2.8 LITER V6

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine may be identified from the Vehicle Identification Number (VIN) stamped on a metal tab located on top of instrument panel at lower left of windshield. VIN number code also appears as part of a production or unit number stamped on front of engine block, below right cylinder head. Code number is also found on tape on front and rear of left rocker arm cover. The VIN number contains 17 digits. The 8th digit identifies the engine and the 10th digit establishes the model year.

Engine Code

Engine	Code
2.8L (173") 2-Bbl.	
Standard	X
High Output	Z

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEADS & MANIFOLDS

INTAKE MANIFOLD

Removal – 1) Disconnect battery, remove air cleaner and drain cooling system. Disconnect upper radiator hose, heater hose and accelerator linkage and springs from manifold. If equipped with automatic transaxle, remove TV linkage at carburetor lever. If equipped, remove cruise control diaphragm actuator mounting bracket. Remove front engine strut at radiator support and engine bracket.

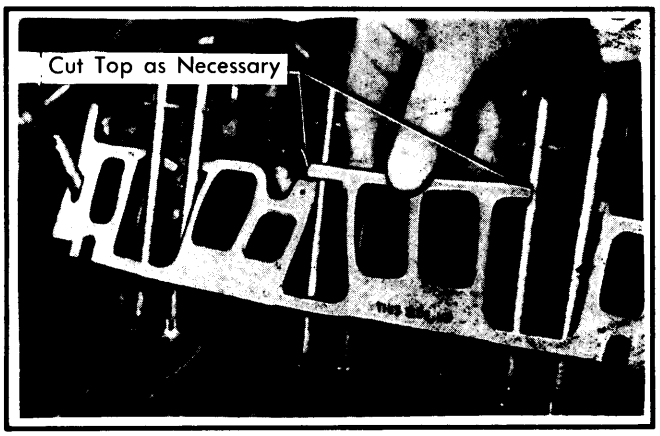

Fig. 1 Installing Intake Manifold Gasket

2) Remove front engine strut bracket from cylinder head. Remove both rocker arm covers. Remove distributor cap, mark position of rotor and remove distributor. Remove power brake vacuum pipe and bracket. Disconnect all electrical wiring, vacuum lines and fuel line at manifold. Remove EFE pipe from rear of manifold. Remove intake manifold retaining bolts and nuts and remove manifold.

Installation – Apply a 3/16" bead of RTV sealer or equivalent on front and rear ridges of block. Install new gaskets on cylinder heads and extend RTV bead 1/4" onto gasket ends to hold them in place. Install intake manifold and check area between ridges and manifold for complete seal. Install bolts and nuts and tighten in sequence. See *Fig. 2*. To complete installation, reverse removal procedure.

NOTE – *When installing intake manifold gaskets, gaskets are marked Right Side and Left Side. New gaskets will have to be cut to install behind push rods. See Fig. 1.*

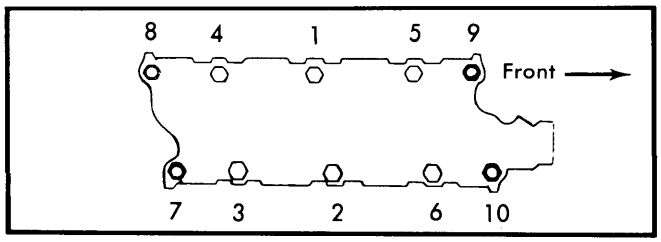

Fig. 2 Intake Manifold Tightening Sequence

EXHAUST MANIFOLDS

Removal (Left Side) – Remove air cleaner and hot air pipe. Remove PAIR manifold and tubing from exhaust manifold. Raise vehicle on hoist. Disconnect exhaust pipe at manifold. Remove exhaust manifold bolts and remove manifold.

Removal (Right Side) – Raise vehicle on hoist. Tighten exhaust flange bolt upper nuts until bolts break. Disconnect exhaust pipe at manifold. Lower vehicle. Disconnect spark plug wires at spark plugs. Remove air injection tubing from exhaust manifold. Remove exhaust manifold bolts and remove manifold. See *Fig. 3*.

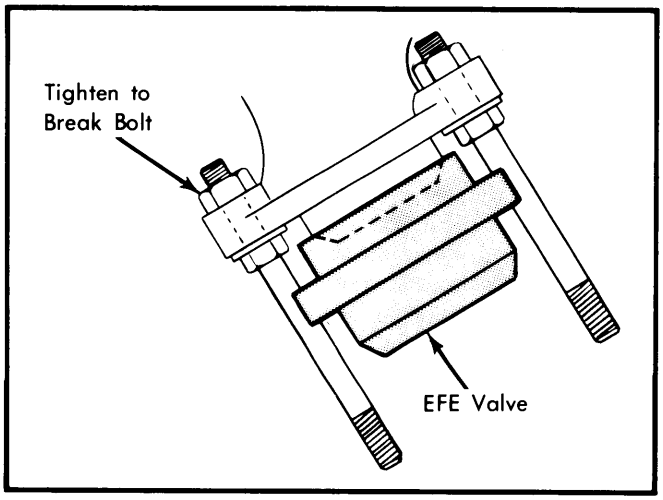

Fig. 3 Exhaust Manifold Flange Bolts (Right Side Only)

Installation – Clean exhaust manifold and cylinder head mating surfaces of any carbon and/or dirt. Position manifold to cylinder head. Install new bolts and tighten. Reverse removal procedure to complete installation.

CYLINDER HEADS

Removal – Remove intake and exhaust manifolds as previously described. Remove alternator bracket and stud. Remove dipstick tube bracket from left cylinder head. Loosen rocker arms and remove push rods. Remove head bolts, cylinder heads and gaskets.

Installation – 1) Clean cylinder block and cylinder head mating surfaces of any gasket material, carbon and/or dirt. Make sure mating surfaces are free of any nicks or heavy scratches. Clean bolt hole threads in cylinder block to ensure proper bolt torque.

2.8 LITER V6 (Cont.)

2) Install gaskets with note "This Side Up" showing. Install cylinder heads, applying sealing compound to head bolt threads and tighten in sequence. See *Fig. 4*. Install push rods and rocker arms and adjust valves. Reverse removal procedure to complete installation.

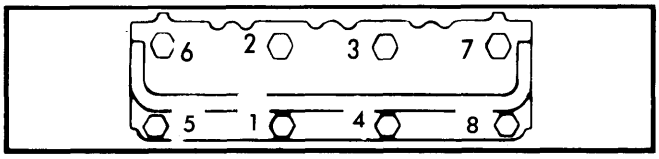

Fig. 4 Cylinder Head Tightening Sequence

VALVES

VALVE GUIDE SERVICING

If valve guide stem-to-guide clearance exceeds specifications, ream valve guide to next oversize. Valves are available with .0035" (.089 mm), .0155" (.394 mm) and .0305" (.775 mm) oversize stems.

VALVE STEM OIL SEALS

An "O" ring type seal is installed on lower groove of valve stem on all valves. A teflon type oil seal is installed on guide on intake valves only, in addition to "O" ring type. A light coat of oil on stem will help prevent twisting of the "O" ring type seal during installation.

VALVE SPRINGS

Removal – Remove rocker arm cover, spark plug, rocker arm and push rod on cylinder(s) to be serviced. Install air line adapter (J-23590) to spark plug port and apply compressed air to hold valves in place. Using a suitable tool (J-5892), compress valve spring and remove valve locks, retainer or rotator, oil shield (exhaust only), valve spring and damper. Remove and discard oil seals. See *Fig. 5*.

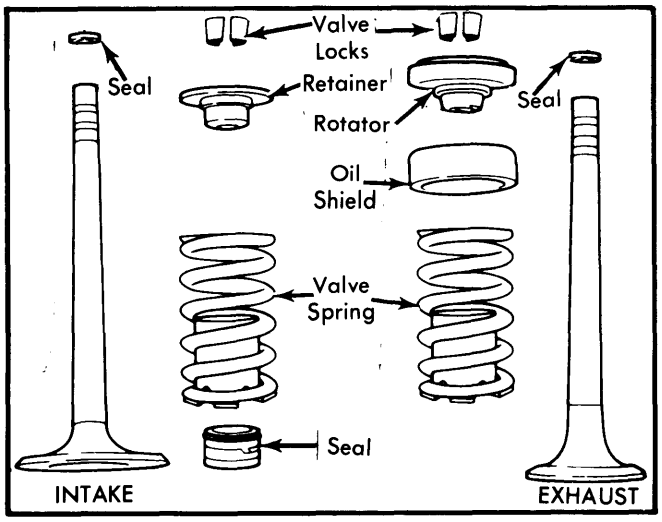

Fig. 5 Exploded View of Valve Assemblies

Installation – **1)** Check springs using suitable valve spring tester. Springs should be replaced if not within 10 lbs. of specified load (without dampers). Position valve spring, damper, oil seal (intake only), oil shield (exhaust only) and retainer or rotator in place.

2) Compress spring and install "O" ring type seals in lower groove of stems (ensure that seal is flat and not twisted). Oil seal with engine oil, install valve locks and release compressor tool. Make sure valve locks are properly seated in upper groove of valve stem.

VALVE SPRING INSTALLED HEIGHT

Installed height of valve spring should be 1.575" (40 mm). Measure from top of spring seat (in head) to top of oil shield (exhaust only) or retainer (intake only). If measurement exceeds specifications, install a .030" (.75 mm) shim at spring seat. See *Fig. 6*.

NOTE – *Do not shim any more than this to obtain a spring height under minimum specifications.*

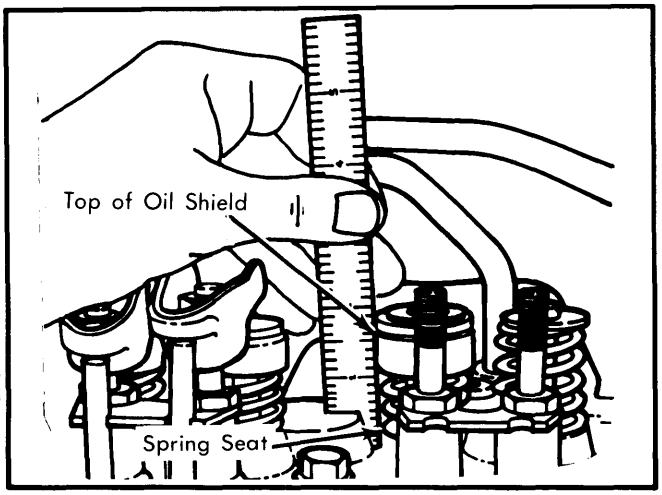

Fig. 6 Checking Valve Spring Installed Height

VALVE ADJUSTMENT

1) To adjust valves, rotate crankshaft to No. 1 firing position and adjust following valves:

- Intake No. 1, 5 and 6.
- Exhaust No. 1, 2 and 3.

2) Adjust valves by backing off adjusting nut until lash is felt at push rod, then tighten until all lash is removed. Tighten adjusting nut an additional 1½ turns. See *Fig. 7*. Rotate crankshaft to No. 4 firing position and adjust following valves:

- Intake No. 2, 3 and 4.
- Exhaust No. 4, 5 and 6.

3) When adjustment is complete, install rocker arm covers. Start engine and check timing and idle speed.

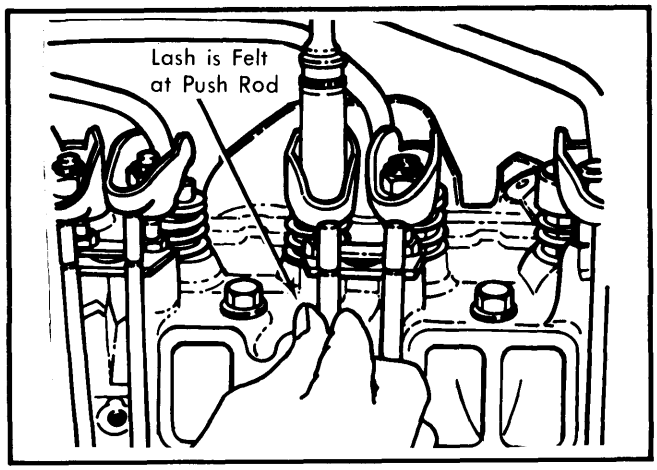

Fig. 7 Adusting Valve Lash

2.8 LITER V6 (Cont.)

ROCKER ARM STUDS

Cylinder heads use threaded rocker arm studs. Rocker arm studs that have damaged threads should be replaced with new studs. If threads in the head are damaged or stripped, the head can be retapped, and a helical type insert installed. If a helical insert is not available, replace cylinder head.

HYDRAULIC VALVE LIFTER ASSEMBLY

If hydraulic valve lifters are being removed, mark or identify lifters to ensure that they are installed in original position. Lifters are serviced as complete assemblies only. If lifter is damaged or worn, complete lifter must be replaced. If lifters are disassembled for cleaning and inspection, after reassembly they should be tested using a suitable leakdown rate tester.

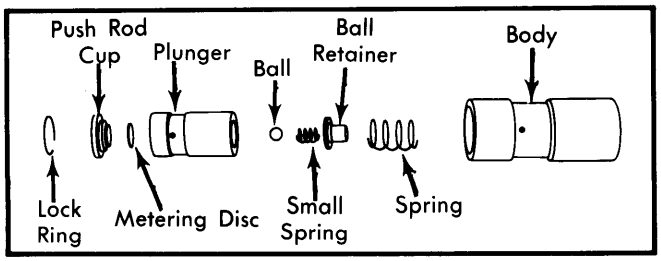

Fig. 8 Exploded View of Hydraulic Lifter Assembly

NOTE – *Some engines will have both standard and .010" oversize valve lifters. The cylinder block will be marked, where the oversize lifters are used, with a dab of white paint and 0.25 (mm) O.S. stamped on lifter boss. See Fig. 9.*

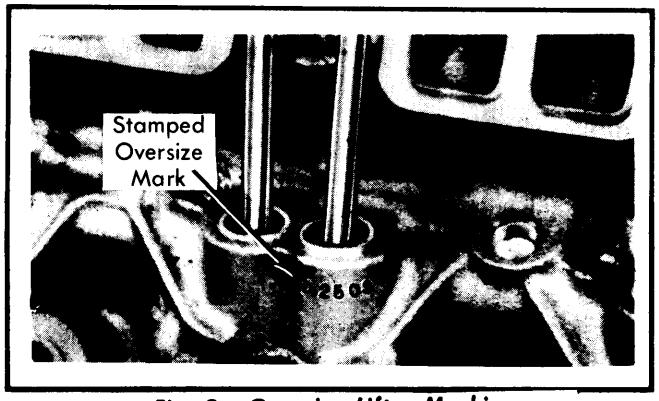

Fig. 9 Oversize Lifter Marking

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

With oil pan, oil pump and cylinder heads removed, place piston at bottom of stroke and cover with a cloth to catch cuttings. Use a suitable ridge reamer to remove any ridge or deposits from upper portion of the cylinder bore. Be sure piston and rod assemblies are marked for installation in their original locations.

Removal – With piston at bottom of stroke, remove connecting rod caps and install suitable guides over rod bolts. Push piston and rod out top of bore. Reinstall caps to their respective connecting rods. If necessary, rotate crankshaft to remove remaining caps.

Installation – 1) Apply a light coat of engine oil to pistons, rings and cylinder bores. Use suitable compression tool to compress rings during installation. Make sure ring gaps are spaced as shown. *See Fig. 10.*

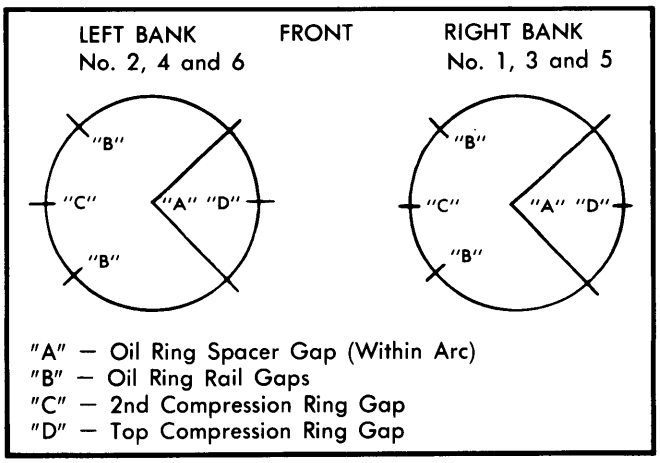

Fig. 10 Piston Ring Gap Spacing

2) Install piston and rod assembly with rod bearing tang slot on opposite side from camshaft.

3) Remove guides from rod bolts and install bearings and caps and tighten.

FITTING PISTONS

Measure cylinder bore diameter, then measure piston diameter (with rod and pin removed) at skirt across centerline of piston pin. Maximum fitted clearance is .002" (.050 mm) for new pistons, and .0024" (.060 mm) for used pistons. Oversize coded pistons are available in .020" (.50 mm) and .040" (1.0 mm) sizes. See Piston Size Code Chart.

Piston Size Code Chart

Code	Size In. (mm)
Standard	
S4	3.5029-3.5034 (88.975-88.988)
S5	3.5034-3.5039 (88.988-89.001)
Max. Limit	
S6	3.5039-3.5045 (89.001-89.014)
S7	3.5045-3.5050 (89.014-89.027)
.020" (.50 mm) Oversize	
1	3.5226-3.5231 (89.475-89.488)
2	3.5231-3.5236 (89.488-89.501)
3	3.5236-3.5242 (89.501-89.514)
4	3.5242-3.5247 (89.514-89.527)
.040" (1.0 mm) Oversize	
1	3.5423-3.5428 (89.975-89.988)
2	3.5428-3.5433 (89.988-90.001)
3	3.5433-3.5438 (90.001-90.014)
4	3.5438-3.5444 (90.014-90.027)

PISTON PINS

Using a suitable piston pin tool (J-24086-20) and adapters, remove pin. With piston and rod separated, inspect pin and pin bore for wear and measure clearance. Pin bore in rod is press fit. If pin bore in piston exceeds .00036" clearance, replace piston and pin as an assembly.

2.8 LITER V6 (Cont.)

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

NOTE – *Precision bearings are used in this engine and shimming is not acceptable for adjustment. Never file or grind connecting rods or caps when fitting bearings.*

Connecting Rod Bearings – 1) Remove rod cap and use Plastigage method to check bearing clearance. Place Plastigage across full width of bearing journal, parallel to crankshaft. Install rod cap and torque nuts to 37 ft. lbs. Remove rod cap and determine amount of clearance by measuring width of compressed Plastigage at widest point.

2) Bearings must be replaced if clearance is not within specifications. New bearings are available in standard, .0005" (.013 mm) and .001" (.025 mm) undersize for use with standard size crankshaft.

3) Use a micrometer to check for out-of-round condition on crankshaft journals. If journals are more than .001" (.025 mm) out-of-round, crankshaft must be replaced.

4) When all bearings are checked and/or replaced and checked once more, tap each rod lightly (parallel to crankpin). Rod clearance between rod cap and side of crankpin should be .006-.017" (.16-.44 mm).

NOTE – *If clearance cannot be brought within specifications with service bearings, grind crankpin(s) to next undersize. If already ground to maximum undersize, replace crankshaft.*

Main Bearings – 1) If bearings are being checked with engine in vehicle, crankshaft must be supported to take up clearance between upper bearing half and crankshaft. Support crankshaft at both damper and flywheel and ensure that all bearing caps, other than the one being checked, are tightened to specifications.

NOTE – *When checking No. 1 main bearing, remove all accessory drive belts to prevent a tapered distortion of the Plastigage.*

2) Start with rear main bearing cap and work forward. Remove main cap and use Plastigage method to check bearing clearance. Place Plastigage across full width of bearing journal, parallel to crankshaft. Install main cap and torque bolts to 70 ft. lbs.

3) Remove main cap and determine amount of clearance by measuring width of compressed Plastigage at widest point. Bearings must be replaced if clearance is not within specifications. New bearings are available in standard, .0005" (.013 mm) and .001" (.025 mm) undersize for use with standard size crankshaft. Replace upper and lower inserts as a unit.

4) Use a micrometer to check for out-of-round condition on crankshaft journals. If journals are more than .001" (.025 mm) out-of-round, crankshaft must be replaced or reconditioned. If within specifications, coat bearings with oil and install main caps. When all bearings are checked and/or replaced and checked once more, check thrust bearing alignment.

THRUST BEARING ALIGNMENT

Make sure all main bearing caps are installed with arrows pointing toward front of engine. Torque main bearing cap bolts (except No. 3) to 70 ft. lbs. Torque No. 3 main thrust bearing cap bolts to 11 ft. lbs. and tap end of crankshaft rearward and then forward to line up main bearing thrust surfaces with crankshaft thrust face. Torque all main bearing cap bolts to specifications. Rotate crankshaft to ensure there is no excessive drag. Measure end play at front end of No. 3 main bearing using feeler gauge. End play should be .002-.007" (.05-.17 mm).

REAR MAIN BEARING OIL SEAL

NOTE – *Upper rear main bearing oil seal is serviced through repair, rather than replacement. Lower rear main bearing oil seal should be replaced at time of repair to upper seal.*

1) Remove oil pan, oil pump and rear main bearing cap. Use a suitable packing tool (J-29114-2 or equivalent) and drive upper oil seal into groove in cylinder block approximately 1/4" on both sides.

2) Measure the amount the seal was driven in on one side and add 1/16" to this amount. Cut this length from the old lower seal. Repeat this for the other side.

3) Place the piece of cut seal into the groove of a suitable seal installer guide (J-29114-1) and install the guide onto the block. Using the packing tool, drive the seal into the block. Drive until the packing tool reaches its machined stop. Repeat for opposite side.

4) Install new seal into rear main bearing cap. Use Plastigage to check clearance. If out of specifications, recheck seal ends for fraying or anything between cap-to-block interface preventing proper seating of cap. Apply anaerobic sealant to cap interface. Install cap and tighten bolts. Install oil pump and oil pan.

CAMSHAFT

FRONT ENGINE COVER

Removal – Disconnect negative battery cable. Remove accessory drive belts and drain cooling system. Remove water pump. Remove A/C compressor and bracket. Use suitable torsional damper tool (J-23523) and remove damper. Disconnect lower radiator hose at front cover and heater hose at water pump connection. Remove front cover. *See Fig. 11.*

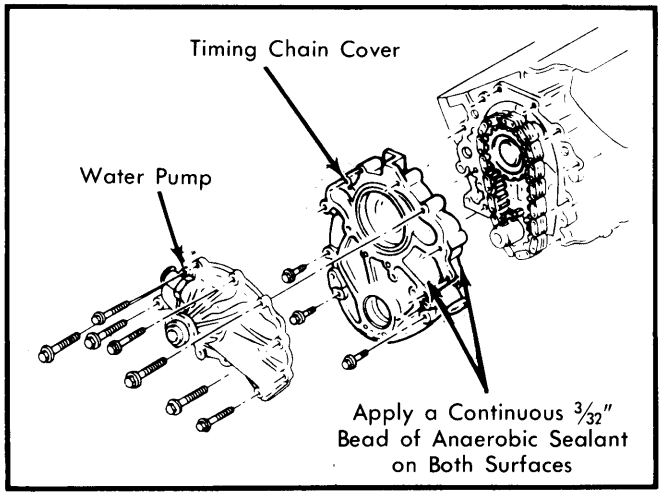

Fig. 11 Water Pump & Front Cover

2.8 LITER V6 (Cont.)

Installation – Clean sealing surfaces thoroughly. Apply a continous 3/32" bead of anaerobic sealant to front cover sealing surfaces. See *Fig. 12*. Place front cover on engine and install water pump. Install bolts and tighten. Reverse removal procedure to complete installation.

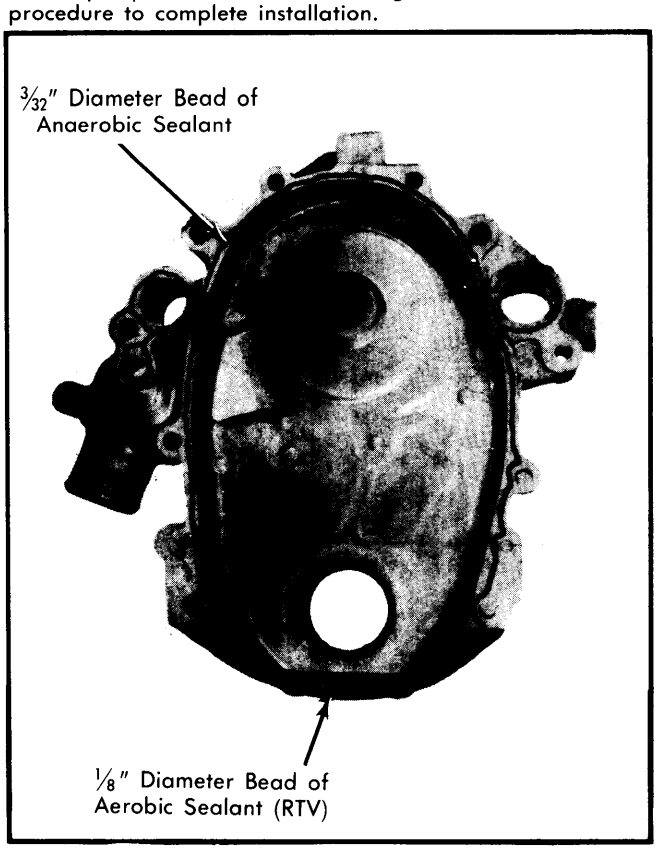

Fig. 12 Front Cover Sealant Placement

FRONT COVER OIL SEAL

Removal – The oil seal may be replaced without removing front cover. Remove torsional damper and pry seal outward. Use caution when removing seal so crankshaft is not damaged.

Installation – Install new seal with open side toward inside of front cover. Use a suitable seal aligner and installing tool (J-23042) to drive seal into position.

TIMING CHAIN

Removal – Remove front cover and rotate engine to TDC and align timing marks on crankshaft and camshaft sprockets (No. 4 firing position). Remove camshaft sprocket-to-camshaft. Remove sprocket and timing chain as an assembly. See *Fig. 13*.

NOTE – *Sprocket is light press fit on camshaft, dislodge by tapping lightly on lower edge of sprocket with a plastic mallet.*

Installation – 1) Place timing chain over camshaft sprocket so that it hangs below sprocket. Align marks on camshaft and crankshaft sprockets. See *Fig. 13*.

2) Align dowel in camshaft with dowel hole in camshaft sprocket. Install sprocket on camshaft. Use mounting bolts to draw sprocket onto camshaft and tighten bolts. Check sprocket alignment, lubricate chain with engine oil and install other components as previously described.

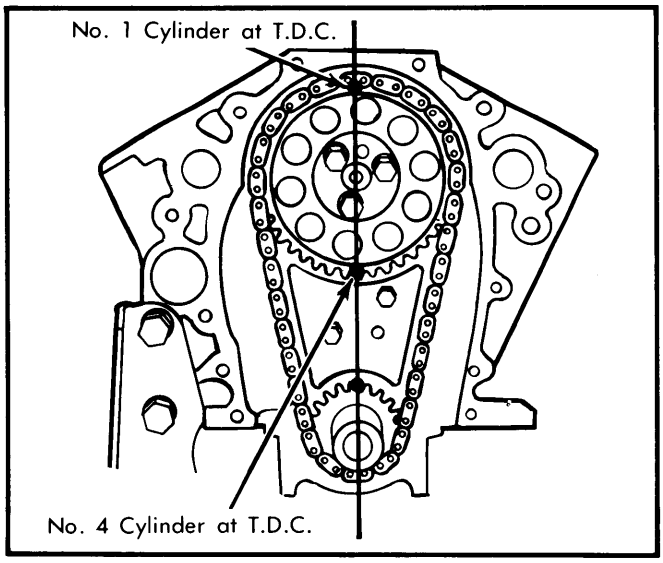

Fig. 13 Timing Chain Sprocket Alignment

CAMSHAFT

Removal – With engine removed from vehicle, remove front cover, intake manifold, rocker arm assemblies, push rods, valve lifters, fuel pump and fuel pump push rod. Remove timing chain and sprocket from end of camshaft and remove camshaft.

NOTE – *All camshaft journals are the same diameter. Use care when removing or replacing camshaft to prevent damage to lobes, journals or bearings. If journals are more than .001" (.025 mm) out-of-round, replace camshaft and install all new lifters of the "flatted" type.*

Installation – Lubricate journals with engine oil and apply Molycote (or equivalent) to camshaft lobes. Carefully install camshaft, making sure not to nick or damage camshaft lobes or journals. Reverse removal procedure to complete installation.

CAMSHAFT BEARINGS

Removal – 1) With crankshaft and camshaft removed, remove cam cover at rear of cylinder block. Use a suitable camshaft bearing removal tool set (J-6098).

2) Remove front intermediate bearing, with tool indexed on front bearing. Remove rear intermediate bearing, with tool indexed on rear bearing. Assemble removal tool on drive handle and remove front and rear bearings by driving them toward the center of the engine.

Installation – 1) Install front and rear bearings first. These act as guides for the pilot and center the remaining bearings which are being pulled into place. Install front and rear bearings by driving toward the center of the block.

NOTE – *Position bearings when installing so that oil holes line up with oil gallery holes in the block.*

2) Install each center bearing using same index location used in removal. Pull bearings into bearing saddle from the center. Reverse removal procedure to complete operation.

2.8 LITER V6 (Cont.)

ENGINE OILING

Crankcase Capacity – 4 quarts with or without filter change.

Oil Filter – Full flow type. Change at first oil change and every other one thereafter.

Normal Oil Pressure – 30-45 psi at 2000 RPM.

Pressure Regulator Valve – Located in oil pump body. Not adjustable.

ENGINE OILING SYSTEM

Oil is supplied under pressure by a gear type pump, driven by the distributor, which in turn is driven by a helical gear on the camshaft. The main oil gallery (along the left of the camshaft) feeds oil through drilled passages to the camshaft and crankshaft to lubricate the bearings. The valve lifter oil gallery feeds valve lifters, which through hollow push rods feed individually mounted rocker arms. All other components are lubricated by splash or nozzle.

OIL PUMP

Disassembly – Remove pump cover and mark teeth on both gears for reassembly with same teeth indexing. Remove idler gear, drive gear and shaft from pump body. Remove pressure regulator valve retaining pin, valve and spring. If necessary to replace, remove oil pickup tube from body.

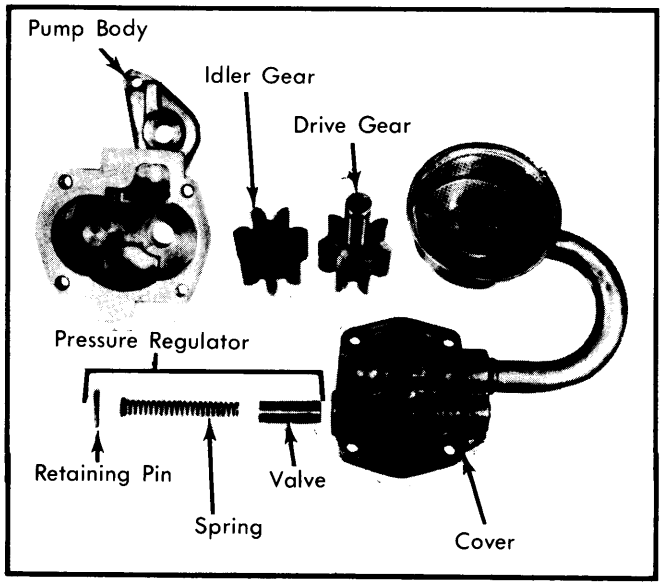

Fig. 14 Exploded View of Oil Pump Assembly

NOTE – *If pump gears or body are damaged and/or worn, replacement of pump assembly is required. Do not disturb pickup screen on pipe. This is serviced as an assembly only.*

Reassembly – If removed, apply sealer to outside of swaged end of pipe and tap into place. Install pressure regulator valve, spring and retaining pin. Install idler gear, drive gear and shaft into pump body. Install pump cover and check drive shaft for free operation. Install oil pump to engine, making sure pickup screen is parallel with oil pan rails.

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Cylinder Head	65-75 (8.99-10.37)
Connecting Rod Cap	34-40 (4.70-5.53)
Main Bearing Cap	63-74 (8.71-10.23)
Camshaft Cover	6-9 (.83-1.24)
Rocker Arm Cover	6-9 (.83-1.24)
Oil Pump	26-35 (3.60-4.84)
Oil Pump Cover	6-9 (.83-1.24)
Oil Pan	
6 mm Bolts	6-9 (.83-1.24)
8 mm Bolts	14-22 (1.94-3.04)
Front Cover	
8 mm Bolts	13-18 (1.80-2.49)
10 mm Bolts	20-30 (2.77-4.15)
Camshaft Sprocket	15-20 (2.07-2.77)
Torsional Damper	66-84 (9.13-11.61)
Flywheel	45-55 (6.22-7.60)
Converter-to-Flex Plate Bolts	25-35 (3.46-4.84)
Clutch Pressure Plate Bolts	13-18 (1.80-2.49)
Exhaust Manifold Bolts	22-28 (3.04-3.87)
Intake Manifold Bolts	20-25 (2.77-3.46)
Rocker Arm Stud	43-49 (5.94-6.77)
Timing Chain Tensioner	13-18 (1.80-2.49)
Water Pump	
6 mm Bolts	6-9 (.83-1.24)
8 mm Bolts	13-18 (1.80-2.49)
10 mm Bolts	20-30 (2.77-4.15)

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Engine	HP at RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore		Stroke		Displ.	
				in.	mm	in.	mm	cu. ins.	cc
2.8L (173″)									
Standard	115@4800	145@2400	8.5:1	3.50	89.0	3.0	76.0	173	2800
High Output	135@5400	145@2400	8.9:1	3.50	89.0	3.0	76.0	173	2800

2.8 LITER V6 (Cont.)

ENGINE SPECIFICATIONS (Cont.)

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	① Journal Diam. In. (mm)	Clearance In. (mm)	Thrust Bearing	Crankshaft End Play In. (mm)	① Journal Diam. In. (mm)	Clearance In. (mm)	Side Play In. (mm)
2.8L (173")	2.4937-2.4947 (63.340-63.364)	.0017-.003 (.044-.076)	No. 3	.002-.008 (.05-.20)	1.9983-1.9993 (50.758-50.784)	.0014-.0035 (.036-.091)	.006-.017 (.16-.44)

① — Maximum out-of-round permissable is .001" (.025 mm).

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)
2.8L (173")							
Int.	.....	45°	46°	.049-.059 (1.25-1.50)	.....	.001-.0026 (.026-.068)	.346 (8.79)
Exh.	.....	45°	46°	.063-.075 (1.60-1.90)	.....	.001-.0026 (.026-.068)	.393 (9.98)

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)
2.8L (173")	.0017-.0027 (043-.069)	.00025-.00035 (.0065-.0091)	.0007-.002① (.0187-.0515)	1	.010-.020 (.25-.50)	.0012-.0027 (.030-.070)
				2	.010-.020 (.25-.50)	.0015-.0037 (.038-.095)
				3	.020-.055 (.51-1.40)	.0078② (.199)

① — Interference fit.
② — Maximum clearance permitted.

CAMSHAFT

Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
2.8L (173")	1.867-1.870 (47.44-47.49)	.001-.004 (.026-.101)	.231 (5.87) .262 (6.67)

VALVE SPRINGS

Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
2.8L (173")	1.91 (48.50)	88@1.57 (39.91@40)	195@1.18 (88.45@30)