

# Pontiac V8 Engines

GENERAL SPECIFICATIONS						
Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
350" 2-Bbl. ①	155 @ 3600	.....	7.6-1	3.88"	3.75"	350"
350" 2-Bbl. ②	170 @ 4000	.....	7.6-1	3.88"	3.75"	350"
350" 4-Bbl. ①	170 @ 4000	.....	7.6-1	3.88"	3.75"	350"
350" 4-Bbl. ②	200 @ 4400	.....	7.6-1	3.88"	3.75"	350"
400" 2-Bbl. ①	175 @ 3600	.....	8.0-1	4.12"	3.75"	400"
400" 2-Bbl. ②	190 @ 4000	.....	8.0-1	4.12"	3.75"	400"
400" 4-Bbl. ①	200 @ 4000	.....	8.0-1	4.12"	3.75"	400"
400" 4-Bbl. ②	225 @ 4000	.....	8.0-1	4.12"	3.75"	400"
455" 4-Bbl. ①	215 @ 3600	.....	8.0-1	4.15"	4.21"	455"
455" 4-Bbl. ②	250 @ 4000	.....	8.0-1	4.15"	4.21"	455"
455" 4-Bbl. S.D.	290 @ 4000	.....	8.4-1	4.15"	4.21"	455"

- ① - Single Exhaust
- ② - Dual Exhaust

**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

Engine code number is located on a machined pad on right side of engine block and is decoded as follows:

Application	Man. Trans.	Auto. Trans.
350" 2-Bbl. ....	WA, WB .....	YA, YB, YC, AA, ZA, ZB
350" 4-Bbl. ....	WN, WP .....	YN, YP, YS, ZP
400" 2-Bbl. ....	.....	YH, YJ, AH, ZH, ZJ
400" 4-Bbl. ....	WT .....	YT, AT, ZT, YZ
455" 4-Bbl. ....	.....	YY, YU, YX, AU, ZU, ZX, YW, ZW, YR
455" Super Duty .....	W8 .....	Y8

## ENGINE REMOVAL

After scribing outline of hinge brackets on hood to assure proper alignment when reinstalling, remove hood, drain cooling system, disconnect battery cables and remove air cleaner. Then proceed as follows:

- 1) Disconnect wire harness, engine-to-body ground straps, radiator and heater hoses, accelerator control linkage, transmission vacuum modulator line (if equipped) and power brake vacuum line at carburetor.
- 2) Remove A/C compressor and power steering pump from brackets, set aside without disconnecting hoses. Raise vehicle and drain crankcase. Disconnect fuel lines at fuel pump, exhaust pipes, and starter wires.
- 3) If equipped with automatic transmission, remove converter cover, retaining bolts and slide converter to rear. If equipped with manual transmission, disconnect clutch linkage, remove clutch cross shaft, starter and lower flywheel cover.

- 4) Remove lower bell housing bolts and disconnect transmission filler tube support (automatic) and starter wire harness shield from cylinder heads. Remove two front motor mount bolts at frame.
- 5) Lower vehicle and support transmission on jack. Remove remaining bell housing bolts and raise transmission slightly. Using suitable lifting equipment, remove engine from vehicle.

## INTAKE MANIFOLD

**Removal** - Drain cooling system. Remove hoses and thermostat housing. Disconnect wiring, vacuum hoses, fuel lines, and carburetor linkage. Remove carburetor and intake manifold as a unit.

**Installation** - Install new gaskets on cylinder heads and install manifold assembly. Install "O" ring seal between manifold and timing chain cover. Install manifold bolt loosely. Tighten intake manifold to timing chain cover bolt. Tighten other bolts evenly.

## CYLINDER HEAD

**Removal** - 1) Remove intake manifold, push rod cover and rocker arm cover. Remove push rods and exhaust pipe to manifold attaching bolts (except left head of 455" S.D.). In order to remove head on 455" S.D., it will be necessary to remove exhaust manifold attaching nuts and drop manifold.

2) Remove battery ground strap, engine ground strap and oil level tube bracket on right head. Remove cylinder head bolts and remove head. **CAUTION** - Care must be taken when removing head bolts not to strike rocker arm studs. Studs are hardened and may crack if hit by wrench.

**Installation** - Three lengths of cylinder head bolts are used. When installed properly, all will project equally from their bosses. Tighten bolts evenly.

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VALVES								
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift	①
350" & 400"	Int.	1.96"	44°	45°	.045" - .071"	.34"	.0016-.0033"	.377"
	Exh.	1.66"	44°	45°	.048" - .070"	.34"	.0021-.0038"	.413"
400" 4-Bbl.	Int.	2.11"	29°	30°	.045" - .071"	.34"	.0016-.0033"	.410"
	Exh.	1.66"	44°	45°	.048" - .070"	.34"	.0021-.0038"	.415"②
455"	Int.	2.11"	29°	30°	.045" - .071"	.34"	.0016-.0033"	.410"
	Exh.	1.66"	44°	45°	.048" - .070"	.34"	.0021-.0038"	.414"
455" S.D.	Int.	2.11"	29°	30°	.045" - .071"	.34"	.0016-.0033"	.410"
	Exh.	1.77"	44°	45°	.048" - .070"	.34"	.0021-.0038"	.410"

① - Must be within limits  $\pm .011"$

② - Lift on 400" 4-Bbl. Man. Trans. exhaust valve is .414"

## VALVE ARRANGEMENT

E-I-I-E-E-I-I-E (both banks, front to rear).

## VALVE GUIDE SERVICING

Valve guides are integral with head. If valve stem to guide clearance is excessive, ream guide to proper size to accommodate oversize valve stems. Valves with oversize stems are

available in .003" and .005" oversize. Valve seat must be refaced after reaming valve guide.

## VALVE STEM OIL SEALS

Valve stem seals are installed in the 2nd groove (from end of stem). Special valve seal installer and tester tools are available. Where necessary, install new umbrella type seal, using plastic protector over end of valve stem.

VALVE SPRINGS					
Engine	Spring	PRESSURE (POUNDS) AT LENGTH (INCHES)			
		INTAKE		EXHAUST	
		Valve Closed	Valve Open	Valve Closed	Valve Open
350"	Outer	61 @ 1.586"	132 @ 1.179"	61 @ 1.590"	132 @ 1.75"
	Inner	33 @ 1.550"	98 @ 1.139"	33 @ 1.550"	99 @ 1.135"
400" 2-Bbl.	Outer	61 @ 1.590"	126 @ 1.213"	61 @ 1.590"	133 @ 1.177"
	Inner	33 @ 1.550"	93 @ 1.173"	33 @ 1.550"	98 @ 1.137"
400" 4-Bbl.	Outer	60 @ 1.598"	131 @ 1.188"	60 @ 1.598"	131 @ 1.184"
	Inner	56 @ 1.528"	122 @ 1.118"	56 @ 1.528"	122 @ 1.114"
400" 4-Bbl.	Outer	65 @ 1.568"	135 @ 1.158"	65 @ 1.568"	136 @ 1.154"
	Inner	37 @ 1.528"	101 @ 1.118"	37 @ 1.528"	102 @ 1.114"
455" 4-Bbl.	Outer	65 @ 1.569"	136 @ 1.159"	66 @ 1.569"	136 @ 1.154"
	Inner	37 @ 1.529"	101 @ 1.119"	37 @ 1.529"	102 @ 1.115"
455" S.D.	Outer	70 @ 1.820"	175 @ 1.410"	70 @ 1.820"	175 @ 1.410"
	Inner	40 @ 1.750"	84 @ 1.340"	40 @ 1.750"	84 @ 1.340"

## VALVE SPRINGS

**Removal** - Remove rocker arm cover, spark plug, and distributor cap. Crank engine until distributor rotor is in position to fire on cylinder being serviced. Install suitable air fitting in spark plug hole and attach air line. Remove rocker arm. Thread suitable valve spring compressor stud (J8929-1) on rocker arm stud. Using suitable compressor (J6384-1) and nut (J8929-2), compress valve spring. Remove valve spring retainer cup locks, and remove compressor, valve spring and seal.

**Installation** - Install new parts and compress valve spring. Install seal and retainer cup locks. Remove compressor. Install

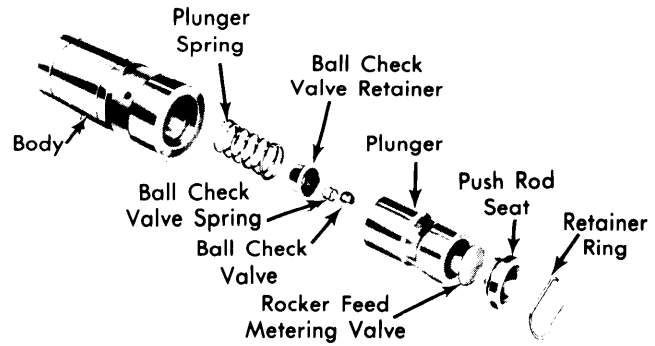
rocker arm and tighten rocker arm ball retaining nut. **NOTE** - Assemble springs on 455" SD with colored ends against cylinder head.

## HYDRAULIC LIFTER TESTING

1) Fill tester cup of suitable tool (J-5790) to about 1" from top with special testing fluid. Swing weight arm out of way, raise ram, and position lifter into boss of cup. Place  $\frac{7}{32}$ " steel ball in pushrod seat of lifter and lower ram onto ball. Adjust ram (with weight arm clear of ram) so pointer is positioned on set line (marked "S"). Tighten jam nut to maintain setting. Operate lifter through full plunger travel to displace air in lifter with tester fluid. Continue pumping weight arm for several strokes

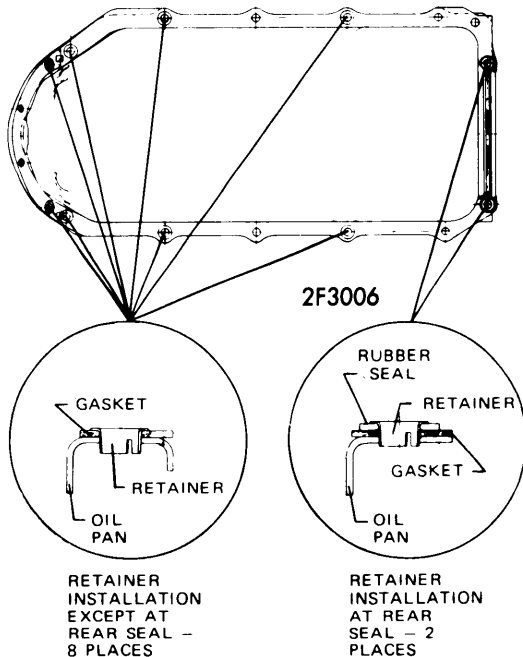
after resistance is felt. **NOTE** — If noticeably weak resistance felt during any one of last few strokes of hard pumping, replace ball in lifter and repeat test.

2) Raise weight arm to allow plunger spring to expand fully. Lower arm onto ram and commence turning crank slowly (one revolution every two seconds). Time indicator travel from lower line (first line above "S") to line marked .125" or 1/8" while still rotating cup. Lifter is satisfactory if rate is between 20 and 90 seconds.



**HYDRAULIC VALVE LIFTER ASSEMBLY**

PISTONS, PINS, RINGS						
Engine	PISTONS	PINS			RINGS	
	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
350" & 400"	.0029-.0037"	.0003 — .0005"	Press Fit	1	.019"	.0015-.005"
				2	.015"	.0015-.005"
				3	.035"	.0015-.005"
455"	.0021 — .0029"	.0003 — .0005"	Press Fit	1	.021"	.0015-.005"
				2	.015"	.0015-.005"
				3	.035"	.0015-.005"
455" S.D.	.0064 — .0072"	.0003 — .0005"	Press Fit	1	.021"	.0015-.005"
				2	.015"	.0015-.005"
				3	.035"	.0015-.005"



**OIL PAN GASKET PLACEMENT**

## OIL PAN

**Removal** — Disconnect battery cable at battery. Remove power steering pump adjusting bracket and drive belt and tilt pump upward. Loosen shroud and remove fan. Remove thermal override switch from rear of left cylinder head (right cylinder head on Ventura models). Raise vehicle and drain crankcase. On Firebird and Grand Prix models, disconnect steering idler arm at frame and pitman arm from shaft.

Disconnect exhaust pipes from manifold and remove starter assembly and flywheel inspection cover. On LeMans and Grand Am models, remove stabilizer-to-frame bracket attaching bolts. Position suitable lifting tool, remove frame bracket-to-engine mount through bolts, oil pan bolts and raise engine. Remove oil pan.

**Installation** — To install, reverse removal procedure and note the following:

Clean all gasket material from block and pan. Install new gaskets and seals. Using a suitable silicone rubber sealer, apply a 1/8" diameter by 1/4" long bead across joints of front and side gaskets. Apply a 1/8" diameter by 1 3/32" long bead of sealer where side gaskets and rear seal mate. Install oil pan, bolts and tighten bolts.

## PISTON & ROD ASSEMBLY

**Removal** — With oil pan, oil baffle, oil pump and cylinder head removed, 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 cylinder identification and mark as necessary. Remove rod cap and push rubber hose onto connecting rod bolts (to protect cylinder walls). Push piston and rod assembly out top of cylinder block. Install rod caps on mating rods.

**Installation** — 1) Ensure stamped markings on compression rings face top of piston and lightly coat cylinder bores, pistons and rings with engine oil. Slide suitable ring compressor over piston and tighten. Install piston and rod assembly into cylinder bore so notch on top of piston faces forward, and dimples on side of rods face forward on right bank and to rear on left bank. When installed correctly dimples on rods will be facing each other on rods which are on the same bearing journal. Install rod cap and tighten nuts.

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2) On 455" SD engines following procedures must be used in tightening connecting rod nuts: Nuts must be replaced with new nuts each time they are removed. With connecting rod nuts loose on bolts, use a micrometer to measure across bolt ends and record measurement. Tighten nuts on each rod bolt alternately and in steps of 10 ft. lbs. until reaching 60 ft. lbs. Remeasure bolts and measurement should have increased by .006-.008". If stretch is not at least .006", tighten nuts in steps of 5 ft. lbs. until .006-.008" stretch is achieved.

## FITTING PISTONS

Measure cylinder bore at its smallest diameter. Measure piston skirt perpendicular to piston pin boss, with pin removed, 1 1/8" from top of piston.

## PISTON PINS

Use a suitable tool and arbor press for removal and installation of piston pins. To install, place plunger and spring in tool support (use correct support and pilot plunger for piston type). Place plunger in piston pin bore. Position on press and coat pin and rod lightly with graphite lubricant and insert pin. Press pin in until it bottoms against plunger. Piston must turn freely on pin. **NOTE** — Pin must not move under 1500 lbs. load after assembly.

**Oversize Pin Installation** — Oversize pins are available in .001" and .003" oversize. When using oversize pin, piston pin bosses must be honed to give required fit. Connecting rod pin bore must be honed with a special grit hone.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft Endplay	Journal Diam.	Clearance	①Sideplay
350" & 400"	3.00"	.0002-.0017"	4	.003-.009"	2.25"	.0005-.0025"	.012-.017"
455"	3.25"	② .0005-.0021"	4	.003-.009"	2.25"	③ .0005-.0025"	.012-.017"

① — Total of two rods.

② — 455" SD is .001-.0026".

③ — 455" SD is .0015-.0031".

## MAIN AND CONNECTING ROD BEARINGS

**NOTE** — Following procedures are performed with oil pan, oil baffle and oil pump removed.

**Connecting Rod Bearings** — After ensuring rod caps are marked for cylinder identification, remove rod caps (with crankshaft journal of cylinder to be checked at bottom of throw). Use Plastigage method to check for proper bearing clearances. New bearings are available in standard, .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. Rotate crankshaft after bearing replacement to ensure that bearings are not tight. **NOTE** — A special procedure is necessary for tightening connecting rod nuts on 455" SD engines. See *Piston & Rod Assembly installation procedure*.

**Main Bearing** — 1) When checking main bearing clearance with engine in vehicle, place a .002" brass shim between crankshaft journal and lower bearing in each bearing cap next to bearing being checked. Ensure that all cap bolts are tight and remove bearing cap of bearing to be checked. Use Plastigage method to check clearances. New bearings are available in standard, .001" and .002" undersize.

2) Remove upper main bearing 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 end of bearing at indented side of bearing seal and rotate crankshaft to install. Install lower bearing in cap so indentation in bearing and cap coincide. Install bearing cap and tighten bolts.

## THRUST BEARING

With all main caps and connecting rods installed and torqued, tap end of crankshaft at rear until tight against front of thrust

bearing. Measure clearance between crankshaft counterweight and thrust bearing. If clearance is outside limits, (.003" to .009"), install new thrust bearing.

## REAR MAIN BEARING OIL SEAL

1) Remove oil pan, oil pump and baffle. Remove rear main bearing cap and use suitable tool (see illustration) made from brass bar stock to pack upper seal. Insert tool against one end of oil seal in block and drive seal gently into groove until tool bottoms. Remove tool and repeat at other end of seal in cylinder block. Clean block and bearing cap parting line thoroughly.

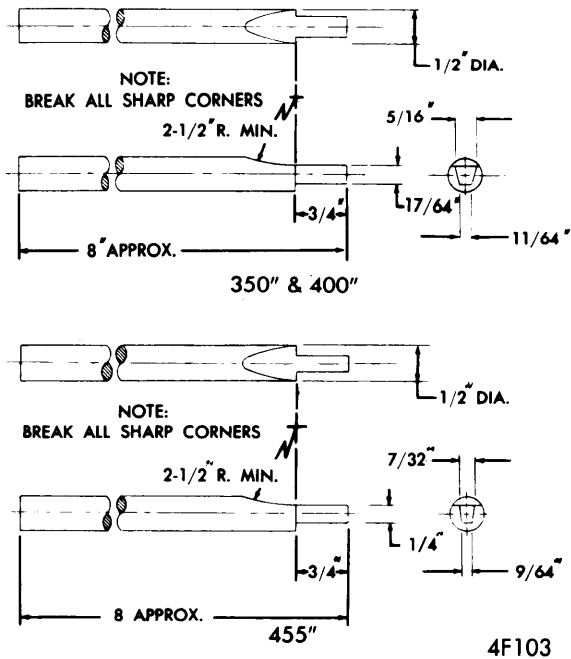
2) Form a new seal in cap using suitable tool (J-7588). Remove new seal and cut four pieces approximately 3/8" long from this seal. Work two 3/8" pieces into each gap which has been made at end of seal in block. Without cutting ends, work seal pieces in until flush with parting line and no fibers are protruding over metal next to groove.

3) Form another new seal in cap using suitable tool (J-7588). Assemble cap to block and tighten. Remove cap and inspect parting line to insure that no seal material has been compressed between block and cap. Clean as necessary. Apply a 1/16" bead of sealer from center of seal to outer gasket groove. Reassemble cap and tighten.

## ENGINE FRONT COVER

**Removal** — Drain radiator and cylinder block, loosen alternator adjusting bolts, remove fan and pulley, disconnect radiator hoses, remove fuel pump, remove harmonic balancer. Remove bolts attaching oil pan to cover. Remove cover.

**Installation** — Thoroughly clean gasket surfaces on block and cover, inspect oil pan gasket and replace if damaged. Use new "O" ring seal in water passage in intake manifold. Install and tighten cover-to-block and intake manifold bolts first, then install oil pan screws.



**OIL SEAL INSTALLATION TOOL**

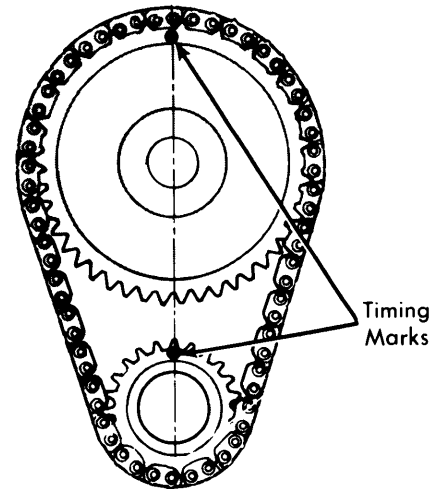
### FRONT COVER OIL SEAL

To replace seal, remove fan and accessory drive belts. Remove harmonic balancer. Remove seal by prying out of bore with pry bar. Using suitable tool, install new seal with lip of seal facing rear of engine.

### TIMING CHAIN

**Removal** - Remove timing chain cover, fuel pump eccentric and bushing. Remove timing chain cover oil seal. Align timing marks (see illustration) to simplify reassembly. If crankshaft sprocket is being replaced, remove using suitable puller (J-22888). Slide timing chain and sprockets off crankshaft and camshaft.

**Installation** - Install new timing chain and/or sprockets, ensuring that marks on timing sprockets are aligned exactly on a straight line passing through shaft centers. Camshaft should extend through sprocket so hole in fuel pump eccentric will locate on shaft.



3F515

**TIMING CHAIN SPROCKET ALIGNMENT**

### CAMSHAFT

**Removal** - Camshaft may be removed without removing engine from vehicle using following procedure:

1) Drain cooling system, remove air cleaner and then disconnect all water and vacuum hoses, spark plug wires, carburetor linkage, fuel lines and wires to thermogauge unit. Remove hood latch brace and radiator. On vehicles equipped with A/C, remove alternator mounting bracket and alternator.

2) Remove crankcase ventilator hose and rocker arm covers. Remove distributor, intake manifold, push rod cover, push rods and valve lifters. Remove harmonic balancer, fuel pump timing chain cover, and timing chain and sprockets. Remove camshaft thrust plate and carefully pull camshaft from engine.

**Installation** - To install, reverse removal procedure. **NOTE** - Before installation, coat camshaft lobes and inner diameters of bearings with heavy oil. Rotate camshaft several revolutions to ensure that it is free.

### CAMSHAFT BEARING REPLACEMENT

Use suitable tool (J-6173) and note the following:

1) To replace rear bearing (without removing and disassembling engine) propeller shaft, transmission and clutch housing must be removed to get at camshaft rear plug. If front bearing is being replaced, insert remover adapter in center bearing to support shaft.

2) Outside of new bearing should be coated with oil before installation. Notch in edge of bearing is used to properly position bearing with respect to oil holes when installing. Index notch in edge of bearing with pin on replacer adapter. When bearings are installed in production, notches all face front except on rear bearing. In field service, all bearings should be installed with notches facing rear.

3) Rear bearing should be pulled in until front edge is flush with block to leave room for camshaft rear plug. Other bearings should be flush with both sides of bearing web.

CAM LOBE LIFT			
Engine Code	Cam No.	Intake	Exhaust
WA, WB, YA, YC, YB, AA, WN, WP, YN, YP, YS	483555	.374"	.407"
ZA, ZB, ZP	494957	.364"	.403"
YH, YJ, AH	491255	.374"	.407"
ZH, ZJ	491266	.374"	.408"
W8, Y8	493323	.406"	.406"
YT, AT, ZT, YZ	9779066	.404"	.408"
WT, YY, YU, YX, AU, ZU, ZX, YW, ZW, YR	9779067	.403"	.406"

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## ENGINE OILING

**Crankcase Capacity** — All engines hold 5 quarts. Add 1 quart with filter change.

**Oil Filter** — Replace at first oil change, then every second oil change after that.

**Normal Oil Pressure** — 455" S.D. engine 75-80 @ 2600 RPM. All others engines 55-60 @ 2600 RPM.

**Pressure Regulator Valve** — In oil pump body. Not adjustable.

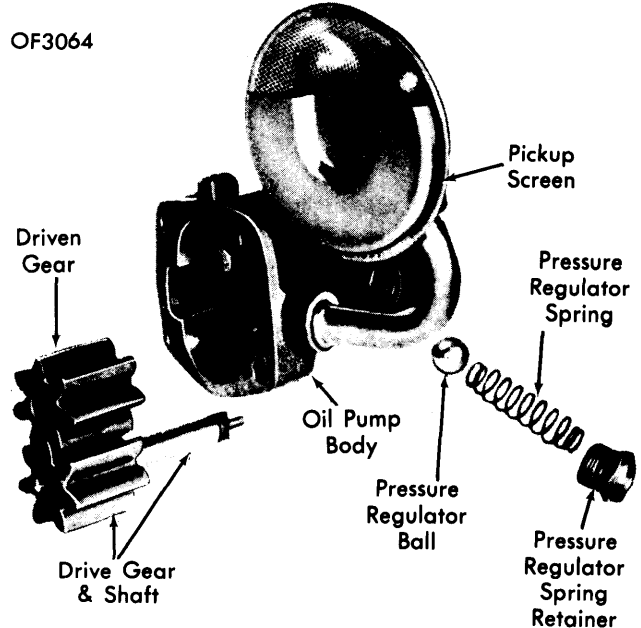
### ENGINE OILING SYSTEM

See illustration. Force feed type with oil supplied under full pressure to all crankshaft, connecting rod, and camshaft bearings and to valve train parts. Spray from main and connecting rod bearings lubricates cylinder walls, piston pins and bushings. Timing chain and sprockets receive metered jet lubrication as do fuel pump eccentric and rocker arm. A hole in block from push rod gallery through distributor boss lubricates distributor shaft and bushings.

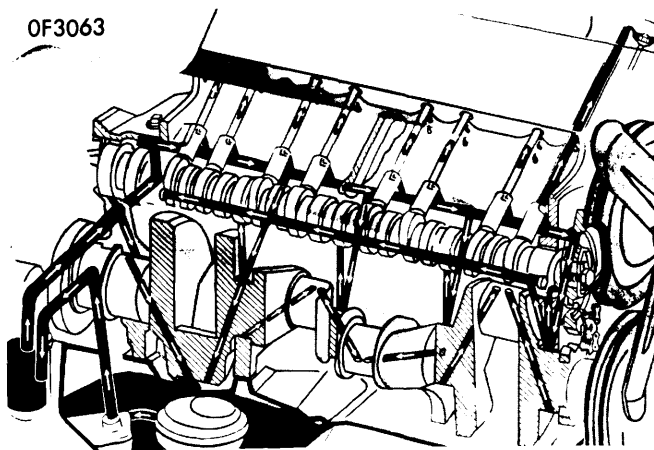
**Valve Lifters** — Hydraulic lifters are fed individually by holes drilled in each lifter boss to main oil galleries in each bank.

**Push Rods and Rocker Arms** — Oil from each lifter is directed up through hollow push rods to rocker arms. Oil then passes through a hole in push rod contact area of rocker arm and fills it. This supply lubricates rocker arm ball and overflow lubricates top of valve stem and other valve train surfaces.

**Installation** — Position drive shaft in distributor and oil pump drive gears. Use new gasket between pump and block. Index drive shaft with pump drive gear shaft and install attaching bolts.



OIL PUMP ASSEMBLY



ENGINE OILING SYSTEM

### OIL PUMP

**Removal** — Remove oil pan splash baffle. Hold oil pump while removing attaching bolts. Lower oil pump carefully while removing pump drive shaft. **NOTE** — Removal and installation of pump does not affect engine timing. If pump is disassembled for cleaning and inspection, do not loosen or remove oil pump screen from pump body. Do not attempt to change oil pressure by varying length of pressure regulator spring.

### TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head .....	95
Intake Manifold .....	40
Exhaust Manifold .....	30
Oil Pan .....	12
Main Bearing Cap (Rear) .....	120
(All Others) .....	100
Con. Rod Caps (455" S.D.) .....	63
(All Others) .....	43
Flywheel .....	95
Vibration Damper .....	160
Camshaft Sprocket .....	40
Camshaft Thrust Plate .....	20
Engine Front Cover .....	12
Oil Pump-to-Block .....	30
Rocker Arm Stud .....	50
Rocker Arm Retaining Nut .....	20
Push Rod Chamber Cover .....	30-70 INCH Lbs.
Front Engine Mounts-to-Engine .....	70
Front Engine Mounts-to-Frame .....	50
Retainers-to-Transmission .....	30
Rear Engine Mounts .....	30