

# Subaru Engines

## 1400 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	83.2	1361	1x2-Bbl.	61@5600	68.7@3600	9.0-1	3.35	85	2.36	60

### ENGINE IDENTIFICATION

Engine can be identified by a number-letter combination stamped on a machined pad on left side of engine.

#### Application

#### Engine Code

1361 cc (Federal)..... E63AF3  
1361 cc (Calif.)..... E63AF4

### ENGINE 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 the following electrical wires: Generator, starter, thermostat, oil pressure switch, back-up light, high tension from coil, secondary ignition from distributor, lower motor fan switch wires.

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 the following cables: Throttle cable at carburetor, choke cable at carburetor and speedometer cable at transmission.

**NOTE** — Engine may be removed without transmission at this time. Remove motor mount bolts and remove exhaust pipe at manifold. Support transmission, lift and remove engine.

6) Loosen shift lever knob lock nut and unscrew knob. Remove six mounting screws from console box. Remove shift lever cover. Lift off console and remove shift lever.

7) Disconnect exhaust pipe from exhaust manifold at pipe flange. Disconnect gear shift rod at transmission. Disconnect gear shift assembly from transmission and leave it connected to body.

8) Remove rear engine mounting bolt, leaving bracket attached to transmission. Unscrew front mounting nuts at inside of crossmember.

9) Drive out axle shaft spring pin. Remove nuts attaching transverse link to crossmember. Remove nuts attaching transverse link to stabilizer. Remove transverse link from inner pivot of crossmember. Pull out double offset joint from driving shaft on transmission case by pushing suspension outward.

10) Attach an engine hoist and carefully lift engine out of vehicle with transmission in a lowered position. Place engine on engine stand.

### ENGINE DISASSEMBLY

With engine and transmission removed from vehicle as an assembly, proceed as follows:

1) Remove two nuts and bolts securing transmission to engine and separate. Mount engine on suitable stand and drain oil and coolant.

2) Remove clutch cover and pressure plate from flywheel. Disconnect breather hose from valve cover and remove air cleaner. Remove engine breather pipe and dipstick.

3) Remove air cleaner bracket and spark plug wire support. Remove distributor and spark plug wires as a unit, leaving distributor vacuum line attached to distributor. Remove generator drive belts and generator along with mounting brackets.

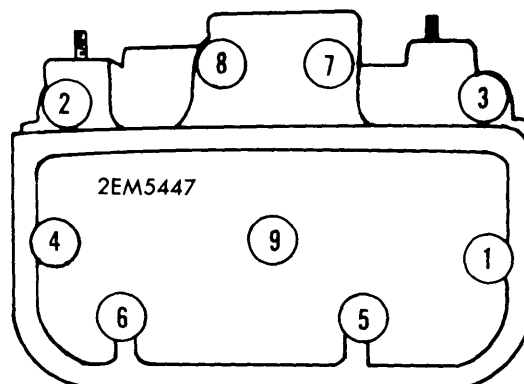
4) Remove water by-pass hose from carburetor and water by-pass hose from connector. Remove intake manifold and carburetor as an assembly.

5) Remove crankshaft pulley, using suitable puller (899524100). Remove four attaching bolts and withdraw oil pump and filter as a unit. Remove seven attaching bolts, and remove water pump, pipes, and hoses as a unit.

6) Invert engine and remove oil pan. Unscrew socket bolt and remove oil strainer. **NOTE** — Do not remove strainer unless necessary. Remove flywheel and flywheel housing.

7) Rotate camshaft gear to expose two bolts behind gear. Bend back lock tab and remove bolts. Remove spark plugs and rocker arm covers.

8) Remove cylinder head nuts in proper sequence. Remove rocker arm assembly and push rods, keeping push rods in order. Remove cylinder heads.



CYLINDER HEAD LOOSENING SEQUENCE

## 1400 4 CYLINDER (Cont.)

9) Remove crankcase Allen plugs using suitable Allen wrench (899974101). Remove cylinder liners using suitable puller (899704100).

**NOTE** — Mark edge of cylinder liner flange and cylinder block so exact positioning may be accomplished on reassembly. Keep liners and liner gaskets in matched sets.

10) Reaching through crankcase plug hole, remove piston pin circlips. Remove piston pins and pistons. Split crankcase halves by removing 11 nuts and one bolt.

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

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.

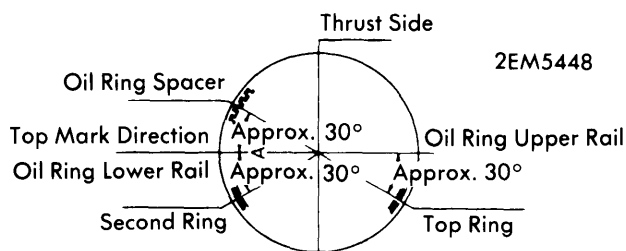
### ENGINE REASSEMBLY

1) Oil all rotating or sliding parts. Replace all gaskets with new ones. Grease oil seal lip before installation. Use sealing compound where required. Recheck all running clearances.

2) Install connecting rods on crankshaft. Position connecting rod name mark and rod cap projecting side of rib facing forward. Torque rod nuts to specifications.

3) Install rings on piston as shown in illustration. Install circlip in side of piston with top mark.

4) Using a ring compressor install piston in bottom of cylinder liner leaving piston pin bore outside of liner. Match top mark on piston with mark on cylinder liner flange.



PISTON RING GAP POSITION

5) Insert Woodruff key in camshaft keyway. Install camshaft plate with protrusion side facing away from bearing journal. Press on camshaft gear with 1.575" (40.0 mm) boss facing toward bearing journal.

6) Install valves and springs in both heads with wide spaced coils (yellow paint end) facing toward spring retainers. Use care not to damage lip of intake oil seal or "O" rings. "O" ring fits into groove in spring retainer. Tap valves with a plastic mallet to seat valves.

7) Screw drain plugs into heads. Rocker shaft spacers are marked "R" and "L"; use care to see that they are installed on proper head. Assemble rocker shaft assemblies and set aside for later installation.

8) Place main bearing halves in each side of crankcase. Install lifters in crankcase using lifter clips to prevent them from falling out.

9) Lay crankshaft and camshaft into crankcase, aligning timing marks. Fit crankcase halves together and install and torque nuts or bolts to specifications. Install crankcase hangers at this time.

10) Position camshaft plate to crankcase. Install bolts and locks through hole in camshaft gear. Torque bolts to specifications and bend up lock tabs. Place engine on suitable engine stand.

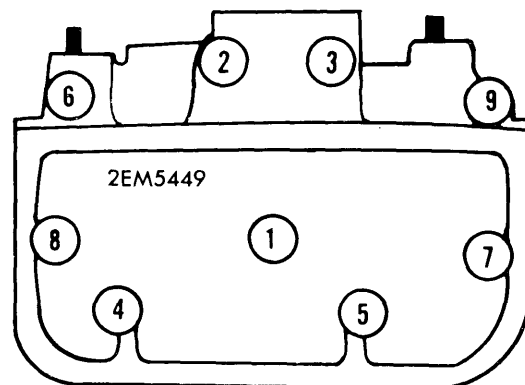
11) Rotate No. 3 cylinder to TDC. Position No. 3 piston, liner and liner gasket so that piston pin and circlip may be inserted, making sure piston faces correct direction.

12) Repeat operation for No. 1 piston. Install a spacer (899838600) and nut over a cylinder head stud on both cylinders to prevent liners from moving out of cylinder block.

13) Rotate engine so No. 2 and No. 4 liners may be installed and repeat installation operation. Check all cylinder liners projection above block. Adjust by selecting proper cylinder gasket if necessary.

**NOTE** — Cylinder projection above block must be correct to achieve a proper seal when cylinder heads are installed.

14) Apply sealing compound to both sides of head gasket. Install gasket and cylinder head using a suitable aligning tool (899738600). Tighten cylinder head nuts gradually in proper sequence (see illustration). **NOTE** — Spacers will be required on rocker shaft studs. Remove spacers and nuts after cylinder head has been tightened.



CYLINDER HEAD TIGHTENING SEQUENCE

15) Install push rods in their proper locations. Loosen tappet adjusting screws and install rocker arm assemblies, torquing bolts to specifications.

16) Install crankcase plug and gasket. Assemble water pipe elbow, pipe and hose with clamps and attach to water pump. Using four steps, torque bolts to specifications.

17) Install oil pump and filter to crankcase and torque bolts to specifications. Apply sealing compound to oil pressure switch and install. Install intake manifold assembly and carburetor. Tighten all bolts evenly, in three steps, to specifications.

18) Install engine breather pipe and dipstick. Drive rear main bearing oil seal into crankcase. Use care not to damage oil seal. Coat flywheel housing contact surfaces with sealing compound and install, torquing attaching bolts to specifications.

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## 1400 4 CYLINDER (Cont.)

19) Coat attaching bolts with sealing compound and attach flywheel assembly and lock washers. Using a suitable tool (899064110), drive front main bearing oil seal into crankcase.

20) Slide crankshaft pulley onto crankshaft and torque attaching bolt and washer to specifications.

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

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

22) Install spark plugs and generator bracket. Install generator assembly and air cleaner bracket. Install drive belt. Reverse removal procedure for remaining components.

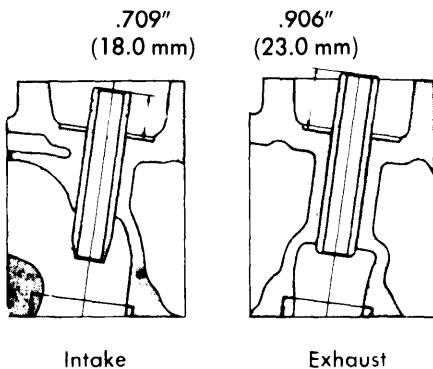
VALVES							
Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm)	Valve Lift In. (mm)
1400 cc Int.	1.452-1.461 (36.88-37.11)	45°	45°	.043 (1.092)	.3130-.3136 (7.950-7.956)	.0013-.0026 (.033-.066)	.....
Exh.	1.280-1.288 (32.51-32.72)	45°	45°	.063 (1.600)	.3124-.3130 (7.935-7.950)	.0020-.0032 (.051-.081)	.....

### VALVE ARRANGEMENT

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

### VALVE GUIDE SERVICING

Check valve guide for wear or damage. Replace defective guides by using a suitable drift and pressing out guide through top of head. Press in new guide from top of head until correct projection of guide above cylinder head is achieved (see illustration).



2EM5450

### VALVE GUIDE POSITION

Ream valve guide to specifications with a suitable reamer. Check valve seat to see if 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 SPRINGS			
Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1400 cc Inner	1.90 (48.2)	....	91.0-104.7@1.22 (41.3-47.5@31)
Outer	1.92 (48.65)	....	40.4-47@1.14 (18.3-21.3@29)

### VALVE SPRING REMOVAL

Using a suitable spring compressor, remove "O" ring, valve keepers and spring retainer. Check spring length and pressure. Replace if necessary. Install spring with wide spaced coils (yellow end) facing valve spring retainer.

### 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 oil hole clogging. Replace lifter if lifter-to-crankcase clearance exceeds .0039" (.099 mm). Standard lifter clearance is .0008-.0024" (.020-.061 mm).

### 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 cc.....	.011-.013 (.279-.330).....	.011-.013 (.279-.330)

## 1400 4 CYLINDER (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)
1400 cc	.0008-.0019 (.020-.049)	.0002-.0005 (.005-.012)	.0002-.0013 (.005-.034)	No. 1	.008-.020 (.203-.508)	.0014-.0029 (.036-.074)
				No. 2	.008-.020 (.203-.508)	.0014-.0029 (.036-.074)
				Oil	.012-.035 (.305-.889)	.....

### 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 .0028-.0035".

#### Color Code

#### Gasket Thickness In. (mm)

White (Two Belt) .....	.0404-.0408 (1.011-1.036)
Yellow (Two Belt) .....	.0408-.0412 (1.036-1.046)
Green (Two Belt) .....	.0412-.0416 (1.046-1.057)
Red (Two Belt) .....	.0416-.0420 (1.057-1.067)
Black (Two Belt) .....	.0420-.0424 (1.067-1.077)
Blue (One Belt) .....	.0424-.0427 (1.077-1.085)
Yellow (One Belt) .....	.0427-.0431 (1.085-1.095)
White (One Belt) .....	.0431-.0435 (1.095-1.105)

### FITTING PISTONS

Measure cylinder liners and pistons. If wear exceeds .0059" (.150 mm) or taper exceeds .0004" (.010 mm), rebore or replace cylinder liner and fit new pistons in all cylinders. Take

measurements at bottom of piston skirt and both thrust and axial faces of cylinder liner.

Always allow liner to cool to 68°F before taking measurements. Check piston ring end gap and side clearance. Check end gap at bottom of worn liner. Fit compression rings with "R" mark facing upward.

#### Piston Specifications

#### Application

#### Piston Diameter In. (mm)

Standard .....	3.3445-3.3557 (84.950-84.980)
.010" OS .....	3.3543-3.3555 (85.200-85.230)

### PISTON PIN REPLACEMENT

Check piston pin, piston and connecting rod bushing for wear or damage. Replace with an oversize piston pin if necessary. Ream connecting rod bushing and hone piston pin bore to proper clearance. At temperature of 68°F, piston pin is thumb push fit in piston and rod.

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 cc Front & Rear	1.9682-1.9688 (49.992-50.007)	.0004-.0020 (.010-.015)	Center	.002-.005 (.015-.127)	1.8898-1.8905 (48.000-48.019)	.0012-.0032 (.030-.081)	.0028-.0118 (.071-.300)
	Center	1.9688-1.9692 (50.007-50.018)					

### CONNECTING ROD & MAIN BEARING SERVICE

Check connecting rod sideplay with a feeler gauge. If sideplay exceeds specifications, replace connecting rod. Check center main bearing endplay, if it exceeds specifications replace bearing. The Plastigage method is used to measure both connecting rod and main bearing clearances. Connecting rod bearing inserts are available in standard, .05 mm (.00197") and .25 mm (.00984") and crankshaft in standard and .05 mm (.00197") undersizes.

Check crankshaft for bend by placing front and rear main journals on pillar blocks and a dial indicator on center journal. Correct or replace crankshaft if bend exceeds .0013" (.02mm).

### REAR MAIN BEARING OIL SEAL SERVICE

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

## 1400 4 CYLINDER (Cont.)

### 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.

2) Measure camshaft gear runout with dial indicator. Replace camshaft gear if runout exceeds .010" (.025 mm). Measure backlash between camshaft gear and pinion gear, if backlash exceeds .006" (.015 mm), replace camshaft gear. Standard value of backlash is .0008-.0019" (.020-.048 mm).

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1400 cc Front & Center	1.0218-1.0226 (25.954-25.975)	.0010-.0025 (.025-.064)	.....
Rear	1.4155-1.4163 (35.954-35.975)	.0012-.0025 (.030-.064)	

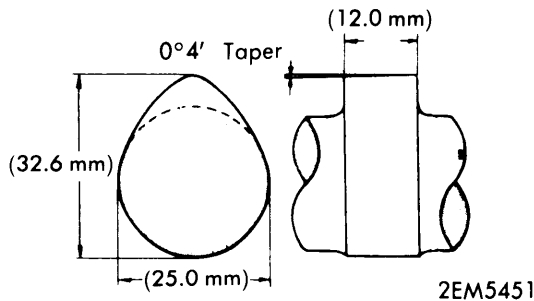
VALVE TIMING				
Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
1400 cc	24°	64°	70°	18°

### CAMSHAFT SERVICE

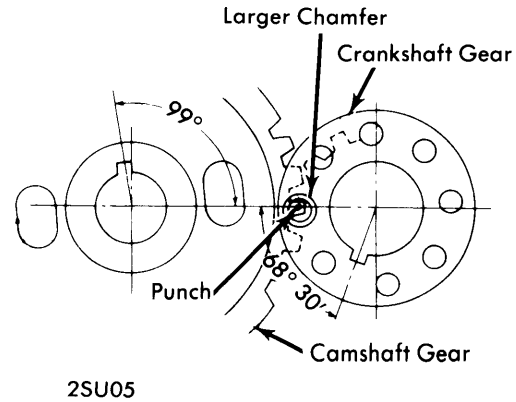
1) Camshaft may be removed when crankcase is split. There are no replacement bearings for camshaft. Check for wear or damage, replace camshaft if necessary. Using a dial indicator, check that bend does not exceed .002" (.051 mm). Measure end play, if it exceeds .0118" (.300 mm), remove cam gear and replace thrust plate. Measure camshaft lobe height. If wear exceeds .0118" (.300 mm), replace camshaft (see illustration).

### VALVE TIMING

With crankcases split, install camshaft so camshaft gear mark aligns with special chamfered hole in crankshaft.



CAMSHAFT LOBE HEIGHT



VALVE TIMING MARKS

## ENGINE OILING

**Crankcase Capacity** - 3.4 qts.

**Oil Filter** - Full-flow. Replace every 6000 miles.

**Normal Oil Pressure** - 35 psi (2.5 kg/cm<sup>2</sup>) @500 RPM: 57 psi (4.0 kg/cm<sup>2</sup>) @2500 RPM.

**Pressure Regulator Valve** - Non-adjustable, opens at 57-64 psi (4.0-4.5 kg/cm<sup>2</sup>).

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.

### 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

**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.

## 1400 4 CYLINDER (Cont.)

### ENGINE OILING (Cont.)

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 .....	.0008-.005 (.020-.127).....	.008 (.203)
Outer Rotor-to-Body .....	.006-.008 (.152-.203).....	.010 (.254)
Rotor Side Clearance.....	.002-.005 (.051-.127).....	.008 (.203)
Relief Valve Spring		
Free Length.....		1.84 (47.1)
Installed Height .....		1.32 (33.5)

## ENGINE COOLING

### THERMOSTAT

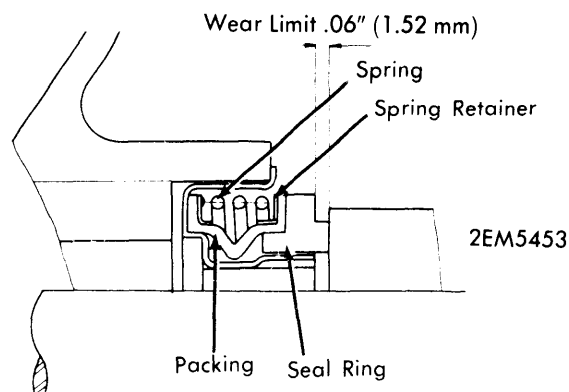
Thermostat is wax pellet type which opens at 200°F (93.3°C). Thermostat is located in intake manifold.

**Cooling System Capacity** — 6.21 qts.

### WATER PUMP

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

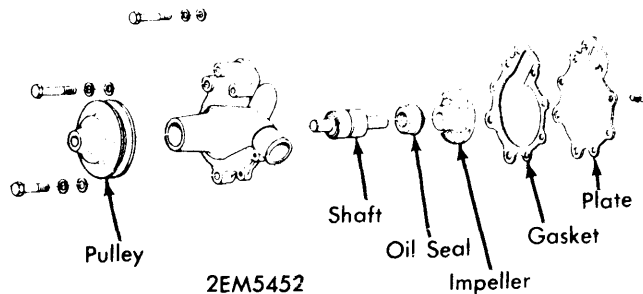
**Disassembly** — 1) Remove four screws attaching cover plate and gasket. Remove pulley and locking clip.



### WATER PUMP SEAL

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 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.



### WATER PUMP

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 illustration).

**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.

## TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Connecting Rod .....	30 (4.6)
Oil Pan .....	4 (.55)
Water Pump .....	4 (.55)
Crankshaft Pulley.....	41 (5.7)
Intake Manifold.....	15 (2.1)
Exhaust Manifold.....	15 (2.1)
Camshaft Plate .....	7 (.97)
Flywheel .....	32 (4.4)
Flywheel Housing.....	37 (5.1)
Crankcase .....	22 (3.0)
Rocker Cover .....	3 (.41)
Cylinder Head Nuts .....	37-43 (5.1-6.0)