

Bearing standard inner diameter:

Number 1	58.500-58.530 mm / (2.3031-2.3043 in)
Number 2	58.250-58.280 mm / (2.2933-2.2945 in)
Number 3	58.000-58.030 mm / (2.2835-2.2846 in)
Number 4	57.750-57.780 mm / (2.2736-2.2748 in)

c. Obtain the maximum oil clearance from the maximum value of the bearing inner diameter and minimum value of the camshaft journal outer diameter. If the limit is exceeded, replace the camshaft or cylinder block.

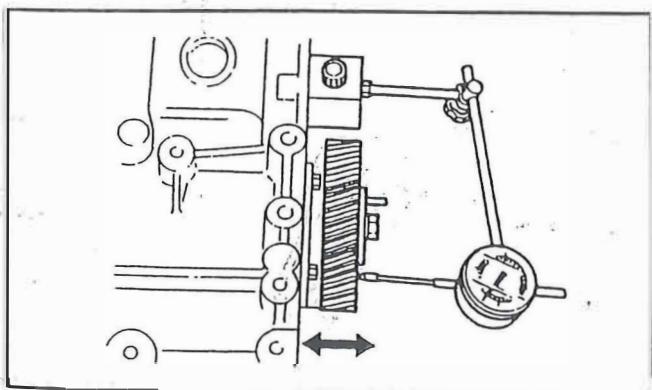
Oil clearance: mm / (in)

Number 1	Standard value	0.06-0.12 (.0024-.0047)
	Limit value	0.145 / (.0057)
Number 2	Standard value	0.06-0.12 (.0024-.0047)
	Limit value	0.145 / (.0057)
Number 3	Standard value	0.06-0.12 (.0024-.0047)
	Limit value	0.145 / (.0057)
Number 4	Standard value	0.06-0.12 (.0024-.0047)
	Limit value	0.145 / (.0057)

7. Measure the end play of the camshaft. If the limit value is exceeded, replace the thrust plate or camshaft.

End play: 0.02-0.18 mm / (.0008-.0071 in)

Limit value: 0.30 mm / (.0118 in)



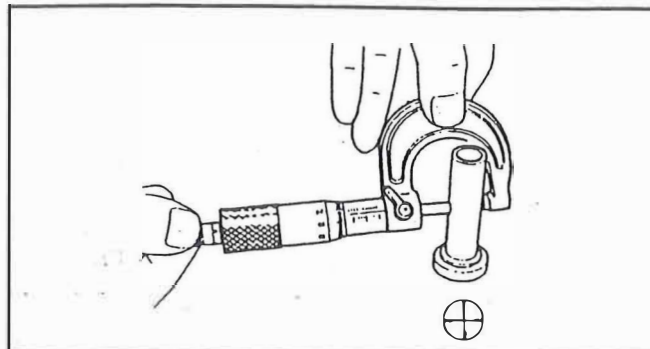
TAPPET INSPECTION

1. Visually check the tappet follower for unusual wear or damage. Replace if defective.

ENGINE DISASSEMBLY / REASSEMBLY

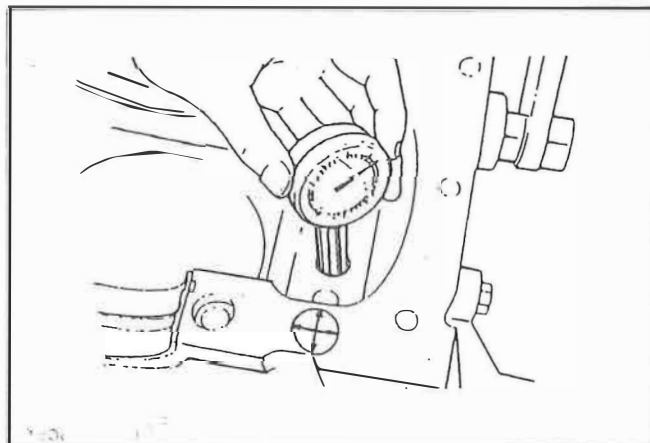
2. Measure the outer diameter of the tappet follower with a micrometer.

Standard value: 15.518-15.533 mm / (.6109-.6115 in)



3. Measure the inner diameter of the tappet cavity in the cylinder block with a caliper gauge.

Standard value: 15.588-15.619 mm / (.6137-.6149 in)



4. Calculate the difference between the cylinder block tappet cavity inner diameter and tappet's outer diameter. If the value exceeds the limit value, replace the tappet or cylinder block.

Standard value: 0.055-0.101 mm / (.0022-.0040 in)

Limit value: 0.15 mm / (.0059 in)

ENGINE REASSEMBLY

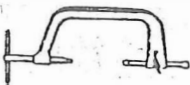







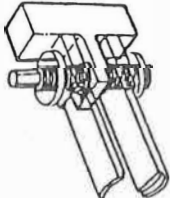
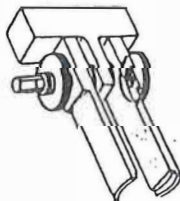
NOTE: Do not reuse the gaskets, O-rings or oil seals. Thoroughly clean all surfaces before installing the new gaskets, O-rings, oil seals or sealant.



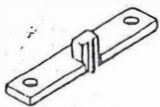
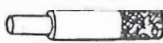
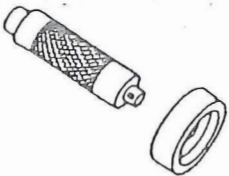


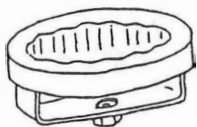
NOTE: Apply new engine oil on all friction points of the engine (bearings, gears etc.) during assembly.

NOTE: Thoroughly clean all parts before assembling. Pay particular attention to the sliding parts of the bearings and other friction points of the engine.

NOTE: Tighten the bolts and nuts to the specified tightening torque.

SPECIAL TOOLS REQUIRED

SPECIAL TOOLS REQUIRED	PROCEDURE	SPECIAL TOOLS REQUIRED	PROCEDURE
9125483-59 Valve spring lifer arm 	For replacement of valves	9125483-56 Valve seal and valve guide installer set 	For replacement of valve seal and valve guide
9125483-81 Installer (valve seal) (component of 9125483-56) 	For replacement of valve seals and valve guide	9125483-82 Body (component of 9125483-56) 	For replacement of valve seal and valve guide
9125483-83 Installer (valve guide) (component of 9125483-56) 	For replacement of valve seals and valve guide	9125483-84 Nut (component of 9125483-56) 	For replacement of valve seal and valve guide
9125483-87 Spacer (component of 9125483-56) 	For replacement of valve seals and valve guide	9225423-04 Pivot 	For replacement of valves, etc.
9225423-05 Body (component of 9225423-04) 	For disassembly of valves, etc.	9225423-06 Foot (component of 9225423-04) 	For disassembly of valves, etc.

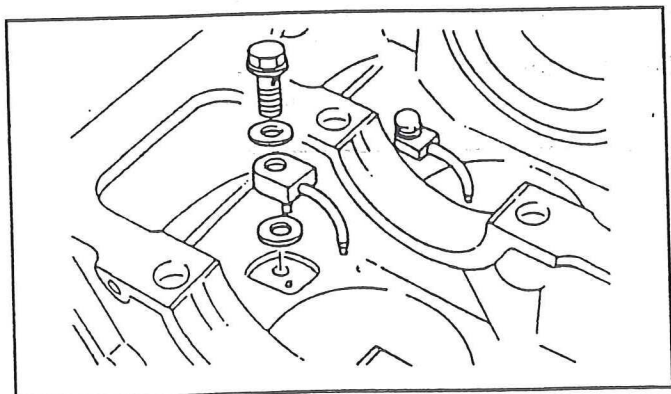
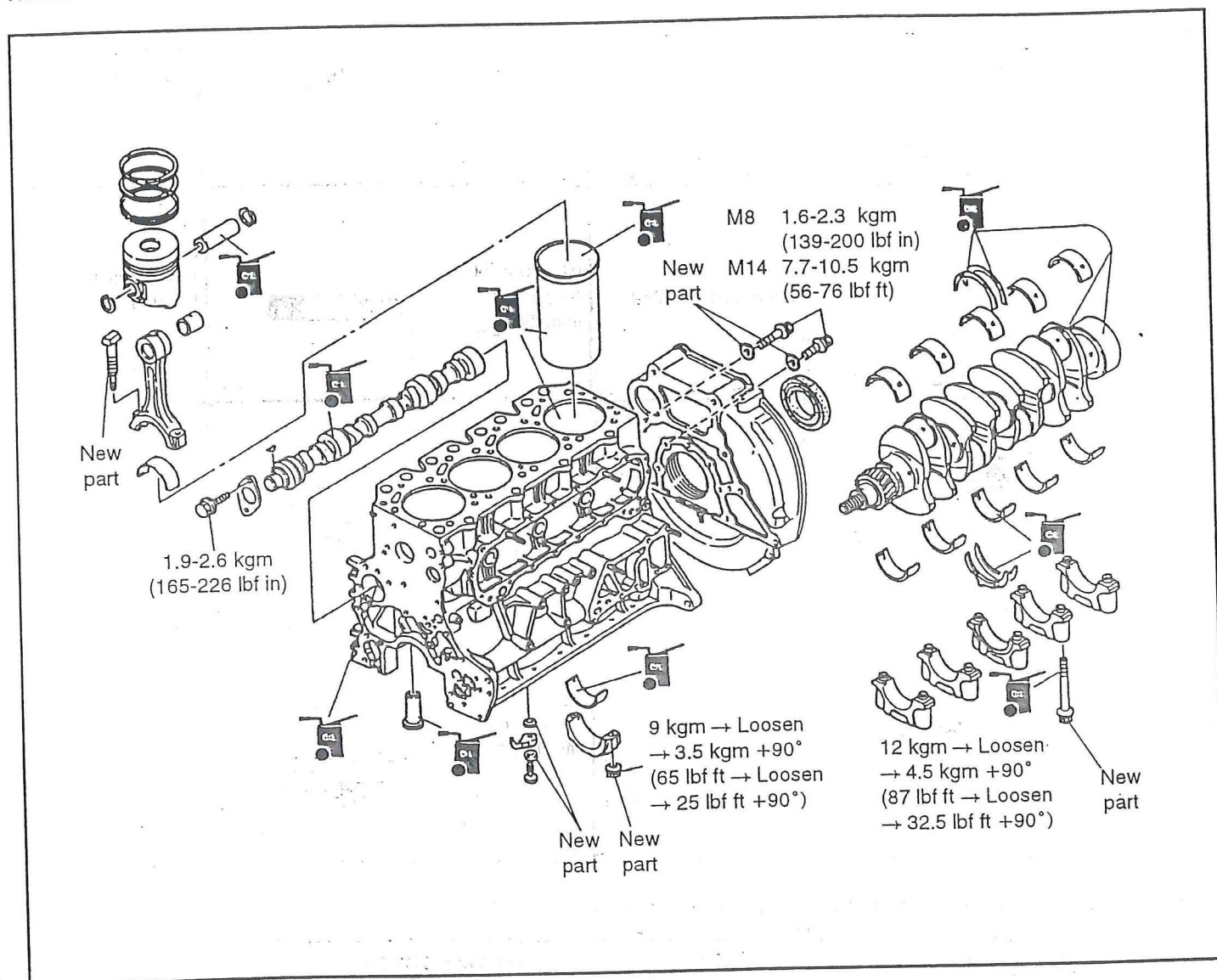
SPECIAL TOOLS REQUIRED	PROCEDURE	SPECIAL TOOLS REQUIRED	PROCEDURE
9225423-07 Lock nut (component of 9225423-04) 	For disassembly of valves, etc.	9225423-13 Clutch disc centering tool 	For installation of clutch disc
9225423-14 Ring gear brake 	To prevent crankshaft from rotating	9125483-34 Piston pin installer 	For installation of piston pins
9225423-15 Oil seal installer 	For installation of oil seal	9225423-16 Handle (component of 9225423-15) 	For installation of oil seal
9225423-07 Oil seal installer (component of 9225423-15) 	For installation of oil seal	9224473-00 Wrench oil filter bypass 	For replacement of oil bypass filter

COMMERCIAL PRODUCT TOOLS (NOT AVAILABLE THROUGH YALE)

SPECIAL TOOLS REQUIRED	PROCEDURE	SPECIAL TOOLS REQUIRED	PROCEDURE
Piston ring tool	For replacement of piston ring	Piston ring compressor	For installing the piston assembly into the cylinder block

CYLINDER BLOCK REASSEMBLY-INTERNAL COMPONENTS

ASSEMBLY AND TORQUE VALUE ILLUSTRATION



PISTON COOLING JET INSTALLATION

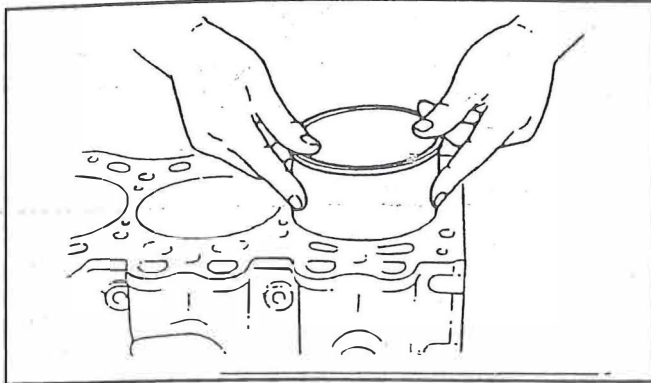
1. Use two new copper sealing washers when installing each piston cooling jet. Bolt the jet nozzle assembly in place as shown.

Tightening torque: 1.2-1.8 kgm / (104-156 lbf in)

1. Apply engine oil to the outer circumference of the cylinder liner.

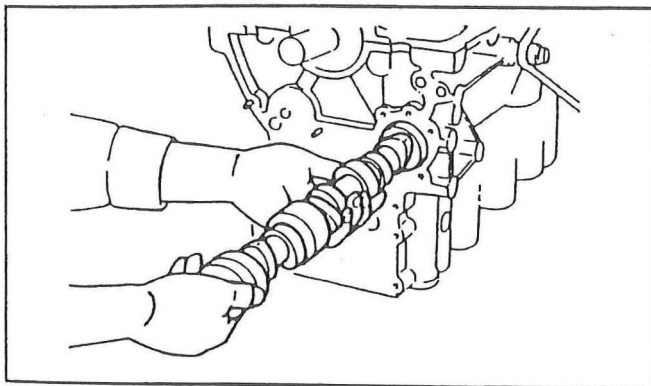
NOTE: Do not drive the liner into the block with a hammer or other similar object, when inserting.

2. Insert the cylinder liner into the cylinder block with an even force. Be sure to position the liner properly. Align the front / rear marks which were made during disassembly.



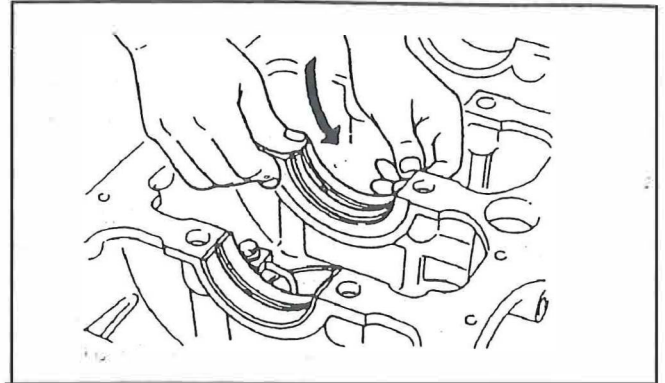
CAMSHAFT INSTALLATION

1. Apply oil to the camshaft and insert into the cylinder block using a slow turning motion.
2. Apply oil to the surfaces (flat surface) where the trust plate contacts the camshaft, and where it contacts the cylinder block.
Tightening torque: 1.9-2.6 kgm / (165-225 lbf in)



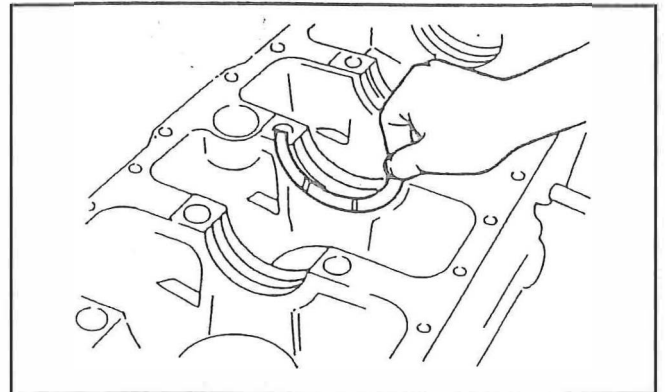
CRANKSHAFT AND BEARING INSTALLATION

1. Thoroughly clean the surface of the upper main bearing metal (with grooves) and the bearing installation surface of the cylinder block.
2. Match the convex and concave sections of the bearing, and install the bearing.



NOTE: The surface of the thrust bearings with grooves should face the side that contacts the crankshaft.

3. Install the thrust bearings.

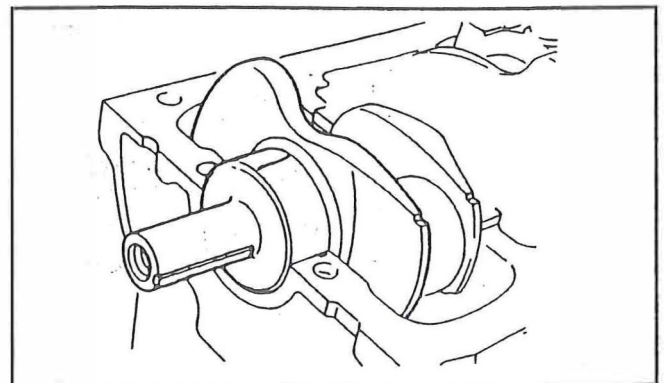


4. Thoroughly clean the journal and pin sections of the crankshaft.



WARNING: The crankshaft is heavy. Be sure that all lifting devices (hoists, cables, chains, slings etc.) are suitable and of adequate capacity to lift the crankshaft. The crankshaft can weigh approximately 38 kg (84 lb).

5. Install the crankshaft into the cylinder block.

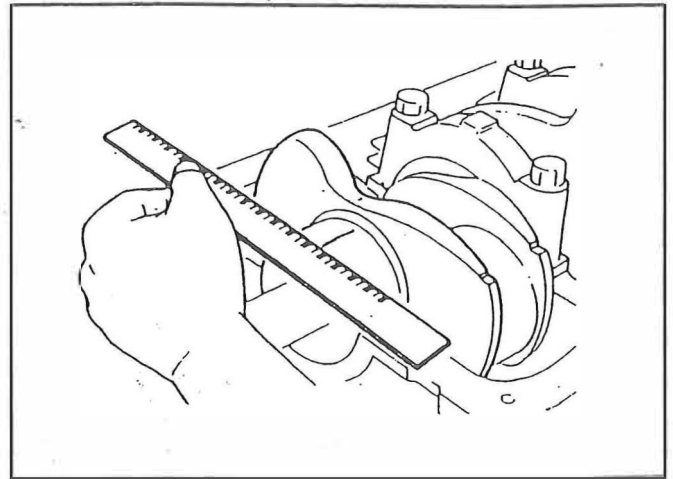
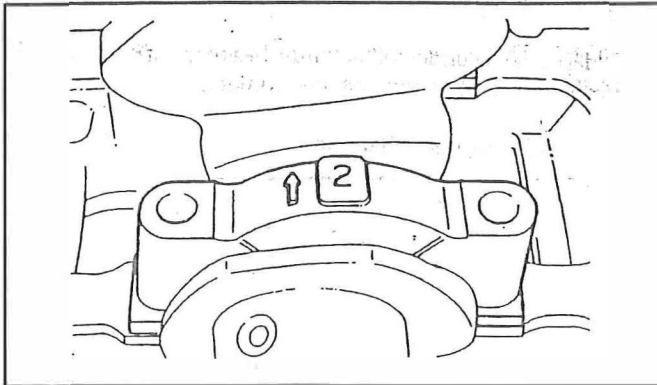


6. Measure the oil clearance with the following procedure:

- a. Cut the plasti-gauge to the same length as the width of the crankshaft journal, and lay it parallel to the crankshaft.

NOTE: Do not turn the crankshaft when measuring the oil clearance.

- b. Thoroughly clean the lower main bearing (no grooves in the center), and the installation surface of the bearing cap. Install the bearings in the cap.
- c. Face the "Cap number" and "←" marks on the bearing cap toward the engine front (fan side) and install.



- g. Measure the oil clearance using the plasti-gauge scale.

Standard value

Number 1,2,4,5: 0.058-0.092 mm / (.0023-.0036 in)

Number 3: 0.084-0.118 mm / (.0033-.0046 in)

Limit value

Number 1,2,4,5: 0.12 mm / (.0047 in)

Number 3: 0.15 mm / (.0059 in)

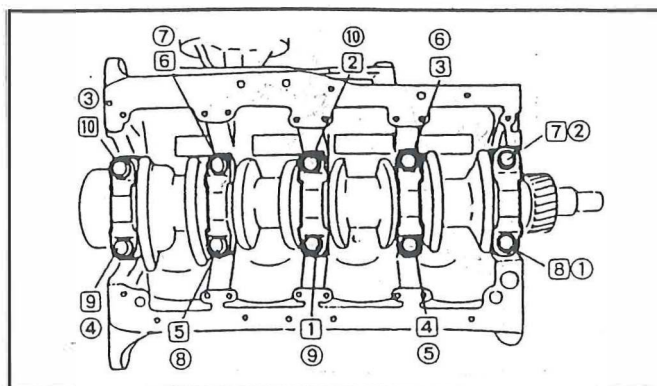
If the limit value is exceeded, replace the bearing or grind the journal section and use undersize bearings.

- d. Use new bolts for the bearing cap. Apply a light coat of engine oil on the bolt threads and the washer, and install.

e. Tighten the bearing cap bolts as follows:

- ① Tighten the bolts in the order of the ○ numbers in the illustration. Tighten in two or three stages to a tightening torque of 12 kgm / (87 lbf ft). Loosen in the order of the □ numbers.
- ② Tighten again in the order of the ○ numbers alternately in two or three stages to a tightening torque of 4.5 kgm / (33 lbf ft).
- ③ Tighten another 90° from that position.

- f. After tightening to the specified torque, remove the bearing caps.

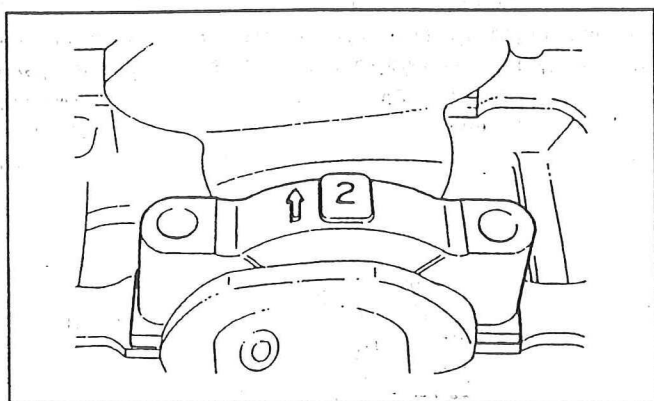


CRANKSHAFT MAIN JOURNAL FINISH DIMENSIONS

Bearing size mm / (in)	Center thickness mm / (in)	Main journal finish dimensions mm / (in)	
Standard	2.520-2.525 (.0992-.0994)	Number 1, 2, 4, 5	78.980-79.000 (3.1094-3.1102)
		Number 3	78.954-78.974 (3.1084-3.1092)
Undersize 0.254 / (0.010)	2.647-2.652 (.1042-.1044)	Number 1, 2, 4, 5	78.726-78.746 (3.0994-3.1002)
		Number 3	78.700-78.720 (3.0984-3.0992)
Undersize 0.508 / (0.020)	2.774-2.779 (.1092-.1094)	Number 1, 2, 4, 5	78.472-78.492 (3.0894-3.0902)
		Number 3	78.446-78.466 (3.0884-3.0892)
Undersize 0.762 / (0.030)	2.901-2.906 (.1142-.1144)	Number 1, 2, 4, 5	78.218-78.238 (3.0794-3.0802)
		Number 3	78.192-78.213 (3.0784-3.0792)

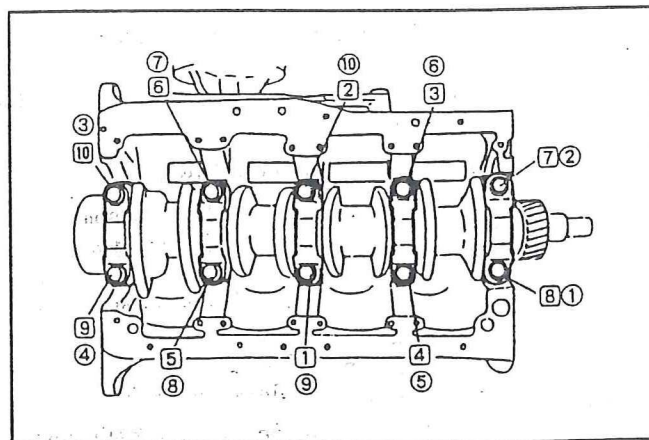
7. After measuring and/or correcting the oil clearance, install the bearing caps with the following procedure:

- Remove the plasti-gauge.
- Apply engine oil to the sliding parts of the crankshaft and main bearing metal.
- Face the "Cap number" and "↔" marks on the bearing caps toward the engine front and install.



- Apply engine oil to the threads of the bearing cap bolts.
- Tighten the bolts using the following procedure:

- (1) Tighten the bolts in the order of the □ numbers in the illustration. Tighten in several stages to a torque of 12 kgm / (87 lbf ft). Loosen in the order of the ○ numbers.

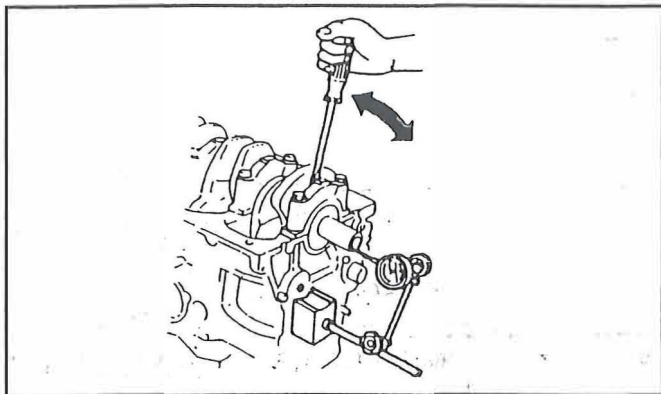


- (2) Tighten again in the order of the □ numbers. Tighten in two or three stages to a torque of 4.5 kgm / (32.5 lbf lb).
- (3) Tighten another 90° from that position.
- (4) Turn the crankshaft and verify that it rotates smoothly.

Mazda TM Engine Parts contact:
EngineParts@HeavyEquipmentRestorationParts.com

Phone: 269 673 1638

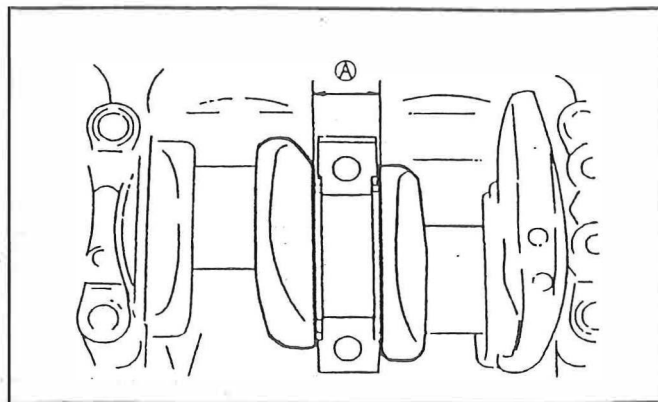
8. Inspect the end play of the crankshaft with the following procedure:



- Position the dial gauge as shown in the illustration.
- Pull the flywheel section of the crankshaft in the direction of the shaft with a screwdriver, and measure the end play.

Standard value: 0.14-0.39 mm / (.0055-.0154 in)
Limit value: 0.40 mm / (.0157 in)

If the limit value is exceeded, replace the thrust bearing, or grind the thrust surface of the crankshaft and use an oversize thrust bearing.

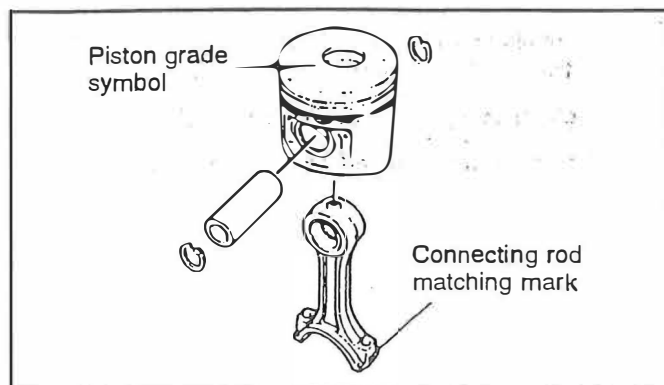


CRANKSHAFT THRUST BEARING FINISH DIMENSIONS

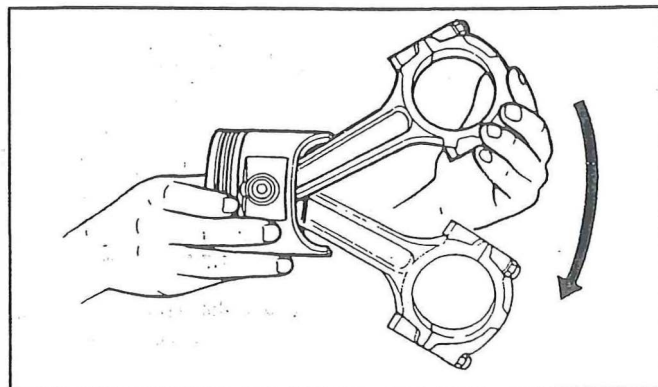
Thrust Bearing mm / (in)	Thickness mm / (in)	(A) section dimensions mm / (in)
Standard	2.275-2.325 / (.0896-.0915)	35.365-35.465 / (1.3923-1.3963)
0.35 / (.0138) Oversize	2.453-2.503 / (.0966-.0985)	35.543-35.643 / (1.3993-1.4033)

PISTON AND CONNECTING ROD INSTALLATION

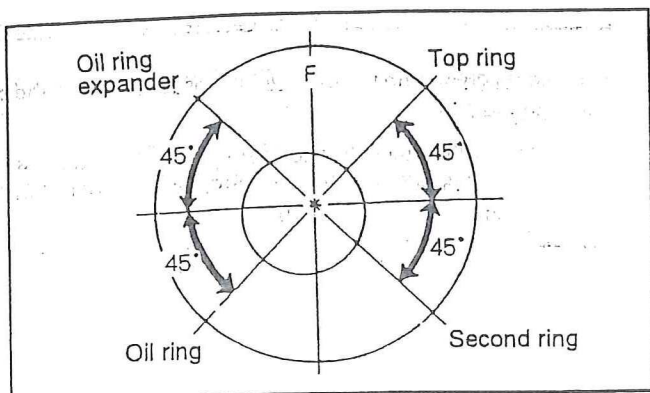
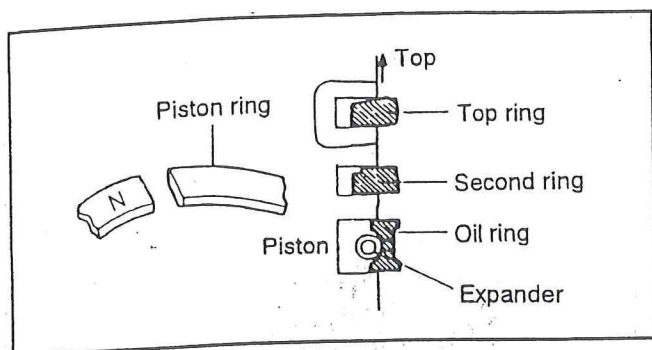
- Place the piston in hot water and warm to approximately 50-60°C / (122-140°F)
- Install a snap ring in one end of the piston.
- Apply engine oil to the piston pin and to the bushing in the connecting rod's small end. When reusing the original piston, assemble the piston so that connecting rod's matching mark faces the grade symbol on the top of the piston as shown in the illustration. Insert the piston pin. If the piston is new, assemble so that the center of the combustion chamber on the top of the piston is near the connecting rod's matching mark.
- Install the second snap ring in the other end of the piston.



- After pressing in the piston pin, inspect the connecting rod's swaying torque. With the piston held stationary, verify that the connecting rod moves freely and smoothly throughout its range. Holding the piston in one hand, lift the large end of the connecting rod upward as shown. Release the large end of the connecting rod. The weight of the connecting rod must cause it to swing downward freely. Replace the piston, piston pin and / or the connecting rod if there is any binding or any defects.



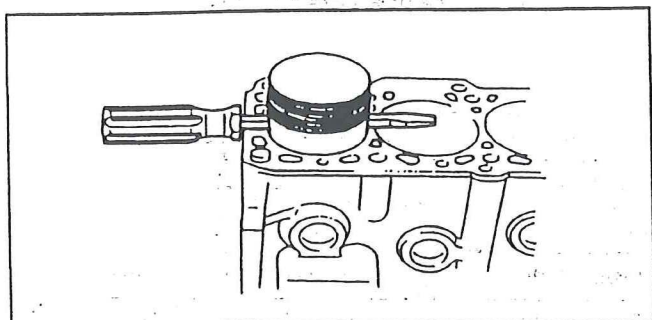
- Install each piston ring as shown in the illustration, assemble in the following order: oil ring expander → oil ring → second ring and top ring. Install the rings so that the gaps are spaced as shown in the illustration.



7. Apply engine oil to the piston, the piston rings and the inside of the cylinder liner.

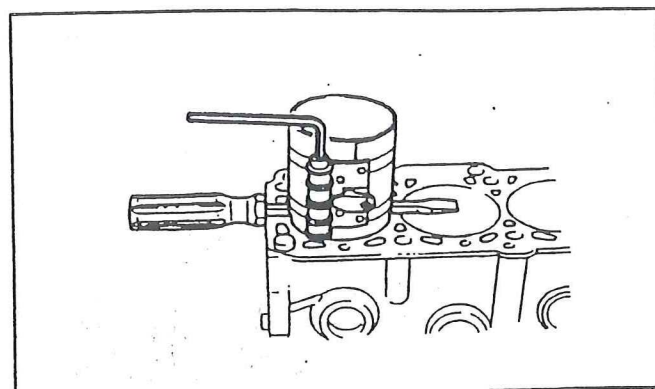
8. Insert a screwdriver or similar tool in the piston pin. Insert the piston and connecting rod into the cylinder with the "Y" or "Z" mark on the piston facing the front of the engine as illustrated.

When using a new piston, insert so that the combustion chamber center on the top of the piston is near the intake manifold side.



9. Install the piston ring compressor (commercial product) as shown in the illustration, and compress the piston rings.

NOTE: Do not rotate the piston or piston ring compressor during this operation. The piston ring gap may shift if the spring compressor is turned while compressing the piston rings.



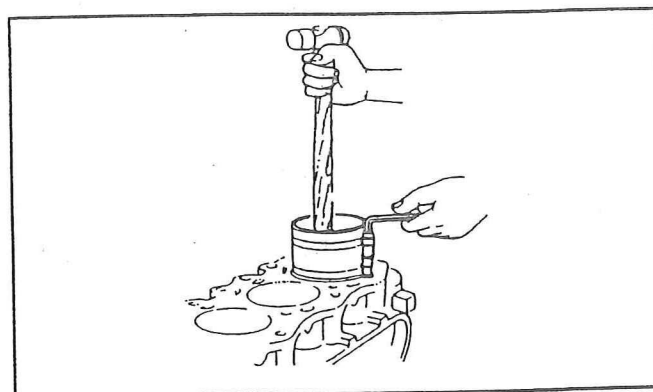
10. Remove the screwdriver from the piston pin hole.

NOTE: Support the piston and connecting rod assembly to prevent it from dropping suddenly into the block.

11. Lightly tap the top of the piston ring compressor with a plastic hammer so that it fits into the block completely.

12. Tighten the piston ring compressor.

13. Install the piston and connecting rod assembly into the cylinder using a hammer handle as shown.



14. Verify that the connecting rod bearings and crank pins are contacting the crankshaft completely.

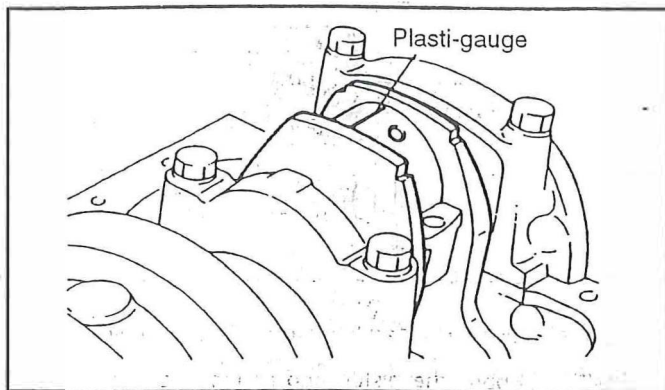
15. Remove the vinyl hose that is covering the connecting rod bolts.

16. Inspect the oil clearance of the large end of the connecting rod, with the following procedure:

NOTE: Do not turn the crankshaft when measuring the oil clearance.

NOTE: The connecting rod to be measured must be at the lower dead point (piston at Bottom Dead Center) when measuring the oil clearance.

- a. Cut the plasti-gauge to the same length as the connecting rod bearing width, and place it parallel to the crankshaft. Avoid the oil hole.

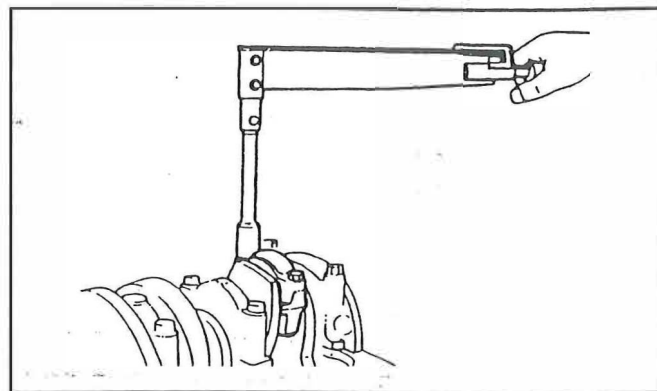


- b. Thoroughly clean the lower connecting bearing and the installation surface of the connecting rod bearing cap. Install the bearings in the cap.
c. Align the matching marks on the connecting rod and cap. Install the connecting rod cap.
d. Tighten the connecting rod cap.

- (1) Apply a small amount of engine oil to the connecting rod bolt threads and the washer. Tighten to a torque of 9 kgm / (65 lbf ft) and then loosen.

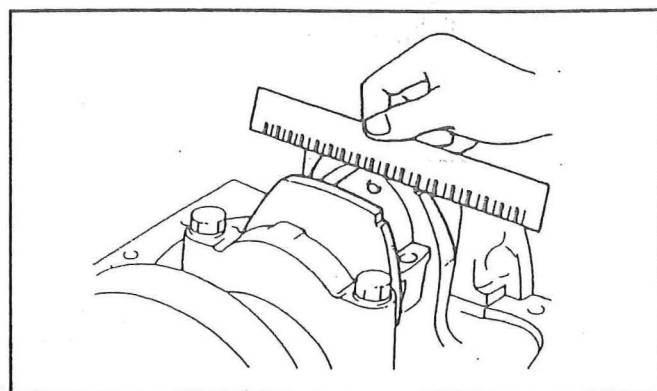
NOTE: Never reuse the connecting cap bolts and nuts. Always replace the connecting cap bolts and nuts with new at reassembly.

- (2) Tightening to a torque of 3.5 kgm / (25 lbf ft). Tighten the bolt another 90°.



- e. After tightening to the specified torque, remove the connecting rod cap.

- f. Measure the oil clearance using the plasti-gauge scale.
Standard value: 0.040-0.062 mm / (.0016-.0024 in)
Limit value: 0.10 mm / (.0039 in)



If the limit value is exceeded, replace the bearings or grind the crank pin and use undersize bearings.

CRANKSHAFT CRANK PIN FINISH DIMENSIONS

Bearing size mm / (in)	Center thickness mm / (in)	crankshaft finish dimensions mm / (in)
Standard	2.025-2.030 / (.0797-.0799)	63.987-64.000 / (2.5192-2.5197)
Undersize 0.254 / (0.010)	2.152-2.157 / (.0847-.0849)	63.733-63.746 / (2.5092-2.5097)
Undersize 0.508 / (0.020)	2.279-2.284 / (.0897-.0899)	63.479-63.492 / (2.4992-2.4997)
Undersize 0.762 / (0.030)	2.406-2.411 / (.0947-.0949)	63.225-63.238 / (2.4892-2.48967)

17. After measuring and / or correcting the oil clearance, install the connecting rod caps with the following procedure:

- a. Remove the plasti-gauge.
b. Apply engine oil to the sliding parts of the crank pin and connecting rod bearings.
c. Align the matching marks on the connecting rod and cap. Install the connecting rod cap.

- d. Tighten the connecting rod cap.

- (1) Apply a small amount of engine oil to the connecting rod bolt threads and the washer. Tighten to a torque of 9 kgm / (65 lbf ft) and then loosen.

- (2) Tightening to a torque of 3.5 kgm / (25 lbf ft). Tighten the bolts another 90°.