1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER

GENERAL SPECIFICATIONS										
Year	Displ.		Carburetor	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke	
	cu. ins.	cc					in.	mm	in.	mm
1965-67	236.7	3878	1x1-Bbl.	135@3800	217@2000	7.7-1	3.54	90	4.00	101.6
1968-73	236.7	3878	1x2-Bbl.	155@4000	230@2200	7.8-1	3.54	90	4.00	101.6

ENGINE IDENTIFICATION

Engine number is preceded by "F". Number is stamped on a boss located at right rear of cylinder block, just above starter.

ENGINE REMOVAL

NOTE – Engine and transmission are removed as a unit.

1965-67 Models – 1) Remove transmission undercover and right and left engine undercovers. Drain engine oil. Disconnect front and rear universal joints from transfer case. Disconnect starter cable at starter and ground cable at battery.

2) Remove battery hold down plate, packing, and battery tray. Drain engine coolant and loosen choke and throttle cable clamps. Disconnect front drive shift valve connecting hose from intake manifold. Remove cotter pin from accelerator link and disconnect link from carburetor.

3) Disconnect fuel line on fuel filter side of fuel pump, disconnect exhaust pipe from manifold and remove rocker arm cover and air cleaner. Disconnect radiator hoses. Disconnect tansfer control intermediate rod from control shaft and disconnect engine ground strap from frame.

4) Disconnect wires at "5" junction blocks located at right and left front end of engine compartment. Remove radiator cover and radiator. Disconnect wires from temperature sending gauge and oil pressure sending gauge.

5) Remove bolts from engine front cushions and then remove bolts from engine rear support arms. Disconnect ignition coil and alternator wires. Remove seat assembly and seat frame assembly and remove gasoline tank assembly. Remove transmission cover.

6) Remove hand brake lock plate on cowl in engine compartment and remove cable pivot pin and cable. Disconnect transmission control rods and remove speedometer cable. Disconnect clutch release fork return spring from fork, and remove clutch release cylinder from clutch housing.

7) Install a hoist chain to cylinder head using two cylinder head holds. Remove engine and transmission assembly as a unit. To install, reverse removal procedure.

1968-73 Models – 1) Disconnect battery and drain cooling system. Remove hood, radiator grille and hood lock support rod. Disconnect hood lock from radiator support and remove radiator support. Disconnect radiator and heater hoses, and remove radiator.

2) Disconnect all necessary wiring and fuel lines. Remove fuel filter assembly and air cleaner. Disconnect rod end of high and low shift rod from shift link lever. Disconnect throttle rod, choke rod, and accelerator rod from carburetor.

3) Remove vacuum hose connection on intake manifold and remove check valve of transfer front drive controller. Disconnect exhaust pipe from manifold and parking brake cable from intermediate lever. Disconnect front propeller shaft from transfer output front shaft flange.

4) Remove engine and transmission undercovers. Disconnect high and low shift rod from transfer high and low shift inner lever. Remove high and low shift link lever and high and low shift rod. Remove clutch release cylinder assembly from engine mount rear bracket.

5) Loosen clamp screws and disconnect vacuum hoses from transfer diaphragm cylinder. Remove front drive indicator switch and disconnect speedometer drive cable from transmission. Disconnect rear propeller shaft from transmission.

6) Disconnect gear shifting rod and gear selecting rod from gear shift outer lever and gear select outer lever. Remove nuts at front and rear engine mounts. Using suitable hoist, move engine up and forward to remove. To install, reverse removal procedure.

INTAKE & EXHAUST MANIFOLDS

Removal – 1) Disconnect battery and remove air cleaner. Disconnect oil filter inlet and outlet pipes from oil filter and remove oil filter assembly from intake manifold. Disconnect throttle rod, choke rod, accelerator wire, vacuum pipe, and fuel pipe 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 – 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.

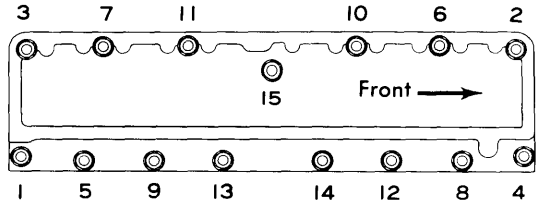
CYLINDER HEAD

Removal – 1) Disconnect battery, drain cooling system and remove air cleaner. Remove intake and exhaust manifolds. See *Intake & Exhaust Manifolds*. Remove bolts attaching oil filler tube to rocker arm cover and remove rocker arm cover.

2) Disconnect all necessary wiring, radiator and heater hoses. Remove ignition coil from cylinder head. Disconnect valve rocker shaft oil delivery union, spring and coil connection sleeve from valve rocker shafts. Remove rocker arm assembly support retaining nuts and bolts and remove rocker arm assembly.

1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER (Cont.)

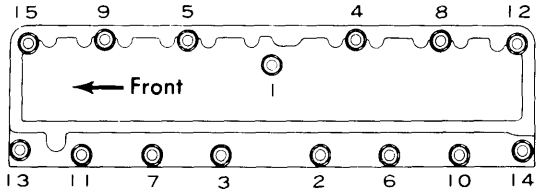
3) Remove push rods and keep in order for proper installation. Remove valve rocker shaft oil delivery union from oil delivery pipe. Loosen cylinder head bolts gradually in sequence shown and remove cylinder head.



3T001

CYLINDER HEAD LOOSENING SEQUENCE

Installation – Clean all gasket surfaces and install new gasket. Install cylinder head and tighten bolts gradually in sequence shown. Reverse removal procedure for remaining components.



3T002

CYLINDER HEAD TIGHTENING SEQUENCE

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)**
1965-67							
Int.	1.732 (43.0)	45°	45°	.06 (1.5)	.3140-.3144 (7.975-7.985)	.0010-.0022 (.025-.055)	
Exh.	1.477 (37.5)	45°	45°	.06 (1.5)	.3134-.3140 (7.960-7.975)	.0014-.0027 (.035-.070)	
1968-73							
Int.	1.81 (46.0)	45°	45°	.059 (1.4)	.3138-.3144 (7.970-7.985)	.0010-.0026 (.025-.060)	
Exh.	1.48 (37.5)	45°	45°	.083 (2.1)	.3134-.3140 (7.960-7.975)	.0014-.0028 (.035-.070)	

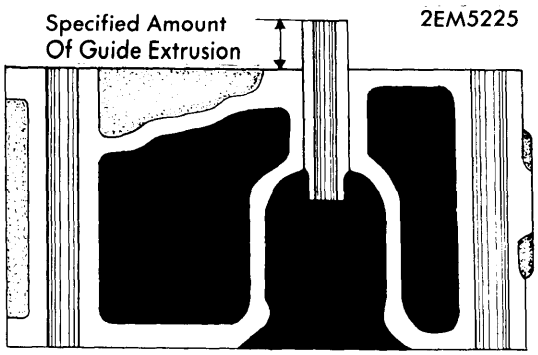
VALVE ARRANGEMENT

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

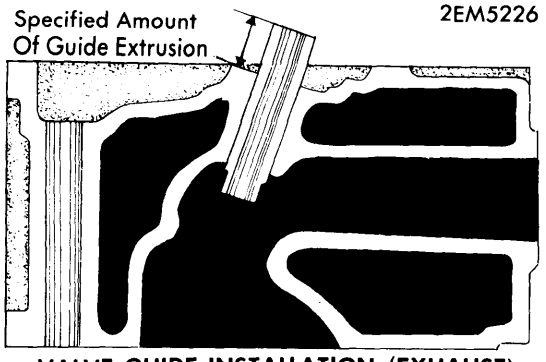
VALVE GUIDE SERVICING

1) Check clearance of valve stem in guide. If clearance exceeds .006" (.15 mm) for 1965-67 models, .004" (.10 mm) for intake valves on 1968-73 models or .005" (.12 mm) for exhaust valves on 1968-73 models, valve guides must be replaced.

2) To replace valve guides, drive out through top of cylinder head using a suitable driver (09201-60010). Drive new guides into head until specified amount of guide extrudes from top of cylinder head. Specified amount for 1965-67 models is .8" (20 mm) and specified amount for 1968-73 models is .65-.69" (16.5-17.5 mm). Ream new guides to specified clearance for valve stems.



VALVE GUIDE INSTALLATION (INTAKE)



VALVE GUIDE INSTALLATION (EXHAUST)

1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER (Cont.)

VALVE STEM OIL SEALS

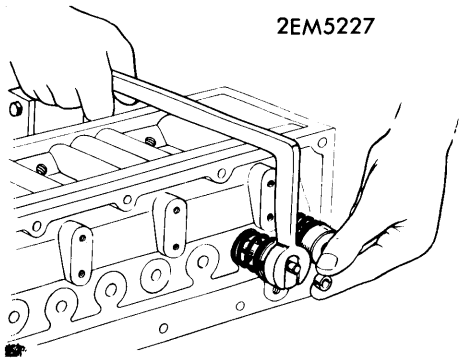
Valve stem oil seals (if equipped) are installed on valve stem before valve spring is installed. See *Valve Springs*.

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE (LBS.) Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1965-67			
Inner			
Int.	1.787	9.2@1.590	.....
	(45.4)	(4.2@40.4)	.....
Exh.	1.787	8.8@1.598	.....
	(45.4)	(4.0@40.6)	.....
Outer			
Int.	2.059	58.5@1.709	.....
	(52.4)	(26.6@43.4)	.....
Exh.	2.059	58.5@1.717	.....
	(52.4)	(25.9@43.6)	.....
1968-73	.....	162.9@1.324	.....
	.....	(74.0@33.6)	.....

VALVE SPRINGS

Removal – Use suitable valve spring compressor, compress valve spring and remove valve spring retainer locks. Release compressor and remove spring retainer, spring, valve stem oil seal and spring seat. Remove valve.



REMOVING VALVE SPRINGS

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.

VALVE SPRING INSTALLED HEIGHT

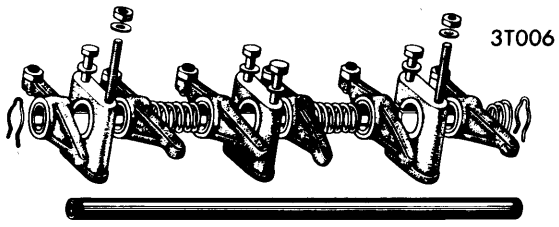
After assembling valves check installed height of valve spring by measuring from spring seat to point where spring contacts oil shield or spacer.

Application	Intake	Exhaust
1965-67 Engines		
Inner	1.590" (40.4 mm)	1.598" (40.6 mm)
Outer	1.709" (43.4 mm)	1.717" (43.6 mm)
1968-73 Engines	1.693" (43 mm)	1.693" (43 mm)

ROCKER ARM ASSEMBLY

1) Check rocker arm and shaft for damage or wear. Clearance between rocker arm bushing and shaft limit is .004" (.1 mm). If clearance is excessive, replace bushing and ream to .0003-.0018" (.008-.046 mm) clearance. 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 shafts, then install valve rocker shaft lock springs. *NOTE – There are two different rocker arms, intake and exhaust. Assemble as shown in illustration.* Open end of shafts should face center when assembled. Oil delivery union, spring, and oil connecting sleeve are assembled between shaft assemblies.



ROCKER ARM ASSEMBLY

VALVE CLEARANCE ADJUSTMENT

Valve clearance is checked or adjusted with engine at normal operating temperature and at idle speed (500 RPM). Adjust valves to specified clearance.

Application	Intake	Exhaust
1965-67 Engines	.010" (.25 mm)	.014" (.36 mm)
1968-73 Engines	.008" (.20 mm)	.014" (.36 mm)

1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER (Cont.)

PISTONS, PINS, RINGS

Engine	PISTONS	PINS		RINGS		
	Clearance In. (mm)	Piston Fit	Rod Fit	Rings	End Gap In. (mm)	Side Clearance In. (mm)
1965-67	.001-.002 (.03-.05)	①	②	1	.0059-.0177 (.15-.45)	.0016-.0031 (.04-.08)
				2	.0059-.0157 (.15-.45)	.0016-.0031 (.04-.08)
				3	.0059-.0177 (.15-.45)	.0016-.0031 (.04-.08)
				4	.0059-.0157 (.15-.45)	.0016-.0033 (.04-.085)
1968-73	.0012-.002 (.03-.05)	①	②	1	.008-.016 (.20-.40)	.0012-.0028 (.03-.07)
				2	.006-.014 (.15-.35)	.0008-.0024 (.02-.06)
				3	.006-.014 (.15-.35)	.0008-.0024 (.02-.06)
				4	.006-.014 (.15-.35)	.0008-.0024 (.02-.065)

① — Pin should push through piston with light thumb pressure with piston heated to 100-140°F (40-60°C).
② — Pin is held tight in rod by means of a lock bolt in connecting rod torqued to 50 ft. lbs. (7 mkg).

OIL PAN

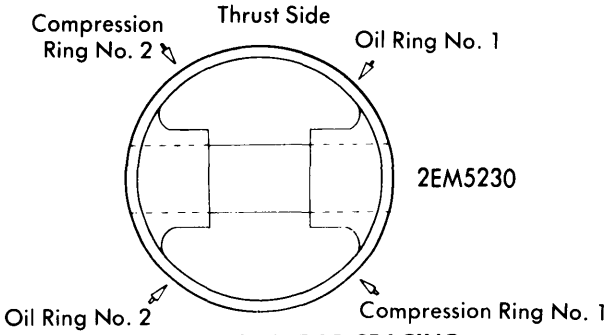
Removal — Remove engine undercovers, and remove flywheel side and undercover. Remove front propeller shaft. Drain oil, remove oil pan attaching bolts and oil pan.

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.

Installation — **1)** Apply oil to piston and piston rings. Position piston ring gaps as shown in illustration. Using suitable ring compressor, install piston and rod assembly through top of cylinder. Make sure mark on piston faces front.



PISTON RING GAP SPACING

2) Replace connecting rod bearings and connecting rod caps. Tighten connecting rod bearing cap nuts and lock with cotter pins. Rotate crankshaft to make sure bearings are not too tight.

FITTING PISTONS

1) Clean all cylinders making sure all oil and carbon is removed. Inspect cylinder bores for scoring or grooves. Measure cylinder bores with a suitable gauge and check for taper, out-of-round and wear. If cylinder bore is worn more than .008" (.20 mm), or is scored or grooved severely, cylinder block must be bored and oversize pistons installed. If wear is less than .008" (.20 mm), remove ridge at top of cylinder bore and hone cylinders lightly.

2) On 1965-67 engines, standard pistons were manufactured in 5 size classes. Size is designated by a number code stamped in top of piston starting with "O" and running consecutively through "4". Each code indicates an increase of .0004" (.01 mm) in piston and bore diameter from standard size. All 1968-73 engines use one size standard piston.

3) Measure piston diameter at bottom of skirt and at right angles to piston pon bore with a micrometer. If clearance with cylinder bore is excessive, cylinder block must be bored and oversize pistons installed. Pistons are available .010" (.25 mm), .020" (.50 mm), .030" (.75 mm), .040" (1.00 mm) and .060" (1.50 mm) oversizes.

4) Measure ring end gap in cylinder bores with a feeler gauge. If cylinder bore is not rebored, check ring end gap at bottom of piston travel in cylinder bore. Ring end gap can be checked at top of bore in a rebored cylinder. If gap is less than specifications, remove ring from bore and file ring end with a fine cut file. Check side clearance of ring in groove, if clearance is excessive, piston must be replaced.

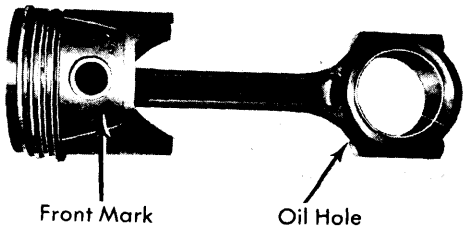
1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER (Cont.)

PISTON PINS

Removal – Remove piston pin bolt and push out piston pin from piston and connecting rod. Mark all parts for correct reassembly.

Inspection – Check piston pin fit by pressing in pin with thumb with piston heated to 100-140°F (40-60°C). If fit is loose, replace both piston and piston pin.

Installation – Heat piston to 100-140°F (40-60°C) for approximately five minutes. Position piston and connecting rod so that when piston faces front, 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.



PISTON & ROD ASSEMBLY 2EM5229

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)
1965-67	① 2.6366-2.6378 (66.97-67.00) ② 2.6957-2.6969 (68.47-68.50) ③ 2.7547-2.7559 (69.97-70.00) ④ 2.8138-2.8150 (71.47-71.50)	.0008-.0024 (.02-.06)	No. 3	.0012-.0051 (.03-.13)	2.1252-2.1260 (53.98-54.00)	.0006-.0026 (.015-.065)	.004-.009 (.11-.23)
1968-73	① 2.6366-2.6378 (66.97-67.00) ② 2.6957-2.6969 (68.47-68.50) ③2.7547-2.7559 (69.97-70.00) ④ 2.8138-2.8150 (71.47-71.50)	.0012-.0018 (.02-.06)	No. 3	.0024-.0065 (.06-.16)	2.1252-2.1260 (53.98-54.00)	.0008-.0024 (.02-.06)	.004-.009 (.11-.23)

① – Journal No. 1.
② – Journal No. 2.
③ – Journal No. 3.
④ – Journal No. 4.

MAIN & CONNECTING ROD BEARINGS

1) With crankshaft removed, check crankshaft for runout with a dial indicator. Crankshaft must be straightened or replaced if runout exceeds .002" (.05 mm). Check main and connecting rod journals for scoring, wear or taper. If journals are worn or tapered more than .0012" (.03 mm), crankshaft journals must be ground and undersize bearings installed.

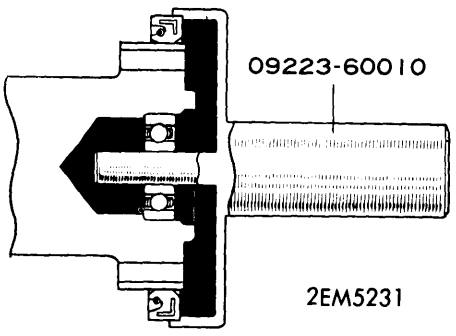
2) Check main and connecting rod clearance using the Plastigage method. If clearance exceeds .004" (.1 mm), crankshaft must be ground and undersize bearings installed. Main and connecting rod bearings are available .010" (.25 mm), .020" (.50 mm), .030" (.75 mm) and .040" (1.00 mm) undersize.

THRUST BEARING ALIGNMENT

With crankshaft pushed toward front of engine, check crankshaft end play at front side of number 3 bearing journal. If endplay exceeds .012" (.03 mm) thrust bearing must be replaced.

REAR MAIN BEARING OIL SEAL

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



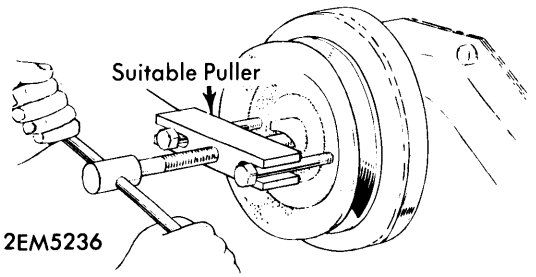
REAR OIL SEAL INSTALLATION

1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER (Cont.)

ENGINE FRONT COVER REMOVAL

1) Drain cooling system and remove upper and lower radiator hoses. Remove bolts holding radiator to radiator support. Remove radiator upward using care not to damage radiator.

2) Remove fan belt. Remove crankshaft pulley using suitable puller (Tool 09213-60013). Remove bolts and remove timing gear cover and gasket. To install, reverse removal procedure.



CRANKSHAFT PULLEY REMOVAL

FRONT COVER OIL SEAL

Pry old oil seal out using screwdriver. Install new oil seal so that open end of seal is towards inside of timing gear cover. Drive seal in place with suitable tool (Transmission Rear Bearing Replacer Tool 09309-12010, or Rear Wheel Bearing Replacer Tool 09515-35010).

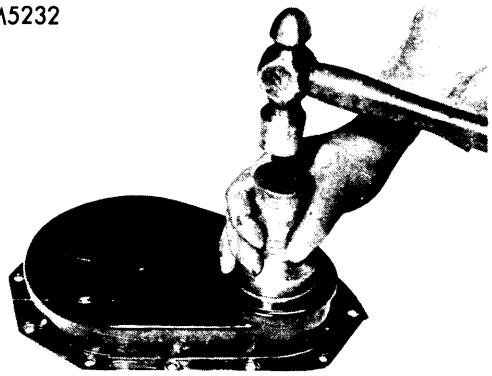
CAMSHAFT			
Engine	**Journal Diam. In. (mm)**	**Clearance In. (mm)**	**Lobe Lift In. (mm)**
1965-73	① 1.8880-1.8888 (47.955-47.975) ② 1.8289-1.8297 (46.455-46.475) ③ 1.7699-1.7707 (44.955-44.975) ④ 1.7108-1.7116 (43.455-43.475)	.001-.003 (.025-.075)	....

① — Journal No. 1.
② — Journal No. 2.
③ — Journal No. 3.
④ — Journal No. 4.

CAMSHAFT

Remove timing gear cover and gasket. Slide out oil slinger from crankshaft. Remove two bolts retaining camshaft thrust plate onto 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.

2EM5232



FRONT OIL SEAL INSTALLATION

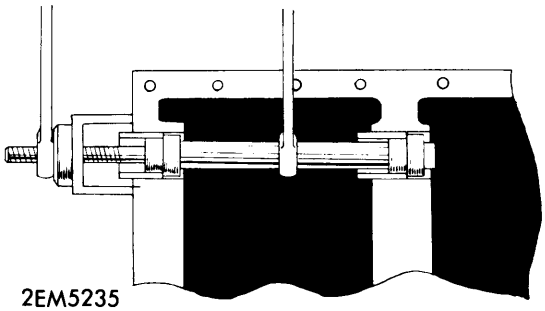
CAMSHAFT BEARINGS

1) Check clearance of camshaft journal and bearing. If clearance exceeds .006", bearing must be replaced. When replacing bearings clearance should be .0010-.0030".

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 replacer against front part of cylinder block.

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

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



Third & Rear

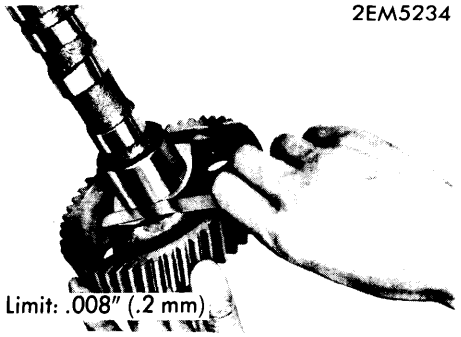
CAMSHAFT BEARING REMOVAL (No. 3 & REAR)

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. Clearance should be .003-.006". If clearance exceeds .008", replace camshaft thrust plate.

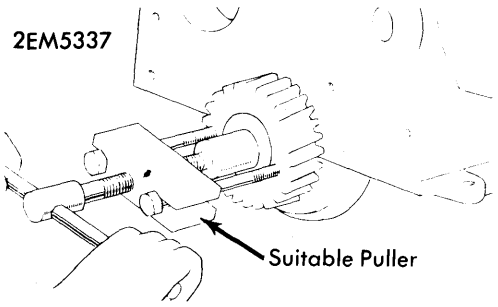
1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER (Cont.)



CAMSHAFT END THRUST

CAMSHAFT TIMING GEAR REMOVAL

Remove camshaft and remove camshaft snap ring. Support thrust plate on the spacer, and press out shaft from gear. To assemble gear, place thrust plate on camshaft and make sure Woodruff key is seated in keyway. Support camshaft at back of front journal and press on gear. Install snap ring.



CRANKSHAFT TIMING GEAR REMOVAL

CAM LOBE LIFT

Measure camshaft lobe lift with a micrometer. Camshaft must be replaced if lobe lift is less than specified limit.

Application	Specified	Limit
1965-67 Engines		
Intake	1.505-1.509" (38.23-38.33 mm)	1.492" (37.9 mm)
Exhaust	1.478-1.482" (37.55-37.65)	1.465" (37.2 mm)
1968-73 Engines		
Intake	1.510-1.514" (38.36-38.46 mm)	1.496" (38.0 mm)
Exhaust	1.506-1.510" (38.25-38.35 mm)	1.492" (37.9 mm)

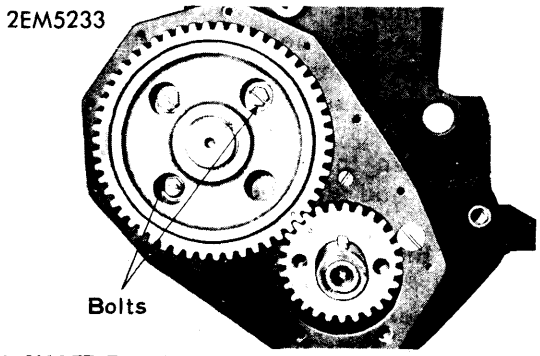
VALVE TIMING

Engine	INTAKE Open (BTDC)	INTAKE Close (ABDC)	EXHAUST Open (BBDC)	EXHAUST Close (ATDC)
F-Engine				
1965-67	10°	46°	52°	12°
1968-73	17°	53°	55°	15°

VALVE TIMING

1) With crankshaft timing gear installed on crankshaft, 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.

2) Tighten camshaft thrust plate retaining bolts to 14.5 ft. lbs. Check to make sure that gear backlash is .002-.005". Replace camshaft gear or crankshaft gear if backlash exceeds .008".



CAMSHAFT THRUST PLATE BOLTS & TIMING GEARS

ENGINE OILING

Crankcase Capacity – 7.4 qts. Add 1.0 qts. with filter.

Oil Filter – Paper element type of partial flow design filtering system.

Normal Oil Pressure – Pressure maintained at 44-50 psi by safety valve in oil pressure regulator.

Pressure Regulator – Regulator serves as safety valve to prevent high oil pressure from pump to rise above 44-50 psi. Pressure can be adjusted by means of screwing in or out on adjusting bolt.

ENGINE OILING SYSTEM

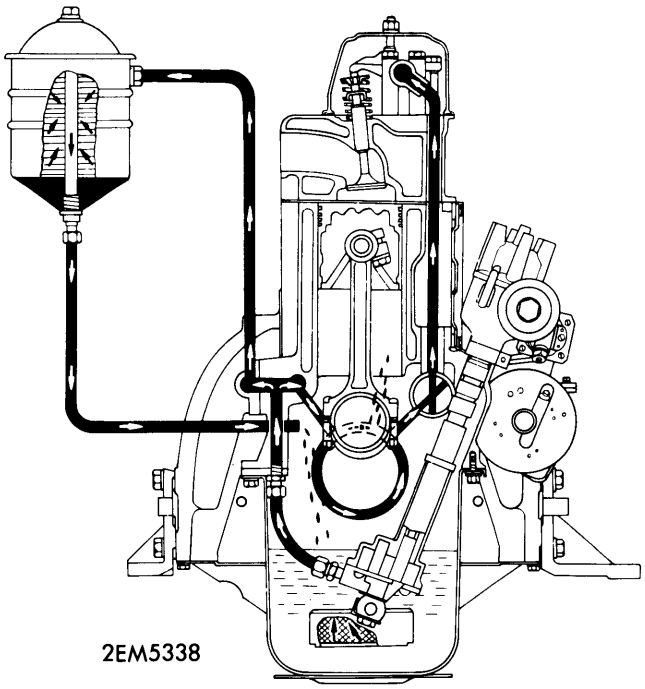
Forced feed system insures positive lubrication through oil holes and galleries in engine block.

OIL PUMP

1) Remove engine front undercover, engine floor pan. Remove flywheel side cover and flywheel housing undercover. Remove front propeller shaft. Drain engine oil.

1965-73 TOYOTA LAND CRUISER (F ENGINE) 6 CYLINDER (Cont.)

ENGINE OILING (Cont.)



ENGINE OILING SYSTEM

2) Remove oil pan. Remove oil strainer and loosen union nuts on oil pump pipe. Remove lock wire and oil pump retaining bolt and remove oil pump and pipe.

3) Straighten union bolt lock washer and remove union bolt, lock washer, gasket, and oil pump inlet pipe from oil pump cover. Remove cover and slide out oil pump driven gear and oil pump drive gear together with oil pump shaft.

4) Inspect gears and housing and check clearance between gear tip and pump body. The clearance should be .001-.004". Replace gear if clearance exceeds .0079". Make sure that backlash does not exceed .037".

5) Measure end clearance between gears and pump cover. The clearance should be .0012-.003". Replace gears or pump assembly if clearance exceeds .006".

ENGINE COOLING

Thermostat – Wax pellet type, begins to open at 166-173°F and is fully opened at 194°F.

Coolant Capacity – Approximately 1.3 gallons.

WATER PUMP

1) Drain cooling system and remove alternator adjusting bar. Remove fan, fan pulley and fan belt. Loosen hose clamps, disconnect radiator lower hose and by-pass hose from water pump.

2) Remove water pump retaining bolts, and remove water pump and gasket. To install, reverse removal procedure using new water pump gasket. Adjust fan belt tension to .28-.40" deflection.

TIGHTENING SPECIFICATIONS

Cylinder Head	83-98 ft. lbs.
Piston Pin Bolt	39-51 ft. lbs.
Connecting Rod Bearing Caps	35-55 ft. lbs.
Crankshaft Main Bearing Caps	
Front, No. 2 & No. 3	90-108 ft. lbs.
Rear	76-94 ft. lbs.
Camshaft Thrust Plate Bolts	14.5 ft. lbs.
Timing Gear Cover	12 ft. lbs.
Oil Pump Bolt	7-12 ft. lbs.
Oil Pan Bolts	4-9 ft. lbs.
Oil Pressure Regulator	14 ft. lbs.
Valve Rocker Shaft Bolts & Nuts	
10 mm Bolts & Nuts	25-30 ft. lbs.
8 mm Bolts	14-22 ft. lbs.
Manifold Nuts	14-22 ft. lbs.
Flywheel Bolts	43-51 ft. lbs.
Clutch Cover Bolts	22 ft. lbs.
Clutch Housing Bolts	58 ft. lbs.