

304", 345", & 392" V8 ENGINES

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine Identification Number is located on right bank, upper front corner. The first four digits indicate displacement.

| Application | Code |
|-------------|-------|
| 304" | V-304 |
| 345" | V-345 |
| 392" | V-392 |

ENGINE REMOVAL

See *Engine Removal* at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD

Removal — 1) Drain cooling system, and remove air cleaner. Disconnect battery. Remove upper radiator hose, and heater hoses from intake manifold. Remove A.I.R. hoses (if equipped) and PCV hose. Disconnect fuel line and accelerator linkage.

2) If equipped with air conditioning, remove compressor support brace. Disconnect coil wires. Remove distributor cap and wires at plugs. Remove manifold bolts and remove intake manifold.

Installation — To install intake manifold, clean all gasket surfaces and apply sealer at all water passages. Install intake manifold and tighten bolts. To complete installation of components reverse removal procedure.

CYLINDER HEAD

Removal — 1) Remove intake manifold as previously outlined. If equipped with air conditioning, remove compressor mounting bolts and set compressor aside. Remove alternator, and compressor and alternator mounting bracket. Remove power steering pump and bracket.

2) Remove air injection manifolds (if equipped), and remove exhaust manifolds. Remove water pump-to-cylinder head pipe. Remove rocker cover and tappet cover. Remove rocker arm assembly. **NOTE** — *Special bolts with nylon plugs are used to hold rocker arm assembly in place. In no case should a standard bolt be used in this application. This type bolt provides a seal for the threads in the cylinder head, and prevents oil from entering the intake port, as these holes are drilled directly into the intake port.*

3) Remove push rods. Remove dipstick tube mounting bracket. Drain engine block of all coolant. Remove cylinder head bolts and remove cylinder head. Take care to avoid damaging sealing surfaces on cylinder head and engine block.

Installation — Reverse removal procedure to install cylinder head. Be sure that gasket surfaces on head and cylinder block are clean and that cylinder head bolt threads and threads in block are clean. Tighten cylinder head bolts in sequence shown in Fig. 7. To install remaining components, reverse removal procedure.

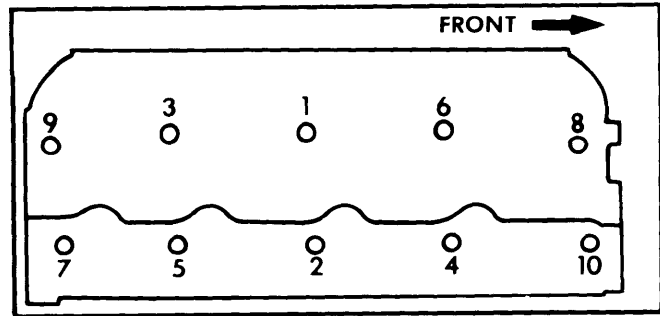


Fig. 1 Cylinder Head Tightening Sequence

VALVES

VALVE ARRANGEMENT

E-I-E-I-E-I-E-I (Left bank, front to rear).
I-E-I-E-I-E-I-E (Right bank, front to rear).

VALVE GUIDE SERVICING

If valve stem clearance is excessive, over .0035", valve guides should be replaced. Remove valve guides using a suitable removal tool (SE-1722). Guides must be driven out from the combustion chamber side through the top of the head. Install valve guides from the top of the cylinder head using a suitable installation tool (SE-1943). Press guides in until specified installed height is obtained.

Valve Guide Installed Height (In.)

| Application | Intake | Exhaust |
|-------------|-----------------|------------------|
| 304" | $\frac{31}{32}$ | $\frac{31}{32}$ |
| 345" | $\frac{31}{32}$ | $\frac{13}{32}$ |
| 392" | $\frac{31}{32}$ | $1\frac{11}{64}$ |

VALVE STEM OIL SEALS

An "O" ring type oil seal is installed on valve stem before valve spring is installed. See *Valve Springs*.

VALVE SPRINGS

Removal — Remove cylinder head. Compress valve spring using suitable valve spring compressor. Remove valve keepers, release spring compressor and remove valve spring retainer and valve spring components. Inspect all parts for undue wear or fatigue, replace if necessary.

Installation — Reinstall all related parts in reverse of removal procedure. Check to ensure all valve springs are fully seated and that valve keepers are firmly in place.

VALVE SPRING INSTALLED HEIGHT

Valve springs are checked in valve spring tension tester. At a test height of 1.429", test pressure should be 188.1±8 lbs. Free length of valve spring is 2.065".

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ROCKER ARM ASSEMBLY

NOTE — On some later model engines, new rocker arm shaft assemblies have been incorporated. This assembly has four less rocker arm shaft support brackets per cylinder head. Brackets and bolts have been replaced by springs and short nylon patch bolts with hardened flat washers to seal previous bolt holes.

Removal & Disassembly — Remove rocker arm assemblies from engine as a unit. On bench, remove rocker arm mounting bolts from supports, and remove supports, rocker arms, and spacers. Keep parts in order. Remove plugs from end of shaft. Clean all parts thoroughly, making sure all oil passages are open. Inspect rocker arm shaft, check for wear or bent condition. Check valve stem contact-pad surface of rocker arm and resurface if necessary. Do not remove more than .010" of material. Check rocker arm bushings for proper clearance on shaft. Clearance should be from .0005-.007", replace rocker arm if excessive wear is indicated.

Reassembly & Installation — To assemble, reverse disassembly procedures, making sure the notches at the end of the rocker arm shaft are facing upward. Also make sure the rocker arm shaft support with the oil feed hole is located third from the rear on the right bank, and third from the front on

the left bank. Rocker arm shaft assemblies are interchangeable with this in mind. Reinstall rocker arm assembly on engine.

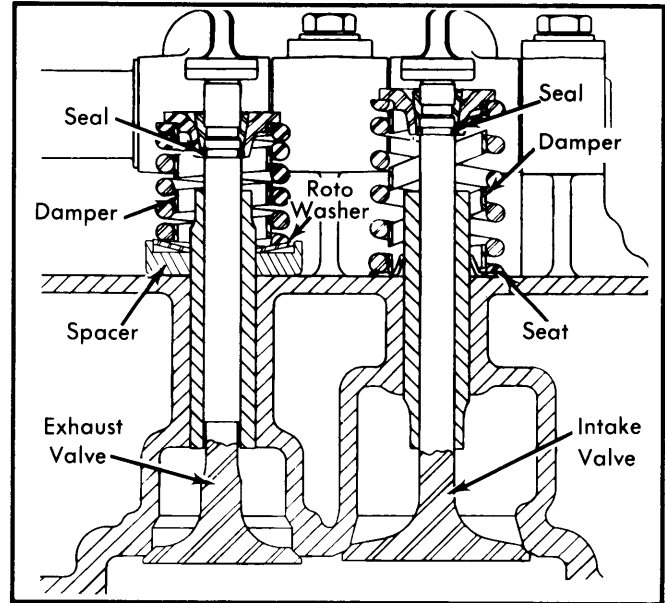
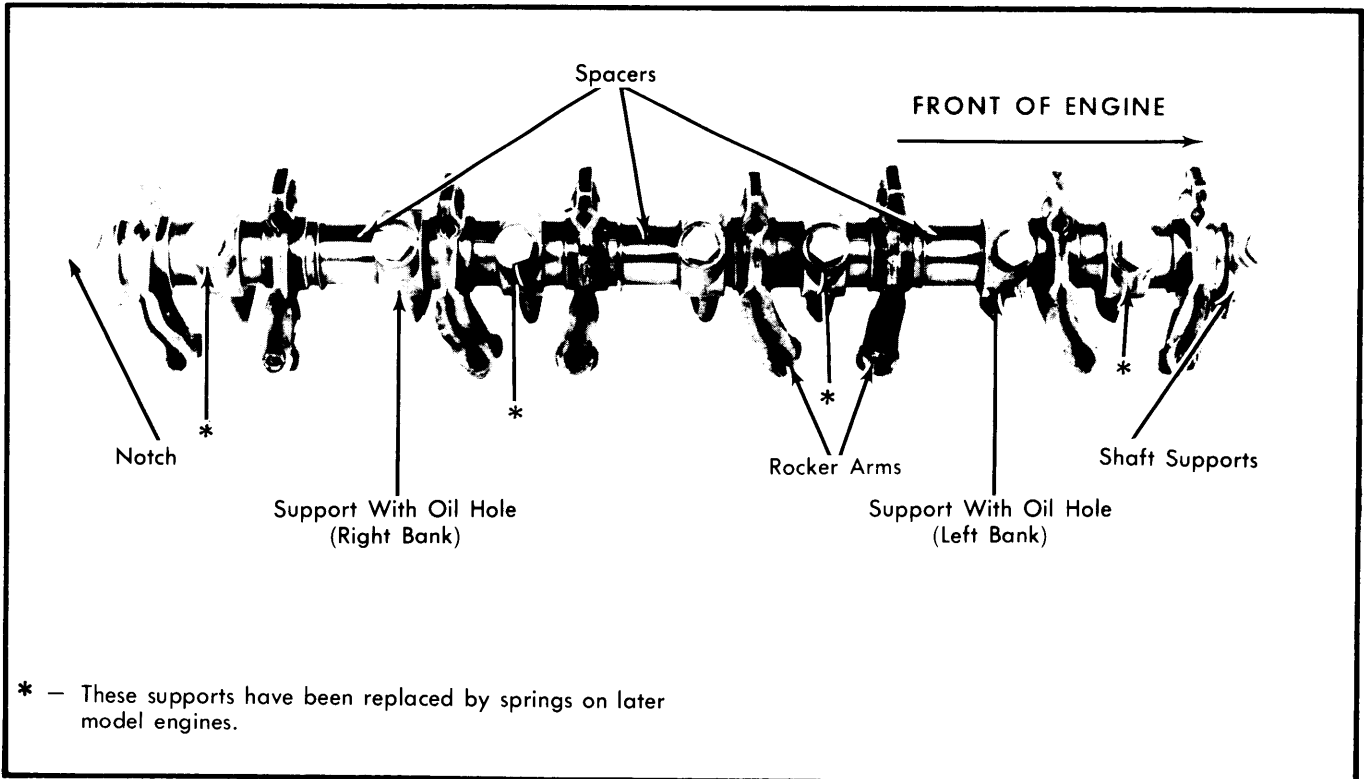


Fig. 2 Cross Section of Valve Assemblies



* — These supports have been replaced by springs on later model engines.

Fig. 3 Rocker Arm Shaft Assembly

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HYDRAULIC VALVE LIFTER ASSEMBLY

NOTE – Two types of valve lifters are used. Lifters operate in the same manner and are serviced basically the same.

Disassembly – Depress plunger in lifter using a push rod, and remove snap ring. Now remove plunger, check valve, and spring.

Reassembly – Thoroughly clean and inspect all lifter components. Inspect plunger and inside bore for scratches. Inspect for nicks on valve seat and for wear on lifter face. Try plunger for free fit in lifter bore. Reassemble all parts in proper sequence, filling lifter body $\frac{1}{3}$ full with clean kerosene for initial running period.

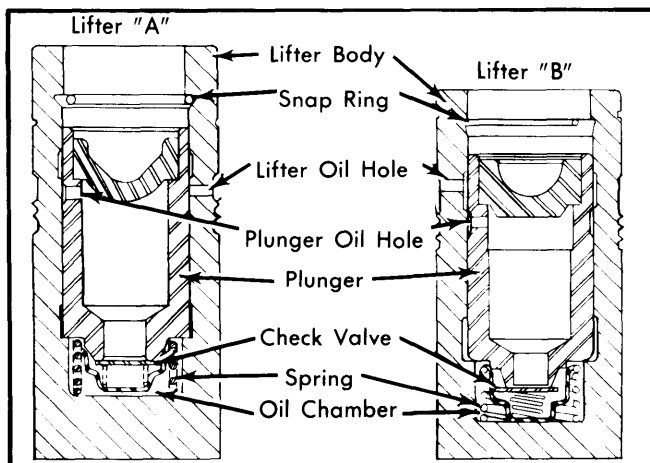


Fig. 4 Cross Section of Hydraulic Valve Lifters

PISTONS, PINS & RINGS

OIL PAN REMOVAL

Procedure is not available from manufacturer.

PISTON & ROD ASSEMBLY

Removal – With oil pan, oil pump, and cylinder heads removed, remove any ridge in top of cylinder bore with a ridge reamer. Check connecting rod and cap for identification marks or numbers. Identify if necessary. Remove connecting rod cap nuts and rod cap. Push piston and rod assembly up and out of cylinder block. It will be necessary to rotate crankshaft to various positions to facilitate removal of piston and rod assemblies.

Installation – Before installing piston and rod assemblies, be sure to stagger ring gaps. Place connecting rod in bore with the large chamfer side of the rod and cap toward the fillet side of the connecting rod journal. Compress piston rings with ring compressor. With rod bearings and crankshaft journal lubricated, push piston and rod assembly into position and install rod cap, being sure numbers match. Install and tighten rod nuts.

FITTING PISTONS

With piston and rod assemblies removed, wipe cylinder bores clean and measure each bore diameter at top and bottom of ring travel at both parallel and at right angles to the crankshaft. If cylinder bore exceeds the limits of .002" out-of-round and .005" taper it must be bored for oversize pistons. Oversize pistons are available in the following sizes: .010", .020", .030", & .040".

To check fit of rings in cylinder bore, push ring in cylinder bore making sure ring is square with bore. Measure ring gap with feeler gauge. Before installing rings on piston, be sure ring grooves are clean. Also check piston ring side clearance.

PISTON PINS

Removal – With piston and rod assembly removed, press out piston pin using suitable removal and installation tool set (SE-1946-1, -2, & -3) and an arbor press. Separate piston from connecting rod. **NOTE** – Tool SE-1946-1 may need some modification for use on 392" components. Modify tool as necessary.

Installation – Check clearance of pin in piston, it should be within .0005-.0009". Position piston on rod so that bearing tangs will be toward the side marked "UP" on the piston. Lubricate piston pin and press in using same tools as were used during removal. Check piston for free movement on piston pin.

MAIN & CONNECTING ROD BEARINGS

NOTE – The following procedures are performed with oil pan and oil pump removed.

Connecting Rod Bearing – 1) Mark or identify rod cap to rod (if unmarked), and remove connecting rod cap bolts. With rod bolts removed, remove connecting rod cap and bearing. Push up on piston and rod assembly and remove bearing shell from rod. Inspect bearings for wear or damage and replace as necessary.

2) Check connecting rod bearing clearance using the Plastigage method. If clearance exceeds specifications, crankshaft must be removed and ground for undersize bearings.

3) To install bearings, clean crankshaft journal and bearing surface in rod. Insert bearing in rod and cap. Lubricate journal and pull piston and rod assembly down, aligning bearing on journal. Install rod cap noting identification marks and evenly tighten rod bolts.

Main Bearings – 1) The crankshaft bearing caps are numbered to identify their position. The number three main bearing cap accommodates a thrust flange. To replace bearings, remove main bearing cap. To remove No. 5 main bearing cap a suitable puller and adapter must be used (SE-1719-.3).

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2) Check crankshaft clearance using the Plastigage method. If clearance exceeds specifications, crankshaft must be removed and ground for undersize bearings.

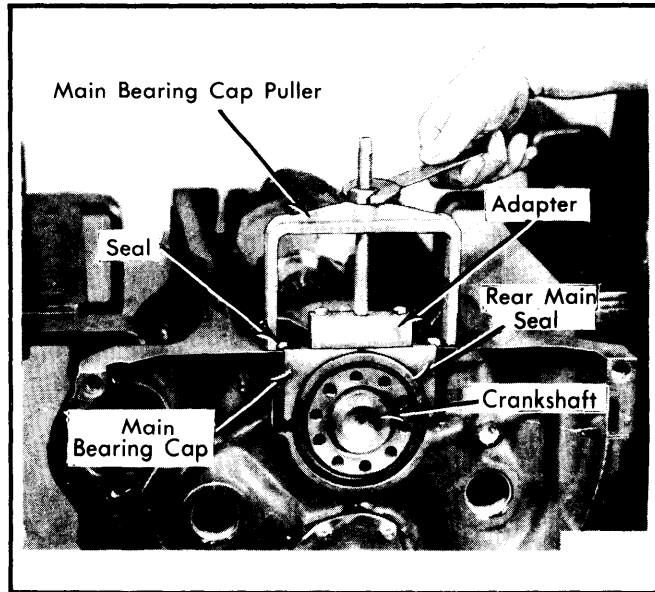


Fig. 5 Removing Rear Main Bearing Cap

THRUST BEARING ALIGNMENT

The No. 3 main bearing controls crankshaft thrust. Pry crankshaft as far forward as possible and check crankshaft end play using a dial indicator. Replace No. 3 main bearing if end play is not to specifications.

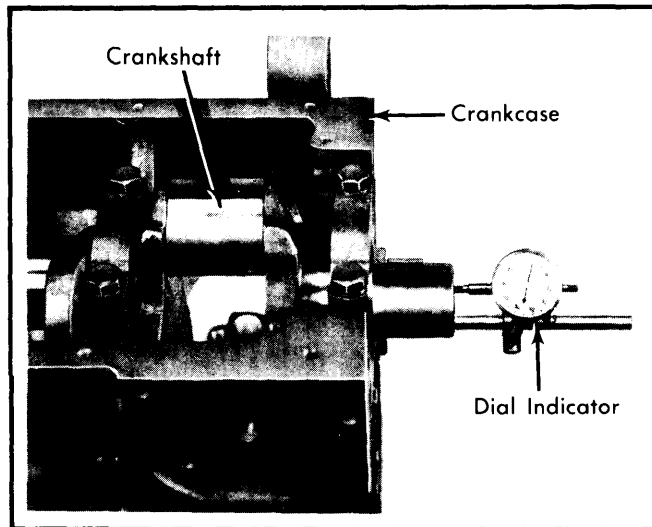


Fig. 6 Checking Crankshaft End Play

REAR MAIN BEARING OIL SEAL

Removal — Transmission, clutch, and flywheel must be removed in order to gain access to oil seal. Pry out seal using a suitable seal removal tool (SE-1941). Position protector plate on crankshaft flange. Insert prying tool in long notch of protec-

tor plate and pry on seal in various positions around seal. Now with seal partially removed, insert prying tool in short notch and pry out seal.

Installation — Position rear main seal on a suitable pilot tool (SE-1942-2). Position pilot on suitable installer tool (SE-1942-1). Place installer and pilot over end of crankshaft and drive seal into position. Seal should now be flush with rear face of cylinder block.

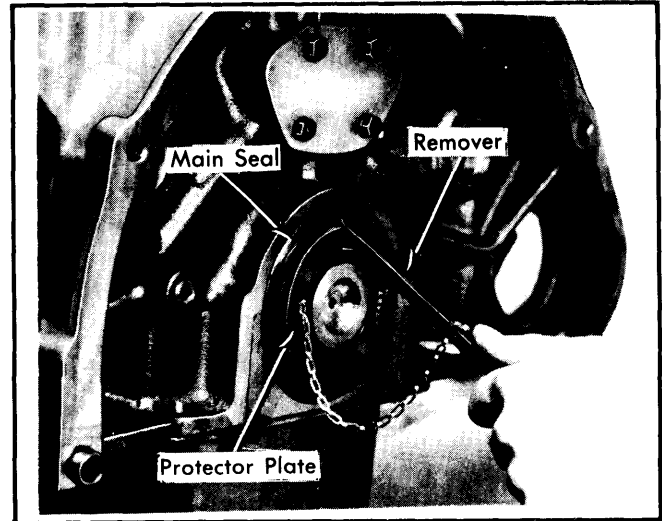


Fig. 7 Removing Rear Main Oil Seal

CAMSHAFT

ENGINE FRONT COVER

Removal — Drain cooling system and remove radiator. Remove fan, water pump pulley, and belts. Remove water pump and both water pipes. Remove fuel pump and fuel line. Remove crankshaft pulley, support engine and remove front motor mount. Remove engine front cover bolts and remove cover.

Installation — Position cover and new gasket on cylinder block. Install cover retaining bolts, but do not tighten. Align front cover to crankshaft with a suitable aligning tool (SE-1949) and tighten bolts. To install remaining components, reverse removal procedure.

FRONT COVER OIL SEAL

Removal — Drain cooling system and remove radiator. Remove drive belts and crankshaft pulley. Use puller tool SE-2091 (or equivalent), and slide hammer to remove seal.

Installation — Coat outside diameter of seal with motor oil, drive seal into place with a suitable driver (SE-1949). To install remaining components, reverse removal procedure.

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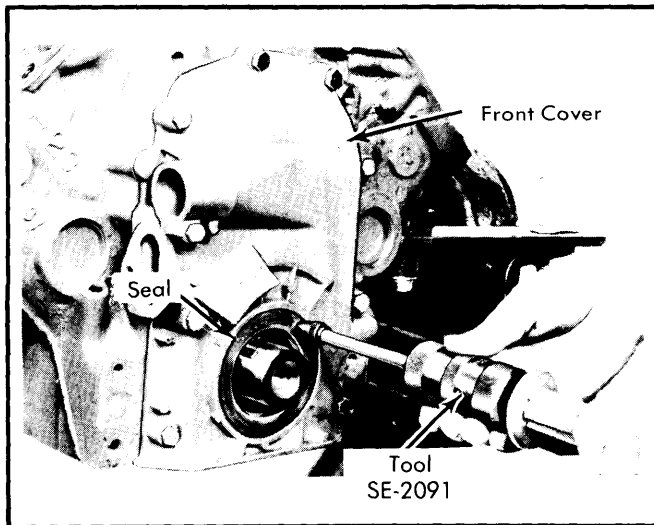


Fig. 8 Removing Front Cover Oil Seal

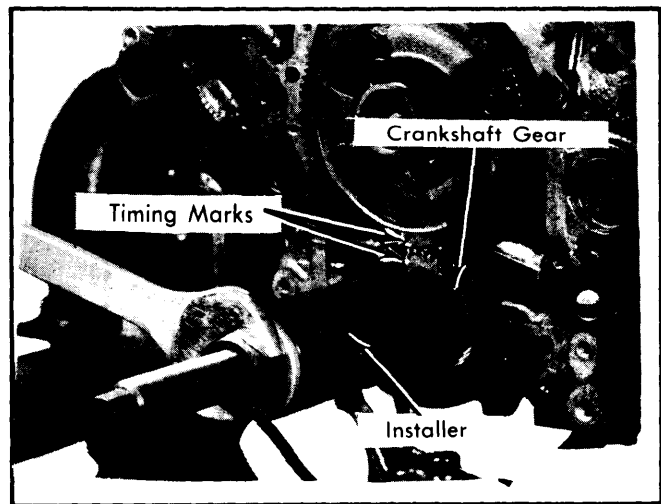


Fig. 10 Installing Crankshaft Gear

TIMING GEARS

Removal – Remove front engine cover as previously outlined. Rotate engine until timing marks on gears are aligned. Remove fuel cam bolt and fuel pump cam. Pull off camshaft gear with a suitable puller (SE-1368) and a heavy steel washer. To remove crankshaft gear use a suitable puller (SE-1368) and an adapter and remove crankshaft gear.

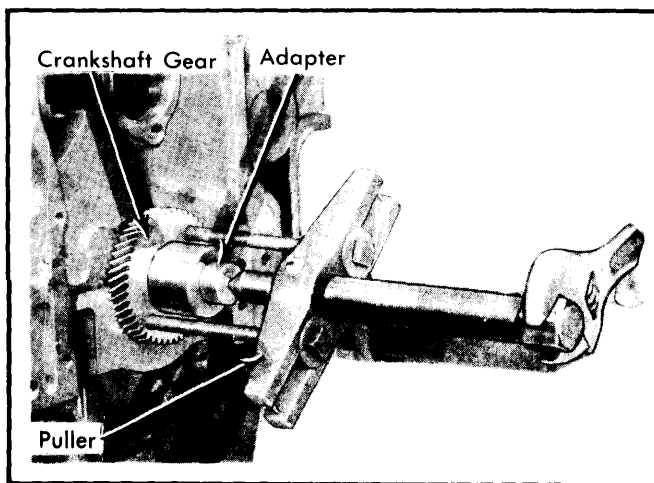


Fig. 9 Removing Crankshaft Gear

Installation – To install camshaft gear, lubricate inside of gear and position on camshaft, aligning gear keyway with key. Press gear into position using a suitable installation tool (SE-1900,-16). Install fuel pump cam and tighten retaining bolt. To install crankshaft gear, lubricate inside of gear and position on crankshaft, aligning gear keyway with key. Press gear into position using a suitable installation tool (SE-1900). Be sure timing marks are aligned.

CAMSHAFT

Removal – Remove rocker arm covers, intake manifold, tappet cover, rocker arm assemblies, and front engine cover as previously outlined. Remove two screws securing camshaft thrust plate to cylinder block. Carefully pull camshaft toward front to remove. Use care not to damage camshaft lobes or camshaft bearings.

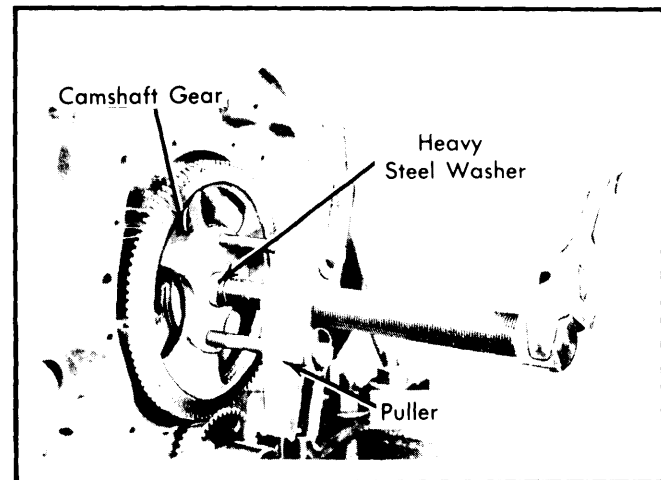


Fig. 11 Removing Camshaft Gear

Installation – Thoroughly clean camshaft and inspect lobes and journals for wear or scoring. To install camshaft, reverse removal procedure.

CAMSHAFT BEARINGS

With camshaft removed, check clearance of camshaft and bearings. If clearance is excessive and camshaft journals are within specifications, bearings must be replaced. Bearings are removed and replaced using a suitable camshaft bearing removal and installation tool set (SE-1897) and a slide hammer. Make sure all holes in camshaft bearings align with holes in cylinder block. Also make sure that none of the bearings interfere with lifter travel.

CAMSHAFT END THRUST

Camshaft end play is controlled by a camshaft thrust plate. If camshaft end play exceeds .014", camshaft thrust plate must be replaced.

IHC V8 Engines

304", 345", & 392" V8 ENGINES (Cont.)

ENGINE OILING

Crankcase Capacity – All engines 5 quarts, add 1 quart with filter change.

Oil Filter – Full-flow, disposable element type. Replace every oil change.

Normal Oil Pressure – Minimum at normal idle, 10 to 20 psi. Maximum at 1800 RPM, 40 to 50 psi.

Pressure Regulator Valve – Mounted in oil pump cover, limits oil pressure to 43 to 51 psi. See *Oil Pump*.

ENGINE OILING SYSTEM

Oil pump, driven by distributor, provides full pressure lubrication to camshaft, crankshaft, and connecting rod bearings. Full pressure lubrication is also provided to valve lifters, push rods, and rocker arm assemblies. Cylinder walls and piston pins are lubricated by splash oil from connecting rod journals. The spring loaded pressure regulator valve limits maximum oil pressure in the system.

OIL PUMP

Disassembly – With oil pump removed, thoroughly clean outside of pump before disassembling. Remove cover retaining bolts and remove cover. Pull pickup tube out of cover. Place pump in press and press drive gear shaft out of sleeve. Remove drive gear and idler gear. Remove cotter pin from cover and withdraw washer, spring, and pressure regulator valve.

Inspection – With pump cover removed and gears and shaft in place, exert thumb pressure against the gears so as to push them away from the outlet side of the pump. While holding gears in this manner, measure clearance between outside diameter of gear and bore of housing. Also check backlash between pump gears. If clearance is not to specifications, replace gears or pump assembly. Also check to be sure pressure regulator valve is not nicked or burred.

Assembly – Coat gears and shaft with oil and install in pump. Check gear end play in pump body. Clearance is determined by gasket between cover and pump body. Add or remove gaskets to obtain correct gear play. Install cover and tighten bolts. Install oil pickup tube and tighten bolt. Lubricate pressure regulator valve and install in cover with chamfered end first. Install spring, washer and cotter pin. Install sleeve on shaft so that the sleeve extends .2" from end of shaft. Now crimp sleeve on shaft to prevent it from moving.

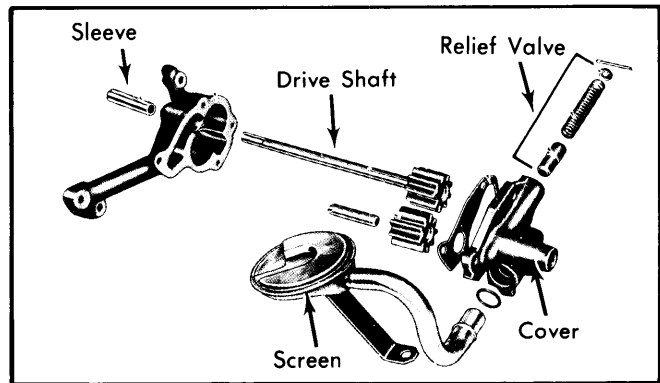


Fig. 12 Disassembled View of Oil Pump

Oil Pump Specifications

| Application | Specification |
|--------------------------------|---------------------|
| Gear End Play..... | .0015-.006" |
| Gear Side Clearance..... | .0007-.0027" |
| Shaft Clearance..... | .001-.0025" |
| Gear Backlash..... | .0107" |
| Pressure Regulator Spring..... | 1.812" @ 13.33 Lbs. |

ENGINE SPECIFICATIONS

| GENERAL SPECIFICATIONS | | | | | | | |
|------------------------|-----------------|------------|-----------|--------------------------|--------------|--------|--------|
| Year | Displ. Cu. Ins. | Carburetor | HP at RPM | Torque (Ft. Lbs. at RPM) | Compr. Ratio | Bore | Stroke |
| 1978 | 304" | 2-Bbl. | 141@4000 | 243@2400 | 8.19:1 | 3.875" | 3.219" |
| | 345" | 2-Bbl. | 158@3600 | 288@2000 | 8.05:1 | 3.875" | 3.656" |
| | 392" | 4-Bbl. | 172@3600 | 288@2400 | 8.02:1 | 4.125" | 3.656" |

| VALVES | | | | | | | | |
|----------------|------------|------------|------------|------------|---------------|----------------|-------------|-------|
| Engine & Valve | Head Diam. | Face Angle | Seat Angle | Seat Width | Stem Diameter | Stem Clearance | Valve Lift | |
| 304" & 345" | Int. | | 45° | 45° | .063-.094" | .372-.373" | .001-.0035" | |
| | Exh. | | 45° | 45° | .078-.109" | .3715-.3725" | .0015-.004" | |
| 392" | Int. | | 30° | 30° | .063-.094" | .372-.373" | .001-.0035" | |
| | Exh. | | 45° | 45° | .078-.109" | .414-.415" | .0015-.004" | |

IHC V8 Engines

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304", 345" & 392" V8 ENGINES (Cont.)

ENGINE SPECIFICATIONS (Cont.)

| PISTONS, PINS, RINGS | | | | | | |
|----------------------|-----------|--------------|--------------|-------------------------|--|---|
| Engine | PISTONS | PINS | | RINGS | | |
| | Clearance | Piston Fit | Rod Fit | Rings | End Gap | Side Clearance |
| 304" & 345" | .0035" | .0005-.0009" | .0006-.0012" | No. 1 No. 2 No. 3 | .010-.020" .010-.020" .015-.055" | .0015-.003" .0015-.003" .000-.0084" |
| 392" | .0035" | .0005-.0009" | .0006-.0012" | No. 1 No. 2 No. 3 | .013-.023" .013-.023" .013-.028" | .0015-.003" .0015-.003" .002-.0035" |

| CRANKSHAFT MAIN & CONNECTING ROD BEARINGS | | | | | | | |
|---|----------------|------------|----------------|---------------------|-------------------------|--------------|------------|
| Engine | MAIN BEARINGS | | | | CONNECTING ROD BEARINGS | | |
| | Journal Diam. | Clearance | Thrust Bearing | Crankshaft End Play | Journal Diam. | Clearance | Side Play |
| 304", 345" & 392" | 2.7484-2.7494" | .001-.004" | No. 3 | .003-.008" | 2.373-2.374" | .0011-.0036" | .008-.016" |

| VALVE SPRINGS | | | |
|-------------------|-------------|-----------------|------------|
| Engine | Free Length | PRESSURE (LBS.) | |
| | | Valve Closed | Valve Open |
| 304", 345" & 392" | 2.065" | | |

| CAMSHAFT | | | |
|-------------------|---------------|--------------|-----------|
| Engine | Journal Diam. | Clearance | Lobe Lift |
| 304", 345" & 392" | | | |
| No. 1 | 2.099-2.100" | .0015-.0035" | |
| No. 2 | 2.089-2.090" | | |
| No. 3 | 2.079-2.080" | | |
| No. 4 | 2.069-2.070" | | |
| No. 5 | 2.059-2.060" | | |

| TIGHTENING SPECIFICATIONS | |
|---|----------|
| Application | Ft. Lbs. |
| Main Bearing Bolts..... | 75-85 |
| Connecting Rod Bolts..... | ① 45-55 |
| Cylinder Head Bolts..... | 90-100 |
| Intake Manifold Bolts..... | 25-30 |
| Camshaft Gear Nut..... | 55-65 |
| Camshaft Thrust Flange..... | 14-16 |
| Flywheel Bolts..... | 45-55 |
| Crankshaft Pulley Bolt..... | 100-110 |
| Rocker Arm Shaft Bolts..... | ② 25-30 |
| ① — 392" Engine 40-45 Ft. Lbs. | |
| ② — On later model engines with springs in place of supports 13-16 ft. lbs. | |