

# CYLINDER HEAD ASSY (1CD-FTV)

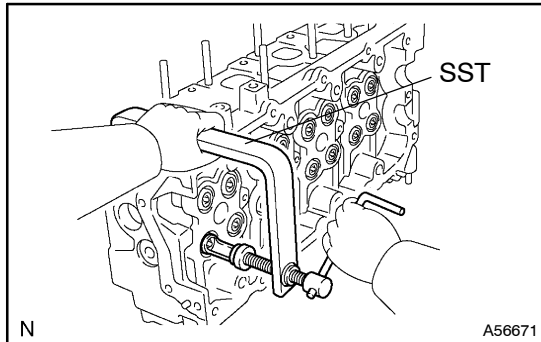
140DR-01

## OVERHAUL

### 1. REMOVE VALVE LIFTER

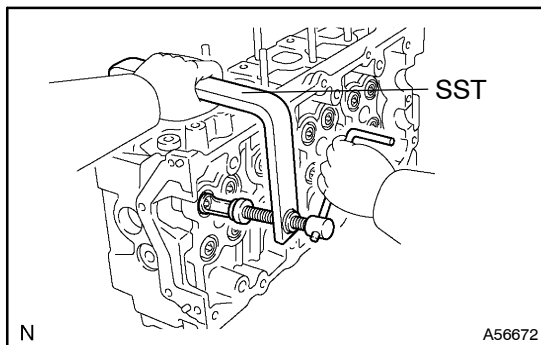
#### HINT:

Arrange the valve lifters in the correct order.



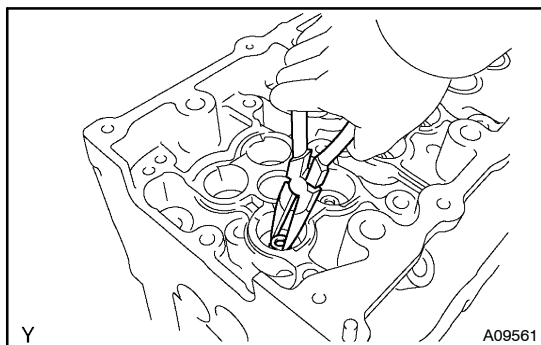
### 2. REMOVE INTAKE VALVE

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



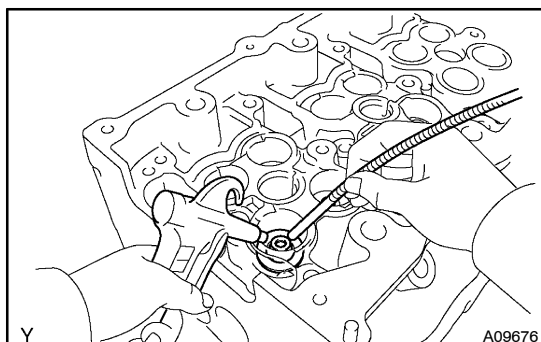
### 3. REMOVE EXHAUST VALVE

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



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

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

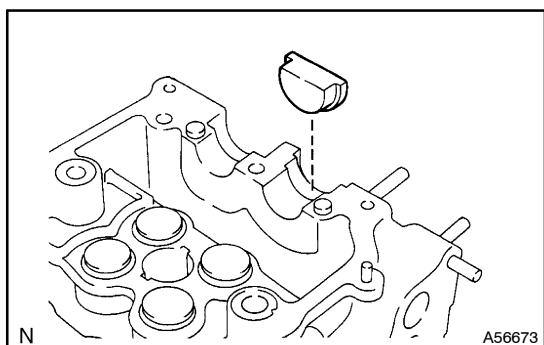


### 5. REMOVE VALVE SPRING SEAT PLATE WASHER

- (a) Using compressed air and a magnetic finger, remove the spring seat by blowing air.

#### HINT:

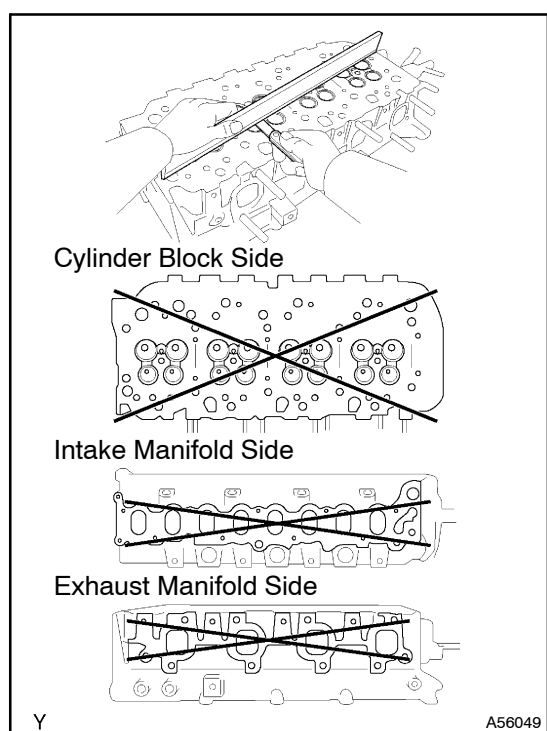
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.



## 6. REMOVE SEMICIRCULAR PLUG

## 7. REMOVE W/HEAD TAPER SCREW PLUG NO.1

- (a) Using an 6mm hexagon wrench, remove the 3 plugs.

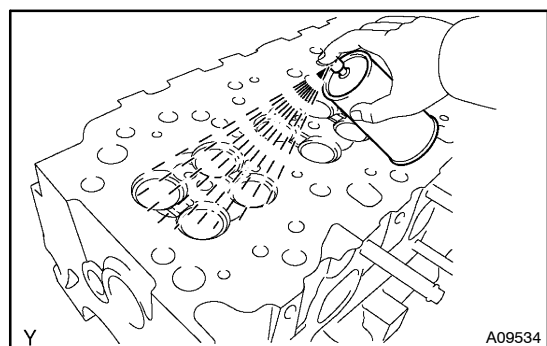


## 8. INSPECT CYLINDER HEAD FOR FLATNESS

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

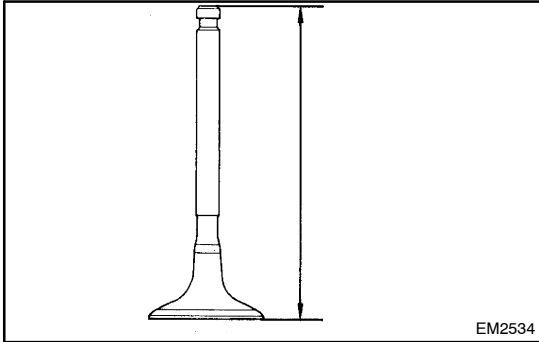
### Maximum warpage:

Cylinder block side	0.08mm (0.0031in.)
Intake manifold side	0.20mm (0.0079in.)
Exhaust manifold side	0.20mm (0.0079in.)



## 9. INSPECT CYLINDER HEAD FOR CRACKS

- (a) Using a dye penetrant, check the intake ports, exhaust ports and cylinder block contact surface for cracks.

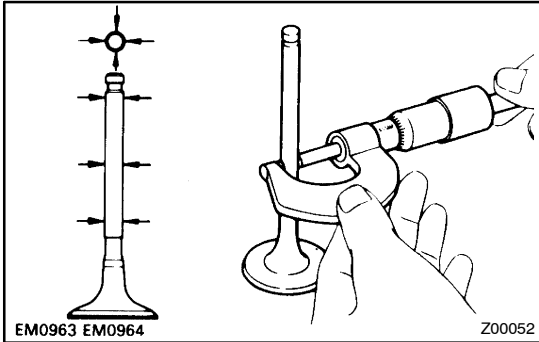


## 10. INSPECT INTAKE VALVE

- (a) Check the valve overall length.

**Standard overall length: 102.53 mm (4.0366 in.)**

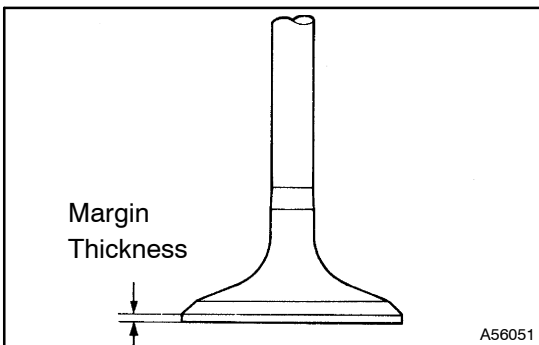
**Minimum overall length: 102.10 mm (4.0197 in.)**



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

**Valve stem diameter:**

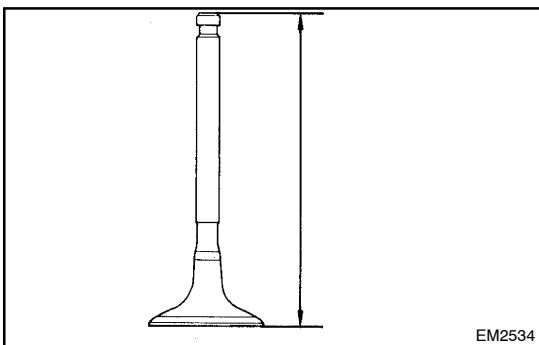
**5.970 – 5.985 mm (0.1957 – 0.1963 in.)**



- (c) Check the valve head margin thickness.

**Standard margin thickness: 0.9 mm (0.035 in.)**

**Minimum margin thickness: 0.6 mm (0.0247 in.)**

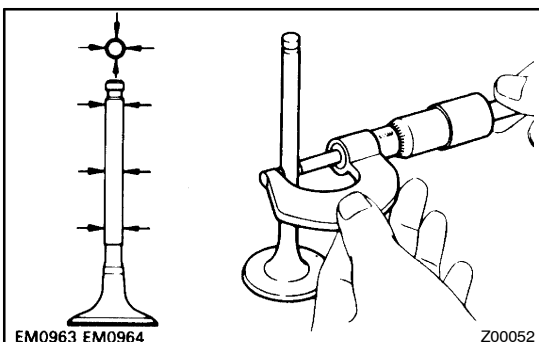


## 11. INSPECT EXHAUST VALVE

- (a) Check the valve overall length.

**Standard overall length: 101.97 mm (4.0146 in.)**

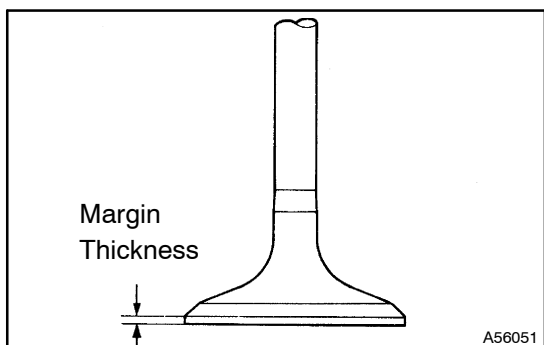
**Minimum overall length: 101.55 mm (3.9980 in.)**



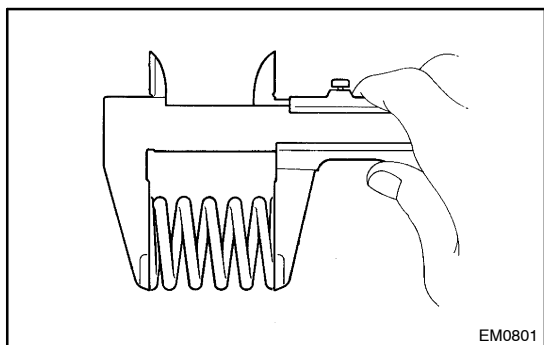
- (b) Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**5.960 – 5.975 mm (0.2346 – 0.2352 in.)**

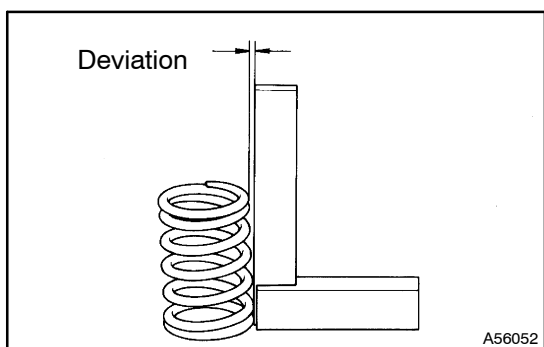


- (c) Check the valve head margin thickness.  
**Standard margin thickness: 0.9 mm (0.035 in.)**  
**Minimum margin thickness: 0.6 mm (0.024 in.)**

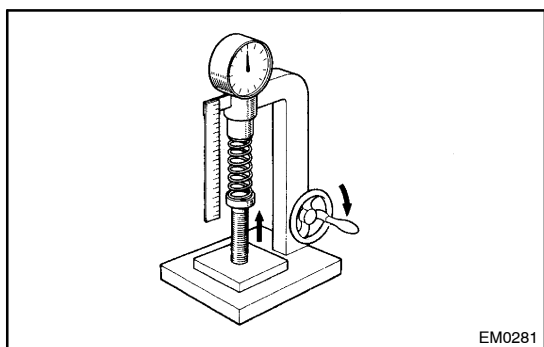


## 12. INSPECT INNER COMPRESSION SPRING

- (a) Using vernier calipers, measure the free length of the valve spring.  
**Free length: 40.45 mm (1.5925 in.)**

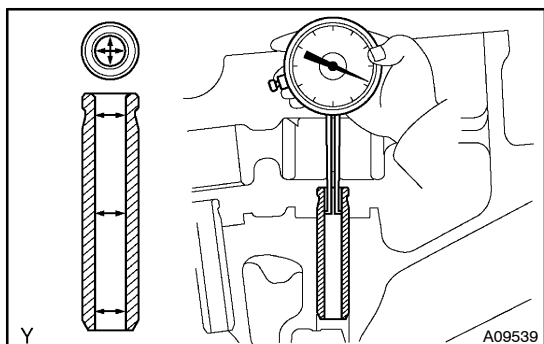


- (b) Using a steel square, measure the deviation of the valve spring.  
**Maximum deviation: 2.0 mm (0.079 in.)**



- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.  
**Installed tension:**  
**177 – 195 N (18.0 – 19.9 kgf, 39.7 – 44.1 lbf) at 31.1 mm (1.224)**

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



## 13. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE

- (a) using a caliper gauge, measure the inside diameter of the guide bushing.  
**Bushing inside diameter:**  
**6.010 – 6.030 mm (0.2366 – 0.2374 in.)**

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

**Standard oil clearance:**

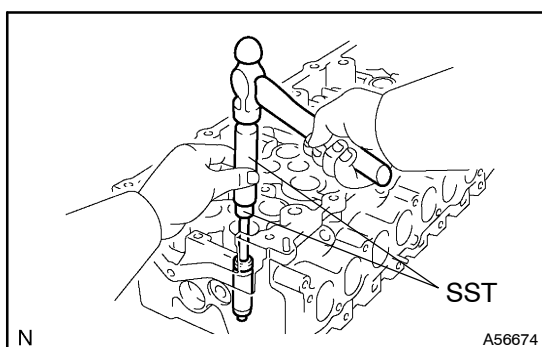
Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.035 – 0.070 mm (0.0014 – 0.0028 in.)

**Maximum oil clearance:**

Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

**14. REMOVE INTAKE VALVE GUIDE BUSH**

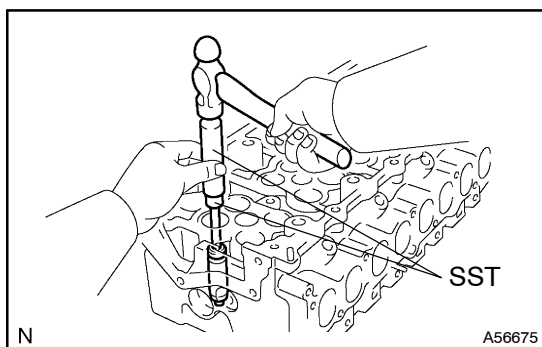
- (a) Heat the cylinder head to 80 – 100°C (176 – 212°F).



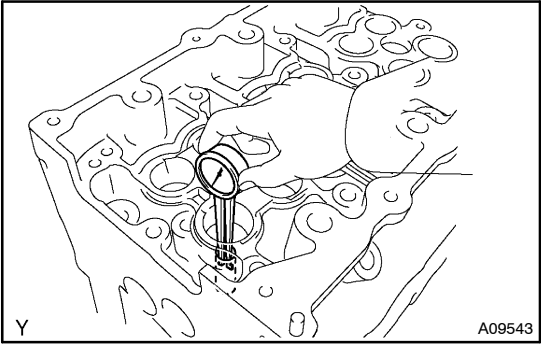
- (b) Using SST and a hammer, tap out the guide bushing.  
SST 09201-10000 (09201-01060), 09950-70010  
(09951-07100)

**15. REMOVE EXHAUST VALVE GUIDE BUSH**

- (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 (09201-01060), 09950-70010  
(09951-07100)



**16. INSTALL INTAKE VALVE GUIDE BUSH**

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

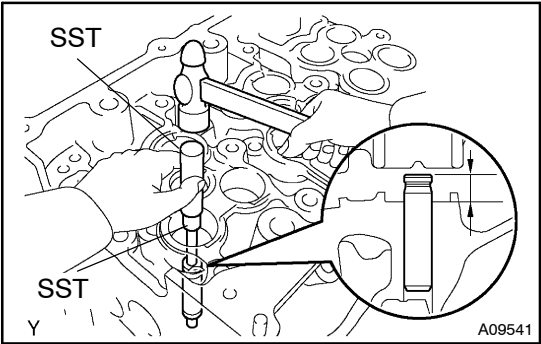
**Diameter: 10.985 – 11.006 mm (0.4325 – 0.4333 in.)**

If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the dimension of 11.035 – 11.056 mm (0.4344 – 0.4353 in.).

**HINT:**

Bushing size	Bushing bore diameter mm (in.)
Use STD	10.985 – 11.006 (0.4325 – 0.4333)
Use O/S 0.05	11.035 – 11.056 (0.4344 – 0.4353)

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

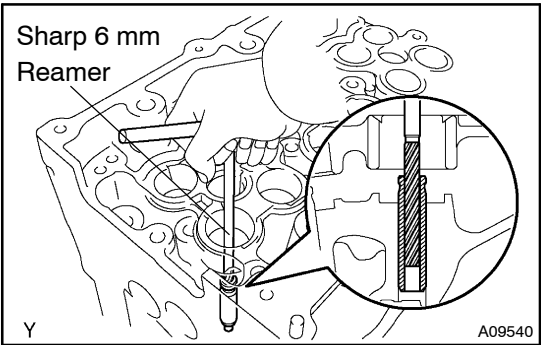


- (c) Using SST and a hammer, top in a new guide bushing to the specified protrusion height.

SST 09201-10000 (09201-01060), 09950-70010  
(09951-07100)

**Protrusion height:**

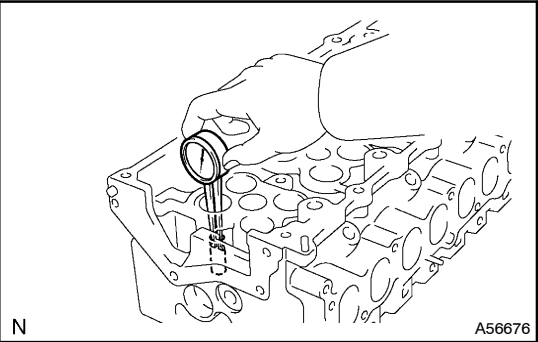
**10.05 – 10.45 mm (0.3957 – 0.4114 in.)**



- (d) Using a sharp 6 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 (0.0010 – 0.0024 in.)**



17. INSTALL EXHAUST VALVE GUIDE BUSH

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

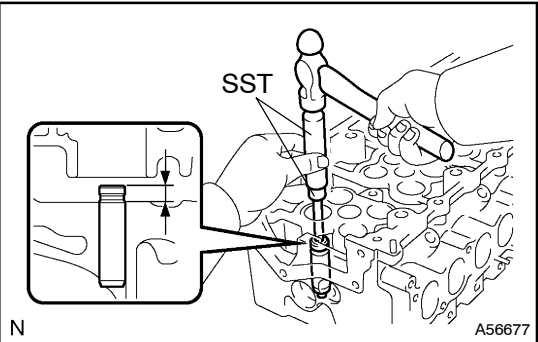
**Diameter: 10.985 – 11.006 mm (0.4325 – 0.4333 in.)**

If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the dimension of 11.035 – 11.056 mm (0.4344 – 0.4353 in.).

HINT:

Bushing size	Bushing bore diameter mm (in.)
Use STD	10.985 – 11.006 (0.4325 – 0.4333)
Use O/S 0.05	11.035 – 11.056 (0.4344 – 0.4353)

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

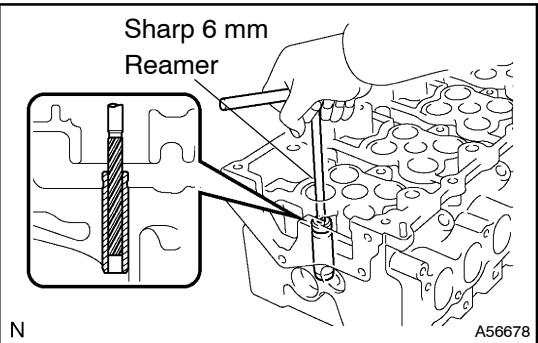


- (c) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.

SST 09201-10000 (09201-01060), 09950-70010  
(09951-07100)

**Protrusion height:**

**9.65 – 10.05 mm (0.3799 – 0.3957 in.)**



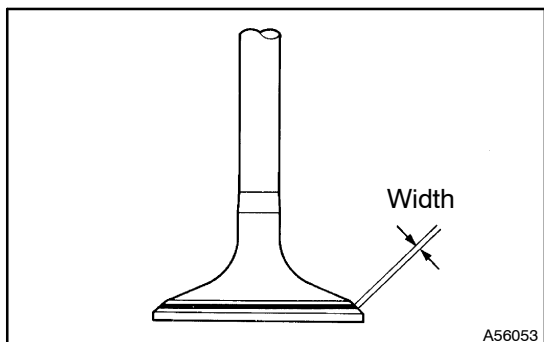
- (d) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and valve stem.

**Standard oil clearance:**

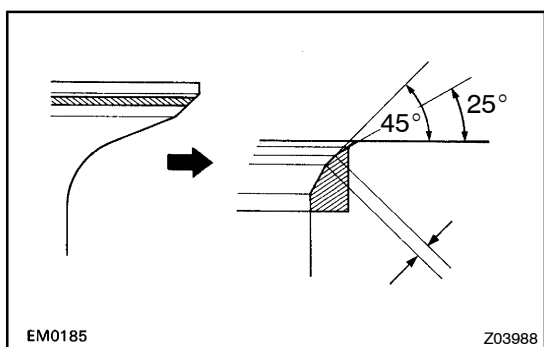
**0.035 – 0.070 mm (0.0014 – 0.0028 in.)**

**18. 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 following width.

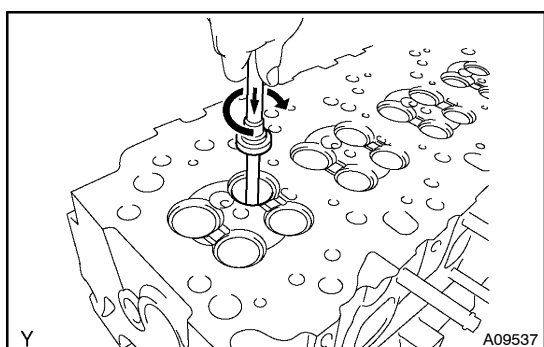
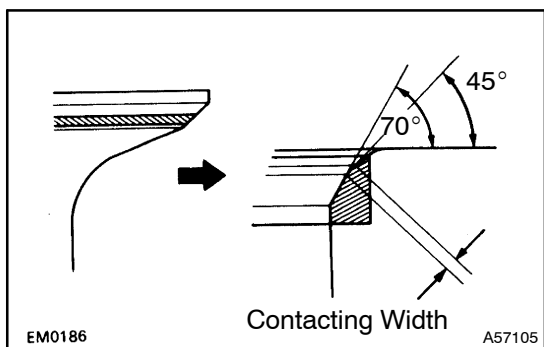


Intake	1.2 – 1.6 mm (0.047 – 0.063 in.)
Exhaust	1.6 – 2.0 mm (0.063 – 0.079 in.)

**19. REPAIR INTAKE VALVE SEATS****NOTICE:**

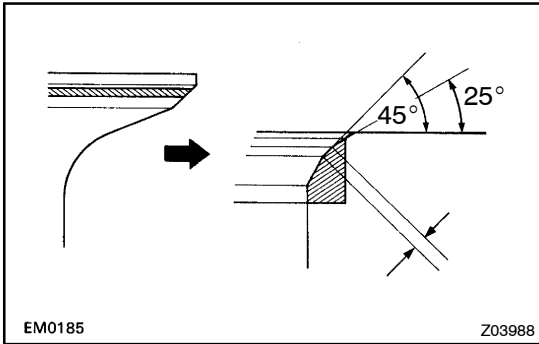
**Take off a cutter gradually to make smooth valve seats.**

- (a) If the seating is too high on the valve face, use 25° and 45° cutters to correct the seat.
- (b) If the seating is too low on the valve face, use 70° 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.



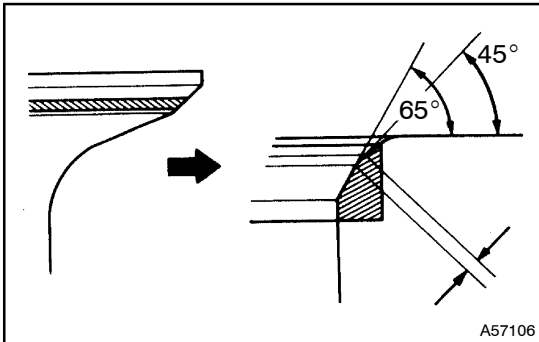


## 20. REPAIR EXHAUST VALVE SEATS

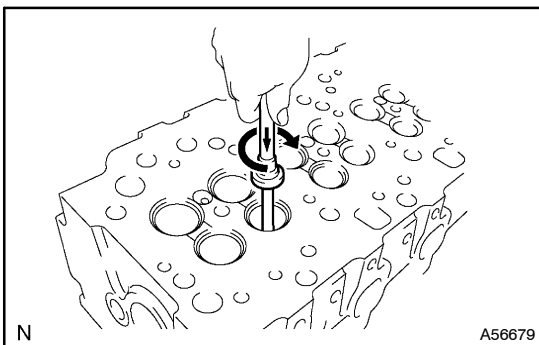
### NOTICE:

**Take off a cutter gradually to make smooth valve seats.**

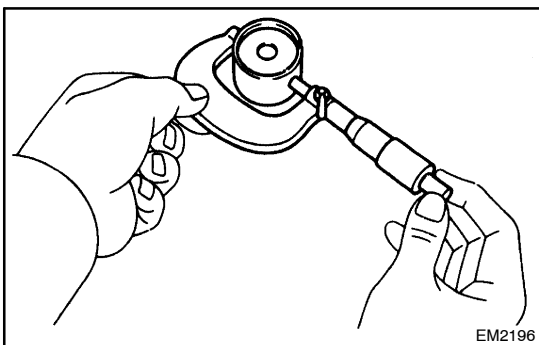
- (a) If the seating is too high on the valve face, use 25° and 45° cutters to correct the seat.



- (b) If the seating is too low on the valve face, use 65° 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.

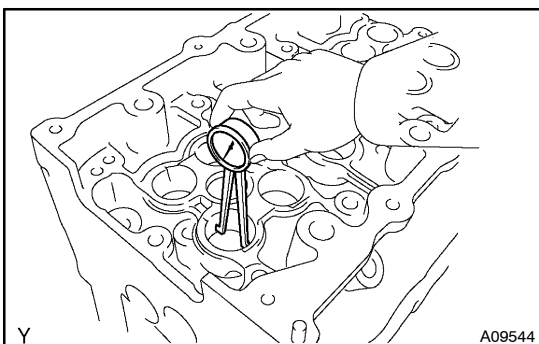


## 21. INSPECT VALVE LIFTER

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

**Lifter diameter:**

**27.975 – 27.985 mm (1.1014 – 1.1018 in.)**



## 22. INSPECT VALVE LIFTER OIL CLEARANCE

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

**Lifter diameter:**

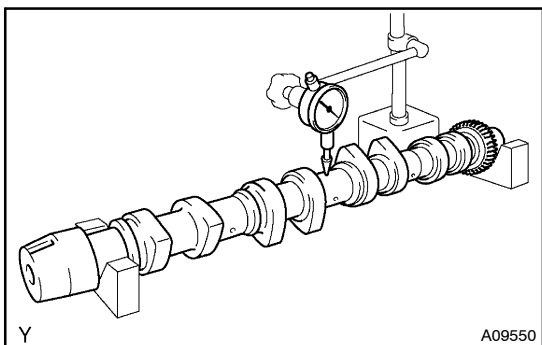
**28.010 – 28.031 mm (1.1028 – 1.1036 in.)**

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

**Standard oil clearance:**

**0.025 – 0.056 mm (0.0010 – 0.0022 in.)**

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

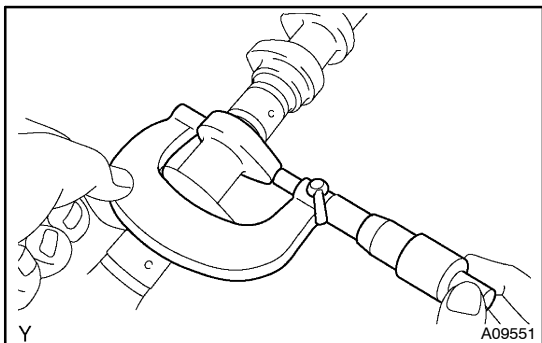


### 23. INSPECT CAMSHAFT

- (a) Inspect the circle runout.
- (1) Place the camshaft on V-blocks.
  - (2) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.06 mm (0.0024 in.)**

If the circle runout is greater than maximum, replace the camshaft.



- (b) Using a micrometer, measure the cam lobe height.

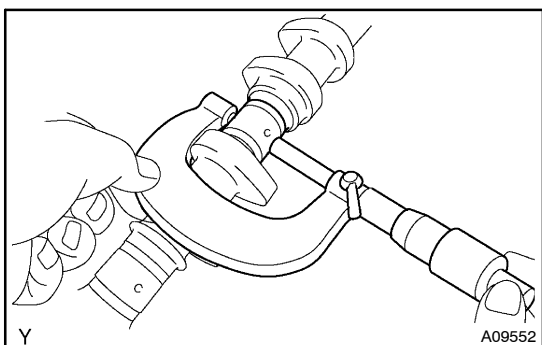
#### Standard cam lobe height:

No.1	46.57 – 46.67 mm (1.8335 – 1.8374 in.)
No.2	47.52 – 47.62 mm (1.8709 – 1.8748 in.)

#### Minimum cam lobe height:

No.1	46.10 mm (1.8150 in.)
No.2	47.05 mm (1.8524 in.)

If the cam lobe height is less than minimum, replace the camshaft.

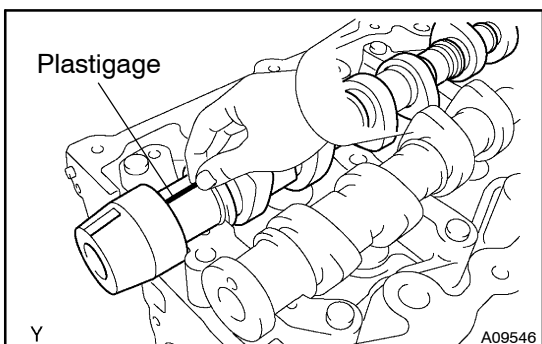


- (c) Using a micrometer, measure the journal diameter.

#### Journal diameter:

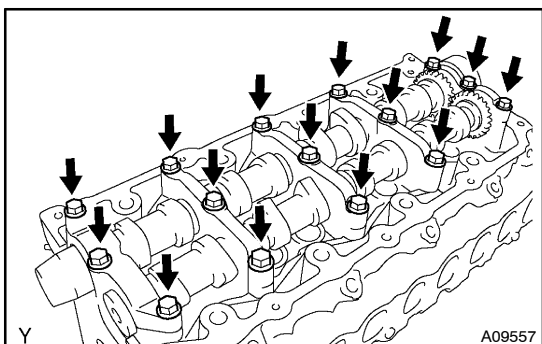
**26.969 – 26.985 mm (1.0618 – 1.0624 in.)**

If the journal diameter is not as specified, check the oil clearance.



### 24. INSPECT CAMSHAFT OIL CLEARANCE

- (a) Clean the bearing caps and camshaft carrier.
- (b) Check the bearings for flaking and scoring.  
If the bearings are damaged, replace the bearing caps, camshaft carrier and cylinder head as a set.
- (c) Place the camshaft carrier and camshafts on the cylinder head.
- (d) Lay a strip of Plastigage across each of the camshaft journals.



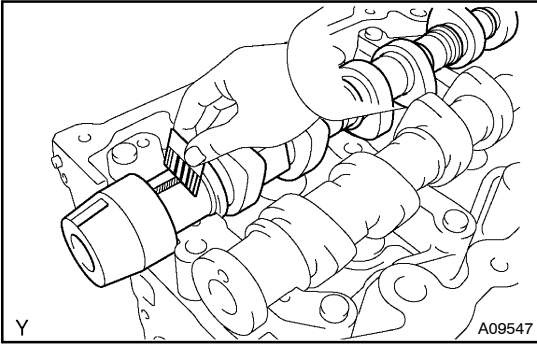
- (e) Install the bearing caps.

**Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)**

#### NOTICE:

**Do not turn the camshaft.**

- (f) Remove the bearing caps.



- (g) Measure the Plastigage at its widest point.

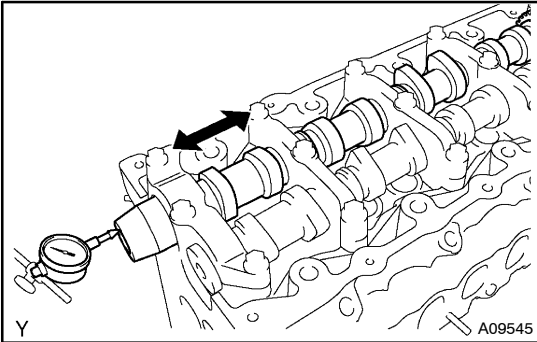
**Standard oil clearance:**

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

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

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

- (h) Completely remove the Plastigage.



## 25. INSPECT CAMSHAFT THRUST CLEARANCE

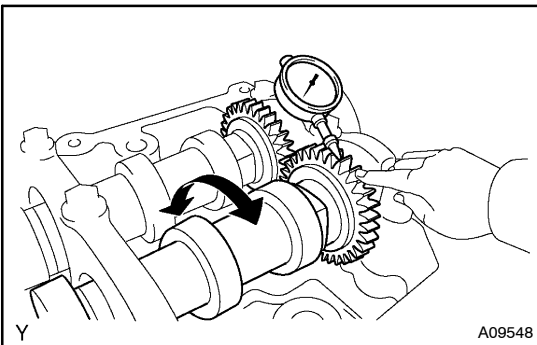
- (a) Install the camshaft.

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

**Standard thrust clearance:**

**0.035 – 0.11 mm (0.0014 – 0.0043 in.)**

If the thrust clearance is not as specified, replace the camshaft. If necessary, replace the bearing caps, camshaft carrier and cylinder head as a set.



## 26. INSPECT CAMSHAFT GEAR BACKLASH

- (a) Install the camshafts.

- (b) Using a dial indicator, measure the backlash.

**Standard backlash:**

**0.014 – 0.070 mm (0.0006 – 0.0028 in.)**

**Maximum backlash: 0.17 mm (0.0067 in.)**

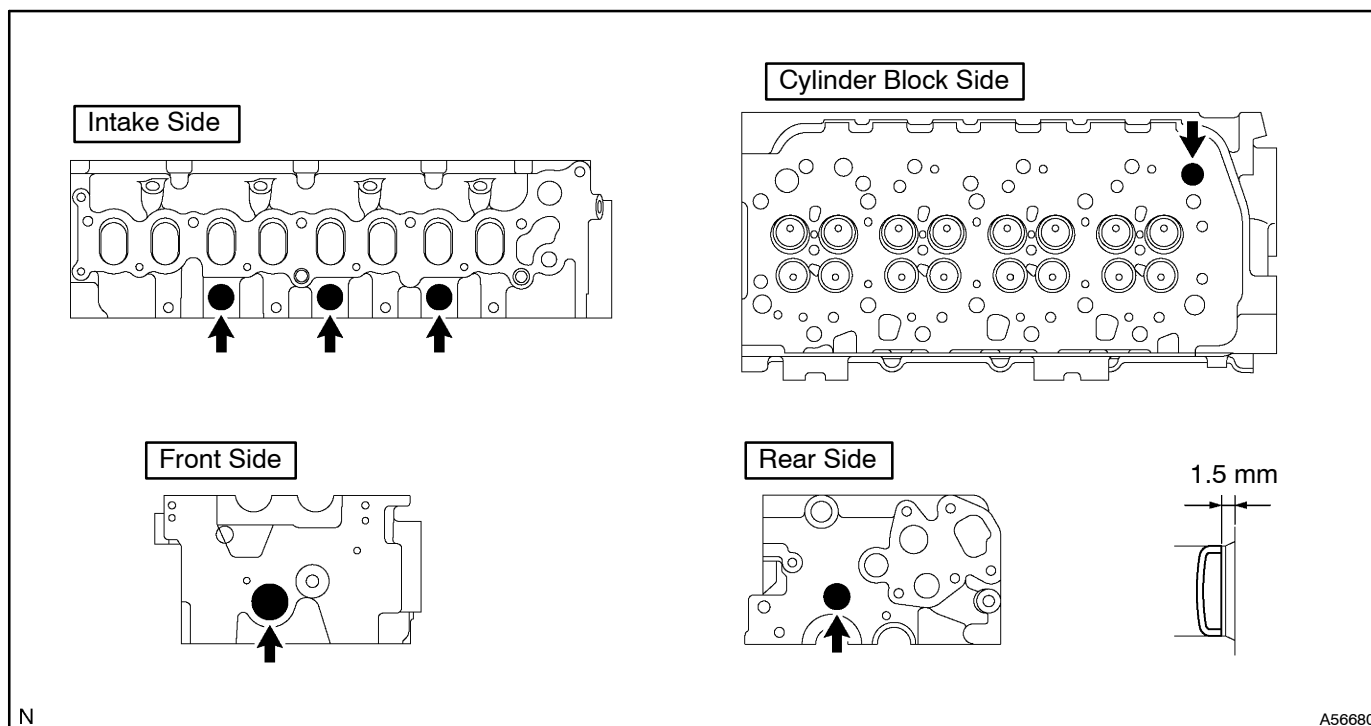
If the backlash is greater than maximum, replace the camshafts.

**27. INSTALL TIGHT PLUG**

- (a) Apply adhesive around tight plugs.

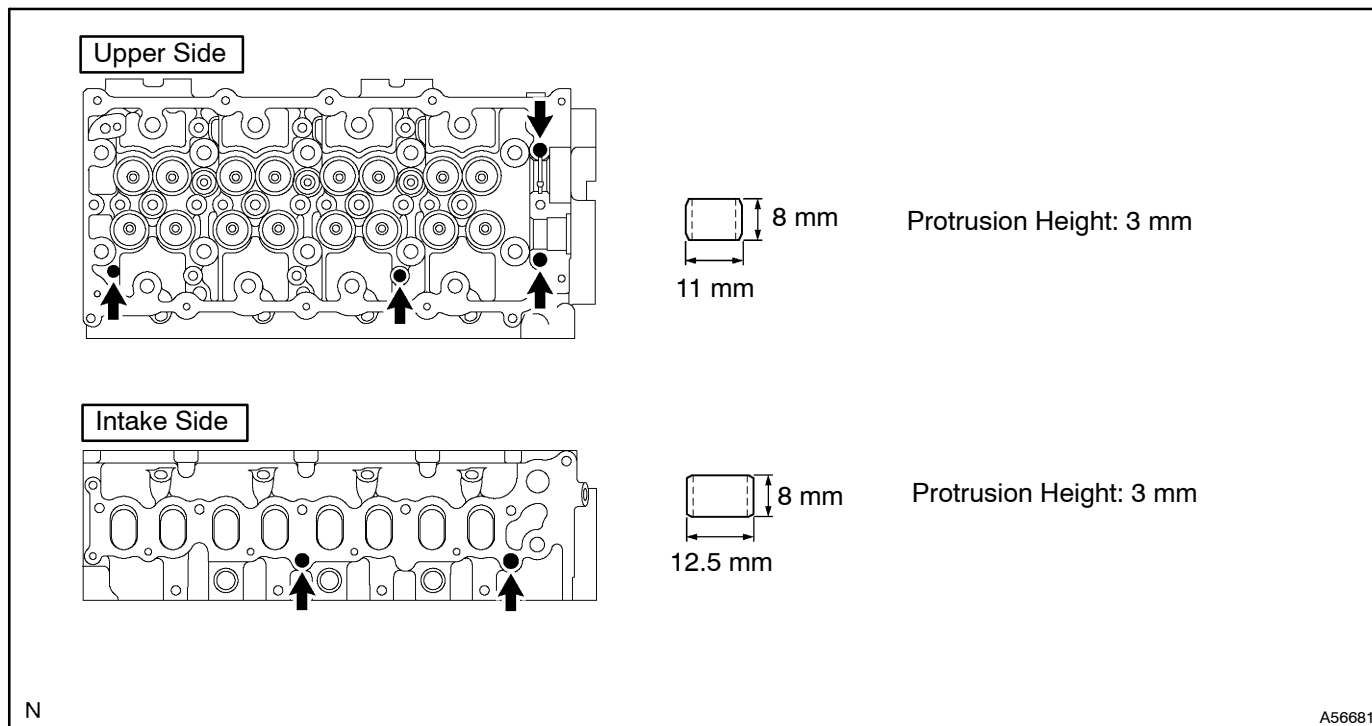
**Adhesive: Part No.08833 - 00070, THREE BOND 1324 or equivalent.**

- (b) Using SST, into the tight plugs as shown in the illustration.  
SST 09950-60010 (09951-00210), 09950-70010 (09951-07100)

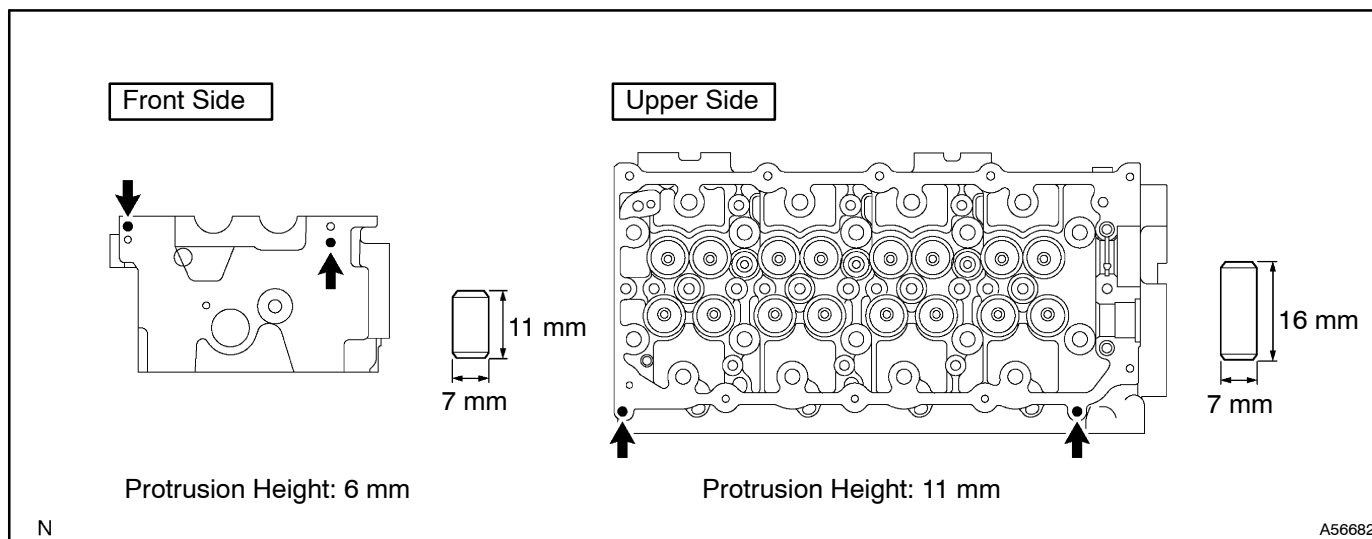


**28. INSTALL RING PIN**

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

**29. INSTALL STRAIGHT PIN**

- (a) Using a plastic-faced hammer, tap into the straight pin.



**30. INSTALL STUD BOLT**

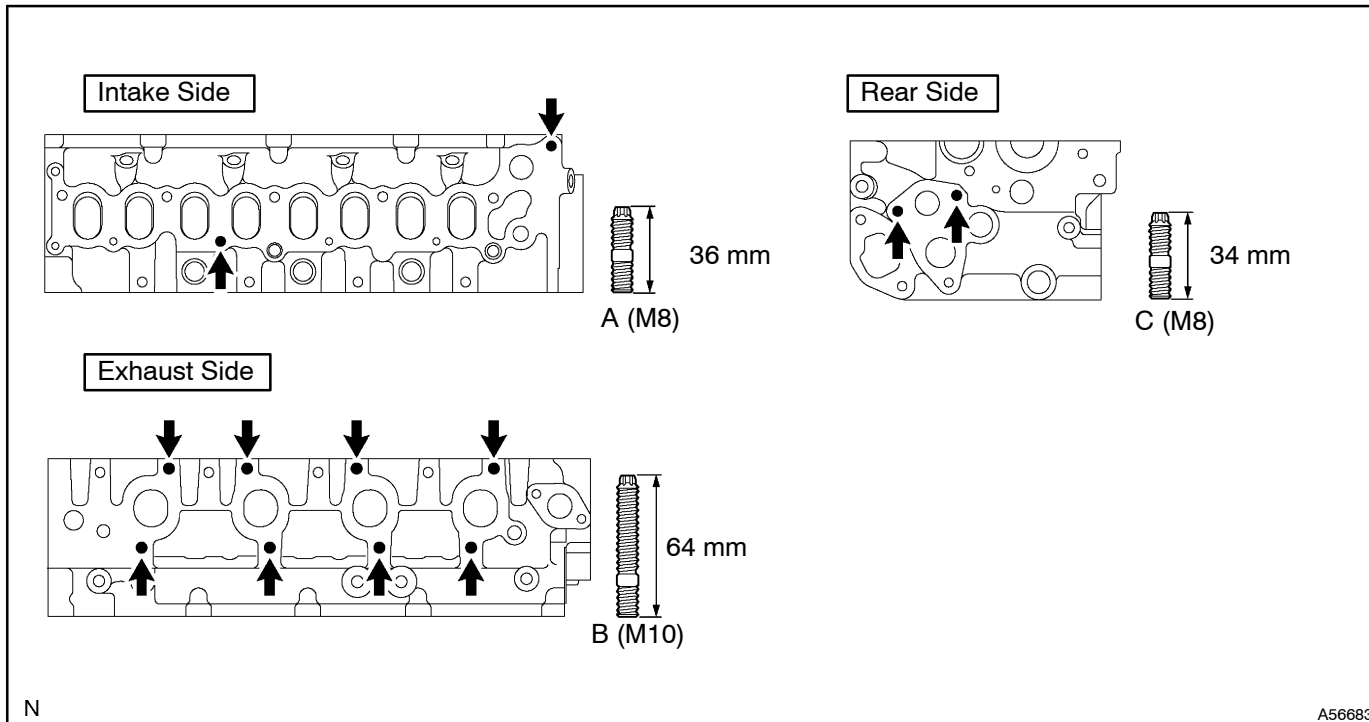
- (a) Install the stud bolts as shown in the illustration.

**Torque:**

**Bolt A 8.8N·m (90 kgf·cm, 78 in·lbf)**

**Bolt B 12N·m (120 kgf·cm, 9 ft·lbf)**

**Bolt C 8.8N·m (90 kgf·cm, 78 in·lbf)**

**31. INSTALL W/HEAD TAPER SCREW PLUG NO.1**

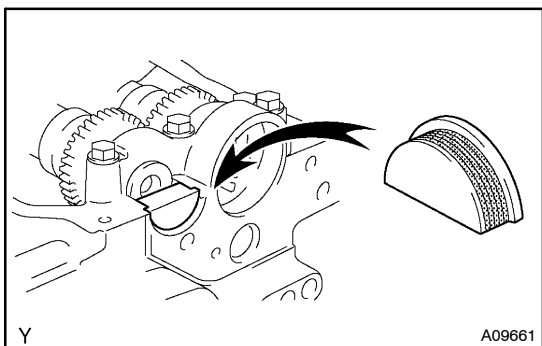
- (a) Apply adhesive to the plugs end.

**Adhesive:**

**Part No. 08833 – 00070, THREE BOND 1324 or equivalent.**

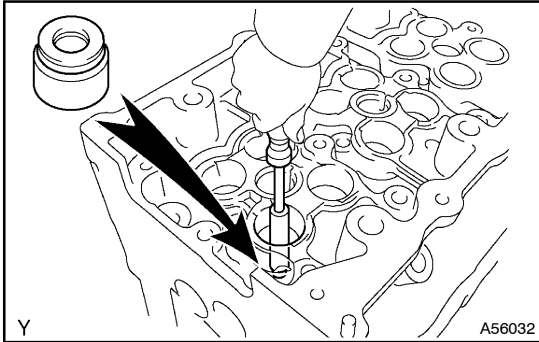
- (b) Using an 6 mm hexagon wrench, install the 3 plugs.

**Torque: 25N·m (255 kgf·cm, 18 ft·lbf)**

**32. INSTALL SEMICIRCULAR PLUG**

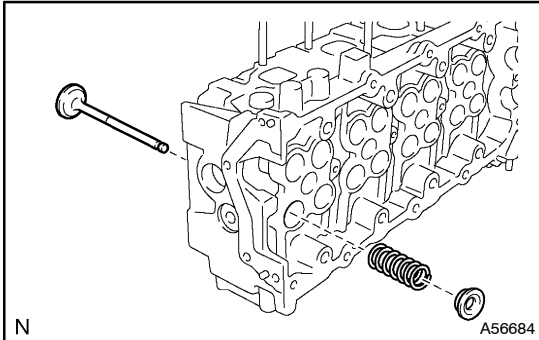
- (a) Apply a seal packing to the semi-circular plug grooves.  
**Seal packing: Part No. 08826 – 00080 or equivalent**
- (b) Install the semi-circular plug to the cylinder head.

**33. INSTALL VALVE SPRING SEAT PLATE WASHER**



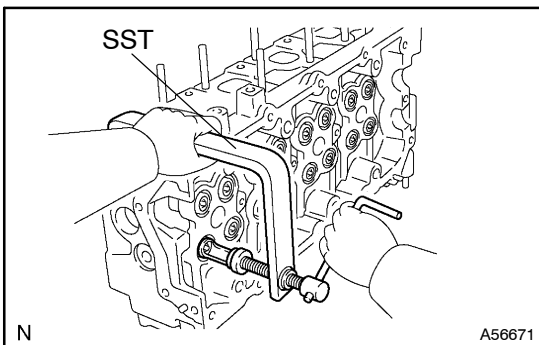
### 34. INSTALL VALVE STEM OIL O SEAL OR RING

- (a) Apply a light coat of engine oil on the valve stem.
- (b) Install a new oil seal on the valve guide bushing.



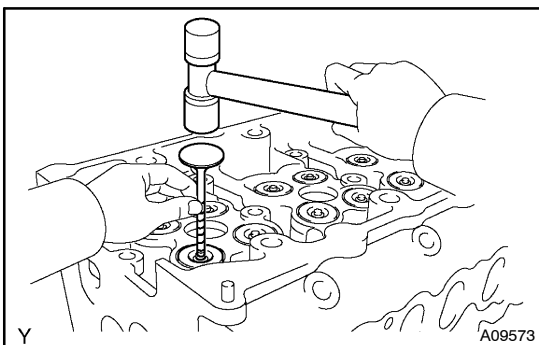
### 35. INSTALL INTAKE VALVE

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



- (b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.

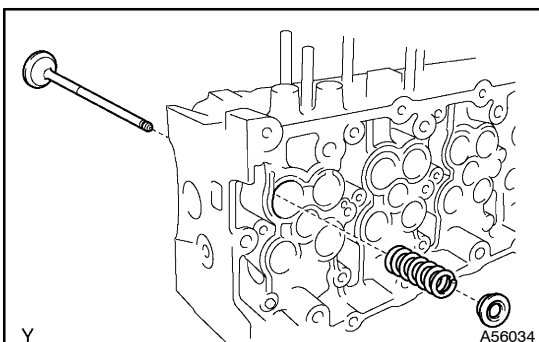
SST 09202-70020 (09202-00010)



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

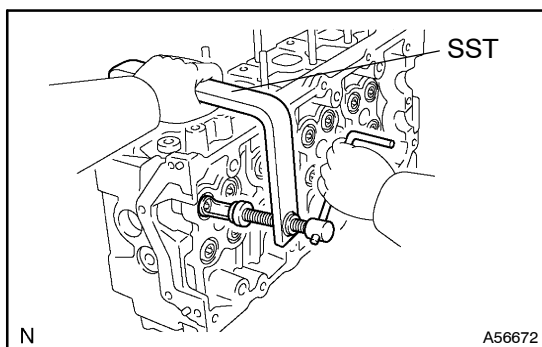
#### NOTICE:

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

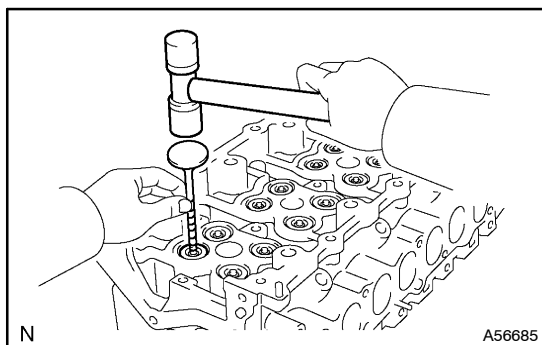


### 36. INSTALL EXHAUST VALVE

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



- (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 and the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to assure proper fit.

**NOTICE:**

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