IMPULSE

MAPAL TECHNOLOGY MAGAZINE | EDITION 84

Focus topic:

AUTOMOTIVE

Dear business partners,
dear readers,

what connects us with many of you is much more than a business relationship: it is a long-standing, evolved partnership based on mutual trust, an understanding of processes at eye level and a shared commitment to technological progress.

We endeavour to demonstrate all of these points in our technology magazine IMPULSE. This issue focuses in particular on our main sales market: the automotive industry. In this dynamic environment in particular, technological change requires a collaborative partnership and continuous development - and this is precisely where we see our role.

We continuously invest in new solutions, often far beyond the immediate customer project. One example of this is our 'generic component' approach, for example of the electric motor housing: a far-sighted development that enables us to react quickly, efficiently and customer-independently to new requirements from the market.

The reports in this issue show that this approach is worthwhile and is already bearing fruit. Our technologies and expertise are used where it counts: in practice, as the case study with NILES-SIMMONS and LTH Castings on the series production of electric motor housings demonstrates. This fills us with pride and confirms our claim to deliver not just tools, but functioning solutions.

We are continuously developing our portfolio and no longer just support you in tool technology, but along the entire process chain. In this issue of IMPULSE, for example, we report on our programming services at Schabmüller Automobiltechnik and our involvement as consortium leader in the ProdaaS research project. We are determined to continue along this path: for established components as well as for new markets and applications.

We are working intensively on our internal structures, processes and project workflows so that we can continue to support you efficiently in the future. After all, our aim is to provide you with even better support in achieving your goals.

One visible step in this context is the renaming of our company headquarters on 1 June 2025: the former MAPAL Fabrik für Präzisionswerkzeuge Dr. Kress KG will become MAPAL Dr. Kress SE & Co. KG. This new legal form strengthens our ability to act, ensures short decision-making channels and creates a future-oriented structure for the further development of our company group.

We would like to thank you sincerely for your loyalty and your impetus. We look forward to taking the next steps together with you.
I hope you enjoy reading IMPULSE 84.

Yours

Dr Jochen Kress

FROM THE COMPANY

FOCUS TOPIC **AUTOMOTIVE**

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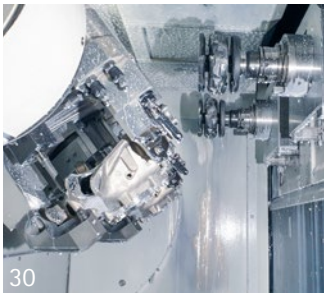

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PARTICULARS

DENILSON MISITI BECOMES NEW MANAGING DIRECTOR AT MAPAL DO BRASIL

MAPAL do Brasil has a Managing Director once again. Denilson Misti took charge of the Brazilian branch on 9 April 2025. He succeeds Conrado Couto Diniz, who had held the dual role of Managing Director of MAPAL Brazil and MAPAL Italia after moving to Italy at the beginning of 2025.

Misiti has 30 years' experience in the precision toolmaking industry and running global companies in Brazil. He was recently General Manager at MAPAL HiTECO TMS do Brasil, where he focused on tool management services. He is known for his practical management style, focus on the strategic achievement of sales and financial targets, and his employee and team motivation skills.

Diniz will offer Misiti his full support in the first few months in order to ensure a smooth and orderly transition. Misiti will simultaneously continue in his position as Managing Director of MAPAL HiTECO TMS do Brasil until a successor is found for this role.

FRANK DREHER IS NEW HEAD OF DISTRIBUTION FOR DACH-HU

With effect from 7 April 2025, Frank Dreher, Managing Director of August Beck GmbH & Co. KG, also assumed the role of Head of Distribution for the DACH-HU region.
In his role as Head of Distribution for the DACH-HU region, Dreher will report to Frank Stäbler. With his extensive experience in distribution and at MAPAL, Dreher will make a major contribution to taking the company's development forward.

Dreher's extensive experience in trade sales contributes to this. At August Beck GmbH & Co. KG, a large part of the product portfolio is sold via trade. Dreher's strong relationships with key partners and in-depth understanding of strategic development also contribute to this decision. In his previous work in aerospace, he also acquired the ability to work effectively in a matrix organisation and assist with sales.

The development of the trade/distribution sales channel is a major aspect of MAPAL's long-term strategy, particularly in the DACH-HU region, which is the company's main sales market. Dreher will implement and coordinate the global strategy on a local level in cooperation with Sergio Zanfrini.

PATRICK WÖSSNER JOINS SENIOR MANAGEMENT AT AUGUST BECK

Patrick Wößner has been a new member of the Board of Management at August Beck GmbH & Co. KG in Winterlingen since 1 January 2025. This makes the state-certified technician specialising in mechanical engineering the third member of the Board of Management at Beck, alongside Managing Director Frank Dreher and Armin Scherer, who is responsible for the commercial division.

Wößner's core responsibility is to continue advancing the automation and increase in productivity of manufacturing processes in Winterlingen. As he was previously responsible for production, construction and technology in the Centre of Competence in Winterlingen, he already brings the relevant experience to his new role.

"Automate, digitise, specialise. That's my motto", says Wößner, who suggests that investments in recent years at the Winterlingen site offer a very good foundation for boosting productivity. The use of new and innovative technologies and alternative manufacturing methods also contribute to this. "It's extremely important to me to ensure process reliability and high periods of autonomy and minimise manual work."

TOBIAS BAYERLE HEADS UP PRODUCT AND APPLICATION MANAGEMENT TOOLHOLDING

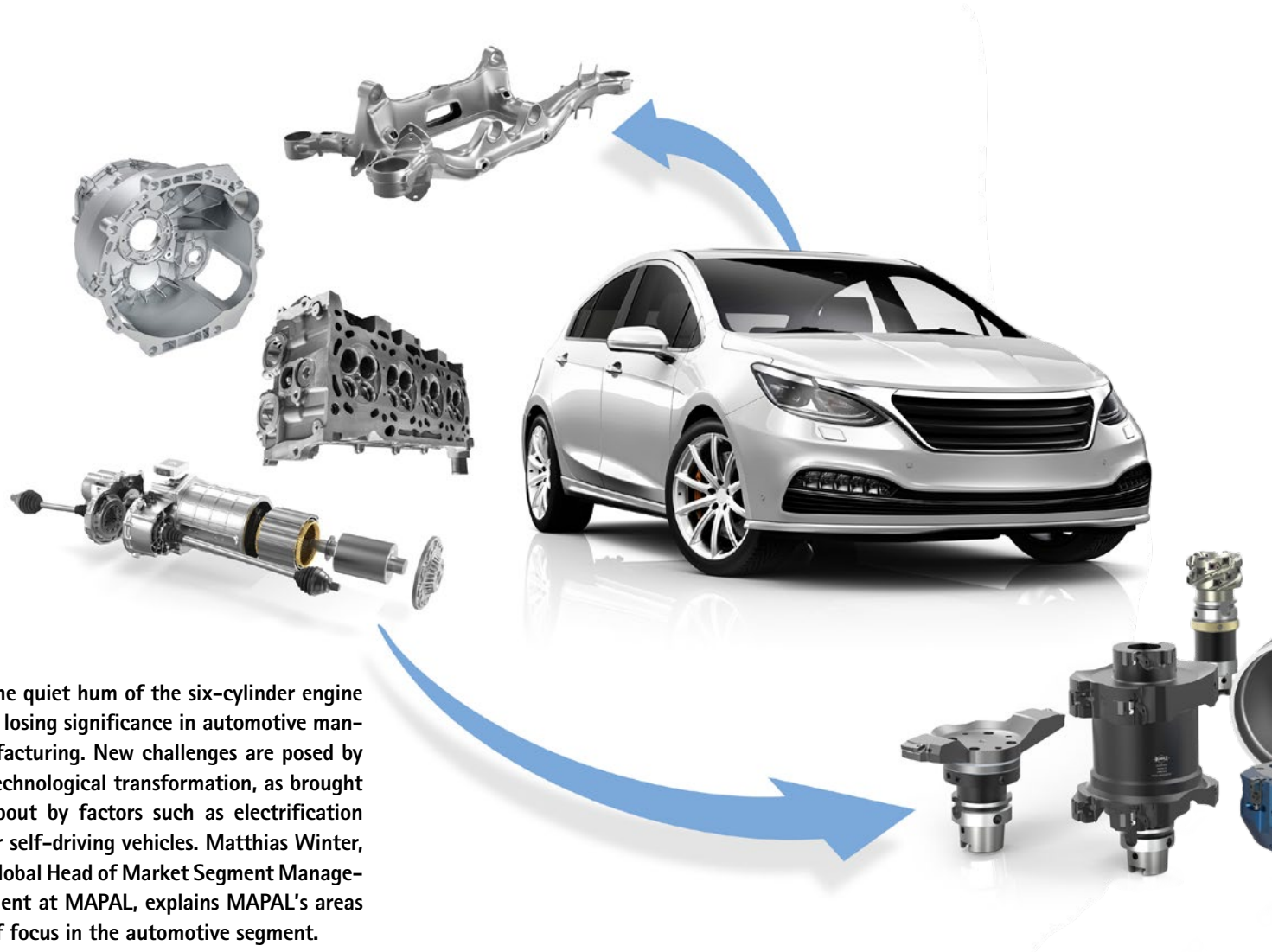
Tobias Bayerle, previously Manager Customer Service Key Account Management and Trade, took on the role of Global Head of Product and Application Management Toolholding at MAPAL Group on 1 January 2025. He succeeded Dennis Minder, who took on a new challenge outside MAPAL Group at the start of the year.

Bayerle has occupied various positions at MAPAL in Aalen since 2013, including in product management and in-house sales for clamping technology. In addition to his extensive specialist and industry knowledge, he is also experienced in managing various teams and has made a major contribution to the success of the clamping technology product group at MAPAL.

One of the key issues for Bayerle and his team in the coming months is the focus on developing the hydraulic chuck in general and expanding the capabilities of the UNIQ series in particular.

INTERVIEW with Matthias Winter, Global Head of Market Segment Manager

KEEPING PACE WITH THE AUTOMOTIVE INDUSTRY



The quiet hum of the six-cylinder engine is losing significance in automotive manufacturing. New challenges are posed by technological transformation, as brought about by factors such as electrification or self-driving vehicles. Matthias Winter, Global Head of Market Segment Management at MAPAL, explains MAPAL's areas of focus in the automotive segment.

What is MAPAL's strategy in the automotive industry?

Automotive manufacturing has been our core business for many years and it will stay that way. Alongside aerospace and general machining, automotive is our biggest primary segment. We have structured this segment in four component divisions, which we keep a close eye on. They are each led by their own Component Manager. These divisions are chassis and brakes, combustion engines, e-mobility with electric motor, battery and attachments for thermal management. The fourth division, driveline, includes everything from the coupling to the wheel, i.e. gearbox, differential housing and constant-velocity joints as well. While large automatic gearboxes are essential in combustion engine vehicles, battery-powered electric vehicles do not need them. Instead, they rely on constant-velocity joints, for example. The common thread that runs through our strategic assessments comprises the market, components and solutions. Based on the market, we recognise driving factors and understand key players.

What do you think about market development?

Vehicle production volumes are predicted to grow between now and 2030. However, this growth mainly comes from electric vehicles. A decline is expected for combustion engines, at a higher rate for diesel than petrol. Right now, the momentum towards electrified mobility has certainly slowed, but this transformation will continue to make ground. As 60% less machining is required for a battery-powered electric vehicle, this isn't a positive development for us to start with. When drawing up strategy, we therefore can't rely on

"Vehicle production volumes are predicted to grow between now and 2030"

Matthias Winter,
Global Head of Market Segment Management at MAPAL

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1 *A special focus of the market segment automotive lies on battery frames for electric motors. MAPAL developed a generic component for the focus component and standardised machining processes up to a certain point.*

the combustion engine continuing to carry us. But this will be an ongoing process over the coming years with a pace that varies depending on the region, so we can adapt and respond accordingly. We're on the right track here.

How is MAPAL using the time to react?

New technologies also give us the opportunity to launch our own solutions on the market. To experience market trends up close, there is a strong alliance between our segment management and sales. It has eyes and ears on the market and gets information on new developments in components and any changes in production processes from customers. This allows us to constantly tailor our range of solutions to changing requirements.

Generally speaking, how do you define components that are of interest to MAPAL?

We take a very structured approach here and also have a data structure on the component level in our systems in the background. This helps us identify focus components that appeal to us. →

As a rule, they are of course components with a large machining component, for which a high level of accuracy is required. This means a large market volume cannot be the only criterion: After all, for instance, the market requires many gears. But as we don't have any serration tools in the portfolio, gears aren't a thing for us. It's different for cylinder heads. Large quantities of these are also required. They have challenging bores and require a high level of accuracy. We have very good tool technology to serve these requirements. The same goes for housings for electric motors, that also require a high level of precision. If we can supply or develop competitive products for this with our product and service portfolio, we're on it. Our product management then develops the right solutions together with R&D.

With the transformation of the automotive industry, are new components also likely to come into play?

Yes, of course. Think of the stator housing for electric vehicles, first of all. This isn't a brand-new component any more, but there was still a great deal of variance here until recently. The geometry has now stabilised. And there are still always new developments, such as cast-in steel bushings that hold bearings. Machining solutions are certainly a challenge. If we look at the exploded view of an electric motor, we can see even more components that may be of interest to us. In addition to the stator housing, there's the gearbox housing, bearing cover, and housing for the power electronics.

Self-driving with by-wire technologies is leading to new components in the area of chassis and brakes. Here, we've developed machining solutions for a combined brake housing that is required in systems with no hydraulic lines. In their basic functions, the new components are similar to the previous ones, but they introduce more sensor and actuator technology into the vehicles. What matters to us is how this changes parts that are also subject to mechanical processing. Irrespective of individual components, the trend continues towards aluminium, which offsets the additional weight of batteries through more lightweight construction, for example.

How do you implement further developments of components? The solutions portfolio you described for a component is tied to a specific component design, isn't it?

If requirements change, we of course adapt our range of solutions accordingly. To understand requirements and features of important focus components, we like working with sample components, which we call generic components. After all, no client wants to be a guinea pig for tool developments. That's why we use our own components here, which demonstrate the real functions as required by industry as clearly as possible. We use generic components like these for electric motors, for instance. Of course, a component's core characteristics may change with time. These may include additional machining steps, higher accuracy or other materials. That's where we need to step in where required and modify our sample component, whose design isn't set in stone. For instance, a lot has happened with valve guides in the past 20 years, in terms of both size and materials. We had to keep launching new test series to continue developing our technology.

The quantities requested may also require changes. The design of a component does not change with the quantity to be produced, but in combination with process requirements, quantities do play a role. This brings us to other tool regions with performance or expert solutions, where more complex tools boost productivity and process capability. These machining solutions for strategic components, which are standardised up to a certain point, are available worldwide through our sales department, by the way. Their significance

2 *The Automotive Market Segment Management team keeps a close eye on the markets and their developments. Matthias Winter (2nd from right) with (from left) Michael Kucher, Johannes Geiß and Igor Ivankovic.*

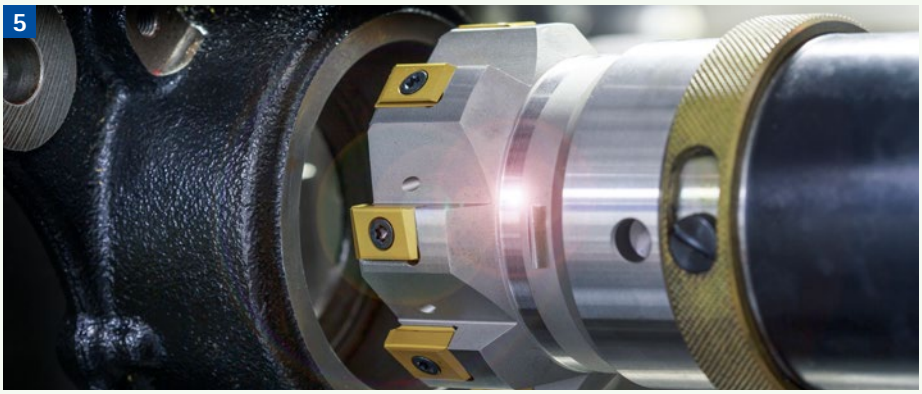
increases as the shift from local or regional production to global production intensifies. To serve our customers as best we can, we are pushing forward with our global footprint in this area.

What is this global footprint all about?

In this case, it has nothing to do with carbon. It describes our international setup and how we are able to swiftly assist our customers everywhere with our solutions. In addition to tool manufacture, these include the production of upstream processes, but also after-sales services in particular. For instance, if we deliver PCD tools from Germany to Mexico for an initial projection, almost no one wants to send them back for repair or regrind. It has to be possible there. Recent years have shown how fragile supply chains can be. Our customers view this more critically in their risk management than before, where everything was always trending towards globalisation.

3 *MAPAL also continuously introduces new and further developments for combustion engines. The picture shows, for example, a combination tool for the machining of valve seat and valve guidance with the HNHX cutting insert introduced in 2023.*

4 *The Bajonet Fitting System connection launched in 2024 is ideal for milling ball tracks in homokinetic joints.*



5 *HPR400 plus high-performance reamer for finish-machining the main bearing bore of a steel swivel bearing.*

How have supply chains changed?

At MAPAL, we run an ongoing supply chain analysis to identify production relocations. We observe these developments in order to respond to them at an early stage and set up appropriate support on the ground. We are also seeing increased outsourcing of production from automobile manufacturers to suppliers. I sometimes get the impression that the major OEMs want less and less to do with mechanics and prefer to dedicate themselves to the software defined vehicle. But with all software there is luckily still all kinds of hardware. We are the optimum technology partner for machining with our expertise in the market, components, solutions and our extensive product portfolio.

Thank you for the interview, Mr. Winter. ■

MAPAL fine boring tool in use at MAN

PUTTING HEADS TOGETHER FOR THE LAST DIESEL ENGINE

The optimised fine boring tool with guide pad technology for fine machining of the blind bore for the valve seat and valve guide. The EasyAdjust system with TEC insert is now used for valve seat machining. This means greater cost-effectiveness and very simple handling.

At commercial vehicle manufacturer MAN Truck & Bus's Nuremberg plant, production of an ultra-efficient new 13-litre diesel engine has begun. As a joint engine platform, it is intended for use across the group. Fine boring tools from MAPAL are used for the cylinder heads. These machine valve guide and valve seat blind bores.

MAN has started two key projects for the future at the Nuremberg site almost simultaneously. At the same time as the new diesel production begins, battery series production for the manufacturer's electric vehicles is going into operation. The plan is for up to 50,000 batteries to be produced here each year at over 50 assembly stations – with the option to increase this capacity to 100,000 high-voltage batteries by 2030. At over 35 metres tall, the new building is the tallest production building on the site.

Diesel engine production is directly opposite on an area spanning 23,000 square metres. As a process planner, Marco Singer is responsible for producing the cylinder heads for the D30 engine, newly developed from the ground up. The newly set-up battery production can be found opposite hall M17. Marco Singer describes the transformation to the electric drive as follows: "The electric motor is the ideal drive for a wide range of applications, such as city traffic. In other areas, however, diesel will continue to exist for a long

time to come." Examples he gives include uses in agriculture, the navy or the armed forces. A mix of different drive technologies will therefore be required for the future.

AN ENGINE FOR ALL BRANDS

The Traton Group, which includes MAN alongside Scania, Volkswagen Truck & Bus and International Motors, uses the Traton Modular System (TMS), whose components are in use across brands. This is how the group efficiently pools its resources, in keeping with the motto "you don't need to reinvent the wheel". The D30 engine is the joint engine platform for the whole group. From development and mechanical production and engine assembly to delivery to the various vehicle manufacturers, everything takes place at MAN in Nuremberg. It still even had its own foundry here until three years ago.

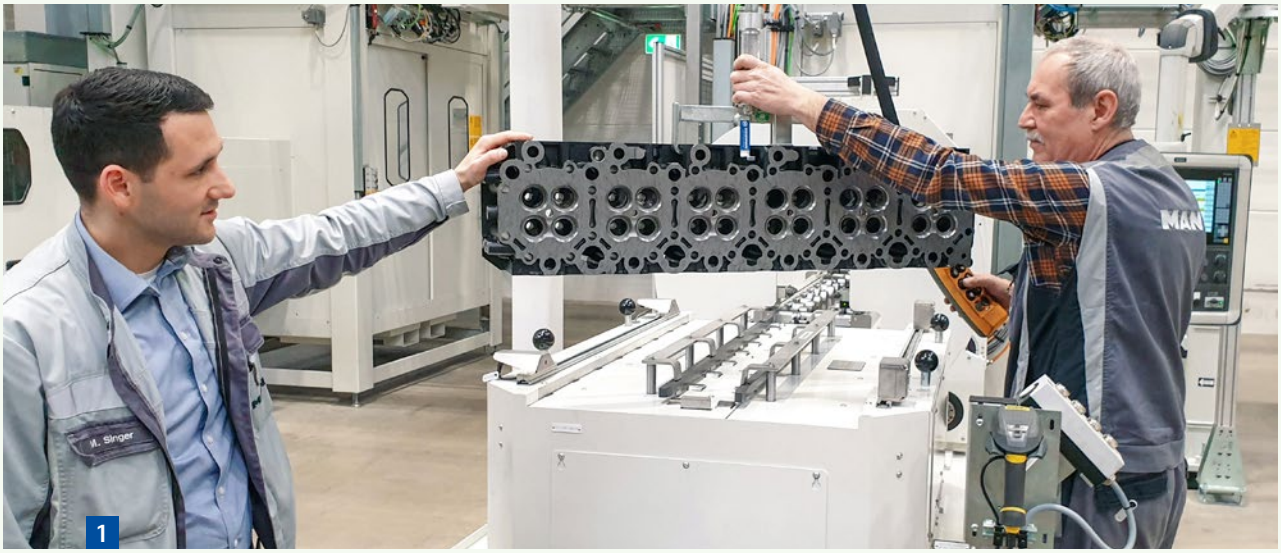
The D30 engine is based on a platform but is produced in six different performance levels, from 360 to 560 HP. It is the largest standard engine in the portfolio and intended for use in various vehicles, with a focus on 40-tonners in the lorry division. The D30 replaces the previous engine series D26 and D15. The innovative engine achieves a maximum efficiency of 50% and requires 5% less fuel than its predecessors, reducing CO2 emissions to the same extent.

MAN has invested around EUR 220 million in the production of the new engine, which will see up to 160 highly qualified employees work in three-shift operation. Technical capacity enables production of around 50,000 engines per year. "The actual production volume is based on demand. Whether this is used to its full potential is ultimately decided by the customers", says Singer. They have been somewhat reserved in recent years. For commercial vehicles, like for passenger cars, discussions on the shift to the electric drive have also caused uncertainty. As production starts up, work will initially be carried out in one shift.

A PARTNERSHIP LASTING DECADES

MAN has been working with MAPAL for decades. When tendering for the D30 project took place in 2019, the Aalen-based tool manufacturer was again awarded the contract for the fine machining of the valve guide and valve seat bore. This was down to the years of shared experience and a recommendation from the machinery manufacturer Grob, which is responsible for the complete process and tool design.

The engine's six cylinders each have two inlet and outlet valves. This means 24 bores must be drilled into the cylinder head bank. As the inlet and outlet diameters vary, tools of different sizes are required for their machining. Machining takes place on a double-spindle machine. It is embedded in a linked system with individual Grob machines that are loaded using linear gantries. ➔



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1 *For process planner Marco Singer (left) the cylinder head with its 6 cylinders and 24 valves is the head of the engine.*

2 *Thomas Teuber, Product and Application Management Fineboring at MAPAL (left), configures a fine machining tool for the valve seat blind bore together with Marco Singer, process planner at MAN. The MAPAL EA system has made this process much quicker, as fewer settings need to be configured manually.*

PROVEN TECHNOLOGY PRODUCES RELIABLE PROCESS

A further tool manufacturer was entrusted with fine machining in the project's initial phase. As a stable and cost-efficient process was not possible with its tools, however, MAN ultimately shifted its full focus to the collaboration with MAPAL. The Aalen-based company's first contribution was a fine machining system which has run on many machines in two production halls at MAN for many years. In close coordination with the client, however, the partners continued to develop the system and achieved significant progress.

Singer hails the achievements: "The machining changed fundamentally. For instance, we saved a semi-cut and were able to do without pilot friction. Instead, we simply moved to our pre-machined diameters with the indexable insert tool, ensured a good bore entrance for the reamer, and then ultimately reamed through once. Experience helped us design the process in the best possible

3 *Narrow tolerances are defined for machining the four valve seats per cylinder.*

4 *Marco Singer, process planner at MAN, among Grob's linked production machinery.*

5 *The ultra-efficient new 13-litre diesel engine MAN D30 is expected to be the last generation of the diesel engine from Nuremberg. Battery production has begun at the Nuremberg site at the same time. ©MAN*

With the tool technology for pre- and fine machining of the blind bore for the valve seat and valve guide from MAPAL, MAN Nuremberg made a positive impact on the 13-litre diesel engine's cost efficiency.

way." The production concept achieved a good machining quality and complied with the specified cycle time of around five minutes in total for fine machining of the valve seat and valve guide. The desired reliable and economical process was achieved. "This was accomplished despite the increased quality requirements for manufacturing the new engine", says Markus Meyer, who works closely with MAN as a technical consultant at MAPAL. For the valve and both valve seat blind bores, the tolerances are less than 20 µm. A tolerance of approximately 50 µm must be maintained from the seat to the guide. There must be no offset between the valve seat and the valve guide that could lead to undesirable shear forces. The surface finishes required are specified at an Rz of less than 20 µm. The cylinder head bank consists of GJV 450 cast iron into which more wear-resistant materials for the valves are pressed in the form of a ring and a guide.

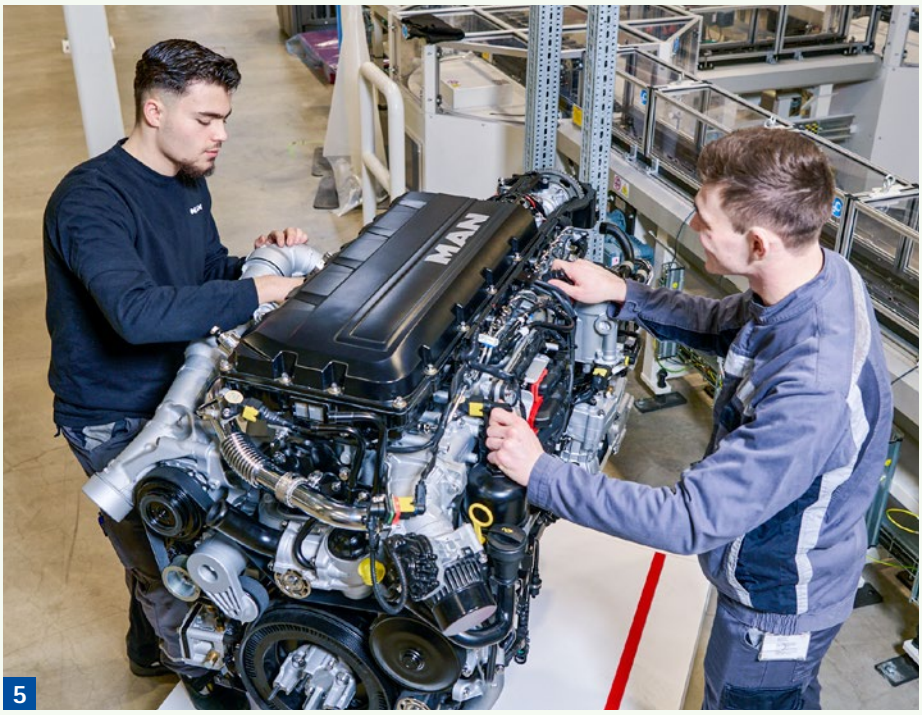
MODERN TECHNOLOGY REDUCES UNIT COSTS FURTHER

However, a series of joint workshops had further improvements in its sights, particularly with regard to unit costs. The aim was to reduce them further before series production began. MAPAL and MAN achieved significant improvements together through their professional partnership.

Simplifying tool handling provided the necessary leverage to lower costs per part – specifically the reduction of configuration time, making things simpler for the operator. For this purpose, MAPAL brought its EA (EasyAdjust) system into play. It was installed for the valve seat tool. In this system, the back taper on the blade is already integrated into the cassette, which acts as the connection for the insert. This feature completely eliminates the need to set the back taper on the minor cutting edge. Only the diameter needs to be adjusted. Thomas Teuber, Head of Product and Application Management Fineboring at MAPAL, summarises the practical benefit: "The operator no longer needs to keep an eye on two dial gauges. They can focus on just one dial gauge, which they can use to adjust the insert's protrusion compared to the guide pads. That's much faster." The EA system also involves an improvement in the inserts: The TEC indexable inserts used in the EA system have four cutting edges, i.e. twice as many as a conventional MAPAL reaming inserts. An optimised cutting material and innovative coating increase tool life and ensure an even more reliable process.

The modifications proved effective: In comparison to the original machining concept, valve seat and valve guide machining costs were reduced by around 40%. "I'm very happy with the milestone that has been achieved", says Singer, singling out the effective partnership with MAPAL for praise. The ambitious process planner aims to keep pushing forward with the continuous process of improvement.

The assumption at MAN is that the D30 will be the company's last entirely newly developed diesel commercial vehicle engine – after over 100 years of diesel engine construction at the Nuremberg site. As of 2030, every second vehicle delivered to customers should have an emissions-free drive. ■



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A technically sophisticated combination

BRAKE HOUSING FOR SELF-DRIVING CARS

Combined brake housing unites main brake cylinder, brake booster and ABS/ESP in a single part. This component smooths the way for self-driving cars and saves weight. When it comes to machining complex aluminium workpieces, MAPAL's solution expertise is very much in demand.

While self-driving cars are already permitted in various countries, the legal framework for them is still not in place in Europe, where only partial driving automation is permitted. The combined break housing – which unites the main brake cylinder, the brake booster and ABS/ESP in a single part – supports all levels of automated driving. Brake-by-wire is closely related to this, whereby the brake signal is no longer sent hydraulically but rather electrically.

While the combined brake housing is a prerequisite for automated driving, it also has further advantages. Because they are applied electronically, the brakes can be operated more quickly, which results in considerably shorter braking distances in an emergency.

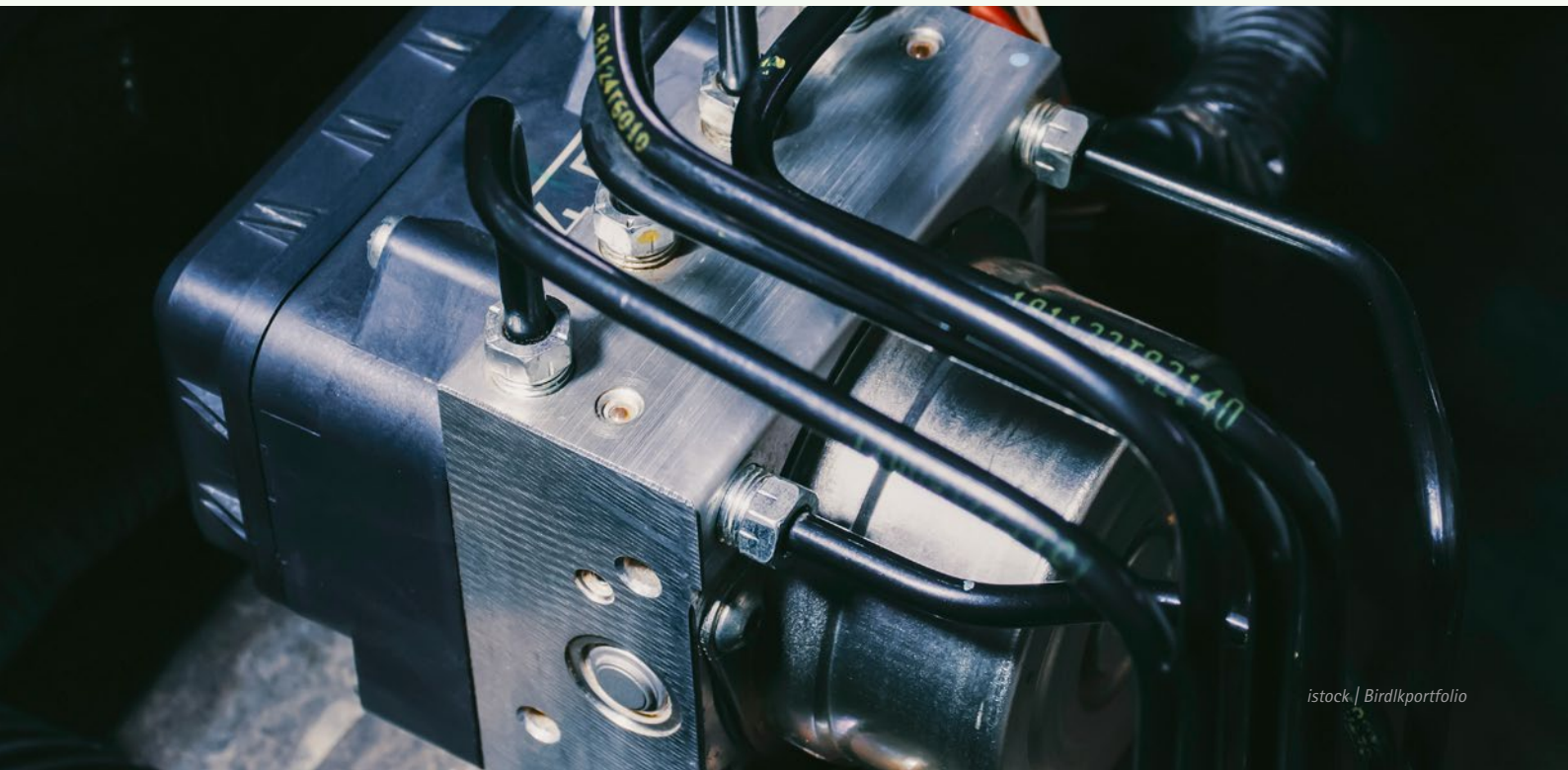
While the first automotive suppliers have already presented all-electric braking systems, vehicles only use a precursor today – the so-called wet-dry system. This hybrid form uses a hydraulic brake at the front and an all-electric system at the rear axle. This redundancy is made possible by a sophisticated central component that combines both worlds in the tiniest of spaces.

DEFINED CHIP BREAKING FOR SHORT ALUMINIUM CHIPS

Aluminium with a low silicon content of less than 1% is the material of choice for the combined brake housing. To save costs, extruded profiles are used for the most part. Long chips are created during machining due to the grain flow and the low silicon content. To ensure excellent chip breaking when boring and reaming aluminium with low silicon content using PCD blades, MAPAL makes use of application-specific chip-breaking geometries. Their special topology, which was developed with the help of 3D simulations, ensures defined chip breaking and thus short chips, even at low feed rates and machining allowances. This enables maximum performance and process reliability.

With its many bores, the part then looks like Swiss cheese. Each bore has tight tolerance requirements, calling for precision in the IT6 to IT7 range. Because liquid flows through the combined housing, there are high demands on the surface finish. The surface must be free of scoring which can be formed by chips or vibration during machining. Some bores are subsequently anodised to provide more resistance to wear. Rawness of Rz 1 is required to hold this coating.

MAPAL provides customised tools to machine the combined brake housing. These include a special carbide step drill for pre-machining the motor bore. Afterwards, PCD tools with many cutting edges are usually used to achieve the desired surface quality. The different contours of



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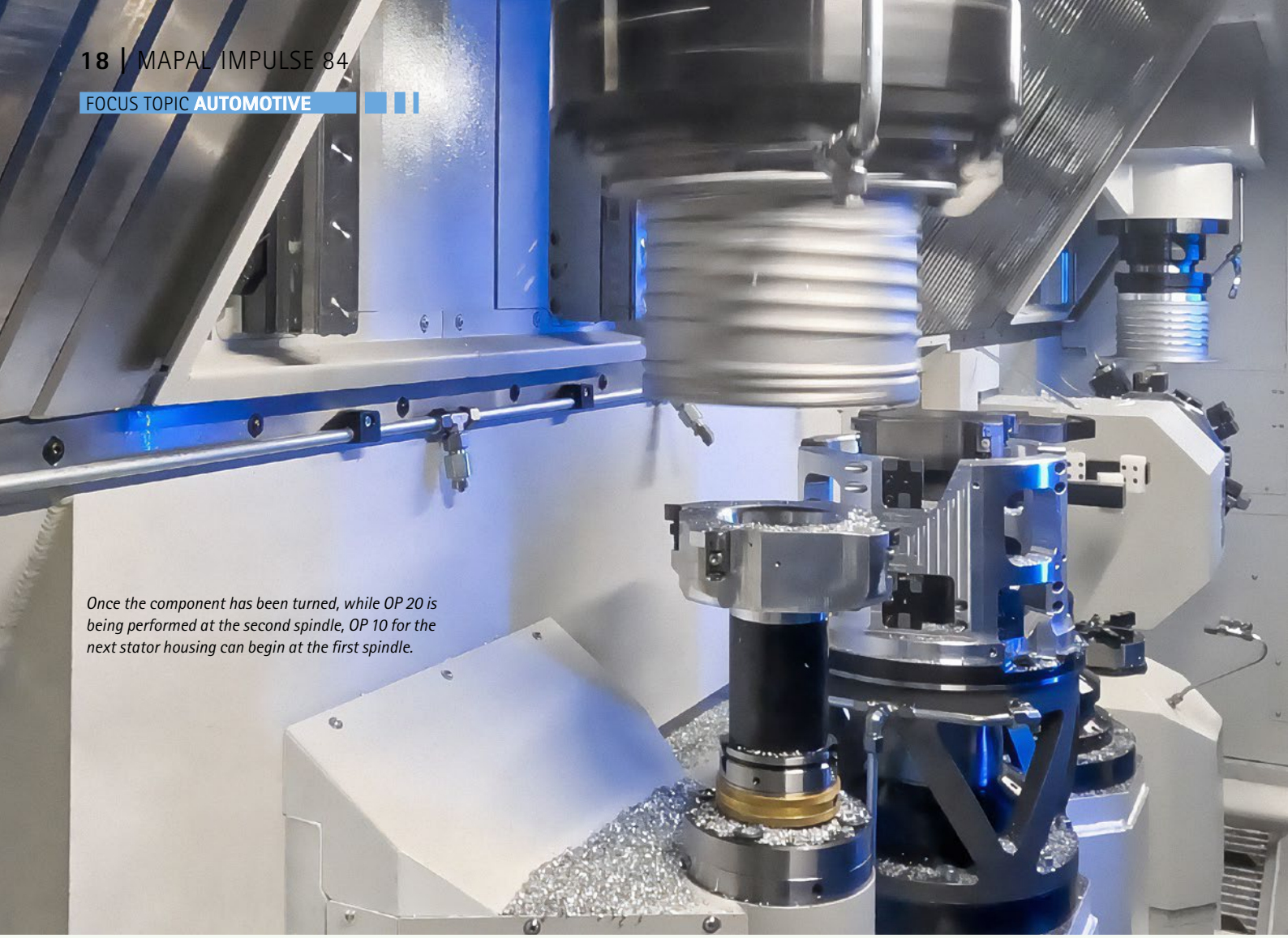
MAPAL's solution expertise is in great demand for the machining of combined brake housings made of aluminium.

the valve bores are created with a circular milling cutter featuring very high contour accuracy. Various deep bores are also drilled in the aluminium block, which overlap inside the component. Twisted tools with machining depths of up to 30xD ensure chips are removed reliably, so the liquids can later flow unhindered. The deep drilling alone takes up about 20% of the cycle time of approximately 15 minutes. Economical bore machining solutions thus have a considerable effect on overall cost efficiency.

Up to 5 million of the combined brake housing units are produced each year. They are predominantly produced in multi-spindle machines in two clamping setups. A four-spindle machine is preferred due to its high productivity. As a technology partner, MAPAL works with its customers to develop application-specific machining processes and tool packages for these aluminium parts. ■

Application-specific chip-breaking geometries from MAPAL ensure excellent chip breaking when using PCD blades to bore and ream aluminium with low silicon content.



Once the component has been turned, while OP 20 is being performed at the second spindle, OP 10 for the next stator housing can begin at the first spindle.

NILES-SIMMONS and MAPAL set new standards

STATOR MACHINING SOLUTION READY FOR SERIES PRODUCTION

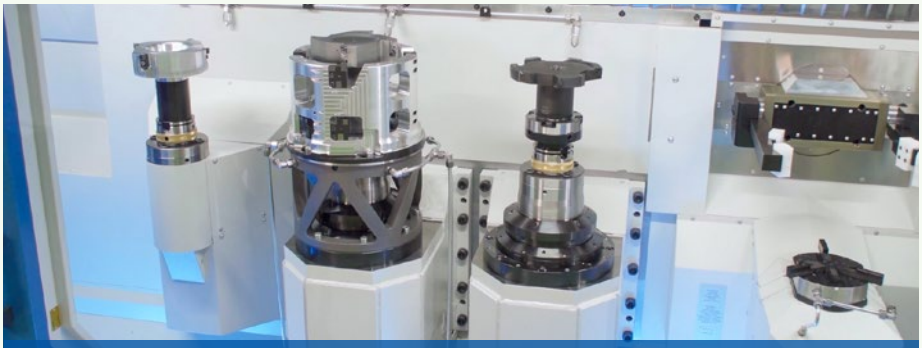
A process for the complete machining of stator housings for electric motors developed by the Chemnitz machinery manufacturer NILES-SIMMONS and tool manufacturer MAPAL has made it to series production. Suppliers and OEMs are now using it to produce high-efficiency components designed for drives for battery-powered electric vehicles and hybrid models from major automotive manufacturers.

Both manufacturers recently proved in a development project that highly cost-efficient and precise production of stator housings is possible on a pick-up lathe. The thin-walled aluminium components are required for the drive in electric vehicles. They are ribbed on the outside for the cooling circuit and are installed in the larger motor housing.

While a converted modular lathe had been used by NILES-SIMMONS during the development stage, a machine specifically designed for stator production now hit the market. The basis for development was the vertical machining centre from the RASOMA brand, which, like NILES-SIMMONS, is an NSH Group (NILES-SIMMONS-HEGENSCHEIDT GmbH) brand. Both brands are organised together in the NSH Group subsidiary NSH TECHNOLOGY and have pressed ahead with the development together. The name RASOMA DZS 400-2 indicates that it operates with two workpiece spindles.

For use in series production, the machine was equipped on the sides with a pick-up area for raw parts and a drop-down area for finished parts. The components are supplied and removed via conveyor belts. With manual assembly, a buffer of ten to twenty components can be used via automation. This makes operating multiple systems possible while the employee can pursue other processes alongside production. "We have realised highly simple automation as standard. No robots or blocks on the machine are required. Operators can place the parts directly on the pallet belt", explains Thomas Lötzsch, Sales Manager at NSH TECHNOLOGY. Fully automated workpiece loading and unloading for several machines with a central conveying system is optionally available. The machine is easy to integrate into an existing production

They brought the new technology to series production maturity (from left): Daniel Pilz (Project Leader NSH TECHNOLOGY) with the MAPAL sample component, André Ranke (MAPAL Regional Sales Manager) with a fine boring tool and Thomas Lötzsch (Sales Manager at NSH TECHNOLOGY) with a customer component.



The workpiece is taken to the different machining stations one after the other in the pick-up turning machine.

At the re-clamping station, the workpiece is turned 180 degrees and readied for spindle clamping.

At RASOMA, the next DZS 400-2 is currently being built. The pick-up area is on the left, the drop-down on the right. Various machining stations are set up between them.

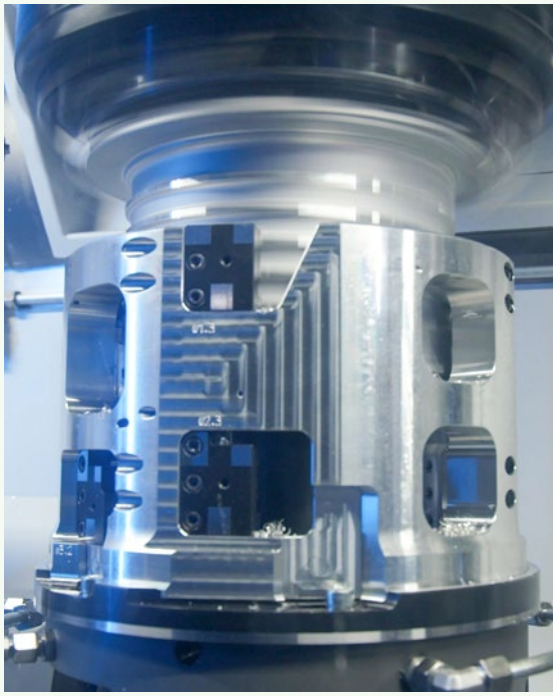
environment. The relatively compact installation dimensions of 7.50 x 2.60 m contribute to this. The basis for the design of the RASOMA DZS 400-2 was created in collaboration with LTH Castings, a partner with lengthy experience in casting and a specialist in machining complex, high-quality and thin-walled components from pressure die cast aluminium. Therefore, the design directly took practical experience and user requirements into consideration.

COMPLETE MACHINING IN TWO CLAMPING SYSTEMS

Between pick-up and drop-down, the complete finishing of the components takes place on the vertical machine in two clamping systems. A clamping device first of all picks up the workpiece from above and moves it to various machining stations in the machine one after another. At a re-clamping station in the working area, the part is turned 180 degrees and picked up by the second workpiece spindle for finishing. During the second clamping, machining of the next component begins at the same time at the first pick-up. ➔

The first step in machining is the pre-roughing of the component's various inner diameters. The tool stands still and only the workpiece rotates.

For the second machining step, the thin-walled component is placed in the gap between the inner and outer tool.



The difference in the tool speed and the workpiece speed produces the cutting speed at the inner blades. The bell-shaped outer tool stands still.

The machining steps follow one another, like on a miniature transfer line. The process begins with the pre-roughing of the component's various inner diameters. The tool stands still and the workpiece rotates. "Unlike conventional turning with a blade, machining with a four-blade ISO boring tool on an HSK-A 100 spindle takes just a quarter of the productive time", says MAPAL regional sales manager André Ranke. The next machining step, in which the rotating stator housing is machined inside and outside simultaneously with four blades each, is also extremely efficient. The inner tool also rotates. The difference in the tool speed and the workpiece speed produces the cutting speed at the inner blades. The bell-shaped outer tool stands still. The component is placed in the gap between the inner and outer tool for machining. This patented process reduces forces that occur on the clamping system. This makes it possible to avoid using a complex workpiece clamping device with vibration damping for precise machining of the thin-walled components. "When designing the tool, particular attention was paid to the large chip volume and the significant forces generated, as it is unusual for the inner and outer diameters to be machined simultaneously", explains Michael Kucher, Component Manager E-Mobility at MAPAL.

During finishing, only the fine boring tool is driven, while the component stands still. This prevents workpiece shapes that are not rotationally symmetrical from causing imbalances in the material and having a negative impact. The workpiece is then reclamped in the machine and the outer area that was previously clamped in the flange area is machined. The re-clamping station can also be used for another purpose: the workpiece is placed here before fine boring to relax the material. The machine has two tool revolvers for driven tools that carry out further machining based on component requirements.

FASTER AND MORE STABLE THAN EXPECTED

"The bottom line is that the RASOMA DZS 400-2 brings together the best of both worlds: the turning speed for pre-machining inner and outer contour with the accuracy of fine boring for finishing the inner contour", says Daniel Pilz, Project Leader at NSH TECHNOLOGY. The machine tool manufacturer and MAPAL contributed their respective core competences to this complete solution. With the serialisation of the machine, tool technology and process, the positive results of the prototype were improved even further. The process reliability achieved even exceeded expectations, allowing the targeted cutting speed of 700 m/min to be increased even further. "For this aluminium machining, the experience NILES-SIMMONS brings from the diversity of technology has a positive impact on the overall reliability of the tool technology and machine", explains Michael Kucher, Component Manager E-Mobility at MAPAL.

The RASOMA DZS 400-2 achieves a much shorter chip-to-chip time than a milling centre. This is because all tools are already in the working area and are only brought into working position by swivelling the revolver disc. This does away with all tool changes, reducing non-productive time substantially. Using this technology, a cycle time reduction of 50% versus standard turning was already anticipated in studies. During process optimisation, cutting speeds of 1,000 m/min were achieved using optimal cutting material. The additional optimisation of non-productive time resulted in even more time saving of 20%.

The process is so reliable that random sampling is sufficient for quality assurance. While all manufactured components were measured at first, the current recommendation is just one part per shift. Daniel Pilz uses figures to demonstrate that this is more than satisfactory: "The RASOMA DZS 400-2 with the special tools from MAPAL achieves a process capability index of over 1.67 for critical characteristics, such as cylinder shape, diameter and concentricity and thus meets industrial specifications." Customers for whom the machine is already in use achieve an annual output of up to 180,000 components produced in three-shift operation.

SUCCESSFUL AT HIGH VOLUMES

LTH Castings in Slovenia is among the first users of the serial process for stator production on the RASOMA DZS 400-2. The casting firm with a long tradition has over 100 casting cells and processes the raw parts on over 250 CNC machining centres. There are around 3,800 employees working at a total of six sites. Dr. Primož Ogrinec, CTO of LTH Castings: "With our all-in-one

solutions from the design to series production, we are a key strategic partner for the automotive industry. Our range includes component for drives, motors for battery-powered electric and hybrid vehicles, steering and braking systems." The RASOMA DZS 400-2 machines are loaded and unloaded by robots in the ultra-modern production.

Like most automotive suppliers, LTH Castings manufactures components for various vehicle models. The flexibility of the RASOMA DZS 400-2, in which only clamping devices and tools need to be re-tooled, is useful for the production of stator housings. "With a single system and using the new process, an optimum solution, manufacturer-specific in quantity and quality, was developed and brought to series production maturity", says André Ranke. Stator housing production is therefore possible up to a diameter of 500 mm and a component length of 500 mm.

"Every kind of housing we've seen can be manufactured on the RASOMA DZS 400-2 – and we've seen plenty of them", says Thomas Lötzsch. The project team also got a surprise when a major car manufacturer's housing design required an indentation on the inside of the component. The sample component from MAPAL, specially designed and produced for the process design, did not present this challenge. Yet MAPAL very quickly had a joint solution ready with the NSH Group specialists: Instead of the tried-and-tested fine boring tool, an ultra-precise actuating tool with four slides from the MAPAL product portfolio was used to create the desired inner contour. On the machine side, a connection designed in coordination with MAPAL was ready in a few days. It already achieved series production maturity during the ongoing order. As their development structure is now tightly networked, the two companies are able to react quickly to newly developed contours.

NEW BENCHMARK FOR LOW COSTS PER PART

The RASOMA DZS 400-2 with the tool technology from MAPAL has become established in series production and solves quality issues that occur on conventional turning and milling machines and horizontal transfer lines. Thomas Lötzsch tells of cases in which the required shape and position tolerances were not achieved with reliable processes and scrap was produced instead – up to 50%. Where the quality was right, cycle times left much to be desired and resulted in higher workpiece costs. An established process for manufacturing components was lacking.

As competition on price is tough among automotive suppliers, when the RASOMA DZS 400-2 was being developed, the focus was on keeping unit costs as low as possible from the outset. This goal was achieved with a combination of high machine availability, short cycle times, machined component quality and production with reliable processes. Current calculations indicate that machining, including tool costs, can achieve economical costs per part as a result. ■

Partners in development and users of the serial process, the LTH Castings team: from left Blaž Peternel (technology specialist), Janez Jelovčan (head of machining technology, Škofja Loka), Nejc Kapus (factory manager, Škofja Loka), Tatjana Cankar Mencinger (project leader), Tilen Štremfelj (head of project management), Dr. Primož Ogrinec (CTO). ©LTH Castings

MAPAL optimises machining for crankshafts and valve seats

TOOL SOLUTIONS FOR MODERN COMBUSTION ENGINES

Production figures for vehicles with combustion engines are in decline but are still very high, at around 75 million cars built per year. Ample reason for the industry to continue seeking ways to optimise series production. MAPAL is lending its support with new tool solutions for modern combustion and hybrid engines.

The automotive industry consistently prioritizes reducing cycle times and minimizing costs per part. With two examples from crankshaft manufacturing and valve seat machining, MAPAL shows how this can be achieved with the combination of processing steps and innovative tool technologies.

ONE-SHOT SOLUTION FOR DRILLING AND DEBURRING

The desire to save weight, and thus fuel, with less moving mass doesn't stop at a classic component like the crankshaft. To remove material, a central relief bore runs through the entire component. Due to the shape of the crankshaft, the tool repeatedly enters and exits the material during machining. How many times depends on the number of cylinders in the engine.

This also determines the length of the drill. To process the entire crankshaft in one go, tools with lengths between 600 and 800 mm are required. MAPAL achieves this with a modular system. The drill body is a special replaceable head holder with TTS (Torque Transfer System) connection that guarantees an extremely stable joint. The MAPAL connection features optimal torque transmission and high changeover and radial run-out accuracies. For the desired tool length, the tool holder is screwed onto an extension. The TTD replaceable drill head at the tip is available in various geometric designs depending on machine performance.

One challenge in machining is the burrs that occur in the metal when the drill goes in and out. These burrs were previously removed in a separate machining step. MAPAL now offers a one-shot solution for simultaneous drilling and deburring. This is made possible by a modular combination tool in which an additional chamfer insert is integrated into the chamfer behind the drill head. This SNAP18 module is a miniaturised deburring system that has been individually designed by HEULE Precission Tools for the application. For reliable forward and reverse deburring, a small spring controls the insert and ensures the pre-drilled diameter is chamfered to the nearest tenth and is not damaged during deburring.

This tool solution saves the user a step and a space for a tool in the magazine. The cycle time is reduced.

TWELVE INSERTS FOR VALVE SEATS

To reduce costs in the fine machining of valve seats, MAPAL has developed an innovative HNHX indexable insert. Like the predecessor model, the HNHX is also hexagonal, but twelve cutting edges can be inserted instead of six. The negative installation position enables this new indexable insert to be turned. A modified clamping star ensures maximum force closure and precise positioning in the insert seat. For the finishing of the valve seat ring, ultra-precise machining is required with regard to the specified tolerances and surface quality. With the HNHX, surface values of less than Ra 2.0 are achieved.

MAPAL recommends a combination tool for machining the valve seat and valve guide. In one machining step, the tool first machines the valve guide and then the valve seat with the HNHX indexable insert.

FURTHER INCREASE IN EFFICIENCY POSSIBLE FOR LARGER VALVE SEAT RINGS

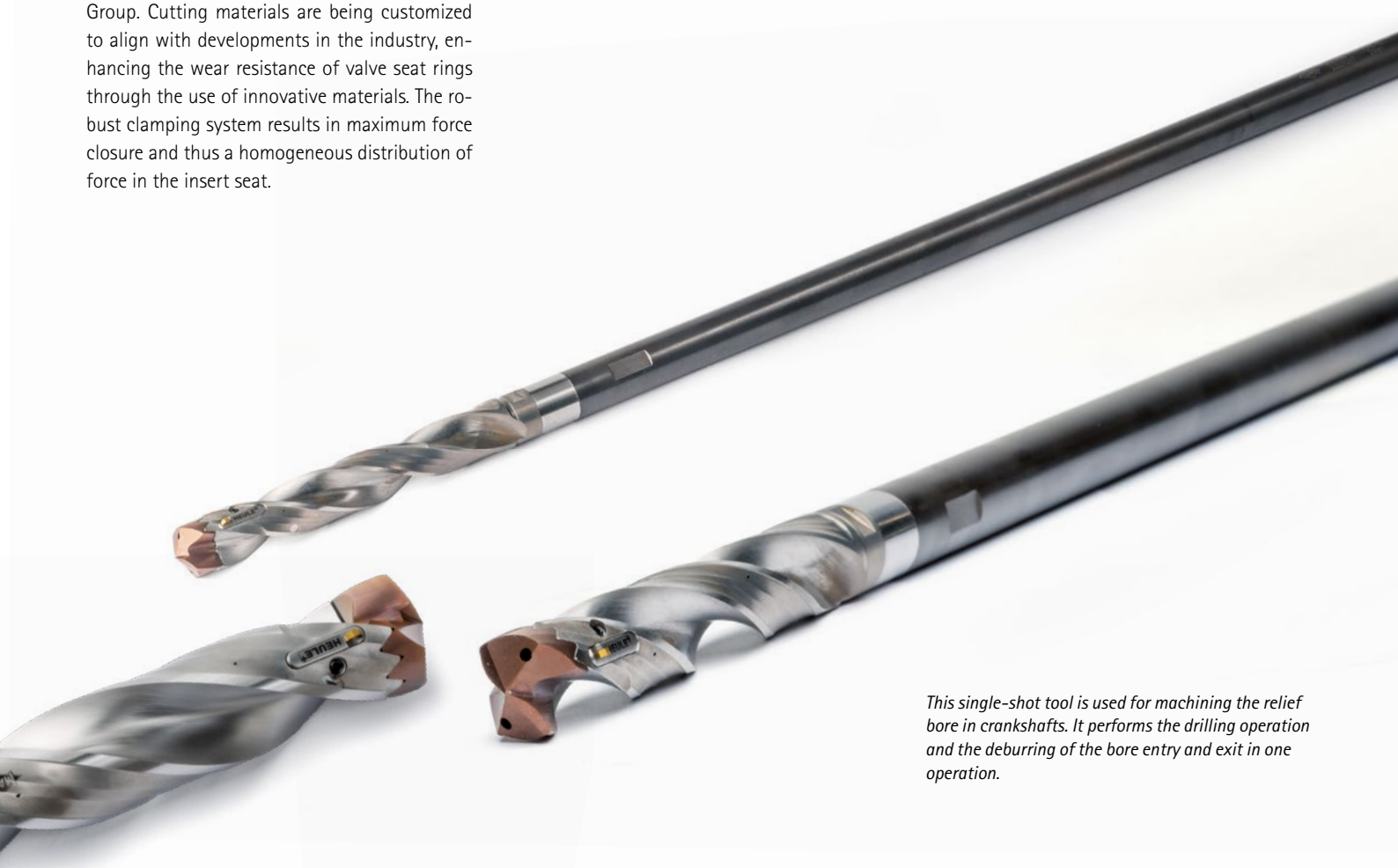
Depending on the valve seat design, the HNHX indexable inserts can also be used much more than 12 times. Where possible from a construction perspective, such as for larger valve seat rings in lorries, these inserts can be used twice, meaning 24 cutting edges can be used. This is done by removing the cutting edge at the end of its tool life and reusing it in a different angular

The HNHX indexable inserts have at least twelve cutting edges and thus raise the cost-effectiveness of of valve seat machining to a new level.

position. The cutting edges used are easy for the user to identify thanks to a corresponding coating. This enables simple repositioning in another insert seat and further processing using an as yet unused area of the cutting edge.

Doubling the number of cutting edges has a direct impact on the user's production costs: The costs per part halve as a result. Tool life is also increased by the use of PcBN high-performance cutting materials developed within the MAPAL Group. Cutting materials are being customized to align with developments in the industry, enhancing the wear resistance of valve seat rings through the use of innovative materials. The robust clamping system results in maximum force closure and thus a homogeneous distribution of force in the insert seat.

Despite the clear trend towards e-mobility, the development of combustion engines continues. Not least for use in modern hybrid vehicles. MAPAL is at its customers' sides as a technology partner and will contribute to further optimising their production in the years to come. ■



This single-shot tool is used for machining the relief bore in crankshafts. It performs the drilling operation and the deburring of the bore entry and exit in one operation.

Collaboration between CHIRON Group and MAPAL in the USA

TURNKEY SOLUTION WITH 78 TOOLS

In a factory in Charlotte, North Carolina, CHIRON America Inc. assembles turnkey solutions based on standard machines supplied by their German parent company in Tuttlingen. These solutions are customised to meet the specific needs of their customers. Once again, MAPAL was selected as partner and tool supplier for a CHIRON machine used in truck parts production.

CHIRON Group has been active in the United States since 1993, with a modern factory opening in Charlotte in 2001. The 7,000-square-meter plant employs 100 employees focused on adapting German-built machines to meet the needs of the American industry. From fine-tuning hydraulic systems to developing advanced automation and turnkey solutions, the focus is on delivering precision and efficiency. These machines are designed for efficient production of specific components and are delivered to customers fully equipped with software, clamping fixtures, and tools—ready for immediate operation.

CUSTOMER PROXIMITY IS KEY

Like CHIRON Group, MAPAL also operates in the United States with two production plants located in Port Huron, Michigan, and Fountain Inn, South Carolina. The precision tool makers and technology partners from Aalen/Germany recognised at an early stage that customer proximity was essential in the American market. This insight led to the establishment of MAPAL's first international subsidiary in 1977. It began in New Jersey with the reconditioning of MAPAL tools. As MAPAL expanded into the automotive industry in the following years, business grew significantly. It soon became clear that the small factory was no longer sufficient. The next logical step involved setting up a manufacturing site closer to key automotive customers. MAPAL opened its production site in Port Huron in 1995 with a focus on manufacturing and reconditioning of high-precision tooling, such as reamers with guide pads. Through its proximity to Detroit, the company was able to provide faster response times and comprehensive technical support to customers.

By consolidating technical knowledge within its international Centres of Competence, MAPAL expanded its know-how and expertise in the manufacturing sector. In 2019, the precision tool maker expanded further by opening a second factory in the southern region. The Fountain Inn site enhanced sales, service, and manufacturing capabilities, complemented by a state-of-the-art aerospace test centre. Today, MAPAL Inc. manufactures solid carbide and PCD tools at both sites using technology and processes that adhere to the MAPAL Group's global standards. The tools include drills with one or more diameters, form cutters, reamers, and tools for composite machining – all of which are also reconditioned in-house.

CHIRON Group and MAPAL have been cooperating in North America for nearly as long as the machine tool builder has been present in the region. As a trusted OEM supplier, MAPAL has supported CHIRON Group's work across the automotive, aerospace, and medical technology industries, as well as their suppliers. "To offer our customers the best solutions, we need reliable partners – a quality MAPAL has consistently demonstrated," says Jesus Flores, Lead Project Engineer at CHIRON Group in Charlotte.

DEMANDING COMPONENTS

In the most recent project, MAPAL provided a complete solution for a truck manufacturer, supplying all the tools and process design. The component being produced is the front transmission housing for a large truck diesel engine. To ensure a smooth start, MAPAL supported the customer with on-site run-off support and expedited optimised tools, keeping the project on track from day one.

This highly complex component with many bores and a complicated form is machined out of aluminium A380 die-casting alloy. The customer aims to produce 120,000 units per year.

2 *Two of the 600 x 600 x 450 mm components can be machined simultaneously on the DZ 25 P five axis from CHIRON Group. ©CHIRON*

3 *Application engineer Kaylee Loyst loads the machine's tool magazine. All 78 tools come from MAPAL. ©CHIRON*

Empower Your
ALUMINIUM MACHINING

1
CHIRON America Inc. has had a modern factory in Charlotte since 2001. ©CHIRON

The double-spindle machining centre DZ 25 P five axis has been developed by CHIRON Group for highly productive machining of components with large-scale production. ©CHIRON

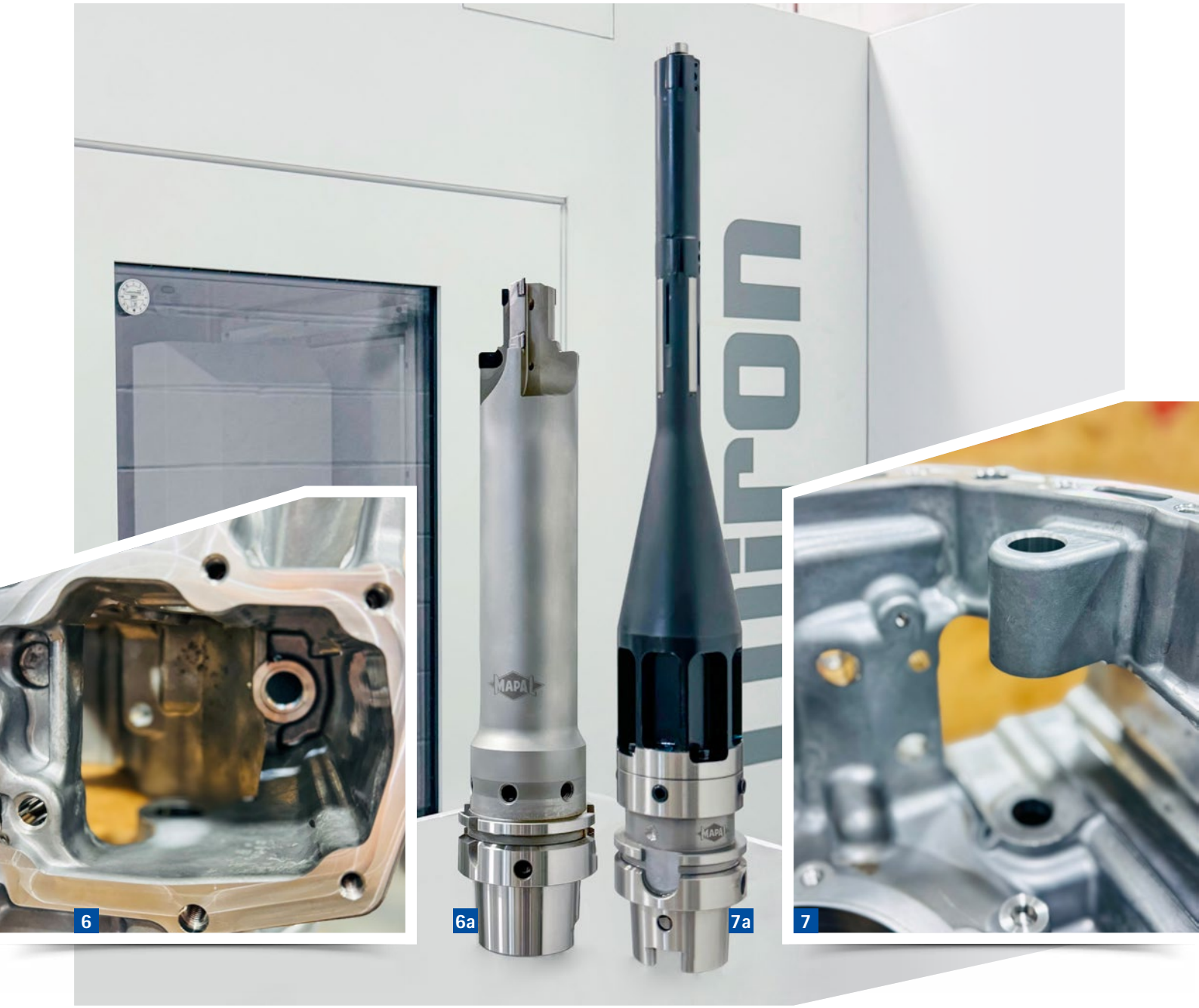
With a potential production run of six to eight years, the total number of units could reach a million before a design modification may occur.

Efficient manufacturing is key to produce the required production volume of transmission housings. The double-spindle machining centre DZ 25 P five axis has been selected for this task, which CHIRON Group has developed especially for the productive machining of components with large volumes.

Its rigid structure allows for high axis acceleration and rapid traverse speeds, ensuring dynamic and precise machining. In the spacious working area, the machine can process two 600 x 600 x 450 mm components simultaneously. In the first step, the workpiece is clamped in its delivered state in order to perform pre-machining, which helps release internal stresses within the component. At the same time, machining with midrange tolerance requirements takes place. The precision machining of fitting bores and surfaces relative to reference points happens in a subsequent clamping step. ➔

4 *Collaborated closely on the turnkey project (from left to right): Markus Beerhalter (MAPAL Global Project Engineer) and Manuel Hipp (Head of Application Engineering CHIRON) with fine boring tool with guide pads and finely adjustable blade. ©CHIRON*

5 *PCD-tipped custom tool for fine machining with highly complex bore contours.*



TWO-THIRDS CUSTOM TOOLS

The tools supplied by MAPAL play a key role. 78 tools have been provided, with two-thirds being custom-made and precisely designed to the corresponding machining step with special geometries and dimensions. In many cases, the complexity of the tools is a direct result of the component design or the selected machining strategy. Among them, 33 of the tools are PCD tools, while the remaining 45 use carbide cutting edges.

Whenever possible, multiple machining steps have been combined into a single tool, allowing the machining of various diameters in one operation. "Cycle times are reduced with these custom tools", explains Jesus Flores. "In this way, we save multiple tool changes every time, which improves both the machining times and precision." Besides speed, the components require a high level of precision and quality that surpass typical automotive industry standards.

When it comes to positioning accuracy, a tolerance of 25 µm has been prescribed for diameter tolerances ranging from 8 to 10 µm. "This component has some of the highest quality requirements that I've ever seen. That's a challenge for a workpiece of this size", says Flores. The combination of state-of-the-art machines and high-performance MAPAL tools has made the project a success. CHIRON Group highlights the quality of the PCD tools in particular, which are ideal for long production runs due to their extreme resilience and hardness.

PROACTIVE SUPPORT

CHIRON is satisfied with the results of its collaboration with MAPAL: "The quality of the tools is excellent. Their performance meets our requirements perfectly." The support CHIRON Group has received in Charlotte since its collaboration with MAPAL began has made a significant impact.

According to CHIRON, MAPAL's tool and process design as well as the application support have been outstanding. The proactive approach to collaboration has also played a key role. MAPAL consistently does more than just provide tools by offering tailored solutions and timely support whenever it is needed.

MAPAL has also praised the excellent teamwork. "I'm very proud of the collaboration, which has made it possible to deliver this large tool package within the tight deadlines prescribed by the customer", says Evan Osantoski, Sales and Application Engineer in Michigan. From project launch to customer handover, the process took just eight months. CHIRON Group and MAPAL want to continue to cooperate in the US and already have the next project in the pipeline. ■

8

6 *View of the area of the workpiece to be machined. The tool is used for finishing the reaming operation and achieves a fit quality IT6. ©CHIRON*

6a *A PCD-tipped custom tool is used to pre-machine a deep blind bore. ©CHIRON*

7 *The PCD-tipped special tool is used for the pre-machining of a deep-seated blind hole. ©CHIRON*

7a *A fine boring tool with guide pads and adjustable blade for fine-machining the main bearing bore to an IT6 tolerance. ©CHIRON*

8 *The CHIRON Group team together with two MAPAL employees (from left to right): Jose Morado (Apprentice), Kaylee Loyst (Application Engineer), Jessica Korolev (Markweting and Communications), Manuel Hipp (Head of Application Engineering), Jesus Flores (Lead Project Engineer), Philipp Reich (Director of Operations), Markus Beerhalter (Global Project Engineer MAPAL) and Shane Anderson (Sales Engineer MAPAL). ©CHIRON*

ALUMINIUM EXPERTISE FOR PNEUMATICS

MAPAL harnesses its machining expertise from the mass production of aluminium components in the automotive industry for the production of critical components for pneumatics. Economical solutions for high quantities are

The story of the Aalen tool manufacturer MAPAL is strongly linked to fluid power. The company's fine boring tools were already deployed in this area 50 years ago. Today, the fluid power market segment at MAPAL includes the areas hydraulics, pneumatics and process engineering. The material employed has a significant influence on the machining solution. Because liquids are under high pressure in hydraulics, casting and steel are used for the most part. Lightweight material like aluminium can be used as less pressure is needed for pneumatics.

Forces and movement are produced, controlled and efficiently transferred in pneumatics via air and gas. This takes place in valves and cylinders for the most part. Areas of application include machine engineering, logistics and medical technology.

MAPAL has identified two critical components in a housing for pneumatic valves and a pneumatic cylinder and has designed economic and high-precision machining processes for them. Due to their quantities of several million per year and the highest demands on process reliability, precision, and quality, both components are the perfect match for the tool manufacturer, which can draw on its aluminium machining expertise and product range for this purpose. The components are made of aluminium material with a small amount of silicon, which places high demands on the machining solution with respect to chip formation and removal. Particular attention is paid to avoiding burr formation or scoring: burrs in bores can have a significant effect on a valve's functionality and even cause it to fail.

SMART TOOL COMBINATIONS FOR PNEUMATIC VALVE HOUSINGS

The cost driver in the production of valve housings is the middle bore for the spool – the spool bore – where tight surface, form and position tolerances must be precisely adhered to. The spool moves in this bore to control the airflow and in end effect move the pneumatic cylinder. MAPAL concentrates on providing customers with the most economical solution for their machining by means of tool combinations.

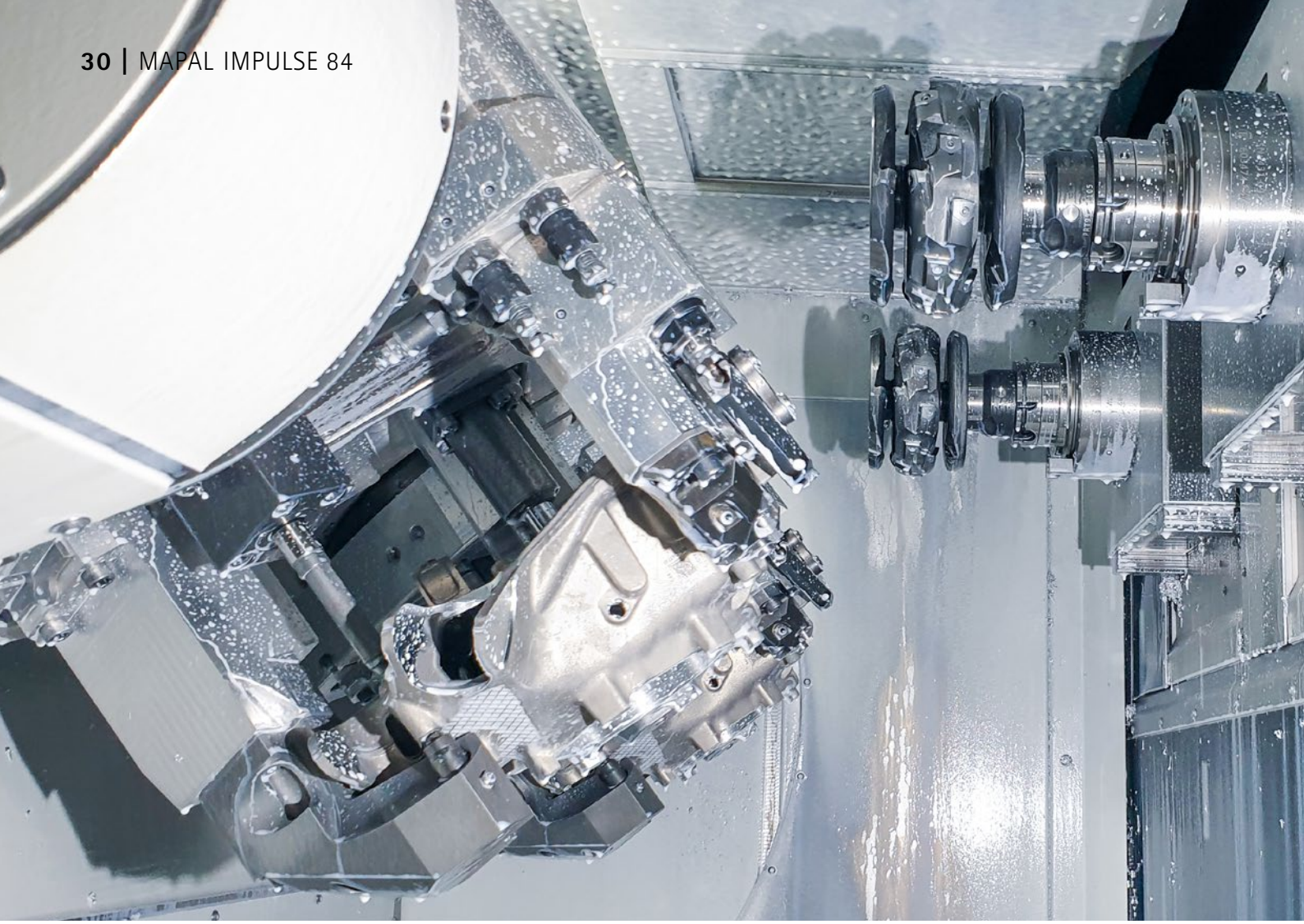
Solid carbide tools with special multi-cut technology and chip grooves for ideal chip control are used for stepped bores. Most tools are

MAPAL can draw on its aluminium machining expertise and product range for machining a pneumatic valve housing and a pneumatic cylinder.

equipped with PCD blades due to the quantities and requirements. For contour machining, MAPAL combines PCD boring tools with milling applications. The tool begins with boring here and follows up with circular milling. Such combination tools mean fewer tools are required and machining and non-productive times are reduced. Multi-stepped PCD combination tools also ensure the highest degree of concentricity for contour machining.

The spool bore has multiple control edges, which are machined by a PCD circular milling cutter. Its cutting edges are precisely adapted to the customer's part. The tool mills out the contours completely in one machining step, which saves a substantial amount of processing time. The mechatronic tool system TOOLTRONIC is a high-tech alternative to the conventional machining processes of the spool bore with PCD circular milling cutters. Thanks to its flexibility and contour-free programmability, the number of tools required is greatly reduced. This allows part variations and changes to parts to be implemented easily and without the need to procure new tools.

For the second critical component, the pneumatic cylinder, an automatically produced housing is also a focal point. The challenges here are posed by the fluctuating hardness properties of the continuous casting material and high machining qualities. While the characteristic features of both critical components may differ, the tasks involved in machining them are very similar. Of course, MAPAL also banks on smart machining here. This includes, amongst other things, a PCD combination tool for the complete machining of the bearing seat in the piston bore with minimised scoring by means of boring, circular milling and chamfering. ■



Schabmüller taps into MAPAL's expertise in aluminium

SERVICE FROM PROGRAMMING THROUGH TO COMPONENT

MAPAL has handled tool management at automotive supplier Schabmüller for some time. The Aalen-based tool manufacturer has now also taken over CAD/CAM programming for components, including simulations. With growing requirements for aluminium machining, the manufacturer values this full-service solution.

Schabmüller Automobiltechnik GmbH (SMI) in Großmehring near Ingolstadt has been an automotive supplier since 1988 and has increasingly specialised in the efficient manufacture of large series. The parts are installed in vehicles made by Mercedes, Porsche, Audi, BMW and Jaguar, among others. SMI operates predominantly as a Tier 2 supplier. Major clients are Aludyne and Strojmetal, which directly supply the automotive industry as an aluminium foundry and forge.

Until a few years ago, Schabmüller produced cylinder head covers for the VW 3.0-litre V-group engine in quantities of up to 320,000 a year. The components, for which Schabmüller also handles installation, are still produced, but the volume has already decreased. However, other major orders have arrived, making the company less dependent on the combustion engine.

"The production of suspension parts has begun since then. This gives us the opportunity to diversify ourselves in this direction", says managing director Helmut Häckl. "Our business

1 *Schabmüller manufactures hub carriers in pairs on a double spindle machine from SW. The image shows the use of disc milling cutters with indexable inserts from MAPAL.*

2 *Production at Schabmüller mainly takes place on multi-spindle machines. Hub carriers are machined by SW on a double spindle.*

3 *In the warehouse system, MAPAL provides all tools needed for a component via the tool management. For hub carriers, 45 to 55 different tools are required.*

4 *Helmut Häckl, CEO of Schabmüller (right) and Stephan Streck, MAPAL technical consultant, with a hub carrier. The tools used for its manufacture are in the background.*

has developed and pursued precisely this goal." However, the new components pose challenges for Schabmüller, too.

When becoming involved in the production of suspension parts, Schabmüller had whole new experiences. Particularly for electric vehicle components, projects are sometimes postponed, originally planned quantities are not reached, or additional changes are required at short notice before series production begins. Häckl knows why: "Up until the end, the OEMs gather experience in load tests for vehicles that are becoming increasingly heavier due to the weight of the batteries. This means that certain components are designed in a more stable way to cover all borderline situations." Stephan Streck, technical consultant at MAPAL, explains using the example of a hub carrier. As issues with stiffness arose during driving. Almost at the last minute, another surface had to be machined and a stiffening rib was added.

Schabmüller has to plan the facilities and prices for the components before their exact design is known, which always presents the manufacturer with challenges. "Cycle time is the decisive factor for getting an order", says Häckl.

MAPAL INVOLVED FROM THE OUTSET

To get a better grip on these short-term changes and continue optimising overall production, Schabmüller decided to bring MAPAL on board already at the CAD/CAM programming phase. "We have a very cooperative partnership with MAPAL and appreciate their rapid response times", explains Häckl. "So we felt good about expanding our cooperation to CNC programming and simulation." MAPAL is already involved in tool design

for new projects and in charge of tool management. These services are tailored to the client's needs. These include tool scheduling, pre-adjustment, dispensing and reconditioning, technical support for series production, tool and cycle time optimisations, and tool life optimisations.

Schabmüller stopped programming itself back in 2018. "For CAD/CAM, we need specialists who know this subject matter inside out", says Häckl. "If we only tackle two to four new projects a year, a staff member can't be fit here." Schabmüller has used the machine manufacturer's services for programming from time to time since then. However, there was no option for 3D simulations, which meant the manufacturer knew that not all options for optimising cycle times were being used.

Now that MAPAL is involved from the beginning, this has changed. NC programming, simulation and tool management are now perfectly intertwined. For instance, simulation data is included in tool planning, which helps detect potential collisions at an early stage. It is possible to respond immediately to component changes by the OEMs before the start of production. Modifications are made in the 3D simulations before the tools are finished. Streck explains the importance of simulation: "If you don't catch adverse changes in good time, costs can run into the five figures."

Simulation also plays a key role in optimising machining. For instance, it shows approach angles that can be used to improve material removal. Data from the computer can also be used to reduce tool wrapping. "This type of detail is much easier to detect in simulations than looking through the window into the machine", says Streck.

FORGED PARTS, NOT CAST ALUMINIUM

The suspension parts involve a shift in starting material from die cast aluminium to forged aluminium. Forged parts have much higher load indicators than cast parts. The higher stability is required in particular for electromobility. However, this also increases machining requirements to achieve the desired cycle time. Material removal and thus the volume to be machined are much higher here, which requires adapted milling strategies.

The material properties have also changed, as Stephan Streck explains: "Compared to aluminium cast parts, the forged material has a much lower silicon content. This means that the chip doesn't break well, long chips are produced in machining, and we need to deal with smeared blades. All of MAPAL's aluminium machining expertise is required to find solutions here." Schabmüller currently uses forged aluminium to produce some of the hub carriers, steering knuckles and control arms made in Großmehring.

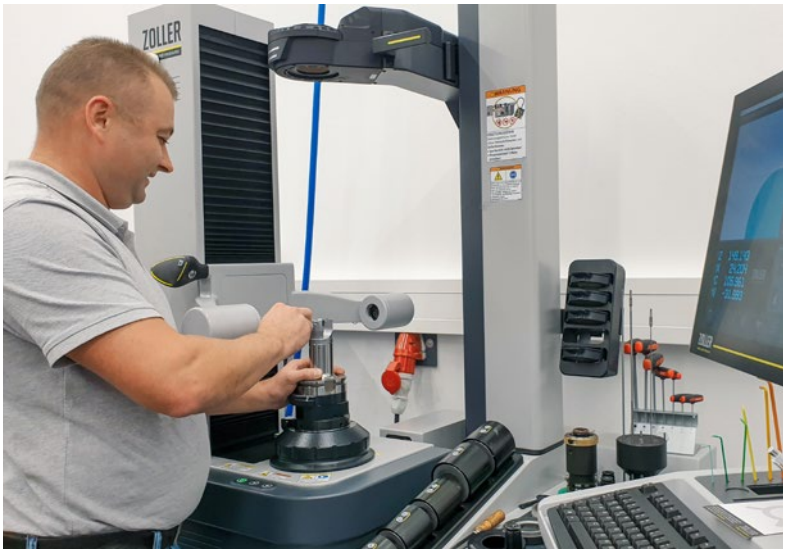
HIGH-VOLUME MILLING CUTTER NEOMILL-ALU-QBIG USED BEFORE ITS MARKET LAUNCH

Another aspect of improving processes is MAPAL bringing new tools on board as soon as they are available and promise benefits. As application engineer Eugen Bien notes, the new indexable insert milling cutter NeoMill-Alu-QBig was used at Schabmüller before it even officially came on the market.

This new indexable insert milling cutter from MAPAL stands out for its top performance in high-volume aluminium milling. It is designed for use at speeds up to 35,000 min-1 to achieve the maximum possible material removal rate. For a tight fit despite high centrifugal forces, screws with increased tensile strength are used to hold the indexable inserts firmly in the prismatic seat. MAPAL has fitted the tool body with a fine balancing system to protect the machine spindle and achieve high surface finishes where possible. In addition, focus was placed during development on low cutting forces and highly precise indexable inserts.

From the three coatings available, MAPAL technicians chose a diamond coating for the machining of mould casting at Schabmüller. During operation, the machine operator rotates the indexable inserts with their two cutting edges directly on the machine. MAPAL retips the mill-

View of the setting room at Schabmüller, where MAPAL preconfigures the tools.



Eugen Bien, application engineer at MAPAL, measuring a NeoMill-Alu-QBig milling cutter.

ing cutter in the setting room. One benefit of the ductile solid carbide inserts of the NeoMill-Alu-QBig in comparison to the milling cutters with brazed PCD blades used before: They break out less quickly when there are sand residues from the casting mould on the raw part.

However, there is another aspect that is decisive for the user, as Häckl affirms: "In production, we achieved shorter cycle times with the NeoMill-Alu-QBig, as we were able to attain greater values for cutting speed and feed. For this, we were readily willing to accept shorter tool lifes."

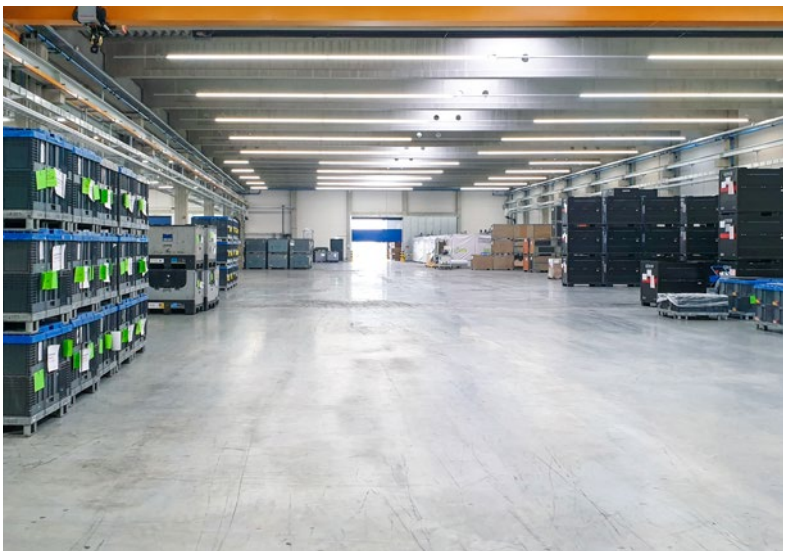
Switching to the NeoMill-Alu-QBig required a different milling strategy and higher central chip density. The values measured by MAPAL are testament to the success achieved as a result. The adjustments implemented with higher cutting parameters, the switch from circular milling to helix milling, and the improved machining conditions resulted in a cycle time saving for this machining operation of 54%. The new tool made it possible to increase the feed per tooth from an average of 14 mm to 32 mm.

In the comprehensive tool set for machining a hub carrier, the NeoMill-Alu-QBig is one of the few standard tools, but it plays a crucial role for the cycle time, as Eugen Bien puts it: "Use of the NeoMill-Alu-QBig constitutes around 30% of the total machining time." The focus is on the roughing of the component, but the tool also produces surfaces in finished part quality.

The hub carriers set high requirements for the machining strategy. For Porsche and AMG, Schabmüller produces around 97,000 of these each per year from cast or forged parts, for which cycle time of six minutes for two components is required on the double spindle. The tool sets for this consist of 45 to 55 tools. For the most part, these are client-specific custom tools. Most of them, such as drills, step drills and fine boring tools, are only used for one or two machining operations. The role of the simulation is to keep non-productive time for all the different tools to a minimum and ideally to start each machining operation once only.

ROOM TO GROW IN FUTURE

Schabmüller currently has around 150 employees and is growing constantly. Work was completed on a third hall recently. Originally designed for the production of large quantities of cylinder head covers for VW, part of the double hall is currently used for other purposes. Schabmüller machines a large amount of the starting material to produce top plates for electric vehicle batteries. Rear axle housings are being produced for another automotive manufacturer in a second project. ■

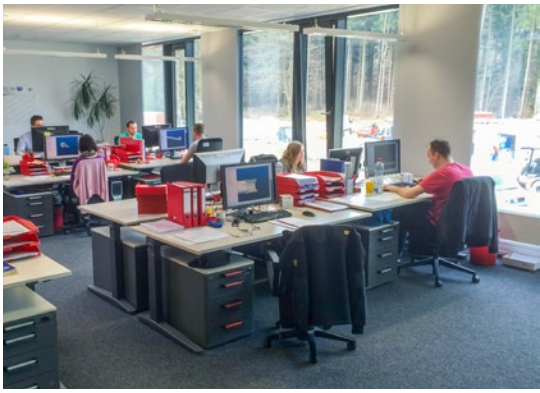


The third production hall at Schabmüller creates room for new projects.

Presenting a rear axle housing (from left): Stephan Streck (MAPAL technical consultant), Eugen Bien, (MAPAL application engineer) and Helmut Häckl (Managing Director, Schabmüller).

MAPAL Centre of Competence PCD tools

HIGHLY-EFFICIENT PROCESS SOLUTIONS FOR INDIVIDUAL CLIENT REQUIREMENTS



From process design to reconditioning across the entire tool life cycle: With the centre of competence for PCD tools, MAPAL sets benchmarks in terms of customer service, technology, efficiency and sustainability. A glimpse behind the scenes of an extraordinary place.

The MAPAL site in Pforzheim is a crucial hub for the development and production of PCD tools (PCD = polycrystalline diamond). Founded in 1980 by Werner Stief, the company combines innovation, process expertise, customer focus, high-precision manufacturing and a sustainable approach to doing business.

In Pforzheim, MAPAL develops and produces ultra-precise PCD tools for demanding applications, whether as an individual tool or tool set for an overall. Over 400 employees work to ensure that clients worldwide benefit from technical excellence, premium quality, short response times and sustainable solutions with a high level of tool reconditioning potential.

Employees at the site develop ultra-efficient PCD process solutions for individual client requirements. The PCD tools are designed, manufactured and reconditioned for almost all machining processes. These include drilling, reaming, countersinking/boring, milling and combination tools, as well as complex hybrid tools with 3D-printed components. A wide spectrum of diameters (from 1 to 500 mm) and tool lengths (up to 500 mm) are covered.

The PCD tools are used worldwide in the automotive and supply industries, aviation, engineering and medical technology. "Customers benefit from comprehensive technical advice, carefully thought out process designs, premium quality, high delivery reliability and a wide service offering", says Christian Molch, Managing Director of MAPAL in Pforzheim.

Pforzheim also acts as a pacesetter for global manufacturing processes with corresponding policy expertise in the production of PCD tools within MAPAL Group: From here, PCD production processes and standards are defined, processes are developed and rolled out internationally through trainings. The associated knowledge transfer strengthens the twelve additional PCD production facilities worldwide – from France, Italy and Czechia to China, Brazil and the United States.

In Pforzheim in recent years, production has been consistently developed to the state of the art. New group standards have been set for technology and production logistics. Recently optimised production planning and order management have reduced lead times by 35% and increased delivery reliability almost to an optimum. At the same time, high levels of investment in production technology, lean management, digitisation and modern environmental technology have strengthened the site's sustainability and future competitiveness. The Pforzheim site is working on becoming carbon neutral in future: through the use of green energy, a newly installed photovoltaic system, heat exchanger and energy-efficiency climate technology.

Pforzheim also sets standards in terms of technology: Accordingly, the red-anodised PCD face milling head systems act as a benchmark in aluminium machining. New machining processes developed internally and optimised in the areas of laser, EDM (spark erosion) or high-precision grinding ensure the consistent high quality and reproducibility of products – in all markets worldwide.

A digitally consistent configuration process for PCD tools is currently taking shape with an eye on the future – another step towards digitisation and boosting efficiency in collaboration with customers worldwide. ■

MAPAL Centre of Competence PCD tools

Pforzheim, Baden-Württemberg

Founded: 1980

Employees: 400

Manufacturing range:
PCD tools

2023 sustainability report

HOW MAPAL IS POSITIONED TO FACE THE FUTURE

How is my company doing when it comes to sustainability? A question that's sure to concern some employees. Particularly as companies with over 500 employees in the European Union (EU) will sooner or later need to provide a sustainability report. In principle, this is about creating transparency on internal developments in areas such as the environment, product durability, and in relation to human resources. This reporting obligation is derived from the EU Corporate Sustainability Reporting Directive (CSRD).

MAPAL Dr. Kress KG published a sustainability report for the reporting year 2023. In addition to the focus on stakeholders – i.e. employees and management – as well as owners, clients and suppliers, the report also looks at MAPAL's products and value chain. The group works closely with customers to develop innovative solutions that enable increases in efficiency, cost reductions and precise results, which make a lasting impact.

In matters regarding sustainable company management, MAPAL combines economic success with environmental and social responsibility. As a leader in precision toolmaking technology, MAPAL draws on resource-saving processes and energy-efficient solutions. With a clear sustainability strategy, the company has set itself the target of continually improving in all relevant areas. Transparency and regular reporting document progress that is systematically recorded and published in accordance with international standards. Through close collaboration with partners and suppliers, MAPAL ensures compliance with environmental and ethical standards along the value chain.

This has allowed the company to reduce its environmental footprint significantly in recent years using innovative manufacturing technologies, renewable energies and optimised logistics processes. The integration of principles of the circular economy and sustainable materials ensures efficient use of commodities and significant waste reduction. Modern production processes help reduce water consumption across the entire company dramatically and protect valuable resources.

MAPAL is aware of its social responsibility – to employees and to society. For the company, employees are the driving force of innovation and success. In terms of employee motivation – further education, training options and targeted development programmes open up long-term career opportunities and boost professional expertise. The open company culture and promotion of diversity contribute to a fair and respectful working environment. In matters of social responsibility, MAPAL supports numerous social projects, educational initiatives and non-profit organisations. Donations regularly flow to regional organisations that focus in particular on the well-being of children, people in need, and those less well off in society.

At MAPAL, sustainability is seen as a long-term commitment. The focus will continue to be on forward-looking technologies, resource-saving production methods and social responsibility in future. The coming years will be characterised by further innovations aimed at actively helping shape the shift to a sustainable industry. ■

Sustainability at MAPAL

The "Productivity as a Service" project researched the possibilities of linking separate process and production data and developed a service to help manufacturers with future challenges by harnessing self-learning algorithms.

The Productivity as a Service consortium project was part of the large-scale research project X-Forge.

Customer Productivity as a Challenge

POOLING KNOWLEDGE FOR HIGHER PRODUCTIVITY

By harnessing all the data created during machining, companies make their processes around ten percent more productive. This was the result of a project where MAPAL together with industry partners pooled previously distributed knowledge and made it available as a digital value-added service.

Within the framework of the major research project X-Forge (Everything as a Service) funded by the state of Baden-Württemberg, tool manufacturer MAPAL was the consortium leader of the Productivity as a Service (ProdaaS) area. MAPAL was cooperating with the machine manufacturer F. Zimmermann and the measurement technology specialist Blum to be able to offer customers solutions from a single source. As an further project partner, Fraunhofer IPA had set out to facilitate the underlying business model between the partners and to assess the value added for the customers. A first pilot project came to an end in mid-2024 after a total of three years. Based on this, the digital service offering is to be continuously expanded over the coming years.

The members of the working consortium already monitor processes with many sensors that deliver the corresponding data. However, existing systems only offer a limited view of the entire system of machines, tools and workpieces. While highly complex expert systems are available to the users on the machine, these individual components do not interact with one another. In reality, it's hardly feasible to bring them together. If problems occur, it is accordingly difficult to analyse them afterwards ode to optimise ongoing processes.

STRUCTURED KNOWLEDGE BASE FOR PROCESS PLANNING

CAM process planning with tool selection, path planning and selection of process parameters provides considerable leverance for increasing productivity. While commissioning a component, further adjustments on the machine are most often necessary to arrive at an optimal result. Today, the planning dimension is largely decoupled from machining. Knowledge gained on the machine does not necessarily make its way to process planning. Insufficient feedback inhibits the learning effect and results in the machine operator having to start from scratch with each new drilling process. A structured knowledge base from practical application is simply missing in CAM process planning.

The project partners contribute various information to the "Productivity-as-a-Service" offer for stable and efficient machining processes. The assessment of the wear on the tools is relevant understanding under what conditions a bore, for example, was made. It also provides information about the current tool life and allows tool life prognoses. Blum extracts the corresponding data in a dedicated software service and makes it available. This measurement data is compared with a MAPAL knowledge database in a process analysis to check if the parameters set on the machine follow the manufacturer's specifications. At the same time, the status assessment of the machines from F. Zimmermann is incorporated, which provides information about the condition of the spindle. Finally, a higher-level software module links the various sources together and makes information available in a structured manner. In an error state analysis, the user can find a cause at a press of a button.

PILOT PROJECT: TOOL PERFORMANCE OPTIMIZER

The pilot project, which took place at Karl Walter Formenbau, involved a Tool Performance Optimizer. With it, the user is able to correct the settings of the process parameters for drilling in the event of deviations to reduce downtime due to breakage or unplanned tool changes. The database also makes it possible to build on structured, methodically collected and evaluated experience from the past during the planning phase for new, previously unknown applications with the help of similarity searches. The Tool Performance Optimizer is to be marketed via two sales channels. In addition to the traditional solution business offered from a single source, it will also be found on large platforms based on Gaia-X.

The goal of the next development step is to record any deviations in an assistance system and warn the user immediately during operation with a traffic light system. For the coming years, self-learning services for autonomous parameter optimization and intelligent CAM process planning is in the pipelines. Finally, end-to-end automation from the drawing to the finished component should be possible from 2029. ■

THE ROAD TO DIGITAL TRANSFORMATION

c-Com GmbH, a MAPAL Group subsidiary, was integrated into the corporate structure on 1 January 2025, with the aim of being able to provide digital services on the market more quickly and in a more targeted manner. Stephan Köstler, Global Head of Machines & Services at MAPAL, discusses the reasons for this integration, the development of c-Com, and how digital technologies and AI are shaping the future of the industry.

Interview conducted by Christof Lampert, Fertigungstechnik

Mr. Köstler, what was the original impulse for integrating c-Com into MAPAL's corporate structure and what benefits do you hope to achieve from this?

To understand this decision, we need to take a look back at why and how c-Com was founded. From the very beginning, MAPAL's aim was to optimise the performance of production and support processes – adapted to our customers' individual needs. With c-Com, we wanted to create a platform that supports these goals through digitisation. After seven years of successful development, we realised it made sense to pool the expertise of MAPAL and c-Com. This reduces interfaces, promotes synergies, ensures we can respond quicker to market requirements, and enables more efficient development of our digital services.

Ultimately, we need to help our customers stay competitive. This is only achieved through higher productivity. With regard to economic developments such as consolidation, relocation or processes of globalisation, we need to react more quickly in future – in months or weeks, not years. This requires strong organisation and we achieved this with the integration.

Will the name c-Com and the software as a product continue to exist?

Yes, the name and the product will continue to exist. This is a purely organisational change. All c-Com employees were also absorbed by MAPAL and integrated into the Machines & Services division. From there, they will develop and look after the product in future. This brings additional positive effects, for instance, because support and development structures are more distinct in a larger unit and a much closer understanding of customer requirements can be experienced in the tool context.

At c-Com, in addition to a digital tool management solution, you also draw on trend-setting areas such as life-cycle management and machining analytics solutions. Can you explain this in more detail?

Of course. Life-cycle management is about tracking the use of individual tools over their entire life cycle. This is the only way we can ensure resources are used efficiently and any potential opportunities for recycling are being utilised as best they can. We've been doing this to great success for many years. I think this is one of the key factors for successfully managing the circular economy and optimum use of resources.

Whereas machining analytics takes us to the next level. Here, we combine data from tool use with process data such as machinery and workpiece parameters. This allows us to obtain deeper insights into processes, identify problems and remedy causes. This is hardly possible without AI, as the quantities of data are enormous.

Speaking of AI – what role does it currently play at MAPAL?

AI is a crucial aspect of our strategy. We are already using it to detect anomalies in data flows and assist our programmers. If I think outside the box a little, there's the question of which role AI will play in future in the MAPAL Group context. MAPAL is a company with 75 years' experience that has always operated close to our customers – particularly through direct support from our

> "The integration of c-Com into the MAPAL Group is an important step towards driving digitisation forward. Our aim remains to offer our customers real added value through technology and expertise and to tackle the challenges of the future together. I am convinced that this strategy puts us in the best possible position."
>
> *Stephan Köstler, Global Head of Machines & Services at Mapal*

experts. Whether it was evaluating issues with machining processes, configurating process parameters, estimating tool life or optimising tools – until now, these services have largely been based on human knowledge. We are currently working to structure all of these knowledge services systemically and gradually transfer them into digital services.

In your view, has the concept of digitisation already reached all your customers and/or the industry?

I would say that awareness of using digitisation to automate processes has now become widespread. There is a growing understanding that digitisation isn't just a "nice to have". It enables huge increases in productivity – even if it comes with costs. This understanding is now firmly entrenched in the industry. Nevertheless, most of the industry is still facing the challenge of building the necessary skills and undertaking the cultural change. Implementation is often complex, particularly in brownfield scenarios, i.e. existing production facilities. But the progress we are seeing is encouraging.

What lessons has MAPAL drawn from the c-Com journey?

One of the key takeaways is that digitisation is only successful if theory and practice go hand in hand. Digital concepts and business models cannot be implemented successfully with the classic mindset of a manufacturing company. Without practice and the associated experience, the organisation lacks the necessary readiness to consistently pursue these approaches. Software development is about gathering experience. This is often associated with errors and rethinks. Integrating this experience into the company takes time and resources. However, I'm happy we've taken this path and now have the right mindset to move forward concretely. The greatest challenge in digitisation lies in acting boldly, failing fast, and continuing to develop on that basis.

Thank you for the interview! ■

A special design element on the UNIQ chuck is the blue actuating screw.

FURTHER DESIGN AWARD FOR THE UNIQ HYDRAULIC CHUCKS FROM MAPAL

They not only meet the highest demands in terms of quality and quality and function, but their design has also won numerous awards: the hydraulic chucks for the UNIQ series from MAPAL. Following the IF Design Award 2020 and the Good Design Award 2021, the Aalen-based tool manufacturer at least received the sustainability-oriented Green Design Award in 2024.

When the precision tool manufacturer and technology partner MAPAL completely revised its hydraulic chucks in 2020, the focus was on making the entire to make the entire product range even more efficient and durable in daily use. The new hydraulic chucks were to be given a uniform appearance - the requirement that the design should guarantee the greatest possible stability with optimum use of resources.

In collaboration with the design agency Ottenwaelder and Ottenwaelder from Schwaebisch Gmuend, the product managers at MAPAL developed a new design new design concept for the product family. In order to emphasize the uniqueness of the revised chucks, the naming was based on the English word "unique".

The two hydraulic chuck series - UNIQ Mill Chuck and UNIQ DReaM Chuck - combine MAPAL's performance promise of quality and function quality and function, in particular through an optimum interplay of geometric and functional properties. Thanks to a polishing process newly developed for the UNIQ series the high-gloss surface of the chuck is more resistant to dirt and corrosion. MAPAL also attached great importance to making the use of the hydraulic chucks process reliability. The blue coloring of the of the actuating screw contributes to this. Specially created signatures also contain handling instructions. "The MAPAL chucks have a significantly unique design language," says Petra Kurz-Ottenwaelder, Managing Director of the design agency Ottenwaelder and Ottenwaelder.

When the first chucks were available after the development available, the agency submitted the UNIQ hydraulic chucks to the iF Award in 2020 - and to the iF Award - and was honored. This was followed in 2021 by the Good Design Award in 2021 and most recently, at the end of 2024, the sustainability-oriented Green Design Award, which focuses on sustainability.

"We are proud that we have won several internationally recognized awards with UNIQ," says Tobias Bayerle. The development of the UNIQ series proves that you can not only win through practicality, but also that product design can offer customers added value. "If you can impress with performance and design, then you've done a lot of things right."

However, it is even more important for Bayerle to emphasize that the UNIQ chucks have been very well received by existing and new customers from day one. "Since the introduction of the UNIQ series, we have always seen exponential growth in this area," he says. ■

Already three times award-winning - the UNIQ hydraulic chucks from MAPAL. The most recent award was the Green Design Award for sustainable design.

GREEN GOOD DESIGN AWARD HONORS SUSTAINABLE DESIGN IDEAS

The latest award for MAPAL and the Gmuend-based agency Ottenwälder and Ottenwälder is the Green Good Design Award, which the Chicago Athenaeum Museum of Architecture and Design presents annually to companies and individuals who pay particular attention to sustainable design. The two companies were honored for the new design of the UNIQ hydraulic chuck.

WHAT MAKES THE UNIQ SERIES PARTICULARLY SUSTAINABLE

A hydraulic chuck is suitable for reconditioning. If the hydraulic oil is refilled during servicing, the chuck is as good as new and ready for a second service life. A UNIQ hydraulic chuck can handle up to 15,000 clamping cycles, which is well above the average value of a shrink fit chuck.

Shrinking devices are energy guzzlers, consuming up to 12,000 kilowatt hours and 3.6 tons of CO2 per year. This is saved by using a UNIQ hydraulic chuck.

In addition, a hydraulic chuck can be changed much more quickly. Shrink fit chucks take between four and six minutes longer, which means a considerable amount of additional work.

Hydraulic chucks are also much safer to handle. With shrink chucks, almost every operator burns their fingers at least once during the hectic working day. With hydraulic chucks, on the other hand, there is no risk of burns.

UNIQ MILL CHUCK: RELIABLE. DYNAMIC. AGILE

The UNIQ Mill Chuck is specially designed for clamping milling tools with HA shanks. Thanks to its high temperature resistance of 80 °C, even with very long milling cycles, it impresses in highly dynamic milling applications, such as SPM (Structural Part Machining), HSC (High Speed Cutting) or HPC (High Performance Cutting), for high-quality components with excellent process reliability and high metal removal rates. It is universally suitable for roughing, semi-finishing and finishing operations.

UNIQ DREAM CHUCK, 4.5°: VISIONARY. FLEXIBLE. ECONOMICAL.

The UNIQ DReaM Chuck, 4.5° is optimized for reaming and drilling applications as well as for use with finishing cutters. It enables maximum rigidity with minimum interference contour thanks to the clamping introduction in the HSK collar and low material usage. The outer contour of the UNIQ DReaM chuck is based one-to-one on DIN 69882-8 for heat shrink chucks. This makes it very easy to switch from shrink-fit technology to hydraulic chucks.

MAPAL AT TRADE FAIRS AND EVENTS IN 2025

Whether in large trade fair halls, open house events or specialist conferences – the direct dialogue and contact are at the heart of what MAPAL does.
The following events are scheduled for 2025. The MAPAL team is looking forward to presenting its products and solutions related to the machining process there and sounding out specific customer needs.
The events calendar is constantly being updated and can be viewed on the MAPAL website at mapal.com/events.

06/05/2025 – 09/05/2025	**Moulding Expo (VDWF Area)**	Stuttgart | Germany
06/05/2025 – 10/05/2025	**EXPOMAFE**	Sao Paulo | Brazil
21/05/2025 – 23/05/2025	**De Nederlandse Metaaldagen**	Hertogenbosch | Netherlands
27/05/2025 – 30/05/2025	**EMAF**	Porto | Portugal
22/09/2025 – 27/09/2025	**EMO**	Hanover | Germany
20/10/2025 – 25/10/2025	**MECT**	Nagoya | Japan
12/11/2025 - 13/11/2025	**Precisie beurs**	Hertogenbosch | Netherlands
10/12/2025 – 11/12/2025	**Aviation Forum**	Hamburg | Germany

Company exhibitions, customer events, conferences and symposia

13/05/2025 – 15/05/2025	**Open House Chiron**	Tuttlingen | Germany
22/05/2025 – 23/05/2025	**Berliner Runde**	Berlin | Germany

A review in pictures

At trade fairs, conferences and customer events in recent months, MAPAL teams have had plenty of conversations with customers, presented products and solutions, made new contacts and cultivated old ones. The outcome was extremely positive for everyone – despite, or perhaps because of, the subdued economic situation on the German market and around the world.

Here is a visual overview of MAPAL's appearances in recent months, from intec and INNOTEQ to a number of company exhibitions. ■

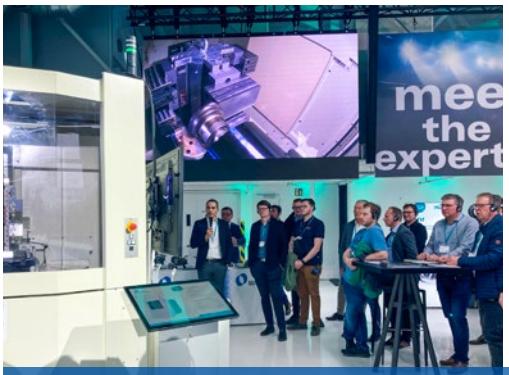
INTEC Leipzig

Expert Forum at Fritz Weg

Global Industry Show Lyon

GROB Open House

Innoteq Bern



Index – Makino Open House

MAZAK Orange Days

MECSPE Bologna

Training activities in Ehrenfriedersdorf

www.mapal.com

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