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**AUTOMOTIVE**

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# Automotive

## A passion for the automobile of the future

As a highly qualified engineering partner of the automotive industry, our innovations have been helping to make the driving experience safer, more comfortable and less stressful for over a decade. A growing number of renowned manufacturers and system suppliers, in both the passenger and commercial vehicle areas, are among our customers.

## **Applications**

## Seat ventilation

### The perfect climate for fatigue-free driving

Nothing makes the comfort of an automobile more immediate and tangible than comfortable seats. Seat ventilation has become a central focus in cars and commercial vehicles alike- "sitting without sweating" is the promise.

## Head space heating

Innovation made with ebm-papst: If you love a breeze and find that February is no bit too early to put the top down on your convertible, head-space heating lets you do so without hesitation. At the push of a button, a soft and soothing "Airscarf" surrounds your head, neck and upper back. This system, developed cooperatively by DaimlerChrysler and Catem, is being used in the new SLK seat from Mercedes-Benz.



# Car climate control components

## Intelligently controlled and decentrally distributed

Climate control components for the cars of the future. Intelligent sensor blowers ensure optimum temperature detection for regulating the automatic climate control system, while decentralized climate control blowers or booster blowers guarantee optimum air distribution. All with longer service life and low noise.

## Sensor blowers

Automatically controlled climate control systems will soon become the norm in almost every vehicle. The number of cars with automatic climate control is rapidly increasing. This means increased comfort, but also requires great effort in designing quick-response temperature sensors for controlling the climate control systems. An additional factor is that the rapid increase in the variety of climate control systems being built makes individual and customized solutions necessary more now than ever. Here, the required standard is fast, tried-and-tested solutions based on platform developments, as well as a high level of engineering experience.



## Booster blowers



Achieving the perfect "wellness climate" in a vehicle requires individual climate control of the entire passenger compartment. To do so, it is necessary to meet the needs of each individual passenger and to treat each passenger's space as a microclimate zone. Decentralized centrifugal blowers in BLDC technology ensure low-noise and energy-efficient air distribution in the passenger compartment- perfectly controllable, durable and tried-and-tested.

# Thermal management

## Axial fans and centrifugal blowers for thermal management

Creating quiet and powerful components and systems for electronics cooling is a challenge that ebm-papst development engineers meet every day. Their experience and mastery in solving complex cooling tasks is reflected in thousands of applications. The basis for this is provided by innovative fan and blower solutions from ebm-papst that guarantee reliable cooling of products, even in a tightly packed instrument panel or the engine compartment of a modern vehicle.

# Thermal management of modern light sources

Long service life, high-level system integration and high functionality. These are the demands of the automotive industry, which constantly requires new technologies in cars. Innovative components are realized to meet these demands. Compact system integration is in the forefront of the challenge. High-performance electronics, such as the groundbreaking technology of modern headlights, requires high-performance cooling for trouble-free operation. This is accomplished by ebm-papst with quiet and reliable axial and centrifugal fans. Innovation is needed, ebm-papst has the answer.

# Thermal management for infotainment

An increasing amount of heat is being generated by higher integration of devices for infotainment, such as navigation unit or central displays. Active cooling elements make these systems more reliable. Smooth and trouble-free function is the essential requirement here. High ambient temperatures decrease of the service life of particularly sensitive and expensive components such as processors or power electronics.

Furthermore, increasing environmental and comfort requirements, such as those for noise, housing design or protection from electromagnetic emissions-along with cost and space strictures-often make it impossible to use traditional, simple cooling methods such as fabrication, larger cooling elements or housing openings.

Therefore, intelligent thermal management is an unavoidable prerequisite for reliable function of the modern electronic and electrotechnical equipment in vehicles.



# Thermal management for the engine control unit



In recent years, the development process for electronic and electrotechnical devices and subassemblies has changed dramatically. The requirements of the automotive industry- which has to offer groundbreaking innovations in increasingly shorter cycles, not to mention increased function in ever more compact spaces-have led to high integration density.

One of the areas to which this applies is the control system for engine management. Due to the high ambient temperature of the control system electronics, active cooling is required for optimal function. Perfectly integrated into the E-Box for the vehicle's engine management system, a micro centrifugal blower from ebm-papst cools the dissipated energy of the electronics and withstands the tough ambient conditions in the engine compartment with reliability and a long service life.

# BLDC electric drive systems

## Drive solutions for the automotive industry

Decentralized drives and drive systems are rapidly becoming more important in motor vehicles. Particularly electronically commutated BLDC motors, with their high operating reliability, convenient control and easy integration into automotive logic interfaces, are being used in the auxiliary and servomotor area.

For decades, we have been driving the market with well-engineered solutions in motor technology. Our experience includes the development of thousands of applications in the widest variety of industries. Many of our solutions were originally customer-specific and later developed into industry standards. BLDC technology offers enormous potential for the automotive industry in particular:

as a replacement for hydraulic systems, for all X-by-wire applications and for intelligent, decentralized drive tasks in engine, chassis and safety functions. In short: this drive concept is perfectly suited to all applications in the car that demand high energy efficiency, durability, low-noise performance and exceptional controllability.

## BLDC drives, engine compartment



Intelligent electronic drives withstand the toughest environmental conditions in the engine compartment. Durable, robust and reliable, decentralized brushless DC motors fulfill a variety of tasks, for example as pump drives or direct drives. In these areas, sustainability issues such as fuel economy and reduction of harmful emissions are the driving force behind new technologies that are realized with innovative drives from ebmpapst .

## BLDC drives, powertrain and chassis

High dynamics, switching gears without delay and comfortable steering make driving fun. Supported by BLDC drives from ebm-papst, automakers are implementing innovative safety and comfort concepts with increasing frequency, whether by using previous hydraulic concepts for braking or steering or new X-by-wire technologies.



## BLDC drives, passenger compartment

In the passenger compartment, many comfort features are realized using electromotive solutions. Electric motors are used in applications ranging from the luggage compartment cover to the seat adjustment. Low-noise performance and intelligent control are critical in these applications. Here, BLDC drives from ebmpapst can generate added value for your customers and substantially increase comfort.



# Commercial vehicle climate control components

## Ideas for technological change in commercial vehicles

A comfortable environment in commercial vehicles is by no means just a matter of amenities. Both passenger transportation in buses and coaches and trucking that is as free of stress and fatigue as possible place high demands on vehicle technology, particularly climate control, ventilation and air-conditioning.

# Fans and climate control components

For many years, renowned bus manufacturers have installed air-conditioning systems with brushless and wear-free centrifugal blowers and axial fans from ebm-papst. These products are also being used increasingly for climate control and ventilation of driver's cabs in trucks, tractors, and construction equipment as well as transport refrigeration systems.

In modern commercial vehicles, EC technology is increasingly becoming the standard. Our new second-generation EC axial fans and EC double centrifugal blowers set the trend in commercial vehicle climate control around the world and have also proven their excellent performance in hot climates and tropical regions. They not only fulfill today's increased expectations for comfort, they also have a wear-free working time of over 25,000 hours. A wide variety of climate control system manufacturers rely on our experience and excellent skills in our core competencies of motor development, aerodynamics and electronics.

**Development skills**

## Development skills

### The center of success

When people need products that do not yet exist, they come to us. They do so because we have unusual solutions to match unusual tasks. With this in mind, we have developed an enormous number of customer-specific custom solutions: starting with individual housing shapes and spanning all the way to designs for use under extreme conditions.

# Testing and measurement laboratory

## Testing and measurement laboratory

"Putting our products to the test." With this as their slogan, the committed employees of our test center busy themselves putting our fans and drives through their paces. The particular focus is on aerodynamics, motor technology and electronics.

The task of our products is to withstand tough conditions throughout the range of applications in which they are used. Offering the customer quality-and thus safety and reliability-is the goal we all share. Every day, countless analyses and tests are carried out with the goal of maintaining and expanding our leadership in the area of quality.

You can have confidence in our products, as they are often required to pass the most stringent tests:

- Air performance measurement, noise analysis, lifecycle test
- Climatic test (e.g. cold start, temperature shock test)
- EMC test, electromechanical motor test
- Vibration test, tension, compression and bending test
- System of protection/leak test (e.g. salt spray test), media resistance (e.g. stone chip resistance)
- Metallographic or microscopic examination
- Test vehicle



# Simulation

For validating individual parts and qualifying the entire system, simulation tools are helpful in the complex system analysis process. For simultaneous engineering in particular, analysis programs are used to optimize further development and shorten the time to market. Whether they are installation space, flow or thermal analyses, simulations speed up processes and have become an indispensable everyday tool for developers.

**Tools used:** Ansys (FEM), Catia V5 (CAD), dSpace, FEMAG (FEM), Flotherm (thermal analysis), Fluent (CFD), Inventor (CAD), Pro-Engineer (CAD), Simplorer, Speed and other tools for flow analysis or calculating impeller geometry.



**Simulation**

# How to 'produce' satisfaction

## Quality management

The name ebm-papst is known and trusted around the world. This trust is based not only on our decades of pioneering research and development work, but also on a standard of quality unmatched anywhere. However, trust brings with it an obligation. ebm-papst stands for the highest level of reliability in every stage of product development, from the initial idea to production and all the way to delivery of our products. In this way, we "produce" satisfaction-and are measured by that standard every day. Particularly in the automotive industry, "zero defects" is the catch phrase of the day. With customer satisfaction as their foremost goal, our dedicated manufacturing and production employees work hard to meet these expectations. They not only meet these expectations, they exceed them!



**ebmpapst**

## **One world, one level**

Whether produced in one of our five factories in Germany or one of our ten international production sites, our products always have the same high level of quality. Quality planning and preventive quality monitoring in all stages of production, including zero-defect programs, characterize our exemplary quality philosophy. We live by and implement this philosophy in all our factories every day.

## **No compromises**

All products must undergo the most difficult test procedures under all real-world conditions of use, including the continuous stress test, salt spray test and vibration test. Tested characteristics include the air flow, pressure increase, operating noise level, cooling efficiency and many others. Only when all of the desired characteristics are present does the product go into production. The sum of all these details-small as they may appear-are fan and drive products with above-average service life and reliability.

## **The marathon fan keeps running...and running...and running...and running...**

The best example of our quality philosophy is the marathon fan, a standard product from many years ago. Our "veteran," one of millions of units that were mass-produced for decades, is a test specimen that has been running in our laboratory for over 185,000 hours with no symptoms of fatigue. It is the symbol of the quality consciousness of the founding years of the company-a consciousness that has not only lasted, but has actually increased over the years. Today, we use the principles and instrumentation of state-of-the-art industrial engineering to create more and more products with the same high quality as the marathon fan.

## **Certified quality**

All of our quality efforts, for both products and services, are documented in a comprehensive quality management system.

## References

## References

### Demonstrating impressive potential over the years

As a medium-sized company with high standards for creativity and continuity, we have a long history of successful cooperation with partners in the automotive industry and their system suppliers. Now as then, we work together to develop new technologies and push them forward. We are there from the beginning, always remaining one step ahead of the competition. Under "Case studies," you can read more about our skills and experience in cooperative development of creative ideas for the automotive industry.

## Case studies

Verschiedene | Case study: Sensor blowers

### **Automatic climate control systems depend on sensor blowers from ebm-papst**

Automatic climate control systems are increasingly becoming standard equipment in today's cars. These immensely popular systems are taking over both the premium class and the high-volume segment. Compact sensor blowers with integrated or external measuring sensors form the technological basis.

## Case studies

Verschiedene | Case study: Navigation systems

### **Reliable cooling: arriving at your destination relaxed, without fail.**

Navigation systems can guide passengers to their destinations reliably-though only if they are dependable. When failures and malfunctions occur, overheating is most likely the cause. Cooling these sensitive hot spots and developing fail-safe systems requires great expertise in the area of fans.

# Case studies

DaimlerChrysler | Case study: Seat ventilation

## Fan technology from ebm-papst powers seating comfort in the new S-Class

Mercedes drivers expect to stay cool in their cars. To make this possible, fan engineers occasionally break a sweat in their work. This is particularly true when the performance specifications include a long list of requirements, such as the least possible vibration, optimum air flow, and great robustness and a long service life of the active seat ventilation. Another critical point was easy integration of the fans into the smallest possible space.



# Case studies

## BMW | Case study: BLDC drive engineering

### EC motor technology from ebm-papst brings a new level of driving excitement to the new 3-Series

Maximum driving safety at high speeds, and comfortable handling when parking: for the first time in a mid-class car, the customer can select Active Steering as an option for the six-cylinder models of the new BMW 3 Series.

The core of BMW's Active Steering is an electronically commutated BLDC internal rotor motor from ebm-papst that is connected to the steering column via a planetary gear. This concept expands the conventional, servo-supported steering system by adding two inputs: one for manual activation via the steering wheel, and another for the electric motor.

The integrated electronics convert the two separate input speeds into one output speed. In real-world terms, this means that the mechanical connection between the wheels and the steering wheel is maintained via the central gear input. Full contact with the road thus guarantees authentic steering feedback.



# Case studies

## NFZ-Hersteller | Case study: Climate control

### ebm-papst ventilation systems for commercial vehicles

For many years, renowned bus manufacturers have installed air-conditioning systems with brushless and wear-free centrifugal blowers and axial fans from ebm-papst. These products are also increasingly being used for climate control and ventilation in trucks, tractors, construction equipment and railcars, as well as transport refrigeration systems. Before brushless systems became available on the market, brush motors were used in commercial vehicles. In brush motors, the "commutator" performs the task of distributing current to the coils. The commutator consists of copper segments embedded in insulating compound. Mechanical springs press the integrated carbon brushes onto the commutator. The friction between these two mechanical components is the weak point of conventional DC motors. After a running time of approximately 5,000 hours, the carbon brushes are used up and the commutator is worn out. As a result, the entire blower needs to be replaced. Furthermore, open loop speed control is possible only with external electronics. In modern commercial vehicle, constantly increasing expectations for comfort mean that this service life is no longer sufficient.



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