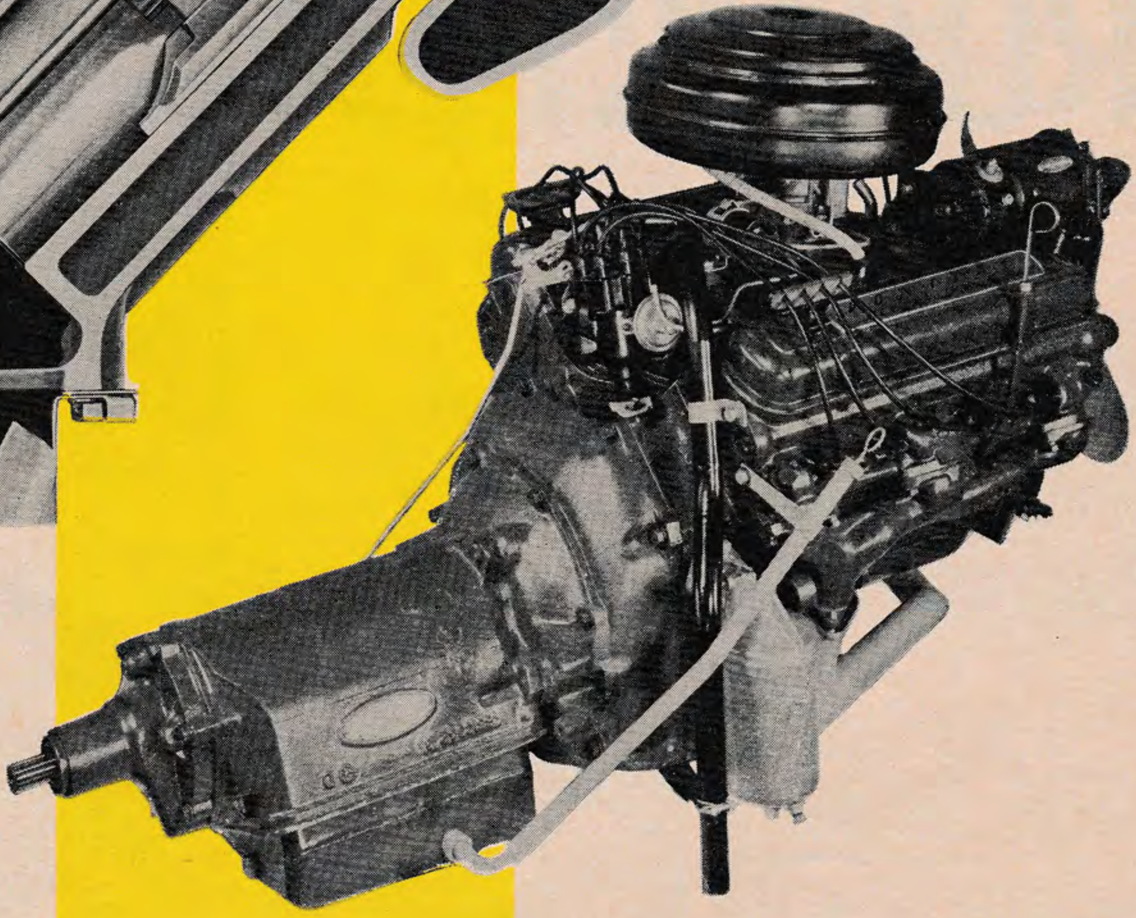
UNDER THE

Pontiac's New V8 Engine Is Loaded with Mechanical Innovations, Possibilities, and Lots of Go!

By Racer Brown

Since their first, the cars produced by the Pontiac Division of General Motors have been the very soul of conservatism. Reliability, comfort, reasonable price, economy, a good resale value and low maintenance costs in years past have tabbed Pontiacs as "best buys." However, in the performance department, they have always been somewhat lacking.



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But this year things will be different, due to a completely new powerplant that has been introduced on all models as standard equipment. In their exuberance over their new engine, Pontiac has gone a step further than other manufacturers by completely junking their six and eight cylinder in-line engines in one fell swoop. This maneuver wasn't as risky as it sounds because the new engine had undergone 3,000,000 miles of road testing and uncounted hours on the dynamometer since 1952, when prototype models were released for testing.

In line with jet age terminology, the new engine is called the "Strato Streak V8" and is certainly a far cry from the first production Pontiac V8 which was built in 1934. In general, the new layout follows the latest trends in engine design: It is a 90 degree V8 with a large bore, short stroke, pushrod operated overhead valves and the Pontiac variation on a now-familiar theme, the wedge-shaped combustion chamber. Aside from this generalization, the engine contains many details and refinements that stem strictly from the Pontiac engine design group.

The bore, stroke and displacement are 3¾ inches, 3¼ inches and 287.2 cubic inches, respectively. The ratio between the stroke and bore is .86 to 1. Two compression ratios are available, standard being 8.0 to 1, while the optional ratio is 7.4 to 1, which is a switch. The advertised brake horsepower output with the higher ratio is 180 at 4600 rpm and advertised torque is rated at 264 pounds-feet at 2400 rpm. The 7.4 to 1 compression ratio yields an advertised 173 brake horsepower at 4400 rpm and 256 pounds-feet of torque at 2400 rpm. These figures were obtained with the standard compression ratio using 93 octane Research gasoline and 86 octane Research gasoline for the 7.4 to 1 ratio, the engine testing procedure following the test code adopted recently by General Motors. This test code demands that the fuel, water and oil pumps be connected and operating, and the generator be rotated by the fan belt but not charging. No fan or air cleaner is used and the carburetor heat is blocked off. Stock exhaust manifolds are used to carry exhaust gases into large capacity collectors. The spark advance is manually adjusted to produce maximum torque. After the dynamometer runs, the figures obtained are corrected to an air temperature of 60 degrees F., by using a standard formula.

Let's look first at the bottom end. The cast iron cylinder block structure, the drop forged SAE 1045 steel crankshaft and the drop forged SAE 1335 steel connecting rods appear to be well designed, stiff and sturdy. The crankpin diameter is 2¼ inches, the main bearing journal diameter is 2½ inches which results in an overlap of ¾ of an inch between main bearing journals and adjacent crankpins. Five well integrated bulkheads support the crankshaft, using removable Durex steel backed inserts, the same material being used in the connecting rods. The number four main bearing inserts are flanged to take the end thrust of the crankshaft. Some dreamers have talked about using the Pontiac V8 crankshaft in the '55 Chevrolet V8 engine to take advantage of the extra ¼ inch longer stroke. Too bad it won't fit. The main, connecting rod and camshaft bearings are lubricated under a 40 psi pressure by a gear type oil pump. Cylinder wall and piston pin lubrication are assured by a metering jet drilled in each connecting rod.

A couple of small points in the block assembly are worthy of mention and show that considerable thought was given to some not-so-obvious details. First, each main cap is doweled to the block in two places which insures positive location in operation and facilitates assembly. The second point is the unusual staggering of the cylinders in the block, the right hand bank, as viewed from the back, being forward of the left hand bank. "Unusual" because in all other production V8 engines, the left hand banks are forward. Either way, staggering of the cylinder banks is necessary because two connect-

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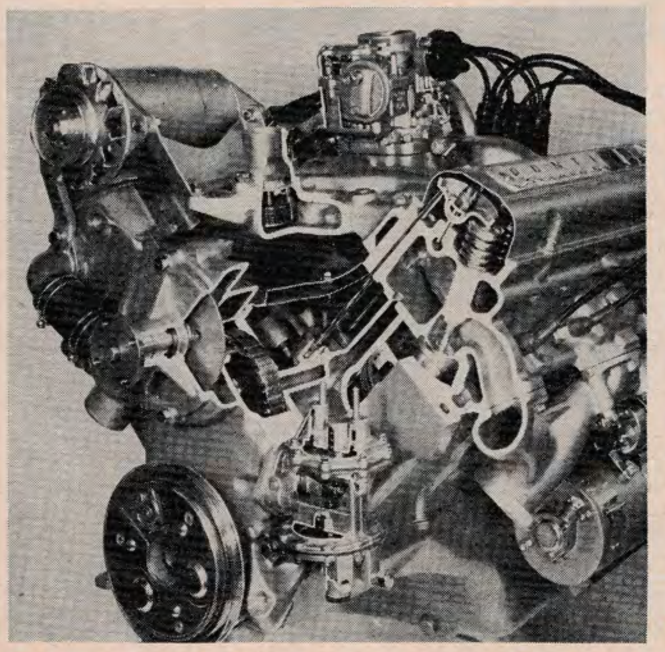
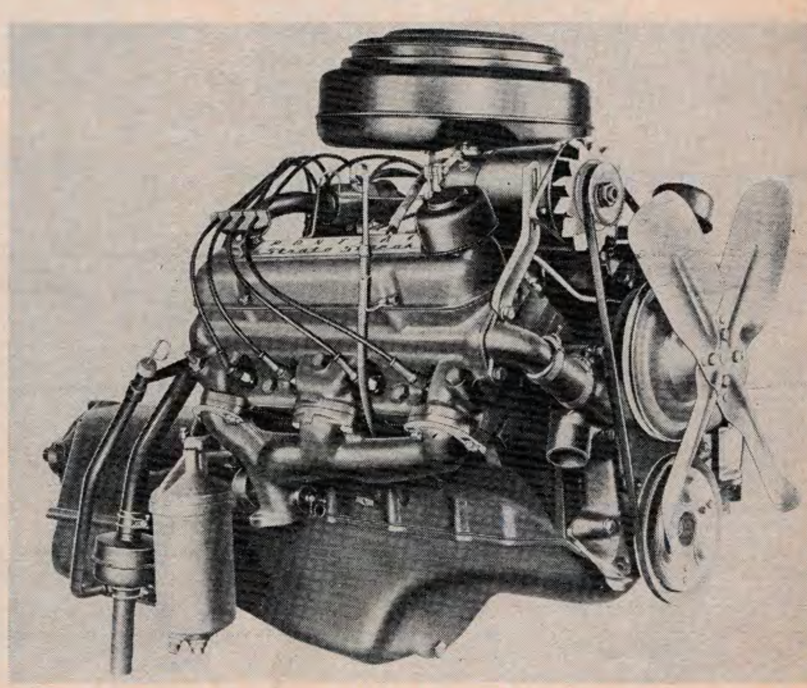
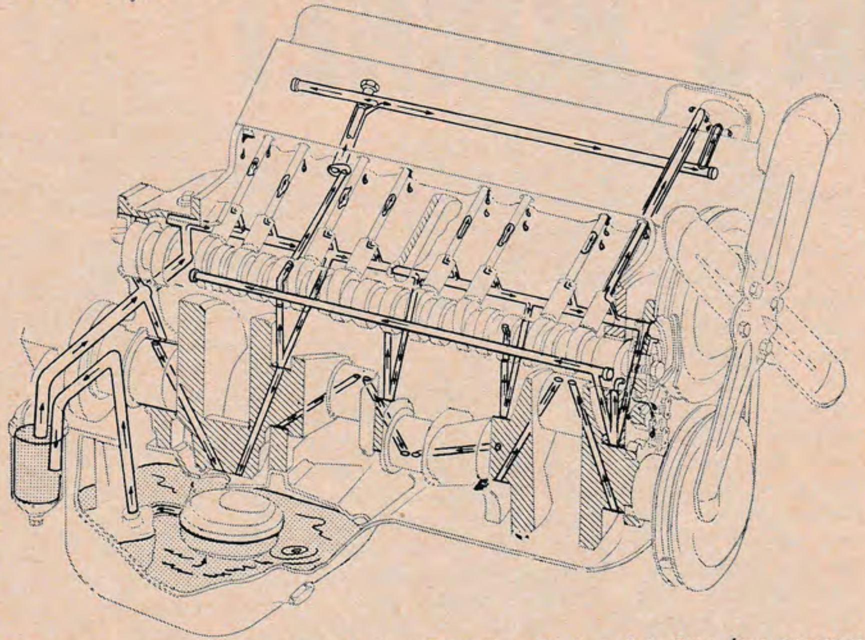


• ***Cutaway Pontiac V8 engine reveals details of combustion chamber, unusual valve mechanism, cooling, exhaust systems.***

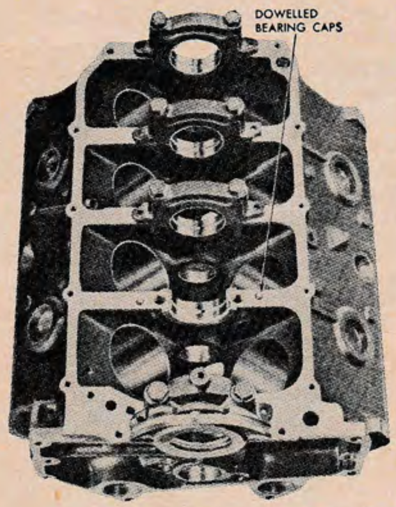


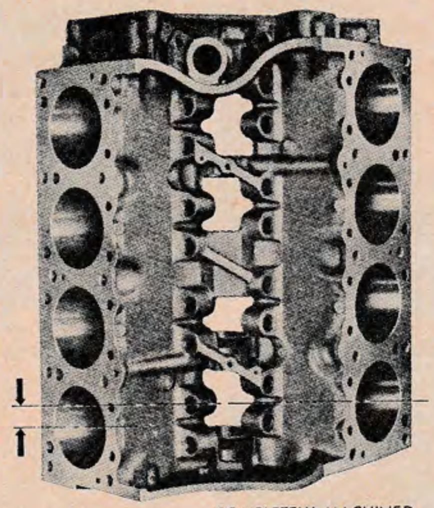
• ***This view emphasizes compact design of new 287 cubic inch Pontiac V8. Full flow oil filter is listed as optional equipment.***

PONTIAC V8 continued



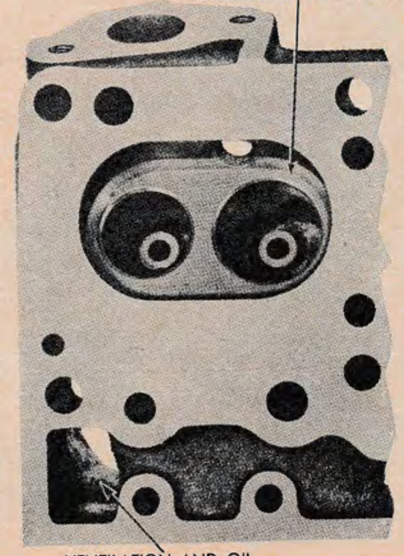
• *Lubrication system follows conventional practice to a point. Two low pressure galleries intersect cam follower bores, rockers are oiled through tube pushrods.*





• *UPPER LEFT. Bottom view of block shows widely spaced dowels used to accurately locate the main bearing caps to block.*

• *UPPER RIGHT. Another unusual twist in the new Pontiac engine is that the right hand bank is ahead of the left hand bank.*



• *Fully machined Pontiac combustion chamber is reminiscent of early Horning Chev heads. This design uses "quench area" equal to about 35% of piston crown. Note that plug is placed toward intake valve.*

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ing rods are clamped on the same crankpin and in order to center each rod in its respective bore, each bore must be offset from the bore on the opposite bank. It's a small point but this allowed Pontiac designers to locate the ignition distributor on the right hand side of the engine at the back so that the resultant thrust of the camshaft drive gear on the distributor gear is upward, which is quite the reverse from most other designs.

The Pontiac V8 pistons are cam ground slipper type aluminum alloy permanent mold castings that incorporate integral steel struts. Three piston rings are located above the piston pin, the two cast iron compression rings being 5/64 of an inch wide while the chrome plated steel rail oil ring is 3/16 of an inch wide. Piston pin diameter is .9805 of an inch. The pins are carburized SAE 1117 steel and of the full floating type, being retained in the pistons by snap rings. The piston pin bores are offset 1/16 of an inch in the interests of peace and quiet from under the hood. As a precaution against piston "scuffing" and as a good bearing surface, the pistons are tin plated. Incidentally, in engines with the standard compression ratio of 8 to 1, the piston crowns are flat, while with the 7.4 to 1 ratio, the crowns are slightly concave, which means that the combustion chambers and the thickness of the head gaskets are identical in either case.

The cylinder heads are alloy iron castings with fully machined combustion chambers. A "squish" and "quench" area with a nominal depth of .055 of an inch (the thickness of the head gasket), and covering about 35 per cent of the piston crown area is provided to minimize detonation by squirting the fuel/air charge into the main combustion chamber cavity and toward the spark plug. The port areas on both intake and exhaust sides appear to be adequate for the 1.78 inch diameter intake and the 1½ inch diameter exhaust valves. However, from what I've seen, some detail refinements to the ports, practically impossible to make in production, would be beneficial here, especially on the intake side. The intake valves seat directly on the head and the seat angle is 30 degrees, which has the theoretical advantages of better fuel/air mixture distribution and a 22½ per cent increase of effective valve opening area, as compared with a 45 degree seat angle for a given amount of valve lift. The drawback to a valve seat angle of less than 45 degrees is that the valve head is less apt to center itself on the seat. This controversial little point will probably never be conclusively proven either way, but it should be pointed out that the Pontiac exhaust valve seat angle is 45 degrees and also seats directly on the head.

At times, the valve seats in a cylinder head or block do some strange things because of combustion temperatures or because the head may not be properly or consistently tightened. A seat may be heated at a non-uniform rate, resulting in an eccentric seat or it may shift from the center of the valve guide bore in operation which is much more likely. The Pontiac engine design staff saw this one coming too and made the bores in the removable valve guides tapered instead of cylindrical, the end of the guide nearest the valve head having the largest diameter. This permits each valve to find its own center on the valve seat without binding the stem in the guide or causing an undesirable stress concentration under the valve head. This is a carry-over from previous years, but worth while, even in this age of so-called "rigid" engine components.

Each valve is retained by a conventional retainer washer and two split keepers. Dual valve springs with a combined pressure of 84 pounds with the valve seated and 159 pounds with the valve open keep valve float and spring surge to a minimum. The valve timing is as follows: Intake opens 22 degrees before top center, closes 67 degrees after bottom center, duration 269 degrees, lift at valve .370 of an inch. Exhaust opens 63 degrees before bottom center, closes 27 degrees after top center, duration 270 degrees, lift at valve .370 of an inch.

The rest of the valve train is almost identical in design to that of the 1955 Chevrolet V8 and, indeed, some of the parts are interchangeable. The material of the camshaft follows most other manufacturers in that it is an alloy iron casting, driven by a one inch wide timing chain. Also, hydraulic valve lifters are used on all models with the lifter body being made from hardenable cast alloy iron. Thin walled tubular steel pushrods are used with swaged, cyanide hardened and ground ends. Small holes in each end permit low pressure oil to be forced upward from two oil galleries that intersect the valve lifter bores to the rocker arm assembly. The rockers, like those of the new Chevrolet V8, but with a 1.5 to 1 lift ratio, are hardened and ground steel stampings that are held in place by individual studs pressed into the heads, a spherical washer and a retainer nut. This permits the valves to operate without valve stem cocking and scrubbing and, of course, without the more conventional rocker arm shaft. Each retainer stud is drilled and receives additional lubricating oil from a longitudinal oil gallery in each head. There appears to be one weak point in the design which is the press fit of the retainer studs in the heads. Each stud is subjected to stresses of tension and bending as the valves operate and it seems almost inevitable, that in time, the studs would work their way out of the holes. The easiest way to overcome this would be to thread the studs and tap the mounting holes, and with the aid of some gasket sealing compound, let the oil flow where it may.

In an attempt to reduce valve train reciprocating weight, some hardy pioneers went to the trouble of plugging the holes in the pushrods and routing individual oil lines to each rocker arm tip and pivot point, only to find that the pushrods curled up like a pretzel at certain engine speeds. Seems that the column of oil in the pushrods acts as a damper and prevents vibrations and other undesirable antics. The critical speed at which hydraulic valve lift "pump up" occurs in the Pontiac V8 is around 4800 rpm, only 200 rpm above the peak speed. Where higher engine speeds and more flexibility are desirable, it would pay off to install 1955 Chevrolet V8 mechanical valve lifters which are the same diameter but about ¼ of an inch shorter than the Pontiac hydraulic lifters. This would necessitate using special pushrods to make up the difference in length and maintain the proper relationship between pushrod, rocker and valve stem tip. When mechanical lifters are used with the stock Pontiac camshaft, the valve clearance should be set to the ridiculous amount of .003 of an inch with the engine hot and running. This is done by adjusting the retainer nut on the rocker arm studs. The reason for such a slight operating clearance is that a camshaft ground for hydraulic valve lifters does not have the opening and closing ramps found on its mechanical lifter counterpart that gradually take up the valve clearance before the valve is opened and closed at an accelerated rate. So in order to insure that the valves are seating properly and to prevent excessive impact loading of valve train components with the resulting noise, the valve clearance must be slight. However a new, wear resistant, low cost method of regrinding cast iron camshafts to any desired profile could be the easy and inexpensive way out of this dilemma.

Raising the compression ratio to 8¾ to 1 should give power and torque increases of about nine percent when used with decent gasoline. This could be most easily done by milling the head .070 of an inch after checking the piston-to-valve clearance. After this, a slight amount of intake port alignment may be necessary.

The cooling system layout is what the Pontiac sales group likes to refer to as "reverse flow gusher valve cooling." Reduced to more understandable terms, this means that cool water is drawn from the lower radiator outlet, as usual, by the centrifugal water pump that is driven by the fan belt. Instead of being pumped through the block then through the heads, the flow pattern is reversed and water is pumped into longitudinal cooling tubes in the heads. The tubes have orifices in them that direct high velocity streams of water to the exhaust valve seats. Water is then forced down through the block into full length water jackets that surround the cylinders, then up into water passages in the intake manifold and back to the radiator. By reversing the flow in this manner, water with the lowest temperature is squirted directly to the area that surrounds the hottest part of the engine, the exhaust valves and seats. This method, in spite of its merits, is in direct opposition to the more natural "thermo-syphon" flow pattern and it is a certainty that the direction of flow in the Pontiac would immediately reverse itself if the water pump were to stop functioning. But it does result in cooler temperatures of the valves and spark plugs.

The engine's fuel system consists of a combination fuel and vacuum pump assembly and either a Carter WGD-22075 or Rochester 7006100 two-throat carburetor. The fuel and vacuum pump assembly is mechanically operated by an arm that bears on an eccentric on the front of the camshaft and is located on the lower left side at the front of the engine. This position is directly behind the fan which assures a good blast of air to the pump, minimizing vapor-lock tendencies. A sintered bronze combination fuel filter and water trap is located in the main fuel line close to the carburetor inlet. The exhaust gases are carried from three ports in each head into two cast iron manifolds. The manifolds are joined by a steel tube that passes under the engine. An automatic choke is provided that is tied into the fuel mixture pre-heat chamber that is an integral part of the intake manifold.

Following GM practice, the new Pontiac comes equipped with a 12 volt electrical system, which results in some improvement in ignition performance. The distributor advance mechanism is controlled by centrifugal weights and a combination of intake manifold vacuum and velocity. Spark plugs are AC44-5's with 14 millimeter threads.

A "power kit" is listed by Pontiac that boosts the advertised maximum brake horsepower output to 200. This kit consists of a four-throat Carter or Rochester carburetor with a matching intake manifold and air cleaner. The price of the complete kit when ordered from the factory is about $50, but availability of the kit is an unknown factor.

The addition of this new engine completes a full line of overhead valve V8's for General Motors. In displacement, the Pontiac V8 falls between the 264 cubic inch Buick "Special" or the 265 cubic inch Chevrolet V8 and the 322 cubic inch Buick "Century," "Super" or "Roadmaster" engines. The Pontiac engine weighs slightly over 600 pounds, which gives it a favorable pounds-per-cubic inch ratio of 2.8 to 1. Already, a few items of speed equipment are available for the new engine and more are on the way. Sharply tuned stock Pontiacs are performing very satisfactorily now and when the engine is properly modified, the results should really be outstanding. Tying together the new engine and the choice of two types of transmissions and several rear end gear ratios, the new Pontiac is sure to be a "better than ever buy" for the most discriminating, performance-minded drivers.