CYLINDER HEAD ASSY (1AZ–FE/2AZ–FE)

140IB–01

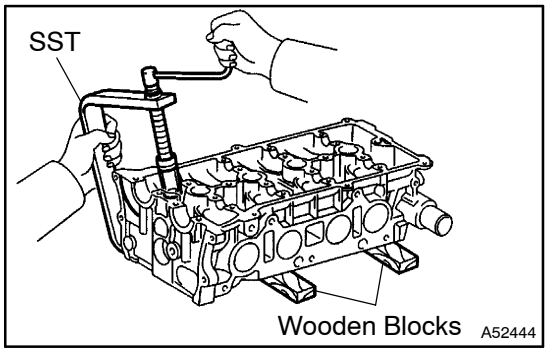
OVERHAUL

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)

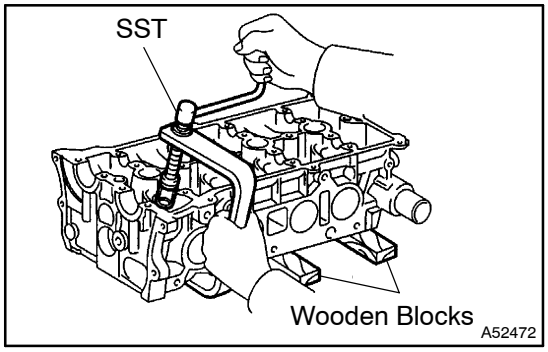
(b) Remove the parts below from the cylinder head.

1	Retainer
2	Valve spring
3	Intake valve

HINT:

Arrange the removed parts in the correct order.

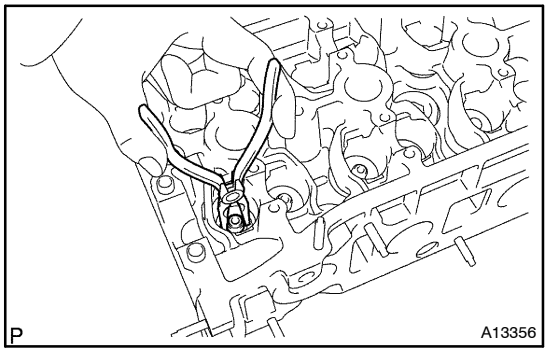
3. REMOVE EXHAUST VALVE



(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

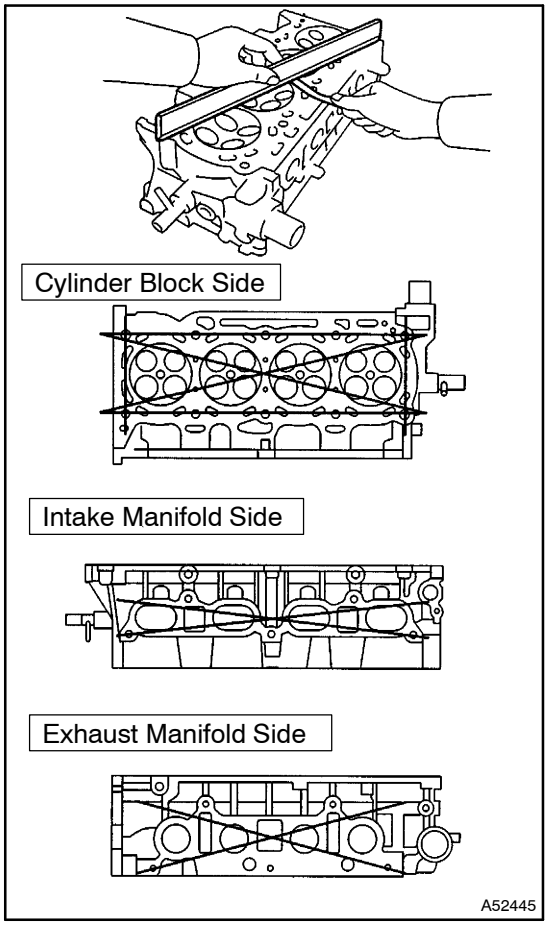


4. REMOVE VALVE STEM OIL O SEAL OR RING

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

5. REMOVE VALVE SPRING SEAT

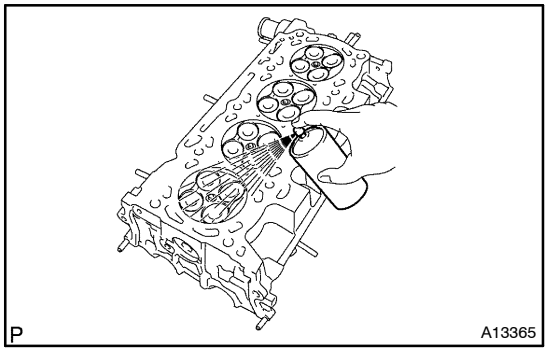
6. REMOVE STUD BOLT



7. INSPECT CYLINDER HEAD FOR FLATNESS

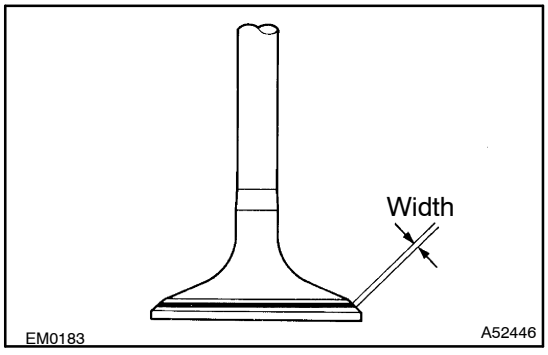
(a) Using a precision straight edge and a feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

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 penetrate, check the intake ports, exhaust ports and cylinder surface for cracks.



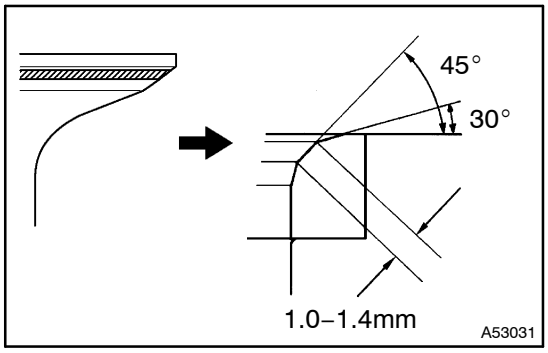
9. INSPECT VALVE SEATS

(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 sat, the guide and face are concentric. If not, resurface the seat.
  (3) Check that the sat contact is in the middle of the valve face with the width between 1.0 – 1.4 mm (0.039 – 0.055 in.).

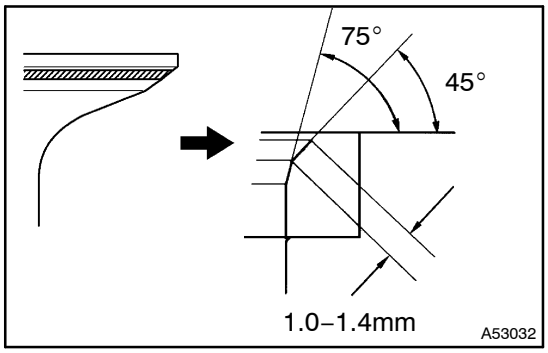
10. REPAIR VALVE SEATS

NOTICE:

Take off a cutter gradually to make smooth seats.



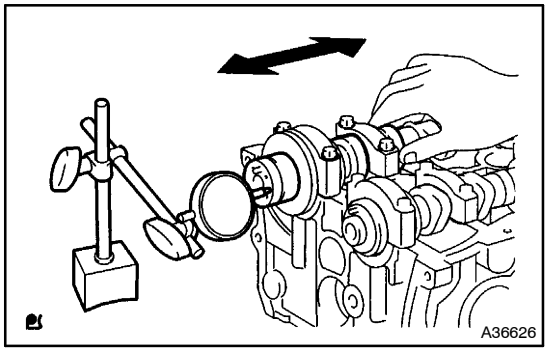
(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



(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.



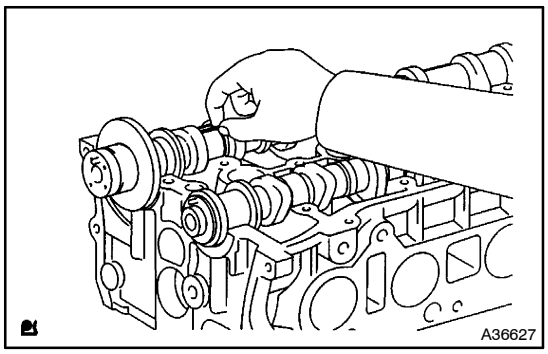
11. INSPECT CAMSHAFT THRUST CLEARANCE

(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.

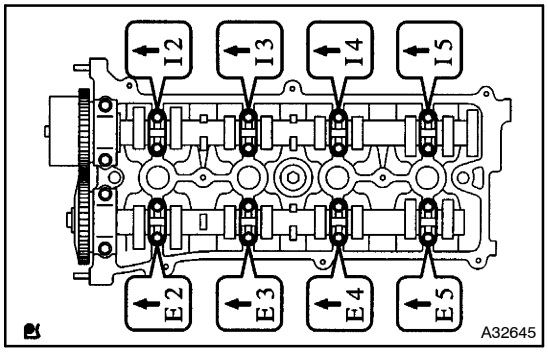


12. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps and camshaft journals.

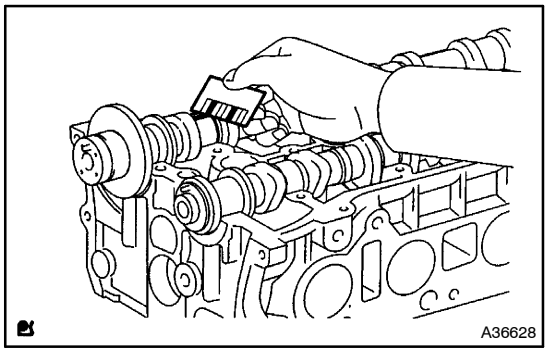
(b) Place the camshafts on the cylinder head.

(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)

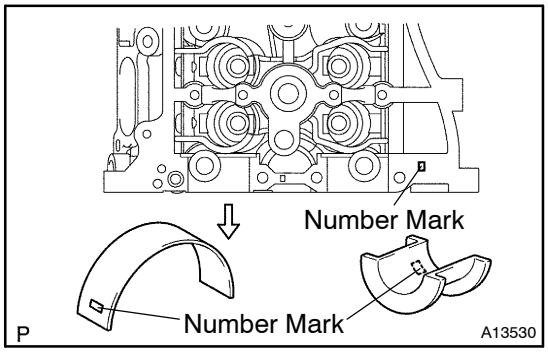
NOTICE:
Do not turn the camshaft.



(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

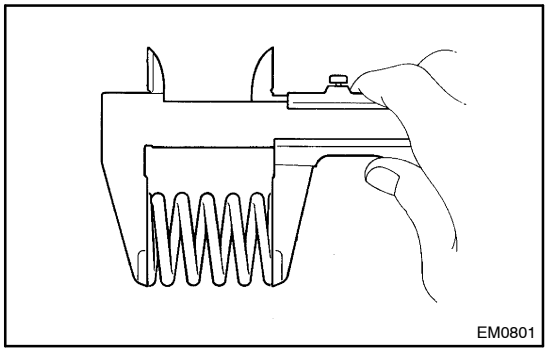
Mark "1"	40.000 – 40.008 mm (1.57480 – 1.57511 in.)
Mark "2"	40.009 – 40.017 mm (1.57515 – 1.57547 in.)
Mark "3"	40.018 – 40.025 mm (1.57551 – 1.57578 in.)

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.)

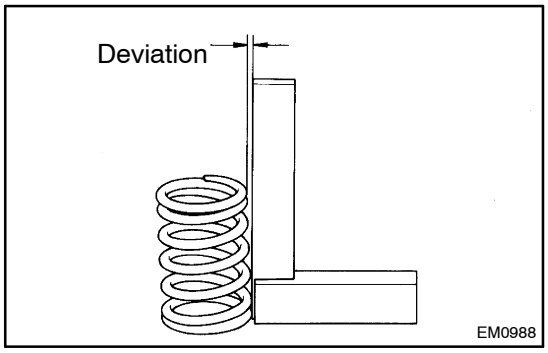
Camshaft journal diameter

	35.971 – 35.985 mm (1.41648 – 1.41673 in.)


EM0801

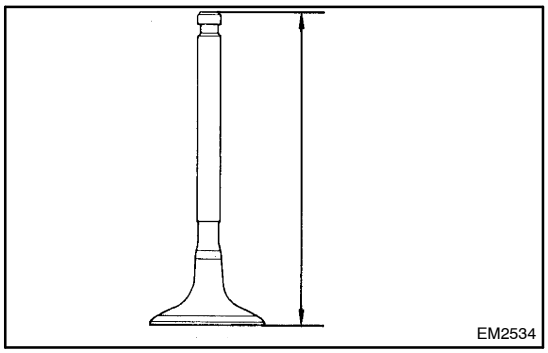
13. INSPECT INNER COMPRESSION SPRING

(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.)



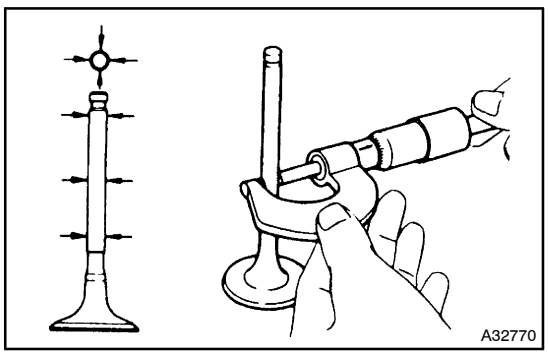
EM0988

(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°

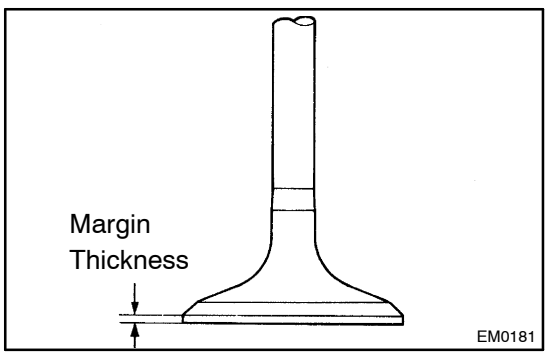

EM2534

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.)

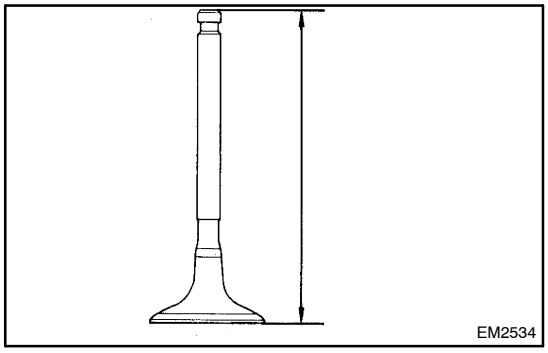

A32770

(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.)



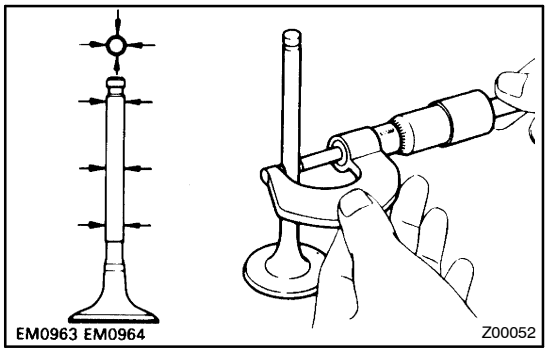
EM0181

(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.)

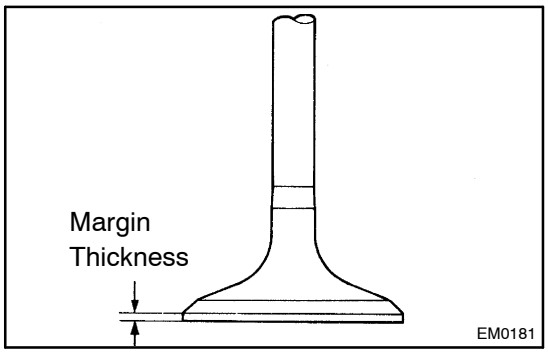


15. INSPECT EXHAUST VALVE

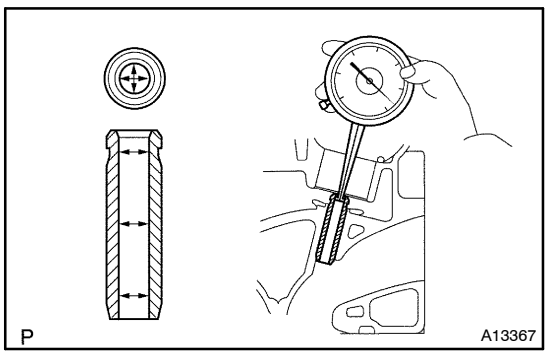
(a) Check the valve overall length.
(1) Using vernier calipers, measure the valve overall length.
Standard overall length: 101.15 mm (3.9823in.)
Minimum overall length: 100.70 mm (3.9646 in.)



(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.)



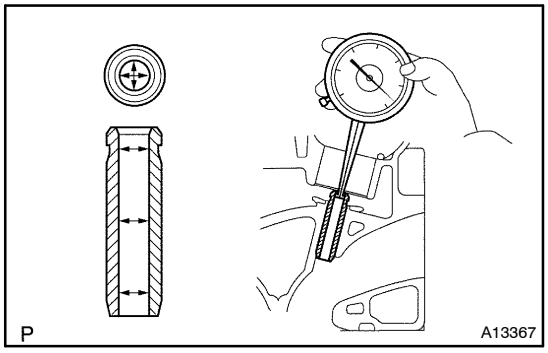
(c) Check the valve head margin thickness.
(1) Using vernier calipers, measure the valve head margin thickness.
Standard margin thickness:
1.2 – 1.6 mm (0.047 – 0.063 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)



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.)

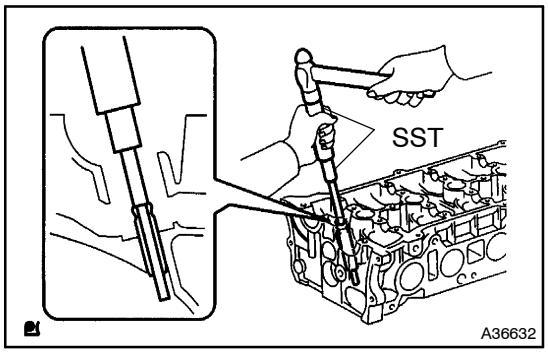
(b) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.
Standard oil clearance:
0.025 – 0.060 mm (0.00098 – 0.00236 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)



17. INSPECT EXHAUST VALVE GUIDE BUSH

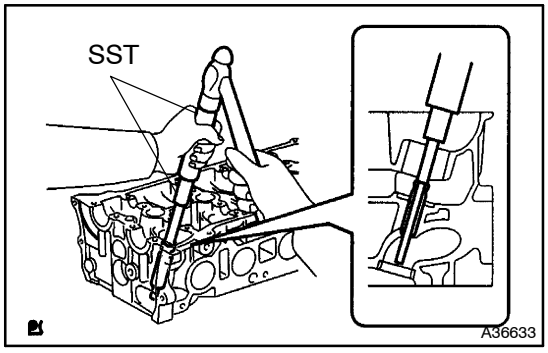
(a) Using a caliper gauge, measure the inside diameter of the guide bushing.
Bushing inside diameter:
5.510 – 5.530 mm (0.2169 – 0.2177 in.)

(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)

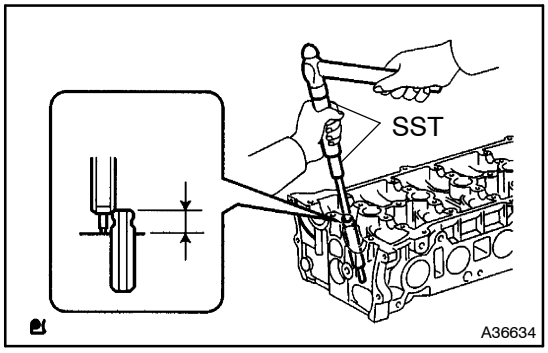
20. INSTALL INTAKE VALVE GUIDE BUSH

(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.)

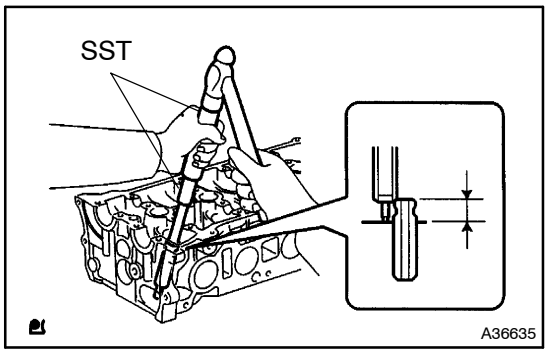
21. INSTALL EXHAUST VALVE GUIDE BUSH

(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.)

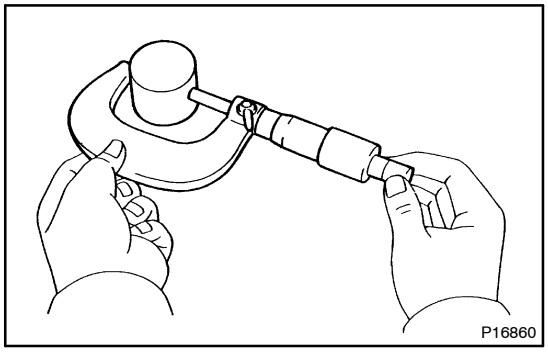


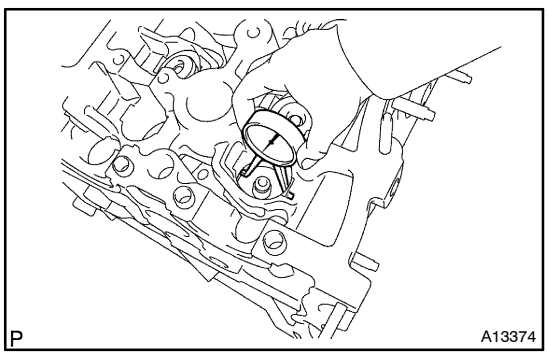
(c) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.
Protrusion height: 9.6 – 10.0 mm (0.3779 – 0.3937 in.)

(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

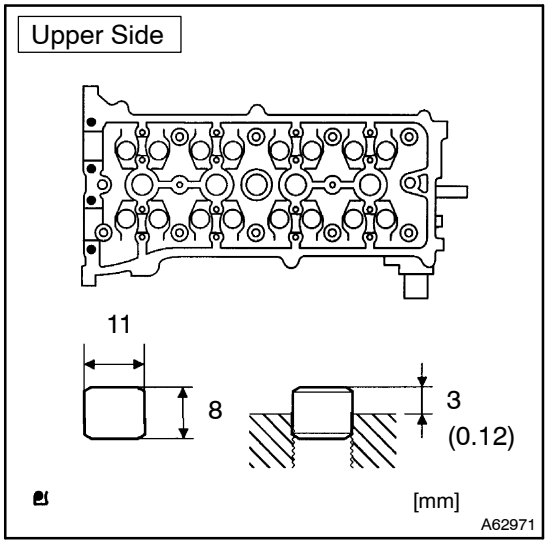
(a) Check the lifter diameter.
(1) Using a micrometer, measure the lifter diameter.
Lifter diameter:
30.966 – 30.976 mm (1.2191 – 1.2195 in.)





(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.)

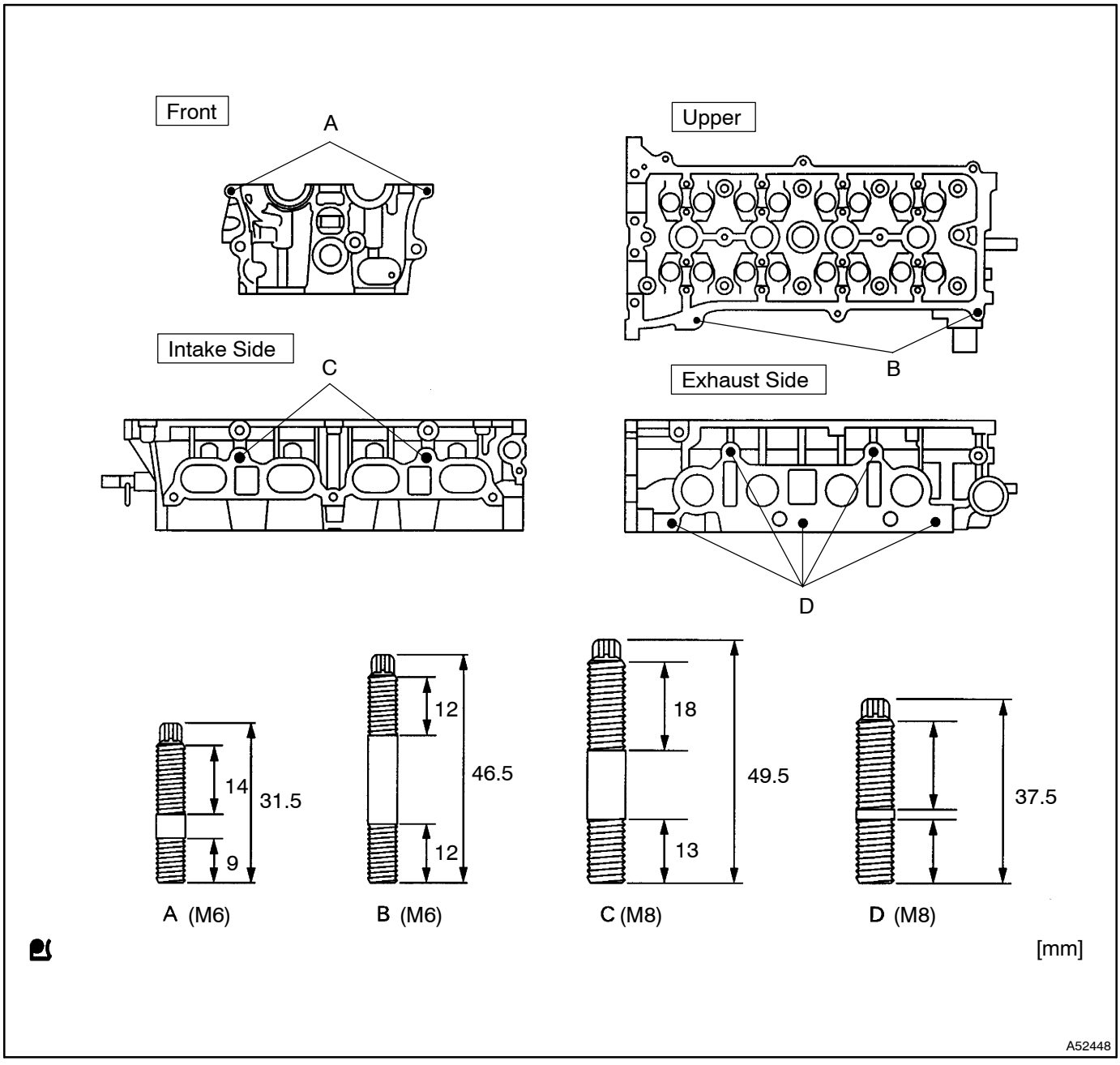


23. INSTALL RING W/HEAD PIN

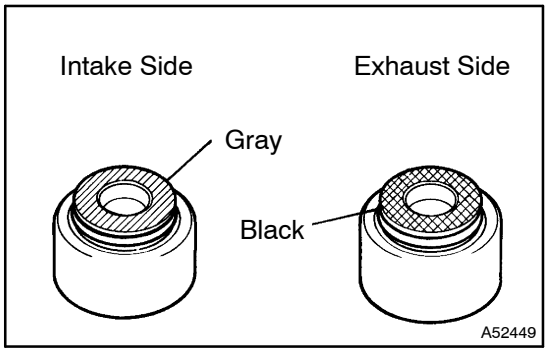
(a) Using a plastic–faced hammer, tap in a new ring pin to the specified protrusion height.
Protrusion height: 3 mm (0.12 in.)

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

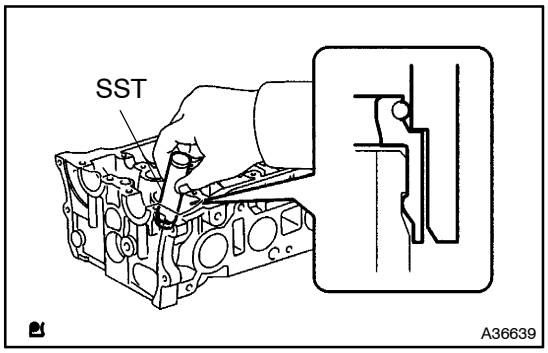
(a) Apply a light coat of engine oil on new valve stem seals.

NOTICE:

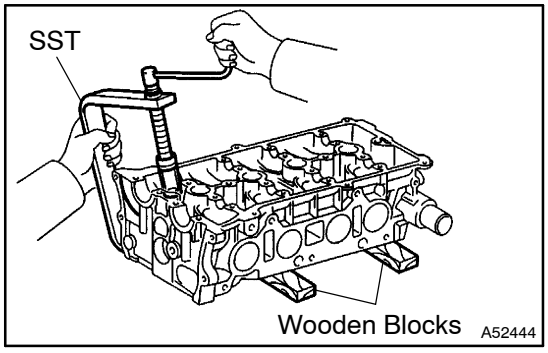
Pay much attention assembling the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.

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

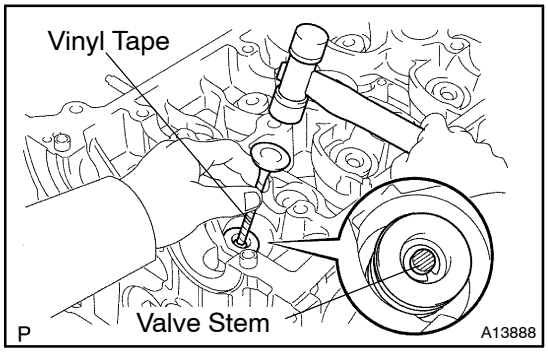


27. INSTALL INTAKE VALVE

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

1	Intake valve
2	Spring
3	Retainer

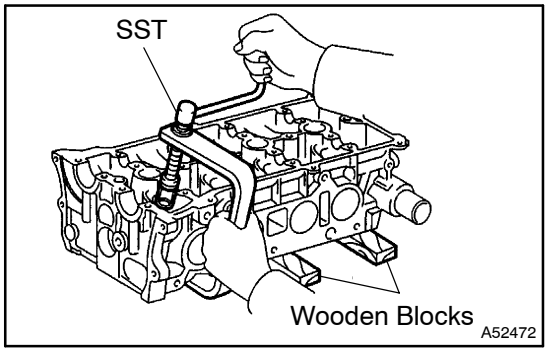
(b) Using SST and wooden blocks, compress and install 2 valve spring retainer locks.
SST 09202–70020 (09202–00010)



(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.

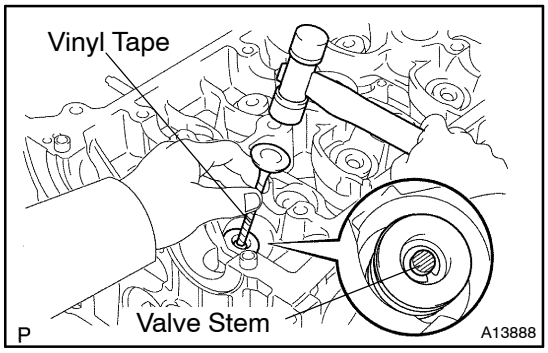


28. INSTALL EXHAUST VALVE

(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.