

2.5L 4-CYLINDER ENGINE

IDENTIFICATION CODING

ENGINE IDENTIFICATION

The 3 character engine identification code is stamped into the rear top left-hand corner of engine block. In addition, engines built for sale in Georgia and Tennessee have a non-repeating number stamped into the left rear block flange.

Engine Identification Codes

Application	Code
2.5L (151")	
Federal Man. Trans. without A/C	WCP, WFM
Calif. Man. Trans. without A/C	WCU
Federal Auto. Trans. without A/C	WCT, WFP
Calif. Auto. Trans. without A/C	WCW, WFS

ENGINE REMOVAL

See *Engine Removal* at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD

Removal – 1) Disconnect battery cable. Remove air cleaner and PCV valve. Drain cooling system. Disconnect throttle linkages, vacuum lines, fuel lines, and electrical connections to carburetor. Remove carburetor and carburetor spacer.

2) Remove heater hose at intake manifold. Remove alternator noting position of spacers for installation. Remove manifold-to-cylinder head bolts, and remove manifold.

Installation – 1) Install manifold and gasket on cylinder head. Start all bolts and finger tighten only.

2) Torque manifold-to-cylinder head bolts using torque sequence shown in Fig. 1. Reverse removal procedure to complete installation.

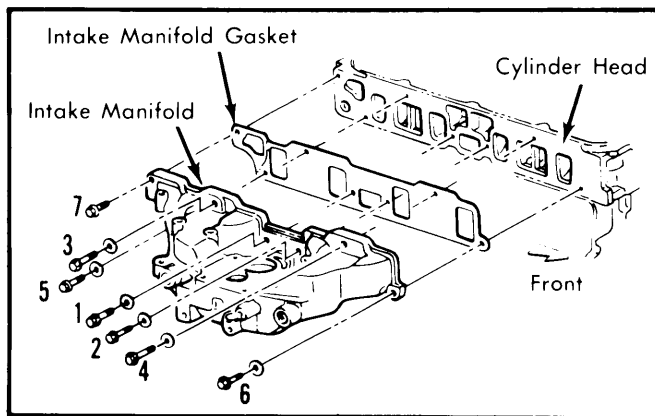


Fig. 1 Intake Manifold Bolt Torque Sequence

EXHAUST MANIFOLD

Removal – 1) Remove air cleaner and carburetor preheat tube. If equipped, remove oxygen sensor. Remove oil dipstick tube attaching bolt.

2) Disconnect exhaust pipe from manifold. Remove exhaust manifold bolts, and remove manifold.

Installation – 1) Install manifold and gasket on cylinder head. Start all bolts and finger tighten only.

2) Torque manifold-to-cylinder head bolts using torque sequence shown in Fig. 2. Reverse removal procedure to complete installation.

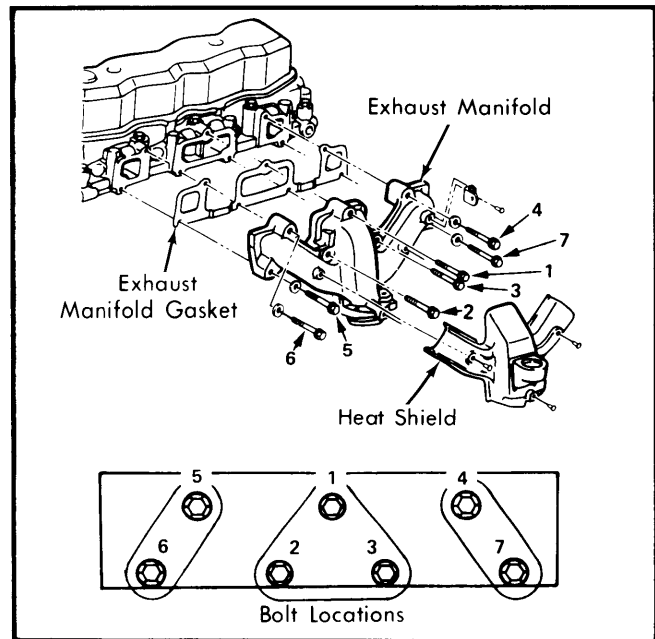


Fig. 2 Exhaust Manifold Bolt Torque Sequence

CYLINDER HEAD

Removal – 1) Disconnect battery cable. Remove air cleaner, PCV valve, spark plugs and wires, and cylinder head cover.

2) Drain cooling system and remove upper radiator hose. Remove intake and exhaust manifolds as previously described.

3) Remove alternator. Remove air conditioning and power steering units if equipped. Disconnect and identify all electrical leads and connections to cylinder head. Remove oil dipstick.

4) Remove rocker arm assemblies and push rods. Note and mark their positions for installation in their original positions.

5) Remove cylinder head bolts and dislodge cylinder head by inserting a bar into alternator bracket and prying upward. Place cylinder head on 2 blocks of wood to prevent damage to valves.

Installation – 1) Make sure gasket surfaces are clean of foreign matter and free of nicks. Install new gasket in position over dowel pins on cylinder block. Carefully install cylinder head over dowel pins and gasket.

NOTE – Make sure all cylinder head bolt threads are clean and oiled. (If the threads are dirty correct torque cannot be achieved).

2) Coat threads and underside of cylinder head bolts with sealer and install in cylinder head finger tight. Gradually tighten bolts following the sequence in Fig. 3. Reverse removal procedures to complete installation.

2.5L 4-CYLINDER ENGINE (Cont.)

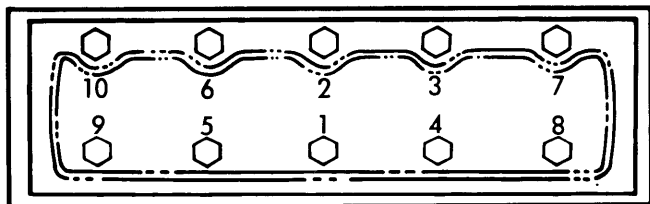


Fig. 3 Cylinder Head Tightening Sequence

VALVES

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

1) With cylinder head and rocker assemblies removed, use spring depressing tool (J-5892-1 or equivalent) to depress valve springs and remove locks. Release tool and remove spring cap, spring shield, spring, and oil seal. Remove valves from cylinder head and place in rack in proper sequence.

2) After cleaning, measure valve stem diameters at top, middle, and at bottom. Exhaust valves are tapered, and are approximately .001" larger at the top than at head end. Using a telescoping gauge, measure valve guide bore diameter and subtract reading from bore diameter reading.

3) If clearance is not within specifications, use next oversize valve stem size, and ream valve guide to fit using a suitable reamer. Valves are available in standard, .003", and .005" oversize.

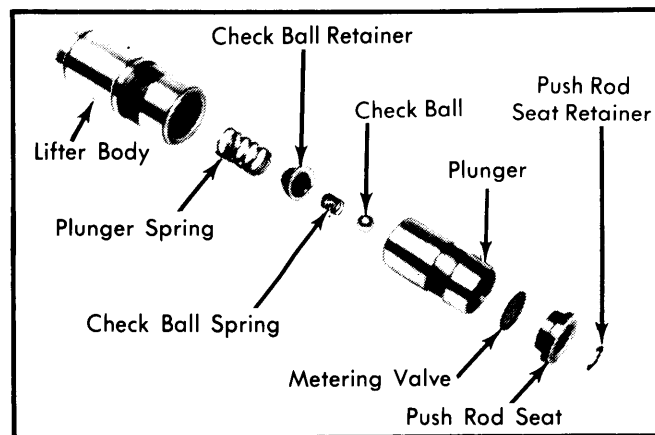


Fig. 4 Hydraulic Valve Lifter Assembly

VALVE STEM OIL SEALS

Oil seals are used on all valve stems, and should be replaced when valve service is performed. To install, set valve shield, spring, and cap in place. Compress valve spring with compressing tool (J-5892-1). Install oil seal in lower groove of stem ensuring it is flat and not twisted. Install locks and release compressing tool.

VALVE SPRINGS

NOTE — Although normal maintenance is performed with head removed, it is possible to replace stem seals, keepers, retainers, or broken springs with cylinder head installed.

Removal — 1) Remove cylinder head cover and rocker arm of valve to be serviced. Remove spark plug and install adaptor (J-

22974 or equivalent) in spark plug hole. Apply a minimum constant air pressure of 90 psi.

2) Using a spring compressor (J-5892-1 or equivalent) compress valve spring and remove locks. Remove tool, cap, shield, spring, and oil seal.

Installation — To complete installation, reverse removal procedures.

VALVE SPRING INSTALLED HEIGHT

Installed height of valve spring must not exceed specifications. Measure spring height from surface of cylinder head pad to underside of spring retainer. If installed height exceeds specifications, install spacer(s) below spring to reduce height to specifications.

HYDRAULIC VALVE LIFTERS

Valve lifters are serviced as complete units, and parts are not interchangeable between lifters. Inspect for signs of scuffing on barrel and face of lifter body. Inspect lifter face and cam lobe for concave wear or pitting, and if present, replace camshaft or lifters as necessary. If lifters are disassembled for cleaning or inspection, (see Fig. 4 for arrangement of parts) they should be tested using a suitable leak-down tester according to manufacturers instructions. Leak-down should take between 12 and 90 seconds. Replace any lifter not within specification.

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. Install used pistons in same cylinders from which they were removed.

NOTE — Piston should be at bottom of stroke and covered with a cloth to collect cuttings.

Removal — 1) With cylinder head and oil pan removed, use a ridge reamer to remove any ridge or deposits from upper end of cylinder bore.

2) Check connecting rod and piston for proper identification and mark if necessary. Remove bearing cap. Remove piston and rod assembly through top of cylinder block, taking care not to damage cylinder wall or crankshaft journal.

Installation — 1) Lightly coat cylinder bores and pistons with oil. Insure ring gaps are evenly spaced and marked side of compression ring is facing upward.

2) Install ring compressor on piston, insuring ring gap spacing does not change. Using suitable tool, gently tap piston assembly into correct cylinder bore, taking care not to damage cylinder bore.

NOTE — Notches in top of piston must face front of engine, and raised notch on bearing end of connecting rod points to rear of engine.

3) Install bearing caps and tighten nuts. Reverse removal procedure to complete installation.

2.5L 4-CYLINDER ENGINE (Cont.)

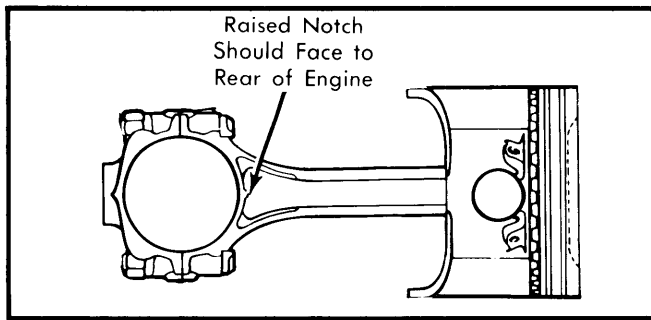


Fig. 5 Making Sure Connecting Rod and Piston Assembly are Properly Indexed

FITTING PISTONS

1) Using an inside micrometer, measure bore of each cylinder crosswise to block to determine smallest diameter. Measure piston skirt diameter perpendicular to piston boss approximately 2" from crown. If clearance is excessive, reboring and oversize pistons are necessary.

NOTE — Measure block and pistons at room temperature, or improper fitting will result.

2) Pistons and rings are available in standard, .005", .010", .020", and .030" oversize. When selecting rings, make sure they correspond to the piston size. Check end gap by placing a ring in lower end of ring travel area in cylinder bore. Level ring and check end gap with a feeler gauge.

NOTE — An incorrect ring gap indicates the wrong rings are being used. It should not be necessary to alter ring gap by filing.

3) Install rings with end gaps 120° apart using appropriate ring installation tool. Check side clearance of rings in ring groove. If side clearance is excessive, it is necessary to replace piston.

PISTON PINS

Piston pins are a press fit in rods. The piston pin specification for fit in piston is .0002-.0004". When determining fit, piston and pin must be at room temperature, and pin must gravity fall from piston.

CRANKSHAFT AND ROD BEARINGS

NOTE — Bearings may be replaced with either the crankshaft installed or removed from engine. Always replace bearings in pairs. Do not shim or mix bearing size, or use a new bearing with an old one.

MAIN & CONNECTING ROD BEARINGS

Connecting Rod Bearings — 1) Before removal of rod caps, stamp side of connecting rod and cap with corresponding cylinder number to assure matched reassembly. With oil pan and oil pump removed, turn crankshaft and rod to be serviced to bottom of stroke.

2) Remove connecting rod cap and bearing and push piston assembly up far enough to remove upper bearing shell.

3) Measure crankshaft journal for out-of-round and taper, and check for any damage. Using Plastigage method, measure

bearing clearances and replace bearings as necessary. Bearings are available in standard, .001", .002", and .003" under-size.

4) Coat bearing surfaces with oil, and install inserts in rod and bearing cap. Tap each rod lightly (parallel to journal) to ensure they have proper clearance. Reverse removal steps to complete installation.

Main Bearings (Crankshaft Removed) — 1) Remove main bearing inserts from engine block and bearing caps. Measure main bearing journals with a micrometer and check for excessive wear or damage. Using Plastigage method, measure bearing clearances and replace bearings as necessary.

2) Coat bearings with oil and position in engine block and main bearing caps. Install crankshaft and caps with arrows pointing towards rear of engine.

Main Bearings (Crankshaft Installed) — 1) With oil pan, oil pump and spark plugs removed, remove cap from main bearing requiring replacement and remove lower bearing insert from cap.

2) Insert upper main bearing insert removal and installation tool in oil hole in crankshaft journal. If tool is not available, tool may be fabricated from a 7/64" cotter pin. See Fig. 6.

3) Rotate crankshaft clockwise as viewed from front of engine. This will roll upper bearing insert out of block.

4) Apply oil to replacement bearing insert and position plain (unnotched) end between crankshaft and notched side of block. Rotate crankshaft to pull bearing into place, and remove tool from oil hole in crankshaft journal.

5) Apply oil to lower bearing insert, and place in bearing cap. Install main bearing cap with arrows pointing toward rear of engine. Complete installation in reverse of removal procedure.

THRUST BEARING ALIGNMENT

Measure crankshaft end play (see specifications) by forcing the crankshaft to the extreme front position. Measure at front end of thrust bearing with a feeler gauge, if not within specifications thrust bearing must be replaced.

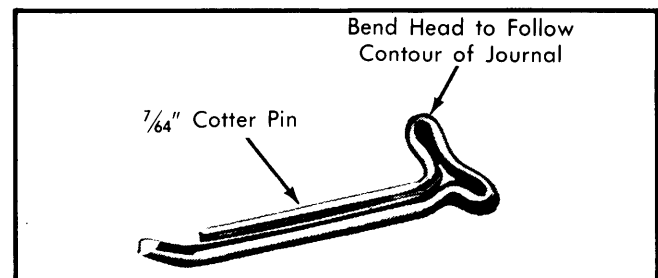


Fig. 6 Fabricated Upper Main Bearing Removal and Installation Tool

REAR MAIN BEARING OIL SEAL

Removal — 1) Remove transmission, clutch housing and flywheel.

2) Remove rear main bearing oil seal by prying it out with a screwdriver taking care not to scratch crankshaft.

2.5L 4-CYLINDER ENGINE (Cont.)

Installation — Coat new seal with engine oil and install with lip toward front of engine. Seat seal firmly in place. Install flywheel, clutch housing and transmission.

CAMSHAFT

FRONT COVER

Removal — 1) Remove alternator and fan belts, or power steering belt if equipped. Remove crankshaft vibration pulley center bolt and slide damper and damper hub from shaft.

2) Remove alternator bracket, fan, and shroud. Remove oil pan-to-timing case cover bolts. Pull cover slightly forward, only enough to permit cutting of oil pan seal.

3) Using a sharp knife or other suitable cutting device, cut oil pan front seal flush with engine block at both sides of cover. Remove front cover.

Installation — 1) Clean mating surfaces of block and front cover. Cut tabs from replacement oil pan front seal, (see Fig. 7) and install seal on front cover. Coat gasket with sealer and place in position on cover. Apply a $\frac{1}{8}$ " bead of sealant to joint formed at cylinder block and oil pan.

2) Install alignment tool (J-23042 or equivalent) in front cover seal, and position front cover to block. Install and partially tighten 2 oil pan-to-front cover bolts.

NOTE — Use of an alignment tool is necessary so seal damage does not result from vibration damper installation, and to ensure correct seal position around hub.

3) Install and tighten all cover-to-block attaching bolts, and remove alignment tool. Reverse steps to complete installation.

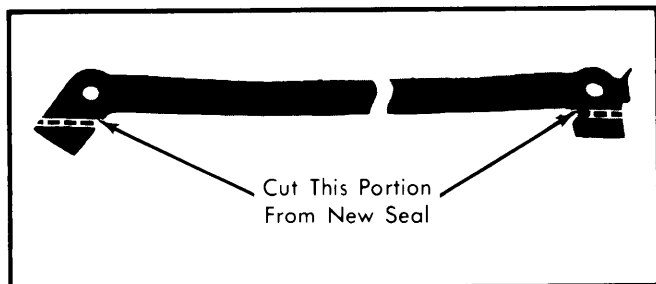


Fig. 7 Oil Pan Seal Modification

FRONT COVER OIL SEAL

Removal & Installation — 1) With vibration damper removed, pry oil seal from front cover using care not to damage cover.

2) Position new seal with lip toward rear of engine. Drive into cover using installer (J-23042 or equivalent).

3) Lightly coat oil seal contact area of balancer with engine oil. Position balancer on crankshaft and push it onto the crankshaft until it bottoms, install center bolt and torque. Reverse removal procedure to complete installation.

NOTE — Apply a locking agent to damper-to-hub bolts before installation.

CAMSHAFT & TIMING GEAR

Removal — 1) Remove air cleaner and drain cooling system. Remove front cover. Disconnect radiator hoses, and remove radiator. Remove valve cover, rocker arms, push rods, and hydraulic lifters, making sure to place them in proper order for installation. Remove distributor, fuel pump, and oil pump drive (see Fig. 8).

2) Remove 2 camshaft thrust plate bolts through holes in camshaft gear (see Fig. 9). Remove camshaft assembly by pulling out through front of block. Support camshaft carefully when removing to prevent damage to camshaft bearings.

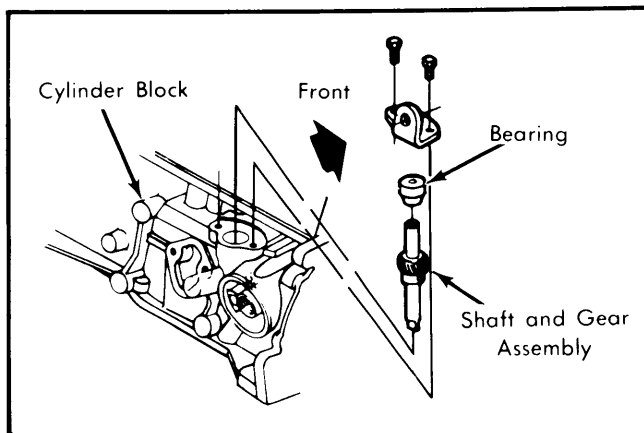


Fig. 8 Removing Oil Pump Drive Shaft

3) If gear must be removed from camshaft, use press plate and appropriate adaptor with hydraulic press. Press shaft out of gear.

NOTE — Thrust plate must be properly aligned to ensure Woodruff key in camshaft does not damage thrust plate when the shaft is pressed out of gear.

Installation — 1) Install gear spacer ring and thrust plate over end of camshaft, and install Woodruff key in shaft keyway.

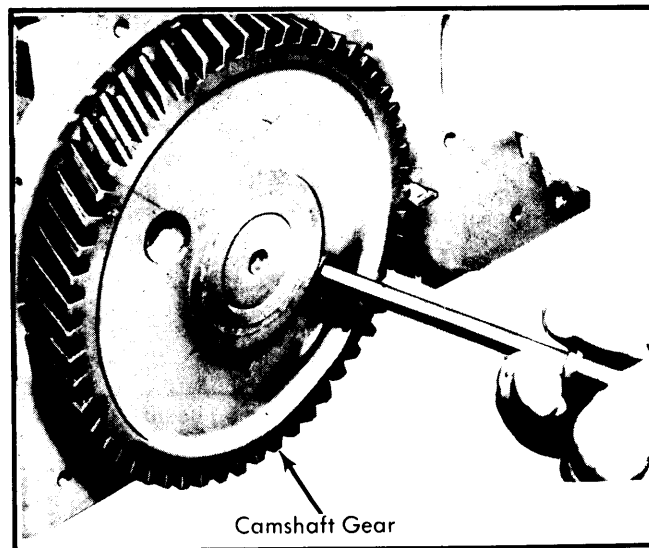


Fig. 9 Removing Thrust Plate Attaching Bolts

2.5L 4-CYLINDER ENGINE (Cont.)

2) Install camshaft gear and press onto camshaft until it bottoms against spacer ring. Measure end clearance of thrust plate, it should be .0015-.005". If less than .0015", spacer ring should be replaced. If more than .005", thrust plate should be replaced.

3) Coat camshaft journals with engine oil and install camshaft in engine block being careful not to damage camshaft bearings. Align timing marks by rotating camshaft and crankshaft until valve timing marks on gear teeth will line up. Engine is now timed in the number 4 cylinder firing position.

4) Install 2 camshaft thrust screws and torque to 7 ft. lbs. Reverse removal procedure to complete assembly.

CAMSHAFT BEARINGS

Removal – 1) Remove engine and place on suitable stand. Remove flywheel and camshaft, drive out rear expansion plug from inside out.

2) Using bearing remover J-21473-1, drive out front bearing toward rear and rear bearing toward front. Install extension J-21054-1 and drive center bearing out toward rear.

Installation – 1) Install bearings using reverse procedure, ensuring that oil holes line up in camshaft and engine block.

2) Install front camshaft bearing approximately $\frac{1}{8}$ " behind front of engine block to expose oil hole for timing gear oil nozzle. Reverse removal procedures to complete installation.

ENGINE OILING

Crankcase Capacity – 3 quarts, with or without oil filter.

Oil Filter – Disposable, full-flow. Change every 15,000 miles or 15 months.

Normal Oil Pressure – 36-40 psi at 2000 RPM with engine at normal operating temperature.

Pressure Regulator Valve – Non-adjustable; located in oil pump body.

ENGINE OILING SYSTEM

Engine lubrication is accomplished through a gear type pump which picks up oil from the oil pan sump, pumps it through the full flow oil filter and into oil passage which runs along the right side of the block and intersects the lifter bosses. Oil is then routed to the camshaft and crankshaft bearings through smaller drilled passages. Oil is supplied to the rocker arms through the hydraulic lifters which feed oil up the push rod tubes to the rocker arms. Bypass valves are located in the pickup screen, oil filter mounting and oil pump to allow for any clogged or restricted conditions. Many internal parts have no direct oil feed and rely on gravity or splash oiling from other direct feed components. Oil returns to the sump through oil return holes in cylinder head and block. See Fig. 10.

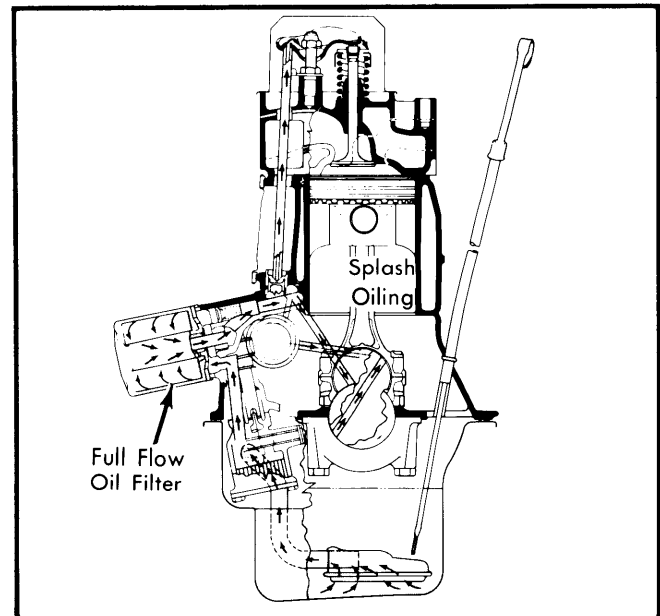


Fig. 10 Engine Oiling System

OIL PUMP

1) Oil pump is located in oil sump, oil pan must be removed for access. See *Oil Pan Removal at end of ENGINE Section.*

2) Remove 2 flange bolts and nut from main bearing cap bolt. Remove oil pump and screen as an assembly. Do not disturb oil pickup tube on screen or pump body. Disassemble pump and inspect for excessive wear or cracks. Replace oil pump as a unit if parts are defective or not within specifications. See Fig. 11.

Oil Pump Specifications

Application	Clearance
Gear-to-Body004" Maximum
Gear End Clearance002-.005"

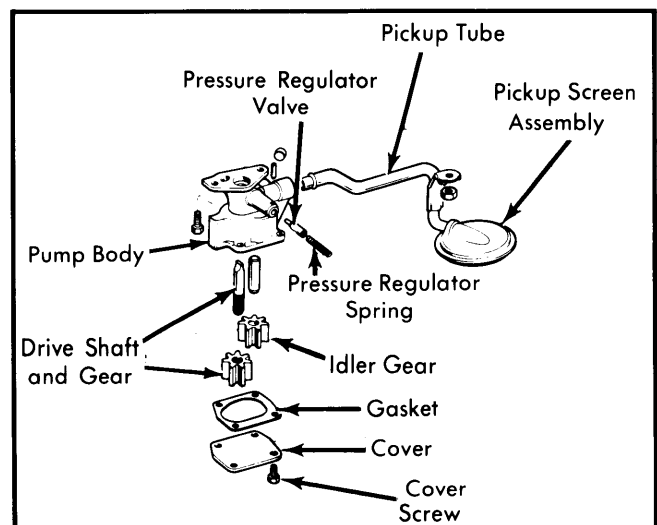


Fig. 11 Exploded View of Engine Oil Pump Assembly

Jeep 4 Engines

7-95

ENGINES

2.5L 4-CYLINDER ENGINE (Cont.)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine	Net HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
2.5L	86@4000	128@2800	8.24:1	4.00"	3.00"	151"

VALVES

Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
2.5L Int.	1.72"	45°	46°	.0353-.0747"	.3418-.3425"	.0010-.0027"	.406"
2.5L Exh.	1.50"	45°	46°	.0580-.0971"	.3418-.3425"	⓪.0010-.0027"	.406"

⓪ — Measured at top of guide. Bottom is .0020-.0037".

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
2.5L	⓪.0025-.0033"	.0003-.0005"	Press Fit	1	.010-.022"	.003"
				2	.010-.028"	.003"
				3	.015-.055"	.003"

⓪ — Top clearance. Bottom clearance is .0017-.0041".

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft End Play	Journal Diam.	Clearance	Side Play
2.5L	2.2988"	.0005-.0022"	No. 5	.0035-.0085"	2.000"	.0005-.0026"	.017"

VALVE TIMING

Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
2.5L	33°	79°	74°	38°

VALVE SPRINGS

Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
2.5L	78-86@1.66"	172-180@1.254"

CAMSHAFT

Engine	Journal Diam.	Clearance ^⓪	Lobe Lift
2.5L	1.869"	.0007-.0027"	.230"

⓪ — End play .0015-.1150".

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Cylinder Head	⓪92
Flywheel-to-Crankshaft	68
Cam Thrust Plate-to-Block	7
Connecting Rod	30
Harmonic Balancer	160
Engine Front Cover	6
Intake Manifold-to-Cyl. Head	37
Exhaust Manifold-to-Cyl. Head	39
Main Bearings	65
Oil Pan-to-Block	6
Oil Pump-to-Block	18
Water Pump	17
Thermostat Housing	22
Carburetor-to-Manifold	13
Rocker Arm-to-Stud	20

⓪ — Requires thread sealer.