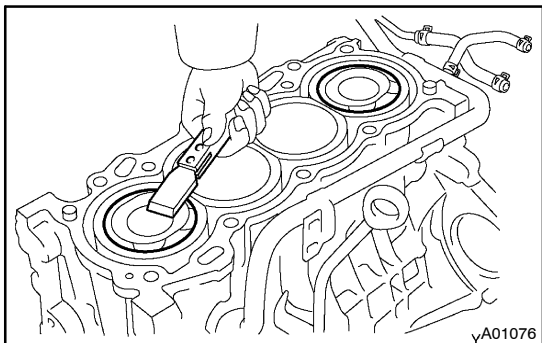
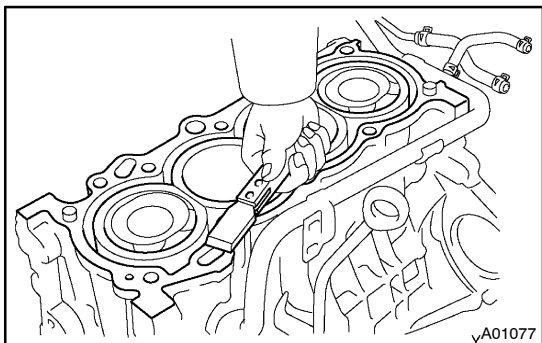




INSPECTION

1. CLEAN TOP SURFACES OF PISTONS AND CYLINDER BLOCK

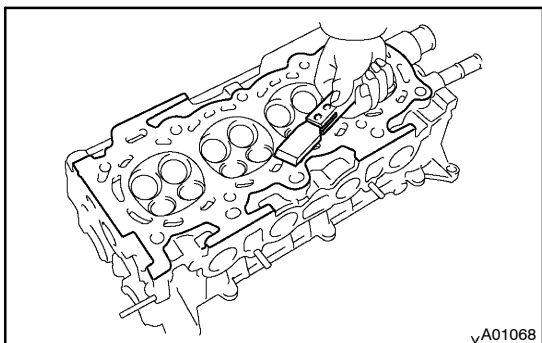
- (a) Turn the crankshaft, and bring each piston to top dead center (TDC). Using a gasket scraper, remove all the carbon from the piston surface.



- (b) Using a gasket scraper, remove all the gasket material from the cylinder block surface.
- (c) Using compressed air, blow carbon and oil from the bolt holes.

CAUTION:

Protect your eyes when using high pressure compressed air.

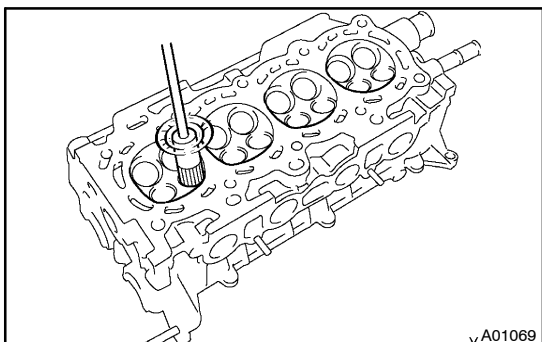


2. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all the gasket material from the cylinder block contact surface.

NOTICE:

Be careful not to scratch the cylinder block contact surface.

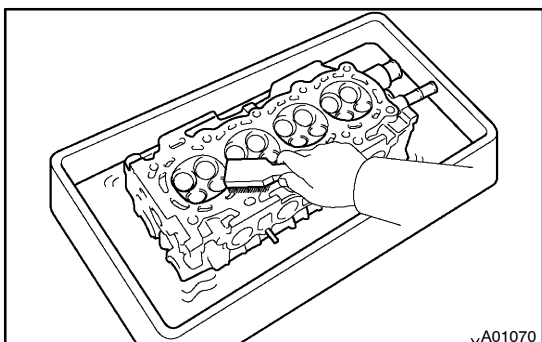


3. CLEAN COMBUSTION CHAMBERS

Using a wire brush, remove all the carbon from the combustion chambers.

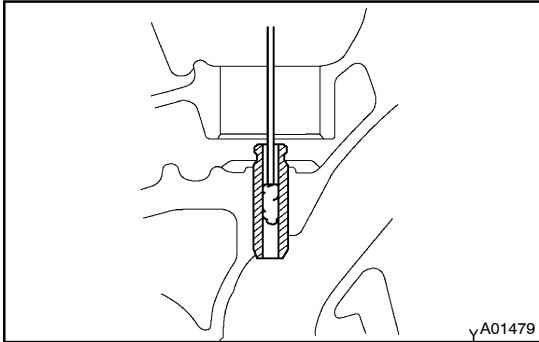
NOTICE:

Be careful not to scratch the cylinder block contact surface.



4. CLEAN CYLINDER HEAD

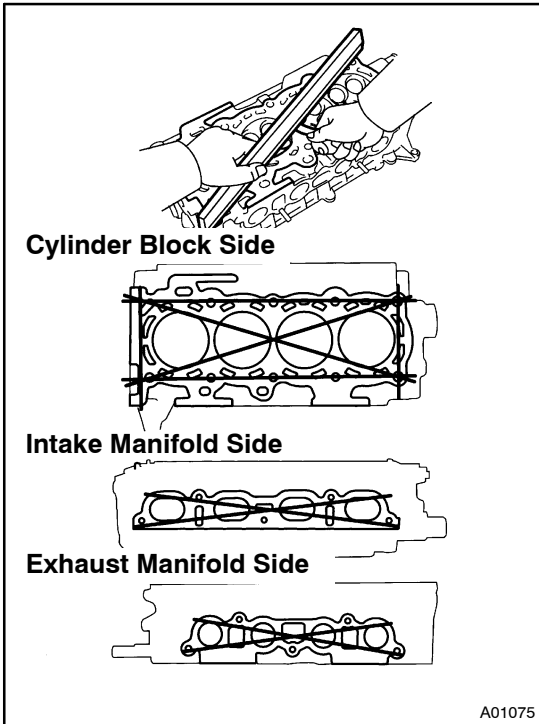
Using a soft brush and solvent, thoroughly clean the cylinder head.



A01479

5. CLEAN VALVE GUIDE BUSHINGS

Using a valve guide bushing brush and solvent, clean all the guide bushings.



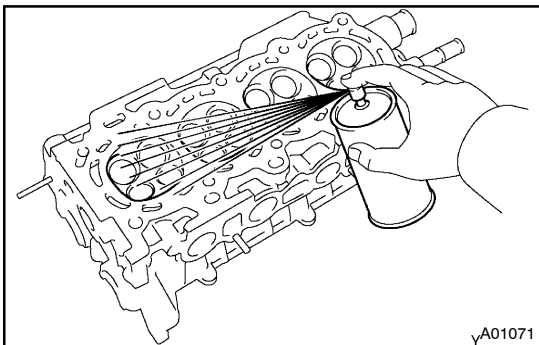
A01075

6. INSPECT FOR FLATNESS

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

Maximum warpage: 0.05 mm (0.0020 in.)

If warpage is greater than maximum, replace the cylinder head.

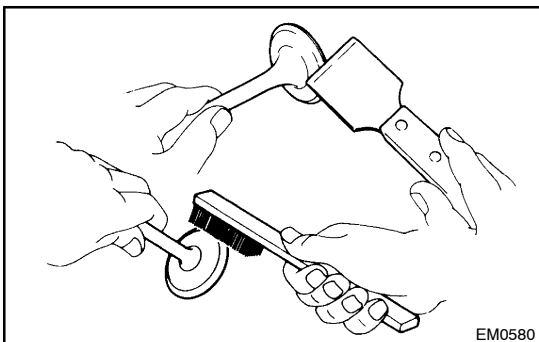


A01071

7. INSPECT FOR CRACKS

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

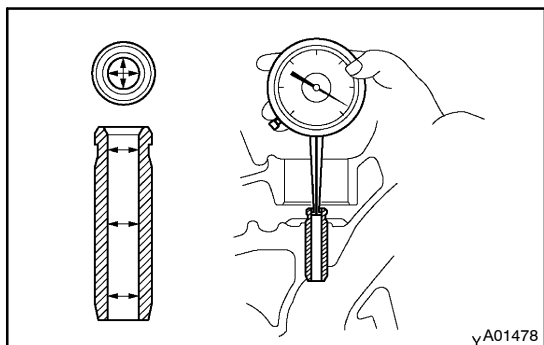
If cracked, replace the cylinder head.



EM0580

8. CLEAN VALVES

- (a) Using a gasket scraper, chip off any carbon from the valve head.
- (b) Using a wire brush, thoroughly clean the valve.



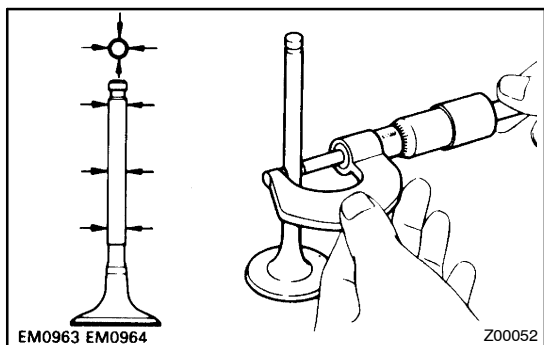
9. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

Bushing inside diameter:

1ZZ-FE 5.510 – 5.530 mm (0.2169 – 0.2177 in.)

2ZZ-GE 5.500 – 5.518 mm (0.2165 – 0.2172 in.)



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

Valve stem diameter:

1ZZ-FE

Intake 5.470 – 5.485 mm (0.2154 – 0.2159 in.)

Exhaust 5.465 – 5.480 mm (0.2152 – 0.2157 in.)

2ZZ-GE

Intake 5.460 – 5.475 mm (0.21496 – 0.21555 in.)

Exhaust 5.445 – 5.470 mm (0.21437 – 0.21535 in.)

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

Standard oil clearance:

1ZZ-FE

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

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

2ZZ-GE

Intake 0.025 – 0.058 mm (0.00098 – 0.00228 in.)

Exhaust 0.030 – 0.063 mm (0.00118 – 0.00248 in.)

Maximum oil clearance:

1ZZ-FE

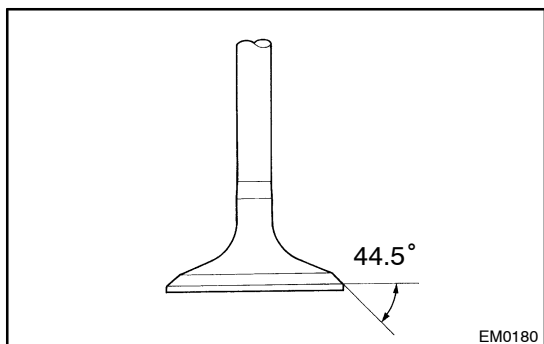
Intake 0.08 mm (0.0031 in.)

Exhaust 0.10 mm (0.0039 in.)

2ZZ-GE

0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the valve and guide bushing.



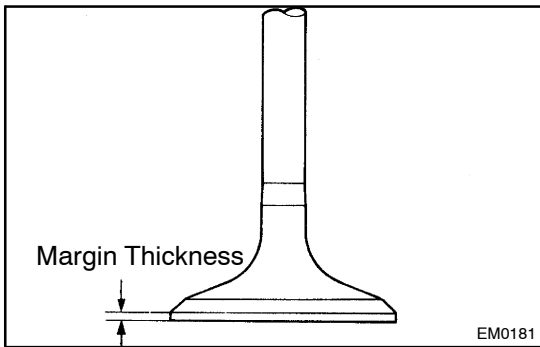
10. INSPECT VALVES

- (a) Check the valve is ground to the correct valve face angle.

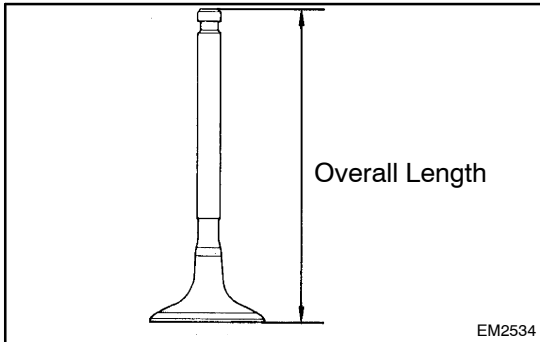
Valve face angle: 44.5°

- (b) Check that the surface of the valve for wear.

If the valve face is worn, replace the valve.



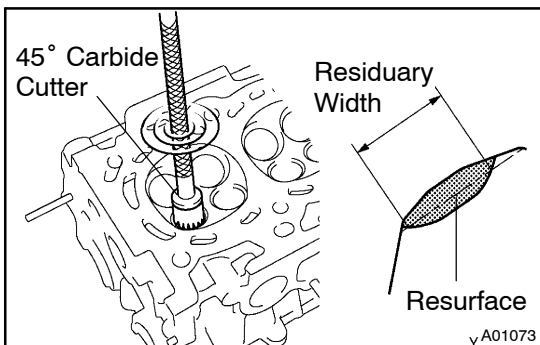
- (c) Check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.7 mm (0.028 in.)
 If the margin thickness is less than minimum, replace the valve.



- (d) Check the valve overall length.
Standard overall length:
1ZZ-FE
Intake 88.65 mm (3.4902 in.)
Exhaust 88.69 mm (3.4917 in.)
2ZZ-GE
Intake 111.3 mm (4.382 in.)
Exhaust 111.7 mm (4.398 in.)
Minimum overall length:
1ZZ-FE
Intake 88.35 mm (3.4783 in.)
Exhaust 88.39 mm (3.4799 in.)
2ZZ-GE
Intake 110.9 mm (4.366 in.)
Exhaust 111.3 mm (4.382 in.)

If the overall length is less than minimum, replace the valve.

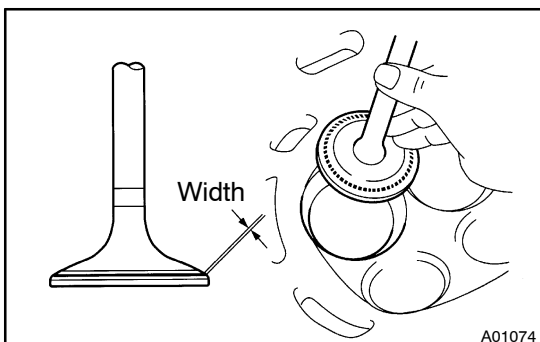
- (e) Check the surface of the valve stem tip for wear.
 If the valve stem tip is worn, replace the valve.



11. INSPECT AND CLEAN VALVE SEATS

- (a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.
 (b) After resurfacing the valve seat 45°, measure the residuary width of the valve seat 45°.
Minimum residuary length:
Intake 3.3 mm (0.130 in.)
Exhaust 3.2 mm (0.126 in.)

If the valve seat 45° residuary width less than minimum, replace the cylinder head.

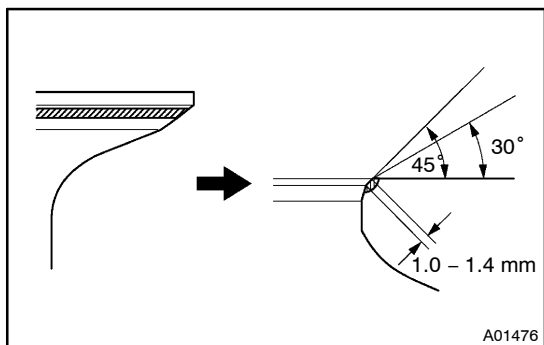


- (c) Check the valve seating position.
 Apply a light coat of prussian blue (or white lead) to the valve face. Lightly press the valve against the seat. Do not rotate valve.
 (d) Check the valve face and seat for the following:
 • If blue appears 360° around the face, the valve is concentric. If not, replace the valve.

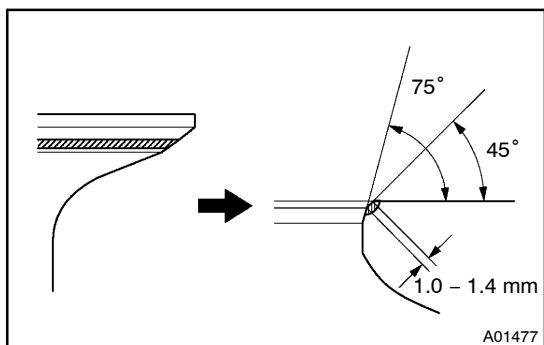
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with the following width:

1.0 – 1.4 mm (0.039 – 0.055 in.)

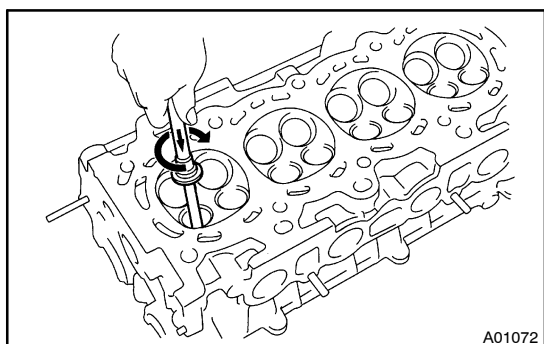
If not, correct the valve seats as follows:



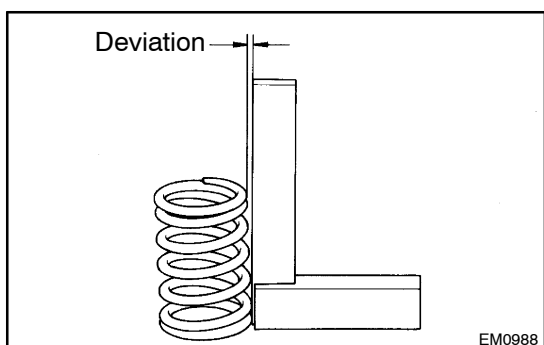
- (1) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



- (2) If the seating is too low on the valve face, use 75° and 45° cutters to correct the seat.



- (e) Hand-lap the valve and valve seat with an abrasive compound.
- (f) After hand-lapping, clean the valve and valve seat.



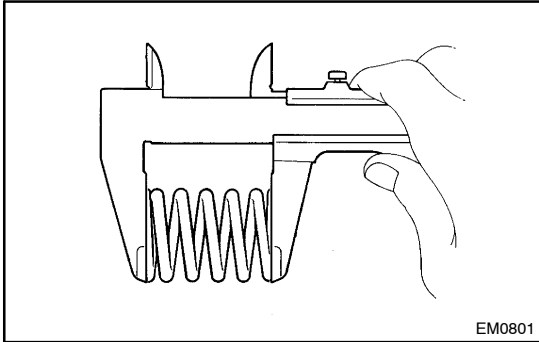
12. INSPECT VALVE SPRINGS

- (a) Using a steel square, measure the deviation of the valve spring.

Maximum deviation: 1.6 mm (0.063 in.)

Maximum angle (reference): 2°

If the deviation is greater than maximum, replace the valve spring.



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

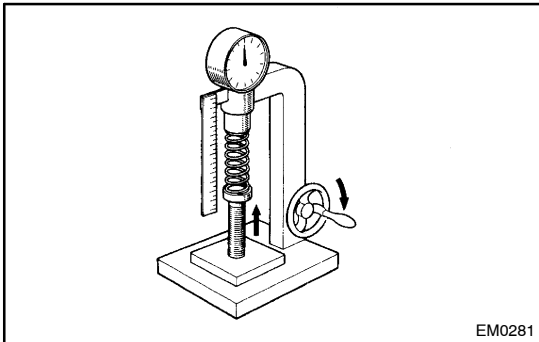
Free length:

1ZZ-FE 45.90 mm (1.8070 in.)

2ZZ-GE

Intake 46.4 mm (1.830 in.)

Exhaust 46.5 mm (1.831 in.)



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

Installed tension:

1ZZ-FE

139.6 – 154.4 N (14.2 – 15.8 kgf, 31.3 – 34.8 lbf)

at 33.6 mm (1.323 in.)

2ZZ-GE

Intake

220.2 – 243.8 N (22.5 – 24.7 kgf, 49.6 – 55.5 lbf)

at 38.5 mm (1.516 in.)

Exhaust

208.2 – 229.8 N (21.2 – 23.4 kgf, 47.6 – 52.6 lbf)

at 38.5 mm (1.516 in.)

Maximum working tension:

1ZZ-FE

244.9 – 276.1 N (25.5 – 28.1 kgf, 56.2 – 61.9 lbf)

at 24.6 mm (0.969 in.)

2ZZ-GE

Intake

533 – 589 N (54.4 – 60.1 kgf, 119.9 – 132.5 lbf)

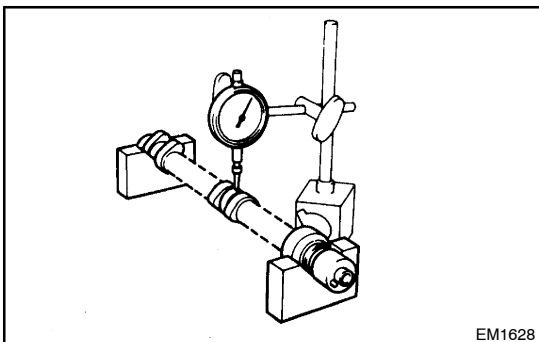
at 27.3 mm (1.075 in.)

Exhaust

495.5 – 548.5 N (50.5 – 55.9 kgf, 111.3 – 123.2 lbf)

at 28.5 mm (1.122 in.)

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

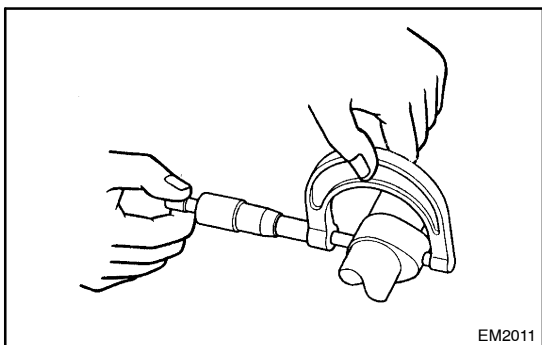


13. INSPECT CAMSHAFT FOR RUNOUT

- (a) Place the camshaft on V-blocks.
 (b) 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.



14. INSPECT CAM LOBES

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

1ZZ-FE:

Intake 44.333 – 44.433 mm (1.7454 – 1.7493 in.)

Exhaust 43.761 – 43.861 mm (1.7229 – 1.7268 in.)

2ZZ-GE:

INTAKE

No. 1 40.607 – 40.707 mm (1.59586 – 1.59979 in.)

No. 2 38.769 – 38.869 mm (1.52362 – 1.52755 in.)

2ZZ-GE:

EXHAUST

No. 1 40.019 – 40.119 mm (1.57275 – 1.57668 in.)

No. 2 38.863 – 38.963 mm (1.52732 – 1.53125 in.)

Minimum cam lobe height:

1ZZ-FE:

Intake 44.18 mm (1.7394 in.)

Exhaust 43.61 mm (1.7169 in.)

2ZZ-GE:

Intake

No.1 40.45 mm (1.5925 in.)

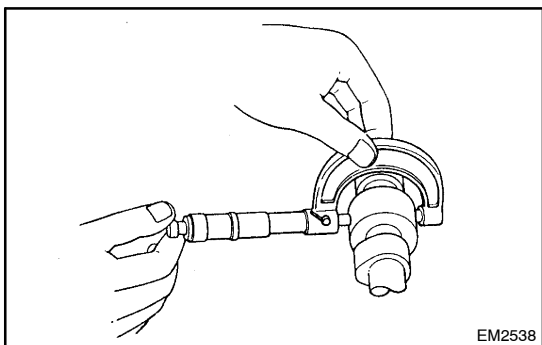
No.2 38.61 mm (1.5201 in.)

Exhaust

No.1 39.86 mm (1.5693)

No.2 38.71 mm (1.5240)

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



15. INSPECT CAMSHAFT JOURNALS

Using a micrometer, measure the journal diameter.

1ZZ-FE:

No.1 journal diameter:

34.449 – 34.465 mm (1.3563 – 1.3569 in.)

Others journal diameter:

22.949 – 22.965 mm (0.9035 – 0.9041 in.)

2ZZ-GE:

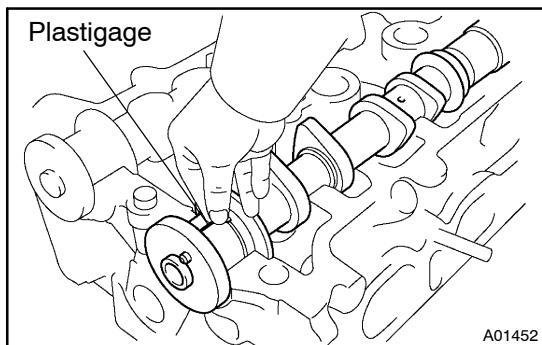
No.1 journal diameter:

34.449 – 34.465 mm (1.35626 – 1.35689 in.)

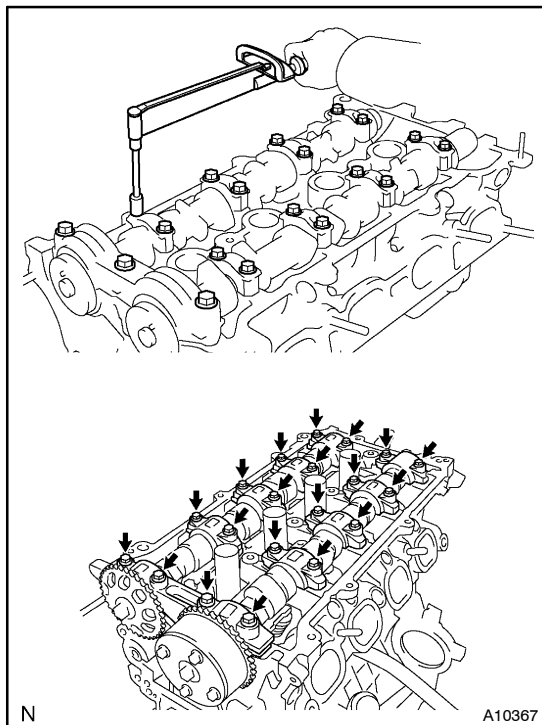
Other journal diameter:

27.949 – 27.965 mm (1.10035 – 1.10098 in.)

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

**16. INSPECT CAMSHAFT JOURNAL CLEARANCE**

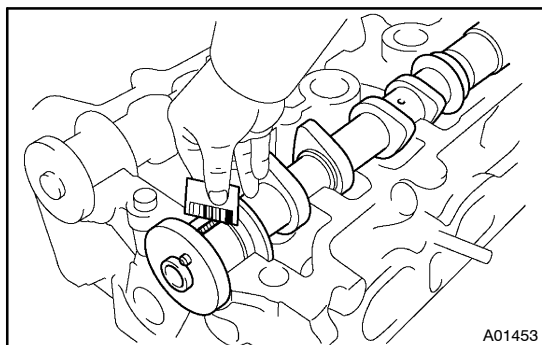
- Clean the bearing caps and camshaft journals.
- Place the camshafts on the cylinder head.
- Lay a strip of Plastigage across each of the camshaft journal.



- Install the bearing caps (See page EM-66).

Torque:**1ZZ-FE:****No.1** 23 N·m (235 kgf·cm, 17 ft·lbf)**No.3** 13 N·m (133 kgf·cm, 10 ft·lbf)**2ZZ-GE:** 18.5 N·m (189 kgf·cm, 14 ft·lbf)**NOTICE:****Do not turn the camshaft.**

- Remove the bearing caps.

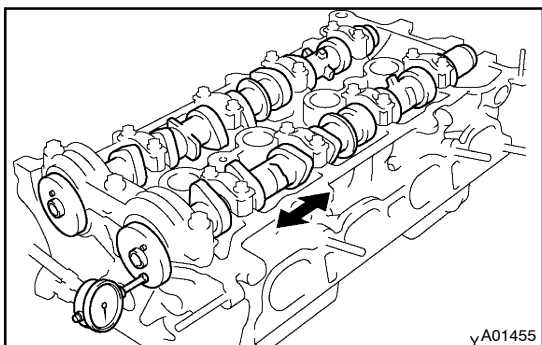


- Measure the plastigage at its widest point.

1ZZ-FE:**Standard oil clearance:****0.035 – 0.072 mm (0.0014 – 0.0028 in.)****Maximum oil clearance:****0.10 mm (0.0039 in.)****2ZZ-GE:****Standard oil clearance:****No. 1 journal** 0.035 – 0.076 mm (0.00138 – 0.00299 in.)**Other journal** 0.035 – 0.072 mm (0.00138 – 0.00283 in.)**Maximum oil clearance:****0.10 mm (0.039 in.)**

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

- Completely remove the Plastigage.
- Remove the camshafts.

**17. INSPECT CAMSHAFT THRUST CLEARANCE**

- (a) Install the camshafts (See page EM-66).
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

1ZZ-FE:**Standard thrust clearance:**

0.040 – 0.095 mm (0.0016 – 0.0037 in.)

Maximum thrust clearance:

0.11 mm (0.0043 in.)

2ZZ-GE:**Standard thrust clearance:**

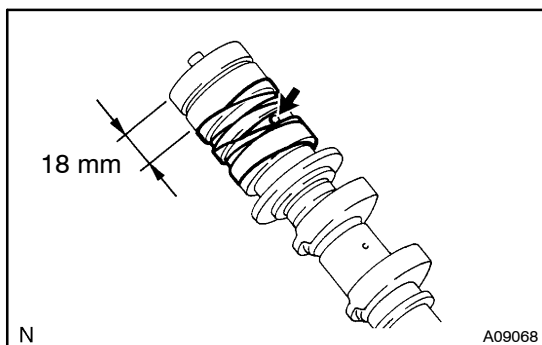
0.04 – 0.14 mm (0.0016 – 0.0055 in.)

Maximum thrust clearance:

0.15 mm (0.0059 in.)

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

- (c) Remove the camshafts.

**18. INSPECT VALVE TIMING CONTROLLER ASSEMBLY**

- (a) Apply vinyl tape to all the ports except the one indicated by the arrow in the illustration.

NOTICE:

Do not apply tape in the range from the tip of the camshaft to 18 mm from that tip.

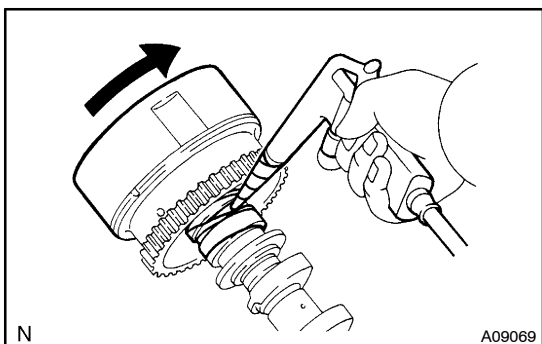
- (b) Install the valve timing controller assembly.

Torque: 47 N·m (480 kgf·cm, 35 ft·lbf)

NOTICE:

Do not push valve timing controller assembly to the camshaft forcibly when installing it.

- (c) Check that the valve timing controller assembly will not turn.



- (d) Wind tape around the tip of the air gun and apply air of approx. 100 kPa (1 kgf/cm², 14 psi) to the port of the camshaft.

NOTICE:

When the oil splashes, wipe it off with a shop rag and the likes.

HINT:

Perform this in order to release the lock pin for the maximum delay angle locking.

- (e) Under the condition of (d), turn the valve timing controller assembly to the advance angel side (the arrow marked direction in the illustration) with your hand.

Standard: Must turn

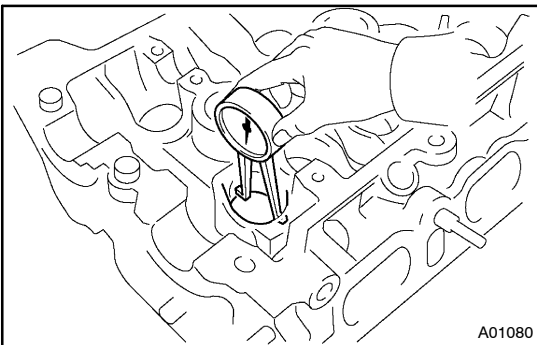
HINT:

Depending on the air pressure, the valve timing controller assembly will turn to the advance angle side without applying force by hand. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.

- (f) Except the position where the lock pin meets at the maximum delay angle, let the valve timing controller assembly turn back and forth and check the movable range and that there is no disturbance.

Standard: Movable smoothly in the range about 30°

- (g) Turn the valve timing controller assembly with your hand and lock it at the maximum delay angel position.



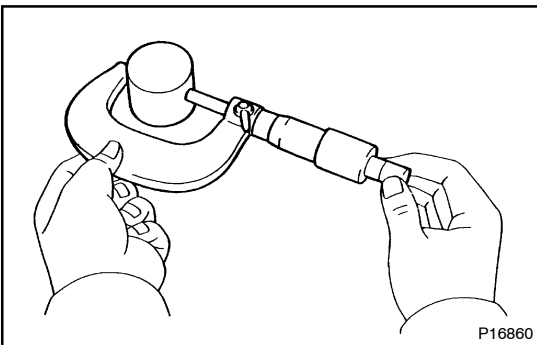
19. 1ZZ-FE:

INSPECT VALVE LIFTERS AND LIFTER BORES

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

Lifter bore diameter:

31.000 – 31.025 mm (1.2205 – 1.2215 in.)



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

Lifter diameter:

30.966 – 30.976 mm (1.2191 – 1.2195 in.)

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

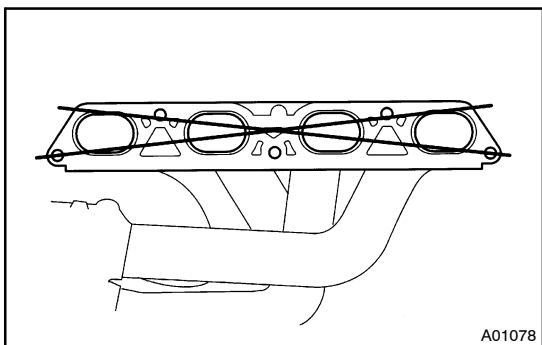
Standard oil clearance:

0.024 – 0.059 mm (0.0009 – 0.0023 in.)

Maximum oil clearance:

0.079 mm (0.0031 in.)

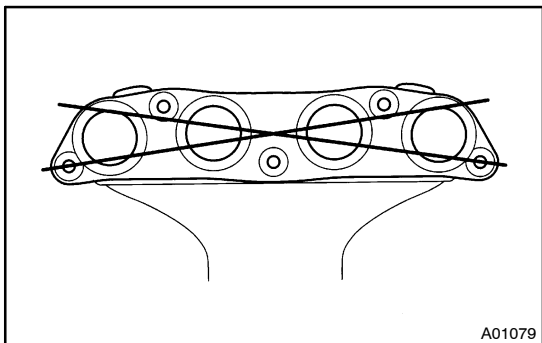
If the oil clearance is greater than maximum, replace the lifter.
If necessary, replace the cylinder head.

**20. INSPECT INTAKE MANIFOLD**

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage: 0.10 mm (0.0039 in.)

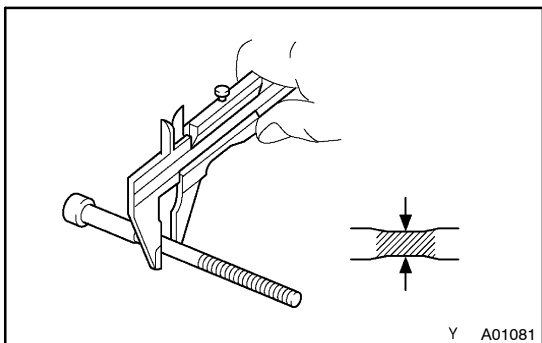
If warpage is greater than maximum, replace the manifold.

**21. INSPECT EXHAUST MANIFOLD**

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head for warpage.

Maximum warpage: 0.70 mm (0.0276 in.)

If warpage is greater than maximum, replace the manifold.

**22. INSPECT CYLINDER HEAD BOLTS**

Standard outside diameter:

9.0 – 9.2 mm (0.354 – 0.362 in.)

Minimum outside diameter:

9.0 mm (0.354 in.)

If the outer diameter is less than minimum, replace the bolt.