I-MARK 4-CYLINDER DIESEL

ENGINE CODING

ENGINE IDENTIFICATION

Engine identification code is 7th character of the Vehicle Identification Number (VIN). The VIN is stamped on a metal tab, located on top of instrument panel near lower left side of windshield. Engine serial number is stamped on a machined pad, located at left rear corner of cylinder block.

ENGINE IDENTIFICATION CODE

Engine	Code
Type 4FB1 (1817 cc)	P

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE

Removal

1) Mark hood hinges for reassembly and remove hood. Disconnect battery cables. Remove cables, battery hold-down and battery. Drain radiator, crankcase and transmission. Remove lower engine splash guard.

2) Remove fan shroud. Disconnect radiator hoses. Remove radiator. Disconnect heater hoses. Remove air connecting hose. Disconnect thermo switch wiring at connectors on thermostat housing.

3) Disconnect alternator wiring at connector. Disconnect vacuum hoses from rear of vacuum pump and at fast idle actuator. Disconnect and remove front exhaust pipe from manifold and mounting bracket.

4) Disconnect accelerator cable from injection pump lever. Disconnect fuel cut solenoid valve switch wiring at connector. If equipped, disconnect tachometer pickup sensor wiring at connector.

5) Disconnect wiring from starter and oil pressure switch. Disconnect fuel hoses from injection pump. Disconnect any remaining engine or transmission to chassis wiring, linkages, cables, lines or hoses.

6) Mark for reinstallation and remove propeller shaft from transmission. Install plug in transmission extension housing to prevent oil spillage. Working inside vehicle, remove console. Pry off shift lever dust boot, then remove shift lever assembly.

7) Remove rear engine mount bolts and bolts attaching exhaust mounting bracket. Attach lifting chain and hoist to engine. Lift engine slightly to remove weight from engine mounts.

8) Remove engine mount nuts and disconnect engine damper from frame. Pull engine forward and carefully remove engine and transmission as an assembly.

Installation

1) Replace any rubber engine mounts showing signs of deterioration or separation. Check engine damper for leakage, worn bushings or any other signs of wear or damage. Replace if needed.

2) Reverse removal procedures to complete installation. Check all fluid levels and purge fuel system of air. Adjust clutch.

INTAKE MANIFOLD

Removal

1) Disconnect negative battery cable. Remove PCV hoses and valve. Remove sensing resistor assembly. Remove 6 injection pipe clips. Remove 8 sleeve nuts attaching injection pipe and remove injection pipe.

2) Remove upper timing belt cover. Remove engine lifting eye. Remove engine stay. Remove attaching bolts and nuts, then remove intake manifold.

Installtion

Clean gasket mating surfaces. Using new gasket, install and tighten intake manifold. Install remaining components in reverse order of removal procedures.

CYLINDER HEAD

Removal

1) Open drain plug on cylinder block and drain cooling system. Remove camshaft. Remove sensing resisotr assembly. Remove 6 injection pipe clips. Loosen 8 injection pipe nuts and separate injection pipe.

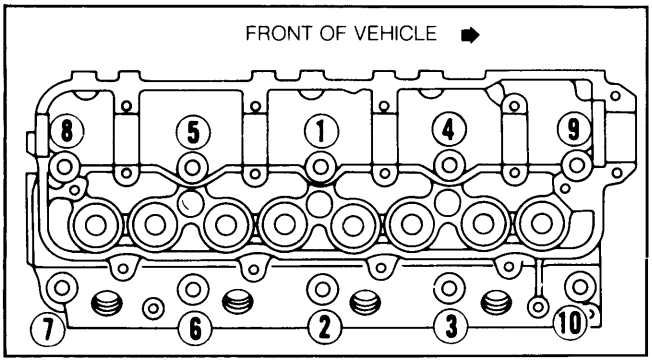
2) Remove fuel leak-off hose, and separate hose from fuel return pipe. Disconnect exhaust pipe from exhaust manifold. Disconnect oil feed pipe from cylinder head. Disconnect heater hose from thermostat housing.

3) Loosen head bolts in reverse order of tightening sequence. *See Fig. 1.* Remove cylinder head and head gasket.

Installation

Clean all gasket mating surfaces. Using new head gasket, install cylinder head. Install head bolts and tighten in 2 steps. *See Fig. 1.* Install remaining components in reverse order of removal.

Fig. 1: Cylinder Head Tightening Sequence



Loosen head bolts in reverse order of tightening.

CAMSHAFT

TIMING BELT COVERS

Removal

Disconnect negative battery cable. Remove fan, pulley and drive belt. Remove crankshaft pulley. Remove 18 attaching bolts, then remove upper and lower timing belt covers.

Installation

To install timing belt covers, reverse removal procedures.

TIMING BELT

Removal

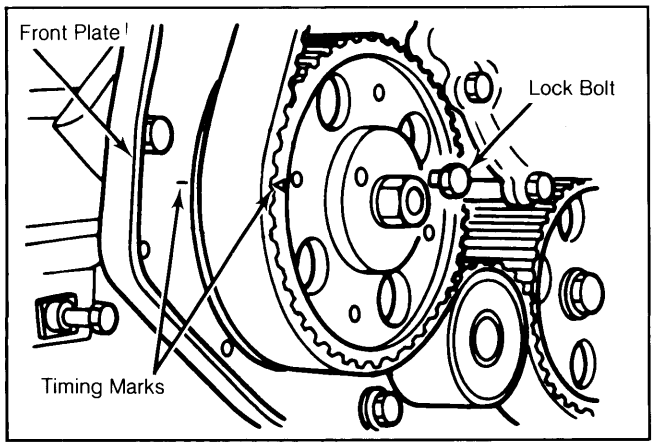
1) Disconnect battery ground cable and drain engine coolant. Remove splash cover from under engine. Remove fan shroud, drive belt, fan and pulley. Remove upper timing belt cover. Remove coolant by-pass hose.

2) With piston of No. 1 cylinder at TDC on compression stroke, check that timing marks on injection

I-MARK 4-CYLINDER DIESEL (Cont.)

pump sprocket and front plate are aligned. Fix sprocket in place by inserting bolt through sprocket and into block. *See Fig. 2.*

Fig. 2: Aligning Injection Pump Timing Marks



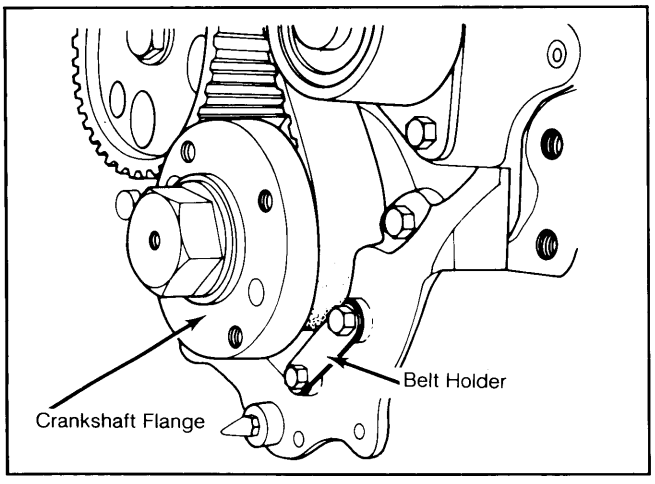
Insert bolt through sprocket and into cylinder block to lock sprocket in place.

3) Remove air connecting hose and PCV hoses, then remove cam cover. Loosen adjusting screws on rocker arms to relieve tension on camshaft. Lock camshaft in place by installing fixing plate (J-29761) in slot at rear of camshaft.

4) Ensure No. 1 piston is still on TDC. Remove crankshaft pulley. Remove lower timing belt cover. Remove timing belt holder. *See Fig. 3.*

5) Remove tension spring located behind front plate. Loosen tension pulley and plate bolts. Remove timing belt.

Fig. 3: Location of Timing Belt Holder



When installing holder, make sure it does not rub on timing belt.

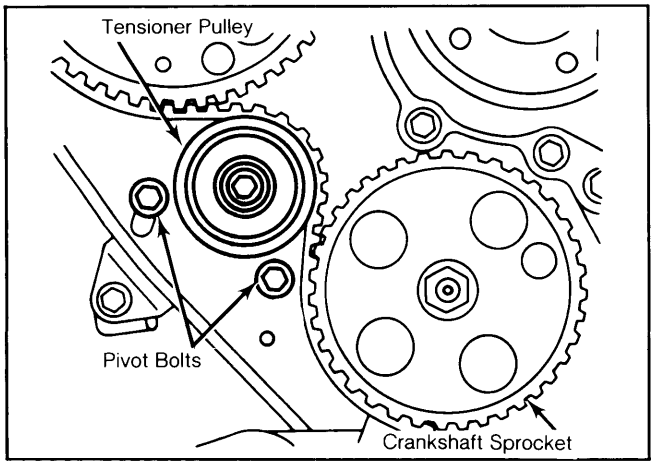
Installation

1) Remove camshaft sprocket center bolt. Using a puller, remove sprocket from camshaft, then install sprocket back on camshaft. Lightly tighten center bolt so sprocket can be turned smoothly by hand.

2) Starting with crankshaft sprocket and working in a counterclockwise direction, engage new timing belt over each sprocket and pulley. Check that belt is properly engaged on all sprockets and pulleys.

3) Take up belt slack at tension pulley. To do so, depress tension pulley and install tension spring. Tighten tension pulley pivot bolts just enough to prevent pulley movement. Do not tighten pulley center bolt at this time.

Fig. 4: Location of Tensioner Pulley



For preliminary belt adjustment, only tighten pivot bolts. Do not tighten pulley center bolt.

4) Tighten camshaft sprocket. Remove bolt used to lock injection pump sprocket in place. Remove fixing plate tool used to lock camshaft in place. Install crankshaft pulley on crankshaft flange.

5) Check that No. 1 cylinder is still on TDC. Ensure that timing marks on injection pump sprocket and front plate are still aligned. Loosen tensioner pulley pivot bolts and take up timing belt slack.

6) Tighten tensioner pulley center bolt, then tighten pivot bolts. Using tension gauge, check for 47-64 lbs. (21-29 kg) tension between camshaft pulley and injection pump. Reverse removal procedures to complete installation. Ensure timing belt holder does not rub against timing belt. Adjust valves.

VALVE TIMING

To check for correct valve timing, refer to procedures explained in Timing Belt removal and installation.

INJECTION PUMP TIMING

1) Check that notched line on injection pump flange is aligned with notched line at rear of front plate. With No. 1 cylinder at TDC on compression stroke, check that injection pump timing marks are aligned. *See Fig. 2.*

2) Ensure timing belt is properly tensioned. Remove cam cover and rear plug. Install camshaft fixing plate (J-29761) into slot at rear of camshaft to check for proper valve timing. Fixing plate should fit smoothly into slot. Remove fixing plate.

3) Disconnect injection pipe from pump. Remove distributor head screw and gasket. Install static timing gauge (dial indicator) and set lift approximately .04" (1.0 mm) from the plunger.

4) Turn engine until No. 1 cylinder is 45-60° BTDC, then calibrate dial indicator to zero.

5) The crankshaft has a total of 7 notched lines on the crankshaft pulley, divided into 2 groups. The group with 4 notched lines is used for static timing. Disregard the group of 3 notched lines (dynamic timing marks).

I-MARK 4-CYLINDER DIESEL (Cont.)

6) Turn crankshaft in normal direction of rotation until 12° BTDC timing mark (next to last notch on pulley) is aligned with timing pointer. Dial indicator should read .020" (.50 mm).

7) If indicator reading is not correct, loosen the 2 injection pump flange retaining nuts and rotate pump housing until a correct reading is obtained. Tighten nuts and recheck reading.

CAMSHAFT

Removal

1) Remove cam cover. Remove timing belt. Hold camshaft in place and remove camshaft sprocket center bolt. Using a puller, remove camshaft sprocket. Remove 4 retaining bolts and remove front head plate.

2) Remove rocker arm shaft assembly. Remove cam bearing caps and bearings. Keep in order for later installation. Remove camshaft oil seal. Remove camshaft.

Installation

1) Using engine oil, heavily lubricate camshaft and journal surfaces in cylinder head. Install camshaft and new oil seal.

2) Apply gasket sealer to No. 1 cam bearing cap-to-cylinder head contact surface. Reverse removal procedures to complete installation. Adjust valves.

CAMSHAFT OIL SEAL

To replace camshaft oil seal, use procedures explained in camshaft removal and installation.

VALVES

VALVE ARRANGEMENT

Intake Valves (Right side)
Exhaust Valves (Left side)

ROCKER ARM SHAFT ASSEMBLY

Removal

Remove cam cover. Starting at the ends and working inward, gradually loosen rocker arm shaft bracket bolts and nuts. Remove rocker arm shaft bracket and rocker arm assembly. Keep parts in order if disassembly is required.

Installation

Heavily lubricate rocker arm shaft, rocker arms and valve tips with engine oil. Install assembly in reverse order of removal. Starting at center and working outward in a circular pattern, tighten brackets. Adjust valves.

VALVE GUIDE SERVICING

Inspection

Using dial indicator method, check valve stem-to-guide clearance. Position dial indicator point about .40" (10 mm) above end of guide. Rock valve stem back and forth and measure movement. If movement exceeds .008" (.20 mm), replace valve guide and valve.

Removal

Working from combustion chamber side of cylinder head, drive out old guide with valve guide driver tool (J-26512).

Installation

Coat outer surface of guide with engine oil. Working from top side of head, drive guide into head with driver tool (J-26512). Guide should project from cylinder head .583" (14.8 mm). Always replace valve guide and valve as a set.

VALVE STEM OIL SEALS

Removal

Remove rocker arm shaft assembly. Position piston of cylinder concerned to TDC. Using spring compressor tool (J-29760), compress spring and remove valve locks. Release pressure and remove spring retainer and springs. Remove valve stem oil seal.

Installation

Apply engine oil to inner face of new oil seal and to valve stem. Install oil seal. Install inner and outer springs with green painted side (closed-coil end) toward cylinder head. Using spring compressor tool, install remaining components in reverse order of removal.

VALVE SEAT INSERTS

Removal

To remove seat, arc-weld a bead of metal around inner face of seat. Allow to cool a few minutes. Using screwdrivers, pry out valve seat.

Installation

Using arbor press, install new seat. Grind seat to correct width and angle. Lap valve and seat to complete installation.

VALVE SPRINGS

To remove and install valve springs, use procedures outlined in Valve Stem Oil Seal removal and installation. Always replace inner and outer springs as a set.

Inspection

1) Measure inner and outer valve spring free length. Test valve spring tension with a valve spring tester. Replace springs that fail tests.

2) Using a flat surface and steel square, check valve spring for squareness. Take measurement between top of spring and square, while slowly rotating spring. Out-of-square must not exceed .04" (1.0 mm).

SWIRL CHAMBER REPLACEMENT

Removal

Measure chamber depth in head with straight edge and feeler gauge. If depth exceeds .0008" (.020 mm), chamber must be replaced. Use a small diameter drift (1/8 - 3/16") to drive out old chamber. Insert drift through injection nozzle hole to swirl chamber and drive out with hammer.

Installation

Install lock ball into groove in swirl chamber. Align lock ball in chamber with groove in cylinder head and drive in. Use press to seat chamber. A piece of metal should be placed between press and chamber to prevent damage. Grind face of swirl chamber flush with face of cylinder head to complete installation.

VALVE CLEARANCE ADJUSTMENT

1) Ensure rocker arm shaft brackets are properly tightened. Cold or hot valve clearances are as follows: .010" (.25 mm) for intake valves, and .014" (.35 mm) for exhaust valves.

2) Turn crankshaft to position No. 1 piston at TDC on compression stroke. Adjust valve clearance of valves listed in "Valve Clearances" table.

I-MARK 4-CYLINDER DIESEL (Cont.)

3) Turn crankshaft 1 revolution to place No. 4 piston on TDC at end of compression stroke and adjust remaining valves.

VALVE CLEARANCES

Piston On TDC	Adjust Int. Nos.	Adjust Exh. Nos.
1	1, 2	1, 3
4	3, 4	2,4

PISTONS, PINS & RINGS

OIL PAN

Oil pan removal and installation is performed with engine removed from vehicle.

PISTON AND ROD ASSEMBLY

Removal

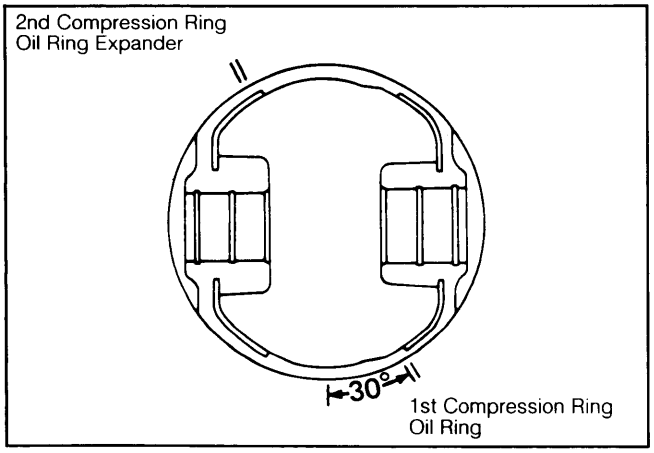
1) Remove engine from vehicle. Remove cylinder head and oil pan. Remove carbon deposits from upper edge of cylinder wall. Remove rod cap.

2) Push piston/rod assembly out top of cylinder block. Install rod cap on its respective piston/rod assembly.

Installation

1) Apply oil to rings, piston and cylinder wall. Make sure ring gaps are properly spaced. *See Fig. 5.* Make sure bearing halves are properly seated in connecting rod and cap.

Fig. 5: Piston Ring Gap Locations



2) Install a ring compressor and compress rings. Install piston in cylinder. Ensure notched mark on piston head points toward front of engine. Install and tighten rod cap. Reverse removal procedures to complete installation.

FITTING PISTONS

1) Measure cylinder bore diameter at a point 5 1/2" below cylinder block deck surface. Take measurements in line with and 90° to crankshaft centerline. If wear is excessive, cylinder should be bored for installation of oversize piston.

2) Measure piston (skirt) diameter at right angle to piston pin. Take piston skirt measurement about 1 3/4" from top of piston head. Subtract this figure from cylinder diameter to determine piston-to-cylinder wall clearance.

REPLACEMENT PISTON SPECIFICATIONS

Piston Size	Piston Diameter In. (mm)
Standard	3.307-3.309 (84.00-84.05)
.020" O/S	3.326-3.328 (84.50-84.54)
.040" O/S	3.346-3.348 (85.00-85.04)

FITTING RINGS

1) Position rings into cylinder bore at a point where bore diameter is smallest. Ring must be square in bore. Measure ring end gap with a feeler gauge.

2) Using a feeler gauge, check ring side clearance. Ensure rings turn freely in their ring grooves. When installing rings on piston, ensure gaps are correct. *See Fig. 5.*

3) Install rings on piston in this order: expander ring, oil ring, 2nd compression ring, then 1st compression ring. The "N" mark on compression rings must be facing upward.

PISTON PIN REPLACEMENT

Removal

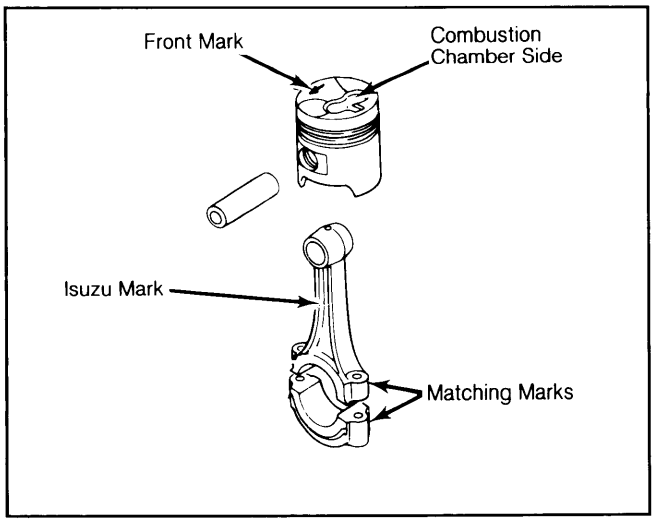
To remove pin, use snap ring pliers and remove snap rings from piston. Push out piston pin with finger. Piston pin bushing in rod's small end is replaceable.

Installation

1) Assemble rod to piston so front mark on piston head and Isuzu mark on rod are on same side. Also, match marks on rod will be on combustion chamber side of piston head. *See Fig. 6.*

2) Coat pin with oil and install in piston and rod. Install snap rings to secure piston pin in place.

Fig. 6: Positioning Rod to Piston



Note positions of identification markings when assembling rod to piston.

I-MARK 4-CYLINDER DIESEL (Cont.)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

NOTE: To check bearing clearances, remove engine from vehicle. Following procedures are performed with oil pan removed, and oil film removed from surfaces to be checked.

CRANKSHAFT MAIN BEARINGS

1) If necessary, mark all bearing caps for cylinder identification. Check clearances 1 at a time. With all bearing caps (except one being checked) tightened, check clearances using Plastigage method.

2) If clearances are excessive, replace crankshaft and bearings. Taper must not exceed .0010" (.025 mm). Crankshaft journals and crankpins cannot be reground.

3) To check crankshaft for straightness, place "V" blocks under crankshaft at No. 1 and No. 5 journals. Position dial indicator point on No. 3 journal.

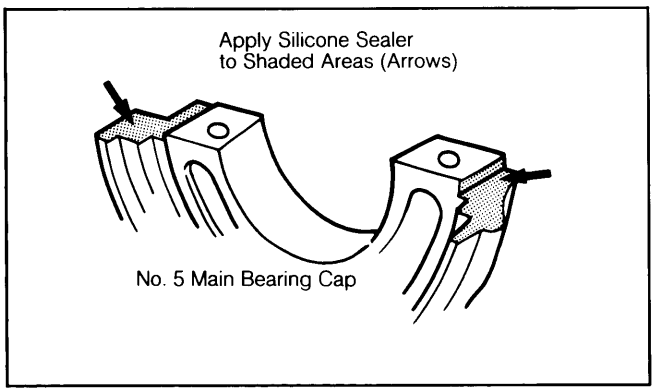
4) Slowly turn crankshaft at least 1 full revolution, while recording runout. If runout exceeds .0024" (.060 mm), replace crankshaft and bearings.

5) When installing thrust bearing on No. 3 journal, oil grooved thrust faces must be turned outward.

6) Coat joining faces of No. 5 main bearing cap and cylinder block with silicone sealer. *See Fig. 7.* No. 1 and No. 5 main bearing caps are installed flush with face of cylinder block.

7) Apply engine oil to threads and seating face of cap bolts. Install all bearing caps. Tighten caps in progressive steps, in sequence of 3, 2, 4, 1 and 5.

Fig. 7: No. 5 Main Bearing Cap Sealer Application



Install bearing cap before sealer sets up.

CONNECTING ROD BEARINGS

1) After ensuring rod caps are marked for cylinder identification, remove rod caps. Use Plastigage method to check for proper clearance.

2) If not within limits, install new bearings if crankpin is not worn beyond limits.

CRANKSHAFT END THRUST

Using a feeler gauge, measure crankshaft end thrust. Move crankshaft fully endwise and measure clearance between crankshaft thrust face and thrust bearing. If clearance is greater than .012" (.30 mm), replace thrust bearings.

REAR MAIN BEARING OIL SEAL

Removal

Remove transmission from engine. If equipped, remove clutch cover and disc. Remove flywheel. Pry rear oil seal from bearing cap.

Installation

Coat seal lip with engine oil. Using seal installer tool, install new seal. Reverse removal procedures to install remaining components.

CRANKSHAFT FRONT OIL SEAL

Removal

Remove timing belt. Remove center bolt from crankshaft flange. Using a puller, remove flange from crankshaft, then use puller to remove crankshaft sprocket. Pry out front oil seal.

Installation

Coat seal lip and fitting face of oil seal with engine oil. Using seal installer, install oil seal into seal retainer. Install remaining components in reverse order of removal.

ENGINE OILING

CRANKCASE CAPACITY

Capacity is 5.5 quarts (5.2L) with oil filter replacement; 5.0 quarts (4.7L) without filter replacement.

NORMAL OIL PRESSURE

Normal oil pressure should be approximately 50-60 psi (3.5-4.5 kg/cm²).

ENGINE OILING SYSTEM

Oil pump is sprocket driven off of timing belt. Oil drawn from pan passes through a strainer to oil pump. Oil is delivered to full flow oil filter, oil cooler, and main oil gallery.

Main oil gallery supplies oil to crankshaft main bearings. Drilled passages in crankshaft route oil to lubricate connecting rods and bearings.

Oil gallery feeds oil to vacuum pump and rocker arm shaft to lubricate rocker arms and cam bearings. Oil is fed from gallery to oil jet pipe which sprays oil from below piston to lubricate and cool cylinder walls and piston.

OIL PUMP

Removal

Remove timing belt. Remove 4 Allen head bolts through access holes in oil pump sprocket, and remove oil pump. *See Fig. 8.*

Inspection

1) Disassemble oil pump. Thoroughly clean pump parts and dry with compressed air. Visually inspect disassembled parts for wear, damage or other abnormal conditions.

2) Measure outside diameter of oil pump sprocket hub. If measurement is less than 1.100" (27.94 mm), replace sprocket.

3) Insert outer rotor into recess in cylinder block. Lay a straightedge over cylinder block and outer rotor. Using a feeler gauge, measure outer rotor end clearance.

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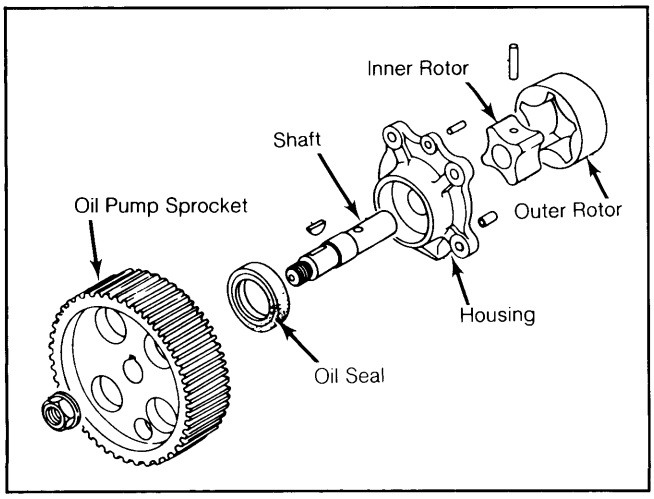
Fig. 8: Oil Pump Assembly



4) With outer rotor inserted into recess in cylinder block, use a feeler gauge to measure side clearance between rotor and recess in cylinder block.

5) Install inner rotor into outer rotor. Using a feeler gauge, measure clearance between rotors.

6) Reassemble pump in reverse order of disassembly.

Installation

Apply engine oil to outer rotor, then install with tapered side turned toward cylinder block. Apply engine oil to new oil seal and install into housing. Install inner rotor after lubricating with engine oil. Install remaining components in reverse order of removal.

OIL PUMP SPECIFICATIONS

Application	[1] Clearance In. (mm)
Outer Rotor End Clearance	.008 (.20)
Outer Rotor Side Clearance	.016 (.40)
Clearance Between Rotors	.008 (.20)

[1] — Clearances given are maximum wear limits.

ENGINE COOLING

THERMOSTAT

Thermostat opens at about 180°F (82°C).

COOLING SYSTEM CAPACITY

Cooling system capacity is 7.4 quarts (7.0L).

RADIATOR CAP

Pressure relief valve opens at approximately 13 psi (.9 kg/cm²).

WATER PUMP

Removal

1) Disconnect negative battery cable. Drain cooling system by opening drain plugs on radiator and cylinder block. Remove fan, fan pulley and drive belt.

2) Remove crankshaft pulley. Remove upper and lower timing belt covers. Remove coolant by-pass hose. Remove water pump and gasket.

Installation

Clean gasket mating surfaces. Using new gasket, install water pump in reverse order of removal.

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	110.8	1817	Fuel Inj.	.....	.....	22:1	3.30	84.0	3.20	82.0

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)
1817 cc	2.201-2.202 (55.92-55.93)	.0015-.0031 (.039-.080)	No. 3	.0024-.0094 (.061-.239)	1.926-1.927 (48.920-48.946)	.0016-.0031 (.040-.080)	.....

I-MARK 4-CYLINDER DIESEL (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)
1817 cc	.0002-.0017 (.005-.045)	.0001-.0005 (.002-.012)	.0003-.0008 [1] (.008-.020)	No. 1	.0078-.0157 (.200-.400)	.0035-.0049 (.090-.125)
				No. 2	.0078-.0157 (.200-.400)	.0014-.0020 (.035-.050)
				Oil	.0078-.0157 (.200-.400)	.0012-.0028 (.030-.070)

[1] — Clearance between pin and bushing in rod.

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)
1817 cc							
Intake	.....	45°	45°	.0472-.0590 (1.200-1.500)	.313 (7.95)	.0016-.0028 (.040-.070)	.....
Exhaust	.....	45°	45°	.0472-.0590 (1.200-1.500)	.313 (7.95)	.0020-.0031 (.05-.08)	.....

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1817 cc	1.1004-1.1011 (27.95-27.97)	.0008-.0035 (.020-.090)	.....

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (Kg @ mm)	
		Valve Closed	Valve Open
1817 cc			
Inner	1.783 (45.3)	17-20@1.52 [1] (7-9@38.5)	.....
Outer	1.846 (46.9)	31-35@1.61 [1] (14-16@41.0)	.....

[1] — Compressed height as measured in tester.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Cylinder Head	
Step 1	21-36 (30-50)
Step 2	
New Bolt	83-98 (113-133)
Used Bolt	90-105 (122-142)
Camshaft Bearing Caps	15-22 (20-30)
Camshaft Sprocket	43-50 (58-68)
Connecting Rod	54-61 (73-83)
Crankshaft Sprocket	98-119 (133-161)
Engine Rear Plate	25-33 (34-45)
Exhaust Manifold	11-18 (15-24)
Flywheel	36-43 (49-59)
Main Bearing Caps	65-72 (88-98)
Idler Pulley Center Bolt	47-61 (64-83)
Injection Pump Timing Pulley	43-50 (58-68)
Intake Manifold	25-32 (34-43)
Oil Jet Pipe (1)	40-54 (54-73)
Oil Pump	11-18 (15-24)
Rocker Arm Shaft Assembly	15-22 (20-30)
Tension Pulley Center Bolt	47-61 (64-83)