

**BEARING-TO-JOURNAL CLEARANCE (CRANKSHAFT INSTALLED)**

When using Plastigage, check only one bearing clearance at a time.

Install the grooved main bearings into the cylinder block and the non-grooved bearings into the bearing caps.

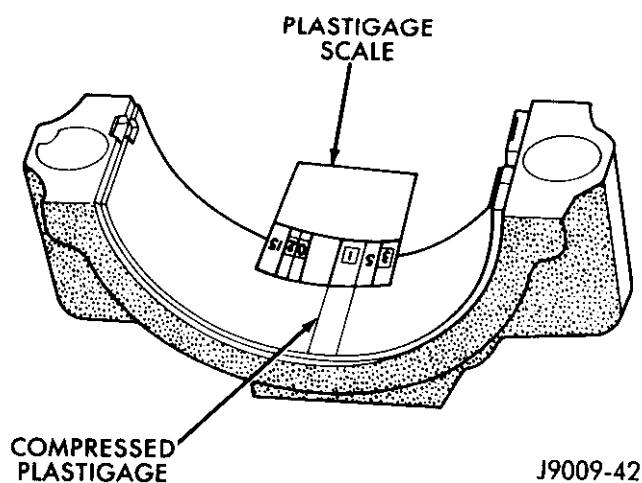
Install the crankshaft into the upper bearings dry.

Place a strip of Plastigage across full width of the crankshaft journal to be checked.

Install the bearing cap and tighten the bolts to 108 N·m (80 ft. lbs.) torque.

**DO NOT rotate the crankshaft. This will cause the Plastigage to shift, resulting in an inaccurate reading. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.**

Remove the bearing cap. Determine the amount of clearance by measuring the width of the compressed Plastigage with the scale on the Plastigage envelope (Fig. 5). Refer to Engine Specifications for the proper clearance.



**Fig. 5 Measuring Bearing Clearance with Plastigage**

Plastigage should indicate the same clearance across the entire width of the insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

If the specified clearance is indicated and there are no abnormal wear patterns, replacement of the bearing inserts is not necessary. Remove the Plastigage from the crankshaft journal and bearing insert. Proceed to Crankshaft Main Bearing—Installation.

If the clearance exceeds specification, install a pair of 0.025 mm (0.001 inch) undersize bearing inserts and measure the clearance as described in the previous steps.

The clearance indicated with the 0.025 mm (0.001 inch) undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance.

**FOR EXAMPLE:** If the clearance was 0.0762 mm (0.003 inch) originally, a pair of 0.0254 mm (0.001 inch) undersize inserts would reduce the clearance by 0.0254 mm (0.001 inch). The clearance would then be 0.0508 mm (0.002 inch) and within the specification. A 0.051 mm (0.002 inch) undersize bearing insert and a 0.0254 mm (0.001 inch) undersize insert would reduce the original clearance an additional 0.0127 mm (0.0005 inch). The clearance would then be 0.0381 mm (0.0015 inch).

**CAUTION:** Never use a pair of inserts that differ more than one bearing size as a pair.

**FOR EXAMPLE:** DO NOT use a standard size upper insert and a 0.051 mm (0.002 inch) undersize lower insert.

If the clearance exceeds specification using a pair of 0.051 mm (0.002 inch) undersize bearing inserts, measure crankshaft journal diameter with a micrometer. If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore.

If journals 1 through 5 diameters are less than 63.4517 mm (2.4981 inches), replace crankshaft or grind crankshaft down to accept the appropriate undersize bearing inserts.

Once the proper clearances have been obtained, proceed to Crankshaft Main Bearing—Installation.

**MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)**

Remove the crankshaft from the cylinder block (refer to Cylinder Block - Disassemble).

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper and out of round is 0.013 mm (0.0005 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

Once the proper clearances have been obtained, proceed to Crankshaft Main Bearing—Installation.

**INSTALLATION**

(1) Lubricate the bearing surface of each insert with engine oil.

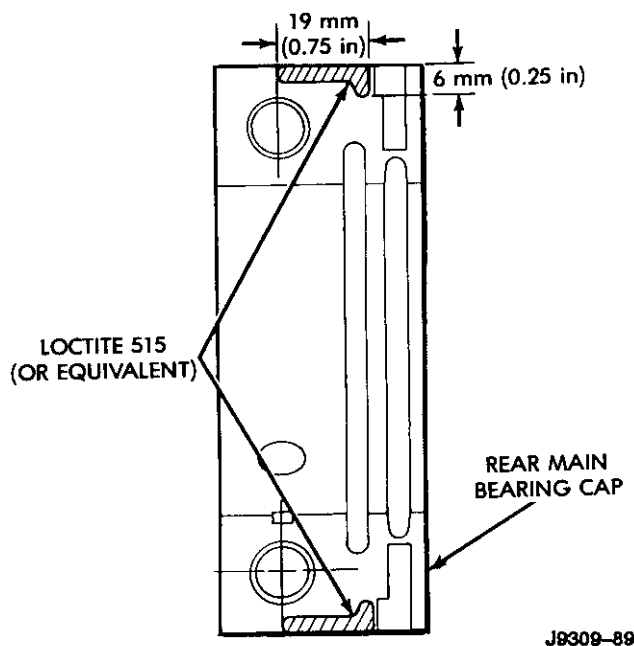
(2) Loosen all the main bearing caps. Install the main bearing upper inserts.

(3) Install the lower bearing inserts into the main bearing caps.

(4) Install the main bearing cap(s) and lower insert(s).

(5) Clean the rear main bearing cap (No.5) mating surfaces.

(6) Apply Loctite 515, or equivalent on the rear bearing cap (Fig. 6). The bead should be 3 mm (0.125 in) thick. DO NOT apply Loctite 515, or equivalent to the lip of the seal.



**Fig. 6 Location of Loctite 515 (or equivalent)**

(7) Install the rear main bearing cap. DO NOT strike the cap more than twice for proper engagement.

(8) Tighten the bolts of caps 1, 3, 4 and 5 to 54 N•m (40 ft. lbs.) torque. Now tighten these bolts to 95 N•m (70 ft. lbs.) torque. Finally, tighten these bolts to 108 N•m (80 ft. lbs.) torque.

(9) Push the crankshaft forward and backward. Load the crankshaft front or rear and tighten cap bolt No.2 to 54 N•m (40 ft. lbs.) torque. Then tighten to 95 N•m (70 ft. lbs.) torque and finally tighten to 108 N•m (80 ft. lbs.) torque.

(10) Rotate the crankshaft after tightening each main bearing cap to ensure the crankshaft rotates freely.

(11) Check crankshaft end play. Crankshaft end play is controlled by the thrust bearing which is flange and installed at the No.2 main bearing position.

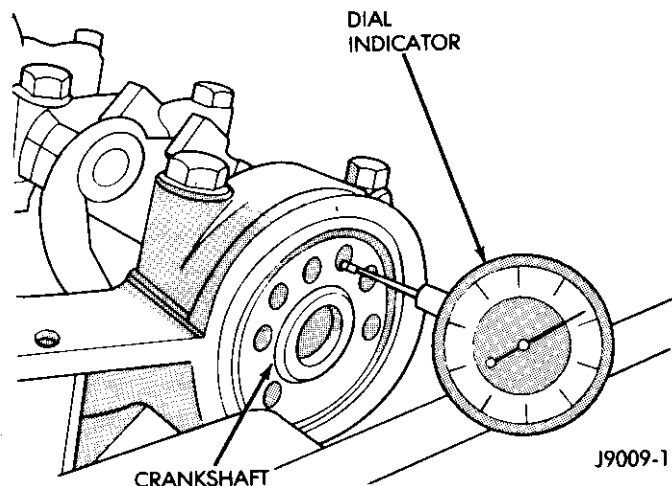
(a) Attach a magnetic base dial indicator to the cylinder block at either the front or rear of the engine.

(b) Position the dial indicator rod so that it is parallel to the center line of the crankshaft.

(c) Pry the crankshaft forward, position the dial indicator to zero.

(d) Pry the crankshaft forward and backward. Note the dial indicator readings. End play is the difference between the high and low measurements (Fig. 7). Correct end play is 0.038-0.165 mm

(0.0015-0.0065 inch). The desired specifications are 0.051-0.064 mm (0.002-0.0025 inch).



**Fig. 7 Crankshaft End Play Measurement**

(e) If end play is not within specification, inspect crankshaft thrust faces for wear. If no wear is apparent, replace the thrust bearing and measure end play. If end play is still not within specification, replace the crankshaft.

If the crankshaft was removed, install the crankshaft into the cylinder block (refer to Cylinder Block - Assemble).

(12) Install the oil pan.

(13) Install the drain plug. Tighten the plug to 34 N•m (25 ft. lbs.) torque.

(14) Lower the vehicle.

(15) Install the spark plugs. Tighten the plugs to 37 N•m (27 ft. lbs.) torque.

(16) Fill the oil pan with engine oil to the full mark on the dipstick level.

(17) Connect negative cable to battery.

## REAR MAIN OIL SEALS

### REMOVAL

(1) Remove the flywheel or converter drive plate. Discard the old bolts.

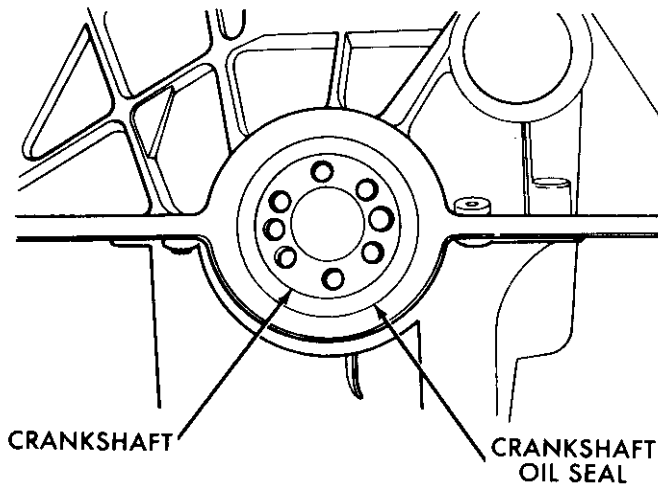
(2) Pry out the seal from around the crankshaft flange (Fig. 8).

### INSTALLATION

(1) Coat the outer lip of the replacement rear main bearing seal with engine oil.

(2) Carefully position the seal into place. Use rear main Seal Installer Tool 6271 to install the seal flush with the cylinder block.

**CAUTION:** The felt lip must be located inside the flywheel mounting surface. If the lip is not positioned correctly the flywheel could tear the seal.



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**Fig. 8 Replacement of Rear Crankshaft Oil Seal**

(3) Install the flywheel or converter drive plate. New bolts **MUST** be used when installing the flywheel or converter plate. Tighten the new bolts to 68 N·m (50 ft. lbs.) torque. Turn the bolts an additional 60°.

### CYLINDER BLOCK

Remove the Engine Assembly from the vehicle.

### DISASSEMBLY

Refer to the applicable sections for detailed instructions.

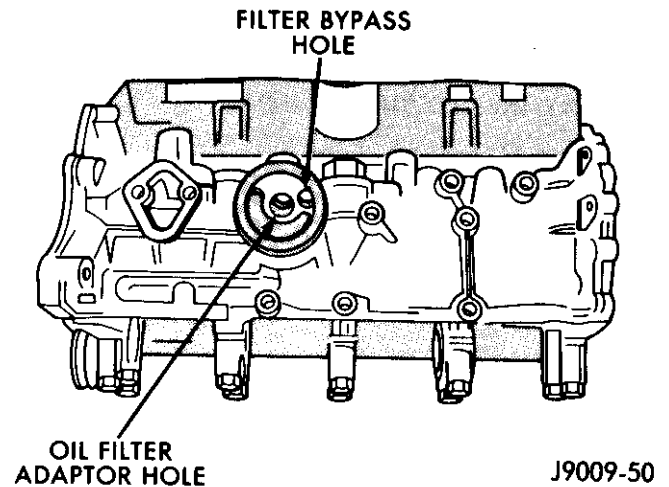
- (1) Drain the engine oil. Remove and discard the oil filter.
- (2) Remove the water pump from the cylinder block.
- (3) Remove the distributor from the cylinder block.
- (4) Remove the vibration damper.
- (5) Remove the timing case cover and lay the cover upside down.
- (6) Position a drift punch into the slot in the back of the cover and tap the old seal out.
- (7) Remove the timing chain bumper.
- (8) Remove the oil slinger from crankshaft.
- (9) Remove the camshaft retaining bolt and remove the sprockets and chain as an assembly.
- (10) Remove the camshaft.
- (11) Remove the oil pan and gasket.
- (12) Remove the timing chain tensioner.
- (13) Remove the front and rear oil galley plugs.
- (14) Remove the connecting rods and the pistons. Remove the connecting rod and piston assemblies through the top of the cylinder bores.
- (15) Remove the crankshaft.

### CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

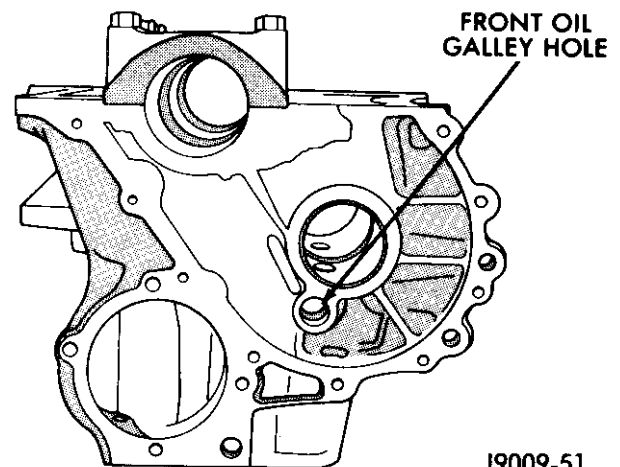
Use compressed air to clean out:

- The galley at the oil filter adaptor hole, the filter bypass hole (Fig. 9).

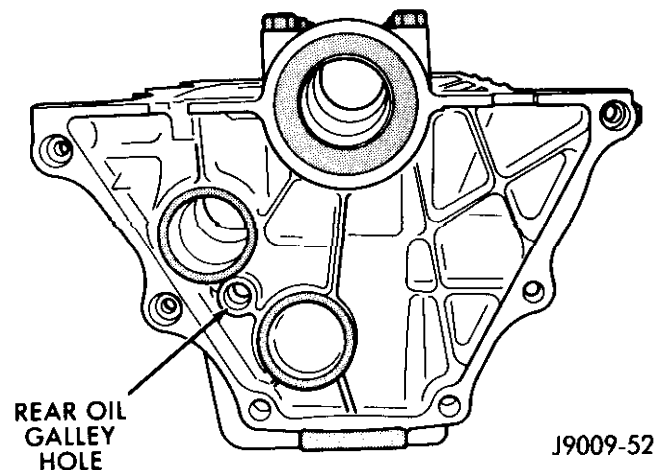


**Fig. 9 Oil Filter Adaptor Hole**

- The front and rear oil galley holes (Figs. 10 and 11).



**Fig. 10 Front Oil Galley Hole**



**Fig. 11 Rear Oil Galley Hole**