Power Company III

Story and technical photographs by Sam Logan

In the final installment of our series on KS Engineering's winning modified engines, Kevin Stoa buttons things up, then concludes with the break-in procedure and dyno test.

As a two-time IMCA Speedway Motors Super Nationals winner, Kevin Stoa understands how to get results within the confines of the dirt modified rulebook. As the principal of KS Engineering, Stoa has applied the same principles to building dirt modified engines. As noted last month, for example, Stoa cares less about achieving peak engine power than about finding the engine's most effective rpm range.

Similarly, Stoa must select among the best components that the rules allow—which are not necessarily the best components for a given application. For instance: The wet-sump oiling systems the dirt mod rules require are vastly inferior to their dry-sump counterparts. Aided by scavenge pumps, the dry-sump system transfers the hot, aerated oil that resides in the crankcase and oil pan to a separate reservoir. In addition, a dry-sump system usually incorporates a vacuum pump that creates negative pressure in the crankcase, allowing the rotating assembly and the pistons to operate with less stress. If dry-sump oiling systems were permitted in dirt modified engines, which use a relatively long stroke, power output would likely increase by around 75 horsepower.

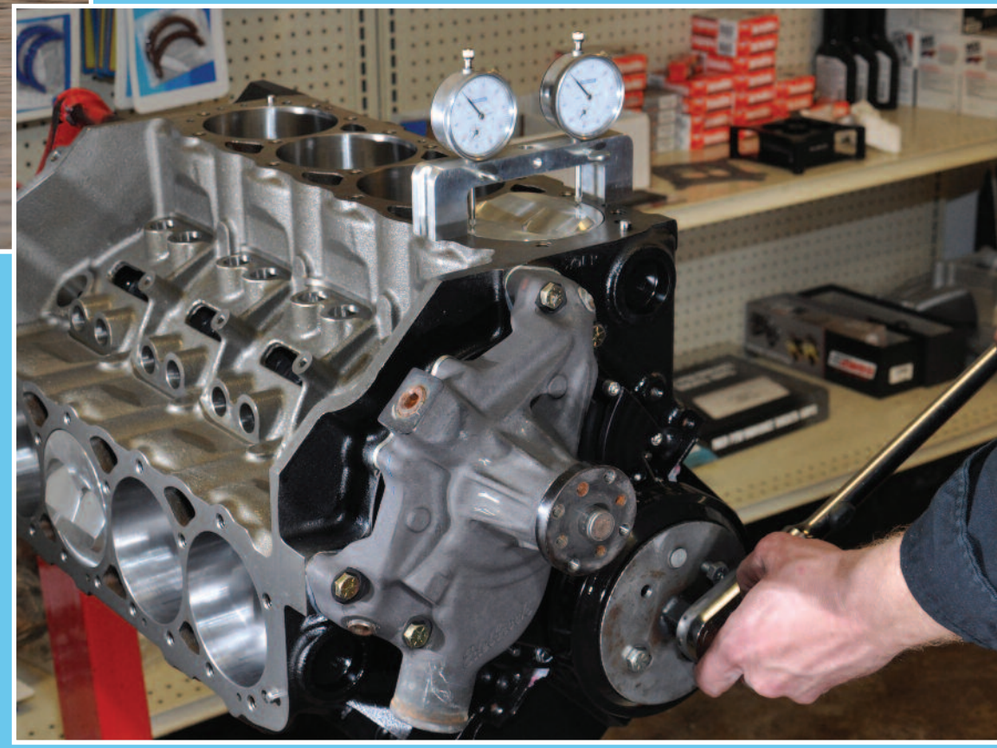
But they're not. Dirt mod engine builders must use wet sumps. Overcoming their inherent inadequacies is a considerable achievement. "Wet-sump oil pans are designed for the G-forces of turning left," Stoa says. Because of those G-forces, the engine oil collects in the right rear corner of the oil pan, which is where the oil pump pickup is.

That creates an extreme environment in which turning right for any

Above: To prevent wear in the advancing mechanism and other potential failures, the distributor is locked with 32-degrees of advance ignition timing. This complicates starting a hot engine, but the solution to avoid kick-back is simply not to pump the throttle pedal.

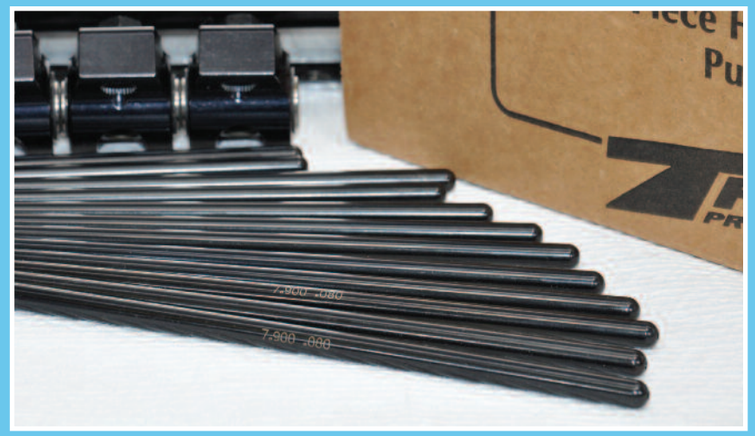
BRUCE BADGLEY (2)

As both a driver and engine builder, Stoa (No. 98, at the 2011 IMCA Speedway Motors Super Nationals) knows that acceleration is more important to a dirt modified racer than peak engine power .

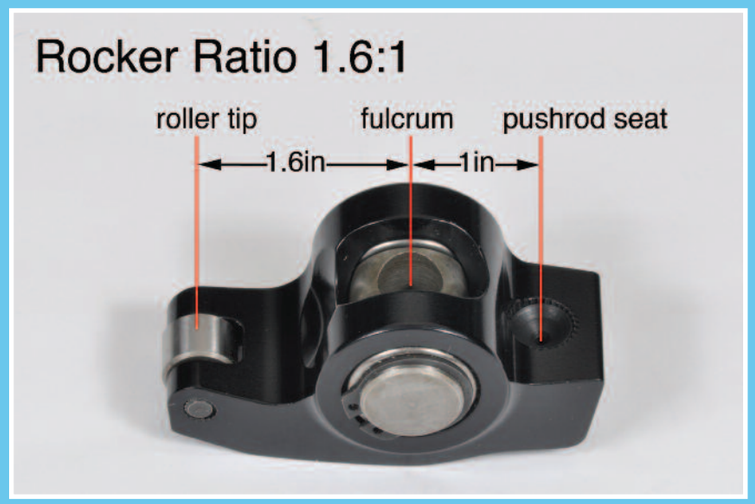


Left: Stoa's success speaks for itself.

Right: Using a pulley tool to rotate the crank, the piston-to-deck clearance is double-checked to determine the correct head gasket thickness. As the pistons are set at .005" down the bores and the desired piston-to-head clearance is .035", the correct head gasket thickness is determined to be .030".



These 5/16"/.080" wall pushrods are the largest diameter that will fit the required cast iron cylinder heads. Made from chrome molybdenum (4130) and with numerous heat treatments, their ball ends are formed to a tolerance of plus-or-minus .001". They operate reliably at 7,800 rpm with either cast iron or the latest tool-steel solid flat tappets. Providing there are no signs of galling on their ends they can be re-used over multiple racing seasons.



Above: The ratios of stud-mounted rockers are usually altered by moving the pushrod seat or cup further away from the fulcrum (lower ratio) or closer to it (higher ratio). Higher ratios provide greater valve lift and faster valve lift. They also intensify the loading on the pushrod.

Left: The best indicator for correct rocker arm geometry is the width of the contact patch on the valve stem tip. A narrow contact patch that remains constant throughout the rocker's arc of travel demonstrates that the positioning of the fulcrum, the roller tip, and the pushrod lengths are all operating with optimum geometry.

reason—such as exiting the track—is a risky maneuver. "If you have to turn right," Stoa says, "it's best to first drive down to the flat apron and then make a wide sweeping turn up the banking."

Further, Stoa notes that some racers refuse to install an oil temperature gauge "because the oil temperatures of a dirt modified wet-sump system are so high—up and over 300 degrees—that it scares the hell out of them."

To combat the extreme heat, Stoa relies on Champion oil. "No failures so far!" he says.

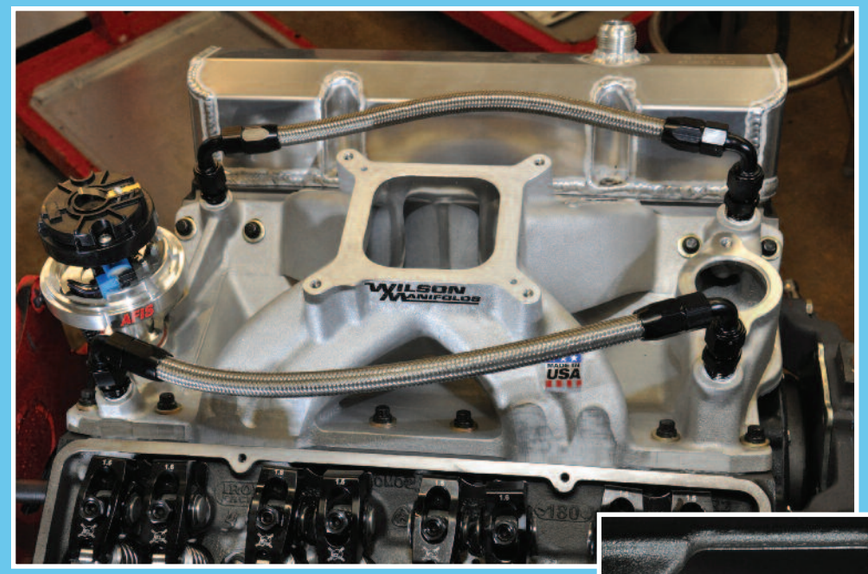
Through evolutionary development, racing valve train components have overcome similar inherent shortcomings. Until the early 1990s racing pushrods weren't straight, they varied in length, and, worse, their ends were susceptible to cracking around the oil holes. In Warren, Michigan, a little-known entrepreneur, Bob Fox, confronted these issues. Five years earlier, while working the phones as tech help at nearby Diamond Racing, he had spent hours wrestling with pushrod problems. But now with Trend Performance established, he had become a pushrod maker in his own right and was determined to blaze new trails. Fox devised procedures to straighten pushrods and to produce them in consistent lengths. To resolve problem of premature fracturing on their radiused ends, he introduced a unique milling operation that created more material in the vital areas. Since then valve train reliability has improved significantly.

One last note about operating under real-world conditions. Engine builders often face constraints of time as well as money. With that in mind, the engine featured in this three-part Speedway Illustrated story was built and dyno-tested within a remarkable 24-hour period. And in the end, the dynamometer revealed that KS Engineering had met its goal: an engine with the capacity to accelerate quickly. That's the essence of dirt modified racing.

SOURCES

KS Engineering
507-552-1572

Trend Performance
586-447-0400



Left: Because the intake manifold does not have a coolant transfer passage across the back side, two external stainless steel braided hoses are used to transfer the coolant from the rear regions of the cylinder heads directly to the thermostat housing. This system eliminates potential hot spots in the cooling system caused by water trapped in the back regions of the cylinder heads.

Right: Spark plugs are marked to ensure their electrodes are positioned from 10 - 2 o'clock. Although piston strike is unlikely this precaution avoids any concerns. "Plus the fire is in a better place," Stoa says, "having the electrodes pointing up like that."

Bottom: The three principal operations that occur in the dyno room are running the break-in procedure with outer valve springs only; checking for cylinder and combustion chamber leaks (known as leak-down testing); and performing the dynamometer test. The leak-down test (pictured) is conducted by applying steady, fixed air pressure to the cylinders. Stoa expects less than five percent leakage. Recently he successfully tested Trend's new tool-steel solid flat tappets using both inner and outer springs during break-in, thus saving several hours of work.