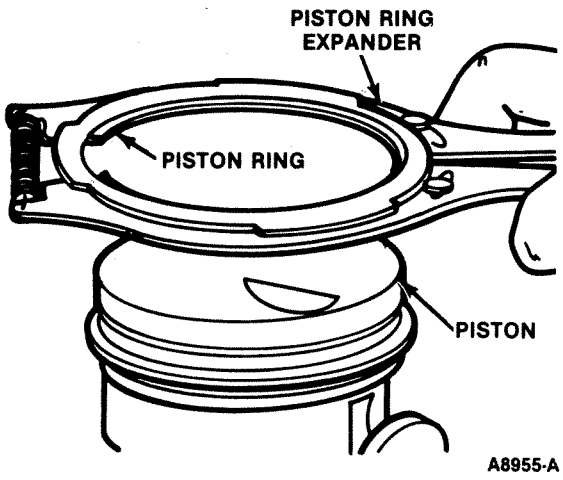
CLEANING, INSPECTION AND OVERHAUL

CONNECTING ROD AND PISTON

Piston Ring Installation (Continued)

9. Start the end of an oil ring rail ring into the oil ring groove above the spacer. The end gap must be approximately 25.4 mm (1 in.) away from the spacer ends. Finish installing the rail ring by spiraling it the remainder of the way on. Repeat the rail installation with the other rail ring. Its gap must be approximately 25.4 mm (1 in.) on the other side of the spacer ends.
10. Select the number two compression ring and install it in a piston ring expander with the proper side up. See instructions on the ring package. Spread the ring and install it in the piston ring groove.



Repeat step 10 with the top compression ring. Space the compression ring gaps approximately 50.8 mm (2 in.) on opposite sides of the oil ring gaps.

11. Oil the rings and piston pin bores. Store the rod/piston assemblies in a clean place until ready for assembly.

CYLINDER HEAD

SPECIAL SERVICE TOOLS REQUIRED:

Front Seals Replacer	T74P-6150-A
Camshaft Bearing Set	T65L-6250-A
Cam Bearing Replacer	T71P-6250-A
Expander Screw	T65L-650-A13
Cam Bearing Adapter Tube	T72C-650
Hydraulic Tappet Leakdown Tester	TOOL-6500-E
Valve Spring Compressor	T74P-6565-A
Front Cover Seal Remover	T74P-6700-B
Valve Guide Reamer Kit	T52L-6085-AEE
Valve Seat Runout Gauge	D81P-6002-E
Dial Indicator with Bracketry	TOOL-4201-C
Valve Stem Clearance Tool	TOOL-6505-E
Valve/Clutch Spring Tester	TOOL-6513-D
Valve Stem Seal Installer	T73P-6571-A

Disassembly

1. Before the cylinder head components are disassembled, support the head assembly, head gasket surface up, on a table or bench. Use blocks or pins to prevent valve or camshaft parts from contacting the table or bench.

   Clean the combustion chamber deposits with a wire wheel and a drill motor. Leave the valves in place to prevent damage to the valves or valve seats.

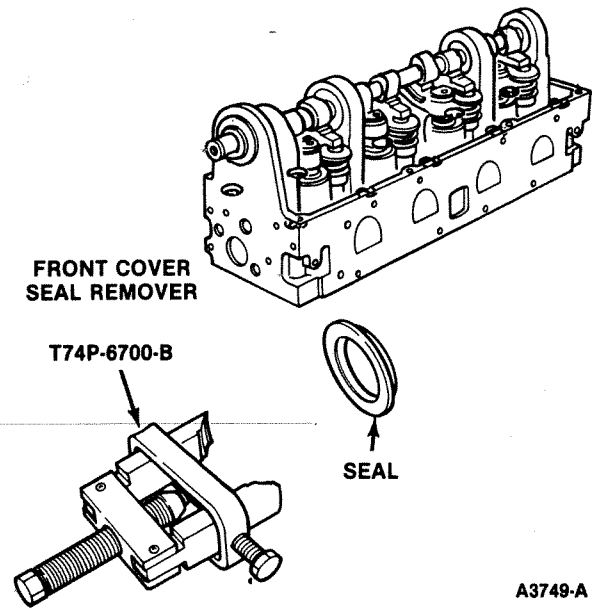
2. Turn the cylinder head camshaft side up and perform Base Procedure 10—Disassembly, Hydraulic Lash Adjusters Removal.

CLEANING, INSPECTION AND OVERHAUL

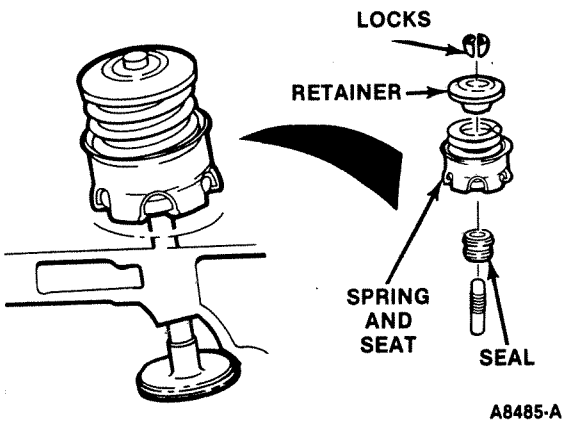
CYLINDER HEAD

Disassembly (Continued)

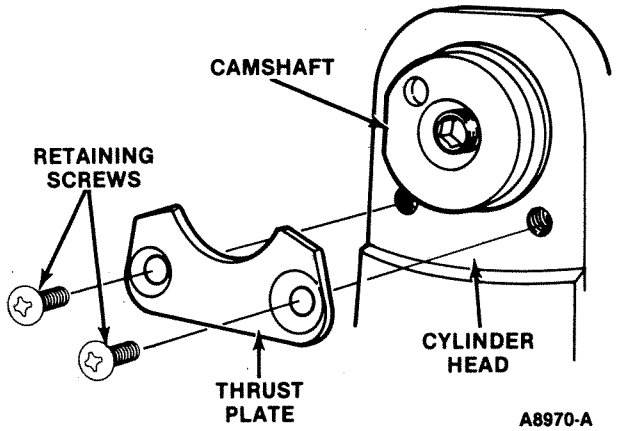
3. Remove the camshaft seal using Front Cover Seal Remover T74P-6700-B, or equivalent.



4. Turn the cylinder head on its side. Using a horseshoe type of valve spring compressor, depress the valve spring retainer and valve spring. Remove the locking keys, the spring retainer, valve spring and seal. Repeat on the remaining valves. Keep the valves in order so that they can be assembled in their original positions.

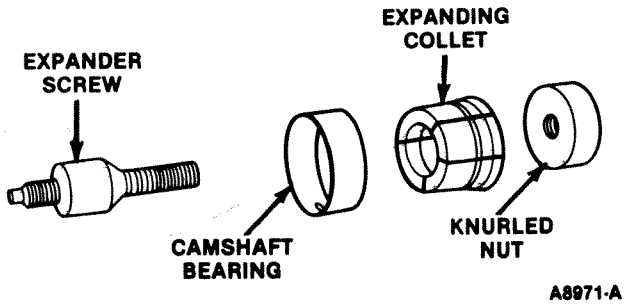


5. Remove the camshaft rear retaining and thrust plate screws and plate. Carefully slide the camshaft through its bearings and out the front of the cylinder head.



6. Remove the plug from the rear of the camshaft.
7. The camshaft bearings can most easily be removed by removing the number 3 and 4 bearings from the rear of the cylinder head and numbers 1 and 2 from the front of the head.
8. Install tools from Camshaft Bearing Set T65L-6250-A, Cam Bearing Replacer T71P-6250-A, and Cam Bearing Adapter Tube T72C-6250, or equivalents, into a camshaft bearing.

9. While holding the expander screw, tighten the round knurled nut until the expanding collet is firmly expanded into the cam bearing.

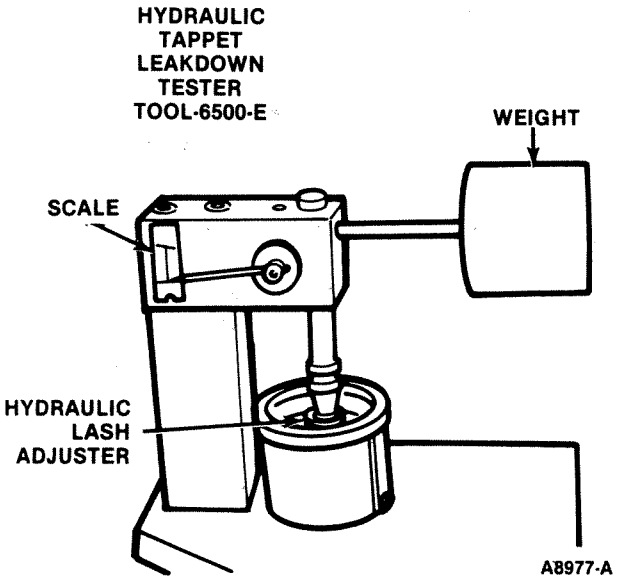


CLEANING, INSPECTION AND OVERHAUL

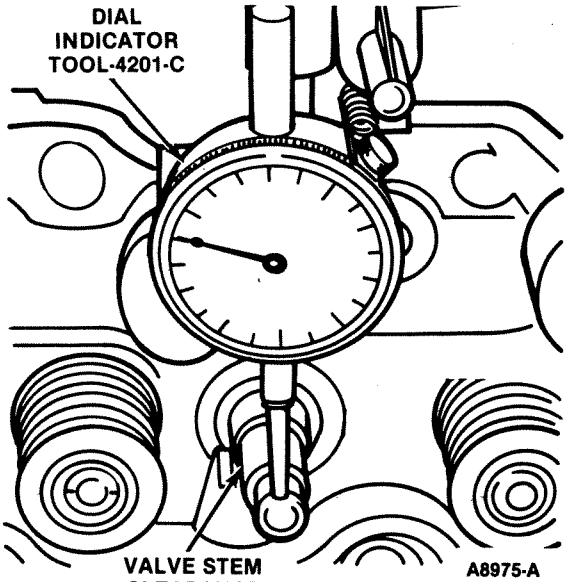
CYLINDER HEAD

Inspection (Continued)

Measure the hydraulic lash adjuster bores. The bore should be 21.4122 to 21.46046 mm (0.8430 to 0.8449 in.). The clearance between the bore and the adjuster should be .0178 to .0686 in. (.0007 to .0027 in.) with a maximum service limit of 0.127 mm (.005 in.). The adjuster outer body diameter should be 21.3919 to 21.4046 mm (.8422 to .8427 in.). The hydraulic lash adjuster should be checked for leakdown rate on the Hydraulic Tappet Leakdown Tester Tool L-6500-E, or equivalent. The leakdown rate is two to eight seconds for a travel of 3.175 mm (1/8 in.) with a 22.68 Kb (50 lb.) load applied. See instructions for use with the tool.



Inspect the valve guide bores for proper size. A telescoping gauge and a 25.4-mm (1-in.) micrometer should be used. The intake and exhaust guide bores should be 8.7198 to 8.7452 mm (.3433 to .3443 in.). Intake valve-to-guide clearance is .0254 to .0686 mm (.0010 to .0027 in.) on a new or overhauled head and a service limit of .1397 mm (.0055 in.) for intake and exhaust. The exhaust valve-to-guide clearance on a new or overhauled cylinder head should be .0381 to .0813 mm (.0015 to .0032 in.).



Check the valve stem to valve guide clearance of each valve in its respective valve guide with Valve Stem Clearance TOOL-6505-E and Dial Indicator TOOL-4201-C, or equivalent. Use a flat end indicator point.

Install the tool on the valve stem until it is fully seated, and tighten the knurled set screw firmly. Permit the valve to drop away from its seat until the tool contacts the upper surface of the valve guide.

Position the dial indicator with its flat tip against the center portion of the tool's spherical section at approximately 90 degrees to the valve stem axis. Move the tool back and forth in line with the indicator stem. Take a reading on the dial indicator without removing the tool from the valve guide upper surface. Divide the reading by two, the division factor for the tool. The resulting measurement is the valve stem clearance.

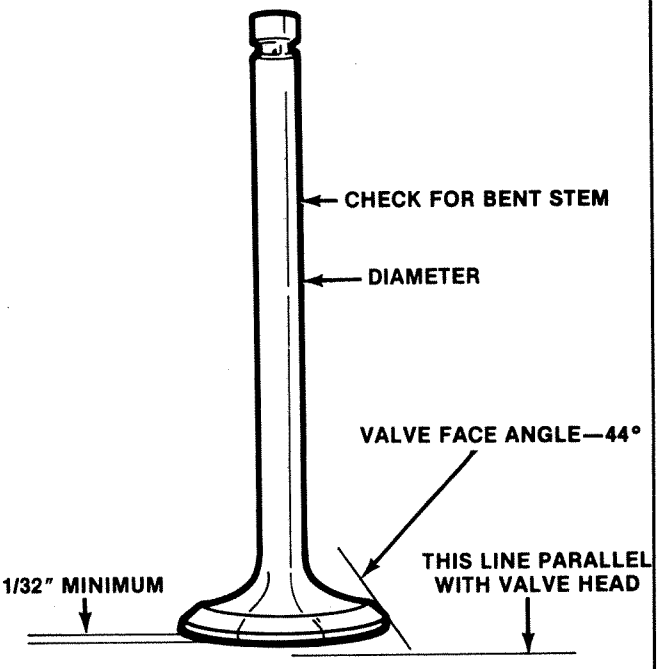
CLEANING, INSPECTION AND OVERHAUL

CYLINDER HEAD

Inspection (Continued)

Intake valve stem diameters are 8.6766 to 8.6944 mm (.3416 to .3423 in.) on a standard valve, 9.0576 to 9.0754 mm (.3566 to .3573 in.) on a .381-mm (.015-in.) oversize valve stem, and 9.4386 to 9.4564 mm (.3716 to .3723 in.) on a .762-mm (.030-in.) oversize valve stem.

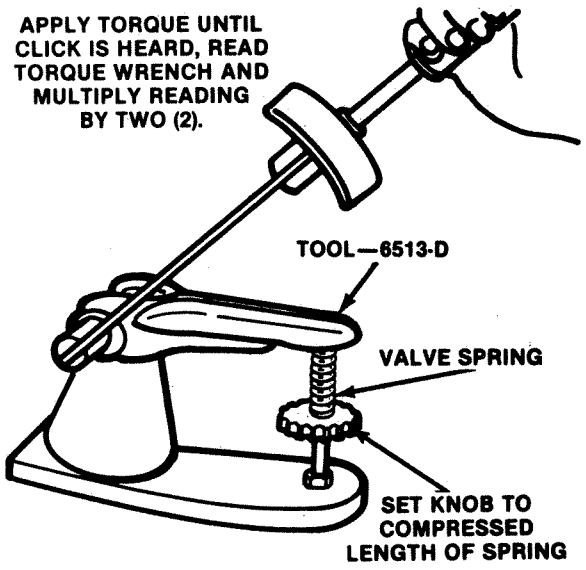
Exhaust valve stem diameters are 8.6639 to 8.6817 mm (.3411 to .3418 in.) for a standard valve stem, 9.0449 to 9.0627 mm (.3561 to .3568 in.) for a .381-mm (.015-in.) oversize stem and 9.4259 to 9.4437 mm (.3711 to .3718 in.) for a .762-mm (.030-in.) oversize stem. Intake and exhaust valve face angle limits are 44 degrees.



A8979-A

The valve key lock grooves in the valve stems should be inspected for having square corners on the grooves and lands.

Valve springs must be of a specified size and strength and not warped. Intake and exhaust valve springs are interchangeable. The valves themselves are not interchangeable.



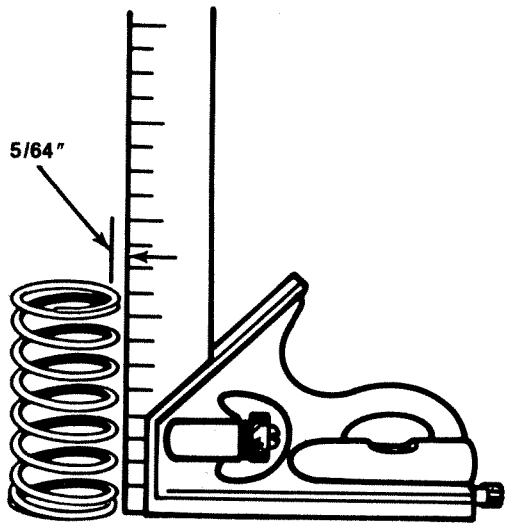
A2917-1C

CLEANING, INSPECTION AND OVERHAUL

CYLINDER HEAD

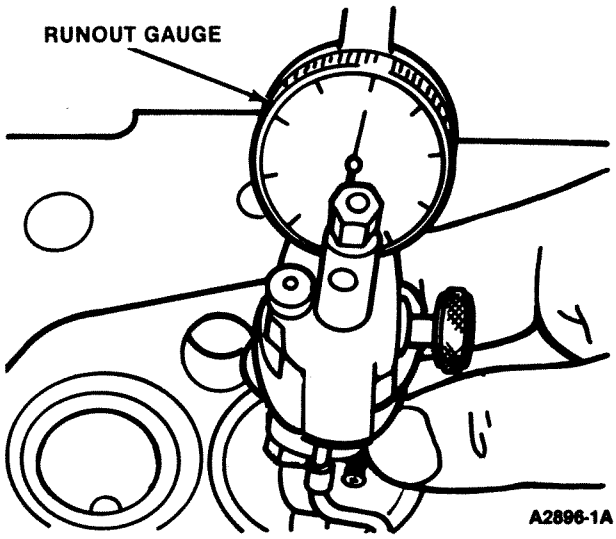
Inspection (Continued)

The valve spring pressures are: 32.2056 to 35.8344 kg (71 to 79 lbs) at 38.608 mm (1.52 in.). The free length is 47.6758 mm (1.877 in.) and assembled height is 38.894 mm to 40.481 mm (1-17/32 to 1-19/32 in. or 1.5313 to 1.5938 in.). A five-percent pressure loss is allowable at the above specified lengths. Springs must be square within 1.981 mm (5/64 or 0.078 in.).



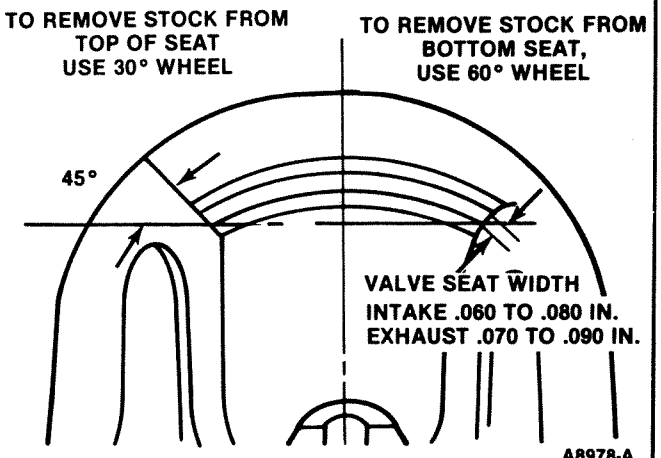
A8976-A

Cylinder head valve seats must be round, have the correct seat angle, face width, and be free of pits or burned areas.



A2896-1A

The seat angle is 45 degrees; the face width on intake valve seats is 1.524 to 2.032 mm (.060 to .080 in.). Face width on the exhaust valve seats is 1.778 to 2.286 mm (.070 to .090 in.). Face runout on intake or exhaust valve seats should not exceed .0406 mm (.0016 in.).



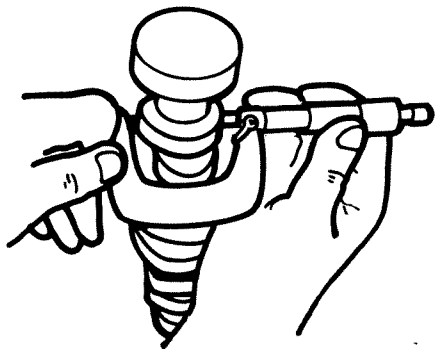
A8978-A

CLEANING, INSPECTION AND OVERHAUL

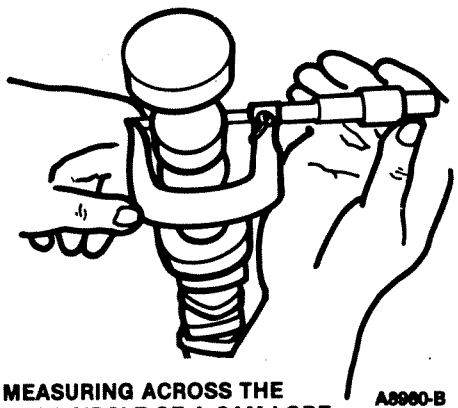
CYLINDER HEAD

Camshaft Inspection

Measure the camshaft lobes across their maximum (lobe height) and minimum (base circle) dimensions. The difference is the lobe lift. The intake and exhaust lobe lift should be 10.6 mm (0.400 in.) with a .127 mm (.005 in.) allowance.



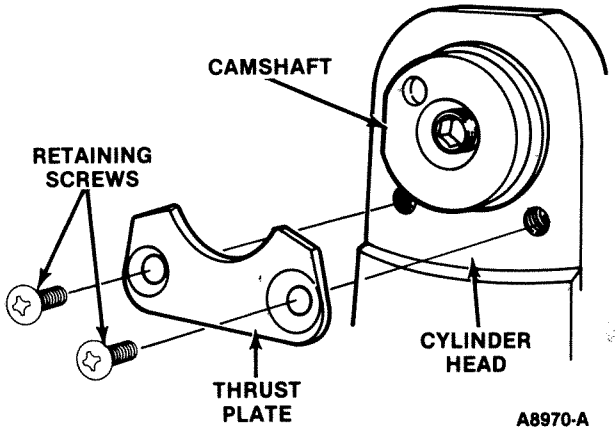
MEASURING ACROSS THE MAXIMUM OF A CAM LOBE



MEASURING ACROSS THE BASE CIRCLE OF A CAM LOBE A8960-B

MAXIMUM—MINIMUM (BASE CIRCLE) = CAM LOBE LIFT

Inspect the thrust plate groove and thrust plate, on the rear of the camshaft, for scoring or wear. Camshaft endplay specifications are .0254 to .1778 mm (.001 to .007 in.) with a maximum service limit of .2286 mm (.009 in.).



All of the camshaft bearing journals are the same size: 44.9910 to 45.0088 mm (1.7713 to 1.7720 in.). The allowable out-of-round on any one journal is .0127 mm (.0005 in.). Total indicated runout of the camshaft is .127 mm (.005 in.). Camshaft journal to bearing clearance is .0254 to .0762 mm (.001 to .003 in.) with a maximum service limit of .1524 mm (.006 in.).

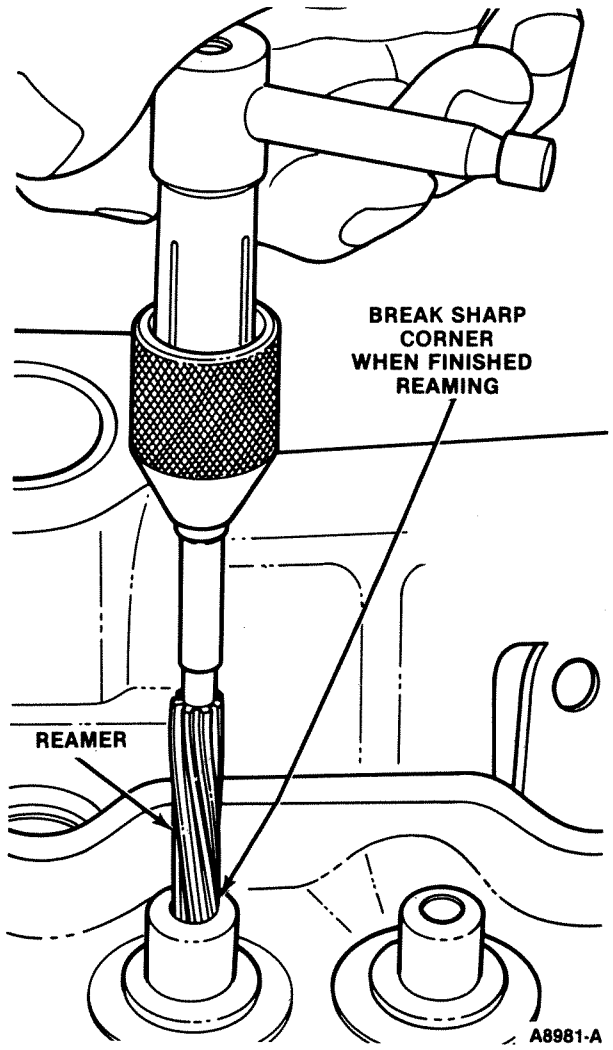
Check the camshaft follower for wear or scoring at the camshaft contact pad and at the valve end. If any scoring or grooves are present, replace the follower.

CLEANING, INSPECTION AND OVERHAUL

CYLINDER HEAD

Overhaul

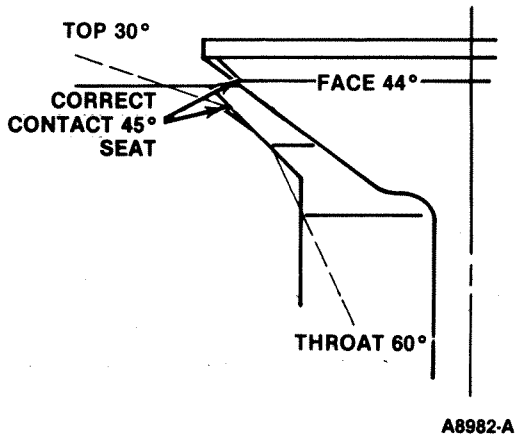
If necessary, ream the valve guides to match the necessary size valve stems using Valve Guide Reamer Kit T52L-6085-AEE, or equivalent.



The kit contains reamers for .0762, .381 or .762 mm (.003, .015 or .030 in.) oversize valve guides. Then, if necessary, grind the valve seats to a 45-degree angle. Follow the instructions of the seat grinding equipment manufacturer. Be sure to use a tight fitting, straight pilot in the valve guide. Do not remove more metal than necessary to clean the seat.

If necessary, reface the valves to a 44 degree angle following the valve grinding equipment manufacturer's recommendations. A minimum .794-mm (1/32-in.) margin at the edge of the valve head must remain after grinding. Remove as much stock from the end of the valve stem as the total removed from the seat and valve face. Bevel the edge of the valve stem end after grinding the end of the stem.

The center of the valve face should contact the seat in approximately the top ⅓ of the valve seat.



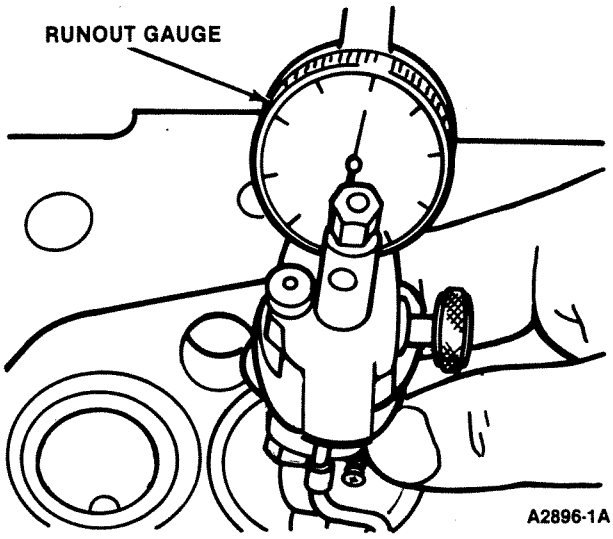
Lower the seat as required with a 15 or 30 degree stone seat cut. If contact is correct but the seat is too wide, trim the bottom of the seat with a 60 or 70 degree stone. After grinding, the seat will almost always be too wide, so some narrowing is usually necessary.

CLEANING, INSPECTION AND OVERHAUL

CYLINDER HEAD

Overhaul (Continued)

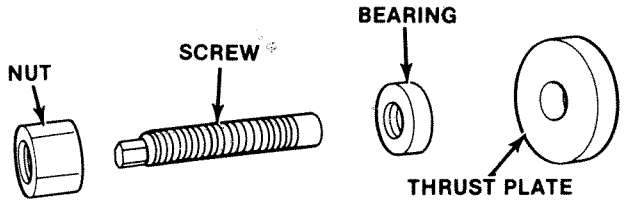
Before assembling the valves into the cylinder head, check the valve seat runout with Valve Seat Runout Gauge D81P-6002-E, or equivalent.



Rinse the cylinder head with detergent and hot water or solvent before proceeding with the next operation.

Place the bearing and tool assembly in a starting position on number 2 or 3 cam bearing bores with the bearing oil hole aligned with the oil hole in the bearing bore. Oil the bearing.

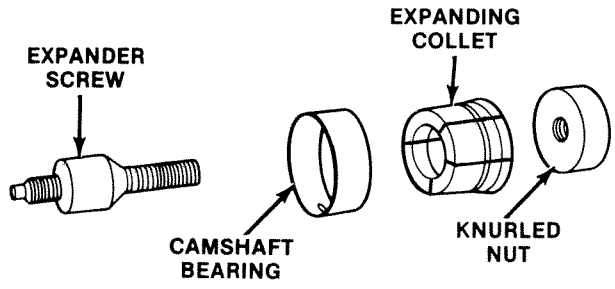
Thread the screw onto the expander screw until fully seated. Slide the thrust plate (from Camshaft Bearing Set T65L-6250-A) and the bearing, from same set, onto the opposite side of the camshaft bearing bore, start and screw the nut on the screw until it contacts the bearing.



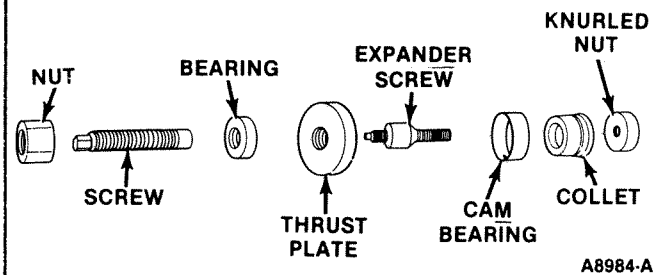
Camshaft Bearings Installation

Oil the camshaft bearing bores in the cylinder head.

Assemble a new camshaft bearing onto the expanding collet of Cam Bearing Replacer T71P-6250-A. Place Expander Screw T65L-6250-A13 through the expanding collet and thread into the knurled nut (part of Cam Bearing Replacer T71P-6250-A) until tight. Do not expand the cam bearing.



While holding the screw with a wrench, tighten the nut until the camshaft bearing is centered into the bearing bore and the bearing and head oil holes are aligned. Remove the tools and repeat with the other three bearings.

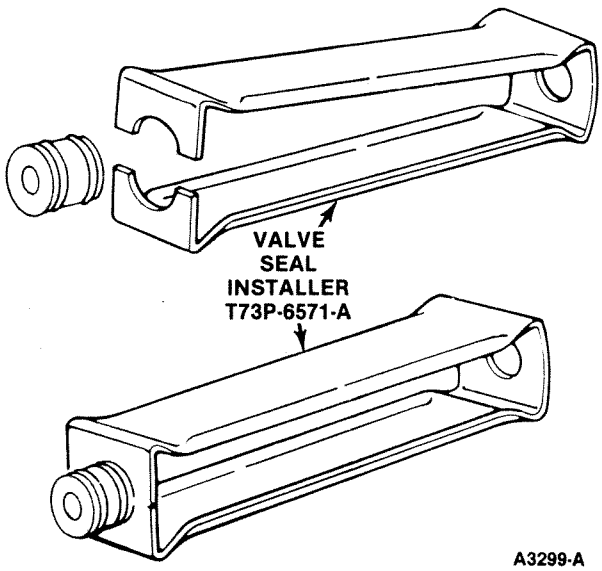


CLEANING, INSPECTION AND OVERHAUL

CYLINDER HEAD

Camshaft Bearings Installation (Continued)

Using Valve Seal Installer T73P-6571-A, or equivalent, force the seal onto the valve guide until it bottoms.



Assemble the valve springs and seat, the spring retainers and the valve key locks. Using a horseshoe type of valve spring compressor, compress the valve spring and install the valve key locks. Be sure the spring retainer is up onto the locks and the locks are seated on the valve stem grooves. Repeat above for all valves. Measure the valve spring installed height. Any assemblies that are too high must be disassembled and a shim placed between the valve spring seat and the cylinder head. The shims are available in .762- and 1.524-mm (.030- and .060-in.) thicknesses.

Oil the camshaft bearing journals and lobes. Be sure the plug is fully bottomed in the rear of the camshaft.

Install the camshaft into the bearings. Be careful not to scratch the bearings with the camshaft lobes.

Install the camshaft thrust plate. Torque the screws to 8 to 12 N·m (6 to 9 lb-ft). Check the camshaft endplay. It should be .0254 to .2286 mm (.001 to .009 in.). Install the camshaft seal using Front Seals Replacer T74P-6150-A, or equivalent.

If, during cylinder head inspection, the hydraulic lash adjuster did not meet the leakdown test specification, it can be disassembled and cleaned.

Remove the retaining ring and the remaining parts. Clean in solvent and reassemble. Test the leakdown rate again. If its rate is out of specification, replace with a new lash adjuster. Test the new lash adjuster before installation.

Install the lash adjusters in the cylinder head. Support the cylinder head to prevent damage to the valves. Turn the camshaft so the camshaft lobe of the cam follower being installed is facing the cam follower. Using Valve Spring Compressor T74P-6565-A, or equivalent, compress the lash adjuster or the valve spring and slide the cam follower into position under the camshaft. Be sure the lash adjuster has been fully compressed before proceeding to the next cam lobe position.

Repeat follower installation until all followers are installed.

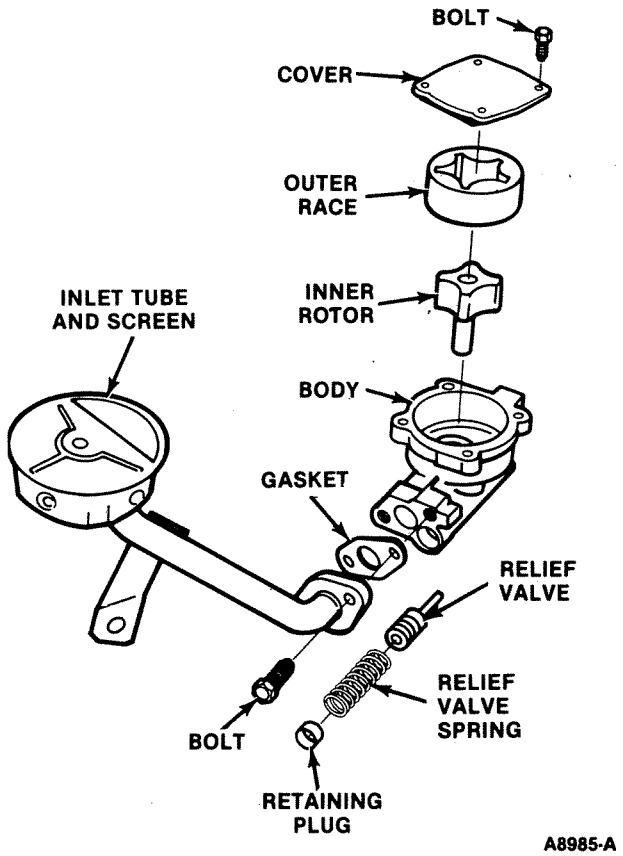
Install the camshaft drive belt spring tensioner spring stop stud. Install a new gasket and the coolant outlet elbow onto the cylinder head. For cylinder head installation, refer to Base Procedure 23—Assembly, Cylinder Head Installation.

CLEANING, INSPECTION AND OVERHAUL

OIL PUMP

Disassembly

1. Remove the two bolts and the inlet tube and screen.
2. Remove four bolts and the oil pump cover.
3. Remove the inner rotor and outer race.
4. Drill or punch a hole in the oil pump relief valve retaining plug.
5. Insert a punch and pry the plug out.
6. Remove the spring and valve.

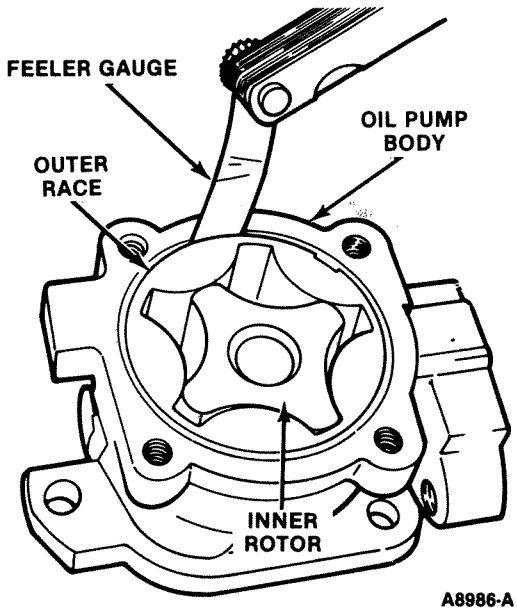


Cleaning

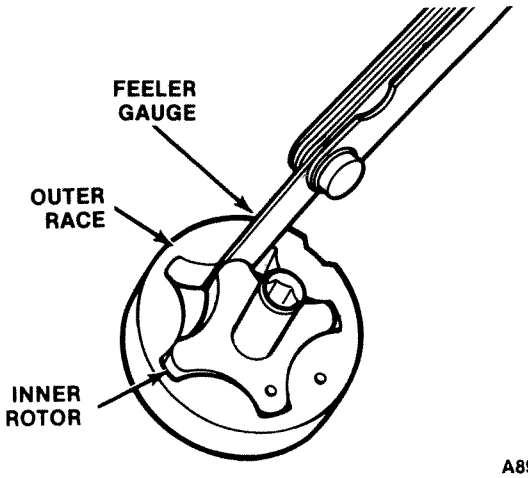
The oil pump may be cleaned with automotive parts cleaning solvent or steam cleaned. Do not clean with caustic or lye-based solutions. If the rotor and race are steam cleaned with a water solution, dry and oil after cleaning as they will rust. Do not drop the rotor or race on a hard surface. They are brittle and may break.

Inspection

Inspect the oil pump body for scoring in the outer race bore. If the scoring is light, then disregard. Measure the body (housing) to outer race clearance with a feeler gauge. The clearance should be .0254 to .3302 mm (.001 to .013 in.).



Measure the rotor tip to outer race clearance at the least clearance point with the rotor and race out of the body. The clearance should be .254 mm (.010 in.) maximum with the feeler gauge inserted 12.7 mm (1/2 in.).



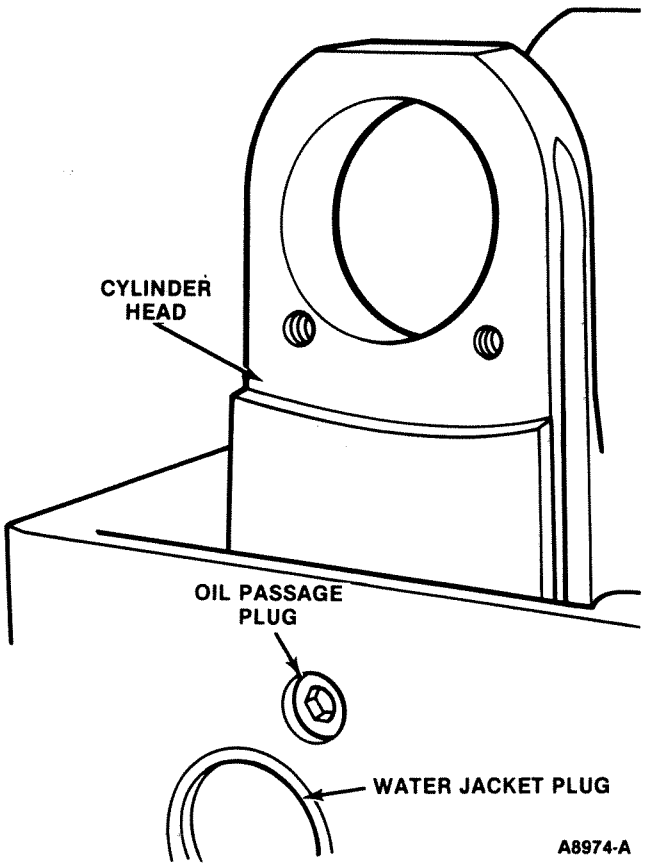
CLEANING, INSPECTION AND OVERHAUL

CYLINDER HEAD

Camshaft Bearing Installation (Continued)

On the rear bearing installation, care must be taken to allow .000- to .254-mm (.000- to .010-in.) clearance between the rear face of the bearing bore and the bearing. The clearance is to prevent interference with the camshaft thrust plate installation.

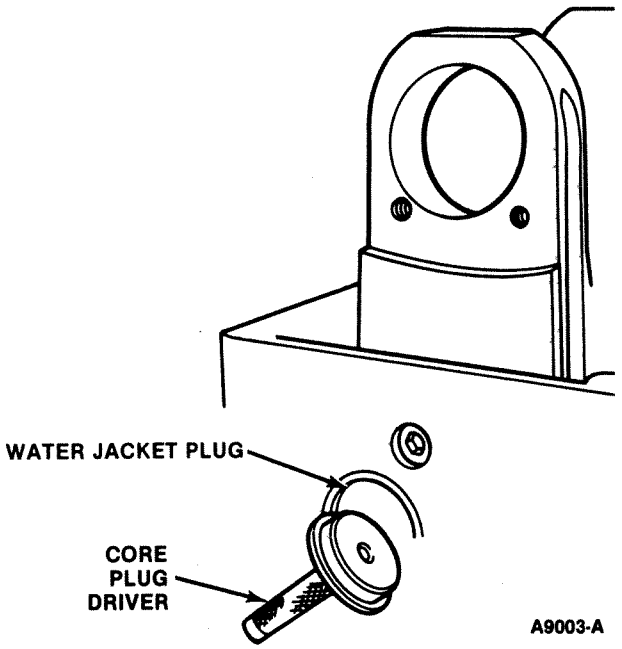
Install the oil passage plugs in the front and rear of the cylinder head using Sealer D8AZ-19554-A. Torque them to 31 to 38 N·m (23 to 28 lb-ft).



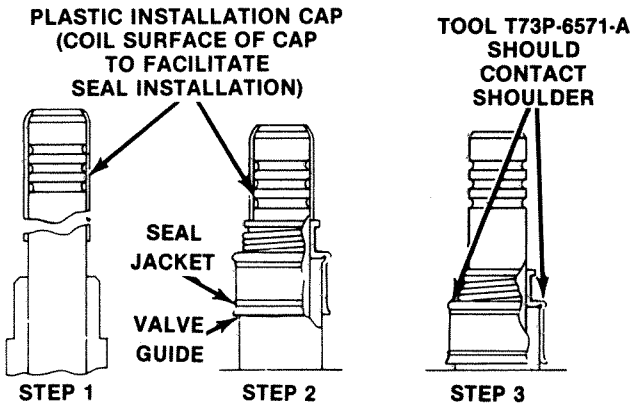
Measure the water jacket core plug hole at the rear of the cylinder head and select a plug of the proper size.

Apply a 3.175-mm (1/8-in.) bead of D8AZ-19554-A sealer to the plug sealing diameter of the water jacket core plug hole at the rear of the cylinder head.

Using a suitable driver, install the core plug in the cylinder head until it bottoms in the bore.



Lay the cylinder head on its side. Oil the valve stems and the valve guides. Install the valves in their original guides. Place a valve seal plastic cap over a valve stem. Lubricate a new seal and slide it over the cap and valve stem and onto the valve guide.



STEP #1— WITH VALVES IN HEAD, PLACE PLASTIC INSTALLATION CAP OVER END OF VALVE SYSTEM.

STEP #2— START VALVE STEM SEAL CAREFULLY OVER CAP. PUSH SEAL DOWN UNTIL JACKET TOUCHES TOP OF GUIDE.

STEP #3— REMOVE PLASTIC INSTALLATION CAP. USE INSTALLATION TOOL T73P-6571-A OR SCREWDRIVERS TO BOTTOM SEAL ON VALVE GUIDE.

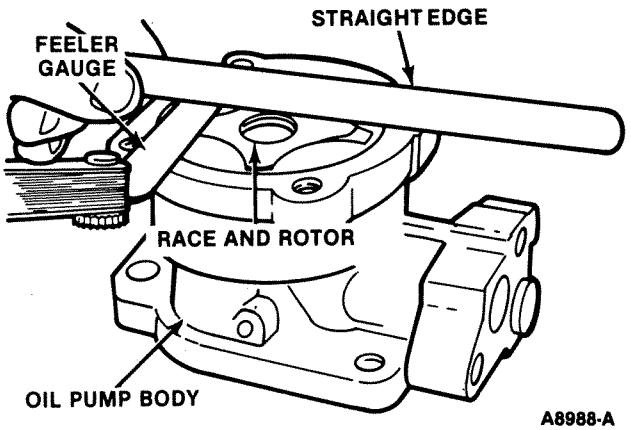
A3451-A

CLEANING, INSPECTION AND OVERHAUL

OIL PUMP

Inspection (Continued)

Using a straightedge, measure the rotor and race endplay in the body. The dimension should be .1016 mm (.004 in.) maximum. Measure the rotor shaft to shaft bearing bore clearance. The specification is .0381 to .0762 mm (.0015 to .0030 in.).



The relief valve to valve bore clearance should be .0381 to .0762 mm (.0015 to .0030 in.). Check the relief valve spring tension. Its length should be 30.48 mm (1.20 in.) with a 6.8947- to 7.8019-kg (15.2- to 17.2-lb) load.

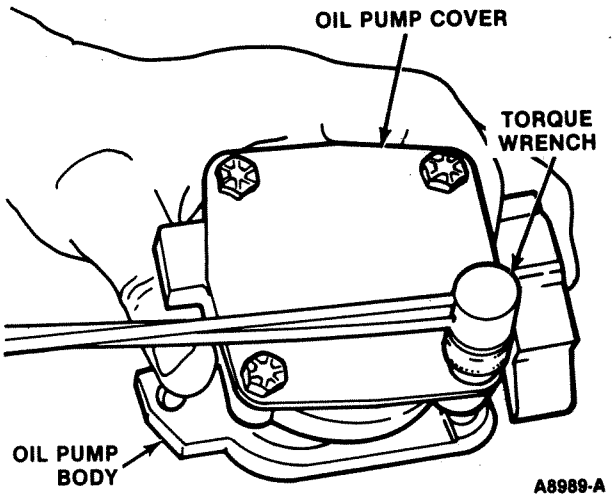
Overhaul

Internal parts of the oil pump are not serviced. If any of the dimensions under Oil Pump Inspection are exceeded, the oil pump assembly must be replaced.

Assembly

Assemble the oil pump relief valve into its bore. Install the spring. Install a new plug with a bar or rod that is slightly smaller than the plug bore. Tap in until the plug bottoms in its bore.

Install the outer race and inner rotor in the pump body. Install the body cover. Torque the cover bolts to 10 to 15 N·m (90 to 130 lb-in.).



Using a new gasket, install the inlet tube and screen. Start the bolts and torque them to 19 to 28 N·m (14 to 21 lb-ft).