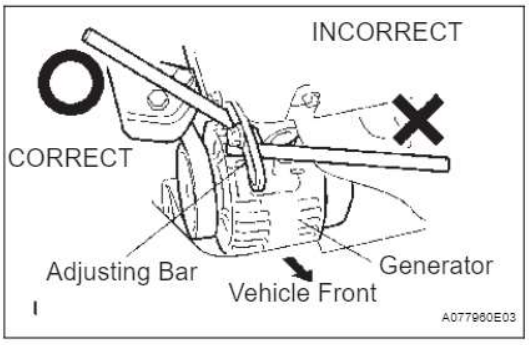
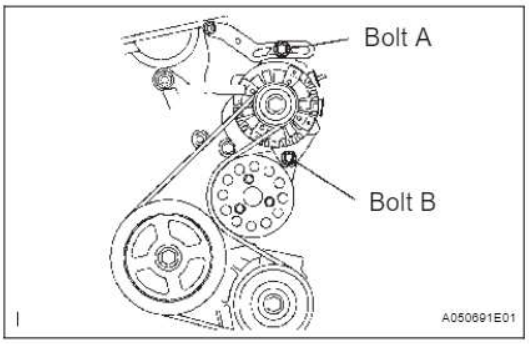
EM

INSTALLATION

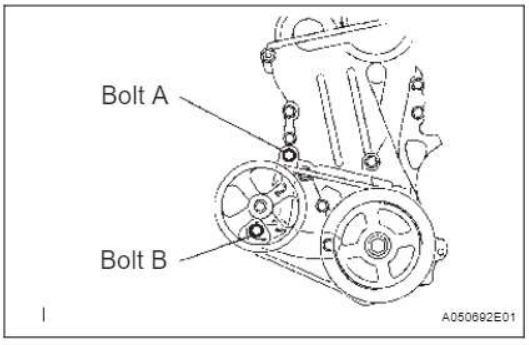
1. **INSTALL VANE PUMP V BELT**
   (a) Temporarily install the belt on each pulley.
2. **INSTALL GENERATOR V BELT**
   (a) Temporarily install the belt on each pulley.
3. **ADJUST GENERATOR V BELT**
   (a) Insert the adjusting bar between the engine RH mount bracket and generator. Push the bar towards the vehicle front to adjust the belt tension.
   NOTICE:
   Do not insert the bar between the oil control valve and generator. It could damage the oil control valve.



   (b) First tighten bolt A, and then tighten bolt B.
   Torque: 18.5 N*m (189 kgf*cm, 14 ft.*lbf) for bolt A
   54 N*m (550 kgf*cm, 40 ft.*lbf) for bolt B
4. **ADJUST VANE PUMP V BELT**
   (a) Using the bar, adjust the belt tension.



   (b) First tighten bolt B, and then tighten bolt A.
   Torque: 44 N*m (449 kgf*cm, 33 ft.*lbf)

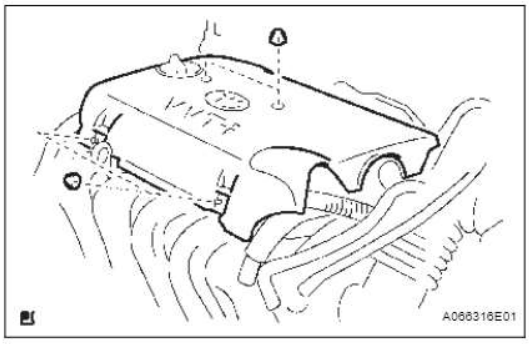


5. **CHECK DRIVE BELT TENSION (See page EM-6)**
6. **INSTALL ENGINE UNDER COVER RH**

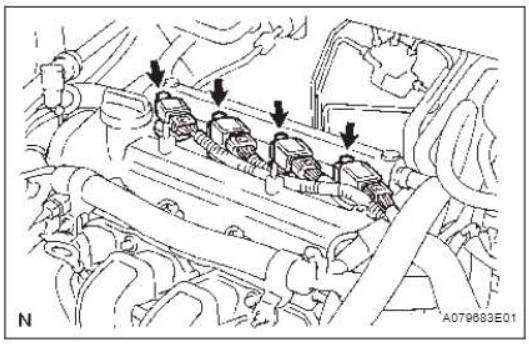
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REMOVAL

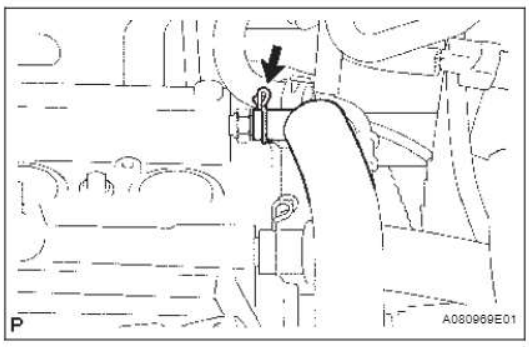
1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE FRONT WHEEL RH**
3. **REMOVE NO. 2 CYLINDER HEAD COVER**
   (a) Remove the 4 nuts and No. 2 cylinder head cover.



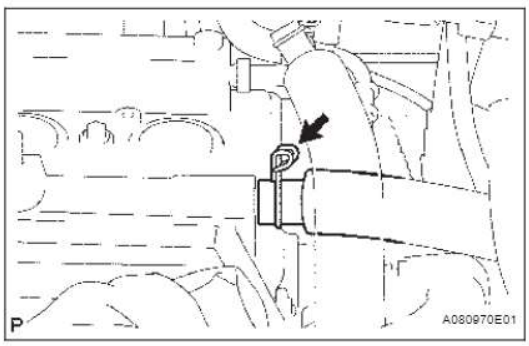
4. **REMOVE IGNITION COIL**
   (a) Remove the 4 bolts and pull out the 4 ignition coils.



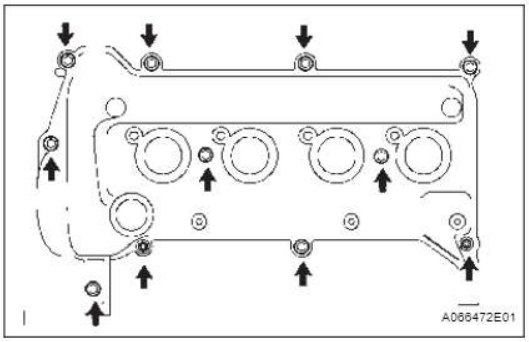
5. **REMOVE VENTILATION HOSE**
   (a) Disconnect the ventilation hose from the cylinder head cover.



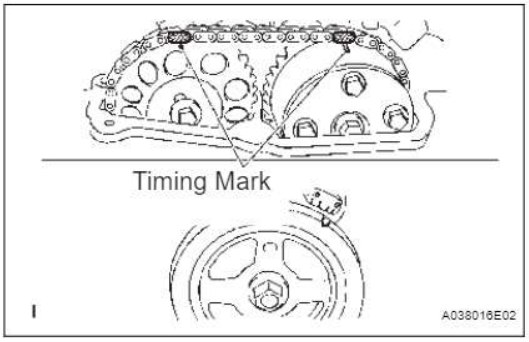
6. **REMOVE NO. 2 VENTILATION HOSE**
   (a) Disconnect the No. 2 ventilation hose from the cylinder head cover.



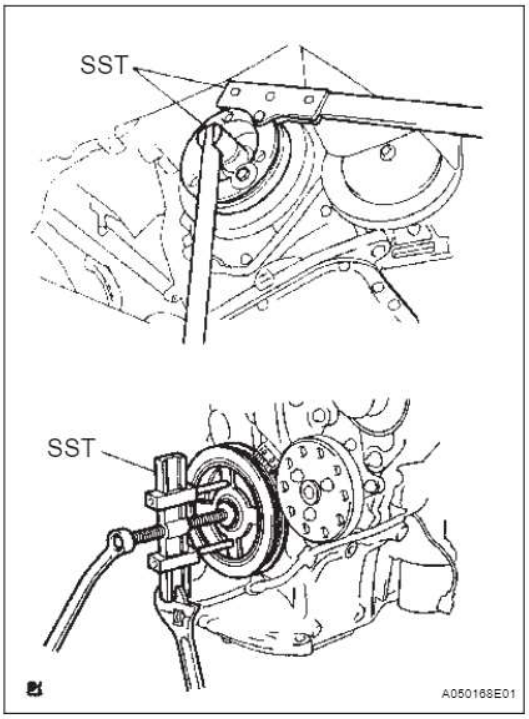
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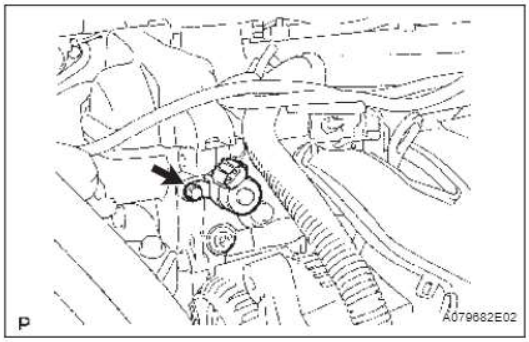
7. **REMOVE CYLINDER HEAD COVER**
   (a) Remove the 9 bolts, 2 nuts and cylinder head cover.
8. **REMOVE GENERATOR V BELT (See page EM-7)**
9. **REMOVE GENERATOR (See page CH-9)**
10. **REMOVE ENGINE UNDER COVER RH**
11. **DRAIN ENGINE OIL (See page LU-3)**
12. **DRAIN ENGINE COOLANT (See page CO-5)**
13. **REMOVE VANE PUMP V BELT (See page EM-7)**
14. **REMOVE WATER PUMP PULLEY (See page EM-91)**
15. **REMOVE WATER PUMP (See page EM-92)**
16. **REMOVE CRANKSHAFT PULLEY**
    (a) Set the No. 1 cylinder to the TDC/compression.
    (1) Turn the crankshaft pulley until its timing notch and the timing mark 0 of the chain cover are aligned.
    (2) Check that both timing marks on the camshaft timing sprocket and the camshaft timing gear are facing upward as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.



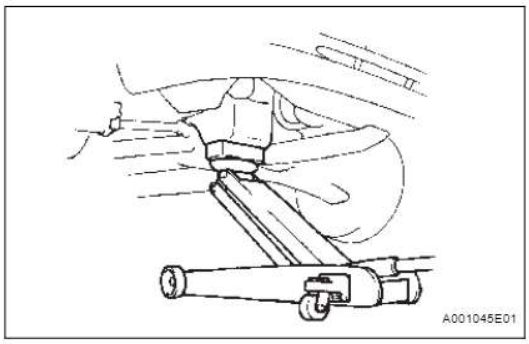
(b) Using SST, remove the pulley bolt.
SST 09213-58012 (91111-50845), 09330-00021
If necessary, remove the pulley with SST.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)



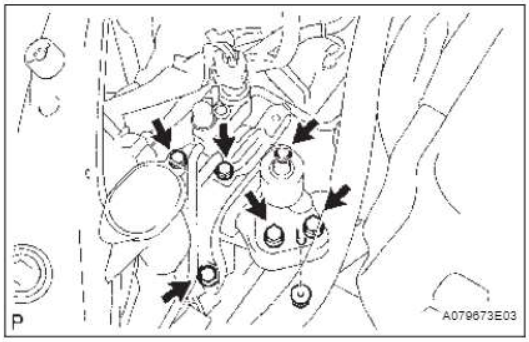
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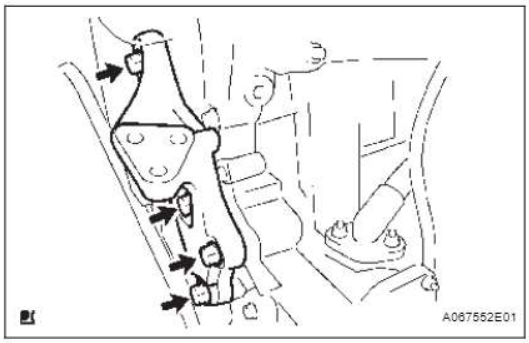
17. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**
    (a) Disconnect the oil control valve connector.
    (b) Remove the bolt, oil control valve and O-ring.
18. **REMOVE CRANKSHAFT POSITION SENSOR (See page ES-338)**



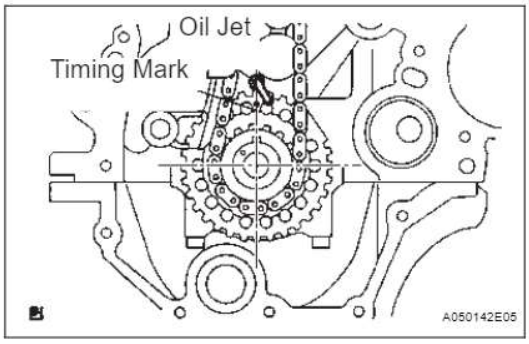
19. **REMOVE ENGINE MOUNTING BRACKET INSULATOR RH**
    (a) Place a wooden block on a jack underneath the engine.



    (b) Remove the bolt which is used to fix the liquid tube to the mounting insulator RH.
    (c) Remove the 5 bolts and nut, and then remove the mounting insulator RH.



20. **REMOVE ENGINE MOUNTING BRACKET RH**
    (a) Remove the 4 bolts and mounting bracket RH.
21. **REMOVE TIMING CHAIN COVER (See page EM-92)**
22. **REMOVE OIL PUMP SEAL (See page EM-106)**
23. **REMOVE NO. 1 CHAIN TENSIONER**
    (a) Remove the 2 bolts and chain tensioner.
    NOTICE:
    - **Do not rotate the crankshaft with the chain tensioner removed.**
    - **When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC and align the oil jet hole with the paint mark to prevent the pistons from coming into contact with the valves.**

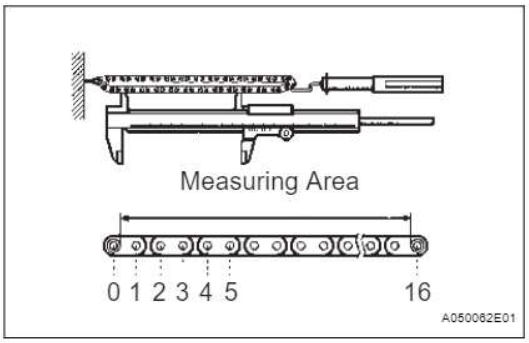


24. **REMOVE CHAIN TENSIONER SLIPPER**
    (a) Remove the bolt and tensioner slipper.
25. **REMOVE NO. 1 CHAIN VIBRATION DAMPER**
    (a) Remove the 2 bolts and chain vibration damper.

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26. REMOVE CHAIN

INSPECTION



1. INSPECT CHAIN

(a) Using a spring scale, pull the timing chain with a force of 140 N (14.3 kgf, 31.5 lbf) and measure the length of it.

Maximum chain elongation:

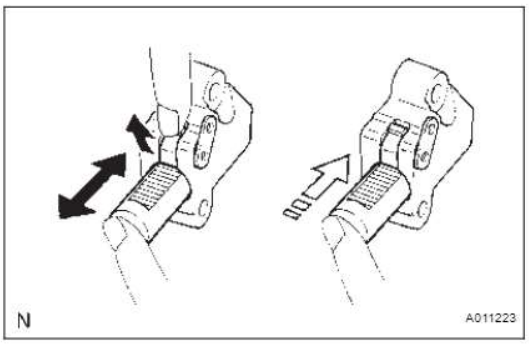
123.2 mm (4.850 in.)

If the elongation is greater than the maximum, replace the chain.

HINT:

Perform the same measurements by pulling at 3 or more random places to obtain the average length.

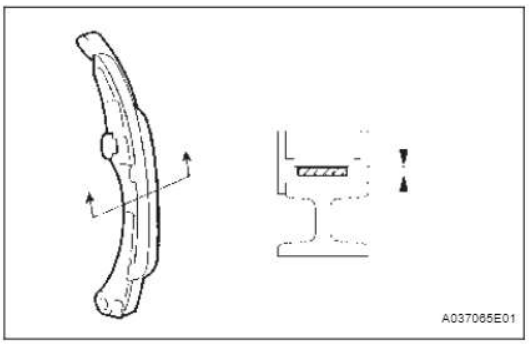
EM



2. 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 and check that the plunger is locked in place by the ratchet pawl and does not move when pushed with your finger.



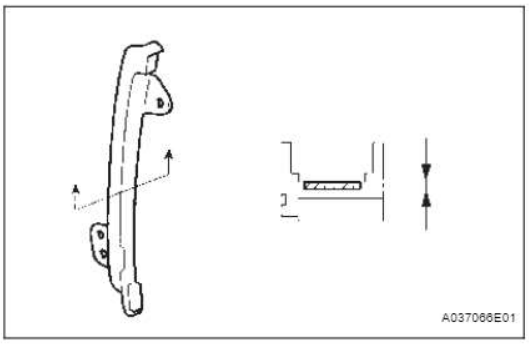
3. INSPECT CHAIN TENSIONER SLIPPER

(a) Measure the chain tensioner slipper wear.

Maximum wear:

1.0 mm (0.039 in.)

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



4. INSPECT NO. 1 CHAIN VIBRATION DAMPER

(a) Measure the vibration damper wear.

Maximum wear:

1.0 mm (0.039 in.)

If the wear is greater than the maximum, replace the damper.

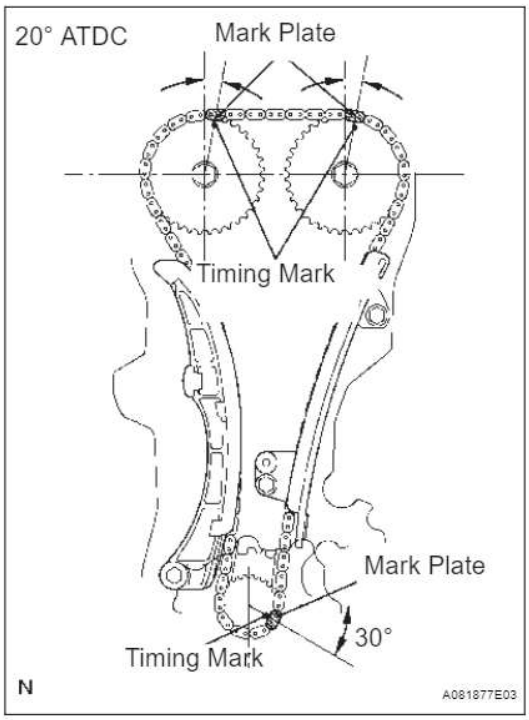
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INSTALLATION

1. INSTALL CHAIN

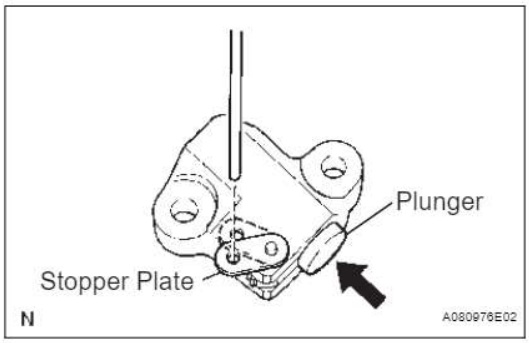
(a) Set the position of the No. 1 cylinder to 20° ATDC.
NOTICE:
To prevent the pistons from hitting against valves, the following procedures must be performed in the order below.
(1) Set the crankshaft between 40 to 140° ATDC.
(2) Set the cams of the intake and exhaust timing sprockets to 20° ATDC.
(3) Reset the crankshaft to 20° ATDC.

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



(c) Align the timing marks of the camshaft timing sprocket, camshaft timing gear and crankshaft timing sprocket with each mark plate (colored in yellow) of the timing chain.
HINT:
To prevent the exhaust camshaft from springing back, turn it using a wrench and set it at the mark on the chain.

(d) Install the chain tensioner slipper with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



(e) Install the chain tensioner with the 2 bolts.
(1) While rotating the stopper plate of the chain tensioner upward as shown in the illustration, push in the plunger of the tensioner.
(2) While rotating the stopper plate of the tensioner downward, insert a 2.5 mm (0.098 in.) diameter bar into the holes of the stopper plate and the tensioner to hold the stopper plate.
(3) Install the chain tensioner with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
(4) Remove the bar from the chain tensioner.

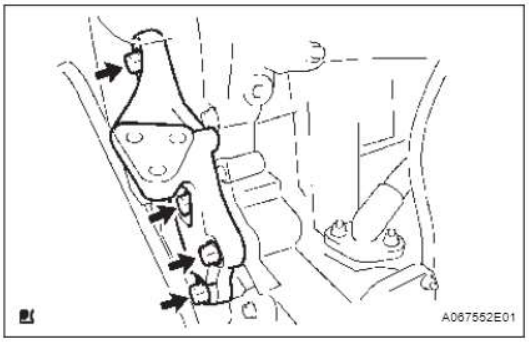
(f) Check the tension between the intake and exhaust camshaft timing sprockets.

2. INSTALL OIL PUMP SEAL (See page EM-106)

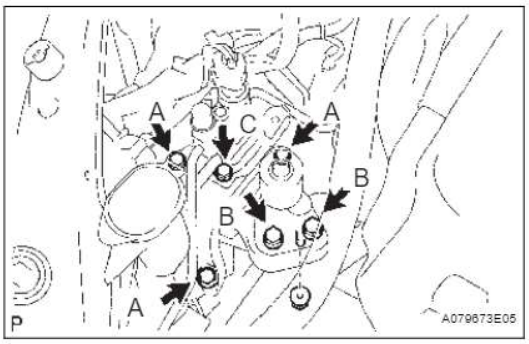
3. INSTALL TIMING CHAIN COVER (See page EM-118)

4. INSTALL WATER PUMP (See page EM-120)

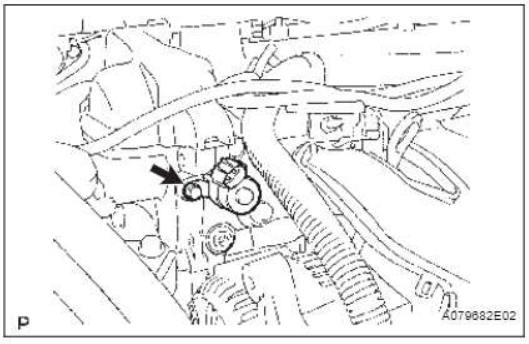
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5. **INSTALL ENGINE MOUNTING BRACKET RH**
   (a) Install the mounting bracket RH with the 4 bolts.
   Torque: 55 N*m (561 kgf*cm, 41 ft.*lbf)



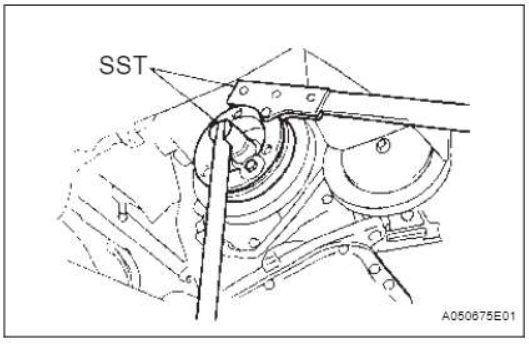
6. **INSTALL ENGINE MOUNTING INSULATOR RH**
   (a) Install the mounting insulator with the 5 bolts and nut.
   Torque: 45 N*m (459 kgf*cm, 33 ft.*lbf) for bolt A
   52 N*m (530 kgf*cm, 38 ft.*lbf) for bolt B and nut
   (b) Install the liquid tube with the bolt.
   Torque: 9.8 N*m (100 kgf*cm, 7 ft.*lbf) for bolt C



7. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**
   (a) Apply a light coat of engine oil to a new O-ring, and install it onto the camshaft timing oil control valve.
   (b) Install the camshaft timing oil control valve with the bolt.
   Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)
   NOTICE:
   Be careful not to twist an O-ring.

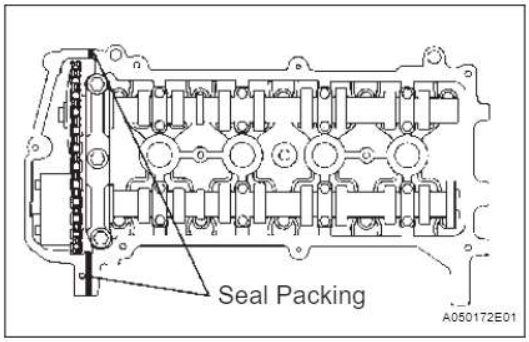
8. **INSTALL CRANKSHAFT POSITION SENSOR (See page ES-339)**

9. **INSTALL WATER PUMP PULLEY (See page EM-121)**



10. **INSTALL CRANKSHAFT PULLEY**
    (a) Align the pin hole of the crankshaft pulley with the pin position and install the crankshaft pulley.
    (b) Using SST, install the pulley bolt.
    SST 09330-00021, 09213-58012 (91111-50845)
    Torque: 128 N*m (1,305 kgf*cm, 95 ft.*lbf)

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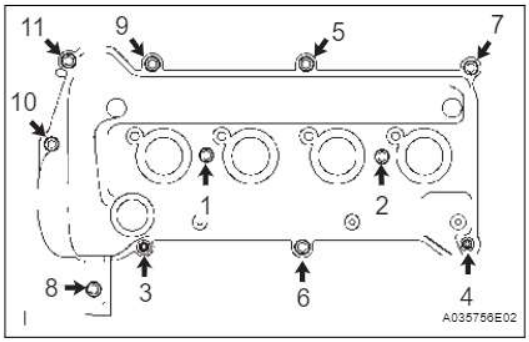
11. INSTALL CYLINDER HEAD COVER

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

Seal packing:
Part No. 08826-00080 or equivalent

NOTICE:

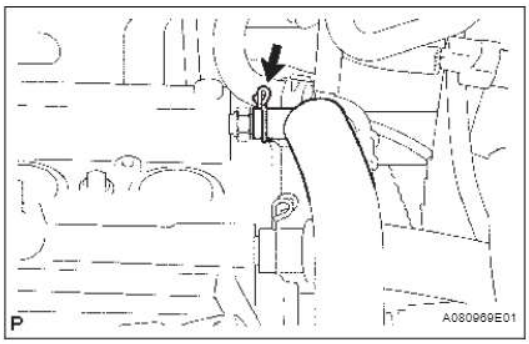
- **Remove any oil from the contact surface.**
- **Install the cylinder head cover within 3 minutes of applying seal packing.**
- **Do not start the engine for at least 2 hours after installation.**



(b) Install the head cover with the 9 bolts, 2 seal washers and 2 nuts.

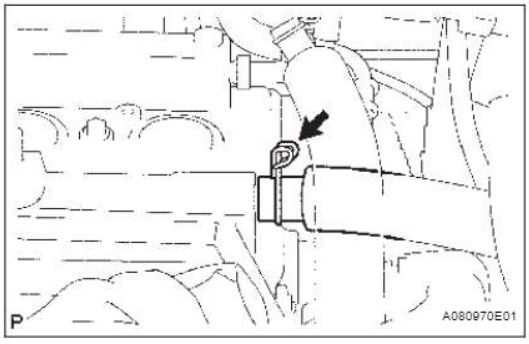
(c) Using several steps, uniformly tighten the bolts and nuts in the sequence shown in the illustration.

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



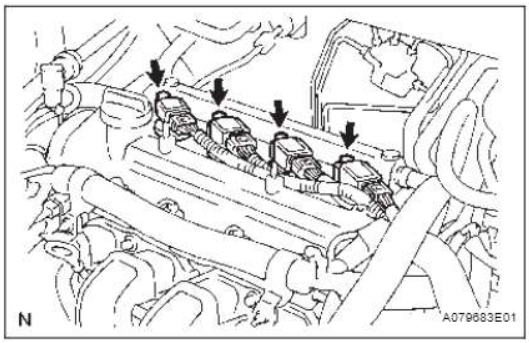
12. CONNECT NO. 2 VENTILATION HOSE

(a) Connect the No. 2 ventilation hose to the cylinder head cover.



13. CONNECT VENTILATION HOSE

(a) Connect the ventilation hose to the cylinder head cover.

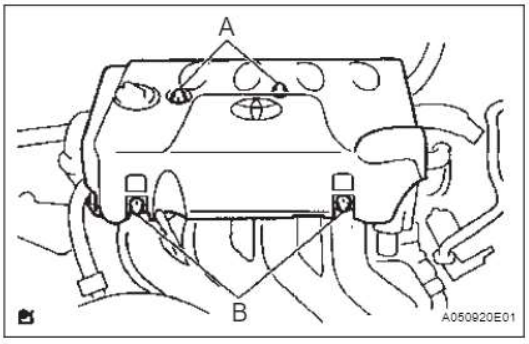


14. INSTALL IGNITION COIL

(a) Install the 4 ignition coils with the 4 bolts.

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

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15. **INSTALL NO. 2 CYLINDER HEAD COVER**
    (a) First tighten the nuts labeled A, and then tighten the nuts labeled B.
    Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)
16. **INSTALL GENERATOR (See page CH-15)**
17. **INSTALL VANE PUMP V BELT (See page EM-7)**
18. **INSTALL GENERATOR V BELT (See page EM-7)**
19. **ADJUST GENERATOR V BELT (See page EM-7)**
20. **ADJUST VANE PUMP V BELT (See page EM-7)**
21. **INSPECT DRIVE BELT TENSION (See page EM-6)**
22. **INSTALL OIL PAN DRAIN PLUG**
    (a) Install the drain plug with a new gasket.
    Torque: 37.5 N*m (383 kgf*cm, 28 ft.*lbf)
23. **ADD ENGINE OIL (See page LU-3)**
24. **CHECK FOR ENGINE OIL LEAKS**
25. **ADD COOLANT (See page CO-5)**
26. **CHECK FOR ENGINE COOLANT LEAKS (See page CO-7)**
27. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
28. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-23).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

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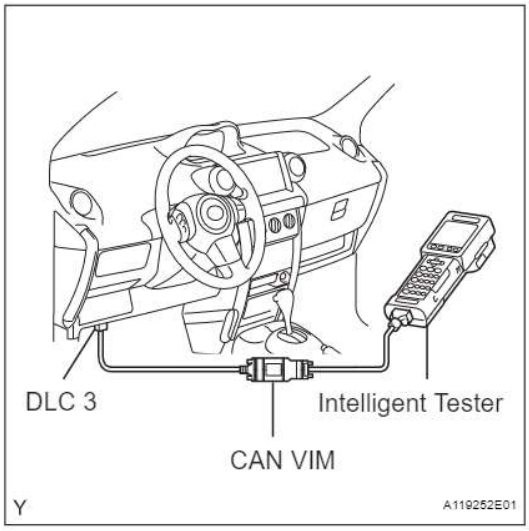
ENGINE

ON-VEHICLE INSPECTION

1. INSPECT AIR CLEANER FILTER ELEMENT

(a) Remove the air filter.

(b) Visually check that the air filter is not excessively damaged or oily.
If necessary, replace the air filter.



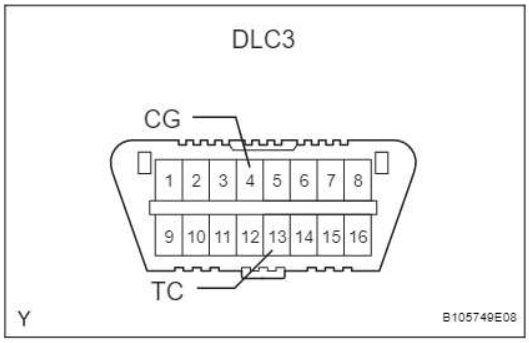
2. INSPECT IGNITION TIMING

(a) Warm up the engine.

(b) When using the intelligent tester or OBD II scan tool:

(1) Connect the intelligent tester or OBD II scan tool to the DLC3.

(2) Enter DATA LIST MODE on the intelligent tester or OBD II scan tool.
Standard ignition timing:
8 to 12° BTDC @ idle
HINT:
Refer to the intelligent tester or OBD II scan tool operator's manual if you need help to select the DATA LIST.

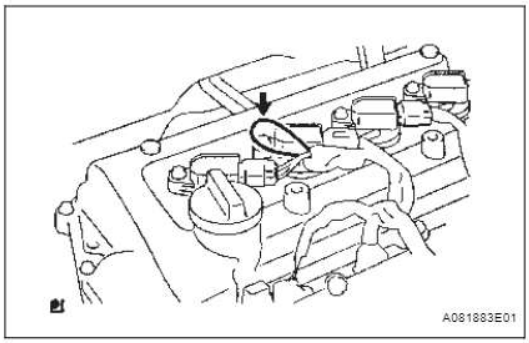


(c) When not using the intelligent tester or OBD II scan tool:

(1) Using SST, connect terminals 13 (TC) and 4 (CG) of the DLC3.
SST 09843-18040
NOTICE:
- **Confirm the terminal numbers before connecting them. Connection with a wrong terminal could damage the engine.**
- **Turn OFF all electrical systems before connecting the terminals.**
- **Perform this inspection after the cooling fan motor is turned OFF.**

(2) Remove the No. 2 cylinder head cover.

(3) Pull out the wire harness as shown in the illustration.



(4) Connect the clip of the timing light to the engine.
NOTICE:
- **Use a timing light which can detect the first signal.**
- **After checking, be sure to tape the wire harness.**

(5) Check the ignition timing.
Standard ignition timing:
8 to 12° BTDC @ idle

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NOTICE:
When checking the ignition timing, shift the transmission to the park or neutral position.
HINT:
Run the engine at 1,000 to 1,300 rpm for 5 seconds, and check that the engine rpm returns to idle speed.

(6) Disconnect terminals 13 (TC) and 4 (CG) of the DLC3.
(7) Check the ignition timing.
Standard ignition timing:
0 to 14° BTDC @ idle
(8) Confirm that ignition timing advances when the engine rpm is increased.
(9) Remove the timing light.

EM

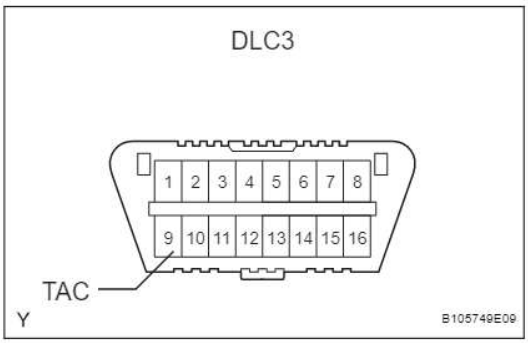
3. INSPECT ENGINE IDLE SPEED

(a) Warm up the engine.
(b) When using the intelligent tester or OBD II scan tool:
(1) Connect the intelligent tester or OBD II scan tool to the DLC3.
(2) Enter DATA LIST MODE on the intelligent tester or OBD II scan tool.
Standard idle speed

Transmission	Specified Condition
M/T	600 to 700 rpm
A/T	650 to 750 rpm

NOTICE:
- **When checking the idle speed, the transmission is in the park or neutral position.**
- **Check the idle speed with the cooling fan OFF.**
- **Switch off all accessories and air conditioning before connecting the intelligent tester or OBD II scan tool.**

HINT:
Refer to the intelligent tester or OBD II scan tool operator's manual if you need help to select the DATA LIST.



(c) When not using the intelligent tester or OBD II scan tool:
(1) Using SST, connect the tachometer test lead to terminal 9 (TAC) of the DLC3.
SST 09843-18040
(2) Check the idle speed.
Standard idle speed

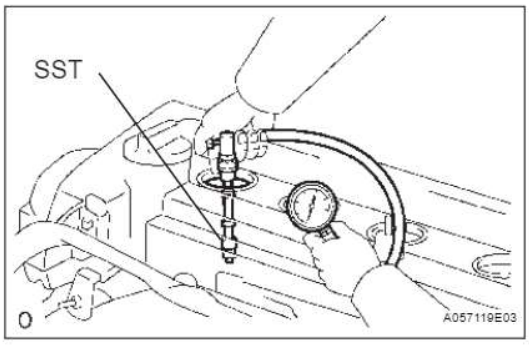
Transmission	Specified Condition
M/T	600 to 700 rpm
A/T	650 to 750 rpm

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NOTICE:
- **When checking the idle speed, the transmission is in the park or neutral position.**
- **Check the idle speed with the cooling fan OFF.**
- **Switch off all accessories and air conditioning before connecting the test lead to the terminal.**

4. INSPECT COMPRESSION

(a) Warm up and stop the engine.
(b) Disconnect the injector connectors.
(c) Remove the ignition coils.
(d) Remove the spark plugs.



(e) Inspect cylinder compression pressure.
(1) Connect SST (attachment) to a compression gauge.
SST 09992-00500
(2) Install the compression gauge with SST into the spark plug hole.
(3) Fully open the throttle.
(4) While cranking the engine, measure the compression pressure.
Standard compression pressure:
1,471 kPa (15.0 kgf/cm^2, 213 psi)
Minimum pressure:
1,079 kPa (11.0 kgf/cm^2, 156 psi)
Difference between each cylinder:
98 kPa (1.0 kgf/cm^2, 14 psi)
NOTICE:
- **Always use a fully charged battery to obtain an engine speed of 250 rpm or more.**
- **Check other cylinder's compression pressure in the same way.**
- **This measurement must be done in as short a time as possible.**

(5) If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and check 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 sticking or seated improperly, or there may be leakage past the cylinder head gasket.

5. INSPECT CO/HC

(a) Start the engine.
(b) Run the engine at 2,500 rpm for approximately 180 seconds.
(c) Insert CO/HC meter testing probe at least 40 cm (1.3 ft.) into tailpipe during idling.

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(d) When performing the 2 mode (2,500 rpm and idle) test, check that the CO/HC concentration complies with local regulations.
HINT:
When doing the 2 mode (with the engine at idle and 2,500 rpm) test, these procedures may vary according to local rules.

(e) If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
(1) Check the heated oxygen sensor operation (see pageES-110).
(2) See the table below for possible causes, and then inspect the applicable causes and repair it if necessary.

EM

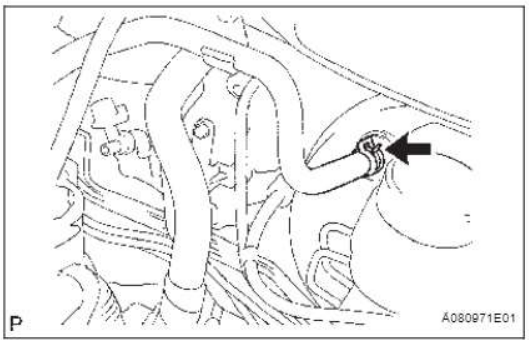
CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignition: – Incorrect timing – Plugs are contaminated, plugs are shorted or plug gaps are incorrect 2. Incorrect valve clearance 3. Leaks in intake and exhaust valves 4. Leaks in cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: – Ventilation hoses – Intake manifold – Throttle body – IAC valve – Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged ventilation valve 3. Faulty SFI system: – Faulty pressure regulator – Defective ECT sensor – Defective mass air flow meter – Faulty ECM – Faulty injectors – Faulty throttle position sensor

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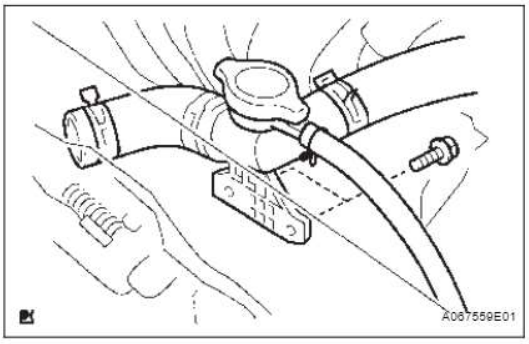
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REMOVAL

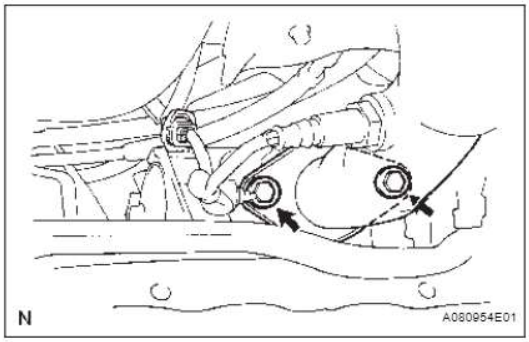
1. **DISCHARGE FUEL SYSTEM PRESSURE (See page FU-11)**
2. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
3. **REMOVE AIR CLEANER (See page ES-346)**
4. **REMOVE NO. 2 CYLINDER HEAD COVER (See page EM-25)**
5. **REMOVE FRONT WHEEL RH**
6. **REMOVE ENGINE UNDER COVER RH**
7. **DRAIN ENGINE OIL**
8. **DRAIN ENGINE COOLANT (See page CO-5)**
9. **DISCONNECT ENGINE WIRE**
10. **DISCONNECT ACCELERATOR CONTROL CABLE (See page ES-346)**
11. **DISCONNECT FUEL TUBE (See page FU-12)**
12. **DISCONNECT UNION TO CHECK VALVE HOSE**
    (a) Disconnect the union to check valve hose for the brake booster.



13. **DISCONNECT RADIATOR HOSE INLET**
    (a) Disconnect the radiator hose inlet from the union.
14. **DISCONNECT NO. 1 WATER BY-PASS PIPE**
    (a) Remove the bolt and disconnect the water by-pass pipe.
15. **DISCONNECT HEATER WATER INLET HOSE**
    (a) Disconnect the heater water inlet hose from the No. 2 water by-pass pipe.
16. **REMOVE WATER FILLER**
    (a) Disconnect the radiator inlet hose.
    (b) Disconnect the No. 3 radiator hose.
    (c) Disconnect the radiator reservoir hose.
    (d) Remove the 2 bolts and water filler.

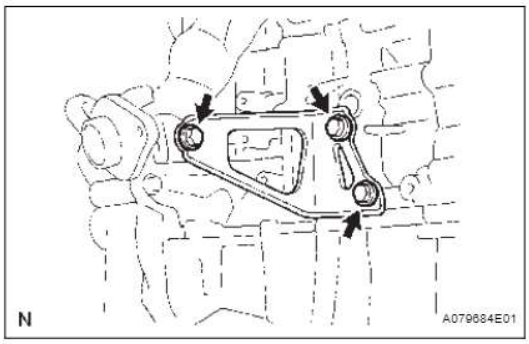


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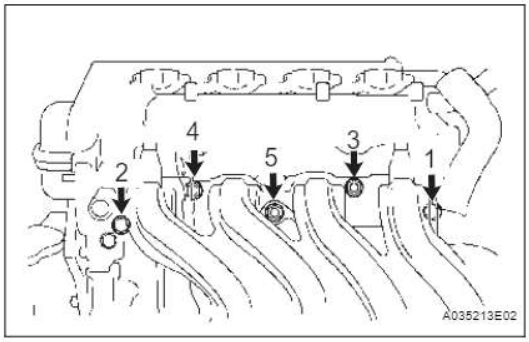
17. **DISCONNECT FRONT EXHAUST PIPE**
    (a) Remove the 2 bolts and 2 compression springs which are installed on the front side of the exhaust pipe.

18. **REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR**
    (a) Remove the 4 bolts and exhaust manifold heat insulator.

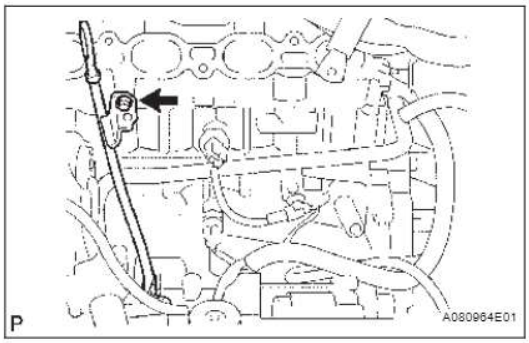


19. **REMOVE MANIFOLD SUPPORT BRACKET**
    (a) Remove the 3 bolts and manifold support bracket.

20. **REMOVE EXHAUST MANIFOLD**
    (a) Remove the 3 bolts, 2 nuts, exhaust manifold and gasket.



21. **REMOVE INTAKE MANIFOLD**
    (a) Using several steps, remove the 3 bolts and 2 nuts in the sequence shown in the illustration. Then remove the intake manifold.
    (b) Remove the gasket from the intake manifold.



22. **REMOVE OIL DIPSTICK GUIDE**
    (a) Remove the bolt and dipstick guide.

23. **REMOVE IGNITION COIL (See page EM-25)**

24. **REMOVE GENERATOR V BELT (See page EM-7)**

25. **REMOVE VANE PUMP V BELT (See page EM-7)**

26. **REMOVE GENERATOR (See page CH-9)**

27. **REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page EM-27)**

28. **DISCONNECT VENTILATION HOSE (See page EM-25)**

29. **DISCONNECT NO. 2 VENTILATION HOSE (See page EM-25)**

30. **REMOVE CYLINDER HEAD COVER (See page EM-26)**

31. **REMOVE WATER PUMP PULLEY (See page EM-91)**

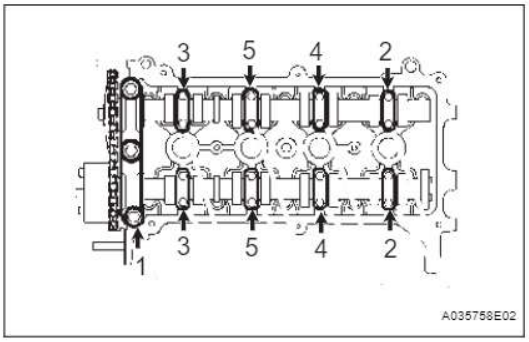
32. **REMOVE TIMING CHAIN COVER (See page EM-92)**

33. **REMOVE WATER PUMP (See page EM-92)**

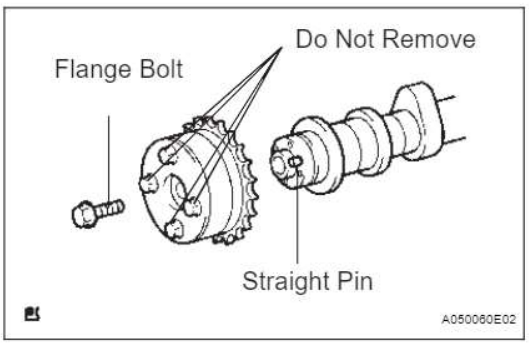
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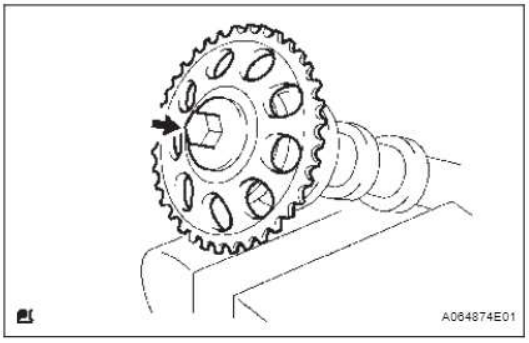
34. **REMOVE CRANKSHAFT PULLEY (See page EM-26)**
35. **REMOVE CRANKSHAFT POSITION SENSOR (See page ES-338)**
36. **REMOVE ENGINE MOUNTING INSULATOR RH (See page EM-27)**
37. **REMOVE ENGINE MOUNTING BRACKET RH (See page EM-27)**
38. **REMOVE NO. 1 CHAIN TENSIONER (See page EM-27)**
39. **REMOVE CHAIN TENSIONER SLIPPER (See page EM-27)**
40. **REMOVE NO. 1 CHAIN VIBRATION DAMPER (See page EM-27)**
41. **REMOVE CHAIN**
42. **REMOVE FUEL DELIVERY PIPE (See page EM-93)**
43. **REMOVE FUEL INJECTOR (See page EM-93)**
44. **REMOVE CAMSHAFT**
    (a) Using several steps, uniformly loosen and remove the 19 bearing cap bolts in the sequence shown in the illustration, and then remove the 9 bearing caps, and the No. 1 and No. 2 camshafts.
    NOTICE:
    Loosen each bolt uniformly, keeping the camshaft level.



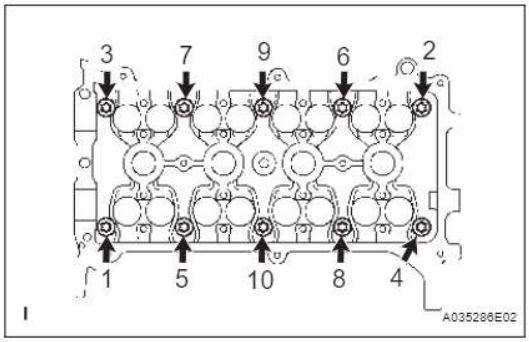
45. **REMOVE CAMSHAFT TIMING GEAR**
    (a) Turn the camshaft timing gear at the most advanced angle (see page EM-49).
    (b) Remove the flange bolt and camshaft timing gear.
    NOTICE:
    - **Be careful not to remove the other 4 bolts.**
    - **If reusing the camshaft timing gear, unlock the lock pin inside the camshaft timing gear first.**



46. **REMOVE CAMSHAFT TIMING SPROCKET**
    (a) Clamp the camshaft in a vise.
    (b) Remove the flange bolt and camshaft timing sprocket.
    NOTICE:
    Be careful not to damage the camshaft.



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47. REMOVE CYLINDER HEAD

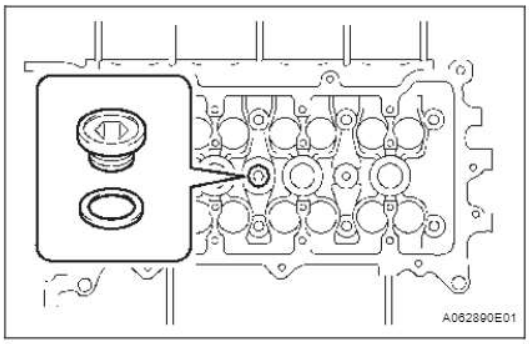
(a) Using several steps, uniformly loosen and remove the 10 cylinder head bolts with an 8 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

NOTICE:

- **Be careful not to drop the washers into the cylinder head.**
- **Head warpage or cracking could result from removing bolts in the incorrect order.**

48. REMOVE CYLINDER HEAD GASKET

DISASSEMBLY



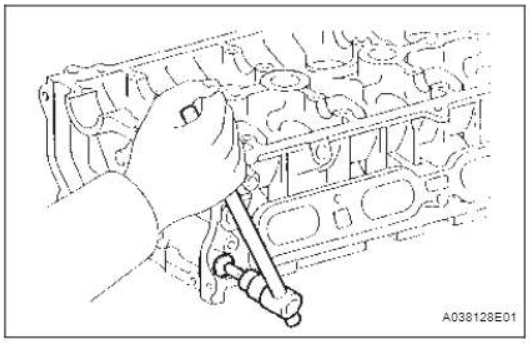
1. REMOVE NO. 1 TAPER SCREW PLUG

(a) Using a 10 mm hexagon wrench, remove the taper screw plug and gasket.

2. REMOVE VALVE LIFTER

HINT:

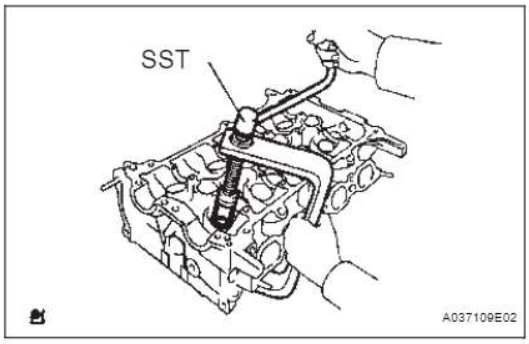
Keep the valve lifters in the correct order so they can be returned to the original locations when reassembling.



3. REMOVE OIL CONTROL VALVE FILTER

(a) Using an 8 mm hexagon wrench, remove the taper screw plug.

(b) Remove the filter and gasket.



4. REMOVE INTAKE VALVE

(a) Using SST, compress the valve spring and remove the 2 retainer locks, valve, retainer and valve spring.

SST 09202-70020 (09202-00010)

HINT:

Keep the valves, valve springs and spring retainers in the correct order so they can be returned to the original locations when reassembling.

5. REMOVE EXHAUST VALVE

(a) Using SST, compress the valve spring and remove the 2 retainer locks, valve, retainer and valve spring.

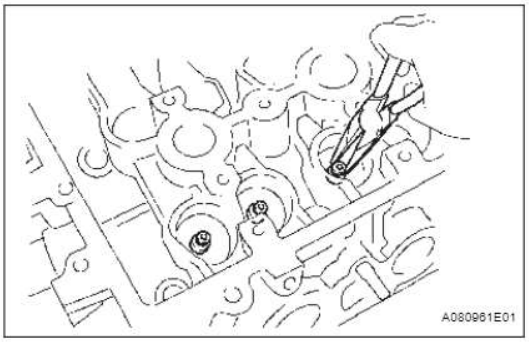
SST 09202-70020 (09202-00010)

HINT:

Keep the valves, valve springs and spring retainers in the correct order so they can be returned to the original locations when reassembling.

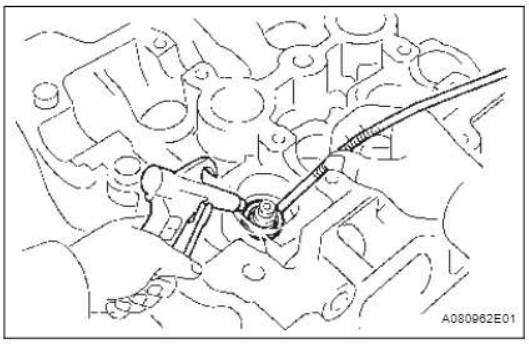
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6. REMOVE VALVE STEM OIL SEAL

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



7. REMOVE VALVE SPRING SEAT

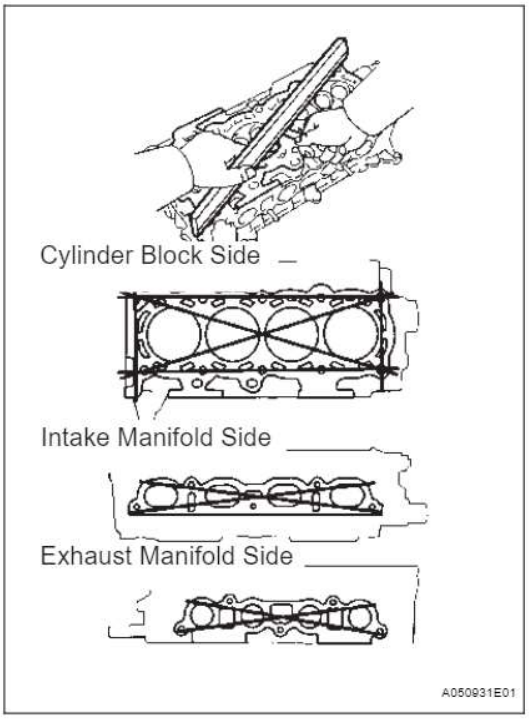
(a) Using compressed air and a magnetic finger, remove the valve spring seat.
HINT:
Keep the valve seats in the correct order so they can be returned to the original locations when reassembling.

8. REMOVE UNION

9. REMOVE STUD BOLT

(a) Using E5 and E7 "torx" sockets, remove the 7 stud bolts.

10. REMOVE CAMSHAFT BEARING CAP SETTING RING PIN



INSPECTION

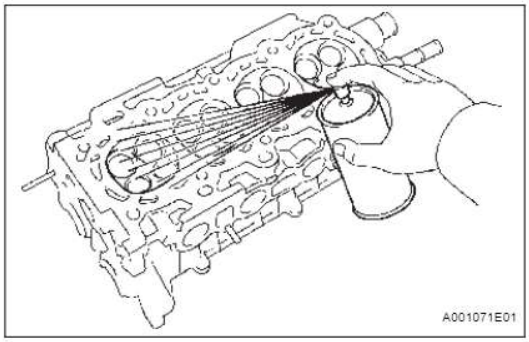
1. INSPECT CYLINDER HEAD FOR FLATNESS

(a) Using a precision straightedge and feeler gauge, measure the surface that is in contact with the cylinder block and the manifolds for warpage.
Maximum warpage

Surface	Specified Condition
Cylinder block side	0.05 mm (0.0020 in.)
Intake manifold side	0.10 mm (0.0039 in.)
Exhaust manifold side	0.10 mm (0.0039 in.)

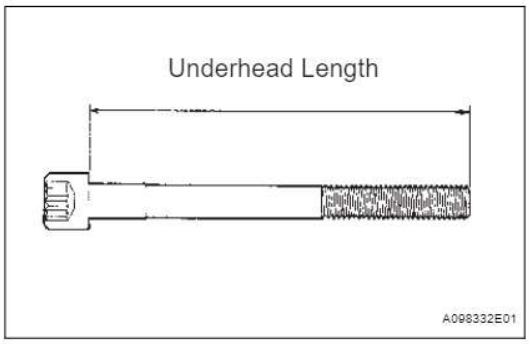
If the warpage is greater than the maximum, replace the cylinder head.

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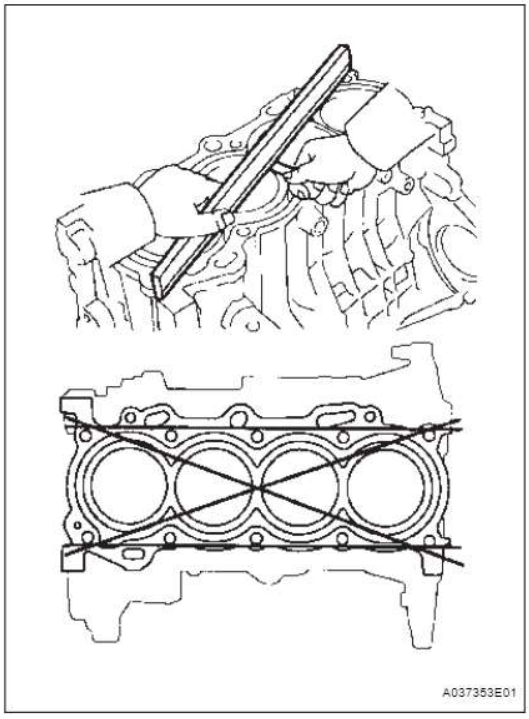
2. INSPECT CYLINDER HEAD FOR CRACKS

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



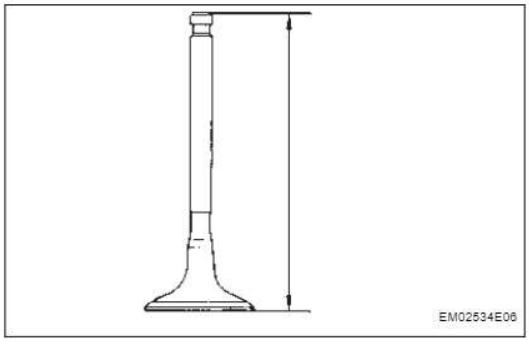
3. INSPECT CYLINDER HEAD SET BOLT

(a) Using a vernier caliper, measure the length of head bolts from the seat to the end.
Standard length:
142.8 to 144.2 mm (5.622 to 5.677 in.)
Maximum length:
147.1 mm (5.791 in.)
If the length is greater than the maximum, replace the bolt.



4. INSPECT CYLINDER BLOCK FOR FLATNESS

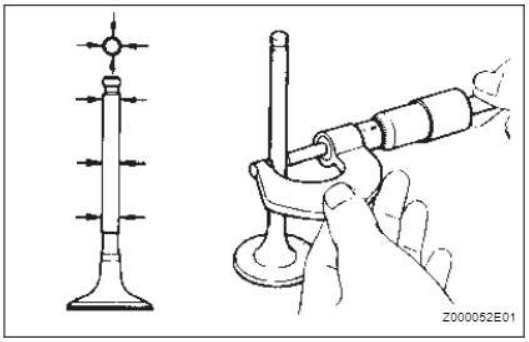
(a) Using a precision straightedge and feeler gauge, measure the surface which is in contact with the cylinder head gasket for warpage.
Maximum warpage:
0.05 mm (0.0020 in.)
If the warpage is greater than the maximum, replace the cylinder block.



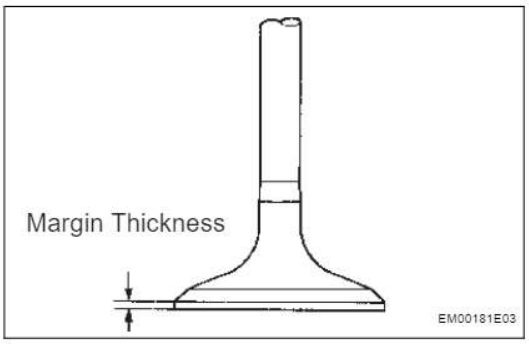
5. INSPECT INTAKE VALVE

(a) Check the overall valve length.
Standard overall length:
89.25 mm (3.5138 in.)
Minimum overall length:
88.75 mm (3.4941 in.)
If the overall length is less than the minimum, replace the valve.

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(b) Using a micrometer, measure the diameter of the valve stem.
Standard valve stem diameter:
4.970 to 4.985 mm (0.1957 to 0.1963 in.)



(c) Check the valve head margin thickness.
Standard margin thickness:
1.0 mm (0.039 in.)
Minimum margin thickness:
0.7 mm (0.028 in.)
If the margin thickness is less than the minimum, replace the valve.

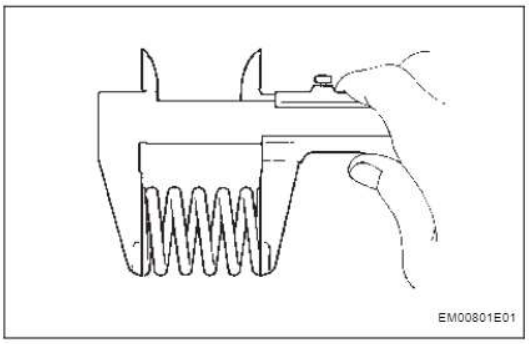
6. INSPECT EXHAUST VALVE

(a) Check the overall valve length.
Standard overall length:
87.90 mm (3.4606 in.)
Minimum overall length:
87.40 mm (3.4409 in.)
If the overall length is less than the minimum, replace the valve.

(b) Using a micrometer, measure the diameter of the valve stem.
Standard valve stem diameter:
4.965 to 4.980 mm (0.1955 to 0.1961 in.)

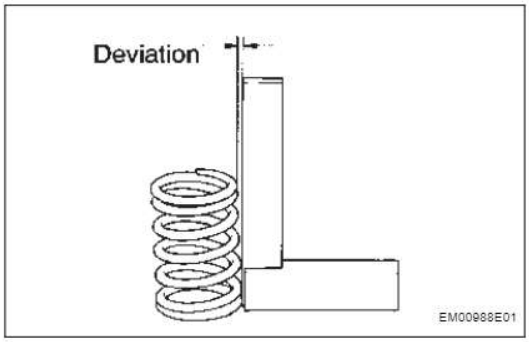
(c) Check the valve head margin thickness.
Standard margin thickness:
1.15 mm (0.045 in.)
Minimum margin thickness:
0.7 mm (0.028 in.)
If the margin thickness is less than the minimum, replace the valve.

7. INSPECT VALVE SPRING

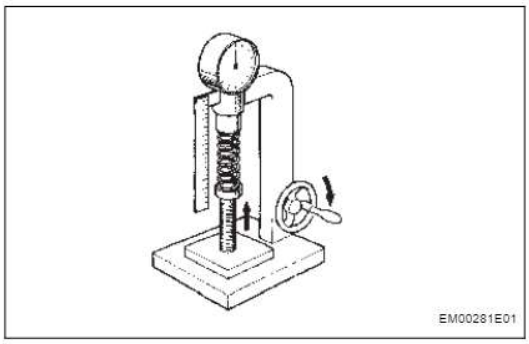


(a) Using a vernier caliper, measure the free length of the valve spring.
Standard free length:
45.05 to 45.15 mm (1.774 to 1.778 in.)
If the free length is not as specified, replace the spring.

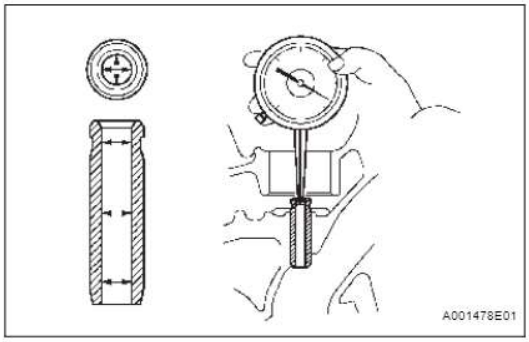
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(b) Using a steel square, measure the deviation of the valve spring.
Maximum deviation:
1.6 mm (0.063 in.)
Maximum angle (reference):
2°
If the deviation is greater than the maximum, replace the spring.



(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.
Standard installed tension:
149 to 165 N (15.2 to 16.8 kgf, 33.5 to 37.1 lbf) at 32.5 mm (1.280 in.)
Maximum working tension:
286 to 316 N (29.1 to 32.2 kgf, 64.2 to 71.0 lbf) at 23.9 mm (0.941 in.)
If the installed tension is not as specified, replace the valve spring.



8. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the guide bush.
Bush inside diameter:
5.010 to 5.030 mm (0.1972 to 0.1980 in.)

(b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.
Standard oil clearance

Guide Bush	Specified Condition
Intake	0.025 to 0.060 mm (0.0010 to 0.0024 in.)
Exhaust	0.030 to 0.065 mm (0.0012 to 0.0026 in.)

Maximum oil clearance

Guide Bush	Specified Condition
Intake	0.08 mm (0.0032 in.)
Exhaust	0.10 mm (0.0039 in.)

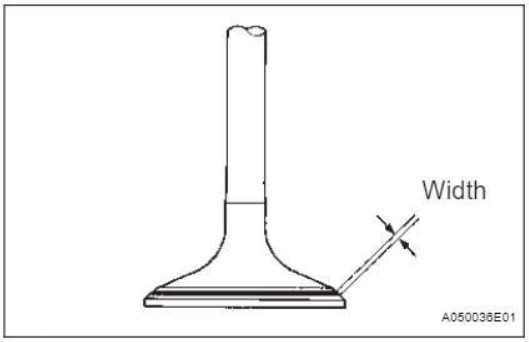
If the clearance is greater than the maximum, replace the valve and guide bush (see page EM-53).

9. INSPECT INTAKE VALVE SEAT

(a) Apply a light coat of Prussian blue (or white lead) to the valve face.

(b) Lightly press the valve against the seat.

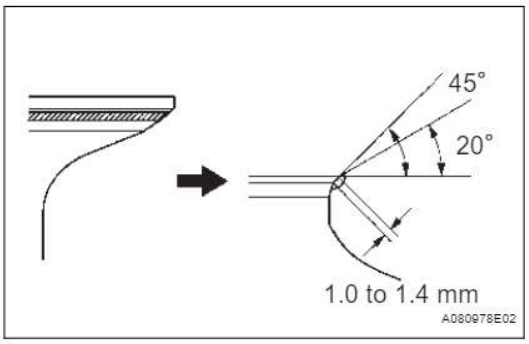
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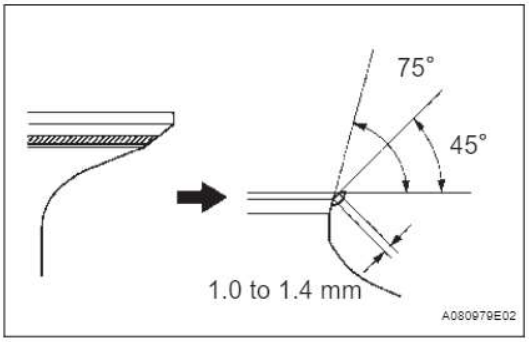
(c) Check the valve face and seat according to the following procedure.
  (1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
  (2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
  (3) Check that the seat contact is in the middle of the valve face with the width between 1.0 to 1.4 mm (0.039 to 0.055 in.).

10. REPAIR INTAKE VALVE SEAT

(a) If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.

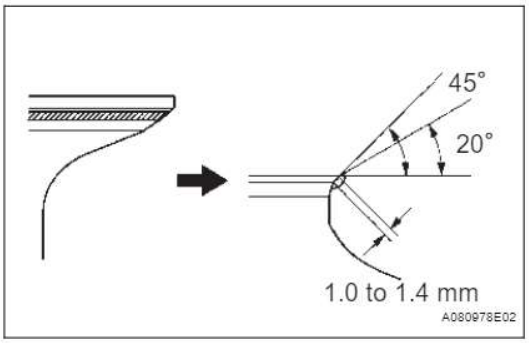


(b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
(c) Hand-lab the valve and valve seat with an abrasive compound.
(d) Recheck the valve seating position.

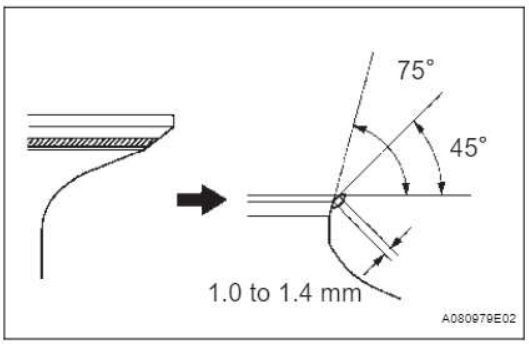


11. REPAIR EXHAUST VALVE SEAT

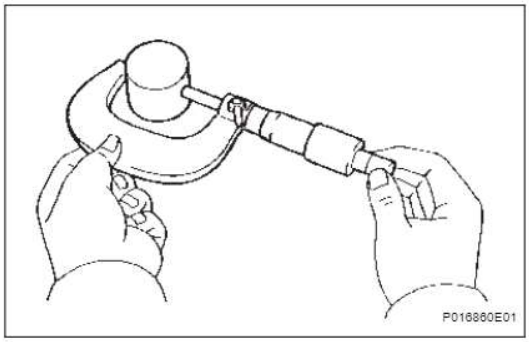
(a) If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.



(b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
(c) Hand-lap the valve and valve seat with an abrasive compound.
(d) Recheck the valve seating position.

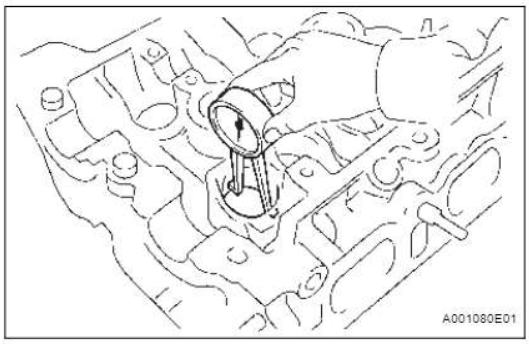


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12. INSPECT VALVE LIFTER

(a) Using a micrometer, measure the lifter diameter.
Standard lifter diameter:
30.966 to 30.976 mm (1.2191 to 1.2195 in.)



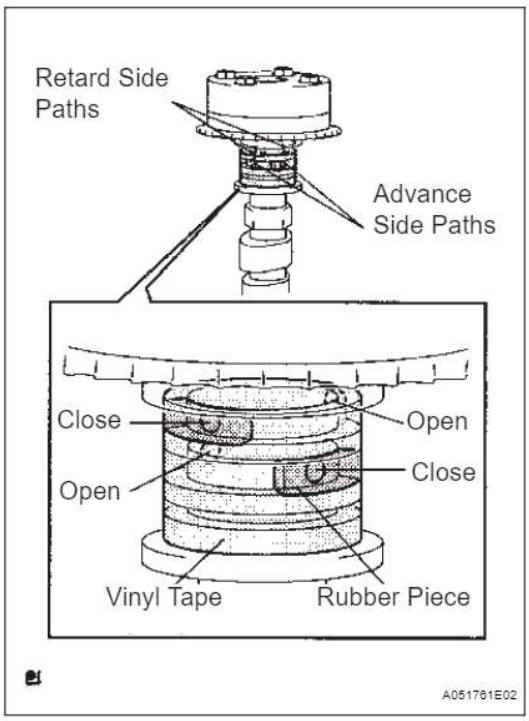
13. INSPECT VALVE LIFTER OIL CLEARANCE

(a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.
Standard lifter bore diameter:
31.000 to 31.025 mm (1.2205 to 1.2215 in.)

(b) Subtract the lifter diameter measurement from the lifter bore diameter measurement.
Standard oil clearance:
0.024 to 0.059 mm (0.0009 to 0.0023 in.)
Maximum oil clearance:
0.1 mm (0.0039 in.)
If the oil clearance is greater than the maximum, replace the lifter. If necessary, replace the cylinder head.

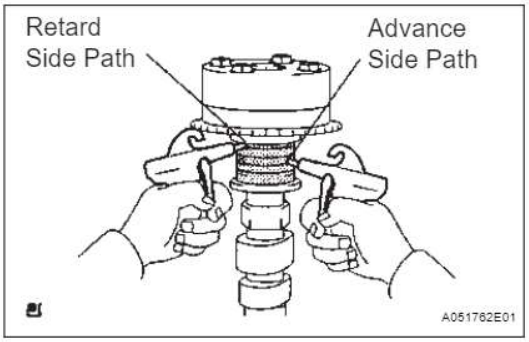
14. INSPECT CAMSHAFT TIMING GEAR OPERATION

(a) Check the lock of the camshaft timing gear.
(1) Clamp the camshaft in a vise, and check that the camshaft timing gear is locked.
NOTICE:
Be careful not to damage the camshaft.

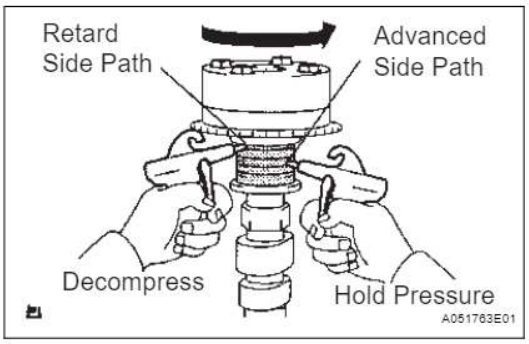


(b) Release the lock pin.
(1) Cover the 4 oil paths of the cam journal with tape as shown in the illustration.
HINT:
One of the 2 grooves located on the cam journal is for retarding cam timing (upper) and the other is for advancing cam timing (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with the tape.
(2) Puncture the tape for the advance oil path and for the retard oil path on the opposite side from the advance oil path.

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(3) Apply air pressure into the 2 broken tape paths (the advance side path and retard side path) with about 150 kPa (1.5 kgf/cm^2, 22 psi).
NOTICE:
Cover the paths with cloth or equivalent to prevent oil from splashing.



(4) Confirm if the camshaft timing gear assembly revolves in the timing advance direction when reducing the air pressure of the timing retard path.
HINT:
The lock pin is released, and the camshaft timing gear revolves in the advance direction.

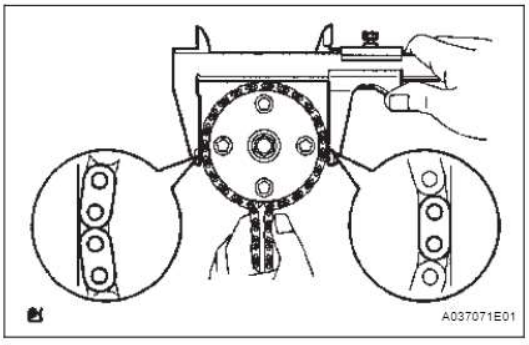
(5) When the camshaft timing gear reaches the most advanced position, remove the air pressure of the timing retard side path, and then release the air pressure of the timing advance side path.
NOTICE:
The camshaft timing gear assembly occasionally shifts to the retard side abruptly if the air compression of the advanced side path is released first. This often results in the breakage of the lock pin.

(c) Check smooth revolution.
(1) Except the position where the lock pin meets at the most retarded angle, let the valve timing controller assembly turn back and forth. Check the movable range and that there is no disturbance.
Standard condition:
Smooth movable range is about 22.5°
NOTICE:
Be sure to perform this check by hand, instead of air pressure.

(d) Check the lock in the most retarded position.
(1) Confirm that the camshaft timing gear assembly is locked at the most retarded position.

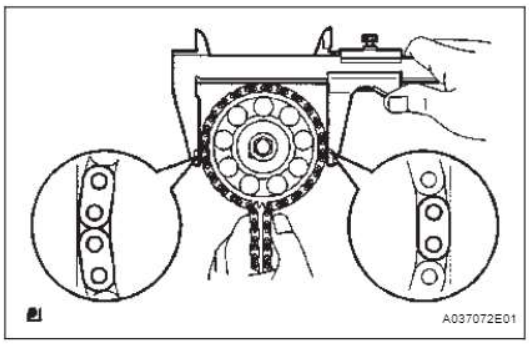
15. INSPECT CAMSHAFT TIMING GEAR

(a) Wrap the chain around the timing sprocket.
(b) Using a vernier caliper, measure the diameter of the timing gear with the chain.
Minimum gear diameter (w/ chain):
96.2 mm (3.787 in.)
If the diameter is less than the minimum, replace the sprocket.



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NOTICE:
Vernier caliper must come into contact with the chain link for measuring.



16. INSPECT CAMSHAFT TIMING SPROCKET

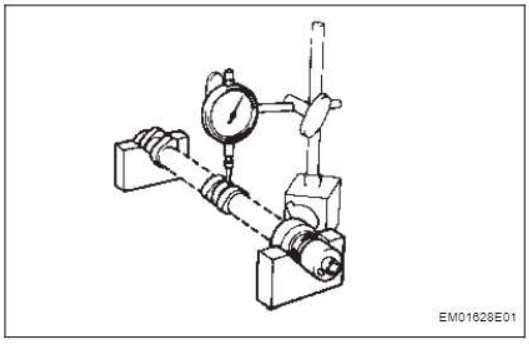
(a) Wrap the chain around the timing sprocket.

(b) Using a vernier caliper, measure the diameter of the timing gear with the chain.

Minimum gear diameter (w/ chain):
96.2 mm (3.787 in.)

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

NOTICE:
Vernier caliper must come into contact with the chain link for measuring.



17. INSPECT CAMSHAFT

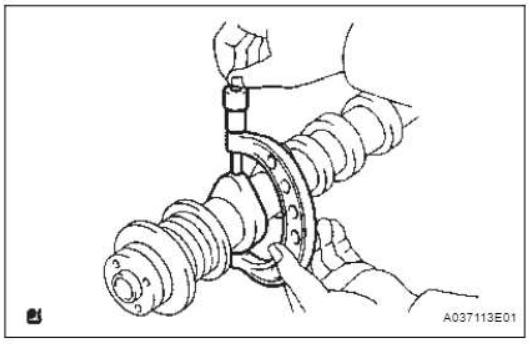
(a) Inspect the camshaft for runout.

(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.

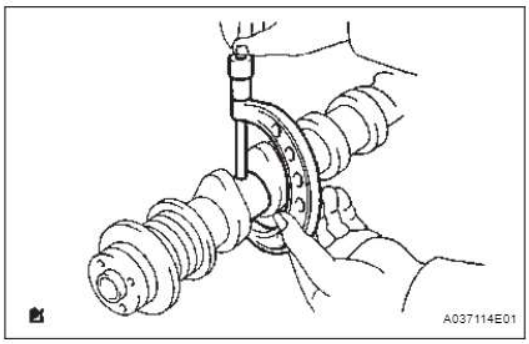


(b) Inspect the cam lobes.

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

Standard cam lobe height:
44.617 to 44.717 mm (1.7566 to 1.7605 in.)
Minimum cam lobe height:
44.47 mm (1.7508 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	Specified Condition
No.1 journal	34.449 to 34.465 mm (1.3563 to 1.3569 in.)
Other journals	22.949 to 22.965 mm (0.9035 to 0.9041 in.)

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

18. INSPECT NO. 2 CAMSHAFT

(a) Inspect the camshaft for runout.

(1) Place the camshaft on V-blocks.

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(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.

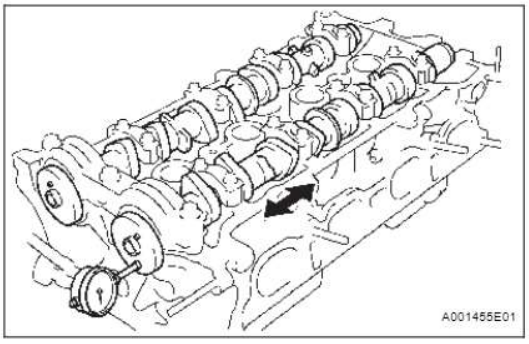
(b) Inspect the cam lobes.
(1) Using a micrometer, measure the cam lobe height.
Standard cam lobe height:
44.666 to 44.766 (1.7585 to 1.7624 in.)
Minimum cam lobe height:
44.52 mm (1.7528 in.)
If the cam lobe height is less than the minimum, replace the camshaft.

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

Journal	Specified Condition
No.1 journal	34.449 to 34.465 mm (1.3563 to 1.3569 in.)
Other journals	22.949 to 22.965 mm (0.9035 to 0.9041 in.)

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

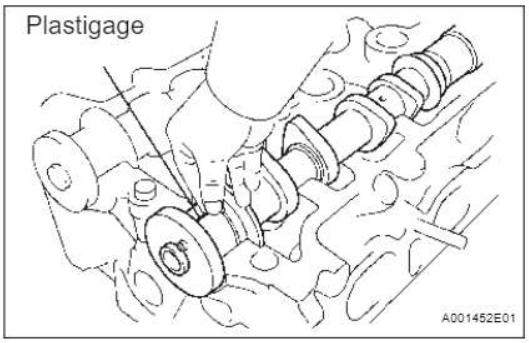
19. INSPECT CAMSHAFT THRUST CLEARANCE



(a) Install the camshafts.

(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.
Standard thrust clearance:
0.040 to 0.095 mm (0.0016 to 0.0037 in.)
Maximum thrust clearance:
0.11 mm (0.0043 in.)
If the thrust clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and the cylinder head together.

20. INSPECT CAMSHAFT OIL CLEARANCE



(a) Clean the bearing caps and the camshaft journals.

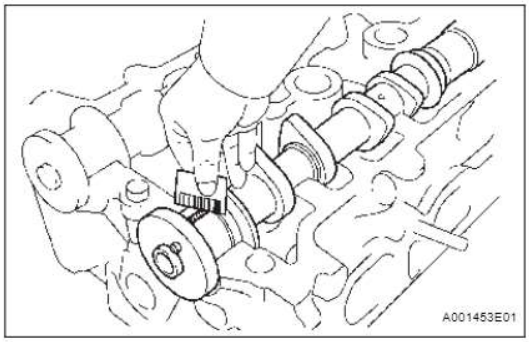
(b) Place the camshafts on the cylinder head.

(c) Lay a strip of Plastigage across each of the camshaft journals.

(d) Install the bearing caps.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf) for No. 1
13 N*m (129 kgf*cm, 9 ft.*lbf) for No. 2
NOTICE:
Do not turn the camshaft.

(e) Remove the bearing caps.

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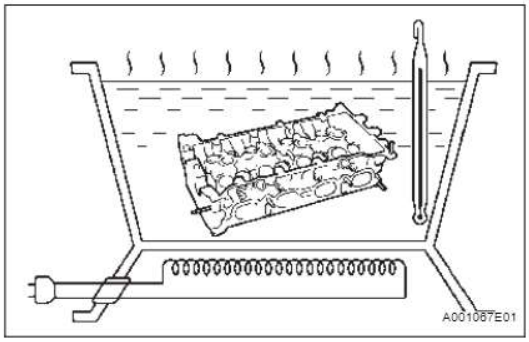


(f) Measure the Plastigage at its widest point.
Standard oil clearance:
0.040 to 0.095 mm (0.0016 to 0.0037 in.)
Maximum oil clearance:
0.115 mm (0.0045 in.)
If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the bearing caps and the cylinder head together.
NOTICE:
Completely remove the Plastigage.

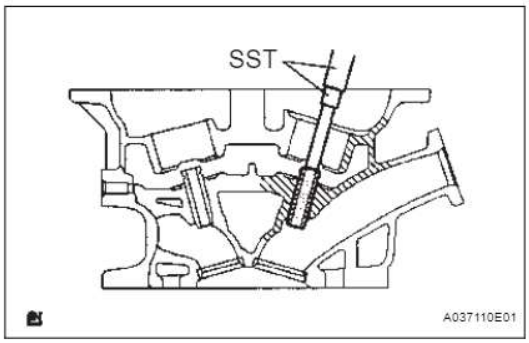
REPLACEMENT

1. REPLACE INTAKE VALVE GUIDE BUSH

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

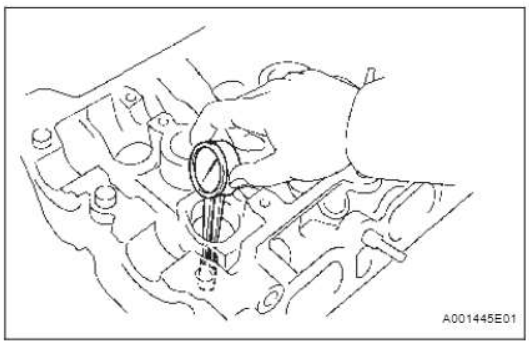


(b) Using SST and a hammer, tap out the guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



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

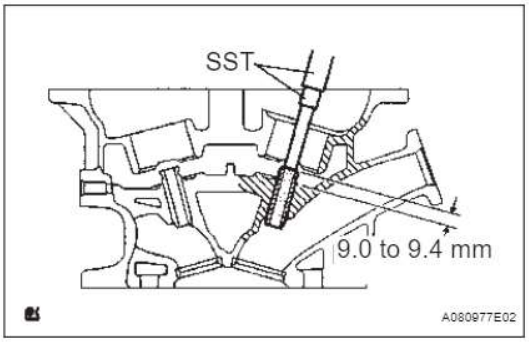
Bush size	Specified Condition
STD	9.685 to 9.706 mm (0.3813 to 0.3821 in.)
O/S 0.05	9.735 to 9.756 mm (0.3833 to 0.3841 in.)



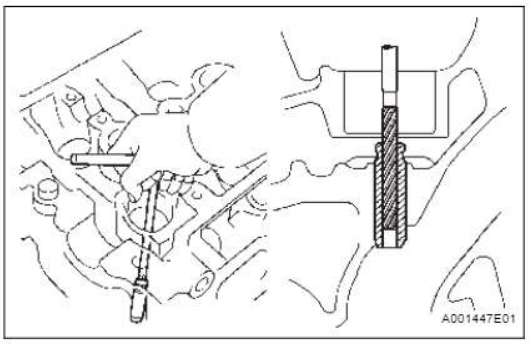
If the bush bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bush bore to a dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).
If the bush bore diameter of the cylinder head is greater than 9.756 mm (0.3841 in.), replace the cylinder head.

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

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(e) 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:
9.0 to 9.4 mm (0.354 to 0.370 in.)



(f) Using a sharp 5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and the valve stem.
Standard oil clearance:
0.025 to 0.060 mm (0.0010 to 0.0024 in.)

EM

2. REPLACE EXHAUST VALVE GUIDE BUSH

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

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

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

Bush size	Specified Condition
STD	9.685 to 9.706 mm (0.3813 to 0.3821 in.)
O/S 0.05	9.735 to 9.756 mm (0.3833 to 0.3841 in.)

If the bush bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bush bore to a dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).
If the bush bore diameter of the cylinder head is greater than 9.756 mm (0.3841 in.), replace the cylinder head.

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

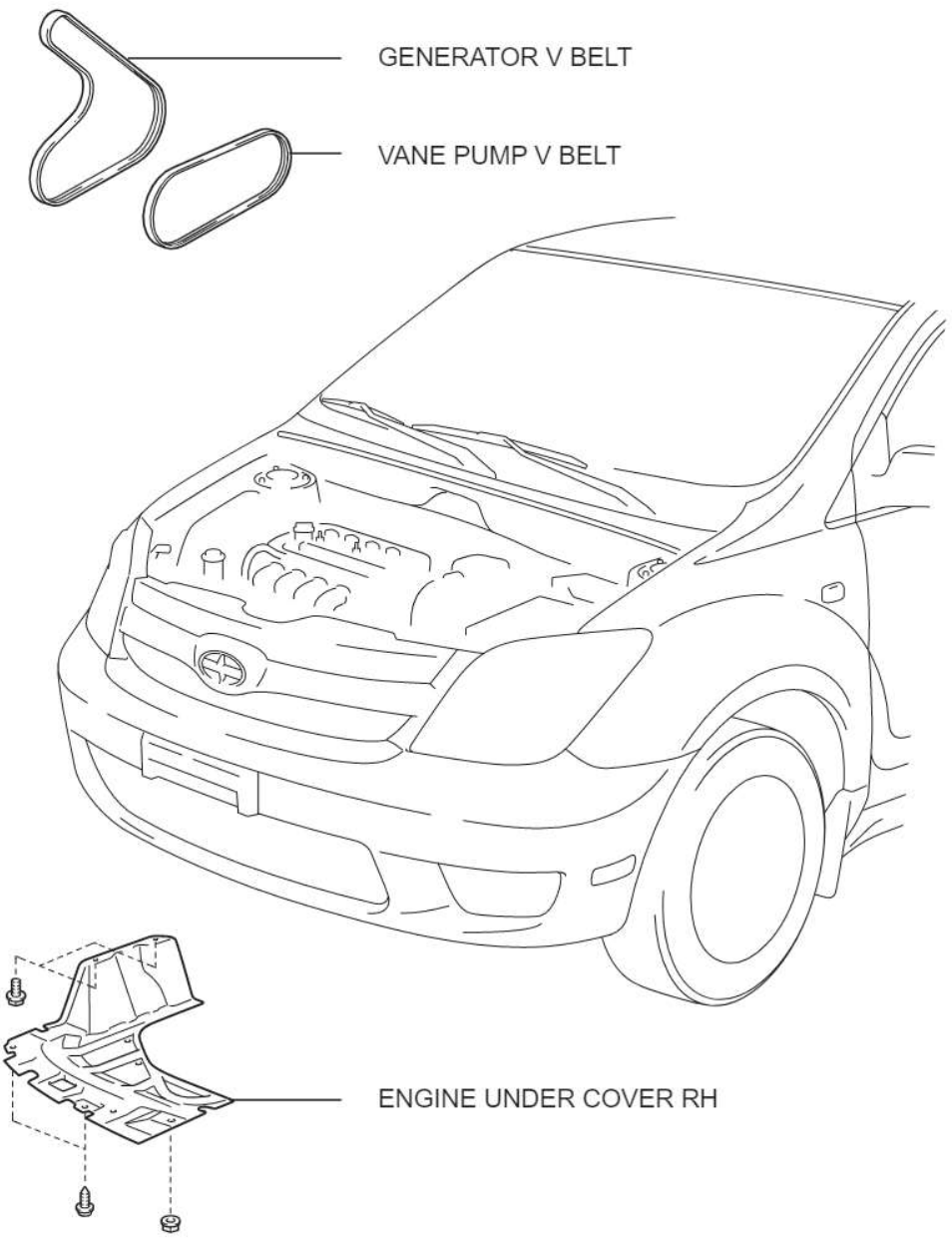
(e) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)
Standard protrusion height:
9.0 to 9.4 mm (0.354 to 0.370 in.)

(f) Using a sharp 5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and valve stem.
Standard oil clearance:
0.030 to 0.065 mm (0.0012 to 0.0026 in.)

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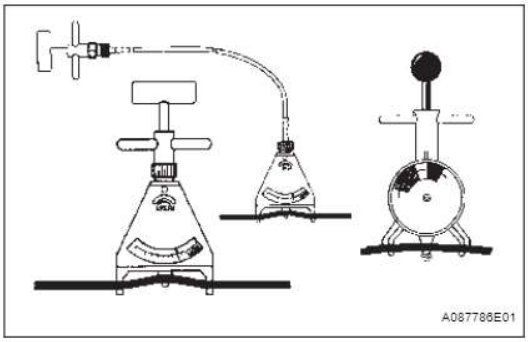
DRIVE BELT

COMPONENTS



EM

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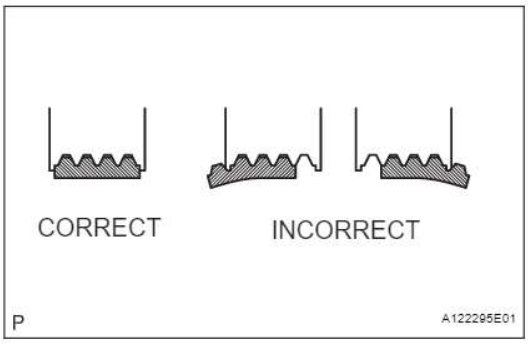
ON-VEHICLE INSPECTION

1. CHECK DRIVE BELT TENSION

(a) Using a belt tension gauge, measure the belt tension.
Belt tension gauge:
DENSO BTG- 20 (95506-00020)
Borroughs No. BT-33-73F
Standard drive belt tension

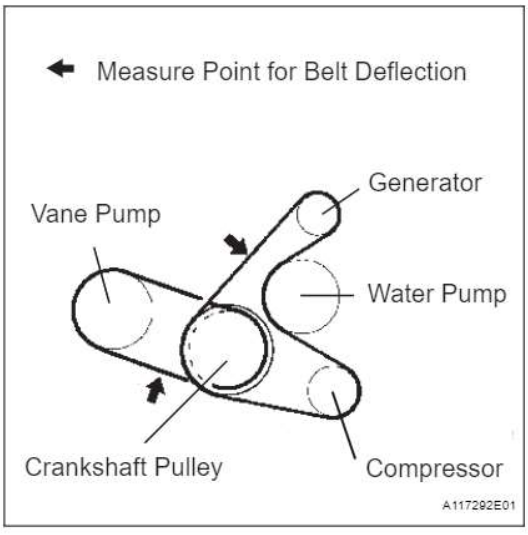
Item	Specified Condition
Crankshaft pulley to cooler compressor or generator	New belt: 121 to 143 lbf
	Used belt: 55 to 88 lbf
Vane pump	New belt: 99 to 121 lbf
	Used belt: 55 to 77 lbf

EM



HINT:
- After installing the drive belt, check that it fits properly in the ribbed grooves. Check with your hands to confirm that the belt has not slipped out of the groove on the bottom of the crankshaft pulley.
- A "new belt" is a belt which has been used 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.

(b) Reference:
Check drive belt deflection.
(1) When not using a belt tension gauge, measure the belt deflection.
Pressing force: 98 N (10 kgf, 22 lbf)
Standard belt deflection

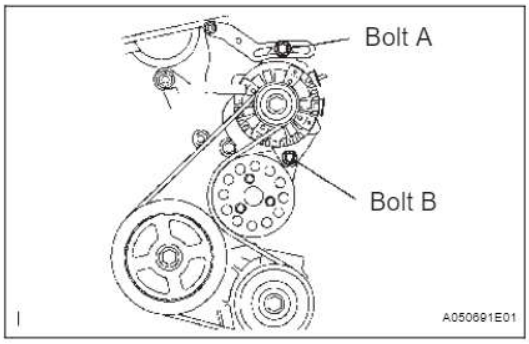


Item	Specified Condition
Belt (for water pump and generator)	New belt: 7.0 to 8.5 mm (0.28 to 0.33 in.)
	Used belt: 11.0 to 13.0 mm (0.43 to 0.51 in.)
Belt (for vane pump)	New belt: 8.0 to 10.0 mm (0.31 to 0.39 in.)
	Used belt: 11.0 to 13.0 mm (0.43 to 0.51 in.)

NOTICE:
- **Check the drive belt deflection at the specified point.**
- **When installing a new belt, set its tension value as specified.**
- **When inspecting a belt which has been used over 5 minutes, apply the specification of "Used Belt".**
- **When reinstalling a belt which has been used over 5 minutes, adjust its deflection and tension to the intermediate value of each specification of "Used Belt".**

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- **Belt tension and deflection should be checked after 2 revolutions of engine cranking.**
- **When using a belt tension gauge, confirm the accuracy by using a master gauge first.**



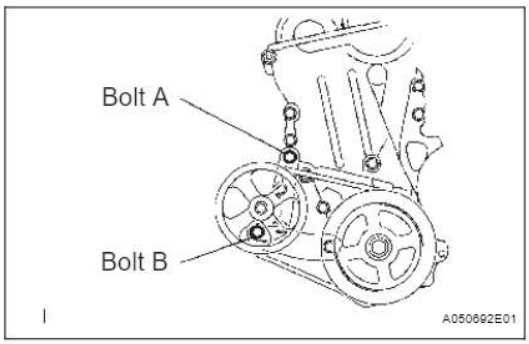
REMOVAL

1. REMOVE GENERATOR V BELT

(a) Loosen bolts A and B.

(b) Release the belt tension and remove the belt.

2. REMOVE ENGINE UNDER COVER RH

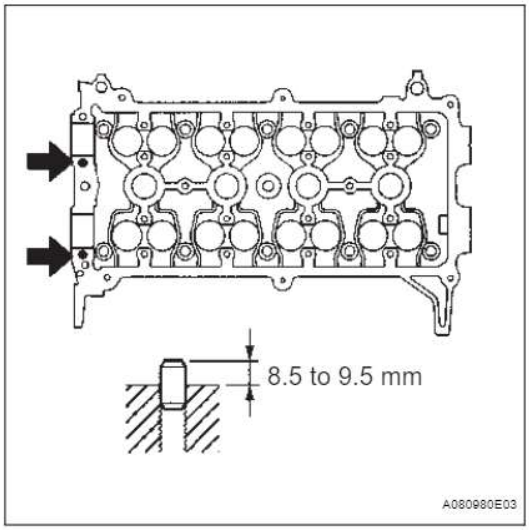


3. REMOVE VANE PUMP V BELT

(a) Loosen bolts A and B.

(b) Release the belt tension, and remove the belt.

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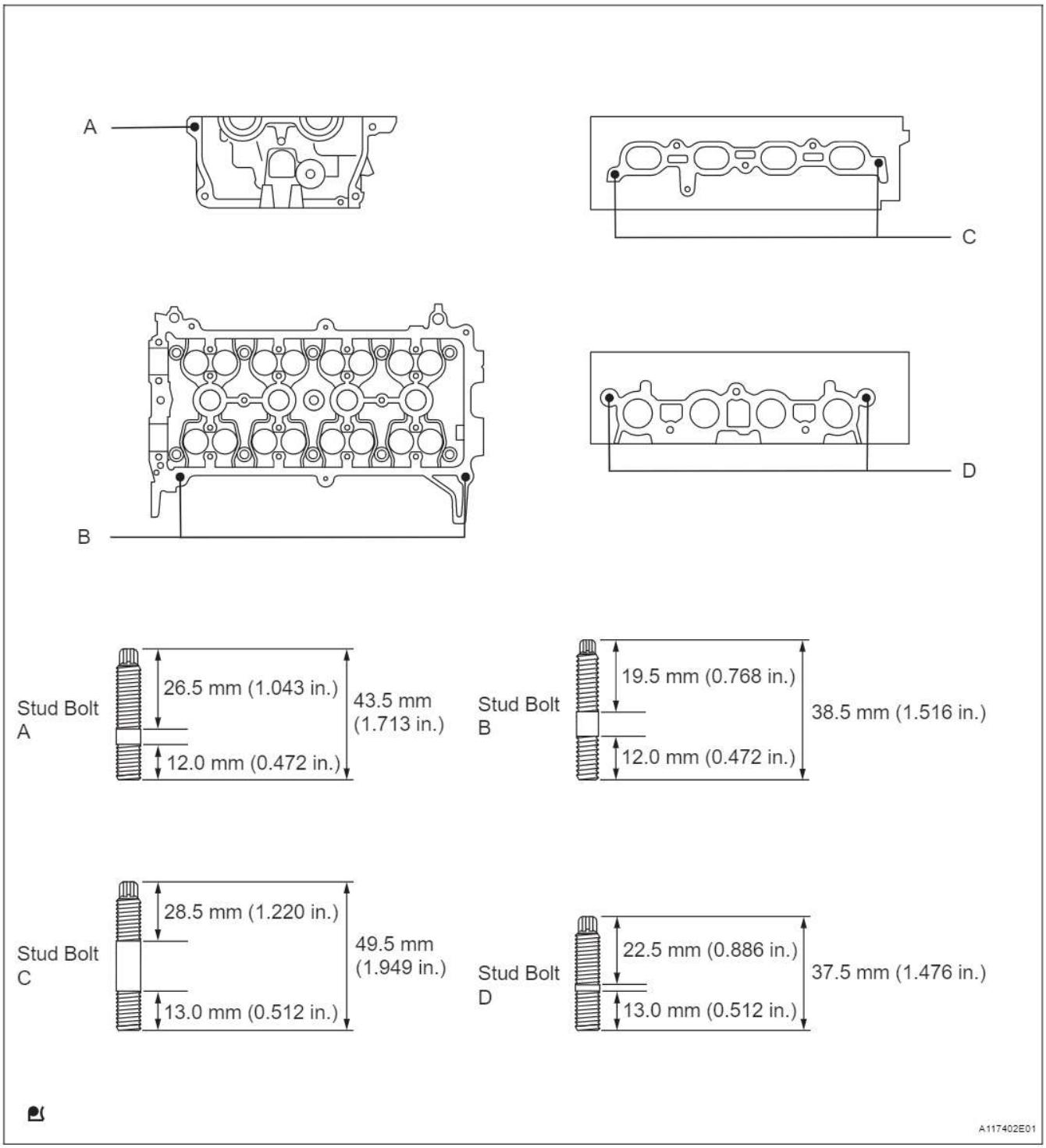
REASSEMBLY

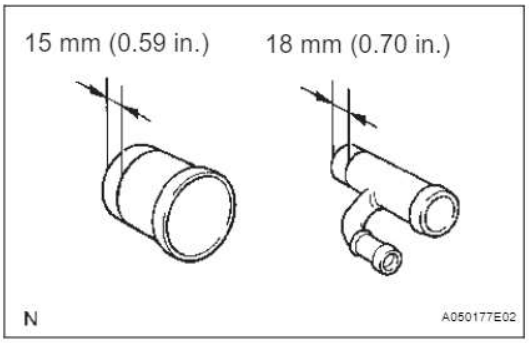
1. **INSTALL CAMSHAFT BEARING CAP SETTING RING PIN**
   (a) Using a plastic-faced hammer, tap in a new ring pin to the specified protrusion height.
   Standard protrusion height:
   8.5 to 9.5 mm (0.335 to 0.374 in.)

2. **INSTALL STUD BOLT**
   (a) Using E5 and E7 "torx" sockets, install the 7 stud bolts.
   Torque: 10 N*m (102 kgf*cm, 7.4 ft.*lbf) for bolt A
   4.0 N*m (41 kgf*cm, 35 in.*lbf) for bolt B
   10 N*m (102 kgf*cm, 7.4 ft.*lbf) for bolt C
   9.0 N*m (92 kgf*cm, 80 in.*lbf) for bolt D

EM

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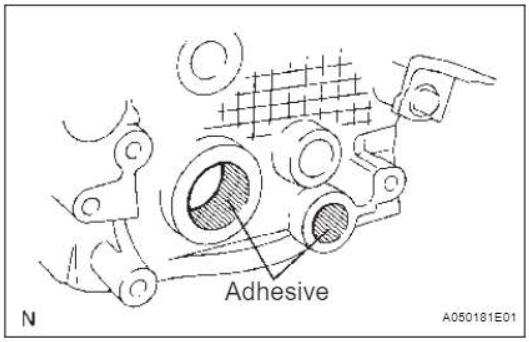




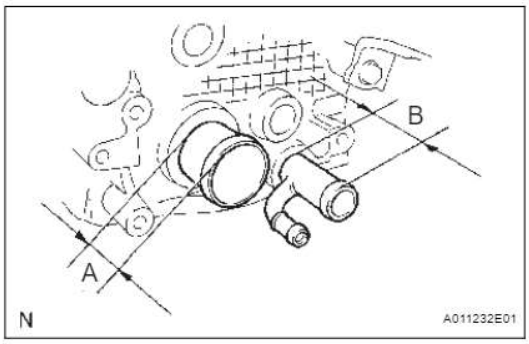
3. INSTALL UNION

(a) Mark the standard position away from the edge onto 2 new water hose unions as shown in the illustration.

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(b) Apply adhesive to the water hose union hole of the cylinder head.
Adhesive:
Part No. 08833-00070, THREE BOND 1324 or equivalent



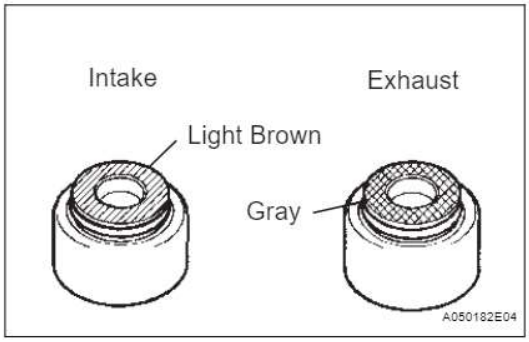
(c) Using a press, press in the water hose union until the marks come to the same level as the cylinder head surface.
Standard protrusion

Union	Specified Condition
A	29 mm (1.14 in.)
B	44 mm (1.73 in.)

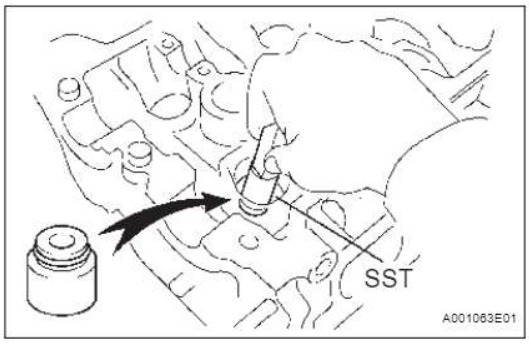
NOTICE:
- **Install the water hose union within 3 minutes of applying adhesive.**
- **Do not expose the water hose union to engine coolant for at least one hour after installation.**

4. INSTALL VALVE STEM OIL SEAL

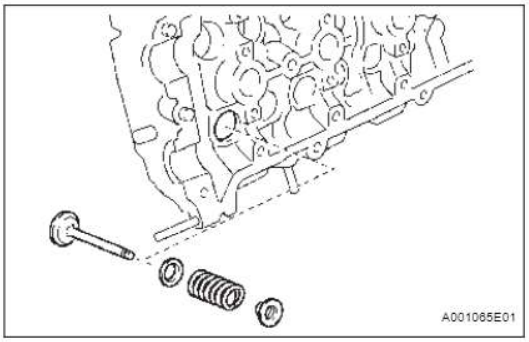
(a) Apply a light coat of engine oil to the valve stem.
NOTICE:
Installing the oil seals for the intake and exhaust onto the opposite valve guide bush may cause failures.
HINT:
The intake valve oil seal is light brown and the exhaust valve oil seal is gray.



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



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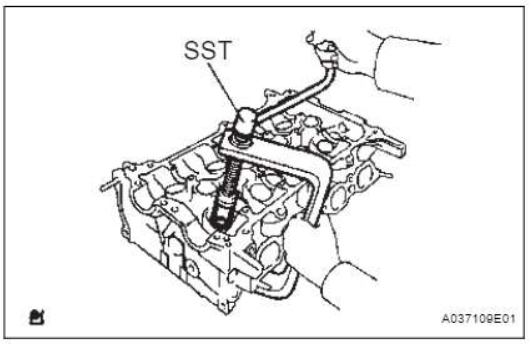


5. INSTALL INTAKE VALVE

(a) Install the valve, spring seat, valve spring and spring retainer.

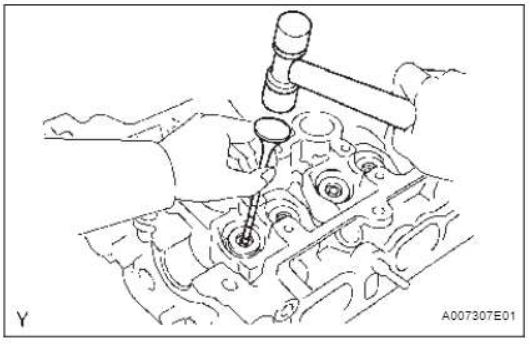
NOTICE:

Install the same parts in the same combination to the original locations.



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

SST 09202-70020 (09202-00010)



(c) Using a plastic-faced hammer and the valve stem (not in use) with the tip wrapped in tape, lightly tap the valve stem tip to ensure a proper fit.

NOTICE:

Be careful not to damage the valve stem tip.

6. INSTALL EXHAUST VALVE

(a) Install the valve, spring seat, valve spring, and spring retainer.

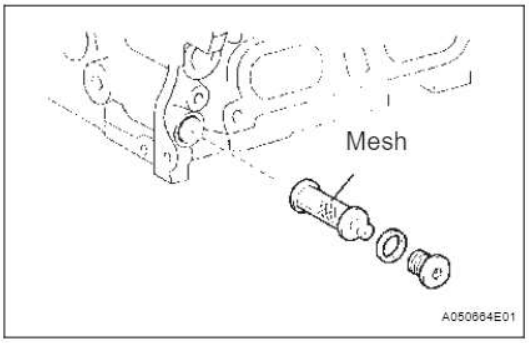
(b) Using SST, compress the valve spring and place the 2 retainer locks around the valve stem.

SST 09202-70020 (09202-00010)

(c) Using a plastic-faced hammer and the valve stem (not in use) with the tip wrapped in tape, lightly tap the valve stem tip to ensure a proper fit.

NOTICE:

Be careful not to damage the valve stem tip.



7. INSTALL OIL CONTROL VALVE FILTER

(a) Using an 8 mm hexagon wrench, install the filter with a new gasket and the plug.

Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

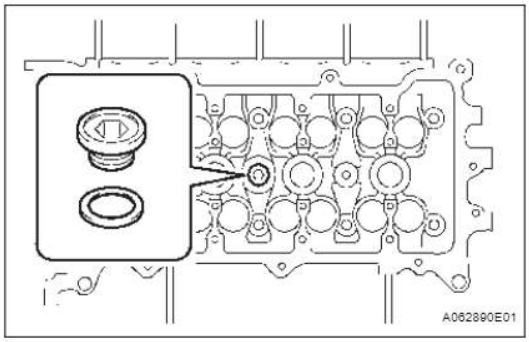
8. INSTALL VALVE LIFTER

(a) Apply a light coat of engine oil to the valve lifter.

(b) Install the valve lifter.

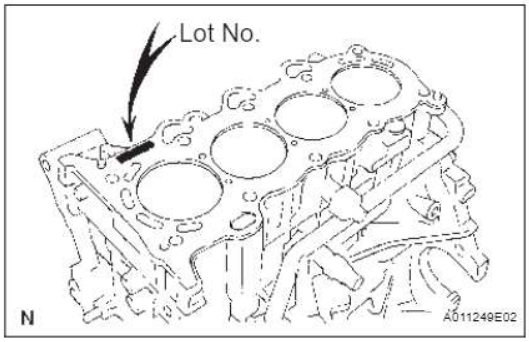
(c) Check that the valve lifter rotates smoothly by hand.

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9. INSTALL NO. 1 TAPER SCREW PLUG

(a) Using a 10 mm hexagon wrench, install the taper screw plug with a new gasket.
Torque: 44 N*m (449 kgf*cm, 33 ft.*lbf)



INSTALLATION

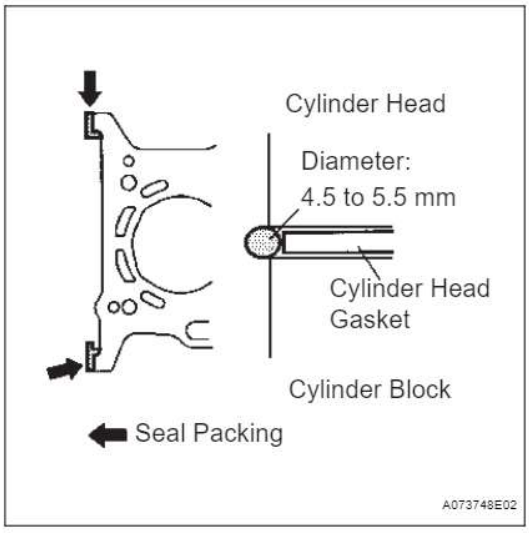
1. INSTALL CYLINDER HEAD GASKET

(a) Place a new cylinder head gasket on the cylinder block with the Lot No. stamp facing upward.
NOTICE:
- **Remove any oil from the contact surface.**
- **Be careful of the mounting orientation.**
- **Place the cylinder head on the gasket gently so as not to damage the gasket at the bottom part of the head.**

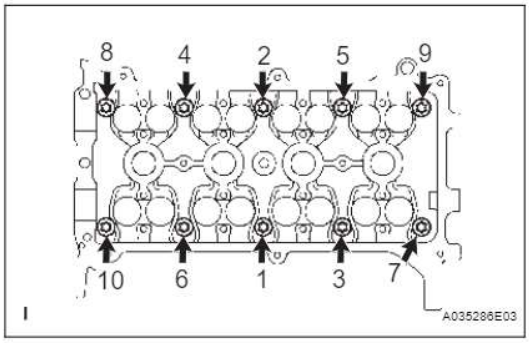
2. INSTALL CYLINDER HEAD

HINT:
The cylinder head bolts are tightened in 2 successive steps.

(a) Apply seal packing as shown in the illustration.
Seal packing:
Part No. 08826-00100
Standard seal diameter:
4.5 to 5.5 mm (0.177 to 0.217 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head within 3 minutes of applying seal packing.**

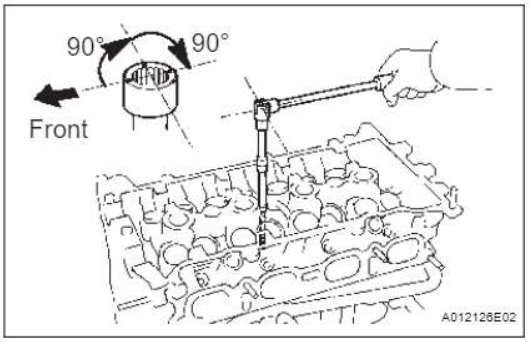


(b) Apply a light coat of engine oil to the threads of the cylinder head bolts.

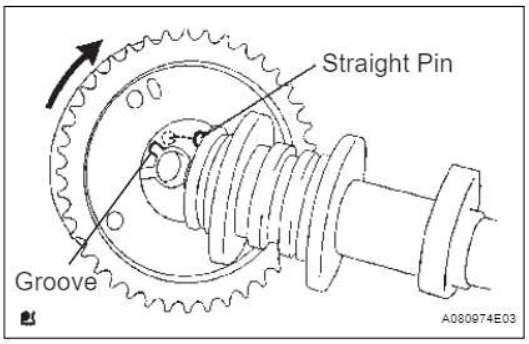


(c) Using several steps, install and tighten the 10 cylinder head bolts and plate washers uniformly with an 8 mm bi-hexagon wrench in the sequence shown in the illustration.
Torque: 29 N*m (300 kgf*cm, 22 ft.*lbf)

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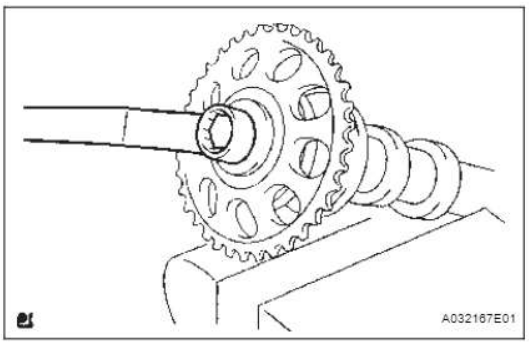


(d) Mark the front of the cylinder head bolt with paint.
(e) Retighten the cylinder head bolts by an additional 90° and then another additional 90°, as shown in the illustration.
(f) Check that the paint mark is now 180° opposite to the front.



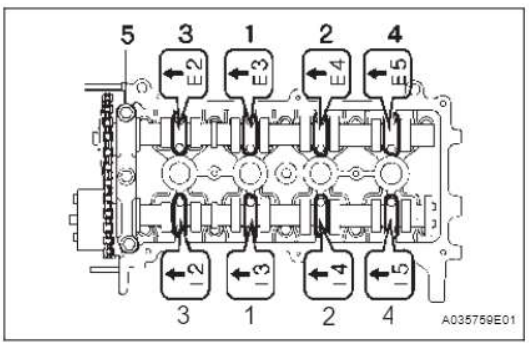
3. INSTALL CAMSHAFT TIMING GEAR

(a) Put the camshaft timing gear assembly and the camshaft together with the straight pin off the groove, as shown in the illustration.
(b) Turn the camshaft timing gear assembly clockwise while pushing it lightly towards the camshaft. Push further at the position where the pin fits into the groove.
NOTICE:
Be careful not to turn the camshaft timing gear to the retard angle (to the right).
(c) Check that there is no clearance between the gear fringe and camshaft.
(d) Tighten the flange bolt with the camshaft timing gear fixed.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)
(e) Check that the camshaft timing gear assembly can move to the retard angle (to the right) and is locked in the most retarded position.



4. INSTALL CAMSHAFT TIMING SPROCKET

(a) Clamp the camshaft in a vise.
(b) Align the knock pin hole of the camshaft timing sprocket with the knock pin of the camshaft, and install the camshaft timing sprocket.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)
NOTICE:
Be careful not to damage the camshaft.



5. INSTALL CAMSHAFT

(a) Apply a light coat of engine oil to the camshaft journals.
(b) Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.
(c) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (129 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.

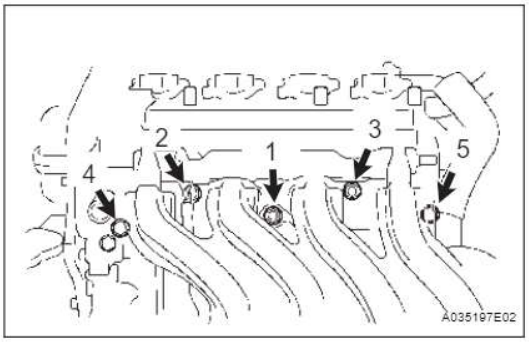
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(d) Install the No. 1 bearing cap.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)

6. **INSTALL FUEL INJECTOR (See page EM-121)**
7. **INSTALL FUEL DELIVERY PIPE (See page EM-121)**
8. **INSTALL CHAIN (See page EM-28)**
9. **INSTALL OIL PUMP SEAL (See page EM-106)**
10. **INSTALL TIMING CHAIN COVER (See page EM-118)**
11. **INSTALL WATER PUMP (See page EM-120)**
12. **INSTALL ENGINE MOUNTING BRACKET RH (See page EM-29)**
13. **INSTALL ENGINE MOUNTING INSULATOR RH (See page EM-30)**
14. **INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (See page EM-30)**
15. **INSTALL CRANKSHAFT POSITION SENSOR (See page ES-339)**
16. **INSTALL WATER PUMP PULLEY (See page EM-121)**
17. **INSTALL CRANKSHAFT PULLEY (See page EM-30)**
18. **INSTALL CYLINDER HEAD COVER (See page EM-30)**
19. **INSTALL IGNITION COIL (See page EM-31)**
20. **INSTALL NO. 2 CYLINDER HEAD COVER (See page EM-31)**
21. **INSTALL GENERATOR (See page CH-15)**
22. **INSTALL VANE PUMP V BELT (See page EM-7)**
23. **INSTALL GENERATOR V BELT (See page EM-7)**
24. **ADJUST GENERATOR V BELT (See page EM-7)**
25. **ADJUST VANE PUMP V BELT (See page EM-7)**
26. **INSPECT DRIVE BELT DEFLECTION AND TENSION (See page EM-6)**
27. **INSTALL CAMSHAFT TIMING CONTROL VALVE ASSEMBLY (See page EM-122)**
28. **CONNECT NO. 2 VENTILATION HOSE (See page EM-31)**
29. **CONNECT VENTILATION HOSE (See page EM-31)**
30. **INSTALL IGNITION COIL (See page EM-31)**
31. **INSTALL OIL DIPSTICK GUIDE**
    (a) Apply engine oil to a new O-ring and install it to the dipstick guide.
    (b) Install the dipstick guide with the bolt.
    Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

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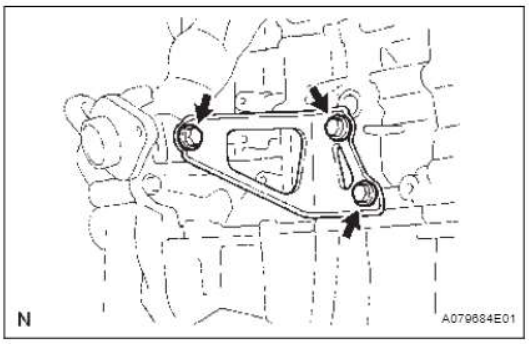


32. INSTALL INTAKE MANIFOLD

(a) Install a new gasket onto the intake manifold.

(b) Install the intake manifold with the 3 bolts and 2 nuts. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in the illustration.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

33. INSTALL EXHAUST MANIFOLD (See page EM-78)

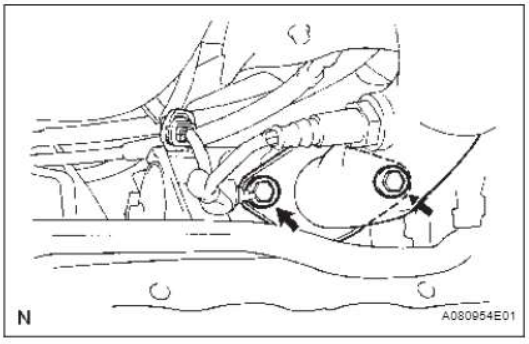


34. INSTALL MANIFOLD SUPPORT BRACKET

(a) Install the manifold support bracket with the 3 bolts.
Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)

35. INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

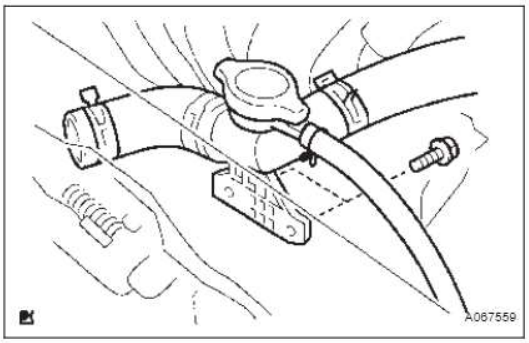
(a) Install the No. 1 exhaust manifold heat insulator with the 4 bolts.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)



36. INSTALL FRONT EXHAUST PIPE

(a) Place a new gasket on the exhaust manifold.

(b) Install the 2 compression springs and 2 bolts.
Torque: 43 N*m (438 kgf*cm, 32 ft.*lbf)



37. INSTALL WATER FILLER

(a) Install the water filler with the 2 bolts.
Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)

(b) Connect the radiator reservoir tank hose.

(c) Connect the No. 3 radiator hose.

(d) Connect the radiator inlet hose.

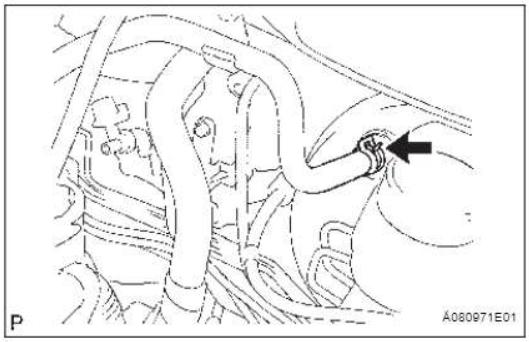
38. INSTALL NO. 1 WATER BY-PASS PIPE

(a) Install the water by-pass pipe with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

39. CONNECT RADIATOR HOSE INLET

(a) Connect the radiator hose inlet to the union.

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40. **CONNECT UNION TO CHECK VALVE HOSE**
    (a) Connect the union to check valve hose to the brake booster.
41. **CONNECT FUEL TUBE (See page FU-15)**
42. **INSTALL ACCELERATOR CONTROL CABLE (See page ES-348)**
43. **CONNECT ENGINE WIRE**
44. **INSTALL AIR CLEANER (See page ES-348)**
45. **INSTALL OIL PAN DRAIN PLUG**
46. **ADD ENGINE OIL (See page LU-3)**
47. **CHECK FOR ENGINE OIL LEAKS**
48. **ADD COOLANT (See page CO-5)**
49. **CHECK FOR ENGINE COOLANT LEAKS (See page CO-7)**
50. **CHECK FOR FUEL LEAKS (See page FU-8)**
51. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**
52. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-23).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

EM

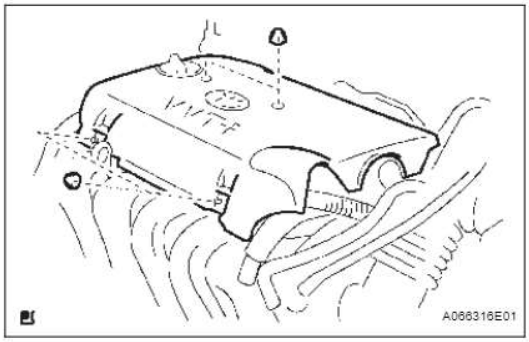
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VALVE CLEARANCE

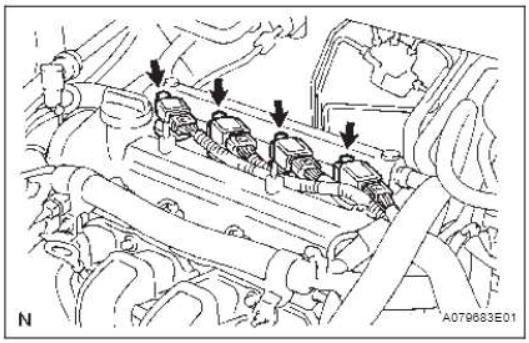
ADJUSTMENT

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.

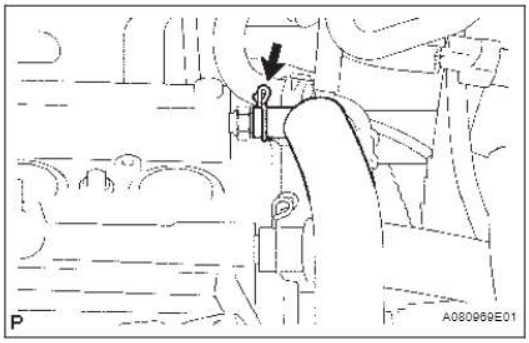
2. **REMOVE NO. 2 CYLINDER HEAD COVER**
   (a) Remove the 4 nuts and cylinder head cover.



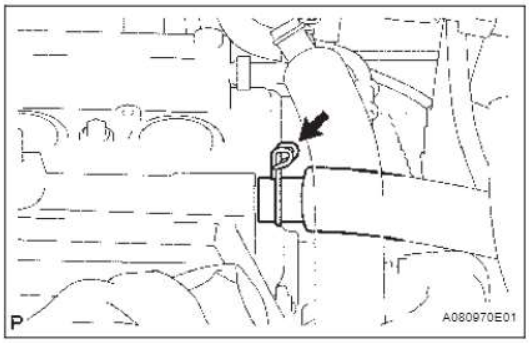
3. **REMOVE IGNITION COIL**
   (a) Remove the 4 bolts and pull out the 4 ignition coils.



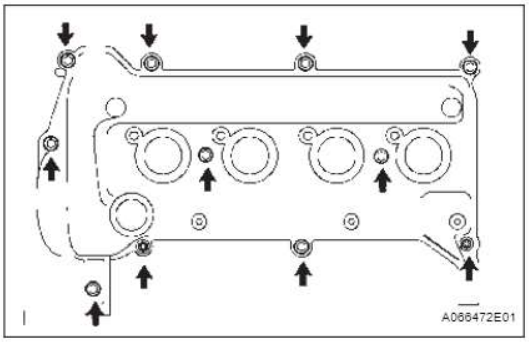
4. **DISCONNECT VENTILATION HOSE**
   (a) Disconnect the ventilation hose from the cylinder head cover.



5. **DISCONNECT NO. 2 VENTILATION HOSE**
   (a) Disconnect the ventilation hose from the cylinder head cover.



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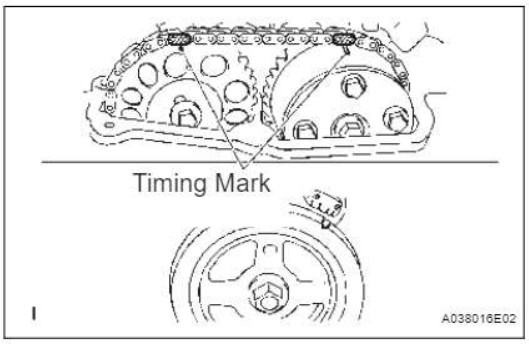
6. REMOVE CYLINDER HEAD COVER

(a) Remove the 9 bolts, 2 nuts and cylinder head cover.

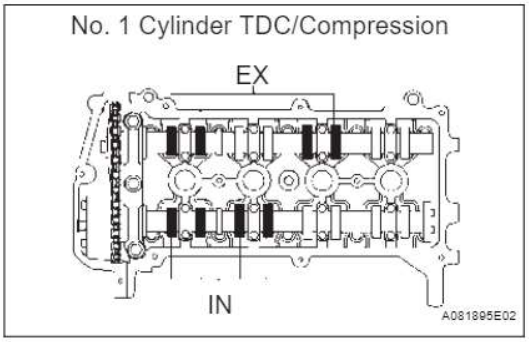
7. REMOVE ENGINE UNDER COVER RH

8. INSPECT VALVE CLEARANCE

HINT:
Inspect and adjust the valve clearance when the engine is cold.



(a) Set the No. 1 cylinder to TDC/compression.
(1) Turn the crankshaft pulley until its timing notch and the timing mark 0 of the chain cover are aligned.
(2) Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in the illustration.
If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.

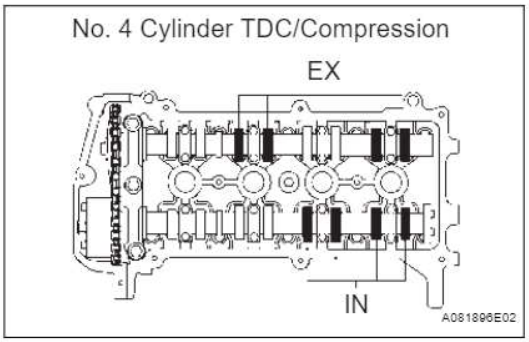


(b) Check the valves indicated in the illustration.
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
Standard valve clearance (Cold)

Item	Specified Condition
Intake	0.15 to 0.25 mm (0.006 to 0.010 in.)
Exhaust	0.25 to 0.35 mm (0.010 to 0.014 in.)

(2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

(c) Turn the crankshaft 1 complete revolution until its timing notch and the timing mark 0 of the chain cover are aligned.

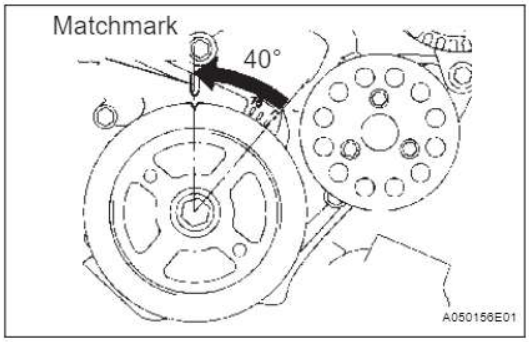


(d) Check the valves indicated in the illustration.
(1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
Standard valve clearance (Cold)

Item	Specified Condition
Intake	0.15 to 0.25 mm (0.006 to 0.010 in.)
Exhaust	0.25 to 0.35 mm (0.010 to 0.014 in.)

(2) Record any out-of-specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

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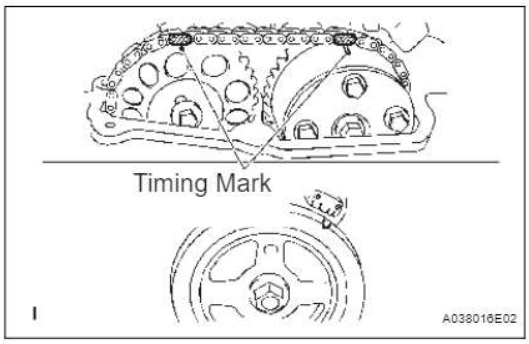


9. ADJUST VALVE CLEARANCE

(a) Rotate the crankshaft pulley.

NOTICE:

When rotating the camshaft with the timing chain removed, rotate the crankshaft damper counterclockwise 40° from the TDC and align its timing notch with the matchmark of the timing chain cover to prevent the pistons from coming into contact with the valves.

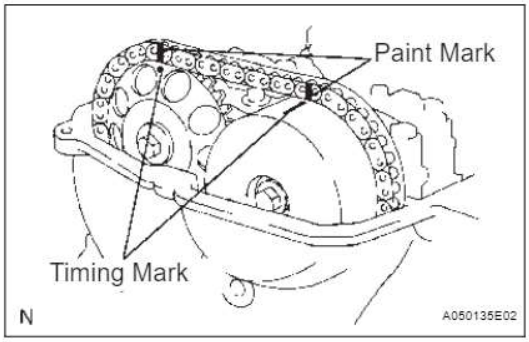


(b) Set the No. 1 cylinder to the TDC/compression.

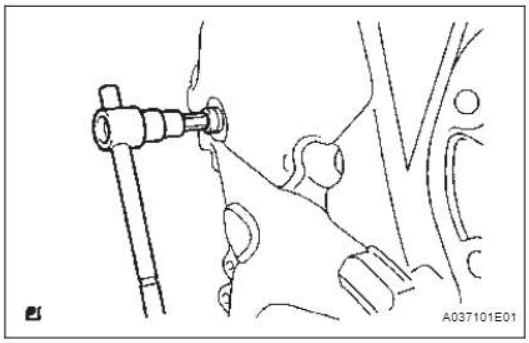
(1) Turn the crankshaft pulley until its timing notch and timing mark 0 of the chain cover are aligned.

(2) Check that both timing marks on the camshaft timing sprocket and valve timing controller assembly are facing upward as shown in the illustration.

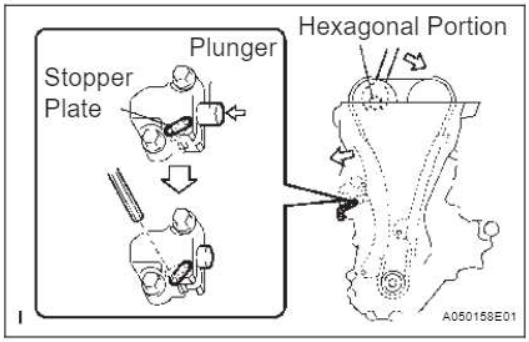
If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.



(c) Put paint marks on the timing chain where the timing marks of the camshaft timing sprocket and the camshaft timing gear are located.



(d) Using an 8 mm hexagon wrench, remove the screw plug.

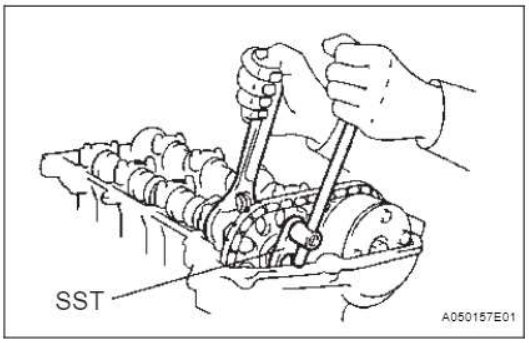


(e) Insert a screwdriver into the service hole of the chain tensioner to hold the stopper plate of the chain tensioner at an upward position.

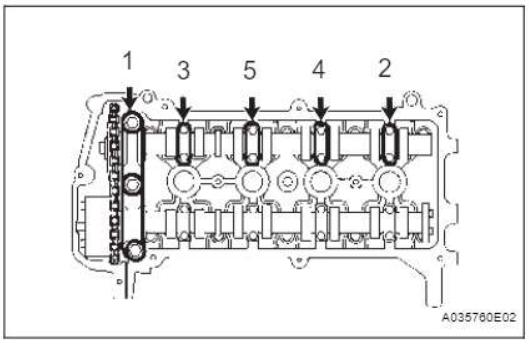
(f) Using a wrench, rotate the No. 2 camshaft clockwise to push in the plunger of the chain tensioner.

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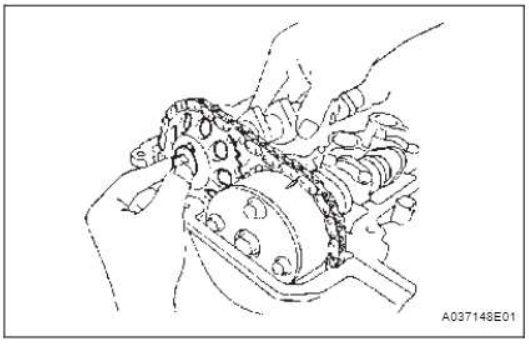
(g) Remove the screwdriver from the service hole, and then align the hole of the stopper plate with the service hole and insert a 2 to 3 mm (0.08 to 0.12 in.) diameter bar into the holes to hold the stopper plate.
HINT:
- Fix the stopper plate in place using the bar while rotating the camshaft right and left slightly.
- Hold the bar with tape so that the bar does not come off.



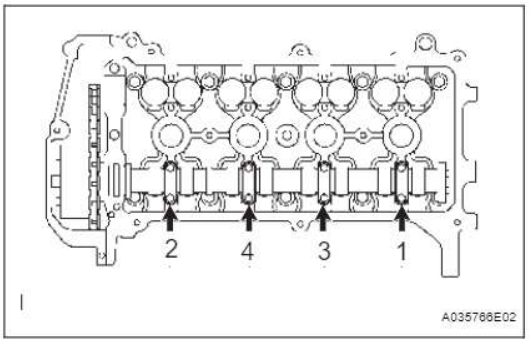
(h) Using SST, hold the camshaft with a wrench on the hexagonal lobe, and remove the bolt.
SST 09023-38400



(i) Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in the illustration. Then remove the 5 bearing caps.
NOTICE:
Loosen each bolt uniformly, keeping the camshaft level.

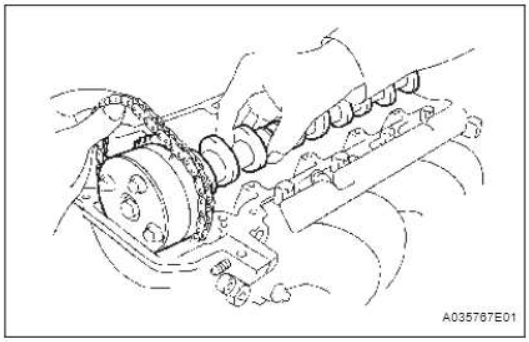


(j) Remove the flange bolt with the No. 2 camshaft lifted up. Then detach the No. 2 camshaft and the camshaft timing sprocket.

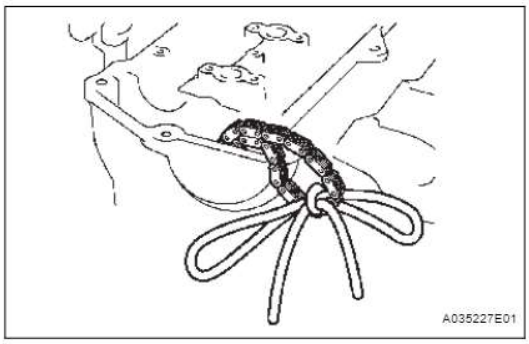


(k) Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration. Then remove the 4 bearing caps.
NOTICE:
Loosen each bolt uniformly, keeping the camshaft level.

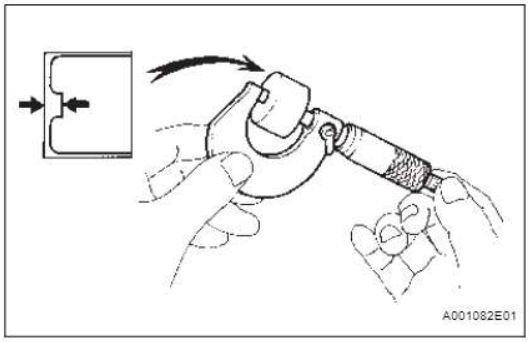
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(l) Hold the timing chain by hand, and remove the camshaft and the camshaft timing gear assembly.



(m) Tie the timing chain with a string as shown in the illustration.
NOTICE:
Be careful not to drop anything inside the timing chain cover.



(n) Remove the valve lifters.
(o) Using a micrometer, measure the thickness of the removed lifter.
(p) Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

A	New lifter thickness
B	Used lifter thickness
C	Measured valve clearance

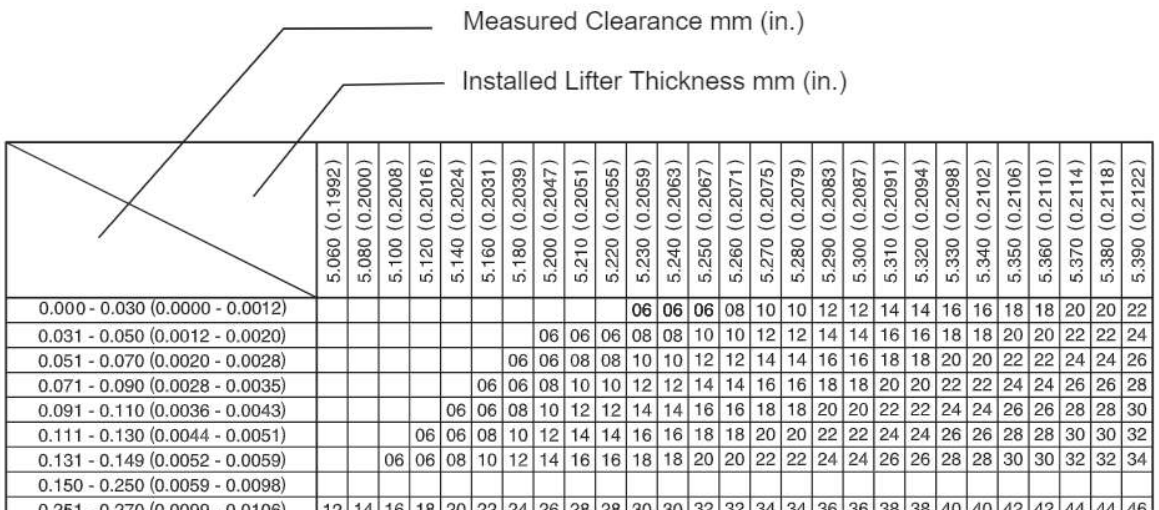
New lifter thickness

Item	Thickness
Intake	**A = B + (C - 0.20 mm (0.008 in.))**
Exhaust	**A = B + (C - 0.30 mm (0.012 in.))**

(q) Select a new lifter with the thickness as close to the calculated values as possible.
EXAMPLE: (Intake)
Measured valve clearance = 0.40 mm (0.0158 in.)
0.40 mm (0.0158 in.) - 0.20 mm (0.0079 in.) = 0.20 mm (0.0079 in.)
(Measured - Specification = Excess clearance)
Used lifter measurement = 5.25 mm (0.2067 in.)
0.20 mm (0.0079 in.) + 5.25 mm (0.2067 in.) = 5.45 mm (0.2146 in.)
(Excess clearance + Used lifter = Ideal new lifter)
Closest new lifter = 5.45 mm (0.2146 in.)
Select No. 46 lifter (5.46 mm (0.2150 in.))
HINT:
- Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).
- Refer to the New Lifter Thickness table below.

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(1) Valve lifter selection chart (intake)



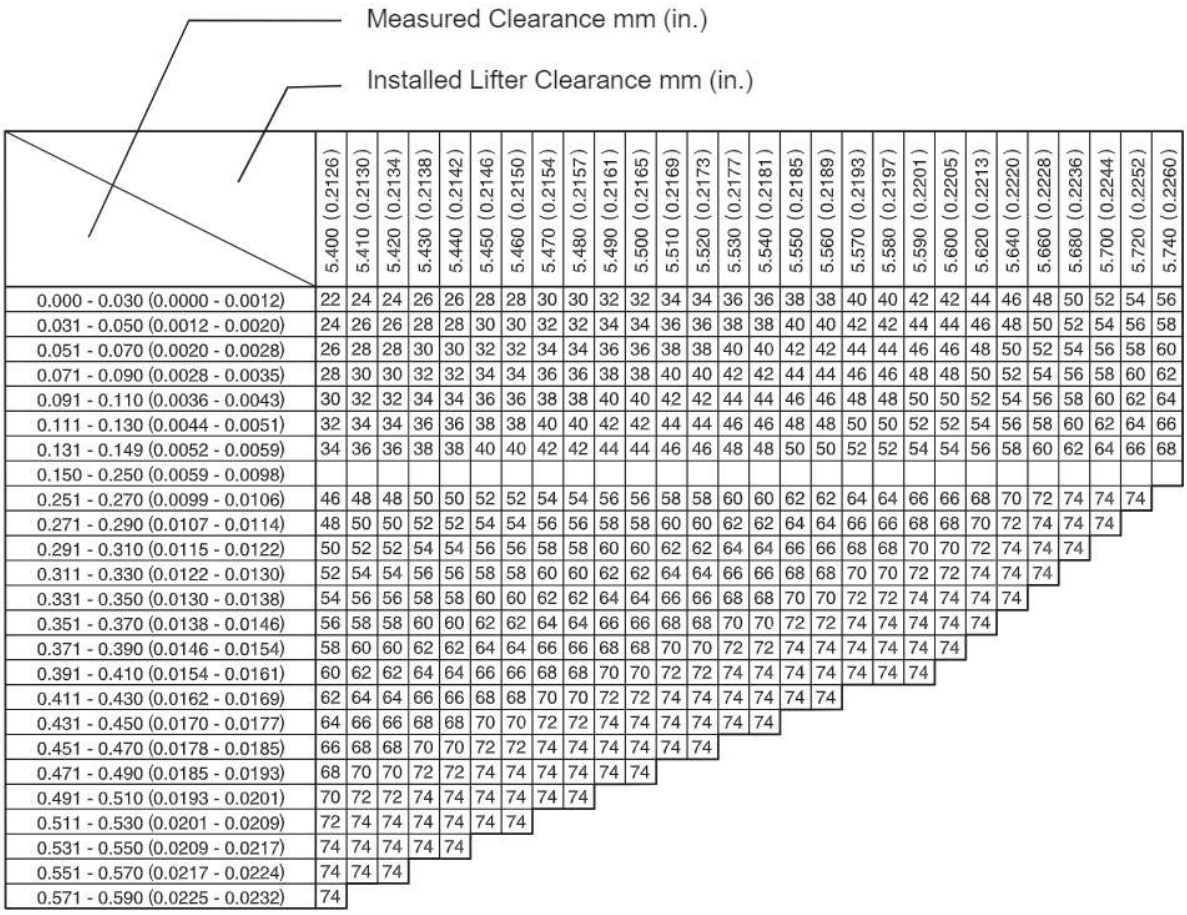
Measured Clearance mm (in.) \ Installed Lifter Thickness mm (in.)	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	5.290 (0.2083)	5.300 (0.2087)	5.310 (0.2091)	5.320 (0.2094)	5.330 (0.2098)	5.340 (0.2102)	5.350 (0.2106)	5.360 (0.2110)	5.370 (0.2114)	5.380 (0.2118)	5.390 (0.2122)
0.000 - 0.030 (0.0000 - 0.0012)											06	06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22
0.031 - 0.050 (0.0012 - 0.0020)								06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24
0.051 - 0.070 (0.0020 - 0.0028)							06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26
0.071 - 0.090 (0.0028 - 0.0035)						06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28
0.091 - 0.110 (0.0036 - 0.0043)					06	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30
0.111 - 0.130 (0.0044 - 0.0051)				06	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32
0.131 - 0.149 (0.0052 - 0.0059)			06	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34
0.150 - 0.250 (0.0059 - 0.0098)																											
0.251 - 0.270 (0.0099 - 0.0106)	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46
0.271 - 0.290 (0.0107 - 0.0114)	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48
0.291 - 0.310 (0.0115 - 0.0122)	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50
0.311 - 0.330 (0.0122 - 0.0130)	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52
0.331 - 0.350 (0.0130 - 0.0138)	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54
0.351 - 0.370 (0.0138 - 0.0146)	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56
0.371 - 0.390 (0.0146 - 0.0154)	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58
0.391 - 0.410 (0.0154 - 0.0161)	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60
0.411 - 0.430 (0.0162 - 0.0169)	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62
0.431 - 0.450 (0.0170 - 0.0177)	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64
0.451 - 0.470 (0.0178 - 0.0185)	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66
0.471 - 0.490 (0.0185 - 0.0193)	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68
0.491 - 0.510 (0.0193 - 0.0201)	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70
0.511 - 0.530 (0.0201 - 0.0209)	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72
0.531 - 0.550 (0.0209 - 0.0217)	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74
0.551 - 0.570 (0.0217 - 0.0224)	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74
0.571 - 0.590 (0.0225 - 0.0232)	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74
0.591 - 0.610 (0.0233 - 0.0240)	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74	
0.611 - 0.630 (0.0241 - 0.0248)	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74			
0.631 - 0.650 (0.0248 - 0.0256)	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74					
0.651 - 0.670 (0.0256 - 0.0264)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.671 - 0.690 (0.0264 - 0.0272)	54	56	58	60	62	64	66	68	70	70	72	72	74	74	74	74	74	74									
0.691 - 0.710 (0.0272 - 0.0280)	56	58	60	62	64	66	68	70	72	72	74	74	74	74	74	74											
0.711 - 0.730 (0.0280 - 0.0287)	58	60	62	64	66	68	70	72	74	74	74	74	74	74													
0.731 - 0.750 (0.0288 - 0.0295)	60	62	64	66	68	70	72	74	74	74	74	74															
0.751 - 0.770 (0.0296 - 0.0303)	62	64	66	68	70	72	74	74	74	74																	
0.771 - 0.790 (0.0304 - 0.0311)	64	66	68	70	72	74	74	74																			
0.791 - 0.810 (0.0311 - 0.0319)	66	68	70	72	74	74	74																				
0.811 - 0.830 (0.0319 - 0.0327)	68	70	72	74	74	74																					
0.831 - 0.850 (0.0327 - 0.0335)	70	72	74	74	74																						
0.851 - 0.870 (0.0335 - 0.0343)	72	74	74	74																							
0.871 - 0.890 (0.0343 - 0.0350)	74	74	74																								
0.891 - 0.910 (0.0351 - 0.0358)	74	74																									
0.911 - 0.930 (0.0359 - 0.0366)	74																										

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(2) Valve lifter selection chart (intake) (continued).



	5.400 (0.2126)	5.410 (0.2130)	5.420 (0.2134)	5.430 (0.2138)	5.440 (0.2142)	5.450 (0.2146)	5.460 (0.2150)	5.470 (0.2154)	5.480 (0.2157)	5.490 (0.2161)	5.500 (0.2165)	5.510 (0.2169)	5.520 (0.2173)	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)
0.000 - 0.030 (0.0000 - 0.0012)	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56
0.031 - 0.050 (0.0012 - 0.0020)	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58
0.051 - 0.070 (0.0020 - 0.0028)	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60
0.071 - 0.090 (0.0028 - 0.0035)	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62
0.091 - 0.110 (0.0036 - 0.0043)	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64
0.111 - 0.130 (0.0044 - 0.0051)	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66
0.131 - 0.149 (0.0052 - 0.0059)	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	58	60	62	64	66	68
0.150 - 0.250 (0.0059 - 0.0098)																												
0.251 - 0.270 (0.0099 - 0.0106)	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72	74	74	74	
0.271 - 0.290 (0.0107 - 0.0114)	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	74	74		
0.291 - 0.310 (0.0115 - 0.0122)	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	74	74	74			
0.311 - 0.330 (0.0122 - 0.0130)	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74				
0.331 - 0.350 (0.0130 - 0.0138)	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74					
0.351 - 0.370 (0.0138 - 0.0146)	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74						
0.371 - 0.390 (0.0146 - 0.0154)	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.391 - 0.410 (0.0154 - 0.0161)	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74	74								
0.411 - 0.430 (0.0162 - 0.0169)	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74											
0.431 - 0.450 (0.0170 - 0.0177)	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74													
0.451 - 0.470 (0.0178 - 0.0185)	66	68	68	70	70	72	72	74	74	74	74	74	74															
0.471 - 0.490 (0.0185 - 0.0193)	68	70	70	72	72	74	74	74	74	74	74																	
0.491 - 0.510 (0.0193 - 0.0201)	70	72	72	74	74	74	74	74	74																			
0.511 - 0.530 (0.0201 - 0.0209)	72	74	74	74	74	74	74																					
0.531 - 0.550 (0.0209 - 0.0217)	74	74	74	74	74																							
0.551 - 0.570 (0.0217 - 0.0224)	74	74	74																									
0.571 - 0.590 (0.0225 - 0.0232)	74																											

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New lifter thickness

Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
06	5.060 mm (0.1992 in.)	30	5.300 mm (0.2087 in.)	54	5.540 mm (0.2181 in.)
08	5.080 mm (0.2000 in.)	32	5.320 mm (0.2094 in.)	56	5.560 mm (0.2189 in.)

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Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
10	5.100 mm (0.2008 in.)	34	5.340 mm (0.2102 in.)	58	5.580 mm (0.2197 in.)
12	5.120 mm (0.2016 in.)	36	5.360 mm (0.2110 in.)	60	5.600 mm (0.2205 in.)
14	5.140 mm (0.2024 in.)	38	5.380 mm (0.2118 in.)	62	5.620 mm (0.2213 in.)
16	5.160 mm (0.2031 in.)	40	5.400 mm (0.2126 in.)	64	5.640 mm (0.2220 in.)
18	5.180 mm (0.2039 in.)	42	5.420 mm (0.2134 in.)	66	5.660 mm (0.2228 in.)
20	5.200 mm (0.2047 in.)	44	5.440 mm (0.2142 in.)	68	5.680 mm (0.2236 in.)
22	5.220 mm (0.2055 in.)	46	5.460 mm (0.2150 in.)	70	5.700 mm (0.2244 in.)
24	5.240 mm (0.2063 in.)	48	5.480 mm (0.2157 in.)	72	5.720 mm (0.2252)
26	5.260 mm (0.2071 in.)	50	5.500 mm (0.2165 in.)	74	5.740 mm (0.2260)
28	5.280 mm (0.2079 in.)	52	5.520 mm (0.2173 in.)	-	-

Standard intake valve clearance (Cold):
0.15 to 0.25 mm (0.006 to 0.010 in.)

EXAMPLE:

The 5.250 mm (0.2067 in.) lifter is installed, and the measured clearance is 0.400 mm (0.0158 in.).

Replace the 5.250 mm (0.2067 in.) lifter with a new No. 46 lifter.

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(3) Valve lifter selection chart (exhaust).

Measured Clearance mm (in.)

Installed Lifter Thickness mm (in.)

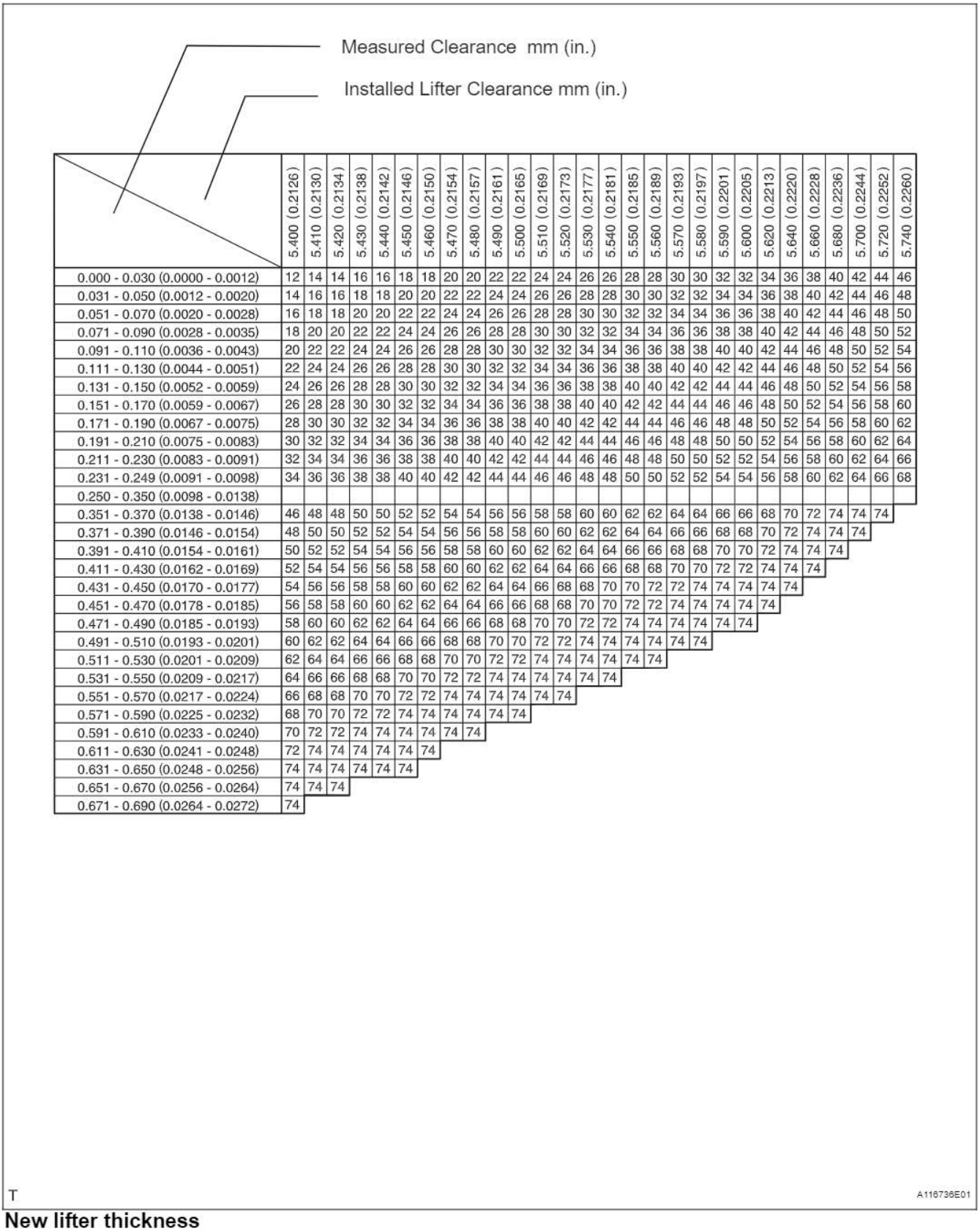
	5.060 (0.1992)	5.080 (0.2000)	5.100 (0.2008)	5.120 (0.2016)	5.140 (0.2024)	5.160 (0.2031)	5.180 (0.2039)	5.200 (0.2047)	5.210 (0.2051)	5.220 (0.2055)	5.230 (0.2059)	5.240 (0.2063)	5.250 (0.2067)	5.260 (0.2071)	5.270 (0.2075)	5.280 (0.2079)	5.290 (0.2083)	5.300 (0.2087)	5.310 (0.2091)	5.320 (0.2094)	5.330 (0.2098)	5.340 (0.2102)	5.350 (0.2106)	5.360 (0.2110)	5.370 (0.2114)	5.380 (0.2118)	5.390 (0.2122)
																			06	06	06	06	08	08	10	10	12
0.031 - 0.050 (0.0012 - 0.0020)																06	06	06	06	06	08	08	10	10	12	12	14
0.051 - 0.070 (0.0020 - 0.0028)														06	06	06	06	06	08	08	10	10	12	12	14	14	16
0.071 - 0.090 (0.0028 - 0.0035)												06	06	06	06	06	08	08	10	10	12	12	14	14	16	16	18
0.091 - 0.110 (0.0036 - 0.0043)											06	06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20
0.111 - 0.130 (0.0044 - 0.0051)									06	06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22
0.131 - 0.150 (0.0052 - 0.0059)								06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24
0.151 - 0.170 (0.0059 - 0.0067)						06	06	06	08	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26
0.171 - 0.190 (0.0067 - 0.0075)					06	06	06	08	10	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28
0.191 - 0.210 (0.0075 - 0.0083)				06	06	06	08	10	12	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30
0.211 - 0.230 (0.0083 - 0.0091)			06	06	06	08	10	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32
0.231 - 0.249 (0.0091 - 0.0098)		06	06	06	08	10	12	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34
0.250 - 0.350 (0.0098 - 0.0138)																											
0.351 - 0.370 (0.0138 - 0.0146)	12	14	16	18	20	22	24	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46
0.371 - 0.390 (0.0146 - 0.0154)	14	16	18	20	22	24	26	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48
0.391 - 0.410 (0.0154 - 0.0161)	16	18	20	22	24	26	28	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50
0.411 - 0.430 (0.0162 - 0.0169)	18	20	22	24	26	28	30	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52
0.431 - 0.450 (0.0170 - 0.0177)	20	22	24	26	28	30	32	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54
0.451 - 0.470 (0.0178 - 0.0185)	22	24	26	28	30	32	34	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56
0.471 - 0.490 (0.0185 - 0.0193)	24	26	28	30	32	34	36	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58
0.491 - 0.510 (0.0193 - 0.0201)	26	28	30	32	34	36	38	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60
0.511 - 0.530 (0.0201 - 0.0209)	28	30	32	34	36	38	40	42	44	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62
0.531 - 0.550 (0.0209 - 0.0217)	30	32	34	36	38	40	42	44	46	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64
0.551 - 0.570 (0.0217 - 0.0224)	32	34	36	38	40	42	44	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66
0.571 - 0.590 (0.0225 - 0.0232)	34	36	38	40	42	44	46	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68
0.591 - 0.610 (0.0233 - 0.0240)	36	38	40	42	44	46	48	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70
0.611 - 0.630 (0.0241 - 0.0248)	38	40	42	44	46	48	50	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72
0.631 - 0.650 (0.0248 - 0.0256)	40	42	44	46	48	50	52	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74
0.651 - 0.670 (0.0256 - 0.0264)	42	44	46	48	50	52	54	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74
0.671 - 0.690 (0.0264 - 0.0272)	44	46	48	50	52	54	56	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74
0.691 - 0.710 (0.0272 - 0.0280)	46	48	50	52	54	56	58	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74	
0.711 - 0.730 (0.0280 - 0.0287)	48	50	52	54	56	58	60	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74			
0.731 - 0.750 (0.0288 - 0.0295)	50	52	54	56	58	60	62	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74					
0.751 - 0.770 (0.0296 - 0.0303)	52	54	56	58	60	62	64	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.771 - 0.790 (0.0304 - 0.0311)	54	56	58	60	62	64	66	68	70	70	72	72	74	74	74	74	74	74									
0.791 - 0.810 (0.0311 - 0.0319)	56	58	60	62	64	66	68	70	72	72	74	74	74	74	74	74											
0.811 - 0.830 (0.0319 - 0.0327)	58	60	62	64	66	68	70	72	74	74	74	74	74	74													
0.831 - 0.850 (0.0327 - 0.0335)	60	62	64	66	68	70	72	74	74	74	74	74															
0.851 - 0.870 (0.0335 - 0.0343)	62	64	66	68	70	72	74	74	74	74																	
0.871 - 0.890 (0.0343 - 0.0350)	64	66	68	70	72	74	74	74																			
0.891 - 0.910 (0.0351 - 0.0358)	66	68	70	72	74	74	74																				
0.911 - 0.930 (0.0359 - 0.0366)	68	70	72	74	74	74																					
0.931 - 0.950 (0.0367 - 0.0374)	70	72	74	74	74																						
0.951 - 0.970 (0.0374 - 0.0382)	72	74	74	74																							
0.971 - 0.990 (0.0382 - 0.0390)	74	74	74																								
0.991 - 1.010 (0.0390 - 0.0398)	74	74																									
1.011 - 1.030 (0.0398 - 0.0406)	74																										

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(4) Valve selection chart (exhaust) (continued).



	5.400 (0.2126)	5.410 (0.2130)	5.420 (0.2134)	5.430 (0.2138)	5.440 (0.2142)	5.450 (0.2146)	5.460 (0.2150)	5.470 (0.2154)	5.480 (0.2157)	5.490 (0.2161)	5.500 (0.2165)	5.510 (0.2169)	5.520 (0.2173)	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)
0.000 - 0.030 (0.0000 - 0.0012)	12	14	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	36	38	40	42	44	46
0.031 - 0.050 (0.0012 - 0.0020)	14	16	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	38	40	42	44	46	48
0.051 - 0.070 (0.0020 - 0.0028)	16	18	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	40	42	44	46	48	50
0.071 - 0.090 (0.0028 - 0.0035)	18	20	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	42	44	46	48	50	52
0.091 - 0.110 (0.0036 - 0.0043)	20	22	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	44	46	48	50	52	54
0.111 - 0.130 (0.0044 - 0.0051)	22	24	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	46	48	50	52	54	56
0.131 - 0.150 (0.0052 - 0.0059)	24	26	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	48	50	52	54	56	58
0.151 - 0.170 (0.0059 - 0.0067)	26	28	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	50	52	54	56	58	60
0.171 - 0.190 (0.0067 - 0.0075)	28	30	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	52	54	56	58	60	62
0.191 - 0.210 (0.0075 - 0.0083)	30	32	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	54	56	58	60	62	64
0.211 - 0.230 (0.0083 - 0.0091)	32	34	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	56	58	60	62	64	66
0.231 - 0.249 (0.0091 - 0.0098)	34	36	36	38	38	40	40	42	42	44	44	46	46	48	48	50	50	52	52	54	54	56	58	60	62	64	66	68
0.250 - 0.350 (0.0098 - 0.0138)																												
0.351 - 0.370 (0.0138 - 0.0146)	46	48	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	70	72	74	74	74	
0.371 - 0.390 (0.0146 - 0.0154)	48	50	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	72	74	74	74		
0.391 - 0.410 (0.0154 - 0.0161)	50	52	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	74	74	74			
0.411 - 0.430 (0.0162 - 0.0169)	52	54	54	56	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74				
0.431 - 0.450 (0.0170 - 0.0177)	54	56	56	58	58	60	60	62	62	64	64	66	68	68	70	70	72	72	74	74	74	74	74					
0.451 - 0.470 (0.0178 - 0.0185)	56	58	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74						
0.471 - 0.490 (0.0185 - 0.0193)	58	60	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74							
0.491 - 0.510 (0.0193 - 0.0201)	60	62	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74									
0.511 - 0.530 (0.0201 - 0.0209)	62	64	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74											
0.531 - 0.550 (0.0209 - 0.0217)	64	66	66	68	68	70	70	72	72	74	74	74	74	74	74													
0.551 - 0.570 (0.0217 - 0.0224)	66	68	68	70	70	72	72	74	74	74	74	74	74															
0.571 - 0.590 (0.0225 - 0.0232)	68	70	70	72	72	74	74	74	74	74	74																	
0.591 - 0.610 (0.0233 - 0.0240)	70	72	72	74	74	74	74	74	74																			
0.611 - 0.630 (0.0241 - 0.0248)	72	74	74	74	74	74	74																					
0.631 - 0.650 (0.0248 - 0.0256)	74	74	74	74	74	74																						
0.651 - 0.670 (0.0256 - 0.0264)	74	74	74																									
0.671 - 0.690 (0.0264 - 0.0272)	74																											

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New lifter thickness

Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
06	5.060 mm (0.1992 in.)	30	5.300 mm (0.2087 in.)	54	5.540 mm (0.2181 in.)
08	5.080 mm (0.2000 in.)	32	5.320 mm (0.2094 in.)	56	5.560 mm (0.2189 in.)

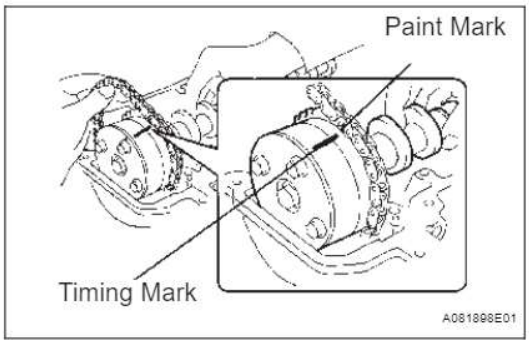
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Lifter No.	Thickness	Lifter No.	Thickness	Lifter No.	Thickness
10	5.100 mm (0.2008 in.)	34	5.340 mm (0.2102 in.)	58	5.580 mm (0.2197 in.)
12	5.120 mm (0.2016 in.)	36	5.360 mm (0.2110 in.)	60	5.600 mm (0.2205 in.)
14	5.140 mm (0.2024 in.)	38	5.380 mm (0.2118 in.)	62	5.620 mm (0.2213 in.)
16	5.160 mm (0.2031 in.)	40	5.400 mm (0.2126 in.)	64	5.640 mm (0.2220 in.)
18	5.180 mm (0.2039 in.)	42	5.420 mm (0.2134 in.)	66	5.660 mm (0.2228 in.)
20	5.200 mm (0.2047 in.)	44	5.440 mm (0.2142 in.)	68	5.680 mm (0.2236 in.)
22	5.220 mm (0.2055 in.)	46	5.460 mm (0.2150 in.)	70	5.700 mm (0.2244 in.)
24	5.240 mm (0.2063 in.)	48	5.480 mm (0.2157 in.)	72	5.720 mm (0.2252 in.)
26	5.260 mm (0.2071 in.)	50	5.500 mm (0.2165 in.)	74	5.740 mm (0.2260 in.)
28	5.280 mm (0.2079 in.)	52	5.520 mm (0.2173 in.)	-	-

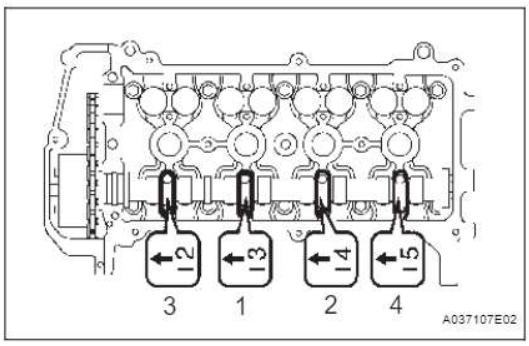
Standard exhaust valve clearance (Cold):
0.25 to 0.35 mm (0.010 to 0.014 in.)
EXAMPLE:
The 5.340 mm (0.2102 in.) lifter is installed, and the measured clearance is 0.440 mm (0.0173 in.).
Replace the 5.340 mm (0.2102 in.) lifter with a new No. 48 lifter.

(r) Reinstall the valve lifters.

(s) Apply a light coat of engine oil to the camshaft journals.

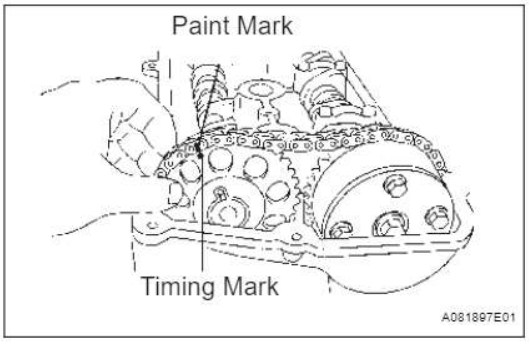


(t) Install the timing chain onto the camshaft timing gear with the paint mark and the timing mark aligned as shown in the illustration.

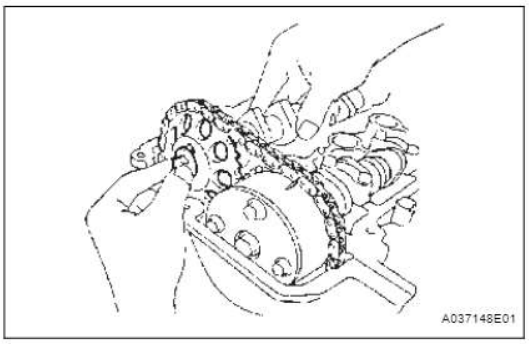


(u) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (129 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.

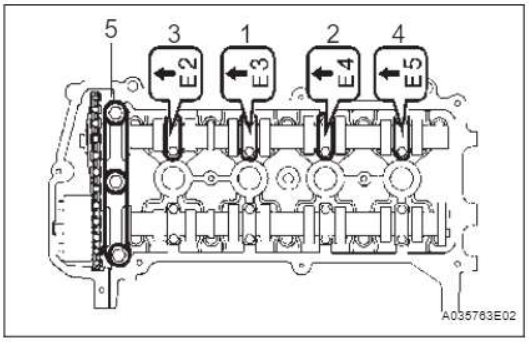
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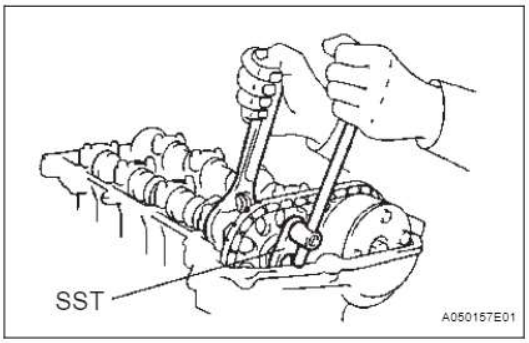
(v) Hold the timing chain, and align the timing mark on the camshaft timing sprocket with the paint mark of the timing chain.



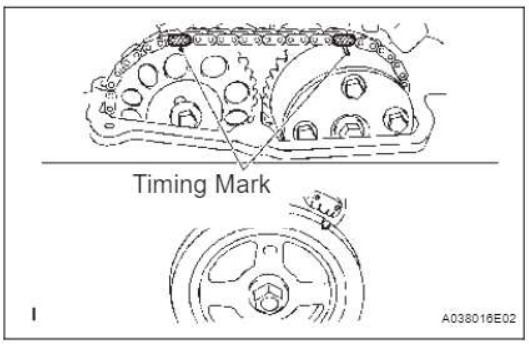
(w) Align the alignment pin hole on the camshaft timing sprocket with the alignment pin of the camshaft, and install the sprocket into the camshaft.
(x) Temporarily install the timing sprocket bolt.



(y) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (133 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.
(z) Install the No. 1 bearing cap.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)

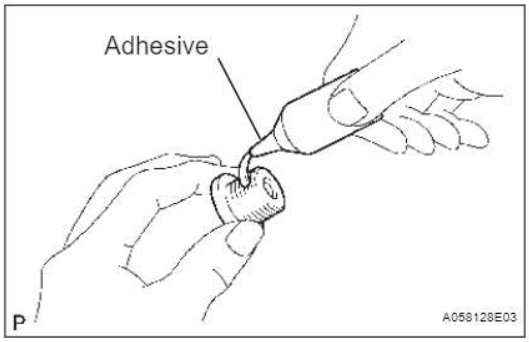


(aa) Using SST, hold the camshaft with a wrench on the hexagon lobe, and install the bolt.
SST 09023-38400
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)
(ab) Remove the bar from the timing chain tensioner.

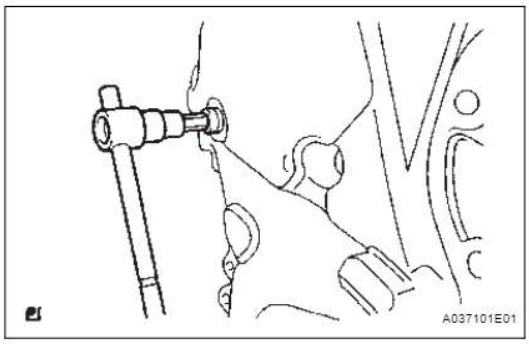


(ac) Turn the crankshaft pulley until its timing notch and the timing mark 0 of the chain cover are aligned.
(ad) Check that all the pairs of the timing marks are aligned.

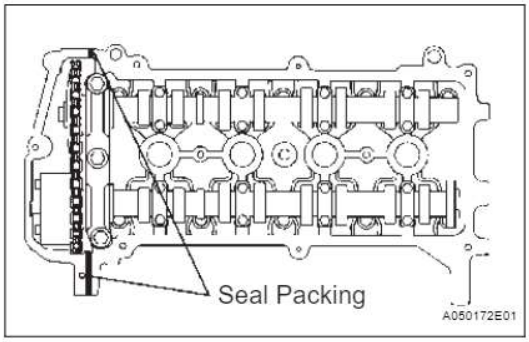
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(ae) Apply seal packing to 2 or 3 threads of the screw plug end.
Seal packing:
Part No. 08833-00070 or equivalent

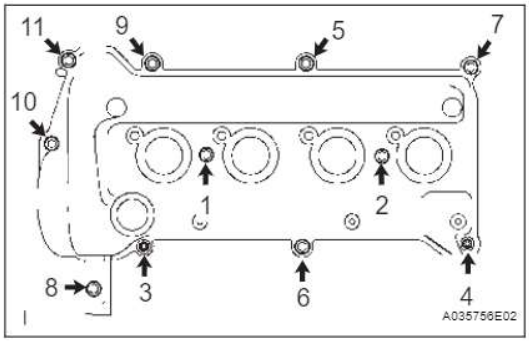


(af) Using an 8 mm hexagon wrench, install the screw plug.
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)



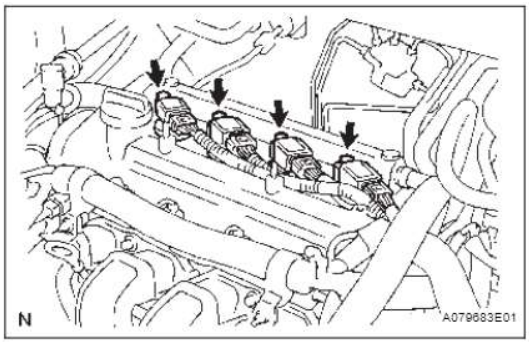
10. INSTALL CYLINDER HEAD COVER

(a) Apply seal packing to the 2 locations shown in the illustration.
Seal packing:
Part No. 08826-00080 or equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head cover within 3 minutes of applying seal packing.**
- **Do not start the engine for at least 2 hours after installation.**



(b) Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.

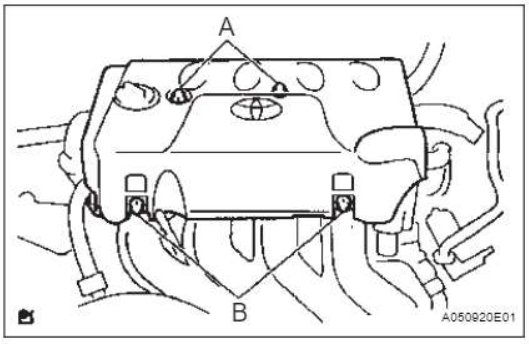
(c) Using several steps, uniformly tighten the bolts and nuts in the sequence shown in the illustration.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



11. INSTALL IGNITION COIL

(a) Install the 4 ignition coils with the 4 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

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12. **INSTALL NO. 2 CYLINDER HEAD COVER**
    (a) First tighten the nuts labeled A, and then tighten nuts labeled B.
    Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)

13. **INSPECT ENGINE OIL LEAKS**

14. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

15. **PERFORM INITIALIZATION**
    (a) Perform initialization (see page IN-23).
    NOTICE:
    Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

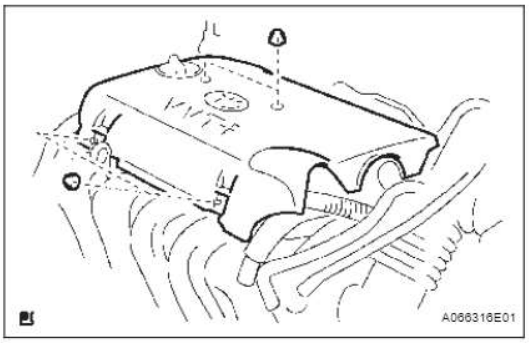
EM

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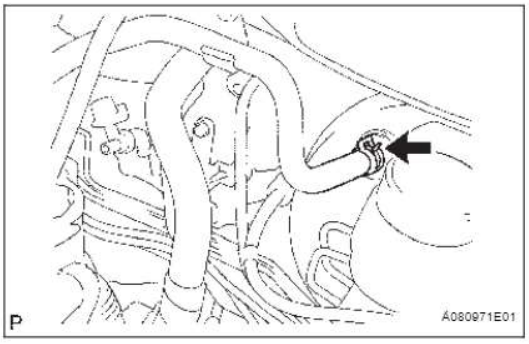
EM

REMOVAL

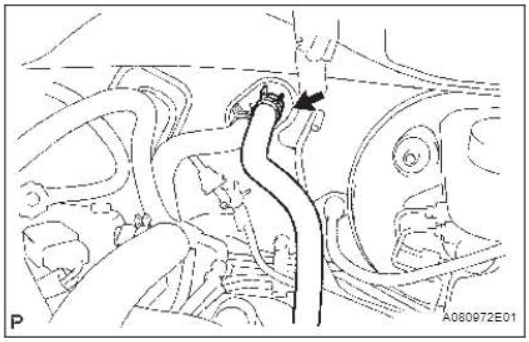
1. **DISCHARGE FUEL SYSTEM PRESSURE (See page FU-11)**
2. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
3. **REMOVE ENGINE UNDER COVER RH**
4. **REMOVE ENGINE UNDER COVER LH**
5. **DRAIN ENGINE COOLANT (See page CO-5)**
6. **REMOVE FRONT WHEEL**
7. **REMOVE NO. 2 CYLINDER HEAD COVER**
   (a) Remove the 4 nuts and No. 2 cylinder head cover.



8. **REMOVE BATTERY**
9. **REMOVE AIR CLEANER (See page ES-346)**
10. **DISCONNECT FUEL TUBE (See page FU-12)**
11. **DISCONNECT ACCELERATOR CONTROL CABLE (See page ES-346)**
12. **REMOVE RADIATOR (See page CO-19)**
13. **DISCONNECT TRANSMISSION CONTROL CABLE (for Manual Transaxle) (See page MX-21)**
14. **DISCONNECT TRANSMISSION CONTROL CABLE (for Automatic Transaxle) (See page AX-134)**
15. **DISCONNECT CLUTCH RELEASE CYLINDER (for Manual Transaxle) (See page CL-13)**
16. **DISCONNECT UNION TO CHECK VALVE HOSE**
    (a) Disconnect the union to check valve hose for the brake booster.

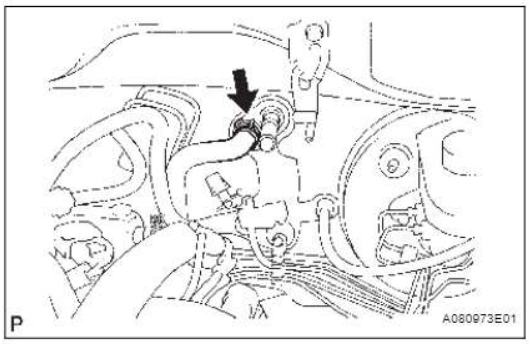


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17. DISCONNECT HEATER WATER INLET HOSE

(a) Disconnect the heater water inlet hose from the air conditioner tube.



18. DISCONNECT HEATER WATER OUTLET HOSE

(a) Disconnect the heater water outlet hose from the air conditioner tube.

19. DISCONNECT ENGINE WIRE

(a) Remove the glove compartment door.
(b) Disconnect the engine wire harness from the ECM and junction block.
(c) Pull out the engine wire.
(d) Disconnect the engine wire from the engine room junction block.
(e) Remove the body ground.

20. REMOVE GENERATOR V BELT (See page EM-7)

21. REMOVE COOLER COMPRESSOR (See page AC-80)

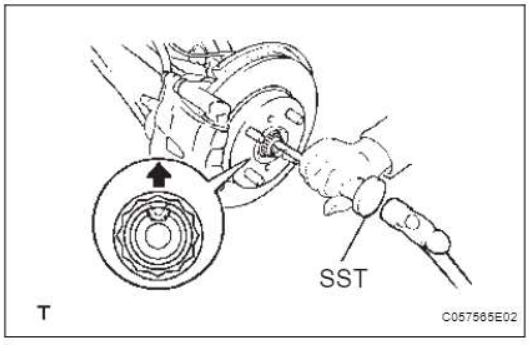
22. REMOVE FLOOR PANEL BRACE FRONT (See page EX-3)

23. REMOVE EXHAUST PIPE FRONT (See page EX-3)

24. DISCONNECT STEERING INTERMEDIATE SHAFT (See page SR-8)

25. REMOVE FRONT AXLE HUB LH NUT

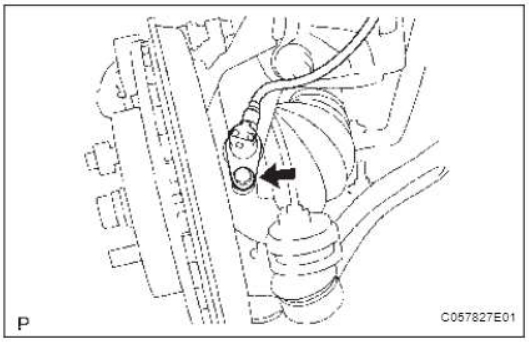
(a) Remove the clip and nut.



(b) Using SST and a hammer, unstake the lock nut.
SST 09930-00010
NOTICE:
- **When removing the nut, unstake the lock nut completely.**
- **Do not damage the threads of the drive shaft.**
- **Do not use SST with the tip sharpened.**
- **Set SST to the groove with the flat face facing upward.**

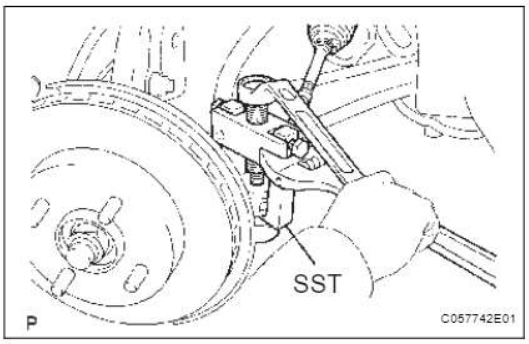
(c) Using a 30 mm socket wrench, remove the lock nut.
HINT:
Perform the same procedure as above on the opposite side.

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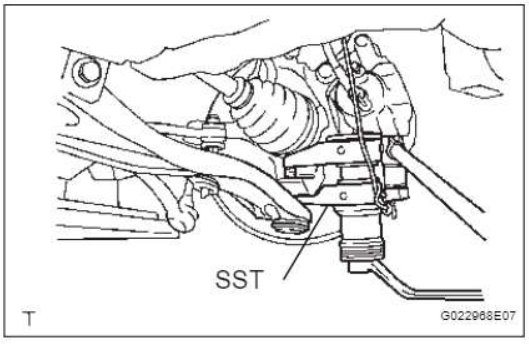
26. DISCONNECT SPEED SENSOR FRONT LH (w/ ABS)

(a) Remove the bolt and disconnect the speed sensor from the steering knuckle.
HINT:
Perform the same procedure as above on the opposite side.



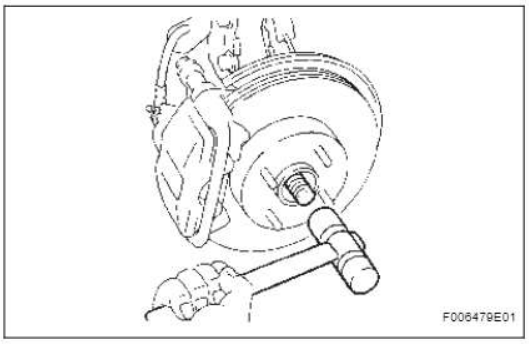
27. DISCONNECT TIE ROD END LH

(a) Using SST, disconnect the tie rod end from the steering knuckle.
SST 09628-62011
NOTICE:
Do not damage the dust cover of the ball joint.
HINT:
Perform the same procedure as above on the opposite side.



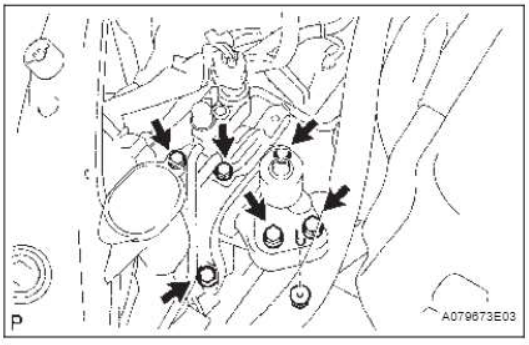
28. DISCONNECT FRONT SUSPENSION ARM LOWER LH

(a) Using SST, disconnect the front suspension arm lower from the steering knuckle.
SST 09628-00011
HINT:
Perform the same procedure as above on the opposite side.



29. DISCONNECT FRONT DRIVE SHAFT LH

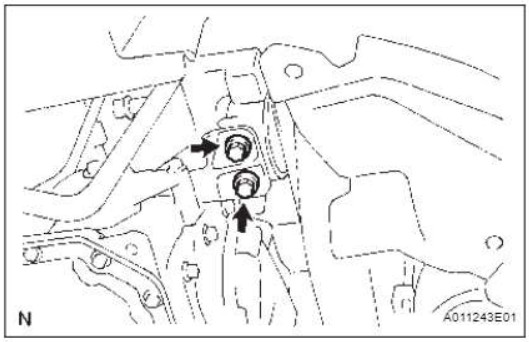
(a) Using a plastic-faced hammer, detach the drive shaft from the axle hub by tapping the drive shaft.
HINT:
Perform the same procedure as above on the opposite side.



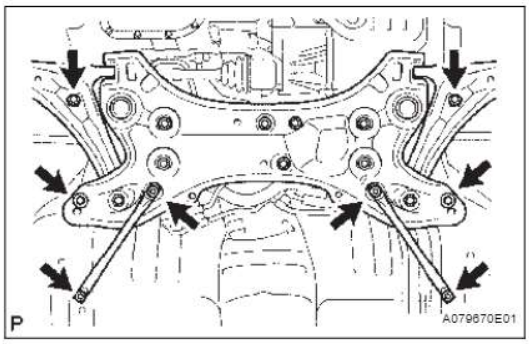
30. REMOVE ENGINE AND TRANSAXLE ASSEMBLY

(a) Set the engine lifter.
(b) Remove the bolt which is used to fix the liquid tube to the engine mounting insulator RH.
(c) Remove the 5 bolts, nut and engine mounting insulator RH.

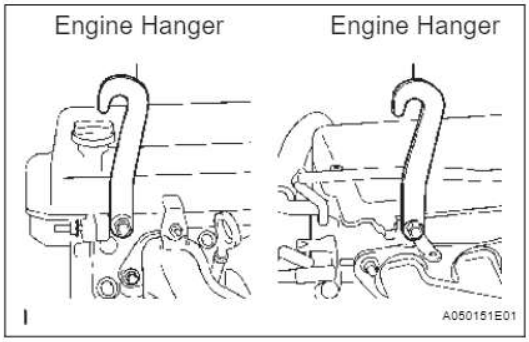
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(d) Remove the 2 bolts and detach the engine mounting bracket from the engine mounting insulator LH.



(e) Remove the engine together with the transaxle.
(1) Remove the 8 bolts shown in the illustration.
(2) Carefully remove the engine assembly from the vehicle.



(f) Install the 2 engine hangers as shown in the illustration.
Part No.

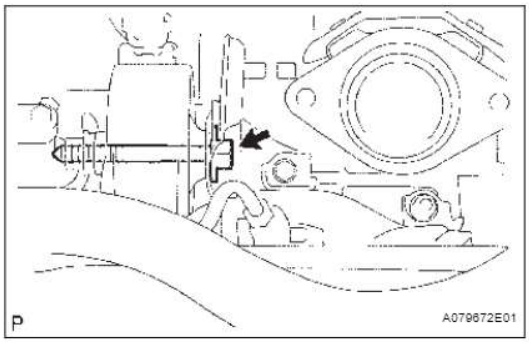
Item	Part
No. 1 engine hanger	12281-21010
Bolt	91642-81025

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

(g) Attach the engine sling device and hang the engine with the chain block.

31. REMOVE VANE PUMP V BELT (See page EM-7)

32. REMOVE VANE PUMP
(a) Disconnect the power steering oil pressure sensor harness.
(b) Remove the 2 bolts and vane pump assembly.



33. REMOVE FRONT SUSPENSION CROSSMEMBER
(a) Remove the through bolt.
(b) Separate the engine and the transaxle assembly from the suspension crossmember.

34. REMOVE STARTER (See page ST-8)

35. REMOVE GENERATOR (See page CH-9)

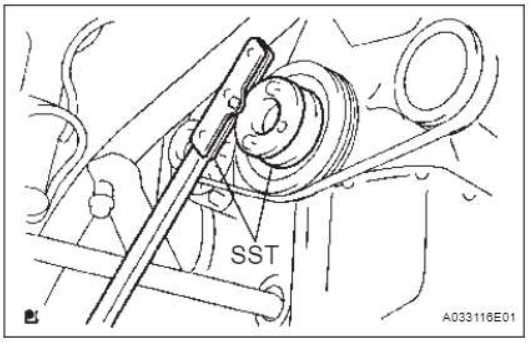
36. REMOVE MANUAL TRANSAXLE (for Manual Transaxle) (See page MX-23)

37. REMOVE AUTOMATIC TRANSAXLE (for Automatic Transaxle) (See page AX-137)

38. REMOVE CLUTCH COVER (for Manual Transaxle) (See page CL-16)

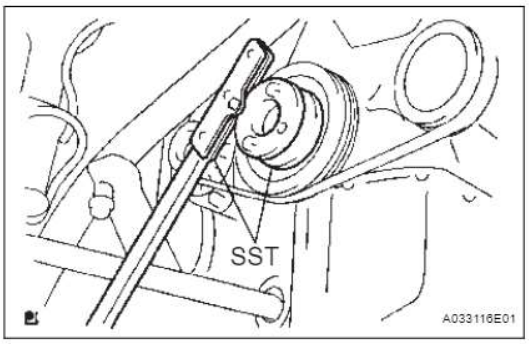
39. REMOVE CLUTCH DISC (for Manual Transaxle)

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40. REMOVE FLYWHEEL (for Manual Transaxle)

(a) Hold the crankshaft pulley with SST, and then remove the 6 bolts and flywheel.
SST 09213-58012 (91111-50845), 09330-00021

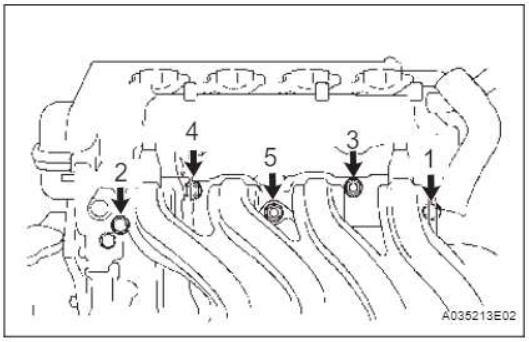


41. REMOVE DRIVE PLATE (for Automatic Transaxle)

(a) Hold the crankshaft pulley with SST, and then remove the 6 bolts and drive plate.
SST 09213-58012 (91111-50845), 09330-00021

42. REMOVE VENTILATION HOSE (See page EM-25)

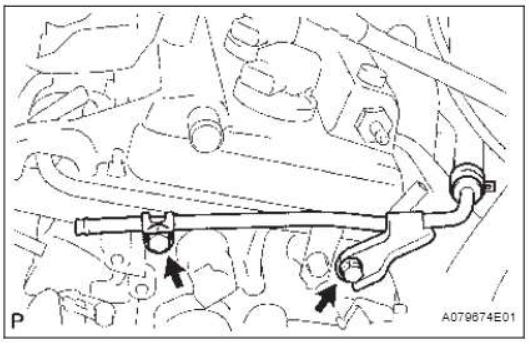
43. REMOVE NO. 2 VENTILATION HOSE (See page EM-25)



44. REMOVE INTAKE MANIFOLD

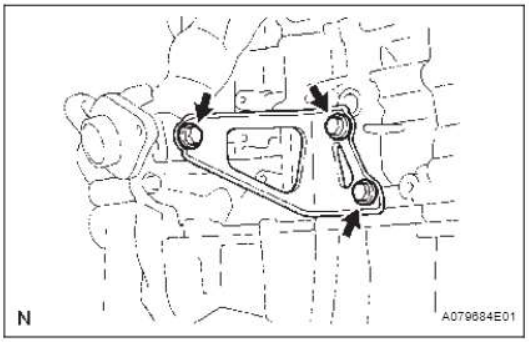
(a) Using several steps, remove the 3 bolts and 2 nuts in the sequence shown in the illustration. Then remove the intake manifold.

(b) Remove the gasket from the intake manifold.



45. REMOVE BOOSTER VACUUM TUBE

(a) Remove the 2 bolts and booster vacuum tube.



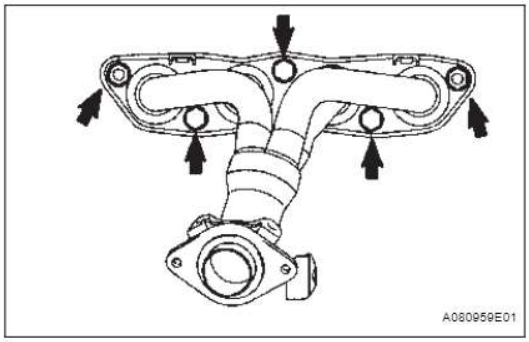
46. REMOVE MANIFOLD SUPPORT BRACKET

(a) Remove the 3 bolts and manifold support bracket.

47. REMOVE NO. 1 EXHAUST MANIFOLD HEAT INSULATOR

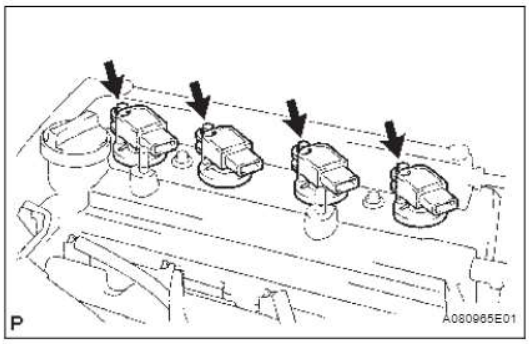
(a) Remove the 4 bolts and exhaust manifold heat insulator.

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48. REMOVE EXHAUST MANIFOLD

(a) Remove the 3 bolts, 2 nuts and exhaust manifold.

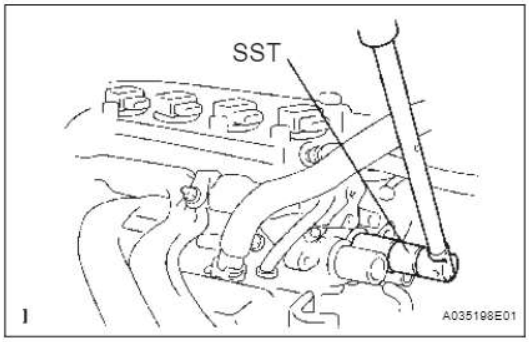


49. REMOVE IGNITION COIL

(a) Remove the 4 bolts and pull out the 4 ignition coils.

50. REMOVE NO. 1 WATER BY-PASS PIPE

(a) Remove the 2 nuts and 2 bolts, and then remove the water by-pass pipe.



51. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

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

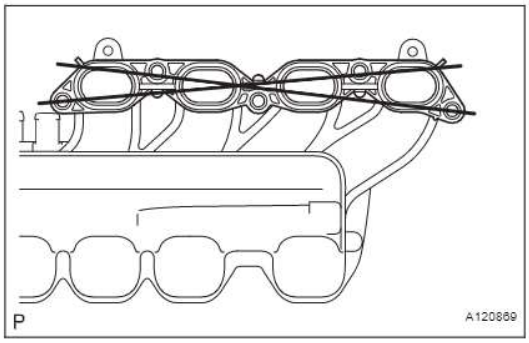
52. REMOVE KNOCK SENSOR

(a) Remove the bolt and sensor.

53. REMOVE ENGINE OIL PRESSURE SWITCH

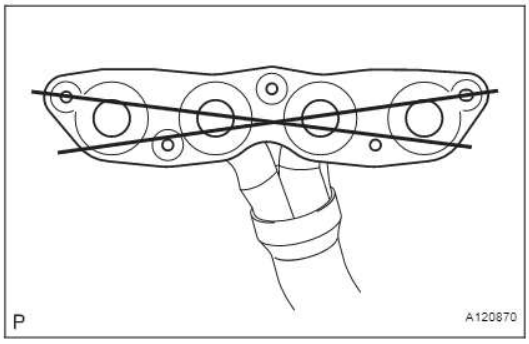
(a) Using SST, remove the switch.
SST 09268-46021

INSPECTION



1. INSPECT INTAKE MANIFOLD

(a) Using a precision straightedge and feeler gauge, measure the surface contacting the cylinder head for warpage.
Maximum warpage:
0.10 mm (0.004 in.)
If the warpage is greater than the maximum, replace the manifold.



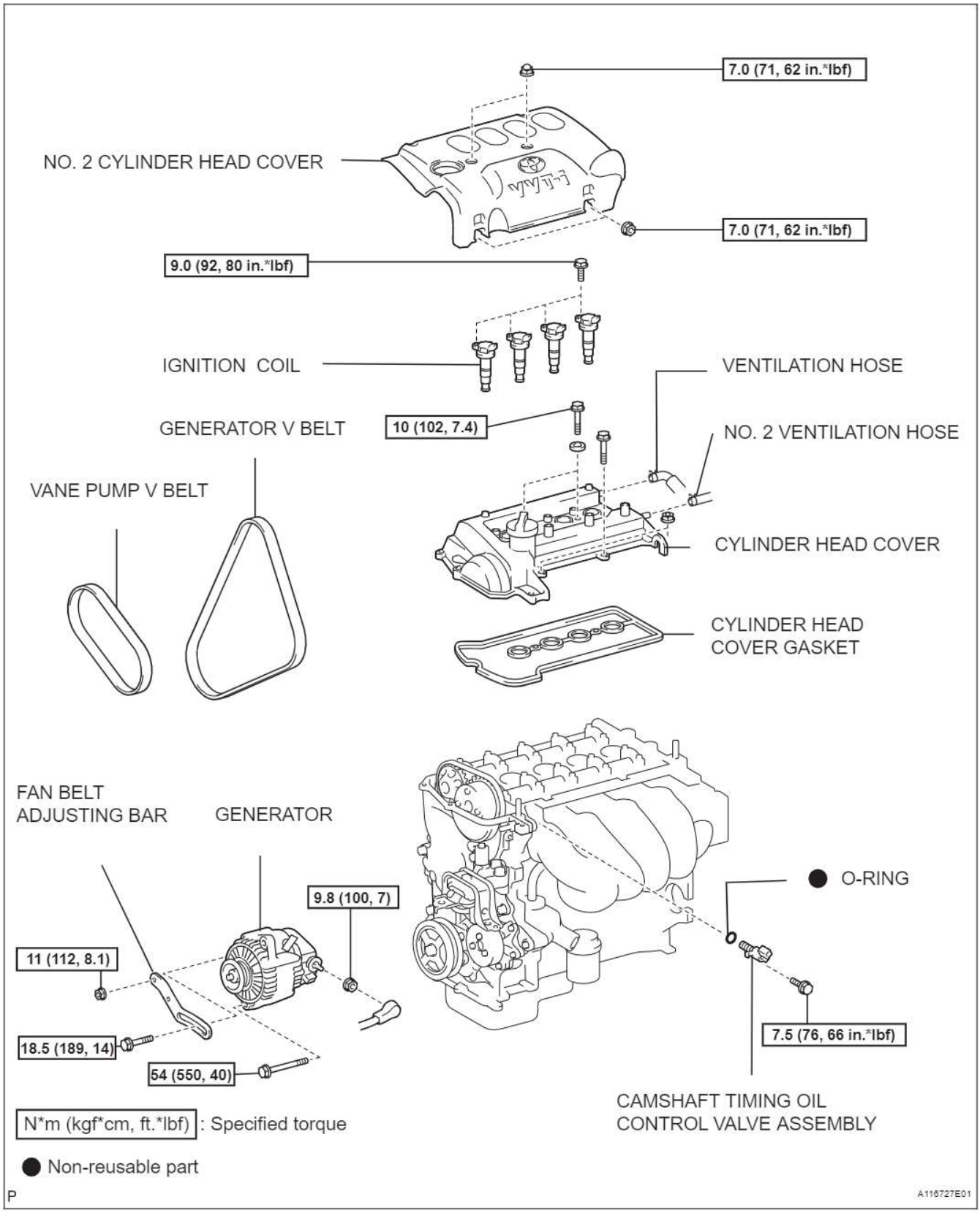
2. INSPECT EXHAUST MANIFOLD

(a) Using a precision straightedge and 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 manifold.

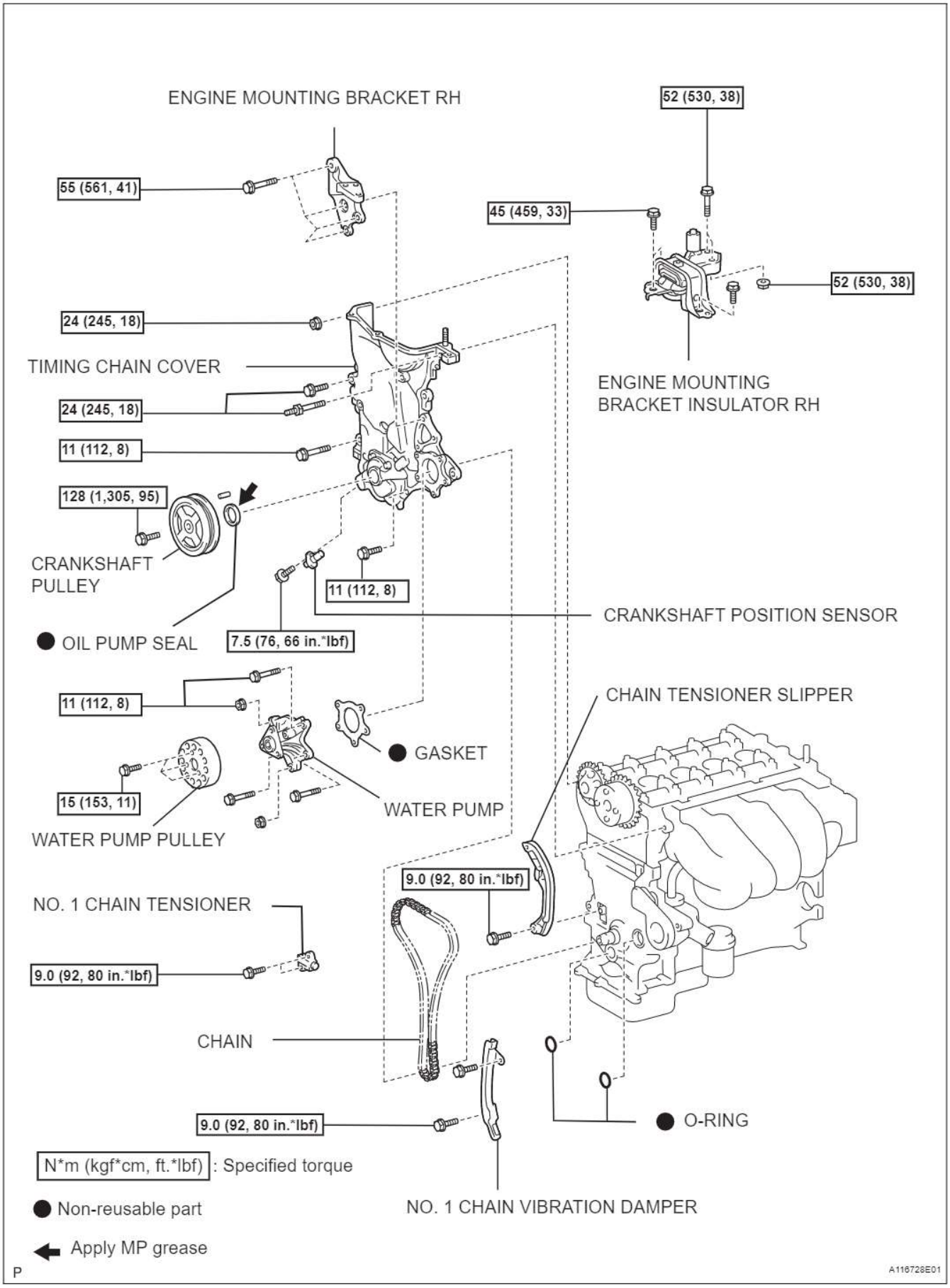
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TIMING CHAIN

COMPONENTS



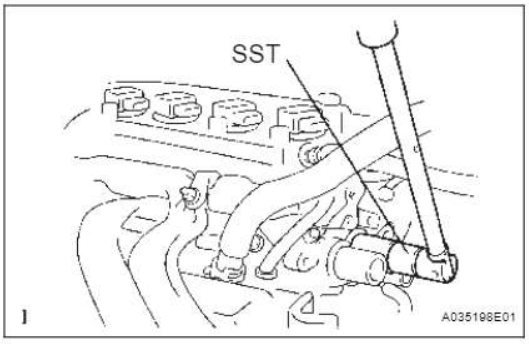
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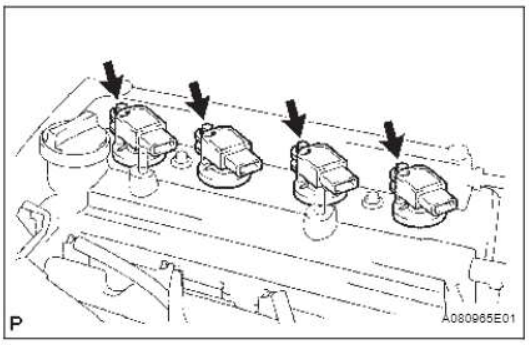


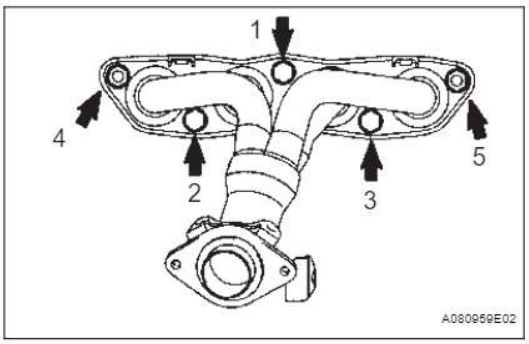
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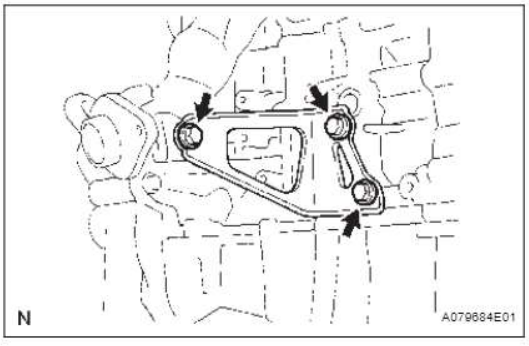
INSTALLATION

1. **INSTALL OIL PRESSURE SWITCH (See page LU-1)**
2. **INSTALL KNOCK SENSOR (See page ES-358)**
3. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR**
   (a) Install a new gasket onto the sensor.
   (b) Using SST, install the temperature sensor in place.
   SST 09817-33190
   Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)
4. **INSTALL NO. 1 WATER BY-PASS PIPE**
   (a) Install a new gasket and the water by-pass pipe with the 2 bolts and 2 nuts.
   Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
5. **INSTALL IGNITION COIL**
   (a) Install the 4 ignition coils with the 4 bolts.
   Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
6. **INSTALL EXHAUST MANIFOLD**
   (a) Using several steps, install a new exhaust manifold gasket and the exhaust manifold with the 3 bolts and 2 nuts in the sequence shown in the illustration.
   Torque: 27 N*m (275 kgf*cm, 20 ft.*lbf)
7. **INSTALL NO. 1 EXHAUST MANIFOLD HEAT INSULATOR**
   (a) Install the exhaust manifold heat insulator with the 4 bolts.
   Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
8. **INSTALL MANIFOLD SUPPORT BRACKET**
   (a) Install the manifold support bracket with the 3 bolts.
   Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)

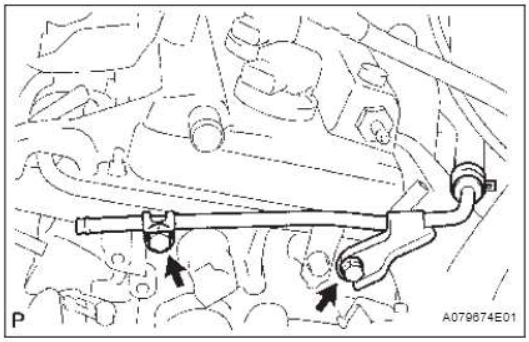






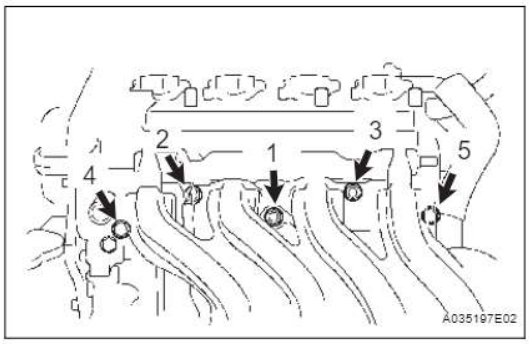


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9. INSTALL BOOSTER VACUUM TUBE

(a) Install the booster vacuum tube with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

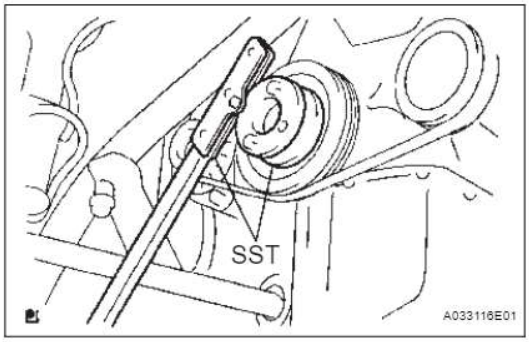


10. INSTALL INTAKE MANIFOLD

(a) Install a new gasket onto the intake manifold.
(b) Install the intake manifold with the 3 bolts and 2 nuts. Using several steps, uniformly tighten the bolts and nuts in the sequence shown in the illustration.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

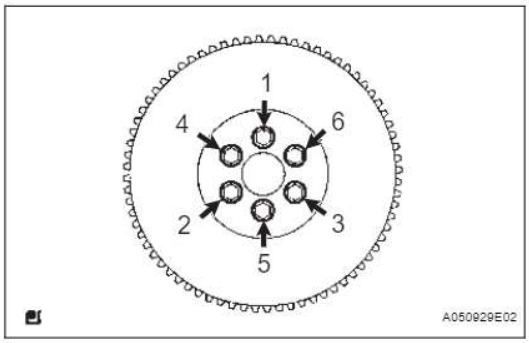
11. CONNECT NO. 2 VENTILATION HOSE (See page EM-31)

12. CONNECT VENTILATION HOSE (See page EM-31)

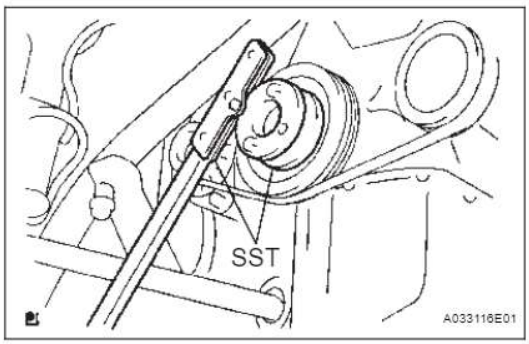


13. INSTALL DRIVE PLATE (for Automatic Transaxle)

(a) Hold the crankshaft pulley with SST.
SST 09213-58012 (91111-50845), 09330-00021



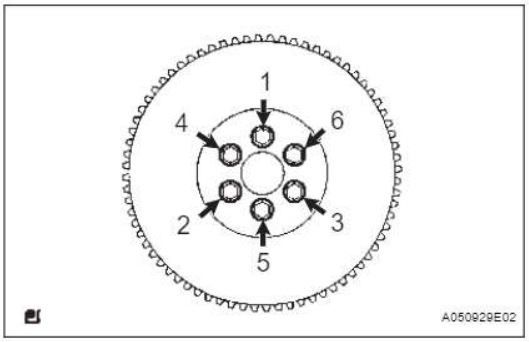
(b) Install the drive plate.
(1) Clean the bolt and bolt hole.
(2) Apply adhesive to the bolts.
Adhesive:
Part No. 0933-00070, THREE BOND or equivalent
(3) Using several steps, uniformly install and tighten the 6 bolts in the sequence shown in the illustration.
Torque: 88 N*m (900 kgf*cm, 65 ft.*lbf)



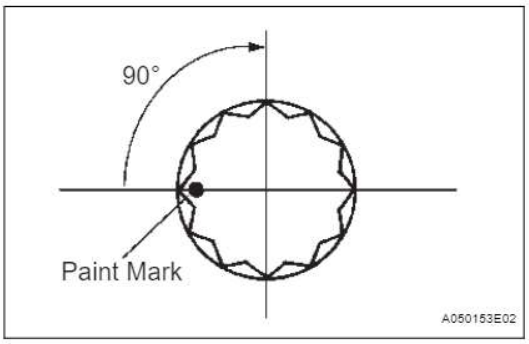
14. INSTALL FLYWHEEL (for Manual Transaxle)

(a) Hold the crankshaft pulley with SST.
SST 09213-58012 (91111-50845), 09330-00021
(b) Install the flywheel.
(1) Clean the bolt hole.
(2) Apply adhesive to the bolts.
Adhesive:
Part No. 0933-00070, THREE BOND or equivalent

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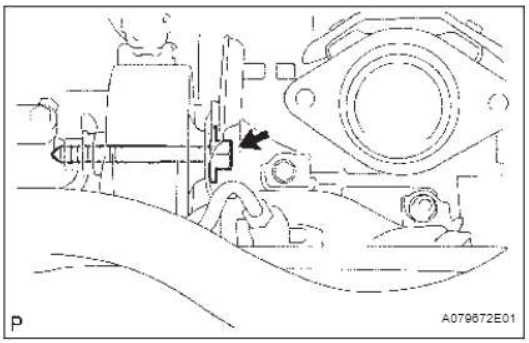


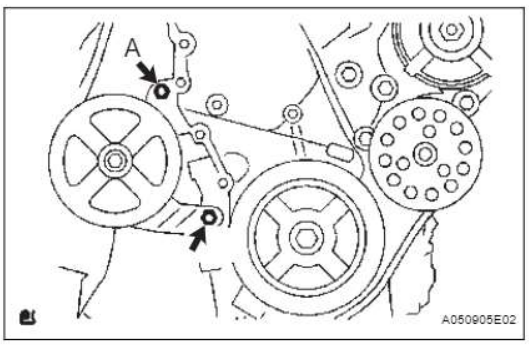
(3) Using several steps, uniformly install and tighten the 6 bolts in the sequence shown in the illustration.
Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)
NOTICE:
Do not reuse the flywheel bolt. It may cause breakage of the flywheel bolt.



(4) Mark the flywheel bolt with paint.
(5) Retighten the flywheel bolts by an additional 90°.
(6) Check that the paint mark is at a 90° position from the original location.

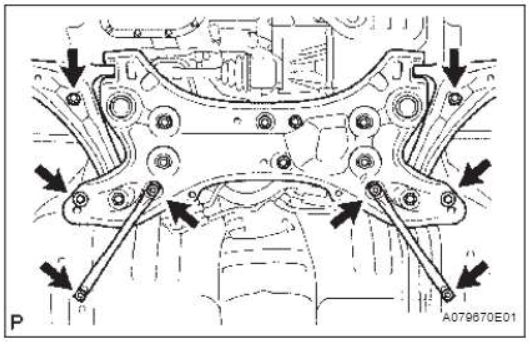
15. **INSTALL CLUTCH DISC (for Manual Transaxle) (See page CL-18)**
16. **INSTALL CLUTCH COVER (for Manual Transaxle) (See page CL-18)**
17. **INSTALL MANUAL TRANSAXLE (for Manual Transaxle) (See page MX-23)**
18. **INSTALL AUTOMATIC TRANSAXLE (for Automatic Transaxle) (See page AX-141)**
19. **INSTALL GENERATOR (See page CH-15)**
20. **INSTALL STARTER (See page ST-14)**
21. **INSTALL FRONT SUSPENSION CROSSMEMBER**
    (a) Fasten the bolt to secure the engine and transaxle assembly to the suspension crossmember.
    Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)





22. **INSTALL VANE PUMP**
    (a) Install the vane pump assembly with the 2 bolts.
    Torque: 44 N*m (449 kgf*cm, 33 ft.*lbf)
    HINT:
    Temporarily tighten bolt A so that the V belt can be adjusted in a later step.
23. **INSTALL VANE PUMP V BELT**
    (a) Temporarily install the V belt on each pulley.
24. **ADJUST VANE PUMP V BELT (See page EM-7)**

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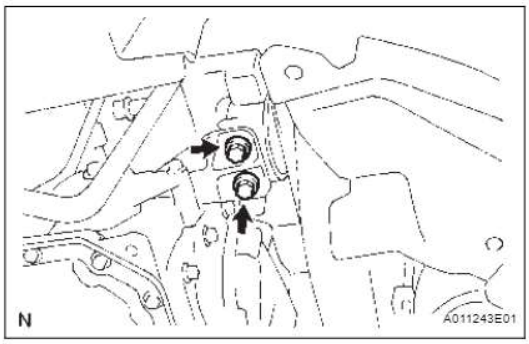


25. INSTALL ENGINE AND TRANSAXLE ASSEMBLY

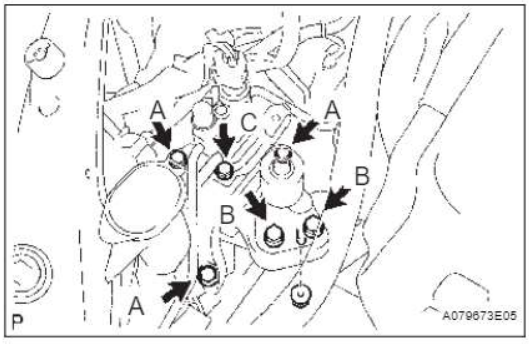
(a) Set the engine together with the transaxle on the engine lifter.

(b) Install the engine together with the transaxle onto the engine compartment.

(c) Temporarily install the suspension crossmember with the 8 bolts.

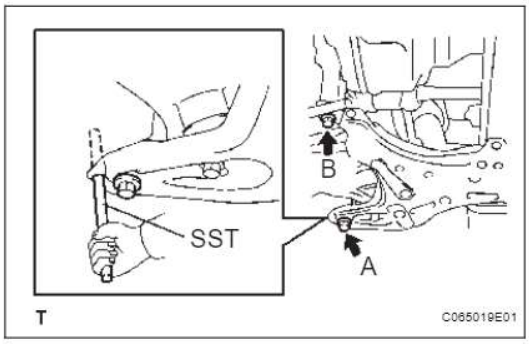


(d) Install the engine mounting bracket LH onto the engine mounting insulator LH with the 2 bolts.
Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)



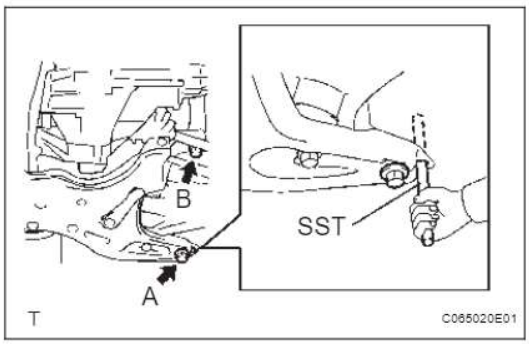
(e) Install the engine mounting insulator RH with the 5 bolts and nut.
Torque: 45 N*m (459 kgf*cm, 33 ft.*lbf) for bolt A
52 N*m (530 kgf*cm, 38 ft.*lbf) for bolt B
52 N*m (530 kgf*cm, 38 ft.*lbf) for nut

(f) Install the liquid tube with the bolt.
Torque: 9.8 N*m (100 kgf*cm, 7.2 in.*lbf) for bolt C



(g) Insert SST to the positioning holes on the right-hand crossmember and on the right-hand of the vehicle.
SST 09670-00010

(h) Temporarily tighten bolt A, and then tighten bolt B.



(i) Insert SST into the positioning holes on the left-hand crossmember and on the left-hand of the vehicle.
SST 09670-00010

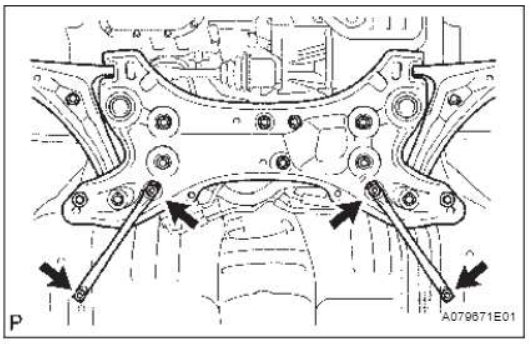
(j) Temporarily tighten bolt A, and then tighten bolt B.

(k) Insert SST into the positioning holes on the right-hand crossmember and the right-hand of the vehicle, and then tighten the bolts to the specified torque.
SST 09670-00010

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Torque: 116 N*m (1,183 kgf*cm, 86 ft.*lbf) for bolt A
70 N*m (714 kgf*cm, 52 ft.*lbf) for bolt B

(l) Insert SST into the positioning holes on the left-hand crossmember and the left-hand of the vehicle, and then tighten the bolts to the specified torque.
SST 09670-00010
Torque: 116 N*m (1,183 kgf*cm, 86 ft.*lbf) for bolt A
70 N*m (714 kgf*cm, 52 ft.*lbf) for bolt B



(m) Tighten the 4 bolts shown in the illustration.
Torque: 47 N*m (479 kgf*cm, 35 ft.*lbf)

26. INSTALL FRONT SUSPENSION ARM LOWER LH

(a) Install the front suspension arm lower to the steering knuckle with the nut.
Torque: 98 N*m (999 kgf*cm, 72 ft.*lbf)

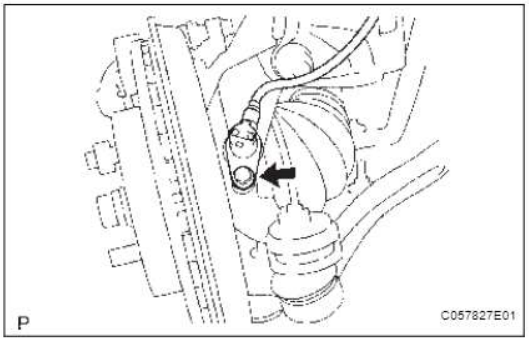
(b) Install a new clip.
HINT:
Perform the same procedure as above on the opposite side.

27. INSTALL TIE ROD END LH

(a) Connect the tie rod end to the steering knuckle with the nut.
Torque: 49 N*m (500 kgf*cm, 36 ft.*lbf)

(b) Install a new cotter pin.
NOTICE:
- **Be careful of the threads and taper portions of the tie rod end to prevent contact with oils.**
- **After tightening the castle nut, turn it clockwise less than 60° to align the pin holes for the cotter pin.**

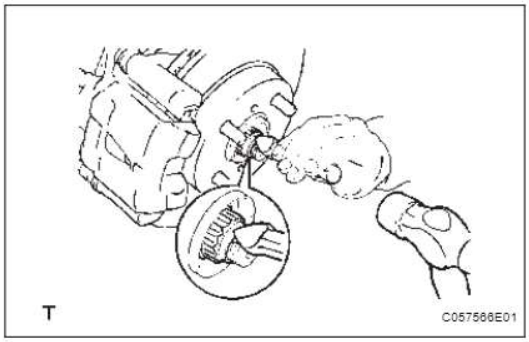
HINT:
Perform the same procedure as above on the opposite side.



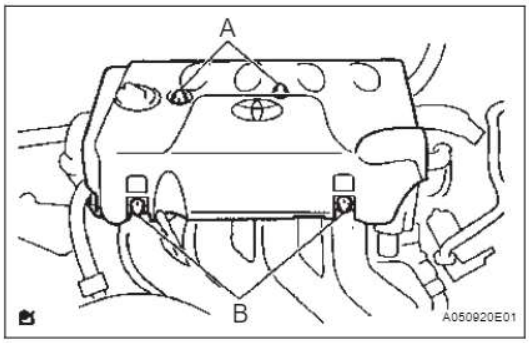
28. CONNECT SPEED SENSOR FRONT LH (w/ ABS)

(a) Install the speed sensor with the bolt.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)
HINT:
Perform the same procedure as above on the opposite side.

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29. **INSTALL FRONT AXLE HUB LH NUT**
    (a) Using a 30 mm socket wrench, install the new hub nut.
    Torque: 216 N*m (2,203 kgf*cm, 160 ft.*lbf)
    (b) Using a chisel and hammer, stake the hub nut.
    HINT:
    Perform the same procedure as above on the opposite side.
30. **INSTALL STEERING INTERMEDIATE SHAFT (See page SR-12)**
31. **INSTALL EXHAUST PIPE FRONT (See page EX-5)**
32. **INSTALL FLOOR PANEL BRACE FRONT (See page EX-5)**
33. **INSTALL COOLER COMPRESSOR (See page AC-81)**
34. **INSTALL GENERATOR V BELT**
    (a) Temporarily install the V belt on each pulley.
35. **ADJUST GENERATOR V BELT (See page EM-7)**
36. **INSTALL RADIATOR (See page CO-19)**
37. **INSTALL CLUTCH RELEASE CYLINDER (for Automatic Transaxle) (See page CL-14)**
38. **CONNECT TRANSMISSION CONTROL CABLE (for Automatic Transaxle) (See page AX-144)**
39. **CONNECT TRANSMISSION CONTROL CABLE (for Manual Transaxle) (See page MX-25)**
40. **CONNECT FUEL TUBE (See page FU-15)**
41. **INSTALL AIR CLEANER (See page ES-348)**
42. **INSTALL BATTERY**



43. **INSTALL NO. 2 CYLINDER HEAD COVER**
    (a) First tighten the nuts labeled A, and then tighten the nuts labeled B.
    Torque: 7.0 N*m (71 kgf*cm, 62 in.*lbf)
44. **ADD ENGINE OIL (See page LU-3)**
45. **ADD ENGINE COOLANT (See page CO-5)**
46. **CHECK FOR ENGINE OIL LEAKS**
47. **CHECK FOR ENGINE COOLANT LEAKS (See page CO-7)**
48. **CHECK FOR FUEL LEAKAGE (See page FU-8)**
49. **INSPECT AND ADJUST FRONT WHEEL ALIGNMENT**
    HINT:
    Inspect and adjust wheel alignment (see page SP-2).
50. **INSPECT IGNITION TIMING (See page EM-1)**
51. **INSPECT ENGINE IDLE SPEED (See page EM-2)**
52. **INSPECT CO/HC (See page EM-3)**

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53. INSPECT ABS SPEED SENSOR SIGNAL

54. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

55. PERFORM INITIALIZATION

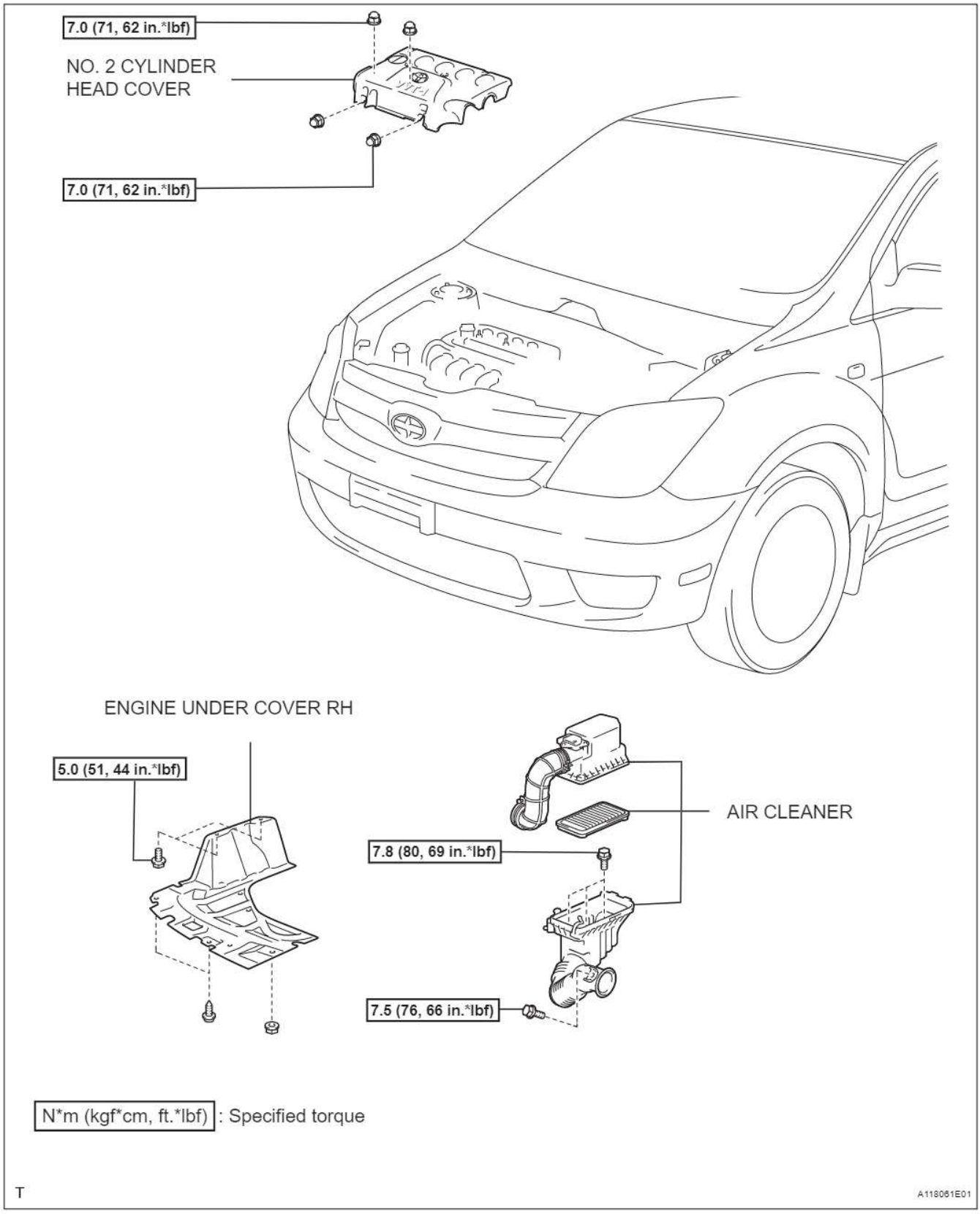
(a) Perform initialization (see page IN-23).

NOTICE:
Certain systems need to be initialized after disconnecting and reconnecting the cable from the negative (-) battery terminal.

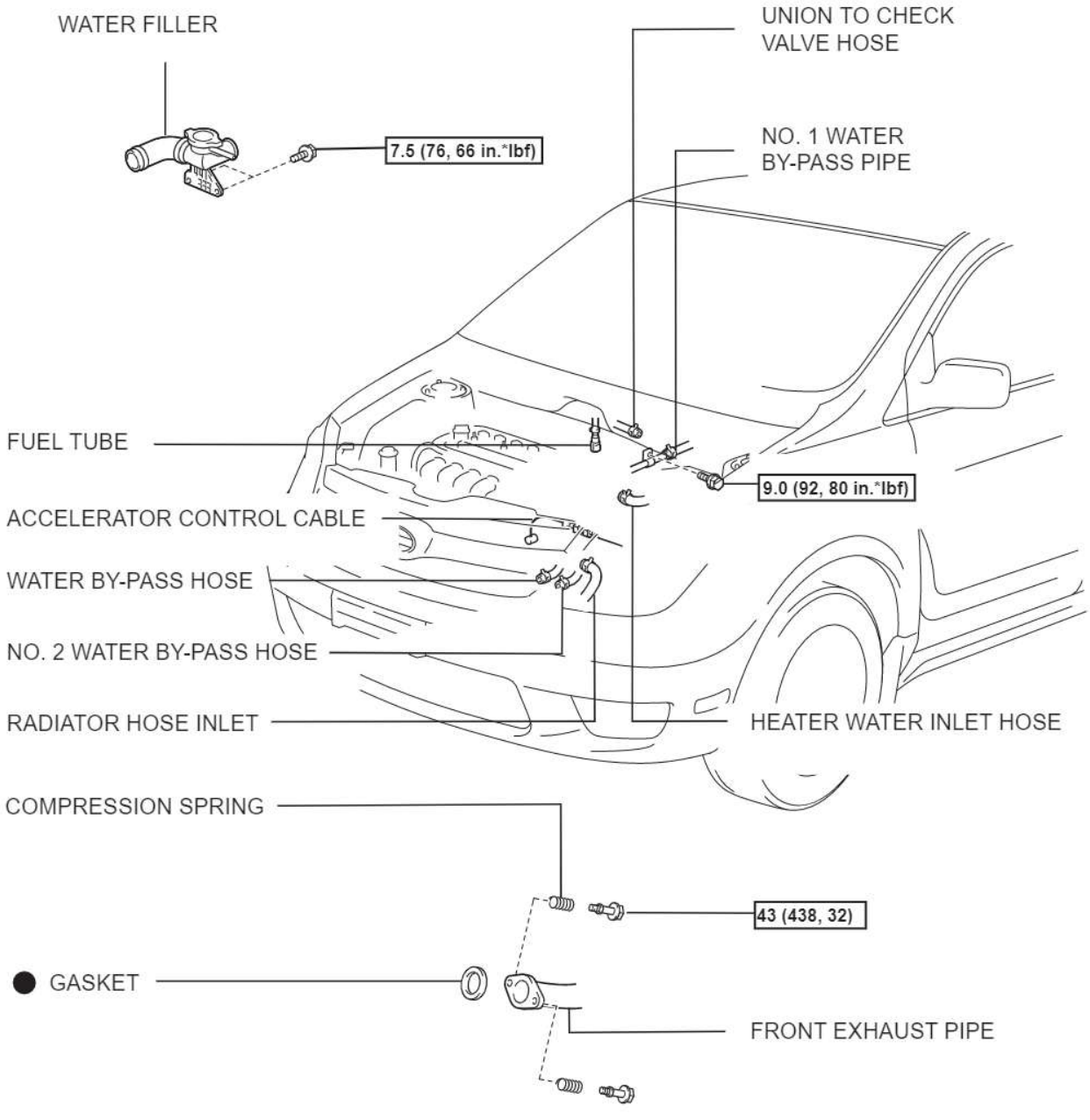
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CYLINDER HEAD

COMPONENTS



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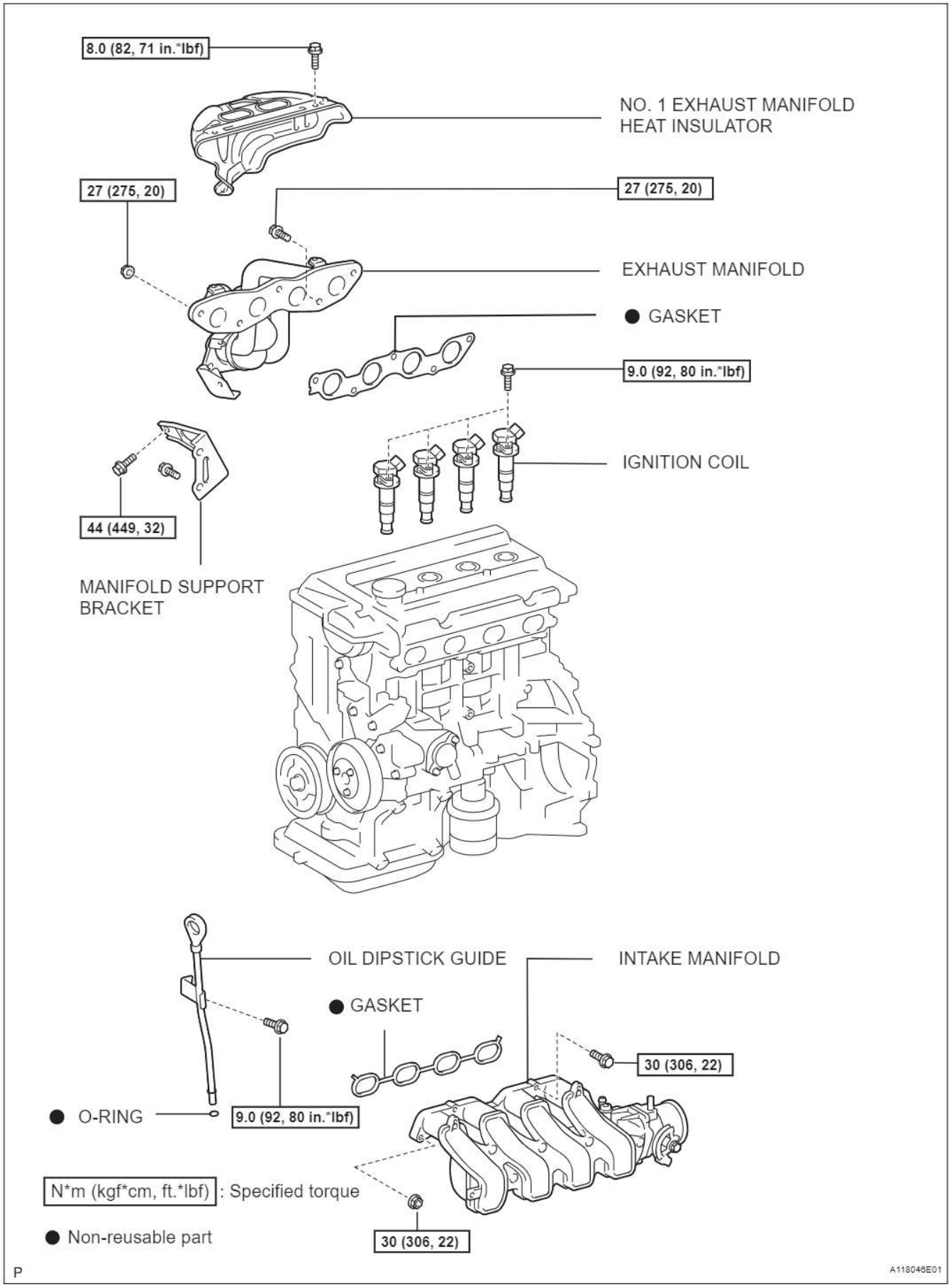
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

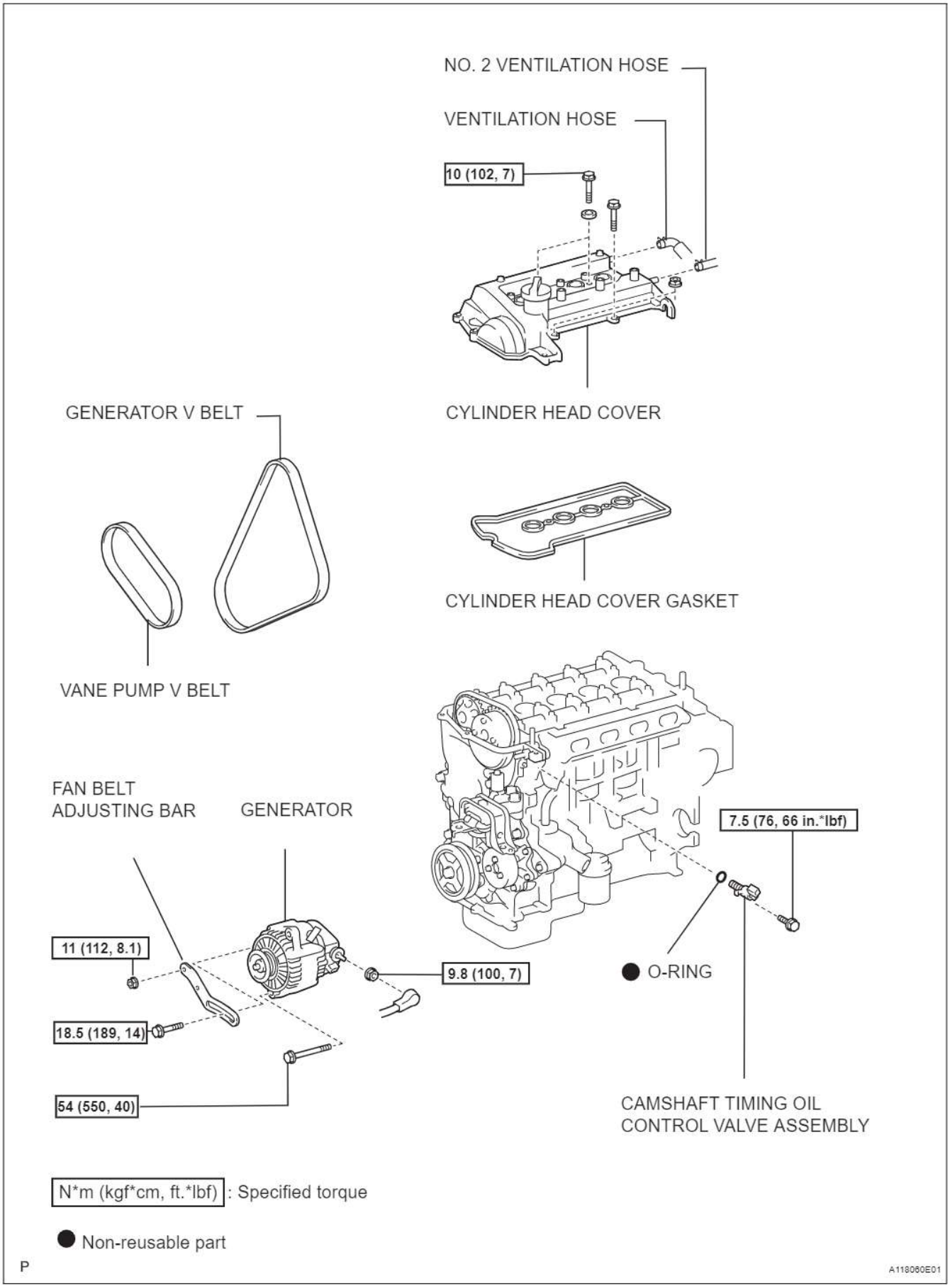
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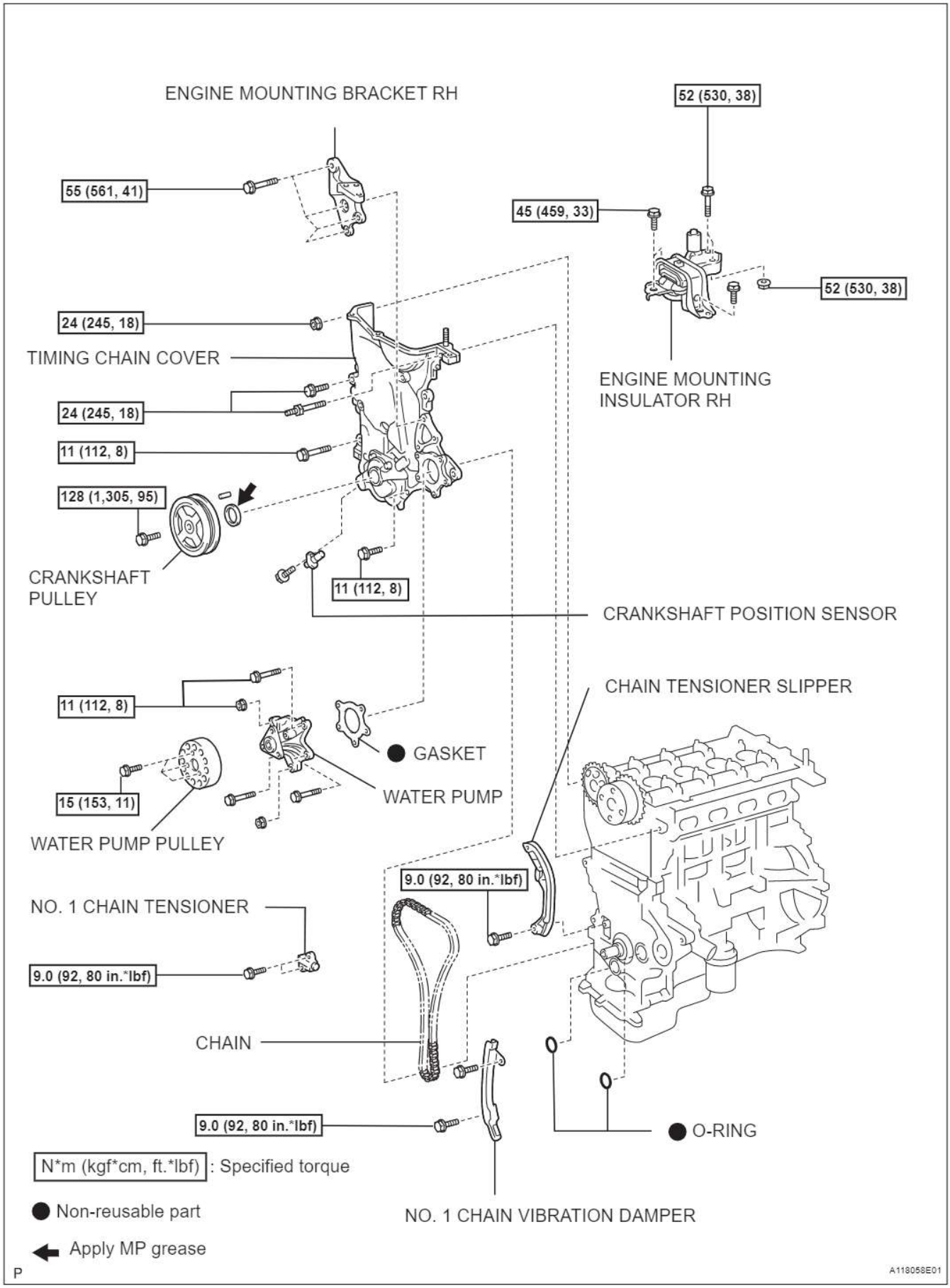
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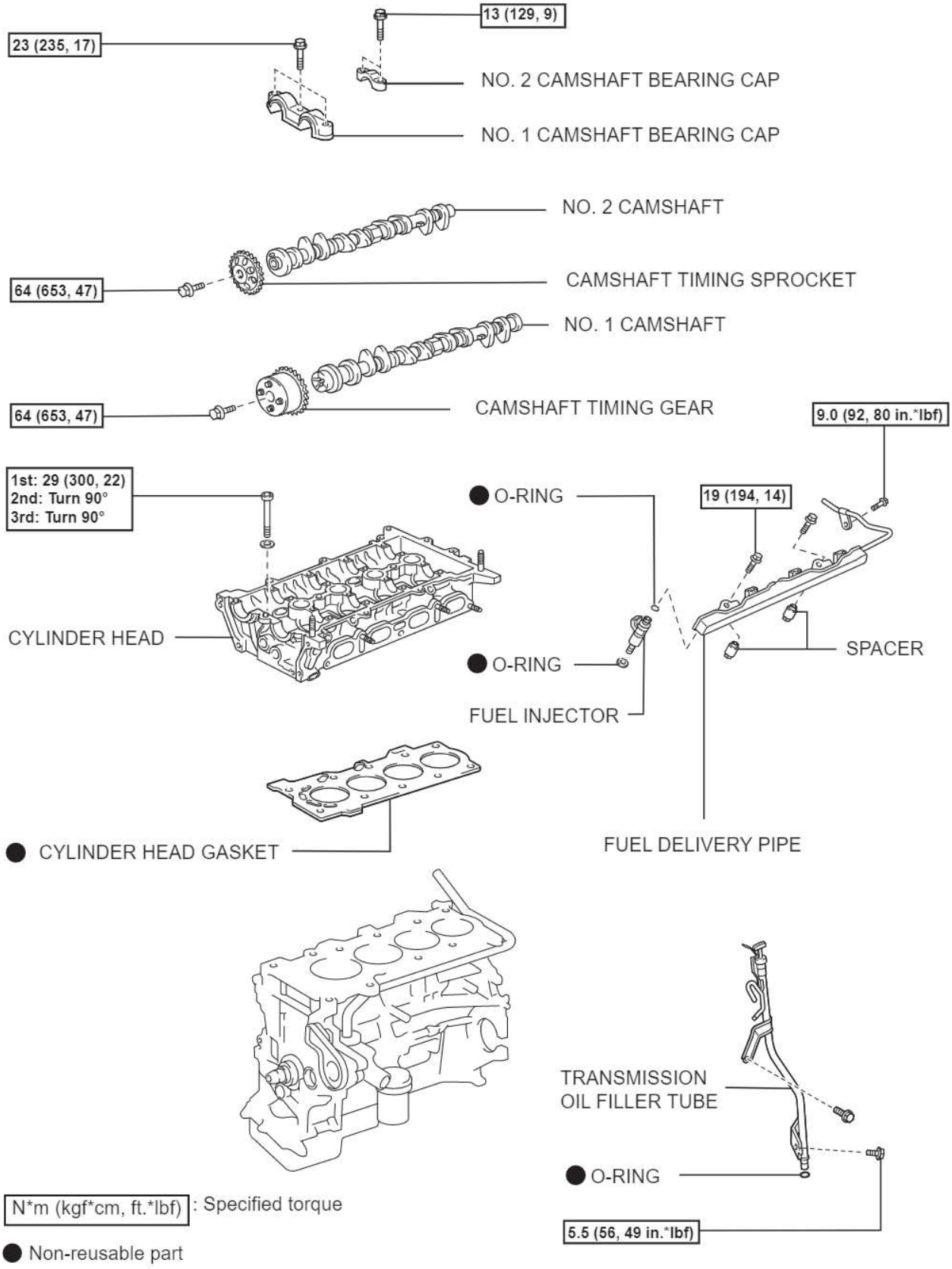
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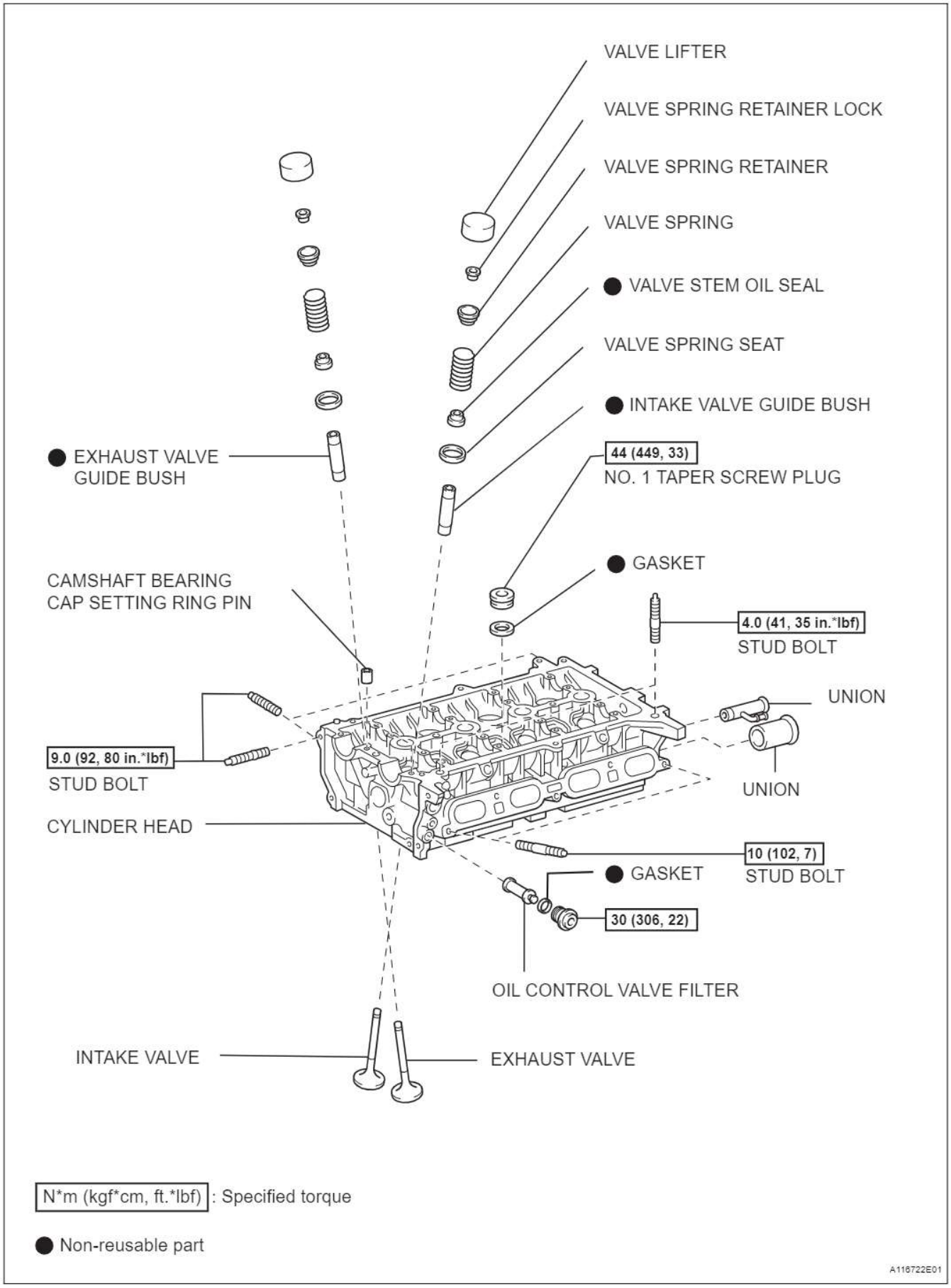
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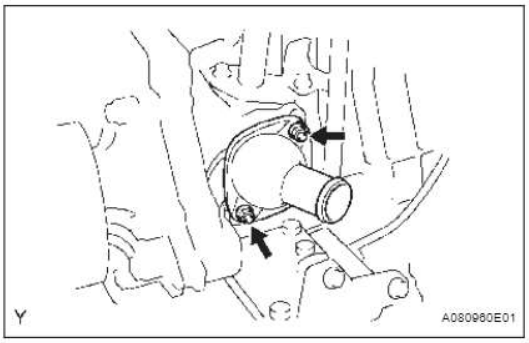


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DISASSEMBLY

1. REMOVE SPARK PLUG

(a) Using a 16 mm plug wrench, remove the 4 spark plugs.

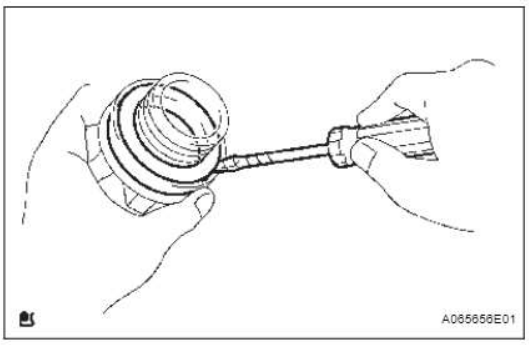


2. REMOVE THERMOSTAT

(a) Remove the 2 nuts and water inlet.
(b) Remove the thermostat.
(c) Remove the gasket from the thermostat.

3. REMOVE OIL FILLER CAP

(a) Remove the oil filler cap from the cylinder head cover.

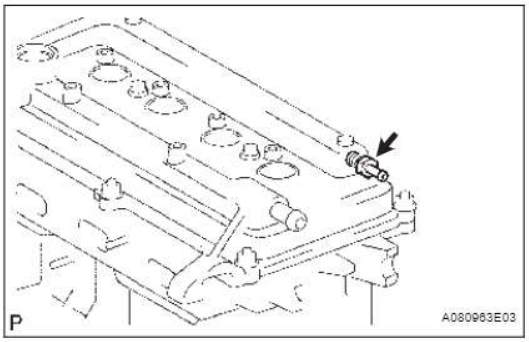


4. REMOVE OIL FILLER CAP GASKET

(a) Using a screwdriver, remove the gasket from the oil filler cap.
HINT:
Tape the screwdriver tip before use.

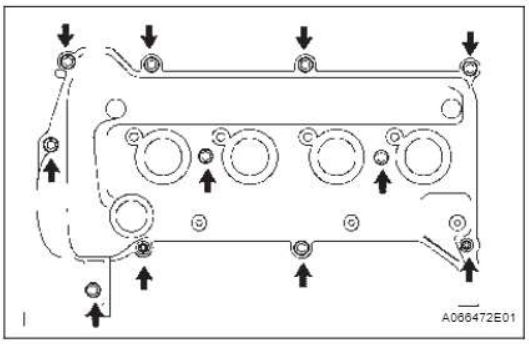
5. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the bolt and crankshaft position sensor.



6. REMOVE VENTILATION VALVE

(a) Remove the ventilation valve from the cylinder head cover.



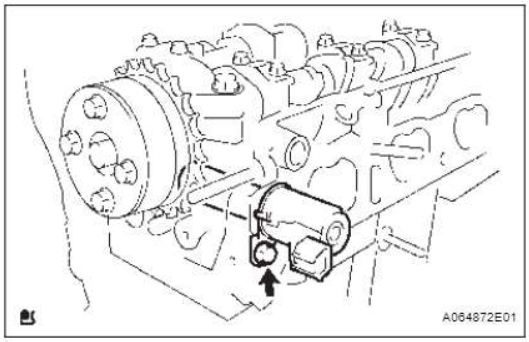
7. REMOVE CYLINDER HEAD COVER

(a) Remove the 9 bolts, 2 nuts and cylinder head cover.

8. REMOVE CYLINDER HEAD COVER GASKET

(a) Remove the gasket from the cylinder head cover.

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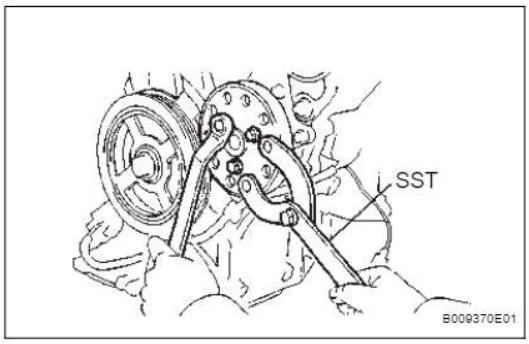


9. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Remove the bolt and oil control valve.

10. REMOVE OIL DIPSTICK GUIDE

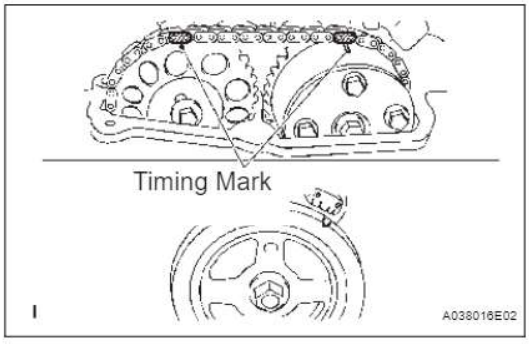
(a) Remove the bolt and dipstick guide.



11. REMOVE WATER PUMP PULLEY

(a) Using SST, hold the pump pulley and remove the 3 bolts and pump pulley.

SST 09960-10010 (09962-01000, 09963-00600)

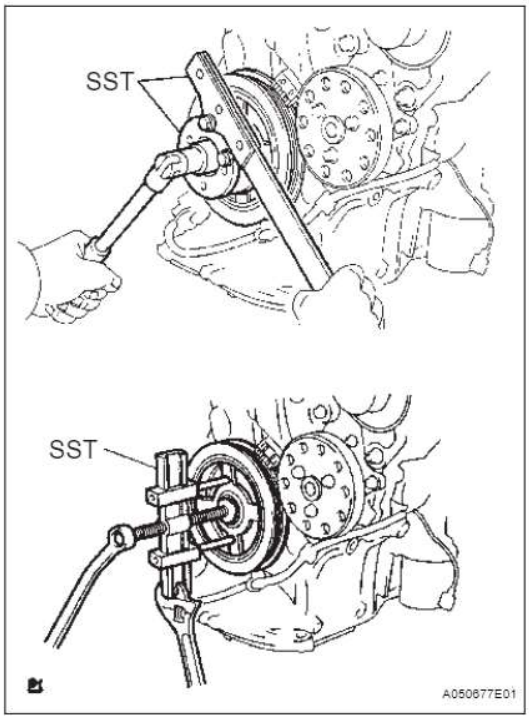


12. REMOVE CRANKSHAFT PULLEY

(a) Set the No. 1 cylinder to TDC/compression.

(1) Turn the crankshaft pulley until its timing notch and the timing mark 0 of the chain cover are aligned.

(2) Check that both timing marks on the camshaft timing sprocket and the camshaft timing gear are facing upward as shown in the illustration. If not, turn the crankshaft 1 complete revolution (360°) and align the marks as above.



(b) Using SST, remove the pulley bolt.

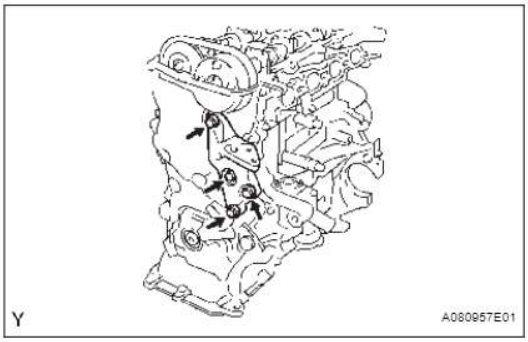
SST 09213-58012 (91111-50845), 09330-00021

If necessary, remove the pulley with SST.

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

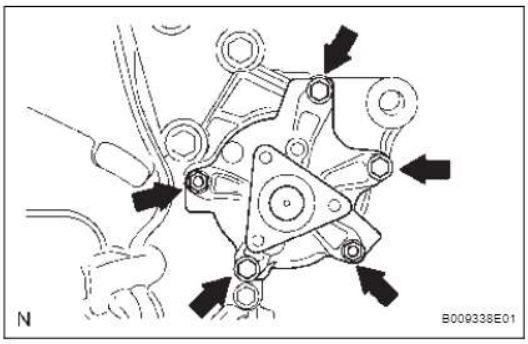
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13. REMOVE ENGINE MOUNTING BRACKET RH

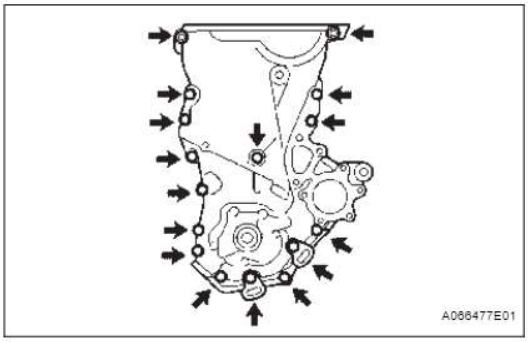
(a) Remove the 4 bolts and engine mounting bracket RH.



14. REMOVE WATER PUMP

(a) Remove the 3 bolts and 2 nuts.

(b) Remove the water pump and gasket.



15. REMOVE TIMING CHAIN COVER

(a) Remove the 15 bolts and nut.

(b) Using a screwdriver with the tip wrapped in tape, remove the chain cover by prying between the cylinder head and cylinder block.

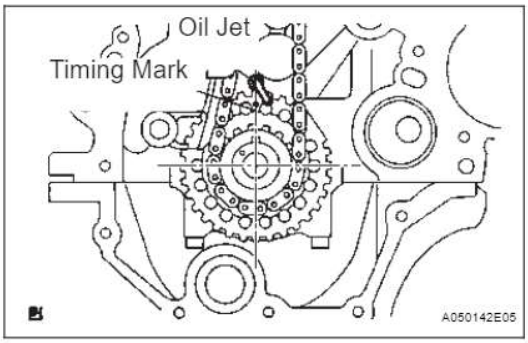
NOTICE:

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

(c) Remove the 2 O-rings from the cylinder block and No. 1 oil pan.

(d) Using an 8 mm hexagon wrench, remove the screw plug from the oil pump.

16. REMOVE OIL PUMP SEAL (See page EM-106)

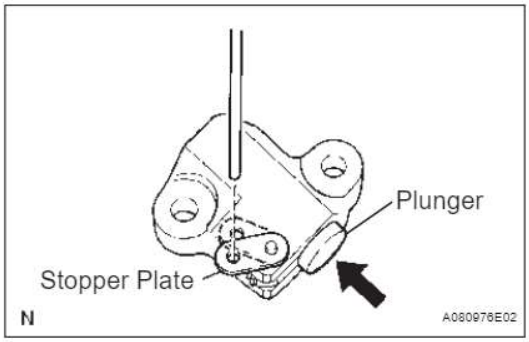


17. REMOVE NO. 1 CHAIN TENSIONER

NOTICE:

- **When rotating the camshaft with the timing chain removed, rotate the crankshaft counterclockwise 40° from the TDC and align the oil jet hole with the paint mark to prevent the pistons from coming into contact with the valves.**
- **Do not rotate the crankshaft with the chain tensioner removed.**

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(a) While rotating the stopper plate of the chain tensioner upward with a screwdriver, push in the plunger of the tensioner as shown in the illustration.
(b) While rotating the stopper plate of the tensioner downward, insert a 2.5 mm (0.098 in.) diameter bar into the holes of the stopper plate and the tensioner to hold the stopper plate.
(c) Remove the 2 bolts and chain tensioner.

18. REMOVE CHAIN TENSIONER SLIPPER

(a) Remove the bolt and chain tensioner slipper.

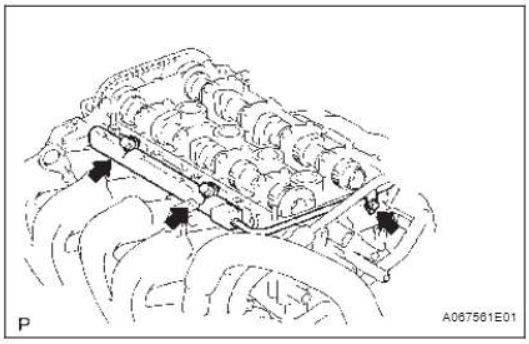
19. REMOVE NO. 1 CHAIN VIBRATION DAMPER

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

20. REMOVE CHAIN

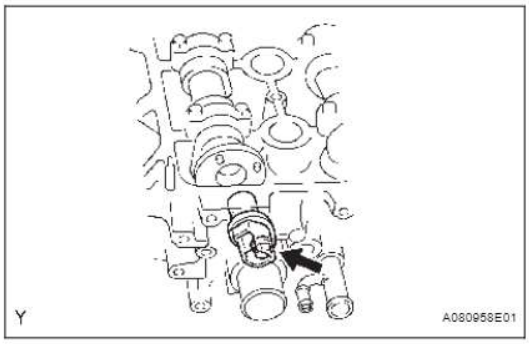
21. REMOVE FUEL DELIVERY PIPE

(a) Remove the 3 bolts and fuel delivery pipe together with the 4 fuel injectors.



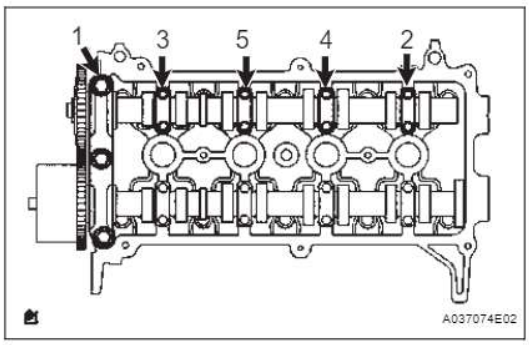
22. REMOVE FUEL INJECTOR

(a) Pull out the 4 injectors from the delivery pipe.



23. REMOVE CAMSHAFT POSITION SENSOR

(a) Remove the bolt and camshaft position sensor.



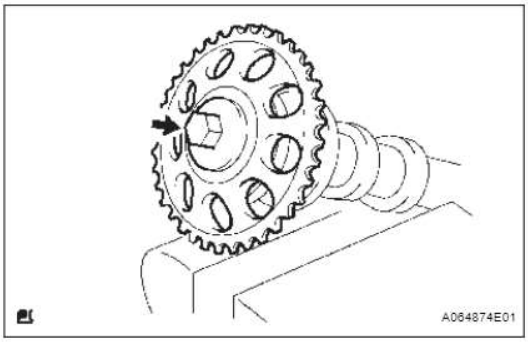
24. REMOVE NO. 2 CAMSHAFT

(a) Using several steps, uniformly loosen and remove the 11 bearing cap bolts in the sequence shown in the illustration, and then remove the 5 bearing caps and No. 2 camshaft.

NOTICE:

Loosen each bolt uniformly, keeping the camshaft level.

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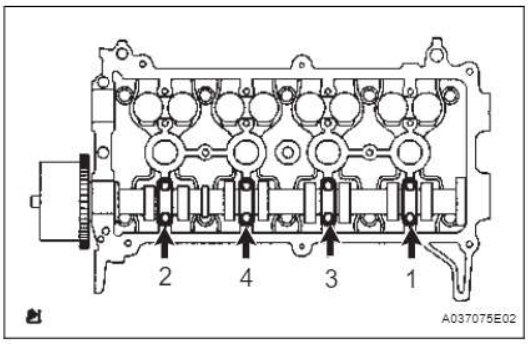
25. REMOVE CAMSHAFT TIMING SPROCKET

(a) Clamp the camshaft in a vise.

(b) Remove the flange bolt and camshaft timing sprocket.

NOTICE:

Be careful not to damage the camshaft.

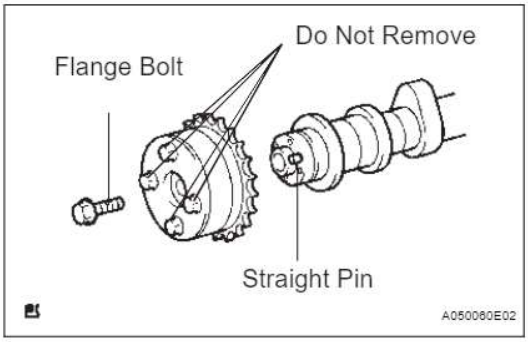


26. REMOVE CAMSHAFT

(a) Using several steps, uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration, and then remove the 4 bearing caps and camshaft.

NOTICE:

Loosen each bolt uniformly, keeping the camshaft level.



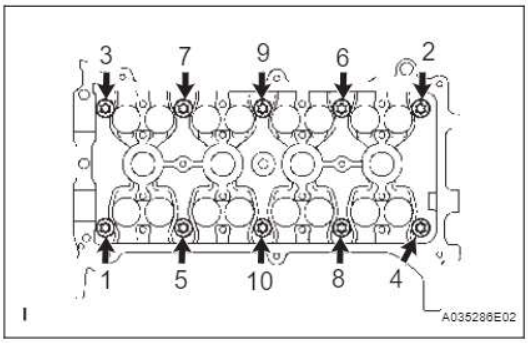
27. REMOVE CAMSHAFT TIMING GEAR

(a) Turn the valve timing controller assembly at the most advanced angle (see page EM-50).

(b) Remove the flange bolt and camshaft timing gear.

NOTICE:

- **Be careful not to remove the other 4 bolts.**
- **If reusing the camshaft timing gear, unlock the lock pin inside the camshaft timing gear first.**



28. REMOVE CYLINDER HEAD

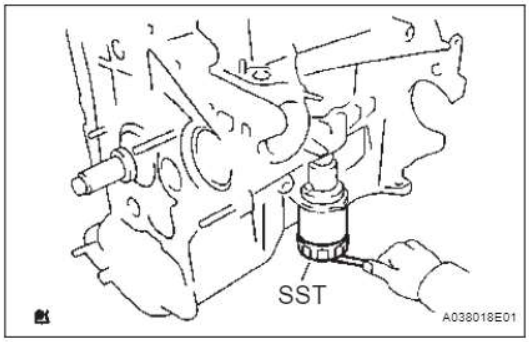
(a) Using several steps, uniformly loosen and remove the 10 cylinder head bolts with an 8 mm bi-hexagon wrench in the sequence shown in the illustration. Remove the 10 cylinder head bolts and plate washers.

NOTICE:

- **Be careful not to drop washers into the cylinder head.**
- **Head warpage or cracking could result from removing bolts in the incorrect order.**

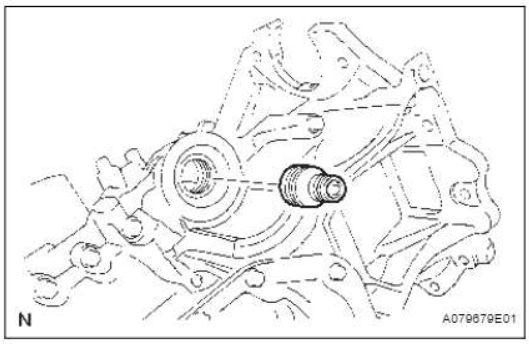
29. REMOVE CYLINDER HEAD GASKET

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30. REMOVE OIL FILTER

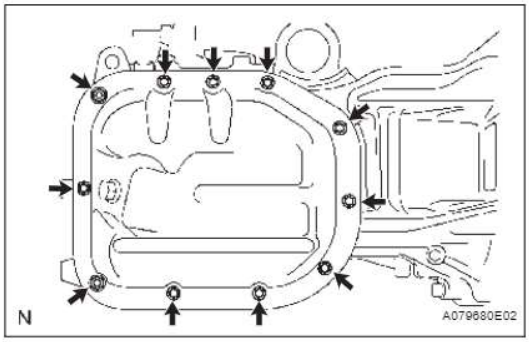
(a) Using SST, remove the oil filter.
SST 09228-06501



31. REMOVE OIL FILTER UNION

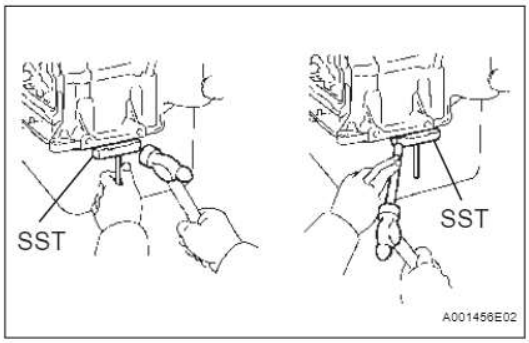
(a) Using a 12 mm hexagon wrench, remove the oil filter union.

32. REMOVE ENGINE REAR OIL SEAL (See page EM-107)



33. REMOVE NO. 2 OIL PAN

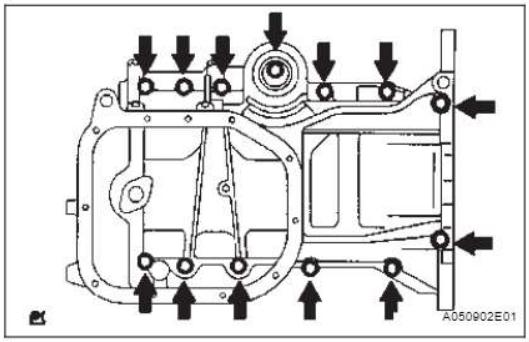
(a) Remove the oil pan drain plug and gasket.
(b) Remove the 9 bolts and 2 nuts.



(c) Insert the blade of SST between the oil pan and No. 2 oil pan, cut off the applied sealer and remove the No. 2 oil pan.
SST 09032-00100
NOTICE:
Be careful not to damage the oil pan and No. 2 oil pan.

34. REMOVE OIL STRAINER

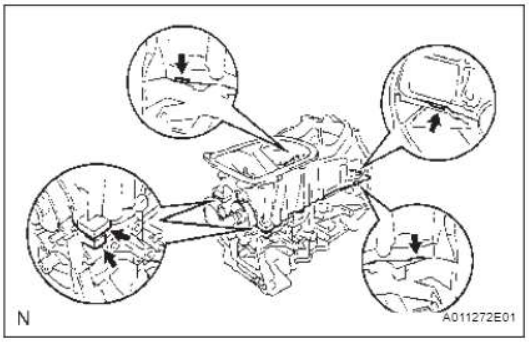
(a) Remove the bolt and 2 nuts.
(b) Remove the oil strainer and gasket.



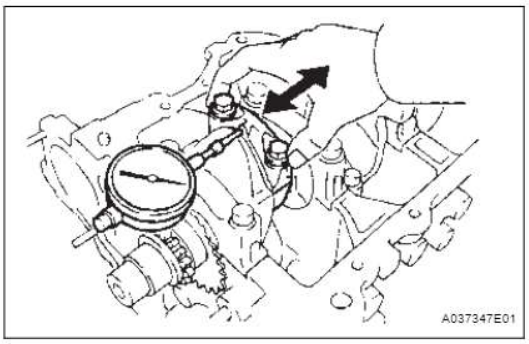
35. REMOVE OIL PAN

(a) Loosen and remove the 13 bolts uniformly in several steps.

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(b) Using a screwdriver, remove the oil pan by prying between the cylinder block and oil pan.
NOTICE:
Be careful not to damage the contact surfaces of the oil pan and cylinder block.
(c) Remove the 2 O-rings from the cylinder block.
(d) Remove the 4 stud bolts.

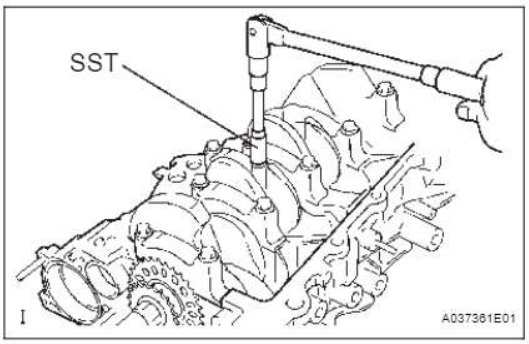


36. INSPECT CONNECTING ROD THRUST CLEARANCE

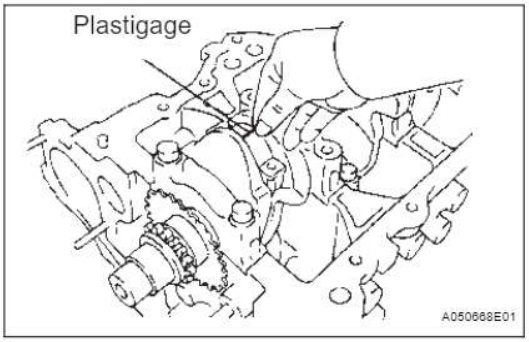
(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.16 to 0.36 mm (0.0063 to 0.0142 in.)
Maximum thrust clearance:
0.36 mm (0.0142 in.)
If the thrust clearance is greater than the maximum, replace the connecting rod.

37. INSPECT CONNECTING ROD OIL CLEARANCE

(a) Check that the matchmarks on the connecting rod and cap are aligned to ensure the correct reassembly.

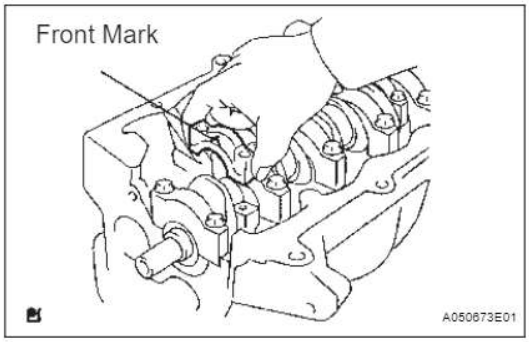


(b) Using SST, remove the 2 connecting rod cap bolts.
SST 09205-16010
(c) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.
(d) Clean the crank pin and bearing.
(e) Check the crank pin and bearing for pitting and scratches.



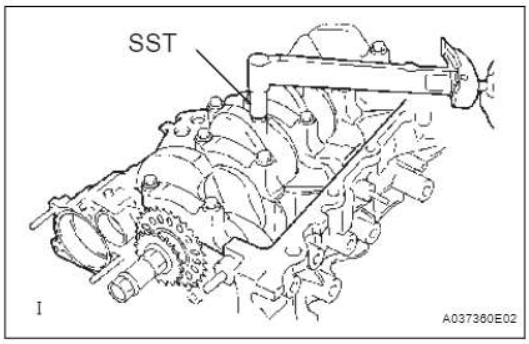
(f) Lay a strip of Plastigage across the crank pin.

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(g) Match together the connecting rod and cap in the correct combination. Then install the cap onto the connecting rod, making sure that the front mark on the cap is correctly oriented.

(h) Apply a light coat of engine oil to the threads of the connecting rod cap bolts.



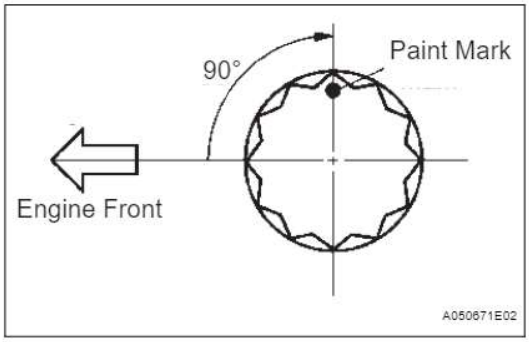
(i) Using SST, tighten the bolts in several steps by the specified torque.

SST 09205-16010

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

NOTICE:

Do not turn the crankshaft.



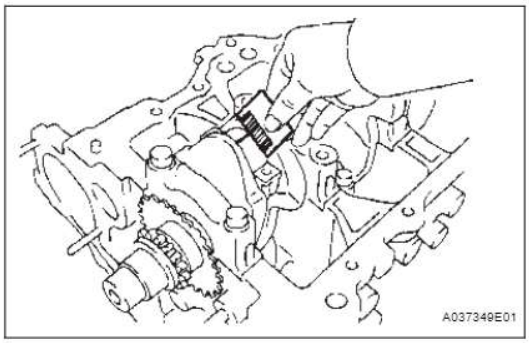
(j) Mark the front of the connecting cap bolts with paint.

(k) Retighten the cap bolts by 90° as shown in the illustration.

NOTICE:

Do not turn the crankshaft.

(l) Remove the 2 bolts, connecting rod cap and lower bearing.



(m) Measure the Plastigage at its widest point.

Standard oil clearance:

0.016 to 0.040 mm (0.0006 to 0.0016 in.)

Maximum oil clearance:

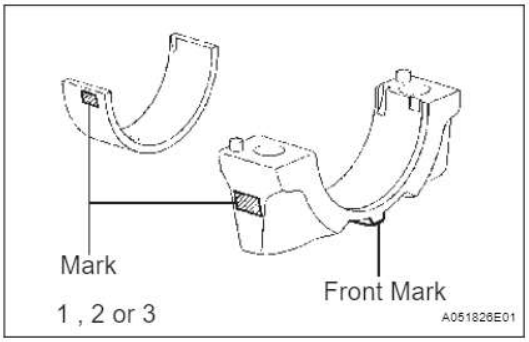
0.06 mm (0.0024 in.)

NOTICE:

Completely remove the Plastigage.

EM

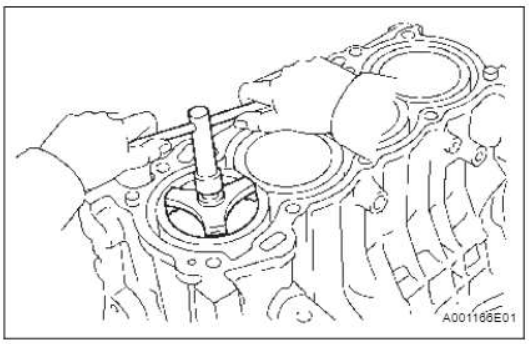
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(n) If the oil clearance is greater than the maximum, select and replace the bearing. If necessary, use an undersized bearing.

Reference

Number Mark	Connecting Rod External Diameter	Center Bearing Thickness	Oil Clearance
1	43.000 to 43.008 mm (1.6929 to 1.6932 in.)	1.491 to 1.494 mm (0.0587 to 0.0588 in.)	0.012 to 0.034 mm (0.0005 to 0.0013 in.)
2	43.008 to 43.016 mm (1.6932 to 1.6935 in.)	1.494 to 1.497 mm (0.0588 to 0.0589 in.)	0.014 to 0.036 mm (0.0006 to 0.0014 in.)
3	43.016 to 43.024 mm (1.6935 to 1.6939 in.)	1.497 to 1.500 mm (0.0589 to 0.0591 in.)	0.016 to 0.038 mm (0.0006 to 0.0015 in.)
U/S 0.25	43.000 to 43.024 mm (1.6929 to 1.6939 in.)	1.608 to 1.614 mm (0.0633 to 0.0635 in.)	0.016 to 0.040 mm (0.0006 to 0.0016 in.)

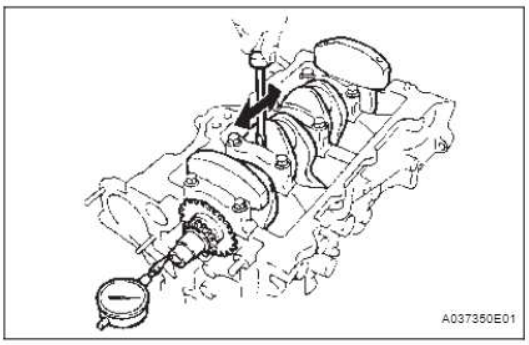


38. REMOVE PISTON WITH CONNECTING ROD

(a) Using a ridge reamer, remove all 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.
- Keep the piston and the connecting rod assemblies in the correct order so that they can be returned to the original locations when re-assembling.

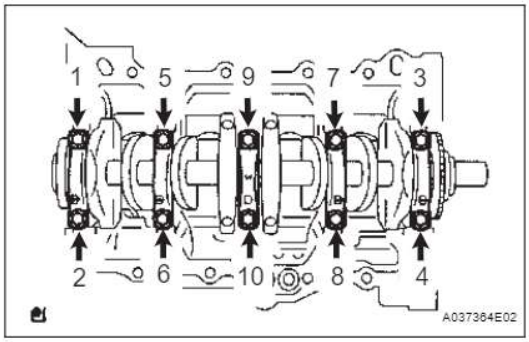
39. REMOVE CONNECTING ROD BEARING



40. 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:
0.09 to 0.19 mm (0.0035 to 0.0075 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)
If the thrust clearance is greater than the maximum, replace the thrust washers as a set. Check the crankshaft and block for wear, and repair or replace if necessary.
HINT:
Thrust washer thickness: 2.43 to 2.48 mm (0.0957 to 0.0976 in.)

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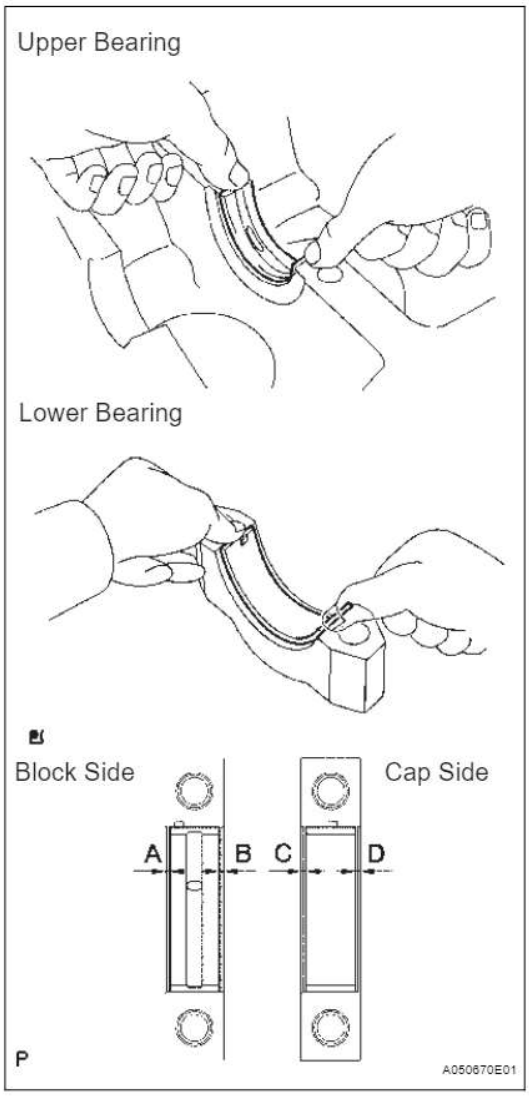


41. REMOVE CRANKSHAFT AND INSPECT OIL CLEARANCE

(a) Using several steps, uniformly loosen and remove the 10 bearing cap bolts with SST in the sequence shown in the illustration.
SST 09011-38121

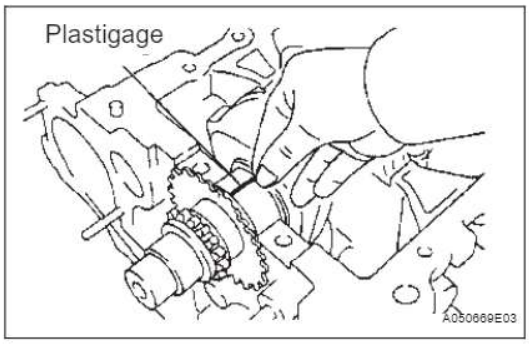
(b) Remove the 5 bearing caps and crankshaft.

(c) Clean each main journal and bearing.



(d) Install the upper bearing with the oil groove onto the cylinder block, and the lower bearing onto the bearing cap.
NOTICE:
Do not apply engine oil to the contact surfaces of the cylinder block or the backside of the bearing.
HINT:
The mass production parts do not have claws as marks. If reusing the mass production parts, measure the clearance of both sides with the bearing in the center of the bearing cap.
Standard clearance:
A - B = within 0.8 mm (0.032 in.)
C - D = within 0.4 mm (0.016 in.)

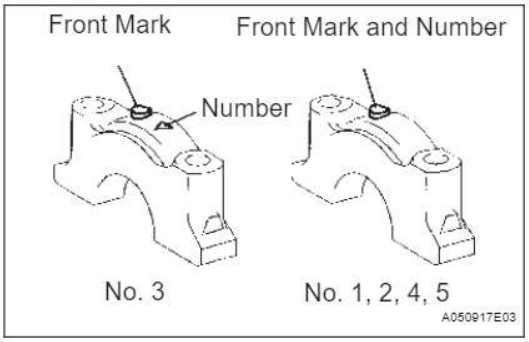
(e) Install the crankshaft onto the cylinder block.



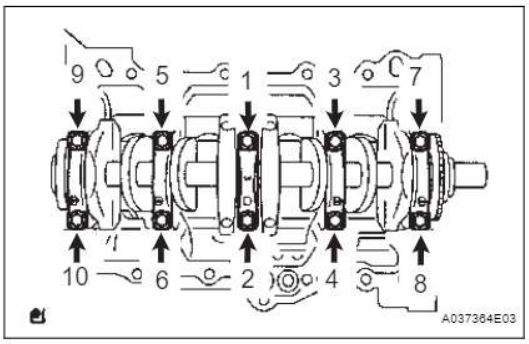
(f) Lay a strip of Plastigage across each journal.

EM

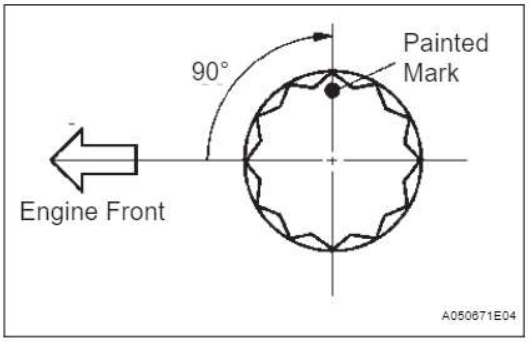
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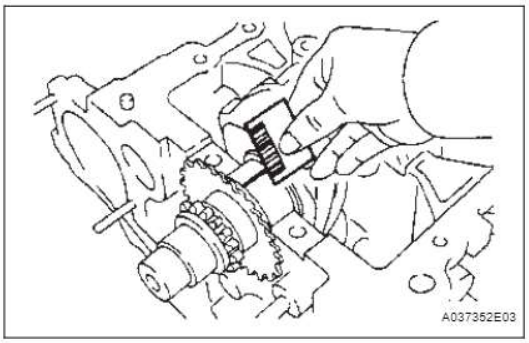
(g) Check the front marks and numbers and install the bearing caps onto the cylinder block.
(h) Apply a light coat of engine oil to the threads of the bearing cap bolts.



(i) Using SST, tighten the bolts in several steps by the specified torque in the sequence shown in the illustration.
SST 09011-38121
Torque: 22 N*m (224 kgf*cm, 16 ft.*lbf)
NOTICE:
Do not turn the crankshaft.

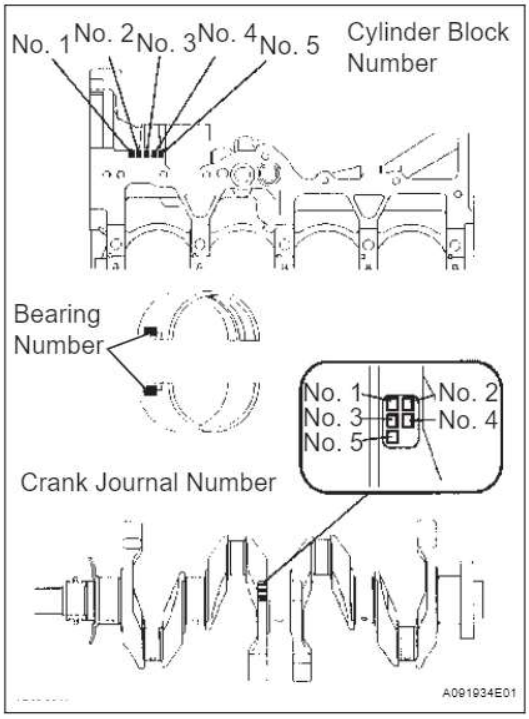


(j) Mark the front of the bearing cap bolts with paint.
(k) Retighten the bearing cap bolts by 90° in the same sequence.
(l) Check that the painted mark is now at a 90° angle to the front.
NOTICE:
Do not turn the crankshaft.
(m) Remove the bearing cap.



(n) Measure the Plastigage at its widest point.
Standard oil clearance:
0.010 to 0.023 mm (0.0004 to 0.0009 in.)
Maximum oil clearance:
0.07 mm (0.0028 in.)
NOTICE:
Completely remove the Plastigage.

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HINT:

- If the oil clearance is greater than the maximum, select and replace the bearing. If necessary, use an undersized bearing.
- To select the correct bearing size, calculate the bearing number by adding together the numbers imprinted on the cylinder block and crank journal. Example:
  Imprinted number on the cylinder block is 3.
  Imprinted number on the crank journal is 5. 3 + 5 = 8 Select the bearing with the bearing number 3.

Standard cylinder block diameter

Number	Specified Condition
0	50.000 to 50.003 mm (1.9685 to 1.9686 in.)
1	50.003 to 50.005 mm (1.9686 to 1.9687 in.)
2	50.005 to 50.007 mm (1.9687 to 1.9688 in.)
3	50.007 to 50.010 mm (1.9688 to 1.9689 in.)
4	50.010 to 50.012 mm (1.9689 to 1.9690 in.)
5	50.012 to 50.014 mm (1.9690 to 1.9691 in.)
6	50.014 to 50.016 mm (1.9691 to 1.9691 in.)

Standard crankshaft journal diameter

Number	Specified Condition
0	45.998 to 46.000 mm (1.8109 to 1.8110 in.)
1	45.996 to 45.998 mm (1.8109 to 1.8109 in.)
2	45.994 to 45.996 mm (1.8108 to 1.8109 in.)
3	45.992 to 45.994 mm (1.81071 to 1.81079 in.)
4	45.990 to 45.992 mm (1.8106 to 1.8107 in.)
5	45.988 to 45.990 mm (1.8106 to 1.8106 in.)

Reference

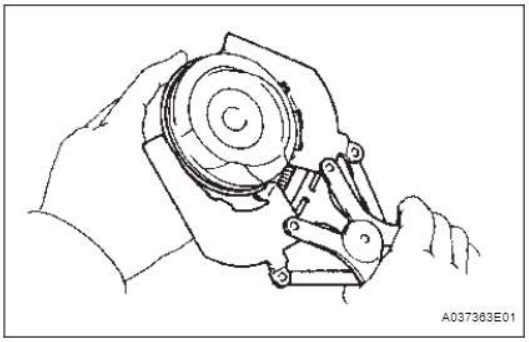
Cylinder Block Number + Crank Journal Number	Bearing Number	Center Bearing Thickness	Oil Clearance
0 to 2	1	1.992 to 1.995 mm (0.0784 to 0.0785 in.)	0.010 to 0.023 mm (0.0004 to 0.0009 in.)
3 to 5	2	1.995 to 1.998 mm (0.0785 to 0.0787 in.)	Same as above
6 to 8	3	1.998 to 2.001 mm (0.0787 to 0.0788 in.)	Same as above
9 to 11	4	2.001 to 2.004 mm (0.0788 to 0.0789 in.)	Same as above
-	U/S 0.25	2.111 to 2.117 mm (0.0831 to 0.0834 in.)	Same as above

42. REMOVE CRANKSHAFT BEARING

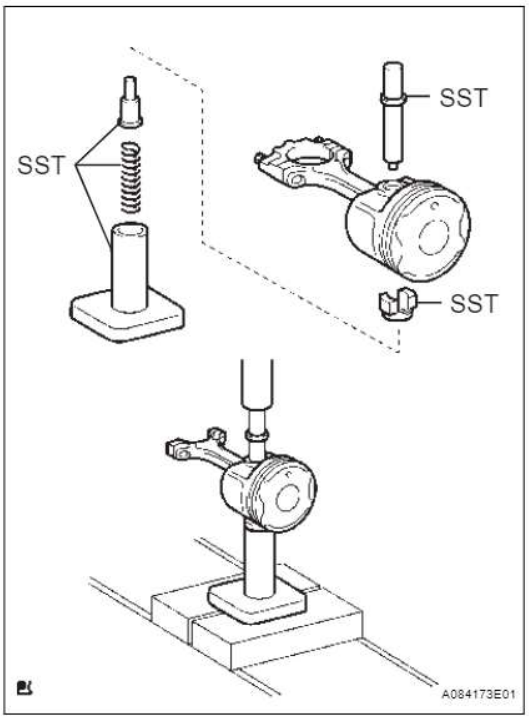
43. REMOVE PISTON RING SET

HINT:
Keep the piston rings in the correct combination and correct order so that they can be returned to the original locations when reassembling.

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



44. REMOVE PISTON PIN

(a) Using SST, press out the piston pin from the piston.

SST 09221-25026 (09221-00021, 09221-00030, 09221-00190, 09221-00141, 09221-00150)

NOTICE:

Keep the pistons, pins, rings, connecting rods and bearings in the correct order so that they can be returned to the original locations when reassembling.

45. REMOVE CYLINDER BLOCK WATER DRAIN COCK

46. REMOVE STUD BOLT

(a) Using an E5 "torx" wrench, remove the 6 stud bolts.

47. REMOVE STRAIGHT PIN

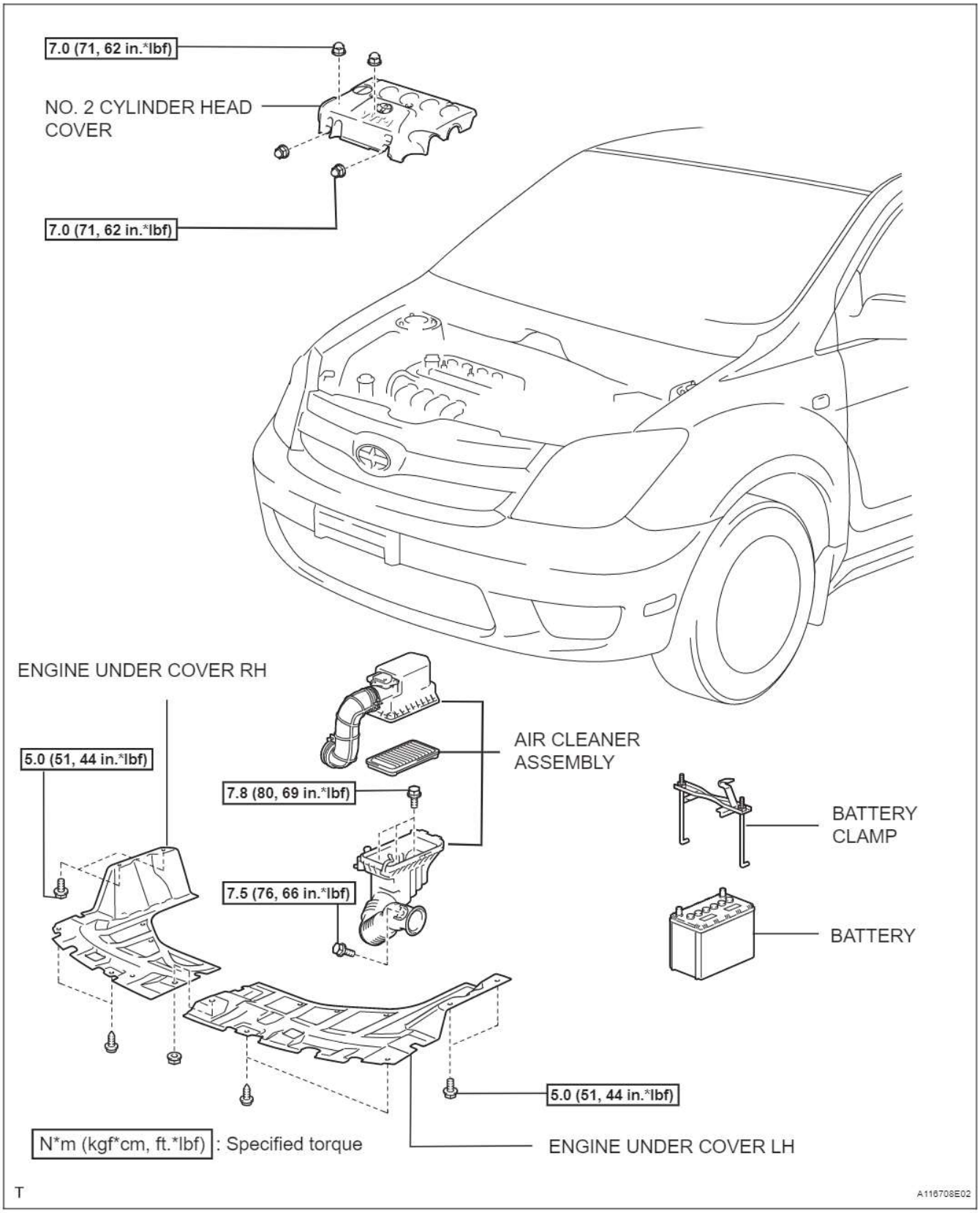
48. REMOVE END PLATE STRAIGHT PIN

49. REMOVE TIGHT PLUG

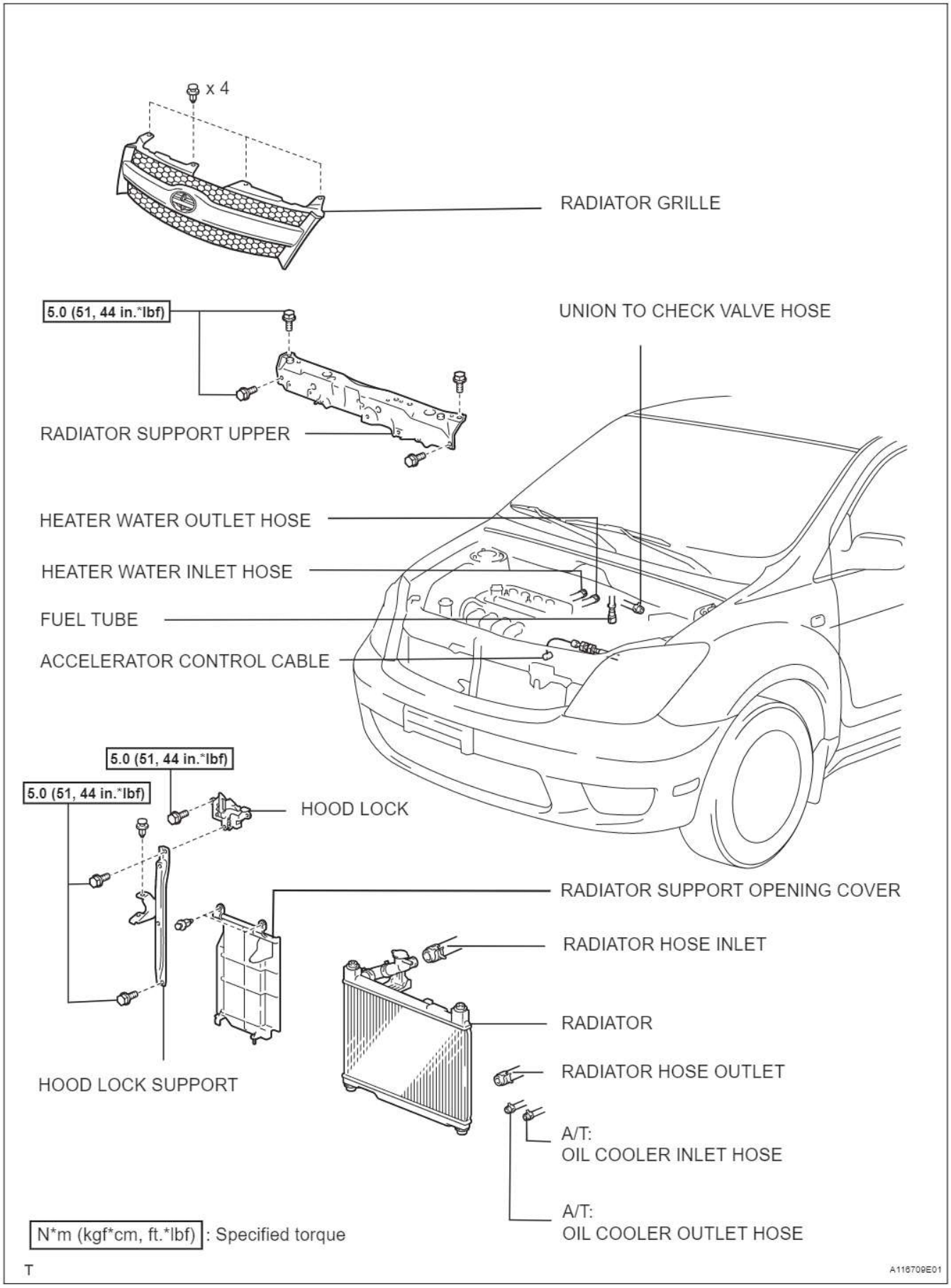
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ENGINE ASSEMBLY

COMPONENTS

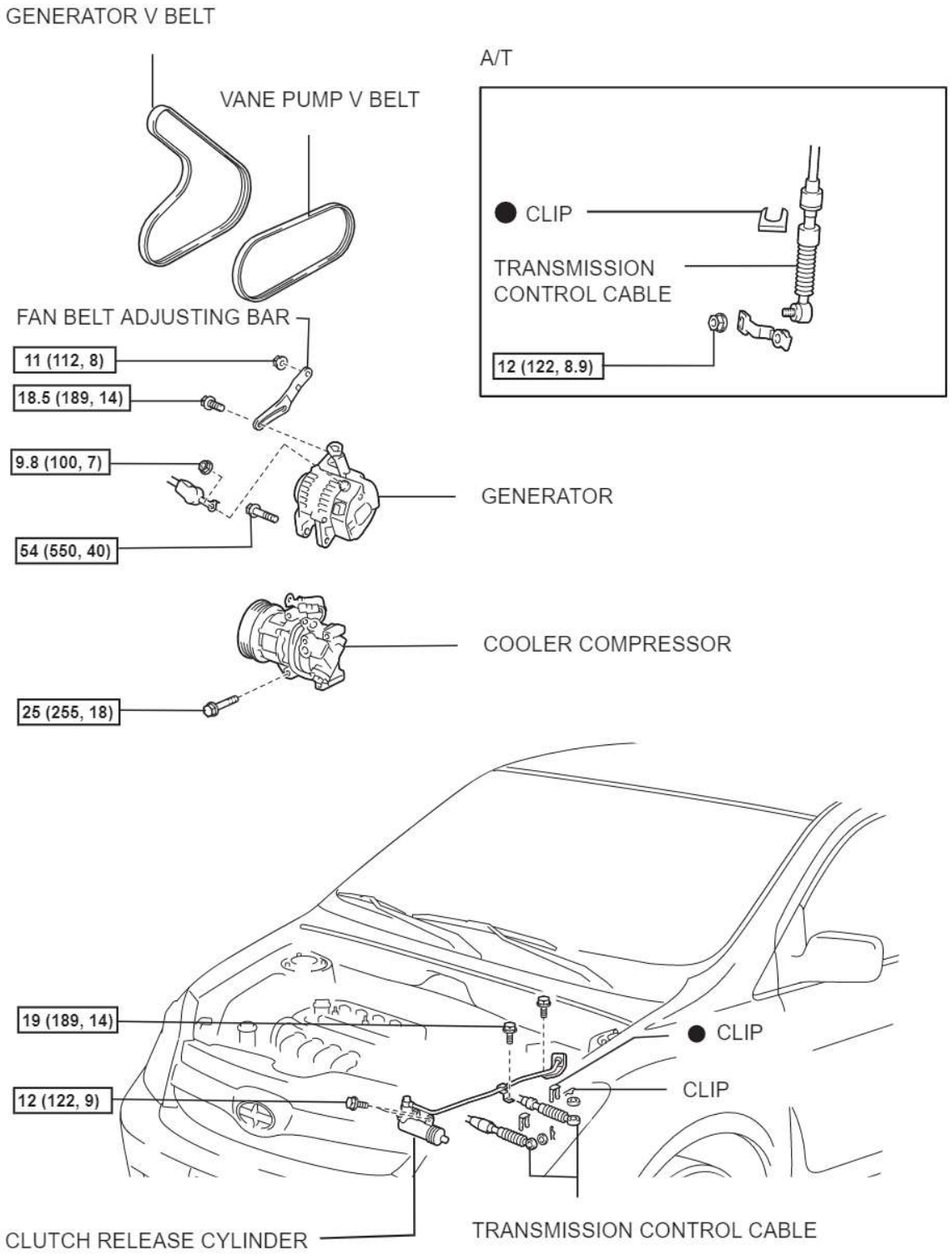


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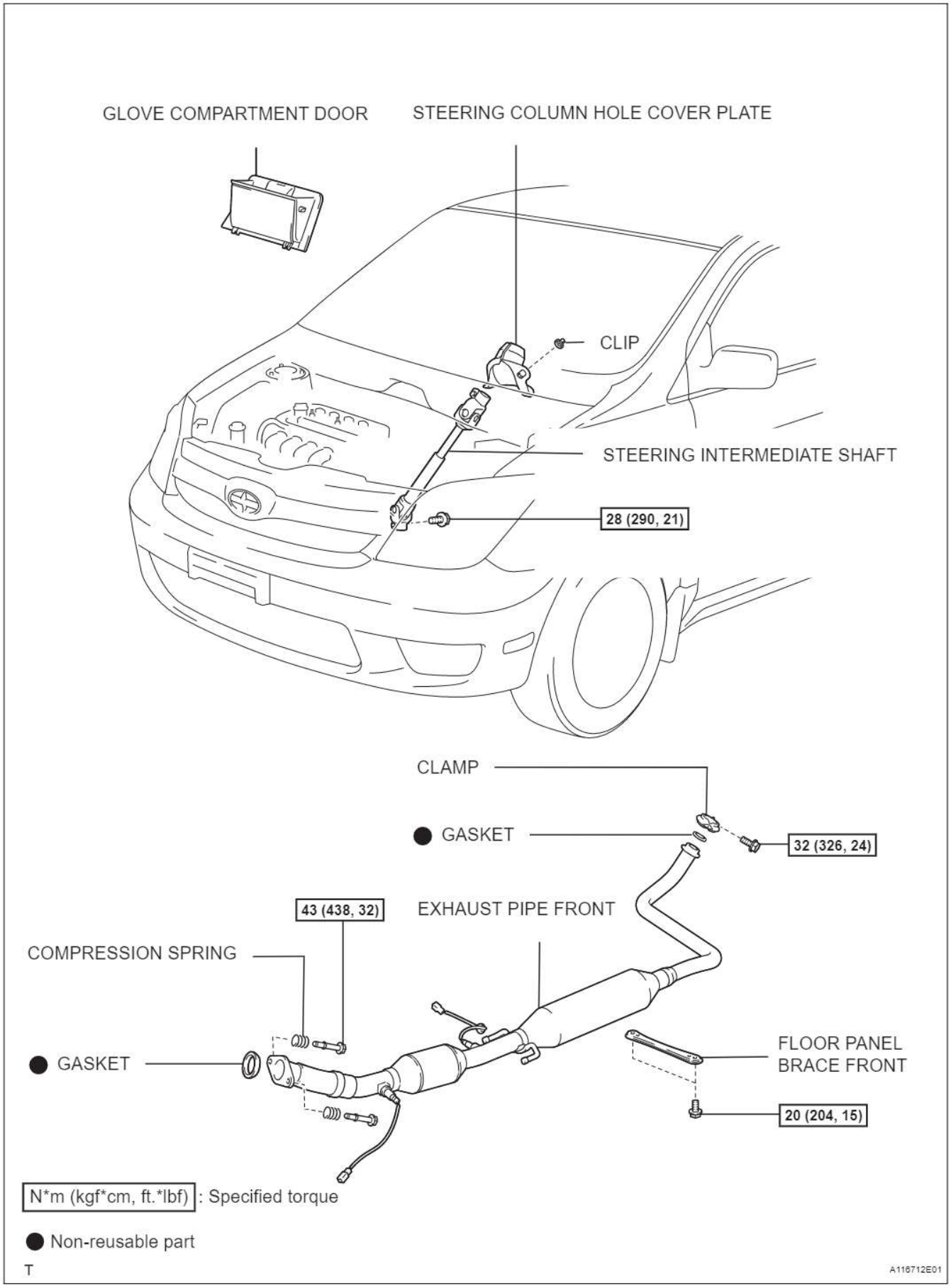
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

T

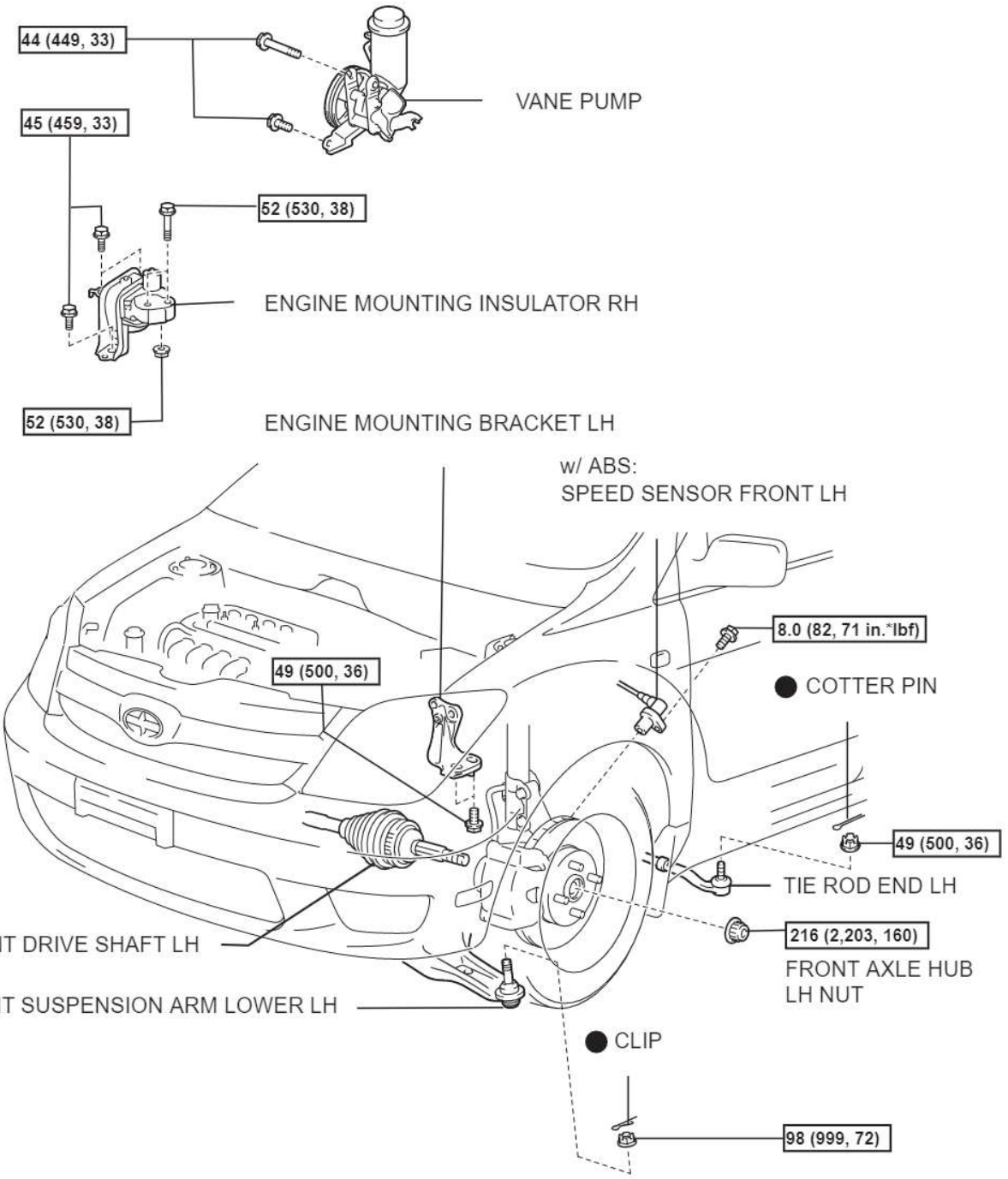
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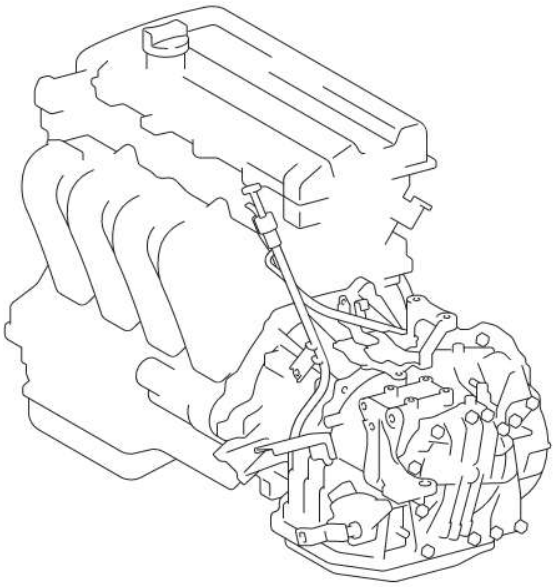
N*m (kgf*cm, ft.*lbf) : Specified torque

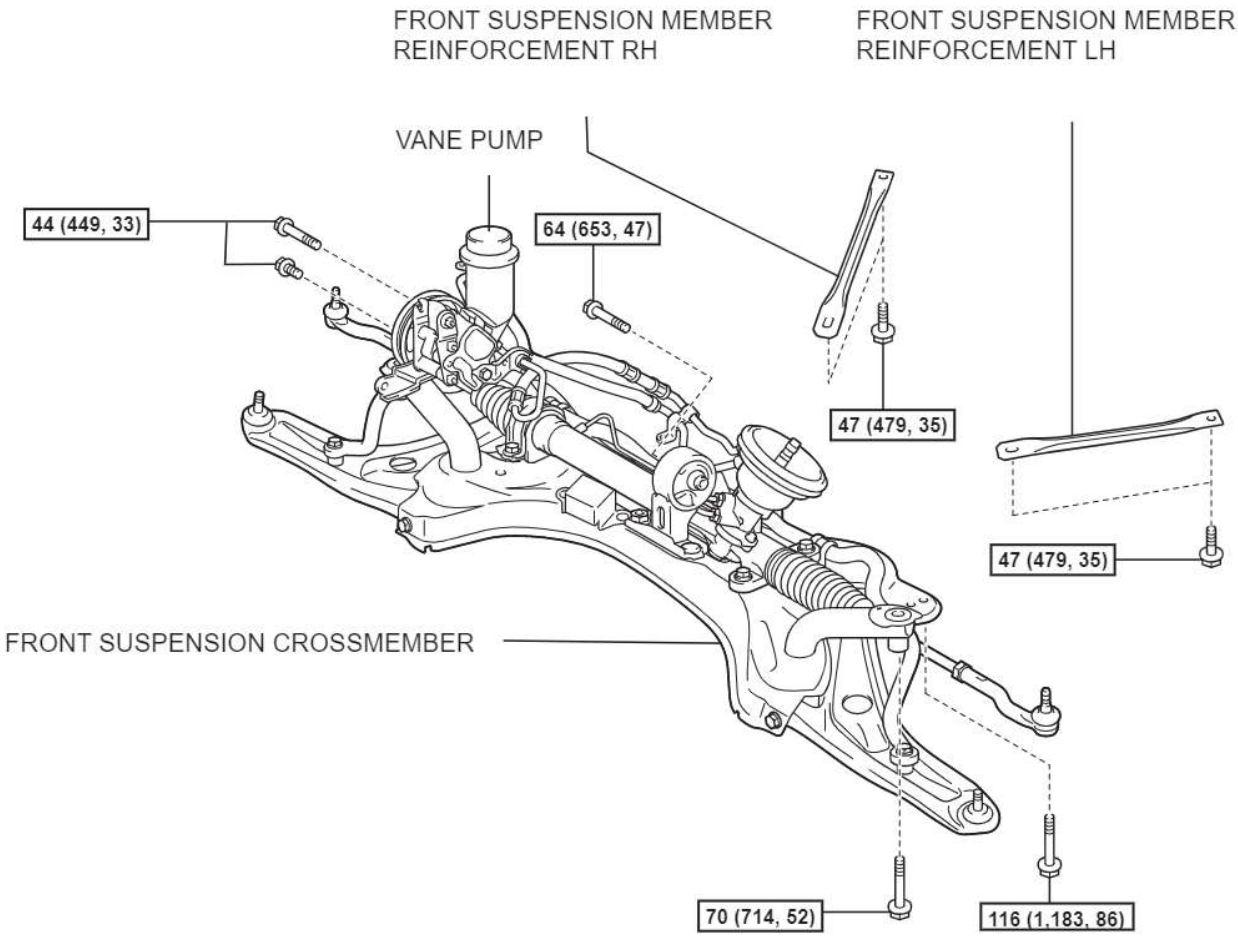
● Non-reusable part

T

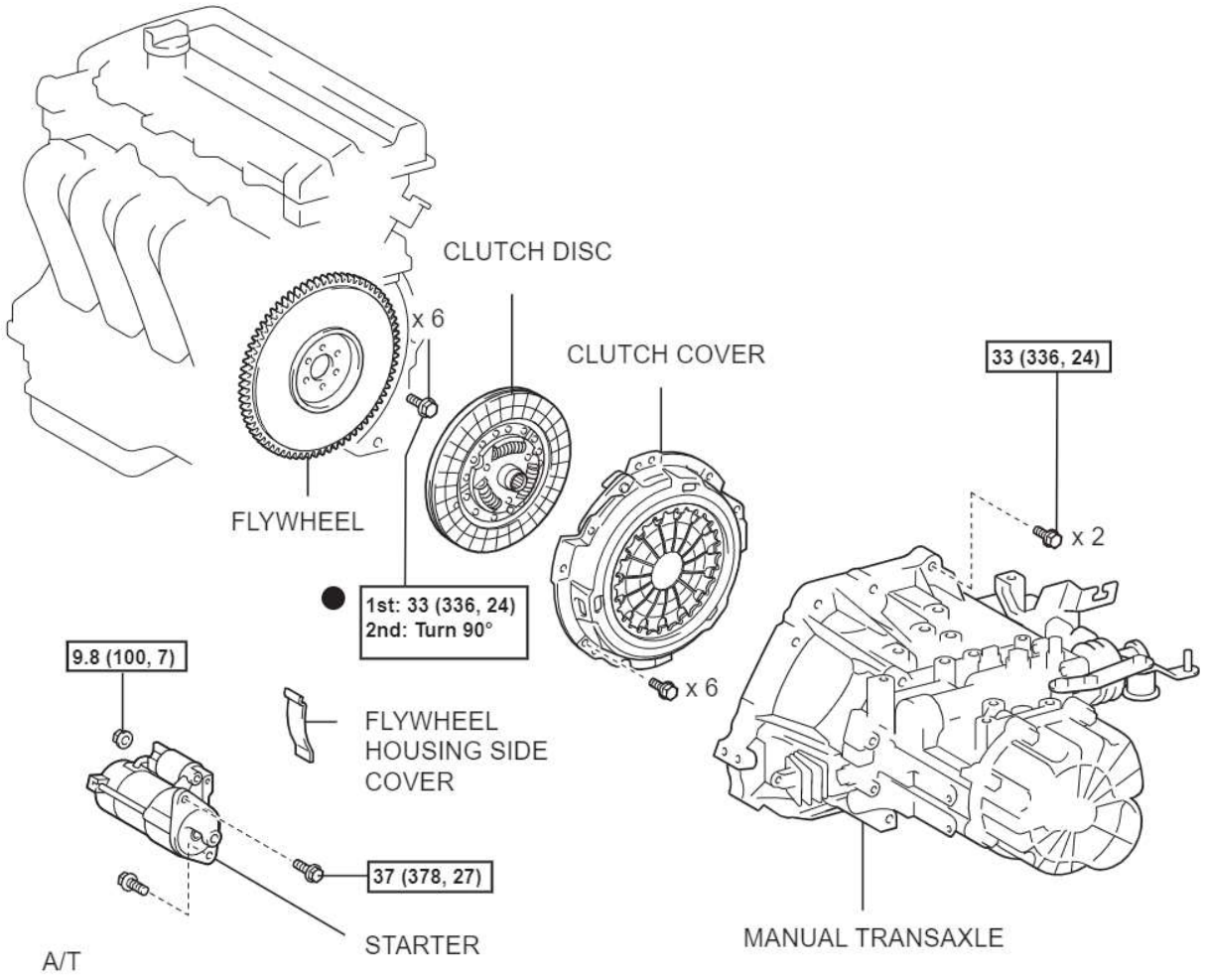
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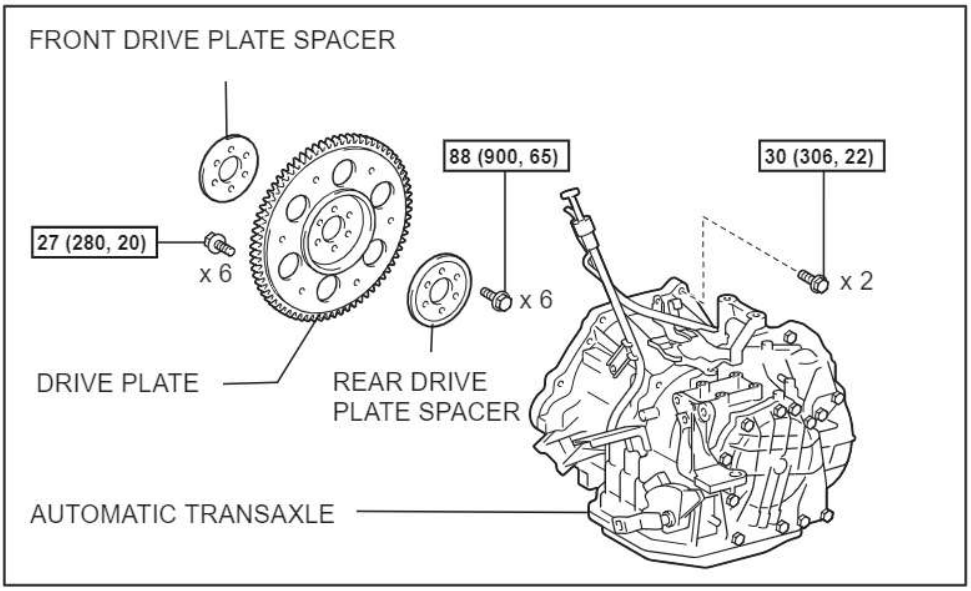
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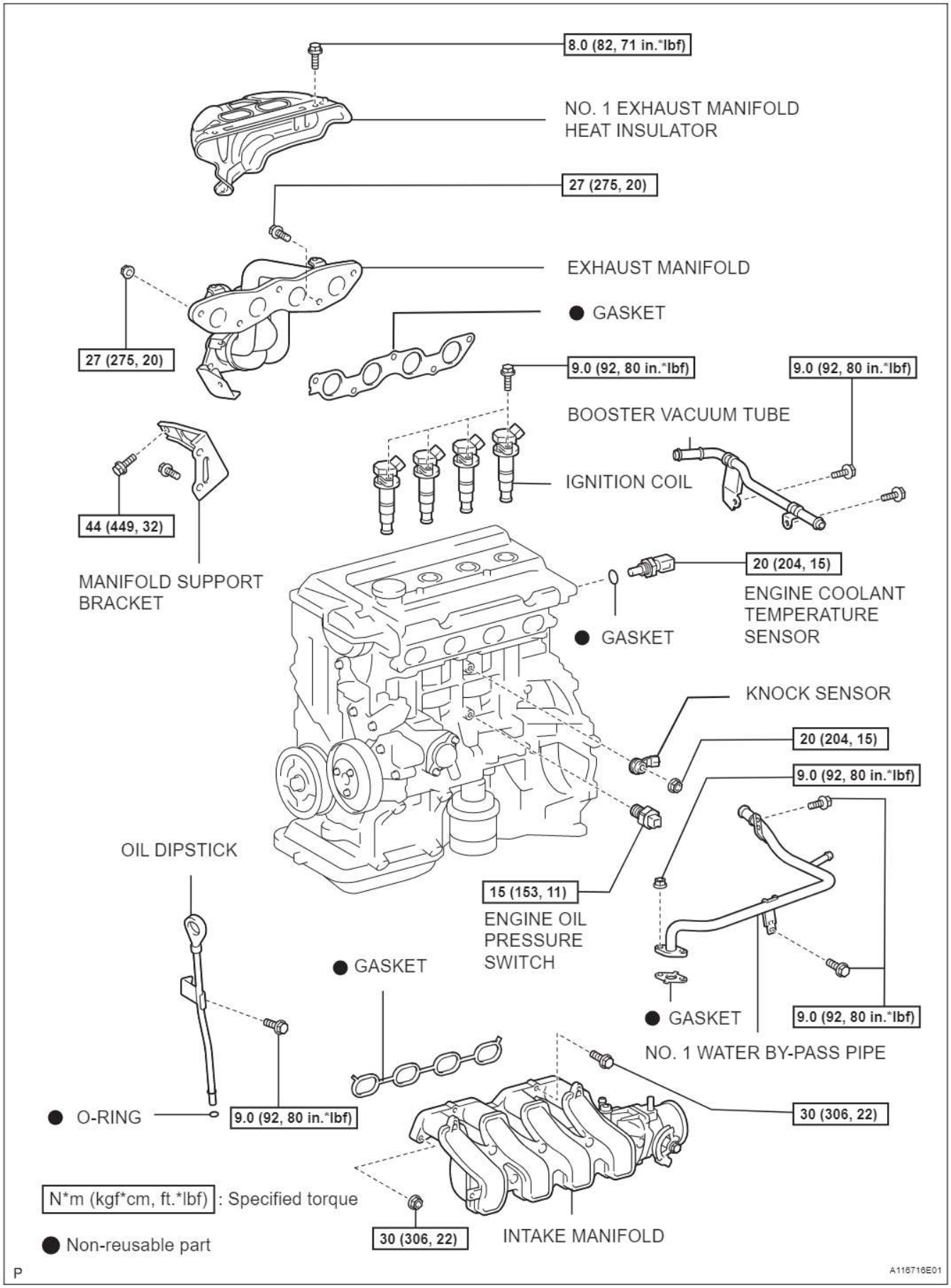
N*m (kgf*cm, ft.*lbf) : Specified torque

● Non-reusable part

P

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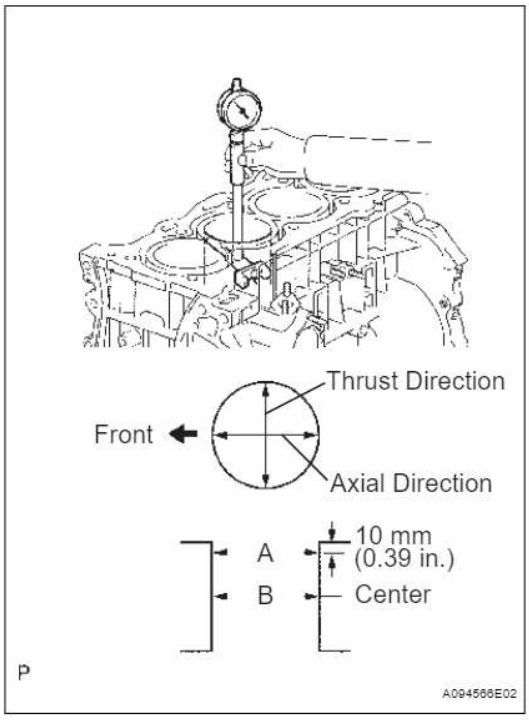


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INSPECTION

1. **INSPECT CYLINDER BLOCK FOR FLATNESS (See page EM-45)**

2. **INSPECT CYLINDER BORE**



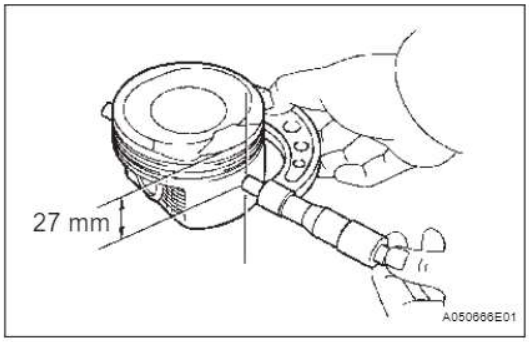
(a) Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

(b) Calculate the average of the thrust diameter and axial diameter at the "A" position in the illustration.

(c) Calculate the average of thrust diameter and axial diameter at the "B" position in the illustration.

Standard diameter:
75.000 to 75.013 mm (2.9528 to 2.9533 in.)

If the value obtained in the step above is not within the range of the standard diameter, replace the cylinder block.



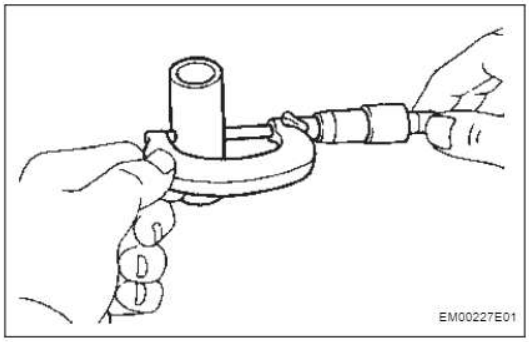
3. **INSPECT PISTON WITH PIN**

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, and at a position 27 mm (1.06 in.) from the top of the piston head.

Standard piston diameter:
74.945 to 74.955 mm (2.9506 to 2.9510 in.)

(b) Using a caliper gauge, measure the piston pin hole diameter of the piston.

Standard piston pin hole diameter:
18.013 to 18.016 mm (0.7092 to 0.7093 in.) at 20°C (68°F)



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

Standard piston pin diameter:
18.001 to 18.004 mm (0.7087 to 0.7088 in.)

(d) Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance:
0.009 to 0.015 mm (0.0004 to 0.0006 in.)

Maximum oil clearance:
0.050 mm (0.0020 in.)

If the clearance is greater than the maximum, replace the bush. If necessary, replace both the piston and piston pin together.

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4. INSPECT PISTON CLEARANCE

(a) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:
0.055 to 0.078 mm (0.0022 to 0.0031 in.)
Maximum oil clearance:
0.08 mm (0.0032 in.)

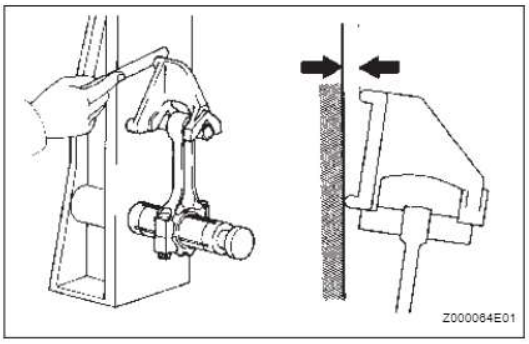
If the oil clearance is greater than the maximum, replace all 4 pistons. If necessary, replace the cylinder block.

5. INSPECT CONNECTING ROD

(a) Using a caliper gauge, measure the internal diameter of the connecting rod.

Standard connecting rod inside diameter:
17.965 to 17.985 mm (0.7073 to 0.7081 in.)

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

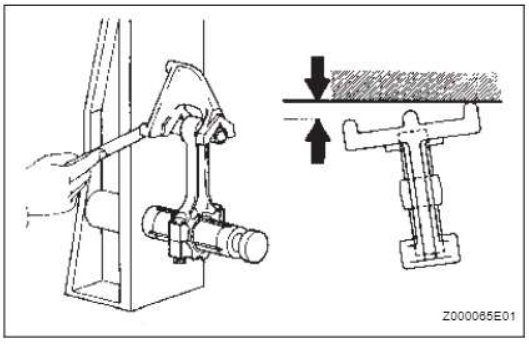


(b) Using a rod aligner and feeler gauge, check the connecting rod alignment.

(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 assembly.



(2) Check for twist.

Maximum twist:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

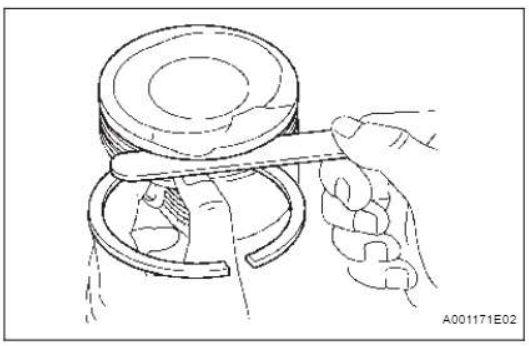
If the twist is greater than the maximum, replace the connecting rod assembly.

6. INSPECT RING GROOVE CLEARANCE

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

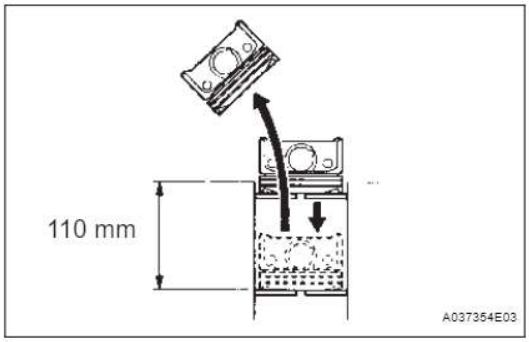
Standard ring groove clearance

Item	Specified Condition
No. 1 ring	0.02 to 0.04 mm (0.0008 to 0.0016 in.)
No. 2 ring	0.01 to 0.03 mm (0.0004 to 0.0012 in.)
Oil ring	0.01 to 0.03 mm (0.0004 to 0.0012 in.)



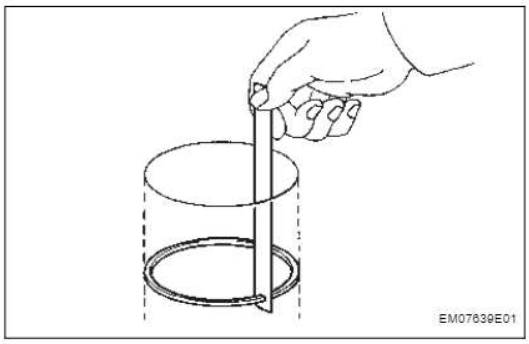
If the clearance is not as specified, replace the piston.

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7. 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.

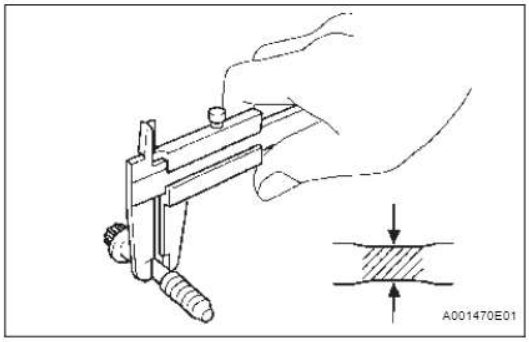


(b) Using a feeler gauge, measure the end gap.

Standard end gap

Item	Standard	Maximum
No. 1 ring	0.25 to 0.35 mm (0.0098 to 0.0138 in.)	0.91 mm (0.0358 in.)
No. 2 ring	0.35 to 0.50 mm (0.0138 to 0.0197 in.)	1.06 mm (0.0417 in.)
Oil ring	0.10 to 0.35 mm (0.0039 to 0.0138 in.)	0.82 mm (0.0323 in.)

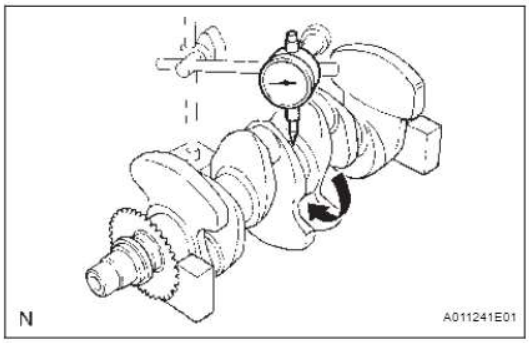
If the end gap is greater than the maximum, replace the piston ring and oil ring.



8. INSPECT CONNECTING ROD BOLT

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

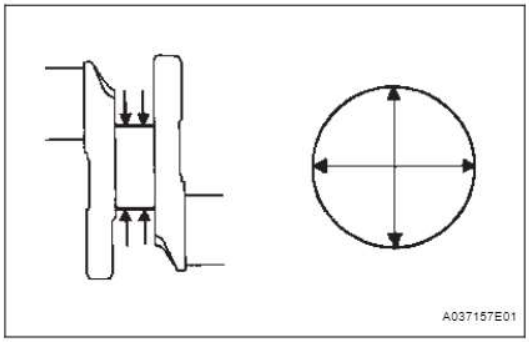
Standard diameter:
6.6 to 6.7 mm (0.260 to 0.264 in.)
Minimum diameter:
6.4 mm (0.252 in.)
If the diameter is less than the minimum, replace the bolt.



9. INSPECT CRANKSHAFT

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

Maximum circle runout:
0.03 mm (0.0012 in.)
If the circle runout is greater than the maximum, replace the crankshaft.



(b) Inspect the diameter.

(1) Using a micrometer, measure the diameter of each main journal as illustrated.

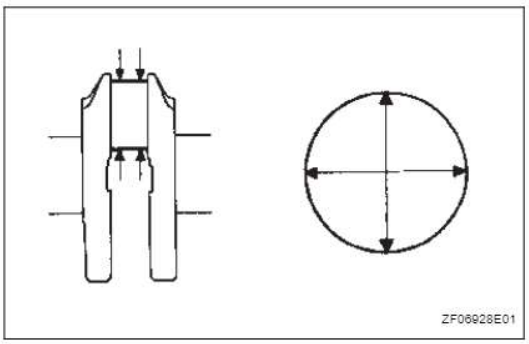
Standard diameter:
45.988 to 46.000 mm (1.8106 to 1.8110 in.)
If the diameter is not as specified, replace the crankshaft.

(2) Calculate the taper and distortion of the main journal.

Maximum taper and distortion:
0.02 mm (0.0008 in.)

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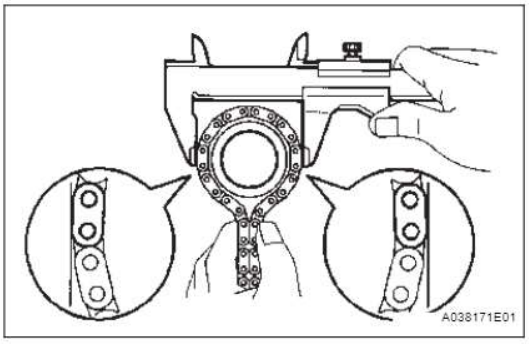
If the taper and distortion are greater than the maximum, replace the crankshaft.



(3) Using a micrometer, measure the diameter of each crank pin as illustrated.
Standard diameter:
39.992 to 40.000 mm (1.5745 to 1.5748 in.)
If the diameter is not as specified, replace the crankshaft.

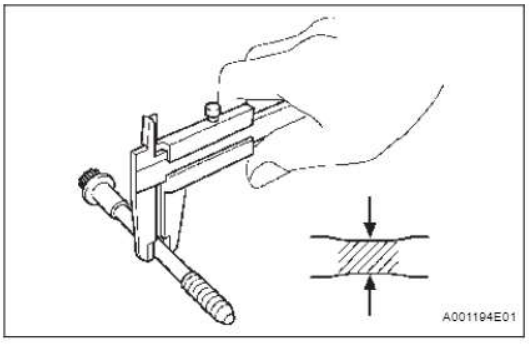
(4) Calculate the taper and distortion of the crank pin.
Maximum taper and distortion:
0.02 mm (0.0008 in.)
If the taper and distortion are greater than the maximum, replace the crankshaft.

EM



(c) Wrap the chain around the timing sprocket as shown in the illustration.

(d) Using a vernier caliper, measure the timing sprocket diameter with the chain wrapped.
Standard sprocket diameter (w/ chain):
51.72 mm (2.0362 in.)
Minimum sprocket diameter (w/ chain):
50.5 mm (1.988 in.)
NOTICE:
When measuring the diameter, the vernier caliper must be in contact with the chain roller.
If the diameter is less than the minimum, replace the chain and crankshaft.



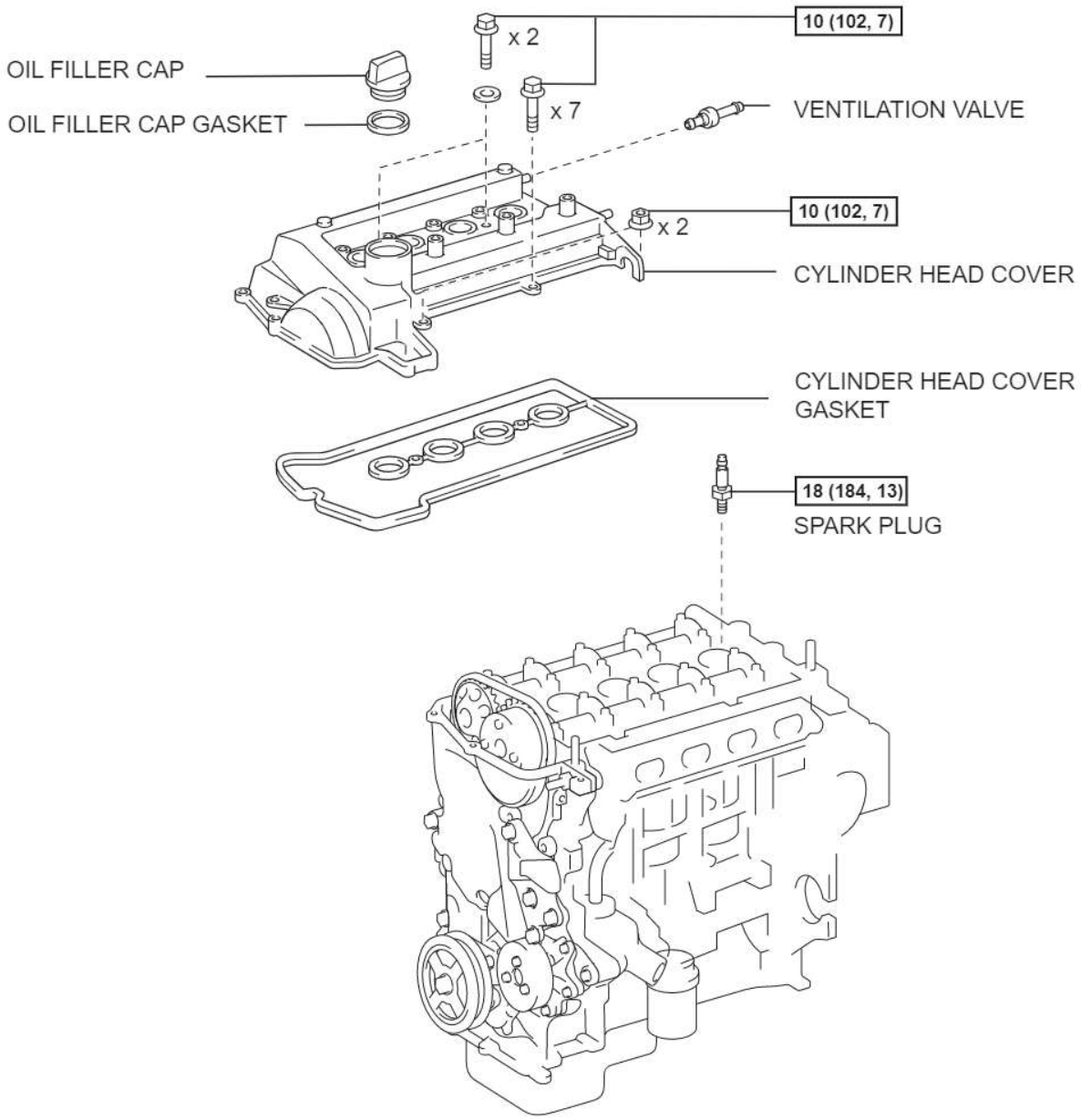
10. INSPECT CRANKSHAFT BEARING CAP SET BOLT

(a) Using a vernier caliper, measure the tension portion diameter of the bolt.
Standard diameter:
7.3 to 7.5 mm (0.287 to 0.295 in.)
Minimum diameter:
7.2 mm (0.283 in.)
If the diameter is less than the minimum, replace the bolt.

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ENGINE UNIT

COMPONENTS



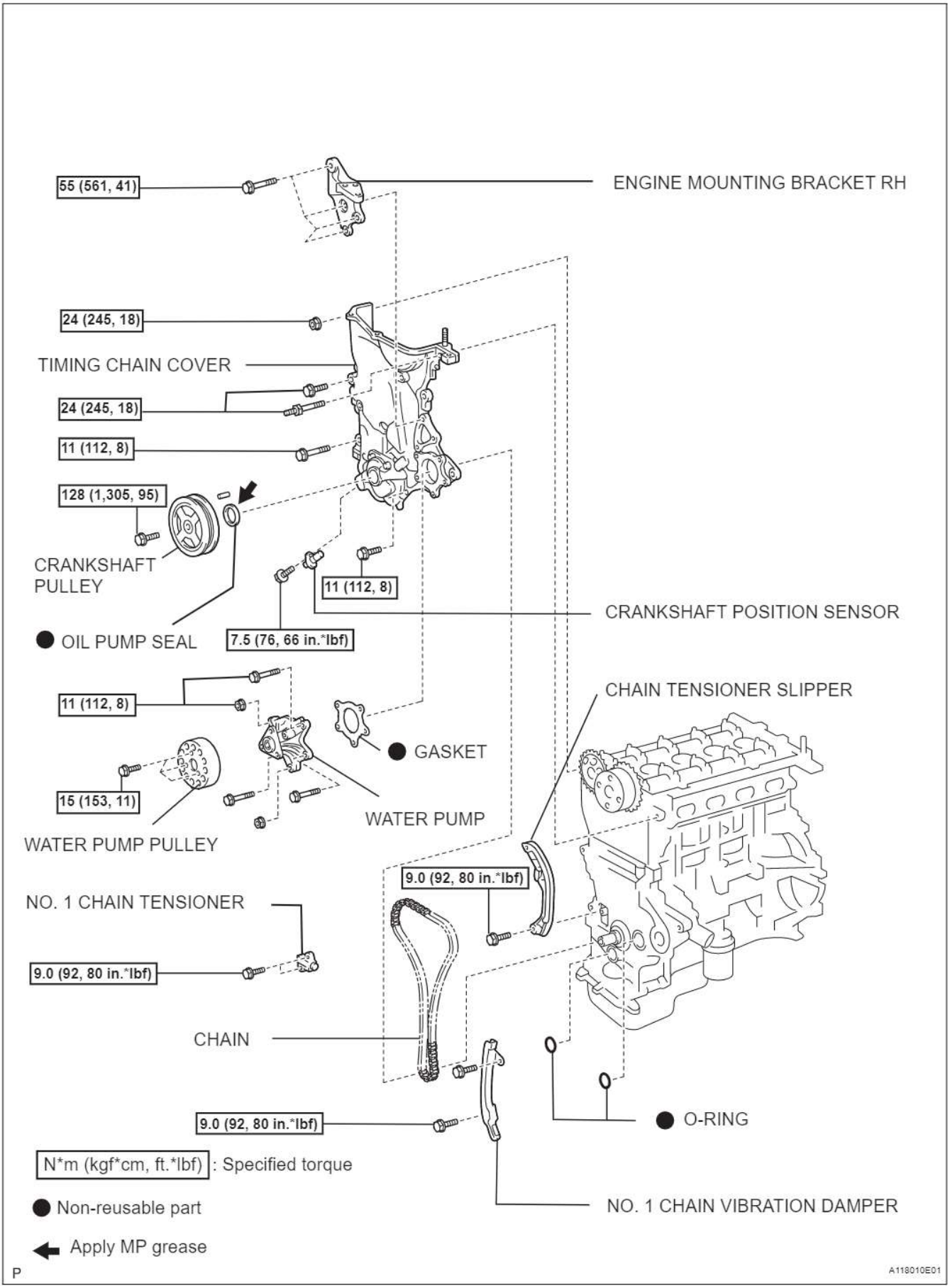
N*m (kgf*cm, ft.*lbf) : Specified torque

Y

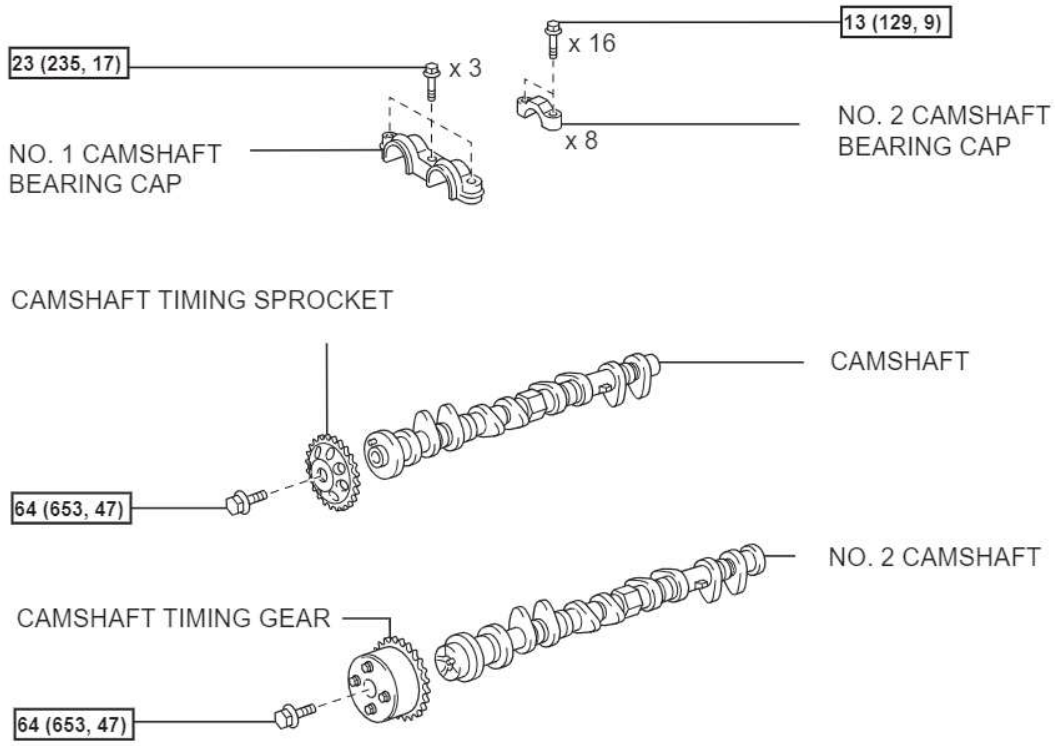
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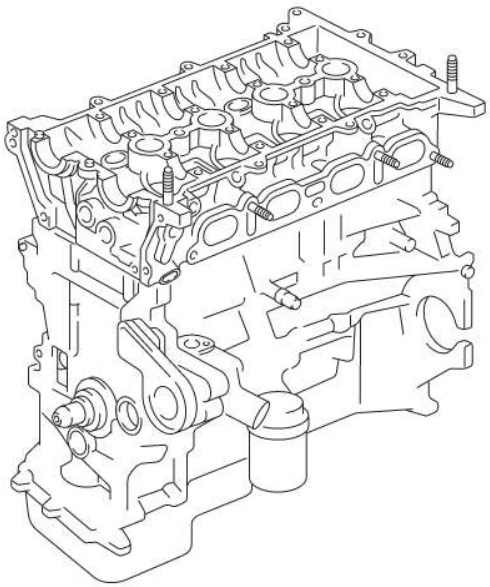
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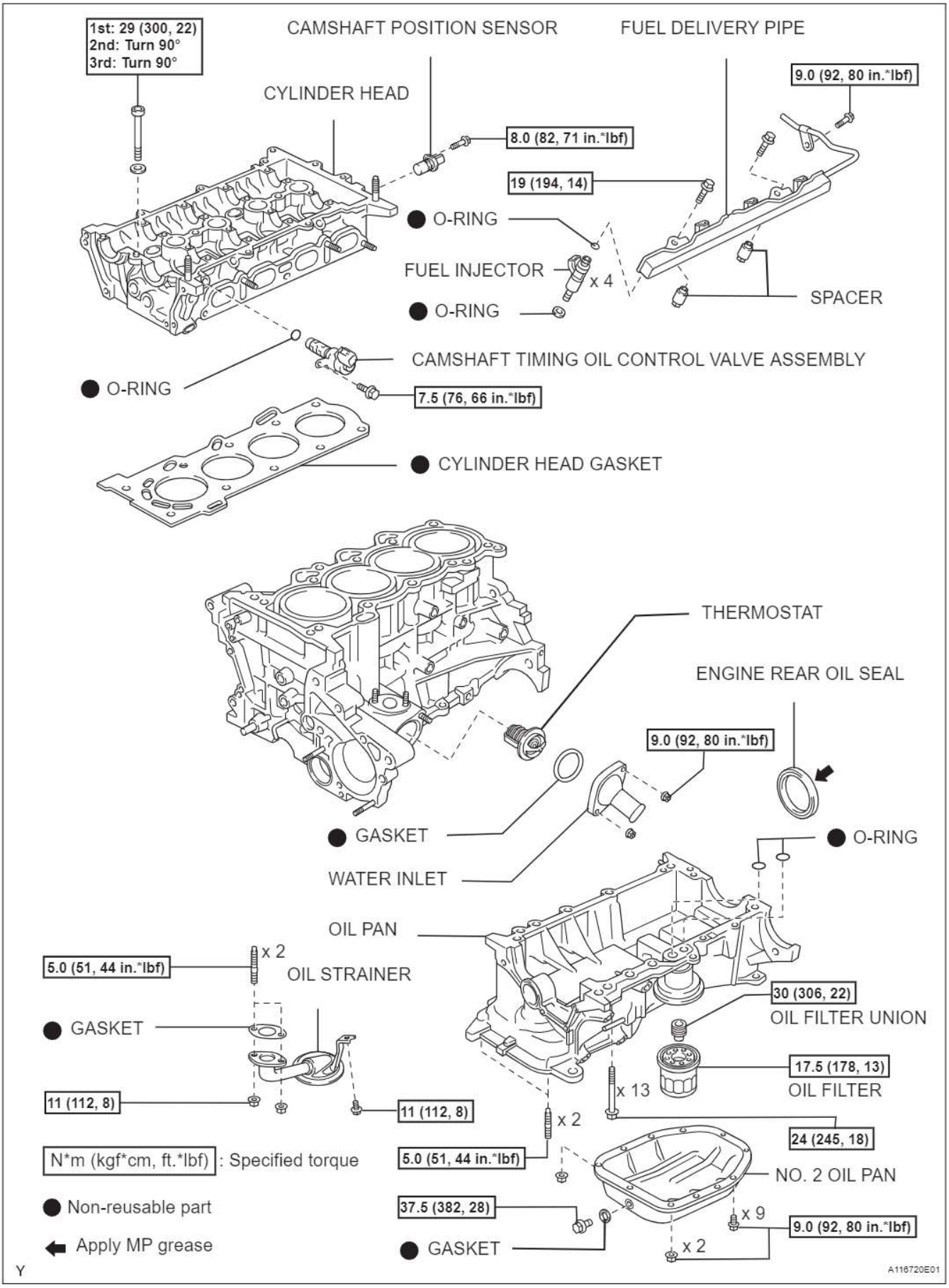


N*m (kgf*cm, ft.*lbf) : Specified torque

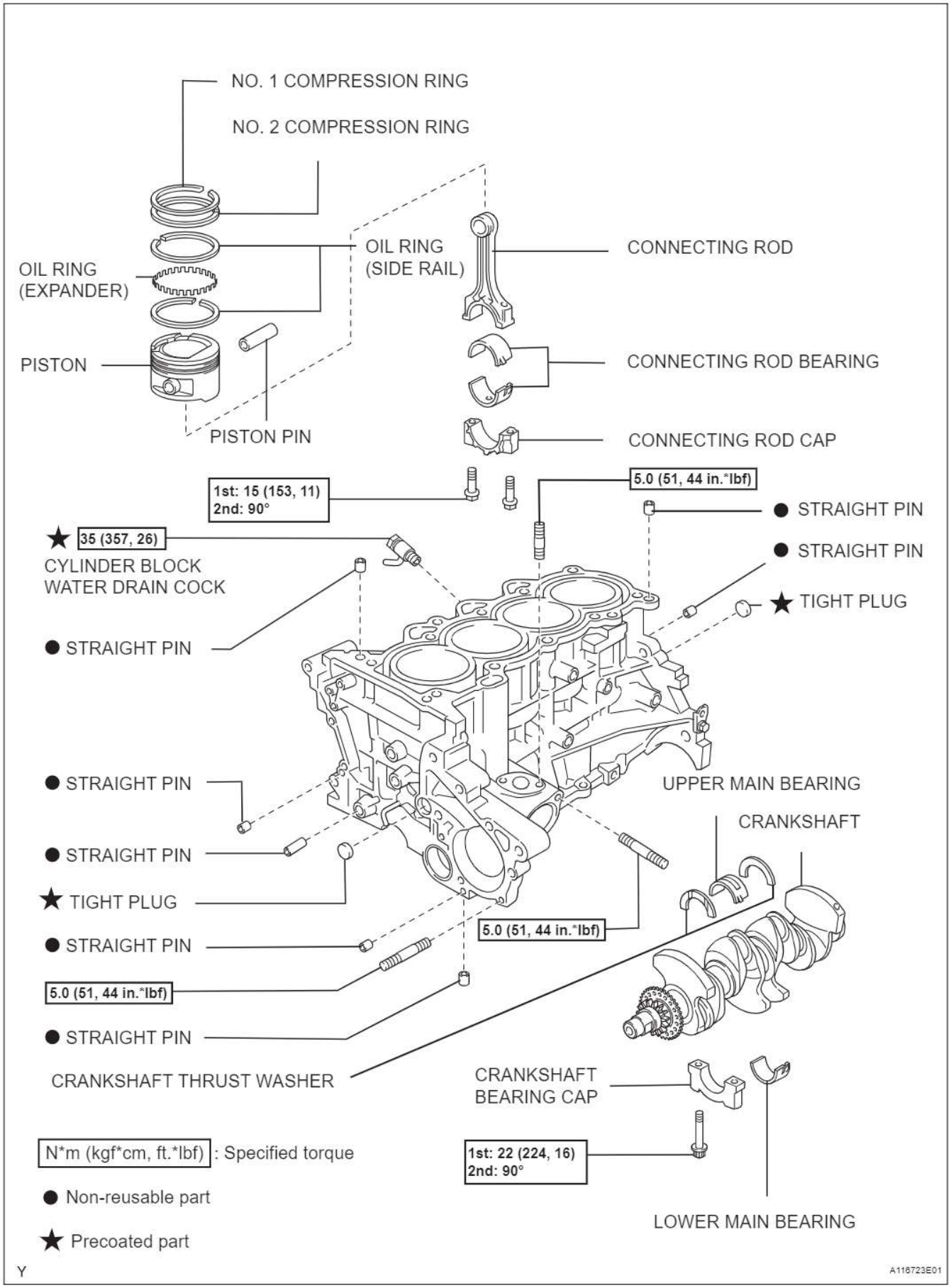
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REPLACEMENT

1. REPLACE OIL PUMP SEAL

HINT:

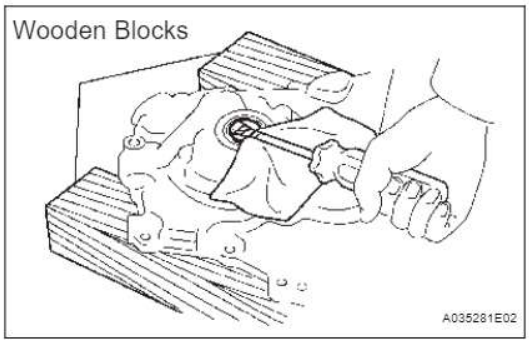
There are 2 ways to remove the oil seal: remove it with the timing chain cover removed, or remove it with the timing chain cover installed.

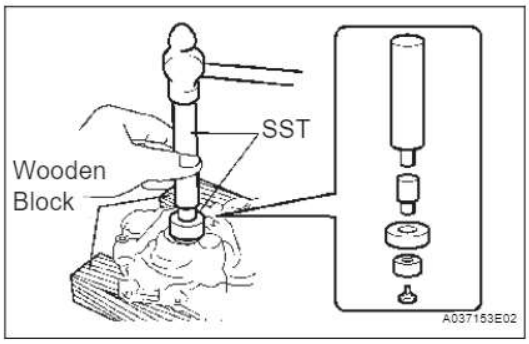
(a) If the timing chain cover is removed:

(1) Using a screwdriver, remove the oil seal.

HINT:

Tape the screwdriver tip before use.





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

SST 09950-60010 (09951-00250, 09951-00380, 09952-06010), 09950-70010 (09951-07100)

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Keep the lip free of foreign objects.**

(3) Apply multi-purpose grease to the lip of the oil seal.

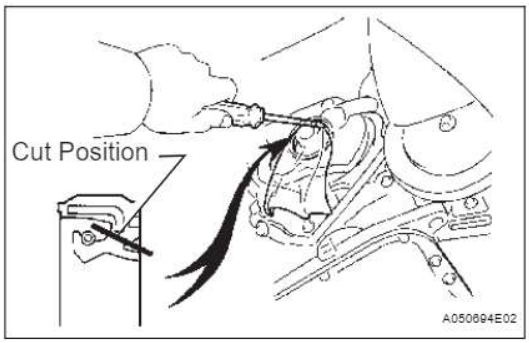
(b) If the timing chain cover is installed:

(1) Using a knife, cut off the lip of the oil seal.

(2) Using a screwdriver with the tip wrapped in tape, pry out the oil seal.

NOTICE:

After removal, check if the crankshaft is not damaged. If it is damaged, smooth the surface with 400-grit sandpaper.



(3) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign objects.

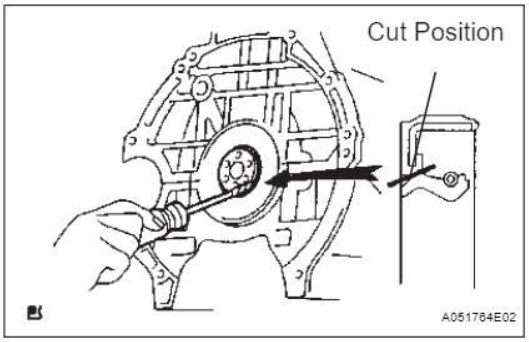
(4) Using SST and a hammer, tap in the oil seal until its surface is flush with the timing chain cover edge.

SST 09223-22010

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Wipe any extra grease off the crankshaft.**

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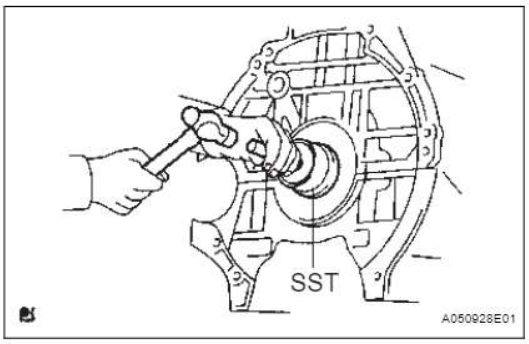
2. REPLACE ENGINE REAR OIL SEAL

(a) Using a knife, cut off the lip of the oil seal.

(b) Using a screwdriver with the tip wrapped in tape, pry out the oil seal.

NOTICE:

After removal, check if the crankshaft is not damaged. If it is damaged, smooth the surface with 400-grit sandpaper.



(c) Apply multi-purpose grease to the lip of a new oil seal.

NOTICE:

Keep the lip free of foreign materials.

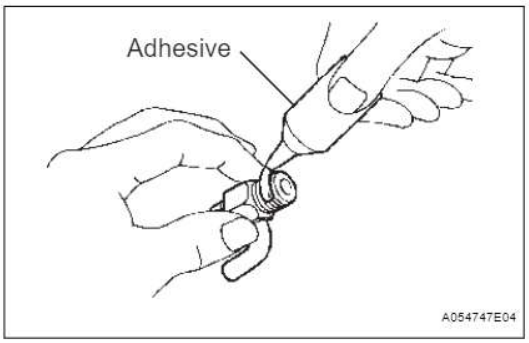
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-56010

NOTICE:

- **Be careful not to tap the oil seal at an angle.**
- **Wipe any extra grease off the crankshaft.**

REASSEMBLY

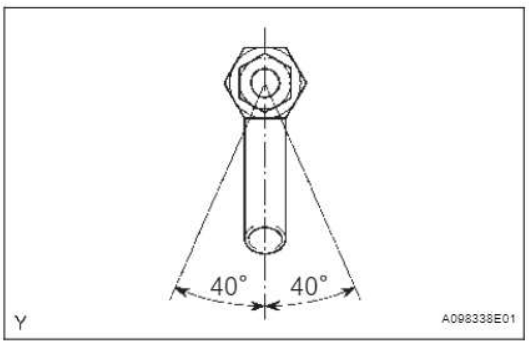


1. INSTALL CYLINDER BLOCK WATER DRAIN COCK

(a) Apply adhesive to 2 or 3 threads of the drain union, and install it within 3 minutes.

Seal packing:

Part No. 08826-00100



(b) After applying the specified torque, rotate the drain union clockwise until its drain port faces downward.

Torque: 35 N*m (357 kgf*cm, 26 ft.*lbf)

NOTICE:

- **Install the water drain cock within 3 minutes of applying adhesive.**
- **Do not add coolant for at least 1 hour after installation.**
- **Do not rotate the drain union more than 360° in this step, and never loosen it after setting the union correctly.**
- **The pipe of the drain cock should be within 40° of the vertical position.**

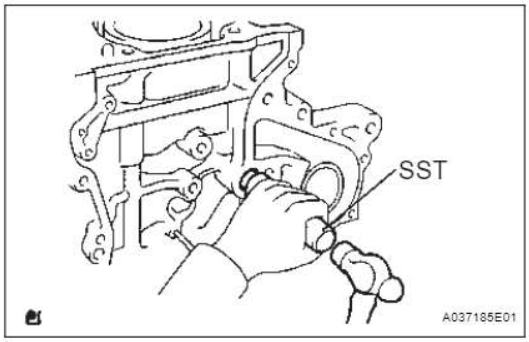
2. INSTALL TIGHT PLUG

(a) Apply adhesive to new tight plugs.

Adhesive:

Part No. 08826-00070, THREE BOND 1324 or equivalent.

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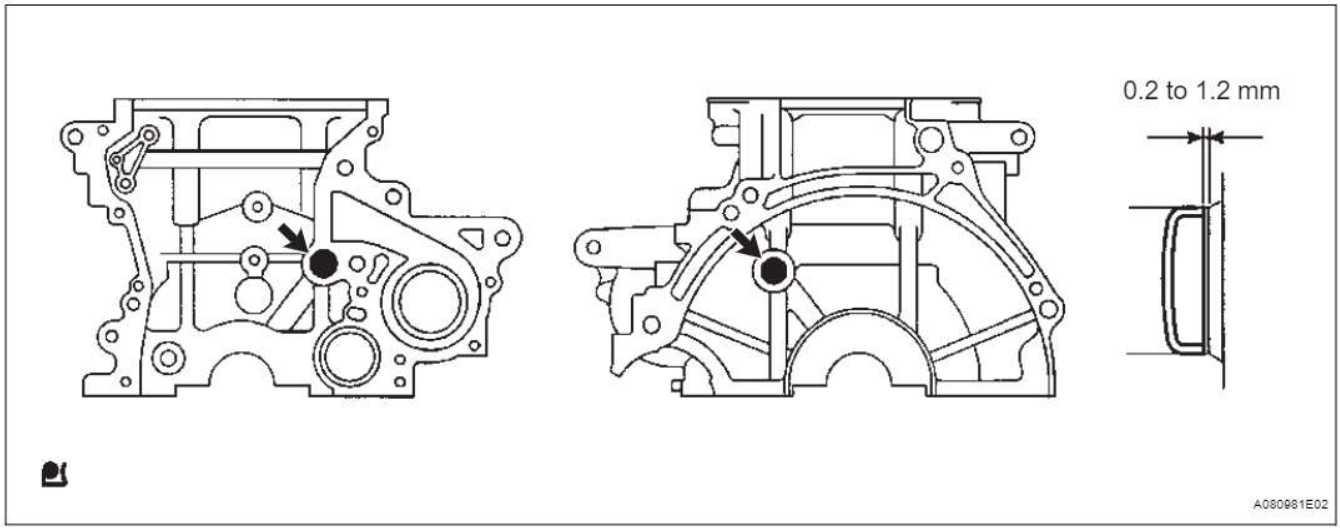


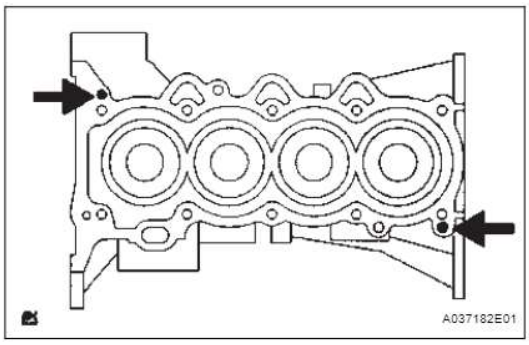
(b) Using SST, tap in the tight plugs as shown in the illustration.

SST 09950-60010 (09951-00180), 09950-70010 (09951-07100)

Standard depth:

0.2 to 1.2 mm (0.008 to 0.047 in.)





3. INSTALL CYLINDER HEAD SET STRAIGHT PIN

(a) Using a plastic-faced hammer, tap in the straight pin.

Standard protrusion:

8.5 to 9.5 mm (0.335 to 0.374 in.)

4. INSTALL STRAIGHT PIN

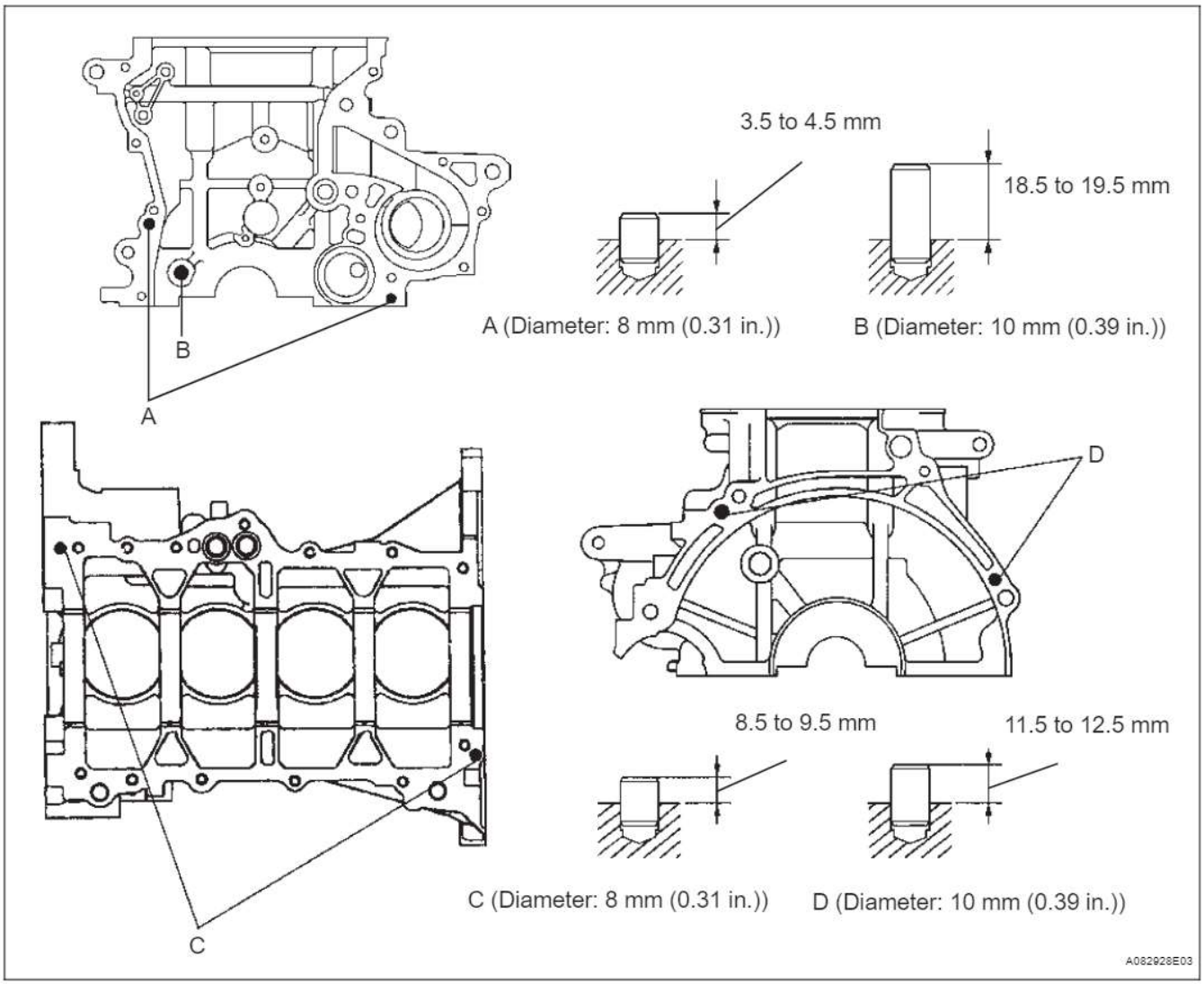
(a) Using a plastic-faced hammer, tap in the straight pin.

Standard protrusion:

3.5 to 4.5 mm (0.138 to 0.177 in.) for pin A
18.5 to 19.5 mm (0.728 to 0.768 in.) for pin B
8.5 to 9.5 mm (0.335 to 0.724 in.) for pin C
11.5 to 12.5 mm (0.453 to 0.492 in.) for pin D

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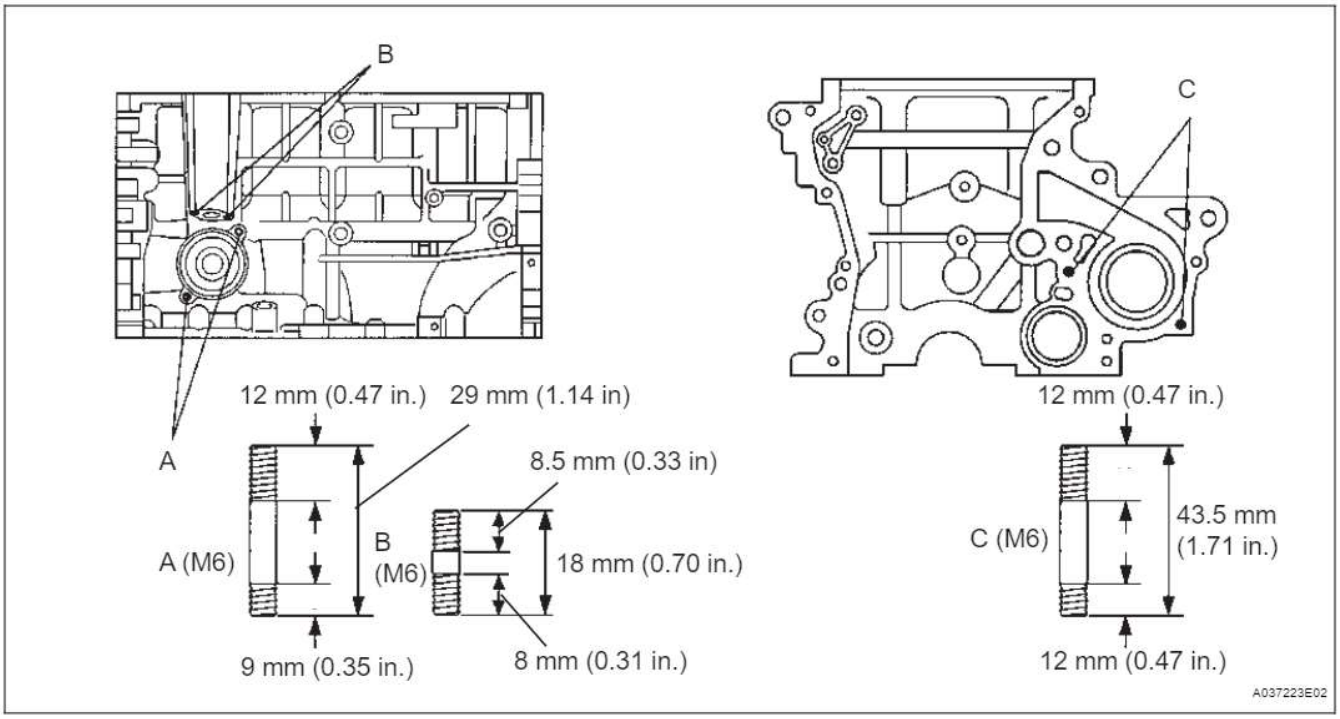
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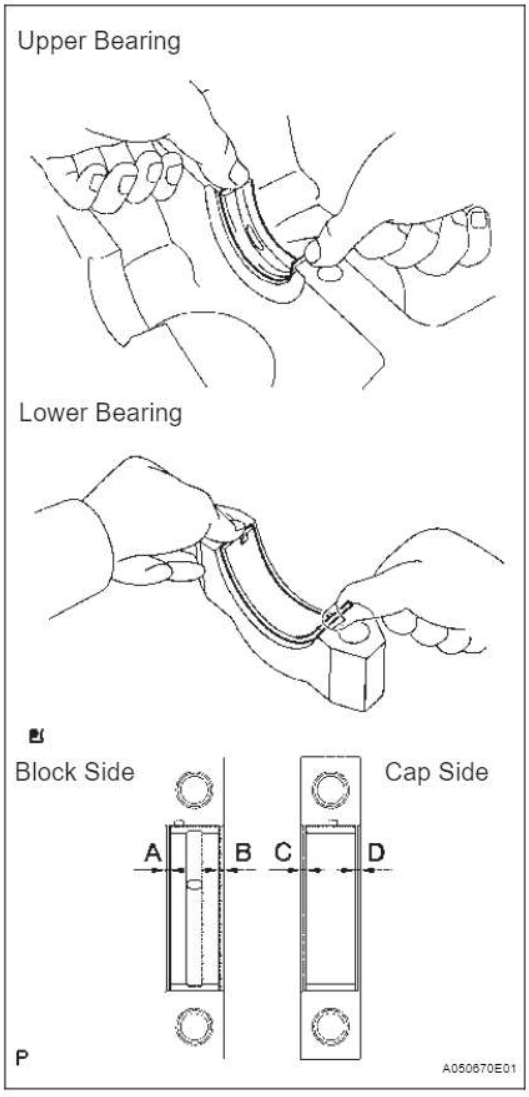


5. INSTALL STUD BOLT

(a) Using an E5 "torx" socket, install the 6 stud bolts.
Torque: 5.0 N*m (51 kgf*cm, 44 in.*lbf)

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6. INSTALL CRANKSHAFT

(a) Install the upper bearing with the oil groove onto the cylinder block, and the lower bearing onto the bearing cap.

NOTICE:

Do not apply engine oil to the contact surface of the cylinder block or the backside of the bearing.

HINT:

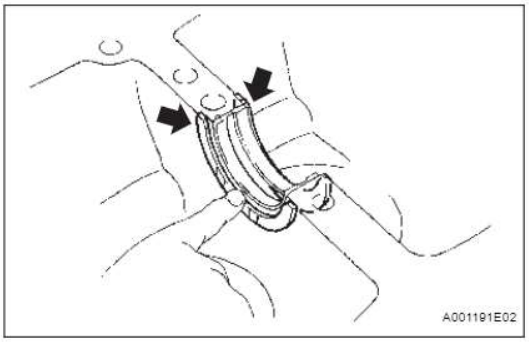
Mass production parts do not have claws as marks. If reusing the mass production parts, measure the clearance of both sides with the bearing in the center of the bearing cap.

Standard clearance:

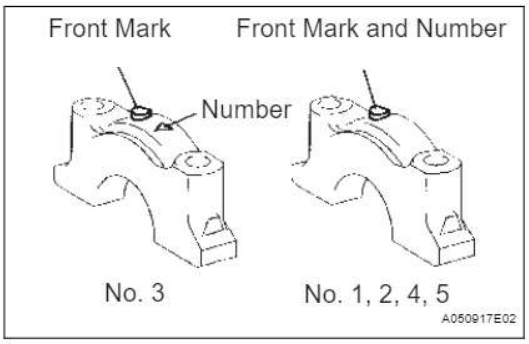
A - B = within 0.8 mm (0.032 in.)

C - D = within 0.4 mm (0.016 in.)

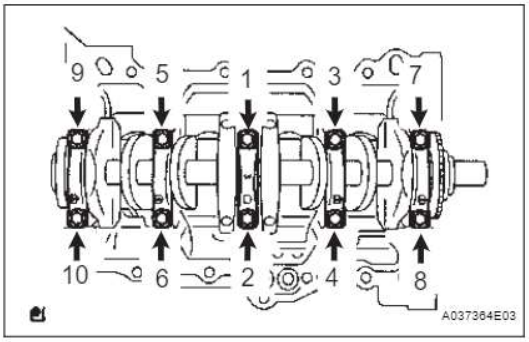
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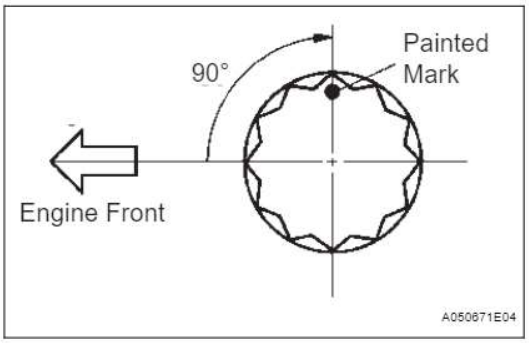
(b) Install the 2 thrust washers onto the No. 3 journal position of the cylinder block with the oil grooves facing outward.
(c) Apply engine oil to the upper bearing and install the crankshaft onto the cylinder block.



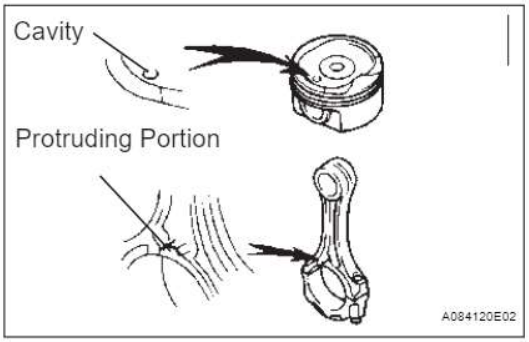
(d) Check the front marks and numbers and install the bearing caps onto the cylinder block.
(e) Apply a light coat of engine oil to the threads of the bearing cap bolts.



(f) Using SST, tighten the bolts in several steps by the specified torque in the sequence shown in the illustration.
SST 09011-38121
Torque: 22 N*m (224 kgf*cm, 16 ft.*lbf)
NOTICE:
Check that the crankshaft turns smoothly.



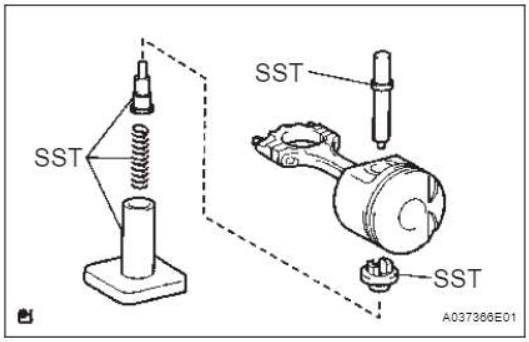
(g) Mark the front of the bearing cap bolts with paint.
(h) Retighten the bearing cap bolts by 90° in the same sequence.
(i) Check that the painted mark is now at a 90° angle to the front.



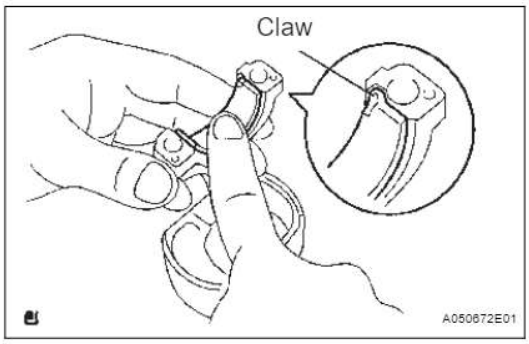
7. INSTALL PISTON PIN

(a) Coat the inner surface of the connecting rod bore and piston pin with engine oil.
(b) Align the cavity of the piston with the protruding portion of the connecting rod.

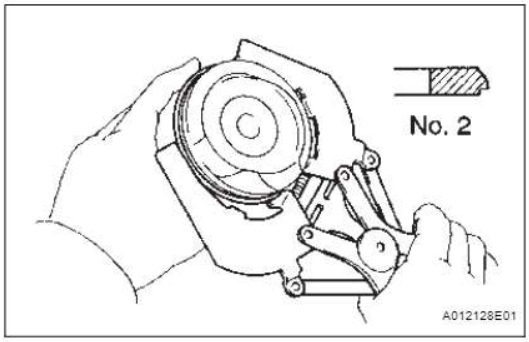
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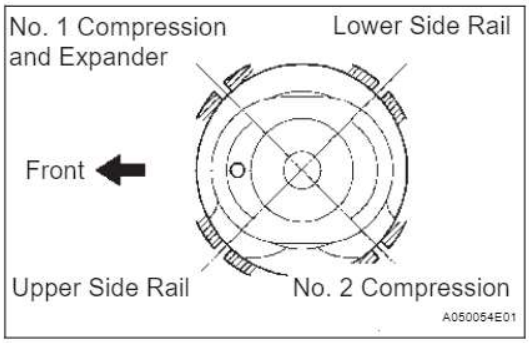
(c) Using SST, push in the piston pin.
SST 09221-25026 (09221-00021, 09221-00030, 09221-00190, 09221-00141, 09221-00150)
NOTICE:
Keep the pistons, pins, rings, connecting rods and bearings in the correct order so that they can be returned to the original locations when reassembling.



8. INSTALL CONNECTING ROD BEARING
(a) Align the bearing claw with the grooves of the connecting rod and connecting rod cap.
NOTICE:
Clean the backside of the bearing and the bearing surface of the connecting rod, and keep them free of oils.

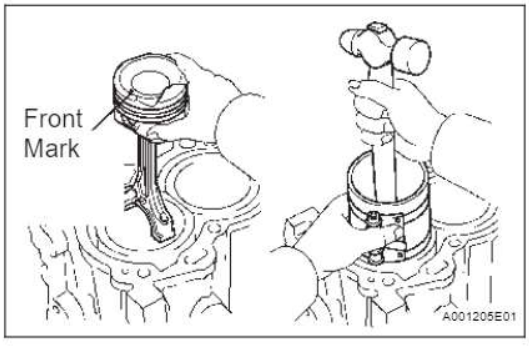


9. INSTALL PISTON RING SET
HINT:
If reusing the piston rings, install them onto the matched pistons with the surfaces facing correctly.
(a) Install the oil ring expander and 2 side rails by hand.
(b) Using a piston ring expander, install the 2 compression rings.



(c) Position the piston rings so that the ring ends are as shown in the illustration.

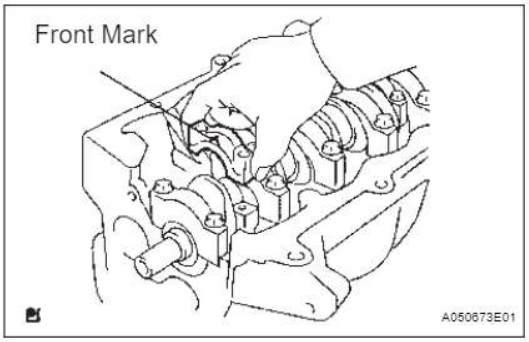
10. INSTALL PISTON WITH CONNECTING ROD
(a) Apply engine oil to the cylinder walls, pistons, and the surfaces of the connecting rod bearings.
(b) Check the position of the piston ring ends.



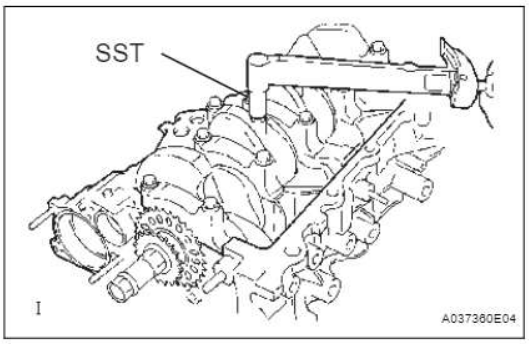
(c) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark on the piston facing forward.
NOTICE:
- **Clean the backside of the bearing and the bearing surface of the connecting rod cap, and keep them free of oils.**
- **Match the numbered connecting rod cap with the correct connecting rod.**

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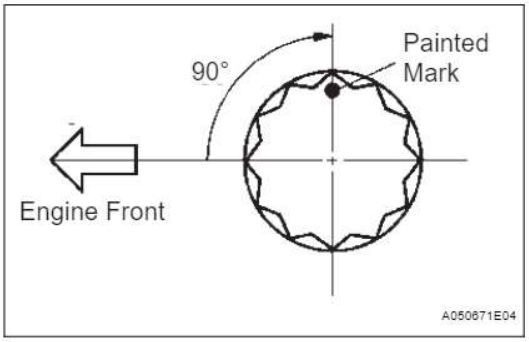
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(d) Match the connecting rod and cap together in the correct combination. Then install the cap onto the connecting rod, making sure that the front mark on the cap is correctly oriented.
(e) Apply a light coat of engine oil to the threads of the connecting rod cap bolts.



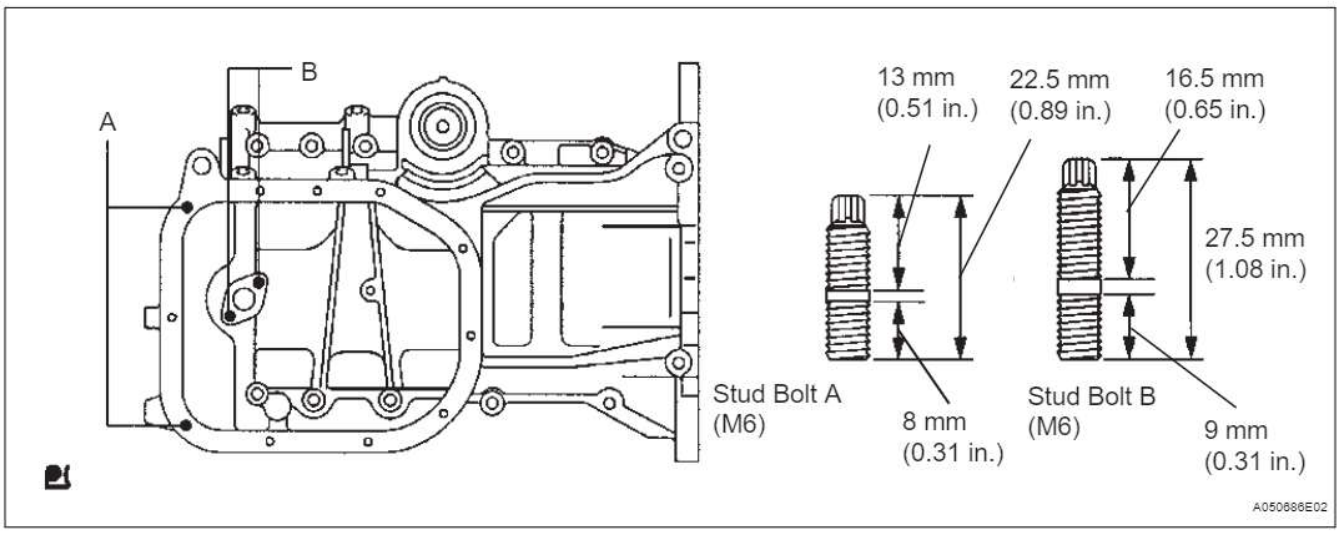
(f) Using SST, tighten the bolts in several steps by the specified torque.
SST 09205-16010
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)



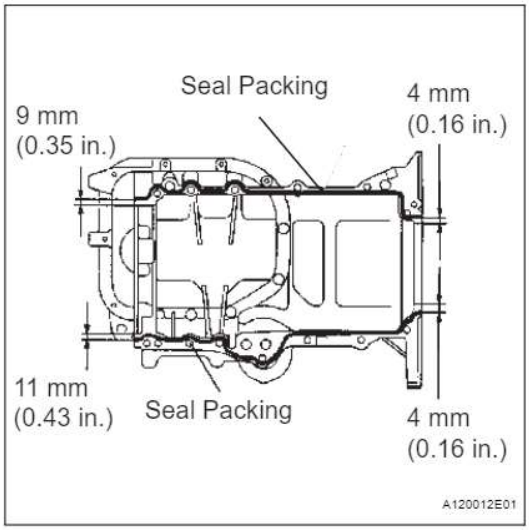
(g) Mark the front of the connecting cap bolts with paint.
(h) Retighten the cap bolts by 90° as shown.
(i) Check that the crankshaft turns smoothly.

11. INSTALL STUD BOLT

(a) Using an E5 "torx" socket, install the 4 stud bolts.



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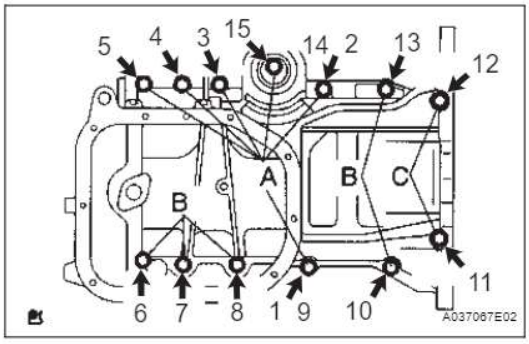


12. INSTALL OIL PAN

(a) Apply a continuous line of seal packing to the oil pan mating surface as shown in the illustration.

Seal packing:
Part No. 08826-00080 or equivalent
Standard seal diameter:
2.0 mm to 3.0 mm (0.079 to 0.118 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes of applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installation.**

(b) Install 2 new O-rings onto the cylinder block.



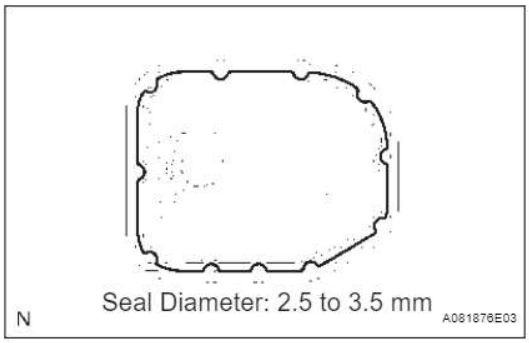
(c) Using several steps, install and uniformly tighten the 13 bolts in the sequence shown in the illustration.

Torque: 24 N*m (245 kgf*cm, 18 ft.*lbf)
HINT:
Each bolt length is as follows:
49 mm (1.93 in.) for bolt A
88 mm (3.47 in.) for bolt B
144 mm (5.67 in.) for bolt C

13. INSTALL OIL STRAINER

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

Torque: 11 N*m (112 kgf*cm, 8.1 ft.*lbf)



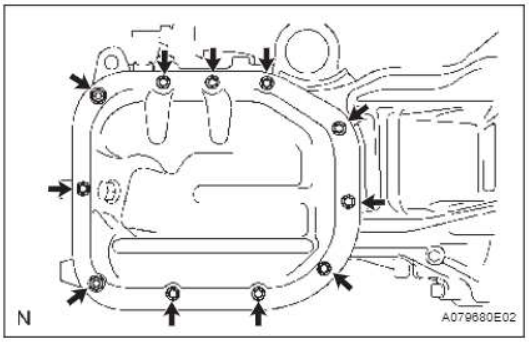
14. INSTALL NO. 2 OIL PAN

(a) Apply a continuous line of seal packing to the oil pan mating surface as shown in the illustration.

Seal packing:
Part No. 08826-00080 or equivalent
Standard seal diameter:
2.5 mm to 3.5 mm (0.098 to 0.14 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes of applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installation.**
- **Do not start the engine within 2 hours of installation.**

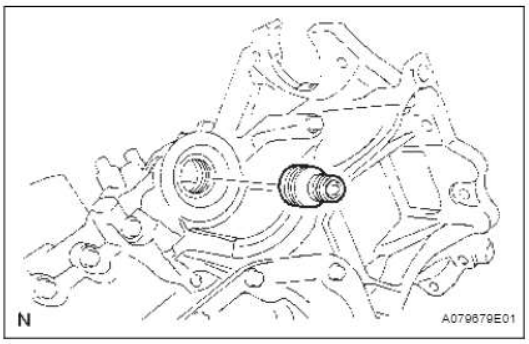
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(b) Install the No. 2 oil pan with the 9 bolts and 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

(c) Install the drain plug with a new gasket.
Torque: 37.5 N*m (382 kgf*cm, 28 ft.*lbf)



15. INSTALL OIL FILTER UNION

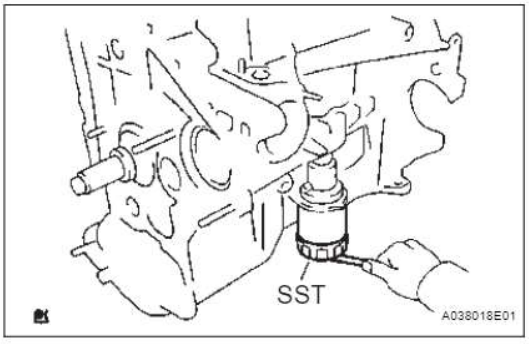
(a) Using a 12 mm hexagon wrench, install the oil filter union.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

16. INSTALL OIL FILTER

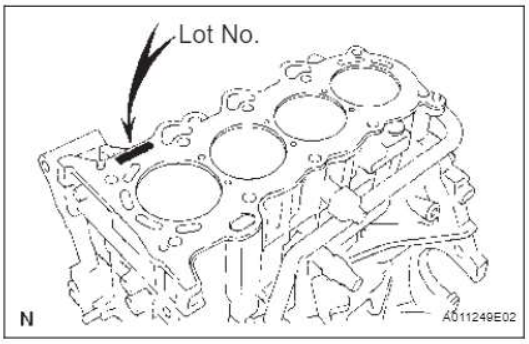
(a) Check and clean the oil filter installation surface.

(b) Apply clean engine oil to the gasket of the new oil filter.

(c) Lightly screw the oil filter into place, and tighten it until the gasket comes into contact with the seat.



(d) Using SST, tighten it an additional 3/4 turn.
SST 09228-06501
If using a torque wrench, tighten to the specified torque.
Torque: 17.5 N*m (178 kgf*cm, 13 ft.*lbf)



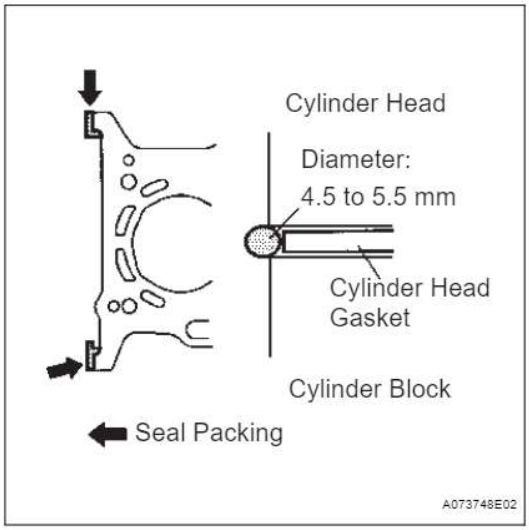
17. INSTALL CYLINDER HEAD GASKET

(a) Place a new cylinder head gasket on the cylinder block with the Lot No. stamp facing upward.
NOTICE:
- **Remove any oil from the contact surface.**
- **Pay attention to the mounting orientation of the cylinder head gasket.**
- **Place the cylinder head on the cylinder block gently in order not to damage the gasket at the bottom part of the head.**

18. INSTALL CYLINDER HEAD

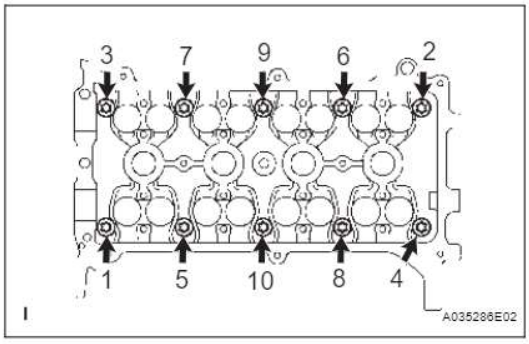
HINT:
The cylinder head bolts are tightened in 2 successive steps.

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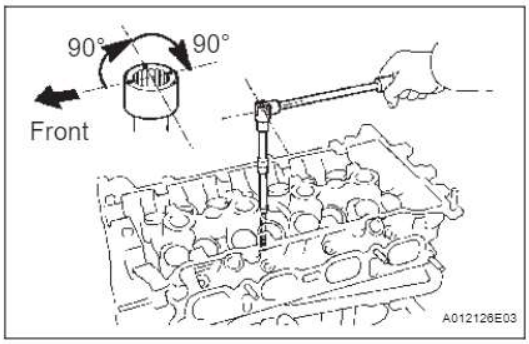


(a) Apply seal packing as shown in the illustration.
Seal packing:
Part No. 08826-00080 or equivalent
Standard seal diameter:
3.5 mm to 4.5 mm (0.177 to 0.217 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the oil pan within 3 minutes of applying seal packing.**

(b) Apply a light coat of engine oil to the threads of the cylinder head bolts.

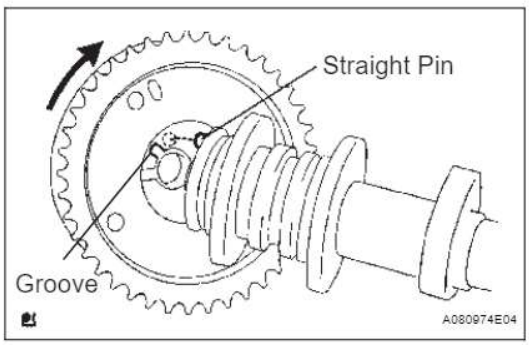


(c) Using several steps, install and uniformly tighten the 10 cylinder head bolts and plate washers with an 8 mm bi-hexagon wrench in the sequence shown in the illustration.
Torque: 29 N*m (300 kgf*cm, 22 ft.*lbf)



(d) Mark the front of the cylinder head bolt with paint.
(e) Retighten the cylinder head bolts by an additional 90° and then another 90°, as shown in the illustration.
(f) Check that the painted mark is now at a 180° angle to the front.

19. INSTALL ENGINE REAR OIL SEAL (See page EM-107)



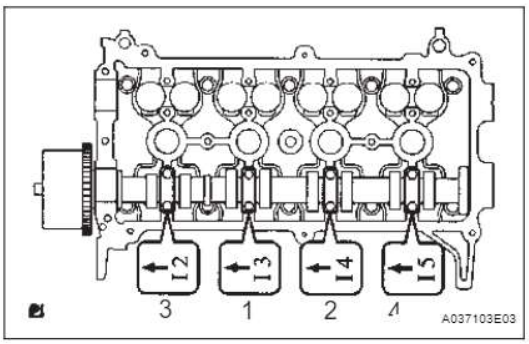
20. INSTALL CAMSHAFT TIMING GEAR

(a) Put the camshaft timing gear assembly and the camshaft together with the straight pin of the groove.
(b) Turn the camshaft timing gear assembly clockwise while pushing it lightly towards the camshaft. Push further at the position where the pin fits into the groove.
NOTICE:
Be careful not to turn the camshaft timing gear to the retard angle (to the right).
(c) Check that there is no clearance between the gear fringe and the camshaft.
(d) Tighten the flange bolt with the camshaft timing gear fixed in place.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)

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

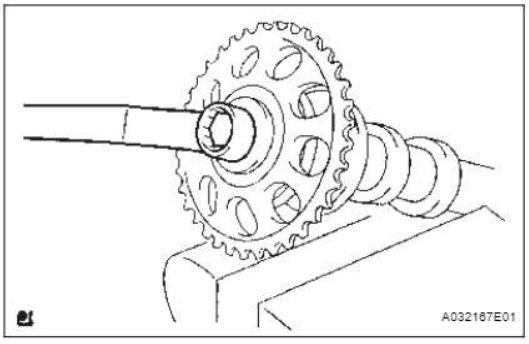


21. INSTALL CAMSHAFT

(a) Apply a light coat of engine oil to the camshaft journals.

(b) Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.

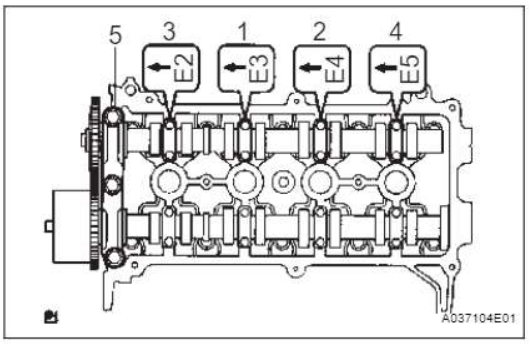
(c) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (129 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.



22. INSTALL CAMSHAFT TIMING SPROCKET

(a) Clamp the camshaft in a vise.

(b) Align the knock pin hole of the camshaft timing sprocket with the knock pin of the camshaft, and install the camshaft timing sprocket.
Torque: 64 N*m (653 kgf*cm, 47 ft.*lbf)
NOTICE:
Be careful not to damage the camshaft.



23. INSTALL NO. 2 CAMSHAFT

(a) Apply a light coat of engine oil to the camshaft journals.

(b) Place the camshaft on the cylinder head with the timing mark on the camshaft timing gear facing upward.

(c) Examine the front marks and numbers, and tighten the bolts in the sequence shown in the illustration.
Torque: 13 N*m (133 kgf*cm, 9 ft.*lbf)
NOTICE:
Tighten each bolt uniformly, keeping the camshaft level.

(d) Install the No. 1 bearing cap.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)

24. INSTALL CAMSHAFT POSITION SENSOR

(a) Apply engine oil to the O-ring.
NOTICE:
If the O-ring is damaged, replace the camshaft position sensor.

(b) Install the camshaft position sensor with the bolt.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

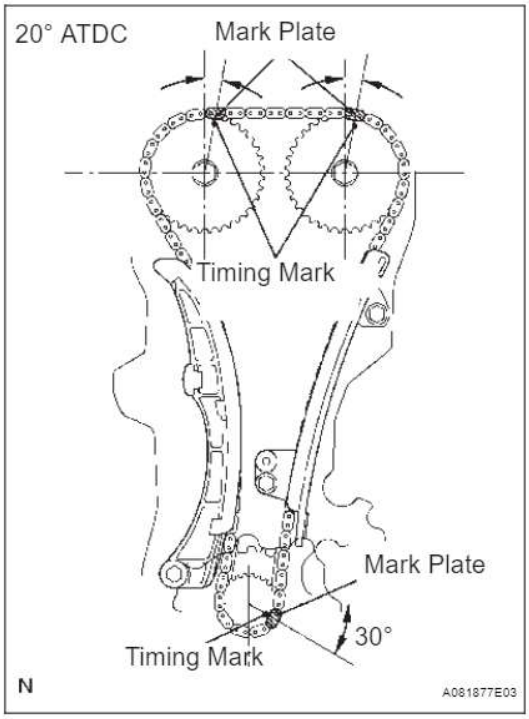
25. INSTALL CHAIN

(a) Set the position of the No. 1 cylinder to 20° ATDC.
NOTICE:
To prevent the pistons from hitting against valves, the following procedures must be performed in the order below.

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(1) Set the crankshaft between 40 to 140° ATDC.
(2) Set the cams of the intake and exhaust timing sprockets to 20° ATDC.
(3) Reset the crankshaft to 20° ATDC.

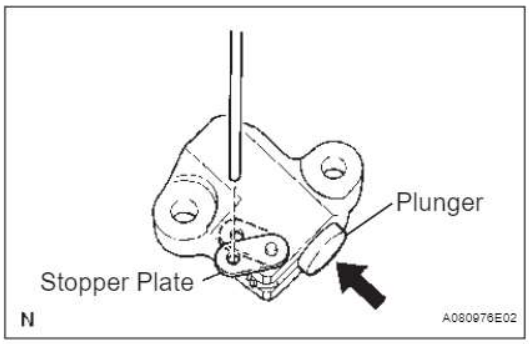
(b) Install the chain vibration damper with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)



(c) Align the matchmarks of the camshaft timing sprocket, camshaft timing gear and crankshaft timing sprocket with each mark plate (colored in yellow) of the timing chain.
HINT:
To prevent the exhaust camshaft from springing back, turn it using a wrench and set it at the mark on the chain.

(d) Install the chain tensioner slipper with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

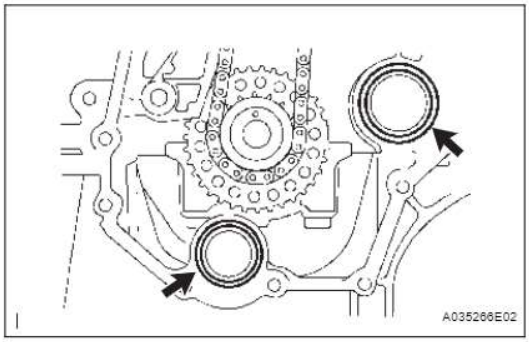
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(e) While rotating the stopper plate of the chain tensioner upward as shown in the illustration, push in the plunger of the tensioner.
(f) While rotating the stopper plate of the tensioner downward, insert a 2.5 mm (0.098 in.) diameter bar into the holes of the stopper plate and the tensioner to hold the stopper plate.
(g) Install the chain tensioner with the 2 bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)
(h) Remove the bar from the chain tensioner.
(i) Check the tension between the intake and exhaust camshaft timing sprocket.

26. INSTALL OIL PUMP SEAL (See page EM-106)

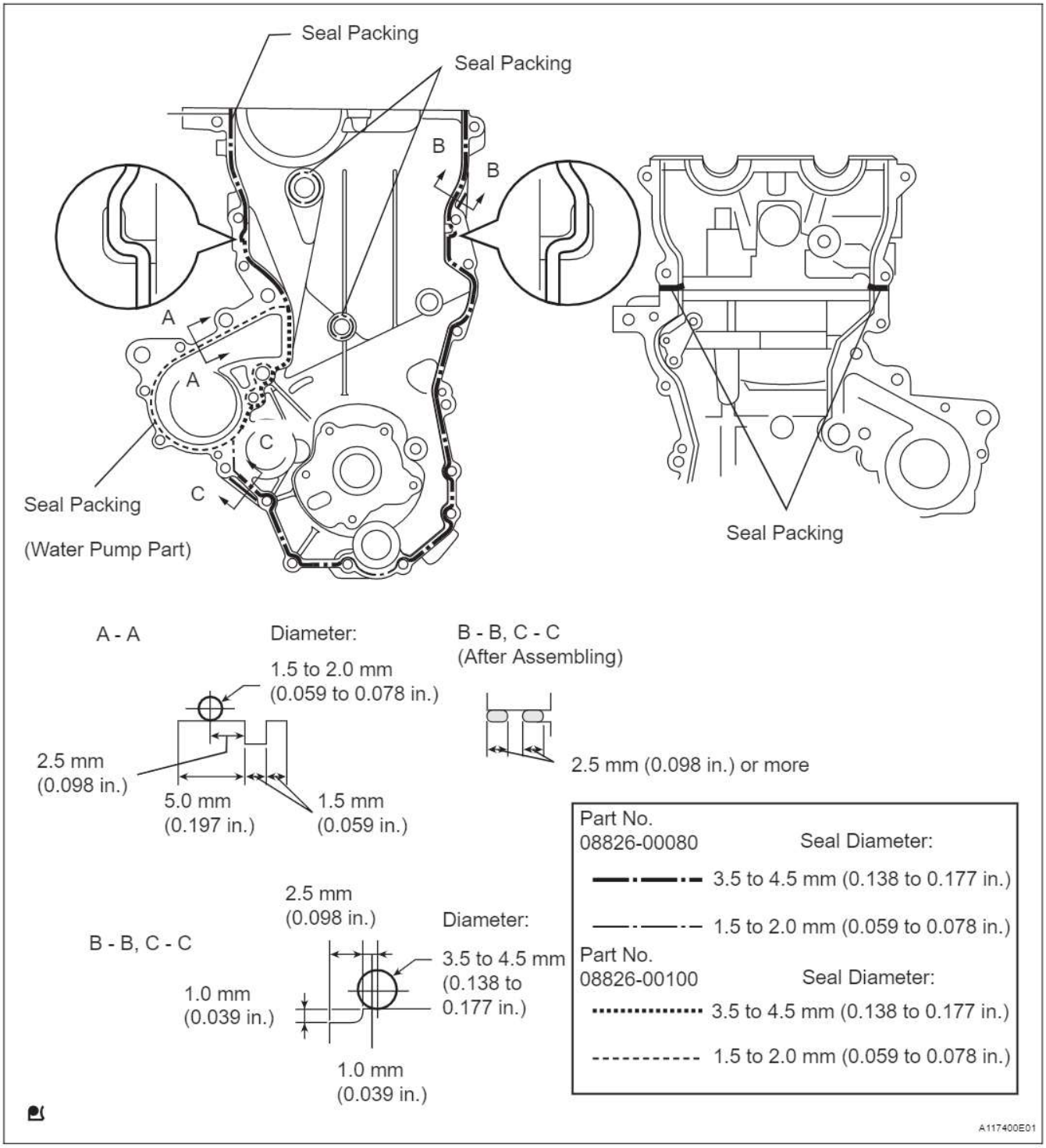
27. INSTALL TIMING CHAIN COVER



(a) Install 2 new O-rings onto the 2 locations as shown in the illustration.
(b) Remove any old packing material from the contact surface.

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(c) Apply seal packing to the oil pump assembly, cylinder head and cylinder block as shown in the illustration below.



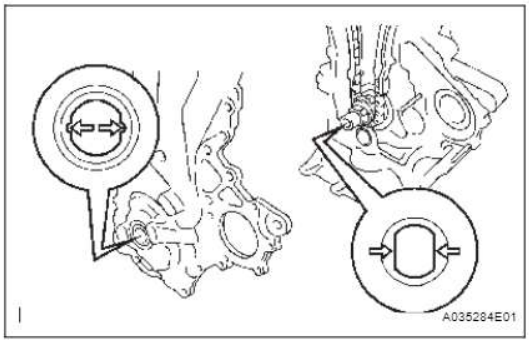
Seal packing:
Water pump part: Part No. 08826-00100 or equivalent
Other part: Part No. 08826-00080 or equivalent

NOTICE:

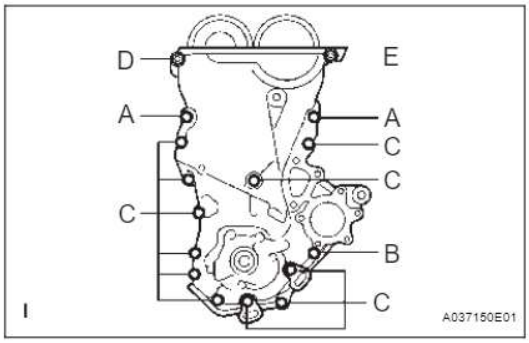
- **Remove any oil from the contact surface.**

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- **Install the oil pump within 3 minutes of applying seal packing.**
- **Do not expose the seal to engine oil for at least 2 hours after installation.**
- **Do not start the engine for at least 2 hours after installation.**



(d) Align the keyway of the oil pump drive rotor with the rectangular portion of the crankshaft, and slide the oil pump into place.



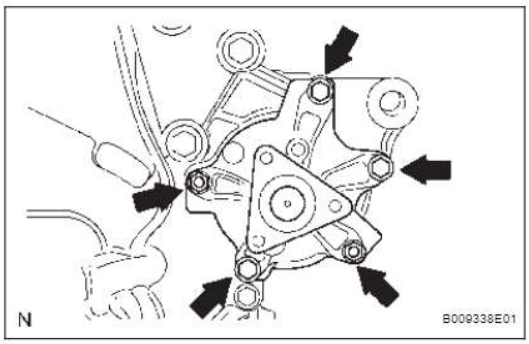
(e) Install the oil pump assembly with the 15 bolts and nut. Uniformly tighten the bolts and nut in several steps.

Torque: 24 N*m (245 kgf*cm, 18 ft.*lbf) for bolt A
11 N*m (112 kgf*cm, 8.1 ft.*lbf) for bolt B
11 N*m (112 kgf*cm, 8.1 ft.*lbf) for bolt C
24 N*m (245 kgf*cm, 18 ft.*lbf) for nut D
24 N*m (245 kgf*cm, 18 ft.*lbf) for bolt E

NOTICE:

- **Pay attention not to disturb the seal packing.**
- **After installing the timing chain case, install the mounting bracket and water pump within 15 minutes.**

HINT:
Each bolt length is as follows:
30 mm (1.18 in.) for bolt A
35 mm (1.38 in.) for bolt B
20 mm (0.79 in.) for bolt C
20 to 14 mm (0.79 to 0.55 in.) for bolt E

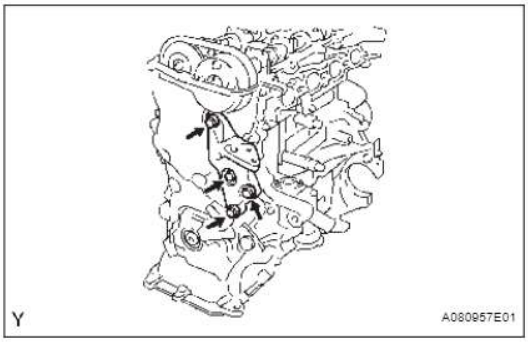


28. INSTALL WATER PUMP

(a) Install a new gasket and the water pump with the 3 bolts and 2 nuts.

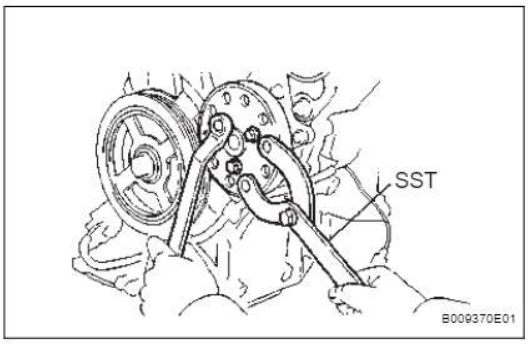
Torque: 11 N*m (112 kgf*cm, 8 ft.*lbf)

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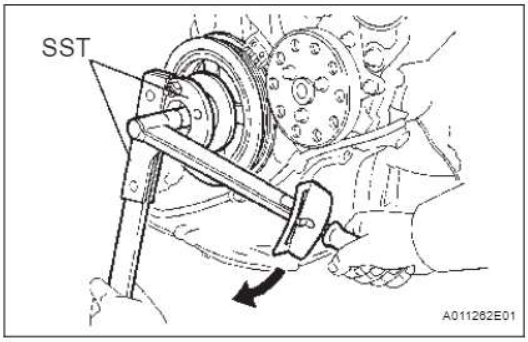
29. INSTALL ENGINE MOUNTING BRACKET RH

(a) Install the engine mounting bracket RH with the 4 bolts.
Torque: 55 N*m (561 kgf*cm, 41 ft.*lbf)



30. INSTALL WATER PUMP PULLEY

(a) Using SST, install the pump pulley with the 3 bolts.
SST 09960-10010 (09962-01000, 09963-00600)
Torque: 15 N*m (153 kgf*cm, 11 ft.*lbf)

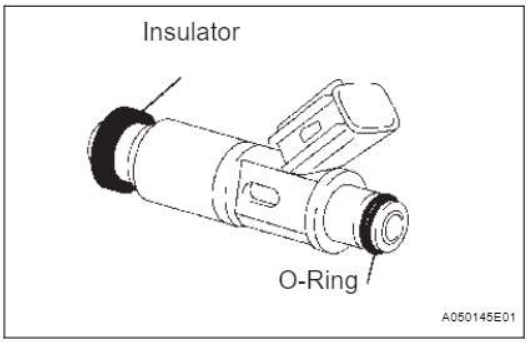


31. INSTALL CRANKSHAFT PULLEY

(a) Align the pin hole of the crankshaft pulley with the pin position, and install the crankshaft pulley.
(b) Using SST, install the pulley bolt.
SST 09330-00021, 09213-58012 (91111-50845)
Torque: 128 N*m (1,305 kgf*cm, 95 ft.*lbf)

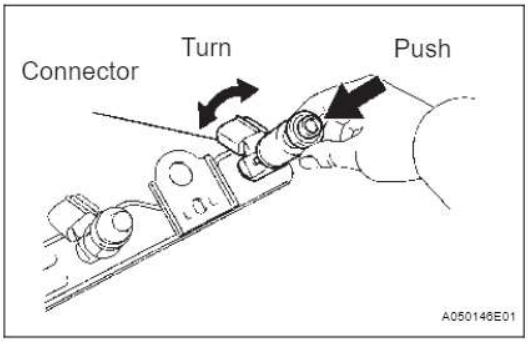
32. INSPECT VALVE CLEARANCE (See page EM-10)

33. ADJUST VALVE CLEARANCE (See page EM-11)



34. INSTALL FUEL INJECTOR

(a) Install new insulators onto each fuel injector.
(b) Apply a light coat of spindle oil or gasoline to new O-rings and install them onto each fuel injector.
(c) Apply a light coat of spindle oil or gasoline to the place where a delivery pipe comes into contact with the O-ring.

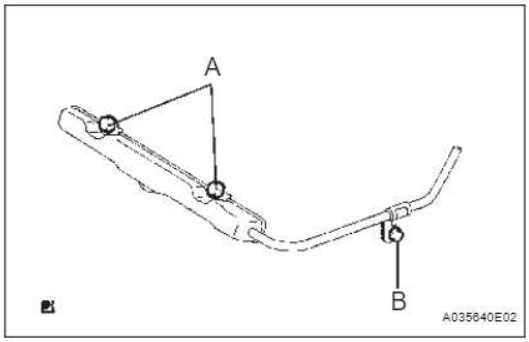


(d) While turning the injector clockwise and counterclockwise, install it to the delivery pipe.
NOTICE:
- **Be careful not to twist the O-ring.**
- **After installing the fuel injectors, check that they turn smoothly. If not, reinstall it with a new O-ring.**

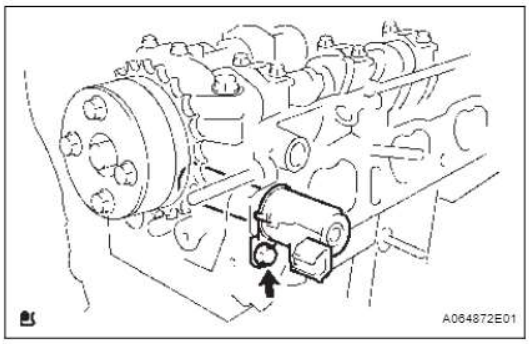
35. INSTALL FUEL DELIVERY PIPE

(a) Install the 2 spacers onto the cylinder head.

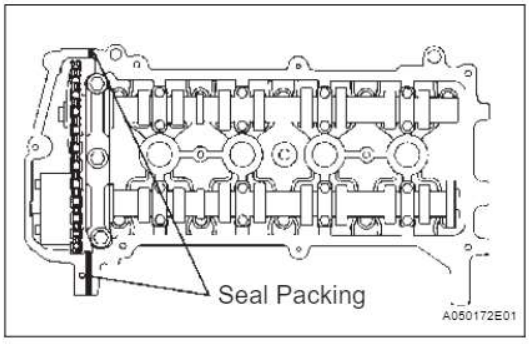
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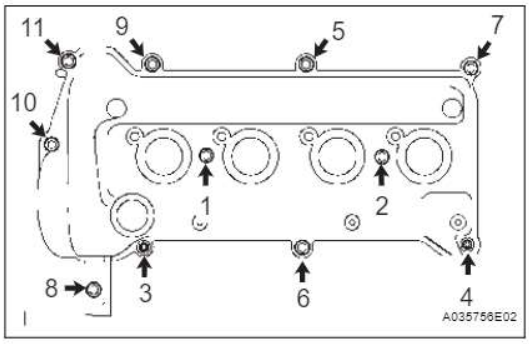
(b) Install the fuel delivery pipe and 4 fuel injectors together.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf) for bolt A
9.0 N*m (92 kgf*cm, 80 in.*lbf) for bolt B
NOTICE:
- **Be careful not to drop the fuel injectors when installing the fuel delivery pipe.**
- **Check that the fuel injectors rotate smoothly after installing the fuel delivery pipe.**



36. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY
(a) Apply a light coat of engine oil to a new O-ring, and install it onto the oil control valve.
(b) Install the oil control valve with the bolt.
Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)
NOTICE:
Be careful not to twist the O-ring.

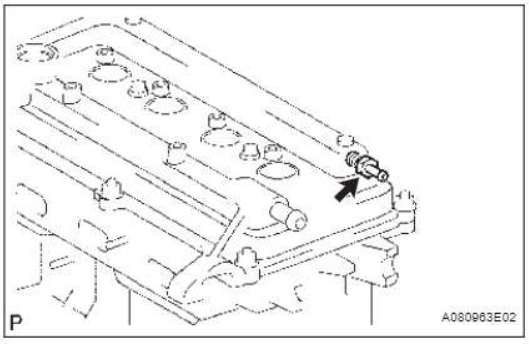


37. INSTALL CYLINDER HEAD COVER
(a) Install the gasket onto the cylinder head cover.
(b) Apply seal packing to the 2 locations as shown in the illustration.
Seal packing:
Part No. 08826-00080 or equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the cylinder head cover within 3 minutes of applying seal packing.**
- **Do not start the engine for at least 2 hours after installation.**



(c) Install the cylinder head cover with the 9 bolts, 2 seal washers and 2 nuts.
(d) Using several steps, uniformly tighten the bolts and nuts in the sequence shown in the illustration.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

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38. INSTALL VENTILATION VALVE

(a) Install the ventilation valve onto the cylinder head cover.
Torque: 27 N*m (275 kgf*cm, 20 ft.*lbf)

39. INSTALL OIL DIPSTICK GUIDE

(a) Apply a light coat of engine oil to a new O-ring and install it to the dipstick guide.
(b) Install the dipstick guide with the bolt.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

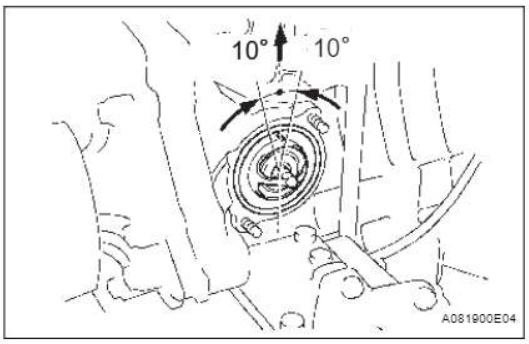
40. INSTALL CRANKSHAFT POSITION SENSOR

(a) Apply a light coat of engine oil to the O-ring on the crankshaft position sensor.
NOTICE:
If the O-ring is damaged, replace the crankshaft position sensor.
(b) Install the crankshaft position sensor with the bolt.
Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)

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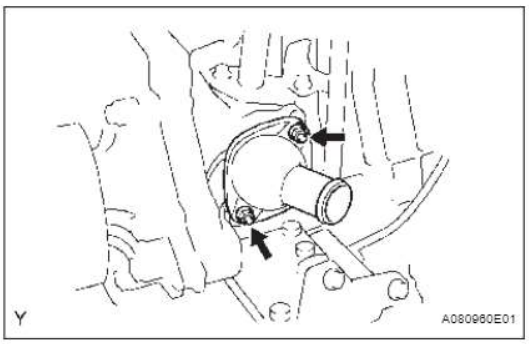
41. INSTALL OIL FILLER CAP

(a) Install a new gasket and the oil filler cap.



42. INSTALL THERMOSTAT

(a) Install a new gasket onto the thermostat.
(b) Install the thermostat with the jiggle valve facing upward.
HINT:
The jiggle valve may be set within 10° on either side as shown in the illustration.



(c) Install the water inlet with the 2 nuts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

43. INSTALL SPARK PLUG

(a) Using a 16 mm plug wrench, install the 4 spark plugs.
Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

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