



BIG-INCH BRACKET BRUISER

KRE Showcases Its MR-1 Block and High-Port Head Combo by Building an 851 HP 505-cube Monster

BY JOHN CAROLLO AND THOMAS A. DEMAURO

PHOTOGRAPHY BY JOHN CAROLLO

For an engine design that was ostensibly put out to pasture in 1979, the traditional Pontiac powerplant has enjoyed new life decades later, thanks to a few companies like Kauffman Racing Equipment (KRE) who have stepped up to service this dedicated market.

You've read about KRE's MR-1 block and High Port Heads in *HPP* before, but this time

we have a full buildup and an extended dyno thrash to illustrate its capabilities. Jeff and Mark Kauffman at KRE teamed up with Kevin Swaney of Tin Indian Performance (TIP) to build this 505ci, 851 hp neck snapper for racer and *HPP* shootout alumni Mike Williams' '66 GTO.

While the exploits of KRE have been documented in these pages before, TIP is a name

that may be new to you. TIP is a Pontiac parts supplier that works closely with KRE, recreating components that are increasingly scarce. Most of TIP's parts are new, and made with today's technology, such as gaskets made from Teflon—hardly a bone stock resto part from the '60s, but a great improvement for today. A few of these new items will be employed in Mike's engine.

MR-1 BLOCK

Technically speaking, the MR-1 is actually a K&M Performance Parts MR-1 block. K&M Performance is owned by Steve Kauffman (Mark and Jeff's father) and racer Bill Mellott. All of the machining is done in-house at K&M Performance on its CNC milling center. Steve says it takes approximately 18 hours to fully machine a block from start to finish. The company currently offers the MR-1 blocks in cast iron while the MR-1A is the cast-aluminum version. Both blocks come in PRO versions, which incorporate enhanced webbing designs and different main cap configurations. There's also a billet aluminum block for serious racers. Bill Mellott says that he knows demand for the billet block will most likely be low, yet K&M felt it was still a project worth pursuing to advance its own racing programs and the Pontiac aftermarket.

The MR-1 block will accept all stock Pontiac engine compartments and has a number of improvements over stock blocks: an upgraded design from the stock patterns; thicker decks; front four-bolt main caps and more. We'll illustrate these and many other features as the build progresses.

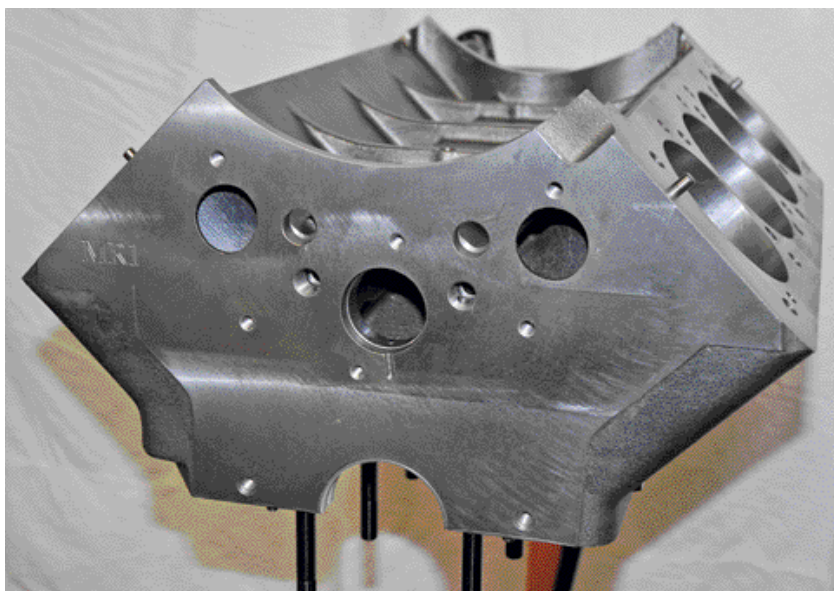
There are also many finished features incorporated into the block that make it almost a bolt-in. In fact, KRE tells us that after it's been bored and honed, all you have to do prior to assembly is to wash it. Now let's check out the heads.

HIGH PORT HEADS

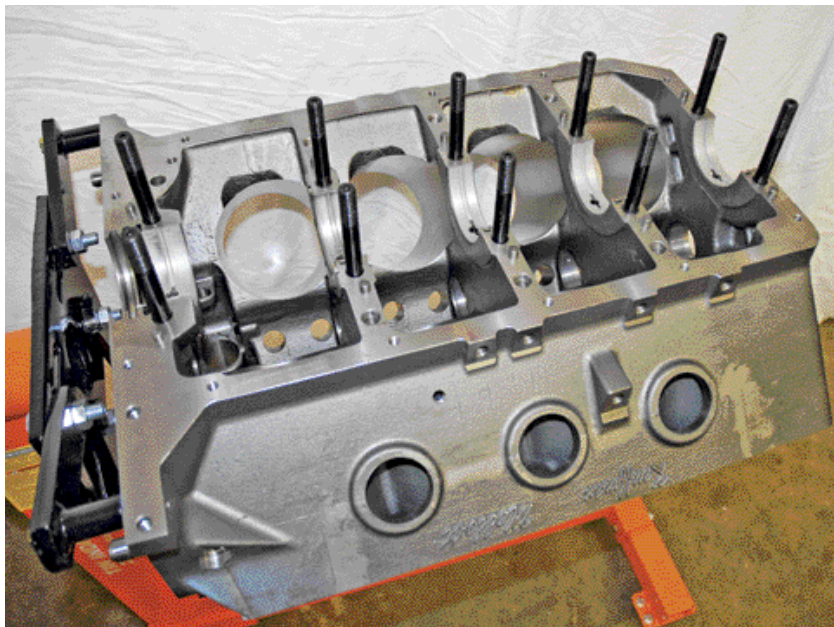
The High Port Heads were covered in depth in the Feb. '08 issue's "Cylinder Head Symphony," so here are the basics. High Ports are the second aftermarket Pontiac cylinder heads from KRE, making their debut in 2005 with 56cc, CNC'd chambers. Like the KRE D-Port, the High Port Heads utilize a fast-burn, heart-shaped chamber design. Flow is 330-cfm intake as cast. They can be used on a minimum bore size of 4.150 inches and utilize 6.200-inch long Ferrea 1200 series valves. Though they have 2.20 intake and 1.70 exhaust valves for our testing, they are upgradeable to 2.25 intakes and 1.75 exhaust if the customer desires.

KRE offers CNC porting options for its High Port heads as well. If that's not enough, a 400+ cfm rocker-shafted head is available for hardcore racers. Jeff and Mark tell us, "We have done a tremendous amount of R&D with this cylinder head, including hours of flow bench testing, dyno testing and track testing. We are currently using MR-1 blocks and the High Port Heads in our own (KRE & TIP) racing programs, which helps us refine our products to make them even better!"

Check out the photos and captions for build-up details.



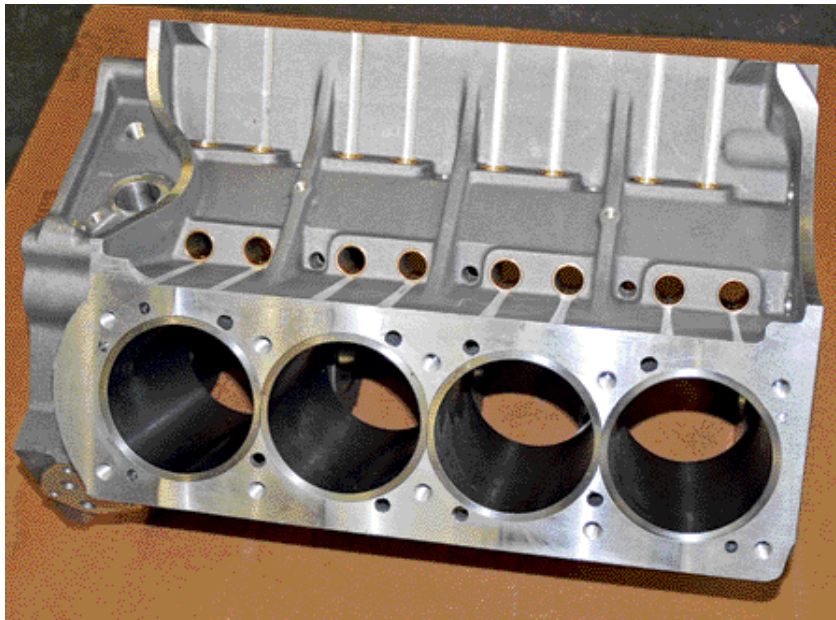
The MR-1 iron block, released in May of 2005, features a host of improvements over the standard Pontiac block. It's made from ASTM Certified Grey Iron, has a thicker pan rail and steel 4-bolt main caps, the ability to accept a maximum of a 4.400-inch bore (minimum bore size is 4.150-inches), has no water passage penetration at the clutch ball, a reinforced lifter valley, thicker head deck and a dual bolt-pattern to accept a BOP or Chevy bellhousing.



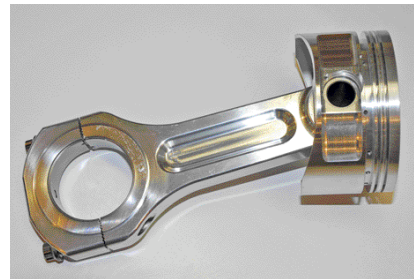
The block retained the bore spacing, cooling passages, mount holes, proper oil pan to frame clearance, and the ability to accept all stock Pontiac engine pieces, right down to the press-in freeze plugs and timing cover from the stocker. The MR-1 is available with 3.00-inch mains or 3.25-inch mains and the cost is \$2,695. Cam tunnel diameters of 50 and 55mm are available optionally. The block shown has 3.00-inch mains and received a 4.350-inch bore and hone with a torque plate.

A FEW MORE HOT NEW PARTS

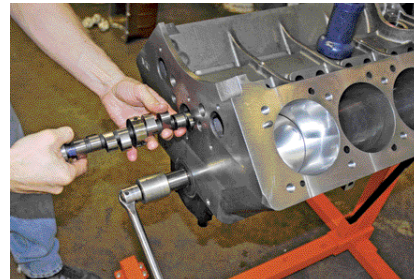
KRE and TIP showcased a few more parts in this buildup. The TIP Teflon gaskets used in many areas—including the KRE billet oil filter relocation kit and billet fuel pump block-off plate—show great promise as they can be reused more often than the usual gasket material. The Teflon makes for a tight fit and easy cleanup as no sealer is required, either. Though a few fresh parts were already covered in the story, here are some more.



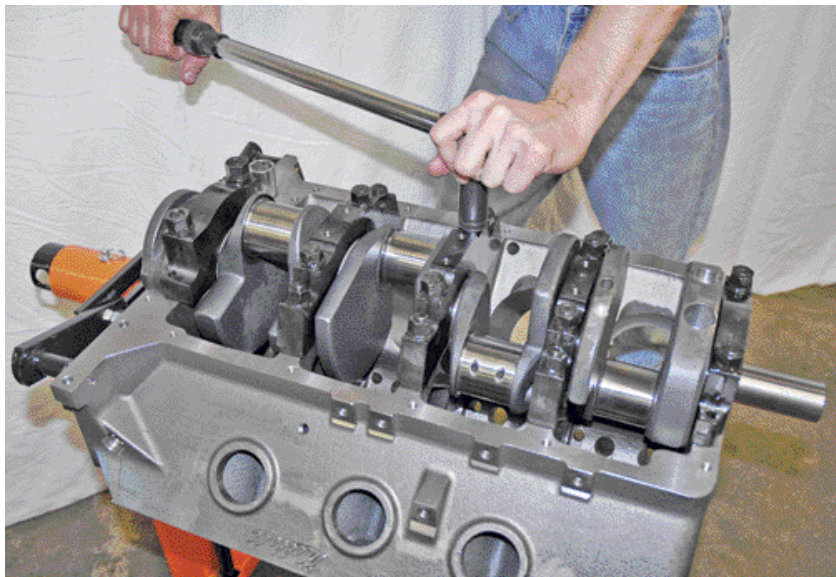
Released in September of 2006, the ductile-iron cylinder-liner-equipped MR-1A retains all the features of the MR-1 but is cast in lighter aluminum. The iron block weighs 238 pounds with a 4.350-inch bore with the main caps installed, and the aluminum block checks in at just 125 pounds.



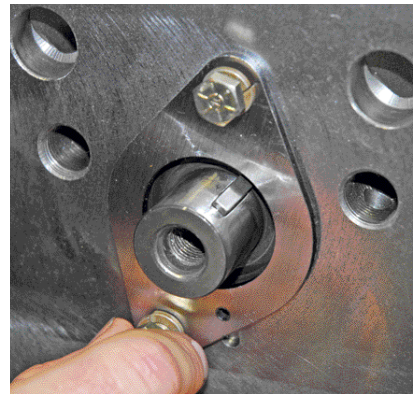
The GRP 5100 series aluminum rod is 6.800 inches long. With the Ross forged 4.350-inch piston, featuring a 1.315-inch compression height, compression ratio checks in at 15.14:1 when used with the small 56cc chamber.



A trick that doesn't always get caught in the photos was how Mark Kauffman only installed the number one piston and rod assembly before degreasing the cam. It's a shortcut that makes rotating the crank easier. Here, a standard journal size Comp Cams custom solid lifter roller stick is nestled inside Durabond cam bearings.



This Ohio Crankshaft piece (a prototype at the time) was forged from 4340 steel and features 3.00-inch mains, a 4.25-inch stroke, 2.200-inch Chevy rod journals and chamfered oil holes. With the main bearings and the rear main seal in place, the main caps are being torqued down to 105 lb-ft (125 for the rear cap) in two increments. Crank endplay was then checked and fell into spec at 0.007 inch.

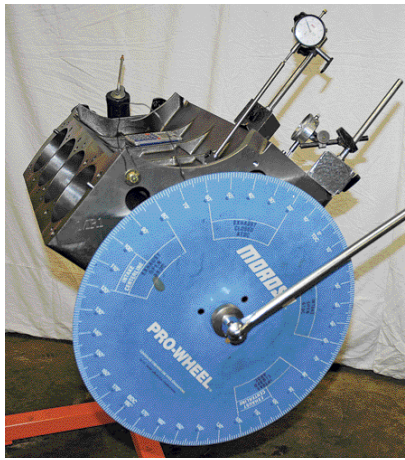


The new Tin Indian Performance CNC laser-cut cam retainer will have its bolts torqued to 35-40 lb-ft.

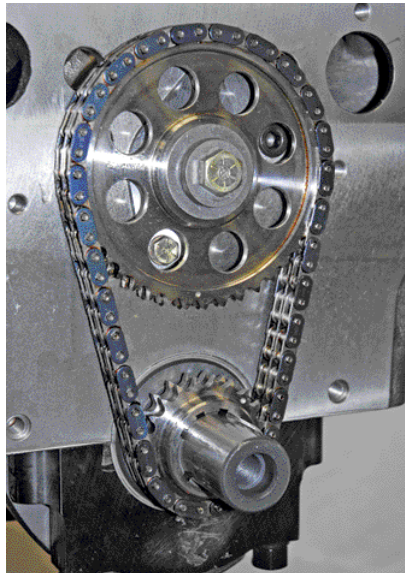
"STROKER KIT SCHOOLING" ADDENDUM

As promised in "Stroker Kit Schooling," here are Jeff Kauffman's comments regarding stroker engine combos. "Long-stroke rotating assembly kits are popular with our customers. It's an easy way of increasing horsepower and hobbyists seem to like the 'bigger is better' theory. They can start with an otherwise ordinary 350 or 400ci block and end up with an engine with much larger displacement. Our basic kit starts at \$1,695, which includes a cast Eagle crank, forged Eagle rods, SRP pistons, and various other high-quality components. It's also fully balanced. A forged-steel crankshaft from Ohio Crankshaft, and a few forged-steel and aluminum rods are among the available options."

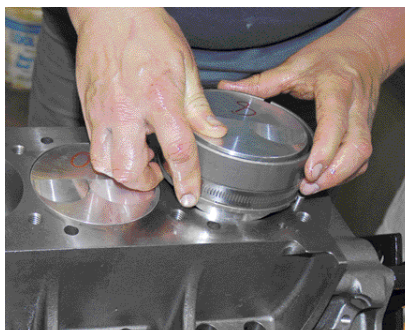
When asked what negative aspects are associated with long-stroke rotating assembly kits, Kauffman says what he sees in street applications is fuel economy. "A larger engine will obviously have a greater appetite for fuel when compared to a smaller engine. When dealing with high output or race-type engines, however, we find that the added displacement from a stroker kit usually requires additional cylinder head airflow to make higher horsepower numbers, and that can sometimes require cylinder head port work or different castings all together." *Rocky Rotella.*



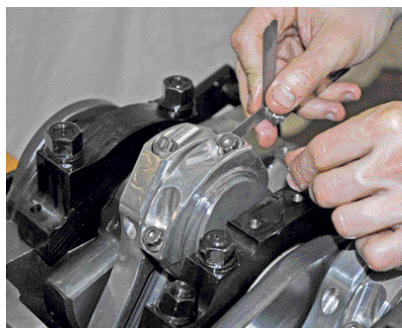
Two dial indicators are used to monitor any motion from the lifter and piston when seeking Top Dead Center (TDC) for degreing the cam. Mark and Jeff like to use the biggest degree wheel available—in this case, a Moroso unit. The bigger diameter means less chance of losing a half or whole degree in the process.



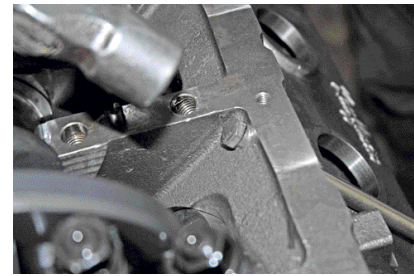
The Rollmaster double-roller timing chain reliably keeps the cam in sync with the crank.



With the cam degreed, the remainder of the pistons and rods were installed. The flat-top Ross pistons feature valve reliefs and use Total Seal file-to-fit rings with an 0.018-inch ring gap. Piston-to-wall clearance is 0.006 inch.



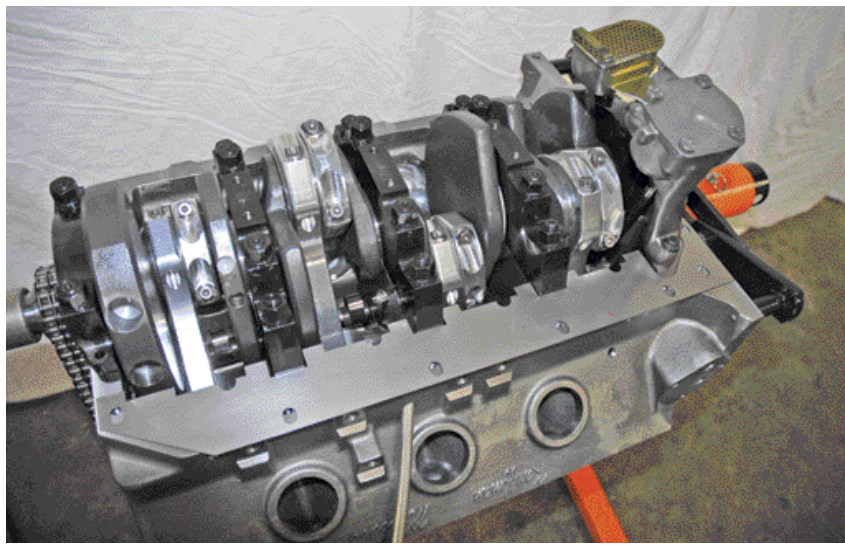
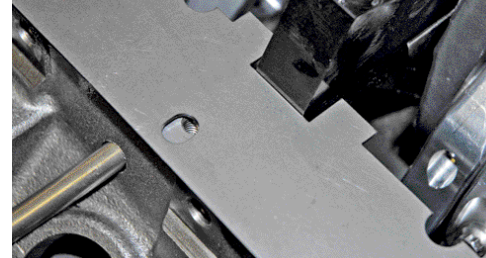
After the rod caps were torqued to 75 lb-ft in two increments, rod side clearance checked in at 0.018.



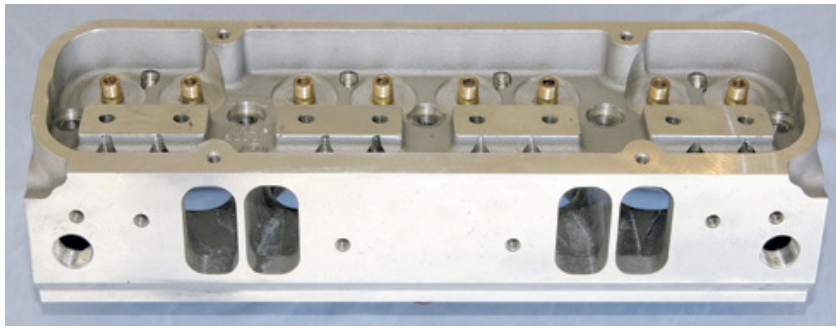
Moving to the oiling system, the big blur at the left is a hammer head pounding down the bolt that was inserted into the dipstick tube to keep it from crushing during its press-fit installation.

Note how the TIP scraper is oversized so you can get a true custom fit for your engine. ▶

▼ Here is the nearly completed bottom end with the scraper (clearance to the reciprocating assembly will be set at 0.035), Melling M54DS oil pump and Moroso pickup in place.

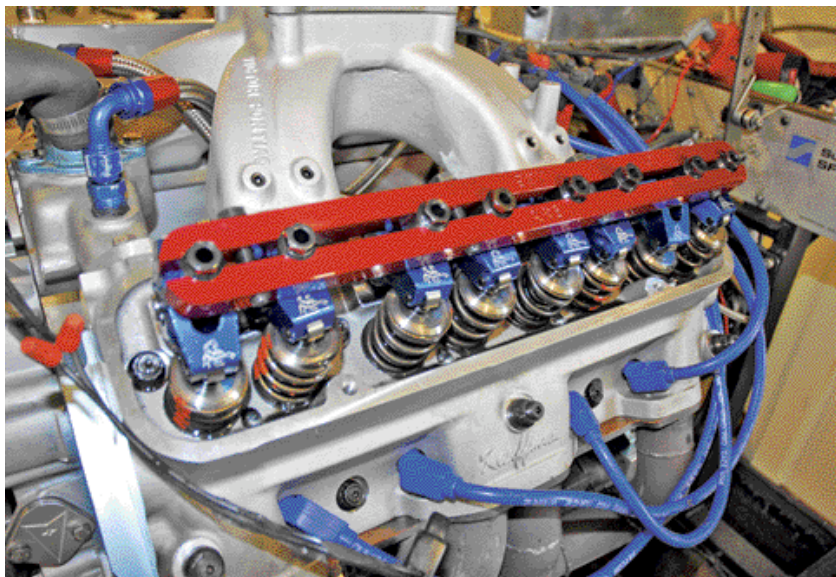
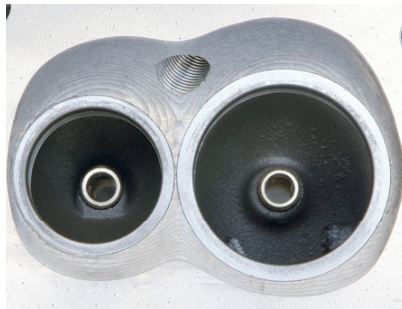


With all the bottom-end internals done, and proper pickup-to-pan clearance verified, the Milodon oil pan is installed using a TIP 0.090-inch thick gasket. Yes, this pan has been used before.



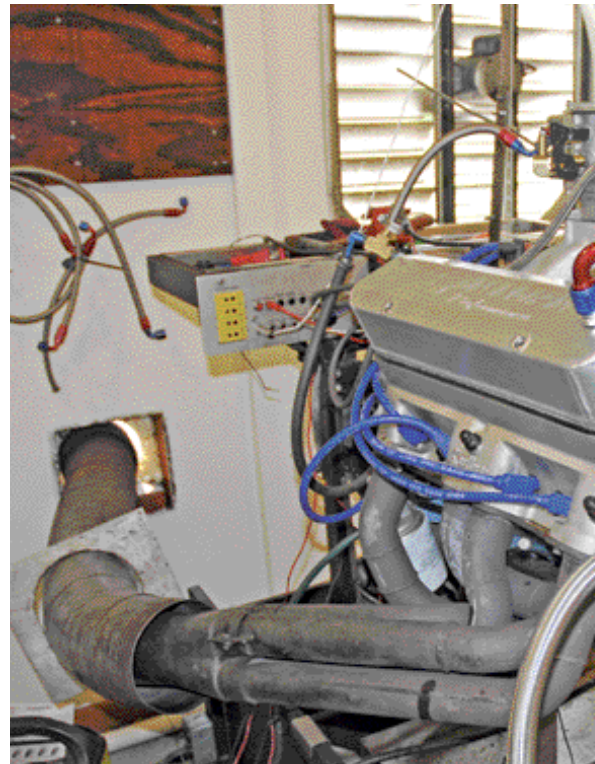
These KRE High Port Heads were first tested as-cast with 330-cfm intake flow, then ported to 380-cfm and retested. The intake flange enables the use of a Victor intake without having to fabricate any intake spacers and the stock pushrod locations remain. PHOTO BY ROCKY ROTELLA

Note the 56cc fast-burn, heart-shaped design. Jeff Kauffman says these have proven to be very efficient chambers. CNC chambers are now available with 64 or 80cc volume for pump gas and blower applications. PHOTO BY ROCKY ROTELLA



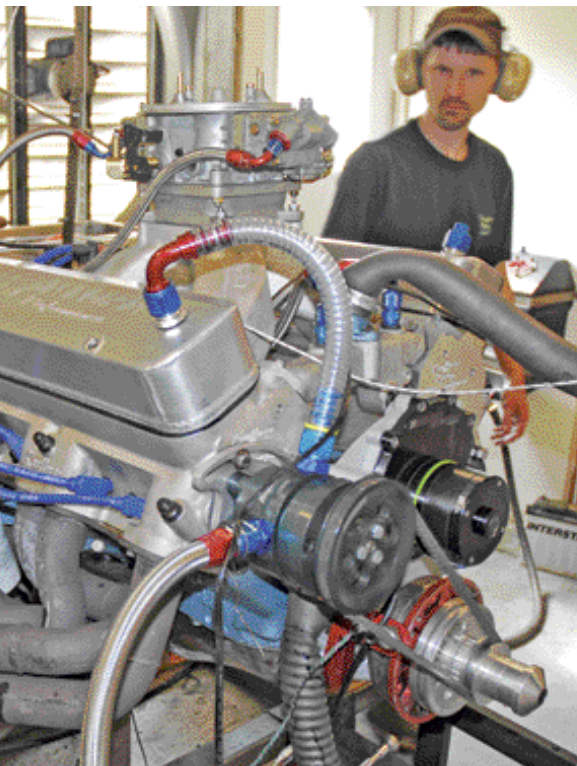
The heads were installed with Cometic 0.040 gaskets and a KRE High Port stud kit. Mark Kauffman says the studs deliver a better-distributed load on the heads and keep the torque accurate longer. He prefers to use oil instead of thread-lockers or sealers to keep his torque readings true—three passes to arrive at 100 lb-ft. Scorpion 1.6:1 roller rockers transfer cam lift to the valves, and a KRE stud girdle ensures that the geometry stays correct, despite the forces put upon the valvetrain.

A 2957 Victor intake was installed with TIP Teflon carb gaskets for use with a 1050 Holley Dominator carb and an HVH 1-inch spacer. On the dyno, it didn't take long to see this baby would need more fuel and air.

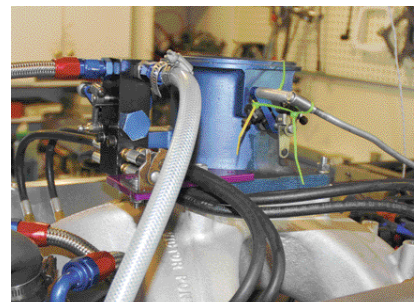


▲ On the front of the engine, a complete TIP Evac system featuring a new TIP Crank Mandrel Drive was installed, along with a Moroso three-vane vacuum pump and custom TIP pump bracket. A set of billet, TIP logo valve covers then went on with new steel core valve-cover gaskets from the same company. You can also see the slick aluminum KRE timing cover and Meziere electric water pump.

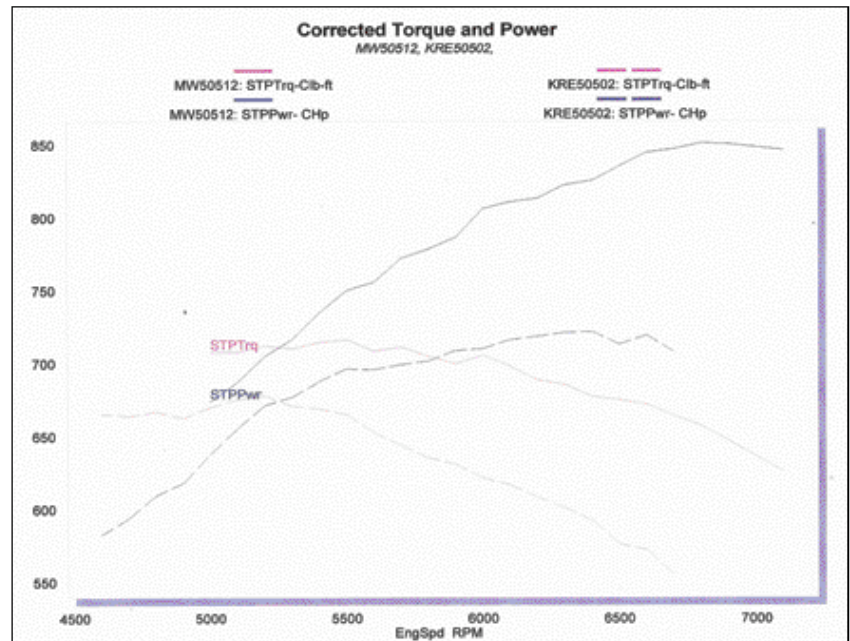




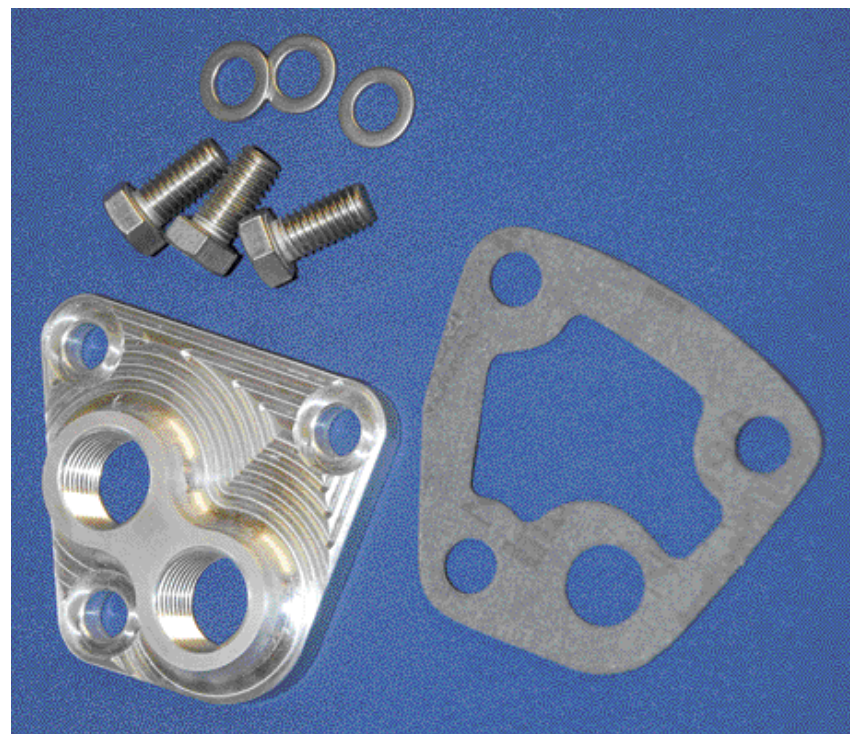
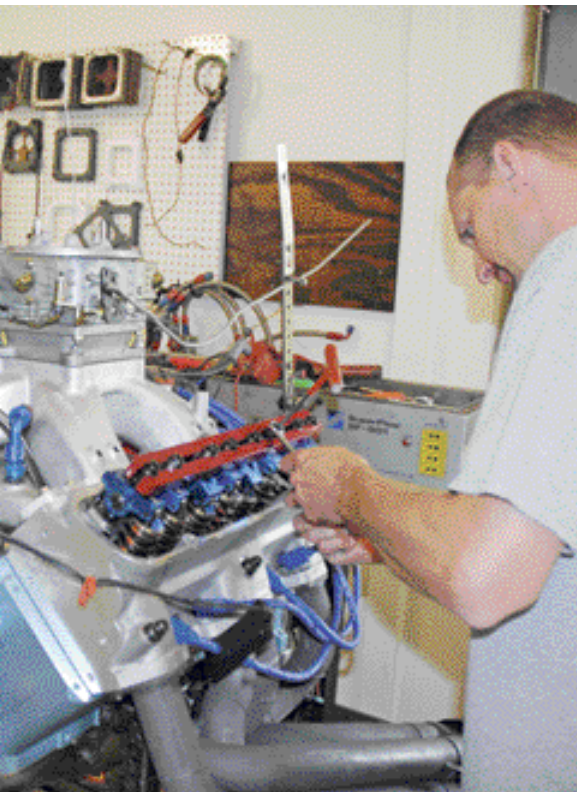
Ron's Flying Toilet injection was also used during dyno testing to see what kind of power numbers could be produced on alcohol.



Mike Williams and Kevin Swaney adjust the valves between dyno pulls. The standard 2-inch dyno "house" headers were used, but later changed to 2.125-inch headers for better results. Out in the real world, Mike used 2-inch headers on his '66 GTO. ▼



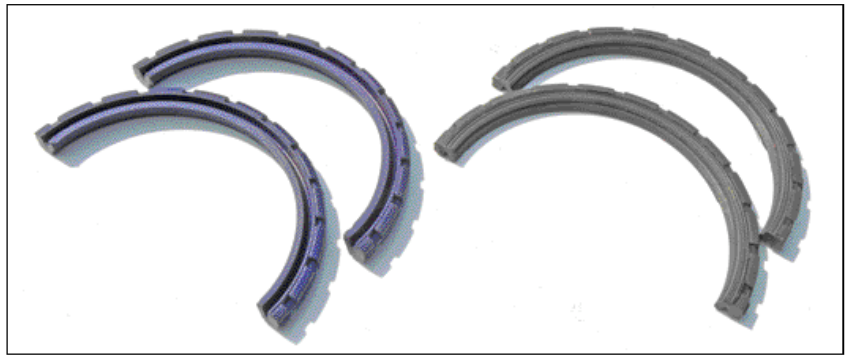
Here is the first pull of the day, compared to the best pull of the day. There's over a 120 horsepower difference between them. Read on to find out why.



Here's KRE's trick billet oil filter bypass kit.



KRE's billet distributor hold-down is made from 6061-T6 aluminum.



TIP's new Viton rear main seal is said to have "the best oil control you get in a seal, because unlike a rope seal, this material has memory properties to better maintain its shape," says Kevin Swaney. They come in 3.00- or 3.25-inch main sizes and will work with stock or aftermarket cranks or blocks.

DYNO TESTING

ROUND 1

The 505ci engine was fitted with 330-cfm KRE High Port Heads, a solid roller cam with 272/276-degrees duration at 0.050 and 0.704/0.704 lift. It was installed 3 degrees advanced. The centerline and LSA specs were withheld by the builder. Valve lash was set to 0.028/0.028, timing was 32 degrees, No. 88/88 jets were used in a Holley 1050 Dominator, and 112-octane blue race fuel was run.

Pull	Corr. HP/RPM	Corr. TQ/RPM	Tuning
1	727/6,200	674/5,000	Baseline
2	729/6,400	683/5,200	Baseline
3	732/6,200	681/4,800	Lash 0.028/0.032
4	737/6,200	684/5,200	Jet up No. 89/91
5	732/6,100	686/5,000	Drop timing to 31-deg
6	722/6,400	682/5,200	Increase timing to 34-deg
7	736/6,300	700/5,200	Drop timing to 32-deg
8	750/6,300	698/5,000	Swap carb to 1,250-cfm, headers to 2.125-inch, jets to No. 98/98
9	760/6,600	710/5,100	Jet up No. 99/99

Correction factor—0.973

ROUND 2

The KRE team saw that while they may not have actually hit the wall on this combo, they wanted to try other options, so they swapped heads to ported 380-cfm KRE High Ports. The intake ports were matched to the larger port openings on these heads and the cam was swapped to one with 280/284 degrees duration with the same 0.704/0.704 lift. Jets in the bigger 1,250-cfm Dominator were No. 100/100, valve lash was 0.025/0.025, and timing was set to 30 degrees to begin the second round of pulls. Once again 112-octane blue race fuel was used.

Pull	Corr. HP/RPM	Corr. TQ/RPM	Tuning
1	802/6,800	677/5,400	Baseline
2	813/6,900	682/5,500	Timing up to 31-deg
3	817/6,900	684/5,400	Intake lash up to 0.030
4	823/6,900	694/5,400	Exhaust lash up to 0.030
5	819/6,900	696/5,400	Exhaust lash up to 0.035
6	826/7,000	705/5,500	Intake lash up to 0.035
7	828/6,700	702/5,400	Timing up to 32-deg
8	847/6,800	718/5,600	Jet down to No. 99/99
9	851/6,800	716/5,500	Jet down to No. 98/98
10	855/6,700	733/5,500	Ron's Flying Toilet on alcohol, 0.078 pill, 38 nozzle, 29-deg timing

Correction factor—0.969

"How much power can I expect to see with alcohol?" is a common question by KRE customers. To find out, the boys decided to try some alcohol on the 505 for the 10th pull. They swapped out the Holley carb for a 4.00-inch Ron's Flying Toilet injection system and the results were an increase of 5 hp at a slightly lower 6,700 rpm and torque improved by 17 lb-ft. KRE made more pulls on alky, but this was the best one.

The average power on gas from 5,100 to 7,000 rpm was 783

hp/693 tq. The average power on alky from 5,100 to 7,000 rpm was 805 hp/701 tq.

Benefits from running alcohol include consistency and lower temperature. KRE normally sees more increases in torque than hp with alcohol and improvements in average power as well, as evidenced here. Since average power is more important than peak power, alcohol has proven its worth.

HIGH PERFORMANCE PONTIAC ENGINE BUILDUP WORKSHEET

Engine Displacement505ci
 Horsepower851
 Torque716 lb-ft
 Bore/Stroke4.350/4.25-in
 Block/Crank ComboMR-1 cast-iron/Ohio Crankshaft forged
 Bore/Stroke Ratio1.0235:1
 Rod/Stroke Ratio1.6:1

BOTTOM END

Block DescriptionNew MR-1 cast-iron
 PreparationBore to size, finish hone to size, wash and assemble
 Deck Height10.240-in
 CrankNew Ohio Crankshaft 4.25-in stroke, forged
 PreparationBalance assembly
 BalancerATI with MSD crank trigger
 RodsGRP 5100 series aluminum
 Rod Length6.800-in
 BearingsFederal Mogul
 PreparationOil feed holes opened up
 PistonsRoss 4.350-in forged flat-top
 Piston To Deck Height0.001-in
 Piston PinsRoss
 Method Used To Retain Piston Pins In PistonsSpiral locks
 RingsTotal Seal plasma-moly low-tension 1/16, 1/16, 3/16 oil
 PreparationFiled to fit
 Rod BoltsARP 2000
 Main And Head StudsARP

OILING SYSTEM

Crank ScraperTin Indian Performance
 Oil PanMilodon
 Oil PumpMelling M54DS
 PreparationSpring shimmed to increase pressure

HEADS

BrandKRE High Ports
 ChamberHeart-shaped fast burn
 Head ModsGasket match on stock HPs/then ported
 Combustion Chamber Volume56 cc
 Maximum Flow At 28 Inches Of Water:
 Intake330-cfm as-cast/380-cfm at 0.800-in lift ported
 Exhaust255 at 0.700-in lift as-cast/270 at 0.800-in lift ported

Compression Ratio15.14:1
 ValvesFerrea SS 6000 series 6.200-in length
 Intake Size2.200-in
 Exhaust Size1.70-in
 Angles Used In Valve Job45-deg seat, 30/60 top and bottom
 RetainersComp Cams Titanium 10-deg
 KeepersComp Cams 10-deg
 Valve GuidesBronze
 Valve SealsPC
 Rocker Studs1/16-in ARP
 Rocker ArmsScorpion 1.6:1 full roller
 PushrodsComp, 3/8-in, 10.400-in length

CAM

BrandComp Cams custom solid roller (see text for specs)
 LiftersCrower solid roller
 Valve SpringsComp Cams
 Seat Pressure230 lbs
 Open Pressure620 lbs
 Timing ChainRollmaster double-roller

INDUCTION

Carb1050 Holley Dominator/1250 Holley Dominator
 F.I.Rons Flying Toilet 4-in
 Intake ManifoldVictor single-plane
 ModsPorts matched to heads

IGNITION

DistributorMSD Pro-Billet
 AmplifierMSD 6AL
 CoilMSD Blaster
 WiresTaylor 8mm
 Total Timing32-deg locked

EXHAUST

HeadersHedman/Custom
 Primary Tube Diameter2.0-in/2.125-in
 Collectors4-in

GASKETS

BrandTin Indian Performance, Cometic head gaskets


Dyno development is serious engine work and it's most often the place where the real secrets of a motor's potential are revealed.

DYNO TIME

Throwing a motor on a dyno and just reading off the numbers is like ordering a gourmet feast and quitting after the first course. You're just not reaping all the benefits or satisfaction. Dyno development is serious engine work and it's most often the place where the real secrets of a motor's potential are revealed. The Kauffman brothers will tell you that it's the dyno and resulting tuning that separates the true engine builders and designers from those who merely assemble a collection of parts, then estimate the horsepower. Dynos effectively provide nearly instant results for each tuning change or parts swap. And we know you've heard it before, but true dyno work lets you compare apples to apples.

In the case of the KRE/TIP 505, they had specific goals, yet an open-minded attitude toward experimentation with tuning. As usual, the first two passes on KRE's Superflow 901 Dyno were to establish a baseline.

CONCLUSION

If you've ever had any doubt about the cost and value of dyno development, go back and look over those numbers and tuning changes. The first gas pull netted 727 horses and the last, 851. It was certainly worth KRE's, TIP's and Mike's time and energy. This story also served to exploit the power-making capabilities of the MR-1 block and High Port Head combo for racing. Mike is still grinning about his new 505. 

SOURCES

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