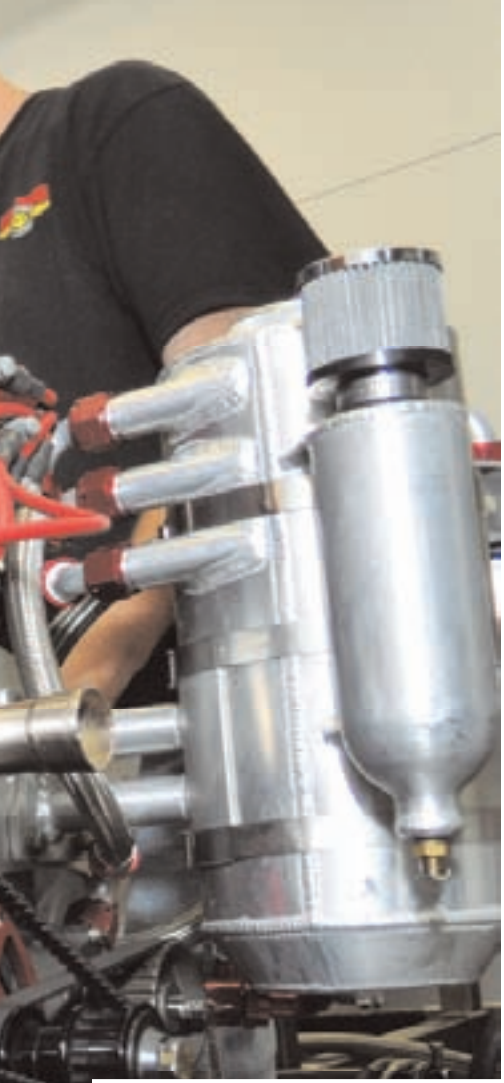
Mountain Motor Magic

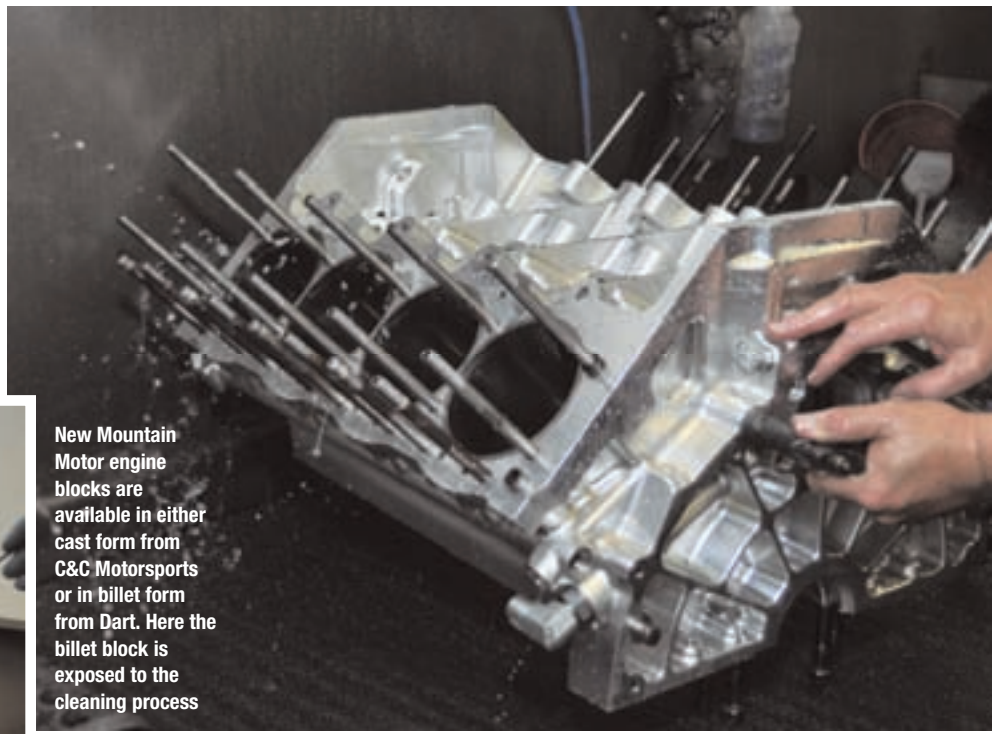
THE ESSENTIAL CRAFT OF KEEPING PRO STOCK MOUNTAIN MOTORS RUNNING

Text and Photos by Sam Moore

Pro Stock Mountain Motors have cubic inch displacements of 820 to 825. Their capacities began much smaller, deriving from original equipment big-block engines of the '60s. But gradually the dimensions between their pan rails grew, allowing longer throw cranks to appear with connecting rods measuring 7.750 inches center to center and 5-inch bore centers with 4.770-inch-diameter pistons, all functioning within a deck height of 12 inches. Today's Pro Stock engines operate on compression ratios of around 18:1, run on VP Race Fuel grade Q16, and generate in the region of 1,900 hp. Depending on weather conditions, they run quarter-mile elapsed times in 6.25 seconds at speeds close to 225 mph.

Jon Kaase Racing Engines has been a driving force in the development of these engines for as long as most can remember. From the beginning, when he worked with Dyno Don Nicholson, Kaase imposed uncompromising standards in race engine building. And his record of success has been impressive: He and his team have produced Pro Stock engines for 12 IHRA national championship winners, plus an NHRA Pro Stock title. Though their business now includes engine part sales to hot rodders, including the supply of the remarkable Boss Nine engine, the Winder, Georgia, firm still maintains about 20 Mountain Motor customers, refurbishing these formidable power plants after every 25 to 30 runs.





New Mountain Motor engine blocks are available in either cast form from C&C Motorsports or in billet form from Dart. Here the billet block is exposed to the cleaning process

The engine is dismantled and the crankshaft is removed, cleaned and Magnaflux tested.

The art of cylinder honing is never taken more seriously than at Kaase's. It is the key to gaining a power output edge while maintaining a fine, consistent pattern of crosshatch scratches that lubricates the rings.

Piston pins are checked for straightness, and run-out is measured to 0.0001-inch. The run-out on the average pin is usually around this figure; if the indicator shows run-out of 0.0005-inch the pin will be renewed.

Until five years ago Kaase used titanium connecting rods. Today they have been replaced mainly by aluminum. On the left is a titanium connection rod and on the right is the aluminum counterpart. The Diamond Pro Stock piston features inboard pin bosses, stiffening ribs, shorter pins and minimal skirts to decrease frictional loses. Friction is further reduced by the use of thin .8mm top rings and Napier-style second rings. Trend's piston pins are coated in a diamond-like carbon and retained in the piston with single round wire locks.

The mighty Bryant billet crankshaft resides in the aluminum block and functions with aluminum rods, bearing caps and main caps. Aluminum is lighter than steel, and it makes accurate line boring easier. When honing dissimilar metals, the hone is inclined to push toward the softer metal.

The diameter of the forged pistons usually measures 4.770 inches. The small-bore holes around the perimeter of the CP pistons are gas ports. These allow combustion gases to enter the top ring grooves, imposing a force on the inner edge of the top rings and forcing them out onto the cylinder walls.

When reciprocating engine parts collide (usually pistons and valves) and a connecting rod or rods explode through the engine walls or the oil pan or both, foreign particles are immediately released into the oil stream to be sucked into the oil pump rotors. Rod bearings are often first to disintegrate, showering the pump with brass, copper and aluminum. Seasoned start-line observers will regale you with stories of inexperienced drivers breaking connecting rods at the starting lights and driving the entire length of the track,

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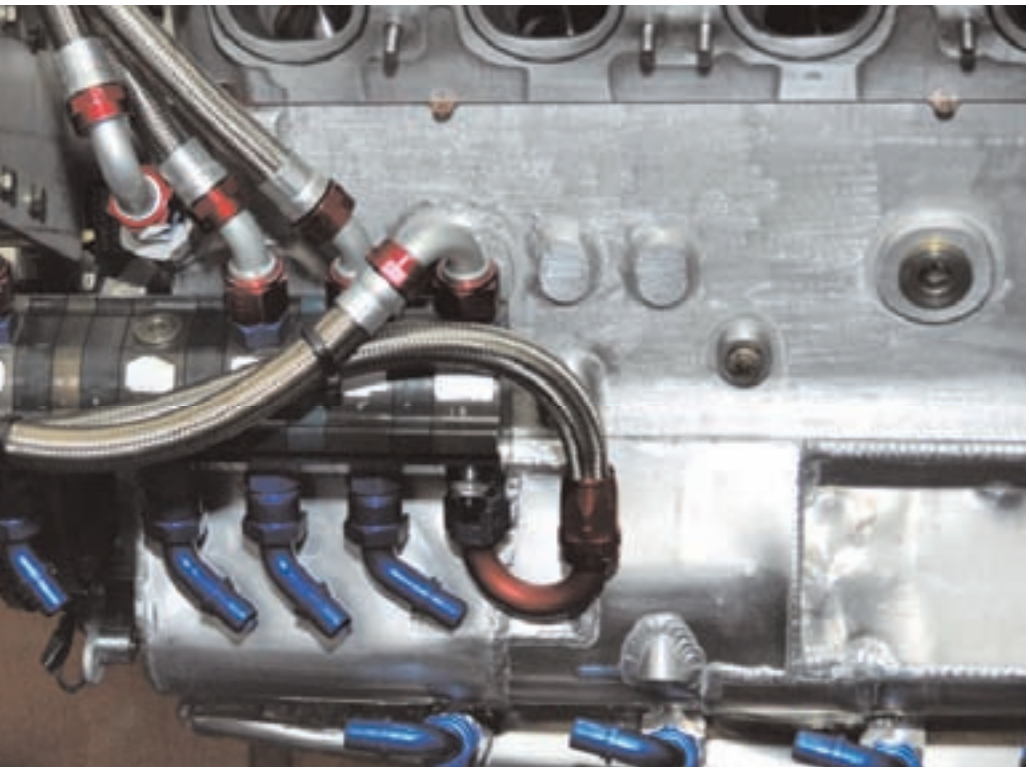
The first part of the process of installing the valves is to check the continuity of the seal between the valve head and the valve seat. This is accomplished by applying red dye to the seats and lapping the valves into them. If continuity is broken and traces of red dye remain, the offending seats will be recut. Both inlet and exhaust valves are made of titanium. The diameter of the inlet valve measures 2.680 inches and the exhaust measures 2.040 inches.

Next, the tension of the triple valve springs is checked. Though the desired seat pressure and the installed height measurement change with different camshaft designs, Kaase's most regular combination generates around 475 pounds at an installed height of 2.400 inches. Both inlet and exhaust valves, as well as the retainers, are made of titanium. Installed heights are maintained within 0.005- to 0.010-inch by adding shims under the springs. Trend Performance provides shims in increments of 0.015, 0.030 or 0.060-inch.



This five-stage oil pump (four scavenge, one pressure) has fine mesh screens embedded in the fittings at the ends of the number 12 lines to minimize the risk of particles entering the pump. But in the aftermath of a blow-up, fine debris usually penetrates to the heart of the system, and the lines and pump parts have to be cleaned and the rotors buffed smooth if necessary. Each of the four scavenge pumps conveys oil from assigned areas of the oil pan and transports it into the oil reservoir. The pressure pump (the one at the end) pumps oil from the bottom of the reservoir and into the filter. From the filter, it is transported into the block.

unaware that the vibration from the engine compartment was a signal of terminal distress. If the camshaft can still operate, usually the engine will continue to keep running—tearing itself apart all the way!

The chief concern about engine durability is the limited life of the connecting rods and also the condition of the skinny top piston rings. The life cycle of these critical parts and others must be strictly observed in the rarified air of Mountain Motor Pro Stock racing.

In Kaase's dynamometer cell, before this engine was tested, ace builder Chuck Lawrence leaned across to a visitor and said, "Have you ever heard one of these on a dyno before?" The visitor shook his head. "It's pretty cool," Lawrence insisted, "I never get tired of it." He was right. That sound resides indelibly in the memory. Captured in the following images is the rebuilding process of a Mountain Motor Pro Stock engine. ***DR***

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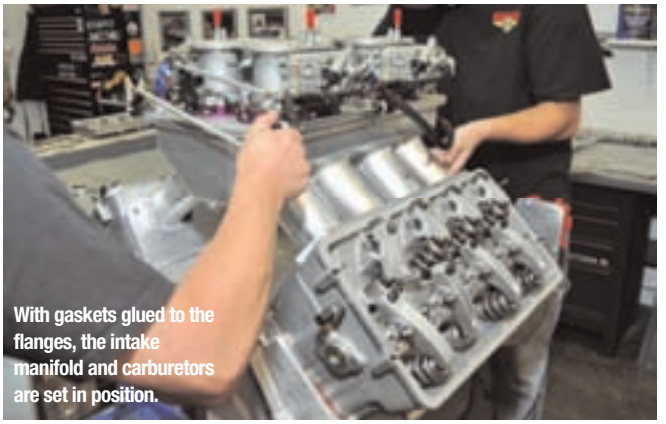
Next, the triple valve springs are laid out for installation. Hardened seats are fit between the spring and the aluminum head. Oil is applied to the valve stems and the valves are inserted into the cylinder head. Aided by a pneumatic valve spring compressor, the locks are carefully sandwiched between the valve stems and the retainers.

Copper spray from an aerosol can is applied to the top and bottom surfaces of the three-layer Cometic head gaskets, then the heads are fit and tensioned to 130-140 ft-lb.

Pushrods are installed, SS billet rockers positioned, their shafts tightened to 35 ft-lb and valve lash adjusted for engine warming on the dyno. Usually the clearance between the exhaust valve and the rocker is zero, and the clearance between the inlet valve and the rocker is 1/8th of a turn from tight. In this way, when the engine warms the inlet, valve lash will measure 0.030-inch and the exhaust 0.020-inch.



With gaskets glued to the flanges, the intake manifold and carburetors are set in position.

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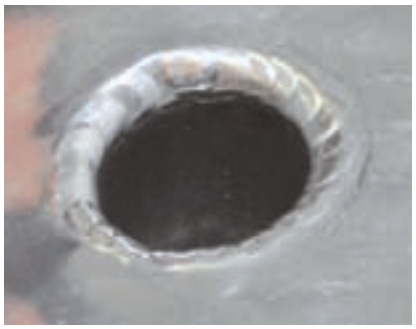
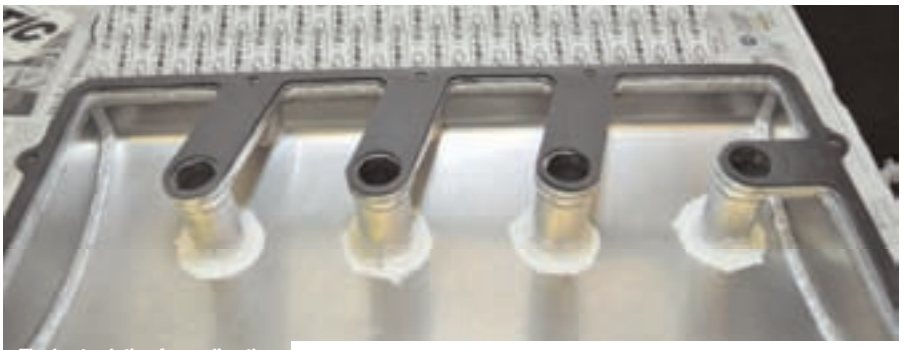
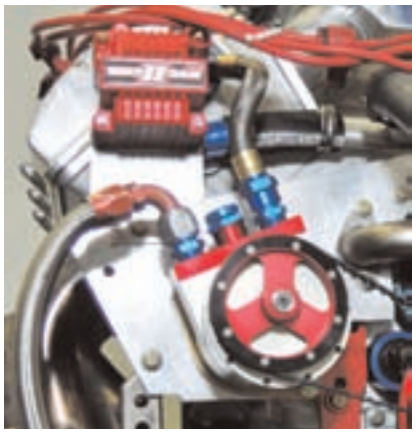


Curiously, the power of the vacuum pump can deflect the top skin of the alloy valve covers enough to propagate a crack around the plug holes. Welding the crack is not without its troubles. Invariably another crack will develop beside the weld.



The best solution for sealing the crack around the plug hole is to apply a special silicone sealer, the cost of which is around $80 for a small tube.



A vacuum pump can generate in excess of 22 inches of vacuum and is so effective it liberates 25 to 30 extra hp. It has the ability to improve ring seal and efficiently evacuates the turbulent air and oil mist from the under the reciprocating pistons in the crankcase, the valley area under the intake manifold, and the valve gear chambers on top of the cylinder heads. It often discharges to a canister through a port in the valley (under the intake plenum) or from the front face of the right cylinder head.

The effects of even the most powerful dyno-room fans are far removed from the pressurized air traveling through a hood scoop of a Pro Stock race car at 200 mph. Still, the dynamometer plays a vital role in assessing the engine's condition: It allows for the examination of engine vacuum and oil pressure, of oil or water leaks, and it allows one to learn how the engine runs and whether it performs as expected. Jon Kaase's notability rests not only on his gift for making big power, but also in his commitment to his customers—he presides over every test.

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