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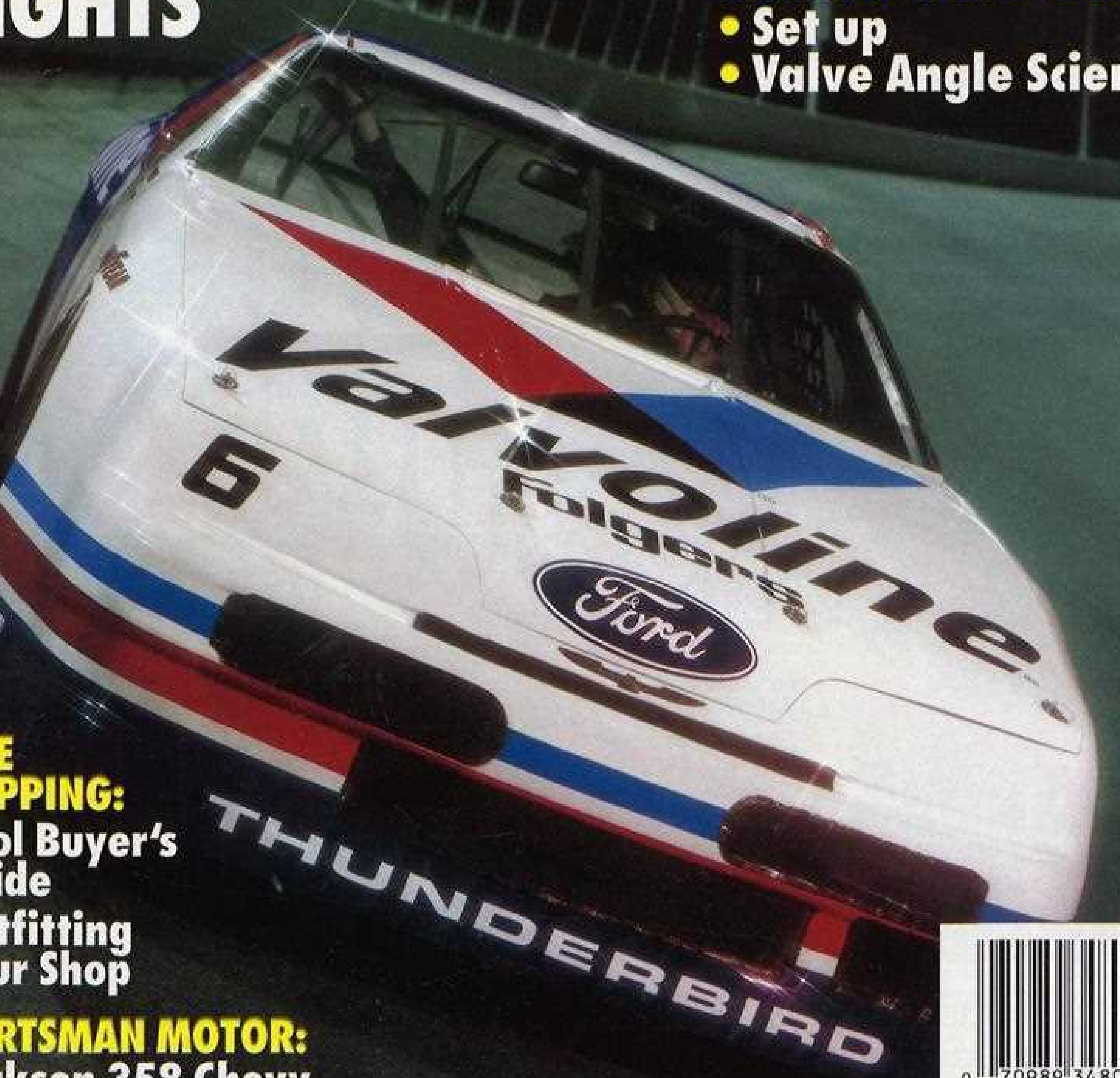

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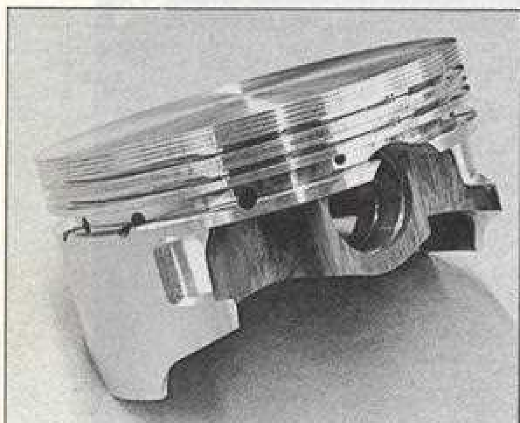
Mike Jackson (left) and his shop foreman Larry Ninneman (right) install the CV Products valvetrain components for another Sportsman engine. Jackson pays a lot of attention to valvetrain geometry when an engine will run from 6000 to 6200 RPM without respite for an entire race, as the Cobra Electronics Sportsman engine does.

HOW TO BUILD A SPORTSMAN ENGINE

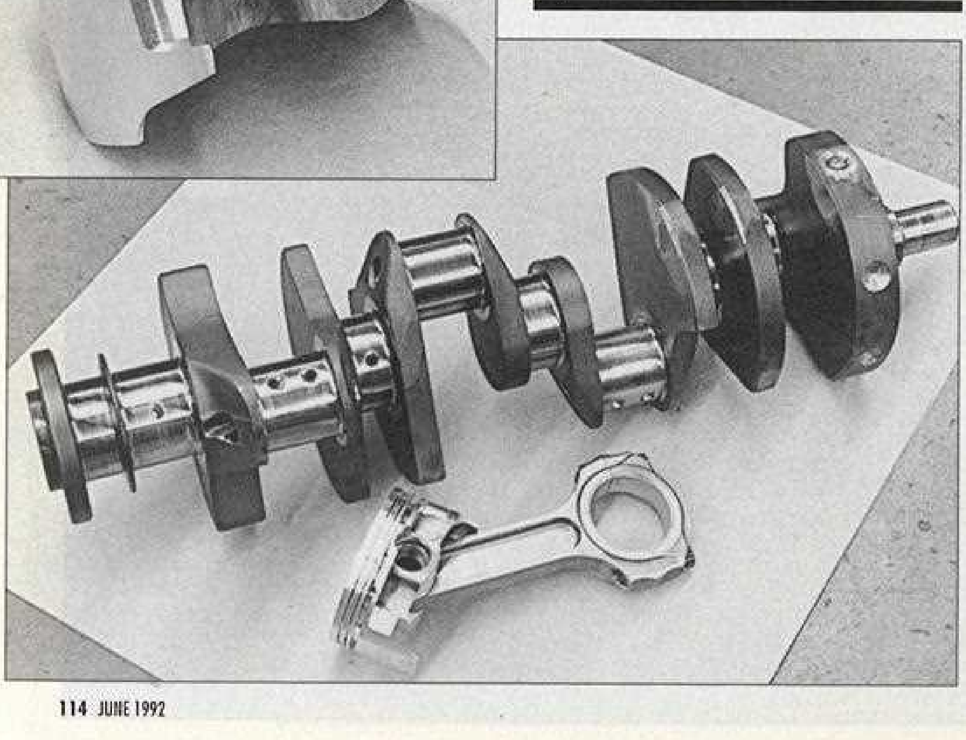


Engine theory meets the reality of NASCAR's restrictive rules.

By PETER SAUERACKER

For better or worse, racing is governed by rules, and there is no area that is subject to more scrutiny than the engines that power race cars around racetracks. The NASCAR Sportsman division, as raced on Winston Cup tracks such as Charlotte Motor Speedway, is an example of a highly competitive class of Stock car racing that employs *very* restrictive engine rules. The challenge to a racer and an engine builder is to utilize ingenuity and a thorough understanding of engine theory to produce the maximum amount of on-track "go" given these restrictive rules.

Mike Jackson, of Jackson Automotive Engineering in Cherryville, North Carolina, is well-known to the racers of the Sportsman division. Over the four years the division has been in existence, his engines have powered many a racer to the front of the pack, and some eventually into the



The total bob weight was a miniscule 1590 grams, due in part to the special RACE Engineering pistons and the 647-gram 6.200-inch Oliver billet rods. Note the pressure seals and anti-detonation grooves on the pistons.

victory circle. In this article, we will examine the engine theories and assembly secrets Jackson used on the engine that powered the Cobra Electronics Sportsman car that we have been chronicling over the past few months.

■ THE RULES

First, let's quickly look at the engine rules for the NASCAR Sportsman division. The rulebook calls for a 358 CID small-block with stock bore and stroke relationships. The heads must be the Chevrolet Bow-Tie Phase II cast-iron units with no less than a 62cc combustion chamber. No porting or other massaging is legal on these heads. The carb must be a 350 CFM Holley 7448 two-barrel sitting on an Edelbrock 5001 Performer RPM intake manifold. The oil pan must be an off-the-shelf design, in this case, a Moroso dry-sump pan. Flat-top pistons must also be employed. Dry-sump systems are allowed, but roller cams are not.

As you can see from the foregoing, it is hard to build compression into these motors, and hard for them to breathe all the air they really need to fill their lungs. Yet despite these constrictions, you must still produce about one horsepower per cubic inch and run all day long flat-footed at 6000 to 6400 RPM if you want to win. It is a big challenge, but Jackson has found a way to meet it.

■ THE KEY TO WINNING

According to Jackson, there are two things that an engine builder must have well in hand to make the one horsepower per cubic inch goal in this division: he must have the proper quality hard parts that all work together, and he must have a coherent theory of engine power. One without the other will result in failure, according to Jackson. We will outline the specific hard parts he uses as well as his theories here.

■ THEORY

When Jackson contemplates race engines that must run under such highly restrictive rules, he feels that there are four theoretical principles to exploit which can yield a high horsepower engine.

First among these is to obtain exceedingly light reciprocating and rotating weight. As will be explained later, a large amount of the effort invested into this motor centers around obtaining the lowest dynamic weight capable of withstanding the power of the engine.

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The second principle is to create as much static compression as possible. While much of this is controlled by the flat-top piston rule and the no-touch heads, there are still a few tricks Jackson employs in this area, which we will show you.

Third is to create as much dynamic compression as possible. This can be addressed through camshaft selection and through piston dwell time at TDC.

The last principle is to make the engine "work" the carburetor, that is, to overcome the tendency of the Holley to fatten up at the top, and thereby improve the overall air/fuel curve for better power production and on-track response.

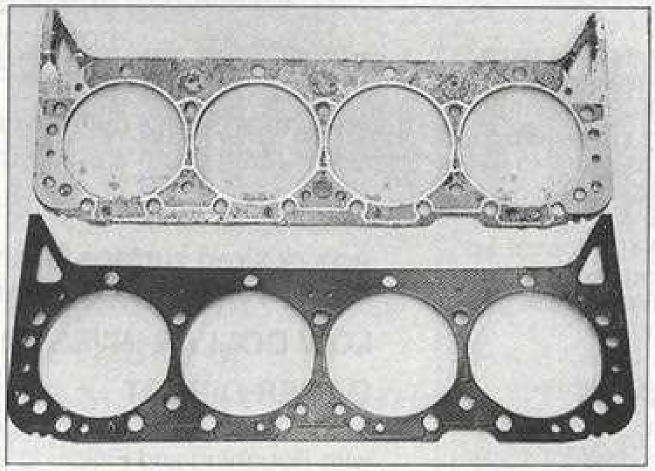
■ HARD PARTS

Moroso was one of the primary suppliers of parts for Jackson. Everything from the dry-sump oil pan, the air cleaner housing and K&N element, and the valve covers and breathers, to the brackets, bolts, screens, plugs, and other such essential components were culled from the Moroso catalog. As we discussed in our "Engine Builder's Data Guide" in the April 1992 issue, there are a lot of important detail parts that can be overlooked when building an engine. As if to prove the point, Jackson ordered 42 different part numbers from Moroso when assembling this motor. The company is a good, all-encompassing source for such parts and much more, according to Jackson.

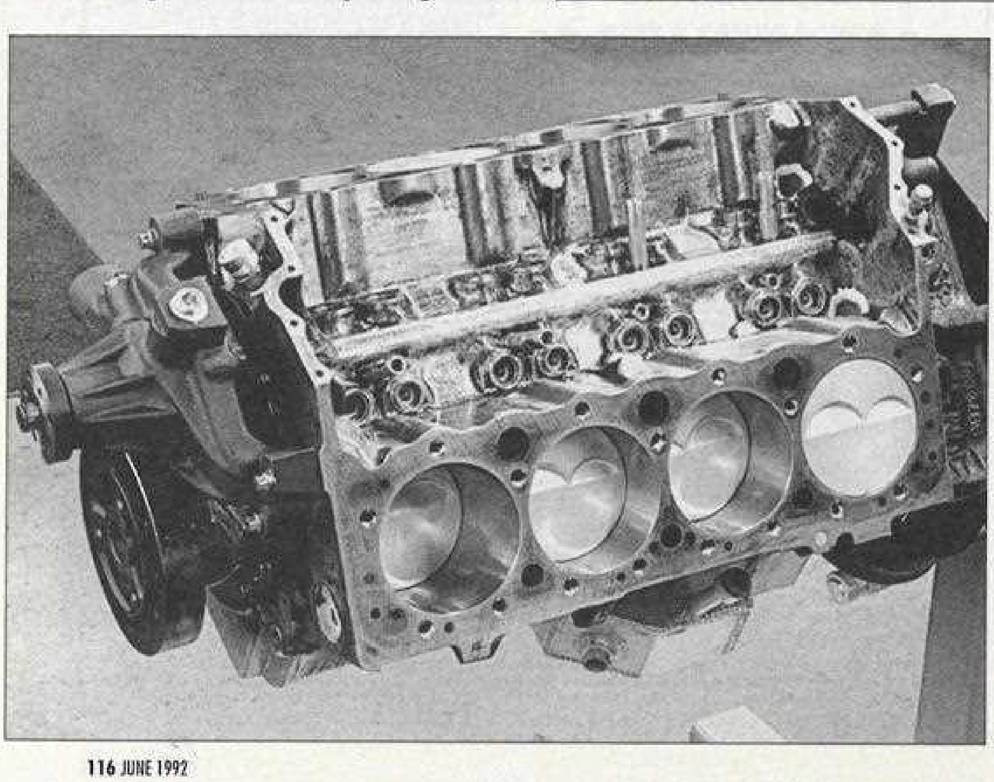
The heart of the engine is the crankshaft/connecting rod/piston assembly. COLA provided one of its 48-pound lightweight forged racing cranks with a 3.500-inch stroke. Onto this stout foundation were hung Oliver 6.200-inch long rods, for a rod ratio of 1.77:1, up from the stock Chevy combination of 1.63:1. The net effect of the long rods is to keep the piston at the top of the cylinder for a longer period of time as the crankshaft rotates, thereby maintaining "compression" in the combustion chamber longer. In a low-compression motor, this is critical to making power.

The pistons are an interesting story. They were custom made to Jackson's specifications by RACE Engineering. Bob Koch at RACE Engineering starts with Wiseco Pro Light aluminum forgings, a very lightweight and durable piston. Then, through the firm's own re-engineering of the pistons, RACE Engineering lops another 50 grams or so off total weight, ending up at 320 to 340 grams, depending upon pin location! That is a lightweight piston, but it makes sense when you consider the importance Jackson places upon getting the lowest inertial weight within the engine as possible. Poly-Dyn also coated various components, from the air cleaner to the oil pan, to maximize heat control and minimize friction.

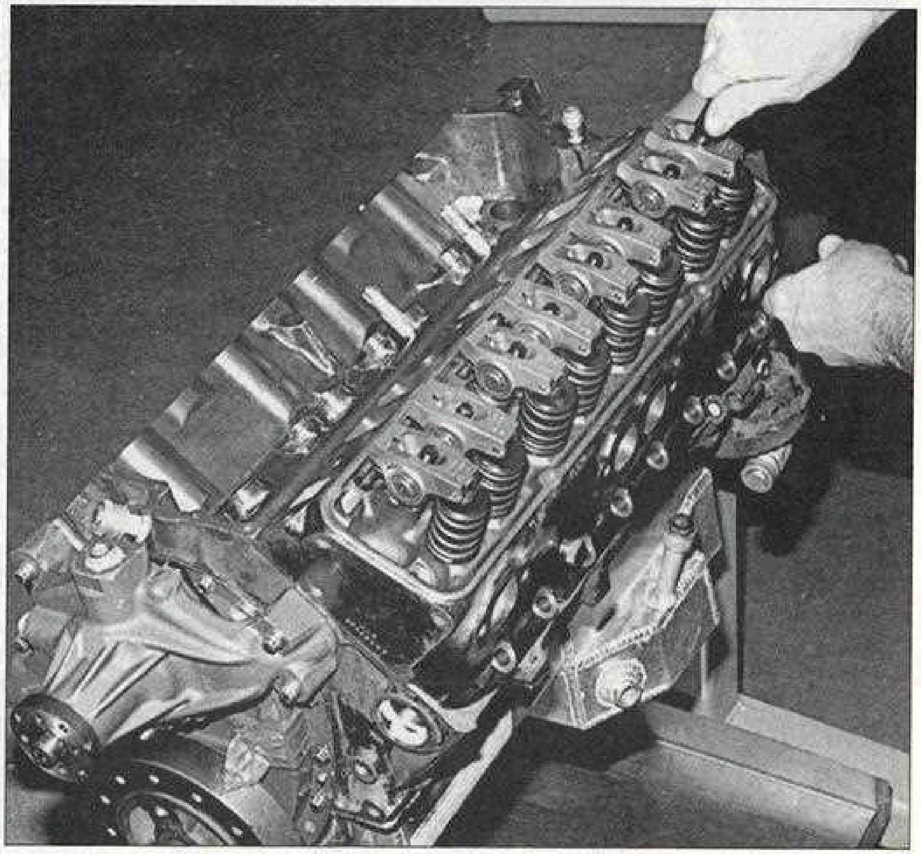
The intake/exhaust conduit and its balance is another area that is worth particular note. Jackson had Hedman Hedders custom fabricate a set of stepped headers for this engine. The header design he wanted was intended to complement the Blake-prepared Holley two-barrel. In essence, Jackson wanted to reduce the signal to the carburetor at high RPM to lean it out in that speed range. By employing 1⅞-inch/2-inch headers, *too big* for this type of engine, the high-speed over richness that is endemic in all carburetors can be reduced, allowing better tailoring of the air/fuel ratio at lower engine speeds. This is quite an interesting way to dial in a carburetor!



One of Jackson's tricks is to gain compression by using a special Chevrolet thin head gasket, PN 10105117. It compresses down to 0.028-inch, yielding a compression ratio of 10.7:1 for this engine, about as much as Jackson feels you can "legally" obtain given the rules.



Jackson grinds the interior of the blocks to eliminate loose bits of metal and sand and to promote oil return. He used a Stewart aluminum Stage III water pump and a Moroso dry-sump pan on this engine. Jackson relies on a Stock Car Products three-stage dry-sump pump to a CV Products oil manifold to circulate the oil.



The cam and valvetrain Jackson chose to use were a combination of parts from Reed Cams, Crane Cams, and Horacio Ferrea. Jackson specified 2.050/1.600-inch stainless steel valves from Ferrea. The bumpstick itself, along with the lifters, springs, retainers, and locks were from Reed. The aluminum roller rockers and the stud girdles were supplied by Crane, as were the racing timing chain and sprockets. OK, here are the specs on the "secret" cam profile Jackson uses with this motor. He specifies a symmetric cam profile with 252 degrees of intake and exhaust duration at 0.050-inch tappet lift. Lobe lift is 0.360 inch for both intake and exhaust,making valve lift 0.576 inch on the intake and 0.540 inch on the exhaust, given the 1.6:1 rocker ratio on the intakes and the standard 1.5:1 ratio on the exhaust. The cam is ground on 110-degree lobe centers. Now you know the secret!

The photos explain a lot of the parts and techniques Jackson uses in motors such as these, and we'll let the pictures do the talking. However, there are a few other items we wish to note here. Jackson is concerned about belts flying off at high engine speeds, as well as pulley balance. Therefore, he specified special deep-groove racing pulleys produced by Del West, a name more normally associated with titanium valves.

As for the electrical end of things, Jackson does run with an alternator, obtaining special heavy-duty units reworked by Phil's Starter and Alternator, a local firm that does a lot of the alternators for Winston Cup teams, too. The ignition itself is an MSD 6T unit with distributor and wires, a complete package that works well together. Spark plugs are Champion's V4C racing plugs and the battery is an off-the-shelf Delco job just the same as you would have in your own station wagon.

Jackson uses a steel bellhousing because it is required by the rules. He chooses to employ a Lakewood unit that was obtained from Doug Herbert Performance Parts. Jackson sends out his bellhousings to be surfaced for absolutely perfect drivetrain alignment. This is about the only machining step he cannot perform on his own in-house machinery.

■ THE FINAL RESULTS

On the dyno, this engine topped out at 342 horsepower, dead on the money as far as Jackson's expectations. That is one heck of a lot of go when you consider the tiny two-barrel carb, the low compression, the mechanical cam, and the no-touch rules. As for on-track performance, as already reported in a previous

Jackson pretty much sticks to standard internal clearances—0.0025 to 0.0027 inch on the rods—and 0.0025 to 0.0030 inch on the mains. Valve-to-piston clearance was kept to 0.040 to 0.050 inch on the intake and 0.080 to 0.100 inch on the exhaust. Interestingly, Jackson will adjust these clearances based upon driver style and rod length. The amount of rocking comes into play here.

article, the car charged to the front from the 12th starting position in the fall 1991 Charlotte race, eventually leading the race under the green, proving the ponies were definitely there. The tires began to go away however, and the car eventually finished the race seventh. Overall, a stellar performance by driver, car, and in no small way, the engine and Mike Jackson.

SOURCES

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