

# CYLINDER HEAD ASSY (1AZ-FE)

## OVERHAUL

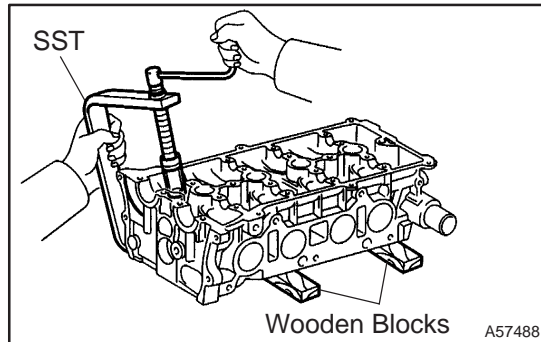
140DV-01

### 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)

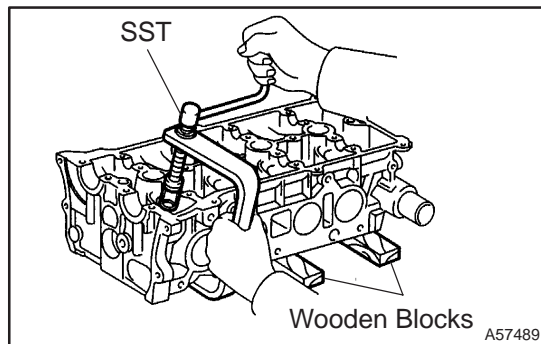
- (b) Remove the parts below from the cylinder head.

1	Retainer
2	Valve spring
3	Intake valve

HINT:

Arrange the removed parts in the correct order.

### 3. REMOVE EXHAUST VALVE

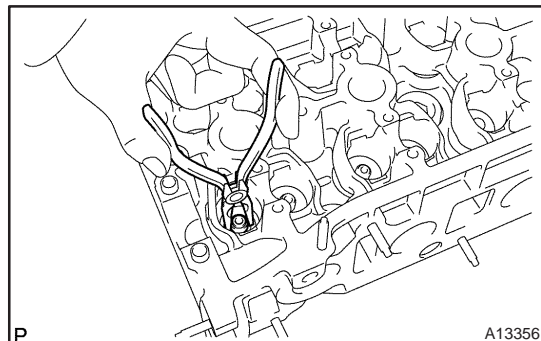


- (a) Using SST and wooden blocks, compress and remove the 8 valve spring retainer locks.

SST 09202-70020 (09202-00010)

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

1	Retainer
2	Valve spring
3	Exhaust valve

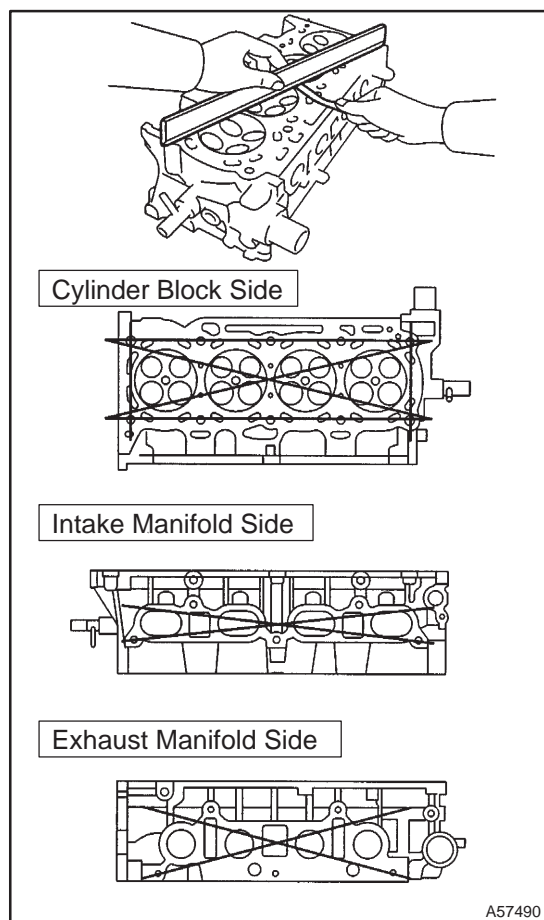


### 4. REMOVE VALVE STEM OIL O SEAL OR RING

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

### 5. REMOVE VALVE SPRING SEAT

### 6. REMOVE STUD BOLT



## 7. INSPECT CYLINDER HEAD FOR FLATNESS

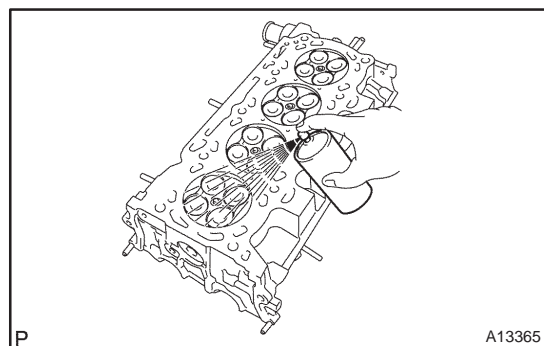
- (a) Using a precision straight edge and a feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

**Maximum warpage:**

**Cylinder block side 0.08 mm (0.0031 in.)**

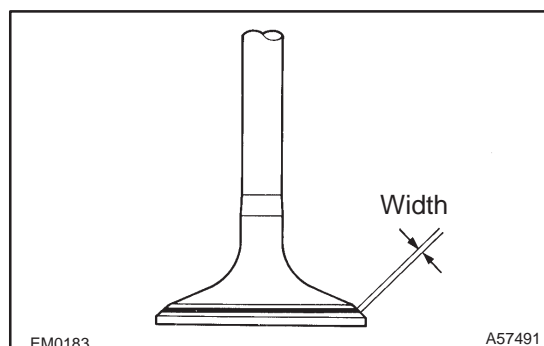
**Intake manifold side 0.08 mm (0.0031 in.)**

**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.

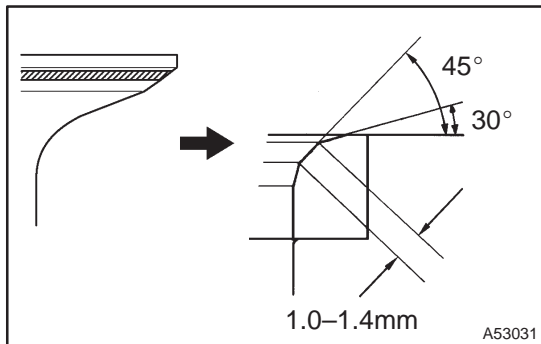


## 9. INSPECT VALVE SEATS

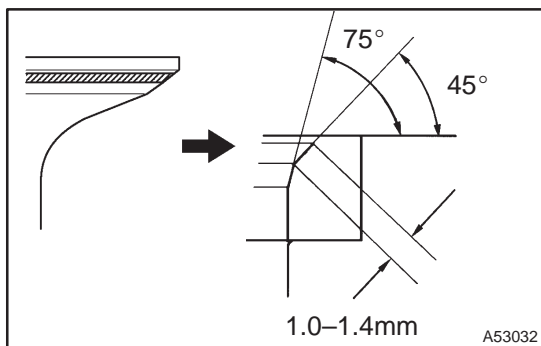
- (a) Apply a light coat of prussian blue (or white lead) to the valve face.
- (b) Lightly press the valve against the seat.
- (c) Check the valve face and seat according to the following procedure.
- (1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
  - (2) 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:**

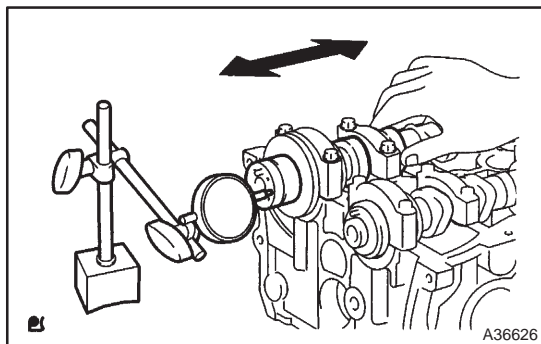
Take off a cutter gradually to make smooth seats.



- (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.)**

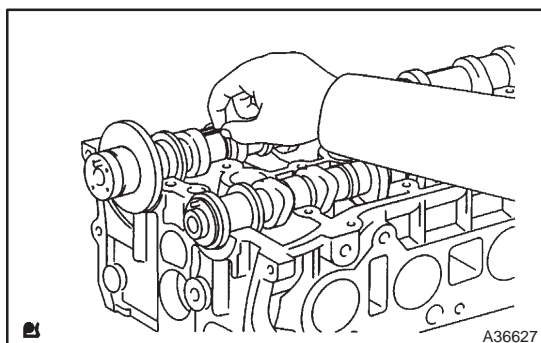
**Exhaust 0.080 – 0.135 mm (0.0032 – 0.0053 in.)**

**Maximum thrust clearance:**

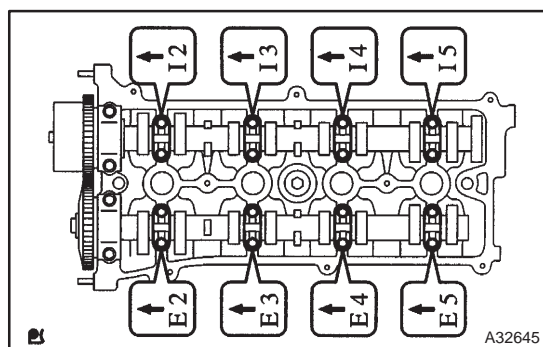
**Intake 0.11 mm (0.0043 in.)**

**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:**

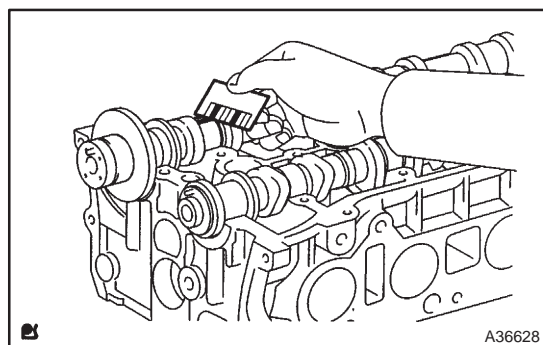
**29.5 N·m (300 kgf·cm, 22 ft·lbf) for No. 1**

**29.5 N·m (300 kgf·cm, 22 ft·lbf) for No. 2**

**9 N·m (90 kgf·cm, 80 in·lbf) for No. 3**

**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.)**

**Exhaust No. 1 journal**

**0.040 – 0.079 mm (0.0016 – 0.003 in.)**

**Other journals**

**0.025 – 0.062 mm (0.00098 – 0.00244 in.)**

**Maximum oil clearance:**

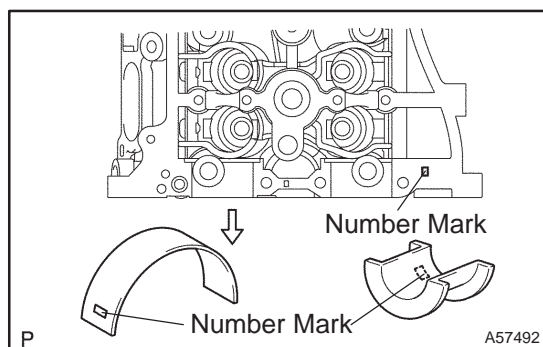
**Intake No. 1 journal 0.07 mm (0.0028 in.)**

**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.

**Cylinder head journal bore diameter**

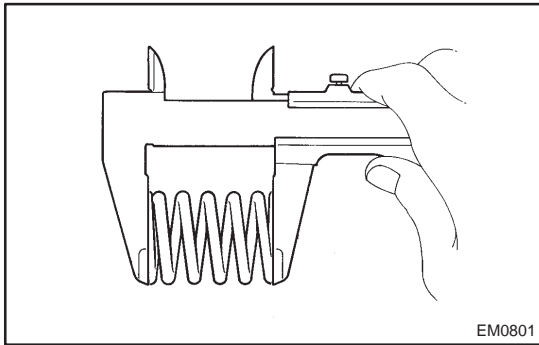
Mark "1"	40.000 – 40.008 mm (1.57480 – 1.57511 in.)
Mark "2"	40.009 – 40.017 mm (1.57515 – 1.57547 in.)
Mark "3"	40.018 – 40.025 mm (1.57551 – 1.57578 in.)

**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**

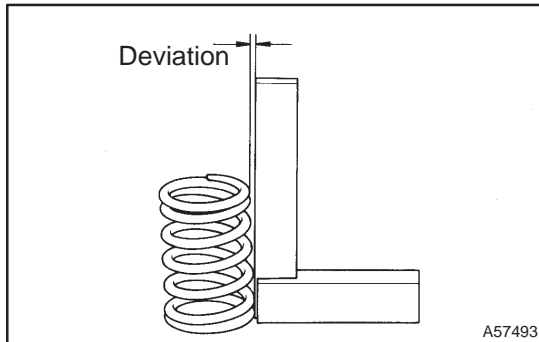
	35.971 – 35.985 mm (1.41648 – 1.41673 in.)
--	--



### 13. INSPECT INNER COMPRESSION SPRING

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

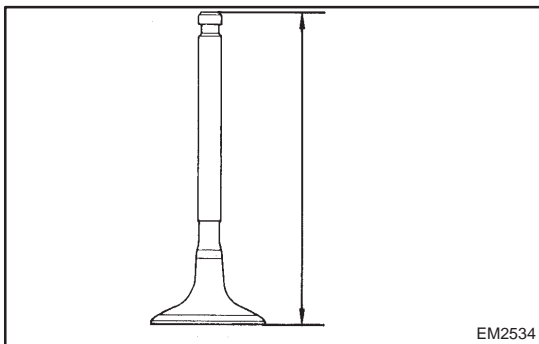
**Free length: 45.7 mm (1.799 in.)**



- (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°**

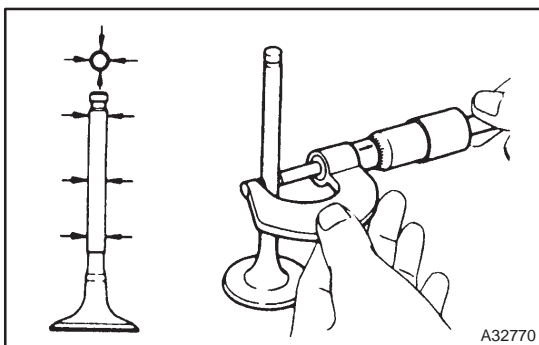


### 14. INSPECT INTAKE VALVE

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

**Standard overall length: 101.71 mm (4.0043in.)**

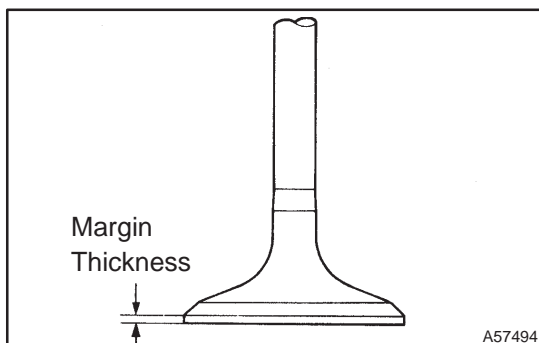
**Minimum overall length: 101.21 mm (3.9846in.)**



- (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.)**

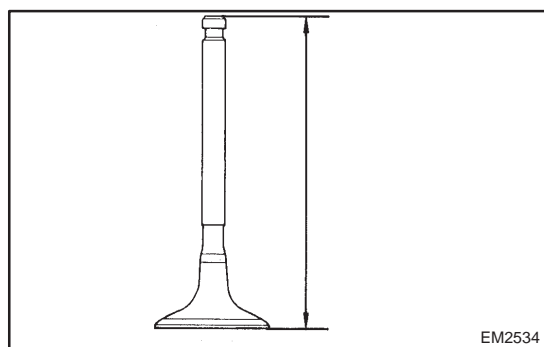


- (c) Check the valve head margin thickness.  
 (1) Using vernier calipers, measure the valve head margin thickness.

**Standard margin thickness:**

**1.05 – 1.45 mm (0.041 – 0.057 in.)**

**Minimum margin thickness: 0.5 mm (0.020 in.)**

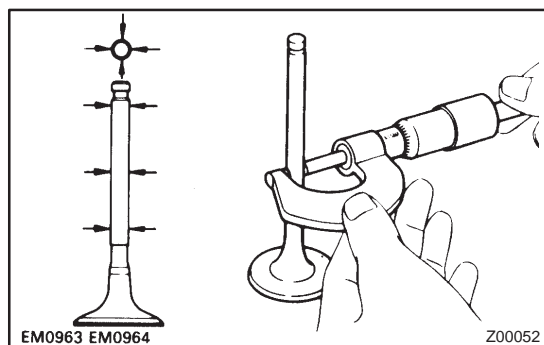


## 15. INSPECT EXHAUST VALVE

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

**Standard overall length: 101.15 mm (3.9823 in.)**

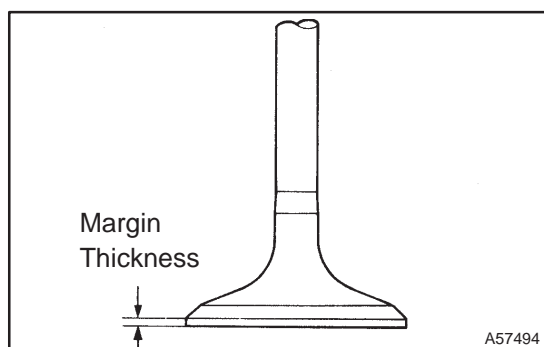
**Minimum overall length: 100.70 mm (3.9646 in.)**



- (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.)**

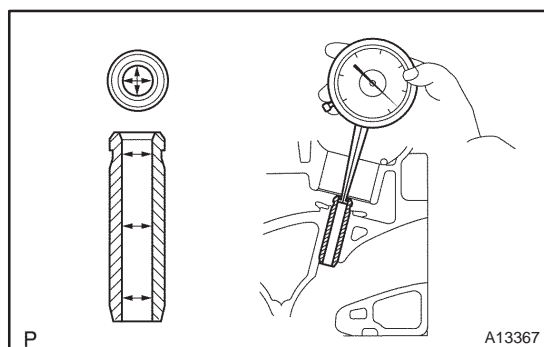


- (c) Check the valve head margin thickness.  
 (1) Using vernier calipers, measure the valve head margin thickness.

**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 BUSHING

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

**Bushing inside diameter:**

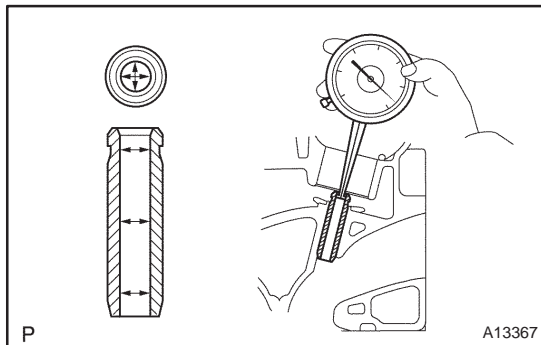
**5.510 – 5.530 mm (0.2169 – 0.2177 in.)**

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

**Standard oil clearance:**

**0.025 – 0.060 mm (0.0010 – 0.0024 in.)**

**Maximum oil clearance: 0.08 mm (0.0031 in.)**

**17. INSPECT EXHAUST VALVE GUIDE BUSHINGS**

- (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.

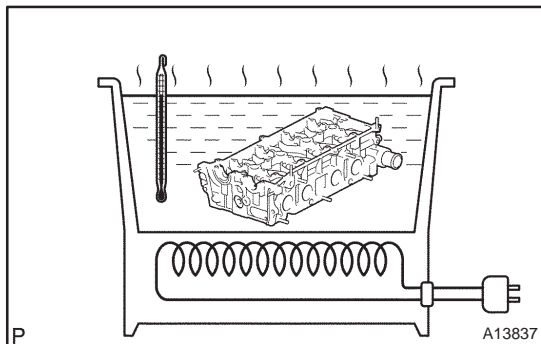
**Standard oil clearance:**

**0.030 – 0.065 mm (0.0012 – 0.0026 in.)**

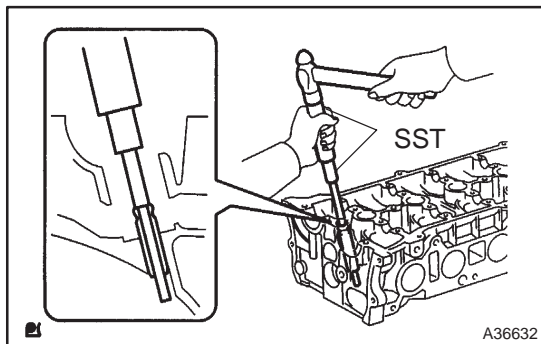
**Maximum oil clearance: 0.10 mm (0.0039 in.)**

**18. REMOVE INTAKE VALVE GUIDE BUSHING**

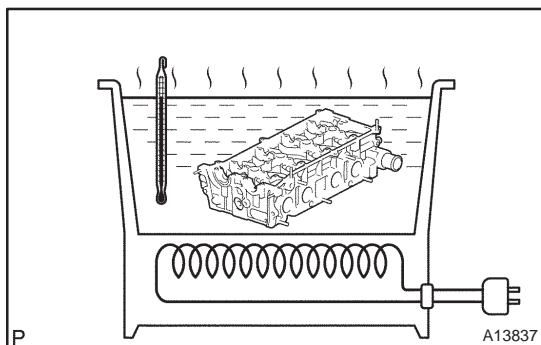
- (a) Gradually heat the cylinder head to 80 – 100°C (176 – 212°F).



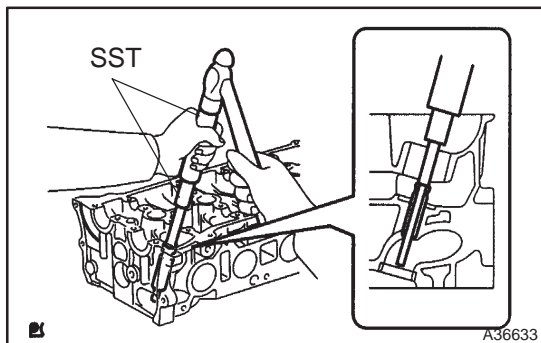
- (b) Using SST and a hammer, tap out the guide bushing.  
SST 09201-01055, 09950-70010 (09951-07100)

**19. REMOVE EXHAUST VALVE GUIDE BUSHINGS**

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



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





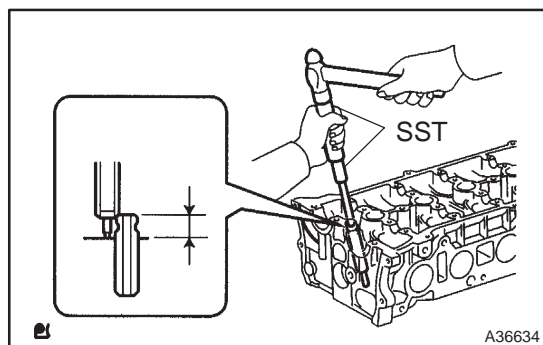
**20. INSTALL INTAKE VALVE GUIDE BUSHING**

- (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.

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 09201-01055, 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.)**

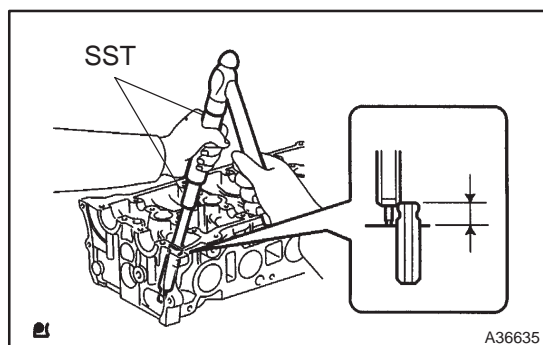
**21. INSTALL EXHAUST VALVE GUIDE BUSHINGS**

- (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.

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 09201-01055, 09950-70010 (09951-07100), 23801

**Standard oil clearance:**

**0.030 – 0.065 mm (0.00118 – 0.00256 in.)**

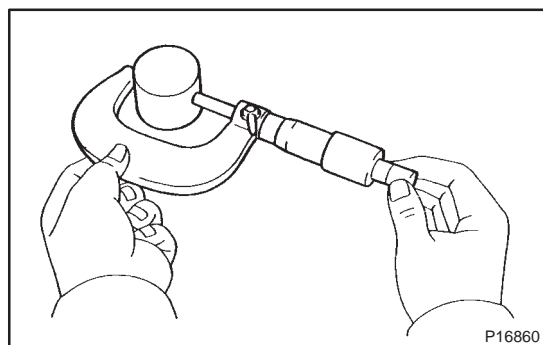
**22. INSPECT VALVE LIFTER**

- (a) Check the lifter diameter.

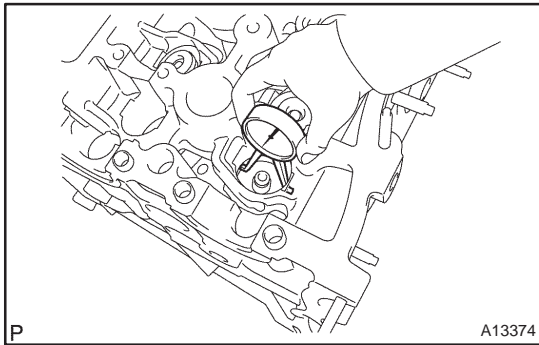
(1) Using a micrometer, measure the lifter diameter.

**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:**

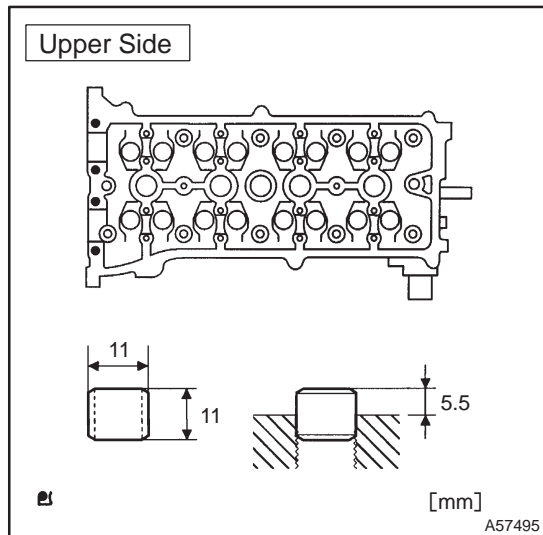
**0.033 – 0.059 mm (0.0013 – 0.0023 in.)**

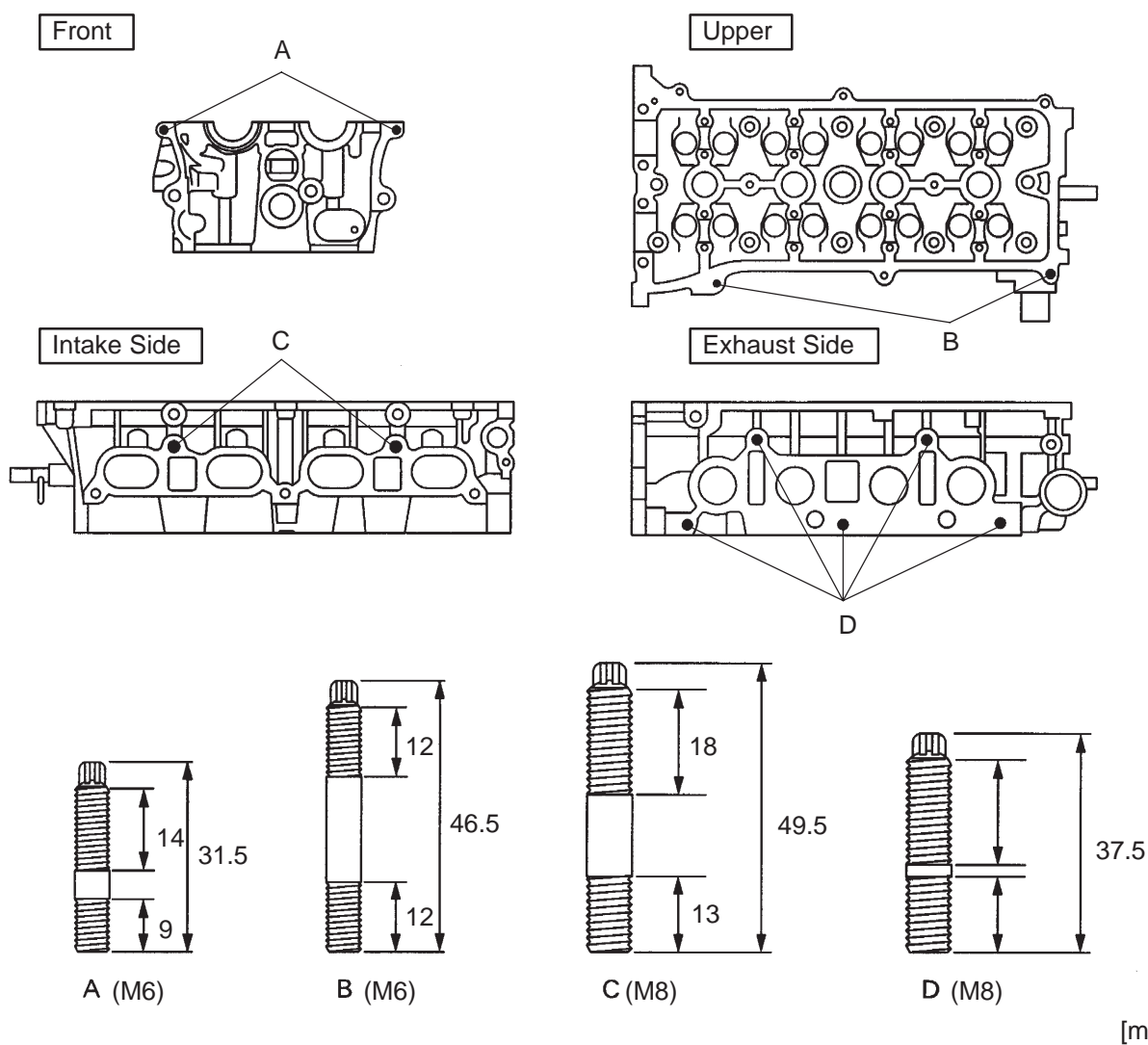
**Maximum oil clearance: 0.07 mm (0.0028 in.)**

## 23. INSTALL RING W/HEAD PIN

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

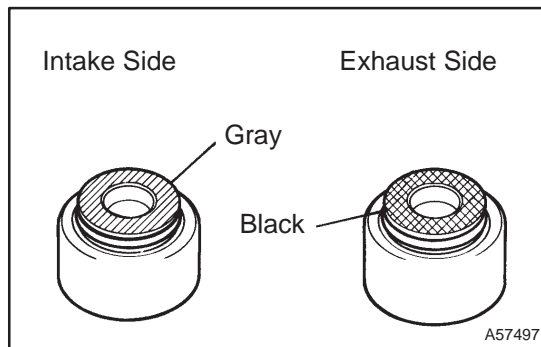
**Protrusion height: 5.5 mm (0.2165 in.)**



**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)**

A57496

**25. INSTALL VALVE SPRING SEAT**



## 26. INSTALL VALVE STEM OIL O SEAL OR RING

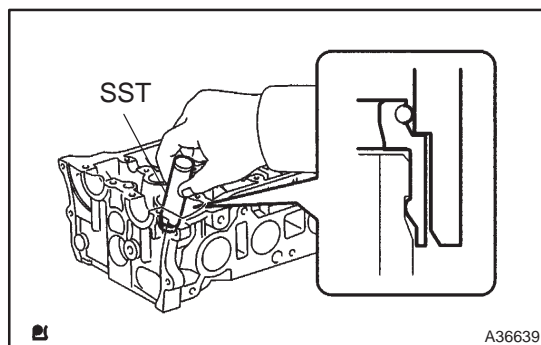
- (a) Apply a light coat of engine oil on new valve stem seals.

### NOTICE:

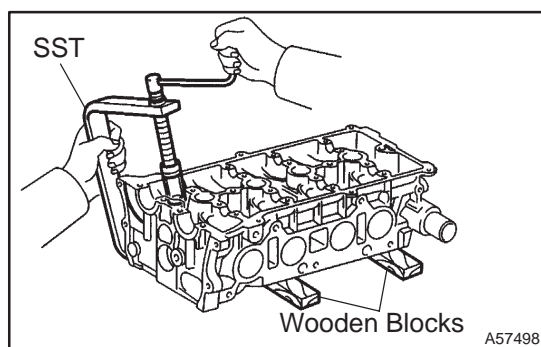
**Pay much attention assembling the oil seal for intake and exhaust. Assembling the wrong one may cause a failure.**

### 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

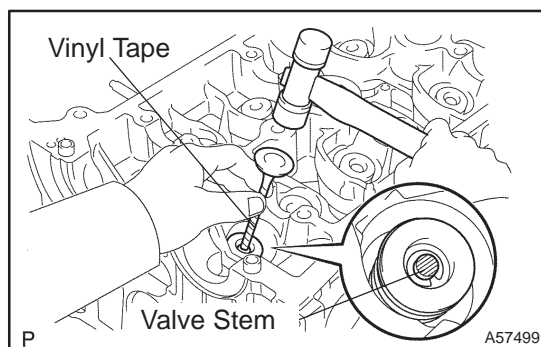


## 27. INSTALL INTAKE VALVE

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

1	Intake valve
2	Spring
3	Retainer

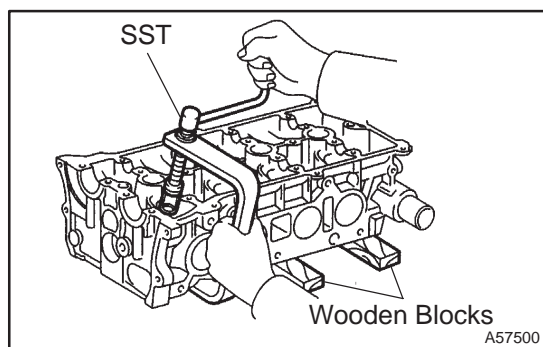
- (b) Using SST and wooden blocks, compress and install 2 valve spring retainer locks.  
SST 09202-70020 (09202-00010)



- (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

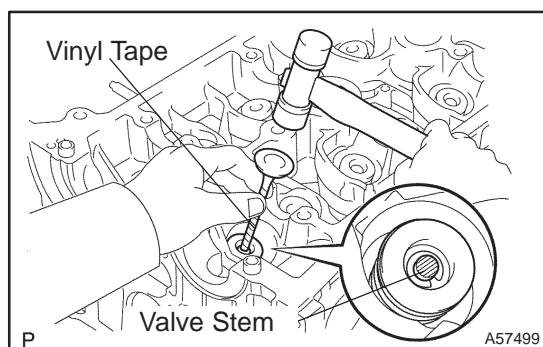
- (b) Using SST and wooden blocks, compress and install 2 valve spring retainer locks.

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.**