



IMPULSE

MAPAL TECHNOLOGY MAGAZINE | EDITION 80



Focus topic:
E-MOBILITY

**Dear business partners,
dear readers,**

the year 2022 was marked by drastic geopolitical and economic events. The war in Ukraine, inflation and the ongoing disruptions to global supply chains have had a significant impact on our work, and certainly on yours, and have made it a bit more unpredictable.

Encouragingly, the economic mood in our industry improved during autumn 2022. This was certainly helped by the fact that in-person encounters were possible once again as Covid-19 transitioned from pandemic to endemic – for instance, at the AMB in Stuttgart, which was a huge success. We presented our consistent focus on the market segments automotive/ electric mobility, die & mould, aerospace and general machining to our customers and interested parties there for the first time. The positive feedback confirms our decision to continue on this path.

In the current issue of Impulse, we present our strategies, solutions and applications in electric mobility, aluminium machining and tool management. We began at a very early stage to develop the processing of strategically important components of electric mobility in

terms of processes and products. As a result, we are in a position to offer our customers sophisticated and cost-effective processes today. There is no one-fits-all approach. Instead, we focus on the requirements of the component and offer various solutions depending on the production lot size and component features. In this way, we remain true to our core principle: the customer and their needs are the be-all and end-all of what we do. With the increasing popularity of electric drive solutions, this approach is now also coming to bear in practice.

With tailored tool management solutions, we support our customers in focusing on their core competencies and enter into a close, trusting relationship with them. Integrating digital solutions from our subsidiary c-Com gives our tool management range a new quality. For new projects in particular, installing digital tool management is now standard, and the cloud has also become established and accepted as an intermediary between different process components. We have made significant progress in this area in recent years – with plenty of associated benefits for our customers.

In this respect, all our efforts draw on the ideas, skills and personal commitment of our employees. They are the foundation of all we do. This is why we attach such great importance here at MAPAL Group to training the skilled workers of tomorrow ourselves – with great commitment and a sustainable approach. I'm especially delighted that 85 apprentices graduated at the MAPAL Group again in 2022. With great success: the 2022 world champions in the field of "Robotic Systems Integration" and the best industrial mechanic in Baden-Württemberg come from MAPAL. Almost all graduates have accepted our offer of employment and are now an integral part of the workforce.

So I am – and we are – optimistic going into 2023 and looking ahead with positivity.

We look forward to many opportunities for in-person interactions with you and working together on your challenges.

Have a good read!

Yours,

Dr Jochen Kress



FROM THE COMPANY



Full House in Fountain Inn, South Carolina
Pages 6-7

MAPAL at trade fairs and events 2023
Page 8

MAPAL at the INTEC in Leipzig
Page 9

Particulars
Page 10

High-level training
Page 11

WorldSkills Competition 2022
Pages 12-13

MAPAL receives three supplier awards
Pages 14-15



14



FOCUS TOPIC E-MOBILITY



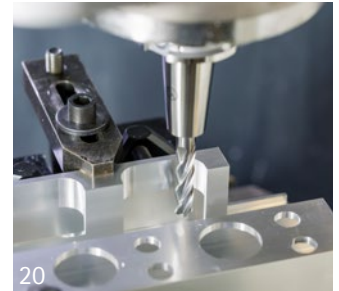
Tool solutions for e-mobility
Pages 16-17

Four inserts for stator bores
Pages 18-19

A strategy for battery frames
Pages 20-21

2A Well positioned for e-mobility
Pages 22-24

Know-how e-mobility
Page 25



FOCUS TOPIC



CONTENTS

ALUMINIUM MACHINING



28

Aluminium face milling –
the optimal system
for every application
Pages 26–27

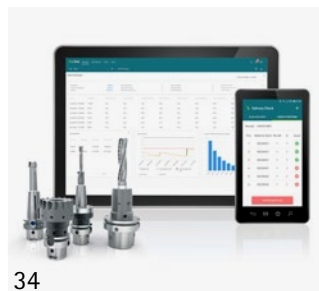
Milling instead of drilling
Pages 28–29

Schlote Gruppe
The best deep bores with PCD
Pages 30–33



30

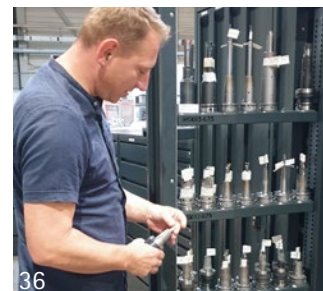
TOOLMANAGEMENT



34

Gnutti Carlo Group relies on
c-Com digital tool management
Pages 34–35

Schabmüller with
tool management from MAPAL
Pages 36–39



36

IMPRINT

Editing: Andreas Enzenbach (Responsible according to the German Press Law), Patricia Müller, Oliver Munz, Sabine Raab, Kathrin Rehor,
Tobias Zimmermann, Manfred Flohr
Layout and design: Alexander Rückle

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 | https://mapal.com

Print: VVA, Austria | Circulation: 17.000 German, 9.500 English

© MAPAL Präzisionswerkzeuge Dr. Kress KG | Reproduction, even in part, only with the approval of the publisher.

FULL HOUSE IN FOUNTAIN INN, SOUTH CAROLINA

MAPAL Inc. invited distributors and manufacturing companies to the MAPAL plant in Fountain Inn, South Carolina, for its Open House event in October 2022. Nearly 100 visitors from various regions of the USA and Canada took the opportunity to hear specialists explain MAPAL's capabilities in detail. Innovative solutions for the focus industries of new mobility, die and mould making, aerospace and fluid power technology were presented. A further focus was on turnkey project solutions.

The Fountain Inn site in the Foothills of South Carolina was established in 2013 as a centre of competence for solid carbide tools and for the aerospace industry. The visitors were able to see for themselves the state-of-the-art production facility for PCD and solid carbide tools in accordance with the global MAPAL manufacturing standards.

The feedback from visitors and partners was exceptionally positive. "The Open House in Fountain Inn is our new standard for customer events in terms of quality and organisation. We will use these events to convince our customers and interested parties worldwide of our products and solutions," says Siegfried Wendel, Chief Sales Officer, underlining the strategic importance of the Open House events. ■





MAPAL AT TRADE FAIRS AND EVENTS 2023

Whether in large exhibition halls, at open house events for close partners or at specialist conferences – direct discussions and close contacts are at the heart of MAPAL's activities. The following events are firmly planned for 2023. The MAPAL team is looking forward to presenting products and solutions relating to the machining process and to sounding out specific customer requirements. The event calendar is constantly updated and can be found on the MAPAL website in the [mapal.com/events](https://www.mapal.com/en/events) section.

07.02. - 09.02.2023	MD&M	Anaheim, CA USA
07.02. - 09.02.2023	Southerin Manufacturing	Farnborough Great Britain
	07.03. - 10.03.2023	INTEC Leipzig Germany
07.03. - 10.03.2023	INNOTEQ	Bern Switzerland
	07.03. - 10.03.2023	GLOBAL INDUSTRIE Lyon France
	14.03. - 18.03.2023	INTERMOULD Seoul South Korea
	29.03. - 31.03.2023	MECSPE Bologna Italy
09.05. - 12.05.2023	METAL SHOW & TIB	Bucharest Romania
	16.05. - 19.05.2023	INDUSTRY DAYS Budapest Hungary
	31.05. - 03.06.2023	EMAF Porto Portugal
13.06. - 16.06.2023	Moulding Expo	Stuttgart Germany
	26.06. - 29.06.2023	16th China International Die Casting Industry Exhibition Shanghai China
18.09. - 23.09.2023	EMO	Hanover Germany
	25.09. - 28.09.2023	CMTS Toronto, ON Canada
	10.10. - 12.10.2023	METAVAK Gorinchem Netherlands
	11.10. - 12.10.2023	Meximold Querétaro Mexico
	17.10. - 19.10.2023	SIANE Toulouse France
18.10. - 21.10.2023	MECT	Nagoya Japan
	01.11. - 02.11.2023	Advanced Engineering Birmingham Great Britain
07.11. - 09.11.2023	Westec/AeroDef	Long Beach, CA USA
15.11. - 16.11.2023	METAL	Madrid Spain
22.11. - 25.11.2023	METALEX	Bangkok Thailand

In-house exhibitions, customer events, conferences and symposia

09.02.23	TOYOTA Customer Day	Cologne Germany
16.02. - 17.02.2023	GF Open House	Penang Malaysia
20.02. - 24.02.2023	MAPAL Open House	Querétaro Mexico
21.03. - 24.03.2023	GROB In-House Exhibition	Mindelheim Germany
23.03.23	mav InnovationsForum	Böblingen Germany
11.05. - 12.05.2023	In-House Exhibition Heinrich Meier GmbH	Mühlacker Germany

MACHINING LIVE – MAPAL AT THE INTEC IN LEIPZIG



Among other things, MAPAL will be showing the OptiMill-Tro-Titan at the Intec in Leipzig

When Messe Leipzig opens its doors for INTEC from 7 to 10 March 2023, MAPAL will be in Hall 3 at Stand B22/C21. On 100 square metres, MAPAL will not only be showing tools and solutions for different industries and materials but will also be presenting machining live to visitors. "In cooperation with Grob, we will be showing some of our tools live under chip removal on a G150," says Frank Stäbler, Sales Director DACH-HU. Among other things, tools from the field of aluminium machining and the MAPAL UNIQ chucks will be on display on the machine.



MAPAL is a full-range supplier for die and mould making and will be presenting its extensive range at the trade fair.

The other MAPAL exhibition area is reserved for the focus topics of e-mobility, fluid power technology and die and mould making as well as titanium machining.

E-MOBILITY: SOLUTIONS FOR DIFFERENT MACHINING STAGES

"For demanding components that will be produced in high quantities in the future, we have defined the solution levels Basic, Performance and Expert," explains Stäbler. This classification describes the different approaches depending on requirements, lot sizes and investment. The Performance Line is geared towards series production and focuses on machining with special tools. It is mainly used when new components are to be produced efficiently and economically on existing systems.

DIE AND MOULD MAKING: COMPLETE MACHINING FROM A SINGLE SOURCE

As a technology partner, MAPAL offers die and mould makers not only high process know-how but also technologically leading tools and services. "We are presenting our portfolio at the trade fair and emphasising how we ensure the highest precision, long tool life and above all process reli-

ability with our tools," says Frank Stäbler. The tool range is complemented by the matching clamping technology as well as various services related to process optimisation and networked manufacturing - all from a single source.

TITANIUM MACHINING: TWO NEW MILLING CUTTERS FOR BEST RESULTS

The MAPAL range for titanium machining has been extended by two efficient milling tools. The solid carbide trochoidal milling cutter OptiMill-Tro-Titan with five cutting edges is characterised by maximum metal removal rate and shines with excellent surfaces as a result of the unequal pitch and unequal spacing. The radial high feed milling cutter NeoMill-4-HiFeed90 with indexable inserts stands for high productivity and is characterised by highest metal removal rates, very high feed rates and large cutting depths.

"We are looking forward to presenting our solutions to trade fair visitors in Leipzig and discussing their specific tasks in direct talks," concludes Frank Stäbler. ■

PARTICULARS



FRÉDÉRIC ESTRAT

**CHIEF SALES OFFICER MAPAL FRANCE
AND GLOBAL HEAD OF BUSINESS DEVELOPMENT AEROSPACE**

In addition to being Chief Sales Officer (CSO) of MAPAL France, Frédéric Estrat is now Global Head of Business Development Aerospace as well. Estrat will develop the growing Aerospace market for MAPAL and unlock future potential worldwide. Estrat has been active in Sales for over 22 years at MAPAL France. He headed the sales office in Nantes and has been CSO for the French market since January 2022. The aerospace industry has a very strong tradition in France. Due to Estrat's efforts to a large part, MAPAL successfully entered this market segment years ago. In his new role, Estrat will report directly to Siegfried Wendel, CSO of the MAPAL Group.

JENS ILG

BUSINESS DEVELOPMENT MANAGER AEROSPACE DACH-HU

Jens Ilg has been given the role of Business Development Manager Aerospace DACH-HU (Germany, Austria, Switzerland and Hungary). Ilg has been working for MAPAL in the Aerospace Segment Management for 13 years and has excellent knowledge about and contacts in the aerospace industry. Ilg reports directly to Frank Stäbler, Director Sales DACH-HU.



High-level training

AWARDS AND PRIZES

In 2022, 85 young professionals successfully completed their dual training or dual studies at the MAPAL sites in Aalen, Pforzheim, Winterlingen, Altenstadt, Meiningen and Ehrenfriedersdorf. The Chambers of Industry and Commerce awarded prizes to twelve graduates, including the best industrial mechanic in Baden-Württemberg.

In addition to twelve award-winning graduates, another six received commendations from the Chambers of Industry and Commerce for good examination performance. All 85 trainees MAPAL locations in Germany passed their final examinations with flying colours. Which shows how great the motivation of the young people is, who, like their trainers, were faced with special challenges during the corona years and mastered them brilliantly thanks to the introduction of digital learning programmes. Qualified instructors and the most modern training facilities have always ensured the high quality of the company's training of young people.

Dr Jochen Kress, President of the MAPAL Group, congratulated the 42 graduates at the headquarters in Aalen and presented the certificates at a ceremony. He encouraged the young people to contribute their newly acquired knowledge to the

company and to work on the future of the MAPAL Group. New technologies such as e-mobility, the development of new business areas and digitalisation offer the career starters numerous opportunities and plenty of scope for professional development.

Tobias Ilg came out on top of the list of graduates with his training certificate. For his outstanding performance, he was awarded by the IHK Ostwürttemberg as the best industrial mechanic in Baden-Württemberg. Ilg was also the most successful industrial-technical trainee in all of East Württemberg. In addition to Ilg, five other apprentices at the Aalen plant graduated with an overall grade of "very good". Among them is Lena Klaus, who, after her apprenticeship as an industrial clerk, is now pursuing a dual study programme in the field of business administration. At the Centre of Competence Pforzheim, eight apprentices

completed their training, four cutting machine operators received an award. At the Centres of Competence in Ehrenfriedersdorf and Altenstadt, one apprentice each received an award. There were 25 graduates in total. Kilian Blumenthal from the Altenstadt site was also the best apprentice in his training occupation in the economic area of West Swabia. The Centre of Competence Winterlingen is pleased about four successful graduates. There were six graduates in Meiningen, including one who came top of his class as a precision tool mechanic.

Almost all graduates accepted MAPAL's job offer and now support their colleagues in production or administration. ■



At the graduation ceremony at the main plant in Aalen, 42 junior employees received their certificates.



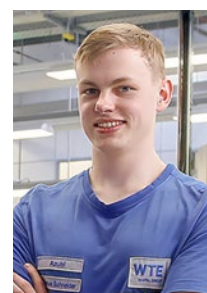
Winterlingen plant: from left Benedikt Lich with Nico Kleine-Boes, who received a commendation.



Pforzheim plant, from left: Edwin Steineker, Ivan Degtyarev, Florian Wanitschek (awards)



Meiningen plant: Maik Oberender (best in class)



Ehrenfriedersdorf plant: Markus Schneider (award)

WorldSkills Competition 2022

THE WORLD CHAMPIONS IN THE DISCIPLINE "ROBOT SYSTEMS INTEGRATION" COME FROM MAPAL

Philipp Raab and Marvin Schuster have completed training as mechatronics engineers at the main plant in Aalen. In 2021, they won the title of German champions at WorldSkills Germany. In October 2022, they took on the international competition. With success: Raab and Schuster achieved the best result and are the winners of the World Skills 2022 in the discipline "Robot Systems Integration".



Reception at the Federal Chancellery in Berlin: In December, Federal Chancellor Olaf Scholz received the German participants of WorldSkills 2022 and congratulated them on their success. Philipp Raab and Marvin Schuster had brought the Chancellor a programmed mini-robot.



A separate training room was set up for robotics at the MAPAL training centre in Aalen. In the picture, from left, trainer Gerd Dambacher and mechatronics technician Marvin Schuster next to a robot cell that was converted and upgraded by the "world champions".

There is great joy at MAPAL: Philipp Raab and Marvin Schuster have returned from Luxembourg with a gold medal. The mechatronics engineers achieved a dream result at the "WorldSkills" in the discipline "Robot Systems Integration". The 20-year-olds had entered the international vocational competition as German champions and showed outstanding performances. In the competition, which was exciting right up to the last minute, "Team Germany" succeeded in relegating the competition, especially from the Far East, to the back of the field. Philipp Raab and Marvin Schuster achieved the best overall result and secured the title of world champion in the "Robot Systems Integration 2022" category with a clear points lead over the teams from Taiwan and Poland.

TEAMS FROM ELEVEN COUNTRIES

Young robot programmers from eleven countries – Austria, France, Hungary, Luxembourg, Poland, Great Britain, India, Japan, Singapore Taiwan and Germany – competed in the competition. WorldSkills aims to promote vocational training for young people. The event is held in more than 60 vocational disciplines every two years.

The robot programming category was to be held in Shanghai, but because of the pandemic it was moved to Esch-sur-Alzette in Luxembourg. For four days, the teams dealt with the programming of a complex robotic application in warehouse logistics. The task was to programme a ro-

bot in such a way that it filled various containers with virtual goods. The task contained two specifications: The filling had to be possible within a certain cycle time as well as by scanning a scanning a QR code. In addition, a digital twin of the real robot was to be created. If errors occurred in the process, it was important to analyse and rectify them quickly.

The participants from Taiwan set a fast pace from the beginning. "We thought they were going to make the race until the very end," recounts Marvin Schuster. It was also clear to Uwe HeBler, Head of Training and Development at MAPAL: "When it comes to programming speed, the Taiwanese team is in a league of its own." Philipp and Marvin could not afford any mistakes, which would have cost valuable time. Ultimately, the scoring key played into Team Germany's hands, says HeBler. Philipp and Marvin were clearly ahead in other disciplines, such as documentation and program design. Whether that would be enough for victory, no one knew. "It was a surprise for us," say a delighted Philipp Raab and Marvin Schuster, who always kept their cool despite the excitement. The two had prepared intensively for the competition. Martin Ernsperger, who works at MAPAL in the area of manufacturing technology and automation, and WorldSkills national coach Jens Mühlegg from FANUC Germany supervised the two. The Aalen Technical School also provided support.

ROBOT SYSTEMS IN THE TRAINING CENTRE

In 2018, the headquarters in Aalen entered the dual training of mechatronics technicians. As it turns out, very successfully. The first trainees to become mechatronics technicians were Marvin Schuster and Philipp Raab. In the meantime, a training room for robotics has been set up in the training centre. A trainer with the appropriate expertise familiarises the industrial-technical trainees with the topic of "robot cells". The basis of the training programme is a documentation prepared by Marvin Schuster and Philipp Raab. During their training, the mechatronics technicians converted a training cell from FANUC, upgraded it and adapted it for use at MAPAL. "We use what they did and offer our trainees, including those from other sites, the opportunity to complete a specialist training course in robotics," says Uwe HeBler. This is an investment in the future. In new production areas, MAPAL relies on robots and assistance systems and needs young trainees who have the necessary know-how in handling these systems. ■

MAPAL RECEIVES THREE SUPPLIER AWARDS

Bosch, the Bocar Group and the Gnutti Carlo Group have been loyal partners of MAPAL for many years. The companies awarded MAPAL as a preferred supplier for the close and trusting cooperation.



BOSCH



Visit to the MAPAL trade fair stand at AMB: Batu Ulucay from Bosch Central Purchasing (2nd from right) presents Siegfried Wendel (CSO MAPAL, 3rd from right) with the Preferred Supplier Certificates 2021 and 2022.

Bosch evaluates the performance of its suppliers at regular intervals. As part of this assessment process, the company once again recognised the excellent cooperation with the MAPAL Group. With the presentation of the Preferred Supplier Certificates for 2021 and 2022, MAPAL has received a high distinction, which is only granted to a few of the more than 45,000 suppliers of the technology and service company worldwide. The criteria for the award were above-average performance in innovation and quality of the precision tools and chucks supplied for machining various components, as well as service and delivery performance. The certificates were presented at a meeting at the AMB (International Metalworking Exhibition) in Stuttgart in September 2022. Batu Ulucay from Central Purchasing at Bosch congratulated Siegfried Wendel (CSO MAPAL) and expressed his thanks for the good cooperation.

BOCAR



Award ceremony at Bocar, from left: Andres Meza (Supplier Development Manager Bocar), Ezequiel Vivas (Procurement Director Bocar), Andreas Wittenauer (MAPAL Key Account Manager), Markus Baur (President Bocar Group), Tobias Bechtel (Deputy Managing Director Bocar Group). ©Bocar

MAPAL also has long-standing connections with the Mexican automotive supplier Bocar. Since 1998 there has been a close and trusting cooperation with Bocar's plants in Mexico and its technology centre in Germany. The Centre of Competence for PCD tools in Pforzheim is responsible for support from MAPAL. Whether it was a question of new machining solutions, intelligent applications, services or delivery performance: MAPAL had demonstrated reliability and a high level of innovation in all areas. MAPAL is proud to be one of 16 companies to receive the award and the only supplier in the field of precision tools. Andreas Wittenauer, MAPAL's Key Account Manager responsible for Bocar, accepted the honour during Bocar's first supplier day in Lerma, Mexico.

Gnutti Carlo Group



Award ceremony at Gnutti Carlo: from left Paolo Buizza (Senior Process Engineer Gnutti Carlo Group), Claudio Gabos (CEO MAPAL Italia), Claudio Cassutti (Area Sales Manager MAPAL Italia), Fabio Zucchi (CPO Gnutti Carlo Group), Fabio Salvalai (Technical Advisor MAPAL). ©Gnutti Carlo Group

The Italian Gnutti Carlo Group is considered a global leader in the development and production of high-precision engine parts, fuel injection components and die-cast components for the automotive industry. The global supplier network consists of a pool of selected companies that share with Gnutti the common goal of striving for best-in-class status through constant innovation, outstanding quality and flexibility, while increasing efficiency along the value and supply chains. "Among these companies, MAPAL stands out for its continuous support," said the jury's statement, which presented the Supplier of the Year Award for 2021 in May this year. The jury highlighted the high level of quality and the concrete added value of MAPAL products. MAPAL is an ideal partner supplier for the Gnutti Carlo Group.



The "Performance" tool package is ideal for medium-sized manufacturing quantities. The image shows the machining solution with HSK63 for the stator housing.



Basic, Performance, Expert

TOOL SOLUTIONS FOR E-MOBILITY

In the years to come, MAPAL expects huge growth in machining solutions for electric vehicles. The tool manufacturer has focused on ambitious components that will be produced in large quantities in future. The new Basic, Performance and Expert classification describes customer-specific solutions for their machining.

MAPAL's strong focus on its customers' needs when developing tool solutions is not new. With the arrangement of machining options into three solution levels – Basic, Performance and Expert – the company now offers a clear classification for tool selection options for a specific part. In doing so, MAPAL gives customers a rough indication, with smooth transitions as the illustration on the right shows.

THREE ROUTES TO THE FINISHED COMPONENT

Basic versions include solutions with standard tools, which cover requirements in the manufacturing of prototypes or small series in a cost-effective way. The investment required is comparatively low, and the use of tools is flexible. As many changes are often still being made to

the component and process at this stage, the flexibility achieved using standard tools is very helpful. Use of custom tools is avoided in the Basic solution where possible.

Performance solutions are designed for series production and focus on machining specific parts using custom tools. Here, multi-stage and combination tools can be used to process the workpiece more efficiently than with Basic versions. The Performance solution enables reliable series-ready production without quite fulfilling the very top requirements for quality and productivity.

This is reserved for the Expert version. It includes solutions designed to machine specific parts with the fewest tools possible productively and

effectively in short cycle times with the best possible quality. Here, multi-staged tools with multiple cutting edges that combine all functions in a single device are typically used. An example of an Expert solution is the tool set for machining the stator housing for an electric motor, which MAPAL has already successfully established in the industry. MAPAL has taken productivity and quality to their absolute limit with these tools. Basic and Performance solutions are also available for manufacturing the stator housing – which meet the requirements for each level respectively.

AMBITIOUS PARTS FOR ELECTRIC CARS

Alongside electric drives, MAPAL is also placing its focus on other electric car components. These include auxiliary units such as the scroll com-

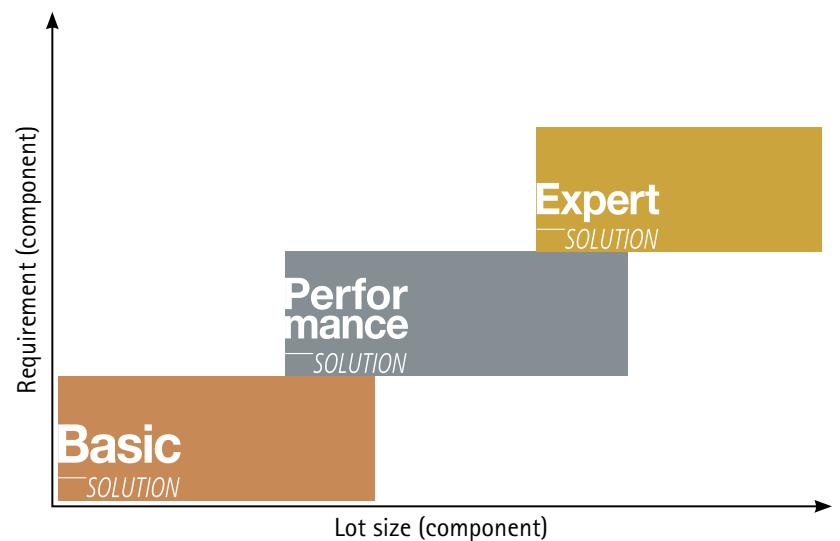


The "Expert" version focuses on large series production. A small number of ultra-productive tools operate in short cycle times to the highest standards of quality.

pressor for thermal management and housing for power electronics and battery frames. The latter requires a great deal of milling operations which can also be illustrated well with the three-staged Basic, Performance, Expert concept. Comparatively simple standard tools can be used for tests or small quantities. The next level involves special solid carbide tools that combine several machining steps and ensure reliable machining. Accordingly, the Expert level brings milling cutters with special coatings or PCD milling cutters into play in order to take tool life to a higher level.

MAPAL determines the optimum solution for the relevant situation in direct dialogue with its customers. In many cases, customers will only take advantage of two of the three potential levels. This is because prototype production often takes place at specialist machinists, which means the OEM starts directly with series production. If the quality requirements are met and productivity is sufficient for the quantities to be manufactured, a Performance-level machining solution is used. Under certain circumstances, the demands placed on machine performance may also not be quite as high with this solution, which can be a criterion when converting existing lines to e-mobility. Of course, a manufacturer can also go straight from prototype production to a Performance-level machining solution, if, for instance, the focus is on costs per part above a specific production volume.

Open and goal-oriented communication with the customer remains at the heart of MAPAL's approach. After all, an open dialogue is crucial in providing the right tool solution for every application and every customer. ■



MAPAL's machining portfolio for electric mobility components is arranged in three solution levels: Basic, Performance and Expert.

FOUR INSERTS FOR STATOR BORES

Actuating tools are the means of choice for creating turning geometries on machining centres. When it comes to machining stator bores on electric motors, tools with indexable inserts and fine boring tools were considered the state of the art until now. MAPAL has developed a complex four-bladed actuating tool to round off its solution portfolio for stator drilling.

With its Expert Solution, MAPAL has come up with a highly productive machining process for the series production of stator housings for electric motors. The solution offers productivity and precision as well as short cycle times with a process of three steps: pre-machining, semi-finishing and fine machining at machining diameters of more than 220 mm and with an HSK100 connection. A sophisticated actuating tool is part of the solution.

"With an actuating tool, the internal machining of the bore can be handled by a machining centre, which means turning is no longer necessary", says Oliver Müller, Customer Service Specialist at the MAPAL Centre of Competence for Actuating Tools. The entire machining process can thus be executed with a single clamping setup. The only thing needed to use the actuating tool is a spindle with a drawbar – a so-called U-axis in the machining centre.

"When it came to machining parts for electric cars, we were at our customers' side with our tools from the very beginning. Today, we help them to increase flexibility while machining the parts reliably and with short cycle times", Müller explains. The actuating tool achieves more flexibility by ensuring both fast machining of varying contour trains in the bore as well as precision down to the micrometre.

For example, a thin-walled stator housing with a 220 mm stator bore is machined on a machining centre with an HSK100 connection. "The machining of the stator bore with indexable insert tools and fine boring tools represents the state of the art. They have proven themselves over and over again. However, to achieve more

flexibility for faster machining, we developed a tool with four slides together with machine manufacturers and customers", Müller says. The drawbar controls four facing slides equipped with ISO inserts and handles both pre-machining and fine machining. PCD cutting edges are used as the housing is made of aluminium. After the machining is done, the inserts are retracted, and the tool is moved out of the housing via rapid traverse. This saves cycle time without the risk of damage to the new surface. This solution is particularly productive and focusses on high quality, which is why it has found its way into the Expert Solution range of MAPAL's solution portfolio.

Each of the four slides of the 22.5-kg-heavy tool has a face stroke of 20 mm – the inserts can thus be extended to a diameter of 40 mm. The drawbar compensates for wear and tear directly during machining. This makes for particularly reliable machining. For even shorter cycle times, the actuating tool is designed as a combination tool. In addition to machining the stator bore, steel bushings are pre-machined with four carbide inserts.

"The tolerance of the large bores is set to IT6 quality. That shows the precision with which our tools are manufactured, assembled and set. The four inserts have to interact with micrometre precision", Müller states.

And so the experienced workers at the MAPAL Centre of Competence know the actuating tool inside out. Müller explains: "Assembling this sophisticated tool is similar to watchmaking." It takes two to four weeks to assemble one tool. In order to set up the tool precisely at the cus-

tomers' premises, MAPAL offers a suitable setting device. The special machine is based on the UNISET-V and equipped with an additional axis – like the machining centre.

Not only the cutting data (see box) and the resulting surfaces with an $R_z < 6.3 \mu\text{m}$ convince on the shop floor, the tool life of the inserts does too. The PCD inserts can machine 3,600 parts before they have to be changed. The carbide inserts manage 600 parts. "Our customers are very happy with the tools", a delighted Müller relates. "The housings continue to be further developed; the contours slightly adapted. Thanks to the actuating tool, we can react to this easily and without changing the tool." ■

CUTTING DATA:

Aluminium machining

$v_c =$	690 m/min
$f_z =$	0.20 mm (pre-machining)
$f_z =$	0.15 mm (fine machining)
Spindle speed =	1000 rpm

Steel machining

$v_c =$	160 m/min
$f_z =$	0.16 mm
Spindle speed =	690 rpm



Explain the technical features of the actuating tool for stator bores (from left): Application Engineer Jürgen Utz and Customer Service Specialist Oliver Müller from the MAPAL Centre of Competence for Actuating tools.

Highly precise setting of the inserts with the UNISET-V from MAPAL.

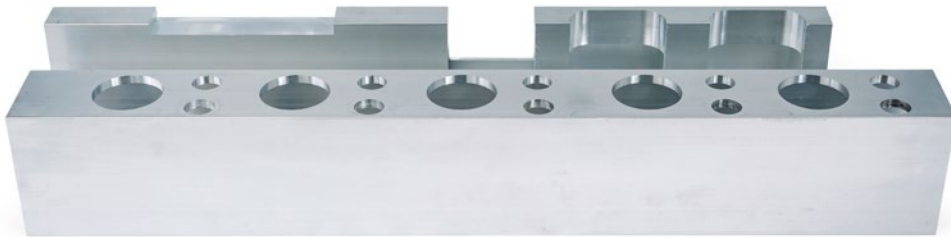


The actuating tool with four cutting edges stands for high process reliability and flexibility during the machining of stator bores.



A STRATEGY FOR BATTERY FRAMES

The complete machining of parts has to be well thought out, every step coordinated with the next. This is the only way to attain reliable and cost-effective manufacturing with perfect results. To provide customers with such sophisticated strategies, MAPAL has defined focus components on electric cars and worked out the optimal machining strategy for them. The battery frame is one of these components.



The generic component presents the challenges involved in machining a battery frame.

The battery frame is a crucial part in every electric car. It usually consists of various frame elements that are welded together after pre-machining and act as the battery's enclosure. Based on various customer parts, MAPAL's electric mobility experts have put together a generic component that encompasses the main machining operations of a battery frame. "With this part, we highlight the special challenges involved in machining", says Michael Kucher, Component Manager E-Mobility at MAPAL.

The challenges faced while machining the part include stepped bores, bores with different diameters through multiple layers, milled pockets with varying dimensions, shoulders, and high demands on the resulting surface.

"We master these challenges above all with the optimally designed milling cutters", says Kucher. Milling is even used for most bores on the frame part. Depending on diameter and machining depth, the experts decide in each case whether to drill or mill. "While the cycle time during the

milling of bores is somewhat longer, milling offers decisive advantages in this case, which more than make up for the lost time." In the past, long chips which occurred while drilling aluminium parts often proved very problematic to customers. "Removing long chips from inside the frame part presented a risk for the process", says Kucher. The short milling chips are easy to remove. There is also a lot less burr formation during milling than drilling. And there is no need for tools changes. Multiple bores with different diameters can easily be machined with a single milling cutter.

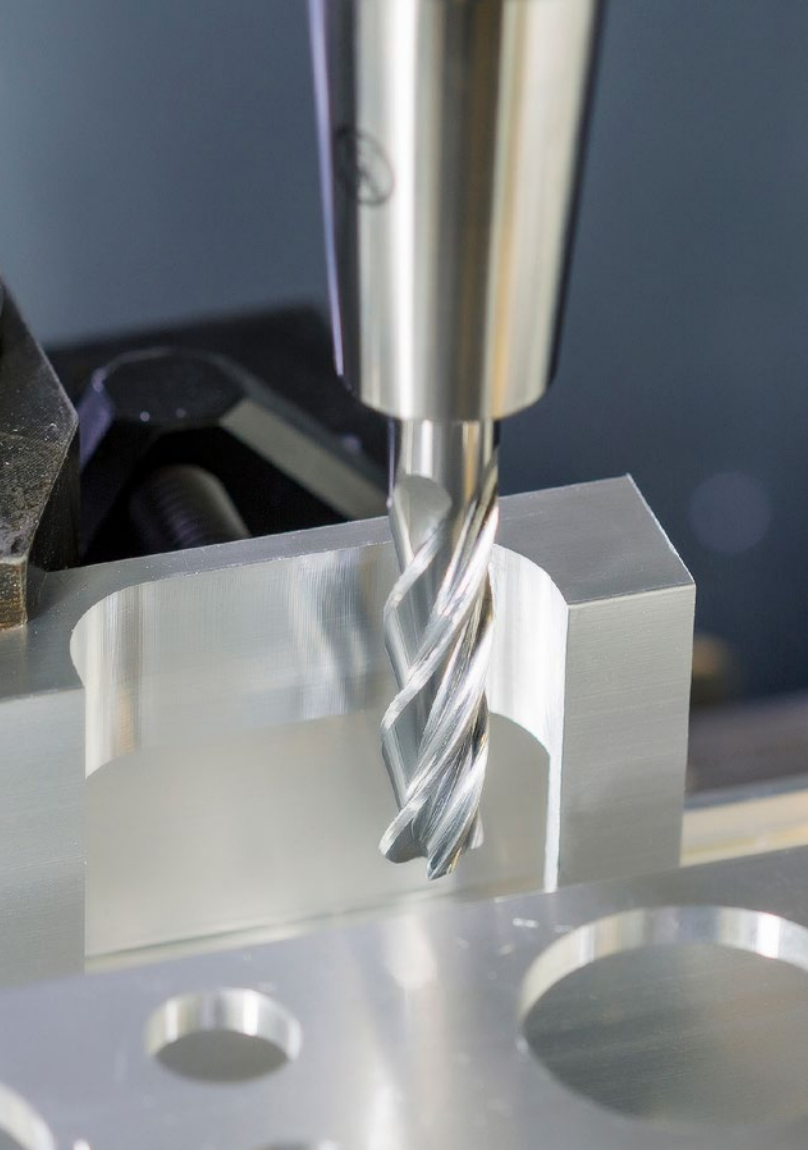
This advantage is brought to bear particularly when a bore has a larger diameter in one of the lower layers than the bore entrance at the top layer. "This can be done effectively with a reverse cutting edge on the milling cutter", says Kucher. The alternative would be re-clamping the workpiece in order to machine the bore from the bottom with a drill. A specially designed PCD milling cutter from MAPAL machines the bore at a spindle speed of 16,000 rpm, a cutting speed of 650 m/min and a feed of 0.063 mm.

OPTIMAL SURFACES WITH THE OPTIMILL-SPM-FINISH

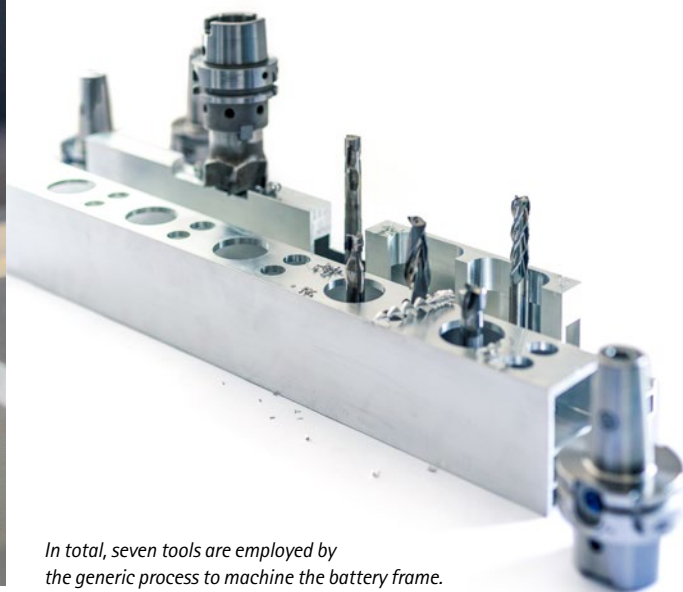
MAPAL recommends the OptiMill-SPM-Finish for roughing shoulders, pockets and slots as well as finishing pockets. "It achieves an optimal surface finish and works stably even in corners with large wrapping and high loads", Kucher says of the tool. Because the chip spaces are polished, chip removal functions perfectly. The special feature of this tool is that the user can finish large depths in a single pass. This saves time, making it particularly cost-effective. When finishing the battery frame, a surface finish of up to $R_z = 1 \mu\text{m}$ is achieved. During roughing, it operates at a spindle speed of 10,981 rpm, a cutting speed of 414 m/min and feed rates between 0.12 and 0.22 mm. The same spindle and cutting speeds are achieved during finishing with a feed of 0.075 mm.

In total, seven tools are used during the generic process, including six milling cutters: besides the OptiMill-SPM-Finish, amongst others the recently introduced FaceMill-Diamond-ES. In or-





The solid carbide milling cutter OptiMill-SPM-Finish finishes large pockets in a single pass.



In total, seven tools are employed by the generic process to machine the battery frame.



The specially designed PCD milling cutter machines both bores with different diameters.

der to attain a perfectly harmonised system, all of the tools with cylindrical shanks are clamped in the new UNIQ chucks in the generic process.

"We can now offer our clients an all-round package to meet the challenges of machining battery frames, which includes PCD and solid carbide tools, chucks, and the corresponding process. For this we adapt the generic process for our customers based on their concrete situation", Kucher explains. ■



Took an in-depth look at battery frames at MAPAL and their optimal machining strategy (from left to right): Andreas Wolf (Test Engineer), Florian Hofmeier (Component Manager Driveline) and Michael Kucher (Component Manager E-Mobility).

Supplier 2A manufactures demanding parts

WELL POSITIONED FOR E-MOBILITY

The Turin-based die-casting foundry 2A specialises in the complete machining of complex aluminium parts for the automotive industry. The company is well positioned for the transition to electric mobility, particularly because it has MAPAL, an experienced tool partner, at its side.

Northwest Italy is often associated with fashion and cars, and not without good reason. In its company history, 2A from Turin has already been involved in both of these sectors. After the die-casting foundry was established in 1974, the zinc alloy zamak was processed, which was used to make zip fasteners. The company name is an acronym of the Italian "Accessori per Abbigliamento", which is translated as "accessories for clothing".

As the production of textiles moved more and more to China and only product development remained in Europe, 2A tapped into the automotive industry and entered the aluminium processing sector in the 90s. With its complete range of castings, mechanical machining, coating and even assembly where required, 2A today primarily targets OEM customers. The company produces parts weighing from a few grams up to 45 kilograms.

The new direction was successful for the company, which became the largest die-casting company in Italy and now employs around 300 people in three plants in Turin. There are also additional plants in the USA and China. Unlike some other suppliers, 2A does not generate its sales volume, which is currently 150 million euros annually, from just a few major customers. Instead, the company is broadly positioned both nationally and internationally. Renowned car manufacturers are supplied directly by 2A. Moreover, many parts are used in truck production and in other industrial sectors such as the manufacturing of compressors.

A FOCUS ON COMPLEX PARTS

"Today, we focus on parts that meet demanding standards in manufacturing and are difficult to produce", says Galiano Braconcini, Technical Manager at 2A. "Customers come to us because they value our manufacturing know-how and only a few suppliers are able to produce premium parts with the required accuracy. Our high quality standard makes us unique in the market." The company values class over mass, and its manufacturing capacity is highly flexible with a high degree of automation. To remain competitive, 2A invests 3 per cent of its sales volume in research and development. The company also has cooperations with technical universities and research institutions.

MAPAL has been the preferred supplier of cutting tools since the die-casting foundry began to mechanically machine complex castings in its own plant in 2011. In the past, high-quality parts were manufactured such as transmission housings and cylinder covers for power trains in internal combustion engines as well as chassis and structural parts. 2A immediately followed car manufacturers' move towards electric cars.

"There's no way around the switch to electric mobility", says Galiano Braconcini. "For a company like 2A with a business model based entirely on cast aluminium parts, this is an advantage, as a lot of aluminium goes into electric mobility for weight reasons." The Turin-based company initially started with battery trays and structural parts. 2A became Tesla's first Italian supplier.

There was no question that MAPAL would remain 2A's first choice as a tool partner for electric mobility. "Due to its experience in this area, we never doubted that we were in good hands with MAPAL and we contacted our tool supplier right away", says Braconcini.

STATOR HOUSING FOR PREMIUM CARS

The two also tackled an extremely challenging project together: manufacturing stator housings for electric motors. 2A also has some parts for e-cars manufactured by partner companies, but produces key parts itself. MAPAL supported 2A right from the start, analysing the parts to be produced, suggesting machining strategies, designing the process and determining the cycle times.

MAPAL technicians were on site to provide support during the commissioning. "It was very difficult in the beginning, and we needed several months until the production line was running stably", Braconcini reports. 2A produces the stator housings on eleven machining centres. One of the main challenges in the beginning was to achieve the required accuracy of repetition when machining these thin-walled parts. This required maximum precision.

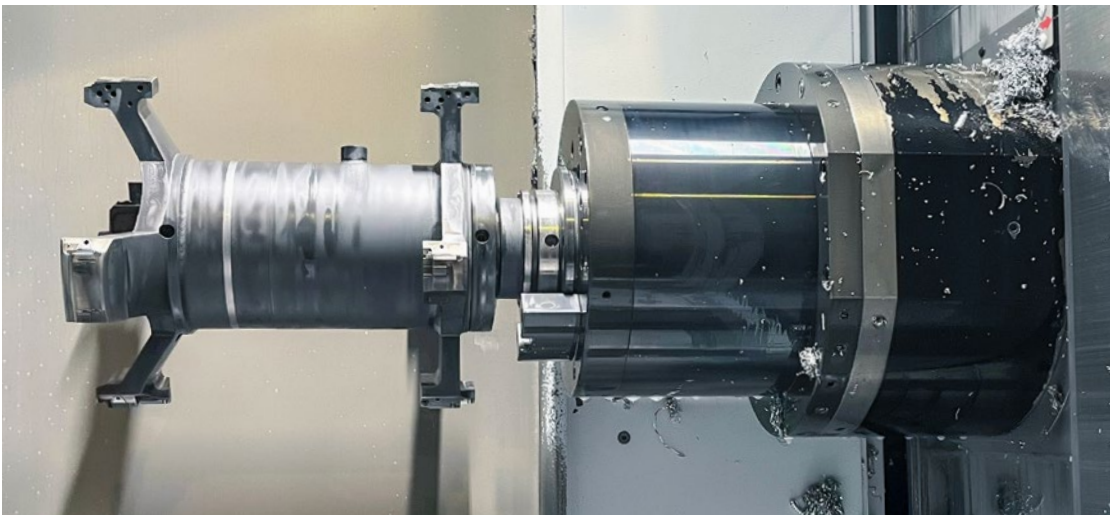
Braconcini is convinced that 2A would not have got far with simple standard tools. Forty different tools are required for manufacturing a single stator housing. "Many of them are very similar to the ones we already used for combustion engines, but there are some highly specialised tools among them", explains Andrea Gallino, who is 2A's Key



On eleven machining centres, 2A in Turin manufactures high-precision stator housings for electric motors. A particular challenge was the required accuracy of repetition when machining these thin-walled parts.



2A has concentrated completely on the machining of cast aluminium parts. The automotive industry's switch to electric vehicles is welcomed here since many parts made of aluminium are in demand.



For part diameters of over 200 mm, the finish machining of the stator housings for premium vehicles is carried out with a MAPAL fine boring tool with an accuracy of a few μm .

Account Manager for MAPAL Italia. "Two custom tools that MAPAL specifically designed for machining this part make all the difference."

The first is an aluminium roughing tool equipped with indexable inserts that is adapted to the dimensions of the workpiece. A fine boring tool is used for finishing. Since three to four different diameters must be machined per part, the tool has an identical number of steps, each equipped with four inserts. In designing the tool, MAPAL had to strike a balance between as little weight as pos-

sible and high rigidity. The complex custom tools allow very precise machining of the part with high efficiency and productivity.

DEMAND FOR MAXIMUM PRECISION

After the successful first project manufacturing stator parts, a second project on electric motors for premium cars has since been launched. The new parts are made on the same manufacturing lines. Since the parts are very similar to the ones already manufactured, the company was able to build on its previous experience in production.

However, even narrower tolerances were required this time around. The requirements for the new stator housings were increased several steps at once, comments Gallino. The tolerances in series production cannot be fully utilised to produce all parts reliably with the required precision. For 2A, this means tolerances within a few μm for diameters of over 200 mm.

Due to the slightly changed dimensions of the parts, 2A and MAPAL had to replace about 70 per cent of the tools used in the first project. However- →

er, at the same time, the partners were able to contribute the experience gained in the design and technical optimisations right from the start. What's more, the dimensions of the stator housings differ from customer to customer, which is why custom tools are used in each case. Currently, the Turin-based company manufactures stator housings for three car manufacturers in Germany and Italy, supplying a total of 180,000 parts annually.

The path to electric mobility is far from complete and could take longer at 2A than at some other suppliers, despite its early entry. This is due to the Turin-based company's strong truck division, where the switch is lagging somewhat. Galiano Braconcini expects there to be continued demand for combustion engine parts for at least another five years. The sector also still needs zips, which some manufacturers use on their seats. These are also supplied by 2A, of course. ■



Working together with MAPAL, 2A ventured into the challenging realm of machining stator housings (from left): Galiano Braconcini (Technical Manager for 2A), Andrea Gallino (Key Account Manager at MAPAL Italia) and Davide Renna (Technical Sales Representative at MAPAL Italia, 2nd from right) with the 2A technician team.

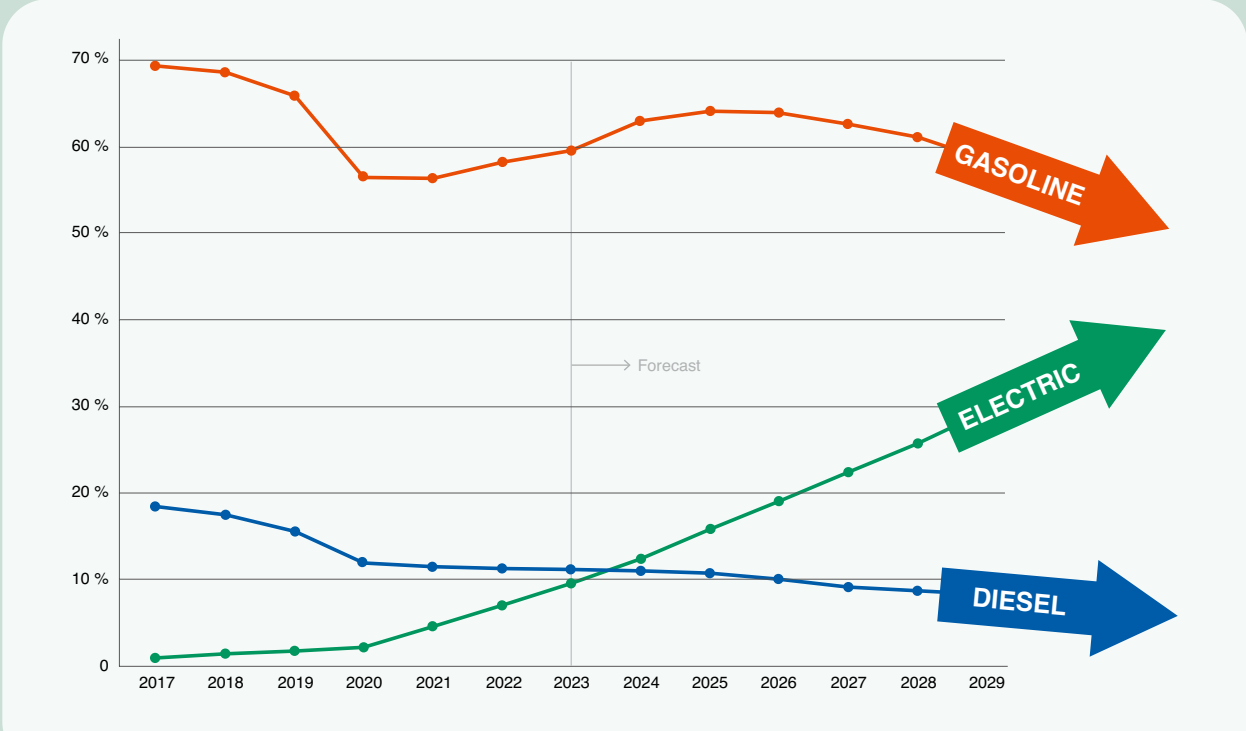


Among the 40 different tools required to produce a stator housing, two custom tools from MAPAL play a decisive role: The tool with indexable inserts for semi-finish machining (left) and a fine boring tool for finish machining.

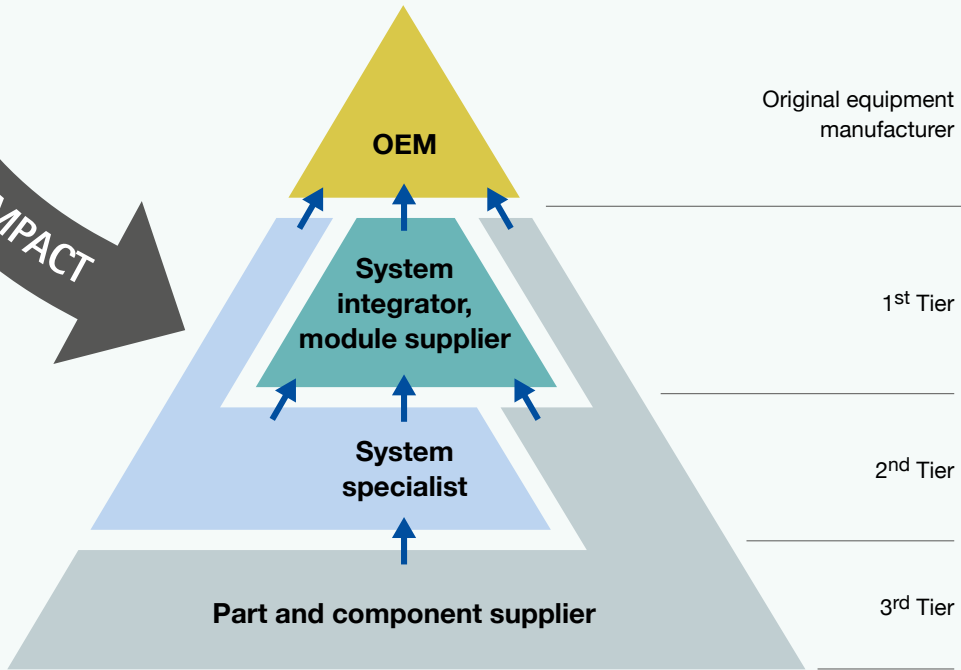
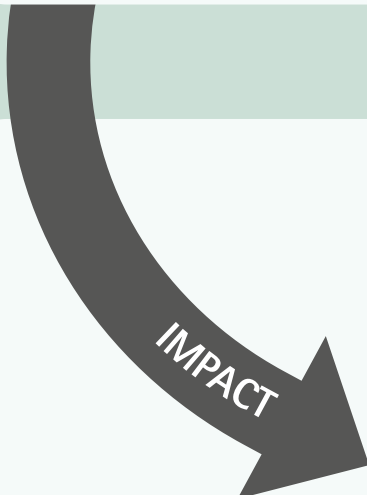
Know-how e-mobility



The development of drive types in the automotive sector influences the entire supplier structure. Innovative tool solutions for all levels of suppliers are an important basis for successful change.



Global market development in the automotive sector per drive type; forecast MAPAL market segment management



Schematically depicted supplier pyramid in automobile production

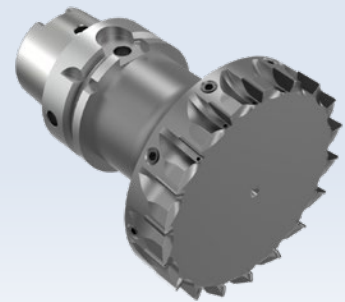
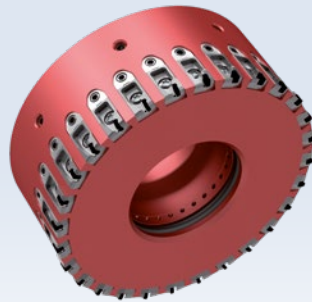
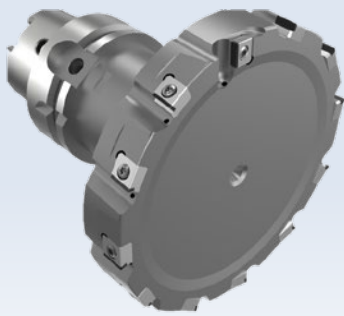
ALUMINIUM FACE MILLING – THE OPTIMAL SYSTEM FOR EVERY APPLICATION

MAPAL presented two new milling tools for aluminium machining, the NeoMill-T-Finish and the FaceMill-Diamond-ES, at AMB 2022. "Another two?" might have crossed one's mind, as after all face milling aluminium is one of MAPAL's core applications. A product overview shows how the two new developments fit in and where which milling cutter makes the most of what it has to offer.

"The two new products complement and complete our portfolio perfectly with their respective special properties", emphasises Heiko Rup, Global Head of Product and Application Management for Indexable Tools: "With our product range, we can optimally meet the different requirements of our customers in every case with-

out making any compromises." Matthias Fuchs, Manager of Sales Development PCD Tools, adds: "An initial guide is provided by the graphic representation of the product range based on the possible cutting depth and the achievable surface quality. In addition, other criteria play a role in defining the ideal tool, such as the number

of pieces to be produced or the handling effort involved in changing cutting inserts or milling cartridges which requires the need of appropriately trained personnel working on site at the customer's premises."



NeoMill-T-Finish – Finishing with the highest accuracy and without setting

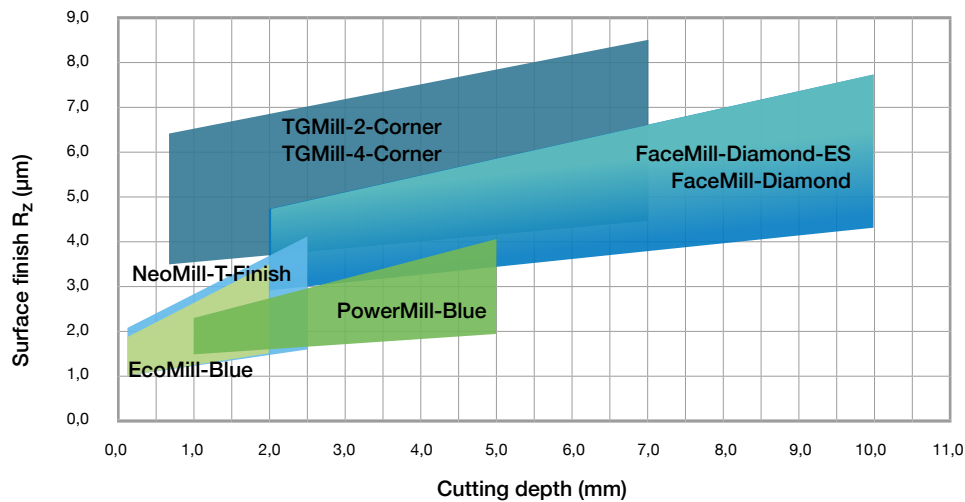
The NeoMill-T-Finish indexable insert milling cutter is designed for economical and process-reliable finish machining in series production. The milling cutter is impressive thanks to its very easy handling: The inserts can be exchanged on site and do not need to be set – MAPAL calls this principle Plug & Mill. Thank to its high cutting material variance, the NeoMill-T-Finish can be used for all aluminium alloys as well as sand casting. The patent-pending insert assembly ensures quiet running, low burr formation, even wear and tear, and therefore the best surfaces.

EcoMill-Blue – Finishing with highest feed rates

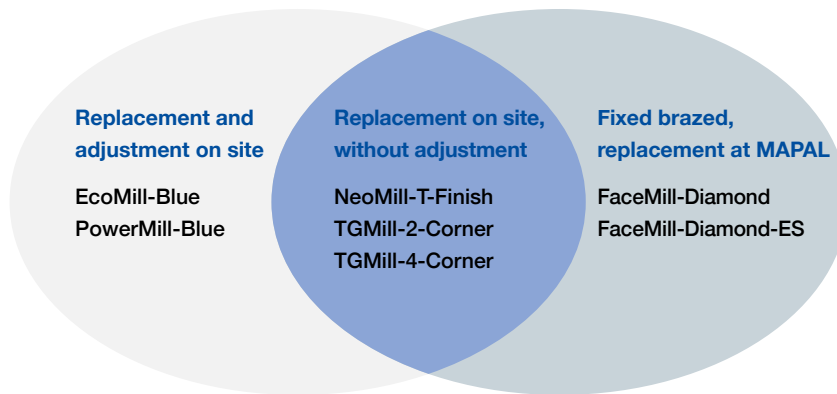
Equipped with replaceable milling cartridges that can be adjusted with μm precision, the EcoMill-Blue is the tool of choice when the highest demands are placed on surface and burr in series production. Different cutting edge geometries allow individual surface requirements to be fulfilled quickly and easily. In the design with the maximum number of teeth, maximum feed rates and therefore highly economical cycle times can be achieved.

FaceMill-Diamond – Maximum number of teeth for the highest level of productivity

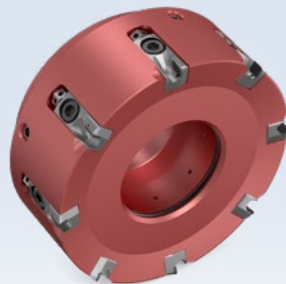
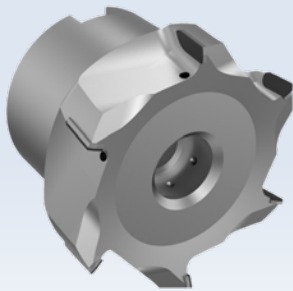
The highly productive face milling cutter for series production when every second counts: As a monobloc milling cutter, the FaceMill-Diamond with brazed PCD cutting edges is very rigid and is mainly used for finishing with high demands on cycle time and quality.



When selecting the optimum face milling cutter for aluminium machining, the surface finish to be achieved and the cutting depth play an essential role.



The face milling range from MAPAL, grouped according to the replacement system for inserts or milling cartridges.



FaceMill-Diamond-ES – Flexible all-rounder for smaller lot sizes and changing parts

The FaceMill-Diamond-ES with brazed PCD cutting edges is a starter version in the face milling range which is an economical purchase even for smaller quantities and varying parts and meets high demands on surface finish. Thanks to the replaceable head design, the FaceMill-Diamond-ES can be used for different machine holders. There is also a high degree of flexibility in terms of application: Aside from face milling, it is also suitable for shoulder milling, trimming, machining thin-walled parts and also for grooving at the maximum material removal rate.

PowerMill-Blue – The robust all-rounder: Semi-finishing and finishing in a single tool

The PowerMill-Blue guarantees high process reliability even under extreme operating conditions in semi-finishing with up to 5 µm cutting depth and finishing operations. Robustly designed for use on machining centres, the PowerMill-Blue also achieves high surface finishes thanks to adjustable and regrindable PCD milling cartridges.

TGMill-2-Corner and TGMill-4-Corner – The tangential milling cutter for roughing and semi-finishing

The two variants of the tangential milling cutter, TGMill-2-Corner and TGMill-4-Corner, can be used for semi-finishing and roughing, for both small and large series. A high cutting material variance and very easy handling with indexable inserts without adjustment further increase flexibility. The tangential milling cutters can also be used for the first roughing cut, cubing, and are therefore also interesting for foundries.

An alternative for long-chipping aluminium materials

MILLING INSTEAD OF DRILLING

Using a milling cutter instead of a drill to drill bores into a workpiece is a suggestion that takes some getting used to and initially causes many manufacturers to frown. However, the technology change makes sense for some parts, especially in the field of e-mobility. MAPAL shows that this not only allows greater process reliability, but even shorter machining times.



Combination tools with milling operation and fine machining operation produce bores in one pass.

The fastest way to drill a bore is using a suitable drill. A milling cutter with a smaller diameter that enters the material circularly covers a significantly longer distance during machining, which results in a higher cycle time. However, certain materials can cause non-productive times that cancel out the drill's time advantage.

During the course of the transformation to e-mobility, welded designs or structural parts are to be machined that consist of long-chipping aluminium. Battery housings, for example, are often made from extruded profiles that contain either no silicon at all or only a very small amount. That makes chip breaking more difficult and leads to nests of chips that can get stuck in the machine or on the tool. The same problem comes up when machining chassis parts made of forged aluminium, where manufacturers also struggle with long chips. If they settle on the shank of the tool, an automatic tool change may no longer be possible. Chip clusters cause disruptions that have an adverse effect on the machining time.

Especially during drilling from solid or certain boring operations, a burr can form which is pressed out and wraps around the tool as a ring. "These rings accumulate at the tool cutting edge and can damage the workpiece and the tool", confirms Leander Bolz, Sales Manager of PCD Tools.

In principle, drills can be equipped with chip breakers, but these usually impair the tool life. In addition, with the materials used, it is not always guaranteed that the chip breaker will reliably do its job. Aluminium with a low silicon content can display different properties depending on cast, batch or the storage condition, which is also reflected in different chip formation. This means that in practice the stock removal situation of the pre-machining is often changed. While blades or entire tools sometimes have to be replaced with a drilling tool, the stock removal with a milling cutter can easily be reduced or increased via the driven tracks.

MILLING BRINGS FLEXIBILITY

The milling strategy also demonstrates its flexibility when bores with different diameters are required. A single milling cutter can be used for this. For larger bores, it eliminates the need to replace one or even two drills for pre-machining. MAPAL favours using the milling cutter for the materials in question since it is possible to save time, particularly during pre-machining, which outweigh the initial performance disadvantages compared to drilling. For certain workpieces, the milling cutter is superior from the outset, for example when there is a risk of deformation due

to drilling thin walls of structural parts or when bores with a very specific roughness are required in chassis technology.

Combination tools further reduce the cycle time, as Leander Bolz explains: "If the milling operation sits at the front of the tool and the fine machining behind it, the bore can be created completely in one pass." With various geometries to choose from, the tools are adapted to the respective machining operation. MAPAL offers SPM milling cutters (Structural Part Machining) with PCD cutting edges for machining aluminium. These very sturdily designed high-volume milling cutters were originally developed for the aerospace industry to machine material from solid.

MAPAL has successfully tested the "milling instead of drilling" process with several customers and has changed machining operations thanks to the positive results. "Here we have to break up old patterns of thinking and dare to do something new", says Bolz, who is working to convince people of the same. ■



PCD-tipped high-volume milling cutters from the SPM range.



Chip balls can get stuck in the machine or on the tool with long-chipping aluminium materials and cause malfunctions.

THE BEST DEEP BORES WITH PCD

When the Schlote Group built a new factory in Harzgerode in 2017, it was designed to mass produce only a single part. MAPAL supplied all the cutting tools. By optimising the tools, the foundation has now been laid for a future with new products.

Schlote's story begins in 1969 as a small workshop in Harsum, where the company is still headquartered. Today 11 companies with 1,800 employees belong to the Group. The OEM has eight factories in Germany as well as further manufacturing facilities in the Czech Republic and China. Schlote Group customers include big car manufacturers, system integrators and foundries. Schlote's turnover stems from engines (55 per cent), transmissions (39 per cent) and chassis (6 per cent).

A successful cooperation with Trimet Aluminium already existed at other sites, manufacturing finished car components from cast blanks. The awarding of a contract for a component by a major OEM, which would involve very high quantities, led to a joint venture between Schlote and Bohai Trimet in Harzgerode.

MORE THAN 4,000 CLUTCH HOUSINGS PER DAY

The part being manufactured in Harzgerode is a clutch housing made of die-cast aluminium. A single version of the automatic transmission is being delivered to various major car manufacturers, where they are predominantly installed in vehicles with two-litre engines. The bell housing connects the transmission to the engine. While the transmission side is the same on all the clutch housings, the other side is adapted to the respective car manufacturer's engine. The differences are mostly small, so the bell housing construction is 99 per cent identical for all of the car manufacturers.



Schlote Harzgerode GmbH is producing 4,000 parts per day currently. At over 80 per cent, the modern factory exhibits a very high degree of automation. Around the clock five days a week, 120 employees work at the Harzgerode site. Production can be expanded to six or seven days a week if need be.

As is the case for the entire automotive industry, the requirements placed on parts are very high here. "The part is not only an adapter flange, but also the back of the transmission. The bearing seats thus require the highest degree of precision", explains Sebastian Swiniarski, Work Preparation Team Lead at Schlote. The part requires many bores with different tolerances, whereby precision manufacturing is needed down to the thousandth of a millimetre.

MAPAL and Schlote can look back on many years of effective cooperation. MAPAL is therefore entrusted with supplying PCD milling cutters (which create the defined rough surfaces on which sealant is applied), tap drills, reamers and an array of diverse drilling tools. "We offer our customers comprehensive solutions including the development of entire processes", says Stefan Frick, MAPAL's technical advisor to Schlote.

SUCCESSFUL IMPROVEMENT PROCESS

A watchful eye was kept on the implemented tools from the very beginning. Since Harzgerode went into operation, analyses have been performed continuously to find possible weak points and optimise manufacturing. Within the context of this continuous improvement process, Schlote and MAPAL have together managed to achieve

longer tool lives, lower tool expenditures and higher production quantities over years. While 3,600 parts were produced at most per day in the beginning, the limit has now been raised to 4,500 parts – without the need for further machines.

The newest optimisation involves deep-hole drilling for oil channels used to change gears in the automatic transmission. "We evaluate every month with our tool management system which tools have to be exchanged how often", Swiniarski reports. "Time and again, the deep-hole drills have proven to be particularly sensitive. As these drills are relatively cost intensive, we have concentrated on them to further cut our tool costs." Quality aspects are also inherent in tool wear as a blunt drill produces burrs at the bore exit. →



A manufacturing cell at Schlote is made up of three machining centres from SW: Two W06 double-spindle machine and a one6 single-spindle machine.



In this particular case, two of five deep-hole bores are involved with a diameter of 8 mm and cutting depths of 180 mm and 141 mm. They run through the part from the side up to the bearing seat in the middle. Solid carbide tool were used for this up to now, which is standard for deep bores. Schlote was able to achieve a tool life of 2,500 parts in this way. The load monitoring of the machine already registered tool wear starting at 2,000 parts though, and burrs could be seen at the bore exit.

SIGNIFICANTLY LONGER TOOL LIFE WITH PCD

When it came to optimising the deep bore, Plant Manager Tino Lucius, a former MAPAL employee, suggested PCD variants. And so, the partners developed the idea of deploying a PCD tip for the deep-hole drills. There was a lot to consider during the implementation, Frick relates: "It is not possible to construct this type of drill

entirely out of PCD. Besides the high costs, the brittleness of the material is a problem. There is also always the danger of chipping of the cutting edges during interrupted cuts. Good cooling must also be ensured as PCD is heat sensitive."

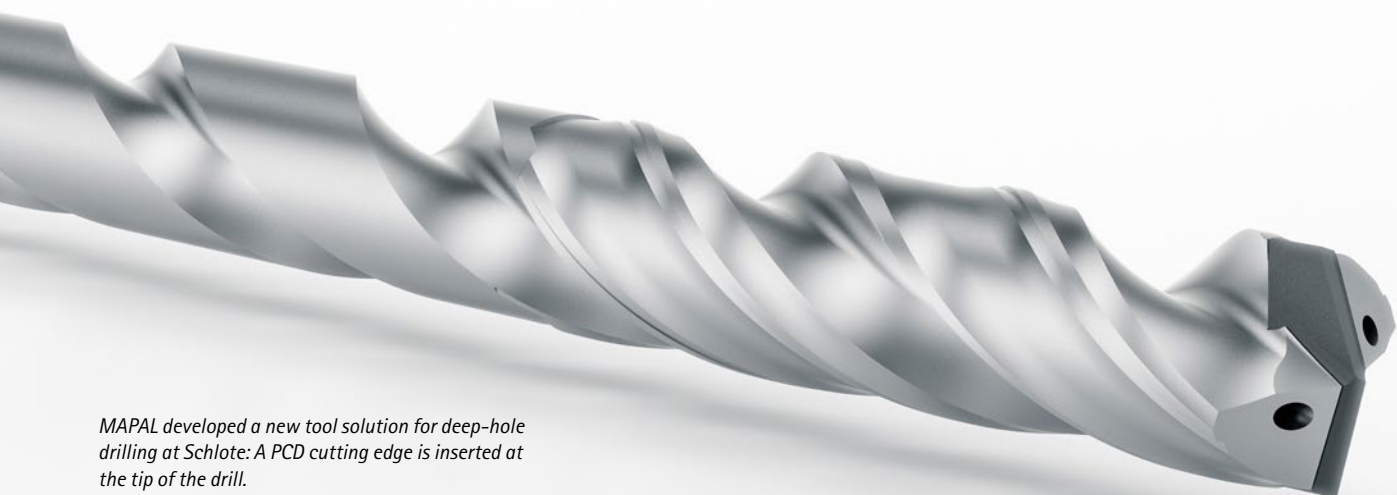
For the new tool, MAPAL started with the existing solid carbide drill and inserted a PCD cutting edge at its tip. The structure of the tool is reminiscent of a concrete drill with a carbide tip. The manufacturers in Harzgerode are very happy with the PCD deep-hole drill's tool life. While the solid carbide drill's tool life ends after 2,500 parts, the PCD version keeps going reliably up to 15,000 parts. There is further scope for improvement in machining challenges, such as blowholes in the material and varying casting quality. The partners are currently working on this together. "We have occasionally been able to achieve a tool life of 40,000 parts. Naturally, we want to make this ultra-long tool life the norm", Frick stresses.

The cutting data is the same as that of the solid carbide drill at a spindle speed of 8,700 rpm, a feed of 0.3 mm/rev and a cutting speed of 218 m/min. The new drill's potential lays in its considerably longer tool life, the resulting lower tool costs and the higher process reliability. Less tool changes also means less machine downtime.

Production at Schlote in Harzgerode involves a total of ten manufacturing cells. Each cell is made up of three machines from the manufacturer SW, two W06 double-spindle machines and a one6 single-spindle machine. The parts are machined in three clamping setups, whereby the double-spindle machines handle the first two setups and finishing takes place during the third.

THE FUTURE IS ELECTRIC

Clutch housing manufacturing at the site was planned to last at least eight years with a peak output of 1.1 million parts per year. This peak



MAPAL developed a new tool solution for deep-hole drilling at Schlote: A PCD cutting edge is inserted at the tip of the drill.



- 1 In total, ten manufacturing cells are set up in two lines in the modern factory in Harzgerode.
- 2 Sebastian Swiniarski (Work Preparation Team Lead at Schlote) checks the cutting edges of the MAPAL PCD deep-hole drill.
- 3 Stefan Frick (Technical Advisor at MAPAL) and Sebastian Swiniarski (Work Preparation Team Lead at Schlote) inspect a finished clutch housing.

- 4 Deep-hole drilling is one of the machining steps that takes place on the double-spindle machine. Bores 180 mm and 141 mm deep are created with an 8 mm drills from MAPAL.
- 5 The first machining steps for the clutch housings occur on double-spindle machines. While machining takes place at the back, new parts can already be clamped at the front.

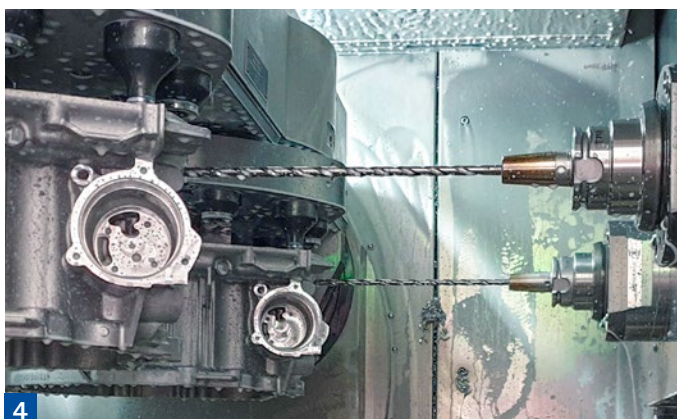
was surpassed in 2020. Production has been ongoing for five years in the meanwhile with 900,000 parts produced per year.

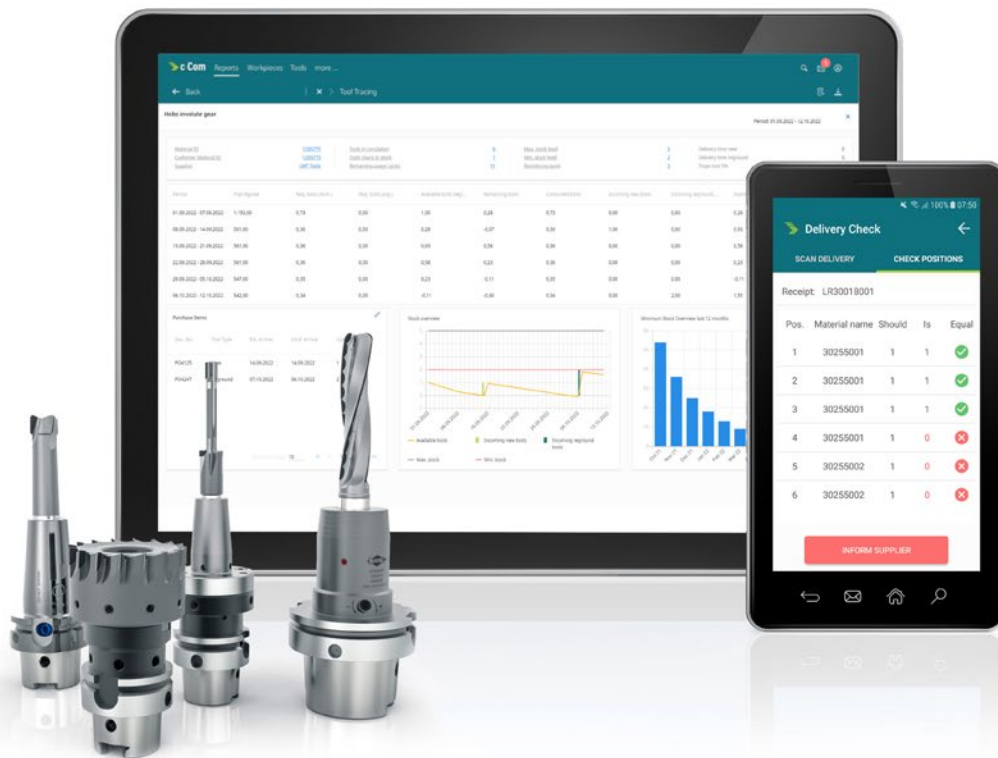
Due to continuously improved productivity and the lower production quantities, there has been time to address future trends and produce different parts. The factory is already being modified for this purpose. The first of two new pro-

jects involves six different parts that Schlote is to produce for a hybrid model of super sports car manufacturer.

In the other project, Schlote's expertise as a clutch housing manufacturer is once again called for – this time for an electric car. Schlote draws from the trend toward electric mobility by supplying e-cars with transmissions as well. For

an innovative model with three gears, the connection between engine and transmission is to be produced in Harzgerode. Half of the factory capacity is currently being converted. The production of parts for combustion engines is to be ramped down to 50 per cent. In future, hybrid cars will account for 10 per cent and purely electric mobility for 40 per cent. Schlote has already produced the first parts for the new projects. ■





GNUTTI CARLO GROUP RELIES ON c-Com DIGITAL TOOL MANAGEMENT

The international Gnutti Carlo Group, headquartered in Italy, is a global supplier in the automotive, e-mobility and heavy industry sectors with around 4,000 employees and 14 locations worldwide. For the digitalisation of tool management, the Gnutti Carlo Group relies on the collaborative c-Com software solutions.

"The consumption of cutting tools represents a significant expenditure block and has therefore always been a strategically important element for us to be competitive in the market," says Paolo Buizza, Senior Process Engineer of the Gnutti Carlo Group, underlining the importance of productivity increases in tool management. "In the development and continuous improvement of industrial processes, tools play a key role in terms of both costs and production performance. That is why we work every day to achieve improvements here." A complex task,

which was reinforced by the strong growth of the Gnutti Carlo Group, including acquisitions, and the different organisational structures and technology levels. A precise management of the tool topics became necessary. "Each manufacturing location of the Gnutti Carlo Group has an excellent level of technological expertise," points out Paolo Buizza, "but we have not yet been able to implement best practice processes across all sites." Three key factors were decisive for introducing a digital tool management solution:

- The use of synergies through a system that integrates and evaluates different data sources. The harmonisation and standardisation of the tool management increase the possibilities for optimization and rationalization.
- An increasing resource efficiency by using a comprehensive, flexible, and user-friendly management system also played an important role. Employees should focus on analysing and implementing improvements and optimisations instead of spending their capacity on administrative activities.

- The introduction of a single data collection system with one interface creates capacity for monitoring cost per part at different levels. Similar machining operations within the group become comparable and technological improvements are simplified by duplicating processes from site to site.

C-COM BECOMES PARTNER FOR ALL LOCATIONS OF THE GNUTTI CARLO GROUP

After a one-year evaluation phase, the Gnutti Carlo Group decided to introduce a digital tool management with c-Com as a partner. The decisive factors were the technological infrastructure, the broad scope and flexibility of the

c-Com software, the possibility of integrating different locations and the economic competitiveness. "We are looking forward to using our combined know-how in precision tools, IT and OT to raise the tool management of the Gnutti Carlo Group worldwide to a completely new level," emphasizes Giari Fiorucci, Managing Director of c-Com GmbH. "The expectations from the Gnutti Carlo Group to establish a worldwide overarching digital tool management system are extremely high but we are ready to accept this challenge."

"The implementation plan is ambitious and complex," admits Paolo Buizza. "But we are confident that we will achieve our goal in the

set time." Defining the basic structure is the first step, including the definition of master data, classifications, logistical processes, etc. In the second step, the system will be introduced, tested and calibrated at the headquarters in Macclodio. "Together with the third step, the roll-out to all other locations, we calculate a project duration for the digital tool management of about three years," estimates Giari Fiorucci confidentially, referring to the entire project. ■

From left: Kai Stückler (Project Manager c-Com), Paolo Buizza (Senior Process Engineer Gnutti Carlo Group), Bernhard Schuster (Team Leader Project Management & Application c-Com), Jan Batha (Smart Factory & AI Manager Gnutti Carlo Group) and Omar Moser (Chief Information Officer Gnutti Carlo Group). ©Gnutti Carlo Group.



Schabmüller with tool management from MAPAL

THE PRODUCTION MUST GO ON

When the automotive supplier Schabmüller received a huge order in 2013 with almost one million parts to be manufactured per year, tool management became necessary for the variety of tools used. The manufacturer placed its trust in MAPAL and has since implemented a whole series of projects together with the tool manufacturer.

The company, which is located in Großmehring near Ingolstadt, has been operating under the name Schabmüller Automobiltechnik GmbH (SMI) since 2003. Before this, the company, founded in 1978 by Franz Schabmüller, was active in the field of special vehicle construction. In 1988, the company entered the automotive supply industry. With the machining and assembly of cubic engine and chassis parts, Schabmüller became a service provider for the automotive industry.

Nowadays, with around 150 employees, Schabmüller is a premium supplier, particularly for automobile manufacturers with high production volumes. Schabmüller can include Daimler, Audi/Porsche and Jaguar/Land Rover in its list of references. However, the most important customer is the VW Group, for which SMI has commissioned its largest plant to date for the production of cylinder head covers. The plant contains 16 machining centres, 26 robots and a number of peripheral machines for downstream machining steps. SMI produces ASM cylinder head covers here for the customer. These consist of a left and right cylinder head cover for the VW 3.0 litre V-group engine, fully assembled with camshaft bearing covers. Over 320,000 sets are produced annually.

SMI operates predominantly as a Tier 2 supplier, machining parts for large foundry companies. In the meantime, an aluminium forge has also joined the list of clients. Managing Director Helmut Häckl sets great store by this expansion: "The forge mainly orders chassis parts from us. This presents an opportunity for us to diversify in that direction."



FOCUS ON LARGE-SCALE SERIES NECESSITATES ORGANISATIONAL ADJUSTMENTS

Before large-scale series production really took off, SMI produced solely with stand-alone machines: One job at a time was processed manually on a machining centre with one worker. When SMI then received an order in 2013 to manufacture bearing frames for the VW Group, which were to be produced in a quantity of 970,000 parts, manufacturing had to be reorganised. "It was clear to us that the tool volume would no longer be manageable for us if we equipped

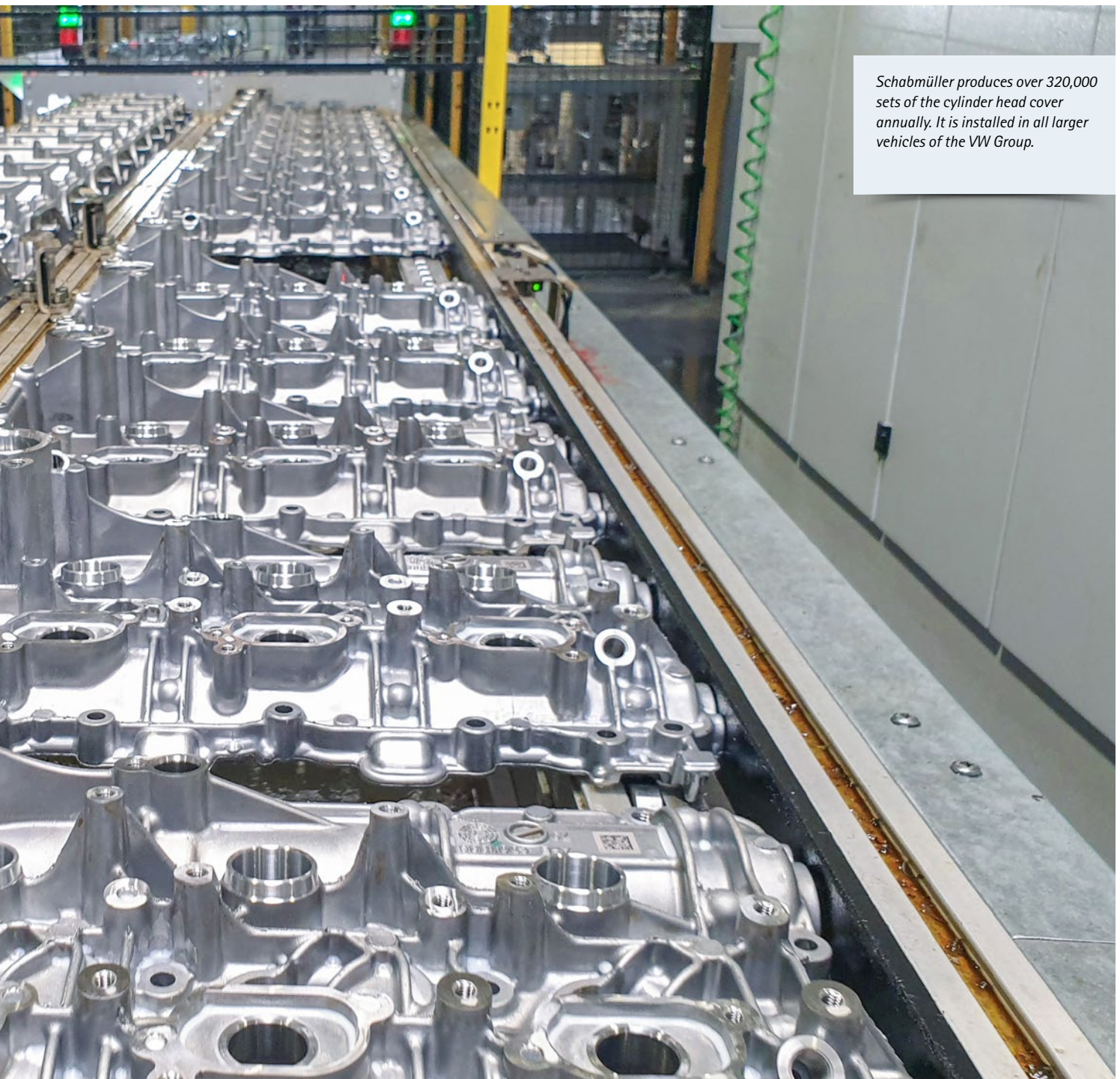
seven or eight machines for the same order", Häckl explains. "It would have been difficult for production management to keep an eye on the quality of the tools and to follow their reconditioning in terms of deadlines. The production must go on and not stop because a tool is missing somewhere."

But that's exactly what had happened in the past. For example, five drills were used up in one night, and the early shift started the day with one last remaining tool. Nobody understood what happened. In other areas, a lack of sys-

tematic tool withdrawal resulted in the fact that worn tools ended up in the drawer together with new ones, leading to bottlenecks since this had not been recognised in time. Managing Director Häckl is clear: "Due to this lack of verifiability of tool removals, we kept having huge problems in production."

MAPAL IS THE SOLE TOOL SUPPLIER

SMI needed a supplier who would provide, manage and continuously optimise the tools. "Of course, we have in-depth knowledge of the tool cutting edge. This is important so that the →



Schabmüller produces over 320,000 sets of the cylinder head cover annually. It is installed in all larger vehicles of the VW Group.

specialists from both companies can discuss the optimal tool design on an equal footing", says Häckl. It was obvious that MAPAL would be entrusted with the tool management, as the tool manufacturer is an important supplier for Schabmüller's production, in which many PCD and solid carbide tools are used.

Tool management services are tailored to the needs of the customer. At Schabmüller, the complete package includes tool material requirement planning, tool presetting, dispensing and reconditioning, technical support for series production, tool and cycle time optimisation as well as tool life optimisation. Tool dispensing is centrally located in the manufacturing area. In addition to a range of horizontal drawer cabinets from the UNIBASE range, MAPAL has also installed vertical cabinets at Schabmüller. Their high drawers are particularly suitable for large complete machining tools.

Around 90 per cent of the tools used by SMI are project-related custom tools. "We use these custom tools to achieve the shortest possible cycle times", explains Michael Stockbauer, Application Engineer and Tool Manager at MAPAL. "You couldn't achieve these times with standard tools." Together with colleagues, Stockbauer is on site in Großmehring three to four times a week. When a new project is being launched, MAPAL can even be on site every day.

ALL-ROUND SERVICE FOR THE CUSTOMER

The tool specialists take care of tools that need to be repaired or sent for regrinding. New tools are ordered if necessary. The technicians set complete tools in the immediate vicinity of tool dispensing and store them with the appropriate dimensions so that the worker can take them from the dispensing machine. A separate shelf is used to store worn tools that have reached the end of their tool life.

Matthias Hahn, Project Manager Tool Management at MAPAL, sees a major advantage for the customer in the tool setting service: "If the workers had to equip and set the tool themselves, they would be busy for about half an hour while the machine is at a stand-still. This adds up very quickly with multiple machines." Quality is also guaranteed better if the same skilled workers always carry out the setting.

"Due to the good experience, MAPAL is regularly one of the first contacts for tool design when new projects come around", emphasises Häckl. They also appreciate the short response times:



"When we send a CAD model to MAPAL, we get word back from Stephan Streck very quickly. If it's urgent, we already have an indicative price quote or suggestions for possible solutions for critical tools after three to four days." As a technical advisor, Streck was already in charge of the introduction of tool management – a familiarity that is also appreciated by the customer.

EVERYTHING IN VIEW VIA DIGITAL LOGISTICS

Schabmüller was one of the first companies to convert its tool data management to c-Com. The software enables end-to-end digital logistics and is connected to the existing SAP system. The large platform makes work easier for all project participants. For each individual material number, all important data such as reorder points, minimum and maximum stocks and lot sizes

are stored here. When a tool is removed from the machine, the stock in the material planning cockpit is updated within seconds. A practical help is being able to visualise the stocks with a traffic light system, where critical values can be detected at a glance.

Since the introduction of tool management, SMI has had an overview of its actual tool consumption. "In the past, we never really knew how high our tool costs were", admits Managing Director Häckl. In a joint monthly meeting, SMI and MAPAL analyse what's been going on in production. The data reveal weak points with tools, but also allow conclusions to be made about problems with the machine or individual spindles. The upcoming quantities are communicated at the meetings so that tool deliveries can be planned in advance.



1 Michael Stockbauer (Application Engineer/Tool Manager MAPAL) setting a 100 mm milling head with PCD milling cartridges.

2 The preset tools are ready for storage in the UNIBASE dispensing system.

3 At Schabmüller, MAPAL also uses vertical cabinets (right) for long projecting tools in addition to the horizontal drawer cabinets.

4 To generate orders, SMI also has to offer assembly services. The two halves of the cylinder head cover and the camshaft bearing cover are assembled completely automatically.

5 The tools stored by MAPAL technicians can be used by the machine operators directly in the machines again if required.

6 Matthias Hahn (Project Manager Tool Management MAPAL) at one of the vertical cabinets in tool dispensing, which also offer space for long tools.

7 At the shelf for worn tools, Matthias Hahn (Project Manager for Tool Management at MAPAL) and Albert Neumeier (Production Manager at Schabmüller) inspect the tools.

8 Have already managed several projects in close partnership at Schabmüller (from left): Helmut Häckl (Managing Director at SMI), Matthias Hahn (Project Manager for Tool Management at MAPAL), Michael Stockbauer (Application Engineer/Tool Manager at MAPAL) and Albert Neumeier (Production Manager at SMI).



7



8



Processes are improved by working on this closely together. SMI first runs in new tools with the cutting data specified by MAPAL, which are then optimised step by step, Production Manager Albert Neumeier reports. "If we don't get anywhere with that, we bring in MAPAL. In every project there are tools that are a bit tricky and where you have to adjust the milling strategy a little to get where you want to go." Matthias Hahn appreciates this approach: "Schabmüller challenges us and that's a good thing, because it leads to good results."

In order to gain even more background knowledge about the tools, a four-day training course was held for three SMI employees at the MAPAL Academy in Aalen and Altenstadt. Aside from the knowledge acquired about solid carbide, PCD and fine boring tools as well as cutting edges, the

participants praised the high practical relevance of the training units more than anything else. "That's why we would like to have the training carried out for more employees", Albert Neumeier continues.

CONFIRMATION BY EXTERNAL AUDIT

Like any supplier, SMI has to undergo regular audits. This year, the external partners operating within the company were also audited. MAPAL Tool Management received independent confirmation and achieved 98.5 out of 100 possible points right away. The auditors praised the audited processes, saying they were well thought-out and efficient.

Schabmüller continues to grow at a rapid pace. At the moment, preparations for a new project are in full swing. As well as the two existing halls,

a third one is being built, where cylinder head covers for a 1.5-litre engine of the VW Group will be exclusively produced from 2025. The annual volume is over 910,000 units, the investments for machinery and equipment amount to 24.5 million euros. MAPAL will also support this project via tool management with a tool dispensing system. To date, SMI already uses 750 different tools from MAPAL. The new project should add about another 150. ■

