140 SERIES 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 B20F	121.43	1990	F.I.	109 @ 6000	115 @ 3500	8.7:1	3.50	88.9	3.15	80

ENGINE IDENTIFICATION

Engine type designation, part number, and manufacturing serial number are located on machined surface on left forward side of cylinder block. Code for engine will be B 20 F.

ENGINE REMOVAL

1) Remove gearshift lever, detach the hood, and disconnect battery. Drain cooling system by removing the lower radiator hose. Disconnect the following fuel lines: rubber hose to control pressure regulator, plastic hose from control pressure regulator at fuel distributor, hose at cold start injector, hose at fuel filter, and fuel return hose at fuel distributor.

2) Remove pipe connecting air cleaner and intake manifold. Disconnect wires from cold start injector, control pressure regulator, auxiliary air valve, coolant temperature sensor, thermal time switch (at engine side), and control pressure regulator ground wire.

3) Detach four fuel hoses at injectors, throttle cable at throttle and intake manifold, oil pressure switch wire, alternator wires, heater hoses at firewall, brake vacuum booster hose at intake manifold, crankcase ventilation hose at air cleaner, spark plug and distributor wires, starter cable, and hose at thermostat housing.

4) Remove fan shroud, disconnect hose from radiator at expansion tank, remove grille, then unbolt and lift out radiator. Remove thermal time switch at right side of block.

5) Attach suitable lifting device to engine, raise vehicle, and support on safety stands. Drain engine oil. Unbolt front and rear mounts. Remove EGR valve pipe (if equipped). Lift engine rear end. Disconnect engine ground strap. Remove clutch spring and cable. Remove front exhaust clamp. Unbolt transmission member. Detach speedometer wire at transmission and disconnect all other transmission electrical wiring. Detach propeller shaft from transmission. Maneuver engine assembly from vehicle.

INLET DUCT

Removal – 1) Remove hose for pressure sensor from inlet duct; fuel hose for cold start valve from distributor pipe, and fuel hoses from pipes on firewall. Remove plug contacts for temperature sensor, cold start valve, and throttle valve switch.

2) Remove hose for induction air, remove electric lead for temperature sensor and ground lead from inlet duct. Remove bolts for pressure regulator bracket. Remove injectors and fit with masking covers and protective plugs in holes.

Installation – 1) Remove protective plugs and masking covers. Place new rubber seals on injectors. Install injectors and distributor pipe, fit pressure regulator.

2) Connect electric leads for temperature sensor and ground lead to inlet duct. Clip on plug contacts for temperature sensor, cold start valve and throttle valve switch. Connect hose for induced air. Attach fuel hoses and hose for pressure sensor.

CYLINDER HEAD

1) Drain cooling system. Remove battery leads. Disconnect brake vacuum booster hose, crankcase ventilation hose, cold start injector hose, fuel hoses at "T" connector of control pressure regulator, and outlet fuel hose at fuel filter. Remove fuel filter. Disconnect fuel distributor hose at control pressure regulator.

2) Disconnect wires at cold start injector, auxiliary air valve, control pressure regulator, and temperature sensor. Remove air cleaner connecting pipe. Disconnect throttle cable at intake manifold. Detach heater hose and upper radiator hose. Remove alternator adjustment bracket.

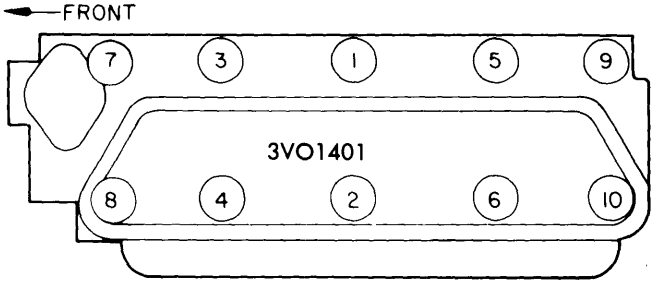
3) Remove straps for injector hoses. Remove injectors (with hoses). Detach bracket for intake manifold and lift off manifold. Unbolt exhaust manifold. Remove spark plugs and wires. Remove rocker cover, rocker arm shaft, and push rods. Unbolt and remove cylinder head.

4) To install head, use suitable guide pins (SVO 2435) inserted in front right hole and left rear hole. Ensure new head gasket is installed with "TOP" mark upward. When head is positioned, remove guide pins, then install and tighten cylinder head bolts in three steps as indicated in table and according to illustrated sequence. Install push rods and rocker arm shaft. Adjust valves to .018-.020" (.45-.50 mm). Reverse remainder of removal procedure, then make final valve adjustment (after running engine for ten minutes) to .016-.018" (.40-.45 mm). Retorque head bolts.

Cylinder Head Tightening Specifications

Sequence	Ft. Lbs. (mkg)
Step One	29 (4.0)
Step Two	58 (8.0)
Step Three ①	65 (9.0)

① – After running engine for ten minutes.



CYLINDER HEAD TIGHTENING SEQUENCE

140 SERIES 4 CYLINDER (Cont.)

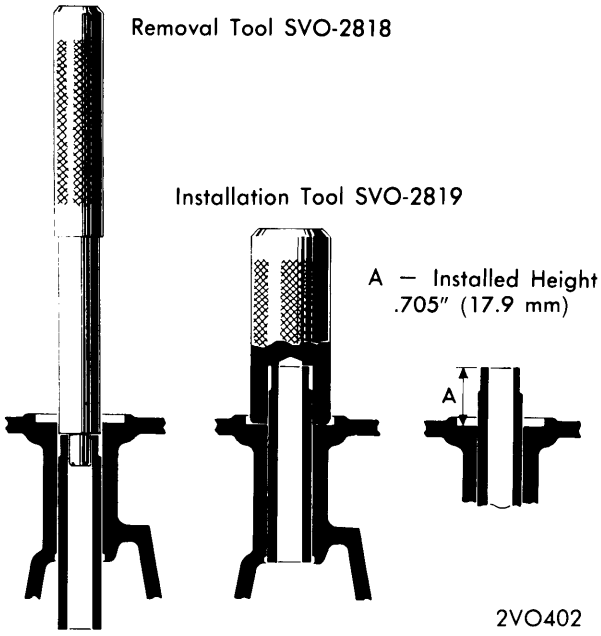
VALVES							
Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
B 20 F							
Intake	1.732 (44)	45°	44.5°	.08 (2)	.3132-.3138 (7.96-7.97)	.0012-.0026 (.030-.068)	.28 (7.2)
Exhaust	1.378 (35)	45°	44.5°	.08 (2)	.3120-.3126 (7.93-7.94)	.0024-.0038 (.060-.097)	.28 (7.2)

VALVE ARRANGEMENT

E-I-I-E-E-I-I-E — Front to rear.

VALVE GUIDE SERVICING

Removal & Installation — Press out old guides using suitable tool (SVO-2818 or equivalent). Press in new guides using drift tool (SVO-2819) to gain correct depth. B-20-F engine uses a .016" (.4 mm) washer between drift tool and cylinder head surface. Check to see that guides are free from burrs, and that valves move freely in guides.



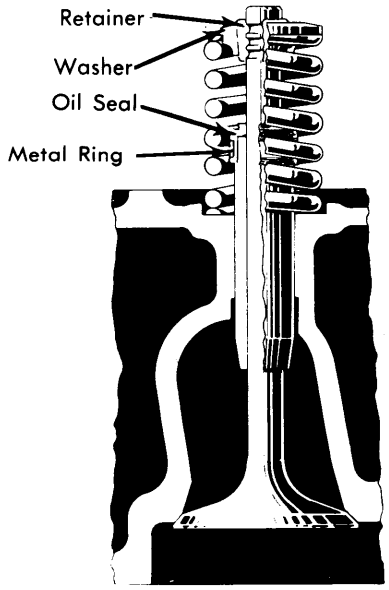
VALVE GUIDE REMOVAL & INSTALLATION

VALVE SPRINGS

Removal & Installation — With cylinder head removed, compress valve springs using suitable valve spring compression tool, and remove valve retainers. Disassemble valve spring components and place valves in order in suitable valve rack. To install, place valves in position, fit valve guide seal, valve spring, upper washer and retainer.

VALVE SPRING INSTALLED HEIGHT

Valve spring ends must be square. Installed height of valve spring cannot exceed specifications. Measure spring height from base of spring pad on cylinder head to underside of spring retainer.



VALVE & GUIDE ASSEMBLY

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
B 20 F	1.81 (46)	60-70@1.57 (26-32@40)	172-191@1.18 (77-87@30)

ROCKER ARM ASSEMBLY

Remove all hoses, electrical leads, and mechanical linkage. Remove rocker arm cover, rocker arm shaft assembly, and push rods. Check rocker arm shaft and push rods for excessive

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wear. Rocker arms can be rebushed if wear exceeds .004" (.10 mm) by pressing out old bushing, using a suitable tool (SVO 1867). Ream new bushing to accurate fit on rocker arm shaft. Oil hole in bushing should be aligned with oil hole in rocker arm. Grind rocker arm tips, if necessary, to ensure correct angle or surface.

VALVE CLEARANCE ADJUSTMENT

Valve clearance is to be adjusted with engine off. This procedure may be done with engine warm or cold. Valve clearance adjustment setting of .016-.018" (.40-.45 mm) is the same for both intake and exhaust valves. Turn crankshaft until No. 1 piston is in firing position, No. 4 rockers balanced, and crankshaft pulley is on "0". Adjust valves in the following sequence:

Valve Adjusting Sequence

Balance ①	Adjust
No. 4	No. 1
No. 2	No. 3
No. 1	No. 4
No. 3	No. 2

① – Balance = Exhaust valve has just closed and intake valve is about to open.

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)
B 20 F	.0004-.0012 (.010-.030)	Push Fit	Push Fit	All	.016-.022 (.40-.55)	.0016-.0028 (.040-.072)

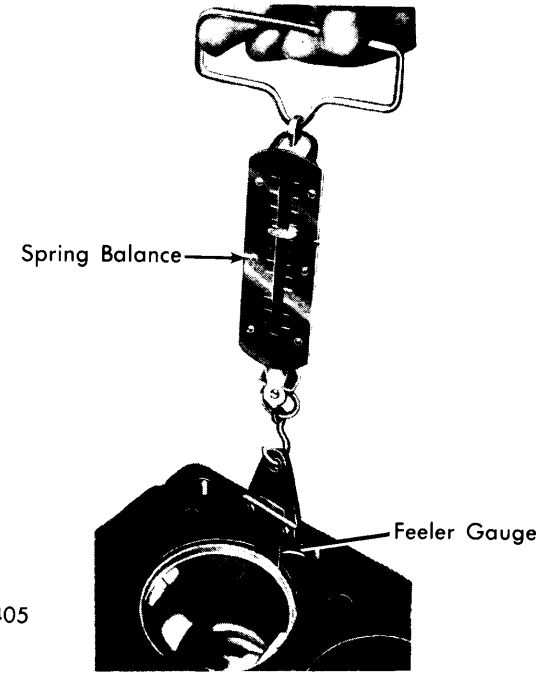
OIL PAN REMOVAL

1) Using suitable engine lifting device, raise front of engine. Place jack stands under vehicle front jacking points. Drain crankcase. Remove lower engine mounting nuts. Remove steering rod from pitman arm.

2) Place jacking device under front axle member, remove two rear bolts and replace with two ½-13x9" auxiliary bolts. Remove front axle member bolts and lower and remove jacking device so that front axle member is suspended in two auxiliary bolts. Disconnect oil temperature gauge fitting and reinforcing bracket at clutch housing. Remove oil pan bolts and oil pan. To reinstall, reverse removal procedure. Replace auxiliary bolts with original bolts.

PISTON & ROD ASSEMBLY

Removal & Installation – Disassemble oil pan and related parts. See *Oil Pan Removal*. Check to ensure that connecting rods and rod caps are marked correctly to reinstall in correct location. Remove carbon ridge from cylinder bores. Remove connecting rods with pistons, replace connecting rod caps on respective connecting rods. To reassemble, lubricate all internal surfaces with engine oil before assembly. Make sure that notch in piston crown is facing front of engine, connecting rod marking should face away from camshaft side. Use suitable installing ring (SVO-2823 or equivalent) to fit piston and connecting rod assembly into block. Tap lightly on piston dome with wooden handle while guiding connecing rod onto crankshaft. Secure and tighten all nuts and bolts. Reassemble in reverse of removal procedure.



MEASURING PISTON CLEARANCE

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FITTING PISTONS

Pistons should be placed into respective cylinders without rings installed. Clearance of piston to cylinder wall should be .0004-.0012" (.01-.03 mm) and is measured at right angle to piston pin hole. Using .0008" (.02 mm) feeler gauge attached to spring balance, a force of 2.2 lbs. (1 kg) should be required to pull out feeler gauge (see illustration). With this force, the piston clearance obtained should be equal to the thickness of the feeler gauge. When replacing pistons, note that standard bore cylinders are letter-stamped; ensure piston has same stamp.

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PISTON PIN FIT

PISTON PINS

Piston pins are available in .002" (.05 mm) oversize from standard diameter. If replacement oversize pins are needed, piston pin hole should be reamed out to correct measurement using suitable reaming tool. Use reamer fitted with pilot guide, take only small cuts at a time. Pin fit is correct when pin can be pushed through connecting rod hole by hand, with only light resistance.

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)
B 20 F	2.4981-2.4986 (63.451-63.464)	.0011-.0033 (.028-.083)	....	.0018-.0054 (.047-.137)	2.1255-2.1260 (53.987-54.000)	.0012-.0028 (.029-.071)	.006-.014 (.15-.35)

MAIN & CONNECTING ROD BEARINGS

Removal & Installation – 1) Remove oil pan and related parts. *See Oil Pan Removal.* Identify and mark connecting rod caps and main bearing caps to ensure correct replacement.

2) Remove connecting rod caps and push pistons to top of cylinders. Remove main bearing caps and thoroughly clean all bearing surfaces.

3) Measure all journals, using a micrometer. Out-of-roundness on connecting rod bearings should not exceed .003" (.07 mm) and on main bearings, it should not exceed .002" (.05 mm). If values obtained are close to, or in excess of wear limits, crankshaft must be reground to next suitable undersize.

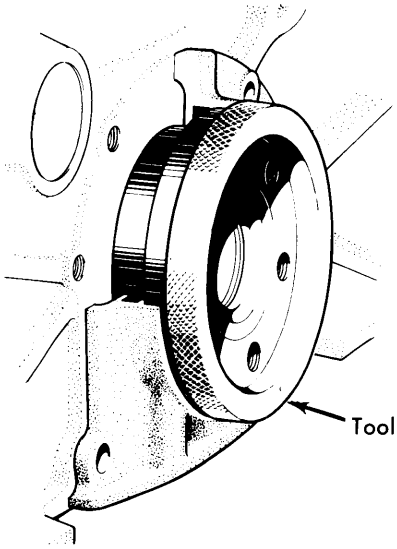
4) If all journals check out to standard size, refit with replacement bearings. Reinstall main bearing caps, refit connecting rods to crankshaft and tighten all nuts and bolts to specifications. Reassemble engine in reverse order of removal.

REAR MAIN BEARING OIL SEAL

Removal & Installation – 1) Remove transmission, clutch, and flywheel from engine. Remove two bolts for oil pan (in flange). Slacken a bolt on either side of flange, to relieve oil pan pressure against flange. Remove the flange. Use a suitable drift (SVO 2817) to remove oil seal.

2) Clean flange area carefully. Fit on sealing flange but do not tighten bolts. Center rear main seal flange using suitable tool (SVO-2439 or equivalent). Adjust position of flange if necessary. Check to see that flange seats flush with underside of block assembly.

3) Fit new felt ring and install washer and circlip. Press circlip into position using centering tool. Ensure that circlip engages in its groove. Reinstall flywheel, clutch assembly, clutch housing and transmission.



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CENTERING REAR MAIN OIL SEAL FLANGE

140 SERIES 4 CYLINDER (Cont.)

ENGINE FRONT COVER OIL SEAL

Removal & Installation – 1) Remove fan belt tensioner. Loosen stabilizer at frame. Screw out bolt in crankshaft, remove belt pulley. Remove circlip and take out washer and felt ring.

2) Check casing for correct installation by inserting a .004" (.10 mm) feeler gauge in gap between casing and crankshaft hub. If feeler gauge jams at any point, casing must be recentered.

3) Fit new felt ring, place washer in position and fit circlip. Check to ensure that circlip is properly in position. Fit remaining parts and tension fan belt.

ENGINE FRONT COVER

Removal & Installation – 1) Loosen fan belt, remove fan and pulley from water pump. Disconnect stabilizer attachment from frame. Take off bolt and remove crankshaft belt pulley.

2) Remove front cover case. Loosen several front bolts for oil pan sump, taking care not to damage gasket. Remove circlip, washer, and felt ring from case.

3) Replace front cover gasket. Ensure that oil drain hole in casing is open. Place case in position and fit bolts without tightening. Center case using suitable tool (SVO-2438 or equivalent), turn tool while tightening bolts and adjust position of case so that tool is not jammed. Tighten all bolts and remove tool.

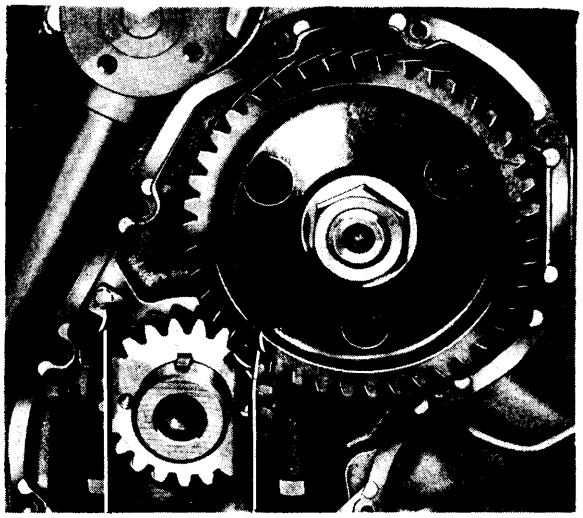
CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
B 20 F			
Front	1.8494-1.8504 (46.975-47.000)	.0008-.0030 (.020-.075)	.....
Mid	1.6919-1.6929 (42.974-43.000)	.0008-.0030 (.020-.075)	.....
Rear	1.4557-1.4567 (36.975-37.000)	.0008-.0030 (.020-.075)	.....

4) Fit new felt ring washer and circlip. Push into position using centering tool, check to ensure that circlip is in groove. Fit all other parts in reverse order of removal. Tighten belts and place stabilizer attachment back onto frame.

TIMING GEAR REPLACEMENT

Drain cooling system, remove radiator. Remove timing cover as previously described. Use a suitable puller (SVO 2440) to remove hub from crankshaft. Remove camshaft nut and extract gear, using suitable puller (SVO 2250). Pull off crankshaft gear (SVO 2405). Screw out oil nozzle and clean it. To install, reverse removal procedure, aligning timing marks as shown. Tooth flank clearance and camshaft axial clearance are determined by spacer ring behind camshaft gear.



ALIGNING TIMING MARKS

ENGINE OILING

Crankcase Capacity – 3.9 qts. including filter.
Oil Filter – Full-flow canister, disposable type.
Normal Oil Pressure – 36-85 psi @ 2000 RPM with engine hot.

ENGINE OILING SYSTEM

Engine utilizes a force-feed lubricating system. Oil is moved through oil pump to oil filter located on outside of engine block assembly. Lubricant is forced from filter to drilled gallery in center of block where oil moves under pressure to main bearings. Main bearings are drilled to pass lubricant on to rod bearings and to camshaft bearings. Oil from camshaft bearings is pushed up into head assembly where it lubricates rocker arm shaft and rocker arms. Push rods and valve lifters receive oil along with valve assembly. Oil nozzle at front of timing gear recess sprays gears with lubricant directly from main oil gallery. Cylinder walls and rings are lubricated by splash from connecting rods. Excess oil from all areas is returned to sump via drain holes in block assembly.

OIL PUMP

1) Remove oil pan and related parts. *See Oil Pan Removal.* Pull oil pump out of engine, disassemble and clean all parts thoroughly. Check all parts for excessive wear or signs of fatigue.

2) Measure backlash (clearance) between pump gears. It should be .006-.014" (.15-.35 mm). Also measure end play of gears. Allowable end play is .0008-.0040" (.02-.10 mm). If any parts show excessive play, replace necessary components. Note that drive shaft and gear are a matched set and must be replaced as an assembly.

3) Reinstall oil pump, making sure that sealing rings on oil delivery pipe are securely in place. Be certain oil pump goes into groove in pump shaft. Replace oil pan and related components.

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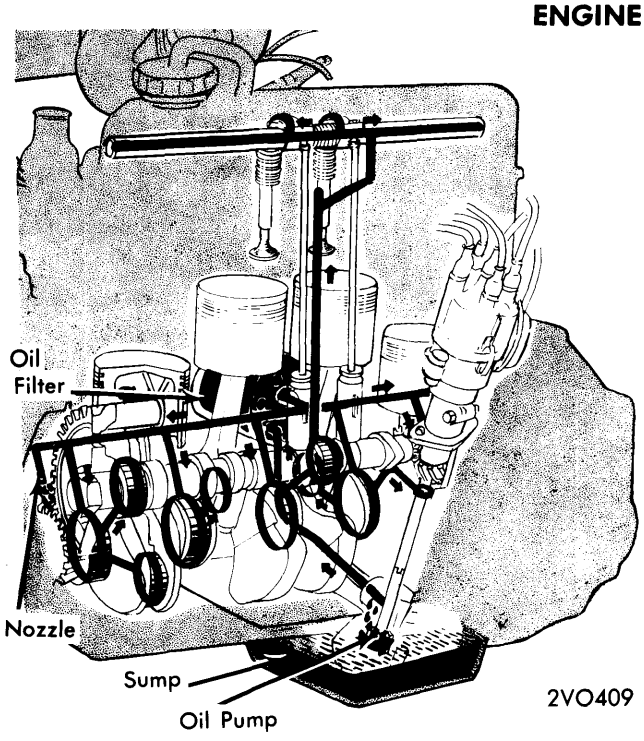
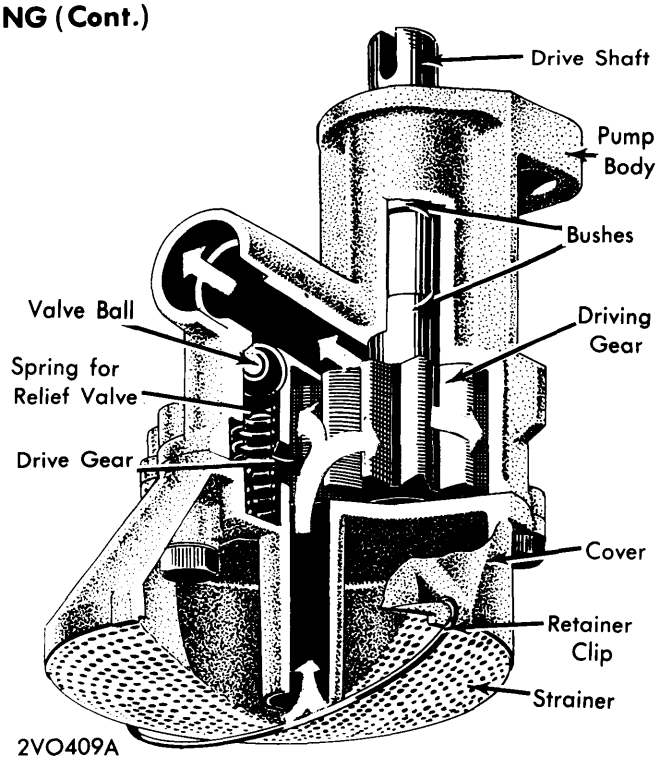
ENGINE OILING (Cont.)



ENGINE LUBRICATING SYSTEM



OIL PUMP ASSEMBLY

ENGINE COOLING

WATER PUMP

1) Remove radiator cap, disconnect lower radiator hose, and drain cooling system. Remove expansion tank with hose. Detach upper radiator hose. Unbolt and lift out radiator. Remove water pump screws and take off pump. Clean all sealing surfaces.

2) To install, first check that all sealing rings are located correctly. Position pump and press it upward against cylinder head extension to ensure complete sealing. Inspect seals at water pipes. Press pipes in fully when attaching water pump.

Thermostat – Type 1 (marked "170") opens at 168-172°F (75-78°C); fully open at 192°F (89°C).
Type 2 (marked "82°") opens at 177-181°F (81-83°C); fully open at 195°F (90°C).

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head Bolts	
Step One	29 (4.0)
Step Two	58 (8.0)
Step Three ①	65 (9.0)
Main Bearing Caps	87-94 (12-13)
Connecting Rod Caps	51-57 (7.0-7.9)
Flywheel Bolts	47-51 (6.5-7.0)
Spark Plugs	25-29 (3.5-4.0)
Camshaft Nut	94-108 (13-14)
Crankshaft Pulley Bolt	
Single Pulley	69-76 (9.5-10.5)
Double Pulley	80-101 (11-13.9)
Oil Pan Bolts	6-8 (.8-1.0)

① – With engine warm.