OVERHAUL

CYLINDER HEAD

Cylinder Head

1. Clean head gasket mating surface. Clean carbon from combustion chambers. Use care not to damage surfaces. Check cylinder head for cracks, burrs, nicks and warpage.
2. DO NOT machine more than .010" (.25 mm) from original cylinder head surface to correct warpage. Replace cylinder head as necessary. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Valve Springs

1. Measure valve spring installed height from top of spring seat to underside of spring retainer. Ensure installed height is within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.
2. If installed height is not within specification, a .03" (.8 mm) shim can be installed between cylinder head and valve spring to obtain correct height. Inspect valve spring free length and pressure. Replace valve spring if free length and pressure are not within specification. See **VALVES & VALVE SPRINGS** table.

CAUTION: DO NOT install valve spring spacers unless necessary. Using more spacers than required can result in spring breakage or worn camshaft lobes.

Valve Stem Oil Seals

When installing NEW valve stem seals, ensure oil seal bottoms on valve guide. Oversized valve stem seals must be installed when oversized valves are used.

Valve Guides

1. Valve guides must be reamed for an oversized valve if valve stem oil clearance exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Valves are available in .015" (.38 mm) and .030" (.76 mm) oversize.
2. If oversized valves or oversized valve stem oil seals are not available, valve guide may be bored out to use a service bushing. Always use reamers in proper sequence (smallest first).

NOTE: Always grind valve seat after valve guide has been reamed or service bushing has been installed.

Valve Seat

1. Grind valve seat to 45 degrees. If seat width is too wide after grinding, use a 30-degree stone to lower seat or a 60-degree stone to raise seat. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Ensure valve seat angle, seat width and seat runout are within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Valve seats must be ground when valve guide is reamed or replaced. Replacement information is not available from manufacturer.

Valves

Ensure head diameter, valve face runout, stem diameter and valve margin are within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

CAUTION: DO NOT remove more than .010" (.25 mm) from end of valve stem when resurfacing tip of valve.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1. Ensure pistons and rods are installed in cylinder from which they were removed. Ensure indentation on piston top is positioned as shown in illustration. See **Fig. 7**.
2. Ensure numbered side of rod faces outward. See **Fig. 7**. When installing replacement rods, ensure large-chamfered side of connecting rod bearing bore is toward crankshaft cheek, facing front of engine for right rods and rear of engine for left rods.

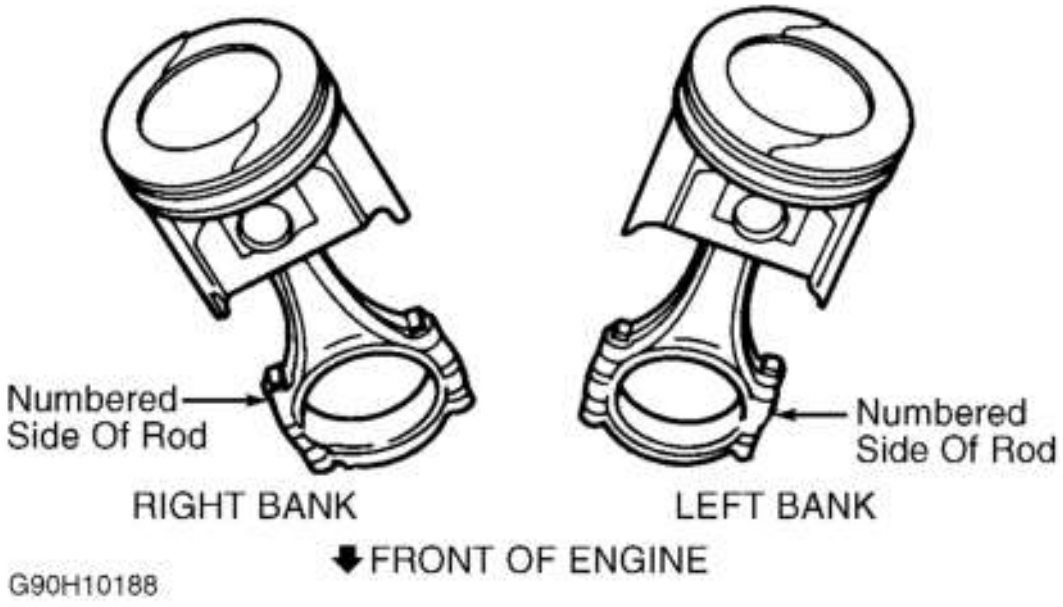

Fig. 7: Positioning Piston & Rod
Courtesy of FORD MOTOR CO.

NOTE: Take measurements with components at a stabilized room temperature of about 70°F (21°C).

Fitting Pistons

1. Check piston-to-bore clearance. See **PISTONS PINS & RINGS** table under ENGINE SPECIFICATIONS. Standard size pistons are color-coded Red, Blue or Yellow on piston dome. See **PISTONS PINS & RINGS** table. Oversize pistons are also available.

2. If bore diameter is in lower one-third of specification, use a Red coded piston. If bore diameter is in middle one-third of specification, use a Blue coded piston. If bore diameter is in upper one-third of specification, use Yellow coded piston. Use proper size piston to obtain specified clearance. See **PISTONS PINS & RINGS** table.

Piston Rings

1. Select rings for bore diameter. Place ring in cylinder bore in which it will be installed. Use piston to square ring in bore and place ring below normal ring wear area. Measure ring end gap. If ring gap is too small, file end of ring until within specification. If ring gap exceeds specification, try another ring set. See, in this article, **PISTONS PINS & RINGS** table under ENGINE SPECIFICATIONS.
2. Check side clearance of rings after installing on piston. Ensure clearance is within specification around entire circumference. Replace piston and/or rings if clearance is not within specification. See **PISTONS PINS & RINGS** table. Ensure rings are properly spaced on piston before installing pistons into cylinder. See **Fig. 8**.

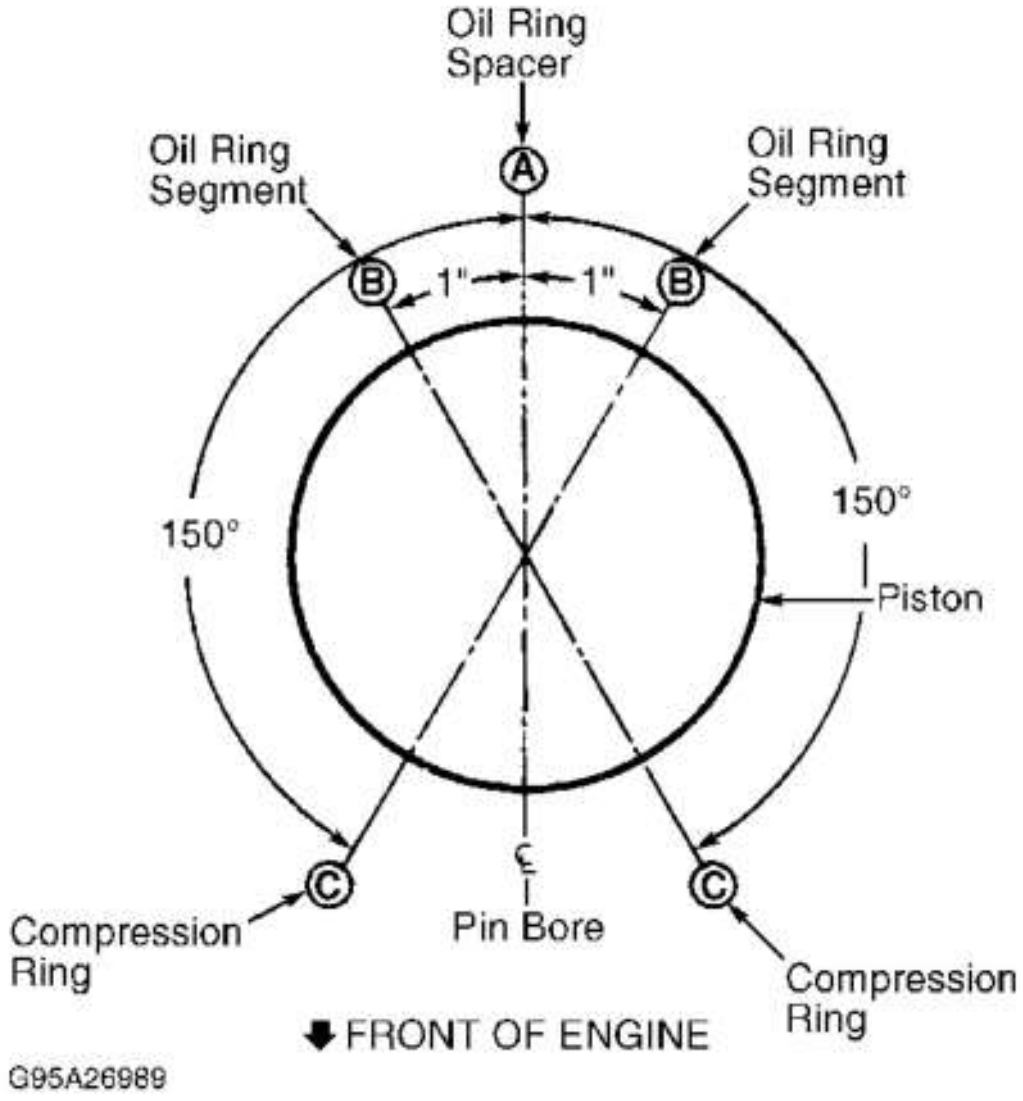

Fig. 8: Positioning Piston Ring End Gaps
Courtesy of FORD MOTOR CO.

Rod Bearings

1. Use Plastigage to check rod bearing clearance. If proper oil clearance cannot be obtained with standard bearings, try a combination of undersize bearings. DO NOT use any bearing combination other than listed. See UNDERSIZE MAIN & ROD BEARING COMBINATIONS table.
2. If use of bearing combinations does not bring clearance within specification, machine or replace crankshaft as necessary. Always replace bearings in pairs. Refer to, in this article, **CRANKSHAFT MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

UNDERSIZE MAIN & ROD BEARING COMBINATIONS (1)

Excess Bearing Clearance: In. (mm)	Use Upper Bearing: In. (mm)	Use Lower Bearing: In. (mm)
0 - .0005 (0-.013)	.001 (.025)	(2)
.0005 - 0010 (.013-.025)	.001 (.025)	.001 (.025)
.0010 - .0015 (.025-.039)	.002 (.050)	.001 (.025)
.0015 - .0020 (.039-.050)	.002 (.050)	.002 (.050)

(1) DO NOT use any bearing combination other than listed. If use of bearing combinations does not bring clearance within specification, machine or replace crankshaft as necessary.

(2) Use standard bearing.

Crankshaft & Main Bearings

1. When checking main bearing clearance in vehicle, position a jack under adjoining bearing counterweight being checked. Remove only one main bearing cap at a time.
2. Use Plastigage to check main bearing clearance. If proper oil clearance cannot be obtained with standard bearings, try a combination of undersize bearings. DO NOT use any bearing combination other than listed. See MAIN & CONNECTING ROD BEARING COMBINATIONS table.
3. If use of bearing combinations does not bring clearance within specification, machine or replace crankshaft as necessary. Always replace bearings in pairs. Refer to, in this article, **CRANKSHAFT MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
4. Install all bearing caps except thrust bearing cap (No. 3 from front of engine). Tighten main bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**. Install No. 3 bearing cap and tighten bolts finger tight.
5. Pry crankshaft forward and pry No. 3 bearing cap to rear of engine to align thrust bearing. While retaining forward pressure on crankshaft, tighten bearing cap to specification. See, in this article, **TORQUE SPECIFICATIONS** table.
6. Ensure crankshaft end play is within specification. Replace thrust bearing if end play is not within specification. See **CRANKSHAFT MAIN & CONNECTING ROD BEARINGS** table.

Cylinder Block

1. Using a feeler gauge and straightedge, check cylinder block head gasket surface for warpage. Check cylinder bore for wear, taper, out-of-round and piston fit. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

CAUTION: DO NOT machine more than .010" (.25 mm) of material from original cylinder block head surface.

2. Install all main bearing caps and tighten to specification before honing cylinder bore. See **TORQUE SPECIFICATIONS**. Ensure bearing caps are installed in their original location, with arrow on cap pointing towards front of engine.
3. Use ONLY a spring-loaded type cylinder hone. After honing, thoroughly clean bore with detergent and water solution. Rinse solution from bore thoroughly with clean water. Wipe bore clean with lint-free cloth. Lubricate cylinder bores with engine oil.