General Motors V6 Engines

2.8 LITER V6

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine identification number is stamped on a machined pad on front of cylinder block, just rearward of engine front cover. Engine type is identified by a letter code (B), in eighth position of Vehicle Identification Number.

ENGINE IDENTIFICATION CODE

Engine	Code
2.8L (173") V6 2-Bbl.	TAD, TAF, TAH, TAJ, TAK TAL, TAM, TAR, TAS, TAT TAU, TAW, TAX, TAY, TWA TWD, TWF, TWH, TWJ

ENGINE REMOVAL

See Engine Removal at end of ENGINE Section.

CYLINDER HEAD & MANIFOLD

INTAKE MANIFOLD

Removal

1) Disconnect negative battery cable. Drain radiator. Remove air cleaner. Label and disconnect all electrical connectors, vacuum hoses and emissions hoses, at distributor, carburetor and intake manifold. Disconnect fuel line at carburetor.

2) Disconnect spark plug wires at spark plugs. Remove distributor cap and mark position of rotor. Remove distributor.

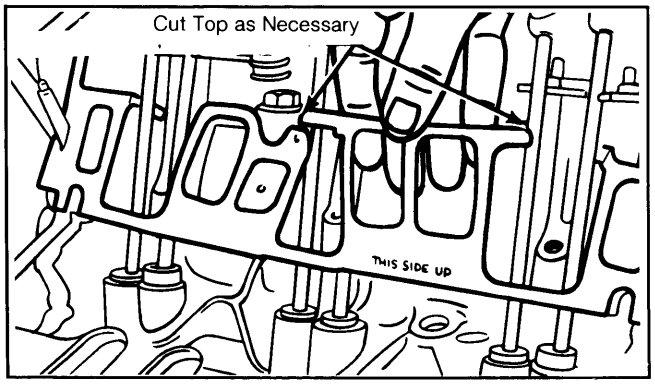
3) Remove all brackets attached to rocker arm covers, and remove covers. Remove upper radiator hose and heater hose from engine. Remove A/C drive belt and rotate compressor aside. Remove intake manifold and discard gaskets.

Installation

1) Clean all gasket mating surfaces. Apply 3/16" bead silicone sealer to front and rear sealing ridges of cylinder block. Install new intake manifold side gaskets onto cylinder heads. Gaskets are stamped "Left Side" and "Right Side."

2) Hold gaskets in place by extending silicone sealer bead 1/4" onto ends of side gaskets. New side gaskets will have to be cut, to install behind push rods. *See Fig. 1.*

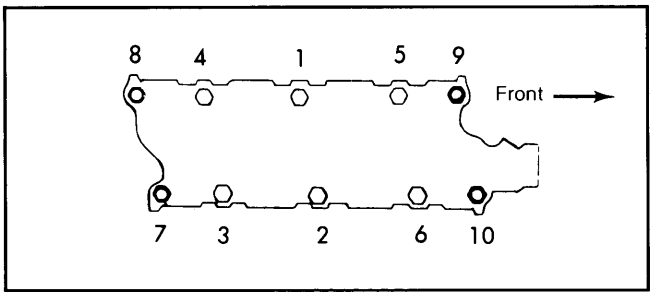
Fig. 1: Intake Manifold Gasket Modification



Gaskets are stamped "Left Side" and "Right Side."

3) Install intake manifold. Make sure sealing areas between cylinder ridges and ends of manifold are completely sealed. Install and tighten manifold attaching bolts and nuts. *See Fig. 2.* To complete installation, reverse removal procedure.

Fig. 2: Intake Manifold Tightening Sequence



Tighten attaching bolts and nuts to 20-25 ft. lbs. (27-34 N.m).

CYLINDER HEADS

Removal

1) Remove intake manifold. Raise vehicle and disconnect exhaust pipes at manifolds. Drain coolant from block. Remove oil dipstick tube attachment. Lower vehicle. Loosen rocker arm nuts and rotate rockers to side.

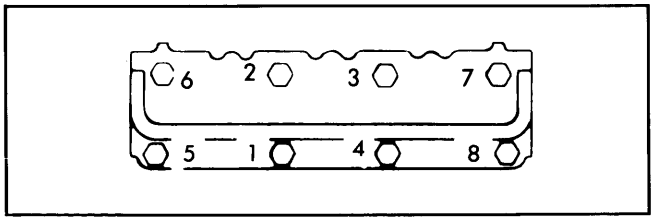
2) Remove push rods in sequence, for reinstallation in original locations. Remove alternator, power steering pump, A/C compressor, and respective mounting brackets for these components. Position assemblies aside. Remove cylinder heads.

Installation

1) Clean all gasket mating surfaces. Clean head bolt threads and threads in cylinder block.

2) Head gaskets are marked "This Side Up." Properly install gaskets in place on cylinder block. Install cylinder heads. Apply sealing compound to head bolt threads and install bolts. Tighten bolts in sequence. *See Fig. 3.*

Fig. 3: Cylinder Head Tightening Sequence



Tighten head bolts to 65-75 ft. lbs. (88-102 N.m).

3) Coat rocker arm balls and mating surface of rocker arms with Molykote (or equivalent), prior to installing. Install remaining components in reverse order of removal. Adjust valves.

VALVES

VALVE GUIDE SERVICING

If valve stem-to-guide clearance exceeds specifications, ream valve guide to proper oversize. Valves are available with .0035" (.089 mm), .0155" (.394 mm) and .0305" (.775 mm) oversize stems. Always use reamers in proper size sequence.

2.8 LITER V6 (Cont.)

VALVE STEM OIL SEALS

All valves use an "O" ring type oil seal, installed in lower groove of valve stem. Intake valves also use a teflon type seal, in combination with the "O" ring type seal.

The teflon type seal is installed over the valve guides of the intake valves. Lightly coat valve stem with engine oil, to help prevent twisting of the "O" ring type seal during installation.

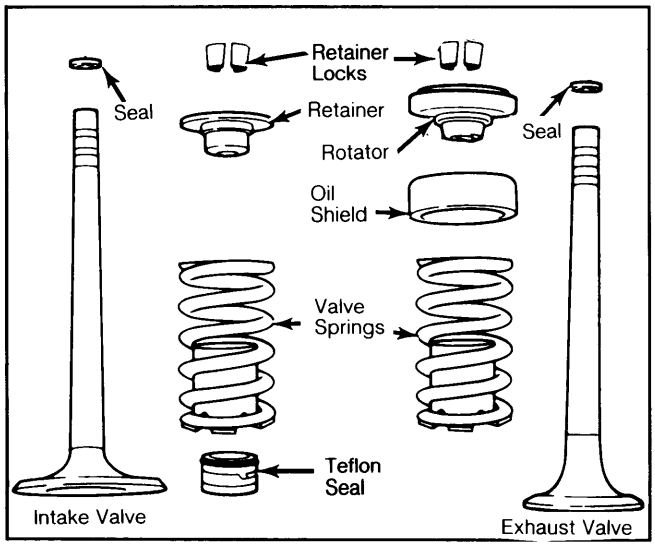
VALVE SPRINGS

Removal

1) Remove rocker arm cover, spark plug, rocker arm and push rod of cylinder to be serviced. Install adapter and air hose to spark plug hole, and apply air pressure. Do not remove air pressure until components are reassembled.

2) Using a valve spring compressor tool, compress valve spring and remove valve locks and oil seal. Release compressor tool and remove retainer (or rotator), oil shield (exhaust only), and valve spring damper. On intake valves, remove teflon oil seal. *See Fig. 4.*

Fig. 4: Intake and Exhaust Valve Assemblies



Teflon oil seal is used in combination with "O" ring seal, on intake valves only.

Inspection

Using valve spring tester, check valve spring tension. Springs should test to within 10 lbs. of specification (without dampers.) Replace spring if not within limits.

Installation

1) Position valve spring and damper on cylinder head. Install teflon oil seal (intake only) in place over valve stem. Position oil shield (exhaust only) and retainer (or rotator) on valve spring.

2) Coat "O" ring type seal and valve stem with engine oil. Compress spring and install seal in lower groove of valve stem. Ensure that seal is not twisted in groove. Install retainer locks and release compressor tool. Make sure retainer locks are properly seated in upper groove of valve stem.

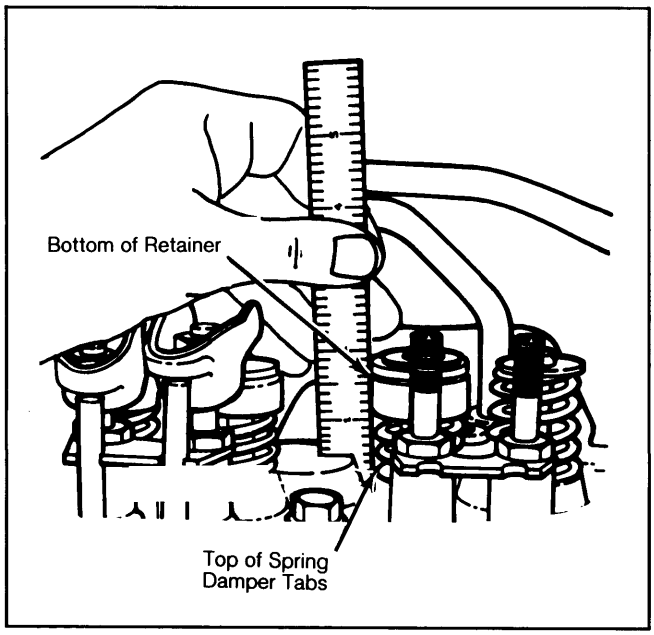
VALVE SPRING INSTALLED HEIGHT

CAUTION: Never shim valve springs to a height less than specifications.

1) Installed height of valve springs should be 1.58" (40 mm). For intake valves, measure from top of spring damper tabs to bottom of retainer. For exhaust valves, measure from top of spring damper tabs, to point where top of valve spring contacts inside bottom of oil shield.

2) If measurement exceeds specified height, install a .030" (.76 mm) shim at spring seat. *See Fig. 5.*

Fig. 5: Checking Valve Spring Installed Height



Installed height is 1.58" (40 mm). Never shim to a height less than specification.

VALVE ADJUSTMENT

1) Adjust valves by backing off adjusting nut until lash (play) is felt at push rod. Now tighten nut until all lash is removed. Tighten adjusting nut an additional 1½ turns. *See Fig. 6.*

2) Rotate crankshaft to bring No. 1 piston on TDC at end of compression stroke. Adjust valves indicated in *Valve Adjustment* table.

3) Rotate crankshaft 360° to bring No. 4 piston on TDC at end of compression stroke. Adjust remaining valves. When adjustment is complete, install rocker arm covers. Start engine and check timing and idle speed.

VALVE ADJUSTMENT

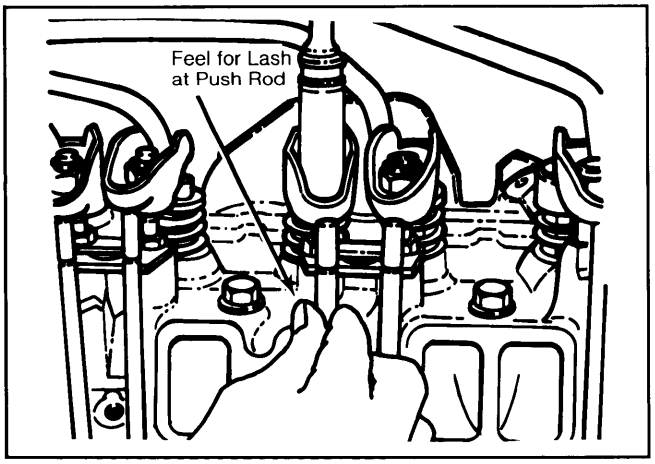
Piston On TDC	Adjust Int. Nos.	Adjust Exh. Nos.
No. 1	1, 5, 6	1, 2, 3
No. 4	2, 3, 4	4, 5, 6

ROCKER ARM STUDS

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

2.8 LITER V6 (Cont.)

Fig. 6: Adjusting Valve Lash

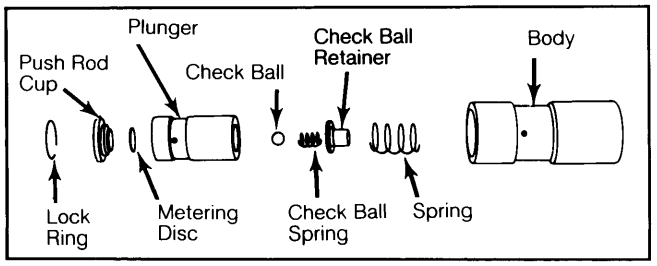


Tighten adjusting nut 1½ turns after push rod lash is eliminated.

HYDRAULIC VALVE LIFTER ASSEMBLY

If lifters are removed, ensure they are installed in original locations. Service lifters as complete assemblies only. If lifter is damaged or worn, replace lifter. If lifters are disassembled for cleaning and inspection, they should be reassembled and tested in a lifter leakdown rate tester. *See Fig. 7.*

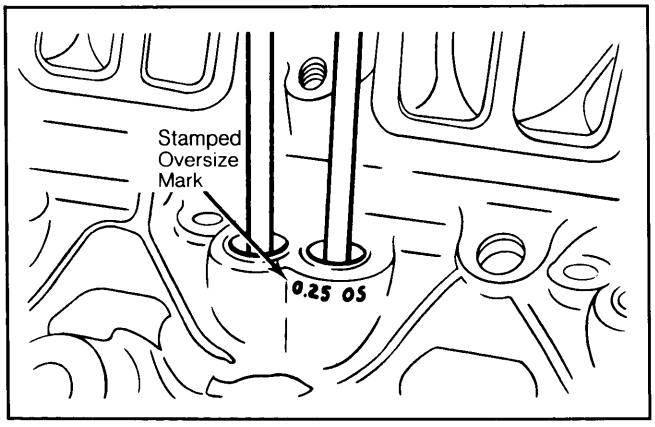
Fig. 7: Hydraulic Lifter Assembly



Service as complete assemblies only; do interchange parts between lifters.

Some engines will have both standard and .010" (.25 mm) oversize valve lifters. The lifter boss of engines with oversize lifters will be marked with a dab of white paint, and "0.25 O.S." stamped on lifter boss. *See Fig. 8.*

Fig. 8: Identifying Oversize Lifters



Lifter bosses are also marked with a dab of white paint.

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

Removal

1) Remove oil pan, oil pump and cylinder heads. Place piston at bottom of stroke and cover piston with a cloth to collect cuttings. Use a ridge reamer to remove any ridge or deposits from upper portion of the cylinder bore.

2) If necessary, mark connecting rod and cap for reinstallation in original location. Remove connecting rod cap and install rubber hose over rod bolts. Push piston and rod out top of bore. Install cap to its respective connecting rod.

Installation

1) Install rings on piston, and properly space ring gaps. *See Fig. 9.* Apply a light coat of engine oil to piston, rings and cylinder bore. Using ring compressor, compress piston rings. Ensure ring gaps do not change during compressor installation.

2) Cover rod bolts with protective rubber hose. Install piston with notch (or machined hole) in piston head, toward front of engine. Rod bearing tang slot must be positioned away from camshaft. Remove rubber hose from rod bolts. With rod bearings installed, install and tighten rod caps.

FITTING PISTONS

1) Using telescope gauge and micrometer, measure cylinder bore diameter. Measure piston diameter across piston skirt, at center line of piston pin. Difference between 2 measurements is piston-to-cylinder bore clearance.

2) Using cylinder bore gauge, measure cylinder bore taper by working gauge up and down in bore. Difference between high and low readings is taper. Taper must not exceed .001" .02 mm).

3) Measure cylinder bore out-of-round. Take out-of-round measurements at different points in bore, by rotating gauge horizontally, around entire circumference of bore. Out-of-round must not exceed .001" (.02 mm).

4) If taper or out-of-round are not within limits, hone or bore cylinders for installation of new pistons. Replacement pistons are available in standard, .020" (.50 mm) oversize and .040" (1.0 mm) oversize. When reboring cylinders, all main bearing caps must be installed and tightened to specification.

FITTING RINGS

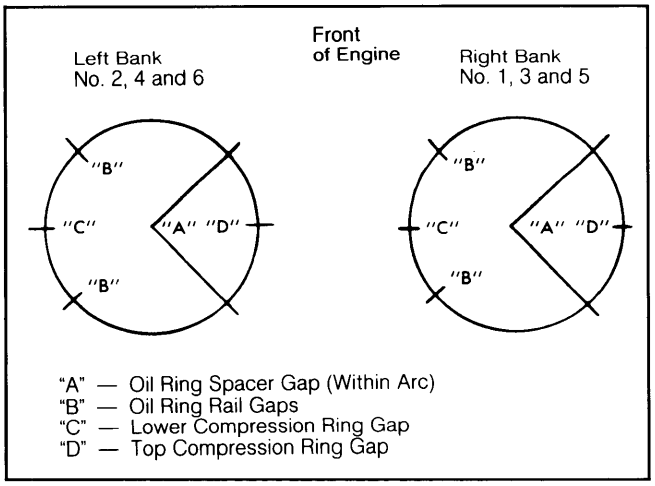
1) Position ring at bottom of cylinder bore, about ¼" above ring travel. Ring must be square in bore. Measure ring end gap with a feeler gauge.

2) Before installing compression rings on pistons, check side clearance. Insert outer edge of ring in its respective groove, and slide ring around entire circumference of groove. The ring should slide freely in groove. If ring grooves have high steps on lower lands, piston must be replaced.

3) Check side clearance of compression rings, with feeler gauge inserted between ring and ring groove. Install and properly space rings on piston. Ensure oil ring spacer ends are butted, and not overlapped. Note that anti-rotation tang of oil ring spacer is inserted into oil hole (or slot) of piston. *See Fig. 9.*

2.8 LITER V6 (Cont.)

Fig. 9: Desired Ring Gap Locations



Insert tang of oil ring spacer in oil hole (or slot) of piston. Hole is located within arc of oil ring spacer gap "A".

PISTON PINS

Removal

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

Installation

Check clearance of piston pin in piston. Replace piston and pin assembly if not within limits. Lubricate piston and connecting rod pin bores. Assemble connecting rod to piston. Using piston pin remover/installer tool and an arbor press, press piston into place. Check piston for freedom of movement on piston pin.

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. With crank pin and bearing clean, place Plastigage across full width of bearing, about ¼" off center, and away from oil holes. Install and tighten rod cap to specification. Do not allow cranksahft to turn.

2) Remove rod cap and determine clearance, by measuring width of compressed Plastigage at widest point. If clearance exceeds specifications, select a new undersize bearing and remeasure clearance.

3) Clean crankshaft journal and bearing seat in rod and cap. Insert bearings in rod and cap, then coat bearings with engine oil. Pull piston and rod assembly down onto crankshaft. Install and tighten rod cap. After all rods are installed, check side play between rod cap and crank pin thrust face.

4) Replacement bearings are available in standard, .0005" (.013 mm) and .0010" (.026 mm) undersize, for use with standard size crankshaft.

Main Bearings

1) If bearings are being checked with engine in vehicle, crankshaft must be supported at both front and rear. Ensure that all bearing caps, other than the one being checked, are tightened to specifications. When checking No. 1 main bearing, remove all drive belts from crankshaft pulley.

2) Start with rear main bearing cap and work forward. Remove main cap and place Plastigage across full width of bearing, about ¼" off center and away from oil holes. Install and tighten main cap to specification.

3) Remove main cap and determine clearance, by measuring width of compressed Plastigage at widest point. Bearings must be replaced if clearance is not within specifications.

4) New bearings are available in standard, .0006" (.016 mm) and .0012" (.032 mm) undersize, for use with standard size crankshaft. These undersize bearing halves may be used in combination to obtain correct clearance. Always replace both upper and lower bearings as a unit.

5) Main bearings are removed from cylinder block using main bearing remover/installer tool. Insert tool in crankshaft oil hole and rotate crankshaft clockwise. If tool unavailable, a cotter pin may be bent, as necessary, to do the job.

6) Lubricate journal and bearing. Insert plain end of new bearing between crankshaft and notched side of block. Insert bearing remover/installer tool into crankshaft oil hole. Rotate crankshaft counterclockwise to install bearing into place.

7) Install lower bearing half into cap, then lubricate with engine oil. Install and tighten main bearing cap with arrow pointing toward front of engine.

8) Check crankshaft end play after aligning thrust bearing. Check end play by prying crankshaft forward, and inserting feeler gauge between crankshaft counterweight and forward face of No. 3 main bearing cap.

THRUST BEARING ALIGNMENT

1) Make sure all main bearing caps, except No. 3, are installed and tightened. Tighten No. 3 thrust bearing cap bolts to 11 ft. lbs. (15 N.m).

2) Tap end of crankshaft rearward, then forward, to line up main bearing and crankshaft thrust surfaces. Tighten thrust bearing cap. Retighten all main bearing cap bolts, including thrust bearing. Rotate crankshaft to ensure there is no excessive drag.

REAR MAIN BEARING OIL SEAL

NOTE: Following procedure is for repair of upper rear main bearing oil seal, rather than replacement.

1) Remove oil pan, oil pump and rear main bearing cap. Remove lower seal from cap, but do not discard. Using upper seal packing tool (J-29114-2 or equivalent), gently drive upper oil seal into groove in cylinder block, approximately ¼" on both sides. *See Fig. 10.*

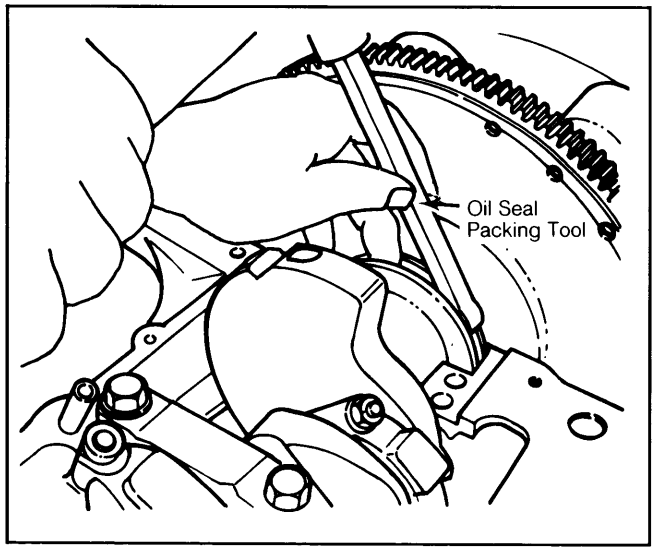
2) Measure the distance upper seal was driven into groove on one side. Add 1/16" to this measurement. Cut

2.8 LITER V6 (Cont.)

a length of the combined measurement from old oil seal removed from cap. Repeat this procedure for the other side.

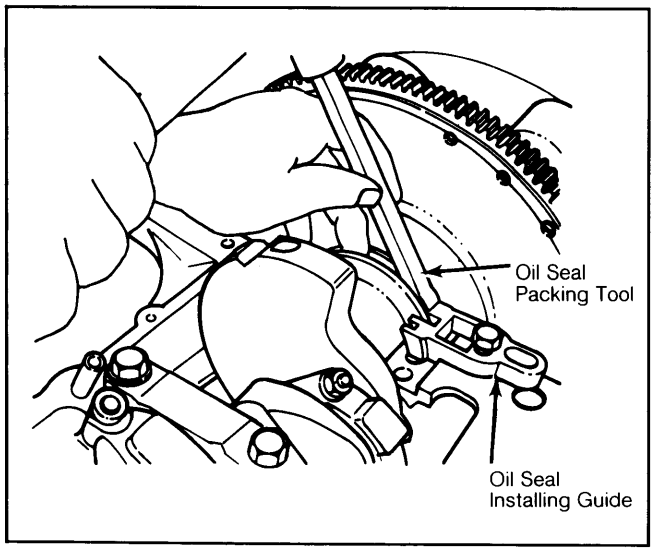
3) Coat short pieces of rope seal with engine oil. Using packing tool (J-29114-2 or equivalent) and oil seal guide tool (J-20114-1 or equivalent), work piece of replacement seal into guide tool, then drive seal into cylinder block until packing tool bottoms. *See Fig. 11.* A built-in stop is designed into the guide tool and packing tool combination. Repeat procedure for opposite side.

Fig. 10: Driving Oil Seal into Cylinder Block



Drive upper seal into cylinder block groove approximately ¼".

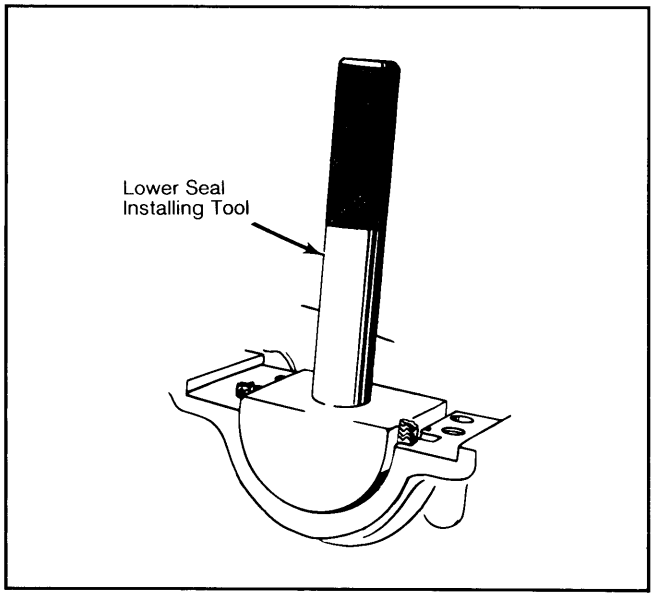
Fig. 11: Installing Replacement Oil Seal Ends into Block



Drive cut seal ends into block, until tool bottoms on built-in stop.

4) Using seal installing tool (J-25950 or equivalent), install new oil seal into rear main bearing cap. Cut ends of lower seal flush with machined surface of main cap. *See Fig. 12.*

Fig. 12: Installing Rear Seal Lower Half



After installing seal, cut protruding seal ends flush with machined surface of cap.

5) Install main bearing in cap. Using Plastigage method to check clearance, install and tighten rear main bearing cap. Remove cap and measure bearing clearance.

6 If out of specification, check seal for frayed ends or loose seal material, that may be preventing proper seating of cap. If seal is known to be properly installed, check bearing-to-crankshaft journal clearance.

7) Clean crankshaft and bearing surfaces. Apply anaerobic sealant to bearing cap at both sides of seal groove. Do not allow sealer to contact rope seal or main bearing. Install and tighten cap. Install oil pump and oil pan.

CAMSHAFT

FRONT ENGINE COVER

Removal

Disconnect negative battery cable. Remove all drive belts. Drain cooling system. Remove water pump. If equipped, remove A/C compressor and mounting bracket. Remove vibration damper. Disconnect lower radiator hose at front cover and heater hose at water pump. Remove front cover.

NOTE: Install and tighten front cover and water pump before sealer sets up.

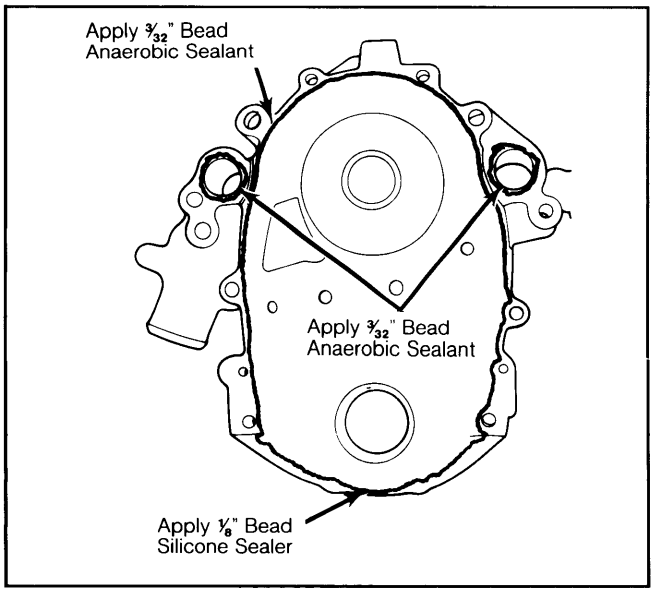
Installation

1)Clean sealing surfaces thoroughly. Apply 3/32" bead of anaerobic sealant to front cover-to-block sealing surface. Apply 1/8" bead silicone sealer to bottom of front cover sealing surface. *See Fig. 13.*

2) Place front cover on engine and install stud bolt and 2 lower bolts. Coat water pump bolts with pipe thread sealer. Apply 3/32" bead anaerobic sealer to water pump sealing surface, and install water pump and attaching bolts. Tighten all bolts. Reverse removal procedure to complete installation.

2.8 LITER V6 (Cont.)

Fig. 13: Front Cover Sealer Application



Install and tighten front cover and water pump before sealer sets up.

FRONT COVER OIL SEAL

Removal

The oil seal may be replaced with front cover installed. Remove vibration damper. Using large screwdriver, pry seal out of cover. Use care not to damage crankshaft.

Installation

Install new seal with open side of seal toward inside of front cover. Use seal installing tool to drive seal into position. Install vibration damper and related parts.

TIMING CHAIN

Removal

1) Remove front cover. Rotate crankshaft to position No. 4 piston on TDC at end of compression stroke. Timing marks on sprockets should be aligned. With crankshaft in this position, No. 1 piston will be on TDC at end of exhaust stroke. *See Fig. 14.*

2) Remove camshaft sprocket bolts, then remove sprocket and chain. To facilitate reinstallation, do not allow camshaft or crankshaft to turn.

Installation

Install timing chain and camshaft sprocket. Timing marks must be aligned. *See Fig. 14.* Use attaching bolts to draw sprocket onto camshaft and tighten bolts. Lubricate chain with engine oil. Install remaining components in reverse order of removal.

CAMSHAFT

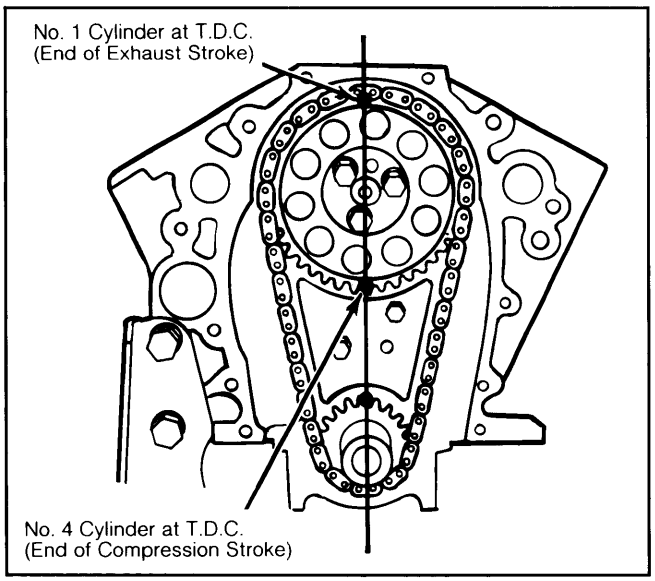
Removal

With engine removed from vehicle, remove front cover and intake manifold. Remove rocker arm assemblies, push rods and valve lifters in sequence, for reinstallation in original locations. Remove fuel pump and push rod. Remove timing chain and sprocket. Remove camshaft, using care not to damage camshaft bearings.

Installation

Lubricate journals with engine oil and apply Molykote (or equivalent) to camshaft lobes. Carefully

Fig. 14: Timing Sprockets Alignment



To facilitate reinstallation, do not allow crankshaft or camshaft to turn, during removal procedure.

install camshaft. Prior to installing rocker arm assemblies, coat rocker arm ball and mating rocker arm surface with Molykote (or equivalent). Reverse removal procedure to complete installation.

CAMSHAFT BEARINGS

Removal

Remove engine from vehicle. Remove camshaft. Ensure rod and main bearing caps are marked, and remove all caps. Push pistons to top of bores. Remove crankshaft. Remove camshaft rear cover from cylinder block. Using a camshaft bearing remover/installer tool, remove camshaft bearings.

Installation

Using bearing remover/installer tool, install front and rear bearings first. These act as guides for the tool pilot, and center the remaining bearings being pulled into place. Ensure that oil holes in bearings line up with oil gallery holes in block. Reverse removal procedure to complete operation.

CAM LOBE LIFT

1) With valve cover removed, remove rocker arm assemblies. Mount dial indicator on rocker arm stud. Position dial indicator and ball socket adapter on push rod.

2) Slowly rotate engine in direction of rotation until lifter is on base circle of camshaft. Zero dial indicator. Rotate engine until push rod is fully raised. Record lobe lift reading and compare with specifications. If not within limits, replace camshaft and lifters.

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.

2.8 LITER V6 (Cont.)

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

Oil is supplied under full pressure by a gear-type pump. The left main oil gallery (along upper left side of camshaft) supplies oil to left bank hydraulic lifters.

Oil from the left gallery is directed to the camshaft bearings, crankshaft and right oil gallery, through intersecting drilled passages.

The right oil gallery supplies oil to the right side hydraulic lifters. From valve lifters, oil is supplied to upper valve train through hollow push rods. All other components are lubricated by splash or nozzle method.

OIL PUMP

Removal

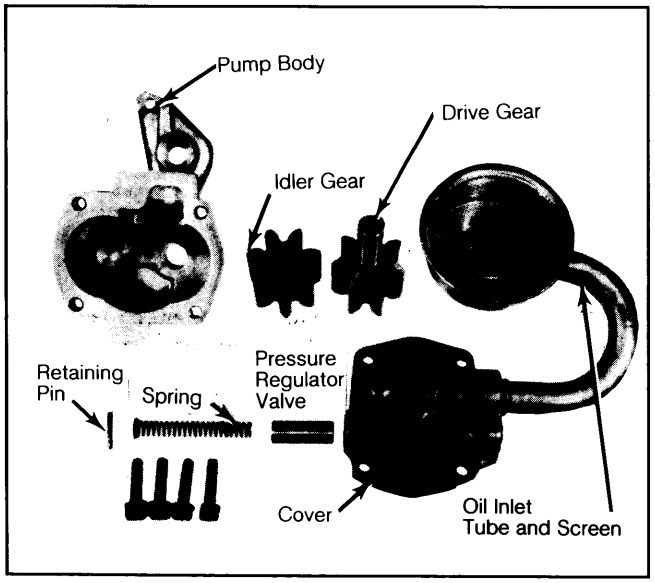
With engine removed from vehicle, remove oil pan. Remove bolt attaching oil pump to rear main bearing cap, then remove oil pump with extension shaft.

Disassembly

1) Remove pump cover. Mark gears at a meshing point, so they may be reassembled with same gear teeth indexing. Remove idler gear and drive gear and shaft from pump body.

2) Remove pressure regulator valve retaining pin, valve and spring. If necessary to replace, remove oil inlet tube from body. Do not disturb screen on oil inlet tube. *See Fig. 15.*

Fig. 15: Oil Pump Assembly



Mark gears at a meshing point, prior to removal from pump housing.

NOTE: If pump gears or body are damaged or worn, the entire pump assembly must be replaced.

Inspection

1) Wash all parts and dry with compressed air. Inspect pump body, pump cover and pump gears for damage or excessive wear.

2) Check drive gear shaft for looseness in pump body. Inspect oil inlet tube and screen for damage. Check pressure regulator valve for fit in bore.

Reassembly

1) If removed, install oil inlet tube and screen. Apply sealer to end of tube, and tap tube into place, using plastic hammer. Install pressure regulator valve, spring and retaining pin.

2) Install idler gear and drive gear and shaft into pump body. Make sure gear teeth previously marked, are indexing. Install pump cover.

Installation

Prime oil pump. Assemble pump and extension shaft (with retainer), to rear main bearing cap. Ensure top end of hexagon extension shaft engages with hexagon socket of distributor drive gear. Install and tighten oil pump attaching bolt.

ENGINE COOLING

WATER PUMP

Removal

Disconnect negative battery cable. Drain cooling system. Remove heater hose from water pump. Remove water pump.

Installation

Apply 3/32" bead of anaerobic sealer to water pump sealing surface. Coat bolt threads with pipe thread sealer. Install and tighten water pump. Install remaining components in reverse order of removal.

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 Rear Cover Bolts	6-9 (8-12)
Camshaft Sprocket Bolts	15-20 (20-27)
Connecting Rod Cap Nuts	34-40 (46-54)
Crankshaft Pulley Bolts	20-30 (27-41)
Cylinder Head Bolts	65-75 (88-102)
Exhaust Manifold Bolts	22-28 (30-38)
Flywheel-to-Crankshaft Bolts	45-55 (61-75)
Front Cover	
8 mm Bolts	13-18 (18-24)
10 mm Bolts	20-30 (27-41)
Intake Manifold Bolts	20-25 (27-34)
Main Bearing Cap Bolts	63-74 (85-100)
Oil Pump Attaching Bolt	26-35 (35-47)
Rocker Arm Studs	43-49 (58-66)
Vibration Damper	66-84 (90-114)
Water Pump	
6 mm Bolts	6-9 (8-12)
8 mm Bolts	13-18 (18-24)
10 mm Bolts	20-30 (27-41)

General Motors V6 Engines

2.8 LITER V6 (Cont.)

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	173	2.8	4-Bbl.	.....	.....	8.5:1	3.50	89.0	2.99	76.0

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							
Int.	.....	45°	46°	(.049-.059) (1.25-1.50)	.....	.0010-.0027 (.026-.068)	.....
Exh.	.....	45°	46°	.063-.075 (1.60-1.90)	.....	.0010-.0027 (.026-.068)	.....

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	.0017-.0027 (.043-.069)	.00025-.00035 (.0065-.0091)	[1] .0007-.0020 (.0187-.0515)	1	.010-.020 (.25-.50)	.0012-.0027 (.030-.070)
				2	.010-.020 (.25-.50)	.0016-.0037 (.040-.095)
				3	.020-.055 (.51-1.40)	[2] .0078 (.199)

[1] — Interference fit.
[2] — Maximum clearance permitted.

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)
2.8L	2.4937-2.4946 (63.340-63.364)	.0017-.0030 (.044-.076)	No. 3	.002-.007 (.05-.17)	1.9983-1.9993 (50.758-50.784)	.0014-.0036 (.036-.091)	.006-.017 (.16-.44)

CAMSHAFT

Engine	Journal In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
2.8L	1.867-1.870 (47.44-47.49)	.0010-.0040 (.026-.101)	[1] .231 (5.87) [2] .263 (6.67)

[1] — Intake.
[2] — Exhaust.

VALVE SPRINGS

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