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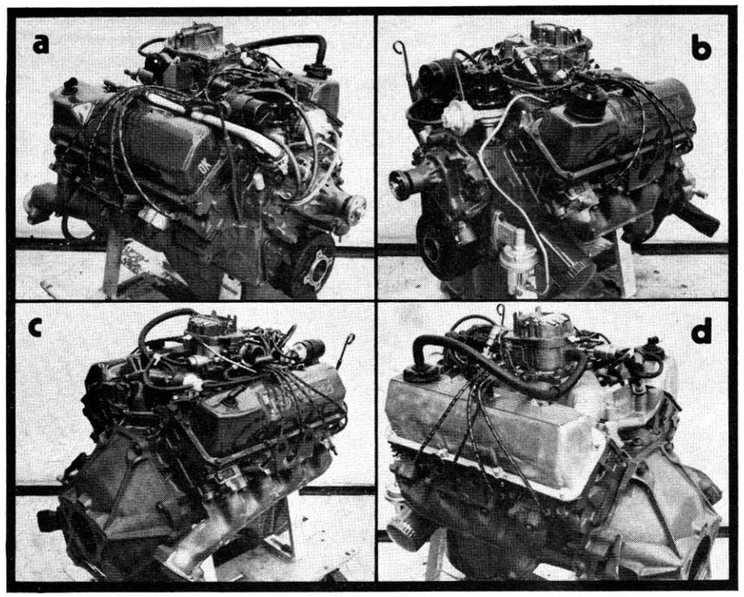
TOP SECRET

Overlooked by most racers, Ford's 351C is a real off-the-shelf eye-opener



LEFT — 351 Cleveland engines in the four basic configurations: A. 2-barrel; B. 4-barrel; C. Cobra Jet; D. HO or Boss 351. OPPOSITE PAGE, ABOVE LEFT — The 351 Cleveland block has an integral front housing for the water pump, thermostat, fuel pump and direct water passage to the cylinder heads. ABOVE RIGHT — Valves set at compound angles give the 351 heads their designation "canted valve." BELOW LEFT — Cylinder head on the left used the early "quench" combustion chamber. Later head on the right uses larger "open chamber." BELOW RIGHT — From left to right, early flat-top piston had 10.7:1 compression ratio, while domed version featured 11.1:1 for high-performance engines. '72 flat-top piston has only 9.2:1 squeeze.

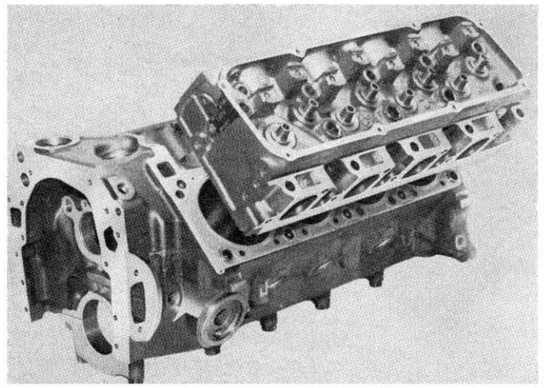
By C. J. Baker ■ It seems that in the world of high-performance engines, the 351 Cleveland has been one of the best-kept secrets in recent years. The 351 Cleveland is one of those series of outstanding performance engines that has apparently been overlooked by most hot rodders. Of course, not all versions of the 351C are suitable for competition usage — Ford has to build some for little old ladies too. But Ford does produce two versions that are real stormers: the 351C-CJ and the super-strong 351C-HO (sometimes called the Boss 351).

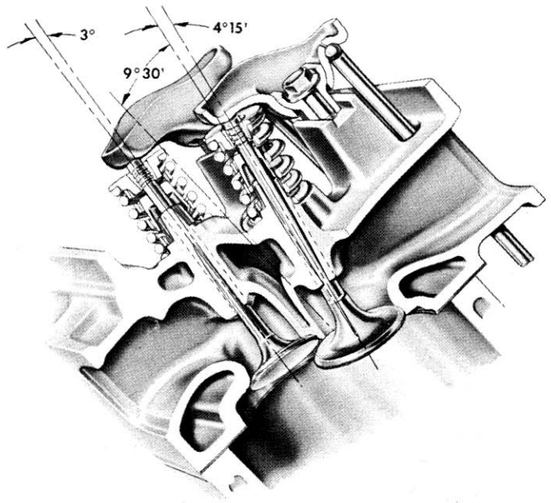
Before we go into a detailed examination of the CJ and HO engines, we'll review briefly the design basics of the 351C series. The 351C block is unique from other Ford small-blocks in that it includes an integral cast housing for the water pump, thermostat and fuel pump. This housing also incorporates water passages which facilitate the circulation of water directly to the cylinder heads without going through the intake manifold, providing a faster warm-up without hot spots. Eliminating water passages from the intake manifold also permits the design of more efficient manifold runners.

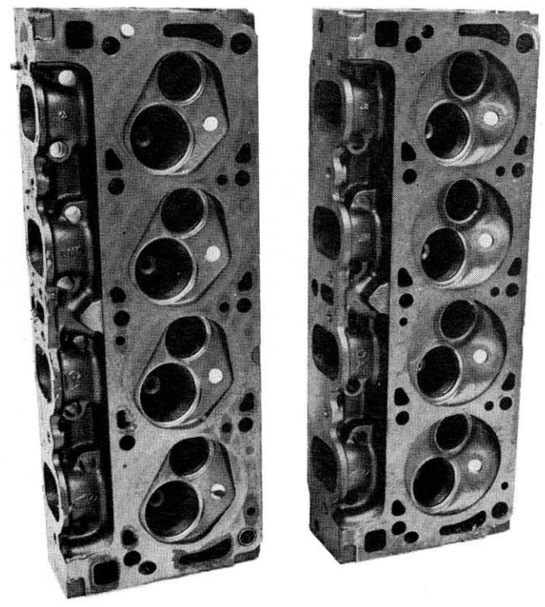
All of the 1972 351C blocks which were to receive a four-barrel carburetor were equipped with four-bolt main bearing caps, as were the '71 CJ and HO engines. All other 351s have two-bolt caps. However, all 351C blocks are cast with extra-wide cap-to-block mating surfaces to accept four-bolt main bearing caps. Therefore, blocks with two-bolt caps can be updated to the four-bolt caps. Since the four-bolt caps are not sold separately, they must be obtained from a discarded block or machined from 1010 steel.

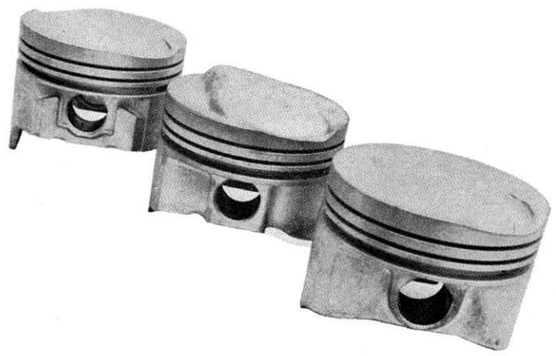
The last major design feature of the Cleveland engines is the use of canted-valve cylinder heads. Canting the valves toward the ports allows another port design and provides optimum flow characteristics. This design produces a more efficient flow pattern by reducing the sharpness of the port turns that are normally required with vertical valve replacement. The ports follow a nearly straight line to the valve centerlines; thus, a more uniform cross-sectional area can be used than is possible with rectangular ports. (See illustration.)

Now that we've acquainted you with the basics of the 351C's design, we'll enlighten you about the component variations between the 351C Cobra Jet engine, called the CJ, and the Boss 351C-HO, called the HO (high output). We will exclude the standard four-barrel 351Cs built up to 1972, and all the two-barrel versions, as they are not generally considered high-performance engines. In 1972 the four-barrel 351C and the 351C-CJ are identical, so we'll just refer to them both as the CJ.









Perhaps the most significant difference between the CJ and the HO engines is that the CJ uses a hydraulic-lifter camshaft and associated valve train while the HO uses mechanical lifters. The type of valve train used dictates several other component changes between the two engine versions. The CJ, with its hydraulic lifters, utilizes a positive-stop rocker arm arrangement with cylindrical-type fulcrums seated on individually slotted pads. A fulcrum guide is milled in the cylinder head pedestal for each of the independently mounted stamped rocker arms to position and lock the mating fulcrum guide. The cylindrical T-shaped fulcrum and rocker arms are bolted to the pedestal to provide a positive-stop feature which requires no adjustment. A more positive control of the rocker-arm-to-valve-tip relationship is attained by locking the fulcrum in the milled slot on the pedestal with a 5/16-inch bolt, thus improving durability of the valve tip and assuring high-speed valve train stability.

The HO, with its mechanical lifters, requires a provision for valve lash adjustment. To facilitate this, the rocker arm stud pedestals on the HO heads are machined flat instead of with the milled slot that the CJ and all other 351C heads received. In place of the T-shaped fulcrum, the HO gets a fully adjustable cylindrical fulcrum mounted on a 7/16-inch stud. Rocker-arm-to-valve-tip relationship is maintained by using pushrod guide plates in this system. For additional durability, the HO gets specially hardened and ground pushrods, stamped steel valve spring seats, higher pressure valve springs, single-groove tight-gripping valve keepers, and short-skirt valve seals for improved lubrication.

The valve sizes on the CJ and the HO are identical, with 2.19-inch intakes and 1.71-inch exhausts. There is, however, some variance in the combustion chamber design between the two engines in different years. The '71 CJ, '72 CJ and the '72 HO heads are identical, featuring "open" combustion chamber configurations of 7.39 to 76.9cc. However, the '71 HO employed a "quench" combustion chamber configuration of 64.6 to 67.6cc. This change on the '72 HO, along with changes in piston dome configuration, was made to make the engine compliant with '72 emission requirements.

Four different types of pistons have been used in '71 and '72 CJ and HO engines. In 1971 the CJ used a cast-aluminum, flat-top piston with a compression ration of 10.7:1. In 1972 the same style of piston was used, but the compression ratio was dropped to 9.0:1.

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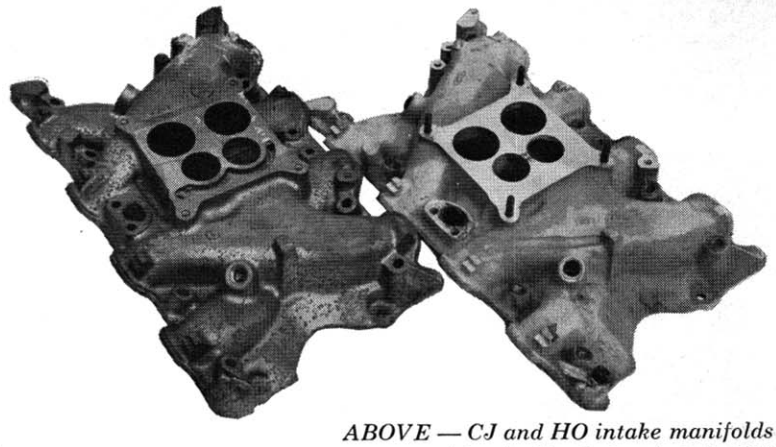
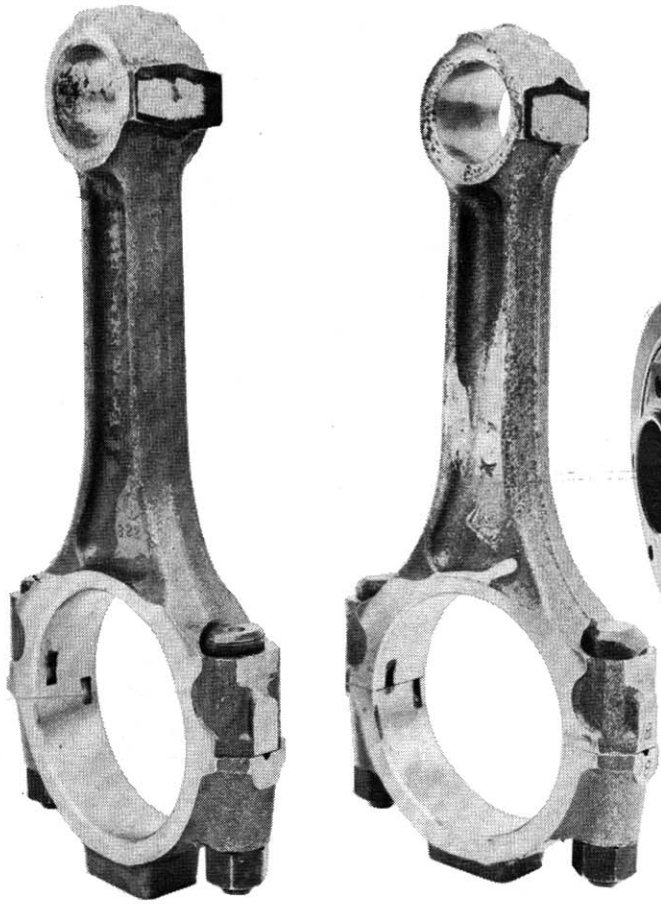
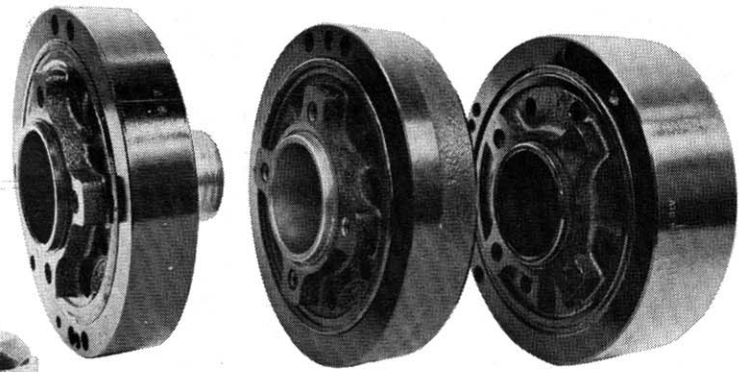


ABOVE — CJ and HO intake manifolds are identical in design, but the HO unit is cast from aluminum (right) while the CJ receives cast iron.

BELOW — Connecting rods for both the CJ (left) and the HO (right) are forged 1041-H steel, but HO rod is shot-peened and magnafluxed. HO rod also gets a more durable 180,000-psi bolt.





ABOVE — Harmonic dampers vary in weight for different engine applications. 2V and 4V engines get the lightest unit, while the CJ receives the middleweight. The heavy damper is reserved for the HO.

Unlike all other 351Cs, the HO uses a forged-aluminum piston. In 1971, the HO piston featured a pop-up dome for a compression ratio of 11.1:1. This was a very good piston, and a compression ratio of 12.0:1 could easily be obtained by reducing deck height and milling the heads. In 1972 the pop-up dome was replaced by a flat-top on the forged piston for a compression ratio of 9.2:1. This change makes the '71 engine a better choice for any serious competition usage.

The connecting rods for both the CJ and the HO engines are forged from 1041-H steel, but the HO units are shot-peened and magnafluxed. In addition, the HO rods get a more durable ⅜-inch, 180,000-psi bolt in place of the ⅜-inch, 150,000-psi bolt used in the CJ rod. Incidentally, the HO rod bolts will fit in any of the other 351C rods. This would be a wise swap when doing an engine overhaul.

A cast-iron crankshaft is used in both engines, although the HO gets a crank selected for hardness (90% nodularity). The lubrication system for both engines is identical; however, the dipstick on the HO engine is recalibrated for a six-quart oil fill instead of the five-quart oil fill used for other 351Cs. Running that sixth quart of oil is another good idea to employ on all 351Cs.

Different harmonic dampers are also used on the various Cleveland engines. The CJ gets a damper that is slightly heavier than the standard production 2V and 4V dampers, while the HO gets a still heavier damper designed for high-rpm operation. (See photo.)

On top of the engine, identically designed intake manifolds are used on both the CJ and the HO engines. The only difference is that the HO manifold is cast from aluminum while the CJ's is cast-iron. Use of the HO manifold on the CJ is a great weight-saving tip.

Carburetion on both the CJ and the HO engines is handled by Autolite 4300-D spread-bore carburetors, varying only in calibration. Ignition chores are handled by dual-point, dual-diaphragm distributors, again varying only in calibration.

One final distinction given the HO is the use of cast-aluminum valve covers, while all other 351Cs get stamped steel covers.

As we said at the beginning, the 351C seems to have been overlooked, but we hope to remedy that. While in Detroit, we had an opportunity to drive a Mustang with the 351C-HO engine. The performance and tractability of the HO was impressive — doubly so when we found out that the Mustang weighed 3750 pounds. It was enough to make us wonder what the HO would be capable of if it received the full treatment and was installed in a lightweight body. The truth is, we're thinking seriously about doing it ourselves for a future story! ■ ■