1.9 LITER 4-CYLINDER

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine identification number is stamped on a machined pad on left rear side of cylinder block. Pad is located just above oil pan near engine rear cover. Engine type is identified by a letter code (A), in eighth position of Vehicle Identification Number.

ENGINE IDENTIFICATION CODE

Engine	Code
1.9L (118.9") 2-Bbl.	TMA, TMB, TMF, TMK TML, TMM, TMR, TMS

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLD

INTAKE MANIFOLD

Removal

1) Drain entire engine cooling system, including cylinder block. Remove air cleaner assembly. Disconnect upper radiator hose and heater hoses from intake manifold, and position out of way.

2) Label and disconnect all vacuum hoses, ventilation hoses and electrical connectors at intake manifold, carburetor and distributor. Disconnect fuel inlet and return hoses from carburetor. Disconnect accelerator cable.

3) Remove bolt and detach oil dipstick tube bracket from intake manifold. Disconnect EGR pipe from EGR valve adapter. Remove intake manifold and carburetor as an assembly.

Installation

Clean all gasket surfaces. Using new gasket, install intake manifold and nuts. Starting at middle of intake manifold and working outward, tighten manifold nuts. Reverse removal procedures to complete installation.

CYLINDER HEAD

Removal

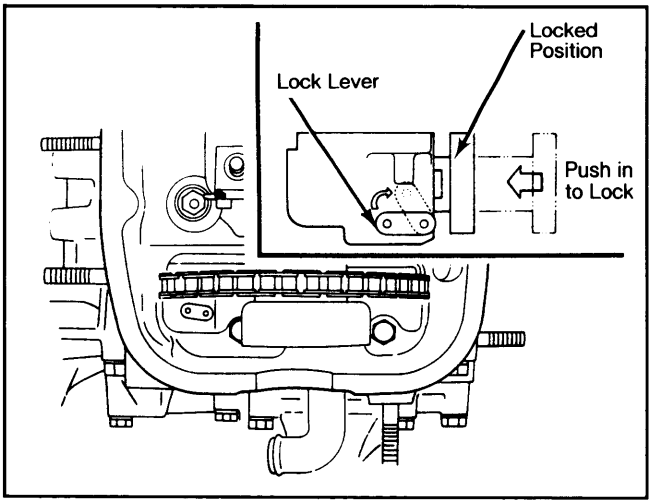
1) Remove cam cover. Remove bolt and detach EGR pipe clamp from rear of cylinder head. Raise vehicle and disconnect exhaust pipe at manifold. Lower vehicle and drain cooling system. Disconnect heater hoses from intake manifold and cylinder head.

2) If equipped, remove A/C compressor and power steering pump and position aside. Disconnect accelerator linkage and fuel hoses at carburetor. Disconnect all necessary electrical connections, vacuum hoses and ventilation hoses, at cylinder head, intake manifold, carburetor and distributor.

3) Rotate distributor until No. 4 piston is on TDC at end of compression stroke. Remove distributor cap and mark rotor to housing relationship. Disconnect spark plug wires at spark plugs, and remove distributor cap with spark plug wires attached. Remove distributor.

4) Remove fuel pump. Lock automatic timing chain adjuster shoe in fully retracted position, by depressing adjuster lock lever with a screwdriver and rotating clockwise (as viewed from top of engine), while pushing in on shoe. *See Fig. 1.* After locking automatic adjuster, check that chain tension is released.

Fig. 1: Releasing Timing Chain Tension



Depress automatic adjuster lock lever and rotate in direction indicated.

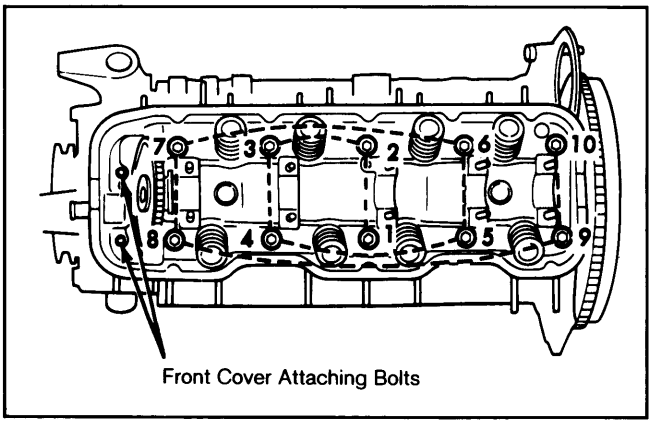
5) Remove timing sprocket attaching bolt, and slide camshaft sprocket and fuel pump eccentric from camshaft. Keep the sprocket on the chain damper and tensioner, without removing chain from the sprocket.

6) Disconnect air pump hose and check valve at air injection manifold. Remove cylinder head, intake and exhaust manifold as an assembly.

Installation

Clean all gasket surfaces. Clean head bolt threads and threads in block. Install new head gasket with words "TOP" facing upward. Install cylinder head and head bolts. Tighten head bolts in progressive steps. Install remaining components. Adjust valves. *See Fig. 2.*

Fig. 2: Cylinder Head Tightening Sequence



Tighten in progressive steps to 60 ft. lbs (81 N.m), then tighten to 72 ft. lbs. (98 N.m).

VALVES

VALVE ARRANGEMENT

Intake valves (Right side)
Exhaust valves (Left side)

1.9 LITER 4-CYLINDER (Cont.)

VALVE GUIDE SERVICING

Valve guides and valves should be replaced as a unit. Replace valve and guide when valve stem diameter is less than .310" (7.88 mm) on intake valves, and less than .309" (7.85 mm) on exhaust valves.

Removal

Disassemble head. Insert valve guide remover/installer tool (J-26512 or equivalent) into valve guide, from combustion chamber side of cylinder head. Drive valve guide out top of cylinder head.

Installation

Apply engine oil to outer surface of valve guide, and position in guide bore. Using tool (J-26512 or equivalent), drive guide into cylinder head until tool bottoms on head.

VALVE STEM OIL SEALS

Lubricate oil seals with engine oil and install over valve stem and onto valve guide. Ensure that lip on inside of oil seal fits into valve guide groove.

VALVE SPRINGS

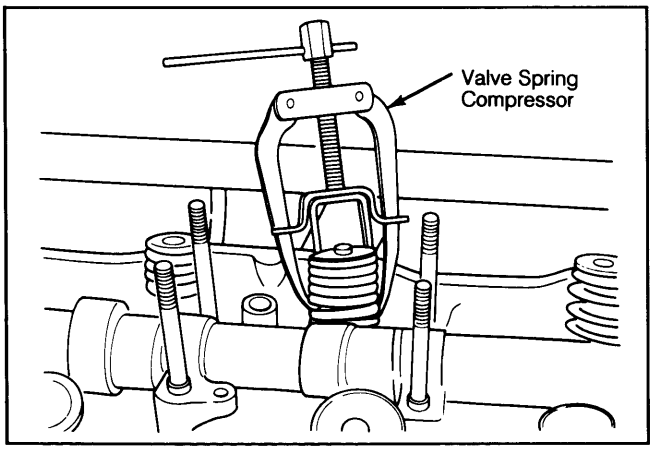
NOTE: Do not remove air pressure from cylinder until valve spring components are reassembled.

Removal

1) Disconnect negative battery cable. Remove air cleaner assembly and cam cover. Remove rocker arm shaft and bracket assembly. *See Rocker Arm Shaft Assembly.* Disconnect spark plug wire from cylinder to be serviced and remove spark plug.

2) Install an air hose and adapter to spark plug hole, and apply air pressure. Using valve spring compressor tool (J-26513 or equivalent), compress valve spring. *See Fig. 3.* Remove retainer locks, spring cap and inner and outer springs. Remove oil seal and lower spring seat.

Fig. 3: Compressing Valve Spring



Do not remove air pressure until components are reassembled.

Inspection

1) Using a flat surface and steel square, measure valve springs for out-of-round condition. Take measurement between top of spring and square, while slowly rotating spring. Out-of-round must not exceed 5/64" (2 mm).

2) Measure inner and outer valve spring free length with a ruler. Check valve spring tension with a valve spring tester. Replace springs that fail tests.

VALVE SPRING TENSION

Valve Spring	Pressure Lbs. @ In. (kg @ mm)
Inner	18-21 @ 1.52 (8-10 @ 38.6)
Outer	32-37 @ 1.60 (15-17 @ 41.0)

Installation

1) Install lower spring seat. Lubricate valve stem and lower spring seat with engine oil. Install new oil seal over valve stem and onto valve guide. Ensure that lip on inside of oil seal fits into valve guide groove. Install inner and outer springs and spring cap.

2) Using spring compressor tool, compress springs and install retainer locks. Ensure retainer locks are fully seated in valve stem groove. Remove air pressure. Heavily lubricate rocker arm shaft assembly and valve stems with engine oil, prior to installing. Install remaining components in reverse order of removal.

ROCKER ARM SHAFT ASSEMBLY

Removal

1) Remove cam cover. Starting with outer rocker arm shaft brackets and working inward, loosen nuts a little at a time. Remove nuts and metal springs.

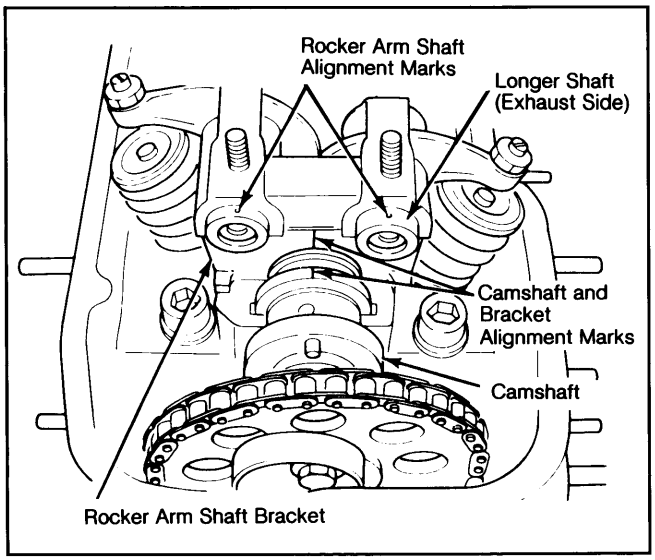
2) Remove rocker arm shaft assembly and brackets. If disassembly is necessary, keep components in order for reassembly in original positions.

Installation

1) If rocker arm shaft was disassembled, reassemble with cylinder number on face of brackets pointing toward front of engine. Position punch marks on shafts upward. Ensure longer shaft is installed on exhaust valve side of engine.

2) Position mark on camshaft thrust flange upward, to align with mark on No. 1 bracket. *See Fig. 4.* Heavily lubricate rocker arm shaft, rocker arms and valve stems with engine oil. Position rocker arm shaft assembly onto cylinder head.

Fig. 4: Correct Rocker Arm Shaft Assembly Installation



Tighten rocker arm shaft brackets to 16 ft. lbs. (22 N.m).

1.9 LITER 4-CYLINDER (Cont.)

3) Install metal springs and stud nuts. Hold outer edges of metal springs between jaws of an adjustable wrench while tightening nuts, to prevent spring damage. Starting with center bracket and working outward in a circular pattern, tighten stud nuts in steps. Install remaining components and adjust valves.

VALVE ADJUSTMENT

1) Ensure rocker arm shaft brackets are properly tightened. Cold valve clearances are .006" (.15 mm) for intake valves, and .010" (.25 mm) for exhaust valves.

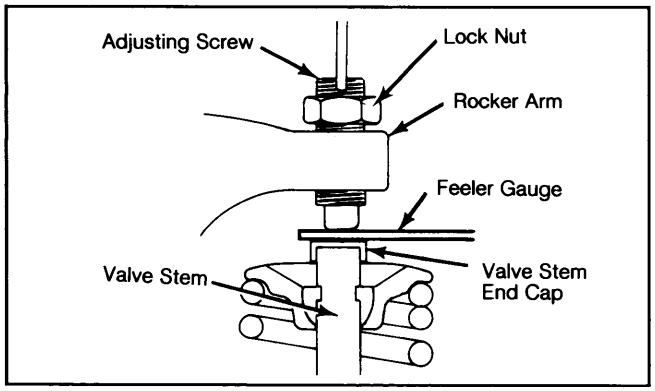
2) Turn crankshaft to position No. 1 piston on TDC at end of compression stroke. Adjust valve clearance of valves listed in table. *See Fig. 5.*

3) Turn crankshaft 1 revolution to place No. 4 piston on TDC at end of compression stroke, and adjust remaining valves.

VALVE CLEARANCE ADJUSTMENT

Piston On TDC	Adjust Int. Nos.	Adjust Exh. Nos.
1	1, 2	1, 3
4	3, 4	2, 4

Fig. 5: Adjusting Valve Clearance



Cold valve clearances are .006" (.15 mm) for intake valves and .010" (.25 mm) for exhaust valves.

PISTON, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

Removal

1) Remove cylinder head and oil pan. With piston placed at bottom of stroke, remove ridge from top of cylinder bore using ridge reamer. Mark connecting rods and caps for cylinder identification. Mark side of rod and cap which faces right side of engine.

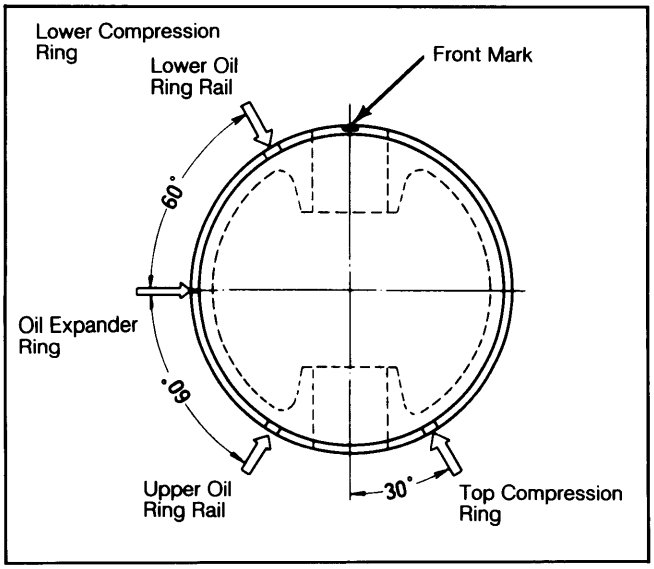
2) Position piston to be removed at bottom of stroke. Remove rod cap and upper bearing from connecting rod. Using wooden hammer handle (or equivalent), push piston out top of cylinder bore. Install rod cap on mating rod.

Installation

1) Properly position rings on piston and install upper bearing in rod. *See Fig. 6.* Coat rod bearing surfaces, cylinder bore and piston and rings with engine oil. Install ring compressor over piston and rings, ensuring position of rings does not change.

2) Position crankshaft journal to uppermost position. With mark on piston head positioned toward front of engine, install piston and rod assembly into cylinder bore while guiding rod onto crankshaft journal. Install and tighten rod cap. Ensure crankshaft turns without binding.

Fig. 6: Desired Piston Ring Spacing



Lower oil ring rail and lower compression ring share same gap position on piston.

FITTING PISTONS

NOTE: Take measurements at normal room temperature (70°F, 21°C).

1) Measure diameter of piston (skirt) 90° to piston pin bore, at a point 1 9/16" below piston head. Measure cylinder bore diameter at bottom of bore (above ring travel), at a point where least wear can be measured. Difference between the two measurements is piston-to-cylinder bore clearance.

2) Using cylinder bore gauge, measure cylinder bore diameter 90° to crankshaft. Also measure diameter in line with crankshaft. Take measurements from 1/32" to 2 5/64" below upper face of cylinder block. Reboring is necessary if wear exceeds .008" (.2 mm). If measurement exceeds .016" (.4 mm), replace cylinder block.

3) Cylinder bore diameter is designated by a letter code, stamped on cylinder block upper face. Corresponding letter code denotes size of piston used.

PISTON PINS

Removal

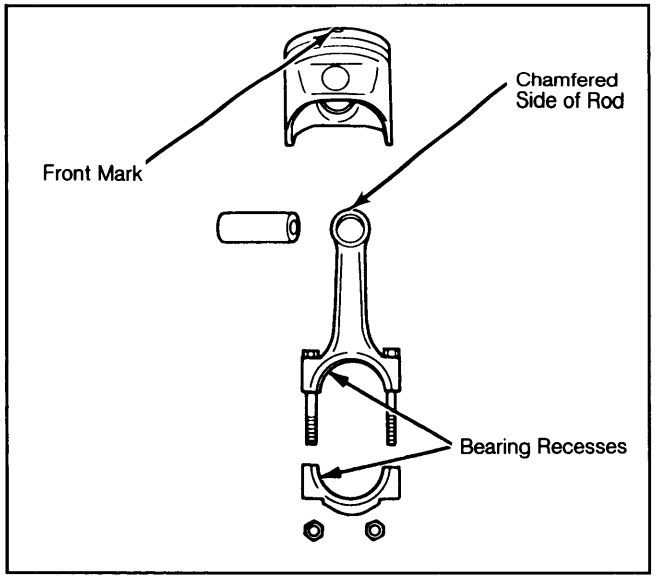
Using arbor press and piston pin remover tool, press pin from piston and connecting rod.

Installation

Apply coat of engine oil to piston pin bores in piston and connecting rod. Assemble connecting rod to piston with chamfered side on rod's pin bore end on same side as mark (front) on piston head. *See Fig. 7.* Using arbor press and pin installer tool, press piston pin into piston and rod assembly.

1.9 LITER 4-CYLINDER (Cont.)

Fig. 7: Piston-to-Connecting Rod Positioning.



Note position of bearing recesses.

FITTING RINGS

1) Position ring into cylinder bore at a point where bore diameter is smallest. Ring must be square in bore. Measure ring end gap with a feeler gauge.

2) Using feeler gauge, measure side clearance between piston rings and ring lands. Take measurements at several points around circumference of piston. Replace piston and rings if measurement exceeds specification, or if abnormal wear is noticeable on piston rings or ring lands.

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

NOTE: Use Plastigage method for checking bearing clearances. Following procedures are performed with oil pan removed, and oil film removed from surfaces to be checked.

Connecting Rod Bearings

1) Mark connecting rod and rod caps for cylinder identification. Place crankshaft journal of cylinder to be checked towards bottom of stroke and remove rod cap.

2) Place strip of Plastigage across journal surface, in line with crankshaft centerline, about ¼" off center, and away from oil holes. Install cap and tighten to specification. Do not allow crankshaft to turn.

3) Remove cap and measure width of compressed Plastigage with scale furnished. Replacement bearings are available in standard, .010" (.25 mm) undersize and .020" (.50 mm) undersize.

Main Bearings

1) Check main bearing clearances one at a time. Make sure main bearing caps are marked for identification. Use Plastigage method (as explained in Connecting Rod Bearings) to measure main bearing clearance, tightening caps to specification.

2) Install upper main bearings in cylinder block and position crankshaft in place. Install thrust washers on both sides of No. 3 journal, with oil grooves towards crankshaft counterweight. Force crankshaft endwise and check end clearance with feeler gauge inserted between crankshaft and thrust washer.

3) Install main bearings and caps. Arrows on bearing caps must be positioned toward front of engine. Tighten bearing caps in progressive steps, in the following sequence: No. 3, No. 4, No. 2, No. 5 and No. 1.

4) Replacement bearings are available in standard, .010" (.25 mm) undersize and .020" (.50 mm) undersize.

REAR MAIN OIL SEAL

Removal

Remove oil pan. Remove crankshaft seal retainer from rear of engine.

Installation

Position new seal in retainer. Fill gap between lips of seal with grease, and coat seal lips with engine oil. Place retainer on a flat surface and drive seal into place using seal installer tool (J-25031). Reverse removal procedure to complete installation.

CAMSHAFT

ENGINE FRONT COVER

Removal

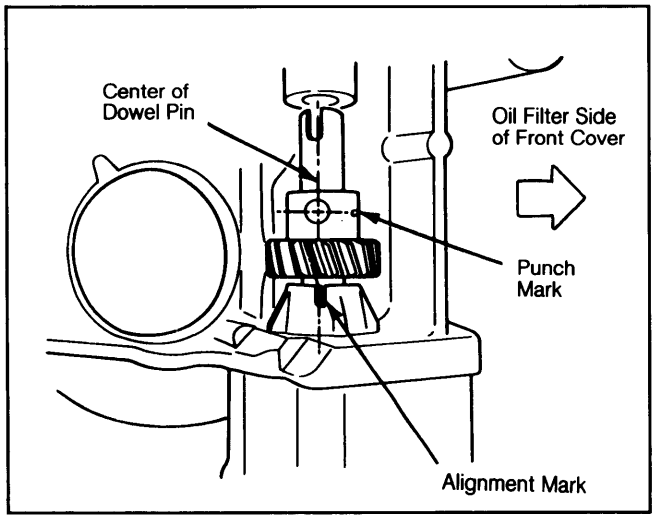
1) Remove cylinder head. Remove oil pan and pick up tube from oil pump. Remove all drive belts from crankshaft pulley, then remove vibration damper.

2) If equipped with A/C and/or power steering pump, remove these components with their respective brackets. Remove distributor. Remove front cover and discard gasket.

Installation

1) Clean all gasket mating surfaces. Install new gasket onto cylinder block. Align punch mark on oil pump gear with oil filter side of cover. Center of dowel pin on pump drive gear must align with pump cover alignment mark. *See Fig. 8.*

Fig. 8: Aligning Oil Pump for Front Cover Installation



Oil pump gear must engage with pinion gear on crankshaft.

1.9 LITER 4-CYLINDER (Cont.)

2) Rotate crankshaft to position No. 1 piston at TDC. Install front cover by engaging pinion gear with oil pump gear on crankshaft. Ensure slotted end of oil pump shaft is parallel with front of cylinder block, and that offset is forward. Install and tighten front cover bolts. Reverse removal procedures to install remaining components.

FRONT COVER OIL SEAL

Removal

Disconnect negative battery cable. Drain cooling system and remove radiator. Remove engine fan. Remove all drive belts from crankshaft pulley. Remove vibration damper. Carefully pry out front cover oil seal with screwdriver.

Installation

Install new seal using seal installing tool (J-26587 or equivalent). Lubricate seal lips with engine oil. Install remaining components in reverse order of removal.

TIMING CHAIN & SPROCKETS

Removal

1) Remove front cover. Lock automatic timing chain adjuster shoe in fully retracted position, by depressing adjuster lock lever and rotating clockwise (as viewed from top of engine), while pushing in on shoe. *See Fig. 1.* After locking automatic adjuster, check that chain tension is released.

2) Remove timing chain and sprockets. Use a gear puller to remove crankshaft sprocket and pinion gear, if removal is necessary.

Installation

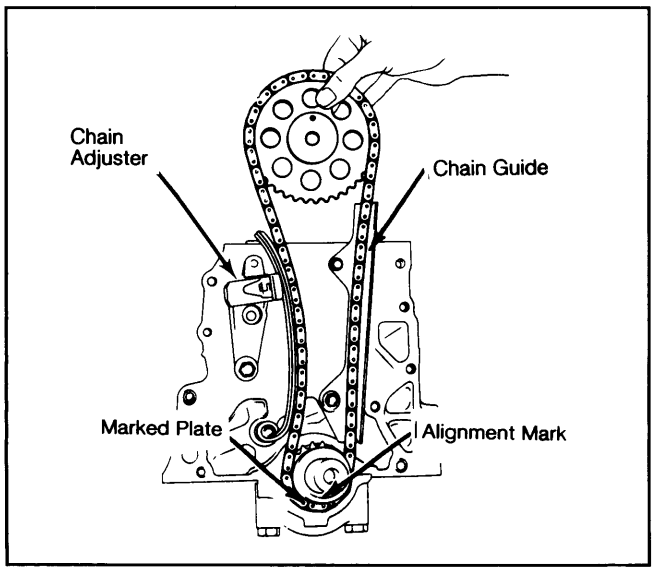
1) Check timing sprockets for wear or damage and replace as necessary. If removed, install crankshaft sprocket and pinion gear onto crankshaft with grooved side toward front cover. Turn crankshaft to place Woodruff key upward.

2) The timing chain has 2 link plates that are marked for sprocket alignment purposes. The positioning of the marked plates on the chain are such, that there are more plain links on one side of chain than on the other side. The side of the chain with more plain links between the marked plates, is installed on chain guide side (left side) of engine.

3) Install timing chain on crankshaft, aligning marked link on chain with mark on crankshaft timing sprocket. *See Fig. 9.*

4) Install chain over camshaft sprocket with triangular timing mark aligned with marked plate on chain. Install and tighten camshaft sprocket on camshaft. If removed, install automatic chain adjuster, and release lock. Reverse removal procedures to install remaining components.

Fig. 9: Aligning Timing Chain and Sprockets



Install timing chain with most links between marked plates, towards chain guide side (left side) of engine.

CAMSHAFT

Removal

1) Remove cam cover. Rotate crankshaft to position No. 4 piston on TDC at end of compression stroke. Remove distributor cap and mark rotor-to-housing position. Remove distributor. Remove fuel pump.

2) Lock automatic timing chain adjuster shoe in fully retracted position, by depressing adjuster lock lever and rotating clockwise (as viewed from top of engine), while pushing in on shoe. *See Fig. 1.* After locking automatic adjuster, check that chain tension is released.

3) Remove camshaft sprocket attaching bolt and fuel pump eccentric, being careful not to allow chain to come off of camshaft sprocket. Keep timing sprocket on chain damper and tensioner without removing chain from sprocket. Remove rocker arm shaft and bracket assembly.

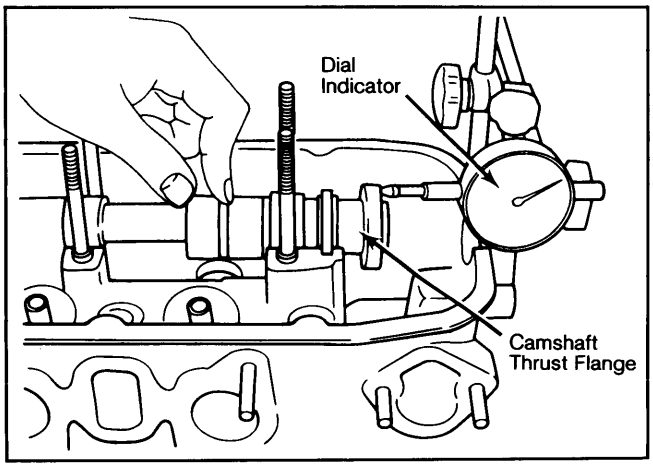
Installation

1) Heavily coat camshaft journals and mating bearing surface in cylinder head with engine oil. Position camshaft on cylinder head, and install rocker arm shaft and bracket assembly. Ensure that mark on No. 1 rocker arm shaft bracket is aligned with mark on camshaft thrust flange, and that TDC mark on front cover is aligned with crankshaft pulley groove.

2) Using care not to allow chain to separate from camshaft sprocket, assemble sprocket to camshaft. Install fuel pump eccentric and sprocket attaching bolt and washer.

3) Remove half-moon seal from front of cylinder head to tighten camshaft sprocket bolt. Replace half-moon seal in cylinder head. Depress shoe on automatic adjuster to release lock. Reverse removal procedures to install remaining components.

Fig. 10: Measuring Camshaft End Play



Maximum camshaft end play is .008" (.2 mm).

General Motors 4 Engines

1.9 LITER 4-CYLINDER (Cont.)

CAMSHAFT END THRUST

Position camshaft on cylinder head. Attach dial indicator to front end of head. *See Fig. 10.* Push camshaft rearward and zero dial indicator. Push camshaft forward to record maximum movement. If end play exceeds .008" (.20 mm), check for cylinder head and camshaft wear. Replace worn components.

ENGINE OILING

Crankcase Capacity

Capacity is 4 quarts (3.8L), with or without oil filter replacement.

Oil Filter

Replace at every other oil change, or more often under severe or dusty operating conditions.

Normal Oil Pressure

With engine at normal operating temperature, oil pressure should be 30-40 psi (2.1-2.8 kg/cm²) at speeds of 35-40 MPH.

Pressure Regulator Valve

Located in oil pump body, not adjustable.

ENGINE OILING SYSTEM

Engine lubrication system is pressure circulation type with full-flow oil filter. Pump delivers oil to main gallery, where it is routed to crankshaft journals. Through oil passages in crankshaft, oil is fed to connecting rod journals, connecting rods, and then to piston pins.

A branched oil passage from No. 3 crankshaft journal, routes oil to cylinder head. This oil flows through rocker arm shafts to lubricate rocker arms. An oil well, located on upper face of cylinder head, provides lubrication to camshaft.

Timing chain and sprockets are lubricated by oil feed from No. 1 crankshaft journal oil passage, and sprayed by oil jet on chain guide. A by-pass valve is incorporated into the lubrication system.

OIL PUMP

Removal

Remove oil pan. Remove bolt attaching oil inlet pipe to engine. Remove oil pump from front cover.

Installation

Prime oil pump. Assemble pump and inlet tube to engine. Install and tighten attaching bolts.

ENGINE COOLING

WATER PUMP

Removal

1) Disconnect negative battery cable. Remove lower fan shroud and drain radiator. If not equipped with A/C, remove fan.

2) On A/C models, remove air pump and alternator mounting bolts and pivot pump and generator in towards engine. Remove drive belts from water pump pulley. Remove fan and pulley and air pump drive pulley. Remove fan set plate and pulley. Remove water pump.

Installation

Reverse removal procedures to install water pump. Adjust belt tensions. Start engine and check for coolant leaks.

NOTE: For further information on cooling system capacities and other cooling system components, see appropriate article in "Engine Cooling Systems" at end of ENGINE Section.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Sprocket Bolt	58 (79)
Connecting Rod Cap Nuts	43 (58)
Cylinder Head Bolts	[1] 72 (98)
Engine Front Cover Bolts	18 (24)
Engine Rear Plate Bolts	36 (49)
Exhaust Manifold Nuts	16 (22)
Flywheel-to-Crankshaft Bolts	76 (103)
Intake Manifold Nuts	16 (22)
Main Bearing Cap Bolts	75 (101)
Rocker Shaft Bracket Bolts	16 (22)
Vibration Damper Bolt	87 (118)

[1] — Tighten in progressive steps to 60 ft. lbs. (81 N.m), then tighten to 72 ft. lbs. (98 N.m)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Year	Displ. cu. ins.	Displ. liters	Carburetor	HP at RPM	Torque Ft. Lbs.@RPM	Compr. Ratio	Bore in.	Bore mm	Stoke in.	Stoke mm
1982	118.9	1.9	2-Bbl.	.....	.....	8.4:1	3.4	87	3.2	82

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)
1.9L							
Int.	1.59 (4.04)	45°	45°		.310 Min. (7.88 Min.)	.0009-.0022 (.023-.056)	.....
Exh.	1.34 (34.0)	45°	45°		.309 Min. (7.85 Min.)	.0015-.0031 (.038-.078)	.....

General Motors 4 Engines

1.9 LITER 4-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)
1.9L	.0018-.0026 (.045-.065)	[1]	Press Fit	1	.012-.020 (.30-.50)	.006 Max. (.15 Max.)
				2	.008-.016 (.20-.40)	.006 Max. (.15 Max.)
				3	.008-.035 (.20-.90)	.006 Max. (.15 Max.)

[1] — Pin should press into piston with finger pressure.

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)
1.9L	2.2016-2.2022 (55.920-55.935)	.0008-.0025 (.021-.064)	No. 3	.012 Max. (.30 Max.)	1.9262-1.9268 (48.925-48.940)	.0007-.0025 (.018-.064)	.014 Max. (.35 Max.)

VALVE SPRINGS

Engine	Free. Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
1.9L			
Inner	1.78 (45.3)	.....	.....
Outer	1.85 46.9		

CAMSHAFT

Engine	Journal In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
1.9L [1]	1.336-1.337 (33.94-33.96)	.0016-.0035 (.040-.090)	.....

[1] — End play is .002-.006" (.05-.15 mm).