250" 6 CYL.

IDENTIFICATION CODING

ENGINE IDENTIFICATION

The fifth digit of the Vehicle Identification Number, located on upper left of instrument panel, identifies the engine. Engine code is also stamped on distributor mounting pad on right side of block and is decoded as follows:

Application	VIN Code
Chevrolet	
250" 1-Bbl.	D

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

NOTE – *Intake manifold is integral with cylinder head.*

EXHAUST MANIFOLD

Removal – **1)** Disconnect negative battery cable. Remove air cleaner, power steering pump and A. I. R. pump brackets (if equipped). Raise vehicle and disconnect exhaust pipe at manifold and converter bracket at transmission mount. Remove manifold converter (if equipped).

2) Lower vehicle and remove rear heat shield and accelerator cable bracket. Remove exhaust manifold.

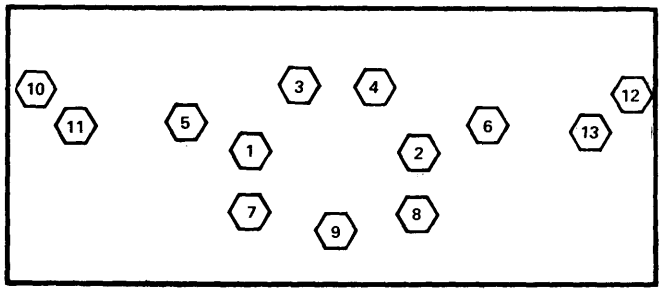

Fig. 1 Exhaust Manifold Tightening Sequence

Installation – To install exhaust manifold, reverse removal procedure. Tighten exhaust manifold bolts in sequence shown in *Fig. 1*. Tighten bolts 1 through 4 to 30-35 ft. lbs. Tighten bolts 5 and 6 to 25-30 ft. lbs. Then tighten bolts 7, 8 and 9 to 30-35 ft. lbs. Tighten bolts 10 through 13 to 18-23 ft. lbs.

CYLINDER HEAD

Removal – **1)** Remove exhaust manifold and valve cover. Remove rocker arm retaining nuts and rocker arm balls, arms and push rods. Mark or identify components to ensure installation in their original locations.

2) Drain cooling system and disconnect fuel and vacuum lines from clip at water outlet. Disconnect leads at temperature sending unit. Disconnect air injection hose at check valve and radiator hose at water outlet.

3) Disconnect battery ground strap at cylinder head. Remove cylinder head bolts and cylinder head with gasket. Discard gasket.

Installation – Make sure all gasket surfaces are clean. Make sure cylinder head bolt threads and threads in cylinder block are clean. Position cylinder head gasket on cylinder block over dowel pins. Install cylinder head. Coat threads of cylinder head bolts with sealer and install finger tight. Tighten bolts in sequence shown in *Fig. 2*. To complete installation, reverse removal procedure.

NOTE – *On composition asbestos steel gaskets, do not use gasket sealer.*

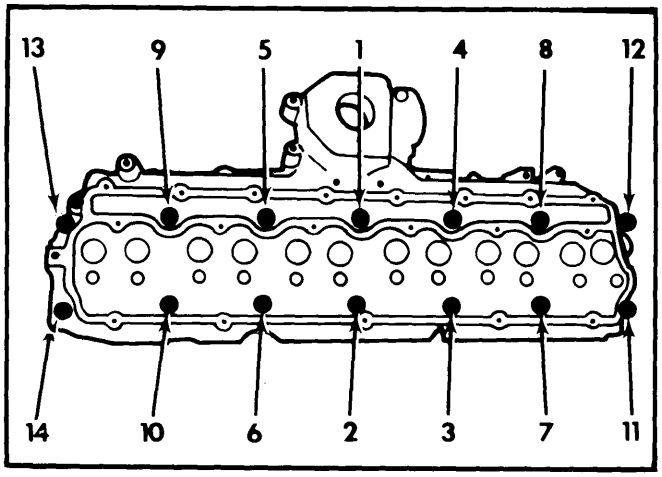

Fig. 2 Cylinder Head Tightening Sequence

VALVES

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

Guides are integral with cylinder head. Valves with oversize stems are available. Ream bores to proper oversize.

VALVE STEM OIL SEALS

"O" ring type used on all valves. Installed on lower groove of valve stem. A light coat of oil on stem will help prevent twisting of oil seal.

VALVE SPRINGS

Removal – Remove rocker arm cover, spark plug, rocker arm and push rod on cylinder(s) to be serviced. Install air line adapter (J-23590) to spark plug port and apply air to hold valves in place. Using suitable tool (J-5892), compress valve spring and remove valve locks, cap, shield and valve spring. Remove and discard oil seal. See *Fig. 3*.

250" 6 CYL. (Cont.)

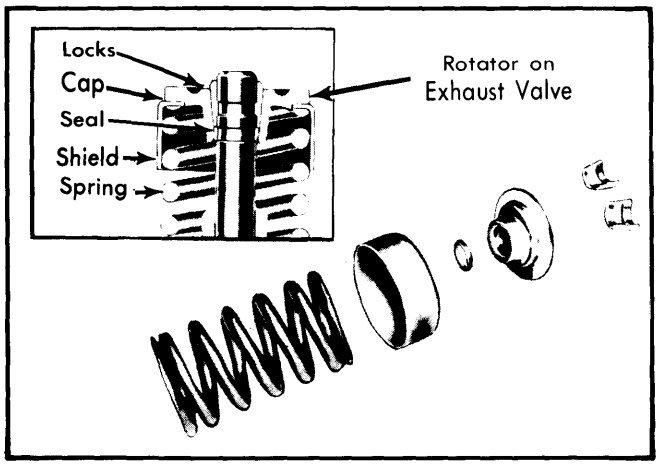

Fig. 3 Valve Spring Installation

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 (ensure that seal is flat and not twisted). 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 $^{21}/_{32}$" ± $^{1}/_{32}$". Measure from top of spring seat in head to top of spring or spring shield. See *Fig. 4*. If measurement exceeds specifications, install $^{1}/_{16}$" shim at spring seat. Do not shim to obtain a height under minimum specifications.

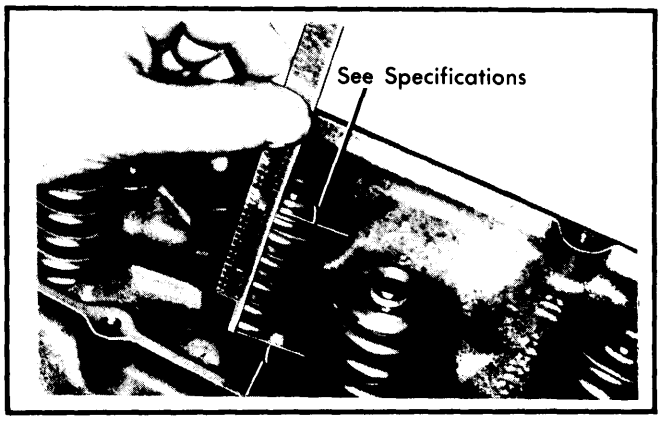

Fig. 4 Valve Spring Installed Height

VALVE ADJUSTMENT

Adjust valves with lifter on base circle of camshaft lobe as follows:

1) Set engine in No. 1 cylinder firing position. Adjust intake valves on cylinders 1, 2 and 4. Adjust exhaust valves on cylinders 1, 3 and 5.

2) Adjust valves by backing off adjusting nut until lash is felt at push rod. Then tighten until all lash is removed. Tighten nut one full additional turn. See *Fig. 5*.

3) Set engine for No. 6 cylinder firing position. Following procedure in step **2)**, adjust intake valves on cylinders 3, 5 and 6. Adjust exhaust valves on cylinders 2, 4 and 6. Install distributor cap and valve covers and adjust idle speed.

Fig. 5 Valve Adjustment

ROCKER ARM STUDS

1) Replace studs that have damaged threads or are loose in head. Studs are available in oversizes from .003" to .013". Ream hole for oversize studs and coat press area of stud with hypoid axle lubricant.

NOTE – *Do not attempt to install oversize studs without first reaming stud holes.*

2) To remove old stud use stud removing tool, J-5802 (or equivalent) with washer and nut. See *Fig. 6*. To install new stud, use installation tool, J-6880 (or equivalent) as a guide. Be sure tool bottoms on cylinder head. See *Fig. 7*.

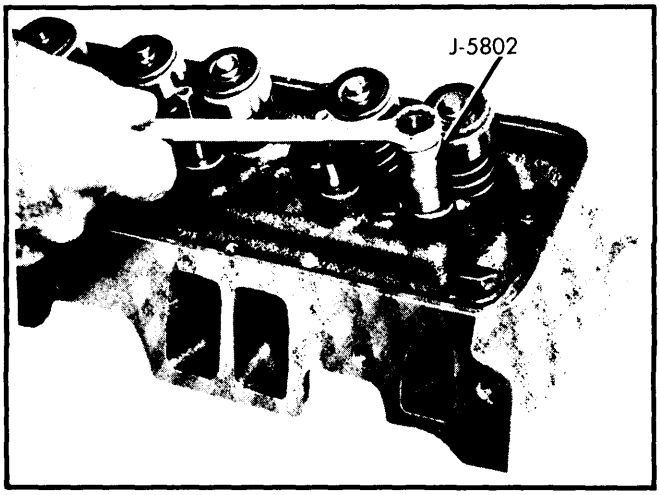

Fig. 6 Rocker Arm Stud Removal

250" 6 CYL. (Cont.)

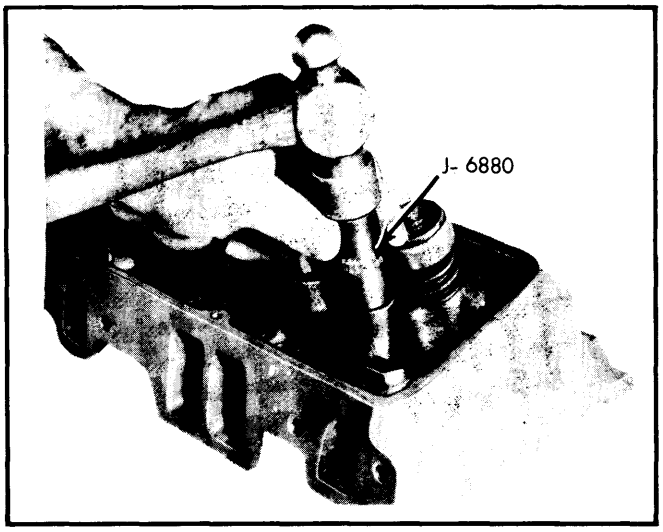

Fig. 7 Rocker Arm Stud Installation

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 with a leakdown tester after reassembly. Follow manufacturer's instructions. Before installing lifters, coat bottom of lifter with Molykote (or equivalent).

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

NOTE – *New pistons must be installed in same cylinders for which they were fitted and used pistons in same cylinder from which they were removed.*

Removal – 1) With oil pan, oil pump and cylinder head removed, use 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.*

2) Inspect connecting rods and caps for cylinder identification and mark as necessary. Remove rod cap and install suitable guide on rod studs. Push piston and rod assembly out top of cylinder block.

Installation – Lightly coat pistons, rings and cylinder walls with engine oil. Be sure gaps are properly spaced and compression ring has marked side toward top of piston. See *Fig. 8*. Install ring compressor on piston. With suitable guide on connecting rod studs, install each piston and rod assembly in its respective bore (notch on piston head towards front of engine). Guide connecting rod onto crankshaft journal. Tap piston head with hammer handle to seat connecting rod against crankshaft. Remove guide from studs and install rod caps. Tighten to specifications.

FITTING PISTONS

Measure cylinder bore diameter 2½" from top of cylinder bore. Measure piston diameter at skirt, across centerline of piston pin. Maximum acceptable clearance is .0030"; maximum bore out-of-round is .0020" and bore taper is .0010".

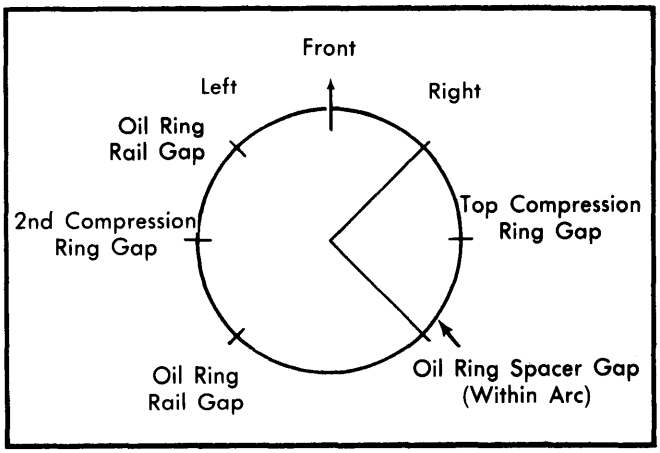

Fig. 8 Ring Gap Location

PISTON PINS

Piston and piston pin are a matched set and are not serviced separately. Measure diameter of piston pin with a micrometer and measure piston pin bore in piston with a dial bore gauge or inside micrometer. If clearance is greater than .001", piston and pin should be replaced.

Removal – Place piston on suitable support (J-24086-20). Using a pilot tool as a driver, use arbor press to push pin from piston and rod.

Installation – Assemble rod to piston with oil hole in rod to right side of piston (notch in piston to be facing forward). Place piston on suitable support and using a pilot tool and arbor press, push pin into assembly. Check piston for freedom of movement on pin.

CRANKSHAFT & ROD BEARINGS

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 proper bearing clearance. If not within specifications, new bearings must be installed. New bearings are available in standard, .001" and .002" undersize for use with new or used standard crankshaft and .010" and .020" for use with reconditioned crankshaft. During production, .009" undersize bearings may have been installed for close tolerances. These bearings will be identified by a "9"

250" 6 CYL. (Cont.)

stamped on one side of the undersize journal along with a spot of green paint. Also the cap will be painted light green on each side. Coat bearing surfaces with oil, install caps 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.

NOTE – *Never use a new bearing half with an old one. Some crankshafts may be precision ground to .009" undersize on SOME journals (not necessarily all journals). Laminated shims are also available when main bearing caps require replacement. Shim requirement will be determined by bearing clearance.*

2) If clearances are not within specifications, bearings are available in standard, .001", .002", .009", .010" and .020" undersize. One half of a standard bearing may be used in conjunction with one half of a .001" undersize bearing to obtain proper clearance.

NOTE – *Main bearings may be replaced with the crankshaft in the engine or removed.*

3) Remove all main bearing upper halves (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. Use a pair of pliers with taped jaws to hold bearing thrust surface to oil slinger. 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.

NOTE – *Use care not to nick crankshaft journal.*

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.

THRUST BEARING ALIGNMENT

Using a large screwdriver, pry crankshaft toward front of engine. Measure crankshaft endplay at front of rear main bearing using a feeler gauge. If end play exceeds specifications, replace rear main bearing. To align thrust bearing, tighten all main bearing bolts, except rear main bearing. Tighten rear main bearing cap to 10 ft. lbs. Tap end of crankshaft, first rearward then forward, to align thrust bearing. Tighten rear main bearing cap.

REAR MAIN BEARING OIL SEAL

With oil pan and oil pump removed , proceed as follows:

NOTE – *Always replace upper and lower seal halves as a unit. When installing seal, be sure lip faces front of engine.*

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 *Fig. 9*. 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.

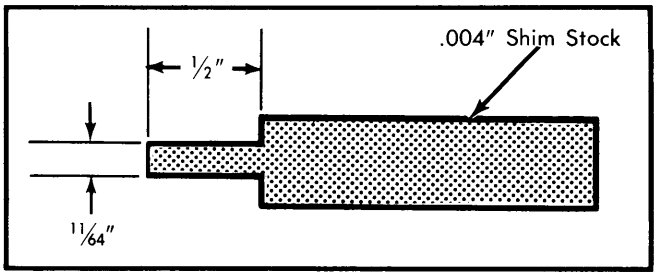

Fig. 9 Rear Main Seal Installing Tool

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.

CAMSHAFT

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 and gasket.

Installation – 1) Clean all gasket surfaces. Cut tabs from new oil pan front seal and install seal in front cover, pressing tips into holes in cover. Coat front cover gasket with sealer and position on cover. Apply a 1/8" bead of RTV sealer 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.*

2) Install front cover to block. Install oil pan-to-cover bolts finger tight. Install front cover bolts and tighten. Remove centering tool and install torsional damper.

250" 6 CYL. (Cont.)

FRONT COVER OIL SEAL

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

Installation – Install new seal with open end toward inside of cover. Drive seal into position with suitable tool (J-23042).

CAUTION – *If cover is removed from engine, it must be supported at sealing area to prevent cover distortion.*

TIMING GEARS

With valve timing marks lined up, check backlash between timing gears with a dial indicator. See *Fig. 10*. Backlash should be .004-.006" for new parts and .004-.008" for worn parts. If not within specifications, and gear replacement is necessary, proceed as follows:

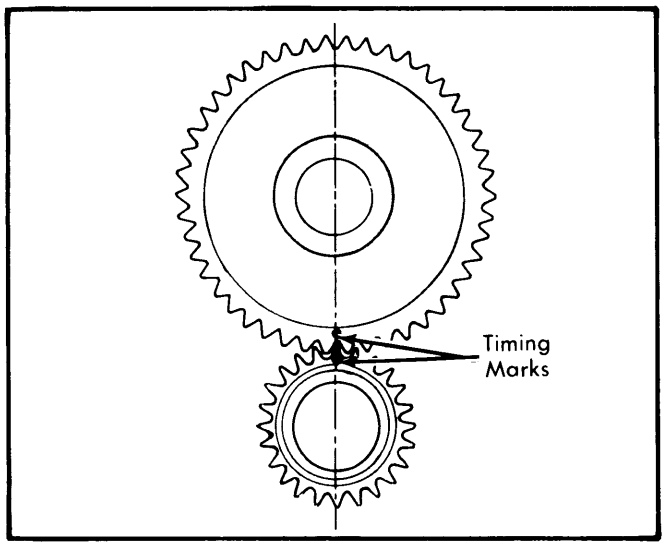

Fig. 10 Timing Gear Alignment

Removal – 1) Remove camshaft from engine and press shaft out of gear using suitable gear remover J-971 (or equivalent).

CAUTION – *Thrust plate must be positioned so Woodruff key in shaft does not damage it when shaft is pressed out of gear.*

2) Support hub of gear to prevent damage. Use puller J-8105 (or equivalent) 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.

CAMSHAFT

Removal – With engine removed from vehicle, remove front cover, rocker arm assemblies, push rods, valve lifters and fuel pump assembly. Align timing marks and remove camshaft thrust plate bolts. Remove camshaft and gear as an assembly by pulling out through front of block.

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

CAMSHAFT BEARINGS

Removal – 1) If camshaft bearings are scored or if clearance with camshaft journals is excessive, bearings must be replaced. Remove engine from vehicle. Remove camshaft, oil pan and oil pump. Drive out camshaft rear plug.

2) Remove bearings nearest center of engine first. Using suitable tool set (J-6098), with nut and thrust washer installed to end of threads, index pilot in camshaft front bearing. Install puller screw through pilot. Install remover and installer tool with shoulder toward bearing. Pull bearing from bore.

3) Remove all bearings but front and rear in same manner. Index pilot in rear bearing to remove rear intermediate bearing. To remove front and rear bearings, assemble remover and installer tool on driver handle and drive toward center of cylinder block.

Installation – 1) Assemble remover and installer tool on driver handle and install camshaft front and rear bearings by driving them toward center of block.

2) Index pilot in camshaft front bearing, index camshaft bearing in bore and pull bearing into bore. For rear intermediate bearing, index pilot in camshaft rear bearing. After all bearings are installed, install camshaft rear plug flush to 1/32" deep and parallel with rear surface of cylinder block.

NOTE – *Be sure all cam bearing oil holes are aligned with oil holes in cam bore.*

CAMSHAFT END THRUST

End play is taken by thrust plate between camshaft sprocket and front bearing journal. End play 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. See *Fig. 11*.

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.

250" 6 CYL. (Cont.)

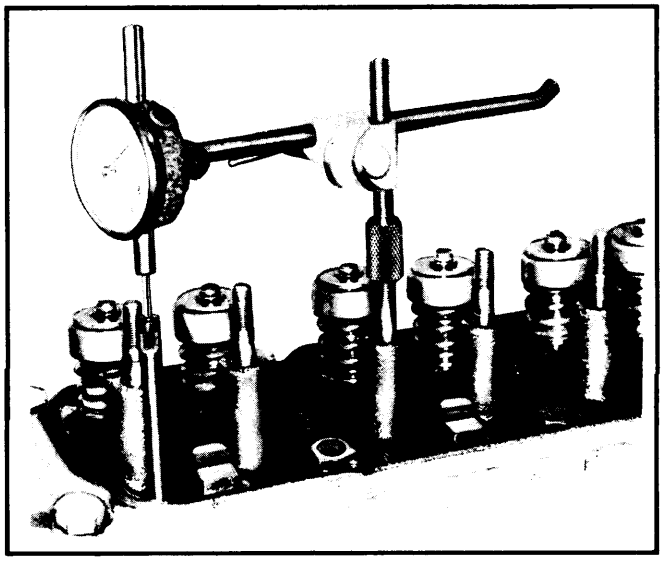

Fig. 11 Measuring Cam Lobe Lift.

CAUTION – *If using an auxiliary starter switch, positive battery ("BATT") lead must be disconnected from 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.

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.

Oil 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 the 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.

Connecting Rods & Pistons – Oil is delivered from each main bearing to adjacent connecting rod bearing through drilled passages in crankshaft. A hole in connecting rod sprays oil onto cylinder walls for piston and pin lubrication, when holes in rod and journal index.

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.

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 compartment.

OIL PUMP

Disassembly – Remove pump cover screws, cover and gasket. Mark gear teeth so they may be reassembled with same teeth indexing. Remove idler gear, drive gear and shaft from pump body. Remove pressure regulator valve retaining pin, regulator valve and related parts. To remove pickup screen and pipe assembly, mount pump in soft-jawed vise and pull pipe from pump.

NOTE – *If pump gears or body are damaged or worn, replace entire pump. Also, pickup screen and pipe are serviced as an assembly only.*

Reassembly – To assemble, reverse disassembly procedure using sealer at end of pickup pipe and ensuring that smooth side of idler gear is towards pump cover.

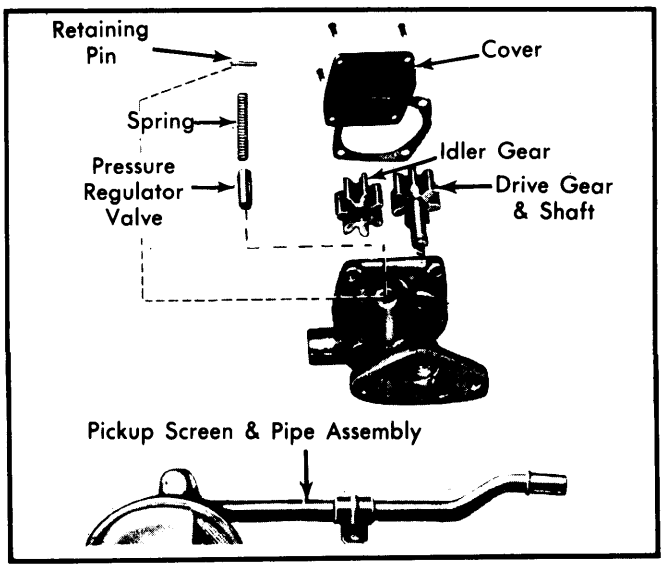

Fig. 12 Oil Pump Assembly

250" 6 CYL. (Cont.)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS						
Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
250" 1-Bbl.	115@3800	200@1600	8.1-1	3.876"	3.530"	250

VALVES							
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
250"							
Int.	1.715-1.726"	45°	46°	.031-.063"	.3410-.3417"	.0010-.0027"	.3880"
Exh.	1.495-1.505"	45°	46°	.063-.094"	.3410-.3417"	.0015-.0032"	.4051"

PISTONS, PINS, RINGS						
	PISTONS	PINS		RINGS		
Engine	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
250"	.0010-.0020"	.00015-.00025"	①.0008-.0016"	1	.010-.020"	.0012-.0027"
				2	.010-.020"	.0012-.0032"
				3	.015-.055"	.0001-.005"

① — Interference Fit.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
	MAIN BEARINGS				CONNECTING ROD BEARINGS		
Engine	Journal Diam.	Clearance	Thrust Bearing	Crankshaft End Play	Journal Diam.	Clearance	Side Play
250"	2.2979-2.2994"	①.0010-.0024"	No.7	.002-.006"	1.998-2.000"	.0010-.0026"	.006-.017"

① — Journals 1 - 6. No. 7 journal, .0016-.0035"

CAMSHAFT①			
Engine	Journal Diam.	Clearance	Lobe Lift
250"	1.8677-1.8697"	.0007-.0027"	②.2217"

① — End play is .001-.005".
② — Intake. Exhaust lift is .2315".

VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
250"	2.08"	78-86@1.66"	170-180@1.26"

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head	①95
Main Bearing Caps	65
Connecting Rod Caps	35
Flywheel	60
Manifold (Exhaust to Inlet)	②
Water Pump	15
Thermostat Housing	30
Oil Pan	
1/4" Bolts	6
5/16" Bolts	7
Camshaft Thrust Plate	6
Front Engine Cover	6
Oil Pump	6

① — Left side, front cylinder head bolt: 85 ft. lbs.
② — See "Exhaust Manifold Installation."