1600 & 1800 4-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

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

ENGINE IDENTIFICATION CODES

Application	Code
2-WD	
1600 cc	
Man. Trans.	
4-Speed	EA71A5
5-Speed	EA71G5
1800cc	
Man. Trans.	
4-Speed	EA81A21
5-Speed	EA81G2
Auto. Trans.	EA81M3, EA81T3
4-WD	
1800 cc	
Man. Trans.	EA81W2, EA81W3
Man. Trans. w/Dual Range	EA81P

ENGINE, MANIFOLDS & CYLINDER HEAD

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 hose at engine.

3) Disconnect all wiring to engine and accessories. On automatic transmission models disconnect oil cooler pipes. Remove all control cables and vacuum hoses from engine.

4) Remove upper radiator bolts, and lift out radiator. Remove nuts on each of engine-to-firewall struts. Remove strut by moving to rear to clear engine hanger. On vehicles with power steering, remove pump assembly and bracket.

5) On automatic transmission models, disconnect torque converter from engine by rotating crankshaft to allow removal of 4 bolts through timing hole. Use care that bolts do not fall into housing.

6) On manual transmission models, remove clutch return spring. Remove nuts from brackets on engine and firewall, and remove engine stabilizer.

7) On all models, 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 and rear hangers, and separate engine from transmission.

8) When separating engine from transmission, ensure that torque converter remains with transmission (automatic transmission only). Slightly jack up transmission during removal procedure. Remove engine completly 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.

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

INTAKE MANIFOLD

Removal

1) Disconnect negative battery cable. Remove air cleaner assembly. Drain coolant and disconnect all hoses from manifold. Disconnect throttle linkages, vacuum lines, fuel lines and electrical connections to manifold.

2) Remove EGR pipe from rear of manifold. Remove 6 manifold-to-cylinder head bolts, and remove manifold.

Installation

After cleaning mating surfaces and installing new gaskets, reverse removal procedure. Tighten all manifold bolts to specified torque.

EXHAUST MANIFOLD

Removal

1) Remove hot air intake hose from exhaust pipe. Disconnect O_2 sensor harness. Remove nuts which secure front exhaust manifold assembly to exhaust port of engine.

2) Remove bolts connecting front exhaust pipe with rear exhaust pipe. Remove bolt connecting front exhaust pipe with bracket of body.

Installation

1) When installing exhaust manifold, always use new gaskets and lock nuts. The manifold-to-engine gasket is installed with the FLAT side toward engine.

2) To install, reverse removal procedure and tighten bolts to specified torque.

CYLINDER HEAD

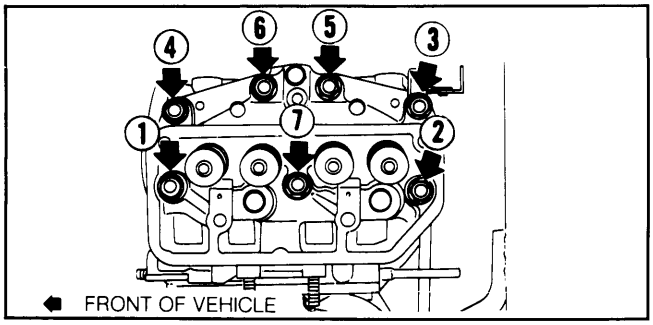
Removal

1) Remove intake and exhaust manifolds. Remove valve covers, rocker arm shafts and push rods.

NOTE: Keep push rods in order for installation in original position.

2) Loosen cylinder head bolts in the sequence shown in *Fig. 1.* Remove cylinder heads.

Fig. 1: Cylinder Head Loosening Sequence



Installation

1) Clean mating surfaces of cylinder head and crankcase so that they are free of oil, grease and dirt.

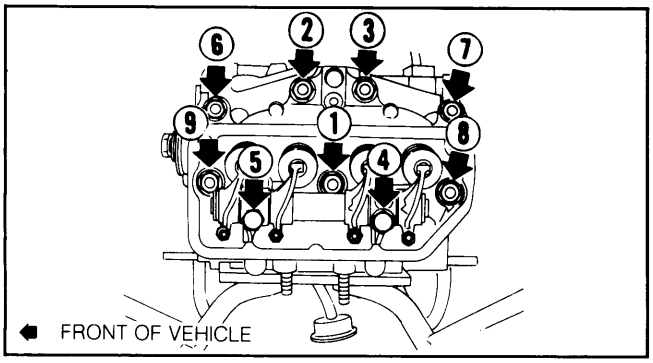
NOTE: Apply head gasket sealant Three Bond 1201 or Dow Corning #92-024 to both sides of new cylinder head gasket. Install gasket quickly after applying sealant.

1600 & 1800 4-CYLINDER (Cont.)

2) Before installing cylinder heads, coat all nut and bolt threads with oil. Reverse removal procedure, tightening nuts and bolts in 3 successive steps. See Tightening Specifications table for torque.

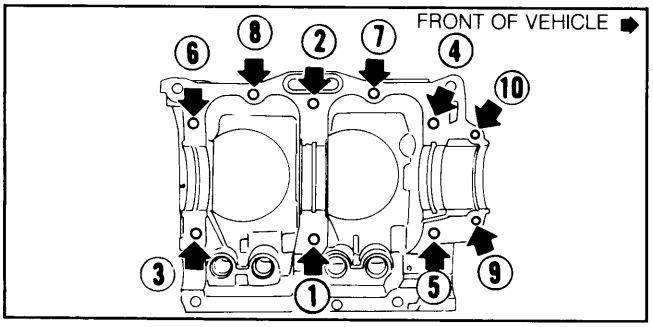
3) After tightening all the cylinder head nuts and bolts, retighten the center nut (No. 1) to ensure it is correctly torqued.

Fig. 2: Cylinder Head Tightening Sequence



Tighten all bolts to 47 ft. lbs. (64 N.m).

Fig. 3: Crankcase Tightening Sequence



Torque varies with bolt size.

CRANKCASE

DISASSEMBLY

1) Remove intake and exhaust manifolds and cylinder heads. Remove oil pump, oil pan and crankcase Allen head plugs. Working through hole in camshaft hole, straighten lock washers and remove bolts.

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

3) To prevent upper crankcase lifters from falling out, use valve lifter clips (899804100 or equivalent). Separate crankcase halves by removing nuts and bolts.

REASSEMBLY

1) Before reassembly, check for loose or bent stud bolts. When replacing stud bolts, coat threads with a torque-holding sealant (Loctite 270 or equivalant) before installation. Check crankcase-to-cylinder head mating surface for warpage, and correct by grinding if necessary. Warping limit is .002 in.(.05 mm).

2) Lubricate all friction surfaces with engine oil prior to reassembly. With bearings installed on the crankcase half having No. 2 and No. 4 cylinders, install crankshaft and camshaft.

3) Clean mating surfaces of crankcase and apply liquid gasket. Install "O" ring and backup ring on the crankcase half having No. 2 and No. 4 cylinders. Reverse disassembly procedure. Tighten crankcase halves and cylinder heads in sequence shown in *Figs. 2 and 3*.

CAMSHAFT

FRONT COVER OIL SEAL

Removal

Remove front pulley bolt and tap pulley lightly to disengage. Drive out old seal.

Installation

Install new seal using installer tool (499067000 or equivalent). Install crank pulley. Apply oil to pulley bolt threads and liquid gasket (Three Bond 1215 or equivalent) on the flange seat. Torque to specifications.

TIMING GEAR

Measure camshaft gear runout with dial indicator. Replace camshaft if runout exceeds .010" (.25 mm). Measure backlash between camshaft gear and crankshaft gear. If backlash exceeds .0039" (.10 mm), replace camshaft gear. Standard value of backlash is .0004-.0020" (.01-.05 mm).

CAMSHAFT BEARINGS

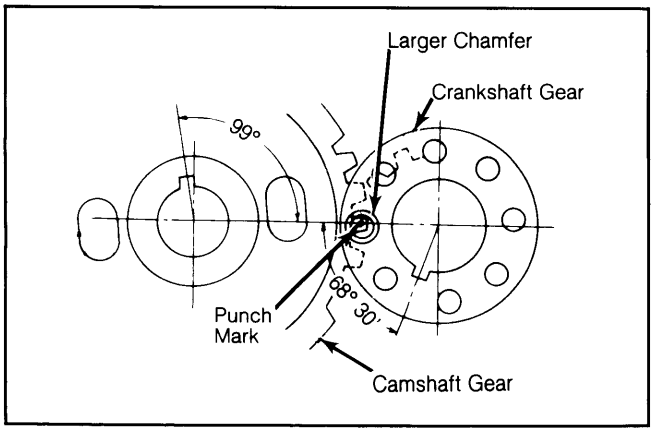
See Crankcase in this article.

VALVES

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. 4: Aligning Camshaft with Crankshaft



Camshaft gear mark should be visible through crankshaft gear chamfered hole.

CAMSHAFT

Camshaft may be removed when crankcase has been split. Check for wear or damage, replace

1600 & 1800 4-CYLINDER (Cont.)

camshaft if necessary. Using a dial indicator, check that bend does not exceed .002" (.051 mm).

NOTE: If camshaft is replaced, all valve lifters should also be replaced. Check identification marks. The 1600 cc engine uses camshaft marked "51", while 1800 cc engine uses camshaft marked "72".

CAMSHAFT END THRUST

Measure thrust clearance between camshaft and camshaft plate. Standard clearance is .0008-.0035" (.02-.09 mm). If clearance exceeds limit of .008" (.20 mm), replace camshaft plate.

CAM LOBE LIFT

Measure camshaft lobe height. If less than 1.269-1.273" (32.23-32.33 mm) overall, replace camshaft.

VALVES

VALVE ARRANGEMENT

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

ROCKER ARM SHAFT ASSEMBLY

Check rocker arm shaft, rocker arm and bushing for wear or damage. Replace any worn parts. Pay special attention to the position and number of all spring washers, plain washers, spacers and rocker arms.

VALVE SPRINGS

Using a spring compressor, remove "O" ring, valve keepers and spring retainer. Check spring under pressure and at free length. Spring squareness must be within .083" (2.10 mm). Replace if necessary. Install spring with wide spaced coil (paint marks) facing valve spring retainer.

VALVE STEM OIL SEALS

Valve stem oil seals are used only on intake valves. Slide seal off of valve guide and replace with a new seal. When inserting stem, use care not to damage seal.

VALVE GUIDE SERVICING

1) Check valve guide for wear or damage. Using a drift punch, drive defective guides out through top of head. Press in new guide from top of head until it projects .689-.709" (17.50-18.00 mm) for intake valves and .886-.906" (22.50-23.01 mm) for exhaust valves.

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 LIFTERS

Remove lifters from crankcase. Inspect lifter for wear or clogged oil hole. Replace if lifter-to-crankcase clearance exceeds .004" (.10 mm). Standard clearance is .0012-.0028" (.030-.07 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:

VALVE CLEARANCE

Application	Intake In. (mm)	Exhaust In. (mm)
1600 cc & 1800 cc	.010 (.25)	.014 (.35)

PISTONS, PINS & RINGS

FITTING PISTONS

1) Measure cylinder bore .028" (.7 mm) from top of cylinder in line with crankshaft and again 90° from centerline of crankshaft. Also measure bore 1.48" (37 mm) and then 2.65" (67 mm) from top of cylinder.

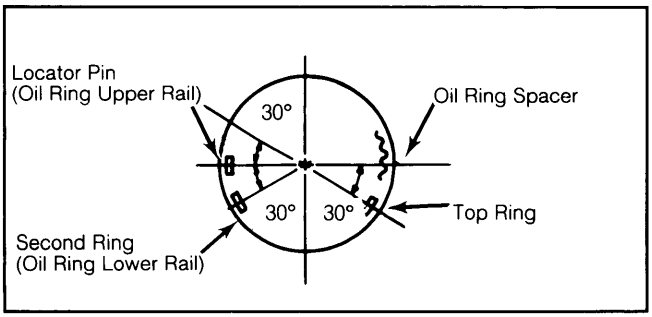
2) After boring and honing, if cylinder bore diameter is .0197" (.50 mm) more than standard bore of 3.6205-3.6216" (91.960-91.990 mm), replace crankcase.

3) Measure piston 1.04" (26.3 mm) from bottom of skirt, 90° from piston pin hole.

NOTE: Measurement of both pistons and cylinder bores should be performed at 68°F (20°C). All cylinders must be bored to same size and use same size pistons.

4) 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 PINS

Check piston pins 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 (20°C).

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

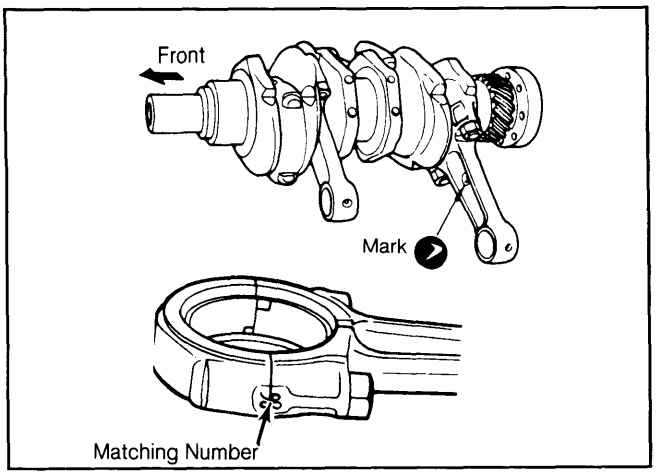
1) Check connecting rod side play with a feeler gauge. If side play exceeds specifications, replace connecting rod.

2) Use Plastigage method to measure both main and connecting rod bearing clearances. Main bearing inserts are available in standard, .001" (.03 mm), .002" (.05 mm) and .010" (.25 mm) undersize. Connecting rod bearing inserts are available in standard, .002" (.005mm) and .010" (.25mm) undersize.

1600 & 1800 4-CYLINDER (Cont.)

NOTE: Position each connecting rod with the marked side facing forward. Make sure connecting rods are assembled correctly by checking their matching number. See Fig. 6.

Fig. 6: Connecting Rod Alignment Marks



Connecting rod mark should face front of engine.

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

Remove engine from vehicle. Flywheel or torque converter flex plate must be removed to gain access to rear seal. Pry oil seal from flywheel housing and coat new seal with oil before installation.

ENGINE OILING

CRANKCASE CAPACITY

Crankcase capacity including filer for 1600 cc engine is 3.5 quarts (upper level) and 2.5 quarts (lower level); for 1800 cc engine, 4.0 quarts (upper level) and 3.0 quarts (lower level).

OIL FILTER

Full-flow type.

NORMAL OIL PRESSURE

Oil pressure for 1600 cc engine is 35 psi (2.5 kg/cm²) @ 500 RPM, 57 psi (4.0 kg/cm²) @ 2500 RPM; for the 1800 cc engine, 50 psi (3.5 kg/cm²) @ 500 RPM, 57 psi (4.0 kg/cm²) @ 2500 RPM.

PRESSURE REGULATOR VALVE

Valve is non-adjustable. It 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, pistons pin bushings and cylinder walls. Oil passes through valve lifters and push rods to oil rocker arms.

OIL PUMP

Removal

Remove 4 attaching bolts and pull pump and filter forward. Remove oil filter from pump.

Disassembly

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.

Inspection

1) Measure rotor-to-drive gear and rotor-to-body clearance. Measure rotor side clearance and measure diameters of rotor and drive gear. Replace any component that exceeds wear limits.

2) 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 CLEARANCES

Application	In. (mm)
Rotor-to-Drive Gear	.0008-.0047 (.02-.11)
Outer Rotor-to-Body	.0012-.0051 (.03-.13)
Rotor Side Clearance	.0059-.0083 (.15-.21)

OIL PUMP DIMENSIONS

Application	In. (mm)
Drive Gear O.D.	1.1693-1.1709 (29.70-29.74)
Rotor O.D.	1.5957-1.5968 (40.53-40.56)
Relief Valve Spring	
Free Length	1.851 (47.10)

ENGINE COOLING

COOLANT DRAINING

A coolant drain plug is provided at the lower right corner of the radiator.

COOLANT CAPACITY

The coolant capacity is 5.6 qts. (5.3L) for 1600 cc engine and 5.8 qts. (5.5L) for the 1800 cc engine.

THERMOSTAT

For both 1600 cc and 1800 cc engines, the thermostat starts to open at 190°F (88°C) and fully opens at 208°F (98°C).

1600 & 1800 4-CYLINDER (Cont.)

WATER PUMP

Removal

Drain coolant and disconnect main radiator outlet hose and by-pass hose. Remove drive belt and attaching bolts. Remove water pump.

Disassembly

1) Remove 4 screws attaching cover plate and gasket. Press pulley off shaft.

NOTE: To prevent bearing damage, do not press the shaft. Press the bearing outer race during disassembly or assembly.

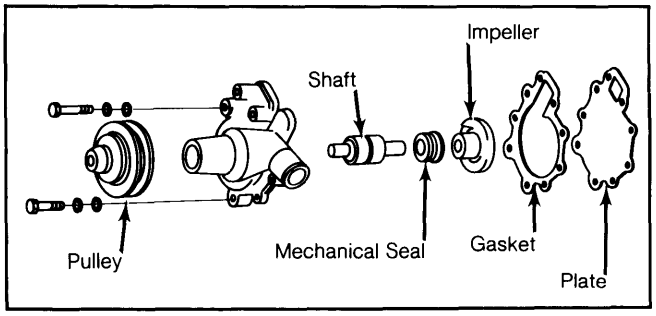
2) Pressing on outer race, press pump shaft from body. Press the impeller from pump shaft, and remove mechanical seal.

Reassembly

1) Before assembly, heat pump body to 176-212°F (80-100°C). Pressing on outer race, press pump shaft into body. Apply liquid gasket to outer edge of seal, and press into pump body with carbon washer facing impeller.

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

Fig. 7: Exploded View of Water Pump



3) Support impeller side of pump shaft. Press on pulley until distance between center of pulley groove and rear face of pump housing is 2.524-2.547" (64.1-64.7 mm) for 1600 cc engine or 2.406-2.429" (61.1-61.7mm) for 1800 cc engine.

Installation

Install water pump, new gasket, drive belt and hoses. 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.

ELECTRIC COOLING FAN

All models are equipped with an electric cooling fan motor. Two different fan motors (Hitachi and Mitsuba) are used on vehicles. They are not interchangeable.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Cylinder Head	
Step 1	22 (30)
Step 2	43 (58)
Step 3	47 (64)
Connecting Rod Nuts	29-31 (39-42)
Crankshaft Pulley	47-54 (64-73)
Crankcase Plug	46-56 (63-76)
Crankcase Halves	
6 mm Bolts	3-4 (4-5)
8 mm Bolts	17-20 (23-27)
10 mm Bolts	29-35 (39-48)
Intake Manifold	13-16 (18-22)
Flywheel	30-33 (41-45)
Rocker Arm	47 (64)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displacement		Fuel System	HP@RPM	Torque Ft. Lbs.@RPM	Compr. Ratio	Bore		Stroke	
	Cu. In.	cc					In.	mm	In.	mm
1982										
1600 cc	97	1595	2-Bbl.	67@5200	81@2400	9.01: 1	3.62	92	2.36	60
1800 cc	109	1781	1-Bbl. & 2-Bbl.	71@4400	94@2400	8.7: 1	3.62	92	2.64	67

VALVES

Engine Size & 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 & 1800 cc							
Intake	.....	45°	45°	.028-.051 (.7-1.3)	.3130-.3136 (7.950-7.965)	.0014-.0026 (.035-.065)	.....
Exhaust	.....	45°	45°	.039-.071 (1.0-1.8)	.3128-.3134 (7.945-7.960)	.0016-.0028 (.040-.070)	.....

Subaru Engines

1600 & 1800 4-CYLINDER (Cont.)

ENGINE SPECIFICATIONS (Cont.)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit In. (mm)	Rod Fit In. (mm)	Ring No.	End Gap In. (mm)	Side Clearance In. (mm)
1600 cc & 1800 cc	.0004-.0016 (.010-.040)	.00016-.00039 (.004-.010)	0-.0009 (0-.022	No.1	.0079-.0138 [1] (.20-.35)	.0016-.0031 [3] (.04-.08)
				No. 2	.0079-.0138 [1] (.20-.35)	.0012-.0028 [3] (.3-.07)
				No. 3	.0079-.0354 [2] (.20-.0-90)	.....

[1] — Limit .0591" (1.5mm). [2] — Limit .07987" (2.0 mm). [3] — Limit .0059" (.15 mm).

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)
1600 cc							
Front & Rear	1.9668-1.9673 (49.957-49.970)	.0004-.0014 [1] (.010-.035)	Center	.0004-.0037 [2] (.010-.095)	1.7715-1.7720 (44.995-45.010)	.0008-.0028 [3] (.020-.070)	.0028-.013 [4] (.07-.33)
Center	1.9673-1.9678 (49.970-49.982)	.0004-.0012 (.010-.030)					
1800 cc							
Front & Rear	2.1636-2.1642 (54.995-54.970)	.0004-.0012 (.010-.030)	Center	.0004-.0037 (.010-.095)	1.7715-1.7720 (44.995-45.010)	.0008-.0028 (.020-.070)	.0028-.013 (.07-.33)
Center	2.1636-2.1642 (54.995-54.970)	.0004-.0010 (.010-.025)					

[1] — Limit front and rear, .0022" (.55mm); limit center, .0018" (.045 mm). [2] — Limit .0118" (.30 mm). [3] — Limit .0039" (.10 mm).
[4] — Limit .016" (.40 mm).

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1600 cc Front & Center	1.022-1.0226 (25.959-25.975)	.0010-.0023 [1] (.025-.059)	.210 (5.34)
1800 cc Front & Center	1.2582-1.2589 (31.959-31.975)	.0010-.0023 (.025-.059)	.210 (5.34)
1600 cc & 1800 cc Rear	1.4157-1.4163 (35.959-35.975)	.0010-.0023 (.025-.059)	.210 (5.34)

[1] — Limit — .0039" (.1 mm).

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (Kg @ mm)	
		Valve Closed	Valve Open
1600 cc & 1800 cc Inner	1.921 (48.8)	19.0-22.1@1.476 (8.6-10.0@37.5)	41.7-48.3@1.122 (18.9-21.9@28.5)
Outer	1.783 (45.3)	32.9-38.1@1.555 (14.9-17.3@39.5)	112.5-127.9@1.20 (51.0-58.0@30.5)