EM1XR−01

INSPECTION

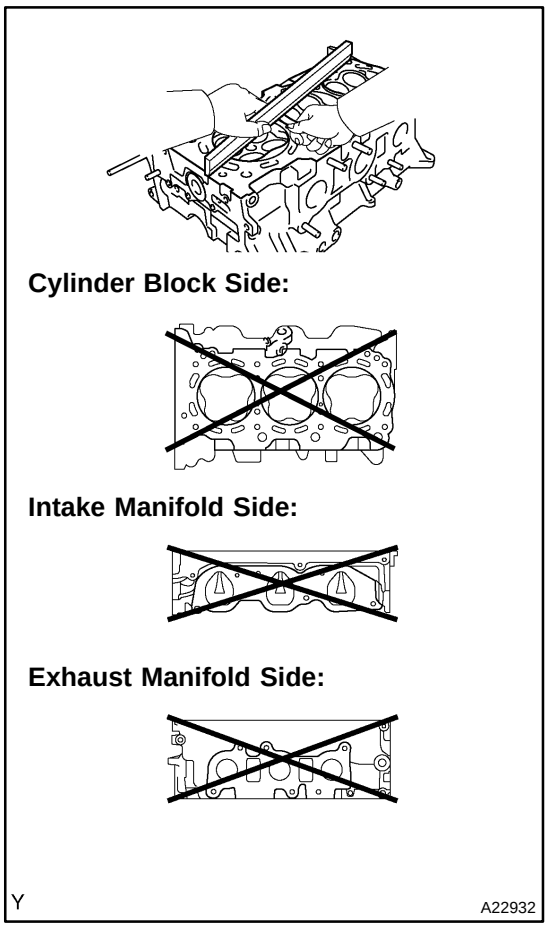
1. INSPECT CYLINDER HEAD

(a) Inspect flatness.

Using a precision straight edge and feeler gauge, measure the flatness of the contact surfaces of the cylinder block and manifolds.

Maximum warpage: 0.10 mm (0.0039 in.)

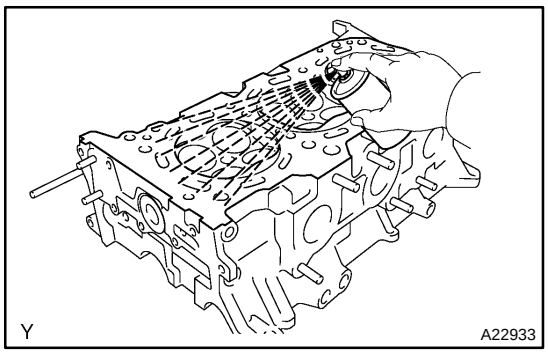
If warpage is greater than the maximum, replace the cylinder head.

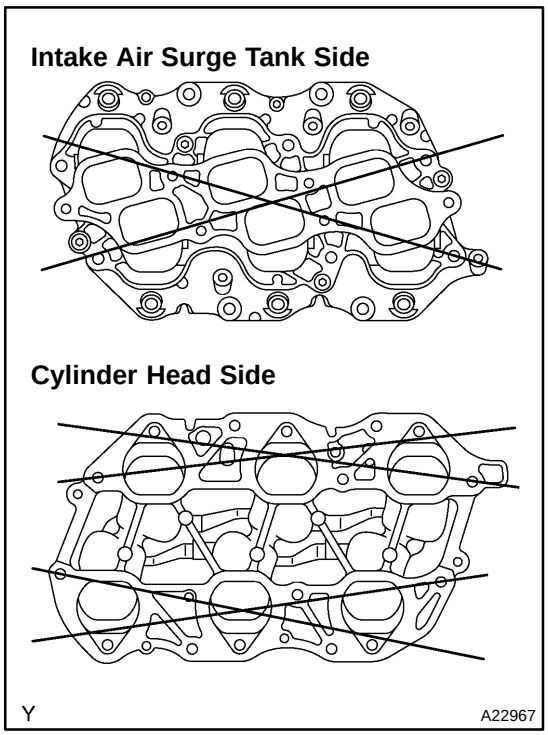


(b) Inspect cranks.

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

If cracked, replace the cylinder head.





2. INSPECT INTAKE MANIFOLD FOR FLATNESS

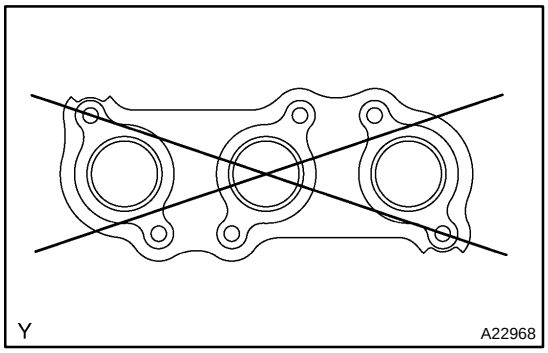
Using a precision straight edge and feeler gauge, measure the flatness of the contact surfaces of the cylinder head and intake air surge tank.

Maximum warpage:

Intake air surge tank side: 0.8 mm (0.031 in.)

Cylinder head side: 0.2 mm (0.008 in.)

If warpage is greater than the maximum, replace the intake manifold.



3. INSPECT EXHAUST MANIFOLD FOR FLATNESS

Using a precision straight edge and feeler gauge, measure the flatness of the contact surface the cylinder head.

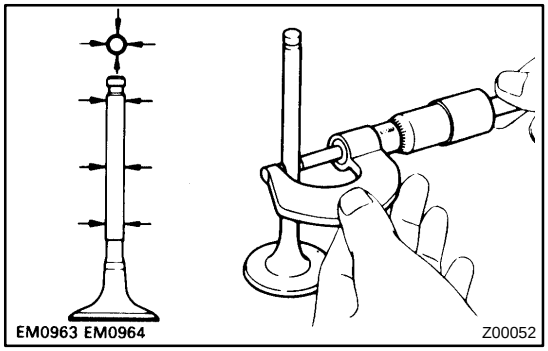
Maximum warpage: 0.7 mm (0.028 in.)

If warpage is greater than the maximum, replace the exhaust manifold.

HINT:

Maximum warpage of each installation surface:

0.3 mm (0.012 in.)



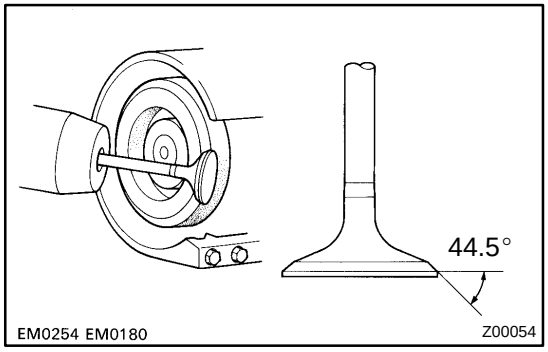
4. INSPECT VALVE

(a) Inspect valve stem diameter.

Using a micrometer, measure the diameter of the valve stem.

Valve stem diameter:

Intake	5.470 to 5.485 mm (0.2154 to 0.2159 in.)
Exhaust	5.465 to 5.480 mm (0.2152 to 0.2158 in.)

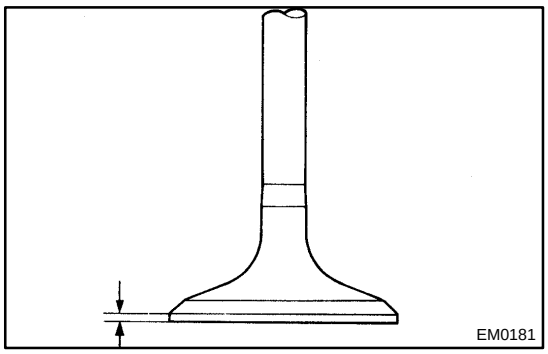


(b) Inspect valve face angle.

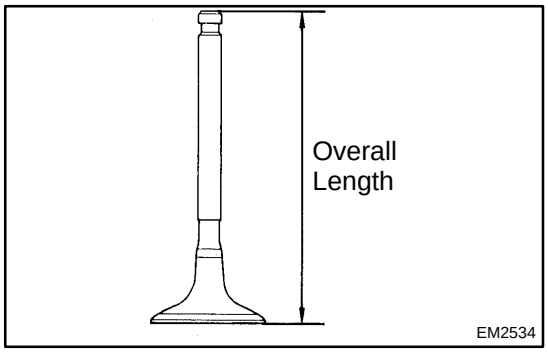
(1) Grind the valve enough to remove pits and carbon.

(2) Check that the valve is ground to the correct valve face angle.

Valve face angle: 44.5°



(c) Inspect valve head margin thickness.
Using vernier calipers, check the valve head margin thickness.
Standard margin thickness: 1.0 mm (0.039 in.)
Minimum margin thickness: 0.5 mm (0.020 in.)
If the margin thickness is less than the minimum, replace the valve.



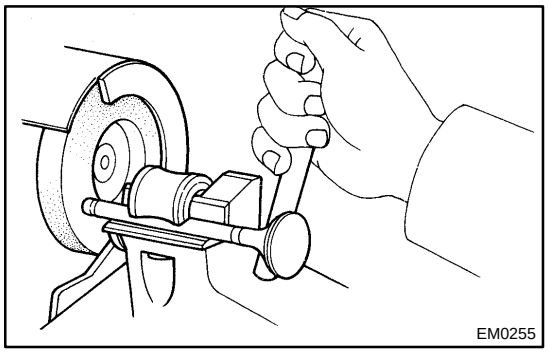
(d) Inspect overall length.
Using vernier calipers, check the overall length.
Standard overall length:

Intake	106.95 mm (4.2106 in.)
Exhaust	105.80 mm (4.1654 in.)

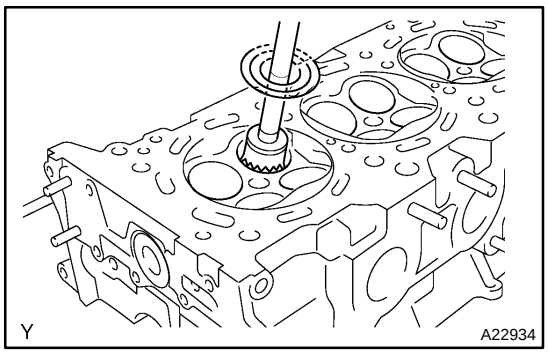
Minimum overall length:

Intake	106.40 mm (4.1890 in.)
Exhaust	105.30 mm (4.1457 in.)

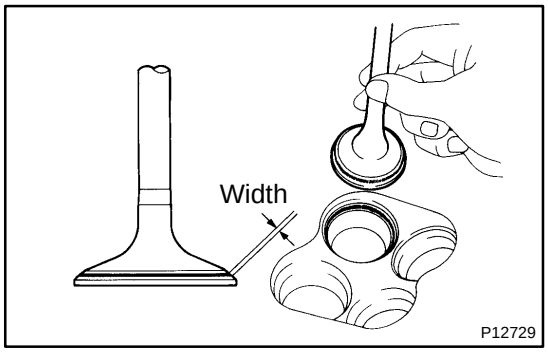
If the overall length is less than the minimum, replace the valve.



(e) Inspect valve stem tip.
Check the surface of the valve stem tip for wear.
NOTICE:
Do not grind off more than the minimum length.
If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.



5. CLEAN VALVE SEAT
(a) Using a 45° carbide cutter, resurface the valve seats.
(b) Clean the valve seats.



6. INSPECT VALVE SEAT
(a) Apply a light coat of prussian blue (or white lead) to the valve face.
(b) Lightly press the valve against the valve seat.
NOTICE:
Do not rotate the valve.
(c) Check the valve face and seat according to the following procedure.
(1) If prussian blue (or white lead) appears around the entire face, the valve is centered.

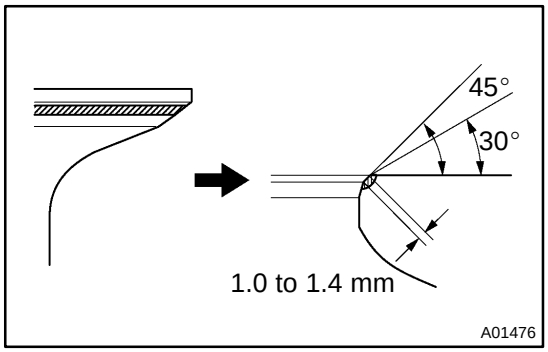
If not, replace the valve.

(2) If the prussian blue (or white lead) appears around the entire valve seat, the guide and face are centered.

If not, resurface the valve seat.

(3) Check that the seat contacts the middle of the valve face with the width below.

Standard width: 1.0 to 1.4 mm (0.039 to 0.055 in.)

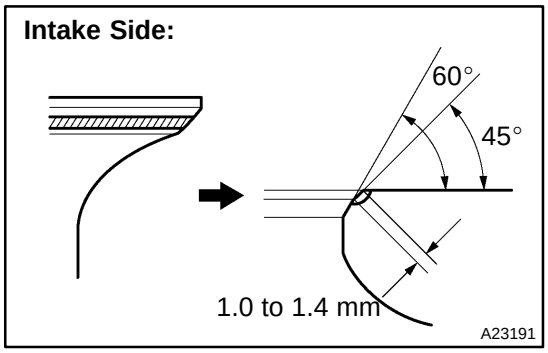


7. REPAIR VALVE SEAT

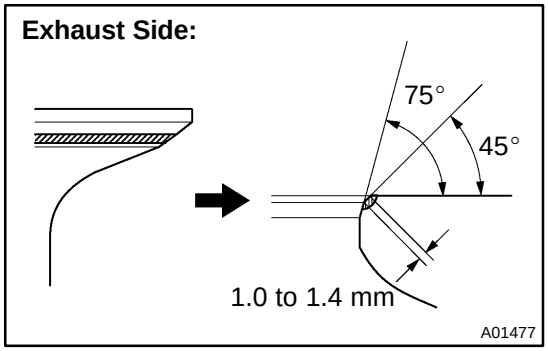
NOTICE:

Take off a cutter gradually to make the intake valve seat smooth.

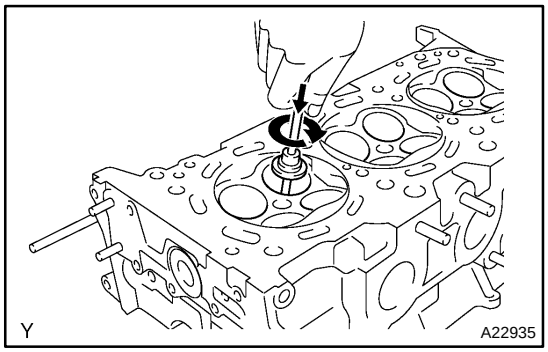
(a) If the seating is too high to the valve face, use 30° and 45° cutters to correct the seat.



(b) Intake side:
If the seating is too low to the valve face, use 60° and 45° cutters to correct the seat.

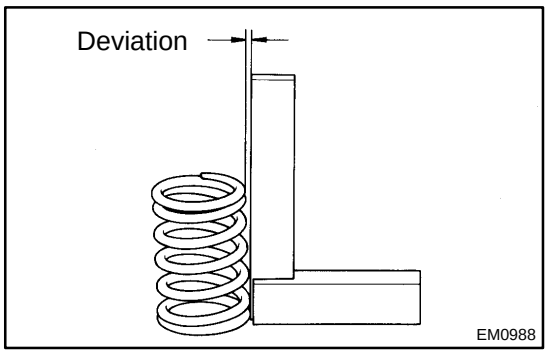


(c) Exhaust side:
If the seating is too low to the valve face, use 75° and 45° cutters to correct the seat.



(d) Handrub the valve and valve seat with an abrasive compound.

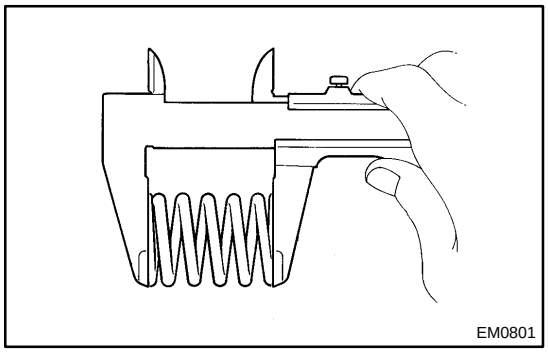
(e) After handrubbing, clean the valve and valve seat.



8. INSPECT INNER COMPRESSION SPRING

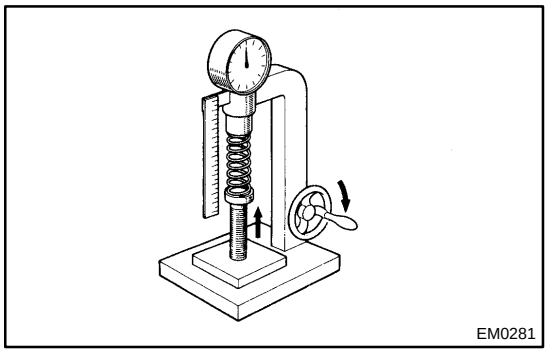
(a) Inspect squareness.
Using a steel square, measure the squareness of the inner compression spring.
Maximum deviation: 2.0 mm (0.079 in.)

If the deviation is greater than the maximum, replace the inner compression spring.



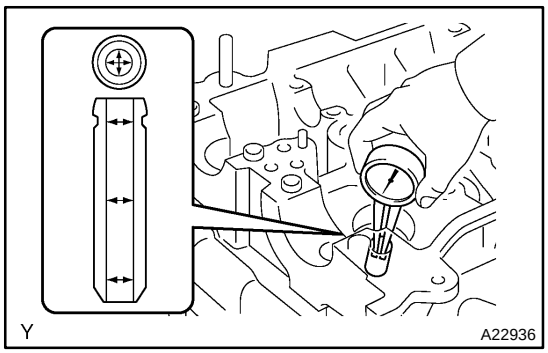
(b) Inspect free length.
Using vernier calipers, measure the free length of the inner compression spring.
Free length: 47.80 mm (1.8819 in.)

If the free length is not as specified, replace the inner compression spring.



(c) Inspect tension.
Using a spring tester, measure the tension of the inner compression spring at the specified installed length.
Installed tension:
186.2 to 205.8 N (19.0 to 21.0 kgf, 41.9 to 46.3 lbf) at 33.3 mm (1.311 in.)

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



9. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the valve guide bush.
Inside diameter:
5.51 to 5.53 mm (0.2169 to 0.2177 in.)

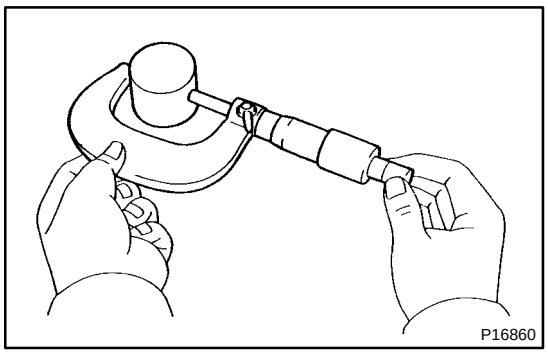
(b) Subtract the valve stem diameter measurement (Step 8) from the valve guide bush inside diameter measurement.
Standard oil clearance:

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

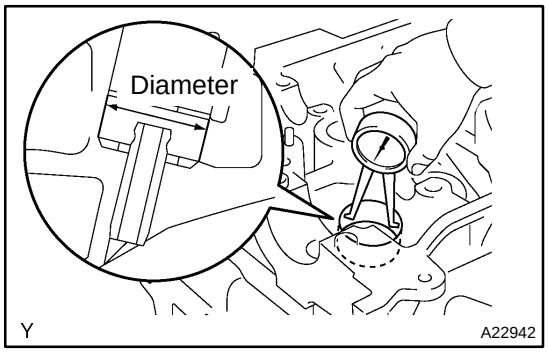
If the oil clearance is greater than the maximum, replace the valve and valve guide bush.



10. INSPECT VALVE LIFTER

Using a micrometer, measure the valve lifter diameter.

Valve lifter diameter:
30.966 to 30.976 mm (1.2191 to 1.2195 in.)



11. INSPECT VALVE LIFTER OIL CLEARANCE

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

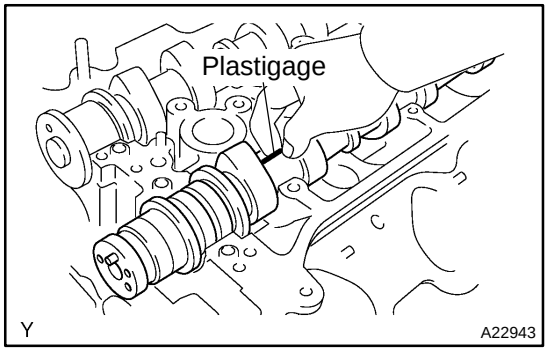
Lifter bore diameter:
31.009 to 31.025 mm (1.2208 to 1.2215 in.)

(b) Subtract the valve lifter diameter measurement (Step 10) from the lifter bore diameter measurement.

Standard oil clearance:
0.033 to 0.059 mm (0.0013 to 0.0023 in.)
Maximum oil clearance: 0.08 mm (0.0031 in.)

If the oil clearance is greater than the maximum, replace the valve lifter.

If necessary, replace the cylinder head.



12. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the camshaft bearing caps, camshaft bearings and camshaft journals.

(b) Install the camshaft bearing (See page EM−89).

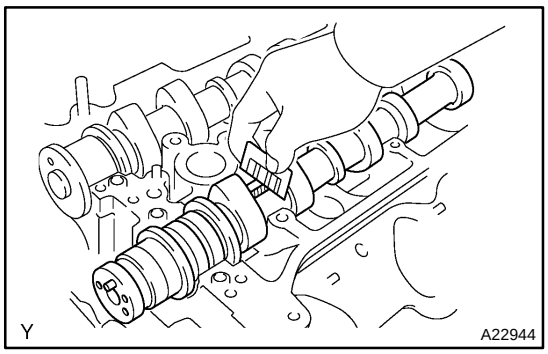
(c) Place the camshaft on the cylinder head.

(d) Lay a strip of Plastigage across each of the camshaft journals.

(e) Install the camshaft bearing caps (See page EM−89).

NOTICE:
Do not turn the camshafts.

(f) Remove the camshaft bearing caps (See page EM−62).



(g) Measure the Plastigage at its widest point.

Standard oil clearance (Cylinder head RH):

No. 1 (Intake)	0.008 to 0.038 mm (0.0003 to 0.0015 in.)
No. 1 (Exhaust)	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Others	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

Standard oil clearance (Cylinder head LH):

No. 1	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Others	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

Maximum oil clearance (Cylinder head RH):

No. 1 (Intake)	0.07 mm (0.0028 in.)
Others	0.10 mm (0.0039 in.)

Maximum oil clearance (Cylinder head LH):
0.10 mm (0.0039 in.)

If the oil clearance is greater than the maximum, replace the camshaft bearings and/or camshaft.

If necessary, replace the camshaft bearing caps and cylinder head together.

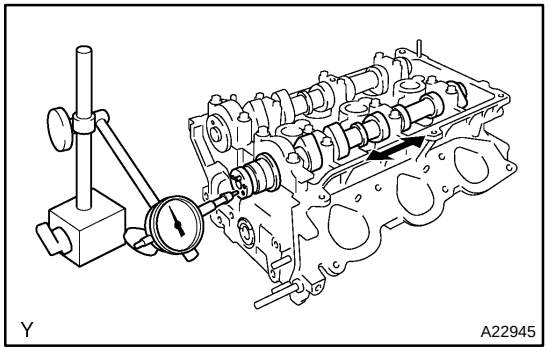
Reference:

Cylinder head journal bore diameter	40.009 to 40.017 mm (1.5752 to 1.5755 in.)
Camshaft bearing center wall thickness (Mark "2")	2.004 to 2.008 mm (0.0789 to 0.0791 in.)
Camshaft journal diameter	35.971 to 35.985 mm (1.4165 to 1.4167 in.)

(h) Remove the Plastigage completely.

(i) Remove the camshafts.

(j) Remove the camshaft bearing.



13. INSPECT CAMSHAFT THRUST CLEARANCE

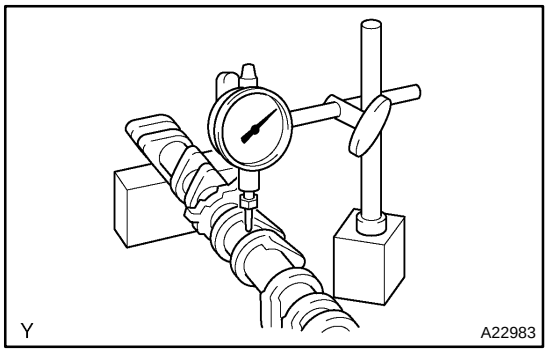
(a) Install the camshafts (See page EM−89).

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

Standard thrust clearance:
0.04 to 0.09 mm (0.0016 to 0.0035 in.)
Maximum thrust clearance: 0.11 mm (0.0043 in.)

If the thrust clearance is greater than the maximum, replace the camshafts.

If necessary, replace the camshaft bearing caps and cylinder head as a set.



14. INSPECT CAMSHAFT

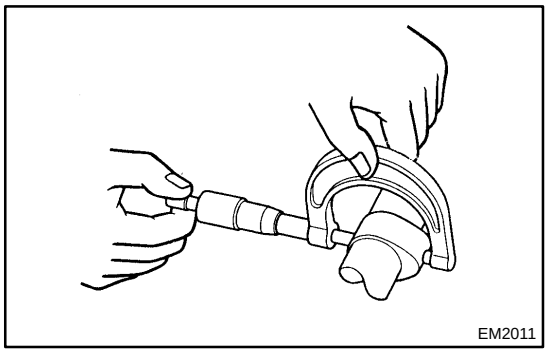
(a) Inspect the camshaft for runout.

(1) Place the camshaft on V−blocks.

(2) Using a dial indicator, measure the runout at the center journal.

Maximum runout: 0.06 mm (0.0024 in.)

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



(b) Inspect the cam lobes.

Using a micrometer, measure the cam lobe height.

Standard cam lobe height:

Intake: 44.168 to 44.268 mm (1.7389 to 1.7428 in.)

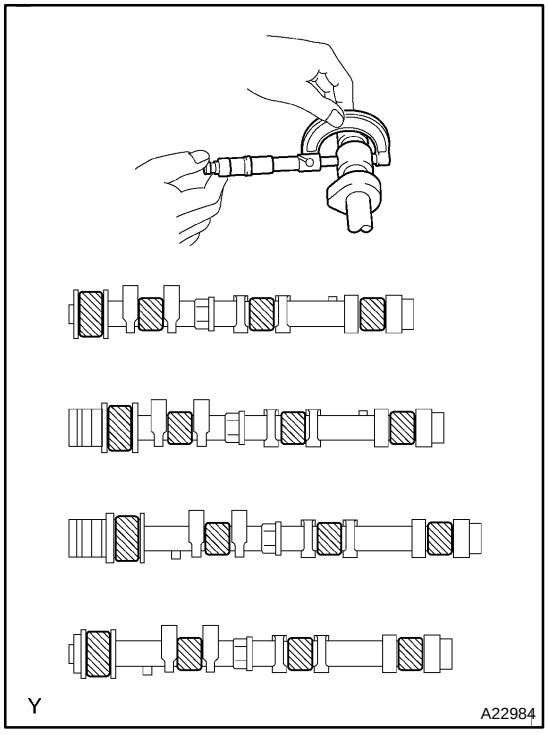
Exhaust: 44.580 to 44.680 mm (1.7551 to 1.7591 in.)

Minimum cam lobe height:

Intake: 44.018 mm (1.7330 in.)

Exhaust: 44.430 mm (1.7492 in.)

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



(c) Inspect the camshaft journals.

Using a micrometer, measure the journal diameter.

No. 1 journal diameter:

35.971 to 35.985 mm (1.4162 to 1.4167 in.)

Other journal diameter:

22.959 to 22.975 mm (0.9039 to 0.9045 in.)

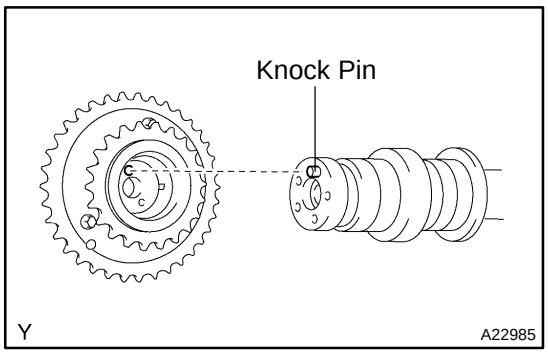
If the journal diameter is not as specified, check the oil clearance.

15. INSPECT CAMSHAFT TIMING GEAR

(a) Fix the intake camshaft with a vise.

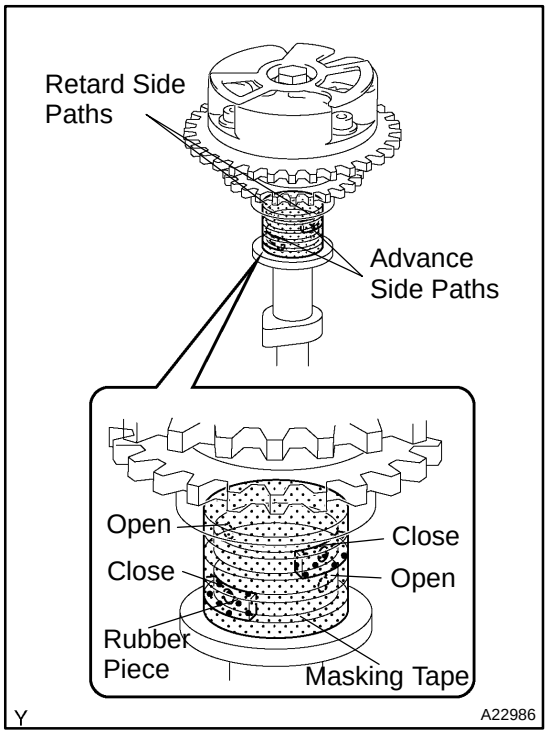
NOTICE:

Be careful not to damage the camshaft.



(b) Align the knock pin hole in the camshaft timing gear assembly with the knock pin of the camshaft, and install the camshaft timing gear assembly with the bolt.
Torque: 100 N·m (1,020 kgf·cm, 74 ft·lbf)

(c) Confirm that the camshaft timing gear assembly is locked.

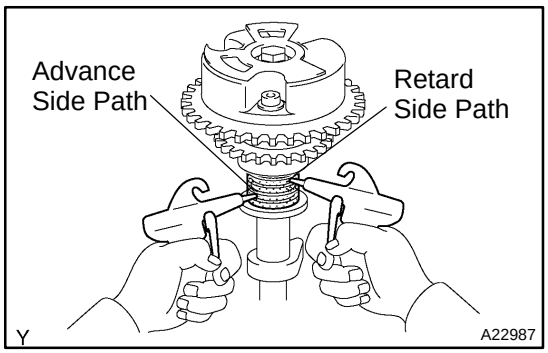


(d) Release the lock pin.

(1) Cover the 4 oil paths of the cam journal with masking tape as shown in the illustration.

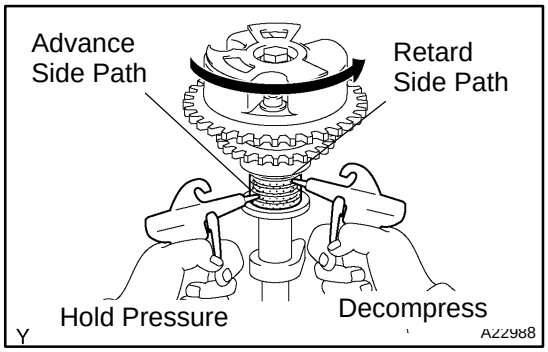
HINT:
One of the 2 grooves on the cam journal is for retards (upper) and the other is for advances (lower). Each groove has 2 oil paths. Plug one of the oil paths for each groove with rubber pieces before wrapping the cam journal with tape.

(2) Prick a hole in the tape placed on the advance side path. Prick a hole in the retard side path, on the opposite side to that of the advance side path, as shown in the illustration.



(3) Apply about 200 kPa (2.0 kgf/cm^2) of air pressure to the two broken paths (the advance side path and the retard side path).

NOTICE:
Cover the paths with a shop rag to avoid oil splashing.



(4) Confirm that the camshaft timing gear assembly rotates in the advance direction when reducing the air pressure applied to the retard path.

HINT:
When the lock pin is released, the camshaft timing gear rotates in the advance direction.

(5) When the camshaft timing gear comes to the most advanced position, release the air pressure from the retard side path, and then release the air pressure from the advance side path.

NOTICE:

The camshaft timing assembly gear occasionally shifts to the retard side abruptly if the air pressure of the advanced side path is released first. This often results in breakage of the lock pin.

(e) Check for smooth revolution.

Allow the camshaft timing gear assembly to turn back and forth at any position, except where the lock pin meets at the most retarded angle. Check the movable range and that there is no disturbance.

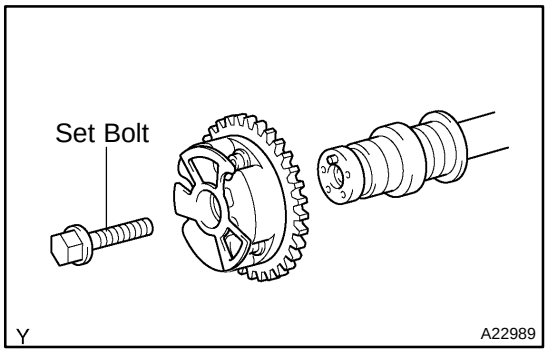
Standard: Moves smoothly in a range of about 31 °

NOTICE:

Be sure to perform this check by hand, instead of air pressure.

(f) Check the lock in the most retarded position.

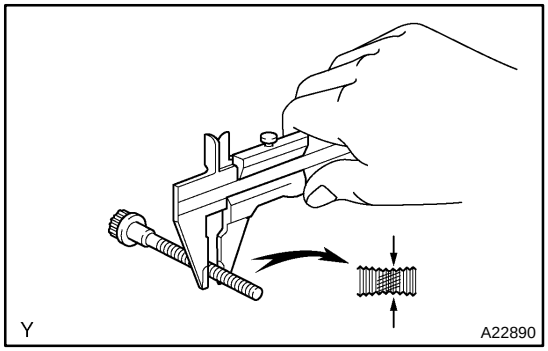
Confirm that the camshaft timing gear assembly is locked at the most retarded position.



(g) Remove the set bolt and camshaft timing gear assembly.

NOTICE:

Be sure not to remove the other 3 bolts.



16. INSPECT CYLINDER HEAD SET BOLT

Using a vernier caliper, measure the outside thread diameter of the bolt.

Standard outside diameter:
10.85 to 11.00 mm (0.4272 to 0.4331 in.)
Minimum outside diameter:
10.7 mm (0.421 in.)