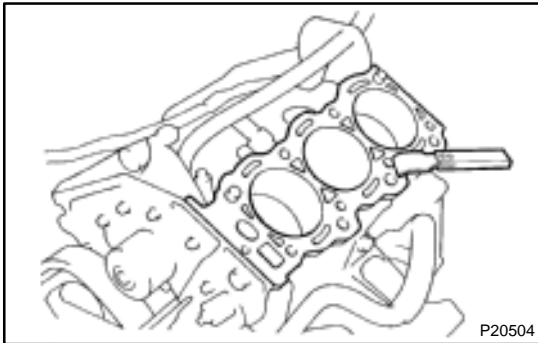


## INSPECTION

### 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 top surfaces.



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

#### CAUTION:

Protect your eyes when using high-compressed air.

### 2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS (See page EM-90)

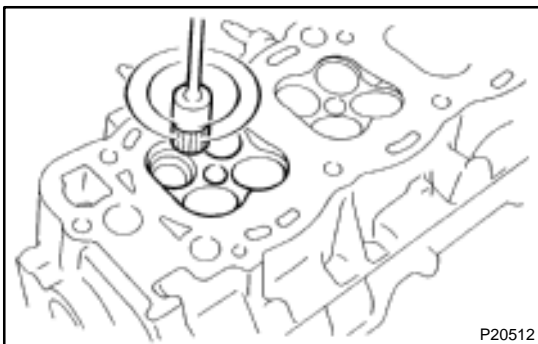


### 3. CLEAN CYLINDER HEAD

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

#### NOTICE:

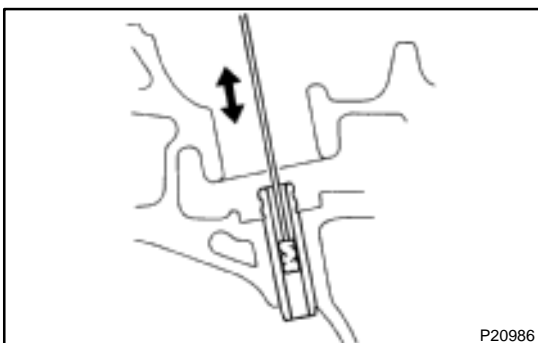
Be careful not to scratch the cylinder block contact surfaces.



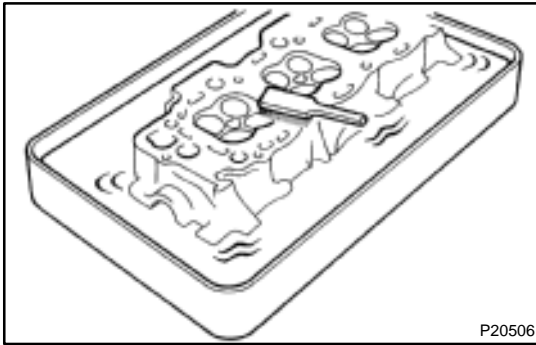
- (b) Using a wire brush, remove all the carbon from the combustion chambers.

#### NOTICE:

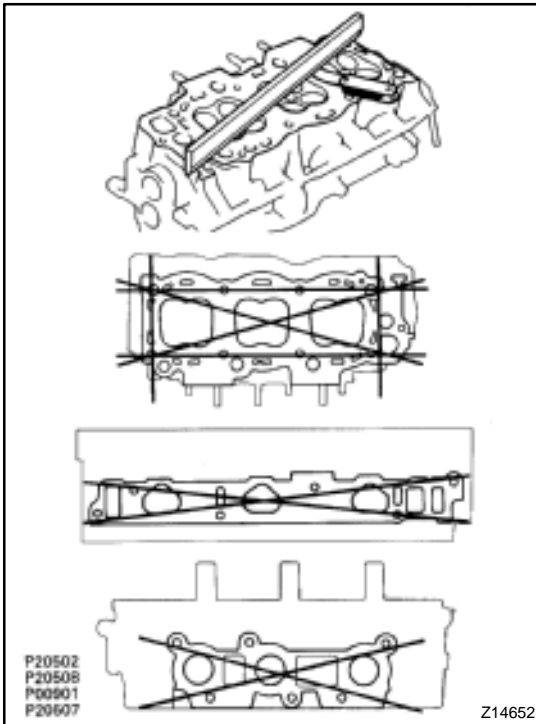
Be careful not to scratch the cylinder block contact surfaces.



- (c) Using a valve guide bushing brush and solvent, clean all the guide bushings.



- (d) Using a soft brush and solvent, thoroughly clean the cylinder heads.



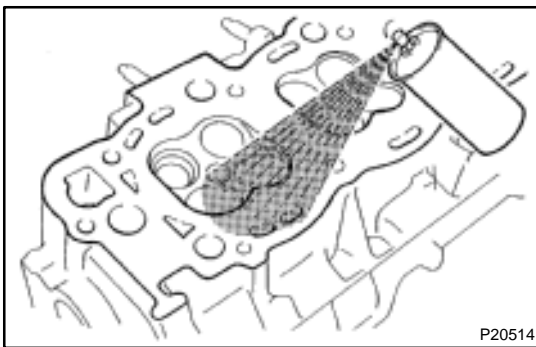
#### 4. INSPECT CYLINDER HEAD

- (a) Inspect for flatness.

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

**Maximum warpage: 0.10 mm (0.0039 in.)**

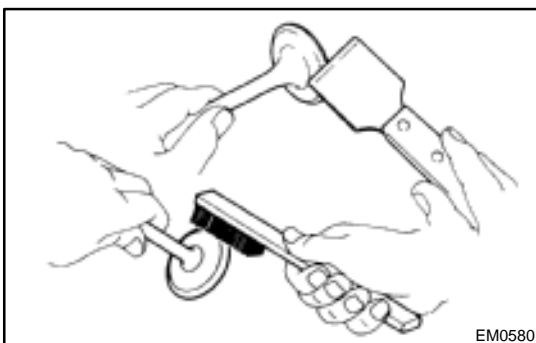
If warpage is greater than maximum, replace the cylinder head.



- (b) Inspect for cracks.

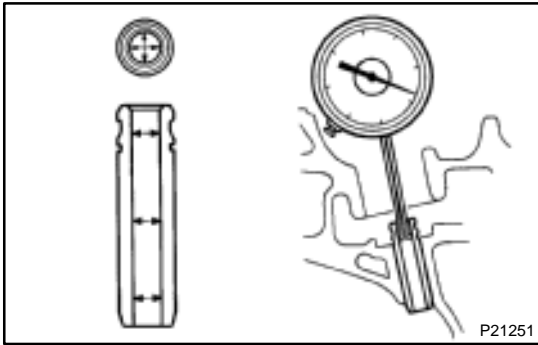
Using a dye penetrant, check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks.

If cracked, replace the cylinder head.



#### 5. CLEAN VALVES

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

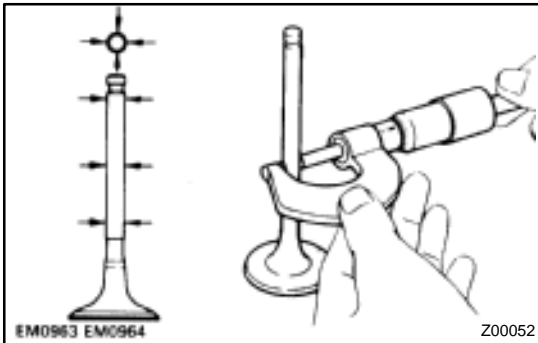


## 6. INSPECT VALVE STEMS AND GUIDE BUSHINGS

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

**Valve stem diameter:**

|         |  |
|---------|--|
| Intake  | 5.970 – 5.985 mm (0.2350 – 0.2356 in.) |
| Exhaust | 5.965 – 5.980 mm (0.2348 – 0.2354 in.) |

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

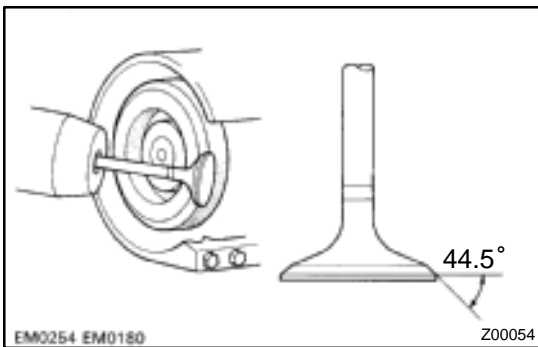
**Standard oil clearance:**

|         |  |
|---------|--|
| 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.) |

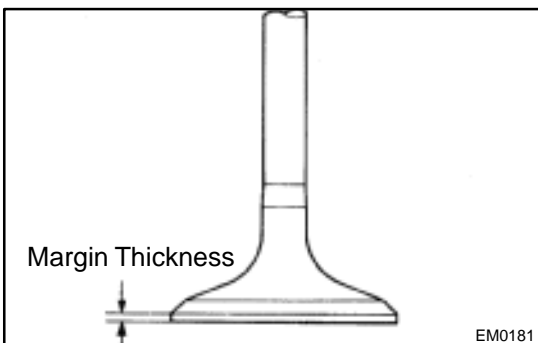
If the clearance is greater than maximum, replace the valve and guide bushing. (See page [EM-48](#))



## 7. INSPECT AND GRIND VALVES

- (a) Grind the valve enough to remove pits and carbon.  
(b) Check that the valve is ground to the correct valve face angle.

**Valve face angle: 44.5°**

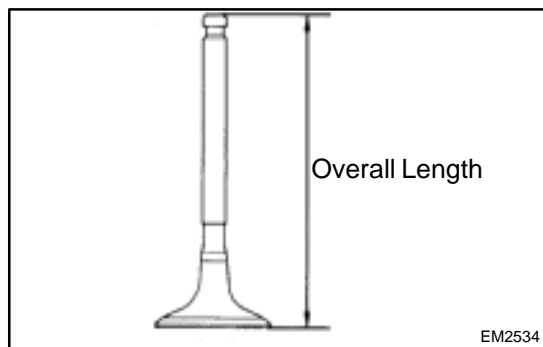


- (c) Check the valve head margin thickness.

**Standard margin thickness: 1.0 mm (0.039 in.)**

**Minimum margin thickness: 0.5 mm (0.020 in.)**

If the margin thickness is less than the minimum, replace the valve.



- (d) Check the valve overall length.

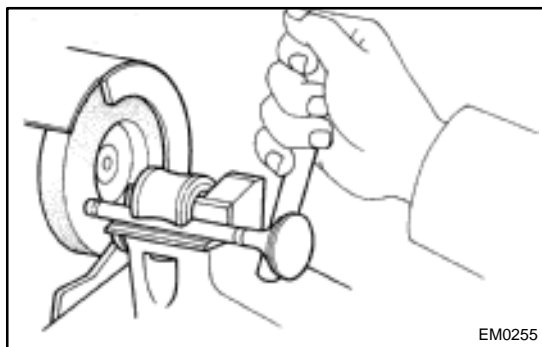
**Standard overall length:**

|         |                       |
|---------|-----------------------|
| Intake  | 95.15 mm (3.7461 in.) |
| Exhaust | 94.90 mm (3.7362 in.) |

**Minimum overall length:**

|         |                       |
|---------|-----------------------|
| Intake  | 94.60 mm (3.7244 in.) |
| Exhaust | 94.40 mm (3.7165 in.) |

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

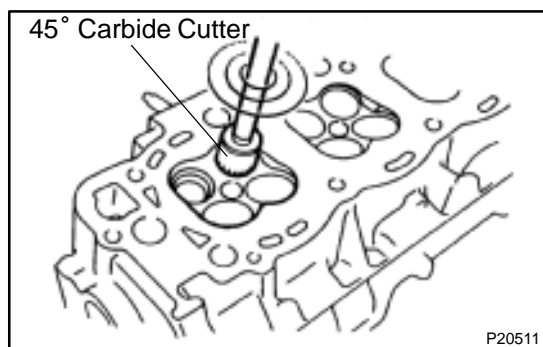


- (e) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, resurface the tip with a grinder or replace the valve.

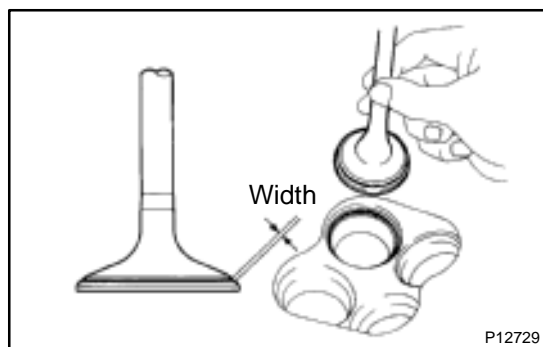
**NOTICE:**

**Do not grind off more than the minimum.**



**8. INSPECT AND CLEAN VALVE SEATS**

- (a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.
- (b) 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 the valve.



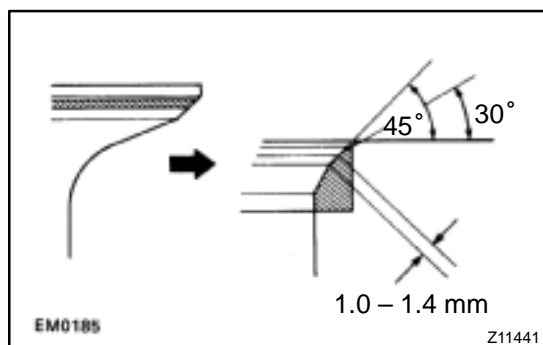
- (c) Check the valve face and seat for the following:

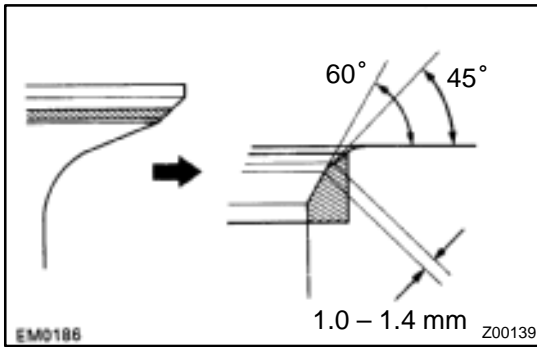
- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
- Check that the seat contact is in the middle of the valve face with these width.

**1.0 – 1.4 mm (0.039 – 0.055 in.)**

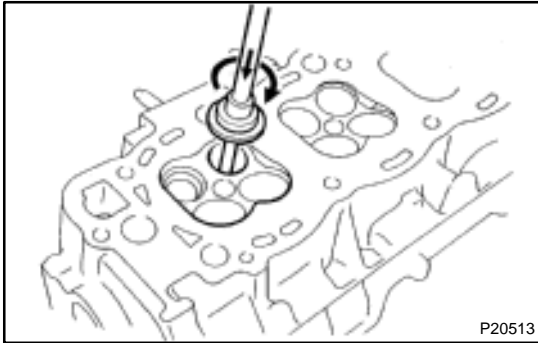
If not, correct the valve seats as follows:

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

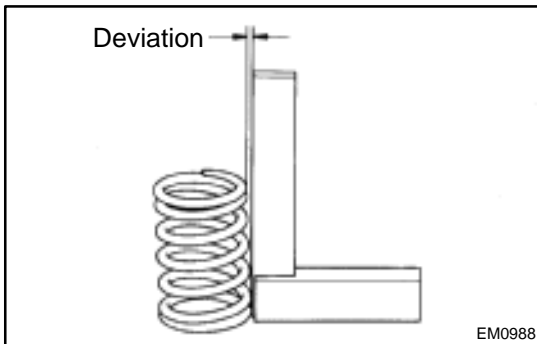




- (2) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.



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

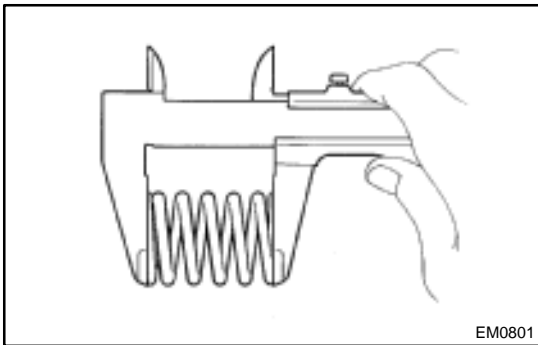


## 9. INSPECT VALVE SPRINGS

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

**Maximum deviation: 2.0 mm (0.079 in.)**

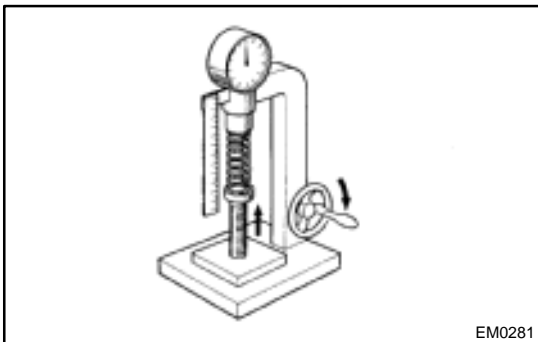
If deviation is greater than maximum, replace the valve spring.



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

**Free length: 44.78 mm (1.7630 in.)**

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



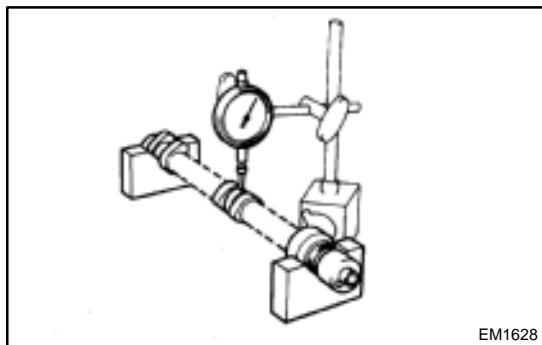
- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.

**Installed tension:**

**186 – 206 N (19.0 – 21.0 kgf, 41.9 – 46.3 lbf)**

**at 33.3 mm (1.311 in.)**

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



EM1628

## 10. INSPECT CAMSHAFTS

(a) Inspect the 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.

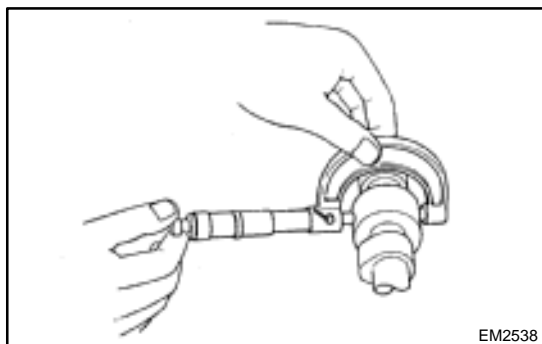
**Standard cam lobe height:**

|         |  |
|---------|--|
| Intake  | 42.31 – 42.41 mm (1.6657 – 1.6697 in.) |
| Exhaust | 41.96 – 42.06 mm (1.6520 – 1.6559 in.) |

**Minimum cam lobe height:**

|         |                       |
|---------|-----------------------|
| Intake  | 42.16 mm (1.6598 in.) |
| Exhaust | 41.81 mm (1.6461 in.) |

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



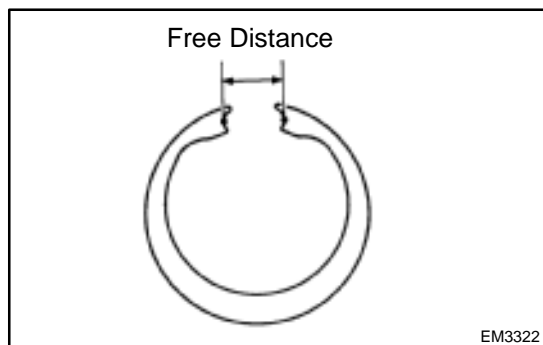
EM2538

(b) Using a micrometer, measure the journal diameter.

**Journal diameter:**

**26.949 – 26.965 mm (1.0610 – 1.0616 in.)**

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

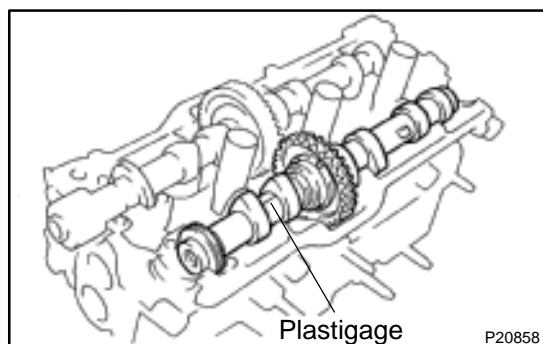


EM3322

(c) Using vernier calipers, measure the free distance between the spring end.

**Free distance: 18.2 – 18.8 mm (0.712 – 0.740 in.)**

If the free distance is not as specified, replace the gear spring.



P20858

(d) Inspect the camshaft journal oil clearance.

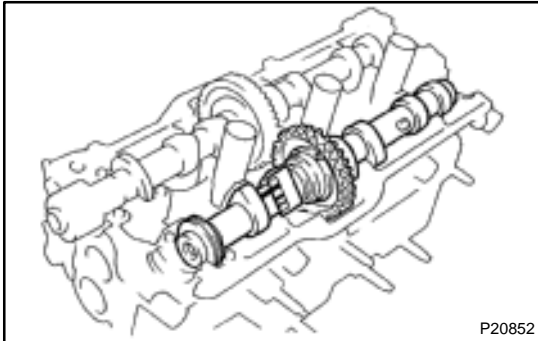
- (1) Clean the bearing caps and camshaft journals.
- (2) Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps and cylinder head as a set.

- (3) Place the camshafts on the cylinder head.
- (4) Lay a strip of Plastigage across each of the camshaft journals.
- (5) Install the bearing caps. (See page [EM-53](#))

**NOTICE:****Do not turn the camshaft.**

- (6) Remove the bearing caps.

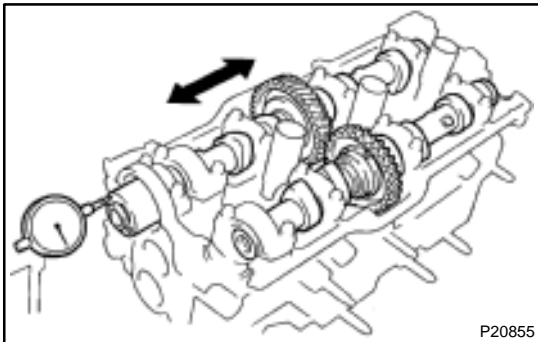


- (7) Measure the Plastigage at its widest point.

**Standard oil clearance:****0.035 – 0.072 mm (0.0014 – 0.0028 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.

- (8) Completely remove the Plastigage.



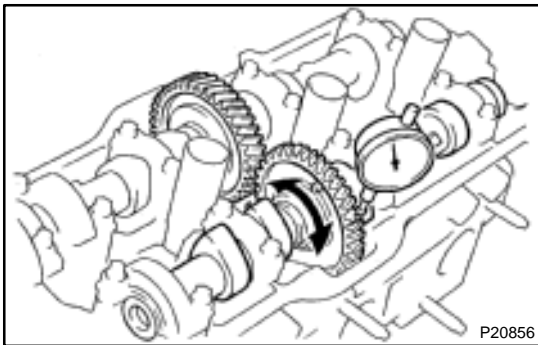
- (e) Inspect the camshaft thrust clearance.

- (1) Install the camshafts. (See page EM-4)

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

**Standard thrust clearance:****0.033 – 0.080 mm (0.0013 – 0.0031 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.



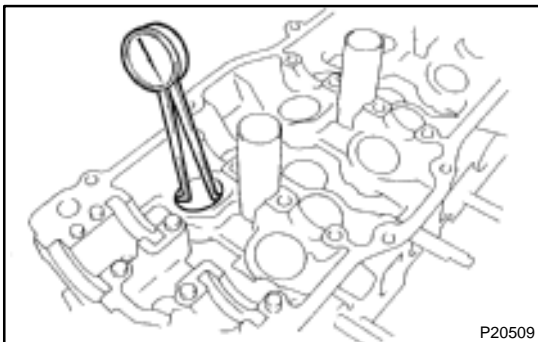
- (f) Inspect the camshaft gear backlash.

- (1) Install the camshafts without installing the exhaust camshaft sub-gear. (See page EM-4)

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

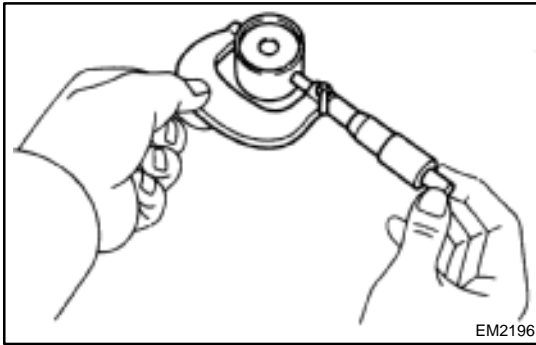
**Standard backlash:****0.020 – 0.200 mm (0.0008 – 0.0079 in.)****Maximum backlash: 0.30 mm (0.0188 in.)**

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

**11. 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 – 31.018 mm (1.2205 – 1.2212 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.

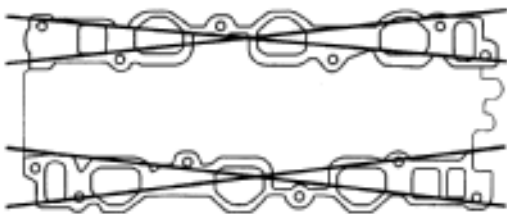
**Standard oil clearance:**

**0.024 – 0.052 mm (0.0009 – 0.0020 in.)**

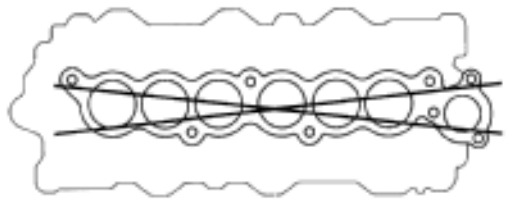
**Maximum oil clearance: 0.08 mm (0.0031 in.)**

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

**Cylinder Head Side**



**Intake Air Connector Side**



P21620  
P21618

Z14655

## 12. INSPECT INTAKE MANIFOLD

Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and intake air connector for warpage.

**Maximum warpage: 0.10 mm (0.0039 in.)**

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

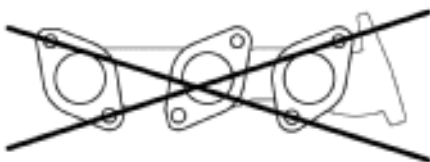
## 13. INSPECT EXHAUST MANIFOLDS

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

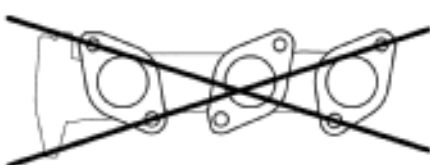
**Maximum warpage: 1.00 mm (0.0394 in.)**

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

**LH Side**



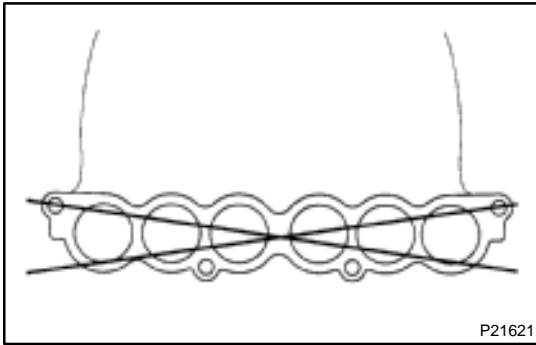
**RH Side**



P

A11027





#### 14. INSPECT AIR INTAKE CHAMBER AND INTAKE AIR CONNECTOR

Using a precision straight edge and feeler gauge, measure the surfaces contacting the intake manifold and intake air connector for warpage.

**Maximum warpage: 0.10 mm (0.0039 in.)**

If warpage is greater than maximum, replace the air intake chamber or intake air connector.