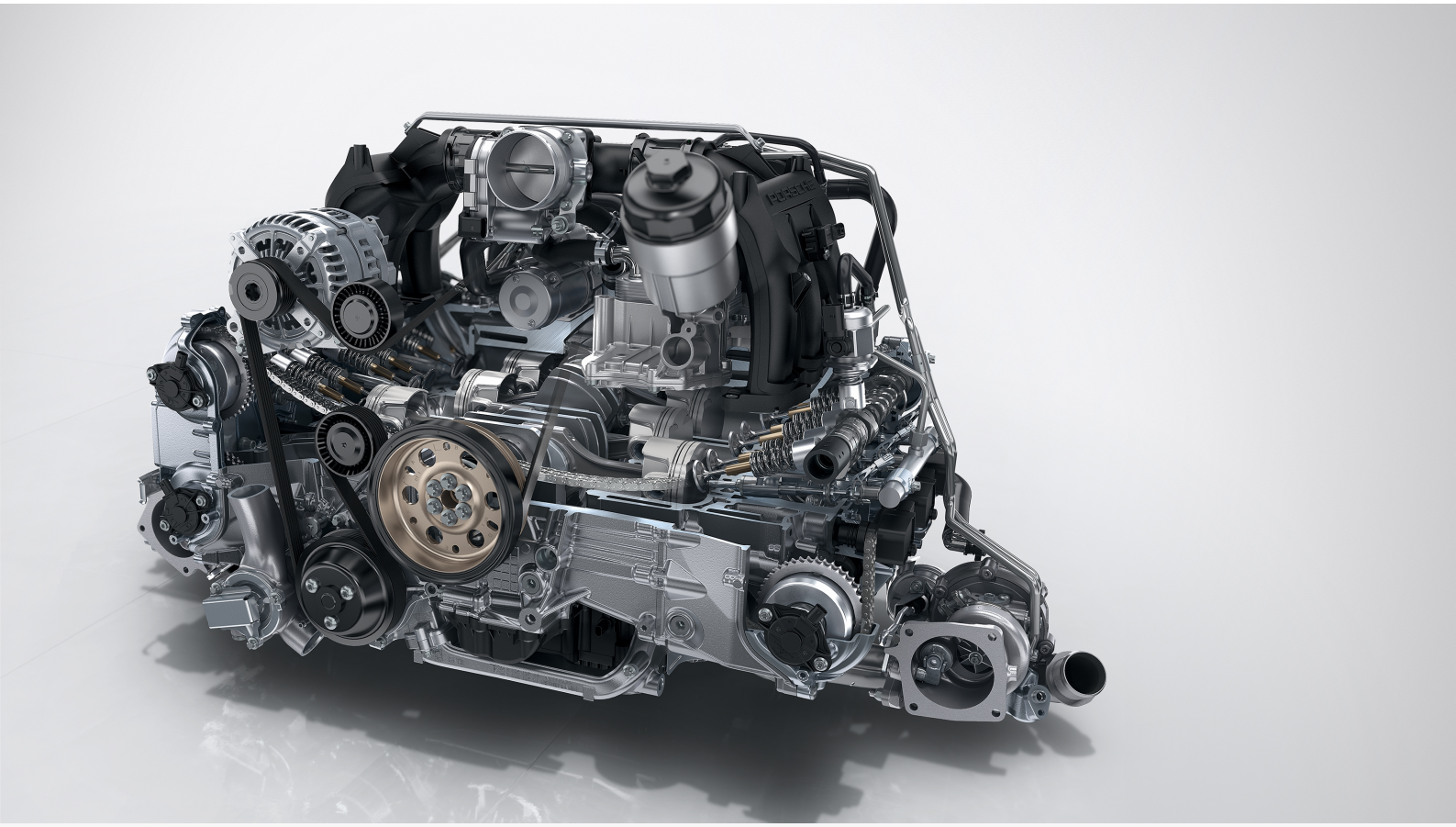


Porsche 911: In Top Form

This article reflects the status at the time of its publication. The content may since have become outdated.

10/11/2015 More power, more torque, more efficiency: The new turbocharged engines in the 911 Carrera leave a lasting impression.

The end of one game is the beginning of the next. The 911 development team has taken this old German saying from the world of sports to heart. Immediately after the current generation of the Porsche 911 had been unveiled to the public in 2011, they withdrew to the Weissach Research and Development Center to begin working on the next stage of the 911 driving experience. Their motto is clear: “You only stay ahead of the pack if you never stop striving.” Elite athletes define themselves by impressive numbers.

Take the 911 Carrera, equipped with the optional Porsche double-clutch transmission (PDK). Compared to its predecessor, it sprints from zero to 200 km/h nearly a second faster, taking just 14.8 seconds (911 Carrera: Combined fuel consumption: 8.3-7.4 l/100 km; CO_2 emissions 190-169 g/km). Another factor—one of the major goals of the program—is its consumption of just 7.4 liters of fuel per

100 km according to the New European Driving Cycle, compared to 8.2 liters previously. With a maximum output of 309 kW (420 hp, 911 Carrera S: Combined fuel consumption: 8.7-7.7 l/100 km; CO_2 emissions 199-174 g/km), the 911 Carrera S needs just 13.2 seconds to go from zero to 200 km/h, but is content with just 7.7 liters of fuel over 100 km—exactly one liter less than before.

More striking than Table Mountain in Cape Town

Even more important than acceleration from standstill is mid-range acceleration—and here the new manual Carrera is staggeringly impressive: in fifth gear it goes from 80 to 120 km/h in 5.5 seconds. “How are these significant performance and efficiency gains achieved?” To answer the question, Thomas Krickelberg picks up a piece of paper that explains it all. He's in charge of project management for the 911 power trains. The sheet shows the torque curve of the new three-liter boxer engine generation being used in the 911 Carrera and Carrera S for the first time. The torque curve is a silhouette more striking than Table Mountain in Cape Town, showing a completely flat plateau between 1,700 and 5,000 rpm.

The technically minded are well aware: this is only possible with a turbocharged engine. Naturally aspirated engines require high rpms to develop their maximum power and torque. While Porsche was a turbocharging pioneer with the 911 Turbo, the Carrera, to date, has been powered by naturally aspirated engines that were characterized by great responsiveness and that didn't shy away from high engine speeds. “We've done absolutely everything to ensure that the Carrera with the new turbo engines still drives like a sports car with a naturally aspirated engine,” Krickelberg promises.

High torque at low engine speeds

Achieving that goal was a major priority for the engineers. The objective: minimizing turbo lag. A whole series of measures was implemented to make it happen. For instance, Porsche uses two smaller turbochargers instead of a single, larger unit—one for each cylinder block. Smaller turbochargers have lower inertia and reach their operating engine speed more quickly. What's more, the exhaust flow through the turbines in the new 911 is regulated by a highly responsive electro-pneumatic wastegate valve. Oh, and the engine control is clairvoyant.

“We have a sportiness detector on board,” explains Krickelberg. “If the car is being driven vigorously, the onboard electronics detect that.” In this case—or when a sportier driving mode has been selected in advance—a particular exhaust flow is continuously directed to the turbines to keep them moving. Keeping them at the ready, so to speak. Another focus was to achieve high torque at low engine speeds. Thanks to the expansion of the VarioCam Plus system, the opening and closing time of both intake and exhaust valves are freely selectable within a wide range. Previously, only the timing and lift for the intake valves could be varied.

Up to 250 bar

For the overall performance of a turbo engine, cooling the charge air is crucial: when compressed, the intake air temperature rises, which results in unfavorable air expansion, reducing the number of oxygen molecules that are required for combustion to reach the combustion chamber. On account of ambient air, performance would suffer without additional cooling. The challenge was to get the requisite cooling air to the charge-air coolers without significantly widening the rear end of the car. An extensive redesign—albeit a barely noticeable one from the outside—was the result.

As much as the turbocharging garners the attention, it is just one aspect of the new boxer engine generation. After all, when it comes to what's new with these powertrains, the answer is practically everything. Take the direct fuel injection. For the first time, the fuel injectors are positioned centrally, that is, the injector is located directly between the four intake and exhaust valves. It propels the fuel into the cylinder at up to 250 bar, atomized into minuscule drops. This helps to distribute the fuel evenly in the combustion chamber, with smaller deposits on the walls, enabling better and cleaner combustion. The 911 Carrera already fulfills the Euro 6 emission standards.

Reducing unsprung mass

In the mechanical part of the new engines, the objective was the lowest-possible weight and friction. The new crankcase unites both characteristics. The previous crankcase, made of a material with higher silicon content, was replaced with a low-alloy aluminum cast material. Thanks to the use of an innovative coating system, it is possible to do without heavy gray cast iron sleeves. Iron particles are applied to the mechanically roughened guide surfaces. The resulting surface is not only robust and resistant to fluctuating fuel qualities, but is also very low-friction.

The entire cylinder crankcase weighs 1.5 kilograms less than before. Another 2 kilos are saved through the use of a composite oil pan and the omission of a secondary air system for emission control. Lightweight construction is especially effective in reducing unsprung mass, for example at the wheels. The new 20-inch wheels don't just look sleek and sprightly, but are also especially light thanks to a production process known as flow-forming. The process allows wall thicknesses that can otherwise only be achieved through forging processes—saving several hundred grams per wheel.

On the rear axle, the wheels are half an inch wider—not least to put the imposing torque on the road safely. The rear wheels in the standard version are wider at 295/35 than was previously the case (285/35). More muscular in appearance, agility has made gains as well, in particular when one adds the optional rear-axle steering. Opposite-direction steering simplifies parking by reducing the turning circle by up to 50 centimeters. At speeds over 80 km/h, the rear wheels steer in the same direction as the front wheels. The effect stabilizes the vehicle in fast corners or during rapid lane changes. Once again, one might conclude that we are witnessing the best 911 ...

Link Collection

Link to this article
https://newsroom.porsche.com/en/christophorus/porsche-carrera-911s-technique-turbo-engine-11471.html

Media Package
https://pmdb.porsche.de/newsroomzips/fddce175-b886-4390-8757-92607a6667cd.zip

External Links
http://www.porsche.com/uk/aboutporsche/christophorusmagazine/

Dr. Ing. h.c. F. Porsche Aktiengesellschaft
Porscheplatz 1
70435 Stuttgart