

Words Fergus Ogilvy
Photos/Illustrations TorqStorm

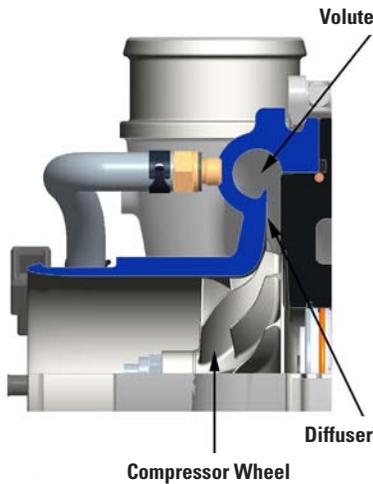
LABORER OF LOVE

**A supercharger with a low-boost fix,
and how it was almost never made**

In their delivery of instantaneous power, superchargers flourish when compared to turbochargers. They suffer no turbo lag. Beyond this, there is now a street-performance centrifugal supercharger that combines this asset with a further dazzlingly effective characteristic.

Commonly, the boost range of traditional centrifugal superchargers is initiated between 3,000 to 5,200 rpm. But Grand Rapids, Michigan, specialists TorqStorm has taken a further leap forward by inducing boosted power at around 1,850 rpm — and it continues to generate it all the way to 6,500 rpm.

This masterwork is accomplished mostly by clever configuration of the compressor wheel. During a short in-



The compressor wheel draws air in and accelerates it through the slender passage of the diffuser. This intensified air collects in the volute, or scroll, where the energy is converted into positive induction pressure and propelled to the engine via a fuel-metering device: EFI throttle body or blow-through carburetor.

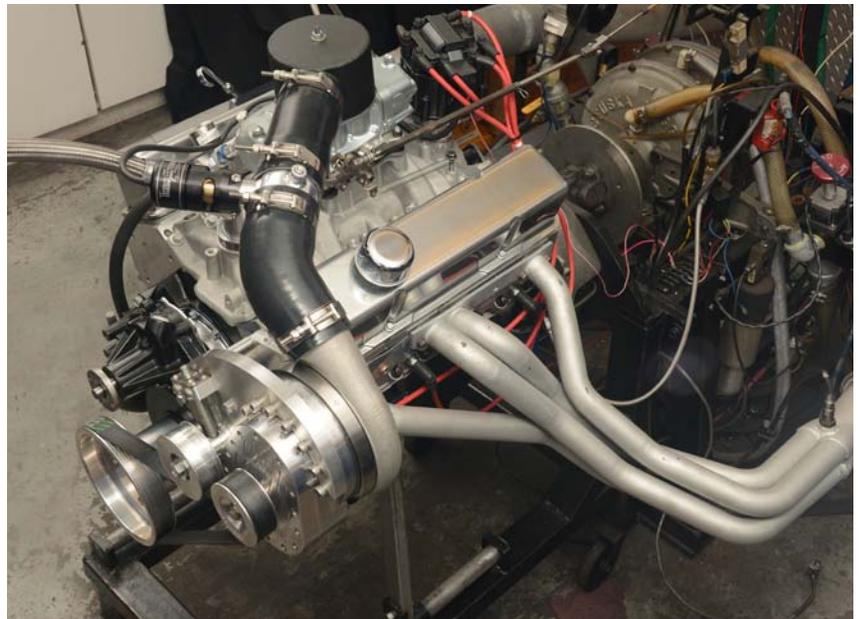
interview with Rick Lewis, who manages TorqStorm's technical sales, he further explains the device and how it almost never saw the light of day.

In the Beginning

An unpretentious, reassuring man, Lewis began by explaining: "We're CNC machinists by trade, and several years ago we were approached by a company interested in having us develop a supercharger to their blueprint. We proceeded, but as the design entered its final stages, the company that had initiated the project abruptly abandoned it.

"Even as the project had been moving along, we all paid close attention as most of us at the shop are confirmed gear heads. But the designs we were following weren't our designs. We began contemplating how good it could be if we applied proven technology already developed. We changed the design of the gears and bearings, reshaped much of its architecture, and introduced a self-contained oiling system."

In the final analysis, TorqStorm had accepted the challenge and entered the supercharger market as a manufacturer. "The design has further qualities to recommend it," says Lewis. "The most conspicuous is its use of a billet gear case, in contrast to the traditional cast case. This significantly reduces bearing deflection and improves sealing. We also introduced a self-contained oil supply, which simplifies the installation; it eliminates oil feed lines."



Superchargers by nature are free of turbo lag — instantaneous power. But this one encompasses a further distinction: low-end grunt. It pulls hard from 1,850 rpm.

Brainstorming the TorqStorm

Given their tool and die background, where everything has to be so precise, they were convinced they had a competent product. The most common criticism of supercharger kits concerns alignment — parts that don't fit well.

"Yes, a fair statement," explains Lewis. "We resolved this in our original designs, by introducing a 3/4-inch-thick billet mounting bracket." Substantial in construction, this bracket is supplied with all TorqStorm kits to eliminate any fitment frustrations. In addition to improving belt alignment, it also halts deflection and ends the risk of belt-throwing.



The compressor wheel is intriguing: an embodiment of mathematical complexity and almost supersonic velocity. Operating at the speed of sound, incidentally, would impede performance and be detrimental to NVH (noise, vibration and harshness) requirements.

A second major cause of annoyance with supercharger kits is often their incompleteness. TorqStorm's solution for overcoming this impediment was novel: they enlisted some of their customers to serve as quality assurance stewards on their R&D programs.

"In fact, without these stalwarts," says Lewis, "the completeness and ease of installation would never have allowed the kits to reach their current standards." This is evidenced by the fact they dispatch Cleveland kits to far-off Australia, confident they are complete, that they'll fit properly, and that they'll match expectations.

In a centrifugal supercharger, the air is propelled through the compressor wheel and compressed in the diffuser — the slender passage formed between the compressor cover and the bearing housing — and in the volute or scroll where its kinetic energy is converted to pressure. The amount of compression is generated by the amount of diffuser gap and the diameter of the volute. As a result, the increased supply of compressed air to the engine burns more air-fuel mixture and produces more power.

Of primary influence is the compressor wheel, which when used in a turbocharger, is powered by exhaust flow. On a supercharger, however, it is driven via a gearbox that takes its power from a crankshaft pulley by way of a drive belt. The gearbox accelerates the compressor wheel from engine speed to a point where the compressor operates

Strange

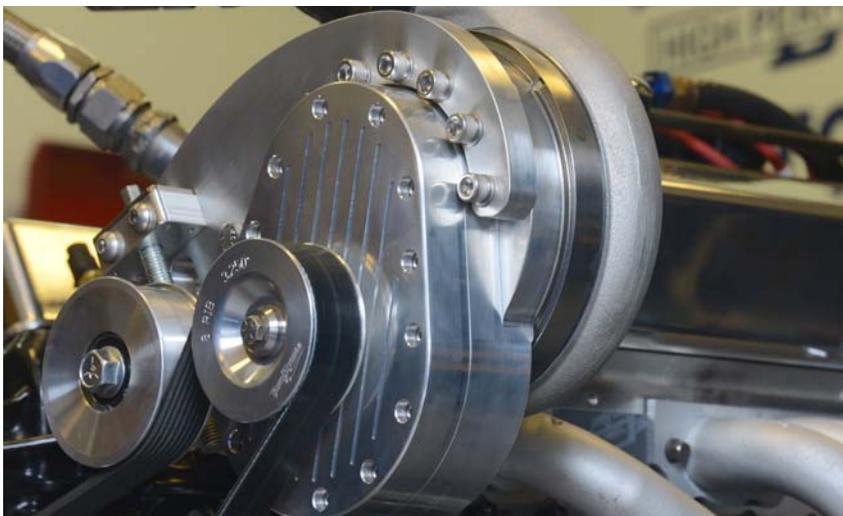
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TorqStorm's background is firmly established in tool-and-die making and performance parts. It resurrects many interesting truths we all once learned, which apply well to their supercharger division. Reliability first: if two ways exist to approach the project — simple and complicated — opt for the former. Produce everything you can in your own shop; it gives you complete control.

efficiently. Typically, maximum efficiency is reached when the compressor wheel spins at 70,000 rpm and beyond.

Interestingly, it is not the compressor wheel's ultimate revolutions on which the engineers focus; instead it is the tip speed of the wheel's outer diameter. Tip speed is calculated in meters-per-second, and it is this velocity that determines the supercharger's efficiency.

To increase further the compressor's efficiency, splitter blades are added to the compressor wheel's traditional eight blades. Shorter than the primary blades to avoid being restrictive, they are placed alternately, extending up the tapered hub toward the inlet.

The boosted air destined for the cylinders is propelled from the supercharger to a carburetor or a fuel injected throttle body via a bonnet and discharge hoses. Positioned in the middle of the hoses is a vacuum-operated pressure release valve, also known as a wastegate. This device releases excessive boost pressure, which in turn prevents overloading the system under sudden deceleration.

Installation

Encouragingly, installation is fairly straightforward and usually can be completed in two or three hours. The process begins by attaching the crank pulley spacer and the accompanying eight-rib, eight-inch diameter supercharger crank pulley to the engine's harmonic damper.

Then the system's robust mounting bracket is fastened to either the left or

right cylinder head, depending upon the design, using three spacers and a backing plate. This step is followed by securing the supercharger to the bracket with seven socket-head bolts.

Sensibly, a V-band clamp allows the supercharger's compressor housing to rotate. This feature is introduced to ease the alignment of the supercharger's discharge port, with the hoses routing to the bonnet or an intercooler.

Adjacent to the 3 1/4-inch supercharger drive pulley, which generates 6 to 8 pounds of boost to most engines, is the tensioner pulley. Manually adjusted, this pulley is lowered onto the eight-rib serpentine belt and adjusted to apply appropriate tension.

Typically, single-supercharger power increases run between 150 and 200 hp at 6 to 9 pounds of boost, and TorqStorm states their units will support 700 hp-plus. Priced modestly at around \$2,800, depending upon finish (natural alloy, black anodized, or micro-polished), and with a self-contained oiling system and limited lifetime warranty, one begins to wonder how this is achieved.

Rick Lewis explains, "We machine everything ourselves in Michigan — including the supercharger gear case, the compressor wheel, brackets, pulleys, tensioner — and it's this tightly controlled policy that contains production costs." If this approach is to your liking, the supercharger will be too. PPN

Source: TorqStorm, torqstorm.com

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