

4M 6 CYLINDER

ENGINE CODING

ENGINE IDENTIFICATION

Engine number is stamped into a machined surface on left side of engine block just above oil dipstick.

ENGINE, CYLINDER HEAD & MANIFOLDS

NOTE — Following general procedures may not apply to all vehicles equipped with 4M engine.

ENGINE

1) Disconnect battery and drain cooling system. Remove hood and fan shroud. Remove radiator hoses, radiator, heater hoses, and all oil cooler hoses. Remove oil pressure gauge sending wire, and alternator wiring.

2) Remove air cleaner and disconnect brake booster vacuum hose. Disconnect distributor primary wiring, coil secondary wiring, and water temperature gauge sending wire. Disconnect fuel line and vacuum hose.

3) Disconnect starter wiring and accelerator connecting rod. Disconnect clutch flexible hose from master cylinder tube (if equipped). **NOTE** — To prevent spillage of fluid, install bleeder plug cap onto master cylinder tube end. Disconnect power steering feed hose (if equipped).

4) Raise front and rear of vehicle with jack and support on stands. Disconnect exhaust pipe from manifold and remove exhaust pipe supports and insulator. Disconnect speedometer drive cable and back-up light wiring.

5) On manual transmission cars with column shift, remove low speed connecting rod, cross shaft, and gear shift rod. On automatic transmission cars with column shift, remove control rod and cross shaft and remove throttle link connecting first rod and second rod.

6) On manual transmission cars with floor shift, remove console box and gear shift lever. On automatic transmission cars with floor shift, remove connecting rod swivel nut and disconnect control rod from shift lever.

7) Remove propeller shaft and plug rear of transmission to prevent oil leakage. Remove rear engine undercover and remove front engine mounts. Support transmission with jack and remove rear engine mount and crossmember.

8) Lower jack supporting transmission and remove stands. Using suitable engine hoist, remove engine and transmission assembly from vehicle.

9) To install, reverse removal procedure. Check all fluid levels and linkage adjustments prior to starting engine.

INTAKE MANIFOLD

Removal — 1) Disconnect battery and drain coolant. Remove air cleaner and distributor cap. Remove radiator inlet hose and heater hoses. Disconnect temperature gauge sending wire and fuel line.

2) Disconnect vacuum hoses at carburetor and manifold, and remove accelerator connecting rod. Remove automatic choke stove inlet hose and outlet pipe. Remove water by-pass hose under manifolds, and remove manifold with carburetor attached.

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) Remove intake and exhaust manifolds. Remove heater and by pass hoses attached to head. Remove spark plugs and cylinder head cover. Turn crankshaft so that number 1 piston is at TDC on firing stroke and note that mating marks are aligned on timing gear and timing chain.

2) Remove chain tensioner, then remove timing gear bolt noting that bolt has *LEFT* hand threads. Loosen head/rocker shaft bolts a little at a time in reverse of tightening sequence shown in Fig. 1. Lift off rocker arm assembly, then lift head straight up from block.

Installation — Clean all gasket surfaces and apply sealer to cylinder head, around oil holes in the block, and in area of timing chain cover and block. Install new gasket. Clean all foreign matter from bolt holes and place cylinder head on block. Make sure valve adjusting screws have been loosened and install rocker shaft assembly. Install bolts and tighten in several steps according to the sequence in Fig. 1. Align timing marks and install remaining components in reverse of removal procedure.

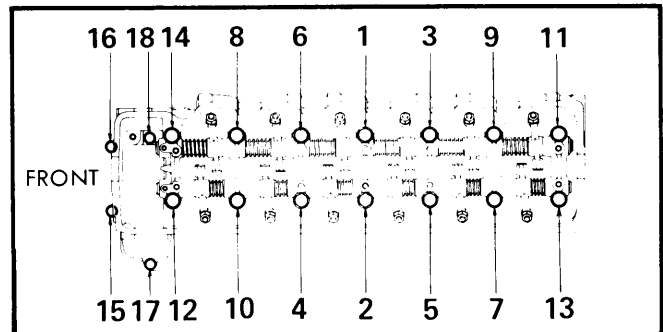


Fig. 1 Cylinder Head Bolt Tightening Sequence
(Loosen in Reverse Order)

VALVES

VALVE ARRANGEMENT

Left Side — All Intake.

Right Side — All Exhaust.

VALVE GUIDE SERVICING

1) Break off valve guide bushing at snap ring and remove snap ring. Heat cylinder head to approximately 176-212°F (80-100°C) and drive out bushing toward combustion chamber.

2) Allow head to cool and measure cylinder head bushing bore. Install oversize bushing if bore exceeds .5118-.5129" (13.000-13.027 mm). Machine cylinder head to .5138-.5148" (13.050-13.077 mm) and fit .05 mm bushing. Ensure valve guide bushing length is 1.97" (50.0 mm) intake and 2.34" (59.5 mm) exhaust. Make sure that proper valve guide bushing to valve stem clearance is obtained.

4M 6 CYLINDER (Cont.)

2) Allow head to cool and measure cylinder head bushing bore. If bore exceeds .5125" (13.018 mm), machine bore to .514" (13.054 mm) and insert .002" (.05 mm) oversize bushing. Head should be heated to 176-212°F (80-100°C) and bushing driven in with drift (09201-60011) until snap ring contacts head.

3) Measure installed height of .650" (16.5 mm) for intake guide and .551" (14 mm) for exhaust guide. Hand ream guide bore to provide specified stem clearance.

NOTE — Valve guide replacement is recommended whenever new valves are installed.

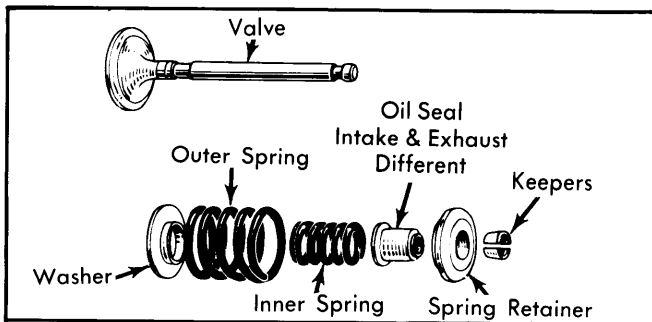


Fig. 2 Disassembled View of Valve with Detail of Components

VALVE STEM OIL SEALS

Intake seals are slightly longer than exhaust valve seals and must not be switched. To install, assemble in order: plate washer, oil seal, inner and outer springs, and valve spring retainer. With suitable tool (09202-43011), install retainer locks.

VALVE & VALVE SPRING

Mark each valve and using valve spring compressor, remove valves, valve retainers, retainer locks, springs and valve stem oil seals. When replacing valve springs, closed coil ends face toward cylinder head.

VALVE SPRING HEIGHT

Measure valve spring free length with caliper type ruler and check for squareness within .063" (1.6 mm). Using a spring tester, check load when spring is compressed to installed height. Check installed height with valve in closed position by measuring distance from upper edge of washer to lower edge of spring retainer.

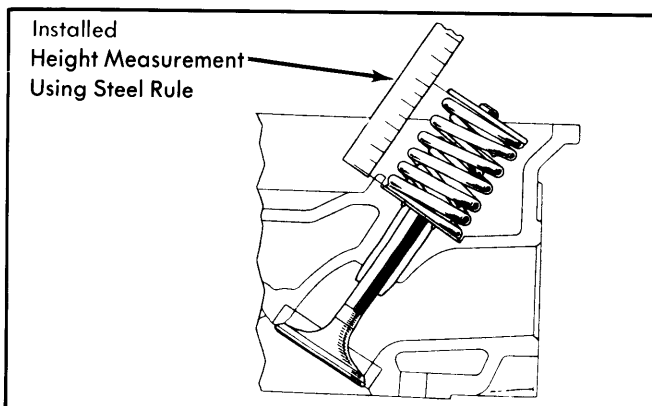


Fig. 3 Measure Installed Valve Spring Height as Shown

ROCKER ARM ASSEMBLY

Check arm-to-shaft clearance by twisting on shaft. Little or no movement should be felt. If movement is felt, disassemble and inspect. Bushings may be replaced and finished to give standard clearance of .0005-.0013" (.012-.033 mm) using pin hole grinder. Assemble rocker arm assembly, starting with rocker support number 1. Install on head and tighten bolts in sequence shown in Fig. 1.

NOTE — Disassemble and mark all parts for reassembly in proper order. Loosen adjusting screws and nuts prior to installing rocker arm assembly.

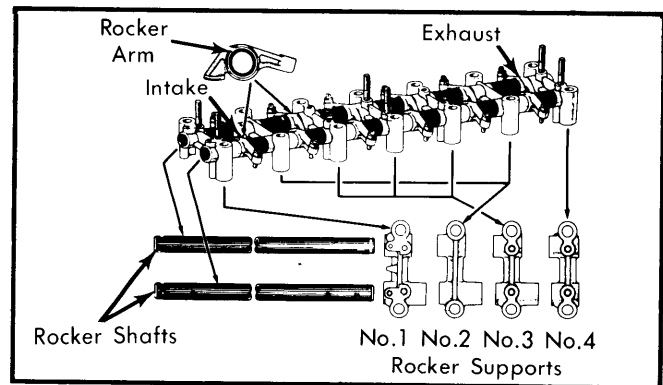


Fig. 4 Assemble Rocker Arm Assembly as Shown (Start with Rocker Support No. 1)

VALVE CLEARANCE ADJUSTMENT

- 1) With No. 1 piston at TDC of compression stroke, adjust intake valves 1, 2, and 4 and exhaust valves 1, 3, and 5 to specified clearance.
- 2) Rotate crankshaft one turn (360°) clockwise and adjust intake valves 3, 5 and 6, and exhaust valves 2, 4 and 6.

Valve Clearance Specifications

Valve	Hot In. (mm)	Cold In. (mm)
Intake .....	.011 (.28)	.010 (.25)
Exhaust .....	.014 (.35)	.013 (.33)

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 head side. Mark all components with cylinder numbers for correct reassembly.

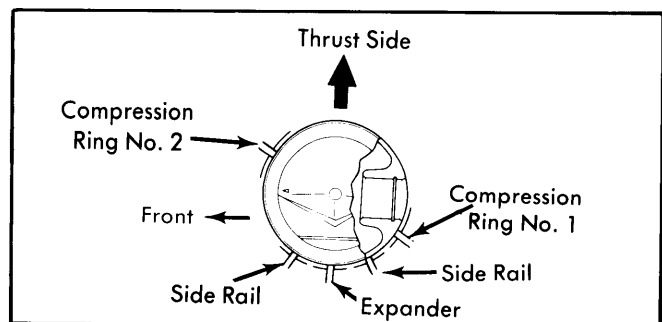


Fig. 5 Position Ring Gaps as Shown for Installation

4M 6 CYLINDER (Cont.)

Installation — 1) Apply oil to piston and piston rings. Install rings with mark on side of ring facing upwards. Position piston ring gaps shown in illustration. Using suitable ring compressor, install piston and rod assembly in cylinder block. Make sure mark on piston faces front.

2) Replace connecting rod caps with mating marks aligned. Tighten nuts evenly in 2 or 3 steps and check connecting rod side play.

FITTING PISTONS

Measure top, center and bottom of cylinder bore with dial indicator. If wear exceeds .008" (.2 mm) or taper and out-of-round exceeds .0008" (.02 mm), cylinders must be rebored. Bore in sequence number 1, 3, 6, 4, 2 and 5 cylinders. Last cut of boring bar should not remove more than .0020" (.05 mm). Finish to final dimension by honing the last .0008" (.02 mm).

NOTE — Allow bore to cool after boring and honing to avoid erroneous readings while measuring. Cool measurement of piston and bore should provide .0020-.0028" (.05-.07 mm) for proper clearance.

Piston Table

Application	Piston O.D. In. (mm)
Standard	3.146-3.148 (79.93-79.98)
.50 Oversize	3.166-3.168 (80.43-80.48)
.75 Oversize	3.176-3.178 (80.68-80.73)
1.00 Oversize	3.186-3.188 (80.93-80.98)

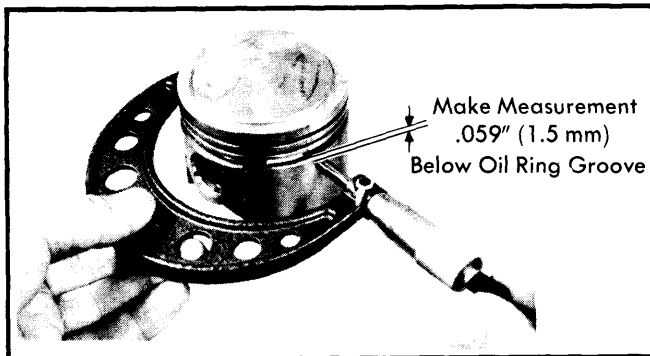


Fig. 6 Measure Piston as Shown at 68°F (20°C)

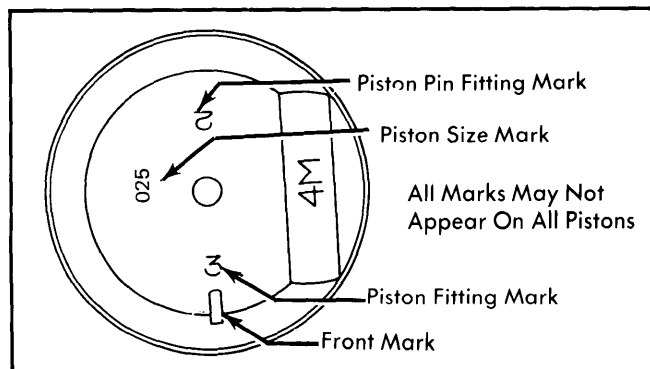


Fig. 7 Typical Reference Marks on Piston Head

PISTON PINS

Removal — Remove circlips in piston pin hole with needle nose pliers. Heat piston to about 140°F (60°C) and remove pin by tapping lightly with plastic hammer. Keep piston, pin and rod together as a set.

Installation — Install one circlip in piston and heat to about 140°F (60°C). Align piston notch with rod mark and push pin in with thumb. Install remaining circlip.

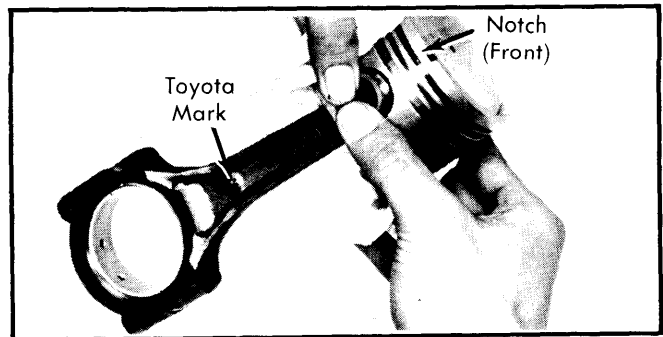


Fig. 8 Notch on Piston and Mark on Rod Must Face Same Direction When Installing Wrist Pin

MAIN & CONNECTING ROD BEARINGS

1) Measure connecting rod side play with dial indicator. If greater than .012" (.3 mm), rod must be replaced. Wipe off bearing and journal, then check clearance with Plastigage. If clearance exceeds .003" (.08 mm) and cannot be corrected with .002" (.05 mm) undersize bearings, or if taper or out-of-round exceeds .0008" (.02 mm), crankshaft must be ground to next undersize.

2) Check crankshaft runout with dial indicator. If runout exceeds .0012" (.03 mm), correct or replace crankshaft. Check main bearing journal for taper and out-of-round. Check main bearing clearance using Plastigage. If required, crankshaft may be reground for undersize bearings. Undersize bearings for main and connecting rods are available in .002" (.05 mm), .010" (.25 mm) and .020" (.50 mm) as well as standard.

THRUST BEARING

Measure crankshaft end play with center (number 4) main bearing and cap installed. If clearance exceeds .012" (.3 mm), replace thrust washers to achieve standard clearance of .002-.010" (.05-.25 mm). Standard thickness of thrust washer is .115" (2.92 mm) with .005" (.125 mm) and .010" (250 mm) oversizes available.

NOTE — Install thrust washers with oil grooves facing outward

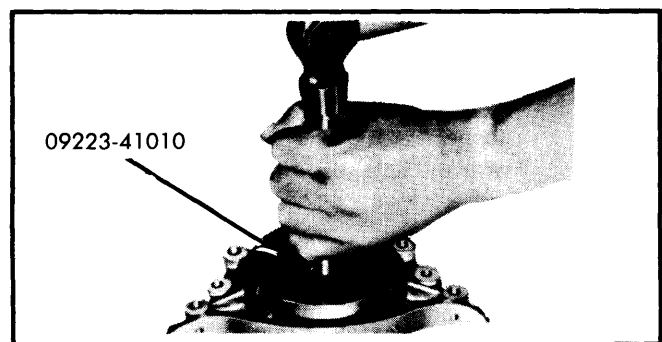


Fig. 9 Using Special Tool to Install Rear Seal

4M 6 CYLINDER (Cont.)

REAR MAIN OIL SEAL

Inspect oil seal lip and replace if worn or damaged. Pry old seal out without damaging cover or retainer. Install seal using replacer tool (09223-41010). Apply multipurpose lubricant to seal lip.

ENGINE FRONT COVER

Remove crankshaft damper attaching bolt and remove damper using suitable puller (09213-41013). Remove oil pan and remove front cover bolts and front cover. Use liquid sealer on front cover gaskets when assembling.

ENGINE FRONT COVER OIL SEAL

Inspect oil seal lip and replace if worn or damaged. Pry old seal out without damaging cover or retainer. Install seal using replacer tool (09223-50010). Apply multipurpose lubricant to seal lip.

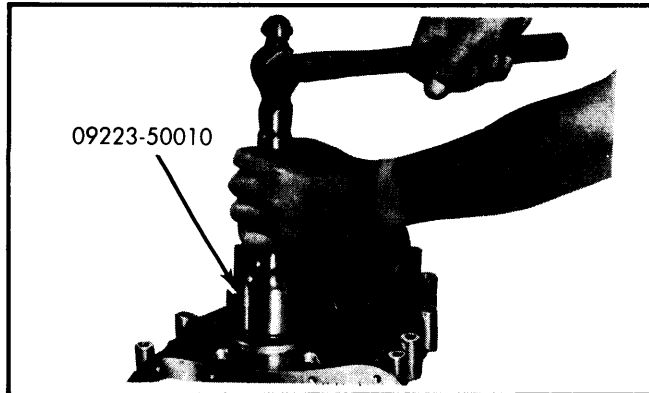


Fig. 10 Using Special Seal Installing Tool to Drive in Front Oil Seal

TIMING CHAIN

Removal — See Valve Timing. Remove cylinder head cover, rocker arm shafts and camshaft. Remove cylinder head. Remove crankshaft damper attaching bolt and remove damper using suitable puller (09213-41013). Remove oil pan, timing chain cover and timing chain.

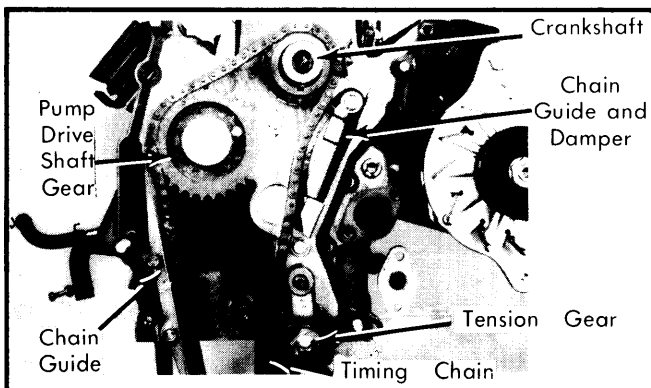


Fig. 11 Front View of Timing Chain and Gears

Installation — 1) Inspect chain, sprockets and tensioner. Position crankshaft sprocket so that key is pointed straight toward cylinder head and Toyota mark is in line with pump sprocket shaft. Install timing chain with white links aligned with punch marks on crankshaft gear and pump gear. See Fig. 12.

NOTE — Do NOT confuse index marks. Plated or white links align with punch marks on gears. Toyota symbol marks align with each other.

2) Insert bolt in collar and install both chain vibration dampers and guide. With head and camshaft in position, assure that camshaft flange pin is aligned with embossed mark on rocker support number 1. Align mating link on chain with punch mark on camshaft drive gear and install drive gear on camshaft. Note that attaching bolt has LEFT hand threads.

3) Adjust timing chain tension by first rotating engine in normal direction (clockwise) until chain is at most slack position. Loosen tensioner locknut, then turn adjusting screw clockwise until resistance is felt. Loosen screw 2 full turns and tighten lock nut. If chain is noisy after starting engine, loosen adjusting screw $\frac{1}{2}$ turn more. See Valve Timing.

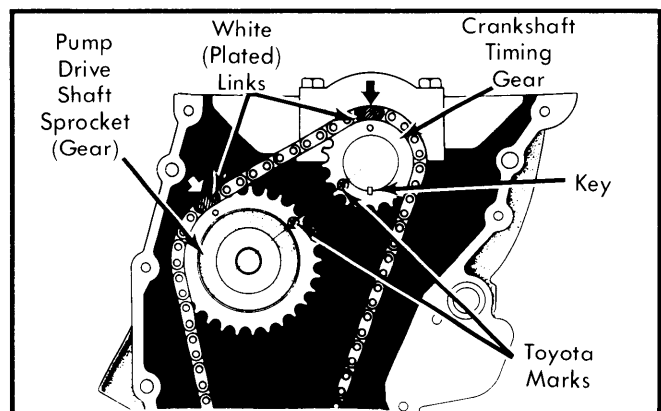


Fig. 12 Timing Chain with Pump Sprocket and Crankshaft Marks Aligned

CAMSHAFT

CAMSHAFT

Removal — Remove rocker arm assembly. See Cylinder Head. Remove camshaft sprocket bolt (LEFT hand threads) and separate sprocket from camshaft. Remove camshaft bearing caps and keep in order for assembly. Remove camshaft from head and check for maximum runout of .0012" (.03 mm).

Installation — Lubricate camshaft bearing journals and place camshaft in position. Assemble bearing caps in original positions with arrow marks toward front. Complete assembly in reverse of removal procedure.

CAMSHAFT BEARINGS

Inspect bearings for wear or damage. Check that oil clearance does not exceed .004" (.10 mm). When checking clearance, use Plastigage method. Bearings are available in standard, .002", .010" and .020" (.05, .25 and .50 mm) over-sizes.

CAMSHAFT END THRUST

Install camshaft in cylinder head and tighten all bearing caps. Attach dial indicator and check end thrust at flange end. Maximum clearance is .012" (.3 mm). Specified standard clearance is .003-.007" (.08-.18 mm).

4M 6 CYLINDER (Cont.)

CAM HEIGHT

Measure cam height. Minimum for intake is 1.664" (42.46 mm) and for exhaust is 1.666" (42.32 mm). If less than specified, replace camshaft.

PUMP SHAFT

1) With front cover and timing chain removed, use puller (09213-36010) to remove pump shaft sprocket. Remove thrust plate bolt and pull pump shaft from cylinder block. Replace and tighten sprocket on shaft, then check end play between gear and plate with feeler gauge. If beyond limits, replace thrust plate.

2) Check bearing bore diameter with inside micrometer and journal diameter with outside micrometer. Standard clearance is .0010-.0026" (.025-.066 mm). If clearance exceeds .0031" (.08 mm), replace bearings with special tool (09233-41010).

Pump Shaft Specifications

Application	In. (mm)
Out-of-Round & Taper Limit .....	.0004 (.01)
Thrust Clearance .....	.002-.005 (.06-.13)
	Limit .012 (.30)
Bearing Clearance .....	.001-.0025 (.025-.066)
	Limit .003 (.08)

VALVE TIMING

1) Rotate crankshaft in normal direction (clockwise) so that number 1 piston is at TDC on compression stroke. Check that camshaft flange timing pin is aligned with embossed mark on rocker support. (Timing chain cover graduation should indicate 0° mark aligned with notch in pulley.)

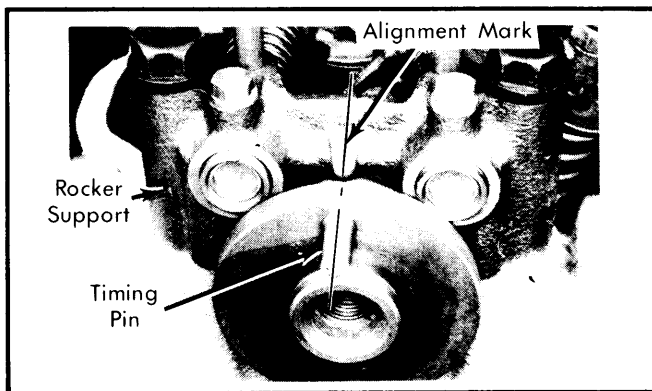


Fig. 13 Camshaft Flange Straight Pin Aligned with Support for Installation of Camshaft Gear

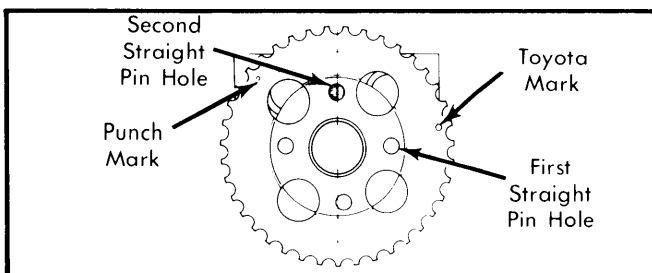


Fig. 14 Front View of Camshaft Gear with Alignment Marks and Straight Pin Holes

2) If marks are not as described, turn crankshaft until timing pin is in line with embossed mark and note timing cover graduation. Remove chain tensioner and timing gear set bolt. If timing was retarded 3 to 9 degrees, remove gear and install to second straight pin hole with piston at TDC. Install and adjust chain tensioner and recheck valve timing.

NOTE — Movement of straight pin to No. 2 hole and No. 3 hole advances valve timing in steps of 6° each.

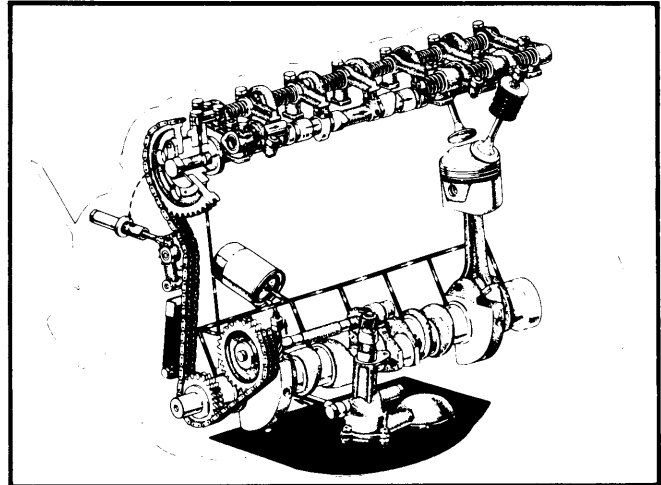


Fig. 15 Diagram of Engine Lubrication System (Oil Cooler Not Shown)

ENGINE OILING

Crankcase Capacity — 5.7 quarts with filter, 4.7 quarts WITHOUT filter.

Pressure Relief Valves — There are 3 relief valves in the engine oiling system. The pressure relief valve in the oil pump opens at 71-85 psi (5.0-6.0 kg/cm²), the oil regulator valve-to-cooler opens at 38-50 psi (2.7-3.5 kg/cm²), and the relief valve in the filter opens with a pressure difference of 1-17 psi (.8-1.2 kg/cm²).

Oil Filter — Full flow spin-on type.

ENGINE OILING SYSTEM

System is force feed with full-flow filtering unit. Pressure is delivered by a gear-driven oil pump. From filter oil travels through cylinder block passages by which internal components are lubricated. An external oil cooler is mounted at the upper left front of the radiator. It receives oil from the regulator mounted on the block, cools and returns the oil to the pan.

OIL PUMP

With pan off engine, remove oil pump mounting bolts and take out oil pump. Disassemble pump by removing (in order) snap ring, spacer, driveshaft gear, Woodruff key, pump cover, pump shaft sub-assembly, driven gear, relief valve plug, gasket, spring and relief valve. Check side clearance between gear and cover for maximum of .006" (.15 mm). Check clearance between gear teeth and body for not more than .008" (.2 mm). Measure backlash between gear teeth with feeler gauge for no more than .035" (.9 mm). Clean and inspect components and reverse disassembly procedure. Pump may be checked for operation by immersing screen in oil and turning shaft clockwise. Oil should discharge from pump outlet.

4M 6 CYLINDER (Cont.)

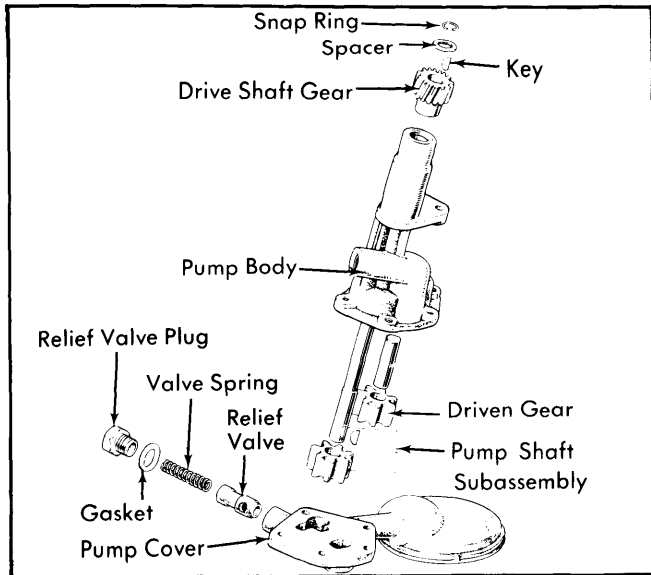


Fig. 16 Exploded View of Gear Driven Oil Pump

ENGINE COOLING

Thermostat – Wax pellet type, begins to open at 176-183°F (80-84°C) and should open to more than .32" (8 mm) at 203°F.

WATER PUMP

NOTE – It is not necessary to remove complete water pump housing to service water pump. Pump cover may be removed from housing and housing may be left on cylinder block.

Remove fluid coupling and fan assembly. Remove fan belt and pulley. Remove 5 cover bolts and take off cover assembly. Replaces seals and bearings as required. Use new gasket and reverse removal procedure.

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
1978 4M	156.4	2563	2-Bbl.	108@5000	134@2800	8.5-1	3.15	80	3.35	85

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)
4M Int.	45.5°	45°	.047-.063 (1.2-1.6)	.3138-.3144 (7.970-7.985)	.0010-.0024 (.025-.060)	.....
Exh.	45.5°	45°	.047-.063 (1.2-1.6)	.3134-.3140 (7.960-7.975)	.0014-.0028 (.035-.070)	.....

① – Wear limit for intake – .004" (.10 mm), exhaust – .005" (.13 mm).

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
4M Inner	1.768 (44.9)	14.1-17.2@1.492 (6.4-7.8@37.9)	.....
Outer	1.846 (46.9)	37.3-46.5@1.630 (17.1-21.1@41.4)	.....

① – If valve spring is out of square more than .063" (1.6 mm), replace spring.

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Runout In. (mm)
4M	1.3378-1.3384 (33.979-33.995)	.0007-.0022 (.017-.057)	.0012 (.03)

Toyota Engines

4M 6 CYLINDER (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)
4M	.0019-.0027 (.05-.07)	.....	.0002-.0004 (.005-.011) Limit .0006 (.015)	No. 1	.0039-.0110 (.10-.28)	.0012-.0028 (.03-.07)
				No. 2	.0059-.0110 (.15-.28)	.0008-.0024 (.02-.09)
				Oil	.0079-.0354 (.20-.90)	

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)
4M	2.3617-2.3627 (59.988-60.012)	.0008-.0021 (.021-.053)	No. 4	.002-.010 (.05-.25)	2.0463-2.0472 (51.976-52.000)	.0008-.0021 (.021-.053)	.006-.012 (.16-.30)

OIL PUMP SPECIFICATIONS	
Application	Specification
Side Clearance .....	.0012-.0035" (.03-.09 mm)
Body Clearance .....	.0012-.0024" (.03-.06 mm)
Gear Backlash .....	.020-.024" (.5-.6 mm)
Driven Shaft Diameter .....	.5496-.5501" (13.96-13.97 mm)
Relief Valve Opening Psi	71.1-83.3 psi (5.0-6.0 kg/cm ²)

TIGHTENING SPECIFICATIONS	
Application	Ft.Lbs. (mkg)
Cylinder Head	
12 mm bolts	54-62 (7.5-8.5)
8 mm bolts	11-16 (1.5-2.2)
Intake Manifold	11-15 (1.5-2.1)
Exhaust Manifold	18-22 (2.5-3.1)
Camshaft Bearing Cap	12-17 (1.7-2.3)
Camshaft Timing Gear (L.H. Thread)	47-54 (6.5-7.5)
Pump Drive Shaft Gear	7-12 (1.0-1.6)
Crankshaft Bearing Caps	72-79 (9.9-10.9)
Connecting Rod Cap	30-35 (4.2-4.8)
Oil Pan	5-7 (.65-.95)
Crankshaft Pulley	69-76 (9.5-10.5)
Flywheel	51-58 (7.0-8.0)
Chain Tensioner	22-29 (3.0-4.0)
Timing Cover	
8 mm Bolt	7-12 (1.0-1.6)
8 mm Nut	11-16 (1.5-2.2)
10 mm Bolt	14-22 (1.9-3.1)
10 mm Nut	14-22 (1.9-3.1)