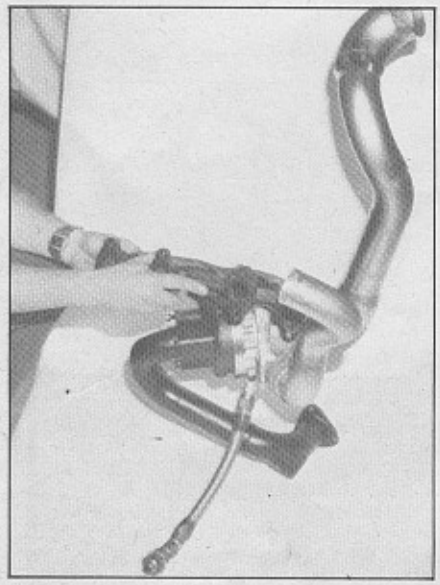
THE TURBO SCIROCCO

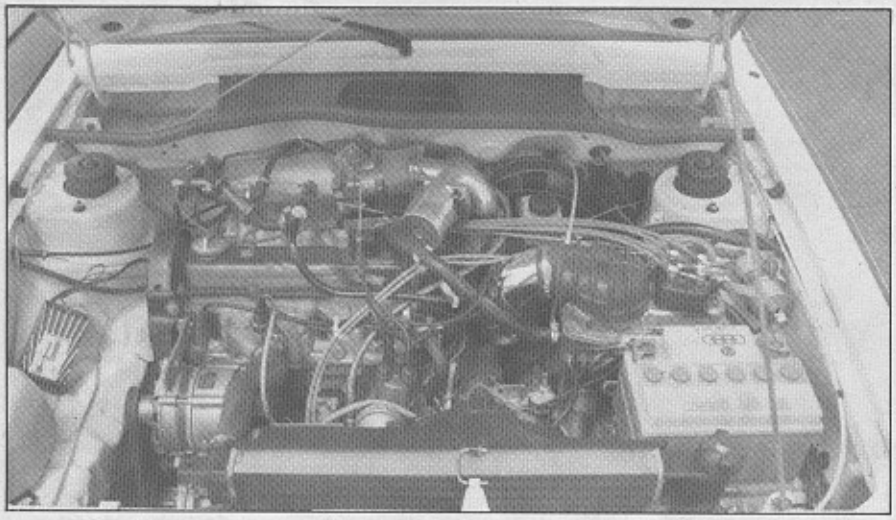


Good things come in small packages. Here Carlson holds the basic components of the Scirocco turbo kit. Braided-steel oil line is typical of kit's quality.

A STAR PERFORMER

Story & photos by Ed Orr

As in the well-known story of the Hollywood star who spent 20 years becoming an "overnight" success, a new star has appeared in the automotive heavens. From coast to coast, everybody from the Detroit ironmongers to the Outback Aftermarket Co. is giving top billing to the suddenly popular turbocharger. After over 70 years of playing one-nighters on the road and appearing in a few well-promoted but short-lived productions such as the Corvair Spyder and the '62 Olds Jet Fire, the turbocharger seems to have perfected its act. From here on it looks like bright lights and packed houses for this "new" performer.

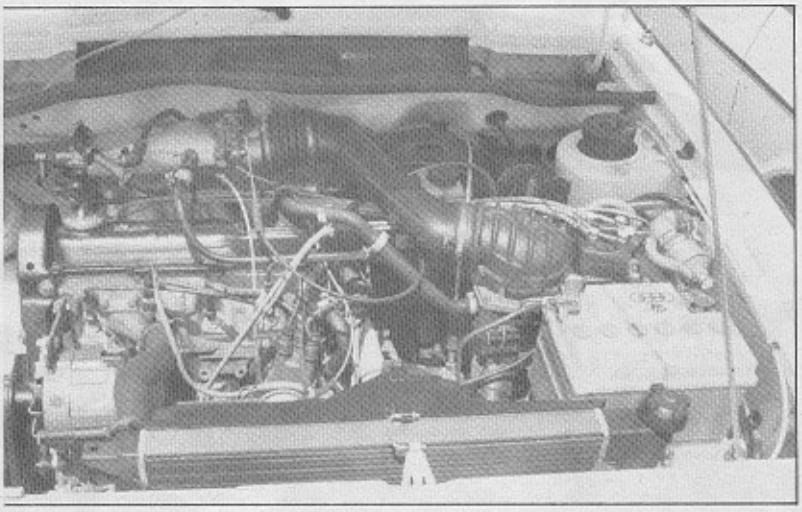


Side by side, the difference in appearance between the stock and turbo-equipped cars is hard to see. Engine slants to rear and covers exhaust manifold. Canister-looking object in center of turbo is BAE's Absolute Pressure Control. Optional CD ignition is Clifford Jacob's CompuSensor.

But why now? Why did it take the automotive public so long to see the advantages of a device that comes as close to providing "free" horsepower as anything can? And is it really as good as the promos claim? Will a turbo really double your horsepower, hold the same mpg and reduce emissions with one quick twist of the wrench?

To find the answers to these and the myriad other questions that pour into our offices every day *Volkswagen Greats* decided to take a look behind the scenes. We talked to turbo engineers, some of whom have been working in the field for over 20 years, and then we got down to the real nitty-gritty by running a head-to-head comparison of two Sciroccos, one stock and the other equipped with a turbocharger from BAE, 3032 Kashiwa St., Dept. VWG, Torrance, CA 90505.

The answer to "why now" is largely a matter of economics. Back in the halcyon days of the horsepower race, muscle cars and 23-cent-a-gallon gasoline, turbos received little attention. Cubic inches were cheaper, more reliable and it didn't take a slide rule to "bore it to the fins and wrap it in piano wire." Emissions weren't even considered, being at the time something nocturnal and generally not discussed in mixed company.



Those who did experiment with turbocharging often met with results that were spectacular, if not successful. The problem was, in part, due to a lack of hardware. Airplanes were using turbos, as were diesel trucks, but there were few units made specifically for automobiles. Adapting a turbo designed for one engine to work on another is a mixture of art and science not found under your average shade tree. It appeared to be in equally short supply in Detroit.

In the early '60s there were two efforts by GM to produce turbocharged cars. Neither enjoyed much success. In fairness to the engineers it should be said that the problem was partially financial, but they should have known that both efforts were doomed from the outset.

Because Chevrolet lacked the potential market to warrant expensive retooling, turbocharged Corvair engines arrived at the dealerships with the same 8.2-to-1 compression found in the stock models. That, combined with the inherently higher operating temperatures of the air-cooled engine, made it all too easy to reach the condition called "point of knock" or detonation. This is bad enough with a normally aspirated engine, but when it happens under boost, the engine's life expectancy is

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reduced to seconds, less if the heat is high enough to generate a backfire that destroys the compressor.

Not to be outdone, Oldsmobile proudly announced its 1962 Jet Fire Sports Coupe featuring an "Ultra-high compression (10 to 1) aluminum V-8." Two years later, the option was quietly dropped.

It took a few years to sort out boost limits too. A turbo is just so damn tempting. With engines whose breathing characteristics allow them to use the extra wind, boost equals horsepower. The higher you set the boost, the faster it goes, right up until the moment when the engine does its impression of a Claymore mine. Anyone who watched Danny Ongais in this year's Indy 500 passing the other cars on the straights by 30 to 40 mph could tell he was twisting the knob off the boost control, and the cloud of smoke that poured from his engine about three quarters of the way through the race should have come as no surprise.

But fortunately for the rest of us, there have been a few diehards through the years who have remained loyal to the turbo and have worked steadily at perfecting designs. And when the handwriting appeared on the wall in the form of early government emission regulations, they knew it was only a matter of time before turbocharging came into its own. Then, in November of 1973, OPEC et al launched their economic Pearl Harbor on the civilized world and the rest of us began to get the message. Performance-minded drivers were going to have to give up their gas-gulping cubic inches and look elsewhere for the extra horses.

No one ever accused the internal combustion engine of being a particularly efficient device. The better portion of the power produced never reaches the rear wheels, and part of this wasted energy pours straight out the tailpipe, both in the form of thermal and kinetic energy. Basically, a turbocharger recycles this wasted power. The additional horsepower realized is "free" only in the sense that you have been paying for it all along without being about to use it. A turbo uses both forms of energy to turn the turbine, which in turn operates the compressor. Thus the charge presented to each cylinder contains more air/fuel mixture than atmospheric pressure alone could supply, and more power out is the result.

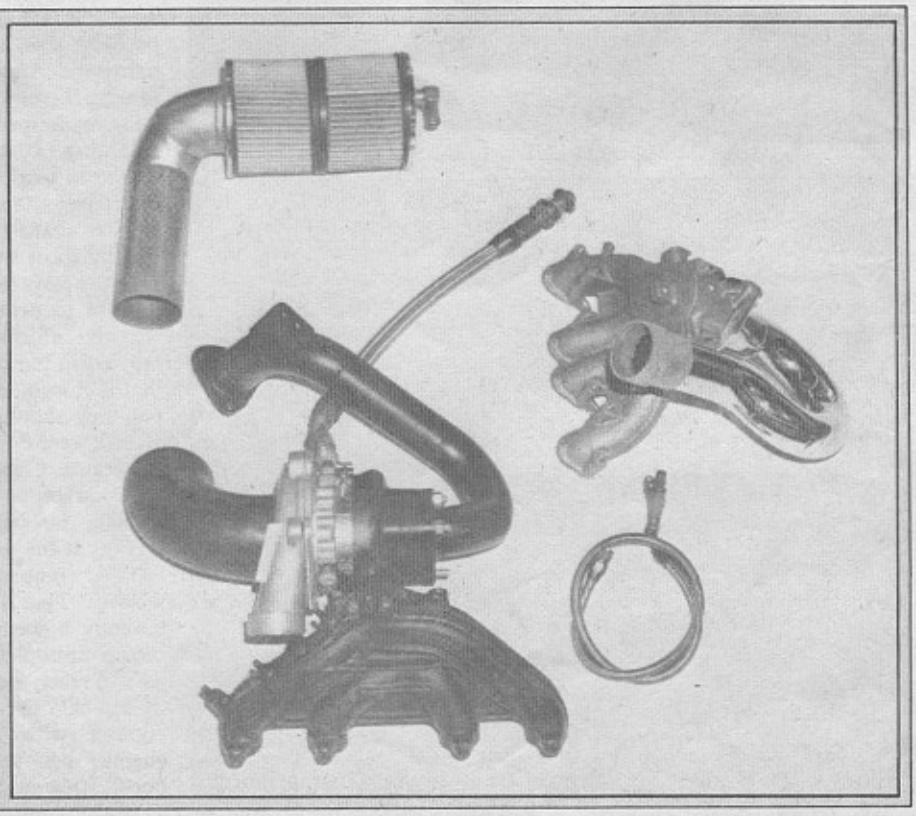
The big advantage of turbocharging over all other means of gaining horsepower, including more cubes, cam and carb combinations and even superchargers, is that it costs next to nothing unless you are using it. A positive-displacement supercharger, such as the 6-71, provides boost starting with the very bottom of the rpm curve and hence must be "fed" whether the extra power is desired or not. Traditional methods of hopping up an engine also increase fuel consumption during normal operations, as well as evoking a number of other problems such as sorting out the various components so that they will function

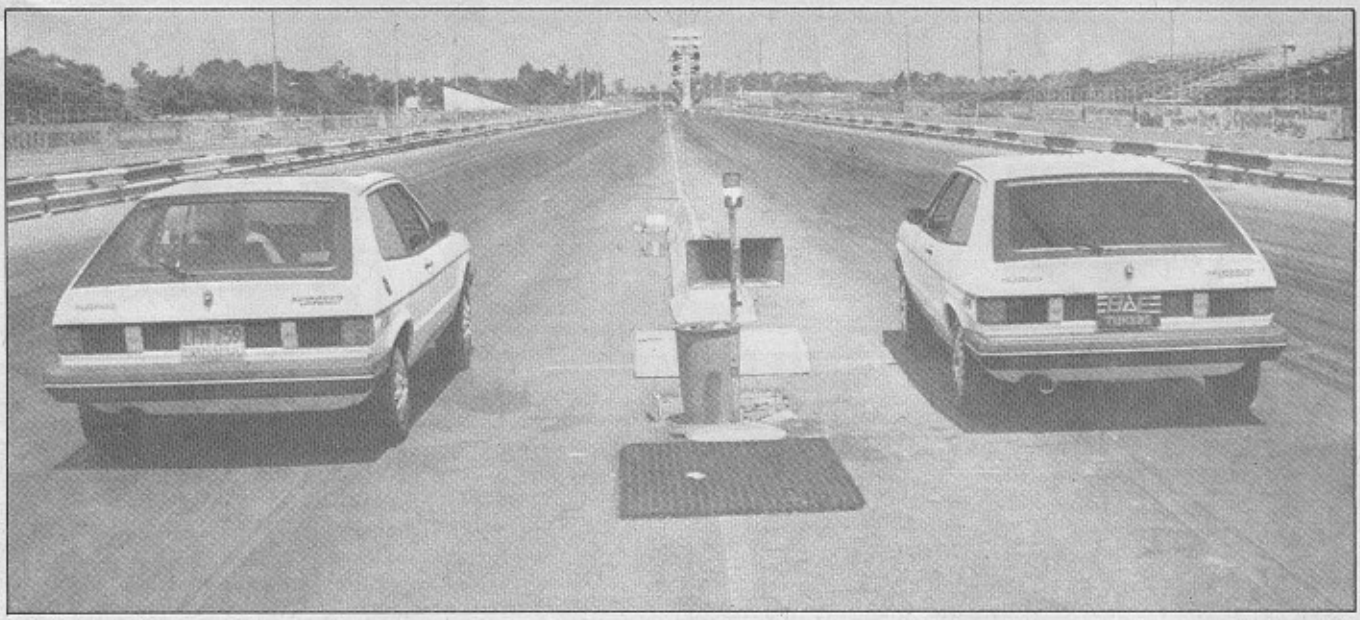
TURBO DIESEL

Volkswagen has announced that a turbo version of its diesel Rabbit will be available in Europe soon, but the company as yet has not announced a date to begin importing it to our side of the ocean. In the meantime, for those of you who can't wait and want more performance from your oil-burning bunny, BAE has a kit made specially for it.

The turbo pumps in seven pounds of boost and should turn a car that is already the peppiest diesel on the road into a real performer. Due to the difference in design between gasoline and diesel engines, the addition of the turbo raises the mpg figure. Drivers of normally aspirated diesel Rabbits are reporting around 45 mpg, but with the turbo in place, that figure is said to go up to 55 mpg.

The kit uses the same type larger exhaust pipe and turbo muffler as the one on the Scirocco and is as easy to install. The Turbo diesel kit costs $1195 for the exhaust and muffler system and is available from BAE.





Head-to-head testing at OCIR proved the turbocharged Scirocco to be a full 2.4 seconds faster in the quarter mile! Note larger exhaust pipe on turboed car on right.

Editor Jay Amestoy and BAE's Ted Carlson inspect the installation prior to the test runs.

with each other.

Turbochargers, however, are designed to come on line in the higher-rpm range, generally around 3000 rpm. This means that, for all intents and purposes, below that figure you have a bone-stock engine. At moderate speeds it is smooth and easy to drive and yields the same mpg and emission figures as a normally aspirated car. The 1978 930 Porsche Turbo is a good example. Cruising around town at low rpm it is perfectly docile. Your grandmother would love it. But once that tach needle reaches 3500 rpm, the thing starts to grow facial hair, and at 5000 rpm the claws come out. By six grand the last vestige of civilization disappears, the sleek little coupe turns into a road-eating monster, and the telephone poles start looking like a picket fence.

While not quite as dramatic, our tests with the two Sciroccos revealed the remarkable difference a little boost can make. With the exception of the turbocharger, the two cars were identical. Both were 1978 Sidewinder II, 49-state Sciroccos, i.e., minus the California-required catalytic converters. Both showed approximately 5000 miles on the odometer and were run through the lights with full gas tanks.

Shifting at the factory-indicated redline of 6300 rpm, the stocker made the first pass with an elapsed time of 18.8 seconds and a top speed of 73.4 mph. The best of three runs produced an 18.5 ET with the top end registering 74.7 mph. Then it was time to try the turbo.

Three runs were made in the turbo car using the same shifting point, but it took only one pass to see the difference. Right off the trailer the turbo version cranked out a 16.4 ET with a top speed of 86.6 mph. Now, in the highly technical terminology of automotive engineering, 2.1 seconds difference in elapsed time is known as a bunch! In professional drag racing, the fastest and slowest cars in an entire class are often separated by no more than .5 seconds.

The best run of the day was made by raising the shift point to 7000 rpm. This pulled the ET down by .2 seconds to a 16.2 and raised the top end to 88.5 mph. This illustrates both the pluses and the minuses of the turbo. At six grand the stock version is beginning to run out of steam. It will continue to wind, but you can tell its heart just isn't in it. The turbo, on the other hand, seems to love to rev, and seven thou feels stronger than five. But be not deceived. Although the engine feels strong, you can't get away with running in the high revs very long unless you have taken steps to make it live. If that's the way you plan to drive, O-ringing the head is highly recommended. Considering the speeds involved, a radar detector and an uncle for a judge wouldn't be bad ideas either.

The kit, as it comes from BAE, has the waste gate set at seven pounds of boost, and that is where it is going to stay since they have deliberately made it impossible to adjust. Frankly, this is so some nerd doesn't crank in ninetyleven pounds of boost, scatter his engine all over the countryside and then want BAE to pay for it. Our test car, however, belonged to a customer who had BAE do the installation and, at his request, his turbo was dialed in for nine pounds. This means that our figures are slightly higher than the seven-pound model would produce, but how much higher is dependent on so many variables that it is almost impossible to say. The most negative estimate claims the difference to be 14 percent, while Bob McClure of BAE calculates that six percent is more like it.

After the question of performance is settled, the next most frequently heard query is, "How long will it live?" This is nearly as easy to answer as "How long is a piece of string?" It depends mainly on three things; basic design of engine be-

Continued on page 97

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ing turbocharged, the amount of boost used, and the weight of your right foot, not necessarily in that order.

It is generally agreed that *most* modern engines are capable of power outputs far in excess of their rated horsepower, but everything has a limit. The seven-pound-boost figure selected by BAE is close to the upper limit recommended if reliability is the primary consideration. Since detonation has already been mentioned as one of the potential problems involved in turbocharging, it should go without saying that any turboed engine should burn only the best premium gasoline available.

Some drivers can get away with more boost, but only if it is used with discretion. Common sense says that an engine putting out 120 horsepower is working harder (and wearing more) than one putting out 60 horses. If you keep your leg in it and stay on the boost most of the time, sooner or later you'll have to pay the piper (or the judge), but this can be said of any high-performance engine. Drivers who save the boost until they need it or use it once in a while for a little added zing should find reliability unimpaired.

The same is true of mileage. That extra power comes from feeding the cylinders more of the fuel/air mixture, not just air alone. Staying up on the boost will cause a noticable drop in the mpg, but once again, normal driving will cure that problem. That is one of the advantages of a turbo. You don't pay for the extra power unless you are using it. A pair of big quads start gulping fuel the minute you hit the key, but your mileage numbers with a turbo can be as good as stock, if you keep the rpm down.

The price of the BAE kit for the new Scirocco is $1195. Add to that another 65 bucks for a two-inch-diameter exhaust pipe and Corvair-type turbo muffler that are needed to keep from building up power-robbing back pressure and you have the package. Installation can be performed in a pro garage in four to six hours, or you can schedule a weekend for the job and do it yourself.

At first glance, the price tag might seem steep, but then again, where can you get that many extra horses for less? This is especially true with the Scirocco because of the paucity of hop-up parts on the market.

After seeing the turbo in action, we want to add our kudos to the rest of the rave reviews. With more and more companies getting into the act by producing turbochargers for an ever-widening field of cars, it is easy to see that this is one star that is in for a long run. ●

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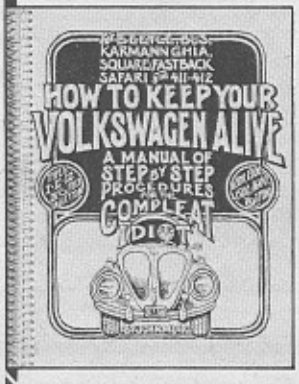

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