SPECIAL ISSUE

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ELECTRONICALLY REPRINTED FROM JUNE 2007

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70HP FAST BURN HEAD SWAP

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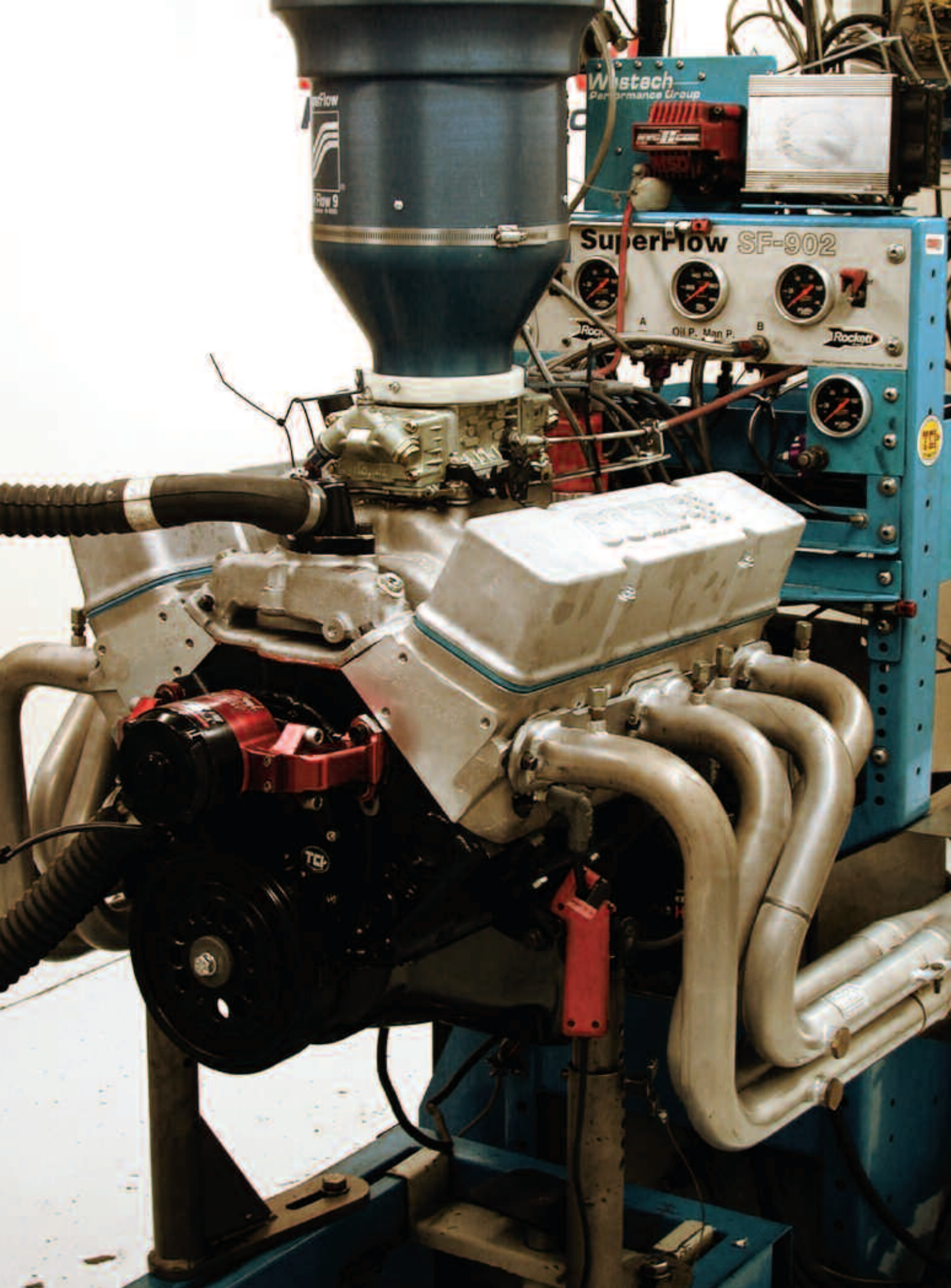

Westech
Performance Group
SuperFlow SF-902
A
Oil P.
Man P.
B

You Can Have a 385hp Street Mill for Less Than You Think

CRATE THIS!

Text and Photos: Scott Crouse

Our combo this month was a GMPP crate engine producing 290 hp at 5,100 rpm and 326 lb-ft of torque at 3,750 from the factory.

With its 8.5:1 compression, four-bolt block, and small street cam, this piece is a true 87-octane-burning mill that'll put new life back into any Chevrolet. While the engine would serve as a great mule for the average commuter, we're about to showcase the untapped potential waiting to be released.

THE PLAN

Our engine design started by addressing several key areas of the engine where GM knowingly sacrificed potential power for a smooth idle, low emissions, and low-octane operation. The factory cylinder heads may be ideal for a daily driver, but they are definitely not meant to make big power. Our plans called for a set of GMPP's newest Fast Burn 210cc aluminum cylinder heads. Their ports offer superior airflow characteristics with vastly improved intake and exhaust runners, while the new Fast Burn combustion chambers ensure that the incoming air/fuel mixture will burn efficiently. These heads alone are so good we decided to bolt them onto our crate engine using an Edelbrock Air Gap Performer RPM and a 650-cfm Holley HP carburetor with mechanical secondaries. Along with these tried-and-true induction pieces we also used an MSD billet distributor, a 6AL ignition box, and high-performance 8.5mm wires to make sure our cylinders stayed lit during the upper-rpm flog. The factory heads feature 76cc combustion chambers, which were hurting power with an 87-octane-compromising 8.5:1 compression ratio. The new GMPP heads feature smaller, 62cc combustion chambers that would raise the compression of our engine to a 91-octane-friendly 9.9:1. This alone would be worth nearly a 3-percent power gain, not to mention how much more power would come from the Fast Burn chamber design and improved port layout.

The GMPP crate engine arrived accessory-free, requiring several supporting pieces, including an oil filter and bracket, cylinder-head water plugs, spark plugs, and a harmonic balancer. The only dilemma we ran into while putting our engine on the dyno was that the Edelbrock intake manifold had some interference issues with the stamped-steel valve covers that came on our engine. We could have milled the factory valve covers to fit, but with our tight schedule, swapped them out for a set of Comp Cams aluminum tall-body valve covers and opted to utilize an electric water pump and 1¾-inch dyno headers with no other accessories. We also added 5 quarts of 20W50 Lucas oil and a bottle of Comp Cams break-in lube to ensure our new hydraulic flat-tappet camshaft would break in properly. It's important to note that GMPP does not break its engines in before they arrive, which makes it critical for the end user to do so with hydraulic flat-tappet applications.

ON THE DYNO

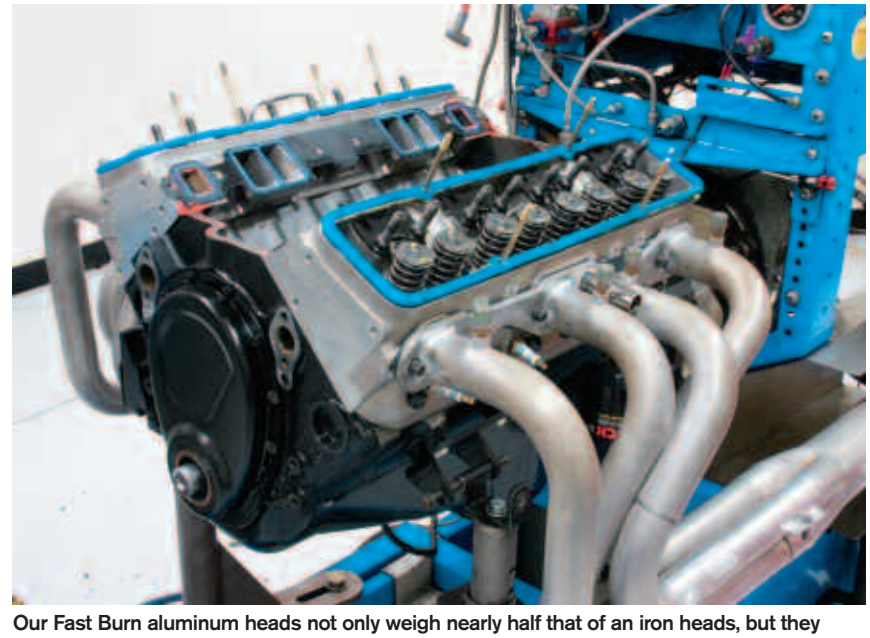
With the new powerplant fired up, we immediately varied the rpm between 1,500 and 3,200 for 20 minutes to make sure the cam, lifters, and piston rings were seated properly. Our first few dyno pulls were made half way through the engine's rpm range to tune for optimum timing and jetting, where we established a total timing advance of 38 degrees with Holley's box-stock HP jetting. Once all the engine vitals were stable we made a series of baseline pulls to come up with a repeatable 315 hp at 5,100 rpm and 351 lb-ft at 3,700 rpm. Both GM and our dyno numbers occurred at the same peak points, showing us that our lack of accessories and use of high-

QUICK NOTES

WHAT WE DID
Baselined a GMPP 290hp crate motor and added Fast Burn heads, a manifold, rockers, and a cam.

BOTTOM LINE
If you don't want to build a motor from scratch, then this is for you.

PRICE (APPROX)
$3,800



Our Fast Burn aluminum heads not only weigh nearly half that of an iron heads, but they made 44 hp and 27 lb-ft of torque more out of the box than a stock head.

Both the stock and new head applications wore an Edelbrock Performer RPM Air Gap intake manifold to promote the best power possible. The factory stamped-steel valve covers had interference issues with this manifold, so we added a set of Comp Cams tall-body covers to go along with the top-end aluminum theme.

The 650-cfm Holley HP-series carburetor and MSD ignition components worked well with our Edelbrock intake manifold. The electric water pump helped ensure that our engine cranked out consistent power numbers.

THE DETAILS

DESCRIPTION	MANUFACTURER	PN	PRICE
1.6:1 Magnum roller rockers	Comp Cams	1417-16	$192
CS270H camshaft	Comp Cams	12-211-2	$100
Cam break-in oil	Comp Cams	159	$15
Iridium spark plugs	Denso	IQ-24	Call
RPM Air Gap intake manifold	Edelbrock	7501	$206
Head gaskets	Fel Pro	1003	$33
Intake manifold gaskets	Fel Pro	1205	$14
GM crate engine	General Motors	12499529	$1,750
Fast Burn 203cc aluminum cylinder heads	GMPP	12464298	$1,220
20W50 oil	Lucas		See stores
Billet distributor	MSD	8360	$306

All prices sourced through jegs.com, sdpc2000.com, and summitracing.com

GMPP CRATE ENGINE SPECS

350CI FOUR-BOLT BLOCK–ORIGINAL SPECS

HEADS	76cc, 8.5:1 compression, 1.94/1.50 inch, intake/exhaust
CAMSHAFT	0.450/0.460 inch, intake/exhaust
DURATION	222/222 degrees at 0.050 inch
POWER	315 hp at 5,100 rpm/351 lb-ft at 3,700 rpm

350CI FOUR-BOLT BLOCK–IMPROVED SPECS

HEADS	62cc, 9.9:1 compression, 2.00/1.55 inch, intake/exhaust
CAMSHAFT	0.470/0.470 inch, intake/exhaust
DURATION	224/224 degrees at 0.050 inch
POWER	385 hp at 5,600 rpm/407 lb-ft at 4,200 rpm

performance dyno headers were perhaps why our baseline numbers were a bit higher than the GMPP ratings. It just goes to show that GMPP doesn't fudge its power numbers to sell engines.

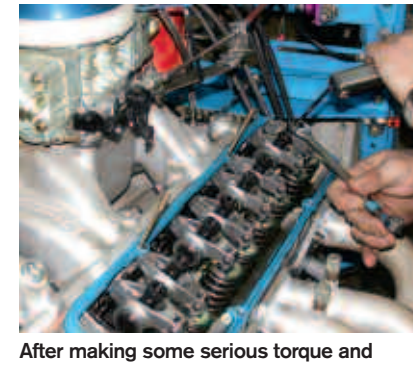
With solid baseline runs under our belt we installed the new GMPP heads by themselves out of the box. While there was a recommended camshaft selection in our engine design to go along with the intake and spark-enhancing pieces, we wanted to see how good the heads were on their own. An added feature of the Fast Burns is that their heads are tapped with two sets of valve cover and intake-mounting holes to allow for use with Vortec or conventional small-block patterns.

After a series of test pulls, we achieved an optimum total timing advance curve of 36 degrees with the box-stock Holley HP jetting. The more efficient combustion chambers of the new heads explained why our engine required less total timing. As for the factory jetting from the Holley HP carburetor, it would take a story in itself to explain why this carburetor continued to deliver optimum air/fuel ratios out of the box; in short, as more air is drawn through the carburetor more fuel is delivered proportionately to accommodate it.

Like kids in a toy store, we couldn't wait to see the potential power our new heads had to offer, so we poured in some 91-octane and began testing. This time around we were absolutely amazed at the power increase our heads had made with the stock cam still in place: peak readings of 359 hp at 5,500 rpm and 378 lb-ft at 4,000 rpm. We knew the improved ports, chambers, and valve size of the new heads would make more power, but without additional valve timing the gains were impressive: 44 hp and 27 lb-ft.

With limited dyno time left in the day, we swapped out the stamped-steel 1.5:1 rockers for a set of Comp Cams 1.6:1 Magnum-style roller pieces. This added nearly 0.300 inch of lift to the intake and exhaust valves, while increasing the duration of the valve by nearly 2 degrees. All carburetor jetting and timing variables remained the same as we pulled our engine to a new peak reading of 371 hp at 5,900 rpm and 382 lb-ft of torque at 4,600 rpm. The additional lift and duration made only a small difference in the torque curve but raised the peak rpm of the

Before running any hydraulic flat-tappet engine it's a good idea to prelube the oiling system and make sure there's some break-in lube included. We used Comp Cams break-in oil No. 159 and an oil-pump-drive prelube tool.



After making some serious torque and horsepower improvements we couldn't wait to see what a little more valve timing would do to our power curve. We swapped out the stamped-steel 1.5:1-ratio factory rockers for a set of Comp Cams Magnum series 1.6:1 roller-tipped pieces and found 12 hp more at the peak rpm point.

To make sure our heads weren't cheating on the dyno we measured their intake-runner volume, combustion chamber size, and intake/exhaust airflow numbers. All was legit, making this test even more impressive than we had expected.

Our new camshaft complemented this street engine nicely. The idle vacuum dropped only a half inch while making 26 hp and 29 lb-ft more than the cylinder head swap only test. Don't forget the Lucas assembly lube, as the camshaft can run dry for several seconds until the engine splashes it.

engine by nearly 400, to deliver an additional 12 hp up top. While the rocker swap delivered a relatively small kick in the pants compared to the heads, we knew there would be more power with a better cam grind.

We were now on a mission for ultimate power, and up next was a new bumpstick from Comp Cams. The grind of choice featured 0.470/0.470-inch intake and exhaust lifts with a 1.5:1 rocker ratio and 224/224 degrees of duration at 0.050 inch lift on 110 LSA. The hydraulic flat-tappet piece is a mild choice, picked to help improve street power without affecting the engine's idle vacuum. Once the fuel lines were hooked back up we started the engine and repeated the break-in procedure. The timing remained at 36 degrees total, and the jetting was still good, showing air/fuel readings of 12.8:1 at peak torque. After a quick look over all the vitals, we ran the engine across its power curve. With new readings of 385 hp at 5,600 rpm and 407 lb-ft at 4,200 rpm, we were pleased to see additional improvements to the tune of 6 hp and 29 lb-ft over the factory cam with 1.5:1 rockers. What's interesting is that our new single-pattern cam increased the horsepower at a lower peak rpm point while also significantly improving the torque across its entire power curve.

THE FINAL WORD

Adding more camshaft duration would have raised the peak rpm point up into the 6,000-rpm range and perhaps made 400-plus horsepower, but idle vacuum would have been sacrificed along with some torque. Our factory long-block with either stock or high-performance GMPP heads delivered 13 inches of idle vacuum at 800 rpm, and our new camshaft delivered more power while sacrificing only a half inch of idle vacuum at the same rpm. We set out to build a solid street engine using readily available performance parts and increased our total power by 70 hp and 58 lb-ft. It just goes to show that with the right parts and help from some of today's leading high-performance manufactures, ultimate street power is only a phone call away. ***CHP***

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