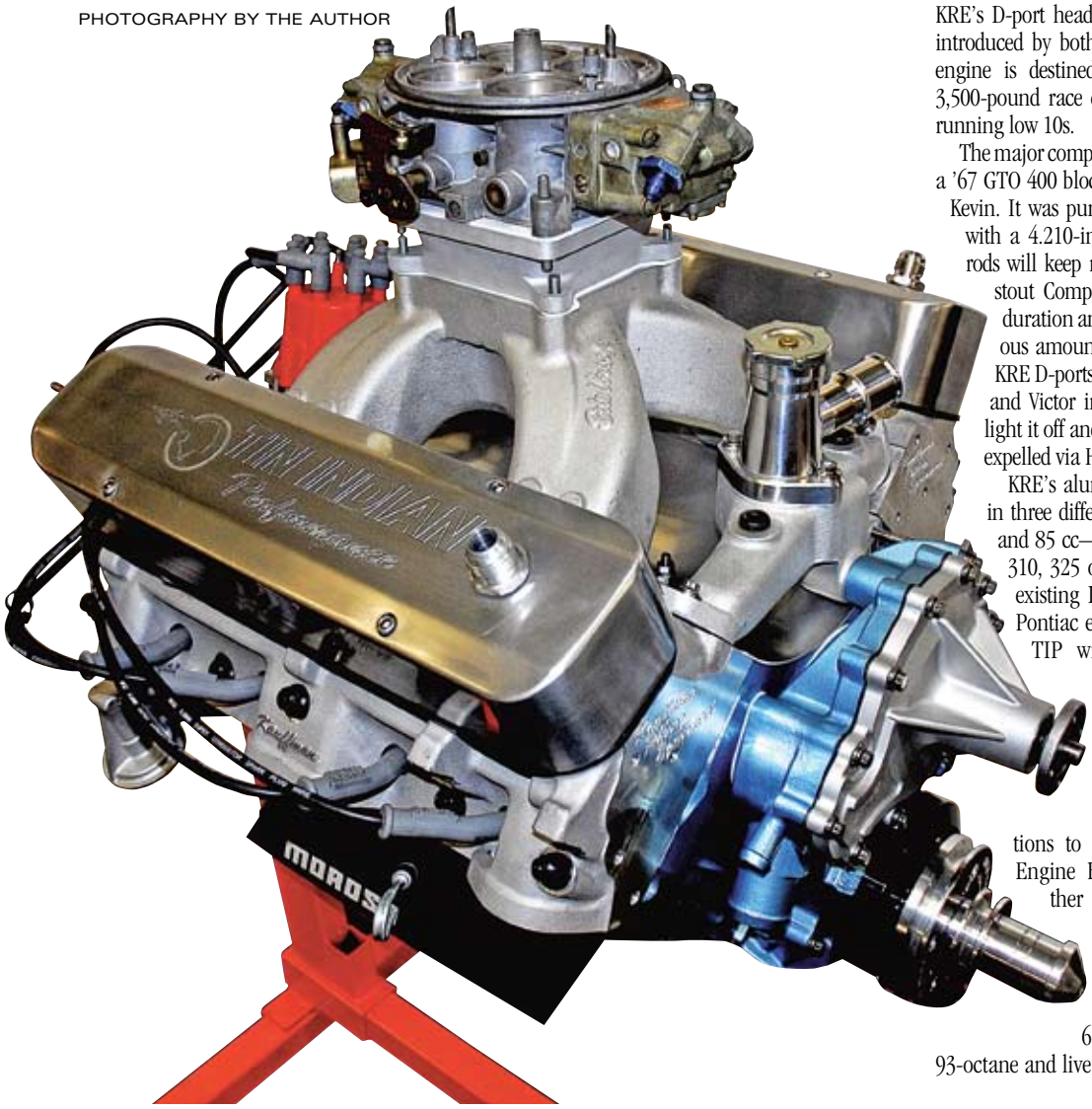
PUMP GAS POUNDER

Will TIP's 400 Block/KRE Head Combo Produce More Than 600 hp on 93-Octane?

BY JOHN CAROLLO
PHOTOGRAPHY BY THE AUTHOR

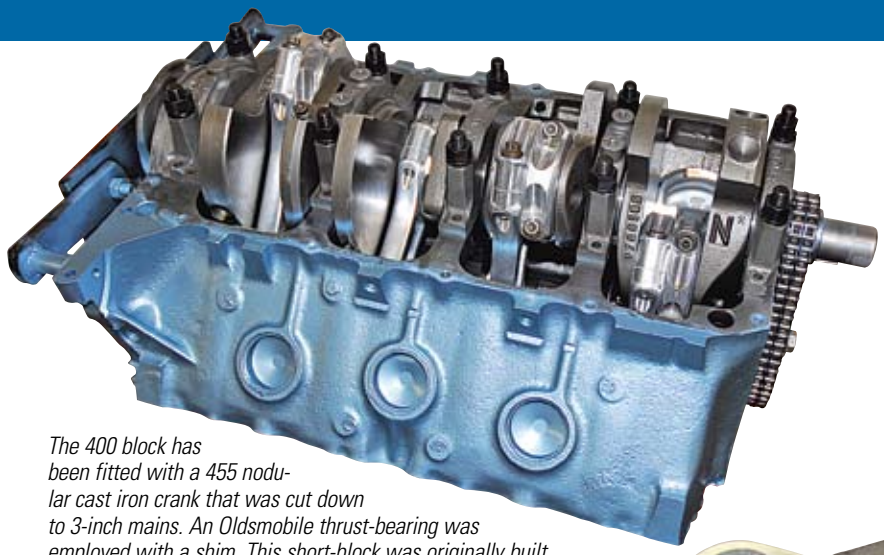


Everyone wants to build a better mousetrap. Some like to compete in the high-compression horsepower chase and some look to push the boundaries of the pump-gas combo. For this story, Tin Indian Performance (TIP) and Kauffman Racing Equipment (KRE) set out to do the latter using a factory Pontiac block, KRE's D-port heads, and various new products introduced by both companies. Ultimately, the engine is destined for TIP's Kevin Swaney's 3,500-pound race car, in which he's intent on running low 10s.

The major components of the build up include a '67 GTO 400 block previously freshened up by Kevin. It was punched 0.035-over and stuffed with a 4.210-inch stroke crank. Aluminum rods will keep reciprocating weight down, a stout Comp roller cam will provide big duration and lift numbers to draw a copious amount of atmosphere through the KRE D-ports via a Holley 1050 Dominator and Victor intake. MSD components will light it off and combustion remains will be expelled via Hedman 1.75-inch Hedders.

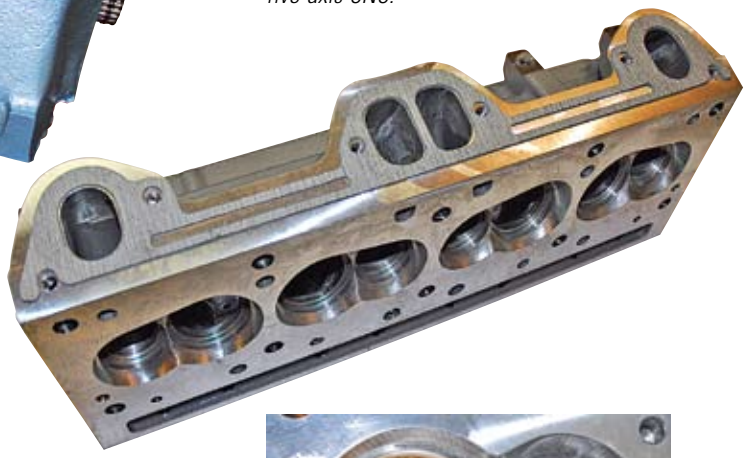
KRE's aluminum D-ports are available in three different chamber sizes—65, 74, and 85 cc—and are CNC-ported to flow 310, 325 or 340 cfm. They also accept existing D-port headers and all stock Pontiac engine parts. For this engine, TIP will use the 74cc 340-cfm versions to keep compression pump-gas friendly at 11.4:1 while still providing enough airflow to produce 600+ hp.

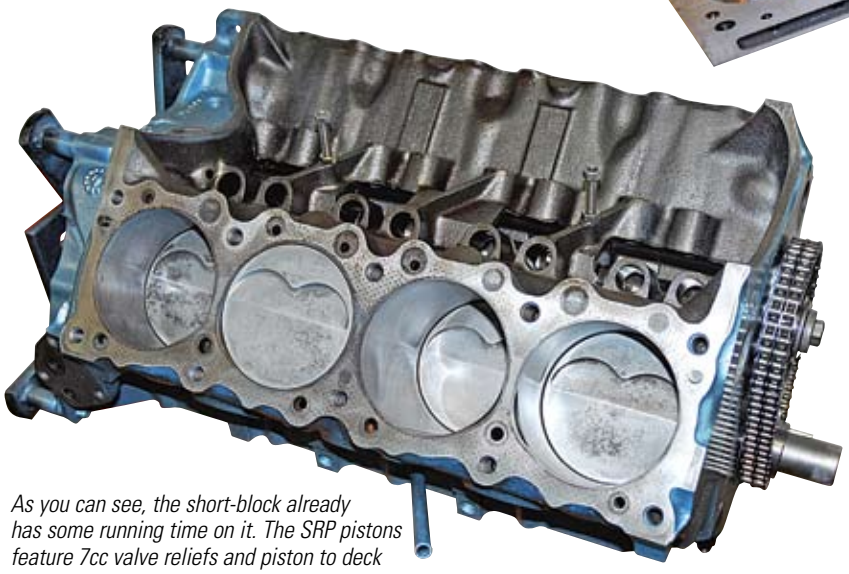
Follow the photos and captions to learn more and check the Engine Buildup Worksheet for further details. Then we'll see how the engine performs on the dyno. Will this two-bolt main 400 block fitted with go-fast goodies make 600-plus hp on the dyno on 93-octane and live to tell the tale? Read on.



The 400 block has been fitted with a 455 nodular cast iron crank that was cut down to 3-inch mains. An Oldsmobile thrust-bearing was employed with a shim. This short-block was originally built some years ago, before aftermarket cranks became widely available. If you decide to build a similar combo, an aftermarket crank is the way to go today. BME aluminum rods and SRP forged pistons round out the reciprocating assembly. The factory 2-bolt mains and stock caps are retained and the owner and builder of this engine—Kevin Swaney, of TIP—says the bottom end will hold up, even with a possible 650 hp on tap.

Here are the 340-cfm 74cc KRE aluminum D-ports with the new TIP-KRE340D exhaust gasket, which features a "non-asbestos material with a non-stick coating applied to both sides," according to TIP. The heads are fully machined and ported in-house on a five-axis CNC.

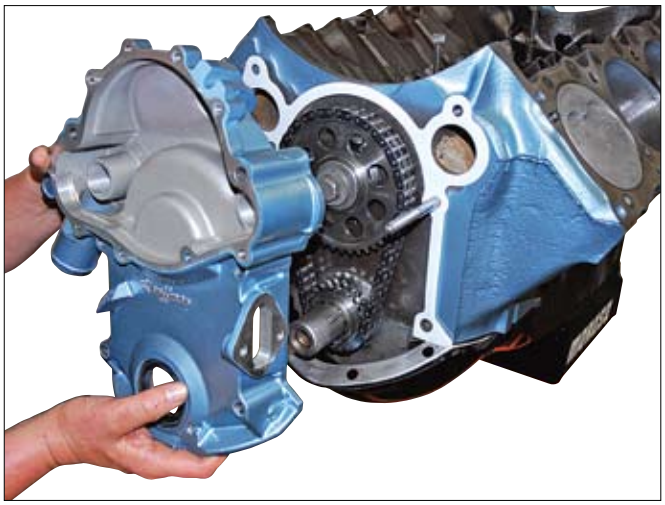




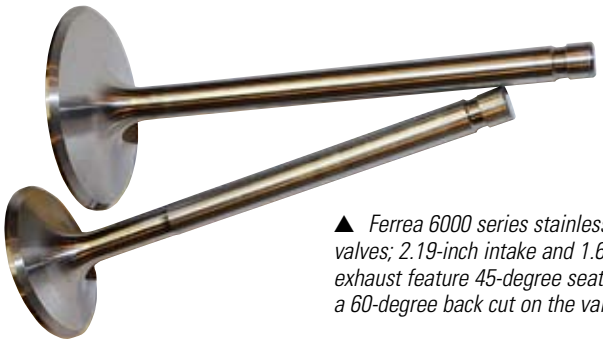
As you can see, the short-block already has some running time on it. The SRP pistons feature 7cc valve reliefs and piston to deck height is 0.005-inch.

This is the business end of the heart-shaped, fast-burn combustion chamber. Note the spark plug is canted toward the exhaust valve, as it's the hottest area of the chamber, providing a quicker and more complete burn. You can also see the bowl work on the intake side. The 30-45-60-degree multi-angle valve job was performed at KRE with a new, state-of-the-art Rottler SG-8 seat and guide machine.

KRE's aluminum timing chain cover, already painted the correct blue, installs over the Rollmaster timing chain. Note the white Teflon TIP gasket.

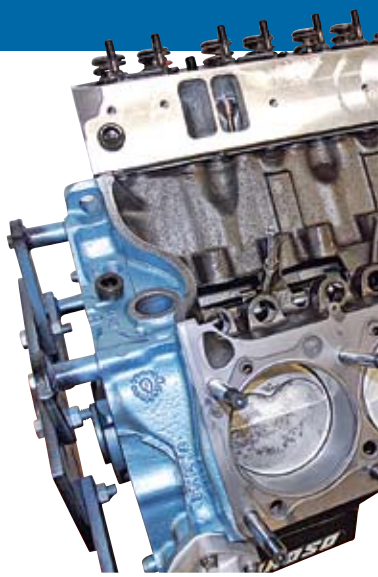


Here's the intake side of the KRE aluminum heads that were ported to flow 340 cfm.

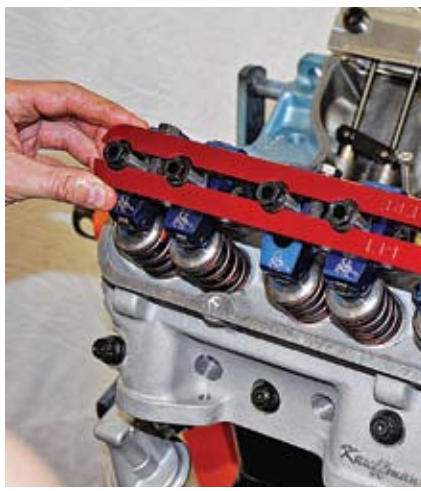


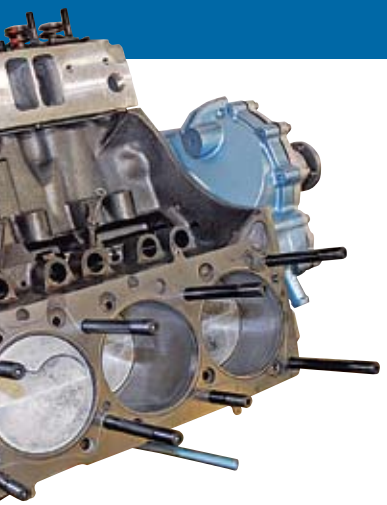
▲ *Ferrea 6000 series stainless steel valves; 2.19-inch intake and 1.66-inch exhaust feature 45-degree seats and a 60-degree back cut on the valves.*

The Cometic 0.040 head gasket is shown in place just prior to mounting the passenger side head. Note the use of ARP studs—highly recommended at this power level.



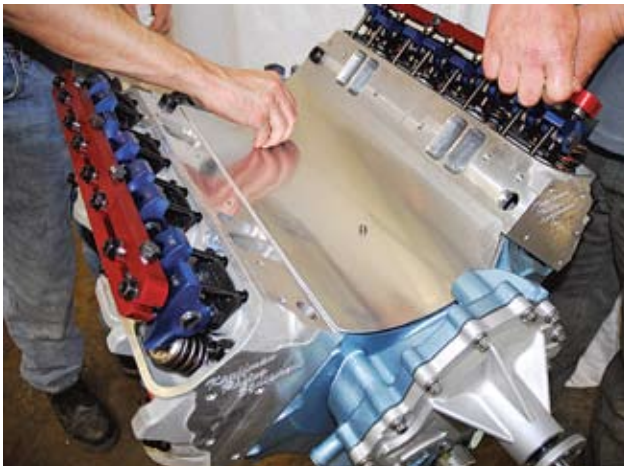
▲ *The Comp Cams custom grind solid roller cam features 265/272-degrees duration at 0.050 and 0.691/0.691-inch lift. Crower roller lifters are employed and, though the Comp Cams valvesprings have an open pressure of 620 pounds, Kevin feels that a lifter bore brace isn't needed with this camshaft profile…*





The new TIP-120240 intake gasket is specifically designed to accommodate the intake port size of the KRE head.

▼*…but a KRE stud girdle certainly is needed to maintain the proper valvetrain geometry by preventing stud deflection. Kevin says, "These CNC-machined 6061T-6 aluminum systems are lightweight, durable, and easy to install." Beneath it are Scorpion 1.6:1 roller rockers.*



Once the other stud girdle is installed, the KRE valley pan goes on using silicone to seal it.

A Holley 1050 Dominator carb is mated to the Edelbrock Victor intake's 850-cfm carb-style flange via an adaptor.

ENGINE BUILDUP WORKSHEET

Engine Displacement 463
Horsepower 650
Torque ..... 596 lb-ft
Bore/Stroke 4.185/4.21-in
Block/Crank Combo ..... 400 block, bored 0.035-in/stock 4.210, stroke 455 crank
Bore/Stroke Ratio 0.99406:1
Rod/Stroke Ratio 1.57:1

Bottom End

Block Description ..... '67 400
Preparation ..... Clean and mag, fill to water jackets with hardblock, bore and finish-hone to size using a torque plate, wash and assemble
Deck Height 10.235-in
Crank ..... 455 turned down to 3-in mains
Preparation ..... Balance rotating assembly
Balancer ..... Professional Products SFI-approved
Rods ..... BME aluminum, 6.625-in, 0.020-in side clearance
Bearings ..... Federal Mogul, main clearance 0.0025-in, rod clearance 0.003-in
Preparation ..... Oil feed holes opened up
Pistons ..... SRP 4.185-in forged, 0.005 piston-to-wall clearance
Piston to Deck Height 0.005-in
Piston Pins ..... SRP with spiral locks
Rings ..... Total Seal 1/16-1/16-3/16-in, Moly top, cast iron second
Preparation ..... Filed-to-fit, 0.018-in gaps
Rod Bolts ..... ARP 2000
Head Studs ..... ARP
Main Studs ..... ARP

Oiling System

Windage Tray ..... None
Crank Scraper ..... Tin Indian Performance
Oil Pan ..... Moroso
Oil Pump ..... Melling M54ds
Preparation ..... Spring shimmed to increase pressure

Heads

Brand ..... 340-cfm 74cc KRE aluminum D-ports
Chamber ..... Heart-shaped, fast-burn
Head Mods ..... Gasket match to TIP-120240 intake gasket, CNC-ported to 340-cfm
Combustion Chamber Volume ..... 74 cc's
Maximum Flow at 28 Inches of Water
Intake ..... 341-cfm at 0.700 lift
Exhaust ..... 261-cfm at 0.700 lift
Compression Ratio 11.41:1
Valves ..... Ferrea SS 6000 series, 2.19/1.66-in
Retainers ..... Comp Cams 10-deg
Keepers ..... Comp Cams 10-deg
Valve Guides ..... Bronze
Valve Seals ..... PC
Rocker Studs ..... ARP
Rocker Arms ..... Scorpion 1.6-ratio full roller
Pushrods ..... Comp Cams, 5/16-in, 9.850-in long

Cam

Brand ..... Comp Cams custom-grind solid roller
Duration at 0.050 ..... 265/272-deg
Lift 0.691/0.691-in
Centerline 110-deg
Lobe Separation Angle 110-deg
Installed Position ..... +4-deg
Lifters Brand ..... Crower roller
Valvesprings ..... Comp Cams
Seat/Open Pressure 230/620-bs
Timing Chain ..... Rollmaster double-roller

Induction

Carb ..... 1050 Holley Dominator
Jets ..... No. 97 square
Intake Manifold ..... Edelbrock Victor 850 base with tapered spacer
Mods ..... Ports matched to heads

Ignition

Distributor ..... MSD Pro-Billet
Amplifier ..... MSD 6AL
Coil Brand ..... MSD blaster
Wires ..... Taylor 8mm
Spark Plugs ..... NKG No. 8
Total Timing ..... 31.5-deg advance locked out

Exhaust

Headers ..... 1.75-in Hedman
Collector Size 3-in

ON THE DYNO

In the dyno cell, the timing is checked on the 463 before a pull is made.

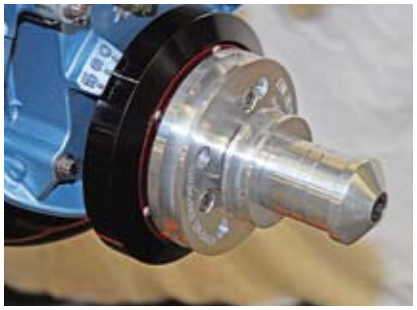
Baseline numbers were established on KRE's Superflow 901 engine dyno. Horsepower checked in at 614 at 6,200 rpm on the first pull. Torque was 563 at 4,600 rpm. Not a bad start. Baseline tuning consisted of No. 97 jets square, 28-degrees timing, and 0.020/0.020-inch valve lash.

BEST DYNO PULL

RPM	CORRECTED TORQUE LB-FT	CORRECTED HP	BSFC
4,300	564.7	462.3	0.446
4,400	572.8	479.9	0.430
4,500	578.3	495.5	0.422
4,600	588.1	515.0	0.410
4,700	582.9	521.6	0.407
4,800	582.0	531.9	0.407
4,900	**596.5**	556.5	0.404
5,000	573.8	546.3	0.412
5,100	576.3	559.6	0.415
5,200	584.5	578.7	0.402
5,300	580.5	585.8	0.403
5,400	571.2	587.3	0.418
5,500	568.3	595.1	0.422
5,600	582.4	621.0	0.415
5,700	574.1	623.1	0.440
5,800	564.9	623.8	0.424
5,900	554.7	623.1	0.440
6,000	555.0	634.1	0.427
6,100	548.0	636.4	0.447
6,200	545.0	643.4	0.445
6,300	542.2	**650.4**	0.437
6,400	527.7	643.0	0.439
6,500	501.3	620.4	0.468

Over the course of 13 dyno pulls, Kevin and Jeff did the usual tuning with jets, valve lash and timing. In the end, No. 97 jets square, 0.030/0.020 valve lash, and 31.5 degrees timing produced 650.4 hp at 6,300 and 596 lb-ft of torque at 4,900 rpm. We learned during tuning that advancing the timing past 32 degrees had a detrimental effect on power and the heads made peak power with 31.5 degrees of total timing. More power may be possible with more tuning, but dyno time was at a premium. Nevertheless, the mission was accomplished.

An MSD Pro Billet distributor featuring a TIP prototype polymer distributor gear, locked out mechanical advance, and Taylor wires will handle the spark.



The TIP crank mandrel drive system is mounted to the Professional Products SFI balancer and is used for driving belts and running the Moroso four-vane enhanced vacuum pump.

Sources

Kauffman Racing Equipment
Dept. HPP
22280 Temple Rd.
Glenmont, OH 44628
(740) 599-5000
www.krepower.com

Tin Indian Performance
Dept. HPP
P.O. Box 1162
Uniontown, OH 44685
(330) 699-1358
www.tinindianperformance.com