Ten Times The Torque....., ...The ultimate TPI Shootout.

Options

Corvette Sep 23 2009, 12:20 PM Post #1

Xtreme Memberr

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Posts: 253
Joined: 30-June 08
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Not a bad read I thought.

Photography: Richard Holdener » Words: Richard Holdener

Yes, this shot is a bit of a tease, since we never got to run the IR manifold on the test engine, but it sure looks trick.

TEN TIMES THE TORQUE

The Ultimate TPI Shootout

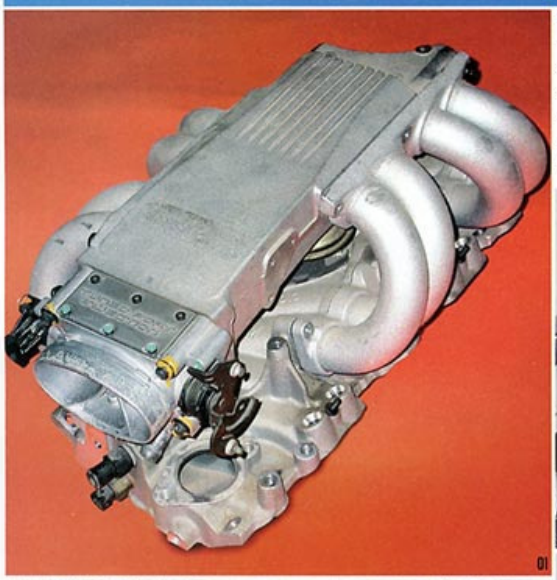
BACK IN 1985, CHEVY INTRODUCED THE WORLD TO A BRAND-NEW FUEL-INJECTION SYSTEM. DESIGNATED TUNED PORT INJECTION (TPI), THE SYSTEM WAS A RADICAL DEPARTURE FROM THE TRADITIONAL CARBURETOR PERCHED ATOP AN INTAKE MANIFOLD, OR EVEN THE SHORT-LIVED CROSS-FIRE INJECTION SYSTEM THAT FEATURED A PAIR OF THROTTLE BODIES THAT DISPENSED BOTH AIR AND FUEL.

By contrast, the Tuned Port Injection system featured individual injectors positioned in the manifold base directed into each cylinder-head port entry. Unlike a carburetor or the fuel-dispensing throttle bodies used in the Cross-Fire system, the individual-port injection ensured even fuel flow to all eight cylinders to maximize performance and economy. The lack of fuel flowing through the intake also minimized problems such as fuel puddling and helped reduce emissions. Many thought the advent of the sophisticated fuel injection had once and for all put an end to performance as we knew it. But the reality is the TPI-equipped engines started the current EFI performance revolution we currently enjoy—with the LS1 and (soon) the LS2 configurations.

Although the L98 TPI engines promised improved fuel distribution and economy, the real trademark of the systems was their long-runner intake configuration. In the world of induction systems, long runners help promote low-speed torque production. While we all brag about how much horsepower our engines make, the cold, hard reality is that it's the torque curve that slams you back in your seat and brings a smile to your face. It is also what impresses the person in the passenger seat every time you stomp on the loud pedal.

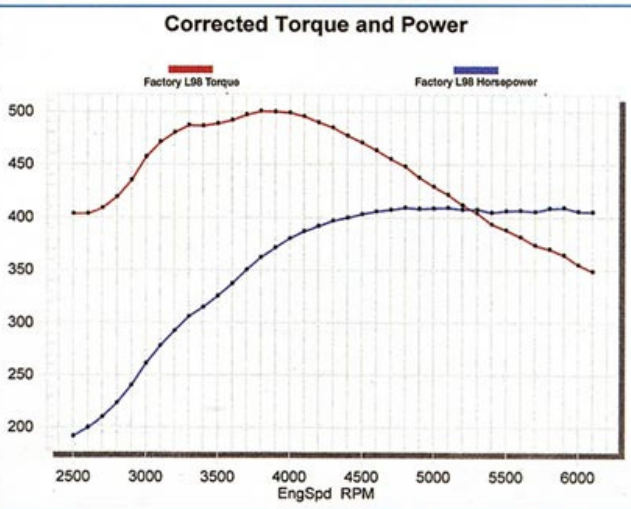
Chevy engineers were obviously shooting for an impressive torque curve when they drew up the TPI systems, as the long-runner intake design gave the small-block Chevy some serious grunt. Never mind the fact that the same runner length that provided so much torque actually limited high-rpm breathing—stepping on the gas of a well-tuned TPI small block immediately brought a smile to your face. Sure, the later LT1 engines offered more peak power, and ulti-

SBC 383 Stroker—Factory L98 TPI System



01» The stock Tuned Port Injection (TPI) setup consisted of a dual-blade throttle body, a common plenum, a pair of runner sections and a base manifold. 02» Our 383 test engine started out life as a carbureted small block equipped with 10.0:1 forged pistons, a set of TFS aluminum heads and a Comp XR288HR hydraulic roller cam. 03» Originally designed to supply the airflow requirements of a 245hp 350, the openings in the base manifold were somewhat small for our 383 stroker. 04» On the dyno, the 383 equipped with the factory L98 TPI setup produced 410 hp and 501 lb-ft of torque.

The graph sends an important message about the factory L98 TPI intake systems, namely, that it excels at low-speed torque production. Check out the fact that this 383 small-block Chevy produced an impressive 500 lb-ft of torque, yet "only" a hair over 400 hp (410 hp). Note, too, that the 400hp barrier was reached at just 4,400 rpm and that the horsepower curve remained basically flat until 6,000 rpm. The long runners used on the factory TPI intake really promote low-speed torque production, especially when applied to an already powerful engine. Remember that this TPI intake was originally designed to feed an engine that produced just 245 hp, so it is not surprising that it would be somewhat restrictive in terms of maximum power on a more powerful 383. Bear that in mind when you bolt on a stock TPI to a strong crate engine. For you trucking enthusiasts with a slightly milder cam profile, this combination would be one serious tow engine. It would also make for a perfect and very reliably efficient combination for a heavy street machine.



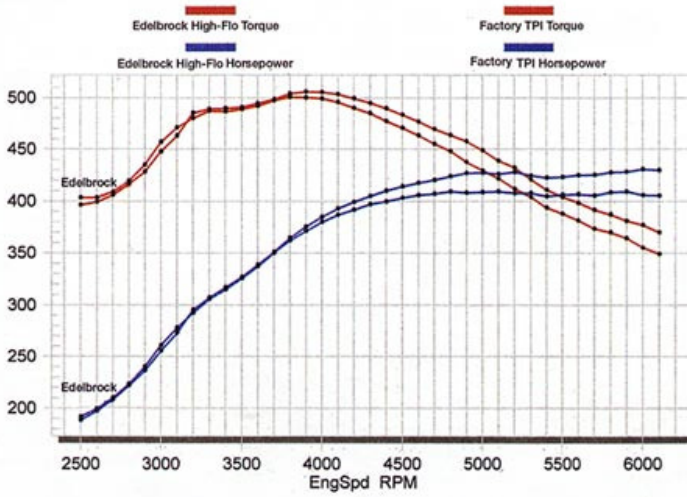
SUPER ROD February 2005

Factory TPI vs. Edelbrock High-Flo TPI System

05» The Edelbrock High-Flo TPI system included a base manifold and a pair of cast-aluminum runners. The Edelbrock system was designed to be used with the factory plenum, although it did offer a pair of larger throttle bodies for the L98. 06» Although heavier than the factory tubing, the cast-aluminum runners from Edelbrock featured a trick finned design and plenty of wall thickness to allow for additional porting. These runners respond very well to Extrude-Hone porting. 07» Designed as an emissions-legal replacement, the Edelbrock High-Flo combination improved the power output by as much as 25 hp over the factory TPI.

Designed as a 50-state-legal replacement combination for the '85-'91 305 and 350 TPI engines, the Edelbrock High-Flo base manifold and matching cast-aluminum runners improved the peak power output by 21 hp (peak of 431 hp), but gains were as high at 25 to 26 hp elsewhere on the curve. The peak torque was up by just 1 lb-ft to 501 lb-ft over the stock TPI system. The Edelbrock High-Flo system improved the power output from 3,800 rpm all the way to 6,000 rpm on this 383 test engine. The airflow improvements offered by the Edelbrock combo cost a few pound-feet of torque down low (below 3,100 rpm), but the trade-off was minimal. For this test, the Edelbrock components were run with the stock plenum and throttle body. Although tested in as-cast condition, the added wall thickness of the cast-aluminum runners and base manifold means that there is plenty of material for porting to further improve the airflow.

Corrected Torque and Power



mately more absolute performance output, but the short-runner LT1 intakes never offered the kind of immediate (off-idle) torque production of the original TPI systems. Chevy has since switched back to the long-runner configuration in the LS1 (and LS2) engines, and the torque curves are all the better for it.

While the TPI systems have come and gone, there are a great many Camaros and Corvettes, as well as all sorts of super rods and much earlier street rods, equipped with TPI engines that are just begging to be modified. Since the TPI engines are so plentiful in wrecking yards, they make for great engine replacements for all sorts of specially modified cars. Knowing that L98 TPI engines are still out there in numbers, and that super rodders are always looking for ways to make their cars go faster, we decided to gather no fewer than 10 different fuel-injection intake manifold combinations and then subject them to the rigors of the dyno.

While the factory TPI system is capable of producing plenty of torque, there are actually ways to improve torque while increasing the top-end power. This intake comparison was not assembled so much as to crown an absolute winner, but to demonstrate the changes in the power curves offered by different intake designs. After all, one power (or torque) curve is not ideal for every application, and there's no telling how many specific combinations exist, so look for one that best suits your own style and power package. A street rod owner may desire a different power curve than, say, a street/strip Camaro, and not everyone wants (or needs) 500 hp at 6,000 rpm, especially when their application might be better suited with a very responsive 400 peak hp and massive 530 lb-ft of torque. Maybe you don't mind trading some low-speed torque for a bit more mid-range, or maybe you have a particular intake design in mind for your engine compartment. Regardless of the reasoning behind your decision, we elected to present you these results to provide a choice—to let you, the reader, decide what best suits your particular application.

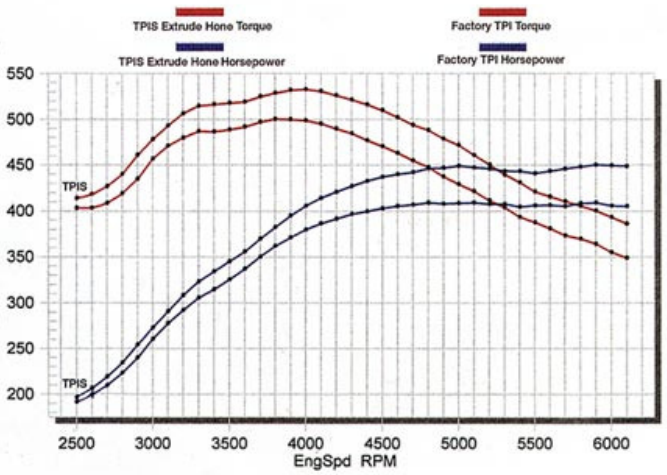
Originally, we intended to run the

Factory TPI vs. Extrude Hone and Big-Tube Runners

08» Despite their humble beginnings, the factory TPI base manifold and plenum can be made to flow better by treating them to Extrude-Hone porting. Add a set of big-tube runners (from TPIS, for instance) and you have the makings of a serious TPI system. 09» The Extrude-Hone process forces abrasive media through the ports, removing material to improve flow. The trademark wall finish is ultra smooth. The limiting factor in porting the factory base manifold is actually the size of the tubular runners. 10» We combined the Extrude-Hone-ported base and plenum with a set of TPIS big-tube runners and 52mm throttle body. 11» The Extrude-Hone-ported combination upped the peak power output to 451 hp, while the torque curve swelled to a whopping 534 lb-ft.

The results of this test were proof positive that a 383 stroker can benefit from additional airflow. Extrude Hone performed its porting magic on the factory L98 base manifold and port-matched the plenum. To this we combined a set of TPIS big-tube runners (supplied for use on the TPIS Big Mouth system) and TPIS 52mm throttle body. The Extrude Hone and big-tube runner combination upped the power peak to 451 hp, but it was the torque that was truly impressive. This combination tied with the TPIS Big Mouth system for top torque honors—with a peak reading of 534 lb-ft. In fact, the Extrude Hone combo exceeded 500 lb-ft from 3,200 rpm to 4,600 rpm. That, my friend, is big-block torque territory, all from a small block that will bolt into any TPI Camaro or Corvette. Unfortunately, the wall thickness of the factory tubular runners will not allow much of an increase through porting, so your best bet is to combine the ported factory base manifold and plenum with a set of aftermarket runners such as the ones from TPIS used on this combination.

Corrected Torque and Power



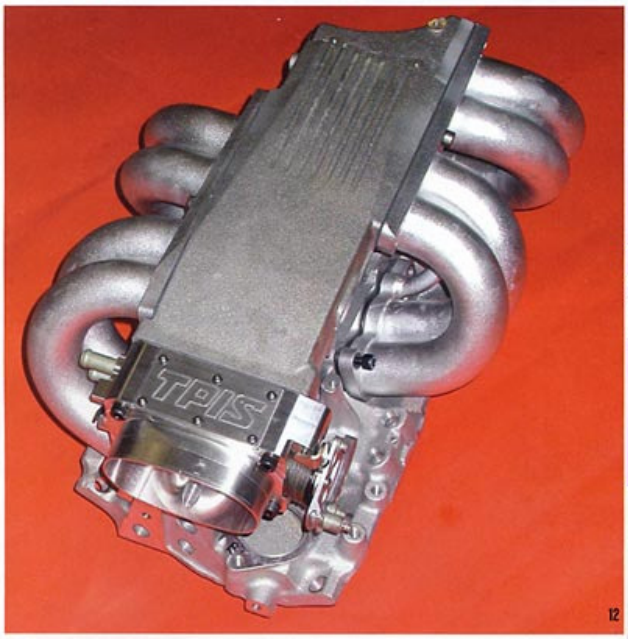
intake comparison on a 10:1 350 small block equipped with CNC-ported AFR 180cc heads, an Xtreme Energy 266 cam and 1-1/2-inch headers. The idea was to establish baseline horsepower and torque curves with a factory L98 (Corvette) Tuned Port Injection system and then, for comparison, install all of the nine remaining systems on the same combination. Unfortunately, our test engine developed problems, so out of necessity it had to be replaced with a slightly wilder 383 stroker (10:1, TFS heads and Comp XR288HR cam). Check out the sidebar on cams for more details on cam timing for your TPI engine.

All of the TPI intake systems were run on the engine dyno using an Accel DFI stand-alone engine management system. Past experience told us that testing TPI intake systems with the inability to accurately tune the factory management system limited the power potential of some systems. The dramatically different power curves produced by these diverse TPI systems naturally required a dedicated management system to ensure that all systems produced maximum safe power. The Accel DFI system was combined with 36-pound injectors to provide adequate fuel delivery to our 383 test engine. So let's get with it. Check out the supplied power graphs for a complete rundown on each of the intake systems, and then decide which one would be best for your particular application. SR

Product Profile

Accel/Mr. Gasket Performance Group Dept. SPR, 10601 Memphis Ave., #2, Cleveland, OH 44144, 216/688-8300, www.mrgasket.com **Arizona Speed and Marine, Inc.** Dept. SPR, 6313 W. Commonwealth Ave., Chandler, AZ 85226, 480/753-0208, www.azspeed-marine.com **Comp Cams** Dept. SPR, 3406 Democrat Rd., Memphis, TN 38118, 800/999-0853, www.compcams.com **Edelbrock Corporation** Dept. SPR, 2700 California St., Torrance, CA 90503, 310/781-2222, www.edelbrock.com **Extrude Hone** Dept. SPR, 1 Industry Blvd., Irwin, PA 15692, 800/613-0983, www.extrudehone.com **Holley Performance Products** Dept. SPR, 1801 Russellville Rd., P.O. Box 10360, Bowling Green, KY 42102, 270/782-2900, www.holley.com **TPI Specialties, Inc.** Dept. SPR, 4255 Creek Rd., Chaska, MN 55318, 952/448-6021, www.tpis.com

Factory TPI vs. TPIS Big Mouth System



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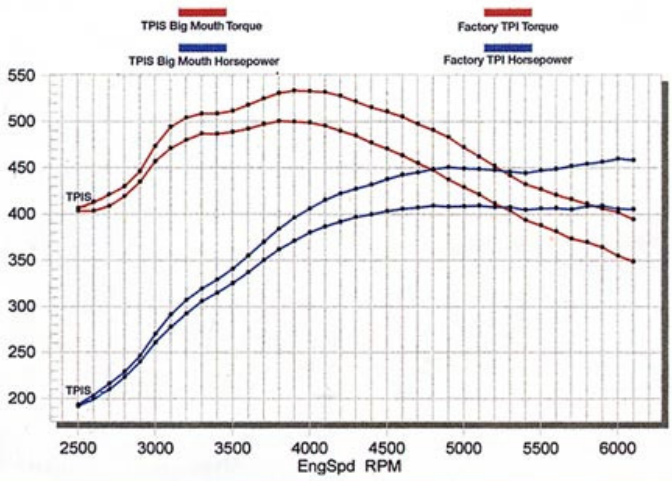
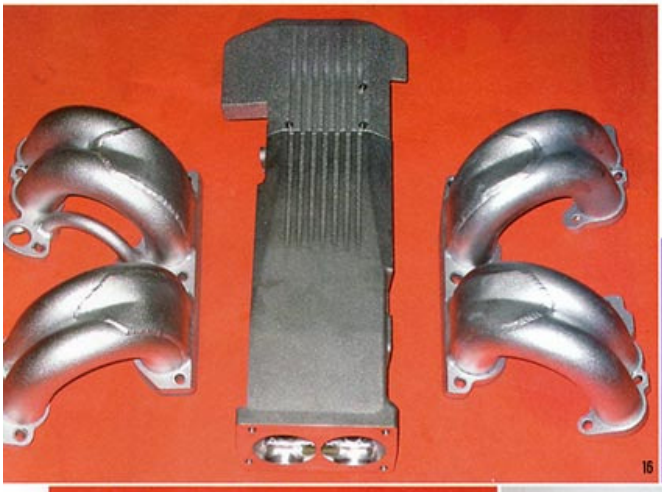
12» It seemed only natural that we would include a company with a name like Tuned Port Induction Specialties (TPIS) in our TPI intake comparison. TPIS has been in the game since the very beginning, and its Big Mouth system still adds torque like nobody's business. 13» The TPIS system included this Big Mouth base manifold that easily outflows the factory casting. 14» The system also included a pair of its big-tube runners. Note the difference in size between the stock and TPIS big-tube runners. In this case, bigger really is better. 15» The TPIS Big Mouth system matched the Extrude-Hone-ported torque figure of 534 lb-ft but bettered peak power another notch to 460 hp.

Like the Extrude-Hone-ported combination before it, the TPIS Big Mouth system showed what the results can be when you provide some much-needed airflow to a starving small block. Obviously, the guys at TPIS did their homework those many years ago with the Big Mouth base manifold, big-tube runners, ported plenum and 52mm throttle body, as the combination thumped out 460 hp and 534 lb-ft. The power and torque curves produced by the TPIS Big Mouth system were very similar to those produced by the Extrude-Hone-ported system, but the TPIS system managed to produce more peak horsepower (460 hp vs. 451 hp). Any time you can improve the torque production by 50 lb-ft for a 2,000-rpm spread, you know you have done something right, and TPIS certainly has, which may be why it is called TPI Specialties (TPIS).

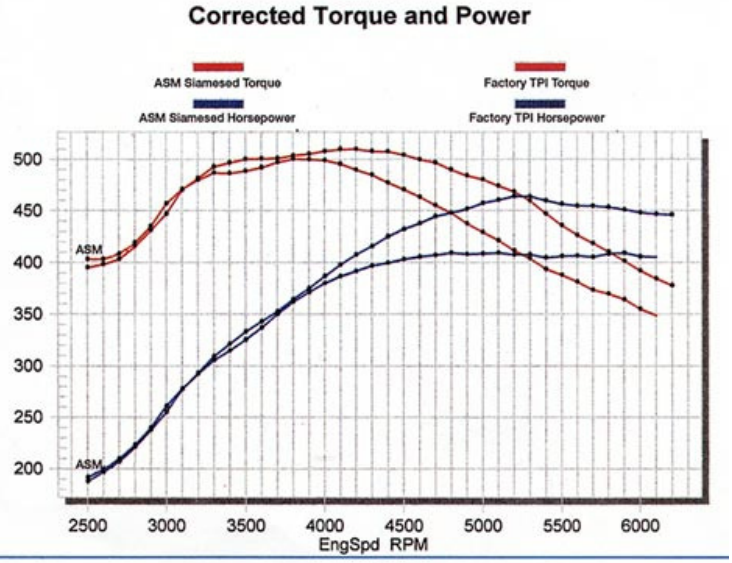


Factory TPI vs. Arizona Speed & Marine Siamesed Runners

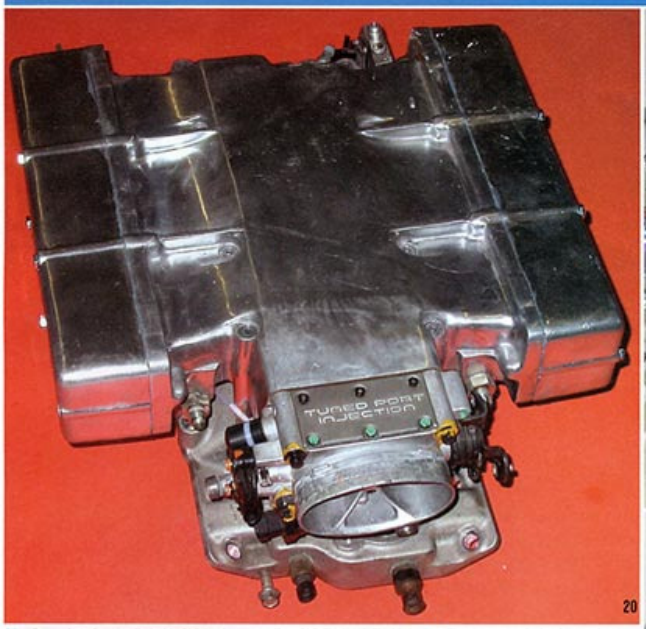


16» Arizona Speed & Marine offered up a pair of siamesed runners for testing along with a matching ported plenum. 17» The siamesed runners effectively decrease the runner length, which tends to shift the power curve higher in the rev range. 18» ASM also supplied a pair of high-flow throttle bodies for testing with its intake system—though the larger throttle body showed no gains on our test engine at the 464hp level. 19» When combined with the TPIS Big Mouth base manifold, the ASM runners, plenum and throttle body produced 464 hp, but the torque peak was off slightly to 510 lb-ft.

The one surprise in all of the TPI testing was the siamesed runners from Arizona Speed & Marine. A longtime and very effective player in the Tuned Port Injection market, Arizona Speed & Marine offered a set of its siamesed runners along with a matching (port-matched) plenum and a pair of high-flow throttle bodies. In theory, the siamesed runners decrease runner length and add plenum volume, which will tend to shift the power curve higher in the rpm range. This usually trades low-speed torque for top-end (or mid-range) power. True to form, the siamesed runners shifted the torque peak of 510 lb-ft from 3,800 rpm (with the factory TPI) to 4,200 rpm, but the power curve seemed to fall off more rapidly beyond that point than we anticipated. Equipped with the ASM siamesed runners, the combination produced the highest peak horsepower rating so far, 464 hp, but the peak occurred at just 5,300 rpm.



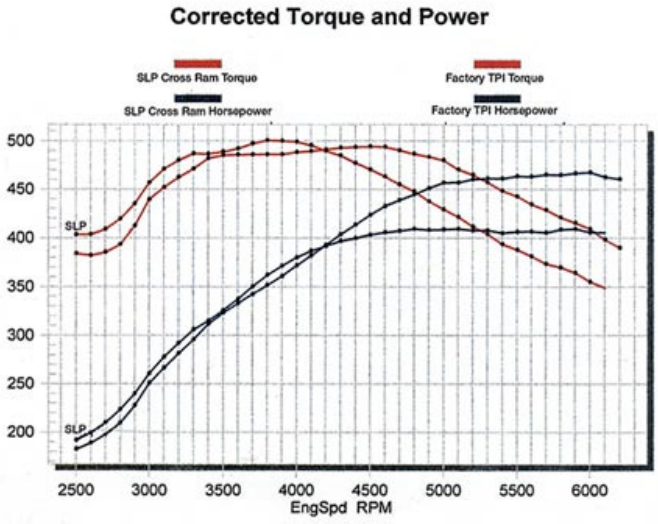
Factory TPI vs. SLP Firehawk



20» Somewhat of a rare find, this SLP intake came off an SLP Firehawk Firebird. 21» The cross-ram design featured a central throttle-body entry with a pair of additional plenums designed to allow the air to make the turn into the respective runners. 22» One unique feature of the SLP intake was that the fuel rails were cast into the upper manifold section. 23» The power peak was up slightly with the SLP intake, to 468 hp, while the torque peak stood at 493 lb-ft. The SLP intake was the first to start trading low-speed torque for high-rpm horsepower.

Although no longer in production, this cross-ram-style TPI intake produced by SLP was installed on the old TPI Firebird Firehawk vehicles, so we thought we'd take a look. This one came from Steve Rideout of Power Train Dynamics (in Huntington Beach, California). Thanks for the loan, Steve.

A cross-ram design, the SLP intake featured a pair of bolt-on plenums located on each side to allow the air to make the turn from the central throttle-body entry. The SLP intake was unique among the other entries in that it featured fuel rails cast into the design, rather than the aluminum extrusions used by the others. The SLP combination proved plenty powerful but was the first of the remaining intakes where we began to see a trade-off in low-speed torque in search of top-end power. Equipped with the SLP TPI intake, the 383 produced 466 hp and 495 lb-ft of torque, bettering the factory L98 TPI system from 4,200 rpm to 6,000 rpm. Below that, the SLP combination gave away a bit of low-speed power, but not excessively. The 50- to 60-hp gains past 4,500 rpm were more than enough to warrant replacing the stock TPI system with this SLP piece, if you could get your hands on one.

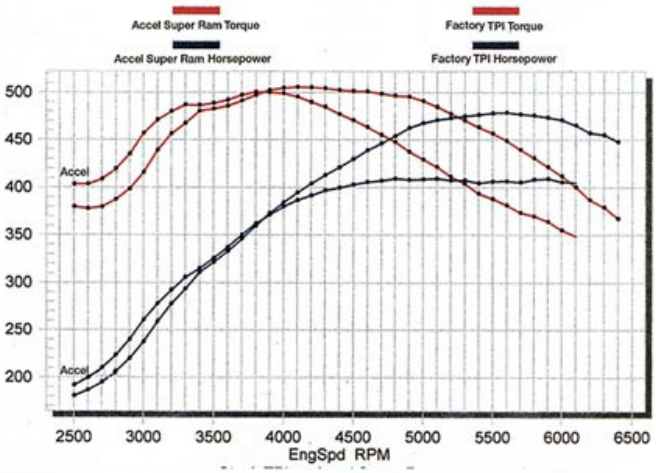


Factory TPI vs. Accel Super Ram

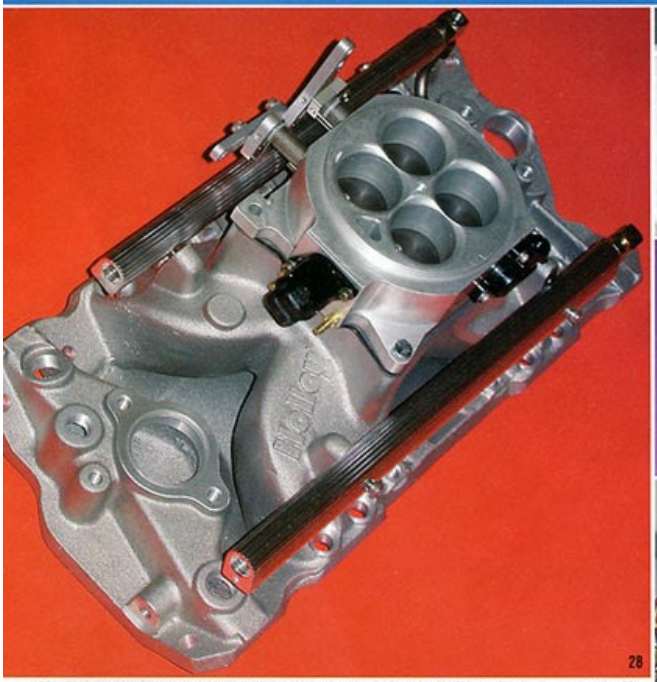
24» The Accel Super Ram has always been a favorite among TPI owners, and for good reason. On looks alone, the big-plenum design is impressive, but when you add the fact that this Lingenfelter-designed intake was responsible for an additional 70 hp, it becomes hard to beat. Also note the 1000cfm throttle body (the one to use) Accel supplied as part of the Super Ram package. 25» The Accel Super Ram shared the multi-piece design philosophy by using a base manifold, runners and a common plenum, but the difference was that the Super Ram featured shorter (and larger cross-section) runners to enhance power production. 26» In addition to the Super Ram, Accel also supplied a complete DFI stand-alone engine management system for our TPI test. It was critical to provide accurate timing and fuel curves to the different intake configurations. With steady air/fuel and timing curves, this intake test would have been nothing more than an exercise in frustration. 27» On the dyno, the Super Ram lived up to its name by combining a peak power number of 480 hp with a peak torque reading of 506 lb-ft. The shorter runner traded off power down low to the long-runner L98 TPI, but above 3,900 rpm it was all Super Ram.

The Accel Super Ram is where our horsepower quest began getting serious. Offering a peak of 480 hp, the Super Ram lived up to its name by besting the factory L98 system by a solid 70 hp. The Super Ram even managed to out-gun the stock system in torque production by posting a peak torque reading of 506 lb-ft at 4,100 rpm. Like the SLP intake, the additional top-end power cost torque below 3,400 rpm. The difference in the power curves created by the Accel Super Ram compared to something like the TPIS Big Mouth can be primarily attributed to the difference in runner length. The runners in the Accel Super Ram are significantly shorter than the long-runner combos—stock, TPIS and Edelbrock. The long-runner intakes definitely promote torque production but fall off on the top end. The shorter runners, as in the Super Ram, allowed the engine to produce more peak horsepower but at a cost of low-speed torque. Basically, these different intakes will allow you to create a power curve that will be most effective for your application.

Corrected Torque and Power

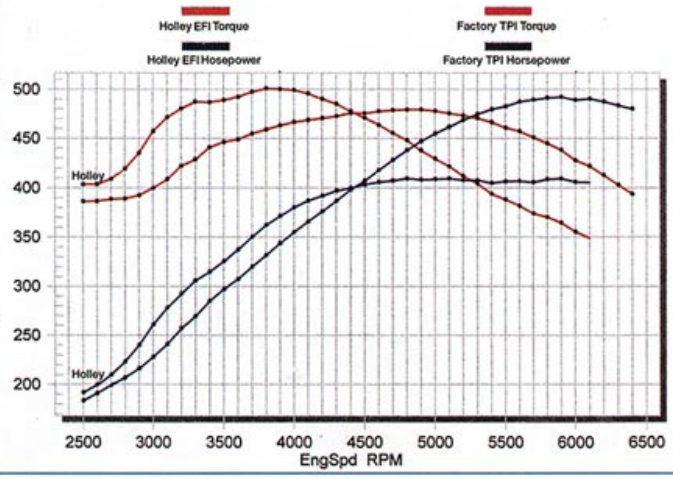


Factory TPI vs. Holley EFI (Converted Single-Plane)

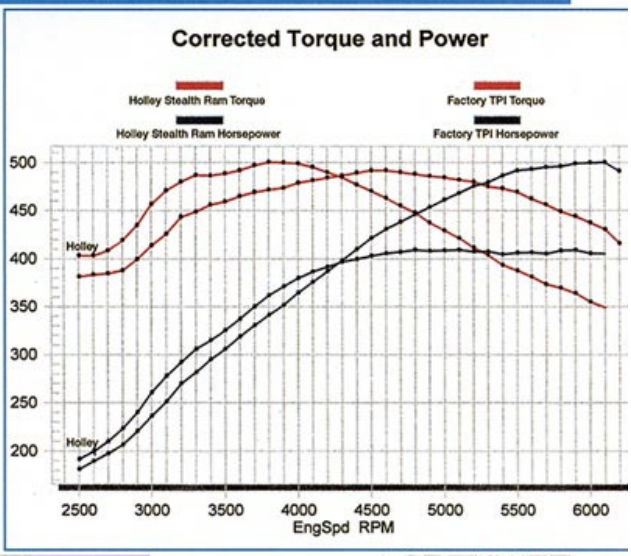


28» We were very curious to see how the Holley single-plane intake fared in this TPI test. The intake was cast for EFI use by including injector bungs, as well as a provision to attach the required fuel rails. 29» In place of the traditional four-barrel carb was a four-hole throttle body capable of flowing 1,000 cfm. 30» The Holley throttle body featured progressive linkage to improve street driveability. 31» On the dyno, the Holley EFI intake showed why so many people choose single-plane intakes for their high-performance carbureted applications, by posting peak numbers of 493 hp and 480 lb-ft of torque.

While not a Tuned Port Injection intake, we decided to include the Holley EFI intake to see how it compared and to illustrate the potential of a traditional carburetor-style manifold design. In place of the usual four-barrel Holley double-pumper carburetor is a four-hole throttle body capable of 1,000 cfm. The throttle body offers progressive linkage, and for that stealth look, it could easily be hidden under one of the many air cleaners designed for a traditional carburetor install. As expected, the shorter runners of the single-plane intake cost low-speed torque compared to the factory (long-runner) TPI system, but the Holley system did make top-end horsepower. The combination of the four-hole throttle body and single-plane intake design allowed the 383 to produce 493 hp and 480 lb-ft of torque. We no longer had the benefit of 500-plus lb-ft of torque, but we were rapidly closing in on the 500hp mark.



Factory TPI vs. Holley Stealth Ram



Choosing a Camshaft for Your TPI Engine

The intake comparison should illustrate that it is important to match the power characteristics of your engine with the intended application, and that the right intake manifold can make a dramatic change in the shape of the curve. Like the intake manifold, the cam profile plays a major part in determining not only peak power output but also the overall shape of the curve. In truth, the cam profile used in our 383 test engine was probably a tad on the wild side for use with most of these TPI systems, especially the long-runner combinations. If we had been building a dedicated combination for the TPSI Big Mouth or Extrude-Hone-ported systems, we would have installed a smaller cam profile than the XR288HR cam used

Comp Cams TPI Recommended Cams

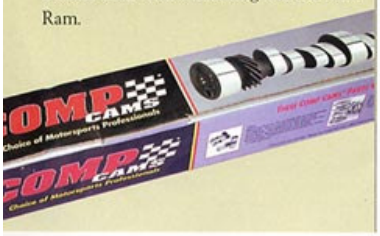
Here's an example of recommended cams from Comp for TPI applications.

XTREME ENERGY™ 1987-1998 305-350 Originally Equipped With Hydraulic Roller Camshaft. EXCEPT LT1 and LT4.												
HYDRAULIC ROLLER-Smallest of the line, good for towing, excellent mileage, smooth idle.	Hyd.	Hyd.	600 to 4600	08-407-8	XR252HR	252	258	200	206	.472	.480	110°
HYDRAULIC ROLLER-Strong torque, good mileage, stock to mildly modified combinations.	Hyd.	Hyd.	1000 to 5000	08-408-8	XR258HR	258	264	206	212	.480	.487	110°
HYDRAULIC ROLLER-Mild performance applications, very good mid-range, 3.23-3.73 gears.	Hyd.	Hyd.	1200 to 5200	08-412-8	XR264HR	264	270	212	218	.487	.495	110°
HYDRAULIC ROLLER-High performance application, largest with stock converter, noticeable idle.	Hyd.	Hyd.	1600 to 5400	08-422-8	XR270HR	270	276	218	224	.495	.502	110°
HYDRAULIC ROLLER-High Performance Street Machines, 2000+ stall, gears, choppy idle.	Hyd.	Hyd.	1900 to 5600	08-423-8	XR276HR	276	282	224	230	.502	.510	110°
HYDRAULIC ROLLER-Great for Street Machines, needs intake, headers, stall, and gears. 2000+ stall.	Hyd.	Hyd.	2200 to 5800	08-432-8	XR282HR	282	288	230	236	.510	.520	110°
HYDRAULIC ROLLER-Street / Strip applications, 9:1 comp, intake, headers, stall, gears. 3000 stall.	Hyd.	Hyd.	2500 to 6000	08-433-8	XR288HR	288	294	236	242	.520	.540	110°

Holley offers this Stealth Ram intake alone or as part of a complete package that includes a complete (Commander 950) programmable fuel-injection system. The Stealth Ram is basically a dual-quad tunnel-ram intake converted for EFI use. The Stealth Ram intake features provisions for the eight injectors and a removable top designed to accept the factory Chevy or aftermarket (in this case Holley 58mm) throttle body. Like the single-plane intake, the Stealth Ram intake traded low-speed torque for top-end power, but the trade-off was greatly reduced thanks to the long runners offered by the tunnel-ram design. Not only did the Stealth Ram allow the 383 to reach the 500hp level, with a peak of 501 hp, but it missed producing 500 lb-ft with a peak reading of 493 lb-ft at 4,600 rpm. Compared to the single-plane Holley intake, the Stealth Ram was better everywhere. Compared to the factory L98 TPI system, the Stealth Ram was up by 90 to 100 hp! That's a serious amount of power for an intake swap.

32» Holley supplied one of its Stealth Ram EFI intakes. Like the single-plane, the Stealth Ram was originally designed for carbureted applications, in this case a dual-quad tunnel-ram. 33» The two-piece design featured a removable lid drilled to accept a stock (or Holley 58mm) throttle body. 34» The lower intake features injector bungs and a dedicated fuel rail complete with adjustable fuel pressure regulator (not used during our dyno session). 35» The tunnel-ram design showed its power value by producing 501 hp and 493 lb-ft of torque. The even and slightly longer runners in the Stealth Ram out-performed the single-plane EFI intake throughout the rpm range. Compared to the factory L98 TPI system, the Stealth Ram lost out in low-speed power production but added 90 hp on the top.

in our 383. Luckily for TPI users, camshaft catalogs are chock-full of available profiles, along with recommendations for usage. With your favorite cam catalog, you will find everything from stock replacement profiles to wild combinations that would be best used with something like the Mini Ram.

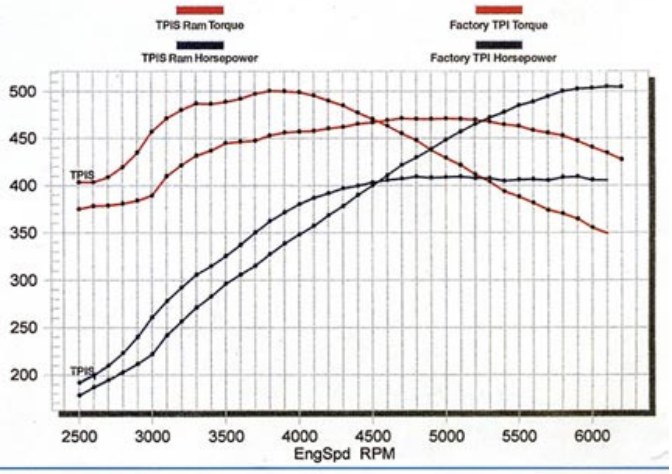


Factory TPI vs. TPIS Mini Ram

36» Looking a great deal like the short-runner factory LT1 intake, the TPIS Mini Ram is actually distinctively different than the factory intake. 37» The Mini Ram featured an oval throttle-body opening that maximized the flow rate into the manifold. 38» Although the oval opening allowed use of the high-flow single (oval)-blade throttle bodies on the Mini Ram, we employed the same dual-blade TPIS 52mm throttle body used on the Big Mouth system. 39» The Mini Ram topped all of the intakes in terms of power production with a peak reading of 505 hp. As expected of the short-runner design, the Mini Ram lost low-speed torque compared to the stock TPI, registering a peak of only 471 lb-ft. As was expected, it was the lowest of the group.

The Mini Ram from TPIS offered the shortest intake runner length of any of the intake systems tested, including the converted Holley single-plane. Not surprisingly, the short runners in the Mini Ram reduced the low-speed torque production compared to the stock L98 TPI system, but the Mini Ram worked well enough upstairs to be crowned the horsepower king—with 505 hp. While a winning margin of 4 hp (over the Stealth Ram) should not be considered a decisive victory, it was a victory nonetheless. The TPIS Mini Ram looked much like the short-runner factory LT1 intakes used by GM, after the demise of the L98 TPI engines, but internally the Mini Ram is different in all respects (plenum volume, runner length and cross section). GM has since returned to the long-runner design on the LS1, but what we'd really like to see is a dual-runner intake that provides all the low-speed power of the TPIS Big Mouth with the top-end charge of something like the Mini Ram.

Corrected Torque and Power



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