4.0 SOHC Tech

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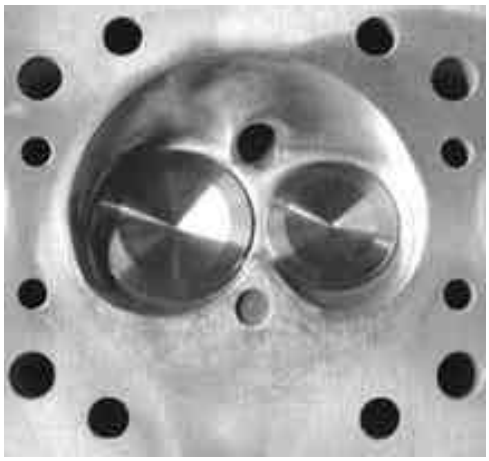
We're all interested in the new 4.0 SOHC engine in the 05 V6 Mustang. Well, its not actually new, its been around for a few years in Explorers and Rangers. Anyway, lets take a look inside one of them at whats good and bad.



The heads have large 68cc heart-shaped combustion chambers with good spark plug location, partially unshrouded valves, large straight intake ports, and 1.81/1.54 valves. The exhaust side uses a small high velocity exhaust port. Theres plenty of room for bigger valves, which we already have available for good reason—the quality of the stock valves is horrible, they have what appears to be visible porosity. Due to the nature of the timing chain systems, there is a right and left cylinder head. Our direct-fit stainless steel valves in 1.83/1.56 sizes are the way to go. OK, speaking of power adders, heres where we get unhappy with the heads—they are very thin walled aluminum construction, and they have the "Swiss Cheese" deck like the 94-95 3.8 heads that were so prone to blowing head gaskets. Each cylinder is surrounded by 4 head bolt holes and 8 large coolant holes! That's 12 holes! The cylinder deck integrity is very important to preventing blown head gaskets, and the deck integrity of the 4.0 SOHC engine is a concern because of all the giant coolant ports that Ford put into the head deck. We already know of blown head gaskets and cracked pistons on supercharged 4.0 SOHC's at only 8 psi. By the way, the stock 4.0 SOHC uses 3-layer MLS gaskets of .030" compressed thickness. We're currently working on a copper hybrid 4-layer MLS gasket with .040" compressed thickness.

The stock cams are a hollow core design with preground lobes welded into place. There is a right and left cam, they are not the same. The lobes are big, which means there is plenty of metal to allow regrinding. The stock cams provide about 185 degrees intake duration @ .050, 193 degrees exhaust duration @ .050, .472" valve lift with 116 degree lobe separation. We have regrinds available now that look like this: intake duration 211 degrees @ .050, exhaust duration 211 degrees @ .050 lift, intake valve lift .500", exhaust valve lift .500", lobe separation 112 degrees. These cams are available now as a set including a specific drivers side and passenger cam. These cams require a custom retainer, valve seal, and spring kit which is also available now. Since the 4.0 SOHC engine drives the passenger side cam from the rear of the engine, changing the cams with the engine in the car is going to be challenging. Please note that when removing the cam gear on the passenger side of the engine, the bolt is reverse threaded! Although there are no timing marks on the cam gears, crank gears, or timing chains, a specialized tool kit is available from Ford for cam timing.

The high 9.7:1 stock compression ratio and deck integrity of the cylinder heads will probably lead to head gasket retention problems in power adder applications, we've already developed several new products for the 4.0 SOHC engine for you power adder guys. Supercharged setups really need to reduce the compression ratio from 9.7:1 to 9.0:1 and the best way to do that is with high strength forged pistons that are dished to reduce the static compression ratio to eliminate the problems associated with high compression ratios in supercharged applications. We've also worked with ARP to provide new head studs to replace the Torx-head torque-to-yield stock head bolts. These forged pistons and head studs are the ticket if you intend to supercharge your 4.0 SOHC engine. For nitrous applications, these new forged pistons are also available in flat top design to retain the 9.7:1 compression ratio which works well with nitrous. The stock flat top hypereutectic pistons will be fine for naturally aspirated applications; they have good ring positioning for naturally aspirated use and employ an off-set pin which is common on most new engines these days.

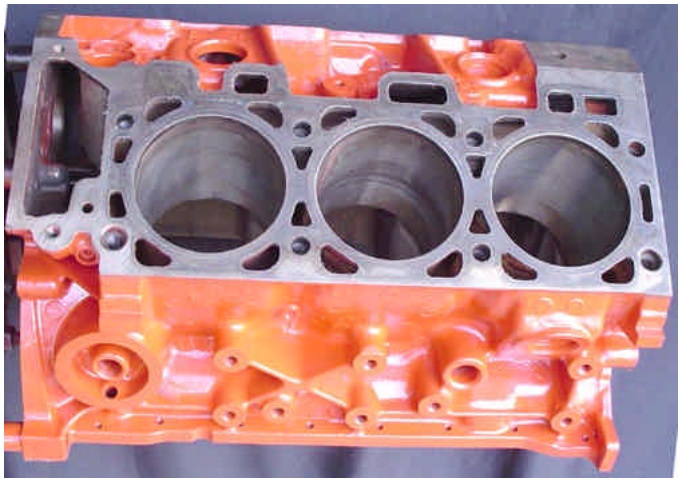
The stock rods (587 gm) are actually forged rods but use a relatively small through bolt and are press-fit with gigantic heavy pins (156 gm). Overall, the rods are not immediately suspicious and would appear to be adequate for modest power adder applications. For performance rebuilds, we'd recommend that the beams be profiled and shot peened. Removing the odd small-end balance pad removes 21 gm from the top of the rod! Add good rod bolts and the race-

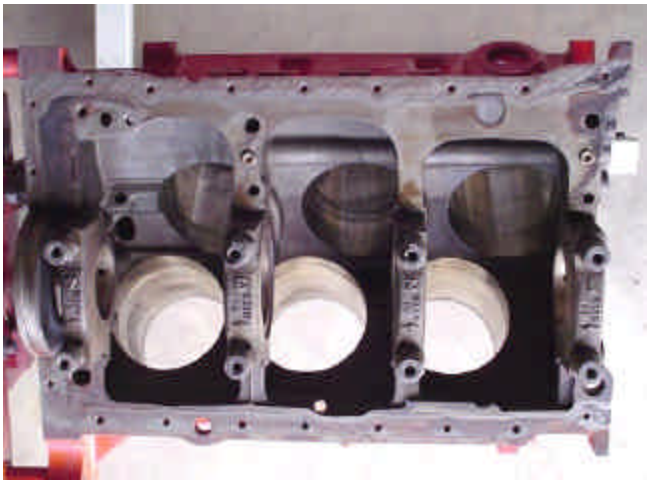
prepped rods will be able to go past 350 horsepower with no problem. Our forged pistons are designed to work with the stock forged rods with press-fit pins except we'll include lighter weight thinner wall pins.

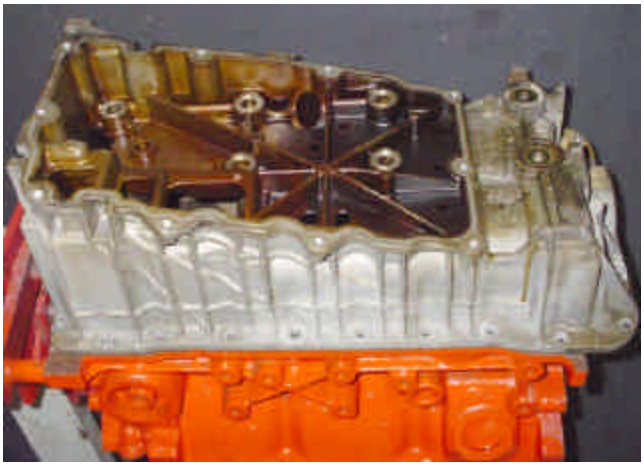
The crank is neutrally balanced and actually looks pretty sturdy. It appears to be heavily counterweighted and is probably close to a 50% balance factor. The crank is robust enough to allow off-set grinding since it uses single pin rod journals, so the potential for stroker motors is there, based on the crank. With shot peening and deburring, it should be good for plenty of power. The harmonic balancer and crank pulley are a one-piece design with relatively small crank pulley diameter, this is good news and indicates that underdrive crank pullies will not be required.

The 60-degree block is sturdy due to the narrow-angle design. The cylinder walls are not very thick, but should hold up at normal overbores. The stock bore is 3.95, the stock stroke is 3.32. Due to the nature of the pressed in oil gallery balls, the use of shot blasting on the blocks is not recommend. For this reason, our engines will be cleaned chemically instead of furnace baking and shot blasting. So far, most of the blocks which we have seen have been brinelled on the deck surface by the head gaskets which means that decking of the blocks will be mandatory. That's OK since the pistons run .010 in the hole at TDC anyhow.

The blocks are adequately cross braced but appear to be very open internally. As we described with the heads, the extensive nature of the coolant transfer holes is also apparent in the deck surface. On the other hand, the main girdles are decent as are the square-shouldered main caps.







The 4.0 uses a unique 2-piece oil pan, the main body of the pan is cast aluminum and is internally stiffened. Furthermore, the oil pan is a structural member of the engine and acts as a girdle since it is through bolted into the main cap bolts. The pan also acts as a windage tray and is baffled to ensure a continuous oil reservoir for the oil pickup.

Strokers. It turns out the cylinder length is adequate for a stroke increase. We'd like to use a 3.5" stroke (up from stock 3.32) with a 3.980 bore. (3.950 stock) to achieve a displacement of about 4.3L which should make outstanding efficiency based on the intake port characteristics of the SOHC heads. Due to the design of the oiling in the crank journals, it looks like off-set grinding will not be possible, which means a billet stroker crank will be the only way to go.

The cammer uses plastic intake manifolds. We haven't looked inside the new Mustang upper but the lowers have nice straight ports of generous volume. The Explorer/Ranger upper uses split-plenums like the late model 3.8/4.2's. The Mustang's throttle body is 65mm which should prove to be very adequate in size for most applications.

A word or to in general. If you are going to be modding your engine and have no hands-on experience with overhead cam designs, you should realize that you must purchase good service manuals and the specialized tool kit. These are not extremely expensive, but they are required. Consider it the price of admission, so to speak, to 4.0 SOHC perform-

ance. Something else, the designers of the 4.0 SOHC are European, so you can hate on them for their love of all things Torx. Just about everything uses Torx head bolts and screws—so be warned, working on a 4.0 cammer requires a whole array of Torx head bits and tools. So far, with a couple of major exceptions, like the cylinder head decks, the rear-driven passenger side cam, and the Torx stuff, we like the 4.0 SOHC engine.

About bolt-on performance. Beware of cold air kits. Its not that they don't work, its just that the 05's demand a PCM re-tune when a cold air kit is added.

The stock cast iron exhaust manifold on the passenger side looks pretty decent, but the one on the drivers side isn't so good, however, MAC offers both short and long tube headers for the new V6 already. MAC also offers complete dual exhaust systems for the V6 as including their ProChamber mid-pipe which we like a lot. However, we still have not seen any real dyno test numbers on these products yet. There are a few installation quirks that we've documented in our on-line forums.