

HEATING TECHNOLOGY | EXPERTISE

AIR-CONDITIONING EXPERTISE – THE RIGHT TEMPERATURE FOR EVERY REQUIREMENT



A WORLD OF COMFORT



Eberspächer





EBERSPÄCHER – INNOVATIVE IDEAS FOR THE MOBILITY OF TOMORROW

Are you looking for a competent partner and expert, who provides not only heat for a diverse range of vehicles, but also the ideal climate for every challenge? Then Eberspächer is just the partner you need. It is this special combination of understanding customers' needs, corporate responsibility and highly motivated employees that makes Eberspächer a very special partner – with air-conditioning expertise. As a member of the globally active Eberspächer Group, we are always there, where you need us – with precisely the range of products and services you require. Put us to the test!

INNOVATION BASED ON TRADITION:

Over its 145-year company history, Eberspächer has always distinguished itself as a pace-setter for futuristic technological solutions. Today, our innovations provide the touchpaper for new drive and vehicle concepts in the automotive industry. As a leading system supplier for exhaust technology, vehicle heaters and bus AC systems, as a pioneer in vehicle electronics and automotive bus systems, all around the world we are making an active contribution to environmentally friendly mobility. In original equipment and the aftermarket, Eberspächer has a foothold in all the key markets of the global automotive industry. With our highly diversified range, we are equipped today for the technological challenges of tomorrow: for stringent emissions standards for passenger cars and commercial vehicles, complex thermal management for electric drives and increasingly demanding requirements facing electronics.

CLIMATISATION EXPERTISE:

For the Heating Technology department, this philosophy means continually harmonising the know-how of the group as a whole, and searching for synergies and development potential. Intertwining the individual sectors in this way ensures that Eberspächer possesses comprehensive air-conditioning expertise in diverse areas of mobility: from applications in trains, construction machinery, light to heavy

commercial vehicles, buses and passenger cars to complex thermal management in the vehicles of tomorrow with alternative drive concepts. The recently founded company, Eberspächer Sutrak GmbH & Co. KG, has been expanded specifically for the field of air conditioning.

Eberspächer – whatever temperature your application needs, we are the right partner.





Headquarters Germany

EBERSPÄCHER IS CLOSE TO CUSTOMERS – LOCAL ADVANTAGES FOR YOUR BENEFIT

What began in 1865 as a small plumbers workshop in Esslingen is, now as ever, family run – except that today we are regarded as a strategically operating global player and system supplier in the automotive sector. As we are not dependent on the stock market, it is easier for us to pursue our corporate strategy and long-term company development. For this reason, Eberspächer is also represented by several dependent companies in numerous countries. Vehicle manufacturers around the world know the value of close, continuous cooperation with Eberspächer.

CUSTOMER ORIENTATION FOR TAILOR-MADE TECHNOLOGY:

Every Eberspächer heater is custom-made. Close cooperation with the customer is therefore very important – at international level too. Approximately 1,399 Eberspächer employees are hard at work in Germany and around the world. In addition to the main plants in Esslingen and Renningen, the global Eberspächer production network includes sites in Europe, Asia and North and Central America. Our global presence is further augmented by development centres in Esslingen, Renningen and Torgelow, as well as various engineering offices with resident engineers. In this way, we ensure that every detail conforms to customer requirements, even in the earliest stages of product development.

OUR COMMITMENT GOES FURTHER:

The automotive industry is meeting global challenges with regional production and development facilities – and Eberspächer is determined to support this development on a worldwide basis. Our international presence is being continually and systematically expanded. In both development and sales, we are continually active on a global scale – in the USA and Japan, for example, and the emerging markets of Russia and China. These cross-border cooperations and joint ventures provide important impetus for the future – and bring Eberspächer expertise even closer to the customer.



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 - ■ ■ Kiev

- ■ ■ VEHICLE HEATERS
- ■ ■ ELECTRIC VEHICLE HEATERS
- ■ ■ BUS AC SYSTEMS



DEVELOPMENT – INNOVATIONS FOR TODAY ...

In future, heating technology will face ever more demanding requirements. Ecology, cost efficiency, acoustics, efficiency, alternative fuels, a long service life, modularity, thermal management and new drive technologies: all these factors are decisive for ensuring our success and that of our customers. Therefore we are constantly working on optimising our development methods and designing new, innovative and highly effective solutions.

DEVELOPMENT STRATEGY: "THE INCONSPICUOUS HEATER":

The latest generation of Eberspächer's fuel-powered heaters satisfies the most exacting requirements. Here, product development has focused on the strategy of the "inconspicuous heater". The customer sets what he feels to be a comfortable temperature, and the Eberspächer auxiliary heater ensures that this temperature is constantly maintained – guaranteeing a comfortable climate in the vehicle interior. In Eberspächer's book, "inconspicuous" means that our heaters work virtually without noise, with no fumes whatsoever, reliably and problem-free throughout their life. The additional focus on energy efficiency during operation means a smaller load on the energy resources of battery and tank.

MAXIMUM POWER SPREAD FOR GREATER ENERGY EFFICIENCY:

Energy efficiency means minimum fuel consumption and a small load on the battery when the heater is in operation. This is achieved by newly developed burning methods, which ensure maximum power spread, i.e. a minimal low heat output and a high maximum heat output. The minimal low output ensures that the vehicle stays comfortably warm without frequent on-off switching cycles, and therefore without increased current draw when starting up. The high maximum outputs guarantee that the vehicle interior reaches a pleasantly warm temperature fast, even at very low temperatures. Both the Airtronic D2 (0.8 – 2.2 kW) and D4 (0.9 – 4 kW) air heaters and our new Hydronic 2 Commercial (1.2 – 4.8 kW) and Hydronic M 2 (1.2 – 12 kW) water heaters boast these features.

NEW BURNING METHODS FOR ALTERNATIVE FUELS:

Alternative fuels continue to play an important role within the context of reducing CO₂. Currently, key players are ethanol and ethanol blends (e.g. E85), but also biodiesel and biodiesel blends (e.g. B30). The development of burning processes for heaters focuses on compatibility with B100 and E85. For air and water heaters developed for commercial vehicles, transporters, campers and construction machinery, the ability to run on biodiesel is an important requirement.

The burning processes for both Airtronic D4 and D5 air heaters and Hydronic M 2 8 kW and Hydronic 2 Commercial water heaters have been developed specifically to meet the requirements of operation with 100 % biodiesel.

DURABILITY THROUGHOUT SERVICE LIFE:

The requirements regarding the reliability of fuel-powered heaters are rightly very exacting. The heaters are always in use, especially in commercial vehicles, and must work reliably even at temperatures below -40°C, for at temperatures like this no other heat source can guarantee heating.

The requirements for service life vary depending on the application. A trend towards increased use is evident, and has already been taken into consideration in our new generations of heaters. Here, the service life target is 5000 h.



As well as the new technology used for the burning process, in the new Hydronic 2 Commercial and Hydronic M 2 water heaters the fan has also been further developed, and is now driven for the first time by a brushless motor. This electronically commutated motor (ECM) technology guarantees maximum running times.

MODULARITY THROUGHOUT THE HEATER FAMILY:

The newly developed Hydronic 2 Commercial, for example, clearly demonstrates that an important developmental goal – i.e. modularity of the components in the product family – is an absolute priority. The aim of this strategy is to reduce the cost of product development, while simultaneously guaranteeing flexibility through innovative solutions that satisfies the most diverse customer requirements.

APPLICATION EXPERTISE:

Today, customers not only expect their supplier to deliver the heat source, but to be capable of designing the complete heating system and to be a competent development partner.

The different possibilities for heating a commercial vehicle, for example, clearly show that there are several approaches, even when determining the basic concept. In auxiliary heating mode, the driver's cab can be heated by a stand-alone air heater, a water heater or an AIR-INTRA integrated in the AC unit. Eberspächer has the necessary expertise to draft and assess all heating systems even in the design phase, and to decide on the right heating concept in the early stages of vehicle development.

Using suitable simulation tools and a defined development process, the requirements for the overall system laid down in the specification are followed to the letter, and applied throughout the development phase.

THERMAL MANAGEMENT:

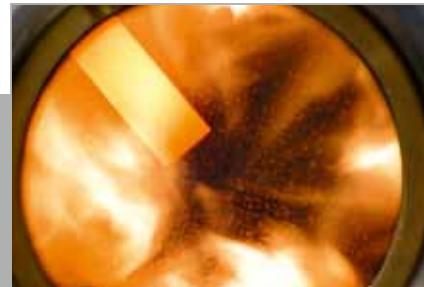
The increased severity of statutory emission requirements is compelling OEMs to come to terms with complex engine management. Here, the temperature of the coolant circuit plays an important part. In this context, the fuel-powered water heater is another "player" in the overall system and an additional variable for optimising thermal management in the vehicle as a whole. Ever more efficient combustion engines and hybrid drives have one thing in common: they produce less waste heat. A fuel-powered supplementary heater with the ability to deliver a heat output of 5 kW into the coolant circuit in just 25 seconds can rapidly compensate for this deficit.

The electrification of drives demands not only additional heating for the vehicle interior but also battery conditioning within a narrow temperature window. This can be reliably achieved through the use of a fuel-powered water heater, for example and a suitably designed coolant circuit.

ELECTRONIC EXPERTISE:

In addition to the burning process, the field of electronics is another key factor for fuel-powered heaters. Not only do the electronics ensure the correct function of the heater by controlling the glow element, fan, sensors, fuel metering pump and water pump but also form the interface to the electronic architecture of the vehicle.

This link can take place by means of various bus systems, such as LIN or CAN, for example. Both solutions are already in production in heater control units today and conform to OEM requirements. With our expertise in Flexray bus systems, Eberspächer offers additional possibilities for the integration of electronics at its own company.



... AND TOMORROW

FUEL-POWERED HEATERS – THE MOST EFFICIENT HEATING FOR ELECTRIC VEHICLES:

As well as the problem of range and the cost of batteries, the success of electric vehicles will also be determined by the air-conditioning comfort they offer. Electric mobility will only have a future if customers' desire for a comfortable climate in the vehicle can be met. Customers will only be willing to suffer a very minor downgrading compared with the familiar comfort of their non-electric vehicle. When driving purely on battery power, the electrification of the drive train entails the loss of the combustion engine as a source of heat for warming up the passenger compartment. Electric and fuel-powered heating systems satisfy this requirement for engine-free, autonomous heating, and guarantee fast and efficient heating of the vehicle interior. Heating from a heating system situated close by reduces the range by over 40 %. Vehicle electrical voltages of up to 500 VDC require special insulation technology and design in order to comply with international safety standards. Fuel-powered heaters offer the most efficient use of electricity. Even today, demanding requirements for service life are met by employing electronically commutated motors. By developing burning processes to work with the regenerative fuels biodiesel and bioethanol, Eberspächer relieves the heating of electric vehicles from its dependence on oil, ensuring environmentally friendly heating.

DIESEL APU – THE ELECTRICITY SOURCE FOR AIR CONDITIONING COMMERCIAL VEHICLES:

Fuel cells produce electricity from fuel, without a detour via mechanical energy. Consequently, these electrochemical energy converters can enjoy a broad application in the vehicle wherever electricity is needed – in the vehicle electrical system and as a source of energy for an electrically-powered auxiliary AC system. The basis for developing a fuel cell APU (auxiliary power unit) for use in vehicles is SOFC (solid oxide fuel cell) technology. In contrast to competing fuel cell technologies, SOFCs have the

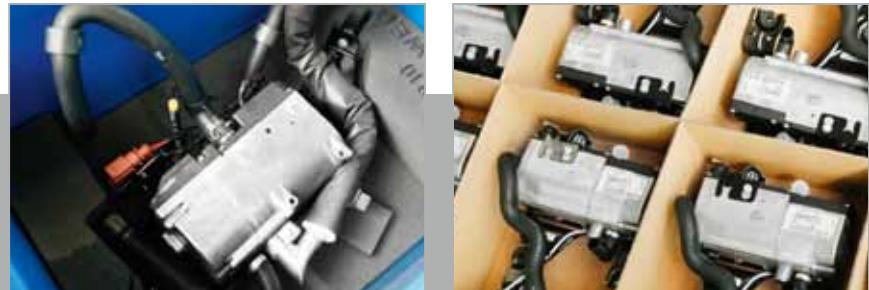
advantage in that all fuels available today and in the future can be used for the production of electricity. Therefore, their emergence onto the market does not depend upon a comprehensive infrastructure for a new fuel becoming available in time.

In a sponsored project, we are developing the necessary components for a diesel-powered SOFC APU system together with partners in industry. Eberspächer and two other industrial partners have set themselves the goal of developing an APU to serial production status.

HOME HEATING – EBERSPÄCHER OFFERS BURNER TECHNOLOGY FOR MODERN HOME HEATING CONCEPTS:

In new and modernised buildings in the housing market, improved insulation has considerably reduced the energy requirement of heaters. The energy consumption of low and passive-energy homes when the heating is on lies below 70 kW/h per square metre per year. Conventional, commercially available home central heating systems are therefore oversized. Thanks to their sophisticated control technology, low-output modulating burners from Eberspächer can guarantee almost seamless operation, thereby dramatically lowering start/stop emissions. Together with a partner from the heating industry, Eberspächer is working on integrating Eberspächer burner technology in a heating boiler.





PURCHASING – STRATEGICALLY IMPORTANT

Increasing focus on our core areas of expertise and the rising complexity of outsourced products and services gives purchasing more and more strategic importance.

SUPPLIER MANAGEMENT:

The course for considerably influencing the quality and cost of our end products is set even as the decision to award a contract is made. So, in order to involve all the relevant process owners and carry out an objective assessment from the point of view of all departments, suppliers are nominated by an interdepartmental sourcing committee. Here, we also systematically draw on our regular supplier assessment and resulting supplier classifications.

COMMODITY MANAGEMENT:

A TCO (total cost of ownership) analysis forms the basis for every decision to award a contract. This approach of systematically taking all incurred costs into account is intended to create transparency concerning both the decision and the costs. We want to preclude any doubts and make decisions transparently and with a high

degree of certainty. This is also a deliberate move against the LCC (low-cost country) strategies so prevalent today.

INTEGRATED PURCHASING PROCESS:

At Eberspächer, the Purchasing department's contribution to results is assured by involving it in the product creation process at an early stage, and through systematic commodity management. The long-term implementation of the resulting road maps ensures lasting and successful customer-supplier relationships.





LOGISTICS – CORE AREA OF EXPERTISE WITH MAJOR CUSTOMER BENEFITS

Logistics as an internal core area of expertise brings our business partners major customer benefits. Even at the stage of requests for quotations, our logistics employees are involved in the product creation process and make sure that customers' logistical requirements are taken into consideration all the way to the start of production. The logistical processes from the supplier to the customer are monitored in their entirety and harmonised.

GUARANTEED SECURITY OF SUPPLY:

Packaging expertise is as much one of our strengths as the use of all standardised forms of EDI/remote data transmission to VDA or Odette. Furthermore, the continual improvement of all logistical processes through CIP and FMEAs forms the basis for efficiently bringing non-value-added activities into line whilst simultaneously pursuing our zero fault strategy.

Scanner-aided continuous supply and order picking processes are a fundamental prerequisite for seamless delivery to our customers. A proven delivery service rate of over 98 % guarantees our customers the necessary security of supply for their production lines. A delivered goods error rate of around 100 ppm demonstrates our logistical competence in the most impressive way.

Through close cooperation between Production, Logistics and Data Processing, we can react extremely quickly to new logistical requirements from our customers, and put these into practice straight away.

Our warehousing system is especially focused on fast throughput times, minimal stocks and highly flexible reactions to fluctuations in amounts ordered by our customers. For us, the FiFo principle is as much a matter of course as the appropriate storage of materials, with clear product identification at all stages of production and storage. The demand-based manufacture of our OEM products helps considerably in this respect.

All these are reasons why our customers regularly rate our logistics performance as "very good".



QUALITY – AT THE HIGHEST LEVEL

As a leader in quality and technology, in all areas – products, services and processes – we pursue a zero fault strategy and work strictly according to our motto, "Quality creates value". Our understanding of quality combined with the quality yardstick defined by the customer ensures a constantly high standard throughout the entire value-added chain.

OUR MOTTO, "QUALITY CREATES VALUE":

Fluctuations in quality are avoided right from the start, thanks to the principle of prevention firmly embedded in our corporate philosophy. Comprehensive advance quality planning, systematic quality control and continually implemented quality improvements make up the foundations of a unique system of quality management throughout the value-added chain – from the customer's system to outsourced parts. Last but not least, our quality management according to TS 16949 has its foundation, above all, in relationships with our customers and suppliers based on partnership. As a result, we deliver added value in terms of quality with every product and service.

Likewise, our comprehensive EPRP project management expertise in project work is attuned to customer requirements and processes – with the systematic recording of customer requirements, expectations and wishes, with maturity control and systematic product and process releases. Systematic supplier development is based on our audit expertise, and supported by supplier days.

Where support is concerned, both in production and in the field, our expertise ensures fast, competent reactions, thereby maintaining and restoring customer satisfaction. Our escalation procedures are based on clarity of communication and rapid decision-making.

We are happy to be measured by our quality results.





PRODUCTION – THE PROCESS-ORIENTED FACTORY

The exacting requirements for quality, reliability and adherence to schedules can only be met through the latest concepts, technologies and machines – and with highly qualified employees. All our manufacturing processes are subject to a continual cycle of planning, action, monitoring and improvement, all with just one goal: satisfied customers.

PRODUCTION STRATEGY: "ALL IN THE FLOW" – PROCESS-ORIENTED WORKSTATION DESIGN:

Our two production centres "Preproduction/Preassembly" and "Unit Assembly/Customer Applications" are at the heart of all activity. At the "Preproduction/Preassembly" centre, machined products and assemblies are prepared for the downstream production centre. These have been manufactured using special processes and are already equipped with precision-set fuel metering pumps for our fuel-powered heaters. The services and activities offered by the surrounding departments provide a protective, supportive network around the two central production centres.

INCREMENTAL IMPROVEMENT WITH KAIZEN:

Our economic success is the result of excellent products and services, which boast superior quality to satisfy all customer requirements. We stand firm behind our basic conviction of continually seeking improvement, and adhere to the following principles in all production and production-related areas:

- Continued expansion of our company suggestion scheme, as our employees are the key to efficiency and quality.
- Investment in further training of employees, for the qualification of our employees is a decisive factor for the success and speed of our continuous improvement activities.
- Employee-oriented management – the employee is the key to achieving our goal.
- Process orientation in commercial and production processes; knowledge of the process input and process output reduces or prevents waste.

- Quality planning and control at all stages of industrialisation and operationalisation, for lasting total quality control.

By introducing the Kaizen principle, our employees now identify more strongly with the company and its products, so that we are continuously improving our competitive position.

"SUPERMARKETS" IN PRODUCTION:

Our workstations, work documents and production facilities are designed on the principle of a clear separation between added value and logistics. Our PSP/PSS, coupled with appropriate planning and foresight in the operative production centres, ensures a continual supply of materials by filling the individual supermarkets.

PRODUCTION SEQUENCE CONTROL ACCORDING TO KANBAN ("PULL PRINCIPLE"):

By introducing self-regulating, independent control loops based on the Kanban system, we have considerably reduced our expenditure on production management. The transparency of causal relationships between processes was also greatly increased. This enables us to avoid over-production, a lack of intermediate products and excessive stocks. Continually expanding pull production is a cornerstone of our production system.



PRODUCTION – THE PROCESS-ORIENTED FACTORY

IMPROVEMENT & STANDARDISATION:

All our manufacturing processes undergo a continual cycle of planning, action, monitoring and improvement (PDCA cycle: Plan, Do, Check, Act). In this way, all procedures relating to production are continuously analysed and improved. Once an improvement has been put into practice, it is defined as a standard and permanently integrated in the company's process model. The cycle is then changed to SDCA (Standardize, Do, Check, Act). Another improvement is sought only once standardisation is fully complete.

For planning new, clean, safe and standardised workstations and improving existing ones, we have introduced the five-stage "5S" procedure:

- Seisō (Clean: Keep the workplace clean).
- Seiri (Sort: Ensure order, i.e. separate the necessary from the unnecessary and remove everything unnecessary).
- Seiketsu (Standardise: e.g. cleaning schedules, standard workplace layout).
- Shitsuke (Self-discipline: Maintaining orderliness, cleanliness and compliance with standards).
- Seiton (Systematise: Keep each object in its proper place).

EFFICIENT PRODUCTION THROUGH DEMAND-BASED PLANNING AND INDUSTRIALISATION:

Our production system is based on the system of "total productive maintenance". By continually monitoring the most important elements of production and analysing parts and processes subject to bottlenecks, in particular, we are in a position to put our material flows through our production processes in a demand-oriented manner at any time. We constantly endeavour to improve our production lines, to get rid of waste of any kind.

NEW WORKSTATIONS WITH INNOVATIVE TEST CONCEPTS:

Our introduction of the production philosophy, "One man, one product" has enabled us to achieve a situation of high employee identification with our products. In our setup-free C-assembly lines, a complete, inspected product is created in a single work operation under the watchful eyes and trained hands of our employees.

CAPABLE PROCESSES AND PROCESS-INTEGRATED TEST METHODS:

The results of our interdisciplinary process and inspection planning are borne of mutually coordinated, simultaneous and sequential planning activities. Working closely with our Development and Test departments, we practice the principles of "design to cost" and "design to manufacture", and allow ourselves to be measured every day by our internal and external customers against the targets we have set ourselves.

We employ innovative methods of product differentiation when order picking assembly kits and preparing similar products on our production lines. Light signals tell employees the right box for material picking (pick to light) and placing (put to light). In combination with the methodology of "one piece flow", our processes satisfy the most stringent requirements in terms of speed, accuracy and reproducibility. Scanner-aided identification provides additional quality assurance. Process-integrated inspection processes ensure testing takes place at the optimum time in the value-added chain, thereby avoiding waste.



ASSEMBLY EXPERTISE IN CUSTOMER-ORIENTED FINISHING:

Our customers determine our goals in terms of our products' quality and variance. In order to constantly satisfy exacting requirements, we set great store on the use of standardised systems and processes.

THE INTERNAL CUSTOMER DETERMINES THE SUPPLY QUALITY:

Our internal customer-supplier relations are put to the test every day. Clear volume purchase agreements and quality gates enable deviations from the standard to be recognised, and concrete, targeted measures to be initiated and tracked by our CIP teams. Instances of non-compliance are analysed rapidly at the quality gates by means of the established PDCA cycle, measures defined and effective implementation initiated.

TEST EXPERTISE:

In addition to suitable and capable test resources, added value and the elimination of waste – with the simultaneous optimisation of material flows – form the basis of purposeful test planning. Reference tests in mechanical production areas ensure efficient SPC inspection, cold tests ensure environmentally friendly, resource-saving product testing, while we also boast fully automated hot and cold test benches and leak test benches with integrated programming stations. All this goes to show that in addition to our outstanding assembly expertise, the planning and execution of suitable inspections and tests is another of our key strengths.



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