

General Motors 4 Engines

1400 cc & 1600 cc 4 CYLINDER

IDENTIFICATION CODING

ENGINE IDENTIFICATION

Engine Code is stamped on pad at right side of block below number 1 spark plug.

Application	Man. Trans.	Auto. Trans.
1400 cc		
Federal	CVA ^① , CVB	CDS
Calif.	②	②
High Alt.	②	②
1600 cc		
Federal	CNA ^① , CNB	CYC ^① , CYD
Calif.	CYF ^① , CYH	CNR ^① , CNS
High Alt.	CNC ^① , CND	CNF ^① , CNH

① — No A/C.

② — Not Available.

ENGINE REMOVAL

See *Engine Removal at end of ENGINE Section.*

CYLINDER HEAD & MANIFOLDS

INTAKE MANIFOLD

Removal — 1) Drain cooling system and remove air cleaner. Disconnect battery negative cable. Disconnect upper radiator and heater hoses at intake manifold.

2) Remove EGR valve. Disconnect all wiring, hoses, linkage and fuel line from carburetor.

3) If equipped with A/C, remove upper radiator support, drive belts, fan and pulley assembly, and timing belt cover. Unbolt compressor and set aside.

4) Remove upper and lower A/C compressor brackets. Remove coil. Remove intake manifold bolts and manifold.

Installation — 1) Clean all gasket mating surfaces. Install intake manifold with new gasket and tighten bolts in sequence.

2) Reverse removal procedure to complete assembly. Ensure that all drive belts are properly adjusted. Start engine and run until at operating temperature. Check for leaks.

EXHAUST MANIFOLD

Removal — 1) Disconnect battery negative cable. Raise vehicle and disconnect exhaust pipe at manifold flange.

2) Lower vehicle and disconnect carburetor heat tube. Remove pulse air injection tubing, if equipped. Remove exhaust manifold bolts and manifold.

Installation — 1) Clean all mating surfaces of manifold and head. Install manifold and torque to specification.

2) Reverse disassembly procedure to complete installation. Start engine and check for exhaust leaks.

CYLINDER HEAD

Removal — 1) Remove engine front upper and lower covers. Remove crankshaft drive pulley, idler pulley and timing belt.

2) Drain cooling system. Disconnect upper radiator hose and heater hose at intake manifold. Remove air cleaner and accelerator cable support bracket.

3) Disconnect all wiring. Raise vehicle and disconnect exhaust pipe from manifold. Lower vehicle and disconnect oil dipstick tube from manifold.

4) Disconnect fuel line at carburetor. Remove coil, cam covers, camshaft, rocker arms, guides and valve lifters with shims.
NOTE — Keep rocker arms, guides, lifters and shims in order for installation in original location

5) Remove cam carrier from head. Remove head from engine.

Installation — 1) Install new head gasket over dowel pins with legend "This Side Up" facing up. Place head on engine.

2) Apply sealer to top of head and cam carrier mating surfaces. Coat head bolts with sealer and tighten in sequence (see Fig. 1). Reverse removal procedure to complete installation.

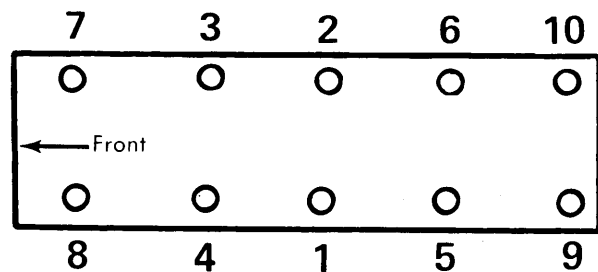


Fig. 1 Cylinder Head Tightening Sequence

VALVES

VALVE ARRANGEMENT

I-E-I-E-I-E-I-E (Front to rear).

VALVE GUIDE SERVICING

Guides are integral with cylinder head. If valve stem clearance in guide is excessive, valves with oversize stems are available. Ream guide bores to accommodate oversize stems and afford specified clearance using suitable reamer set (J-26590).

VALVE STEM OIL SEALS

Install oil seal on valve stem before installing spring. Make sure that seal is flat and not twisted. **NOTE** — Do not interchange intake and exhaust seals. Intake is identified by the letters "IN" and exhaust by "EX".

VALVE SPRINGS

Removal — 1) Remove camshaft covers, depress valve spring with tool (J-25477 or equivalent) and remove rocker arms.
NOTE — Keep rocker arms and guides in order for reinstallation in original location.

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2) Install suitable air line adapter to spark plug port and apply air pressure. Depress valve springs and remove rocker guides, valve retainers, caps, springs and valve stem oil seals.

Installation — 1) Test spring with suitable spring tester. Replace springs not within specifications.

2) Install oil seal, compress valve spring and cap and install retainers and guides. **NOTE** — Grease may be used to hold retainers in place. Release spring tension ensuring retainers seat properly. Reverse removal procedure to complete assembly.

VALVE SPRING INSTALLED HEIGHT

Specified height is 1.25" (32 mm) measured from top of spring seat or shim to top of valve spring. If measured height exceeds specifications, install a valve spring seat shim to meet specifications.

VALVE STEM INSTALLED HEIGHT

Specified height is .71" (18 mm) measured from end of valve stem to top of cylinder head. This height is required to assure correct operation of hydraulic lifters. If measured height exceeds specifications, grind tip of valve. **CAUTION** — Do not grind more than .030" (.75 mm) from any exhaust valve tip.

HYDRAULIC VALVE LASH ADJUSTERS

NOTE — Lash adjusters are serviced as complete assemblies only. Parts are not interchangeable between adjusters

No adjustment of lash adjusters is required. Servicing of adjusters requires only that care and cleanliness be exercised in the handling of parts. Adjuster must be full of oil prior to installation.

PISTONS, PINS & RINGS

OIL PAN

See Oil Pan Removal at end of ENGINE Section.

PISTON & ROD ASSEMBLY

NOTE — New pistons must be installed in same cylinders for which they were fitted and used pistons in same cylinder from which they were removed.

Removal — 1) With cylinder head and oil pan removed, use a ridge reamer to remove any ridge or deposits on upper end of cylinder bore. **NOTE** — Piston must be at bottom of stroke and covered with cloth to collect cuttings.

2) Inspect rods and caps for cylinder identification and mark as necessary. Remove rod cap covering studs for crankshaft and cylinder wall protection.

3) Carefully push piston and rod assembly out top of cylinder block.

Installation — 1) Lightly coat cylinders, pistons and rings with engine oil. Ensure ring gaps are properly spaced (see Fig. 2). Marked side of compression rings are toward top of piston.

2) Install ring compressor on piston ensuring ring gap positions do not change. Install piston and rod assembly with notch in piston top facing front of engine.

3) Tap piston and rod assembly carefully into correct cylinder with suitable tool. **NOTE** — Do not damage cylinder wall or crankshaft journal with rod studs.

4) With connecting rod seated on crankshaft journal, install rod caps and tighten nuts.

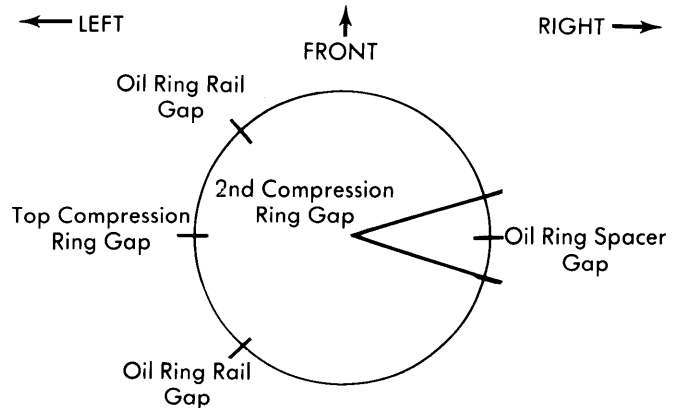


Fig. 2 Ring Gap Location on Piston

FITTING PISTONS

Measure piston bore diameter, then measure piston diameter at skirt across centerline of piston pin. Maximum acceptable clearance is .002" (.050 mm) for either a used or new piston in worn cylinder bore. Oversize pistons are available in .001" (.025 mm) and .030" (.75 mm) oversize.

PISTON PINS

Piston and piston pin are a matched set and are not serviced separately. Measure diameter of piston pin with a micrometer and measure piston pin bore in piston with a dial bore gauge or inside micrometer. If clearance is in excess of specifications, replace piston and pin.

Removal — Place piston on suitable support. Using a pilot tool as driver, use arbor press to push pin from piston and rod.

Installation — Lubricate piston pin bores in piston and connecting rod and assemble rod to piston (alignment of rod in relation to notch on piston head is not important). Place piston on suitable support and using a pilot tool and arbor press, push pin into piston and rod assembly. Check piston for freedom of movement on pin.

CRANKSHAFT & ROD BEARINGS

MAIN & CONNECTING ROD BEARINGS

NOTE — Following procedures are with oil pan removed.

Connecting Rod Bearings — 1) Remove rod caps after ensuring caps and rods are marked for cylinder identification. Use Plastigage method to check for proper clearances.

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2) Replace bearings not within specifications. New bearings are available in standard and the following undersizes: .001" (.025 mm), .010" (.25 mm) and .020" (.50 mm).

3) Selective fitting is required on each connecting rod. **NOTE** — Standard bearing halves may be used with a .001" (.025 mm) undersize bearing. Coat bearing surfaces with oil, install rod cap with bearing and tighten nuts.

Main Bearings — 1) With oil pan removed, support crankshaft at both ends. Start with rear main cap and work forward. Remove one cap at a time and use Plastigage method to check clearances. Replace bearings not within specifications.

2) Check crankshaft journal for wear. If journal is not within specifications, remove crankshaft and grind to suitable undersize. **NOTE** — A standard bearing half may be used with a .001" (.025 mm) undersize, or a .001" (.025 mm) bearing half may be used with a .002" (.050 mm) to obtain correct clearance.

3) Using a suitable tool installed in crankshaft oil hole, rotate crankshaft clockwise to remove upper bearing half. Coat new upper bearing half with engine oil, press firmly to crankshaft journal and rotate bearing into place. Ensure tang on bearing corresponds to notch in bearing saddle.

4) Install main bearing cap with lower bearing half in place. Ensure "F" on cap points toward front of engine. Tighten bolts.

THRUST BEARING ALIGNMENT

With crankshaft forced toward front of engine, check end play at front of number five bearing cap with a feeler gauge. If end play exceeds specifications, thrust bearings must be replaced.

REAR MAIN BEARING OIL SEAL

Removal — With engine removed from vehicle, remove oil pan and rear main bearing cap. Clean bearing cap and cylinder block and inspect crankshaft seal surface for excessive wear, nicks, etc.

Installation — Install new seal in cylinder block, taking care to seat seal against rear main bearing bulkhead. Coat horizontal bearing cap split line with suitable sealer and install rear bearing cap while sealer is still wet to touch. Install and tighten cap bolts and place suitable two part sealer in vertical grooves. Remove excess sealer and reinstall oil pan.

CAMSHAFT

ENGINE FRONT COVER

Removal — 1) Remove upper and lower timing belt covers. Remove crankshaft drive pulley, timing belt and timing sprocket.

2) Remove attaching bolts, three oil pan bolts to cover and remove front cover. Remove oil cover gasket and exposed portion of oil pan gasket. Inspect front cover oil seal and replace if necessary.

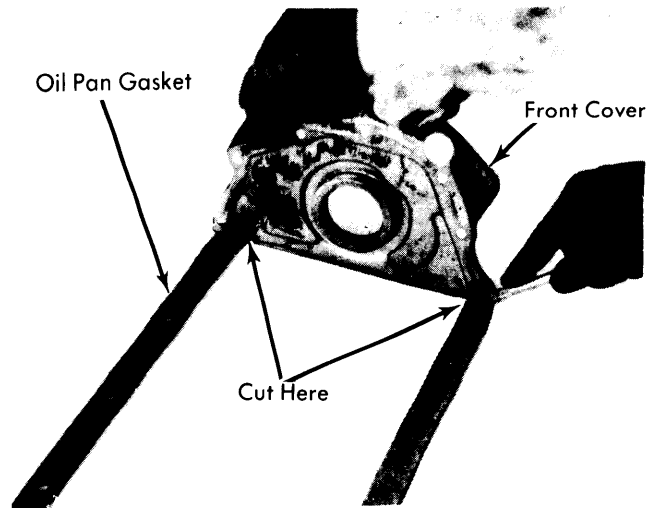


Fig. 3 Cutting Oil Pan Gasket

Installation — 1) Replace front cover gasket. Cut portion of oil pan gasket as shown in Fig. 3. Apply suitable sealing compound to new portion of oil pan gasket.

2) Install front cover with installing tool (J-26434 or equivalent) in place. Complete installation by reversing removal procedure.



Fig. 4 Installation of Engine Front Cover

FRONT COVER OIL SEAL

Front cover oil seal may be replaced with engine front cover removed. To remove front oil seal sleeve on crankshaft, remove fuel pump and distributor. Insert long punch through distributor hole against rear of sleeve. Using proper tools, tap sleeve off front of crankshaft.

TIMING BELT REPLACEMENT

Removal — 1) Remove timing belt upper and lower covers. Remove crankshaft drive pulley and timing belt idler pulley. Remove timing belt from sprockets.

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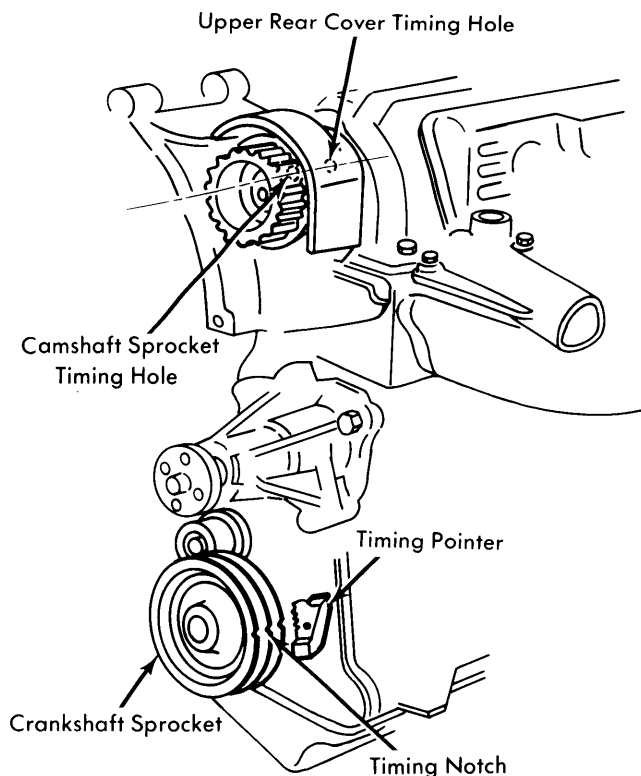


Fig. 5 Sprocket Timing Marks

2) Remove distributor cap and mark location of No. 1 spark plug on distributor housing for ease of reinstallation.

3) Remove A/C compressor and lower compressor bracket, if equipped.

Installation – 1) Lay timing belt over crankshaft sprocket and install crankshaft pulley. Rotate crankshaft to place No. 1 piston at TDC. Align distributor with mark made during removal indicating No. 1 spark plug.

2) Align timing hole in camshaft sprocket with hole in upper rear cover. Install timing belt on camshaft sprocket and adjust belt tension. Reverse removal procedure to complete installation.

Timing Belt Tension Adjustment – 1) Remove engine fan assembly, water pump pulley and upper cam belt cover. Turn crankshaft clockwise to place No. 1 piston at TDC.

2) Install belt tension gauge tool (J-26486). Check tension on idler pulley side midway between cam sprocket and idler pulley. **NOTE** – Follow current manufacturer's instructions on proper tensioning tool.

3) Adjust belt tension by loosening idler pulley bolt and using $\frac{1}{4}$ " Allen wrench, turn idler pulley counterclockwise on its attaching bolt until proper tension is obtained. Reverse procedure used in removal to complete reassembly.

CAMSHAFT

Removal – With timing belt and camshaft sprocket removed, remove rocker arms and heater assembly. Remove cam carrier

rear cover and camshaft thrust plate bolts, slide camshaft rearward slightly and remove thrust plate. Remove motor mount nuts and wire retainers, raise engine and remove camshaft.

Installation – To install, reverse removal procedure. **NOTE** – Apply Molycoat (or equivalent) to rocker arms if camshaft was replaced.

CAMSHAFT BEARINGS

This engine uses no camshaft bearings. Camshaft rides directly in camshaft carrier. Inspect bearing surfaces of carrier for wear or damage. If bearing areas are defective, camshaft carrier must be replaced.

CAM LOBE LIFT

1) Remove camshaft cover and install dial indicator on cam carrier. Intake and exhaust lobe on same cylinder can be measured in this manner. Turn crankshaft in direction of normal rotation until plunger is on heel of cam lobe.

2) Zero indicator. Turn engine slowly until indicator is in fully raised position. **NOTE** – Ignition primary lead must be disconnected from coil if using remote starter switch.

3) Record reading and compare with specifications. Continue procedure for each cylinder to be checked.

ENGINE OILING

Crankcase Capacity – 4 quarts. Add $\frac{1}{2}$ quart with filter change. Change oil every 12 months or 7500 miles, whichever comes first.

Oil Filter – Replace at first oil change and every second oil change thereafter.

Normal Oil Pressure – 39-46 psi at 2000 RPM.

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

ENGINE OILING SYSTEM

All oil from the oil pump passes through a full-flow oil filter and into a main gallery. Main, connecting rod and camshaft bearings are pressure lubricated along with the valve lash adjusters. Piston pins and cylinder walls are splash lubricated. No lubrication is supplied to the timing belt.

OIL PUMP

Disassembly – Remove oil pump cover bolts. Remove cover and gasket. Remove pump gear assembly, pressure regulator valve and related parts. Replace pickup tube "O" ring if necessary. Ensure "O" ring seats properly when pickup tube is installed in pump body.

Reassembly – Clean and inspect all parts for wear or damage. **NOTE** – Pump gears and body are not serviced separately. If pump gears or body are worn or damaged, replace entire pump assembly. To assemble, reverse disassembly procedure.

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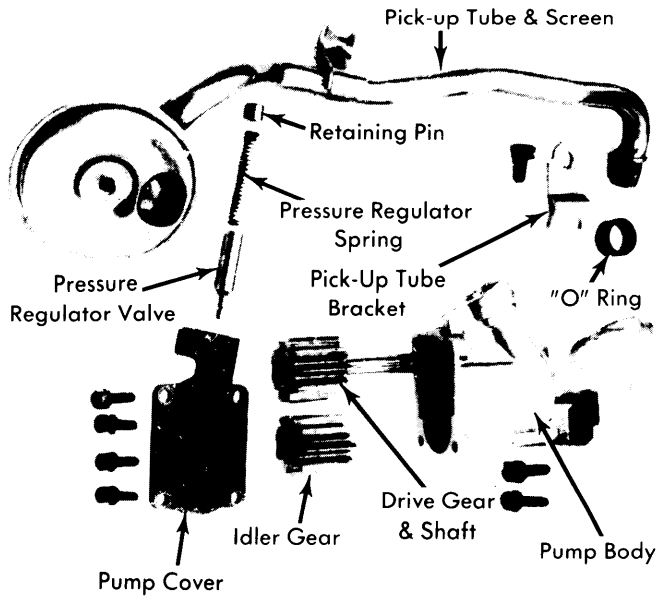


Fig. 6 Oil Pump Assembly

TIGHTENING SPECIFICATIONS

Application	Ft. Lbs.
Camshaft Carrier/Head Bolts	75
Camshaft Sprocket Bolts	75
Crankshaft Pulley Bolt	65-85
Connecting Rod Nuts	34-40
Exhaust Manifold	19-25
Flywheel Bolt	40-52
Idler Pulley Bolt	13-18
Intake Manifold Bolt	13-18
Main Bearing Caps	40-52
Water Pump Bolts	13-18
	Inch Lbs.
Camshaft Cover Nuts	12-16
Crankcase Cover Bolt	55-75
Crankcase Cover Nut	50-70
Oil Pan Bolts	45-60
Oil Pump Cover Screws	71-97
Oil Pump Bolts	45-60

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
1400 cc	52@5300	67@3400	8.5:1	3.228	82.0	2.606	66.2	85	1400
1600 cc	60@5300	77@3200	8.5:1	3.228	82.0	2.900	75.7	97.6	1600

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)
1400 & 1600 cc Int.	1.5303-1.5405 (38.87-39.13)	45°	46°	.049-.059 (1.25-1.50)	.3138-.3144 (7.972-7.985)	.0006-.0017 (.015-.045)
Exh.	1.2547-1.2650 (31.87-32.13)	45°	46°	.063-.075 (1.60-1.90)	.3130-.3136 (7.952-7.965)	.0014-.0025 (.035-.065)

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)
1400 & 1600 cc	2.0078-2.0088 (51.024-51.00)	.0009-.0026 (.024-.066)	No. 5	.004-.008 (.100-.202)	1.8093-1.8103 (45.958-45.984)	.0014-.0031 (.036-.078)	.004-.012 (.110-.316)

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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)
1400 & 1600 cc	.0008-.0016 (.020-.040)	.0001-.0003 (.003-.007)	①	1	.009-.019 (.229-.483)	.012-.027 (.305-.686)
				2	.008-.018 (.203-.452)	.012-.032 (.305-.813)
				3	.015-.055 (.381-1.397)	.000-.005 (.000-.127)

① — Pin is locked in rod.

VALVE SPRINGS			
Engine	Free Length In. (mm)	PRESSURE Lbs. @ In. (kg @ mm)	
		Valve Closed	Valve Open
All	1.505" (38.23)	64-72@1.26 (29-33@32)	167-179@.886 (76-81@22.5)

CAMSHAFT ①			
Engine	Journal Diam. In. (mm)	Clearance In. (mm)	Lobe Lift In. (mm)
All	②1.1816-1.1831 (30.013-30.050) ③1.7387-1.7402 (44.163-44.200)232 (5.8931)

① — End play is .007-.017" (.17-.43 mm)

② — Number 5 (rear) journal.

③ — Number 4 journal. Each succeeding journal is .0098" (.25 mm) larger than preceding journal.