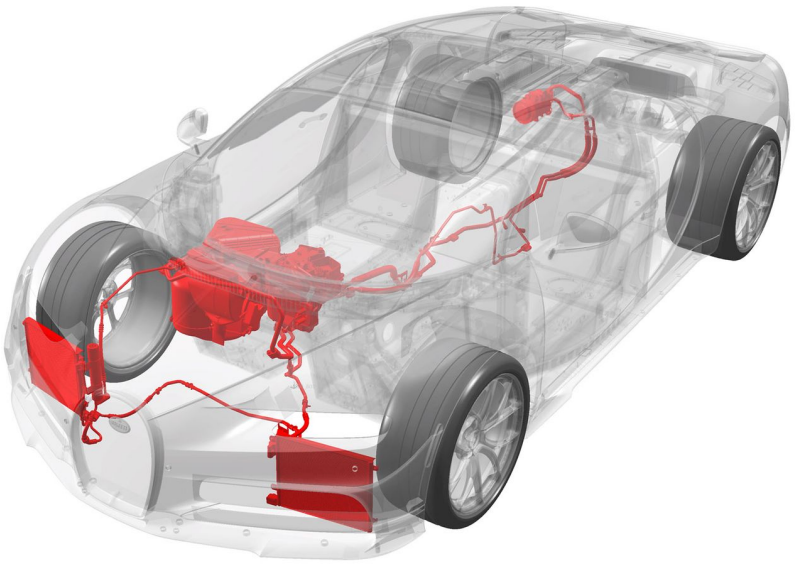
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BUGATTI DEVELOPMENT — PERFECT TEMPERATURE CONTROL AT 400 KM/H



Julia Lemke on the challenges of developing the air conditioning system.

The atmosphere in the interior is pleasantly cool despite the baking heat outside. No draughts can be felt at all — just the way things have to be to create a sense of comfort that is very noticeable even though it's completely invisible. As the overall technical coordinator for Bugatti air conditioning systems — and holder of a doctorate in engineering — Julia Lemke designs new air conditioning systems to ensure that the air flow and air conditioning work perfectly in the new Chiron Pur Sport[1], Divo[2] and all other Chiron[3] models. It's a task with considerable responsibility: two air-conditioning condensers ensure heat dissipation from the vehicle, a central air conditioning unit is responsible for control, and a compressor drives the entire system. This system is made up of air conditioning lines with a considerable length of approximately 9.5 metres in total due to the mid-mounted engine concept.

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Julia Lemke has been working in the automotive industry since 2013 and has been with Bugatti for the last four years. It's a brand whose fascination for Julia Lemke is not limited to the sheer performance, technology and quality of craftsmanship, but also includes handling and usability — a unique combination of ultimate performance with exclusive design and convenience. ''The Chiron, Divo and even the extreme Chiron Pur Sport are easy and convenient to drive on a day-to-day basis — they're straightforward to use. Even inexperienced drivers can handle a Bugatti right from the word go,'' says Lemke.

As far as she's concerned, she has an absolute dream job. Julia Lemke grew up in southern Germany and became aware of her interest in technology early on, during her school days. She helped her father and brother repair her bike and started tinkering with cars at an early age. Her first car — an old 1985 VW Passat — had neither power steering nor air conditioning. Despite her fascination with technology, Julia Lemke initially took a degree in history — her second passion. She completed her studies with a qualification as an archivist — but then went on to study energy and process engineering with a focus on thermodynamics in Brunswick.

''I came to the realisation that current and future technical problems and their solutions are more fascinating than the past. I was particularly interested in thermodynamics,'' explains Julia Lemke. After graduating, she conducted research at the Technical University's Institute of Thermodynamics and wrote her doctoral dissertation on ''Energy assessment of car air conditioning systems with secondary circuits''.

EVERYONE HAS THEIR OWN SENSATION OF TEMPERATURE

One challenge when adjusting the air conditioning system is that each individual has their own individual sensation of temperature. Europeans usually feel comfortable between 21 and 22 degrees, while most Americans prefer it a few degrees colder. ''For us, it's important to ensure that the selected temperature is quickly established. But there mustn't be any draughts. The air conditioning system is working best when occupants don't notice it. We have to make sure there are no draughts or noise — only then does it make you feel comfortable,'' she explains. The entire air conditioning system includes the cooling circuit for the interior, air flow, electrical system, electronics and the air conditioning unit as the system's central control unit.

The requirements are huge: ''Our vehicles travel very fast. In order for the air supply to work properly at maximum speed too, we need to ensure the ventilation and air conditioning are particularly well controlled,'' she says. For this purpose, the air conditioning system changes the air flow at fast driving speeds. In conventional vehicles, air is forced into the interior at the lower end of the windscreen, but in a Bugatti this only happens up to about 250 km/h. From this point onwards, there is a switch to negative pressure: a sophisticated control system with an additional ram air flap and an optimised blower ensures that air continues to enter the interior.

The Bugatti hyper sports car also has other unique features: because of the incredible speeds reached, sometimes well over 400 km/h, the body is designed to be particularly streamlined. This requires a flat windscreen with an inclination of just 21.5 degrees. This increases the surface area of the glass to 1.31 square metres — a conventional compact car has a glass area of around 0.70 square metres and an angle of inclination of around 30 degrees. As a result, the interior of a Bugatti heats up more due to the higher solar radiation or solar load. Sky View — the glass roof option popular among Bugatti customers — further increases the level of interior

heat when the sun is shining. To counteract this, the Chiron models and the Divo have a powerful air conditioning compressor with a cooling capacity of up to 10 kW and two air conditioning condensers — enough to cool an apartment in Europe measuring approximately 80 square metres. Approximately 3 kg of coolant per minute can be compressed from a pressure of about 2 bar to a high pressure of up to 30 bar.

In addition, the compressor mounted on the engine is exposed to very high ambient temperatures due to its proximity to the exhaust system, so this is cooled by another sophisticated system. ''At first glance, our air conditioning system appears to function like a conventional system. But it's a real challenge to perfectly harmonise the highly complex system of a small-series hyper sports car so that it works impeccably even at maximum speed and engine load,'' says Julia Lemke. She therefore conducts research and development with regard to maximum cooling capacity as well as efficiency, system acoustics and draught reduction. This includes reducing and refining the refrigerant circuit so as to minimise the use of refrigerants and energy consumption.

As the coordinator for the interior, she is in charge of all matters relating to the passenger compartment of the new Chiron Pur Sport. The various departments collaborate very closely and all employees are involved in driving forward product development. As an exclusive luxury manufacturer, Bugatti also gives its employees the opportunity to develop and implement ideas quickly. In addition to this, there is her main job as the person responsible for the air conditioning system: she has to ensure all components of the system function reliably and provide pleasant interior comfort in all operating conditions. ''Due to the increased engine speed in the Chiron Pur Sport of up to 6,900 rpm, the main focus is on the proper functioning of the air conditioning compressor as an engine peripheral. This is why I take part in a lot of test drives to ensure the functionality of my system in all climatic conditions,'' she says. Julia Lemke naturally gets to drive the hyper sport cars herself during testing. For her, cars in general and the Chiron in particular are a technical masterpiece. ''The deeper I get involved as an engineer, the more I admire what is achieved overall in the development of these vehicles. The enormous power of the W16 engine and the incredible speed are unique — this is what makes this highly complex system different from the rest,'' she says.

Her hobbies match her love of cars and technology: motor racing and racing photography. In her spare time she enjoys going to motor racing events to take pictures. When asked which Bugatti model is her favourite, she answers without hesitation: ''The Chiron Super Sport 300+ is my absolute dream car. It has even more power and a maximum speed that goes far beyond anything before it, shifting the boundaries of physics. I have huge respect for all my colleagues who have made this possible.''

Despite the small series of only 500 planned vehicles, Bugatti goes to enormous lengths to achieve perfection. Two test vehicles were available for climate trials during development of the Chiron. To make draughts more visible, Julia Lemke tracks air flow using 3D simulation, smoke lances and even wool threads. It might look strange, but the light wool threads clearly indicate the air flow. Her goal is to continue perfecting and adjusting the air conditioning system so that the vehicle occupants feel comfortable and do not hear or feel any draughts. The result is perfect only if they don't notice anything at all.