Jeep 4 Engines

2.5 LITER 4-CYLINDER

IDENTIFICATION CODING

ENGINE IDENTIFICATION

The three character engine identification code is stamped into the front, 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.	X4P
Calif. Man. Trans.	X4Z

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD

Removal

1) Disconnect negative 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. Remove bellcrank and throttle linkage brackets and move to one side.

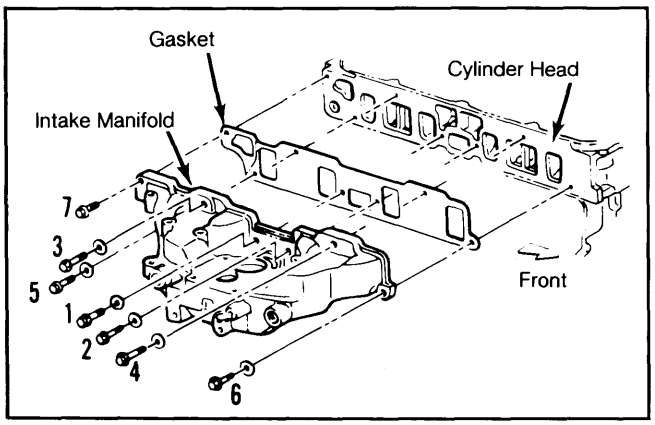
2) Remove heater hose at intake manifold. Remove air pump and bracket, if equipped, noting position of spacers for installation. Remove manifold-to-cylinder head bolts, and remove manifold.

Installation

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

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

Fig. 1: Intake Manifold Tightening Sequence



Tighten bolts to 37 ft. lbs. (50 N.m).

EXHAUST MANIFOLD

Removal

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

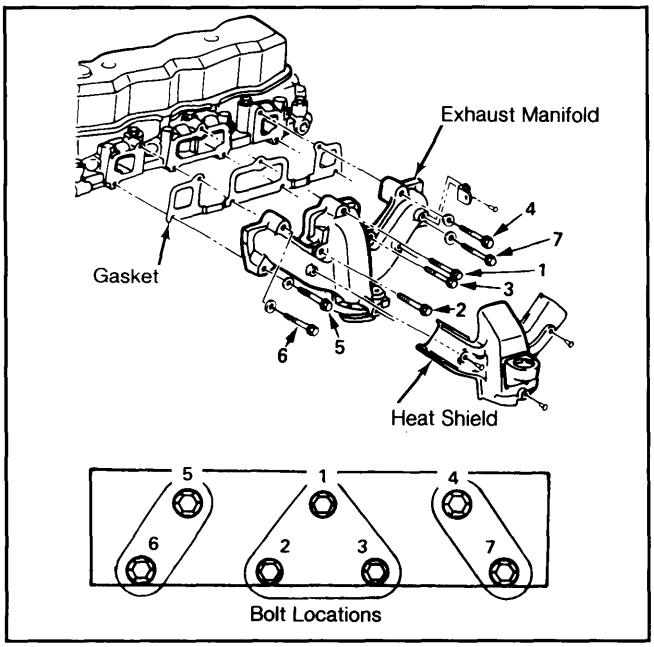
2) Disconnect exhaust pipe from manifold. Remove exhaust manifold bolts, and remove manifold with gasket.

Installation

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

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

Fig. 2: Exhaust Manifold Tightening Sequence



Tighten bolts to 39 ft. lbs. (52 N.m).

CYLINDER HEAD

Removal

1) Disconnect negative battery cable. Remove air cleaner, PCV valve, spark plugs and wires, and rocker arm cover.

2) Drain cooling system and remove upper radiator hose and rear heater hose. Disconnect exhaust pipe from exhaust manifold. Tag and disconnect vacuum hoses.

3) If equipped, remove air pump and bracket, noting number and position of spacers. Disconnect fuel line from carburetor and move aside to allow clearance for cylinder head removal.

4) Remove power steering pump and bracket and place to one side without disconnecting hoses. Remove dipstick. 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

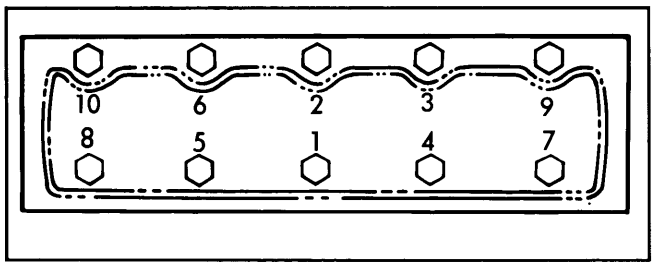
1) Make sure gasket surfaces are clean of foreign matter and free of nicks. Install new gasket in position over dowel pins on cylinder block. Carefully install cylinder head over dowel pins and gasket.

2.5 LITER 4-CYLINDER (Cont.)

NOTE: Make sure all cylinder head bolt threads are clean and oiled. If 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 in steps following sequence in *Fig. 3*. Reverse removal procedures to complete installation.

Fig. 3: Cylinder Head Tightening Sequence



Tighten bolts to a final torque of 92 ft. lbs. (125 N.m)

VALVES

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

1) With cylinder head and rocker assemblies removed, use valve spring compressor to compress 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 to ensure they are installed in original positions.

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-to-valve guide clearance.

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 with standard, .003" (.076 mm) and .005" (.13 mm) oversize stem diameters.

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 compressor tool. Install oil seal in lower groove of stem ensuring it is flat and not twisted. Install locks and release compressor tool.

VALVE SPRINGS

NOTE: Although normal maintainance 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 air hose adaptor (J-22794 or equivalent) in spark plug hole. Apply a minimum constant air pressure of 90 psi.

NOTE: Do not remove air pressure until all components have been reinstalled.

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 install, reverse removal procedure using a new valve stem oil seal.

VALVE SPRING INSTALLED HEIGHT

Installed height of valve spring must not exceed specifications. Measure spring height from top of spring seat to top of valve spring or oil shield. If installed height exceeds specifications, install $^{1}/_{16}$" (1.6 mm) valve spring seat shim.

CAUTION: Never shim a spring excessively. Installed height should never be less than specified.

VALVE SPRING INSTALLED HEIGHT

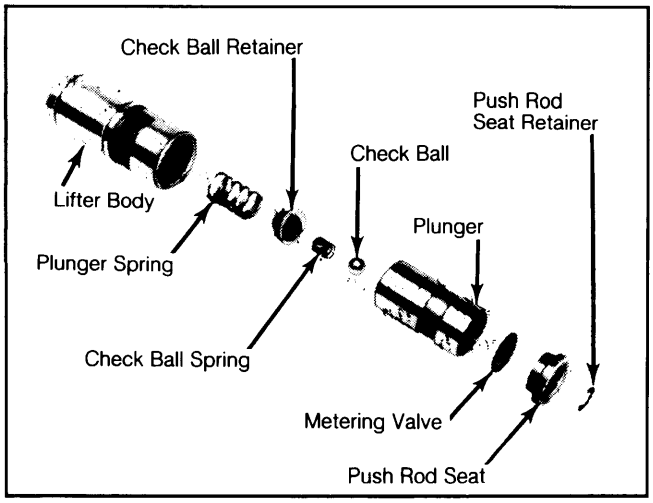
Application	In. (mm)
Intake & Exhaust	1.66 (42.2)

HYDRAULIC VALVE LIFTERS

1) Valve lifters are serviced as complete assemblies, and parts are not interchangable 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.

2) If lifters are disassembled for cleaning or inspection, 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.

Fig. 4: Hydraulic Valve Lifter Assembly



Parts are not interchangeable between lifters.

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

Jeep 4 Engines

2.5 LITER 4-CYLINDER (Cont.)

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.

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. Piston must be at bottom of stroke and covered with cloth to collect cuttings.

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 carnkshaft journal.

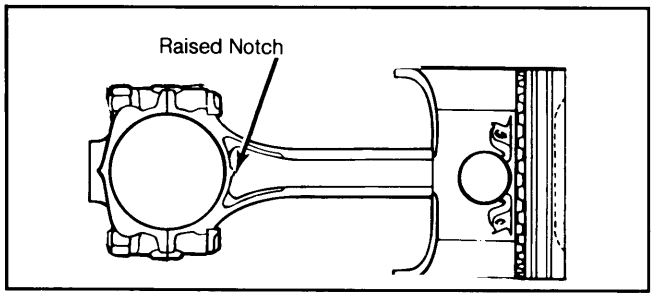
Installation

1) Lightly coat cylinder bores and pistons with oil. Insure ring gaps are evenly spaced. *See Fitting Rings.* Install ring compressor on piston, insuring ring gap spacing does not change.

2) Insert piston and rod assembly into cylinder bore with notches on top of piston facing front of engine. Using suitable tool, gently tap piston assembly into cylinder bore, taking care not to damage cylinder bore.

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

Fig. 5: Correct Positioning of Connecting Rod to Piston



Raised notch on rod to rear of engine

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" (.13 mm), .010" (.25 mm) and .030" (.76 mm) oversize. When selecting rings, make sure they correspond to the piston size.

FITTING RINGS

1) 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.

2) 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, piston must be replaced.

PISTON PINS

NOTE: Piston pins are a press fit in rods. When determining fit, piston and pin must be at room temperature, and pin must gravity fall from piston.

Removal

Using an arbor press and piston pin removal and installation tool (J-24086 or equivalent), press pin from piston and rod.

Installation

1) Lightly lubricate piston pin holes in piston and rod with graphite lubricant. Position rod in its original piston so that raised notch at bearing end is 180° opposite notches in top of piston when installed. *See Fig. 5.*

2) Position piston and rod in arbor press and insert pilot of pin installation tool through piston and rod. Note position of notches on piston.

3) Start pin into piston and rod. Press on installation tool until guide bushing bottoms, indicating pin is fully installed. Remove piston from press and check piston pin for freedom of movement in piston bore.

CRANKSHAFT & 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 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. Wipe bearings and journal clean of oil.

3) Measure crankshaft journal for out-of-round and taper. If not within specifications, replace or recondition crankshaft. Using Plastigage method, measure bearing clearance and replace bearings as necessary. Bearings are available in standaard, .001" (.025 mm), .002" (.050 mm) and .010" (.25 mm) undersize.

NOTE: Standard size bearings may be used in combination with a .001" (.025 mm) undersize bearing.

4) Coat bearing surfaces with oil, and install inserts in rod and bearing cap. Tighten cap nuts. When all rod bearings have been installed, tap each rod lightly (parallel to journal) to ensure they have proper clearance. Measure all rod side clearances between rod caps. Reverse removal procedure to complete installation.

2.5 LITER 4-CYLINDER (Cont.)

Main Bearings (Crankshaft Removed)

NOTE: Main bearings are available in standard, .001" (.025 mm), .002" (.050 mm) and .010" (.25 mm) undersize. Standard size bearing may be used in combination with a .001" (.025 mm) undersize main bearing. This will decrease clearance .0005" (.013 mm) from that of two standard bearing inserts.

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 clearance 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. Tighten cap bolts.

Main Bearings (Crankshaft Installed)

NOTE: Main bearings are available in standard, .001" (.025 mm), .002" (.050 mm) and .010" (.25 mm) undersize. Standard size bearing may be used in combination with a .001" (.025 mm) undersize main bearing. This will decrease clearance .0005" (.013 mm) from that of two standard bearing inserts.

1) With oil pan, oil pump and spark plugs removed, remove cap from main bering requiring replacement and remove lower bearing insert from cap.

2) Insert upper main bearing 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.

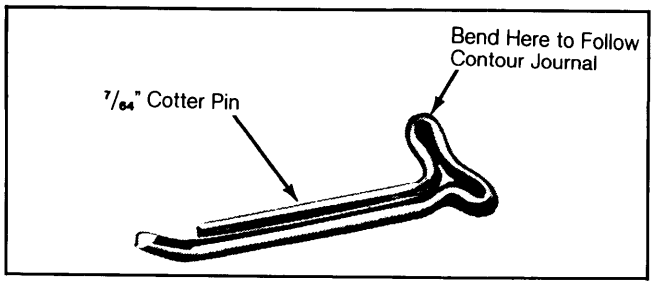
4) Apply oil to replacement bearing insert and position plain (unnotched) end between crankshaft and notched side of block. Rotate crankshaft to pull bearing into place. Remove tool from oil hole in crankshaft journal.

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

THRUST BEARING ALIGNMENT

Measure crankshaft end play 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 bering must be replaced.

Fig. 6: Fabricated Upper Main Bearing Removal and Installation Tool



REAR MAIN BEARING OIL SEAL

NOTE: Rear main bearing oil seal is a one piece unit and can be replaced without removing oil pan or crankshaft.

Removal

Remove transmission, clutch housing and flywheel. Remove rear main bearing oil seal by prying it out with a screwdriver, taking care not to scratch crankshaft.

Installation

Center new oil seal over crankshaft with lip of seal toward front of engine. Tap around perimeter of seal with a soft-faced hammer until seal seats in groove. Use care to prevent seal from binding on crankshaft and not seating fully. Install flywheel, clutch housing and transmission.

CAMSHAFT

FRONT COVER

Removal

1) Remove drive belts. Remove crankshaft vibration pulley center bolt and slide damper and damper hub from shaft.

2) Remove fan and fan shroud. Remove oil pan-to-front cover bolts. Pull cover slightly forward, only enough to permit cutting of oil pan front 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 and gasket.

Installation

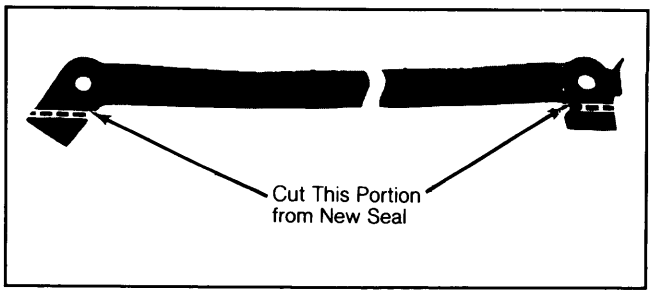
1) Clean mating surfaces of block and front cover. Cut tabs from replacement oil pan front seal. *See Fig. 7* Install seal on front cover, pressing tips of seal into holes in cover. Coat gasket with sealer and place in position on cover. Apply a $^{1}/_{8}$" bead of RTV sealant to joint formed at cylinder 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 front cover-to-block attaching bolts, and remove alignment tool. Reverse removal procedure to complete installation.

Fig. 7: Oil Pan Seal Modification for Front Cover Installation



This is necessary for replacing cover with oil pan installed

Jeep 4 Engines

2.5 LITER 4-CYLINDER (Cont.)

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 contacts crankshaft gear. Install balancer center bolt and tighten. Reverse removal procedure to complete installation.

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

CAMSHAFT & TIMING GEAR

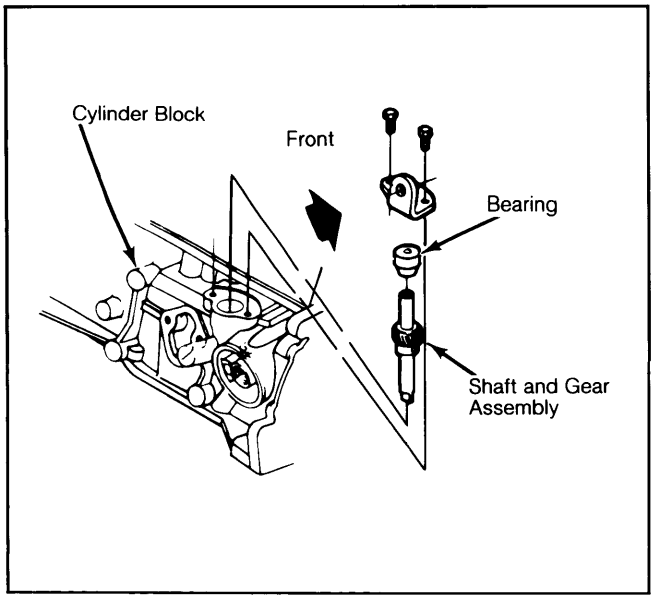
Removal

1) Remove air cleaner and drain cooling system. Remove front cover. Disconnect radiator hoses, and remove radiator.

2) 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.*

3) Remove 2 camshaft thrust plate bolts through holes in camshaft gear *See Fig. 9.* Remove camshaft and gear 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

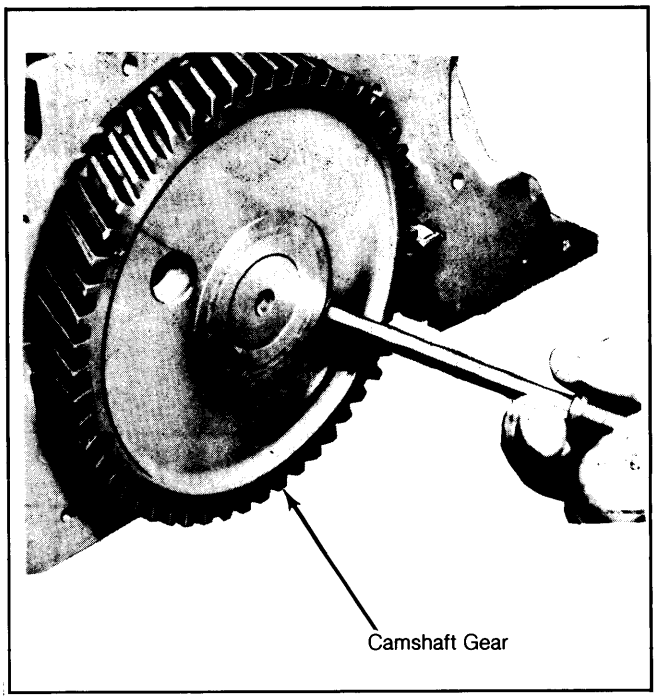


4) If gear must be removed from camshaft, use press plate and appropriate adaptor with arbor press. Press shaft out of gear. Thrust plate must be properly aligned to ensure Woodruff key in camshaft does not damage thrust plate when the shaft is pressed out of gear.

Installation

1) Firmly support camshaft at back of front journal in arbor press using press plate and adapter. Install gear spacer ring and thrust plate over end of camshaft, and install Woodruff key to shaft keyway.

Fig. 9: Removing Thrust Plate Attaching Bolts



Align holes in gear with bolt heads.

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" (.04-.13 mm). If less than .0015" (.04 mm), spacer ring should be replaced. If more than .005" (.13 mm), thrust plate should be replaced.

3) Coat camshaft journals with high quality engine oil supplement (EOS). 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 are aligned. Engine is now in the number 4 cylinder firing position.

4) Install 2 camshaft thrust screws and tighten to specifications. Reverse removal procedure to complete assembly and note the following: Make sure engine is in the number 1 cylinder firing order before installing distributor.

CAMSHAFT BEARINGS

NOTE: Engine must be removed from vehicle to replace camshaft bearings.

Removal

1) Remove flywheel and camshaft from engine. Drive out rear camshaft bearing expansion plug from inside out.

2) Using camshaft bearing removal tool (J-21473-1 or equivalent), drive front bearing toward rear and rear bearing toward front. Install extension (J-21054-1) on removal tool and drive center bearing out toward rear.

Installation

1) Install bearings by reversing removal procedure and noting the following: Make sure oil holes in bearings and engine block are aligned.

2) Install front camshaft bearing approximately $^{1}/_{8}$" (3.2 mm) behind front of engine block to expose oil hole for timing gear oil nozzle.

Jeep 4 Engines

2.5 LITER 4-CYLINDER (Cont.)

ENGINE OILING

Crankcase Capacity

Capacity is 3 quarts (2.8L), including 1/2 quart (.47L) for filter change.

Oil Filter

A disposable, full-flow oil filter is mounted on the lower right side of engine block. Change every 5,000 miles or 5 months, whichever comes first.

Normal Oil Pressure

36-41 psi (2.5-2.9 kg/cm²) at 2000 RPM.

Pressure Regulator Valve

Non-adjustable; located in oil pump body.

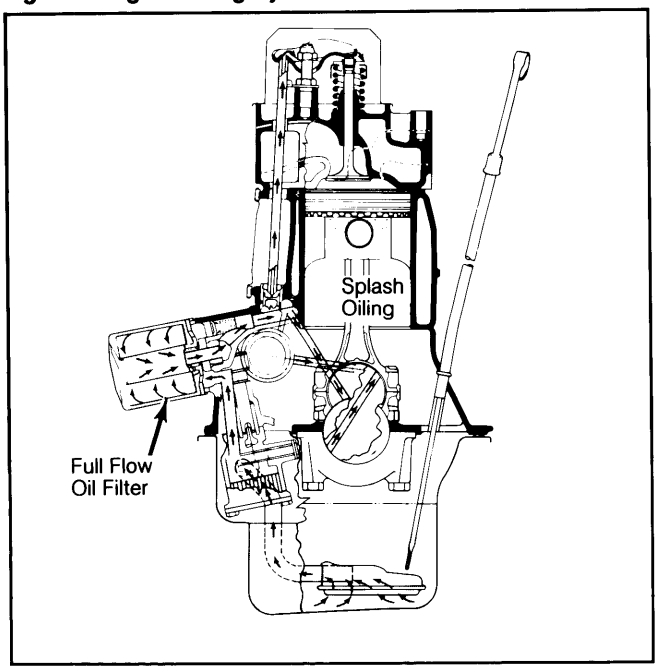
ENGINE OILING SYSTEM

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 hydraulic lifter bores.

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. By-pass valves are located in the oil filter mounting boss 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



Arrows show oil flow route.

OIL PUMP

Removal

Oil pump is located in oil sump, oil pan must be removed for access. *See Oil Pan Removal at end of ENGINE Section.* Remove 2 flange bolts and nut from main bearing cap bolt. Remove oil pump and screen as an assembly.

Disassembly

Remove pump cover attaching screws, cover, idler gear, and drive gear and shaft. Remove pressure regulator valve and spring from pump bore.

NOTE: Do not disturb oil pickup tube on strainer or oil pump. This pipe is attached at factory and cannot be removed.

Inspection

Inspect pump cover, body and gears for cracks, excessive wear and damage. Check drive gear shaft for a tight fit in pump body. Check oil strainer and relief grommet for damage. If any of these conditions are found, complete oil pump assembly must be replaced.

Reassembly

Reverse disassembly procedure noting the following: Install idler gear in pump body so that smooth side of gear is toward cover.

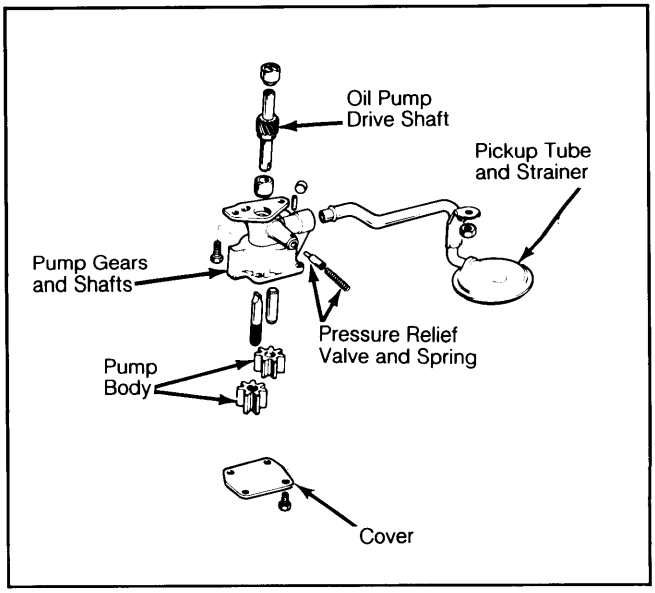
Installation

Position oil pump gear shaft tang to align with oil pump drive shaft slot. Install oil pump-to-block positioning flange over pump drive shaft lower bushing. Do not use gasket. Tighten pump attaching bolts. Install oil pan using a new gasket.

OIL PUMP SPECIFICATIONS

Application	Clearance
Gear-to-Body	.004" (.10 mm) Maximum
Gear End Clearance	.002-.005" (.05-.13 mm)

Fig. 11: Exploded View of Oil Pump Assembly



Install idler gear with smooth side toward cover

ENGINE COOLING

WATER PUMP

Removal

Drain coolant, remove drive belt(s) and cooling fan. Disconnect lower radiator hose and heater hoses from water pump. Remove attaching bolts and lift off water pump and gasket.

Jeep 4 Engines

2.5 LITER 4-CYLINDER (Cont.)

Installation

Scrape and clean gasket mating surfaces. Install new gasket. Position water pump on block, then install and tighten attaching bolts. To complete installation, reverse removal procedure.

NOTE: For further information on cooling system capacities and other cooling system components, see appropriate article in "Engine Cooling Systems" at end of ENGINE section.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Thrust Plate Bolts	7 (9)
Connecting Rod Cap Nuts	30 (40)
Cylinder Head Bolts	92 (125)
Damper Pulley Hub Bolt	160 (220)
Exhaust Manifold Bolts	39 (52)
Flywheel-to-Crankshaft Bolts	68 (93)
Intake Manifold Bolts	37 (50)
Main Bearing Cap Bolts	65 (88)
Oil Pump-to-Block Bolts	18 (25)
Pulley-to-Crankshaft Hub Bolts	25 (34)
Rocker Arm Bolts	20 (27)
Front Cover Bolts	7 (9)
Water Pump Bolts	25 (34)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displ. cu. ins.	Displ. liters	Carburetor	HP at RPM	Torque Ft. Lbs.@RPM	Compr. Ratio	Bore in.	Bore mm	Stoke in.	Stoke mm
1982	151	2.5	2-Bbl.	.....	.....	8.24:1	4.00	101.6	3.00	76.2

VALVES

Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
2.5L							
Int.	1.72 (43.69)	45°	46°	.035-.075 (.90-1.90)	.3418-.3425 (8.68-8.70)	.001-.003 (.025-.076)	.398 (10.1)
Exh.	1.50 (38.4)	45°	46°	.058-.097 (1.47-2.47)	.3418-.3451 (8.68-8.77)	.002-.003 (.050-.076)	.398 (10.1)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit In. (mm)	Rod Fit In. (mm)	Rings	End Gap In. (mm)	Side Clearance In. (mm)
2.5L	[1] .0025-.0033 (.064-.084)	.0003-.0005 (.003-.013)	Press Fit	1	.010-.022 (.25-.56)	.003 (.076)
				2	.010-.028 (.25-.71)	.003 (.076)
				3	.015-.055 (.38-1.4)	.003 (.076)

[1] — Top clearance. Bottom clearance is a.0017-.0041" (.043-.04 mm).

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
2.5L	2.2988 (58.39)	.0005-.0022 (.013-.056)	No. 5	.0035-.0085 (.089-.216)	2.00 (50.8)	.0005-.0026 (.013-.066)	.017 (.436)

2.5 LITER 4-CYLINDER (Cont.)

ENGINE SPECIFICATIONS (Cont.)

VALVE SPRINGS

Engine	Free. Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
2.5	.....	78-86@1.66 (35-39@42.2)	172-180@1.25 (78-82@31.8)

CAMSHAFT

Engine	Journal In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
2.5	1.869 (47.47)	.0007-.0027 (.018-.069)	.230 (5.8)