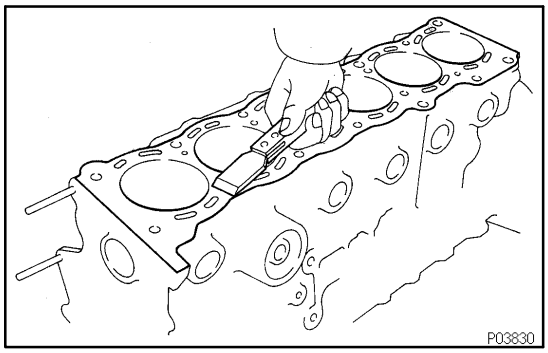
EM1EH–02

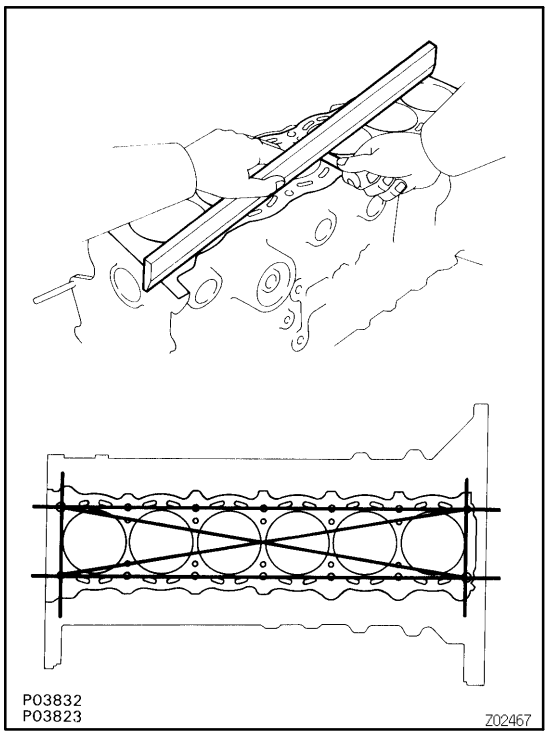
INSPECTION



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.



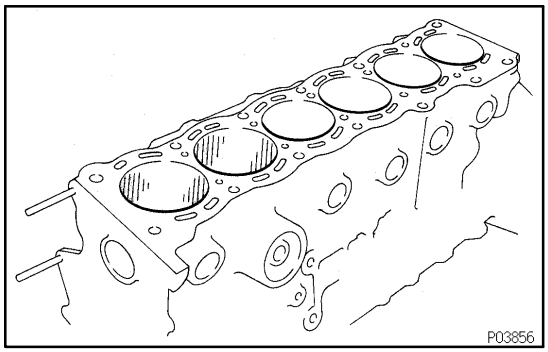
2. INSPECT CYLINDER BLOCK

(a) Inspect for flatness.

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

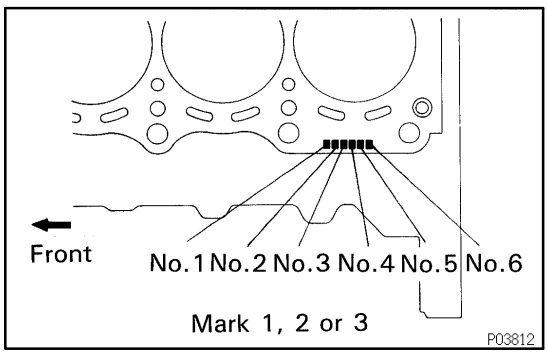
Maximum warpage: 0.05 mm (0.0020 in.)

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



(b) Visually check the cylinder for vertical scratches.

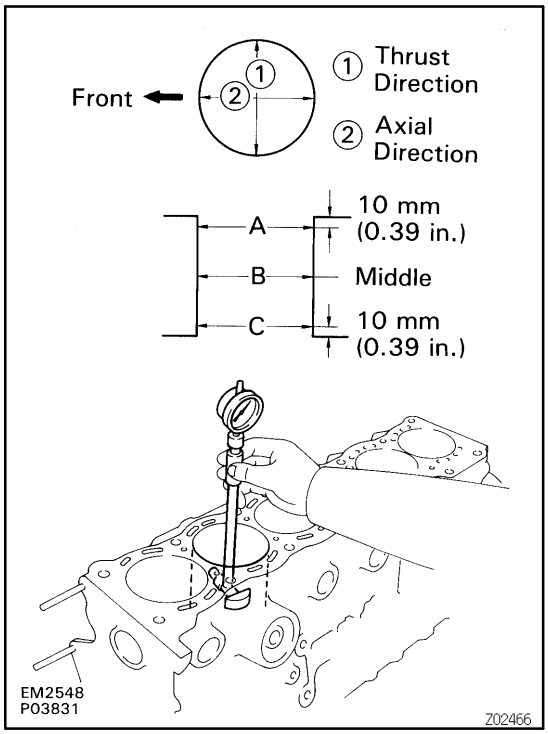
If deep scratches are present, rebore all the 6 cylinders. If necessary, replace the cylinder block.



(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.



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

Standard diameter:

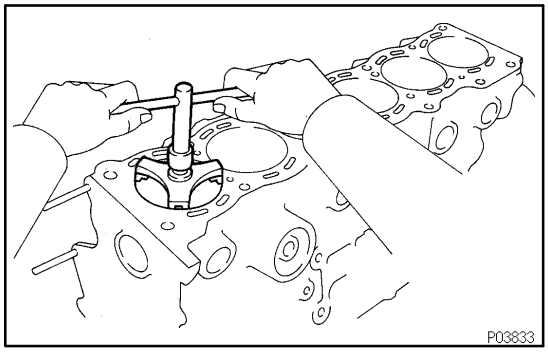
STD

Mark "1"	100.000 – 100.010 mm (3.9370 – 3.9374 in.)
Mark "2"	100.010 – 100.020 mm (3.9374 – 3.9378 in.)
Mark "3"	100.020 – 100.030 mm (3.9378 – 3.9382 in.)

Maximum diameter:

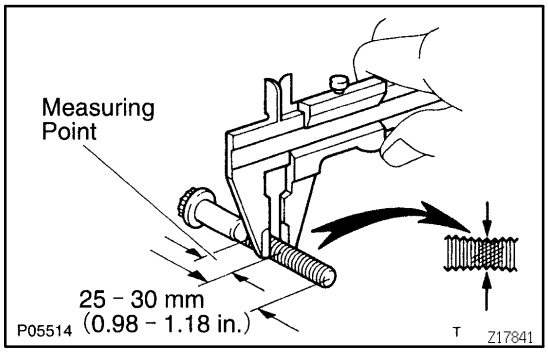
STD	100.23 mm (3.9461 in.)
O/S 0.50	100.73 mm (3.9658 in.)
O/S 1.00	101.23 mm (3.9854 in.)

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



(d) 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.



(e) Inspect the main bearing cap bolts.

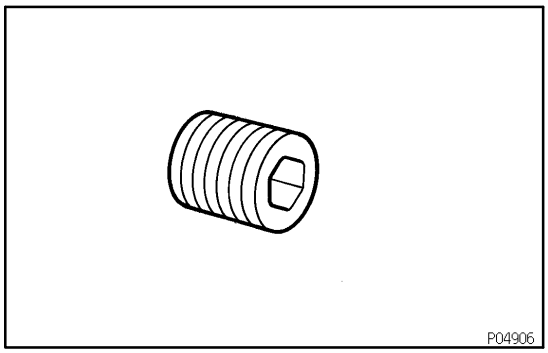
Using vernier calipers, measure the thread outside diameter of the bolt.

Standard outside diameter:

10.85 – 11.00 mm (0.4271 – 0.4331 in.)

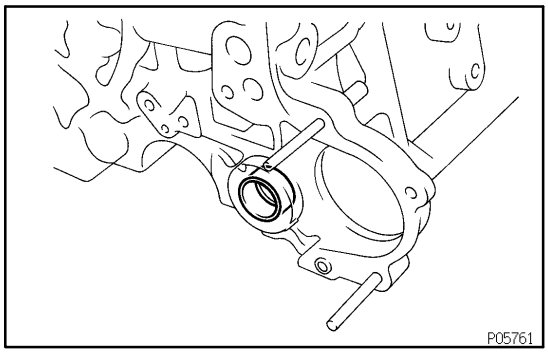
Minimum outside diameter: 10.6 mm (0.417 in.)

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



(f) Inspect the cylinder blockl oil orifice for clogging.

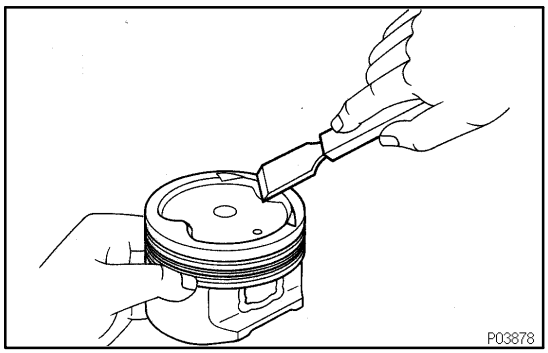
If necessary, replace the orifice.



3. INSPECT BEARING OF OIL PUMP DRIVE SHAFT GEAR

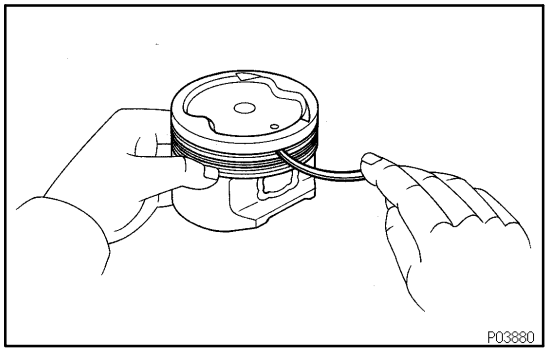
Check the bearing for pitting and scratches.

If the bearing is damaged, replace the cylinder block.

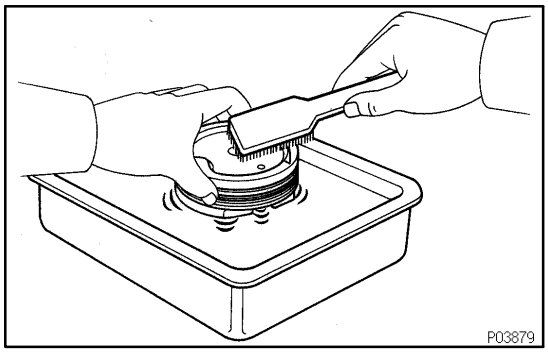


4. CLEAN PISTON

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



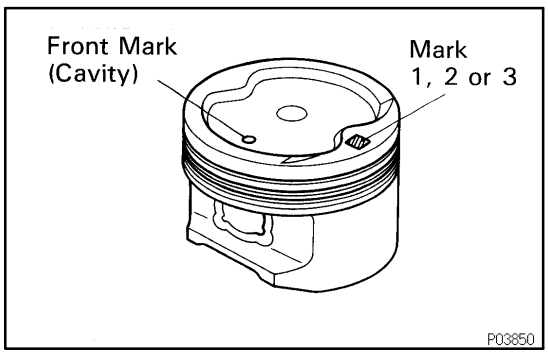
(b) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



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

NOTICE:

Do not use a wire brush.

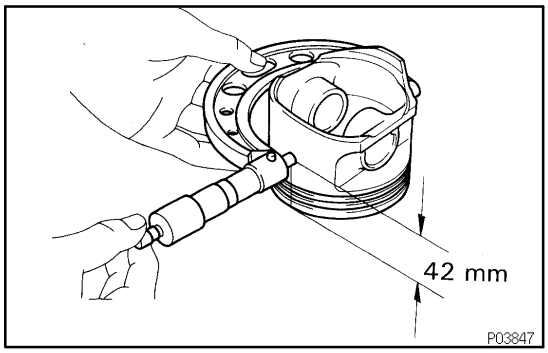


5. INSPECT PISTON AND CONNECTING ROD

(a) Inspect the piston oil clearance.

HINT:

There are 3 sizes of the standard piston diameter, marked ”1”, ”2” and ”3”. 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, 42 mm (1.65 in.) from the piston head.

Piston diameter:

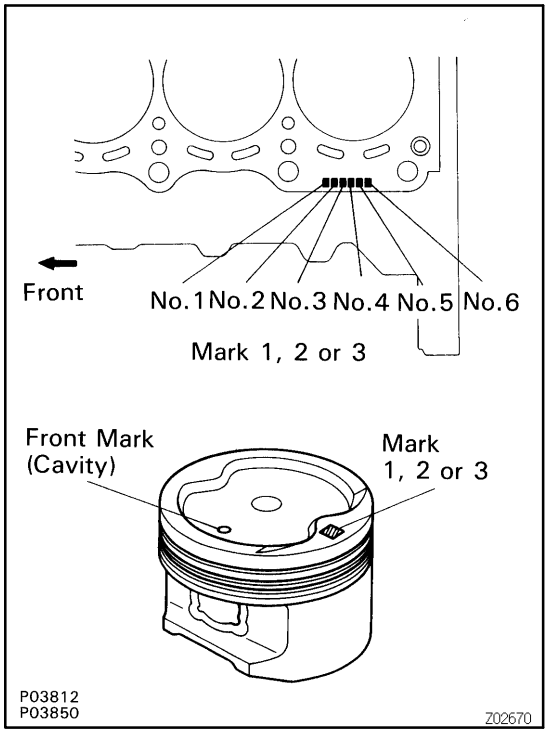
STD	Mark "1"	99.950 – 99.960 mm (3.9350 – 3.9354 in.)
	Mark "2"	99.960 – 99.970 mm (3.9354 – 3.9358 in.)
	Mark "3"	99.970 – 99.980 mm (3.9358 – 3.9362 in.)
O/S 0.50		100.450 – 100.480 mm (3.9547 – 3.9559 in.)
O/S 1.00		100.950 – 100.980 mm (3.9744 – 3.9756 in.)

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

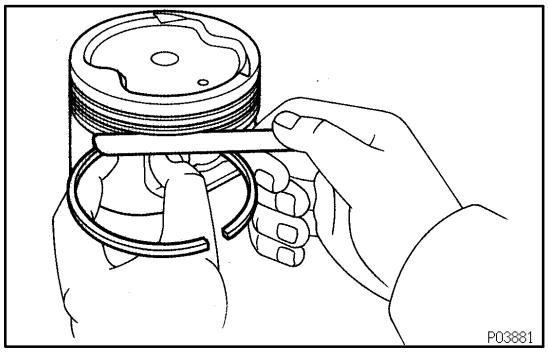
(3) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:
0.040 – 0.060 mm (0.0016 – 0.0024 in.)
Maximum oil clearance: 0.080 mm (0.0031 in.)

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



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

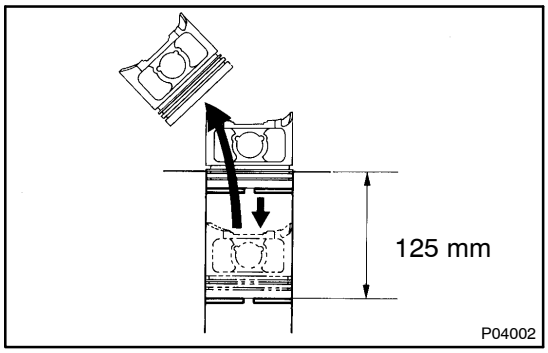


(b) Inspect the piston ting groove clearance.
Using a feeler gauge, measure the clearance between new piston ring and the wall of the piston ring groove.

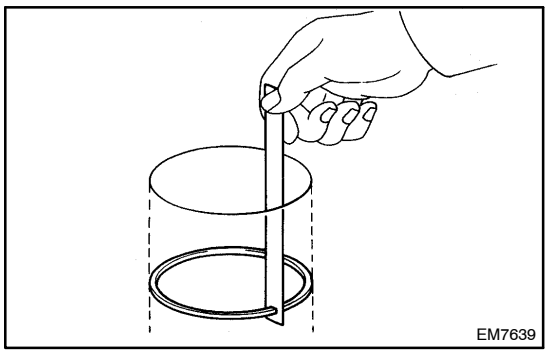
Ring groove clearance:

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

If the clearance is greater than maximum, 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, 125 mm (4.92 in.) from the top of the cylinder block.



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

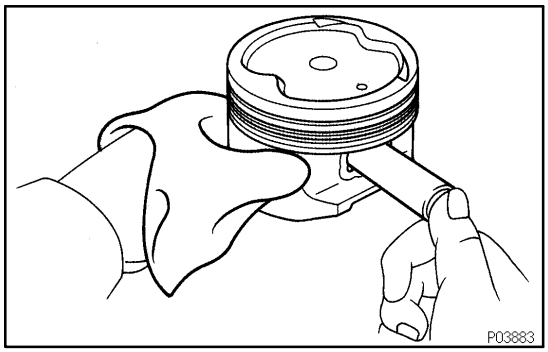
Standard end gap:

No. 1	0.300 – 0.520 mm (0.0118 – 0.0205 in.)
No. 2	0.450 – 0.670 mm (0.0177 – 0.0264 in.)
Oil (Side rail)	0.150 – 0.520 mm (0.0059 – 0.0205 in.)

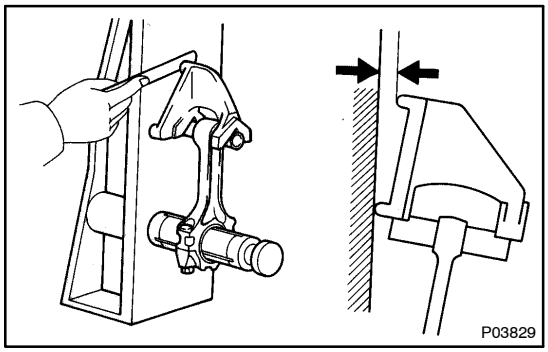
Maximum end gap:

No. 1	1.12 mm (0.0441 in.)
No. 2	1.17 mm (0.0461 in.)
Oil (Side rail)	1.12 mm (0.0441 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.



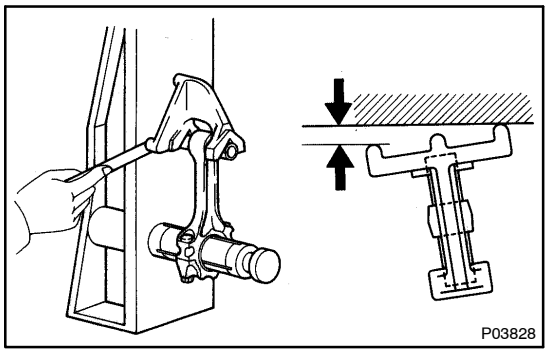
(d) Inspect the piston pin fit.
At 80 – 90°C (176 – 194°F), you should be able to push the piston pin into the piston pin hole with your thumb.



(e) Using a rod aligner and feeler gauge, check the connecting rod alignment.
(1) Check for out–of–alignment.

Maximum out–of–alignment:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)

If out–of–alignment is greater than maximum, replace the connecting rod assembly.

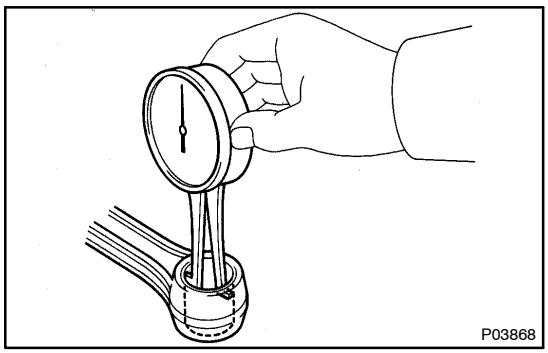


(2) Check for twist

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.

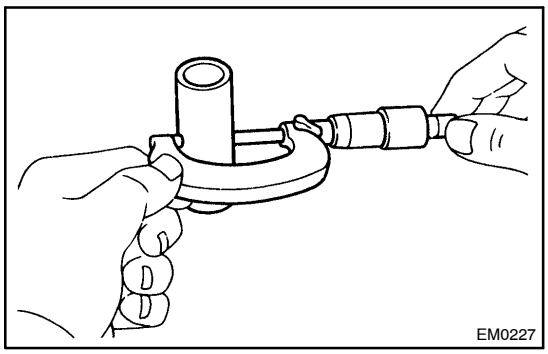


(f) Inspect the piston pin oil clearance.

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

Bushing inside diameter:

26.008 – 26.020 mm (1.0239 – 1.0244 in.)



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

Piston pin diameter:

26.000 – 26.012 mm (1.0236 – 1.0241 in.)

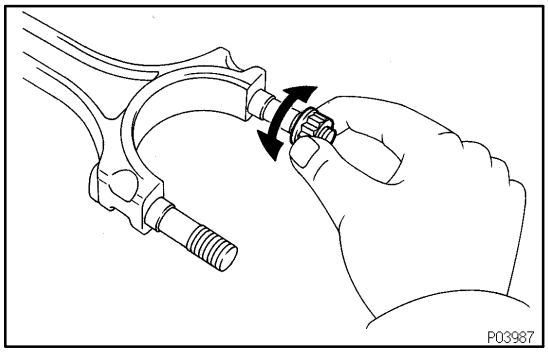
(3) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance:

0.004 – 0.012 mm (0.0002 – 0.0005 in.)

Maximum oil clearance: 0.05 mm (0.0020 in.)

If the oil clearance is greater than maximum, replace the bushing. If necessary, replace the piston and piston pin as a set (See page EM–99).



(g) Inspect the connecting rod bolts.

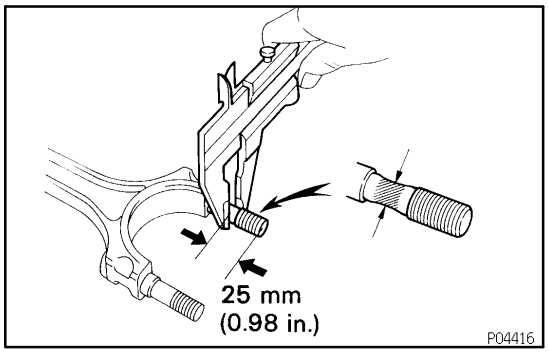
Install the cap nut to the connecting rod bolt. Check that the cap nut can be turned easily by hand to the end of the thread.

If the cap nut cannot be turned easily, measure the outside diameter of the connecting rod bolt with vernier calipers.

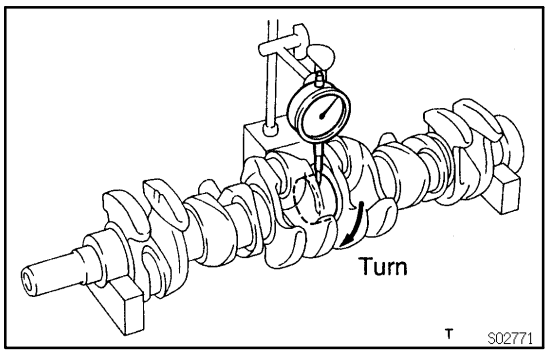
Standard outside diameter:

8.40 – 8.60 mm (0.3307 – 0.3386 in.)

Minimum outside diameter: 8.00 mm (0.3150 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 outside diameter is less than minimum, replace the connecting rod bolt and nut as a set.

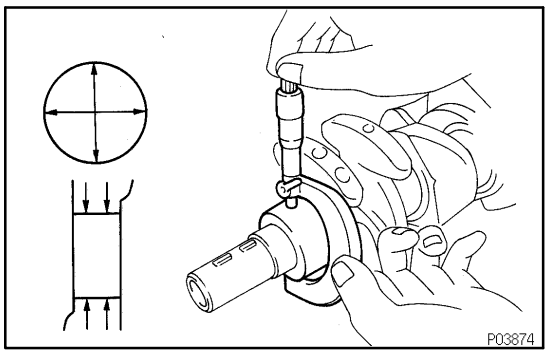


6. INSPECT CRANKSHAFT

(a) Inspect for circle runout.
(1) Place the crankshaft on V–blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.

Maximum circle runout: 0.06 mm (0.0024 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:

STD	68.982 – 69.000 mm (2.7158 – 2.7165 in.)
U/S 0.25	68.745 – 68.755 mm (2.7065 – 2.7069 in.)

Crank pin diameter:

STD	56.982 – 57.000 mm (2.2434 – 2.2441 in.)
U/S 0.25	56.745 – 56.755 mm (2.2341 – 2.2344 in.)

If the diameter is not as specified, check the oil clearance (See page EM–83). If necessary, grind or 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.

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

Grind and hone the main journals and/or crank pins to the finished undersized diameter. Install new main journal and/or crankshaft pin undersized bearings.