GENERAL SPECIFICATIONS						
Engine	Net HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
250" 1-Bbl.	100 @ 3600	175 @ 1800	8.2-1	3.87"	3.53"	250

NOTE — Horsepower and Torque figures given above are NET. Net Horsepower and Torque represents power at the flywheel when the engine is installed in a vehicle, with wide open throttle and all systems operating such as; air cleaner, exhaust system, water pump, generator, oil pump and air conditioning.

ENGINE IDENTIFICATION

Six cylinder engine code is stamped on distributor mounting pad on right side of block and is decoded as follows:

Application	Man. Trans.	Auto. Trans.
250" 1-Bbl.	CCR	CCX, CCW

ENGINE REMOVAL

1) Drain cooling system, disconnect battery cables, remove hood (mark hinge positions) and radiator shroud. Disconnect all wires, water and vacuum hoses, hot air pipe and fuel line (from tank) at fuel pump. Disconnect accelerator linkage at manifold bellcrank and exhaust pipe at manifold flange. If equipped with power steering, remove pump bracket at block and lay aside.

2) Remove upper radiator support and radiator. Raise car on hoist. On models with manual transmission, disconnect clutch equalizer. On all models, remove transmission-to-engine attaching bolts and leave transmission in car.

3) Lower car and using a floor jack, raise transmission slightly then remove engine front mount through bolts. Attach lifting tackle to engine and remove engine assembly from chassis.

INTAKE MANIFOLD

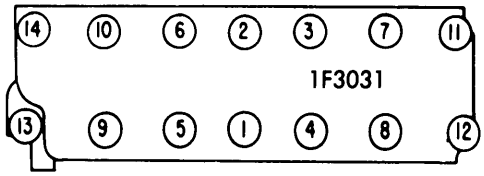
Removal — Remove air cleaner, disconnect throttle controls at bellcrank and remove throttle return spring. Disconnect fuel and vacuum lines, crankcase ventilation hose at rocker arm cover and exhaust pipe at manifold. Remove manifold bolts and remove intake and exhaust manifolds as an assembly.

Installation — After checking for cracks on manifold casting, clean cylinder head and intake manifold gasket surfaces. Install new gasket, then install manifold. Tighten bolts evenly.

CYLINDER HEAD

Removal — Drain cooling system, remove intake manifold assembly, rocker arm nuts, balls, rocker arms and push rods. Disconnect necessary wires and hoses, remove coil, cylinder head bolts, and remove cylinder head and gasket.

Installation — Thoroughly clean all gasket surfaces and threads on cylinder head bolts and in block. Do not use gasket sealer on composition steel asbestos gaskets. Install head bolts finger tight, then tighten evenly in sequence (see illustration).



CYLINDER HEAD TIGHTENING SEQUENCE

VALVES							
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
250" Int.	1.715-1.725"	45°	46°	1/32-1/16"	.3410-.3417"	.001-.0027"	.....
Exh.	1.495-1.505"	45°	46°	1/16-3/32"	.3410-.3417"	.0015-.0032"	.....

VALVE ARRANGEMENT

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

VALVE GUIDES

Guides are integral with head. Valves with .003" oversize stems are available. Using suitable 3/8" reamer, ream old bores to proper oversize.

VALVE STEM OIL SEALS

"O" ring type used on all valves. Installed in lowest groove on upper part of valve stem above spring shield and below spring cap and locks.

VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
250"	1.90"	55-64 @ 1.66"	180-192 @ 1.27"

VALVE SPRINGS

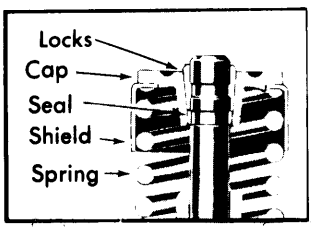
Removal — Remove rocker arm cover, spark plug, rocker arm and push rod on cylinder(s) to be serviced. Install air line adapter to spark plug port and apply air to hold valves in place. Use suitable tool (J-22891) to compress valve spring and remove valve locks, cap, shield and valve spring. Remove and discard oil seal.

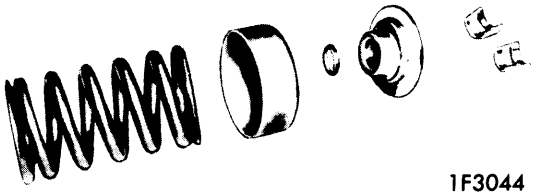
Installation – Before reinstalling old springs, check with a suitable spring tester. Springs should be replaced if not within 10 lbs. of specified load. Set valve spring, shield and cap in place on valve stem. Compress spring and install oil seal in lower groove of stem. Install valve locks and release compressor tool. Check that valve locks are properly seated in upper groove of valve stem.

VALVE SPRING INSTALLED HEIGHT

Installed height of valve spring should be $1^{21}/_{32}$-$1^{23}/_{32}$". Measure from top of spring seat in head to top of spring shield. If measurement exceeds specification, install $1/16$" spring seat shim. Do not shim to obtain a height under the minimum specified.

VALVE SPRING INSTALLED HEIGHT

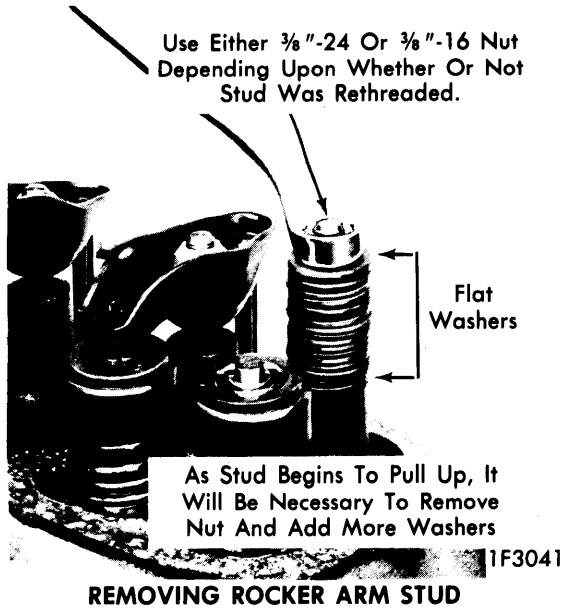




VALVE SPRING ASSEMBLY

ROCKER ARM STUDS

Studs that have damaged threads or are loose in head should be replaced. Studs are available in .003" and .013" oversize. Ream hole for oversize studs and coat press fit area of stud with hypoid axle lubricant. *CAUTION – Do not attempt to install oversize studs without reaming stud hole.*

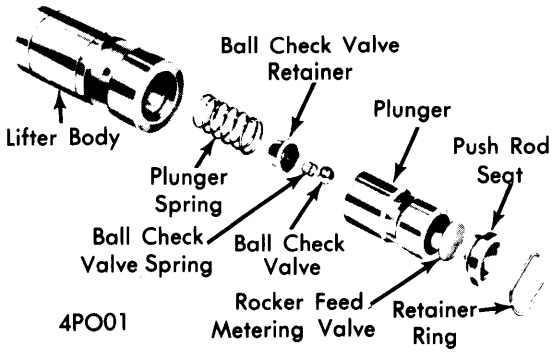


REMOVING ROCKER ARM STUD

HYDRAULIC VALVE LIFTER ASSEMBLY

NOTE – Lifters are serviced as complete assemblies only. Parts are not interchangeable between lifters. If any component of lifter is worn or damaged, complete lifter must be replaced.

If lifters are disassembled for cleaning and inspection, they should be tested using a manufactured leak-down rate tester. Lifter leak-down rate should be 12-65 seconds with 50 lbs. load at .0338" plunger travel. Replace any lifter that does not meet specifications.



HYDRAULIC VALVE LIFTER ASSEMBLY

HYDRAULIC VALVE LIFTER ADJUSTMENT

1) Crank engine until rotor points to No. 1 cylinder position and points are open. Adjust the following valves:

Intake – Nos. 1, 2, 4. **Exhaust** – Nos. 1, 3, 5.

Back out rocker arm adjusting nut until lash is felt at push rod, then turn in nut until all lash is removed. When lash is removed, turn adjusting nut in one full additional turn.

2) Crank engine until rotor points to No. 6 cylinder position and points are open. Adjust following valves:

Intake – Nos. 3, 5, 6. **Exhaust** – Nos. 2, 4, 6.

PISTONS, PINS, RINGS						
	PISTONS	PINS		RINGS		
Engine	① Clearance	② Piston Fit	③ Rod Fit	Ring	End Gap	Side Clearance
250"	.0005-.0015"	.00015-.00025"	.0008-.0016"	Top 2nd Oil	.010-.020" .010-.020" .015-.055"	.0012-.0027" .0012-.0032" .005" Max.

① – Wear Limit – .0025"
② – Wear Limit – .001"
③ – Interference fit.

OIL PAN

Removal – Remove upper radiator shield assembly and negative battery terminal. Raise vehicle and drain crankcase. Disconnect exhaust pipe at exhaust manifold. Remove starter and flywheel inspection cover. Remove frame bracket to engine mount through bolts and right front engine insulator. Remove oil pan bolts. Raise engine with suitable lifting tool (J-23515-1) and adapter (J-23515-3) and remove oil pan.

Installation – Install rear oil pan gasket on rear main bearing cap and front gasket on timing chain cover. Install side gaskets on oil pan and install oil pan. *CAUTION – Do not disturb oil pickup pipe on screen or body.*

PISTON & ROD ASSEMBLY

NOTE – Following procedures are performed with cylinder head and oil pan removed.

Removal – Use a suitable ridge reamer to remove any ridge or deposits on upper end of cylinder bore. *NOTE – Piston must be at bottom of stroke and covered with cloth to collect cuttings.* Inspect connecting rods and caps for identification and mark as necessary. Remove rod cap and install suitable guide tool (J-5239) on connecting rod studs. Push piston and rod assembly out top of cylinder block.

Installation – Lightly coat pistons, rings and cylinder walls with engine oil. Ensure that compression rings are installed with side stamped "GM" toward top of piston. Install ring compressor on piston and suitable guide tool on connecting rod studs. Insert rod and piston assembly in cylinder bore so notch in top of piston is facing front of engine. Guide connecting rod over crankshaft journal while tapping lightly on piston head with a hammer handle to seat connecting rod against crankshaft. Remove tool from studs and install mating rod cap. Tighten rod cap nuts. *NOTE – Install bearing cap with oil groove facing camshaft.*

FITTING PISTONS

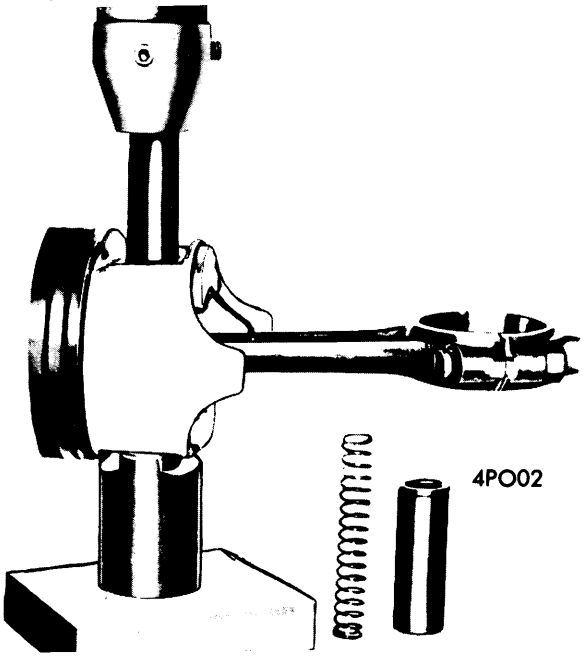
Measure cylinder bore diameter 2½" from top of cylinder. Measure piston diameter across center line of piston pin. If clearance is not within limits, cylinder requires honing or boring. Oversize pistons are available in standard, .001", .010" and .030" oversize.

PISTON PINS

Piston and piston pin are a matched set and are not serviced separately.

Removal – Place piston on suitable support. Using a pilot tool as a driver, use arbor press to press pin from piston and rod.

Installation – Assemble rod to piston (alignment of rod in relation to notch on piston head not important) and place piston on suitable support. Using a pilot tool and an arbor press (see illustration), press pin into piston and rod assembly. Check piston for freedom of movement on pin.



PISTON PIN INSTALLATION

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
	MAIN BEARINGS				CONNECTING ROD BEARINGS		
Engine	Journal Diam.	① Clearance	Thrust Bearing	Crankshaft Endplay	Journal Diam.	Clearance	Sideplay
250"	2.2983-2.2993"	.0035"	Rear	.002-.006"	1.999-2.000"	.0035"	.009-.014"

① – No. 1 Bearing .002".

MAIN & CONNECTING ROD BEARINGS

NOTE — Following procedures are with oil pan and oil pump removed.

Connecting Rod Bearings — After ensuring rod caps are marked for cylinder identification, remove rod caps. Use Plastigage method to check for proper bearing clearances. If not within specifications, new bearings must be installed. New bearings are available in .001" and .002" undersize. Selective fitting is required on each connecting rod. A standard bearing half may be used in combination with a .001" undersize or a .002" undersize in combination with a .001" undersize. Coat bearing surfaces with oil, install rod cap and tighten nuts.

Main Bearings — 1) Support crankshaft at both front and rear (damper and flywheel) and ensure that all bearing caps, other than one being checked, are tight. Starting with rear main bearing cap and working forward, remove one cap at a time and check bearing clearances using Plastigage method.

2) If clearances are not within specifications, bearings are available in .001", .002", .010" and .020" undersize. One half of a standard size bearing can be used in conjunction with one half of a .001" undersize bearing to obtain proper clearances. *NOTE — Some production crankshafts are ground .009" undersize. A engine fitted with a undersize crankshaft is identified by ".009" stamped on crankshaft counterweight forward of center main journal. A figure "9" will be stamped on block at left front oil pan rail.*

3) Remove all main bearing upper half (except rear main) by inserting suitable tool in oil hole of crankshaft journal and rotating crankshaft clockwise to roll bearing from engine. Oil new upper bearing and insert plain (unnotched) end between crankshaft and indented (or notched) side of block. Rotate bearing into place.

4) To replace rear main bearing upper half, use a small drift punch and hammer to start bearing rotating out of block. *NOTE — Take care not to nick crankshaft journal.* Use a pair of pliers (with taped jaws) to hold bearing thrust surface to oil slinger and rotate crankshaft to remove bearing. Oil new bearing and insert plain (unnotched) end between crankshaft and indented or notched side of block. Use pliers as in removing to rotate bearing into place.

5) Main bearing caps are to be installed with arrows pointing forward. Tighten main bearing bolts except rear main. Torque rear main bolts 10-12 ft. lbs. and tap end of crankshaft, first rearward, then forward to line up rear main bearing with crankshaft thrust face. Tighten all main bearing cap bolts. Rotate crankshaft to ensure there is no excessive drag.

REAR MAIN BEARING OIL SEAL

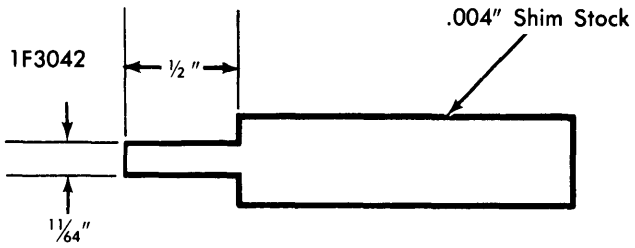
NOTE — Replace upper and lower seal halves as a unit. Install seal with lip facing front of engine. With oil pan and oil pump removed, proceed as follows:

Removal — Remove rear main bearing cap and remove seal from cap. Use a small brass drift punch to tap upper seal until end protrudes far enough to be removed with pliers.

Installation — 1) Coat seal lips and bead with light engine oil, keeping oil off seal mating ends. To replace upper seal, fabricate a tool from .004" shim stock (see illustration). Position tip of tool between crankshaft and seal seat, then position seal between crankshaft and tip of tool so seal bead contacts tip of tool.

2) Roll seal around crankshaft using tool as a "shoehorn" to protect seal bead from sharp corner of seal seat surface. Remove tool, being careful not to withdraw seal.

3) Install lower seal in bearing cap, using tool as a "shoehorn". Feed seal into cap using light pressure with thumb and finger. Apply sealant to bearing cap interface, being careful to keep sealant off seal split line. Install bearing cap and tighten bolts.



REAR MAIN SEAL INSTALLING TOOL

ENGINE FRONT COVER

Removal — Remove torsional damper and two oil pan-to-front cover bolts. Remove front cover bolts. Pull cover slightly forward and cut oil pan front seal flush with cylinder block at both sides of cover. Remove front cover.

Installation — Clean all gasket surfaces. Cut tabs from new oil pan front seal and install seal to front cover, pressing tips into holes in cover. Coat front cover gasket with sealer and position on cover. Apply a ⅛" bead of silicone rubber sealant to joint formed at oil pan and cylinder block. Install suitable centering tool (J-23042) in front cover seal. *NOTE — Centering tool must be used so torsional damper installation will not damage seal and seal is positioned evenly around balancer.* Install front cover to block. Install oil pan-to-cover bolts finger tight. Install front cover bolts and tighten all bolts.

FRONT COVER OIL SEAL

Removal — With front cover removed, pry old seal out of cover from front. If cover is on engine, remove torsional damper and pry old seal from cover.

Installation — Install new seal with open end towards inside of cover. Drive seal into position with suitable tool. *CAUTION — If cover is removed from engine, it must be supported at sealing area to prevent cover distortion.*

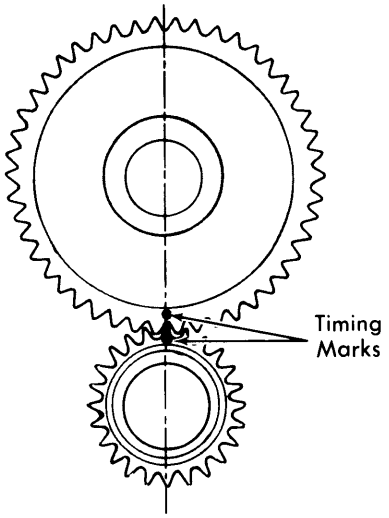
CAMSHAFT			
Engine	Journal Diam.	Clearance	Lobe Lift
250"	1.8682-1.8692"	.....	.2217"

TIMING GEARS

With valve timing marks lined up (see illustration), check backlash between timing gears with a dial indicator. Backlash should be .004" to .006". If not within specifications and gear replacement is necessary, proceed as follows:

Removal – Remove camshaft from engine and press shaft out of gear using suitable gear remover (J-971). *CAUTION – Thrust plate must be positioned so Woodruff key in shaft does not damage it when shaft is pressed out of gear.* Support hub of gear to prevent damage. Use suitable puller (J-8105) to remove crankshaft gear.

Installation – Support camshaft at back of front journal in a arbor press. Place gear spacer ring and thrust plate over end of shaft. Install Woodruff key in shaft keyway. Install gear and press onto shaft until it bottoms against gear spacer ring. End clearance of thrust plate must be .001-.005". Install crankshaft gear. Install camshaft assembly into block, turning crankshaft and camshaft to line up timing marks.



TIMING GEAR ALIGNMENT

CAMSHAFT

Removal – Remove radiator, fan and water pump pulley. Remove front grille assembly, rocker arm assemblies, push rods and valve lifters. Remove distributor, fuel pump, coil and spark plugs. Remove front cover and line up timing marks. Remove two camshaft thrust plate screws and pull camshaft and gear assembly out through front of block.

Installation – Install camshaft and gear assembly being careful not to damage bearings or camshaft. Line up timing marks and push camshaft into position. Install thrust plate bolts and tighten.

CAMSHAFT BEARINGS

Removal – With camshaft and flywheel removed, drive out expansion plug from rear cam bearing by driving from inside. Using suitable tool, drive out front bearing toward rear and rear bearing toward front. Drive two center bearings out toward rear.

Installation – Install bearings reversing removal procedure, and noting the following: Front bearing must be driven ⅛" behind front of cylinder block to uncover oil hole to timing gear oil nozzle. Align bearing oiling holes with block oiling holes and install new expansion plug.

CAMSHAFT END THRUST

Endplay is taken by thrust plate between camshaft sprocket and front bearing journal. Endplay should be .001-.005".

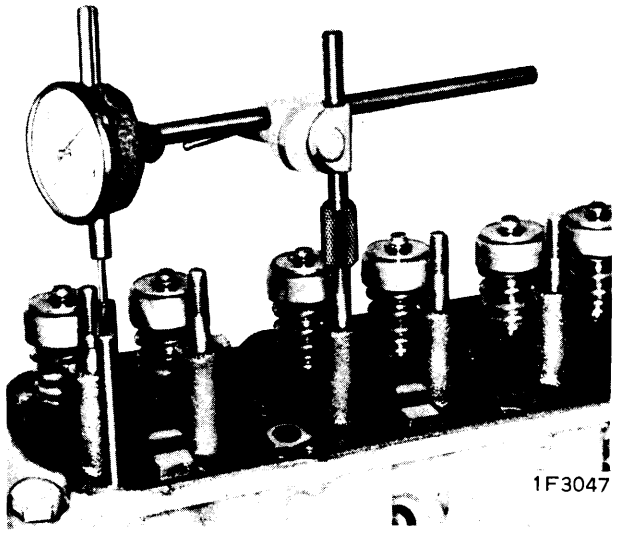
CAMSHAFT LOBE LIFT

With valve cover, rocker arms and balls removed from cylinder head, proceed as follows:

1) Using suitable clamping or mounting fixture, attach dial indicator to rocker arm stud so indicator probe rests on top of push rod with indicator and probe in a vertical position over push rod.

2) Rotate crankshaft slowly in direction of engine rotation or, using an auxiliary starter switch, "bump" engine until valve lifter is on heel of cam lobe. At this point, push rod will be at its lowest point. *CAUTION – If using an auxiliary starter switch, distributor primary lead must be disconnected from negative post of coil.*

3) With push rod at lowest position, "zero" dial indicator. "Bump" engine over until push rod is in fully raised position. Compare total lift with specifications. Continue to rotate crankshaft until indicator reads zero (checks accuracy of original indicator reading). Check all remaining lobes of camshaft in same manner.



MEASURING CAM LOBE LIFT

ENGINE OILING

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

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

Normal Oil Pressure (Hot) – 36-41 psi @ 2000 RPM.

Pressure Regulator Valve – In oil pump. Not adjustable.

ENGINE OILING SYSTEM

Oil under pressure is directed from oil pump to full flow oil filter. In case filter becomes clogged and restricts full flow of oil, a by-pass valve is located in filter mounting base. From oil filter, oil flow is directed as follows:

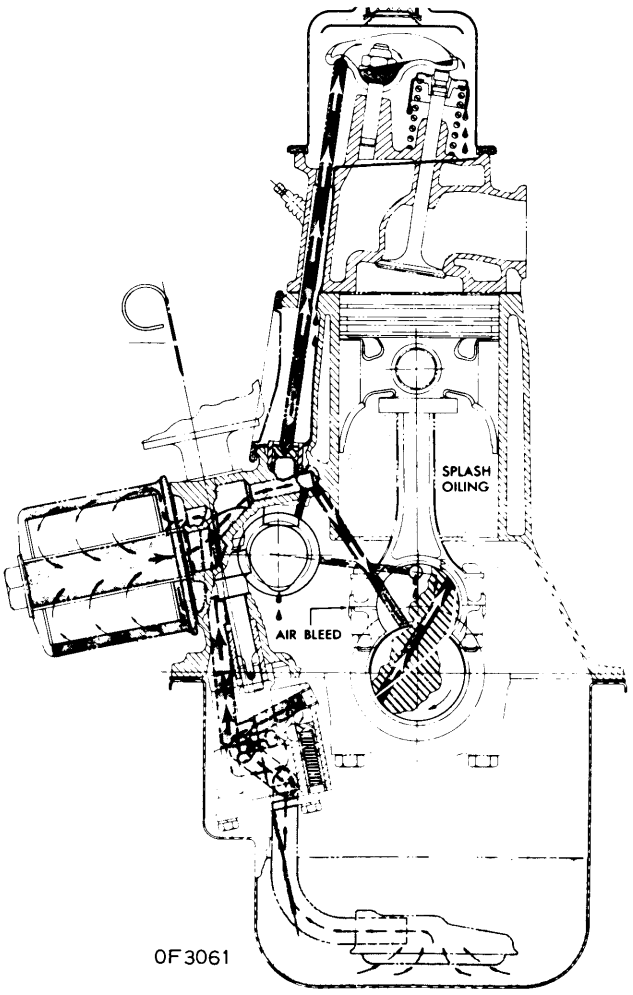
Crankshaft & Camshaft Bearings – Each main and camshaft bearing receives oil from a passage extending through crankcase webs from main oil gallery.

ENGINE OILING (Cont.)

Connecting Rods & Pistons – Oil is delivered from each main bearing to adjacent connecting rod bearing through drilled passages in crankshaft. Pistons, pins, and cylinder walls are lubricated with oil splash from connecting rods and crankshaft as they rotate.

Valve Lifters – Main oil gallery intersects lifter bores and lifters are supplied with oil directly from main oil gallery. Lifter has metering valve directly below hole in push rod seat to permit oil to pass into hollow push rod.

Rocker Arms & Valve Stems – Oil passes up through hollow push rods to a hole in upper end of push rods that matches hole in rocker arm. Oil sprayed from this hole and across rocker arm lubricates valve stem tip. Oil in rocker arm chamber drains down through push rod holes to valve lifter chamber, then returns to crankcase through drain holes.



ENGINE OILING SYSTEM

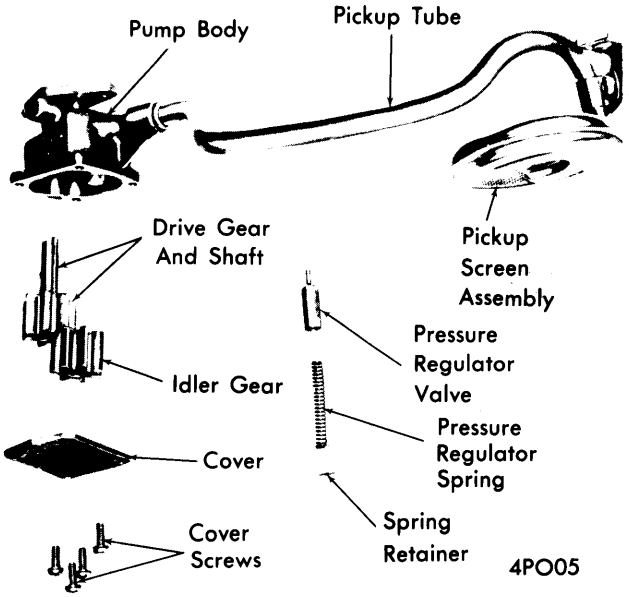
Timing Gears – Lubricated by oil flow from a nozzle pressed in front face of block above crankshaft gear. Oil is fed to nozzle through cross-passage from front camshaft bearing.

Distributor Drive Gear – Lubricated by oil drainage from valve lifter chamber.

OIL PUMP

Removal – Mark gears so they may be reassembled with the same teeth indexing. Do not disturb pickup screen on pipe. Screen is serviced as an assembly. *NOTE – If pump gears or body are damaged or worn, replacement of entire pump assembly is required.*

Installation – Apply sealer to end of pipe and tap into place. Install idler gear in pump body with smooth side of gear toward cover opening. *NOTE – Bottom of screen must be parallel with bottom of pan.*



OIL PUMP ASSEMBLY

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head	95
Manifold Clamp Bolt	35
Intake Manifold-to-Exhaust Manifold	30
Oil Pan-to-Block (1/4")	7
(5/16")	7
Oil Pan-to-Front Cover	5
Main Bearing Caps	65
Flywheel	60
Connecting Rod Caps	35
Camshaft Thrust Plate	7
Engine Front Cover	7
Water Pump	15
Water Outlet	20
Thermostat Housing	30
Oil Pump Mounting	9