PRECISE AND FLEXIBLE

The new aeroacoustic wind tunnel at the Weissach Development Center

____ The new aeroacoustic wind tunnel at the Development Center in Weissach went into operation in early 2015. Together with the electronics integration center and the design studio with concept design, the three buildings set a new standard for forward-looking vehicle development "engineered and designed in Weissach." The core objectives of the new wind tunnel are to promote energy-efficient aerodynamics, even greater driving safety and greater comfort in future vehicle generations.

It was already possible to conduct highly precise aerodynamics measurements in the wind tunnel used as yet in Weissach. The new aeroacoustic wind tunnel that went into operation in early 2015 enables even more realistic testing capabilities. The most important reason for this: While the prototypes in the old wind tunnel remained in a fixed position, now they "drive" on a belt system located beneath the vehicle being tested. It simulates the relative motion of the car in relation to the road at speeds of up to 300 km/h. This makes it possible to test the air flow under the vehicle during real driving with even greater precision. But precisely here, in the area around the car's underbody and wheelhouses, is where there is considerable potential to increase efficiency and stability by enhancing the aerodynamics.

Combined belt systems

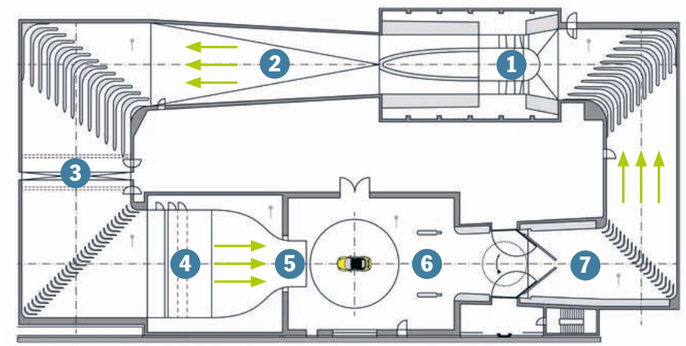
The heart of the new wind tunnel is its belt system and scale. A special feature of the Weissach tunnel is that it offers test engineers a choice between two different belt systems. One system has five steel belts: one runs below each of the four wheels and a larger one down the middle below the vehicle floor, enabling even more precise measurements. The other is the one-belt system, which, as its name suggests, consists of a single steel belt that runs below the test object. It reflects real conditions more closely, which has great advantages in many testing scenarios, but yields measurements that are somewhat less precise. Porsche followed the motto "Take two!" in its decision to incorporate both measurement systems in one facility. With the use of an industrial freight crane, it takes just a few hours to switch the systems, which weigh more than 20 tons.

Another crucial benefit of the belt systems is that they allow the engineers to measure the forces that the wind exerts on the car. Linked with a precision scale that stands on its own foundation, the belt system can measure minimal changes in the wind forces on the car or their distribution among the wheels. This measurement in turn enables the engineers to calculate the drag and the up- or downforces on the front and rear axles. ›

911 TURBO CABRIOLET
Fuel consumption
city: 13.4 l/100 km
highway: 7.8 l/100 km
combined: 9.9 l/100 km
CO_2 emissions (combined): 231 g/km
Efficiency class: G

A 911 Turbo Cabriolet in the plenary on a five-belt system.

Acoustic measurements are carried out with the aid of several microphones.



Structure of the new aeroacoustic wind tunnel

1 Fan 2 Main diffuser 3 Heat exchanger 4 Antechamber 5 Jet 6 Plenary 7 Diffuser

Closed air circuit

The wind tunnel has what is known as a Göttingen design (see above). A powerful turbine generates an air flow in a closed circuit, which means that less energy is required. A jet upstream from the actual test section accelerates the wind by a factor of six, and a diffuser downstream of the test section decelerates it again. A powerful heat exchanger removes the heat generated by air friction. The wind is generated by a huge fan with carbon vanes and a diameter of about eight meters. It has a peak output of around seven megawatts, or 9,300 horsepower, generated by an electric motor the size of a small bus. Many of the measurements, such as those to determine drag, continue to be done at the usual European speed on freeways of 140 km/h. However, it is important to be able to generate considerably higher wind speeds, in order to test the structural strength, for example, or to contribute to developments in racing.

Acoustic measurement detective work

The wind tunnel is not terribly loud, however, and at 200 km/h is far quieter than its predecessor. Consequently, certain acoustic measurements can now be done in Weissach which used to be sent to external service providers. Of interest here is not so much the absolute noise level, but some detailed detective work. For example, how does a certain mirror shape or a new door seal affect the sound pattern? Several hundred microphones are set up on the car in the test section, allowing a computer to generate a three-dimensional representation of the sound propagation from the car. ■