

Mazda Engines

1971-72 MAZDA 1200 4 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
1971-72	71.3	1169	1x2-Bbl.	73@6000	72@35000	8.6-1	2.756	70	2.992	76

ENGINE REMOVAL

NOTE – Engine and transmission are removed as a unit.

1) Mark position of hood to hinges and remove hood. Drain cooling system. Disconnect battery cables at battery and remove battery. Disconnect engine to body ground strap at body.

2) Remove hot air hose at exhaust manifold. Remove air cleaner and bracket. Disconnect choke cable and accelerator cable at carburetor.

3) Separate wire connector at alternator and disconnect "B" terminal from alternator. Disconnect fuel line from fuel pump inlet. Disconnect wire at distributor and remove coil wire.

4) Disconnect radiator hoses at radiator and remove radiator. Disconnect wires at oil pressure switch, back-up light switch and starter.

5) Remove dust boot from shifting lever. Remove bolts from cover plate and remove cover plate and shifter.

6) Disconnect exhaust pipe at exhaust manifold and remove exhaust pipe mounting bracket at transmission. Disconnect speedometer cable at transmission.

7) Unhook clutch return spring from clutch fork. Remove slave cylinder from clutch housing. Drain transmission oil.

8) Unhook parking brake return spring from guide lever. Disconnect cable at parking brake guide lever. Disconnect drive shaft at differential and pull drive shaft from transmission.

9) Remove exhaust manifold from cylinder head. Disconnect wiring at starter switch and disconnect starter cable. Support engine from top with a suitable hoist.

10) Remove nuts and bolts from both front motor mounts. Remove transmission crossmember from vehicle. Remove engine and transmission. Separate engine from transmission.

11) To install engine in vehicle, reverse removal procedure.

INTAKE MANIFOLD

1) Remove air cleaner and disconnect fuel line at carburetor. Remove accelerator cable bracket.

2) Remove carburetor and air cleaner bracket. Remove intake manifold retaining nuts and remove intake manifold.

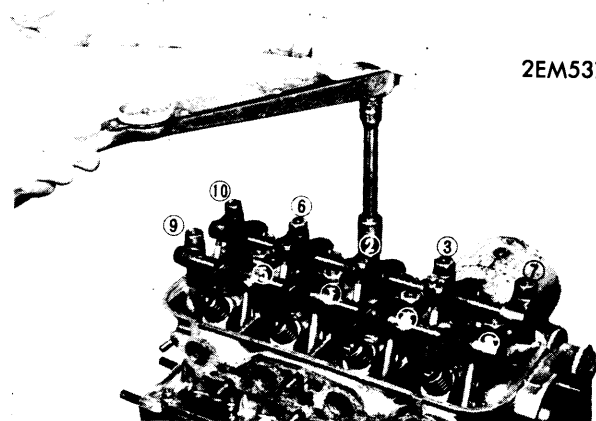
3) Reverse removal procedure to install intake manifold using new gaskets.

CYLINDER HEAD

1) Remove intake manifold as previously outlined. Remove thermostat housing and thermostat. Disconnect spark plug wires at spark plugs.

2) Remove rocker arm cover. Remove cylinder head retaining nuts. Remove cylinder head.

3) To install, reverse removal procedure. Use new gaskets and install long pushrods on exhaust side. Tighten retaining nuts to specifications in sequence shown in illustration. Adjust valve clearance. See *Valve Clearance Adjustment*.



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CYLINDER HEAD TIGHTENING SEQUENCE

VALVES							
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
All							
Intake	1.34"	45°	45°	0.0697"	0.2756"	0.0008-0.0026"
Exhaust	1.1418"	45°	45°	0.0697"	0.2756"	0.0016-0.0034"

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VALVE ARRANGEMENT

Left Side – Exhaust valves.

Right Side – Intake valves.

VALVE GUIDE SERVICING

With cylinder head removed, check clearance of valve in guide. If clearance is more than specified, knock guide from cylinder head with a hammer and a suitable driver (49 0249 010). Install new guide using same driver. Drive guide into cylinder head until stop clip comes in contact with head.

VALVE STEM OIL SEALS

All intake valve guides are equipped with oil seals. New seals can be installed by driving on intake valve guide with a suitable driver (49 0223 025).

VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
ALL	1.596"	46.3

VALVE SPRING REMOVAL

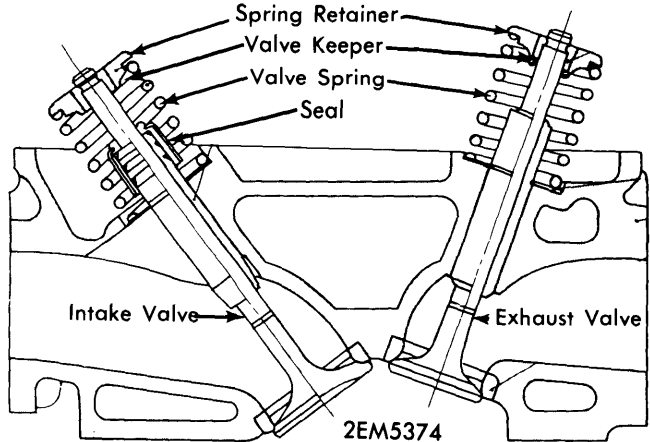
Compress valve spring with a suitable valve spring compressor and remove valve keepers. Release spring compressor and remove spring retainer and spring. Check spring in a suitable valve spring tester. Apply 46.3 lbs. to spring and measure length. Length should be 1.378".

ROCKER ARM ASSEMBLY

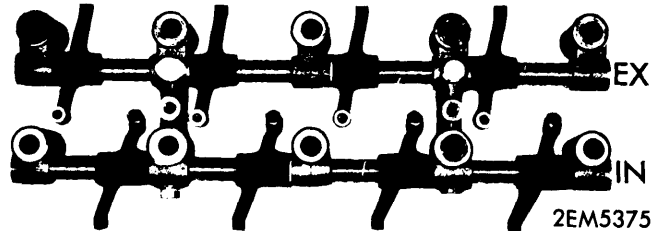
If rocker arm assembly is disassembled, reassemble with components installed in proper position as shown in illustration.

VALVE CLEARANCE ADJUSTMENT

Valve clearance must be set when engine has been sufficiently warmed up. Turn engine until TDC of compression stroke is obtained and adjust both intake and exhaust to .010". Repeat procedure for all four cylinders.



INTAKE & EXHAUST VALVE COMPONENT ARRANGEMENT



ROCKER ARM ASSEMBLY COMPONENT ARRANGEMENT

PISTONS, PINS, RINGS						
Engine	PISTONS		PINS		RINGS	
	Clearance	Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
ALL	0.0017-0.0022"	⊙	0.0004-0.0012"	# 1 # 2 # 3	.0079-.0157" .0079-.0157" .0079-.0157"	.0014-.0028" .0012-.0025" .0012-.0024"

⊙ – Piston pin is push fit in piston when piston is heated to 250-300°F.

OIL PAN REMOVAL

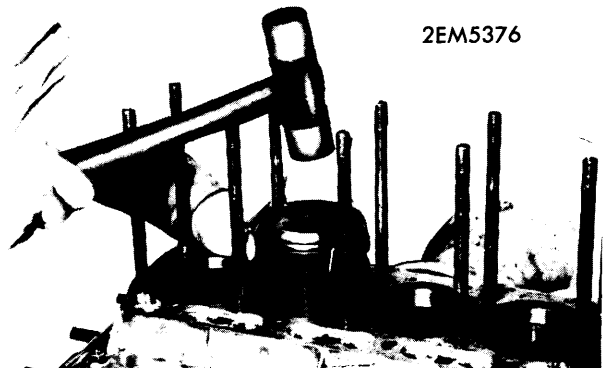
The engine must be removed in order to remove oil pan.

PISTON & ROD ASSEMBLY

1) Remove cylinder head and oil pan as previously outlined. Bend lock tabs away from connecting rod bolts and remove bolts. Remove rod cap with bearing and push piston and rod assembly out toward top of engine.

2) Before installing, thoroughly lubricate cylinder liner and piston. Separate ring gaps approximately 120° apart but do not align ring gap on thrust side of piston or with piston pin hole. Install bearing half in connecting rod.

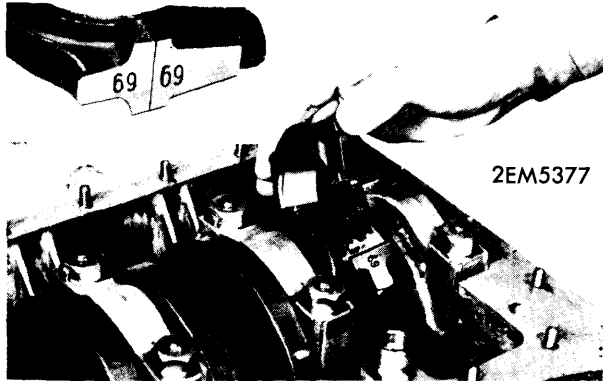
3) Using a suitable ring compressor (49 0221 201), install piston and rod from top. Install piston in cylinder with "F" mark (next to piston pin hole) toward front of engine.



PISTON INSTALLATION

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4) Install bearing half in rod cap and install cap with numbers on cap and rod aligned on same side. Tighten rod bolts to specifications and bend up lock tabs. Check connecting rod side play. Install remaining components as previously outlined.



CONNECTING ROD CAP INSTALLATION

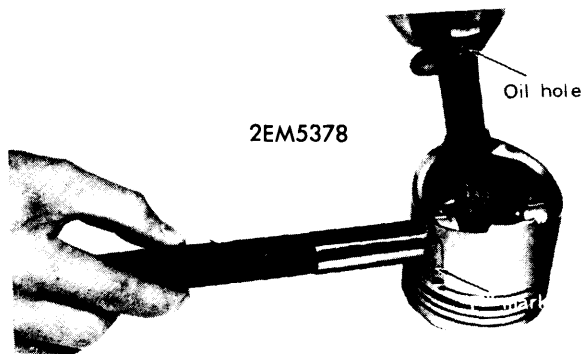
PISTON PIN REPLACEMENT

1) With piston and rod assembly removed as previously outlined, remove circlips from piston. Heat piston to approximately 250-300°F and push pin from piston.

2) Check piston pin fit in piston. Pin should push fit in piston with piston heated to 250-300°F. Check piston pin and rod clearance. If clearance is more than specified, piston pin and bushing must be replaced.

3) Press bushing from connecting rod using a suitable mandrel. Press new bushing in rod making sure oil holes in bushing and connecting rod align. Ream bushing to specified clearance with new piston pin.

4) When assembling piston and connecting rod, make sure oil hole at crankshaft end of rod and "F" mark on piston are on the same side. Install piston and rod assembly as previously outlined.



PISTON & ROD ASSEMBLY

FITTING PISTONS

1) With piston removed, measure diameter of piston and liner. If clearance is over 0.006", piston or liner must be replaced. See *Cylinder Liner Replacement*.

2) Pistons and liners are marked to designate sizes of diameter within manufacturing limits. Correct clearance is obtained by combining pistons and liners with matching marks or pistons and liners that are unmarked. See specifications for appropriate sizes.

Application	Liner (In.)	Piston (In.)
Mark "A"	2.7634	2.7583
Unmarked	2.7606	2.7556
Mark "C"	2.7584	2.7532

3) Check piston ring side clearance in piston, if clearance exceeds .006", replace rings. Check ring gap in cylinder liner. Ring gap should not exceed .0047". If rings are replaced, install with "R" mark on ring facing up.

CYLINDER LINER REPLACEMENT

1) If it has been determined that cylinder liner must be replaced, engine must be removed from vehicle and completely disassembled. Drive cylinder liner out of crankcase from bottom using a suitable driver (49 0249 015). Remove "O" rings from grooves in crankcase.



CYLINDER LINER REMOVAL

2) Install new "O" rings in crankcase. "O" rings must protrude 0.02" or more from groove in crankcase. Coat "O" rings with soapsuds and install liner with same driver as used during removal.

3) Liners and top deck of crankcase are marked "A" or unmarked. Liners must be installed with marks matching top deck. If liner and top deck are marked "A", liner must protrude .0004-.0024". If liner and top deck are unmarked, liner must protrude .0006-.0028".

4) Top deck and crankcase are machined to match. If cylinder liner does not protrude correct distance, replace liner, not top deck.

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CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft Endplay	Journal Diam.	Clearance	Sideplay
All	2.2048"	.0001-.0020"	⊙	.0043-.0108"	1.7717"	.027-.073"	.0043-.0084"

⊙ — Thrust washers of appropriate size are installed at number 5 bearing journal.

MAIN & CONNECTING ROD BEARING SERVICE

1) Remove engine from vehicle and remove piston and rod assemblies as previously outlined. Remove crankshaft pulley and engine front cover. Remove timing chain tensioner and vibration damper. Remove oil pump driven gear. See *Oil Pump Removal*.

2) Remove oil baffle plate and Woodruff key from crankshaft end. Remove bolts from camshaft thrust plate. Pull camshaft, timing sprocket and crankshaft sprocket out far enough to remove from crankshaft. Remove clutch and flywheel.

3) Bend up lock tabs on main bearing caps and remove nuts. Remove main bearing cap with bearing. Remove crankshaft and thoroughly clean.

4) Measure diameter of main bearing and connecting rod bearing journals. If journals are over .002" from standard size, crankshaft must be ground. Crankshaft can be ground .010", .020" & .030" undersize. Check crankshaft runout, runout must not exceed .001".

5) Main and connecting rod bearing clearance is checked with the Plastigage method. Place a small piece of Plastigage wire on crankshaft bearing surface. With bearings thoroughly clean, install main bearing cap or rod bearing cap and tighten to specification. Do not turn crankshaft. Remove main or rod cap and check flattened wire against scale on back of Plastigage package to determine clearance.

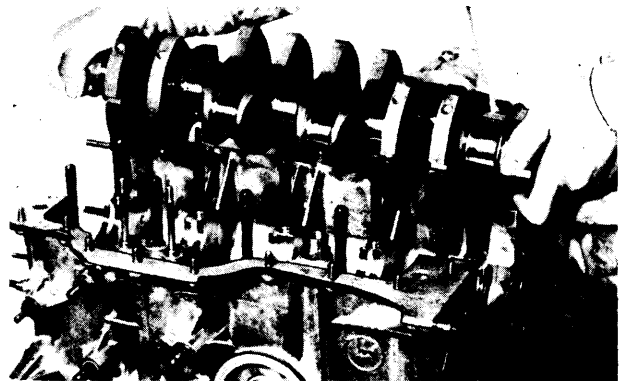
6) Main bearing bores in crankcase, main bearings and crankshaft are color coded. The correct combination of colored components will obtain correct clearance of main bearings. See chart to determine correct combination of colored components.

Main Bearing Clearance Color Code

Main Bearing Bore	Crankshaft	Main Bearing
Green.....	Green	Brown
	Brown	Green
	Blue.....	Yellow
Brown.....	Green.....	Black
	Brown.....	Brown
	Blue.....	Green
Blue.....	Green.....	Blue
	Brown.....	Black
	Blue.....	Brown

7) Install bearing halves in crankcase and caps. Coat bearings with oil and install crankshaft. Install thrust washers. See *Thrust Bearing Alignment*. Install crankshaft oil seal. See *Rear Main Bearing Oil Seal Service*.

8) Install oil seals in sides of rear main cap. Main bearing caps are numbers 1 through 4 and must be installed that order from front to rear. Install main bearing caps and tighten nuts to specifications. Bend lock tabs to secure main bearing cap nuts. Make sure crankshaft turns freely.



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CRANKSHAFT INSTALLATION

9) Install remaining components in reverse of removal order or as previously outlined. Install timing chain correctly. See *Valve Timing*. Install engine as previously outlined.

THRUST BEARING ALIGNMENT

1) Push forward on crankshaft with a lever. Mount a dial indicator at end of crankshaft and measure endplay. If endplay is over .12", install suitable thrust washers to obtain specified crankshaft endplay. Thrust washers are available in .010", .020" & .030" oversizes.

2) With crankshaft removed, install lower thrust washer half of correct size in crankcase with oil grooves out. Install upper thrust washer half with rear main bearing cap with oil grooves out. Recheck crankshaft endplay.

REAR MAIN BEARING OIL SEAL SERVICE

Rear main bearing oil seal must be installed with rear main bearing cap removed. Coat lip of seal with grease and install on rear of crankshaft. Install rear main bearing cap.


 REAR MAIN BEARING OIL SEAL
INSTALLATION

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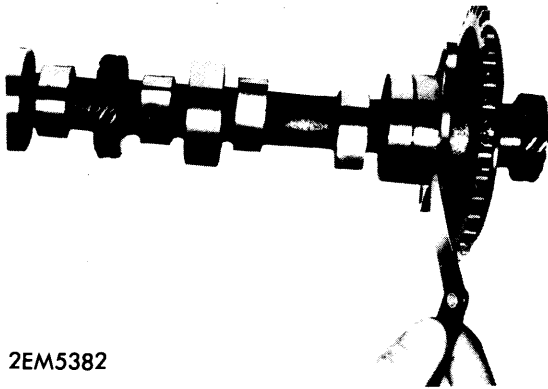
ENGINE FRONT COVER OIL SEAL

Coat lip of seal with grease when installing front cover.

CAMSHAFT			
Engine	Journal Diam.	Clearance	Lobe Lift
ALL JOURNAL		0.0014-0.003"	1.439"
# 1	1.8898"		
# 2	1.8111"		
# 3	1.7717"		
# 4	1.7323"		
# 5	1.6929"		

CAMSHAFT REMOVAL

- 1) With engine removed, remove front pulley and cover. Remove timing chain tensioner and vibration damper. Remove crankshaft oil baffle plate and Woodruff key. Remove oil pump drive gear. See *Oil Pump Removal*.
- 2) Remove two bolts from camshaft thrust plate and pull camshaft out far enough to remove crankshaft sprocket and timing chain. Pull camshaft from motor.
- 3) Thoroughly clean and inspect camshaft for cracking or damage. Measure camshaft lift. If down more than .008" from standard, replace camshaft. Measure camshaft journals. If down more than .002", replace camshaft.
- 4) Check camshaft runout, if more than .003", correct in a press. Check camshaft endplay between thrust plate and first cam journal. Endplay should not be more than .012".



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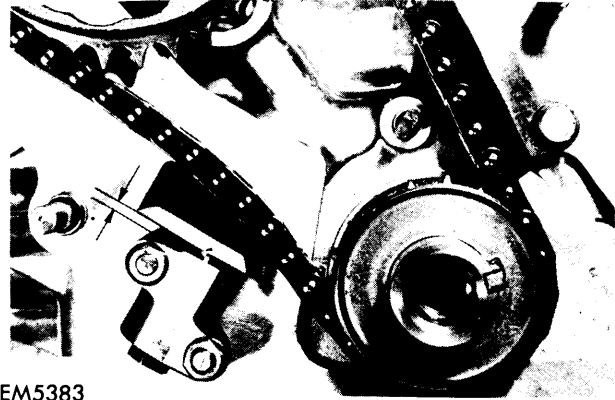
CAMSHAFT ENDPLAY CHECKING

- 5) Apply oil to camshaft journals. Install camshaft, making sure it is timed correctly with crankshaft. See *Valve Timing*. Install timing chain tensioner correctly. See *Timing Chain Replacement*. Install remaining components in reverse of removal order.

VALVE TIMING				
Engine	INTAKE		EXHAUST	
	Open (BTDC)	Close (ABDC)	Open (BBDC)	Close (ATDC)
ALL	14°	53°	57°	10°

TIMING CHAIN REPLACEMENT

- 1) Remove timing cover and front pulley. If distance between tensioner head and tensioner body is more than 1/2", replace timing chain or sprockets.



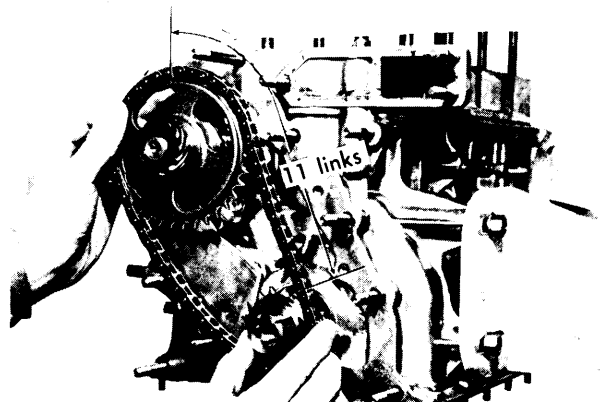
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TIMING CHAIN TENSIONER CHECKING

- 2) To remove timing chain, remove chain tensioner and vibration damper. Remove oil pump drive gear. See *Oil Pump Removal*. Remove bolts from camshaft thrust plate. Remove oil baffle plate and Woodruff key from crankshaft end. Pull camshaft out far enough to remove crank sprocket and timing chain.
- 3) Install new timing chain or sprockets correctly timed. See *Valve Timing*. Install camshaft thrust plate and tighten bolts. Install timing chain vibration damper.
- 4) Remove plug from chain tensioner. Compress tensioner by turning inner cylinder clockwise with an Allen wrench. Install tensioner in position on motor. Release chain tensioner by turning inner cylinder counterclockwise with an Allen wrench. Install plug and secure with lock tab bent in position.

VALVE TIMING

- 1) With timing chain removed, rotate crankshaft until number one cylinder is at top dead center. Position timing chain on sprockets with 11 links between marks on sprockets.



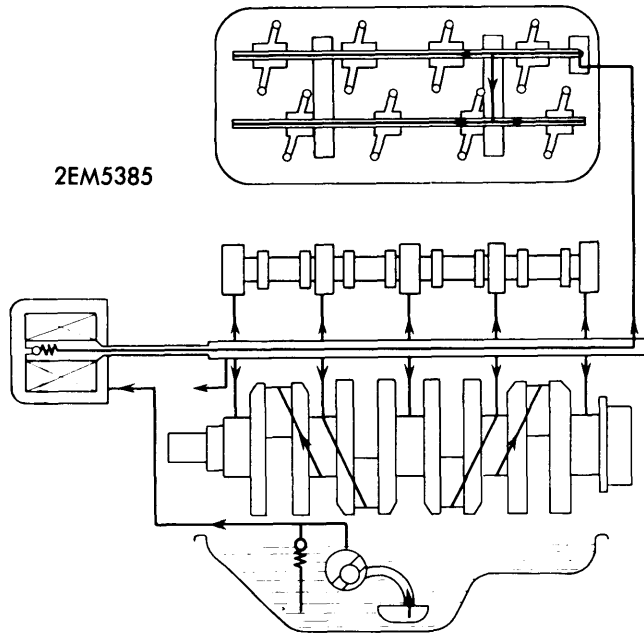
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CAMSHAFT TIMING

- 2) Without changing position of sprockets with chain, install crank sprocket on crankshaft. Push in camshaft without turning crankshaft. Install remaining components as previously outlined.

1971-72 MAZDA 1200 4 CYLINDER (Cont.)

ENGINE OILING



OIL CIRCULATION DIAGRAM

ENGINE OILING SYSTEM

Oil is circulated through engine by pressure provided by a trochoid type oil pump. Pump is mounted on bottom of crankcase and driven by camshaft via an oil pump drive gear. Oil is drawn from oil pan and circulated through a full flow oil filter to main oil passage. Oil is then distributed to camshaft journals and crankshaft main bearing journals. Oil flows from main bearing journals to connecting rod journals. Cylinders, piston pins and piston pin bushings in connecting rod are lubricated by oil squirting from hole in connecting rod. Oil is supplied to camshaft sprocket and timing chain tensioner by main oil passage. Oil flows from main oil passage to rocker arm shafts. This supplies oil to rocker arms. Excess oil from rocker arms lubricates valves and valve stems. Oil not used flows back to oil pan thru push rod holes.

Crankcase Capacity – 3 1/4 qts.

Oil Filter – Full-flow, mounted on right center of crankcase.

Normal Oil Pressure – With engine warm, 55 lbs. @ 3000 RPM.

Pressure Control Valve – Mounted in oil pump. See *Oil Pump*.

OIL PUMP

1) With oil pan removed, remove pickup tube and oil screen. Disconnect oil line at crankcase and remove oil pump with oil line. Remove oil line. Remove cotter pin and remove pressure control plunger, spring and spring seat.

2) Remove pump cover and check clearance between inner and outer rotor. If clearance is more than .010", replace both rotors. Check clearance between outer rotor and pump body. If clearance is more than .011", replace rotor or pump body.

3) Place a straight edge over pump body and check clearance between straight edge and rotor with a feeler gauge. Place straight edge on pump cover and check clearance with a feeler gauge. If total clearance is more than .006", remachine pump cover.

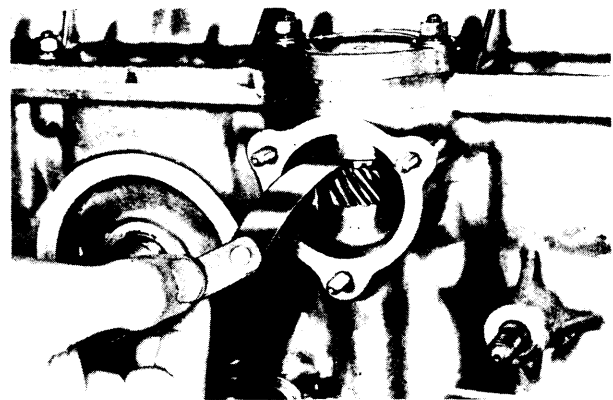
4) Check pressure control plunger for wear or scoring and replace as necessary. Check spring for wear. Check spring against specifications. Replace if necessary.

5) Reverse disassembly procedure to assemble pump. Coat plunger with oil and install in pump, install spring, spring seat and new cotter pin. Reverse removal procedure to install.

Oil Pump Drive Gear

1) Remove oil pump drive gear cover from crankcase. Remove blind cover next to oil filter mount. Pull out drive gear with shim and washer.

2) Install drive gear and shim with slot to bottom. Install washer on top. Install cover and tighten bolts to specifications. Check clearance between washer and cover through blind cover opening.



OIL PUMP DRIVE CLEARANCE CHECKING

3) Specified clearance is .002-.004". If clearance is incorrect, install a suitable washer to obtain correct clearance. Washers are available in .07", .08", .09" & .10" thickness. Install blind cover and gasket.

Oil Pump Specifications

Application	Measurement (In.)
Rotor-to-Rotor Clearance (Max.)	0.010"
Rotor-to-Pump Body Clearance	0.008-0.011"
Rotor End Float	0.002-0.004"
Drive Gear Clearance	0.002-0.004"
Pressure Control Spring (Free Length)	2.165"
Pressure Control Spring (5.91 lbs. Load)	1.693"

Mazda Engines

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ENGINE COOLING

WATER PUMP

1) Loosen alternator holding strap and remove fan belt. Remove fan and pulley. Disconnect hoses at water pump and remove pump.

2) Reverse removal procedure to install and use new gasket.

Thermostat – Starts opening at 190°F, fully opens at 212°F.

Cooling System Capacity – 9.7 pints with heater, 8.7 pints without heater.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Main Bearing Nuts.....	45
Connecting Rod Bolts.....	28
Cylinder Head Nuts.....	50
Camshaft Thrust Plate Bolts.....	16
Timing Chain Vibration Damper.....	6.5
Timing Chain Tensioner.....	6.5
Engine Front Cover.....	16
Oil Pan.....	6.5
Intake Manifold.....	16
Exhaust Manifold.....	16
Top Deck.....	6.5
Oil Pump to Crankcase Bolts.....	6.5
Oil Pump Drive Gear Cover.....	6.5
Oil Pump Drive Gear Blind Cover.....	6.5
Water Pump.....	16
Alternator Holding Strap.....	16
Thermostat Cover.....	6.5
Flywheel Bolts.....	63
Clutch Cover Bolts.....	16
Front Pulley Bolt.....	65
Motor Mount Bolts.....	30