

Subaru Engines

1400 & 1600 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
1976										
1400	83	1361	1x2Bbl.	①58@5200	②68@2400	8.5-1	3.35	85	2.36	60
1600	97	1590	1x2Bbl.	67@5200	81@2400	8.5-1	3.62	92	2.36	60

① - 4WD, 56@5200 RPM

② - 4WD, 67@2400 RPM

ENGINE IDENTIFICATION

Engine number is stamped on a machined pad near distributor. See table below for engine codes.

Engine Codes

Application	Calif.	Federal
1400		
4-Speed.....	EA63AFB.....	EA63AFA
4-Speed, 4WD.....	EA63AP6.....	EA63AP5
5-Speed.....	EA63EF5.....	EA63EF4
1600		
Auto. Trans.....	EA71AT2.....	EA71AT

ENGINE

NOTE - It is possible to remove engine with transmission fitted. Removal procedure given is with transmission remaining in vehicle.

Removal - 1) Disconnect battery cable. Remove spare wheel from engine compartment. Remove air cleaner assembly.

2) Disconnect fuel line from fuel pump intake, allow fuel to drain into a suitable container. Drain radiator and engine block. Disconnect radiator hoses at engine.

3) Disconnect all wiring to engine and accessories. On 4-WD models remove engine fan from pulley. On Automatic Transmission models disconnect oil cooler pipes.

4) Remove two upper radiator bolts and lift out radiator. Remove nuts on each end of engine-to-firewall strut and remove strut by moving to rear to clear engine hanger. Remove starter from transmission housing.

5) Remove all control cables and vacuum hoses from engine. On Automatic Transmission models disconnect torque converter from engine by rotating crankshaft to remove four bolts through timing hole. Use care that bolts do not drop into housing.

6) Remove engine-to-transmission bolts and nuts and disconnect exhaust pipe. Remove bolts securing front engine mounts-to-engine. Slightly hoist engine with chain hoist attached to front to rear hangers and separate engine from transmission.

7) When separating engine from transmission, ensure that torque converter remains with transmission (Automatic Transmission only). Also, it may be helpful to slightly jack up

transmission during removal procedure. Remove engine completely and place on engine stand.

Installation - To install, reverse removal procedure and tighten all bolts and nuts. Adjust all controls and fill engine with suitable coolant.

ENGINE DISASSEMBLY

NOTE - Remove engine, place on suitable stand (399814300) and proceed as follows:

1) Separate engine from transmission, if necessary. On automatic transmission only, make sure converter remains on transmission. Drain oil and coolant. Make sure liquid does not run over clutch cover. On manual transmission models, remove clutch cover and disc.

2) Remove fan and pulley. Remove following emission control components: Air cleaner, distributor, air pump (on alternator bracket), EGR pipe (Calif. models) and air suction valve and air distribution plugs.

3) Remove oil filter duct. 4WD models have a bracket. Use a puller and remove crankshaft pulley. Remove oil pump and filter as an assembly. Remove water pump with hoses and tubes attached.

4) Turn engine over on stand and remove oil pan, crankcase, gasket and transmission cover (if necessary). Remove oil strainer and brackets. Remove either flywheel or converter drive plate. Take off flywheel housing.

5) Remove spark plugs. Remove valve cover. Loosen valve rocker nuts and remove rocker arm with push rods. Loosen cylinder head nuts in sequence (See Fig. 1). Remove cylinder head and gasket. Use an Allen wrench and remove crankcase plug. Remove cylinder liners with puller 899704100 (or equivalent).

NOTE - Mark edge of cylinder liner flange and cylinder block so exact positioning can be achieved. Keep liners and gaskets in matched sets.

6) On 1400 models only, reach through crankcase plug hole and remove piston pin circlips. On 1600 models only, set pistons to bottom dead center and remove circlip with long nosed pliers. On 1600 models, access to No. 1 and No. 2 pin is through front service hole. Access to No. 3 and No. 4 pin is through rear service hole. On 1400 models, insert pin removal tool through crankcase. Remove pins and pistons, marking for reassembly.

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7) Work through hole in camshaft gear and straighten lockwasher, then remove nut. Remove nuts and washers and separate cases.

8) Remove oil seal. Lift out crankshaft, distributor gear, and connecting rods. Keep crankshaft bearings in order for reassembly. Remove camshaft and gear. Remove oil pressure switch and valve lifters.

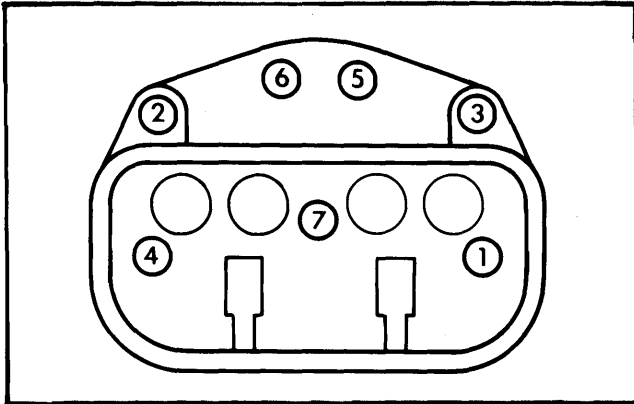


Fig. 1 Cylinder Head Loosening Sequence

This completes major engine disassembly. Repair or replacement of individual components will be covered under separate titles. In the following section *Engine Reassembly* it will be assumed all components are properly fitted and in good condition.

ENGINE REASSEMBLY

- 1) Oil all rotating or sliding parts. Replace all gaskets with new. Grease oil seal lip before installation. Use sealing compound where required. Recheck all running clearances.
- 2) On 1400 models only, install connecting rod over crankshaft and fit bearing caps. Make sure symbol mark and ribbed portion on each connecting rod faces forward. Threads must be oiled before tightening rods. Fit Woodruff keys to crankshaft and install distributor gear on crankshaft.
- 3) On 1400 models only, install rings on piston and space as shown in Fig. 2. Install circlip in rear side of piston. Fit piston to liner. Push piston pin in until it protrudes about .039" (1 mm) from inside edge of pin boss. Make sure pistons are aligned so pin circlip can be fitted.
- 4) On 1600 models only, install rings on each piston. Stagger rings as shown in Fig. 2. Insert circlip into rear end of piston (faces rear) on No. 1 and No. 2. On No. 3 and No. 4 cylinders, insert circlip into front end of pistons (faces front).
- 5) Install Woodruff key on camshaft. Fit camshaft gear. Make sure side with no protrusion faces camshaft journal. Press on camshaft gear with 1.575" (40 mm) boss facing toward camshaft journal.

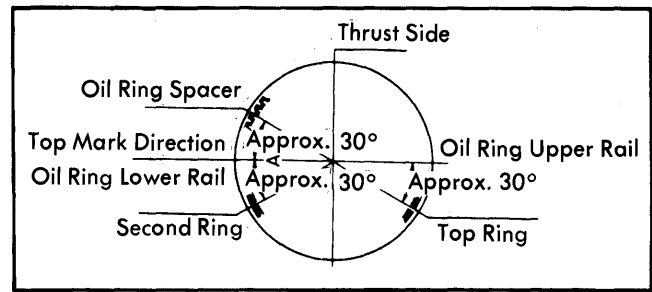


Fig. 2 Piston Ring Gap Position

- 6) Apply oil to seal and press new seal into flywheel housing. Screw drain plugs into heads. Rocker shaft spacers are marked "R" and "L", install properly. Assemble rocker shaft assemblies and set aside for later installation.
- 7) Place main bearings halves in each side of crankcase. Make sure oil passages are not blocked. Oil lifters and fit in crankcase. Install lifter clip.
- 8) Lay crankshaft and camshaft into crankcase. Make sure crankshaft gear bolt hole with large chamfer is installed so punch mark on camshaft gear can be seen. Apply sealer to crankcase halves and refit together.
- 9) Position camshaft plate to crankcase. Install bolts and locks through hole in camshaft gear. Tighten bolts and bend up lock tabs.
- 10) On 1400 models only, set crankcase so No. 2 and No. 4 cylinder face down. Place No. 3 connecting rod at TDC. Position No. 3 piston, liner and liner gasket so that pin and circlip may be inserted. Make sure piston is facing right direction. Repeat procedure for No. 1 cylinder. Install liner holder over a cylinder head stud to prevent liner moving when engine is rotated.
- 11) Still on 1400 models only, rotate engine so No. 2 and No. 4 liner may be installed. Repeat installation operation. Check all cylinder liner projections above block. Adjust by selecting proper thickness gasket.
- 12) On 1600 models only, apply oil to piston and inner surface of cylinder liner. Position crankcase so No. 2 and No. 4 cylinders are down. Bring No. 2 connecting rod to bottom dead center. Insert piston into cylinder liner using guide 398744300 (or equivalent). Insert piston pin and second circlip through access hole. Repeat procedure on No. 4 cylinder inserting pin from flywheel housing side. Turn engine to expose No. 1 and No. 3 cylinders and repeat procedure.
- 13) Turn crankshaft and check that pins are fully seated and do not bind. Insert crankcase plugs. Install cylinder head. Use suitable aligner and spacer (399734300) to make sure head is properly situated. Apply oil to threads and tighten head nuts. Remove alignment tool and insert push rods.
- 14) Install flywheel to crankcase. Do not damage oil seal lip. Note that flywheel can only be installed one way. Install pilot bearing. Fit clutch cover and disc onto guide. Make sure "O" marks on flywheel and cover are at least 120° apart.

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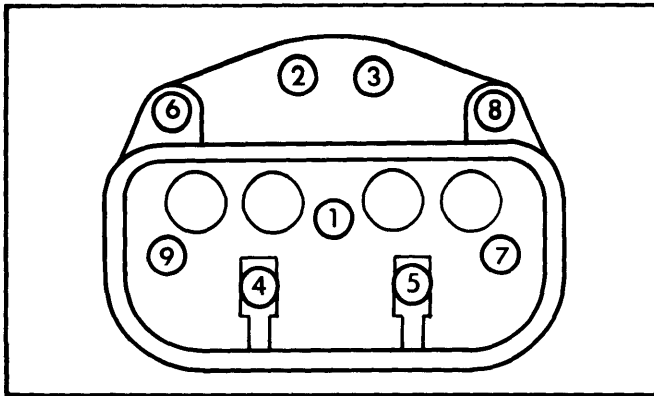


Fig. 3 Cylinder Head Tightening Sequence

15) Refit oil pan and transmission cover. Install water pipe elbow, pipe and hose with clamps and attach water pump. Install oil duct with bracket (if equipped). Install oil pump with new "O" ring. Fit crankshaft pulley and tighten attaching bolt.

NOTE - Hold flywheel from turning by inserting a rod through hole in flywheel.

16) Adjust valve clearance and install valve cover and gasket. Set No. 1 piston to TDC, align distributor gear and distributor housing mark. Set arrow of indicator to zero position of octane selector. Insert distributor and "O" ring into crankcase and adjust timing.

17) Install spark plugs and generator bracket. Install generator/air pump assembly. Fit air cleaner bracket. Install drive belts. Reverse disassembly 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)
1400 & 1600 Int.	1.452-1.461 (36.88-37.11)	45°	45°	.043 (1.092)	.3130-.3136 (7.950-7.956)	.0014-.0026 (.033-.066)	.....
Exh.	1.280-1.288 (32.51-32.72)	45°	45°	.063 (1.600)	.3124-.3130 (7.935-7.950)	.0020-.0032 (.051-.081)	.....

VALVE ARRANGEMENT

I-E-I (both banks, front to rear).

VALVE GUIDE SERVICING

1) Check valve guide for wear or damage. Replace defective guides by using a drift and driving out guide through top of head. Press in new guide from top of head until correct projection of guide above head is achieved. See Fig. 4.

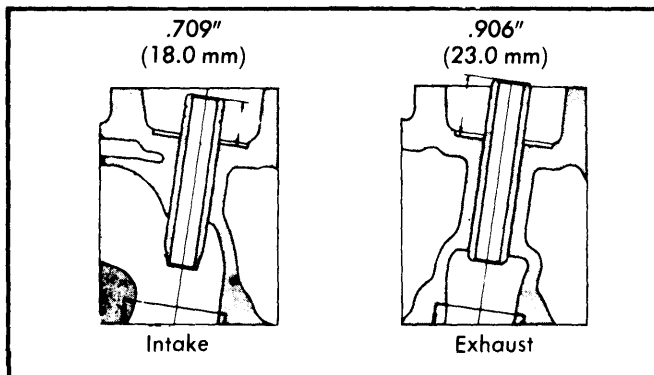


Fig. 4 Correct Valve Guide Projection

2) Ream valve guide to provide correct clearance. Inspect valve seat to make sure it is true with guide. Reface valve seat if necessary.

VALVE STEM OIL SEALS

Valve stem oil seals are found only on intake valves. Slide seal off of valve guide and replace with a new seal. Use care when inserting valve stem not to damage seal.

VALVE SPRING

Use a spring compressor, remove "O" ring, valve keepers and spring retainer. Check spring under pressure and at free length. Replace if necessary. Install spring with wide spaced coils (paint mark) facing valve spring retainer.

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1400 & 1600	Inner	.....	87.9-101@1.25 (39.9-45.8@31.8)
	Outer	.....	39.2-44.5@1.16 (17.8-20.2@29.5)

ROCKER ARM ASSEMBLY

Check rocker shaft, rocker arm and bushing for wear or damage. Replace any worn parts. Press in new bushing and ream until a clearance of .0006-.002" (.015-.051 mm) is achieved between bushing and shaft.

VALVE TAPPET SERVICE

Remove lifters from crankcase. Inspect tappet for wear or clogged oil hole. Replace lifter if lifter-to-crankcase clearance exceeds .0039" (.099 mm). Standard lifter clearance is .0012-.0028 (.030-.072 mm).

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VALVE CLEARANCE ADJUSTMENT

With engine cold, rotate engine to TDC of firing stroke. Insert feeler gauge between rocker arm and valve stem. Clearances should be as follows:

Application	Intake In. (mm)	Exhaust In. (mm)
1400 & 1600 .....	.011-.013 (.28-.32).....	.013-.015 (.32-.37)

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)
1400 & 1600	.0008-.0019 (.020-.049)	.0001-.0039 (.003-.010)	.0002-.0016 (.005-.040)	No. 1	.012-.020 (.3-.5)	①.0014-.0030 (.035-.075)
				No. 2	.012-.020 (.3-.5)	②.0010-.0026 (.025-.065)
				Oil	.012-.035 (.3-.9)	.....

- ① - 1600, .0016-.0032" (.04-.08 mm)
 ② - 1600, .0012-.0028" (.03-.07 mm)

CYLINDER LINER INSTALLATION

When installing cylinder liners in block, correct projection of liner flange above cylinder block is achieved by using liner gaskets of varying thicknesses. Select gasket which gives projection of .0035-.0043" (.09-.11 mm).

Part No.	Gasket Thickness In. (mm)
31219 0101.....	.0404-.0407 (1.025-1.035)
31219 0102.....	.0407-.0411 (1.035-1.045)
31219 0103.....	.0411-.0415 (1.045-1.055)
31219 0104.....	.0415-.0419 (1.055-1.065)
31219 0105.....	.0419-.0423 (1.065-1.075)
31219 0106.....	.0423-.0427 (1.075-1.085)
31219 0107.....	.0427-.0431 (1.085-1.095)
31219 0108.....	.0431-.0435 (1.095-1.105)
31219 0301.....	.0435-.0439 (1.105-1.115)
38259 0102.....	.0439-.0443 (1.115-1.125)
31219 0303.....	.0443-.0447 (1.125-1.135)

FITTING PISTONS

1) Measure cylinder liners and pistons. If wear exceeds .0059" (.15 mm) or taper exceeds .0008" (.02 mm), rebore liner and fit oversize pistons or replace liner and piston. When one cylinder liner has been bored all must be bored and fitted with oversize pistons.

2) Make sure measurements are made at bottom of piston skirt and on both thrust and axial faces of cylinder liners. Allow liner to cool to 68° F before making measurements.

3) Check piston ring end gap and side clearance. Check gap at bottom of worn liner. Check side clearance between ring and groove only after groove has been thoroughly cleaned. Fit compression rings with "R" mark facing up.

Piston Specifications

Application	Piston Diameter In. (mm)
1400	
Standard	
"A" Class	3.3451-3.3457 (84.966-84.980)
"B" Class	3.3448-3.3453 (84.958-84.972)
"C" Class	3.3445-3.3449 (84.950-84.960)
.010" (.25 mm) OS	
"A" Class	3.3550-3.3555 (85.216-85.230)
"B" Class	3.3546-3.3552 (85.208-85.222)
"C" Class	3.3543-3.3547 (85.200-85.210)
1600	
Standard	
One Dot.....	3.6213-3.6216 (91.980-91.990)
Two Dots	3.6209-3.6213 (91.970-91.980)
Three Dots	3.6205-3.6209 (91.960-91.970)
.010" (.25 mm) OS	
One Dot.....	3.6311-3.6315 (92.230-92.240)
Two Dots	3.6307-3.6311 (92.220-92.230)
Three Dots	3.6303-3.6307 (92.210-92.220)
.020" (.5 mm) OS	
One Dot.....	3.6409-3.6413 (92.480-92.490)
Two Dots	3.6405-3.6409 (92.470-92.480)
Three Dots	3.6402-3.6405 (92.460-92.470)

NOTE - On 1400 models letter markings are on cylinder liner. On 1600 models dot markings are located on top of crankcase.

PISTON PIN

Check piston pin for damage, cracks, wear or distortion. Check connecting rod bushing for wear. If pin or bushing are worn beyond specification, replace bushing in connecting rod and ream to fit standard pin. Piston pin is a thumb push fit at 68°F.

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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)
1400 & 1600 Front & Rear	1.9667-1.9673 (49.955-49.970)	.0004-.0020 (.010-.050)	Center	.0016-.0054 (.040-.137)	1.7711-1.7717 (44.985-45.000)	ⓐ.0012-.0031 (.030-.080)	.0028-.013 (.07-.33)
Center	1.9673-1.9677 (49.969-49.980)	0-.0014 (0-.036)					

ⓐ — With F770 bearings. .0012-.0029" (.030-.074 mm) with A17S bearings.

CONNECTING ROD & MAIN BEARING SERVICE

1) Check connecting rod side play with a feeler gauge. If side play exceeds specifications, replace connecting rod. Check center main bearing end play, if play exceeds specifications, replace bearing.

2) Use Plastigage method to measure both connecting rod and main bearing clearances. Connecting rod bearing inserts are available in standard and .5 mm (.020") and .25 mm (.010") undersizes. Main bearing inserts are available in standard and .3 mm (.012"), .5 mm (.020") and .25 mm (.010") undersizes.

3) Check crankshaft for bend by placing front and rear main journals on "V" blocks and fitting a dial indicator on center journal. Correct or replace crankshaft if bend exceeds .0014" (.035 mm).

REAR MAIN BEARING OIL SEAL SERVICE

Seal is replaced when crankcase halves are split. After crankcase halves have been reassembled, install new seal.

ENGINE FRONT COVER OIL SEAL

With front cover removed drive out old seal. Install new seal using suitable tool (899064110) with or without front cover on engine.

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1400 & 1600 Front & Center	1.0218-1.0226 (25.954-25.975)	.0010-.0025 (.025-.064)	.....
Rear	1.4155-1.4163 (35.954-35.975)	.0010-.0025 (.025-.064)	

CAMSHAFT

1) Camshaft may be removed when crankcase has been split. Check for wear or damage, replace camshaft if necessary. Us-

ing a dial indicator, check that bend does not exceed .002" (.051 mm).

2) Measure end play, if it exceeds .0118" (.300 mm), remove cam gear and replace thrust plate. Measure camshaft lobe height. If wear exceeds .0118" 300 mm), replace camshaft.

3) Measure camshaft gear runout with dial indicator. Replace camshaft gear if runout exceeds .010" (.25 mm). Measure backlash between camshaft gear and crankshaft gear, if backlash exceeds .006" (.015 mm), replace camshaft gear. Standard value of backlash is .0008-.0019" (.020-.050 mm).

VALVE TIMING				
Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
1400 & 1600	24°	64°	70°	18°

VALVE TIMING

With crankcase halves split, install crankshaft and camshaft so punch mark on camshaft gear is visible through chamfered hole in crankshaft gear.

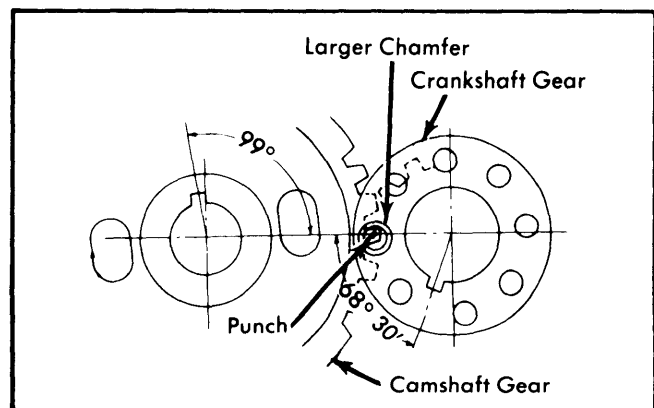


Fig. 5 Valve Timing Marks

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ENGINE OILING

Crankcase Capacity – 3.8 quarts with filter change.

Oil Filter – Full-flow.

Normal Oil Pressure – 35 psi (2.5 kg/cm²) @500 RPM: 57 psi (4.0 kg/cm²) @2500 RPM.

Pressure Regulator Valve – Non-adjustable, opens at 57-64 psi (4.0-4.5 kg/cm²).

ENGINE OILING SYSTEM

Oil is pressure fed by a camshaft driven trochoid type oil pump. Pump incorporates an oil relief and by-pass valve in its body. Oil pump is located externally on engine. Oil from pump passes from main oil gallery to journals of camshaft and crankshaft. From there, oil goes to main bearings, piston pin bearings and cylinder walls. Oil passes through valve lifters and push rods to oil rocker arms.

OIL PUMP

Removal – Remove four attaching bolts and pull pump and filter forward. Remove oil filter from pump.

Disassembly – 1) Remove screws, lift cover and rotor from pump body. Remove "O" ring. Remove by-pass spring and ball. Unscrew plug and remove washers, spring and pressure relief valve.

2) Measure rotor-to-rotor and outer rotor-to-body clearance, replace any component which exceeds wear limits. Measure rotor side clearance.

3) Inspect relief valve spring, valve and pump body for wear or damage. Reassemble in reverse order, using all new gaskets and "O" rings.

NOTE – Make sure oil pump shaft is aligned with slot in camshaft when reassembling.

Oil Pump Specifications

Application	Std. Clearance In. (mm)	Wear Limit In. (mm)
Inner-to-Outer Rotor .....	.001-.005 (.02-.12)	.008 (.2)
Outer Rotor-to-Body .....	.006-.008 (.15-.21)	.010 (.25)
Rotor Side Clearance .....	.002-.005 (.02-.12)	.008 (.2)
Relief Valve Spring		
Free Length		1.85 (47.1)
Installed Height		1.32 (33.5)

ENGINE COOLING

THERMOSTAT

Thermostat – Begins to open at 190°F (88°C) and is fully open at approximately 212°F (100°C).

Coolant Capacity – All models approximately 6.3 quarts.

WATER PUMP

Removal – Drain coolant and disconnect main radiator outlet hose. Remove drive belt and attaching bolts, remove water pump.

Disassembly – 1) Remove four screws attaching cover plate and gasket. Remove pulley and locking clip.

2) Withdraw shaft, impeller and mechanical seal from pump body. Press pump shaft from impeller.

3) Inspect all parts for wear or damage. Measure the amount of wear of carbon washer of mechanical seal, if wear has reached .06" (1.52 mm), replace mechanical seal. See Fig. 8.

Reassembly – 1) Using an arbor press, press pump shaft into pump body until locking clip may be installed. Apply sealing compound to edge of mechanical seal and press in housing with carbon ring facing toward impeller.

2) Press impeller onto shaft until impeller-to-body and impeller-to-cover plate clearances are .0196-.0275" (.498-.699 mm) and .0275 (.699 mm). Support impeller side of

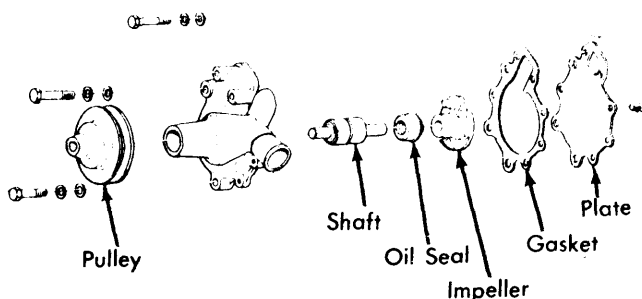


Fig. 6 Exploded View of Water Pump

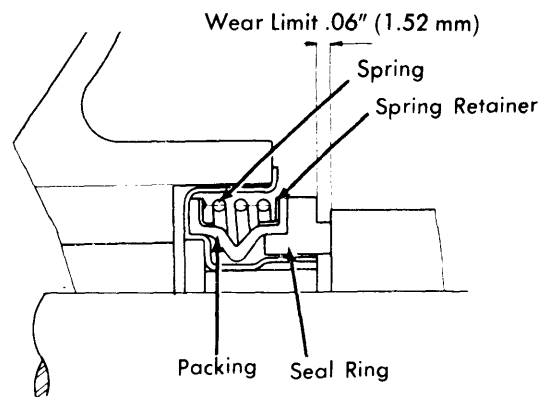


Fig. 7 Detail of Water Pump Seal

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ENGINE COOLING (Cont.)

pump shaft and press on pulley until distance between center of pulley groove and rear face of pump housing is 2.59-2.61" (65.8-66.3 mm).

3) Install cover plate and new gasket using sealing compound. Reverse removal procedures for remaining components.

ELECTRIC COOLING FAN

All models are equipped with an electric cooling fan motor. 4WD models use a combination of electric fan, engine drive fan and forced cooling (water cooling). All other models utilize electric fan and forced cooling (water cooling).

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head	
Step 1	14 (1.9)
Step 2	25-29 (3.4-4.0)
Step 3	37-43 (5.1-6.0)
Connecting Rods	
1400 Models	36 (5.0)
1600 Models	29-31 (4.0-4.3)
Crankshaft Pulley	39-42 (5.4-5.8)
Flywheel Housing	17-19 (2.3-2.6)
Pressure Plate Assembly	
4 & 5 Speed Models	7 (.97)
4WD Models	12 (1.6)
Crankcase Halves	
10 mm Bolts	19-35 (4.0-4.8)
8 mm Bolts	17-19 (2.3-2.6)
6 mm Bolts	3-4 (.41-.55)
Crankcase Plug	
1400 Models	51 (7.0)
1600 Models	65 (9.0)
Rocker Nuts	37-43 (5.1-6.0)