

## 1600 4 CYLINDER

## ENGINE CODING

## ENGINE IDENTIFICATION

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

Application	Engine Codes	
	Calif.	Federal
1600 cc		
4-Speed	EA71AC	EA71AA, EA71AH EA71AK
4-Speed, 4WD	EA71WC	EA71WA, EA71WH EA71WK
5-Speed	EA71GC	EA71GA, EA71GH EA71GK
Auto. Trans.	EA71TC	EA71TA, EA71TH EA71TK

## ENGINE

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

## REMOVAL &amp; INSTALLATION

**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 &amp; REASSEMBLY

**NOTE** — Remove engine, place on engine stand (399814300X2 or equivalent). Remove starter and proceed as follows:

**Disassembly** — 1) Separate engine from transmission if necessary. Ensure that converter remains attached to automatic transmission (if equipped). Drain oil and coolant. Make sure that liquid does not run over clutch cover. On manual transmission models, remove clutch cover and disc.

2) Remove silencer with tapered sleeve. Remove fan and pulley. Remove intake manifold assembly with carburetors, vacuum control valve and modulator. Remove EGR valve, thermostat and sending unit. Remove air cleaner, distributor, EGR pipe and air suction system.

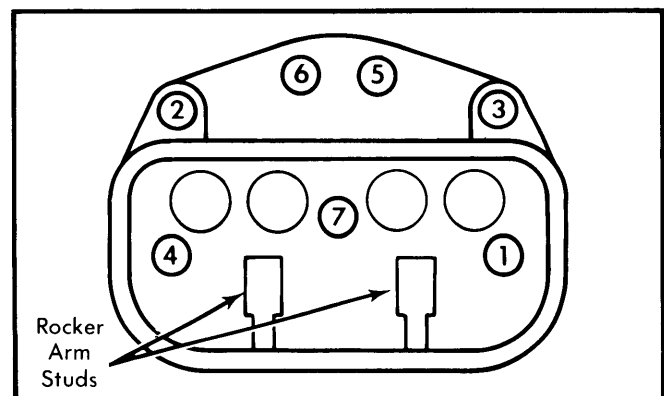
3) Remove oil filter duct. 4WD models have a bracket. Use a puller and remove crankshaft pulley. Remove oil pump and filter as an assembly. Remove water pump with hoses and tubes attached.

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 and valve cover. Remove rocker assembly and push rods. Remove cylinder head bolts in sequence. See Fig. 1. Remove cylinder head and gasket. Use Allen wrench and remove crankcase plug.

6) Position pistons at bottom dead center and remove circlip with long nosed pliers. Access to No. 1 and No. 2 pins is through front crankcase plug holes. Access to No. 3 and No. 4 pins is through rear service holes. Remove pins and pistons, marking for reassembly.

7) Work through hole in camshaft gear and straighten lockwasher, then remove nut. Remove nuts and washers and separate cases. Use valve lifter clips (899804100 or equivalent), to prevent upper crankcase lifters from falling off.



**Fig. 1 Cylinder Head Nut Loosening Sequence (Rocker Arm Assembly Removed)**

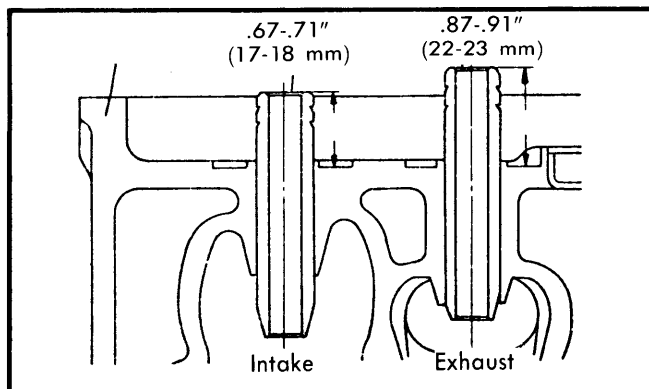
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**NOTE** — Pull camshaft to rear for crankcase clearance.

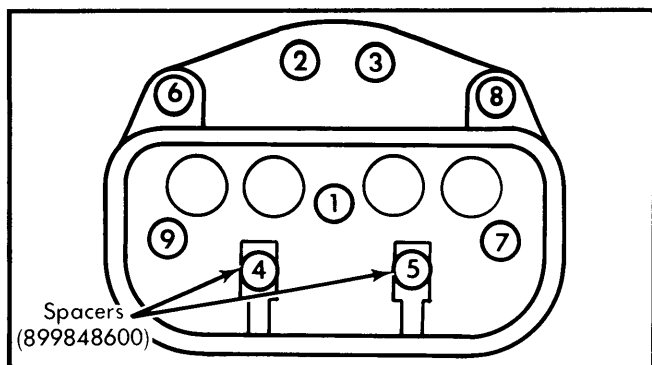
8) Remove oil seal. Lift out crankshaft, distributor gear, and connecting rods. Keep crankshaft bearings in order for reassembly. Remove camshaft and gear. Remove oil pressure switch and valve lifters.

**Reassembly** — Lubricate all friction surfaces with engine oil prior to reassembly. Install crankshaft and camshaft with bearings in left half (No. 2 & 4 Cyl.) of crankcase. Apply liquid gasket to mating surfaces of crankcase and continue in reverse order of disassembly. Tighten crankcase halves and cylinder heads in sequence shown.

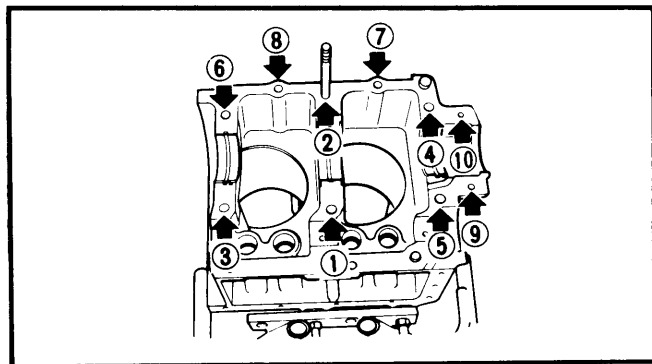
**NOTE** — Use spacers (899848600) in place of rocker arm supports when tightening head nuts.



**Fig. 4 Correct Projection of Valve Guides**



**Fig. 2 Cylinder Head Tightening Sequence**



**Fig. 3 Tightening Sequence for Crankcase**

### VALVES

#### 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. 3.

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.

#### 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" (.016-.052 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 .004" (.100 mm). Standard lifter clearance is .0012-.0028" (.030-.072 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)
1600 .....	.009-.011 (.23-.27)...	.013-.015 (.33-.37)

### PISTON, PINS & RINGS

#### FITTING PISTONS

1) Measure piston bore .028" (7 mm) from top of cylinder in line with crankshaft and again 90° from centerline of crankshaft. Make same measurements 1.48" (37 mm) from top and 2.64" (67 mm) from top of cylinder bore.

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- 2) Measure piston at bottom of skirt 90° from piston pin hole. Measurements should be performed at temperature of 68°F (20°C).
- 3) Check piston ring end gap and side clearance. Check gap at bottom of cylinder bore. Fit piston rings with "R" or "N" facing up.

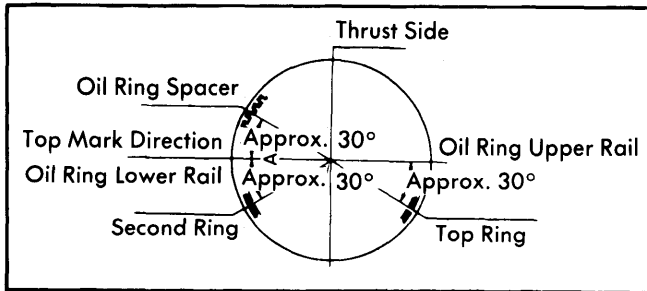


Fig. 5 Piston Ring Gap Position

## 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.

## CRANKSHAFT MAIN &amp; CONNECTING ROD BEARINGS

## MAIN &amp; CONNECTING ROD BEARINGS

- 1) Check connecting rod side play with a feeler gauge. If side play exceeds specifications, replace connecting rod.
- 2) Use Plastigage method to measure both connecting rod and main bearing clearances. Bearing inserts are available in standard, .002" (.05 mm) and .010" (.25 mm) undersize.
- 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.

## CAMSHAFT

## 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 or engine.

## CAMSHAFT

- 1) Camshaft may be removed when crankcase has been split. Check for wear or damage, replace camshaft if necessary. Using a dial indicator, check that bend does not exceed .002" (.051 mm).
- 2) Measure end play, if it exceeds .0018-.0045" (.045-.115 mm), remove cam gear and replace thrust plate. Measure camshaft lobe height. If wear exceeds .012" (.3 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-.0020" (.020-.050 mm).

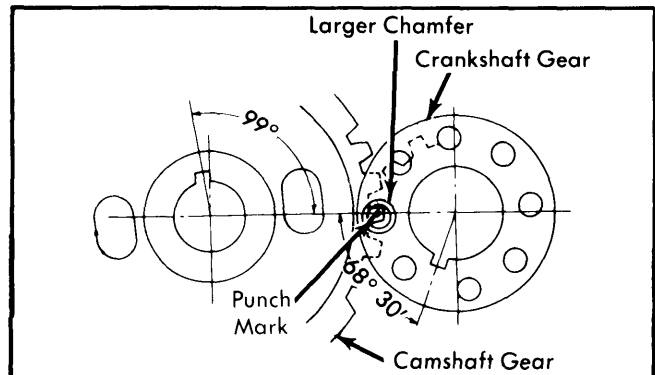


Fig. 6 Align Camshaft with Crankshaft as Shown

## VALVE TIMING

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

## ENGINE OILING

**Crankcase Capacity** – 3.8 quarts with filter change.

**Oil Filter** – Full-flow.

**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>).

## 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, pistons 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.

## 1600 4 CYLINDER (Cont.)

**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.

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

**Reassembly** — Reassemble in reverse order, using all new gaskets and "O" rings.

**Installation** — Install oil filter on pump. Using rearward movement reinstall oil pump and four attaching bolts.

### Oil Pump Specifications

Application	Std. Clearance In. (mm)
Inner-to-Outer Rotor .....	.0008-.005 (.02-.12)
Outer Rotor-to-Body .....	.006-.008 (.15-.21)
Rotor Side Clearance .....	.002-.005 (.05-.12)
Relief Valve Spring Free Length .....	1.85 (47.1)

## 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.

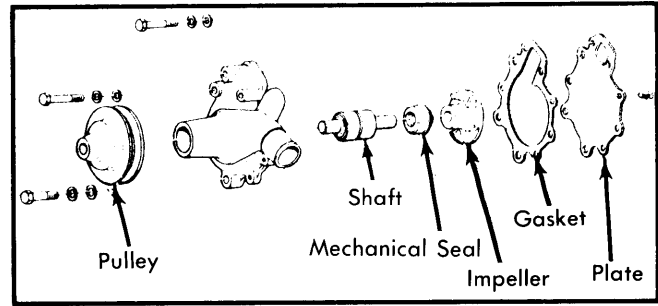
**Radiator** — Cross flow with electric cooling fan. (Station Wagon with 4WD also has engine driven fan.)

### 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.

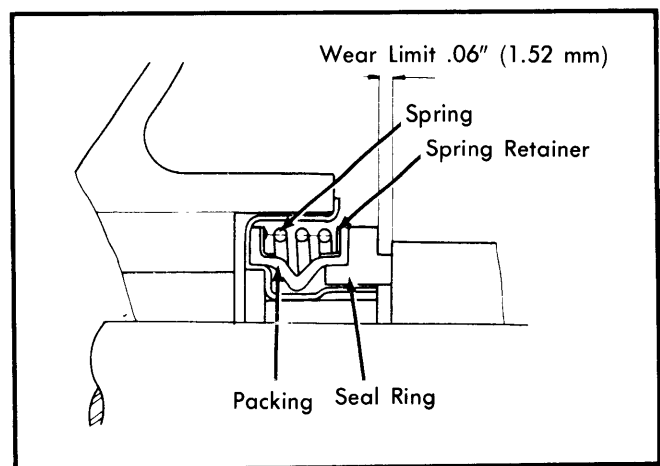


**Fig. 7 Exploded View of Water Pump**

**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 in housing with carbon ring facing toward impeller.

2) Press impeller onto shaft until impeller-to-body clearance is .020-.028" (.5-.7 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 2.34-2.37" (59.5-60.1 mm).

**Installation** — Install water pump together with slotted clip, water pipe, and water by-pass pipe as a unit. Gradually tighten bolts alternately and evenly in several steps to prevent leakage. The clamps for the water hose should be positioned low to prevent interference with the EGR pipe.



**Fig. 8 Detail of Water Pump Seal**

### 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).

# Subaru Engines

## 1600 4 CYLINDER (Cont.)

### 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	97	1595	2-Bbl.	67@5200 <sup>①</sup>	81@2400	8.5-1	3.62	92	2.36	60

① — 4-Wheel drive vehicles — 65@5200.

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)
1600 cc Int.	.....	45°	45°	.028-.051 (.7-1.3)	.3130-.3136 (7.950-7.965)	.0014-.0026 (.035-.065)	.....
Exh.	.....	45°	45°	.039-.071 (1.0-1.8)	.3128-.3134 (7.945-7.960)	.0016-.0028 (.040-.070)	.....

PISTONS, PINS, RINGS						
Engine	PISTONS Clearance In. (mm)	PINS		RINGS		
		Piston Fit In. (mm)	Rod Fit In. (mm)	Rings	End Gap In. (mm)	Side Clearance In. (mm)
1600 cc	.0004-.0016 (.010-.040)	.00004-.00067 (.001-.017)	.0002-.0016 (.005-.040)	No.1	.012-.020 (0.3-0.5)	.0016-.0031 (.04-.08)
				No.2	.012-.020 (0.3-0.5)	.0012-.0028 (.03-.07)
				No.3	①.012-.035 (0.3-0.9)	.....

① — Riken piston ring. For Nippon piston ring, .008-.035" (.20-.89 mm)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft End Play	Journal Diam.	Clearance	Side Play
1600 cc Front & Rear	1.9667-1.9673 (49.955-49.970)	①.0004-.0016 (.010-.040)	Center	.0016-.0054 (.040-.137)	1.7715-1.7720 (44.995-45.010)	.0008-.0025 (.020-.064)	.0028-.013 (.07-.33)
Center	1.9671-1.9677 (49.965-49.980)	②.0-.0008 (.0-.020)		③			④

① — Limit — .0022" (.055 mm).

② — Limit — .0018" (.045 mm).

③ — Limit — .012" (.3 mm).

④ — Limit — .016" (.4 mm).

## 1600 4 CYLINDER (Cont.) ENGINE SPECIFICATIONS (Cont.)

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)ⓐ	Lobe Lift In. (mm)
1600 cc 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)	

ⓐ - Limit - .0039" (.100 mm).

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1600 cc Inner	1.92 (48.7)	19.7-22.6@1.46 (8.93-10.3@37)	43.1-49.5@1.10 (19.5-22.5@28)
Outer	1.90 (48.2)	40.0-46.0@1.54 (18.1-21.0@39)	91.1-104.7@1.22 (41.3-44.5@31)

### TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head	
Step 1 .....	14 (2.0)
Step 2 .....	25-29 (3.5-4.0)
Step 3 .....	37-43 (5.1-5.9)
Connecting Rod Nuts .....	29-31 (4.0-4.3)
Crankshaft Pulley .....	39-42 (5.4-5.8)
Flywheel Housing .....	17-20 (2.3-2.7)
Crankcase Plug .....	51 (7.0)
Crankcase Halves 10 mm Bolts .....	29-35 (4.0-4.8)
8 mm Bolts .....	17-20 (2.3-2.7)
6 mm Bolts .....	3.3-4 (.45-.55)
Intake Manifold .....	13-16 (1.8-2.2)
Rocker Arm Cover .....	2.2-2.9 (.30-.40)
Flywheel .....	30-33 (.42-4.6)
Rocker Arms .....	37-43 (5.1-5.9)
Oil Pan .....	3.3-4.0 (.45-.55)