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Consumer Orientation
No. 19 in a Series
Subject: Introducing T.O.P.
The first Thermodynamically-Optimized Porsche engine.

19 Porsche 944

From the beginning, Dr. Ferry Porsche has urged his engineers not to accept the commonly accepted. But to go beyond. To explore the possibilities of what could be, rather than accept what already was.

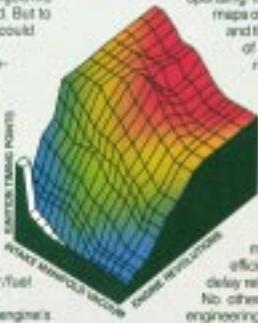
One result: the new T.O.P. (Thermodynamically-Optimized Porsche) engine.

Historically, gasoline-fueled, spark-ignition engines have been bred for the highest possible output per liter. As a result, they generally have had to be operated throughout their entire working range—from idle to maximum load—with rich air/fuel mixtures.

An objective of the new T.O.P. engine was to improve efficiency and lower exhaust emissions in the partial load realm—where an engine normally operates—without loss of maximum performance. To accomplish this, Porsche engineers laid out the optimum air/fuel mixtures along the engine's entire working range.

In addition, Porsche engineers divided the T.O.P. engine's operating range into 256 parts and developed separate maps of the optimum ignition timing points (shown left) and the optimum fuel injection volumes as a function of intake manifold vacuum (load) and engine revolutions (speed). Both maps have been programmed into a computer in the 944 which reads engine temperature, engine speed, crank position, throttle position, intake air temperature, intake air flow, and exhaust-gas oxygen content—then makes instantaneous calculations, and provides optimum values for both the electronic ignition timing and fuel injection quantity.

Porsche engineers also included an automatic fuel shut-off system to provide further efficiency when the throttle valve is closed. (A time-delay relay prevents fuel shut-off during gear-shifting.) No other engine has this combination of advanced engineering features. At Porsche, excellence is expected.



An engine's efficiency is also largely determined by its compression ratio and combustion-chamber design.

The T.O.P. engine's compression ratio is a high 9.5:1 to optimize performance. Its combustion-chamber design (shown left) is extremely compact and has dual quench zones to optimize the velocity swirl of the air/fuel mixture.

And the spark plug in each chamber is center-positioned to optimize combustion efficiency.

On the track, the 944 accelerates from 0 to 50 mph in 5.9 seconds. And it reaches the 1/4-mile mark from a standing start in only 16.2 seconds at 84 mph. Its top speed: 130 mph.

Test drive the 944. For your nearest dealer, call toll-free: (800) 447-4700. In Illinois, (800) 322-4400.

PORSCHE - AUDI
NOTHING EVEN COMES CLOSE

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A slightly later US advert describing the technology behind Porsche's new engine. Again, note the different bumper and side marker (fortunately, far prettier than those found on the 924s), and the standard foglamps. European cars could also be ordered with foglights, which were fitted in a modified front apron produced purely for that purpose.

of this engine; the curve is almost flat from 3000rpm to 5500rpm, peaking as early as 3000rpm when it reaches 151lbft and never falling below 138lbft between 2500 and the 6400rpm red-line."

By July 1982, due to the popularity of the 944, production of the 924 Turbo had officially ceased, although some were still being built for the Italian market, where the exorbitant tax on vehicles with engines over two litres (it rose from 18% to 35%) made it a viable proposition, until the end of 1983.

Despite a late introduction, it was the 944 that was Porsche's top seller Stateside in 1982. Accounting for 5125 (or 37%) of the 13,748 sales made that year in America (not including tourist deliveries), the 944 also helped push up the annual total, as it had been only 11,241 units in 1981. Total Porsche production for 1982 was 31,734 vehicles, incidentally.

was easier to get the most from the new model, and they were neck and neck throughout all of the performance tests (the 2.5 litre machine clocking a 0-60 time of 7.74 seconds, incidentally). The only area in which there was a significant difference was braking, where the fatter tyres on the 944 gave it an advantage of around 7% over its turbocharged cousin. All told, the results were very admirable.

Even Paul Frere, a staunch supporter of the 911, was impressed. In the April 1982 issue of *Road & Track*, he noted: "The car is a lot quicker than advertised. The engine is beautifully smooth, silent and torquey; and the gearchange and the steering are better than the 911's - the steering mainly because it suffers from much less kickback. Porsche can certainly be proud of the torque characteristics

Another picture of the French 944 on its tour of Europe. Note the standard wheels.



Below: American advertising from the period, this particular piece featuring a cutaway drawing of the 944's four-cylinder engine.

standard. At the same time, cruise control and an electric sunroof were added to the options list (the roof panel could still be removed and stowed in the boot, incidentally).

A standard 944 had won the Longest Day of Nelson Ledges (an important 24-hour Showroom Stock event held annually at the Ohio race track) in 1982, but in 1984, the flag fell before a prototype 944 Turbo. Driven by Porsche veteran Jim Busby, Rick Knoop and Freddy Baker, it finished 42 laps ahead of the rest of the field, and gave the public a good idea of what



was to come in the near future; the more freely-available, normally-aspirated 944, filled the second, fourth and fifth slots. Ironically, shortly after, an article appeared in *Road & Track*, gathering together eight of the best vehicles eligible for the SCCA Showroom Stock GT category - the Chevrolet

Camaro Z28 and Corvette, the Dodge Daytona Turbo Z, Ford Mustang GT, Mazda's RX-7 GSL-SE, the Nissan 300ZX Turbo, Pontiac Firebird TransAm, and the 944. Prices ranged from around \$10,000 to \$23,360 (for the 'Vette), with the Porsche listed at \$21,440.

Conducted at the Willow Springs race track, the 944 seemed to be in the



An atmospheric shot from the mid-1980s.

announced for the 944 to distance it further from the much cheaper entry-level 924. One of the most noticeable differences was the new dashboard. The main instrument binnacle was

A 1985 944 with 15-inch Fuchs alloys and locking wheel nuts. That year, there was a new 16-inch forged alloy wheel option consisting of 7J rims with 205/55 VR-rated tyres up front, and 8J x 16s with 225/50 VR16s at the back, while those customers who opted for painted centres on the forged alloys could now choose between Grand Prix White or Gold Metallic, the latter shade superseding Pewter Metallic. This picture shows the traditional - and vastly more popular - matt black centre.

extended in an oval shape to house the two central air vents (as before, another smaller vent was situated at each end of the fascia), and some of the switches and controls were moved from the

centre console to a largely flat panel between the top roll and lower dash trim, the latter providing the latest location for the lockable glovebox. As a consequence, the fusebox and relays



What it takes to turbocharge a Porsche, including the turbocharger.

The theory that a whole is greater than the sum of its parts did not originate with Professor Porsche.

But he, for one, wholeheartedly subscribes to it.

Because if he's learned anything in four decades of building cars, it's that a change in one component can profoundly affect

the performance of the others. And ultimately, the performance of the whole car.

Nowhere is this truth more evident than in the area of turbocharging.

Porsche pioneered this technology for production cars back in 1975. And realized right from the start that simply bolting on a turbocharger, tweaking the

engine a little and re-naming the car was the wrong way to go about it.

The right way is revealed below.

Every component shown here was deemed necessary to transform a normally aspirated 944 into a turbocharged 944.

Major engine components, more than 30 in all, to compensate for increased internal loads and heat.

Chassis components, from shock absorbers and brakes to wheels and tires, to meet higher performance demands.

Front and rear body components, to improve wind resistance at higher speeds, while controlling lift and drag.

To say nothing of the turbocharger itself which, among other innovative bits of technology, includes two water cooling systems to protect turbine bearings, even after the engine is turned off.

Of course, if we hadn't gone to such lengths with the 944, we could still have built a turbo.

We just couldn't have built a Porsche.



This superb advert from America shows all the major components used in converting the normally-aspirated 944 to a 944 Turbo. Although developed for the turbocharged model, a number of these parts, such as the cast aluminium alloy suspension pieces, were carried over onto the standard car.

installation in the 944 went a lot further than the typical bolt-on kit.

Although the basic construction and layout of the engine remained unchanged, in their quest for more power, Paul Hensler and his team of engineers added a KKK K26 turbocharger and specified new forged aluminium alloy pistons with recessed crowns, hollow-stemmed, sodium-filled exhaust valves, special ceramic liners in the exhaust ports, a beautifully-sculptured inlet manifold (to give equal length tracts to each cylinder), a different camshaft profile, a new oil pump, a separate oil cooler (to replace

the oil-to-water heat exchanger found on normally-aspirated cars), and an air-to-air intercooler.

Unusually, the exhaust-driven turbocharger was positioned on the induction side of the powerplant. Although this complicated the unit's plumbing, it ultimately led to a number of advantages over traditional installations: there was a shorter distance between the turbo and intake manifold, meaning a significant reduction in turbo lag, and because of the long crossover pipe needed to join the exhaust on the opposite side of the engine, the air was much cooler by the

time it entered the turbocharger. Interestingly, the entire exhaust system was constructed in heat-resistant steel tube, even the manifold, which was usually a much heavier cast-iron item. A further advantage was a better environment for the turbocharger. Turbos run hot anyway, but being mounted away from the heat of the exhaust helped keep it as cool as possible, thus improving long-term reliability. To further prolong the life of the turbocharger, it was given a separate thermostatically-controlled cooling system to dissipate heat from the vulnerable turbine bearings, even