

3A-C 4-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine serial number and code are stamped on the left side of the block.

ENGINE IDENTIFICATION

Application	Code
Tercel (1452 cc)	3A-C

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE

Removal

1) Disconnect negative battery cable. Remove hood, air cleaner and, on models with automatic transmission, grille. Wrap drive shaft boots with shop towels.

2) Drain cooling system and remove hoses and oil cooler lines (if so equipped). Remove fan shroud and radiator. Remove exhaust pipe and bracket, differential plate bolts and oil cooler pipe (if so equipped).

3) Disconnect ignition coil cable and all engine-to-chassis electrical connections at engine. Disconnect carburetor linkage, fuel lines and heater hoses.

4) On models with manual transmission, remove starter cable and windshield washer tank. On models with automatic transmission, remove starter and torque converter cover. On all models, support transmission with a floor jack and remove engine mounts.

5) Attach hoist to engine hangers and, with hoist supporting engine, remove transaxle bolts. On models with manual transmission, remove engine.

6) On models with automatic transmission, remove 4 bolts to torque converter. Pull engine about 2" forward, disconnect torque converter and remove engine. On all models, suspend clutch or converter housing.

Installation

To install, reverse removal procedure, assuring that all adjustments and fluid levels are checked prior to starting engine.

SPECIAL ENGINE MARKS

There are 3 possible sizes of standard main bearings available for the 3A-C engine. Bearings are marked with either a 1, 2 or 3. If replacing the bearing, replace with one having the same number as marked on the cylinder block.

Remove the oil pan. See Oil Pan. The cylinder block marks are near the No. 5 main bearing cap. They are located in the lower left hand corner of oil pan gasket mating surface, viewed from flywheel end of block.

The numbers are stamped in ascending order from No. 1 to No. 5 main bearing (front-to-rear). The number stamped closest to flywheel edge of block corresponds to number No. 5 main bearing.

For example, the block might be stamped with a code such as "22123". This indicates that No. 1, 2 and 4 main bearings must be replaced with a "2" bearing. No. 3 main bearing must be replaced with a "1" bearing and No. 5 requires a "3" bearing.

INTAKE & EXHAUST MANIFOLDS

NOTE: Intake and exhaust manifolds are removed and installed as an assembly.

Removal

1) Remove air cleaner. Disconnect fuel and vacuum lines at carburetor. Disconnect choke and throttle linkage at carburetor.

2) Remove heat insulator, PCV valve and PCV hose. Disconnect exhaust pipe at manifold. Remove manifold retaining nuts and bolts; remove manifold.

Installation

To install, reverse removal procedure, ensuring that mating surfaces are clean and new gaskets are used. Tighten 2 center bolts first, then tighten the remainder in a front-rear, top-bottom star pattern.

CYLINDER HEAD

Removal

1) Drain cooling system and remove upper radiator hose. Remove manifold and carburetor assembly. See Intake & Exhaust Manifolds. Disconnect heater hose at rear of head. Remove rocker arm cover.

2) Remove spark plug wires, distributor and fuel pump. Position crankshaft to TDC compression stroke of No. 1 cylinder. Remove drive belt, water pump pulley and alternator.

3) Using a puller, remove crankshaft pulley. Remove timing belt covers and water pump. Mark position of camshaft timing sprocket and timing belt. Remove timing belt.

NOTE: Do not bend or twist timing belt. Keep belt free of oil, water or steam.

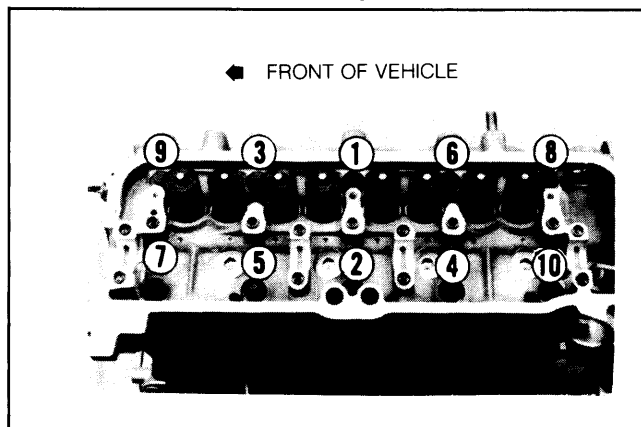
4) Loosen cylinder head bolts in 2 or 3 steps in reverse of sequence shown in Fig. 1. Lift head from engine.

Installation

1) After checking cleanness of mating surfaces, install new gasket and head. Tighten head bolts gradually in 2 or 3 steps. See Fig. 1.

2) Install timing belt and set valve timing. See Timing Belt. Continue installation in reverse order of removal.

Fig. 1: Cylinder Head Tightening Sequence



Loosen in reverse sequence.

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CAMSHAFT

ENGINE FRONT COVER

Removal

1) Drain cooling system and remove radiator. Remove idler pulley, idler pulley bracket and all fan belts. Remove upper section of engine front cover.

2) Remove the crankshaft pulley bolt. Using a gear puller, remove the crankshaft pulley. Lower section of engine front cover can now be removed.

Installation

Clean all gasket surfaces thoroughly. Install front covers and new gaskets. Reverse removal procedure to complete assembly.

TIMING BELT & GEAR

Removal

1) Drain cooling system and remove radiator. Remove all fan belts and water pump drive pulley. Position crankshaft to TDC compression stroke on No. 1 cylinder. Using a puller, remove crankshaft pulley.

2) Remove upper and lower engine front covers. If timing belt is to be reused draw a direction arrow on the belt. Place matchmarks on the camshaft and crankshaft timing sprockets and timing belt. Loosen the idler pulley and remove timing belt.

Inspection

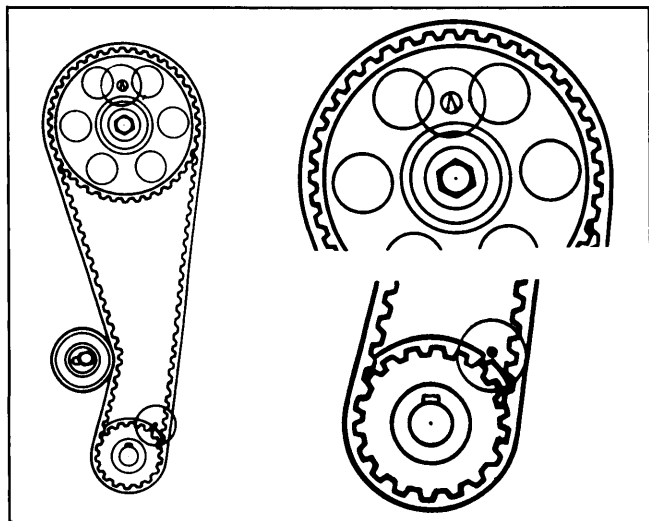
1) If belt is severed, check timing gear gasket for damage or improper installation. If belt teeth are cracked or damaged, check to see if camshaft is locked.

2) If there is noticeable wear or cracks on belt face, check for nicks on idler pulley lock. If there is damage or wear on only one edge of belt, check belt guide and alignment of each pulley.

3) If there is excessive wear or cracks on the belt face, check to see if there are any nicks on one side of the idler pulley lock. Inspect idler pulley for smooth operation.

4) If there is wear or damage on only one side of the belt, check the belt guide and the alignment of each pulley.

Fig. 2: Aligning Valve Timing Marks



Check the belt tension after installation.

Installation

1) Loosen timing belt idler pulley and move toward the left as far as possible. Using care not to excessively bend or twist timing belt, install timing belt.

2) If reusing old belt, align the marks made during removal and install the belt with the arrow pointing in direction of revolution. Release idler pulley and place tension on belt.

3) If installing new belt, align crankshaft timing pulley and TDC mark on the oil pump cover. Align the front cam bearing cap mark and the center of the small hole on the camshaft timing pulley. See Fig. 2.

4) Turn crankshaft 2 revolutions clockwise and recheck timing marks. Measure timing belt tension on the side opposite the idler pulley. Pushing belt toward idler pulley, deflection should be .24-.28" (6-7 mm) at a tension of 4.4 lbs. (2 kg).

5) If tension is not correct, readjust with the idler pulley. Complete installation by reversing removal procedure.

CAMSHAFT

Removal

1) Remove air cleaner and rocker arm cover. Remove engine front covers and timing belt. See Timing Belt. Loosen rocker arm support bolts in 3 to 4 steps and in reverse order of sequence shown in Fig. 3. Remove rocker arm assembly.

2) Remove camshaft timing sprocket. Remove camshaft bearing caps in the following sequence: front, rear, front center and rear center. Keep bearing caps in order.

3) Remove camshaft and distributor drive gear. Check cam lobe height. Check camshaft for maximum runout of .0024" (.06 mm). Replace the camshaft if runout is excessive.

Installation

1) Coat camshaft and bearings with engine oil. Apply grease to oil seal lip and sealant on outside edge of seal. Install camshaft and bearing caps. Arrows on bearing caps must face forward.

2) Install front bearing cap and tighten all bearing cap bolts gradually in 3 or 4 steps. Torque in reverse of removal procedure. Continue installation in reverse order of removal.

CAMSHAFT END THRUST

Check the camshaft end thrust with a dial indicator. If end thrust exceeds maximum, replace the cylinder head.

CAM LOBE HEIGHT

The minimum cam lobe height is 1.5409" (39.14 mm). Replace camshaft if the height is below minimum specification.

CAMSHAFT BEARING

Measure the camshaft bearing journals. Replace if the journal is below minimum. Check the camshaft oil clearance by the Plastigage method. If the oil clearance is greater than the maximum, the camshaft and cylinder head must be replaced. There are no cam bearings in the cylinder head.

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VALVES

VALVE ARRANGEMENT

I-E-I-I-E-E-I. (Front-to-rear).

ROCKER ARM SHAFT ASSEMBLY

Removal

1) Remove air cleaner and rocker arm cover. Loosen rocker arm support bolts in 3 to 4 steps and in reverse order of sequence shown in Fig. 3. Remove rocker arm assembly.

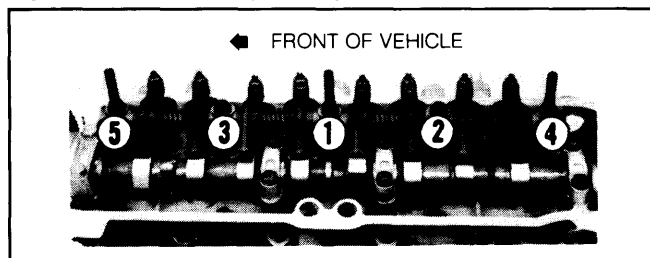
2) Check arm-to-shaft clearance by twisting on shaft. Little or no movement should be felt. Disassemble and mark all parts for reassembly in proper order.

3) If oil clearance exceeds .0024" (.06 mm), replace rocker arm and/or shaft. Check the valve contact surface of the rocker arm. If worn excessively, replace the rocker arm.

Installation

Loosen adjusting screws and nuts prior to installation of assembly. When assembling rocker shaft, shaft oil holes must face to the right, left and bottom. To install, reverse removal procedure. Tighten rocker arm support bolts in 3 to 4 steps and in sequence. See Fig. 3.

Fig. 3: Rocker Arm Tightening Sequence



Loosen in reverse sequence.

VALVE SPRINGS

1) Mark each valve and, using valve spring compressor, remove valves, valve retainers, retainer locks, springs and valve stem oil seals. Using a Vernier caliper, measure valve spring free length.

2) Check for spring squareness within .079" (2.0 mm). Using a spring tester, measure tension of each spring at specified height. Replace springs that do not meet specifications.

VALVE SPRING INSTALLED HEIGHT

Using a valve spring tester, check the tension of each spring at the installed height. If the installed tension is less than minimum, replace the spring. The installed tension is 46.3 lbs. (21.0 kg) at 1.520" (38.6 mm).

VALVE STEM FREE LENGTH

Valve stem tips may be refaced with a valve grinder if worn. DO NOT grind more than .020" (.5 mm) from the tip. The standard overall intake valve length is 4.2079" (106.88 mm). For exhaust valves, the overall length is 4.2039" (106.78 mm).

VALVE HEAD MARGIN

The minimum valve head margin is .020" (.5 mm) for intake valves. Exhaust valve minimum margin is .039" (1.0 mm).

VALVE GUIDE SERVICING

1) Using inside micrometer, measure inside diameter of valve guide at several places (use maximum wear point for calculation). Measure valve stem diameter and subtract difference from valve guide inside diameter.

2) If valve stem clearance exceeds specifications, replace valve and guide. Break off valve guide bushing at snap ring and remove snap ring. Heat cylinder head to approximately 194°F (90°C) and drive out bushing toward combustion chamber.

3) Re-heat cylinder head and install new guides from top of head. Drive guide in until snap ring makes contact. Using a .28" (7.0 mm) reamer, ream valve guides to provide proper clearance.

VALVE CLEARANCE ADJUSTMENT

1) With engine at normal operating temperature, bring No. 1 piston to TDC of compression stroke. Adjust cylinder numbers 1 & 2 intake valves and cylinder numbers 1 & 3 exhaust valves to specified clearance.

2) Rotate crankshaft one full turn (360°) clockwise to align timing mark on damper with "O" mark on timing cover. Adjust cylinder numbers 3 & 4 intake valves and cylinder numbers 2 & 3 exhaust valves to specified clearance.

NOTE: Valves should be adjusted with engine at normal operating temperature. Cold specifications are provided for initial settings after assembly.

VALVE CLEARANCE SPECIFICATIONS

Valve	Hot		Cold	
	In. (mm)		In. (mm)	
Intake	.008 (.20)		.007 (.18)	
Exhaust	.012 (.30)		.011 (.28)	

PISTONS, PINS & RINGS

OIL PAN

Removal

1) Raise vehicle and drain engine oil and coolant. Remove the radiator and engine under cover. Remove 4 bracket bolts, and lower the stabilizer bar.

2) Remove the right and left stiffener plates. Remove the engine rear under plate with the dust seal (A/T only). Remove the oil pan.

Installation

Clean all gasket mating surfaces. Install new gasket and oil pan. Install remaining components in reverse order of disassembly.

PISTON & ROD ASSEMBLY

Removal

With cylinder head and oil pan removed, ream ring ridge from top of cylinder. Mark rods and caps for correct assembly, then remove rod caps. Cover rod bolts with short lengths of hose to prevent crankshaft damage, then push piston/rod assembly out of block.

Installation

Lubricate piston, cylinder and journal with clean engine oil. Position rings on piston and apply ring

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compressor. See Fitting Rings. Install piston/rod assembly in proper position with notch on connecting rod facing forward. Align rod and cap marks and tighten rod caps to specification.

FITTING PISTONS

1) Using a straight edge and feeler gage, measure the surface of the block for warp. If warp is greater than .002" (.05 mm) replace the cylinder block.

2) Measure piston diameter at right angle to piston pin center line and .20" (5 mm) below the lower edge of the oil ring groove. Pistons are available in 3 oversizes. See Piston Diameter Table.

PISTON DIAMETER SPECIFICATIONS

Application	In. (mm)
Standard	3.0468-3.0480 (77.39-77.42)
.50 mm Oversize	3.0665-3.06771 (77.89-77.920)
.75 mm Oversize	3.0764-3.0776 (78.14-78.17)
1.00 mm Oversize	3.0862-3.0874 (78.39-78.42)

3) Piston oil clearance should be .0039-.0047" (.10-.12 mm). Measure ring groove side clearance. See Fitting Rings.

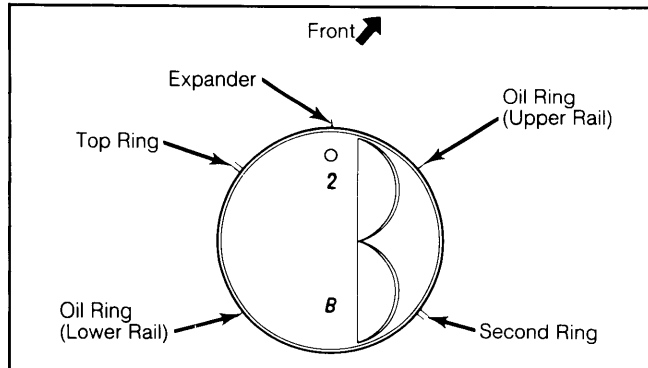
4) Measure cylinder bore at top, center and bottom of piston travel. Measure in line with and at 90° to crankshaft. Wear limit is .008" (.2 mm). Maximum taper and out of round is .001" (.02 mm).

5) If not within specifications, rebore and/or replace pistons. When reboring, finish to final dimension by honing the last .0008" (.02 mm).

FITTING RINGS

Check the ring end gap at the bottom of the ring travel. If not within specification, replace the ring. Check the ring side clearance in the piston. Install rings with the code marks facing up and end gaps staggered. See Fig. 4.

Fig. 4: Positioning Piston Ring Gaps



The code marks must face upward.

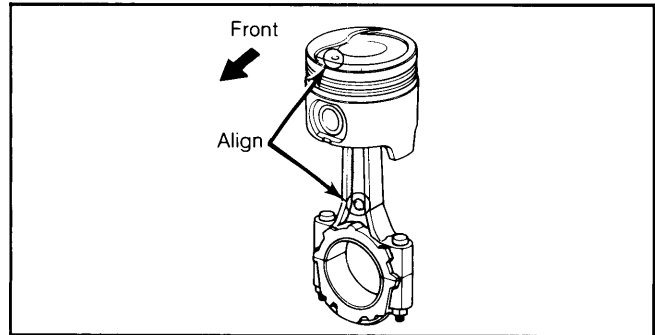
PISTON PIN REPLACEMENT

1) With the piston and rod assembled, move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin.

2) Using a press and piston pin removal tool set, press piston pin out of piston and connecting rod. Check the rod for bend and twist. The maximum bend and twist is .0020" (.05 mm).

3) Lightly coat piston pin and pin hole with engine oil. Align the cavity on the piston head with the protrusion on the connecting rod. See Fig. 5. Press in pin until centered in connecting rod.

Fig. 5: Assembling Piston & Connecting Rod



Align piston cavity and connecting rod protrusion.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT MAIN BEARINGS

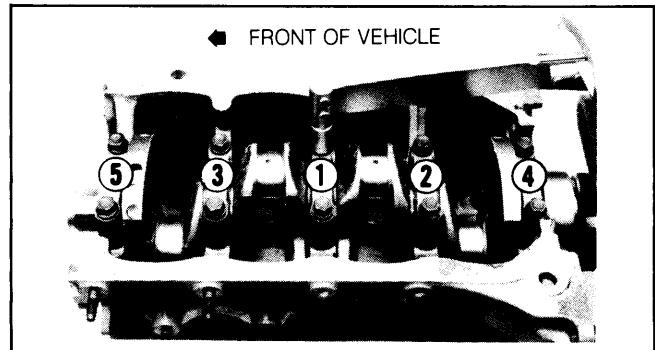
1) Prior to disassembly, check crankshaft end play and connecting rod side play. Remove piston and connecting rod assemblies. Remove main bearing caps, keeping in order for reassembly, and remove crankshaft.

2) Measure crankshaft main journal diameter. Check crankshaft for maximum runout of .0024" (.06 mm), and maximum taper and out-of-round of .0008" (.02 mm). If any measurement exceeds specifications, crankshaft must be replaced.

3) Using Plastigage method, determine all bearing clearances. Replace any bearing not meeting specifications. Replace the bearing with one having the same number as marked on the cylinder block. See Special Engine Marks.

4) Coat crankshaft and bearings with engine oil and install. Thrust washers are installed with oil grooves facing outward. Arrows on main bearing caps must face forward.

Fig. 6: Main Bearing Tightening Sequence



Loosen in reverse order.

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5) Torque bolts to tightening specifications in two or three steps. Torque in sequence shown in Fig. 6.

CONNECTING ROD BEARINGS

1) Before disassembly, mark connecting rods and caps to ensure correct reassembly. Check connecting rod side play. If clearance is greater than maximum, replace the connecting rod.

2) Measure the connecting rod journal for wear, taper and out-of-round. Taper and out-of-round limit is .0008" (.02 mm). If the journals are worn, replace the crankshaft.

3) Check the connecting rod oil clearance using the Plastigage method. There are three sizes of standard connecting rod bearings. When replacing the bearing, replace with one having the same number as marked on the bearing cap.

THRUST BEARING ALIGNMENT

Crankshaft end thrust is measured at the center bearing. If clearance is greater than maximum, replace the bearing as a set. The maximum clearance is .0118" (.30 mm). Install the bearings with the oil grooves facing outward.

REAR MAIN BEARING OIL SEAL

Oil seal may be replaced without removing the crankshaft and oil pan. Remove oil seal from case by driving out with a screwdriver. Using oil seal tool, drive new seal into cover making sure that seal goes in straight. Lightly coat seal lip with multi-purpose grease.

CRANKSHAFT FRONT OIL SEAL

Remove engine front covers and timing belt. See Engine Front Cover and timing Belt & Gear. Pry out seal from oil pump cover using screwdriver. Using oil seal tool, drive new seal into cover making sure that seal goes in straight.

ENGINE OILING

CRANKCASE CAPACITY

The crankcase capacity is 3.7 qts. (3.5L) with filter. Refill without filter is 3.4 qts. (3.2L).

NORMAL OIL PRESSURE

The normal oil pressure 4.3 psi (.3 kg/cm²) at idle. At 3000 RPM the oil pressure should be 35.6-71.1 psi (2.5-5.0 kg/cm²).

OIL PRESSURE REGULATOR VALVE

The oil pressure regulator valve is located in the oil pump cover. It is a nonadjustable type valve.

ENGINE OILING SYSTEM

Oil is forced from a gear type oil pump to full-flow oil filter. From the filter, oil is directed to the crankshaft main bearings which in turn feeds the connecting rod bearings. The oil passage above the No. 1 main bearing feeds the camshaft and rocker arm shaft through the No. 1 rocker support. The oil is then returned to the pan.

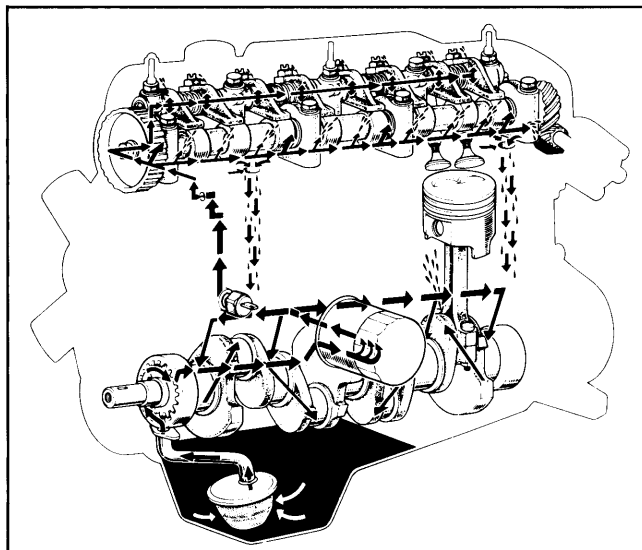
OIL PUMP

Removal

1) Remove timing covers and timing belt. See Timing Belt. Remove oil pan and strainer. See Oil Pan.

2) Remove oil pump and disassemble by removing (in order) cover, drive gear, driven gear, oil seal and relief valve. See Fig. 7.

Fig. 7: Engine Oiling System



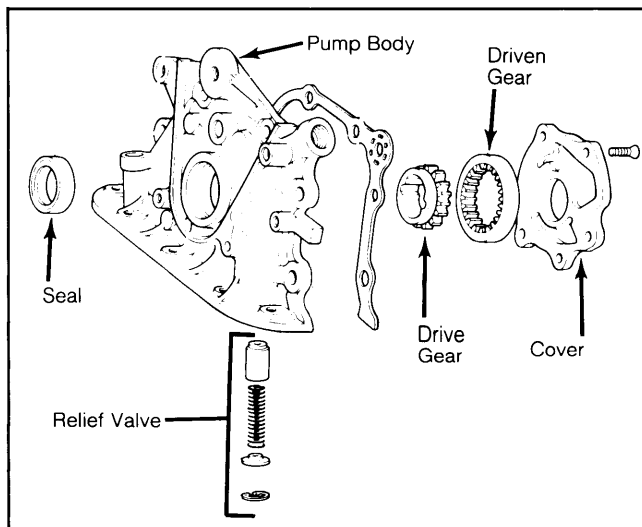
Inspection

Check gears for wear or damage. Install new oil seal using proper seal tool. Measure clearances between gear tip of drive gear and driven gear, side clearance, and gear-to-body clearance. If any clearance exceeds specifications replace necessary part(s). Check relief valve for wear or damage.

Installation

To install, ensure that mating surfaces are clean and use new gasket. Reverse removal procedures to complete installation.

Fig. 8: Exploded View of Oil Pump



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OIL PUMP SPECIFICATIONS

Application	In. (mm)
Gear Tip Clearance	
Drive Gear004-.010 (.10-.25) Limit .013 (.35)
Driven Gear .....	.002-.012 (.05-.31) Limit .013 (.35)
Gear Side Clearance .....	.001-.003 (.03-.08) Limit .004 (.10)
Gear-to-Body Clearance .....	.004-.007 (.10-.19) Limit .008 (.20)

ENGINE COOLING

COOLANT CAPACITY

The coolant capacity is 5.5 qts. (5.2L).

THERMOSTAT

The thermostat starts to open at 176-183°F (80-84°C) and is fully open at 203°F (95°C).

FAN THERMOSWITCH

The fan thermoswitch operates between 181-194°F (83-90°C).

WATER PUMP

Removal

Drain cooling system. Remove water pump pulley and drive belt. Remove the water outlet housing, by-pass pipe, water inlet housing, timing belt upper cover and oil dip stick tube. Remove heater outlet pipe mounting bolt. Remove water pump.

Disassembly

Press pulley seat off of pump shaft. Heat pump body to about 185°F (85°C). Press out the bearing-shaft-impeller assembly. Press impeller off of pump shaft and remove seal.

Reassembly

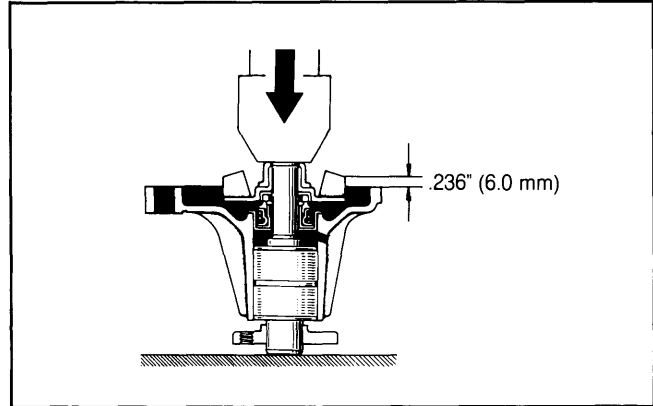
1) Heat pump body to 185°F (85°C). Press the bearing into the pump body until the bearing race is flush with the neck of the body neck.

2) Apply sealant to the pump seal and press into the housing. Press the pulley seat onto pump shaft.

3) Distance between face of pulley seat and rear of pump body should be 3.58" (91 mm). If vehicle is equipped with an air pump the distance must be 2.99" (76 mm).

4) Install new packing and seat into the impeller. Apply a little engine oil to the seal and rotor contact surfaces. Press the impeller onto the shaft to the specified depth of .236" (6 mm). See Fig. 9.

Fig. 9: Installing Impeller to Specified Depth



Impeller will not clear housing if depth is not correct.

Installation

To install, use new gasket on clean mating surfaces and reverse removal procedures.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Sprocket Bolt	29-39 (39-53)
Connecting Rod Cap Nuts	26-32 (36-44)
Crankshaft Pulley Bolt	80-94 (109-128)
Cylinder Head Bolts	40-47 (54-64)
Flywheel Bolts	55-61 (75-83)
Main Bearing Cap Bolts	40-47 (54-64)
Manifold Nuts	15-21 (20-29)

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	88.6	1452	1x2-Bbl.	62@4800	75@2400	9.1:1	3.05	77.5	3.03	77.0

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)
1452 cc Intake	44.5°	45°	.047-.063 (1.2-1.6)	.2744-.2750 (6.969-6.985)	.0010-.0024 (.025-.060)
Exhaust	44.5°	45°			.0012-.0026 (.030-.065)

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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)
1452 cc	.004-.005 (.10-.12)	Press Fit	.....	No. 1	.008-.015 (.20-.40)	.0016-.0031 (.04-.08)
				No. 2	.006-.013 (.15-.35)	.0012-.0028 (.03-.07)
				Oil	.004-.024 ¹ (.10-.60)	.....

¹ — For TP type; Riken type — .012-.035" (.30-.90 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)
1452 cc	1.889-1.890 (47.98-48.00)	.0008-.0019 (.020-.051)	Center	.0008-.0073 (.020-.185)	1.5742-1.5748 (39.985-40.000)	.0008-.0020 (.020-.051)	.006-.010 (.15-.25)

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1452 cc	1.101-1.102 (27.97-27.99)	.0015-.0029 (.037-.073)	.....

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (Kg @ mm)	
		Valve Closed	Valve Open
1452 cc	1.756 (44.60)	52.0@1.520 (23.6@38.6)	.....