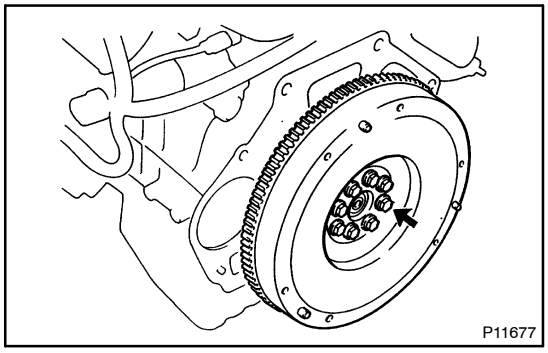
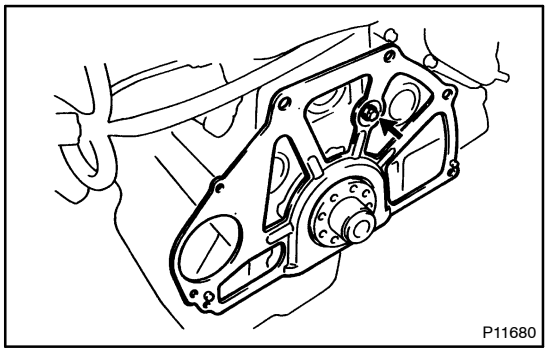
EM15K–01

DISASSEMBLY



1. REMOVE CLUTCH COVER AND DISC
2. REMOVE FLYWHEEL

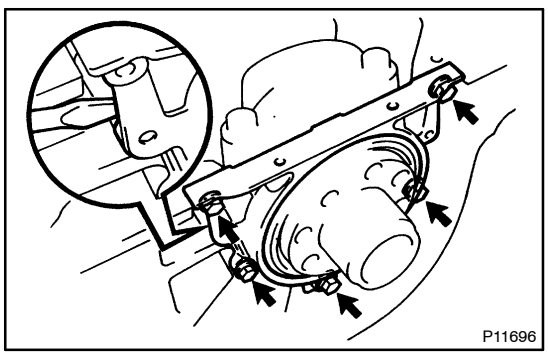
Remove the 8 bolts and flywheel.



3. REMOVE REAR END PLATE

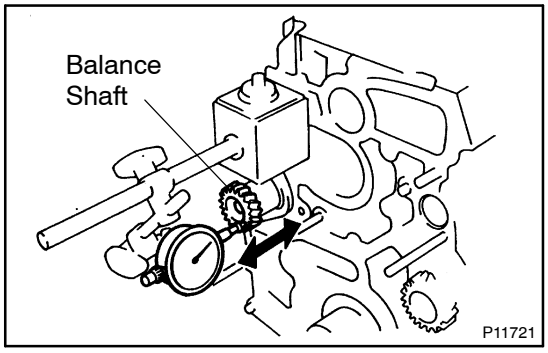
Remove the bolt and end plate.

4. INSTALL ENGINE TO ENGINE STAND FOR DISASSEMBLY
5. REMOVE TIMING BELT AND PULLEYS (See page EM–13)
6. REMOVE CYLINDER HEAD (See page EM–44)
7. REMOVE ALTERNATOR AND ALTERNATOR BRACKET (See page CO–5)
8. REMOVE WATER PUMP (See page CO–5)
9. REMOVE INJECTION PUMP (See page FU–18)
10. REMOVE OIL COOLER (See page LU–21)
11. REMOVE TIMING GEARS (See page EM–24)
12. TIMING GEAR CASE (See page LU–7)
13. REMOVE WATER INLET AND THERMOSTAT (See page CO–11)
14. REMOVE WATER TEMPERATURE SENSOR
15. REMOVE ENGINE MOUNTING
16. REMOVE OIL PAN
17. REMOVE PLUG HOLE



18. REMOVE REAR OIL SEAL RETAINER

Remove the 5 bolts and retainer.



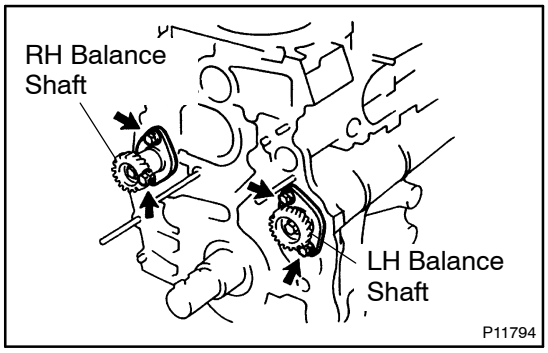
19. CHECK THRUST CLEARANCES OF RH AND LH BALANCE SHAFTS OF ENGINE BALANCER

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

Standard thrust clearance:
0.065 – 0.140 mm (0.0026 – 0.0055 in.)
Maximum thrust clearance: 0.25 mm (0.0098 in.)

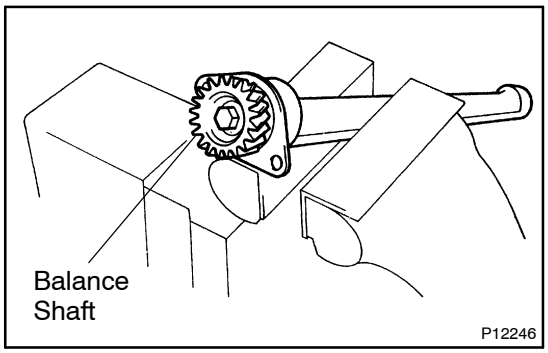
If the thrust clearance is greater than maximum, replace the balance shaft thrust washer.

If necessary, replace the balance shaft.



20. REMOVE RH AND LH BALANCE SHAFTS

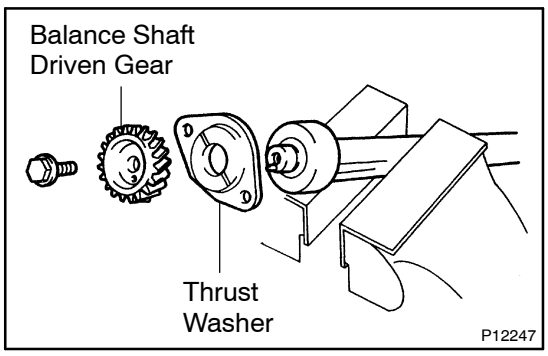
(a) Remove the 2 bolts and RH balance shaft.
(b) Remove the 2 bolts and LH balance shaft.



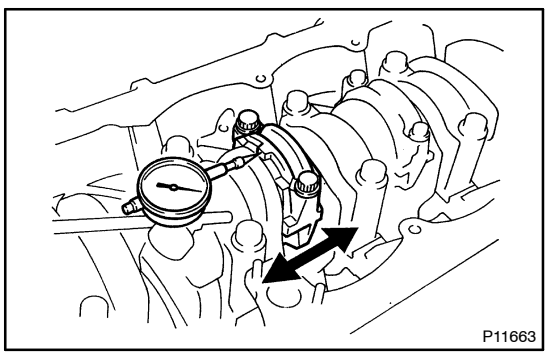
21. DISASSEMBLE RH AND LH BALANCE SHAFTS

(a) Mount the weight of the balance shaft in a vise.

NOTICE:
Be careful not to damage the balance shaft.



(b) Remove the bolt, balance shaft driven gear and thrust washer.

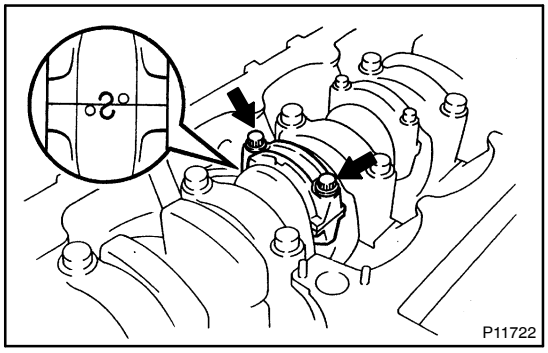


22. CHECK CONNECTING ROD THRUST CLEARANCE

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

Standard thrust clearance:
0.10 – 0.30 mm (0.0039 – 0.0118 in.)
Maximum thrust clearance: 0.40 mm (0.0157 in.)

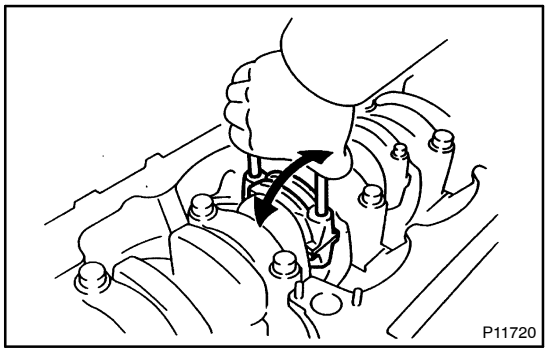
If the thrust clearance is greater than maximum, replace the connecting rod assembly. If necessary, replace the crankshaft.



23. REMOVE CONNECTING ROD CAPS AND CHECK OIL CLEARANCE

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

(b) Remove the connecting rod cap bolts.

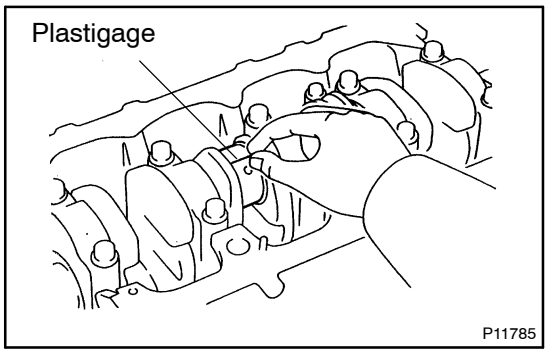


(c) Using the 2 removed connecting rod bolts, pry the connecting rod cap back and forth, and remove the connecting cap.

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

(d) Clean the crank pin and bearing.

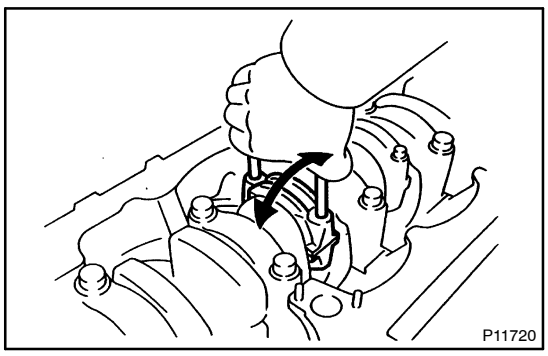
(e) Check the crank pin and bearing for pitting and scratches.
If the crank pin or bearing is damaged, replace the bearings.
If necessary, grind or replace the crankshaft.



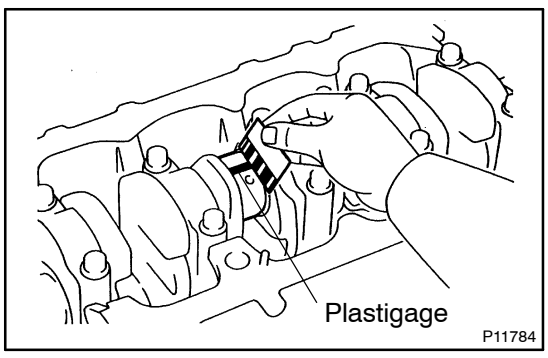
(f) Lay a strip of Plastigage across the crank pin.

(g) Install the connecting rod cap with the 2 bolts.
(See page EM–94)
1st
Torque: 29 N·m (300 kgf·cm, 22 ft·lbf)
2nd Turn 90°

NOTICE:
Do not turn the crankshaft.



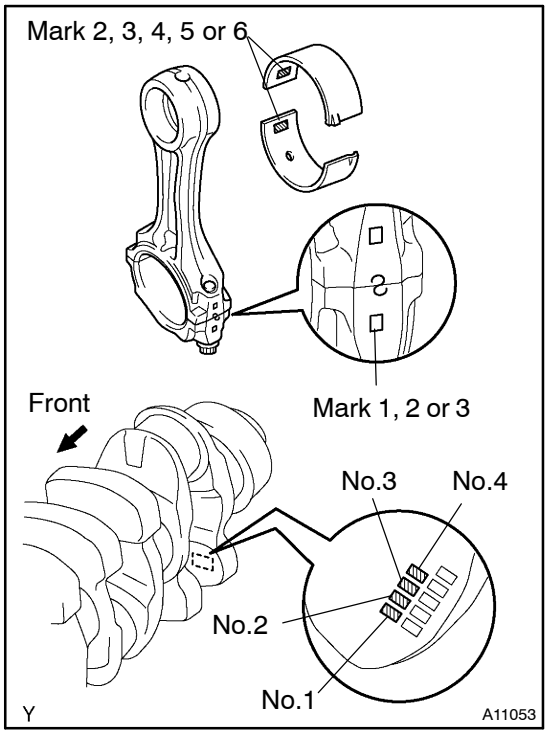
(h) Remove the 2 bolts, connecting rod cap and lower bearing. (See procedure (b) and (c) above)



(i) Measure the Plastigage at its 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 it 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 5 sizes of standard bearings, marked ”2”, ”3”, ”4”, ”5” and ”6” accordingly.



	Number Marked								
Cylinder block	1			2			3		
Crankshaft	1	2	3	1	2	3	1	2	3
Use bearing	2	3	4	3	4	5	4	5	6

EXAMPLE: Cylinder block ”2” + crankshaft ”1”
= Total number 3 (Use bearing ”3”)

Y A11054

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.)

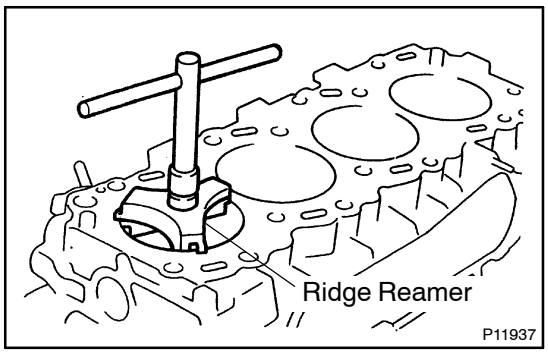
Crankshaft pin diameter:

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.

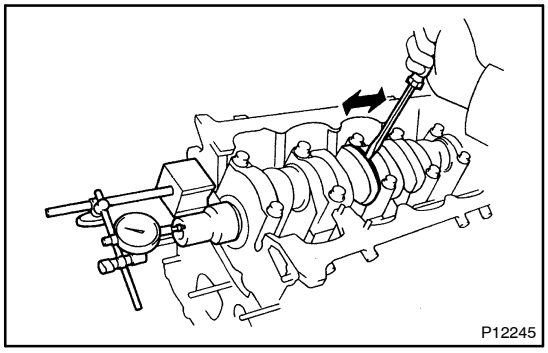


24. REMOVE PISTON AND CONNECTING ROD ASSEMBLIES

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

(b) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

HINT:
- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in correct order.



25. CHECK CRANKSHAFT THRUST CLEARANCE

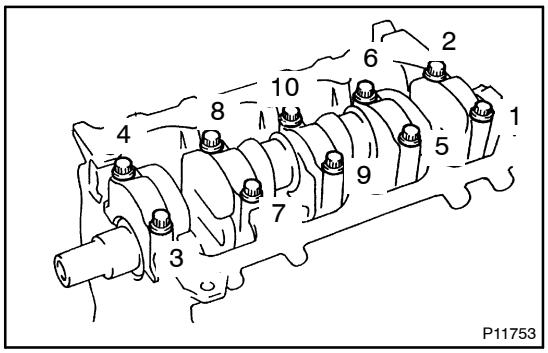
Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:
0.040 – 0.240 mm (0.0016 – 0.0094 in.)
Maximum thrust clearance: 0.30 mm (0.0118 in.)

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

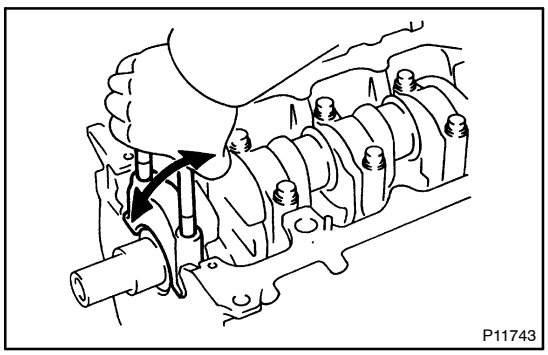
Thrust washer thickness:

STD	2.430 – 2.480 mm (0.0957 – 0.0976 in.)
U/S 0.250	2.555 – 2.605 mm (0.1006 – 0.1026 in.)
U/S 0.125	2.493 – 2.543 mm (0.0981 – 0.1001 in.)



26. 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, pry the main bearing cap back and forth, and remove the main bearing caps, lower bearings and lower thrust washers (No.5 main bearing 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.

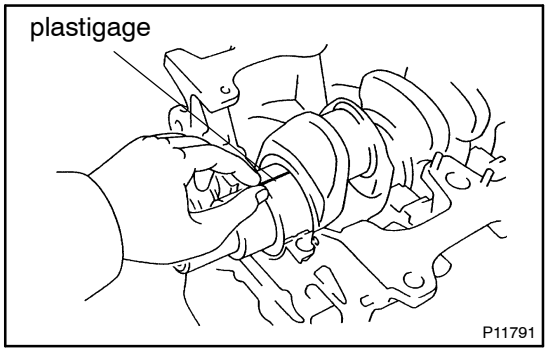
HINT:

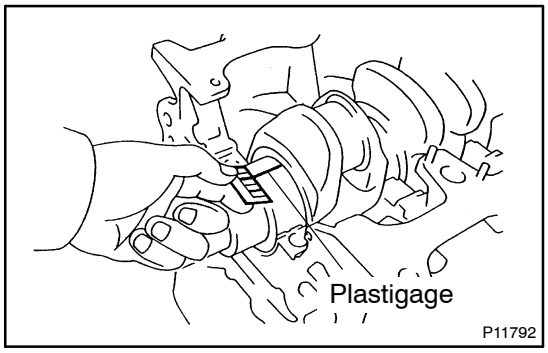
Keep the upper bearings and upper thrust washers together with the cylinder block.

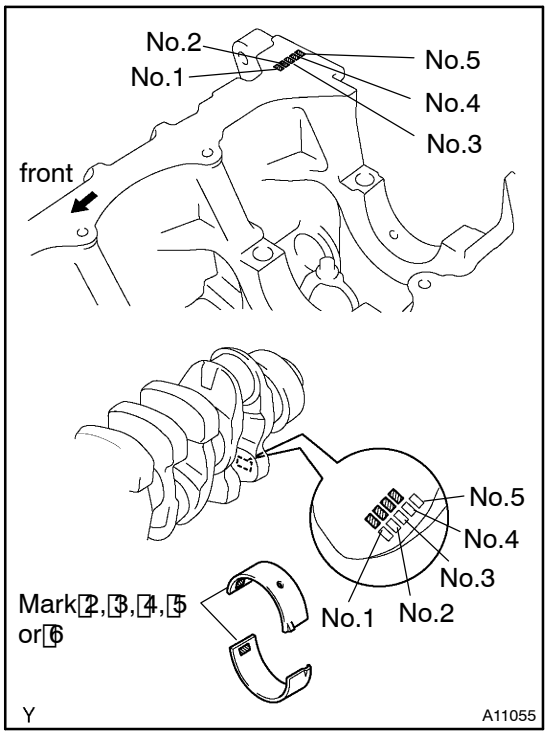
(d) Clean each main journal and bearing.

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

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







(f) Place the crankshaft on the cylinder block.

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

(h) Install the main bearing caps. (See page EM–94)

1st

Torque: 49 N·m (500 kgf·cm, 36 ft·lbf)

2nd Turn 90°

NOTICE:

Do not turn the crankshaft.

(i) Remove the main bearing caps. (See procedure (a) and (b) above)

(j) 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.)

HINT:

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

0.036 – 0.054 mm (0.0014 – 0.0021 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 it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then selecting the bearing with the same number as the total. There are 5 sizes of standard bearings, marked "2", "3", "4", "5" and "6" accordingly.

	Number Marked								
Cylinder block	1			2			3		
Crankshaft	1	2	3	1	2	3	1	2	3
Use bearing	2	3	4	3	4	5	4	5	6

EXAMPLE: Cylinder block "2" + crankshaft "1"
= Total number 3 (Use bearing "3")

Y A11056

Reference

Cylinder block main journal bore diameter:

Mark "1"	75.000 – 75.006 mm (2.9528 – 2.9530 in.)
Mark "2"	75.006 – 75.012 mm (2.9530 – 2.9532 in.)
Mark "3"	75.012 – 75.018 mm (2.9532 – 2.9535 in.)

Crankshaft journal diameter:

Mark "1"	69.994 – 70.000 mm (2.7557 – 2.7559 in.)
Mark "2"	69.988 – 69.994 mm (2.7554 – 2.7557 in.)
Mark "3"	69.982 – 69.988 mm (2.7552 – 2.7554 in.)

Standard sized bearing center wall thickness:

Mark "2"	2.479 – 2.482 mm (0.0976 – 0.977 in.)
Mark "3"	2.482 – 2.485 mm (0.0977 – 0.0978 in.)
Mark "4"	2.485 – 2.488 mm (0.0978 – 0.0980 in.)
Mark "5"	2.488 – 2.491 mm (0.0980 – 0.0981 in.)
Mark "6"	2.491 – 2.494 mm (0.0981 – 0.0982 in.)

(k) Completely remove the Plastigage.

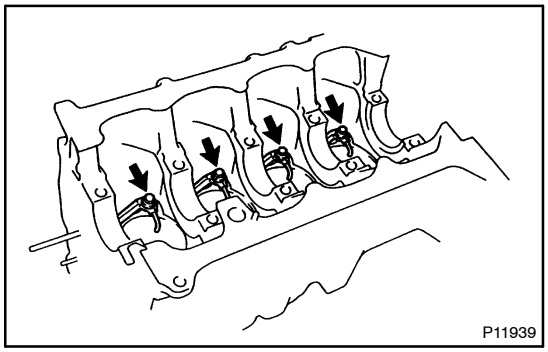
27. REMOVE CRANKSHAFT

(a) Lift out the crankshaft.

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

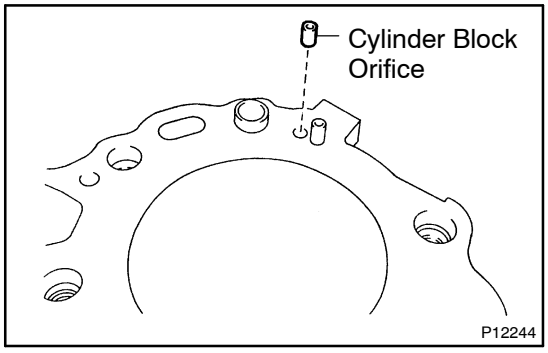
HINT:

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



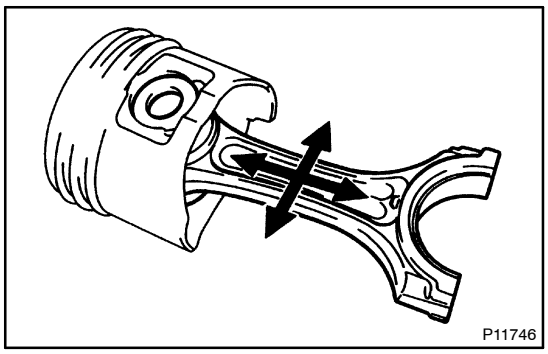
28. REMOVE CHECK VALVES AND OIL NOZZLES

Remove the 4 check valves and oil nozzles.



29. REMOVE CYLINDER BLOCK ORIFICE

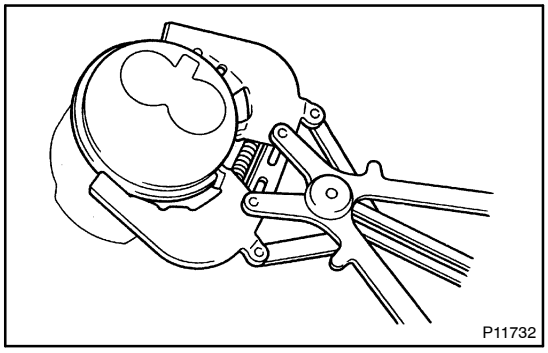
Remove the cylinder block orifice from the cylinder block.



30. CHECK FIT BETWEEN PISTON AND PISTON PIN

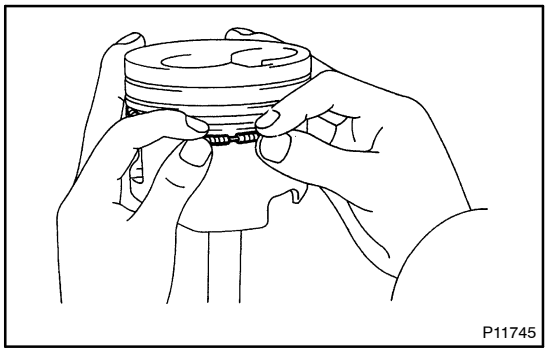
Try to move the piston back and forth on the piston pin.

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


P11732

31. REMOVE PISTON RINGS

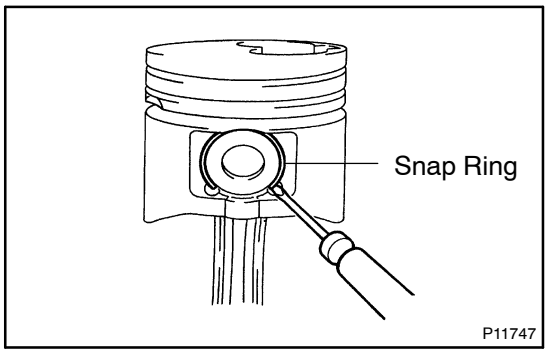
(a) Using a piston ring expander, remove the 2 compression rings and oil ring.


P11745

(b) Remove the coil by hand.

HINT:

Arrange the rings in correct order only.

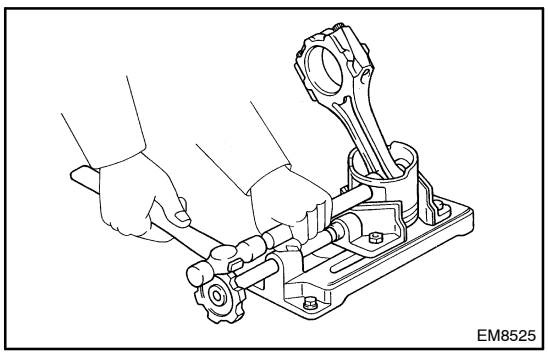


P11747

32. DISCONNECT CONNECTING ROD FROM PISTON

(a) Using a small screwdriver, pry off the snap ring form the piston.

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


EM8525

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

HINT:

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