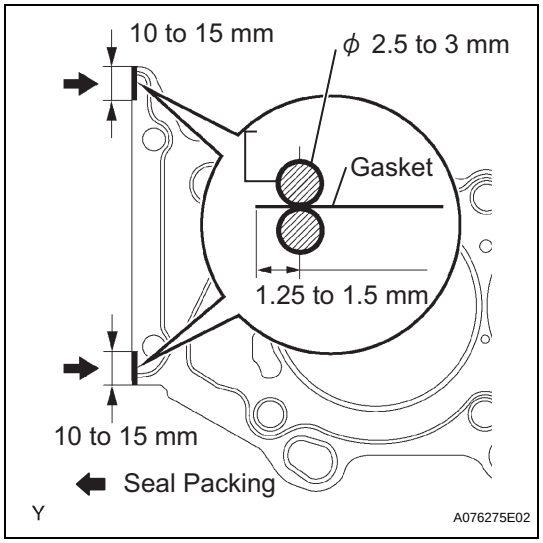
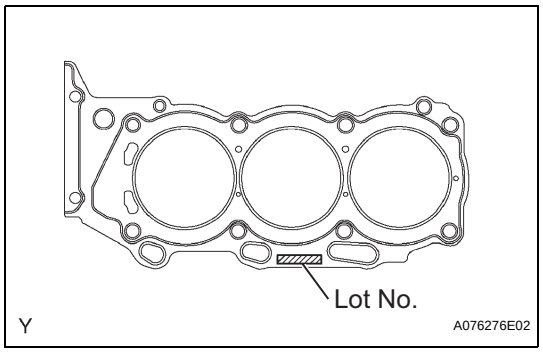
INSTALLATION

1. INSTALL NO. 2 CYLINDER HEAD GASKET

(a) Remove any old packing (FIPG) material.
HINT:
Do not drop any oil on the contact surface of the cylinder head and cylinder block.



(b) Apply a continuous bead of seal packing (diameter 2.5 to 3.0 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or the equivalent
NOTICE:
Install the cylinder head within 3 minutes of applying the seal packing. Tighten the cylinder head bolts within 15 minutes of installing the cylinder head. Otherwise, the seal packing must be removed and reapplied.

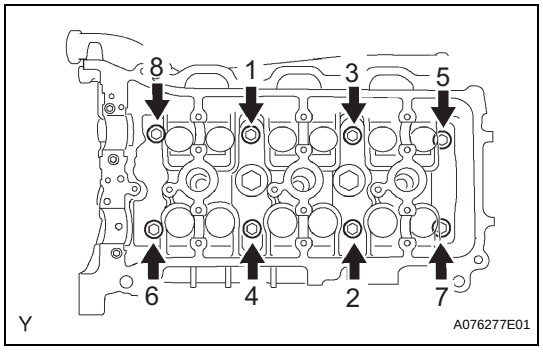


(c) Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp facing upward.
NOTICE:
- **Orient the cylinder head gasket correctly.**
- **Place the cylinder head carefully in order not to damage the gasket with the bottom part of the head.**

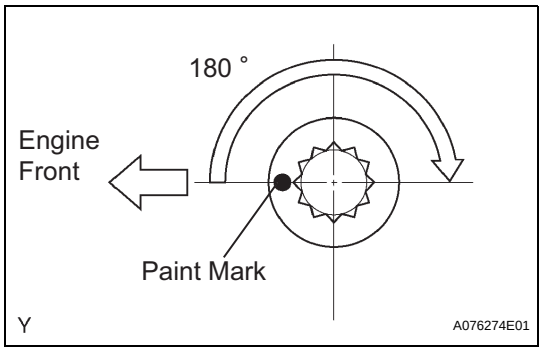
2. INSTALL CYLINDER HEAD LH

(a) Place the cylinder head on the cylinder head gasket.
(b) Install the 8 cylinder head bolts.
HINT:
- The cylinder head bolts are tightened in 2 successive steps (steps (*1) and (*2)).
- If any cylinder head bolts are broken or deformed, replace them.

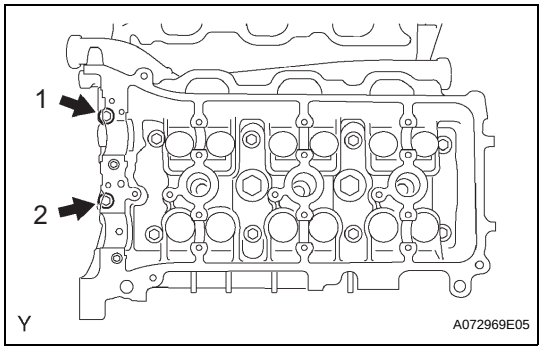
(1) Apply a light coat of engine oil to the threads of the cylinder head bolts.
(2) Install the plate washer onto the cylinder head bolt.



(3) Using several steps, uniformly tighten each bolt with a 10 mm bi-hexagon wrench in the sequence shown in the illustration. (*1)
Torque: 36 N*m (367 kgf*cm, 27 ft.*lbf)
If any cylinder head bolts do not meet the torque specification, replace them.
NOTICE:
Do not drop the washers into the cylinder head.

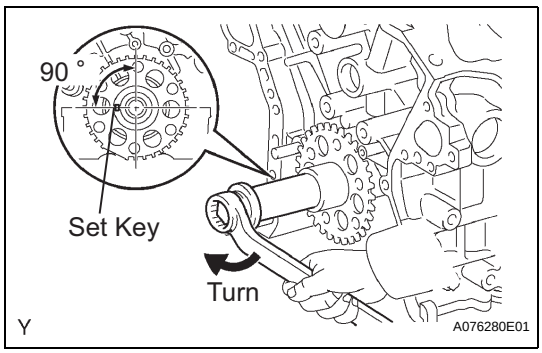


(4) Mark the front side of each cylinder head bolt with paint.
(5) Retighten the cylinder head bolts 180° as shown. (*2)
(6) Check that the painted marks are now at 180° from the engine front.

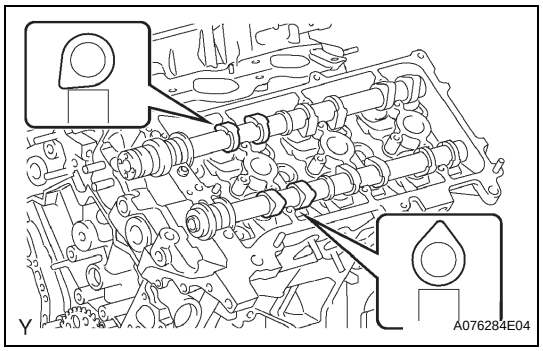


(c) Install the 2 cylinder head bolts.
(1) Apply a light coat of engine oil to the threads of the cylinder head bolts.
(2) Using several steps, uniformly install and tighten the 2 cylinder head bolts in the sequence shown in the illustration.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)
(d) Install the ground cable with the bolt.
Torque: 8.0 N*m (82 kgf*cm, 71 ft.*lbf)
(e) Install the air fuel ratio sensor connector bracket with bolt.
Torque: 19 N*m (189 kgf*cm, 14 ft.*lbf)

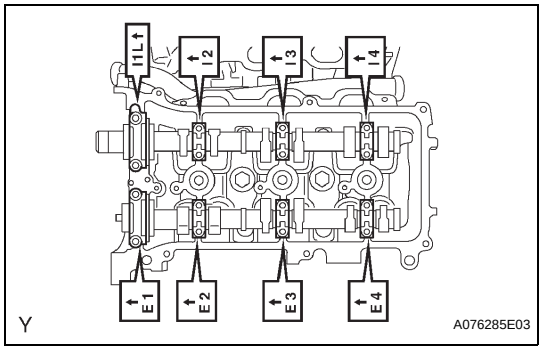
3. INSTALL CAMSHAFTS (for Bank 2)
NOTICE:
Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust force. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.



(a) Set the crankshaft position.
(1) Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key in the left horizontal position.
NOTICE:
Installing the crankshaft at the wrong angle could cause the piston head and valve head to come into contact with each other when installing the camshaft. This could cause damage, so always set the crankshaft at the correct angle.
(b) Apply new engine oil to the thrust portion and journal of the camshafts.

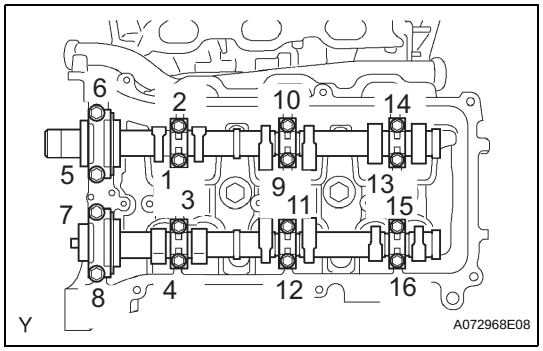


(c) Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder facing in the directions shown in the illustration.



(d) Install the 8 bearing caps in the proper locations as shown.

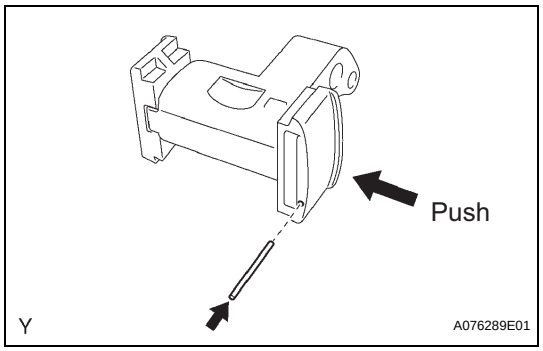
(e) Apply a light coat of engine oil to the threads and under the leads of the bearing cap bolts.



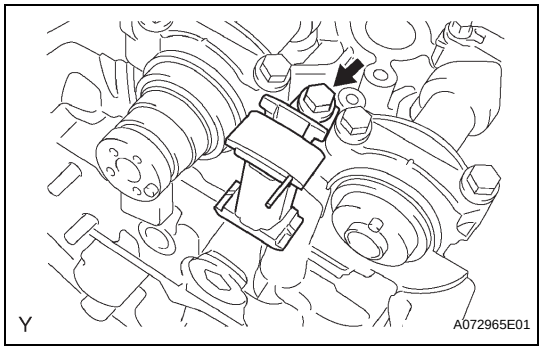
(f) Using several steps, uniformly install and tighten the 16 bearing cap bolts in the sequence shown in the illustration.

Torque: 10 mm (0.39 in.) head
9.0 N*m (92 kgf*cm, 80 in.*lbf)
12 mm (0.47 in.) head
24 N*m (245 kgf*cm, 18 ft.*lbf)

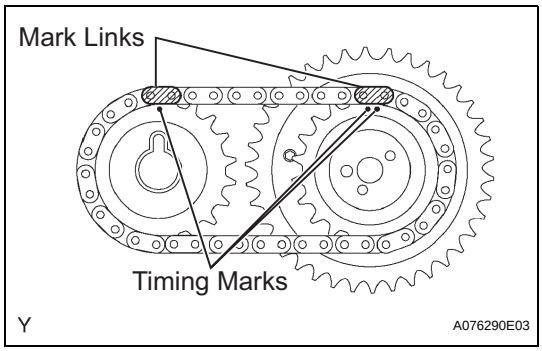
4. INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY



(a) While pushing in the tensioner, insert a pin of ϕ 1.0 mm (0.039 in.) into the hole to fix it.

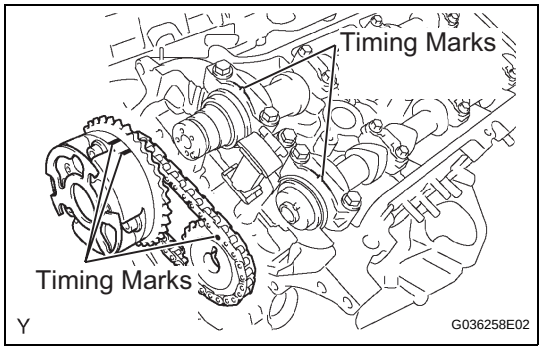


(b) Install the No. 2 chain tensioner with the bolt.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)



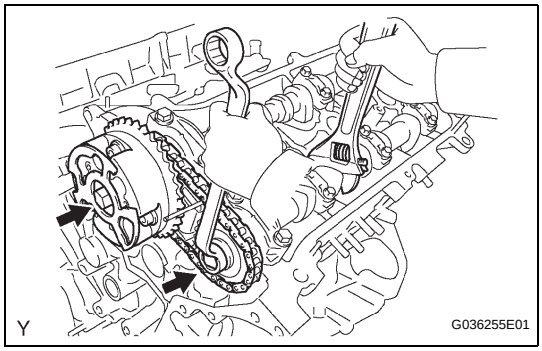
5. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 2)

(a) Align the yellow mark links with the timing marks (1 dot mark and 2 dot marks) of the camshaft timing gears as shown in the illustration.



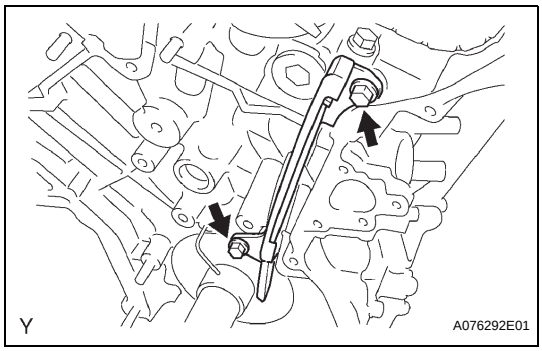
(b) Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain onto the LH camshafts.

(c) Temporarily install the 2 camshaft timing gear bolts.
NOTICE:
Do not push the camshaft timing gear assembly against the camshaft forcibly when installing it.



(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.
Torque: 100 N*m (1,020 kgf*cm, 74 ft.*lbf)

(e) Remove the pin from tensioner No. 2.

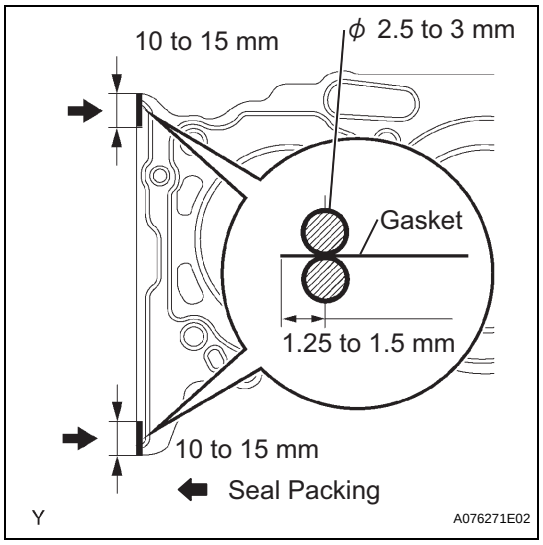


6. INSTALL NO. 1 CHAIN VIBRATION DAMPER

(a) Install the chain vibration damper with the 2 bolts.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)

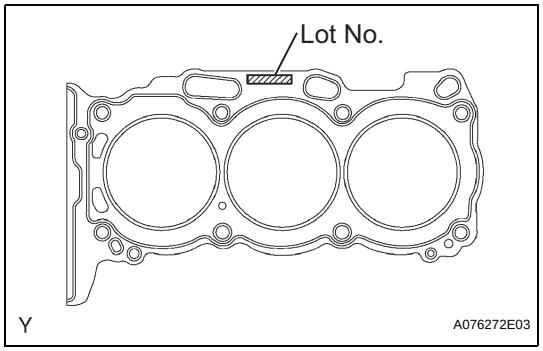
7. INSTALL CYLINDER HEAD GASKET

(a) Remove any old packing (FIPG) material.
HINT:
Do not drop any oil on the contact surfaces of the cylinder head and cylinder block.



(b) Apply a continuous bead of seal packing (diameter 2.5 to 3 mm (0.098 to 0.118 in.)) to a new cylinder head gasket as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Black, Three Bond 1207B or the equivalent
NOTICE:
Install the cylinder head within 3 minutes of applying the seal packing. Tighten the cylinder head bolts within 15 minutes of installing the cylinder head. Otherwise, the seal packing must be removed and reapplied.

EM



(c) Place the cylinder head gasket on the cylinder block surface with the Lot No. stamp facing upward.
NOTICE:
- **Orient the cylinder head gasket correctly.**
- **Place the cylinder head carefully in order not to damage the gasket.**

8. INSTALL CYLINDER HEAD SUB-ASSEMBLY

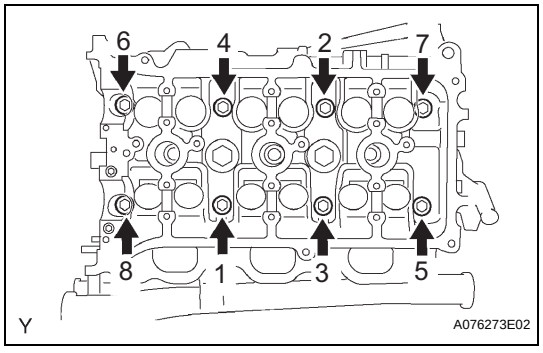
(a) Place the cylinder head on the cylinder head gasket.

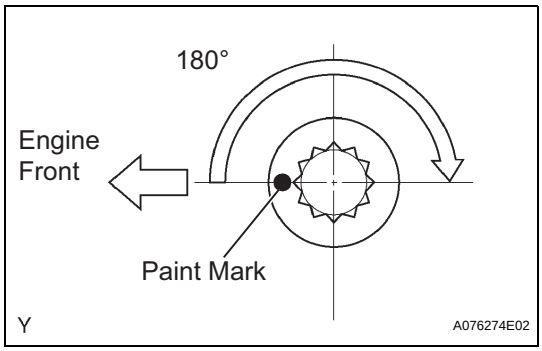
(b) Install the 8 cylinder head bolts.
HINT:
- The cylinder head bolts are tightened in 2 successive steps (steps (*1) and (*2)).
- If any cylinder head bolts are broken or deformed, replace them.

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

(2) Install the plate washer onto the cylinder head bolt.

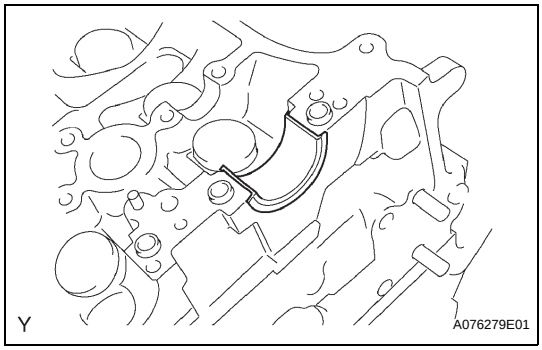
(3) Using several steps, tighten each bolt uniformly with a 10 mm bi-hexagon wrench in the sequence shown in the illustration. (*1)
Torque: 36 N*m (367 kgf*cm, 27 ft.*lbf)
If any cylinder head bolts do not meet the torque specification, replace them.
NOTICE:
Do not drop the washers into the cylinder head.





(4) Mark the front side of each cylinder head bolt with paint.
(5) Retighten the cylinder head bolts 180° as shown. (*2)
(6) Check that the painted marks are now at 180° from the engine front.

(c) Install the ground cable with the bolt.
Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)

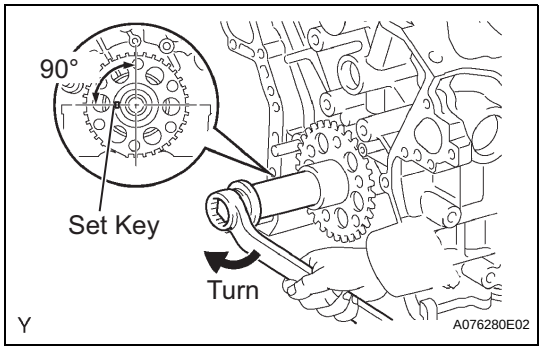


9. INSTALL NO. 2 CAMSHAFT BEARING

(a) Install the No. 2 camshaft bearing onto the cylinder head.
NOTICE:
Clean the installation planes of the back side of the bearing and cylinder head and keep them free of oil.

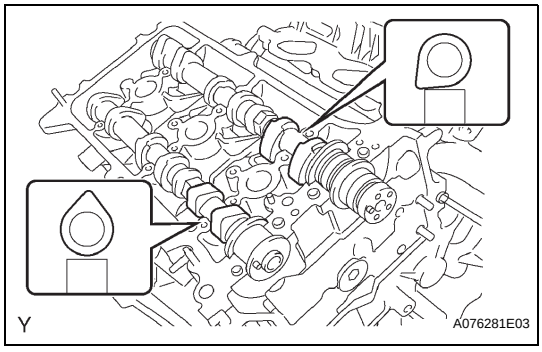
10. INSTALL CAMSHAFTS (for Bank 1)
NOTICE:
Keep the camshaft level while it is being removed. The camshaft thrust clearance is very small and failing to keep it level could crack or damage the cylinder head journal surface, which receives the thrust force. This could subsequently lead the camshaft to seize or break. Perform the following steps to avoid such problems.

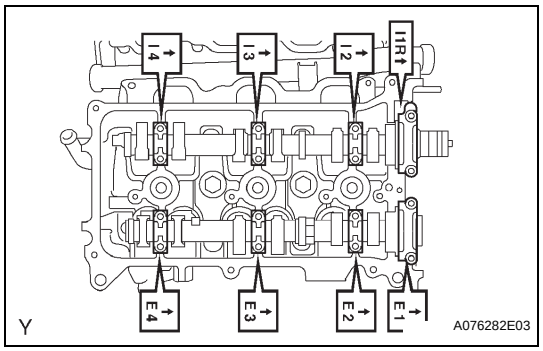
(a) Set the crankshaft position.
(1) Using the crankshaft pulley set bolt, turn the crankshaft, and set the crankshaft set key in the left horizontal position.
NOTICE:
Installing the crankshaft at the wrong angle could cause the piston head and valve head to come into contact with each other when installing the camshaft. This could cause damage, so always set the crankshaft at the correct angle.



(b) Apply new engine oil to the thrust portion and journal of the camshafts.

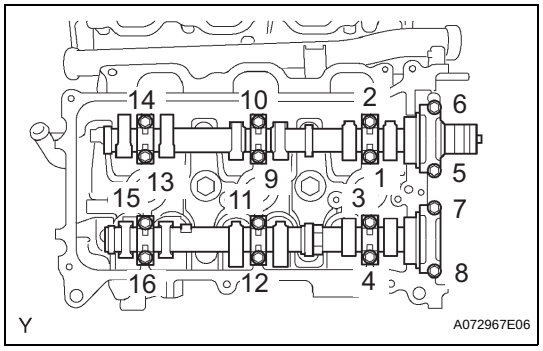
(c) Place the 2 camshafts onto the cylinder head with the cam lobes of No. 1 cylinder facing in the directions shown in the illustration.





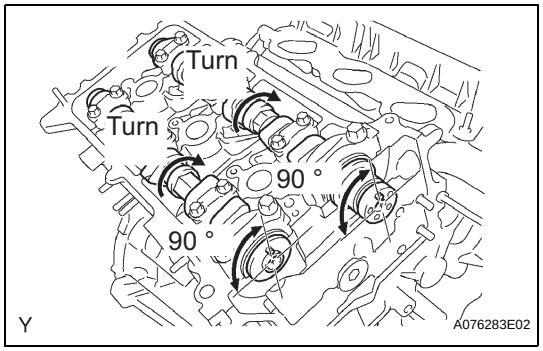
(d) Install the 8 bearing caps in the proper locations as shown.

(e) Apply a light coat of engine oil to the threads and under the heads of the bearing cap bolts.



(f) Using several steps, uniformly install and tighten the 16 bearing cap bolts in the sequence shown in the illustration.

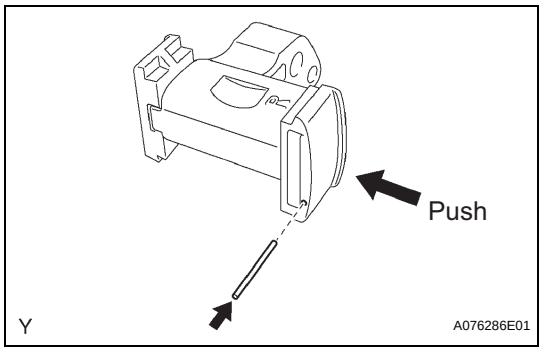
Torque: 10 mm (0.39 in.) head
9.0 N*m (92 kgf*cm, 80 in.*lbf)
12 mm (0.47 in.) head
24 N*m (245 kgf*cm, 18 ft.*lbf)

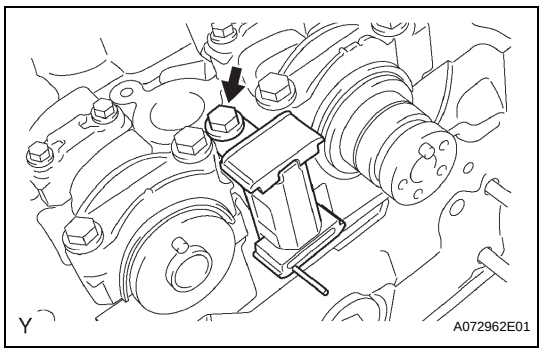


(g) Turn the camshafts clockwise until the knock pin comes to a position 90° to the cylinder head.

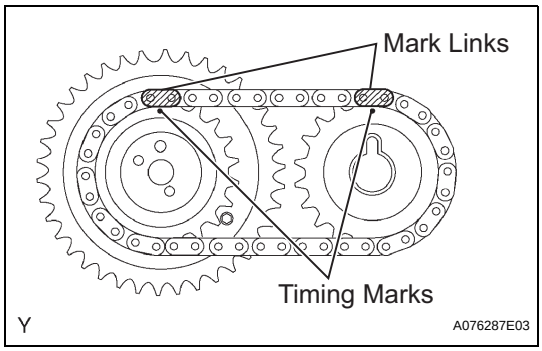
11. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

(a) While pushing in the tensioner, insert a pin of ϕ 1.0 mm (0.039 in.) into the hole to fix it.



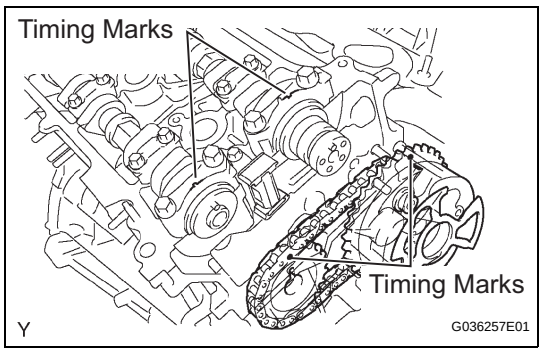


(b) Install the No. 2 chain tensioner with the bolt.
Torque: 19 N*m (194 kgf*cm, 14 ft.*lbf)



12. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 1)

(a) Align the yellow mark links with the timing marks (1 dot mark) of the camshaft timing gears as shown in the illustration.

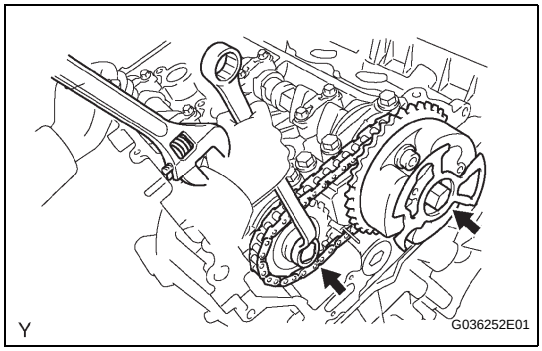


(b) Align the timing marks on the camshaft timing gears with the timing marks on the bearing caps, and install the camshaft timing gears with the chain onto the RH camshafts.

(c) Temporarily install the 2 camshaft timing gear bolts.

NOTICE:

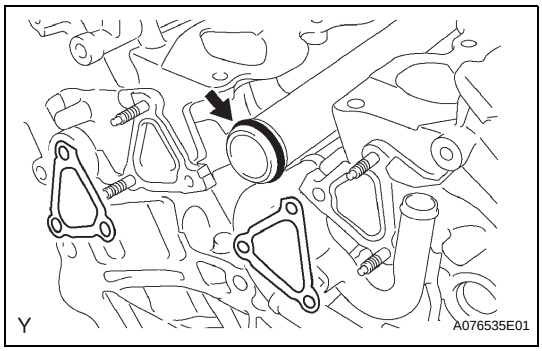
Do not push the camshaft timing gear assembly against the camshaft forcibly when installing it.



(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.

Torque: 100 N*m (1,020 kgf*cm, 74 ft.*lbf)

(e) Remove the No. 2 pin from the tensioner.



13. INSTALL WATER BY-PASS JOINT RR

(a) Install a new O-ring onto the water outlet pipe.

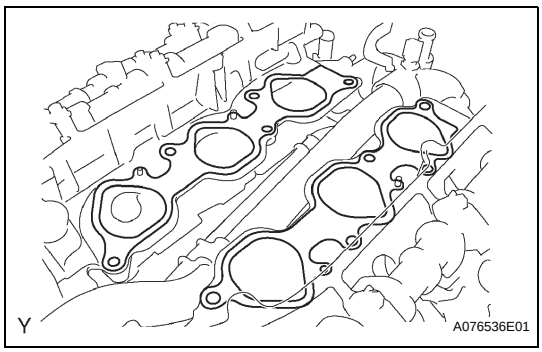
(b) Apply soapy water to the O-ring.

(c) Install 2 new gaskets and water by-pass joint rear with the 2 bolts and 4 nuts.

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

(d) Connect the heater hose.

(e) Connect the engine coolant temperature sensor connector.



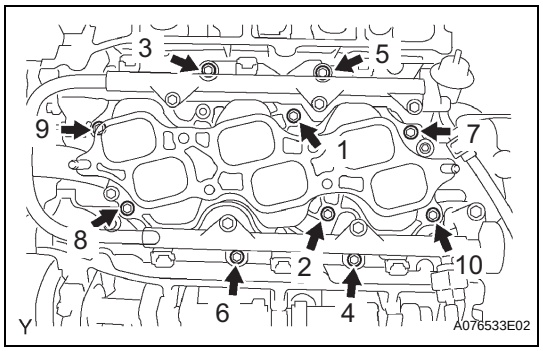
14. INSTALL INTAKE MANIFOLD

(a) Set a new gasket on each cylinder head.

NOTICE:

- **Align the port holes of the gasket and cylinder head.**
- **Orient the gasket correctly.**

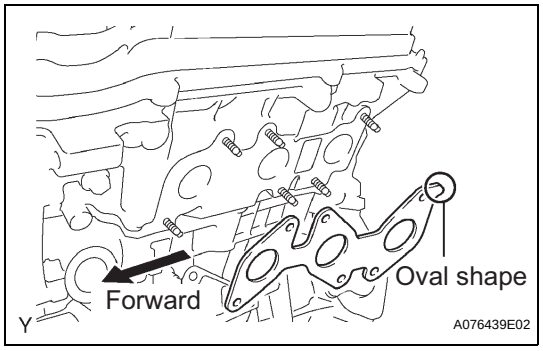
(b) Set the intake manifold on the cylinder heads.



(c) Install and tighten the 10 bolts uniformly in several steps.
Torque: 26 N*m (265 kgf*cm, 19 ft.*lbf)
(d) Connect the 6 fuel injector connectors.

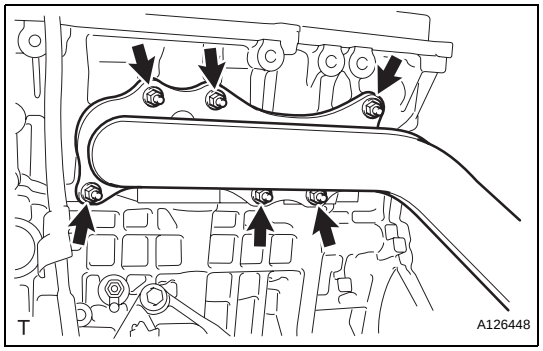
15. CONNECT NO. 2 FUEL PIPE SUB-ASSEMBLY (See page FU-19)

16. CONNECT NO. 1 FUEL PIPE SUB-ASSEMBLY (See page FU-17)

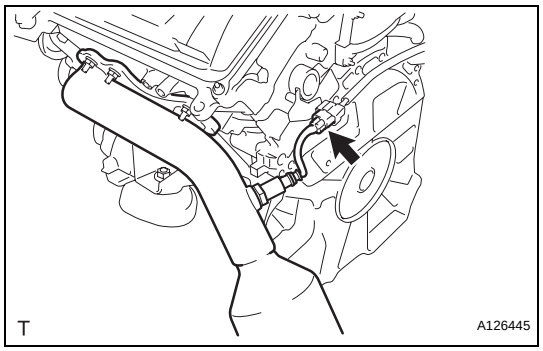


17. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY LH
(a) Set a new gasket to the bank 2 cylinder head with the oval shape facing forward.
NOTICE:
Orient the new gasket correctly.

EM

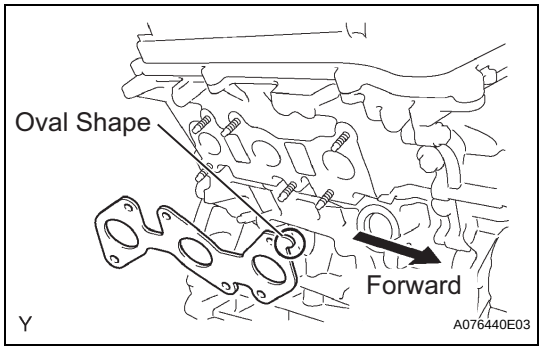


(b) Install the exhaust manifold with the 6 nuts.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

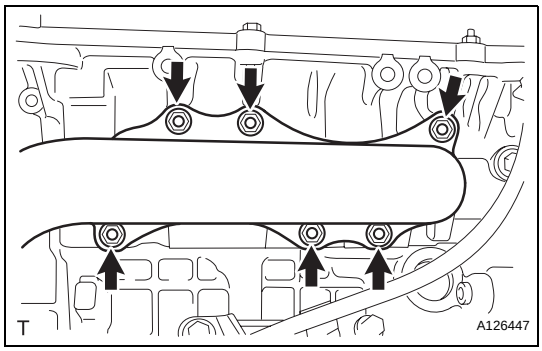


(c) Connect the air fuel ratio sensor connector.

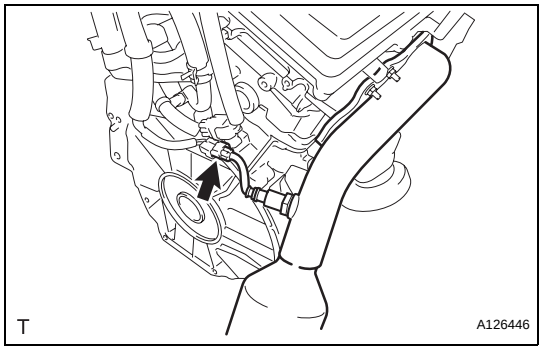
18. INSTALL NO. 2 MANIFOLD STAY
(a) Install the No. 2 manifold stay with the 3 bolts.
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)



19. INSTALL EXHAUST MANIFOLD SUB-ASSEMBLY RH
(a) Set a new gasket to the bank 1 cylinder head with the oval shape facing forward.
NOTICE:
Orient the new gasket correctly.



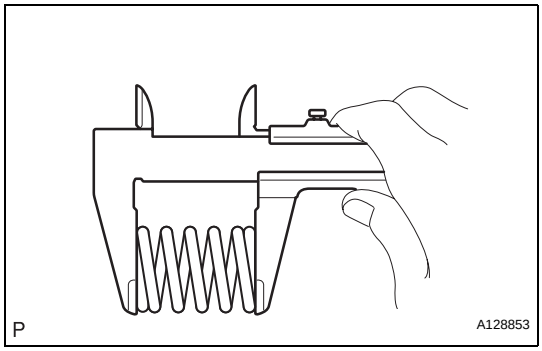
(b) Install the exhaust manifold with the 6 nuts.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)



(c) Connect the air fuel ratio sensor connector.

20. INSTALL MANIFOLD STAY

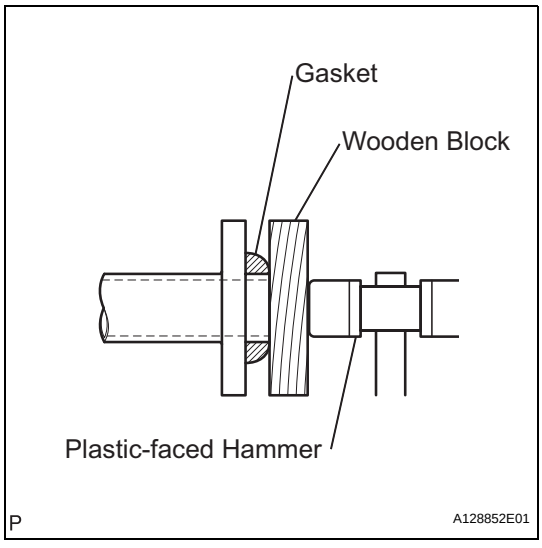
(a) Install the manifold stay with the 3 bolts.
Torque: 40 N*m (408 kgf*cm, 30 ft.*lbf)



21. INSTALL FRONT EXHAUST PIPE ASSEMBLY

(a) Check the free length.
(1) Using vernier calipers, measure the free length of the compression spring.
Minimum:
40.5mm (1.594 in.)
If the free length is less that the minimum, replace the compression spring.

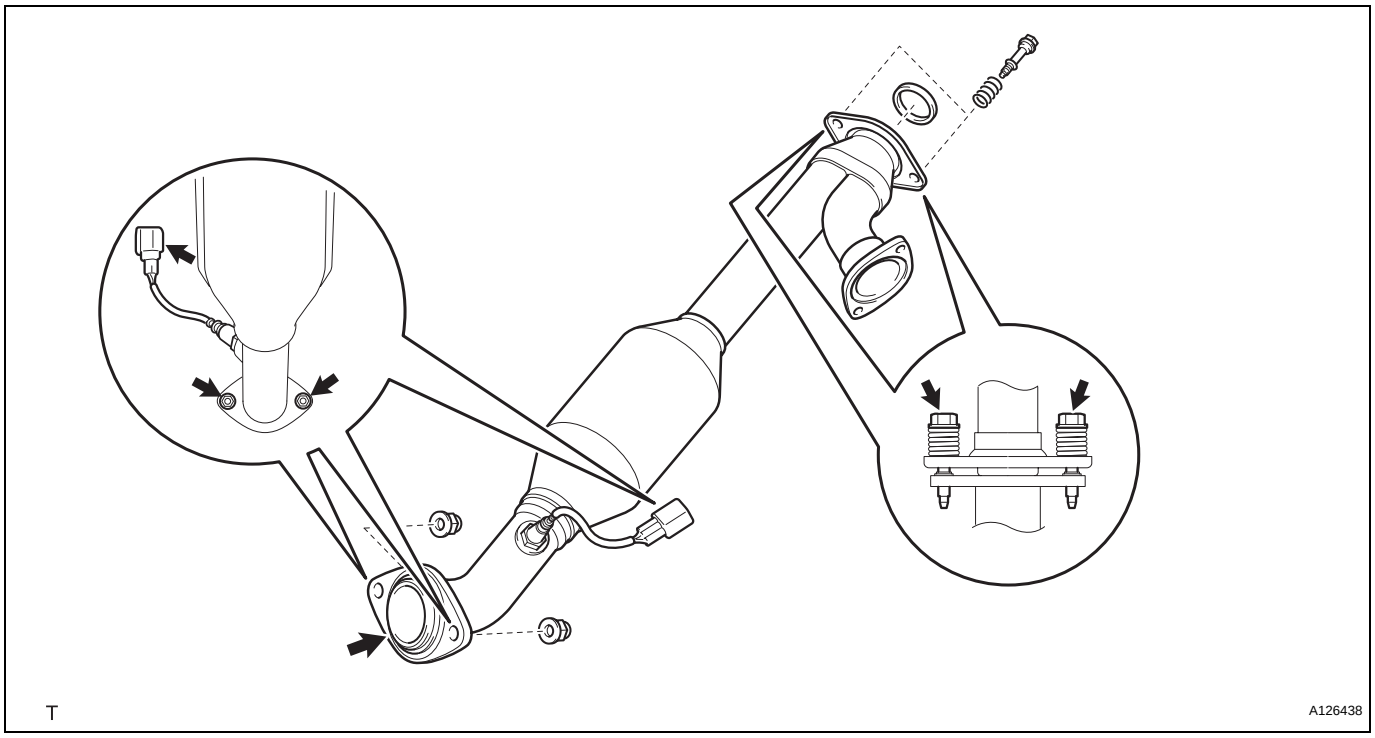
(b) Install a new gasket onto the exhaust manifold RH.



(c) Install a new gasket onto the exhaust front pipe.
(1) Using a wooden block and plastic-faced hammer, tap in the new gasket until it is flush with the exhaust front pipe.
NOTICE:
- **Make sure that the gasket is in the correct direction when installing.**
- **Do not reuse the removed gasket.**

(d) Install the exhaust front pipe with new 2 nuts.
Torque: 54 N*m (554 kgf*cm, 40 ft.*lbf)

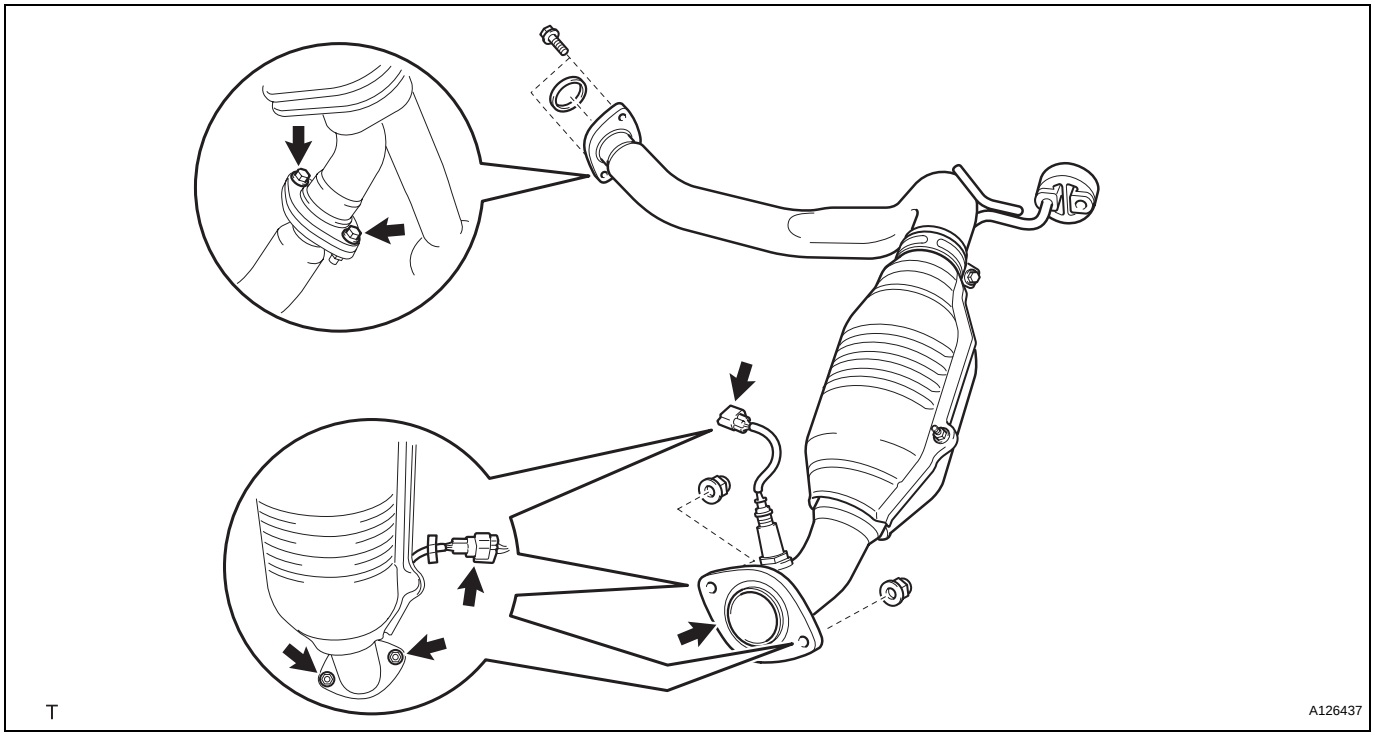
(e) Install the exhaust center pipe onto the front exhaust pipe with the 2 bolts and 2 springs.



Torque: 43 N*m (438 kgf*cm, 32 ft.*lbf)

(f) Connect the oxygen sensor connector.

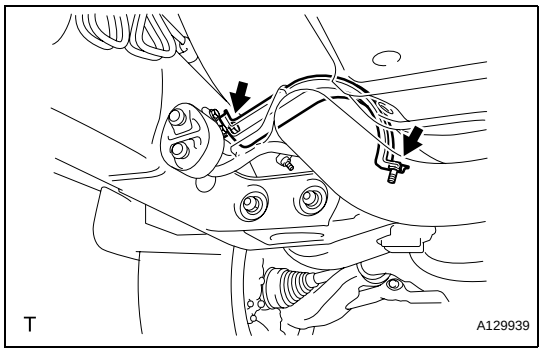
22. INSTALL NO. 2 FRONT EXHAUST PIPE ASSEMBLY



(a) Install a new gasket onto the exhaust manifold LH.

(b) Install a new gasket onto the No. 2 front exhaust pipe.

(c) Install the No. 2 front exhaust pipe with the 2 new nuts and 2 bolts.
Torque: Nut
54 N*m (554 kgf*cm, 40 ft.*lbf)
Bolt
48 N*m (489 kgf*cm, 35 ft.*lbf)
(d) Connect the oxygen sensor connector.



23. INSTALL EXHAUST PIPE STOPPER BRACKET (for 4WD)
(a) Install the exhaust pipe stopper bracket with the 2 bolts.
Torque: 19 N*m (193 kgf*cm, 14 ft.*lbf)

24. INSTALL NO. 1 COOL AIR INLET
(a) Install the cool air inlet with the 2 bolts.
Torque: 12 N*m (122 kgf*cm, 9.0 ft.*lbf)

25. INSTALL CHAIN SUB-ASSEMBLY
Refer to the procedures up to "INSTALL CHAIN TENSIONER SLIPPER" (See page EM-27).

26. CHECK FOR FUEL LEAKAGE

27. CHECK FOR EXHAUST GAS LEAKAGE

28. INSPECT IGNITION TIMING (See page EM-1)

29. INSPECT ENGINE IDLING SPEED (See page EM-2)

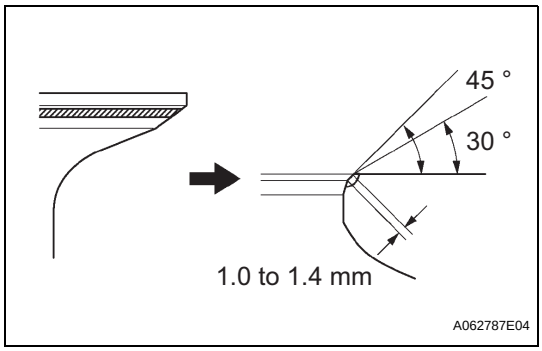
30. REMOVE COMPRESSION (See page EM-3)

31. INSPECT CO/HC (See page EM-3)

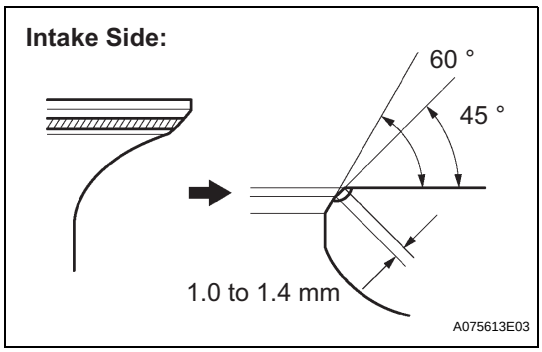
32. INSPECT AND ADJUST FRONT WHEEL ALIGNMENT (See page SP-2)

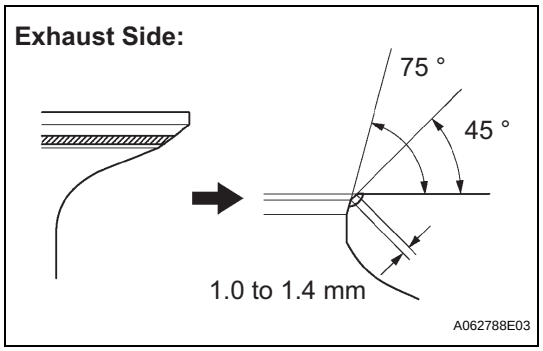
REPAIR

1. REPAIR VALVE SEAT
NOTICE:
Use a cutter to gradually smooth the intake valve seat.
(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

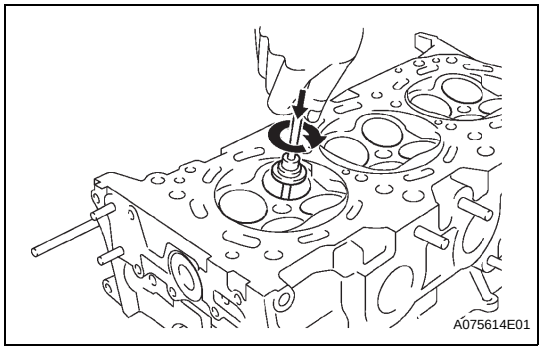


(b) Intake side:
If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.





(c) Exhaust side:
If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



(d) Lap the valve and valve seat with an abrasive compound by hand.
(e) After lapping, clean the valve and valve seat.