IMPULSE

MAPAL TECHNOLOGY MAGAZINE | EDITION 87



Coverstory:

DRIVING CUSTOMER MANUFACTURING PERFORMANCE



Dear business partners,
dear readers,

we are rapidly approaching the AMB in Stuttgart, one of the most important international trade shows for the metal machining industry. We believe this industry platform is more than just an event at which to showcase new products – it is a place to highlight our core technological priorities and to explain how we continue to evolve as a group of companies.

In Stuttgart, we are presenting a broad range of innovations and solutions that have been designed to increase the productivity of manufacturing processes and make them easier to manage. In my view, two new products clearly symbolise the developments that we are driving forward at MAPAL.

The MEGA-Drill-Composite-MD-EdgePro is a new drill designed for machining multidirectional carbon fibre-reinforced plastic (CFRP), a material that is above all used to meet the high demands of the aerospace industry. Offering a laser-sharpened cutting edge, self-sharpening feature and diamond-coated solid carbide, it provides for high-quality drilling, process reliability and long cutting tool life.

This tool is not only exceptional from a technical viewpoint; it also demonstrates what lies at the heart of our transformation: this single tool brings together expertise from multiple areas – solid carbide technology, diamond coating and laser machining. It also presents clear evidence of what is increasingly setting the MAPAL Group apart: by relying on specialist expertise across sites, we combine technical capabilities in a targeted way to design solutions that provide customers with measurable added value.

The second example is the new EA-Performance-System for fine boring. In respect of the challenging diameter range of 10 to 19 mm, this is the first time that adjustments can be simply made by using only one single adjustment screw, thereby enabling precise fine machining with significantly less setting effort. This is just one of the ways in which we are continually developing our core business. When it comes to fine machining, we are also pushing forward to actively expand our capabilities in this area. After all, precision is and will always remain a distinguishing feature of MAPAL. New technological advancements are being employed to ensure precision work is even quicker, easier and more reliable for our customers.

The combination of innovation, ongoing development and a definite focus on our customers is evident throughout this issue. The three case studies are perfect examples of this since they range from aerospace and hydraulics to applications outside of our established core industries. Simultaneously, they also illustrate the many different ways we collaborate with our customers, from custom individual solutions to tool management and turnkey projects, all from a single source.

This variety sits at the heart of everything we're presenting this autumn in Stuttgart and elsewhere: high-performance product innovations, component-based solutions, services and our ability to assume responsibility for the entire manufacturing process. In today's world, modern manufacturing needs more than just good tools. It also needs partners who understand applications, have a solid knowledge of processes and who can collaborate with their customers to develop sustainable solutions.

I look forward to being able to talk about all of this with you in person, whether at Stuttgart, at a future event or when we work together to develop the manufacturing processes of tomorrow.

Yours,

Dr Jochen Kress

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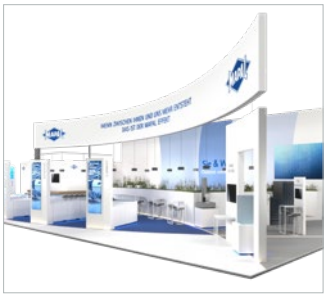
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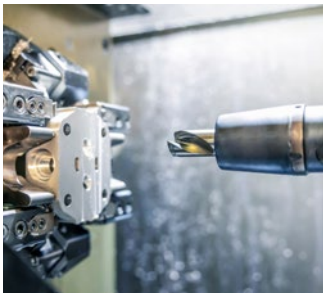
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Editorial Team: Franziska Grund
(Responsible according to the German Press Law), Mathias Ostertag,
Kathrin Rehor, Manfred Flohr
Guest article: Robert Fraunberger, x-technik
Layout: Alexander Rückle

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MAPAL Dr. Kress SE & Co. KG
P.O. Box 1520 | D-73405 Aalen
Phone +49 7361 585-0
info@mapal.com | https://mapal.com

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MAPAL LAYS THE FOUNDATION FOR GREATER SPEED

Industrial manufacturing around the world is undergoing rapid change. Geopolitical tensions, structural shifts in key industries, a weak economy in Europe and new challenges in global supply chains are changing the way companies do business.



Investments in modern production structures create the foundation for greater efficiency, transparency and speed.

With the merger of the German entities, MAPAL has completed the largest organisational project in the company's history.

At MAPAL, several of these developments are coming together at the same time. The company group has deep roots in Germany and Europe, holds a strong position in the automotive industry, and supports its customers through long-term investment projects. These are precisely the areas that have come under significant pressure in recent years. "We are not experiencing a temporary market slowdown, but rather profound changes across many of the markets that are important to us. These changes affect economic conditions, technological developments and geopolitical influences alike", explains Dr Jochen Kress, President of the MAPAL Group.

Since mid-2025, growing uncertainty in global raw material markets has added to the challenges, driven in particular by export restrictions and rising prices for carbide pre-products. "Developments in the raw material markets highlight just how important resilient supply chains and long-term partnerships are. Reliable supply is becoming an even more important issue for the industry as a whole", says Dr Kress.

BUSINESS PERFORMANCE IN 2025 MET EXPECTATIONS

Against the backdrop of these market changes, the 2025 financial year developed in line with expectations. The MAPAL Group generated revenue of 514 million euros, around 7 per cent below the previous year's figure of 551 million euros. Performance varied across regions. While economic growth in Europe and China remained subdued and the automotive industry continued to be shaped by far-reaching changes, individual markets in North and South America as well as Asia proved more resilient.
By the end of 2025, the MAPAL Group employed around 4,500 people worldwide. The adjustment of the workforce structure was made in response to market conditions. In doing so, the family-owned company focused on socially responsible solutions and long-term decisions.

DRIVING TRANSFORMATION FORWARD

"The environment was challenging – and remains so. That makes it all the more important to focus on things we can influence ourselves. That is exactly what we have done, driving MAPAL forward with determination", says Dr Kress.

With the merger of its German entities, MAPAL completed the largest organisational project in the company's history. At the same time, the group was realigned as a process-driven organisation. Standardised workflows, clearly defined responsibilities and structures, and end-to-end processes provide the foundation for more transparency, higher efficiency and, most of all, greater speed.

"Many of these changes initially took place behind the scenes and were not visible to the outside. Transformation initiatives of this scale require time, consistency and a willingness to challenge established ways of working. For us, 2025 was mainly a year of implementation", summarises Dr Kress.

THE FIRST RESULTS ARE BECOMING VISIBLE

The intensive work on structures and processes is beginning to deliver results. The organisation is gaining speed, and customer requirements are being implemented more efficiently.

MAPAL reached a milestone in spring 2026 in achieving TISAX certification at Assessment Level 3. The certification confirms the company's high standards in information security and meets the requirements of demanding customers, particularly in the automotive industry. At the same time, it reflects the ongoing development of processes, structures and the organisation as part of the company's transformation journey.

Alongside its organisational progress, the strategic direction MAPAL has pursued in recent years is also proving successful in key market segments. This is particularly evident in the aerospace sector. Over the past two years, MAPAL has achieved sig-





Over the past two years, MAPAL has grown significantly faster than the market in the aerospace sector.

nificant double-digit growth in its aerospace business, clearly outperforming the market as a whole. As a result, MAPAL has further strengthened its position in this technologically demanding segment and is benefiting from strong global demand in the aerospace industry.

MAPAL also remains committed to its long-term investment strategy. In the 2025 financial year, the MAPAL Group invested around 25 million euros in its locations, production capabilities, digitalisation and future technologies. A similar level of investment is planned for 2026.

Following its 75th anniversary year, MAPAL continues to combine the strengths of a long-established family-owned company with a clear focus on meeting the demands of future markets.

INNOVATION STRENGTHENS COMPETITIVENESS

Despite its extensive transformation projects, innovation remained a central focus of the company's activities. In 2025, for example, MAPAL introduced the NeoMill-16-Finish indexable insert milling cutter, a new milling system for cost-efficient semi-finishing and finishing. The new standardised chip-breaking geometries for fine boring inserts increase process reliability and deliver productivity gains. These examples are representative of the company's ongoing commitment to innovation. The goal remains to help customers make their manufacturing operations more productive and efficient through high-performance tools, intelligent processes and comprehensive system solutions.

EXPANDING INTO FUTURE MARKETS WITH PRECISION FOCUS

Alongside its established market segments, MAPAL is also keeping a close eye on emerging industrial growth areas. These include applications in the defence sector as well as industrial applications arising from new requirements in security, infrastructure and energy supply. The company is deliberately taking a long-term approach in these areas. New markets and technologies are evaluated according to clearly defined criteria: they must align with the company's technological strengths in precision machining, offer sufficient market scale and production volumes, and demonstrate long-term potential. "We closely monitor new developments and stay technologically connected to the topics that matter. At the same time, we invest selectively in areas where we see sustainable market opportunities and can create real value for our customers. Not every trend automatically becomes a market", says Dr Kress.

CHALLENGES CONTINUE TO SHAPE THE MARKET ENVIRONMENT

Market conditions will remain challenging throughout the 2026 financial year. Economic growth in Europe continues to be subdued, while geopolitical uncertainty, changes in global supply chains and developments in raw material markets continue to influence the business environment. At the same time, investments in aerospace, infrastructure and other future-focused technologies are creating new opportunities.

For the 2026 financial year, the company expects revenue to remain at a similar level to the previous year. Nevertheless, MAPAL believes it has created the conditions to respond to market opportunities more quickly and decisively in the future. "The challenges in our markets are not going away anytime soon. What matters is how quickly and decisively we respond to change. That is exactly why we have created the right conditions: We are becoming faster, strengthening our ability to get things done. And we are sharpening our focus on identifying opportunities earlier, making decisions more quickly, and bringing solutions to our customers faster", says Dr Kress. ■

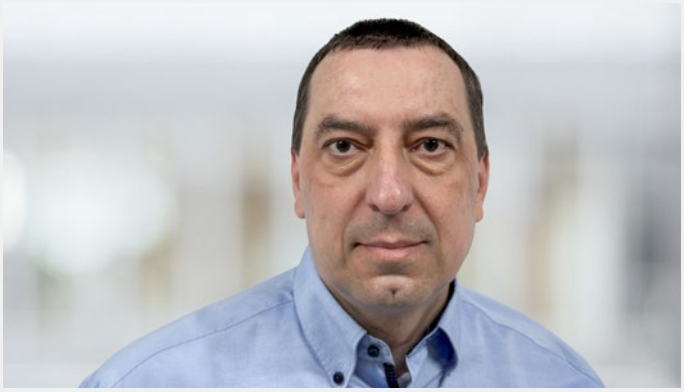
PARTICULARS

NEW SALES RESPONSIBILITIES FOR DACH/HU REGION

Regional sales responsibilities within the sales region of Germany, Austria, Switzerland and Hungary have been re-organised at MAPAL, with three Sales Directors now responsible for clearly defined regions. André Ranke will be responsible for the North Region, Michael Hofmann for the South-West, while Hanns Lackinger will take on the South-East Region. With the ability to draw on many years of experience in senior sales positions within the MAPAL Group, they will ensure continuity with regard to market development. This new structure will strengthen the regional approach to sales, while also aligning sales activities more closely to customers and markets, resulting in a more targeted focus on regional priorities and the ability to implement solutions more quickly.



Michael Hofmann | Sales Director South West DACH/HU



Hanns Lackinger | Sales Director South East DACH/HU



André Ranke | Sales Director North DACH/HU



Frédéric Estrat | Sales Director France & Morocco

CHANGE IN THE MANAGEMENT OF MAPAL FRANCE SAS

Christophe Potier, Managing Director of MAPAL France SAS, has retired on 31 August 2026. The MAPAL Group expressly thanks him for 24 years of commitment and continuity in this important role. Under his leadership, MAPAL's market position in France was sustainably strengthened and the Group's aerospace activities were expanded.

As of 1 September 2026, Frédéric Estrat, Sales Director France & Morocco, assumed overall responsibility for sales, administrative tasks and the external representation of MAPAL France SAS. Responsibility for Operations at the French MAPAL subsidiary will be assumed by Plant Manager Sébastien Gallais.

With this new setup, MAPAL France SAS is ensuring continuity in supporting customers and partners while also contributing to the consistent development of the MAPAL Group into a process-driven organisation.



Christophe Potier

Successfully certified:

MAPAL MEETS THE HIGHEST STANDARDS IN INFORMATION SECURITY AND QUALITY

MAPAL Dr. Kress SE & Co. KG, headquartered in Aalen, successfully completed the TISAX certification at Assessment Level 3 in April 2026, thereby meeting the highest requirements for confidentiality and availability. In the same month, the certifications according to VDA 6.4 and DIN EN ISO 9001 were renewed.



Especially in the automotive industry and in sensitive development and production processes, robust security and quality standards are becoming increasingly important. Customers in the automotive sector make the protection of sensitive data a prerequisite for collaboration. In recent months, MAPAL has systematically further developed its existing information security processes and enhanced both technical and organisational measures. The goal was to establish a consistently high and transparent level of security across the company. To this end, structures were systematically expanded, responsibilities clearly defined, and processes standardised.

With the certified TISAX Assessment Level 3, MAPAL meets key requirements of many customers in the automotive industry while also strengthening the foundation for existing and future collaborations.

SUCCESSFUL SURVEILLANCE AUDITS OF THE QUALITY MANAGEMENT SYSTEM AT SEVERAL LOCATIONS

As part of the matrix certification, successful surveillance audits of the quality management system in accordance with VDA 6.4 or DIN EN ISO 9001 were conducted at several MAPAL Group sites in April 2026. In this context, external auditors confirmed the effectiveness and compliance of the internal quality management processes, as well as the commitment of the involved departments to continuous improvement and high quality standards.

Alexander Koschewski, Executive Vice President Strategy & Business Development at MAPAL, comments: **"The successful audits confirm the consistent efforts of our teams and our commitment to the highest standards in information security, quality management, and customer-oriented processes. This further strengthens our position as a high-performance partner for our customers."** ■



Alexander Koschewski, Executive Vice President Strategy & Business Development at MAPAL, stands for the consistent expansion of high standards in information security and quality management, which have been confirmed by the successful certifications.

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MAPAL at AMB 2026

MORE THAN JUST PRODUCTS: SOLUTIONS FOR CUSTOMERS' SUCCESS

In September 2026, MAPAL exhibits at the AMB in Stuttgart in Hall 1, Stand C11, across an area of 390 m², showcasing product innovations, its comprehensive turnkey offer and specific machining solutions for strategic components from its key sectors.

The precision tool manufacturer's innovations for 2026/2027 are making customers' production processes more productive and easier to manage, whilst setting new industry benchmarks. "Today, users expect manufacturing solutions that ensure both cost-effectiveness and process reliability, whilst also allowing for flexible adaptation to different requirements," says Jacek Kruszynski, Chief Technology Officer at MAPAL. "At AMB, we present innovations that meet these requirements and take the opportunity to engage directly with customers and partners."

Among the highlights of the product innovations is the new EA-Performance-System for fine boring (see page 13). For the first time, MAPAL presents a solution for setting fine boring tools even in the challenging diameter range of 10 to 19 mm using just one adjustment screw. The second generation of the MEGA-Deep-Drill-Alu also sets new standards. The new deep drill has been developed for the reliable machining of large drilling depths in aluminium and combines an optimised geometry, a high-performance cooling system and a tailored cutting material concept. This enables the flexible and reliable machining of various aluminium alloys.

COMPONENT-FOCUSED MANUFACTURING SOLUTIONS

As technology partner, MAPAL provides its customers with bespoke support, from the individual application to comprehensive turnkey solutions. MAPAL assumes full responsibility for the entire process, from process analysis and design, through the supply of tools and setting fixtures, to simulation, programming and production support. Visitors to the stand can find out how MAPAL delivers complete project planning, right through to a process ready for production, within 12 to 14 weeks.

As always, MAPAL's trade fair presence focuses on the customer, their individual production portfolio and the machining requirements for their components. MAPAL will showcase representative solutions for applications in the automotive industry, general machining and the aerospace sector, creating a basis for in-depth discussions with visitors.

MAPAL is once again using the AMB as one of the industry's most important platforms to showcase the further development of its offer portfolio and its key focus areas in the individual market segments. At the same time, the trade fair provides an opportunity to gather practical insights and discuss the future direction of modern manufacturing processes with customers and partners. ■



OVERVIEW INNOVATIONS 2026/2027



For the first time, the EA-Performance-System brings single-screw adjustment to the diameter range of 10 to 19 mm, making high-precision fine boring easier than ever.



The second-generation MEGA-Deep-Drill-Alu enables reliable deep drilling in aluminium up to 40×D, combining high process reliability with broad application versatility.



The OptiMill-Tro-Uni delivers reproducibly stable trochoidal machining and high material removal rates across varying CAM strategies and operating conditions.



The UNIQ DReaM Chuck with its original shrink-fit chuck contour extends the benefits of hydraulic expansion clamping technology to shank diameters from 3 to 5 mm. It can be seamlessly integrated into existing machining processes without any process adjustments.



The MEGA-Drill-Composite-MD-EdgePro, developed for multidirectional CFRP materials, significantly increases tool life and cutting speeds through maximum cutting-edge sharpness and a self-sharpening effect.



For the first time, an innovative actuation concept allows six sliders to be integrated into a single actuating tool, cutting cycle times in stator housing machining by approximately 70 per cent.





New PcBN cutting materials and a five-edged milling cutter design increase tool life and productivity in the machining of constant velocity joints.



The EA-Performance-System enables micrometre-precise fine boring with high process reliability, making it ideal for demanding fit and bearing bores in the diameter range from 10 to 19 mm.

A TECHNOLOGICAL BREAKTHROUGH IN FINE BORING

The EA-Performance-System from MAPAL is unique in combining easy setting with maximum precision in the diameter range from 10 to 19 mm

MAPAL is setting a new benchmark in fine boring with the EA-Performance-System. For the first time, easy setting with just one adjustment screw is now available in the demanding 10 to 19 mm diameter range, significantly reducing setting effort while delivering maximum precision.

THE SETTING CONCEPT IS KEY

MAPAL has embodied expertise in fine boring for decades. Classic fine boring tools use two adjustment elements for setting diameter and cutting-edge taper, therefore achieving maximum precision. This highly sensitive setting process requires in-depth know-how on the part of the onsite operator and was the starting point when developing the EasyAdjust-System in diameter ranges from 20 mm. With just one adjustment screw for the diameter and a back taper permanently integrated in a cartridge system, it significantly shortens setting times while maintaining high dimensional accuracy and surface quality. It also minimises sources of error.

In 2026, MAPAL is transferring the principle of one-screw setting to the technically demanding diameter range from 10 to 19 mm through a new design configuration. It is also the first company to launch the new EA-Performance-System for a broad spectrum of materials.

TECHNICAL DESIGN FOR DEMANDING APPLICATIONS

The design implementation of stable insert fixation with integrated back taper in this diameter range places high demands on system design, manufacturing precision and stability. It requires the insert seat and clamping mechanism to be precisely coordinated. MAPAL has achieved this by adapting the design of the connection between the insert and the clamping system.

At the heart of the innovation is a newly developed indexable insert with defined contact geometry, which, in combination with a matching clamping jaw, achieves positive-locking and reproducible positioning of the insert. The clamping mechanism between the indexable insert and clamping jaw transfers the setting movement precisely and ensures stable fixation under process load.

NEW BENCHMARK FOR EASY, PRECISE FINE BORING

In order to meet the highest precision requirements in small diameter ranges, the new EA-Performance-System from MAPAL for the first time enables micrometre-precise setting with easy handling and maximum process reliability. Minimised correction effort, low reject rates and stable machining processes ensure high efficiency in applications like high-precision fit and bearing bores, for example in transmission housings, cylinders, crankshafts and camshafts.

The system is already being used by select customers, where the stable setting behaviour and reproducible machining results have been confirmed in ongoing production. ■



The new EA-Performance-System for fine boring from MAPAL significantly reduces setting effort in the diameter range from 10 to 19 mm and achieves maximum precision with just one adjustment element for diameter setting.



Greater performance in the process: thanks to its self-sharpening effect, the new MEGA-Drill-Composite-MD-EdgePro from MAPAL achieves consistently high hole quality and significantly longer tool life.

MEGA-Drill-Composite-MD-EdgePro from MAPAL

SELF-SHARPENING DRILL FOR MULTIDIRECTIONAL CFRP MATERIALS

With an innovative drill for CFRP, MAPAL significantly increases tool life and cutting speeds when machining these demanding materials, which play an important role above all in the aerospace industry. The highlight of the new MEGA-Drill-Composite-MD-EdgePro: the tool sharpens itself during drilling.

Maximum sharpness for demanding CFRP machining operations: the new MEGA-Drill-Composite-MD-EdgePro prevents fibre tear-out and enables precise, clean bores in multidirectional CFRP materials.

MULTIDIRECTIONAL CFRP LAYERS AS A PARTICULAR CHALLENGE

Of the various possible arrangements of the fibres when bonding the carbon fibre fabric, the multidirectional layers of the composite material present the greatest machining challenge. For this reason, they are machined using specially designed tools with specific features. Clean cuts require very sharp tools – whose cutting edges are correspondingly sensitive to wear. For this reason, the drills are usually coated with CVD diamond. However, the coatings increase the cutting-edge radius, which has a negative effect on cutting performance. Due to the coating, the cutting edge is not as sharp as it should ideally be for this type of machining in order to produce clean bores without delamination at the entry and exit points.

EDGEPRO TECHNOLOGY FOR MAXIMUM CUTTING EDGE SHARPNESS

MAPAL has taken a look at this issue and quite literally sharpened things up with new technology. At AMB 2026, it is presenting a drill that sets new performance standards for the machining of multidirectional CFRP materials: with the new EdgePro technology, the main cutting edge is sharpened by laser on the first flank face. What remains is an extremely sharp cutting edge for flawless CFRP bores without fibre tear-out. With its good cutting characteristics, the drill can also be used for very thin-walled components. The cutting edge generates low cutting pressure, thus preventing the component from springing back and bending. For self-centring spot drilling with high dimensional accuracy and positional accuracy of the bore, the point has a 90° angle.

DESIGN FEATURES FOR QUALITY AND PROCESS RELIABILITY

The cutting edge corner of the new MEGA-Drill-Composite-MD-EdgePro has been redesigned and is significantly more stable than that of the predecessor tool. This results in less delamination even after longer machining times, contributing to high dimensional accuracy of the bore and very good surface quality. In the multidirectional (MD) version of CFRP, the fibres often stand up again when the drill is withdrawn. An integrated fibre catcher cuts off these protruding fibres and helps ensure clean bore quality. For the MEGA-Drill-Composite-MD-EdgePro, MAPAL uses the newly developed HC611 CVD diamond coating as cutting material. It ensures low thermal load and long cutting tool life, even with abrasive materials. In addition to high bore quality and process reliability, the new drill also impresses with greater possible application parameters. Compared with standard CFRP drills on the market, the MEGA-Drill-Composite-MD-EdgePro allows cutting speeds to be increased by at least 50 per cent.

SELF-SHARPENING EFFECT INCREASES TOOL LIFE WITH CONSISTENTLY HIGH QUALITY

A major advantage of the new MAPAL drill arises during use. It has a so-called self-sharpening effect that ensures consistently high bore quality and process reliability in production. This increases tool life by at least 50 per cent.

DEVELOPED FOR DEMANDING CFRP APPLICATIONS

MAPAL offers the new drilling tools in the diameter range from 3 to 12 mm; larger bores are generally milled. The drills are used wherever CFRP has to be machined. Applications can be found in the wind power industry, general machining, and sport and leisure. However, MAPAL's clear target group is the aerospace industry, where the highest demands are placed on bore quality and the use of the tools quickly pays off in series production. The first tools are already being used in this sector. Customer feedback has been positive across the board. In practical use, both the increase in cutting data promised by MAPAL and the specified tool life were exceeded.

With the self-sharpening drill, MAPAL has a clear unique selling point in the market. A comparable principle can be found in nature: beavers' teeth also sharpen themselves continuously as they gnaw. Drawing on this analogy, MAPAL refers to the beaver-tooth effect in connection with the EdgePro technology. ■

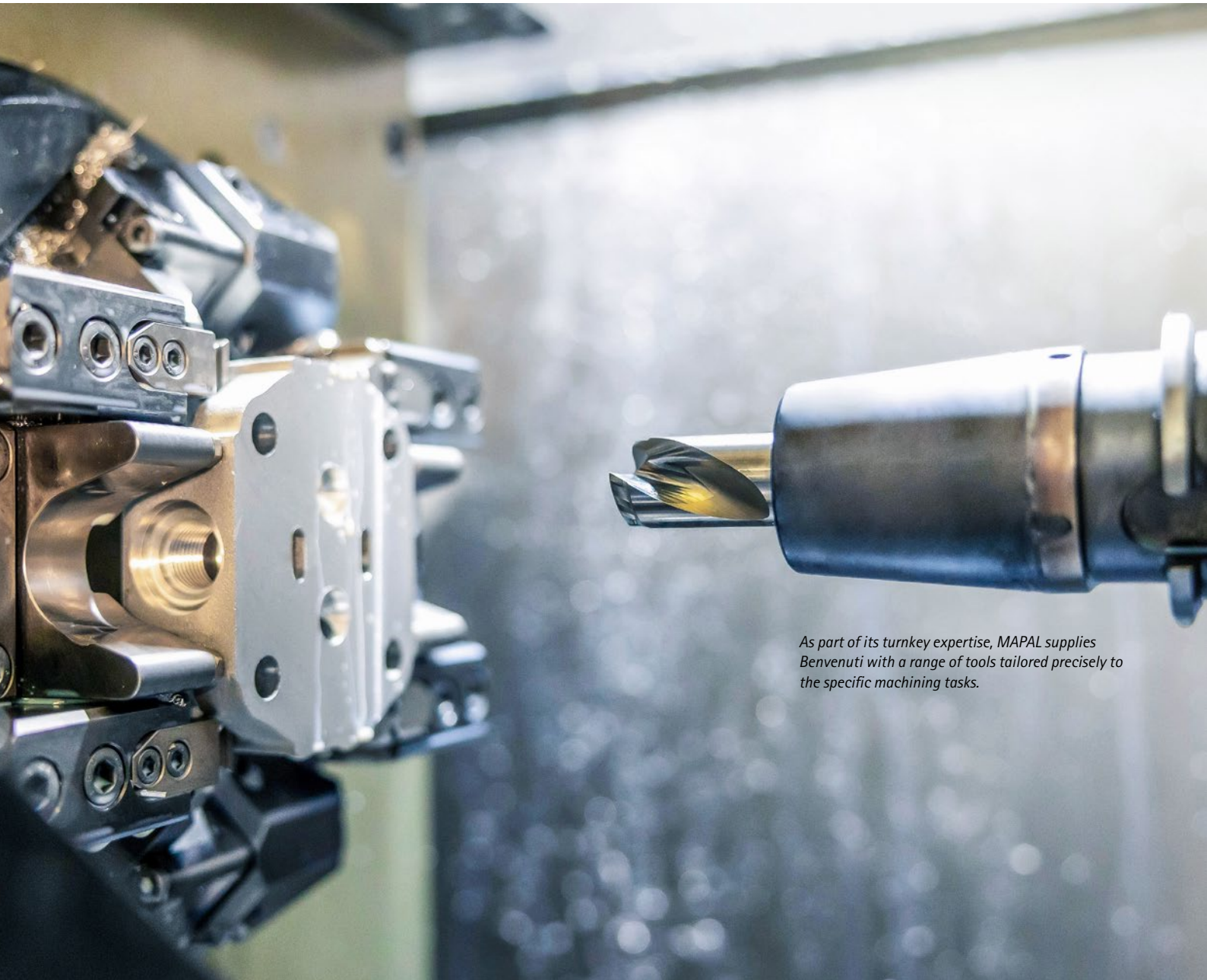


Developed for series applications in the aerospace industry: the MEGA-Drill-Composite-MD-EdgePro plays to its strengths wherever CFRP components need to be machined with process reliability and high bore quality.

MAPAL collaborates with Italian hydraulic manufacturer Benvenuti

DRIVING CUSTOMER MANUFACTURING PERFORMANCE

Italian hydraulic manufacturer Benvenuti S.r.l. runs its modern manufacturing with MAPAL – relying on tooling, tool management and tailored turnkey solutions of the precision tooling specialist throughout. With this setup, production has been made so efficient that it is now set to be rolled out to other sites within the parent company Casappa S.p.A. and Casappa Hydraulics Shanghai China.



As part of its turnkey expertise, MAPAL supplies Benvenuti with a range of tools tailored precisely to the specific machining tasks.





A total of 57 horizontal machining centres from MAZAK, MCM, MAKINO and DOOSAN are available for flexible manufacturing – as stand-alone machines, operated manually or by robot, and within FMS setups. ©Casappa S.p.A.

Systematically expanding the strategic partnership between Benvenuti and MAPAL, from left to right: Sergio Masperi, Area Sales Manager MAPAL Italia, Roberto Bergamaschi, Operations & Supply Chain Director Casappa Group, as well as CEO and member of the board at Benvenuti, Luca Benvenuti, Plant & Operations Manager Benvenuti, and Riccardo Benvenuti, Production Coordinator Benvenuti.

Benvenuti S.r.l. was founded by the Benvenuti family in 1987 and produces high-precision mechanical components, mainly for the hydraulics, energy and industrial engineering sectors. The company works closely with its customers to deliver tailored projects, from components to pre-assembled parts.

With its workforce of 70 employees, Benvenuti primarily produces hydraulic piston pumps, hydraulic gear motors, hydraulic blocks and heat exchangers in cast iron, steel, or aluminium. Lot sizes range from single prototypes through to series of 500 parts or more. In total, the company manufactures around 3,000 different components, across product families that differ in individual features. 57 horizontal machining centres operate around the clock in three shifts, seven days a week. Half of the machines are equipped with robotic cells, while the others are connected in groups to an FMS system for automatic loading and unloading. This means that each operator can oversee between three and five machines. "For us, being able to combine automated standalone machines and the FMS system are the key to maximum flexibility and makes us extremely competitive", explains Production Coordinator Riccardo Benvenuti.

In 2023, Benvenuti was acquired by Casappa S.p.A., a global leading manufacturer of piston pumps, gear motors, filters, and hydraulic systems. Casappa is also an Italian family-owned company with 850 employees. Being internationally established, Casappa has production sites in China and India as well as a global sales network. "At the company headquarters in Parma, we have recently opened a modern logistics centre covering 10,000 square metres, from which we feed the production of the plant in the Parma headquarters and ship to our distribution centers worldwide and also directly to our European customers", reports Roberto Bergamaschi, Group Operations & Supply Chain Director of the Casappa Group, as well as CEO and Board Member at Benvenuti.

The hydraulic components are mainly used in building and construction, material handling, agriculture and turf care and on-highway vehicles. The company produces more than 1 million parts each year. Alongside Casappa's focus on fluid power, the companies Ikron, from the filtration sector, and Tecnord, which specialises in hydraulic controls, form part of a common holding company. They complement each other in the development and manufacturing of products for electro-hydraulics – a growing trend that will play an increasingly important role in the future.

A 20-YEAR PARTNERSHIP WITH MAPAL

The collaboration between Benvenuti and MAPAL goes back to 2006, when the first fine boring tools were applied. "With these tools, we were able to significantly improve the production of our gear pumps", reports Federico Neri, Technical Office Coordinator at Benvenuti. MAPAL's fine boring solution expertise was also needed for the machining of specific cavities in extremely precise hydraulic components. Here, Benvenuti achieved the highest level of accuracy ever reached in such a process with MAPAL technology.

The collaboration really picked up pace in 2020, as Neri explains: "From that point on, we started to look not just at individual tools, but at the entire process with all the tools required." MAPAL has defined a complete tooling range for Benvenuti, which includes drills, milling cutters and reamers made from solid carbide, many of which were specially designed for the customer. For aluminium machining, MAPAL PCD tools have been introduced, and tool holders are also supplied. With the integration of an Italian setting fixture manufacturer into the MAPAL Group in 2024, Benvenuti has also gained access to workpiece clamping equipment designed and supplied to meet high-productivity requirements. With its comprehensive offer portfolio, MAPAL has become the preferred supplier and technology partner, with its know-how used to machine a large share of the components.

COMPLETE TOOL MANAGEMENT 4.0

Benvenuti took a huge step forward by introducing MAPAL's tool management system. Alongside the UNIBASE-M tool dispensing system, the set-up includes two UNISET-V tool setting machines. This allows Benvenuti to take full advantage of MAPAL's complete Tool Management 4.0. "Tool management continually highlights opportunities for optimisation and has become a key focus at Benvenuti", says Sergio Masperi, Area Sales Manager at MAPAL Italy.

By ensuring every tool is perfectly preset, Benvenuti is able to maintain consistently high quality and reliable production. The UNIBASE-M tool dispensing system, managed via the c-Com software, ensures that all the tools needed for production are always available. For Benvenuti, this is a major advantage – especially as, prior to the introduction of tool management, issues occasionally arose regarding availability and quality,

The production process is supplemented by around 28 automated cells equipped with FANUC robots.





A well-established team for 20 years – the responsible team members at Benvenuti and MAPAL: Riccardo Benvenuti, Production Coordinator Benvenuti, Giuseppe D'Asaro, TMS Logistics Clerk MAPAL Italia, Sergio Masperi, Area Sales Manager MAPAL Italia, Roberto Bergamaschi, Operations & Supply Chain Director Casappa Group and CEO and member of the board at Benvenuti, Luca Benvenuti, Plant & Operations Manager Benvenuti, Matteo Benvenuti, Sales and Supply Chain Manager Benvenuti, Federico Neri, Technical Office Coordinator Benvenuti, Federico Vettore, TMS Commercial Clerk MAPAL Italia.



For the machining of aluminium components, Benvenuti relies on high-performance PCD tool technology from MAPAL.

and also in the management of tools from various manufacturers. "Since we started using the MAPAL system, we haven't experienced any tool shortages at all in our production", says Riccardo Benvenuti. With real-time analysis from c-Com, MAPAL specialists have full visibility of stock levels and usage at all times. Tools in the UNIBASE-M cabinets are restocked every three weeks on average, and tools which have reached the end of their service lives are picked up. Tool reconditioning and regrinding are mostly handled by MAPAL at its facility in Gessate, Italy.

TURNKEY SOLUTION WITH ROBOT WITH AUTOMATED LOADING

When it comes to new products or optimising ongoing production, Benvenuti and MAPAL work closely together. Step by step, the partners review each stage of the process, decide on the right technologies, and agree on the best way to carry out the project. This approach led to the development of an initial turnkey solution for the efficient and automated manufacturing of aluminium pump covers a number of years ago. Particular attention was also paid to the clamping fixture: A clamping fixture which rotates 90 degrees enables two components to be machined from six sides in a single setup.

With its turnkey solutions, MAPAL now offers a comprehensive range of services covering the end-to-end planning and implementation of manufacturing processes. From project analysis and tool and fixture design through to commissioning and production support, every element is perfectly coordinated and tailored to the customer's requirements – all from a single source. The result is stable processes, high cutting data and low cost per part. For Benvenuti, MAPAL took on responsibility for the complete tooling package, including process design, while the machining programme was developed in-house. "It was a very complex project, with all elements needing to be precisely coordinated", says Riccardo Benvenuti, highlighting the benefits now achieved in production. It took eight months from initial quotation to the start of production, which was much quicker than expected.

Another turnkey project developed jointly involved prototype setting fixtures and dedicated tooling for machining oil pump covers for a new version of Casappa's piston pump. The machine was ready for operation in just two and a half

At Benvenuti, robotic cells and FMS integration enable a single operator to automatically load and unload multiple machines. As part of its turnkey expertise, MAPAL also supports Benvenuti in the reliable design of automated production processes.



Benvenuti relies on MAPAL's turnkey expertise and sources for example for the automated production of aluminium pump covers not only tooling technology but also process design and clamping fixtures from its technology partner.





"MAPAL is a very important strategic partner for us, supporting us in implementing tailored, automated solutions that enhance efficiency, quality and cost performance."

Roberto Bergamaschi, Operations & Supply Chain Director Casappa Group as well as CEO and member of the board at Benvenuti

months. "We see our collaboration with MAPAL in a very positive light and are keen to complete more projects together", confirms Riccardo Benvenuti. MAPAL's ability to deliver complete turnkey projects – providing tools, clamping fixtures and all other process components all from a single source – has been met with strong demand. Benvenuti was among the first customers in Italy to adopt MAPAL's workpiece clamping solutions.

With the purchase of Benvenuti, in addition to an important competitive advantage, Casappa has improved business continuity by significantly reducing the risks of dependence on machining suppliers, bringing back into balance the make-buy ratio that had been unbalanced in favor of machining in house in recent years of strong growth. The Board of Directors of Benvenuti confirmed the strategy of dedicating 60 to 70 per cent of the installed production capacity to the other companies of the group (Casappa, Ikron and Tecnord) and the remaining 30 to 40 per cent to other important Italian companies with which it can develop a long-term relationship. As Roberto Bergamaschi announces, Benvenuti has drawn up a business plan that forecasts a growth in turnover of over 30 per cent in the next two years compared to 2026 and which aims for 12 million euros in 2028. In addition to the introduction of the subsidiary Tecnord, the plan provides for the introduction of new customers in various sectors in addition to that of hydraulics for which the company has an exceptional specialization. The next step in development after 2028 involves the evolution from a national supplier to an international player capable of making competitive business proposals to important European companies, proposing itself as prime contractor, also taking advantage of the Casappa group's network of suppliers of raw materials and surface treatments.

INVESTING IN MODERN TECHNOLOGY

To become more competitive in terms of costs and delivery times, the company has invested one million euros in TEM technology, i.e. thermal deburring and lapping, and continues to invest in automated CNC machining with the aim of having more than 60 per cent of cells automated and the rest with FMS technology by 2028. Modern tooling and measuring technology are also a key focus, as Bergamaschi emphasises: "MAPAL is a very important strategic partner for us, supporting us in implementing tailored, automated solutions that enhance efficiency, quality and cost performance. This is a central pillar of our strategy, which is built on a strong and competitive position across a wide product portfolio. MAPAL is a key partner for us as a supplier – there's no question about it."

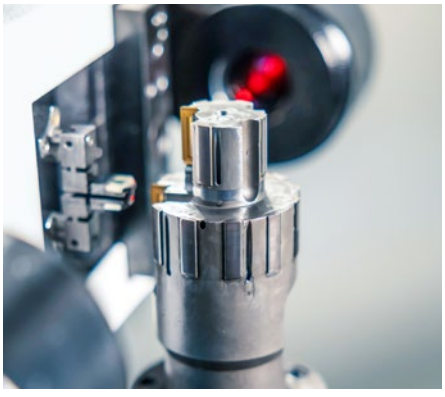
Bergamaschi now aims to leverage the positive experience gained with MAPAL's complete tooling solutions across other Casappa and Tecnord production sites. With this strategic decision, Benvenuti has entered into a close, long-term partnership with the tooling specialist – unlocking clear added value. "Casappa is not yet fully taking advantage of this added value, we're still building that up while with Tecnord we still have to define the objectives and a consequent programme for the introduction of MAPAL technology", says Bergamaschi. However, MAPAL tools and presetting



MAPAL's Tool Management 4.0 is a key component at Benvenuti, ensuring efficient operations, high availability and reliable process quality.

The UNIBASE-M tool dispensing system and two UNISET setting devices from MAPAL ensure that all the necessary tools are always available throughout the production process. ©Casappa S.p.A.





For Benvenuti, the use of MAPAL's state-of-the-art setting and measuring technology is a key factor in ensuring high process and component quality.



Benvenuti and MAPAL work closely together as equal partners on technical and quality-related matters.

systems are already in use at Casappa's plant in Shanghai. To ensure process reliability for components with particularly high functional and manufacturing requirements, machining processes evaluated and applied by Benvenuti were transferred to China, including all the necessary tools.

MAPAL's global presence and international production could offer advantages to Casappa in its existing plants in China and India and also with regard to European and Asian machining suppliers which are supported by a team of dedicated technologists. They aim to introduce the best standards of processing and process control to guarantee both competitiveness and high quality standards. MAPAL has already established itself there and can support international sites with projects right through to sophisticated turnkey solutions – where close collaboration between all partners involved is key. ■



60 to 70 per cent of the components manufactured by Benvenuti are supplied internally to other companies within the Casappa Group. ©Casappa S.p.A.



At the Sant'Ippolito di Fano site, around 70 employees at Benvenuti manufacture hydraulic piston pumps, hydraulic gear motors, hydraulic blocks, heat exchangers and other fluid technology components. ©Casappa S.p.A.

NeoMill-Diamond-FlyCutter for clean surfaces

PLASTICS MACHINING FOR CHIP MANUFACTURING

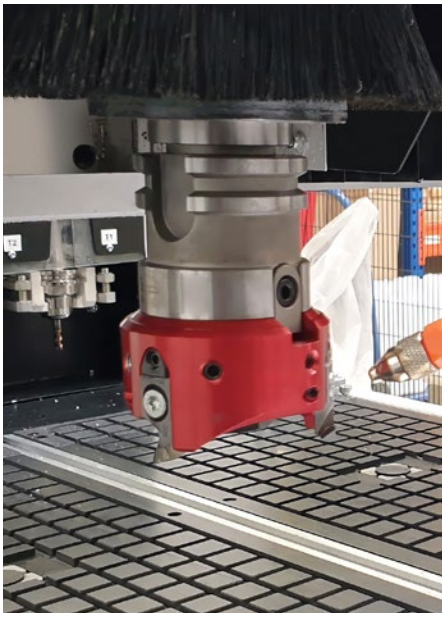
The core business of M-O-T Mikro- und Oberflächentechnik GmbH in Saarbrücken is the provision of equipment for manufacturing microchips. In their endeavour to manufacture as many of the required plastic components as possible in house, the company has made great progress using the MAPAL NeoMill-Diamond-FlyCutter.



At the front of the system are various process cells in a line that are used by microchip manufacturers to process the silicon wafers.



Group photo at the machine: (front row, from left to right) Robin Kollmann, M-O-T milling, Mike Jakob, M-O-T Production Lead, (back row, from left to right) Jan Schattschneider, Milling & Production Center M-O-T, Klaus-Dieter Leick, MAPAL Application Engineering and Leander Bolz, Component Management MAPAL.



MAPAL's lightweight HSC NeoMill-Diamond-FlyCutter milling cutter is perfectly suited for machining the surfaces of plastic parts clamped by M-O-T on a vacuum table using a BT30 connection.

Established in 2001, M-O-T Mikro- und Oberflächentechnik GmbH has been a part of the Woll Group since 2011. M-O-T complements the versatile range of the custom machine manufacturer by producing wet chemical process systems for the microsystem and semiconductor sectors. With a workforce of around 30 employees, this specialist company is fully integrated into the group, which is also evident with regard to its premises: M-O-T works out of three rooms in the middle of one of Woll's manufacturing halls.

In this area, a number of things are different from the general production process, which is predominantly focused on metalworking. It is not permitted to wear outdoor shoes, and there is a slight yet constant atmosphere of overpressure. Although manufacturing does not take place in a cleanroom, it is carried out in a controlled environment with elevated cleanliness standards, as explained by production manager Mike Jakob. Contaminants that enter the space could change readings in the high-precision equipment and therefore jeopardise the process. When working at the customers' premises, operations will subsequently take place in cleanrooms.

With the exception of the built-in electronics, the systems are almost completely made from plastic and designed in a modular fashion so that the necessary individual process steps can be accommodated in sequence during semiconductor manufacturing. Process cells are arranged in rows on the front side; silicon wafers are inserted into these for machining. Storage tanks are located behind the machine. They hold the liquids that are needed – mostly acids, bases and solvents. It is also possible to perform electroplating if necessary. Depending on the specific application, surface treatment is performed using M-O-T's custom-designed systems, either before or after the wafers have been exposed. By using off-the-shelf components, it is also possible to directly integrate photolithography into the system.

PLASTICS FOR VARIOUS APPLICATIONS

In order to manufacture the containers for the processing and storage of chemicals, M-O-T primarily uses sheets that are welded together using a thermal joining process. A number of different plastics are used for this purpose, the choice of which depends on the specific chemicals and the process temperature. The usual choice is PP or PVC, but in some cases it is also necessary to use PEEK, which is resistant to high temperatures, or fully acid-resistant PVDF. If a combination of different extreme requirements is needed, the best choice is often PTFE (also known as Teflon).

The number of systems constructed has increased greatly in recent years. In 2021, the figure was five or six per year, but M-O-T now supplies 20 to 30 of them. Fluctuations depending on market conditions do exist, and these in turn are the result of developments in the global semiconductor market. Furthermore, the equipment is becoming more complex. Manufacturing initially relied on suppliers most of the time. The fact that M-O-T has been relying on in-house production since 2022 is also linked to quality issues experienced with parts supplied by external suppliers: there were repeated instances of leakages in finished systems.

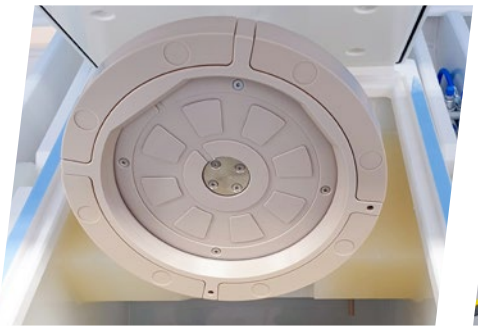
The way in which M-O-T processes its plastic sheets may at first seem to be rather unusual: the machine originates from the modelmaking sector, the tool was developed for milling aluminium, and a disinfectant is used as the cooling lubricant. For the purposes of this system engineering firm in Saarbrücken, however, this non-traditional combination proved to be very effective.

NEOMILL-DIAMOND-FLYCUTTER PROVIDES A SOLUTION AFTER A YEAR OF SEARCHING

The chosen machine was the T-Rex open-frame milling machine built by the manufacturer CNC-Step. The small SK30 connection is used as tool interface, while workpieces up to 1,000 x 1,000 mm in size can be clamped onto the vacuum table.



Production Manager Mike Jakob demonstrates how work is performed in the system's process cells.



The process cells hold round silicon wafers supplied by users. These are then treated with chemicals as part of processes that can frequently last for hours.



The system's electronics are housed at the upper end of the back, whilst the lower section contains the storage tanks for liquids such as acids, bases and solvents.

It proved challenging to find a suitable tool for the intended machining operations where good surface quality was the primary concern. Jakob explained the situation: "We weren't happy with the quality we were getting at the start. I spent a year looking for a suitable cutter head, but nobody was able to offer us a product that was completely suitable for the surface finish. It was while attending AMB 2024 in Stuttgart that I found what I was looking for with MAPAL, who had a milling cutter for our connection."

Together with Klaus-Dieter Leick, an application engineer at MAPAL, they determined the most feasible solution for the existing machine. They decided to go for a NeoMill-Diamond-FlyCutter with a milling head diameter of 63 mm. "We originally developed this tool for machining aluminium components in the electronics industry, where our aim was to produce a surface during face machining that was as close to perfection as possible", explained Leander Bolz from MAPAL's Component Management team. The Aalen-based tool manufacturer immediately felt confident that this would also work for plastics, especially since the tool had originally been designed for critical machine concepts such as small spindles and vacuum clamping.

The lightweight triple-edged milling cutter provided with a special cutting geometry lowers cutting pressure and removes chips from the machining zone relatively quickly. The low cutting pressure was already a core feature with regard to milling aluminium surfaces. By choosing the appropriate cutting material, MAPAL was able to adapt the tool to different materials.

M-O-T is very pleased with the NeoMill-Diamond-FlyCutter that has now been widely rolled out and has proven to be a genuine game-changer in surface machining. When the milling machine was purchased, the manufacturers only imagined it would be used to machine the doors of the enclosure. Over time, the company gradually expanded its in-house production capabilities and began manufacturing an increasing number of components itself. M-O-T now entirely manufactures the storage tanks for the necessary chemicals in-house and is also intending to manufacture the process cells in the future. Specialist components, such as Teflon process tanks, will continue to be manufactured externally. M-O-T uses the NeoMill-Diamond-FlyCutter for face milling the sheets. With regard to lateral machining and to finish contours, another tool from MAPAL, a PCD end milling cutter, is used.

ONGOING OPTIMISATION

Jakob's department doesn't yet believe that its goal has been fully met. Trials will be carried out with cooling lubricant to optimise surface quality and to better protect the tool. In particular, machining the rigid and brittle PVDF has at times caused wear to the PCD cutting edges on the NeoMill-Diamond-FlyCutter. However, M-O-T



M-O-T can use a vacuum to clamp components with dimensions of up to 1,000 x 1,000 mm onto the machine's worktable. MAPAL's NeoMill Diamond FlyCutter provides low cutting pressure and is perfectly suited for milling sheets.

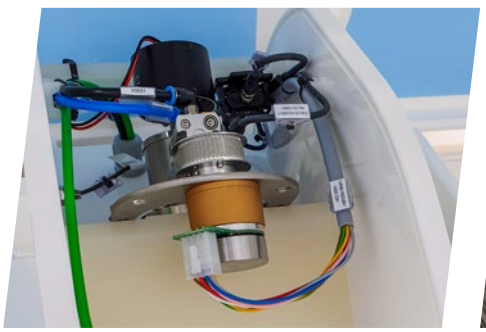
is severely limited in its choice of cooling lubricant. It is not possible to consider using oil since it may lead to the introduction of contaminants into the system that could, for example, affect the pH value or other process parameters. That is also why no metal chips are permitted in the M-O-T production area. Since it evaporates very quickly, isopropanol was chosen as the cooling lubricant, but the significant odour nuisance it causes means that it can only be used in a limited way on the machine.

It is also challenging to use plastics when it comes to cooling, as Robin Kollmann, who is responsible for milling operations at M-O-T, explains: "Plastics absorb less heat than aluminium. This means that the heat cannot be dissipated from the component rapidly enough. As a result, chips may fuse or clump together, which builds up more pressure and might potentially damage the cutting edge. The quality of the surface finish is also not as good as we would like it to be." During the machining process, 0.3 mm is milled away per cut. Depending on the material and quality grading, the stock allowance is up to 1 mm.

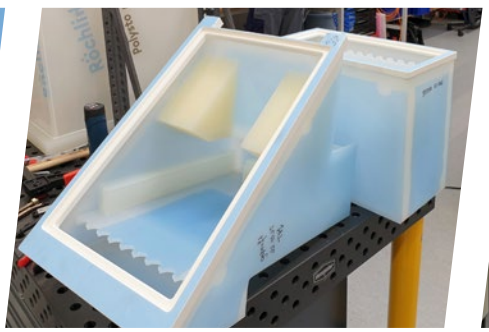
To avoid generating too much heat during machining, M-O-T is currently operating at a cutting speed of 6,000 rpm and a feed rate of 1,200 mm/min. This means the manufacturer is working well below the values initially suggested by MAPAL, which were already set lower than those for aluminium machining. To date, there is insufficient evidence to be able to assess the impact of isopropanol cooling on the service life of the cutting edges. Alongside this, M-O-T has started testing a new water-based coolant. As part of the testing process, the manufacturer has also decided to test working with higher cutting speeds.

Meanwhile, there has been a successful trial of the next optimisation step: M-O-T tested a larger version of the NeoMill-Diamond-FlyCutter with a milling head diameter of 100 mm, consequently deciding to place an order for the tool. Making a change to the milling head in a modular system such as this is not difficult since all MAPAL milling head diameters from from 63 to 160 mm are mounted on the same milling arbour. This is a good example of how MAPAL not only supports the application through provision of an appropriate tool but is also working on additional ways in which to increase productivity through an ongoing dialogue with the customer. ■

The system consists almost entirely of plastic, although electronic components are also installed in the process cells.



M-O-T constructs feed tanks and process cells from plastic sheets, which are welded together using a thermal joining process.



Different plastics are employed depending on the intended application, some of which are resistant to high temperatures or are fully acid-resistant



Continental Aerospace Technologies GmbH takes off with MAPAL

DIESEL IN FULL FLIGHT

Continental Aerospace Technologies GmbH builds diesel engines for aeroplanes in the German town of St. Egidien and is a global leader in this unusual field. Machining tools for important parts are provided by MAPAL.



Thanks to the fine boring tool with HX indexable insert, MAPAL was able to reduce the measuring effort by 50 per cent and machining time by 40 per cent compared to the previously used tool. The HX indexable inserts with six cutting edges also reduce tool costs.

Today's Continental Aerospace Technologies GmbH has been a driving force behind modern aeroplane engines for decades. From their highly specialised innovative centres in St. Egidien and Altenburg, they provide customers worldwide with a broad range of Jet A piston engines and components. The acquisition of the long-standing company by Continental Aerospace Technologies GmbH in 2013 signified an important turning point in their history. According to the company, this triggered a phase of dynamic growth, fuelled by their commitment to providing the highest degree of quality and focus on the satisfaction of their customers worldwide. The main factory of Continental Aerospace Technologies GmbH is located in St. Egidien. Development, production, assembly, testing, sales and administration are all found here. Electrical engineering is performed at their Hamburg location, while parts assembly and flight testing take place in Altenburg. Together, they are a closely intertwined network, which covers the entire engine-building process.

Continental Aerospace Technologies GmbH manufactures Jet-A piston engines for propeller aeroplanes in general aviation, which are used by companies such as Cessna, Piper and Diamond. Many flight schools also use these robust engines. In contrast to automotive engines, the aerospace industry prescribes strict replacement intervals: after a set number of operational hours, the aircraft engine must be replaced.

A special characteristic of engines from Continental Aerospace Technologies GmbH is that they can also run on kerosene. Pilots thus benefit from security of supply regardless of their destination. In addition, the turbo diesel engines also score points against air-cooled gas-turbine engines due to their fuel efficiency, which not only reduces costs but also extends range significantly.

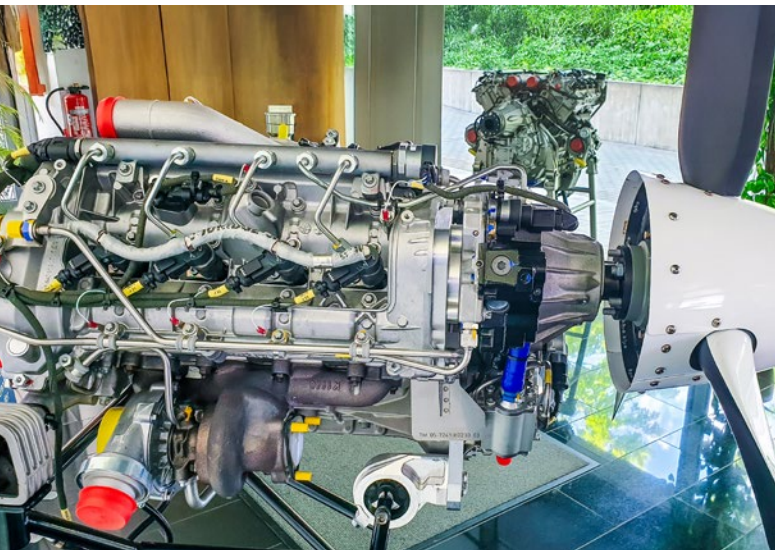
600 ENGINES PER YEAR

Manufacturing in St. Egidien cannot be compared with mass production in the automotive industry. There is more craft involved. The machine fleet is continuously updated and expanded. Well-filled order books ensure that manufacturing at the 6,000-square-metre plant is almost at capacity. Around 20 machines are available for turning, milling and grinding. "We produce everything that can be machined ourselves by harnessing the knowledge we've acquired over the years", Philipp Wilczynski, Head of Manufacturing at Continental Aerospace Technologies GmbH, says of their in-house manufacturing capabilities. On average, 600 engines are produced per year in St. Egidien. The various versions of the four-cylinder CD-100 make up the lion's share. The six-cylinder CD-300 is produced in smaller quantities.

When production started in 1999, the focus was on developing the gearbox, which reduces the engine speed to the propeller speed. "The engine can really only fly because of this development", Wilczynski explains.

Continental Aerospace Technologies GmbH showcases its products in its foyer in St. Egidien. The flags represent the ownership structure: the German machine builder belongs to an American company, which is owned by a Chinese group.





Diesel engine with propeller: the gearbox reduces the speed, allowing the engine to fly.



Troublesome connecting rod: reliable fine machining of the small end was only possible thanks to a MAPAL custom tool.



Every kilogramme helps: To save weight, Continental Aerospace Technologies GmbH replaced the casting material in the engine, originally designed for a car, with aluminium.

TOOLS FOR THE "PREMIERE CLASS"

Continental Aerospace Technologies GmbH relies on tools by MAPAL for the machining of strategic components like camshafts, valve seats in cylinder heads and turbo exhausts. "We call these the premier class of machining on the engine", says Tim Helgert, who advises customers for MAPAL as a technical consultant. For the most part, custom tools are required, which are designed to machine the corresponding components precisely.

While the shortest possible cycle times are of utmost importance in automotive serial production, Continental Aerospace Technologies GmbH sets great store by the level of quality achieved. The manufacturer also keeps an eye on machining times, but a few seconds more or less don't make a difference. "The prescribed tolerances and required precision can only be achieved reliably with custom tools", states André Ranke, Sales Director North DACH/HU. "The process can thus be realised in just a few steps; the precision is transferred from the tool to the component."

Wilczynski explains why process reliability is enormously important to Continental Aerospace Technologies GmbH: "In aerospace, you have to be sure beyond a doubt that all parts adhere to the required specifications. Unstable processes increase quality assurance requirements and thus expenditure." The standard inspection periods are tailored to the respective component and involve everything up to a full inspection. After final assembly, each motor finds its way to the test bench, where checks are conducted for leaks, performance and exhaust values.

PESKY SMALL END

MAPAL tools weren't always used for all important parts. However, the connecting rods weren't being machined with the required process reliability, which increased the metrological requirements and necessitated reworking, resulting in frequent rejects. The fine machining of its small end proved to be the critical step. This takes place as 27th machining step, i.e. at the end of the connecting rod machining. By this time, a lot of work has already been put into the connecting rod, which had already been sent to third parties for surface grinding and cracking three times.

"We put a lot of work into this part, but we had to throw some of them away in the end if they didn't come within the prescribed diameter tolerance of ± 3 µm", reports Andreas Knapp, Milling Shop Team Lead. The small end was spindled with a standard tool for years before the manufacturing department asked MAPAL to rise up to the challenge. As a technology partner, MAPAL quickly suggested machining with a custom tool. Tim Helgert explains: "Machining of connecting rods is one of MAPAL's core competencies, so we were able to apply our process expertise to finding a solution meeting Continental Aerospace Technologies GmbH's specific requirements quickly."

FORTY PER CENT LESS MACHINING TIME, METROLOGICAL EFFORT REDUCED BY MORE THAN 50 PER CENT

To machine the connecting rod's small end, Continental Aerospace Technologies GmbH now uses a MAPAL multi-staged fine boring tool with a HX indexable insert system and guide pads. It offers high changeover accuracy and optimised tool expenditures thanks to its indexable inserts with six cutting edges. Bevels on both sides of the bore are also no problem for this tool. The switchover from the conventional ISO spindle tool to the custom fine boring tool quickly paid off, according to Philipp Wilczynski: "We were fighting with dimensional variations from the spindle tool. A relatively high number of trial parts were required, there were a lot of rejects, and machine downtime was high because we had to measure a lot more during manufacturing. This was reduced by 50 per cent with the fine boring tool and the process reliability greatly increased correspondingly. Add to that the 40 per cent quicker machining time, which was a significant improvement for us." ■



Maik Wagenlehner, Tool Presetting Specialist at Continental Aerospace Technologies GmbH (left), and Tim Helgert, Technical Consultant at MAPAL, adjusting the MAPAL tool with HX indexable inserts.



Improving process reliability and efficiency at Continental Aerospace Technologies GmbH together (from left to right): Andreas Knapp, Milling Shop Team Head, Continental Aerospace Technologies GmbH, Philipp Wilczynski, Head of Manufacturing, Continental Aerospace Technologies GmbH, André Ranke, Sales Director North DACH/HU, MAPAL and Tim Helgert, Technical Consultant, MAPAL.

Stephan Köstler in an interview on transformation, new products and turnkey expertise at MAPAL

"GET IT RIGHT THE FIRST TIME"

The past few years have seen MAPAL adapt to changing market conditions. Requirements for tools, processes and services have changed as a result of shorter product life cycles, smaller lot sizes and changes to the driveline. In this interview, Stephan Köstler, Senior Director Product & Service Management at MAPAL, discusses how the portfolio is being adapted, the automation of quotation processes, and ongoing growth in terms of turnkey expertise.

Interview by Engineer Robert Fraunberger, x-technik

Mr Köstler, you're responsible for the product and service portfolio at MAPAL. What exactly does that mean in terms of your role?

I've held various roles at MAPAL since 2005, starting off in mechanical engineering and development positions, before moving into digital solutions, tool management and c-Com. I'm now responsible for the MAPAL Group's entire product and service portfolio, including product management, pricing strategy, market launches and everything that relates to how products, sales and the market interface with each other.

At the moment, MAPAL is undergoing a transformation process. What have been the most significant changes in the market?

The biggest change for us has been the increasing volatility in the markets. Although the automotive sector remains a significant one, components, quantities and the lengths of projects are changing in a big way. Here at MAPAL, it is not simply the smaller volumes that are decisive, but also the speed at which customers now require new processes. We have seen a significant shortening in terms of component and model life cycles – for example an internal combustion engine used to have a life cycle of several years. MAPAL therefore was granted implementation periods that lasted several months when it came to new generations of components. When we look at e-mobility projects today, these can sometimes include 50,000 to 70,000 parts and a model life cycle that is significantly reduced. As a result, customer expectations regarding process development times are also shorter.

It is no longer possible to systematically ramp up a project over the course of a year with the machine tool builder and the customer, and to optimise it throughout the course of the process. We now need the process to work very quickly: time, cost and quality all have to be balanced against each other. In turn, this is changing both our organisation and our product portfolio.

What does this mean for product development?

We need to focus in even greater depth on simplicity and process reliability. If things need to be right the first time, the tool needs to work reliably right from the very start. This is why we are working on systems that are easier to set or cover a broad range of applications or perform consistently in various machining situations.
What this doesn't mean is that we are just increasing the number of standard items. MAPAL offers around 1 million products; roughly 15,000 of these are included in the catalogue. The focus of our development is therefore on the creation of standard products that offer a broader range of applications, as well as the design automation of custom tools. Especially when it comes to smaller quantities, we need to be able to develop a quick, reliable and cost-effective solution.

Does this mean that the quotation phase also needs to happen at a different pace?

That is a genuine game changer. Previously, it could take up to two and four weeks to draw up a detailed quotation for a multi-stage solid carbide drilling tool, including the approval cycles, changes and final approvals. It was only at this stage that the manufacturing design phase could begin.

Today, it is possible to produce a fully qualified, production-ready proposal in fewer than 30 minutes. This represents a massive step forward that has been taken over the previous three to four years. We have seen that this process works very well in the solid carbide sector. In the meantime, PCD tools for multi-stage boring can also be configured using this process. On a global scale, several custom product configurations are now created every hour.

How is this achieved in practice?

We have made significant investments in product configuration, product automation and expert systems. These systems assist our colleagues in determining the correct design. The focus is not on the individual tool, but on ensuring that it fits the requirements of the component: What are the features of the component, what machining steps are necessary, and which strategy is most suitable from both a technical and economic perspective?

Stator housing or valve housing cannot be assessed just by using simple standard logic. While one customer may focus more on optimisation of quality, another customer may decide that optimising costs is the priority. It is parameters such as these that must be taken into account when creating the design.

How does MAPAL transfer this engineering expertise to international markets?

Historically speaking, MAPAL has focused strongly on Europe. A large number of core capabilities are based at the headquarters in Aalen, but if we want to transfer these capabilities to Asia or America, we will need international expertise at the same level. This is exactly why we are investing in regional capabilities. In the aerospace sector, for example, we have installed the Global Organization for Assembly and an R&D hub in France to respond to the fast pace of qualification processes. In India, we are establishing a development hub for the electronics industry: our aim is to meet local needs more rapidly and effectively.

As part of the transformation, how has MAPAL's product range changed?

We can divide our market offering into three areas. Firstly, we have products that are strongly application-driven and that focus on bore machining. A second area is component-based solutions. Final-

Guest article Fertigungstechnik 6/2026, x-Technik Industriemarketing,
Author: Robert Fraunberger



> "In the future, MAPAL will be in even greater demand in those areas where tools, processes and engineering have to work in conjunction with each other. This is exactly how we want to provide our customers with peace of mind: the provision of high-performance products, a top level of expertise in solutions and services, and the assumption of real responsibility for production."
>
> *Stephan Köstler, Senior Director Product & Service Management, MAPAL.*

ly, a third area is services, and these are becoming increasingly significant. Services include turnkey solutions and tool management projects. In the meanwhile, we view them as a core component of our offer.

This is why we will be showcasing new products and benchmark solutions at AMB 2026, all of which will also be available as of the AMB. What we're talking about here are market-ready solutions that have been trialled and validated.

Turnkey solutions have also become more important. How come?

Turnkey solutions are becoming increasingly important, both for us and for our customers. Lots of customers find themselves under enormous pressure. They need partners who can provide them with expertise in processes and take responsibility for them. This is an area where the major efforts and energy we have put into ensuring our portfolio is accessible and straightforward will really pay off.

Our expertise means that we can deliver complete project planning, including a finished process, within 12 to 14 weeks. This can include process design, clamping strategy, process flow, tools, cycle time evaluation and modelling through to NC programming, fixture design and manufacturing – right up to good parts confirmation on the coordinate measuring machine.

Which customers particularly value this service?

Demand predominantly comes from the Tier 1 and Tier 2 sectors, although OEMs also have requirements such as these. The further down you follow the supply chain, you tend to find there is less and less time. This is the reason we particularly find turnkey solutions in the fluid sector, in general machining where there are moderate production quantities, and in the automotive sector. Lot sizes are typically between 50,000 and 100,000 components, so in this context, it's a big advantage if partners can set up processes quickly and reliably.

The term turnkey is used by lots of suppliers today – what are MAPAL's strengths in this area?

Turnkey is one of those buzzwords that comes up in many contexts. We've already touched on this, but it's the in-house capabilities that are crucial: engineering, process understanding, tool expertise, modelling, NC programming, setting fixtures, ramp up support, and the ability to consistently deliver these services on a national basis and achieve a reliable standard. We are uniquely positioned in this area and are continuing to invest in it. The feedback we've received from the market shows that we've made the right decision.

What is the current situation with regard to c-Com and digital services?

The integration of c-Com is finished. c-Com was important to us because it allowed us to build the capabilities we needed to develop digital products for the market. Ultimately, what we have discovered is that digital products need to be very closely linked to our core business. That's why it was the right decision to reintegrate c-Com into the core processes that relate to machining.

Projects that use c-Com as a digital tool management solution continue to be successful. Over the next year or two, we will also be making progress in the product range, where one of our focus areas will be automated demand planning and process optimisation for our customers.

On which sectors specifically is MAPAL currently focusing?

Our core segments are still the automotive, aerospace and general machining sectors, including fluid technology. We are experiencing good performance in the aerospace sector but scaling-up can prove particularly challenging. There is also potential in the fluid technology sector. In addition to these, we are exploring new fields on a very selective basis. In South-East Asia, electronics manufacturing is an interesting area, particularly with regard to housing components. We are also looking into the defence sector and humanoid robots, but simply because there is a lot of buzz around a market, doesn't mean it will automatically be a good fit for us. The key factor is whether our capabilities match the requirements and whether we have the ability to meet customer expectations right from the start.

How do you see the future of the automotive sector developing?

With regard to Europe, our expectation is that the automotive sector will remain relatively flat over the coming years. The move in the market towards hybrid and electric vehicles is continuing, and we are aligning ourselves with this trend. Internal combustion engine projects will still exist, although these will vary greatly on a regional basis. In the USA, it seems more stable in this regard. In Asia, and specifically in China, e-mobility remains a key issue, although there are still challenges in terms of access there. That is one of the reasons we are making targeted investments in local capabilities in order to better understand the market and align ourselves more closely with our customers.

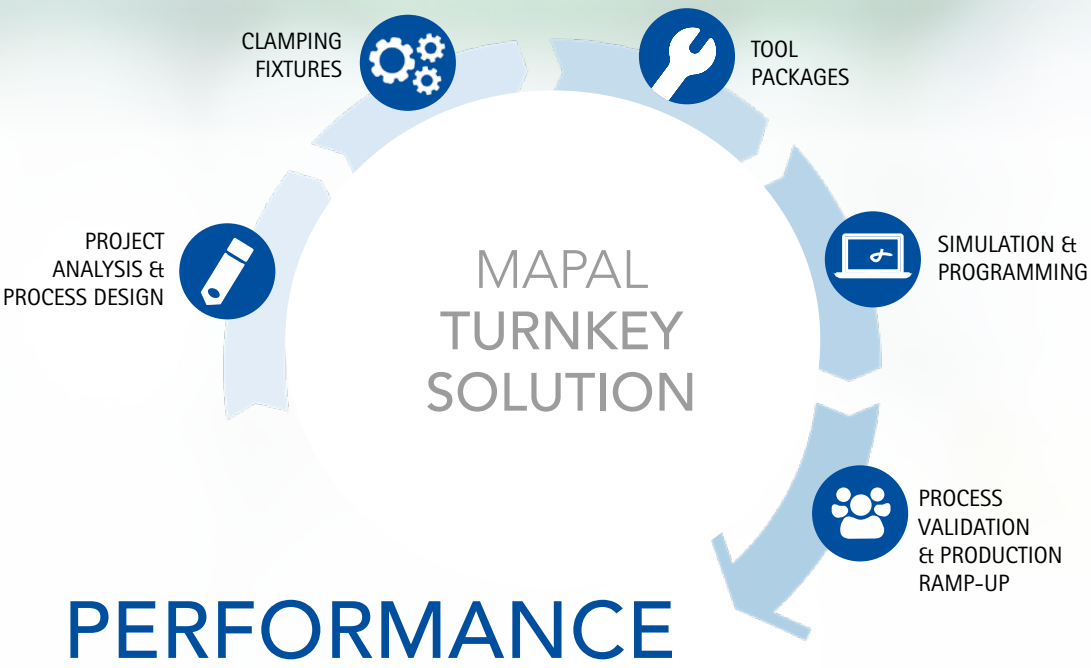
What is your assessment of Germany, Austria and Switzerland as a manufacturing region?

The manufacturing technology currently available is now on a very similar level around the world. The differences become more pronounced, however, when you look at automation, productivity and local adaptability. A lack of investment in scalable automation is likely to result in difficulties. For MAPAL, the issue is not so much a question of safeguarding our presence in Germany, but rather about making sure we are able to deliver on our value promise to customers. We are committed to upholding this value promise at all times and in line with the expectations of customers, as well as ensuring our working practices are aligned accordingly. As a result, we are acquiring a better understanding of regional needs and developing the right skills in the right places.

So to conclude, what direction will MAPAL take next?

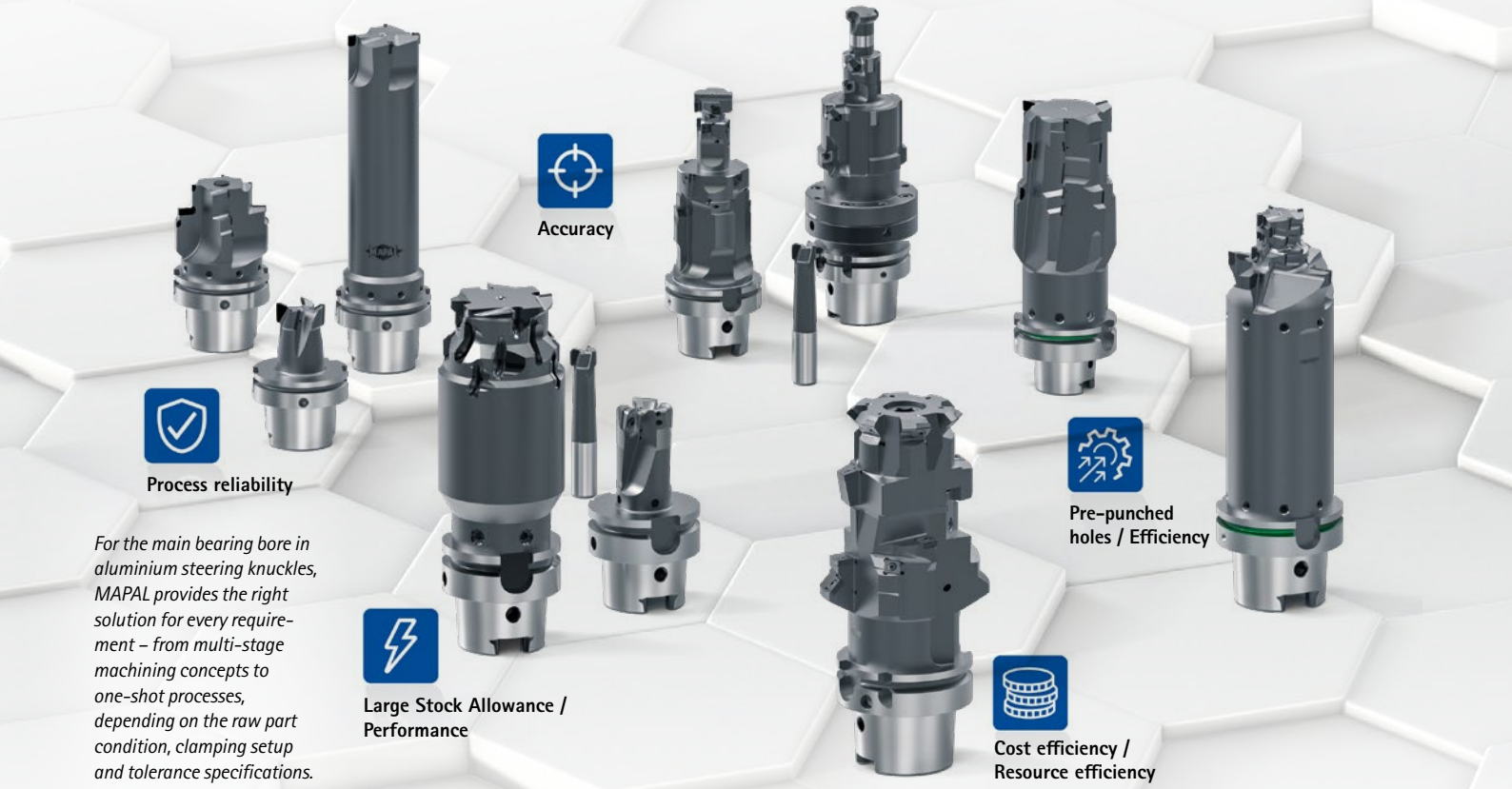
Over the next few years, our aim is for our transformation to continue to build on a stable foundation that can be scaled globally. The continued automation of our portfolio and engineering processes is a key driver of this. Although we have made good progress to date in this area, we have not yet achieved our goal. We also expect the trend towards becoming a full-service provider to continue to grow, in particular in terms of engineering and services. Pressure on our customers to be increasingly competitive is growing, with many of them deciding to focus more closely on their own core competencies. This in turn gives us at MAPAL an opportunity to contribute our process and engineering expertise in an even more targeted manner.

Thank you for the interesting insights!



PRECISION SOLUTIONS FOR COMFORT AND SAFETY

Wheel carriers and steering knuckles play a decisive role in a vehicle's ride comfort and safety. Over recent years, these chassis components have become significantly more complex, evolving from passive structural parts into highly integrated, precision-engineered functional modules. With a wide variety of component designs in use throughout the industry, MAPAL provides efficient machining solutions tailored to every requirement as a technology partner for machining.



For the main bearing bore in aluminium steering knuckles, MAPAL provides the right solution for every requirement – from multi-stage machining concepts to one-shot processes, depending on the raw part condition, clamping setup and tolerance specifications.

Depending on the axle and vehicle concept, wheel carriers and steering knuckles perform key functions in wheel guidance, force transmission and steering kinematics. As safety-critical components, they must withstand high wheel loads while meeting the most demanding mechanical and kinematic requirements. A wide range of component variants is used, depending on the manufacturer, steering system, vehicle class and installation space.

The materials used also vary considerably. Cast iron remains a cost-effective choice, particularly in lower vehicle segments where components are often required in high production volumes. MAPAL's machining solutions are specifically designed to address the high abrasiveness of this material.

Driven by increasingly stringent efficiency requirements and the continuing lightweight design trend – further accelerated by electromobility – these components are now being manufactured increasingly from aluminium. At the same time, a shift is taking place from die-cast aluminium to forged aluminium, which offers higher load-bearing capacity and a longer service life. This development presents new challenges in machining. The forged material contains less silicon, making chip breaking more difficult and increasing the tendency for material to adhere to the cutting edge.

THE STEERING KNUCKLE BECOMES A FUNCTIONAL MODULE

These components have become considerably more sophisticated over time. While a control arm was previously bolted directly to the component, modern designs incorporate additional bearing arrangements. To ensure these bearings can be pressed in reliably, tight tolerances and high-quality surface finishes are required. Functional integration continues to advance. The steering knuckle now provides mounting points for the brake caliper, wheel hub, control arm and ABS system. As a functional module, it contributes to efficiency, driving dynamics and the integration of additional sensors, for example for autonomous driving functions.

As functional integration increases, so do the demands placed on machining solutions. The specified precision requirements and tight tolerance ranges contribute directly to drive comfort, noise reduction and bearing life. To achieve maximum accuracy and avoid errors caused by re-clamping, steering knuckles and wheel carriers are increasingly machined in a single setup and on multi-spindle machines. Depending on the component variant, annual production volumes can exceed 500,000 parts.

For the key machining operations, MAPAL offers multiple solutions tailored to different customer requirements. The following examples illustrate these solutions using aluminium steering knuckles. This approach allows the tooling specialist to address both the wide variety of designs used by vehicle manufacturers and differences in raw part quality and clamping conditions.

FOCUS ON THE MAIN BEARING BORE

MAPAL has defined a range of tooling concepts for machining the main bearing bore. As a technology partner, the company is familiar with the specific requirements of its customers, selects the most suitable machining strategy and adapts it to local production conditions.

Depending on the casting process and component geometry, the bore may be completely cast closed, near-net-shape cast with a radial allowance of up to 4 mm, or, in the best-case scenario, pre-punched. As a result, high material removal rates are often required in the first machining step. MAPAL specialists use PCD circular milling tools to reduce the allowance and prepare the bore close to its final contour. Depending on the bore geometry, different process strategies are applied using milling tools, drill-milling tools or boring tools equipped with hook cutting edges for back boring operations. Tolerance requirements for the main bearing bore can be as demanding as IT6.

Where machining is carried out in two setups and clamping conditions are critical or unstable, MAPAL's three-stage machining concept for aluminium steering knuckles begins with rough machining from both sides using a PCD milling tool. Two PCD boring tools then complete the finish machining of the diameter.

Where circular milling is possible, MAPAL offers a machining solution that enables higher cutting parameters. The OptiMill-Diamond-SPM milling cutter with brazed PCD cutting edges demonstrates its strengths in this application. Thanks to its highly positive cutting geometry and optimised chip spaces, cutting forces can be reduced by up to 15 per cent compared with conventional PCD milling cutters. The optimally integrated PCD cutting edges ensure high stability during machining. As an alternative using indexable inserts, MAPAL offers the NeoMill-Alu-QBig. Designed for high-speed machining, this high-volume aluminium milling cutter features a finely balanced tool body for optimum performance. In the final machining step, a complex PCD milling tool completes the entire contour of the main bearing bore.

Where the tightest tolerances are required, MAPAL combines rough machining with the OptiMill-Diamond-SPM and semi-finishing using a multi-stage boring tool equipped with indexable inserts. The final machining operation is then carried out using a fine boring tool featuring the EasyAdjust-System. With this system, the back taper is already integrated into the cartridge that holds the insert, eliminating the need for a separate adjustment process. The diameter can still be adjusted with maximum sensitivity, ensuring highly precise machining results.

MAPAL's portfolio for machining main bearing bores is complemented by one-shot solutions for pre-punched aluminium steering knuckles. PCD drill-milling and milling combination tools offer exceptionally high efficiency, particularly in applications with very stable clamping conditions that allow complete contour finishing by milling. Customers looking for an alternative to brazed PCD tools and requiring a solution without adjustment capability can opt for a tool with replaceable indexable inserts. The tangential milling cutter represents a sophisticated tooling concept that combines as many machining operations as possible in a single tool.

KEEPING THE WHEEL ON TRACK

Alongside the main bearing bore, the control arm connection is another critical steering knuckle feature that receives particular attention from MAPAL. It forms the central interface between the steering knuckle and the chassis. Tight tolerance requirements up to IT6, demanding form and positional tolerances, and high surface quality standards are essential to ensure that connected components keep the wheel precisely on track. MAPAL designs the tooling accordingly, tailoring it to the specific requirements of each applica-



MAPAL also designs customised machining solutions for the control arm connection based on proven reference concepts.

tion. The process generally involves two tools, although one-shot solutions are possible under suitable conditions.

Rough machining is performed from solid material, with the lugs of the control arm connection typically unsupported in the clamping fixture. It is therefore essential to keep cutting forces low during rough machining. MAPAL once again relies on the advantages of the OptiMill-Diamond-SPM, which mills the bores using helical interpolation without distorting the component.

Because high feed rates and aggressive helical infeed strategies are often used, significant heat generation can occur in practice, particularly when minimum quantity lubrication (MQL) is applied. This can lead to built-up edges on the cutting tool. Any resulting bore deformation may only become visible after the finished component has cooled down. Drawing on extensive process expertise and a holistic view of the control arm connection, MAPAL works closely with customers to develop the optimum process, maximising productivity while avoiding such undesirable effects.

During finish machining, the fixture design may require tools with overhang lengths of up to 300 mm. With tools of this length, spindle engagement can create a tilting moment that prevents the set tool diameter from being transferred accurately to the component. To ensure compliance with demanding tolerance requirements under these conditions, MAPAL once again relies on the EasyAdjust-System. Thanks to its user-friendly cartridge design, the tool diameter can be adjusted with micrometre precision using a single adjustment screw. Diameter corrections can therefore be made quickly and efficiently, helping maintain process capability and quality requirements. For applications with slightly lower precision requirements, a brazed PCD boring tool is available as an alternative finishing solution.

PRECISION AT THE WHEEL HUB INTERFACE

Another function-critical machining operation concerns the bolt-hole bore that creates the force-transmitting connection between the steering knuckle and the wheel hub. This feature demands high contour accuracy. During machining, the component must be swivelled into a specific position to allow tool access. Due to the angled machining position, significant deflection forces can occur, causing the PCD ball-nose milling cutter to vibrate. The consequences would be excessive machining noise, poor surface quality, inadequate form accuracy and reduced tool life.

MAPAL ensures reliable process performance even in these challenging machining conditions through optimised tool design. A precisely defined arrangement of cutting edges and cutting-edge positions, combined with tailored edge preparation, effectively suppresses vibration while maintaining high machining performance.

TURNKEY EXPERTISE FOR DEMANDING COMPONENTS

The machining of steering knuckles requires extensive process and application expertise as well as tooling solutions precisely adapted to individual customer requirements. Against this backdrop, turnkey projects are becoming increasingly important. MAPAL has systematically expanded this area into a strategic focus and combines process design, fixture engineering and supply, tooling design and supply, programming and commissioning within an integrated approach.

As a result, the technology partner supports its customers in implementing even highly demanding machining operations with maximum process reliability and efficiency. ■

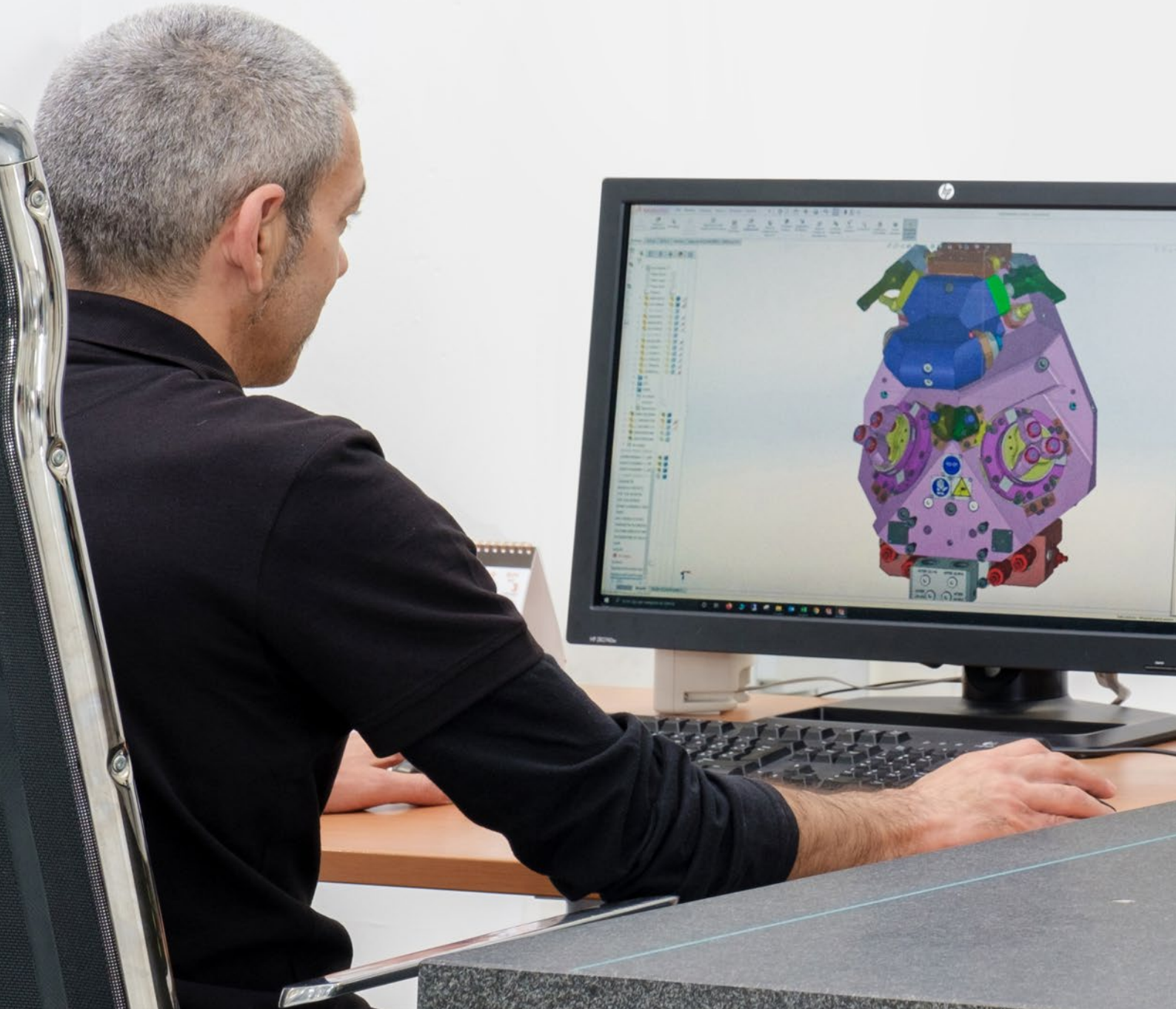


MAPAL offers a comprehensive range of tooling solutions for the efficient machining of cast wheel carriers and steering knuckles, tailored to material properties, component geometry and production requirements.

The bolt-hole bore is critical to the connection between the steering knuckle and the wheel hub. MAPAL's PCD ball-nose milling cutter ensures contour accuracy, surface quality and process reliability.

CLAMPING DEVICES
AS PART OF A TURNKEY SOLUTION

The success of a turnkey project depends on how efficiently the elements of the manufacturing process all work together: tools, machine, machining strategy and clamping fixture. The more coordinated these components are from the start, the larger the potential for achieving process stability, accuracy of repetition and productivity. In this respect, clamping fixtures play a crucial role. They have a direct impact on the extent to which workpiece positioning can be reproduced, the level of reliability in terms of maintaining tolerances, and how fully the potential of the tool solution can be exploited.



TURNKEY EXPERTISE THAT GOES BEYOND THE TOOL

To complete its turnkey competence, MAPAL has added the area of clamping fixtures to its portfolio by adding a specialist company to the group in 2024. This enables MAPAL to integrate the design and supply of clamping fixtures directly into turnkey projects. Together with tools, machining processes, project management and process support, customers thus access a complete production solution from a single source as the clamping fixtures are coordinated with the tool layout, machine environment and production targets from the beginning.

DESIGNED AROUND THE COMPONENT

Every clamping fixture starts with the component. Drawings or CAD models, material data, machining operations, tolerances, machine tool details, production volumes and quality targets define the framework for engineering. From this information, the team determines how the component is located, which surfaces can be used for support and clamping, how the tools can access the machining areas and how deformation can be avoided. The clamping fixture is therefore designed as a functional element within the entire process chain.

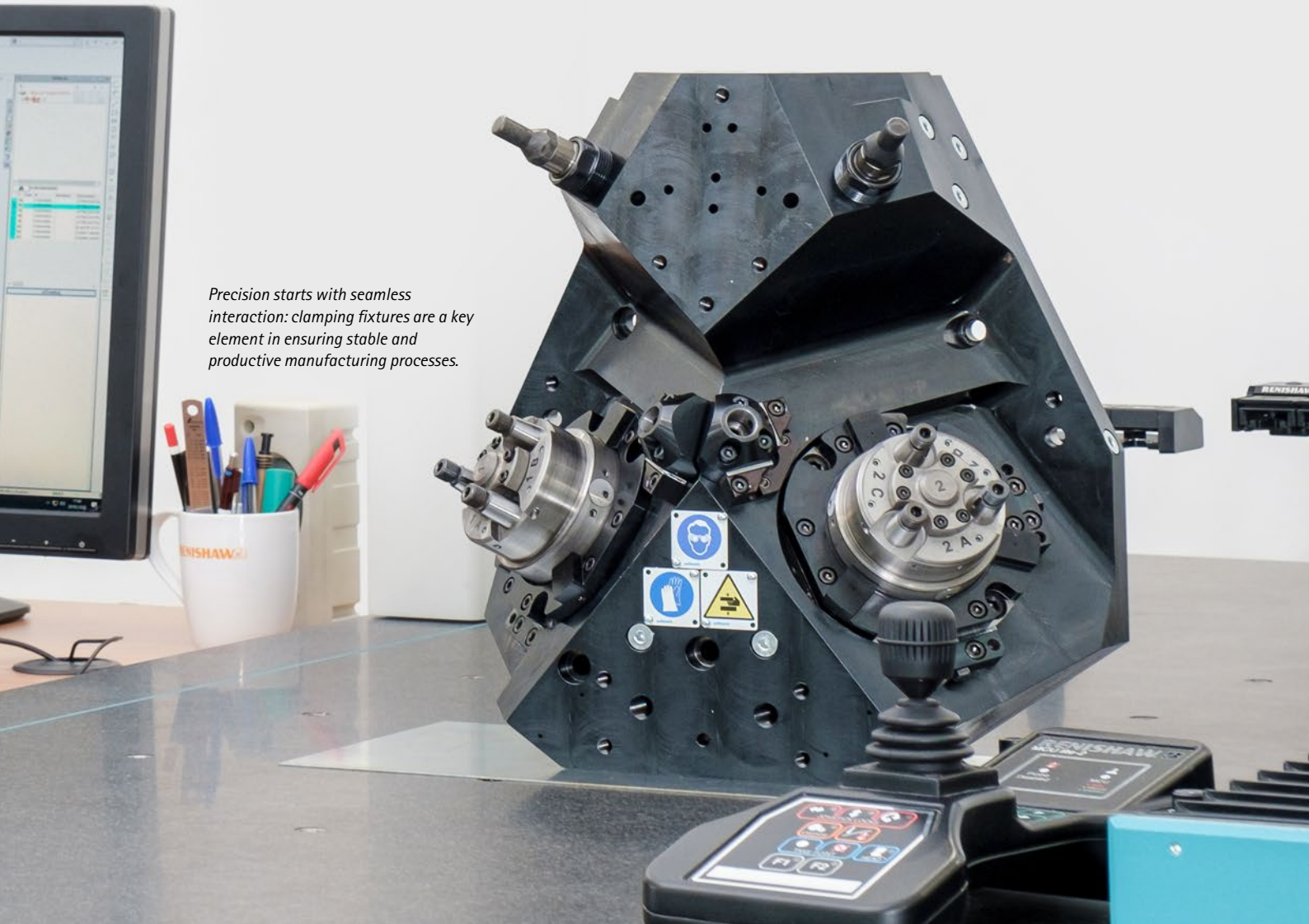
This close coordination becomes especially important for complex components, multi-sided machining and automated production environments. Tool access, spindle orientation, machine strokes, cutting forces, clamping points and pallet positions all influence one another. If they are considered separately, restrictions may only become visible late in the project. When tools, machining strategy and clamping fixture concept are developed together, possible collisions or unfavourable accessibility can be identified early. This reduces additional loops during commissioning and supports a stable ramp-up of production.

MECHANICAL, HYDRAULIC AND AUTOMATED SOLUTIONS

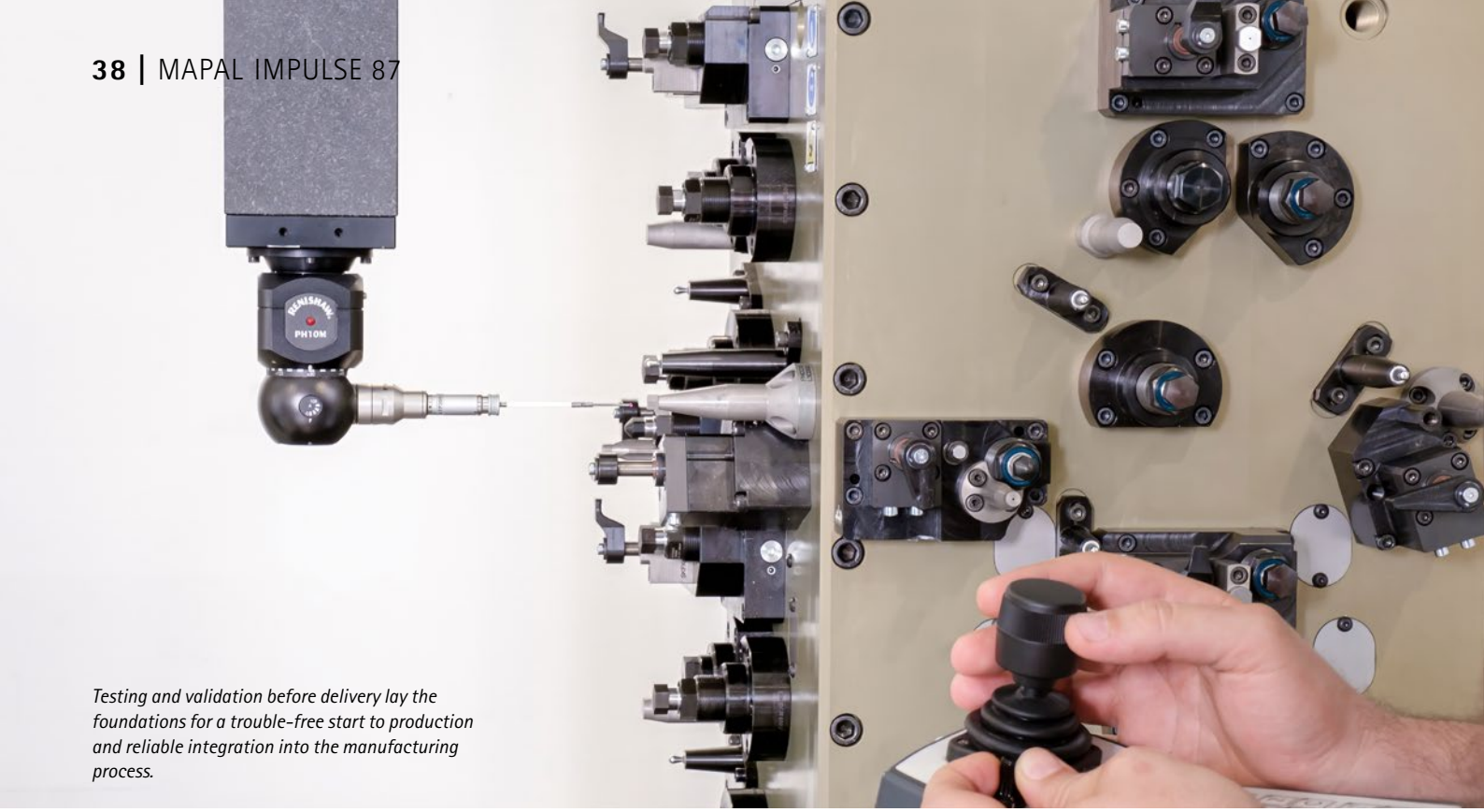
The right clamping technology depends on the component, the production environment and the level of automation required. MAPAL offers custom mechanical and hydraulic clamping fixtures for turnkey projects, complemented by pneumatic or automated functions where required. Each solution is developed specifically for the customer's application, while proven engineering principles and standardised elements are used wherever possible. This makes the clamping fixtures reliable in operation, easy to maintain and user-friendly for production personnel to handle.

Repeatability is one of the key quality characteristics of a clamping fixture. Particularly in series production, where even small deviations can affect process capability, it becomes an important lever for machining quality, quality assurance and productivity. Repeatably stable clamping reduces micro-movements and vibration, helps avoid workpiece deformation caused by uneven clamping forces and supports dimensional accuracy over long production runs. It also contributes to surface quality and tool life, because the cutting edge operates under more predictable conditions.

Mechanical clamping fixtures are particularly suitable where robust, compact and cost-effective



Precision starts with seamless interaction: clamping fixtures are a key element in ensuring stable and productive manufacturing processes.



Testing and validation before delivery lay the foundations for a trouble-free start to production and reliable integration into the manufacturing process.

solutions are needed. The mechanical brackets used in these clamping fixtures are designed for controlled and repeatable clamping forces. Compared with conventional mechanical slide clamps, the system reduces dependence on the operator: the position of the clamp and the force applied to the workpiece become more consistent from one production cycle to the next.

Hydraulic clamping fixtures come into play where higher clamping forces, shorter cycle times, defined clamping sequences or a higher degree of automation are required. They are particularly common in high-volume production environments, where the need for automated loading and unloading often becomes a key driver. Depending on the application, pneumatic and automated functions can also be integrated. The choice of clamping technology is driven by the customer's productivity targets, batch sizes, component geometry, available machine environment and investment objectives. In this way, the clamping fixture concept can be aligned with the required balance of process reliability, flexibility, operating costs and return on investment.

Yet even the most sophisticated clamping technology has to prove itself on the shop floor. The clamping fixture must work for the people who use it every day. Ergonomics and operation safety are therefore considered during engineering. Clear clamping sequences, good accessibility for loading and unloading, easy cleaning and maintenance-friendly design help reduce setup times and avoid handling errors. This is particularly important in demanding production environments with high machine utilisation and short response times.

VALIDATED BEFORE DELIVERY

Process reliability is not left to the final run-off. It is built into the clamping fixture concept step by step through a structured validation process. After the 3D modelling phase, the concept is checked with regard to maximum dimensions, compatibility with the machine tool strokes, reference and clamping points, clamping sequence and positioning of the workpiece in relation to the pallet centre. Potentially critical spindle positions are also reviewed. For hydraulic clamping fixtures, the relevant hydraulic and pneumatic connections are included in the validation.

Validation goes beyond the digital model. Before delivery, the clamping fixtures are assembled, inspected and tested. Depending on the project, this can include dimensional reports from the metrology room, verification of workpiece reference and clamping points for each machining phase, functional tests and performance acceptance. Deformation tests show how the clamping fixture influences the workpiece, based on the criteria defined during the approved design phase. For hydraulic clamping fixtures, leak tests and sequence tests ensure that the hydraulic functions operate reliably.

SUPPORT THROUGHOUT THE LIFECYCLE

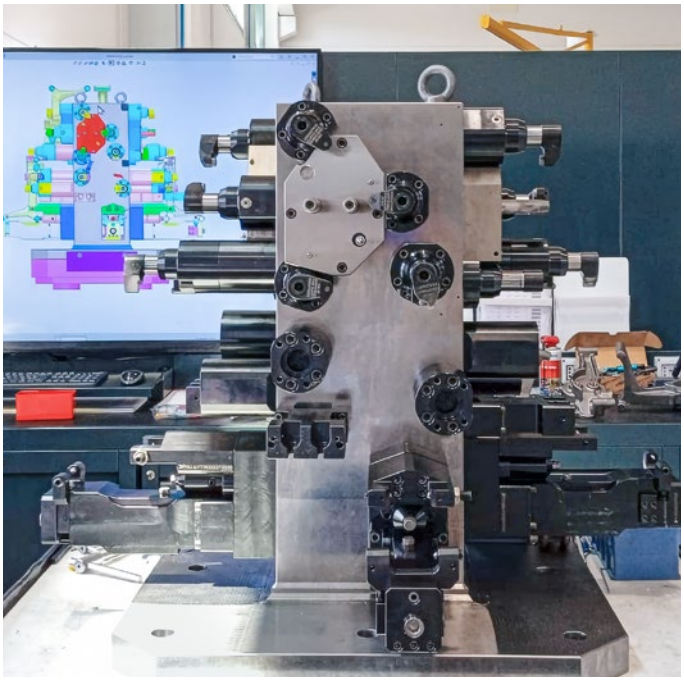
Customers receive the relevant documentation for operation and maintenance, including operating and maintenance manuals, assembly drawings, spare parts lists, inspection reports and hydraulic or pneumatic schematics where required. Support during installation, production start-up and capability runs is also part of the offering. This ensures that the clamping fixture can be integrated into production reliably and that operators have the information they need for safe, efficient use.

If the component, machining process or production environment changes during production, clamping fixtures can often be modified, upgraded or adapted. This helps customers use existing investments for longer and react flexibly to new requirements. Spare parts, maintenance and repair concepts contribute to long-term availability and make the clamping fixture a reliable part of the production system rather than a one-off project component.

AN EVEN STRONGER BASIS FOR RELIABLE MACHINING

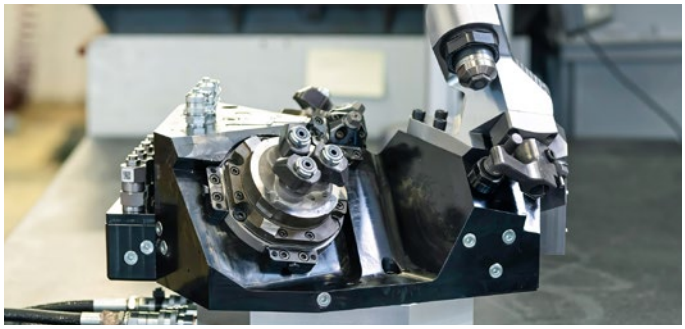
With clamping fixtures from the company group, MAPAL strengthens its turnkey competence even further. Customers benefit from a holistic and integrated production solution. This reduces interfaces, increases planning reliability and speed and creates a robust basis for productive, repeatable and high-quality machining. ■

Reproducibly stable clamping provides the basis for dimensional accuracy, process reliability and high-quality machining.



Clamping fixtures are tailored from the outset to the tool design as well as the machining environment and process.





Hydraulic clamping fixtures are often used when high production quantities, short cycle times or automated processes are needed.



Clamping fixtures from the MAPAL Group add another key component to the turnkey offering within the process chain.



From the start of the development phase, tool accessibility, clamping points and machining processes are considered within the framework of an integrated system.

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