GENERAL PROCEDURES

COMPRESSION TEST

Special Tools

Illustration	Tool Name	Tool Number
 ST2709-A	Adapter, Crankcase Pressure Test	303-757

1. Make sure the oil in the crankcase is the correct viscosity and at the correct level.
2. Operate the engine until it is at normal operating temperature. Turn the ignition switch to the OFF position.

NOTE: Failure to remove all the glow plugs may result in inconsistent test results.

3. Remove the glow plugs. For additional information, refer to appropriate GLOW PLUG SYSTEM service information.

NOTE: The battery charger must be left connected during the compression test and disconnected when the test is complete.

4. Connect a battery charger to the battery.

NOTE: It may be necessary to install a commercially available adapter fitting to connect the Crankcase Pressure Test Adapter to the commercially available diesel compression gauge.

5. Install the Crankcase Pressure Test Adapter and a commercially available diesel engine compression gauge.

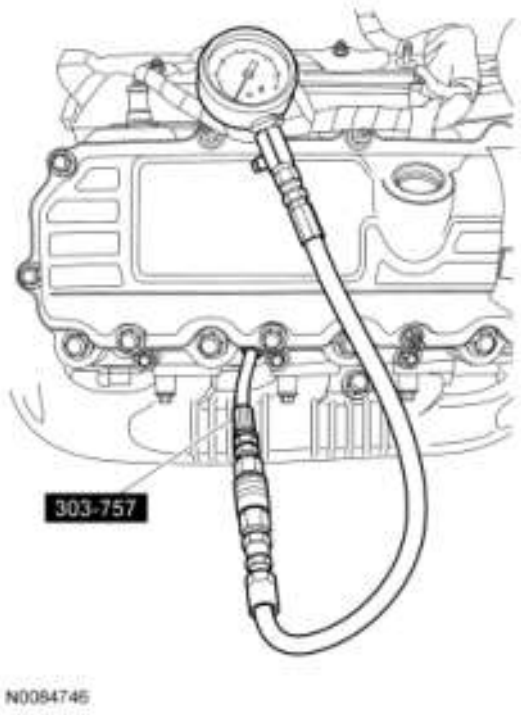

Fig. 12: Identifying Crankcase Pressure Test Adapter
Courtesy of FORD MOTOR CO.

6. Install an auxiliary starter switch to the starting circuit. With the ignition switch in the OFF position, crank the engine a consistent number of strokes (minimum of 2 compression strokes to 12 compression strokes). Record the readings.
7. Repeat the test on each cylinder, cranking the engine the same number of compression strokes, record the readings. Compare the readings of the 8 cylinders.
    - There must be no more than a 10% difference between the readings.
8. Investigate and repair any cylinder(s) that are outside of the 10% range.
9. Install the glow plugs. For additional information, refer to appropriate GLOW PLUG SYSTEM service information.

PISTON INSPECTION

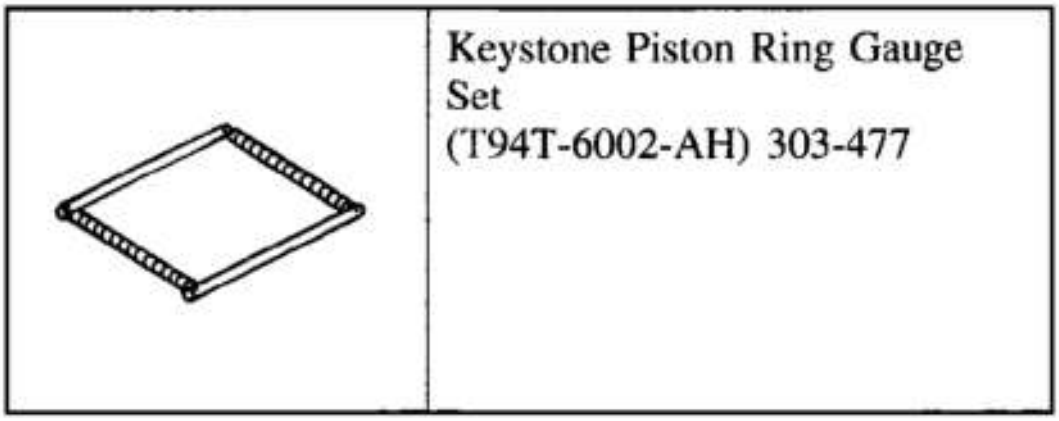

Fig. 13: Identifying Special Tool
Courtesy of FORD MOTOR CO.

Inspection

1. Clean the pistons with liquid soap and water.

   CAUTION: Do not use a caustic cleaning solution or a wire brush to clean pistons.

   CAUTION: Extreme care must be used when cleaning piston ring grooves on aluminum pistons.

2. Break the old compression rings in half, then use the compression rings to clean the piston ring groove areas of the piston.

   NOTE: Use the top compression ring to clean the top ring groove, and the bottom compression ring to clean the bottom ring groove. Because the ring grooves are different designs, using the wrong compression ring to clean each ring groove will damage the piston.

3. Inspect the piston ring lands, skirts, oil ring slot corners and pin bosses for scoring, scuffing or cracks. Install a new piston if these types of damage appear.
4. Measure keystone piston ring groove wear.
   1. Install the Keystone Piston Ring Gauge.
   2. Install the gauge pins in the appropriate groove.
   3. Using a micrometer, measure the distance between the gauge pins. Install a new piston if not within specification.

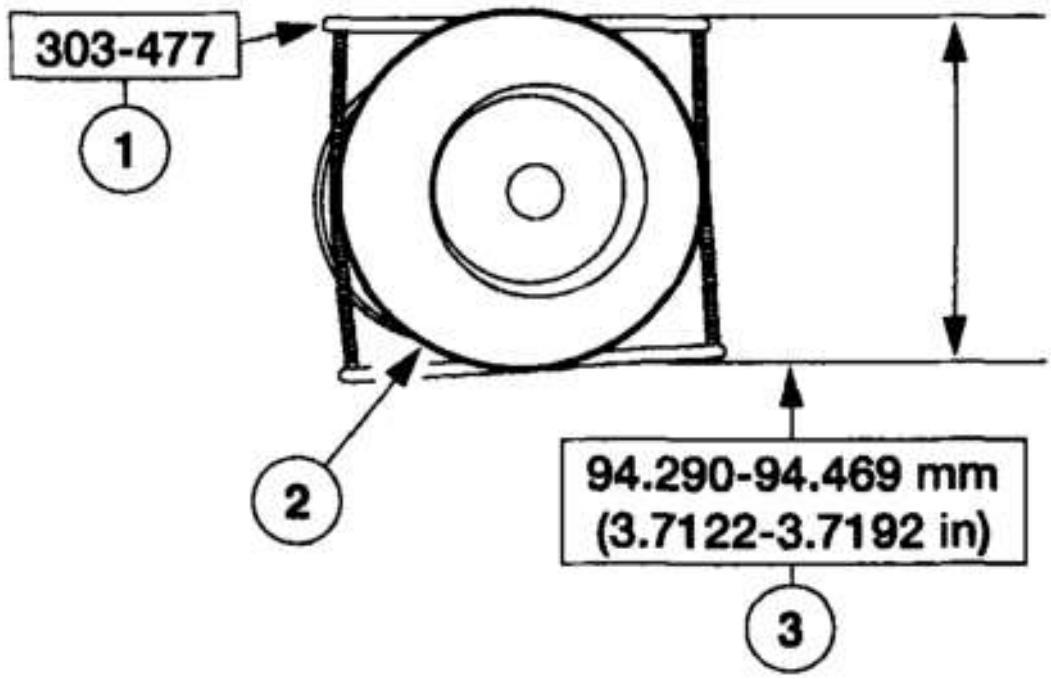

Fig. 14: Measuring Keystone Piston Ring Groove Wear
Courtesy of FORD MOTOR CO.

5. Measure the piston pin diameter in two directions at the points shown. Verify the diameter is within specification.
    - If out of specification, install a new piston pin.

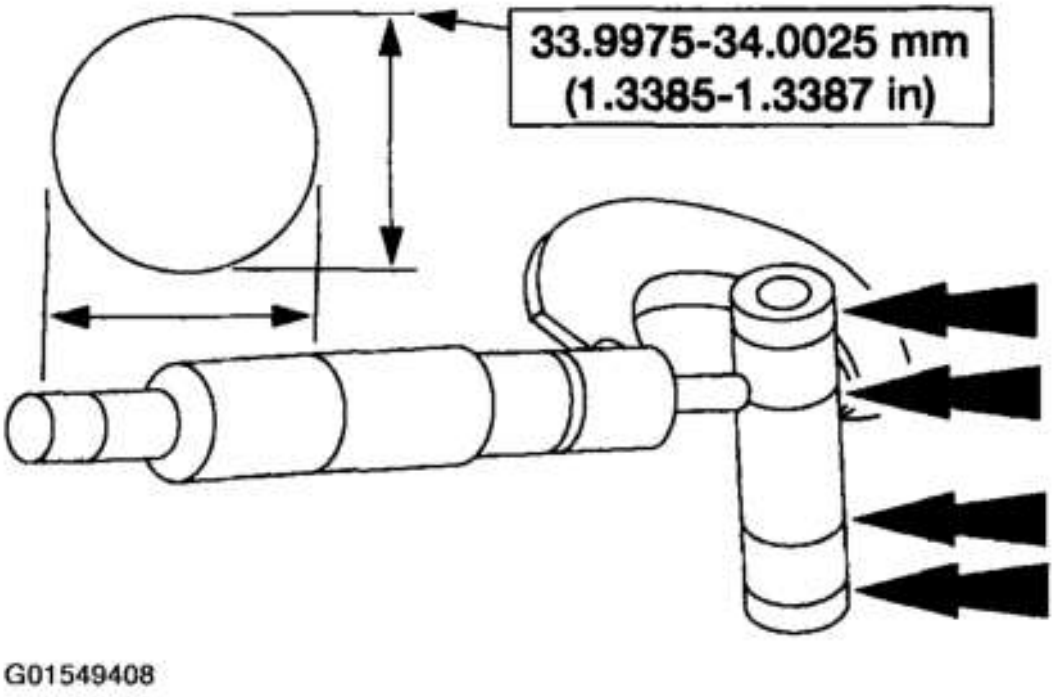

Fig. 15: Measuring Piston Pin Diameter
Courtesy of FORD MOTOR CO.

6. Measure the outside diameter of the piston pin and the inside diameter of the piston pin bore. The difference between the two readings is the piston pin-to-bore clearance. Install a new piston pin or piston if not within specification.

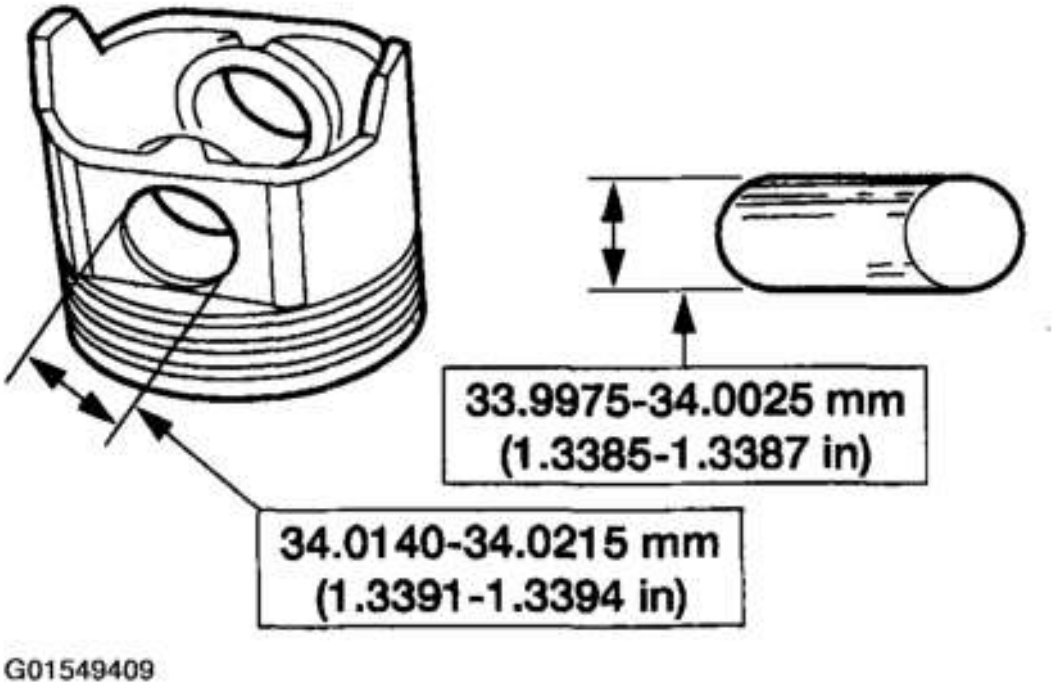

Fig. 16: Measuring Piston Pin-To-Bore Clearance
Courtesy of FORD MOTOR CO.

CONNECTING ROD CLEANING

Inspection

1. Using a suitable solvent, thoroughly clean the connecting rod and rod cap.
2. Mark each connecting rod and its corresponding rod cap for correct installation.
3. Measure the inside diameter of the piston pin bushing. Install a new connecting rod, if not within specification.

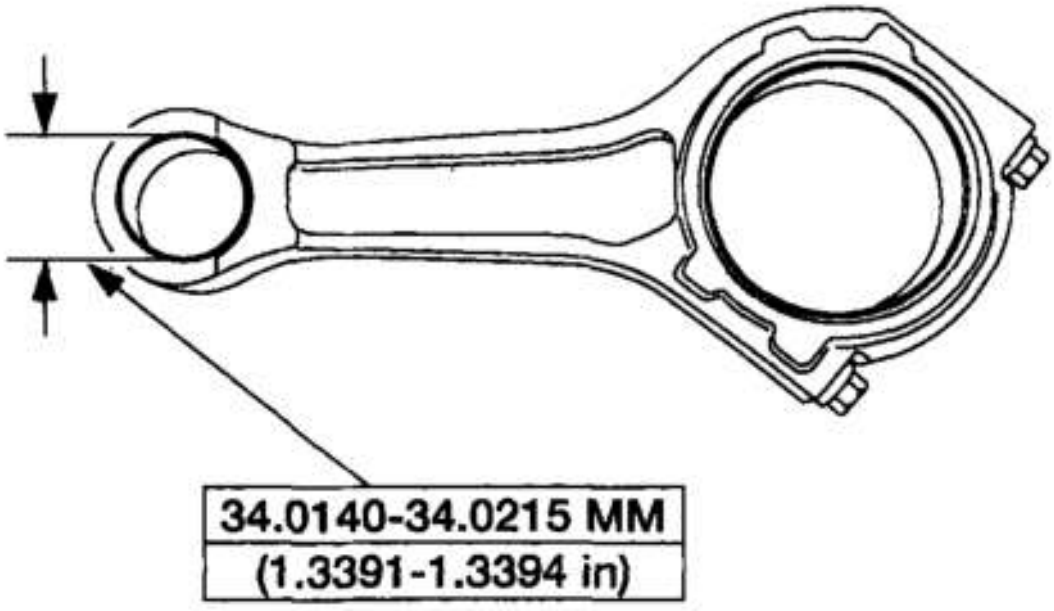

Fig. 17: Identifying Piston Pin Bushing Diameter
Courtesy of FORD MOTOR CO.

4. Using a suitable micrometer, measure the connecting rod bearing bore.
    1. Remove the connecting rod bearings from the connecting rod and the connecting rod cap. Install the connecting rod cap onto the connecting rod and tighten the bolts.
    2. Further tighten the connecting rod cap bolts.
        - Measure and record the connecting rod bearing bore as indicated. Install new connecting rods if not within specification.

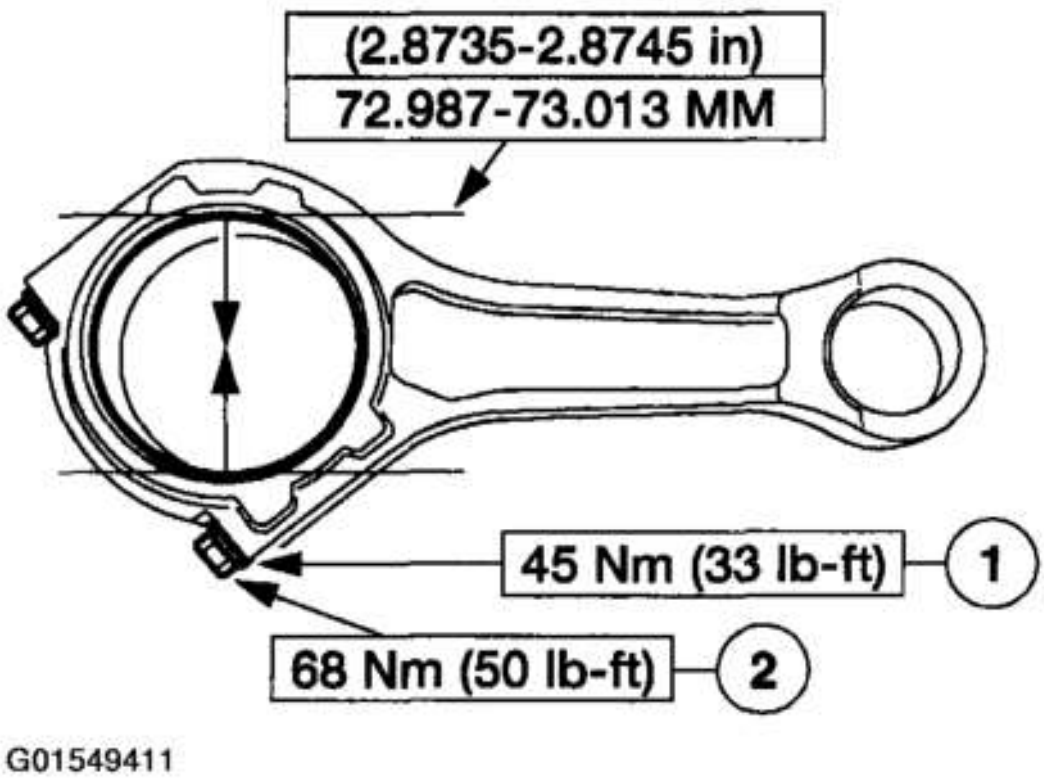

Fig. 18: Measuring Connecting Rod Bearing Bore
Courtesy of FORD MOTOR CO.

5. Using a suitable micrometer, inspect the connecting rod bearing bore taper.
    1. Measure the bearing bore inside diameter near the large chamfer.
    - Measure the bearing bore inside diameter near the small chamfer.
        - The difference between the two readings is the bore taper. Install new connecting rods if not within specifications.

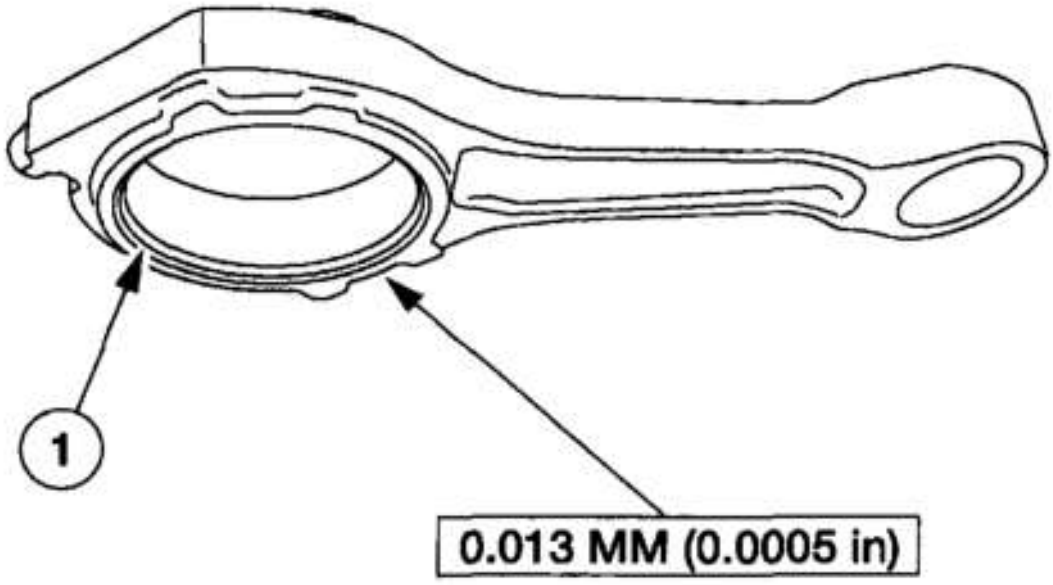

Fig. 19: Identifying Bearing Bore Inside Diameter
Courtesy of FORD MOTOR CO.

OIL PUMP ROTOR INSPECTION

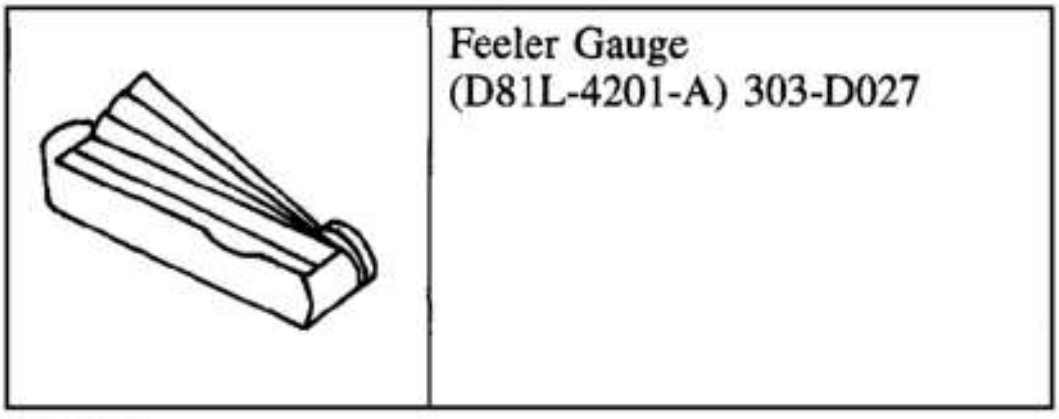

Fig. 20: Identifying Special Tool
Courtesy of FORD MOTOR CO.

Clearance Test

1. Inspect the oil pump for excessive metal particles.

2. Inspect the oil pump for gouging, cracks or deep scratches.
3. Inspect the oil pump inner and outer gear rotors for damage or excessive wear.
4. Using a straightedge and the Feeler Gauge, measure the height clearance between the oil pump housing and the inner and outer rotors. If the measurement does not meet specifications, install new gerotors as a set.

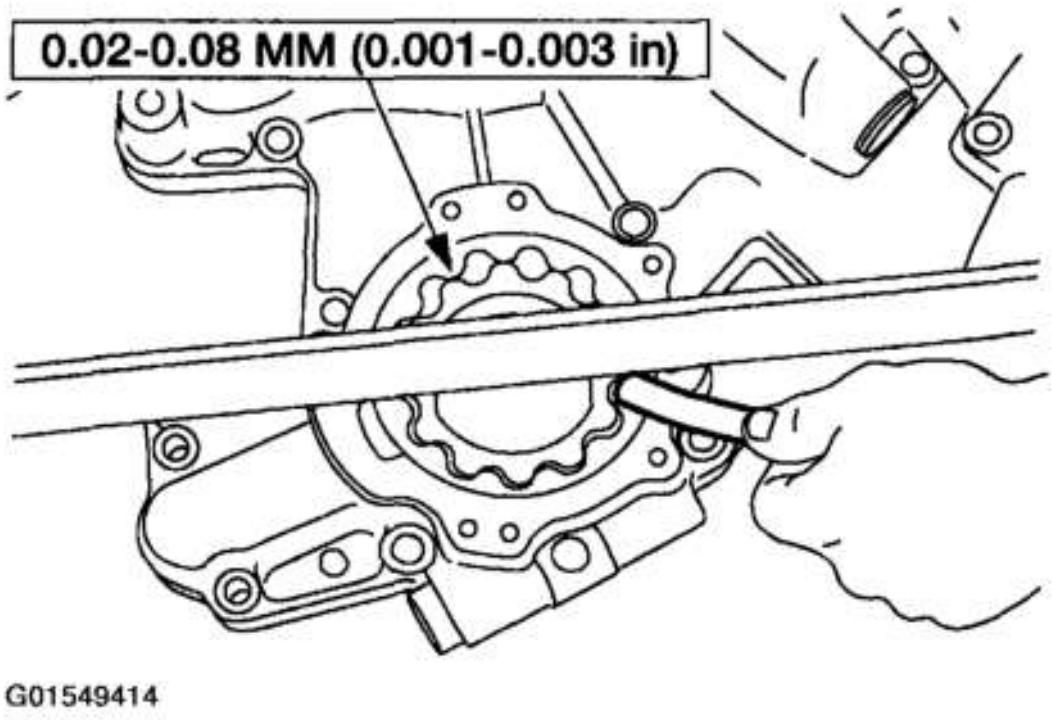

Fig. 21: Measuring Height Clearance Between Oil Pump Housing & Rotors
Courtesy of FORD MOTOR CO.

5. Using the Feeler Gauge, measure the clearance between the outer rotor and the oil pump housing. If the measurement does not meet specifications, install new gerotors as a set.

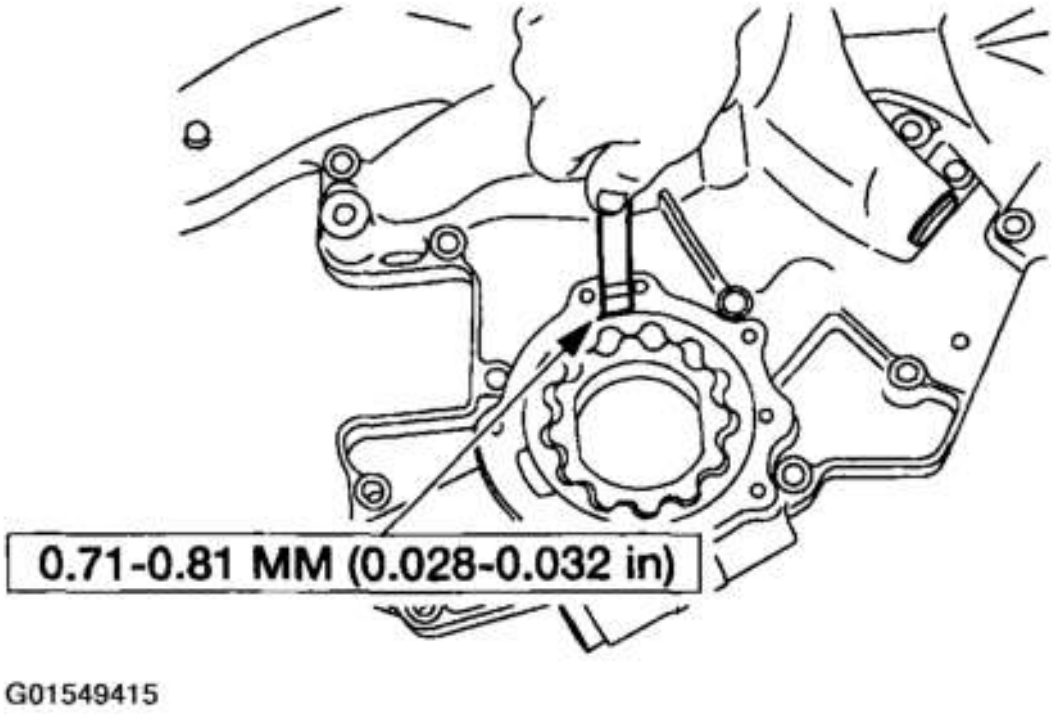

Fig. 22: Measuring Clearance Between Outer Rotor & Oil Pump Housing
Courtesy of FORD MOTOR CO.

CYLINDER BORE HONING

Service

1. The most desired cylinder block cleaning method is the "hot tank" method. All gallery plugs must be removed prior to hot tanking the cylinder block. If a hot tank is not available, soap and water is the approved alternative cleaning method.
2. Remove the gallery plugs.
    1. Remove the tappet oil gallery plugs.
    2. Remove the main oil gallery plug.
3. Apply a coating of Perfect Seal Sealing Compound F2AZ-19554-AA or equivalent meeting Ford specification ESR-M18P2-A and ESE-M4G115-A.

NOTE: A sealing compound must be applied to the gallery plugs prior to installation.

4. Spray cylinder wall using Rust Penetrant and Inhibitor F2AZ-19A501-A or equivalent meeting Ford specification ESR-M99C56-A.

CAUTION: Continuously spray the cylinder wall with the Rust Penetrant and Inhibitor F2AZ-19A501-A or equivalent meeting Ford specification ESR-M99C56-A while honing. Do not exceed more than 25 strokes

per cylinder bore because too much could be removed from the cylinder wall.

5. Insert the hone into a cylinder and begin honing for three seconds at a cycle of two strokes per second. Remove the hone from the cylinder.

CAUTION: Remove the piston cooling oil jets prior to honing the cylinders. Failure to do so will cause damage to the piston cooling oil jets.

CAUTION: Always remove the hone from the cylinders while the hone is still rotating. Failure to do so may cause an inconsistent pattern to form allowing excess engine oil to enter the combustion chamber.

NOTE: It is not necessary to remove the crankshaft to hone the cylinder block, however it is recommended to oil the crankshaft journals then wrap them with clean shop towels and tape.

NOTE: An air or electric drill motor with an adjustable speed down to 100 RPM is required to hone the cylinders. If a drill motor meeting this requirement is not available, cylinder honing cannot be performed.

NOTE: A 4-inch deglazing hone is required to hone the cylinders of this diesel engine.

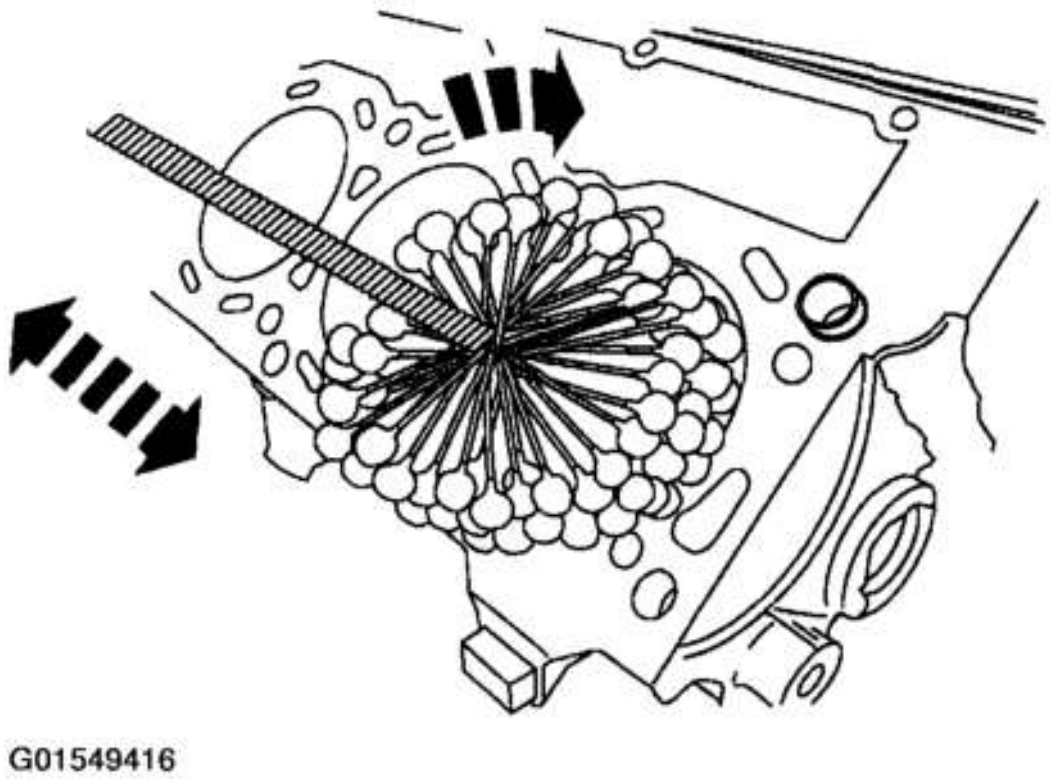

Fig. 23: Honing Cylinder
Courtesy of FORD MOTOR CO.

6. Wipe a section of the cylinder wall and inspect the crosshatch pattern comparing it to the neighboring (untouched) cylinder.

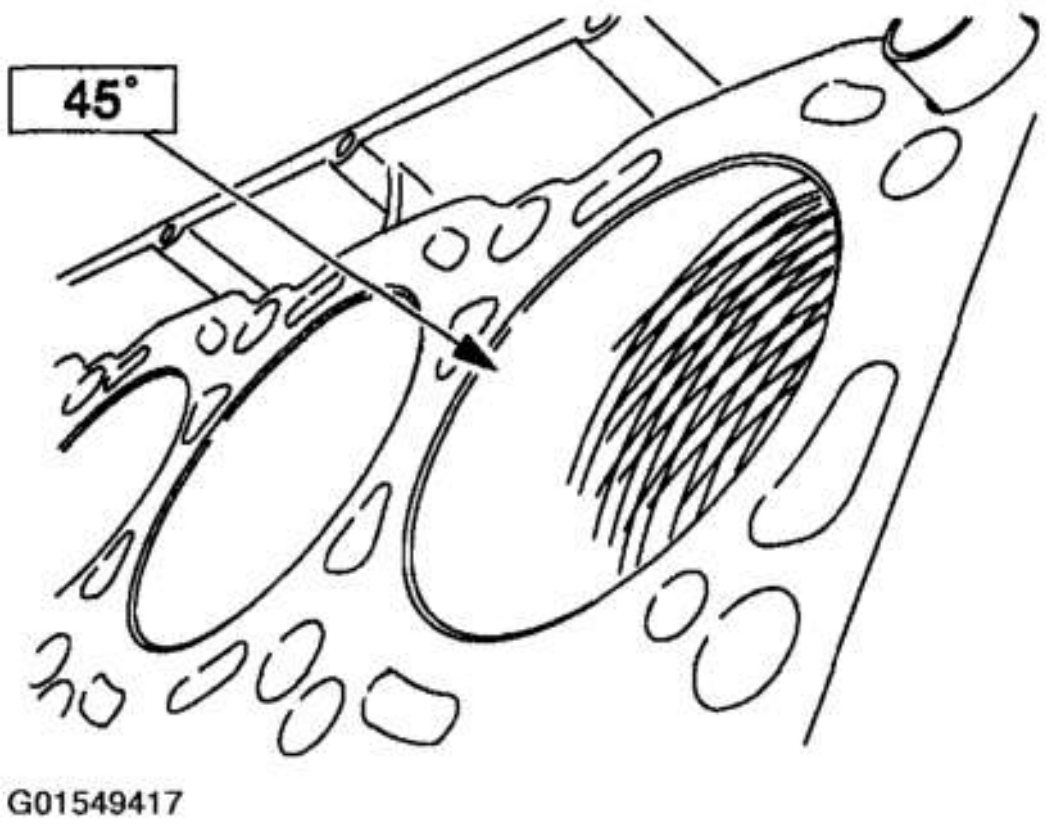

Fig. 24: Inspecting Crosshatched Pattern On Cylinder Walls
Courtesy of FORD MOTOR CO.

7. Repeat the honing process until the cylinder wall has a satin-like finish, or the maximum 25 strokes are achieved.

CAUTION: Continuously spray the cylinder wall with the Rust Penetrant and Inhibitor F2AZ-19A501-A or equivalent meeting Ford specification ESR-M99C56-A while honing. Do not exceed more than 25 strokes per cylinder bore because too much could be removed from the cylinder wall.

8. Clean and preserve the cylinder bores.

CAUTION: If the following steps are not followed, rusting of the cylinder bore (s) can occur.

1. Clean the cylinder bores using a mild soap and water.
2. Dry the cylinder bores thoroughly using a clean, lint-free cloth.
3. Soak a clean cloth in clean engine oil, and wipe the cylinder bores with the cloth.
4. Drape a clean cloth over the cylinder block to keep contaminants out of the cylinder bores.

Inspection

1. Inspect the cylinder block for cracks not visible to the eye.

CAUTION: There is no authorized repair for cracks in the cylinder block. If cracks are present, install a new cylinder block.

NOTE: Do not substitute rubbing alcohol for wood alcohol.

1. Coat the suspected area with a mixture of 25 percent kerosene and 75 percent light engine oil.
2. Wipe the area dry, and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the coating will become discolored at the damaged area.

CYLINDER HEAD CLEANING

Inspection

1. With valves installed to protect the valve seats, remove deposits and gasket material from the valve heads and gasket surface with a scraper and wire brush. Be careful not to damage cylinder head gasket surface.
2. Use a suitable solvent to remove dirt, grease and other deposits from the removed parts.
3. Clean all bolt holes and be sure gasket surfaces, oil return holes, and coolant passages are clean. After rinsing thoroughly with hot water, blow them out using filtered compressed air.
4. Wash all bolts (except head bolts, these must be replaced) with a suitable solvent and dry thoroughly.
5. Inspect the cylinder head for cracks, burned valves or seats and scratched or marred gasket mating surfaces.

NOTE: Cylinder heads used on the diesel engine cannot be resurfaced. Install a new cylinder head if it is cracked or warped.

6. Measure the cylinder head thickness. If the deck-to-deck measurements are not within specifications, install a new cylinder head.

NOTE: If it is suspected that the cylinder head has been resurfaced, use a suitable micrometer to measure the cylinder head thickness at four different points.