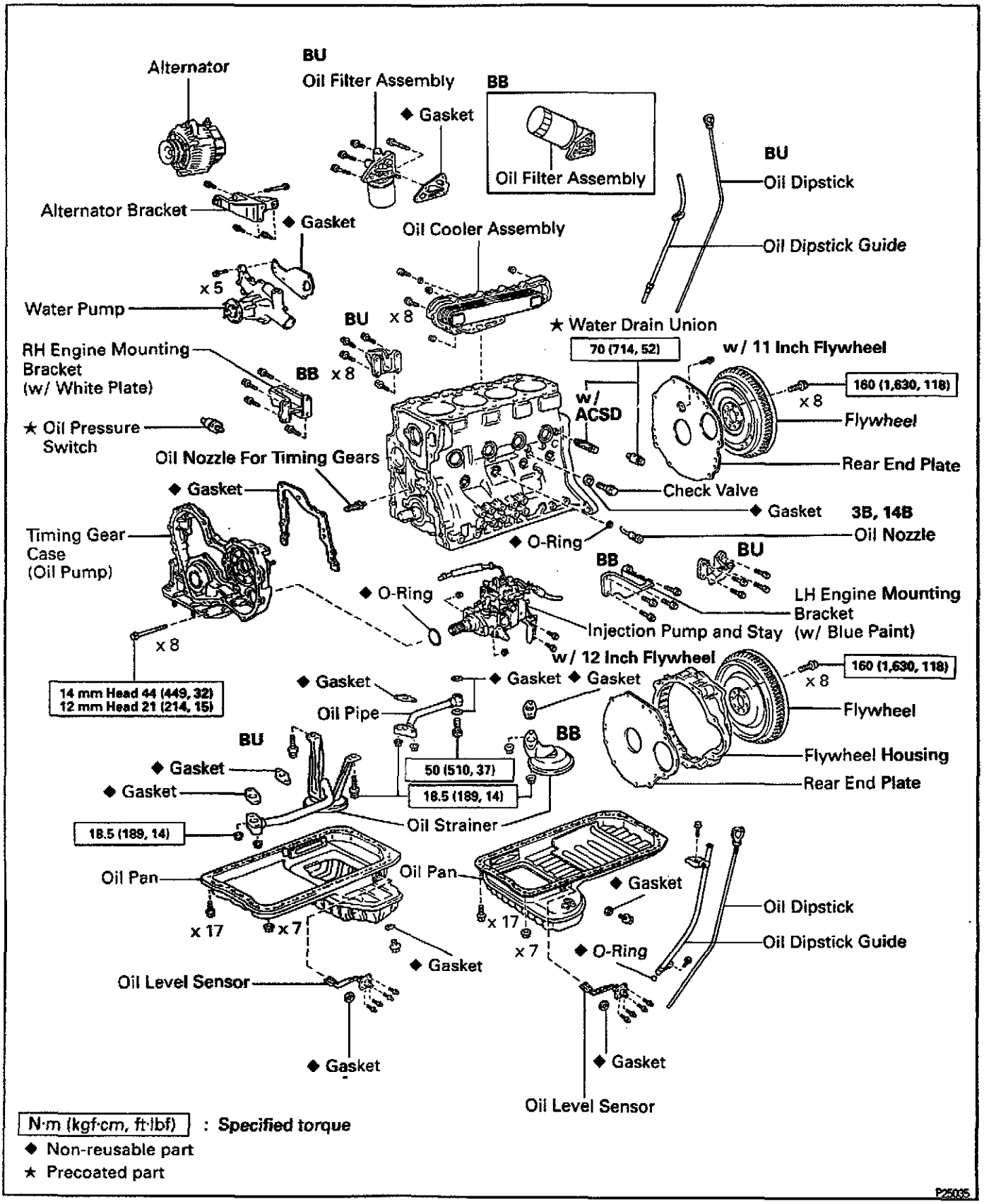
CYLINDER BLOCK
COMPONENTS FOR PREPARATION AND AFTER ASSEMBLY



N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part
★ Precoated part

P25035

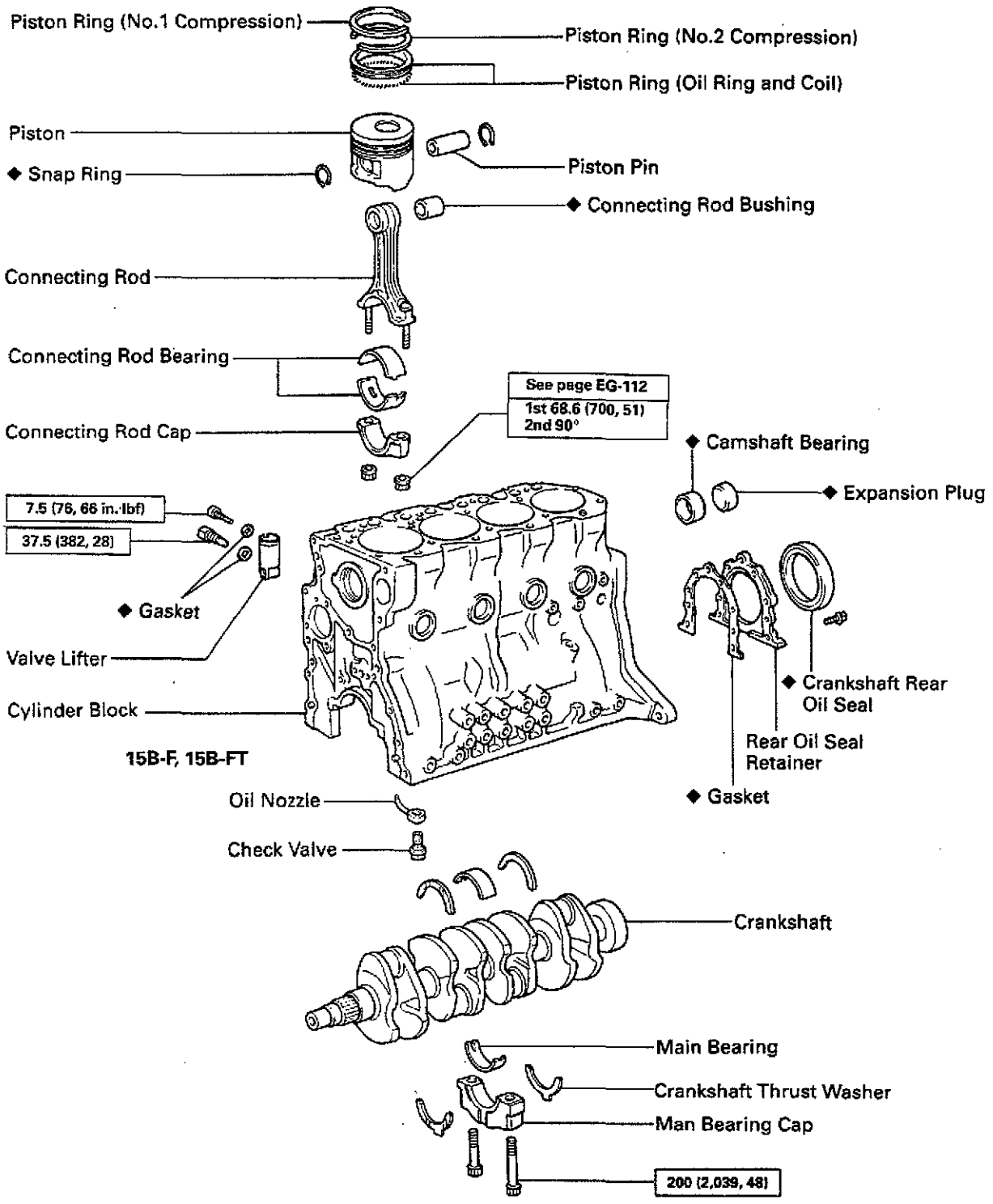
EG

PREPARATION FOR DISASSEMBLY

1. REMOVE FLYWHEEL
2. w/ 12 INCH FLYWHEEL:
   REMOVE FLYWHEEL HOUSING
3. REMOVE REAR END PLATE
4. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
5. REMOVE ALTERNATOR AND BRACKET
6. REMOVE WATER PUMP
   (See water pump removal in Cooling System)
7. REMOVE CYLINDER HEAD
   (See cylinder head removal)
8. REMOVE TIMING GEARS AND CAMSHAFT
   (See timing gears and camshaft removal)
9. REMOVE INJECTION PUMP AND STAY
   (See injection pump removal in Fuel System)
10. REMOVE OIL PAN, OIL STRAINER AND TIMING GEAR CASE (OIL PUMP)
    (See oil pump removal in Lubrication System)
11. BU:
    REMOVE OIL DIPSTICK AND GUIDE
12. REMOVE OIL FILTER AND OIL COOLER ASSEMBLIES
    (See oil cooler removal in Lubrication System)
13. REMOVE OIL PRESSURE SWITCH
14. REMOVE OIL NOZZLE FOR TIMING GEARS
15. REMOVE WATER DRAIN UNION
16. 3B, 14B:
    REMOVE OIL NOZZLES AND CHECK VALVE
17. REMOVE ENGINE MOUNTING BRACKETS

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY

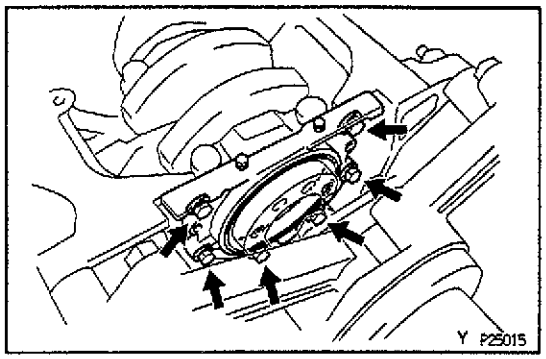
EG



N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non-reusable part

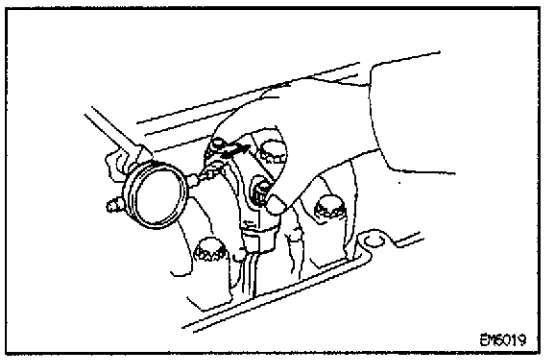
P25013

EG

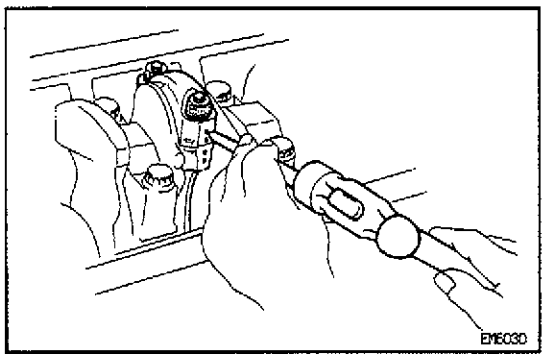


CYLINDER BLOCK DISASSEMBLY

1. **REMOVE REAR OIL SEAL RETAINER**
Remove the 6 bolts, oil seal retainer and gasket.

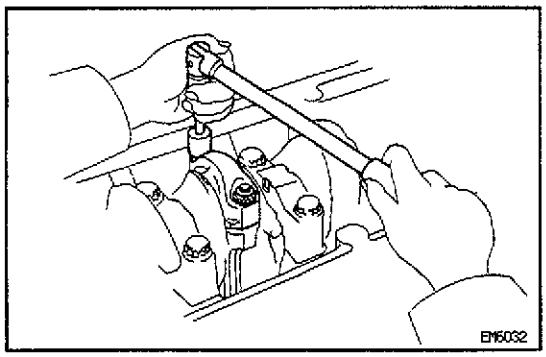


2. **CHECK CONNECTING ROD THRUST CLEARANCE**
Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.200 — 0.320 mm (0.0079 — 0.0126 in.)
Maximum thrust clearance:
0.40 mm (0.0157 in.)
If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.

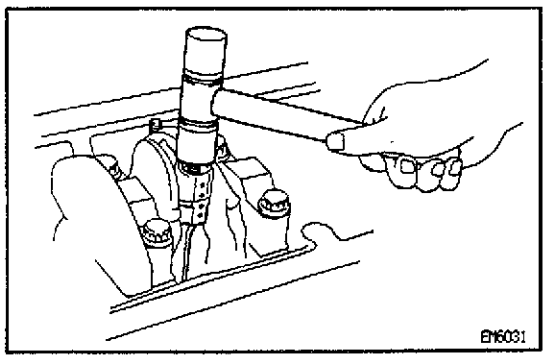


3. **REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE**

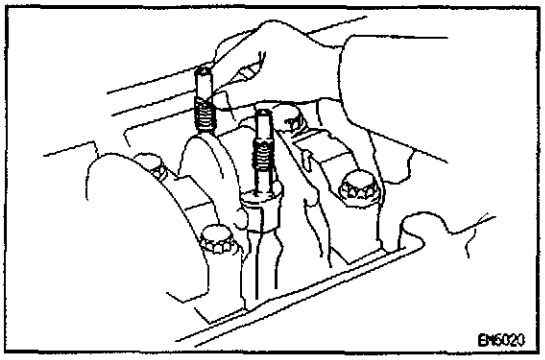
(a) Using a punch or numbering stamp, place matchmarks on the connecting rod and cap to ensure correct reassembly.



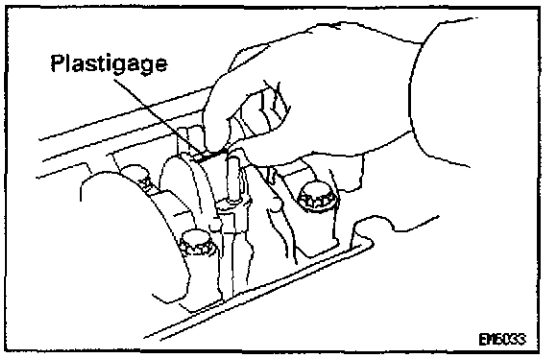
(b) Remove the 2 connecting rod cap nuts.



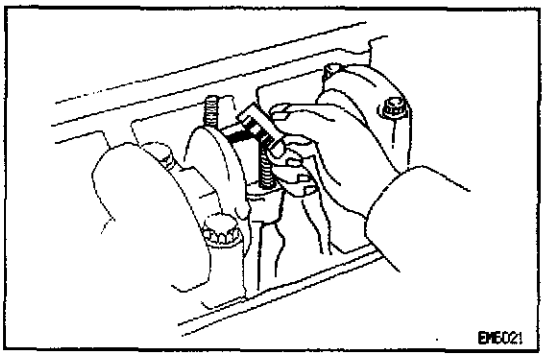
(c) Using a plastic—faced hammer, lightly tap the connetting rod bolts and lift off the connecting rod cap.
HINT: Keep the lower bearing inserted with the connecting rod cap.



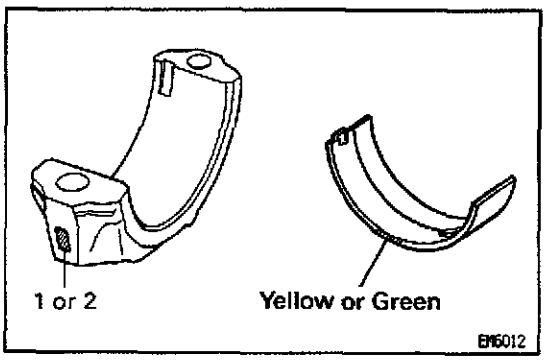
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.
(e) Clean the crank pin and bearing.
(f) Check the crank pin and bearing for pitting and scratches.
If the crank pin or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(g) Lay a strip of Plastigage across the crank pin.
(h) Install the connecting rod cap with the 2 nuts.
(See step 8 in cylinder block assembly)
Torque:
1st
68.6 N·m (700 kgf·cm, 51 ft·lbf)
2nd
Turn 90°
NOTICE: Do not turn the crankshaft.



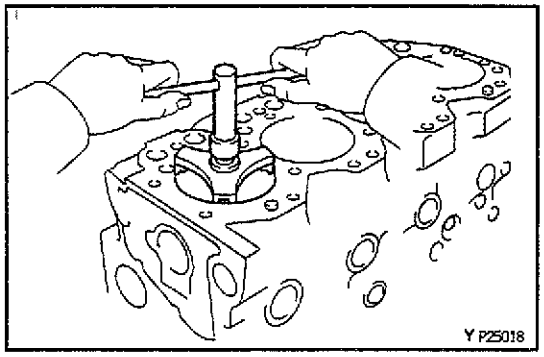
(i) Remove the 2 nuts, connecting rod cap and lower bearing. (See procedure (b) and (c) above)
(j) Measure the Plastigage at its widest point.
Standard oil clearance:
STD
0.030 — 0.070 mm (0.0012 — 0.0028 in.)
U/S 0.25, 0.50, 1.00
0.030 — 0.072 mm (0.0012 — 0.0028 in.)
Maximum oil clearance:
0.10 mm (0.0039 in.)
If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.
HINT: There are 2 sizes of standard bearings, colored yellow and green. If using a standard bearing, select one having the color corresponding to the number on the bearing cap:
1 with Yellow
2 with Green



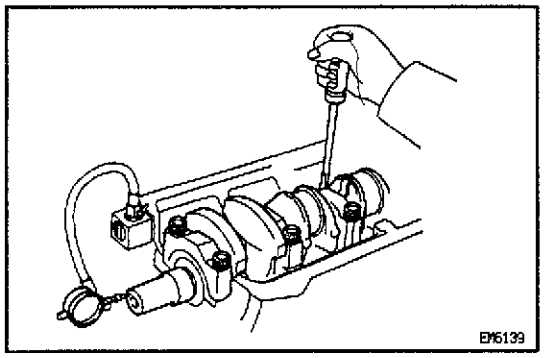
Reference
Standard sized bearing center wall thickness:

Yellow	1.480 — 1.485 mm (0.0583 — 0.0585 in.)
Green	1.486 — 1.490 mm (0.0585 — 0.0587 in.)

(k) Completely remove the Plastigage.



EG



4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.
HINT:
- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.

5. CHECK CRANKSHAFT THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:

0.040 — 0.250 mm (0.0016 — 0.0098 in.)

Maximum thrust clearance:

0.30 mm (0.0118 in.)

If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:

STD

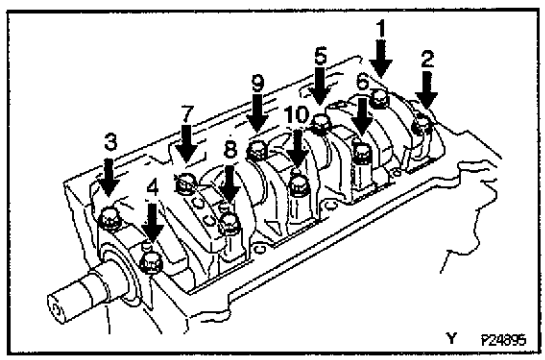
2.430 — 2.480 mm (0.0957 — 0.0976 in.)

O/S 0.125

2.493 — 2.543 mm (0.0981 — 0.1001 in.)

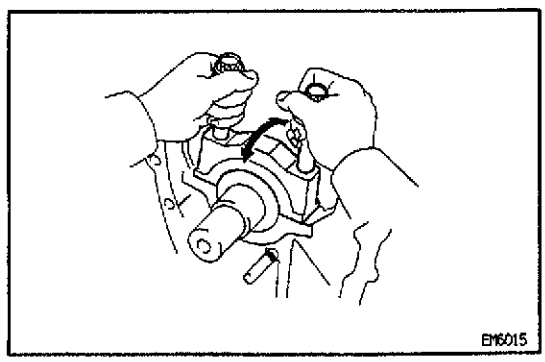
O/S 0.250

2.555 — 2.605 mm (0.1006 — 0.1026 in.)



6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE

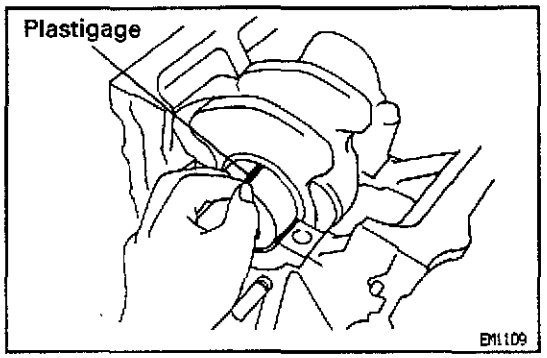
(a) Remove the 10 main bearing cap bolts.



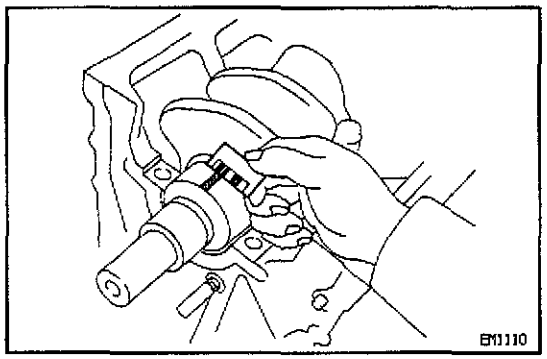
(b) Using the removed main bearing cap bolts, pry the cap back and forth, and remove the main bearing caps, lower thrust washers (No.3 main bearing cap only).

(c) Lift out the crankshaft.
HINT:
- Keep the upper bearings inserted with the cylinder block.
- Arrange the thrust washers in correct order.

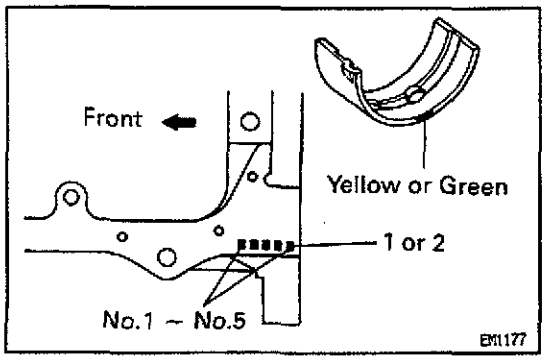
(d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.
If the journal or bearing is damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(f) Place the crankshaft on the cylinder block.
(g) Lay a strip of Plastigage across each journal.
(h) Install the 5 main bearing caps with the 10 bolts. (See step 6 in cylinder block assembly)
Torque:
200 N·m (2,039 kgf·cm, 148 ft·lbf)
NOTICE: Do not turn the crankshaft.
(i) Remove the 10 bolts and 5 main bearing caps. (See procedure (b) and (c) above)



(j) Measure the Plastigage at its widest point.
Standard oil clearance:
No.3 journal
STD
0.060 — 0.104 mm (0.0024 — 0.0041 in.)
U/S 0.25, 0.50, 1.00
0.060 — 0.106 mm (0.0026 — 0.0042 in.)
Others
STD
0.030 — 0.074 mm (0.0012 — 0.0029 in.)
U/S 0.25, 0.50, 1.00
0.030 — 0.076 mm (0.0012 — 0.0030 in.)
Maximum clearance:
No.3 journal
0.15 mm (0.0059 in.)
Others
0.10 mm (0.0039 in.)
If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.
HINT: There are 2 sizes of standard bearings, colored yellow and green. If using a standard bearing, select one having the color corresponding to the number on the cylinder block:
1 with yellow
2 with Green



Reference

Standard sized bearing center wall thickness:

Yellow	2.480 — 2.485 mm (0.0976 — 0.0978 in.)
Green	2.486 — 2.490 mm (0.0979 — 0.0980 in.)

(k) Completely remove the Plastigage.

7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

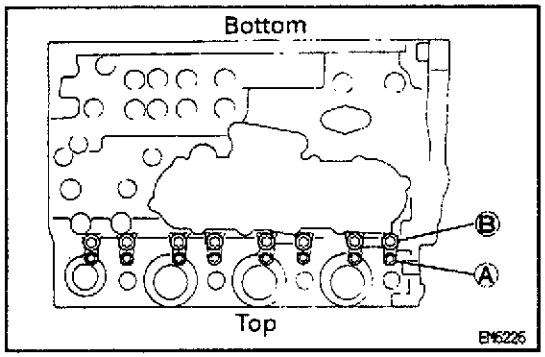
(b) Remove the upper bearings and thrust washers from the cylinder block.

HINT: Arrange the main bearing caps, bearings and thrust washers in correct order.

8. 15B—F, 15B—FT:

REMOVE CHECK VALVES AND OIL NOZZLES

(See step 3 in oil nozzles and check valves removal in Lubrication System)

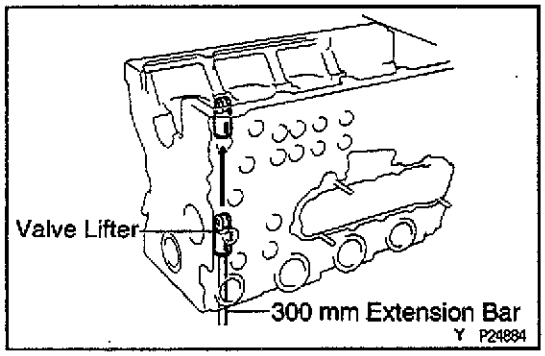


9. REMOVE VALVE LIFTERS

(a) Remove the 8 Ⓑ bolts.

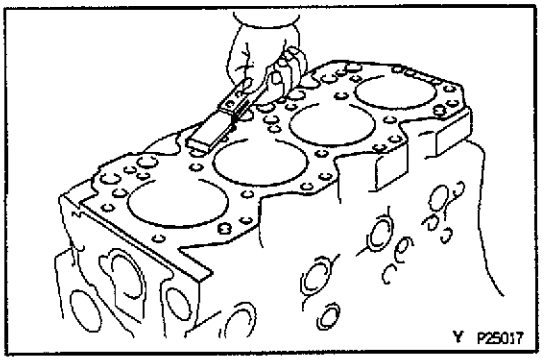
NOTICE: With the engine in the upside down position, the lifters will drop in the engine if the Ⓐ bolts are removed.

(b) Remove the 8 Ⓐ bolts, if necessary.



(c) Pull out valve lifters.

HINT: Arrange the valve lifters in correct order.



CYLINDER BLOCK INSPECTION

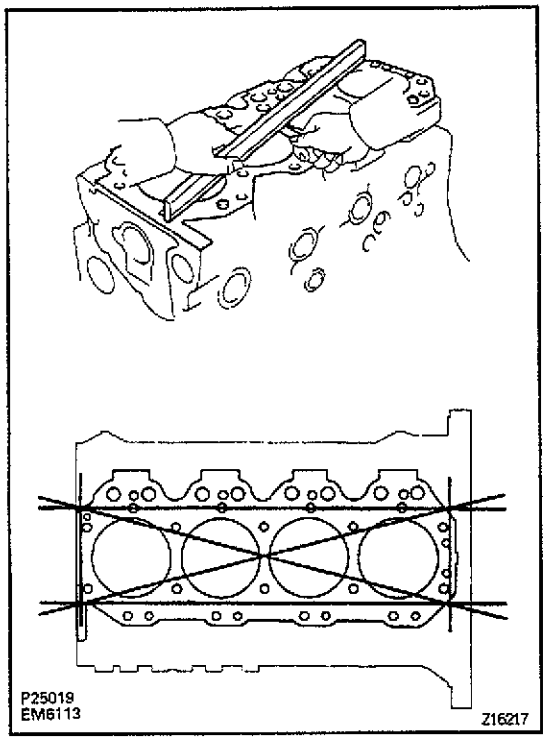
1. CLEAN CYLINDER BLOCK

A. Remove gasket material

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

B. Clean cylinder block

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



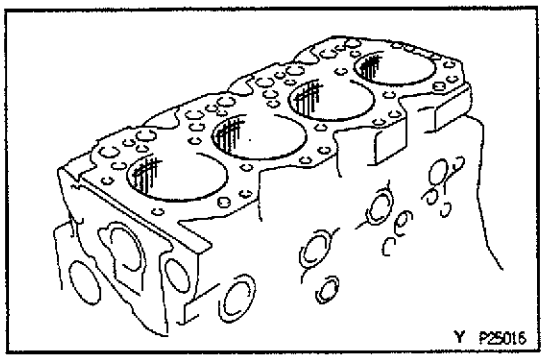
2. INSPECT TOP SURFACE OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage:

0.20 mm (0.0079 in.)

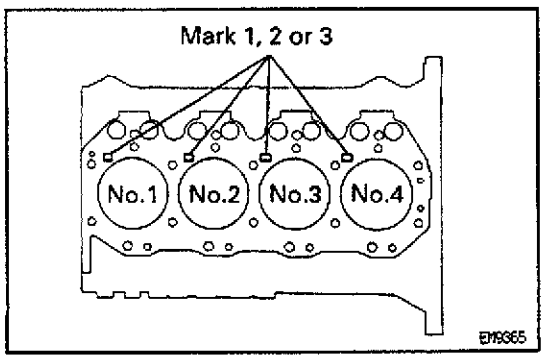
If warpage is greater than maximum, replace the cylinder block.



3. INSPECT CYLINDER FOR VERTICAL SCRATCHES

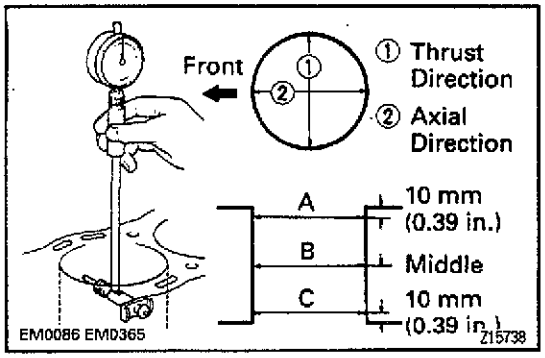
Visually check the cylinder for vertical scratches.

If deep scratches are present, rebore all the 4 cylinders. If necessary, replace the cylinder block.



4. INSPECT 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.



EG

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

Standard diameter:

3B, 14B

STD	Mark "1"	102.000 — 102.010 mm (4.0157 — 4.0161 in.)
	Mark "2"	102.010 — 102.020 mm (4.0161 — 4.0165 in.)
	Mark "3"	102.020 — 102.030 mm (4.0165 — 4.0169 in.)
O/S 0.50		102.500 — 102.530 mm (4.0354 — 4.0366 in.)
O/S 0.75		102.750 — 102.780 mm (4.0453 — 4.0464 in.)
O/S 1.00		103.000 — 103.030 mm (4.0551 — 4.0563 in.)

15B—F, 15B—FT

STD	Mark "1"	108.000 — 108.010 mm (4.2520 — 4.2524 in.)
	Mark "2"	108.010 — 108.020 mm (4.2524 — 4.2528 in.)
	Mark "3"	108.020 — 108.030 mm (4.2528 — 4.2531 in.)
O/S 0.50		108.500 — 108.530 mm (4.2717 — 4.2728 in.)
O/S 0.75		108.750 — 108.780 mm (4.2815 — 4.2827 in.)
O/S 1.00		109.000 — 109.030 mm (4.2913 — 4.2925 in.)

Maximum diameter:

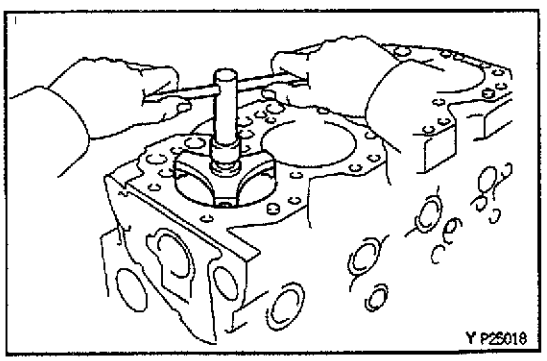
3B, 14B

STD	102.23 mm (4.0248 in.)
O/S 0.50	102.73 mm (4.0445 in.)
O/S 0.75	102.98 mm (4.0543 in.)
O/S 1.00	103.23 mm (4.0642 in.)

15B—F, 15B—FT

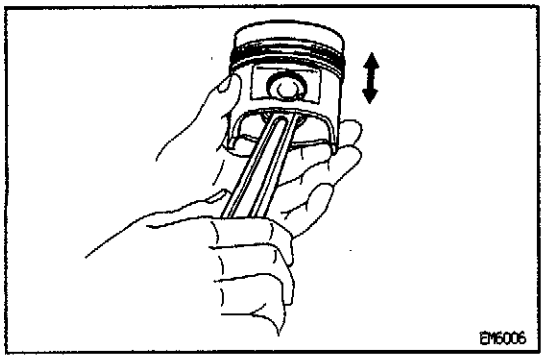
STD	108.23 mm (4.2610 in.)
O/S 0.50	108.73 mm (4.2807 in.)
O/S 0.75	108.98 mm (4.2906 in.)
O/S 1.00	109.23 mm (4.3004 in.)

If the diameter is greater than maximum, rebore all the 4 cylinders. If necessary, replace the cylinder block.



5. 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.

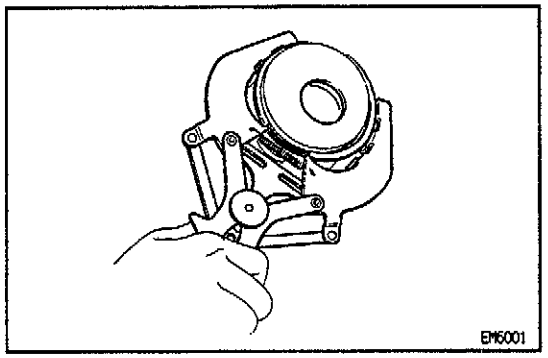


PISTON AND CONNECTING ROD DISASSEMBLY

1. CHECK FIT BETWEEN PISTON AND PISTON PIN

Try to move the piston back and forth on the piston pin.

If any movement is felt, replace the piston and pin as a set.

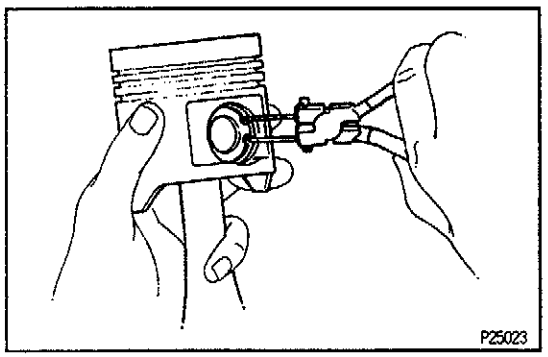


2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the No.1, No.2 and oil rings.

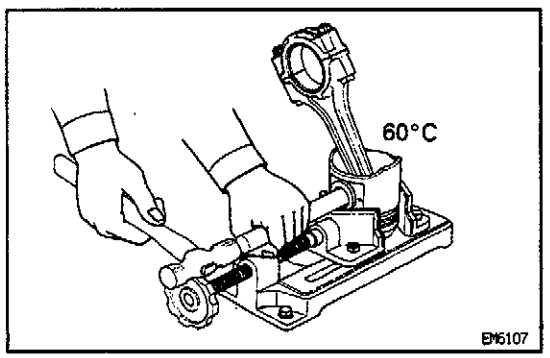
(b) Remove the coil by hand.

HINT: Arrange the rings in correct order only.



3. DISCONNECT CONNECTING ROD FROM PISTON

(a) Using needle–nose pliers, remove the snap rings.

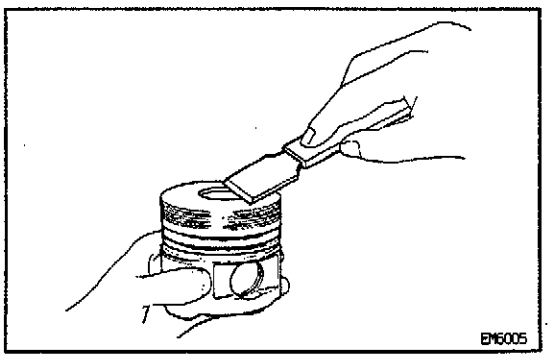


(b) Gradually heat the piston to approx. 60°C (140°F).

(c) Using a plastic–faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.

HINT:

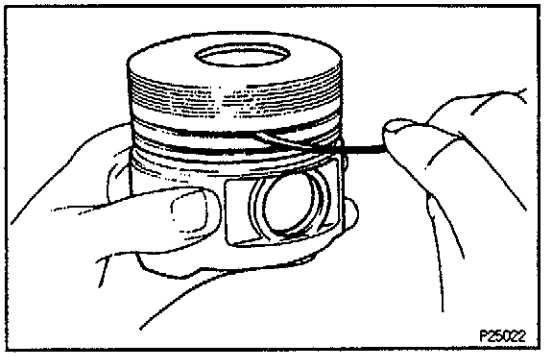
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



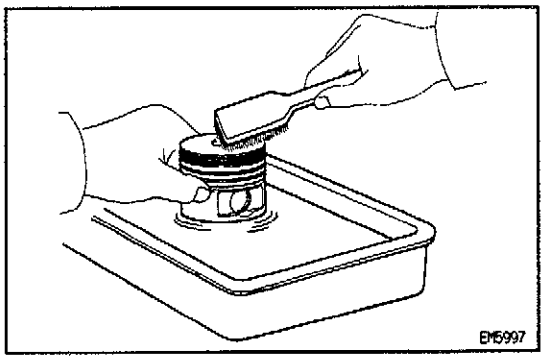
PISTON AND CONNECTING ROD INSPECTION

1. CLEAN PISTON

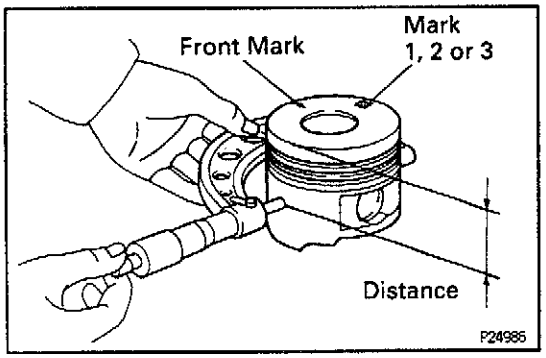
(a) Using a gasket scraper, remove the carbon from the piston top.



(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.



2. INSPECT PISTON AND PISTON RING

A. Inspect piston diameter and 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.

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, the indicated distance from the piston head.
Distance:

3B	45.20 mm (1.7795 in.)
14B	42.83 mm (1.6862 in.)
15B-F, 15B-FT	50.55 mm (1.9902 in.)

Piston diameter:

3B

STD	Mark "1"	101.800 — 101.810 mm (4.0079 — 4.0083 in.)
	Mark "2"	101.810 — 101.820 mm (4.0083 — 4.0087 in.)
	Mark "3"	101.820 — 101.830 mm (4.0087 — 4.0090 in.)
O/S 0.50		102.300 — 102.330 mm (4.0276 — 4.0287 in.)
O/S 0.75		102.550 — 102.580 mm (4.0372 — 4.0386 in.)
O/S 1.00		102.800 — 102.830 mm (4.0473 — 4.0484 in.)

14B

STD	Mark "1"	101.760 — 101.770 mm (4.0063 — 4.0067 in.)
	Mark "2"	101.770 — 101.780 mm (4.0067 — 4.0071 in.)
	Mark "3"	101.780 — 101.790 mm (4.0071 — 4.0075 in.)
O/S 0.50		102.260 — 102.290 mm (4.0260 — 4.0272 in.)
O/S 0.75		102.510 — 102.540 mm (4.0358 — 4.0370 in.)
O/S 1.00		102.760 — 102.790 mm (4.0457 — 4.0468 in.)

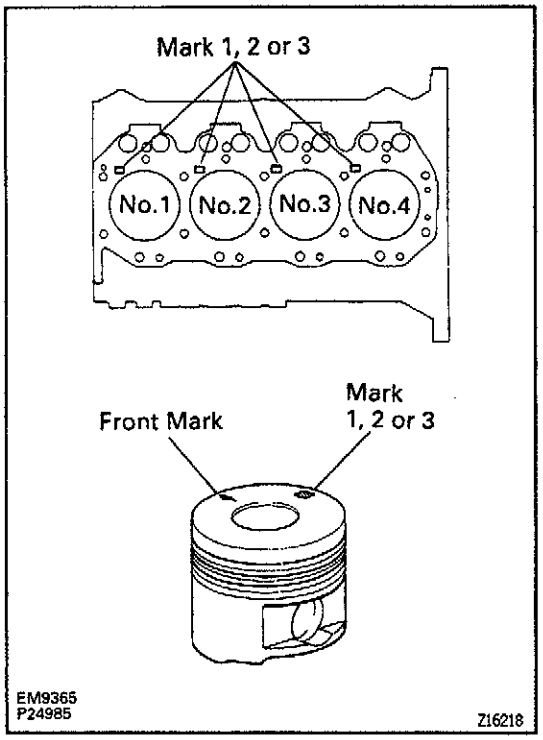
15B–F

STD	Mark "1"	107.830 – 107.840 mm (4.2453 – 4.2457 in.)
	Mark "2"	107.840 – 107.850 mm (4.2457 – 4.2461 in.)
	Mark "3"	107.850 – 107.860 mm (4.2461 – 4.2465 in.)
O/S 0.50		108.330 – 108.360 mm (4.2650 – 4.2661 in.)
O/S 0.75		108.580 – 108.610 mm (4.2748 – 4.2760 in.)
O/S 1.00		108.830 – 108.860 mm (4.2846 – 4.2858 in.)

EG

15B–FT

STD	Mark "1"	107.820 – 107.830 mm (4.2449 – 4.2453 in.)
	Mark "2"	107.830 – 107.840 mm (4.2453 – 4.2457 in.)
	Mark "3"	107.840 – 107.850 mm (4.2457 – 4.2461 in.)
O/S 0.50		108.320 – 108.350 mm (4.2646 – 4.2657 in.)
O/S 0.75		108.570 – 108.600 mm (4.2744 – 4.2756 in.)
O/S 1.00		108.820 – 108.850 mm (4.2843 – 4.2854 in.)



(b) Measure the cylinder bore diameter in the thrust directions. (See step 4 in cylinder block inspection)

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

Standard oil clearance:

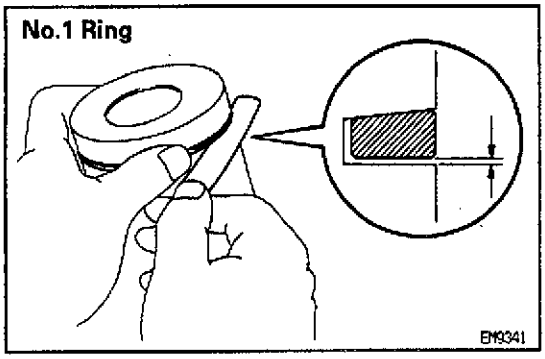
3B	0.190 – 0.210 mm (0.0057 – 0.0065 in.)
14B	0.230 – 0.250 mm (0.0091 – 0.0098 in.)
15B–F	0.160 – 0.180 mm (0.0063 – 0.0071 in.)
15B–FT	0.170 – 0.190 mm (0.0067 – 0.0075 in.)

Maximum oil clearance:

3B	0.26 mm (0.0102 in.)
14B	0.30 mm (0.0118 in.)
15B–F	0.23 mm (0.0091 in.)
15B–FT	0.24 mm (0.0094 in.)

If the oil clearance is greater than maximum, replace all the 4 pistons and rebore all the 4 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.



EG

B. Inspect piston ring groove clearance

No.1 Ring:

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

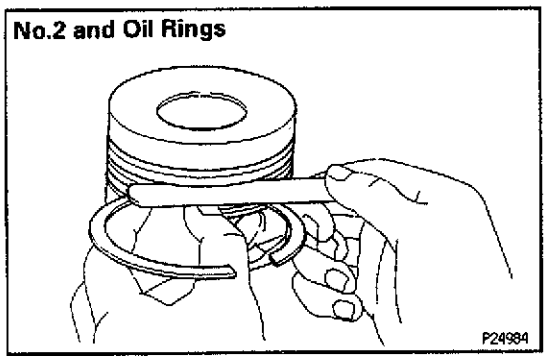
Standard groove clearance:

3B	0.061 — 0.091 mm (0.0024 — 0.0036 in.)
14B	0.062 — 0.092 mm (0.0024 — 0.0036 in.)
15B—F	0.067 — 0.108 mm (0.0026 — 0.0043 in.)
15B—FT	0.065 — 0.107 mm (0.0026 — 0.0042 in.)

Maximum groove clearance:

0.20 mm (0.0079 in.)

If the clearance is greater than maximum, replace the piston.



No.2 and Oil Rings:

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

Standard groove clearance:

No.2

0.060 — 0.100 mm (0.0024 — 0.0039 in.)

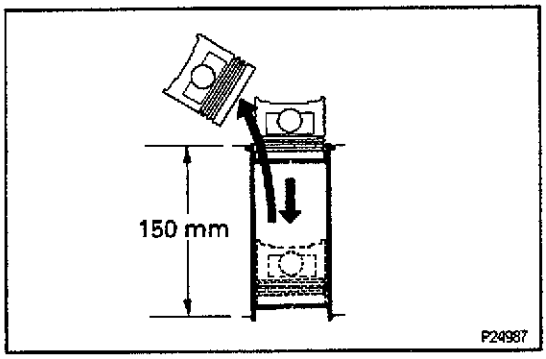
Oil

0.030 — 0.070 mm (0.0012 — 0.0028 in.)

Maximum groove clearance:

0.20 mm (0.0079 in.)

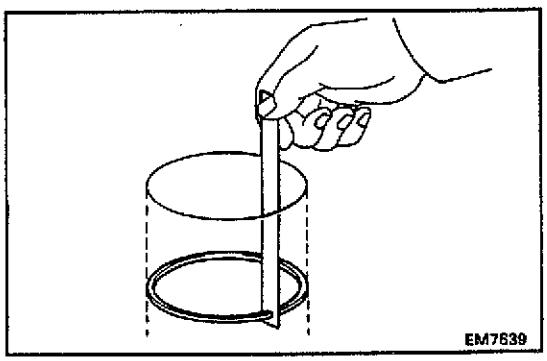
If the clearance is greater than maximum, replace the piston.



C. Inspect piston ring end gap

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 150 mm (5.91 in.) from the top of the cylinder block.



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

Standard end gap:

3B

No.1	0.350 — 0.620 mm (0.0138 — 0.0244 in.)
No.2	0.450 — 0.720 mm (0.0177 — 0.0283 in.)
Oil	0.200 — 0.520 mm (0.0079 — 0.0205 in.)

14B

No.1	0.350 – 0.620 mm (0.0138 – 0.0244 in.)
No.2	0.400 – 0.650 mm (0.0157 – 0.0256 in.)
Oil	0.200 – 0.520 mm (0.0079 – 0.0205 in.)

15B–F, 15B–FT

No.1	0.350 – 0.570 mm (0.0138 – 0.0224 in.)
No.2	0.470 – 0.720 mm (0.0185 – 0.0236 in.)
Oil	0.200 – 0.520 mm (0.0079 – 0.0205 in.)

Maximum end gap:

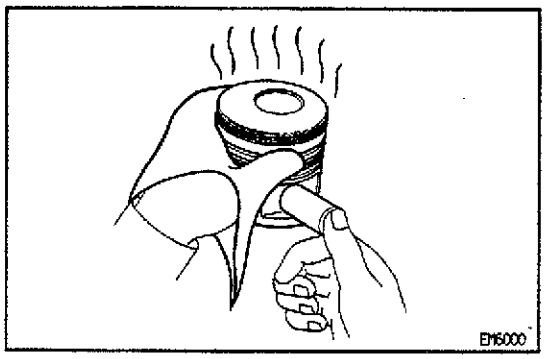
3B, 14B

No.1	1.46 mm (0.0575 in.)
No.2	1.61 mm (0.0634 in.)
Oil	1.61 mm (0.0634 in.)

15B–F, 15B–FT

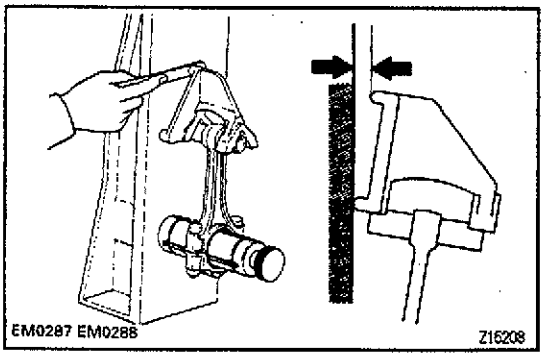
No.1	1.41 mm (0.0555 in.)
No.2	1.61 mm (0.0634 in.)
Oil	1.61 mm (0.0634 in.)

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 4 cylinders or replace the cylinder block.



3. INSPECT 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.
If the pin can be installed at a lower temperature, replace the piston and pin as set.



4. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

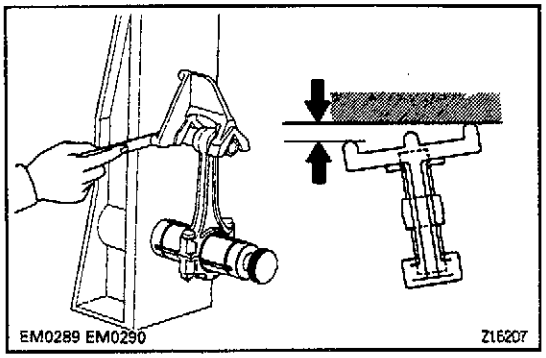
Using a rod aligner and feeler gauge, check the connecting rod alignment.

- 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.



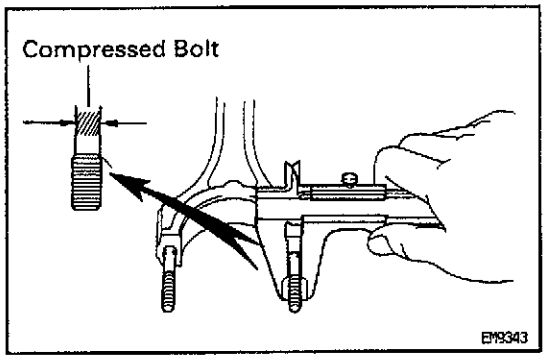
EG

- 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.



B. Inspect connecting rod bolts

Using vernier calipers, measure the tension portion diameter.

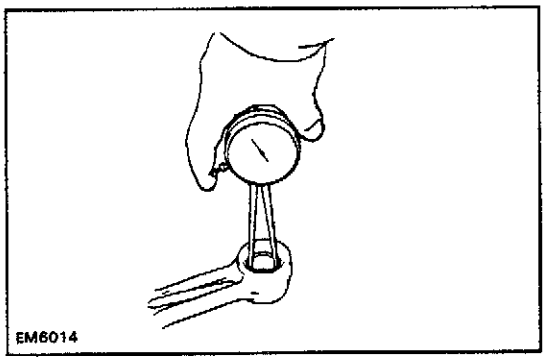
Standard diameter:

9.900 – 10.100 mm (0.3898 – 0.3976 in.)

Minimum diameter:

9.70 mm (0.3819 in.)

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



C. Inspect piston pin oil clearance

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

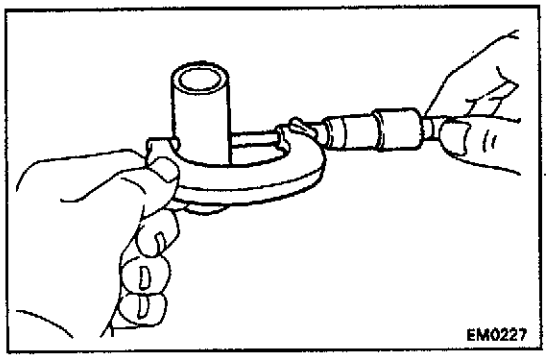
Bushing inside diameter:

3B, 14B

31.999 – 32.009 mm (1.2598 – 1.2602 in.)

15B–F, 15B–FT

33.999 – 34.009 mm (1.3385 – 1.3389 in.)



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

Piston pin diameter:

3B, 14B

32.000 – 32.010 mm (1.2598 – 1.2602 in.)

15B–F, 15B–FT

34.000 – 34.010 mm (1.3386 – 1.3390 in.)

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

Standard oil clearance:

3B, 14B

0.004 – 0.014 mm (0.0002 – 0.0006 in.)

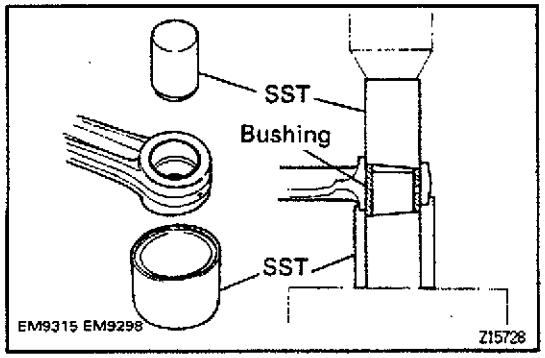
15B–F, 15B–FT

0.005 – 0.015 mm (0.0002 – 0.0006 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.

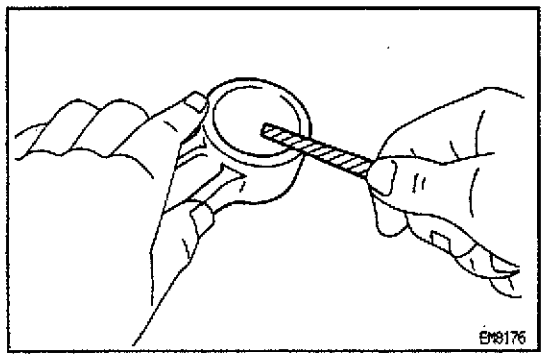


D. If necessary, replace connecting rod bushing

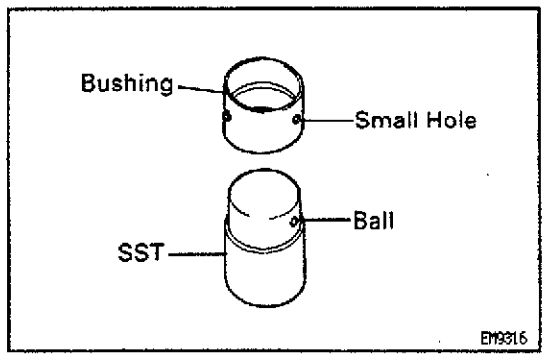
(a) Using SST and a press, press out the bushing.

SST

3B, 14B:
09222—58021 (09222—04016, 09222—04026)
15B—F, 15B—FT:
09222—58012 (09222—01022, 09222—01041)



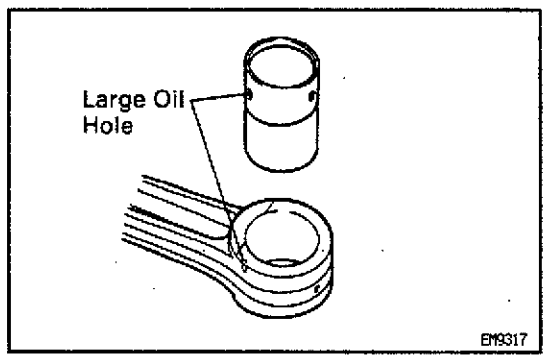
(b) Using a round file, lightly file off any roughness from the small end of the connecting rod.



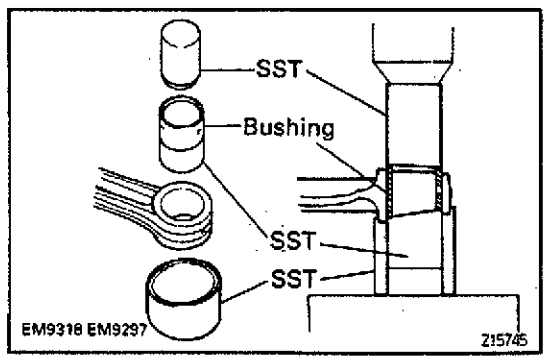
(c) Attach the bushing to SST with the ball of SST inside the oil hole of the bushing.

SST

3B, 14B:
09222—58021 (09222—04021)
15B—F, 15B—FT:
09222—58012 (09222—01031)



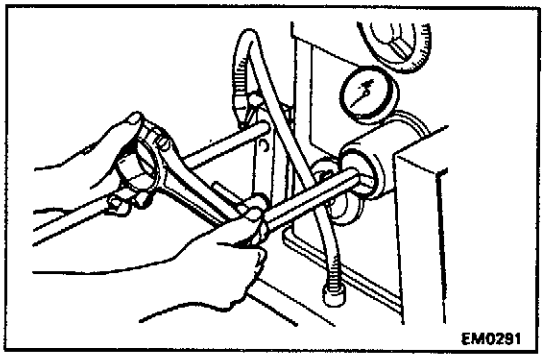
(d) Align the oil holes of a new bushing and the connecting rod.



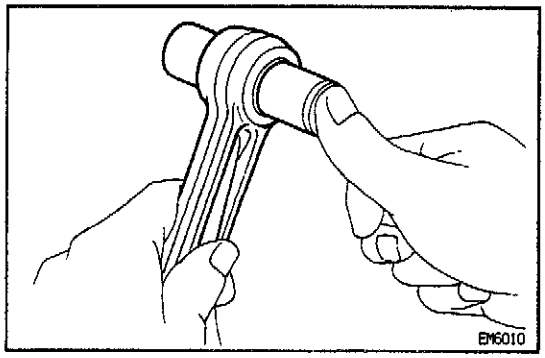
(e) Using SST and a press, press in the bushing.

SST

3B, 14B:
09222—58021 (09222—04016, 09222—04021, 09222—04026)
15B—F, 15B—FT:
09222—58012 (09222—01022, 09222—01031, 09222—01041)



(f) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see item C above) between the bushing and piston pin.



(g) Check the piston pin fit at normal room temperature. Coat the piston pin with engine oil, and push it into the connecting rod with your thumb.

CYLINDER BORING

EG62T-01

HINT:

- Bore all the 4 cylinders to the oversized piston outside diameter.
- Replace all the piston rings with ones to match the oversized pistons.

1. **KEEP OVERSIZED PISTONS**

Oversized piston diameter:

3B

O/S 0.50	102.300 — 102.330 mm (4.0276 — 4.0287 in.)
O/S 0.75	102.550 — 102.580 mm (4.0372 — 4.0386 in.)
O/S 1.00	102.800 — 102.830 mm (4.0472 — 4.0484 in.)

14B

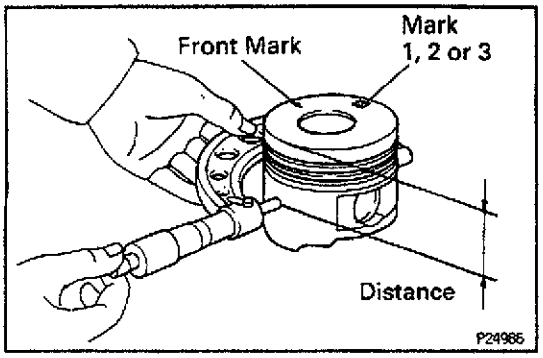
O/S 0.50	102.260 — 102.290 mm (4.0260 — 4.0272 in.)
O/S 0.75	102.510 — 102.540 mm (4.0358 — 4.0370 in.)
O/S 1.00	102.760 — 102.790 mm (4.0457 — 4.0468 in.)

15B—F

O/S 0.50	108.330 — 108.360 mm (4.2650 — 4.2661 in.)
O/S 0.75	108.580 — 108.610 mm (4.2748 — 4.2760 in.)
O/S 1.00	108.830 — 108.860 mm (4.2846 — 4.2858 in.)

15B—FT

O/S 0.50	108.320 — 108.350 mm (4.2646 — 4.2657 in.)
O/S 0.75	108.570 — 108.600 mm (4.2744 — 4.2756 in.)
O/S 1.00	108.820 — 108.850 mm (4.2843 — 4.2854 in.)



2. CALCULATE AMOUNT TO BORE CYLINDERS

(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, the indicated distance from the piston head.

Distance:

3B	45.20 mm (1.7795 in.)
14B	42.83 mm (1.6862 in.)
15B–F, 15B–FT	50.55 mm (1.9902 in.)

(b) Calculate the amount each cylinder is to be rebored as follows:

Size to be rebored = P + C − H

P = Piston diameter

C = Piston clearance

3B	0.190 – 0.210 mm (0.0057 – 0.0065 in.)
14B	0.230 – 0.250 mm (0.0091 – 0.0098 in.)
15B–F	0.160 – 0.180 mm (0.0063 – 0.0071 in.)
15B–FT	0.170 – 0.190 mm (0.0067 – 0.0075 in.)

H = Allowance for honing

0.02 mm (0.0008 in.) or less

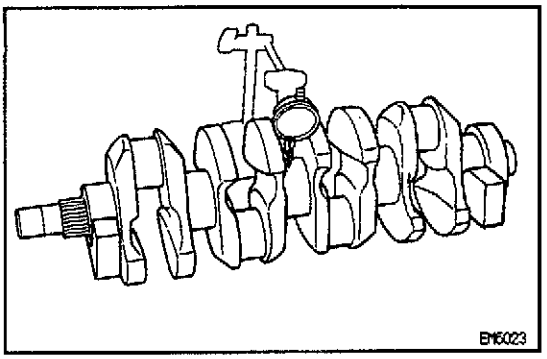
3. BORE AND HONE CYLINDER TO CALCULATED DIMENSIONS

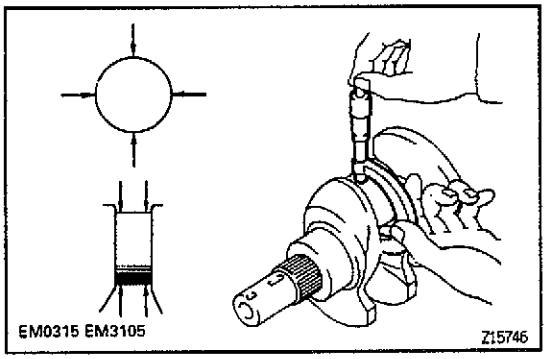
Maximum honing:

0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.

EG





CRANKSHAFT INSPECTION AND REPAIR

1. INSPECT CRANKSHAFT FOR RUNOUT

(a) Place the crankshaft on V–blocks.

(b) 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.

2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter:

STD	No.3	69.950 – 69.970 mm (2.7539 – 2.7547 in.)
	Others	69.980 – 70.000 mm (2.7551 – 2.7559 in.)
U/S 0.25	No.3	69.710 – 69.720 mm (2.7445 – 2.7449 in.)
	Others	69.740 – 69.750 mm (2.7457 – 2.7461 in.)
U/S 0.50	No.3	69.460 – 69.470 mm (2.7346 – 2.7350 in.)
	Others	69.490 – 69.500 mm (2.7358 – 2.7362 in.)
U/S 1.00	No.3	68.960 – 68.970 mm (2.7150 – 2.7153 in.)
	Others	68.990 – 69.000 mm (2.7161 – 2.7165 in.)

Crank pin diameter:

STD	60.980 – 61.000 mm (2.4008 – 2.4016 in.)
U/S 0.25	60.740 – 60.750 mm (2.3913 – 2.3917 in.)
U/S 0.50	60.490 – 60.500 mm (2.3815 – 2.3819 in.)
U/S 1.00	59.990 – 60.000 mm (2.3618 – 2.3622 in.)

If the diameter is not as specified, check the oil clearance. (See steps 6 and 9 in cylinder block assembly) If necessary, grind or replace the crankshaft.

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

Maximum taper and out–of–round:

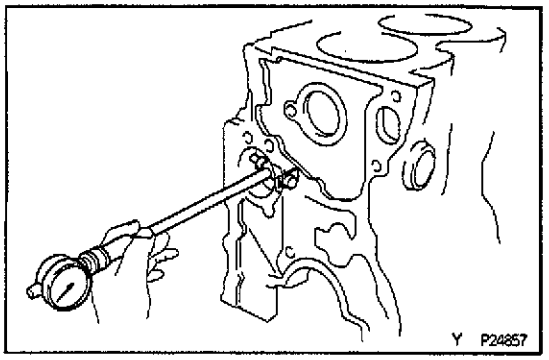
0.020 mm (0.0008 in.)

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

3. 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 (See procedure in step 2).

Install new main journal and/or crankshaft pin undersized bearing.



CAMSHAFT BEARINGS AND CAMSHAFT INSPECTION AND REPAIR

EG0ZU-01

1. INSPECT CAMSHAFT OIL CLEARANCE

(a) Using a cylinder gauge, measure the inside diameter of the camshaft bearing.

Bearing inside diameter (from front side):

No.1	53.500 – 53.525 mm (2.1063 – 2.1073 in.)
No.2	53.250 – 53.275 mm (2.0965 – 2.0974 in.)
No.3	53.000 – 53.025 mm (2.0866 – 2.0876 in.)
No.4	52.750 – 52.775 mm (2.0768 – 2.0778 in.)
No.5	52.500 – 52.525 mm (2.0669 – 2.0679 in.)

(b) Subtract the journal diameter measurement (See step 1 in timing gears and camshaft inspection) from the bearing inside diameter measurement.

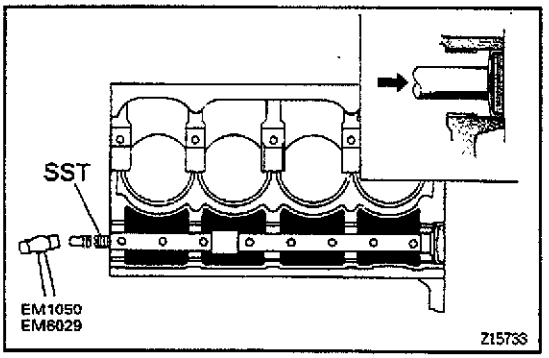
Standard oil clearance:

0.025 – 0.066 mm (0.0010 – 0.0026 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

If the clearance is greater than maximum, replace the camshaft bearings. If necessary, replace the camshaft.

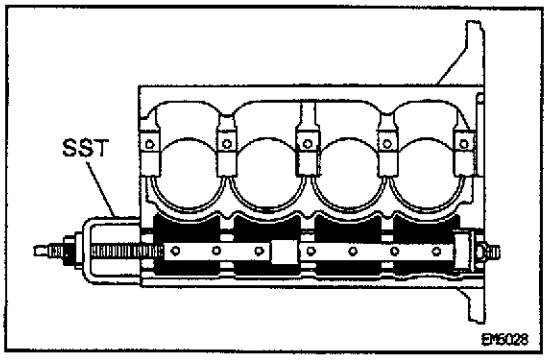


2. IF NECESSARY, REPLACE CAMSHAFT BEARINGS

A. Remove expansion plug

Using SST and a hammer, tap out the expansion plug.

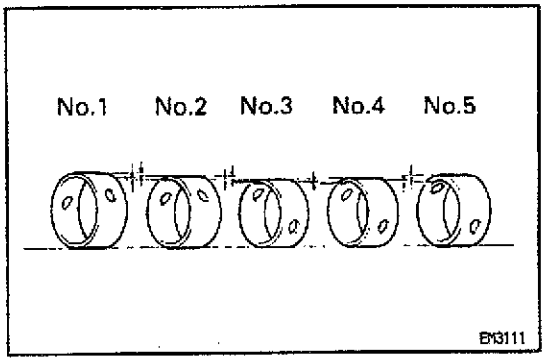
SST 09215–00101 (09215–00130, 09215–00150, 09215–00211)



B. Remove camshaft bearings

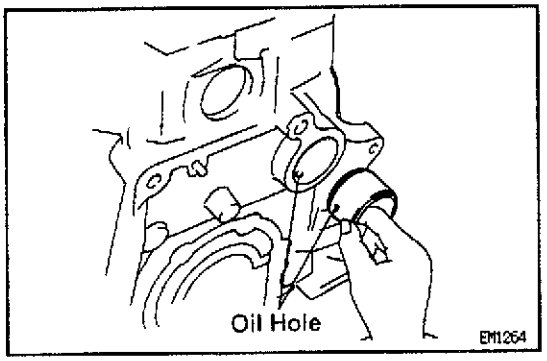
Using SST, remove the camshaft bearings.

SST 09215–00013 (09215–00021, 09215–00471), 09215–00101 (09215–00130, 09215–00141, 09215–00150, 09215–00161)

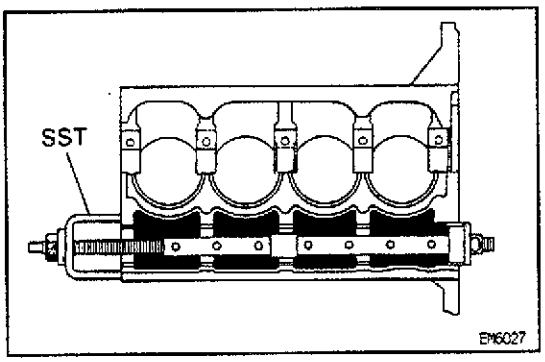


C. **Install new camshaft bearings.**

(a) Install new bearings in their proper location.



(b) Align the oil holes of the bearing and cylinder block.

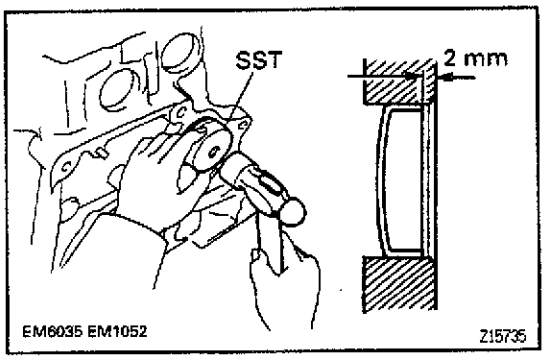


(c) Using SST, install the camshaft bearings.
SST 09215–00013 (09215–00021, 09215–00441, 09215–00471), 09215–00101 (09215–00130, 09215–00414, 09215–00150, 09215–00161)

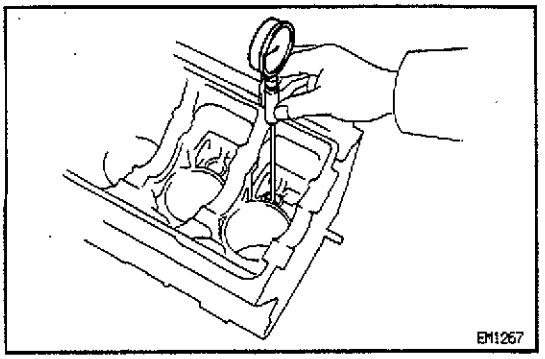
D. **Check camshaft oil clearance (See step 1 above)**

E. **Install expansion plug**

(a) Apply liquid sealer to the expansion plug surface of the cylinder block.



(b) Using SST and a hammer, drive in the expansion plug to a distance of 2 mm (0.08 in.) from the cylinder block edge.
SST 09215–00013 (09215–00471)



VALVE LIFTER AND VALVE LIFTER BORE INSPECTION

INSPECT VALVE LIFTER OIL CLEARANCE

(a) Using a cylinder gauge, measure the valve lifter bore diameter.

Bore diameter:

27.010 – 27.030 mm (1.0634 – 1.0642 in.)

(b) Using a micrometer, measure the valve lifter diameter.

Lifter diameter:

26.955 – 26.975 mm (1.0612 – 1.0620 in.)

(c) Subtract the valve lifter diameter measurement from the valve lifter bore diameter measurement.

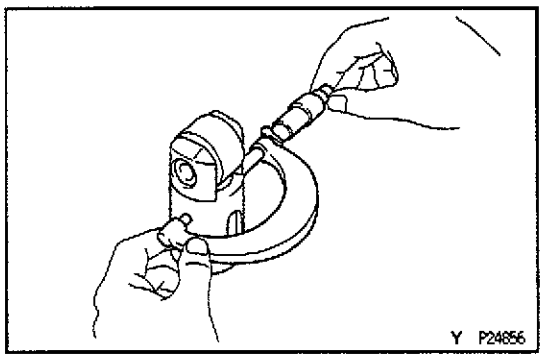
Standard oil clearance:

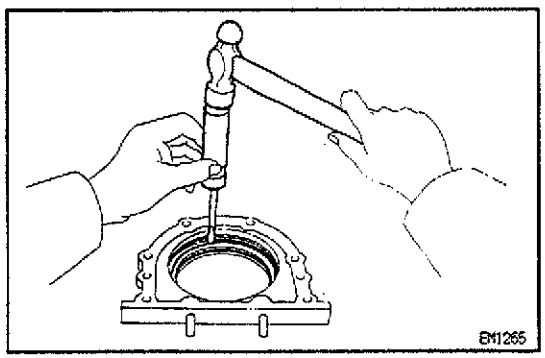
0.035 – 0.075 mm (0.0014 – 0.0030 in.)

Maximum oil clearance:

0.10 mm (0.0039 in.)

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





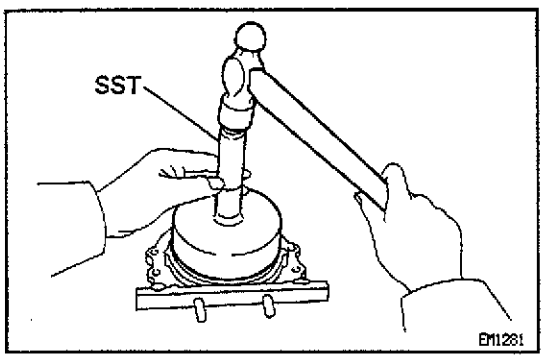
CRANKSHAFT OIL SEAL REPLACEMENT

HINT: There are 2 methods (A and B) to replace the oil seal which are as follows:

REPLACE CRANKSHAFT REAR OIL SEAL

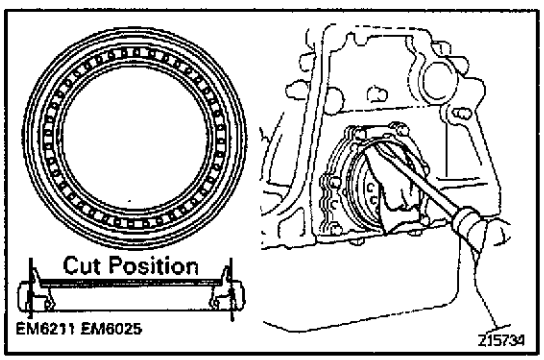
A. If rear oil seal retainer is removed from cylinder block:

(a) Using a screwdriver and hammer, tap out the oil seal.



(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223–56010

(c) Apply MP grease to the oil seal lip.

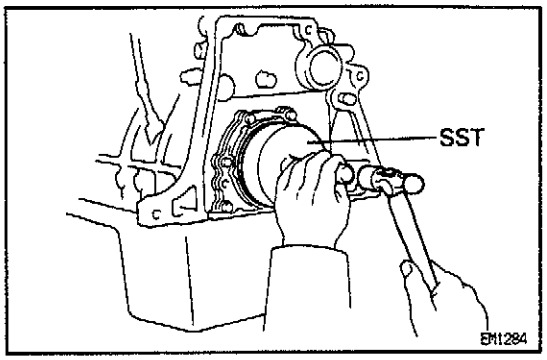


B. If rear oil seal retainer is installed to cylinder block:

(a) Using a knife, cut off the oil seal lip.

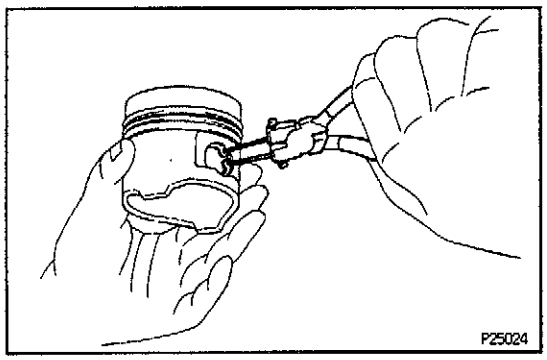
(b) Using a screwdriver, pry out the oil seal.

NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



(c) Apply MP grease to a new oil seal lip.
(d) Using SST and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.
SST 09223—56010

EG

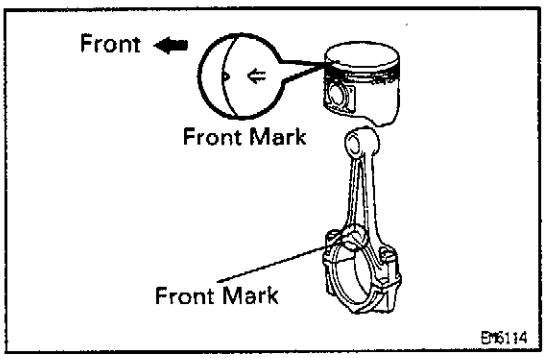


PISTON AND CONNECTING ROD ASSEMBLY

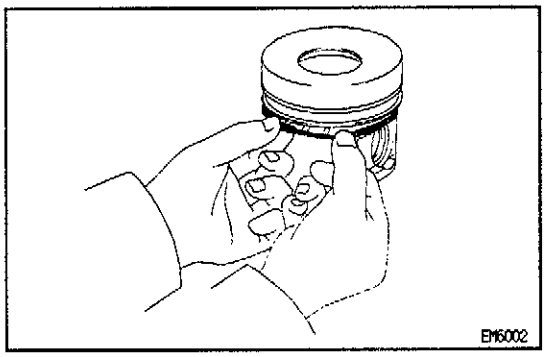
E0482W—01

1. ASSEMBLE PISTON AND CONNECTING ROD

(a) Install a new snap ring on one side of the piston pin hole.

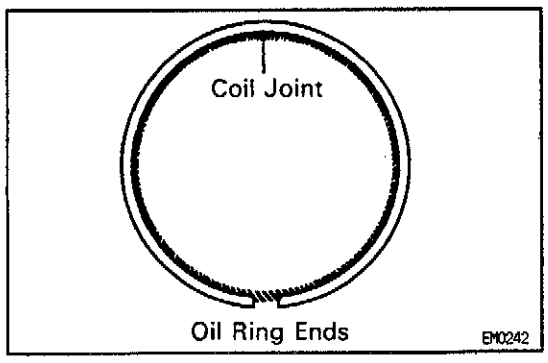


(b) Gradually heat the piston to 60°C (140°F).
(c) Coat the piston pin with engine oil.
(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.
(e) Install a new snap ring on the other side of the piston pin hole.

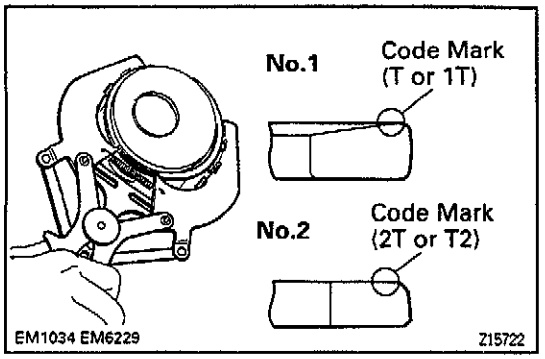


2. INSTALL PISTON RINGS

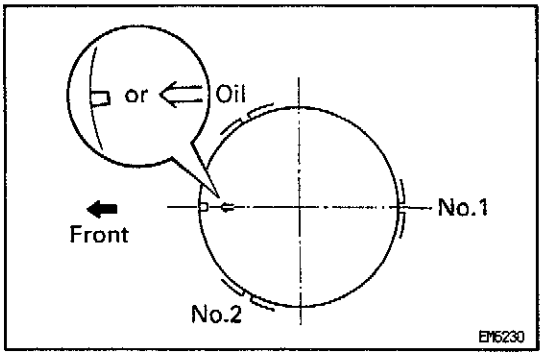
(a) Install the coil by hand.
(b) Install a piston ring expander, install the oil ring.



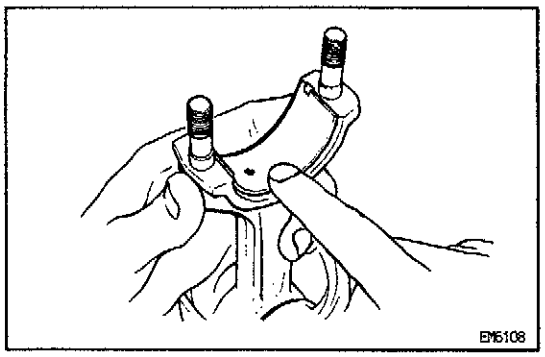
HINT: Face the end gap of the oil ring in the opposite direction of coil joint.



(c) Using a piston ring expander, install the No.1 and No. 2 piston rings with the code mark facing upward.
Code mark:
No.1
T (3B, 14B) or 1T (15B—F, 15B—FT)
No.2
2T (3B) or T2 (14B, 15B—F, 15B—FT)



(d) Position the piston rings so that the ring ends are as shown.
NOTICE: Do not align the ring ends.



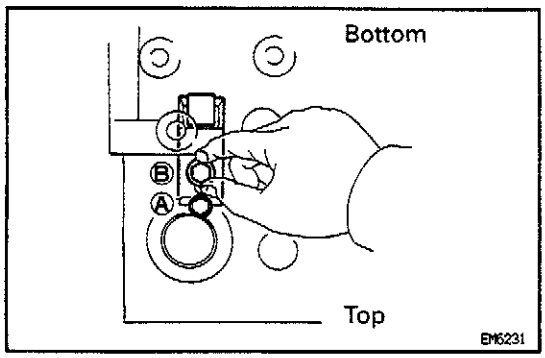
3. INSTALL CONNECTING ROD BEARINGS

(a) Align the bearing claw with the groove of the connecting rod or connecting rod cap.
(b) Install the bearings in the connecting rod and connecting rod cap.

CYLINDER BLOCK ASSEMBLY

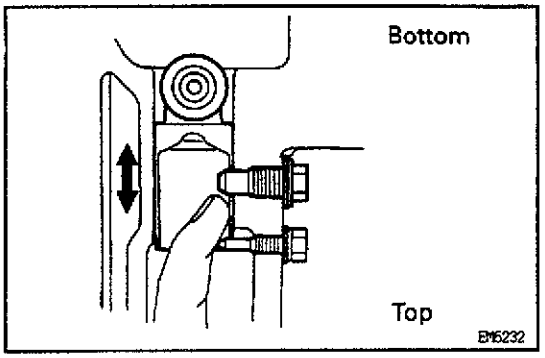
EM62X-01

HINT:
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.



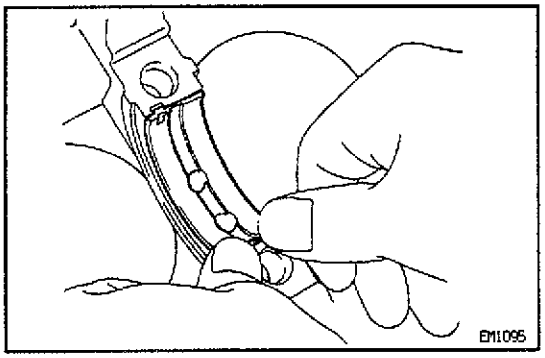
1. INSTALL VALVE LIFTERS

(a) Install bolt Ⓐ to the cylinder block with a new gasket.
Torque: 7.5 N·m (76 kgf·cm, 66 in.·lbf)
(b) Install the valve lifter so that the tip of bolt Ⓐ fits in the groove.
(c) Install bolt Ⓑ with a new gasket by hand, check that its tip is inside the long hole.

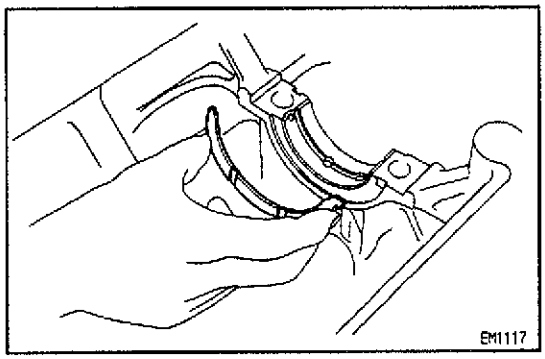


(d) Torque bolt Ⓑ.
Torque: 37 N·m (375 kgf·cm, 28 ft·lbf)
HINT: Check that the valve lifter moves smoothly up and down.

2. 15B—F, 15B—FT:
INSTALL OIL NOZZLES AND CHECK VALVES
(See step 1 in oil nozzles and check valves installation in Lubrication System)

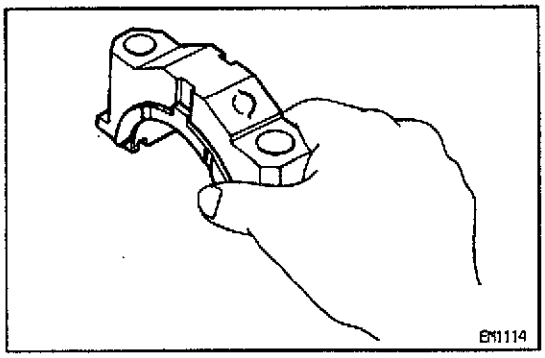


3. INSTALL MAIN BEARINGS
HINT: Upper bearings have an oil groove and oil hole; lower bearings do not.
(a) Align the bearing claw with the claw groove of the cylinder block, and push in the 5 upper bearings.
(b) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

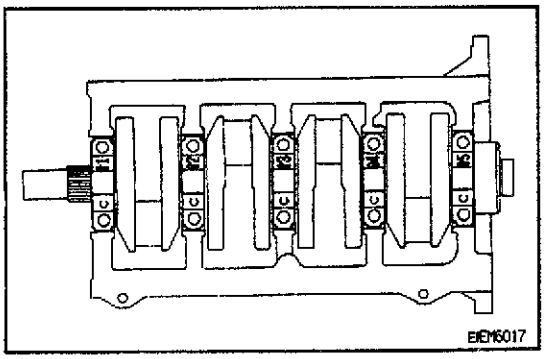


4. INSTALL UPPER THRUST WASHERS
Install the 2 thrust washers under the No.3 journal position of the cylinder block with the oil grooves facing outward.

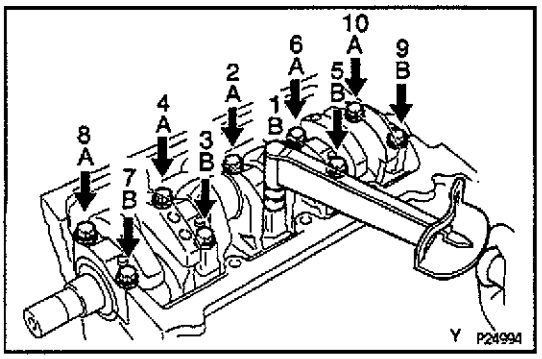
5. PLACE CRANKSHAFT ON CYLINDER BLOCK



6. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS
(a) Install the 2 lower thrust washers on the No.3 main bearing cap with the grooves facing outward.



(b) Install the 5 main bearing caps in their proper locations.



(c) Apply a light coat of the engine oil on the threads and under the bolt heads of the main bearing caps.

(d) Install and uniformly tighten the 10 bolts of the main bearing caps, in several passes, in the sequence shown.

Torque: 200 N·m (2,039 kgf·cm, 148 ft·lbf)

HINT: Each bolt length is indication in the illustration.

Bolt length:

A 129.5 mm (5.098 in.)

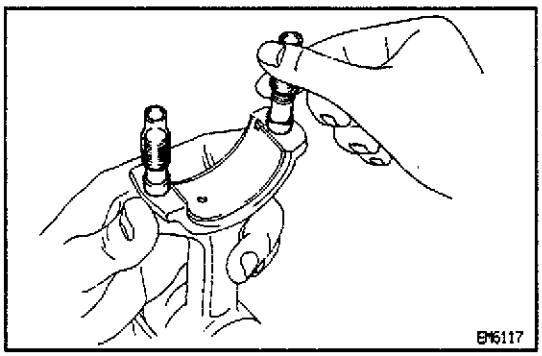
B 93.5 mm (3.681 in.)

(e) Check that the crankshaft turns smoothly.

7. CHECK CRANKSHAFT THRUST CLEARANCE

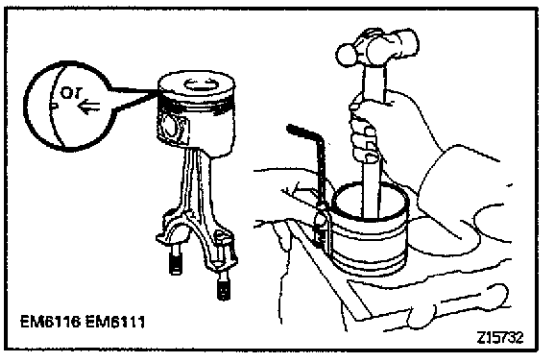
(See step 5 in cylinder block disassembly)

EG

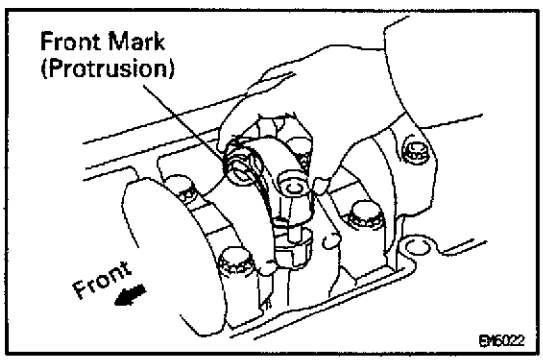


8. INSTALLATION PISTON AND CONNECTING ROD ASSEMBLIES

(a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft and cylinder bore from damage.



(b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assembly into the cylinder with the front mark of the piston facing forward.

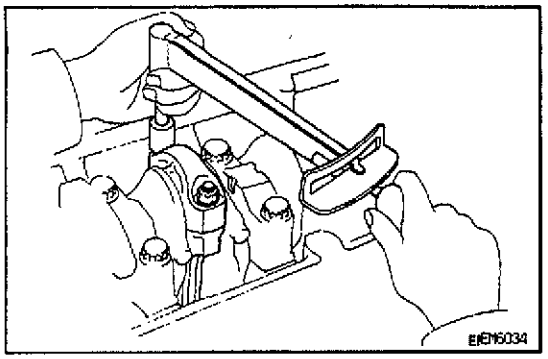


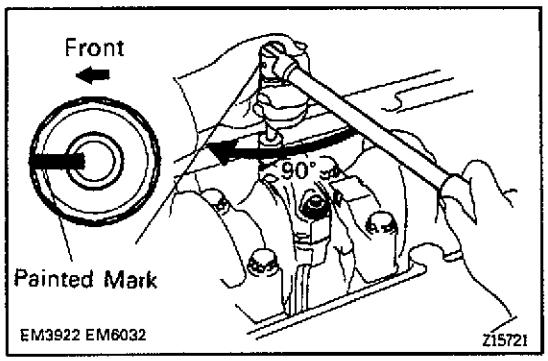
9. INSTALL CONNECTING ROD CAPS

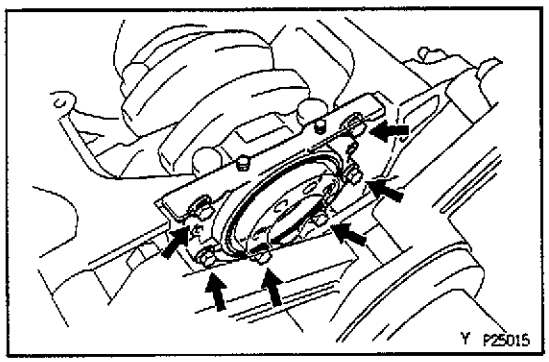
A. Place connecting rod cap on connecting rod

(a) Match the numbered connecting rod cap with the connecting rod.

(b) Install the connecting rod cap with the front mark facing forward.







B. Install connecting rod cap nuts

HINT:

- The connecting rod cap nuts are tightened in 2 progressive steps (steps (b) and (d)).
- If any connecting rod bolt is broken or deformed, replace it.

(a) Apply a light of engine oil on the threads and under the heads of the connecting rod cap bolts and nuts.

(b) Install and alternately tighten the nuts of the connecting rod cap in several passes.

Torque: 68.6 N·m (700 kgf·cm, 51 ft·lbf)

If any one of the connecting rod cap nuts does not meet the torque specification, replace the cap nuts.

(c) Mark the front of the connecting rod cap nuts with paint.

(d) Retighten the connecting rod cap nuts 90° as shown.

(e) Check that the painted mark is now at a 90° angle to the front.

(f) Check that the crankshaft turns smoothly.

10. CHECK CONNECTING ROD THRUST CLEARANCE
(See step 2 in cylinder block disassembly)

11. INSTALL REAR OIL SEAL RETAINER

Install a new gasket and the retainer with the 6 bolts.

Torque: 18.5 N·m (189 kgf·cm, 14 ft·lbf)

AFTER ASSEMBLY

1. INSTALL ENGINE MOUNTING BRACKETS
Torque: 44 N·m (449 kgf·cm, 32 ft·lbf)

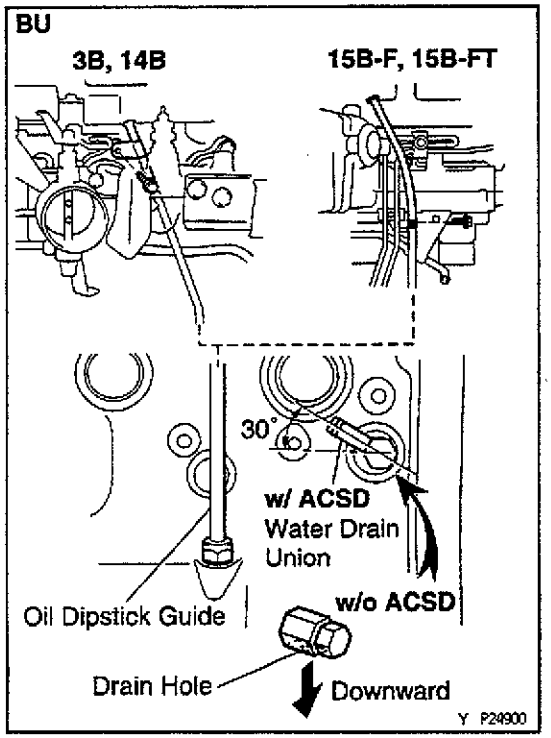
2. 3B, 14B:
INSTALL OIL NOZZLES AND CHECK VALVE
(See steps 1 and 2 in oil nozzles and check valve in Lubrication System)

3. INSTALL OIL NOZZLE FOR TIMING GEARS
(See step 4 (d) in timing gears and camshaft installation)
Torque: 13 N·m (133 kgf·cm, 10 ft·lbf)

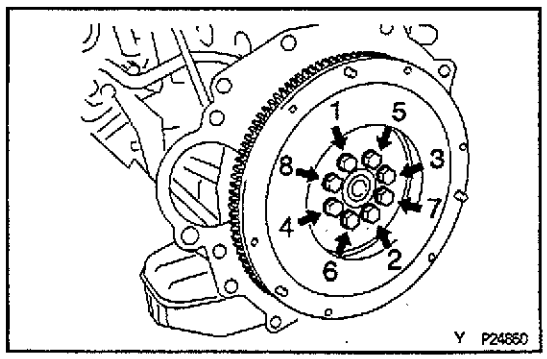
4. INSTALL OIL PRESSURE SWITCH
(See step 8 in oil pressure check in Lubrication System)

5. INSTALL OIL COOLER AND OIL FILTER ASSEMBLIES
(See oil cooler installation in Lubrication System)

6. **INSTALL TIMING GEAR CASE (OIL PUMP), OIL STRAINER AND OIL PAN**
(See oil pump installation in Lubrication System)
7. **INSTALL INJECTION PUMP AND STAY**
(See injection pump installation in Fuel System)
8. **INSTALL TIMING GEARS AND CAMSHAFT**
(See timing gears and camshaft installation)
9. **INSTALL CYLINDER HEAD**
(See cylinder head installation)



10. **BU:**
INSTALL OIL DIPSTICK GUIDE AND OIL DIPSTICK
(a) Pull in the dipstick guide end into the guide hole of the cylinder block.
(b) Install the bolt as shown.
(c) Install the dipstick.
11. **INSTALL WATER DRAIN UNION**
(a) Apply seal packing to 2 or 3 threads.
Seal packing:
Part No. 08826—00100 or equivalent
(b) Install the drain union.
Torque: 70 N·m (714 kgf·cm, 52 ft·lbf)
HINT: After applying the specified torque, rotate the drain union clockwise until its drain hole is facing downward.
12. **INSTALL WATER PUMP**
(See water pump installation in Cooling System)
13. **INSTALL ALTERNATOR BRACKET AND ALTERNATOR**
(a) Apply a light of engine oil on the threads and under the heads of the alternator bracket bolts and pivot bolt.
(b) Install the alternator bracket with the 3 bolts.
Torque: 98 N·m (1,000 kgf·cm, 72 ft·lbf)
(c) Install the alternator with the pivot bolt.
14. **DISCONNECT ENGINE FROM ENGINE STAND**
15. **INSTALL REAR END PLATE**
w/ 11 inch flywheel:
Install the rear end plate with the bolt.
Torque: 18.5 N·m (189 kgf·cm, 14 ft·lbf)



16. **w/ 12 INCH FLYWHEEL:**
INSTALL FLYWHEEL HOUSING
17. **INSTALL FLYWHEEL**
(a) Install the flywheel on the crankshaft.
(b) Apply a light of engine oil on the threads and under the heads of the flywheel bolts.
(c) Install and uniformly tighten the bolts, in several passes, in the sequence shown.
Torque: 160 N·m (1,630 kgf·cm, 118 ft·lbf)