

2.5 LITER 4-CYLINDER

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine can be identified by the fourth letter of the Vehicle Identification Number, located on left front of the instrument panel. Engine is marked with a 3 character code. All 4 cylinder engine codes begin with the letter "X" and are located at the top left hand corner of the block, above the water pump. Engines produced in Georgia or Tennessee will have the 3 character code located at the top left rear of the engine block.

Engine	Engine Code	Code
2.5L (151")	B

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 hose. Drain cooling system. Disconnect fuel line, vacuum lines and electrical connections at carburetor.

CAUTION – Disconnect negative battery cable before disconnecting fuel line, or possible fire hazard could exist.

2) Disconnect throttle linkage, down-shift linkage and cruise control (if equipped), carburetor and carburetor spacer. Remove bellcrank, throttle linkage brackets and move to one side. Remove heater hose at intake manifold.

3) Remove alternator or air conditioning compressor, if equipped. 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.

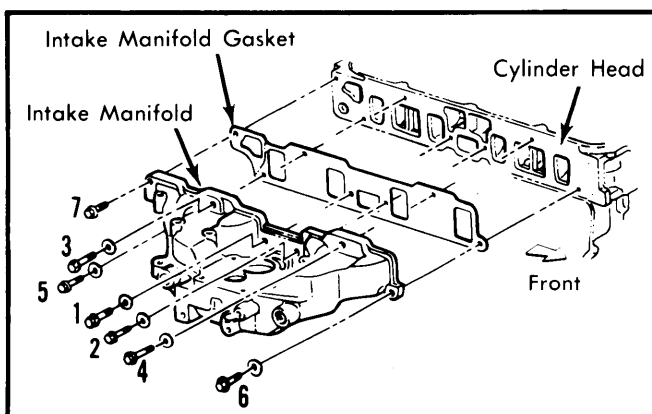


Fig. 1 Intake Manifold Tightening Sequence

EXHAUST MANIFOLD

Removal – Remove air cleaner and carburetor preheat tube. Remove dipstick tube attaching bolt. Raise vehicle and 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.

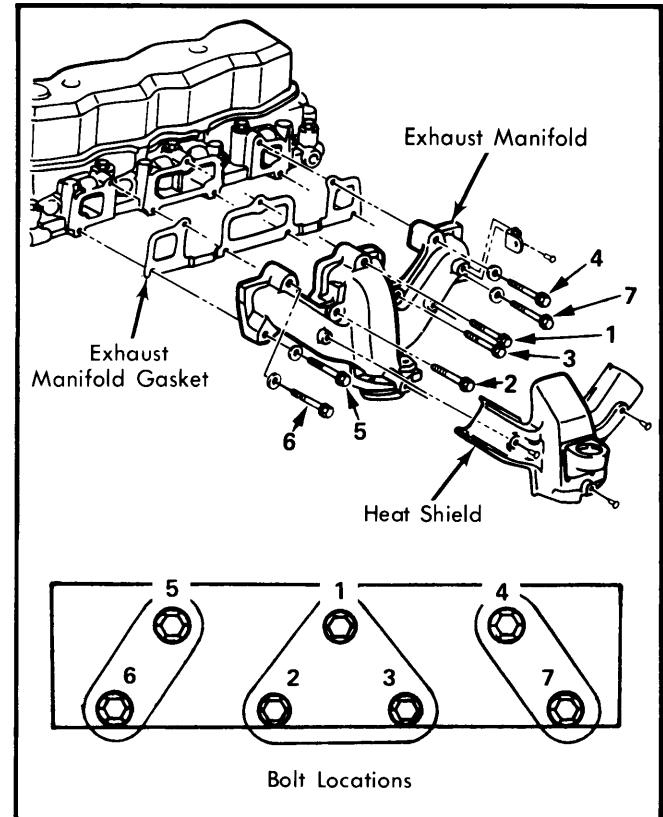


Fig. 2 Exhaust Manifold Tightening Sequence

CYLINDER HEAD

Removal – 1) Disconnect negative battery cable. Drain cooling system and remove air cleaner. Remove intake and exhaust manifolds as previously outlined.

2) Remove alternator, A/C and power steering units. Disconnect all hoses and electrical connections at cylinder head and identify for reinstallation.

3) Disconnect spark plug wires and remove spark plugs. Remove rocker arm cover and back off rocker arm nuts, then pivot rocker arms to clear push rods and remove push rods.

4) Remove cylinder head bolts and remove cylinder head; place on two blocks of wood to prevent damage.

CAUTION – To insure a tight fit on bolt heads and prevent slipping, use a 12-point, 12 mm socket.

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).

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2) Apply sealing compound to threads and underside of heads on cylinder head bolts and install finger tight. Gradually tighten bolts in sequence as shown in Fig. 3. Reverse removal procedure for remaining components.

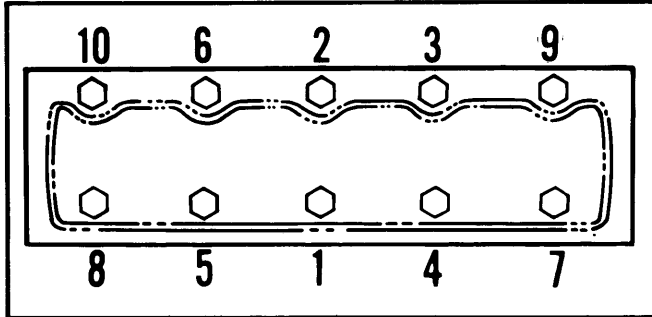


Fig. 3 Cylinder Head Tightening Sequence

VALVES

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

Valve guides are an integral part of the cylinder head. If valve guide-to-stem clearance is excessive (see engine specifications) guides should be reamed and new oversize valves should be installed.

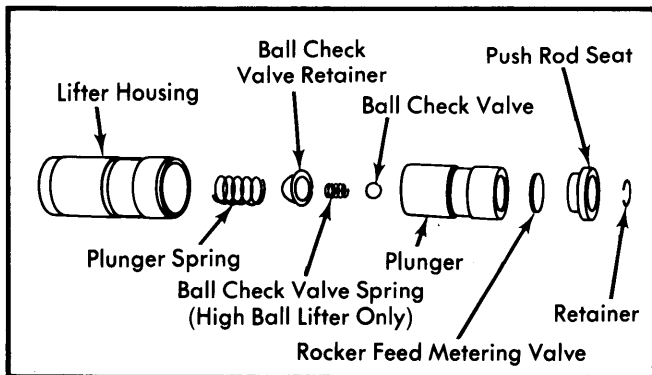


Fig. 4 Hydraulic Valve Lifter Assembly

VALVE STEM OIL SEALS

Oil seals are used on all valve stems and should be replaced whenever valve spring is removed or valve service is performed.

VALVE SPRINGS

Removal — 1) Remove rocker arm cover. Remove rocker arms on cylinder to be serviced, also remove spark plugs. Install air hose adapter to spark plug hole and apply air pressure.

2) With rocker arm removed, install rocker arm nut loosely on stud. Using spring compressor (J-5892-1 or equivalent), compress valve spring and remove valve locks. Remove tool, retainer, cup shield, spring and oil seal.

Installation — Reverse procedure used in removal to complete assembly.

NOTE — Valve spring installation height is 1.69" (43 mm). Test valve spring tension with tester while removed. Springs should be compressed to 1.66" (42 mm) without internal damper springs. Proper tension is 78-86 lbs. (347-382 N) at this height.

HYDRAULIC VALVE LIFTERS

Valve lifters are serviced as complete units. Parts are not interchangeable between lifters. If lifter shows signs of wear or is noisy, it should be replaced.

Check cam mating surface for wear and if present, inspect camshaft. Replace parts as necessary. See Fig. 4.

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.

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.

NOTE — Piston should be at bottom of stroke and covered with a 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 crankshaft journal.

Installation — 1) Before installing rings on piston, insure that correct size rings have been selected by measuring ring gap. Place ring in block at lower end of travel area and insure that ring is level. Using proper feeler gauge, measure ring gap. After installing rings on piston, measure ring side clearance using proper feeler gauge.

NOTE — Incorrect ring gap indicates that wrong size ring has been selected. It should not be necessary to alter ring gap by

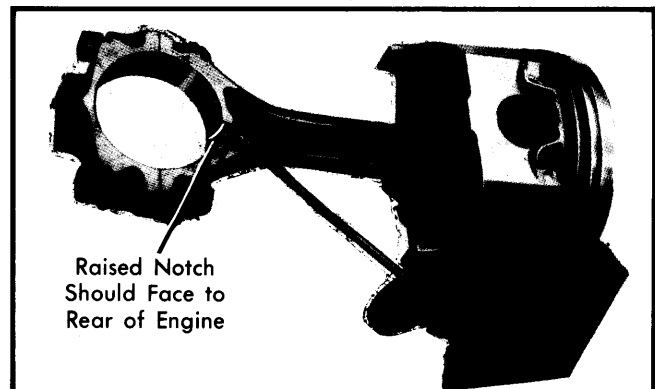


Fig. 5 Piston and Rod Installation

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filing. If ring side clearance is not within specifications, piston must be replaced.

2) Install connecting rod bolt guide tool (J-6305-11) on connecting rod bolts. Using piston ring installer tool (J-5569), insert rod and piston assembly into cylinder so that notches in top of piston face toward front of engine.

3) From beneath engine, position connecting rod with upper bearing insert into place against journal. Remove guide tool and install lower bearing insert and cap. Tighten cap nuts. Reverse removal procedure to complete installation.

NOTE — *Notches in top of piston face front of engine; raised notch on side of rod bearing end should be opposite notch in piston when installed. See Fig. 5.*

FITTING PISTONS

Measure cylinder bore 2.25" (57 mm) from top of bore. Measure piston diameter at a point perpendicular to piston pin and 1.81" (46 mm) from top of piston. Pistons are available in standard, .010" (.25 mm), .020" (.50 mm) and .030" (.76 mm) oversize. Selective fitting of each piston is required. Once proper piston has been selected, mark piston with cylinder number it was fitted for.

NOTE — *Measure cylinder bore and pistons at room temperature, otherwise improper fit will result.*

PISTON PINS

Pins are press fit in piston. Oversize pins are available, piston and rod must be reamed for correct fit. Remove and install piston pins using arbor press and suitable adapters.

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

Connecting Rod Bearings — **1)** Remove oil pan. Turn crankshaft and rod to be serviced to bottom of stroke. Remove bearing cap and lower shell.

2) Push piston and rod assembly up far enough to remove upper bearing shell.

3) Check clearances using Plastigage and replace bearings as necessary. Bearings are available in standard, .001" (.025 mm), .002" (.050 mm) and .010" (.25 mm) undersize.

NOTE — *If bearing inserts are fitted to minimum diameter, journal is out of round. Interference between bearing inserts and journal will result, causing rapid bearing failure.*

4) Rotate crankshaft after installation of new bearing to insure crankshaft is not binding. Reverse removal steps to complete assembly.

Main Bearings — **1)** Replace main bearings in pairs. Do not shim or mix bearing size and do not use a new bearing with an old bearing.

2) Remove oil pan, oil sump and spark plugs. Remove cap on bearing requiring replacement and remove lower bearing insert from cap. Using suitable tool, rotate crankshaft clockwise, as viewed from front, this will roll upper bearing insert out of block.

3) Check clearances using Plastigage and replace bearings as necessary. Bearings are available in standard, .001" (.025 mm), .002" (.050 mm) and .010" (.25 mm) undersize.

4) With new bearings lightly oiled and installed, rotate crankshaft to check for excessive drag.

THRUST BEARING ALIGNMENT

Using a rubber hammer, tap crankshaft to extreme front position. Using a feeler gauge, measure crankshaft end play at front end of thrust bearing. Number 5 bearing is the thrust bearing. If not within specifications, replace thrust bearing.

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.

Installation — **1)** With lip of seal facing toward front of engine, center seal over end of crankshaft. With soft hammer, tap seal into groove until it seats.

2) Take care to prevent seal from binding on crankshaft and not seating properly. Install flywheel, clutch assembly, clutch housing and transmission.

NOTE — *Main bearing oil seal is a one piece unit that can be removed and replaced without removal of oil pan or crankshaft.*

CAMSHAFT

ENGINE FRONT COVER

Removal — **1)** Disconnect negative battery cable. Remove center hub and slide pulley and hub from crankshaft. Remove alternator and air conditioning compressor bracket, if equipped.

2) Remove fan and shroud screws. Loosen belts and remove fan and shroud. Remove oil pan-to-timing gear cover screws. Pull cover slightly forward only enough to permit cutting of oil pan front seal.

3) Using a sharp knife, cut oil pan front seal flush with cylinder block at both sides of cover. Remove cover and attached portion of oil pan front seal. Remove cover gasket.

Installation — **1)** Clean mating surfaces of engine block and front cover. Cut tabs off new oil pan front seal, and install seal on front cover, pressing tips into holes provided in cover. Coat gasket with gasket sealer and place in position. Apply RTV sealant to joint of oil pan and cylinder block.

2) Install centering tool (J-23042 or equivalent) in front cover seal. Install front cover to block, install and partially tighten 2 oil pan-to-front cover screws.

3) Install cover-to-block screws, tighten all screws. Remove centering tool. Reverse steps to complete installation.

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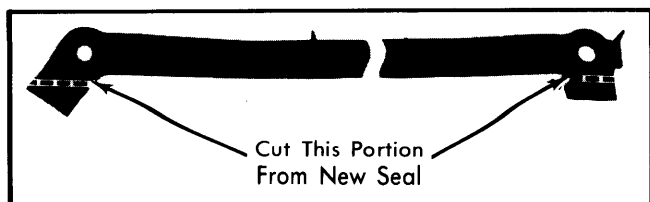


Fig. 6 Oil Pan Front Seal Modification

FRONT COVER OIL SEAL

Removal & Installation – 1) Remove oil seal from front cover using care not to damage front 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.

CAMSHAFT & TIMING GEAR

NOTE – Support camshaft carefully when removing to prevent damaging the camshaft bearings.

Removal – 1) Drain cooling system. Remove timing gear cover. Disconnect oil cooler lines (if equipped) and remove radiator. If equipped with air conditioning, remove condenser and compressor.

2) Remove 2 camshaft thrust plate screws through holes in camshaft gear. Remove valve tappets. Remove distributor, oil pump drive and fuel pump. Remove camshaft and gear assembly by pulling out through front of block.

NOTE – Camshaft timing gear is pressed onto camshaft. When removing, ensure that Woodruff key does not damage camshaft.

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 in shaft keyway.

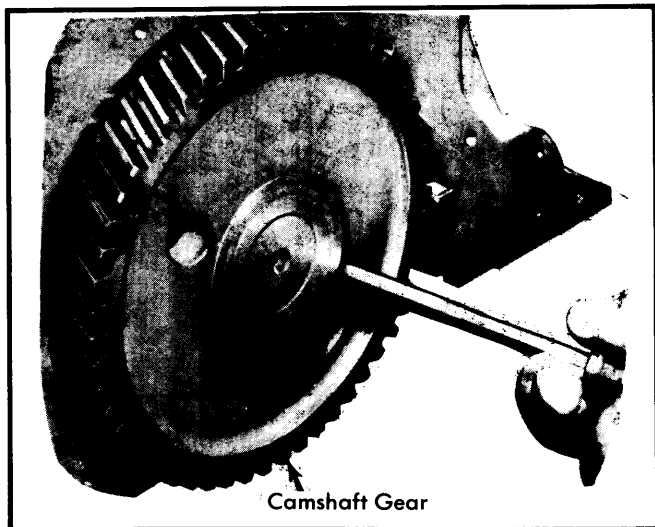


Fig. 7 Removing Thrust Plate Screw with Screwdriver Inserted Through Timing Gear

2) Install camshaft gear and press it onto camshaft until it bottoms against spacer ring. End clearance of thrust plate should be .0015-.0050" (.038-.131 mm). If more than .0050" (.131 mm), thrust plate must 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 tighten. Reverse removal procedure to complete installation.

CAMSHAFT BEARINGS

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

2) Using bearing remover tool (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 so that bearing is recessed about .125" (3.1 mm) into engine block. This will allow for lubrication of timing gears. Reverse removal procedure to complete installation.

ENGINE OILING

ENGINE OILING

Crankcase Capacity – 3 quarts without oil filter.

Oil Filter – Full flow type. Change oil filter at every oil change.

Normal Oil Pressure – 36-41 psi. (2.5-2.8 kg/cm²) @2000 RPM.

Pressure Regulator Valve – Located in oil pump body. Not adjustable.

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 oil filter mounting and the 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 oil sump through oil return holes in cylinder head and block. See Fig. 8.

OIL PUMP

NOTE – Oil pump is located in oil sump. Oil pan must be removed for access. See Oil Pan Removal at end of ENGINE Section.

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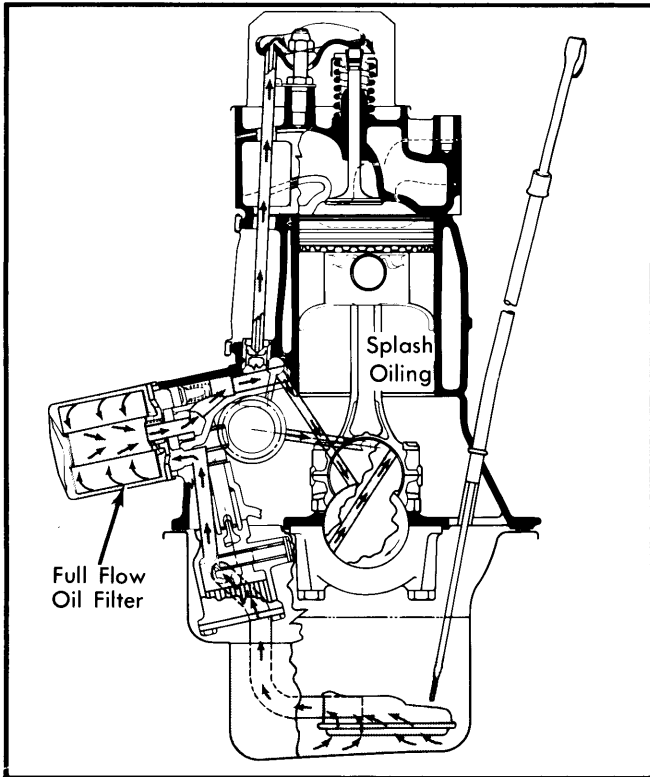


Fig. 8 Engine Oiling System

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 and remove pump and screen as an assembly. Do not disturb oil pickup pipe on screen or body. Disassemble pump and inspect for excessive wear or cracks. Replace pump as a unit if parts are defective. See Fig. 9.

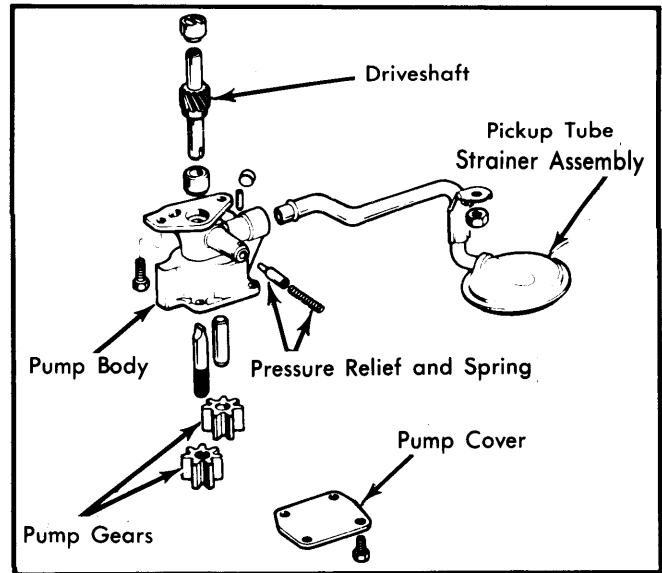


Fig. 9 Exploded View of Engine Oil Pump Assembly
ENGINE COOLING

WATER PUMP

Removal - 1) Drain cooling system. Disconnect fan shroud from radiator. Remove drive belts. Remove fan retaining bolts and remove shroud, fan pulley and fan assembly.

2) Disconnect lower radiator hose at water pump. Disconnect heater hoses from water pump. Remove water pump retaining bolts and remove water pump.

Installation - Clean all gasket surfaces. Drive belts must be positioned in fan pulley when fan assembly and pulley are installed. To complete installation, reverse removal procedures.

NOTE - For further information on cooling system capacities and other cooling system components, see appropriate article in *ENGINE COOLING SYSTEMS* Section.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS									
Engine	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke		Displ.	
				in.	mm	in.	mm	cu. ins.	cc
2.5L (151")	86@4000	128@2800	8.24:1	4.0	101	3.0	76	151	2475

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 (151") Intake	1.72 (44)	45°	46°	.0353-.0747 (.896-1.897)	.3418-.3425 (8.68-8.69)	.0010-.0027 (.025-.068)
Exhaust	1.50 (38)	45°	46°	.058-.097 (1.4-2.4)	.3418-.3124 (8.68-7.93)	.0010-.0027⓪ (.025-.068)⓪	

⓪ - Measured at top of guide. Bottom is .0020-.0037" (.050-.093 mm).

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ENGINE SPECIFICATIONS (Cont.)

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 (151")	.0025-.0033 (.063-.083)	.0003-.0005 (.007-.012)	Press Fit	1	.010-.022 (.25-.55)	.003 (.07)
				2	.010-.028 (.25-.71)	.003 (.07)
				3	.015-.055 (.38-1.3)	.003 (.07)

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 (151")	2.2988 (58.39)	.0005-.0002 (.01-.05)	No. 5	.0035-.0085 (.08-.21)	2.000 (50.80)	.0005-.0026 (.01-.06)	.017 (.43)

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
2.5L (151")	1.869 (47.47)	.0007-.0027 (.017-.068)	.406 (10.31)

VALVE TIMING				
Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ATDC)	Open (BTDC)	Close (ATDC)
2.5L (151")	23°	249°	246°	27°

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. N·m
Cylinder Head	⓪160 (218)
Flywheel-to-Crankshaft	68 (92)
Connecting Rod	30 (41)
Harmonic Balancer	92 (125)
Intake Manifold-to-Cyl. Head	37 (50)
Exhaust Manifold-to-Cyl. Head	37 (50)
Main Bearings	65 (88)
Oil Pump-to-Block	18 (24)
Water Pump	17 (23)
Thermostat Housing	22 (30)
Carburetor-to-Manifold	13 (18)
Rocker Arm-to-Stud	20 (27)

Application	INCH Lbs. (N·m)
Cam Thrust Plate-to-Block	84 (9.5)
Engine Front Cover	48 (5.5)
Oil Pan-to-Block	48 (5.4)

⓪ — Requires thread sealer.