

# CYLINDER HEAD ASSY (1MZ-FE)

## OVERHAUL

140EQ-02

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

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

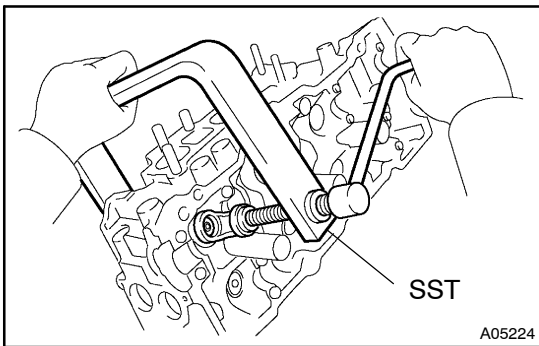
### 2. REMOVE W/HEAD STRAIGHT SCREW PLUG NO.2

- (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.



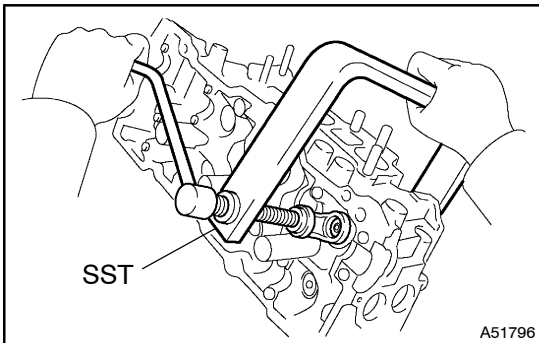
### 4. REMOVE INTAKE VALVE

- (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:

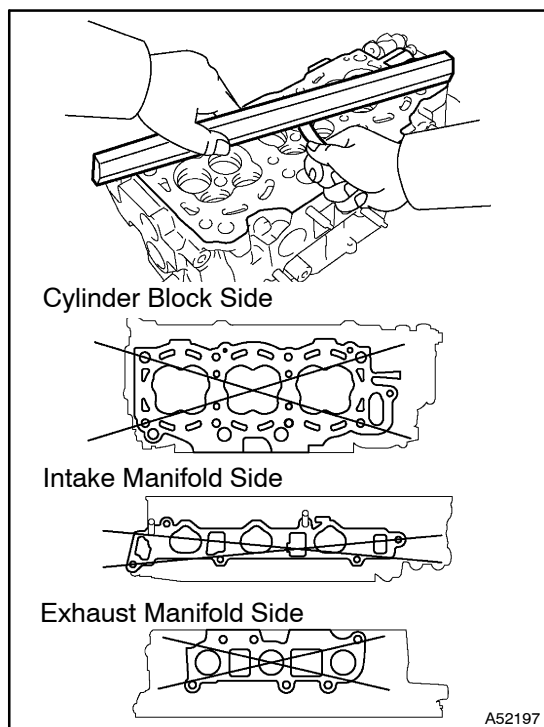
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.

### 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

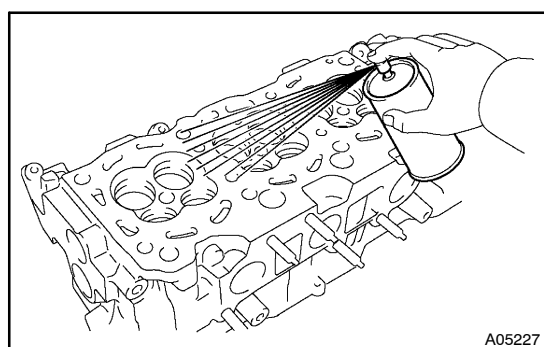
- (a) Using a precision straight edge and a feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

**Maximum warpage:**

**Cylinder block side 0.05 mm (0.0020 in.)**

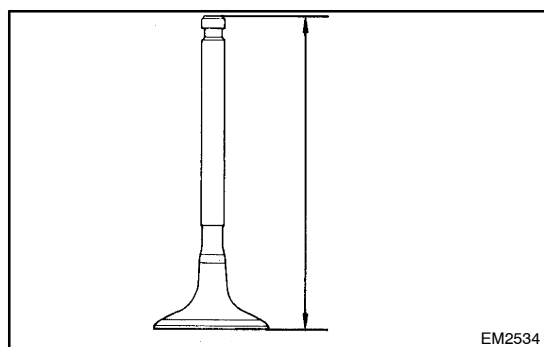
**Intake manifold side 0.10 mm (0.0039 in.)**

**Exhaust manifold side 0.10 mm (0.0039 in.)**



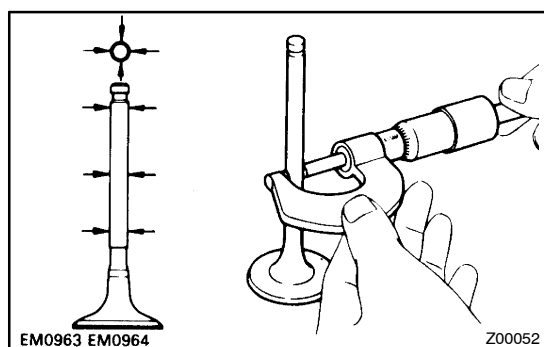
## 10. INSPECT CYLINDER HEAD FOR CRACKS

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



## 11. INSPECT INTAKE VALVE

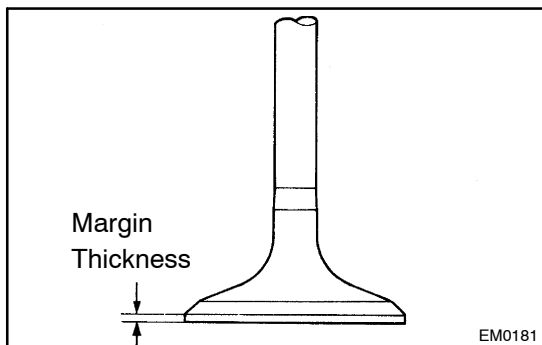
- (a) Check the valve overall length.  
**Standard overall length: 95.45 mm (3.7579 in.)**  
**Minimum overall length: 94.95 mm (3.7382 in.)**



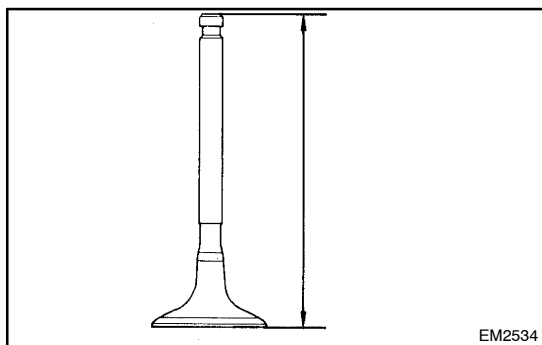
- (b) Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**5.470 - 5.485 mm (0.2154 - 0.2159 in.)**

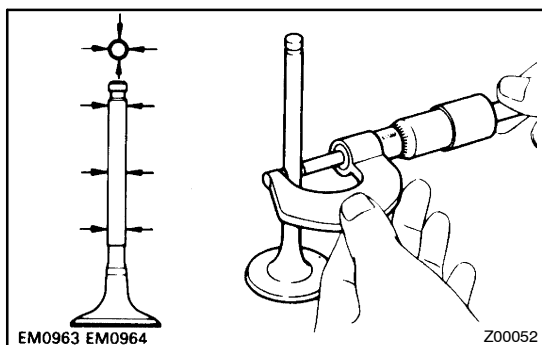


- (c) Check the valve head margin thickness.  
**Standard margin thickness: 1.0 mm (0.039 in.)**  
**Minimum margin thickness: 0.5 mm (0.020 in.)**

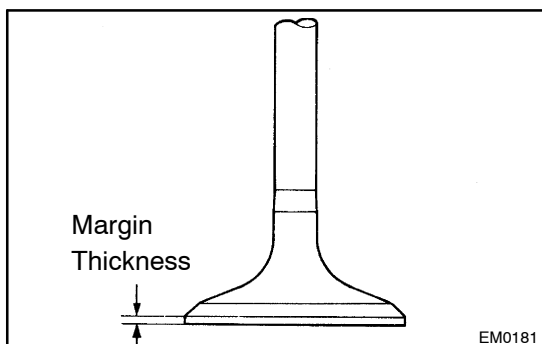


## 12. INSPECT EXHAUST VALVE

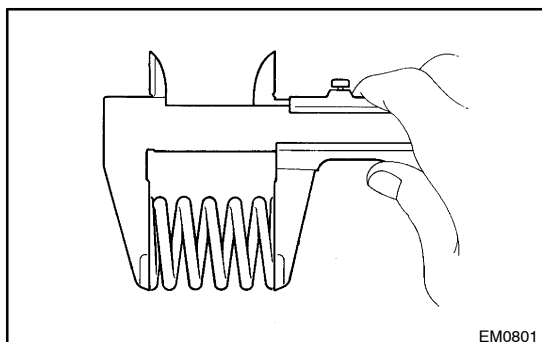
- (a) Check the valve overall length.  
**Standard overall length: 95.40 mm (3.7559 in.)**  
**Minimum overall length: 94.90 mm (3.7362 in.)**



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

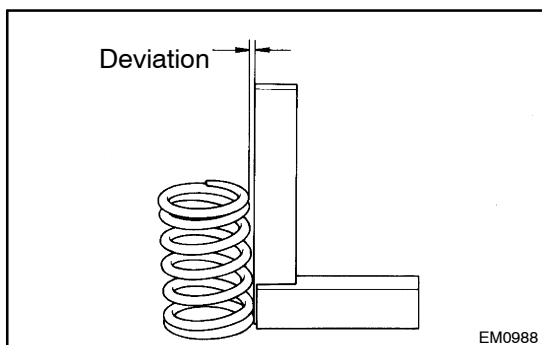


- (c) Check the valve head margin thickness.  
**Standard margin thickness: 1.0 mm (0.039 in.)**  
**Minimum margin thickness: 0.5 mm (0.020 in.)**



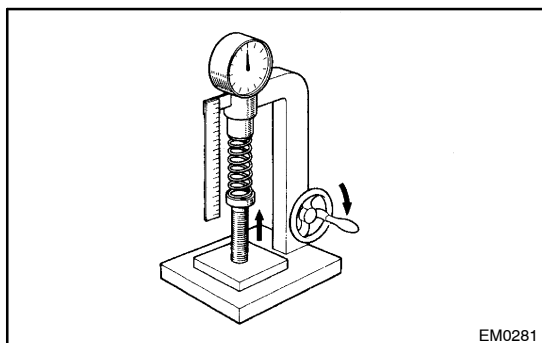
## 13. INSPECT INNER COMPRESSION SPRING

- (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.)**



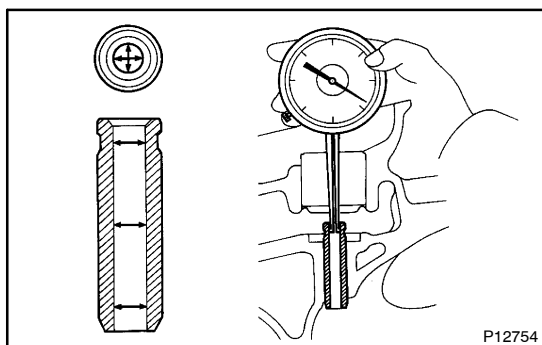
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

**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:**

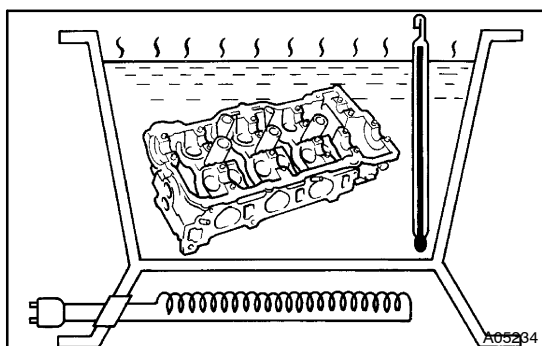
**Intake 0.025 – 0.060 mm (0.0010 – 0.0024 in.)**

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

**Maximum oil clearance:**

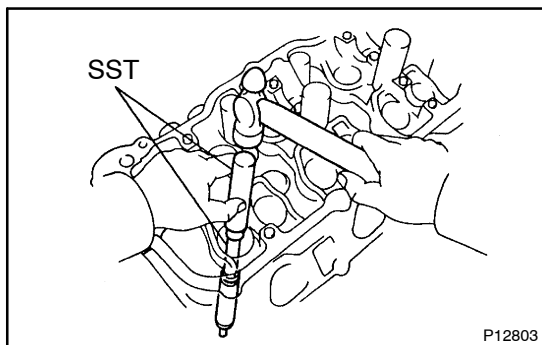
**Intake 0.08 mm (0.0031 in.)**

**Exhaust 0.10 mm (0.0039 in.)**

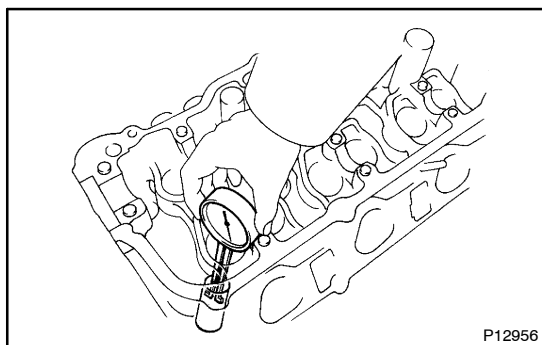


#### 15. REMOVE VALVE GUIDE BUSHING

- (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.)

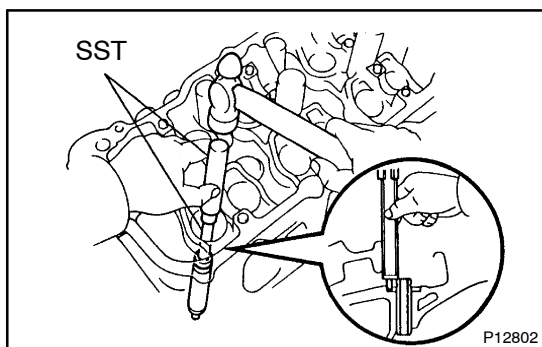
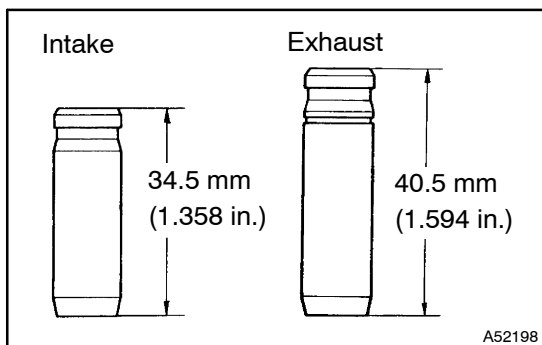
HINT:

### 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.)

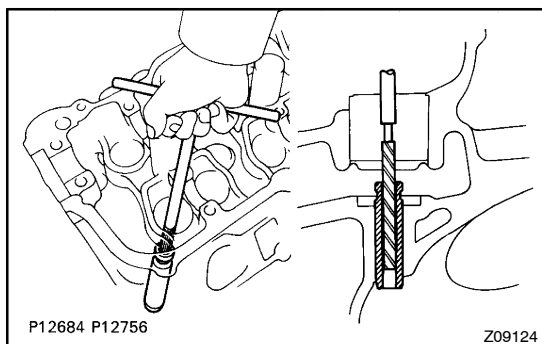


- (c) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.  
 SST 09201-10000, 09201-01055, 09950-70010  
 (09951-07100)

### 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.)**

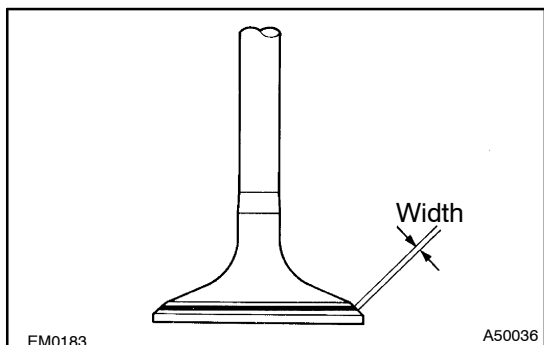
**Exhaust 0.030 – 0.065 mm (0.0012 – 0.0026 in.)**

**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.**



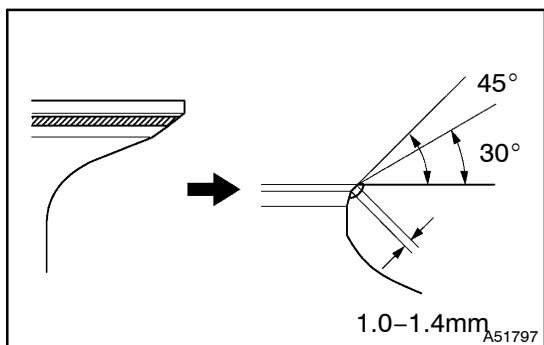
- (c) Check the valve face and seat according to the following procedure.

- (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.).

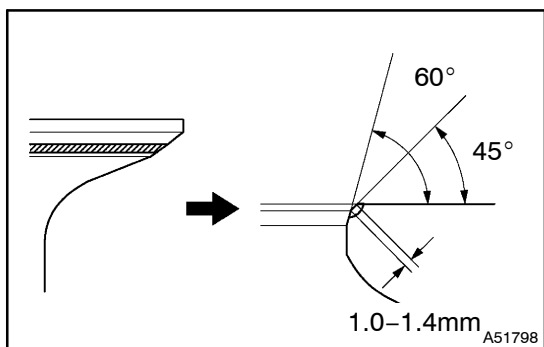
**18. REPAIR VALVE SEATS****NOTICE:**

**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.



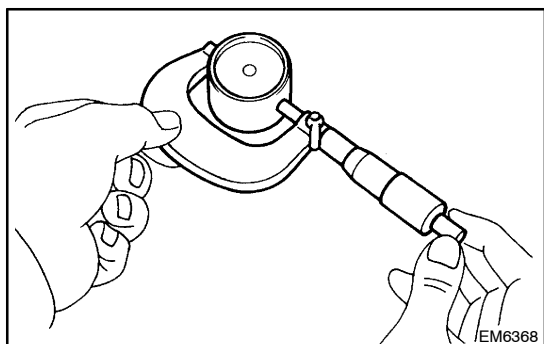
- (b) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.
- (c) Hand-lap the valve and valve seat with an abrasive compound.
- (d) Check the valve seating position.

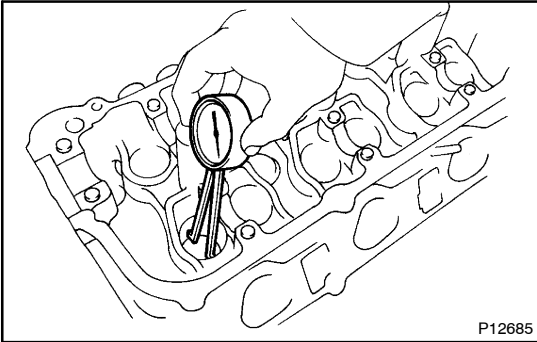
**19. INSPECT VALVE LIFTER**

- (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.**

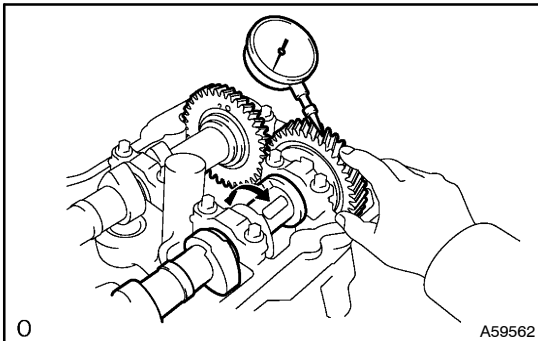
- (b) Set the dial indicator to the teeth of the intake camshaft at a right angle (90°).

- (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.

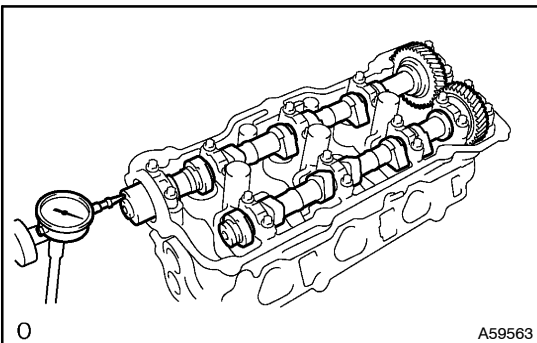
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance:**

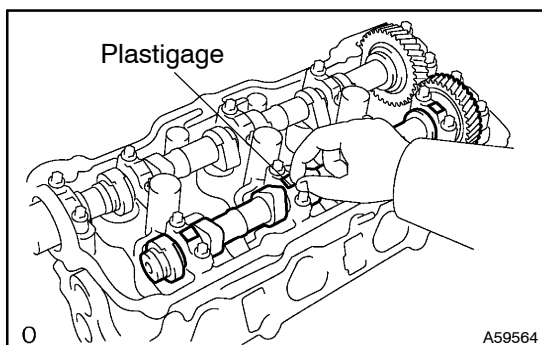
**0.040 – 0.090 mm (0.0016 – 0.0035 in.)**

**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.

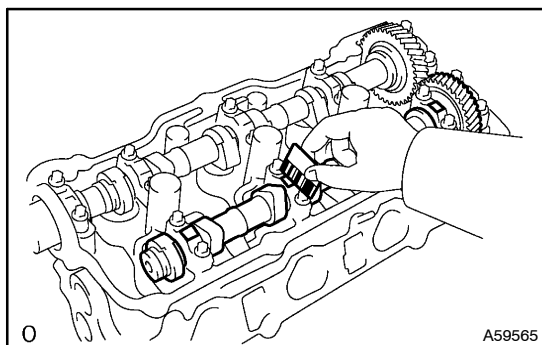
- (d) Install the bearing caps.

**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.)**

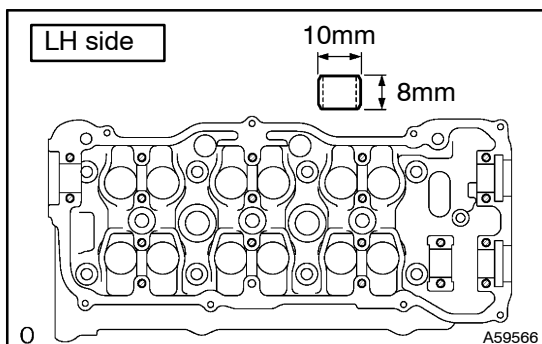
**Other journals 0.025 – 0.062 mm (0.0010 – 0.0024 in.)**

**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:**

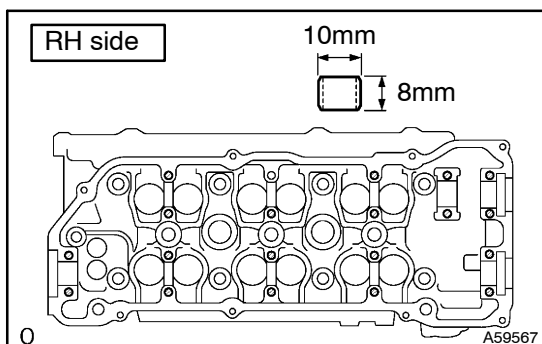
**Completely remove the plastigage.**



**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.)**

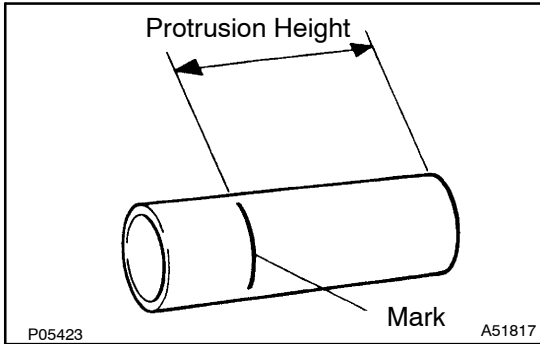


**25. INSTALL RING PIN**

- (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.

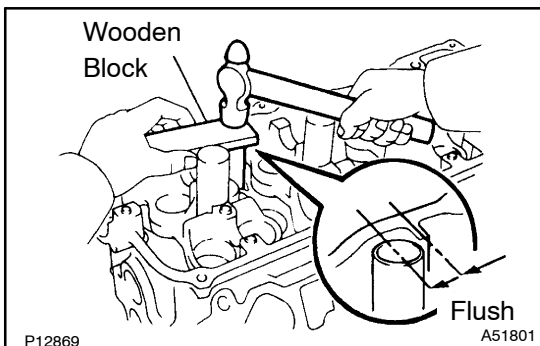
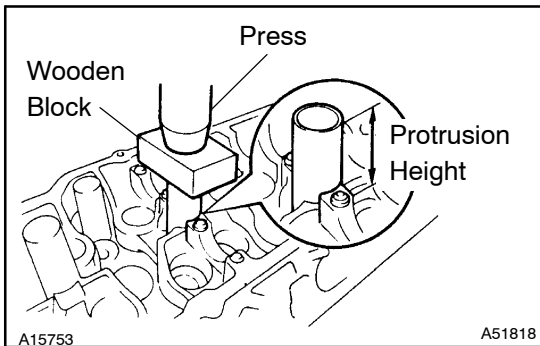
**Adhesive: Part No. 08833-00070 THREE BOND 1324 or equivalent**

**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:**

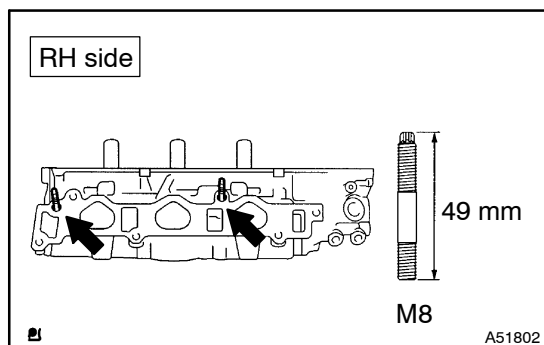
**Be careful not to drip the adhesive.**

**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.

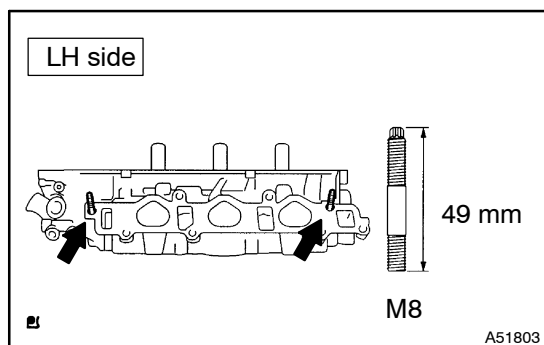
**NOTICE:**

**Be careful not to damage the cylinder head edge.**

**28. INSTALL STUD BOLT**

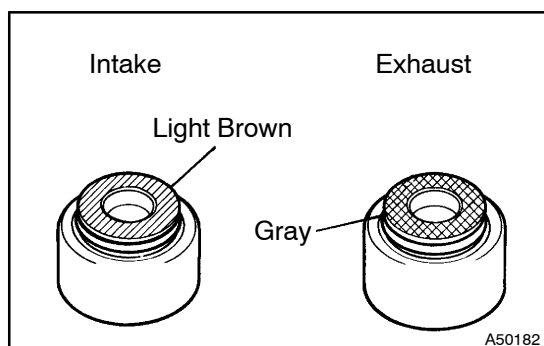
- (a) Install stud bolts on the intake side.

**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**

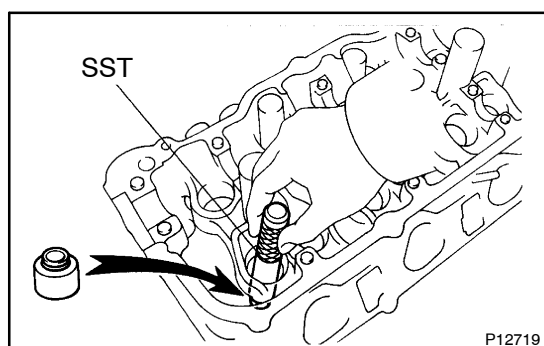
- (a) Apply a light coat of engine oil on the valve stem.

**NOTICE:**

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

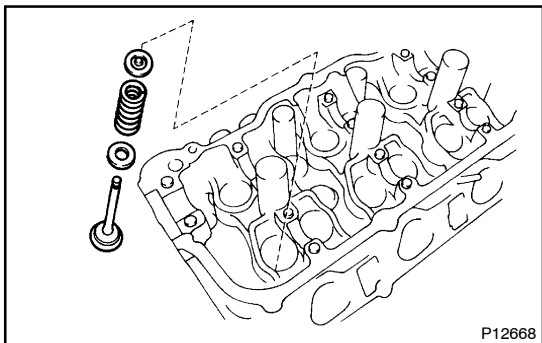
**HINT:**

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

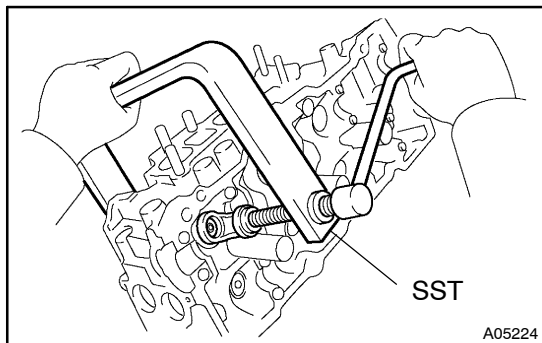


### 31. INSTALL INTAKE VALVE

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

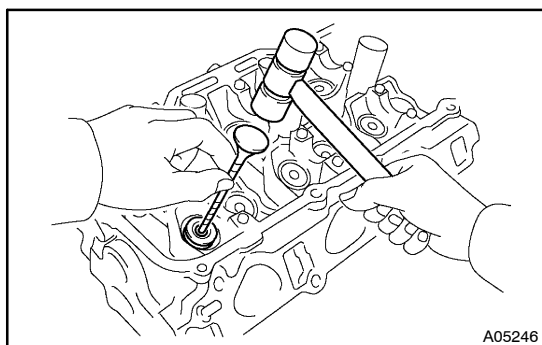
**NOTICE:**

**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.

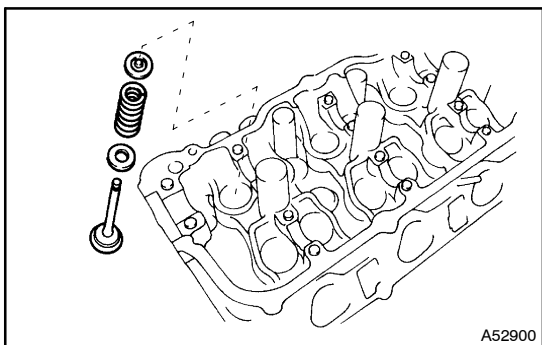
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- (c) Using a plastic-faced hammer at the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to ensure a proper fit.

**NOTICE:**

**Be careful not to damage the valve stem tip.**

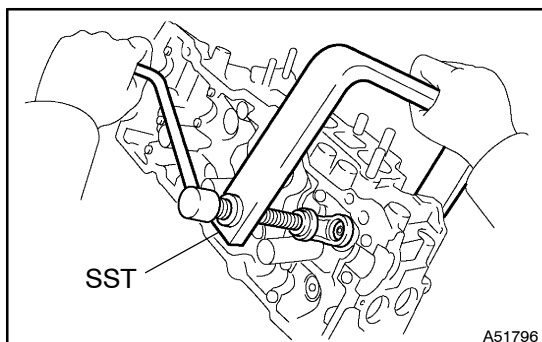


### 32. INSTALL EXHAUST VALVE

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

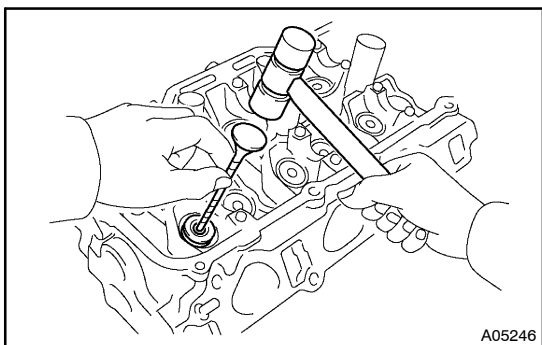
**NOTICE:**

**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.**

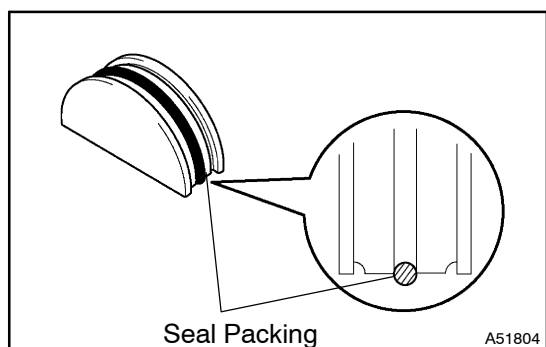
**33. INSTALL VALVE LIFTER**

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

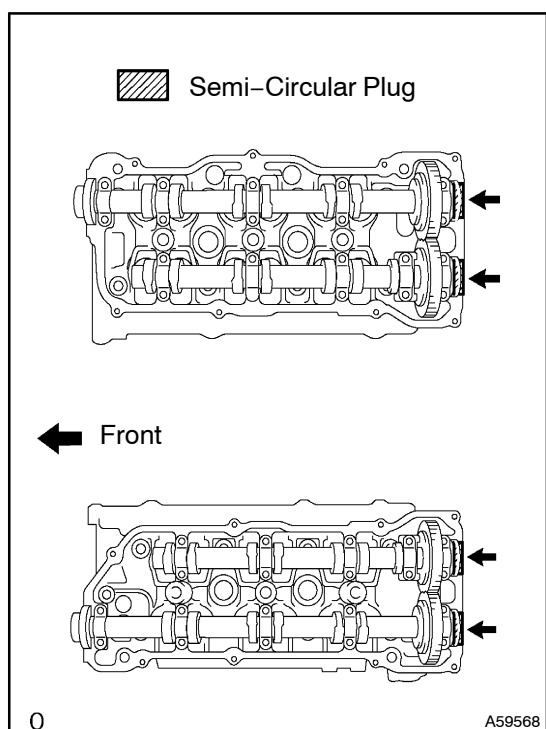
**NOTICE:**

**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 flush 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)**