EM10Y–01

INSPECTION

1. CLEAN CYLINDER BLOCK

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

(b) Using a soft brush and solvent, thoroughly clean the cylinder block.

2. INSPECT CYLINDER BLOCK

(a) Inspect for flatness.

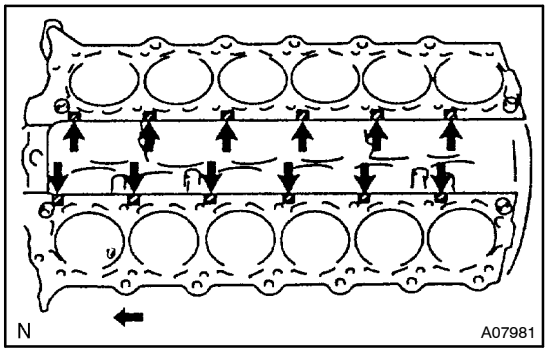
Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder head and main bearing cap for warpage.

Maximum warpage: 0.07 mm (0.0028 in.)

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

(b) Visually check the cylinder for vertical scratches.

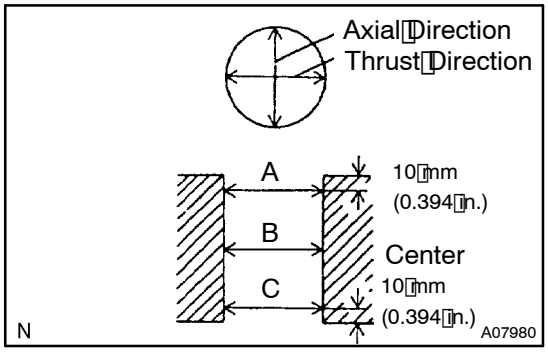
If deep scratches are present, rebore all the 12 cylinders and replace all the 12 pistons (See page xx–xxx). If necessary, replace the cylinder block.



(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.



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

Standard diameter:

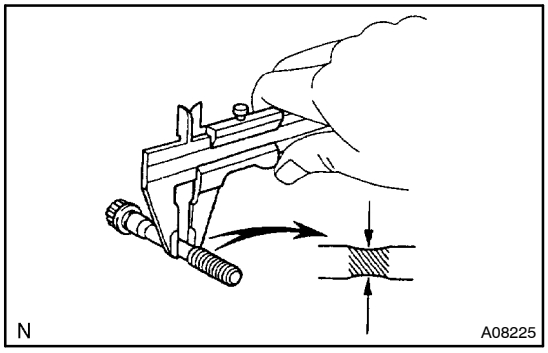
STD	Mark "1"	81.000 – 81.010 mm (3.18897 – 3.18936 in.)
	Mark "2"	81.011 – 81.020 mm (3.18940 – 3.18976 in.)
	Mark "3"	81.021 – 81.030 mm (3.18980 – 3.19015 in.)

Maximum diameter: 81.23 mm (3.1980 in.)

If the diameter is greater than maximum, replace the cylinder block.

(e) Remove the cylinder ridge.

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



(f) Using vernier calipers, measure the thread outside diameter of the main bearing cap bolt.

Standard diameter:
7.5 – 7.6 mm (0.295 – 0.299 in.)
Minimum diameter: 7.2 mm (0.283 in.)

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

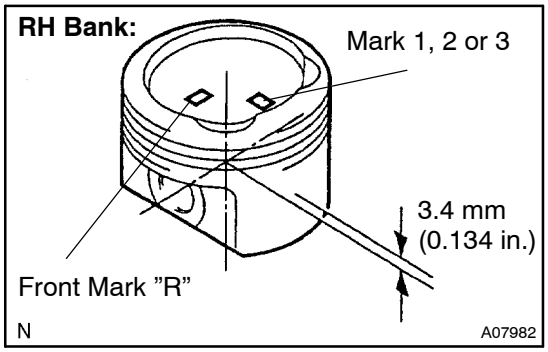
3. CLEAN PISTON

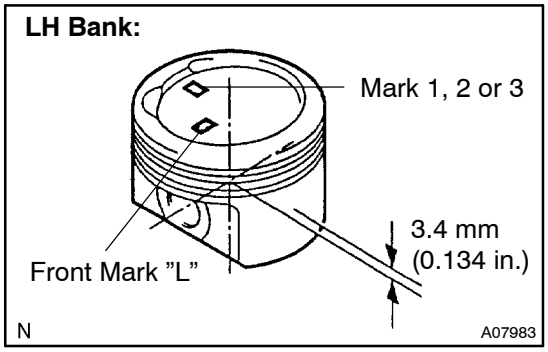
(a) Using a gasket scraper, remove the carbon from the piston top.

(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.





4. 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, 3.4 mm (0.134 in.) from the center of the piston pin hole.

Piston diameter:

STD	Mark ”1”	80.940 – 80.950 mm (3.18661 – 3.18700 in.)
	Mark ”2”	80.951 – 80.960 mm (3.18704 – 3.18740 in.)
	Mark ”3”	80.961 – 80.970 mm (3.18743 – 3.18779 in.)

(2) Measure the cylinder bore diameter in the thrust directions. (See step 2 on the previous page)

(3) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:
0.050 – 0.070 mm (0.00197 – 0.00276 in.)
Maximum oil clearance: 0.09 mm (0.0035 in.)

If the oil clearance is greater than maximum, replace the cylinder block.

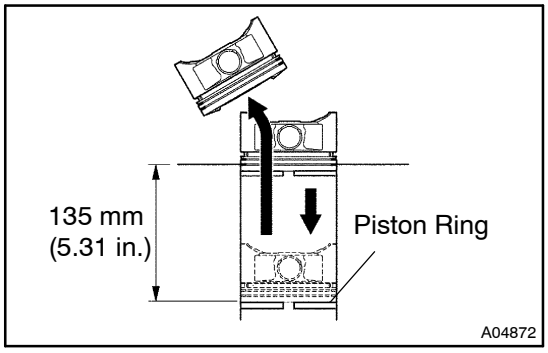
(b) Inspect the piston ring groove clearance.

Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

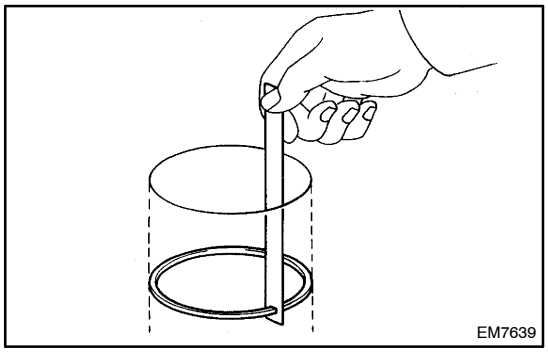
Ring groove clearance:

No.1	0.030 – 0.070 mm (0.00118 – 0.00276 in.)
No.2	0.030 – 0.070 mm (0.00118 – 0.00276 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, 135 mm (5.31 in.) from the top of the cylinder block.



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

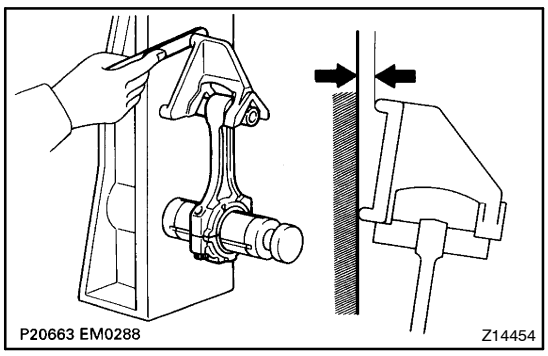
Standard end gap:

No.1	0.250 – 0.350 mm (0.00984 – 0.01378 in.)
No.2	0.350 – 0.450 mm (0.01378 – 0.01772 in.)
Oil (Side rail)	0.100 – 0.350 mm (0.00394 – 0.01378 in.)

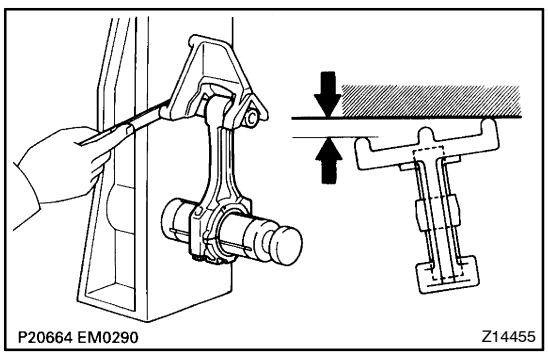
Maximum end gap:

No.1	0.75 mm (0.0295 in.)
No.2	0.85 mm (0.0335 in.)
Oil (Side rail)	0.75 mm (0.0295 in.)

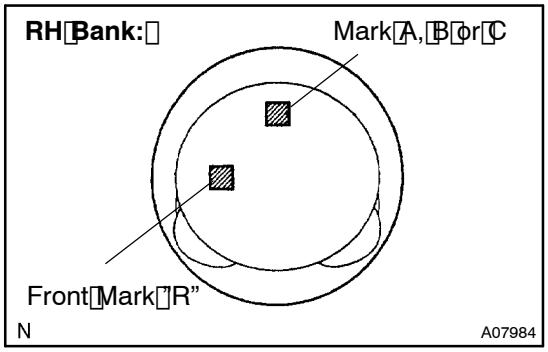
If the end gap is greater than maximum, replace the piston ring.
If the end gap is greater than maximum, even with a new piston ring, replace the cylinder block.

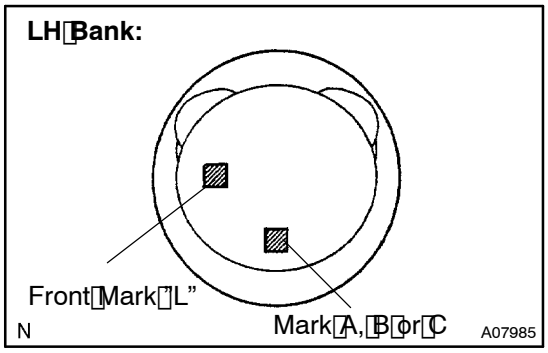


(d) Using a rod aligner and feeler gauge, check the connecting rod alignment.
(1) Check for bend.
Maximum bend:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)
If bend is greater than maximum, replace the connecting rod assembly.



(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.





(e) Inspect the piston pin oil clearance.

(1) Using a caliper gauge, measure the inside diameter of the piston pin hole of the piston.

Standard diameter:

Mark A	21.013 – 21.016 mm (0.82728 – 0.82740 in.)
Mark B	21.016 – 21.019 mm (0.82740 – 0.82752 in.)
Mark C	21.019 – 21.022 mm (0.82752 – 0.82764 in.)

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

Standard diameter:

Mark A	21.003 – 21.006 mm (0.82689 – 0.82701 in.)
Mark B	21.006 – 21.009 mm (0.82701 – 0.82712 in.)
Mark C	21.009 – 21.012 mm (0.82712 – 0.82724 in.)

NOTICE:

The pin hole diameter mark of the piston is stamped at the piston shown in the illustration but the mark is not stamped on the piston pin. Accordingly, do not change the combination with the piston.

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

Standard oil clearance:

0.007 – 0.013 mm (0.00028 – 0.00051 in.)

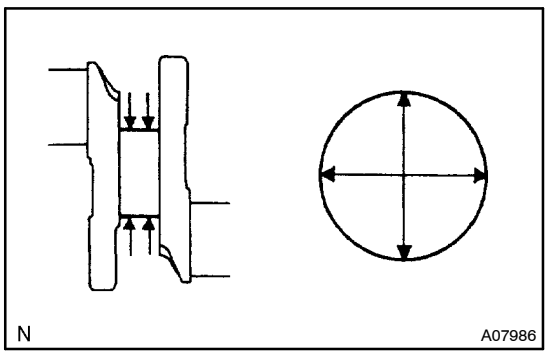
5. INSPECT CRANKSHAFT

(a) Inspect for circle runout.

(1) Place the crankshaft on V–blocks.

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

Maximum circle runout: 0.08 mm (0.0031 in.)



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

(b) Inspect the main journals and crank pins.

(1) Using a micrometer, measure the diameter of each main journal and crank pin.

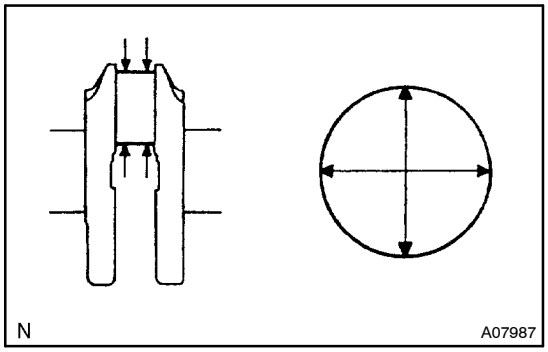
Main journal diameter:

66.988 – 67.000 mm (2.6373 – 2.6378 in.)

Crank pin diameter:

47.982 – 48.000 mm (1.8891 – 1.8898 in.)

If the diameter is not as specified, check the oil clearance (See page EM–63). If necessary, replace the crankshaft.



(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 and out–of–round is greater than maximum, replace the crankshaft.