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world^{of} tools



THE HORN MAGAZINE



LADIES AND GENTLEMEN,



When we look at the world today and engage in conversation, the focus is on politics. It is about worldwide unrest and wars. About commodity prices. About security of supply. About bureaucracy. It is about many concerns, risks and uncertainties. But part of the conversation is how we are responding to this: with confidence! We believe in ourselves as a company. As the HORN Group. We believe in our employees and in our set of values. And we believe in our products, solutions and the service we provide. All of this allows us to look to the future with optimism, despite the current situation. Always with the focus on creating added value for you, our customers, and helping you move forward.

Furthermore, we are tackling these challenging times with technology. At AMB in Stuttgart and IMTS in Chicago, we are showcasing our products. We have been active on the market with rotating PCD tools for a good two years now, demonstrating how the range is constantly evolving and that numerous bespoke solutions are possible.

This issue of 'world of tools' also focuses on the raw materials mentioned above – specifically, tungsten. This vital resource forms the basis for many of our precision tools. Particularly when it comes to material prices, there has been only one direction for some time now: upwards. You can read on the following pages about how we are addressing this issue.

Immerse yourself in the HORN universe in this 'world of tools' and be inspired.

Two handwritten signatures in black ink. The signature on the left is 'Markus' followed by a stylized surname. The signature on the right is 'M. Rommel' followed by a stylized surname.

Markus Horn and Matthias Rommel, Managing Directors of Paul Horn GmbH

world^{of} tools

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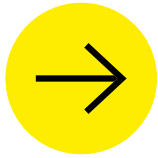
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DELICATE INSERTS FOR MAXIMUM SECURITY

Keys, locks and locking systems – the development and production of secure lock cylinders and the appropriate keys require expertise and experience, always with the aim of staying one step ahead of burglars. The Dutch company Ankerslot is regarded as a specialist in modern locking systems. For the production of individual components and keys, the Ankerslot team relies on precision tools from Paul Horn GmbH and technical advice from the Dutch HORN representative, Harry Hersbach. A new production line featuring a multi-stage, custom-made HORN tool is used for key production.

Keys and locks are precision-manufactured assemblies that function as mechanical code systems. Their technology is based on a sophisticated interplay of shape, dimensions and material, which enables the secure and reliable operation of the lock. Particularly characteristic are the longitudinal grooves and notches, which constitute the key's actual code. The longitudinal grooves usually run along the key blade. They serve not only to provide stability but, above all, to guide the key within the lock cylinder. The depth and position of each groove are precisely defined, ensuring that the key fits only into its corresponding lock. In modern profile cylinders, the specific groove profile also prevents the insertion of unauthorised or counterfeit keys. The profile thus acts as a kind of mechanical signature.

PRECISION ENGINEERING

The notches or indentations on the upper edge of the key form the second, crucial level of coding. Their varying depths and spacings correspond to the pairs of pins inside the lock. When the key is inserted, the notches push the pins upwards until their dividing line is exactly level with the so-called locking line. Only then can the cylinder be turned and the lock opened. High-quality systems often incorporate additional security features, such as lateral drill recesses or embedded magnets that interact with lateral rows of pins or moving elements within the lock. This creates a complex mechanism that makes tampering significantly more difficult. Key technology is thus an example of precision engineering.

The mass production of locking systems requires a high level of expertise, specially adapted production cells and a wide range of specialised tools to ensure cost-effective manufacturing. The Ankerslot team manufactures the complex locking systems at its Dutch headquarters in Enschede. For all assemblies, the company relies on tooling solutions from HORN. These include, for example, systems for boring and slot broaching as well as various milling tools.

**THE PROJECT TEAM SAID THAT THE
TOOL DESIGN WOULDN'T WORK.**



HORN uses the S117 insert for this special tool.



The HORN milling tool is used in numerous types.



Ankerslot offers over 6,500 different keys.

SCEPTICISM ABOUT A TOOLING CONCEPT

"As part of a newly-planned production line for an Italian company in the field of mechanical engineering, there was a need to rethink the tooling concept for milling the longitudinal grooves," says Product Manager Daniël Mebius, continuing: "The tool system proposed by another manufacturer did not convince us. So we got in touch with Joop Nijland." Nijland works for the Dutch HORN distributor Harry Hersbach Tools. He is regarded as a specialist in bespoke tooling solutions. Together with his HORN contact, Roger Kasper, they developed a milling tool that initially had the mechanical engineering company's engineers shaking their heads. "The project team said that the tool concept wouldn't work," recalls Nijland.

The previous tool concept consisted of a milling cutter with two cutting rows, each with two inserts. Nijland and Kasper's idea, however, was based on a tool with four cutting rows, each with three inserts. "A tool with four cutting rows makes tool management much easier for us. You have to bear in mind that we have to mill around 6,500 different key grooves," says production manager Gert Visser. Based on the idea, HORN produced several prototype tools and sent them to Italy for initial tests. "The trials were an immediate success. The project managers were delighted," says Kasper.



A finished key comes out of the machine every seven seconds.



Blanks are fed into the system via a magazine or in bulk.

NUMEROUS TYPES

Following the successful tests, HORN immediately developed further variants. Kasper emphasises the collaboration between the individual HORN teams and those responsible at Ankerslot: "Due to the many different key codings, we also had to design and manufacture many different insert profiles. We designed and manufactured all the required tools within four weeks. Thanks to the close coordination between everyone involved, this collaboration was simply brilliant." The tool system for the key grooves currently consists of 52 toolholders, each with four different cutting rows. This allows a number of different 'combinations' of key grooves to be milled without increasing cycle time through unnecessary tool changes. During the milling process, the left and right sides are milled at different stations. Consequently, 26 milling cutters are available for each side.

**WE DESIGNED AND MANUFACTURED
ALL THE NECESSARY TOOLS WITHIN
FOUR WEEKS.**

For the inserts, HORN relies on the S117 system. The single-edge insert is mainly used for turning and groove broaching. However, due to the high repeatability during clamping, the insert is also suitable for precise milling applications. The various profiles are precision-ground. "Grinding the intricate cutting edge profiles with tight recesses was, in some cases, very challenging. Our specialists in the grinding production department did a superb job executing this," says Kasper. A major concern for the mechanical engineering company at the outset was concentricity and runout. HORN set a new standard with a value of less than 0.01 mm (0.0004").

KEYS PRODUCED EVERY SECOND

Ankerslot manufactures the keys from nickel silver, a special alloy of copper, nickel and zinc. Machining is carried out dry. Due to the shallow depths of cut, the fine chips can be reliably extracted. In operation, a finished key emerges from the production line every seven seconds. "We offer over 6,500 different keys in our portfolio. In the



A successful collaboration: Gert Visser, Joop Nijland, Dennis Nijmeijer, Daniël Mebius and Roger Kasper.

new plant, we produce around 1.6 million keys a year,” says the owner and managing director, Mr Dennis Nijmeijer. The current set of 52 tools is only the beginning of series production. Over 300 further variants are in the planning stage.

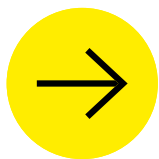
To ensure that neighbours do not have the same key, distribution is based on specific calculations and geographical distance. The company’s main markets are in the Netherlands, Germany and Austria. Investment in the new production system represented a further step towards growth for the team.

With the new production facility and the multi-stage HORN special-purpose tools, Ankerslot has raised its production to a new technical level. The combination of precision-ground inserts, excellent concentricity and well-designed tool management enables reliable and cost-effective series production of complex key grooves. Thanks to the close collaboration between Ankerslot, HORN and Harry Hersbach Tools, a production system has been created that excels through high repeatability, reduced setup times and maximum dimensional accuracy. Ankerslot is thus laying the foundation for further growth and underlining its expertise as a manufacturer of secure and modern locking systems.



ANKERSLOT B. V.

Ankerslot B.V., based in Enschede, Netherlands, has been developing and manufacturing high-quality locking systems since 1946. The company is committed to precision, reliability and innovation. It combines traditional craftsmanship with state-of-the-art technology, whilst managing the entire production process from material selection to final assembly. Ankerslot is actively working to redefine security by continuously investing in research, development and sustainability. Through efficient processes and dedicated staff, the company is strengthening its position as a leading supplier in the European market. With its guiding principle ‘Anchored in Security’, Ankerslot embodies responsibility, quality and progress in every detail of its work.



AMB: WHERE METAL COMES ALIVE



HALL 1, STAND J10

Every two years since 1982, AMB has showcased the highlights of the international metalworking industry. The event focuses on products, technologies, innovations, services and concepts for people who are passionate about metalworking. It is therefore a marketplace, a training opportunity and a networking platform all in one. Whether for visitors or companies participating in an exhibition, AMB has over the years become one of the most important events in the industry calendar.

AMB has established itself as the foremost exhibition in even-numbered years. It occupies a leading position amongst the industry's exhibitions and ranks among the top five worldwide. Across a total exhibition area of over 120,000 square metres (1,291,669 ft²), numerous global market and technology leaders gather to present technologies for tomorrow's production. Trade visitors benefit above all from the clear, theme-based layout of the halls. AMB is complemented by an attractive supporting programme and exciting special exhibitions. Whether arriving by plane, car, S-Bahn or train – the Stuttgart Exhibition Centre is easily accessible.

HORN AT AMB

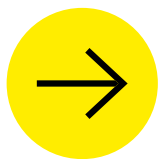
Paul Horn GmbH is exhibiting at Messe Stuttgart on a stand covering around 500 square metres (5,382 ft²). Three machines performing live cutting operations demonstrate HORN's expertise. The display features not only existing standard products, but also bespoke solutions and innovations. HORN is bringing the shop floor to the exhibition – not just visually, but also in

terms of content. Furthermore, the 2026 edition of AMB will spotlight special focus areas such as defence and aerospace. A highlight on the Saturday of the fair is a parent-child rally, at which Paul Horn GmbH will be a stop on the route. The aim is to inspire young people to take an interest in mechanical engineering.

Markus Horn, Managing Director of Paul Horn GmbH: "In even-numbered years, AMB in Stuttgart is Europe's leading trade fair for metal cutting. Visitors to AMB can expect an experience that engages all the senses – hearing, sight, smell, touch and taste. I am convinced that a trip to Stuttgart is well worth it and that our customers and guests will take home clear added value. Solutions, innovations and dialogue on equal terms form the basis for this. Please visit us in Hall 1, stand J10. We look forward to seeing you."

For more information about HORN at AMB, please visit: www.horn-group.com/amb-2026





IMTS: ACHIEVE THE IMPOSSIBLE



The International Manufacturing Technology Show (IMTS) is one of the most important platforms for manufacturing technology in North America. Every two years, the international industry gathers in Chicago to present and discuss developments in production engineering. The focus is on machine tools, automation solutions and digital technologies for industrial manufacturing.

From 14th to 19th September 2026, HORN USA will be presenting its latest solutions for precision machining at IMTS. On stand 431722 in the West Hall, visitors can experience how HORN USA combines local manufacturing, technical expertise and the rapid delivery of bespoke tooling solutions. In this way, HORN helps customers to increase their productivity and remain competitive.

A key focus of the exhibition appearance is Greenline, the fast-delivery programme for customised tools. Thanks to local development and manufacturing capabilities, bespoke tool solutions can be delivered just five days after the customer has approved the drawings. In this way, HORN USA helps its customers shorten the path from concept to production.

Unlike other exhibitions, IMTS prioritises practical, real-world applications. Throughout the event, HORN USA will therefore be conducting live machining demonstrations on a Gosiger Nomura NN-38J XB Swiss-type lathe, during which a stainless steel whisky bottle cap will be manufactured. At the same time,

operations such as turning, groove broaching, milling, S117 profile grooving, slotting and chamfering will be demonstrated.

In addition, HORN will be showcasing its latest tool innovations from 2025 and 2026. The main focus is on solutions designed to enhance process reliability, productivity and tool life across a wide range of machining applications. Sales and application engineers from all regions will be on hand for technical discussions and personalised consultations.

Whether it's higher productivity, short lead times for customised tools or expert technical support – visitors to the HORN USA stand will gain an insight into the latest tooling technologies, local manufacturing expertise and practical production solutions.

For more information on HORN at IMTS, please visit:
www.horn-group.com/us/news/imts-2026



MODULAR PCD END MILL

With the DM40 system, HORN is expanding its product range to include a modular PCD end mill series for universal milling applications in aluminium, die-cast aluminium and materials in Groups N and O. The tool system combines a permanently reusable, solid carbide toolholder with a PCD-tipped, interchangeable head based on a steel body.

HORN has specifically designed the system to reduce wear, conserve resources and ensure cost-effective processes. The modular design functionally separates long-lasting components from those subject to high wear. The face cutting edges, in particular, are among the main wear zones in milling applications. At the same time, cutting lengths exceeding twice the diameter increase the risk of edge chipping. In these areas, the interchangeable head system reduces material usage and lowers follow-on costs compared with conventional monoblock tools.

Users can replace the cutting module directly on site. The tool can then be put back into service without any additional adjustment. This reduces machine downtime, replacement lead times and repair costs. The separation between the durable base toolholder and the replaceable head also ensures transparent and predictable maintenance costs. The system is therefore particularly suitable for series production and automated production lines.



FACTS

- Sustainable and straightforward replacement of the main wear zone
- Cost-effective standard range with universally applicable replacement heads
- Cost reduction thanks to a durable, solid carbide toolholder

HORN connects the PCD-tipped steel head to the toolholder via a central clamping screw, ensuring both a force-fit and a form-fit connection. Additional colour coding facilitates the identification of components during assembly. The integrated poka-yoke principle prevents assembly errors and enhances process reliability during use.

The interface between the interchangeable head and the toolholder ensures precise, step-free milling results for both new tools and re-sharpened tool pairings. Worn interchangeable heads can be resharpened up to twice within specified diameter ranges. The ability to resharpen reduces resource consumption and further improves the system's cost-effectiveness.

The high axial rake angle design enables smooth cutting and excellent surface finishes. At the same time, the geometry ensures stable and reliable milling across universal applications.



IG96 – NEW GRADE

IG96 – NEW GRADE

With the IG96 carbide grade, HORN is expanding the range of applications for the S224 and S229 grooving systems for machining general and stainless steels. The carbide grade features a coating approximately 9 µm (0.0004") thick and is available for the L, KF, HR and KR geometries. The internally applied coating increases the grade's high-temperature strength and ensures a stable machining process even under demanding conditions. Users benefit from cost-effective machining of a wide variety of steel materials, as well as short lead times made possible by the in-house HiPIMS coating technology.

PRACTICAL TRIALS DEMONSTRATE THE POTENTIAL OF THE NEW CARBIDE GRADE.



FACTS

- Increased productivity due to a heat-resistant carbide grade
- Efficient machining of general and stainless steel materials
- Fast lead times thanks to in-house HiPIMS coating



Field tests demonstrate the potential of the new carbide grade. When machining C55 steel, an S229.0600.L4 insert in IG96 achieved a tool life of 500 components. The version previously used achieved a service life of between 250 and 280 components under identical cutting conditions. Service life was also significantly increased when machining 42CrMo steel. A custom insert in IG96 achieved 534 components, whereas comparable tools only reached 300 components. The carbide grade's higher wear resistance enables longer tool life and reduces the frequency of tool changes. IG96 thus supports productive and reliable machining in numerous groove turning applications.

NEW CUTTING WIDTH FOR THE SYSTEM 315

NEW CUTTING WIDTH FOR THE SYSTEM 315

HORN is expanding the System 315 grooving system to include a new variant for form grooving up to a width of 20 mm (0.787"). The system comprises standard toolholders as well as customised insert profiles for different workpiece contours. Users can machine wide form geometries in a single operation with this system. The expansion is particularly suitable for components with complex groove profiles and high process reliability requirements. For this new variant, HORN has developed a toolholder featuring both a top clamp and wedge clamping.

The tools are available in right-hand and left-hand versions with a shank size of 25 x 25 mm (0.984" x 0.984"). HORN is specifically supplementing the existing System 315 for wide form grooves and expanding the range of turning applications. For the variant with a 20 mm (0.787") grooving width, HORN utilises a modified top clamp with an M6 clamping screw, as well as new concepts incorporating wedge clamping. It is based on an existing clamping element and enables the clamping concept to be applied to larger cutting widths. At the same time, HORN optimised the chip clearance space and developed adapted toolholder geometries for stable machining processes.

THE EXPANSION IS SUITABLE FOR COMPONENTS WITH COMPLEX GROOVE PROFILES.



FACTS

- Expansion of System 315 for form grooving up to 20 mm (0.787") wide
- Short cycle times by eliminating machining steps
- For custom component geometries



SYSTEM 395 FOR PROFILE GROOVING

SYSTEM 395 FOR PROFILE GROOVING

HORN is expanding its tool range with the new Type 395 indexable insert. The horizontally-orientated, three-edged cutter is suitable for profile grooving and turning custom threads. With this new system, HORN offers a cost-effective yet flexible solution for demanding internal and external turning operations.

What sets the new Type 395 apart is the positioning of the indexable insert. Unlike in conventional systems, the insert does not rest against the periphery but is positioned in specially designed grooves. This opens up entirely new possibilities for profile design. The insert can be profiled almost freely, enabling customised tool solutions for a wide variety of customer requirements. The precision-ground cutting edges ensure a high level of process reliability. At the same time, the large contact surface of the indexable insert in the direction of the cutting force guarantees stable clamping in the toolholder. This has a positive effect on tool life, surface quality and process stability.

WHAT SETS THE NEW TYPE 395 APART IS THE POSITION OF THE INDEXABLE INSERT.



FACTS

- New insert seat for expanded possibilities in cutting edge profiling
- Three-edged indexable insert for greater cost-effectiveness in profile grooving and threading
- Stable clamping due to a flat contact surface in the direction of the cutting force



With three usable cutting edges, the new type 395 indexable insert also enhances cost-effectiveness in profile grooving and threading. The inserts can be customised to customer specifications and can optionally be manufactured with a chip-breaker groove. The tool coating is individually tailored to the specific application. HORN also prioritises high flexibility when it comes to toolholders. Various custom designs, such as boring bars or square shank toolholders, can be precisely adapted to the respective machining task.

Two blank sizes are available for the new Type 395, including a completely newly developed variant. HORN is thus expanding its portfolio with a high-performance tool system for complex profiling and threading operations with stringent demands on precision and cost-effectiveness.

NEW SINTERED CHIP-BREAKING GEOMETRIES FOR THE S274 TOOL SYSTEM

NEW SINTERED CHIP-BREAKING GEOMETRIES FOR THE S274 TOOL SYSTEM

With the expansion of the S274 tool system, HORN is strategically broadening its portfolio for grooving and turning. New sintered chip-breaker geometries ensure improved chip control, greater process reliability and more cost-effective machining on Swiss-type lathes.

For grooving and parting off, HORN is adding narrow grooving widths of 0.8 mm [0.031"] and 0.6 mm [0.236"] to the precision-sintered .1A chip-breaker geometry. The new variants enable a significant reduction in material loss whilst also supporting reliable chip formation, even with narrow cutting widths. The geometry is universally suitable for a variety of materials and covers feed rates ranging from 0.03 to 0.12 mm/rev [0.0012 to 0.0047"/rev]

The new inserts are available as type RS274 and as the RE274 variant featuring a pressed-in threaded insert for RH274 tool holders. HORN offers the inserts in the carbide grades TH35 and IG35. Due to the optimised chip-breaker geometry, users benefit from improved chip control and high process reliability during grooving and parting off.

In addition, HORN is expanding the S274 system to include the new sintered chip-breaker geometries .NF and .PR. The .NF geometry has been specially developed for grooving and longitudinal turning, whilst the .PR geometry is designed for back turning. Both geometries ensure controlled chip formation and stable machining processes, particularly on Swiss-type lathes. The .NF geometry is suitable for feed rates of 0.02 to 0.1 mm/rev [0.0008" to 0.0039"/rev] during grooving and longitudinal turning. The .PR geometry covers the same feed rate range for back turning. Both types are universally applicable to various materials and are also available in grades TH35 and IG35.

With these new geometries, HORN is specifically expanding the range of applications for the S274 system for demanding grooving and turning operations. Users benefit from high process reliability, improved chip control and cost-effective machining, even with narrow grooving widths and complex machining tasks.



HORN OFFERS THE INSERTS IN THE CARBIDE GRADES TH35 AND IG35.

FACTS

- Precision-sintered chip-breaker geometries .PR and .NF
- Reliable grooving and longitudinal turning on Swiss-type lathes
- Specially designed for back machining on Swiss-type lathes





INTERVIEW WITH MARKUS HORN

What is the significance of tungsten in the machining industry and, in particular, for HORN?

Tungsten forms the foundation for carbide tools. In cutting tools, tungsten is predominantly used in the form of tungsten carbide. For us, it is the most important raw material. It is used to manufacture inserts, milling cutters, drills and other precision tools. The advantages of tungsten carbide are its exceptional hardness, high wear resistance and excellent temperature resistance. Furthermore, tools made from tungsten carbide can achieve significantly higher cutting speeds than, for example, HSS tools.

To what extent is the precision tool industry currently dependent on supply chains?

The industry is heavily integrated into global supply chains. For us, factors such as availability, trade restrictions and geopolitical developments all have an impact on supply and cost structure.

To minimise these dependencies, the industry is increasingly focusing on recycling raw materials, for example by recovering cemented carbide from worn tools.

Have geopolitical changes in recent years had a tangible impact on procurement or production at HORN? If so, how?

Definitely. However, I need to look at the bigger picture here. Raw material prices are moving in an unfavourable direction worldwide and this affects

all tool manufacturers. However, material usage is not the only lever for offsetting or at least cushioning price increases, at least to a certain extent. Modular systems and interchangeable head systems are key. Conditions for production at our site are good. Alongside growth that has increasingly been taking place internationally for some time, we have recently invested again in land, buildings, machinery and equipment. These investments allow us to continue optimising our operations and to counteract the difficult market conditions, which include not only elevated raw material prices but also, for example, bureaucracy.

How important is recycling today for the supply of raw materials, and how well established is the circular economy within the industry?

As already mentioned, recycling plays an important role in the supply of raw materials. Around 50 per cent of the cemented carbide used in Europe comes from recycling. Cemented carbide is one of the materials for which reclamation and recycling have been established for many years. In our industry, the circular economy is comparatively well developed. Worn and decommissioned tools and production scrap represent valuable sources of raw materials.

Furthermore, unless technically required otherwise, we at HORN rely on solutions such as interchangeable head systems. One example of this is our DG milling system, where the toolholder body is made of tool steel and only the cutting head is made of cemented carbide. In turning and grooving operations, on the other hand, the use of indexable inserts is already very resource-efficient.

Unfortunately, there is little scope for improvement here. Nevertheless, we have been able to produce grooving tools with up to six cutting edges per indexable insert. Here too, the responsible use of raw materials is a priority, as is the cost per cutting edge.

RECYCLING PLAYS AN IMPORTANT ROLE IN THE SUPPLY OF RAW MATERIALS TODAY.

In your view, is there still untapped potential in the recycling of carbide?

Yes, there is still potential, particularly when it comes to the return of used tools. Not all carbide actually makes its way back into the recycling loop today.

As I mentioned, at HORN we manufacture in the most resource-efficient way technically possible. The issue of the circular economy has become increasingly important in recent years, on one hand to produce in a resource-efficient manner and on the other to reduce our dependency on the supply chain.

The circular economy plays an important role, not only with regard to cemented carbide, but also in the field of plastics. At HORN, we have now switched to using recycled plastics in order to operate even more sustainably in this area too. For this to succeed, all parties involved must play their part throughout the circular process. This also involves making the entire process as straightforward as possible.

How do you see the future development of cemented carbide as a cutting material compared to alternatives such as CBN or PCD?

Precision tools made from cemented carbide are constantly evolving, for example through the development of new substrates, coatings and geometries. As a result, this cutting material remains economically and technologically attractive for many applications. In certain sectors, CBN, PCD, as well as CVD-D and MCD, will continue to gain ground. Nevertheless, I am convinced that cemented carbide will retain a central role due to its versatility and broad range of applications. Ultimately, it is the customer benefit that determines which solution is economically viable and able to ensure process reliability.

Cemented carbide is not only used as a base material for tools, but also as a workpiece material by your customers. Do you have any examples of this?

Carbide is used, for example, to produce drawing dies for beverage cans or for ploughshares in agricultural machinery. Another example is guide jaws for jigsaw blades or punching tools for thin-film packaging, which our customers use to produce items such as yoghurt lids. We have the right tools to machine these products.

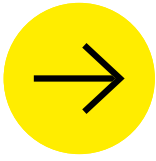


Markus Horn, Managing Director of Paul Horn GmbH.

How do you meet customer requirements when it comes to machining this specific material?

We rely on CVD diamond as the cutting material. It is extremely sharp and hard and, in our view, the first choice for machining carbide components. The major advantage over other processes, such as EDM, is the geometrically defined cutting edge. This provides the customer with high precision whilst also offering great freedom of movement and excellent tool life. It is clear that cemented carbide, whether as a cutting material or as a workpiece material, is fascinating and highly important. We at HORN have mastered both.





RELIABLE MACHINING OF CEMENTED CARBIDE

Turning carbide instead of grinding it – what still sounds like a theoretical experiment to many tool-makers – has long been part of everyday life at Linhardt Tec.Point. In the toolmaking department of the international packaging specialist Linhardt, high-precision components are produced which are required throughout the group for squeeze tube and can production lines. The team in the Viechtach factory in Germany relies on G30 carbide grade – an extremely tough, wear-resistant material that places the highest demands on the machine, tool and process. Together with Paul Horn GmbH, Linhardt has spent over ten years developing a machining technology that today delivers genuine competitive advantages: stable processes, long tool life, first-class surface finishes and machining capabilities that were previously only achievable through time-consuming grinding.

By Robert Fraunberger, x-technik

Linhardt is one of the leading manufacturers of aluminium and plastic packaging solutions. Tubes, aerosol cans, small aluminium containers – products used worldwide in the healthcare, beauty and home sectors. To ensure that the necessary tools, moulded parts and wear components are always available in consistently high quality, the group operates its own state-of-the-art toolmaking facility, Linhardt Tec.Point.

TOOLMAKING OF STRATEGIC IMPORTANCE

“We produce the tools for tube and can manufacturing, as well as spare parts and mould components and maintenance parts for the entire Linhardt Group,” explains Stefan Bielmeier, who has been heading up the Tec.Point since early 2025. “In our

CARBIDE IS A KEY MATERIAL FOR THE COMPANY’S FUTURE VIABILITY.

department, we assess technical feasibility, design and manufacture the tool, then run it in, test it and finally hand it over to production.”

For sustainability reasons, Linhardt is increasingly working with recycled materials such as PCR aluminium. “These materials can only be machined reliably using carbide tools. It simply doesn’t work any other way,” emphasises Bielmeier. Carbide is therefore a key material for the company’s future viability.

MATERIAL PROPERTIES THAT MAKE ALL THE DIFFERENCE

At Tec.Point, grade G30 carbide is predominantly used. “A fine-grained, very hard material that is prone to significant chipping if machined incor-



Internal threads in G30 carbide: The turning process, developed in collaboration with HORN, enables reliable thread production.

rectly,” explains Michael Högerl, a CNC turner and certified carbide specialist at Linhardt. It is precisely this combination of hardness and fine grain size that makes G30 valuable for the manufacture of durable tool components, whilst at the same time making it difficult to machine.

Martin Preißer, Team Leader for Turning/Grinding, sums up its importance: “Carbide is essential for us because it increases tool life and the process reliability of our products.” Components such as upsetting heads or necking rings must function precisely over long periods. Conventionally hardened tool steels do not achieve this service life – but carbide does.



SHORTCUTS

Task: To economically manufacture durable, high-precision tool components from cemented carbide and reduce time-consuming grinding.

Solution: Reliable turning of G30 cemented carbide using specially designed CVD diamond tools in close partnership with Paul Horn GmbH.

Benefits: Longer tool life, shorter machining cycles, consistent surface quality, greater design freedom and significantly improved process reliability.

FROM GRINDING TO TURNING

For decades, carbide was almost exclusively ground. However, grinding is time-consuming, geometrically limited and not suitable for every contour. "Thanks to HORN's CVD inserts, we can largely eliminate the need for grinding," says Högerl. "We can switch much of the work to turning, making it more cost-effective, faster and highly process-reliable."

Preißer confirms the added value from a manufacturing perspective: "More complex contours, which would be very time-consuming to grind, can now be produced in less time using HORN tools." Linhardt has thus achieved something that very few companies worldwide are capable of: turning cemented carbide with precision, stability and process reliability.

CVD DIAMOND AS THE KEY

For machining, Linhardt relies consistently on tools from Paul Horn GmbH. Sales representative Michael Götze has been supporting the company since 2014 – the year Linhardt first began turning cemented carbide.

The use of thick-film CVD diamond is central to this. "CVD is ideally suited to machining cemented carbide," explains Götze. "PCD contains a binder and is not as hard. For G30, CVD diamond is clearly superior." Furthermore, the geometries and substrates have been continuously refined over the years. "Our product specialist for ultra hard cutting materials was very resourceful in this regard, both geometrically and technically." The prerequisites are a stable machine, precise clamping and exact cutting parameters. Provided these conditions are met, G30 can be machined reliably.

MASTERING PROCESSES

Today, Linhardt machines carbide to a standard that was unimaginable just a few years ago: face turning, internal and external turning, contouring, grooving and, more recently, even internal threading in car-



"Carbide machining is a key factor in our success. With the right technology and a strong partner like HORN, we are now able to master processes that ensure sustainability in terms of tool life, quality and cost-effectiveness."

Stefan Bielmeier, Head of Tec.Point – Tools & Technology, Linhardt Viechtach GmbH & Co. KG



Quality assurance after machining: Where required, components are measured on a CMM at Linhardt to ensure dimensional and geometric accuracy.



Axial groove in G30 cemented carbide: a particularly demanding machining operation that is carried out reliably at Linhardt Tec.Point.

bide. "That didn't exist before," emphasises Högerl. "The development of internal threading in carbide was carried out in collaboration with HORN."

Götze also describes the complexity of the subject: "The corner radius is extremely small and the cutting parameters must be exactly right. The

WITH HORN TOOLS, WE CONSISTENTLY ACHIEVE R_z VALUES BELOW 1 μm .

number of passes is crucial. But we managed it together." This enables Linhardt to tap into applications that were previously only possible through grinding or EDM.

SURFACE QUALITY AS A CRITICAL SUCCESS FACTOR

As the machined components come into direct contact with the final material during production, the surface finish also plays a key role. "Surface finish is extremely important because it is directly reflected in the end product," says Preißer. "With HORN tools, we consistently achieve R_z values below 1 μm ." This reproducibility is crucial for process reliability and avoiding scrap.

PARTNERSHIP RATHER THAN A SUPPLIER RELATIONSHIP

The collaboration between Linhardt and HORN has developed over the years into a close technical partnership. Götze describes it in clear terms: "It's hardly a collaboration anymore – more of a partnership. Very trusting, very open. It couldn't work any better."

HORN also demonstrates a strong commitment to support. "Six times a year and on call at a moment's notice," Götze continues. Bielmeier confirms the high regard in which the tool manufacturer is held. "All HORN staff responsible for our account are highly qualified, efficient and quick. We are very satisfied."



"For years, Linhardt has demonstrated that machining carbide with CVD diamond is entirely feasible. This partnership is a true example of what becomes possible when processes are systematically mastered."

**Michael Götze, Field Sales Representative,
Hartmetall-Werkzeugfabrik Paul Horn GmbH**



Linhardt relies exclusively on CVD tools from HORN for carbide machining.



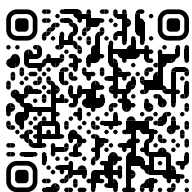
Mastering processes together (from left to right): Stefan Bielmeier, Michael Götze (HORN), Michael Högerl and Martin Preißer (both Linhardt Tec.Point).

TURNING CEMENTED CARBIDE

Carbide, particularly fine-grained carbide grades such as G30, combines extreme hardness with high wear resistance. During turning, this results in high cutting forces and a risk of chipping along the cutting edge. For this reason, for a long time carbide was predominantly ground.

Today, CVD diamond tools offer a cost-effective alternative. Due to their binder-free structure, they achieve exceptionally high hardness and wear resistance. In combination with stable machines, optimised geometries and precisely defined cutting parameters, even complex contours and internal threads in cemented carbide can be turned reliably.

The advantages include: shorter machining cycles, reduced grinding requirements, high process reliability, excellent surface finishes ($R_z < 1 \mu\text{m}$) and expanded geometric possibilities.



Watch the video case study:
www.horn-group.com/news/application-stories/detail-page/reliable-machining-of-carbide

A TECHNOLOGY WITH A FUTURE

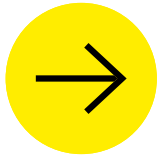
Today, carbide machining is a strategically important cornerstone for Linhardt. Processes such as turning instead of grinding make toolmaking faster, more flexible and more cost-effective – whilst also delivering longer tool life and better quality. Götze sums it up: “We have proven that machining with CVD diamond is absolutely viable and offers a real future.”

For Linhardt, the direction is clear. “Further optimisation, further automation and, together with HORN, developing new applications that will continue to set technological benchmarks in the years to come,” says Stefan Bielmeier, looking to the future.



LINHARDT VIECHTACH GMBH & CO. KG

The Linhardt Group is one of the leading manufacturers of aluminium and plastic packaging solutions. The company develops and produces squeeze tubes, aerosol cans, rigid aluminium tubes and containers for customers in the healthcare, beauty and home sectors. Linhardt has an international presence and operates production sites in Europe and Asia. With Linhardt Tec.Point, the group has its own highly specialised toolmaking facility with a high degree of vertical integration. This is where tools, moulded parts and wear components for group-wide production are manufactured – with particular expertise in carbide machining.



MACHINING CEMENTED CARBIDE COST-EFFECTIVELY

Machining cemented carbide is one of the most demanding tasks in manufacturing. It is precisely the properties that make the material suitable for wear-resistant applications that make it difficult to machine. Hardness levels exceeding 1,500 HV cause severe wear on conventional cutting tools within a very short time. Nevertheless, the demand for complex cemented carbide components is rising steadily. For these applications, HORN uses tools with a CVD thick-film diamond coating to machine sintered cemented carbides by turning, drilling and milling.

Cemented carbide has long since ceased to be used exclusively as a cutting material. In metal forming, drawing dies, matrices and punches are made from cemented carbide. Pump and valve technology utilises the material for highly stressed sealing and wear components. In the wire industry, guides and drawing tools are made of the material. There are also applications in the medical industry, semiconductor manufacturing and in plants that convey or process abrasive media. Many of the components feature contours, radii, grooves or bores. They are often manufactured by grinding. Whilst this process delivers high precision, it can involve significant manufacturing effort, depending on the geometry. Grinding reaches its economic limits particularly when dealing with internal contours, small radii or three-dimensional geometries. In such cases, single-point machining offers an alternative or complements existing process chains.

CVD-D AS A CUTTING MATERIAL

For machining cemented carbide, HORN relies on tools tipped with thick-film CVD diamond. The cutting material is produced by chemical vapour deposition (CVD). Unlike CVD-coated tools, the cutting edge consists almost entirely of diamond (99.9 per cent). The high hardness of the cutting material significantly reduces wear when machining abrasive materials. Its range of applications is not limited to individual machining processes. Different tool systems are used depending on the task at hand. This enables both external and internal contours, as well as milling operations, to be carried out on sintered carbide.

Turning often involves creating profile contours, grooves or transition radii. In the past, these geometries often had to be ground. With CVD-coated turning tools, many of these operations can be carried out directly by machining. The tools produce defined contours in the cemented carbide and reduce the effort required for subsequent machining. Turning offers particular advantages for smaller production runs or varying geometries. Tool adjustments can be made quickly and without the need for the time-consuming manufacture of special grinding wheel profiles. For the user, the focus is less on the pure machining



The use of CVD-coated tool systems enables complex contours to be machined in fully sintered cemented carbide.

GUIDES AND DRAWING TOOLS ARE USED IN THE WIRE INDUSTRY.



CVD milling tool for chamfering or countersinking.



CVD-coated ISO indexable inserts are also used for internal turning.

cycle. The key factor is the simplification of the process chain. If a contour is already produced by turning, the effort required in subsequent operations is reduced.

INTERNAL MACHINING WITH SUPERMINI AND MINI

Special requirements arise when machining bores and internal contours. Small internal diameters limit the available machining space whilst simultaneously increasing the load on the tool. For these applications, HORN uses CVD-coated tool systems from its Supermini and Mini product lines. The tools machine bores, internal radii and grooves, allowing even complex internal geometries to be produced economically and reliably. Particularly in the case of drawing tools or wear components, the quality of the internal contour determines the subsequent functionality of the component. The requirements for dimensional accuracy and process stability are correspondingly high. Alongside turning and drilling, milling and drilling are increasingly gaining ground. Double-fluted or single-fluted CVD-coated milling systems machine pockets, grooves and free-form surfaces, as well as bores, directly in cemented carbide. This creates geometries that previously could only be manufactured using conventional grinding processes at considerable expense. Milling offers particular advantages for prototypes, individual parts or small production runs. Changes to the component geometry can be implemented quickly without having to redesign entire grinding processes. Machining takes place while the material is in its sintered state. This eliminates the need for additional process steps between shaping and finishing.

A PRACTICAL EXAMPLE

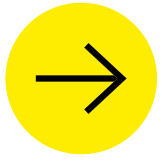
A practical example from the production of a carbide press punch demonstrates the potential of machining with CVD-coated tools from HORN. The aim was to replace the previous process – comprising electrode production, EDM, grinding and polishing – with direct machining. The entire process is carried out on a machining centre in a single setup. Several milling operations using CVD diamond tools create the final contour directly in the sintered carbide. The result: finishing time is reduced from more than two hours to just 12.5 minutes. Including electrode production, the previous process took up to eight hours. For the user, this example demonstrates the potential offered by new manufacturing technologies.

EXPANDING CAPABILITIES

With tool systems based on CVD thick-film diamond, HORN is expanding the possibilities for machining cemented carbide. Contour turning, internal machining with Supermini and Mini, as well as milling and drilling processes, enable cost-effective process solutions for complex components. For users, this means shorter process chains, greater flexibility in production and new degrees of freedom in the design of cemented carbide components.



Double-fluted tools are usually used for milling and drilling.



PCD MILLING CUTTERS FOR THE FOOD INDUSTRY

Precision, performance and hygiene: machines for meat processing are subject to strict regulations. Consequently, in the manufacture of machines for the meat industry, great emphasis is placed on the quality of the individual components. The contract manufacturer CNC-Service Eisemann, based near Winnenden, is regarded as a specialist in the machining of these assemblies. For milling an aluminium casting for a carcass splitting saw, the company relies on PCD milling systems and a 280 mm (11.024") diameter side milling cutter from Paul Horn GmbH. "The performance of the tools, as well as the service and fast delivery from HORN, won us over," says Managing Director Steffen Eisemann.

Carcass splitting saws are key machines in the meat industry and are used in particular in slaughterhouses for the precise longitudinal splitting of pig and cattle carcasses. Thanks to powerful drive systems and precisely guided saw blades, they enable a straight cut along the spine, thereby laying the foundation for subsequent butchering and processing operations. Modern splitting saws reduce cutting losses, minimise bone splintering and ensure a consistently high cut quality even at high cycle rates. Ergonomic designs, low-vibration construction and hygienic materials made of stainless steel and aluminium support safe and efficient operation. Thanks to easy cleaning and a robust design, splitting saws meet the meat industry's high standards for product quality and hygiene.

SAND-CAST RAW PARTS

Eisemann's team manufactures around 250 splitting saw housings per year on its machining centres. It receives the raw parts directly from the equipment manufacturer, which produces them using the aluminium sand casting process. This is precisely where the challenge of ensuring reliable manufacturing arises. "When machining the large surfaces, we very quickly reached the limits of conventional indexable insert milling cutters," explains Eisemann. Due to the thin walls of the component, vibrations occurred during machining as a result of the high cutting pressure. Switching to special aluminium geometries for the indexable inserts did solve the vibration problem, but the wear on the cutting edges was too high. "The problem lies with sand casting. The cast skin always contains small abrasive sand inclusions from the mould. After just two workpieces, the inserts were worn out, meaning we could no longer maintain the required surface finish," explains Eisemann.

The solution was clear to Eisemann: to ensure process reliability and cost-effective machining of the aluminium parts, he needed to switch the milling process to PCD-tipped milling systems. The managing director examined the solutions offered by various manufacturers in detail and, in doing so, became aware of the



The required surface quality can be reliably achieved through the use of finishing cutters.



The DM60 milling cutter is part of the newly developed HORN PCD milling system.

newly developed PCD milling system from HORN. He therefore contacted his designated HORN sales representative, Stephan Weiß. "Once he had described the machining problems, it was clear to me that we could solve them with our system," says Weiß.

PCD MILLING CUTTERS IN ACTION

Standard tools from HORN are used to machine the castings. Eisemann uses four different milling tools per component. For roughing, an 80 mm (3.149") diameter tool with a wide tooth pitch and 7 teeth is used, followed by a fine-pitch variant with 16 teeth for finishing. For other operations, a 63 mm (2.480") diameter tool with a wide tooth pitch and 6 teeth is used for roughing and a fine-pitch version with 14 teeth for finishing. The results of the changeover were clear: the roughing process is twice as fast compared to the carbide indexable carbide inserts. The cutting speed during roughing is $v_c = 2,000$ m/min (6,561.68 ft/min) (previously $v_c = 1,000$ m/min (3,280.84 ft/min)). Roughing is carried out in two infeed settings with a depth of cut of $a_p = 2.5$ mm (0.098"). To achieve the high surface finish required, Eisemann relies on the types with fine tooth pitch and a large number of teeth. The milling cutters perform the finishing cut with an allowance of 0.1 mm (0.004") and a cutting speed of $v_c = 2,000$ m/min (6,561.68 ft/min).

EISEMANN USES FOUR DIFFERENT MILLING TOOLS PER COMPONENT.



HORN supplied the special side milling cutter with a diameter of 280 mm (11.024") within four weeks.

"Good tools and a precise machine are one thing, but correct clamping of the component is another," says Eisemann, discussing fixturing of the component. The outer surface must have a maximum parallelism tolerance of no more than 0.05 mm (0.002") relative to the inner surface. For a thin-walled cast component measuring around 1,200 mm (47.244") in length and 400 mm (15.748") in width, this tolerance poses a major challenge. As soon as the initial casting skin is rough-machined away, internal stresses are released in the raw part, leading to warping. Eisemann solved the problem by utilising a four-setup sequence. First clamping (outer side): roughing and pre-finishing. Second clamping (inner side): roughing and semi-finishing. Third clamping (outer side): finishing. Fourth clamping (inner side): finishing.

LESSONS LEARNT

"We've learnt a great deal from this component. We know exactly where to position the clamping jaws and how to support the thin-walled component so that we can meet the tight tolerances," says Eisemann. Tool life also impressed the managing director. Whereas he originally produced two components per carbide insert, the end of the service life of the PCD milling cutters has not been reached after 75 components. The required surface finish can be reliably maintained throughout the process.

SPECIAL SIDE MILLING CUTTERS

When the splitting saw is subsequently used, the saw band runs in a deep groove that passes through the housing. The precision of the groove is critical to ensure that the saw band does not come into contact with the groove flanks during operation. Touching them would result in the meat being contaminated with metal debris or swarf. To machine the groove, Eisemann required a side milling cutter having a diameter of 280 mm (11.024") and a cutting width of 5 mm (0.197"). He requested quotes for such a tool from various manufacturers. "We evaluated the full range of responses: from no reply at



The use of the HORN PCD roughing milling cutter halves the machining cycle time and ensures a long tool life.



A successful collaboration: Steffen Eisemann in conversation with HORN's field sales representative Stephan Weiß.

all to exorbitant prices and a lead time of six months. HORN supplied us with the custom tool within four weeks. It worked straight away," says Eisemann.

The side milling cutter has a diameter of 280 mm (11.024") and a maximum cutting depth of 96 mm (3.779"). The cutting width is 5 mm (0.197"), divided between left-hand and right-hand inserts. The tool has 16 teeth and is fitted with type 314 inserts, whose geometry is designed for machining aluminium. In operation, the tool mills the groove at a cutting speed of $v_c = 600 \text{ m/min}$ (1,968.5 ft/min).

CUSTOMER SATISFACTION

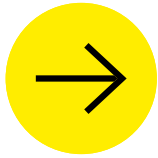
"We are very satisfied with HORN's performance and service. The production solutions for this aluminium part have once again shown us why we prefer to buy directly from the tool manufacturer. Experience has shown us that this offers the highest consistency in quality and service, and the guarantee that the process works," says Eisemann.

THE PRECISION OF THE GROOVE IS CRUCIAL TO ENSURE THAT THE SAW BAND DOES NOT COME INTO CONTACT WITH THE GROOVE FLANKS DURING THE CARCASS SPLITTING OPERATION.



CNC-SERVICE EISEMANN

CNC-Service Eisemann specialises in high-precision CNC machining and bespoke manufacturing solutions in the field of metalworking. At its Berglen site, the company produces individual parts, small batches and series runs for customers across a wide range of industries. State-of-the-art 3-, 4- and 5-axis machining centres, together with a climate-controlled production environment, enable machining to within a hundredth of a millimetre and ensure maximum process stability. Through the use of robot-assisted manufacturing technologies, CNC-Service Eisemann combines precision, efficiency and excellent adherence to deadlines. The company focuses on collaborative partnerships, short decision-making paths and bespoke solutions for demanding manufacturing tasks. With a modern, well-equipped factory floor, a high degree of vertical integration and a consistent focus on quality, CNC-Service Eisemann is establishing itself as a reliable partner for demanding CNC milling and machining projects.



25 YEARS OF HORN IN HUNGARY

HORN is still going strong in the Hungarian market, 25 years after the founding of HORN Magyarország Kft. Yet things didn't necessarily look that way in the early years. Founded on 1st February 2001, the company was officially registered on 17th May 2001. This is when the first problem arose. The primary business activity had to be registered as "wholesale trade in furniture, household goods and hardware on a commission basis". There was nothing more appropriate. Between 2001 and 2003, the focus was on the Hungarian market. From 2003 onwards, our sales territories expanded to neighbouring countries – first to Romania, then to Croatia, followed by Bulgaria and Serbia.

A CHALLENGING MARKET

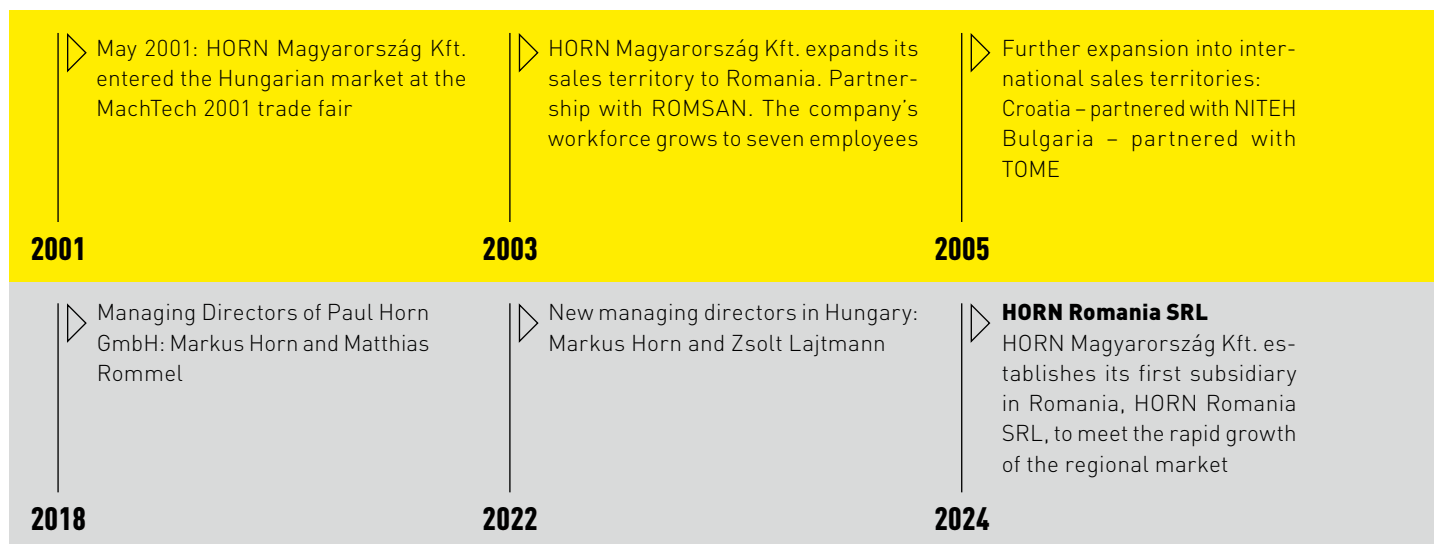
The first six years in the market were challenging. Andreas Vollmer in particular – now Head of Global Sales and at that time Head of Exports and Managing Director of the Hungarian branch – and Zsolt Lajtmann, now Managing Director and at that time National Sales Manager for Hungary, faced particularly demanding hurdles during that period. Indeed, there were even discussions about how – and indeed whether – the company could carry on. Lothar Horn, the former Managing Director of Paul Horn GmbH, said at the time: "Either I'll be here to celebrate the 10th anniversary, or we draw a line under it." And although the forecasts were not positive, the HORN team demonstrated what is possible. Perseverance, ambition,



Markus Horn, Managing Director of Paul Horn GmbH.

PERSEVERANCE, AMBITION, DEDICATION, LOYALTY, PASSION AND A CUSTOMER-FOCUSED APPROACH HAVE LED TO A SUCCESS STORY.

dedication, loyalty, passion and a customer-focused approach have led to a success story emerging in this difficult and price-driven market. Each and every team member demonstrated that the Hungarian machining market not only held immense potential for HORN, but that HORN was exactly where it belonged.





The HORN team in Hungary at Mach-Tech 2026.

GYŐR AS A STRATEGIC LOCATION

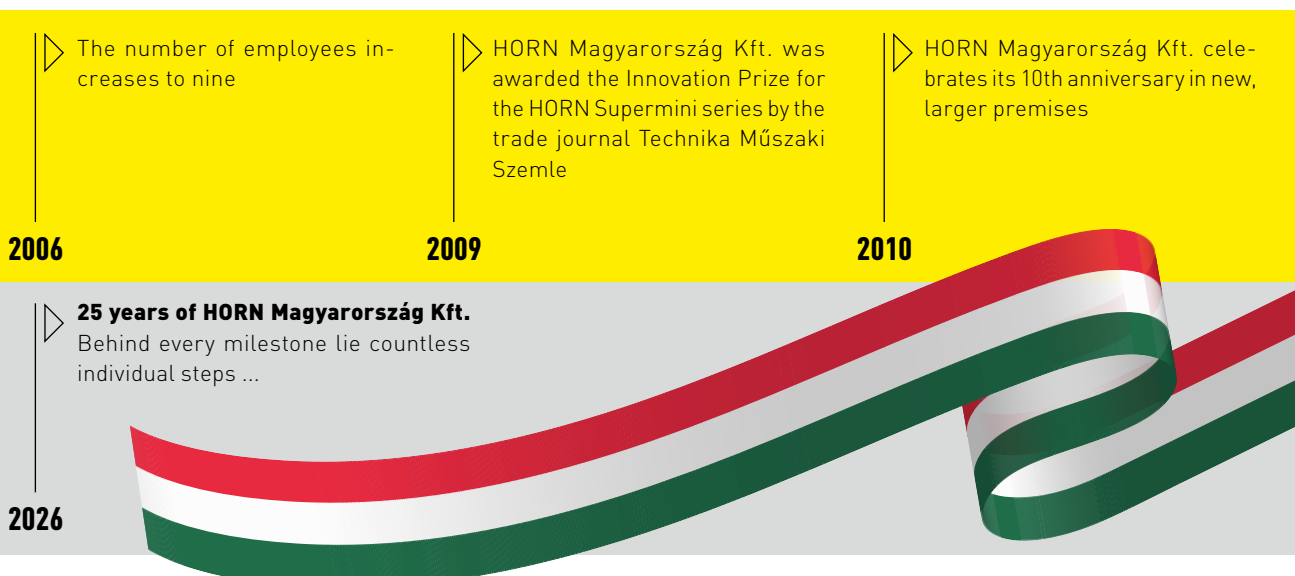
HORN serves the Hungarian market from its base in Győr. Győr is not just any location – it is the vibrant, beating heart of Hungarian industry. “Here, we are incredibly close to the pulse of our customers’ businesses. Furthermore, we have embarked on a new joint venture by establishing our own sales office in Romania. What a remarkable development!” says Zsolt Lajtmann.

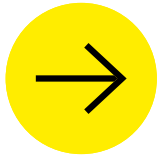
WHAT DOES THE FUTURE HOLD?

Markus Horn, Managing Director of Paul Horn GmbH: “I’m optimistic about the future. I know that, with our expertise, our products and our service, we’re ideally positioned. We’re partners on an equal footing with our customers. We listen. We keep our finger on the pulse and develop market-oriented products. Yet we still give our creative minds enough freedom. After all, innovation comes about in different ways. For Hungary, this means we’re looking ahead and building on the positive momentum of the past 25 years.”



Zsolt Lajtmann, Managing Director of HORN Magyarország Kft.





STANDARD TOOLS AS THE FOUNDATION OF ECONOMICAL MANUFACTURING PROCESSES

In machining, companies face the challenge of manufacturing components cost-effectively, reproducibly and with a high degree of process reliability. Standard tools play a key role in this context. They are available at short notice, cover a wide range of applications and form the basis of daily production in many workshops. Paul Horn GmbH develops and manufactures a comprehensive range of standard tools for various machining methods and materials.

The portfolio comprises around 25,000 tools for turning, grooving, milling, drilling, threading and other machining processes. Users can find solutions for numerous machining tasks, ranging from simple standard applications to more demanding geometries and materials. At the same time, proven tool systems can often be flexibly adapted to different requirements.

GROOVING AND TURNING AS CORE APPLICATIONS

A key focus of the standard range is on grooving and turning. Here, HORN offers various tool systems for grooving, parting off, face grooving and profile turning. The systems are used in both series production and for smaller batch sizes. Thanks to optimised cutting geometries and a range of cutting materials,

THE SYSTEMS ARE USED IN BOTH MASS PRODUCTION AND FOR SMALLER BATCH SIZES.

users can tailor the tools to the workpiece material and machining task. This supports controlled chip formation and contributes to stable processes. In addition, solutions are available for threading and for machining complex contours. In numerous manufacturing sectors, the challenge lies in efficiently combining different machining steps. Standardised tool systems simplify this task, as they are based on tried-and-tested platforms and can be integrated into existing production workflows.

MILLING TOOLS FOR DIVERSE APPLICATIONS

In addition to turning operations, the standard range includes a wide variety of milling tools. These include, for example, tools for groove and slot milling, thread milling, and systems for machining special features and contours. Precise tool design is particularly im-



The sintered I-geometry is specifically designed for machining materials with poor chip-forming properties.



The DA65 milling system ensures process reliability across a wide range of applications, high performance and cost-effectiveness for the user.

important for small diameters and delicate component geometries. Standard tools offer the advantage that their properties and performance limits are already known in many applications. This allows users to draw on existing experience and set up machining processes more quickly. Tools with polycrystalline diamond (PCD) cutting materials are also available for machining aluminium and other non-ferrous metals. These tools are primarily used where stringent requirements are placed on surface quality and tool life.

HOLE PRODUCTION

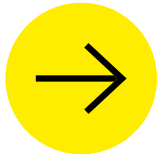
Drilling and boring are among the most common machining operations in metalworking. Accordingly, the standard HORN range includes various drilling systems for different materials and applications. Depending on the task, tools are available for both initial drilling and finishing. This allows dimensional accuracy and surface quality to be specifically controlled. Particularly in areas such as general engineering, the automotive industry, the medical sector and the aerospace industry, component functionality and ease of assembly often depend on precisely machined holes. Standardised tool systems support reproducible manufacturing processes in these areas.

AVAILABILITY AND PLANNING RELIABILITY

A key advantage of standard tools lies in their immediate availability. Companies can draw from a defined inventory without having to develop a bespoke solution for every machining task. This simplifies procurement, stock management and production planning. At the same time, users benefit from the fact that

many tools are already in use in comparable applications. Practical field experience is continuously incorporated into the further development of the systems. This results in tools that are tailored to the requirements of modern manufacturing processes.

For users, it means greater planning reliability. Tools can be selected, procured and integrated into existing processes more quickly. This reduces the effort involved in introducing new components and supports flexible production.



TOOLS FOR THE PHARMACEUTICAL INDUSTRY

Superminis, circular interpolation milling cutters or grooving systems – with its standard product portfolio of over 25,000 tools, Paul Horn GmbH offers a wide range of tool systems that are used daily worldwide. Rommelag, a specialist in the development and manufacture of filling systems, has relied on HORN tooling systems for more than 30 years. They are used extensively in Rommelag's production across the board in a wide variety of configurations. "To be able to react quickly to variable production requirements, standard tools are our first choice. We can have these on site within 24 hours," says Senior Strategic Manufacturing Technician Robin Korn.

The bottelpack systems developed by Rommelag are based on blow-fill-seal (BFS) technology, an aseptic process for the manufacture, filling and sealing of plastic containers in a closed system. The container is formed from plastic granulate, filled immediately with the product and then hermetically sealed – all within a few seconds and without human intervention in a critical production area. The process minimises the risk of contamination and meets the strict requirements of regulated sectors such as the pharmaceutical and medical industries. The systems are characterised by their high process reliability, reproducibility and flexibility. Different container geometries, fill volumes and product types can be accommodated on a single platform. Modern control and monitoring systems ensure precise oversight of all process parameters and support seamless documentation. By integrating moulding, filling and sealing into a single machine, bottelpack systems reduce space requirements, simplify validation processes and enable cost-effective production.

HORN SYSTEMS IN USE

The company has relied on systems from the Tübingen-based tool manufacturer for over 30 years. Consequently, a wide range of different systems is in use on the machines at Rommelag. "You'll find Superminis and Minis on every lathe here," says Korn. The Supermini system, for example, is used in the production of so-called mandrel tubes. Here, the new HORN Supermini with sintered geometry solved one of Rommelag's biggest problems – scratched surfaces caused by long, tangled bird's nest swarf. "Surface finish is a key quality metric for us, particularly in the production of mandrel tubes," explains production planner Stephan Bussmann. A mandrel tube consists of several individual tubes connected one inside the other. Its function is to inflate the plastic containers, cool them and subsequently fill them. During the filling phase, the liquid (for example, an infusion solution) comes into contact with the inner surface of the tube.

The chip-breaker geometry of the Supermini ensures short, fine chips during boring. This significantly reduces the time and effort needed to electropolish the tube, whilst simultaneously increasing the process reliability of the boring operation, as



The System 315 handles axial grooving of O-ring grooves.



The Superminis with sintered geometry ensure short chips, high surface finishes and process reliability.

there is no longer any risk of swarf becoming entangled. "The tool offers us enormous added value for boring, as we machine almost exclusively long-chipping, stainless materials." With the Supermini type 105, HORN has succeeded in developing a universal boring tool with sintered chip-breaker geometry. The tool offers high process reliability in use thanks to its excellent chip control. For internal boring, the tool manufacturer offers inserts for machining various diameters, starting at 4 mm (0.157"), 5 mm (0.197") and 6 mm (0.236"). The cutting edge geometry extends well into the corner radius of the insert. This ensures chip control even at small depths of cut.

WITH THE SUPERMINI TYPE 105, HORN HAS SUCCEEDED IN DEVELOPING A UNIVERSAL TURNING TOOL WITH SINTERED CHIP-BREAKER GEOMETRY.

AXIAL GROOVING WITH THE SYSTEM 315

For the production of axial grooves, Rommelag relies on the three-edged indexable insert from the 315 system. "We have to cut axial O-ring grooves into numerous components that are flanged together. As these are usually aseptic connections, a high surface finish is, of course, essential," says Korn. The standardised, full-radius Type 315 insert is used to machine the grooves. "The System 315 is a 'jack-of-all-trades' among three-edged indexable inserts. In addition to numerous standard variants, the tool system can also be easily configured



The Supermini system is used for internal grooving.

as a custom tool for customer-specific profiles," says HORN field sales representative Stephan Weiß. Profiles with a cutting width of up to 20 mm (0.787") can be produced with the System 315.

Another application is the milling of gear teeth. At Rommelag, all gear components are manufactured in-house. The gears are also made from stainless steels. For milling the teeth, the production department relies on HORN's circular interpolation milling system. The standard profile of the tool's six teeth matches the target profile of the workpiece's tooth flanks. Due to the nature of the workpiece, the tool has a long overhang. Thanks to the vibration-damping solid carbide shank, there are no issues with tool vibration. The precise interface between the holder and the insert ensures that the insert enables micrometre-accurate roundness and run-out when swapping inserts. Roughing and finishing are carried out using the same tool.

HIGH STABILITY

The tool mills the individual teeth into the workpiece in several passes. The roughing cuts have a depth of $a_p = 1 \text{ mm}$ (0.039") and are milled at a cutting speed of $v_c = 100 \text{ m/min}$ (328.084 ft/min). The finishing allowance is 0.1 mm (0.004"). The finishing pass for the final tenth of a millimetre (0.0039") to achieve the finished dimension is at a cutting speed of $v_c = 100 \text{ m/min}$ (328.084 ft/min) using conventional up-cut milling. Despite the high cutting pressure exerted by the six teeth, HORN's tools demonstrate impressive stability. The six teeth deliver excellent milling performance and allow for higher cutting speeds.

Groove milling, cut-off milling or gear milling: these are just three of the milling processes that the HORN circular interpolation milling system handles efficiently. As a true all-rounder, the extensive tool portfolio of this system is capable of handling several other milling processes. Suitable for use from an internal diameter of 8 mm (0.315") for precise boring, slot milling of narrow grooves having a width of 0.2 mm (0.008") and milling of splines, these milling tools prove to be reliable problem-solvers in their numerous standard configurations as well as in special customised forms for a range of other milling processes.



For gear cutting, Rommelag relies on the HORN circular interpolation milling system.



A successful collaboration: Robin Korn in conversation with Stephan Weiß and Stephan Bussmann.

SUCCESSFUL COLLABORATION

The examples described represent only a small selection of the HORN tool systems in daily use at Rommelag. Alongside numerous standard tools, a wide range of bespoke solutions tackle complex machining applications. "We are very satisfied with HORN's tools. That is why we have been using their systems for over 30 years. Furthermore, service, advice and fast delivery times are also important to us. As a supplier, HORN meets all these criteria for us," says Bussmann.

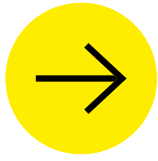
The long-standing collaboration between Rommelag and HORN demonstrates how both standard and custom tools can contribute equally to making demanding manufacturing processes cost-effective and reliable. In addition to the tools' performance, Rommelag particularly values the technical advice and ready availability of the systems.

IN ADDITION TO NUMEROUS STANDARD TOOLS, A WIDE RANGE OF CUSTOMISED SOLUTIONS TACKLE SPECIAL MACHINING APPLICATIONS.



ROMMELAG SE & CO. KG

Rommelag is a leading worldwide supplier of aseptic packaging and filling solutions for the pharmaceutical, chemical and cosmetics industries. The family-owned company, headquartered in Sulzbach-Laufen, is regarded as the inventor of blow-fill-seal (BFS) technology, in which plastic containers are manufactured, filled and sealed directly in a fully automated process. With its bottelpack systems, Rommelag enables the safe, efficient and low-contamination packaging of liquid and semi-solid products. In addition to machinery and technologies, the company offers development, contract filling and support services throughout the entire product life cycle. Rommelag operates internationally and supports customers worldwide in implementing sophisticated packaging solutions.



RELIABLE GRAPHITE MACHINING

“The surface finish was too good; we had to tweak the process parameters to make it worse,” jokes Konrad Zipser as he talks about their first use of the new PCD tools. The managing director of Zipser Milling GmbH in Lorch, together with his team, specialises in contract machining of graphite components and other workpieces. For machining high-purity graphite, Zipser relies on diamond tools from Paul Horn GmbH, thereby increasing the cost-effectiveness of his machining processes.

Cost-effective machining of graphite places particular demands on cutting tools. Due to its ceramic-like structure and highly abrasive properties, experienced machinists rely on diamond cutting materials. PCD or CVD tool systems are usually employed for this purpose. By using high cutting speeds, appropriate feed rates and dry machining, the user achieves precise contours and exceptional surface finishes. At the same time, tool wear is reduced and contamination is avoided, which could compromise the high purity of the material.

HIGH-PURITY GRAPHITE

The production of high-purity graphite (99 per cent purity) involves a precisely coordinated process comprising shaping, carbonisation and subsequent high-temperature treatment. Petroleum coke or pitch coke with a precisely defined ash content is used as the raw material. Following moulding, the material is carbonised at 800 to 1,000 degrees Celsius (1,472 to 1,832 degrees Fahrenheit) in the absence of oxygen. This drives off volatile components and creates a carbon-rich matrix. During the subsequent graphitisation at temperatures above 2,000 degrees Celsius (4,532 degrees Fahrenheit), the carbon atoms rearrange themselves into a hexagonal crystal structure. To further reduce metallic and mineral impurities, a halogen purification process is employed in which undesirable substances are converted into gaseous compounds and removed. This is how the material achieves its high purity.

Ultra-pure graphite fulfils vital functions in technologically demanding applications requiring extreme chemical purity and thermal stability. In semiconductor manufacturing, the material is used for crucibles, susceptors and heating elements in CVD and crystal growth processes, as it can withstand temperatures in excess of 2,000 degrees Celsius (4,532 degrees Fahrenheit) and corrosive atmospheres. In photovoltaics, graphite is used as a process material in the manufacture of silicon wafers. In nuclear technology, it is used as a moderator and structural material due to its low neutron



Parting off with a 1 mm (0.039") cutting width: HORN uses the Supermini system as the baseline for its designs.

IN THE PHOTOVOLTAIC INDUSTRY, GRAPHITE IS USED AS A PROCESS MATERIAL IN THE MANUFACTURE OF SILICON WAFERS.

absorption. Furthermore, the material is used in electrochemical systems such as lithium-ion batteries and fuel cells, as its electrical conductivity and chemical inertness offer decisive advantages.

NO CHANCE WITH CEMENTED CARBIDE

"We carried out extensive testing whilst machining the material and, as a result, have built up a high level of expertise," explains company founder Friedrich Zipser. Initially, the team machined the graphite components using uncoated carbide. However, the cutting edges quickly became so rounded that maintaining dimensional accuracy during the machining processes required constant adjustment. "We need very sharp inserts for this brittle material, but the extremely hard graphite particles cause them to wear out quickly," Friedrich Zipser continues. Even coated carbide inserts were no match for the abrasive material. "The particles literally sanded the coating off the tool in no time at all," adds Konrad Zipser. As a result, tool life averaged only around 40 finished components.

Konrad Zipser discussed his process issues with HORN's field sales representative, Stephan Weiß. "The decisive step was the use of PCD inserts; these withstand the abrasive effects and ensure a high level of process reliability," says Weiß. Zipser switched the machining process entirely to HORN tool systems fitted with PCD inserts. ISO inserts are used for the external contours, whilst the Mini and Supermini systems are used for internal turning. "The diamond inserts provide us with a sharp cutting edge and, thanks to the high hardness of the cutting material, enable us to maintain tight tolerances over a longer period," said Konrad Zipser.

SUPERMINI FOR PARTING OFF

The Zipser team machines a wide variety of turned and milled parts made from high-purity graphite. These range from 2 mm-wide (0.079"-wide) discs to 'hand-sized' milled parts. A special tool is used for parting off the turned components. "The material is relatively expensive to purchase. We were therefore tasked with designing a PCD-tipped parting tool with a maximum cutting width of one millimetre," explains Weiß. Furthermore, the tool was required to have a cutting depth of 30 mm (1.181").



The PCD-tipped Supermini system is used for boring.



PCD-tipped ISO tools are also used.



HORN solved the problem with the Supermini system. "The tool is actually designed for internal turning, but the shape of the carbide blank allows it to be configured as a narrow parting-off tool," says Weiß.

The PCD inserts also demonstrate their strengths in contour turning. The turned parts are mostly thin-walled of thicknesses less than one millimetre. This is where the tools' potential really comes to the fore. Whereas the use of carbide inserts would previously have left chatter marks on the surfaces, the results now exhibit high surface finishes. "In some cases, the surface finishes were actually too good. On a component for semiconductor manufacturing, the surface was too reflective; in this instance, we had to deliberately degrade it by adjusting the process parameters," jokes Konrad Zipser. On average, tool life increased ten to fifteen-fold compared with carbide. Furthermore, tolerances remain stable throughout the entire machining process.

PCD INSERTS ALSO DEMONSTRATE THEIR STRENGTHS IN CONTOUR TURNING.

GREASE IS THE ENEMY

Handling the graphite components also requires a fair amount of expertise. "Basically, grease and oil spell the end for a high-purity graphite component. These evaporate during subsequent use at high temperatures and in a vacuum. This is particularly true where cleanroom conditions apply, such as in the semiconductor industry," says Friedrich Zipser. Even touching the part with bare hands renders it unusable. For this reason, only specially purified compressed air is used to clean the components. As a rule, they are handled only with gloves and without automation. "The thin-walled components are too fragile due to the brittle nature of the material," says Konrad Zipser.



A close look reveals a significant improvement in surface finish. On the left, machined with carbide; on the right, with PCD.



A successful collaboration: HORN field sales representative Stephan Weiß with Friedrich and Konrad Zipser.

Zipser Milling GmbH, based in Lorch, looks back on many years of development in tool and equipment manufacturing. Since its foundation by Friedrich Zipser in 1984, the company has continued to develop and expand its expertise in the field of machining and manufacturing. Despite suffering a severe setback due to flooding in 2024, the company restored its expertise through rapid clean-up efforts and investment in new machinery. Today, Zipser Milling stands for flexibility, profound experience and a successful fresh start.

SUCCESSFUL COLLABORATION

"By using HORN PCD tools, we have been able to significantly increase our process reliability when machining high-purity graphite. We were impressed by both the performance of the tools and the service provided by HORN," says Konrad Zipser.



THE HORN PCD SYSTEM

With over 30 years' experience in the development and production of precision tools featuring ultra-hard cutting materials, HORN offers a comprehensive range of PCD tools for the productive machining of non-ferrous metals and other materials. Over this period, HORN has proven its worth across numerous industries and has become a key partner in the field of PCD tools. Drawing on its market experience and customer requirements, HORN has developed a comprehensive standard tool range specifically tailored to these needs. The diversity of the range ensures reliable machining of aluminium, non-ferrous metals and engineering plastics. With a focus on resource conservation, optimised cutting lengths and advanced designs, the tools are available from stock. With this product range, HORN offers a wide selection of standard and custom tools, ranging from simple PCD-tipped ISO turning tools to complex, modular combination tools. The driving force behind this is a focus on economically sound solutions delivering high productivity, combined with HORN technology, extreme flexibility and reliability.

HORN's high-performance PCD cutting material consists of a sophisticated mixture of diamond grains of varying sizes. As the volume proportion of diamond increases, so do the effective hardness, toughness and cutting quality. Strict quality standards and rigorous quality control are a matter of course and ensure outstanding performance.



MASTERING GROOVING AND PARTING OFF

TURNING IN A NEW DIMENSION

With our grooving and parting off tools, HORN is redefining these processes. Extensive product portfolio, modular systems, maximum machining performance thanks to proprietary carbide grades: **EXPLORE HORN.**

Explore HORN
grooving and parting off
processes now



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