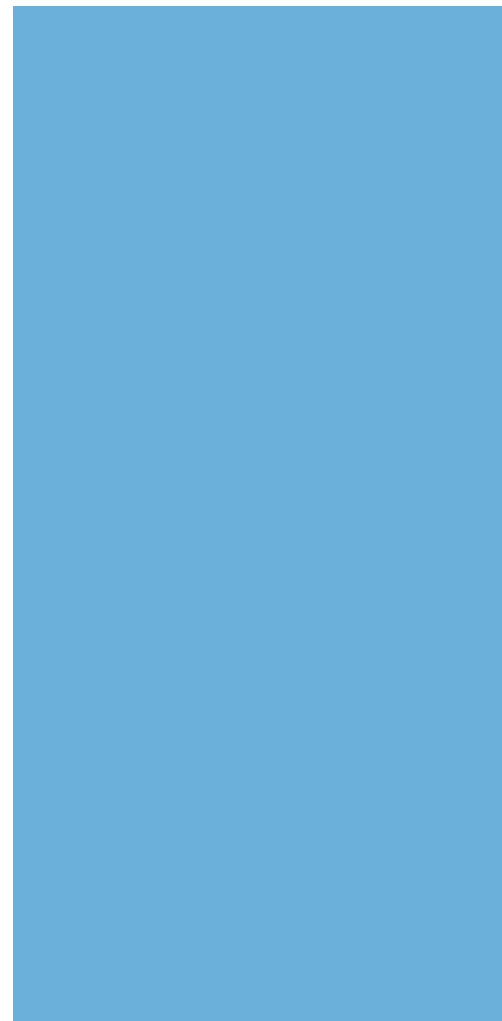


Thermal management

Axial fans, radial fans
and cooling systems



Fans and blowers for vehicle electronics.

ebmpapst

Tapping into market potential together, in the spirit of innovation

Winning over car buyers today and in the future with innovations and ideas, and consolidating and expanding market share as development partners of the automotive industry for air and drive applications, we know about the demanding objectives set by automotive manufacturing. Indeed, for more than 2 decades, we have been supplying the automotive industry with not only fans, ventilators and drives of the highest quality, but also, and above all, with a spirit of innovation, 60-years experience in the field of electronics cooling and a real passion for the automobile. Many leading manufacturers using our engineering know-how to develop complex solutions for the car of the future by working with us in close cooperation – and to tap into market potential together.

Up to 40 ebm-papst motors or fans in a single vehicle

Leaders of the world market in fans and ventilators and highly specialised for electrical drive systems and motors, ebm-papst is behind many of the components and systems featured in automobile manufacturing today. An important area of focus is the cooling electronic assemblies using our high-tech fans and, increasingly, our entire cooling systems. Moreover, we develop and produce components and modules for seat air conditioning and components for vehicle air conditioning, actuators, and drive systems for the most varied of auxiliary functions. In many vehicles today, there are up to 40 motors or fans brought to you by ebm-papst!

A joint challenge: electronics development in the automobile

For years, the development of electronics in the automobile has been an important source of potential for innovations. With the introduction of bus systems and the increasing digitalisation of the power consumer the trend is continuing towards ever more electronics. This development applies to convenience-oriented applications such as on-board navigation systems, powerful hi-fi components, PCs, displays, and also complex peripherals of the vehicle management system and driver's assistance and safety systems.





The associated, continuous increase in the integration density of electronic components used in automotive equipment, combined with expanding functional scopes and the intensified networking of electronics represents a great challenge for electronics cooling. This is even before the very restricted installation conditions in the vehicle are taken into consideration. A clear trend is emerging towards the active cooling of temperature-sensitive components – and therefore an inseparable combination of high-tech electronics and high-tech cooling equipment in the car.

Reliable thermal management based on innovative fan and blower solutions

Quiet, powerful components and systems for electronics cooling are bread and butter to our development engineers, having become familiar with these sophisticated application scenarios from their use in the IT and telecommunications sectors. Today, thousands of applications bear witness to our experience and knowledge in the mastery and solution of complex cooling problems. Thanks to innovative fan and blower solutions, we can guarantee reliability of thermal management in a densely packed dashboard or in the engine compartment: improving still further the comfort and safety of the modern car.



Quality down to the finest detail

Quality is the decisive factor defining the market success of a new technology in the face of increasingly competitive conditions. And quality – especially for us as an engineering partner of the automotive industry – is a multidimensional promise that we keep both in our methods and manner of cooperation as well as in the smallest product detail. Since our customers expect uncompromising functionality and safety in their applications we do intensive research, trials, and tests even in the preliminary stages of a development. We assimilate the development of cooling components and systems directly into the individual application. Our international presence helps us to maintain a close relationship with our customers which is so important to us; a personal relationship with total commitment. Maximum quality overall – down to the finest detail.

Quality safeguards competitive advantage and financial results

In the pursuit of our joint ambitious goals, we operate our own development departments dedicated to the automotive sector. In our test and measurement labs, we use the latest simulation and validation tools to realise development and manufacturing processes in accordance with the principle of simultaneous engineering – thereby ensuring maximum quality from the very start. Together with our customers, we determine and evaluate each individual application to meet technical, logistical, and financial requirements and then implement them to create compelling products. Our fulfilment of the international standards ISO/TS 16949, ISO 9001, VDA 6.1 and QS 9000 and our cooperation with all the major automotive manufacturers are proof of our comprehensive quality management.

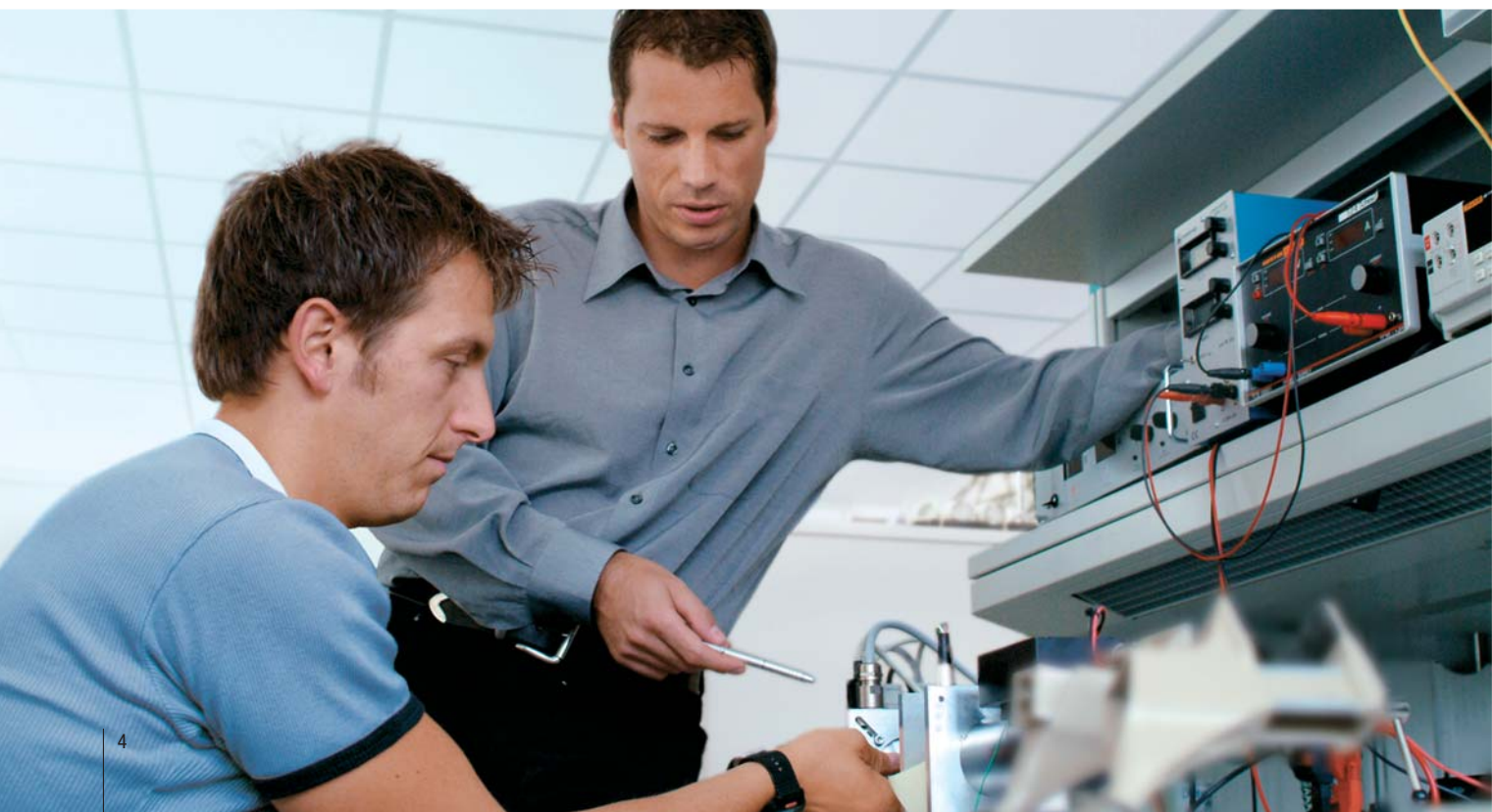
In addition, our tried and tested platform modules speed the implementation of our projects. For the time factor also ultimately plays a major role in the competition for market share and in gaining that crucial competitive edge.

An example for excellent cooperation

Our vast experience in drive technologies, aerodynamics, and acoustics makes it possible to develop cooling components and systems that achieve success through pure functionality, optimum reliability, and maximum service life. Take for example, the cooling elements for the Comand system of Mercedes-Benz new S-Class, which unites the central instrumentation display controls and infotainment, including the navigation system.

Requirements could hardly be “hotter”

Efficient cooling performance with pin-point heat dissipation from the place of origin. Cooling offers maximum operational comfort in terms of speed regulation and smooth running. Extreme temperature range from minus 40 °C to plus 85 °C. Electromagnetic compatibility. Greatest tolerance to power supply fluctuations with possible voltage peaks. All in all, the “hottest” of requirements created the climate for precision hot spot cooling.





Intelligent air routing, whisper-quiet fans

In partnership with Mercedes-Benz, we developed an innovative cooling system for the new S-Class that draws in cool air from the footwell of the vehicle and directs it to target the hotspots in the electronics systems. Since the components of the Comand system are roughly divided into two sub-areas, it was necessary to design the routing of cooling air accordingly: this gave rise to a flow-optimised cooling system with integrated cooling-air lines.

The electronically commutated radial fan – as a key part of the solution – is temperature-regulated directly by the Comand electronics. A sensorless motor receives its speed information via a control line. From a component temperature of 65 °C, the motor starts up and adjusts its speed to the amount of cooling currently required. The particularly quiet and electro-

magnetically compatible commutation reduces both the audible and the electrical “emissions” of the fan. The ball bearings which have been adapted for changing environmental conditions such as air humidity and temperature, delivers a service life extending well into several tens of thousands of hours.

As a supplier package, the “complete solution” implements vehicle-specific design and optimum aerodynamics of the air ducts perfectly. Complex simulation programs calculate the ideal shape of the air ducts based on virtual channel flow models and optimise the aerodynamic layout considering pressure generation and air output. This cooling system, which is fully integrated into the cockpit, sets a brand new standard in the cooling of automotive electronics.



Extreme demands? A clear case for ebm-papst ...

Regardless of whether it's the thermal management of modern light sources, the infotainment system, or the engine control unit – all fields of automotive electronics place the highest of demands on a modern, active cooling system. And regardless of whether they are axial fans, radial fans, or even complete cooling systems – all solutions have to be capable of fulfilling these requirements; to prove their worth in fluctuating temperature ranges from minus 40 °C to plus 125 °C; to guarantee maximum operating reliability over the entire lifetime of the vehicle, to be increasingly prepared to connect with bus systems. Not to mention EMC, load dumping, polarity reversal protection, and noise decoupling. To sum up, even the most demanding of requirements are quite clearly a job for us!

For all scenarios: Thermal management brought to you by ebm-papst

▶ Light sources

High-performance electronics and, in particular, the ground-breaking technology behind modern headlights demand high-performance cooling to keep things functioning smoothly. In this regard, special emphasis is placed on system integration with a compact construction. We entrust this task to our quiet and reliable axial or radial fans.

▶ Infotainment

Heat generation in the dashboard remains on the increase as a result of the increasing integration of devices. Active cooling elements produced by ebm-papst improve the reliability of these systems and more than cope with the ever more stringent environmental and comfort requirements, such as noise development, housing design, or protection against electromagnetic emissions. We deliver intelligent thermal management solutions – as an inseparable prerequisite for the reliable functioning of modern electronic and electrotechnical products.

▶ Engine control unit

Naturally, the problem of integration density also impacts on the control unit for the engine management system. The high ambient temperature to which the control electronics are subjected calls for active ventilation to ideally ensure no loss of functionality. Perfectly integrated into the electronics box for the vehicle's engine management system, an ebm-papst micro radial fan cools the thermal energy given off by the electronics, with high reliability and a long service life, which defies the harsh ambient conditions in the engine compartment.



High-performance blowers for the high-performance engines of BMW

In BMW engines, ebm-papst blowers are entrusted to reliably cool the engine management system, which coordinates all the engine functions of the vehicle. Just as complex is the collection of electronic components in the engine compartment – integrated into one or more e-box units. The demands placed on e-box cooling are particularly high. A lot of air at high pressure is required to flow through the densely packed electronics. This necessitates blowers of compact design, a minimal sound pressure level, electronic motor commutation for lifetime operation, and high electromagnetic compatibility. For this “hot job” ebm-papst high-tech blowers provide a compelling solution thanks to their outstanding reliability and long life. They are either used directly inside the hermetically sealed electronics box to recirculate air and prevent hotspots or externally to provide the electronics box with cooling air.

Infotainment cooling for Harman-Becker

Navigation systems are the “in” thing. In particular, the built-in units of today offer much more than just a route finding function. “Car infotainment” is the embodiment of everything that is state of the art and combines entertainment, communication and navigation into a single unit. In this way, the navigation computer, radio, CD player, monitor, disc drives, and the processing unit are bundled together in the most compact of spaces. The high component density and special installation situation therefore require active cooling for reliable operation. In cooperation with Harman-Becker, ebm-papst has developed a cooling system that is precisely tuned to the sensitive components which integrates perfectly into the design. Small, compact and silent, ebm-papst fans deliver maximum performance for infotainment cooling. They are also designed for lifetime operation and have a fan housing utilizing 2K technology for noise decoupling.



The integration specialists: ebm-papst axial fans

Compact, efficient, tried and proven for many years: ebm-papst axial fans stand out for their versatility, reliability and intelligence. They integrate perfectly, provide a fresh wind with high air output and, with their robust and uncomplicated engineering are time and again the first choice for many of the applications in the area of electronics cooling.

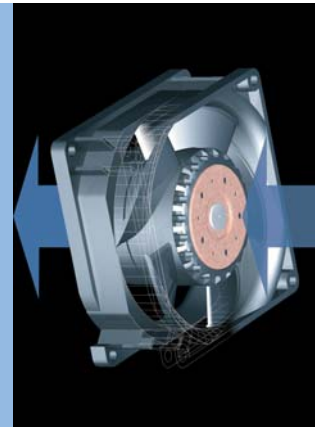
High flow volumes with moderate pressure generation

Air flows through the propeller-like blade wheel of an axial fan mainly parallel to the axis of rotation i.e. in an axial direction. When freeblowing and at a static pressure of zero, axial fans have the lowest power consumption which increases with rising backpressure. For electronics cooling the majority of axial fans are equipped complete with outer housing. The electric motor is

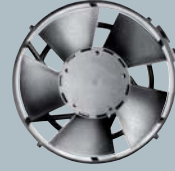
integrated into the hub of the blade wheel. This compact design supports space-saving installation in the unit. For security, the flanges have pre-drilled assembly holes. Axial fans are always aimed directly at or through the source of heat.

Axial fans in brief:

- Electronically commutated DC motor
- Low noise level thanks to special commutation electronics
- Electronic anti-locking protection and polarity reversal protection
- External speed input by PWM signal
- External speed control or regulating electronics
- Common line for speed input and diagnostics function
- EMC protection. Suitable for direct connection to the vehicle electrical circuit
- Fans made of glass-fibre-reinforced plastic
- Fan unit or assembly dressed and prepared for installation
- Various assembly options for noise insulation
(e. g. 2K plastic housing made of elastic, vibration-damping material)



Axial fans	Size	Depth	Max. air output	Max. pressure generation	Min. sound pressure level	Temperature range	Service life	Bearing system
Series	mm	mm	l/s	Pa	dB(A)	°C	hours	
250	25x25	8	1.0	25	15	-10 to +70	> 5,000	Sleeve bearing
400	40x40	10-25	6.5	220	17	-20 to +70	> 5,000	Ball/Sleeve bearing
500	50x50	15	5.5	35	30	-20 to +70	> 5,000	Sleeve bearing
600	60x60	15-32	19.5	300	16	-40 to +85	> 5,000	Ball/Sleeve bearing
700	70x70	15	12.0	65	25	-20 to +70	> 5,000	Ball/Sleeve bearing



The high-pressure specialists: ebm-papst radial fans

Radial fans brought to you by ebm-papst are the high-pressure specialists among cooling experts. With 90° air diversion, equipped with painstakingly optimised blade wheels, and aerodynamically designed for high pressure demands, these fans provide ultra-efficient precision cooling. Our radial fans are supplied with an outer housing and/or separate all-in-one air routing modules, which are incorporated into the application as finished components.

High-pressure generation with limited flow volumes

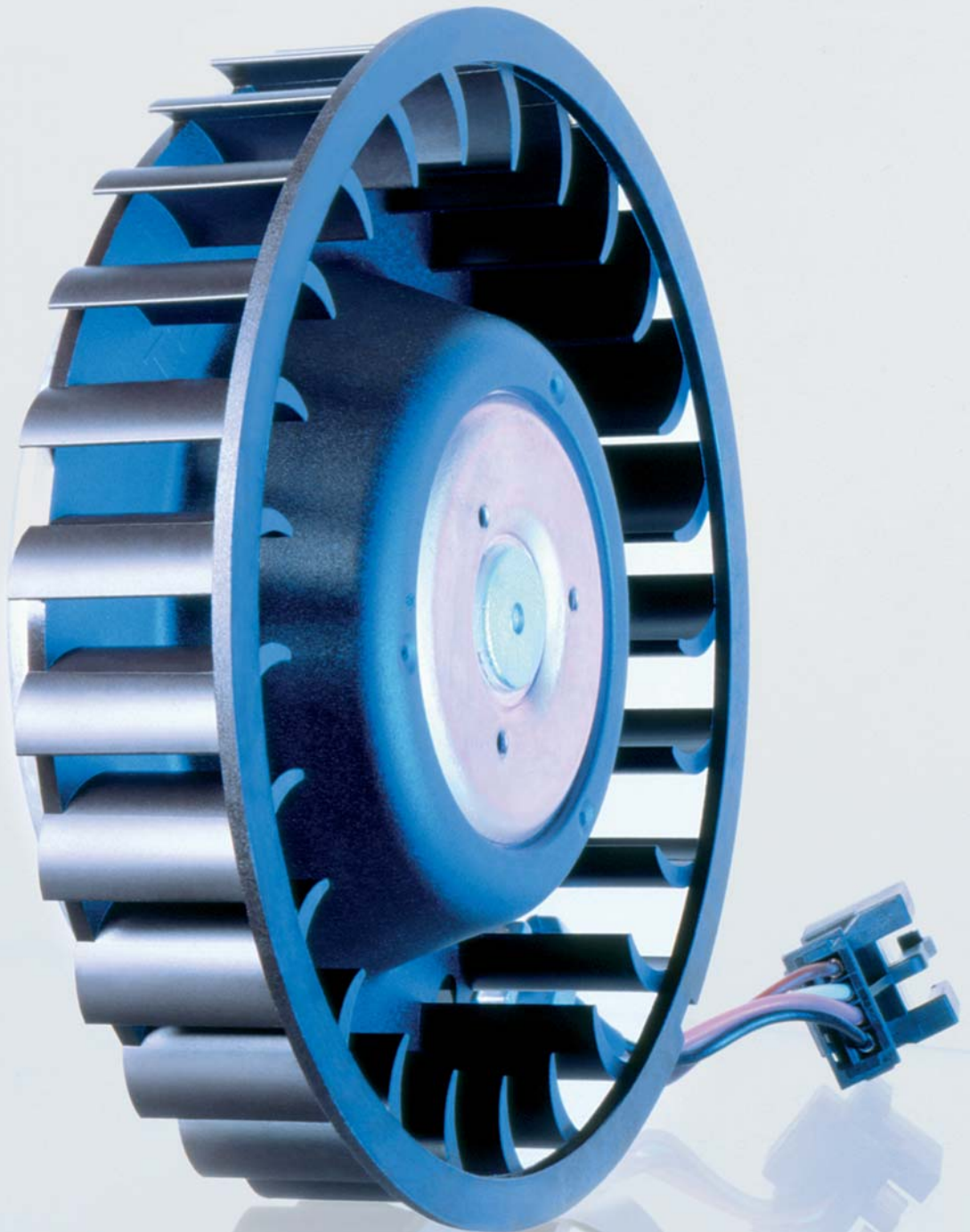
On the whole, many cooling tasks are best solved using axial or diagonal fans. If, however, the flow of cooling air needs to be diverted or even greater pressure generation is required, for example, radial fans are the more effective solution. For their application, we offer complete radial fans or motor/blade wheel combinations without an outside housing. ebm-papst radial fans are exceptionally suitable for connection to air ducts and routing systems. In this way the fan can be used in a decentralised arrangement. The cooling air is then supplied through a system of pipes.

The high pressures generated with radial fans ensure that all of the air is fed around the densely packed electronic components. The air can be routed to hotspots through a system of ducts. So only one central blower is needed to provide the cooling required – as opposed to several decentralised axial fans.

Radial fans in brief:

- **Electronically commutated DC motor**
- **Low noise level thanks to special commutation electronics**
- **Electronic anti-locking protection and polarity reversal protection**
- **External speed input by PWM signal**
- **External speed control or regulating electronics**
- **Common line for speed input and diagnostics function**
- **EMC protection. Suitable for direct connection to the vehicle electrical circuit**
- **Fans made of glass-fibre-reinforced plastic**
- **Fan unit or assembly dressed and prepared for installation**
- **Available as a blade wheel without outside housing or as a complete module**
- **Various assembly options**

Radial fans	Size	Depth	Spiral housing	Max. air output	Max. pressure generation	Min. sound power level	Temperature range	Service life	Bearing system
Series	mm	mm		l/s	Pa	bels	°C	hours	
RLF 35	51x51	15	with	2.6	190	5.5	–40 to +90	> 5,000	Ball bearing
RV 40	105x79	59	with	6.5	150	5.0	–40 to +85	> 5,000	Ball bearing
RL 48	76x76	27	with	8.0	150	5.0	–20 to +70	> 5,000	Ball bearing
RL 65	97x94	33	with	16.0	350	6.5	–20 to +70	> 5,000	Ball bearing
RLF 100	127x127	25.4/1"	with	18.0	450	6.5	–20 to +75	> 5,000	Ball bearing
RER 100	Ø 100	25	without	24.0	350	6.5	–20 to +75	> 5,000	Ball bearing
RER 101	Ø 101	52	without	53.0	450	7.0	–20 to +70	> 5,000	Ball bearing



You will find supplementary information in the following brochures:

- Company brochure/Facts and figures
- Automotive brochure
- Fans catalogues

We are pleased that the information about our services in the domain of automotive electronics cooling has attracted your interest. Are you thinking of a new project, perhaps a vision, that will need ventilators, fans, and drives to come to fruition? We'd be more than happy if you would like to speak to us personally about all the options open to you with ebm-papst. That's why we're here!

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