99 – 4 CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine number is stamped on block and is located near the summer setting on air cleaner.

Engine Identification

Application	①Engine Code
Federal	
Man. Trans.	B120-P06
Auto. Trans.	B120-P03
Calif.	
Man. Trans.	B120-P04
Auto. Trans.	B120-P05

① – Engine code number is followed by 6 digit serial number.

ENGINE & CYLINDER HEAD

ENGINE

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) Disconnect vacuum hoses from power assist cylinder and air flow sensor. Disconnect fuel lines from injector tubes. Disconnect EGR system. Remove air cleaner and mixture control unit.

3) Disconnect electrical wires from following components: coil, temperature sender, radiator fan, headlights, and automatic transmission switch.

4) Disconnect wires at fuel injection warm-up regulator, auxiliary air valve, cold start valve and thermo-time switch.

5) Disconnect throttle control cable. Disconnect coolant hoses at thermostat housing, radiator, water pump and intake manifold.

6) Remove hood lock operating cable at both firewall and fender panel. Remove 2 front panel metal screws and the 4 other screws mounting headlights to body. Lift out entire front panel (radiator and electric fan will come out with panel).

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

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

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

10) 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.

11) 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 Saab tool 8790388 (or equivalent) on wire, turn tool a small amount and pull out wire.

12) 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.

13) 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.

14) 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.

CYLINDER HEAD

Removal – 1) Disconnect battery cables. Drain coolant (including block). Disconnect throttle cable at housing. Disconnect electrical lead from temperature sender. Remove brake vacuum hose from intake manifold.

2) Disconnect and plug fuel lines from fuel distributor. Disconnect all necessary coolant hoses. Separate exhaust pipe from manifold. Take off ignition wires and cap. Thread a nut on center stud of camshaft sprocket. Clamp stud against mounting plate.

NOTE – *Make sure nut is securely tightened so center stud will not move.*

3) Unbolt retaining bolts from camshaft sprocket. Separate sprocket from camshaft plate. Let sprocket hang in mounting plate by center stud. Remove cylinder head bolts. Support rear of engine. Remove engine mount bolt from head. Take out screws at transmission cover. Remove head.

Installation – To install reverse removal procedures and note the following: Make sure camshaft and bearing cap index marks are aligned. Align flywheel mark with mark on cylinder block. Set ignition with No. 1 piston at TDC. Retorque head bolts after engine has run and allowed to cool.

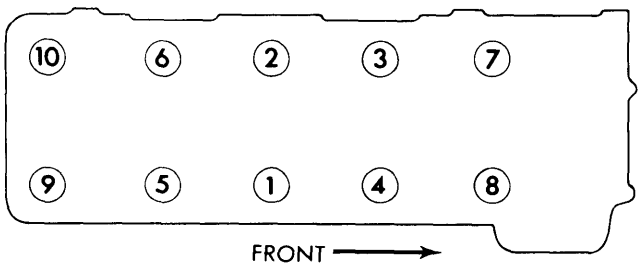

Fig. 1 Cylinder Head Tightening Sequence

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99 – 4 CYLINDER (Cont.)

VALVES

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 tool 8390437 (or equivalent), withdraw valve guide from camshaft side of head.

2) Install guide from cylinder side of head, using valve guide removal/installation tool 8390437 and adapters. Ream guide to standard size, using a suitable reamer. Check valve seat for true, reface if necessary.

VALVE SPRINGS

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 valve measuring tool 8391450 and 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" (.20-.25 mm) intake and .016-.018" (.40-.45 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

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.

Installation – Use a ring compressor over piston and fit piston to bore. Make sure notch in piston faces engine/transmission. Install rod cap in 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-.0016" (.014-.040 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)	3.5433-3.5437 (89.999-90.010)
1st Oversize	3.5619-3.5625 (90.472-90.487)
2nd Oversize	3.5816-3.5822 (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

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.

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THRUST BEARING ALIGNMENT

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

CAMSHAFT

FRONT OIL SEAL SERVICE

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

Remove seal ring with a screwdriver. Oil ring surface before installing. Fit new seal with spring ring facing crankshaft.

TIMING COVER & OIL SEAL

Remove pulley using a puller. Pry out old seal. Grease seal with silicone. Install new seal.

CAMSHAFT

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.

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

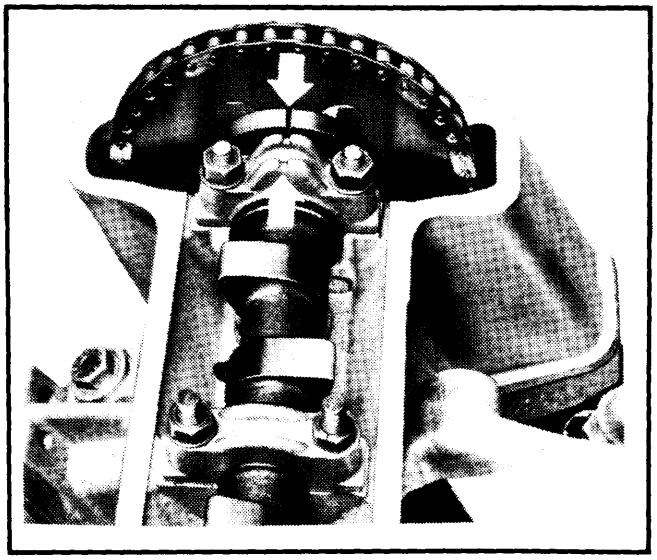

Fig. 2 Camshaft Timing Marks

5) Replace camshaft bearings and caps, then tighten cap nuts. Align camshaft timing mark with mark on cylinder head as shown in *Fig. 3*.

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.*

CHAIN TENSIONER MECHANISM

If chain tensioner mechanism has been dismantled or came apart, follow porcedure outlined for reassembly before fitting to engine:

- Place lock washer with ratchet sleeve into tensioner housing, large diameter end first.
- Fit spring against ratchet sleeve.
- Push neck of tensioner and spring into housing, simultaneously pressing and turning tensioner neck until seated.

NOTE – *Tensioner neck must be kept depressed while tensioner mechanism is being fitted.*

VALVE TIMING & CHAIN REPLACEMENT

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

2) Mount pinion sprocket on crankshaft. Align "O" degree mark on flywheel with mark on cylinder block. See *Fig. 3*.

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).

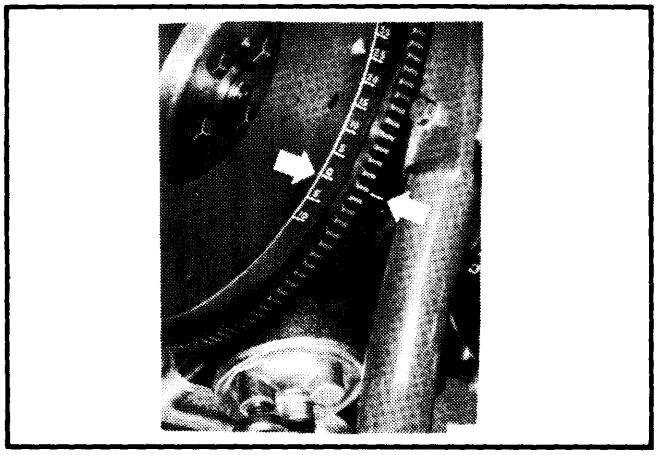

Fig. 3 Aligning "O" Degree Mark on Flywheel with Mark on Cylinder Block.

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.

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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 as shown in *Fig. 4*. Do not change any of the sprocket settings while installing chain.

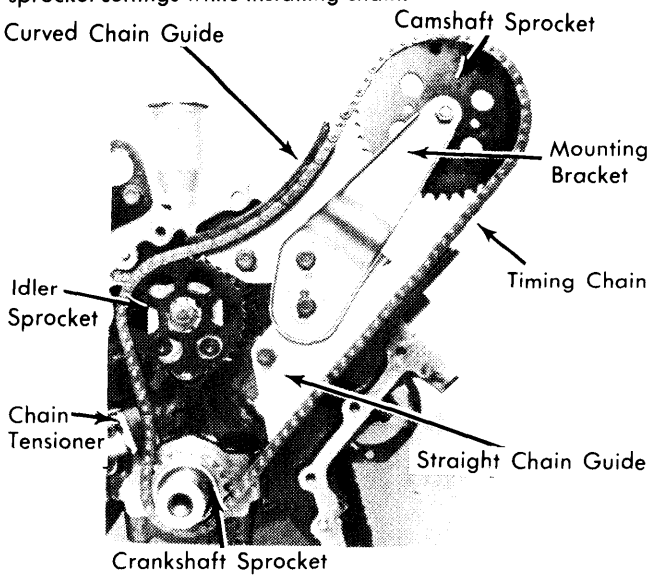

Fig. 4 Front View of Timing Chain Installed and Tightened

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.

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 block. Press curved chain guide against chain to stretch it and push tensioner neck into housing. Remove spacer. Adjust to leave a clearance of .020" (.5 mm) between housing and tensioner neck, then tighten chain guide.

12) Rotate crankshaft 1 full turn and check that tensioner has not less than .020" (.5 mm) and not more than .060" (1.5 mm) of clearance. Remove nut from camshaft center stud. Reinstall remaining components in reverse order of removal.

IDLER SHAFT

Removal – 1) Remove alternator drive belt. Remove cover screws, then tap cover forward to unseat from dowels. Rotate crankshaft until No. 1 piston is at TDC. Remove distributor.

2) Hold idler shaft sprocket and take off lock plate. Make sure crankshaft is not moved from this point on. Loosen tensioner mounting screws and move tensioner out-of-way. Remove idler shaft.

Installation – 1) Install idler shaft with mounting plate. Tighten countersunk screws. Install a new locating pin. Align chain and sprocket as shown in *Fig. 5*. Fit locating plate with new retaining bolt. Hold sprocket and tighten retaining bolt.

2) Set chain tensioner self-adjuster so it is in seated position. Reposition chain tensioner. Set clearance between tensioner and pad to .020-.040" (.5-1 mm). Slightly tap in cover dowels. Install cover and new gasket (if necessary). Reverse removal procedure for remaining components.

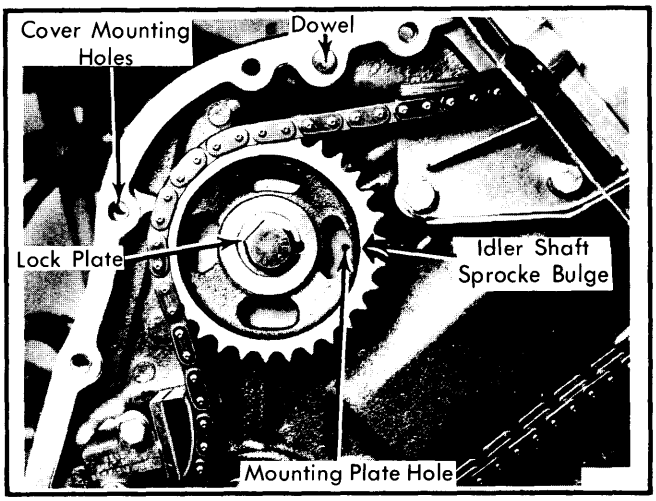

Fig. 5 Idler Shaft Index Marks. Bow in Cutout on Idler Shaft Sprocket Must Line Up with Small Hole in Mounting Plate.

ENGINE OILING

Crankcase Capacity – 4.0 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 cover and remove plug, "O" ring, spring and pressure relief valve piston. Using a straightedge and feeler gauge, measure clearance between rotors and housing face. If clearance exceeds .002-.0035" (0.05-0.09 mm), use fine emery paper to resurface housing or sides of rotors.

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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 up until drive shaft engages in engine. Slide pump up against engine and install four attaching bolts.

ENGINE COOLING

Cooling System Capacity – 8.5 quarts.

Thermostat – Thermostat begins to open at approximately 190°F (88°C).

Radiator Cap – Radiator pressure cap opens at approximately 14.2 psi.

WATER PUMP

Removal – 1) Drain coolant. Disconnect battery. Remove intake manifold. Remove alternator. Remove bolt mounting bracket to pump cover. Unbolt rear engine mounts. Raise rear of engine. Remove bolt mounting alternator bracket to transmission cover. Loosen lower bolt and twist bracket away from engine. Remove last two bolts from cover and remove.

2) Position special tool 8392441 (or equivalent) over water pump and fit two bolts (DO NOT TIGHTEN). Turn tool counterclockwise so peg engages a fin on impeller. Loosen center impeller nut (left hand threads). Remove water pump. DO NOT tap out with hammer.

Installation – To install, reverse removal procedure and note: It may be necessary to use sleeve 8392490 (or equivalent) to seat bearing housing.

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1978	121	1985	Fuel Inj.	.....	.....	9.25-1①	3.543	90	3.071	78

① – Calif. 8.7-1

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.	1.654 (42.9)	44.5°	45°	.004-.008 (1-2)	.313-.314 (7.950-7.976)	0.02 (0.5)	.....
Exh.	1.398 (35.5)	44.5°	45°	.004-.008 (1-2)	.313-.314 (7.950-7.976)	0.02 (0.5)	.....

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	.0006-.0016 (.014-.040)	.0002-.0006 (.005-.014)	①	No. 1	.014-.021 (.35-.55)	.002-.003 (.050-.082)
				No. 2	.012-.018 (.30-.45)	.0016-.003 (.040-.072)
				Oil	.015-.055 (.38-1.40)	.....

① – Interference fit.

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99 - 4 CYLINDER (Cont.)

ENGINE SPECIFICATIONS (Cont.)

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	2.283-2.284 (57.981-58.000)	.001-.002 (.026-.062)	Center	.003-.0011 (0.08-0.28)	2.046-2.047 (51.981-52.000)	.001-.002 (.026-.062)	.....

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1985 cc	1.700 (43.1)	.....	170-183@1.161 (77.1-83.0@29.5)

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm) ①	Lobe Lift In. (mm)
1985 cc	1.139 (28.94)	.....	Int. .421 (10.7) Exh. .433 (11.0)

① — End play is .003-.010" (.08-.25 mm)

VALVE TIMING

Engine	INTAKE ①		EXHAUST ②	
	Open (BTDC)	Close (ALDC)	Open (BLDC)	Close (ATDC)
1985cc	10°	54°	46°	18°

① — With .014" (.35 mm) valve clearance.
② — With .022 (.55 mm) valve clearance.

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	11 (1.5)
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	14 (1.9)
Thermostat Housing	13 (1.8)

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