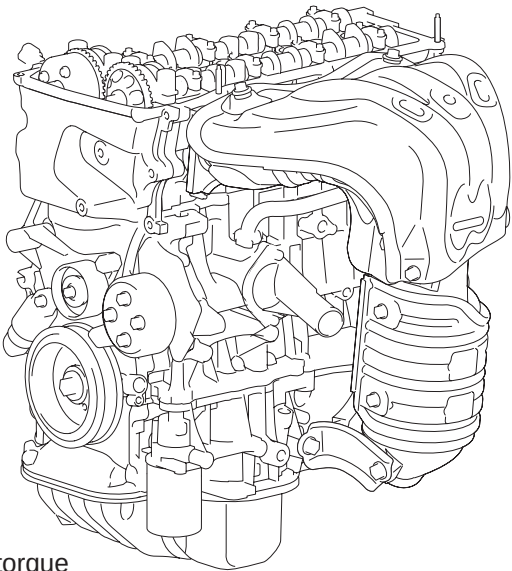
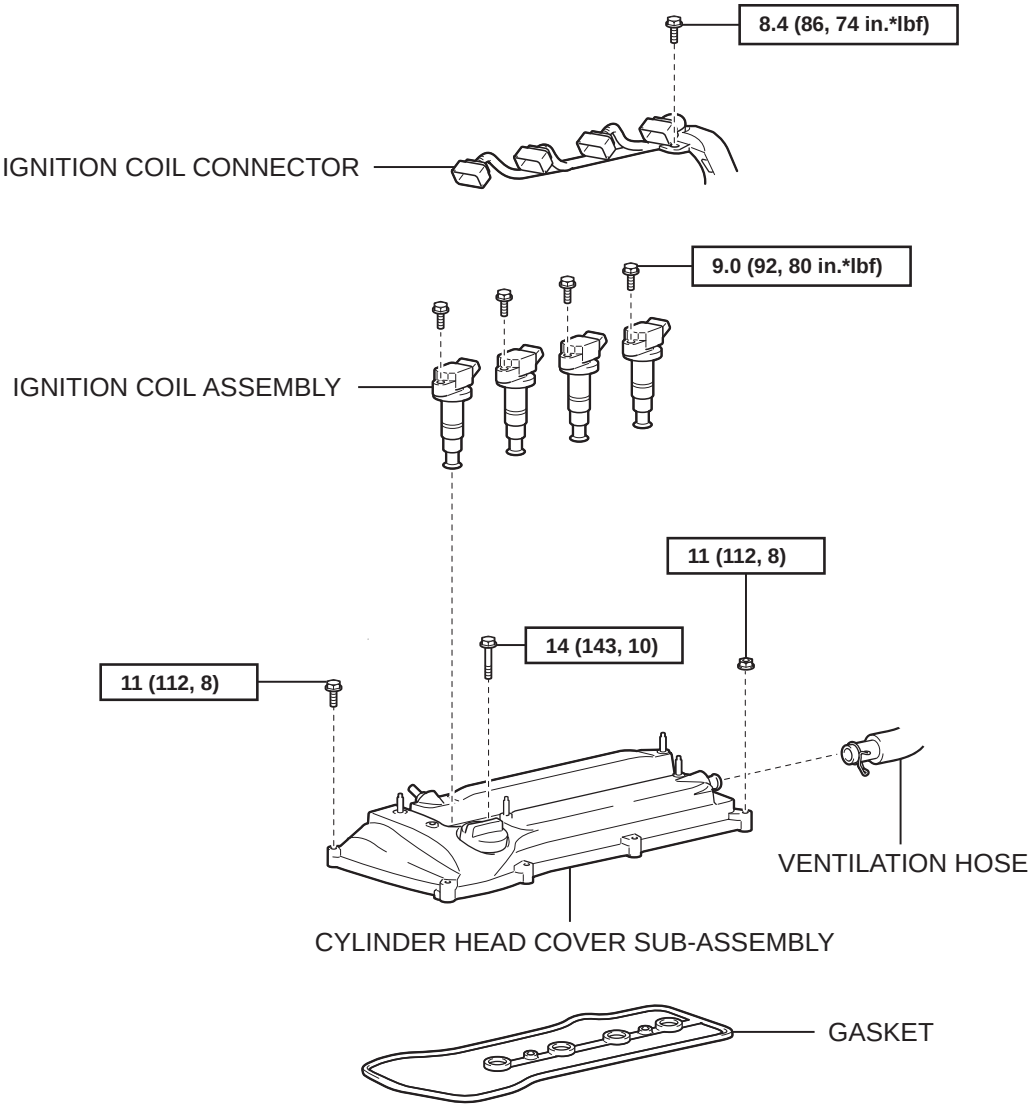
EM



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

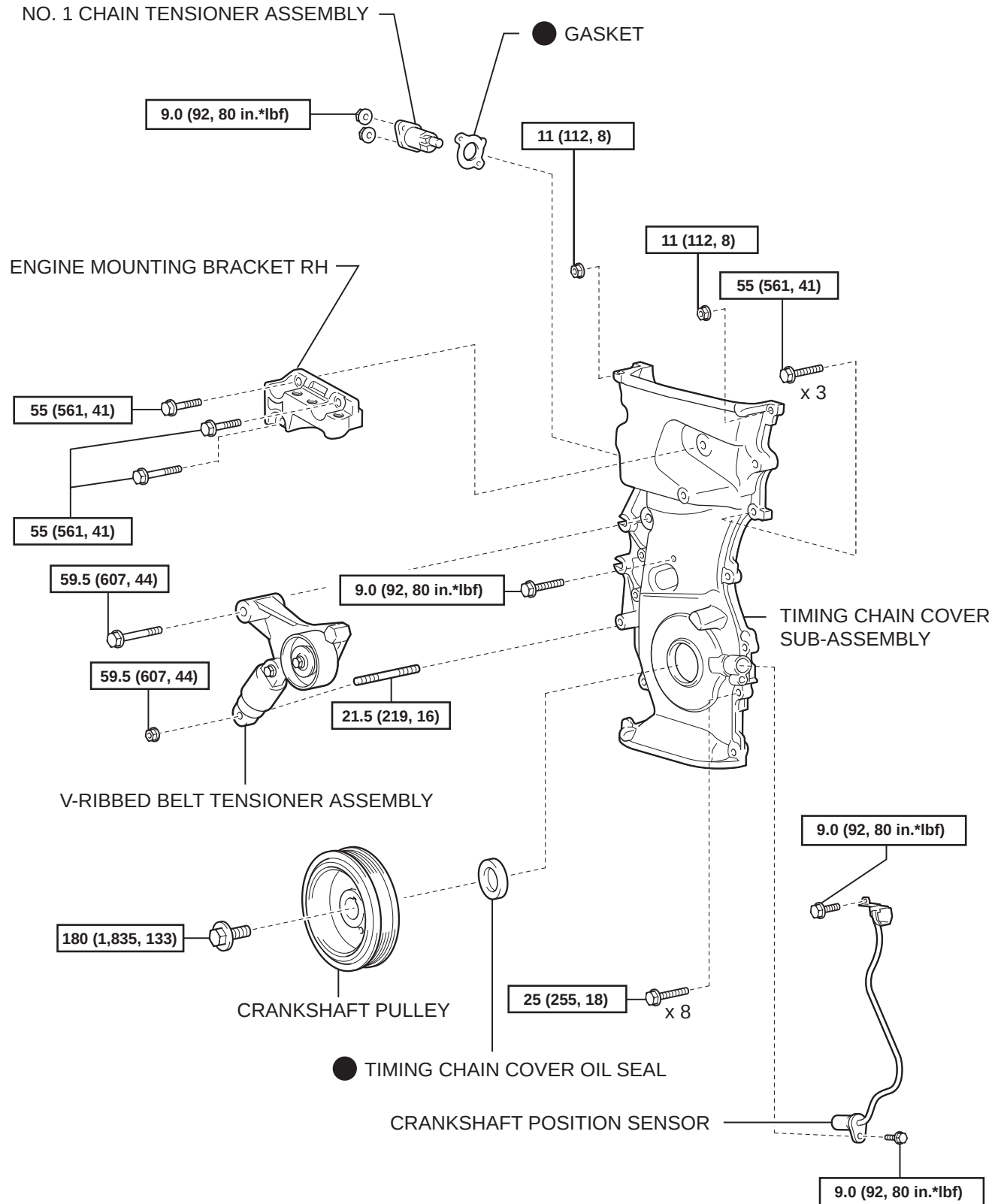
● Non-reusable part



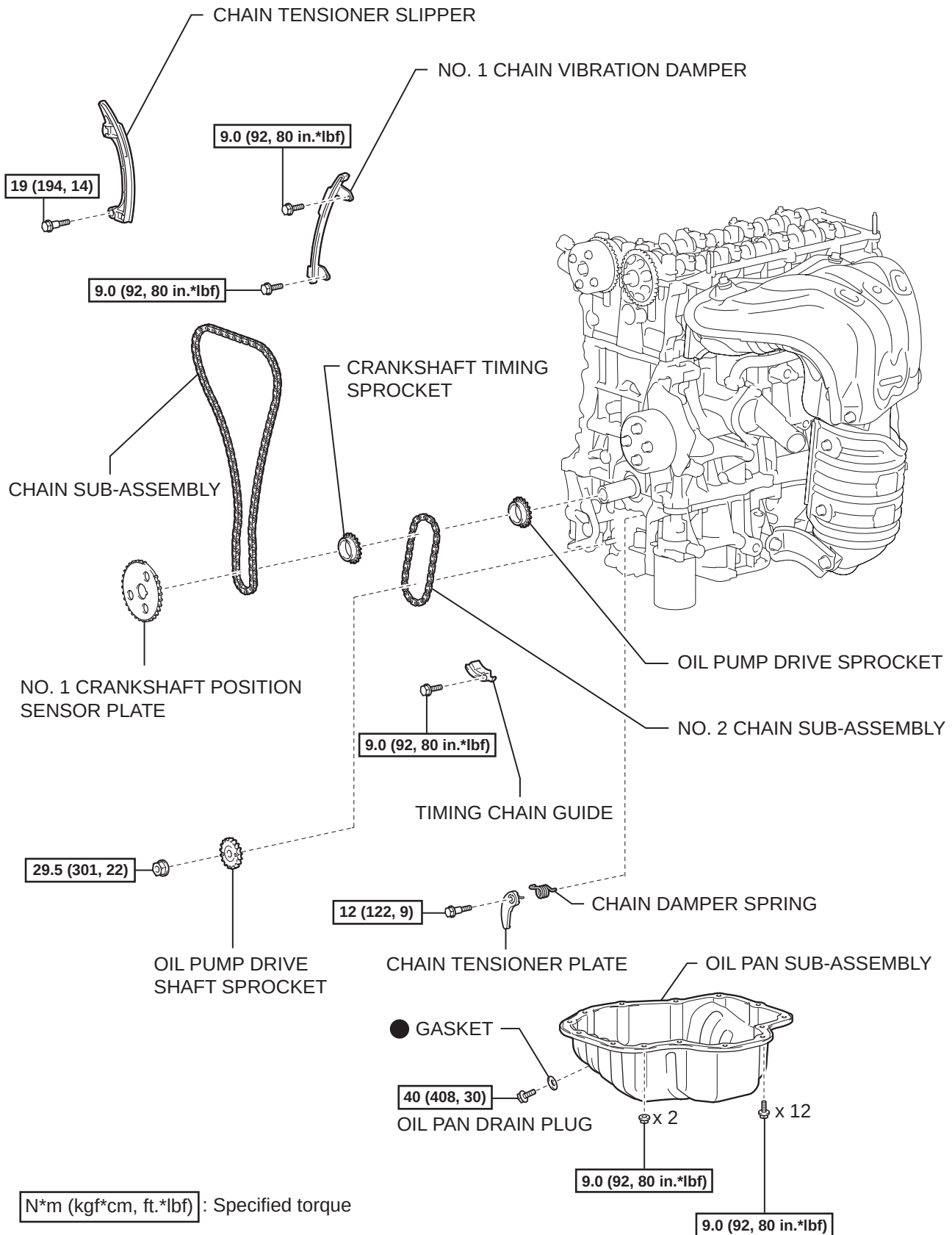


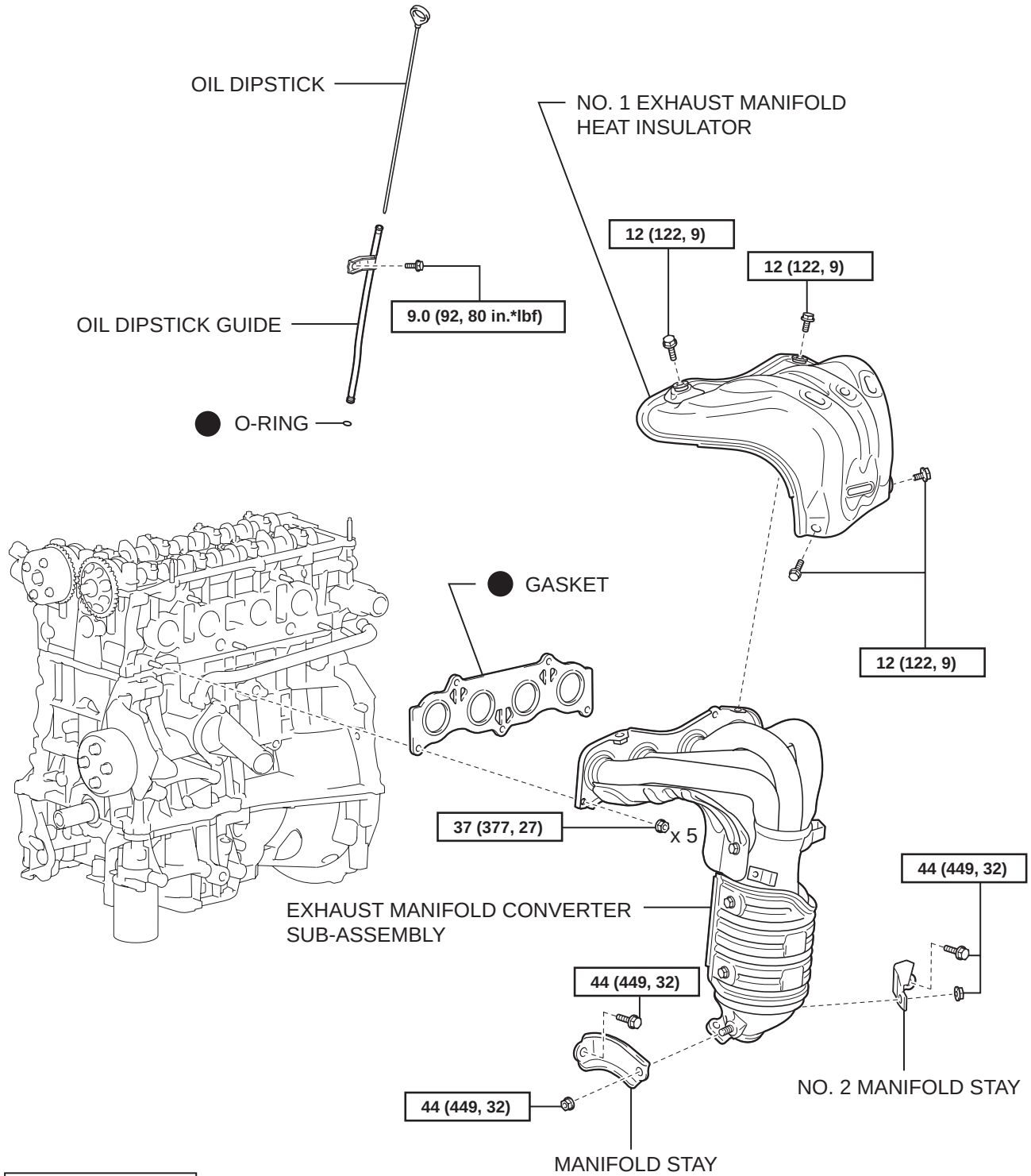
N*m (kgf*cm, ft.*lbf) : Specified torque

EM



EM

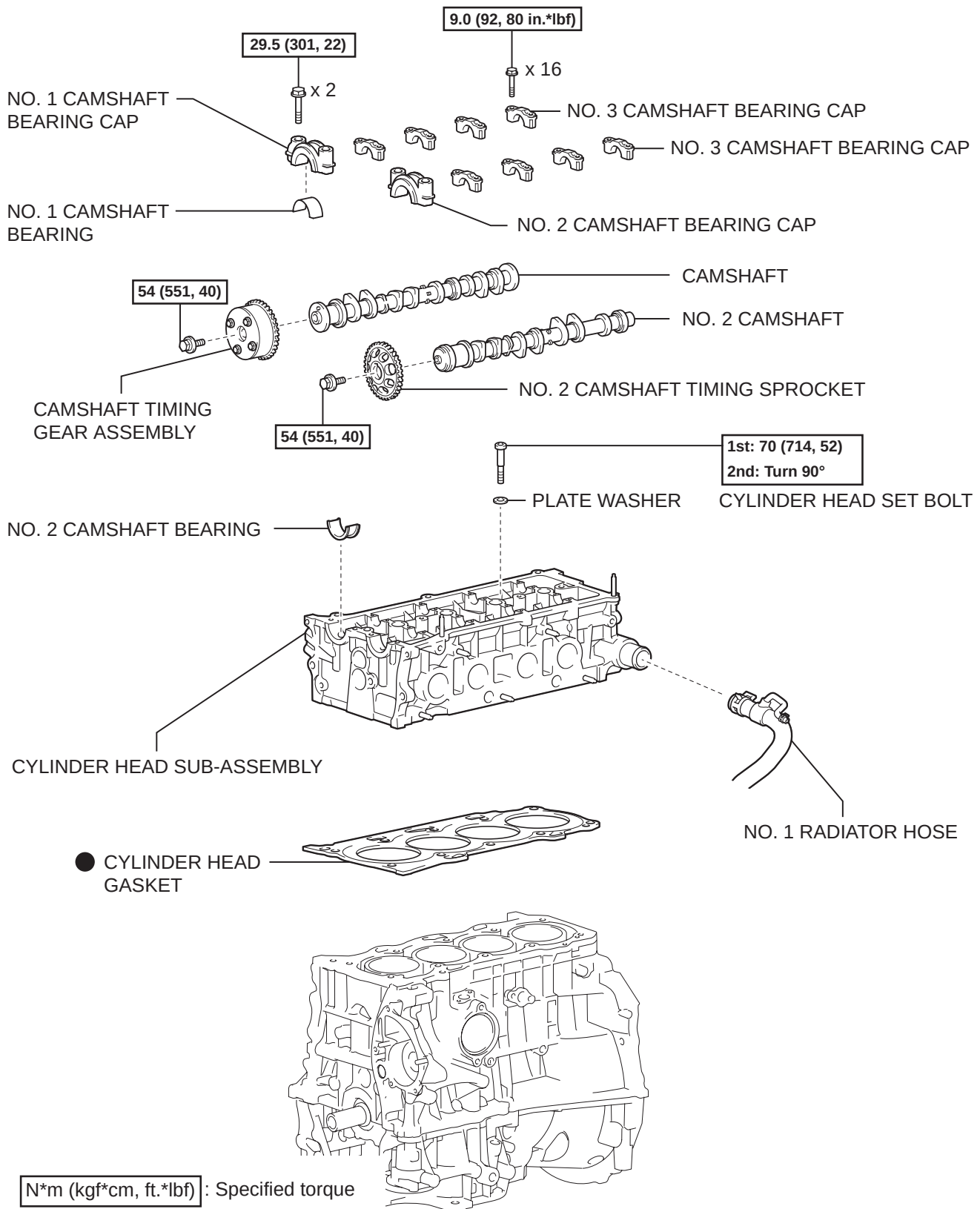


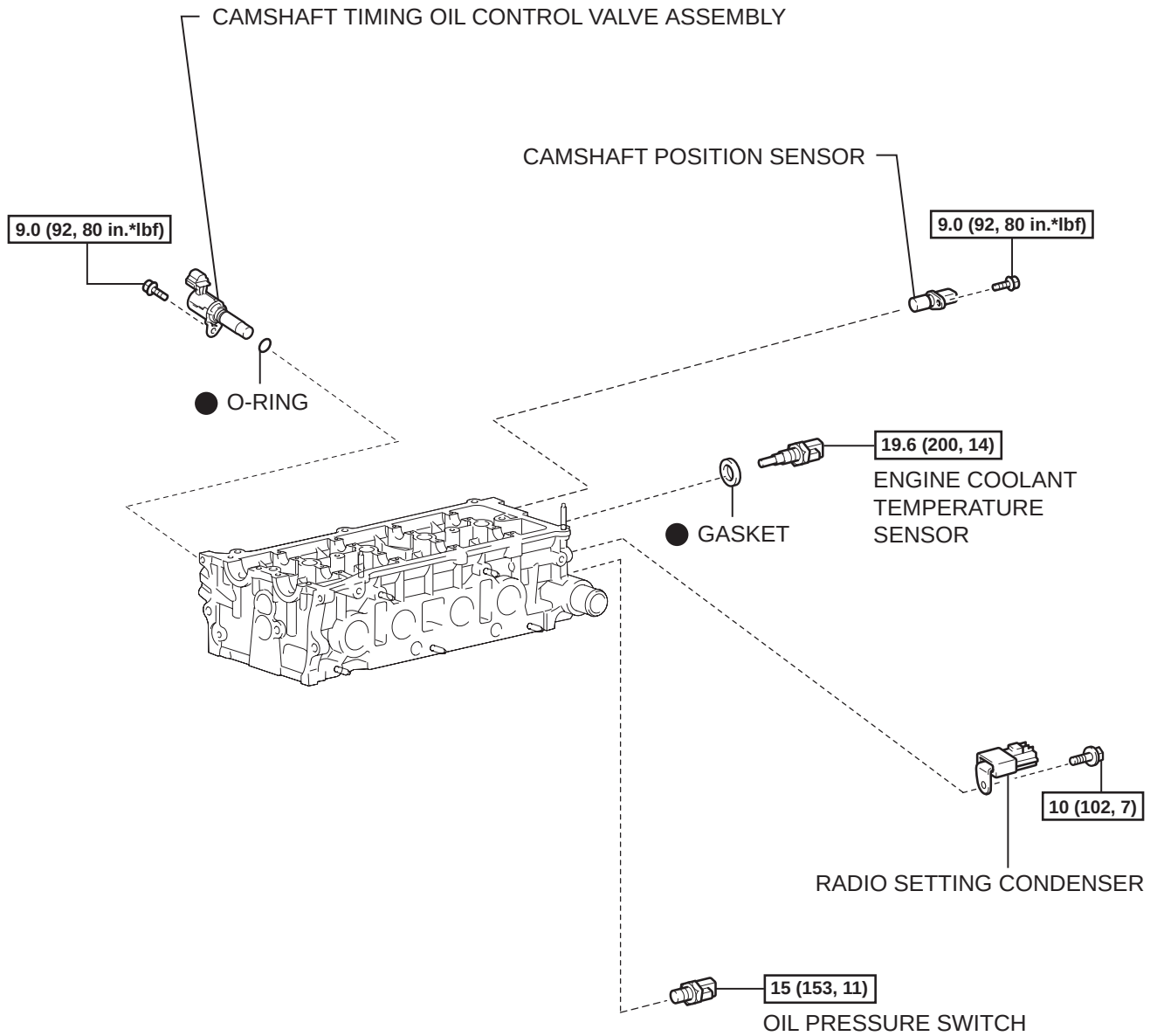


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

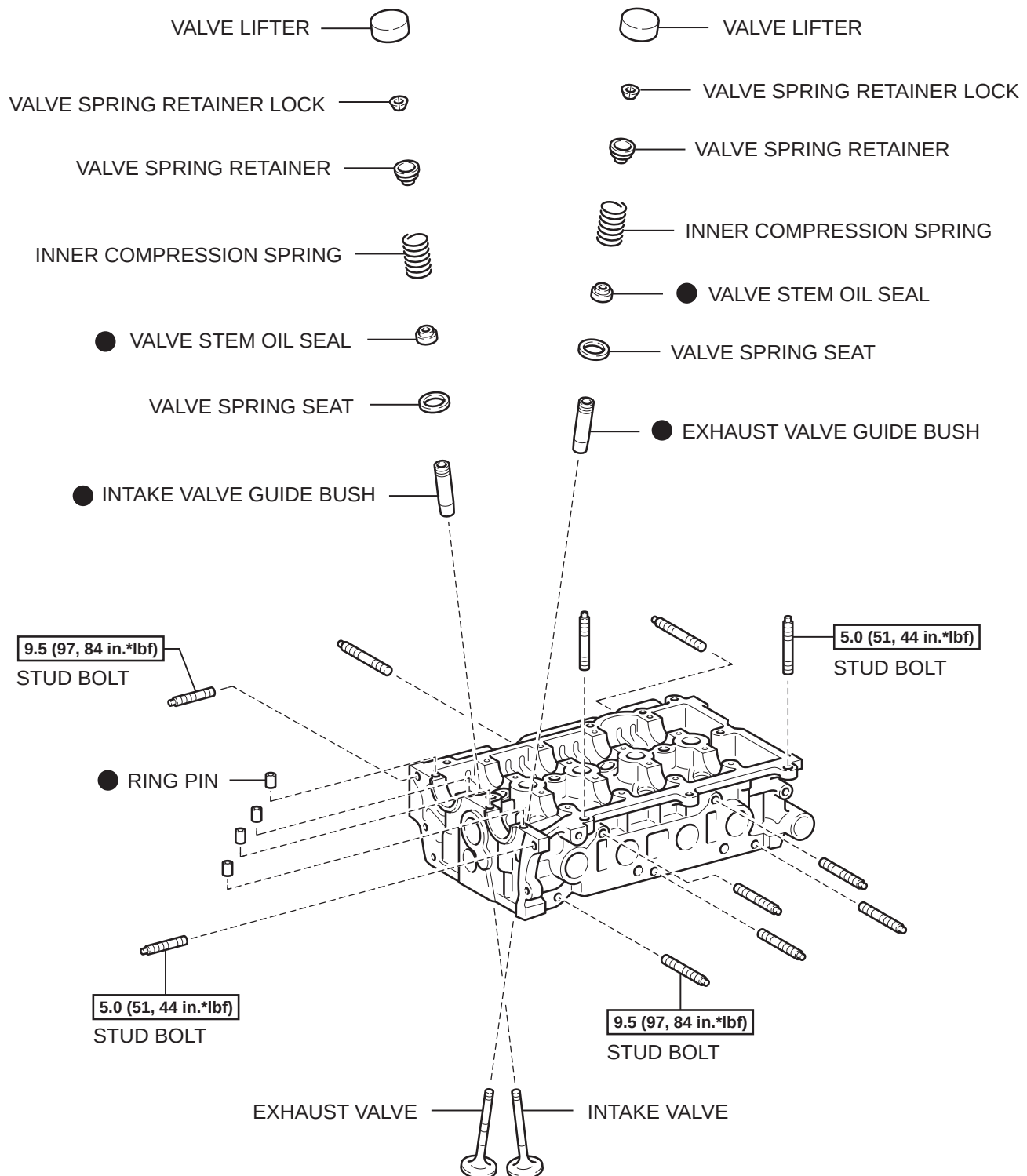
EM





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

● Non-reusable part

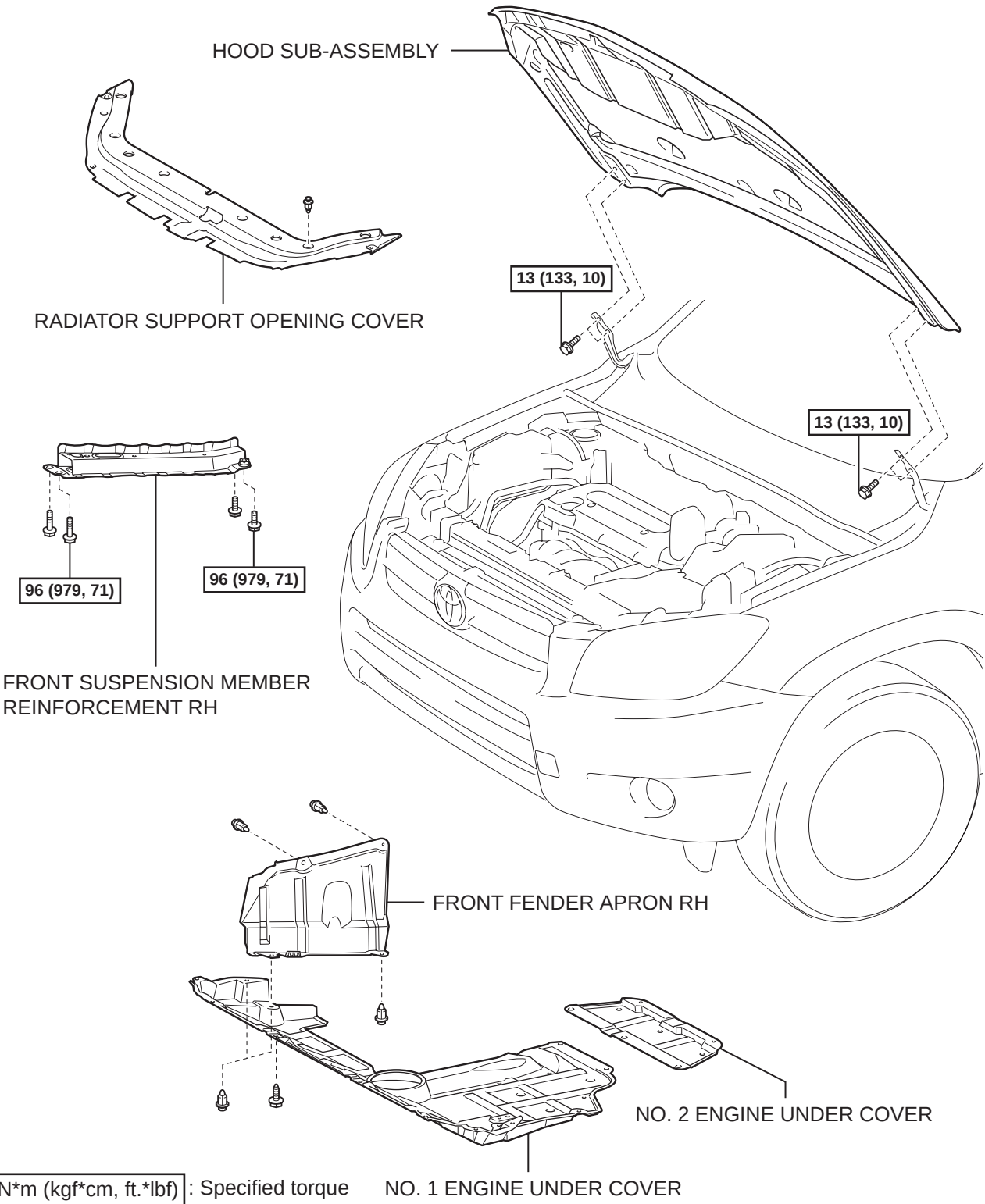


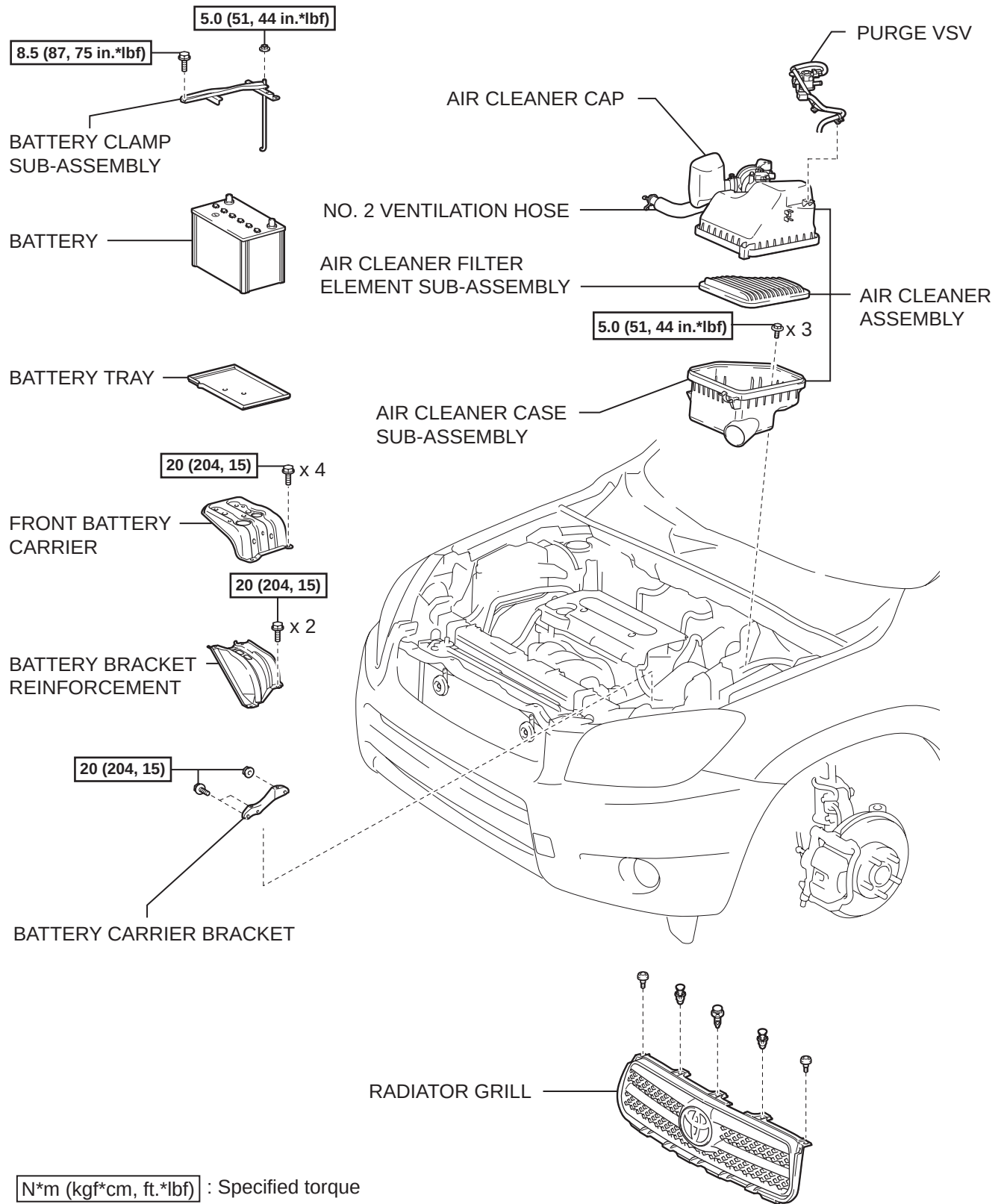
N*m (kgf*cm, ft.*lbf) : Specified torque

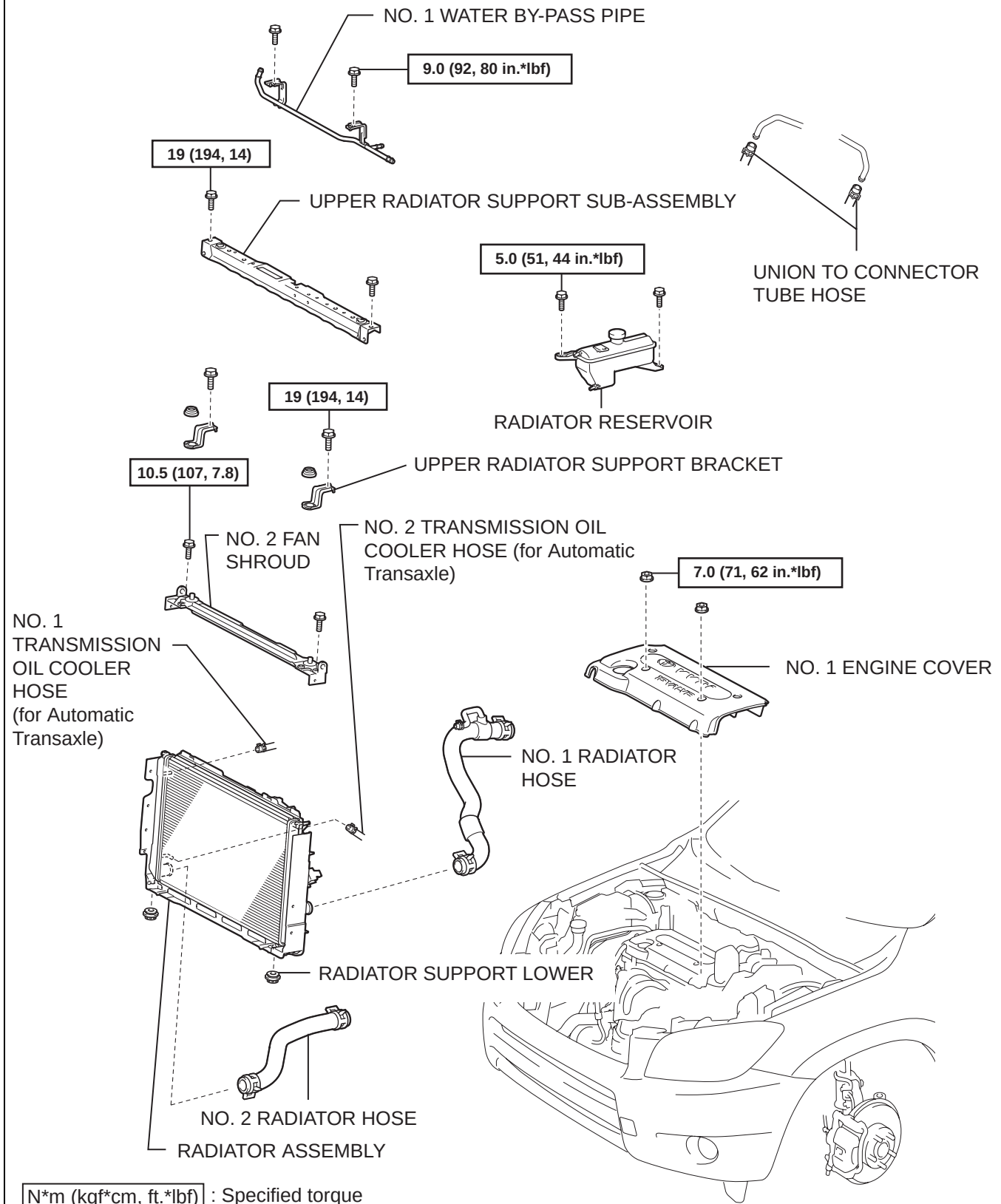
● Non-reusable part

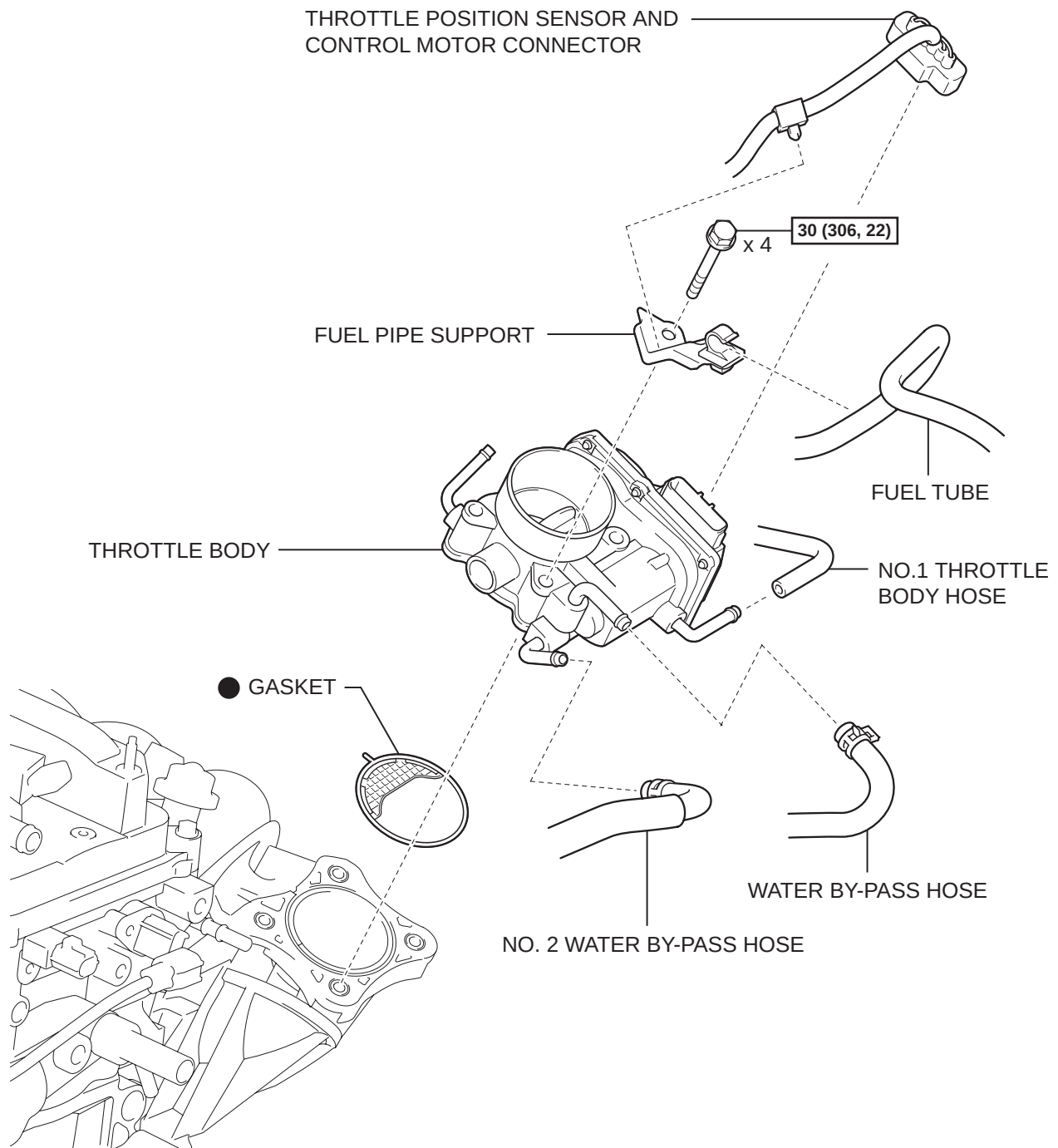
ENGINE ASSEMBLY
COMPONENTS

EM









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

● Non-reusable part

EM

CAMSHAFT TIMING OIL CONTROL VALVE CONNECTOR

FUEL INJECTOR CONNECTOR

FUEL DELIVERY PIPE SUB-ASSEMBLY

20 (204, 15)

x 2

FUEL TUBE

x 4

● INJECTOR VIBRATION INSULATOR

FUEL TUBE CLAMP

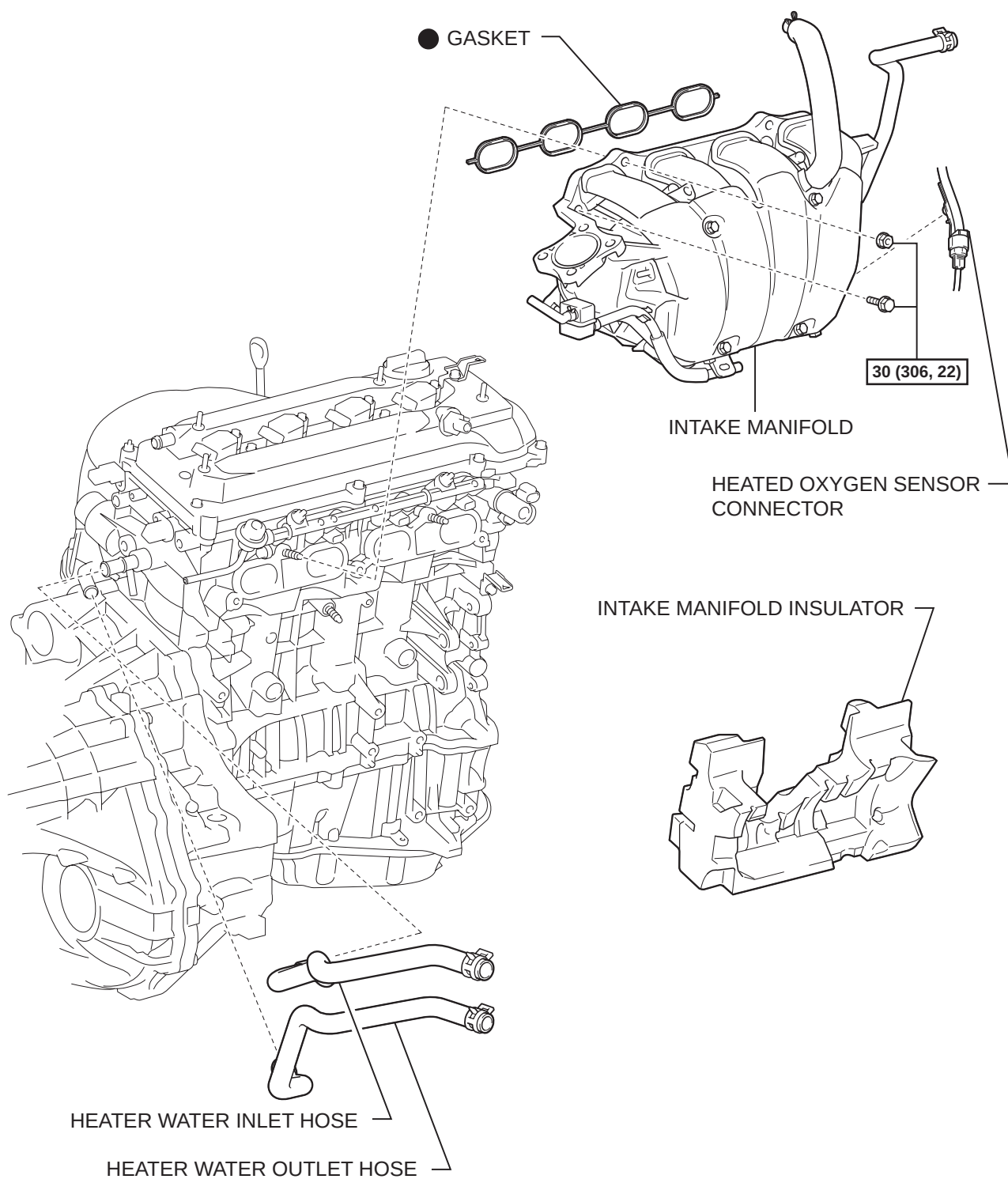
x 2

NO. 1 DELIVERY PIPE SPACER

NO. 2 VENTILATION HOSE

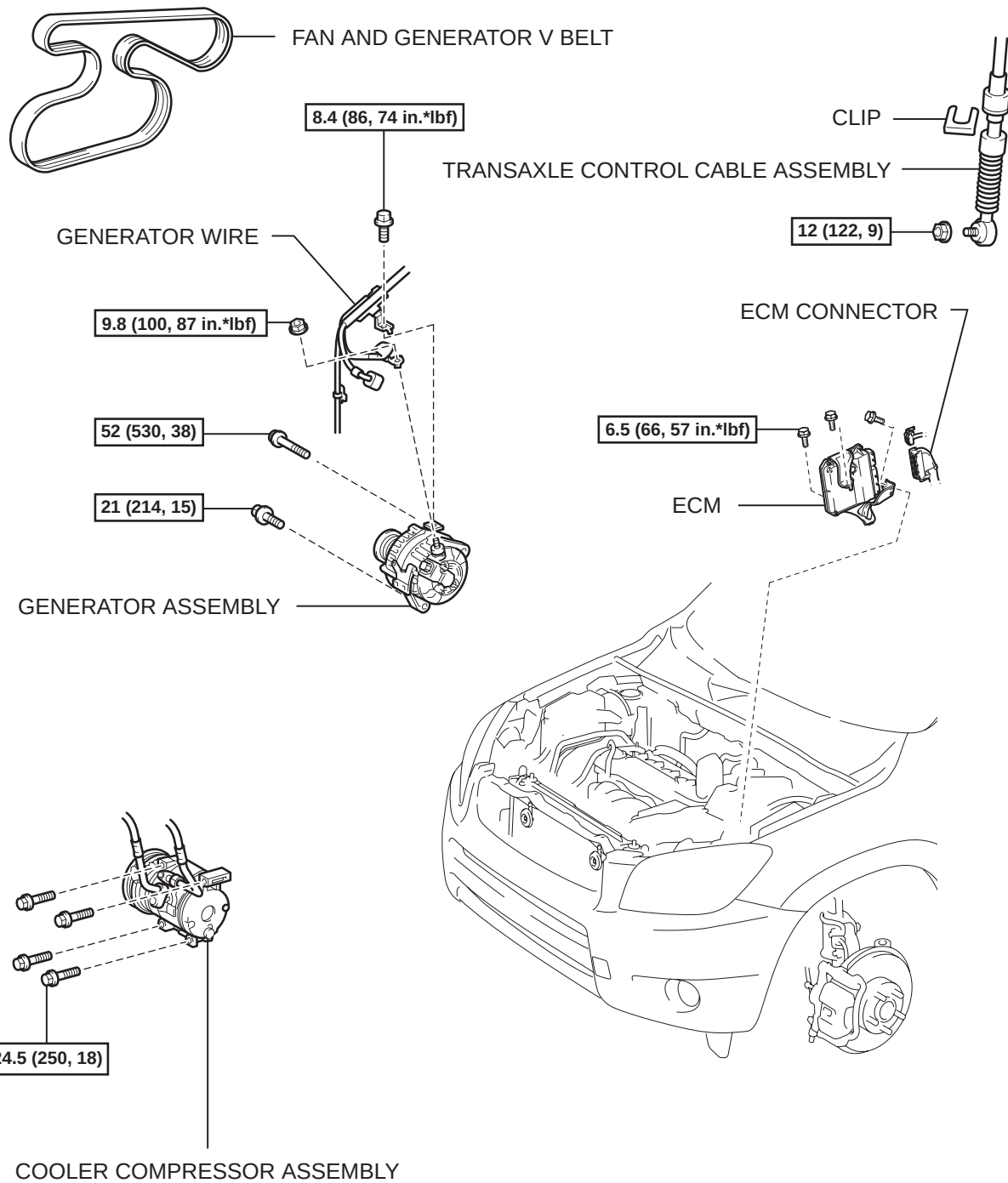
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

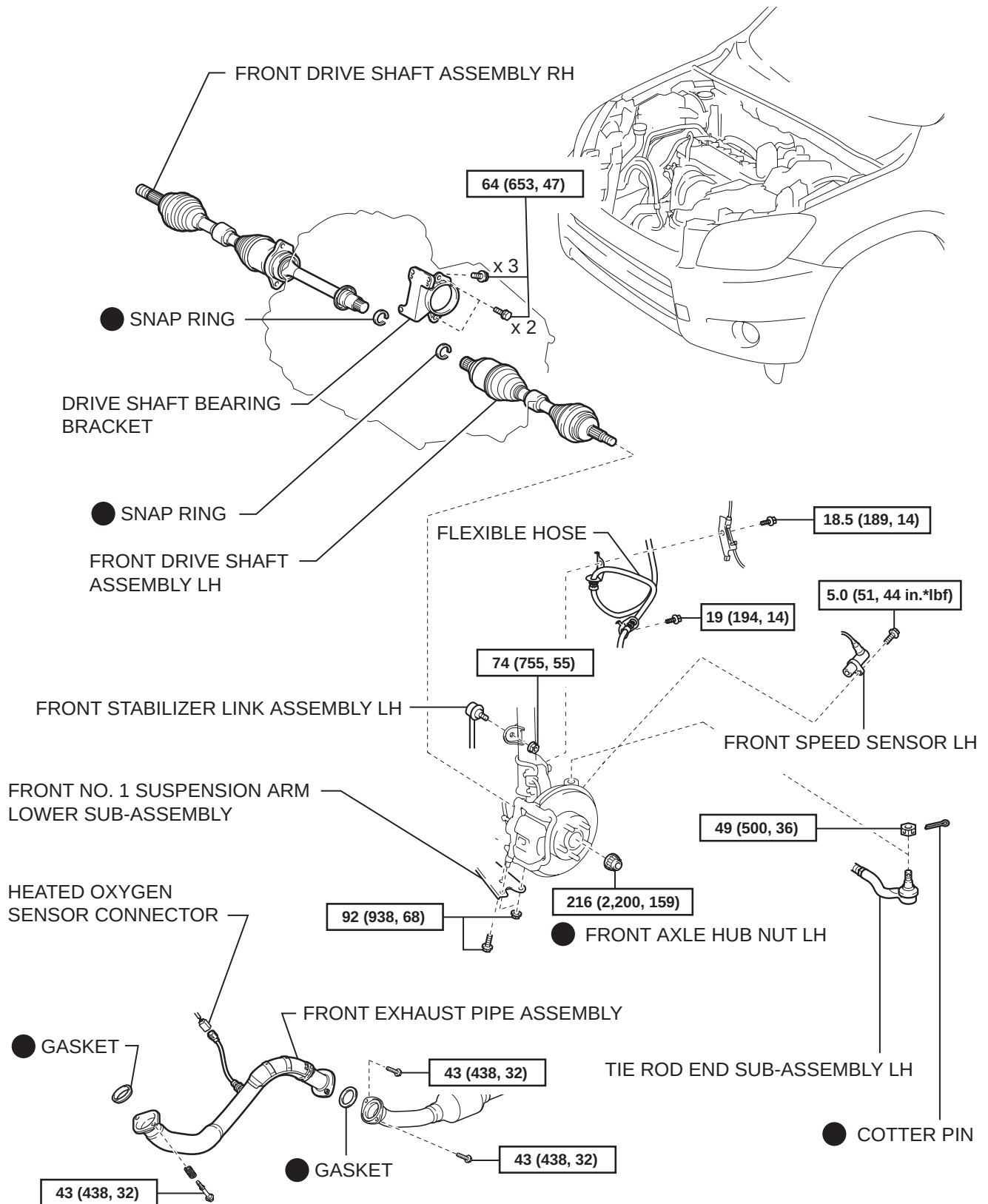


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part



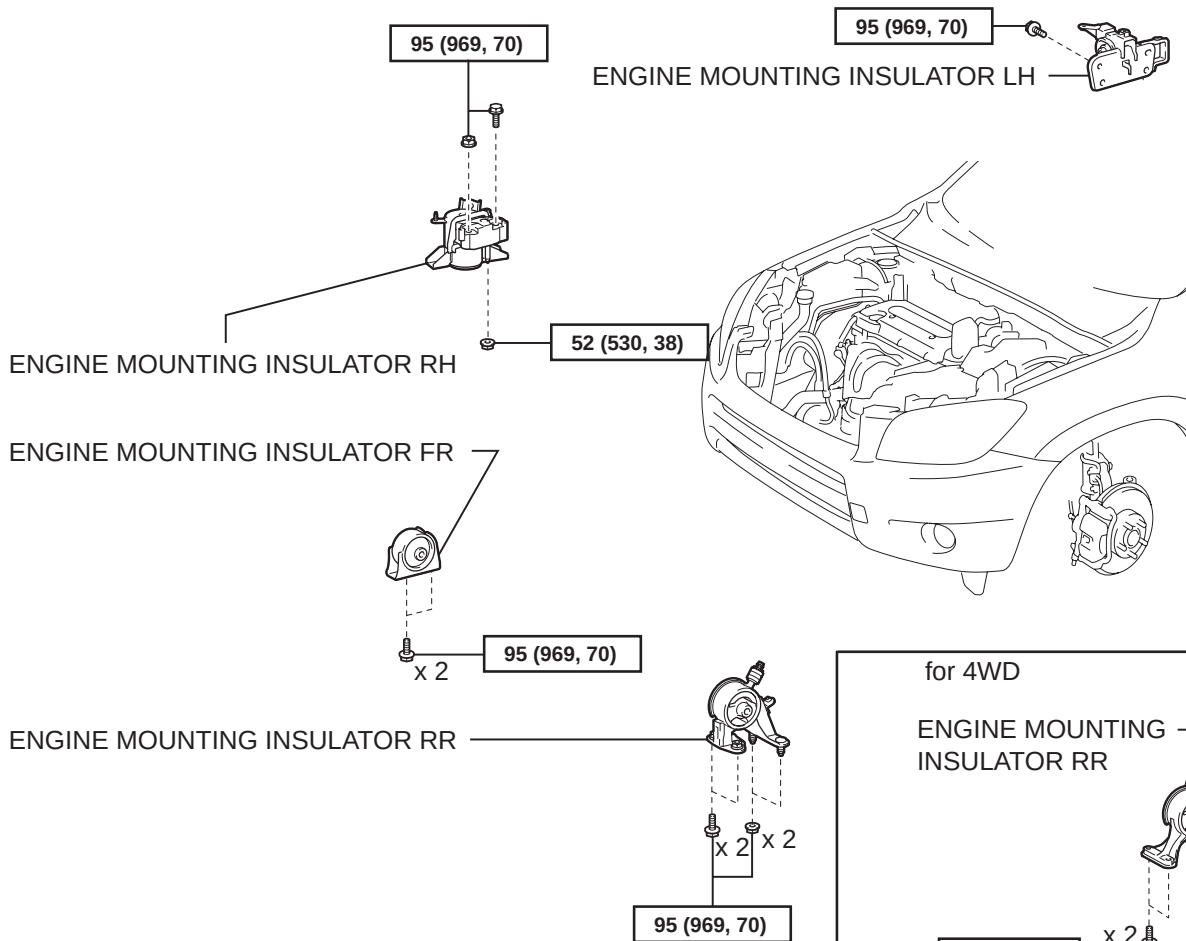
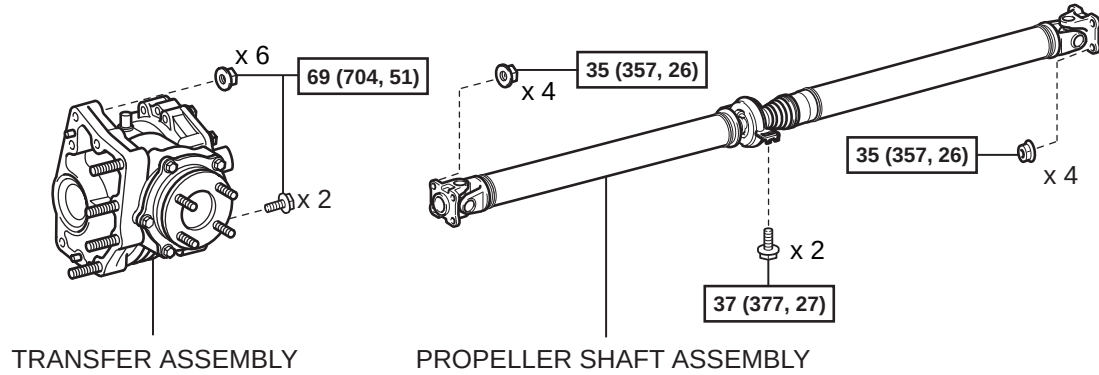
N*m (kgf*cm, ft.*lbf) : Specified torque



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

● Non-reusable part

for 4WD



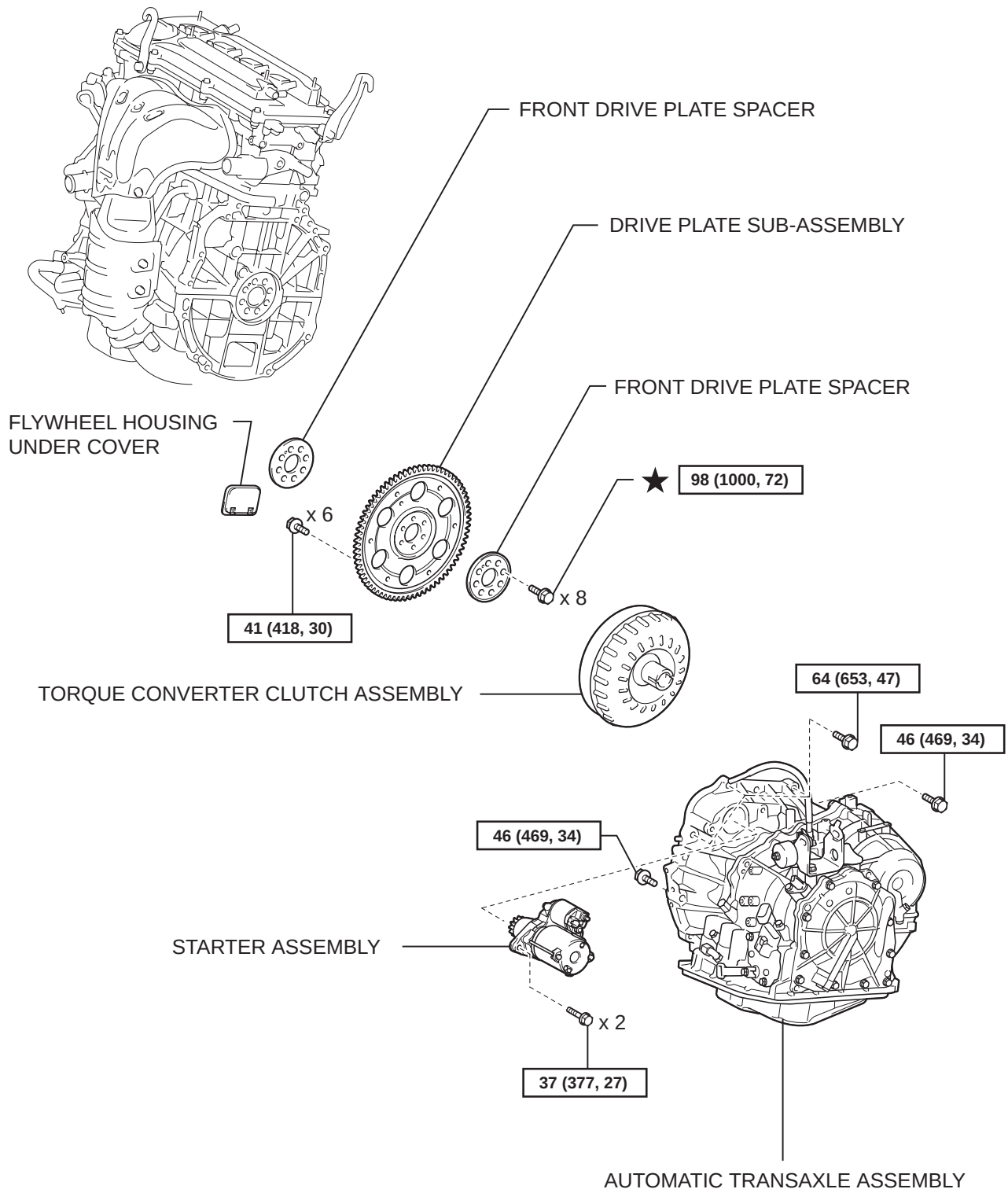
for 4WD

ENGINE MOUNTING INSULATOR RR

95 (969, 70)

x 2 x 2

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

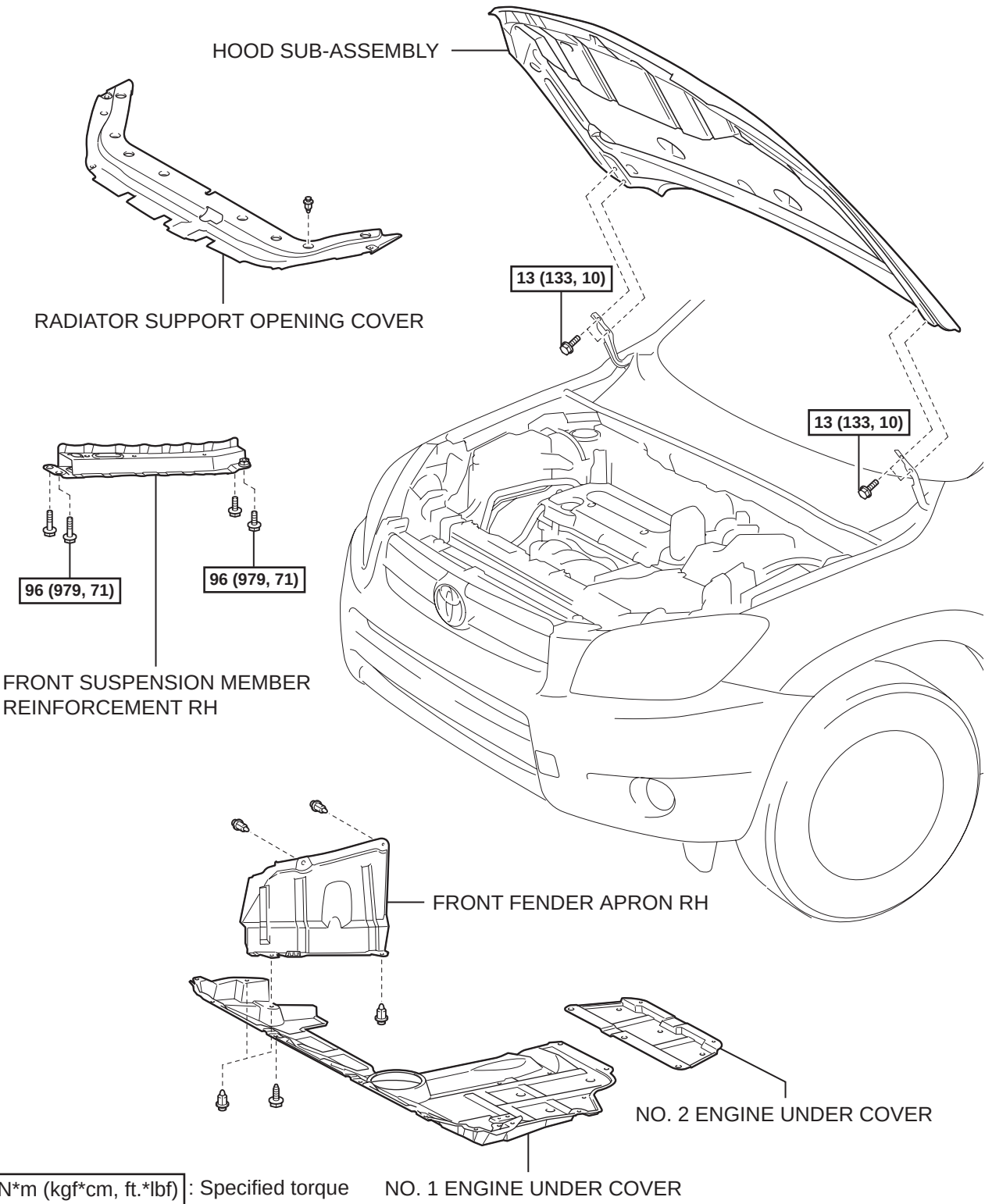


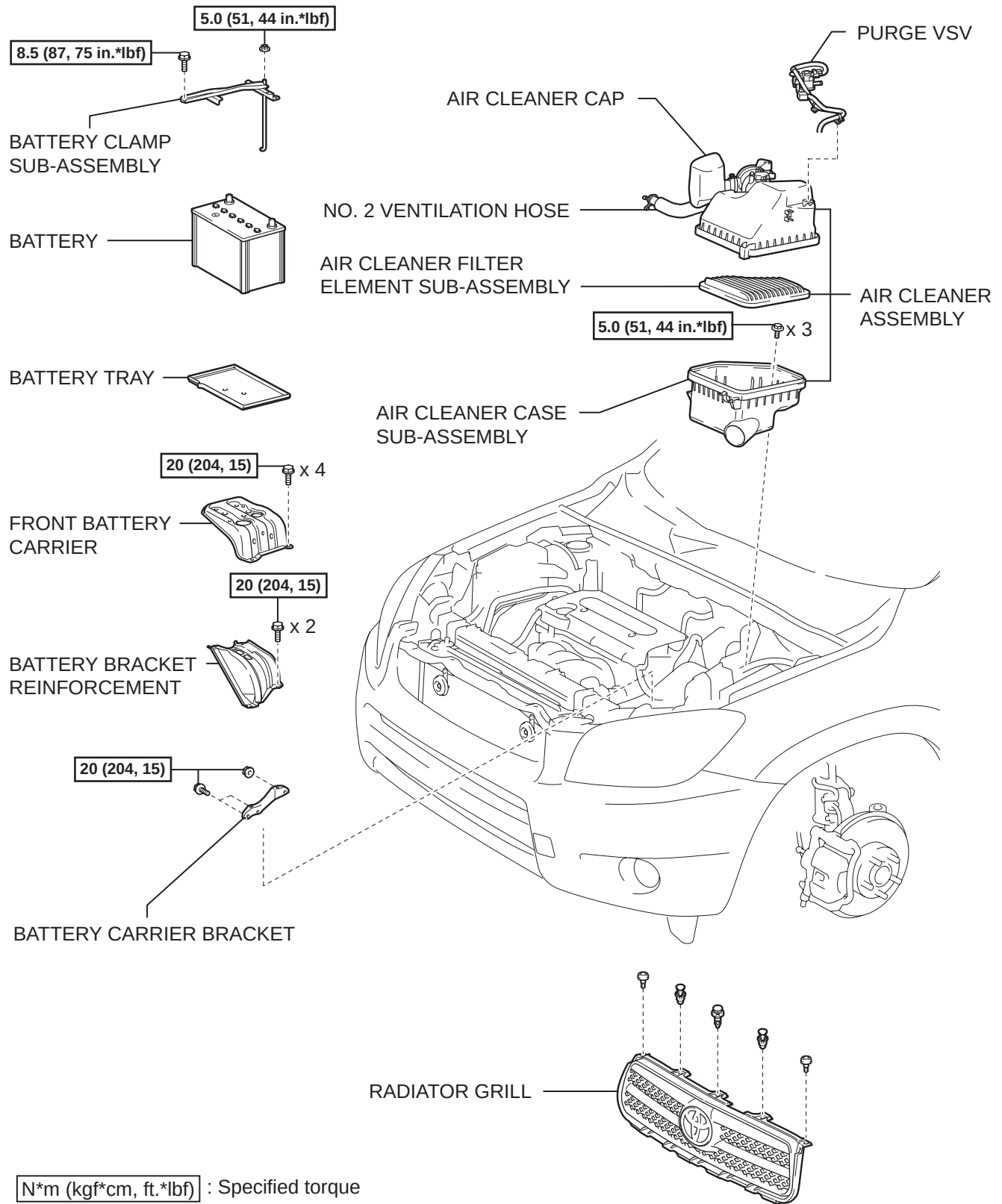
N*m (kgf*cm, ft.*lbf) : Specified torque

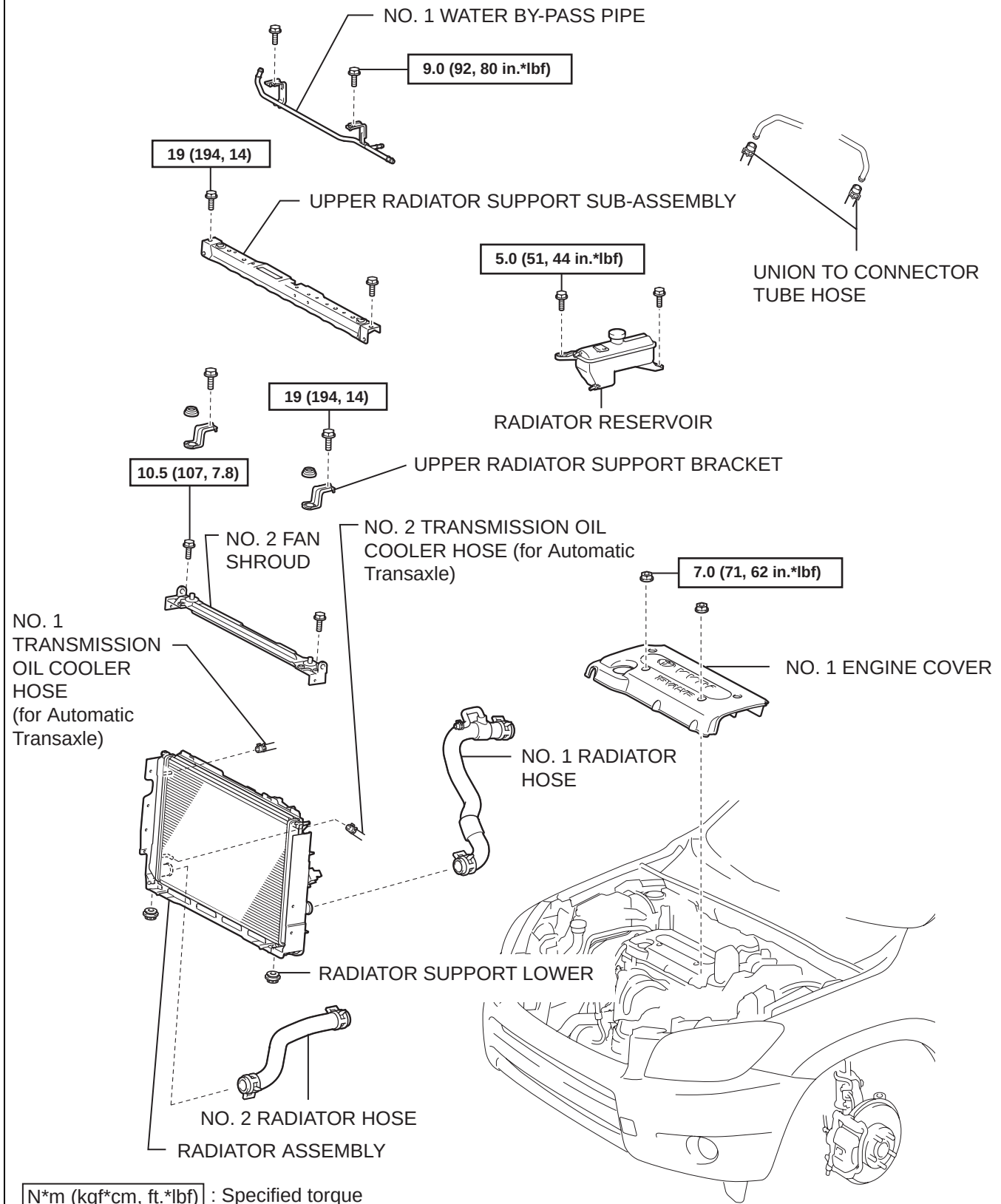
★ Precoated part

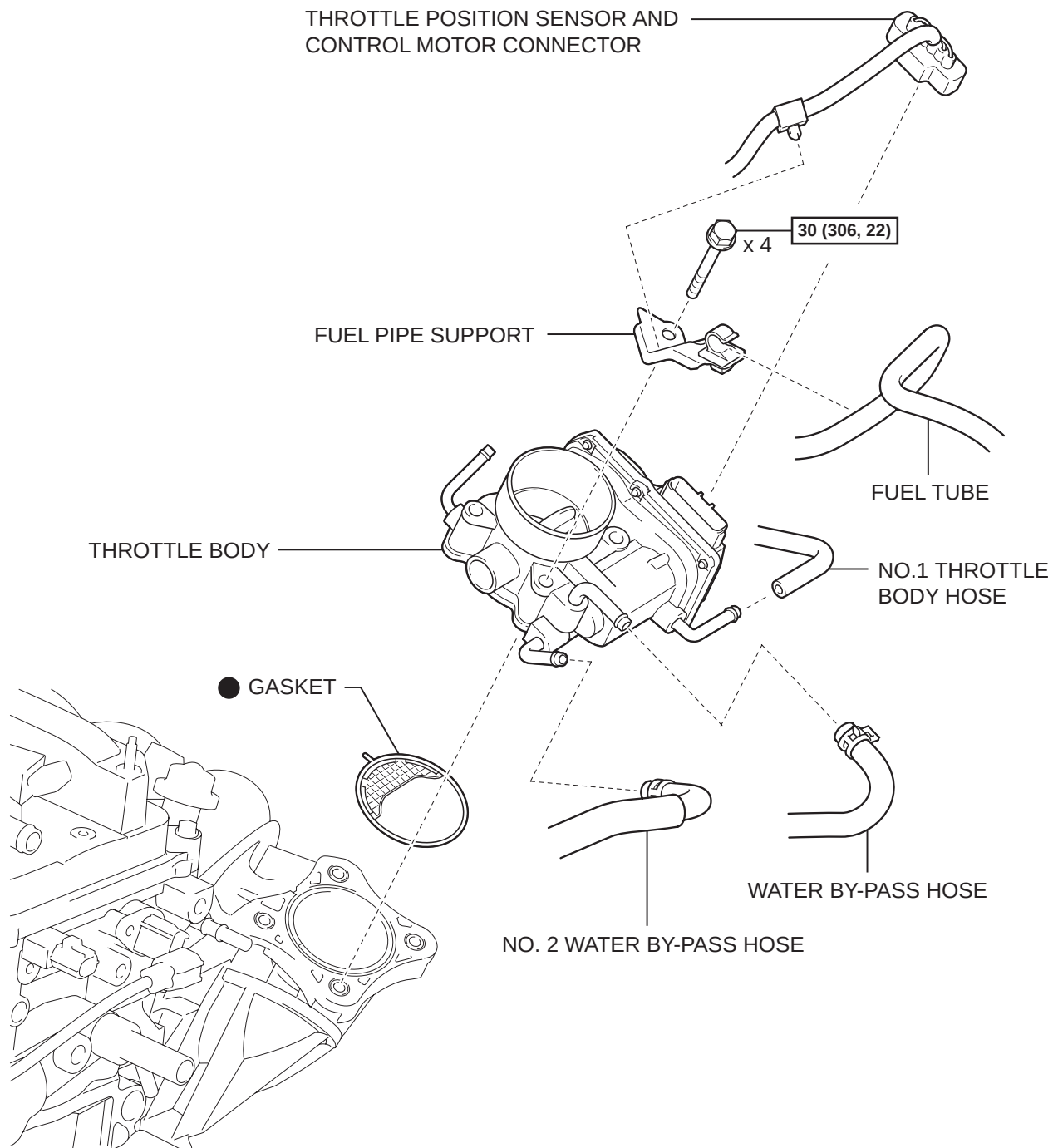
ENGINE ASSEMBLY
COMPONENTS

EM









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

● Non-reusable part

EM

CAMSHAFT TIMING OIL CONTROL VALVE CONNECTOR

FUEL INJECTOR CONNECTOR

FUEL DELIVERY PIPE SUB-ASSEMBLY

20 (204, 15)

x 2

FUEL TUBE

x 4

● INJECTOR VIBRATION INSULATOR

FUEL TUBE CLAMP

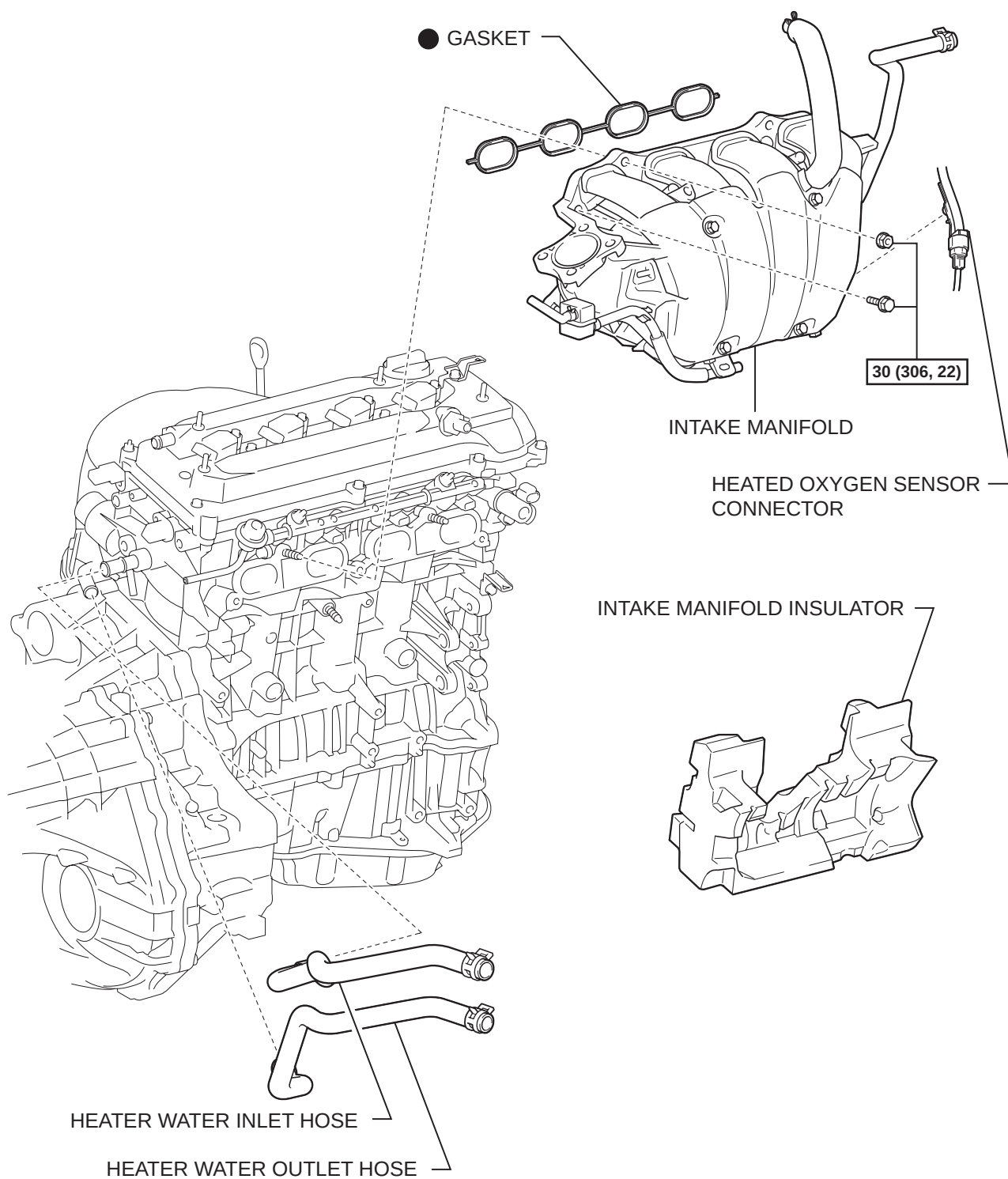
x 2

NO. 1 DELIVERY PIPE SPACER

NO. 2 VENTILATION HOSE

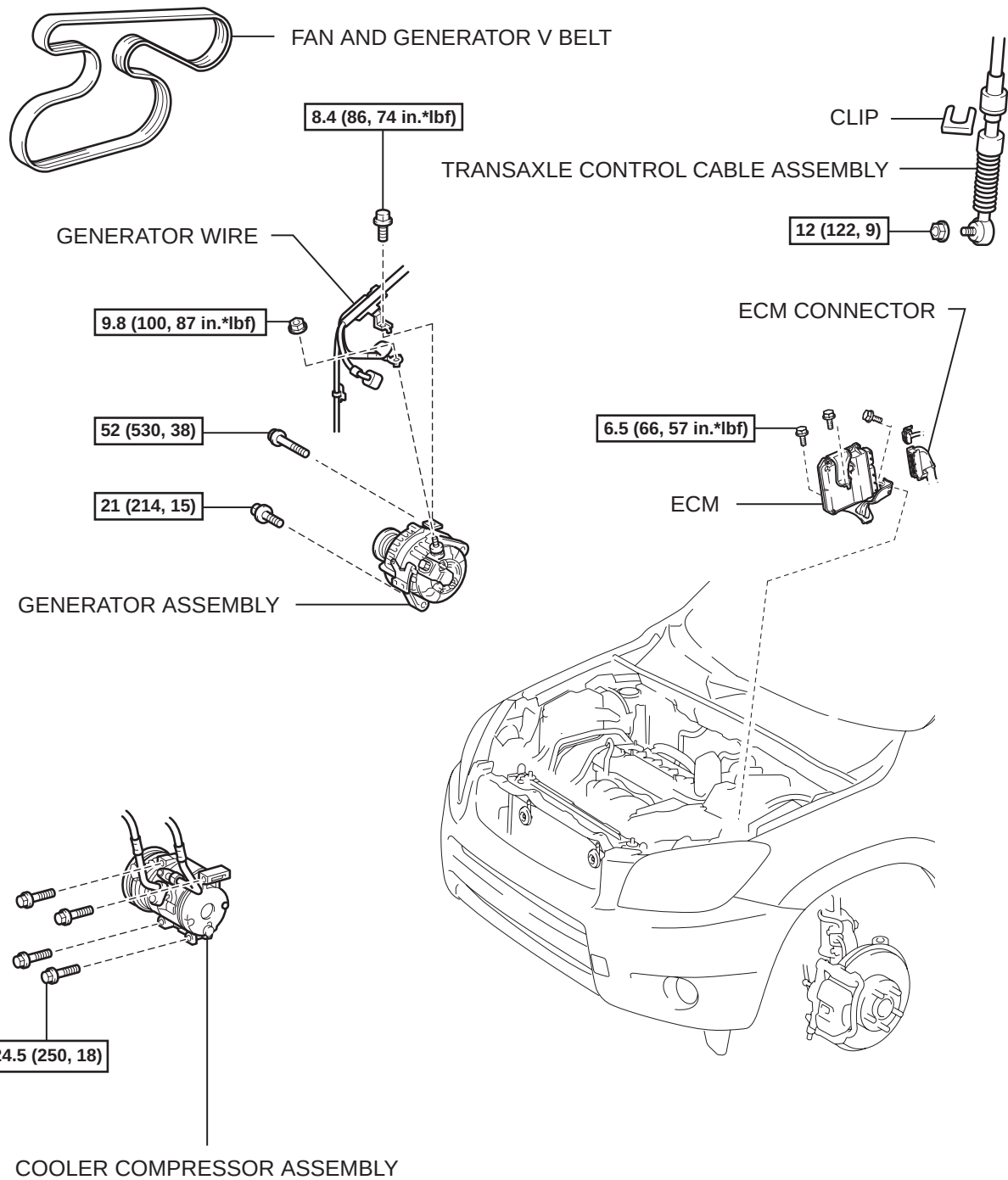
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

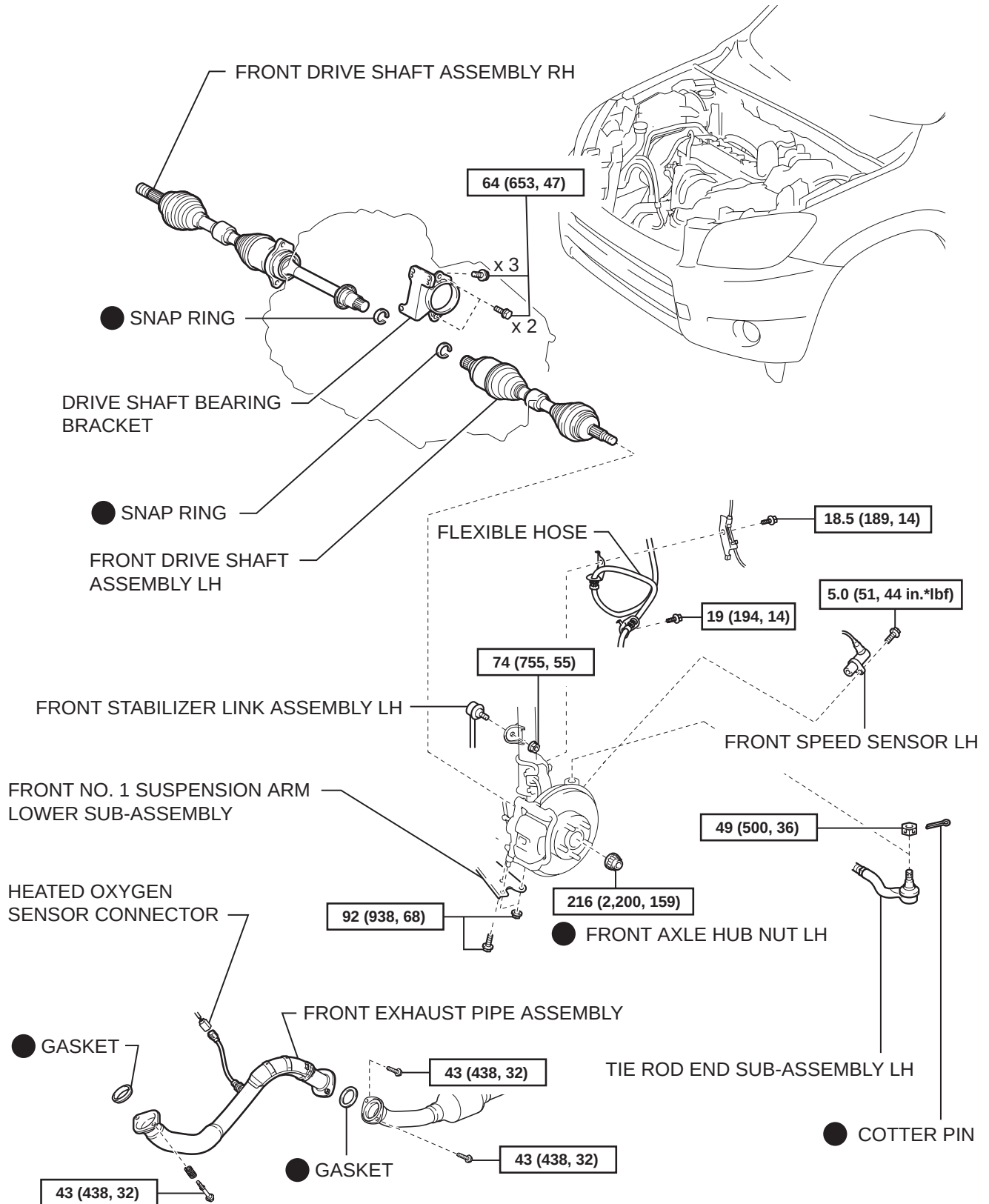


N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part



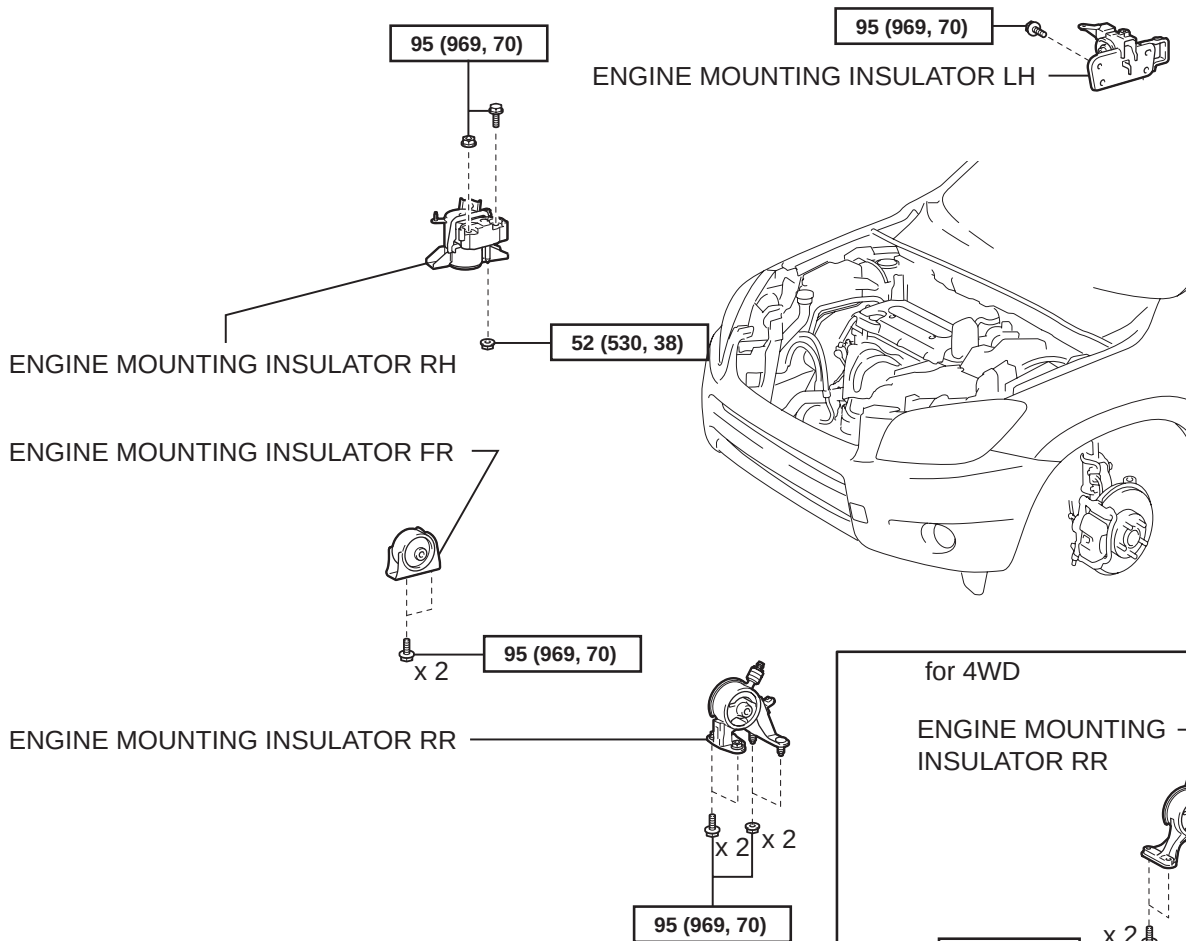
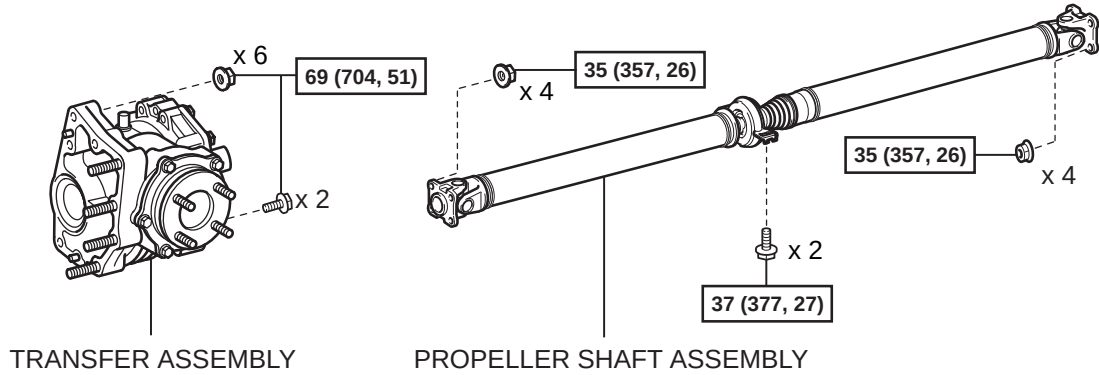
N*m (kgf*cm, ft.*lbf) : Specified torque



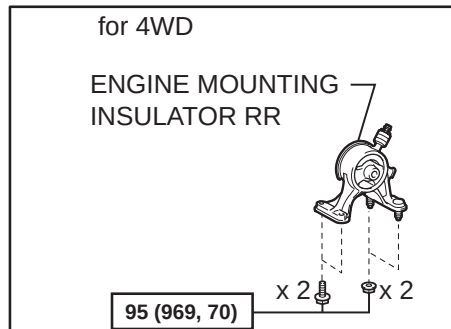
N*m (kgf*cm, ft.*lbf) : Specified torque

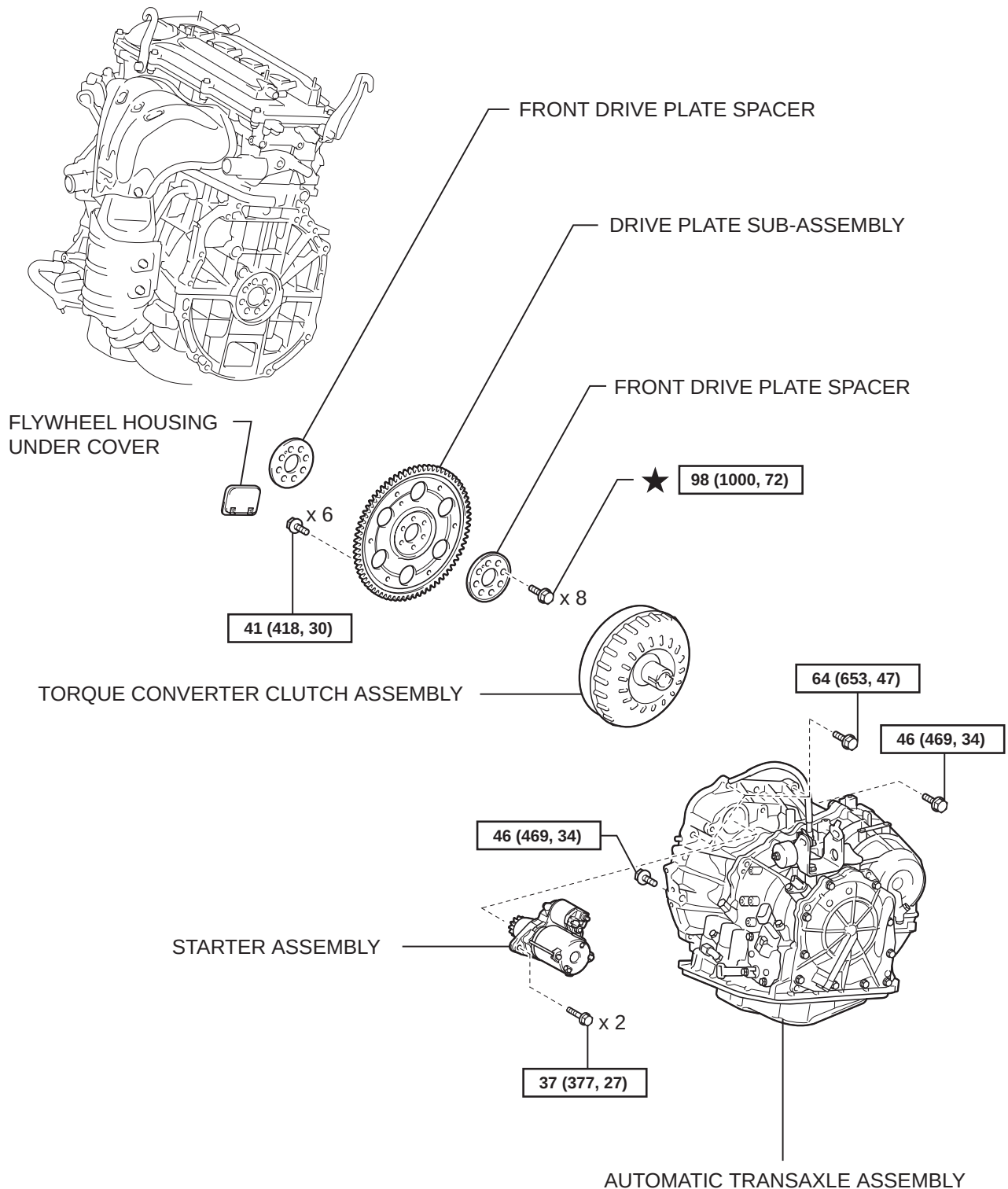
● Non-reusable part

for 4WD



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



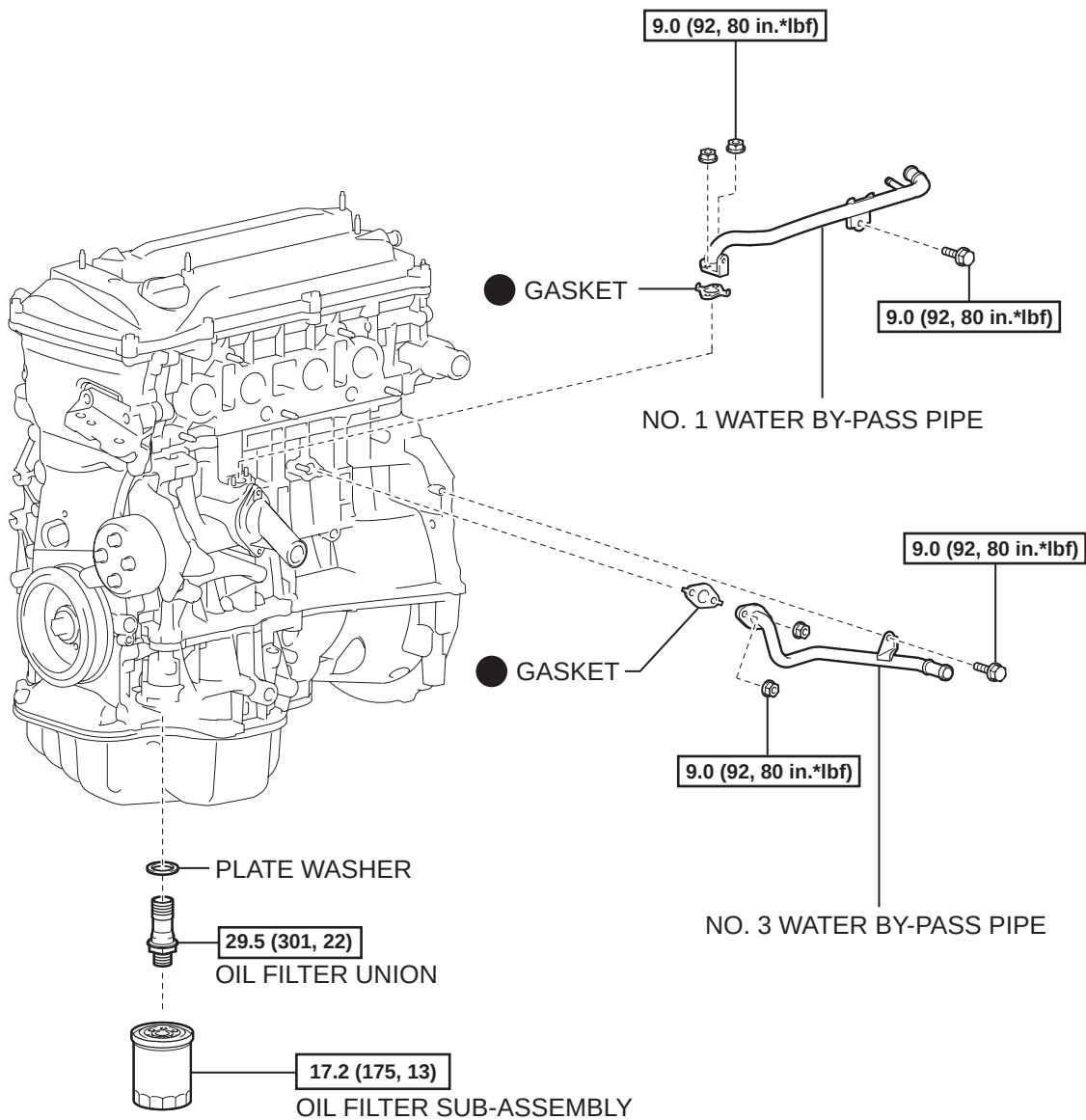


N*m (kgf*cm, ft.*lbf) : Specified torque

★ Precoated part

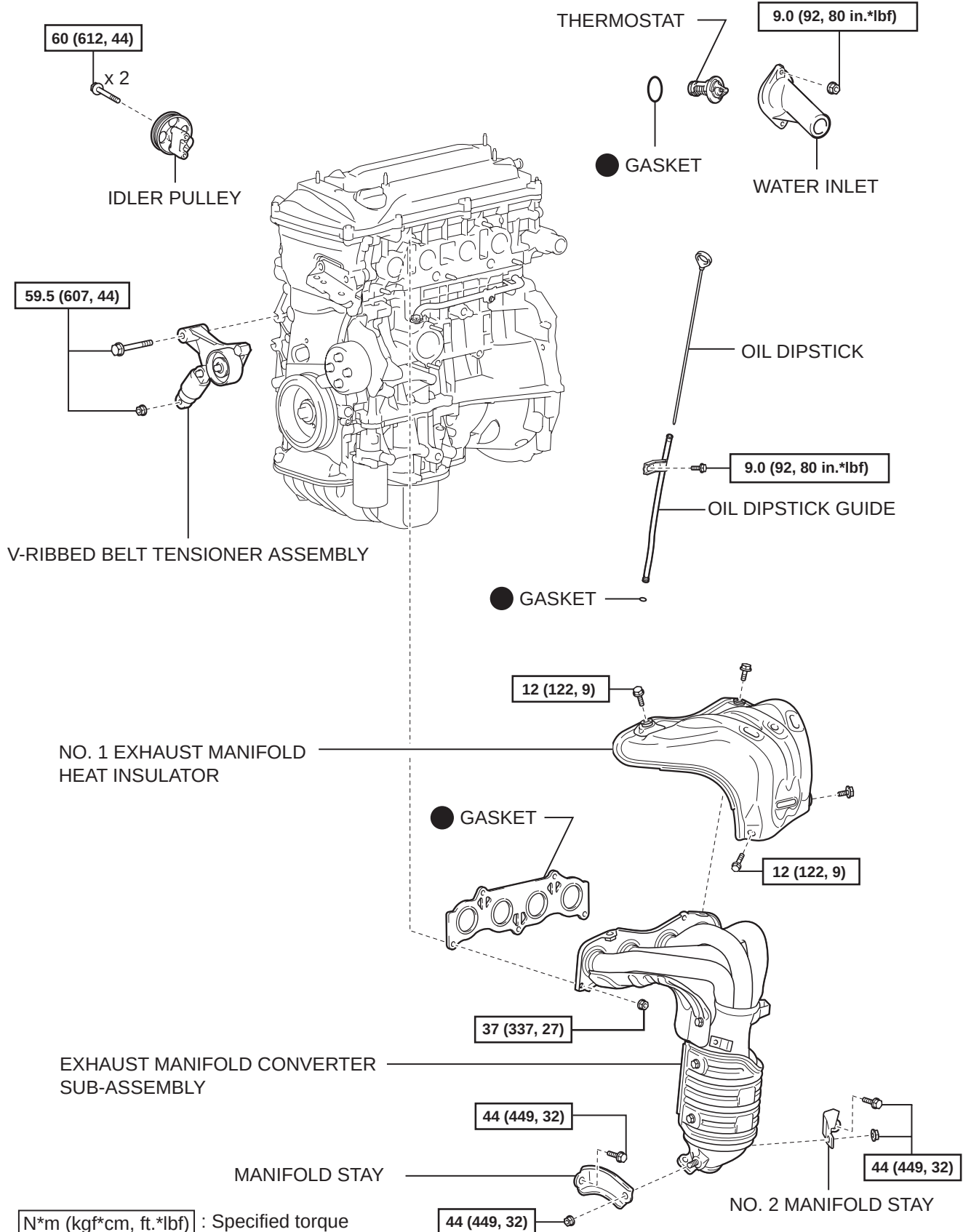
ENGINE UNIT
COMPONENTS

EM



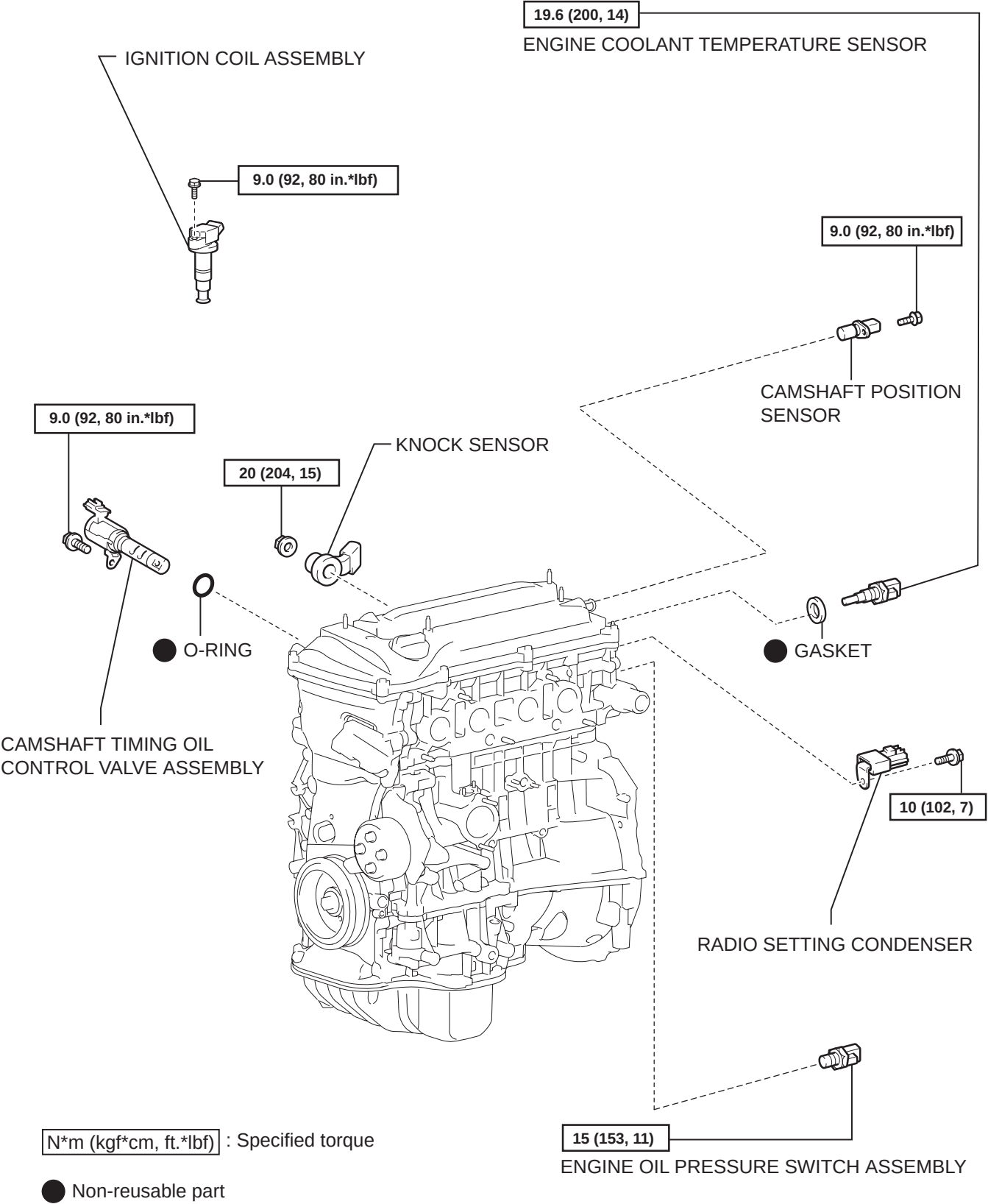
N*m (kgf*cm, ft.*lbf) : Specified torque

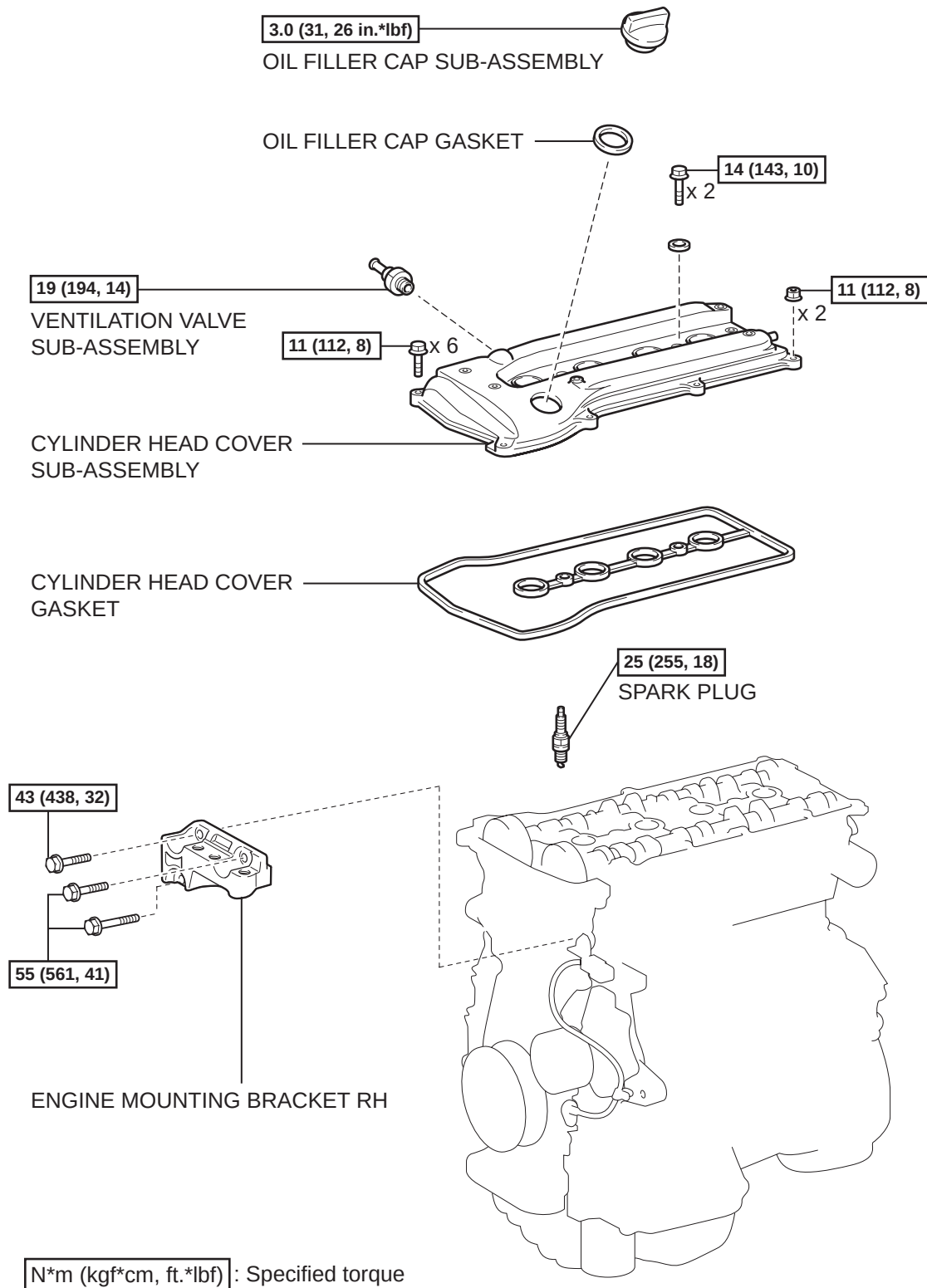
● Non-reusable part



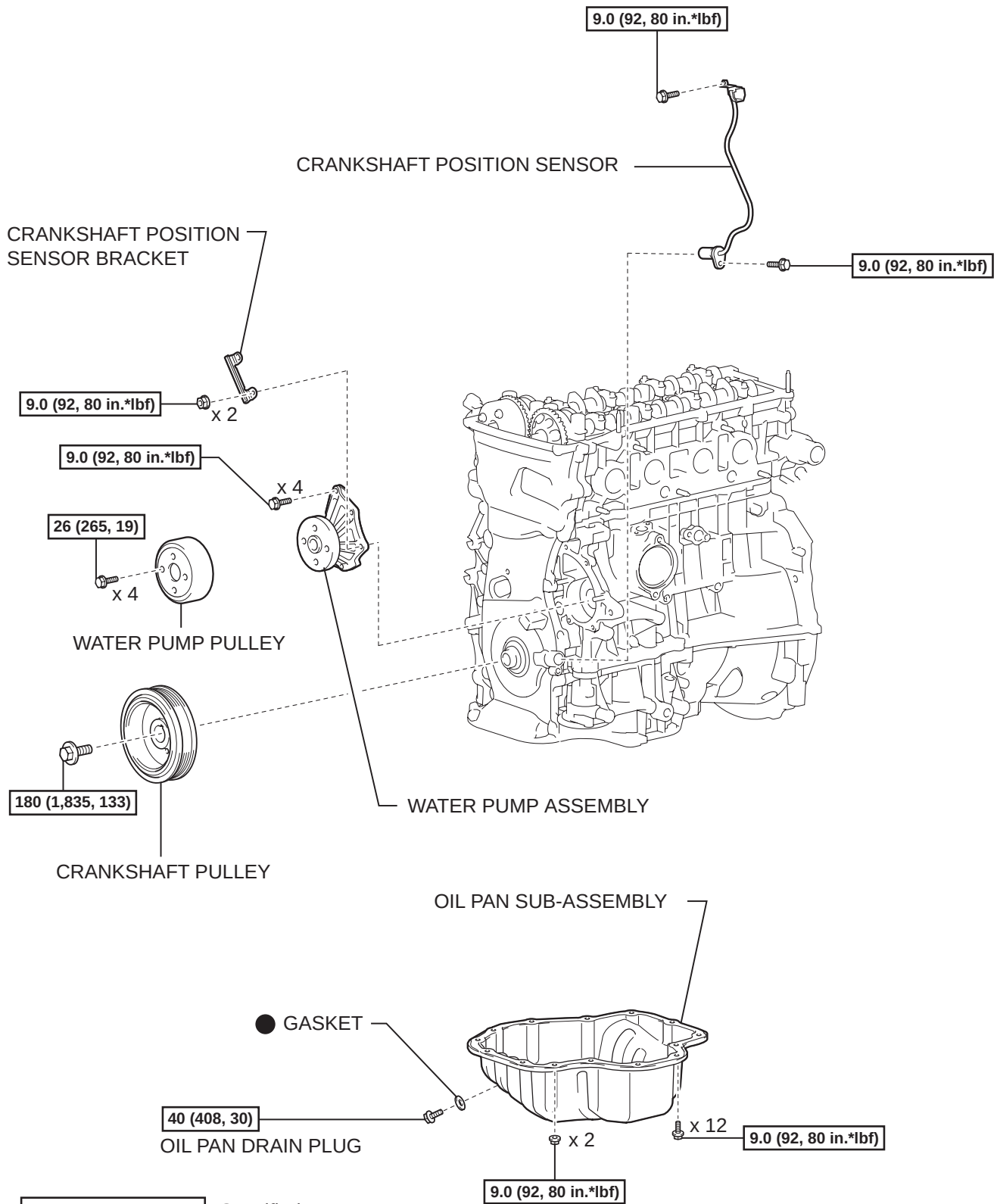
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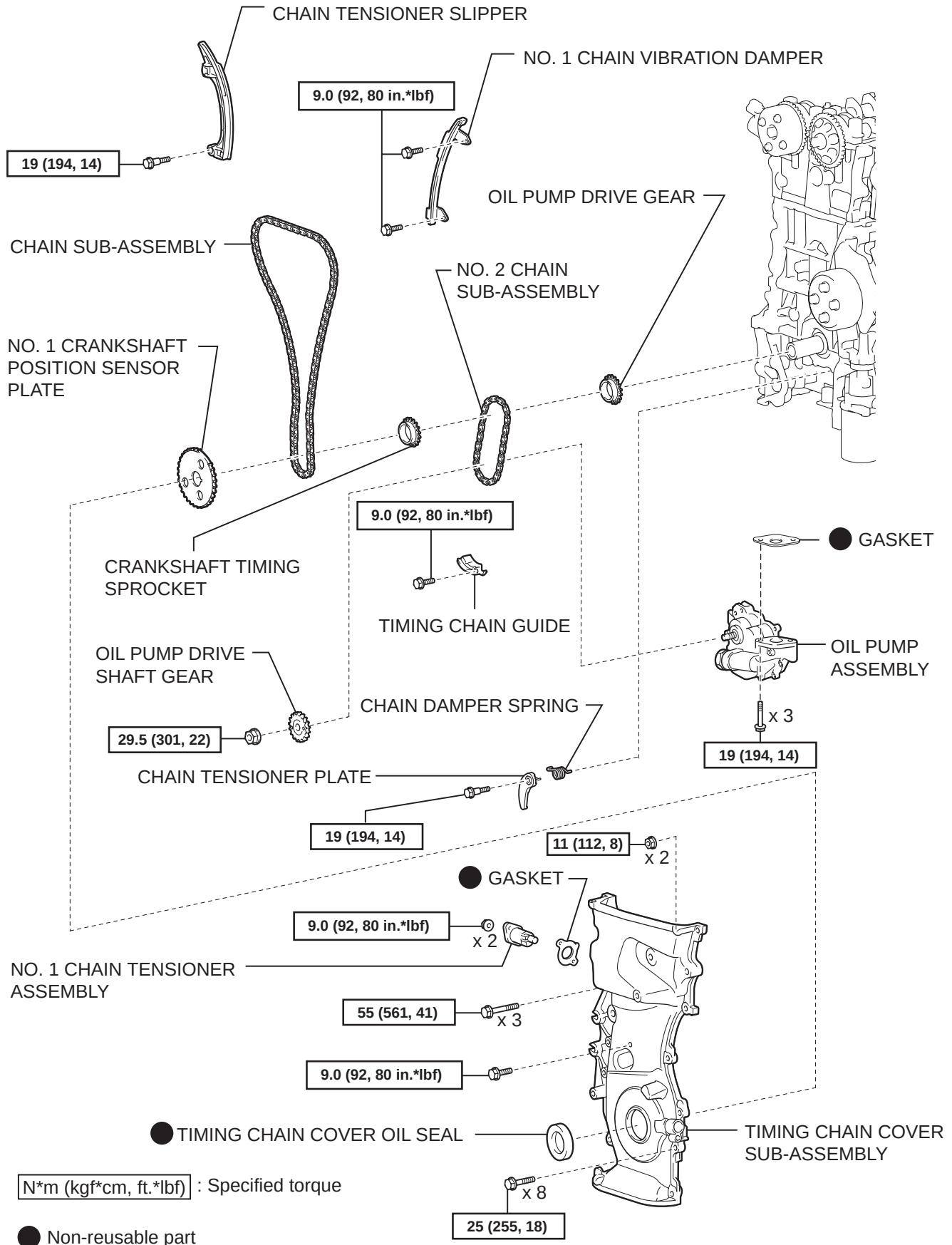
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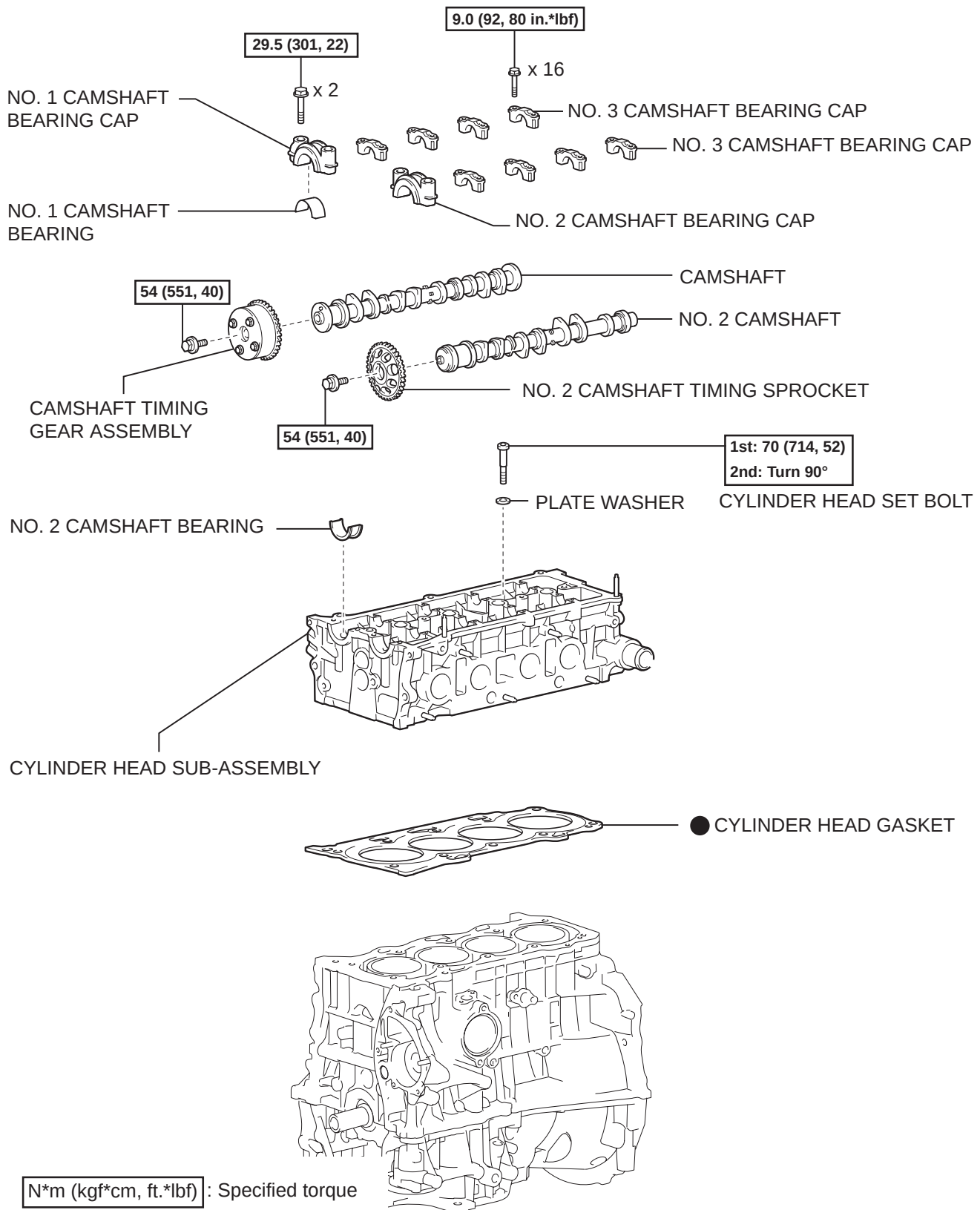


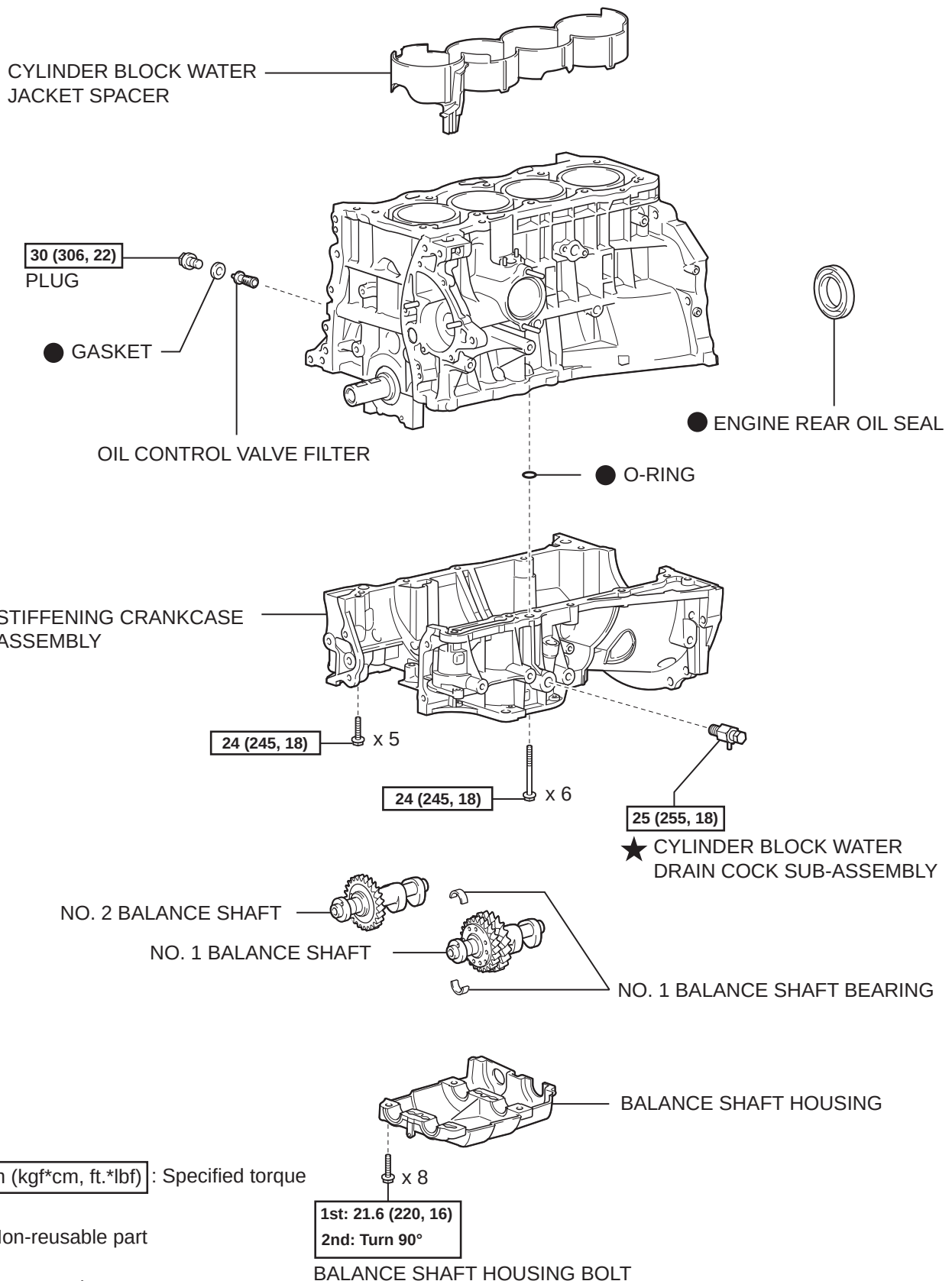


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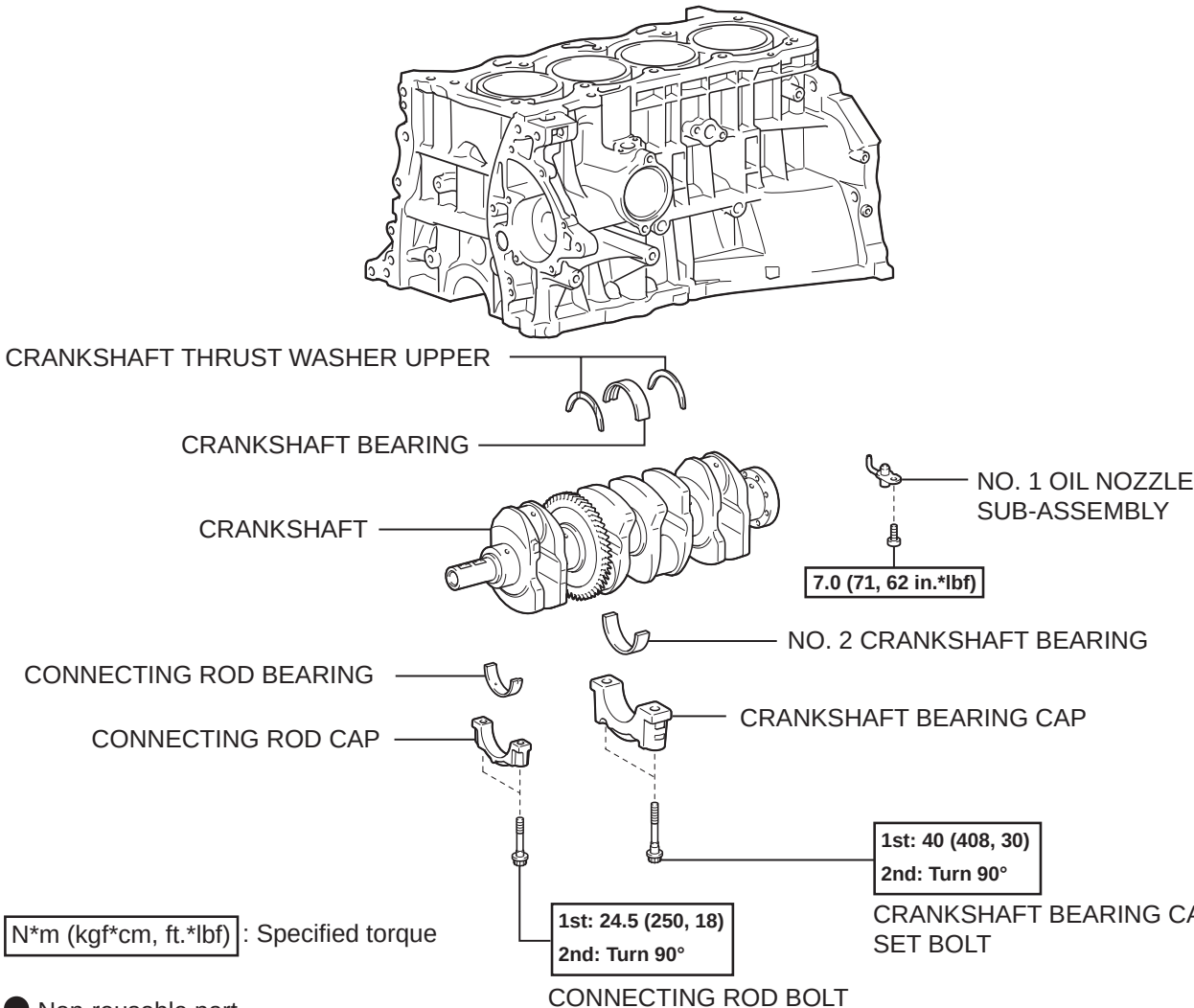
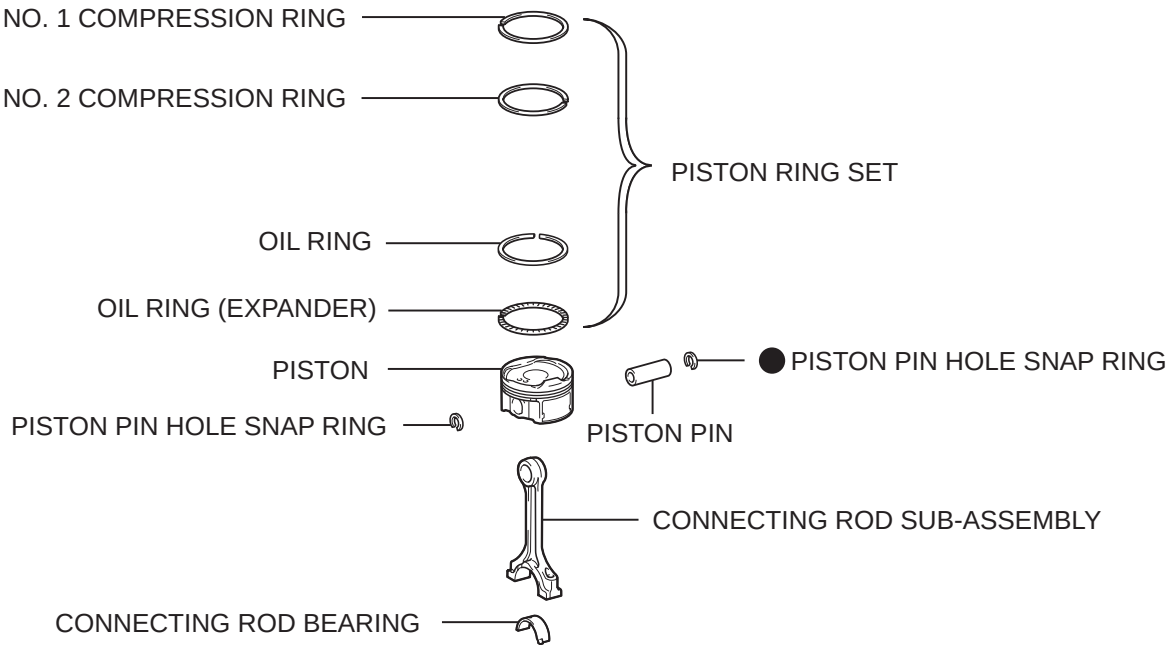








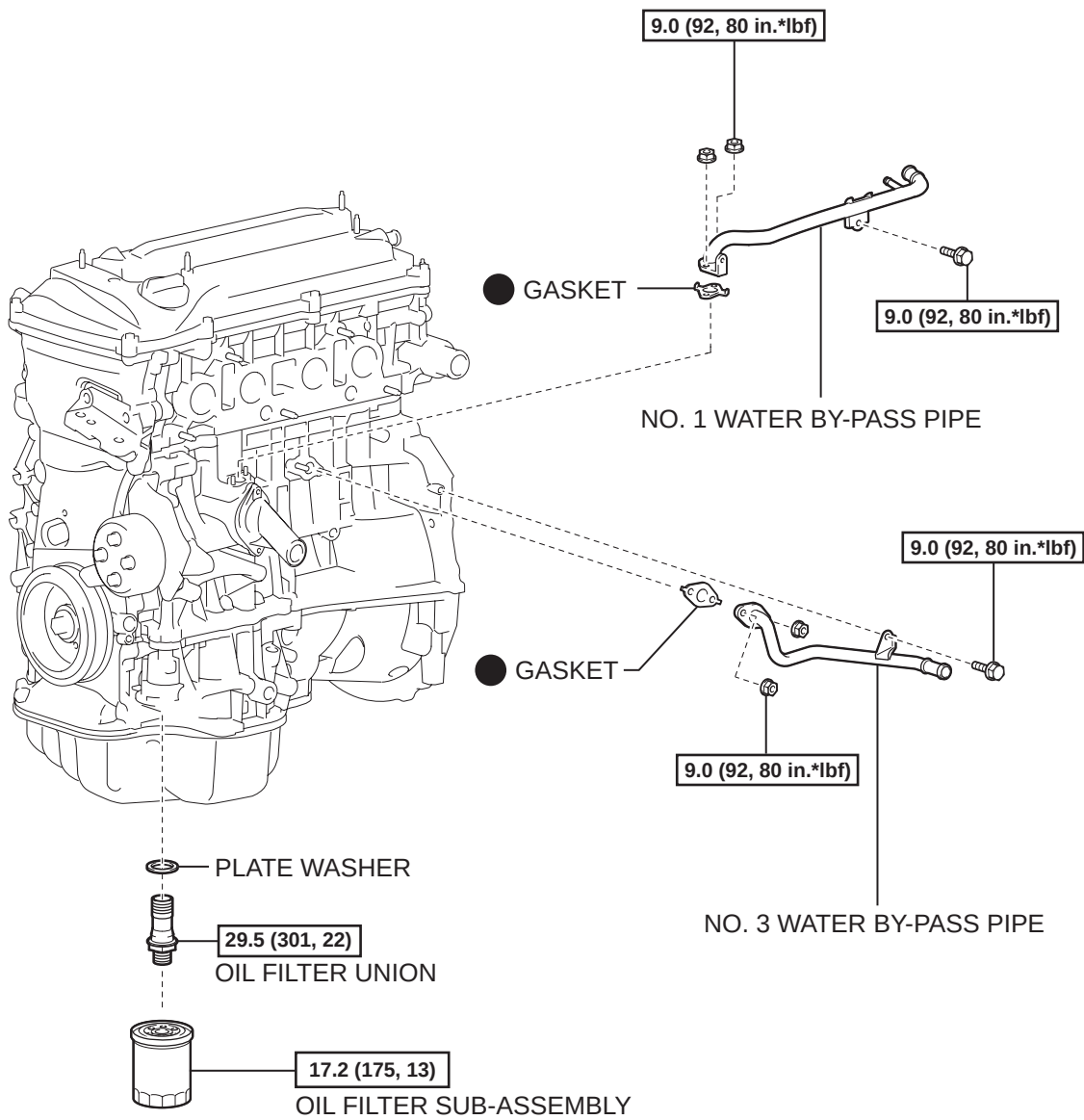
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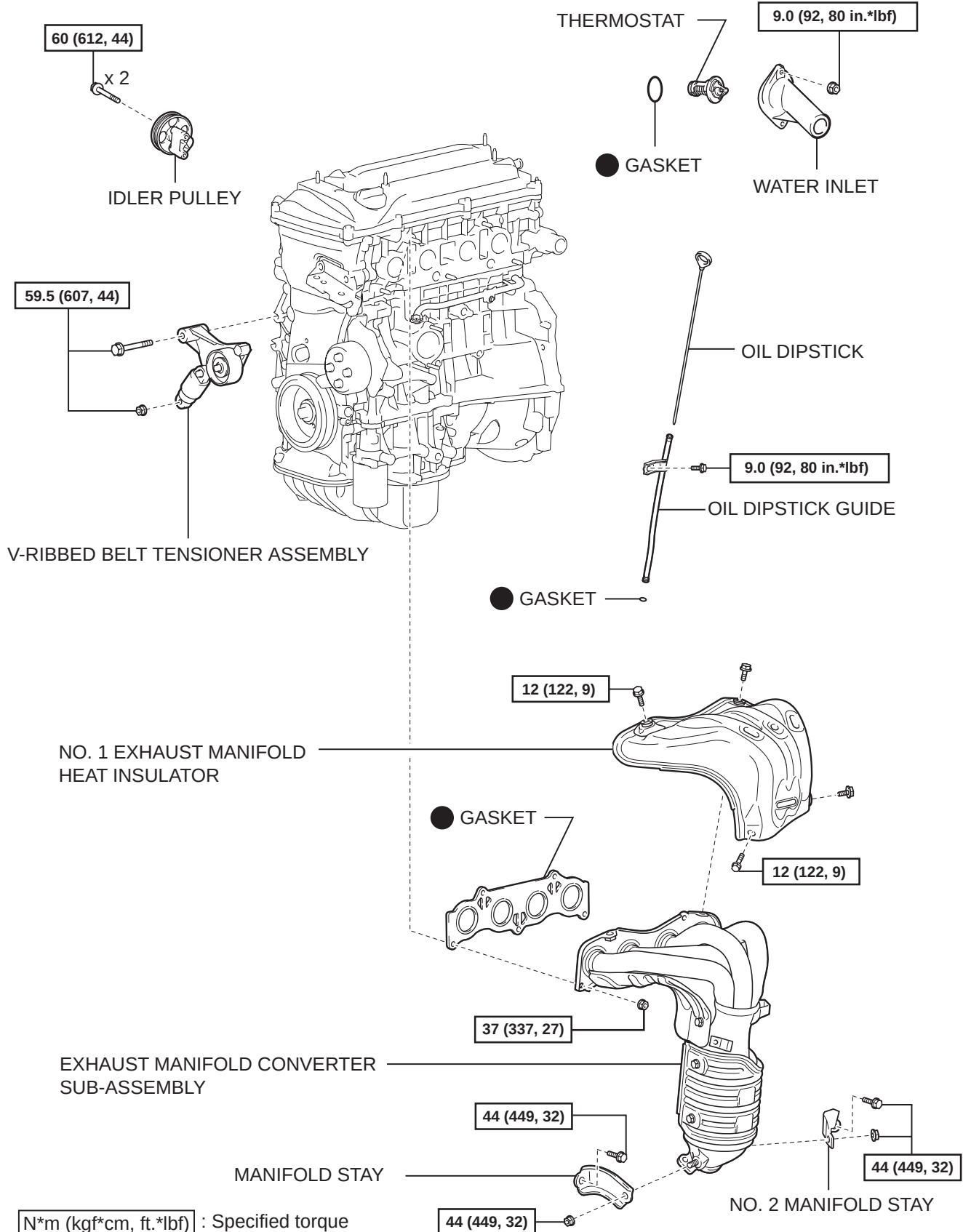
ENGINE UNIT
COMPONENTS

EM



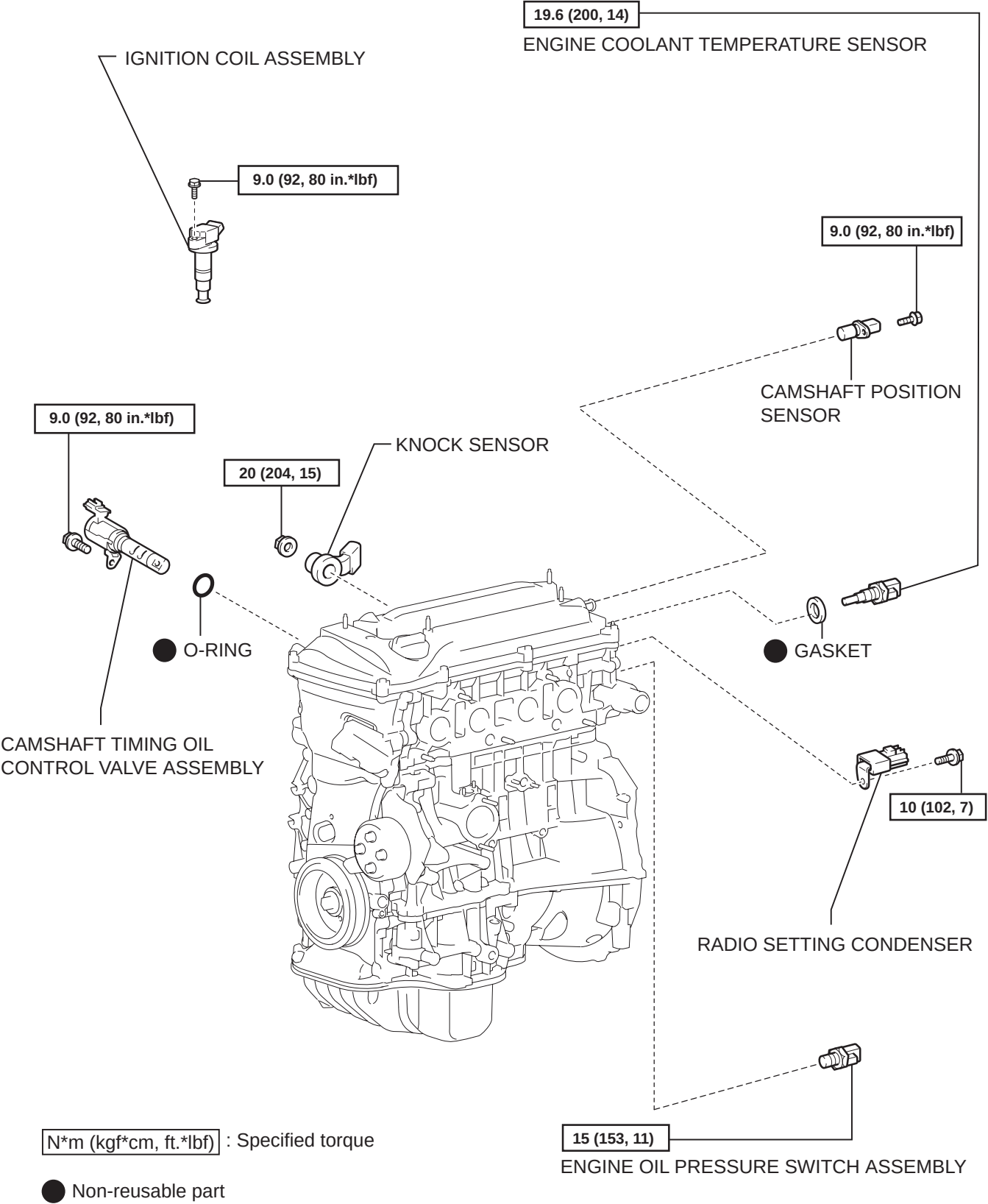
N*m (kgf*cm, ft.*lbf) : Specified torque

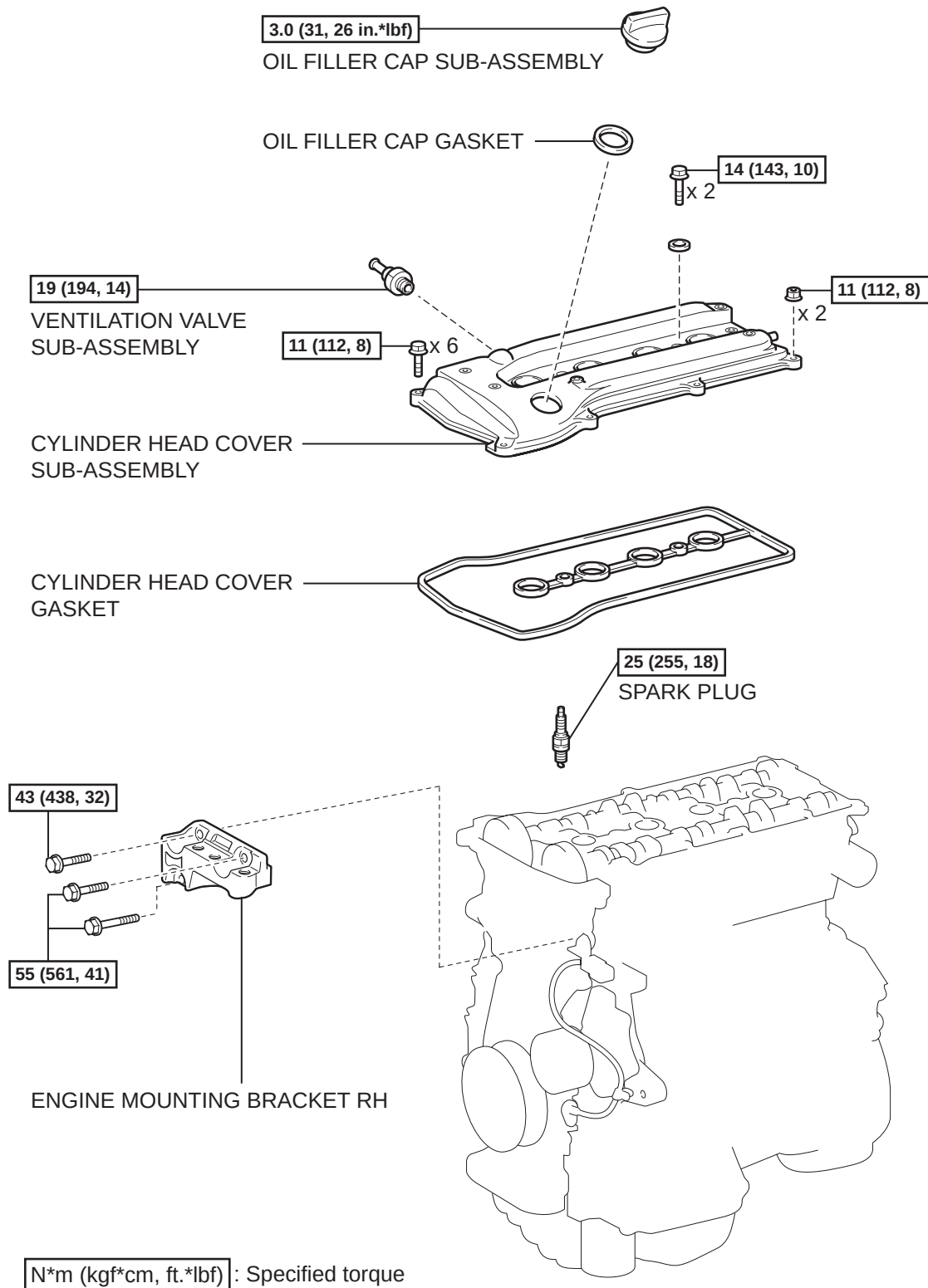
● Non-reusable part



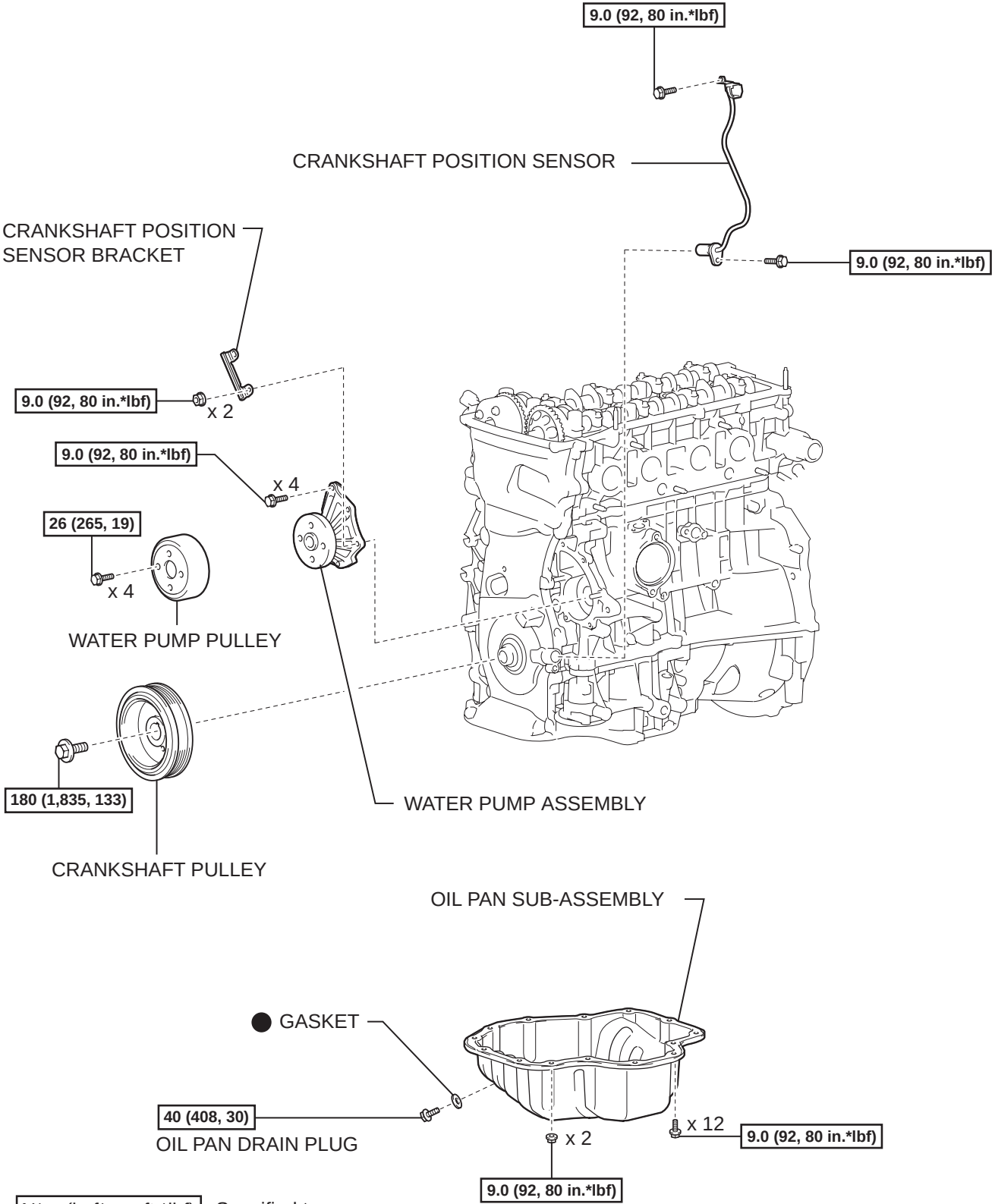
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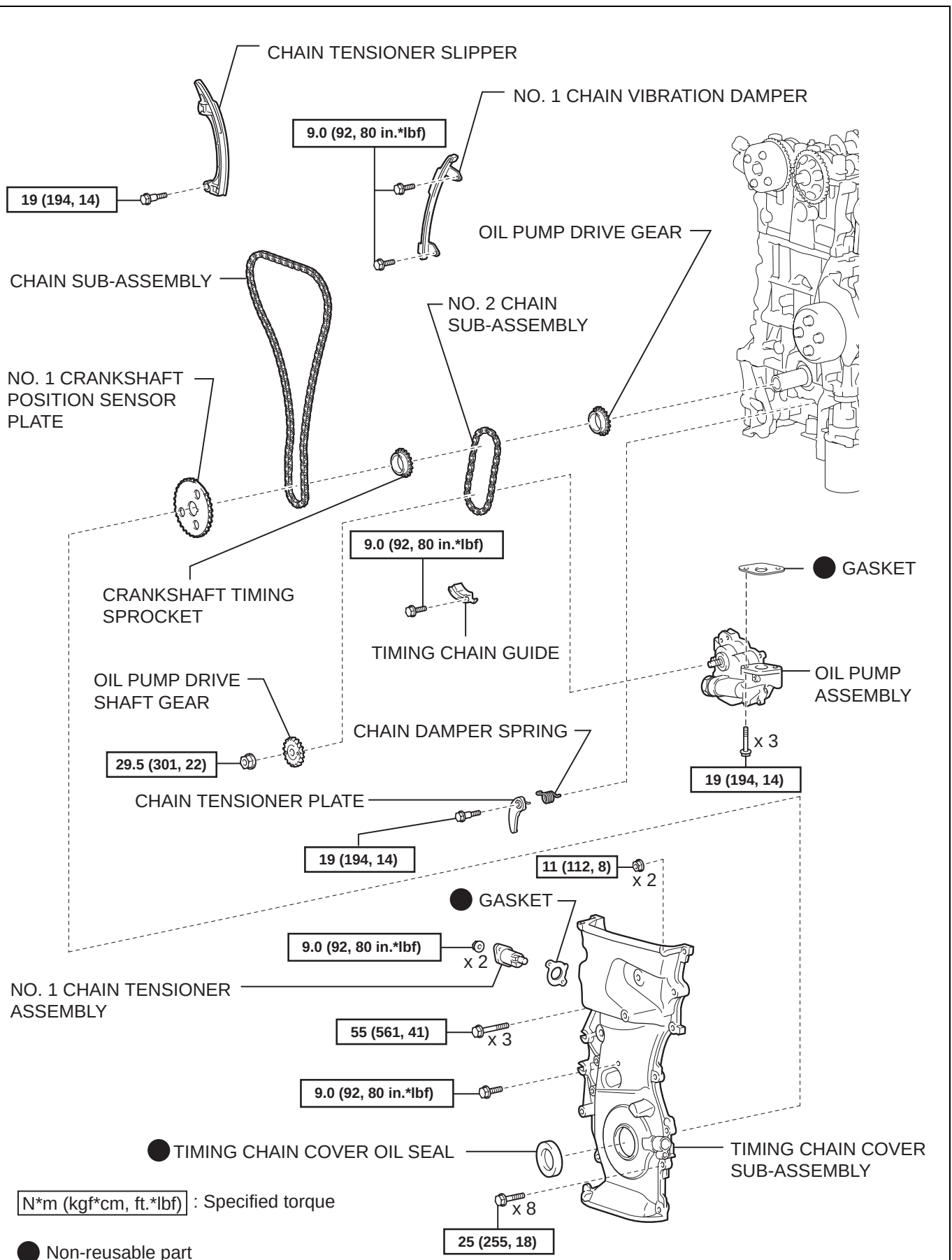
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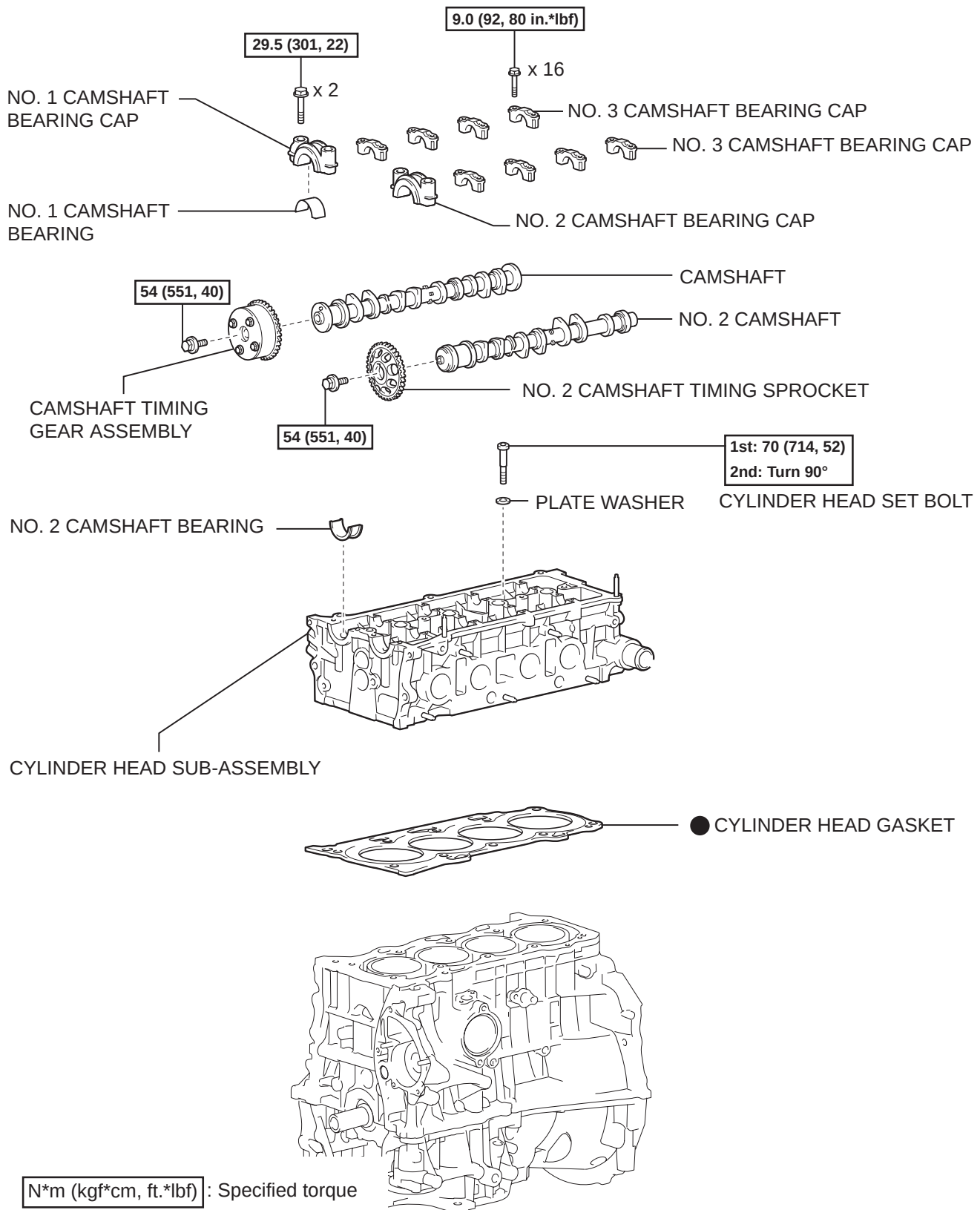


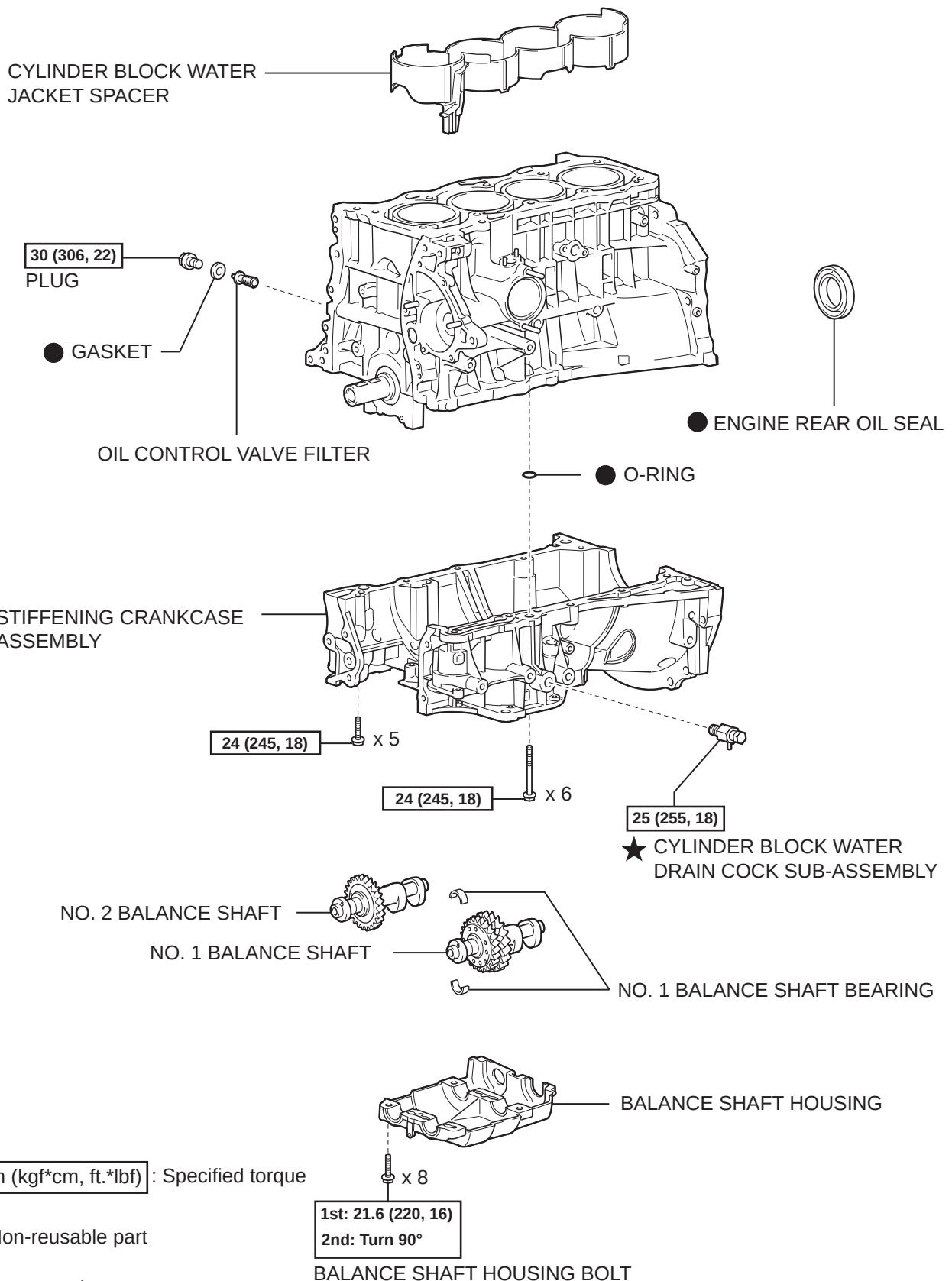


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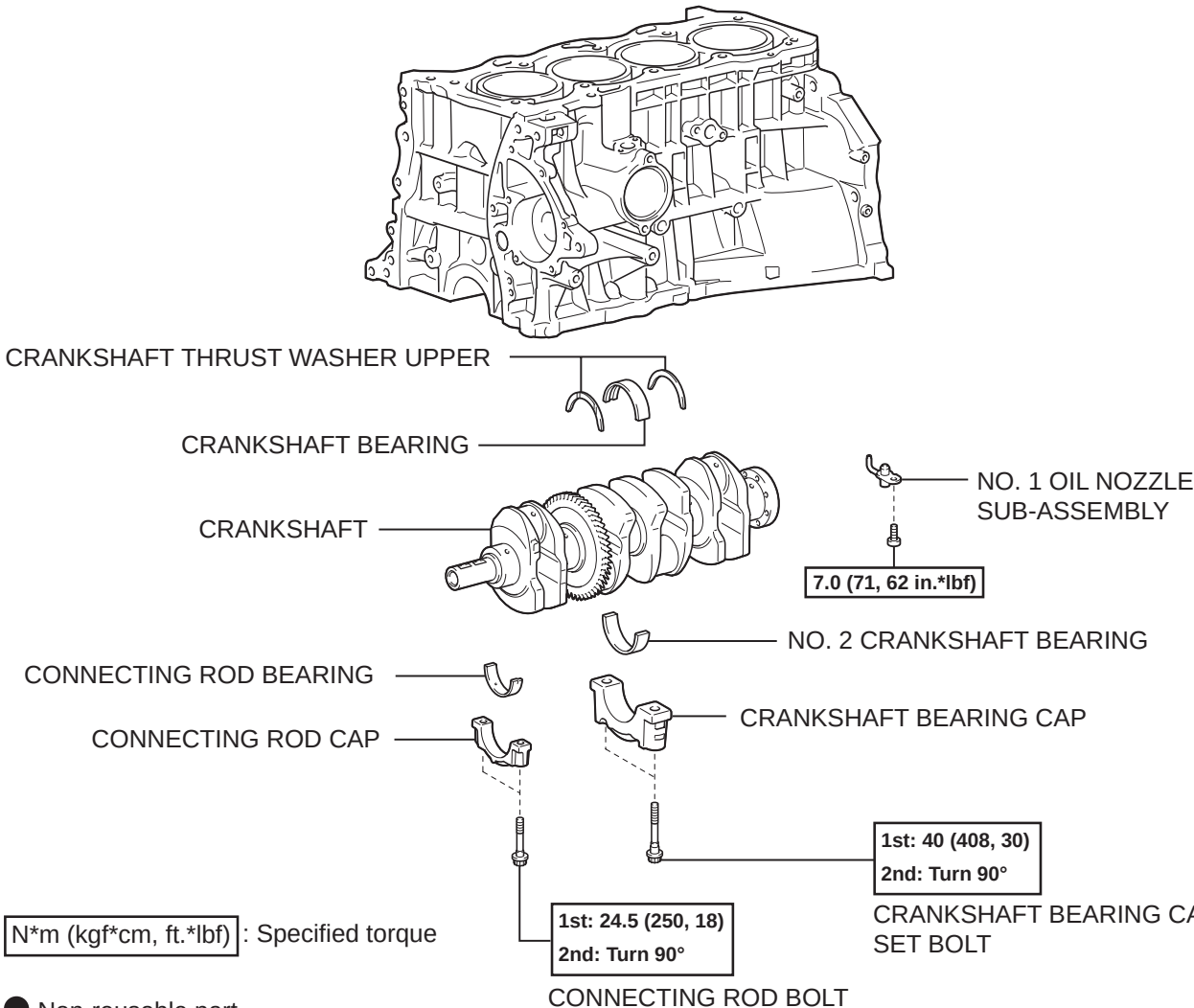
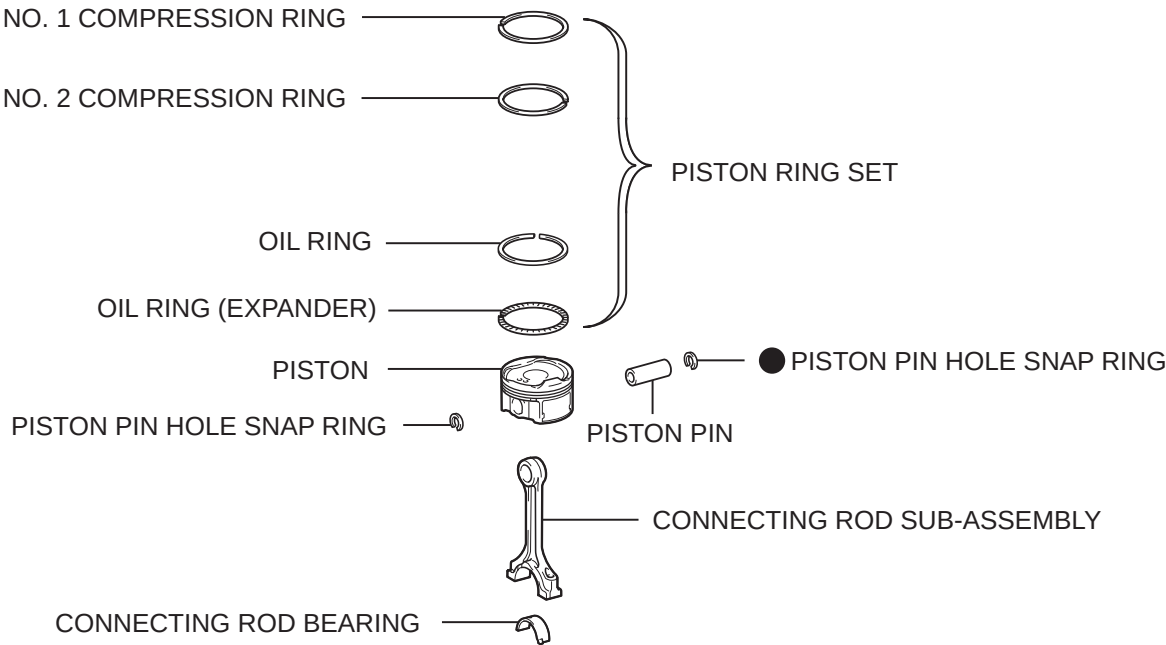








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