



# IMPULSE

MAPAL TECHNOLOGY MAGAZINE | EDITION 73



Cover story  
Maximum Tool Life in CFRP  
Thanks to Diamond Coating

**Dear readers,  
dear business associates,**

Who would have thought that about one year after the EMO in Hanover, which I thought went extremely well, we would find ourselves in a situation like the one we're in today. Under normal circumstances, we would have been meeting at the AMB trade fair in Stuttgart. The industry's leading trade fairs in September each year were an integral part of the calendar. That was until 2020 came along. Having a trade fair on the scale of AMB is simply unthinkable at the moment. Nobody knows just how long these so-called unprecedented times will last.

Here at MAPAL, we've tried to use this extraordinary time to our advantage. Not just to take a look within and to examine and optimise internal processes, but also to think outside the box. In times like these, it's even more important to provide a broad foundation for a company. It's important to make the future as independent of individual sectors as possible.

We decided to focus our attention on answering the following questions, among others: What applications, which were previously only niches for us, still give us the scope for upward potential? In which sectors, which MAPAL has only partially supplied up to now, can we create further added value for customers with our developments? During the process, we came up with a lot of potential for our tools as well as exciting topics and projects. In this issue of Impulse, we present the first success stories from sectors that are new to MAPAL, such as mining or e-bike manufacturing. Happy reading!

I sincerely hope for all of us that we will gradually return to the normality we all know and miss. Until then, stay safe and keep positive.

Yours sincerely,

Dr Jochen Kress



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Tool-Nr. 20e0150-00C-150 Datum / Zeit  
Teilname: A1\_20e0150-00C-150 2020-01-28  
Benutzer: Handel, Gemma 10:21:40  
XIDA 1.499 ZIA 151.250  
10:21:40

Tool-Nr. 88e2100-00E-125B Datum / Zeit  
Teilname: B\_88e2100-00E-125B T-Nut 2020-02-18  
Benutzer: b 10:54:19  
XIDA 20.796 ZIA 131.156

Tool-Nr. 10e0400n00C-145B Datum / Zeit  
Teilname: B\_10e0400n00C-145B - Sch 2020-02-18  
Benutzer: b 10:53:42  
XIDA 3.930 ZIA 147.453

Prepared tools waiting to be used in the machine. These are clearly identifiable via a barcode. Walter Formenbau purchases 80 percent of its tools and chucks from MAPAL.



Die & Mould sector of tomorrow

# WALTER FORMENBAU TRUSTS IN MAPAL'S EXPERTISE

"If autonomous driving is possible, then surely so too is autonomous manufacturing", says Dr Jens Buchert, owner of Karl Walter Formen- und Kokillenbau GmbH & Co. KG. His goal is to achieve fully networked production. And he's got MAPAL on board to make this happen – not only as a tool specialist, but as a complete provider. Including services covering process optimisation and networking. →



*Alfred Baur provides support in production for all questions regarding tools, machining and the processes surrounding the tools. Below is his interview with David Frommhold (left) from Walter Formenbau.*

Karl Walter Formen- und Kokillenbau GmbH & Co. KG (Walter) is located in the industrial area of Ursenwang, a suburb of Göppingen in the Filstal region. On a site covering approx. 3,000 square metres, the company manufactures moulds and dies for aluminium wheels and other cast parts and is regarded as one of the leading manufacturers in this field. The company was founded in 1960 and the mould maker today employs 32 staff.

Dr Jens Buchert took the reins of the company in 2016 and has big plans for the future – he wants to introduce end-to-end digital production. That is his aim. Nothing less will suffice. Because: "If autonomous driving is possible, then surely so too is autonomous manufacturing." It should even be much easier: "There are no other drivers involved in the manufacturing process, there are no kids running on the road. If everything is planned properly, there can be few surprises", says Buchert. Yet at the same time introducing fully end-to-end networking and automated manufacturing into an existing company is not an easy task.

#### FIRST STEPS HAVE BEEN TAKEN

"We're gradually digitising and networking, and working hard towards achieving optimum manufacturing", explains Dr Jens Buchert. To this end, the entire process from the incoming order to delivery of the finished moulds must be considered. This also includes the machining work itself and all associated processes. "I've been looking for a partner with expertise in both these areas, a partner that takes a complete overview of matters." And in MAPAL he's found that partner: "MAPAL is the only tool manufacturer that can map the entire process chain. Covering the tool itself, clamping technology, tool management, tool presetting and with c-Com even the networking of the machinery."

Walter was already using its first MAPAL products towards the end of 2017. "The first thing we delivered were chucks, not tools", recalls Alfred Baur, who supports Walter as a sales representative of MAPAL. However, it wouldn't be long before the company placed its first tool order – reamers and drills made



*Moulds for wheels like these are manufactured at Walter Formenbau.*

of solid carbide. More and more orders followed and Walter made the switch to MAPAL products. The tool manufacturer has expanded its die & mould sector portfolio considerably over recent years and now offers all required standard tools for milling, drilling and reaming.

#### **QUALITY AND PERFORMANCE IMPRESS**

Today, Walter procures 80 % of its chucks and tools from MAPAL. "It's not just the quality and performance of MAPAL products that impresses me. The chucks and tools come from a single source – meaning that both components are perfectly matched to one another", says Dr Jens Buchert. In addition, the fact that MAPAL displays expertise and flexibility in this specialist area is a →

*Complex clearance surfaces characterise the moulds from Walter Formenbau. Here is an example of a mould for a battery tray used in an electric vehicle.*



huge plus for him: "If we need special geometries, for example, for ball-nose cutters made of solid carbide, MAPAL manufactures these tools for us quickly and without any fuss."

In addition to the products, MAPAL is also supporting the mould maker in its goal of achieving networked manufacturing. One issue has been the complexity involved in tracing tool data. "We spent 1.5 man-years searching for and compiling tool information", admits Dr Buchert. UNIBASE software provided the solution.

### DISPENSING SYSTEM FOR ORDER AND TRANSPARENCY

"We integrated the data from the CAM system into the software and installed two UNIBASE-M dispensing systems", explains Stephan Köstler, Mechatronic Systems Engineering Manager at MAPAL. "Köstler's team also connected some of our existing cabinets to the system", adds Buchert. The software now contains accurate information on existing tools and available dimensions and where they are located. If an employee takes a tool out of the UNIBASE-M system, this is registered by the software.

In this way, the software makes the life of a purchaser at Walter much easier. Once a week, the system generates an email detailing current stock volumes and ordering requirements. As a result, this has greatly improved the safeguarding of tool availability.

### c-Connect FOR NETWORKING AND AUTOMATION

In order to maximise automation, Dr Buchert also made the networking of his machines a top priority. However, this proved to be a difficult task for the mould maker due to the variety and diversity of machinery. "Here too, we provide the optimum solution", explains Stephan Köstler. As a pilot project, Buchert completely automated two of his machines, even the loading tasks being performed by a robot. MAPAL experts connected a c-Connect box to both machines. c-Connect is a product from MAPAL subsidiary c-Com.

The machines are connected to the open cloud platform c-Com via the c-Connect boxes. This platform is in turn also connected to the setting fixture UNISSET-C, which is integrated into Walter's CAM system. This allows the setting fixture operator to directly display and start the measurement programme for the respective tool from the CAM system. The measurement data calculated in this way is fed back into the machine directly by the UNISSET-C via c-Com and the c-Connect box.

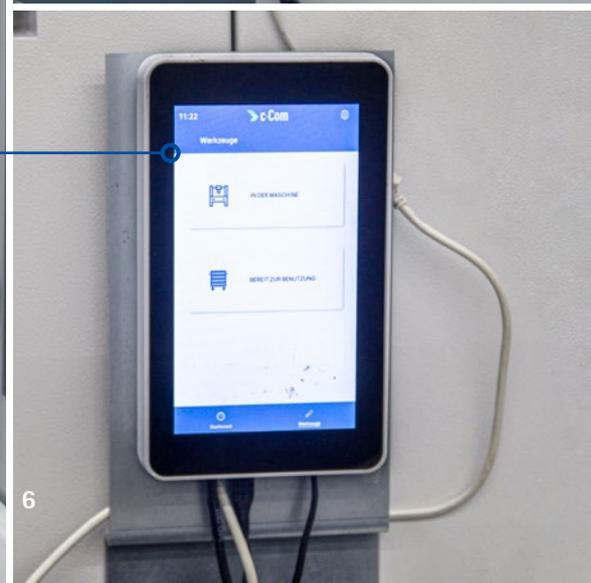
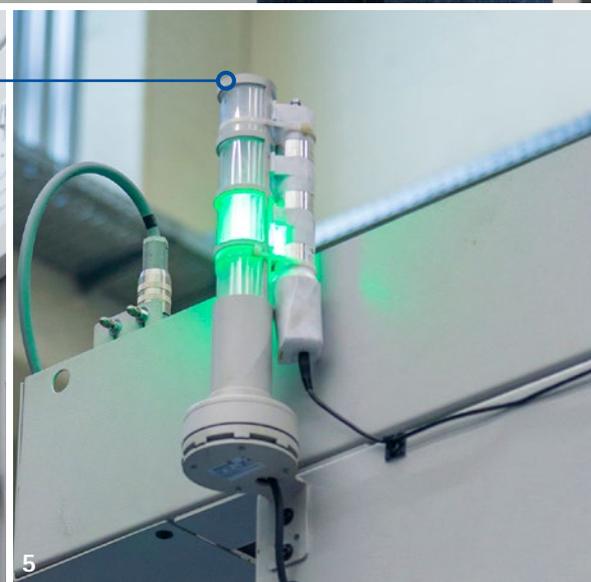
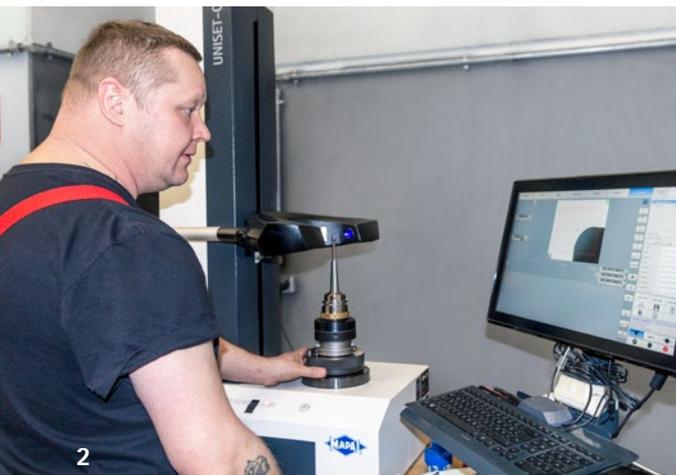
### NETWORKING FURTHER EXPANDED

c-Connect offers further benefits for Walter in addition to the transfer of data. For example, tool life data is recorded and requirements are registered. And: Walter uses an additional function of the c-Connect box – machine monitoring. The box records the status of the respective machine traffic

light using sensors. This provides Dr Buchert with an evaluation of the OEE (overall equipment effectiveness) quickly and easily. "As soon as these two pilot machines work autonomously without any issues, then we'll start adding further machines", says Buchert.

It's not simply the individual components that define the cooperation between Walter and MAPAL. It's more about the bigger picture and mutual learning. "Through close cooperation, we've really got to know the die & mould sector", confirms Alfred Baur. Dr Jens Buchert emphasises: "MAPAL's flexibility has really impressed me. The fact that we can get everything from a single source from one single expert point of contact is a big plus from my perspective". ■

- 1 *Walter uses two UNIBASE-M dispensing systems from MAPAL in manufacturing. This saves a massive amount of time that was previously spent on searching for tools.*
- 2 *On the UNISSET-C tool setting fixture, David Frommhold prepares the tool system for manufacturing use. He receives the measurement programme directly from the CAM system. The measurement log is transferred to the machine via c-Com and the c-Connect Box.*
- 3 *Working together in partnership. From right: Dr Jens Buchert, owner and Managing Director of Karl Walter Formen- und Kokillenbau GmbH & Co. KG, and Alfred Baur, sales representative at MAPAL.*
- 4 *Dr Jens Buchert at one of his autonomously working machines. He has set himself the goal of achieving completely networked manufacturing.*
- 5+6 *A c-Connect box is connected to two machines at Walter. This then transfers the measurement data of the tools to the machine. Walter also benefits from another advantage of the c-Connect box – sensors monitor the status of the machine traffic light.*





**PARTNER IN THE  
MINING INDUSTRY**



*Mining to extract mineral resources has been around since the Stone Age, here we see the example of coal.*



Mining has existed for as long as humans have been around. Even during the Stone Age, people mined mineral resources – in the form of flint stones. Today, as a partner of manufacturers of drilling tools for mining, MAPAL also makes a small contribution to modern mining.

#### Experts differentiate between three types of mining:

Surface mining

Underground mining

Borehole mining

All over the world, mining companies extract mineral resources such as coal, oil, gas, metals, precious stones and salts. Constructing tunnels, pipelines or wells is also part of modern mining. Just the same as work carried out in quarries. While primitive tools were used to dig for mineral resources in the early days, we now use high-tech structures, equipment and tools for mining.

#### DRILLING TOOLS ARE AN IMPORTANT ELEMENT OF MODERN MINING

Drilling tools that break up the rock and render it in chunks, when, for example, blast hole drillings, bores for pipelines or new shafts in mines are created, are a fundamental part of the process. For the various applications, rotary bits are often used for larger diameters. These usually consist of three movable rollers, which press against the rock when they turn. In this way, the rock particles are gradually broken off.

The use of drill bits has also already proven itself in the mining industry, especially when drilling smaller diameters. In combination with the corresponding tool holder and the machine, they work on the same principle as a hammer drill.

What both types of tools (rotary bits and drill bits) have in common is that their tool bodies, made of steel (cold work steel, alloyed tempering steel or special steel) are fitted with bit inserts made of carbide in order to break even very hard rock. Because the bit inserts are literally at the forefront when it comes to creating the different cavities in the various types of rock and soil.

#### MACHINING BIT INSERT SEATS WITH $\mu\text{m}$ ACCURACY

In order to guarantee process reliability in mining, we place great importance on the high-precision production of the tools. For this reason, the seats for the bit inserts are machined to  $\mu\text{m}$  accuracy by the drilling tool manufacturers for the mining industry. MAPAL has developed the Rockbit-Drill in solid carbide especially for this application. In combination with the MAPAL hydraulic chuck, customers are able to machine the seats for the bit inserts with high precision.

#### More details about the Rockbit-Drill:

- Solid carbide drills with innovative coating for high resistance to wear
- Specially designed chip flute for optimal chip removal
- Four chamfer geometry for maximum bore quality in terms of alignment and positioning accuracy
- Tip angle of  $141^\circ$  for machining the drill bit seats
- Tip angle of  $180^\circ$  for machining the rotary bit seats



*Rotary bits and drill bits are often used in mining*



*The Rockbit-Drill is ideally suited for high-precision machining of seats for bit inserts in rotary bits and drill bits.*

## SUCCESSFUL APPLICATION IN PRACTICE

One MAPAL customer is successfully using the new Rockbit-Drill with a diameter of 16 mm for their drill bits. The manufacturer produces the drill bits from low-alloy steel on a machining centre with a hollow shank taper A63 spindle. The drilling depth is 1xD-1.5xD.

### Cutting values:

- Cutting speed 80 m/min
- Spindle speed 1,600 rpm
- Feed 0.2 mm

The Rockbit-Drill can reliably machine 1,618 bores. The customer is impressed: "We were only able to machine 600 bores with the tool we used to use that was produced by a competitor". The customer was able to double the feed rate compared to the previous tool they used. And in this way, they were able to significantly increase the number of cycles. Furthermore, the MAPAL tool produces an optimum surface quality of Ra (average roughness value) = 0.8 µm. The Rockbit-Drill has left the customer impressed at every stage of production – both in terms of the accuracy of the bores and the low burr formation.

## MASSIVE SAVINGS, MORE PROCESS RELIABILITY AND A HIGHER DEGREE OF AUTOMATION

The customer has also mentioned another advantage they're able to achieve thanks to the MAPAL tool. Because: Depending on the bore diameter achieved, different bit inserts are pressed into the tool body. The mining tool manufacturer has various diameters of bit inserts in stock for this. The greater the fluctuations in the bore diameter, the more different inserts they have to keep in stock. "Thanks to the high dimensional accuracy you get with the MAPAL Rockbit-Drill, we can significantly limit this variety of bit inserts and therefore save costs. The bores move within a much narrower tolerance field", the customer is pleased to report. Process reliability also increases. And: "This allows us to achieve a higher degree of automation". ■



# ELECTRIFIED MOBILITY

Reliable machining of small housings  
for electric motors made of magnesium  
and aluminium

Today amateur cyclists are climbing heights seemingly without any effort at all; heights that would actually make even cycling professionals sweat. E-bikes (pedelecs) are their secret, i.e. bicycles with electric auxiliary motors; they're found all over the place today and are becoming more and more common. As the popularity of e-bikes increases, so do the production figures for their parts. →





In 2019, on average every third bicycle sold in Germany was an e-bike – a total of 1.36 million units. According to Zweirad-Industrie-Verband, this brought the total in Germany to 5.4 million.

### THE PRODUCTION OF E-BIKES

In Germany alone, manufacturers produced one million electrically powered bicycles in 2019. The motor housings, among other things, pose a challenge during the production phase. After all, they have to be small and light and at the same time highly accurate. The small size of the entire drive is a result of the limited space available on an e-bike. Most of the motors are installed directly in or onto the frame itself as unobtrusively as possible. The entire drives must be particularly light-weight to ensure a long battery life. The less loads have to be moved, the less the motor has to "work" and the longer the battery can go without needing to be charged. After all, the housings must be manufactured with high precision to ensure that the motor runs both quietly and smoothly. As well as this, only a precisely manufactured motor runs smoothly and achieves the highest possible level of efficiency.

As a result of the requirements mentioned above, most manufacturers of small electric motors produce their motor housings from die-cast aluminium, more often from die-cast magnesium. Both workpiece materials are low in weight. Magnesium has a density of 1.7 g/cm<sup>3</sup> and so is slightly lighter than aluminium with a density of 2.7 g/cm<sup>3</sup>. On top of this, magnesium is even easier to cast than aluminium. This allows for designs with even thinner walls and more intricate structures. Whether they're made from aluminium or magnesium – most motor housings consist of the actual housing plus one or two covers. They have very thin walls and are unstable, so are therefore susceptible to vibrations. Multi-stage contours within the housing provide space for the various functional components of the motors. The geometric and dimensional requirements are high – narrow shape, running and position tolerances are specified.

### THE MOTOR HOUSING CHALLENGE

"For machining the housings, the properties of the material and the thin walls of the part pose the greatest challenges", says Leander Bolz, Sales Manager at the MAPAL Centre of Competence for PCD tools. Furthermore, the housings are often already coated when they are machined. These coatings must not be damaged during machining. "Our customers in this sector produce very high volumes, so it is equally important that the tools for machining are highly economical to use", adds Bolz.

Over the past decades, MAPAL has gained extensive experience in the machining of small motor housings in both aluminium and magnesium. "Small housings have always been used for chainsaws, mopeds or lawnmowers, for example, but with electrification the precision requirements have increased even more", explains Leander Bolz. And so MAPAL has adapted its programme for the complete machining of small housings to the changed conditions. First and foremost, PCD and solid carbide tools are best suited for machining both workpiece materials. In some cases, the tool experts design the process as dry machining. Polished chip spaces and particularly smooth surfaces on the tools stop them from getting dirty. They make the machining process safe even without the need for a cooling lubricant. →



*More details about the motor of an e-bike.*



"When it comes to designing the tools for machining a magnesium housing, we're always at the upper tolerance limit in the first step", explains Bolz. This is because stresses inside the workpiece, different coating thicknesses or the ductility of the material, which contracts after machining due to the heat introduction, cause deviations in some diameters and bearings. "It's only after a test drilling with a subsequent dimensional check on the part that we determine the required tool diameters, which also apply to the subsequent tools".

### MOST ECONOMICAL SOLUTION THANKS TO COMBINATION TOOLS

In order to make the machining of motor housings as economical as possible and keep non-productive time to a minimum, several work steps are combined for the individual tools.

### PCD TOOL MACHINES BEARING AND POSITION BORES



One example is the tool for machining the bearing seat of a magnesium housing. "During this machining process, we had to deal with strong vibrations as the part has extremely thin walls, especially in the area of the third bearing bore", recalls Leander Bolz. The tool must remove 0.6 – 1 mm of material at the pre-cast bores.

The customer had high demands:

- Roundness < 0.01 mm
- Diameter tolerance IT7
- Average roughness depth Rz < 10 µm

MAPAL designed a complex, multi-stage PCD combination tool for this. "This allowed us to machine the three bearing bores and the position bore of the bearing seat in one go – in a way that was process reliable and within the required tolerances", says Bolz.

The tool works with the following cutting values:

- Spindle speed 8,000 rpm
- Feed rate 3,200 – 4,800 mm/min
- Feed 0.1 – 0.15 mm

### DRILLING AND MILLING COMBINED IN A SINGLE TOOL



Another tool combines milling and drilling processes. While drilling steps machine the bearing bore and position bore, a milling step is used to produce the sealing slot. "With this tool too, our main task was to prevent vibrations and reduce the cutting pressure", explains Bolz. The tool experts achieved this by optimally coordinating the number of teeth and geometry of the milling step. "This also helps us avoid chips in the slot and ensures that the milling process runs reliably", says Bolz.

The milling step for the tool works with the following cutting values:

- Spindle speed 8000 rpm
- Feed rate 7,200 mm/min
- Feed 0.15 mm

### MAPAL OFFERS THE COMPLETE PACKAGE

MAPAL also designed the other tools for the complete machining of the housing as combination tools. "For one of our customers, we process the complete housing with only eight different tools", says Bolz. However, this number varies depending on the part, workpiece material and requirements. Another customer with a much more complex housing requires 31 tools. "Today we offer the complete package for the machining of small aluminium or magnesium housings. Depending on requirements and complexity, we design the appropriate tool concept", concludes Bolz. ■



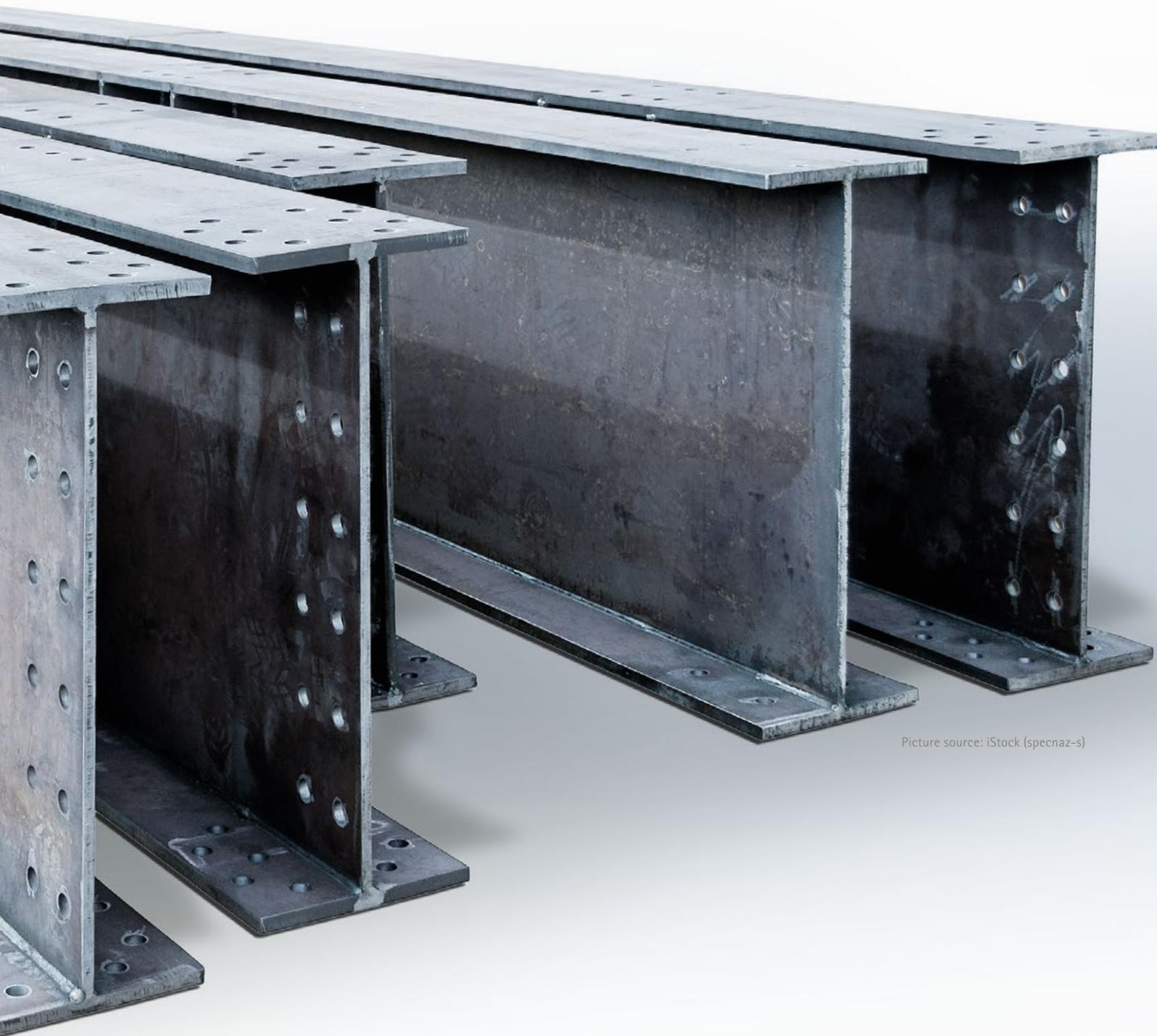
Picture source: iStock (angeluisma)



MAPAL offers the complete package  
for machining small electric motors.



Economical and  
Reliable Machining of  
**STEEL BEAMS**



Picture source: iStock (specnaz-s)

Steel beams and sectional steels are indispensable in many areas. Both their dimensions as well as the position and size of their bores are standardised. For this reason, the manufacturers of steel beams focus on the bore quality produced during machining, in addition to process reliability and cost-effectiveness. MAPAL offers the optimum solution for this with the QTD indexable insert drill with pyramid tip.

Steel beams are a prime example of successful recycling. Mainly produced from scrap metal, they're used in the construction of halls, bridges or apartments, in mining, in the transport and logistics sector as well as in mechanical and vehicle engineering. Their job is just as important as the variety of possible applications and uses. For example, if load-bearing walls are knocked down during house renovations, steel beams are the solution to maintain the statics and replace the wall as a support.

Dimensions, masses and cross-sectional properties of steel beams and sectional steels are standardised. For the various profile shapes, it is precisely defined which static values they must meet for defined dimensions. The →



**Work is carried out with MQL and with the same cutting values as the previously used tool:**

- Cutting speed: 63 m/min
- Spindle speed: 1,115 rpm
- Feed: 0.3 mm

The results are exciting. With the MAPAL tool, the customer is now able to machine a whole 2,000 bores reliably and economically.

position and size of the pin bores are also defined. The machining of these bores is subject to challenging conditions. Generally speaking, machining conditions are usually unstable, the material thickness fluctuates and the material specification also varies.

In one specific case in Australia, the managers at a company that manufactures steel construction materials were not satisfied with the performance of the tool produced by one of the other players on the market. The tool life of the drill fluctuated immensely. Jammed chips in particular meant that the machinist often had to replace it after just 150 bores.

The customer turned to MAPAL. The experts at the precision tool manufacturer designed a QTD indexable insert drill (QTD) with a diameter of 18 mm especially tailored to the conditions on site. The QTD was predestined for the machining of steel beams.

In addition to the significantly longer tool life, the QTD provides the construction material manufacturer with extra advantages over the previously used drill. The chips are broken up better. They're significantly smaller and therefore easier to transport. Problems with jammed chips are a thing of the past thanks to the MAPAL tool. Even with fluctuating material thicknesses (in this case between three and twelve millimetres) the QTD works reliably with consistent performance. It produces excellent bore quality with a burr-free bore exit. Moreover, changing indexable inserts is as simple as it is safe.

The tool not only persuaded the customer with its high performance and user-friendliness, using it also saves resources and is extremely economical. This is because the cost-intensive carbide is limited to the indexable insert. And all of this without the user having to accept losses compared to the solid carbide counterpart. ■

## More details about the MAPAL tool:

- More details about the MAPAL tool:
- QTD indexable insert drill with pyramid tip
- Indexable insert made from coated solid carbide especially for steel machining
- Pyramid tip for the best possible self-centring and therefore a reliable bore entrance
- Shank according to ISO 9766
- Back relief for reliable chip removal
- Optimum power transmission due to embedded indexable insert
- Hardened steel holder with cylindrical shank
- Stable Torx Plus tension
- Prismatic insert seat for optimum centring of the indexable insert
- Maximum performance when combined with MAPAL chucks





**DANIEL SHELTON**  
CEO | MAPAL Inc. USA

Daniel Shelton (49) is the new CEO of MAPAL Inc. Back in May, Shelton took over operational management of MAPAL's US sites in Port Huron and Fountain Inn. He succeeds Sidney Paiva, who has reached retirement age and is therefore taking a step back, but will remain on the board of MAPAL Inc. Daniel Shelton will continue with the repositioning of the company, which has already been successfully initiated. His goal is to accelerate Paiva's advance into new sectors and customer groups within the USA and Canada. At the same time, he will continue to expand the core business with the automotive industry and its suppliers. The experienced tool expert and graduate of Ohio State University gained his first professional experience in Detroit. That was when he switched to the tool industry. Shelton worked as an OEM specialist and regional sales manager and was also active on an international level later as sales director for North and South America. Most recently, he was the manager at a subsidiary of one of our market competitors. "Although we are going through a very challenging time at the moment, I'm excited about the new role and the opportunity to lead Mapal Inc. into a successful future", says Shelton.

# PARTICULARS

**CONRADO CUOTO DINIZ**  
CEO | MAPAL do BRASIL

Conrado Cuoto Diniz (35) has been the CEO of MAPAL do Brasil since 1 August. Diniz had been acting Managing Director of the Ibirité branch since 2018 and worked his way up to this position as Sidney Paiva's designated successor. The mechanical engineer and MBA started at MAPAL do Brasil way back in 2004 and gained experience in the areas of development and project planning as well as in customer service. From 2008 he worked for one of MAPAL's trading partners as well as for one of the market competitors. In 2014 he returned to MAPAL do Brasil with extensive market and management knowledge. Diniz served as Area Sales Manager for the South of Brazil. He then took over the position of Production Manager before he was finally appointed to the top management level of MAPAL do Brasil.



**SIDNEY PAIVA**

Sidney Paiva (62), CEO of MAPAL do Brasil for many years and CEO of MAPAL Inc. in the USA since 2018, has retired. Dr Jochen Kress has thanked him for his long and successful commitment to the MAPAL Group. One of Paiva's great achievements has been integrating the subsidiary he founded, MAPAL do Brasil, into the MAPAL Group and successfully managing it for more than 20 years. In 2018 he accepted the challenge of managing the US subsidiary MAPAL Inc. during hard times. As CEO, he led the strategic further development of the subsidiary forward and expanded the portfolio beyond the automotive and OEM sectors. "Under his leadership, MAPAL Inc. started many new initiatives, some of which are already bearing fruit", says Kress, referring to the aviation sector and MAPAL's sales activities in Canada. Kress adds that Paiva has also built up a powerful team of employees which he is confident will lead MAPAL Inc. into a good future. Paiva will remain on the board of MAPAL Inc. even after his retirement as CEO in order to guide the strategic development of the subsidiary and ensure a smooth transition.

# MAXIMUM TOOL LIFE IN CFRP THANKS TO **DIAMOND** COATING

MAPAL relies on technology from SP3





Picture source: SP3

SP3 is based in Silicon Valley in the USA.

You don't get better than diamond-coated tools and indexable inserts when machining CFRP and similar materials, for example in the aerospace industry. Want to know why MAPAL relies on SP3 technology for the coating of solid carbide tools, what makes their machines special and where exactly the most expertise for coating with diamond comes from?

It's the world's hardest material: the diamond. That's why it's the cutting material of choice, for example when machining aluminium or CFRP (carbon fibre reinforced plastic). In this regard, we make a distinction between PCD (polycrystalline diamond) and diamond coatings. Binders are used for PCD blanks to hold the diamond crystals together. This binder is not necessary for CVD diamond coating (chemical vapor deposition). "With CVD we have 100 percent diamond on carbide", says Dr Wolfgang Baumann, who is responsible for coating and cutting material technology at MAPAL. Another difference between the two types of diamond is the sharpness of the cutting edge. Whenever an extremely sharp cutting edge is required, nothing holds a candle to PCD. In many other cases, CVD diamond coating is a real alternative.

#### STRATEGIC PARTNERSHIP FOR CVD DIAMOND COATING

In the field of PCD tools, MAPAL has the largest production worldwide and for decades has been finding the best strategy for the respective machining task together with its customers. MAPAL is now building up the same expertise with its new strategic partner SP3 in the field of diamond coatings. "Diamond-coated tools or indexable inserts have the best application values and tool lives, especially when machining CFRP, plastics and ceramics", explains Dr Wolfgang Baumann. Diamond-coated carbides are also suitable for machining graphite electrodes, for example in the die & mould sector.

SP3 is a coating company based in Silicon Valley in the USA. The company, which gets its name from the chemical structure of diamond, has developed its own processes for applying CVD diamond coatings to various substrate materials. Bob DeFeo, Managing Director of SP3, says: "Working closely with tool manufacturers, carbide suppliers and tool users is our recipe for success". This close cooperation has resulted in various coatings, which SP3 today offers its customers as a service.

#### COMPLEX PROCESS WITH THE COMPANY'S OWN CVD DIAMOND REACTOR

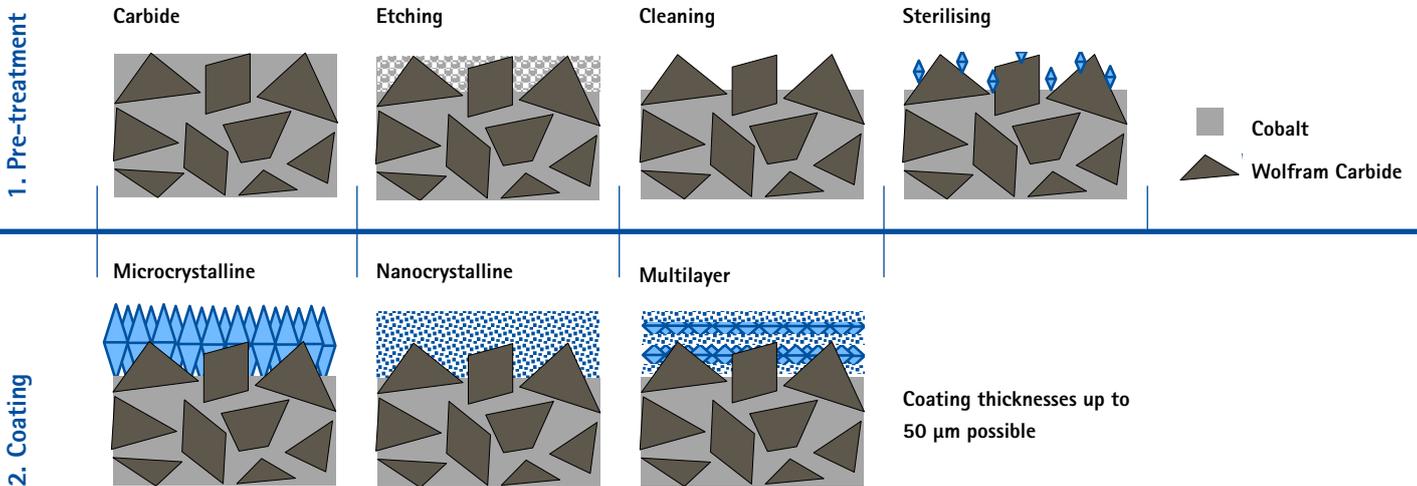
"Depending on the application and our customer's requirements, we find the optimum solution together", promises DeFeo and goes on to describe diamond coating as "a complex process. Numerous factors must be taken into account". The most important points he mentions are the carbide, the tool geometry, the preparation of the cutting edge or substrate for the coating as well as the coating thickness and roughness.

For the actual coating, SP3 uses the so-called "hot filament CVD" process. Dr Wolfgang Baumann explains the process: "We use tungsten wires to heat up hydrogen and methane to 2,550 degrees Celsius. This produces very reactive methane radicals. These gradually deposit their C-atoms on diamond nuclei on the carbide surface, which causes the diamond to grow. The size of the crystals varies depending on pressure, gas flow and temperature. It ranges from nanocrystalline to microcrystalline. The surface of the coating depends on the size of the crystal produced. It ranges from extremely smooth to rough".

#### THE UNIFORMITY OF DIAMOND THICKNESS ENSURES PROCESS RELIABILITY

In order to carry out the coating process in the best possible way, SP3 has developed its own CVD diamond reactors. The company has designed a special arrangement of the heating wires for uniform energy distribution and has had this patented. In particular, it's the maximum coating thickness of 50 µm that makes the process developed by SP3 so special. "Our

## Diamond coating process



system is very impressive due to the excellent uniformity of the diamond thickness. As well as this, the process variables can be controlled in real time", says DeFeo. This makes the coatings precise and repeatable, which is extremely important, particularly in sectors such as the aerospace industry. "Only tools that are qualified are used for this. They must consistently deliver the same performance every time to ensure the reliability of the process", emphasises Bob DeFeo.

Coating adhesion is also important for the later use of the coated tools or indexable inserts. "The substrate as well as how it's pre-treated are crucial for this", reveals Bob DeFeo. The pre-treatment, in which the majority of the expertise is also invested, is divided into etching, cleaning and sterilisation.

### CFRP MILLING CUTTER WITH MAXIMUM APPLICATION VALUES FOR THE AEROSPACE INDUSTRY

The first joint project between SP3 and MAPAL was the coating of the OptiMill-Composite-Speed-Plus. "Together we worked tirelessly to develop the optimum coating", says Baumann. The milling cutter, which is mainly used in the aerospace industry, is designed for machining CFRP. Thanks to a new high-performance substrate in combination with a reinforced core diameter, the developers at MAPAL increased the fracture strength of the eight-bladed milling cutter by 50 percent compared to the previous model. The optimised flute profile ensures fast and safe removal of dust and process heat even at extremely high machining volumes. The cutting edge was specifically optimised for the requirements of brittle workpiece materials. "The icing on the cake was then the coating that ensures maximum tool life", says DeFeo happily. Thanks to the diamond coating, it's also possible to operate with the maximum application values.

When using a milling cutter for CFRP machining, for example, a spindle speed of 5,968 rpm, a cutting speed of 150 m/min and a feed of 955 mm/min are used. Both the cutting depth and the cutting width are 8 mm in this case. "We achieve the best results with the new coating and reach a tool life that is 20 percent longer than the previous model", says DeFeo.

The coating of the OptiMill-Composite-Speed-Plus is the first success of the strategic partnership, which will certainly be followed by numerous others, both DeFeo and Baumann agree. Because: "To achieve the best possible performance of a CVD diamond-coated tool, tool manufacturers and coaters must work very closely together. This is the only way to achieve the maximum tool life, reliable process results and the best surfaces for the user". ■

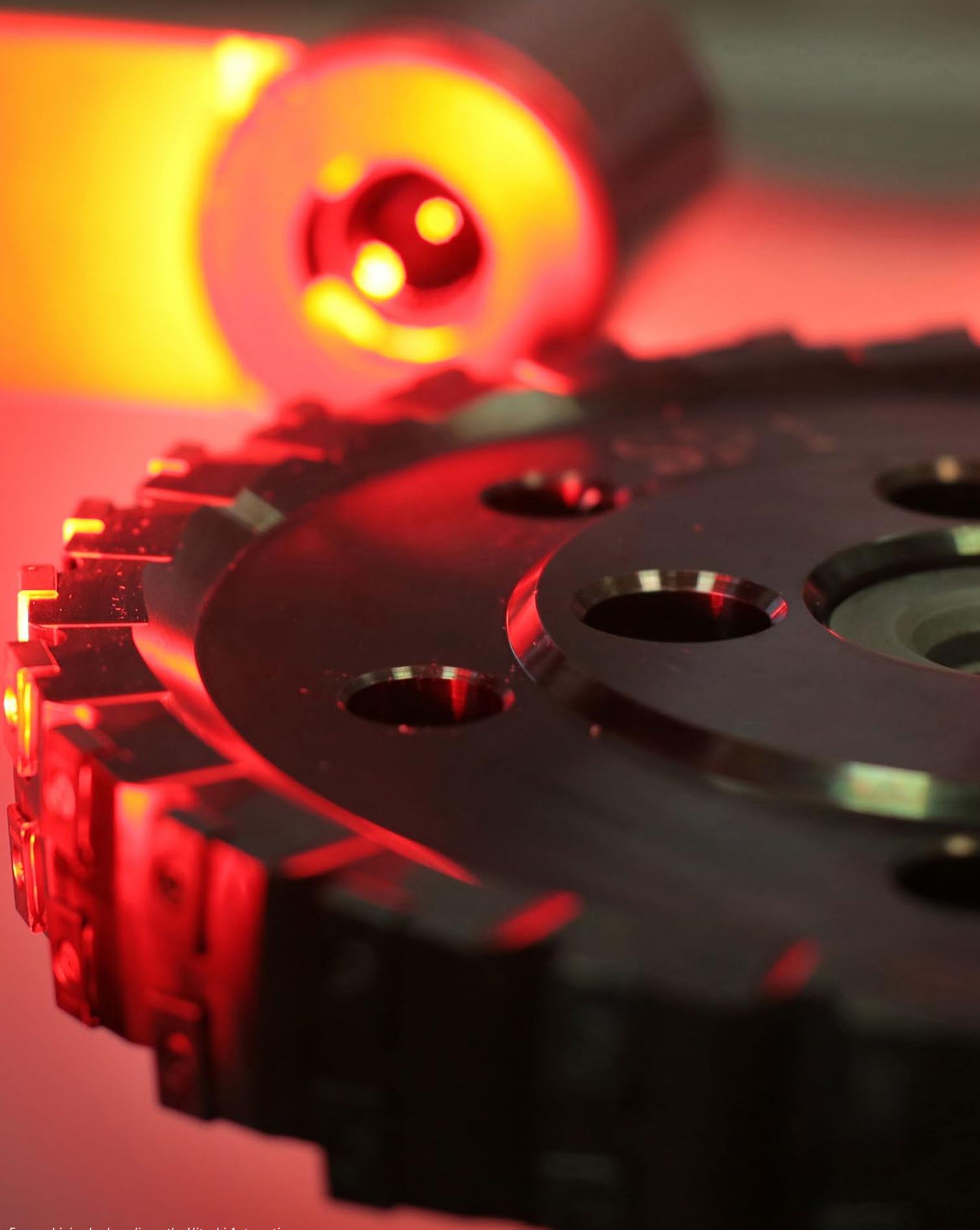


*The coating of the OptiMill-Composite-Speed-Plus is the first joint project between MAPAL and SP3.*

# MULTI-SITE TOOL MANAGEMENT 4.0

MAPAL takes over tool management at Hitachi Automotive Systems Group in Poland, Mexico and Turkey

For manufacturing companies, procuring and preparing tools requires a great deal of time and effort that demands both capacity and competence. For that reason, the Hitachi Automotive Systems Group has entrusted tool management for the entire brake manufacturing process at three of its locations – in Mexico, Turkey and Poland – to MAPAL. By doing so, the company benefits not only from tool management but also from the opportunities provided by digital connectivity. →

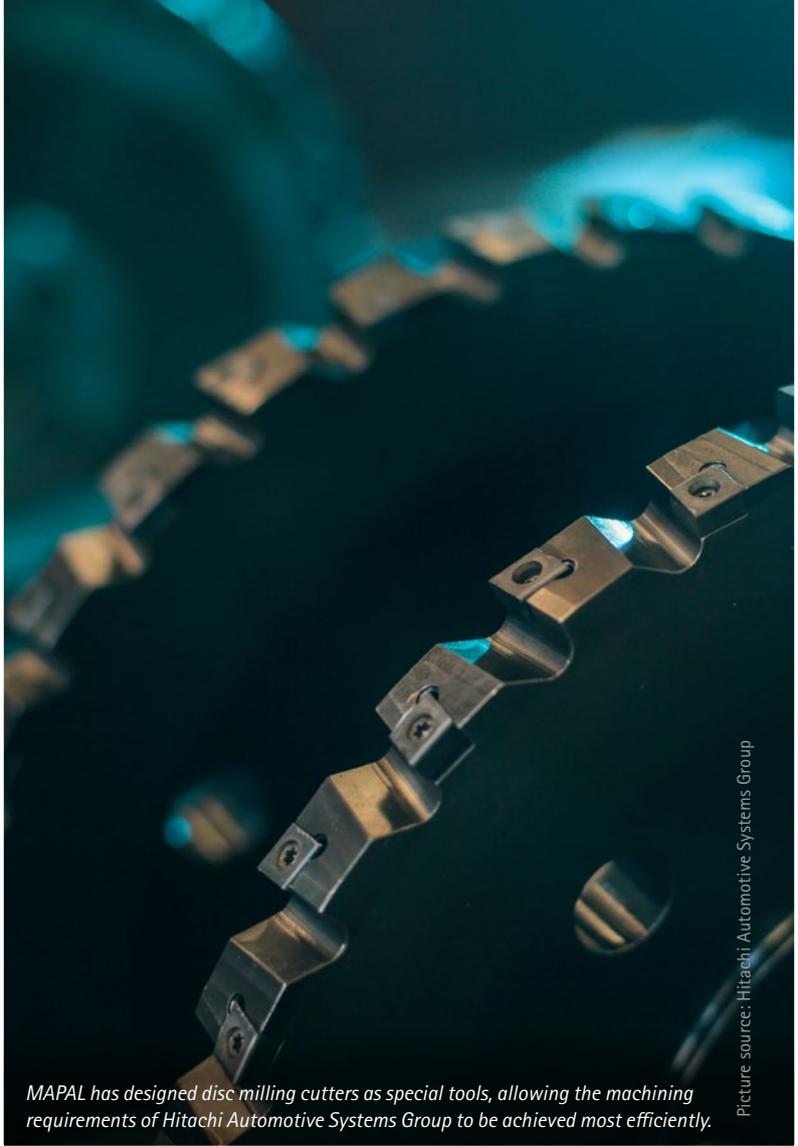


*For machining brake calipers the Hitachi Automotive Systems Group relies on disc milling cutters from MAPAL.*

Picture source: Hitachi Automotive Systems Group

Chassis Brakes International has been part of Hitachi Automotive Systems since 2019. The acquisition made Hitachi Automotive Systems one of the world's largest brake manufacturers. "In Hitachi Automotive Systems's Brake Business Unit, we manufacture disc brakes, drum brakes, electric parking brakes and rotors," says Hubert Klehenz, the company's global sourcing director for braking systems. The products are used in cars, light commercial vehicles and two-wheeled vehicles.

At its three factories in Mexico, Poland and Turkey, Hitachi Automotive Systems Group primarily manufactures disc and drum brakes. "We have been successfully working with the Turkish factory in Bursa for 13 years," recalls Frank Stabler, Head of Tool Management Services at MAPAL. Over time, the two companies expanded their collaboration. "Following our work at the Turkish factory, Hitachi Automotive Systems Group entrusted us with the tool management for its facility in Wroclaw, Poland," says Stabler. Their most recent partnership is in Queretaro, Mexico. In 2017, when it was still operating as Chassis Brakes International, the company opened a completely new plant there.



MAPAL has designed disc milling cutters as special tools, allowing the machining requirements of Hitachi Automotive Systems Group to be achieved most efficiently.

Picture source: Hitachi Automotive Systems Group

At the plant in Bursa amongst other items the employees produce brake calipers.



Picture source: Hitachi Automotive Systems Group

### MASTERING GLOBAL CHALLENGES WITH WORLDWIDE ON-SITE SUPPORT

Hubert Klehenz's team was looking for a partner company that would be able to take over complete responsibility for tools at the plant in Mexico: "In order to deal with global challenges and global projects, we need a tool-management provider that can support us worldwide," says Klehenz. Brake manufacturer's main concern was finding a provider to work to the same standards as they themselves did – and deliver at a consistently high quality.

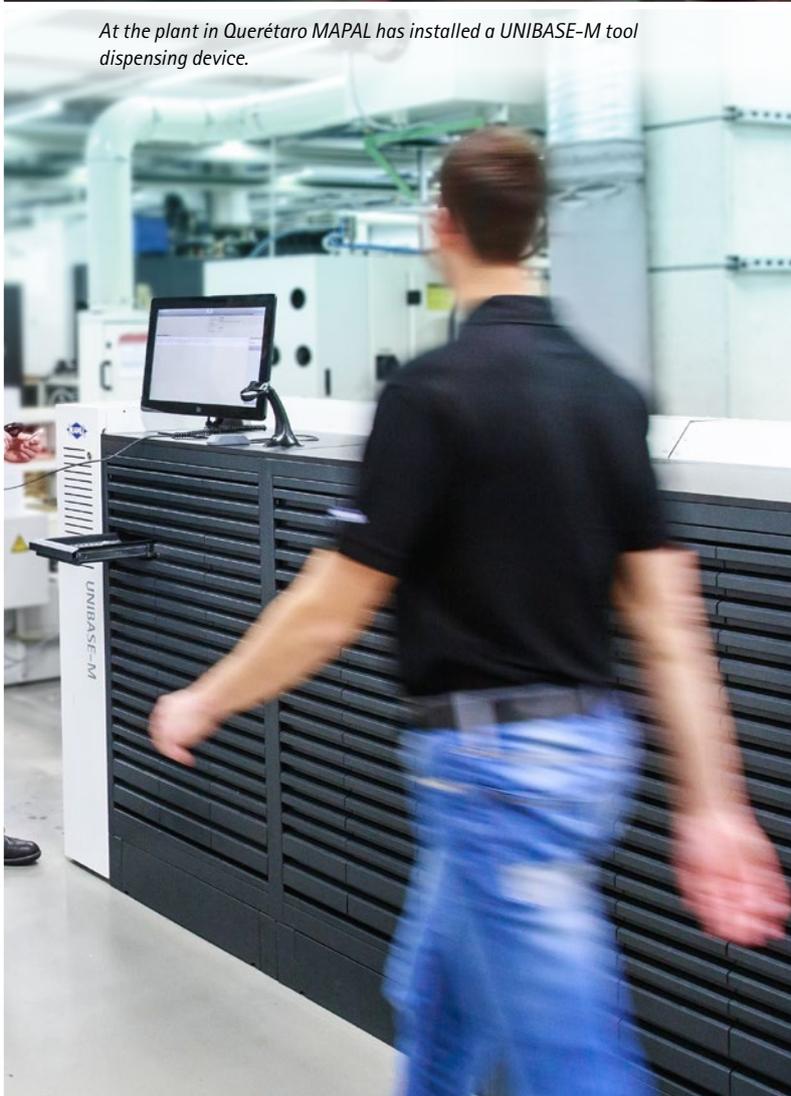
"Brakes are among the most critical safety features of every vehicle, and they need to operate perfectly under all circumstances," Hubert Klehenz points out. In order to meet the high quality, safety and reliability requirements, brake manufacturers machine each part with the greatest care. "We receive the unfinished parts for brackets and brake calipers made of aluminium and cast-iron and take care of the entire machining and assembly process."

In doing this, Hitachi Automotive Systems Group needs to eliminate all conceivable potential errors in order to ensure that none of their products are faulty. This approach is used across the board in the automobile industry and is the reason that the brakes in modern cars almost never fail. However, it does lead to increasing expenditure in terms of the equipment and tools used in brake manufacturing. Only components and processes that have been confirmed to rule out failures are used. →

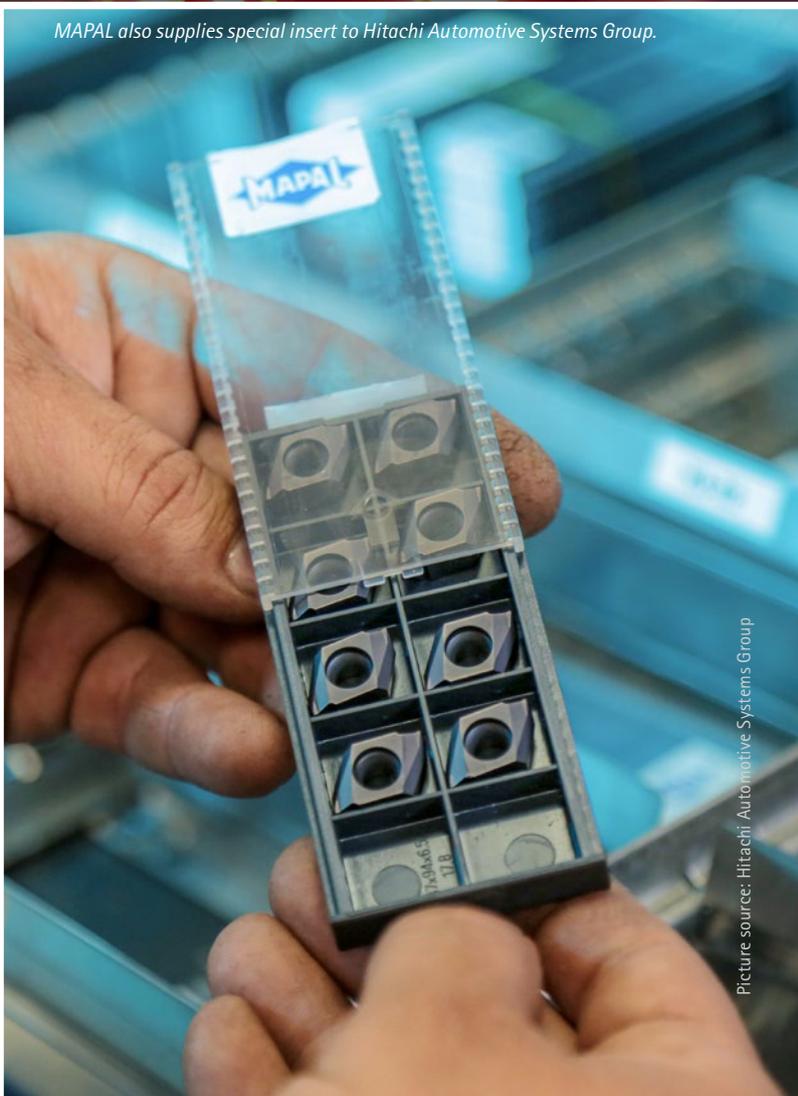


*In the setting room an employee measures the special disc milling cutters from MAPAL.*

Picture source: Hitachi Automotive Systems Group



*At the plant in Querétaro MAPAL has installed a UNIBASE-M tool dispensing device.*



*MAPAL also supplies special insert to Hitachi Automotive Systems Group.*

Picture source: Hitachi Automotive Systems Group



*A Hitachi Automotive Systems Group employee removes a brake caliper from the machine.*

Picture source: Hitachi Automotive Systems Group

*MAPAL invoices Hitachi Automotive Systems Group for Tool Management as Cost-per-Part.*



Picture source: Hitachi Automotive Systems Group

#### **FOCUSING ON CORE COMPETENCIES**

"That makes it even more important for us to focus on our core competencies and place our tool management in the hands of a company that specialises in precisely that part of operations," says Klehenz. "By using an external tool management company, we are able to ensure that we are using the best tools – and we also receive technical support and assistance in cost-optimising our processes," he explains further.

After the runaway success of their partnerships in Poland and Turkey, Hitachi Automotive Systems Group decided to continue working with the precision tool manufacturer in Mexico as well. "MAPAL's structure is similar to ours, which enables them to support us at a regional level," says Klehenz. "On top of that, MAPAL offered us a ready-made solution for implementing the operations at our factories."

#### **ALL-ROUND TOOL MANAGEMENT**

"We implemented an all-round tool management system at the plant in Mexico – we are responsible for procuring and providing all tools," says Stäbler. That includes a tool-setting area. "It helped that our new MAPAL site at Frhenosa is very close by." That means short transport distances and quick reaction times are the order of the day.

At Querétaro, MAPAL implemented – and continues to implement – all the components of the modular tool management system. Amongst other things, it installed its own UNIBASE-M tool dispensing system, as well as a UNISSET-C setting fixture. On top of that, as in Turkey and Poland, the MAPAL service includes a complete tool-setting area. "We make use of the complete service, from the procurement of various consumables – including the tools – all the way through to the dispensing of materials and stock monitoring with automatic re-ordering. MAPAL also takes care of the setting and installation of the tools. When we receive the tools, they're already on the machine and ready for operation," Hubert Klehenz explains. MAPAL is also responsible for all regrinding and reconditioning procedures.

And that's just the tip of the iceberg when it comes to tool management: "While all this is going on, MAPAL constructs tools and chucks that perfectly match our manufacturing standards and make high-performance, economical production possible." For example, MAPAL is continually working on ways to help Hitachi Automotive Systems Group to reduce cycle times and increase production outputs.

#### **TOOL MANAGEMENT 4.0 – AN IMPRESSIVE SERVICE**

In the interests of transparency and even more efficiency, MAPAL further enhanced its conventional tool management system in 2019 and now offers Tool Management 4.0. To do so, the tool manufacturer uses an open-cloud platform from c-Com GmbH. Thanks to c-Com, MAPAL is able to illustrate the tool processes to the customer transparently and digitally.

Hubert Klehenz is pleased: "Tool Management 4.0 has definitely given us a boost when it comes to digitalisation and all its benefits for manufacturing." He says that the direct transfer of information makes a difference – for example in the automatic restocking of inventory, which ensures that all necessary materials are available. "We have significantly more flexibility when replacing tools. As a result, the machines have noticeably less downtime," says Klehenz, naming just one of the benefits. On top of that, Hitachi Automotive Systems Group can now digitally track its tools and receive automated reports about them.

"Having MAPAL as our tool manager gives us maximum transparency across all locations in terms of technology and machining processes – and in terms of cost," says Klehenz. MAPAL calculates the cost per part for tool management at Hitachi Automotive Systems Group.

Hubert Klehenz lists the following tangible improvements resulting from tool management:

- No more difficulties finding the right tool when you need it;
- Completely accurate stock inventories – which has a positive effect on purchase costs and tied-up capital;
- More resources for activities that add value – like brake installation – as MAPAL manages the set-up and adjustment of tools;
- Each plant regularly receives its own key figures, making it possible to monitor the costs and outputs of individual machines;
- Productivity is increased as a result of amendments made on the basis of these figures;
- Hitachi Automotive Systems Group has access to the newest technologies when it comes to tools and their applications;
- MAPAL takes care of the reconditioning of the tools, leading to a longer service life and higher maintenance efficiency.

*The brake calipers undergo scrupulous quality control.*



Picture source: Hitachi Automotive Systems Group



*Frank Stähler, head of Tool Management Services at MAPAL.*

*"We implemented an all-round tool management system at the plant in Mexico – we are responsible for procuring and providing all tools."*



Picture source: Hitachi Automotive Systems Group

*Hubert Klehenz, global sourcing director for braking systems at Hitachi Automotive Systems Group.*

*"In order to deal with global challenges and global projects, we need a tool-management provider that can support us worldwide."*

#### **GLOBAL AND LOCAL COOPERATION**

It's not just the overall global collaboration that runs like clockwork. The cooperation on-site is what's most important. "The two head offices have made a global agreement, but it's the local MAPAL locations that make a real difference in implementing our requirements at a regional level," says Klehenz.

During day-to-day operations on site, the company's production managers meet regularly with the MAPAL employees. Together, they discuss the production schedule and analyse the most important key figures. These include machine and tool failures, output figures and productivity. Every year, there are workshops at the three factories in Mexico, Poland and Turkey to share best practices and harmonise processes across the different locations. Having all the data digitally recorded by c-Com facilitates a great help.

And cooperation is going to be significantly increased in the future: "We are now going to assess additional locations and units to identify where a similar tool management system would be helpful and increase efficiency," says Klehenz. In doing this, the three current locations will act as model plants providing evidence of the increased efficiency. ■

Precision tools made by MAPAL for Spain

# AYMA HERRAMIENTAS – CLOSENESS CREATES TRUST

In part two of the IMPULSE series on MAPAL's worldwide sales partners, we focus on AYMA Herramientas in Spain. We interviewed Jesús M. García Lanciego, Managing Director of the commercial agency, and discussed, among other things, how to gain the trust of customers and how good communication and international contacts contribute to this.





### **Jesús M. García Lanciego | CEO | Ayma Herramientas**

*Jesús M. García Lanciego (57) studied engineering and joined the commercial agency AYMA HERRAMIENTAS in 1989. He initially worked in the technical area to drive the development of the tool programme. Jesús García is running the company together with José Maria Gorostidi.*

AYMA Herramientas is a long-standing partner and one of the largest commercial agencies to work together with MAPAL in Europe. The family business employs around 80 people and has established a trading network throughout Spain. In addition to its headquarters in Ezkio-Itsaso, AYMA has offices in Vitoria (Álava), Gijón (Asturias) and La Llagosa (Barcelona). The company also has branch offices in Madrid, Bollullos de la Mitacion (Seville), Valencia (Valencia) and Bilbao (Vizcaya). Jesús García Uralde, the father of the current managing director Jesús M. García Lanciego, founded the commercial agency in 1959 together with other partners.

Ezkio-Itsaso is located in the Basque Country. The small region on the Atlantic coast was once the centre of the Spanish steel and shipyard industry. AYMA's business was initially based on the sale of special steels for machine engineering. Precision tools were added in the 1980s – today the company concentrates entirely on this market and offers customers a comprehensive range and individual process solutions.

### **MR. GARCIA, HOW LONG HAVE AYMA AND MAPAL BEEN WORKING TOGETHER AND HOW DID THE PARTNERSHIP COME ABOUT?**

Our cooperation began in the 1970s. My father contacted MAPAL at the time and spoke to the Managing Partner back then, Dr Georg Kress, about the possibilities of a commercial agency. He wanted to create a second mainstay for AYMA by selling precision tools. Since my father was on site with the customers anyway, he wanted to present them with a more versatile product range. In principle it was a logical step since the buyers of the special steels were potential customers for precision tools that they could use to process the steel. →

*Ayma Herramientas is a long-time distribution partner of MAPAL's. The company's headquarter is in Ezkio-Itsaso.*



Presence of AYMA at the BIEMH 2018 in Bilbao

Picture source: AYMA Herramientas

### WHAT HAPPENED NEXT?

So after that AYMA entered the market with the first tools from MAPAL. Initially these were reamers, milling tools and tools with guide pads, which quickly brought us success. MAPAL expanded the product and service range in the following years and we then expanded our range to include the new releases as well. Today, AYMA is present throughout Spain with eight sites and we're able to react quickly and flexibly to the needs of our customers. Our customers come primarily from the machine engineering and automotive industries. But we're also active in the aerospace sector, with suppliers and many small companies that manufacture the most diverse products.

### YOU'VE SINCE GIVEN UP STEEL DISTRIBUTION AND NOW TRADE EXCLUSIVELY IN PRECISION TOOLS.

The steel business became more difficult in the 1980s. We decided at the time to focus solely on trade with precision tools. We knew we were well positioned with MAPAL tools and had the necessary expertise to move forward.

### WHAT DOES THAT MEAN FOR YOUR CUSTOMERS?

Our customers can rely on us developing the best machining solution for every application. Our close cooperation with the specialists from MAPAL

has always proved worthwhile. We support users in the design and commissioning of new tools right through to the optimisation of machine processes. We're there for you virtually every step of the process. We take care of the downstream processes and offer customers a comprehensive after-sales service. We keep a range of common standard tools at all AYMA sites, we have various tool management systems in our programme and, if required, we set up a consignment stock for the customer. We also carry out repairs or the reconditioning of tools.

### WHAT'S THE SECRET OF THE LONG-STANDING RELATIONSHIP BETWEEN AYMA AND MAPAL?

Both MAPAL and AYMA are family businesses. Both companies stand for continuity in terms of the staff and this creates a lot of trust among customers. As well as this, we maintain a similar corporate culture. We focus heavily on quality, service and innovation. We claim to be at the cutting edge of technology. AYMA benefits from the fact that MAPAL has been consistently expanding its product and service range for decades and is providing strong impetus with new tool developments. This has greatly enhanced our market position in Spain. We have to keep in mind the dynamics with which the automotive industry has developed here in this country. And MAPAL knows

the requirements of this sector very well. This is also evident in the field of electric mobility. We see good opportunities there and already have some customers that we are supplying with the appropriate tools from MAPAL.

#### ARE THERE ANY OTHER MEMBERS OF YOUR FAMILY WHO ARE INVOLVED WITH AYMA?

Yes, my brother Luis Garcia (55) also works in the company. He joined AYMA in 1988 and has been with us a little longer than me. Luis has worked in various fields. He started in Sales, where he specialised in the large machine tool manufacturers. He now heads up our Madrid office and serves one of our largest customers.

#### HOW INTENSIVE WOULD YOU SAY THE COOPERATION WITH MAPAL IS?

Our employees are in daily contact with the MAPAL Customer Service team and communication runs smoothly and directly. We're also in contact with the technicians and development engineers at MAPAL. This is important because larger projects usually involve a corresponding number of custom tools. With technical support from MAPAL, we can optimise the process as soon as the tools are commissioned. Errors do not occur in the first place. It is quite common with major customers that employees from other MAPAL sites are also involved in projects. We have personal contacts there too, which is of course a huge advantage for the customer. In this way, we avoid duplicating work in the design of processes. Everything runs quickly, easily and efficiently.

#### AND HOW DOES THAT PAN OUT IN REAL LIFE?

I can think of two projects with major automobile manufacturers. First, there was a project with FORD. When we first started working with FORD, we worked closely with the specialists at company headquarters and the MAPAL subsidiary in the UK. The work involved a new machining process. We were

very well supported in the design and commissioning of the tools. Our concept was perfect and this has had an extremely positive effect on subsequent projects, both here in Spain and at FORD's other factories abroad. The same applies to our projects with RENAULT. Here, we've been working very closely with the MAPAL team in France for many years and have enjoyed lasting success here as well. Projects like these have earned us great trust from our customers.

#### WHERE CAN I GET MORE INFORMATION ABOUT THE AYMA HERRAMIENTAS COMMERCIAL AGENCY?

Anyone interested in finding out more can visit our website [www.ayma.es](http://www.ayma.es) and get an overview of our company and our range of services. Our catalogues are also available to download there. Our staff at the headquarters in Ezkio-Itsaso and at our branch offices will be happy to answer your queries. At the moment, the best way to reach them is by email or telephone. But we hope that in the post-coronavirus world, we'll be able to focus more on face-to-face meetings again. And maybe we'll even meet at a visit to a trade fair again. We regularly have a stand at BIEMH (International Machine-Tool Biennial Exhibition) in Bilbao and at Metal Madrid. ■



Picture source: AYMA Herramientas

*Technicians and customer service specialists collaborate closely.*

