

2F 6-CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

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

Application	Engine Identification	Code
Land Cruiser (4230 cc)		2F

ENGINE, CYLINDER HEAD & MANIFOLDS

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 and ducting and cover carburetor. Disconnect throttle and choke controls to carburetor. If equipped with air conditioning, dismount compressor and condenser but DO NOT disconnect hoses.

2) Disconnect alternator and ignition wiring between engine and chassis. Tag all vacuum and emission control hoses for identification and disconnect from engine. If equipped with power steering, remove pump and reservoir from engine and tie out of way, but do not disconnect hoses.

3) Remove engine and transmission undercovers. Remove front propeller shaft and winch drive shaft. Place jack or suitable supporting device under transmission and transfer case. Remove bolts attaching transmission and transfer case to engine bell housing. Disconnect exhaust pipe from manifold and fuel line at pump.

4) Attach suitable hoist and sling to engine and remove engine mount bolts and nuts. Move engine forward and up very carefully 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.

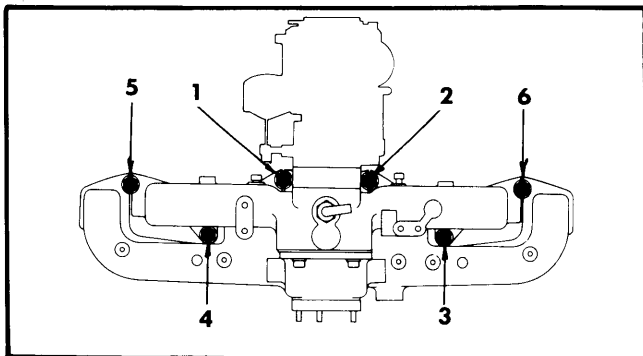


Fig. 1 Manifold Tightening Sequence

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 - Thoroughly clean all gasket surfaces and install new gaskets. Install manifold assembly and gradually tighten bolts working from center out. Install remaining components in reverse of removal procedure.

CYLINDER HEAD

Removal - Drain cooling system and remove intake and exhaust manifold as previously described. Disconnect spark plug wires and remove cylinder head cover. Remove rocker arm assembly and take out push rods, keeping them in order for installation. Loosen head bolts in 2 or 3 steps in reverse of tightening sequence and remove head.

Installation - 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. Install cylinder head and tighten bolts in 2 or 3 steps in the sequence illustrated. Complete installation in reverse sequence of removal.

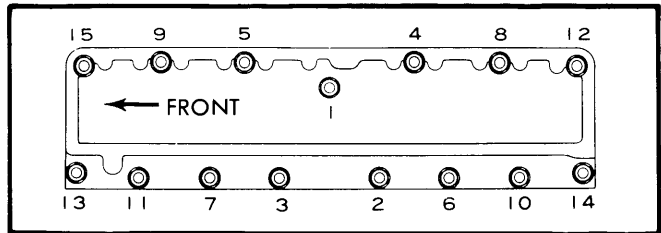


Fig. 2 Cylinder Head Tightening Sequence (Loosen in Reverse Order)

VALVES

VALVE ARRANGEMENT

E-I-I-E-E-I-I-E-E-I-I-E

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.

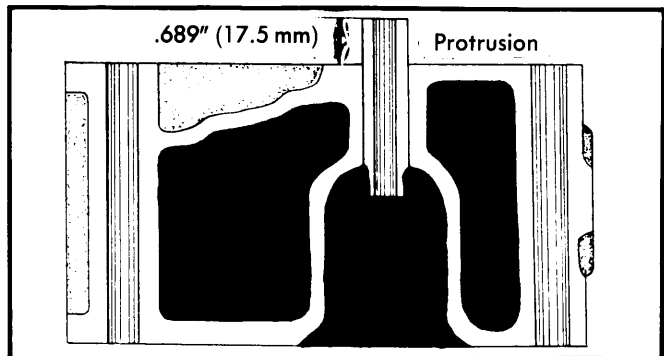


Fig. 3 Valve Guide Installation

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2) To replace valve guide, drive toward combustion chamber with suitable tool (09201-60011). Use same tool to drive new guide in from top of cylinder head. When properly installed guide should extend .689" (17.5 mm) from top of cylinder head. 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.

VALVE SPRINGS

Removal — Using suitable compressor, compress valve spring and remove retainer locks (keepers). Release compressor and remove spring retainer, spring, valve stem oil seal and spring seat. 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 — Insert valve into valve stem guide, and install valve spring seat, valve spring, valve stem oil seal and valve spring retainer onto valve stem. Compress valve spring using suitable valve spring compressor and install valve spring retainer locks. Make sure retainer locks seat properly in valve stem groove.

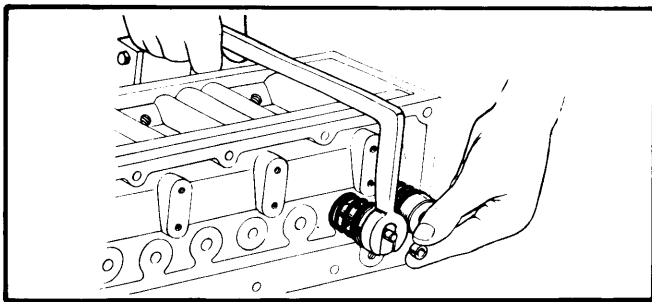


Fig. 4 Removing and Installing Valve Springs

ROCKER ARM ASSEMBLY

- 1) Check rocker arms and shaft for damage or wear. If clearance is excessive, replace bushing and ream to provide a clearance of .0007-.0015" (.017-.037 mm). When replacing bushing make sure oil hole in bushing lines up with oil hole in rocker arm.
- 2) Install rocker arms, springs and rocker shaft supports onto valve rocker shaft, then install valve rocker shaft lock springs.

NOTE — There are two types of rocker arms and two types of rocker supports. Rocker support with oil hole is installed in the fourth position. Boss of rocker supports should face forward.

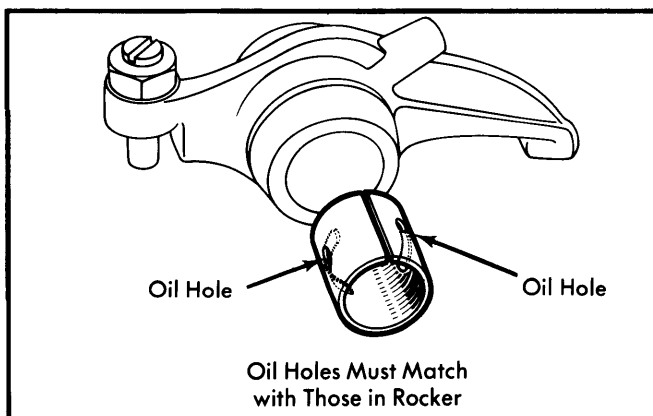


Fig. 5 Rocker Shaft Bushing Alignment

VALVE CLEARANCE ADJUSTMENT

- 1) Set No. 1 piston at TDC of compression stroke and align timing mark with pointer. Adjust valves 1,2,3,5,7 and 9 (as numbered from front).
- 2) 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)
Intake008 (.20)
Exhaust014 (.35)

PISTONS, PINS & RINGS

OIL PAN

Removal — Remove engine undercovers, and 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.

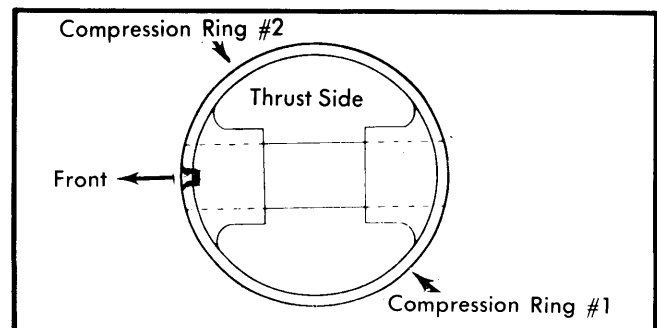


Fig. 6 Piston Ring Gap Spacing

Installation — Lubricate piston and rings and position ring gaps as illustrated. 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. Oil hole in rod will face right (camshaft) side. Install bearings and caps.

NOTE — Check for smooth rotation of crankshaft after tightening each bearing cap.

FITTING PISTONS

- 1) Measure cylinder bores and pistons to be fitted. Measure piston with micrometer at bottom of skirt at right angles to piston pin. If clearance exceeds specifications, replace piston.

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2) If cylinder bore is worn or tapered 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).

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 Cyls.002 (.05)

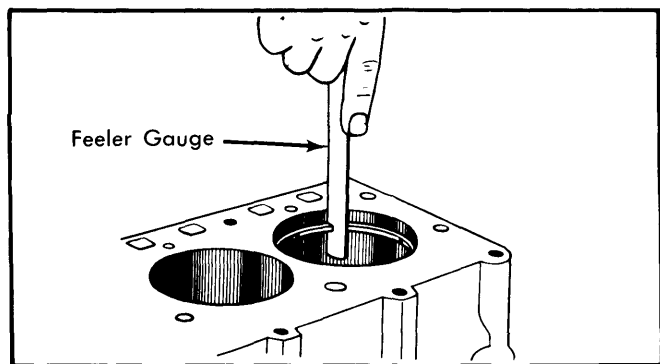


Fig. 7 Measuring Ring End Gap

3) Use .001-.002" (.03-.05 mm) feeler gauge with pull scale to check clearance of oversize pistons. Force of 2.2-5.5 lbs. (1.0-2.5 kg) must not be exceeded when pulling feeler gauge from cylinder.

4) Measure piston ring gaps in cylinder. If cylinder has not been bored, check gap with ring in lowest part of cylinder. Check clearance of piston ring in ring groove. Always install rings with marks facing upward.

PISTON PINS

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

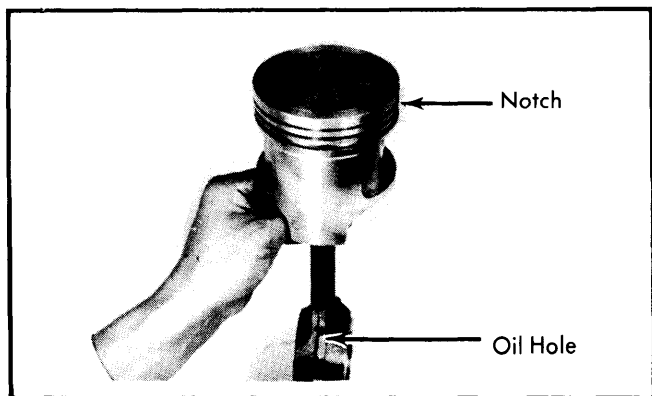


Fig. 8 Piston and Rod Assembled Properly

Installation — Position piston and connecting rod so that when notch on top of piston faces forward, oil hole in connecting rod faces camshaft side. Push pin into assembly and

center pin in piston. Center connecting rod between piston pin bosses and tighten piston pin bolt.

CRANKSHAFT MAIN & CONNECTING ROD BEARING

MAIN & CONNECTING ROD BEARINGS

1) Thoroughly clean crankshaft and blow out oil passages with compressed air. Check crankshaft for runout with a dial indicator on second or third main bearing journal. If runout exceeds .004" (.10 mm), straighten or replace crankshaft.

2) Check main and connecting rod bearing journals for taper or out-of-round. If taper or out-of-round exceeds .0004" (.01 mm), crankshaft must be ground to next undersize.

3) Main and connecting rod bearing clearance is checked by the Plastigage method. If clearance exceeds specifications, replace bearings. If crankshaft wear is excessive and clearance cannot be brought to specifications by use of new standard size bearings, crankshaft must be reground to next undersize. 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 toward block. Arrow on connecting rod cap must face front.

THRUST BEARING

Check crankshaft end play at No. 3 main bearing. If clearance exceeds .012" (.3 mm), replace crankshaft bearings.

REAR MAIN BEARING OIL SEAL

To install oil seal without disassembling engine, pry out oil seal with a screwdriver. Use crankshaft rear oil seal replacer tool (09223-60010) to drive new seal into place.

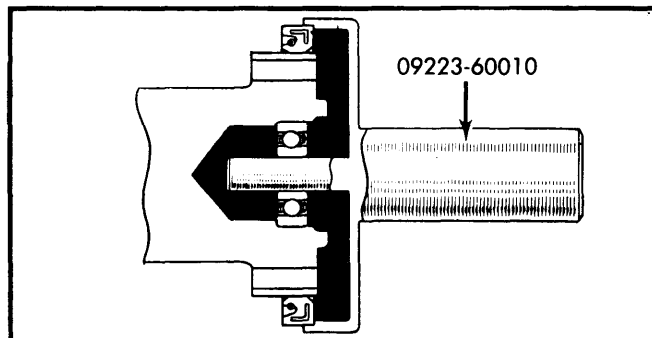


Fig. 9 Rear Oil Seal Installation

CAMSHAFT

ENGINE FRONT COVER

Removal — Drain cooling system and remove radiator. Take off fan belt and remove crankshaft pulley using a suitable puller (09213-60015). Remove timing gear cover bolts and take off cover.

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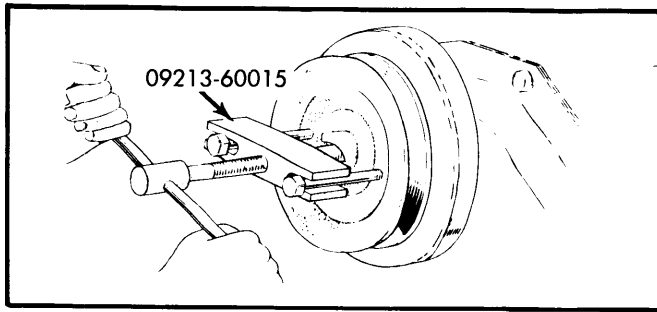


Fig. 10 Crankshaft Pulley Removal

Installation — Install cover and gasket. Ensure that bolts of proper length are used and screw in finger tight. Use liquid sealer on threads of lower 2 bolts. Drive pulley into position with suitable tool (09214-60010) to locate cover properly. Tighten cover bolts.

FRONT COVER OIL SEAL

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 suitable tool (09515-35010).

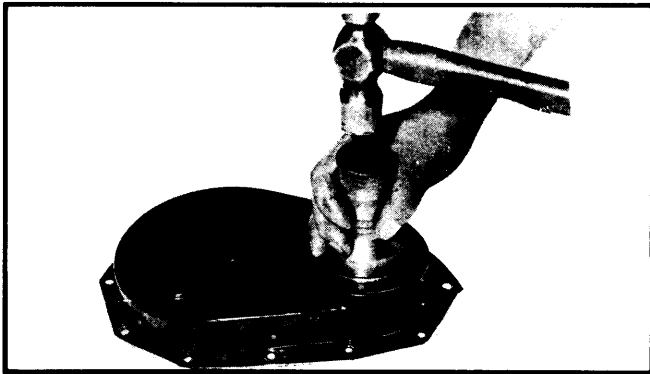


Fig. 11 Front Oil Seal Installation

CAMSHAFT

Removal & Installation — Remove timing gear cover and slide oil slinger out from crankshaft. Remove 2 bolts retaining camshaft thrust plate to cylinder block by working through holes in camshaft timing gear. Remove camshaft by pulling out through front of block. Use care not to damage camshaft bearings or journals. To install, reverse removal procedure and set valve timing.

NOTE — Ensure timing gear oil nozzle is positioned to direct oil onto timing gears. Stake into place with a punch.

CAM LOBE HEIGHT

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

CAMSHAFT BEARING

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

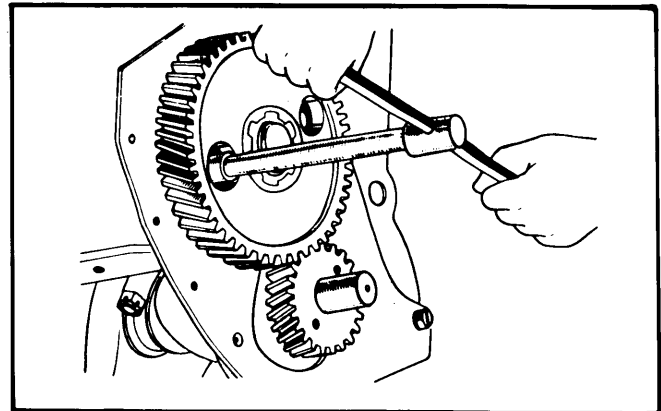


Fig. 12 Removing Crankshaft Thrust Plate Bolts

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

2) Drive out camshaft rear expansion plug from cylinder block. Remove front and No. 2 bearing using Camshaft Bearing Remover (Tool 09215-60010). Place front and second bearing adapters against rear of respective bearing and place tool against front part of cylinder block.

3) Insert replacer shaft into the 3 parts and screw retainer nut onto replacer shaft. Hold slotted part of shaft with wrench to prevent shaft from turning. Front and No. 1 bearings will be pulled out to front by screwing in retainer nut with another wrench.

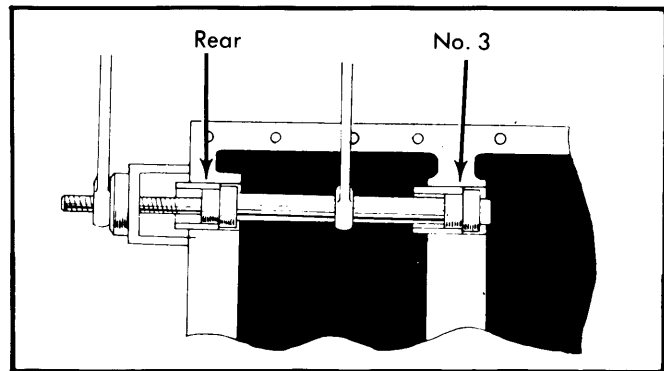


Fig. 13 Typical Camshaft Bearing Removal Procedure (No. 3 and Rear Bearings Shown)

4) Remove No. 3 and rear bearing toward rear of block using tool in same manner as for front and No. 1 bearing. When installing new bearings, ensure that oil holes of bearing match up with oil holes in cylinder block.

5) When new bearings have been installed, measure to obtain proper clearance. Only a very light cut is required to ream bearings to proper size. Coat rear expansion plug with sealer and reinstall plug in block.

CAMSHAFT END THRUST

Measure end thrust with feeler gauge. Thrust should be .0079-.0103" (.200-.261 mm). If thrust exceeds .012" (.30 mm), replace camshaft thrust plate.

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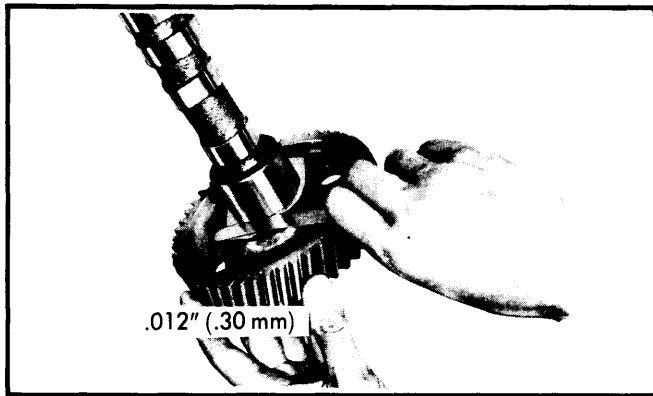


Fig. 14 Measuring Camshaft End Thrust

CRANKSHAFT TIMING GEAR

Remove pulley key from crankshaft. Using suitable puller (09213-60015), pull off crankshaft gear. To reinstall, drive on gear using suitable driver (09214-60010). Make sure timing mark on gear faces outward.

VALVE TIMING

1) With crankshaft timing gear installed, oil camshaft journals and bearings and insert camshaft. Align mating mark on camshaft timing gear with mark on crankshaft timing gear and push camshaft into position. No. 6 cylinder should be at TDC on compression stroke. If oil nozzle was removed, refit with oil hole facing down (toward gears).

2) Tighten camshaft thrust plate retaining bolts to specifications. Check that timing gear backlash does not exceed .008" (.20 mm). Standard backlash is .0020-.0047" (.050-.119 mm). If backlash exceeds specifications, replace both camshaft and crankshaft gears.

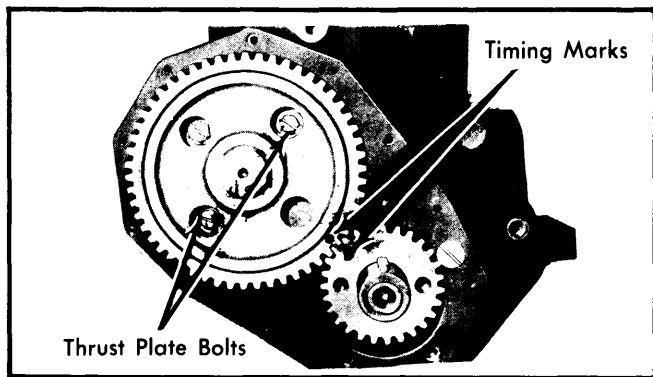


Fig. 15 Timing Mark Alignment

ENGINE OILING

Crankcase Capacity — 7.4 quarts (8.2 quarts with filter).

Oil Filter — Full flow cartridge type with integral relief valve.

Normal Oil Pressure — Pressure maintained at 50-64 psi (3.5-4.5 kg/cm²) by safety valve in oil pressure regulator.

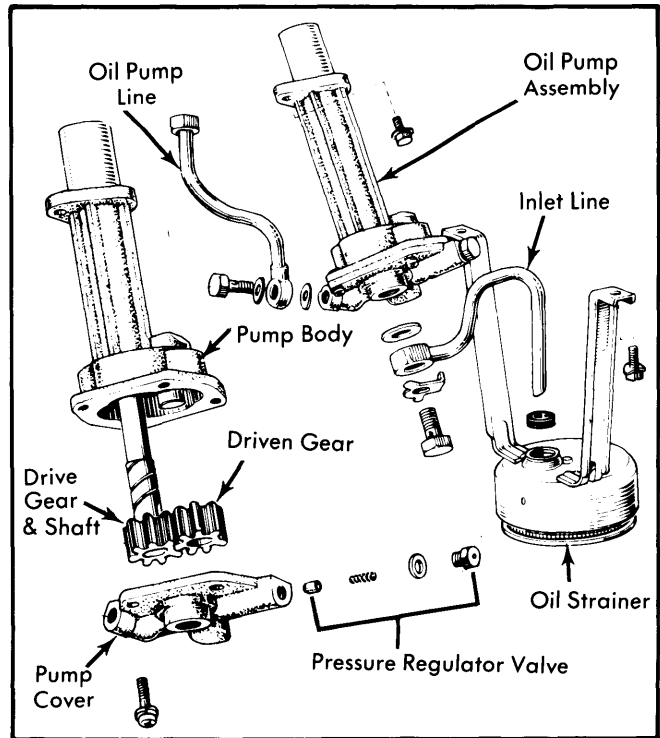


Fig. 16 Exploded View of Oil Pump Assembly

Pressure Regulator — Located in oil pump, non-adjustable.

ENGINE OILING SYSTEM

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

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. Remove cover and inspect gears and housing for proper clearances. Replace worn or damaged components.

Installation — 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. Cover discharge hole with thumb and turn as before. Turning resistance should be felt. Install pump on engine, noting that lower end of distributor drive shaft aligns with oil pump shaft. To complete installation, reverse removal procedure.

Oil Pump Specifications		
Application	Standard In. (mm)	Wear Limit In. (mm)
Gear-to-Housing Clearance	.0043-.0071 (.109-.180)	.008 (.20)
Gear Backlash	.0020-.0028 (.050-.071)	.0375 (.952)
Gear Side Clearance	.0012-.0035 (.030-.088)	.0059 (.149)
Cover Wear		.0059 (.149)

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ENGINE COOLING

Thermostat — Wax pellet type. Begins to open at 180°F (82°C) and is fully opened at 203°F (95°C).

Radiator Cap — 11-15 psi (75-1.05 kg/cm²).

Coolant Capacity — Approximately 16.9 quarts.

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.

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.

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	257.9	4230	1x2-Bbl.	125@3600	200@1800	8:3:1	3.70	94	4.00	101.6

VALVES							
Engine & Valve	Head Diam. In. (mm)	Face Angle	Seat Angle	Seat Width In. (mm)	Stem Diameter In. (mm)	Stem Clearance In. (mm) ①	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)	Rings	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-.398)	.0012-.0028 (.030-.071)
				No. 2	.0079-.0157 (.200-.398)	.0008-.0024 (.020-.060)
				Oil	.0074-.0197 (.200-.500)	.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)						

Toyota Engines

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ENGINE SPECIFICATIONS (Cont.)

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE (LBS.) Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
4230 cc	2.028 (51.5)	71.7@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)		

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)