Designing for Performance @ AWE

The car’s turbo boost gauge looks like it came installed from the factory; its styling is a perfect match for the rest of the dash right down to the texture and the color of the illumination. On the other hand, this gauge sits in the center of the grill covering one of the dashboard air vents. Both vent and gauge are fully functional, but it’s definitely not a factory installation.

“There’s just no room for an extra gauge in the existing instrument cluster,” says Chris Dollery, director of engineering at AWE Tuning. “You could put it in a pod mounted on the steering wheel, but then you block the view of other gauges in the dash. In the past, you could mount a gauge on the ‘A’ pillar, until they started putting airbags there. But if you’re going to get the most out of your turbo, you need a boost gauge to help you stay in the meat of the power band, and you want it someplace where it can be seen. The vent just made sense.”

Creative solutions are nothing new at AWE Tuning. The Willow Grove PA company has been developing and distributing performance upgrades for European vehicles since 1991. Initially the company focused on performance tuning Volkswagens. (The original name, Air Water Enterprises, referred to Volkswagen’s two lines of engines: air-cooled and water-cooled.) Today, the company provides performance-enhancing products for Audi and Porsche as well and has dealers throughout North America, in Europe, and Asia.

Want an extra 200 horsepower from your 250 horsepower Audi S4? AWE’s RSK04 bolt-on performance package kit, along with a modified exhaust system, will do the trick. Or, if you’re the do-it-yourself type, you can purchase the entire kit and break it down into components—T304 stainless steel exhaust manifolds, oversize twin K04 turbos, an oversize CNC T6061 aluminum mass air flow meter housing, and replacement fuel pressure regulator, fuel injectors, and spark plugs—and select the individual parts you need to assemble your own, personal road rocket.

The company’s small staff of just 21 handles R&D, design, manufacturing, and distribution. Products offered at their web site range from woven stainless steel brake lines and high-flow air filters to ECU chips and custom tuning to complete performance kits like the one mentioned above. AWE partners with specialized companies like Bilstein for shocks, Borla for exhaust components, GIAC for automotive performance software, and H&R for suspension products. These augment the company’s own line of products designed and, in some cases, manufactured in-house.

“The bottom line is performance,” says Dollery, “but our customers are very picky about fit and appearance. “Take the vent-mounted gauge for example. We offer them for a number of different vehicles. One is modified from the original factory part, one is machined, two of them are injection molded and we’ll soon be adding another injection-molded model. They are a popular product, but we don’t sell them in large enough quantities to justify the cost of traditional in-
jection molding. And prototyping to add new models to the line would have been particularly difficult if it weren’t for the rapid injection molding which we get from Protomold."

“To add a boost gauge for a new car model, we start by bringing the car in and looking at the insides to decide what we can do. We’ll rip out the guts of the vent assembly and use a Microscribe CMM digitizing arm to reverse engineer the vent grill insert. The robotic arm records landmark points on the part to create a 3D image in the computer. We import that model into our CAD system, SolidWorks, modify it to hold the gauge, and send the 3D CAD model to Protomold.”

“Protomold’s online quoting system gets back to us within a day with pricing for injection molded prototypes, but it also gives us moldability feedback on the design we’ve submitted. We’ve got some really good engineers on staff, but our knowledge is spread across everything from electronics to metal; we’re not really plastics experts, so the feedback we get from the ProtoQuote system can be really helpful. The feedback is graphic and straightforward. If we need to change a wall thickness or draft angle, it shows us exactly where and how to make the change.”

“When we first started working with Protomold, we had to make a lot of changes in our designs; now we’ve learned a lot and don’t have to change much at all. Other companies we worked with relied on us to design a perfect part and gave us exactly what we ordered even if it was wrong. In another case, we designed a fairly thin-walled part, and the molder said it would be no problem, but they couldn’t produce the part. With ProtoQuote, the system spots that sort of problem before they accept a final model.”

“The best thing about rapid injection molding is that it is economical both for prototypes and for production. We get the moldability analysis from ProtoQuote before the first prototype is made. The prototypes are quick and affordable and are perfect for detailed functional testing. Protomold’s standard 15-day turnaround on parts is fast enough for all our needs, but it’s good to know that, if we need it, we can get fast turn parts in as few as three days. If our functional tests show a need for changes, we can get new prototypes quickly and inexpensively. For example, we had one Delrin prototype that had a shrinkage problem. Delrin does tend to shrink, so we redesigned the part and solved the problem in the next prototype.”

“Once the prototypes are finalized we can go right into production. Before rapid injection molding our choice were machining parts, which was expensive, or having steel injection molds made, which was extremely expensive before we even had the first part made. Now injection molding is affordable and we can have parts manufactured in small lots as we need them.”

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AWE has had parts molded in a variety of resins. In some cases, these are a blend of ABS and polycarbonate to match the OEM part being replaced. In another instance, a snap-fit part was molded in Delrin for its surface lubricity, which aided insertion. Parts were molded in custom colored resin supplied by Clariant. The vent-mounted gauge has won design awards including a “top gear” award from European Car magazine.

“We plan to keep expanding our product line,” says Dollery. “We’ll use whatever materials and processes work best for the product. But these days, we always look at injection molding first.”