

Buick V8 Engines

GENERAL SPECIFICATIONS						
Engine	Net HP At RPM	Torque (Ft. Lbs. at RPM)	Compr. Ratio	Bore	Stroke	Displ. Cu. Ins.
350" 2-Bbl.	150 @ 3600	270 @ 2000	8.5-1	3.800"	3.850"	350
350" 4-Bbl.	175 @ 3800	260 @ 2000	8.5-1	3.800"	3.850"	350
455" 2-Bbl.①	175 @ 3400	355 @ 2000	8.5-1	4.312"	3.900"	455
455" 2-Bbl.②	190 @ 3600	370 @ 2000	8.5-1	4.312"	3.900"	455
455" 4-Bbl.①	210 @ 3600	335 @ 2200	8.5-1	4.312"	3.900"	455
455" 4-Bbl.②	230 @ 3800	355 @ 2200	8.5-1	4.312"	3.900"	455
455" 4-Bbl.③	245 @ 4000	360 @ 2400	8.5-1	4.312"	3.900"	455
455" 4-Bbl.④	255 @ 4400	370 @ 2800	8.5-1	4.312"	3.900"	455

- ① - Single exhaust.
- ② - Dual exhaust.
- ③ - Century Gran Sport Stage 1.
- ④ - All Models (Exc. Century Gran Sport) Stage 1 (G.S.).

► **NET HORSEPOWER & TORQUE NOTE** - Horsepower and Torque figures given above are NET. Net Horsepower and Torque represents power at the flywheel when the engine is installed in a vehicle, with wide open throttle and all systems operating such as; air cleaner, exhaust system, water pump, generator, oil pump and air conditioning.

ENGINE IDENTIFICATION

Engines are identified by first two letters in production code numbers, located on left side of block below front two spark plugs (350" engines) and on left side of block below rear two spark plugs (455" engines). Code letters are as follows:

Engine	Code Letters
350" 2-Bbl.	ZP,ZC
350" 4-Bbl.	ZM,ZB
455" 2-Bbl.	ZH,ZI
455" 4-Bbl.	ZK,ZF
455" 4-Bbl.	
Stage 1 Century.....	ZS
Stage 1 All Other Models.....	ZA

ENGINE REMOVAL

1) Remove hood (mark hinge positions), air cleaner, drain cooling system and disconnect battery. On vehicles with A/C, disconnect wiring, remove compressor from bracket and position to one side. Remove fan blade, pulley and belts. Disconnect all water hoses from engine and remove fan shroud assembly. Disconnect battery ground cable from engine.

2) Remove power steering pump from bracket and position to one side. Remove and plug fuel pump hoses. Disconnect all vacuum hoses at engine and throttle control at carburetor. Disconnect body ground strap at engine, oil sending unit wire and temperature sending unit wire.

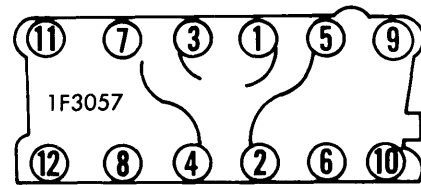
3) Raise car, disconnect starter cables and cable shield from engine. Disconnect exhaust pipe from manifolds and support exhaust system. Remove flywheel and converter cover. Remove flywheel-to-converter bolts and scribe marks on flywheel and converter for reassembly alignment (not necessary on manual transmissions).

4) Remove transmission attaching bolts, remove nuts from motor mount through bolts. Lower car and support transmission. With lifting tackle attached, raise engine slightly so mounting through bolts can be removed. Disengage engine from transmission and lift engine from chassis.

INTAKE MANIFOLD

Removal - Disconnect battery and drain cooling system. Disconnect breather tube at air cleaner, heated air pipe at top end of pipe, air cleaner sensor hose at tee and remove air cleaner. Remove A/C mounting bracket bolt (if equipped), loosen bracket to compressor bolt and slide bracket outboard. Disconnect temperature sending unit wire, throttle linkage at carburetor and fuel line at carburetor inlet. Remove manifold attaching bolts and manifold.

Installation - Clean all gasket surfaces and position new intake manifold gasket and rubber manifold seals in position at front and rear rails of cylinder block. Apply suitable sealer to ends of manifold seals. *NOTE* - Ensure that pointed end of seal fits snugly against block and head. Install one piece manifold gasket and carefully set intake manifold on engine block dowel pin. Install bolts and tighten in sequence (see illustration).



INTAKE MANIFOLD TIGHTENING SEQUENCE

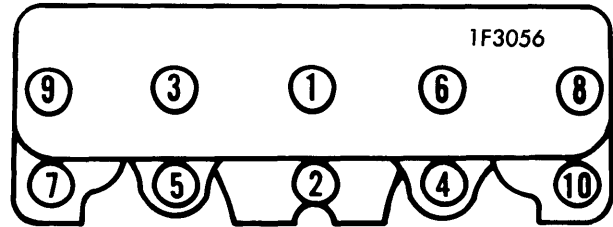
CYLINDER HEAD

Removal - 1) Remove intake manifold, oil dipstick and loosen belt(s). Remove A/C compressor with bracket (position to one side), power steering pump with bracket (position to one side) and A.I.R. pump (if necessary). Remove wires from alternator and alternator with mounting bracket (if necessary).

2) Disconnect spark plug wires and exhaust manifolds from head. Remove rocker arm cover and rocker arm shaft assembly. Remove push rods. *NOTE* - Retain rocker arm components and push rods in order for reinstallation in original location. Disconnect power brake unit hose at rear of left cylinder head on Apollo.

3) Remove cylinder head bolts and cylinder head. **NOTE** — When removing left cylinder head on Apollo, remove left front engine mount through bolt and loosen right front engine mount through bolt. Raise engine to provide clearance for cylinder head removal.

Installation — Clean all gasket surfaces, threads on cylinder head bolts and in block. Position new head gasket on block and install cylinder head. Use engine oil on cylinder head bolts and tighten bolts in sequence (see illustration) taking three times around to reach final torque.



CYLINDER HEAD TIGHTENING SEQUENCE

VALVES							
Engine & Valve	Head Diam.	Face Angle	Seat Angle	Seat Width	Stem Diameter	Stem Clearance	Valve Lift
350" Int.	1.875"	45°	45°	1/16"	.3725"	.0015-.0035"	.....
350" Exh.	1.500"	45°	45°	1/16"	.3725"	.0015-.0032"	.....
455" Int.	2.000"①	45°	45°	1/16"	.3725"	.0015-.0035"	.....
455" Exh.	1.625"②	45°	45°	1/16"	.3725"	.0015-.0032"	.....

- ① — Stage 1 engines 2.125".
- ② — Stage 1 engines 1.750".

VALVE ARRANGEMENT

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

VALVE GUIDE SERVICING

Guides are integral with cylinder head. If valve stem-to-guide clearance is not within specifications, ream guide to .006" oversize and then to .010" oversize. Valves are available in .010" oversize. **NOTE** — .006" oversize valves are occasionally used in production and identified by oversize marking stamped on valve head. New valves must not be lapped under any conditions as the aluminum alloy surface on the intakes or the nickel-plated surface on exhaust valves will be removed.

VALVE STEM OIL SEALS

Lubricate valve stem and guide, then start seal over valve stem and push down until it touches top of guide. Use suitable tool (J-22509) to push seal over valve guide until upper inside surface of seal touches top of guide. **NOTE** — Do not install seals on exhaust valves.

VALVE STEM INSTALLED HEIGHT

Normal height of valve stem tips above spring seat on head must be 1.933" (350") and 2.082" (455"). If height more than .050" over specification, grind end of valve stem or replace valve.

VALVE SPRINGS			
Engine	Free Length	PRESSURE (LBS.)	
		Valve Closed	Valve Open
350"	75 @ 1.727"	180 @ 1.340"
455"	72 @ 1.890"	177 @ 1.450"

VALVE SPRINGS

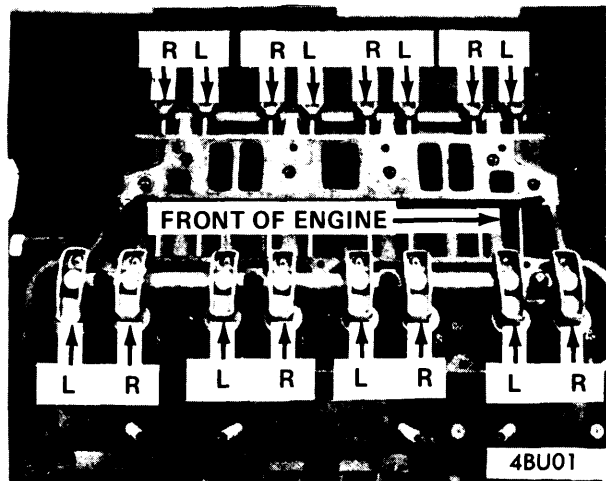
Removal — Remove cylinder head and use suitable spring compressor (J-8062) to compress valve spring. Remove valve cap retainer, valve cap, spring and valve oil seal (if necessary).

Installation — Install oil seal on intake valve. Install springs with close wound coils toward cylinder head (350" only). Install cap, compress spring and install retainers. **CAUTION** — Compress spring only enough to install retainers to avoid damage to valve stem oil seal.

ROCKER ARM ASSEMBLY

Removal — Remove rocker arm assembly from cylinder head. Remove nylon arm retainers by prying them out using suitable pliers. Remove rocker arms, then remove retainer pieces from inside shaft.

Installation — Install rocker arms on shaft lubricating all parts with engine oil. Center each arm on the 1/4" hole in shaft and install new nylon retainers in holes, using a drift of at least 1/2" diameter. **NOTE** — Service rocker arms are stamped "R" (right) and "L" (left). See illustration for positioning of service rocker arms.



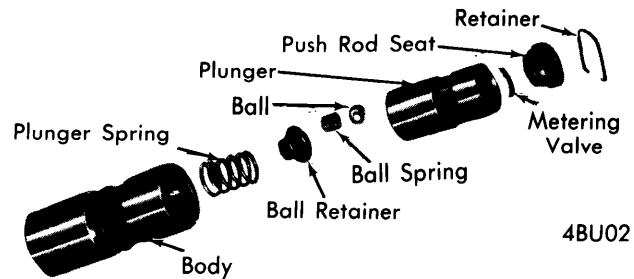
SERVICE ROCKER ARM POSITIONS

HYDRAULIC VALVE LIFTER ASSEMBLY

NOTE — Lifters are serviced as complete assemblies only. Parts are not interchangeable between lifters. In any component of lifter is worn or damaged, complete lifter must be replaced.

If lifters are disassembled for cleaning and inspection, after reassembly they should be tested using a suitable leak-down tester. Leak-down rate should be 12-60 seconds. Replace lifters which are not within limits.

NOTE — On some engines oversize lifters (.010") are used in production. Bores are marked with an "O" and lifter will be marked with two grooves in lifter body. When replacing lifters, ensure that oversize lifters are installed in oversize bores.



4BU02

HYDRAULIC VALVE LIFTER ASSEMBLY

PISTONS, PINS, RINGS						
Engine	PISTONS ① Clearance	PINS		RINGS		
		Piston Fit	Rod Fit	Rings	End Gap	Side Clearance
350"	.0008-.0020"	.0004-.0007"	.0007-.0017"②	1&2	.010-.020"	.....
				3	.015-.035"	.....
455"	.0010-.0016"	.0004-.0007"	.0006-.0016"②	1&2	.013-.023"	.....
				3	.015-.035"	.....

① — Top of Skirt.

② — Press Fit.

OIL PAN

Removal — 1) Disconnect battery, remove fan shroud-to-radiator tie bar screws, remove air cleaner and disconnect throttle linkage. Raise vehicle, support on stands and drain oil. Disconnect exhaust crossover pipe at engine and remove lower flywheel housing cover.

2) Remove shift linkage attaching bolt and swing out of way. Remove front engine mount through bolts. Disconnect idler arm at frame and swing assembly downward (Apollo only). Raise engine. **NOTE** — On A/C equipped models (Exc. Apollo) support transmission under right side prior to raising engine. Remove oil pan bolts and oil pan. Remove rear seal (455" only). **NOTE** — May be necessary to position crankshaft so No. 1 and No. 2 crankshaft journal and counterweight do not interfere with front of oil pan.

Installation — Clean gasket surfaces. Install rear seal (455" only). Use suitable sealer and install pan gasket to block. Install oil pan and tighten bolts.

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 — With oil pan and cylinder head removed, use a suitable 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. Inspect connecting rods and caps for cylinder identifications and mark as necessary. Remove rod cap and install suitable guide tools on connecting rod studs. Push piston and rod assembly out top of cylinder block.

Installation — 1) Lightly coat pistons, rings and cylinder walls with engine oil. Ensure all ring gaps are 90° apart and compression rings have identification mark toward top of piston. Oil ring may have either rail facing top of piston (350" has only one rail). Install ring compressor on piston and guide tools on connecting rod studs. Install piston and rod assembly in cylinder bore. **NOTE** — Oil ring gap must be on camshaft side of piston.

2) When installing piston and rod assembly in engine ensure that notch on piston faces front of engine. On 455", the boss on connecting rod and cap must face front on right bank and to rear on left bank. On 350" right bank, boss on connecting rod must face front and chamfered corners on cap to rear. On left bank, boss faces rear and chamfered corners face front.

3) Guide connecting rod onto crankshaft journal while tapping piston head with hammer handle to seat connecting rod against crankshaft. Remove guide tools from connecting rod studs and install mating rod cap. Tighten rod cap nuts.

FITTING PISTONS

Pistons are cam ground. Measure piston diameter 1/4" below bottom of oil ring groove, at points 90° to the piston pin. Measure cylinder bore diameter 1 1/2"-2" from top of bore and at right angles to the piston pin.

PISTONS PINS

Pins are selected press fit in rod. Arbor press, driver tool and suitable piston support tool are required to press pin in and out of piston and rod assembly. See specification for proper pin fit in piston and rod. Oversize pins are not practical due to pins being press fit in rod. Pins should fit piston with light thumb press fit at room temperature (70°F).

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS							
Engine	MAIN BEARINGS				CONNECTING ROD BEARINGS		
	Journal Diam.	Clearance	Thrust Bearing	Crankshaft Endplay	Journal Diam.	Clearance	Sideplay
350"	2.9995"	.0004-.0015"	No. 3	.003-.009"	2.000"	.0002-.0023"	.006-.020"
455"	3.2500"	.0007-.0018"	No. 3	.003-.009"	2.249"	.0002-.0023"	.005-.019"

MAIN & CONNECTING ROD BEARINGS

Connecting Rod Bearings — With oil pan removed, ensure rod caps are marked for cylinder identification and remove rod caps. Use Plastigage method to check for proper bearing clearances. If not within specifications, new bearings must be installed. New bearings are available in standard and .001" undersize. Selective fitting is required on each connecting rod. **NOTE** — Always replace bearings in pairs. Never use a new bearing with a used bearing. Coat bearing surfaces with oil, install rod cap and tighten nuts.

Main Bearings — 1) Support crankshaft at both front and rear and ensure that all bearing caps, other than one being checked, are tight. Remove one bearing cap at a time and check bearing clearances using Plastigage method. If clearances are not within specifications, bearings are available in standard, .001" and .002" undersizes. **NOTE** — Always replace bearings in pairs. Never use a new bearing with a used bearing. Upper and lower bearings are not interchangeable.

2) Remove all upper main bearings by inserting suitable tool in oil hole of crankshaft journal and rotating crankshaft clockwise to roll bearing from engine. Oil new upper bearing and position against crankshaft so tang on bearing will engage notch in crankshaft when rotated into place. Install main bearing caps with lower bearing installed and tighten bolts. **NOTE** — Arrow on main bearing cap must face forward.

THRUST BEARING ALIGNMENT

To align thrust bearing, move crankshaft forward and to the rear with thrust bearing cap bolts finger tight. Tighten thrust bearing cap bolts. **NOTE** — Last movement to be forward.

REAR MAIN BEARING OIL SEAL

Removal & Installation — 1) Drain crankcase, remove oil pan and rear main bearing cap. Using suitable tool (J-21526-2), drive both ends of oil seal into bearing groove in cylinder block until groove is packed tight. Measure amount seal was driven up into block, add $\frac{1}{16}$ ", then cut this length from the old seal in bearing cap (remove bearing cap seal carefully with a razor blade). Repeat procedure on other side of block.

2) Install suitable guide tool (J-21526-1) onto cylinder block and use packing tool to work new pieces of seal into guide tool and then pack into cylinder block. **NOTE** — Small amount of oil on seal may help installation. Remove guide tool and install a new seal in rear main bearing cap. Use small amount of suitable sealer on rear main bearing cap mating surfaces and install cap to engine. Tighten bolts.

350" Engine Only — Neoprene seals are placed on sides of bearing cap. Seals are slightly undersize when newly installed (and may leak) since neoprene composition swells in presence of heat and oil. Seals are slightly longer than grooves in cap,

but must not to cut to length. Soak seals in light oil or kerosene for one to two minutes before installation. After seals are installed, force up into cap with end of hammer handle. **CAUTION** — Operate engine at slow speed when first started after new seals installed.

ENGINE FRONT COVER

Removal — 1) Drain cooling system and disconnect upper and lower radiator hoses at water pump. Remove radiator, fan, fan pulleys and belts. Remove crankshaft pulley, disconnect fuel lines and remove fuel pump. Remove alternator and brackets.

2) Remove distributor cap with wires attached and swing aside. Remove distributor primary wire, then remove distributor. Loosen and slide front clamp on thermostat by-pass hose rearward. Remove harmonic balancer. Remove bolts attaching oil pan to front cover and cover to cylinder block. Remove front cover and gasket.

Installation — Reverse removal procedure and observe the following.

1) Remove oil pump cover and pack space around gears with petroleum jelly. There must be no air space left inside pump. If pump is not packed, it may not pump oil when engine is started.

2) Clean all gasket surfaces, install new gasket and position front cover against block. Ensure dowel pins engage pin holes before installing and tightening bolts. Use suitable sealer on bolts.

FRONT COVER OIL SEAL

Removal & Installation — Drive out old seal and shedder with a punch. Coil new packing around opening so that ends are at top. Use suitable punch to drive in shedder and stake in place at least three places. Size packing by rotating a hammer handle around packing until balancer hub can be inserted through the opening.

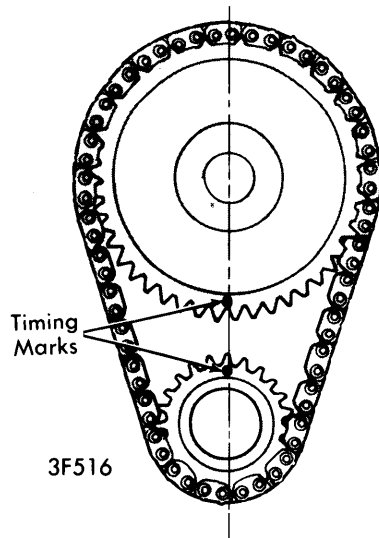
CAMSHAFT			
Engine	Journal Diam.	Clearance ①	Lobe Lift
350"	1.785-1.786"	.0005-.0035"	.....
455"	1.785-1.786"	.0005-.0035"	.....

① — No. 1 bearing is .0005-.0025".

TIMING CHAIN

Removal 350" Engine — Remove timing chain cover and align sprocket timing marks (see illustration). Remove front crankshaft oil slinger, then distributor drive gear and fuel pump eccentric from camshaft. Using two large screwdrivers, alternately pry the camshaft and crankshaft sprockets forward until camshaft sprocket is free. Remove camshaft sprocket and chain. Work crankshaft sprocket off shaft.

Removal 455" Engine — Remove timing chain cover and align sprocket timing marks (see illustration). Remove front crankshaft oil slinger, oil pan and camshaft sprocket bolts. Using two large screwdrivers, alternately pry the camshaft and crankshaft sprockets forward until camshaft sprocket is free. Remove camshaft sprocket and chain. Work crankshaft sprocket off shaft.



TIMING CHAIN SPROCKET ALIGNMENT

Installation All Engines — Assemble timing chain on sprockets and slide assembly on the shafts with timing marks aligned (see illustration). Reverse removal procedure and tighten all bolts.

CAMSHAFT

Removal — Remove intake manifold, rocker arm shaft assembly, push rods and valve lifters. Remove radiator and front cover. Remove timing chain and sprockets and carefully slide camshaft forward out of bearing bores.

Installation — Reverse removal procedure taking care not to mar the bearing surfaces.

CAMSHAFT BEARINGS

Engine must be removed from car and crankshaft removed from engine to install new camshaft bearings. Slightly scored bearings will be satisfactory if camshaft journals are polished and bearings cleaned up to remove burrs, and if the fit of shaft in bearings is free and within clearances. Special remover and installer tools will be required to replace cam bearings in block. Align boring will not be necessary as precision replacement bearings are available.

ENGINE OILING

Crankcase Capacity — 4 quarts. Add 1 quart with filter change.

Oil Filter — Replace at first oil change and then every second change after that.

Normal Oil Pressure — 350" is 37 psi at 2600 RPM.
455" is 40 psi at 2400 RPM.

Pressure Regulator Valve — In oil pump. Not adjustable.

ENGINE OILING SYSTEM

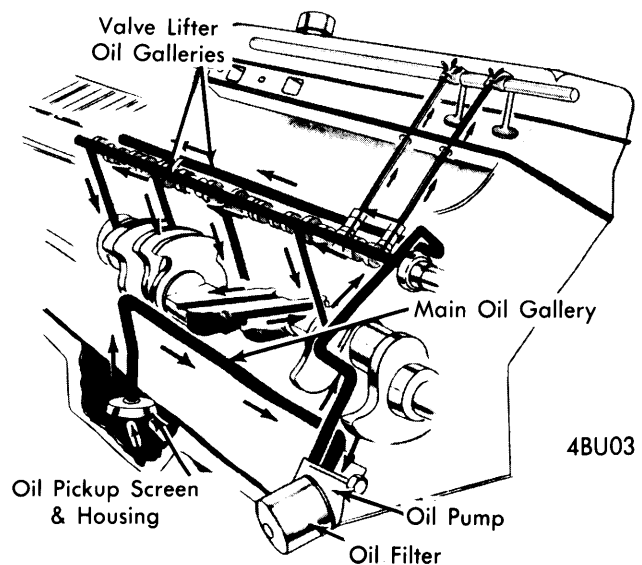
Lubrication is force-feed type. Oil is supplied under full pressure to crankshaft, connecting rods, and camshaft bearings. Controlled volume of oil is supplied to valve lifters, rocker arms and push rods.

Oil pump is located in timing chain cover and receives oil from crankcase by a drilled passage to pickup pipe. Oil passes through full-flow oil filter, equipped with by-pass valve, and to main oil galleries which run full length of crankcase and supply oil to valve lifters, camshaft bearings, main and connecting rod bearings. Pistons, cylinder walls, piston pins, distributor gears and timing chain and sprockets are lubricated by splash, gravity flow, or spurt holes. Rocker arms and valves are supplied with oil through tubular push rods.

OIL PUMP

Inspection — Clean gears and inspect for wear or scoring. Remove relief valve and spring. Oil filter by-pass valve and spring are staked in place and should not be removed. Replace any relief valve spring which is worn on its side. Relief valve should have no more clearance in its bore than an easy slip fit. If any side play is present, valve and cover should be replaced.

Reassembly — Oil relief valve before installation. Place straight edge across gears and clearance to cover gasket should be .0023-.0058". If less than .0018" check timing chain cover gear pocket for evidence of wear. Replace cover and tighten bolts. *NOTE* — Pump cavity and gears must be packed with petroleum jelly or pump may not prime itself when engine is started. Do not use chassis lube.



ENGINE OILING SYSTEM

ENGINE OILING (Cont.)

TIGHTENING SPECIFICATIONS

FT. LBS.

Application	350"	455"
Camshaft Sprocket Bolt.....	48	22
Connecting Rod Caps.....	40	45
Cylinder Head.....	80	100
Exhaust Manifold.....	28	28
Flywheel.....	60	60
Front Cover.....	29	29
Fuel Pump.....	20	20
Intake Manifold.....	45	45
Main Bearing Caps.....	115	115
Oil Pan-to-Block.....	14	14
Oil Pump Cover.....	10	10
Rocker Arm Shaft.....	30	30
Thermostat Housing.....	20	20
Vibration Damper.....	140 ①	200 ①
Water Pump Cover.....	7	7

① — Minimum torque.