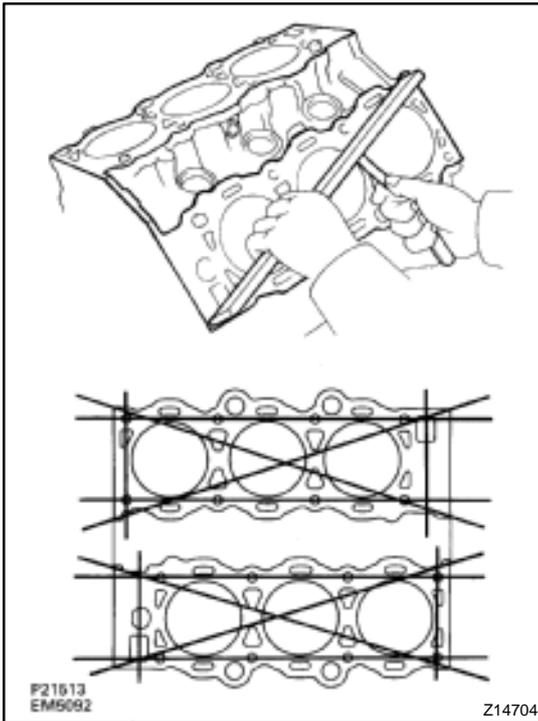


P21512

## INSPECTION

### 1. CLEAN CYLINDER BLOCK

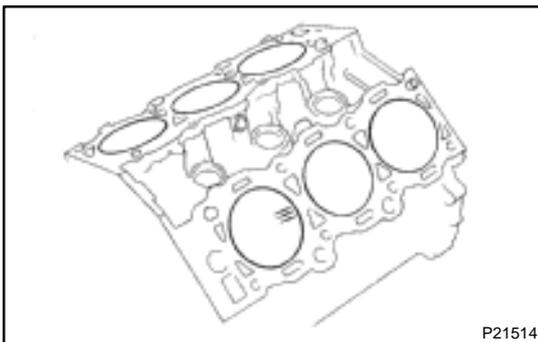
- (a) Remove the gasket material.  
Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.
- (b) Clean the cylinder block.  
Using a soft brush and solvent, thoroughly clean the cylinder block.

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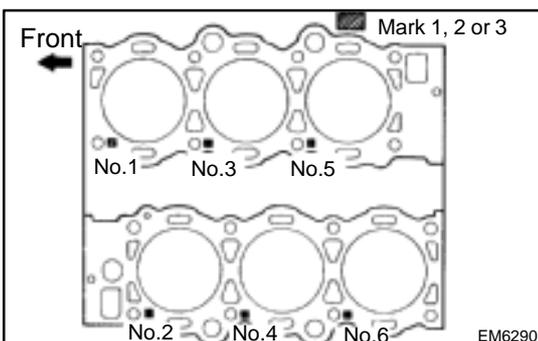
### 2. INSPECT CYLINDER BLOCK

- (a) Inspect for flatness.  
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head gasket for warpage.  
**Maximum warpage: 0.05 mm (0.0020 in.)**  
If warpage is greater than maximum, replace the cylinder block.



P21514

- (b) Visually check the cylinder for vertical scratches.  
If deep scratches are present, rebore all the 6 cylinders. If necessary, replace the cylinder block.

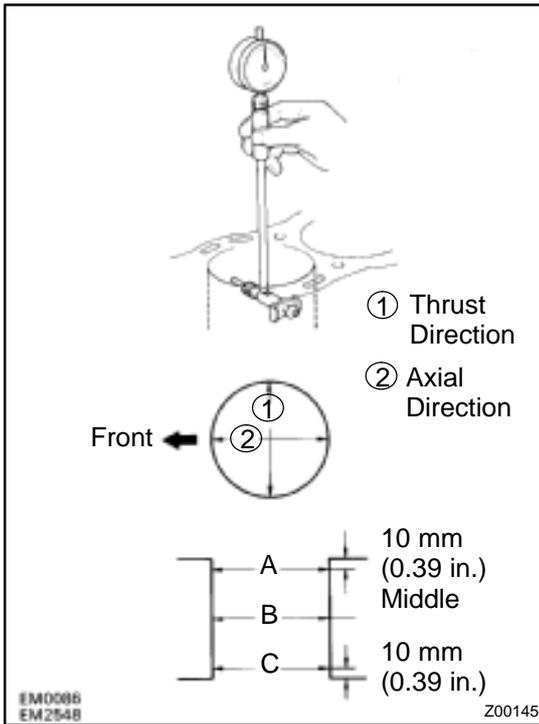


EM6290

- (c) Inspect the cylinder bore diameter.

#### HINT:

There are 3 sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the top of the cylinder block.



Using a cylinder gauge, measure the cylinder bore diameter at positions A, B and C in the thrust and axial directions.

**Standard diameter:**

Mark "1"	93.500 – 93.510 mm (3.6811 – 3.6815 in.)
Mark "2"	93.510 – 93.520 mm (3.6815 – 3.6819 in.)
Mark "3"	93.520 – 93.530 mm (3.6819 – 3.6823 in.)

**Maximum diameter:**

STD	93.730 mm (3.6902 in.)
O/S 0.50	94.230 mm (3.7098 in.)

If the diameter is greater than maximum, rebore all the 6 cylinders. If necessary, replace the cylinder block.

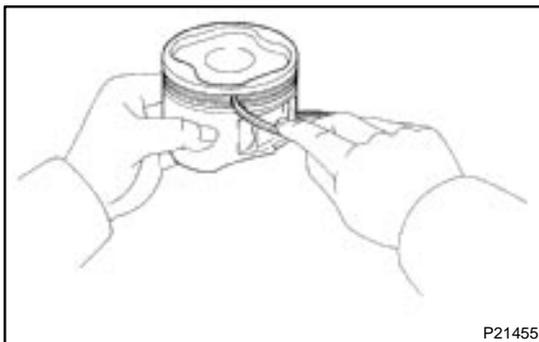
**3. REMOVE CYLINDER RIDGE**

If the wear is less than 0.2 mm (0.008 in.), using a ridge reamer, grind the top of the cylinder.

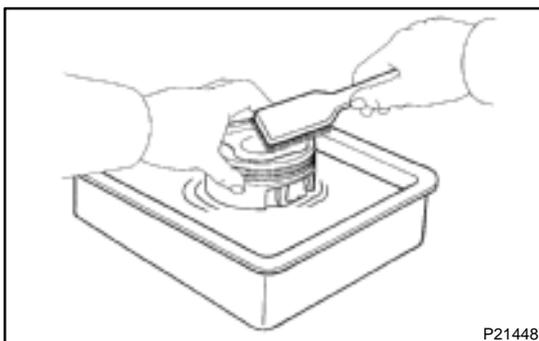


**4. CLEAN PISTON**

(a) Using a gasket scraper, remove the carbon from the piston top.



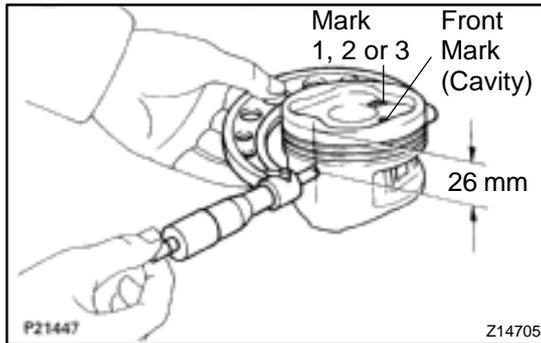
(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



(c) Using solvent and a brush, thoroughly clean the piston.

**NOTICE:**

**Do not use a wire brush.**



## 5. INSPECT PISTON AND CONNECTING ROD

(a) Inspect the piston oil clearance.

HINT:

There are 3 sizes of the standard piston diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the piston top.

- (1) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, 26 mm (1.02 in.) from the piston head.

### Piston diameter:

STD	Mark "1"	93.356 – 93.366 mm (3.6754 – 3.6758 in.)
	Mark "2"	93.367 – 93.376 mm (3.6759 – 3.6762 in.)
	Mark "3"	93.377 – 93.386 mm (3.6763 – 3.6766 in.)
O/S 0.50		93.856 – 93.886 mm (3.6951 – 3.6963 in.)

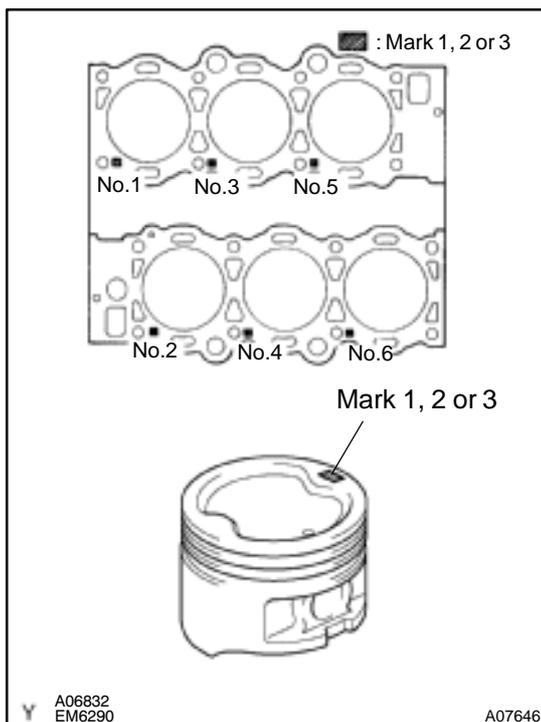
- (2) Measure the cylinder bore diameter in the thrust directions. (See step 2)
- (3) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

### Standard oil clearance:

**0.134 – 0.154 mm (0.0053 – 0.0060 in.)**

**Maximum oil clearance: 0.174 mm (0.0069 in.)**

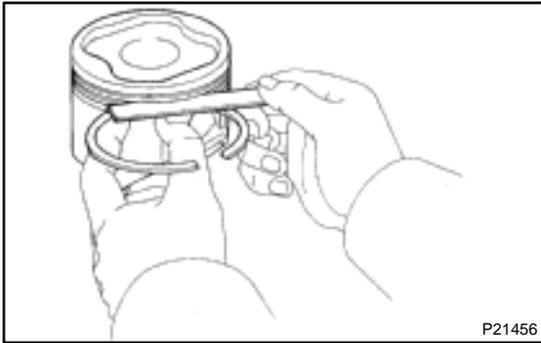
If the oil clearance is greater than maximum, replace all the 6 pistons. If necessary, rebore all the 6 cylinders or replace the cylinder block.



HINT:

Use new cylinder block:

Use a piston with the same number mark as the standard bore diameter marked on the cylinder block.

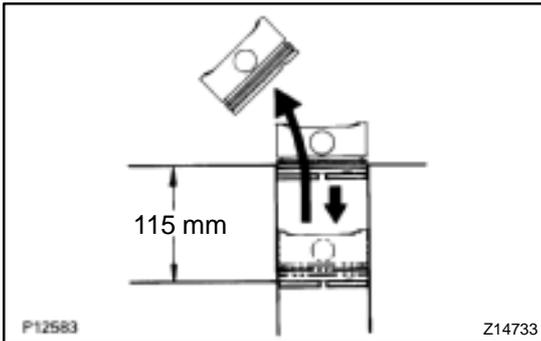


- (b) Inspect the piston ring groove clearance.  
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

**Standard ring groove clearance:**

No.1	0.040 – 0.080 mm (0.0016 – 0.0031 in.)
No.2	0.030 – 0.070 mm (0.0012 – 0.0028 in.)

If the clearance is not as specified, replace the piston.



- (c) Inspect the piston ring end gap.
- (1) Insert the piston ring into the cylinder bore.
  - (2) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 115 mm (4.53 in.) from the top of the cylinder block.

- (3) Using a feeler gauge, measure the ring end gap.

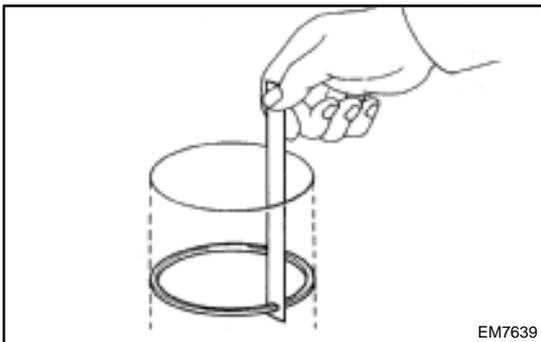
**Standard end gap:**

No.1	0.300 – 0.500 mm (0.0118 – 0.0197 in.)
No.2	0.400 – 0.600 mm (0.0157 – 0.0236 in.)
Oil (Side rail)	0.150 – 0.550 mm (0.0059 – 0.0217 in.)

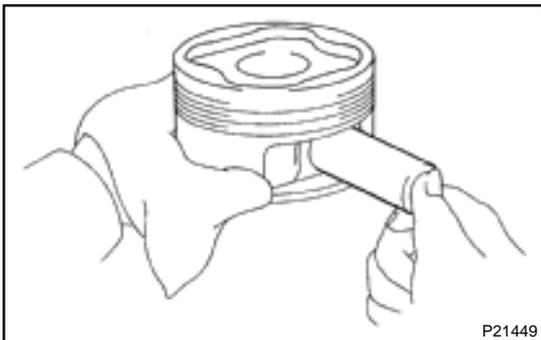
**Maximum end gap:**

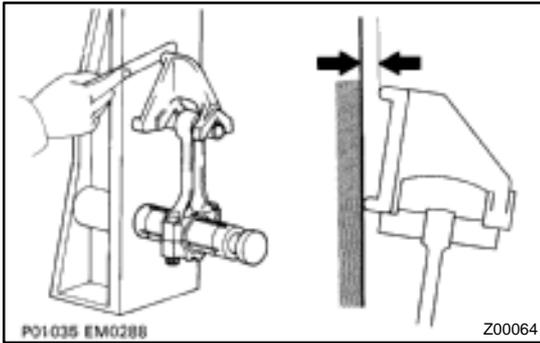
No.1	1.10 mm (0.0433 in.)
No.2	1.20 mm (0.0472 in.)
Oil (Side rail)	1.15 mm (0.0453 in.)

If the end gap is greater than maximum, replace the piston ring.  
If the end gap is greater than maximum, even with a new piston ring, rebore all the 6 cylinders or replace the cylinder block.



- (d) Inspect the piston pin fit.  
At 60°C (140°F), you should be able to push the piston pin into the piston pin hole with your thumb.





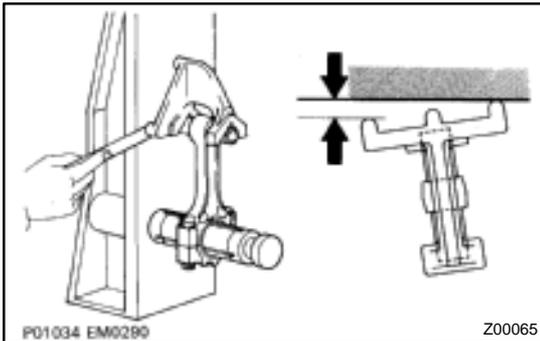
(e) Using a rod aligner and feeler gauge, check the connecting rod alignment.

(1) Check for bend.

**Maximum bend:**

**0.05 mm (0.0020 in.) per 100 mm (3.94 in.)**

If bend is greater than maximum, replace the connecting rod assembly.

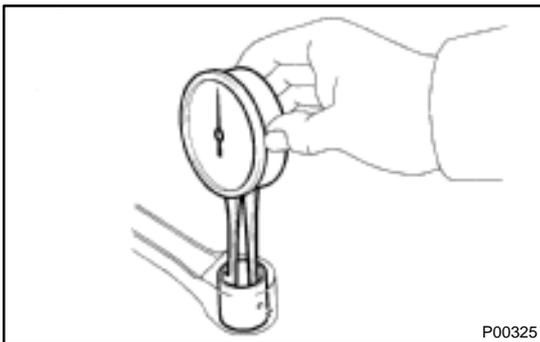


(2) Check for twist.

**Maximum twist:**

**0.15 mm (0.0059 in.) per 100 mm (3.94 in.)**

If twist is greater than maximum, replace the connecting rod assembly.

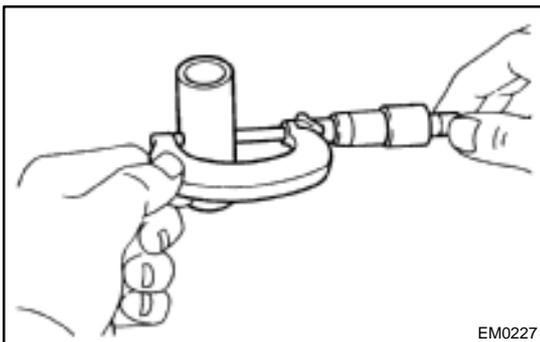


(f) Inspect the piston pin oil clearance.

(1) Using a caliper gauge, measure the inside diameter of the connecting rod bushing.

**Bushing inside diameter:**

**22.005 – 22.017 mm (0.8663 – 0.8668 in.)**



(2) Using a micrometer, measure the pin diameter.

**Piston pin diameter:**

**21.997 – 22.009 mm (0.8660 – 0.8665 in.)**

(3) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

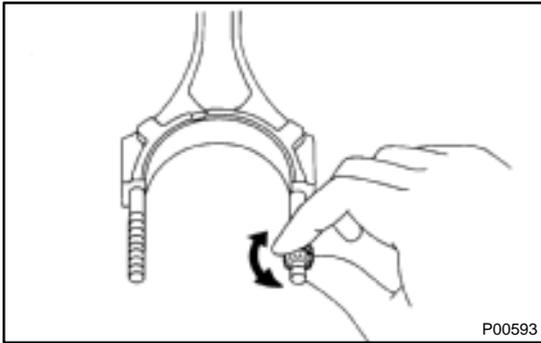
**Standard oil clearance:**

**0.005 – 0.011 mm (0.0002 – 0.0004 in.)**

**Maximum oil clearance: 0.05 mm (0.0020 in.)**

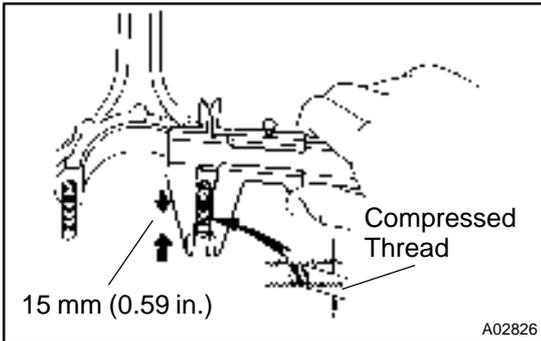
If the oil clearance is greater than maximum, replace the bushing (See page [EM-97](#)).

If necessary, replace the piston and piston pin as a set.



P00593

- (g) Inspect the connecting rod bolts.
  - (1) Install the cap nut to the connecting rod bolt. Check that the rod cap nut can be turned easily by hand to the end of the thread.



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- (2) If the cap nut cannot be turned easily, measure the outer diameter of the compressed thread with a vernier caliper.

**Standard outer diameter:**

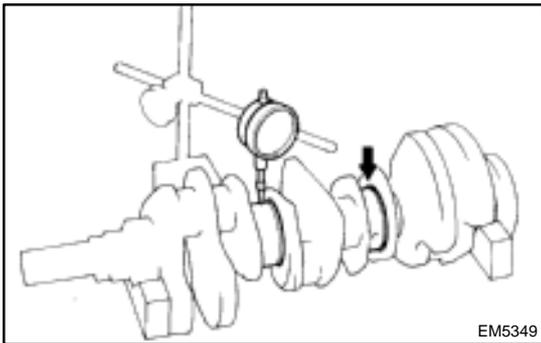
**7.860 – 8.000 mm (0.3094 – 0.3150 in.)**

**Minimum outer diameter: 7.600 mm (0.2992 in.)**

**HINT:**

If the location of this area cannot be judged by visual inspection, measure the outer diameter at the location shown in the illustration.

If the outer diameter is less than minimum, replace the connecting rod and rod cap nut as a set.



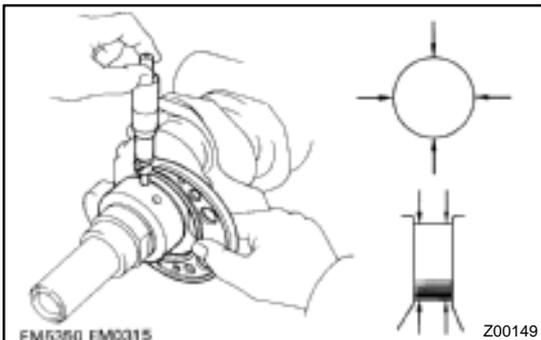
EM5349

**6. INSPECT CRANKSHAFT**

- (a) Inspect for circle runout.
  - (1) Place the crankshaft on V-blocks.
  - (2) Using a dial indicator, measure the circle runout at the No.2 and No.3 journals.

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

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



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- (b) Inspect the main journals and crank pins.
  - (1) Using a micrometer, measure the diameter of each main journal and crank pin.

**Main journal diameter:**

STD	63.985 – 64.000 mm (2.5191 – 2.5197 in.)
U/S 0.25	63.745 – 63.755 mm (2.5096 – 2.5100 in.)

**Crank pin diameter:**

STD	54.987 – 55.000 mm (2.1648 – 2.1654 in.)
U/S 0.25	54.745 – 54.755 mm (2.1553 – 2.1557 in.)

If the diameter is not as specified, check the oil clearance (See page [EM-83](#)).

- (2) Check each main journal and crank pin for taper and out-of-round as shown.

**Maximum taper and out-of-round:  
0.02 mm (0.0008 in.)**

If the taper or out-of-round is greater than maximum, grind or replace the crankshaft.

**7. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS**

- (a) Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure step 6).
- (b) Install new main journal and/or crank pin undersized bearings.