EDITION 69

MAPAL TECHNOLOGY MAGAZINE

IMPULSE

FROM THE COMPANY

TECHNOLOGY HIGHLIGHTS

PRACTICE REPORTS

Cover story:
Digitalisation for reground tools

Dear readers
and business partners,

We are living in interesting times. Our business is feeling the effects of factors such as the uncertainty surrounding Brexit and persistent barriers to trade, and I am sure that things are no different for you. In spite of that, we are cautiously optimistic for the future.

Our growth of almost 5% in 2018 shows that this optimism is justified. Consolidated Group turnover climbed from €610 million in 2017 to €640 million in 2018. MAPAL currently has more than 5,500 employees worldwide, with over 3,600 in Germany. We have confidence in our capacity for innovation and our flexibility, which are based on our employees' skills and expertise.

To ensure that we can maintain our track record of success, we have made substantial investments in the locations in the past year and will continue to do so. In Asia, we founded a new joint venture in Vietnam and acquired

the majority stake in ADICO, a manufacturer of PCD and PcBN round blanks.

We are building up our operations in America as well so that we can respond more quickly to your needs in the region. We have expanded our location in Fountain Inn, South Carolina. A completely new plant was also opened in Mexico in February 2019. In Germany, capacity at the Centre of Competence for solid carbide tools in Altenstadt is currently being increased with a new production hall. In addition to new buildings and expansions, there are continuous investments in new machinery all around the world in order to maintain the highest level of quality and productivity.

We will continue to work together to do everything we can to offer you the best possible tools, solutions and services.

Yours,

Dr Jochen Kress

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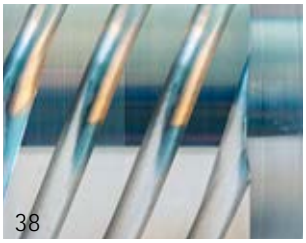
FROM THE COMPANY



TECHNOLOGY HIGHLIGHTS

PRACTICE REPORTS

IMPRINT

Editorial team: Andreas Enzenbach (V. i. S. d. P.), Patricia Hubert, Oliver Munz, Sabine Raab, Kathrin Rehor, Tobias Zimmermann
Layout and Design: Alexander Rückle
Picture credits: pp. 6–9: ZEISS, Manfred Stich; pp. 10–13: Aircraft Industries; p. 23: iStock, zentilia/MAPAL;
p. 26: iStock, LordRunar; p. 35: iStock, ScofieldZa; all other pictures: MAPAL

Publisher: MAPAL Präzisionswerkzeuge Dr. Kress KG
P.O. Box 1520 | D-73405 Aalen | Phone +49 7361 585-0 | Fax +49 7361 585-1029 | info@mapal.com | www.mapal.com

Print: VVA, Austria | Circulation: 19.000 German, 11.000 English

You can subscribe to Impulse under http://www.mapal.com/en/news/customer-magazine-Impulse

Guest article | ZEISS

THE eMOBILITY ROADMAP

Speeding up tool development at MAPAL with the ZEISS PRISMO ultra

These days, the employees from the development department at MAPAL Dr. Kress KG generally know within an hour if new tools will offer the level of precision their customers require. Instead of having to wait days for a service provider to deliver the measurement results, the company started performing on-site measurements at the beginning of 2018. With the high-precision coordinate measuring machine ZEISS PRISMO ultra, MAPAL inspects the workpieces machined with the new tools it manufactures. The time saved on measurements helps this global company develop innovative tool solutions even more quickly for trends that will play such a pivotal role in the future like eMobility.

Automotive manufacturers achieved a significant milestone in 2017: for the first time, they sold over one million electric vehicles worldwide. The major players in this industry continue to make significant investments in eMobility to ensure they are well-positioned in future markets. Volkswagen, for example, plans to spend 20 billion euros over the coming years. The company will roll out around 50 different electric cars and 30 plug-in hybrids by 2025.

This feat will require a lot of tool manufacturers as well. „We're the ones who have to quickly develop the right tools and tool solutions to produce the new components and materials required for eMobility," explains Dr. Dirk Sellmer, Vice President of Research & Development at MAPAL Dr. Kress KG.

And since less effort is needed to machine electric motors as compared to combustion engines, fewer tools will be required in the future. Hence MAPAL is establishing new fields of business alongside its Powertrain area. The familyowned company, which has 5,500 employees worldwide, will invest in tool and mold-making technologies.

HOW A WORKPIECE ENSURES A PRECISE TOOL

„We need extremely exact measurement results to develop high-precision, innovative tools and tool solutions," says Sellmer. For years, the company had an external service provider measure its workpieces and tools. Sellmer compares MAPAL's tools to „Lego blocks that are combined to create complex solutions." To deliver these bespoke products to the customers more quickly, the company invested in an extremely precise coordinate measuring machine (CMM) from ZEISS in 2018.

That year, at the beginning of January, two employees began working with the ZEISS PRISMO ultra. Almost a year later, Sellmer has reached the following conclusion: „The investment has paid off." The measuring machine provided this tool maker with the necessary precision and was immediately running at full capacity. The two employees from the development department, who alternate between the measuring system and the production machines every two weeks, inspect the department's tools on the CMM.

Most importantly, however, MAPAL employees measure workpieces that are machined in the development area with the company's own tools, thereby determining the workpieces' precision and stability under manufacturing conditions. Precision is on everyone's mind at this company headquartered in Aalen, Germany, because most MAPAL tools and tool solutions are used when components need to be machined with a very high level of accuracy.

The stator housing for an electric motor is one example of how MAPAL is successfully meeting its customers' requirements. The challenge with this cast part is to create the primary, large-diameter borehole that runs through the entire component – all with an accuracy of just a few microns. For perpendicularity, the tolerance is just 30 microns (0.03 millimeters) and, for coaxiality, 50 microns.

THE RIGHT TOOL FOR STATOR HOUSINGS

These are extremely narrow tolerances for such large boreholes. Yet a closer look at the design of the electric motor illustrates why these stringent requirements are necessary. Take, for example, the permanent magnet synchronous motor, the most frequently used motor design in New Energy Vehicles (NEV). The stator is the stationary component within the motor. Coils or copper wires known as hairpins are attached. These generate a current that creates a rotating magnetic field. The rotor is located within the stator and, thanks to its own constant magnetic field, follows the magnetic field of the stator. The three-phase current of the rotor causes it to rotate in synch with the magnetic field. ➔

"We need extremely exact measurement results to develop high-precision tools," says Dr Dirk Sellmer, Vice President Research & Development der MAPAL Dr. Kress KG.

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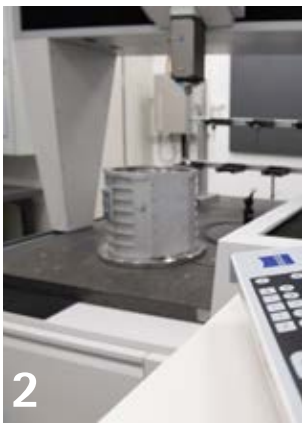


2

The rotor cannot actually move unless there is a gap between it and the stator. However, the rotor is subject to considerable magnetic resistance, which in turn reduces the magnetic flux density and with it the power of the motor. Thus designers make this gap as narrow as possible. To ensure that the manufacturing process does not compromise the component's design, MAPAL offers its customers a high-precision tool which is also very light for its size.

First, a borehole is made in the cylinder for the stator housing. This means that a tool approximately 30 centimeters in length creates a hole in the outer die-cast layer of the housing. Then the surface is carefully ground down. Tools for the highly precise machining of primary boreholes for stator housings have been part of MAPAL's product portfolio for one-and-a-half years. And since not all housings are identical, these tools are customized for each customer.

ON-SITE MEASUREMENTS FOR REDUCED WAIT TIMES

Automotive manufacturers generally provide ten to 30 housings that MAPAL must then machine with the corresponding tools in its testing area. The measurements performed after multiple rounds of machining serve as the basis for optimizing the highly complex tool solutions in line with the customer's needs.

Before purchasing their own coordinate measuring machine, MAPAL had an external service provider measure its workpieces and tools. However, the company's measuring expenses rose significantly within the span of just 10 years. MAPAL increasingly manufactures the tools for its customers and takes on pre-series production. Numerous measurements are performed to ensure that the customer has all the information they require.

The need for more measurements also increased outlay. „Compared to 2007, we spent twice as much on external measuring services in 2017," says Sellmer. Yet as the company considered whether or not to invest in a CMM, it was not the costs that ultimately tilted the balance, but time.

„We used to have to wait two to three days for measuring results. This is no longer the case," explains Sellmer. Now, these are generally available within an hour.

And that is not all. Since the employees performing measurements at MAPAL have also received metrology training, there are fewer artifacts. „Since our team also works with the machines used in production, they have a highly developed intuition and know, for example, where contaminants might have impacted the measurement result," says Sellmer.

Moreover, the components are now clamped in the machining fixtures for measurements and measured on the company's premises. This reduces potential artifacts caused by removing the workpieces from the fixtures or reclamping them. Another significant benefit for MAPAL is the ability to intermittently perform unplanned measurements, such as with thin-walled components like a stator housing. This way, the company can see how fixturing impacts machining. Dr. Sellmer highlights yet another key advantage: the improved communication between engineers and technicians. They can now discuss the results at the measuring machine, rather than relying solely on measurement reports. This promotes knowledge sharing. „We now achieve our goals significantly faster," says Dr. Sellmer.

Thanks to the measurement with ZEISS PRISMO ultra Frank Deschner, employee of Research and Developement at MAPAL, knows within one hour whether the tools meet the high-precision requirements.

1 *MAPAL sees itself as a technology partner who supports its customers developing efficient machining processes with individual tool concepts.*

2 *Since the beginning of 2018, two employees of MAPAL have been working with ZEISS PRISMO ultra.*

3 *Frank Deschner presents the results of the measurement with ZEISS PRISMO ultra to Alessandro Gabbia, product manager at ZEISS.*

NEW MEASURING MACHINE, NEW MEASURING LAB

In order to utilize the potential of their new, high-precision bridge-type CMM, the tool manufacturer first had to construct a Class 1 measuring lab. This investment cost about as much as the measuring machine itself, which is why MAPAL put its trust in ZEISS' recommendations on building the measuring lab, including which contractors to hire.

„The end result is quite impressive," says Dr. Sellmer. Around 20 square meters in size, the newly constructed measuring lab offers a high level of reliability thanks to special climate control and its own ventilation system: „All this makes it the right space for our measuring jobs."

Sellmer never considered purchasing the system from any company other than ZEISS. First, because MAPAL has been working with ZEISS machines for years. He describes the systems' ease-of-use, quality and the level of service as „extremely impressive."

And the second reason? „A lot of our customers use ZEISS systems," says Sellmer. Working with ZEISS generates trust and even simplifies customer communication. „This way, we can address problems together and find solutions more quickly." ■

MILLING CUTTERS FOR THE NEW GENERATION

Machining structural parts for aircraft reliably, cost-effectively and without defects calls for purpose-built tools. Czech civil aircraft manufacturer Aircraft Industries depends on milling cutters for high-volume machining from MAPAL to get the job done.

From left: Libor Krchňáček and Oldřich Zich (Aircraft Industries) discuss the machining with Petr Macho (MAPAL).

The story of Aircraft Industries began in 1936. Since then, the company, based in Kunovice in the Czech Republic, has built more than 8,000 aircrafts of various types. The manufacturer is currently focusing primarily on the latest generation of its L 410 model, the L 410 NG, which entered series production last year. The standard version of the aircraft, 90% of which consists of aluminium parts, is designed for short-haul flights. The multipurpose aircraft can transport 19 passengers and is also used for transporting cargo from remote areas to major cities.

The L 410 NG represents a significant improvement on its predecessor, featuring a new wing structure that allows for higher fuel capacity and thus a longer range. It is also fitted with more powerful engines and cutting-edge avionics.

MANUFACTURING PARTS QUICKLY AND EFFICIENTLY

In preparing for the production of parts for the aeroplane, Aircraft Industries revised its approach to machining and, in 2015, installed a new horizontal machining centre for high-performance aluminium machining. "This enables us to manufacture our parts more quickly and efficiently," say Libor Krchňáček and Oldřich Zich from Aircraft Industries, explaining their decision to purchase the equipment. At the same time, the company was in the market for tools that satisfied its requirements with regard to machining speed, durability and surface quality. ➔

The aircraft L410 NG is the latest generation that Aircraft Industries produces.

The inside shape of the wing made of aluminium is machined with MAPAL tools.

Parts for the L 410 NG – the skin on the upper and lower surfaces of each wing, which forms the outer shape of the wing, as well as the integral subframe and fuselage sections – are machined from large blocks of aluminium. "MAPAL's glowing references and experience in aluminium machining made it our first port of call when we were drawing up the process for machining the aircraft skin," the responsibles from the Aircraft Industries team recall. For milling machining, Aircraft Industries contacted Petr Macho, who is MAPAL's technical consultant responsible for the Czech Republic.

PCD MILLING CUTTERS OFFER IMPRESSIVE PERFORMANCE ACROSS THE BOARD

"We conducted some exploratory trials with a PCD-tipped high-feed milling cutter, and the customer was thrilled with the tool right from the start," recalls Petr Macho. The four-bladed milling cutter, which is designed specifically for machining convex surfaces, has a diameter of 20 mm and features a special toroidal geometry. At a spindle speed of 23,000 rpm and a cutting speed of 1,445 m/min, it produces an average surface roughness of between 0.4 and 0.8 µm. "We are very happy both with the surface and with the tool life of the milling cutter," say Libor Krchňáček and Oldřich Zich.

Starting with this first tool, the partnership gradually grew broader. "Once we had made effective use of the PCD milling cutter for machining the surface of the wing skin, we tested solid carbide milling cutters for machining the integral subframes of the main wing," recalls Libor Krchňáček. As Oldřich Zich adds, "We are absolutely delighted with the machining quality and reliability of these tools as well." To rough machine the entire structure, including the pockets, the company uses the SPM-Rough high-performance milling cutter with a corrugated profile. It impresses with high material removal rates, excellent rigidity and perfect chip flow at high machining values. For example, it is capable of operating at a feed rate up to 13 m/min. "The bottom panel of the wing, which is part of the fuel tank, is made from 2000 kg of material – and after 35 hours, 73 kg is all that is left," says Krchňáček.

Aircraft Industries uses a solid carbide milling cutter from the SPM series for finishing the structures of the main wing as well. It features polished chip flutes that ensure that chips are removed reliably. "This was another milling cutter that delivered optimal results right from the first test," says Macho. The result is that all three tools are now being used to great effect for manufacturing various parts of the aircraft. "What matters to us is that the tools we use are reliable and provide accuracy of repetition while still being cost-effective," stresses Zich, "and all of that is exactly what we get from the MAPAL tools."

FROM PARTS MANUFACTURING TO FINAL ASSEMBLY

It is little wonder, then, that the decision-makers at Aircraft Industries not only employ MAPAL tools for manufacturing parts but are also considering using them for final aircraft assembly. "The latest stage in our partnership has involved carrying out tests with combination tools for reaming and countersinking for hand drills to machine the rivet bores," says Macho. Aircraft Industries has also tested a MAPAL reamer for reaming H8 bores in the aircraft interior. These tests, too, have been successful, which means that MAPAL tools will no longer be limited to parts manufacturing but will soon be appearing in final assembly at the Aircraft Industries factory in Kunovice. ■

Aircraft Industries uses different milling cutters, drills and reamers from MAPAL. From left: Reamer for H8 bores, milling cutters for finishing and roughing the pockets, PCD high feed milling cutter and a combination tool for reaming and countersinking for hand drills to machine the rivet bores.

Aircraft Industries not only produces the components (picture below), but also completely assembles the aeroplanes (picture above).

Digitalisation for regrinding of tools –

Transparency and efficiency courtesy of c-Com

Reconditioning tools represents a significant expense for manufacturing companies. But regrinding and recoating to manufacturer quality are essential to continuously make use of the full potential of the tools. There's nothing especially critical about that. What often is critical about reconditioning, though, is the process of registering and managing the tools at the regrinding company. To create transparency for customers, safeguard a reconditioning service that takes just a few days and take some of the strain off its own employees, MILLER GmbH & Co. KG therefore uses c-Com GmbH for its regrinding management. ➔

Once the tools have been scanned at incoming goods, colour-coding is used to indicate whether all items on the delivery note are fully accounted for.

About c-Com

At c-Com GmbH, it's all about digital services. c-Com was established in 2017 and is part of the global MAPAL Group. The start-up is the company behind c-Com, an open-cloud platform for data management for tools from any manufacturer. There are numerous applications that can be used to enhance the platform.

Before regrinding management from c-Com, staff at incoming goods had to sort through all the tools and compare their order numbers with the items on the delivery note.

The order numbers can often be read only with the aid of a magnifying glass.

Every week, around 6,000 tools arrive at MILLER in Altenstadt, Germany, for regrinding. "We are seeing robust growth of roughly 20% every year in tool reconditioning," says Stephan Loska, Director of Technical Projects and International Service at the manufacturer of solid carbide tools. Consequently, something of a "company within a company" has grown up over the years, dedicated solely to regrinding solid carbide drills and milling cutters. It is important to note that exactly the same machinery, software and grinding wheels are used here as for manufacturing new tools. "That is how we reliably ensure that tools are reconditioned to manufacturer quality," says Loska. There are around 30 employees working on the machines over three shifts, plus another four employees in incoming goods and five in customer service working exclusively on regrinding.

In 2018, the supervisors under Stephan Loska faced the challenge to align a significant upturn in incoming orders with the customer expectation of a few days of run-through time. "It was

Measurements are automatically transferred from the Bluetooth-enabled callipers to c-Com at the touch of a button.

Thanks to c-Com and the specifically developed scanner, registering tools at incoming goods is now a much faster process.

clear that we would need either to expand our capacity considerably or to refine and simplify our processes," explains Loska. Incoming goods in particular offered a great deal of potential.

A MANUAL PROCESS – TIME-CONSUMING AND PRONE TO MISTAKES

"We sometimes receive parcels full of various unsorted tools," explains Tobias Spiegl, who is responsible for customer service at MILLER's regrinding department. The only information about these tools, if there is any at all, is printed on the delivery note. "That meant that our employees had to sort through all the tools and compare their order numbers, which on tools with small diameters can often be read only with the aid of a magnifying glass, against the items on the delivery note," says Spiegl. The next item on the agenda was to inspect the tools to determine whether they could be reground. Criteria that could rule a tool out include its condition, its minimum length or customer specifications such as the maximum number of regrinding operations. Following tool identification, the check as to whether the items and quantities match those on the delivery note and the diagnostic process to determine whether the tools can be reground, all this information needed to be entered manually in the ERP system (SAP) so that a service report and order confirmation could be created.

"For a delivery of 80 tools, this largely manual process took around two hours," explained Spiegl. In addition to the amount of time taken, this process was susceptible to typographical and transcription errors. "As a member of the MAPAL Group, we got to know the c-Com GmbH regrinding management system very early on," recalls Loska. The supervisors quickly established that the module of the c-Com platform visualised the very processes that MILLER needed. "We worked closely with the people at c-Com to adapt the module to suit our specific needs", says Loska, "and thus gradually made the entire process digital." The c-Com module for efficient regrinding management went live at the start of 2019.

"Since then, the process for tools from three pilot customers has looked completely different," reports Spiegl, who is clearly delighted with the improvement. Tools still arrive at incoming goods in an unsorted state and with nothing but the information printed on the delivery note. Yet the similarities with the "old" process end there. "Firstly, an employee at incoming goods scans the delivery note. A text recognition system automatically enters all the data in c-Com," explains Spiegl. This applies to the quantities, items and customer data. Each tool from the three pilot customers is assigned a data matrix code to make it accurately identifiable.

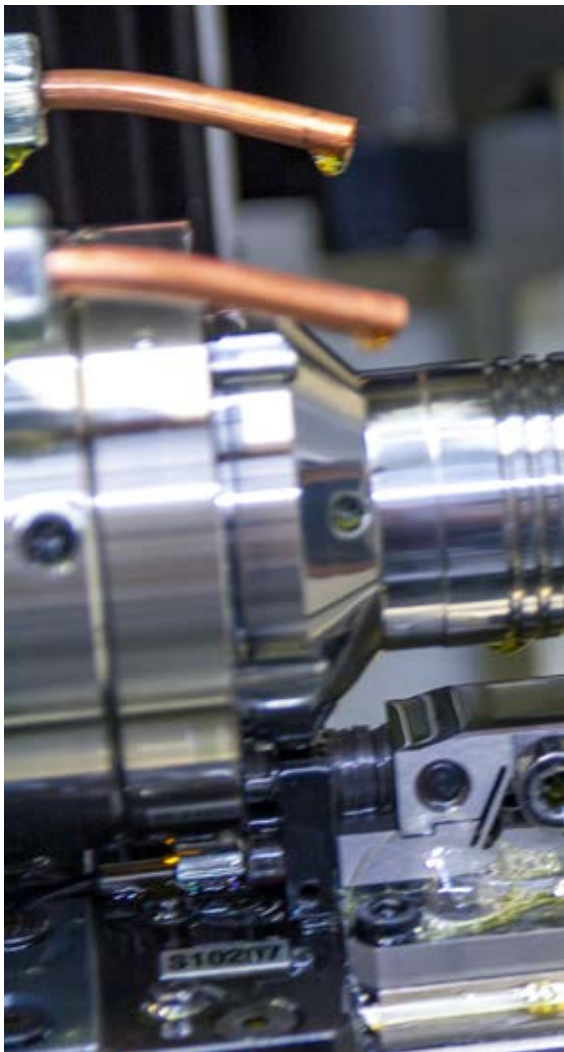
The incoming goods employee uses a specifically developed scanner to scan all the tools from the delivery in question. "We developed the scanner with the specific purpose of minimising the time spent reading the codes, which are extremely difficult to see with the naked eye," says Loska. The tools are automatically assigned to the various items on the digital delivery note. →

Responsible for the new regrinding management process at MILLER (from left): Stephan Loska and Tobias Spiegl.

Once all tools have been scanned, colour-coding is used to indicate whether all items on the delivery note are fully accounted for. The c-Com module keeps up constant correspondence with SAP, which means that a single mouse click is all it takes to create an automated internal service report. "With c-Com, we have also switched straight to labels," adds Spiegl. In other words, instead of having to deal with multiple sheets of A4 paper for each order, the new c-Com process involves generating a label and affixing it to the relevant box.

When the box reaches the diagnostics area, this label is scanned, and the tools are inspected to determine whether they can be reground. All criteria concerning the tool in question and all exclusion criteria are entered in c-Com. The employee scans the tool again and is shown information about it immediately; for example, that a tool needs to be checked for minimum length.

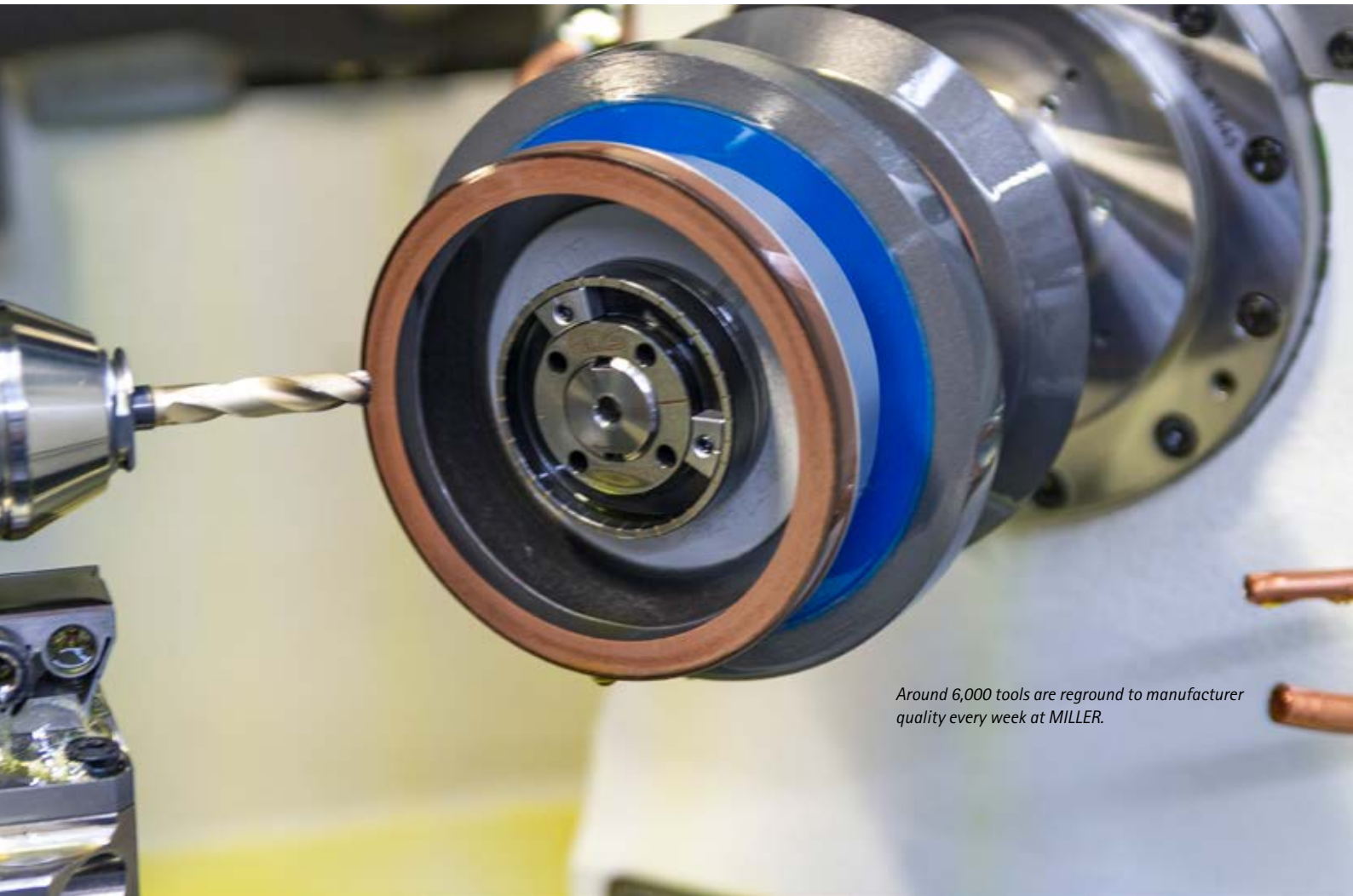
At MILLER, the data matrix codes needed for accurately identifying the tools are applied to the tools using the RayDesk laser system from LASERPLUSS.



The employee uses a set of callipers linked to c-Com via Bluetooth to measure the tool before transmitting the findings to c-Com at the push of a button. c-Com compares the actual measurement with the intended measurement and indicates whether the tool can in fact be reground. If the employee identifies chipping on the cutting edge, for example, he or she selects this on the list of exclusion criteria. Once all tools have been inspected, the order confirmation is issued by a single click. This automatically shows which tools cannot be reground and why.

"If we take the example of the delivery of 80 tools again, the new process means that instead of the previous two hours, we need just 15 minutes," says Loska – an impressive amount of time saved. The enormous reduction in administrative work is not the only benefit of the process, as it also frees up a lot of capacity for employees. "Employees no longer have to spend hours entering data in SAP. Instead, they can work on much more varied and challenging tasks", says Loska. That is just one of the reasons that employees at incoming goods are excited about using c-Com for regrinding management. Despite the high level of automation, there is still always the option to intervene in the process manually.

Another benefit offered by the new process with c-Com, and one that Loska deems the most important, is the transparency that it creates for customers. "Customers can use the c-Com service portal at any time to see where each tool is at the moment, how many times each tool has already been reground or why a particular tool can no longer be reground," he explains. Thanks to c-Com and tool serialisation, customers can see the big picture at all times and trace the history of each tool. That also means that it is possible to determine the best time to order more tools. "We can offer a lot more transparency and be much more open with customers – and that has been very well received," says Loska. As a result, MILLER is gradually rolling c-Com out across the entire factory for purposes such as transferring measurement data directly from setting fixtures to machinery. ■



Around 6,000 tools are reground to manufacturer quality every week at MILLER.

Guest article by Frederick Rindle | "mav" magazine | published at Konradin-Verlag | mav.industrie.de

"REGRINDING MANAGEMENT IS EXTREMELY WELL RECEIVED"

c-Com GmbH, a software start-up established by tool manufacturer MAPAL, has grown in leaps and bounds since its launch in 2017, and Managing Director Giari Fiorucci is already anticipating six-figure turnover in 2019. In this interview, Fiorucci talks about the benefits of a software company having access to an immense wealth of tool-related expertise.

How many de facto customers does c-Com GmbH have at the moment?

Giari Fiorucci: Our employees are currently taking care of a customer base that extends into double figures. All our available modules are being used. Our customers turn to c-Com especially when tools need to be serialised, to make manufacturing as efficient and cost-effective as possible. That applies to regrinding management, for example, or tool management at full scale.

What are the main reasons that customers have chosen c-Com?

The key point that wins our customers over above all else is the collaborative approach to c-Com. That means that all parties have real-time access to the data relevant to them – and always the latest version. Our close collaboration with SAP is also very important to our customers. Of course, the fact that our products and services are easy to implement and to use doesn't do them any harm, either. To that end, we have made our software interface very user-friendly and intuitive, among other refinements.

How well has regrinding management been received?

We have really struck a chord with regrinding management. It has met with a great reception among customers and made a process that had previously been difficult to manage a lot easier. We have recently even expanded our software to include coaters. Tools are often recoated as well after being reconditioned. Our regrinding management system now comprehensively covers this stage of the process as well.

FYou have developed the c-Connect module, including the box of the same name, for companies wishing to go digital without incurring high costs. What can the new module do?

Using c-Connect will pay for itself many times over. The module enables tool measurement data to be transferred digitally from the setting fixture to the machine, including registration of stock movements. In addition, thanks to various sensors, the c-Connect box can be used to monitor aspects such as machine status.

This involves mounting a c-Connect box on every machine and linking the two via USB/PS2 – a quick and easy process. This allows pools of very different machinery and controllers to be connected rapidly and without any fuss. After all, c-Connect is compatible with all common machine controllers and thus represents an affordable entry model for digitalisation in the field of machining. Not only that, but it also has plenty of potential for expansion. With c-Connect, no avenue of development is closed off; the level of digitalisation can be gradually increased. For example, all the benefits offered by the other c-Com modules can be integrated.

c-Connect can also be used when machinery is dismantled to store important tool information such as tool life or reason for replacement in c-Com. That enables meaningful analysis and optimised processes as a result.

To what extent is c-Com co-operating with MindSphere from Siemens?

c-Com was the first platform to offer a cloud-to-cloud link with Siemens MindSphere. We offer interested customers the option to work with both clouds, with our focus very clearly on the tools. MindSphere concentrates more on machinery and systems. We are currently in discussions with providers of other platforms. Some initial projects and collaborations with machine tool manufacturers have got off to a successful start.

Do you also offer apps?

c-Com is not primarily about apps. Our apps are a means of support for our platform. We currently offer three mobile apps. These are "Tool Manager", which makes life easier for tool managers; "Tool Tag", which acts as a digital tool operation card; and "Tool Organizer", which allows for simple, mobile tool management for large and thus heavy tools that cannot be stored in normal tool dispensing cabinets, for example ➔

"We have the expertise to offer optimised solutions for the tool industry."

Giari Fiorucci

The c-Connect box is linked to the machine via USB/PS2.

How is MAPAL benefiting from the "new" software expertise available inside the Group? Has the way that MAPAL handles tool data changed since c-Com?

One of the reasons that c-Com was established in the first place was that MAPAL had identified the need to make the best possible use of its own data for systematic interconnectivity and digitalisation. For example, MAPAL is making a lot of progress on the concept of a digital twin, which is where every physical product has a digital counterpart. Although we at c-Com are now an independent entity, we still work very closely with MAPAL. I would say that both parties get a huge amount out of the arrangement.

What form does that take?

We discuss ideas, provoking some useful flashes of inspiration in both directions. For example, we can call upon MAPAL's extensive and indisputable expertise concerning projects and tool management. We can then use that to devise solutions tailored specifically to customers from the tool industry. This is one of the things that clearly sets us apart from other software companies. Furthermore, our products are increasingly being used at MAPAL; for example, for Tool Management 4.0, which MAPAL now offers on the basis of c-Com, or for regrinding management at the Centre of Competence for solid carbide tools.

What are the next milestones to come in the company's development?

It is still very much the early days for us. That is why it is important to consolidate our position on the market. In addition, we are of course focusing mainly on continuing to optimise our products and developing new ones. To generate the best possible offers for our customers, we are committed to productive partnerships in various areas and are stepping up our efforts in this regard. ■

PUTTING YOU IN THE PICTURE:

Tool Management 4.0 and the setting room

In addition to the brochures and catalogues about Tool Management 4.0 that have already been released, a series of video clips is now available. Seven short films bring the various storage and logistics areas of the setting room to life for users. The films are an easy-to-understand way of presenting all elements of a state-of-the-art tool organisation and the associated data management.

To introduce the theme, a three-minute animation explains the basic concept behind the comprehensive Tool Management 4.0 based on the c-Com open-cloud platform. Some additional clips provide more detailed information and use examples of real applications to demonstrate the functions and capabilities of the MAPAL systems for setting, measuring and dispensing tools. Viewers can get to know how to handle the equipment and gain some insight into various development, manufacturing and service areas at MAPAL.

Whether as a means of providing basic information, for training users or for starting a conversation about procuring or optimising tool management systems, the films from MAPAL have a wide range of uses and offer a concise way of providing plenty of useful suggestions.

All you need to do to view the videos is scan the QR code or go to https://www.mapal.com/toolmanagement

New location in Central Mexico

SECOND FACTORY OPENED IN MEXICO

In February, the MAPAL Group celebrated the opening of its new branch in Santiago de Querétaro, Mexico, at a ceremony attended by a number of prominent guests. MAPAL Frhenosa, the Group's Mexican subsidiary, now also has an operation right at the heart of the country.

The new MAPAL Frhenosa factory started operations in the Mexican city of Santiago de Querétaro last year. On February 1, a ceremony was held to open the branch officially. Dr Jochen Kress, Siegfried Wendel (Senior Vice President Global Sales), Lazaro Garza Sr (joint venture partner and Managing Director of MAPAL Frhenosa), Hugo Perez (Managing Director of MAPAL Frhenosa) and Lazaro Garza Jr (Head of the branch in Querétaro) celebrated the opening with prominent guests from politics and business. In addition to the governor of the state of Querétaro, Francisco Dominguez Servién, they also welcomed international partners of MAPAL, including representatives from automotive suppliers Bocar and ZF, as well as machine manufacturer Grob.

The event started with a reception and speeches, including one by governor Servién. Following the symbolic cutting of the ribbon, Dr Kress and the persons responsible from MAPAL Frhenosa took their guests on a guided tour of the new plant. An exhibition that had been set up in the machine hall displayed the product range. Banners in front of every machine station provided information on the individual manufacturing steps and the range of services offered by MAPAL Frhenosa. The festivities were rounded off with a lunch.

CAPACITIES DOUBLED

MAPAL Frhenosa was founded in 2004. The company occupies a leading position on the precision tools market in Mexico and employs roughly 120 people at the headquarters in Monterrey. The second factory in Querétaro gives it considerably more production capacity for reconditioning tools. PCD and solid carbide tools are reconditioned and reground at the new site, while solid carbide tools are also reconditioned in Monterrey. The same applies to tools with ISO elements, which are also manufactured in Monterrey.

Thirty-five employees work in Querétaro at the moment, and further expansion is planned. "This gives us the opportunity to cut our response times by quite some margin whilst also satisfying the increasing demand of our customers," says Dr Jochen Kress. The prospects in Querétaro are excellent. In recent years, the region has flourished into a major hub for the international automotive and aerospace industries. Mexico is also a strategically important location for the MAPAL Group at the international level. The country cooperates with more than 60 countries and has concluded corresponding free trade and cooperation agreements.

Well-trained employees in both Monterrey and Querétaro are responsible for the reconditioning of MAPAL tools. The machinery and production processes comply with the international standards of the MAPAL Group. "The new plant constitutes a fundamental step in our endeavour to keep pace with the rate of growth in Mexico," comments a delighted Lazaro Garza Sr. Approximately 50 million pesos, which corresponds to roughly €2.3 million, was invested in constructing the new branch. ■

The production hall of the new factory in Querétaro spans 650 square metres. The service and sales departments are located in a two-storey administrative section.

Dr Jochen Kress (left) hands a plaque commemorating the opening of the factory to Lazaro Garza Sr(right, CEO of MAPAL Frhenosa in Mexico); 2nd from left: Francisco Dominguez Servién (governor of Querétaro).

Presence in Asia expanded

NEW JOINT VENTURE MAPAL HiTECO VIETNAM

Hanoi skyline

Vietnam is one of the fastest-growing markets in Asia. MAPAL is expanding its operations in this emerging economy and has opened a sales and service office in Hanoi in cooperation with South Korean joint venture partner MAPAL HiTECO. The company trades under the name of MAPAL HiTECO Vietnam. Employees from MAPAL HiTECO in South Korea have been seconded to Hanoi to build up the workforce there and organise the new sales structures.

MAPAL has been operating on the Vietnamese market for many years. The previous collaboration with sales partner Cap Do Industrial Equipment in Ho Chi Minh City is continuing, but now through the joint venture, MAPAL HiTECO Vietnam. With the locations in Hanoi in the north and Ho Chi Minh City in the south, rapid and expert customer support is ensured. MAPAL HiTECO Vietnam will also be getting involved in new areas of the market. Armin Kasper, MAPAL Vice President Asia-Pacific, describes the strategic alignment of MAPAL HiTECO Vietnam as follows: "We intend to use our connections in South Korea to reach out to their plants in Vietnam, which will allow us to gain a foothold in various industry sectors." ■

MAPAL ACQUIRES MAJORITY STAKE IN ADICO

DEPARTURE OF DR HYUN SAM CHO (72)

A ceremony was held for Dr Hyun Sam Cho, founder and former CEO of ADICO, when he visited Aalen in December. Dr Jochen Kress thanked Dr Cho for the many years of close cooperation. As a farewell gift, he handed the former managing director of ADICO an ammonite from the Swabian Alps. The fossil, which is 200 million years old, was a symbol for the lasting connection between ADICO and MAPAL, said Dr Kress. Dr Cho also expressed his gratitude for the constructive cooperation and thanked his close personal contacts. He said he was happy that ADICO was now part of the Group and that the future of the company and his employees was in the best hands.

Image, from left to right:
Dr Jochen Kress, Dr Hyun Sam Cho (founder and former CEO of ADICO), Dr Wolfgang Baumann (Product Manager Tools with ISO elements), Kyoungryoul Han (CEO of ADICO), Armin Kasper (Vice President Asia-Pacific), Hyunki Ko (Internal Sales Management at ADICO)

MAPAL has acquired the majority stake in ADICO, a manufacturer of PCD and PcBN round blanks headquartered in Gyeonggi-do, South Korea. MAPAL and ADICO have been working together closely for many years. MAPAL acquired a stake in ADICO in 2016. The company has now been integrated into the MAPAL Group. The reason for this was the departure of Dr Hyun Sam Cho. The cofounder and managing director of ADICO left the company when he retired in December 2018. MAPAL acquired all of his shares in the company.

ADICO has been developing and producing PCD and PcBN round blanks with various diameters and in various qualities since 1999. The blanks serve as the base material for the production of PCD and PcBN cutting edges and are in demand all over the world. The main buyers are the metal and wood industries. In addition to the companies belonging to the MAPAL Group, which is its biggest customer, ADICO also supplies other tool manufacturers. In the course of the acquisition, ADICO is increasing its production capacity at the plant in Gyeonggi-do and expanding the company's product range. The most recent development that was placed on the market was a round blank with a diameter of 75 mm. What is special about this product is that there is only one other supplier in the world. The round blank is of interest to the wood market in particular. ■

ELECTRIC MOTOR HOUSINGS
reliably enter large-scale production

The importance of electric mobility in the automotive industry is continuously growing. The number of vehicles being produced with electric drives is increasing. Although electric motors per se are nothing new, the automotive industry is currently entering uncharted waters in many areas in terms of both their use as means of propulsion for vehicles and their large-scale series production. Being a technology partner to its customers, MAPAL has therefore devised a number of innovative machining systems, including some for the complex machining of electric motor housings.

The development of electric motors is clearly moving towards integration. Modern designs encase the electric motor, power electronics and gearbox in one central housing. In addition, the requirements that apply to each motor can differ significantly depending on the application. When used as drive systems in vehicles, they need to maintain their performance across a wide range of temperatures. Their weight and efficiency also play a major role. Highly automated, large-volume production that is as cost-effective as possible is another factor in the automotive industry.

Internal combustion engines have been optimised to suit these criteria and manufactured in their millions for decades. Things that are commonplace for these engines and related components are now presenting new challenges for carmakers and their suppliers when it comes to components for electric motors. The housing for an electric motor provides an example of just how big these challenges are. This housing needs to be manufactured within much tighter tolerances than a gearbox housing, as accuracy is pivotal in determining the efficiency of the motor.

Furthermore, the electric motor housing usually has much thinner walls than a conventional gearbox housing owing to its integrated cooling

channels. There are also bearing bushes pressed into some of these housings. This results in mixed machining, which is not easy to master.

Although these aspects can often be managed without too much difficulty in prototype production, they present a real challenge in large-scale production. That applies not only with regard to ensuring compliance with all tolerances down to the nearest micrometre, but also in terms of process costs. In addition to the bearing bore, machining the stator bore is especially difficult. This has a large diameter and considerable depth.

HOW THE MACHINING APPROACH AFFECTS TOOL DESIGN

Due to their bell-like shape, the thin-walled electric motor housings are prone to natural oscillation. For this reason, and because of casting-related stresses in the part, particular attention needs to be paid to the clamping setup and the various machining operations. During clamping setup for the part, it should be ensured that the radial forces are low so that the eventual outcome of machining, especially the cylindrical form, is not negatively affected.

Whereas the radial stock removal at the bore entrance is roughly 0.5 mm, the draft angles caused by casting result in material build-up measuring up to 13 mm in diameter forming at the base of the bore. This results in significant machining forces acting on the part and the tool, and these need to be taken into account in process and tool design.

MOMENT OF TILT: A LIMITING FACTOR

It is not unusual for stator bores to measure up to 300 mm in diameter. Machining this type of bore cost-effectively therefore calls for large tool diameters and long tool projection length. At such proportions, both the weight of the tool and its moment of tilt have a decisive impact on the machining process. For example, the maximum possible tool weight and the moment of tilt of the machine spindle and tool gripper need to be taken into account. The tools should therefore be made as lightweight as possible.

One possible means of achieving this comes in the form of special tool designs. These can be used to reduce tool weight and moment of tilt. Yet when conventionally manufactured tools start to reach their limits, resorting to additive manufacturing and the ultra-lightweight designs ➔

Developing welded designs required numerous analyses to be performed.

that it makes possible is one option. This not only enables customisable cooling channel design, but also allows enormous amounts of weight to be saved as a result of the geometric freedom that it opens up and the option to have hollow interiors.

Thanks to the weight savings, it is possible to devise machining approaches for smaller machine connections, such as the HSK-A63. After all, the large diameters can only be machined on less powerful equipment with tools with low weight. Meanwhile, to make it easier to machine large diameters on machining centres with smaller tool connections, it is possible to reduce the number of teeth on the tool and thus the machining volume or the cutting torque. However, that comes at the expense of cycle time.

This is particularly important because most of the existing machining centres in the automotive industry are fitted with HSK-A63 connections. One way of meeting the new requirements for parts for electric vehicles is to retrofit existing machine pools accordingly. A multi-machine approach is recommended for many machining processes. With smaller spindles, it is possible to work more flexibly and up to 15% more quickly than with HSK-A100 spindles. In ideal cases, machining centres with HSK-A63 connections should be used for all-round machining; for machining stator bores, however, machines with HSK-A100 connections are preferred. In each case, the connection on the machine side has a fundamental impact on tool design. That is because the number of teeth on the tool in question is chosen on the basis of the maximum possible torque and cutting power. As a general rule, the greater the number of teeth, the shorter the cycle times and the more powerful the machine and spindle need to be.

To ensure that chips are broken up and extracted reliably, MAPAL has used the finite element method (FEM) to develop special chip guiding stages and chip breaker geometries.

REQUIREMENTS TO THE MACHINING PROCESS

Machining of the housing is ultimately subject to tight tolerances with regard to the concentricity of the bearing and stator bores, the perpendicularity of the bores to the reference surface and the roundness and cylindrical form of the stator bore and bearing seat. In addition to the tolerances, the Al-Si alloys usually used for electric motor housings impose particular requirements on the machining process. Depending on the composition, machining these alloys can sometimes produce very long chips. However, these are undesirable for any machining process and must be avoided as they may result in wear on the part and tool as well as an increase in torque or the temperature of the part. The temperature of the chips is usually in excess of 100 degrees Celsius, which means that the heat needs to be extracted along with the chips. To meet this requirement reliably, MAPAL has used the finite element method (FEM) to develop special chip guiding stages and chip breaker geometries.

Another challenge involved in highly accurate housing machining is that of parts becoming distorted due to differences in temperature. These are far from rare owing to the thermal expansion characteristics of aluminium. For example, when the temperature changes by 5 °C, a solid shaft with a diameter of 219 mm will expand by 0.026 mm. That may not seem very much at first glance, but it is actually quite a lot given the tolerances that need to be complied with during machining. This expansion roughly corresponds to the diameter and shape tolerance of an electric motor housing. Fluctuations in temperature can be reduced if an emulsion cooling lubricant is applied or, in some cases, via the appropriate chip removal if minimum quantity lubrication is used. Adjusting cutting parameters and feed rates is another option.

TOOL DESIGN

MAPAL has developed designs for tools that meet the aforementioned requirements. These include lightweight and yet stable tools in welded design that are highly suited to machining the thin walls of the housing.

For the welded designs, the tool body takes the form of a tubular design. One of these tools weighs just half as much as a conventional boring bar. The carriers for the cutting edges and guide pads, if applicable, are welded on and support each other by means of connecting ribs. This minimises the risk of chattering. It also ensures that support is provided in the event of interrupted cuts. The bending section modulus is excellent thanks to the tubular design and the stabilising ribs. Despite long projection lengths and large diameters, the tools are highly accurate. Achieving this involves using extensive analyses based on the finite element method (FEM) to investigate coolant distribution, machining forces, torque and moment of tilt.

The machining process and the tools are custom-designed to suit the dimensions, machine pool and clamping setup in question. This helps to minimise the cutting forces working on the part. The process of machining the stator bore is split into three stages – pre-machining, semi-finishing and fine machining.

In most cases, the machine tool is the critical factor in the design of the tool for pre-machining the stator bore. In the machining process that MAPAL recommends, the first choice is a boring tool with a cartridge and PCD-tipped indexable inserts. The advantage of this tool is that it achieves a high material removal rate very quickly and thus cost-effectively because it allows work at high cutting speeds and feed rates. However, using this tool requires a machine with high maximum torque and power to match.

If that is not available, the alternative is to pre-mill the stator bore. MAPAL offers an ISO helix milling cutter with PCD-tipped indexable inserts for this very purpose. Although this tool can also be used to work with very high cutting speeds and feed rates, the machining time is much longer than it is with boring on account of the longer machining stroke.

In designing the tool for semi-finishing, MAPAL also focused on the torque and power of the machine. This stage of machining involves pre-machining the complex contour definition of the electric motor housing in such a way that the complete contour including chamfers and radial transitions can subsequently be created to the required quality during fine machining. For this stage of machining, MAPAL recommends a precision boring tool in welded design with PCD-tipped ISO indexable inserts.

The final stage involves machining the stator bore to micron precision with a fine boring tool, also a welded design. The PCD-tipped indexable inserts are finely adjustable, which helps to maximise accuracy. The tool is fitted with guide pads to provide the best possible support in the bore.

THE CHALLENGE OF MIXED MACHINING FOR THE BEARING BORE

With some types of housings for electric motors, a steel bushing is pressed in for the bearing for the rotor shaft. The seat for the bushing is machined first and a bushing is pressed in the further course of the process. Because of the tough requirements for the concentricity of the bearing and stator bores, both bores are then fine-machined with a combination tool.

This involves on stage of the tool being used to machine the steel bushing and the rest to machine the stator bore out of aluminium at the same time. This is referred to as mixed machining, and presents tool manufacturers with a number of challenges. Firstly, the steel chips need to be kept reliably away from the aluminium area. Otherwise, there is a considerable risk of damage to the surfaces of the component and the PCD guide pads on the tool.

Precision tools manufacturer MAPAL has been careful to take this aspect into account in its designs for tools for the machining process. Consequently, the steel chips are reliably conveyed forwards. This takes place with the aid of a special chip guiding stage, the appropriate coolant ➔

MAPAL offers the entire process for complete machining of electric motor housings

A fine boring tool, a welded design, is used for machining the stator bore to micron precision.

Method	Work step	Z (# teeth)	Dia [mm]	n [min-1]	f_z [mm/Z]	v_f [mm/min]	a_p [mm]	t_H [min]	Comparison of productive times
Finish-boring	Roughing	1	219.0	600	0.2	120	1.70	1.67	5.00 Min.
	Finishing	1	220.0	600	0.1	60	0.50	3.33	
Boring and fine boring	Boring	4	215.7	1476	0.2	1180	max. 7.00	0.17	0.48 Min.
	Semi-finishing	8	219.7	1083	0.3	2600	2.00	0.08	
	Finishing	4	200.0	1083	0.2	866	0.15	0.23	

Figures for comparing machining options taking a specific part as an example.

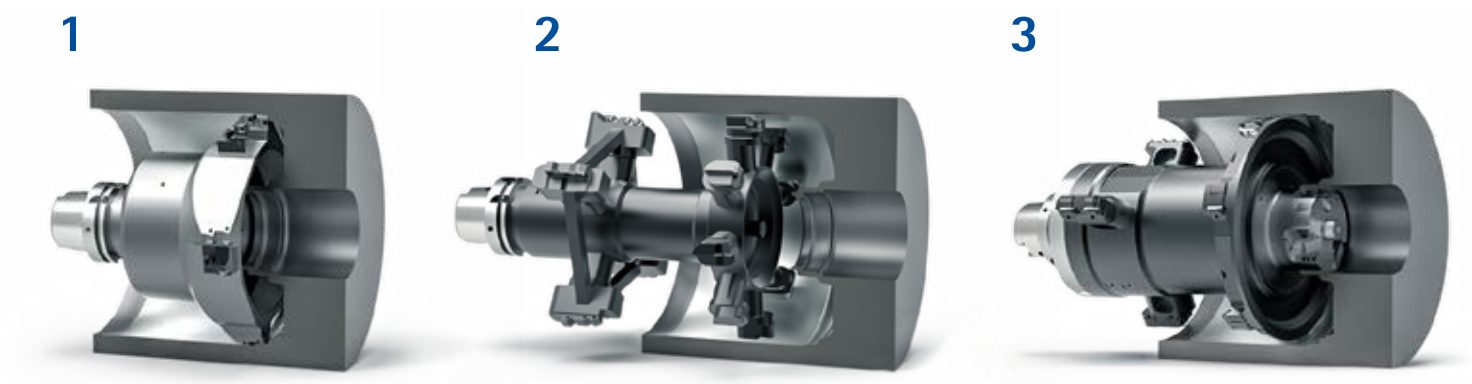
supply and open chip spaces. The aluminium chips, however, are routed backwards by means of a specially designed flushing mechanism. To ensure that no steel chips make their way into the aluminium area, the tool is fitted with a protective plate that ensures that the steel chips are kept in the front area (see picture below, tool 3).

An additional challenge comes in the form of the differing cutting speeds that are recommended for machining aluminium (800 m/min) and steel (200 m/min). The tool lives of the various cutting edges used also differ. Whereas PCD-tipped cutting edges can be used to machine aluminium on 6,000 to 8,000 aluminium parts, the tool life of the cutting edges for machining steel is at 250 to 300 parts. Indexable inserts are the solution in this case. The PCD-tipped inserts are used for machining aluminium, while the cutting edges for machining steel are made from cermet. Both insert types can be replaced on-site. That means that it is possible to make full use of the tool life of the PCD cutting edges, despite the significant difference between their tool life and that of the cutting edges for machining steel.

COMPARING THE MACHINING OPTIONS FOR DEEP BORES WITH LARGE DIAMETERS

In addition to the solution presented, which comprises boring and fine boring, there is another option for machining stator bores: finish-boring. However, working on the basis of a part length of 200 mm, a target diameter of 220 mm and a blank diameter of 215.7 mm, the productive machining time is around five minutes. This involves using two tools, each with a PCD-tipped cutting edge, for roughing and finishing. Comparing this machining option with the alternative of boring and fine boring with tools featuring eight and four PCD-tipped cutting edges respectively shows that the productive time of the process designed by MAPAL is much shorter. Instead of five minutes, it takes just under 0,48 minutes. Table 1 shows a comparison of the two machining options.

Consequently, it is possible to carry out the process of boring and fine boring much more cost-effectively than finish-boring. The system described, which comprises three different machining steps, is already being used in practice and delivering good results. The required tolerances for concentricity, roundness and cylindrical form are reliably maintained to within just a few micrometres even in large-scale production. ■



For machining the stator bore, MAPAL recommends a three-stage process – pre-machining (1), semi-finishing (2) and fine machining (3).

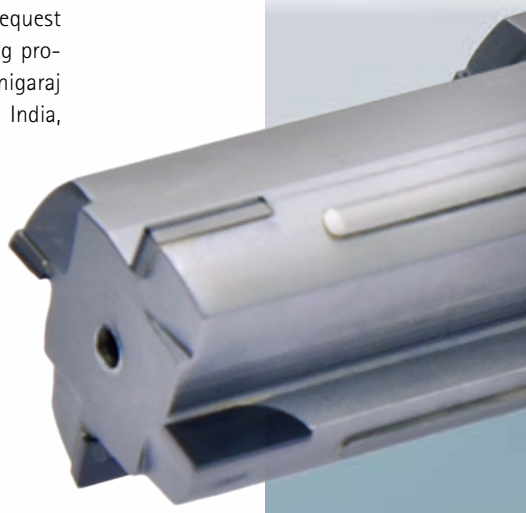
MACHINING TIME REDUCED SIGNIFICANTLY

When it comes to increasing the level of productivity of existing production processes, Mikuni India Private Limited relies on its preferred tool supplier, MAPAL. This trust has paid off. MAPAL designed a new combination tool for machining carburetor housings. And this tool is a success: With the production time reduced considerably, Mikuni needs one machining centre less for the process.

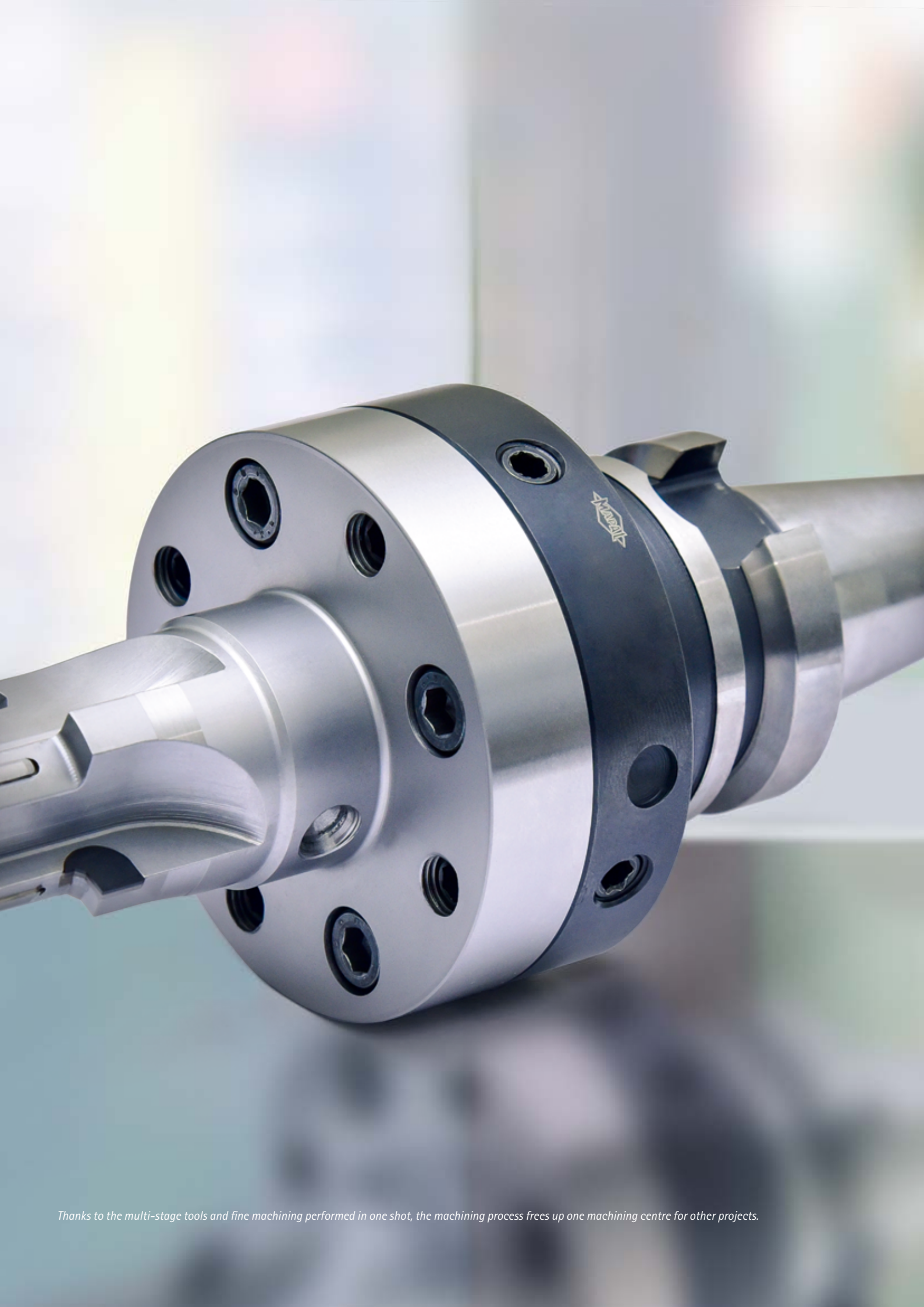
Mikuni Corporation was founded in Tokyo in 1923. Today, the Japanese company has a worldwide presence, with branches in the USA, Mexico, Germany, Indonesia, China, Thailand, Taiwan and Korea. In 2008, the company established its Indian subsidiary, Mikuni India Private Limited, in the Indian city of Neemrana, located 122 kilometres south-west of Delhi.

Today, Mikuni India offers its customers a broad range of components for the automotive industry, including carburetors and throttle valves. Mikuni India consequently received the "Best Supplier" award from the automotive industry for its outstanding quality products and terms of delivery.

In 2017, Mikuni India faced the challenge of increasing the production volume of carburetors. "Mikuni approached us with the request to considerably accelerate the machining process for large-scale production," Thanigaraj Sripathy, Managing Director of MAPAL India, remembers. ➔



MAPAL optimised the machining of throttle and piston bores for a carburetor housing like this one.



Thanks to the multi-stage tools and fine machining performed in one shot, the machining process frees up one machining centre for other projects.

Two PCD combination tools were custom designed for the machining process at Mikuni India and discussed together. From left: Toshiya Ochiai, Plant Head Mikuni, Dinesh Gupta, Executive Director Mikuni, and Rajesh Kumar, National Sales Manager MAPAL India.

When carburetor housings are manufactured from an aluminium alloy, the challenging machining of the piston bore and throttle bore are the most time-consuming operations and contribute substantially to the overall cycle time. This was reason enough for the tool specialists at MAPAL to scrutinise these two bores and their machining processes. In the machining process used previously, individual tools with ISO indexable inserts were used for finishing.

The MAPAL team determined that there was great room for improvement here. "We developed a PCD tool that fine machines both the piston and the throttle bores in a single shot," explains Sripathy. As PCD tools are produced at the MAPAL subsidiary in India, the new tools could be delivered after a short lead time and used immediately.

MAPAL designed a two-stage PCD combination tool for fine machining the piston bore. Four brazed PCD cutting edges are used for boring (21 mm diameter) and two are used for spot facing (30 mm diameter). The machining is performed with a cutting speed of 250 m/min and a feed rate of 600 mm/min.

A three-stage PCD combination tool with two boring steps (diameters of 24.016 mm and 24.664 mm) with two respectively four cutting edges as well as a stage for spot facing (34 mm diameter) uses the same cutting parameters to manufacture the throttle bore in one shot.

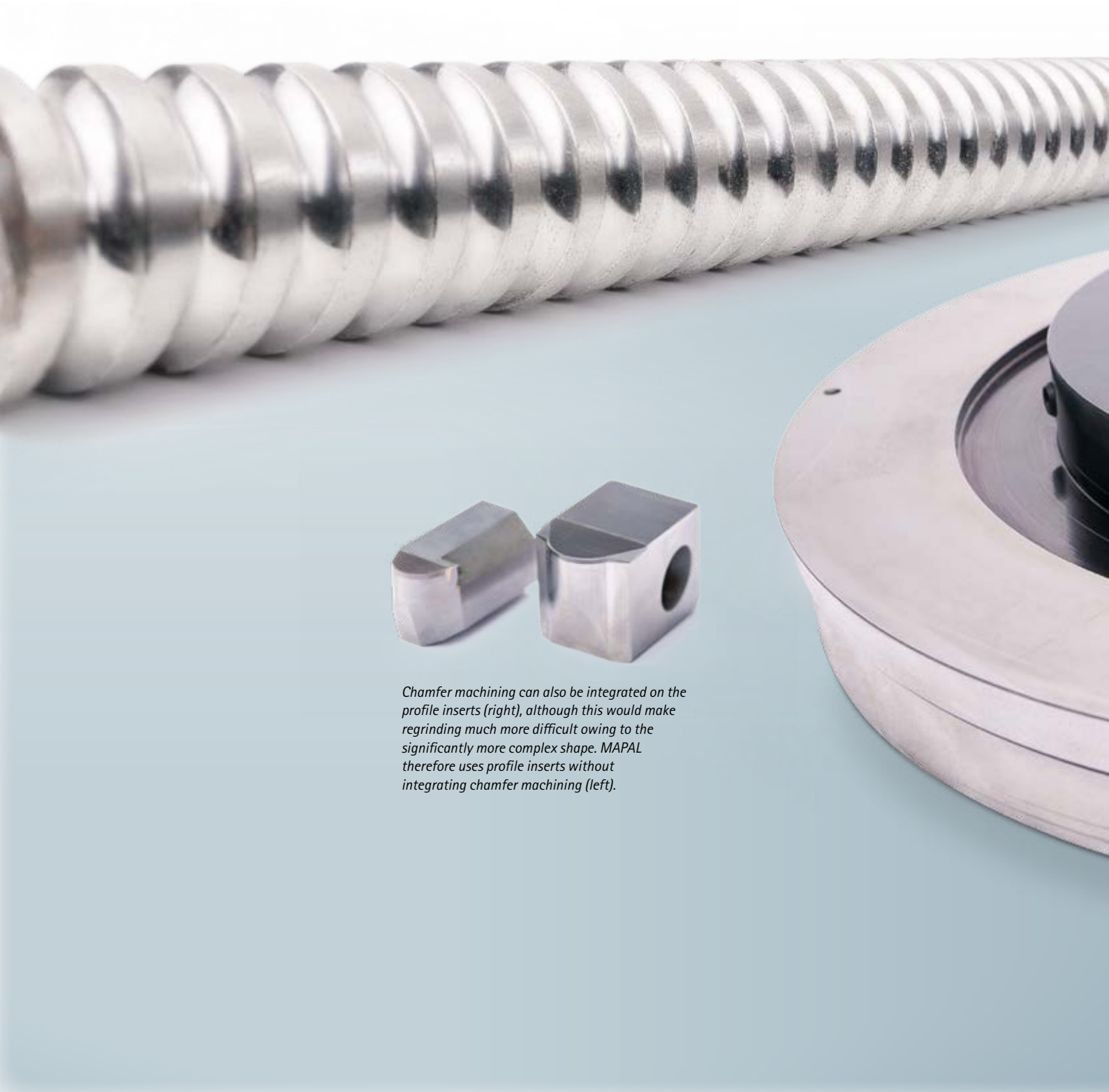
Krishan Gopal, Production Manager at Mikuni India, is impressed: "The tool solution from MAPAL not only reduces the machining time significantly. We also don't need to use a further machining centre, which frees up capacities. We work with considerably higher cutting speeds and machine the bores in one shot. This allows us to save a huge amount of time in the overall process, which is excellent."

The set target was reached, and productivity was increased considerably. The company now manufactures 2,400 housings per day. Following

this successful process optimisation, the Mikuni management distinguished the project as the best kaizen improvement project of the year. The whole team at Mikuni India is very satisfied with the results achieved using the solutions from MAPAL. And so, parts of this type are to be machined with MAPAL tools in the future, too. ■

The teams of Mikuni India and MAPAL India work together closely.

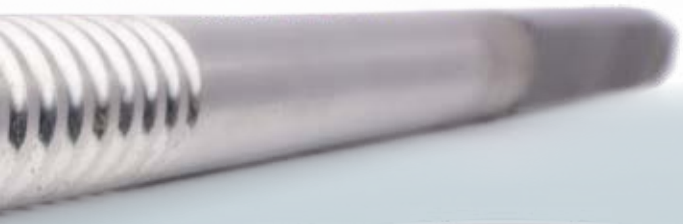
WHIRLING,



Chamfer machining can also be integrated on the profile inserts (right), although this would make regrinding much more difficult owing to the significantly more complex shape. MAPAL therefore uses profile inserts without integrating chamfer machining (left).

NOT GRINDING

On ball castors, which are required for applications such as vehicle steering rods and machine drive systems, the thread profiles are often created by grinding. There is a much quicker way, and that is "whirling". MAPAL has developed a tool system for hard machining intended for this very purpose, featuring suitable air nozzles to ensure optimised chip removal. ➔



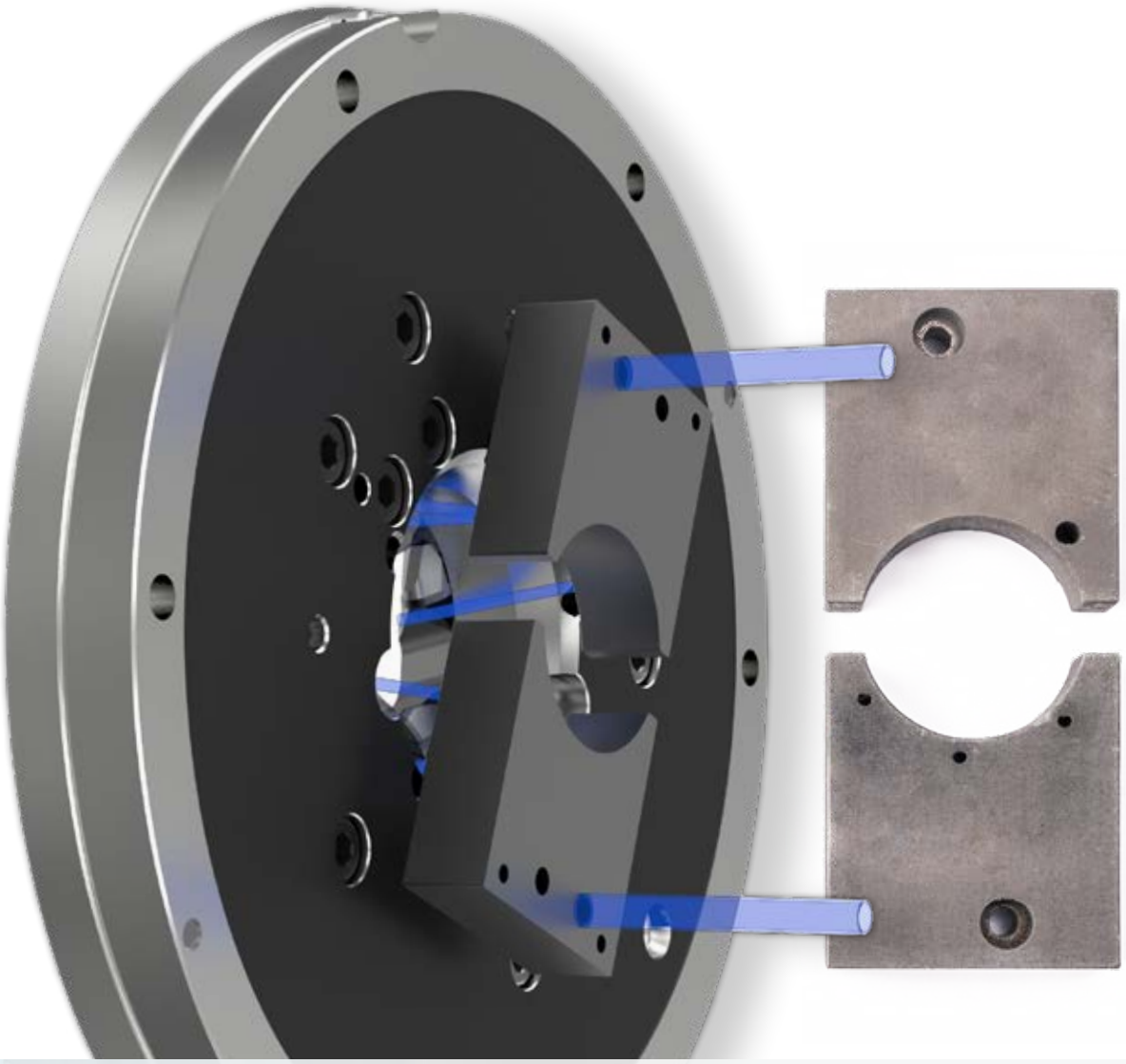
Ball castors can be found on vehicle steering rods.

MAPAL has developed a ring-shaped tool system for whirling.

The whirling manufacturing process is something special, combining turning with milling. That means that not only does the tool rotate, but the workpiece does as well. Special machines are therefore required to "whirl". This presents the question of why companies should choose a manufacturing process of this kind when it means investing in new machinery. Michael Gebhard, product management for hard machining, has the answer, quoting a specific application example. "Although grinding is a long-established process, whirling is much, much faster." Specifically, "To manufacture the thread for a steering rack, the grinding process takes more than seven minutes. With whirling, it is finished in 60 seconds." Consequently, when large quantities are involved, purchasing such a machine will pay off very quickly.

When a customer introduced this process, MAPAL developed the tool system to go with it. After all, external whirling on ball castors as part of hard machining has similar requirements for the tool as ball nose milling of constant-velocity joints. "We have been one of the leading suppliers in the field of ball nose milling for years, and we have taken that experience and applied it to whirling," says Gebhard. With ball castors, as with ball nose applications, the contours, contact angle and bevel radius need to be taken into account and the tolerances reliably maintained.

The ring-shaped tool system developed by MAPAL is fitted with PcBN profile indexable inserts and a PcBN indexable insert that creates the chamfers. Various numbers of profile inserts are used depending on the diameter. Although



To provide a controlled means of cooling the air and removing chips, MAPAL has developed special air nozzles that are located behind the tool system.

chamfer machining could be integrated into the profile inserts, this would make regrinding much more difficult owing to the significantly more complex shape. The inserts can be reground numerous times to get the most out of the PcBN cutting material.

The indexable inserts, which are directed inwards, are clamped via a specially developed system. "We have based the clamping on that used for our VersaCut system, which has proved its worth in hard grooving with PcBN," explains Gebhard. The insert is pressed into the insert seat over bevelled edges and clamped effectively using a clamping jaw. Our inserts are clamped directly to the base plate of the tool and not in an additional cassette, which means one connection fewer and thus a positive impact on the axial run-out.

The indexable inserts can be adjusted axially to µm accuracy. "Our system gives us outstanding results in machining", says Gebhard, "although we have identified some room for improvement with regard to cooling."

Whirling is an air-cooled process. The whirling machines are fitted with two coolant tubes that have to be adjusted to suit each machining operation. "The problem with that is that the tube is easy to move. That means that it occasionally also happens by accident," says Gebhard. If the air supply tubes move, the chips are not reliably removed during machining, which in a worst-case scenario can result in the cutting edges breaking, but certainly means a much shorter tool life.

MAPAL has developed special air nozzles to prevent this from happening. These can quickly and easily be attached to the machine directly behind the tool system. The nozzles are adjusted to the diameter to be machined. The compressed air is directed through the nozzles and split across several ducts. MAPAL has designed the ducts to ensure that the air is aimed at exactly the right places. This has been made possible by additive manufacturing. "With this, we can ensure an optimised air supply and thus chip removal," says Gebhard, "which means that we can offer our customers a complete package to whirl ball castors quickly and reliably." ■

MAPAL SPOTLIGHT

MillChuck, HB system

for sophisticated milling operations

The new MillChuck power chuck offers impressive clamping, simple handling and excellent radial run-out. The location bore is made with accuracy in the single-digit micrometres range. A patented spring element in the adapter ensures a defined tight fit between the tool and adapter.

The tool can reliably be clamped in the adapter by hand without the aid of a torque wrench. The power chuck really comes into its own for high-performance milling operations in particular. ■

KEY FACTS:

- Decentralised cooling channel bores for use of standard tools without internal cooling and with long tool life
- Extremely precise location bore
- Minimal free tool movement
- Excellent radial run-out
- Clamping diameter: 12–32 mm
- Balancing quality: 2.5 at 16,000 rpm
- Easy to use without a torque wrench
- High clamping force
- No impact load on the cutting edge due to defined tight fit

1 | Decentralised cooling ducts
- Optimised coolant supply

2 | Differential screw
- Simple handling and reliable tool clamping

3 | Spring assembly
- Perfect system on HB clamping surface

4 | Contours
- Application-optimised contours for maximum rigidity

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