

EFI Dyno

We examine 11 intake manifolds for the 5.0 HO engine, confirming that it's tough, really tough, to beat the factory

text and photography by Earl Davis

Over the last few years the fuel injected 5.0-liter HO engine has spawned quite a few intake manifolds. By our count there are six new systems, three modified stock combinations and three factory manifolds, depending of course on how you categorize Ford's GT-40. Some of these have obvious similarities, while others so radically court a specialized spectrum of the performance envelope they don't even look like they fit the same engine. We were curious how this diverse group of intakes compared. Is the market-leading GT-40 the optimum intake, or have we all overlooked something?

In preparing our examination, we attempted to obtain every factory or aftermarket induction package currently available for the 5.0 liter HO engine, and except for one, we think we have all of the available intakes. Not represented is the intake sold by Ron Anderson Performance, as Ron declined when invited to participate. Also, there are intake manifolds currently under development by some of the aftermarket giants, but they were not close enough to production at test time.

We couldn't think of a better way to spend eight continuous days than swapping intake manifolds in a dyno cell, but

Showdown at the Mustang Corral

before we could test anything we had to build a suitable dyno mule. We believed a real-world street engine would best represent the sort of engine these intakes are purchased for, also, it was equally important the engine be healthy enough to sufficiently tax each intake. Therefore, we built an engine from a selection of proven aftermarket bolt-on performance pieces.

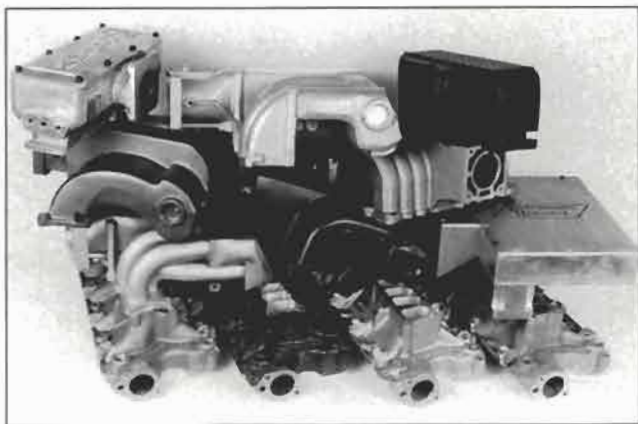
We wanted to assemble an engine without having to engineer it, so we chose compatible components which could be used out of the box with little or no machining. As we had selected the DSS Competition Engines, Inc. 901 SuperFlow dyno as an impartial testing ground, it was a simple conclusion to use one of their "Bullet" shortblocks as the foundation for our engine.

Interpreting the Results

As you review the test results, remember, it's the area under the torque curve that counts. Peak numbers give an idea of a manifold's potential, but in street driving where the engine must have a broad powerband, a tall, flat torque curve is the number one criterion. It is also the most difficult characteristic to improve upon over the factory

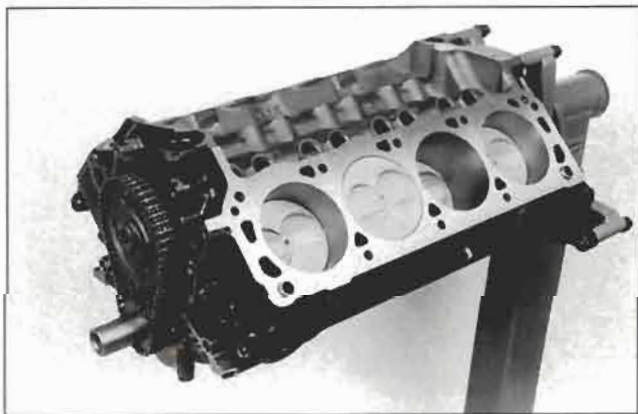
efforts. Of course, if you are interested in strip performance, then high peak horsepower is more desirable, and low-rpm torque becomes less and less necessary as you add rpm to your engine combination and low gears to your rear axle. But for street driving, look to see how long your favorite manifold maintains high torque numbers. It will be easier and more fun to drive.

We might add these intakes build more power than we thought. The current factory intakes are good parts, unlike the old carbureted days where almost any old intake and a big carb would unlock 40 horsepower, so it's doing some to get 20 horsepower in an efi intake.



The DSS Bullet short block assembly consists of a .030-inch overbored stock roller block filled with a precision machined, blueprinted and fully balanced reciprocating unit. Because DSS is a full service race shop, all machining and assembly steps follow proven hotrodding procedures. DSS Bullet blocks are hot tanked, Magnafluxed and decked. Then, new core plugs, oil galley plugs and cam bearings are installed. Connecting rod I-beams are polished before the ends are resized. Then they are shotpeened, Magnafluxed and equipped with 5/16-inch Milodon rod bolts. DSS fly cuts the TRW forged pistons to provide adequate room for big valves, and the pin bores are resized to ensure sufficient oil clearance. The crank is shotpeened, Magnafluxed, ground .010-inch under, oil-scooped and micro polished. The Bullet short block is then assembled using Speed Pro (SAE) plasma moly rings, TRW bearings and a Cloyes true roller timing chain and gears. For \$1599 you also get your choice of a B303, E303 or one of several Blue Racer cams. Other camshafts are available for an additional \$50. In our case, we opted for a Crane 2040 emissions-legal grind.

We covered the Bullet short-block with a pair of World Products Windsor Jr cylinder head pads using Fel-Pro's new graphite head gaskets. To handle the necessary head prep, Ron Raffanti of DSS performed the valve pocket cleanup work and a competition three-angle valve job. Aside from the necessary blending work, the heads were installed as delivered. Windsor Jrs are bolt-on heads for the 5.0 HO, and with 1.94-inch intake and 1.50-inch exhaust valves, will accommodate more than enough air flow for any of the manifolds tested. Their 61cc combustion chambers yielded a 9.05:1 compression ratio.



The Participants

Current 5.0-liter intakes generally fall into four categories: Stock, Modified Stock, New and Boxes. Stock includes the three 5.0 HO intakes fitted to production Fords, ie; the standard Mustang, Thunderbird/Cougar 5.0



and Mustang Cobra, along with the popular GT-40 from Ford SVO.

Modified Stock covers production Ford intakes which have been modified by the aftermarket. Before the advent of the GT-40, this was a large group as many tuners cut apart the standard Mustang intake so they could whittle away at it with their die grinders, then weld it back together when finished. While a few firms will still modify your stock intake if you ask them, the practice has practically died with the advent of the GT-40.

The practice isn't completely gone, however. Induction Systems sent us their version of

Milodon tapered stem, swirl polished stainless steel valves and aircraft grade fasteners were used for air flow and durability reasons.



Valve timing was dictated by a Crane Cams emissions legal 2040 Compucam delivering .489-inch valve lift and 220 degrees of duration at .050-inch lift. Compatible Crane hydraulic roller lifters, hardened steel pushrods, 1.6 ratio roller rocker arms and part number 99838 valve springs installed to deliver 320 pounds of open pressure, along with Motorsport guide plates and Milodon rocker studs, completed the valvetrain.

A Pro-M 77mm mass air meter calibrated for the stock 19 pound per hour fuel injectors was used because according to Ford engineers, it is the most accurate piece available. Some engine builders might opt for 24 pound per hour injectors for this application, but considering the stockers are good for approximately 320 horsepower at stock fuel pressure, we felt the modification unnecessary. The smaller injector enhances low-speed driveability and improves fuel mileage. Except for optimizing the fuel rail pressure to accommodate each manifold, no other adjustments were made. Initial ignition timing was set at 17 degrees for all the tests, and Citgo 93 octane pump gas fueled our small-block. We used the same 65mm Motorsport throttle body and EGR spacer on all manifolds in this test, except for the T-Bird Cougar intake which has a unique throttle body with integrated EGR spacer.

All data was collected by DSS' SuperFlow 901 dyno. Thermal-coated Texas Turbo long-tube headers did their part to promote a healthy appetite for torque in our test engine, as we believed going into the test that torque capability would be the major difference among the intakes. The Jacobs sparkplug wires were the only non-stock part of the ignition system.

the cut-ground-welded stock intake. Also, Extrude Hone, with their unique paste honing procedure is now catering to the 5.0 market with a ready supply of Extrude Honed stock intakes.

We're using the New heading to denote those intakes, or at least upper intakes, which are new products of the aftermarket. Saleen's unique upper casting works with a stock Ford truck lower section, while Performance Resources mates their upper section with a stock Mustang lower.

Finally, we have the Boxes. So called because of their shape, we're lumping these shoebox upper plenums together because their design is aimed at top-end efficiency. The three units currently on the market from CarTech, Hartman and Downs Motorsports are represented.



Manifold	Weight*	Cost	EGR
Cartech	30 pounds	\$325 (upper only)	no
Cobra	35 pounds	\$289 (upper only)	yes
Downs Motorsport	31 pounds	\$399 (upper only)	yes
Extrude Hone	32.5 pounds	\$650	yes
GT-40	28 pounds	\$600	yes
Hartman	24 pounds	\$349 (upper only)	no
Induction Sys	31 pounds	\$400/exchange	yes
Peri Resources	42 pounds	\$569 (upper only)	no
Saleen	39 pounds	\$995	yes
Stock	35 pounds		yes
T-Bird/Cougar	34 pounds		yes

*Includes lower manifold

Stock

Since the arrival of fuel injection in '86, the 5.0 HO Mustang has used a long-runner intake manifold designed to promote torque. With its compact block and short stroke, the small-block Ford is not naturally torquey, and in the carbureted days, racers zeroed in on the 289 and 302's rpm capability. But with an increased emphasis on fuel economy, in the '80s Ford engineers tuned the small-block for lower rpm and more torque. Multi-port fuel injection fits right in with this, as it allows long, complex runner shapes in the intake manifold because they need flow nothing more than air, and air bends around long runners better than a heavier air/fuel mixture.

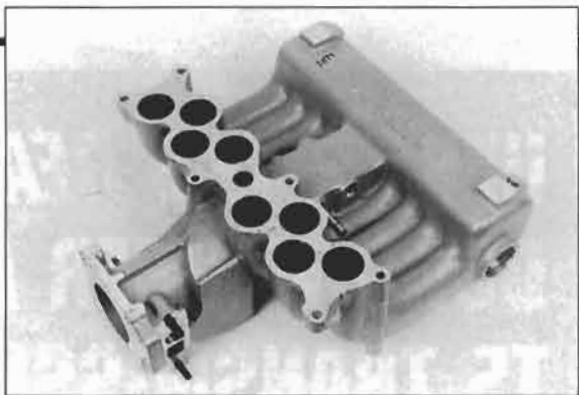
Optimized for torque, it's no surprise the plain-Jane stock intake showed as well as it did. In fact it out-pulled or equaled the box-type intakes which work at the other end of the tach. Where the stocker comes up lacking is in upper-end horsepower, and that's just because the plenum and runners are sized a bit small for the rest of our engine. As the Extrude Hone modified stocker illustrates, though, there is nothing intrinsically wrong with the stock intake.



Mustang Cobra *continued from page 16*

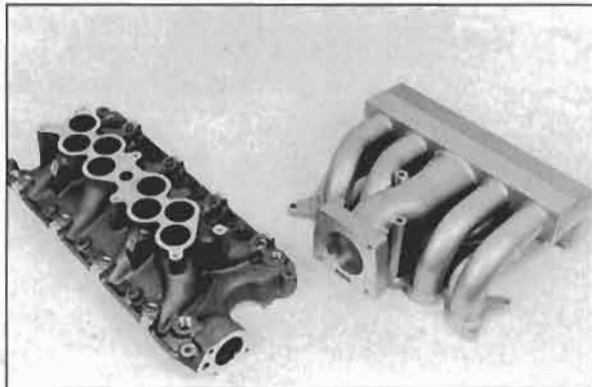
Introduced as a unique part for the limited-production Mustang Cobra, this factory intake manifold is essentially a cast aluminum version of SVO's GT-40. In fact, a GT-40 lower manifold is part of the production Cobra Mustang's induction package.

Mass producing a version of the famed GT-40 is great economic news for the budget minded speed seeker because the one-piece aluminum casting is much less expensive to produce than the built-up tubular GT-40 intake. Jim Dingle at Mustang Dynamics (3204 Jasper Road, Fairfax, VA 22033, (703) 818-9892) provided our Cobra intake. He sells the upper manifold for \$289 plus shipping. The Cobra manifold also features an inte-



grated EGR spacer which further lightens the financial load on the after-market buyer by eliminating the need to purchase a separate, large-bore EGR spacer.

Rumors following the new Cobra manifold say compromises had to be made in order to successfully mass produce the GT-40's intricate design and shape. But our dyno exercise shows the Cobra's performance equals that of the GT-40, generating 295.9 horsepower at 5300 rpm and 321.6 ft/lbs of torque at 4400 rpm. The only compromise we can detect is weight; at 19 pounds, the cast aluminum Cobra upper plenum weighs 6 pounds more than a tubular GT-40 upper half. No modifications are required to mate the cast aluminum Cobra upper plenum with a GT-40 lower.



GT-40

Motorsport's GT-40 manifold has become the industry standard by providing dependable, hassle-free bolt-on performance. Its ability to improve torque as well as horsepower are what make it such a strong contender, not to mention the pricing and distribution capabilities enjoyed by SVO.

We had heard from industry insiders that the GT-40 was tough to beat, so the fact only two intakes really came close to it in overall power production is not surprising. The Extrude Hone swapped torque for horsepower with the GT-40, while the Saleen intake, clearly the surprise piece of this test, did itself proud by practically matching the GT-40 in torque while inching ahead in horsepower.

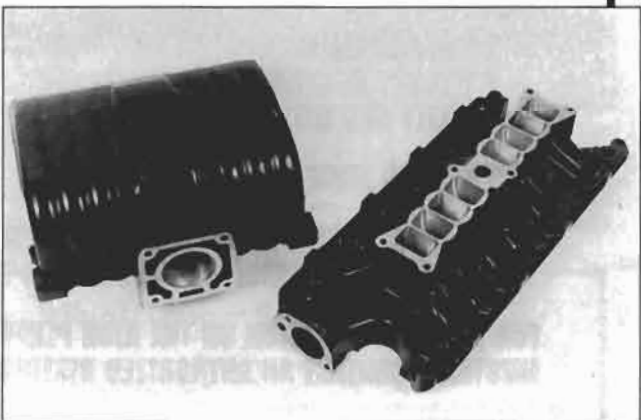
Hardly as surprising is the mauling the GT-40 gave the stock intake with no more prep than ripping the shipping carton open. Motorsport's pride cranked out 301.2 horsepower at 5200 rpm — an excellent 33.8 horsepower more than the stocker — and 321 ft/lbs of torque at 4200 for a 4.6 ft/lb bonus just to show it doesn't hurt torque.

We should note Motorsport's GT-40 package includes a 65mm throttle body and matching EGR spacer, and our test intake was so equipped.

Induction Systems

In the early days of EFI Mustangs, numerous vendors experimented with hand porting the stock Mustang manifold. But they almost all later abandoned the idea as the cost of aftermarket manifolds came down while the labor needed to produce a custom ported stocker was going up. The boys at Induction Systems continue to offer custom ported stock manifolds at a reasonable price (\$400 exchange) to service the budget minded racer or the person who drives a Crown Victoria, Mercury Marquis or the 5.0 full-size Lincolns and is looking for a bit more power and mileage.

Induction Systems is quick to point out their intake is not the ultimate word in hand-porting manifolds, and its performance improvements are modest. You might say the gain is in keeping with the cost of the unit. It would have been nice to run some of the other hand-porting intakes still around out there during this controlled test, as we have previously seen



more power from modified stockers. In the February '93 Super Ford, as part of the Head, Intake and Cam article, we found one of JBA's hand-porting intakes came within 14.1 horsepower and 4.5 ft/lbs of a port-matched GT-40 on a 313.7 horsepower small-block. Furthermore, at 2500 rpm the JBA hand-port was 22.3 ft/lbs and 10.6 horsepower ahead of the GT-40, which says something about driveability and fuel mileage at street cruising rpm.

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Sources:

Downs Motorsport
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Toms River, NJ 08753
(800) 553-6967
Ext. 57

CarTech Mfg. Inc.
11723 Warfield
San Antonio, TX 78216
(512) 308-

8464
Hartman Enterprises
949 N. Cataract Unit D
San Dimas, CA 91773
(909) 592-7706

Charlie's Mustangs
766-A N. 9th St.
San Jose, CA 95112
(408)275-6511

Performance Resource
12 Barbara Drive
Fairfield, NJ
07004

Saleen Performance
Parts
3080 29th St.
Long Beach, CA 90806
(800) 888-8945

Mustang Dynamics
13204 Jasper Road
Fairfax, VA 22033
(703)818-9892

World Products, Inc.
353 Oliver

Troy, MI 48084
(313)244-9822
Crane Cams
530 Fentress Blvd.
Daytona Beach, FL
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(904) 252-1151

Professional Flow
Technologies
25760 John R Road
Maddison Heights, MI
48071
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Milodon, Inc.
20716 Plummer St.
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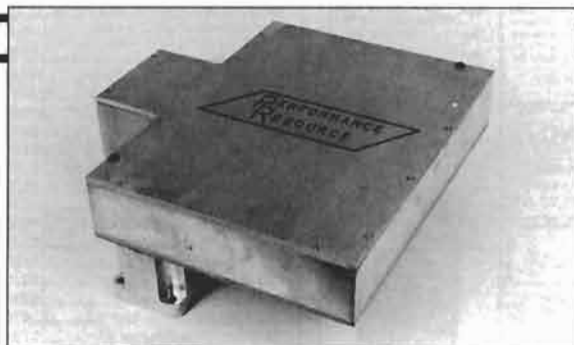
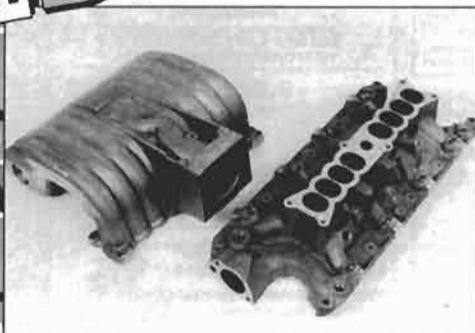
Extrude Hone

Charlie Bruno of Charlie's Mustangs submitted an Extrude Hone stock manifold which he says, "... doesn't give up low-end torque like a GT-40 when combined with stock heads and cam," a claim fairly well substantiated by the test results. Extrude Hone's modified stock system produced a whopping 331.5 ft/lbs of torque at 4100 rpm; more than any other manifold in our exercise. Horsepower leveled off at 287.7 at 4900 rpm.

Clearly, the Extrude Hone stocker builds upon the merits of the stock Mustang manifold — long runner length and moderate plenum volume for max torque — while being limited at the top end only by those same parameters. The

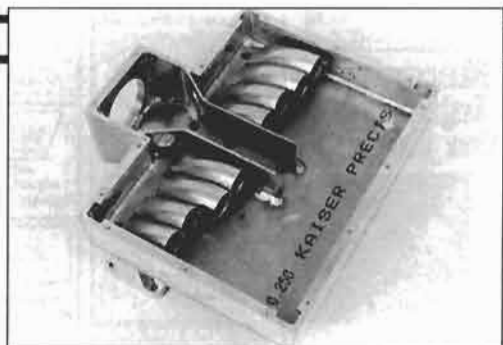
Extrude Hone stocker ran impressively, and for torque applications, or under low-profile hoods, the Extrude Hone process clearly bears some looking into. Anecdotal evidence with Tokico's 5.0 Thunderbird project where the only option was to Extrude Hone the intake was very good; we would have liked to Extrude Hone the T-Bird, and especially the Cobra intake to see what they could do.

The Extrude Hone process removes equal amounts of material from the inside of a manifold using an abrasive putty-like substance. Unlike hand porting, the process eliminates the need to cut the upper plenum apart. Both the upper and lower sections are treated to the process. Charlie sells Extrude Hone Mustang manifolds for \$650 exchange.



Performance Resource

This composite aluminum upper manifold was voted best in overall appearance. Materials and workmanship are first rate and at 23 pounds, the PR manifold is as rugged as it looks. The billet aluminum base bolts directly to a stock lower, simplifying the installation and minimizing cost. Because the Performance Resource manifold combines small diameter runners with a large plenum, peak torque arrives very early in the rpm range and horsepower is delayed until late in the pull. At 2700 rpm the PR upper plenum generated



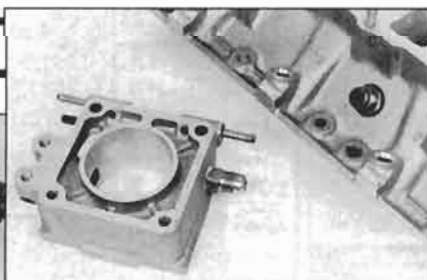
301.2 ft/lbs of torque and 250 horsepower at a comparatively high 5100 rpm. On the street, 300 ft/lbs at such a low rpm will deliver a solid kick in the pants off the starting line provided you've got the traction to hook it up.

Furthermore, PR's composite aluminum manifold has removable runners which can be tuned to accommodate a particular application. The size of the plenum and its construction lends itself to personalized modification, which we unfortunately did not have time to experiment with during our test. Fiddling with the runner length will obviously change the way this intake performs, and could prove a worthwhile feature on unusual or custom engine builds.



Saleen

Saleen's custom cast aluminum upper plenum and modified 5.0-liter truck lower is another engineering masterpiece. High-quality



products have always been a Saleen trademark as indicated by the workmanship required to build this manifold. The dyno numbers confirm the Saleen manifold's impressive performance capabilities, as the unit ran neck-and-neck with the GT-40, just about matching it in torque, and narrowly besting it in peak power. At 2000 rpm torque was well over 200 ft/lbs, while peak torque of 318.6 ft/lbs arrived at 4200 rpm followed shortly by 306.2 peak horsepower at 5400 rpm.

The unique upper plenum is engineered to

mate strictly with a ported truck lower manifold and will not mate to any other piece. The large free-flowing runners help generate high horsepower and the length helps to maintain adequate torque over a long rpm range.

Also notable, designed for the certified SSC Saleen back in '90, the Saleen intake comes with its own EGR spacer. It connects to the exhaust crossover passage in the lower intake via a flexible tube.

With such a strong showing, street-legality and three years on the market, the question is, why isn't the Saleen intake seen more often? The answer is cost. At \$995 the Saleen is pricey, especially when you consider that until recently Saleen asked a staggering \$1500 for it! Limited distribution and lack of objective performance data didn't help, but perhaps now we'll see a few more of them.

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CarTech

CarTech's open-chambered unit is designed as a direct replacement for the stock upper plenum. Originally the low-profile manifold was engineered to complement CarTech's turbocharger system by providing

a direct, unrestricted path to the lower intake runners when the stock 5.0 upper plenum proved too restrictive at high boost and rpm. Thus the "breadbox" was optimized for high-rpm air flow; the turbo provided the necessary low-rpm flow.

Except for its diminished overall size, the CarTech plenum retains several fundamental design features. Its throttle body is positioned very near the stock location, but the stock's long entry leading to the plenum and the individual curved runners

were eliminated.

The 14-lb upper plenum lists for \$325 and has no provisions for an EGR valve. Dyno testing confirmed the CarTech's high-rpm nature as the powerband was shifted upwards, with peak torque falling off six foot pounds and horsepower making a nice 20 hp gain over the stocker. Under naturally aspirated conditions, it produced an impressive 295.8 horsepower at 5500 rpm and 310.1 ft/lbs of torque at 4400 rpm. Mark Harwell at CarTech recommends combining their upper plenum with a ported stock lower for best results.



Hartman Enterprises

At four pounds, Hartman's polymer "Powerbox" is by far the lightest test participant. The two-piece plenum accepts a 65mm throttle body with no modifications and up to an 80mm by opening the flange

with a die grinder. Like the Downs Motorsport and CarTech manifolds, the Hartman is an open plenum design explaining why its power peaks are well-elevated over the stocker's. The Hartman manifold's slightly smaller plenum size is the main reason it generated more torque and less horsepower

than its box counterparts. Another Hartman characteristic is its plastic construction. It acts as a heat insulator, helping charge air density. At 4400 rpm, the Hartman plenum made 314 ft/lbs of torque and at 5500 rpm it produced 290.7 horsepower.



Downs Motorsport

The Downs Motorsport unit is also a cast-aluminum, open-plenum upper intake, but this one-piece version is designed to fit a GT-40 lower manifold. Like CarTech's upper plenum, the Downs Motorsport housing was engineered and designed to complement a forced induction system. Because these two plenums all but elimi-

nate the individual runners normally contained in the upper manifold, overall runner length is greatly reduced, pushing the torque and horsepower peaks higher in the rpm scale.

As expected, the larger GT-40 lower section didn't do anything to help this box intake pick up any torque, but it didn't seem to help it make any horsepower, either. Of course, this is a forced induction intake, and with supercharged quantities of air

passing through it, we'll wager the GT-40 lower has to help. But that's another dyno test.

To gain necessary clearance for the short, wide Downs Motorsport, CarTech and Hartman plenums, it was necessary to replace our larger-than-stock Kenne Bell billet aluminum adjustable fuel pressure regulator with a stock regulator. Several vendors offer an adjustable stock-type regulator that would best suit this application.