99 INLINE 4 CYLINDER

GENERAL SPECIFICATIONS

Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1974	121	1985	1x1-Bbl.	95@5200	115@3500	8.7-1	3.543	90	3.071	78
	121	1985	Fuel Inj.	110@5500	123@3700	8.7-1	3.543	90	3.071	78

ENGINE IDENTIFICATION

Engine number is stamped on a pad on cylinder block, just below distributor on right-hand side of engine. Typical engine number digit arrangement is shown:

B 20 P01 000 000

ENGINE REMOVAL

NOTE – It is not recommended to remove engine without transmission. Remove engine and transmission as an assembly.

1) Remove hood attaching bolts and lift off hood. Disconnect battery cables. Unclamp and remove battery. Drain coolant from radiator, engine block and heater core by opening all petcocks.

2) On carburetor engines, detach vacuum hose from power assist servo at intake manifold. Disconnect fuel line from intake side of fuel pump.

3) On fuel injection engines, disconnect vacuum hoses of power assist cylinder and pressure sensor from intake manifold. Disconnect fuel lines from injector tubes at intake manifold.

4) On all models, disconnect electrical wires from the following: Ignition coil, ballast resistor, temperature transmitter, oil pressure transmitter (carburetor engine), radiator fan, thermostat, headlights and headlight wipers, and automatic transmission (fuel injection engine).

5) On fuel injection engines, disconnect electrical leads from the following: Fuel injection distributor, injectors, air cleaner, throttle valve switch at temperature sensor, and temperature switch below intake manifold.

6) On carburetor engines, disconnect preheater hose, and PCV hose at air cleaner. Remove air cleaner and cold air hose.

7) On carburetor engines, remove preheater housing with hose at exhaust manifold. Disconnect throttle cable at driver bracket and choke cable and control wire from carburetor. Disconnect hoses at thermostat, radiator, intake manifold and water pump.

8) On fuel injection engines, remove air cleaner with hoses. Disconnect throttle cable at driver bracket. Disconnect hoses at thermostat, radiator, water pump and valve at heater core.

9) Remove four screws from front panel. Remove headlight frames and headlights. Disconnect hood lock cable at firewall and wheel housing. Remove front panel, lifting forward and upward.

10) On Man. Trans., remove clutch slave cylinder and hang it out of the way.

11) On Auto. Trans., remove heat shield on exhaust manifold at exhaust manifold and exhaust pipe.

12) On all models, remove exhaust pipe from manifold. Disconnect ground strap at transmission. Raise front of vehicle and place blocks under chassis.

13) On Man. Trans., place transmission in neutral. Knock out front taper pin from gear shift rod. Pull rubber bellows free of groove in gear selector rod, if so equipped. Separate gear selector rod and arm.

14) On Auto. Trans., remove screw for gear selector wire at transmission. Move gear selector lever to position No. 1 and pull outer cable housing back. Using a suitable tool (Saab Tool No. 879038) on wire, turn tool a small amount and pull out wire.

15) Disconnect speedometer cable from transmission. Remove nuts from engine mounts. Unclamp larger clamps around rubber bellows on inner universal joints. Attach suitable lifting sling to engine.

NOTE – On models with top mounted alternator, remove alternator and attach rear lifting sling cable to alternator bracket.

16) Remove attaching hardware from lower end piece of control arm on right-hand side. Turn steering wheel to left and raise engine slightly. Move engine to right and withdraw left universal joint, then move it to left and remove right universal joint.

17) Raise engine to gain access to starter and alternator, disconnect cables. Lift engine clear of vehicle and place on an engine stand. To install, reverse removal procedures.

NOTE – To separate engine and transmission see Oil Pan Removal.

INTAKE MANIFOLD REMOVAL

1) Remove air cleaner and carburetor. On injection engines, remove throttle housing.

2) Remove attaching bolts and lift off manifold.

CYLINDER HEAD REMOVAL

Removal – 1) With engine in vehicle, disconnect battery cables. Drain coolant from engine block and radiator. Open heater core petcock.

99 INLINE 4 CYLINDER (Cont.)

2) Disconnect power assist vacuum hose from intake manifold and fuel line from fuel pump. On fuel injection engines, disconnect fuel hoses from inlet and outlet of injector valves.

3) Disconnect lead from temperature transmitter. Remove air cleaner and preheater. Loosen hose clamps at thermostat housing, water pump and intake manifold. Disconnect choke cable on carburetor engines. Loosen exhaust pipe and remove exhaust manifold.

4) Remove distributor cap and ignition leads. Remove camshaft cover and gaskets.

5) Remove camshaft sprocket by screwing a nut onto center stud against mounting bracket. Bend back locks and remove attaching screws from camshaft sprocket. Separate sprocket from camshaft plate until it hangs free with bracket.

CAUTION — Tighten nut securely, so sprocket and chain can not move. Otherwise chain tensioner will tighten chain, and tensioner can not be reset without lifting engine out of vehicle

6) Remove all cylinder head nuts and bolts.

7) Using suitable tool (Saab Tool No. 839212), remove two studs and screw these in two cylinder head bolt holes to act as locating dowels.

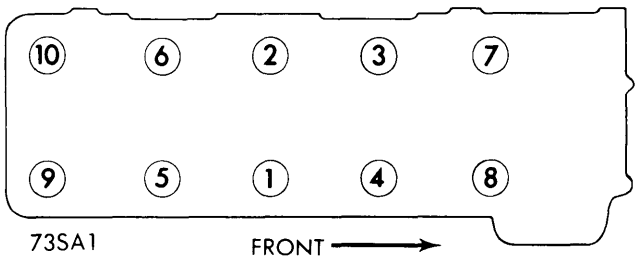
8) Remove timing cover screws and remaining studs and lift off head.

NOTE — Before installing cylinder head, align camshaft timing mark with mark on cylinder or damage to valves may occur.

Installation — 1) Clean cylinder head and block. Install head gasket over locating dowels.

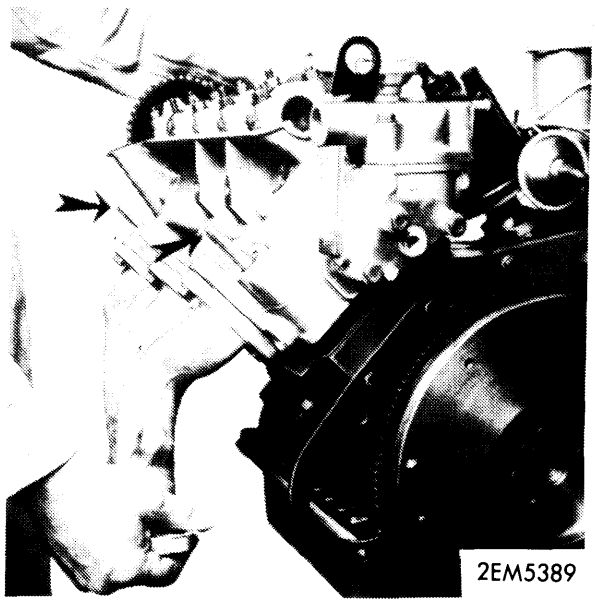
NOTE — Do not use sealing compound on head gasket or engine. Gasket is fitted dry.

2) Make sure that markings on camshaft and bearing cap are aligned. Check that flywheel mark is aligned with mark on engine block and ignition is set on No. 1 cylinder.



CYLINDER HEAD TIGHTENING SEQUENCE

3) Mount cylinder head on dowels. Screw in studs. Install nuts and bolts and tighten to specifications. Remember to reinstall locating studs in their original locations.



CYLINDER HEAD LOCATING DOWELS

4) Warm engine and then allow to cool approximately 30 minutes. Loosen each nut and bolt in sequence and retighten. *NOTE — Cylinder head bolts should be retorqued after 1200 and 6000 miles service.* Reverse removal procedure for remaining components.

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)
1985 cc							
Int.	1.653 (41.97)	44.5°	45°	.063-.106 (1.60-2.69)	.313-.314 (7.95-7.98)	①	.....
Exh.	1.397 (35.48)	44.5°	45°	.063-.106 (1.60-2.69)	.312-.313 (7.62-7.95)	①	.....

① — .019" (.483 mm) measured at valve head pulled .118" (2.99 mm) from seat.

VALVE ARRANGEMENT

E-I-I-E-E I-I-E (front to rear).

VALVE GUIDE SERVICING

1) Check valve guide and valve stem for wear or damage. Using a suitable tool (839043), withdraw valve guide from camshaft side of head.

99 INLINE 4 CYLINDER (Cont.)

2) Install guide from cylinder side of head, using suitable tool (839043). Ream guide to standard size, using a suitable reamer. Check valve seat for true, reface if necessary.

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1985 cc	1.744 (44.30)	.....	178-198@1.161 (80.7-89.8@29.49)

VALVE SPRING REMOVAL

1) With cylinder head removed, remove camshaft bearing caps and camshaft.

2) Using a magnet, lift out cam followers along with adjusting pallets and retain in proper order for reassembly.

3) With spring compressor, depress spring and remove valve keepers. Release spring and valve collar.

4) Replace spring and reverse removal procedure.

VALVE CLEARANCE ADJUSTMENT

1) With valve cover removed, rotate engine until valve to be adjusted or checked has heel of cam opposite cam follower. Measure clearance with feeler gauge. If clearance is not within specifications, intake .006-.012" (.152-.305 mm) and .014-.020" (.356-.508 mm) for exhaust, a direct measurement will be required.

2) Install suitable tool (839145) and a dial indicator. Measure clearance of all valves and note reading. Proceed to adjust any valve which does not come within the following limits: .008-.010" (.203-.254 mm) intake and .016-.018" (.406-.457 mm) exhaust.

3) Remove camshaft, cam followers and adjusting pallets of any valve needing adjustment.

4) Measure pallet thickness and add noted valve clearance to arrive at total clearance. Subtract proper valve clearance from total clearance to determine needed pallet thickness.

5) Install new adjusting pallets and recheck valve clearance.

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)
1985 cc	.0005-.0015 (.013-.038)	.0002-.0005 (.005-.013)	①	No. 1	.014-.021 (.356-.533)	.002-.003 (.051-.076)
				No. 2	.012-.018 (.305-.457)	.0015-.003 (.038-.076)
				Oil	.015-.016 (.038-.406)	.....

① — Push fit.

OIL PAN REMOVAL

The oil pan is an assembly made up of oil pan, transmission and various drives. It requires engine removal for disassembly.

Manual Transmission — 1) Drain engine oil and remove clutch cover. Remove starter, alternator and alternator drive belt. Withdraw clutch shaft.

2) Remove three screws of release bearing guide sleeve.

3) Back off adjusting screw and disconnect clutch lever.

4) Remove all screws in mating flange of engine and transmission and two screws from under transmission.

NOTE — Do not mix screws. Screws threaded into alloy transmission case have UNC threads and screws threaded into cast iron engine block have UNF threads.

5) Lift engine carefully off transmission. At same time remove release bearing guide sleeve.

6) Reassembly in reverse order.

Automatic Transmission — 1) Drain engine oil. Remove cover over flywheel ring gear, starter, alternator and drive belt.

2) Remove cover over flywheel ring gear, starter, alternator and alternator drive belt.

3) Disconnect throttle wire from throttle housing. Remove crankcase ventilation device and all screws (17 in number) in mating flanges of engine and transmission.

4) Remove four screws attaching flywheel gear to torque converter. These screws can be reached through a recess in starter mount. Lift engine carefully off transmission and support torque converter. Reassemble in reverse order.

5) Remove four screws attaching flywheel gear to torque converter. These screws can be reached through an opening for ventilation connection. Lift engine carefully off transmission and support torque converter. To install, reverse removal procedures.

PISTON & ROD ASSEMBLY

Connecting rods and rod caps are numbered. Note positioning and location before disassembly.

Removal — With oil pan and cylinder head removed, unscrew rod nuts and withdraw bearing caps. Place plastic sleeves over rod bolts and push out rod and piston.

99 INLINE 4 CYLINDER (Cont.)

Installation – Using a ring compressor, place piston in cylinder bore with notch facing timing cover end of engine. Install rod caps in their proper position and tighten bolts.

PISTON PIN REPLACEMENT

Piston pins are retained by circlips. Remove circlips and press out piston pins. Check pins and bearings for wear or damage, replace if necessary.

FITTING PISTONS

1) To fit pistons to cylinder bores, use a feeler gauge .500" (12.7 mm) wide and .0005-.0014" (.013-.036 mm) thick. Oil cylinder lightly and insert piston without rings.

2) Attach feeler gauge to a spring scale. Insert feeler gauge between piston and cylinder wall at right angles to piston pin. When feeler gauge can be pulled out of cylinder with a force of 1.8-2.6 lbs. (.816-1.18 kg), piston clearance has been determined.

3) Repeat test at several different depths in cylinder bore. Graded standard and non-graded oversize pistons are available.

Piston Specifications

Application	Diameter In. (mm)
Std. (AB)	3.5425-3.5427 (89.980-89.986)
Std. (C)	3.5432-3.5436 (89.999-90.010)
1st OS	3.5618-3.5624 (90.472-90.487)
2nd OS	3.5815-3.5821 (90.972-90.987)

4) Check piston rings for end gap and side clearance, using an inverted piston to position ring in bore. On worn bores, measure at lower end of bore.

5) Install rings on piston, making sure gaps of compression rings are 180° apart with lower compression ring mark "TOP" facing up. On three piece oil ring make sure ends are staggered.

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)
1985 cc	2.2829-2.2834 (57.986-57.998)	.001-.003 (.025-.076)	Center	.003-.011 (.076-.279)	2.0467-2.0472 (51.986-51.999)	.001-.003 (.025-.076)	.....

MAIN BEARING SERVICE

1) Remove connecting rods and main bearing caps. Measure journals with a micrometer. Out-of-round should not exceed .002" (.051 mm). If crankshaft is near or over stated limit of wear, regrind journals and fit undersize bearings.

2) Using "V" blocks and a dial indicator check crankshaft for bend. If bend exceeds .002" (.051 mm), replace or repair crankshaft.

3) Using Plastigage method, check main bearing and connecting rod bearing journals. If clearance is found excessive, combine suitable undersize bearings to correct clearance. Undersize bearings are available in various thicknesses.

THRUST BEARING ALIGNMENT

Center main bearing is thrust bearing. Check crankshaft endplay. If it exceeds specifications, replace thrust washers with oil grooves facing crankshaft.

FRONT MAIN BEARING OIL SEAL SERVICE

NOTE – Seal may be replaced with engine in vehicle if clutch and flywheel are first removed.

Remove attaching screws from cap seal and drive out old seal. Using suitable tools (839196 & 839192), install new seal with spring ring facing flywheel. Slip suitable guide sleeve (839197) over end of crankshaft. Slip suitable guide sleeve (839197) over end of crankshaft. Oil guide sleeve. Slide seal cap into position and install attaching screws. Remove guide sleeve tool.

ENGINE TIMING COVER & OIL SEAL

Remove belt pulley screw and pulley, using a suitable puller. Pry out old seal. Install new seal, using suitable tools (839188 & 839044). Grease seal with silicone grease and make sure keyway of tool is aligned with keyway of crankshaft.

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm) ①	Lobe Lift In. (mm)
1985 cc	1.2499 (31.747)	.....	.....

① – End Play is .004-.007" (.102-.178 mm).

CAMSHAFT REMOVAL

Removal – 1) Remove camshaft cover and gaskets. Rotate crankshaft until number one piston is at TDC of compression stroke.

2) Remove camshaft sprocket by screwing a nut onto center stud of camshaft sprocket and clamp center stud against mounting bracket.

CAUTION – Tighten nut securely, so sprocket and chain can not move. Otherwise chain tensioner will tighten chain, and tensioner can not be reset without lifting engine out of vehicle.

3) Bend back locks and remove attaching screws from camshaft sprocket. Separate sprocket from camshaft plate until it hangs free with bracket.

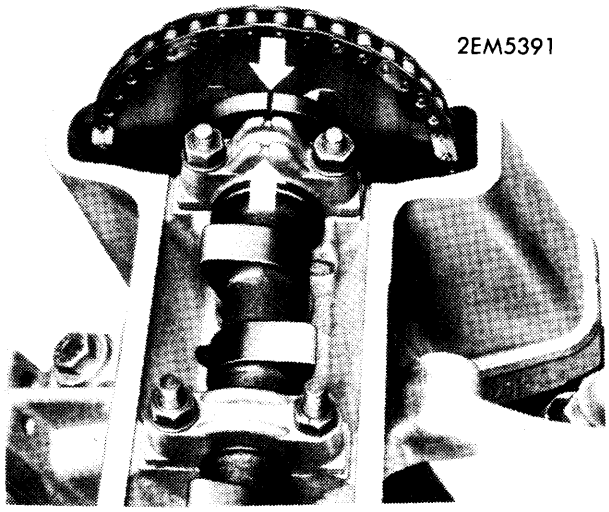
99 INLINE 4 CYLINDER (Cont.)

4) Remove camshaft bearing caps. Lift off camshaft, inspect camshaft and bearings for wear or damage.

5) Replace camshaft, bearings and caps, and tighten cap nuts to specifications. Align camshaft timing mark with mark on cylinder head (see illustration).

6) Install camshaft sprocket on camshaft. Unscrew nut from center stud on camshaft sprocket and lock both attaching screws. Replace camshaft cover and gaskets.

CAUTION — Nut on camshaft sprocket center stud must not on any account be unscrewed before sprocket is tightly screwed to camshaft.



2EM5391

CAMSHAFT TIMING MARKS

VALVE TIMING				
	INTAKE ①		EXHAUST ②	
Engine	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
1985cc	26°	70°	70°	26°

① — With .010" (.025 mm) valve clearance.
② — With .018" (.457 mm) valve clearance.

VALVE TIMING & CHAIN REPLACEMENT

Removal — 1) Remove timing cover and camshaft cover. Separate camshaft from camshaft sprocket. See *Camshaft Removal.*

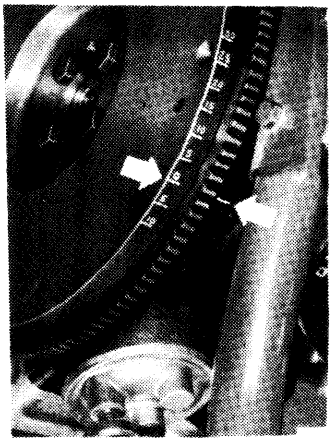
2) Remove chain tensioner, chain guide screws and mounting plate complete with camshaft sprocket and chain.

3) Remove chain guides, oil thrower ring and pull sprocket off crankshaft, using a suitable puller.

4) Remove idler shaft keeper plate and withdraw idler shaft.

Installation — 1) Reinstall idler shaft. Install keeper plate and attaching bolts. Position idler sprocket so marked line is horizontal.

2) Mount pinion sprocket on crankshaft. Align "O" degree mark on flywheel with mark on cylinder block (see illustration).



2EM5392

CRANKSHAFT TIMING MARKS

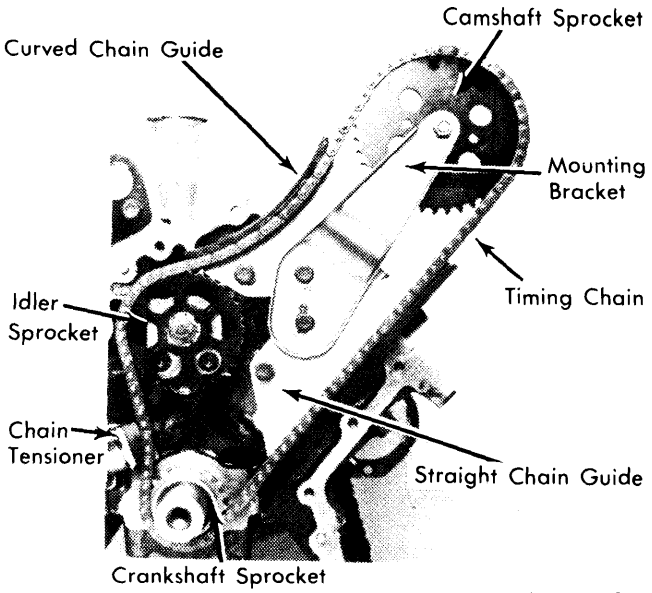
3) Align camshaft mark with mark on cylinder head. Install straight chain guide with long screw in bottom hole.

4) Loosely mount curved chain guide with short screw in hole nearest idler shaft.

5) Place camshaft chain over camshaft sprocket and mounting bracket. Lower chain and sprocket past camshaft flange until center stud of sprocket is lined up with camshaft.

6) Rotate camshaft sprocket until screw holes match threaded holes in camshaft flange.

7) Place timing chain over crankshaft and idler sprockets so chain will be in a straight line between camshaft and crankshaft (see illustration). Do not change any of the sprocket settings while installing chain.



2EM5393

TIMING CHAIN INSTALLATION

8) Guide center stud of camshaft sprocket into camshaft. Install locking plate and one screw. Install screws for chain guides and camshaft sprocket mounting bracket.

INLINE 4 CYLINDER (Cont.)

9) Rotate crankshaft one revolution. Install and tighten camshaft sprocket screws. Lock screws with locking plate. Check timing marks to see they are properly aligned.

10) Install chain tensioner as follows: Relieve spring pressure on tensioner by turning clamping sleever clockwise to mounting position. Fit a spacer on neck of tensioner and push neck into body of tensioner.

11) Mount chain tensioner and guide plate on block. Remove spacer. Press curved chain guide against chain to stretch it and push tensioner neck into housing. Adjust to leave a clearance of .020" (.508 mm) between housing and tensioner neck, then tighten chain guide. Rotate crankshaft one full turn and check that tensioner has not less than .020" (.508 mm) and not more than .060" (1.524 mm) of clearance. Remove nut from camshaft center stud. Reinstall remaining components in reverse order of disassembly.

ENGINE OILING

Crankcase Capacity – 4.5 qts. (including filter).

Oil Filter – Full-flow type.

Normal Oil Pressure – 43 psi (3.0 kg/cm²) @2000 RPM.

Pressure Regulator Valve – Non-adjustable, opens at 57-71 psi (4.0-5.0 kg/cm²).

ENGINE OILING SYSTEM

Oil pressure is generated by a dual-rotor pump driven from idler shaft. Pump is located on outside of engine. Oil is forced through a full-flow filter and oil channels to various lubrication points. Each connecting rod bearing has a separate oil passage from main bearings.

OIL PUMP

Removal – 1) Remove four screws attaching pump to engine. Withdraw pump and "O" ring from engine. Remove two screws attaching pump cover to housing. Remove rotors and "O" ring from housing.

2) Pull cotter pin from pump cover and remove plug, "O" ring, spring and pressure relief valve piston. Using a straightedge and a feeler gauge, measure clearance between rotors and housing face. If clearance is excessive, lap face of pump until proper clearance is achieved.

Installation – 1) Clean and oil all parts. Install outer rotor with chamfered edge inward facing toward drive shaft. Install valve piston, spring, plug, "O" ring and cotter pin in pump cover.

2) Place "O" ring in pump housing groove. Install cover and tighten screws. Rotate pump until drive shaft engages in engine. Slide pump up against engine and install four attaching screws.

Oil Pump Specifications

Application	Clearance In. (mm)
Rotor-to-Housing End Clearance	.002-.003 (.051-.076)
Rotor Blades-to-Housing Clearance	max. .026 (.660)
Rotor Shaft Diameter	.498-.499 (12.64-12.67)
Rotor Shaft Bore in Housing	.500-.501 (12.7-12.72)
Pressure Relief Spring	
Free Length	2.06 (52.3)
Compressed Length	1.32 (33.5)
Spring Pressure, Compressed Length	15-16 lbs (6.8-7.2 kg)

ENGINE COOLING

Cooling System Capacity – 10 qts. (with heater).

Thermostat – 185°F (85°C).

Radiator Cap – 8.5 psi.

WATER PUMP

Removal – 1) Drain coolant and remove battery cable. Disconnect power assist vacuum hose from intake manifold. Disconnect fuel line at carburetor and hose from camshaft cover-to-crankcase.

2) Remove preheater hose and air cleaner. Disconnect throttle linkage. Loosen hose clamps to pump, intake manifold and distributor vacuum hoses.

3) Remove six manifold screws. Lift off intake manifold and carburetor as an assembly. If necessary remove choke cable. Remove alternator and engine mount bolts. Raise engine slightly and remove screw attaching bracket to timing cover. Loosen lower screw and swing bracket out of the way.

4) Remove three water pump cover screws and tap lower hose gently with a plastic mallet to loosen cover.

5) Unscrew center screw from impeller while holding impeller with suitable pliers.

NOTE – Center screw of impeller is a left-hand thread.

CAUTION – Impeller must not turn when removing center nut or damage to gear teeth on pump and idler shaft may result.

6) Attach slide hammer and suitable adapter (839057) to water pump shaft and take out as unit. If bearing housing remains in block, use slide hammer for removal.

Disassembly – 1) Mount pump in suitable tool and press out impeller.

2) Press pump shaft, seals and bearing from bearing housing. Place worm drive uppermost.

99 INLINE 4 CYLINDER (Cont.)

ENGINE COOLING (Cont.)

3) Remove pump seal, "O" ring, thrower and seal ring. Loosen ball bearing lock ring.

4) Place pump shaft and bearing with drive end downward and press shaft from bearing.

Assembly – 1) Fit oil thrower ring and press ball bearing onto pump shaft. Install bearing lock ring.

2) Press shaft and bearing into bearing housing. Install seal ring.

3) Install thrower, "O" ring and water pump seal in this order.

4) Mount pump in engine block, checking that pump gear engages with idler gear. Seat bearing housing using suitable sleeve and drift. Make sure flange of bearing housing butts against engine block.

5) Install impeller screw and washer. Tighten screw counterclockwise (left-hand thread). Tighten cover screws and reinstall remaining components in reverse order of removal.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Main Bearings	79 (10.9)
Rod Bearings	40 (5.5)
Camshaft Bearing Caps	13 (1.8)
Camshaft Cover	1 (.14)
Crankshaft Pulley	137 (19.00)
Rear Crankshaft Seal	14 (1.9)
Cylinder Head	
Step One	43 (6.0)
Step Two	69 (9.5)
Flywheel	43 (6.0)
Water Pump Impeller	18 (2.5)
Oil Pump	13 (1.8)
Idler Shaft Plate	14 (1.9)
Idler Sprocket	18 (2.5)
Camshaft Sprocket	14 (1.9)
Intake Manifold	13 (1.8)
Exhaust Manifold	18 (2.5)
Thermostat Housing	13 (1.8)