

ENGINE ASSEMBLY (2AZ-FE)

1404R-02

INSPECTION

1. INSPECT COOLANT (See page 16-20)
2. INSPECT ENGINE OIL
3. INSPECT BATTERY

Standard specific gravity: 1.25 – 1.29 at 20°C (68°F)

4. INSPECT AIR CLEANER FILTER ELEMENT SUB-ASSY
5. INSPECT SPARK PLUG
(See page 18-1)
6. INSPECT V-RIBBED BELT

7. INSPECT IGNITION TIMING

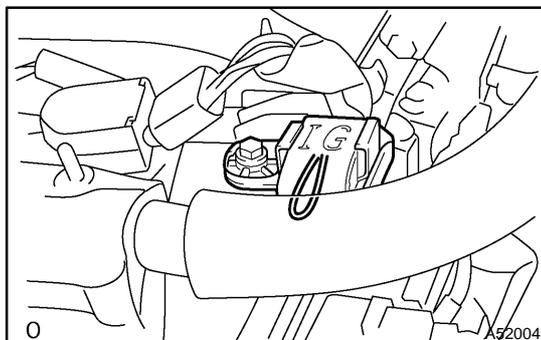
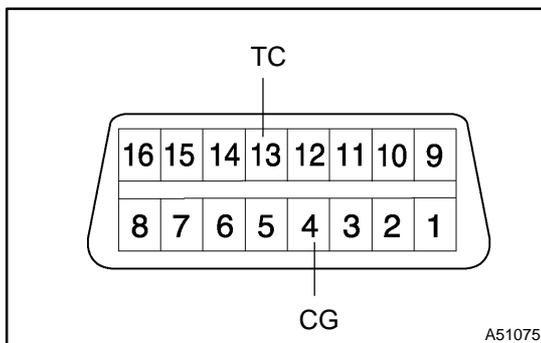
- (a) Warm up engine.
- (b) When using hand-held tester.
 - (1) Connect the hand-held tester to the DLC3.

Ignition timing: 8 – 12° BTDC

HINT:

Please refer to the hand-held tester operator's manual for further details.

- (c) When not using hand-held tester.



- (1) Using SST, connect terminals 13 (TC) and 4 (CG) of DLC3.

SST 09843-18040

NOTICE:

- Be sure not to connect incorrectly. It causes breakage of the engine.
- Turn OFF all electrical systems.
- Operate the inspection when the cooling fan motor is turned OFF.

- (2) Remove the cylinder head cover No.2.
- (3) Pull out the wire harness as shown in the illustration. 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.

- (4) Inspect ignition timing at idle.

Ignition timing: 8 – 12° BTDC

NOTICE:

When checking the ignition timing, the transmission is at neutral position.

HINT:

After engine rpm is kept at 1,000 – 1,300 r/min. for 5 seconds, check that it returns idle speed.

- (5) Disconnect terminals 13 (TC) and 4 (CG) of DLC3.
- (6) Inspect ignition timing at idle.

Ignition timing: 5 – 15° BTDC

- (7) Confirm that ignition timing moves to advanced angle side when the engine rpm is increased.
- (8) Remove the timing light.

8. INSPECT ENGINE IDLE SPEED

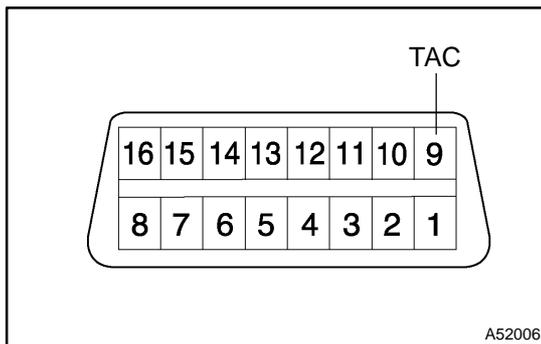
- (a) Warm up engine.
- (b) When using hand-held tester.
 - (1) Connect the hand-held tester to the DLC3.

Idle speed:**A/T 610 – 710 r/min.****M/T 650 – 750 r/min.****NOTICE:**

- **Check idle speed with cooling fan OFF.**
- **Switch off all accessories and air conditioning.**

HINT:

Please refer to the hand-held tester operator's manual for further details.



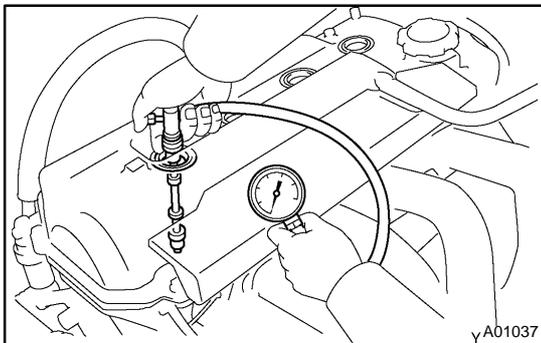
- (c) When not using hand-held tester.
 - (1) Using SST, connect tachometer test probe to terminal 9 (TAC) of DLC3.

SST 09843-18040

- (2) Check the idle speed.

Idle speed:**A/T 610 – 710 r/min.****M/T 650 – 750 r/min.****9. INSPECT COMPRESSION**

- (a) Warm up and stop engine.
- (b) Disconnect the injector connectors.
- (c) Remove ignition coils.
- (d) Remove spark plugs.
- (e) Inspect cylinder compression pressure.
 - (1) Insert a compression gauge into the spark plug hole.
 - (2) Fully open the throttle.



- (3) While cranking the engine, measure the compression pressure.

Compression pressure:

1.360 MPa (13.9 kgf/cm², 198 psi)

Minimum pressure:

0.98 MPa (10 kgf/cm², 142 psi)

Difference between each cylinder:

100 kPa (1.0 kgf/cm², 14 psi)

NOTICE:

- **Always use a fully charged battery to obtain 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.**

- (4) If the cylinder compression is low, pour a small amount of engine oil into the cylinder through the spark plug hole and inspect again.

HINT:

- If adding oil increases the compression, it is likely that the piston rings and/or cylinder bore are worn or damaged.
- If pressure stays low, a valve may be sticking or seating improperly, or there may be leakage past the gasket.

10. INSPECT CO/HC

- (a) Start the engine.
- (b) Race engine at 2,500 r/min for approx. 180 seconds.
- (c) Insert CO/HC meter testing probe at least 40 cm (1.3 ft) into tailpipe during idling.
- (d) Immediately check CO/HC concentration at idle and/or 2,500 r/min.

HINT:

- Complete the measuring within 3 minutes.
 - When doing the 2 mode (idle and 2,500 r/min.) test, these measuring orders are prescribed by the applicable local regulations.
- (e) If the CO/HC concentration does not comply with regulations, troubleshoot in the order given below.
 - (1) Check heated oxygen sensor operation. (See page 12-1)
 - (2) See the table below for possible causes, and then inspect and correct the applicable causes if necessary.

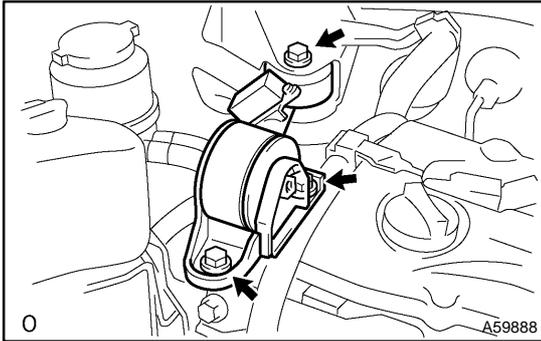
CO	HC	Problems	Causes
Normal	High	Rough idle	1. Faulty ignitions: <ul style="list-style-type: none"> • Incorrect timing • Fouled, shorted or improperly gapped plugs 2. Incorrect valve clearance 3. Leaky intake and exhaust valves 4. Leaky cylinders
Low	High	Rough idle (Fluctuating HC reading)	1. Vacuum leaks: <ul style="list-style-type: none"> • PCV hoses • Intake manifold • Throttle body • ISC valve • Brake booster line 2. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Plugged PCV valve 3. Faulty EFI systems: <ul style="list-style-type: none"> • Faulty pressure regulator • Defective water temperature sensor • DEFECTIVE Air-flow meter • Faulty ECU • Faulty injectors • Faulty throttle position sensor

FAN AND GENERATOR V BELT (2AZ-FE)

REPLACEMENT

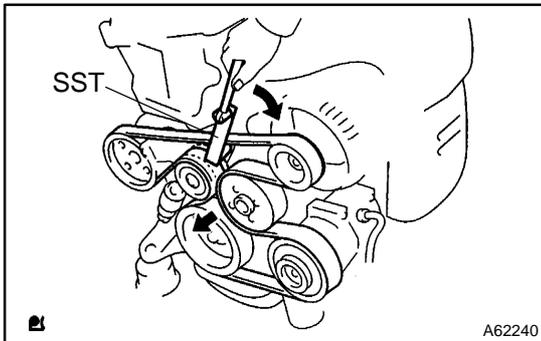
1405U-02

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH
3. REMOVE ENGINE COVER SUB-ASSY NO.1

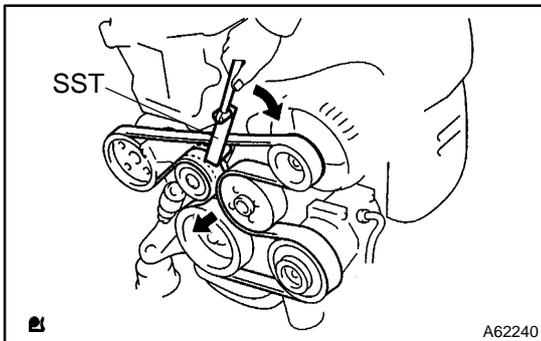


4. REMOVE ENGINE MOVING CONTROL ROD W/BRACKET
 - (a) Remove the 3 bolts and engine mounting control rod w/ bracket.

5. REMOVE ENGINE MOUNTING STAY NO.2 RH
6. REMOVE ENGINE MOUNTING BRACKET NO.2 RH



7. REMOVE FAN AND GENERATOR V BELT
 - (a) Slowly turn the drive belt tensioner clockwise in more than 3 seconds, and remove the drive bolt by using SST.
SST 09249-63010



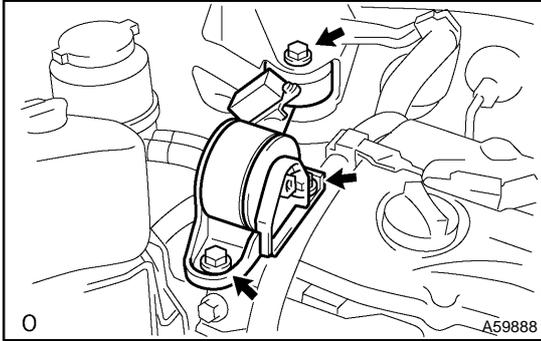
8. INSTALL FAN AND GENERATOR V BELT
 - (a) Slowly turn the drive belt tensioner clockwise in more than 3 seconds, and install the drive bolt by using SST.
SST 09249-63010

9. INSTALL ENGINE MOUNTING BRACKET NO.2 RH

Torque: 52 N·m (531 kgf·cm, 38 ft·lbf)

10. INSTALL ENGINE MOUNTING STAY NO.2 RH

Torque: 64 N·m (653 kgf·cm, 47 ft·lbf)

**11. INSTALL ENGINE MOVING CONTROL ROD W/BRACKET**

- (a) Install the engine mounting control rod with the 3 bolts w/ bracket.

Torque: 64 N·m (653 kgf·cm, 47 ft·lbf)

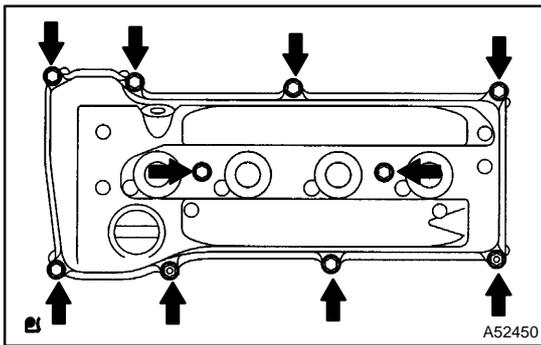
12. INSTALL FRONT WHEEL RH

Torque: 103 N·m (1,050 kgf·cm, 76 ft·lbf)

VALVE CLEARANCE (2AZ-FE) ADJUSTMENT

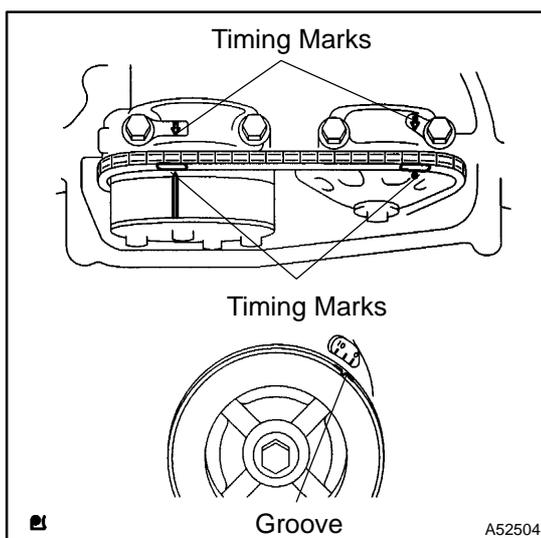
1405V-02

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH
3. REMOVE ENGINE COVER SUB-ASSY NO.1
4. REMOVE IGNITION COIL ASSY
5. DISCONNECT VENTILATION HOSE
6. DISCONNECT VENTILATION HOSE NO.2
7. DISCONNECT ENGINE WIRE



8. REMOVE CYLINDER HEAD COVER SUB-ASSY

- (a) Remove the bolt and disconnect the engine wire harness clamp.
- (b) Remove the 8 bolts, 2 nuts, cylinder head cover and gasket.

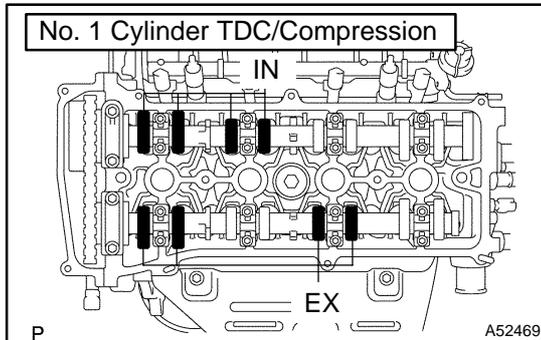


9. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.
- (b) Check that the timing marks of the camshaft timing sprockets are aligned with the timing marks of the No.1 bearing cap as shown in the illustration.

10. INSPECT VALVE CLEARANCE**HINT:**

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



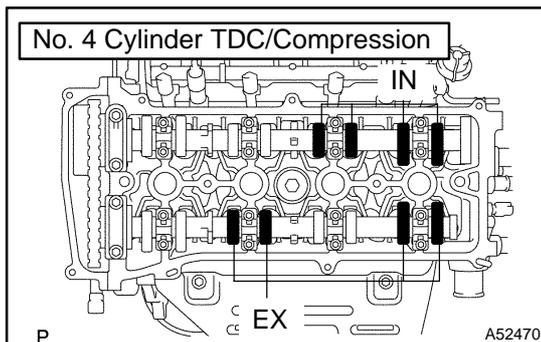
- (a) Check only the valve indicated.
 - (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
 - (2) Record the out-of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

Intake 0.19 – 0.29 mm (0.0075 – 0.0114 in.)

Exhaust 0.30 – 0.40 mm (0.0118 – 0.0157 in.)

- (b) Turn the crankshaft clockwise 1 revolution (360°) and set No.4 cylinder to TDC/compression.

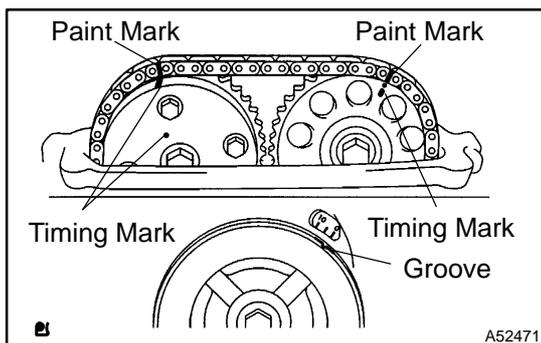


- (c) Check only the valve indicated.
 - (1) Using a feeler gauge, measure the clearance between the valve lifter and camshaft.
 - (2) Record the out-of specification valve clearance measurements. They will be used later to determine the required replacement adjusting shim.

Valve clearance (Cold):

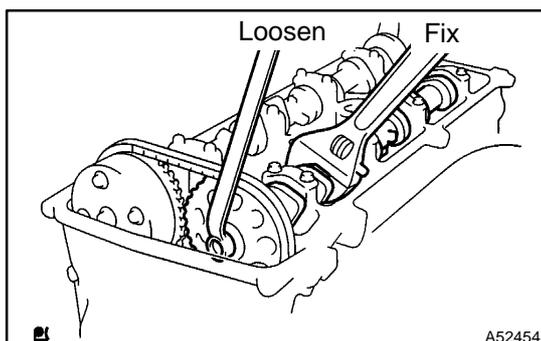
Intake 0.19 – 0.29 mm (0.0075 – 0.0114 in.)

Exhaust 0.30 – 0.40 mm (0.0118 – 0.0157 in.)

**11. ADJUST VALVE CLEARANCE****NOTICE:**

Be sure not to turn the crankshaft without the chain tensioner.

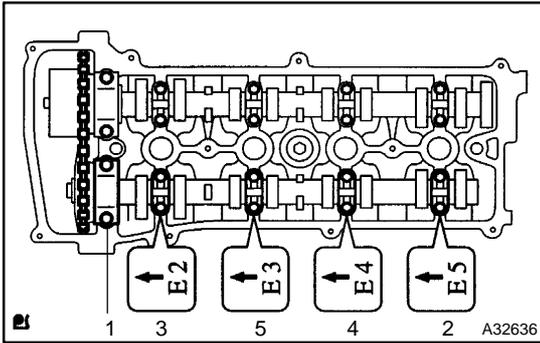
- (a) Turn the crankshaft clockwise 1 revolution (360°) and set the No.1 cylinder to the TDC/compression.
- (b) Place matchmarks on the timing chain and camshaft timing gear.
- (c) Remove the 2 bolts and chain tensioner.



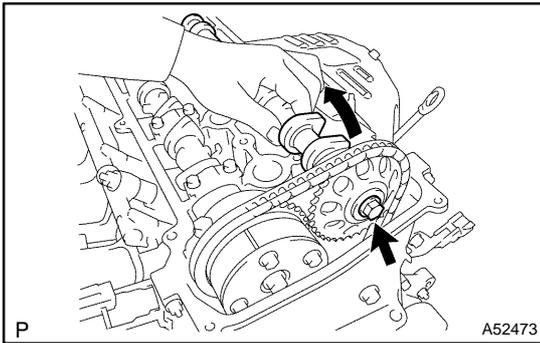
- (d) Fix the camshaft with a spanner and so on, then loosen the camshaft timing gear set bolt.

NOTICE:

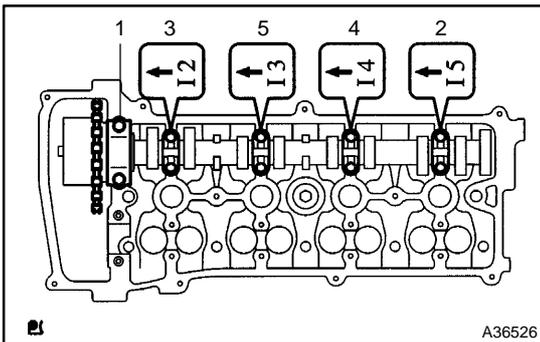
Be careful not to damage the valve lifter.



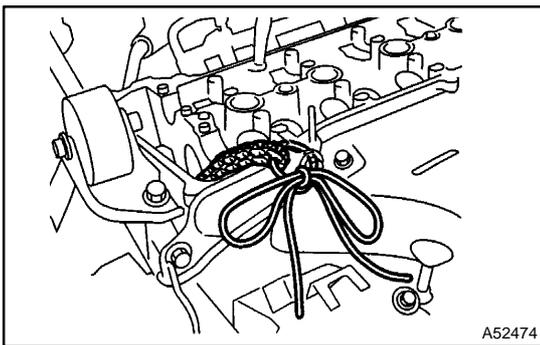
- (e) Loosen the camshaft bearing cap bolts on No.2 camshaft in the sequence shown in the illustration in several passes, and remove the caps.



- (f) Raising the camshaft, remove the set bolt.
- (g) Remove the timing chain sprocket from the camshaft with timing chain.
- (h) Remove the timing chain sprocket from the timing chain.

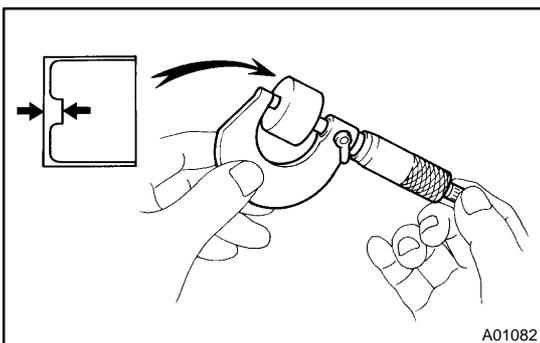


- (i) Loosen the camshaft bearing cap bolts on camshaft in the sequence shown in the illustration in several passes, and remove the caps.
- (j) Remove the intake camshaft.



- (k) Tie the timing chain with a string.
- NOTICE:**
Be careful not to drop anything inside the timing chain cover.

- (l) Remove the valve lifters.



- (m) Using a micrometer, measure the thickness of the removed lifter.

- (n) Calculate the thickness of a new lifter so that the valve clearance comes within the specified value.

A	Thickness of new lifter
B	Thickness of used lifter
C	Measured valve clearance

Valve clearance:

Intake $A = B + (C - 0.24 \text{ mm (0.0094 in.)})$

Exhaust: $A = B + (C - 0.35 \text{ mm (0.0138 in.)})$

EXAMPLE: (Intake)

Measured valve clearance = 0.44 mm (0.0173 in.)

$0.44 \text{ mm (0.0173 in.)} - 0.24 \text{ mm (0.0094 in.)} = 0.20 \text{ mm (0.0079 in.)}$

(Measured – Specification = Excess clearance)

Used shim measurement = 5.30 mm (0.2087 in.)

$0.20 \text{ mm (0.0079 in.)} + 5.30 \text{ mm (0.2087 in.)} = 5.50 \text{ mm (0.2165 in.)}$

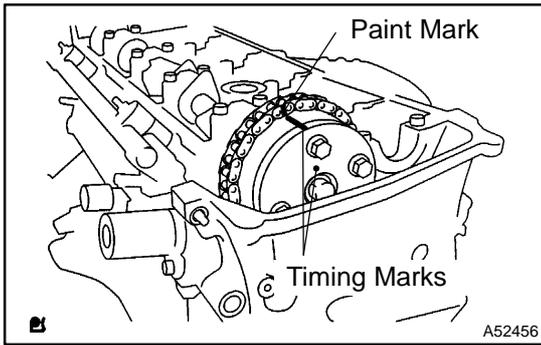
(Excess clearance + Used shim = Ideal new shim)

Closest new shim = 5.50 mm (0.2165 in.) = Shim No. "50"

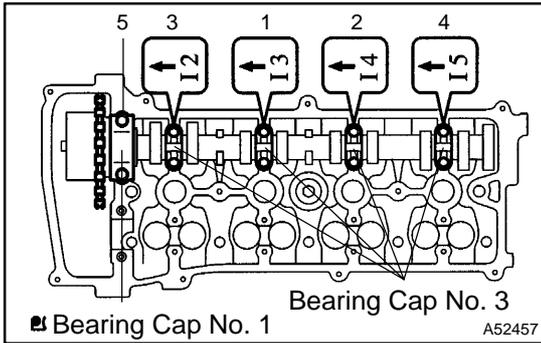
- (1) Select a new lifter with a thickness as close as possible to the calculated values.

HINT:

- Lifters are available in 35 sizes in increments of 0.020 mm (0.0008 in.), from 5.060 mm (0.1992 in.) to 5.740 mm (0.2260 in.).
- Refer to valve lifter selection chart on the following 2 pages.



- (o) Install the timing chain on the camshaft timing gear, with the painted links aligned with the timing marks on the camshaft timing sprockets.

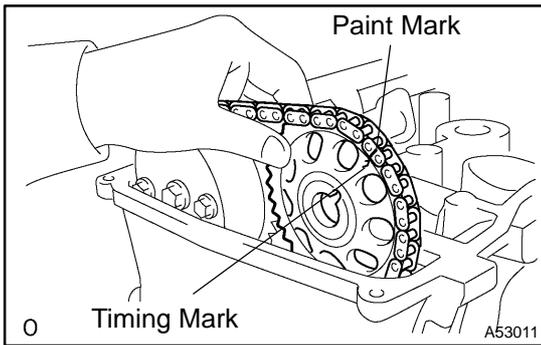


- (p) Examine the front marks and numbers and tighten the bolts in the order shown in the illustration.

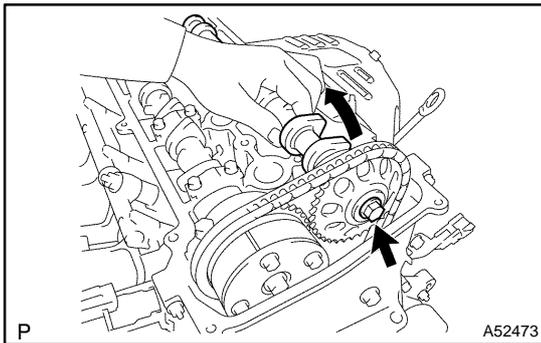
Torque:

Bearing cap No. 1 30 N·m (301 kgf·cm, 22 ft·lbf)

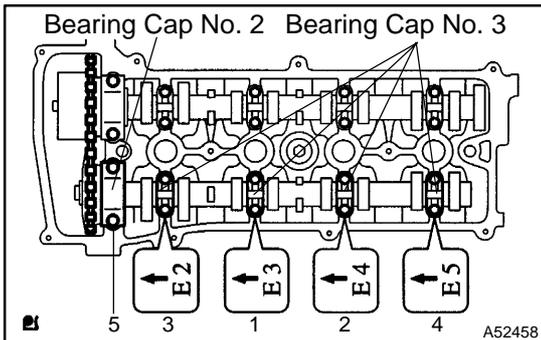
Bearing cap No. 3 9.0 N·m (92 kgf·cm, 80 in·lbf)



- (q) Put the camshaft No.2 on the cylinder head with the painted links of chain aligned with the timing mark on the camshaft timing sprockets.



- (r) Raising the camshaft, tighten the set bolt temporarily.

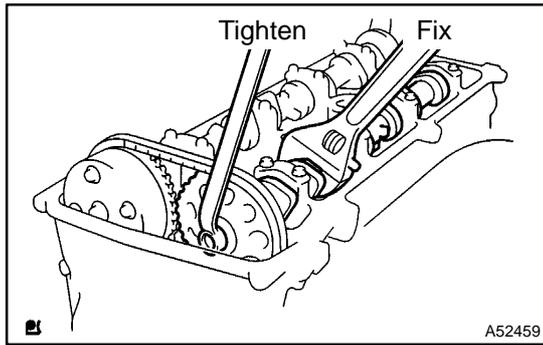


- (s) Examine the front marks and numbers and tighten the bolts in the sequence shown in the illustration.

Torque:

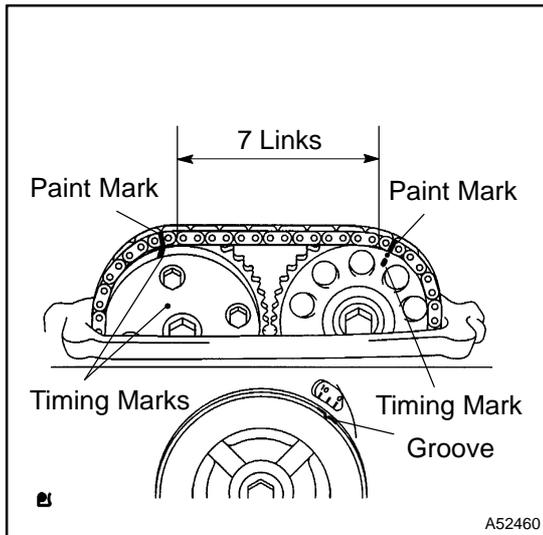
Bearing cap No. 2 30 N·m (301 kgf·cm, 22 ft·lbf)

Bearing cap No. 3 9.0 N·m (92 kgf·cm, 80 in·lbf)

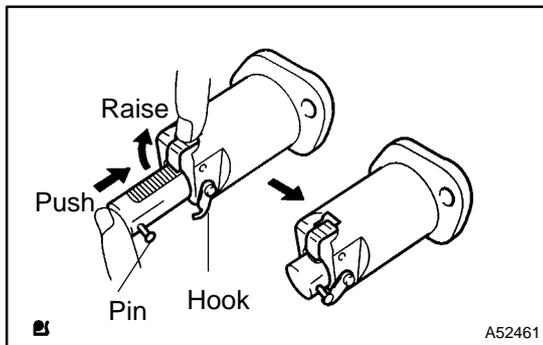


- (t) Fix the camshaft with a spanner and so on, then tighten the camshaft timing gear set bolt.
Torque: 54 N·m (551 kgf·cm, 40 ft·lbf)

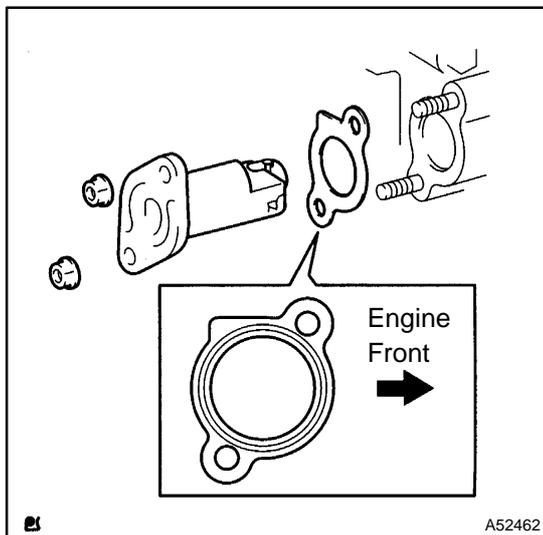
NOTICE:
Be careful not to damage the valve lifter.



- (u) As shown in the illustration, check the matchmarks on the timing chain and camshaft timing sprockets and the alignment of the pulley groove with timing mark of the chain cover.

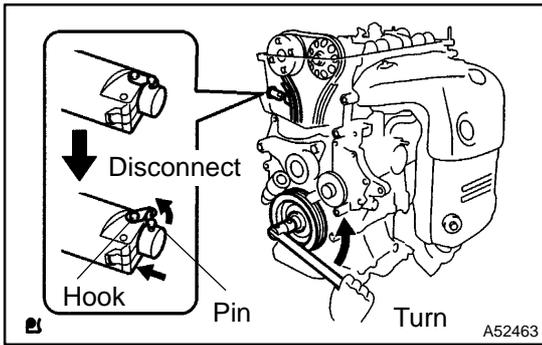


- (v) Install chain tensioner.
 (1) Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.

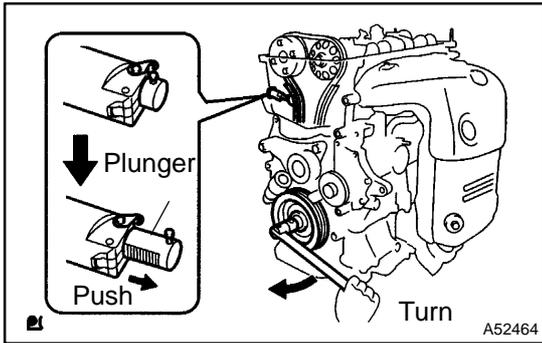


- (2) Install a new gasket and chain tensioner with the 2 nuts.

Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)
NOTICE:
When installing the tensioner, set the hook again if the hook releases the plunger.



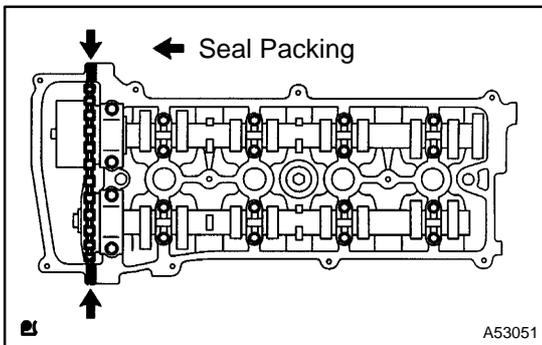
- (3) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.



- (4) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.

12. INSTALL CYLINDER HEAD COVER SUB-ASSY

- (a) Remove any old packing (FIPG) material.

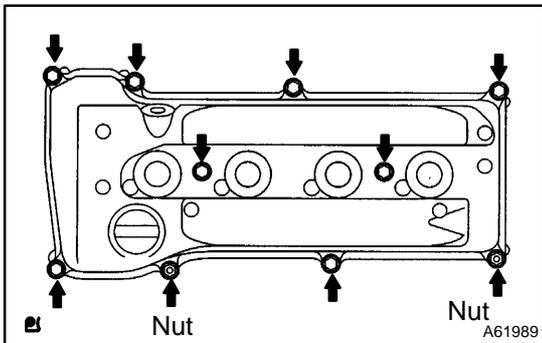


- (b) Apply seal packing to 2 locations as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

- Remove any oil the contact surface.
- Install the cylinder head cover within 5 minutes after applying seal packing.
- Do not put into engine oil 2 hours after installing.



- (c) Install the cylinder head cover with the 8 bolts and 2 nuts.
Torque: 11 N·m (110 kgf·cm, 8 ft·lbf)

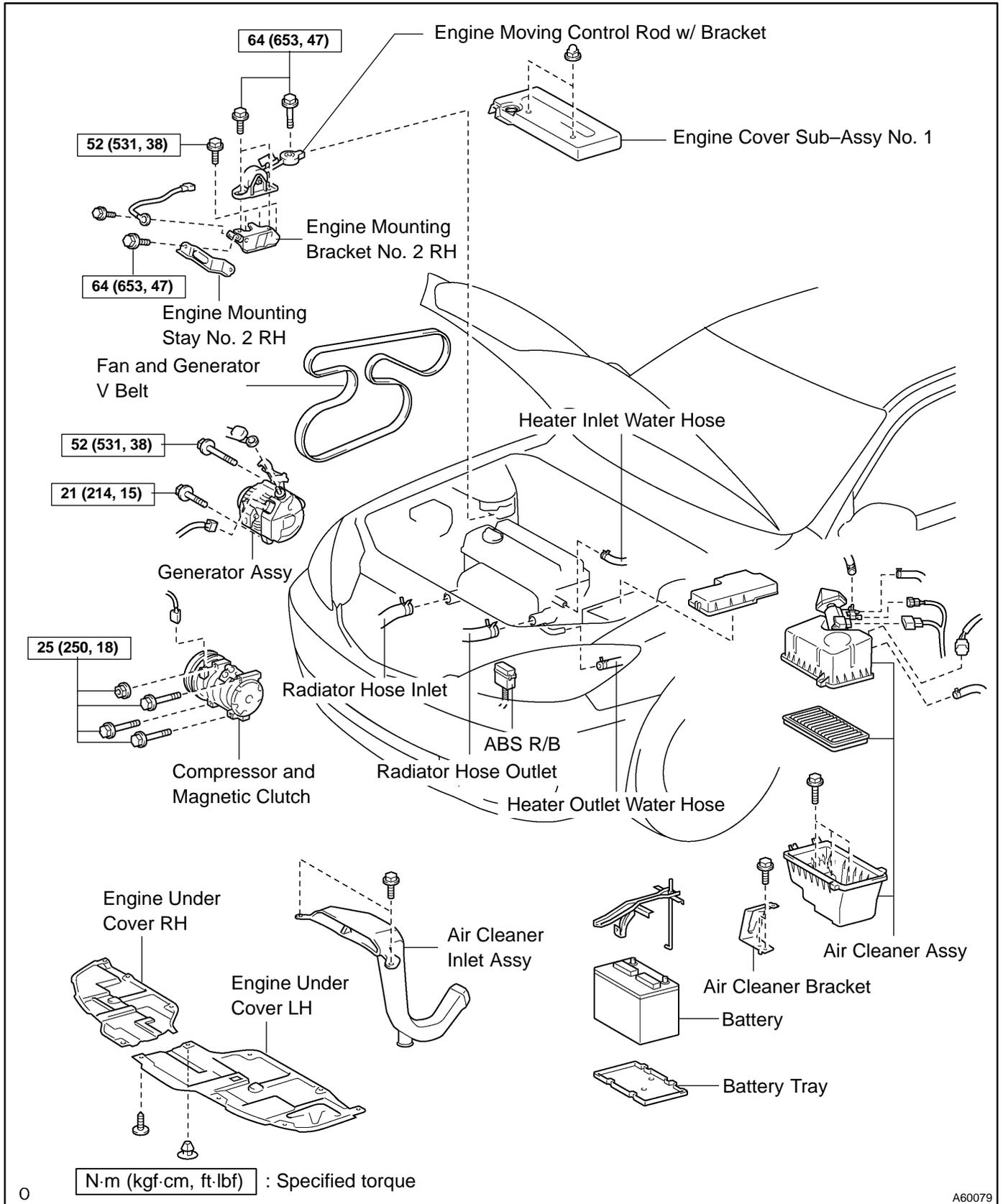
13. INSTALL IGNITION COIL ASSY
Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)

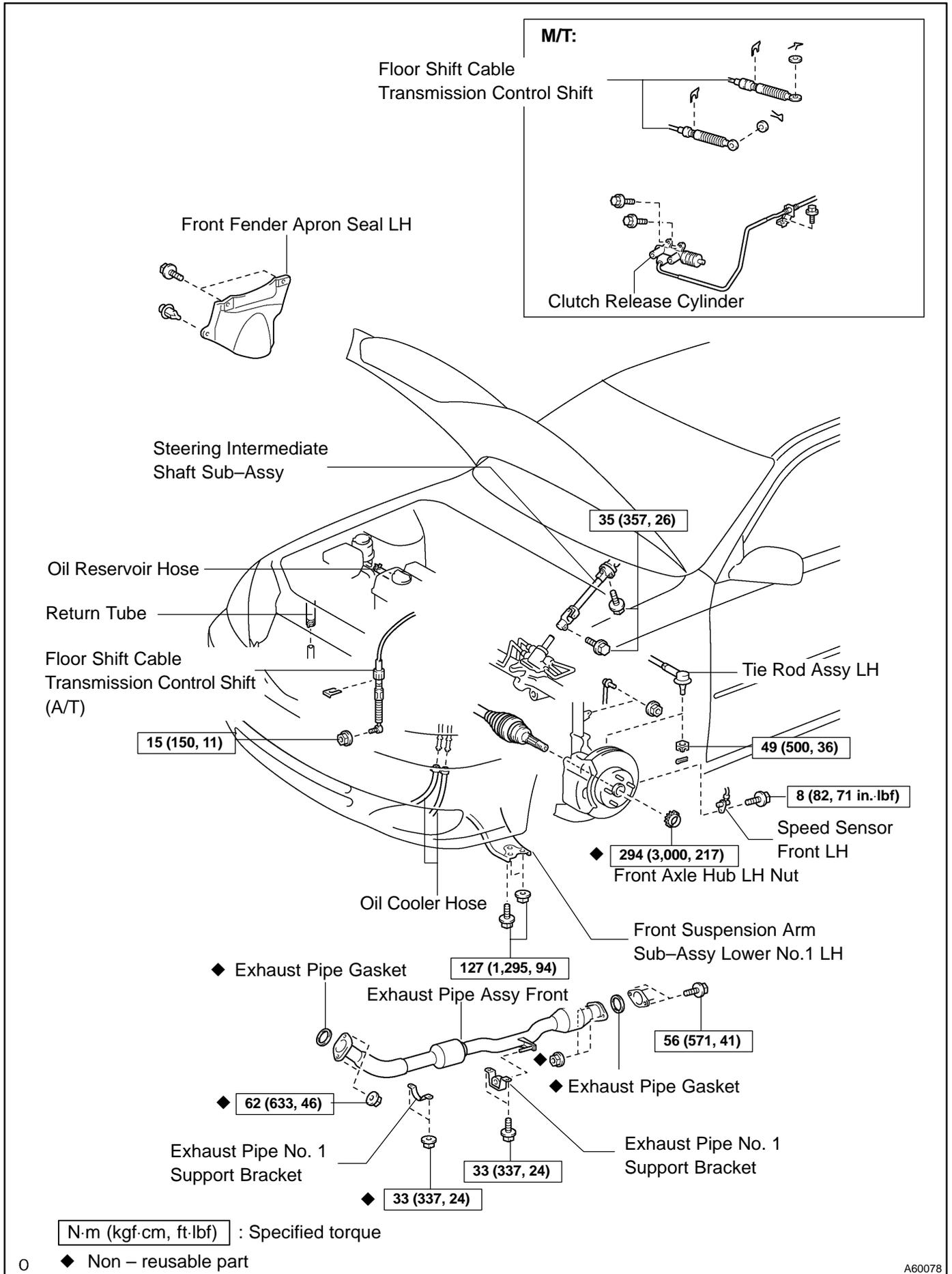
14. INSTALL FRONT WHEEL RH
Torque: 103 N·m (1,050 kgf·cm, 76 ft·lbf)

15. INSPECT OIL LEAK

PARTIAL ENGINE ASSY (2AZ-FE) COMPONENTS

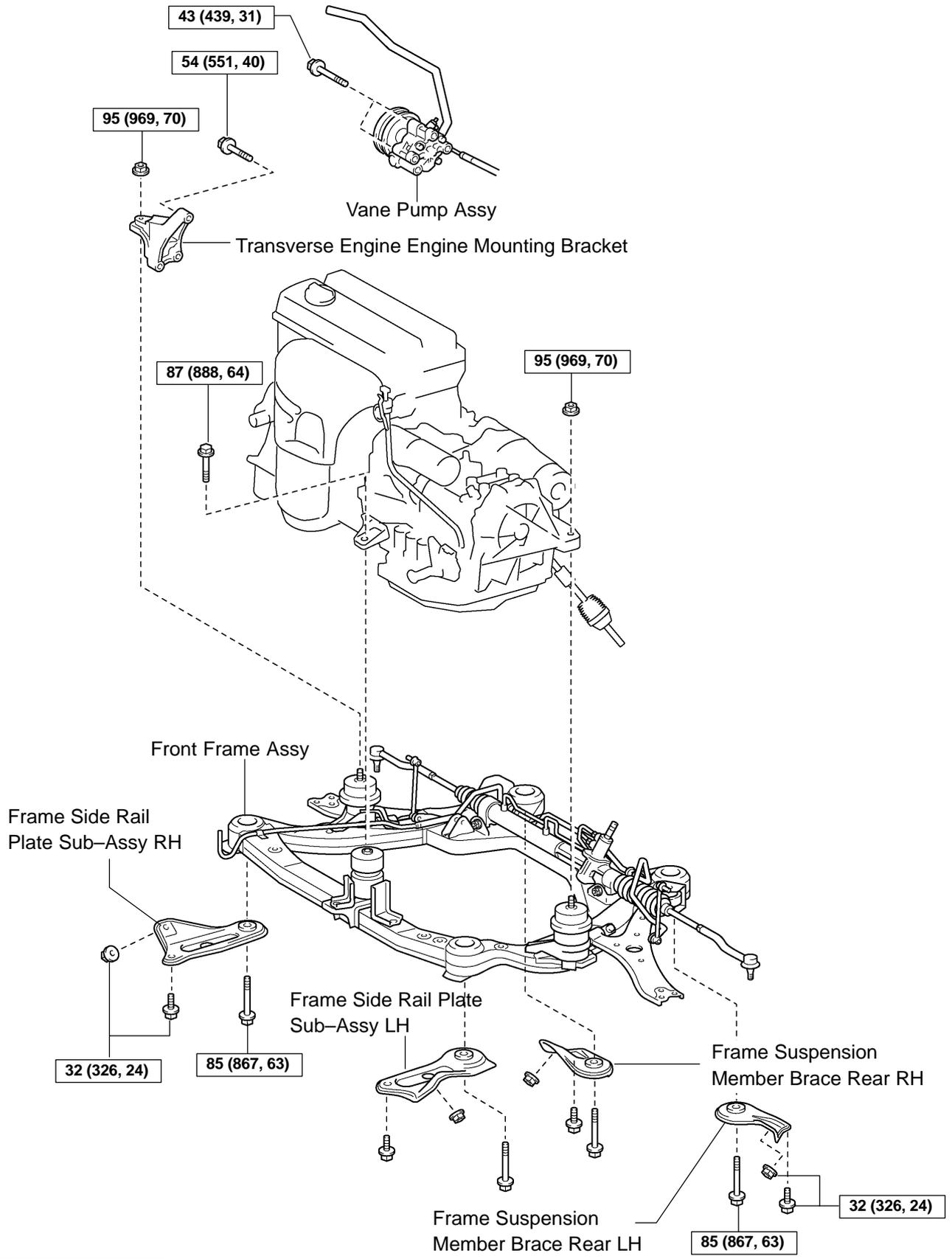
140HS-01





A60078

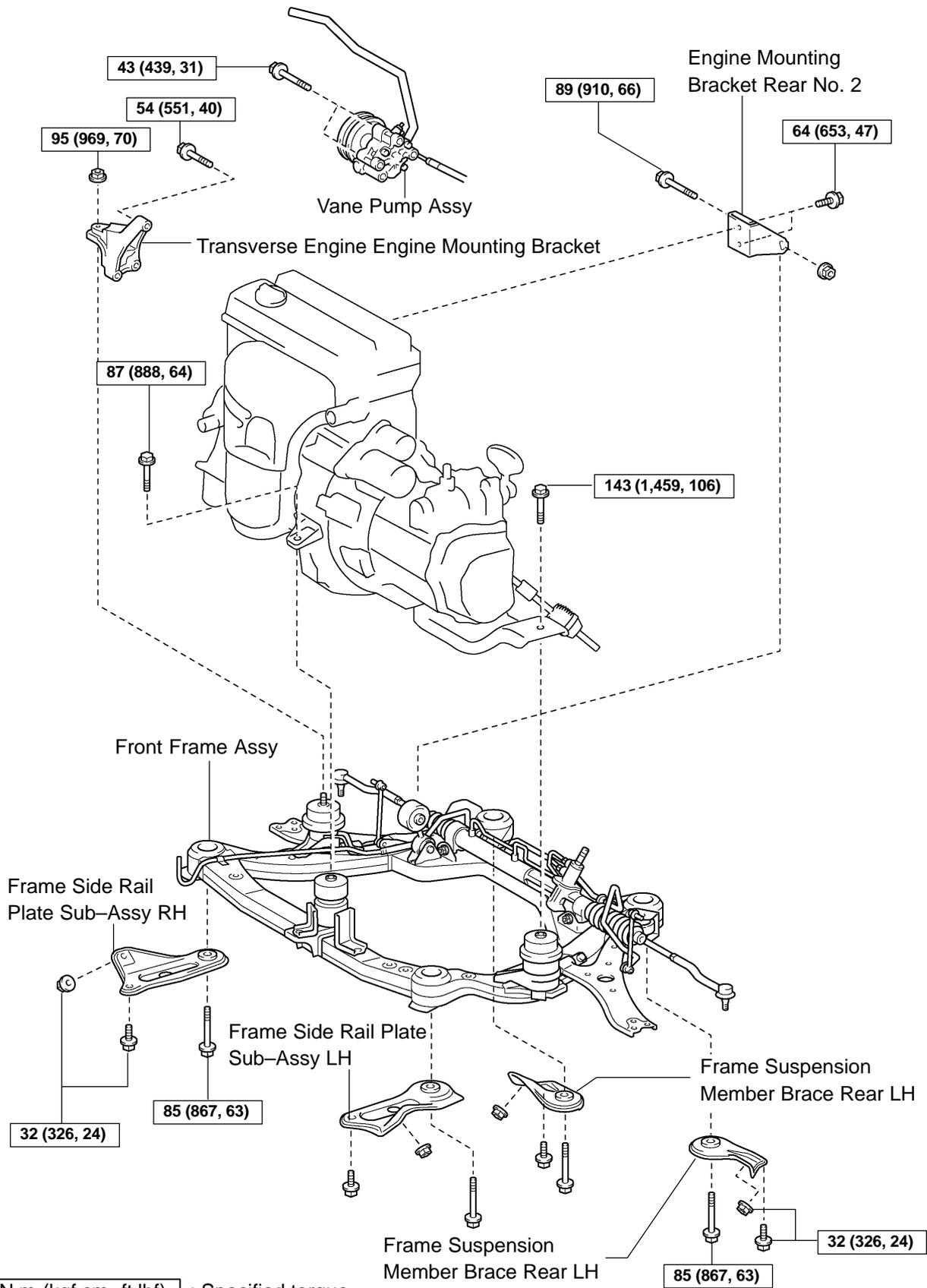
A/T:



0 N·m (kgf·cm, ft·lbf) : Specified torque

A60070

M/T:

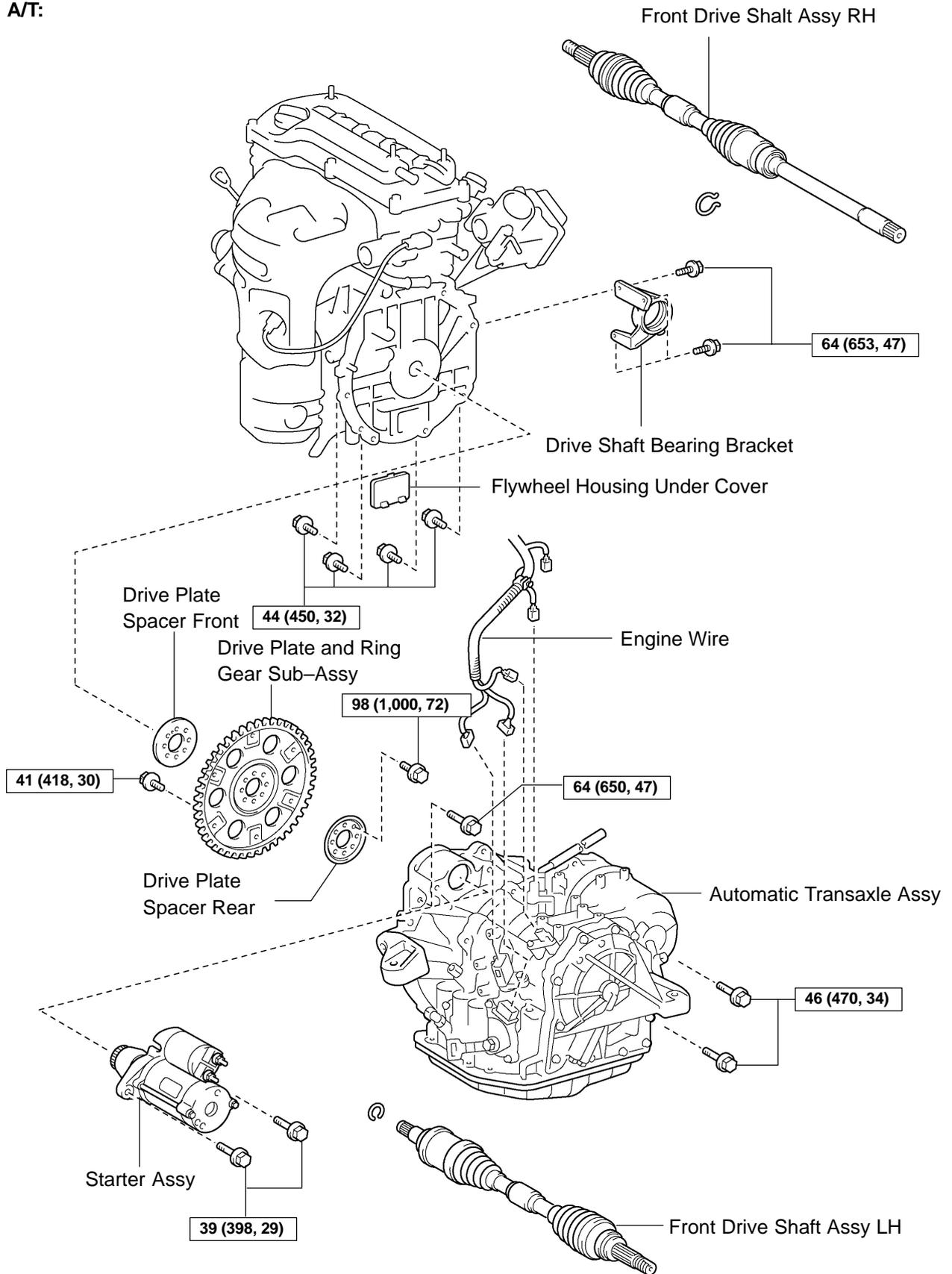


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N·m (kgf·cm, ft·lbf) : Specified torque

A59886

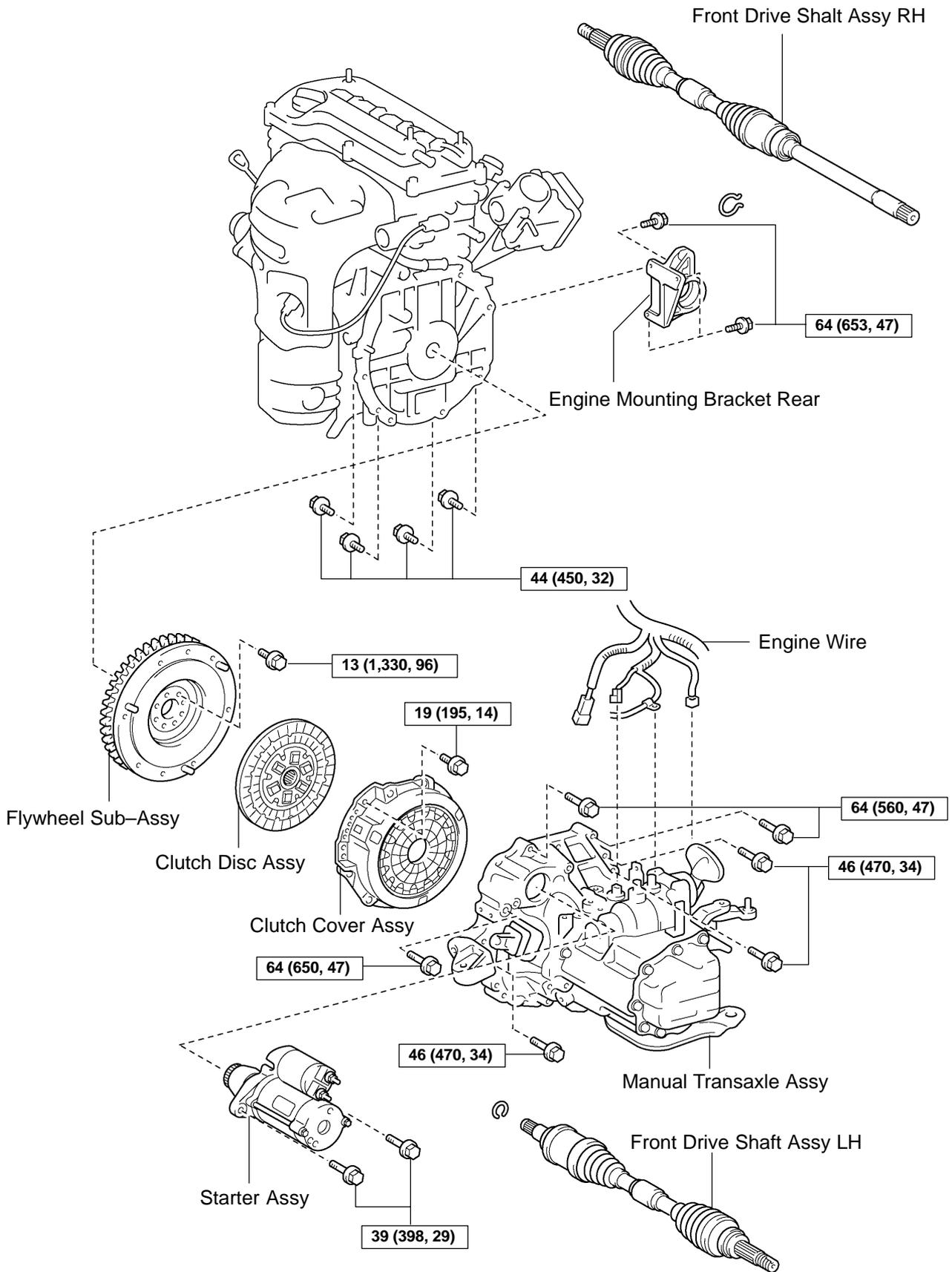
A/T:



0 N·m (kgf·cm, ft·lbf) : Specified torque

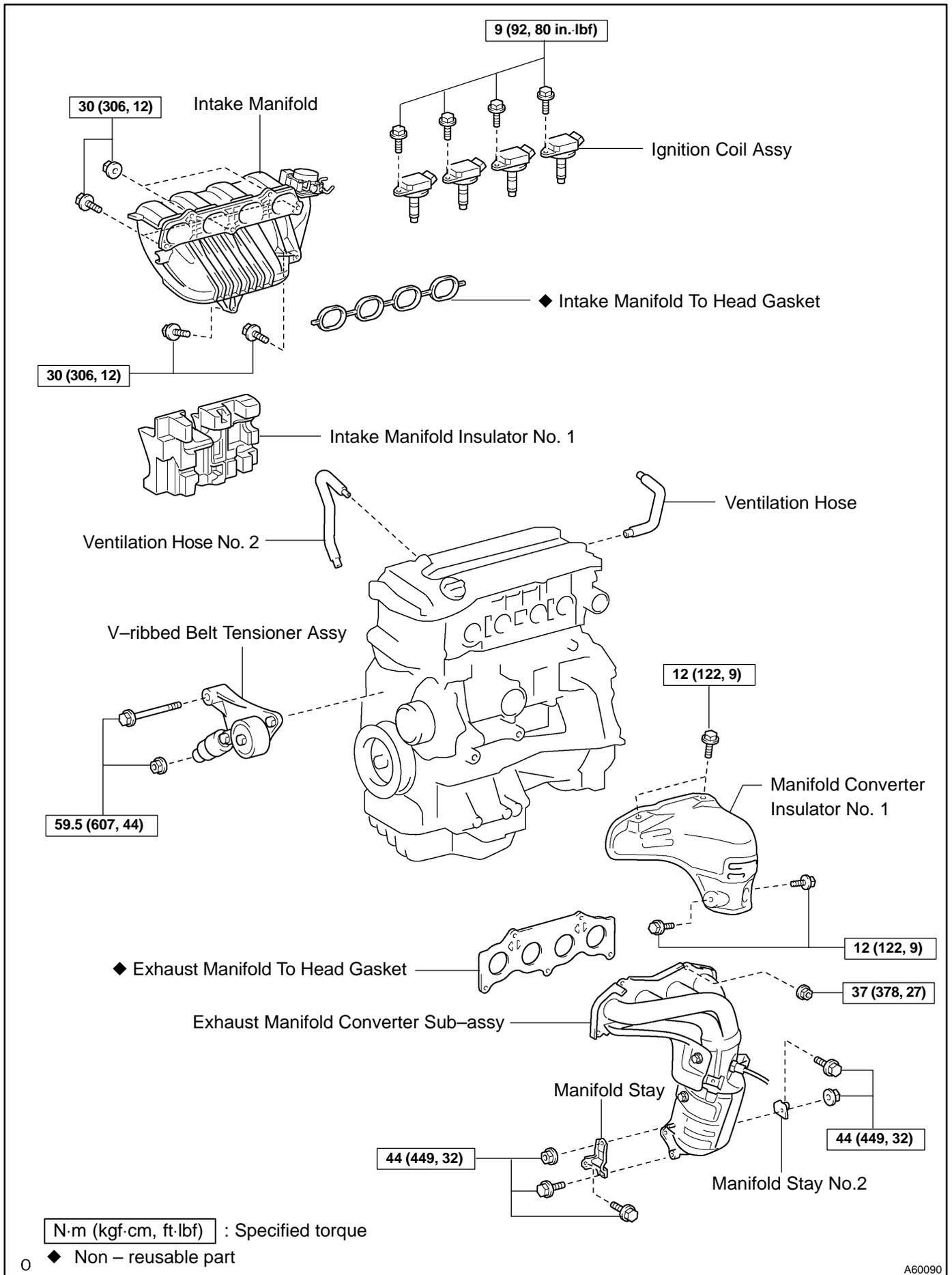
A60075

M/T:

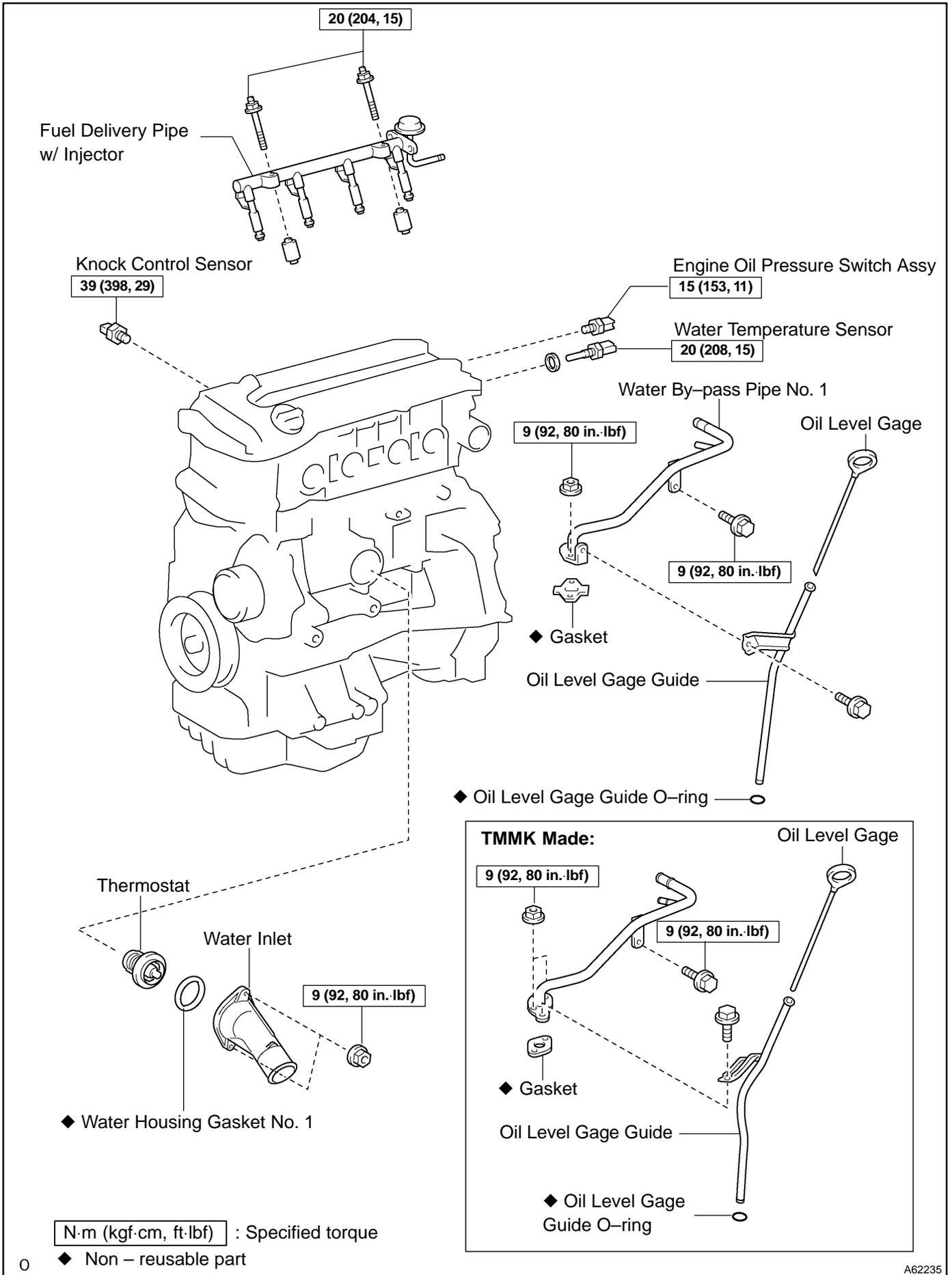


o N·m (kgf·cm, ft·lbf) : Specified torque

A60074



A60090

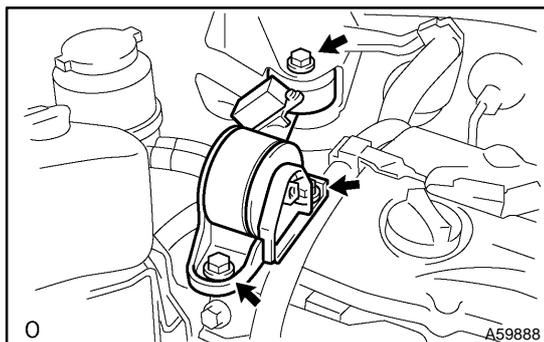


A62235

CHAIN (2AZ-FE) REPLACEMENT

140HV-01

1. REMOVE HOOD SUB-ASSY
2. REMOVE FRONT WHEEL RH
3. REMOVE ENGINE UNDER COVER LH
4. REMOVE ENGINE UNDER COVER RH
5. REMOVE FRONT FENDER APRON SEAL RH
6. DRAIN ENGINE OIL
 - (a) Install a new gasket and the drain plug after draining engine oil.
Torque: 25 N·m (255 kgf·cm, 18 ft·lbf)
7. REMOVE EXHAUST PIPE ASSY FRONT



8. REMOVE ENGINE MOVING CONTROL ROD W/BRACKET
 - (a) Remove the 3 bolts and engine moving control rod w/ bracket.

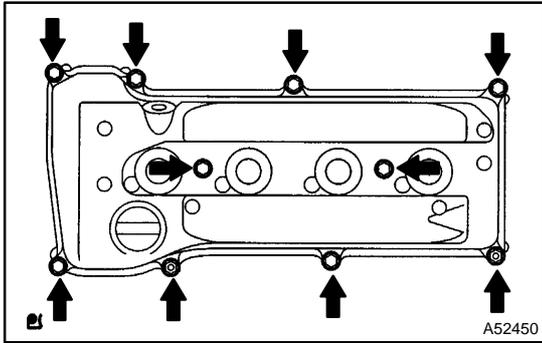
9. REMOVE ENGINE MOUNTING STAY NO.2 RH
10. REMOVE ENGINE MOUNTING BRACKET NO.2 RH
11. REMOVE FAN AND GENERATOR V BELT
(See page 14-5)
12. REMOVE ENGINE COVER SUB-ASSY NO.1
13. DISCONNECT ENGINE WIRE
14. REMOVE GENERATOR ASSY
15. REMOVE VANE PUMP ASSY
(See page 51-8)

NOTICE:

Do not disconnect the hose.

16. REMOVE IGNITION COIL ASSY
17. DISCONNECT VENTILATION HOSE

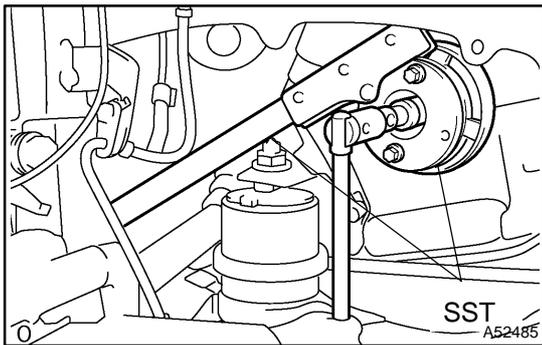
18. DISCONNECT VENTILATION HOSE NO.2



19. REMOVE CYLINDER HEAD COVER SUB-ASSY

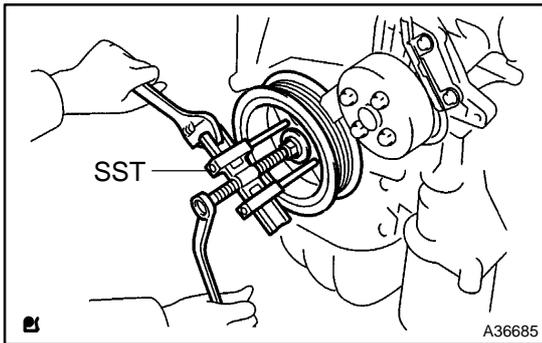
- (a) Remove the bolt and disconnect the engine wire harness clamp.
- (b) Remove the 8 bolts and 2 nuts, and disconnect the cylinder head cover.

20. SET NO.1 CYLINDER TO TDC/COMPRESSION (See page 14-7)

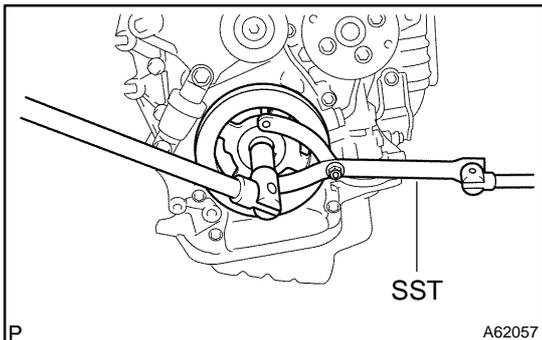


21. REMOVE CRANKSHAFT PULLEY

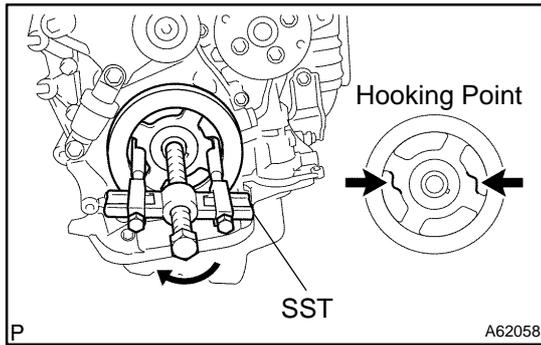
- (a) Remove the crankshaft pulley (TMC made).
 - (1) Using SST, loosen the pulley bolt.
SST 09213-54015 (91651-60855), 09330-00021



- (2) Using SST, remove the crankshaft pulley.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)

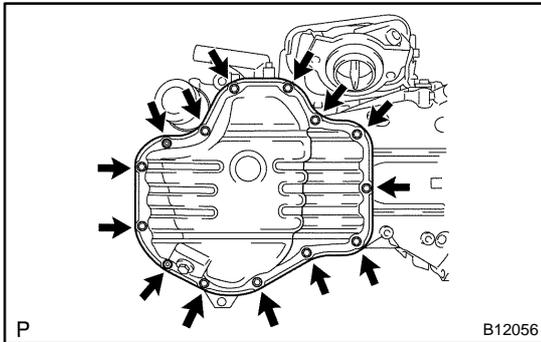


- (b) Remove the crankshaft pulley (TMMK made).
 - (1) Using SST, loosen the pulley bolt.
SST 09960-10010 (09962-01000, 09963-01000)



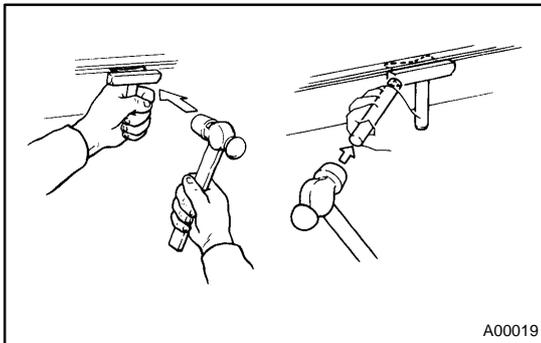
- (2) Using SST, remove the crankshaft pulley.
 SST 09950-40011 (09951-04010, 09952-04010,
 09953-04030, 09954-04010, 09955-04041,
 09957-04010, 91111-51014)

22. REMOVE CRANK POSITION SENSOR



23. REMOVE OIL PAN SUB-ASSY

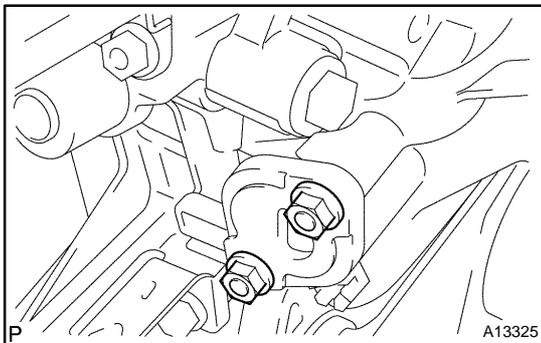
- (a) Remove the 12 bolts and 2 nuts.



- (b) Insert the blade of SST between the crank case and oil pan, cut off applied sealer and remove the oil pan.
 SST 09032-00100

NOTICE:

Be careful not to damage the contact surface of the cylinder block and oil pan.

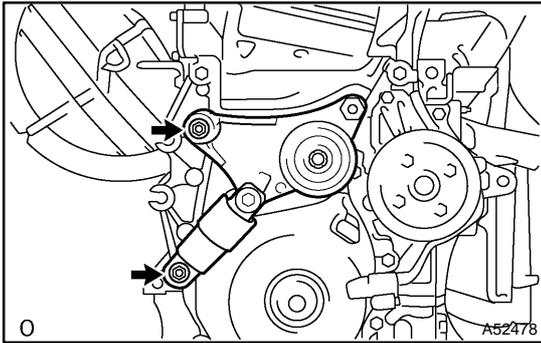


24. REMOVE CHAIN TENSIONER ASSY NO.1

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

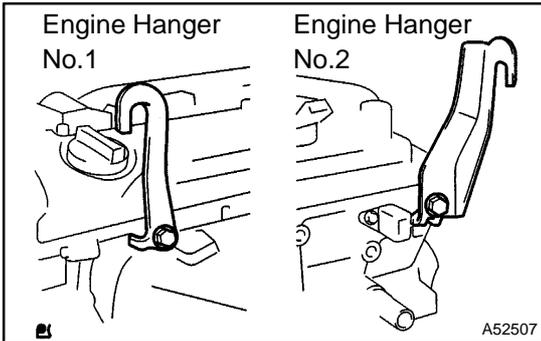
NOTICE:

Be sure not to revolve the crankshaft without the chain tensioner.



25. REMOVE V-RIBBED BELT TENSIONER ASSY

- (a) Remove the bolt, the bolt and drive belt tensioner.



26. INSTALL ENGINE HANGER NO.1

- (a) Install the engine hanger No.1, No.2 and bolt as shown in the illustration.

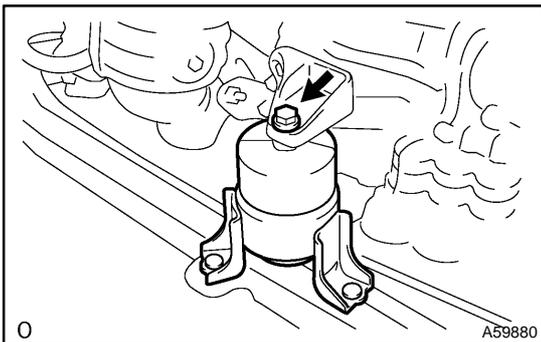
Torque: 38 N·m (387 kgf·cm, 30 ft·lbf)

Parts No.:

Engine hanger No. 1 12281-28010

Engine hanger No. 2 12282-28010

Bolt 91512-61020



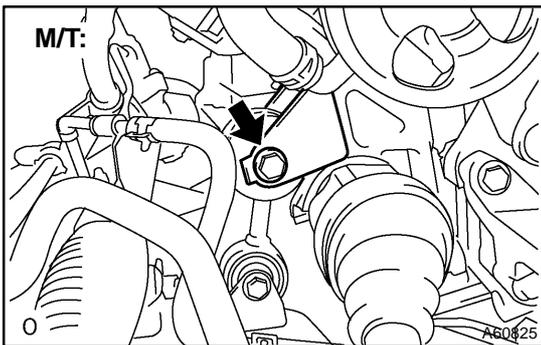
27. REMOVE TRANSVERSE ENGINE ENGINE MOUNTING INSULATOR

- (a) Attach the engine chain hoist to the engine hangers.

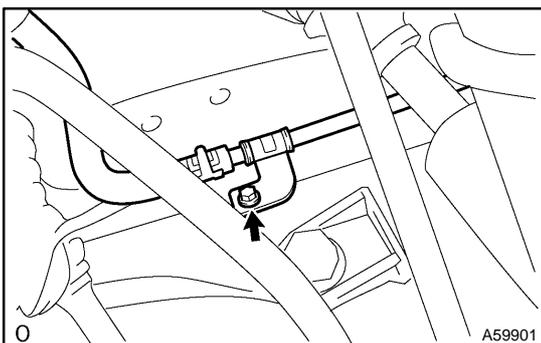
CAUTION:

Do not attempt to hang the engine by hooking the chain to any other part.

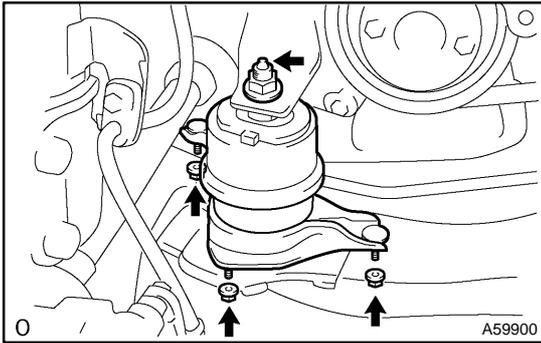
- (b) Remove the bolt, and disconnect the engine mounting insulator.



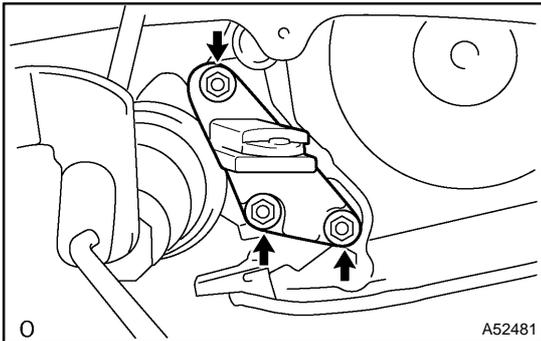
- (c) Remove the bolt and disconnect the engine lateral control rod (M/T).



- (d) Remove the bolt and disconnect the steering gear return hose clamp from the frame.

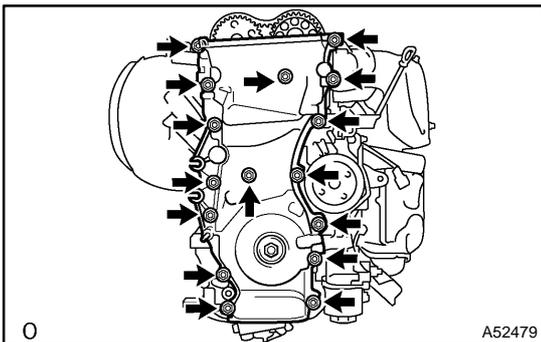


- (e) Remove the 4 nuts from the engine mounting insulator RH.
- (f) Raise the engine and remove the engine mounting insulator RH.



28. REMOVE TRANSVERSE ENGINE ENGINE MOUNTING BRACKET

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



29. REMOVE TIMING CHAIN OR BELT COVER SUB-ASSY

- (a) Remove the stud bolt for drive belt tensioner from the cylinder block.
- (b) Remove the 14 bolts and 2 nuts.
- (c) Remove the timing chain cover with a screwdriver.

NOTICE:

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

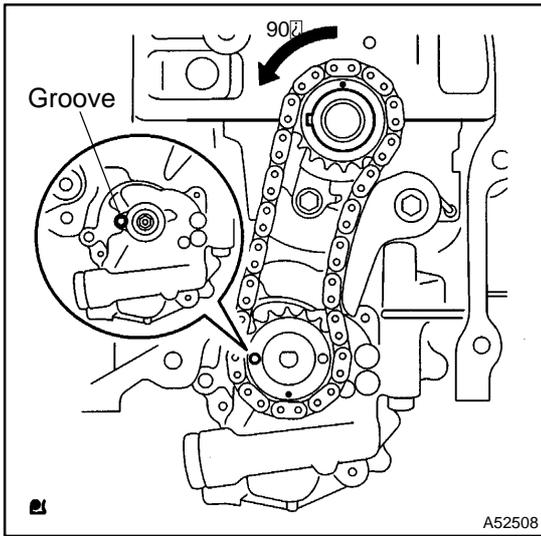
30. REMOVE CRANKSHAFT POSITION SENSOR PLATE NO.1

31. REMOVE CHAIN TENSIONER SLIPPER

32. REMOVE CHAIN VIBRATION DAMPER NO.1

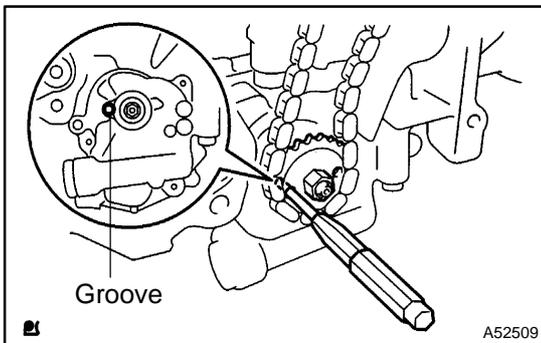
33. REMOVE CHAIN SUB-ASSY

34. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

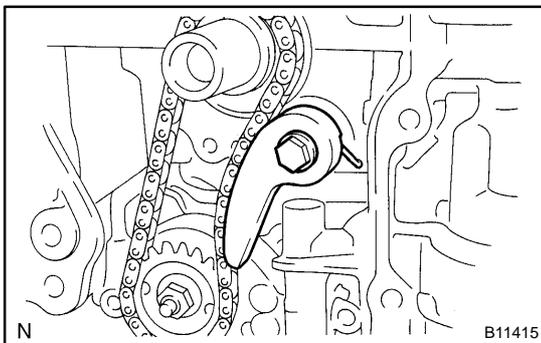


35. REMOVE NO.2 CHAIN SUB-ASSY

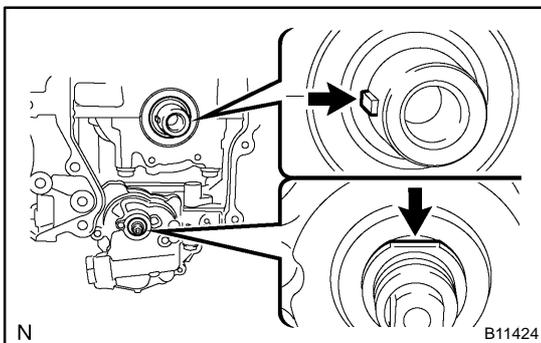
- (a) Turn the crankshaft counterclockwise 90°, and align an adjusting hole of the oil pump drive shaft gear with the groove of the oil pump.



- (b) Put a bar ($\phi 4\text{mm}$) in the adjusting hole of the oil pump drive shaft gear to lock in position, and remove a nut.

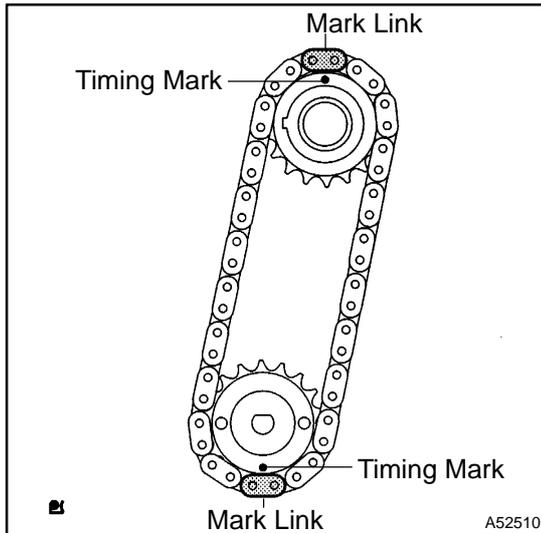


- (c) Remove the bolt, chain tensioner plate and spring.
 (d) Remove the chain tensioner, oil pump drive shaft gear and No.2 chain.

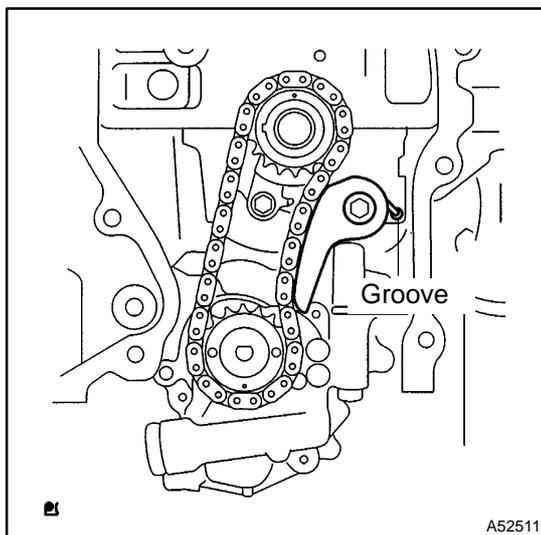


36. INSTALL NO.2 CHAIN SUB-ASSY

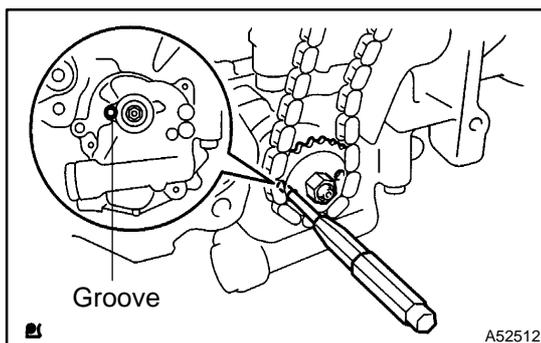
- (a) Set the crankshaft key into the left horizontal position.
 (b) Turn the cutout of the drive shaft to the top.



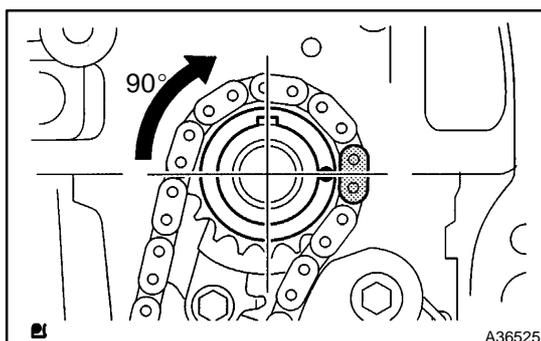
- (c) Align the mark links (yellow colored links) with the timing marks of the gear as shown in the illustration.
- (d) Insert the gears with chain to the crankshaft and oil pump shaft.
- (e) Temporarily tighten the oil pump drive shaft gear by a nut.



- (f) Inset the damper spring into the adjusting hole, and install the chain tensioner plate by a nut.
Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)



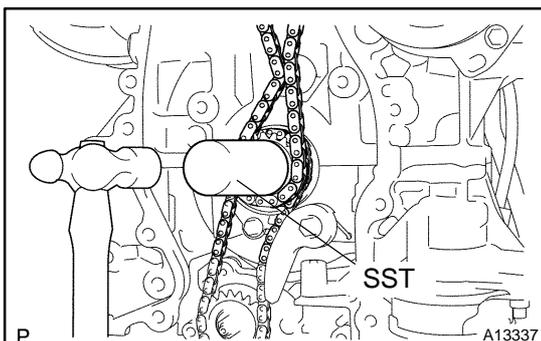
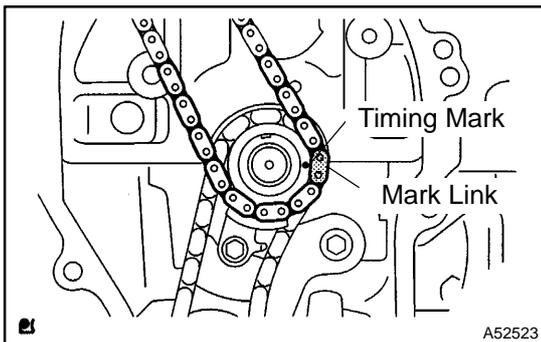
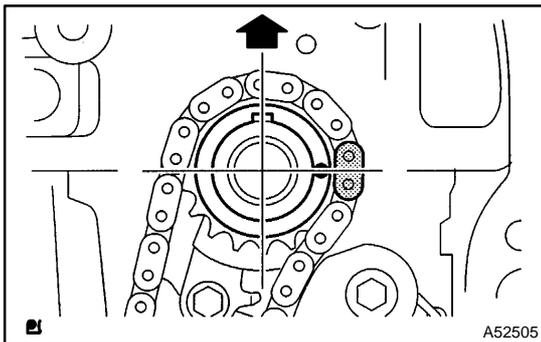
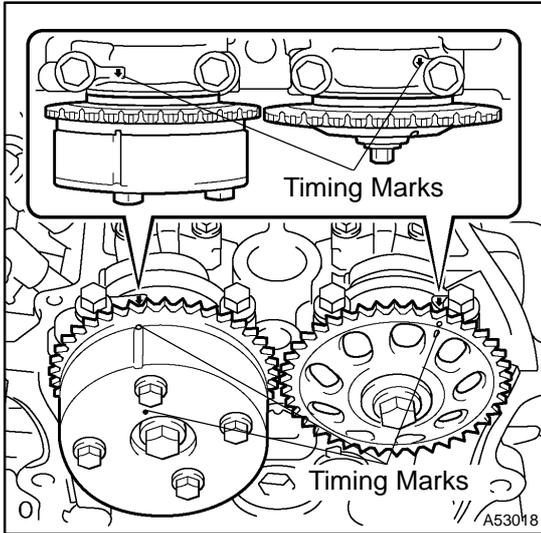
- (g) Align an adjusting hole of the oil pump drive shaft gear with the groove of the oil pump.
- (h) Put a bar ($\phi 4\text{mm}$) in the adjusting hole of the oil pump drive shaft gear to lock in position, and assemble a nut.
Torque: 30 N·m (301 kgf·cm, 22 ft·lbf)



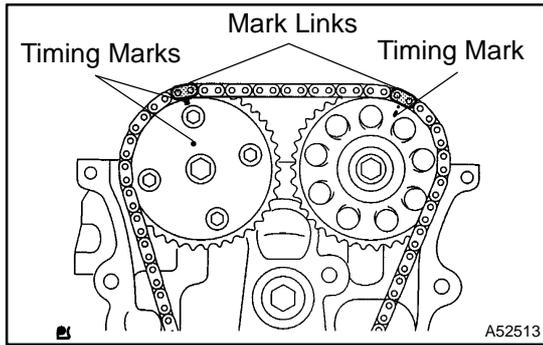
- (i) Rotate the crankshaft counterclockwise 90° , and align the crankshaft key to the top.

37. INSTALL CHAIN VIBRATION DAMPER NO.1

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

**38. INSTALL CHAIN SUB-ASSY**

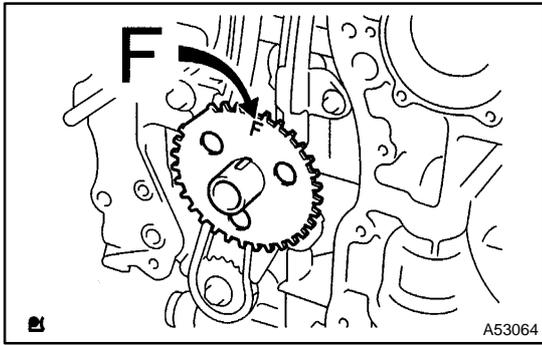
- (a) Set No.1 cylinder to TDC/compression.
- (1) Align the timing marks of the camshaft timing sprockets with No.1 bearing caps.
 - (2) Using the crankshaft pulley bolt, turn the crankshaft and set the set key on the crankshaft upward.
- (b) Align the mark link (gold or orange colored link) with the timing mark of the crankshaft timing gear.
- (c) Using a SST, install the sprocket.
SST 09309-37010



- (d) Align the mark links (gold or yellow colored links) with the timing marks of the camshaft timing gear, and install the chain.

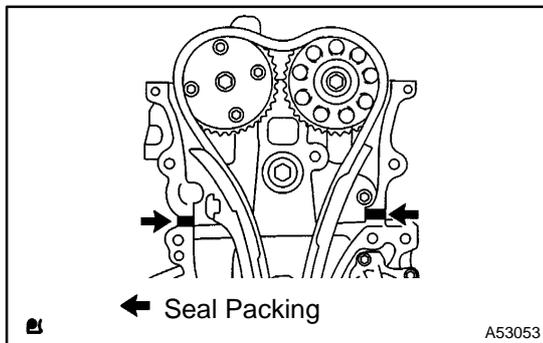
39. INSTALL CHAIN TENSIONER SLIPPER

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



40. INSTALL CRANKSHAFT POSITION SENSOR PLATE NO.1

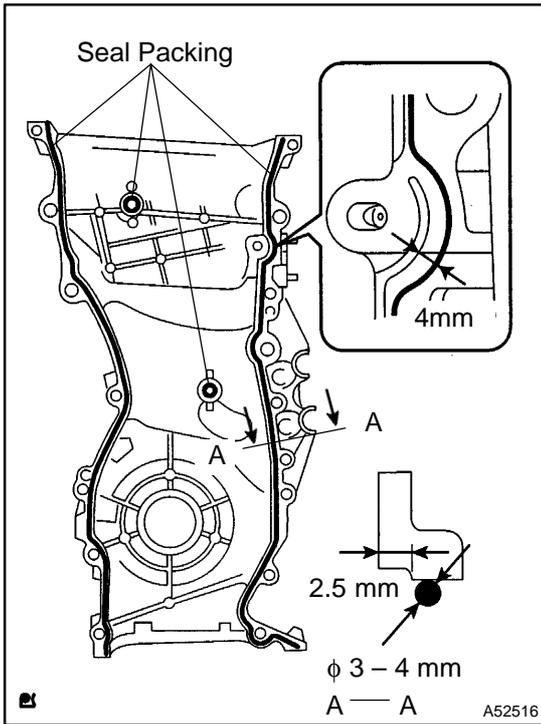
- (a) Install the crankshaft position sensor plate the "F" mark facing forward.



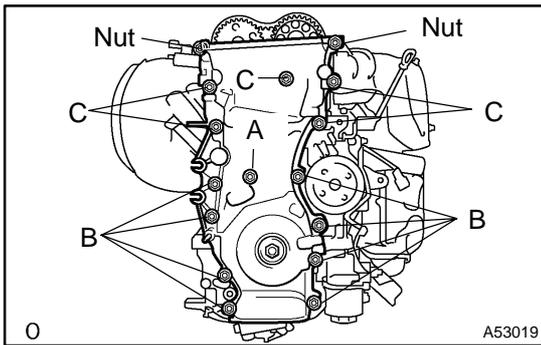
41. INSTALL TIMING CHAIN OR BELT COVER SUB-ASSY

NOTICE:

- Remove any oil from the contact surface.
 - Install the chain cover within 3 minutes after applying seal packing.
 - Do not start the engine 2 hours after installing.
- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the timing chain cover, cylinder head and cylinder block.
- (b) Apply seal packing in the shape of bead (Diameter 2 mm (0.099 in.)) as shown in the illustration.
- Seal packing: Part No. 08826-00080 or equivalent**

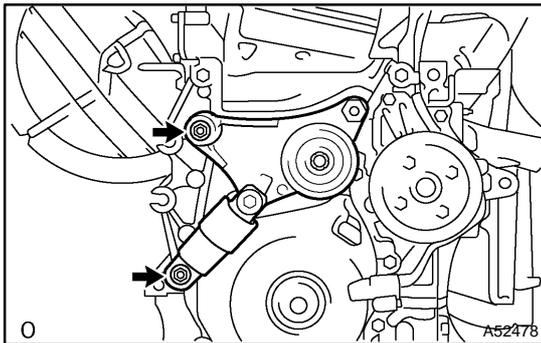


- (c) Apply seal packing in the shape of bead (Diameter 3 – 4 mm (0.118–0.157 in.)) as shown in the illustration .
Seal packing: Part No. 08826-00080 or equivalent



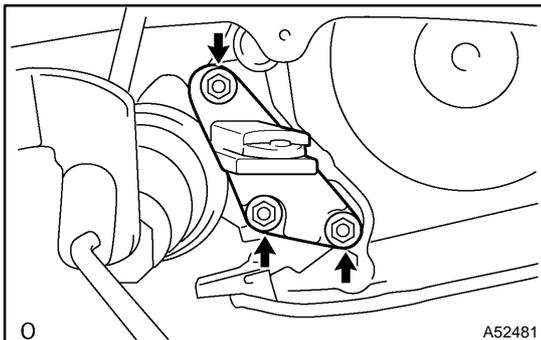
- (d) Install the timing chain cover with the 14 bolts and 2 nuts.
Torque:
Bolt A 9.0 N·m (92 kgf·cm, 80 in·lbf)
Bolt B 21 N·m (214 kgf·cm, 15 ft·lbf)
Bolt C 43 N·m (438 kgf·cm, 32 ft·lbf)
Nut 9.0 N·m (92 kgf·cm, 80 in·lbf)
- (e) Install the stud bolt to the drive belt tensioner.
Torque: 10 N·m (102 kgf·cm, 7 ft·lbf)

42. INSTALL V-RIBBED BELT TENSIONER ASSY

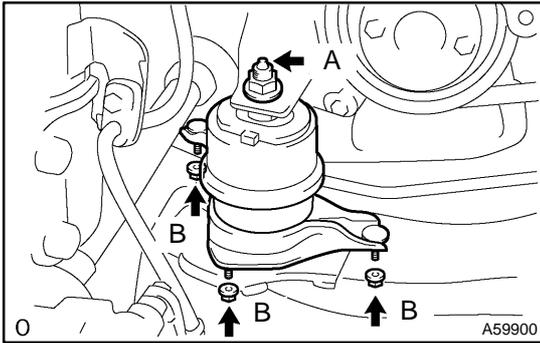


- (a) Install the drive belt tensioner with the bolt and nut.
Torque: 59.5 N·m (607 kgf·cm, 44 ft·lbf)

43. INSTALL TRANSVERSE ENGINE ENGINE MOUNTING BRACKET



- (a) Install the engine mounting bracket RH with the 3 bolts.
Torque: 54 N·m (551 kgf·cm, 40 ft·lbf)



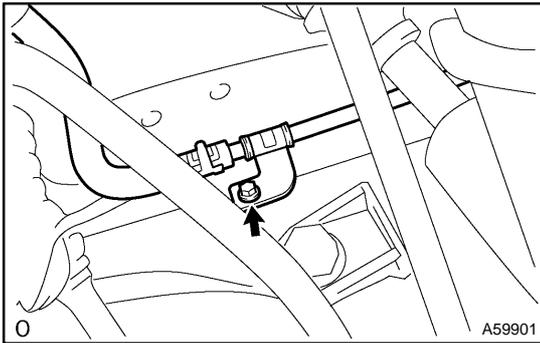
44. INSTALL TRANSVERSE ENGINE ENGINE MOUNTING INSULATOR

- (a) Raise the engine and install the engine mounting insulator RH.
- (b) Install the engine mounting insulator RH with the 4 nuts.

Torque:

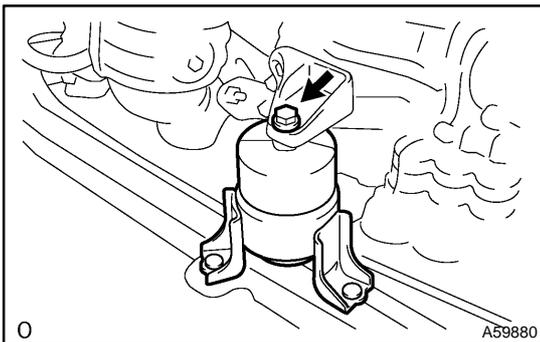
Bolt A 95 N·m (969 kgf·cm, 70 ft·lbf)

Bolt B 87 N·m (888 kgf·cm, 64 ft·lbf)



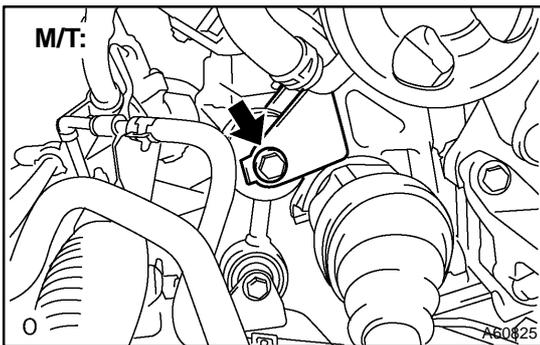
- (c) Install the bolt and disconnect the steering gear return hose clamp from the frame.

Torque: 8.0 N·m (80 kgf·cm, 69 in·lbf)



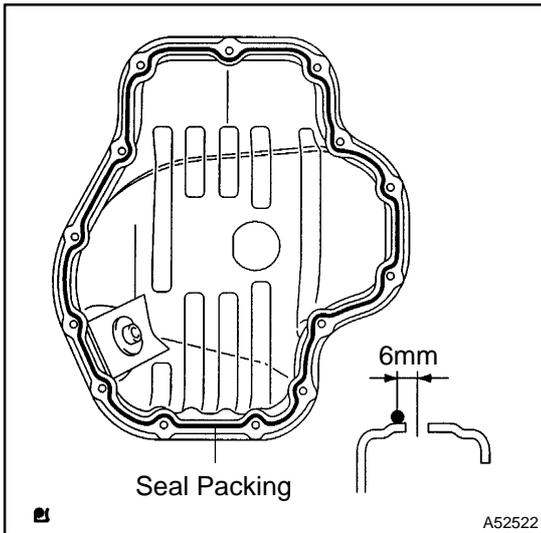
- (d) Install the engine mounting insulator FR with the bolt.

Torque: 87 N·m (888 kgf·cm, 64 in·lbf)



- (e) Install the engine lateral control rod with the bolt (M/T).

Torque: 89 N·m (910 kgf·cm, 69 in·lbf)



45. INSTALL OIL PAN SUB-ASSY

NOTICE:

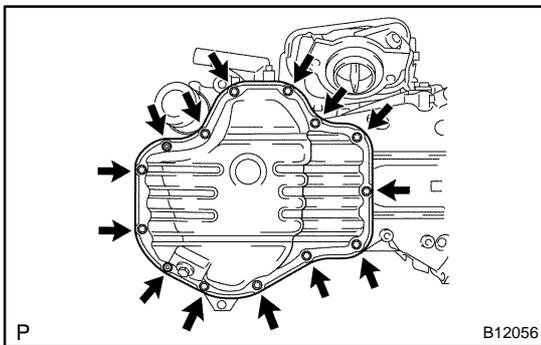
- Remove any oil from the contact surface.
 - Install the oil pan within 3 minutes after applying seal packing.
 - Do not start the engine 2 hours after installing.
- (a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surface of the cylinder block and oil pan.
- (b) Apply seal packing in the shape of bead (Diameter 3 – 4 mm (0.157 in.)) as shown in the illustration, and install the oil pan.

Seal packing:

Part No. 08826-00080 or equivalent

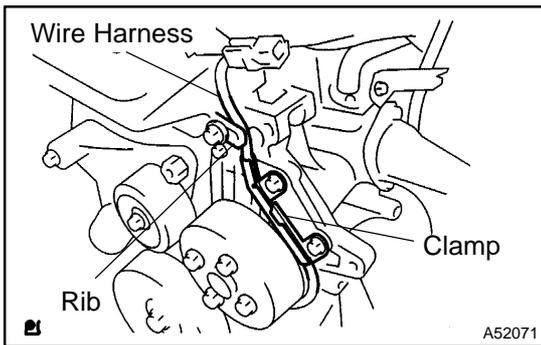
- (c) Install the oil pan with the 12 bolts and 2 nuts.

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



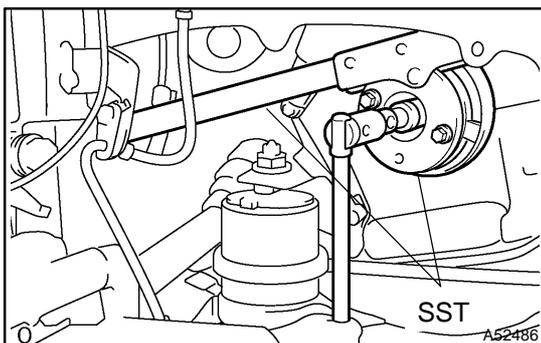
46. INSTALL CHAIN TENSIONER ASSY NO.1

(See page 14-88)



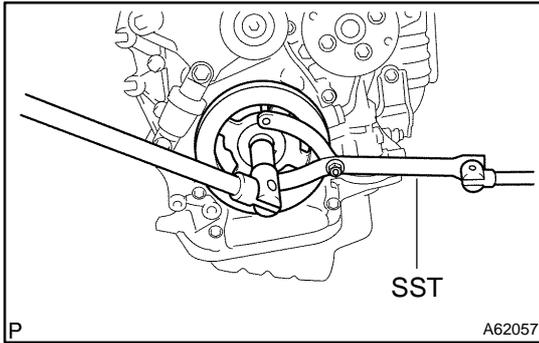
47. INSTALL CRANK POSITION SENSOR

- (a) Install the bolt and crankshaft position sensor.
Torque: 9.0 N·m (92 kgf·cm, 80 in·lbf)
- (b) Confirm the wire harness of the crank position sensor is placed as shown in the illustration.

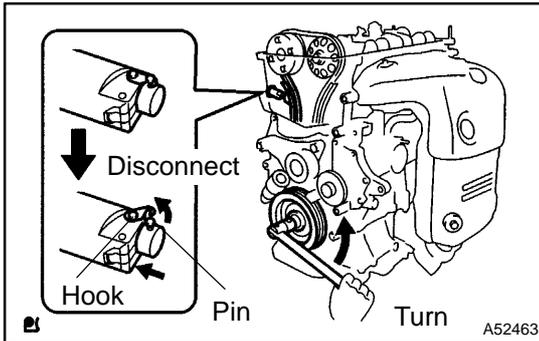


48. INSTALL CRANKSHAFT PULLEY

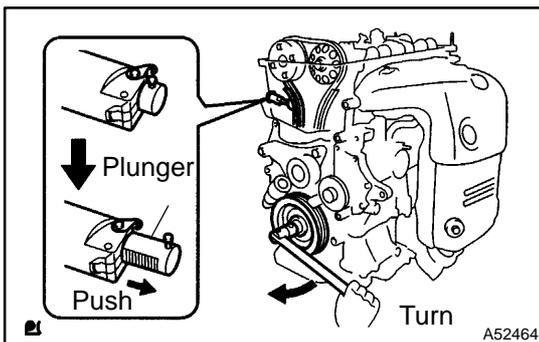
- (a) Install the crankshaft pulley (TMC made).
- (1) Align the pulley set key with the key groove of the pulley, and side on the pulley.
SST 09213-54015 (91651-60855), 09330-00021
- (2) Using SST, install the pulley bolt.
Torque: 170 N·m (1,733 kgf·cm, 125 ft lbf)



- (b) Install the crankshaft pulley (TMMK made).
- (1) Align the pulley set key with the key groove of the pulley, and side on the pulley.
SST 09960-10010 (09962-01000, 09963-01000)
 - (2) Using SST, install the pulley bolt.
Torque: 170 N·m (1,733 kgf·cm, 125 ft·lbf)



- (c) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.



- (d) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.

49. INSTALL CYLINDER HEAD COVER SUB-ASSY

(See page 14-88)

50. INSTALL IGNITION COIL ASSY

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

51. INSTALL VANE PUMP ASSY

(See page 51-8)

52. INSTALL GENERATOR ASSY

(See page 19-13)

53. INSTALL ENGINE WIRE

54. INSTALL FAN AND GENERATOR V BELT

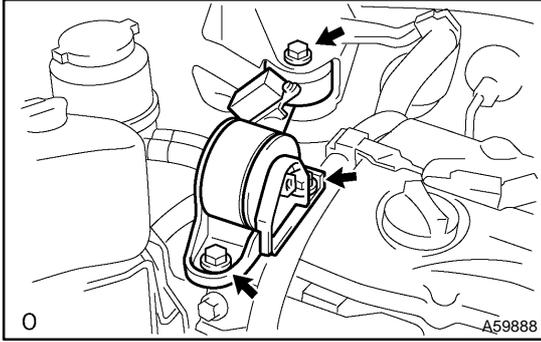
(See page 14-5)

55. INSTALL ENGINE MOUNTING BRACKET NO.2 RH

Torque: 52 N·m (531 kgf·cm, 38 ft·lbf)

56. INSTALL ENGINE MOUNTING STAY NO.2 RH

Torque: 64 N·m (653 kgf·cm, 47 ft·lbf)



57. INSTALL ENGINE MOVING CONTROL ROD W/BRACKET

- (a) Install the engine mounting control rod w/bracket with 3 bolts.

Torque: 64 N·m (653 kgf·cm, 47 ft·lbf)

58. INSTALL EXHAUST PIPE ASSY FRONT
(See page 15-2)

59. INSTALL FRONT WHEEL RH
Torque: 103 N·m (1,050 kgf·cm, 76 ft·lbf)

60. INSTALL HOOD SUB-ASSY

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

61. ADD ENGINE OIL

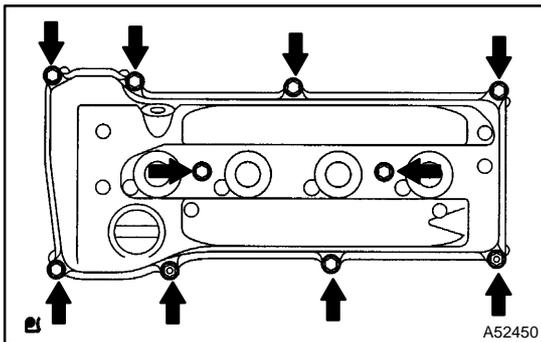
62. INSPECT OIL LEAK

CAMSHAFT (2AZ-FE)

REPLACEMENT

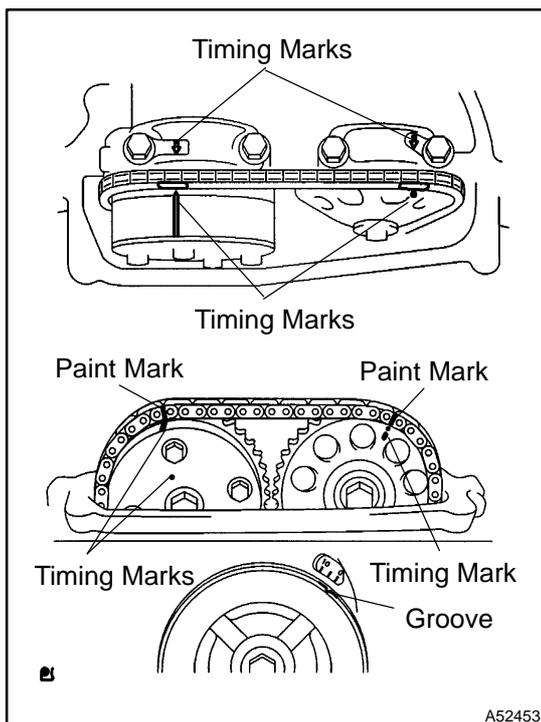
1405Y-02

1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH
3. REMOVE ENGINE COVER SUB-ASSY NO.1
4. REMOVE IGNITION COIL ASSY
5. DISCONNECT VENTILATION HOSE
6. DISCONNECT VENTILATION HOSE NO.2
7. DISCONNECT ENGINE WIRE



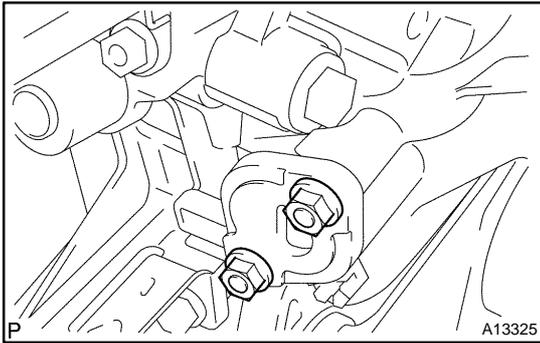
8. REMOVE CYLINDER HEAD COVER SUB-ASSY

- (a) Remove the bolt and disconnect the engine wire harness clamp.
- (b) Remove the bolts, 2 nuts, cylinder head cover and gasket.



9. SET NO.1 CYLINDER TO TDC/COMPRESSION

- (a) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.
- (b) Check that the timing marks of the camshaft timing sprockets are aligned with the timing marks of the bearing cap as shown in the illustration.
- (c) Place match marks on the timing chain and camshaft timing sprocket.

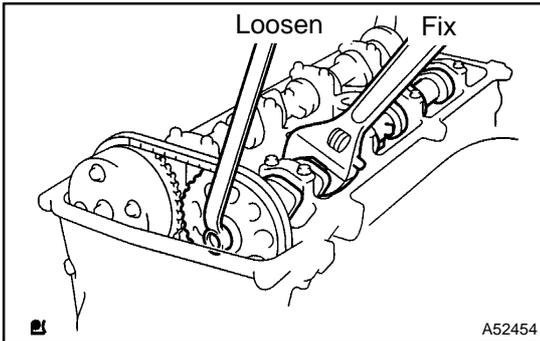


10. REMOVE CHAIN TENSIONER ASSY NO.1

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

NOTICE:

Be sure not to revolve the crankshaft without the chain tensioner.

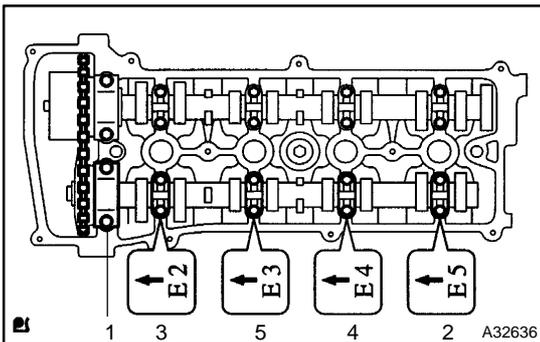


11. REMOVE NO.2 CAMSHAFT

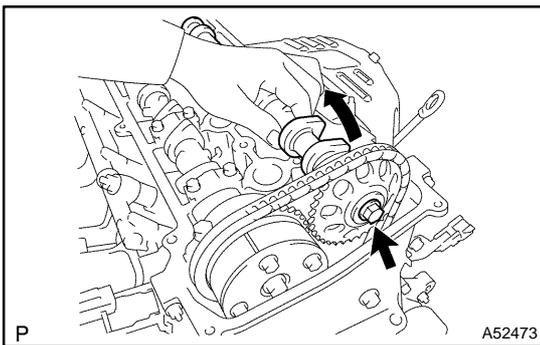
- (a) Fix the camshaft with a wrench and so on, then loosen the camshaft timing gear set blot.

NOTICE:

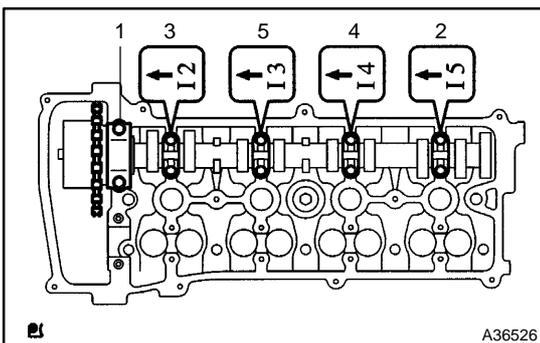
Be careful not to damage the valve lifter.



- (b) Loosen the camshaft bearing cap bolts on No.2 camshaft in the sequence shown in the illustration in several passes, and remove the caps.

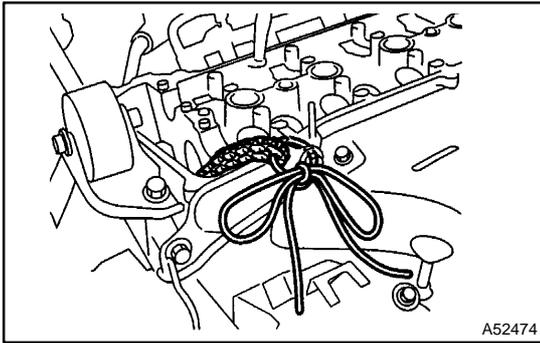


- (c) Raising the camshaft, remove the set bolt.
- (d) Remove the camshaft timing gear from the camshaft with timing chain.
- (e) Remove the camshaft timing gear from the timing chain.



12. REMOVE CAMSHAFT

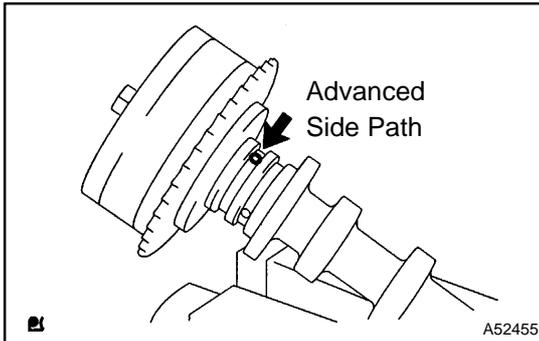
- (a) Loosen the camshaft bearing cap bolts on camshaft in the sequence shown in the illustration in several passes, and remove the caps.
- (b) Remove the intake camshaft.



(c) Tie the timing chain with a string.

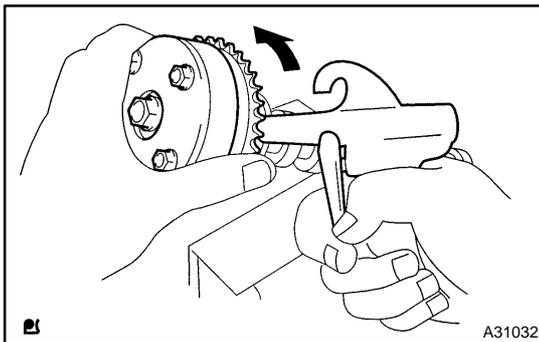
NOTICE:

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



13. REMOVE CAMSHAFT TIMING GEAR ASSY

- (a) Fix the No. 1 camshaft with a vise, and make sure the camshaft timing gear assembly does not rotate.
- (b) Cover all the paths with vinyl tape except an advanced side path shown in the illustration.



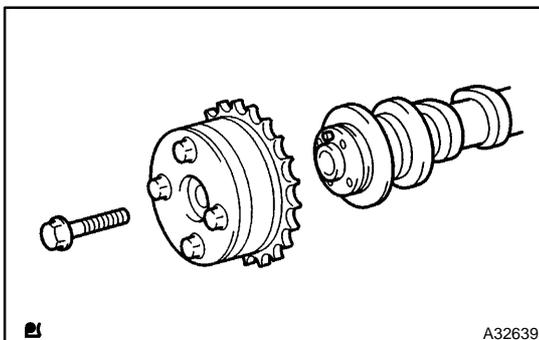
- (c) Put air pressure into the oil path with 150 kpa (1.5 kgf/cm² 21 psi), and turn the camshaft timing gear assembly to the advance direction (counterclockwise) by force.

CAUTION:

Cover the paths with shop rag to avoid oil splashing.

HINT:

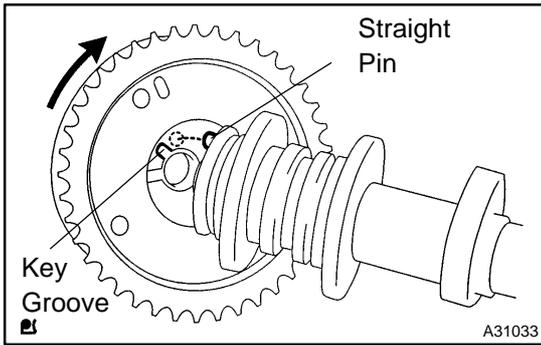
Depending on the air pressure, the VVT timing sprocket will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.



- (d) Remove a fringe bolt of camshaft timing gear assembly.

NOTICE:

- **Be sure not to remove the other 4 bolts.**
- **In case of reusing the camshaft timing gear assembly, release the straight pin lock first, and then install the gear.**



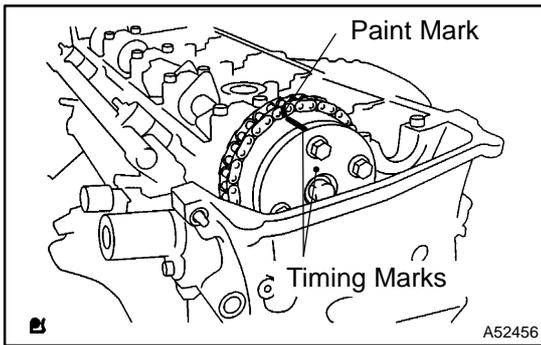
14. INSTALL CAMSHAFT TIMING GEAR ASSY

- (a) Put the camshaft timing gear assembly and the a camshaft together with the straight pin off the key groove.
- (b) Turn the camshaft timing gear assembly to the left direction (as shown in the illustration) with pushing it lightly against the camshaft. Push further at the position where the pin gets into the groove.

NOTICE:

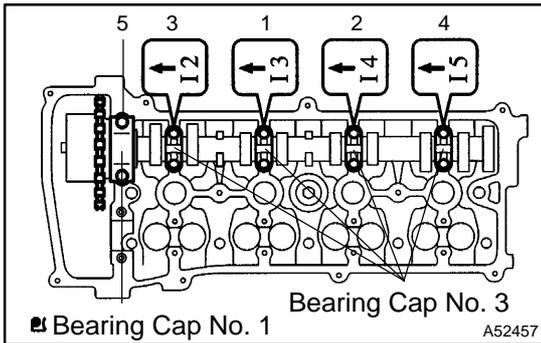
Be sure not to turn the camshaft timing gear to the retard angle side (to the right direction).

- (c) Check that there is no clearance between the gear's fringe and the camshaft.
- (d) Tighten the fringe bolt with the camshaft timing gear fixed.
Torque: 54 N·m (551 kgf·cm, 40 ft·lbf)
- (e) Check that the camshaft timing gear assembly can move to the retard angle side (to the right direction), and is locked at the most retarded position.



15. INSTALL CAMSHAFT

- (a) Install the timing chain on the camshaft timing gear, with the painted links aligned with the timing marks on the camshaft timing sprockets.

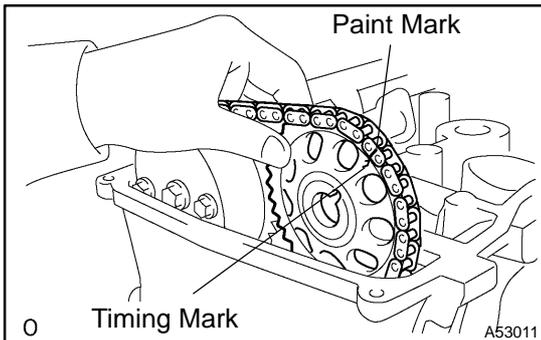


- (b) Examine the front marks and numbers and tighten the bolts in the order shown in the illustration.

Torque:

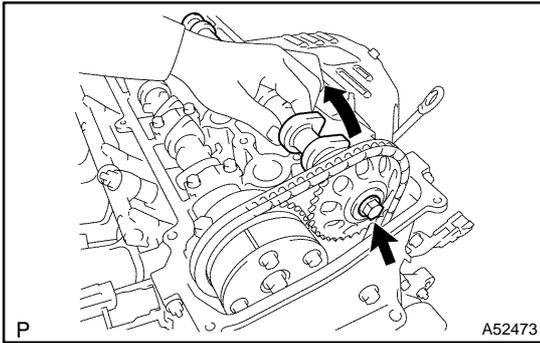
Bearing cap No. 1 30 N·m (301 kgf·cm, 22 ft·lbf)

Bearing cap No. 3 9.0 N·m (92 kgf·cm, 80 in·lbf)

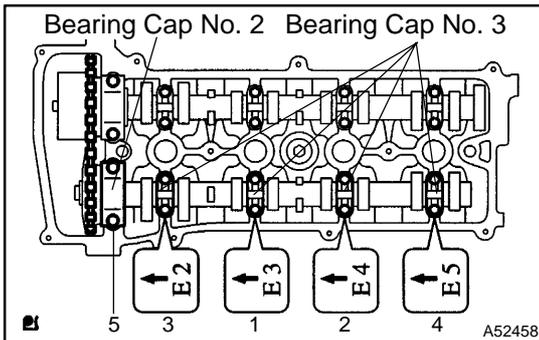


16. INSTALL NO.2 CAMSHAFT

- (a) Put the camshaft No.2 on the cylinder head with the painted links of chain aligned with the timing mark on the camshaft timing sprockets.



- (b) Raising the camshaft, tighten the set bolt temporarily.

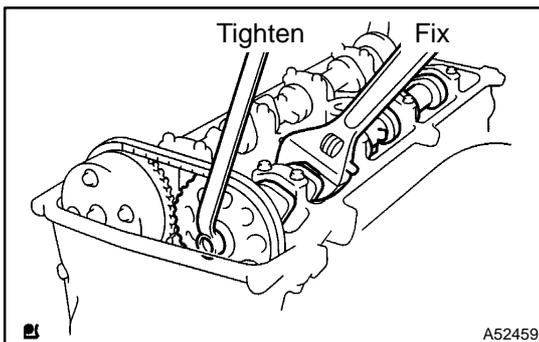


- (c) Examine the from marks and numbers and tighten the bolts in the sequence shown in the illustration.

Torque:

Bearing cap No. 2 30 N·m (301 kgf·cm, 22 ft·lbf)

Bearing cap No. 3 9.0 N·m (92 kgf·cm, 80 in·lbf)

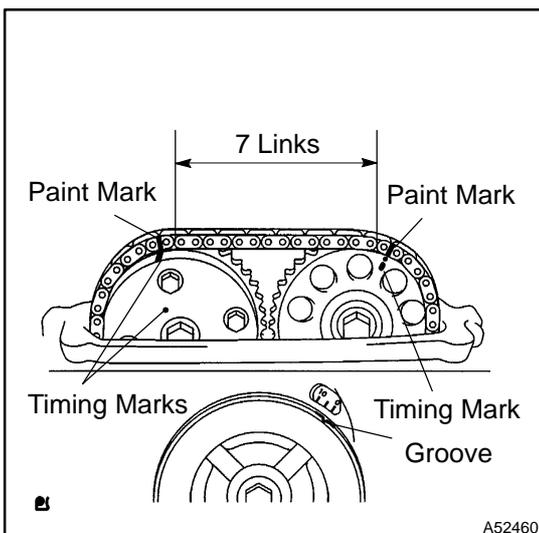


- (d) Fix the camshaft with a spanner and so on, then tighten the camshaft timing gear set bolt.

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

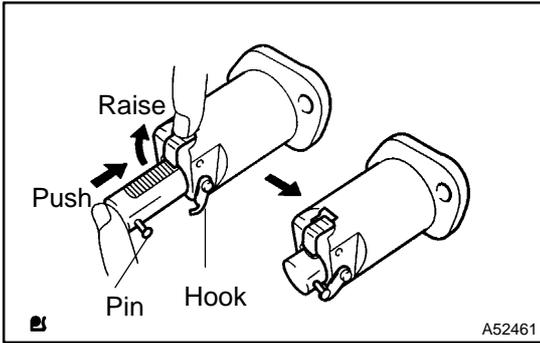
NOTICE:

Be careful not to damage the valve lifter.

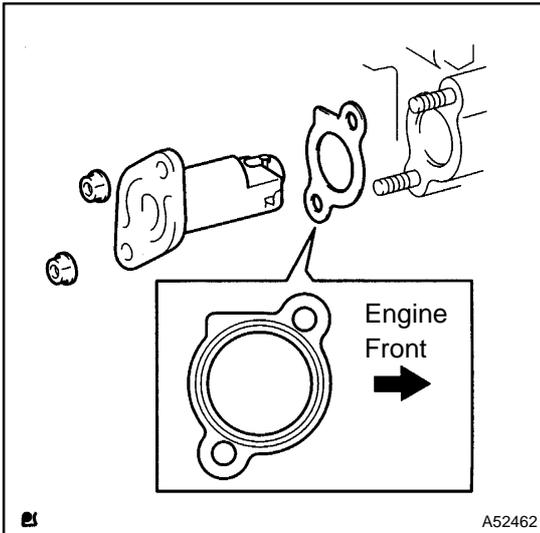


- (e) As shown in the illustration, check the match marks on the timing chain and camshaft timing sprockets and the alignment of the pulley groove with timing mark of the chain cover.

17. INSTALL CHAIN TENSIONER ASSY NO.1



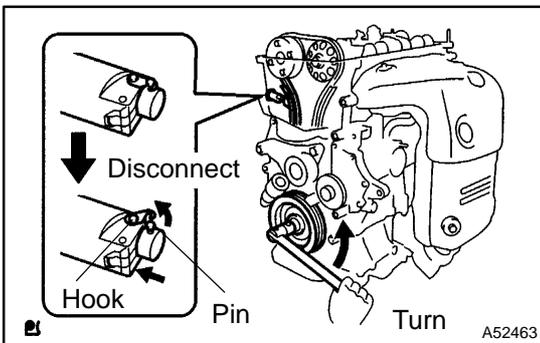
- (a) Release the ratchet pawl, fully push in the plunger and apply the hook to the pin so that the plunger cannot spring out.



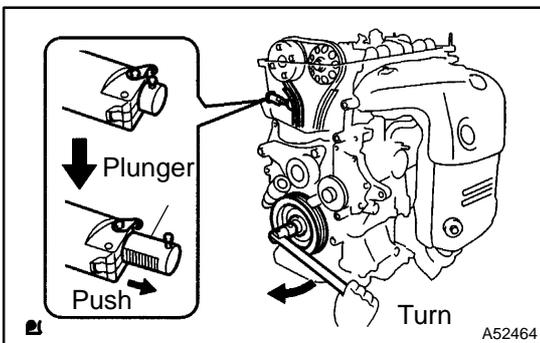
- (b) Install a new gasket and chain tensioner with the 2 nuts.
Torque: 9.0 N·m (92 kgf·cm, 80 in.-lbf)

NOTICE:

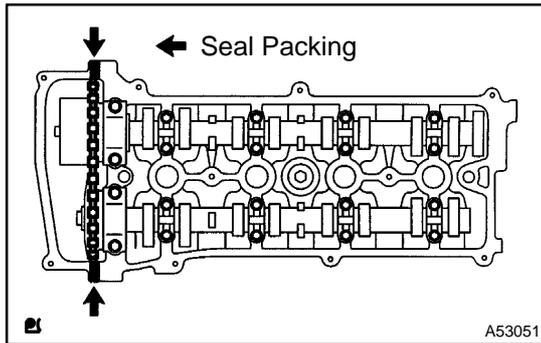
When installing the tensioner, set the hook again if the hook releases the plunger.



- (c) Turn the crankshaft counterclockwise, and disconnect the plunger knock pin from the hook.



- (d) Turn the crankshaft clockwise, and check that the slipper is pushed by the plunger.



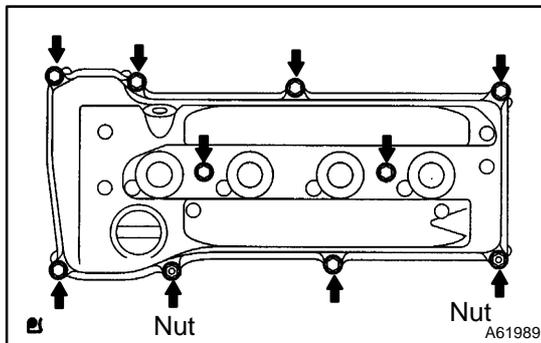
18. INSTALL CYLINDER HEAD COVER SUB-ASSY

- (a) Remove any old packing (FIPG) material.
- (b) Apply seal packing to 2 locations as shown in the illustration.

Seal packing: Part No. 08826-00080 or equivalent

NOTICE:

- Remove any oil the contact surface.
- Install the cylinder head cover within 5 minutes after applying seal packing.
- Do not put into engine oil 2 hours after installing.



- (c) Install the cylinder head cover with the 8 bolts and 2 nuts.
Torque: 11 N·m (110 kgf·cm, 8 ft·lbf)

19. CONNECT ENGINE WIRE

20. INSTALL IGNITION COIL ASSY

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

21. INSTALL FRONT WHEEL RH

Torque: 103 N·m (1,050 kgf·cm, 76 ft·lbf)

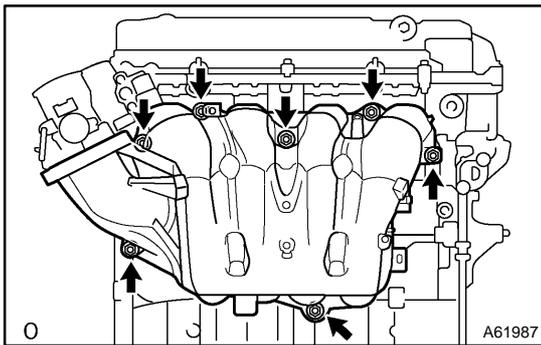
22. INSPECT OIL LEAK

CYLINDER HEAD GASKET (2AZ-FE)

140HU-01

REPLACEMENT

1. WORK FOR PREVENTING GASOLINE FROM SPILLING OUT (See page 11-1)②
2. REMOVE FRONT SUSPENSION UPPER BRACE CENTER(W/ FRONT SUSPENSION BRACE UPPER CENTER)
3. REMOVE CHAIN SUB-ASSY
(See page 14-74)
4. DRAIN COOLANT (See page 16-6)
5. DISCONNECT RADIATOR HOSE OUTLET
6. DISCONNECT UNION TO CONNECTOR TUBE HOSE
7. DISCONNECT HEATER INLET WATER HOSE
8. DISCONNECT FUEL TUBE SUB-ASSY
(See page 11-1)②



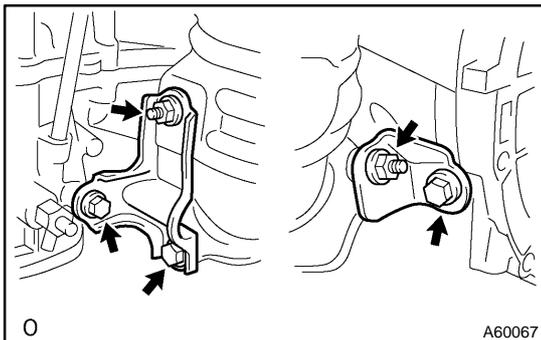
9. REMOVE INTAKE MANIFOLD

- (a) Disconnect the 2 water by-pass hoses of the throttle body.
- (b) Remove the 5 bolts, 2 nuts, intake manifold and gasket.

10. DISCONNECT ENGINE WIRE

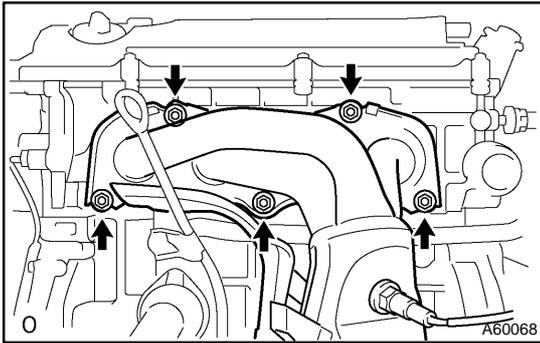
11. REMOVE INTAKE MANIFOLD INSULATOR NO.1

12. REMOVE EXHAUST MANIFOLD HEAT INSULATOR NO.1

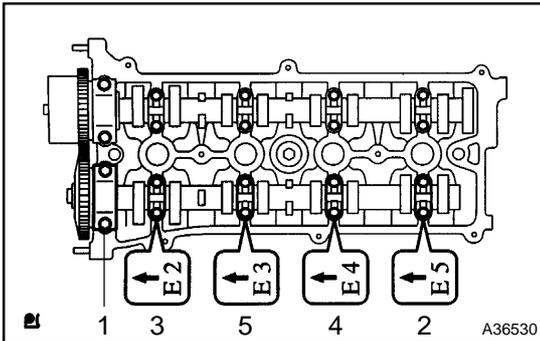


13. REMOVE EXHAUST MANIFOLD CONVERTER SUB-ASSY

- (a) Remove the 3 bolts, 2 nuts No.1 and No.2 exhaust manifold stay.

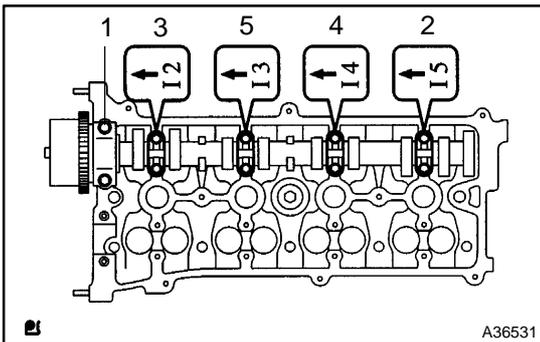


- (b) Remove the 5 nuts, exhaust manifold and gasket.



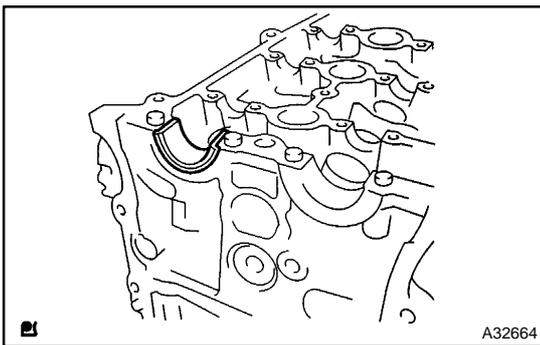
14. REMOVE NO.2 CAMSHAFT

- (a) Remove the No.2 and No.3 camshaft bearing cap in the sequence shown in the illustration.
 (b) Remove the No.2 camshaft.



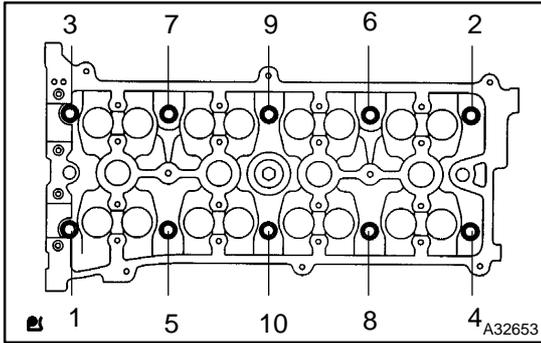
15. REMOVE CAMSHAFT

- (a) Remove the No.1 and No.3 camshaft bearing cap in the sequence shown in the illustration.
 (b) Remove the No.1 camshaft.



16. REMOVE CAMSHAFT BEARING NO.2

17. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSY



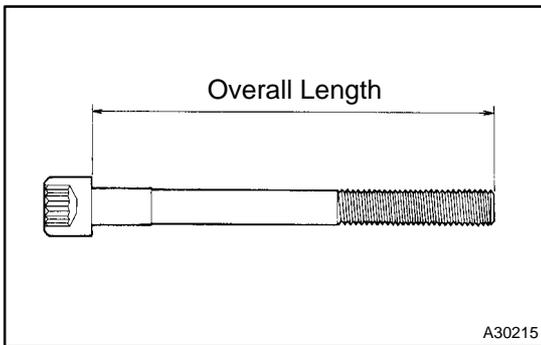
18. REMOVE CYLINDER HEAD SUB-ASSY

- (a) Using a 10 mm bi-hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown. 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 and installing incorrect order.

19. REMOVE CYLINDER HEAD GASKET



20. INSPECT CYLINDER HEAD SET BOLT

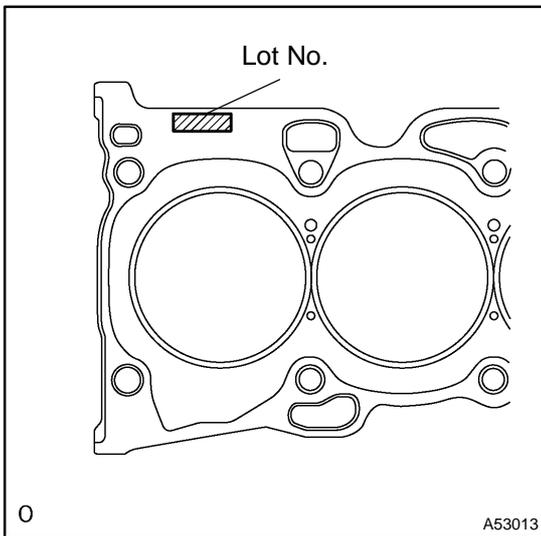
- (a) Using vernier calipers, measure the length of head bolts from the seat to the end.

Standard bolt length:

161.3-162.3 mm (6.350-6.390 in.)

Maximum bolt length: 164.2 mm (6.465 in)

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



21. INSTALL CYLINDER HEAD GASKET

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

NOTICE:

- Remove any oil from contact surface.
- Be careful of the installation direction.
- Place the cylinder head quietly in order not to damage the gasket with the bottom part of the head.

22. INSTALL CYLINDER HEAD SUB-ASSY

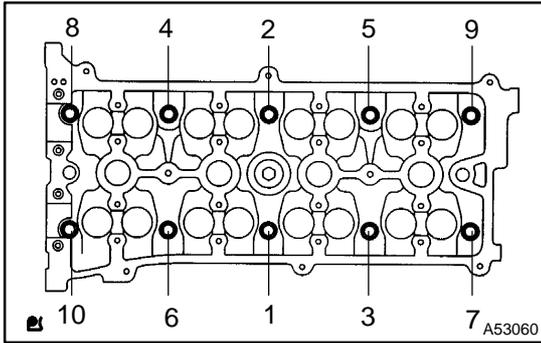
HINT:

The cylinder head bolts are tightened in 2 progressive steps.

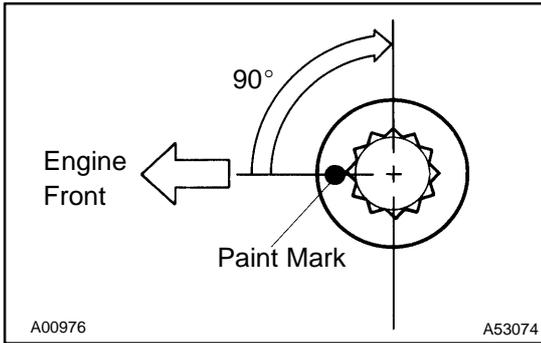
- (a) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
- (b) Install bolts and plate washers to the cylinder head.

NOTICE:

Do not drop the washers into the cylinder head.



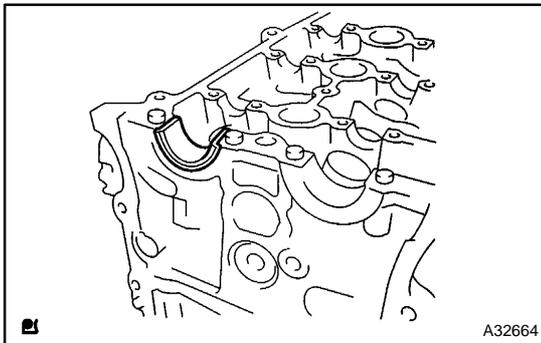
- (c) Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.
Torque: 79 N·m (806 kgf·cm, 58 ft·lbf)



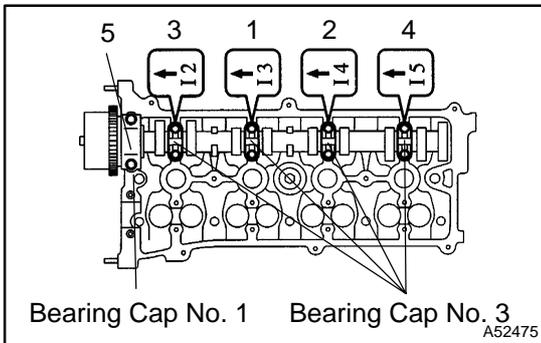
- (d) Mark the front side of the cylinder head bolt with paint.
 (e) Retighten the cylinder head bolts by 90° in the sequence shown.
 (f) Check that the paint mark is now at a 90° angle to the front.

23. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSY

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



24. INSTALL CAMSHAFT BEARING NO.2



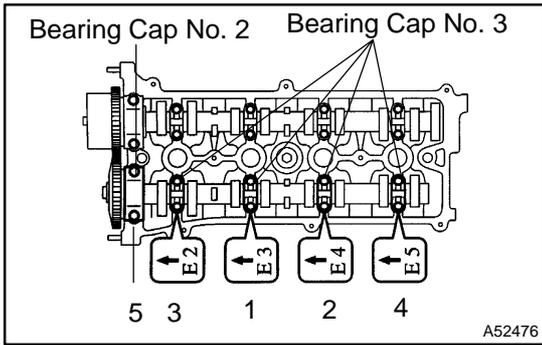
25. INSTALL CAMSHAFT

- (a) Tighten the camshaft bearing cap No.1 and No.3 as the sequence shown in the illustration.

Torque:

Bearing cap No.1 30 N·m (301 kgf·cm, 22 ft·lbf)

Bearing cap No.3 9.0 N·m (92 kgf·cm, 80 in·lbf)



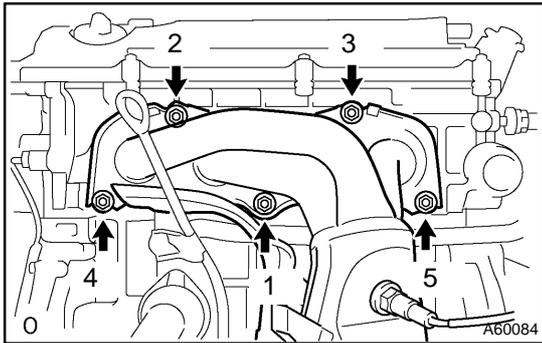
26. INSTALL NO.2 CAMSHAFT

- (a) Tighten the camshaft bearing cap No.2 and No.3 as the sequence shown in the illustration.

Torque:

Bearing cap No.2 30 N·m (301 kgf·cm, 22 ft·lbf)

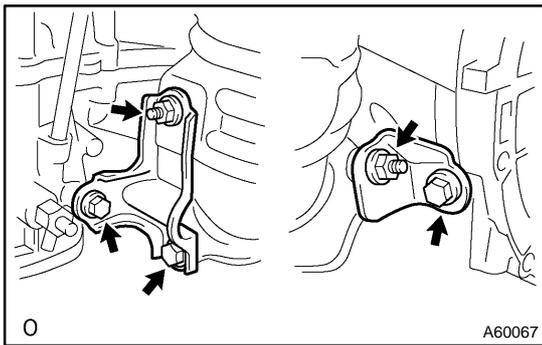
Bearing cap No.3 9.0 N·m (92 kgf·cm, 80 in·lbf)



27. INSTALL EXHAUST MANIFOLD CONVERTER SUB-ASSY

- (a) Install a new gasket and the exhaust manifold with the 5 nuts.

Torque: 37 N·m (378 kgf·cm, 27 ft·lbf)

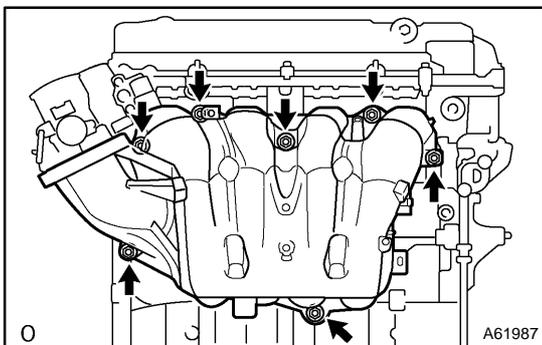


- (b) Install the No.1 and No.2 exhaust manifold stay with the 3 bolts and 2 nuts.

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

28. INSTALL EXHAUST MANIFOLD HEAT INSULATOR NO.1

Torque: 12 N·m (122 kgf·cm, 9 ft·lbf)



29. INSTALL INTAKE MANIFOLD

- (a) Install a new gasket and the intake manifold with the 5 bolts and 2 nuts.

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

30. CONNECT FUEL TUBE SUB-ASSY

(See page 11-1)

31. INSTALL CHAIN SUB-ASSY

(See page 14-74)

SST 09309-37010

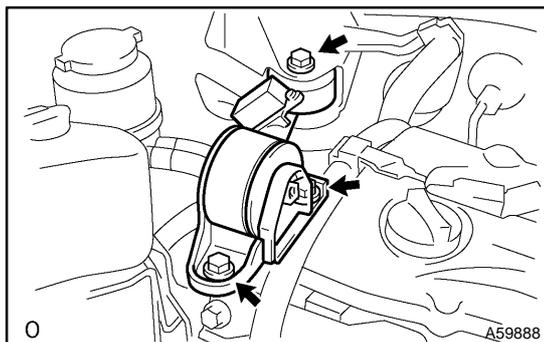
32. ADD ENGINE OIL
33. ADD COOLANT (See page 16-6)
34. INSPECT OIL LEAK
35. CHECK ENGINE COOLANT LEAK (See page 16-1)
36. INSPECT FUEL LEAK (See page 11-5)
37. INSPECT CHECK IDLE SPEED AND IGNITION TIMING (See page 14-1)
38. INSPECT CO/HC (See page 14-1)

TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL (2AZ-FE)

REPLACEMENT

140HW-01

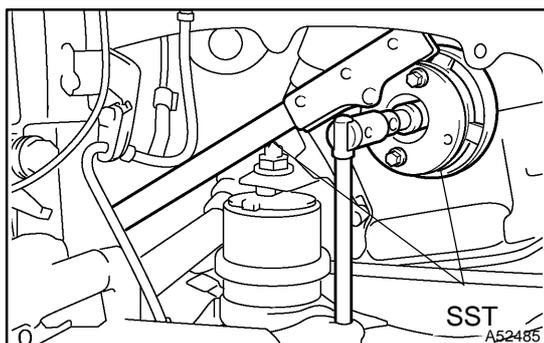
1. REMOVE FRONT WHEEL RH
2. REMOVE FRONT FENDER APRON SEAL RH
3. REMOVE ENGINE COVER SUB-ASSY NO.1



4. REMOVE ENGINE MOVING CONTROL ROD W/BACKET

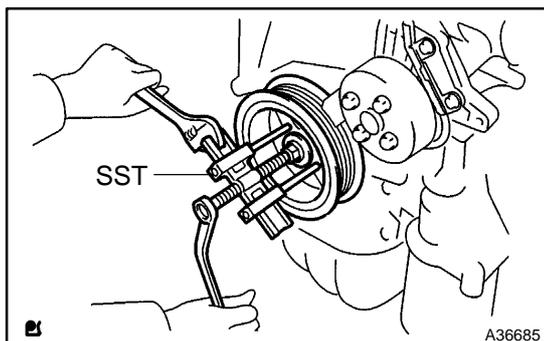
- (a) Remove the 3 bolts and engine moving control rod w/ bracket.

5. REMOVE ENGINE MOUNTING STAY NO.2 RH
6. REMOVE ENGINE MOUNTING BRACKET NO.2 RH
7. REMOVE FAN AND GENERATOR V BELT
(See page14-5)
SST 09249-63010

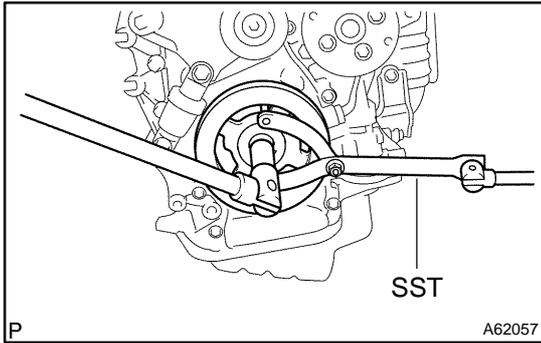


8. REMOVE CRANKSHAFT PULLEY

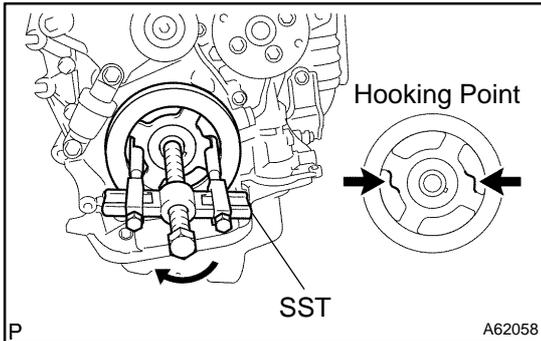
- (a) Remove the crankshaft pulley (TMC made).
 - (1) Using SST, loosen the pulley bolt.
SST 09213-54015 (91651-60855), 09330-00021



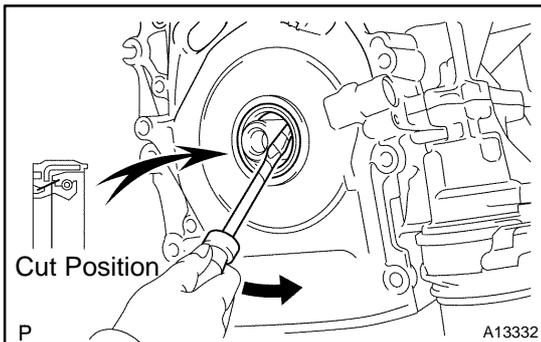
- (2) Using SST, remove the crankshaft pulley.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)



- (b) Remove the crankshaft pulley (TMMK made).
 (1) Using SST, loosen the pulley bolt.
 SST 09960-10010 (09962-01000, 09963-01000)

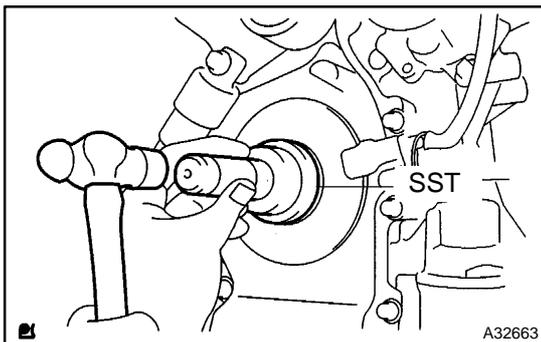


- (2) Using SST, remove the crankshaft pulley.
 SST 09950-40011 (09951-04010, 09952-04010, 09953-04030, 09954-04010, 09955-04041, 09957-04010, 91111-51014)



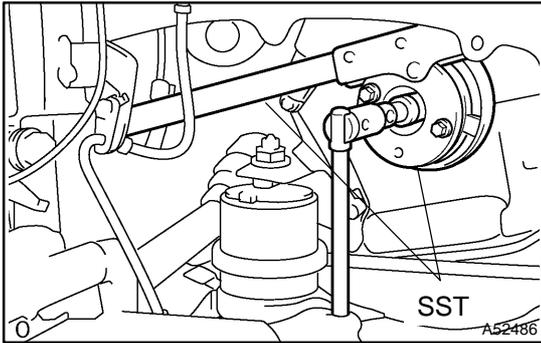
9. REMOVE TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

- (a) Using a knife, cut off the oil seal lip.
 (b) Using a screwdriver with taping tip, pry out the oil seal.
HINT:
 After the removal, check if the crankshaft is not damaged.
 If there is, mend it with a sandpaper (#400).



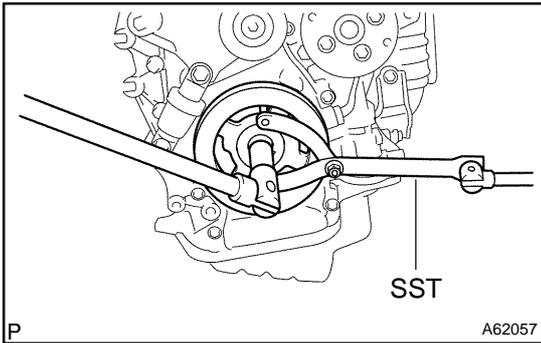
10. INSTALL TIMING GEAR CASE OR TIMING CHAIN CASE OIL SEAL

- (a) Apply MP grease to a new oil seal lip.
NOTICE:
Keep the lip off foreign materials.
 (b) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
 SST 09223-22010
NOTICE:
Wipe off extra grease on the crankshaft.



11. INSTALL CRANKSHAFT PULLEY

- (a) Install the crankshaft pulley (TMC made).
 - (1) Align the pulley set key with the key groove of the pulley.
 - (2) Using SST, install the pulley bolt.
- SST 09213-54015 (91651-60855), 09330-00021
Torque: 170 N·m (1,733 kgf·cm, 125 ft·lbf)



- (b) Install the crankshaft pulley (TMMK made).
 - (1) Align the pulley set key with the key groove of the pulley.
 - (2) Using SST, install the pulley bolt.
- SST 09960-10010 (09962-01000, 09963-01000)
Torque: 170 N·m (1,733 kgf·cm, 125 ft·lbf)

12. INSTALL FAN AND GENERATOR V BELT

(See page 14-5)

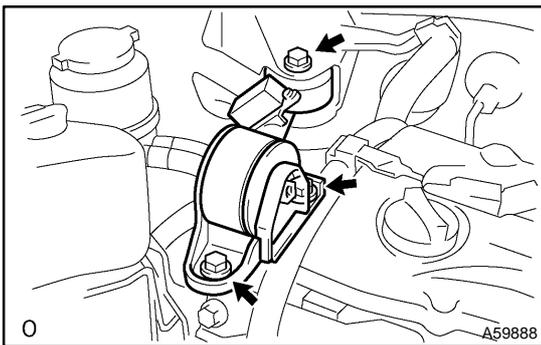
SST 09249-63010

13. INSTALL ENGINE MOUNTING BRACKET NO.2 RH

Torque: 52 N·m (531 kgf·cm, 38 ft·lbf)

14. INSTALL ENGINE MOUNTING STAY NO.2 RH

Torque: 64 N·m (653 kgf·cm, 47 ft·lbf)



15. INSTALL ENGINE MOVING CONTROL ROD W/BRACKET

- (a) Install the engine moving control rod w/bracket with 3 bolts.
- Torque: 64 N·m (653 kgf·cm, 47 ft·lbf)**

16. INSTALL FRONT WHEEL RH

Torque: 103 N·m (1,050 kgf·cm, 76 ft·lbf)

17. INSPECT OIL LEAK

ENGINE REAR OIL SEAL (2AZ-FE)

REPLACEMENT

140HX-01

1. SEPARATE AUTOMATIC TRANSAXLE ASSY(A/T TRANSAXLE)

(See Page 40-14)

HINT:

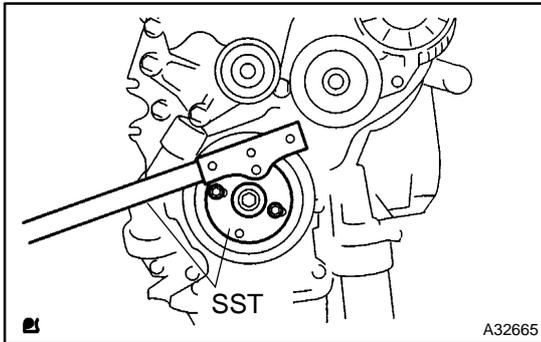
Remove and install the transaxle assembly after removing the engine assy w/transaxle.

2. SEPARATE MANUAL TRANSAXLE ASSY(M/T TRANSAXLE)

(See page 41-11)

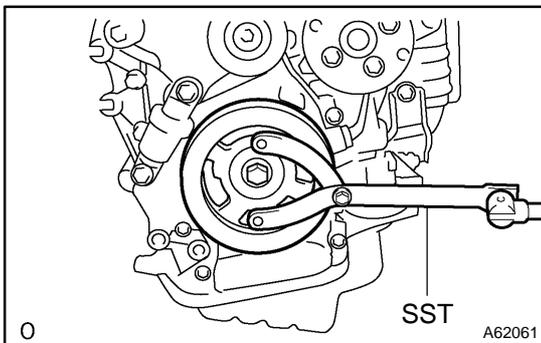
HINT:

Remove and install the transaxle assembly after removing the engine assy w/transaxle.



3. REMOVE DRIVE PLATE & RING GEAR SUB-ASSY(A/T TRANSAXLE)

- (a) Fix the crankshaft with SST (TMC made).
SST 09213-54015 (91651-60855), 09330-00021



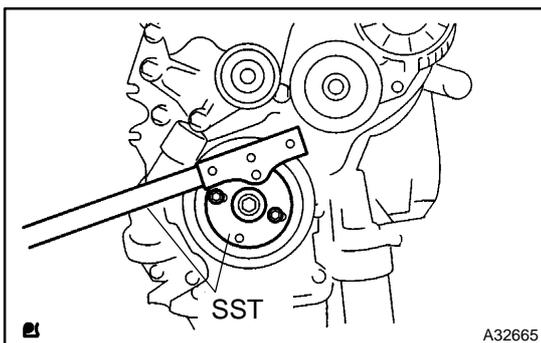
- (b) Fix the crankshaft with SST (TMMK made).
SST 09960-10010 (09962-01000, 09963-01000)
- (c) Remove the 8 bolts, rear spacer, drive plate and front spacer.

4. REMOVE CLUTCH COVER ASSY(M/T TRANSAXLE)

(See page 42-14)

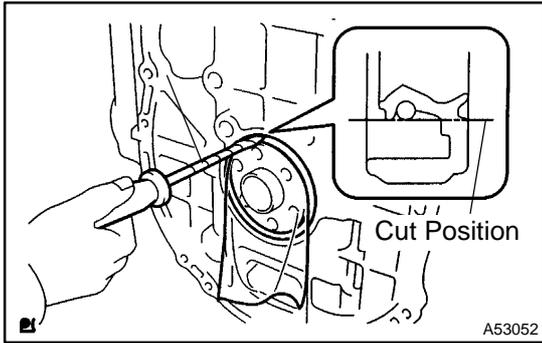
5. REMOVE CLUTCH DISC ASSY(M/T TRANSAXLE)

(See page 42-14)



6. REMOVE FLYWHEEL SUB-ASSY(M/T TRANSAXLE)

- (a) Fix the crankshaft with SST.
SST 09213-54015 (91651-60855), 09330-00021
- (b) Remove the 8 bolts, rear spacer, flywheel sub-assy.

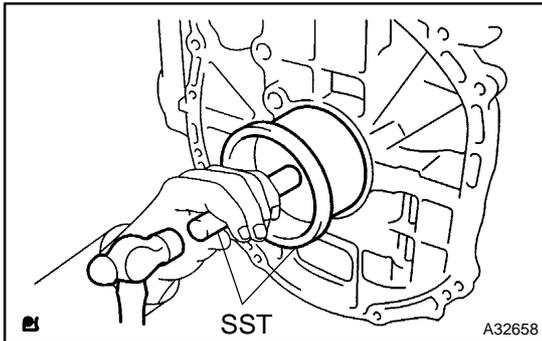


7. REMOVE ENGINE REAR OIL SEAL

- (a) Using a knife, cut off the oil seal lip.
- (b) Using a screwdriver with taping its tip, pry out the oil seal.

HINT:

After the removal, check if the crankshaft is not damaged. If there is, mend it with a sandpaper (#400).



8. INSTALL ENGINE REAR OIL SEAL

- (a) Apply MP grease to a new oil seal lip.

NOTICE:

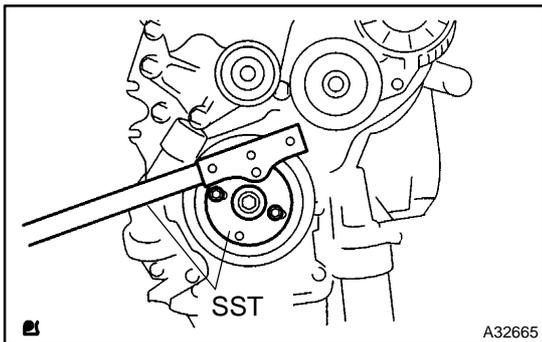
Keep the lip off foreign materials.

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

SST 09223-15030, 09950-70010 (09951-07100)

NOTICE:

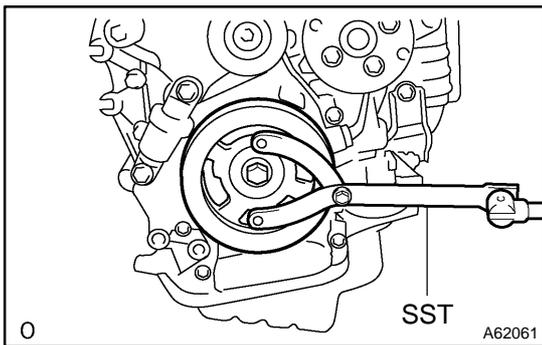
Wipe off extra grease on the crankshaft.



9. INSTALL DRIVE PLATE & RING GEAR SUB-ASSY(A/T TRANSAXLE)

- (a) Fix the crankshaft with SST (TMC made).

SST 09213-54015 (91651-60855), 09330-00021



- (b) Fix the crankshaft with SST (TMMK made).

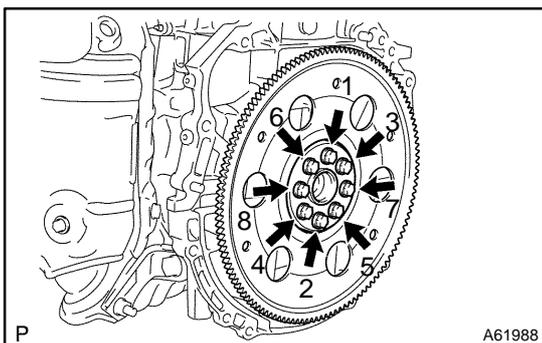
SST 09960-10010 (09962-01000, 09963-01000)

- (c) Clean the bolt and the bolt hole.

- (d) Apply Adhesive to 2 or 3 threads of the bolt end.

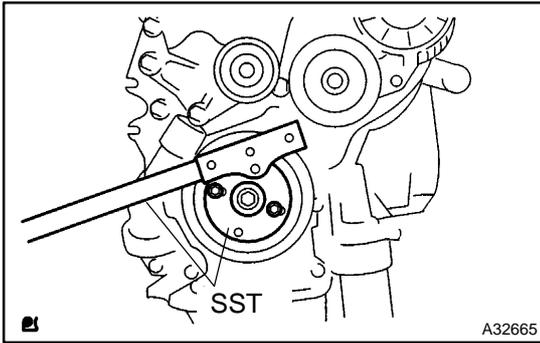
Adhesive :

Part No. 08833-00070, THREE BOND or equivalent



- (e) Install and uniformly tighten the 8 bolts, in several passes, in the sequence shown.

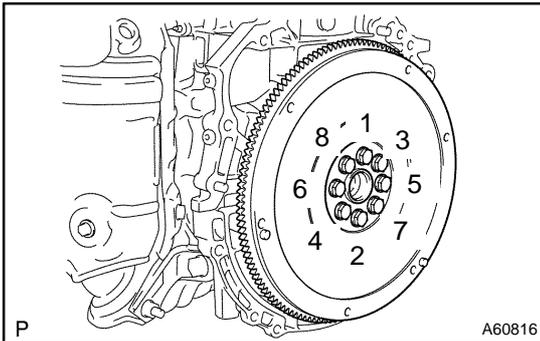
Torque: 98 N·m (1,000 kgf·cm, 72 ft·lbf)

**10. INSTALL FLYWHEEL SUB-ASSY(M/T TRANSAXLE)**

- (a) Fix the crankshaft with SST.
SST 09213-54015 (91651-60855), 09330-00021
- (b) Clean the bolt and the bolt hole.
- (c) Apply Adhesive to 2 or 3 threads of the bolt end.

Adhesive:

Part No. 08833-00070, THREE BOND or equivalent.



- (d) Install and uniformly tighten the 8 bolts, in several passes, in the sequence shown.

Torque: 130 N·m (1,330 kgf·cm, 96 ft·lbf)

11. INSTALL CLUTCH DISC ASSY(M/T TRANSAXLE)

(See page 42-14)

12. INSTALL CLUTCH COVER ASSY(M/T TRANSAXLE)

(See page 42-14)

13. INSTALL AUTOMATIC TRANSAXLE ASSY(A/T TRANSAXLE)

(SeePage 40-14)

14. INSTALL MANUAL TRANSAXLE ASSY(M/T TRANSAXLE)

(See page 41-11)

CYLINDER HEAD ASSY (2AZ-FE)

14061-02

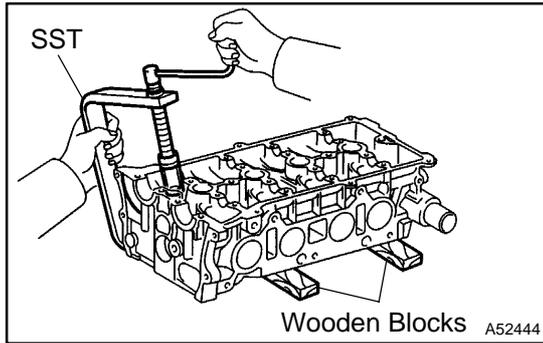
OVERHAUL

1. REMOVE VALVE LIFTER

HINT:

Arrange the valve lifters in the correct order.

2. REMOVE INTAKE VALVE



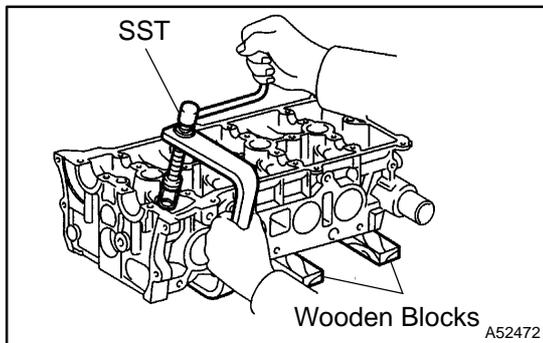
- (a) Using SST and wooden blocks, compress and remove the 8 valve spring retainer locks.
SST 09202-70020 (09202-00010)
- (b) Remove the parts below from the cylinder head.

1	Retainer
2	Valve spring
3	Intake valve

HINT:

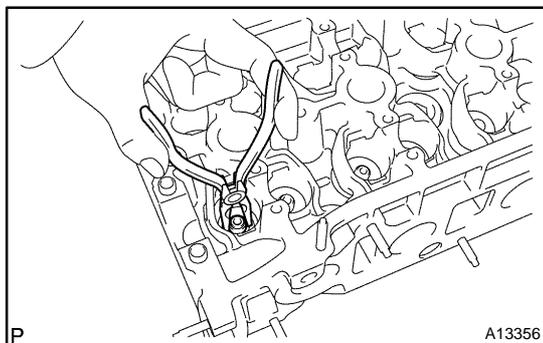
Arrange the removed parts in the correct order.

3. REMOVE EXHAUST VALVE



- (a) Using SST and wooden blocks, compress and remove the 8 valve spring retainer locks.
SST 09202-70020 (09202-00010)
- (b) Remove the parts below from the cylinder head.

1	Retainer
2	Valve spring
3	Exhaust valve

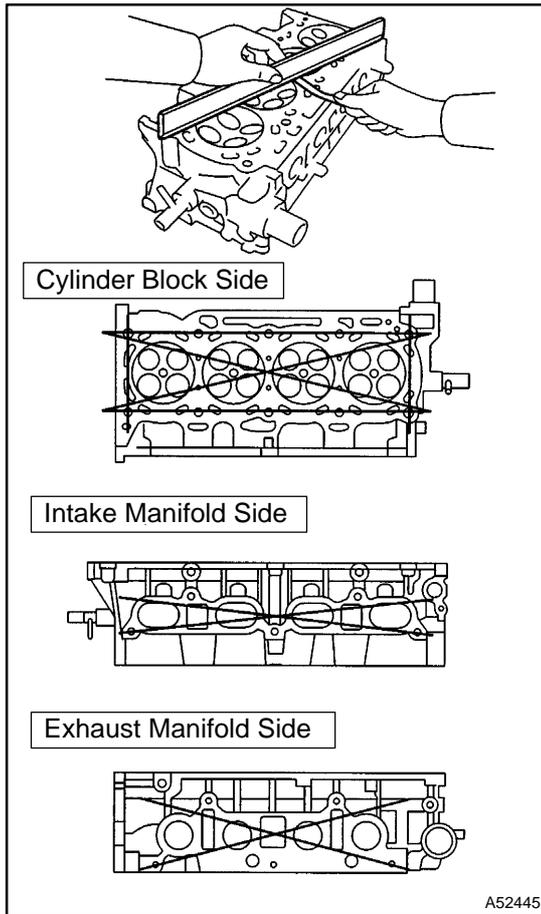


4. REMOVE VALVE STEM OIL O SEAL OR RING

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

5. REMOVE VALVE SPRING SEAT

6. REMOVE STUD BOLT



7. INSPECT CYLINDER HEAD FOR FLATNESS

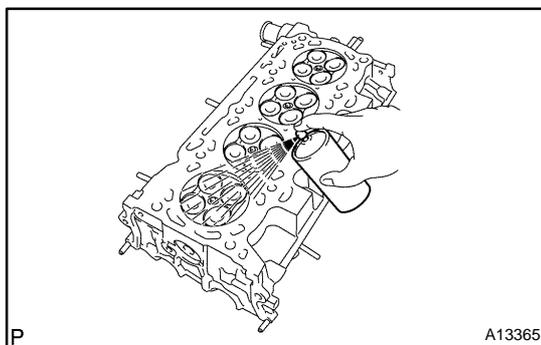
- (a) Using a precision straight edge and a feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

Maximum warpage:

Cylinder block side 0.05 mm (0.0020 in.)

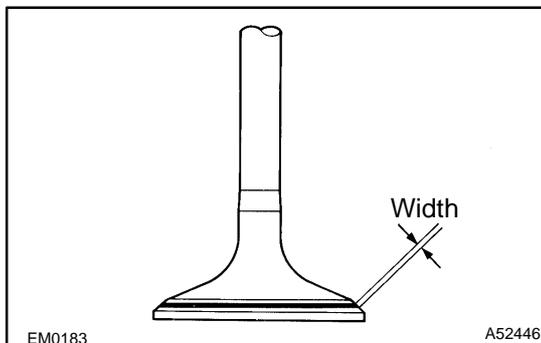
Intake manifold side 0.08 mm (0.0031 in.)

Exhaust manifold side 0.08 mm (0.0031 in.)



8. INSPECT CYLINDER HEAD FOR CRACKS

- (a) Using a dye penetrant, check the intake ports, exhaust ports and cylinder surface for cracks.



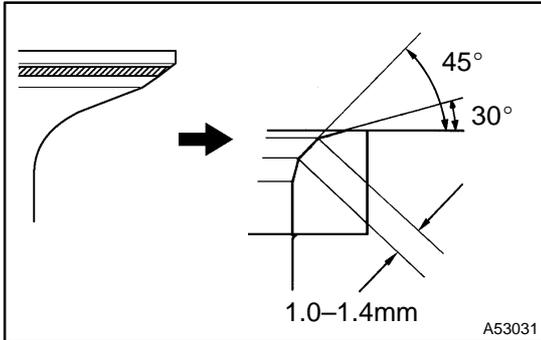
9. INSPECT VALVE SEATS

- (a) Apply a light coat of prussian blue (or white lead) to the valve face.
- (b) Lightly press the valve against the seat.
- (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 – 1.4 mm (0.039 – 0.055 in.).

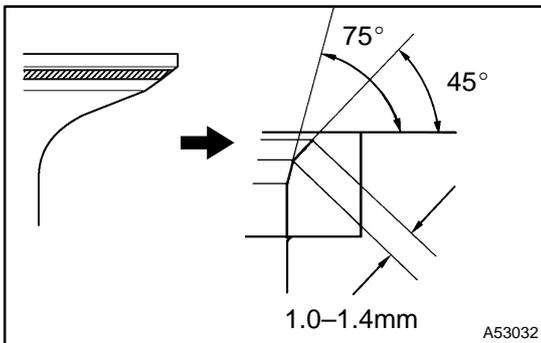
10. REPAIR VALVE SEATS

NOTICE:

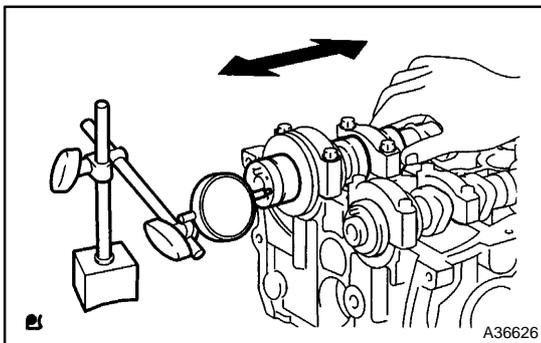
Take off a cutter gradually to make smooth seats.



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



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



11. 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:

Intake 0.040 – 0.095 mm (0.0016 – 0.0037 in.)

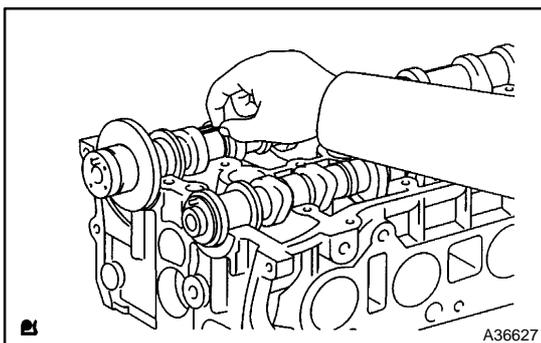
Exhaust 0.080 – 0.135 mm (0.0032 – 0.0053 in.)

Maximum thrust clearance:

Intake 0.11 mm (0.0043 in.)

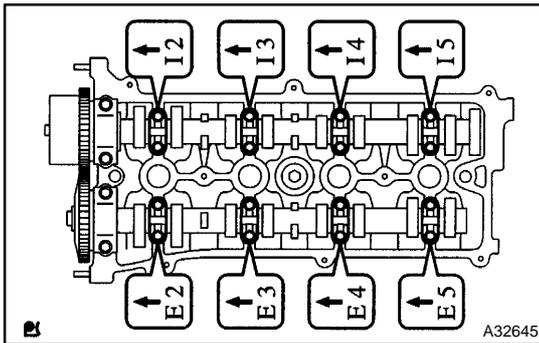
Exhaust 0.15 mm (0.0059 in.)

- (c) If the thrust clearance is greater than maximum, replace the cylinder head. If the thrust surface is damaged, replace the camshaft.



12. INSPECT CAMSHAFT OIL CLEARANCE

- (a) Clean the bearing caps and camshaft journals.
- (b) Place the camshafts on the cylinder head.
- (c) Lay a strip of plastigage across each of the camshaft journal.



- (d) Install the bearing caps.

Torque:

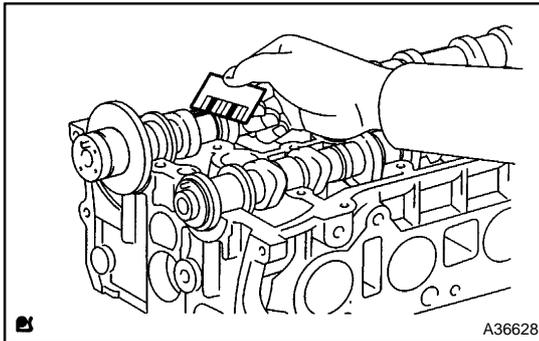
No. 1 30 N·m (301 kgf·cm, 22 ft·lbf)

No. 2 30 N·m (301 kgf·cm, 22 ft·lbf)

No. 3 9 N·m (92 kgf·cm, 80 in·lbf)

NOTICE:

Do not turn the camshaft.



- (e) Remove the bearing cap, and measure the plastigage at its widest point.

Standard oil clearance:

Intake No. 1 journal bearing mark 1

0.007 – 0.038 mm (0.0028 – 0.00150 in.)

Intake No. 1 journal bearing mark 2

0.008 – 0.038 mm (0.0031 – 0.00150 in.)

Intake No. 1 journal bearing mark 3

0.008 – 0.038 mm (0.0031 – 0.00150 in.)

Other journals

0.025 – 0.062 mm (0.00098 – 0.00244 in.)

Exhaust No. 1 journal

0.040 – 0.079 mm (0.00157 – 0.00311 in.)

Other journals

0.025 – 0.062 mm (0.00098 – 0.00244 in.)

Maximum oil clearance:

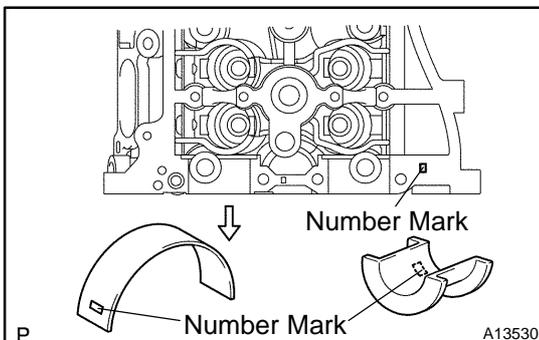
Intake No. 1 journal 0.07 mm (0.0028 in.)

Other journals 0.10 mm (0.0039 in.)

NOTICE:

Completely remove the plastigage after the inspection.

- (f) If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the cylinder head.



- (g) If the oil clearance on No.1 journal is greater than maximum, choose and replace the bearing.

HINT:

Cylinder head journal bore diameter

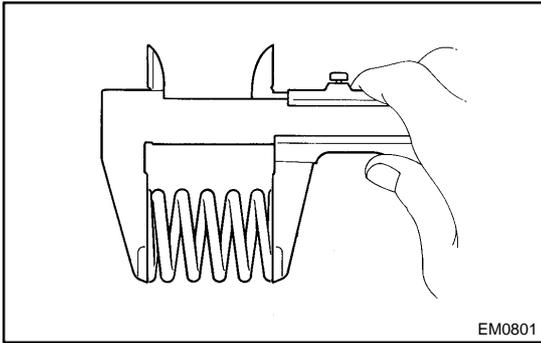
Mark "1"	40.000 – 40.008 mm (1.57480 – 1.57511 in.)
Mark "2"	40.009 – 40.017 mm (1.57515 – 1.57547 in.)
Mark "3"	40.018 – 40.025 mm (1.57551 – 1.57578 in.)

Standard bearing center wall thickness

Mark "1"	2.000 – 2.004 mm (0.07874 – 0.07890 in.)
Mark "2"	2.005 – 2.008 mm (0.07894 – 0.07905 in.)
Mark "3"	2.009 – 2.012 mm (0.07909 – 0.07921 in.)

Camshaft journal diameter

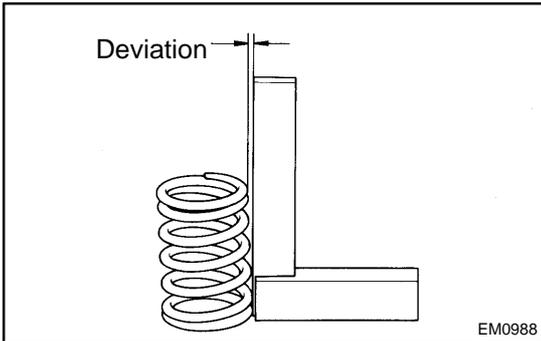
	35.971 – 35.985 mm (1.41648 – 1.41673 in.)
--	--



13. INSPECT INNER COMPRESSION SPRING

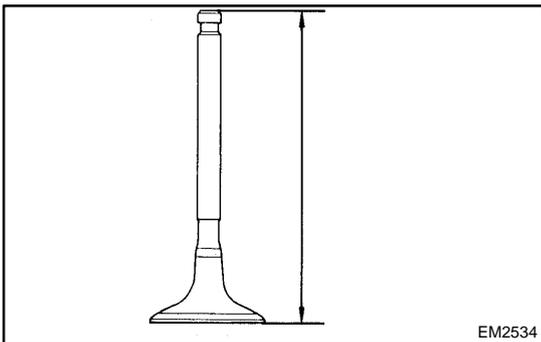
- (a) Check the free length.
 - (1) Using vernier calipers, measure the free length of the valve spring.

Free length: 45.7 mm (1.799 in.)



- (b) Check the deviation.
 - (1) Using a steel square, measure the deviation of the valve spring.

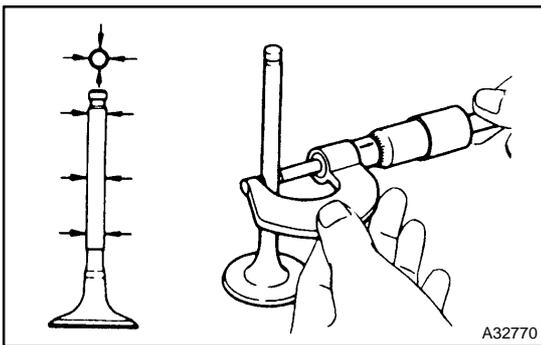
Maximum deviation: 1.6 mm (0.063 in.)
Maximum angle (reference): 2°



14. INSPECT INTAKE VALVE

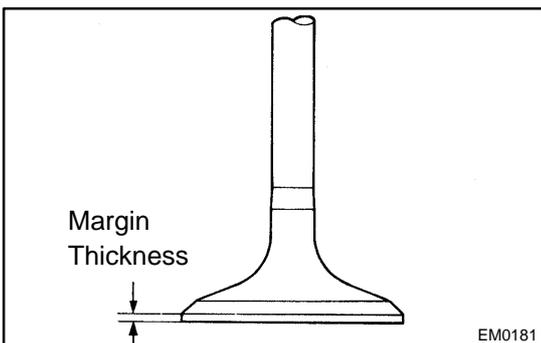
- (a) Check the valve overall length.
 - (1) Using vernier calipers, measure the valve overall length.

Standard overall length: 101.71 mm (4.0043in.)
Minimum overall length: 101.21 mm (3.9846in.)



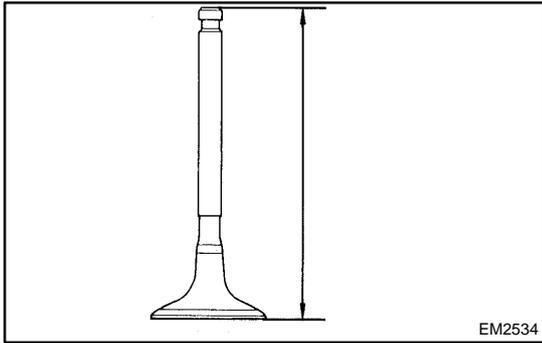
- (b) Check the diameter of the valve stem.
 - (1) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:
5.470 – 5.485 mm (0.2154 – 0.2159 in.)



- (c) Check the valve head margin thickness.
 - (1) Using vernier calipers, measure the valve head margin thickness.

Standard margin thickness:
1.05 – 1.45 mm (0.041 – 0.057 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)

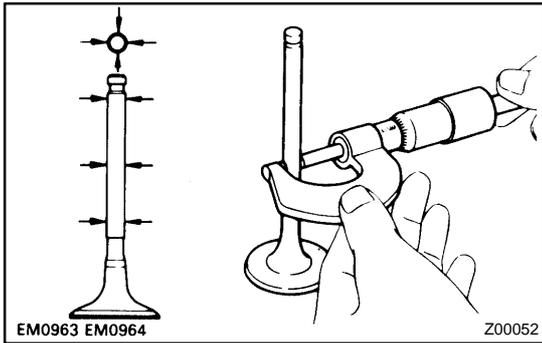


15. INSPECT EXHAUST VALVE

- (a) Check the valve overall length.
 - (1) Using vernier calipers, measure the valve overall length.

Standard overall length: 101.15 mm (3.9823in.)

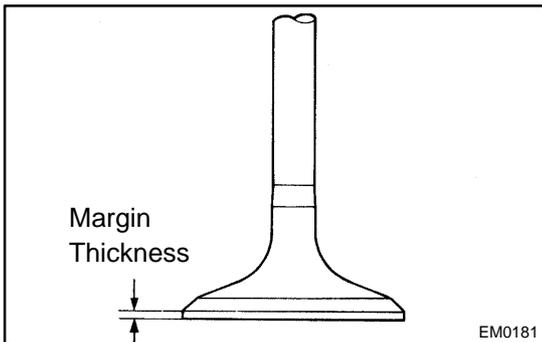
Minimum overall length: 100.70 mm (3.9646 in.)



- (b) Check the diameter of the valve stem.
 - (1) Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

5.465 – 5.480 mm (0.2152 – 0.2157 in.)

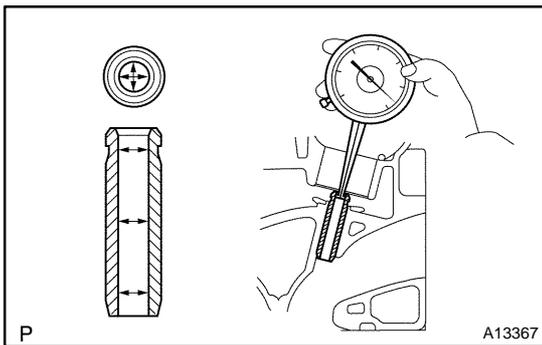


- (c) Check the valve head margin thickness.
 - (1) Using vernier calipers, measure the valve head margin thickness.

Standard margin thickness:

1.2 – 1.6 mm (0.047 – 0.063 in.)

Minimum margin thickness: 0.5 mm (0.020 in.)



16. INSPECT INTAKE VALVE GUIDE BUSH

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

Bushing inside diameter:

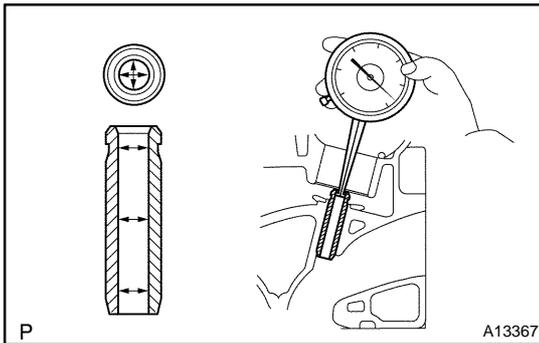
5.510 – 5.530 mm (0.2169 – 0.2177 in.)

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

Standard oil clearance:

0.025 – 0.060 mm (0.00098 – 0.00236 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

**17. INSPECT EXHAUST VALVE GUIDE BUSH**

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

Bushing inside diameter:

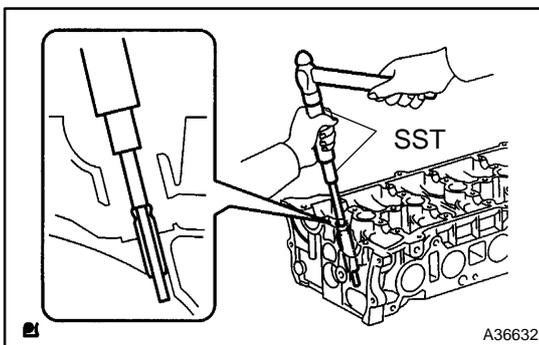
5.510 – 5.530 mm (0.2169 – 0.2177 in.)

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

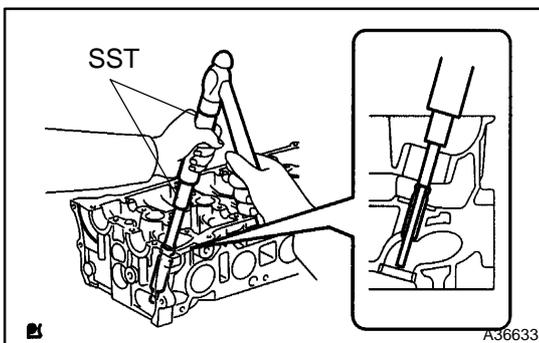
Standard oil clearance:

0.030 – 0.065 mm (0.0012 – 0.0026 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

**18. REMOVE INTAKE VALVE GUIDE BUSH**

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

**19. REMOVE EXHAUST VALVE GUIDE BUSH**

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

20. INSTALL INTAKE VALVE GUIDE BUSH

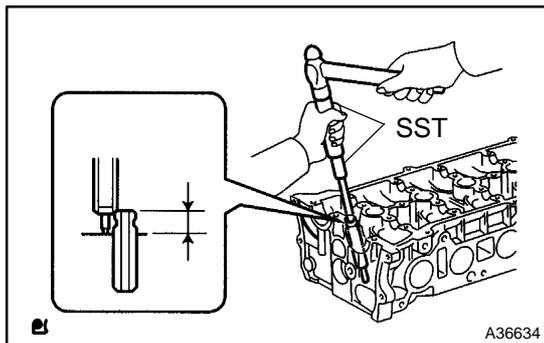
- (a) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Diameter: 10.285 – 10.306 mm (0.4049 – 0.4057 in.)

- (b) Install the STD bushing if the diameter is within specified diameter.

HINT:

STD	10.333 – 10.344 mm (0.4068 – 0.4072 in.)
-----	--



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

Protrusion height: 9.6 – 10.0 mm (0.3779 – 0.3937 in.)

SST 09201-10000 (09201-01050), 09950-70010
(09951-07100), 23801

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

Standard oil clearance:

0.025 – 0.060 mm (0.00098 – 0.00236 in.)

21. INSTALL EXHAUST VALVE GUIDE BUSH

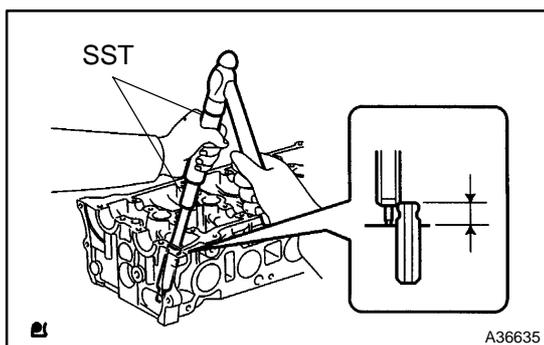
- (a) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

Diameter: 10.285 – 10.306 mm (0.4049 – 0.4057 in.)

- (b) Install the STD bushing if the diameter is within specified diameter.

HINT:

STD	10.333 – 10.344 mm (0.4068 – 0.4072 in.)
-----	--



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

Protrusion height: 9.6 – 10.0 mm (0.3779 – 0.3937 in.)

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

SST 09201-10000 (09201-01050), 09950-70010
(09951-07100), 23801

Standard oil clearance:

0.030 – 0.065 mm (0.00118 – 0.00256 in.)

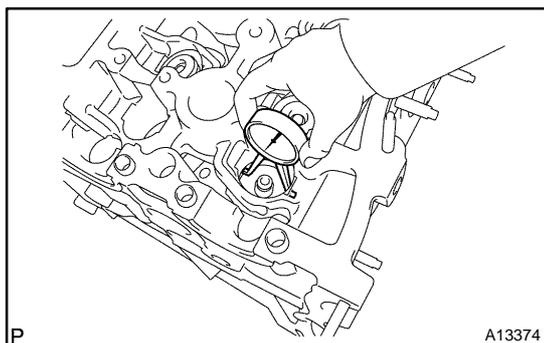
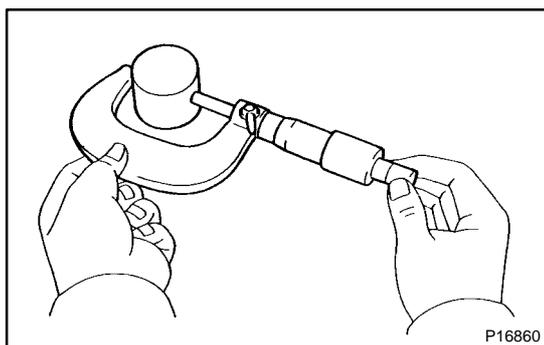
22. INSPECT VALVE LIFTER

- (a) Check the lifter diameter.

(1) Using a micrometer, measure the lifter diameter.

Lifter diameter:

30.966 – 30.976 mm (1.2191 – 1.2195 in.)



- (b) Check the valve lifter oil clearance.

(1) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

Lifter bore diameter:

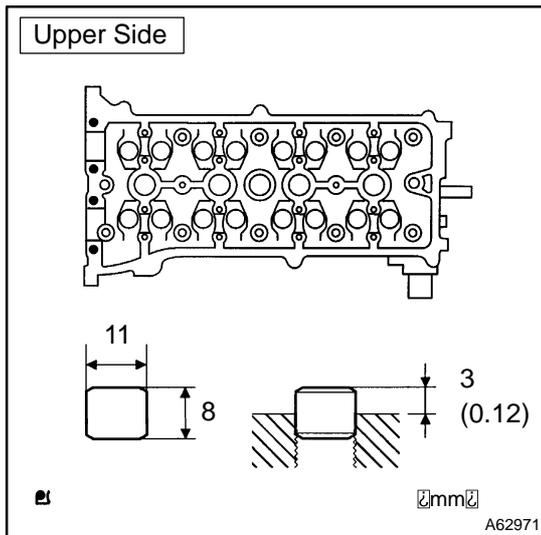
31.009 – 31.025 mm (1.2208 – 1.2215 in.)

- (c) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

Standard oil clearance:

0.033 – 0.059 mm (0.0013 – 0.0023 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)



23. INSTALL RING W/HEAD PIN

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

Protrusion height: 3 mm (0.12 in.)

24. INSTALL STUD BOLT

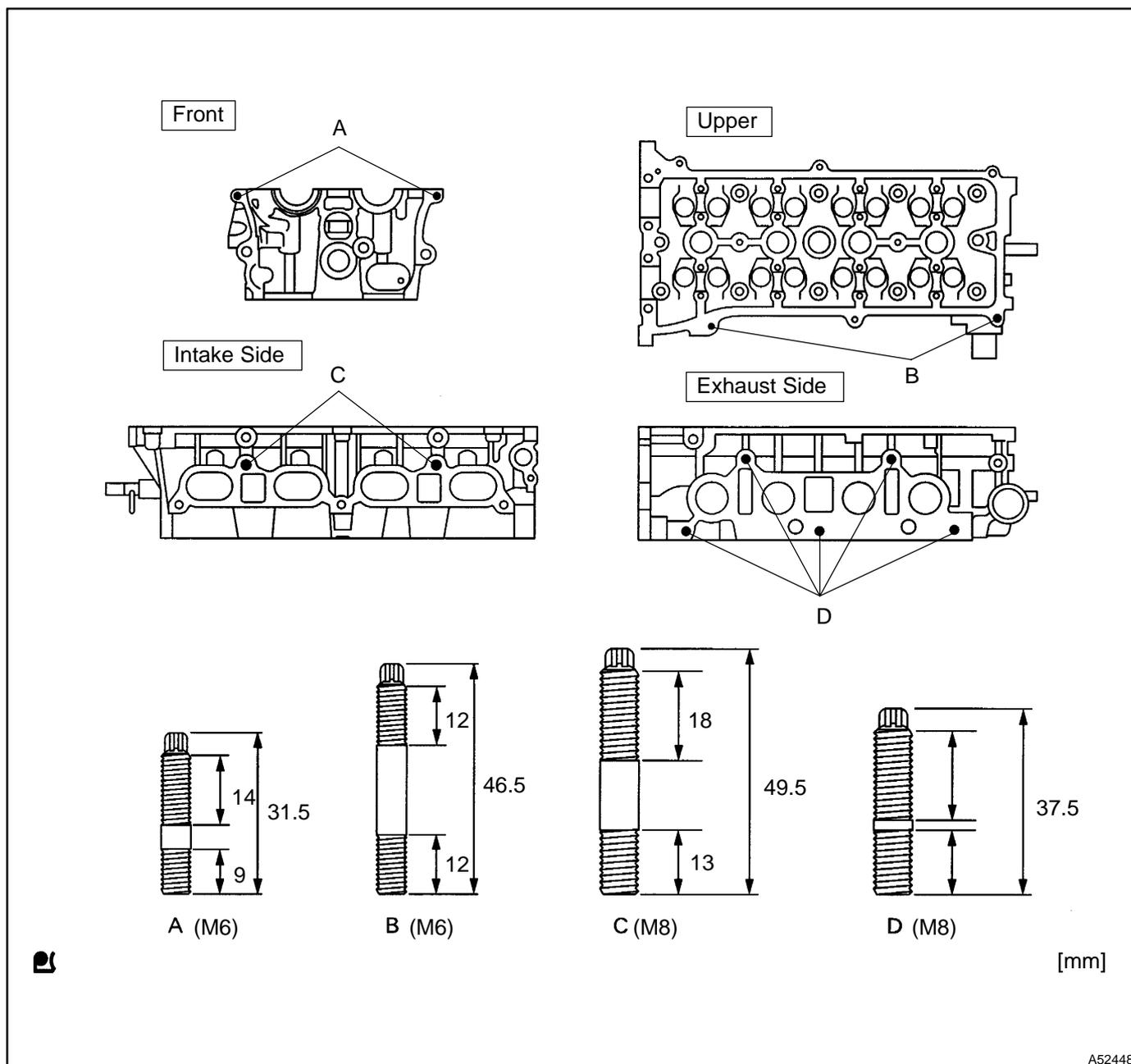
Torque:

Bolt A 5 N·m (51 kgf·cm, 44 in.·lbf)

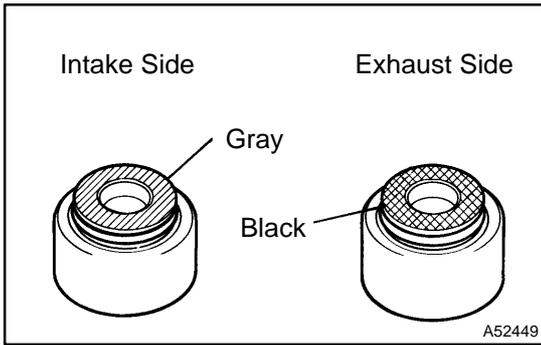
Bolt B 5 N·m (51 kgf·cm, 44 in.·lbf)

Bolt C 10 N·m (97 kgf·cm, 84 in.·lbf)

Bolt D 10 N·m (97 kgf·cm, 84 in.·lbf)



25. INSTALL VALVE SPRING SEAT



26. INSTALL VALVE STEM OIL O SEAL OR RING

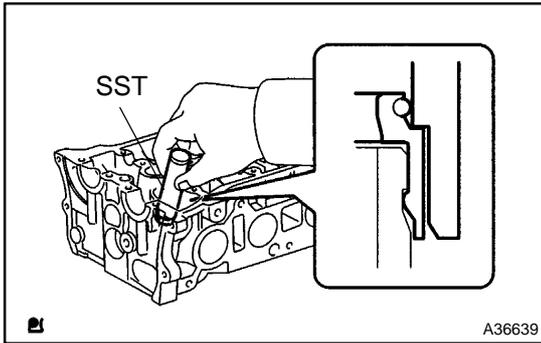
(a) Apply a light coat of engine oil on new valve stem seals.

NOTICE:

Pay much attention assembling the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.

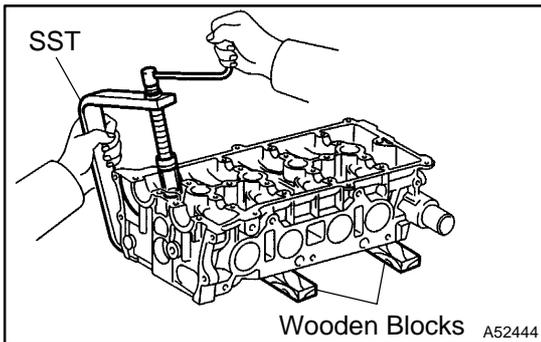
HINT:

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



(b) Using SST, push in a the oil seal.

SST 09201-41020



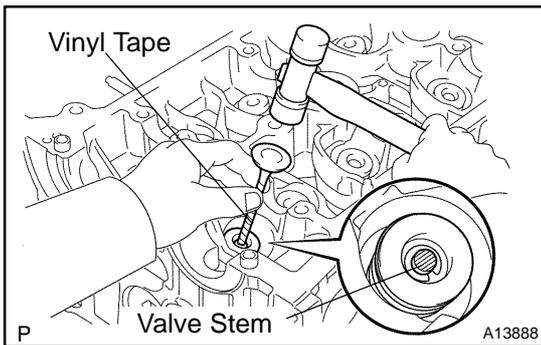
27. INSTALL INTAKE VALVE

(a) Install the parts below to the cylinder head.

1	Intake valve
2	Spring
3	Retainer

(b) Using SST and wooden blocks, compress and install 2 valve spring retainer locks.

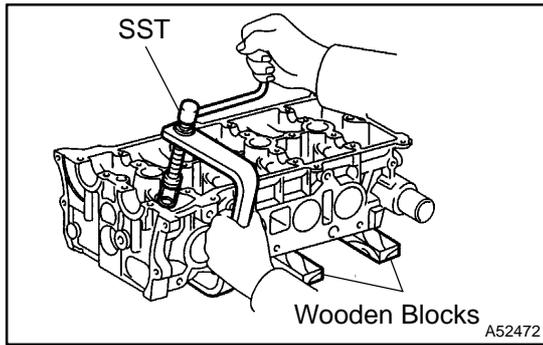
SST 09202-70020 (09202-00010)



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

NOTICE:

Be careful not to damage the valve stem tip.



28. INSTALL EXHAUST VALVE

- (a) Install the parts below to the cylinder head.

1	Exhaust valve
2	Spring
3	Retainer

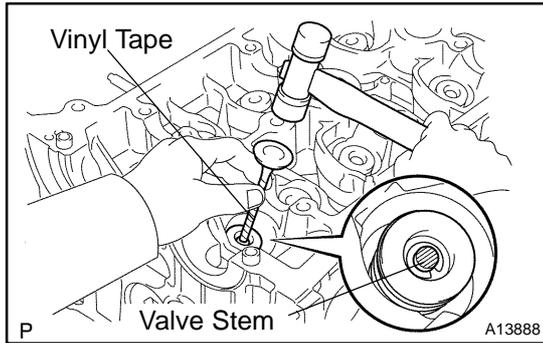
- (b) Using SST and wooden blocks, compress and install 2 valve spring retainer locks.

SST 09202-70020 (09202-00010)

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

NOTICE:

Be careful not to damage the valve stem tip.



29. INSTALL VALVE LIFTER

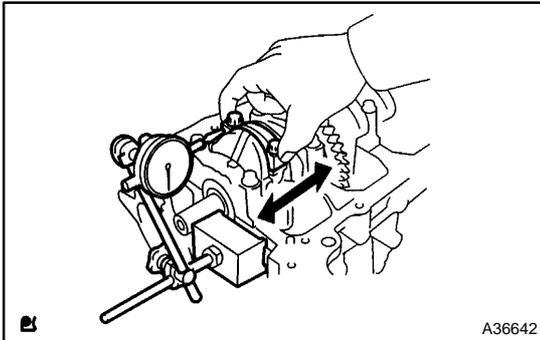
- (a) Assemble the valve lifter and the tip of the valve stem with a light coat of engine oil applied.

NOTICE:

Install the valve lifters originally placed.

CYLINDER BLOCK (2AZ-FE) OVERHAUL

14062-02



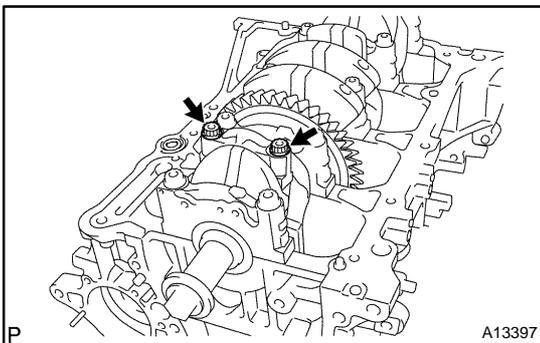
1. **INSPECT CONNECTING ROD THRUST CLEARANCE**
 - (a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance:

0.160 – 0.362 mm (0.0063 – 0.0143 in.)

Maximum thrust clearance: 0.362 mm (0.0143 in.)

- (b) If the thrust clearance is greater than maximum, replace the connecting rod assembly(s). If necessary, replace the crankshaft.



2. INSPECT CONNECTING ROD OIL CLEARANCE

HINT:

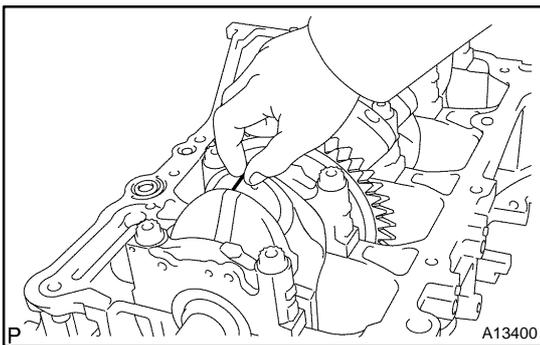
The connecting rod cap bolts are tightened in 2 progressive steps.

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

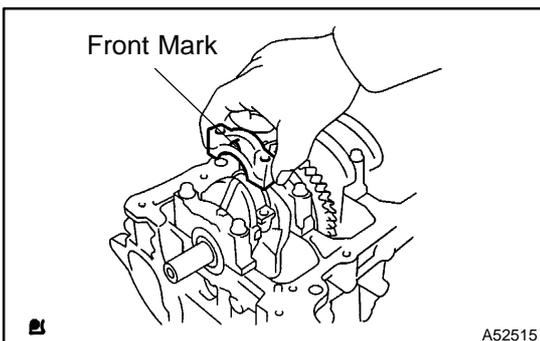
HINT:

The matchmarks on the connecting rods and caps are for ensuring correct reassembly.

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

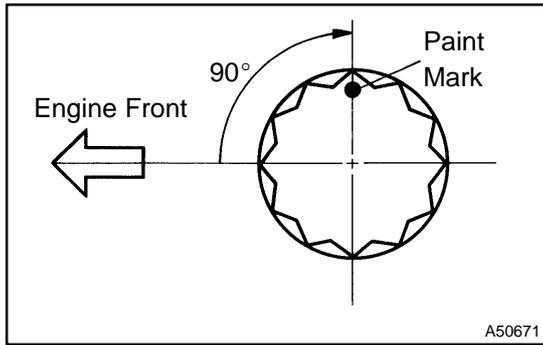


- (e) Lay a strip of plastigage on the crank pin.



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

Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)

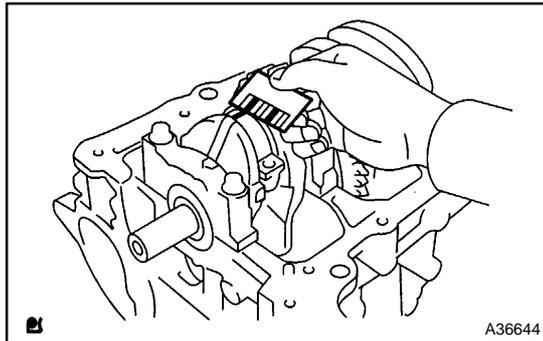


- (i) Mark the front of the connecting rod cap bolts with paint.
- (j) Retighten the cap bolts by 90° as shown in the illustration.

NOTICE:

Do not turn the crankshaft.

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



- (l) Measure the plastigage at its widest point.

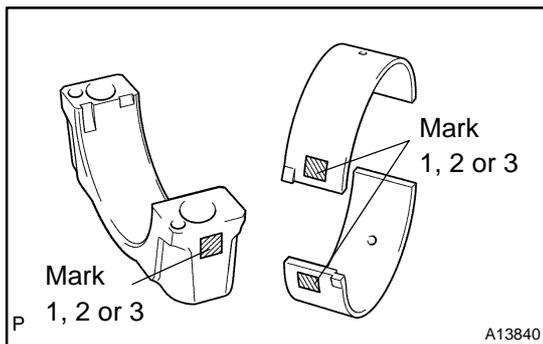
Standard oil clearance:

0.024 – 0.048 mm (0.0009 – 0.0019 in.)

Maximum oil clearance: 0.08 mm (0.0031 in.)

NOTICE:

Completely remove the plastigage.

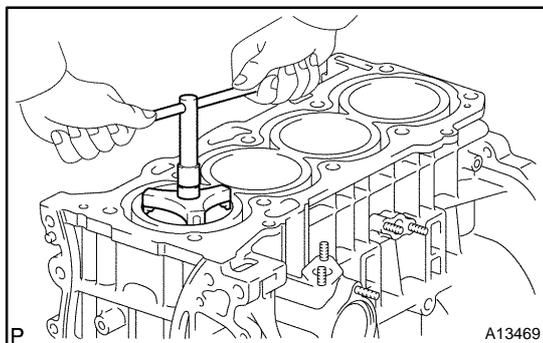


- (m) If replacing a bearing, replace it with one having the same number as marked on the connecting rod. There are 3 sizes of standard bearings, marked "1", "2" and "3" accordingly.

HINT:

Standard bearing center wall thickness.

Mark 1	1.485 – 1.488 mm (0.0585 – 0.0586 in.)
Mark 2	1.488 – 1.491 mm (0.0586 – 0.0587 in.)
Mark 3	1.491 – 1.494 mm (0.0587 – 0.0588 in.)



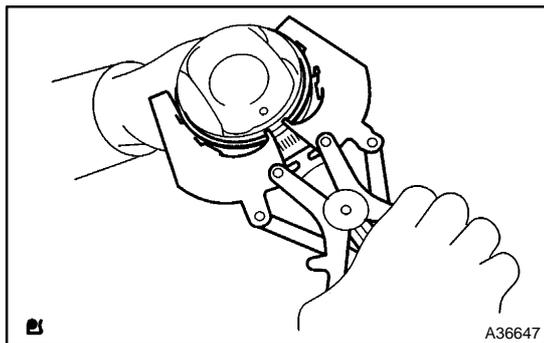
3. REMOVE PISTON SUB-ASSY W/CONNECTING ROD

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

HINT:

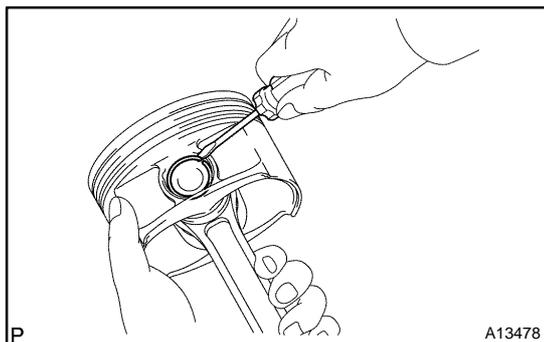
- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

4. REMOVE CONNECTING ROD BEARING



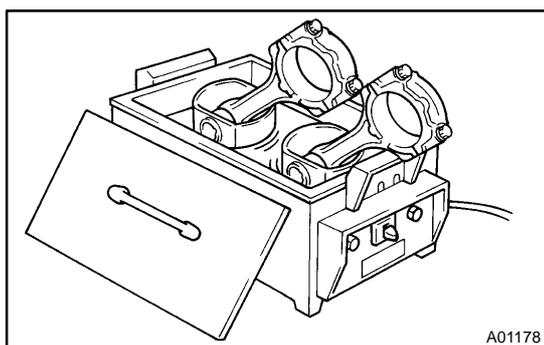
5. REMOVE PISTON RING SET

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



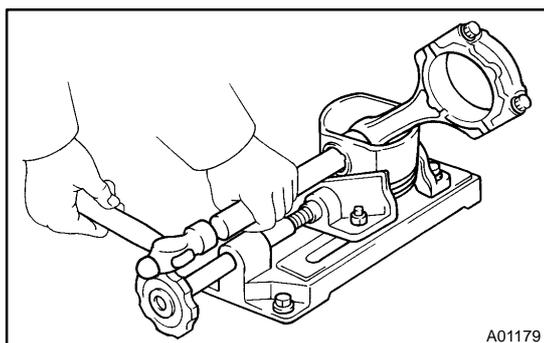
6. REMOVE PISTON PIN HOLE SNAP RING

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



7. REMOVE PISTON

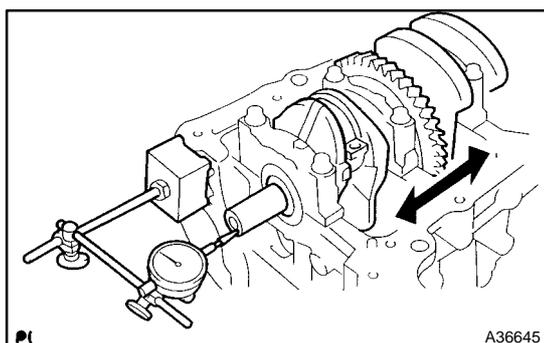
- (a) Gradually heat the piston to 80 – 90 °C (176 – 194 °F).



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

HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.



8. 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:

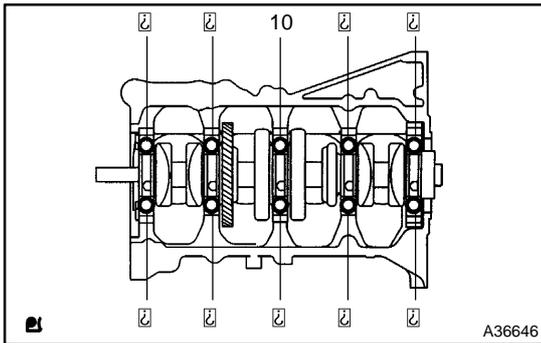
0.040 – 0.240 mm (0.0016 – 0.0094 in.)

Maximum thrust clearance: 0.30 mm (0.0118 in.)

- (b) If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

1.930 – 1.980 mm (0.0760 – 0.0780 in.)



9. REMOVE CRANKSHAFT

- (a) Uniformly loosen and remove the 10 bearing cap sub-assembly bolts, in several passes, in the sequence shown.
- (b) Remove the bearing cap and crankshaft.

10. REMOVE CRANKSHAFT THRUST WASHER UPPER

11. REMOVE CRANKSHAFT BEARING

NOTICE:

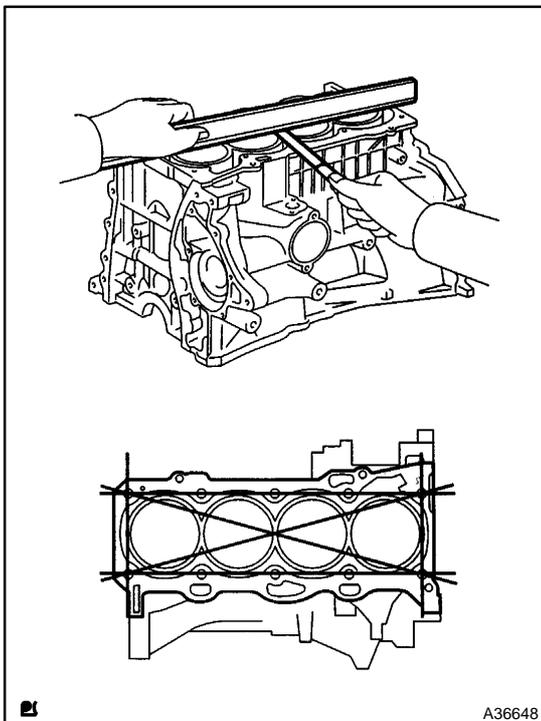
Arrange the bearings in the correct order.

12. REMOVE CRANKSHAFT BEARING NO.2

NOTICE:

Arrange the main bearings and thrust washers in the correct order.

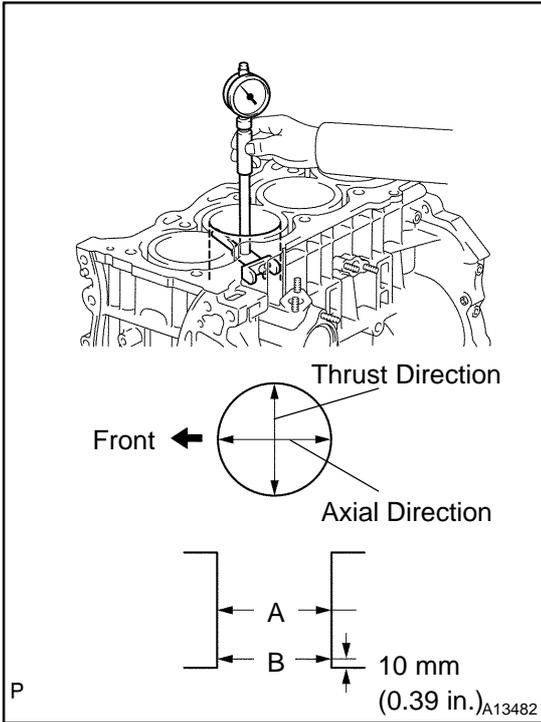
13. REMOVE STUD BOLT



14. INSPECT CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

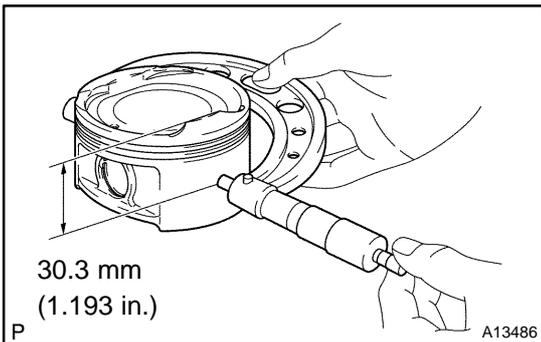


15. INSPECT CYLINDER BORE

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

Standard diameter:

88.500 – 88.513 mm (3.4843 – 3.4848 in.)



16. INSPECT PISTON DIAMETER

- (a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 30.3 mm (1.193 in.) from the piston head.

Piston diameter:

88.439 – 88.449 mm (3.4818 – 3.4822 in.)

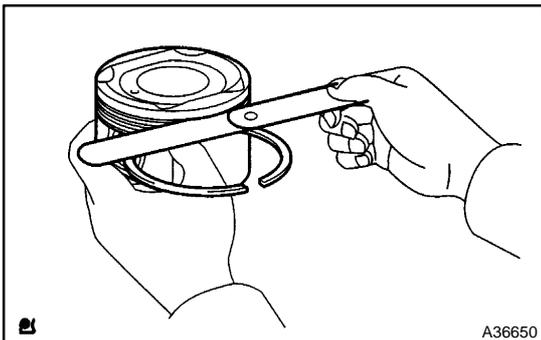
17. INSPECT PISTON CLEARANCE

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

Standard oil clearance: 0.051 – 0.074 mm (0.0020 – 0.0029 in.)

Maximum oil clearance: 0.1 mm (0.0039 in.)

- (b) If the clearance is greater than maximum, replace all the 4 pistons. If necessary, replace the cylinder block.

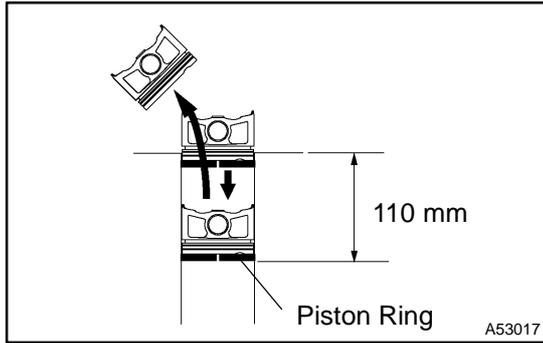


18. INSPECT RING GROOVE CLEARANCE

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

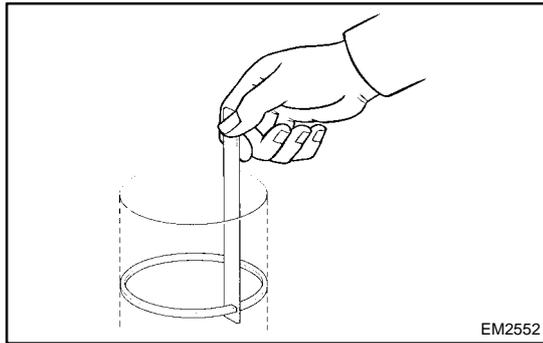
Ring groove clearance:

0.030 – 0.070 mm (0.0012 – 0.0028 in.)

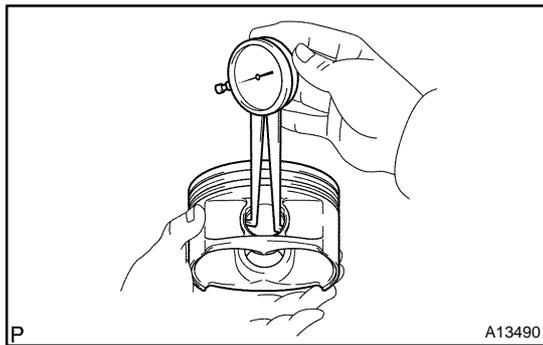


19. INSPECT PISTON RING END GAP

- (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:
 No. 1 0.22 – 0.32 mm (0.0087 – 0.0126 in.)
 No. 2 0.50 – 0.60 mm (0.0197 – 0.0236 in.)
 Oil (side rail) 0.10 – 0.35 mm (0.0039 – 0.0138 in.)
Maximum end gap:
 No. 1 0.89 mm (0.0350 in.)
 No. 2 1.35 mm (0.0531 in.)
 Oil (side rail) 0.73 mm (0.0287 in.)



20. INSPECT PISTON PIN OIL CLEARANCE

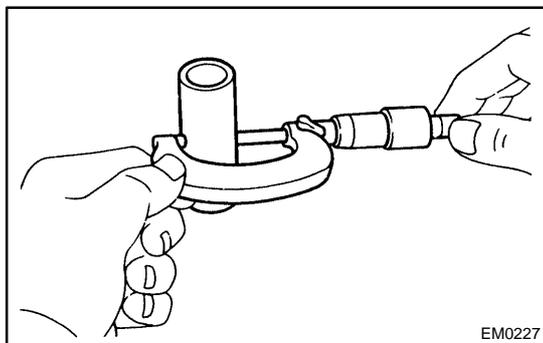
- (a) Using a caliper gauge, measure the inside diameter of the piston bushing.

Bushing inside diameter:
 22.001 – 22.010 mm (0.8662 – 0.8665 in.)

HINT:

Bushing inside diameter

Mark	mm (in.)
A	22.001 – 22.004 (0.8662 – 0.8663)
B	22.114 – 22.007 (0.8663 – 0.8664)
C	22.007 – 22.010 (0.8664 – 0.8665)



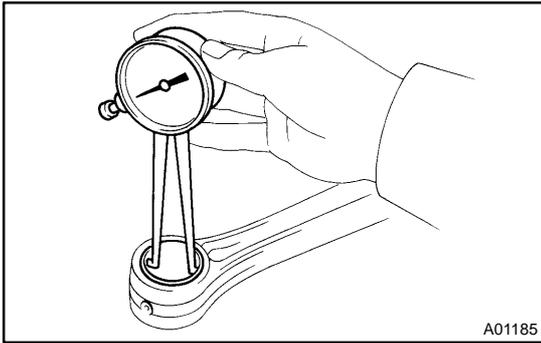
- (b) Using a micrometer, measure the piston pin diameter.

Piston pin diameter:
 21.997 – 22.009 mm (0.8660 – 0.8665 in.)

HINT:

Piston pin diameter

Mark	mm (in.)
A	21.997 – 22.000 (0.8660 – 0.8661)
B	22.000 – 22.003 (0.8661 – 0.8663)
C	22.003 – 22.006 (0.8663 – 0.8664)
D	22.006 – 22.009 (0.8664 – 0.8665)



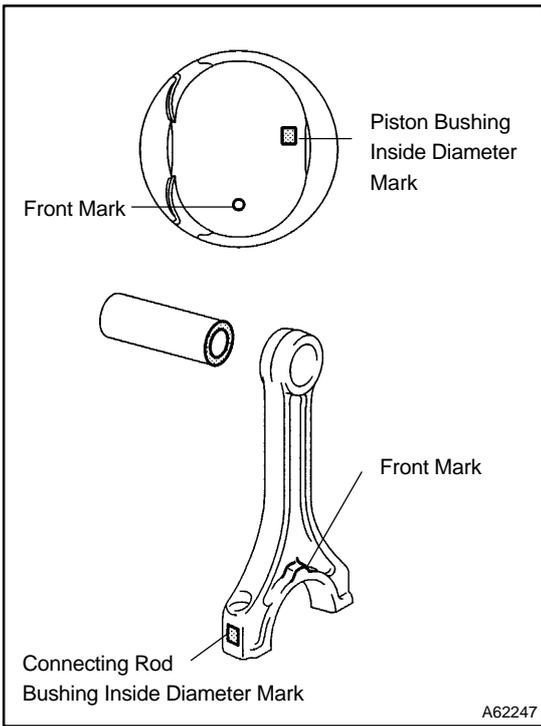
- (c) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.
Bushing inside diameter:
22.005 – 22.014 mm (0.8663 – 0.8667 in.)

HINT:

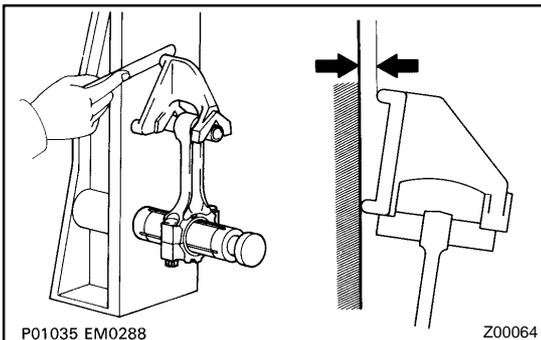
Bushing inside diameter

Mark	mm (in.)
A	22.005 – 22.008 (0.8663 – 0.8665)
B	22.008 – 22.011 (0.8665 – 0.8666)
C	22.011 – 22.014 (0.8666 – 0.8667)

- (d) Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.
Standard oil clearance:
0.001 – 0.007 mm (0.00004 – 0.00028 in.)
Maximum oil clearance: 0.010 mm (0.0020 in.)

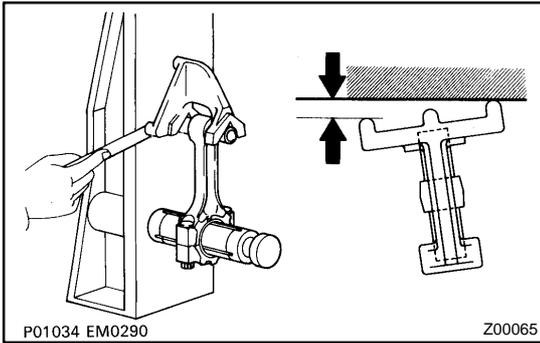


- (e) If the oil clearance is greater than maximum, replace the connecting rod. If necessary, replace the piston and piston pin as a set.
 (f) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.
Standard oil clearance:
0.005 – 0.011 mm (0.0002 – 0.0004 in.)
Maximum oil clearance: 0.010 mm (0.0020 in.)
 (g) If the oil clearance is greater than maximum, replace the connecting rod. If necessary, replace the connecting rod and piston pin as a set.



21. INSPECT CONNECTING ROD SUB-ASSY

- (a) Using a rod aligner and feeler gauge, check the connecting rod alignment.
 (1) Check for out-of-alignment.
Maximum out-of-alignment:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)
 (b) If out-of-alignment is greater than maximum, replace the connecting rod assembly.

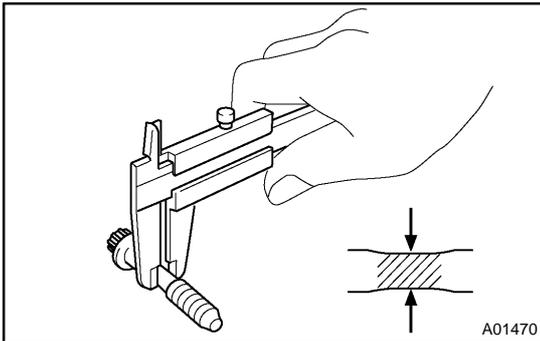


(1) Check for twist.

Maximum twist:

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

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



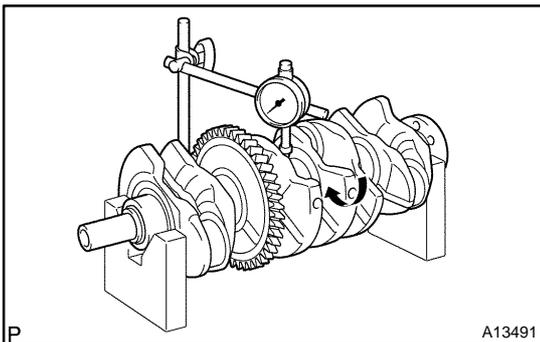
22. INSPECT CONNECTING ROD BOLT

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

Standard diameter: 7.2 – 7.3 mm (0.283 – 0.287 in.)

Minimum diameter: 7.0 mm (0.276 in.)

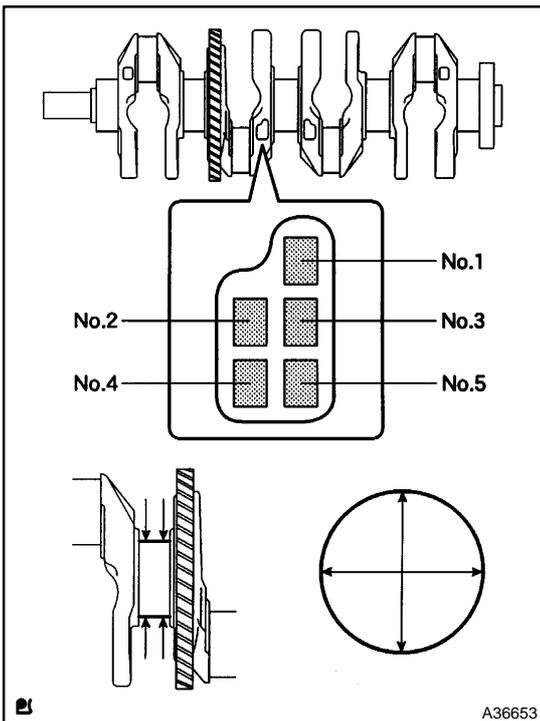
(b) If the diameter is less than minimum, replace the bolt.



23. 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.)



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

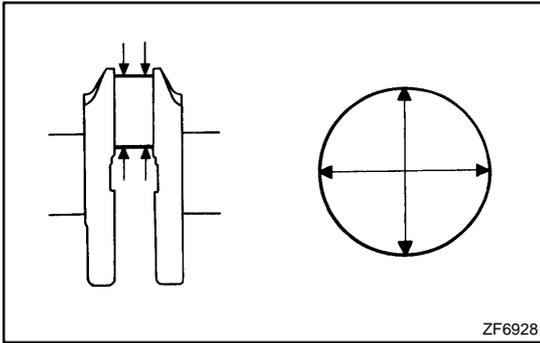
Diameter: 54.988 – 55.000 (2.1648 – 2.06535 in.)

(c) Check each main journal for taper and out-of-round as shown.

Maximum taper and out-of-round: 0.003 mm (0.0001 in.)

HINT:

Mark	mm (in.)
0	54.998 – 55.000 (2.16528 – 2.16535)
1	54.996 – 54.998 (2.16520 – 2.16528)
2	54.994 – 54.996 (2.16512 – 2.16520)
3	54.992 – 54.994 (2.16504 – 2.16512)
4	54.990 – 54.992 (2.16496 – 2.16504)
5	54.988 – 54.990 (2.16490 – 2.16496)

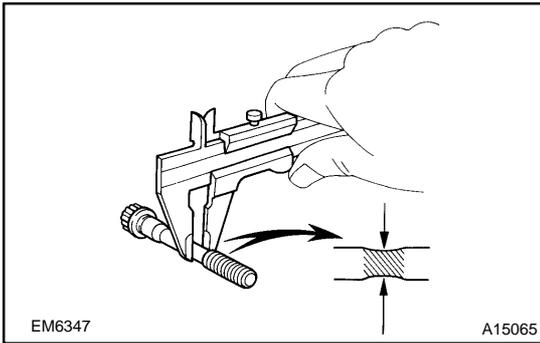


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(d) Using a micrometer, measure the diameter of each crank pin.
Diameter: 47.990 – 48.000 mm (1.8894 – 1.8898 in.)

(e) Check each crank pin for taper and out-of-round as shown.

**Maximum taper and out-of-round:
 0.003 mm (0.0001 in.)**



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24. INSPECT CRANKSHAFT BEARING CAP SET BOLT

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

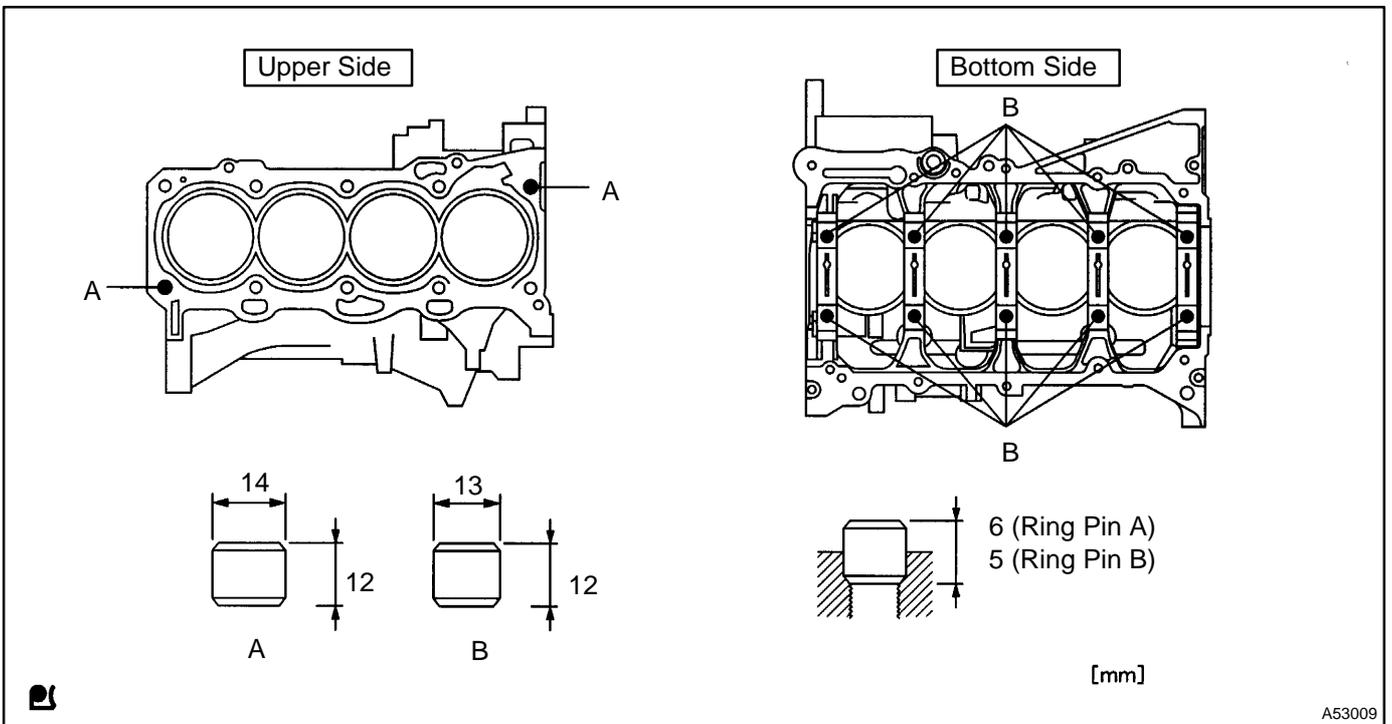
**Standard diameter: 7.5 – 7.6 mm (0.295 – 0.299 in.)
 Minimum diameter: 7.2 mm (0.283 in.)**

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

25. INSTALL RING PIN

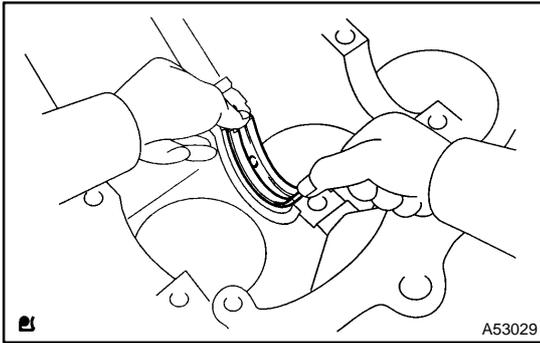
(a) Using a plastic-faced hammer, tap into the ring pin.

**Standard protrusion:
 Ring pin A 6 mm (0.236 in.)
 Ring pin B 5 mm (0.197 in.)**



[mm]

A53009

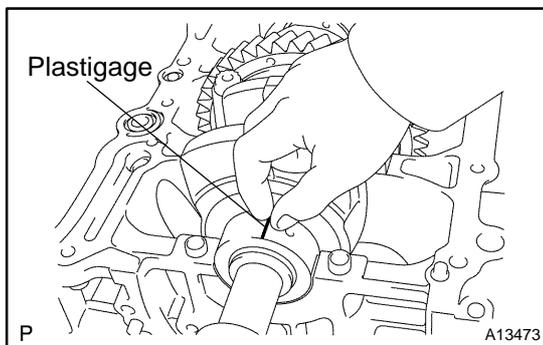


26. INSPECT CRANKSHAFT OIL CLEARANCE

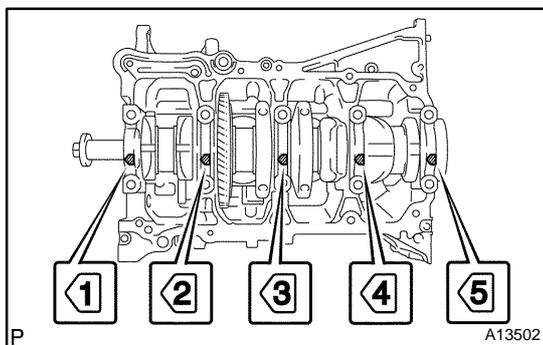
NOTICE:

- Clean the backside of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.
- The bearing cap bolts are tightened in 2 progressive steps.

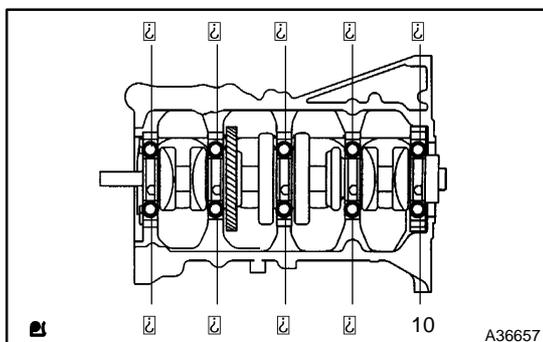
- (a) Clean each main journal and bearing.
- (b) Install the upper bearing with an oil groove on cylinder block.
- (c) Install the lower bearing on the bearing cap sub assembly.
- (d) Place the crankshaft on the cylinder block.



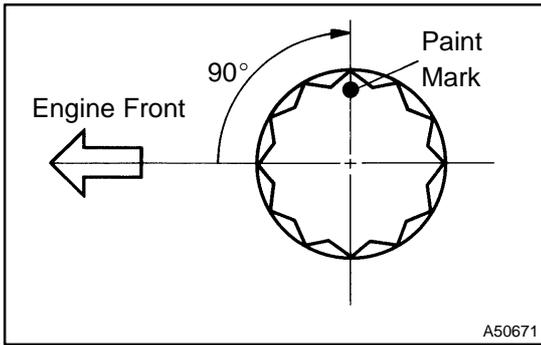
- (e) Lay a strip of plastigage across each journal.



- (f) Examine the front marks and install the bearing caps on the cylinder block.
- (g) Apply a light coat of engine oil on the threads and under the bearing cap bolts.



- (h) Tighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)
- (i) Retighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 40 N·m (408 kgf·cm, 29 ft·lbf)

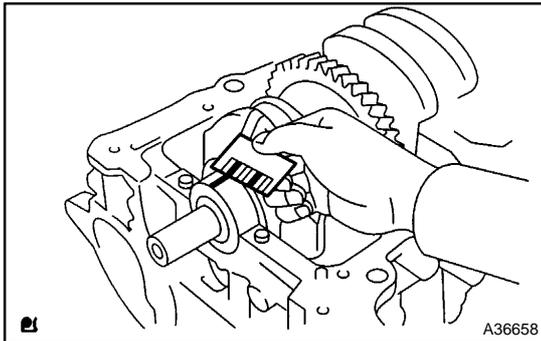


- (j) Mark the front of the bearing cap bolts with paint.
- (k) Retighten the bearing cap bolts by 90° in the numerical order shown.
- (l) Check that the painted mark is now at a 90° angle to the front.

NOTICE:

Do not turn the crankshaft.

- (m) Remove the bearing cap.



- (n) Measure the plastigage at its widest point.

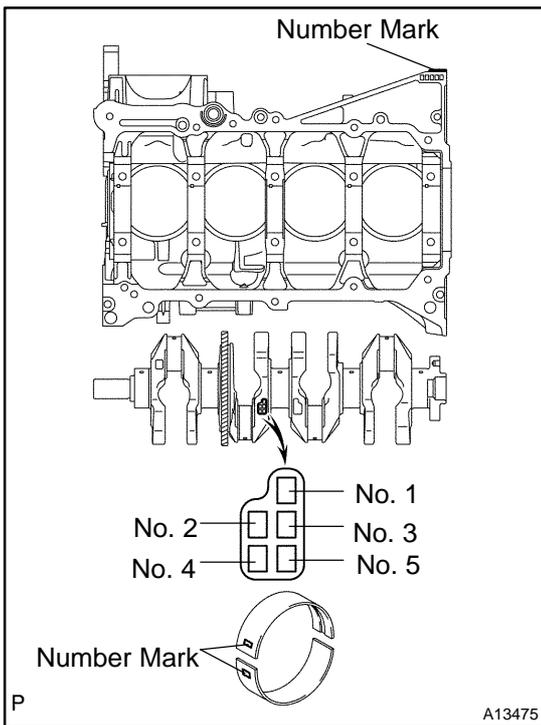
Standard oil clearance:

0.017 – 0.040 mm (0.0007 – 0.0016 in.)

Maximum oil clearance: 0.07 mm (0.0028 in.)

NOTICE:

Completely remove the plastigage.



- (o) If using a standard bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are 4 sizes of standard bearings, marked "1", "2", "3" and "4" accordingly.

Cylinder block (A)				
+				
Crankshaft (B)	0-2	3-5	6-8	9-11
Use bearing	"1"	"2"	"3"	"4"

HINT:

EXAMPLE

Cylinder block "4" (A) + Crankshaft "3" (B) =
Total number 7 (Use bearing "3")

Reference:

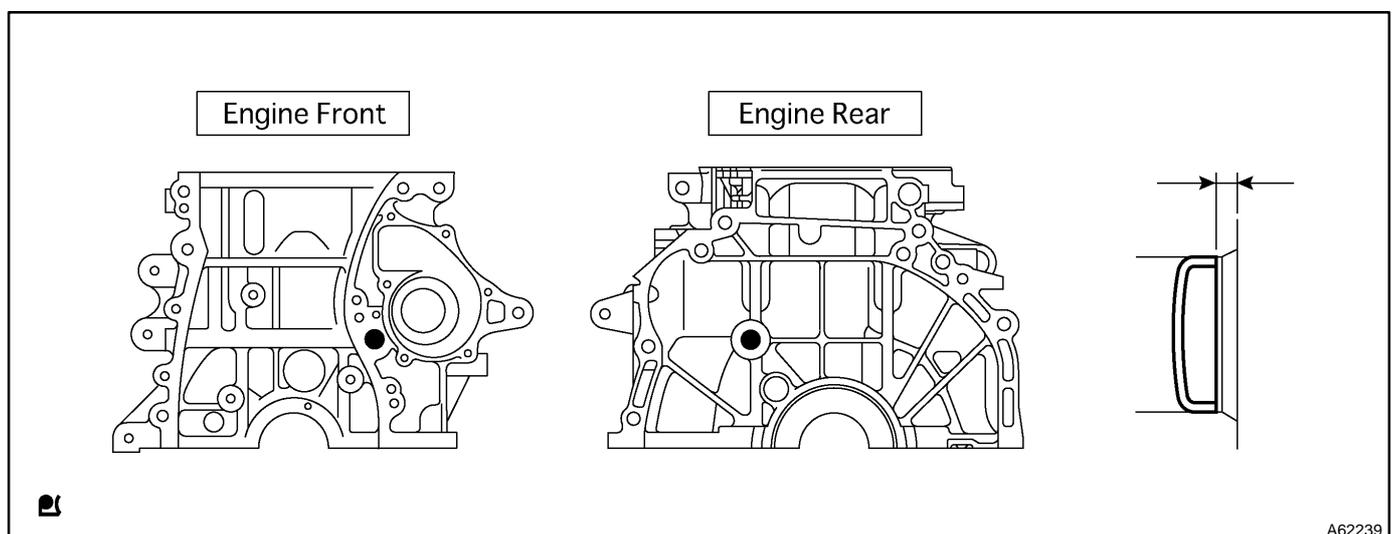
Item	Mark	mm (in.)
Cylinder block main journal bore diameter (A)	0	59.000 – 59.002 (2.08683 – 2.32291)
	1	59.003 – 59.004 (2.08694 – 2.32299)
	2	59.005 – 59.006 (2.08701 – 2.32307)
	3	59.007 – 59.009 (2.08708 – 2.32318)
	4	59.010 – 59.011 (2.08718 – 2.32326)
	5	59.012 – 59.013 (2.08725 – 2.32334)
	6	59.014 – 59.016 (2.08733 – 2.32346)
Crankshaft main journal diameter (B)	0	54.998 – 55.000 (1.94528 – 2.16535)
	1	54.996 – 54.998 (1.94521 – 2.16527)
	2	54.994 – 54.996 (1.94514 – 2.16519)
	3	54.992 – 54.994 (1.94507 – 2.16511)
	4	54.990 – 54.992 (1.94500 – 2.16504)
	5	54.988 – 54.990 (1.94493 – 2.16496)
Standard bearing center wall thickness	1	1.993 – 1.996 (0.07846 – 0.07858)
	2	1.996 – 1.999 (0.07858 – 0.07870)
	3	1.999 – 2.002 (0.07870 – 0.07882)
	4	2.002 – 2.005 (0.07882 – 0.07894)

27. INSTALL TIGHT PLUG

- (a) Apply adhesive around tight plugs.

Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent.

- (b) Using SST, into the tight plugs as shown in the illustration.
-
- SST 09950-60010 (09951-00200), 09950-70010 (09951-07100)

Standard depth:**Engine front 1.7 – 2.7 mm (0.067 – 0.106 in.)****Engine rear 2.2 – 3.2 mm (0.087 – 0.126 in.)**

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28. INSTALL STUD BOLT

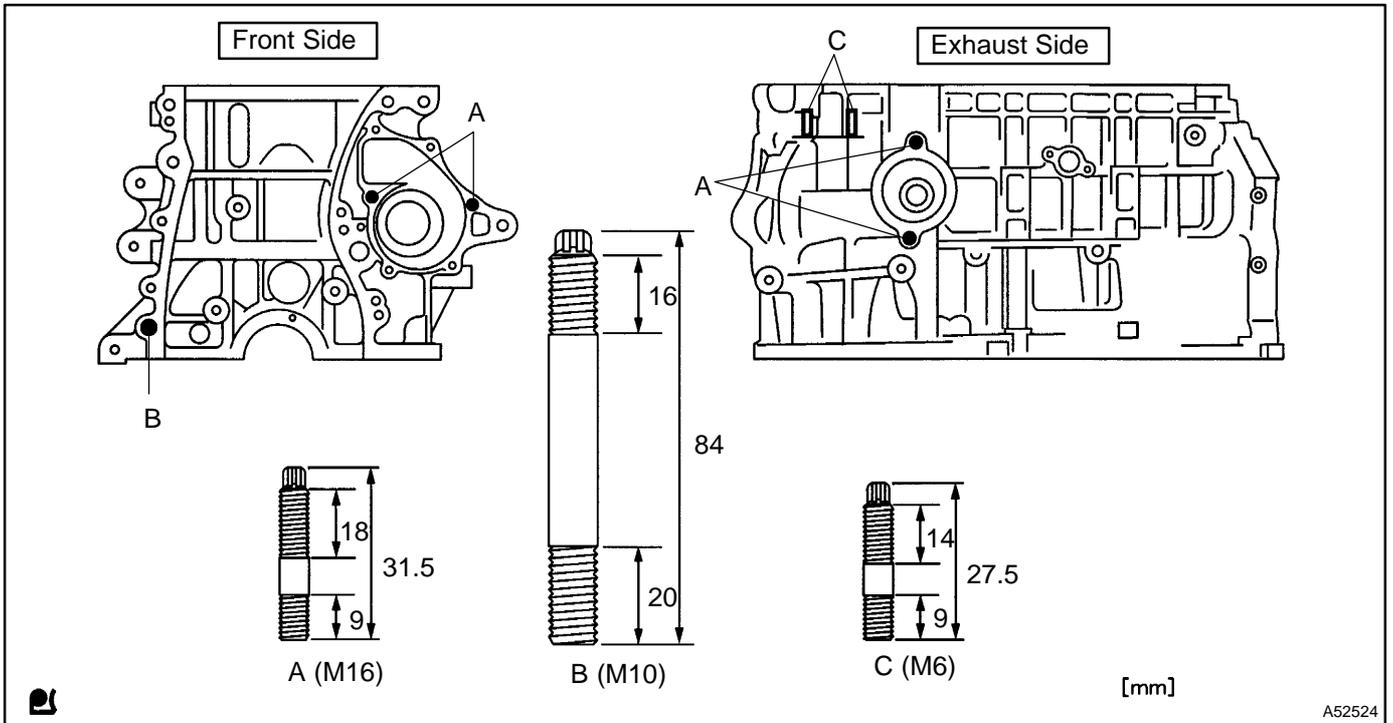
(a) Install the stud bolts as shown in the illustration.

Torque:

Stud bolt A 5.0 N·m (51 kgf·cm, 44 in·lbf)

Stud bolt B 10N·m (97 kgf·cm, 84 in·lbf)

Stud bolt C 5.0N·m (51 kgf·cm, 44 in·lbf)



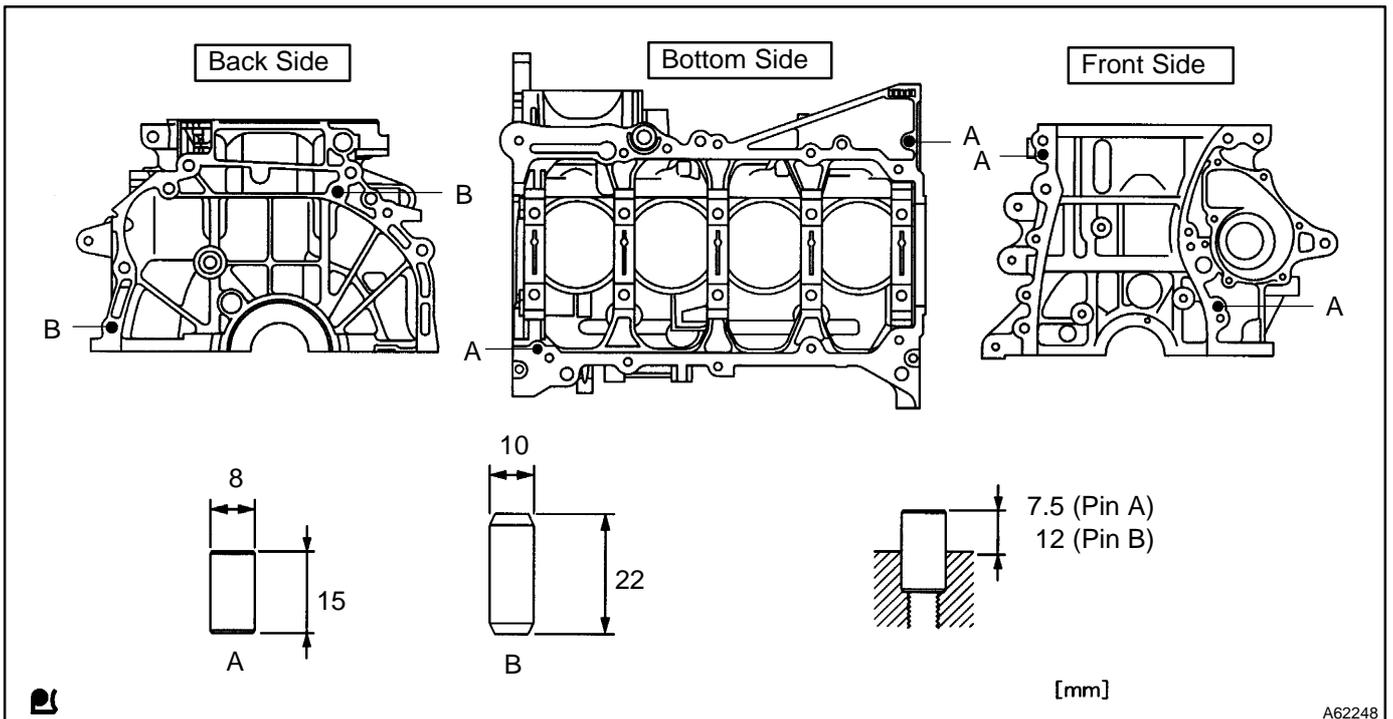
29. INSTALL STRAIGHT PIN

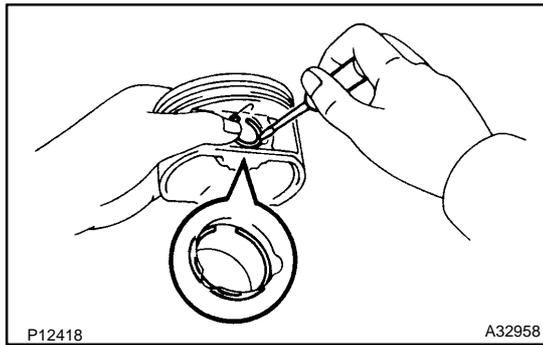
(a) Using a plastic-faced hammer, tap into the straight pin.

Standard protrusion

Pin A 7.5 mm (0.295 in.)

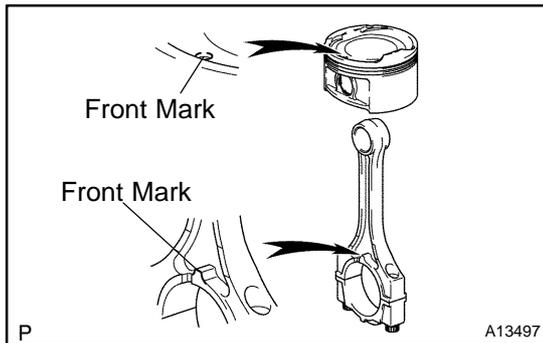
Pin B 12 mm (0.472 in.)



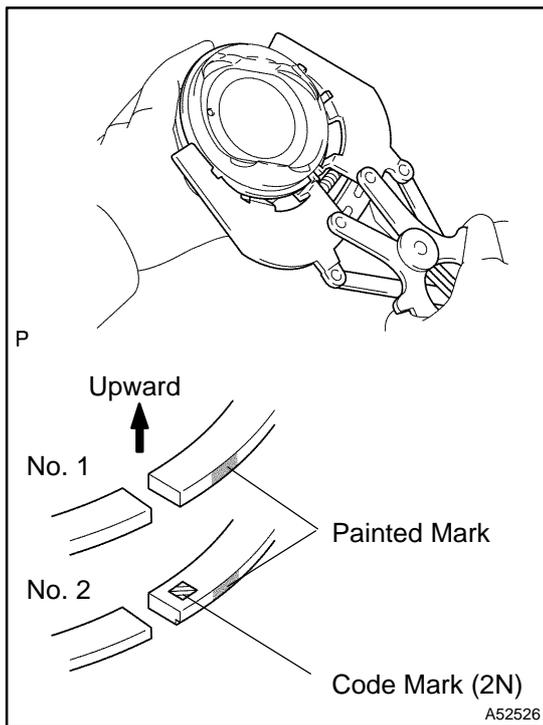


30. INSTALL PISTON

- (a) Using a small screwdriver, install a new snap ring at one end of the piston pin hole.
- (b) Gradually heat the piston to 80 – 90°C (176 – 194°F).



- (c) Align the front marks on the piston with connecting rod, and push in the piston with your thumb.
- (d) Using a small screwdriver, install a new snap ring on the other end of the piston pin hole.

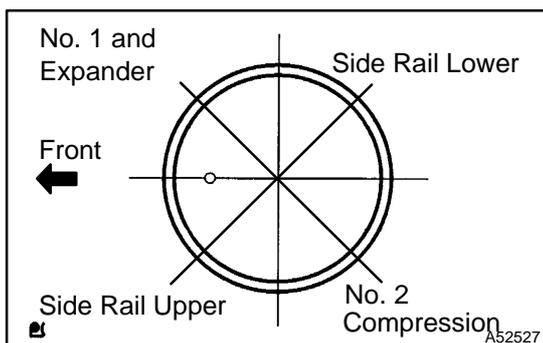


31. INSTALL PISTON RING SET

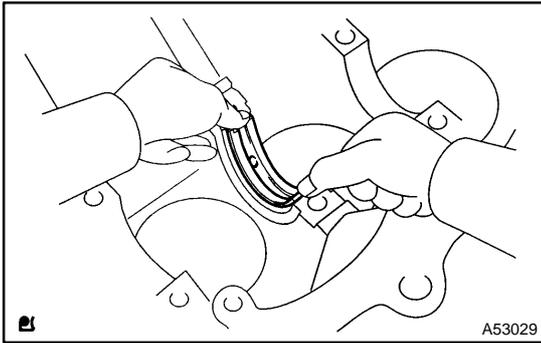
- (a) Install the oil ring expander and 2 side rails by hand.
- (b) Using a piston ring expander, install the 2 compression rings with the point mark facing right side.

NOTICE:

Install the compression ring No. 2 with the code mark (2N) facing upward.



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

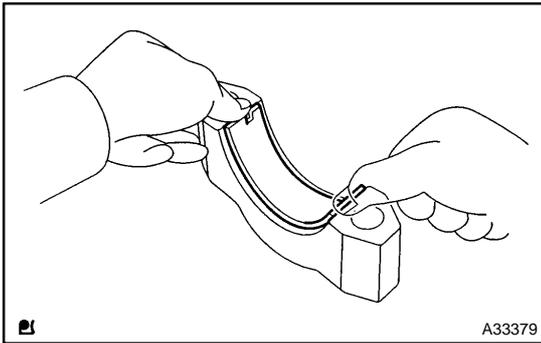


32. INSTALL CRANKSHAFT BEARING

- (a) Install the upper bearing with an oil groove on cylinder block.

NOTICE:

Clean the back side of the bearing and the bearing surface of the cylinder block and let not stick the oils and fats.

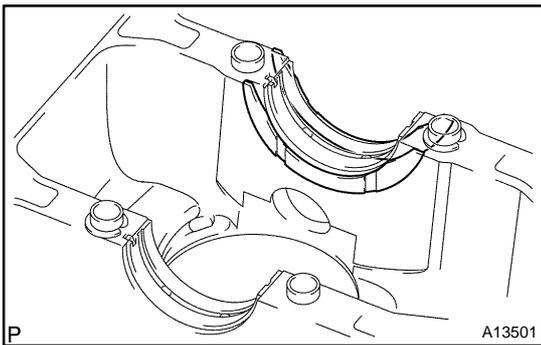


33. INSTALL CRANKSHAFT BEARING NO.2

- (a) Install the lower bearing on bearing cap.

NOTICE:

Clean the back side of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.

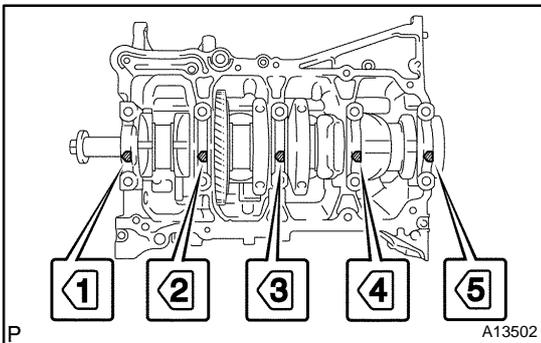


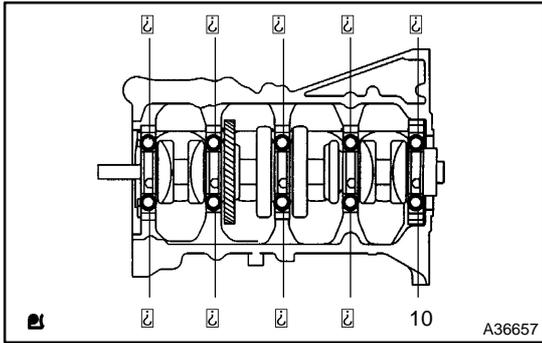
34. INSTALL CRANKSHAFT THRUST WASHER UPPER

- (a) Install the 2 thrust washers under the No. 3 journal position of the cylinder block with the oil grooves facing outward.

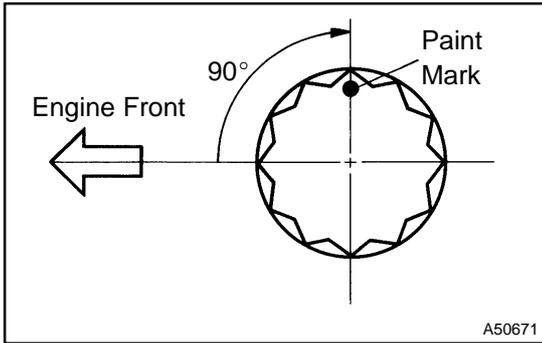
35. INSTALL CRANKSHAFT

- (a) Apply engine oil to upper bearing and install the crankshaft on the cylinder block.
- (b) Apply engine oil to lower bearing.
- (c) Examine the front marks and install the bearing caps on the cylinder block.
- (d) Apply a light coat of engine oil on the threads and under the bearing cap bolts.

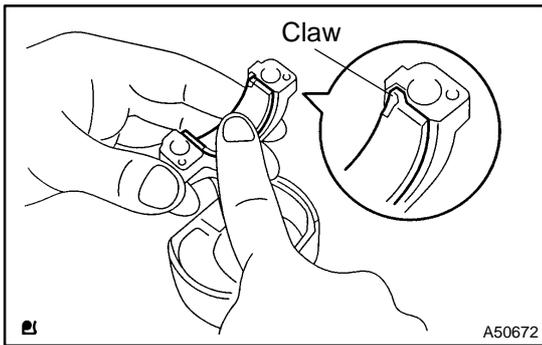




- (e) Tighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 20 N·m (204 kgf·cm, 15 ft·lbf)
- (f) Tighten the bolts in several passes, in the sequence shown, by the specified torque.
Torque: 40 N·m (408 kgf·cm, 29 ft·lbf)



- (g) Mark the front of the bearing cap bolts with paint.
- (h) Retighten the bearing cap bolts by 90° in the numerical order shown.
- (i) Check that the painted mark is now at a 90° angle to the front.
- (j) Check the crankshaft turns smoothly.

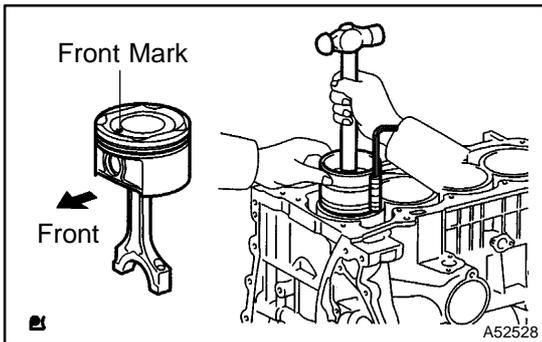


36. INSTALL CONNECTING ROD BEARING

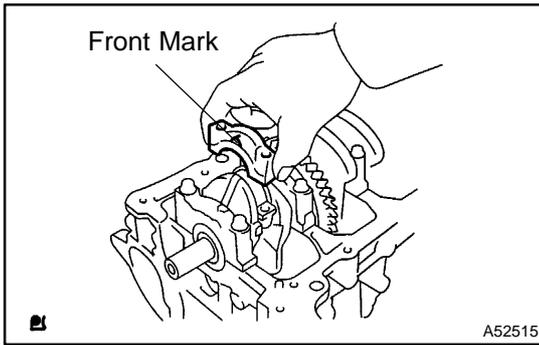
- (a) Align the bearing claw with the groove of the connecting rod or connecting cap.
- NOTICE:**
Clean the back side of the bearing and the bearing surface of the bearing cap and let not stick the oils and fats.

37. INSTALL PISTON

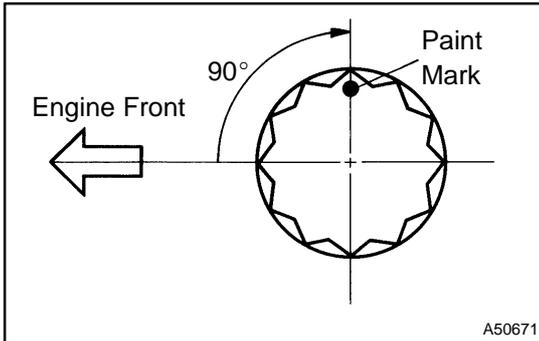
- NOTICE:**
The connecting rod cap bolts are tightened in 2 progressive steps.
- (a) Apply engine oil to the cylinder walls, the pistons, and the surfaces of connecting rod bearings.
 - (b) Check the position of the piston ring ends.



- (c) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.
- NOTICE:**
Match the numbered connecting rod cap with the connecting rod.



- (d) Check that the protrusion of the connecting rod cap is facing in the correct direction.
- (e) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.
- (f) Using a 12 mm socket wrench, tighten the bolts in several passes by the specified torque.
Torque: 25 N·m (250 kgf·cm, 18 ft·lbf)
- (g) Mark the front of the connecting cap bolts with paint.



- (h) Retighten the cap bolts by 90° as shown in the illustration.
- (i) Check that the crankshaft turns smoothly.