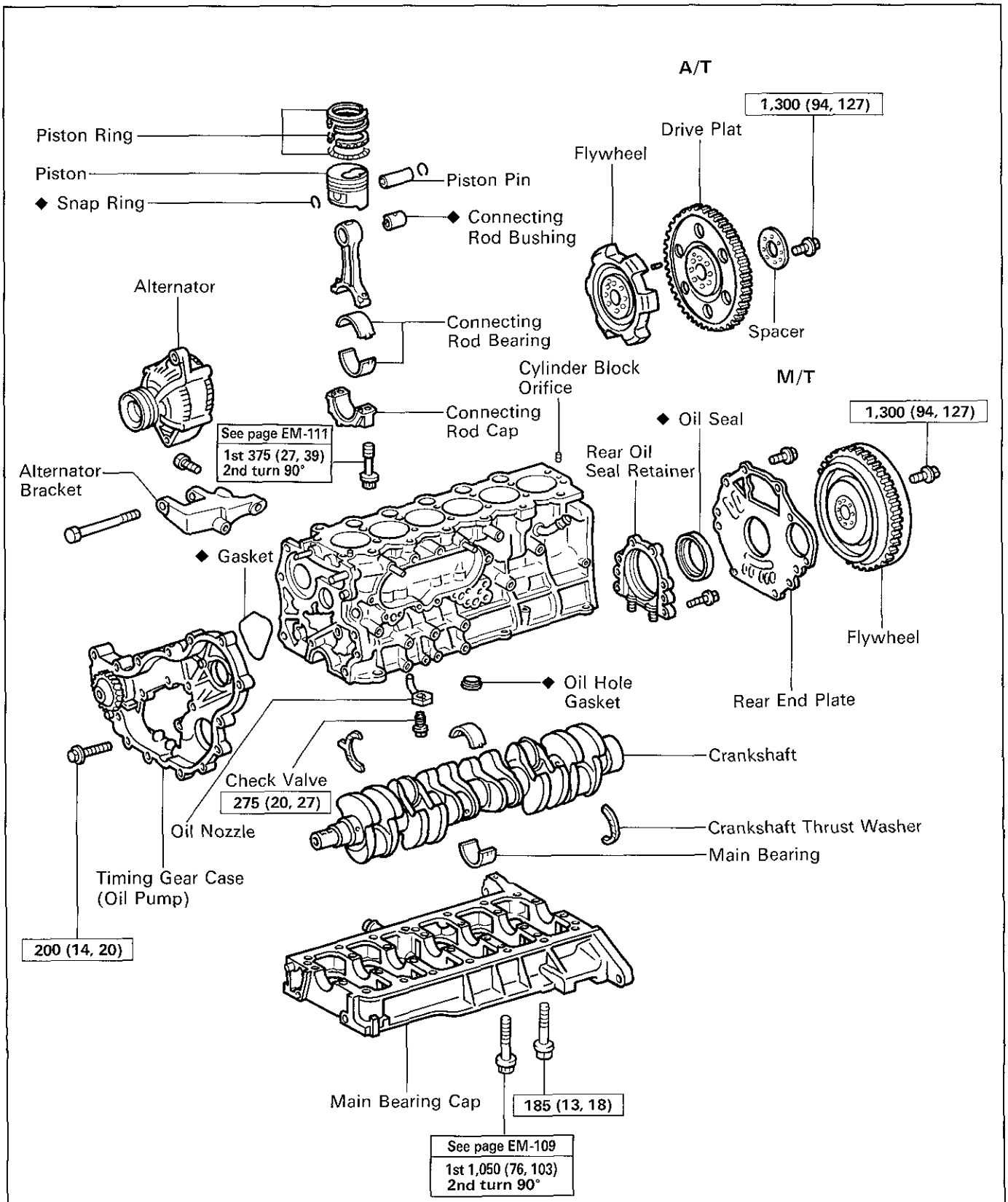
CYLINDER BLOCK

COMPONENTS



kg-cm (ft-lb, N·m) : Specified torque

◆ Non-reusable part

EM8499

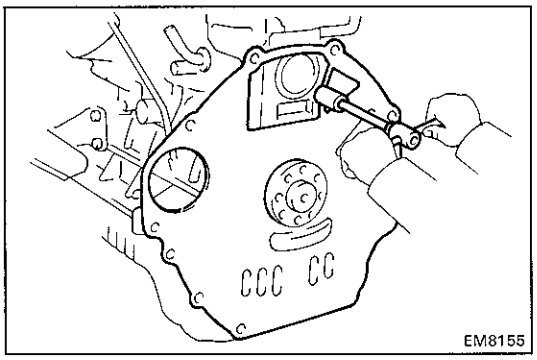
PREPARATION FOR DISASSEMBLY

1. (M/T)
   REMOVE CLUTCH COVER AND DISC

2. (M/T)
   REMOVE FLYWHEEL

3. (A/T)
   REMOVE DRIVE PLATE AND FLYWHEEL

   Remove the drive plate rear spacer, drive plate and flywheel.



4. REMOVE REAR END PLATE

   Remove the bolt, end plate and dust cover.

5. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY

6. REMOVE TIMING BELT AND PULLEYS
   (See page EM-33)

7. REMOVE CYLINDER HEAD (See page EM-55)

8. REMOVE WATER PUMP (See page CO-6)

9. REMOVE ALTERNATOR

10. REMOVE TIMING GEARS (See page EM-43)

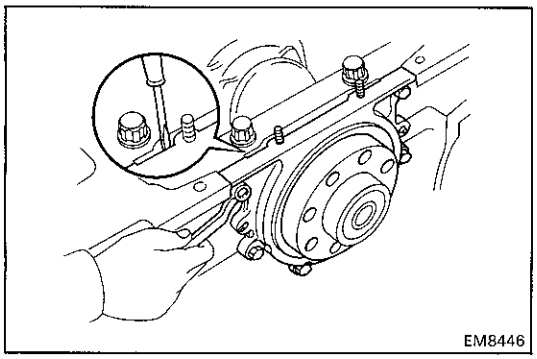
11. REMOVE INJECTION PUMP (See page FU-27)

12. REMOVE OIL PAN AND TIMING GEAR CASE (OIL PUMP)
    (See page LU-8)

13. REMOVE OIL COOLER (See page LU-14)

14. REMOVE WATER INLET AND THERMOSTAT

15. REMOVE ENGINE MOUNTING

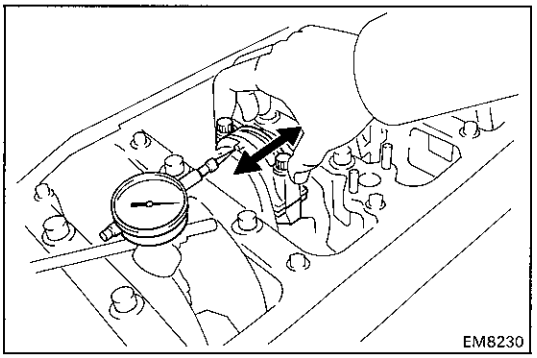


DISASSEMBLY OF CYLINDER BLOCK

(See page EM-84)

1. REMOVE REAR OIL SEAL RETAINER

Remove the six bolts and retainer.



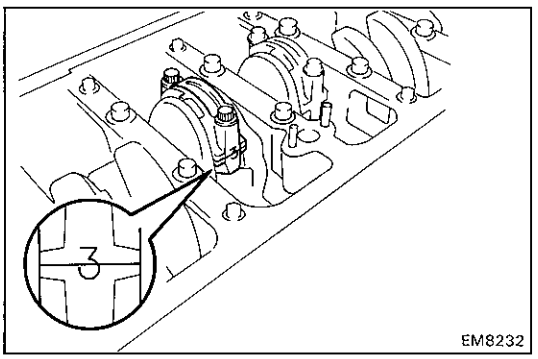
2. CHECK CONNECTING ROD THRUST CLEARANCE

Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.

Standard thrust clearance: **0.10 – 0.20 mm (0.0038 – 0.0079 in.)**

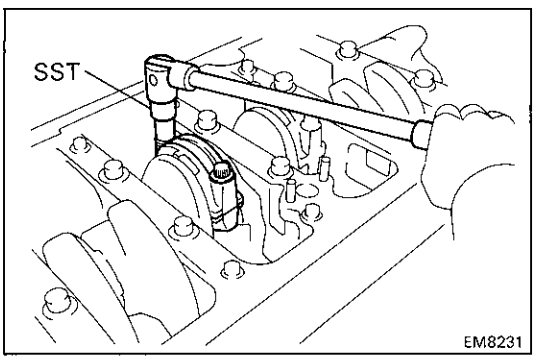
Maximum thrust clearance: **0.30 mm (0.0118 in.)**

If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.



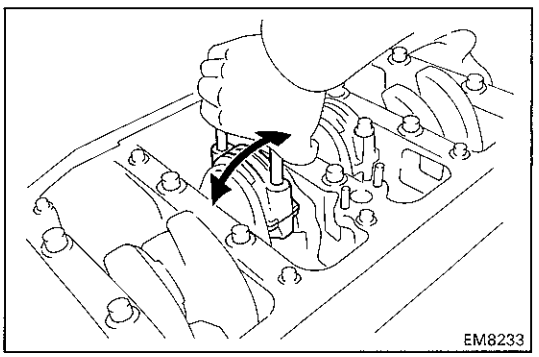
3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

(a) Using paint, place the matchmarks on the connecting rod and cap to ensure correct reassembly.



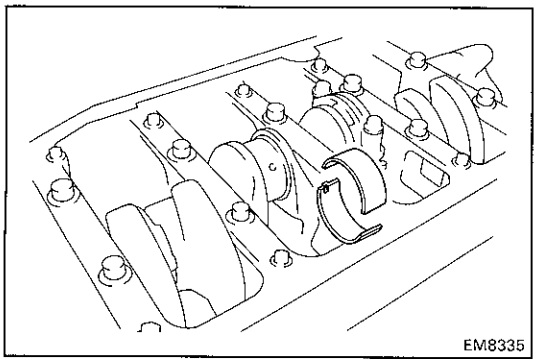
(b) Using SST, remove the connecting rod cap bolts.

SST 09011-38121



(c) Using the removed connecting rod cap bolts, pry the connecting rod cap back and forth, and remove the connecting cap.

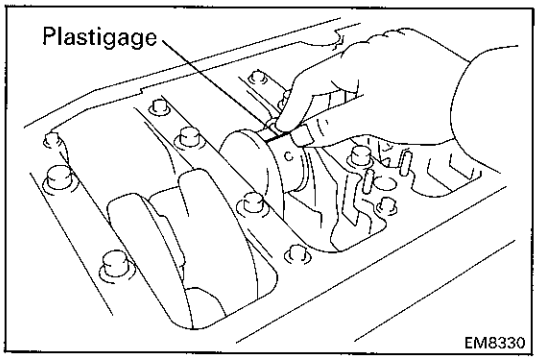
HINT: Keep the lower bearing inserted with the connecting rod cap.



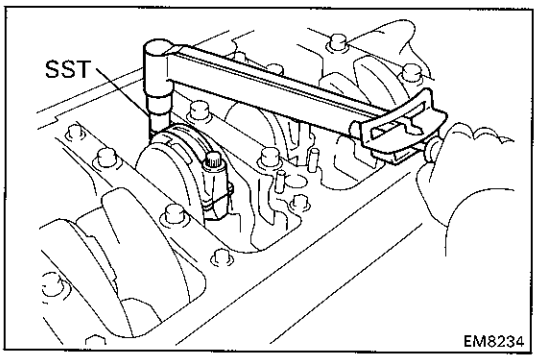
(d) Clean crank pin and bearing.

(e) 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.



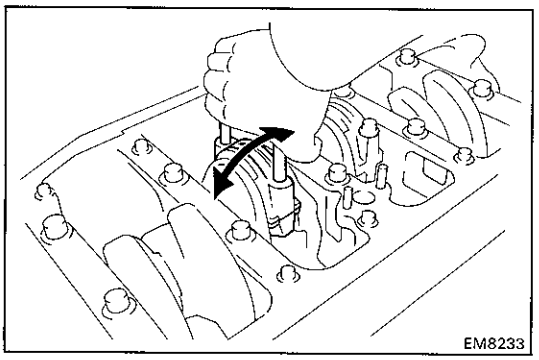
(f) Lay a strip of Plastigage across the crank pin.



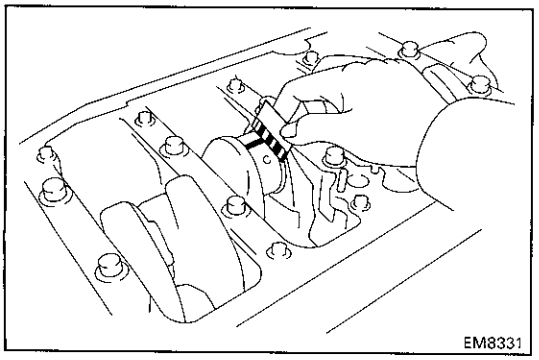
(g) Install the connecting rod cap.
(See step 8 on page EM-111)

Torque: 1st 375 kg-cm (27 ft-lb, 37 N·m)
2nd turn 90°

HINT: Do not turn the crankshaft.



(h) Remove the connecting rod cap.
(See procedure (b) and (c) above)

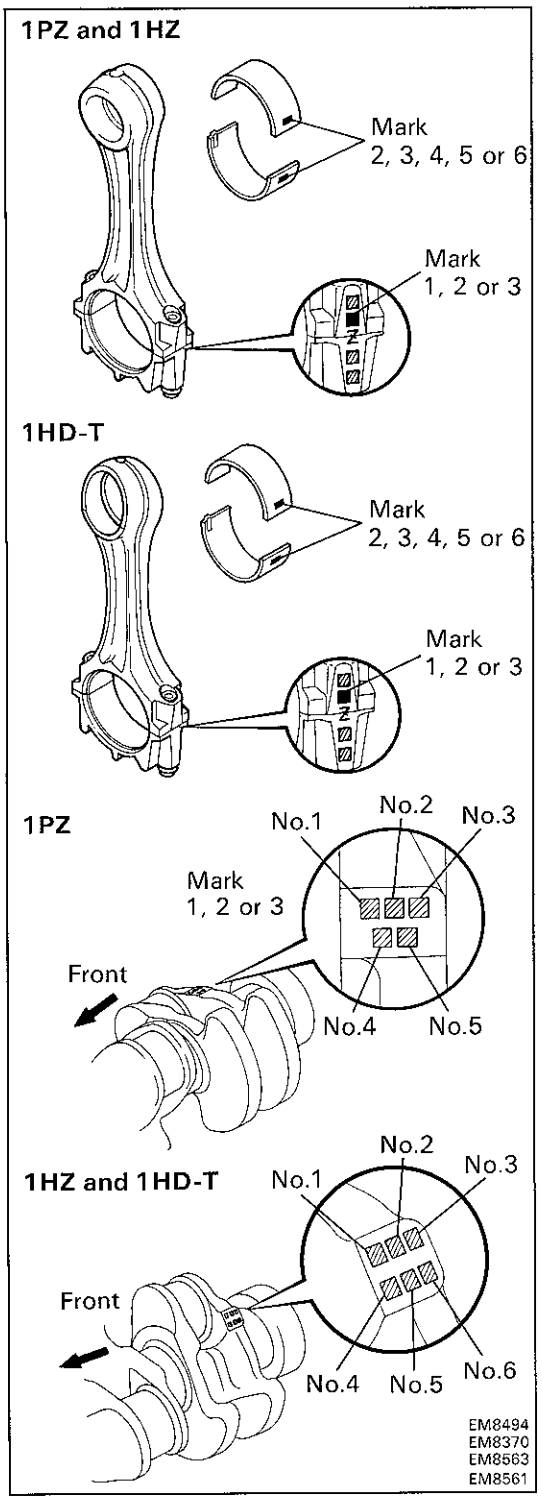


(i) Measure the Plastigage at widest point.

Standard oil clearance:
STD 0.036 – 0.054 mm
(0.0014 – 0.0021 in.)
U/S 0.25 and U/S 0.50
0.037 – 0.077 mm
(0.0015 – 0.0030 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: If using a standard bearing, replace with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers inprinted on the crankshaft and connecting rod, then selecting the bearing with the same number as the total. There are five sizes of standard bearings, marked "2", "3", "4", "5" and "6" accordingly.

	Number marked								
Connecting rod	1			2			3		
Crankshaft	1	2	3	1	2	3	1	2	3
Bearing	2	3	4	3	4	5	4	5	6

EXAMPLE: Connecting rod "2" + Crankshaft "1" = Total number (Use bearing "3")

(Reference)

Connecting rod big end inner diameter:

Mark "1" 62.014 – 62.020 mm (2.4415 – 2.4417 in.)
Mark "2" 62.020 – 62.026 mm (2.4417 – 2.4420 in.)
Mark "3" 62.026 – 62.032 mm (2.4420 – 2.4422 in.)

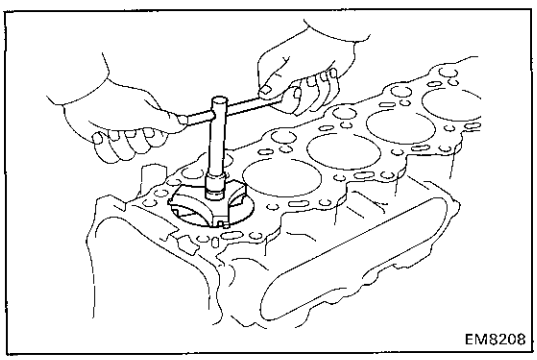
Crankshaft pin diameter:

Mark "1" 58.994 – 59.000 mm (2.3226 – 2.3228 in.)
Mark "2" 58.988 – 58.994 mm (2.3224 – 2.3226 in.)
Mark "3" 58.982 – 58.988 mm (2.3221 – 2.3224 in.)

Standard sized bearing center wall thickness:

Mark "2" 1.486 – 1.489 mm (0.0585 – 0.0586 in.)
Mark "3" 1.489 – 1.492 mm (0.0586 – 0.0587 in.)
Mark "4" 1.492 – 1.495 mm (0.0587 – 0.0589 in.)
Mark "5" 1.495 – 1.498 mm (0.0589 – 0.0590 in.)
Mark "6" 1.498 – 1.501 mm (0.0590 – 0.0591 in.)

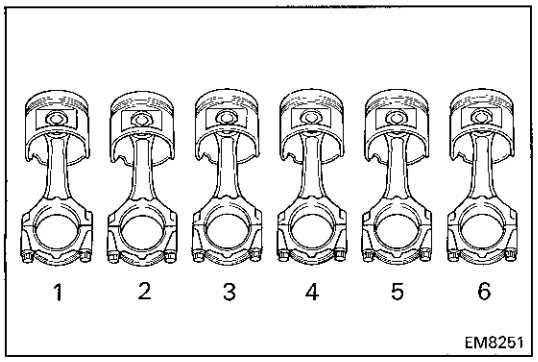
(j) Completely remove the Plastigage.



4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

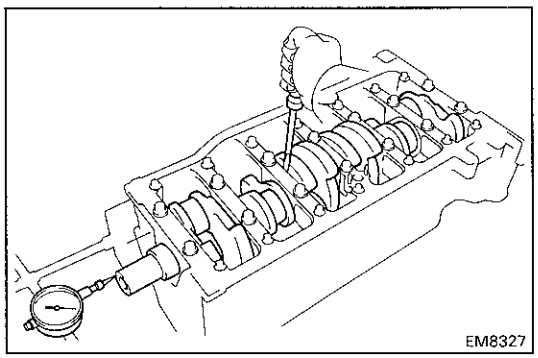
(a) Remove the all carbon from the top of the cylinder.

(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

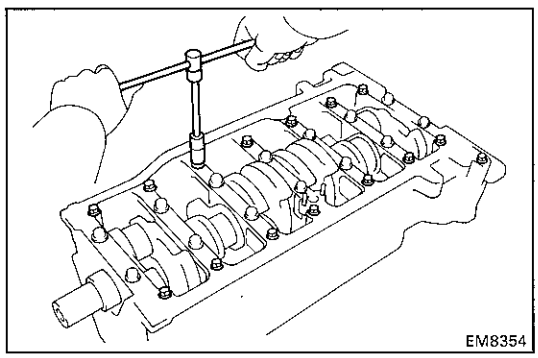
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance: **0.04 – 0.24 mm (0.0016 – 0.0094 in.)**

Maximum thrust clearance: **0.30 mm (0.0118 in.)**

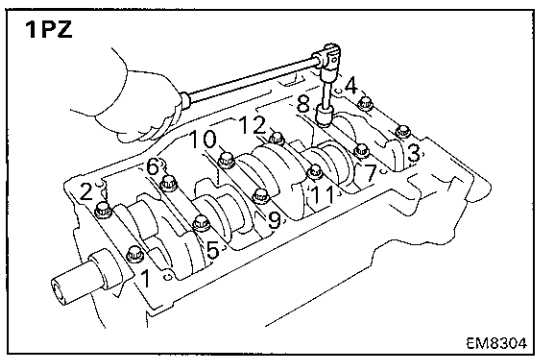
If the thrust clearance is greater than maximum, replace the thrust washers as a set.

Thrust washer thickness:
2.930 – 2.980 mm (0.1154 – 0.1173 in.)

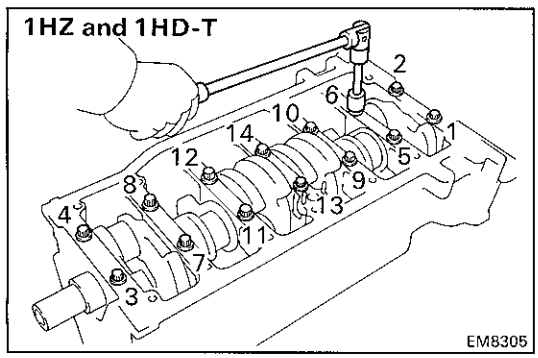


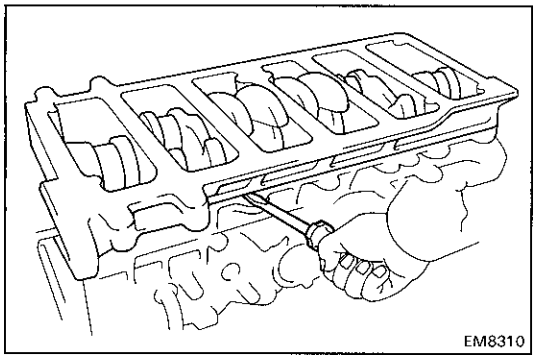
6. REMOVE MAIN BEARING CAP AND CHECK OIL CLEARANCE

(a) Remove the thirteen bolts (1PZ) or fifteen bolts (1HZ and 1HD-T).



(b) Uniformly loosen and remove the main bearing cap bolts in several passes in the sequence shown.

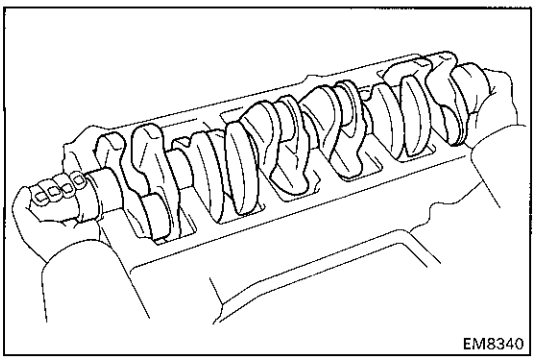




(c) Using a screwdriver, pry out the main bearing cap.

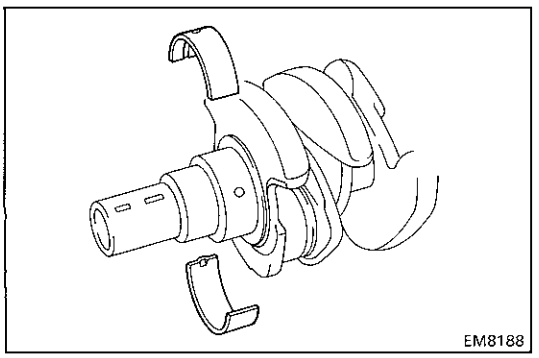
HINT: Keep the lower main bearings and main bearing cap together.

NOTICE: Do not scratch the surface which will be coated with FIPG.



(d) Lift out the crankshaft.

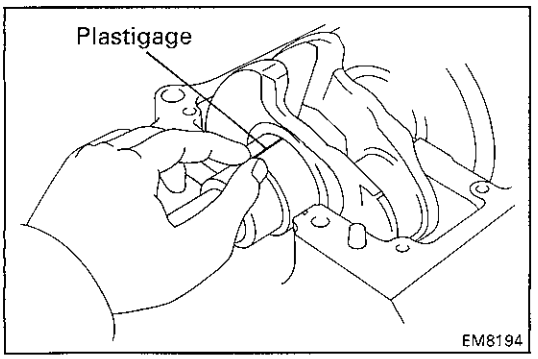
HINT: Keep the upper main bearings and thrust washers together with the cylinder block.



(e) Clean each main journal and bearing.

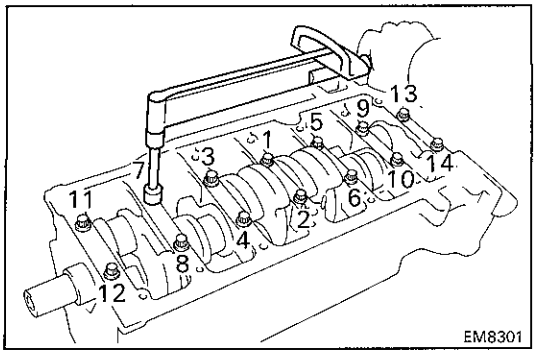
(f) Check each main journal and bearing for pitting and scratches.

If the journal or bearing are damaged, replace the bearings. If necessary, grind or replace the crankshaft.



(g) Place the crankshaft on the cylinder block.

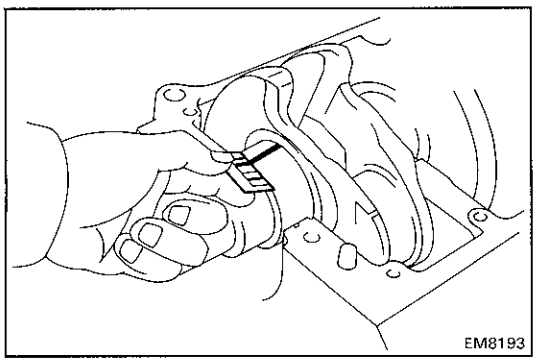
(h) Lay a strip of Plastigage across each journal.

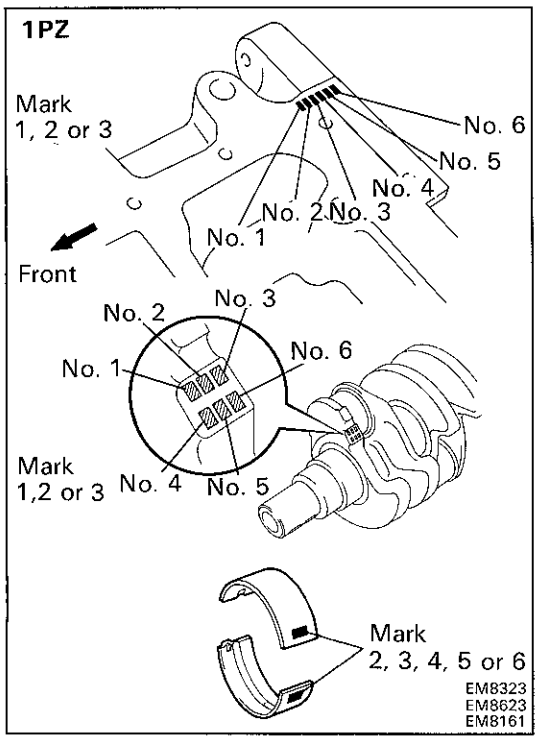


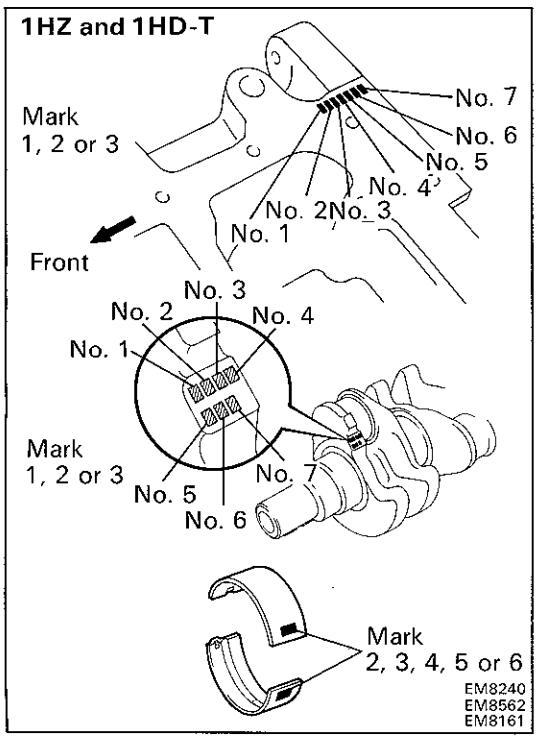
(i) Install the main bearing cap with the bearings. (See step 6 on page EM-109)

Torque: 1st 1,050 kg-cm (76 ft-lb, 103 N·m)
2nd turn 90°

HINT: Do not turn the crankshaft.







(j) Remove the main bearing cap bolts and cap.

(k) Measure the Plastigage at its widest point.

Standard clearance:

STD	**0.036 – 0.054 mm (0.0014 – 0.0021 in.)**
U/S 0.25 and U/S 0.50	**0.037 – 0.077 mm (0.0015 – 0.0030 in.)**
Maximum 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: If using a standard bearing, replace with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers inprinted on the main bearing cap and crankshaft, then selecting the bearing with the same number as the total. There are five sizes of standard bearings, marked "2", "3", "4", "5" and "6" accordingly.

	Number marked								
Main bearing cap	1			2			3		
Crankshaft	1	2	3	1	2	3	1	2	3
Bearing	2	3	4	3	4	5	4	5	6

EXAMPLE: Main bearing cap "2"" + Crankshaft "1" = Total number (Use bearing "3")

(Reference)

Cylinder block main journal bore diameter:

Mark "1"	**71.000 – 71.006 mm (2.7953 – 2.7955 in.)**
Mark "2"	**71.006 – 71.012 mm (2.7955 – 2.7957 in.)**
Mark "3"	**71.012 – 71.018 mm (2.7957 – 2.7960 in.)**

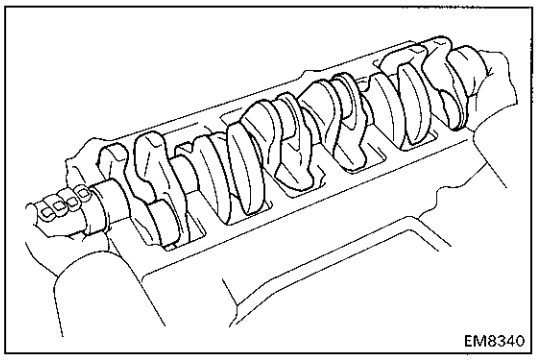
Crankshaft journal diameter:

Mark "1"	**66.994 – 67.000 mm (2.6376 – 2.6378 in.)**
Mark "2"	**66.988 – 66.994 mm (2.6373 – 2.6376 in.)**
Mark "3"	**66.982 – 66.988 mm (2.6371 – 2.6373 in.)**

(Reference) (Cont'd)
Standard sized bearing center wall thickness:

Mark "2"	**1.979 – 1.982 mm (0.0779 – 0.0780 in.)**
Mark "3"	**1.982 – 1.985 mm (0.0780 – 0.0781 in.)**
Mark "4"	**1.985 – 1.988 mm (0.0781 – 0.0783 in.)**
Mark "5"	**1.988 – 1.991 mm (0.0783 – 0.0784 in.)**
Mark "6"	**1.991 – 1.994 mm (0.0784 – 0.0785 in.)**

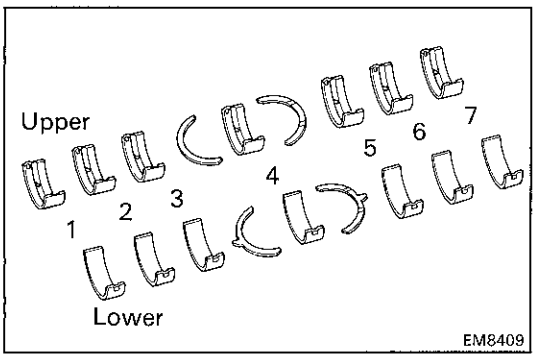
(l) Completely remove the Plastigage.


EM8340

7. REMOVE CRANKSHAFT

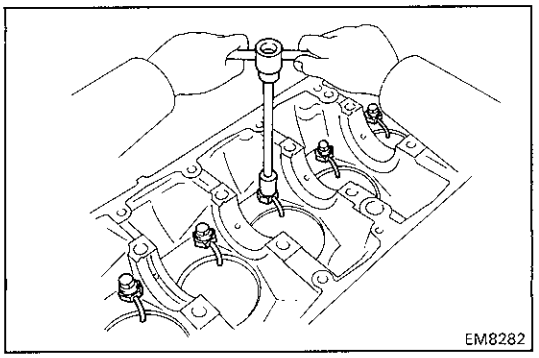
(a) Lift out the crankshaft.

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



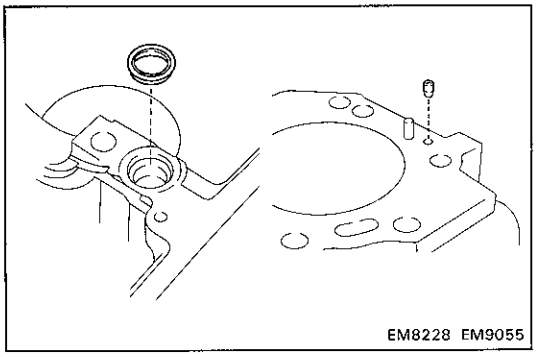
EM8409

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


EM8282

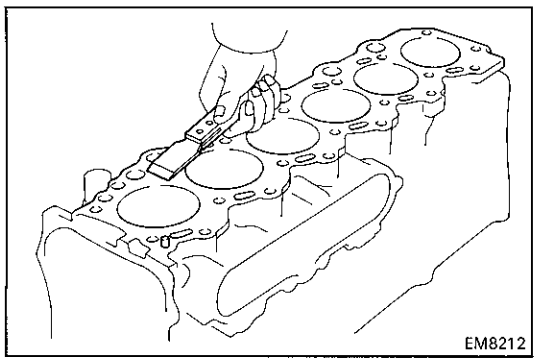
8. REMOVE CHECK VALVES AND OIL NOZZLES

Remove the five (1PZ) or six (1HZ and 1HD-T) check valves and oil nozzles.


EM8228 EM9055

9. REMOVE CYLINDER BLOCK OIL HOLE GASKET

10. REMOVE CYLINDER BLOCK ORIFICE



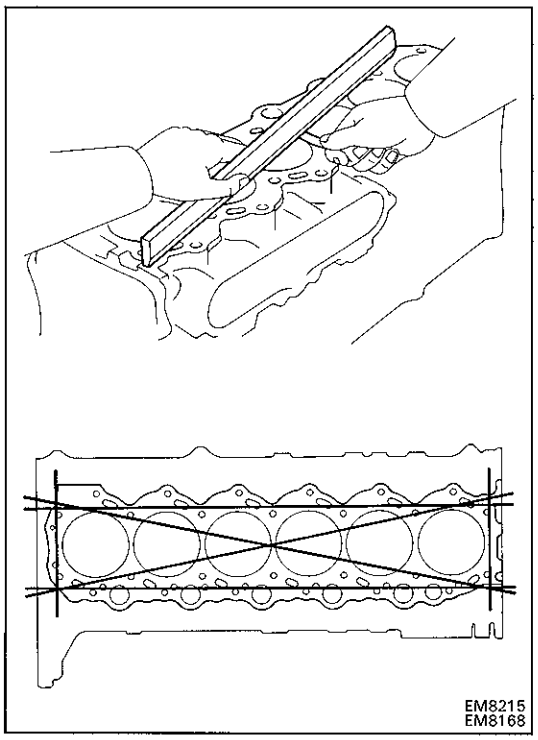
INSPECTION OF CYLINDER BLOCK

1. REMOVE GASKET MATERIAL

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

2. CLEAN CYLINDER BLOCK

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

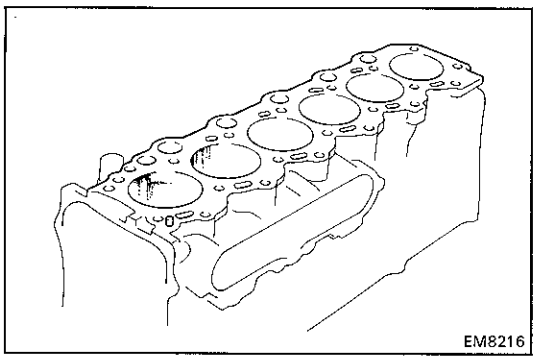


3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.20 mm (0.0079 in.)

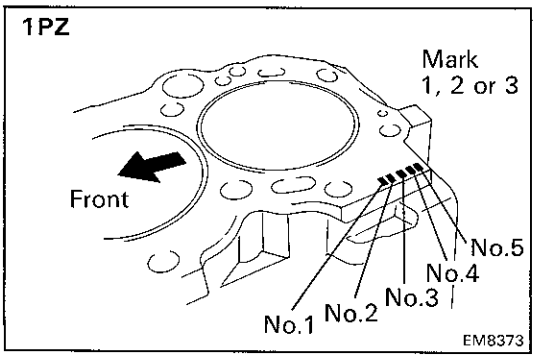
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDER FOR VERTICAL SCRATCHES

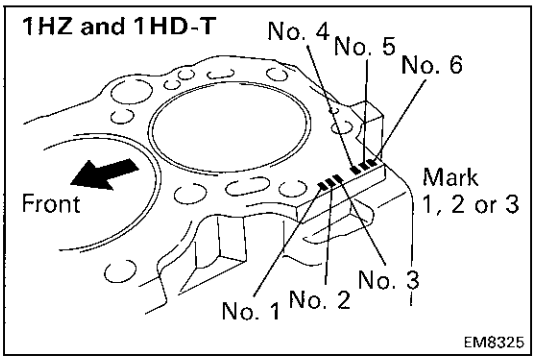
Visually check the cylinder for vertical scratches.

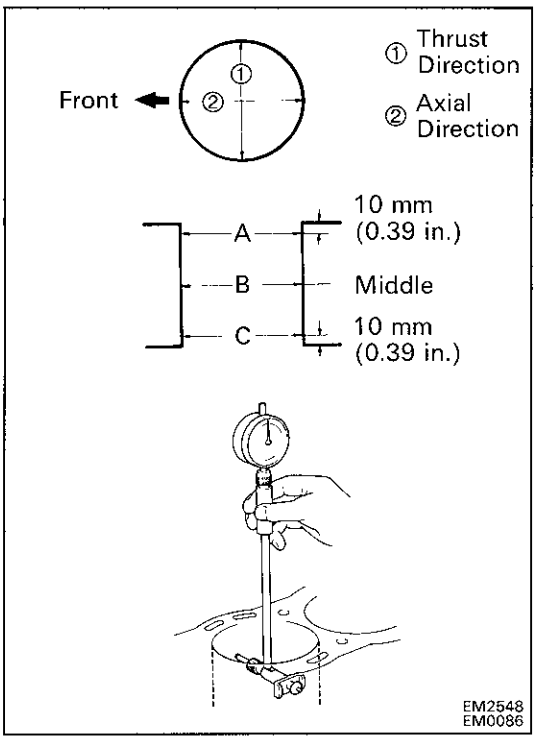
If deep scratches are present, rebore all five (1PZ) or six (1HZ and 1HD-T) cylinders. If necessary, replace the cylinder block.



5. INSPECT CYLINDER BORE DIAMETER

HINT: There are three sizes of the standard cylinder bore diameter, marked "1", "2" and "3" accordingly. The mark is stamped on the upper left rear of the cylinder block.





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

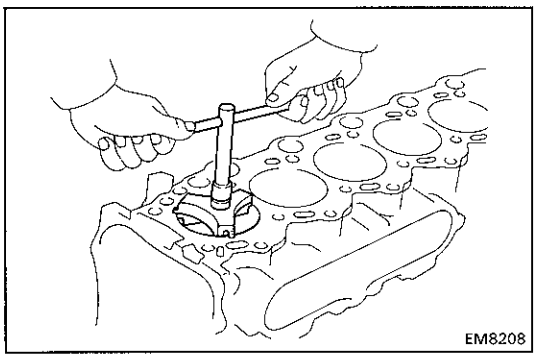
Standard diameter:

STD Mark "1"	**94.000 – 94.010 mm (3.7008 – 3.7012 in.)**
Mark "2"	**94.010 – 94.020 mm (3.7012 – 3.7016 in.)**
Mark "3"	**94.020 – 94.030 mm (3.7016 – 3.7020 in.)**

Maximum diameter:

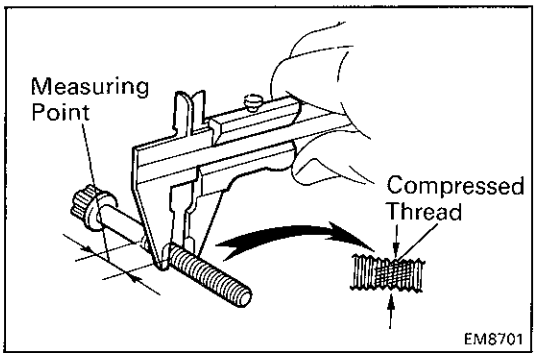
STD	**94.23 mm (3.7098 in.)**
O/S 0.50	**94.73 mm (3.7295 in.)**

If the diameter is greater than maximum, rebore all five (1PZ) or six (1HZ and 1HD-T) cylinders.
If necessary, replace the cylinder block.



6. REMOVE CYLINDER RIDGE

If the wear is less than 0.2 mm (0.008 in.), use a ridge reamer to machine the piston ring ridge at the top of the cylinder.



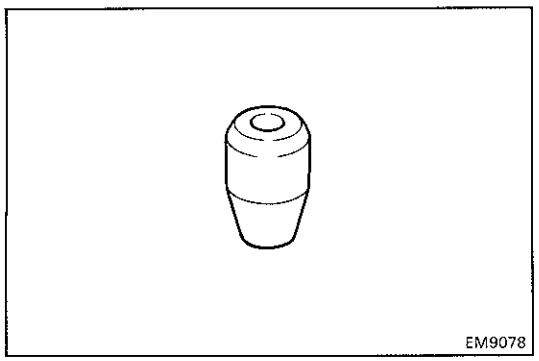
7. INSPECT MAIN BEARING CAP BOLTS

Using vernier calipers, measure the minimum diameter of the compressed thread at the measuring point.

Standard diameter: **11.800 – 12.000 mm (0.4646 – 0.4724 in.)**

Minimum diameter: **11.50 mm (0.4528 in.)**

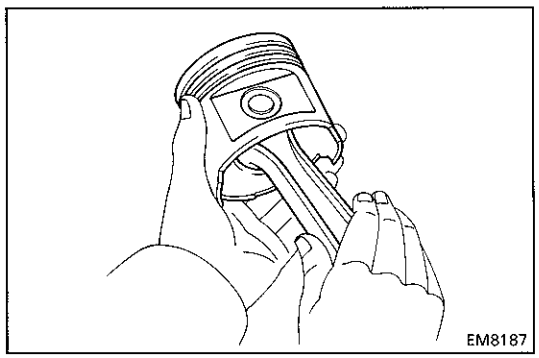
If the diameter is less than minimum, replace the bolt.



8. INSPECT CYLINDER BLOCK ORIFICE

Check that the oifice is not clogged.

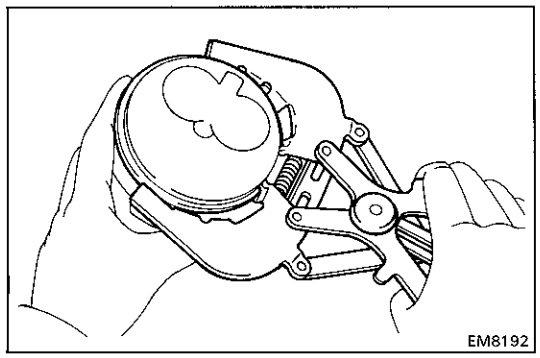
DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES



1. CHECK FIT BETWEEN PISTON AND PISTON PIN

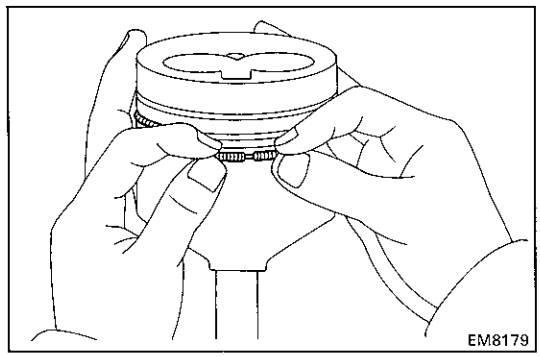
Try to move the piston back and forth on the piston pin.

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



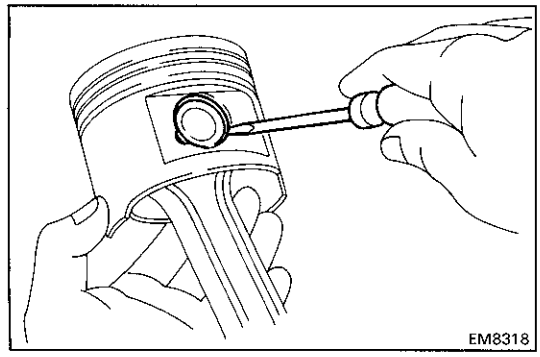
2. REMOVE PISTON RINGS

(a) Using a piston ring expander, remove the two compression rings and oil ring.



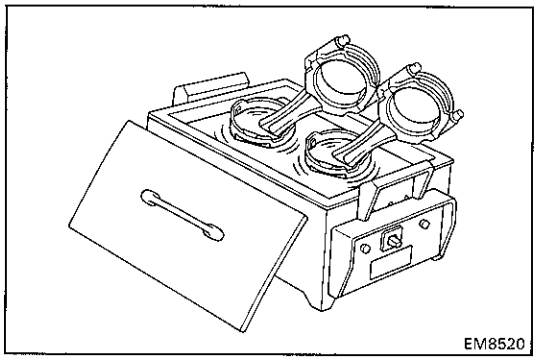
(b) Remove the coil by hand.

HINT: Arrange the rings in correct order only.

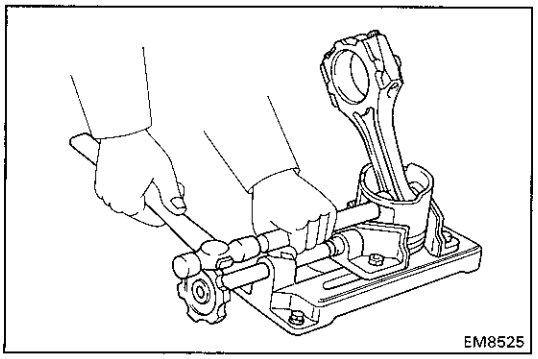


3. DISCONNECT CONNECTING ROD FROM PISTON

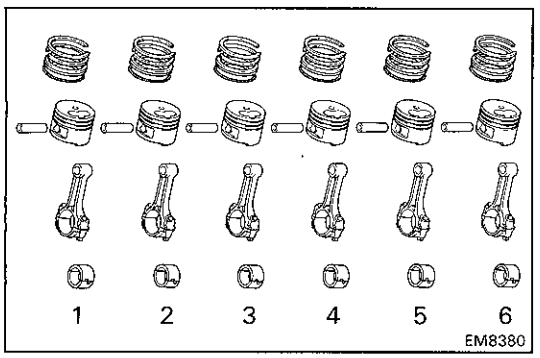
(a) Using a small screwdriver, remove the snap rings.



(b) Gradually heat the piston to approx. 80°C (176°F).

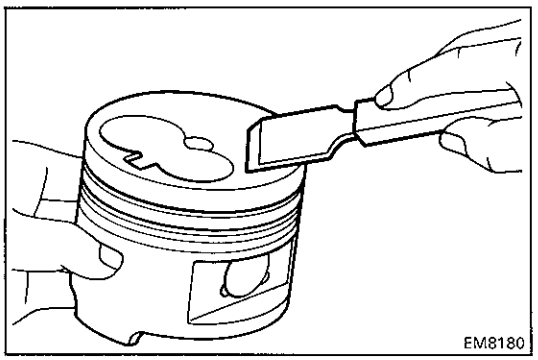


(c) Using a plastic-faced hammer and brass bar, lightly tap out the piston pin and remove the connecting rod.



HINT:

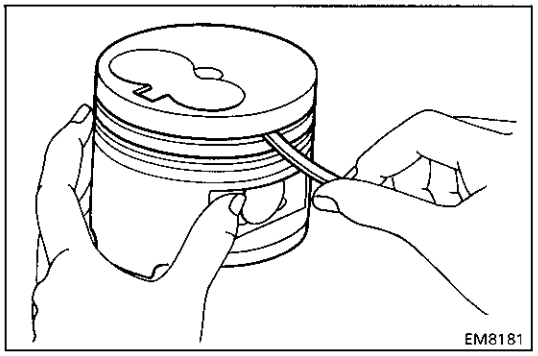
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



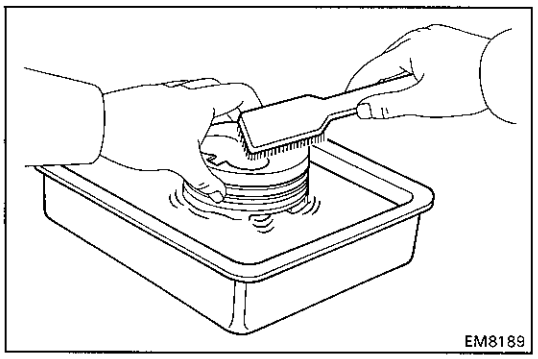
INSPECTION AND REPAIR OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTON

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

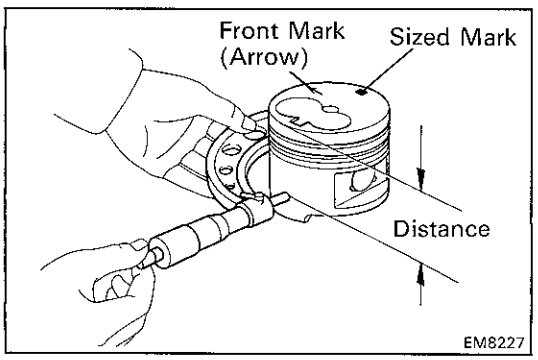


(b) Using a groove cleaning or broken ring, clean the piston ring grooves.



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

NOTICE: Do not use a wire brush.



2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

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

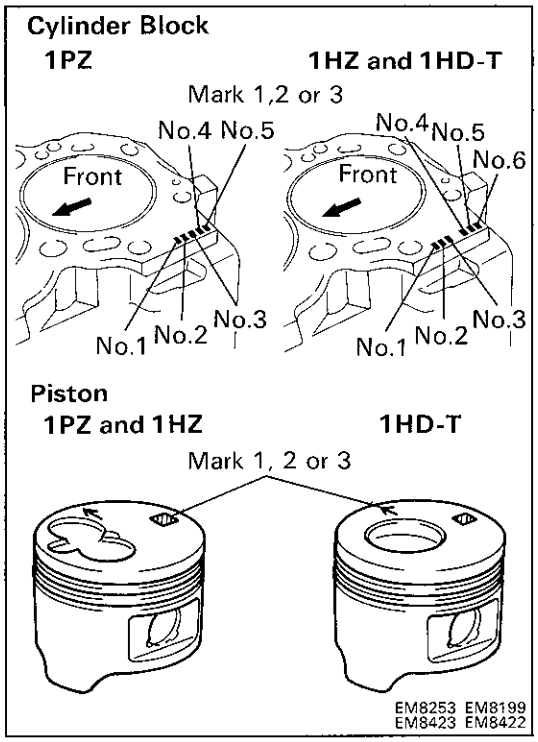
(a) Using a micrometer, measure the piston diameter at right angles to the piston pin center line, at the indicated distance from the piston head.

Distance:

1PZ and 1HZ	**58.6 mm (2.3071 in.)**
1HD-T	**65.7 mm (2.5866 in.)**

Piston diameter:

STD Mark "1"	**93.95 – 93.96 mm (3.6988 – 3.6992 in.)**
Mark "2"	**93.96 – 93.97 mm (3.6992 – 3.7000 in.)**
Mark "3"	**93.97 – 93.98 mm (3.7000 – 3.7000 in.)**
O/S 0.50	**94.45 – 94.48 mm (3.7185 – 3.7197 in.)**



(b) Measure the cylinder bore diameter in the thrust directions. (See step 5 on page EM-93)

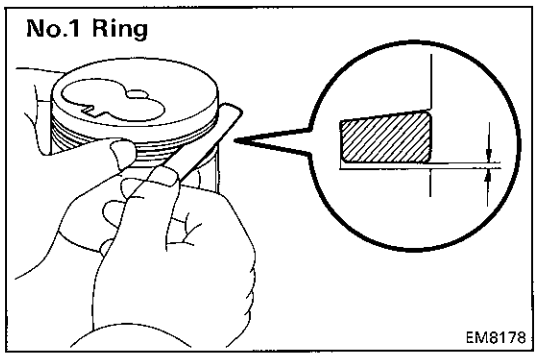
(c) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance: 0.04 – 0.06 mm (0.0016 – 0.0024 in.)

Maximum oil clearance: 0.14 mm (0.0055 in.)

If the oil clearance is greater than maximum, replace all five (1PZ) or six (1HZ and 1HD-T) pistons and rebore all five (1PZ) or six (1HZ and 1HD-T) cylinders. If necessary, replace the cylinder block.

HINT (Use cylinder block subassembly): When installing a standard piston, install one with the same number mark as the standard bore diameter mark on the cylinder block.



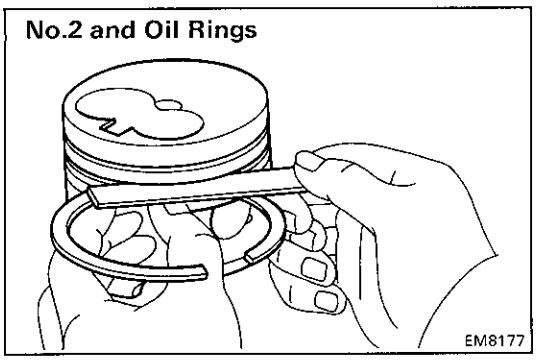
3. INSPECT CLEARANCE BETWEEN WALL OF RING GROOVE AND NEW PISTON RING

(No.1 Ring)

Install new No.1 piston ring to the piston. Using a thickness gauge, measure the clearance between the piston ring and wall of the piston ring groove.

Ring groove clearance:

No.1 0.050 – 0.095 mm (0.0020 – 0.0037 in.)



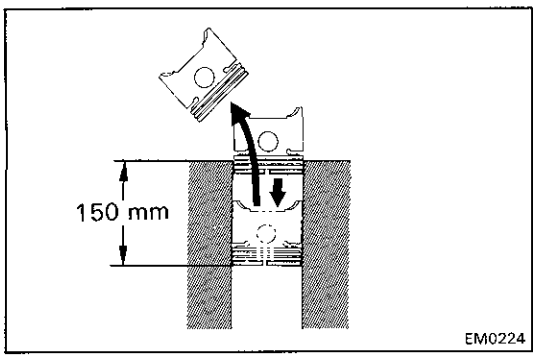
(No.2 and Oil Rings)

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

Ring groove clearance:

No.2 0.06 – 0.10 mm (0.0024 – 0.0039 in.)
Oil 0.03 – 0.07 mm (0.0012 – 0.0028 in.)

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



4. INSPECT PISTON RING END CAP

(a) Insert the piston ring into the cylinderbore.

(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 thickness gauge, measure the end gap.

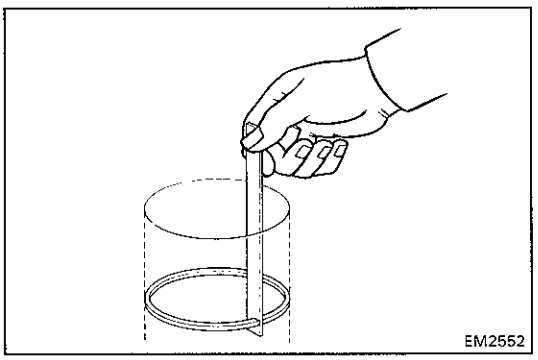
Standard end gap:

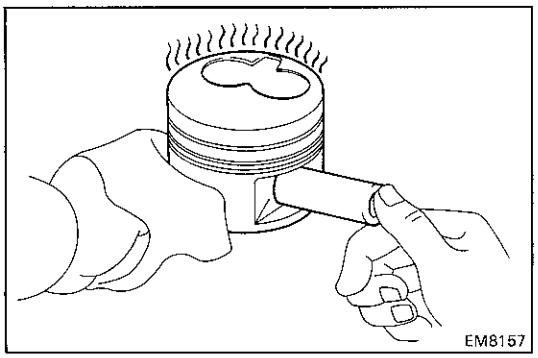
No.1	**0.27 – 0.54 mm (0.0106 – 0.0213 in.)**
No.2	**0.40 – 0.62 mm (0.0157 – 0.0244 in.)**
Oil	**0.20 – 0.52 mm (0.0079 – 0.0205 in.)**

Maximum end gap:

No.1	**1.34 mm (0.0591 in.)**
No.2	**1.42 mm (0.0551 in.)**
Oil	**1.32 mm (0.0520 in.)**

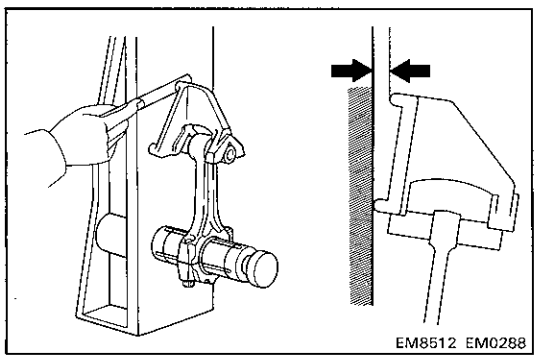
If the end gap is greater than maximum, replace the piston ring. If the end gap is greater than maximum, even with a new piston ring, rebore all five (1PZ) or six (1HZ and 1HD-T) cylinders or replace the cylinder block.


EM2552


EM8157

5. INSPECT PISTON PIN FIT

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


EM8512 EM0288

6. INSPECT CONNECTING ROD

A. Inspect connecting rod alignment

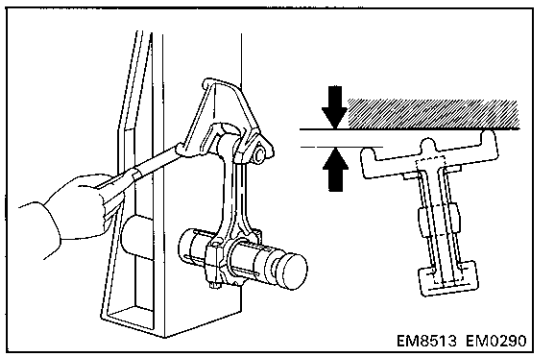
Using a rod aligner, check the connecting rod alignment.

- Check for bending.

Maximum bending:

0.03 mm (0.0012 in.) per 100 mm (3.94 in.)

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

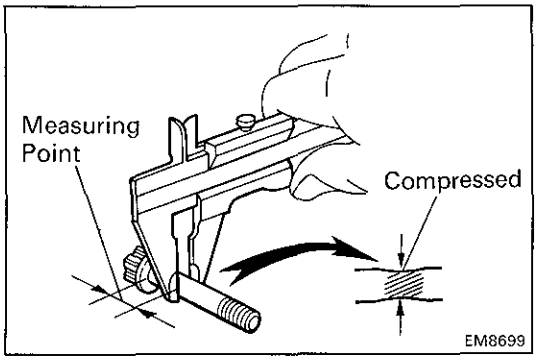

EM8513 EM0290

- 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.



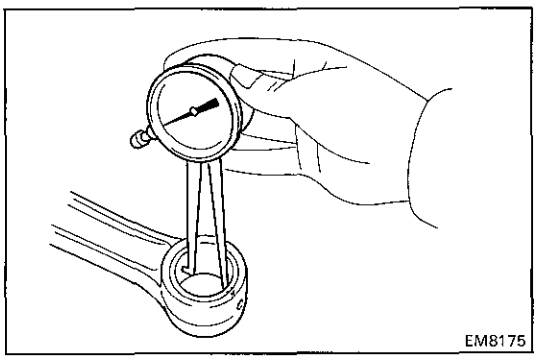
B. Inspect connecting rod bolts

Using vernier calipers, measure the minimum diameter of the compressed bolt at the measuring point.

Standard diameter: 8.300 – 8.400 mm (0.3268 – 0.3307 in.)

Minimum diameter: 7.95 mm (0.3130 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.

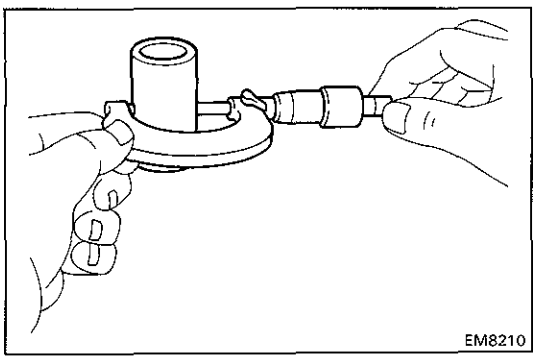
Bushing inside diameter:

1PZ and 1HZ

29.008 – 29.020 mm (1.1420 – 1.1425 in.)

1HD-T

33.008 – 33.020 mm (1.2995 – 1.3000 in.)



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

Piston pin diameter:

1PZ and 1HZ

29.000 – 29.012 mm (1.1417 – 1.1422 in.)

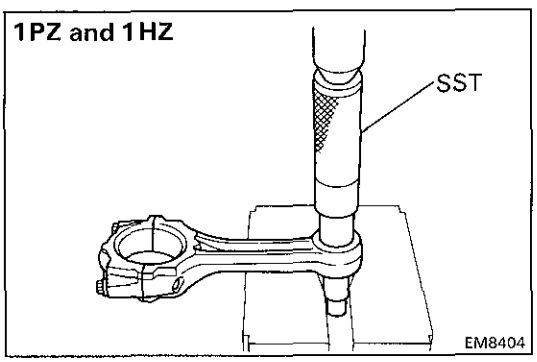
1HD-T

33.000 – 33.012 mm (1.2992 – 1.2997 in.)

(c) 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: 0.03 mm (0.0012 in.)

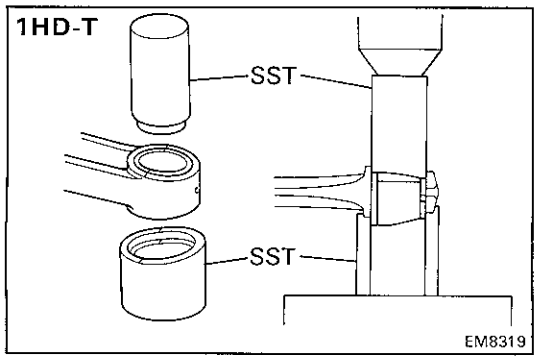


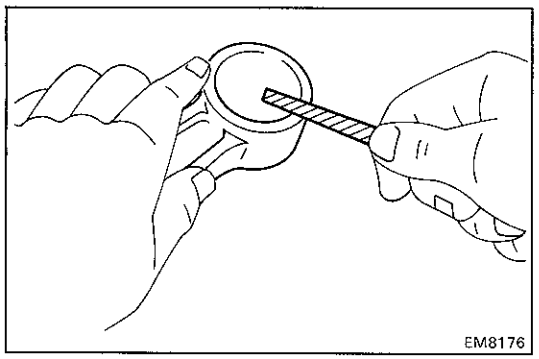
7. IF NECESSARY, REPLACE CONNECTING ROD BUSHINGS

A. Remove connecting rod bushings

Using SST and a press, press out the bushing.

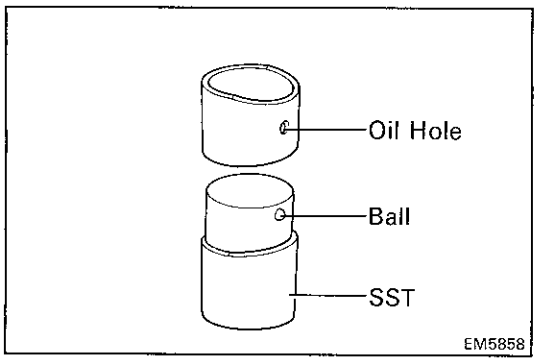
SST 1PZ and 1HZ	09222-66010
1HD-T	09222-17010 (09222-05020, 09222-05040)





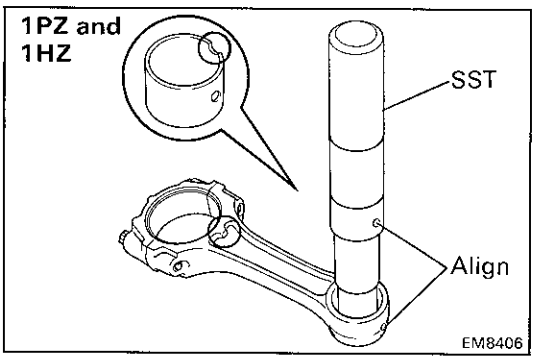
B. Install new connecting rod bushings

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

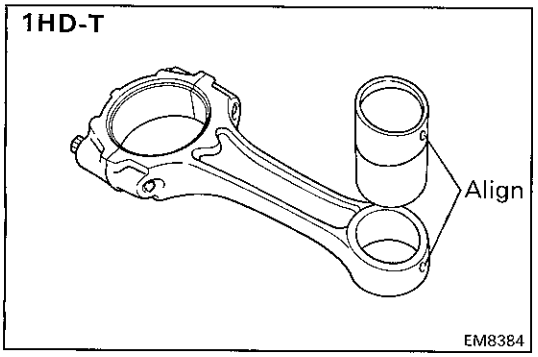


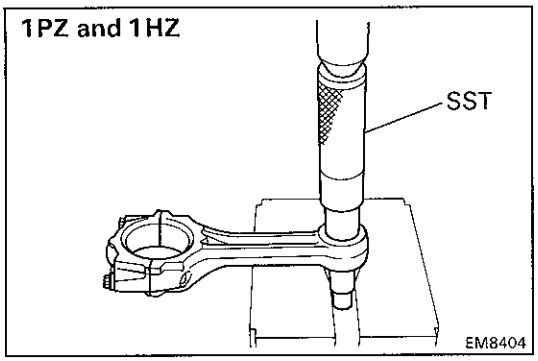
(b) (1HD-T)
Attach the bushing to SST with the ball of SST inside the oil hole of the bushing.

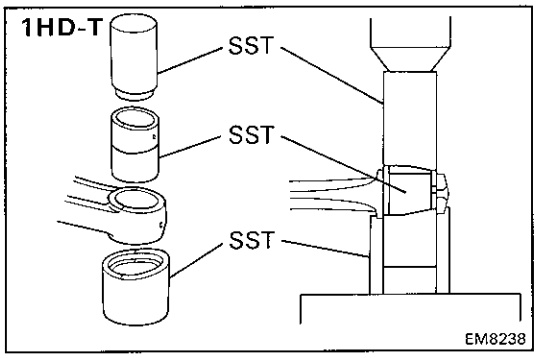
SST 09222-17010 (09222-05030)



(c) Align the oil holes of the bushing and connecting rod.

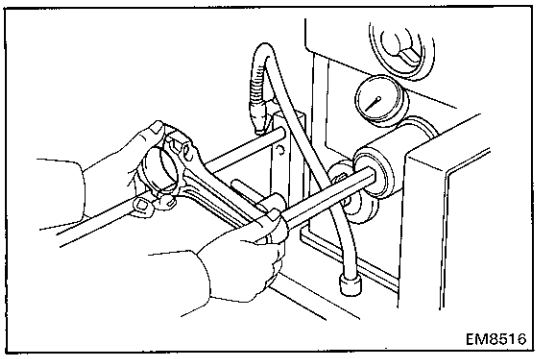






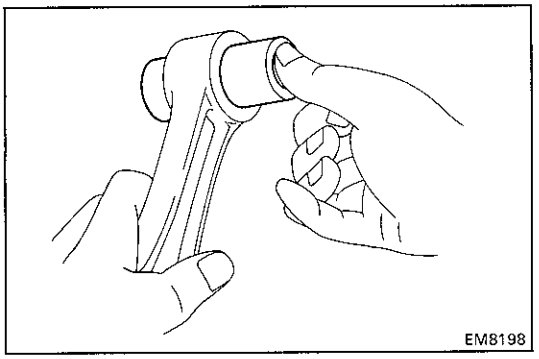
(d) Using SST and a press, press in the bushing.

SST 1PZ and 1HZ 09222-66010
1HD-T 09222-17010 (09222-05020, 09222-05030, 09222-05040)



C. Hone connecting rod bushing and check piston pin fit

(a) Using a pin hole grinder, hone the bushing to obtain the standard specified clearance (see page EM-100) between the bushing and piston pin.



(b) 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.

BORING OF CYLINDERS

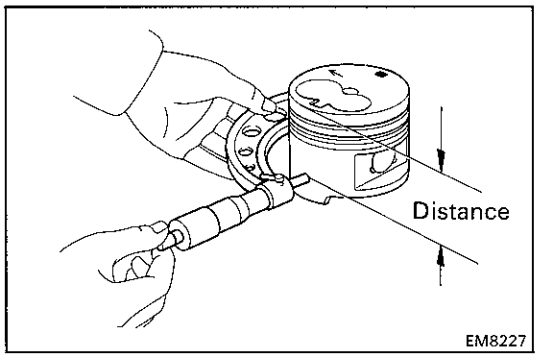
HINT:

- Bore all five (1PZ) or six (1HZ and 1HD-T) cylinders for the oversized piston outside diameter.
- Replace the piston rings with ones to match the oversized pistons.

1. KEEP OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50 94.45 – 94.48 mm (3.7185 – 3.7197 in.)



2. CALCULATE AMOUNT TO BORE CYLINDER

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

Distance:

1PZ and 1HZ	**58.6 mm (2.3071 in.)**
1HD-T	**65.7 mm (2.5866 in.)**

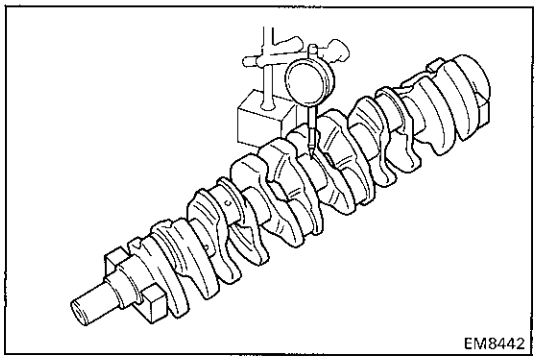
(b) Calculate the amount each cylinder is to be rebored as follows:

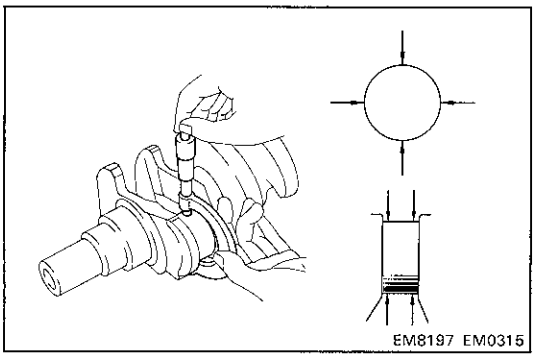
Size to be rebored = P + C – H
P = Piston diameter
C = Piston oil clearance
0.04 – 0.06 mm (0.0016 – 0.0024 in.)
H = Allowance for honing
0.02 mm (0.0008 in.) or less

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Maximum honing: 0.02 mm (0.0008 in.)

NOTICE: Excess honing will destroy the finished roundness.


EM8442


EM8197 EM0315

INSPECTION AND REPAIR OF CRANKSHAFT

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: 0.06 mm (0.0024 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	**66.982 – 67.000 mm (2.6371 – 2.6378 in.)**
U/S 0.25	**66.745 – 66.755 mm (2.6278 – 2.6281 in.)**
U/S 0.50	**66.495 – 66.505 mm (2.6179 – 2.6183 in.)**

Crank pin diameter:

STD	**58.982 – 59.000 mm (2.3221 – 2.3228 in.)**
U/S 0.25	**58.745 – 58.755 mm (2.3128 – 2.3132 in.)**
U/S 0.50	**58.495 – 58.505 mm (2.3029 – 2.3033 in.)**

If the diameter is not as specified, check the oil clearance (See pages EM-86 to 92).

(b) 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.

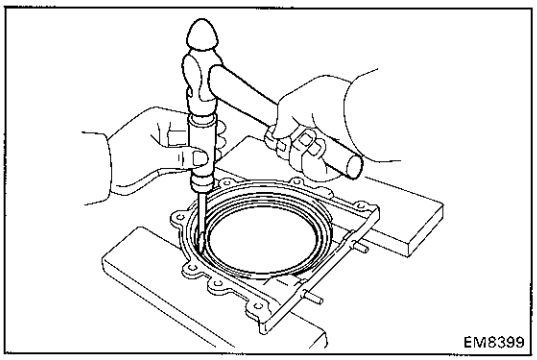
3. IF NECESSARY, GRIND AND HONE MAIN JOURNALS AND/OR CRANK PINS

Grind and hone the main journals and/or crank pins to the finished undersized diameter (See procedure step 2).

Install new main journal and/or crank pin undersized bearings.

REPLACEMENT OF CRANKSHAFT OIL SEAL

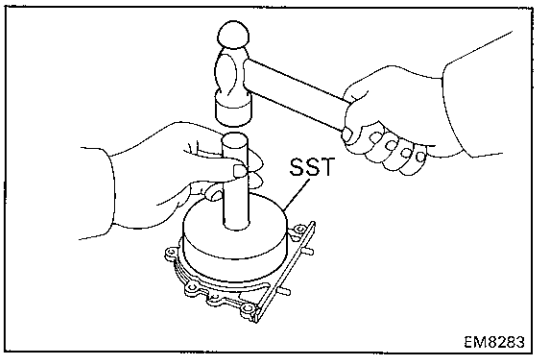
HINT: There are two methods (A and B) to replace the oil seal as follows:



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.

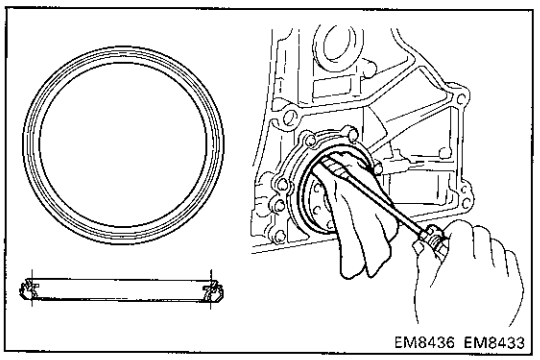


(b) Using SST and a hammer, tap in a new oil seal until its surface is flush with the rear oil seal retainer edge.

SST 09223-56010

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

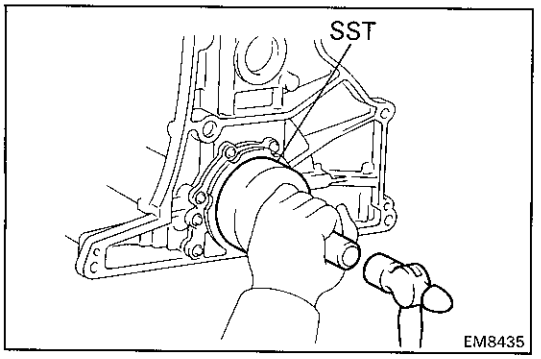
B. If rear oil seal retainer is installed to cylinder block:



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

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

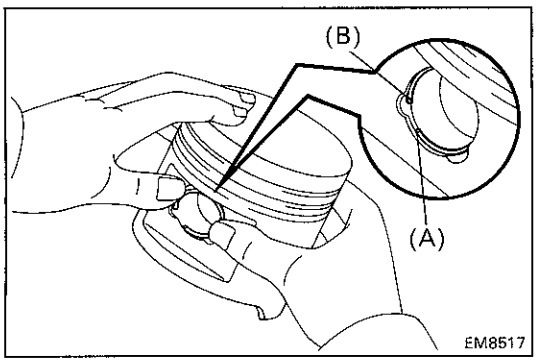
NOTICE: Be careful not to damage the crankshaft. Tape the screwdriver tip.



(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

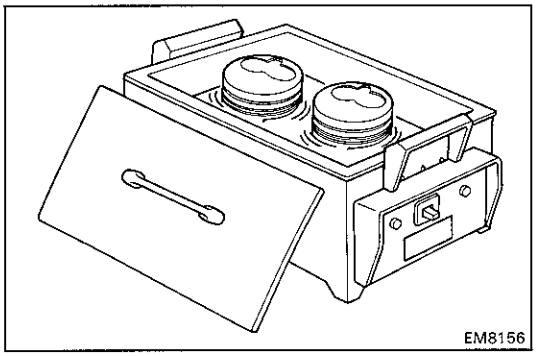


ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

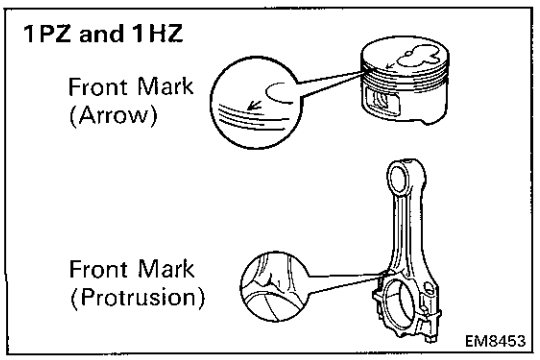
1. ASSEMBLE PISTON AND CONNECTING ROD

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

- Position the snap ring so that end (B) of the snap ring is aligned with the hollow, then push the snap ring into the piston groove starting from end (A).



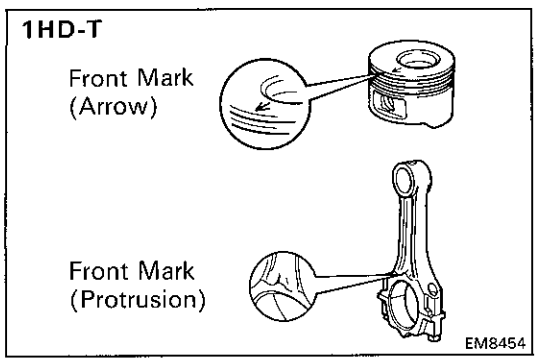
(b) Gradually heat the piston to about 80°C (176°F).



(c) Apply a light coat of engine oil to the piston pin.

(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.

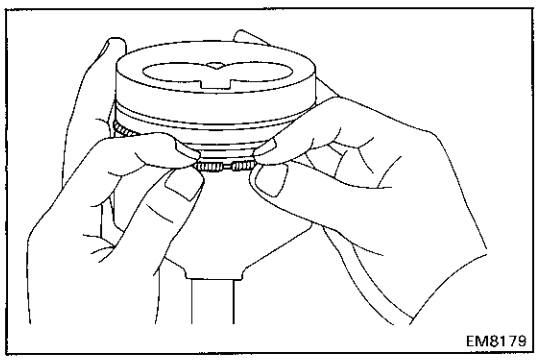
(e) Install a new snap ring on the other side of the piston pin hole using the same method as in (a) above.

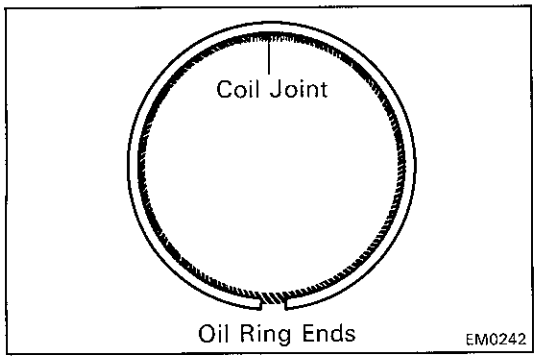


2. INSTALL PISTON RINGS

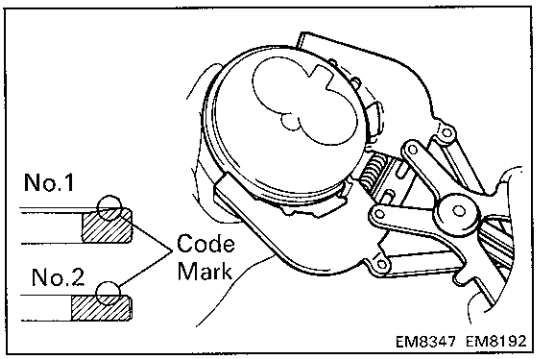
(a) Install the coil by hand.

(b) Using a piston ring expander, install the oil ring.



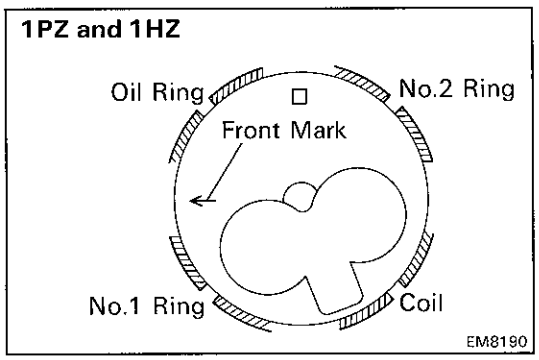


HINT: Face the end gap of the oil ring in the opposite direction of coil joint.



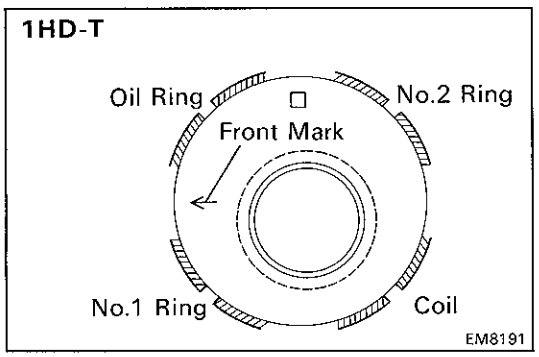
(c) Using a piston ring expander, install the two compression rings with the code mark facing upward.

Code mark: No.1 1T
No.2 2T



(d) Position the piston rings so that the ring ends are as shown.

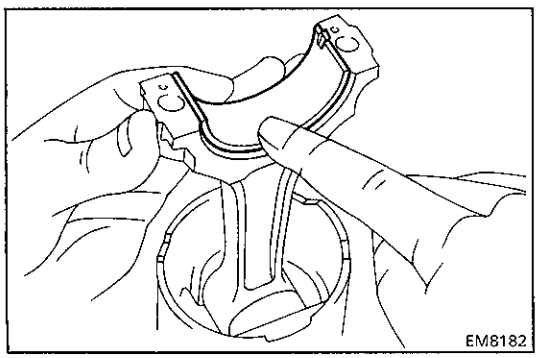
NOTICE: Do not align the ring ends.



3. INSTALL BEARINGS

(a) Align the bearing claw with the claw groove of the connecting rod or connecting cap.

(b) Install the bearings in the connecting rod and connecting rod cap.

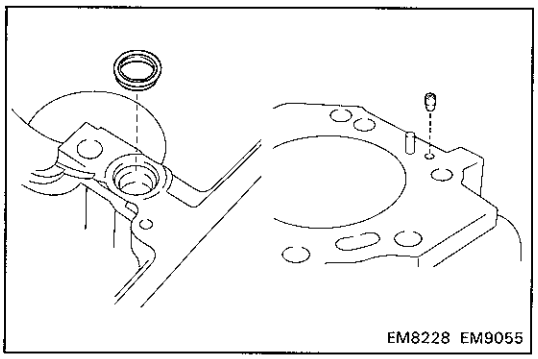


ASSEMBLY OF CYLINDER BLOCK

(See page EM-84)

HINT:

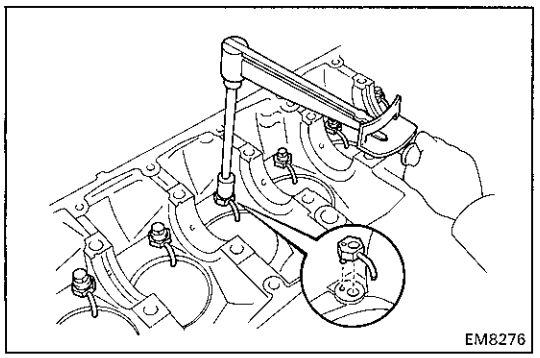
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



EM8228 EM9055

1. INSTALL NEW CYLINDER BLOCK OIL HOLE GASKET

2. INSTALL CYLINDER BLOCK ORIFICE



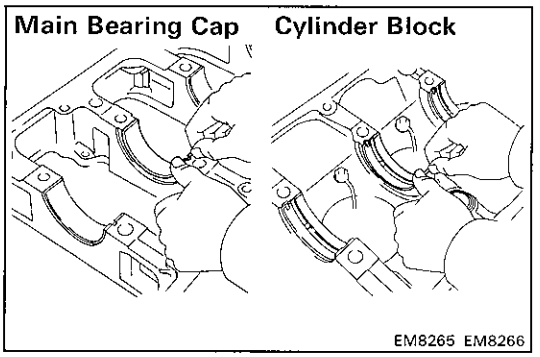
EM8276

3. INSTALL OIL NOZZLES AND CHECK VALVES

(a) Align the pin of the oil nozzle with the pin hole of the cylinder block.

(b) Install the oil nozzle with the check valve. Install the five (1PZ) or six (1HZ and 1HD-T) oil nozzles and check valves.

Torque: 275 kg-cm (20 ft-lb, 27 N·m)



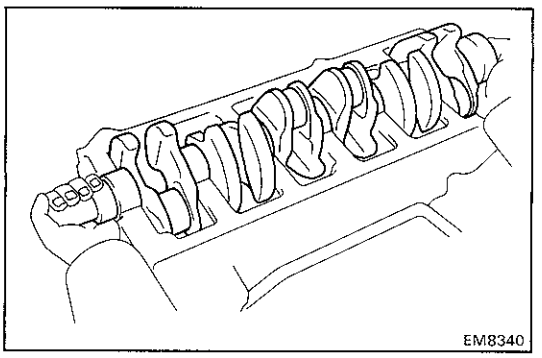
EM8265 EM8266

4. INSTALL MAIN BEARINGS

(a) Align the bearing claw with the claw groove of the main bearing cap or cylinder block.

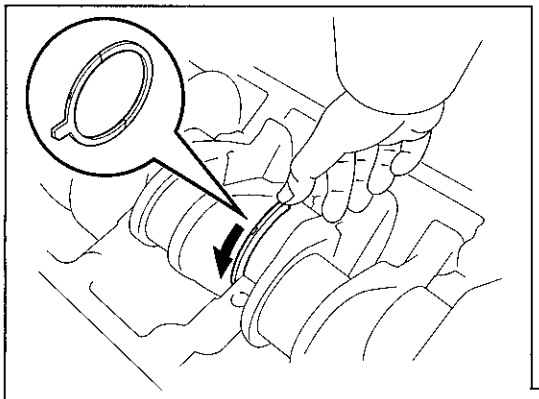
(b) Install the bearings in the cylinder block and main bearing cap.

NOTICE: Install the bearing with the oil hole in the cylinder block.



EM8340

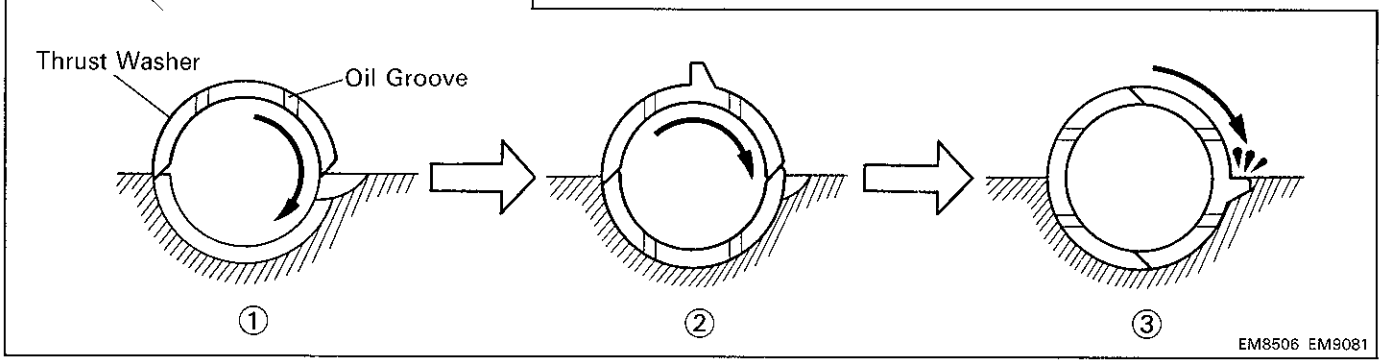
5. PLACE CRANKSHAFT ON CYLINDER BLOCK

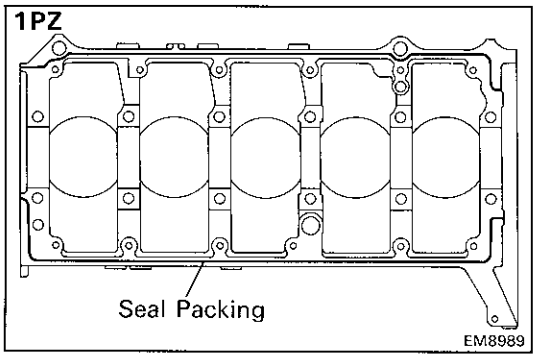


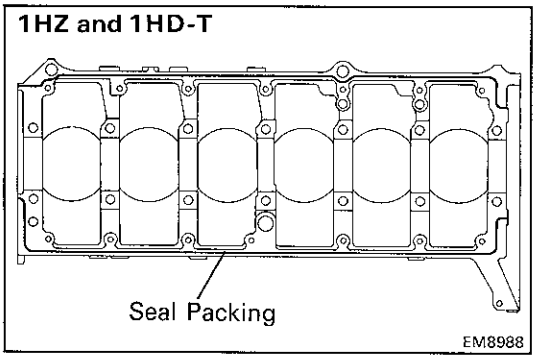
6. INSTALL THRUST WASHERS

(a) Push the crankshaft toward the front (rear) side.

(b) Install the thrust washers to the No.4 main journal position of the cylinder block with the oil grooves facing outward.







7. INSTALL MAIN BEARING CAP

A. Install main bearing cap on cylinder block

(a) Remove any old packing (FIPG) material and be careful not to drop any oil the contact surfaces of the main bearing cap and cylinder block.

- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.

(b) Apply seal packing to the cylinder block as shown in the illustration.

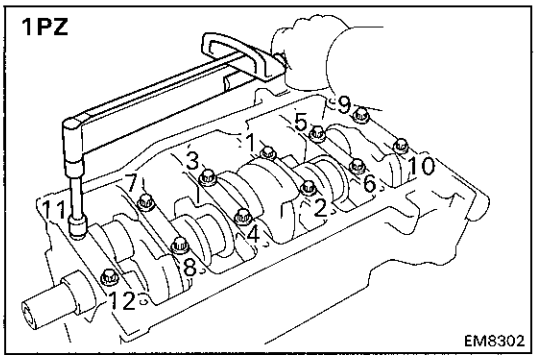
Seal packing: Part No. 08826-00080 or equivalent

- Install a nozzle that has been cut to a 5 mm (0.20 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.

B. Install main bearing cap bolts

HINT:

- The main bearing cap bolts are tightened in two progressive steps.
- If any of the main bearing bolts break or deform, replace them.

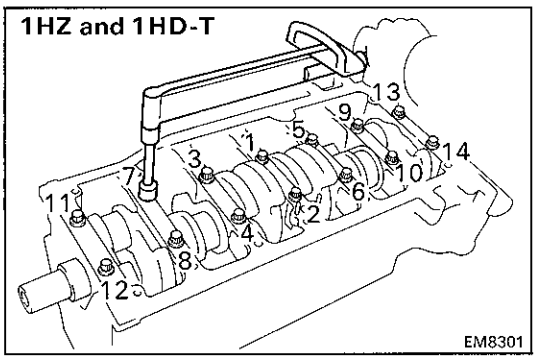


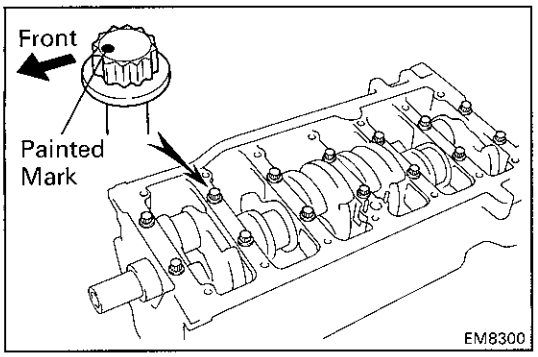
(a) Apply a light coat of engine oil on the threads and under the heads of the main bearing cap bolts.

(b) 1st, install and uniformly tighten the twelve (1PZ) or fourteen (1HZ and 1HD-T) main bearing cap bolts in several passes in the sequence shown.

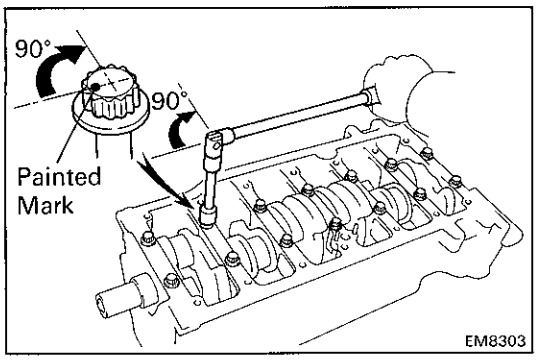
Torque: 1,050 kg-cm (76 ft-lb, 103 N·m)

If any one of the main bearing cap bolts does not meet the torque specification, replace the main bearing cap bolt.





(c) Mark the front of the main bearing cap bolt head with paint.

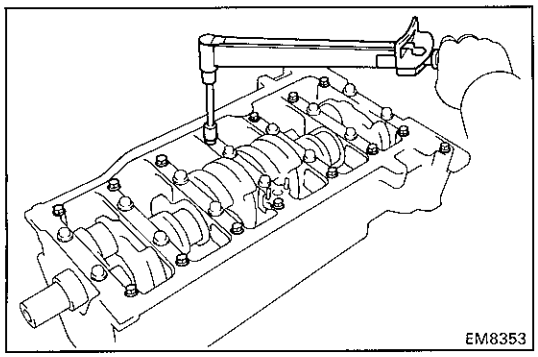


(d) 2nd, retighten the main bearing cap bolts 90° in the numerical order shown above.

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

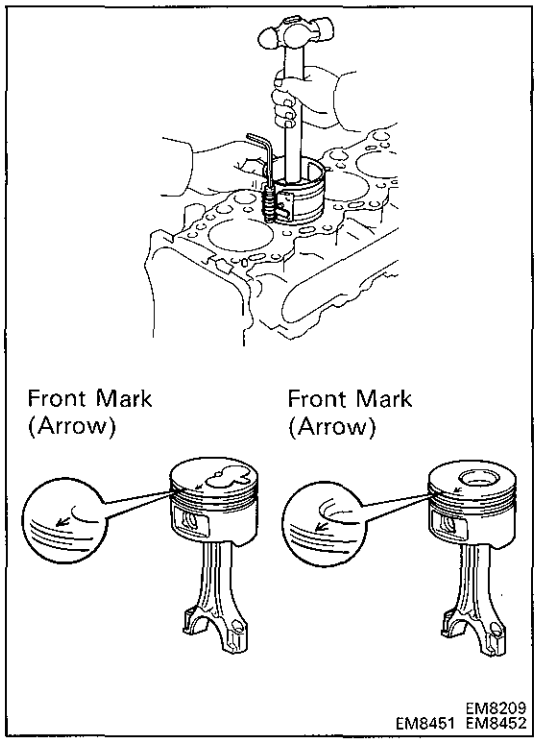
(f) Check that the crankshaft turns smoothly.

(g) Check the crankshaft thrust clearance.
(See step 5 on page EM-89)



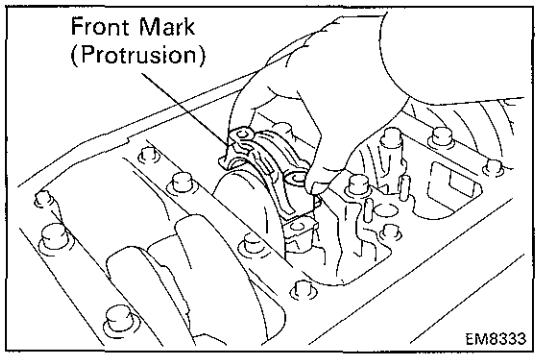
(h) Install and torque the thirteen bolts (1PZ) or fifteen bolts (1HZ and 1HD-T).

Torque: 185 kg-cm (13 ft-lb, 18 N·m)



8. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into each cylinder with the front mark of the piston facing forward.



9. INSTALL CONNECTING ROD CAPS

A. Place connecting rod cap on connecting rod

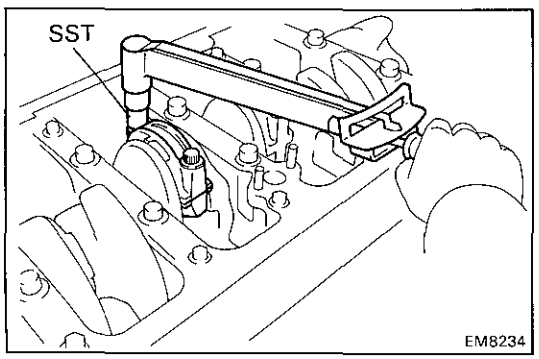
(a) Match the numbered connecting rod cap with the connecting rod.

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

B. Install connecting rod cap bolts

HINT:

- The connecting rod cap bolts are tightened in two progressive steps.
- If any of the connecting rod bolts break or deform, replace them.



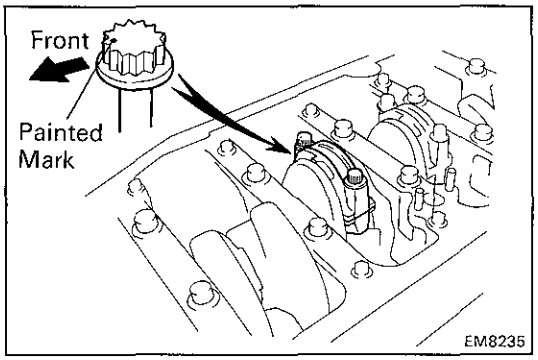
(a) Apply a light coat of engine oil on the threads and under the heads of the connecting rod cap bolts.

(b) 1st, using SST, install and alternately tighten the bolts of the connecting rod cap in several passes.

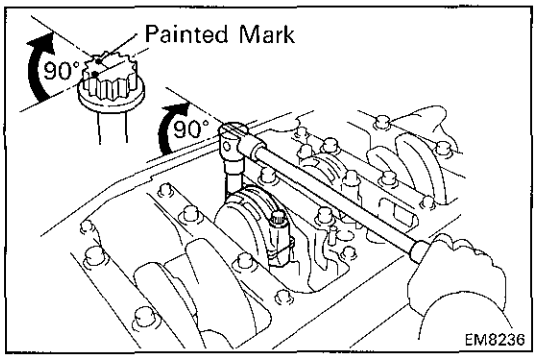
SST 09011-38121

Torque: 375 kg-cm (27 ft-lb, 37 N·m)

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



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



(d) 2nd, retighten the connecting rod cap bolts by an additional 90°.

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

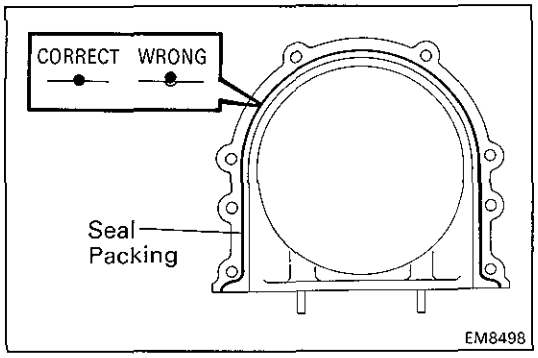
(f) Check that the crankshaft turns smoothly.

(g) Check the connecting rod thrust clearance.
(See step 2 on page EM-86)

10. INSTALL REAR OIL SEAL RETAINER

(a) Remove any old packing (FIPG) material and be careful not to drop any oil on the contact surfaces of the rear oil seal retainer and cylinder block.

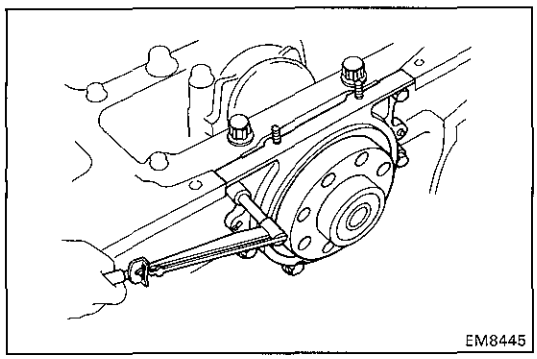
- Using a razor blade and gasket scraper, remove all the old packing (FIPG) material from the gasket surfaces and sealing groove.
- Thoroughly clean all components to remove all the loose material.
- Using a non-residue solvent, clean both sealing surfaces.



(b) Apply seal packing to the rear oil seal retainer as shown in the illustration.

Seal packing: Part No.08826-00080 or equivalent

- Install a nozzle that has been cut to a 2 – 3 mm (0.08 – 0.12 in.) opening.
- Parts must be assembled within 5 minutes of application. Otherwise the material must be removed and reapplied.
- Immediately remove nozzle from the tube and reinstall cap.



(c) Install the retainer with the six bolts.

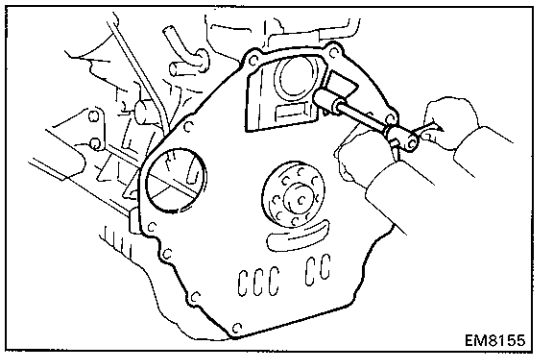
Torque: 65 kg-cm (56 in.-lb, 6.4 N·m)

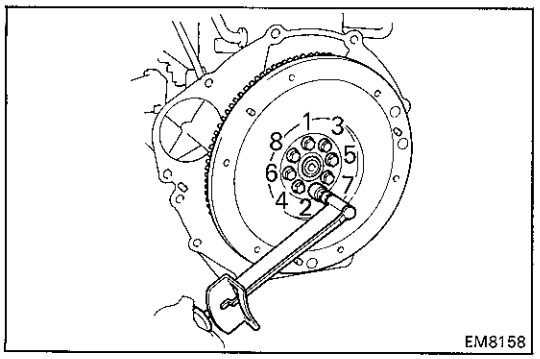
POST ASSEMBLY

1. INSTALL ENGINE MOUNTING
2. INSTALL THERMOSTAT AND WATER INLET (See page CO-11)
3. INSTALL OIL COOLER (See page LU-18)
4. INSTALL TIMING GEAR CASE (OIL PUMP) AND OIL PAN (See page LU-12)
5. INSTALL INJECTION PUMP (See page FU-93)
6. INSTALL TIMING GEARS (See page EM-50)
7. INSTALL ALTERNATOR
8. INSTALL WATER PUMP (See page CO-8)
9. INSTALL CYLINDER HEAD (See page EM-75)
10. INSTALL PULLEYS AND TIMING BELT (See page EM-38)
11. REMOVE ENGINE STAND
12. INSTALL REAR END PLATE

    Install the end plate with the bolt.

    Torque: 185 kg-cm (13 ft-lb, 18 N·m)





13. (M/T)
    INSTALL FLYWHEEL
    (a) Install the flywheel on the crankshaft.
    (b) Install and uniformly tighten the eight mount bolts in several passes, in the sequence shown.

    Torque: 1,300 kg-cm (94 ft-lb, 127 N·m)

14. (A/T)
    INSTALL FLYWHEEL, DRIVE PLATE AND SPACER (See procedure step 13)

    Torque: 1,300 kg-cm (94 ft-lb, 127 N·m)

15. (M/T)
    INSTALL CLUTCH DISC AND COVER