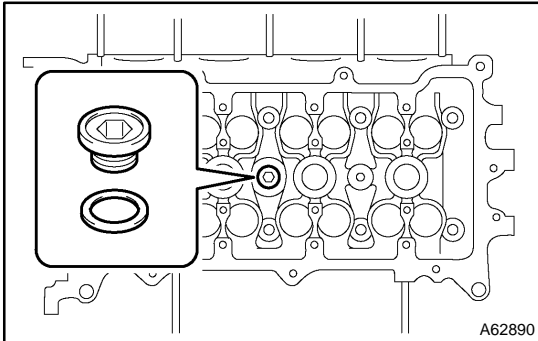


## OVERHAUL



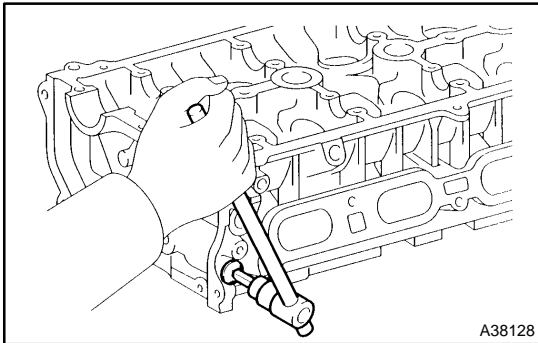
### 1. REMOVE W/HEAD TAPER SCREW PLUG NO.1

- (a) Using a 10 mm socket hexagon wrench, remove the taper screw plug and gasket.

### 2. REMOVE VALVE LIFTER

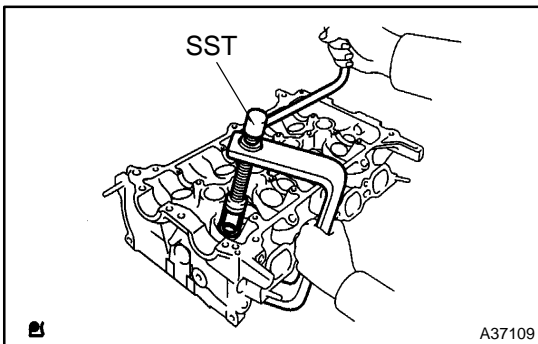
#### HINT:

Keep the valve lifters in the correct order so they can be returned to the original locations when re-assembling.



### 3. REMOVE OIL CONTROL VALVE FILTER

- (a) Using an 8 mm hexagon wrench, remove the taper screw plug.  
 (b) Remove the filter and gasket.



### 4. REMOVE INTAKE VALVE

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

#### HINT:

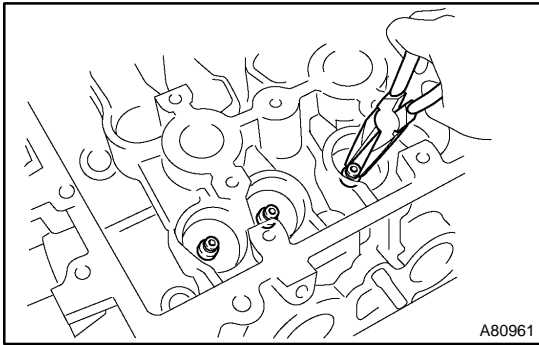
Keep the valves, valve springs, spring seats and spring retainers in the correct order so they can be returned to the original locations when re-assembling.

### 5. REMOVE EXHAUST VALVE

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

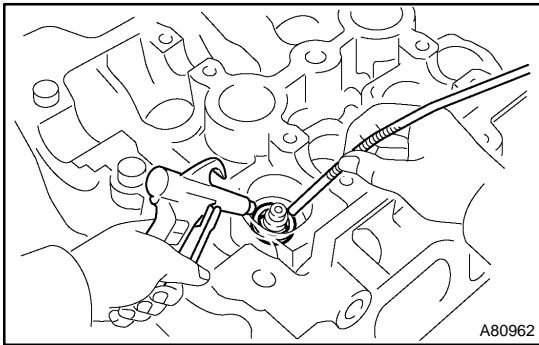
#### HINT:

Keep the valves, valve springs, spring seats and spring retainers in the correct order so they can be returned to the original locations when re-assembling.



**6. REMOVE VALVE STEM OIL O SEAL OR RING**

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



**7. REMOVE VALVE SPRING SEAT**

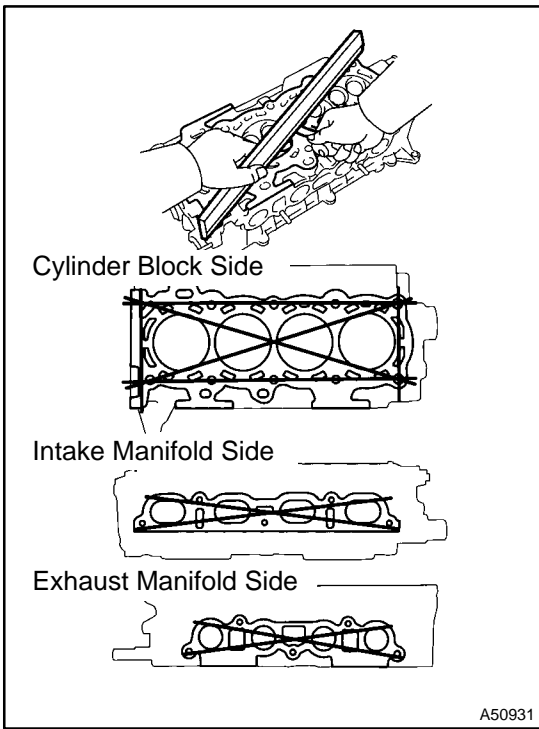
- (a) Using a compressed air and magnetic finger, remove the valve spring seats.

**8. REMOVE UNION**

**9. REMOVE STUD BOLT**

- (a) Using Torx socket wrench E5 and E7, remove the 7 stud bolts.

**10. REMOVE CAMSHAFT BEARING CAP SETTING RING PIN**



**11. INSPECT CYLINDER HEAD FOR FLATNESS**

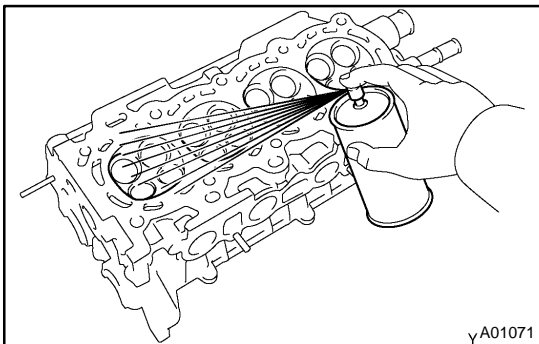
- (a) Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder block and manifolds for warpage.

**Maximum warpage:**

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

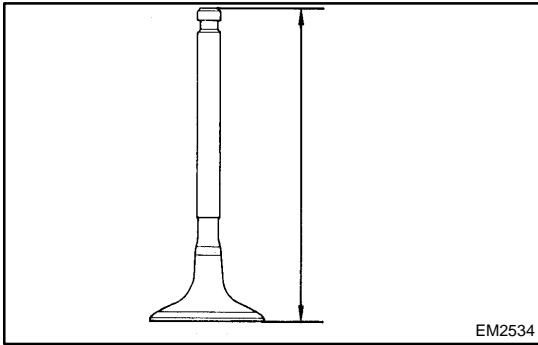
**Intake manifold side 0.10 mm (0.0039 in.)**

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

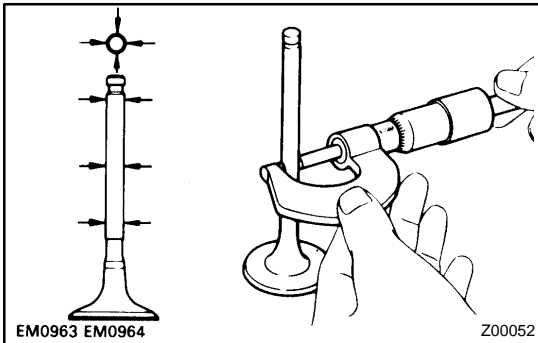


**12. INSPECT CYLINDER HEAD FOR CRACKS**

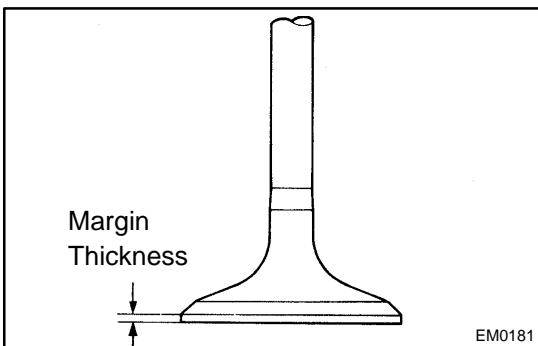
- (a) Using a dye penetrate, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

**13. INSPECT INTAKE VALVE**

- (a) Measure the valve overall length.

**Standard overall length: 89.25 mm (3.5138 in.)****Minimum overall length: 88.75 mm (3.4941 in.)**

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

**Valve stem diameter:****4.970 to 4.985 mm (0.1957 to 0.1963 in.)**

- (c) Measure the valve head margin thickness.

**Standard margin thickness: 1.0 mm (0.039 in.)****Minimum margin thickness: 0.5 mm (0.020 in.)****14. INSPECT EXHAUST VALVE**

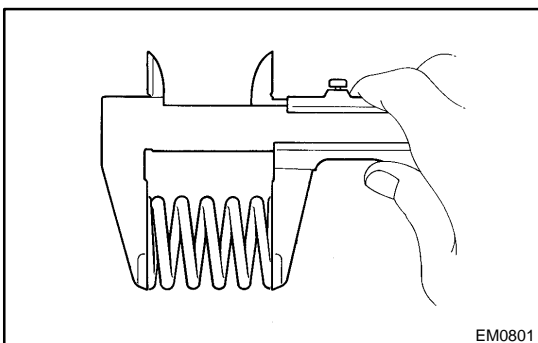
- (a) Measure the valve overall length.

**Standard overall length: 87.90 mm (3.4606 in.)****Minimum overall length: 87.40 mm (3.4409 in.)**

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

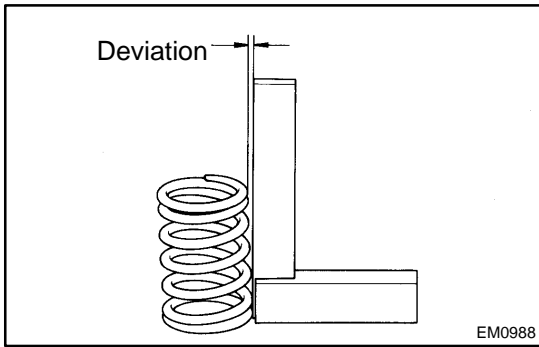
**Valve stem diameter: 4.965 to 4.980 mm (0.1955 to 0.1961 in.)**

- (c) Measure the valve head margin thickness.

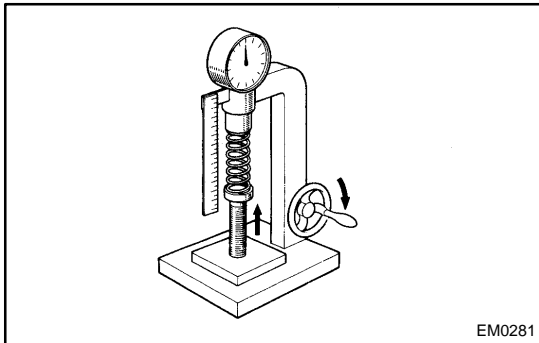
**Standard margin thickness: 1.15 mm (0.045 in.)****Minimum margin thickness: 0.5 mm (0.020 in.)****15. INSPECT OUTER COMPRESSION SPRING**

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

**Free length: 45.1 mm (1.776 in.)**

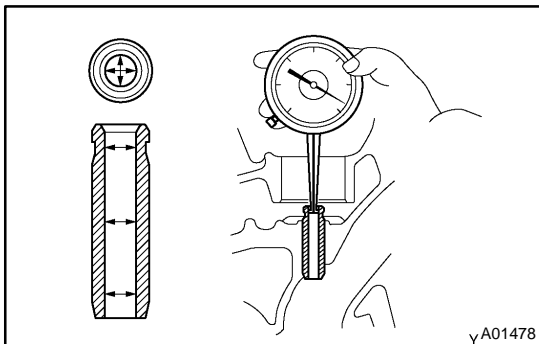


- (b) Using a steel square, measure the deviation of the valve spring.  
**Maximum deviation: 1.6 mm (0.063 in.)**  
**Maximum angle (reference): 2°**

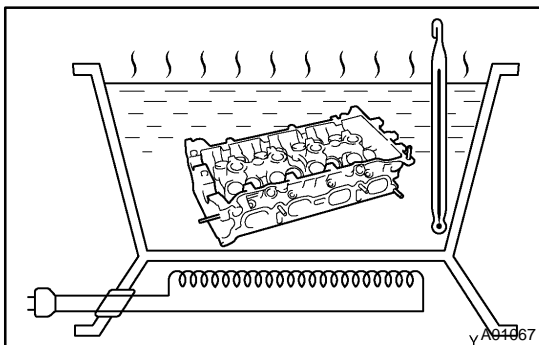


- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.  
**Installed tension:**  
**149 to 165 N (15.2 to 16.8 kgf, 33.5 to 37.1 lbf) at 32.5 mm (1.280 in.)**  
**Maximum working tension:**  
**286 to 316 N (29.1 to 32.2 kgf, 64.2 to 71.0 lbf) at 23.9 mm (0.941 in.)**

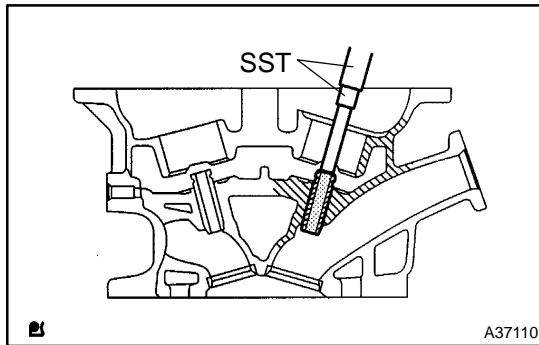
If the installed tension is not as specified, replace the valve spring.



- 16. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE**
- (a) Using a caliper gauge, measure the inside diameter of the guide bushing.  
**Bushing inside diameter:**  
**5.010 to 5.030 mm (0.1972 to 0.1980 in.)**
  - (b) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.  
**Standard oil clearance:**  
**Intake 0.025 to 0.060 mm ( 0.0010 to 0.0024 in.)**  
**Exhaust 0.030 to 0.065 mm (0.0012 to 0.0026 in.)**  
**Maximum oil clearance:**  
**Intake 0.08 mm (0.0032 in.)**  
**Exhaust 0.10 mm (0.0039 in.)**



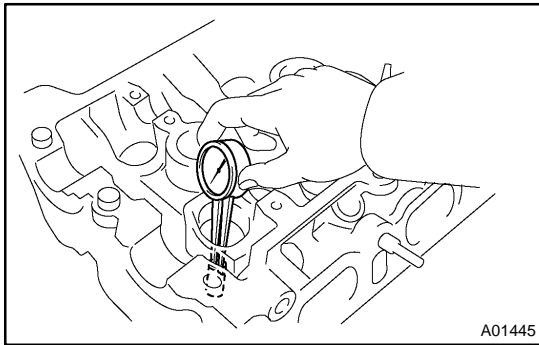
- 17. REMOVE INTAKE VALVE GUIDE BUSH**
- (a) Heat the cylinder head to 80 to 100°C (176 to 212°F).



- (b) Using SST and a hammer, tap out the guide bushing.  
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

### 18. REMOVE EXHAUST VALVE GUIDE BUSH

- (a) Heat the cylinder head to 80 to 100°C (176 to 212°F).  
(b) Using SST and a hammer, tap out the guide bushing.  
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



### 19. INSTALL INTAKE VALVE GUIDE BUSH

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

**Diameter: 9.685 to 9.706 mm (0.3813 to 0.3821 in.)**

If the bushing bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bushing bore to the dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).

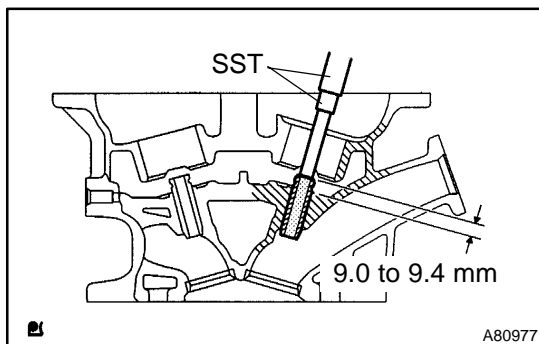
HINT:

Bushing bore diameter mm (in.)	Bushing size
9.685 to 9.706 (0.3813 to 0.3821)	STD
9.735 to 9.755 (0.3833 to 0.3841)	O/S 0.05

- (b) Heat the cylinder head to 80 to 100°C. (176 to 212°F)  
(c) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.

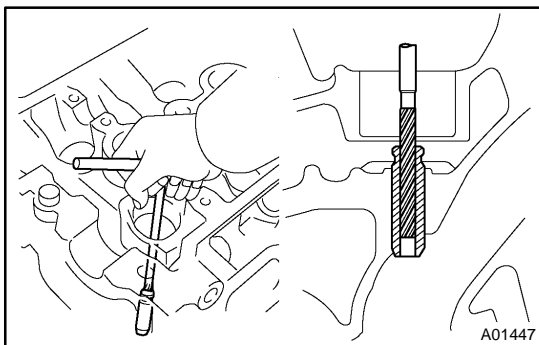
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

**Protrusion height:  
9.0 to 9.4 mm (0.354 to 0.370 in.)**



- (d) Using a sharp 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 to 0.060 mm (0.0010 to 0.0024 in.)**



**20. INSTALL EXHAUST VALVE GUIDE BUSH**

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

**Diameter: 9.685 to 9.706 mm (0.3813 to 0.3821 in.)**

If the bushing bore diameter of the cylinder head is greater than 9.706 mm (0.3821 in.), machine the bushing bore to the dimension of 9.735 to 9.755 mm (0.3833 to 0.3841 in.).

HINT:

Bushing bore diameter mm (in.)	Bushing size
9.685 to 9.706 (0.3813 to 0.3821)	Use STD
9.735 to 9.755 (0.3833 to 0.3841)	Use O/S 0.05

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

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

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

**Protrusion height: 9.0 to 9.4 mm (0.354 to 0.370 in.)**

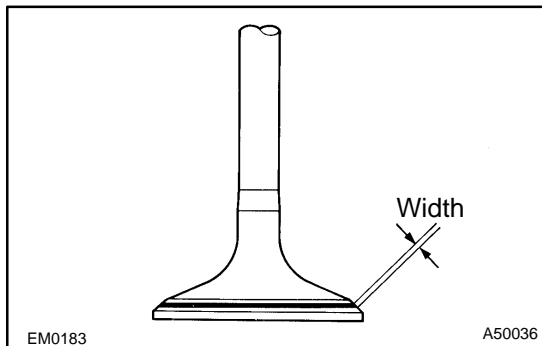
(d) Using a sharp 5 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and valve stem.

**Standard oil clearance: 0.030 to 0.065 mm (0.0012 to 0.0026 in.)**

**21. 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.

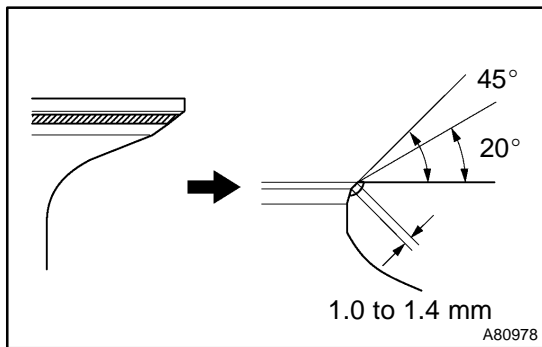


(c) Check the valve face and seat according to the following procedures.

(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 to 1.4 mm (0.039 to 0.055 in.).

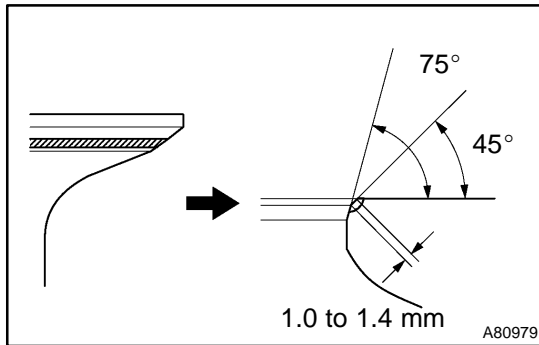


**22. REPAIR INTAKE VALVE SEAT**

**NOTICE:**

**Releasing the seat cutter pressure gradually helps to make smoother valve seat faces.**

(a) If the seating is too high on the valve face, use 20° and 45° cutters to correct the seat.



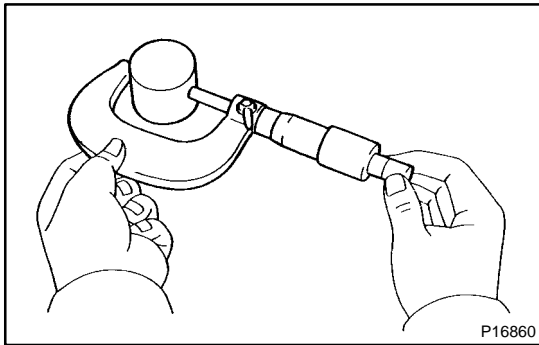
- (b) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.
- (c) Hand-lap the valve and valve seat with an abrasive compound.
- (d) Recheck the valve seating position.

### 23. REPAIR EXHAUST VALVE SEAT

#### NOTICE:

Releasing the seat cutter pressure gradually helps to make smoother valve seat faces.

- (a) If the seating is too high on the valve face, use 20° 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) Recheck the valve seating position.

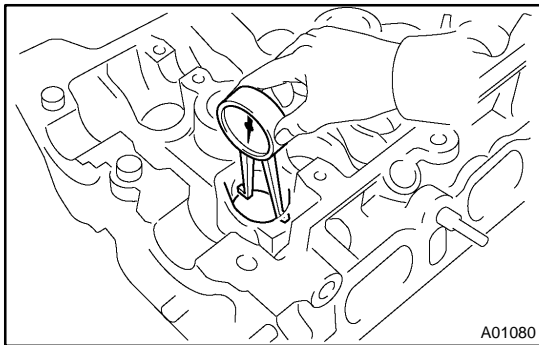


### 24. INSPECT VALVE LIFTER

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

**Lifter diameter:**

**30.966 to 30.976 mm (1.2191 to 1.2195 in.)**



### 25. INSPECT VALVE LIFTER OIL CLEARANCE

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

**Lifter bore diameter:**

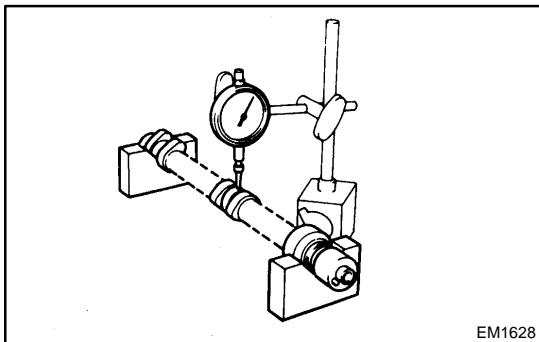
**31.000 to 31.025 mm (1.2205 to 1.2215 in.)**

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

**Standard oil clearance:**

**0.024 to 0.059 mm (0.0009 to 0.0023 in.)**

**Maximum oil clearance: 0.1 mm (0.0039 in.)**

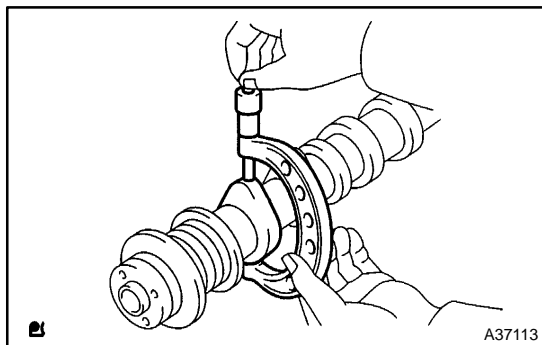


### 26. INSPECT CAMSHAFT

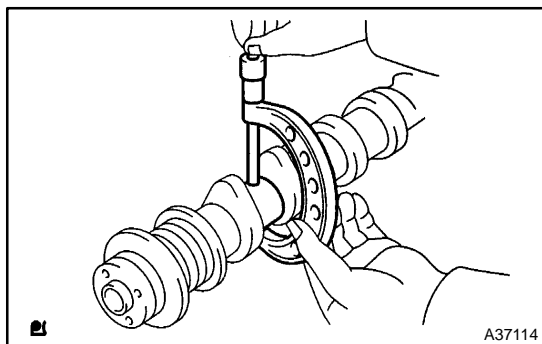
- (a) Inspect the camshaft for runout.
  - (1) Place the camshaft on V-blocks.
  - (2) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.03 mm (0.0012 in.)**

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



- (b) Inspect the cam lobes.
- (1) Using a micrometer, measure the cam lobe height.  
**Standard cam lobe height:**  
**44.617 to 44.717 mm (1.7566 to 1.7605 in.)**  
**Minimum cam lobe height: 43.16 mm (1.6992 in.)**
- If the cam lobe height is less than minimum, replace the camshaft.



- (c) Inspect the camshaft journals.
- (1) Using a micrometer, measure the journal diameter.  
**No. 1 journal diameter:**  
**34.449 to 34.465 mm (1.3563 to 1.3569 in.)**  
**Other journals diameter:**  
**22.949 to 22.965 mm (0.9035 to 0.9041 in.)**
- If the journal diameter is not as specified, check the oil clearance.

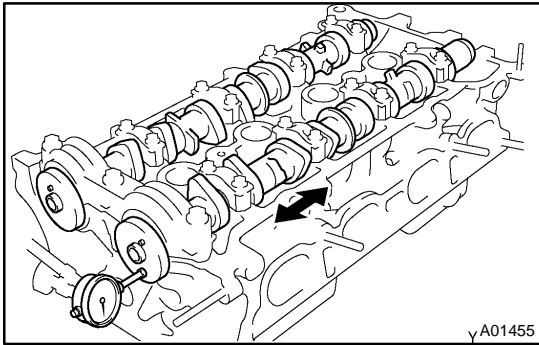
## 27. INSPECT NO.2 CAMSHAFT

- (a) Inspect the camshaft for runout.
- (1) Place the camshaft on V-blocks.
- (2) Using a dial indicator, measure the circle runout at the center journal.  
**Maximum circle runout: 0.03 mm ( 0.0012 in.)**

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

- (b) Inspect the cam lobes.
- (1) Using a micrometer, measure the cam lobe height.  
**Standard cam lobe height:**  
**44.666 to 44.766 mm (1.7585 to 1.7624 in.)**  
**Minimum cam lobe height:**  
**44.52 mm (1.7528 in.)**
- If the cam lobe height is less than minimum, replace the camshaft.
- (c) Inspect the camshaft journals.
- (1) Using a micrometer, measure the journal diameter.  
**No. 1 journal diameter: 34.449 to 34.465 mm (1.3563 to 1.3569 in.)**  
**Other journals diameter: 22.949 to 22.965 mm (0.9035 to 0.9041 in.)**

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



**28. 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:**

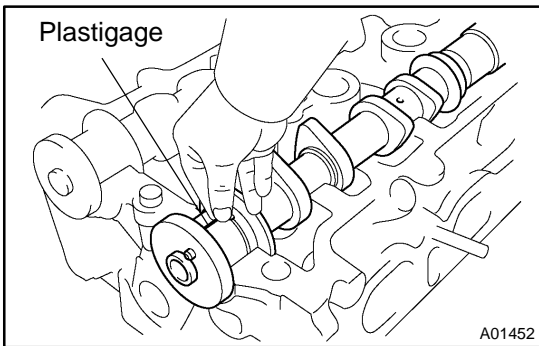
**0.040 to 0.095 mm (0.0016 to 0.0037 in.)**

**Maximum thrust clearance: 0.11 mm (0.0043 in.)**

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

**29. 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 journals.
- (d) Install the bearing caps.

**Torque:**

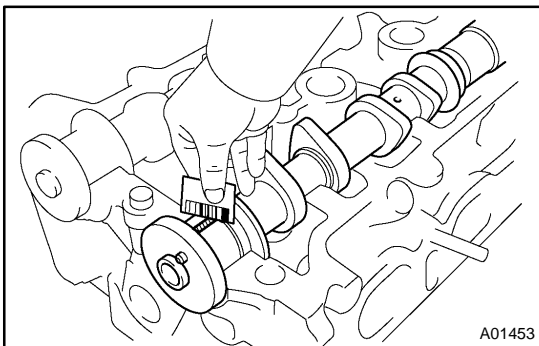
**No. 1 23 N·m (235 kgf·cm, 17 ft·lbf)**

**No. 2 13 N·m (129 kgf·cm, 9.4 ft·lbf)**

**NOTICE:**

**Do not turn the camshaft.**

- (e) Remove the bearing caps.



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

**Standard oil clearance:**

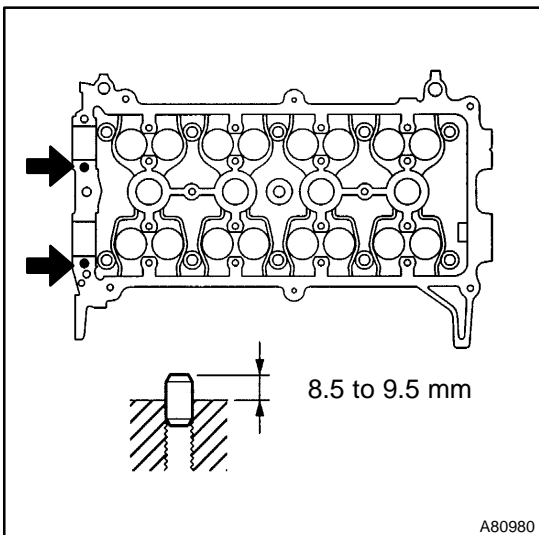
**0.035 to 0.072 mm (0.0014 to 0.0028 in.)**

**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 and cylinder head together.

**NOTICE:**

**Completely remove the Plastigage.**



**30. INSTALL CAMSHAFT BEARING CAP SETTING RING PIN**

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

**Protrusion height: 8.5 to 9.5 mm (0.3346 to 0.3740 in.)**

**31. INSTALL STUD BOLT**

- (a) Using Torx socket wrench E5 and E7, install the 7 stud bolts.

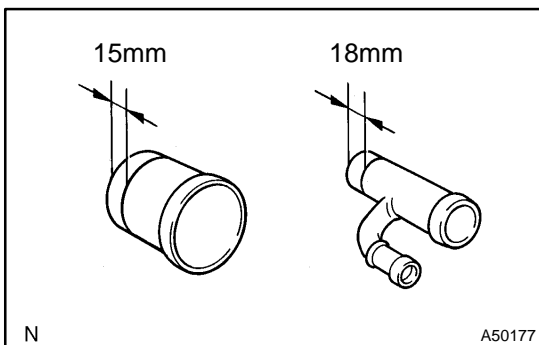
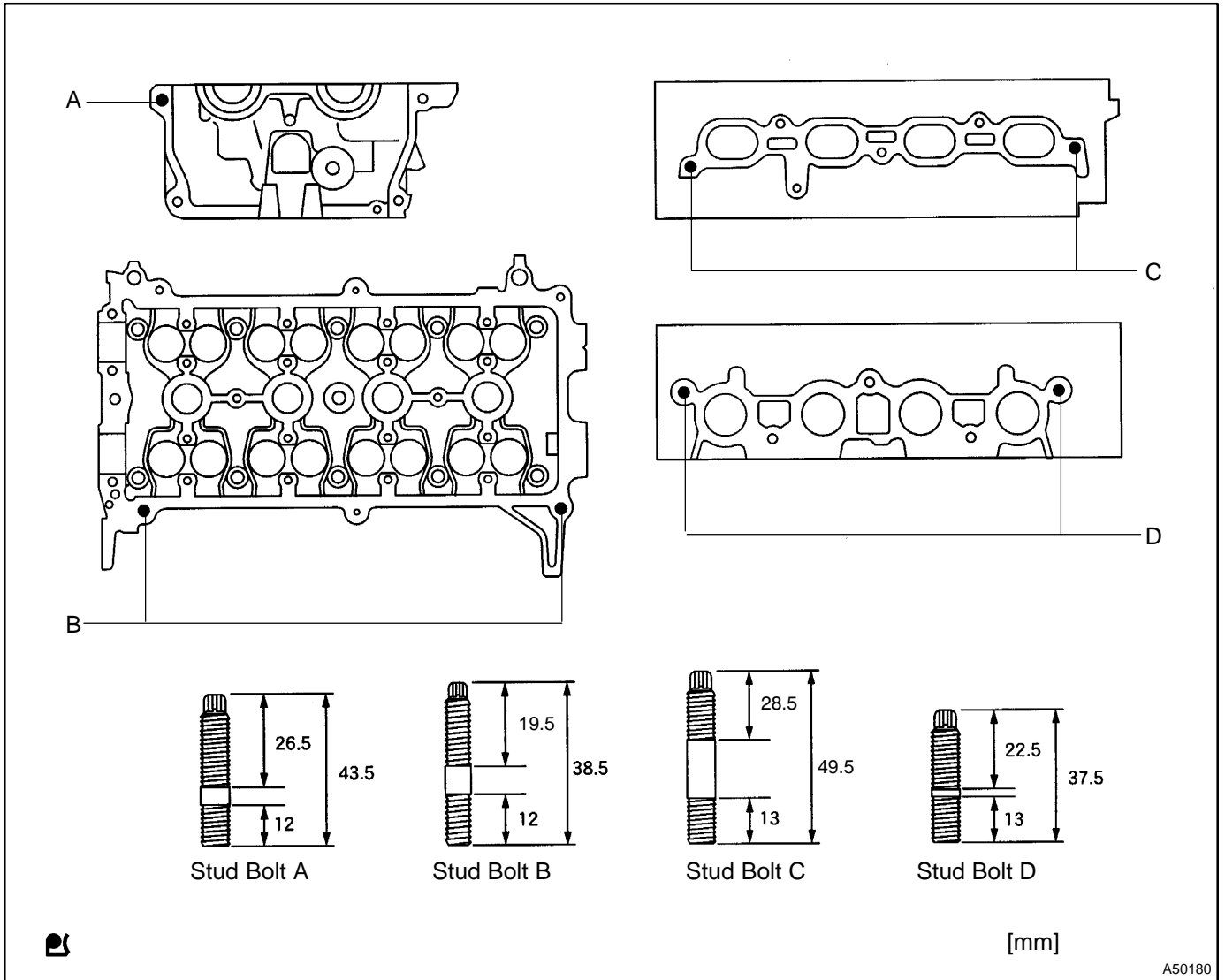
**Torque:**

**Bolt A 10 N·m (102 kgf·cm, 7.4 ft·lbf)**

**Bolt B 4.0 N·m (41 kgf·cm, 35 in·lbf)**

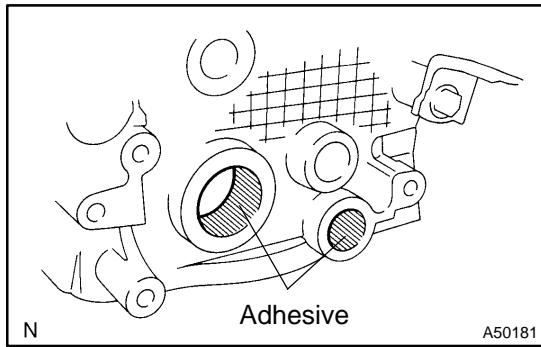
**Bolt C 10 N·m (102 kgf·cm, 7.4 ft·lbf)**

**Bolt D 9.0 N·m (92 kgf·cm, 80 in·lbf)**



**32. INSTALL UNION**

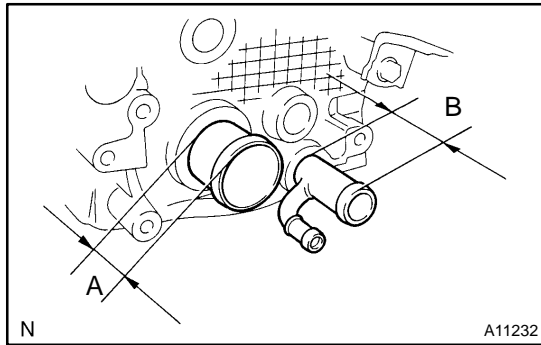
- (a) Mark the standard position away from the edge onto the new water hose unions as shown in the illustration..



(b) Apply adhesive to the water hose union hole of the cylinder head.

**Adhesive:**

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



(c) Using a press, press in a new water hose union until the marks come to the same level as the one of the cylinder head surface.

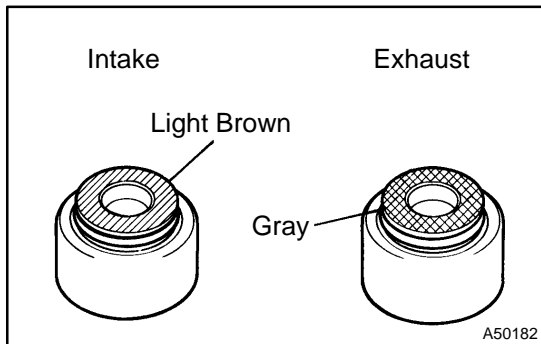
**Standard protrusion:**

**A 29 mm (1.14 in.)**

**B 44 mm (1.73 in.)**

**NOTICE:**

- Install the water hose union within 3 minutes after applying adhesive.
- Do not expose the water hose union to engine coolant within 1 hour of installation.



**33. INSTALL VALVE STEM OIL O SEAL OR RING**

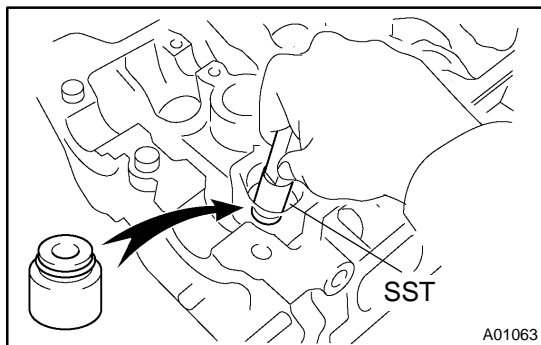
(a) Apply a light coat of engine oil on the valve stem.

**NOTICE:**

**Installing the oil seal for intake and exhaust to the opposite valve guide bush may cause failures.**

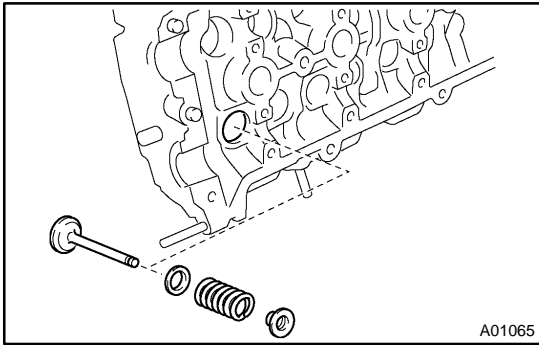
**HINT:**

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



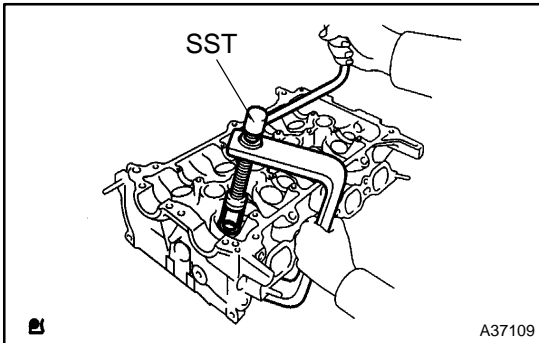
(b) Using SST, push in a new oil seal.

SST 09201-41020



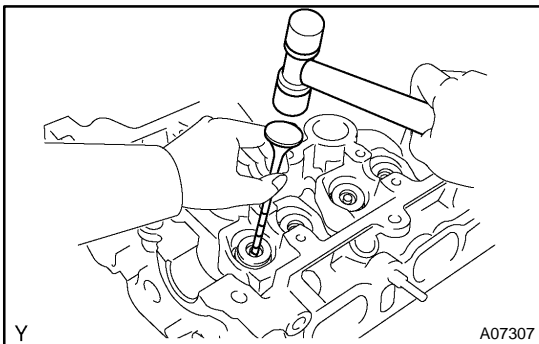
**34. INSTALL INTAKE VALVE**

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



(b) Using SST, compress the valve spring and place the valve spring retainer lock around the valve stem.

SST 09202-70020 (09202-00010)



(c) Using a plastic-faced hammer and discarded valve with the tip wrapped in tape, lightly tap the installed valve to ensure proper fit.

**NOTICE:**

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

**35. INSTALL EXHAUST VALVE**

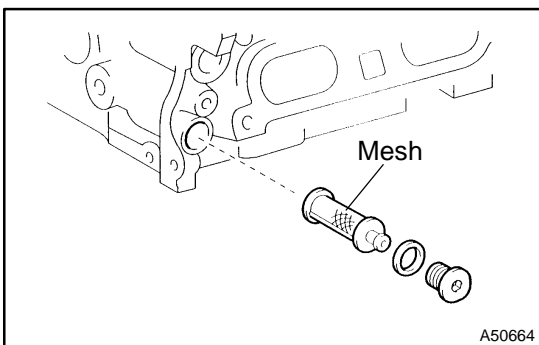
(a) Install the valve, spring seat, valve spring, and spring retainer.

(b) Using SST, compress the valve spring and place the valve spring retainer lock around the valve stem.  
SST 09202-70020 (09202-00010)

(c) Using a plastic-faced hammer and discarded valve with the tip wrapped in tape, lightly tap the installed valve to ensure proper fit.

**NOTICE:**

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



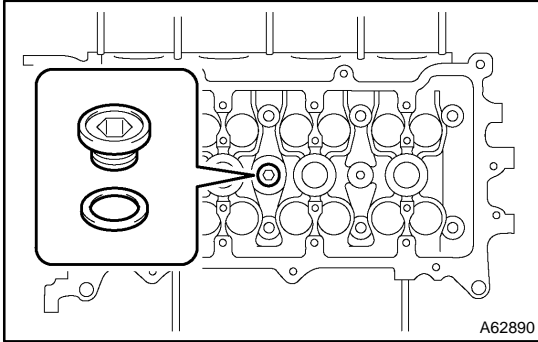
**36. INSTALL OIL CONTROL VALVE FILTER**

(a) Using an 8mm hexagon wrench, place a new gasket on the plug and install the filter.

**Torque: 30 N·m (306kgf·cm, 22 ft·lbf)**

**37. INSTALL VALVE LIFTER**

- (a) Apply a light coat of engine oil on the valve lifter.
- (b) Install the valve lifter.
- (c) Check that the valve lifter rotates smoothly by hand.

**38. REMOVE W/HEAD TAPER SCREW PLUG NO.1**

- (a) Using a 10 mm socket hexagon wrench, install the taper screw plug with a new gasket.

**Torque: 44 N·m (449kgf·cm, 33 ft·lbf)**