113 Degrees in 0.4 Seconds

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Never before in automobile history has an attempt been made to adapt a sports car, which is as easy as it is safe to handle at such a wide range of speeds, for use on public roads. The team around Bugatti's Head of Development, Dr. Wolfgang Schreiber, is faced with the enormous challenge of finding the balance between three essential aerodynamic requirements profiles. On the one hand, the body should have the lowest possible wind resistance to permit extreme acceleration at speeds in excess of 200 kph and reach the top speed of over 400 kph. On the other hand, the down forces on the front and rear axles must be perfected to such an extent that the fastest sports car in the world literally hugs the road at all speeds. And last but not least, it is expected that all of the high-performance systems packed extremely tightly into the aluminium body for cooling at all speeds have the optimum air flow. Dr. Schreiber: "The aerodynamic management of the Veyron is a fascinating high-tech solution which is beyond rival in contemporary automobile construction".

The heart piece of the regulatory installations is a computer-controlled hydraulic system which regulates the ground clearance of the 4-wheel drive Bugatti Veyron over every road surface, whereby three speed-dependent levels are planned. A diffuser flap has been installed in both sides of the underbody to increase the descending force at the front. Both of these flaps open and close with the help of two hydraulic cylinders. The down force at the back is regulated by diffusers in the underbody and a rear aerofoil.

When driving in normal conditions in city traffic, on major highways and on motorways, the road clearance at the front and rear axles are 125 millimetres. When doing so, the diffuser flaps are open and the rear aerofoil and spoiler remain retracted flush with the bodywork. There is one exception to this: if the exhaust temperature of the middle engine exceeds a critical value, the aerofoil above it opens up a slit. This "cool-down" position

kicks in automatically. The normal driving level remains unchanged up to a speed of 220 kph.

At speeds of more than 220 kph, the Bugatti chassis is lowered automatically to a ground clearance of 80 millimetres at the front and 95 at the back. The diffuser flaps remain open and the rear aerofoil and spoiler are raised automatically. A higher down force is built up at the front and rear of the vehicle in this so-called "Handling" setting. Dr. Schreiber: "Our goal is to maintain the ideal axle load distribution for the Bugatti Veyron of 45 : 55 percent (front/rear), even at high speeds." To be more precise, this means speeds of up to 375 kph, when this super sports car is pressed onto the asphalt with a down force of around 350 kilos. Once the speed drops below 140 kph, the stabilizer system returns to the neutral position.

The driver is at liberty to drive with increased down force at speeds below 220 kph if so desired. The Handling setting can be selected at any time via a switch in the middle console. Only when the switch is pressed a second time does the system revert to automatic control.

The driver reaches the decision to take the Bugatti Veyron beyond 375 kph after making a thorough check of the safety situation. Access authorization for the top speed of over 400 kph is given via a second key to be entered into a cylinder at the left of the driver's seat. The words "Top Speed" then appear in the cockpit display. For safety reasons, a checklist must then be run through, which includes such things as a tyre pressure check. In the "Top Speed" setting, the chassis squats a mere 65 millimetres above the asphalt at the front and 70 at the back. The diffuser flaps remain closed and the angle of incidence of the rear aerofoil is minimized. In this way, the down forces tend towards zero to reduce the wind resistance of the Bugatti.

Outstanding vehicle movement dynamics and high deceleration values are inseparable, as far as the Bugatti engineers are concerned, and for this reason, the Bugatti Veyron is fitted with a carbon-ceramic high-performance braking system which is unique in automotive construction. It is supported by the aerodynamic braking function of the rear aerofoil - the so-called "airbrake" - which makes use of the high wind resistance at speeds of over 200 kph. It is activated by the brake pedal in the "Handling" configuration only, at speeds between 200 and 375 kph, when a defined brake pedal pressure is exceeded. The rear aerofoil shifts itself to an angle of 113 degrees to the direction of travel in only 0.4 seconds here, thereby increasing the vehicle's wind resistance. In addition to this, the down force mounts to around 300 kilos above the rear alone, thereby strengthening the braking torque at the back wheels. This reduces the wheel load displacement in the direction of the front of the car, which occurs when there is severe deceleration.

The complexity of the Bugatti Veyron's aerodynamic management system is one of the greatest challenges facing the development team. The infallibility of this system is given top priority by Bugatti President, Dr. Thomas Bscher: "Customers must be able to rely on Bugatti technology when they drive the most fascinating car in the world into border line driving dynamic regions which are beyond anything experienced anywhere to date".