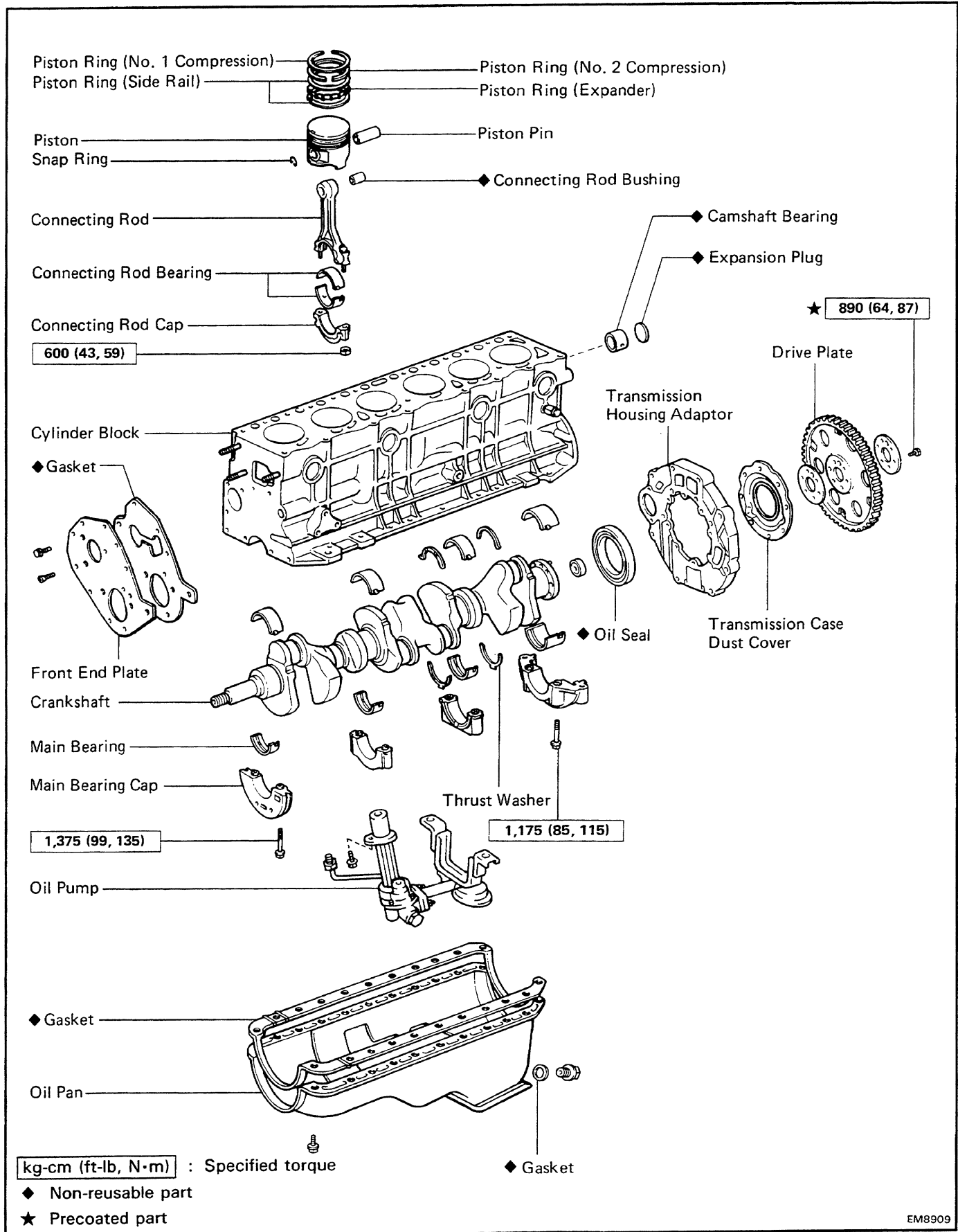
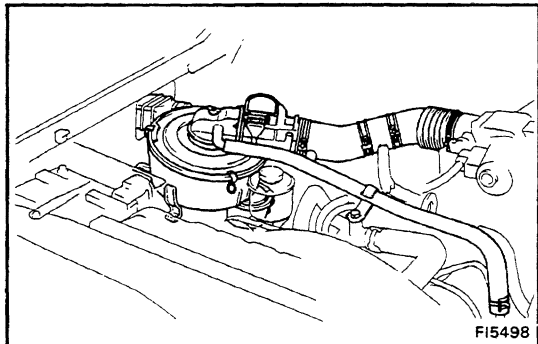
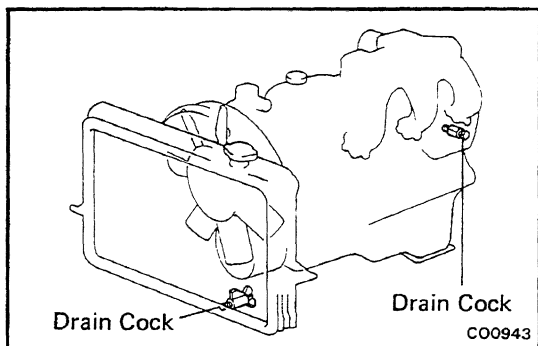


CYLINDER BLOCK COMPONENTS





REMOVAL OF ENGINE

1. DRAIN ENGINE COOLANT

(See page [CO-5](#))

2. DRAIN ENGINE OIL

3. REMOVE HOOD

4. REMOVE BATTERY AND BATTERY TRAY

5. DISCONNECT ACCELERATOR AND THROTTLE CABLES

6. REMOVE AIR INTAKE HOSE, AIR FLOW METER AND AIR CLEANER ASSEMBLY

- (a) Disconnect the air flow meter connector and clamp.
- (b) Disconnect the following hoses:
 - ISC hose
 - Air pump hose
 - Distributor hose
 - PCV hose
 - Three hoses from the intake chamber rear side
 - Two hoses from the VCV of the charcoal canister
- (c) Disconnect the air intake hose clamp.
- (d) Remove the wing nut and loosen the three clips, and remove the air intake hose, airflow meter and air cleaner cap.
- (e) Remove the air cleaner element.
- (f) Remove the three bolts and air cleaner case.

7. REMOVE COOLANT RESERVOIR TANK

8. REMOVE RADIATOR

(See page [CO-14](#))

9. DISCONNECT FOLLOWING WIRES AND CONNECTORS

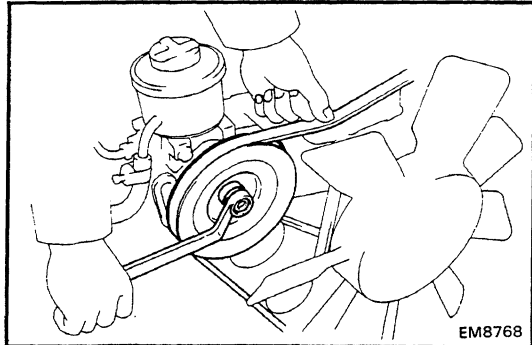
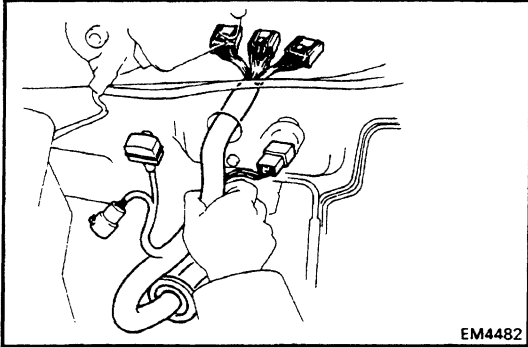
- (a) Oil pressure connector
- (b) High tension cord from ignition coil
- (c) Neutral start switch and transfer connectors located near the starter
- (d) Front differential lock connector
- (e) Starter wire and connector
- (f) Ground strap from starter
- (g) Oxygen sensor connectors
- (h) Alternator wire and connector
- (i) Cooling fan connector
- (j) Check connector
- (k) Connector on RH fender apron

10. DISCONNECT FOLLOWING HOSES:

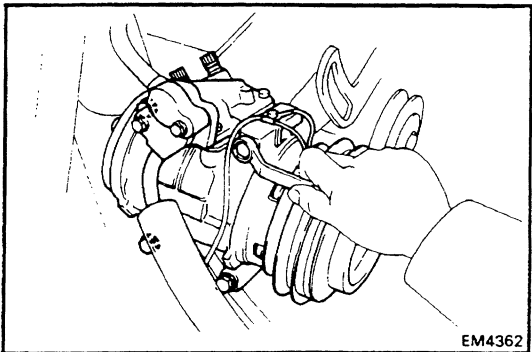
- (a) Heater hoses
- (b) Fuel hoses
- (c) Transfer hose
- (d) Brake booster hose
- (e) PS air control valve hose
- (f) AI hoses
- (g) Distributor hose
- (h) Emission control hoses

11. DISCONNECT EFI WIRE HARNESS FROM ECU

- (a) Remove the glove box.
- (b) Disconnect the four connectors.
- (c) Pull out the EFI wire harness from the cowl panel.

**12. REMOVE PS PUMP WITHOUT DISCONNECTING HOSES**

- (a) Push on the drive belt to hold the pulley in place and loosen the pulley nut.
- (b) Loosen the idler pulley nut and adjusting bolt, and remove the drive belt.
- (c) Remove the pulley mount nut, drive pulley and woodruff key.
- (d) Remove PS mount bolts, and remove the PS pump from the bracket.

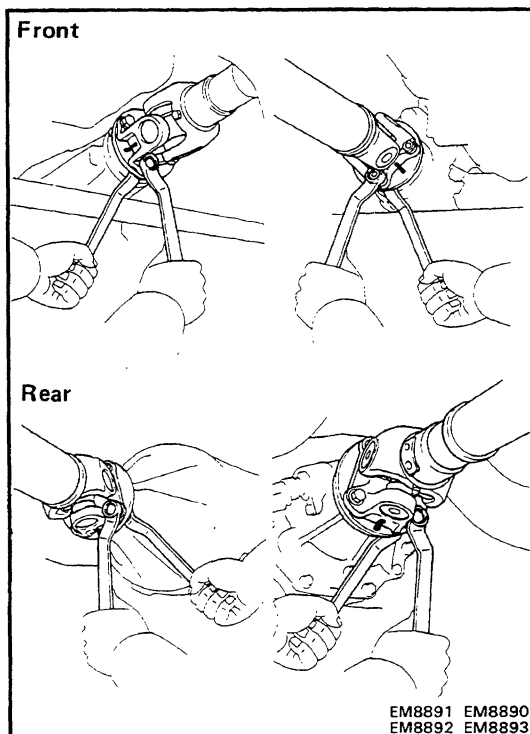
**13. REMOVE A/C COMPRESSOR WITHOUT DISCONNECTING HOSES**

- (a) Disconnect the connector.
- (b) Loosen the idler pulley nut and adjusting bolt, and remove the drive belt.
- (c) Remove the four compressor mount bolts.
- (d) Put aside the compressor, and suspend it to the fender apron with the string.

14. RAISE VEHICLE

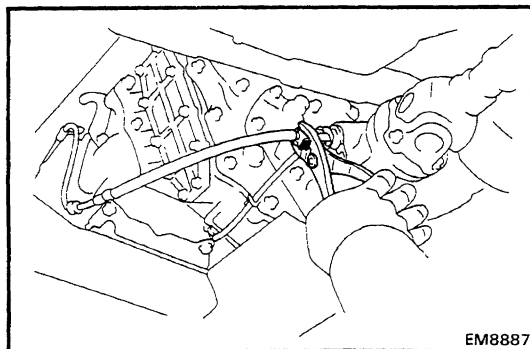
NOTICE: Be sure the vehicle is securely supported.

15. REMOVE TRANSFER UNDER COVER

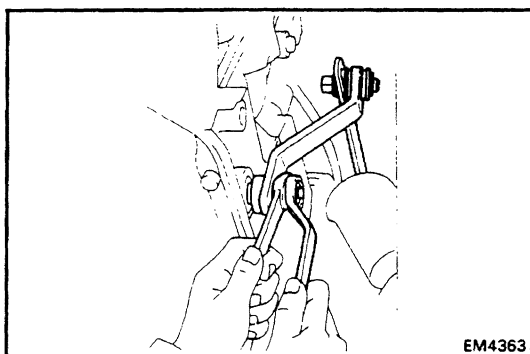


16. REMOVE FRONT AND REAR PROPELLER SHAFTS

- Put matchmarks on the flanges.
- Remove the four bolts and nuts.
- Remove the four nuts.
- Remove the propeller shaft.

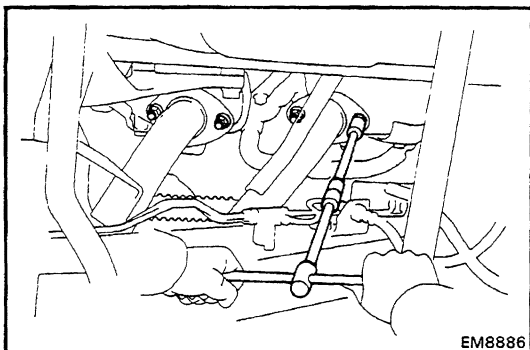


17. DISCONNECT SPEEDOMETER CABLE



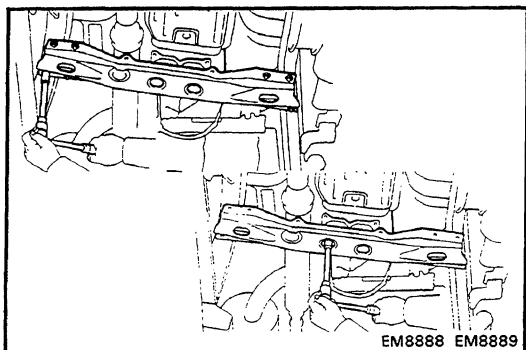
18. DISCONNECT TRANSMISSION CONTROL ROD

Remove the two nuts and disconnect the control rod.



19. DISCONNECT EXHAUST PIPE FROM EXHAUST MANIFOLD

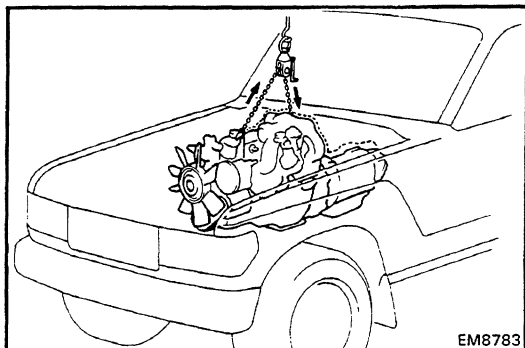
- Remove the exhaust pipe front bracket.
- Remove the four nuts, and disconnect the exhaust pipe.

**20. PLACE JACK UNDER TRANSMISSION**

Be sure to put a wooden block between the jack and the transmission pan to prevent damage.

21. REMOVE FRAME CROSSMEMBER

Remove the eight bolts and two nuts, and then remove the frame crossmember.

**22. REMOVE ENGINE WITH TRANSMISSION**

- (a) Attach the engine hoist chain to the two engine hangers.
- (b) Remove the mount nuts and washers.
- (c) Lift the engine with transmission out of the vehicle slowly and carefully.

HINT: Make sure the engine is clear of all wiring and hoses.

- (d) Place the engine and transmission assembly onto the stand.

23. REMOVE A/T OIL COOLER PIPES**24. REMOVE TRANSMISSION FROM ENGINE**

PREPARATION FOR DISASSEMBLY

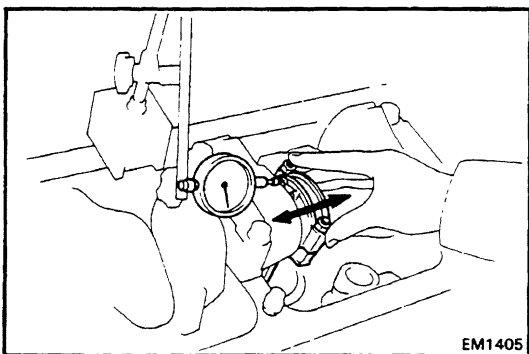
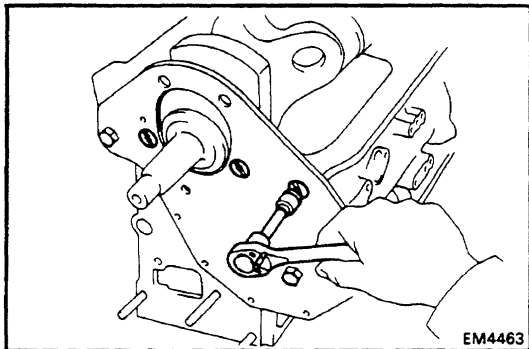
1. REMOVE DRIVE PLATE
2. REMOVE TRANSMISSION HOUSING ADAPTOR
3. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
4. REMOVE CYLINDER HEAD
(See page EM-14)
5. REMOVE ALTERNATOR
6. REMOVE WATER PUMP
7. REMOVE TIMING GEAR AND CAMSHAFT
(See pages EM-36 to 39)
8. REMOVE OIL COOLER AND OIL FILTER BRACKET
(See page LU-14)
9. REMOVE OIL PAN AND OIL PUMP
(See page LU-8)

DISASSEMBLY OF CYLINDER BLOCK

(See page EM-47)

1. REMOVE FRONT END PLATE

- (a) Using a torx socket wrench, remove the three screws.
- (b) Remove the two bolts, front end plate and gasket.



2. CHECK CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance: 0.160 – 0.300 mm

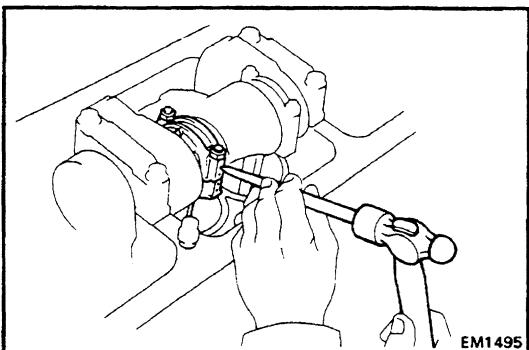
(0.0063 – 0.0118 in.)

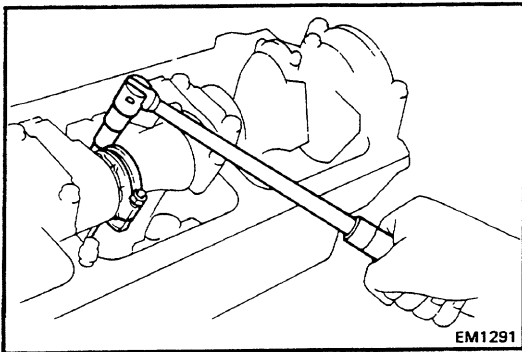
Maximum thrust clearance: 0.40 mm (0.0156 in.)

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

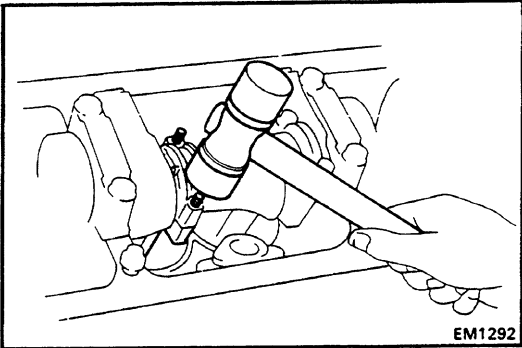
3. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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



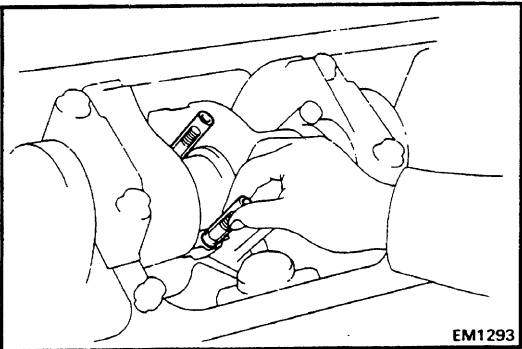


(b) Remove the connecting rod cap nuts.

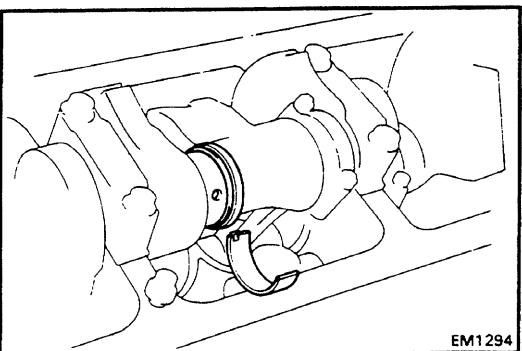


(c) Using a plastic-faced hammer, lightly tap the connecting rod bolts and lift off the connecting rod cap.

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



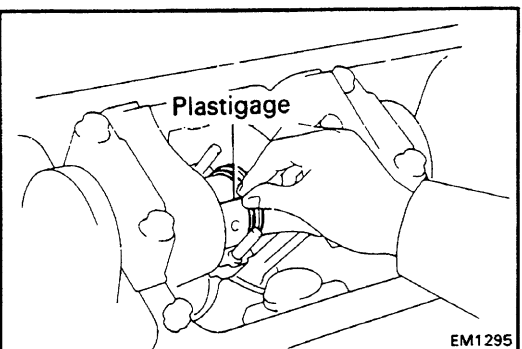
(d) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



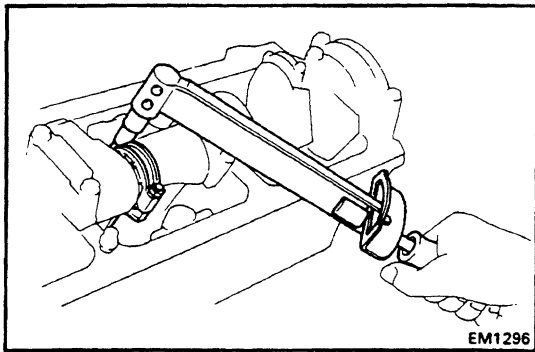
(e) Clean the crank pin and bearing.

(f) Check the crank pin and bearing for pitting and scratches.

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



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

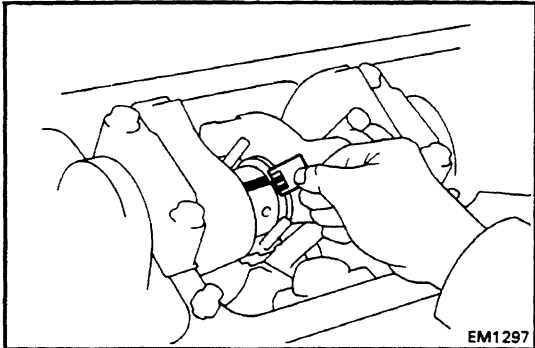


(h) Install the connecting rod cap.

(See step 7 on page [EM-75](#))

Torque: 600 kg-cm (43 ft-lb, 59 N-m)

HINT: Do not turn the crankshaft.



(i) Remove the connecting rod cap.

(j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD size 0.020 – 0.050 mm

(0.0008 – 0.0020 in.)

U/S 0.25 and 0.50 0.019 – 0.063 mm

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 marked on the connecting rod cap.

There are three sizes of standard bearings, marked A, B and C.

(Reference)

Standard bearing thickness (at center wall):

Mark "A" 1.484 – 1.488 mm

(0-0584 – 0.0586 in.)

Mark "B" 1.488 – 1.492 mm

(0.0586 – 0.0587 in.)

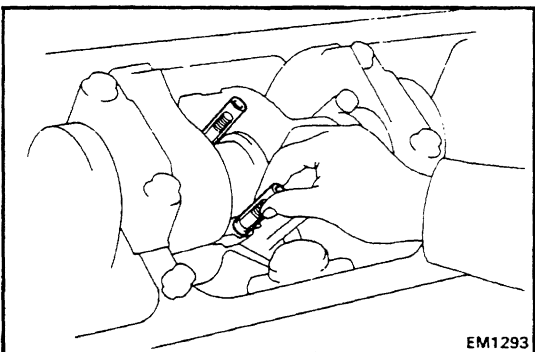
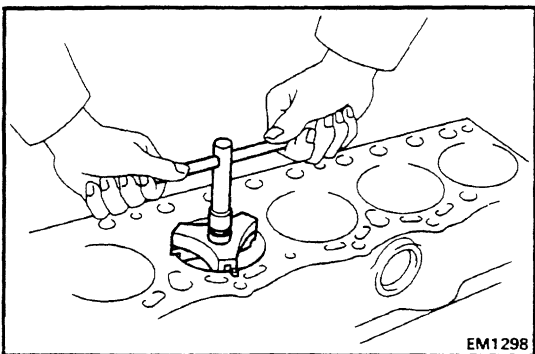
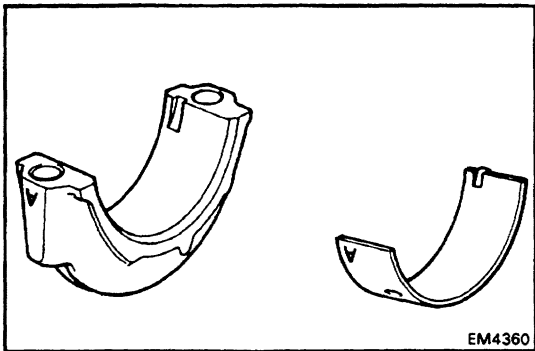
Mark "C" 1.492 – 1.496 mm

(0-0587 – 0.0589 in.)

(k) Completely remove the Plastigage.

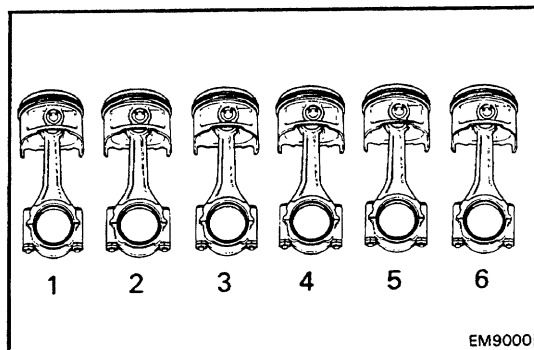
4. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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

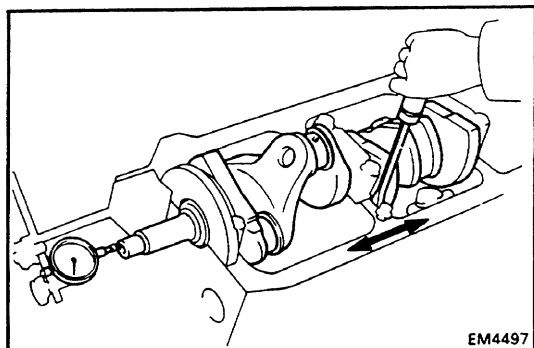


(b) Cover the rod bolts with a short piece of hose to protect the crankshaft from damage.

(c) Push the piston, connecting rod assembly and the 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.

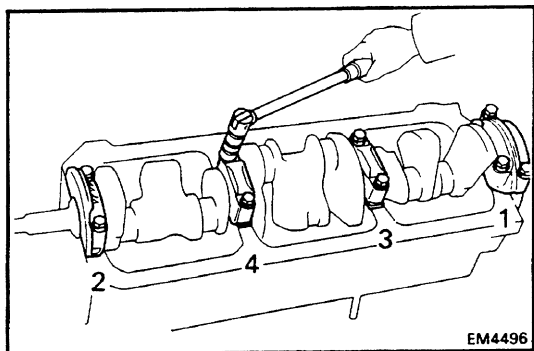
Standard thrust clearance: 0.015 – 0.204 mm

(0–0006 – 0.0080 in.)

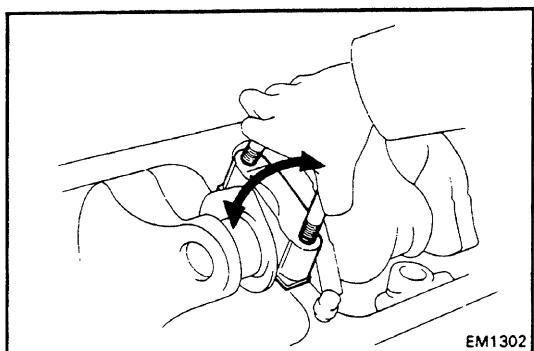
Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

Thrust washer size: STD, O/S 0.125, 0.25

**6. REMOVE MAIN BEARING CAPS AND CHECK OIL CLEARANCE**

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



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

HINT:

- Keep the lower bearing and main bearing cap together.
- Arrange the main bearing caps and lower thrust washers in correct order.

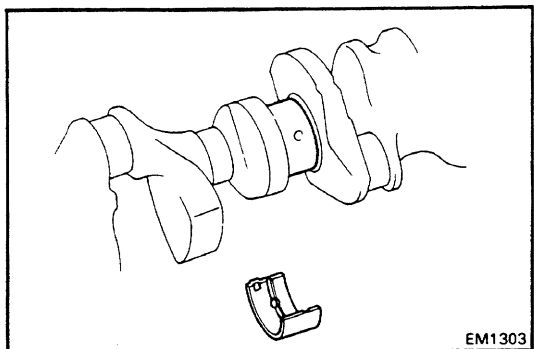
- (c) Lift out the crankshaft.

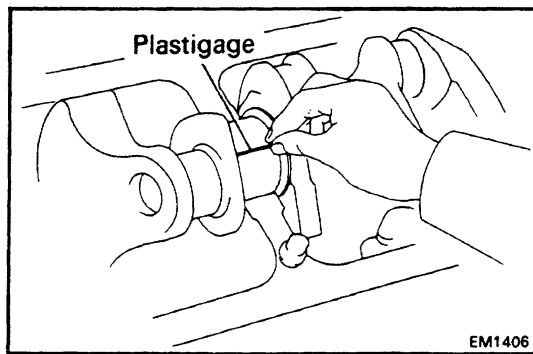
HINT: Keep the upper bearings and upper thrust washers together with the cylinder block.

- (d) Clean each journal and bearing.

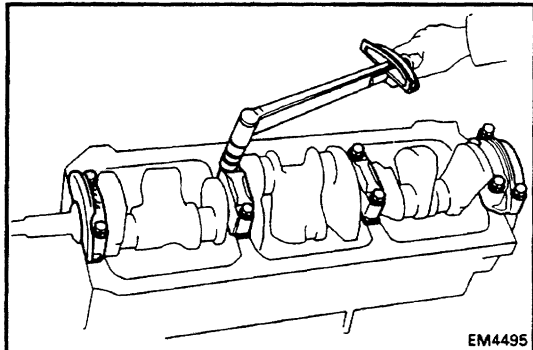
- (e) Check each journal and bearing for pitting and scratches.

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 main caps.
 (See step 5 on page [EM-74](#))

Torque:

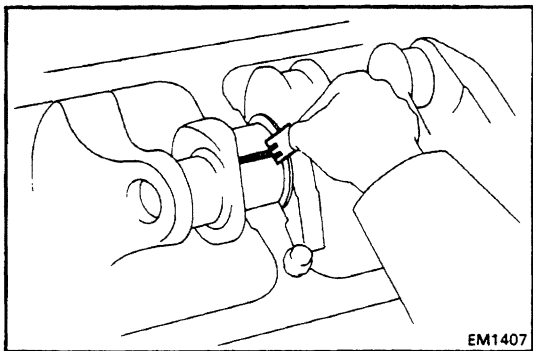
19 mm bolt head

1,375 kg-cm (99 ft-lb, 135 N-m)

17 mm bolt head

1,175 kg-cm (85 ft-lb, 115 N-m)

HINT: Do not turn the crankshaft.



- (i) Remove the main bearing caps.
 (j) Measure the Plastigage at its widest point.

Standard oil clearance:

STD size 0.016 – 0.056 mm

(0.0006 – 0.0022 in.)

U/S 0.25 and 0.50 0.021 – 0.067 mm

(0.0008 – 0.0026 in.)

Maximum oil clearance: 0.10 mm (0.0039 in.)

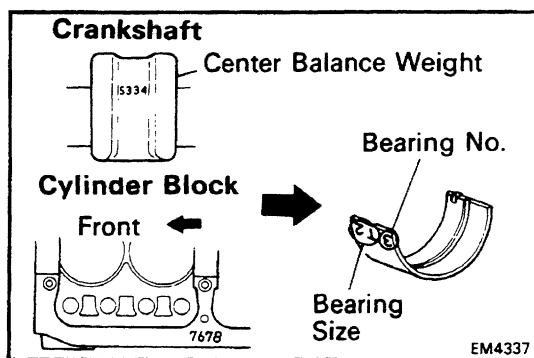
HINT: If replacing the cylinder block subassembly the bearing standard clearance will be:

0.004 – 0.060 mm (0.002 – 0.0024 in.)

If the oil clearance is greater than maximum, replace the bearings. If necessary, grind or replace the crankshaft.

HINT: If replacing a standard size bearing with a standard oil clearance, replace with one having the same number. If the number of the bearing cannot be determined, select a bearing from the table below according to the numbers imprinted on the cylinder block and crankshaft.

There are five sizes of standard bearings, marked T1, T2, T3, T4 and T5.



	Number marked								
Crankshaft	3			4			5		
Cylinder block	6	7	8	6	7	8	6	7	8
Bearing	T3	T4	T5	T2	T3	T4	T1	T2	T3

Example: Crankshaft "5", Cylinder Block "7"
 = Bearing "T2"

(Reference)**Crankshaft journal diameter:**

**Mark "3" No-166.972 – 66.980 mm
(2.6367 – 2.6370 in.)**

**No.2 68.472 – 68.480 mm
(2.6957 – 2.6961 in.)**

**No.3 69.972 – 69.980 mm
(2.7548 – 2.7551 in.)**

**No.4 71.472 – 71.480 mm
(2.8139 – 2.8142 in.)**

**Mark "4" No-1 66.980 – 66.988 mm
(2.6370 – 2.6373 in.)**

**No-2 68.480 – 68.488 mm
(2.6961 – 2.6964 in.)**

**No-3 69.980 – 69.988 mm
(2.7551 – 2.7554 in.)**

**No.4 71.480 – 71.488 mm
(2.8142 – 2.8145 in.)**

**Mark "5" No.1 66.988 – 66.996 mm
(2.6373 – 2.6376 in.)**

**No.2 68.488 – 68.496 mm
(2.6964 – 2.6967 in.)**

**No-3 69.988 – 69.996 mm
(2.7554 – 2.7557 in.)**

**No-4 71.488 – 71.496 mm
(2.8145 – 2.8148 in.)**

Cylinder block main journal bore diameter:

**Mark "6" No.1 72.010 – 72.018 mm
(2.8350 – 2.8353 in.)**

**No.2 73.510 – 73.518 mm
(2.8941 – 2.8944 in.)**

**No.3 75.010 – 75.018 mm
(2.9531 – 2.9535 in.)**

**No-4 76.510 – 76.518 mm
(3.0122 – 3.0125 in.)**

**Mark "7" No.1 72.018 – 72.026 mm
(2.8353 – 2.8357 in.)**

**No.2 73.518 – 73.526 mm
(2.8944 – 2.8947 in.)**

**No.3 75.018 – 75.026 mm
(2.9535 – 2.9538 in.)**

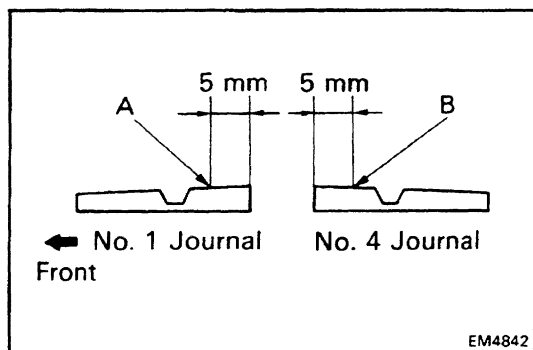
**No.4 76.518 – 76.526 mm
(3.0125 – 3.0128 in.)**

**Mark "8" No.1 72.026 – 72.034 mm
(2.8357 – 2.8360 in.)**

**No.2 73.526 – 73.534 mm
(2.8947 – 2.8950 in.)**

**No-3 75.026 – 75.034 mm
(2.9538 – 2.9541 in.)**

**No.4 76.526 – 76.534 mm
(3.0128 – 3.0131 in.)**



Standard bearing thickness (at center wall):

Mark "T1" 2.493 – 2.497 mm
(0.0981 – 0.0983 in.)

Mark "T2" 2.497 – 2.501 mm
(0.0983 – 0.0985)

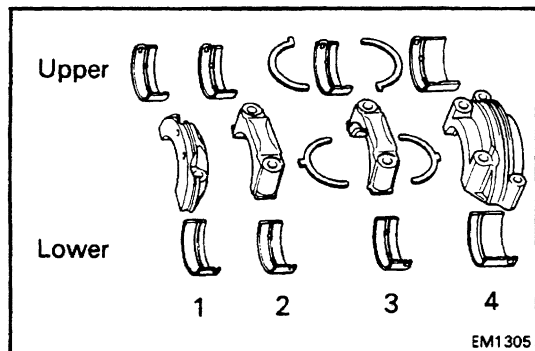
Mark "T3" 2.501 – 2.505 mm
(0.0985 – 0.0986)

Mark "T4" 2.505 – 2.509 mm
(0.0986 – 0.0988)

Mark "T5" 2.509 – 2.513 mm
(0.0988 – 0.0989)

HINT: Check the bearing thickness of No. 1 and No. 4 journals in the positions A, B shown in the illustration.

(k) Completely remove the Plastigage.

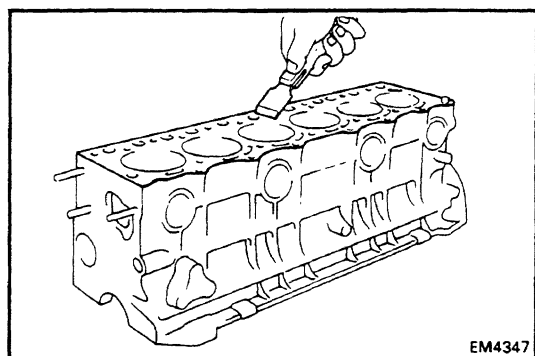


7. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

(b) Remove the upper bearings and upper thrust washers.

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



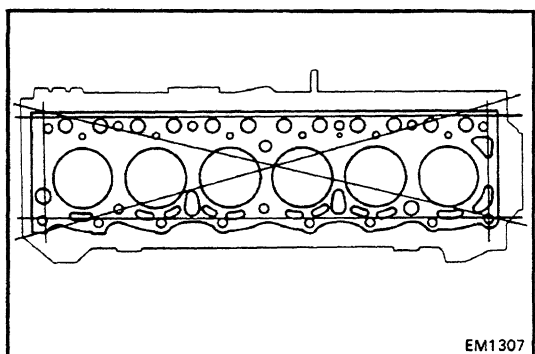
INSPECTION OF CYLINDER BLOCK

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 block.

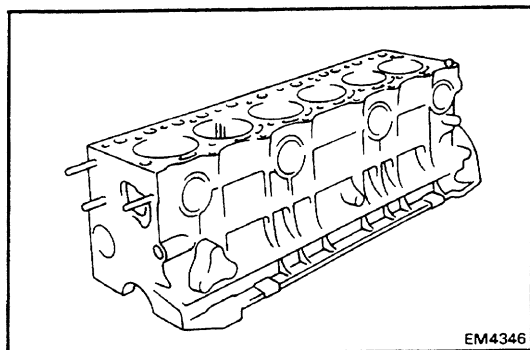


3. INSPECT TOP OF CYLINDER BLOCK FOR FLATNESS

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

Maximum warpage: 0.15 mm (0.0059 in.)

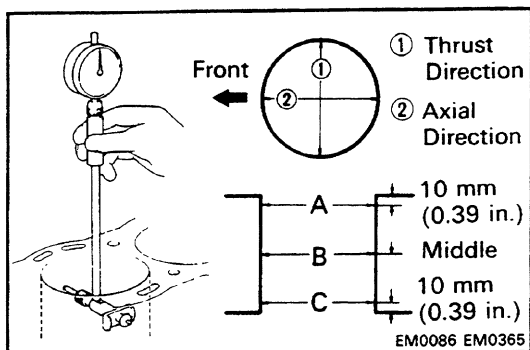
If warpage is greater than maximum, replace the cylinder block.



4. INSPECT CYLINDERS FOR VERTICAL SCRATCHES

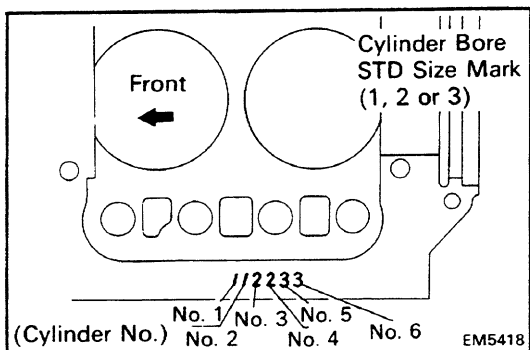
Visually check the cylinder for vertical scratches.

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



5. INSPECT CYLINDER BORE DIAMETER

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



HINT: There are 3 standard sizes for the cylinder bore diameter which are marked on the cylinder block as shown in the illustration.

Standard diameter:

STD size

**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:

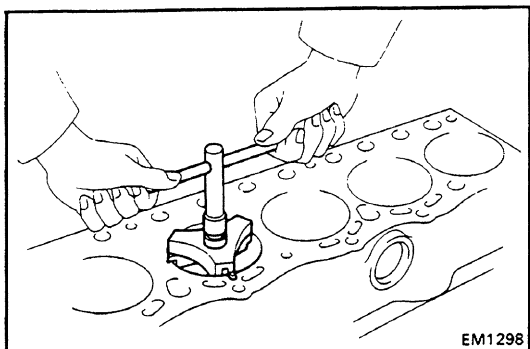
STD size 94.23 mm (3.7098 in.)

4/S 0.50 94.73 mm (3.7295 in.)

O/S 1.00 95.23 mm (3.7492 in.)

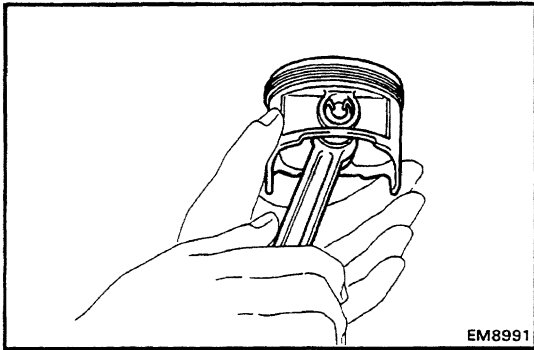
O/S 1.50 95.73 mm (3.7689 in.)

If the diameter is greater than maximum, rebore all six 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 top of the cylinder.



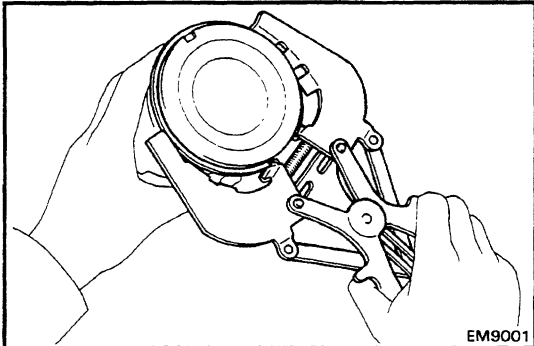
DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLIES

(See page [EM-47](#))

1. CHECK FIT BETWEEN PISTON AND PIN

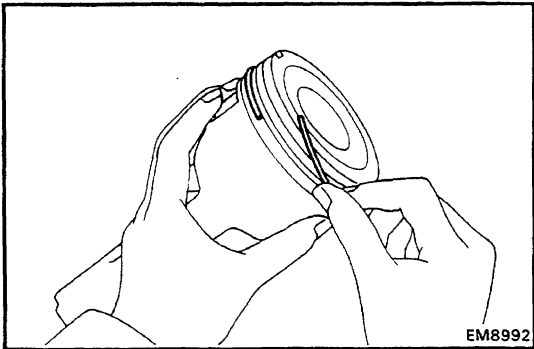
Try to move the piston back and forth on the piston pin.

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



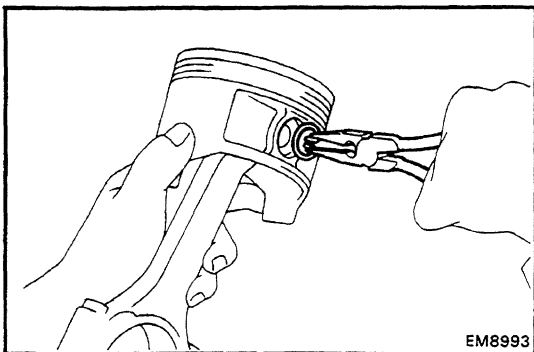
2. REMOVE PISTON RINGS

- (a) Using a piston ring expander, remove the compression rings.



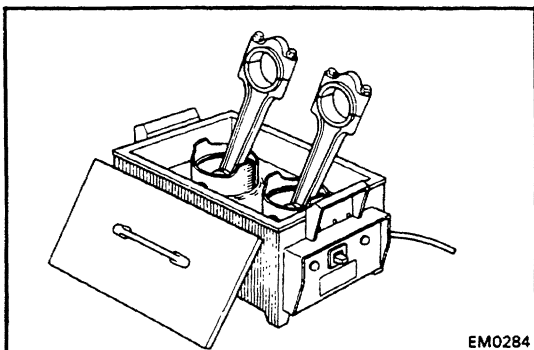
- (b) Remove the two side rails and oil ring expander by hand.

HINT: Arrange the rings in correct order.

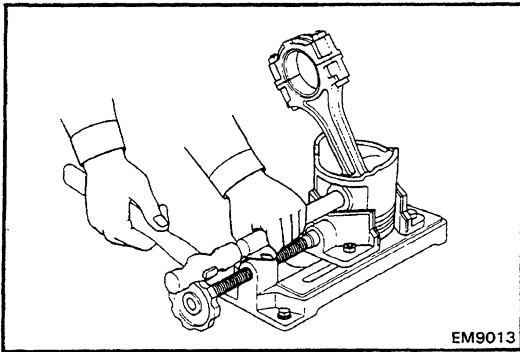


3. DISCONNECT CONNECTING ROD FROM PISTON

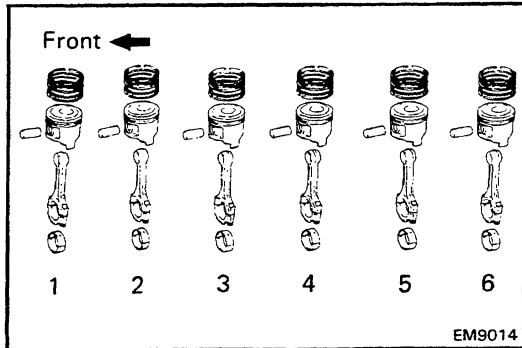
- (a) Using needle-nose pliers, remove the snap rings from the piston.



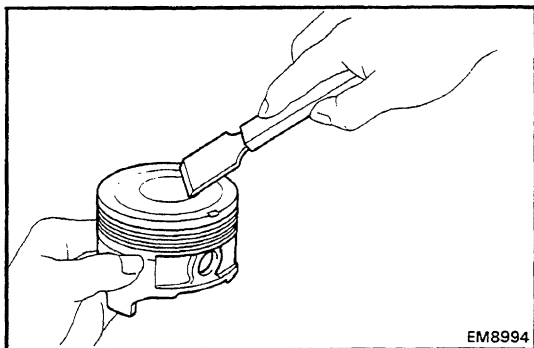
- (b) Gradually heat the piston to approx. 80°C (176°F).



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

**HINT:**

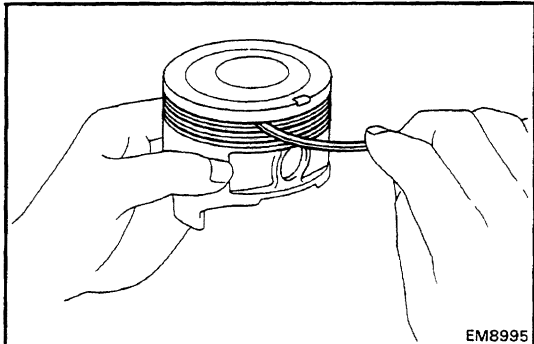
- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in correct order.



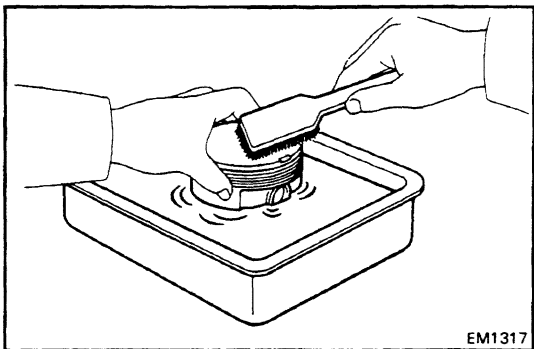
INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLIES

1. CLEAN PISTONS

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

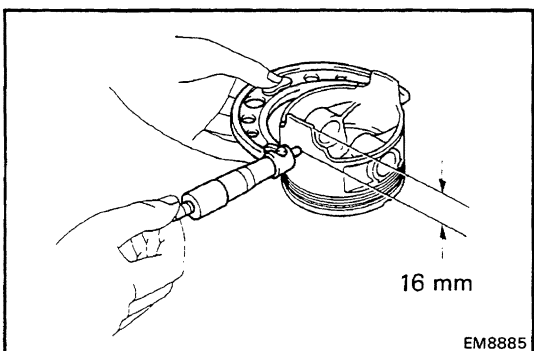


- (b) Using a groove cleaning tool or broken ring, clean the ring grooves.



- (e) Using a soft brush and solvent, thoroughly clean the piston.

NOTICE: Do not damage the piston.



2. INSPECT PISTON DIAMETER AND OIL CLEARANCE

- (a) Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 16 mm (0.63 in.) below the skirt bottom edge.

HINT: There are 3 sizes of standard pistons, marked 1, 2 or 3 as shown in the illustration.

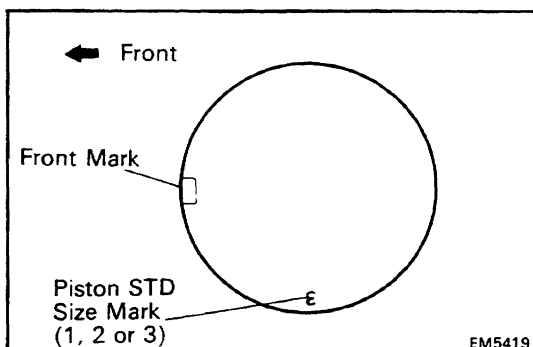
Standard diameter:

STD size

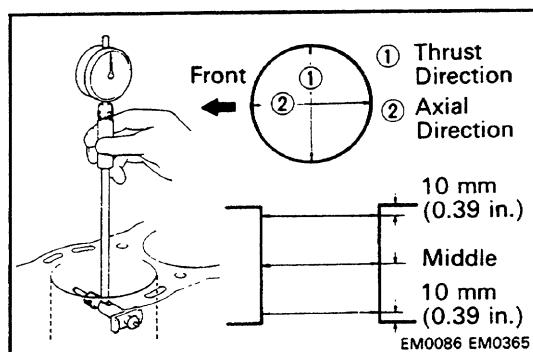
Mark "1" 93.963 – 93.973 mm
(3.6993 – 3.6997 in.)

Mark "2" 93.973 – 93.983 mm
(3.6997 – 3.7001 in.)

Mark "3" 93.983 – 93.993 mm
(3.7001 – 3.7005 in.)



O/S 0.50	94.463 – 94.493 mm (3.7190 – 3.7202 in.)
O/S 1.00	94.963 – 94.993 mm (3.7387 – 3.7399 in.)
O/S 1.50	95.463 – 95.493 mm (3.7584 – 3.7596 in.)



(b) Measure the cylinder bore diameter in thrust directions.
(See step 5 on page EM-59)

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

**Oil clearance: 0.027 – 0.047 mm
(0.0011 – 0.0019 in.)**

If the oil clearance is not within specification, replace the piston. If necessary, rebore all six cylinders and replace all six pistons. If necessary, replace the cylinder block, install a piston with the same mark as marked on the cylinder block.

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

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

Ring groove clearance:

No 10. 030 – 0.070 mm (0.012 – 0.0028 in.)

No 20. 050 – 0.090 mm (0.020 – 0.0035 in.)

If the clearance is not within specification, replace the piston.

4. 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.

(110 mm or 4.33 in. from top surface of cylinder block)

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

Standard end gap:

**No.1 0.200 – 0.420 mm
(0.0079 – 0.0165 in.)**

No. 2 0.050 – 0.720 mm (0.0197 – 0.0283 in.)

**Oil (Side rail) 0.200 – 0.820 mm
(0.0079 – 0.0323 in.)**

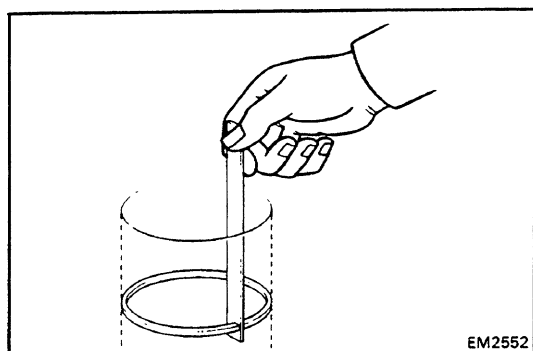
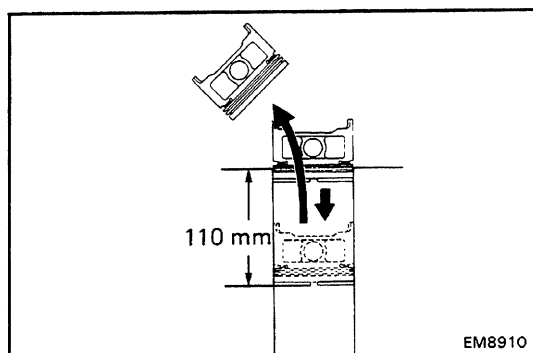
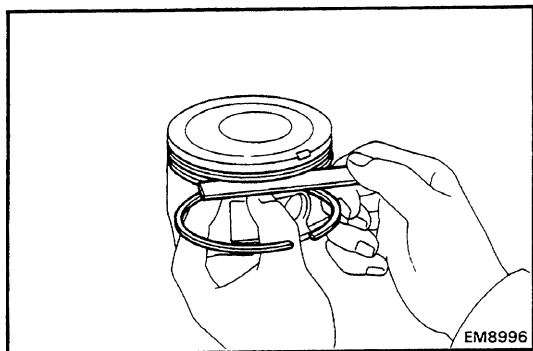
Maximum end gap:

No.1 1.02 mm (0.0402 in.)

No.2 1.32 mm (0.0520 in.)

Oil (Side rail) 1.42 mm (0.0559 in.)

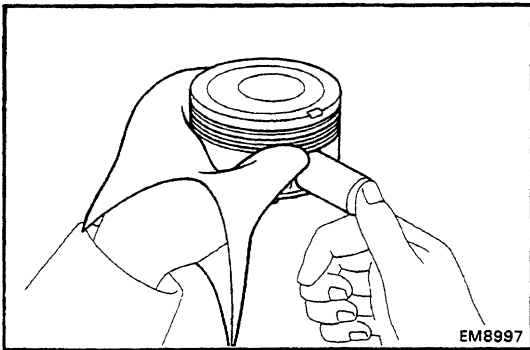
If the gap is greater than maximum, replace the piston ring. If the gap is greater than maximum, even with a new piston ring, rebore the cylinder and use an O/S piston ring.



5. CHECK PISTON PIN FIT

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

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



EM8997

6. INSPECT CONNECTING RODS

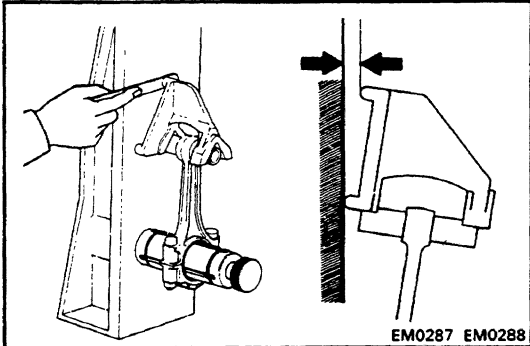
(a) Using a rod aligner and thickness gauge, check the connecting rod alignment.

- Check for bend.

Maximum bend:

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

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



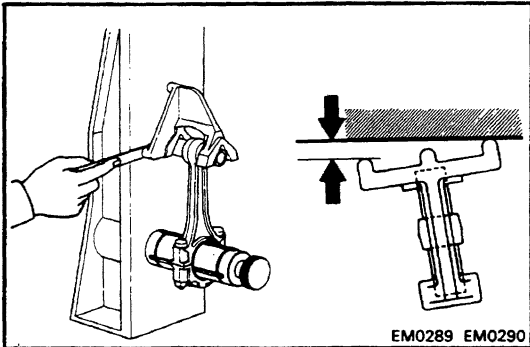
EM0287 EM0288

- Check for twist.

Maximum twist:

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

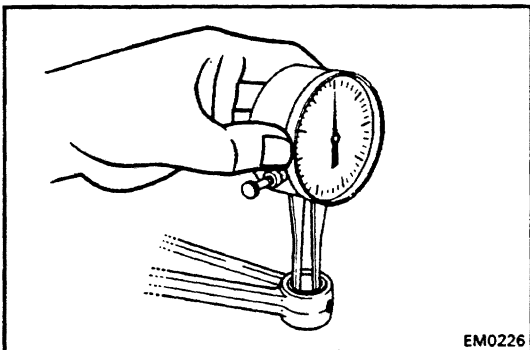
If twist is greater than maximum, replace the connecting rod assembly.



EM0289 EM0290

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

**Bushing inside diameter: 22.012 – 22.027 mm
(0.8666 – 0.8672 in.)**



EM0226

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

**Piston pin diameter: 22.004 – 22.019 mm
(0.8663 – 0.8669 in.)**

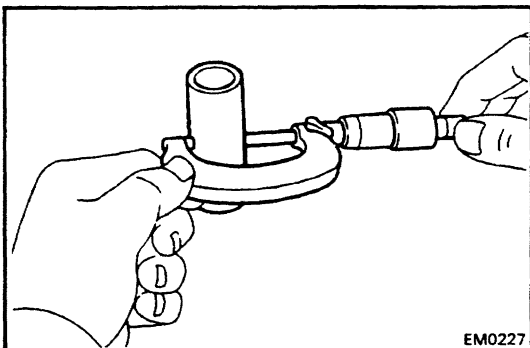
(d) Subtract the piston pin diameter measurement from the bushing inside diameter measurement.

Standard oil clearance: 0.005 – 0.011 mm

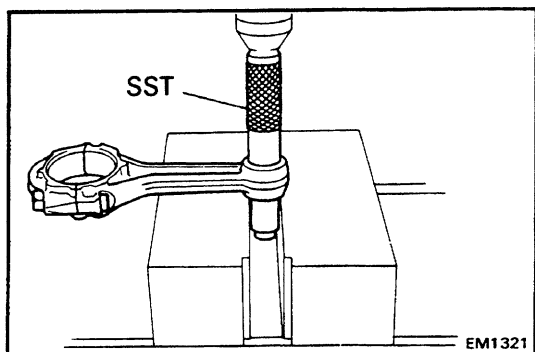
(0.0002 – 0.0004 in.)

Maximum oil clearance: 0.03 mm (0.0012 in.)

If the oil clearance is greater than maximum, replace the connecting rod bushing. If necessary, replace the piston and piston pin assembly.



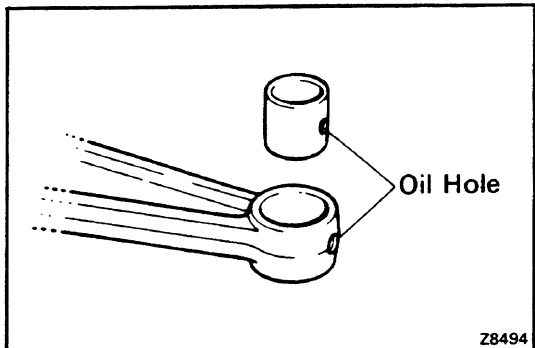
EM0227



REPLACEMENT OF CONNECTING ROD BUSHINGS

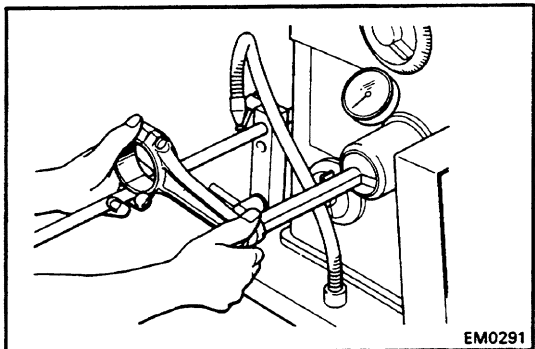
1. REMOVE CONNECTING ROD BUSHING

Using SST and a press, press out the bushing.
SST 09222-30010



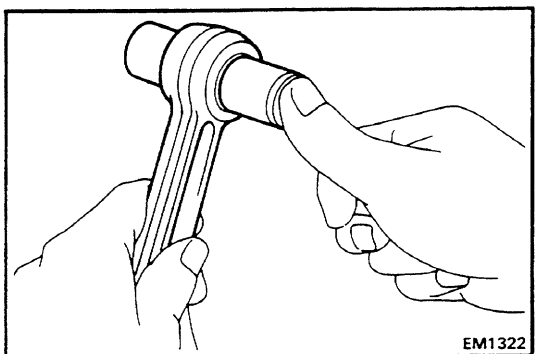
2. INSTALL NEW CONNECTING ROD BUSHING

- (a) Align the oil holes of the bushing and connecting rod.
- (b) Using SST and a press, press in the bushing.
SST 09222-30010



3. HONE ROD BUSHING AND CHECK PISTON PIN FIT IN CONNECTING ROD

- (a) Using a pin hole grinder, hone the bushing to obtain the specified clearance 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 six cylinders for the oversized piston outside diameter.
- Replace the piston rings with ones to match the oversized pistons.

1. SELECT OVERSIZED PISTONS

Oversized piston diameter:

O/S 0.50 94.463 – 94.493 mm

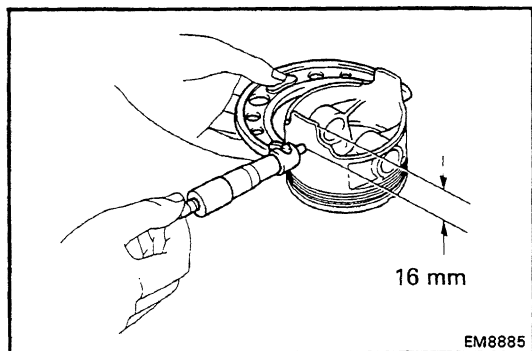
(3.7190 – 3.7202 in.)

O/S 1.00 94.963 – 94.993 mm

(3.7387 – 3.7399 in.)

O/S 1.50 95.463 – 95.493 mm

(3.7584 – 3.7596 in.)



2. CALCULATE AMOUNT TO BORE CYLINDER

- Using a micrometer, measure the piston diameter at a right angle to the piston pin hole center line, 16 mm (0.63 in.) below the skirt bottom edge.
- Calculate the amount each cylinder is to be rebored as follows:

$$\text{Size to be rebored} = P + C - H$$

P = Piston diameter

C = Piston clearance

0.027 – 0.047 mm (0.0012 – 0.0020 in.)

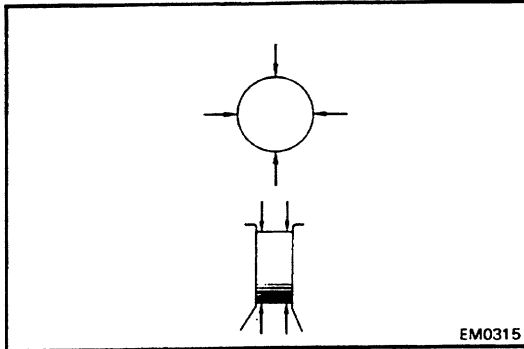
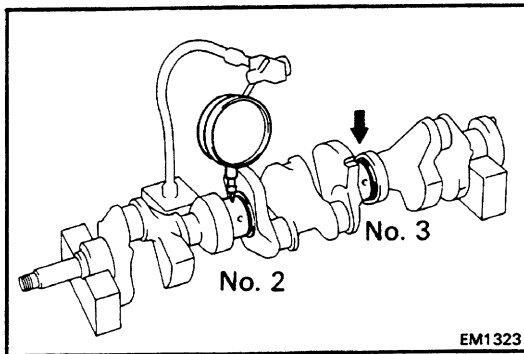
H = Allowance for honing

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.



INSPECTION AND REPAIR OF CRANKSHAFT

1. INSPECT CRANKSHAFT FOR RUNOUT

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

Maximum circle runout: 0.12 mm (0.0048 in.)

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

2. INSPECT MAIN JOURNALS AND CRANK PINS

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

Main journal diameter (from front side):

STD size No-1 66.972 – 66.996 mm
(2.6367 – 2.6376 in.)

No.2 68.472 – 68.496 mm
(2.6957 – 2.6967 in.)

No.3 69.972 – 69.996 mm
(2.7548 – 2.7557 in.)

No.4 71.472 – 71.496 mm
(2.8139 – 2.8148 in.)

U/S 0.25 No-1 66.745 – 66.755 mm
(2.6278 – 2.6281 in.)

No.2 68.245 – 68.255 mm
(2.6868 – 2.6872 in.)

No.3 69.745 – 69.755 mm
(2.7459 – 2.7463 in.)

No.4 71.245 – 71.255 mm
(2.8049 – 2.8053 in.)

U/S 0.50 No.1 66.495 – 66.505 mm
(2.6179 – 2.6183 in.)

No.2 67.995 – 68.005 mm
(2.6770 – 2.6774 in.)

No.3 69.495 – 69.505 mm
(2.7360 – 2.7364 in.)

No.4 70.995 – 71.005 mm
(2.7951 – 2.7955 in.)

Crank pin diameter:

STD size 52.988 – 53.000 mm
(2-0861 – 2.0866 in.)

U / S 0.25 52.701 – 52.711 mm
(2-0748 – 2.0752 in.)

U / S 0.50 52.451 – 52.461 mm
(2.0650 – 2.0654 in.)

If the diameter is not within specification, check the oil clearance. If necessary, grind or replace the crankshaft.

- 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 taper or 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 step 2).
Install new main journal and/or crank pin undersized bearings.

INSPECTION AND REPAIR OF CAMSHAFT BEARINGS

1. INSPECT CAMSHAFT OIL CLEARANCE

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

Bearing inside diameter (from front side)

STD size No.1 48.000 – 48.030 mm
(1.8898 – 1.8909 in.)

No.2 46.500 – 46.530 mm
(1.8307 – 1.8319 in.)

No.3 45.000 – 45.030 mm
(1.7717 – 1.7728 in.)

No-4 43.500 – 43.530 mm
(1.7126 – 1.7138 in.)

U / S 0.25 No-1 47.750 – 47.825 mm
(1.8799 – 1.8829 in.)

No-2 46.250 – 46.325 mm
(1.8209 – 1.8238 in.)

No-3 44.750 – 44.820 mm
(1.7618 – 1.7646 in.)

No-4 43.250 – 43.320 mm
(1.7028 – 1.7055 in.)

U / S 0.50 No.1 47.500 – 47.575 mm
(1.8701 – 1.8730 in.)

No.2 46.000 – 46.075 mm
(1.8110 – 1.8140 in.)

No.3 44.500 – 44.570 mm
(1.7520 – 1.7547 in.)

No-4 43.000 – 43.070 mm
(1.6929 – 1.6957 in.)

- (b) Subtract the journal diameter measurement (See page [EM-40](#)) from the bearing inside diameter measurement.

Standard clearance:

STD size 0.025 – 0.075 mm
(0.0010 – 0.0030 in.)

U/S 0.25 and 0.50

No.1 and No.2 0.025 – 0.110 mm
(0.0010 – 0.0043 in.)

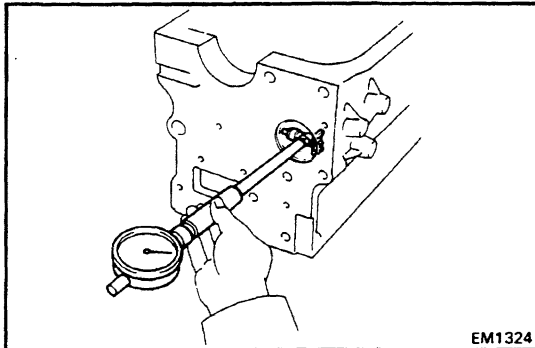
No-3 and No.4 0.025 – 0.105 mm
(0.0010 – 0.0041 in.)

Maximum clearance:

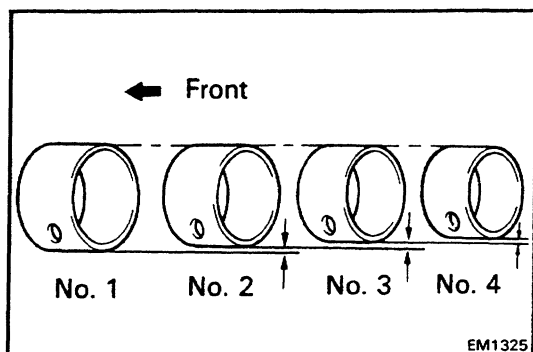
STD size 0.10 mm (0.0039 in.)

U/S 0.25 and 0.50 0.15 mm (0.0059 in.)

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

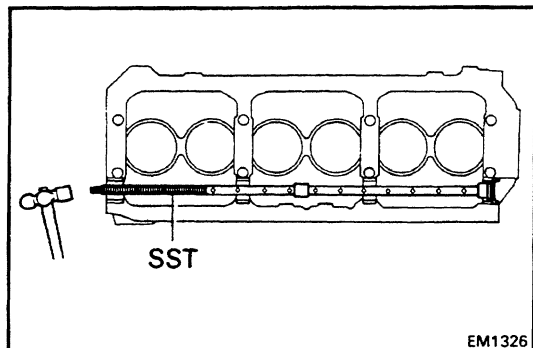


EM1324



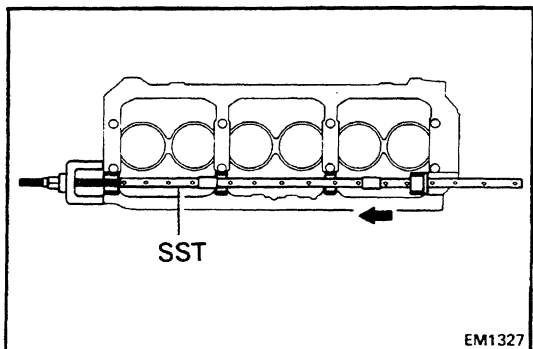
2. IF NECESSARY, REPLACE CAMSHAFT BEARINGS

HINT: The outside diameter varies with each bearing.



A. Remove expansion plug

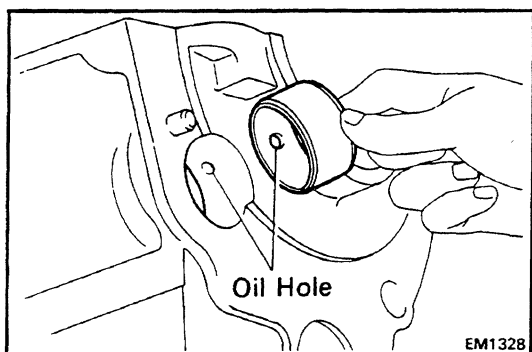
Using SST and a hammer, tap out the expansion plug.
SST 09215-00100 (09215-00130, 09215-00150, 09215-00210)



6. Remove camshaft bearings

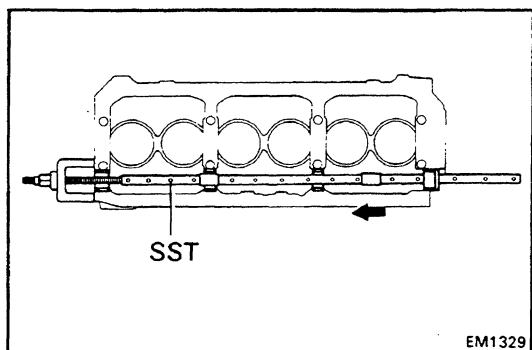
Using SST, remove the bearings.

SST 09215-00012 (09215-00020, 09215-00030, 09215-00410, 09215-00420) and
09215-00100 (09215-00130, 09215-00140, 09215-00150, 09215-00160, 09215-00240, 09215-00270)



C. Install new camshaft bearings

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



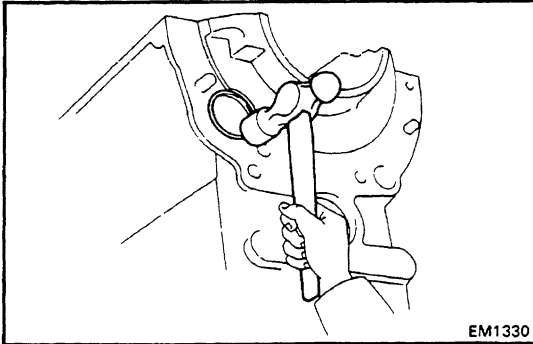
(b) Using SST install the bearings.

SST 09215-00012 (09215-00020, 09215-00030, 09215-00410, 09215-00420) and
09215-00100 (09215-00130, 09215-00140, 09215-00150, 09215-00160, 09215-00240, 09215-00270)

D. Ream camshaft bearings

Ream the bearings to the finished diameter.

(See page [EM-68](#))

**E. Install expansion plug**

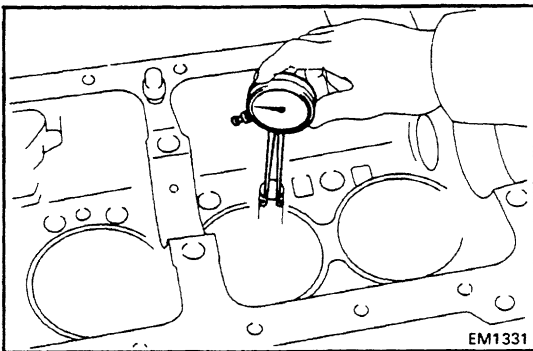
- (a) Apply sealant to the expansion plug surface of the cylinder block.

Sealant: Part No. 08833-00070, THREE BOND 1324 or equivalent

- (b) Using a hammer, tap in a new expansion plug until its surface is flush with the cylinder block edge.

3. IF NECESSARY, GRIND AND HONE CAMSHAFT JOURNALS

Grind and hone the journals to the undersized finished diameter. (See page [EM-40](#))

**INSPECTION OF VALVE LIFTER BORES****INSPECT VALVE LIFTER OIL CLEARANCE**

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

**Bore diameter: 21.417 – 21.443 mm
(0.8432 – 0.8442 in.)**

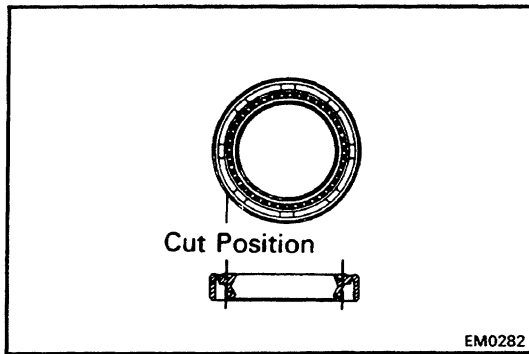
- (b) Subtract the valve lifter diameter measurement (See page [EM-42](#)) for diameter measurement.

**Standard oil clearance: 0.013 – 0.056 mm
(0.0005 – 0.0022 in.)**

Maximum oil clearance: 0.10 mm (0.0039 in.)

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

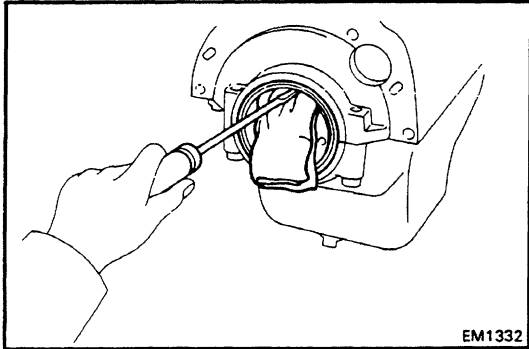
Valve lifter size: STD, O/S 0.05



REPLACEMENT OF CRANKSHAFT REAR OIL SEAL

REPLACE CRANKSHAFT REAR OIL SEAL

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

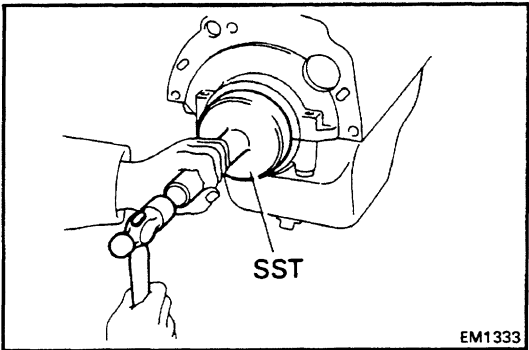


(b) Using a screwdriver, pry out the oil seal.

NOTICE: Be careful not to damage the crankshaft.

Tape the screwdriver tip.

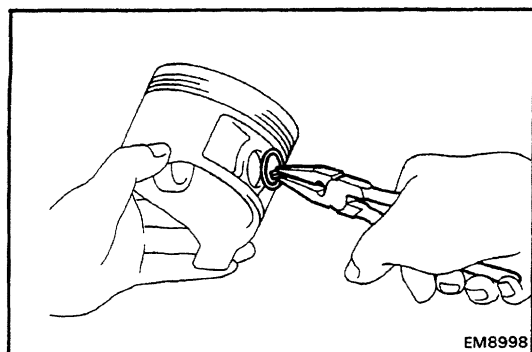
(c) Check the oil seal lip contact surface of the crankshaft for cracks or damage.



(d) Apply MP grease to a new oil seal lip.

(e) Using SST and a hammer, tap in the oil seal until its surface is flush with the cylinder block and main bearing cap edges.

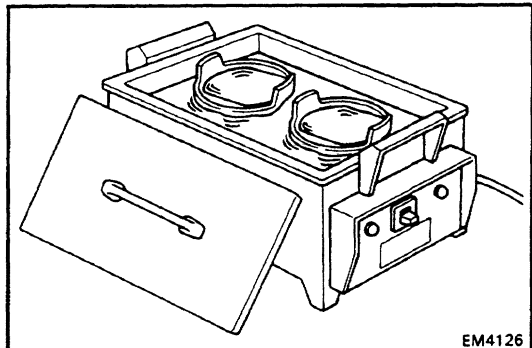
SST 09223-60010



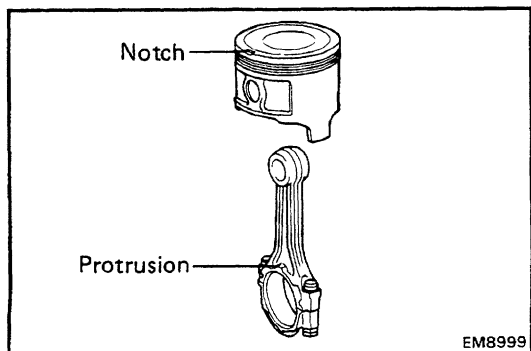
ASSEMBLY OF PISTON AND CONNECTING ROD

1. ASSEMBLE PISTON AND CONNECTING ROD

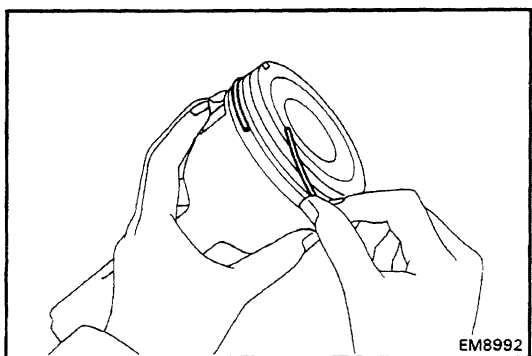
- (a) Install a new snap ring on one side of the piston pin hole.



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

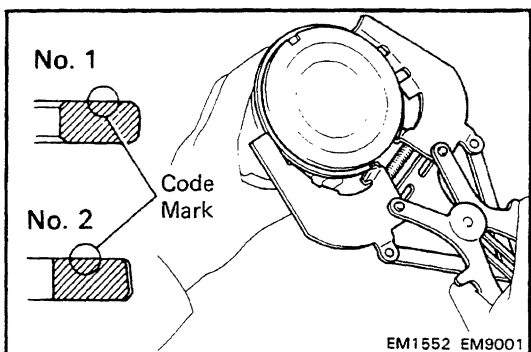


- (c) Coat the piston pin with engine oil.
 (d) Align the notch of the piston with the protrusion of the connecting rod and push in the piston pin with your thumb.
 (e) Install a new snap ring on the other side of the pin hole.

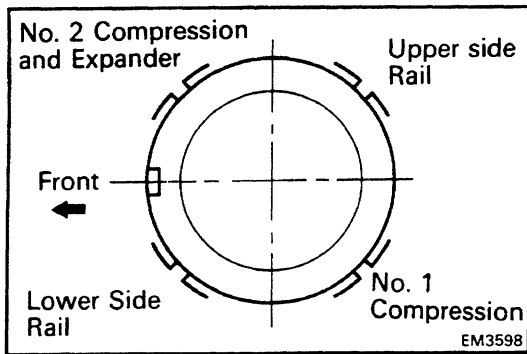


2. INSTALL PISTON RINGS

- (a) Install the oil ring expander and two side rails by hand.

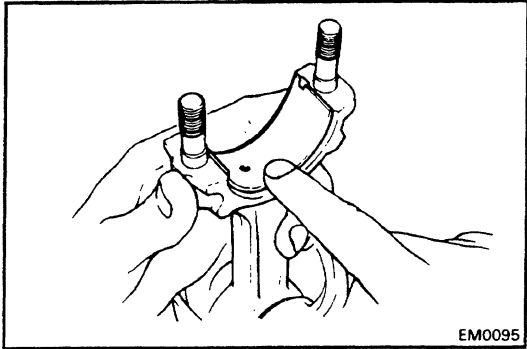


- (b) Using a piston ring expander, install the two compression rings with the code mark facing upward.



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

NOTICE: Do not align the end gaps.



3. INSTALL CONNECTING ROD BEARINGS

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

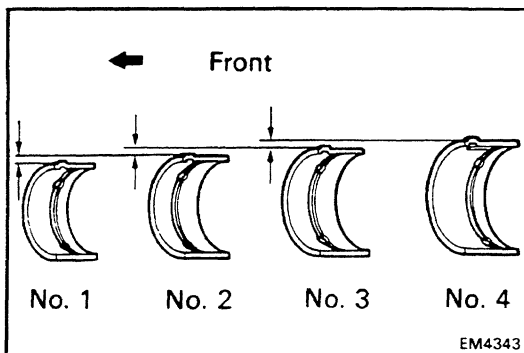
NOTICE: Install the bearings with the oil hole in the connecting rod.

ASSEMBLY OF CYLINDER BLOCK

(See page [EM-47](#))

HINT:

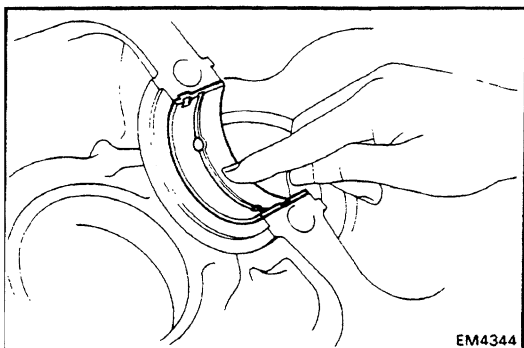
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.



1. INSTALL MAIN BEARINGS

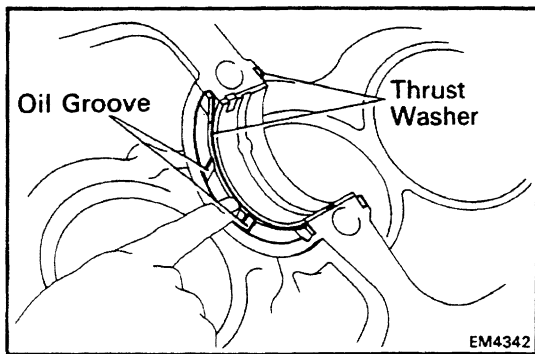
HINT:

- The outside diameter varies with each bearing.
- All main bearing have oil holes except No. 1 and No. 4 bearings on the lower side.



- (a) Align the bearing claw with the the claw groove of the main bearing cap or cylinder block.
 (b) Install the bearing in the cylinder block and bearing caps.

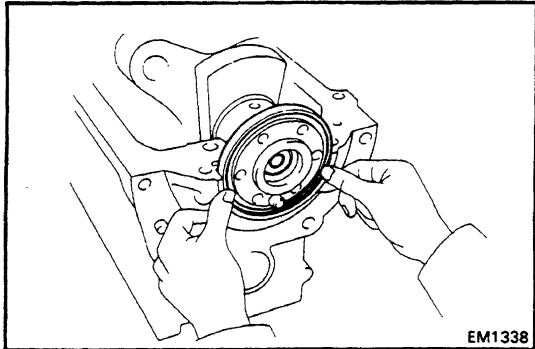
NOTICE: Install the bearing with the oil hole in the block.



2. INSTALL UPPER THRUST WASHERS

Install the thrust washers under the No. 3 main journal cap position of the block with the oil grooves facing outward.

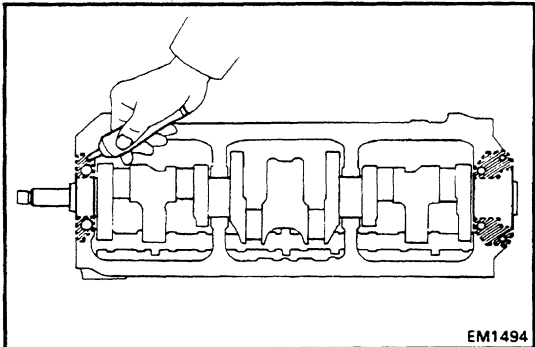
3. PLACE CRANKSHAFT ON CYLINDER BLOCK



4. INSTALL NEW CRANKSHAFT REAR OIL SEAL

- (a) Apply MP grease to the oil seal lip.
- (b) Push in the oil seal until its surface is flush with the cylinder block edge.

NOTICE: Be careful not to install the oil seal slantwise.

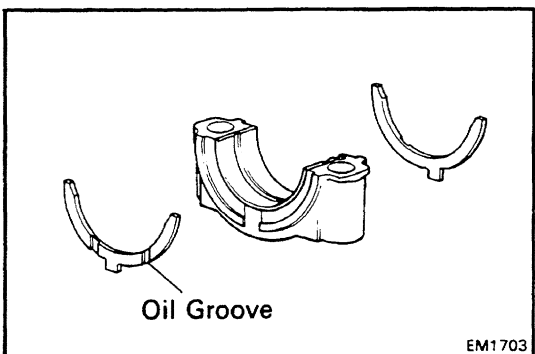


5. INSTALL MAIN BEARING CAPS AND LOWER THRUST WASHERS

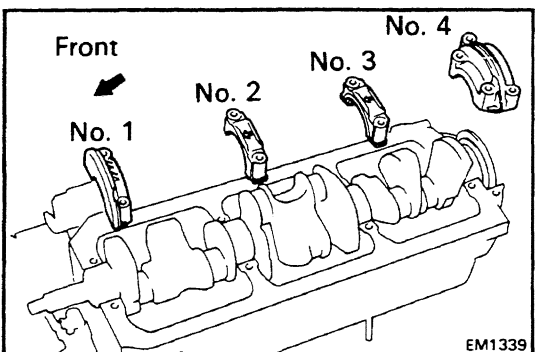
- (a) Apply seal packing to the main bearing installation surface of the cylinder block.

Seal packing: Part No. 08820-00080 or equivalent

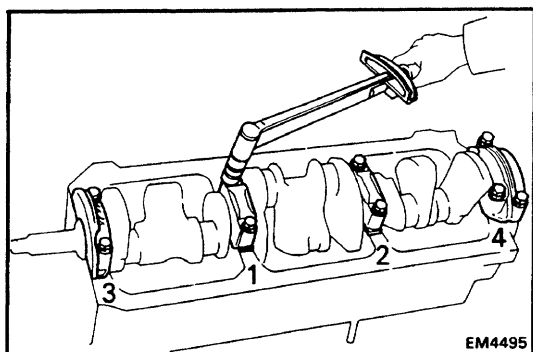
NOTICE: Be careful not to apply seal packing to the main bearing.



- (b) Install the lower thrust washers on the No. 3 main bearing cap with the grooves facing outward.



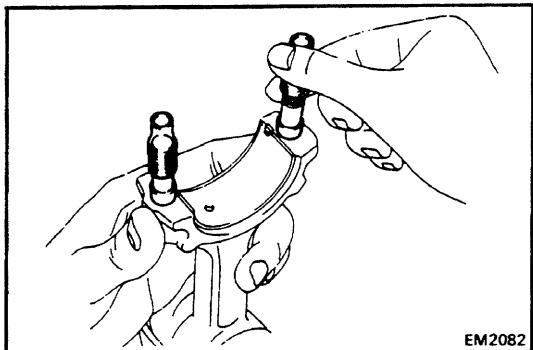
- (c) Install the main bearing caps in their proper location.



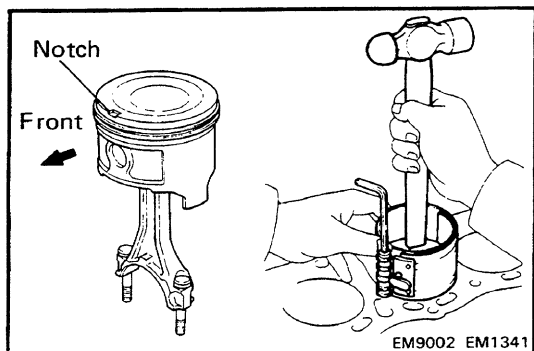
- (d) Apply a light coat of engine oil to the threads and the bolt heads of the main bearing caps.
- (e) Install and uniformly tighten the ten bolts of the main bearing caps in several passes, in the sequence shown.

Torque:**19 mm bolt head****1,375 kg-cm (99 ft-lb, 135 N-m)****17 mm bolt head****1,175 kg-cm (85 ft-lb, 115 N-m)**

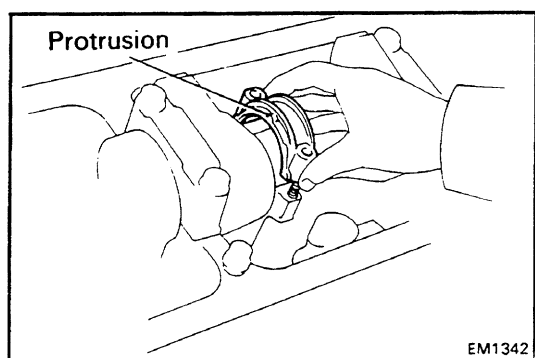
- (f) Check that the crankshaft turns smoothly.
- (g) Check the crankshaft thrust clearance.
(See step 5 on page [EM-55](#))

6. INSTALL PISTON AND CONNECTING ROD ASSEMBLIES

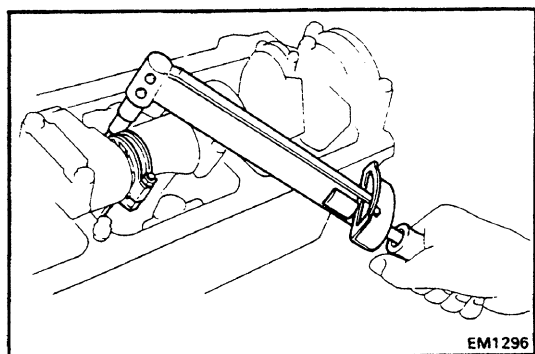
- (a) Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



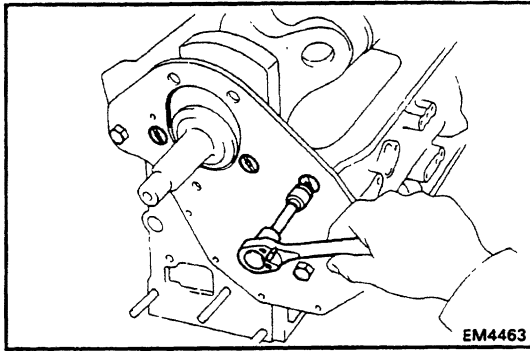
- (b) Using a piston ring compressor, push the correctly numbered piston and connecting rod assemblies into the cylinder with the notch of the piston facing forward.

**7. INSTALL CONNECTING ROD CAPS**

- (a) Match the numbered cap with the numbered connecting rod.
- (b) Install the connecting rod cap with the protrusion facing forward.



- (c) Apply a light coat of engine oil to the threads and under the nuts of the connecting rod cap.
 - (d) Install and alternately tighten the connecting rod cap nuts in several passes.
- Torque: 600 kg-cm (43 ft-lb, 59 N-m)**
- (e) Check that the crankshaft turns smoothly.
 - (f) Check the connecting rod thrust clearance.
(See step 2 on page [EM-52](#))



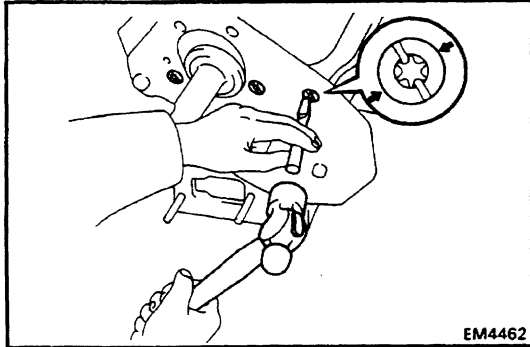
8. INSTALL FRONT END PLATE

- (a) Install the end plate with the two bolts.
- (b) Using a torx socket wrench, torque the screws.

Torque: 250 kg-cm (18 ft-lb, 25 N-m)

- (c) Torque the bolts.

Torque: 310 kg-cm (22 ft-lb, 30 N-m)



- (d) Using a chisel and hammer, stake the screws.

POST ASSEMBLY

1. INSTALL OIL PUMP AND OIL PAN

(See page [LU-12](#))

2. INSTALL OIL COOLER AND OIL FILTER BRACKET

(See page [LU-16](#))

3. INSTALL TIMING GEARS AND CAMSHAFT

(See pages [EM-43](#) to 46)

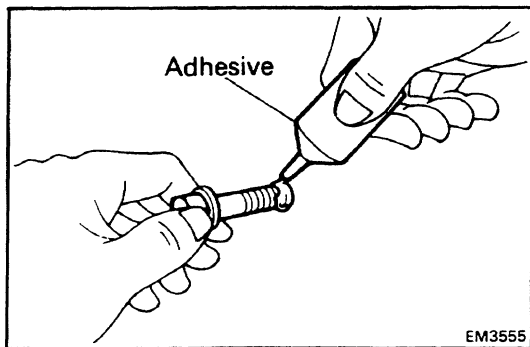
4. INSTALL WATER PUMP

5. INSTALL CYLINDER HEAD

(See page [EM-30](#))

6. REMOVE ENGINE STAND

7. INSTALL TRANSMISSION HOUSING ADAPTOR



8. INSTALL DRIVE PLATE

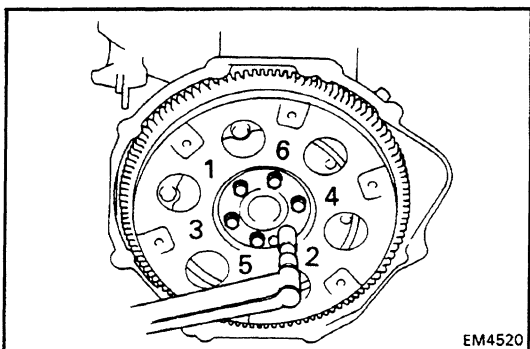
- (a) Clean the mount bolt threads and crankshaft bolt holes of any residual sealer, oil or foreign particles. Remove any oil with kerosene or gasoline.
- (b) Apply adhesive to two or three threads of the mount bolt end.

Adhesive: Part No. 08833-00070, THREE BOND 1324 or equivalent

HINT:

- This sealant will not harden while exposed to air.
 - It will act as a sealer or binding agent only when applied to threads, etc. when the air is cut off.
- (c) Install the drive plate on the crankshaft.
 - (d) Install and uniformly tighten the bolts in several passes, in the sequence shown.

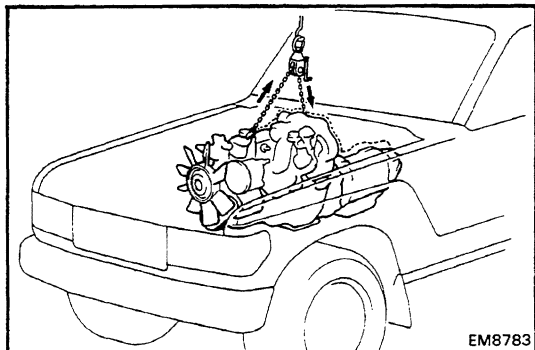
Torque: 890 kg-cm (64 ft-lb, 87 N-m)



INSTALLATION OF ENGINE

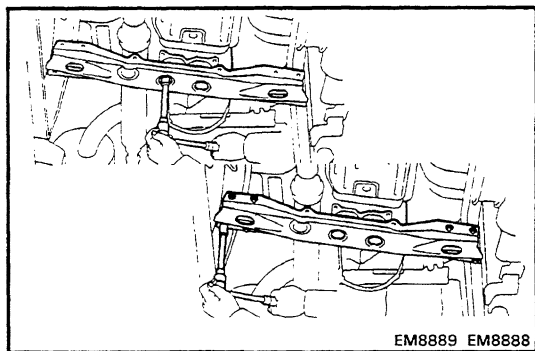
1. INSTALL TRANSMISSION TO ENGINE

2. INSTALL A/T OIL COOLER PIPES



3. INSTALL ENGINE WITH TRANSMISSION IN VEHICLE

- (a) Attach the engine hoist chain to the engine hangers.
- (b) Lower the engine into the engine compartment.
- (c) Align the engine with the transmission and engine mounting supports.
- (d) Install the washers and mount nuts.
- (e) Remove the hoist chain.



4. RAISE VEHICLE

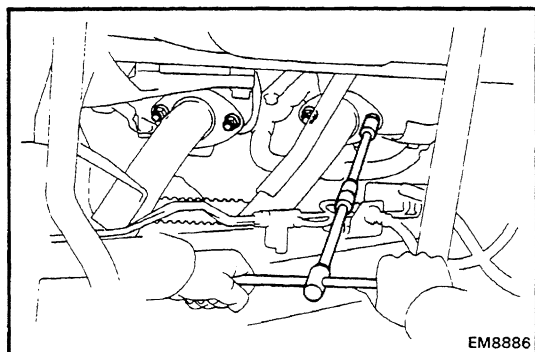
NOTICE: Be sure the vehicle is securely supported.

5. INSTALL FRAME CROSSMEMBER

Install the frame crossmember with the eight bolts and two nuts.

Torque: Bolt 400 kg-cm (29 ft-lb, 39 N-m)

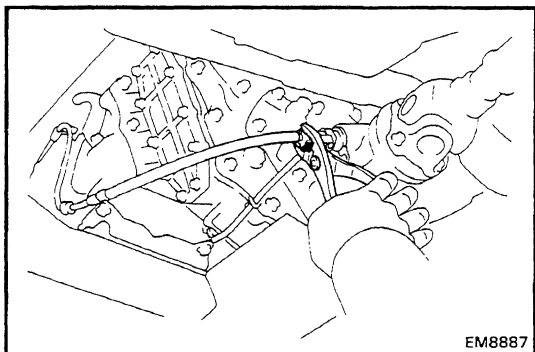
Nut 600 kg-cm (43 ft-lb, 59 N-m)



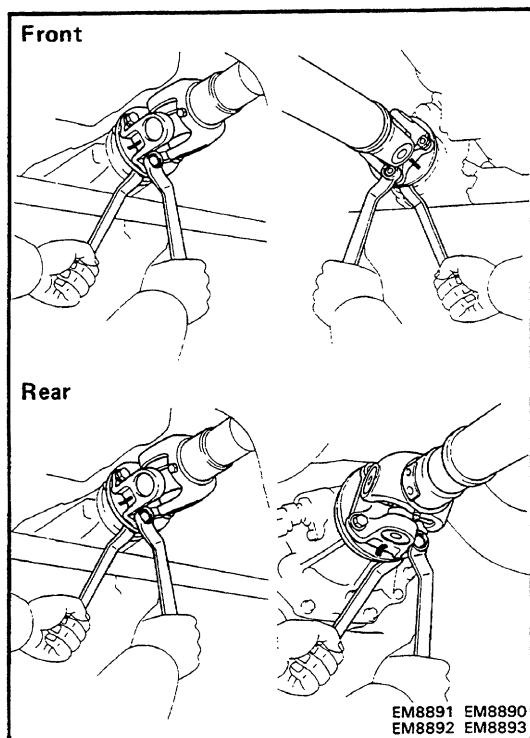
6. CONNECT EXHAUST PIPE TO EXHAUST MANIFOLD

- (a) Place two new gaskets on the exhaust pipe.
- (b) Connect the exhaust pipe with four new nuts.

Torque: 630 kg-cm (46 ft-lb, 62 N-m)



7. CONNECT SPEEDOMETER CABLE



8. INSTALL FRONT AND REAR PROPELLER SHAFTS

(Front)

- Align the matchmarks on the flanges and connect the flanges with the four nuts.

- Torque the nuts.

Torque: 900 kg-cm (65 ft-lb, 88 N-m)

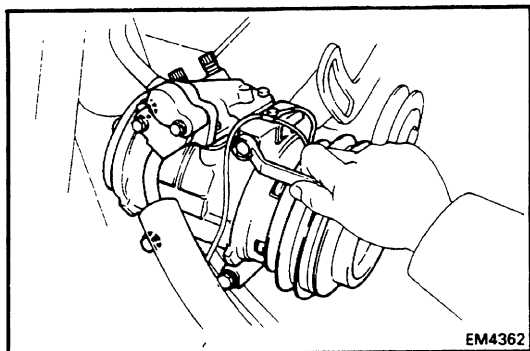
(Rear)

- Align the matchmarks on the flanges and connect the flanges with the four bolts and nuts.

- Torque the bolts and nuts.

Torque: 900 kg-cm (65 ft-lb, 88 N-m)

9. INSTALL TRANSFER UNDER COVER

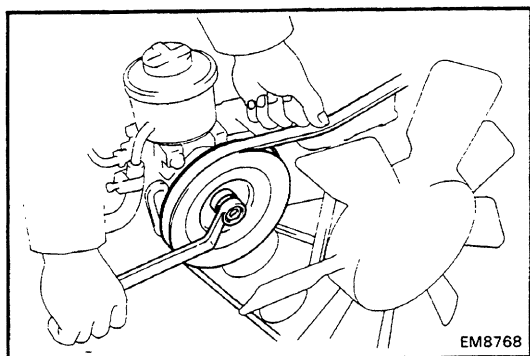


10. INSTALL A/C COMPRESSOR

- Install the A/C compressor with the four bolts.

- Install and adjust the drive belt.

(See page [MA-4](#))



11. INSTALL PS PUMP

- Install the PS pump with the two bolts. Do not tighten the bolts.

- Install the woodruff key, drive pulley with the plate washer spring washer and mount nut.

- Install and adjust drive belt

(See page [MA-4](#))

- Push on the drive belt to hold the pulley in place and torque the pulley nut.

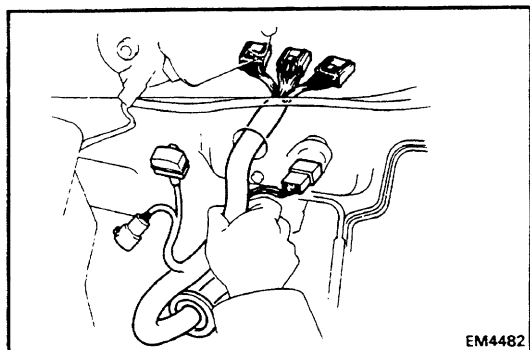
Torque: 480 kg-cm (35 ft-lb, 47 N-m)

12. CONNECT EFI WIRE HARNESS TO ECU

- Push in the EFI wire harness through the cowl panel.

- Connect the four connectors.

- Install the glove box.



13. CONNECT FOLLOWING HOSES:

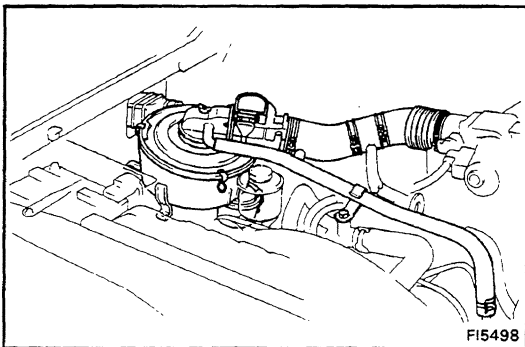
- (a) Heater hoses
- (b) Fuel hoses
- (c) Transfer hose
- (d) Brake booster hose
- (e) PS air control valve hose
- (f) AI hoses
- (g) Distributor hose
- (h) Emission control hoses

14. CONNECT FOLLOWING WIRES AND CONNECTORS

- (a) Oil pressure connector
- (b) High tension cord from ignition coil
- (c) Neutral start switch and transfer connectors located near the starter
- (d) Front differential lock connector
- (e) Starter wire and connector
- (f) Ground strap from starter
- (g) Oxygen sensor connectors
- (h) Alternator wire and connector
- (i) Cooling fan connector
- (j) Check connector
- (k) Connector on RH fender apron

15. INSTALL RADIATOR

(See page [CO-20](#))

16. INSTALL COOLANT RESERVOIR TANK**17. INSTALL AIR INTAKE HOSE, AIR FLOW METER AND AIR CLEANER ASSEMBLY**

- (a) Install the air cleaner case with the three bolts.
- (b) Install the air cleaner element.
- (c) Install the air intake hose, air flow meter and air cleaner cap with the wing nut and three clips.
- (d) Connect the following hoses:
 - . ISC hose
 - . Air pump hose
 - . Distributor hose
 - . PCV hose
 - . Three hoses from the intake chamber rear side
 - . Two hoses from the VCV of the charcoal canister

18. CONNECT ACCELERATOR AND THROTTLE CABLES, AND ADJUST THEM**19. FILL WITH ENGINE COOLANT (See page [CO-5](#))****Capacity**

w/ Front heater

17.5 liters (18.5 US qts, 15.4 Imp. pts)

w/ Front and rear heaters

19.5 liters (20.6 US qts, 17.2 Imp. qts)

20. FILL WITH ENGINE OIL (See page [LU-6](#))**Capacity:****Drain and refill****w/o Oil filter change****7.0 liters (7.4 US qts, 6.2 Imp. qts)****w/ Oil filter change****7.8 liters (8.2 US qts, 6.9 Imp. qts)****Dry fill 8.0 liters (8.5 US qts, 7.0 Imp. qts)****21. INSTALL BATTERY TRAY AND BATTERY****22. START ENGINE AND CHECK FOR LEAKS****23. PERFORM ENGINE ADJUSTMENT****(a) Adjust the ignition timing.****(See steps 10 to 14 on page [IG-11](#))****Ignition timing: 7° BTDC @ idle****(w/ Terminals TE1 and E1 connected)****(b) Adjust the valve clearance. (See page [EM-9](#))****Valve clearance (Hot):****Intake 0.20 mm (0.008 in.)****Exhaust 0.35 mm (0.014 in.)****24. INSTALL HOOD****25. PERFORM ROAD TEST**

Check for abnormal noise, shock, slippage and smooth operation.

26. RECHECK ENGINE COOLANT LEVEL AND OIL LEVEL