I-MARK 4-CYLINDER DIESEL

ENGINE CODING

ENGINE IDENTIFICATION

Engine number is stamped on the left rear corner of the cylinder block. Diesel engines are identified by the number 4FB1.

ENGINE & CYLINDER HEAD

ENGINE

NOTE – *Engine and transmission should be removed as a unit. Engine can then be separated from transmission.*

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

2) Remove fan shroud, disconnect radiator hoses, remove radiator attaching bolts and lift out radiator. Disconnect heater hoses. Remove heat riser tube. Disconnect thermo switch wiring at connector on thermostat housing.

3) Disconnect alternator wiring at connector. Disconnect vacuum hose from rear of vacuum pump and fast idle actuator. Disconnect exhaust pipe from manifold and mounting bracket and remove front pipe. Disconnect accelerator cable from injection pump lever and fuel cut solenoid switch wiring at connector.

4) Disconnect tachometer wire (if equipped), starter, oil pressure switch and fuel hoses at injection pump. Disconnect any remaining engine/transmission to chassis wiring, tubes or hoses.

5) Mark for installation and remove propeller shaft. Plug transmission. Remove console, pry off shift lever dust boot, remove shift lever cover bolts and remove shift lever assembly. Remove rear engine mount bolts and attach hoist to engine.

6) Lift engine slightly to remove weight from engine mounts and remove front mount and engine damper. Pull engine forward and carefully remove engine and transmission as an assembly.

Installation – 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. Reverse removal procedures to complete installation. Check all fluid levels and bleed fuel system.

CYLINDER HEAD

Removal – 1) Drain cooling system and remove camshaft as outlined in camshaft removal section. Remove 6 injection pipe clip retaining screws and remove clip. Loosen 8 injection pipe nuts and separate injection pipe. Remove fuel return hose.

2) Disconnect exhaust pipe from manifold. Disconnect oil feed pipe from cylinder head and heater hose from thermostat housing. Loosen head bolts in reverse of tightening sequence shown in *Fig. 1* and remove cylinder head.

Installation – Make sure new head gasket is clean and free of any scratches or nicks. Do not use sealer. Install cylinder head and tighten bolts in at least 2 steps in order shown. Install camshaft and rocker arm assembly. Install timing belt. Reverse removal procedures to complete installation.

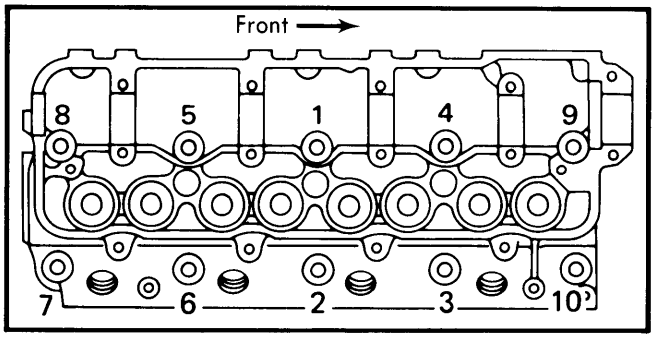

Fig. 1 Cylinder Head Tightening Sequence (Loosen in Reverse Order)

TIMING BELT & CAMSHAFT

TIMING BELT

Removal – 1) Disconnect battery ground cable and drain engine coolant. Remove lower engine splash guard. Remove fan shroud, fan belt, fan and pulley. Remove upper front cover and bypass hose located in front of camshaft sprocket.

2) With No. 1 cylinder at TDC on compression stroke, check that timing marks on the injection pump and pump pulley are in alignment. Fix pulley position with lock bolt inserted through pulley into block.

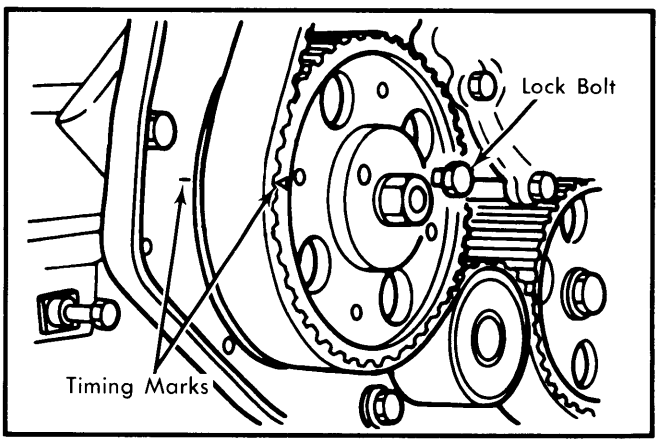

Fig. 2 Injection Pump Timing Marks

3) Remove air connecting hose, PCV hoses, and 3 cam cover retaining bolts. Remove cam cover. Loosen adjusting screws on rocker arms and fix camshaft in position using special fixing plate (J-29761) fitted through slot in rear of camshaft.

4) Remove crankshaft pulley. Remove lower dust cover, timing belt holder and tension spring. Loosen tension pulley and pivot plate bolts and remove timing chain.

I-MARK 4-CYLINDER DIESEL (Cont.)

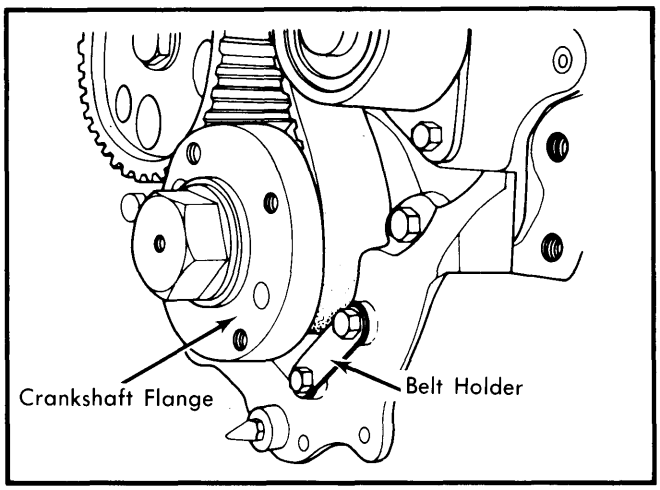

Fig. 3 Location of Timing Belt Holder

Installation – 1) Remove camshaft pulley retaining bolt and camshaft pulley. Install pulley and tighten bolt finger tight. Ensure that pulley can be turned smoothly by hand.

2) Install timing belt on pulleys one at a time starting at the crankshaft pulley and working in a counterclockwise direction. Check that belt is properly engaged on all pulleys. Take up belt slack at tension pulley and tighten pivot bolts just enough to prevent pulley movement.

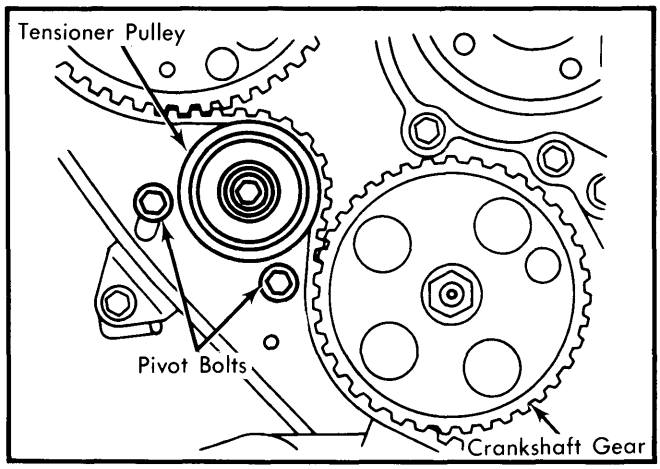

Fig. 4 Location of Tensioner Pulley

3) Tighten camshaft pulley bolt. Remove injection pump pulley lock bolt and camshaft fixing plate. Install crankshaft pulley and check that No. 1 cylinder is still at TDC. Ensure that timing marks on injection pump and pulley are still aligned.

4) Loosen tensioner pulley bolts and take up belt slack. Tighten pivot and pivot pulley bolts (in that order). Check that belt tension between camshaft pulley and injection pump is 47-64 lbs. (21-29 kg). Adjust valves and install cam cover. Reverse removal procedures to complete installation.

CAMSHAFT

Removal – Remove timing belt. Remove camshaft pulley bolt and camshaft pulley. Remove 4 head plate retaining bolts and remove front head plate. Remove cam bearing caps with bearing halves. Remove camshaft oil seal and camshaft.

Installation – Install camshaft with new oil seal. Apply sealant to contact surface of No. 1 cam bearing cap. Reverse removal procedures to complete installation.

VALVES

VALVE ARRANGEMENT

Right Side – All intake.
Left Side – All exhaust.

VALVES

Removal – 1) Remove cylinder head. Remove intake and exhaust manifolds from head. Loosen rocker shaft bolts in several steps starting with end bolts and working to the middle. Remove rocker shaft.

2) Remove valve caps. Compress valve springs with spring compressor (J-29760), and remove valve locks, retainers, inner and outer spring seats and valves. Retain components in correct order for installation.

Installation – Reverse removal procedures to install. Valve springs are of a varied pitch design. Be sure that they are installed with the close coiled end (painted green) against the cylinder head.

VALVE GUIDE SERVICE

Check valve stem clearance in valve guide with a dial indicator. Insert valve in valve guide and move left or right (parallel with rocker arm). Measure stem movement .4" (10 mm) above guide edge. If movement exceeds .008" (.2 mm) and valve stem is not worn, the valve guide must be replaced.

Removal – Drive out old guide with tool (J-26512) from combustion chamber side.

Installation – To install new guide, coat outer surface of guide with engine oil and drive into head from opposite side with tool (J-26512). Guide should project from cylinder head .583" (14.8 mm). Whenever a valve is replaced, a new guide should be used.

VALVE SEAT INSERTS

Check condition of valve seat contact area. If pitted, worn or otherwise damaged, replace seat. To remove, arc-weld a bead of metal around contact surface of seat. Allow to cool a few minutes. Pry out valve seat. Install new seat with press. Grind to correct width and angle. Lap valve and seat to complete installation.

SWIRL CHAMBER REPLACEMENT

Removal – Measure chamber depth in head with straight edge and feeler gauge. If depth exceeds .001" (.2 mm), chamber must be replaced. Use a drift of .15-.20" (3-5 mm) diameter 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

I-MARK 4-CYLINDER DIESEL (Cont.)

drive in. To seat chamber, use press to apply 1000-1100 lbs. (450-500 kg.) pressure. A piece of metal should be placed between press and chamber to prevent damage.

VALVE SPRING TENSION

Valve springs must be less than .004" (1.0 mm) out of square. Inner valve springs should require 20 lbs. (9.1 kg) of pressure at a height of 1.52" (38.5 mm). Outer spring should require 34.6 lbs. (15.7 kg) at 1.61" (41.0 mm). If tension required is less than 16.5 lbs. (7.5 kg) for the inner spring or 30.8 lbs. (14.0 kg) for the outer, the spring should be replaced. Inner and outer springs should always be replaced as a set.

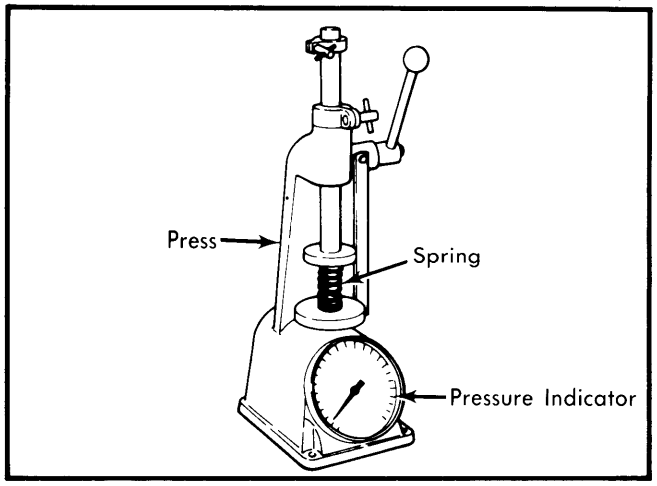

Fig. 5 Checking Valve Spring Tension

VALVE ADJUSTMENT

Valve adjustment can be made with engine warm or cold. Bring No. 1 cylinder to TDC on compression stroke and adjust No. 1 and No. 2 intake valves, No. 1 and No. 3 exhaust valves. Rotate crankshaft 180° and adjust remaining valves (No. 3 and 4 intake, No. 2 and 4 exhaust).

Valve Adjustment Clearances

Valve	Clearance
Intake	.010" (.25 mm)
Exhaust	.014" (.35 mm)

PISTONS, PINS & RINGS

PISTON & ROD ASSEMBLY

Removal – With cylinder head and oil pan removed, remove connecting rod cap nuts. Remove rod cap with bearing half. Push piston/rod assembly with bearing half up and out through top of engine. Rod caps must be kept with their respective piston and rod assembly as caps are not interchangeable.

Installation – 1) Thoroughly oil rings, piston and cylinder wall. Make sure ring gaps are located 180° apart and not on thrust side of piston or in line with piston pin. Make sure bearing halves are properly seated in connecting rod and cap.

2) Install a ring compressor and compress rings. Install piston in cylinder. Ensure mark in piston top points towards front of the engine. With piston installed in cylinder, and connecting rod and bearings seated against crankshaft journal, install rod caps to their respective piston and rod assembly. Make sure that marks in cap and rod end match and are installed on the same side.

3) With threads of rod bolts and seating face of nuts oiled, install and tighten nuts to specifications. Reverse removal procedures to complete installation.

FITTING PISTONS

1) Measure cylinder bores for wear at depths of .5" and 3.0" (10 and 80 mm). Measurements should be made in line with and at right angles to the crankshaft centerline. If excessive wear is found, cylinder should be bored to accomodate next oversize piston. Whenever one cylinder is bored, all cylinders must be bored.

2) Measure piston diameter at right angle to piston pin. Subtract this figure from cylinder diameter to obtain piston to wall clearance. Final hone of cylinder wall should provide .0002-.0020" (.005-.045 mm) clearance.

Piston Specifications

Piston Size In. (mm)	Piston Diameter In. (mm)
Standard	3.307-3.309 (84.00-84.05)
.020 (.50) O/S	3.326-3.328 (84.50-84.54)
.040 (1.0) O/S	3.346-3.348 (85.00-85.04)

PISTON PINS

Removal – Piston pin is a full floating type. To remove pin, use snap ring pliers and remove snap ring from piston. Push out pin.

Inspection – Visually inspect pin for signs of damage or excessive wear. Replace if needed. With hole gauge and micrometer, measure piston pin diameter and diameter of pin hole in piston. Subtract pin diameter from hole diameter to get pin to piston clearance figure. Clearance should be between .0001 and .0005" (.002-.012 mm). If clearance exceeds limit of .0019" (.05 mm), pin and piston should be replaced.

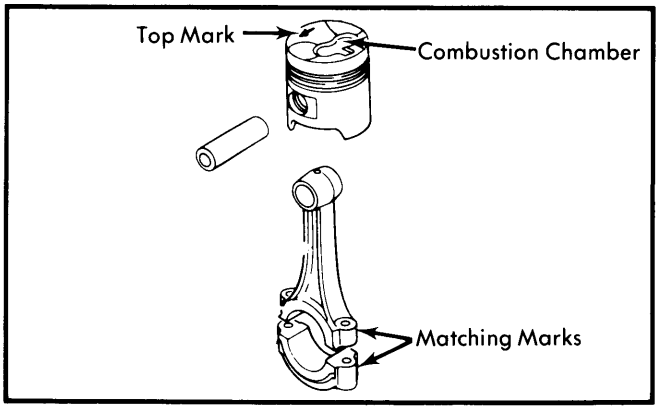

Fig. 6 Relationship of Piston to Connecting Rod

I-MARK 4-CYLINDER DIESEL (Cont.)

Installation – Reverse removal procedures to install. Make sure that piston and rod are joined so that the combustion chamber on the piston is on the same side as the match marks on the connecting rod.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT

Removal – With engine removed from vehicle, remove cylinder head and timing belt as outlined. Remove front crank pulley, front oil seal, oil pan and pump, and crankshaft rear oil seal. Remove piston and rod assemblies. Remove flywheel and crankshaft rear mounting hub. Loosen crankshaft main bearing caps starting with outside caps and working toward the middle. Remove caps and lift out crankshaft.

Inspection – Check all shaft journals and crankpins for scoring, wear, or cracks. Taper and out-of-round on all journals must not exceed .001" (.015 mm). Check crankshaft for bend using dial indicator at center journal. If bend exceeds limit of .0023" (.06 mm), the crankshaft must be replaced.

NOTE – *Crankshafts have been tufftrided and should never be ground to obtain correct clearances. If journals are worn beyond acceptable limits, the crankshaft must be replaced.*

Installation – 1) Install main bearing halves to engine block ensuring that all bearings are on their respective journal. All main bearings are grooved on both halves except for the No. 3 lower (cap side) bearing half. All grooved bearings have an oil hole as well.

2) Coat all bearing surfaces liberally with clean engine oil. Carefully install crankshaft. Insert thrust washer on No. 3 crankshaft journal with oil grooves facing outwards.

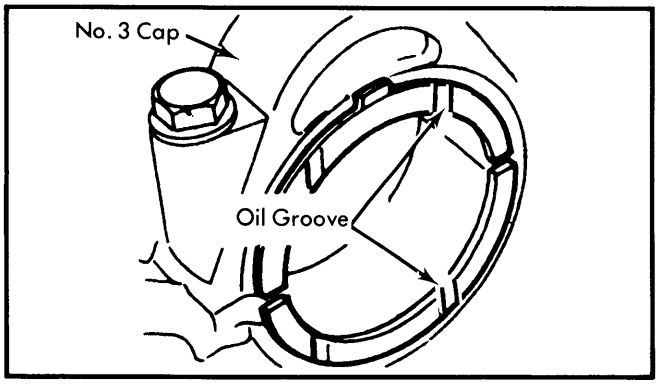

Fig. 7 Thrust Washer Installation

3) Install bearing halves in main caps. Check bearing clearance with Plastigage. Bearing surfaces should be well oiled during this procedure. After proper clearances have been determined, install main caps and torque to specifications. Be sure to coat contact surface of No. 5 main cap with sealer before installation.

4) Check crankshaft end play at thrust washer. If play exceeds .012" (.30 mm) replace the thrust washer. Reverse removal procedures to complete installation.

MAIN BEARINGS

Check all bearings for scoring or wear and replace if damage is found. Clean oil from crankshaft and place a strip of Plastigage on crankshaft journal. Install main bearing cap with bearing installed, and tighten to specifications.

NOTE – *Plastigage should run parallel with crankshaft and not block oil hole. Do not turn crankshaft while Plastigage is inserted.*

Remove cap and measure width of Plastigage at widest point using gauge provided. If clearance is not to specifications, replace bearings.

CONNECTING ROD BEARINGS

Check all bearings for scoring or signs of excessive wear and replace if damage is found. Measure inside diameter of bearings and outside diameter of crankshaft connecting rod journals. Use these figures to determine rod bearing clearance. If not to specifications, replace rod bearings. Assemble rod caps to rods with bearings in place and tighten rod bolts to specifications.

ENGINE OILING

ENGINE OILING SYSTEM

Oil drawn from pan passes through a screen 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 and drilled passages in crankshaft which in turn lubricate connecting rod 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 cylinder walls and piston pins.

Crankcase Capacity (with filter) – 5.8 quarts.

Oil Filter – Full-flow with disposable cartridge.

Oil Pressure – 50-60 psi (3.5-4.5 kg/cm²)

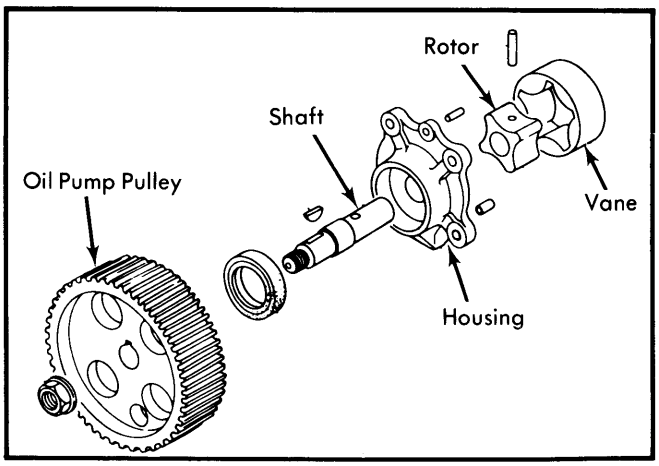

Fig. 8 Exploded View of Oil Pump

I-MARK 4-CYLINDER DIESEL (Cont.)

OIL PUMP

Removal – Oil pump is mounted to front of engine between water pump and crankshaft pulley. It is belt driven by the timing belt. To remove, first remove timing belt. Remove 4 allen head retaining bolts located behind oil pump pulley. Remove pump.

Inspection – Disassemble oil pump and clean all parts thoroughly in clean solvent. Inspect for signs of unusual wear or damage. Replace as needed. Check all clearances to specifications. Check outside diameter of pulley sleeve. If sleeve measures less than 1.1" (27.9 mm), the pulley should be replaced.

Installation – Reverse removal procedures to install.

Oil Pump Specifications

Application	① Clearance In. (mm)
Vane Depth in Cylinder Block	.008 (.200)
Vane Side Clearance	.016 (.400)
Rotor Tip Clearance	.008 (.200)

① – Clearances given are wear limits.

ENGINE COOLING

Thermostat – Opens at 180°F (82°C). Full open at 203°F (95°C).

Radiator Cap – 13 psi (.9 kg/cm²).

Cooling System Capacity – 7.4 quarts.

Water Pump – Centrifugal type pump with aluminum body.

Removal & Installation – To remove, drain cooling system and remove fan, pulley and fan belt. Remove crankshaft pulley and front covers. Remove by-pass hose, water pump retaining bolts (5) and water pump with gasket. Reverse removal procedures to install. Make sure mating surfaces of pump and block are clean, and always use a new gasket.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N·m)
Cylinder Head	
New Bolts	85-100 (116-136)
Used Bolts	90-105 (122-143)
Camshaft Bearing Cap	
Camshaft Gear	40-47 (54-64)
Connecting Rod	54-61 (73-83)
Crankshaft Gear Bolt (1)	100-120 (136-163)
Crankshaft Pulley Bolts (4)	10-20 (14-27)
Engine Plate – Rear	25-33 (34-45)
Flywheel	36-43 (49-59)
Head Plate	11-18 (15-25)
Main Bearing Caps	65-72 (88-98)
Manifolds	
Intake	25-32 (34-44)
Exhaust	11-18 (15-25)
Idler Pulley	47-61 (64-83)
Injection Pump Drive Gear	43-50 (58-68)
Oil Jet Pipe	40-54 (54-73)
Oil Pump	11-18 (15-25)
Oil Pump Drive Gear	47-61 (64-83)
Rocker Shaft	15-22 (20-30)
Tensioner Pulley	
Pulley Bolt (1)	47-61 (64-83)
Plate Bolts (4)	11-18 (15-25)

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
1981 4FB1	110.8	1817	Fuel Inj.	.....	.....	22:1	3.3	84	3.2	82

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	2.201-2.202 (55.92-55.93)	.0012-.0027 (.039-.080)	①	.0024-.0094 (.06-.24)	1.925-1.926 (48.92-48.94)	.0016-.0027 (.040-.080)	.....

① – Utilizes thrust washer on No. 3 main journal.

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)	Rings	End Gap In. (mm)	Side Clearance In. (mm)
1817	.0002-.0017 (.005-.045)	.0001-.0005 (.002-.012)	① .0003-.0078 (.008-.020)	No. 1 No. 2 Oil	.0078-.0157 (.200-.400) .0078-.0157 (.200-.400) .0078-.0157 (.200-.400)	.0035-.0049 (.090-.125) .0015-.0019 (.035-.050) .0012-.0027 (.030-.070)

① — Clearance between pin and bushing.

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)
1817							
Int.	.....	45°	45°	.0472-.0590 (1.200-1.500)	.313 (7.95)	.0015-.0027 (.040-.070)	.....
Exh.	.....	45°	45°	.0472-.0590 (1.200-1.500)	.313 (7.95)	.002-.003 (.05-.08)	.....

VALVE TIMING

Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
1817	32°	60°	65°	29°

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1817	1.1004-1.1010 (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			
Inner	1.783 (45.3)	① 20 @ 1.515 (9.1 @ 38.5)	.....
Outer	1.846 (46.9)	34.6 @ 1.614 (15.7 @ 41.0)	.....

① — Compressed height as measured in tester.