

INNOVATIVE PRODUCT AND PROCESS SOLUTIONS
FOR HIGH-PERFORMANCE VEHICLES,
MOTOR SPORTS AND SPECIAL APPLICATIONS





INDEPENDENTLY OPERATED

TECHNOLOGY-ORIENTATED

IN THE EBERSPÄCHER GROUP NETWORK

PREMIUM PRODUCTS AND QUALITY

INNOVATION AND TRADITION



CUSTOMER-ORIENTATED

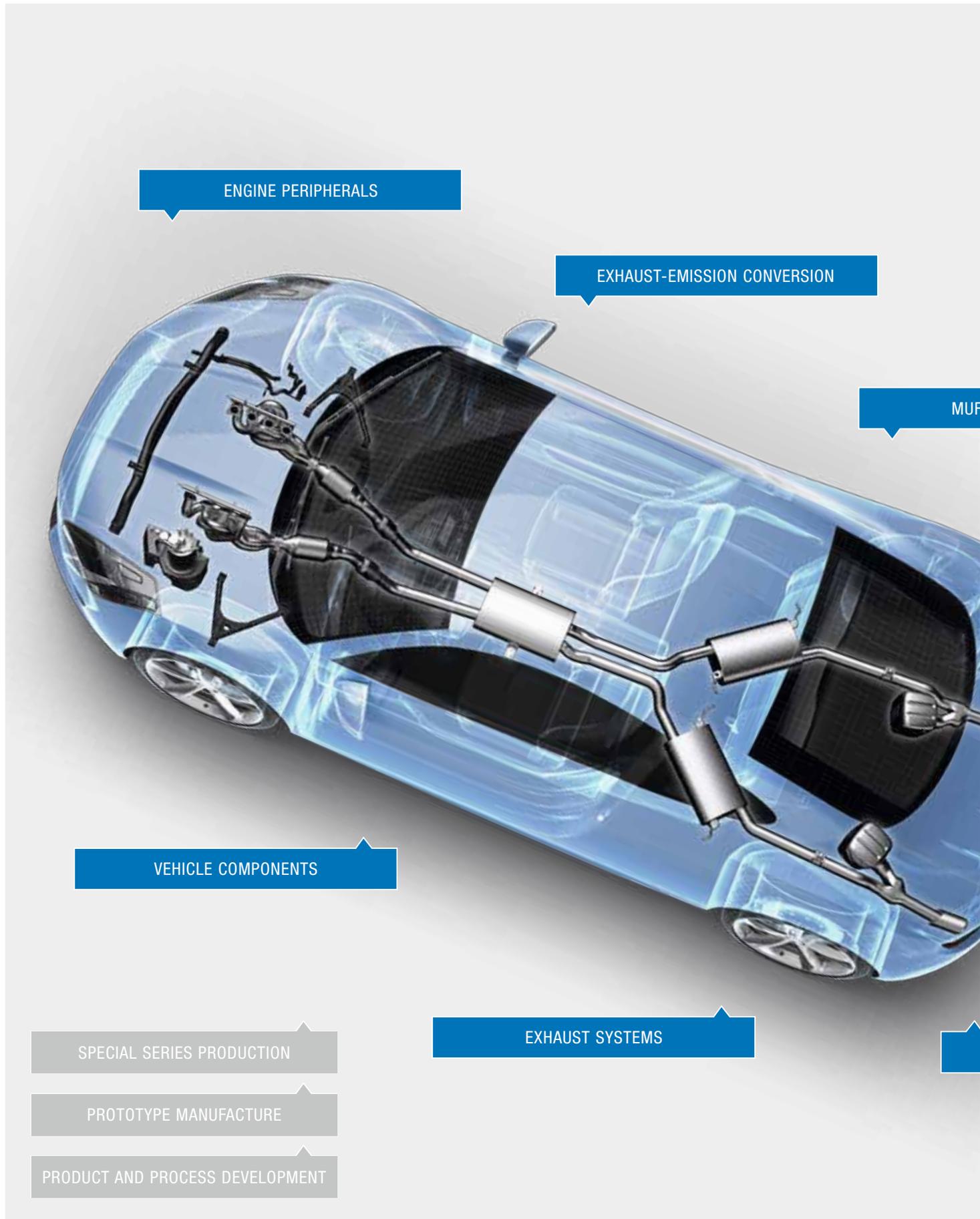
Prototechnik is a leader for innovations in lightweight, high-performance exhaust systems and vehicle components for the automotive industry and other areas of powertrain technology. As a precision manufacturer for special series, the company, which is part of the Eberspächer Group but operates independently, fills the gap between prototype engineering and large-scale production.

All Prototechnik's activities are founded on 30 years of experience in motor sports and special series manufacturing. The company is a highly specialised provider of high-tech exhaust systems, engine peripherals and metal components for racing cars – usually prototypes and once-off pieces. Automotive customers from all over the world now use this expertise, skilled craftsmanship and detailed knowledge of industrial manufacturing methods to realise lightweight engineering and high-performance projects, especially for exhaust systems.

The high-tech hub in Schwäbisch Gmünd near Stuttgart covers almost the entire product process, from development and design to jig and tool engineering, right through to prototype and special series manufacturing. It perfectly unites craftsmanship and industrial production, tests and perfects processes, technologies and manufacturing methods, especially in steel and lightweight metal working.

Prototechnik therefore offers its customers high-tech solutions for the most demanding projects and, as a technology centre for lightweight engineering within the Eberspächer Group, at the same time delivers important stimuli for innovations in large-scale series production. Prototechnik also profits from having unlimited access to the infrastructure of the group – which creates unique opportunities for a company of this size and therefore also its customers.

FAST AND FLEXIBLE



ENGINE PERIPHERALS

EXHAUST-EMISSION CONVERSION

MUF

VEHICLE COMPONENTS

EXHAUST SYSTEMS

SPECIAL SERIES PRODUCTION

PROTOTYPE MANUFACTURE

PRODUCT AND PROCESS DEVELOPMENT

COMPETENCE AND PERFORMANCE IN LIGHTWEIGHT ENGINEERING

FLER SYSTEMS



ACTIVESILENCE / ACTIVESOUND

Companies, especially if they work for motor sports, are similar to a racing team, in that highly motivated specialists work together in a close-knit and success-orientated way. The team will only win if they can flawlessly complete all the tasks required and deliver top results even in highly stressful circumstances and under time pressure. This brochure will show you how the combined skills of the Prototechnik team deliver this kind of unbeatable performance in the area of lightweight engineering.



USING INNOVATIVE IDEAS TO CONTINUALLY DECREASE WEIGHT

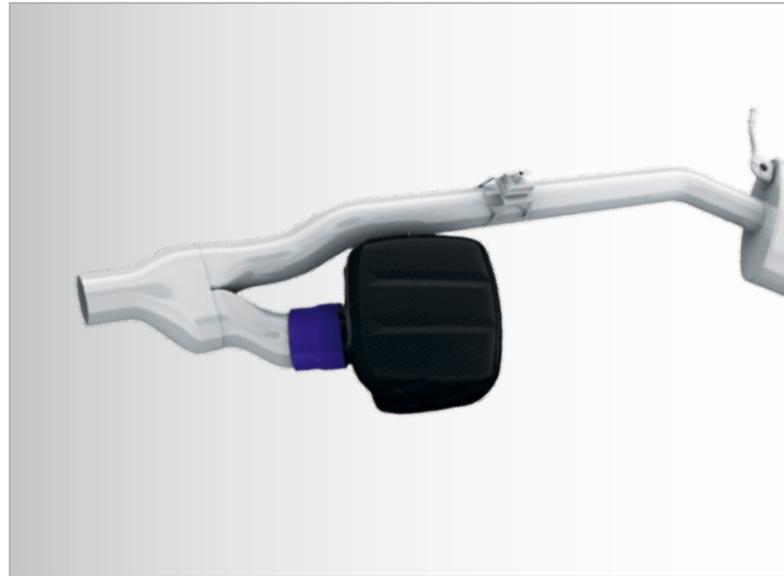
LIGHTWEIGHT ENGINEERING – HOW LESS BECOMES MORE:

The dictum "less is more" is generally attributed to creative minimalists in the areas of architecture, art and design. This motto, which emphasises the reduction of things to their essential elements, of course also equally applies to engineering activities in motor sports – and increasingly in automotive series manufacture. While the engine must reliably provide (the highest) performance, all the other components of a vehicle must be designed to be as light as possible and sensible. Lightweight is the keyword – for achieving the best performance in all areas.

The exhaust system's contribution to the overall weight of the vehicle is fairly significant. The increasing demands on its function, stability and endurance are especially high. The solution to the issue of weight reduction lies in using the right materials processed in the optimal way. For this, motor sports provides the ideal environment to quickly test new solutions and approaches. Under the toughest conditions, new technologies and production processes can be tested or complete systems put thoroughly through their paces. The staff at Prototechnik use their many years of experience from motor racing and special series to find alternative, innovative approaches and leave behind habitual patterns of thinking in the development of new exhaust systems and engine peripherals. Their knowledge about the most diverse materials and their characteristics and processing options is the deciding factor in what enables them to develop really new, independent solutions – and these can then be produced exactly as the customer wishes in whatever quantity they like. The aim: always make more from less!

ENGINEERING – EXPERTISE AND PERFECTLY EQUIPPED:

Prototechnik has access to all current technology options in engineering. Whether in-house or within the Eberspächer Group: the combination of expert knowledge and technical facilities for carrying out lightweight engineering projects for exhaust systems, engine peripherals and vehicle parts is unique in the industry. Whether it's

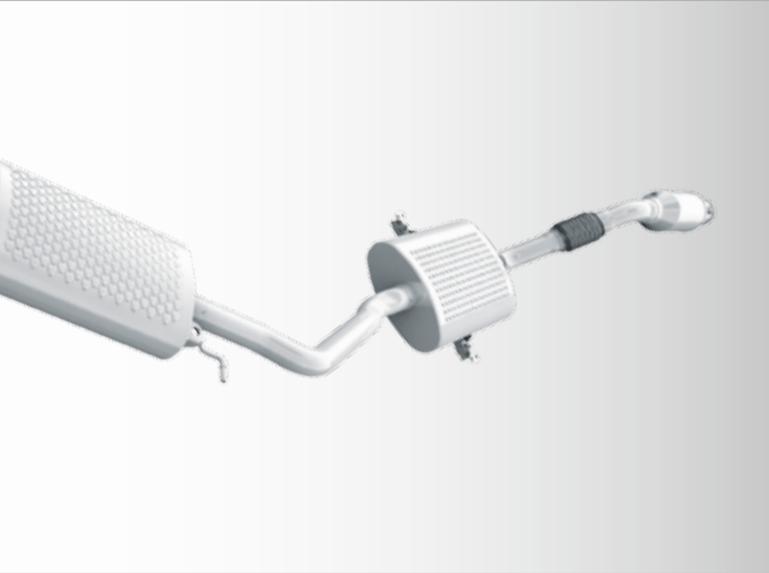


["Extrem" lightweight engineering study]

3D installation space analysis or geometric design, whether acoustic, vibration, flow or thermo-mechanics calculations – new systems can be examined comprehensively right from the early development phases and then be enhanced and/or optimised according to internal or external specifications. The foundation for all the engineers' activities is their wide range of knowledge in materials technology. These experts are supported by the most modern laboratory technology available – such as CT x-ray scanning or REM – and by Prototechnik's direct access to the Eberspächer materials lab. In-house enhanced analysis and simulations processes with a level of precision that is unrivalled in the industry also ensure processes are efficient and reduce the need for real testing, which in turn cuts down costs and time. Close links to universities and institutions in the region also ensure that there is a flow of information and knowledge transfer when it comes to the newest trends in materials, processes and production processes. And last but not least, the development team profits from close teamwork between engineering, prototype engineering and manufacturing, and the rapid exchange of information that this allows. All of this guarantees that Prototechnik will retain its competitive edge into the future.

JIG AND TOOL ENGINEERING – ALL FROM THE SAME SOURCE:

One of Prototechnik's strengths is in-house jig engineering, which recently has been significantly expanded and now includes the most modern CNC machinery and technical facilities. All of the jigs and tools required for prototype engineering and series manufacture are engineered, built and calibrated for operation at Prototechnik. The team's work covers everything from analysing briefs to design and simulation, right through to manufacturing the hardware – all in-house of course. The high level of expert knowledge and the close proximity of the different departments in the company guarantee that manufacturing lead times are reduced and optimisations can be



directly implemented in a continuous process. And this is the only way to ensure that specific customer requirements are implemented more rapidly on the way to production start-up.

PROTOTYPES – TRADITIONAL CRAFTSMANSHIP WITH THE HIGHEST PRECISION:

The maxim of carrying out all steps in the process in-house to the greatest extent possible, from the first CAD design to the finished product, is what makes prototype manufacture at Prototechnik so unique. Whether it's individual components like oil or water lines for engines or exhaust components, right through to complete systems. Using their comprehensive know-how, our experts create exceptionally precise samples, once-off pieces and near-series parts using traditional craftsmanship. These prototypes deliver very accurate results for later series manufacture at a very early stage in the development cycle. The rich treasure trove of experience at Prototechnik really pays off for the customer here, in the truest sense of the word.

SPECIAL COMPONENTS WITH A REAL FUN FACTOR:

A particular challenge for the team of selected specialists and fans of sports vehicles are projects called "special series" at Prototechnik. These are projects that equip high-performance vehicles with series or optional components – mainly exhaust systems to increase performance or with exclusive sound design. Subsidiaries of large OEMs, which offer high-quality derivatives of mass-produced vehicles, place their trust in the expertise of the team from Schwäbisch Gmünd. The team then makes these projects, with the highest demands in terms of complexity, joining technology and processing, a reality. The perfect welding of titanium parts is one of the solutions developed and made available for use in special series by Prototechnik. All in all a challenge that also brings a real fun factor to the expert at work.



[Development and design]



[Jig and tool engineering]



[Prototype engineering]



[Special series production]

INNOVATIVE PROCESS TECHNOLOGY AS THE BASIS FOR SUCCESS

OUR MAIN COMPETENCY – JOINING MATERIALS:

A precise knowledge of material characteristics and the effect of processing on materials plays an important role starting from the development process: at Prototechnik, the right technologies are discussed and defined in an early exchange between development engineers and production experts. The latest results from constant research and pre-development work are continuously taken into account here. Added to this is close cooperation with manufacturers of production systems such as welding cells, configured according to Prototechnik's specifications or separately adapted and optimised during titanium manufacture for example.

SUCCESSFULLY PUSHING INDUSTRY BOUNDARIES:

Prototechnik uses conventional, i.e. standard, industry welding processes such as MIG/MAG welding, TIG welding and the orbital welding technique in unconventional ways for prototype and special series production, to process a wide range of different stainless steel, aluminium and nickel-based alloys as well as in manual processes and robotic systems. These specially optimised and derivative welding processes, for example the Force TIG and micro-MIG process, are always used when there are specific requirements in terms of visual appearance, low excess weld metal and welding spatter. As different material requirements, production volumes and



[Titanium manufacture]

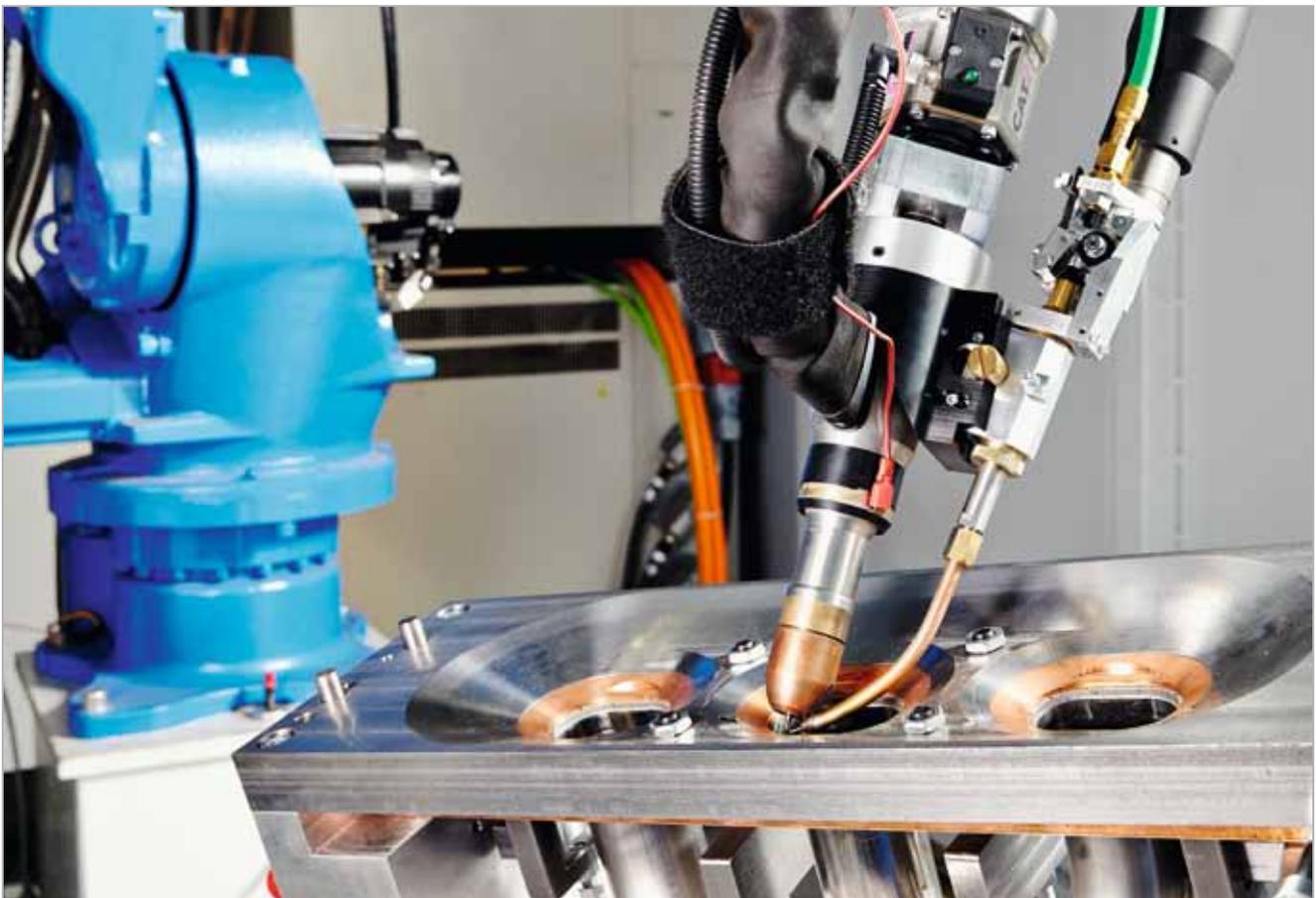
application areas need to be taken into account when considering the specific pros and cons of the many processes available, we advise discussing these possible solutions for upcoming projects with the experts at Prototechnik.

JOINING TECHNOLOGY IN TITANIUM MANUFACTURE:

Using the TIG process, Prototechnik welds titanium parts in protective argon atmospheres. This is done manually using the "glove box technique", well-known from medical technology and optimised by Prototechnik, or using two robotic systems that have also been configured and modified in-house to fit our own requirements – with exceptional results in terms of precision and speed. Along with TIG welding Prototechnik uses the MIG process, the advantages of which are a much higher melting deposition rate and welding speed than TIG, reducing production time and cutting costs.



[NC glove weld box]



[Force TIG NC weld robots]

INNOVATIVE PROCESS TECHNOLOGY AS THE BASIS FOR SUCCESS

ALTERNATIVE JOINING METHODS – MIG BRAZING:

How can you join two different materials that cannot be welded, such as stainless steel and titanium? This exciting question has been examined, discussed and finally answered by the joining technology specialists in the Prototechnik team: in MIG brazing, stability-optimised joining processes for hybrid joins are used – with outstanding results. Sample pieces that have been made with this brazing process are already in preproduction.



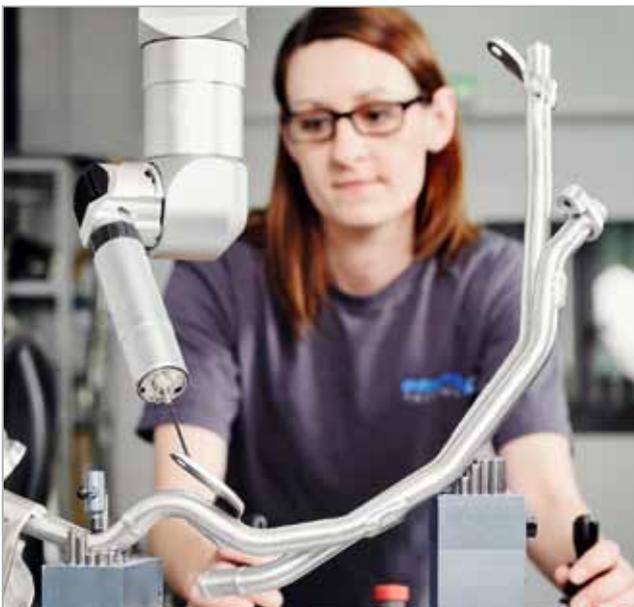
[Fully automated furrow screwing]

CAN ALSO BE USED WITH STAINLESS STEEL – FURROW SCREWING:

The process of furrow screwing has previously only been used for carbon steel and light alloys connections in series production. Working with partners, Prototechnik has implemented and adapted this time- and cost-effective screwing technique for series production so that it can also be used for stainless steel sheets. In this way, a permanently durable screwed connection between sheet elements is possible without any need for drilling, stamping or thread cutting.



[Hydroforming applications]



[Measurement with CNC portal coordinate measuring machines]



[Measurement with 7-axis measuring arm]

COMPETENCY FOR MOULDED PARTS – HYDROFORMING:

Along with expertise in the area of joining technology already described, Prototechnik has also achieved a high level of competency in the moulding of materials. Using interior and exterior hydroforming, complex shaped hollow and moulded parts can be manufactured with the highest level of precision. Hydroforming also provides exciting design possibilities and high formability for the widest range of component shapes and sizes. The flexibility of this production process in combination with different materials gives the developers at Prototechnik space to play around with new ideas again and again. That's why a specially designed hydroforming press with 1,500 tons of locking pressure and a table size of 1,000 times 1,200 millimetres is available in Schwäbisch Gmünd for prototypes and special series projects.

EVERYTHING UNDER CONTROL – MEASURING AND TESTING TECHNOLOGY:

Trusting your own skills is all well and good – but testing, especially with the highly complex production processes used in Prototechnik, is even better: in order to monitor the processes and to continuously improve them, the most modern measuring and testing technology is used. Plans for testing begin during the development phase and are based on internationally recognised standards. Dimensional tests are carried out by two coordinate measuring machines with a turning/swivel head and 7-axis measuring arm, while the specialists get down to the details in a fully equipped preparation laboratory and with semi-automated micrograph analysis. This means it is possible to test any process step being carried out in-house at any time. Furthermore, Prototechnik has access to the main Eberspächer Group laboratory: there, experts with REM and x-ray machines are available for further testing.

PRODUCTS AND MARKETS



[Passenger car applications]



[Diverse racing series]



[Non-road applications]



[Commercial vehicles – applications]



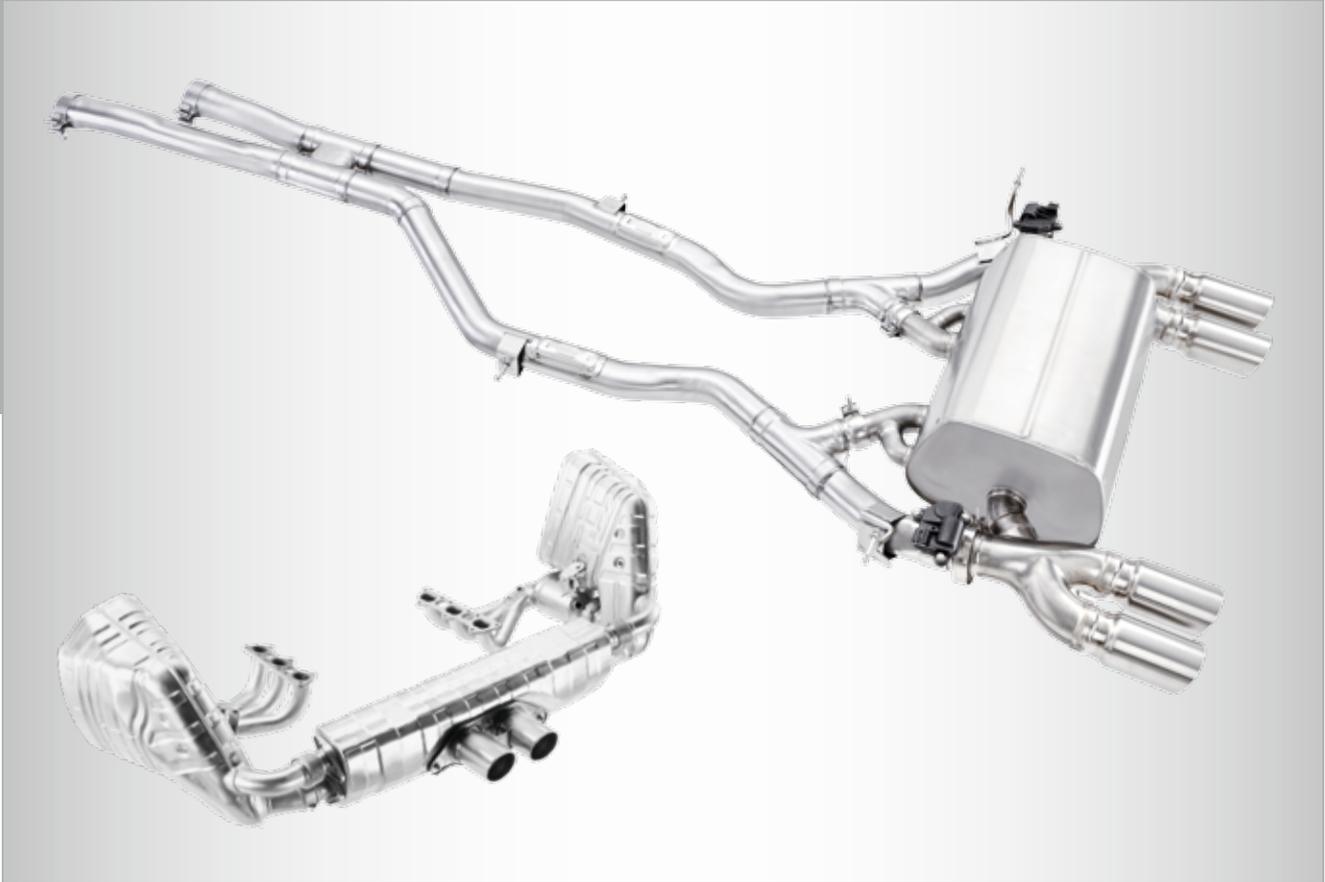
[Aviation]

PRODUCTS:

The product range spans exhaust components like manifolds and catalytic converters to complete systems with all of the standard exhaust aftertreatment components, as well as mountings, connectors and stylish tailpipe trims. We also manufacture components for engine peripherals, such as coolant pipes, fuel, oil and charge air lines, intake systems, oil and water tanks, swirl pots and drive train technology as well as chassis components. Special components such as roll cages for special applications, laser-cut and beveled parts and even complete jig constructions complement our product portfolio.

DIVERSE MARKETS AND COMPREHENSIVE PORTFOLIO:

Prototechnik delivers tailor-made solutions and systems anywhere where engines are used to move any kind of vehicle. Our products can be found in passenger cars with an emphasis on high performance and racing, motorbikes, special vehicles, commercial vehicles, 'off-road' applications and in the aviation industry.



[Complete exhaust systems of two different special series]



[Oil tank with integrated swirl pot]



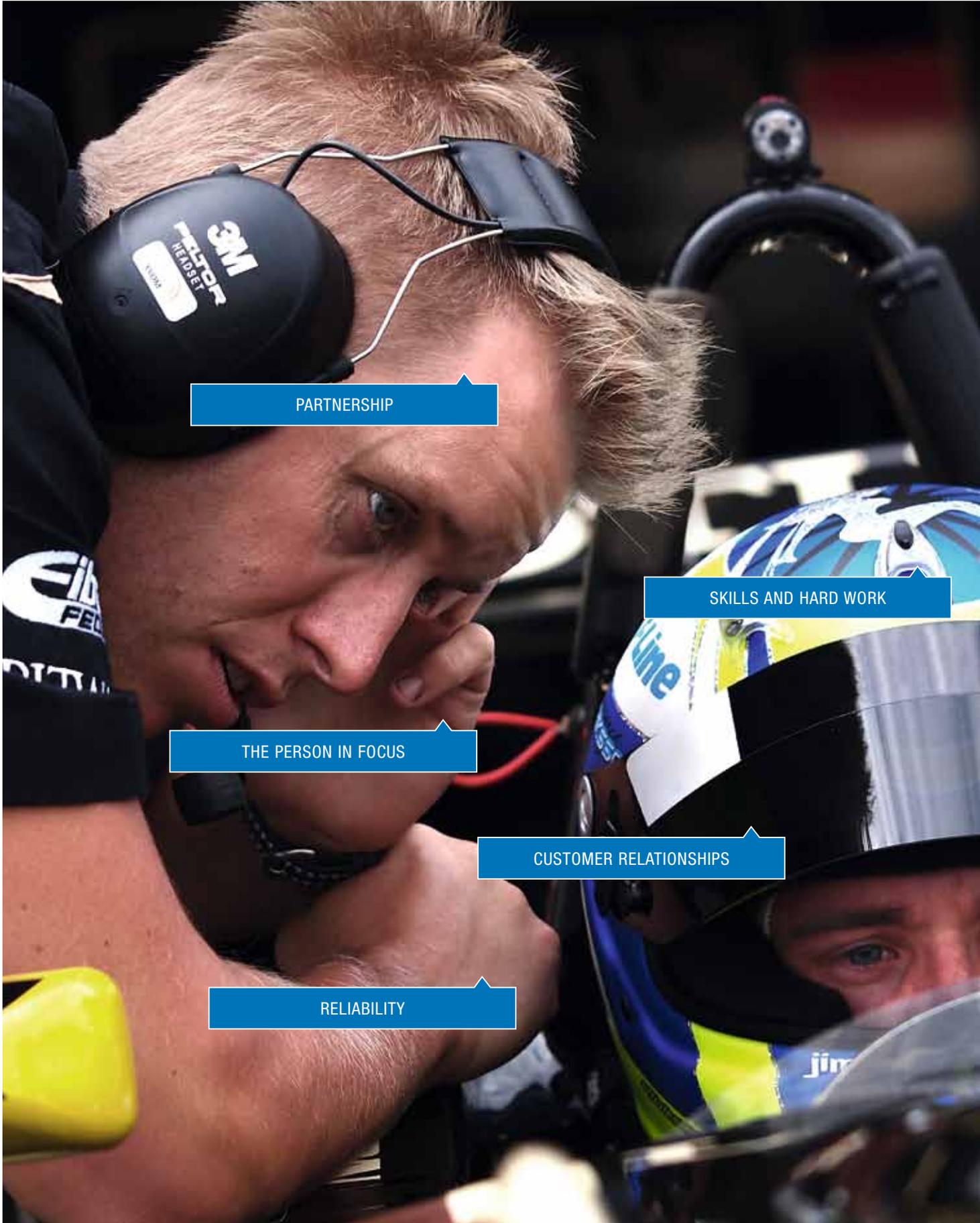
[Fuel distributor rail, water line]



[Euro-6 commercial vehicle exhaust system heavy duty]



[Fan exhaust for motor sports]



PARTNERSHIP

SKILLS AND HARD WORK

THE PERSON IN FOCUS

CUSTOMER RELATIONSHIPS

RELIABILITY

TRADITION AND PARTNERSHIP



As early as Roman times, when the border wall known as 'Limes' ran near Schwäbisch Gmünd, the region was already specialised in metal work. In the late middle ages, the region's craftsmen had become significantly wealthy out of the production and sale of scythes all over Europe. Gold- and silversmithery also have a centuries-old tradition here. The first goldsmith is mentioned in public records in 1372. From the middle of the seventeenth century, this craft continued to grow into the most important business in the then principality of Schwäbisch Gmünd. Roots in craftsmanship, skill and hard work still define the people in the region today. As a specialist company for complex tasks in metal processing, Prototechnik is able to access what must surely be a unique reservoir of excellent craftsmen as well as especially well-trained and motivated employees. On a foundation like this, unusual customer projects can be turned into reality, and that's how new ideas and real innovation are born.

An extremely important component for successful partnership is an open and constructive dialogue with customers – and this is demonstrated by the success of numerous projects for one-off pieces, prototypes and special series. Prototechnik knows its customers' expectations with regard to delivery times, quality and consistency of the products extremely well. Technical aspects do not need to be checked in detail every single time. This creates the potential for solid and reliable advice, also with regard to possible alternative technology, materials, manufacturing processes and scheduling. Both sides profit from this – and for decades it has resulted in long-term, sustainable partnerships.

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