

318" & 360" V8

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine identification number locations are found on the right side of block to the rear of engine mount. The first number indicates model year, the next letter the manufacturing plant and the following three numbers indicate the cubic inch displacement. Engine can also be identified by fifth digit of Vehicle Identification Number.

Application	Engine No.	VIN Code
318" 2-Bbl.	318	G
318" 4-Bbl.	318	H
360" 2-Bbl.	360	K
360" 4-Bbl.	360	J
360" 4-Bbl.	360	L

SPECIAL ENGINE MARKS

Information identifying undersize crankshaft journals, oversize cylinder bores, tappets and valve stems is stamped in various locations on engine, depending on engine. Information and location is decoded as follows:

R Or M – Numbers 1, 2, 3 or 4 following R or M indicates .001" undersize rod or main bearing journals and which journal is undersize. Stamped on number eight crankshaft counterweight on 318" engine and on number three crankshaft counterweight on 360" engines.

RX Or MX – Indicates all rod or main bearing journals are .010" undersize. Stamped on number eight crankshaft counterweight on 318" engines and on number three crankshaft counterweight on 360" engines.

A – Indicates .020" oversize cylinder bore. Stamped after engine identification number.

"♦" – Indicates .008" oversize tappets. Stamped on top pad at front of engine and on flat surface at outside of each tappet bore.

X – Indicates .005" oversize valve stems. Stamped on milled pad adjacent to two 3/8" tapped holes on each end of cylinder head.

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD

Removal – 1) Drain cooling system and disconnect upper radiator hose, by-pass hose and heater hoses. Disconnect battery ground and remove alternator, air cleaner and fuel line to carburetor.

2) Disconnect accelerator linkage, coil wires and temperature sending unit wire. Remove distributor cap, wires and vacuum hose.

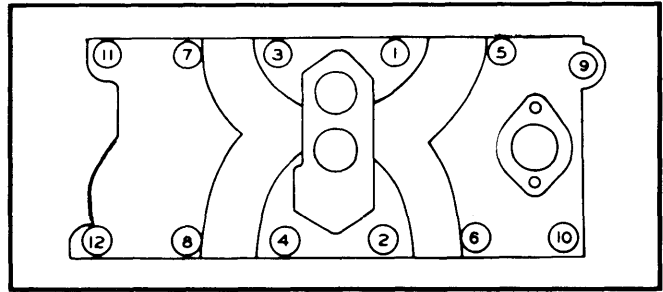


Fig. 1 Engine Intake Manifold Tightening Sequence

3) Remove closed ventilation system, evaporation control system and rocker arm covers. Remove intake manifold bolts and remove intake manifold, coil and carburetor as an assembly.

Installation – Coat intake manifold side gaskets with gasket sealer on 318" 2-Bbl. engines. On other engines, do not use sealer on side composition gaskets. Position side and end gaskets in place on cylinder block and carefully lower intake manifold into position. Install cap screws finger tight. Tighten bolts in sequence shown in Fig. 2. Make sure to use two steps when torquing bolts.

CYLINDER HEAD

Removal – Remove intake manifold and exhaust manifold. Remove rocker arm and shaft assemblies. Remove push rods and identify them to insure installation in original locations. Remove cylinder head bolts, cylinder heads and gaskets.

Installation – Coat new gasket lightly with suitable sealer and install gaskets and cylinder heads. Install cylinder head bolts and tighten in sequence shown in Fig. 2. Tighten in two steps to specifications.

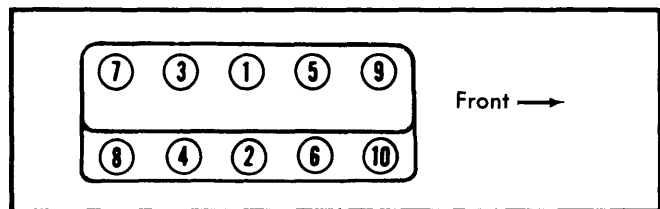


Fig. 2 Cylinder Head Tightening Sequence

VALVES

VALVE ARRANGEMENT

Each Head – E-I-I-E-E-I-I-E

VALVE GUIDE SERVICING

Wear Check – Remove valve springs and install suitable sleeve (C-3973) over valve stem and install valve in guide. Attach dial indicator to cylinder head and set it at right angle to valve stem being measured. Total side play should not exceed .017". If dial reading is excessive or stems are scuffed or scored, ream guides for installation of valves with oversize stems.

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Servicing — Ream guides to next oversize valve stem. Oversize valve stems are available in .005", .015", and .030" sizes.

NOTE — Do not attempt to ream guides from standard diameter to .030" oversize in one step. Use step procedure to obtain the .030".

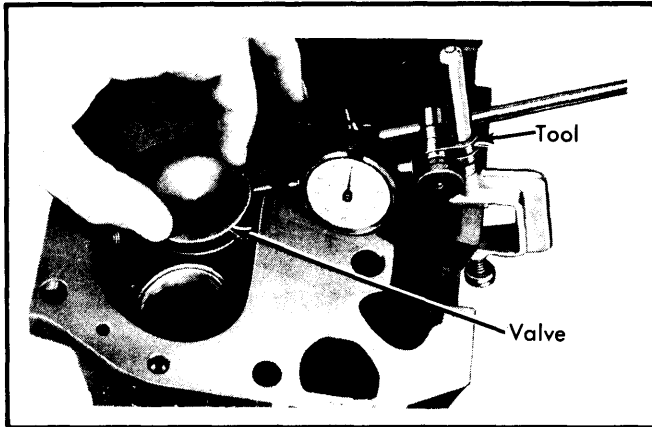


Fig. 3 Using Dial Indicator to Measure Valve Guide Wear

VALVE STEM OIL SEALS

Cup type oil shields are used on all exhaust valves; oil seals on intake valves. Coat valve stems with oil and insert in cylinder heads. Press new shields or seals squarely over valve guide, using valve stem as a positioning aid. Do not force seal against top of guide as the sealing lip pressure of the seal will be greatly reduced. See Fig. 4.

VALVE SPRINGS

Removal — With cylinder head removed, compress valve springs using a suitable tool (C-3422A). Remove valve retaining locks, retainers, cup seals and valve springs.

Installation — Reverse removal procedure and only compress spring enough to install the locks. Check valve spring height.

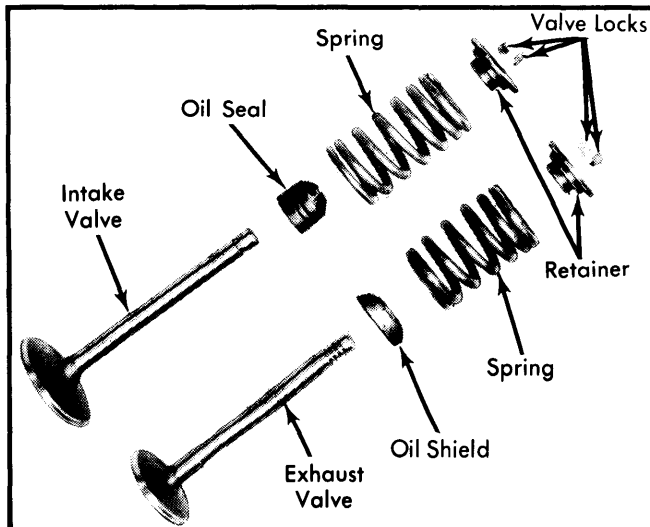


Fig. 4 Disassembled View of Intake and Exhaust Valve Assemblies

VALVE SPRING INSTALLED HEIGHT

Valve springs must be square within $\frac{1}{4}$ ". Installed height of springs (measured from spring contact area on head to underside of spring retainer) should not exceed specifications. If height is greater than maximum allowable, install a $\frac{1}{16}$ " spacer(s) in head counterbore to bring spring height back to normal. If spacers are installed, measure from top of spacer.

Valve Springs Installed Height

Engine	Minimum	Maximum
318" & 360"	1 $\frac{3}{8}$ "	1 $\frac{1}{16}$ "

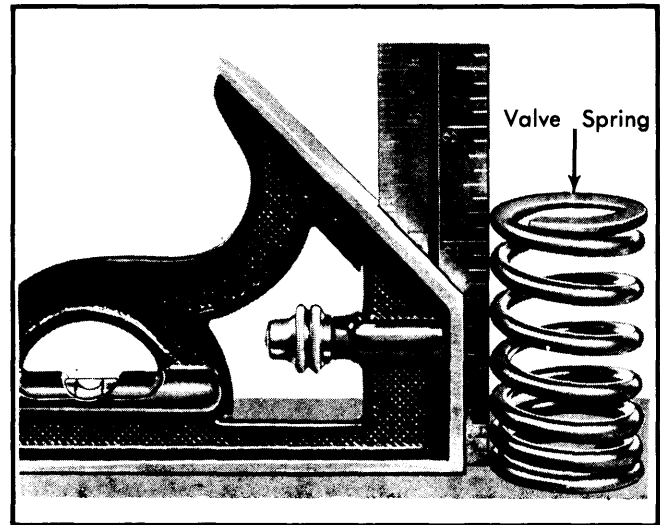


Fig. 5 Checking Valve Spring Squareness

ROCKER ARM ASSEMBLY

NOTE — Whenever rocker arm shaft assemblies are being installed, tighten support bracket bolts slowly and evenly in order that lifters have time to bleed down to operating length.

Notch on end of rocker shaft must face inward toward center of engine, and must point toward rear of engine on right bank and front of engine on left bank. Long stamped steel retainers go in number two and four positions

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.

To test, remove cap from plunger. See Fig. 6. Remove plunger from lifter body. Fill plunger body with clean kerosene and install plunger. Unseat check ball and replace cap. Place lifter upright in suitable lifter testing tool (C-4343), and check leak down. If lifter collapses immediately, disassemble, clean and retest. If rapid leakdown still occurs, replace lifter.

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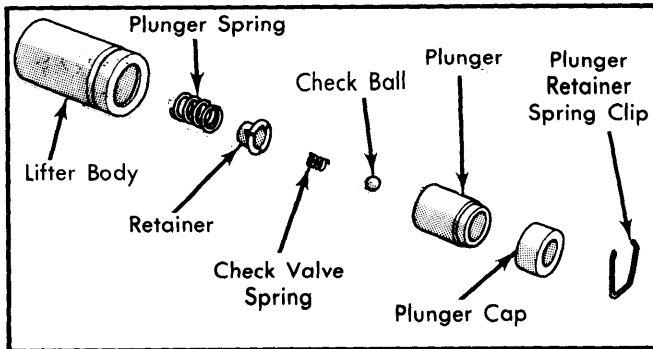


Fig. 6 Exploded View of Hydraulic Lifter Assembly

HYDRAULIC VALVE LIFTER ADJUSTMENT

Lifters are set at zero lash. Clearance between valve stem tip and rocker arm pad with lifter fully collapsed is .060-.210" on all engines.

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

NOTE — When removing or installing piston and connecting rod assemblies, rotate the crankshaft so connecting rod journal is on the center of cylinder bore.

Removal — 1) Remove ridge at top of cylinder bores using suitable tool (C-3012).

NOTE — Keep tops of pistons covered during this procedure to collect cuttings.

2) Rotate crankshaft and mark connecting rods and rod caps for cylinder identification. Remove rod cap and push piston and rod assembly out top of cylinder bore, being careful not to nick crankshaft journals. Install rod caps on mating rods.

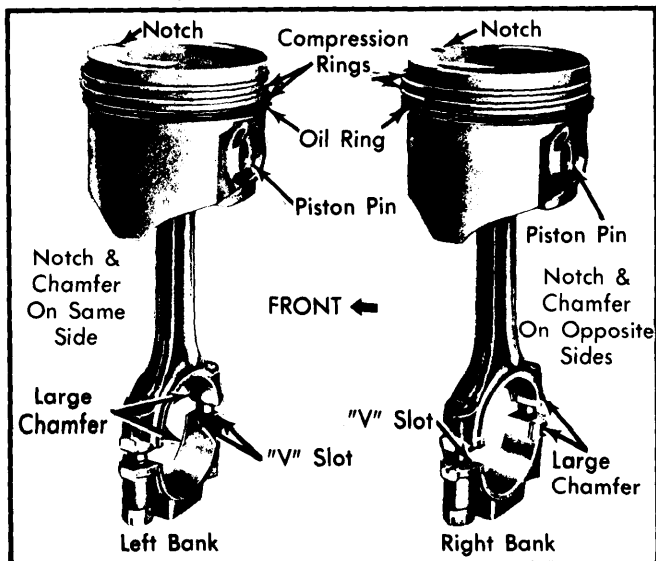


Fig. 7 Precautions for Assembling Piston to Connecting Rod

Installation — 1) Before installing piston and connecting rod assemblies into cylinder block, compression ring gaps must be staggered so neither is in line with oil ring rail gaps. The oil ring expander ends should be positioned under the notch on piston. Oil ring rail gaps should be facing middle of engine upon installation and spread 3" apart.

2) Immerse piston head and rings in clean engine oil and slide suitable ring compressor over piston and tighten.

NOTE — Do not allow position of rings to change during ring compressor installation and tightening.

3) Install connecting rod bolt protectors on rod bolts (long one on numbered side of rod). Rotate crankshaft so connecting rod journal is on center of cylinder bore. Insert rod and piston assembly into cylinder bore and guide rod over crankshaft journal, taking care not to nick the journal.

NOTE — Notch on top of piston must face front of engine and larger chamfer of connecting rod bore must be installed toward crankshaft journal fillet.

4) Tap piston into cylinder bore using wooden handle of a hammer and guide connecting rod into place on crankshaft journal. Install rod cap and tighten. Repeat procedure for each piston assembly.

FITTING PISTONS

Pistons should be measured 90° to piston pin axis at top of skirt. Measure cylinder bore halfway down the bore 90° to crankshaft center line. Pistons and cylinder bores should be measured at normal room temperature, 70°F.

PISTON PINS

Removal — 1) Use one of the following tool combinations for piston pin removal:

- 318 engines; tool C-4158 with pilot C-4200-3 and anvil C-4200-1.
- 360" engines; tool C-4158 with pilot SP-5523 and anvil SP-5520.

2) Install pilot on main screw. See Fig. 8. Fit screw through piston pin. Install anvil, with spring removed, over threaded end of main screw. Make sure small end of anvil is against piston boss.

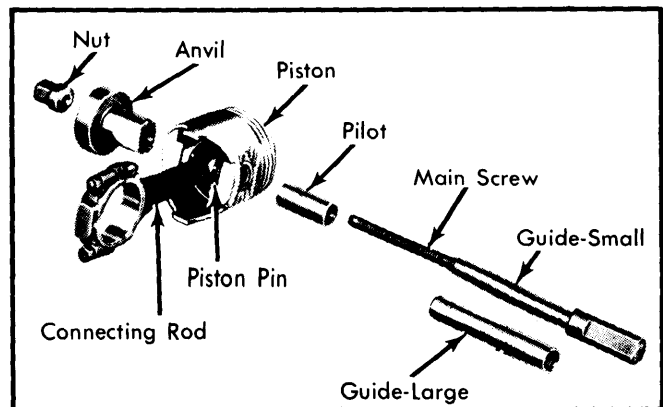


Fig. 8 Piston Pin Removal

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3) Install nut loosely on main screw and place assembly on press. Force pin from connecting rod.

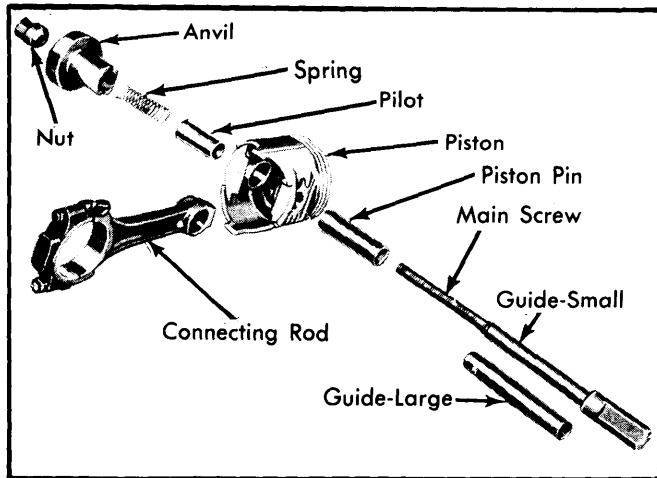


Fig. 9 Piston Pin Installation

Installation — 1) Lubricate piston pin holes and connecting rod and with same tools used for removal, install spring in pilot and pilot into anvil. Install piston over main screw.

2) Place piston (with front up) and connecting rod over pilot so pilot extends through piston pin holes. Assemble rods to pistons of the right cylinder bank (2,4,6 and 8) with indent on piston head opposite to larger chamfer on large bore end of connecting rod. Assemble rods to pistons of the left cylinder bank (1,3,5 & 7) with indent on piston head on the same side as the large chamfer on the large bore end of connecting rod. See Fig. 7.

3) Install main screw and piston pin in piston and install nut on main screw to hold assembly together. Place assembly in a vise. Press piston pin in until piston pin bottoms on the pilot.

Checking Pin Fit — Assemble suitable tool in the same manner as for piston pin removal and place assembly in a vise. Attach a torque wrench to nut and test torque to 15 ft. lbs. If connecting rod moves downward on the piston pin, reject connecting rod and piston pin combination. Install a new connecting rod and recheck. If connecting rod does not move under 15 ft. lbs. torque, piston pin fit is satisfactory.

CRANKSHAFT & ROD BEARINGS

NOTE — Use either shim stock method or Plastigage method to check bearing clearance.

MAIN & CONNECTING ROD BEARINGS

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

Connecting Rod Bearings — 1) After ensuring rod caps are marked for identification, remove rod caps. If shim stock method is used, smooth edges of a piece of $\frac{1}{2}$ " by $\frac{3}{4}$ " brass shim stock (.001" thick for 318" engines; .002" thick for 360" engines). Oil shim and place between bearing and connecting rod journal. Install bearing cap and tighten.

2) Rotate crankshaft $\frac{1}{4}$ turn in each direction. If slight drag is felt, clearance is within limits. If no drag is felt, clearance is excessive. If crankshaft cannot be rotated, clearance is not enough.

3) Using Plastigage method, insert a .001" to .003" (Green) piece of plastigage between bearing and connecting rod journal. Install bearing cap and tighten to correct torque specification.

4) Remove bearing cap and compare width of Plastigage with scale on package. If Plastigage width is within specifications, fit with correct undersized bearing.

5) New bearings are available in standard, .001", .002", .003", .010" and .012" undersize. Always install bearings in pairs. Do not use a new bearing with an old bearing. Install connecting rod bearings so formed tang fits into machined groove in connecting rod. Install rod caps and tighten nuts.

Main Bearings — 1) Using either Shim Stock method or Plastigage method, check main bearing clearances one at a time while all other main bearing caps are tight. New bearings are available in standard, .001", .002", .003", .010" and .012" undersize. A new .001" bearing half may be used in combination with a new standard bearing half or a .002" with a .001" bearing.

NOTE — Always use smaller diameter bearing half as the upper bearing.

2) If bearing clearances are not within limits, remove bearing cap, insert suitable tool (C-3509) in oil hole journal and rotate crankshaft clockwise to remove upper bearing half. To install new upper bearing, slightly chamfer sharp edges from plain side and start bearing in place.

3) Install tool and slowly rotate crankshaft counterclockwise, sliding bearing into place. Install main bearing cap with new bearing installed and tighten.

NOTE — Upper main bearings are grooved and lower main bearings are plain. Bearing halves are not interchangeable.

4) Check crankshaft end play and if it is not within the correct specifications, change number three main bearing. This bearing carries thrust load. Recheck crankshaft end play.

REAR MAIN BEARING OIL SEAL

Removal — With oil pan and oil pump removed, remove rear main bearing cap. Remove lower seal by carefully prying from the side with small screwdriver. Remove upper seal by turning suitable tool (C-4148) into end of seal and pulling seal out with tool. Use care not to mar crankshaft.

Installation — 1) Split type rubber seals may be replaced without removing the crankshaft and must be installed as a pair.

2) On 318" engines, insert cap seals into slots in bearing cap. Seal with yellow paint goes into right side (bearing cap in

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engine position). Install seals with narrow sealing edge up. Be certain that edge of cap seals line up exactly with shoulder in bearing cap or leakage will occur.

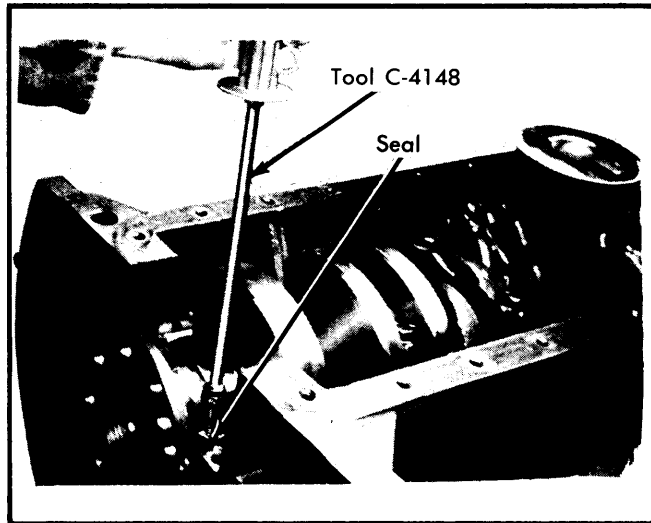


Fig. 10 Using Tool C-4148 to Remove Upper Rear Main Oil Seal

3) Install seal edge toward inside of shoulder. Pull outward on small end of seal until edge lines up with shoulder. Lightly oil lips of crankshaft seals. Rotate half seal into cylinder block with paint stripe toward rear.

CAUTION — Sharp edge of groove in block may shave or nick back of seal. Use care not to damage sealing lip.

4) Place the other half seal in bearing cap with paint stripe toward rear. On 360" engines, apply suitable sealer adjacent to rubber seal. Assemble bearing cap to block immediately after applying sealer and tighten to proper torque. On 318" engines assemble bearing cap to cylinder block and tighten.

CAMSHAFT

ENGINE FRONT COVER

Removal — 1) Drain cooling system and remove water pump assembly and power steering pump. Remove vibration damper bolt and using suitable tool (C-3688), pull damper assembly from end of crankshaft.

2) Remove fuel lines and fuel pump, loosen oil pan bolts, and remove front bolt at each side. Remove cover bolts and front cover.

NOTE — Use extreme caution to avoid damaging oil pan gasket.

Installation — Check that mating surfaces of engine front cover and cylinder block are clean and free from burrs. Install cover and new gasket. Apply $\frac{1}{8}$ " bead of suitable sealer on oil pan gasket. Tighten bolts. Tighten oil pan bolts and install fuel pump, lines and power steering pump. Install vibration damper and water pump assembly. Fill cooling system.

FRONT COVER OIL SEAL

NOTE — 318" and 360" engines use an externally mounted oil seal.

Removal — Remove belts, radiator shroud, pulley and vibration damper. Use suitable tool to pry out old seal. Be careful not to damage crankshaft seal surface or cover.

Installation — 1) Insert threaded shaft (part of tool C-4251) into threads of crankshaft. Place seal with spring toward inside of engine. Place installation adaptor with thrust bearing and nut on shaft.

2) Tighten nut until tool is flush with cover. Reinstall vibration damper, pulley, radiator shroud, and belts. Torque as necessary.

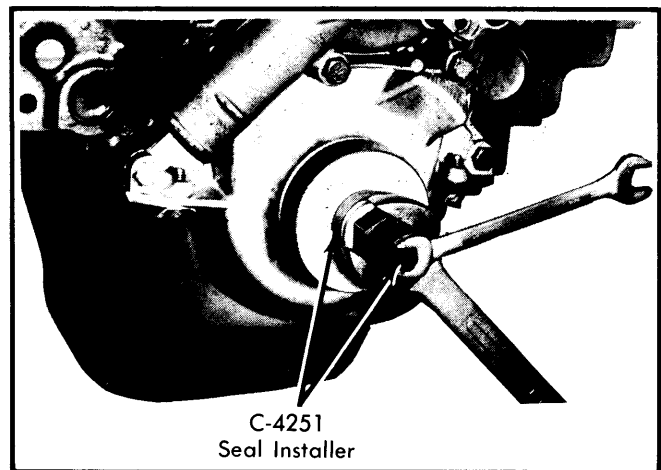


Fig. 11 Using Tool C-4251 to Install Front Cover Oil Seal

TIMING CHAIN

Removal — With front cover removed, remove camshaft sprocket attaching bolt, washer and fuel pump eccentric. Remove timing chain with crankshaft and camshaft sprockets.

Installation — When installing timing chain, use a suitable tool (C-3509) to prevent camshaft from contacting welch plug in rear of engine block. Remove distributor and oil pump-distributor drive gear. Locate tool against rear side of cam gear and attach tool with distributor retainer plate bolt. Then proceed as follows:

1) Place camshaft and crankshaft sprockets on bench with timing marks on imaginary centerline through bore of both sprockets. Place timing chain around both sprockets. Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and camshaft sprocket.

2) Slide both sprockets evenly over their respective shafts (with new chain installed on sprockets). Use a straightedge to measure alignment of timing marks. Install fuel pump eccentric, washer and camshaft sprocket bolt and tighten.

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Chain Stretch Test – 1) Place a measuring scale next to chain to measure movement of chain. Place a torque wrench and socket over camshaft sprocket bolt and tighten to take up slack. Apply 30 ft. lbs. torque in direction of rotation with cylinder heads installed, or 15 ft. lbs. with cylinder heads removed. Block crankshaft to prevent movement.

2) Hold scale next to chain link and apply torque in reverse direction (30 ft. lbs. with heads installed, 15 ft. lbs. with heads removed). Note amount of chain movement. If more than $\frac{1}{8}$ " movement, replace timing chain.

CAMSHAFT

NOTE – Whenever a new camshaft is installed, inspect and check, with a straightedge, all lifter faces for "dishing" wear. Replace any lifters with a negative crown.

Removal – With engine removed from vehicle, remove rocker arm assemblies, push rods and lifters, timing chain and sprockets, distributor with drive shaft, and thrust plate. Note location of oil tab. Install long bolt in front of camshaft to facilitate removal. Carefully remove camshaft to avoid damage to cam bearings.

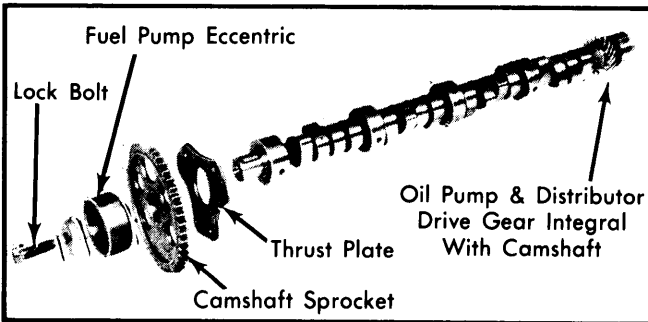


Fig. 12 Camshaft and Related Components

Installation – Lubricate camshaft lobes and bearing journals. Insert camshaft within 2" of its final position in cylinder block. Install suitable tool (C-3509) in distributor drive hole and hold in position using distributor retainer plate bolt. Install camshaft to proper position.

NOTE – Tool will prevent camshaft from being pushed in too far and knocking out camshaft rear plug. Leave tool installed until sprockets and chain are secured.

CAMSHAFT BEARINGS

Removal – Drive out welch plug at rear of block. With suitable driver-installer tool (C-3132A), use proper adapter on tool and drive out old bearings.

Installation – Using correct size adapter on tool, slide new rear bearing over adapter and carefully drive bearing into place. Install remaining bearings in same manner. Oil holes in new bearings must be aligned with oil passages from main bearings. Bearing oil hole index may be checked by inserting a pencil flashlight in the bearing. If oil holes are not in exact alignment, remove bearing and reinstall correctly. Install new welch plug at rear of cylinder block.

CAMSHAFT END THRUST

End thrust is taken up by thrust plate behind camshaft sprocket. End play is .002-.006" with new thrust plate and up to .010" with used thrust plate. If not within specifications, replace thrust plate.

VALVE TIMING

1) Turn crankshaft clockwise until No. 6 exhaust valve is closed and No. 6 intake valve is opening. Insert $\frac{1}{4}$ " spacer between rocker arm pad and valve stem of No. 1 intake valve. Spring load will bleed lifter down to effect a solid lifter lash.

2) Install dial indicator so plunger contacts valve spring retainer in a perpendicular position. Zero indicator. Turn crankshaft clockwise until valve has lifted .010" for 318" engine or .034" for 360" engine.

CAUTION – Do not turn crankshaft any further. Valve spring may bottom and result in damage to rocker arm or push rod.

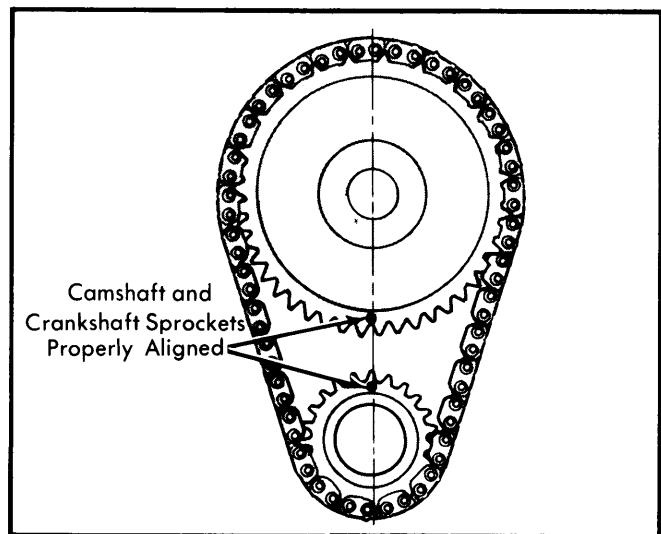


Fig. 13 Camshaft and Crankshaft Timing Chain Sprocket Alignment

3) Timing mark on crankshaft pulley should read from 10° BTDC to 2° ATDC. If reading is not correct, check sprocket index marks, inspect timing chain for wear and check accuracy of DC mark on timing indicator.

ENGINE OILING

Crankcase Capacity – 4 qts. Add 1 qt. with filter change.

Normal Oil Pressure – 30-80 psi at 2000 RPM.

Oil Filter – Change at first oil change and every second oil change after that.

Pressure Regulator Valve – In oil pump. Not adjustable.

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OIL PUMP

Disassemble, clean and inspect all parts for proper clearance. See Fig. 14.

NOTE — Inner rotor and shaft assembly can only be replaced if outer rotor is replaced, as units are matched assemblies.

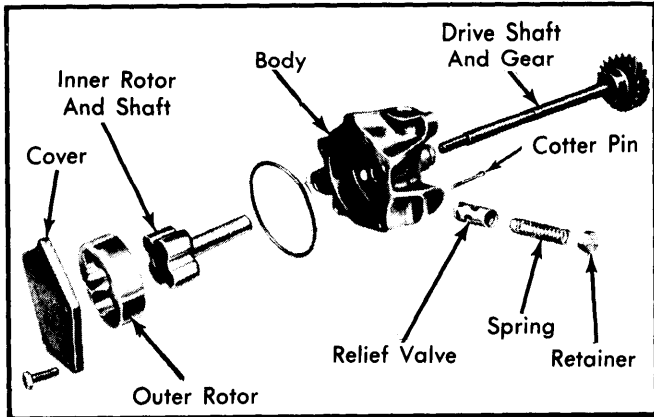


Fig. 14 Exploded View of Oil Pump

Oil Pump Specifications

Application	Measurement
Oil Pump Cover Wear	.0015" Max.
Outer Rotor Thickness	⓪ .825" Min.
Outer Rotor Diameter	2.469" Min.
Inner Rotor Thickness	⓪ .825" Min.
Clearance Over Outer Rotor	.004" Max.
Clearance Over Inner Rotor	.004" Max.
Outer Rotor Clearance	.014" Max.
Tip Clearance Between Rotors	.010" Max.

⓪ — .943" Min. on 360" engine.

Pressure Relief Valve Springs

318" & 360" Engines — Spring has free length of $2\frac{1}{32}$ - $2\frac{3}{64}$ ". Spring should test 16.2-17.2 lbs. when compressed to $1\frac{1}{32}$ ".

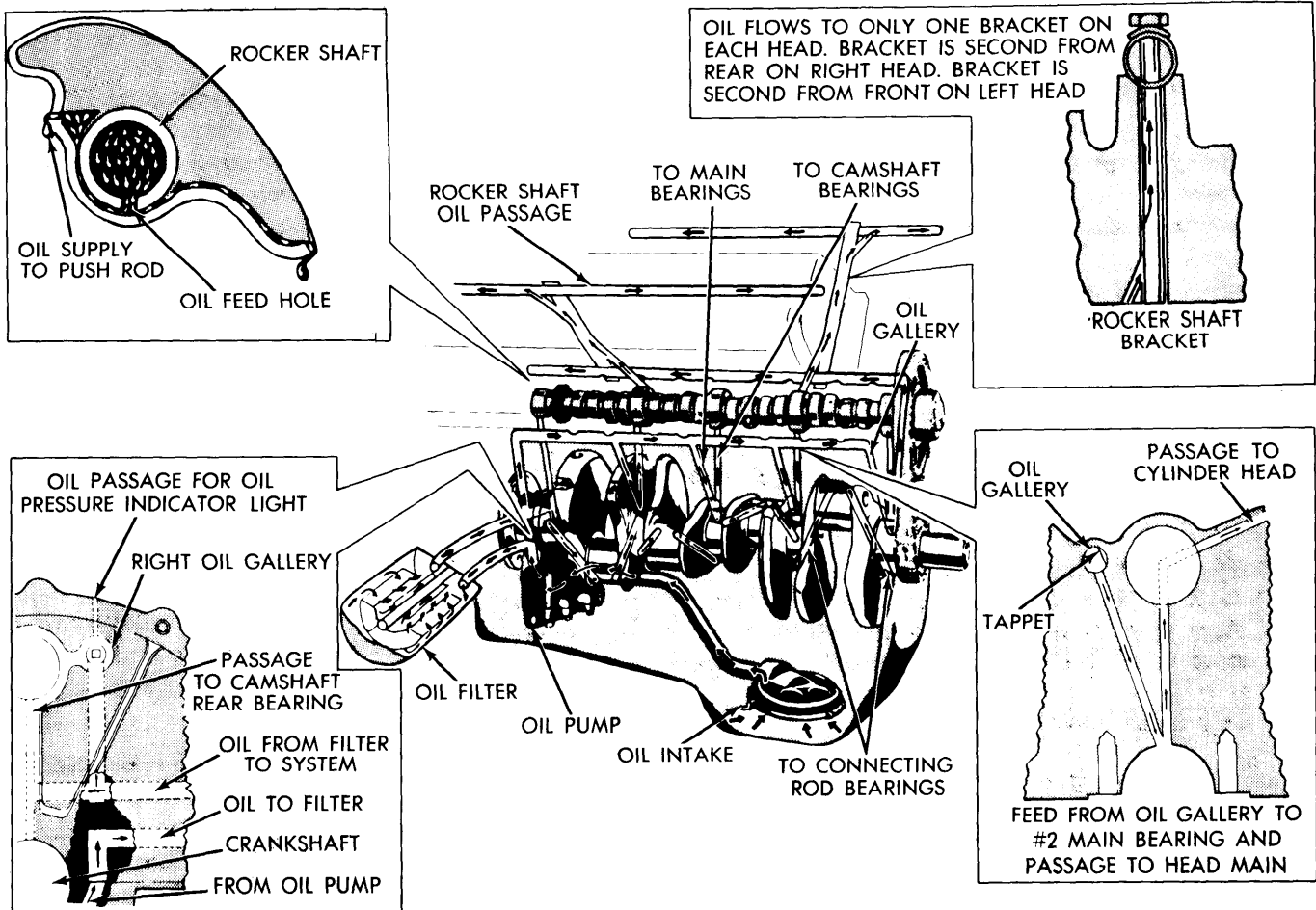


Fig. 15 Engine Oiling System

318" & 360" V8 (Cont.)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS						
Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
318" 2-Bbl.	140@4000	245@1600	8.5-1	3.91"	3.31"	318
318" 4-Bbl.	155@4000	245@1600	8.5-1	3.91"	3.31"	318
360" 2-Bbl.	155@3600	270@2400	8.4-1	4.00"	3.58"	360
360" 4-Bbl.	175@4000	260@2400 ^①	8.0-1	4.00"	3.58"	360

① — Calif. H.P. 170@4000; Torque 310@1600.

VALVES								
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift	
318"	Int.	1.78"	45°	45°	.065-.085"	.372-.373"	.001-.003"	.373"
	Exh.	1.50"	45°	45°	.080-.100"	.371-.372"	.002-.004"	.400"
360"	Int.	1.88"	45°	45°	.065-.085"	.3715-.3725"	.0015-.0035"	.410"
	Exh.	1.60"	45°	45°	.080-.100"	.3705-.3715"	.0025-.0045"	.410"

VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
318"	2.00"	77-88@ 1 ¹¹ / ₁₆ "	170-184@ 1 ⁵ / ₁₆ "
360"	2.10"	108-118@ 1 ²¹ / ₃₂ "	186-200@ 1 ¹ / ₄ "

VALVE TIMING				
Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ALDC)	Open (BLDC)	Close (ATDC)
318"	10°	50°	52°	16°
360"	18°	54°	57°	15°

PISTONS, PINS, RINGS						
Engine	PISTONS	PINS		RINGS		
	Clearance ^①	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
318" & 360"	.0005-.0015" ^②	.00025-.00075"	.0007-.0024 ^③	1 & 2 3	.010-.020" .015-.055"	.0015-.0030" .0002-.0050"

① — Measured from top of piston skirt.

② — .001-.002" on 360" 4-Bbl. engine.

③ — Interference fit. On 360" 4-Bbl., .0007-.0014".

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft End Play	Journal Diam.	Clearance	Side Play
318"	2.4995-2.5005"	.0005-.0020"	No. 3	.002-.009"	2.124-2.125"	.0005-.0025"	.006-.014" ^①
360"	2.8095-2.8105"	.0005-.0020"	No. 3	.002-.009"	2.124-2.125"	.0005-.0025"	.006-.014" ^①

① — Total Two Rods

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ENGINE SPECIFICATIONS (Cont.)

CAMSHAFT			
Engine	Journal Diam.	Clearance	Lobe Lift
318"			
No. 1	1.997-1.999"	.001-.003"
No. 2	1.981-1.983"		
No. 3	1.966-1.968"		
No. 4	1.950-1.952"		
No. 5	1.5595-1.5615"		
360"			
No. 1	1.998-1.999"	.001-.003"
No. 2	1.982-1.983"		
No. 3	1.967-1.968"		
No. 4	1.951-1.952"		
No. 5	1.5605-1.5615"		

TIGHTENING SPECIFICATIONS	
Application	Ft. Lbs.
Camshaft Sprocket	50
Camshaft Thrust Plate	17
Cylinder Head	105
Connecting Rod Cap Nut	45
Crankshaft Bolt	100
Exhaust Manifold	⓪
Flex Plate-to-Converter	23
Flywheel-to-Crankshaft	55
Front Cover	35
Intake Manifold	45
Main Bearing Cap	85
Oil Pan Screw	17
Oil Pump Cover	8
Oil Pump-to-Mount	30
Rocker Arm Bracket Bolt	17
Rocker Arm Cover	3
Vibration Damper	100
Water Pump	30

⓪ — Screw, 20 ft. lbs; Nut, 15 ft. lbs.