

4M 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
1976	156.4	2563	1x2-Bbl.	.....	.....	8.5-1	3.15	80	3.35	85

ENGINE IDENTIFICATION

Engine number is cast into a machined surface on left side of engine block just above oil dip stick.

ENGINE REMOVAL

NOTE — Engine and transmission should be removed as assembly using engine hoist.

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.

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 and remove water by-pass pipe. Remove cylinder head cover and place shop towel over camshaft timing gear to prevent bolt or washer from dropping into timing chain cover.

2) Remove attaching bolts and oil union between number one camshaft bearing cap and number one rocker arm assembly support. Loosen rocker shaft attaching bolts in sequence shown in Fig. 6

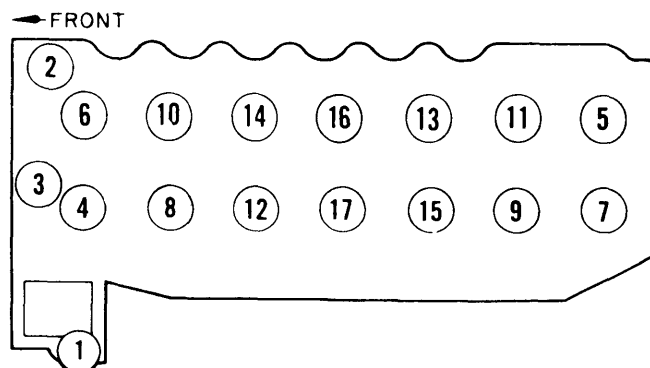


Fig. 1 Cylinder Head Bolt Loosening Sequence

4M 6 CYLINDER (Cont.)

3) Remove timing chain tensioner, camshaft timing gear and camshaft. See *Camshaft Removal*. Loosen cylinder head bolts in two or three steps as shown in Fig. 1.

CAUTION — Dowel pins are installed at front and rear of cylinder block. Do not slide cylinder head on block as locating dowels may cause damage to gasket surface.

Installation — Fit new cylinder head gasket. Apply sealer around oil holes in block and area of timing chain cover and cylinder block.

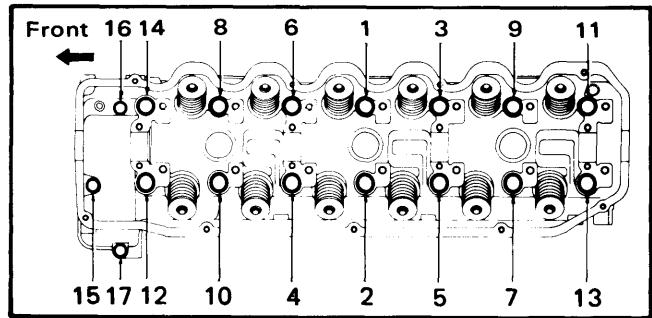


Fig. 2 Cylinder Head Bolt Tightening Sequence

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)
4M Int.	1.575 (40)	45°	45°	0.47-.063 (1.2-1.6)	.3142-.3148 (7.980-7.995)	.0006-.0020 .015-.050)	.....
Exh.	1.339 (34)	45°	45°	.047-.063 (1.2-1.6)	.3138-.3144 (7.970-7.985)	.0010-.0024 (.025-.060)	.....

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.

VALVE STEM OIL SEALS

1) Install valve and plate washer, and install oil seal on valve guide by pressing with hands. Make sure there is a clearance of .008-.020" (.2-.5 mm) between plate washer and oil seal. Use longer oil seal for intake valve and shorter seal for exhaust valve.

2) Install compression springs, valve spring retainer and install spring retainer locks using suitable spring compressor. Place valve springs in position with closed coil ends toward cylinder head.

VALVE & VALVE SPRING REMOVAL

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.

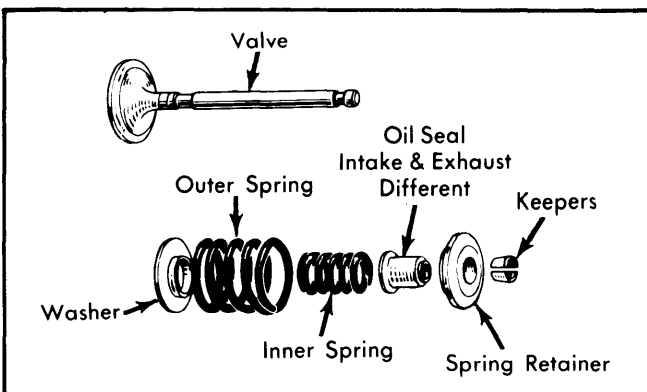


Fig. 3 Disassembled View of Valve with Detail of Components

Engine	Free Length In. (mm)	PRESSURE (LBS.) lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
4M Intake	1.843 (46.8)	25.7@1.504 (11.7@38.2)
Exhaust	1.843 (46.8)	25.7@1.504 (11.7@38.2)

4M 6 CYLINDER (Cont.)

VALVE SPRING INSTALLED HEIGHT

Valve spring installed height is measured with valve in closed position. Measure distance from upper edge of valve washer to lower edge of valve spring retainer, see Fig. 4. Refer to *Valve Springs Table* for specifications. Check squareness of springs by placing spring on flat surface next to steel square. Squareness should be within .062" (1.6 mm) for inner spring and .075" (1.9 mm) for outer spring.

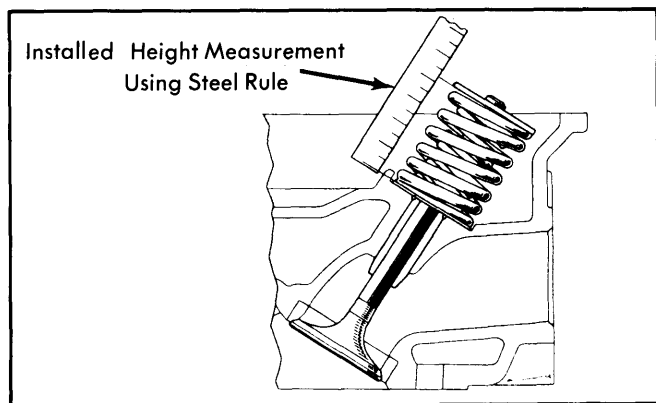


Fig. 4 Using a Steel Rule to Measure Installed Height

ROCKER ARM ASSEMBLY

1) To disassemble rocker arm assembly, remove two retaining screws and one spring retainer. **NOTE** — Mark all parts in order for correct reassembly. Remove supports, rocker arms, and tension springs from rocker shafts.

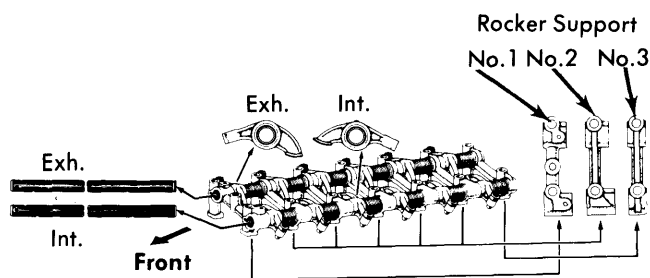


Fig. 5 Reassembly Locations for Rocker Arms and Supports

2) Inspect clearance between rocker shaft and rocker arm bushings. If clearance exceeds .002" (.06 mm), replace rocker arms or shaft. Inspect contacting surface of rocker arm and cam. Replace rocker arm if excessively worn.

3) Assemble rocker arm assembly in reverse of removal and install on cylinder head see Fig. 5. Tighten bolts gradually in sequence shown in Fig. 6 taking three or four steps. Install oil union between number one rocker shaft support and number one camshaft bearing cap.

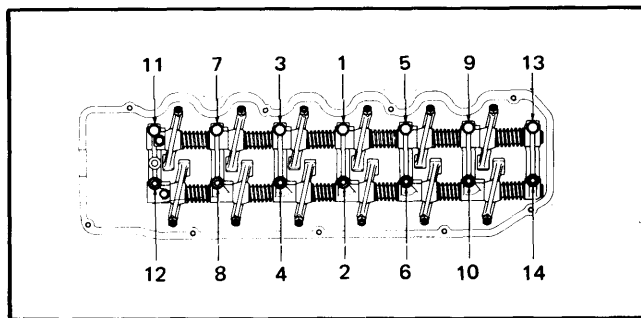


Fig. 6 Rocker Arm Tightening Sequence

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 complete revolution and align crankshaft damper V groove with timing chain cover "O" mark. Adjust intake valves 3,5, and 6 and exhaust valves 2,4, and 6 to specified clearance.

Valve Clearance Specifications

Valve	Hot In. (mm)	Cold In. (mm)
Intake	.007 (.18)	.006 (.14)
Exhaust	.010 (.25)	.008 (.21)

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	①.002-.003 (.05-.07)	②	.0002-.0004 (.005-.011)	No. 1	.006-.012 (.16-.31)	.001-.003 (.03-.07)
				No. 2	.006-.012 (.16-.31)	.001-.002 (.02-.06)
				Oil	.007-.040 (.17-1.03)	Zero

① — Measured under oil ring.

② — Thumb press fit with piston heated to 122-140°F.

4M 6 CYLINDER (Cont.)

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.

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 bearings and connecting rod caps. Tighten bolts with rod and cap flush with thrust surface of crankshaft. After tightening bolts, check side play.

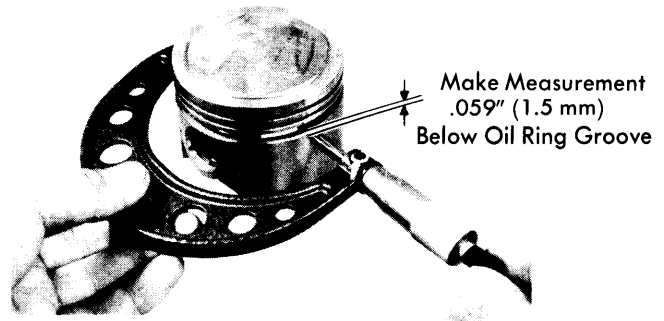


Fig. 8 Using a Micrometer to Measure Piston Diameter

2) After final honing of cylinder, measure piston clearance (with pin removed) with components at 68°F. Insert a .0020" (.05 mm) feeler gauge between piston and cylinder at thrust side. Force required to pull feeler gauge from cylinder with spring scale should be 2.2-5.5 lbs. (1.0-2.5 kg).

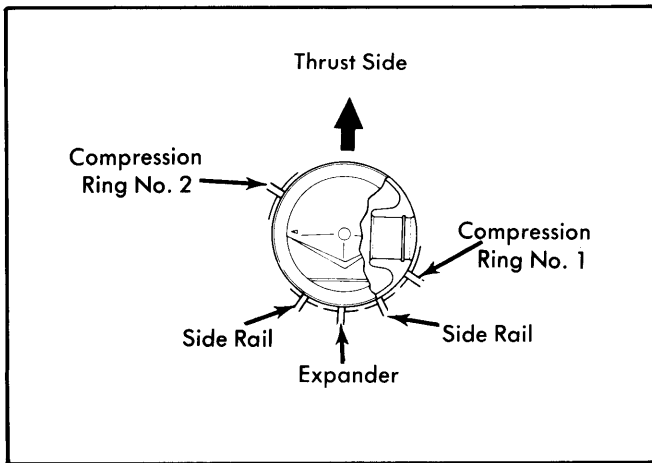


Fig. 7 Piston Ring Gap Spacing

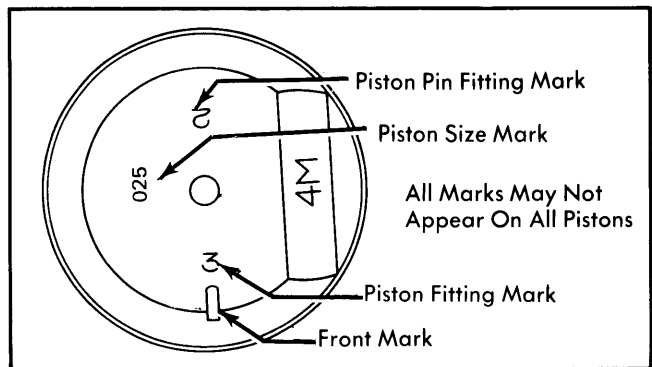


Fig. 9 Typical Reference Marks on Piston Head

FITTING PISTONS

1) Measure cylinder bore using an inside dial gauge. Make measurements at top, center and bottom of cylinder. If wear limit of .008" (.2 mm) or taper limit of .0008" (.02 mm) is exceeded, rebore cylinder and install oversize pistons. **NOTE** – If only one cylinder is beyond wear limits, manufacturer still recommends refinishing all cylinders for oversize pistons. Oversize pistons are detailed in table.

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)

PISTON PINS

Removal – Remove circlips, heat piston to 122-140°F and push piston pin out of piston and connecting rod. Piston pin should push through connecting rod with thumb pressure when rod is at 68°F.

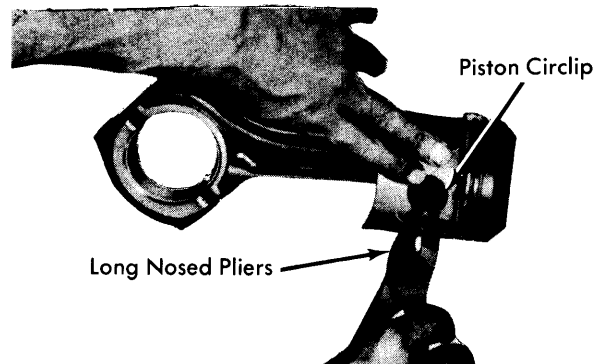


Fig. 10 Using Special Long Nosed Pliers to Remove Snap Ring

4M 6 CYLINDER (Cont.)

Installation — 1) Install one circlip in piston and heat piston to 122-140° F. Position piston and connecting rod so identifying marks on piston and rod face same direction.

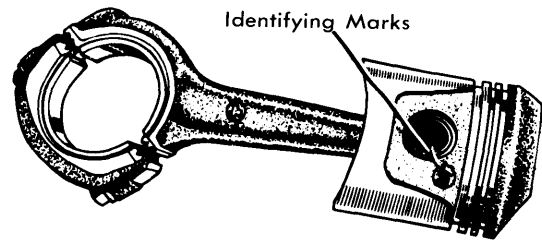


Fig. 11 Connecting Rod and Piston Index Marks

2) Push piston pin into piston and rod assembly and replace remaining circlip. Circlips should be inserted with open end down.

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 (59.998-60.012)	.001-.002 (.03-.05)	No. 4	.002-.010 (.05-.25)	2.0463-2.0472 (51.976-52.000)	.0008-.0021 (.021-.053)	.006-.012 (.16-.30)

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 center main bearing journal. If runout exceeds .001" (.03 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 .0008" (.02 mm), crankshaft must be ground to next undersize.

3) Main and connecting rod bearing clearances are checked using Plastigage method. If clearance exceeds .003" (.08 mm) and cannot be corrected with .002" (.05 mm) oversize bearings, crankshaft must be reground to next undersize. Bearings are available in standard, .010" and .020" (.25 and .50 mm) oversizes.

THRUST BEARING

Check crankshaft end thrust at No. 4 bearing. If clearance exceeds .012" (.3 mm), replace thrust washers as required. Select standard or oversize thrust washers as needed to achieve correct clearance. Standard thickness of thrust washer is .115" (2.92 mm) with .005" and .010" (.125, .250 mm) oversizes available.

NOTE— When assembling thrust washer, position oil groove toward crankshaft (outside) thrust surface.

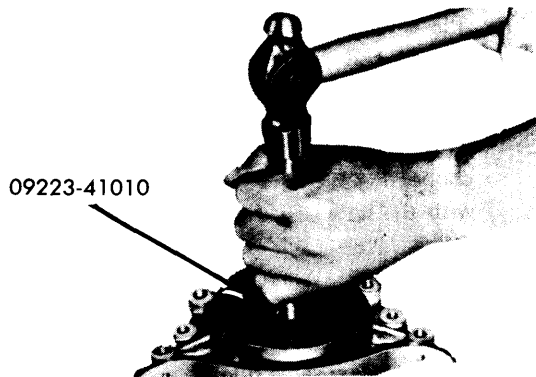


Fig. 12 Using Special Tool to Install Rear Oil Seal

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 suitable oil seal replacer (Tool 09223-41010). After installing, lightly apply multipurpose lubricant to lip of seal.

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 suitable oil seal replacer (Tool 09223-50010). After installing, lightly apply multipurpose lubricant to lip of seal.

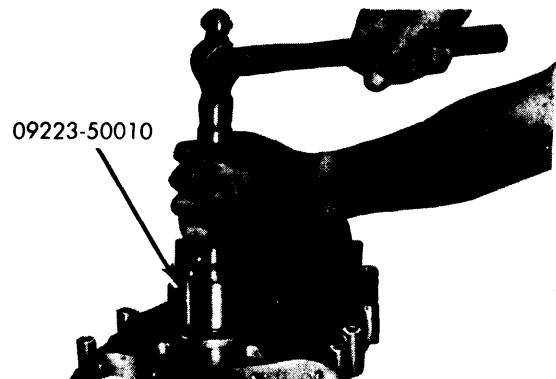


Fig. 13 Using Special Seal Installing Tool to Drive in Front Oil Seal

4M 6 CYLINDER (Cont.)

CAMSHAFT			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
4M	1.3771-1.3778 (34.979-34.995)	.0005-.0025 (.012-.064)	.....

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.

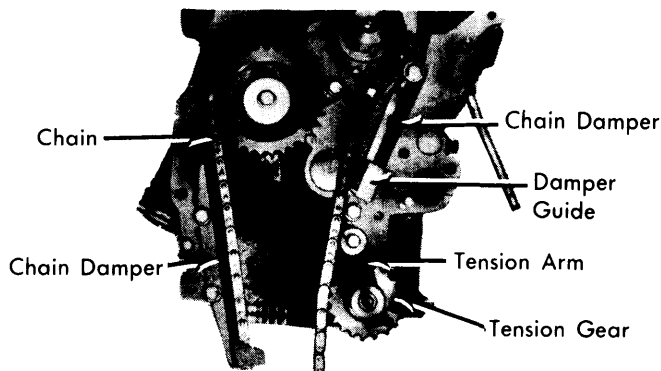


Fig. 14 Front View of Timing Chain with Detail of Components

Installation — 1) Visually inspect timing chain tensioner and chain. Install crankshaft timing sprocket (index marks face forward). Fit flat side of thrust plate to block and leave loose. Install oil pump chain sprocket.

2) Position crankshaft timing sprocket and oil pump drive sprocket as shown in Fig. 15. Fit timing chain over sprockets. Make sure plated links in timing chain align with stamped recess in both sprockets.

NOTE — DO NOT confuse index marks. Stamped marks align with chain plated links. Symbol marks align with each other.

3) Fit chain dampers. Make sure collar for bolt is fitted before installing chain damper.

4) Align camshaft timing mark ("V" on flange) with the embossed mark on bearing cap. Align camshaft sprocket so stamped index recess matches with "V" on flange. Fit chain with plated link aligned with stamped recess on camshaft sprocket.

5) Make sure camshaft dowel pin is fitted to No. 1 hole. Finger tighten camshaft sprocket set bolt. Adjust tensioner. Turn crankshaft in clockwise rotation until maximum slack (on

slack side of chain) is obtained. Loosen lock nut and turn screw clockwise until tight. From tightened position, loosen screw two turns. Tighten lock nut. See *Valve Timing*.

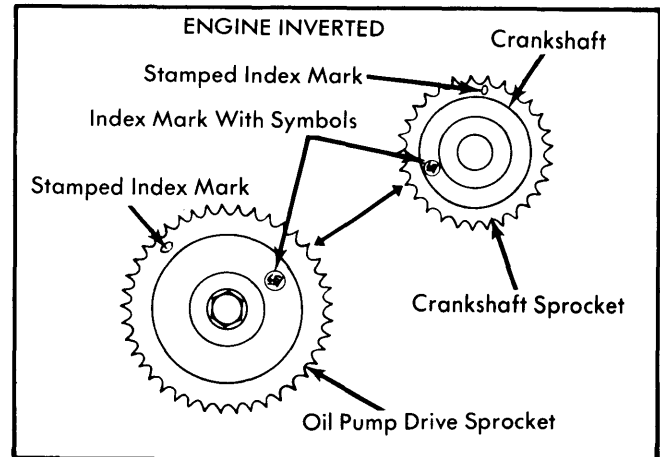


Fig. 15 Oil Pump Drive Sprocket and Crankshaft Sprocket Alignment

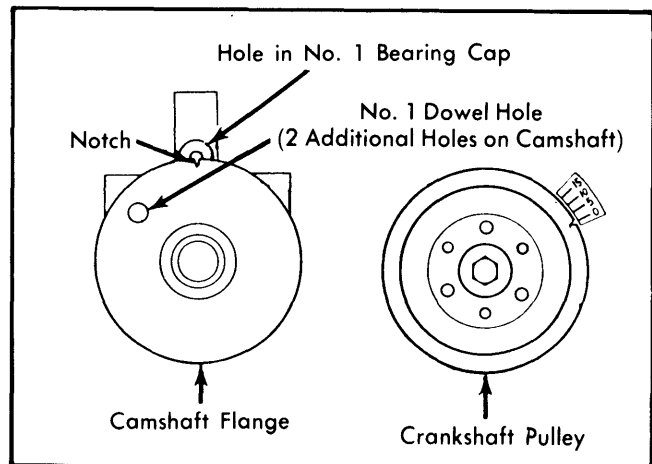


Fig. 16 Timing Mark Alignment Location Marks

CAMSHAFT REMOVAL

1) Remove head cover and valve rocker shafts. Remove chain tensioner.

NOTE — Before removing tensioner, inspect timing chain for stretch. This will facilitate valve timing at time of reassembly.

2) Straighten lock plate, remove camshaft timing sprocket bolt and remove camshaft timing sprocket. **NOTE** — Camshaft sprocket bolt is left hand thread.

3) Remove camshaft bearing caps and remove camshaft. After camshaft is removed, temporarily assemble caps. Make sure caps are marked for identification and replacement.

4M 6 CYLINDER (Cont.)

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

To measure end thrust, use feeler gauge with camshaft installed on cylinder head. If end thrust exceeds .012" (3.0 mm), replace cam bearing No. 2. Specified end thrust is .002-.005" (.055-.155 mm).

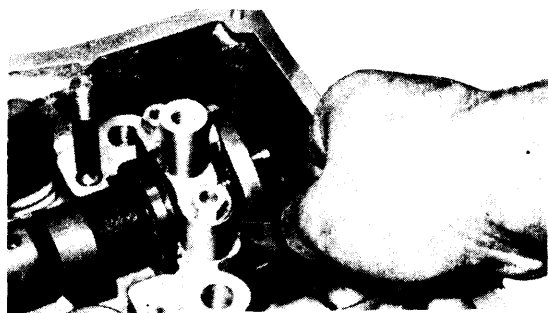


Fig. 17 Using a Feeler Gauge to Measure Camshaft End Thrust

CAM HEIGHT

Measure height of cam. If height is less than following specified limits, camshaft must be replaced.

Cam Height Specifications

Application	Normal In. (mm)	Minimum In. (mm)
Intake	1.604 (40.730)	1.587 (40.32)
Exhaust	1.603 (40.707)	1.587 (40.32)

AUXILIARY SHAFT

Remove auxiliary shaft thrust plate bolt and remove gear and shaft as a unit. Inspect auxiliary shaft journals and gear for wear or damage. Replace thrust plate if thrust clearance exceeds limit.

Auxiliary 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)

Engine	VALVE TIMING			
	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
4M

VALVE TIMING

1) With timing gears, timing chain, engine front cover and crankshaft pulley installed, align "V" groove on crankshaft pulley with 0° graduation on chain cover.

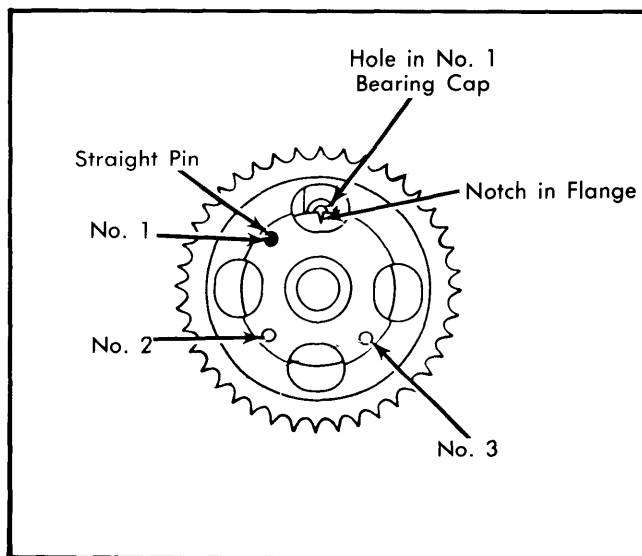


Fig. 18 Timing Chain Sprocket with Alignment Holes

2) Check to see if timing mark in camshaft flange is within indent hole in camshaft front bearing cap. Look through opening in camshaft sprocket.

3) If timing mark is off mark to the left, remove camshaft sprocket attaching bolt (left hand threads) and rotate camshaft sprocket clockwise until dowel pin hole on camshaft flange fits in No. 2 dowel hole in camshaft sprocket.

4) If V groove is still off mark, repeat procedure and try No. 3 straight pin hole. Replace chain if straight pin must surpass No. 3 hole to achieve alignment of timing mark within indent hole.

5) When straight pin is installed in No. 2 hole, valve timing will advance 6 degrees more than if installed in No. 1 hole. If No. 3 hole is used, advance will be 6 degrees more than if installed in No. 2 hole.

NOTE— Valve timing is ±6 degrees when timing line aligns within indent hole.

4M 6 CYLINDER (Cont.)

ENGINE OILING

Pressure Relief Valve — Located in oil pump, valve opens at pressure of 71-85 psi (5.0-6.0 kg/cm²).

Crankcase Capacity — 5.1 quarts approximate refill capacity.

Oil Filter — Full flow spin-on type.

Normal Oil Pressure — 57 psi.

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.

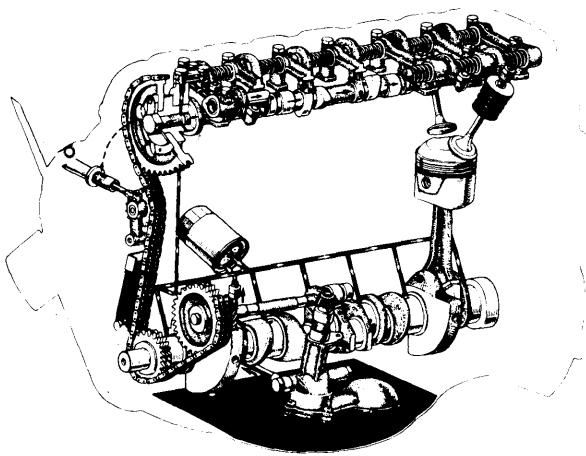


Fig. 19 Diagram Showing Engine Lubrication Circuit

OIL PUMP

Removal — Raise front and rear of car and support on stands. Drain engine oil. Disconnect steering relay rod from steering idler arm and pitman arm using suitable tie rod end puller (Tool 09611-20013). Remove exhaust pipe support bracket, flywheel housing undercover, engine left rear undercover. Remove oil pan. Remove oil pump outlet pipe, remove oil pump.

Disassembly — Remove pump cover, gear, relief valve plug, gasket, spring, and relief valve (in this order) from pump body. Remove snap ring and spacer from top end of shaft. After removing drive shaft gear and Woodruff key, remove oil pump shaft from pump body.

Inspection — 1) Measure side clearance between gear and mounting surface. If clearance is greater than .006" (.15 mm), replace gear or oil Pump body.

2) Measure body clearance between gear teeth and body, if greater than .008" (.2 mm), replace components.

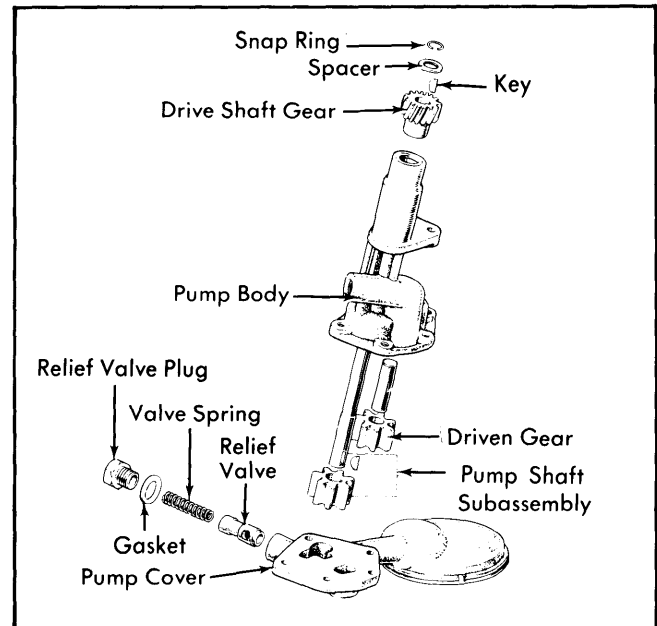


Fig. 20 Exploded View of Gear-Driven Oil Pump

3) Make backlash measurement between drive gear and driven gear. Backlash must not exceed .035" (.9 mm).

Reassembly & Installation — Reverse previous procedures for reassembly and installation.

ENGINE COOLING

Thermostat — Wax pellet type, begins to open at 177-182°F, fully opened at 203°F.

Cooling System Capacity — Approximately 12.3 qts.

WATER PUMP

NOTE — It is not necessary to remove entire water pump housing to service water pump. Water pump cover may be removed from pump housing with housing left on cylinder block.

Removal — Remove bolts and remove fan shroud. Remove fan belt and four water pump cover bolts. Remove cover complete with coupling and fan assembly.

Installation — To install, reverse removal procedure.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Crankshaft Bearing Caps.....	71-79 (9.8-10.9)
Cylinder Head	
13 mm bolts.....	54-61 (7.4-8.4)
8 mm bolts.....	11-16 (1.5-2.2)
Camshaft Bearing Caps.....	12-17 (1.6-2.3)
Camshaft Sprocket Bolt.....	47-54 (6.5-7.5)
Connecting Rod Cap.....	30-35 (4.1-4.8)
Crankshaft Pulley.....	69-76 (9.5-10.5)
Timing Cover	
8 mm bolt.....	7-11 (.97-1.5)
10 mm bolt.....	(1.8-3.0)