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Get Pumped!

5500 in sixth and still pulling strong

by Tim McKinney

Wife. Whining. Generally two words you don't want in the same paragraph, let alone the same sentence. But for you Audi 3.0 V6 owners out there, get the OK from the former and the latter—courtesy of the Eaton M62 supercharger in PES' new G3 kit, a sound available only at full throttle—borders on the addictive, a sound you'll want to hear as often as possible.

Audi's popular A4 seems to attract three sets of owners: budget conscious buyers just happy to be surrounded by German engineering (often for the first time) and content with the stock 1.8T's modest output; power-crazed lunatic-fringe tuner types seduced by quattro and dreams of 500-hp 1.8Ts (see our masthead); and last, those slightly



older, married with kids, intellectual types (see our masthead) who can read a torque curve and find the dohc, 30-valve, 3-liter six a more appropriate engine for a car in this class. A group including a few, like Steve Hardison, who look longingly at the myriad 1.8T tuning options available and wish for just one or two for the V6.

Hardison had special ordered his 2004 A4 with the Ultrasport package and swapped a set of Eibach springs and Mille Miglia MS wheels for the stock bits but was still looking for that little performance extra, and finding parts hard to come by. "The Ultrasport package is mainly cosmetics. I wish Audi had given me more performance from the 3.0-liter," said the former Navy cook and graduate of the prestigious *Le Cordon Bleu* in Paris. "The V6 is a motor with not much interest from tuners but I felt it was better suited to the vehicle if—it's probably a guy thing—you could get some more performance out of it." But the classically trained chef appreciates the difficulties found in certain recipes. "I've had to find that happy medium [tuning the car]—married



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life, you know." He found it with the PES G3 kit.

"You know what, it's a big deal, The Wife," said PES President Tony Ricci. "You can't believe how many guys say 'I've got to run this by the wife first.' For the most part, guys running around in an A4 or A6 3.0-liter have a wife and kids. They have their fun toy but have to be able to hand the keys to their wife and be sure

she's not going to get stuck on the side of the road. [Unlike some high-horsepower 1.8T kits], we don't take it to the ragged edge of reliability, we actually tune these kits on 87 octane." And unlike a turbo or centrifugal supercharger kit, there is no additional piping to leak or work loose.

PES' new G3 supercharger kit is a direct

descendant of the kit originally developed for Ricci's personal 2.8-liter A4. The compact cast aluminum manifold was designed in house and the G3 kit uses the same Eaton M62 supercharger as the G2. Under development for most of a year, differences include a new idler pulley/bracket, two beautifully machined spacers incorporated to clear one of the 3.0-liter's coolant hoses, throttle body adapter, supercharger pulley and, of course, new GIAC programming.

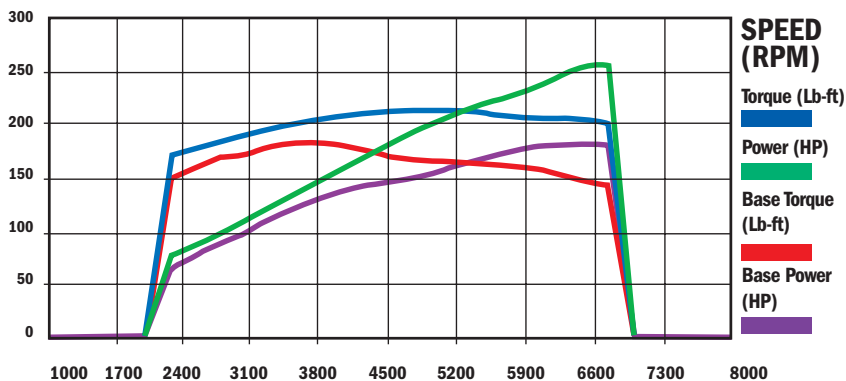
Installation is straightforward, at least for experienced mechanics. PES assembles all the major components before shipping the kit and includes complete instructions. "Unbolt the stock intake manifold, drop in the big turkey and you're done," says Ricci. Though truly bolt-on, the procedure is not quite that simple, figure six hours at PES or budget 12 for a first-time DIY. As a bonus, no stock parts are modified, so save 'em and reverting your car back to original form is simple.

Once you're done wrenching, the fun truly starts. Around town, the supercharged 3.0 is as docile and smooth as stock but feels more alive and ready to run, as even off idle there is a noticeable jump in torque—and potentially 5 psi of boost. Get a little feisty with your right foot and the machine really comes alive, especially above 4000 rpm. The stock torque curve peaks at 3100 rpm and falls off considerably by redline. With nearly as much torque at just 2000 rpm and lovely flat curve to a peak some 31.4 lb-ft higher than stock at 5000 rpm, the PES equipped car pulls hard to redline in every gear we had room to try, maxing out between 8 and 10 psi of boost.

Worried wandering around Annapolis hadn't truly shown the car's full potential, a PES vice-president—nameless to protect the guilty—planted his foot later that evening while cruising up a deserted stretch of Interstate. APBs are probably still out in three states, as the car was still calmly pulling past 5500 rpm in sixth when discretion suggested more than twice the rural interstate speed limit was probably fast enough. The drilled and slotted ATE rotors and Kevlar pads ably bled off the excess speed and we crossed the state line uneventfully a mile later.

And if a healthy dose of torque and nearly 100-hp gain aren't enough, there's that addictive whine, available in any gear. The stock airbox does a yeoman's job of sound control but Hardison added a freer-flowing cone-type filter and the supercharger sings with delight at full throttle. Noiseless at part throttle, there is no mistaking this car means business wide open. Forced induction engines almost always benefit from a freer flowing exhaust, yet the growl from the Supersprint system—good for 8-10 hp—still meets with Mrs. Hardison's approval.

"Steve asked me, 'Are you happy with 320



| Limits/View | Test Information | |
|--------------------|------------------|--------------------------------|
| Min Speed: 1000 | Max Power: | Base: 181.7 hp @ 6500.0 rpm |
| Max Speed: 8000 | | Test: 255.4 hp @ 6750.0 rpm |
| Show Test Graph(s) | | Change: 73.6 hp 250.0 rpm |
| Show Difference | Max Torque: | Base: 182.4 lb-ft @ 3500.0 rpm |
| | | Test: 213.7 lb-ft @ 5000.0 rpm |
| | | Change: 31.4 lb-ft 1500.0 rpm |

***Take a look at this dyno chart.** Notice the nice flat torque curve with little fall off as rpms increase, especially compared to stock. And note the steady rise of horsepower as well. As the stock motor runs out of breath, the supercharger finds its stride. It's area under the curve that's important – an easy way to quickly sum up a dyno graph – and we like what we see here. The extra torque provides great drivability and the nonstop rise in horsepower combined with that fat, flat torque curve means this car will willingly pull through the rev range to redline every time. No short-shifting here.

A note on dyno charts. Results vary not only between manufacturers but even between individual dynos. The only way to really compare apples to apples is to use the same dyno before and after any changes to the car. PES used nearby AWE Tuning's 4WD (another variable) Mustang dyno (known to often read lower than a Dynojet) and the same operator for all testing.

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hp (using a 1.25 correction factor – my math said 1.21 is closer?)” said Ricci. “Well, yeah! You gained 45% over stock yet retained complete reliability. I think that’s enough to ask.” While nothing radical, the

extra ponies totally transform the staid A4, and why Audi couldn’t have just given us 300 bhp to start is beyond me. Of course, then there would have been little need for that other pressure-fed V6 in the S4. ☒

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A QUICK FORCED INDUCTION REVIEW

An engine is really only an air pump. The more air that flows through, the more fuel you can burn and more power can be produced. You can optimize any engine for any given rpm range by playing with intakes and exhausts, cam profiles and overlaps, compression ratios, etc., making power but compromising drivability or vice versa, but eventually you reach a point where the only way to get more power is to flow more air. At that point, either get a bigger engine or turn to forced induction.

Turbochargers use exhaust gases to spin a turbine (to 30-90,000 rpm) connected to a compressor wheel, free energy with a couple of compromises. There is always some lag in power delivery going from part throttle to full throttle as compressor speed is dependent on exhaust flow and the compressor needs to reach its particular critical speed before real boost is produced. Small turbo equals little lag; big turbo equals more power but potentially greater lag. The charge is easily intercooled, but the longer the plumbing run, the more potential for leaks and more time spent waiting for boost as all that volume is pressurized.

A Supercharger’s compressor wheels, on the other hand, are driven by the engine. The biggest compro-

mise? It takes power to make more power. In moderate boost applications, though, a supercharger will have an advantage in volumetric efficiency due to the turbocharger’s turbine slowing the exhaust flow, i.e. adding backpressure. At higher boost pressures with larger turbos, the advantage goes to the turbo’s better compressor efficiency.

Centrifugal superchargers have a compressor similar to a turbo charger but driven by a jackshaft or belt and a step-up drive to 30-60,000 rpm. Like a turbo, they are usually mounted away from the intake manifold and the extra plumbing makes mounting an intercooler relatively simple, but also like a turbo, centrifugal superchargers operate most efficiently over a relatively small range (the low end suffers).

Positive-displacement Roots-type blowers use two intermeshing lobes spun at two or three times the crankshaft speed to displace more air than the engine every two engine revolutions, and bolt directly to the intake manifold. Least efficient of the group, this type of blower nonetheless offers smooth, immediate and proportional boost across the entire rpm range, though efficiencies are best at moderate boost levels. The biggest drawbacks are the size of the unit and the fact that intercoolers need to fit between the blower and the manifold, something not always possible in the underhood space allotted.

The Eaton blower used by PES is an evolution of the Roots blower, built with two counter-rotating, three-lobed helixes with a 60-degree twist and carefully shaped ports to increase adiabatic efficiency to about 60%. (Those slots next to the main port are for noise control.) As an OEM part used by a variety of manufacturers from Saturn to Jaguar, its reliability is well-proven. The Eaton also incorporates an internal bypass valve that effectively lets the supercharger lobes spin in vacuum under light loads, reducing parasitic losses and increasing fuel economy. Put your foot down, the valve opens and boost happens.

