3.3L LITER 6-CYLINDER

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine may be identified from the Vehicle Identification Number stamped on a metal tab attached to instrument panel close to windshield on drivers side of vehicle and is visible from outside. VIN number is also stamped on both Safety Certification Decal, mounted on the left front door lock face panel and on the Engine Identification Label mounted on valve cover. The VIN number contains 17 digits. The 8th digit identifies the engine and the 10th digit establishes the model year.

Engine Code	
Engine	**Code**
3.3L (200") 6-Cyl. 1-Bbl.	B

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLD

EXHAUST MANIFOLD

Removal – Remove air cleaner and heat tube assembly. Disconnect muffler inlet pipe and remove gasket. Disconnect EGR tube and all other emission control devices that would interfere with exhaust manifold. Remove retaining bolts and nuts and remove exhaust manifold.

Installation – Clean all gasket surfaces. Position exhaust manifold to cylinder head and install retaining bolts, washers and nuts. Tighten retaining bolts and nuts in sequence shown in *Fig. 1*. Reverse removal procedure to complete installation.

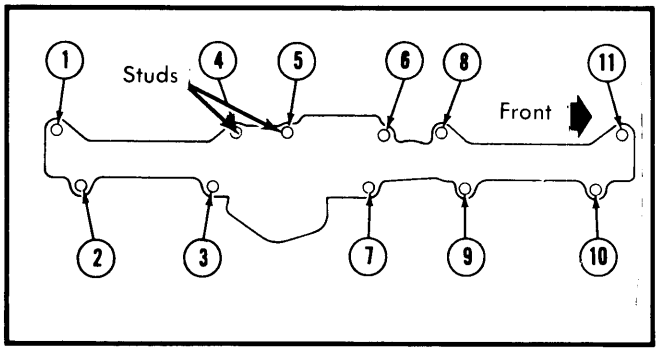

Fig. 1 Exhaust Manifold Tightening Sequence

CYLINDER HEAD

Removal – 1) Drain cooling system. Remove air cleaner and disconnect upper radiator hose at engine. Disconnect muffler inlet pipe and remove gasket. Disconnect accelerator control cable, kickdown rod and linkage (at bellcrank assembly).

2) Disconnect fuel lines, vacuum lines, spark plug wires at spark plugs and temperature sending switch wire at sending unit. Remove PCV system. Remove rocker arm cover, rocker arm shaft assembly and push rods in sequence for reinstallation in original positions. Remove cylinder head bolts and remove cylinder head.

NOTE – *Composition type gaskets do not need sealer.*

Installation – Clean all gasket surfaces and apply sealer to both sides of new steel head gasket. Position gasket on block and install cylinder head. Install and tighten cylinder head bolts in 3 steps, in sequence shown. Reverse removal procedure to complete installation. *See Fig. 2.*

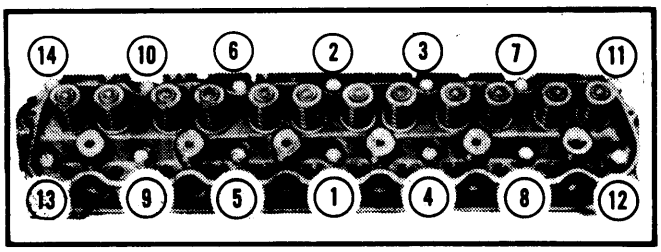

Fig. 2 Cylinder Head Tightening Sequence

VALVES

VALVE ARRANGMENT

E-I-I-E-I-E-E-I-E-I-I-E

VALVE GUIDE SERVICING

To ream guides for installation of valves with oversize stems, always use reamers in sequence and reface valve seat after valve guide is reamed. Reamers are available .003" oversize with standard diameter pilot; .015" oversize with .003" oversize pilot; and .030" oversize with .015" oversize pilot.

VALVE STEM OIL SEALS

Cup type used on all valves. Install cupped side down, below upper spring retainer.

VALVE SPRINGS

Removal – 1) Remove air cleaner. Remove PCV valve from rocker arm cover and remove cover. Remove spark plug from cylinder to be serviced. Loosen rocker arm shaft support bolts 2 turns at a time until valve spring pressure is relieved.

2) Identify and remove push rods of cylinder to be serviced, keeping push rods in sequence for reinstallation in original positions. Install air line with adapter in spark plug hole.

3) Tighten rocker arm shaft bolts just enough to seat shaft supports on cylinder head. Push rocker arm to one side and secure in position.

NOTE – *To move end rocker arms, it is necessary to remove retaining pin and spring washer and to slide rocker arm off the shaft.*

4) Using valve spring compressor tool (T65P-6513-A), compress valve spring and remove retainer locks, sleeve, spring retainer and valve spring. Remove valve stem seal. Do not remove air pressure as this will allow valve to fall into cylinder if piston has been forced to bottom of cylinder. *See Fig. 3.*

NOTE – *If air pressure fails to hold valve closed during this operation, remove cylinder head for inspection.*

3.3L LITER 6-CYLINDER (Cont.)

Installation – 1) Install a new valve stem seal. Position spring over the valve and install spring retainer and sleeve. Compress valve spring and install valve spring retainer locks.

2) Apply Lubriplate or equivalent to both ends of push rod, valve, push rod end of rocker arm, and valve stem tip. Install push rods ensuring that lower end is positioned in valve lifter push rod cup. Slide rocker arm into position.

3) Secure rocker arm shaft. Turn off air and remove air line and adapter. Install spark plug and wire. Install rocker arm cover with new gasket and secure. Install regulator valve and air cleaner.

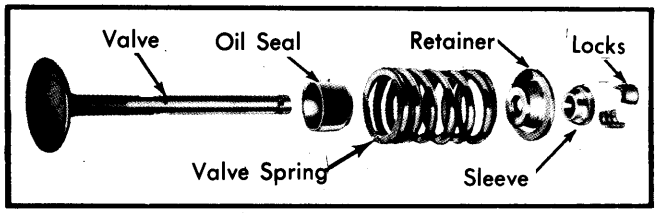

Fig. 3 Exploded View of Valve Assembly

VALVE SPRING INSTALLED HEIGHT

Valve spring ends must be square within 5/64". Installed height of springs (measured from spring contact area on head to underside of spring retainer) should be within specifications. If height is greater than maximum allowable, install .030" spacer(s) between cylinder head and valve spring.

NOTE – *Do not install spacers unless necessary. Excessive use of spacers will overstress the valve and spring, overloading camshaft lobes. Spring breakage and lobe wear will result.*

Valve Spring Installed Height

Engine	Height
200"	
Int. & Exh.	1 9/16-1 19/32"

ROCKER ARM ASSEMBLY

Lubricate all rocker arms and rocker arm shaft with engine oil before installation. Make sure end plugs have cup side facing out and oil holes in rocker arm shaft are facing downward. See *Fig. 4*.

HYDRAULIC VALVE LIFTER ASSEMBLY

Lifters are serviced as assemblies only. Parts are not interchangeable. Place lifter upright in leakdown tester tool (6500-E) and check for leakdown rate of 1/16" in 5-50 seconds with 50 lb. load. If not within specifications, replace lifter assembly.

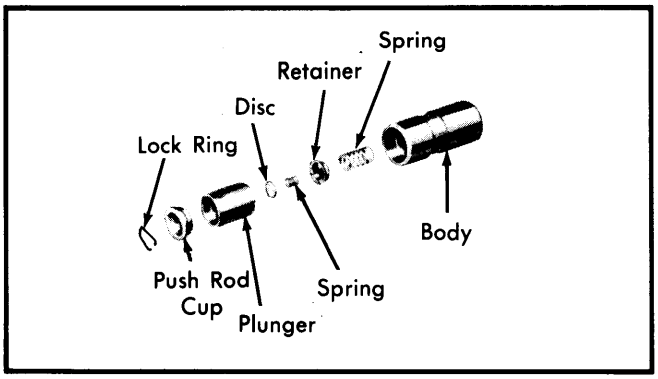

Fig. 5 Exploded View of Hydraulic Lifter Assembly

HYDRAULIC VALVE LIFTER ADJUSTMENT

1) Turn crankshaft so that No. 1 piston is at TDC after compression stroke and check clearance of valves listed in Table 1. Using suitable tool (T71P-6513-A), apply pressure to push rod end of rocker arm to slowly bleed down the valve lifter until plunger is completely bottomed.

2) Hold lifter in this position and check the clearance between rocker arm and valve stem tip with a feeler gauge. If clearance is less than specification, install an undersize push rod; if greater, install an oversize push rod. After checking all valves in Table 1, rotate crankshaft until No. 6 piston is at TDC after compression stroke (1 revolution of crankshaft), and check clearance of valves shown in Table 2.

Table 1

No. 1 Int.	No. 1 Exh.
No. 2 Int.	No. 3 Exh.
No. 4 Int.	No. 5 Exh.

Table 2

No. 3 Int.	No. 2 Exh.
No. 5 Int.	No. 4 Exh.
No. 6 Int.	No. 6 Exh.

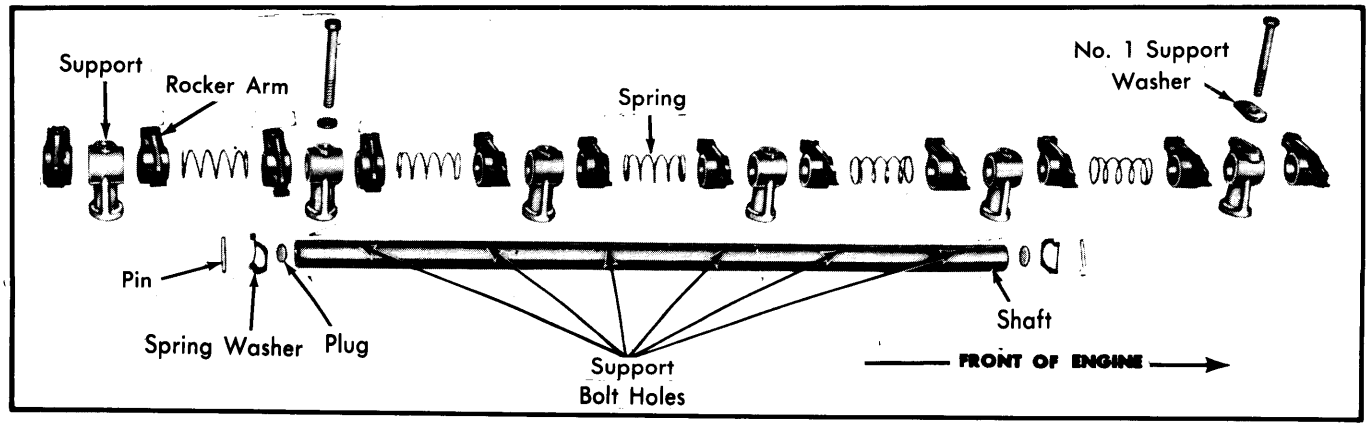

Fig. 4 Exploded View of Rocker Arm and Rocker Shaft Assembly

3.3L LITER 6-CYLINDER (Cont.)

Collapsed Lifter Clearance		
Application	**Allowable**	**Desired**
200"	.085-.185"	.110-.160"

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

NOTE – *Following procedure is with cylinder head, oil pan, oil pump and pickup tube removed from engine.*

Removal – 1) Remove ridge at top of cylinder bores, using suitable ridge reamer. Pistons should be at bottom of stroke and covered with a cloth to collect cuttings.

2) Rotate crankshaft and inspect connecting rods and rod caps for cylinder identification. Identify if necessary. Remove rod cap and push each piston and rod assembly out top of cylinder block. Install rod caps on mating rods.

NOTE – *Be careful not to nick crankshaft journals.*

Installation – 1) Oil piston rings and cylinder walls with a light coat of engine oil. Ensure that ring gaps are properly spaced on piston and install ring compressor tool. Insert piston and rod assembly into correct cylinder bore, guiding rod over crankshaft journal. *See Fig. 6.*

2) Tap piston into cylinder bore using a wooden handle and install rod cap and tighten. Repeat procedure for each piston assembly. Check rod bearing clearance and rod side play.

NOTE – *Notch on piston head must be toward front of engine and connecting rod oil squirt hole should be facing to the right. See Fig. 7.*

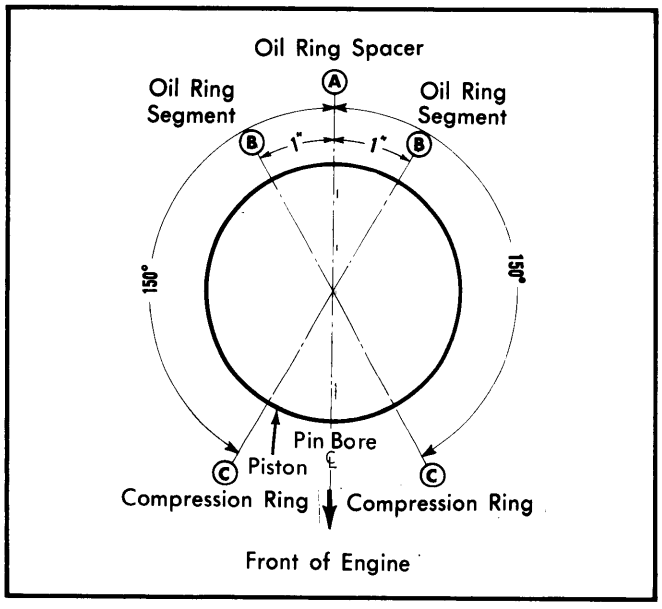

Fig. 6 Piston Ring Gap Spacing

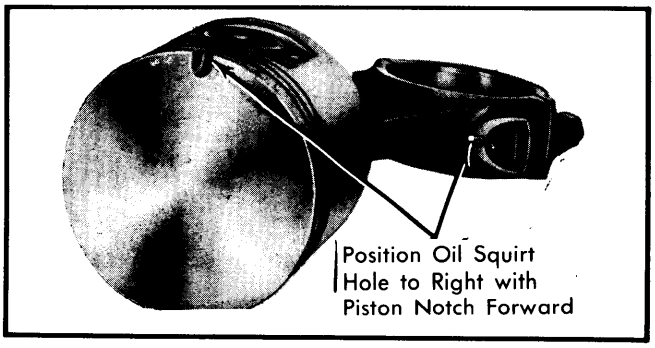

Fig. 7 Piston and Connecting Rod Assembly

FITTING PISTONS

Measure cylinder bore at right angles to crankshaft centerline, below ring travel. Piston to cylinder bore clearance should be within specifications. Make sure piston and cylinder block are at normal room temperature (70° F) when fitting.

Piston Size Code Chart	
Code	**Size (In.)**
Red	3.6784-3.6790
Blue	3.6796-3.6802
.003" Oversize	3.6808-3.6814

PISTON PINS

Removal – Use arbor press and suitable tool; press out pin.

Installation – Light tap with mallet may be needed to start pin into piston and rod assembly. Using arbor press and pilot tool, press pin into piston and rod assembly until pin centers in piston. *See Fig. 8.*

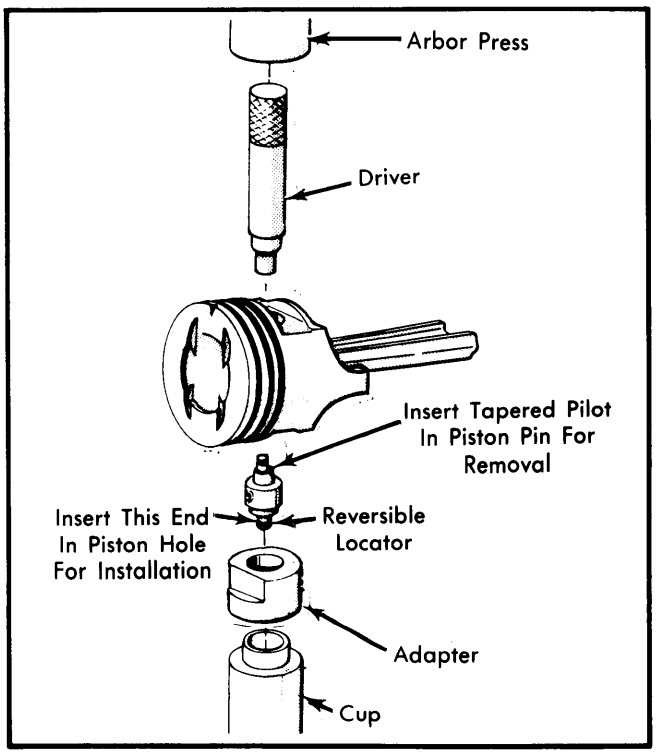

Fig. 8 Removing and Installing Piston Pin

3.3L LITER 6-CYLINDER (Cont.)

CRANKSHAFT & ROD BEARINGS

NOTE – *To obtain access to main and connecting rod bearings, remove cylinder head and oil pan.*

MAIN BEARINGS

Removal – Before removing main bearing caps, mark caps for reassembly reference so they may be installed in original position. Remove main bearing cap bolts and remove cap. Remove upper half of bearing by inserting bearing removal tool (6331-E) in oil hole of crankshaft and slowly rotate crankshaft in direction of engine rotation. This will force upper bearing half out of block.

Installation – 1) Determine crankshaft journal clearance in bearing by Plastigage method. Place a jack under counterweight adjoining bearing being checked so weight of crankshaft will not compress Plastigage, providing an erroneous reading.

2) If bearing clearance is excessive, a .001" or .002" undersize bearing half may be used in combination with a standard size bearing half. If the .002" undersize bearings are used on more than 1 journal, they may be positioned in cylinder block instead of bearing cap.

3) If a standard and a .002" undersize combination does not bring bearing clearance within specified limits, crankshaft will have to be refinished and undersize bearings installed.

4) To install upper main bearing, lubricate bearing with engine oil and place plain end of bearing over shaft on locking tang side of block. Partially install bearing so suitable tool (6331-E) can be inserted in journal oil hole. Rotate crankshaft slowly in opposite direction of engine rotation until bearing tang is seated. Remove bearing tool. Install bearing cap and tighten.

CONNECTING ROD BEARINGS

Removal – Position crankshaft so connecting rod to be checked or serviced is down. Inspect connecting rod caps for cylinder identification so caps can be installed in original position. Remove rod cap and bearing inserts.

Installation – Install bearing inserts with tangs fitted in slots provided. After bearings have been fitted, apply a light coat of engine oil to the journals and bearings. With crankshaft throw at bottom of stroke and upper half of bearing installed, push piston down until connecting rod bearing seats on journal. Install connecting rod cap and tighten. Check connecting rod side clearance.

THRUST BEARING ALIGNMENT

Install all bearing caps except thrust bearing cap and tighten. Install thrust bearing cap with bolts finger tight. Pry crankshaft to front of engine and pry thrust bearing cap to rear of engine. While holding crankshaft forward, tighten thrust bearing cap bolts. Check crankshaft end play.

REAR MAIN BEARING OIL SEAL

Removal – Upper and lower seals may be installed without removing crankshaft. Remove rear main bearing cap and loosen remaining bearing caps allowing crankshaft to drop no more than 1/32". Remove old seals and rear seal pin (if present). Discard pin, which must not be used with split seals.

Installation – 1) Clean seal groove in cylinder block and cap. Dip new seal halves in engine oil. Install upper seal in groove with undercut side of seal towards front of engine. Allow approximately 3/8" to protrude below parting surface.

CAUTION – *Make sure no rubber is shaved from outside of seal during installation.*

2) Apply sealer to parting surfaces of bearing cap and block. Install lower seal in bearing cap with undercut side toward front of engine. Allow approximately 3/8" to protrude above parting surface. Install cap immediately and tighten bolts.

CAMSHAFT

ENGINE FRONT COVER

Removal – Drain crankcase and cooling system. Remove radiator, fan, belt and pulley. Remove condenser attaching bolts and position condenser forward without disconnecting refrigerant hoses. Remove crankshaft damper using suitable tool (T58P-6316-B). Remove front cover attaching screws from cover and from oil pan. Pry top of front cover away from block slightly. Using thin bladed knife, cut the oil pan gasket flush with front of cylinder block.

Installation – Clean all gasket surfaces. Apply sealer to gaskets and position on cylinder block. Install front cover using alignment tool (T61K-6019-A) to center cover on crankshaft. Install and tighten front cover attaching screws. Install crankshaft damper using installer tool (T52L-6306-AEE). Reverse removal procedure to complete installation.

FRONT COVER OIL SEAL

Removal & Installation – Drive out oil seal with a pin punch. Clean recess in front cover. Coat new seal with grease and install. Drive seal in until fully seated in recess. Inspect seal to ensure spring is properly seated in seal. *See Fig. 9.*

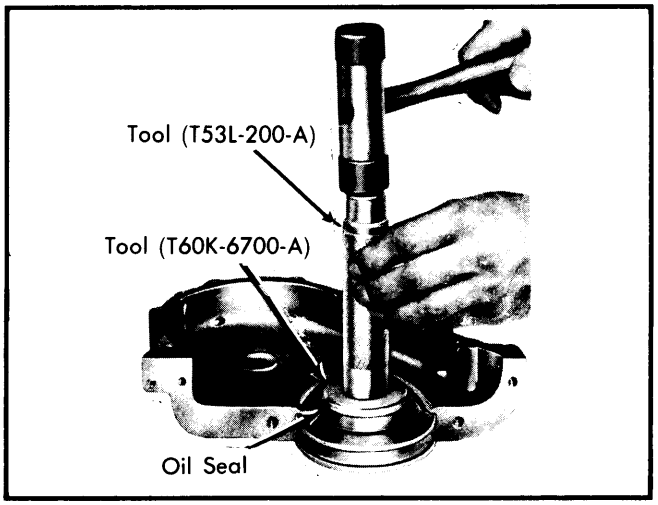

Fig. 9 Installing Front Cover Oil Seal

3.3L LITER 6-CYLINDER (Cont.)

TIMING CHAIN

Inspection – With front cover removed, rotate crankshaft in counterclockwise direction to take up slack on left side of chain. Establish a reference point on engine block and measure from this point to chain. Rotate crankshaft in opposite direction to take up slack on right side of chain. Force left side of chain out and measure difference between reference point and chain. If deflection exceeds .50", replace timing chain.

Removal – Crank engine until timing marks are aligned. Remove camshaft sprocket bolt and washer. Slide both sprockets and timing chain forward, removing them as an assembly. *See Fig. 10.*

Installation – Install timing chain on sprockets with timing marks aligned according to *Fig. 10.* Slide both sprockets and timing chain onto engine. Install camshaft sprocket bolt and washer. Tighten bolt, and oil timing chain. Install other parts previously removed.

CAMSHAFT

Removal – 1) Drain cooling system and crankcase. Remove radiator and grille. Remove condenser attaching bolts and position condenser to one side without disconnecting refrigerant lines. Remove distributor, fuel pump and oil filter. Remove all wires, hoses, fuel lines, pipes and vacuum hoses attached to cylinder head. Remove cylinder head and valve lifters.

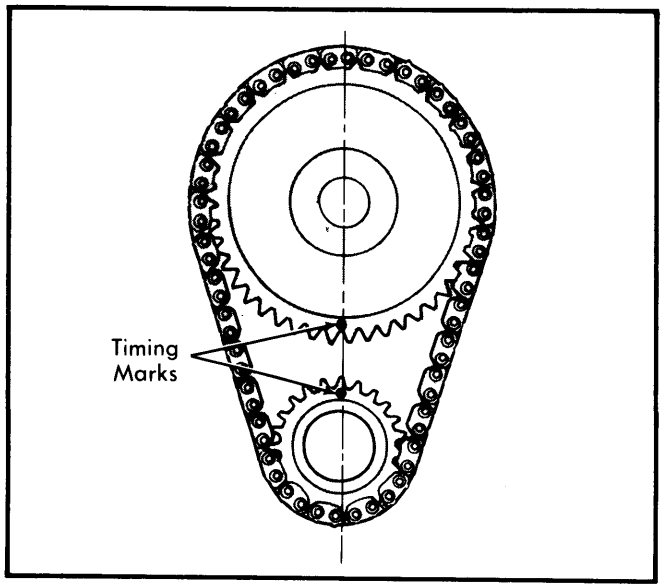

Fig. 10 Timing Chain Sprocket Alignment

2) Remove drive belt, fan, pulley and crankshaft damper. Remove front cover and check camshaft end play. If end play clearance is excessive, thrust plate should be replaced during reassembly. Remove timing chain and sprockets. Remove camshaft thrust plate and carefully remove camshaft by pulling toward front of engine.

CAUTION – *Use care not to damage camshaft journals and lobes upon removal.*

Installation – Clean oil passage at rear of cylinder block, which feeds rocker arm shaft, by blowing compressed air into opening in block. Coat camshaft lobes with Lubriplate and journals with engine oil. Carefully slide camshaft through bearings and install thrust plate with oil groove toward rear of engine and tighten bolts. Replace front oil seal. Continue installation in reverse of removal procedure.

CAMSHAFT BEARINGS

Removal & Installation – Remove engine from vehicle and remove flywheel. Remove camshaft and rear bearing bore plug. Using suitable driver-puller tool (T65L-6250-A), remove camshaft bearings. Position new bearings at bearing bores and press into place while noting the following: Oil holes in bearings must be aligned with oil holes in cylinder block. Front bearing must be installed below front face of cylinder block .110-.130". Rear bearing has 2 oil holes and must be installed 24¾" from face of camshaft thrust plate surface. Install new bearing bore plug and other components previously removed.

CAMSHAFT END THRUST

With engine front cover removed, push camshaft toward rear of engine and install dial indicator so indicator point is on camshaft sprocket cap screw. Zero dial indicator. Position large screwdriver between camshaft sprocket and block. Pull camshaft forward and release it. If dial indicator reading is not within specifications, replace thrust plate.

CAM LOBE LIFT

With rocker arm shaft removed, check lift of each lobe in consecutive order. Using a suitable dial indicator, position point on end of push rod and in same plane as push rod movement. Rotate crankshaft until lifter and push rod are at the lowest position and zero indicator. Rotate crankshaft slowly until push rod is in fully raised position. Check that total lift recorded with indicator is within specifications. If lift on any lobe is below specifications, camshaft and the valve lifters operating on worn lobe(s) must be replaced.

ENGINE OILING

Crankcase Capacity – 4 quarts. Add 1 quart with filter change.

Oil Filter – Replace at first oil change, then every second oil change after.

Normal Oil Pressure (Hot) – 30-50 psi at 2000 RPM.

Pressure Regulator Valve – In pump body. Not adjustable.

ENGINE OILING SYSTEM

Rocker Arms, Push Rods & Valve Stems – Oil from lower hole in rear camshaft bearing flows around grooved rear camshaft journal. It passes out through upper hole in rear camshaft bearing and up through vertical passage in block. Still under pressure, oil is then pumped around left rear corner cylinder head bolt to oil port at rear rocker arm shaft bracket. Oil is then forced through hollow rocker arm shaft and thence to each rocker arm, push rod and valve tip. Oil from rocker chamber runs down push rods to lubricate push rod seat and lifter. Finally, oil drains back to pan through cored openings in block. *See Fig. 11.*

Timing Chain & Sprockets – Lubricated by splash from oil pan.

Oil Filter – Full flow type mounted externally on left front corner of engine. Filter has integral bypass valve and anti-drain back diaphragm.

3.3L LITER 6-CYLINDER (Cont.)

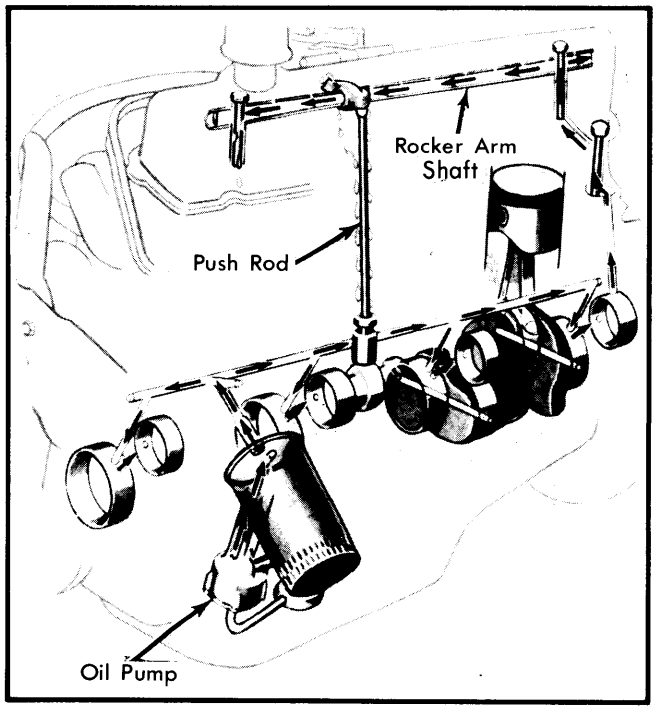

Fig. 11 Engine Oiling System

OIL PUMP

Removal & Disassembly – Remove oil pan. Remove oil pump attaching bolts and pump from engine. Remove oil inlet tube, cover attaching screws and cover. Remove inner rotor and shaft assembly, and remove outer race. Drill a small hole and insert self-threading sheet metal screw into oil pressure relief valve chamber cap and pull cap from chamber. Remove spring and plunger. *See Fig. 12.*

Inspection & Reassembly – 1) Clean, inspect and oil all parts thoroughly and measure clearances. Install outer race, inner rotor and shaft assembly.

NOTE – *Identification mark on rotor and on outer race both face bottom of pump.*

2) Inner rotor and shaft and outer race are serviced as an assembly. Install cover and tighten cover bolts. Prime oil pump by submerging inlet port in oil and rotating shaft until oil flows from outlet port. Place intermediate shaft into distributor socket. Position new gasket on housing and install pump and shaft as an assembly.

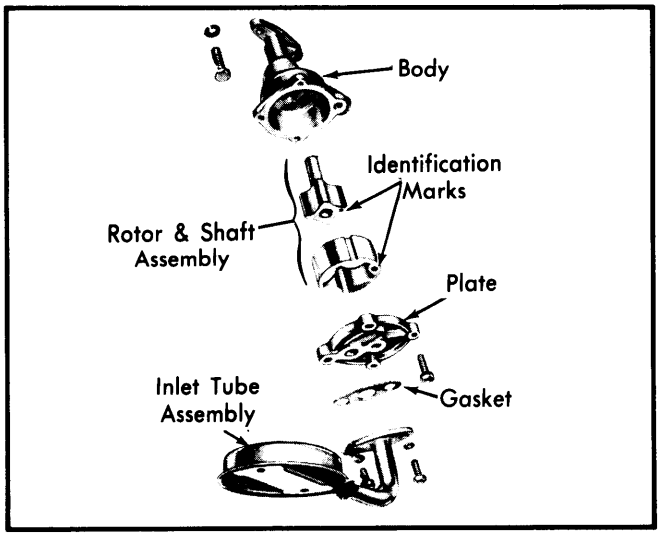

Fig. 12 Exploded View of Oil Pump Assembly

NOTE – *Do not attempt to force pump into position. Shaft hex may be misaligned with distributor shaft. To align, rotate intermediate shaft to a new position and tighten attaching bolts.*

Oil Pump Specifications

Application	Specification
Shaft-to-Hsg. Bearing Clearance	.0015-.0030"
Rotor End Clearance	.004" Max.
Outer Race-to-Hsg. Clearance	.001-.013"
Inner-to-Outer Rotor Tip	.012"
Relief Valve Spring Tension	9.0-10.1 lbs.@1.078"
Relief Valve-to-Bore	.0015-.0030"

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
3.3L (200")	①88@3800	①154@1400	8.6:1	3.68"	3.13"	200

① – Fairmont, Zephyr, Mustang and Capri is 94@4000 and 158@1400.

VALVES

Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
3.3L (200")							
Int.	1.739-1.763"	44°	45°	.060-.080"	.3100-.3107"	.0008-.0025"	.372"
Exh.	1.378-1.402"	44°	45°	.070-.090"	.3098-.3105"	.0010-.0027"	.372"

3.3L LITER 6-CYLINDER (Cont.)

VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
3.3L (200")	1.79"	51-57 @1.59"	142-158 @1.22"

CAMSHAFT①			
Engine	Journal Diam.	Clearance	Lobe Lift
3.3L (200")	1.8095-1.8105"	.001-.003"	.245"

① — End play is .001-.007".

PISTONS, PINS, RINGS						
	PISTONS	PINS		RINGS		
Engine	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
3.3L (200")	.0013-.0021"	.0003-.0005"	Press Fit	1&2 3	.008-.016" .015-.055"	.002-.004" Snug

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
	MAIN BEARINGS				CONNECTING ROD BEARINGS		
Engine	Journal Diam.	Clearance	Thrust Bearing①	Crankshaft End Play	Journal Diam.	Clearance	Side Play
3.3L (200")	2.2482-2.2490"	.0008-.0015"	No. 5	.004-.008"	2.1232-2.1240"	.0008-.0015"	.0035-.0105"

① — Thrust bearing journal length is 1.275-1.277".

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head	①70-75
Exhaust Manifold	18-24
Oil Pan	7-9
Main Bearing Caps	60-70
Connecting Rod Caps	21-26
Vibration Damper	85-100
Camshaft Sprocket	35-45
Camshaft Thrust Plate	12-18
Flywheel	75-85
Rocker Shaft Support	30-35
Engine Front Cover	7-9
Water Outlet Housing	14-21
Pulley-to-Damper	35-50
Water Pump	12-15
Oil Pump	10-15

① — Tighten cylinder head bolts in three steps as follows: Step 1 — 55 ft. lbs. Step 2 — 65 ft. lbs. Step 3 — 70-75 ft. lbs.