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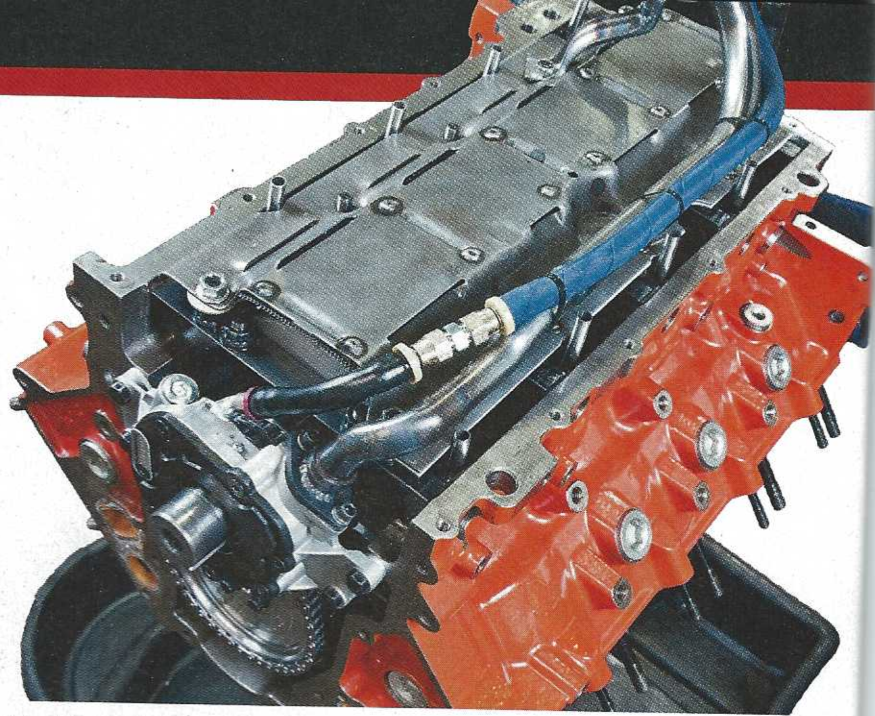
with the deeply skirted block and cross-bolted mains. By its very design, the LS was destined to be a superstar of the performance scene.

When contemplating an engine combination to compete in the 2013 AMSOIL Engine Masters Challenge, the advantages of the LS series engine were not lost to Judson Massingill of the School of Automotive Machinists (SAMs). Jud had been an early adopter of the Chevy LS and has years of success with LS power on the dragstrip. The LS would be the basis of the build, the only question being how it would be configured.

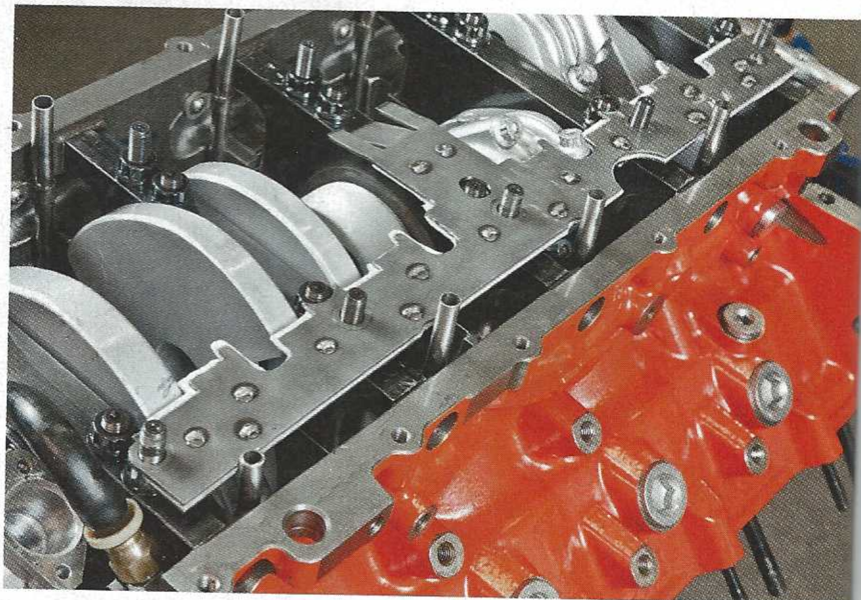


A look inside the crankcase with the oil pan removed shows a bottom end well protected from power-robbing oil splash and windage. The tubes opening below the pan rail direct oil from the top end to below the rotating assembly, while the Schumann oil pump redirects bypass oil back to the pickup tube.

The Bottom End

As an OEM engine, the LS engine was offered with both aluminum and iron blocks, in a variety of bore sizes and crankshaft strokes. While the production block can be the basis of a very powerful build, the SAMs team elected to go with the GMPP LSX block.

As Jud explains, "The basic thing is the strength of the block to keep the cylinders round and straight. That is why we prefer a cast-iron block to the aluminum blocks. Also, this block has the six-bolt pattern for the heads, and it accommodates a bigger bore. We have used one of these blocks in our drag car for the last five years, and when we take the engine down to freshen it, we observe that the cylinders stay round. Our experience with this block made us confident that it was the right choice for this build."



Removing the windage tray reveals the very effective crank scraper, painstakingly fitted to the rotating assembly. The scraper features a Teflon edge. Note the open breathing area adjacent to the main caps, allowing air pressure to move freely within the crankcase.

Jud continued, "We decided to build the engine to 436 ci, going with 4.164 inches on the bore and 4.00 inches on the stroke. We were thinking the larger engine capacity would help with power down low. The crankshaft is a billet piece from Bryant, and the main thing on the Bryant crank is that it is a very strong and lightweight crank; it is made of premium metal. It probably is not needed at this horsepower level, but even if we decide to do something more serious with this engine later, we will not have to worry about the crankshaft. We used a Scat 6.00-inch H-beam rod, which gives us a compression height of 1.240 inches. We don't like anything below about 1.200 inches if possible, because the piston can get unstable. I'm not too much of a believer in the rod length theories, and I know there is a lot of debate on the topic, but our main thing is that the center to center of the rod connects the pistons to the crank. We have been building engines for a long time and we really do not see enough difference to register."

The pistons are custom-dished forgings from Diamond. As Jud tells us, the block choice, along with the stroke and piston, all work together. "The LSX block has a longer cylinder than a conventional LS block, and that keeps the skirt from hanging out of the bottom of the cylinder at bottom dead center. We do not even like a 4.00-inch stroke in a street LS using a production block. The piston comes way out of the cylinder at the bottom, and that lets things rattle around; you need to put more oil ring in it, and that adds friction. With the LSX block, you can go with the longer stroke and still keep the piston stable in the cylinder."

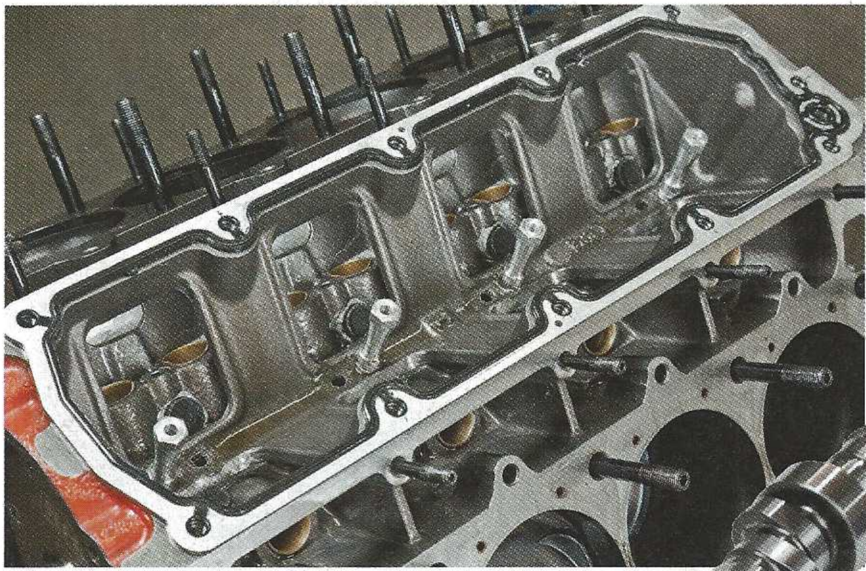
Jud detailed the piston crown configuration as an important aspect of the build. "What we like is a small tension on the oil ring. The Mahle oil ring just right out of the box was right on the specs for what wanted to do, and it is also a very nice ring assembly."

The oiling system, including oil control within the engine, was an area where the SAMs team focused a great deal of attention. Jud detailed, "The scraper has a Teflon lip on it, and we fitted it extremely tightly—this was indeed a crank scraper. The windage tray features a screen that breaks up the oil and prevents the oil from splashing on the inside of the tray. To further control the oil, we bored the cam tunnel out and actually put sleeves in to create a closed cam tunnel. Then we bored and line-honed the sleeves to size the new tunnel for the cam bearings. We then used tubes to drain oil from the tunnel, bypassing the rotating assembly completely. At the top in the lifter valley, each segment of the cam bore has an oil drain provision from the top end and a standpipe to allow ventilation. The oil drains into the tunnel and reaches the level of the drain tubes and then runs down the tubes to the sump." An additional trick component of the oiling system is the oil pump itself, a specially configured unit from Schumann, with a unique bypass system using an internal hose to run the bypass oil right back to the pickup tube.

Jud went further in describing the measures taken to control the oil, this time at the lifters, "We bushed the lifter bores only to control the oil. In this way, we were able to restrict the oil passage to just a 0.030-inch hole to the lifter. We could go even less than that with a solid lifter, but to work the hydraulic lifter, we opened it up a little. We also set the lifter to bore clearance tighter than normal at just 0.0008 inch."

Working the Valves

The 2013 AMSOIL Engine Masters Challenge rules specified hydraulic cams only, and here the SAMs team went with a high-lift custom ground camshaft from Competition Cams. Jud elaborated on the camshaft development process, "Our problem with the cam was we kept making power at too high an rpm. Generally, we tend to overdo it with our heads, and that makes the engine want to rpm. We kept shortening the duration until we got down to the 240-degree number. Then we tightened the lobe separation



Inside the lifter valley, additional oil control measures were evident. The lifter bores were bushed to restrict oil flow to the lifters with a 0.030-inch orifice. The valley drains to the enclosed cam tunnel via a drain at each cell, with a ventilation standpipe adjacent to each drain. From the tunnel, oil is drained to the pan via fabricated tubes.

A custom Comp hydraulic roller dials in the rpm range. Specifications here are 240/240 degrees duration, and 0.840 lift, with a tight 102-degree lobe separation. The installed centerline was set to 97 degrees.

Bullet 0.842-inch hydraulic roller lifters follow the cam, while the stiff Smith Brothers tapered 3/8 to 7/16-inch pushrods transfer the motion. Minimizing pushrod deflection is an important aspect of valvetrain stability.