

Toyota Engines

2F 6-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine number is stamped on right side of cylinder block above starter motor. First 2 digits indicate engine type.

ENGINE IDENTIFICATION

Application	Code
Land Cruiser 4230 cc	2F

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE

Removal

1) Drain crankcase and cooling system and remove battery. Remove hood and tip grill forward. Disconnect radiator and heater hoses and remove radiator. Remove air cleaner assembly and cover carburetor.

2) Disconnect throttle and choke controls to carburetor. If equipped with air conditioning, remove compressor and condenser but DO NOT disconnect hoses.

3) Disconnect alternator and ignition wiring between engine and chassis. Tag all vacuum and emission control hoses for identification and disconnect from engine.

4) If equipped with power steering, remove pump and reservoir from engine and tie out of way, but do not disconnect hoses.

5) Remove engine and transmission undercovers. Remove front propeller shaft and winch drive shaft. Place jack or supporting device under transmission and transfer case.

6) Remove bolts attaching transmission to bell housing. Disconnect exhaust pipe from manifold and fuel line at pump.

7) Attach hoist and sling to engine, and remove engine mount bolts and nuts. Move engine forward and up, using care to avoid damage to engine compartment components.

Installation

Use guide dowels in transmission bolt holes and lower into position. Use care when aligning clutch assembly over transmission pilot shaft. Continue installation in reverse sequence of removal.

INTAKE & EXHAUST MANIFOLDS

Removal

1) Disconnect battery and remove air cleaner. Disconnect throttle rod, choke rod, accelerator wire, vacuum line, and fuel line from carburetor.

2) Disconnect magnetic valve wire from ignition coil terminal, and remove carburetor assembly. Disconnect exhaust pipe from exhaust manifold. Remove manifold nuts, manifolds and gaskets.

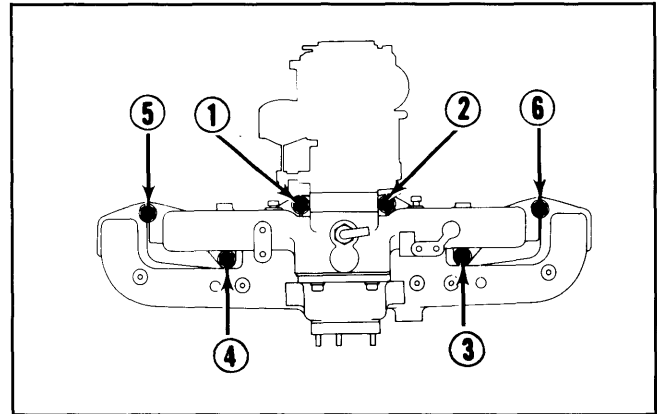
Installation

1) Thoroughly clean all gasket surfaces and install new gaskets. Before installation, check intake-exhaust manifold assembly for warpage.

2) The warpage limit is .079" (2 mm). Replace the manifold if it exceeds the limit.

3) Install manifold assembly, and gradually torque bolts working from center out. See Fig. 1. Install remaining components in reverse of removal procedure.

Fig. 1: Intake-Exhaust Manifold Tightening Sequence



Check for warpage before installation.

CYLINDER HEAD

Removal

1) Drain cooling system and remove air cleaner assembly. After marking for identification, disconnect spark plug wires, electrical connectors and vacuum hoses from head. Remove intake and exhaust manifold.

2) Remove valve cover and rocker arm assembly. Take out push rods, keeping them in order for installation. Loosen head bolts in 2 or 3 steps in reverse of tightening sequence. See Fig. 2. Remove head.

Inspection

1) The limit of head surface warpage is .0059" (.15 mm). The manifold mounting surface warpage limit is .0039" (.1 mm).

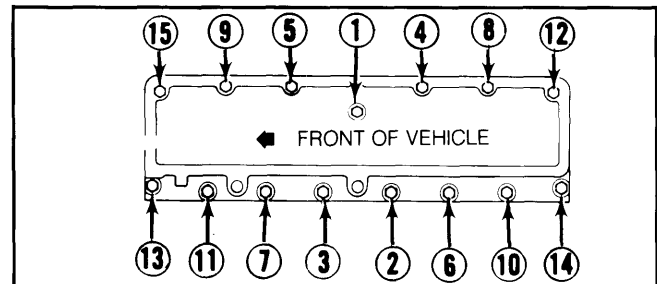
2) If warpage exceeds the limit, correct by machining or replacement. The maximum reface limit for both surfaces is .0079" (.2 mm).

Installation

1) Ensure that all mating surfaces are clean, and place new head gasket on cylinder block. Ensure that mating oil hole on push rod side is between No. 4 and 5 cylinder.

2) Install cylinder head and torque bolts in 2 or 3 steps. See Fig. 2. Complete installation in reverse sequence of removal.

Fig. 2: Cylinder Head Tightening Sequence



Loosen in reverse order.

2F 6-CYLINDER (Cont.)

CAMSHAFT

ENGINE FRONT COVER

Removal

Drain cooling system and remove radiator. Take off all fan belts. Using a gear puller, remove crankshaft pulley. Remove timing gear cover bolts, and take off cover.

Installation

1) Install cover and gasket. Ensure that bolts of proper length are used, and liquid sealer is used on threads of lower 2 bolts.

2) Drive pulley into position with tool (09214-60010) to locate cover properly. Tighten cover bolts. Reverse disassembly procedure.

FRONT COVER OIL SEAL

Removal & Installation

Pry old oil seal out using screwdriver. Install new oil seal so that open end of seal is toward inside of timing gear cover. Drive seal in place with tool (09515-35010).

TIMING GEAR

NOTE: If camshaft gear needs to be replaced, camshaft must be removed from engine. Due to model variations, engine may have to be removed from vehicle.

Checking for Wear

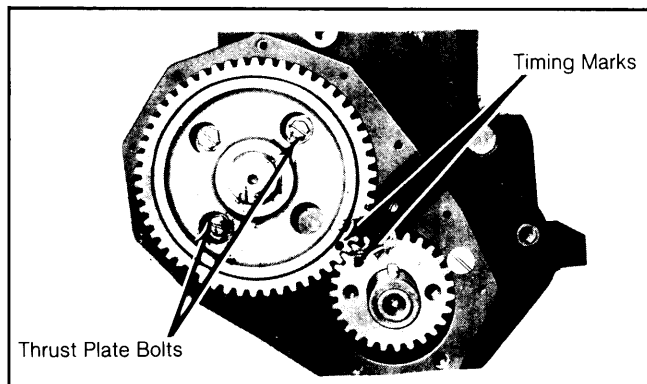
1) Set engine to TDC of No. 1 cylinder. Drain cooling system and remove radiator. Remove engine front cover. See Front Cover.

2) Check camshaft timing gear backlash. Backlash must not exceed .008" (.2 mm). If limit is exceeded, both timing gears must be replaced.

Removal

1) Align the timing marks, and remove the camshaft thrust plate aligning bolts. See Fig. 3.

Fig. 3: Aligning Timing Marks on Gears



Use puller to remove gears.

2) Remove valve cover and engine side cover. Remove rocker arm shaft. Noting position for reinstallation, remove push rods and valve lifters. Pull out the camshaft.

3) Remove the snap ring and press timing gear off of camshaft. Pry pulley key from crankshaft. Using a gear puller, pull timing gear off of crankshaft.

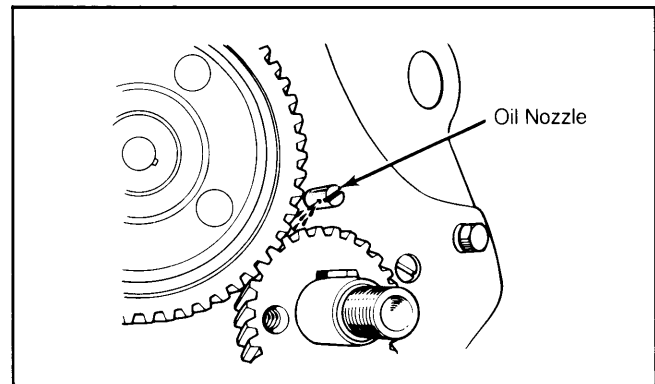
Installation

1) Install crankshaft timing gear and pulley key. Press new timing gear on camshaft. Oil camshaft journals and bearings and install camshaft.

2) Align timing marks on camshaft and crankshaft timing gears. See Fig. 3.

3) If oil nozzle was removed, screw in and stake in two places. Oil hole must face gears. See Fig. 4.

Fig. 4: Adjusting Oil Nozzle so Hole Faces Gears



Screw nozzle in and stake at 2 places.

4) Reverse disassembly procedure and re-install engine. Refill cooling system with 50-50 mixture of antifreeze and water.

CAMSHAFT

Removal & Installation

See Timing Gear in this article.

CAMSHAFT END THRUST

1) Measure end thrust with feeler gauge. Measurement is taken between thrust plate and first cam journal.

2) Thrust should be .0079-.0103" (.200-.261 mm). If thrust exceeds .012" (.30 mm), replace camshaft thrust plate.

CAM LOBE HEIGHT

Measure height of cam lobe. If wear exceeds specification limit, replace camshaft. Intake lobe limit is 1.496" (38 mm). Exhaust lobe limit is 1.492" (37.9 mm).

CAMSHAFT BEARING

Removal

1) Inspect camshaft for runout. If runout exceeds .0059" (.15 mm), replace camshaft. Inspect camshaft journals and bearings for wear or damage.

2) If clearance exceeds specifications, replace camshaft bearings and/or camshaft. Bearings are available in standard .010" and .020" (.25 and .50 mm) oversizes.

3) Drive out camshaft rear expansion plug from cylinder block. Remove bearings using camshaft bearing remover/installer tool (09215-00010).

Installation

When installing new bearings, ensure that oil holes of bearing align with oil holes in cylinder block. Coat rear expansion plug with sealer, and reinstall plug in block.

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VALVES

VALVE ARRANGEMENT

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

ROCKER ARM ASSEMBLY

1) When disassembling, note position of rocker arms and supports. Check rocker arms and shaft for damage or wear.

2) Measure the oil clearance between rocker arms and shaft. Clearance should be .0007-.0017" (.018-.043 mm).

3) Check contact surface of rocker arm. If only lightly scored, reface with an oil stone. If badly scored, replace rocker arm.

4) Assemble rocker arms, springs and rocker shaft supports onto rocker arm shaft. Oil hole of shaft must be aligned with oil hole of No. 4 support. Install valve rocker shaft lock springs.

VALVE SPRINGS

Removal

1) Using compressor, compress valve spring and remove retainer keepers. Release compressor and remove spring retainer, spring, valve stem oil seal and spring seat.

2) Remove valves and keep in order. Check spring squareness, free height and tension at installed height. Spring should be square within .079" (2 mm).

Installation

1) Insert valve into valve stem guide, and install valve spring seat, valve spring, valve stem oil seal and valve spring retainer onto valve stem.

2) Compress valve spring using valve spring compressor, and install valve spring retainer locks. Make sure retainer locks seat properly in valve stem groove.

VALVE STEM LENGTH

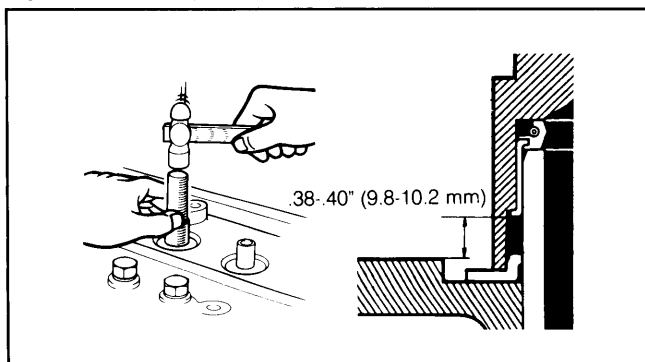
1) Valve stem tips may be resurfaced if necessary. The tip resurfacing limit is .020" (.5 mm).

2) The overall valve length limit is 4.894" (124.3 mm) for intake and 4.902" (124.5 mm) for exhaust.

VALVE STEM OIL SEALS

Cup-type oil seals are used on all valves. Coat new seals with engine oil, and install with seal installer tool (09201-31010). Drive in a distance of .386-.406" (9.8-10.2 mm). See Fig. 5.

Fig. 5: Measuring Valve Seal Installed Height



Coat seals with oil before installation.

VALVE GUIDE SERVICING

1) Check clearance between valve stems and valve guides. If clearance exceeds .004" (.10 mm) for intake or .005" (.12 mm) for exhaust, replace valve and/or valve guide.

2) To replace valve guide, drive toward combustion chamber with installer/remover tool (09201-60011).

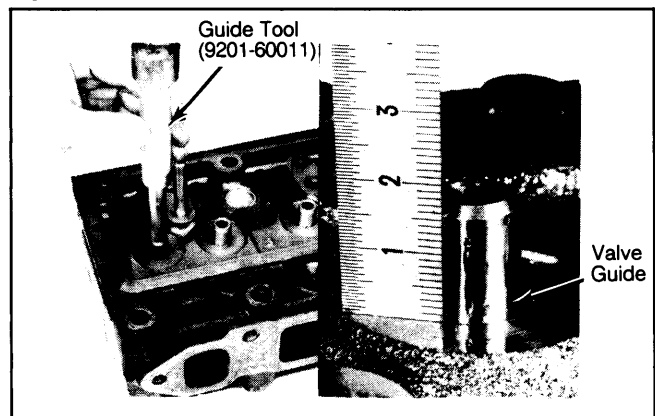
3) After removing guide, measure valve guide bore in cylinder. If guide bore is more than .5519" (14.018 mm), machine the bore to .5531-.5539" (14.050-14.068 mm).

4) Install oversize valve guide. Oversize guide will measure .5519" (14.018 mm). Drive new guide in from top of cylinder head.

5) When properly installed guide should extend .689" (17.5 mm) from top of cylinder head.

6) Intake valve guide length is 2.13" (54 mm) and exhaust guide is 2.32" (59 mm) long. After installing, ream guide for proper clearance.

Fig. 6: Installing Valve Guides to .689" (17.5 mm) Depth



Protrusion is the same for intake and exhaust guides.

VALVE LIFTERS

1) Check the lifters and bores for wear or damage. Valve lifter standard diameter is .9902" (25.15 mm).

2) The standard oil clearance is .0007-.003" (.019-.075 mm). If clearance exceeds limit, replace lifter with oversize lifter. Oversize lifters are available in .002" (.05 mm).

VALVE CLEARANCE ADJUSTMENT

1) Valves are adjusted at normal operating temperature. Set No. 1 piston at TDC of compression stroke, and align timing mark with pointer.

2) Adjust valves 1,2,3,5,7 and 9 (as numbered from front). Rotate crankshaft one complete turn and again align timing mark with pointer. Adjust remaining valves 4,6,8,10,11 and 12.

VALVE CLEARANCE SPECIFICATIONS

Valve	Clearance (Hot) In. (mm)
Intake	.008 (.20)
Exhaust	1.014 (.35)

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PISTONS, PINS & RINGS

OIL PAN

Removal

Remove engine undercovers. Remove flywheel side and undercover. Remove front propeller shaft. Drain oil, remove oil pan attaching bolts and oil pan.

Installation

Thoroughly clean all gasket mating surfaces. Apply liquid sealer onto both oil pan gasket surfaces. Install oil pan and tighten bolts. Reverse removal procedure for remaining components.

PISTON & ROD ASSEMBLY

Removal

With cylinder head and oil pan removed, remove connecting rod caps and remove bearings. Push piston and rod assembly up through cylinder block. Mark all components with cylinder numbers for correct reassembly.

NOTE: Cover rod bolts with a short piece of hose during removal and installation to prevent damage to crankshaft.

Installation

1) Lubricate piston and rings and position ring gaps. See Fig. 7. Use a ring compressor and install piston/rod assembly in proper position. Notch on piston must face FRONT and Toyota trademark on rod should face REAR.

2) Oil hole in rod faces right (camshaft) side. Install bearings and caps. Check for smooth rotation of crankshaft after tightening each bearing cap.

FITTING PISTONS

1) Measure cylinder bores at 90° and parallel to crankshaft centerline. Also measure bores at top, center and bottom of piston travel.

2) If cylinder bore is worn beyond specifications, cylinder must be bored and oversize pistons installed. Oversize pistons are available in .020", .040" and .060" (.50, 1.00 and 1.50 mm).

3) Measure piston with micrometer at bottom of skirt at right angles to piston pin. Standard piston diameter is 3.6992-3.7012" (93.96-94.01 mm). If worn beyond limits, replace piston.

CYLINDER BORE SPECIFICATIONS

Application	Wear Limits In. (mm)
Standard Bore	3.701-3.703 (94.00-94.05)
Bore Wear Limit008 (.20)
Taper0008 (.020)
Difference Between Cylinders.002 (.05)

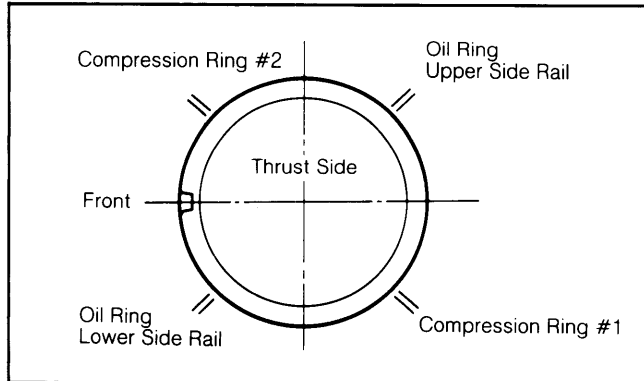
FITTING RINGS

1) Measure ring gaps in cylinder. If cylinder has not been bored, check gap with ring in lowest part of cylinder.

NOTE: Two types of rings are used: NP & Riken. Check specifications for ring gap.

2) Check clearance of piston ring in ring groove. If groove worn beyond limit, replace piston. Install rings with marks facing upward.

Fig. 7: Spacing Piston Ring Gaps



Code marks on rings will face upward.

PISTON PINS

Removal

Remove piston pin bolt and push piston pin from piston and connecting rod. Mark all parts for correct assembly order.

Inspection

1) Coat piston pin with engine oil. The piston pin should push into piston hole with thumb pressure.

2) The oil clearance limit between piston and piston pin is .0028" (.07 mm). If clearance is exceeded, replace piston and piston pin as a set.

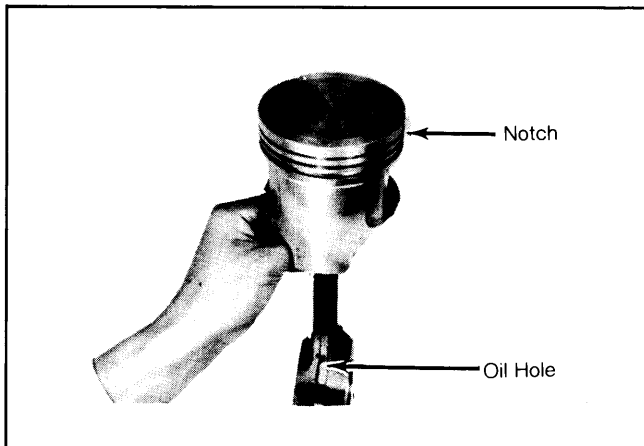
3) Check connecting rod for bending or twisting. The bend limit per 3.94" (100 mm) is .002" (.05 mm). The twist limit per 3.94" (100 mm) is .006" (.15 mm).

Installation

1) Position piston and connecting rod so that when notch on top of piston faces forward, oil hole in connecting rod faces camshaft side.

2) Push pin into assembly, and center pin in piston. Center connecting rod between piston pin bosses and torque piston pin bolt.

Fig. 8: Proper Assembling of Piston and Rod



Notch on top of piston must face forward.

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CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

MAIN BEARINGS

1) Thoroughly clean crankshaft, and blow out oil passages with compressed air. Inspect crankshaft for scoring or wear.

2) Check crankshaft for runout with a dial indicator on second or third main bearing journal. If runout exceeds .004" (.10 mm), replace crankshaft.

3) Check main bearing journals for excessive wear, taper or out-of-round. If taper or out-of-round exceeds .0004" (.01 mm), grind crankshaft to next undersize.

4) Main bearing oil clearance is checked by the Plastigage method. If clearance cannot be brought to specifications by use of new standard size bearings, grind crankshaft to next undersize.

5) Crankshaft bearings are available in .002", .010", and .020" (.05, .25, and .50 mm) undersize.

NOTE: All main bearings are different. No. 1 (front) and No. 4 (rear) have oil holes and must be installed on block side. Arrow on connecting rod cap must face front.

CONNECTING ROD BEARINGS

1) Check connecting rod journals for wear, taper or out-of-round. The taper and out-of-round limit is .0004" (.01 mm). Grind crankshaft if worn beyond limit.

2) Check connecting rod oil clearance by Plastigage method. Grind crankshaft if new standard size bearings will not restore proper clearance. Undersize bearings are available in .002", .010" and .020" (.05, .25 and .50 mm).

THRUST BEARING ALIGNMENT

Install main bearing caps and torque to specifications. Check crankshaft end play at No. 3 main bearing. If clearance exceeds .012" (.3 mm), replace No. 3 crankshaft bearings.

REAR MAIN BEARING OIL SEAL

Removal

Remove transmission and transfer case assembly. Mark position of pressure plate relative to flywheel for later installation. Remove pressure plate, clutch and flywheel. Pry out oil seal with a screwdriver.

Installation

Use crankshaft rear oil seal replacer tool (09223-60010) to drive new seal into place. Replace parts in reverse order of removal.

ENGINE OILING

CRANKCASE CAPACITY

The crankcase capacity is 8.2 qts. (7.8L) with filter replacement.

OIL FILTER

The oil filter is a full-flow, cartridge-type with integral relief valve.

NORMAL OIL PRESSURE

The oil pressure is maintained at 50-64 psi (3.5-4.5 kg/cm²) by safety valve in oil pressure regulator.

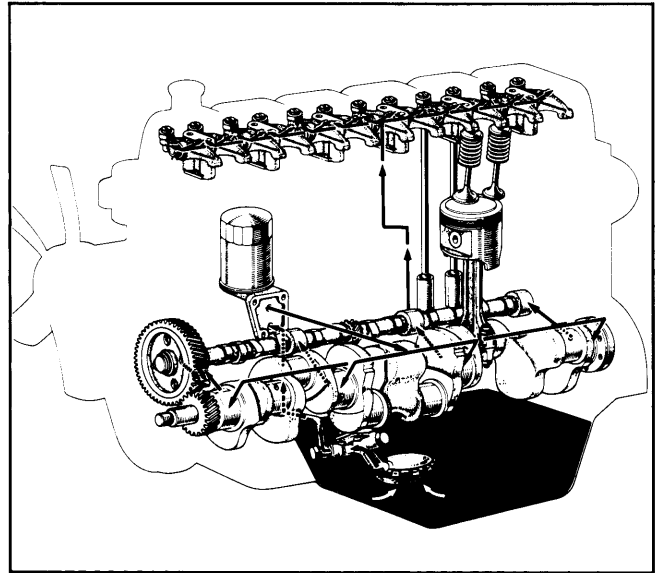
OIL PRESSURE REGULATOR VALVE

The oil pressure regulator valve is located in the oil pump. It is non-adjustable.

ENGINE OILING SYSTEM

Force-feed system ensures positive lubrication through oil holes and galleries in engine block. See Fig. 9.

Fig. 9: Toyota 2F Engine Oiling System



OIL PUMP

Removal

With oil pan removed, remove bolts attaching oil strainer to crankcase. Remove oil pump mounting bolt and oil pump line. Remove pump from engine.

Disassembly

Remove oil pump cover, regulator valve plug and disassemble pump. Inspect all parts for wear or damage.

Inspection

Inspect regulator valve in valve bore for smooth operation. Install gears in housing and check for proper clearances.

Reassembly

1) Reassemble in reverse order of disassembly. Ensure that the pump cover discharge hole faces toward the pump body bolt hole.

2) Prior to installing assembled pump, check operation by submerging inlet line in fresh engine oil. Turn shaft clockwise with a screwdriver and check for oil flow from discharge hole.

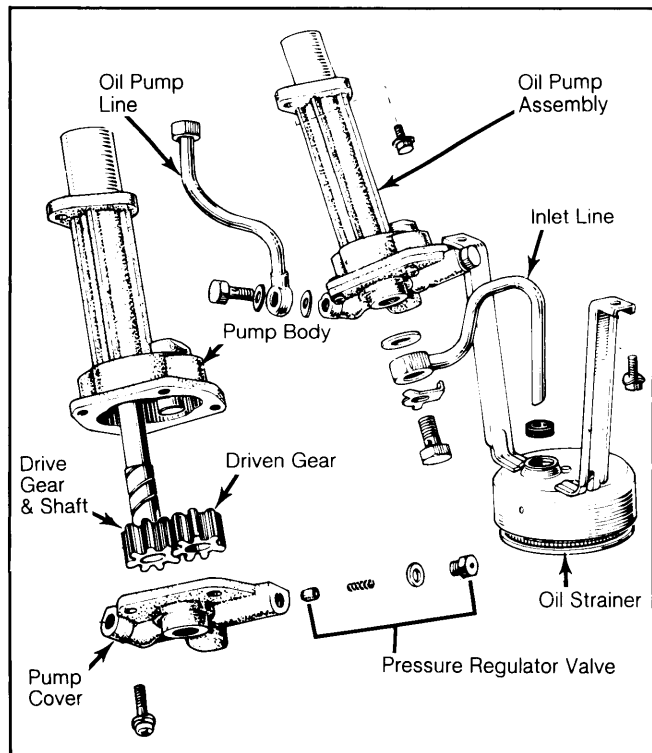
3) Cover the discharge hole with thumb, and turn shaft. Turning resistance should be felt.

Installation

Install pump on engine, noting that lower end of distributor drive shaft aligns with oil pump shaft. To complete installation, reverse removal procedure.

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Fig. 10: Exploded View of Oil Pump Assembly



OIL PUMP SPECIFICATIONS

Application	Standard In. (mm)	Wear Limit In. (mm)
Gear-to-Housing Clearance	.0043-.0071 (.109-.180)	.008 (.20)
Gear Backlash	.020-.024 (.050-.6)	.0375 (.952)
Gear Side Clearance	.0013-.0035 (.030-.088)	.0059 (.15)
Cover Wear		.0059 (.15)

ENGINE COOLING

COOLANT CAPACITY

Coolant capacity is 16.9 qts. (16L).

THERMOSTAT

The thermostat is a wax pellet type. It begins to open at 187°F (86°C) and is fully opened at 212°F (100°C).

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	257.9	4230	2-Bbl.	125@3600	200@1800	8.3:1	3.70	94	4.00	101.6

WATER PUMP

Removal

Drain cooling system, and loosen alternator adjusting bar. Remove fan, fan pulley and fan belt. Remove lower radiator hose and heater hose from pump. Remove water pump retaining bolts, pump and gasket.

Disassembly

1) Remove the rear plate and gasket. Press the pulley seat off of the pump shaft.

2) Heat the pump housing to approximately 176°F (80°C). Press shaft and bearing assembly out through the rear of the housing.

3) Press the impeller off of the pump shaft and remove seal set. Inspect all parts for wear, cracks or damage.

Reassembly

1) Press bearing and shaft into pump housing. Apply liquid sealer to outside edge of seal set and press into pump housing.

2) Install the packing and seal into the impeller. Press impeller onto pump shaft. The impeller-to-housing clearance should be .03" (.75 mm).

3) Press pulley seat onto pump shaft to specified depth. Measurement is from front face of pulley seat to rear face of pump housing.

PULLEY SEAT INSTALLATION DEPTH

Type	Depth
Direct Drive	6" (152.3 mm)
Fan Clutch	4.6" (117.3 mm)

Installation

Ensure that mating surfaces are clean and free from pitting or damage. Install pump with new gasket and tighten mounting bolts. Complete installation in reverse sequence of removal and adjust belt tension.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Thrust Plate Bolts	8-11 (11-15)
Connecting Rod Bearing Caps	35-54 (48-73)
Crankshaft Main Bearing Caps	
No. 1 - No. 3	91-108 (124-147)
No. 4	76-94 (103-128)
Crankshaft Pulley	116-144 (158-196)
Cylinder Head	84-97 (114-132)
Flywheel Bolts	58-79 (79-107)
Manifold Nuts	29-36 (39-49)
Piston Pin Bolt	40-50 (54-68)
Rocker Arm-to-Cyl. Head	
8 mm Bolt	15-21 (20-29)
10 mm Bolt	22-32 (30-44)

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ENGINE SPECIFICATIONS (Cont.)

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)
4230 cc Intake	1.81 (46.0)	45.5°	45°	.055 (1.4)	.3138-.3144 (7.970-7.985)	.0012-.0024 (.030-.060)
Exhaust	1.48 (37.5)	45.5°	45°	.067 (1.7)	.3134-.3140 (7.960-7.975)	.0016-.0028 (.040-.071)

¹ — Wear limits: Intake — .004" (.10 mm); Exhaust — .005" (.12 mm).

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)
4230 cc	.0012-.0020 (.034-.050)	.0003-.0005 (.008-.012)	Locked in Rod	No. 1	.0079-.0157 (.200-.400)	.0012-.0028 (.030-.071)
				No.2	.0079-.0157 (.200-.400)	.0008-.0024 (.020-.060)
				Oil (NP)	.0079-.0197 (.200-.500)	.0016-.0075 (.040-.190)
				Oil (Riken)	.0118-.0354 (.30-.90)	.0016-.0075 (.040-.190)

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)
4230 cc No. 1	2.6367-2.6376 (66.972-66.996)	.0008-.0017 (.020-.044)	No. 3	.002-.006 (.06-.16)	2.1252-2.1260 (53.98-54.00)	.0008-.0024 (.020-.060)	.004-.009 (.11-.23)
No. 2	2.6957-2.6967 (68.472-68.496)						
No. 3	2.7548-2.7557 (69.972-69.996)						
No. 4	2.8139-2.8148 (71.472-71.496)						

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (Kg @ mm)	
		Valve Closed	Valve Open
4230 cc	2.028 (51.5)	71@1.693 (32.5@43.0)

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
4230 cc No. 1	1.8810-1.8888 (47.777-47.975)	.001-.003 (.025-.075)
No. 2	1.8289-1.8297 (46.455-46.475)		
No. 3	1.7699-1.7707 (44.955-44.975)		
No. 4	1.7108-1.7116 (43.455-43.475)		