CYLINDER HEAD ASSY (1MZ–FE)

140EQ–02

OVERHAUL

1. REMOVE W/HEAD STRAIGHT SCREW PLUG NO.1

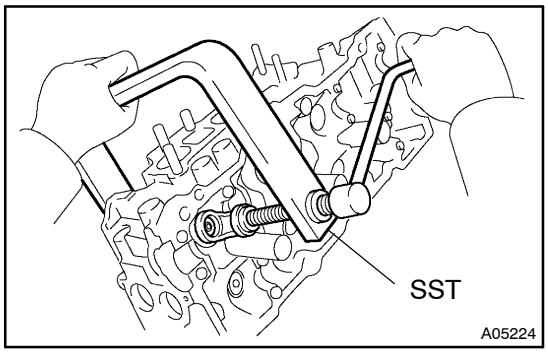
(a) Using a 14 mm straight hexagon wrench, remove the screw plug.

2. REMOVE W/HEAD STRAIGHT SCREW PLUG NO.2

(a) Using a 14 mm straight hexagon wrench, remove the screw plug.

3. REMOVE VALVE LIFTER

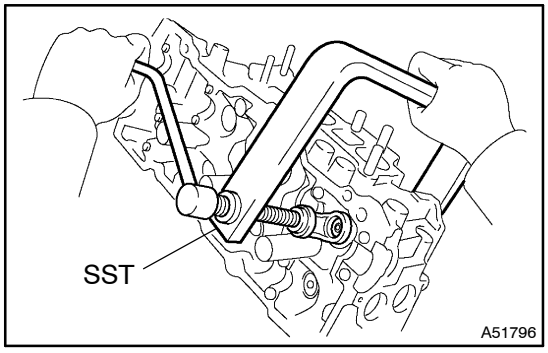
HINT:
Arrange the valve lifters in the correct order.



4. REMOVE INTAKE VALVE

(a) Using SST, compress the valve spring and remove the 2 keepers, retainer, spring and valve.
SST 09202–70020 (09202–00010)

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



5. REMOVE EXHAUST VALVE

(a) Using SST, compress the valve spring and remove the 2 keepers, retainer, spring and valve.
SST 09202–70020 (09202–00010)

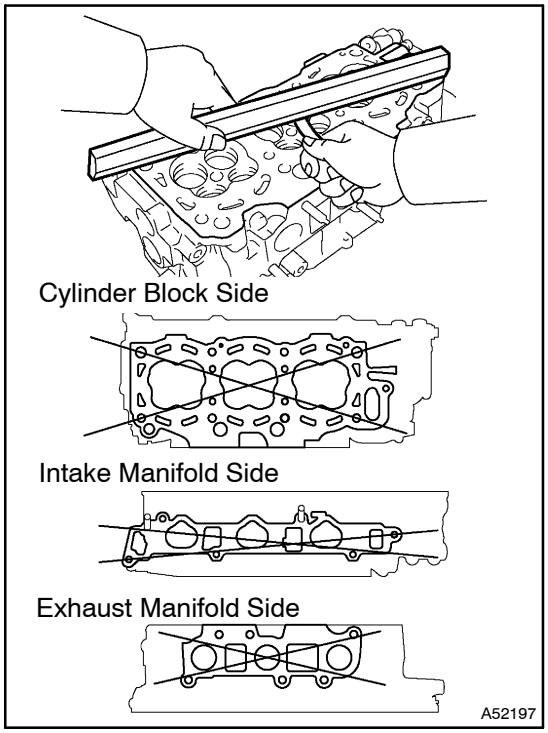
HINT:
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.

6. REMOVE VALVE STEM OIL O SEAL OR RING

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

7. REMOVE VALVE SPRING SEAT

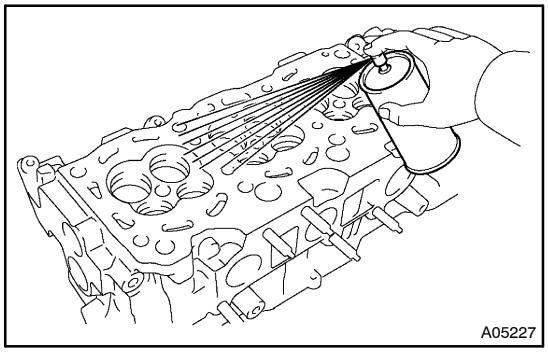
8. REMOVE SEMICIRCULAR PLUG



9. INSPECT CYLINDER HEAD FOR FLATNESS

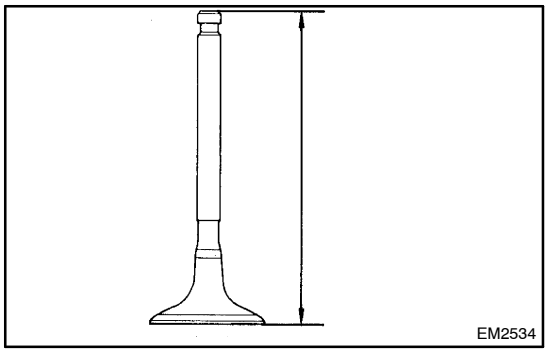
(a) Using a precision straight edge and a feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

Maximum warpage:
Cylinder block side 0.05 mm (0.0020 in.)
Intake manifold side 0.10 mm (0.0039 in.)
Exhaust manifold side 0.10 mm (0.0039 in.)



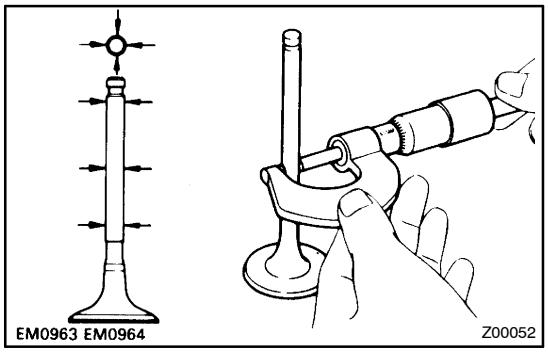
10. INSPECT CYLINDER HEAD FOR CRACKS

(a) Using a dye penetrate, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

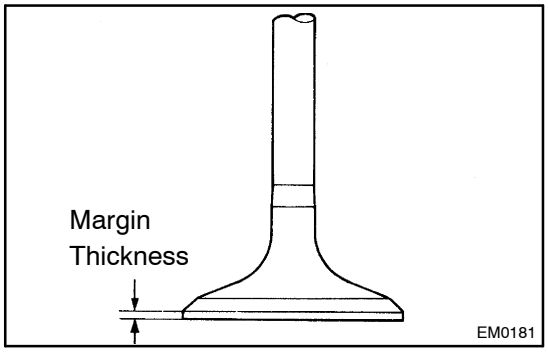


11. INSPECT INTAKE VALVE

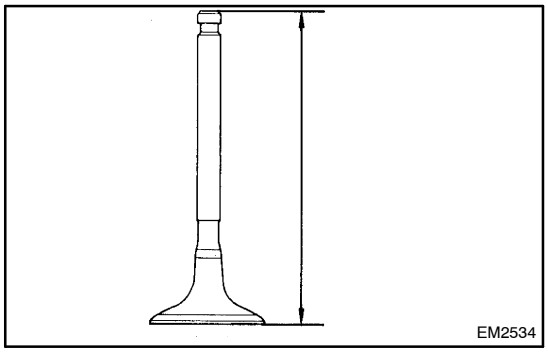
(a) Check the valve overall length.
Standard overall length: 95.45 mm (3.7579 in.)
Minimum overall length: 94.95 mm (3.7382 in.)



(b) Using a micrometer, measure the diameter of the valve stem.
Valve stem diameter:
5.470 – 5.485 mm (0.2154 – 0.2159 in.)

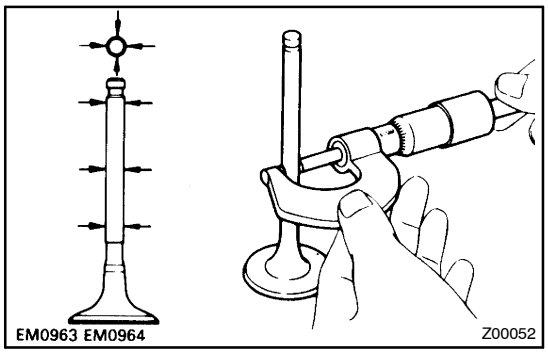


(c) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)

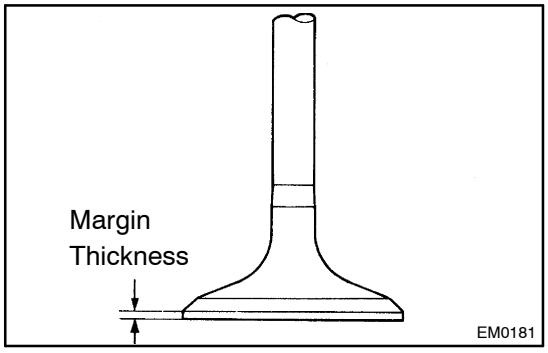


12. INSPECT EXHAUST VALVE

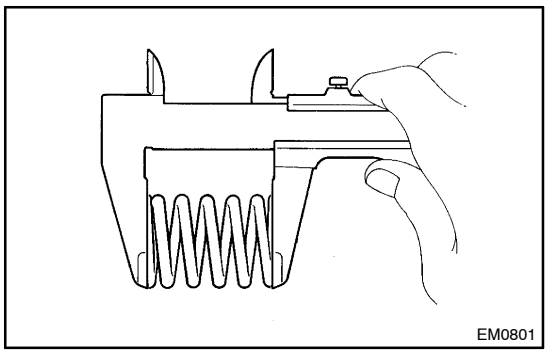
(a) Check the valve overall length.
Standard overall length: 95.40 mm (3.7559 in.)
Minimum overall length: 94.90 mm (3.7362 in.)



(b) Using a micrometer, measure the diameter of the valve stem.
Valve stem diameter:
5.465 – 5.480 mm (0.2152 – 0.2157 in.)

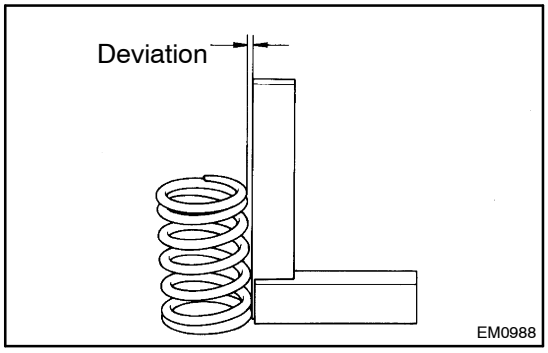


(c) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)

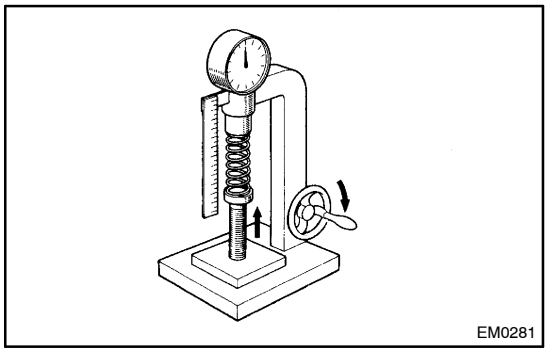


13. INSPECT INNER COMPRESSION SPRING

(a) Using vernier calipers, measure the free length of the valve spring.
Free length: 45.50 mm (1.7913 in.)

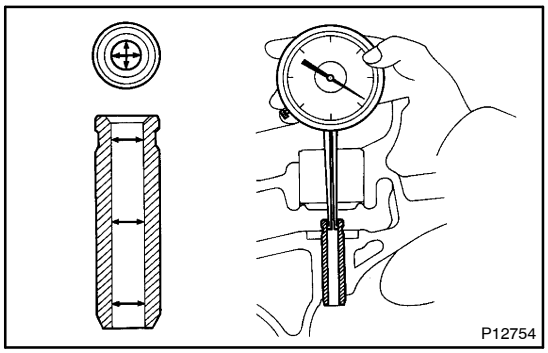


(b) Using a steel square, measure the deviation of the valve spring.
Maximum deviation: 2.0 mm (0.079 in.)



(c) Using a spring tester, measure the tension of the valve spring at the specified installed length.
Installed tension:
186 – 206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)
at 33.8 mm (1.331 in.)

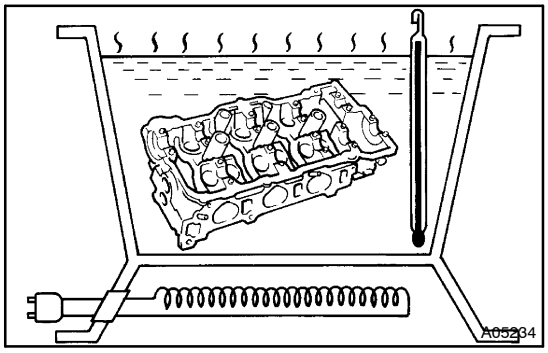
If the installed tension is not as specified, replace the valve spring.



14. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE

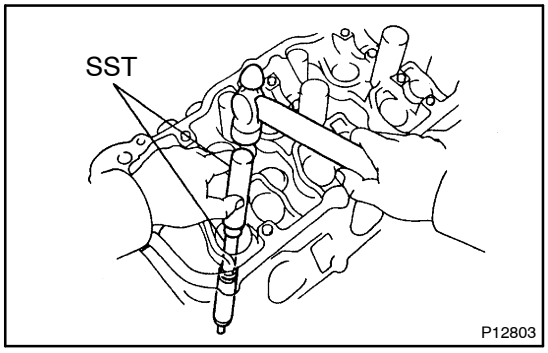
(a) Using a caliper gauge, measure the inside diameter of the guide bushing.
Bushing inside diameter:
5.510 – 5.530 mm (0.2169 – 0.2177 in.)

(b) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.
Standard oil clearance:
Intake 0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust 0.030 – 0.065 mm (0.0012 – 0.0026 in.)
Maximum oil clearance:
Intake 0.08 mm (0.0031 in.)
Exhaust 0.10 mm (0.0039 in.)

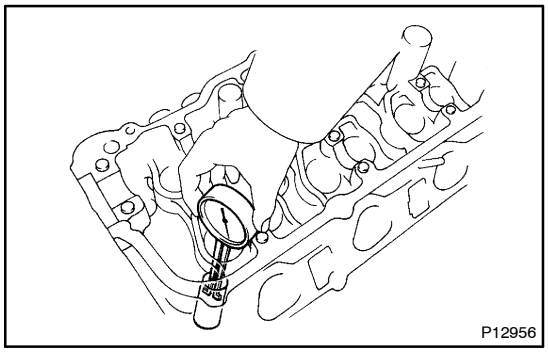


15. REMOVE VALVE GUIDE BUSHING

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



(b) Using SST and a hammer, tap out the guide bushing.
SST 09201–10000, 09201–01055, 09950–70010 (09951–07100)



16. INSTALL VALVE GUIDE BUSHING

(a) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.
Diameter: 10.295 – 10.313 mm (0.4053 – 0.4060 in.)

If the bushing bore diameter of the cylinder head is greater than 10.313 mm (0.4060 in.), machine the bushing bore to the dimension of 10.345 – 10.363 mm (0.4073 – 0.4080 in.)

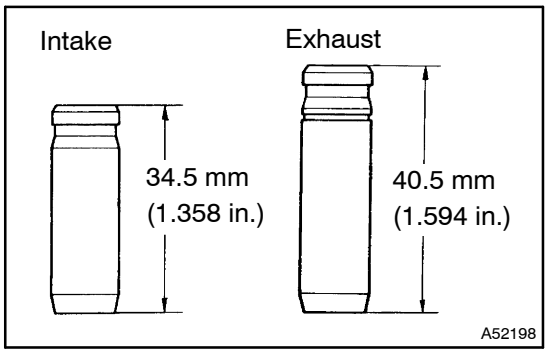
HINT:

Bushing diameter

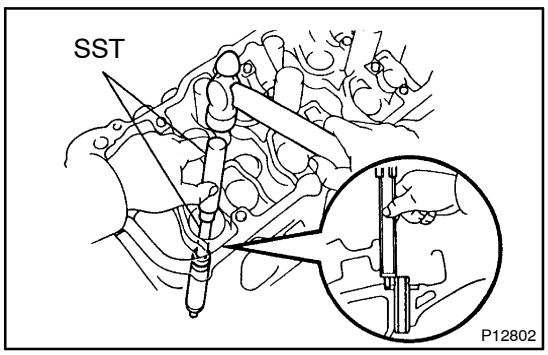
STD	10.333 – 10.344 mm (0.4068 – 0.4072 in.)
O/S	10.383 – 10.394 mm (0.4088 – 0.4092 in.)

Bushing length

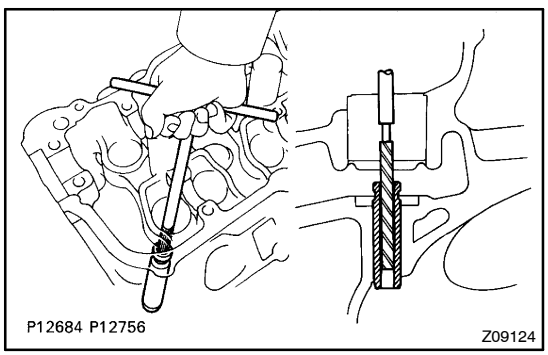
Intake	34.5 mm (1.358 in.)
Exhaust	40.5 mm (1.594 in.)



(b) Heat the cylinder head to 80 – 100 °C (176 – 212 °F)



(c) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.
SST 09201–10000, 09201–01055, 09950–70010 (09951–07100)
Protrusion height:
Intake: 11.1 – 11.5 mm (0.437 – 0.453 in.)
Exhaust: 8.9 – 9.3 mm (0.350 – 0.366 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.
Standard oil clearance:
Intake 0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust 0.030 – 0.065 mm (0.0012 – 0.0026 in.)

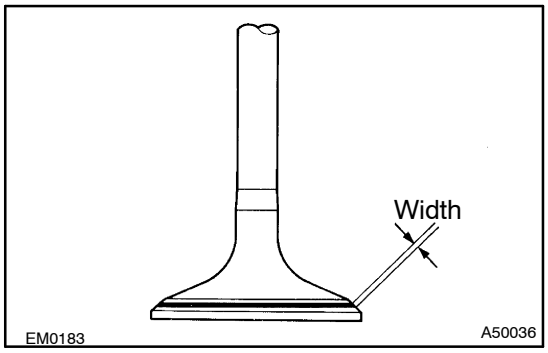
17. INSPECT VALVE SEATS

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

(b) Lightly press the valve against the seat.

NOTICE:

Do not rotate the valve.

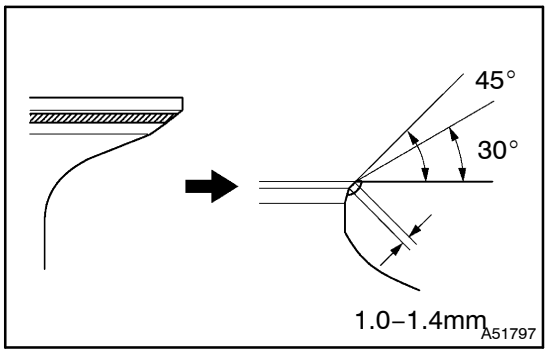


(c) Check the valve face and seat according to the following procedure.

(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.).

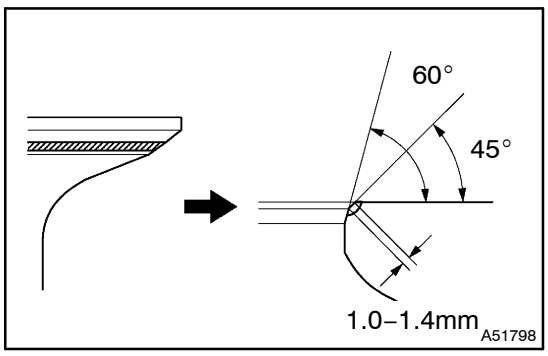


18. REPAIR VALVE SEATS

NOTICE:

Take off a cutter gradually to make smooth valve seats.

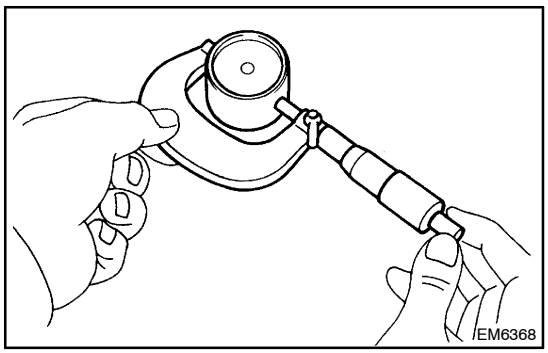
(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



(b) If the seating is too low on the valve face, use 60° 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.

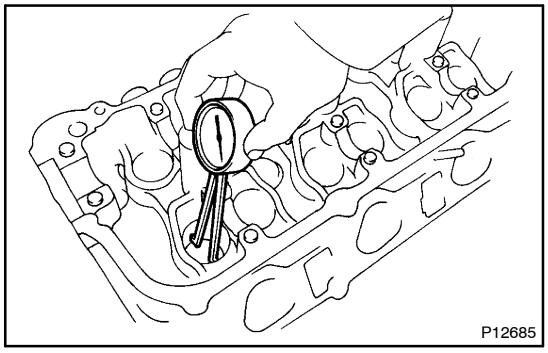


19. INSPECT VALVE LIFTER

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

Lifter diameter:

30.966 – 30.976 mm (1.2191 – 1.2195 in.)



20. INSPECT VALVE LIFTER OIL CLEARANCE

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

Lifter bore diameter:
31.000 – 31.016 mm (1.2205 – 1.2211 in.)

(b) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

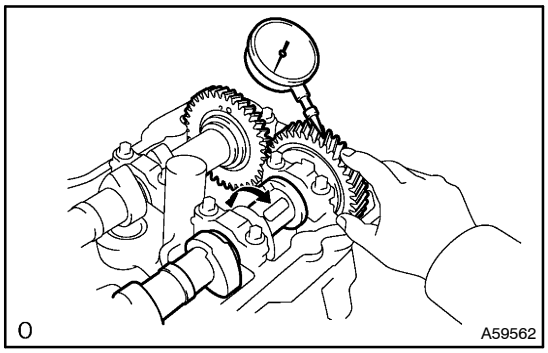
Standard oil clearance:
0.024 – 0.050 mm (0.0009 – 0.0021 in.)
Maximum oil clearance: 0.07 mm (0.0028 in.)

21. INSPECT CAMSHAFT GEAR BACKLASH

(a) Install the camshafts to the cylinder head.

NOTICE:

- **Install without valves and sub–gear.**
- **Install with its timing mark matched.**



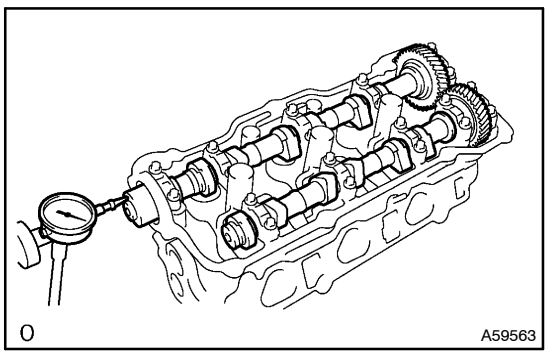
(b) Set the dial indicator to the teeth of the intake camshaft at a right angle (90°).

(c) Measure the backlash of the camshaft gear at least 4 positions.

Standard backlash:
0.020 – 0.200 mm (0.0008 – 0.0079 in.)
Maximum backlash: 0.30 mm (0.0118 in.)

22. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Install the camshafts.



(b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

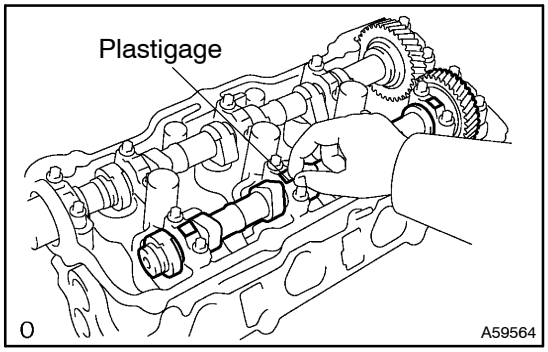
Standard thrust clearance:
0.040 – 0.090 mm (0.0016 – 0.0035 in.)
Maximum thrust clearance: 0.12 mm (0.0047 in.)

If the thrust clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

23. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.

(b) Place the camshafts on the cylinder head.

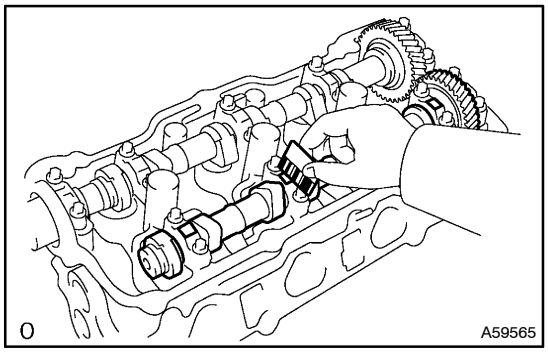


(c) Lay a strip of plastigage across each of the camshaft journal.

(d) Install the bearing caps.
Torque: 16 N·m (163 kgf·cm, 12 ft·lbf)

NOTICE:
Do not turn the camshaft.

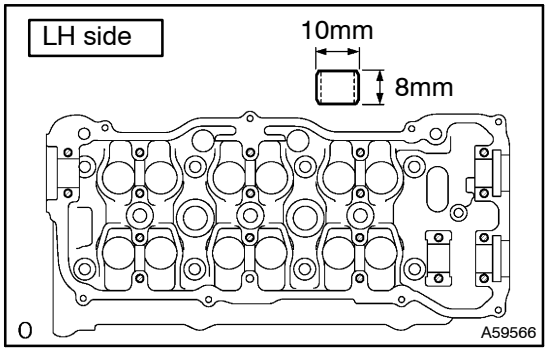
(e) Remove the bearing caps.



(f) Measure the plastigage at its widest point.
Standard oil clearance:
Intake #4, #5 journals
0.025 – 0.057 mm (0.0010 – 0.0022 in.)
Other journals 0.025 – 0.062 mm (0.0010 – 0.0024 in.)
Maximum oil clearance 0.10 mm (0.0039 in.)

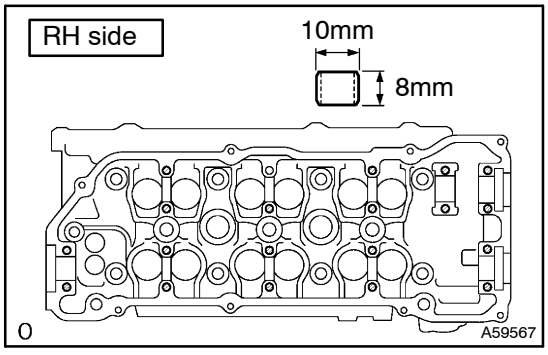
If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

NOTICE:
Completely remove the plastigage.



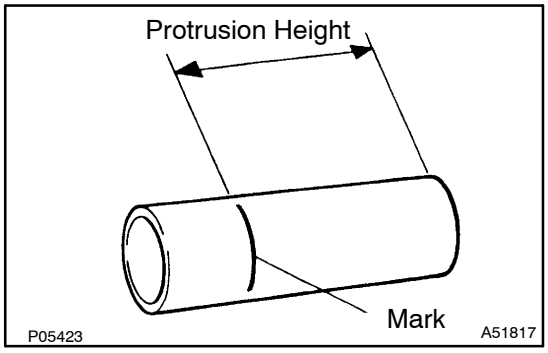
24. INSTALL RING W/HEAD PIN

(a) Using a plastic–faced hammer, tap in a new ring pin to the specified protrusion height.
Protrusion height: 3 mm (0.12 in.)



25. INSTALL RING 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.)



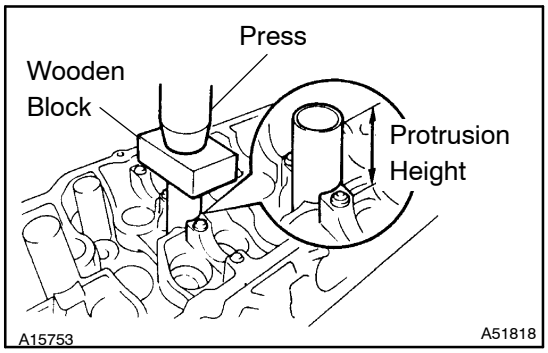
26. INSTALL SPARK PLUG TUBE

(a) Using paint, mark the standard position from the edge.
Standard protrusion height:
42.4 – 43.4 mm (1.669 – 1.709 in.)

HINT:
Use either side of the spark plug tube.

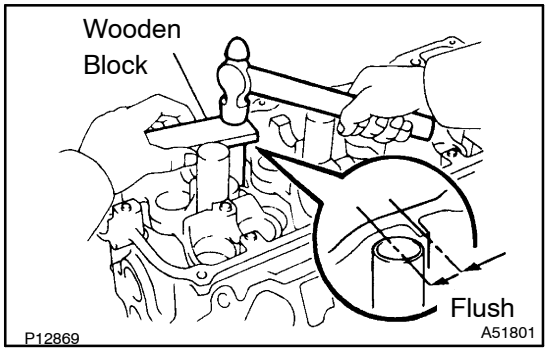
(b) Apply adhesive to the spark plug tube except protrusion height.
Adhesive: Part No. 08833–00070 THREE BOND 1324 or equivalent

NOTICE:
- **Install the spark plug tube within 3 minutes after applying adhesive.**
- **Do not deform the spark plug tube.**
- **Do not put into coolant within an hour after installing.**



(c) Using a wooden block, press in the spark plug tube until its mark.

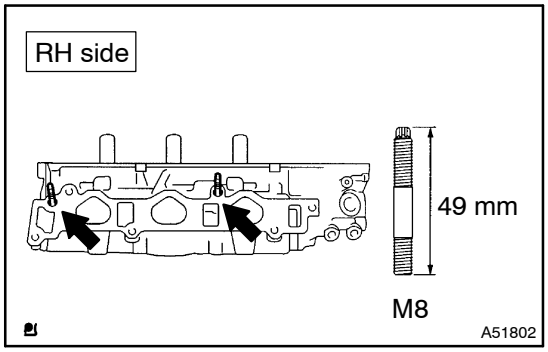
NOTICE:
Be careful not to drip the adhesive.



27. INSTALL PCV PIPE

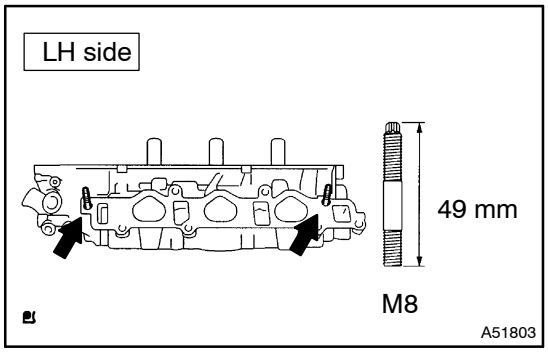
(a) Using a wooden block and hammer, tap in a new PCV pipe until its top side is flush with the cylinder head edge.

NOTICE:
Be careful not to damage the cylinder head edge.



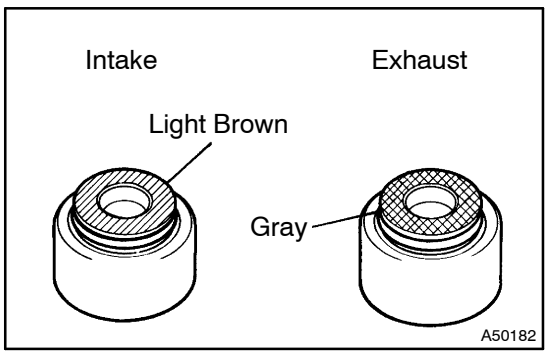
28. INSTALL STUD BOLT

(a) Install stud bolts on the intake side.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)



29. INSTALL STUD BOLT

(a) Install stud bolts on the exhaust side.
Torque: 20 N·m (199 kgf·cm, 14 ft·lbf)



30. INSTALL VALVE STEM OIL O SEAL OR RING

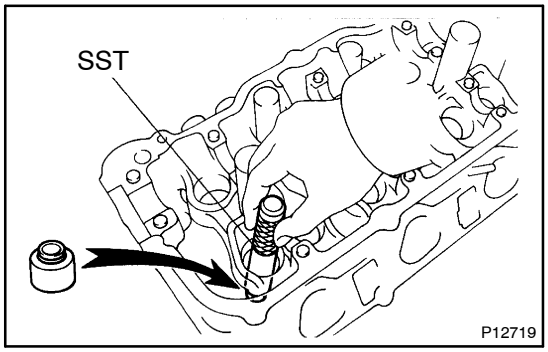
(a) Apply a light coat of engine oil on the valve stem.

NOTICE:

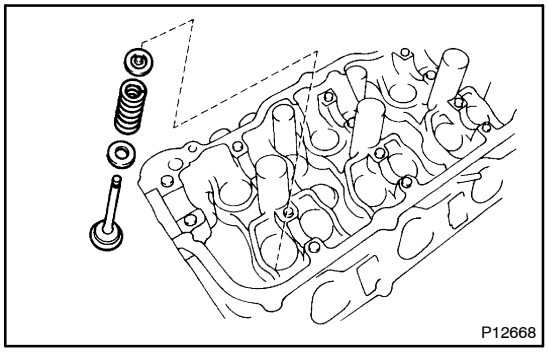
Pay much attention assembling the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.

HINT:

The intake valve oil seal is light brown and the exhaust valve oil seal is gray.



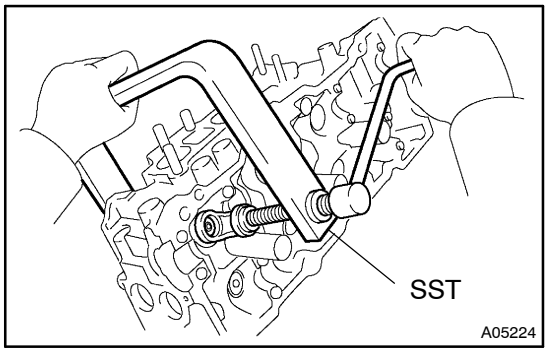
(b) Using SST, push in a new oil seal.
SST 09201–41020



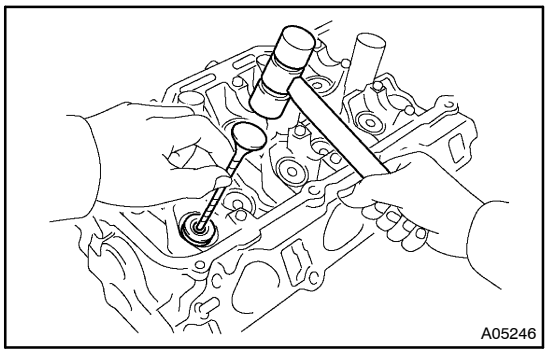
31. INSTALL INTAKE VALVE

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

NOTICE:
Install them with the same combination at the original place.

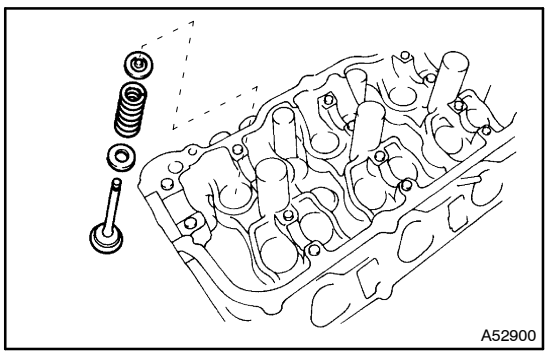


(b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70020 (09202–00010)



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

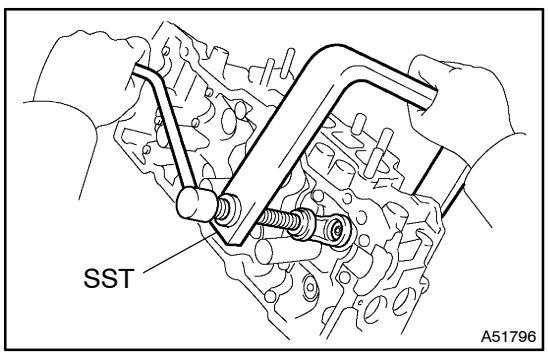
NOTICE:
Be careful not to damage the valve stem tip.



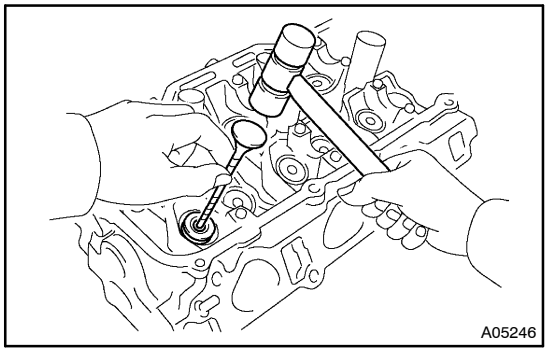
32. INSTALL EXHAUST VALVE

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

NOTICE:
Install them with the same combination at the original place.



(b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.
SST 09202–70020 (09202–00010)



(c) Using a plastic–faced hammer at 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.

33. INSTALL VALVE LIFTER

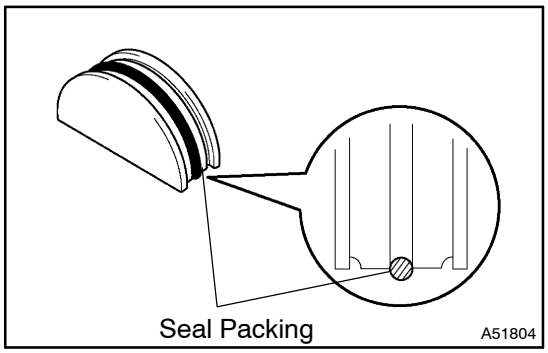
(a) Apply a light coat of engine oil on the valve lifter.

NOTICE:

Install them with the same combination at the original place.

(b) Install the valve lifter.

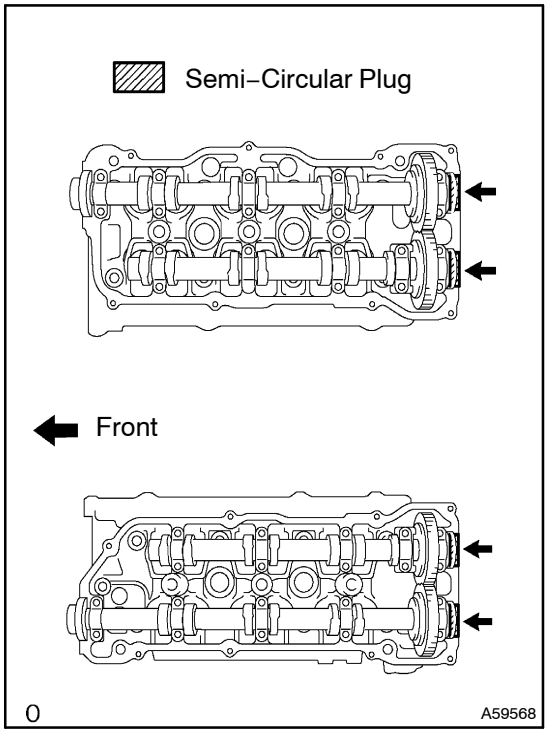
(c) Check that the valve lifter rotates smoothly by hand.



34. INSTALL SEMICIRCULAR PLUG

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

(b) Apply seal packing to the semi–circular plug grooves.
Seal packing: Part No. 08826–00080 or equivalent



(c) Install the 4 semi–circular plugs to the cylinder heads.

NOTICE:

- **Install the plugs flash with the top of the cylinder head.**
- **Install the semi–circular plugs within 3 minutes after applying seal packing.**
- **Do not put into engine oil within 2 hours after installing.**

35. INSTALL W/HEAD STRAIGHT SCREW PLUG NO.1

(a) Using a 10mm socket hexagon wrench, install a new gasket and the screw plug.
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)

36. INSTALL W/HEAD STRAIGHT SCREW PLUG NO.2

(a) Using a 10mm socket hexagon wrench, install a new gasket and the screw plug.
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)