OVERHAUL

CYLINDER HEAD

Cylinder Head

1. Clean head gasket mating surface. Clean carbon from combustion chambers. DO NOT damage surfaces. Check cylinder head for cracks, burrs, nicks and warpage.
2. Check cylinder head warpage. Resurface cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. DO NOT machine more than .010" (.25 mm) from original cylinder head surface.

Valve Springs

1. Measure valve spring installed height from surface of cylinder head spring pad to underside of spring retainer. Refer to **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS. 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.
2. 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-to-guide oil clearance exceeds specification. Refer to **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Valves are available with .015" (.38 mm) and .030" (.76 mm) oversize stems.
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

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. Seat replacement information is not available from manufacturer.

Valves

1. Ensure head diameter, valve face runout, stem diameter and valve margin are within specification. See

VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

2. Oversize valves are available in .015" (.38 mm) and .030" (.76 mm). When servicing valve stem tip, DO NOT remove more than .010" (.25) from end of valve stem.

Valve Seat Correction Angles

Grind valve seat to a true 45-degree angle. 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.

CYLINDER BLOCK ASSEMBLY

CAUTION: NEVER cut into ring travel area more than 1/32" when removing ridge ring at top of bore.

Piston & Rod Assembly

Note direction of connecting rod installation on piston before removal. Ensure pistons and rods are installed in cylinder from which they were removed. When installing piston in bore, ensure arrow on top of piston is facing front of engine and bearing tang on connecting rod is facing camshaft. See **Fig. 9**.

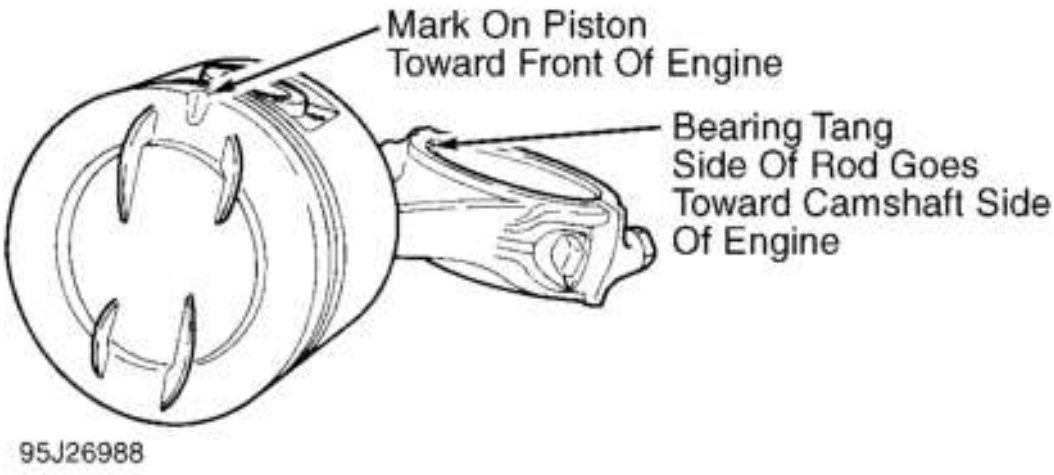

Fig. 9: Positioning Piston On Connecting Rod
Courtesy of FORD MOTOR CO.

NOTE: Make all measurements when piston and block are at normal room temperature of 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 the piston dome. See **PISTONS PINS & RINGS** table under ENGINE SPECIFICATIONS. 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 under ENGINE SPECIFICATIONS.

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 not within specification, try another ring set. See **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 under ENGINE SPECIFICATIONS. Ensure rings are properly spaced on piston before installing pistons into cylinder. See **Fig. 10**.

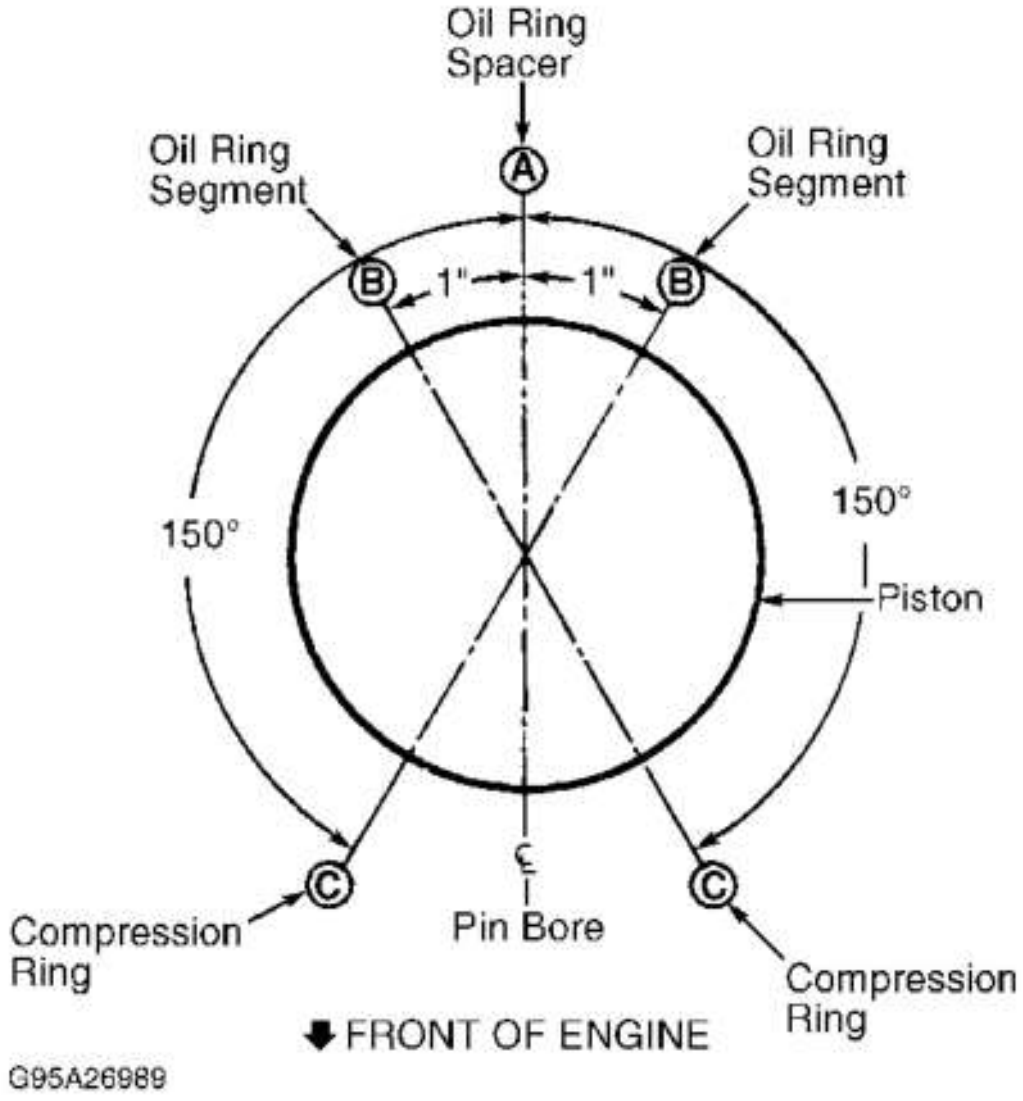

Fig. 10: Positioning Rings On Piston
Courtesy of FORD MOTOR CO.

Piston Pin Replacement

1. Remove bearing inserts from connecting rod and cap. Mark pistons and pins to ensure assembly to original location. Remove piston rings. Using a press and Piston Pin Remover/Replacer (T81P-6135-A), press piston pin from piston and connecting rod.
2. Before assembling piston and rod, ensure connecting rod pin bore diameter and piston diameter are within specification. See **CONNECTING RODS** and **PISTONS PINS & RINGS** tables under ENGINE SPECIFICATIONS. Apply light coat of engine oil to parts to be assembled. When installing piston pin, ensure piston and connecting rod are assembled as shown. See **Fig. 9**.

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 bearing combinations cannot bring clearance within specification, machine or replace crankshaft as necessary. Always replace bearings in pairs. Refer to **CRANKSHAFT MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

UNDERSIZE MAIN & ROD BEARING COMBINATIONS (1)

Excess Clearance: In. (mm)	Use Upper Bearing: In. (mm)	Use Lower Bearing: In. (mm)
0 - .0005 (0-.013)	.001 (.025)	(2)
0.0005 - .0010 (.013-.025)	.001 (.025)	.001 (.025)
0.0010 - .0015 (.025-.039)	.002 (.050)	.001 (.025)
0.0015 - .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 **UNDERSIZE MAIN & 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. See **CRANKSHAFT MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
4. Install all bearing caps except thrust bearing cap (No. 5 from front of engine). Tighten main bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**. Install No. 5 bearing cap and tighten bolts finger tight. Pry crankshaft forward and pry No. 5 bearing cap to rear of engine to align thrust bearing. While retaining forward pressure on crankshaft, tighten main bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**.
5. Ensure crankshaft end play is within specification. Replace thrust bearing if end play is not within specification. See **CRANKSHAFT MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

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** and also see **PISTONS PINS & RINGS** tables 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.