THE ALUMINUM V8 A MASS PRODUCTION MILESTONE

Not only is this a remarkably bug-free engine for its age, with modification it is capable of performing far above its advertised output.

CREDIT must go to Buick for designing the first American aluminum V8 to be produced on a mass production basis. Viewed in the light of its past few years of service, it is a remarkably successful engine. Viewed as a hot riding item, it is an engine of limitless potential, thanks to its light weight and sturdiness, and is capable of much more than its current stock ratings. Equipped, the engine weighs about 350 pounds depending upon the type of transmission, and who is quoting the figures.

One interesting aspect of the development of this engine is that Buick went over to aluminum on a full scale basis, rather than getting its feet wet piecemeal. Cylinder heads, timing case cover, water pump, intake manifold and a host of small parts are made of aluminum, insuring maximum weight cutting. Many of the parts benefit from Buick's design experience gained through the use of aluminum in its larger engine. The combustion chamber also shows the influence of Buick's big engine, with a centrally located plug, short flame travel, and porting that is highly studied for good gas flow rather than just "big."

Among the many methods of casting an aluminum block the easiest at first glance is a water jacket and crankcase combination using wet sleeves. However, wet sleeves are quite costly in production and a potential source of sealing problems between block and cylinders. Considerable work was done on casting a block from high silicon aluminum. Here the block could be cast with conventional casting methods and weight savings were considerable, but cold scuff wear presented a major obstacle.

Maximum weight saving was achieved by die casting. Here the molten metal is introduced into steel dies under high pressure. This makes possible the use of very thin sections with accurately placed ribbing and reinforcements. Oil galleries can be cored by means of steel punches, and there is no possibility of core shifting. Offseting these advantages are high die costs and some fairly fragile die sections. Also, to withdraw the water jacket dies it is necessary to use free-standing cylinders without top decks. Even here, some sort of sleeve or insert is necessary to provide adequate bore wear qualities.

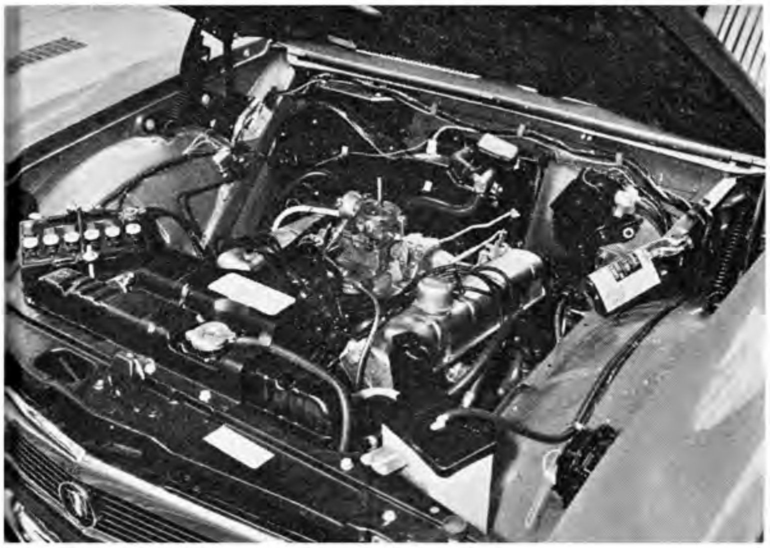
Buick decided upon a block cast by the semi-permanent mold method, plus centrifugally-cast cylinder inserts. Here steel molds are used for the outside of the block and the tappet valley, and sand for interior core sections. This is the closest to existing production methods and produces a block with good rigidity and integrally cast cylinder walls. An eight-pitch shallow thread is cut into the outside of the cylinders to a depth of .005 to .015 inches. When the block is being poured, molten aluminum flows into this thread forming a mechanical bond and surrounding each cylinder with a permanent retaining muff. Even though aluminum expands more than cast iron, the sleeves cannot become loose since they are closer to the heat source. Also, there is an unavoidable heat barrier between the sleeves and the block due to the change in material. As the centrifugally cast sleeves carry very little load, the designer is free to select a grade of cast iron with the most desirable wear qualities. Unfortunately, the .090-inch thickness of the sleeves imposes severe limits on boring the block; .030 inches seems like the available maximum.

The crank is a fully-counterweighted, cast pearlitic malleable iron unit well up to Buick's usual precision standards. Main bearings have ample dimensions, 2.2992 inches in diameter and a .802-inch width, except at the number three main which takes up thrust and is .821 inches wide. All crank journals have 2.000-inch diameters. The crank is fitted with a substantial vibration damper which helps push up the engine's rpm limit. The deep skirts at the sides of the block and the hefty main bearing webs contribute to block rigidity and smooth running. To control expansion at the main bearings and avoid loose fit as the block heats up, the main bearing caps are made of cast iron.

The crank offers major souping possibilities. While it would hardly be worthwhile to attempt the building up of the cast alloy iron crank by welding, you can purchase a steel crank stretched out to the stroke best suited to your needs from Jewell Tool Company in Detroit. Stock stroke is 2.80 inches, giving a 215 cubic inch displacement. You can readily go to a 3.5-inch stroke and a 270 cubic inch displacement. It is quite likely that a larger stroke can also be fitted to the engine. One record-making machine we know of is being fitted with a billet stroker crank for the aluminum V8. Since a horsepower-per-cubic-inch is entirely possible with the Buick mill, a stroker crank could bring this engine quite close to the magic horsepower-per-pound mark.

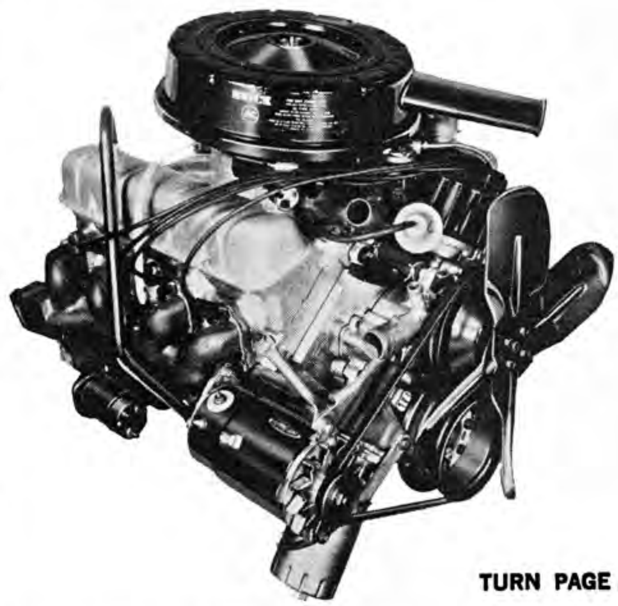
The forged rods weigh 17.5 ounces and are quite short, 5.660 inches. Wrist pins are press-fitted into the rods for ease of assembly at the factory and to save on bushings and retainers. Wrist pin walls are quite thick to reduce deflection under load.

Pistons are of an all-aluminum design, without the customary steel struts or rings to control expansion across the thrust faces. A full skirt is used at the bottom of the piston.



Buick aluminum V8 delivers 155 horsepower at 4,500 rpm as shown or 185 hp at 4,800 rpm with a four-barrel and its matching intake manifold.

The engine retains a characteristic Buick appearance. Note the elaborate timing case cover which houses the oil and water pumps and supports both the fuel pump and the distributor.



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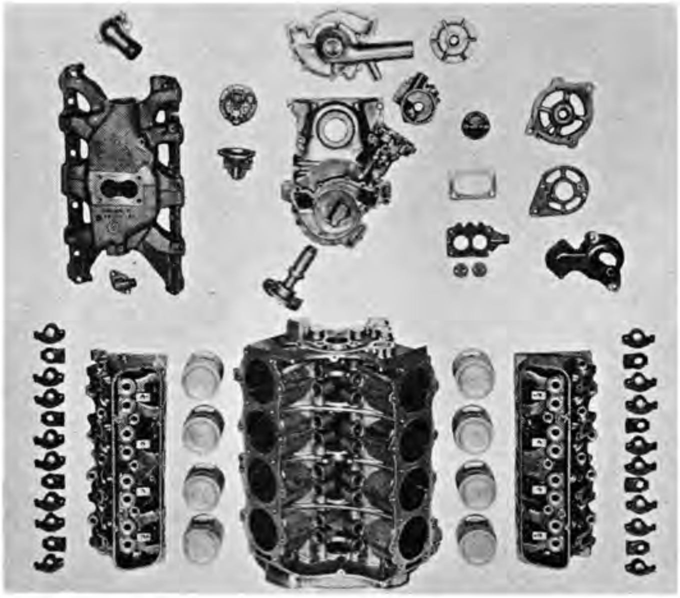
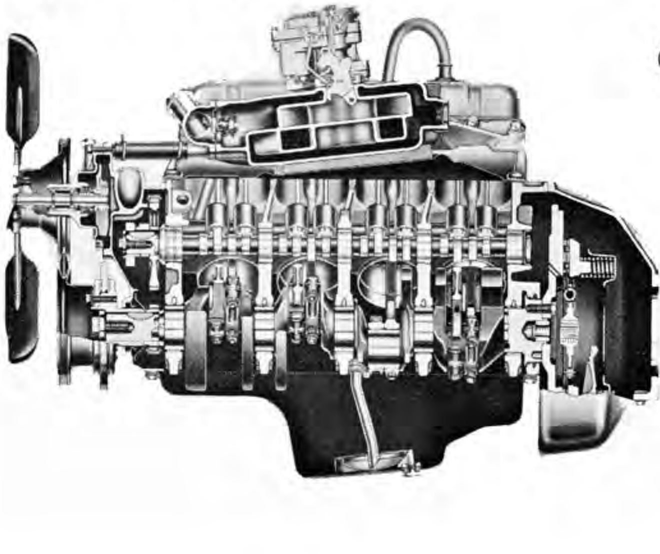
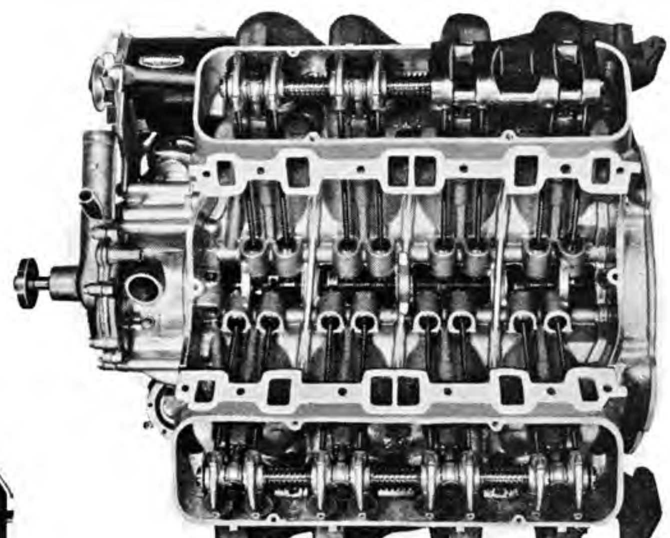


The engine's 350 pound weight, including accessories, is made possible by extensive use of aluminum. Everything from the block to the heads, including the rocker arms, is cast out of aluminum alloys.

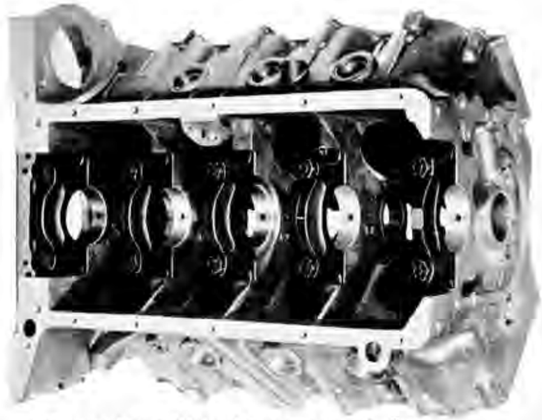
The plugs are centrally located within the combustion chambers for equal, and short, flame travel. They are angled in to clear the exhaust ports. Smooth transitions in the exhaust manifolds help by contributing to efficient gasoline flow.

After picking up engine heat, coolant flows through underside of intake manifold passages, then above them, before returning to radiator. Aluminum's excellent heat transfer properties insure even, ample heat for fuel vaporization.





The valve valley is thoroughly ribbed for maximum rigidity. Rocker arm shafts, rather than ball sockets, are used because studs would be hard to retain in aluminum. Coolant flow front to rear.



Pistons have dished tops, are all-aluminum. Switch to flat top pistons ups compression from 8.8 or 10.25 to 11-to-1. Full skirt at bottom offers better resistance to piston slap. Cast iron main bearings (above) control both expansion at mains and cut down clearance changes. Block's inside and water jackets are sand core-cast while its exterior is permanent mold-cast. Note that there is ample room for a stroker shaft here.

You'll notice, however, that two large cutouts separate the bottom of the piston from the wrist pin bosses. This prevents the bosses from distorting the piston skirt. Also, since the wrist pin will deflect to some extent under load, Buick engineers considered it best to allow the wrist pin bosses to deflect with the pin, retaining a maximum bearing area rather than having the pin cock within the bosses.

The Buick piston is dished and centered under the machined combustion chamber in the cylinder head. The flat portion of the piston provides a ring-shaped squish or quench area which both increases turbulence during compression and combustion and provides a cooling area for the end gases so far as to offer better combustion control. This is quite important, since end gases (the unburned portion of the air/fuel mixture) are subject to auto ignition after "cooking" under high pressures and at high temperature as the flame front progresses outward from the squish area. By allowing them to cool off until the flame front travels far enough to complete normal combustion, knock is prevented.

The standard aluminum V8 engine is delivered with an 8.8-to-1 compression ratio. This can be raised to 10.25-to-1 by using the Sklark pistons. These pistons have much shallower dishes. An 11-to-1 compression can be readily attained by switching to Oldsmobile pistons, which have flat tops. Higher compression ratios entail the use of colder plugs as well as premium fuel. Recommended plugs for the lower compression engine are AC 45 FFS. For the 10.25-to-1 engine, AC 44 FFS plugs are recommended.

The aluminum cylinder heads have replaceable cast iron valve guides and cast iron seats for both intake and exhaust valves. 1.500-inch valves are used for intake, with 1.3125-inch valves for exhaust. There isn't too much room for increasing valve size and port walls are not too thick, so go easy with the grinder! Spring pressures are 168 pounds with the valves open and 64 with the valves closed.

As in the larger Buick engine, the rockers are of die cast aluminum with steel inserts at the valve and push rod ends. The camshaft is of sintered iron with fairly mild timing. Lifters are hydraulic. We understand that '57 Buick solid lifters will fit, provided you use adjustable push rods. Iskenderian has several grinds for this engine, plus dual valve springs.

The stock Buick manifold sports a two-barrel Rochester carb with a 1.3125-inch bore size. Next up the ladder, and used in conjunction with the higher compression pistons, is a manifold designed to accept a four-barrel carb with 1.3125-inch primaries and 1.4375-inch secondaries. This provides a healthy power boost from 155 hp at 4,600 rpm to 185 hp at 4,800 rpm. The conversion is pretty much of a bolt-on nature. We understand that carburetion transplanted from a Chevy 283 does wonders for breathing. In addition, several manifolds are available from specialty houses, including a two-barrel unit from Edelbrock. The stock exhaust manifold is quite studied, probably as good as you can get within normal production costs. Hedman makes a set of headers for the Buick which is considerably lighter than the stock product.

The die cast timing case cover is something of a masterpiece. It serves as a mounting for the fuel pump and distributor, and embodies the oil pump housing. The oil pump, in turn, supports the oil filter and its mount. A ridge cast into the case diverts oil away from the front oil seal, and a protrusion around the seal and a slinger on the crank also contribute to oil control. As if this were not enough, the water pump is mounted at the front of the cover and delivers to the cylinder banks through two passages cast—you guessed it—in the cover.

Coolant flows through the cylinder banks from front to rear, then enters the cylinder heads and flows forward. After picking up engine heat, the coolant enters the intake manifold and flows under the floor of the intake passages (insuring a quick warmup and good fuel vaporization). Finally, the coolant is returned back to the radiator through the top of the manifold. Use of coolant to heat the manifold eliminates the use of the exhaust crossover, heat riser valves and all attendant problems. The water jackets in the block extend below the ring travel and spark plug bosses are completely surrounded by water. Thermocouple tests and observation via high speed cameras have shown that use of aluminum in the head, plus the elaborate cooling system, have completely eliminated heat problems in critical areas such as the exhaust valve seats.

Don't overlook the Buick aluminum engine as a good drag strip and general competition bet. Its light weight makes it a natural for specials and boats as well as fine engine conversion material. The availability of a four-speed box further enhances its possibilities. You could, of course, use it in a Buick Special, the car for which it was originally designed. But that would be much too simple . . .