

No
01

world^{of} tools



20
23

SPECIAL FEATURE: AGRICULTURAL TECHNOLOGY



**TECHNOLOGY
DAYS 2023**

**HORN
THAILAND**

**RESPONSIBILITY/
SUSTAINABILITY**

**PROCESS
GROOVE TURNING**

DEAR READERS,



Construction and agricultural machines shape our lives sometimes visibly, sometimes invisibly. Nevertheless, they are omnipresent and do heavy work in the most diverse areas, be it in the expansion of infrastructure, in structural and civil engineering, in the supply of food or in the extraction of raw materials. Hardly anything functions today without heavy plant. Of course, machining also plays a central role in the preliminary production stages of these machines and vehicles.

After a break of four years, we are pleased to invite you again to the HORN Technology Days. From 14th to 16th June 2023, we will open our doors and present this year's motto "Mastering processes" to you in Tübingen. Let us inspire you by experiencing HORN and exploring our technologies. As at previous events, many of our partners will be supporting our Technology Days and, together with us, will present you with the very latest machining practices.

Internationally, the HORN Group has opened a new subsidiary in Thailand, which the HORN Group is now focusing on more strongly due to the buoyant manufacturing sector.

Sustainability is on everyone's lips. For us, sustainability is an integral part of our corporate philosophy. As a family business, we have a long-term plan in which sustainable action is indispensable.

We hope this issue of our "world of tools" will leave you with interesting ideas for the future.

Markus Horn, Lothar Horn and Matthias Rommel

world^{of} tools

Nº 01 2023

04 **SPECIAL FEATURE**

High-tech agricultural technology
Pioneers in agricultural engineering
Threading in seconds
A long partnership

20 **PRODUCT INNOVATION**

Modular tooling system for high efficiency
Optimised for Swiss-type lathes
Nine cutting edges for higher metal removal rates
Polished rake faces for System 409

24 **PREVIEW**

HORN Technology Days 2023

26 **ABOUT US**

HORN Thailand
Andreas Vollmer and Michael Mellerup interviewed about HORN Thailand
Responsibility from HORN – when words are followed by deeds
Sustainability: Interview with Andreas Loock
Minimum quantity lubrication as the key to sustainable production
Mastering processes: grooving

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SPECIAL FEATURE

HIGH-TECH AGRICULTURAL TECHNOLOGY

Big tyres, powerful machines and sustainable technology for feeding people. The time of pitchforks and rubber boots is over in modern agriculture. Today, the agricultural industry is one of the most innovative sectors worldwide. With ever higher demands on efficiency and sustainability, manufacturers of agricultural machinery are developing high-tech products that will play an important role in the future. According to experts and studies, agricultural production will have to almost double by 2050. This is due to the steady increase in the world's population coupled with the need to fight famine in poorer countries. Such a vital goal can only be achieved through significantly less waste of resources, precision agriculture and modern agricultural systems.



According to figures from the VDMA Agricultural Machinery Association, the total turnover of German agricultural machinery manufacturers in 2021 was around 10.5 billion euros. In that year, the industry produced more than ever before and grew by 16 percent compared to 2020. According to the VDMA, tractors, digital system solutions and crop protection technology were particularly in demand. Almost 40,000 people work in the 185 companies that are associated with agricultural technology.

Agriculture 4.0

Providing the population with high-quality and affordable food is the central task of agriculture. However, the sector is also a major producer of greenhouse gases, a cause of climate change. Due to the steadily increasing demand for agricultural products, methods used in the future will have to work even more efficiently and sustainably than ever before.

In terms of technology, this means that highly automated, precise and also autonomous machine systems will increasingly be used. For example, in the future, robots with artificial intelligence could employ image processing methods to recognise the needs of individual plants

THE SUPPLY OF HIGH-QUALITY FOOD IS THE CENTRAL TASK OF AGRICULTURE.

and supply them with the appropriate fertiliser, leading to minimum supply for maximum yield of the crop, without wasting fertiliser.

In the design and manufacture of complex machines that undergo rigorous use, such as a combine harvester, there are conflicting requirements. Combine harvesters must be robust and capable of off-road use, despite their heavy weight. During their limited period of use



To ensure reliability of the components used in agricultural technology, we rely on a high level of manufacturing precision.

each year, they are expected to deliver maximum reliability and performance. Despite this, the total investment including capital expenditure, running costs, servicing and labour must be amortised in a few hundred hours per year, despite low grain prices due to the world market. It places stringent demands on design and production, i.e. a need for high quality, economical manufacture in a competitive global environment. This applies to every single component.

SPECIAL FEATURE

PIONEERS OF AGRICULTURAL TECHNOLOGY



The cutting division of the teeth enables a soft cut.



The development and manufacture of loader wagons is also one of the specialties of Pöttinger Landtechnik GmbH.

Mowers, ploughs, seed drills and much more – Pöttinger Landtechnik GmbH has been developing machines for use in agriculture for over 150 years. During this time, expertise and a passion for economical solutions have made the family business one of the world's leading companies in this sector. With a high level of vertical integration at the headquarters in Grieskirchen, Austria, the manufacturing specialists are constantly looking for new solutions to further optimise their production processes. For milling power take-off gears, Pöttinger was looking for a new solution for complete machining on one production platform. Together with HORN's Austrian representative Wedco and HORN application engineers, they found the solution with the DG replaceable head system.

THE ENERGY CAN BE USED DIRECTLY VIA A PTO SHAFT.

Tractor accessories such as a mower or loader wagon do not have their own drive. For operation, the mechanical drive energy of the tractor must be transmitted to the accessory. This is done via an auxiliary drive, also called a power take-off (PTO) shaft. This drive, which can usually be switched on and off, is an ancillary output of the tractor transmission. The energy can be used directly via the PTO shaft. The profiled stub shaft, which protrudes from the gearbox, uses splines or involute gear teeth to connect to the PTO shaft of the device. In operation, the farmer connects the PTO shaft to the stub shaft in the axial direction. Rotationally symmetrical locks secure the connection, which can be released easily without tools.

Reason for optimisation

Around 25,000 PTO shafts are manufactured in Grieskirchen every year. Pöttinger produces them as splined shafts with six teeth in the common sizes 1-3/8 inch and 1-3/4 inch. The main material used is 16Mn-Cr5 steel, which is well suited to subsequent induction surface hardening. "We previously manufactured the gear teeth on a hobbing machine before switching to tools from HORN. Since we are constantly optimising our production processes, we wanted to manufacture the PTO shaft completely in one clamping," explains Pöttinger work technician Roland Grafe. For machining, Pöttinger is relying more and more on automated production cells. For reliable, unattended machining, Grafe's team was looking for a tool solution to mill the gear teeth of the power take-off shafts on a lathe with driven tools.

"We received precise requirements from Pöttinger as to what the tool had to achieve and what other demands were to be placed on the machining," explains Wedco sales representative Alfons Kocher. One challenge was that the individual teeth including

IN MACHINING, PÖTTINGER RELIES MORE AND MORE ON AUTOMATED PRODUCTION CELLS.

a chamfer had to be produced in one operation. The problem here, however, was the limited power of the driven tool. Another factor was the possibility to regrind the tool up to four times.

Special cutting edge design

"To counteract the limited machine performance, HORN's technicians developed a special design of the individual teeth of the milling cutter to introduce a cut distribution. Due to the

machine power, the tool had to be streamlined" explains Kocher. In use, the tool's six cutting edges alternately mill the left and right sides of the groove. The cutting edges are ground with the required tooth profile including the profile of the root circle diameter. The expected hardening distortion of the PTO after heat treatment is provided for in the design of the tool profile. Furthermore, the clearance angles of the individual cutting edges are designed so that they can be reground up to four times. Regrinding only changes the tool diameter and not the profile of the individual teeth.

HORN chose the DG exchangeable head tool system. The screw-on cutting head is centred via a tapered face and with a centring pin. This guarantees a changeover accuracy of the cutting head of +/- 0.02 mm (0.001") in length and 0.01 mm (0.0004") in concentricity. This interface results in several advantages: high rigidity, stable support and cutting head exchange without having to remeasure the tool. In addition, changing the cutting head is simple and user-friendly with a torque wrench. The interfaces of the cutting head and the tool holder are of tool steel. The solid carbide cutting edges are brazed onto

the tool head, enabling economical use of the carbide material and consequently a lower tool price.

THE SERVICE LIFE OF THE CUTTING EDGE EXCEEDS PÖTTINGER'S EXPECTATIONS.

Requirements met

In practice, the HORN technicians' thoughts on tool selection and cutting edge design were vindicated. For machining the six 87 mm (3.425") long spline teeth to a depth of 3.3 mm (0.130"), the milling cutter requires a machining time of 85 seconds. Machining is performed in full cut at a speed of $v_c = 200$ m/min (7.874"/min). "At the moment, we are still using conventional up-milling. With a more stable interface for the driven tool, we will change to climb milling. Then we will be able to run the tool at an even higher

HORN's DG high performance milling system.



A successful cooperation: Roland Grafe in conversation with Alfons Kocher.

speed," says Grafe. The mill achieves the required dimensional tolerances and the specified surface quality of $Ra 3.2 \mu m$ (0.0001") has been exceeded by a factor of two. The service life of the cutting edge also exceeds Pöttinger's expectations. Before the cutting edges are reground, the milling system achieves a service life of 300 PTO shafts, i.e. 1,800 grooves. With the changeover to climb milling, tool life will be increased even further.

Two different versions of the tool are already in use in Pöttinger's production and further projects may follow. "This was the first tool from HORN used in our production. The technical implementation and the advice provided by Wedco and HORN fully met our expectations. I am looking forward to further projects," says Grafe.

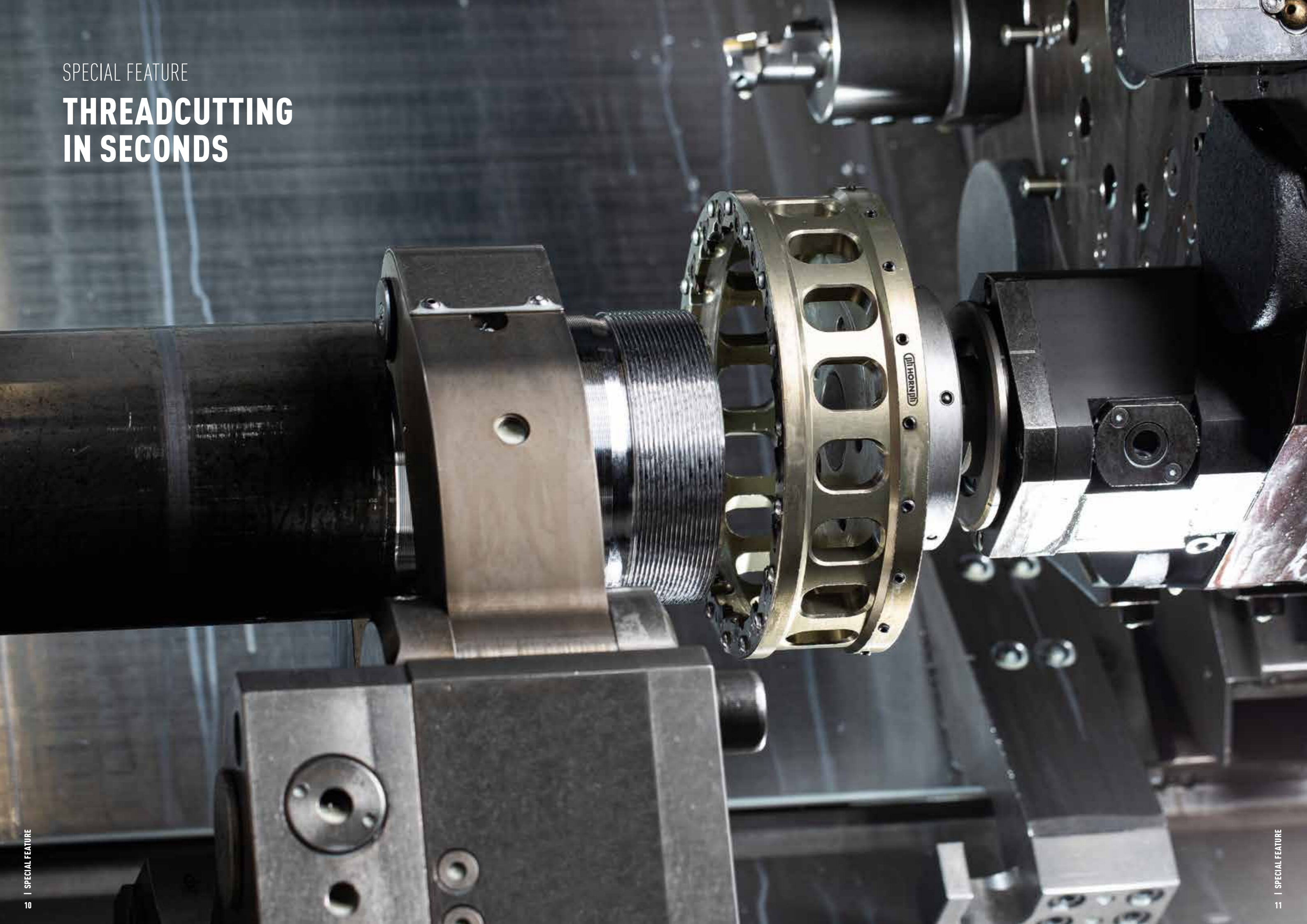


Pöttinger

The master watchmaker, locksmith, blacksmith and well builder Franz Pöttinger founded the company Pöttinger Landtechnik in 1871. He always kept abreast of the latest trends in manufacturing and recognised when the hour of mechanisation in agriculture had come. 150 years later, the family business Pöttinger Landtechnik GmbH is considered one of the leading companies in the industry. With its know-how, Pöttinger has developed into a specialist in grassland and sowing technology as well as for tillage. With its sustainable increase in effectiveness, efficiency and quality in agricultural equipment production, the family-owned company has proved to be a reliable partner to its customers.

SPECIAL FEATURE

THREADCUTTING IN SECONDS



SPECIAL FEATURE

THREADCUTTING IN SECONDS

"We only need about thirteen seconds to produce a thread," says Ben Broekhuis. He is responsible for the metalcutting processes in the company Vremac, Apeldoorn, in the Dutch province of Gelderland. The company is a specialist in the development and production of hydraulic cylinders. For machining an external thread on a cylinder, Vremac switched to a special milling system from Paul Horn GmbH. The result: approximately three times faster production than previously and a considerable increase in tool life as well as process reliability for unmanned production.

Vremac Cylinders has been involved in the development and manufacture of cylinders, accumulators and swivel joints since the company was founded over 60 years ago. In addition to the standard range of hydraulic cylinders, the company also supplies customised products. Over the last 20 years, Vremac has increasingly shifted its focus to the production of bespoke hydraulic cylinders. Vremac specialises in bores up to 1,000 mm (39.370"), piston rods up to 700 mm (27.559") and cylinders with a stroke of up to 15,000 mm (590.551"). Service and repair are also part of the company's range of services. With its many years of experience, Vremac specialises in the manufacture of hydraulic cylinders for almost all application areas. This includes preventive maintenance, spare parts management and repair on-site or at the factory in Apeldoorn.

Hydraulic moving floor systems

Vremac's range of services also includes its own products. For example, a hydraulically operated loading platform was developed in cooperation with another Dutch company. These moving floor systems are installed on trailers, semi-trailers and other loading vehicles. The system is used, for example, for unloading silage, bulk goods and wood chips in agriculture or for pallet goods. The advantage of these systems is horizontal unloading without having to tilt the trailer. Solid goods such as pallets can simply be moved hydraulically over the loading area via the rear and without a lift truck or forklift. Three hydraulic cylinders are always used for the different moving floors. One cylinder lifts the floor, while the other two cylinders move the floor slats in a horizontal direction. A travel speed of up to 2.5 m/min (8,202 ft/min) can be achieved in this way.

For the production of the cylinder components, Vremac relies on modern machinery with a high degree of automation. "Due to the large quantities of components, some machines run without operator attendance," explains Broekhuis and continues: "The process reliability of the production steps is a very important aspect of our daily work. A major problem was the production



The changeover to the shell mill resulted in a large time saving and increased process reliability.



It took about two years to convert the process from turning to milling.

of the external thread on the cylinder housing. The M120-x-2 thread is 40 mm (1.575") long and is used to screw the cylinder cover on later. When turning the thread, long stringy swarf was produced, which either clogged the chip conveyor or filled the swarf bin too quickly. This situation required optimisation of the production strategy to ensure reliable operation during unattended shifts.

First approach

"The first enquiry we received from HORN was whether we could produce the thread by whirling. However, that process is more suitable for smaller workpiece diameters," recalls HORN application engineer Roger Kasper. Together with Joop Nijland and Roy Rademaker, sales representatives from the Dutch HORN agency Harry Hersbach Tools, he set about solving the problem. The first approach was to use a double-edged S229 insert. "Use of the HORN insert was immediately successful. We solved the main problem of long, stringy swarf but the customer was still not fully satisfied with the solution," says Roy Rademaker. A new solution was needed. The goal: even higher process reliability with small chips as well as a reduction of the cycle time.

The solution was to produce the thread with a shell mill. The problem, however, was the weight of the milling cutter body. "On the machine we only have driven tools and no real milling spindle.



Assembly of the hydraulic cylinder used in the moving floor systems.

A MAJOR PROBLEM WAS THE PRODUCTION OF THE EXTERNAL THREAD ON THE CYLINDER HOUSING.

The power would not have been sufficient for a solid steel cutter body," says Kasper. HORN solved the problem by machining recesses into the cutter body to reduce its weight. The tool was of 135 mm (5.315") diameter and was equipped with 16 three-edged S302 inserts. The first trials with the tool produced the desired results in terms of time savings and chip breaking. "We had found the right solution with the shell mill. However it was like walking a tightrope, as we were always at the maximum feasible cutter weight for the driven tool position," says Nijland.

Use in series production

The body of a shell mill resembles a bell. During machining, the tool moves over the workpiece and starts the milling process in circular movements. Such tools can be used, for example, to produce threads, grooves or other shapes on the component. Major advantages of shell milling cutters are a shorter cycle time compared to turning and better chip breaking. Such tool systems are mainly used for series production.

The solution to the problem was found with the shell mill. However, in order to reduce stress on the machine's tool turret and to increase reliability even further, the HORN technicians had to refine the process further. The diameter of the tool was set at a certain ratio to the diameter of the workpiece for optimum milling. "The aim of the optimisation was to make the tool even lighter but at the same time to increase the diameter. This was not an easy task, as we were already at the weight limit," explains Nijland.

Aluminium milling body

Steel was ruled out for the larger diameter milling body due to the weight. The designers found the solution in a special aluminium alloy. With a larger diameter of 155 mm (6.102"), the new version weighs only half as much as the previous steel version.

SUCH TOOL SYSTEMS ARE MAINLY USED IN SERIES PRODUCTION.

The HORN technicians increased the number of inserts to 18. All cutting edges are cooled directly in the contact zone via an internal coolant supply. The polygonal shank interface for the tool turret is screwed to the body.

The first tests of the new milling variant were immediately successful and fulfilled Broekhuis' expectations: "Our problems



Hydraulic moving floor systems are used, among other industries, in agriculture.



A successful collaboration: Bram Kuiper, Cargo Department Manager (Vremac), Ben Broekhuis (Vremac), Jos Hersbach (Harry Hersbach Tools), Roy Rademaker (Harry Hersbach Tools), Roger Kasper (HORN) and Joop Nijland (Harry Hersbach Tools).

have been solved. The process runs reliably and the quality of the thread produced fully meets our requirements." Before the change, the machining time was around 30 seconds for turning the thread. The shell mill reduced the production time to only 13 seconds. Furthermore, the tool solved the problem of long tangled swarf, replacing it with small broken chips. This increased the process reliability during unattended shifts, as the danger of the chip conveyor becoming blocked and the swarf bin filling up too quickly has been eliminated. Tool life of the inserts is 800 threads per cutting edge.

Increase in service life

HORN went even further by introducing a newly developed IG35 insert coating. Thanks to HiPIMS technology, the coating has very smooth properties and high heat resistance. Furthermore, the coating is free from defects such as droplets or other coating imperfections on the cutting edge. The use of the new coating increased tool life to 1,200 threads per cutting edge, i.e. 3,600 threads produced per tool.

VREMAC HAS BEEN WORKING WITH HORN FOR AROUND 40 YEARS.



Vremac

Vremac has been working with HORN and Harry Hersbach Tools for around 40 years. "During this long association, we have been able to solve a number of problems. The solution with the shell mill again shows us why we like to have HORN as a tool partner. They don't give up until the task is solved to our complete satisfaction," says Broekhuis.

A LONG PARTNERSHIP

"Our quality pays off." This is the company motto of Knott GmbH from Eggstätt in Bavaria. The owner and managing director Valentin Knott and his employees live by this motto every day. For more than 40 years he has managed the company, which specialises in development and production in the field of brake and trailer technology. "Shortly after I started here at the company, I began my partnership with Paul Horn GmbH as a tool supplier," says Knott. Since then, numerous systems from the Tübingen-based tool specialist have been used in his production. Knott is always open to new tool and machine technologies. "We are constantly looking for new solutions to make our processes even more productive," says Andreas Neubauer, head of mechanical production.

"My father founded the company in 1937 and since then we have developed from a supplier of gearboxes to a leading global manufacturer of brake and trailer products," says Knott. Quality is of major importance in the company. In addition to operating fully automated production cells, Knott also still uses hand craftsmanship. Currently, about 2,500 people work for Knott worldwide. In the field of brake technology, the company produces drum, disc, wet disc and electromagnetic brakes. The systems are found in vehicles used in the agricultural, construction and mining industries, the military and in industrial trucks. In trailer technology, Knott supplies the chassis, axles, add-on parts and additional accessories to its customers. They are used in caravans, horse trailers, boat trailers and classic transport trailers.

Optimisation potential

"Continuous improvement plays a key role in our production. Almost every day we

strive to further optimise our manufacturing processes," says Neubauer. The machining of mounting holes on a brake carrier was one aspect of production that Neubauer wanted to improve. The carrier, made from nodular cast iron, is found in the braking systems of construction and agricultural machinery. Knott produces about 10,000 of this type of carrier per year. The bore with countersink and the chamfer/countersink were machined in three operations: pre-drilling, boring and countersinking. "We wanted to combine these three steps into one operation," says Neubauer.

With this requirement, the head of mechanical production turned to Michael Götze, the HORN sales representative responsible for Knott. He suggested producing the bore in one operation with the HORN D117 form drilling system. "In

QUALITY PLAYS A MAJOR ROLE IN THE COMPANY.



HORN's D117 form drilling tool produces the hole profile in one operation.



14 blanks are clamped onto a tower for machining.

addition to form turning operations, HORN's 117 insert system is well suited to form drilling," Götze explains. Once in possession of the profile of the bore to be produced, the HORN engineers in Tübingen set to work designing the appropriate tooling solution. The first tests at Knott were immediately successful and so Neubauer converted production of the brake carrier to the HORN solution. "The entire implementation took five to six weeks, including enquiry, technical consultancy, drawing approval, production and implementation in our production. We are very satisfied with this quick turnaround," Neubauer tells us.



Considerable time saving

The D117 form tool drills the hole profile in one operation. The cutting speed is $v_c = 120$ m/min [393.7 ft/min], with a feed rate of $f = 0.25$ mm/rev [0.010"/rev]. In addition to the fewer tool changes on the machine, the cycle time was shortened by 30 seconds. With a quantity of 10,000 pieces, this results in an annual saving of around 83 hours. Furthermore, tool life increased compared to the tool systems previously used. "We cannot yet determine the exact tool life because the first insert is still in operation after 1,000 bores," says Neubauer. A Mazak FH 6800 is used for production. It is a horizontal, high-speed machining centre that, due to its design, has very high torsional rigidity for excellent machining accuracy in heavy-duty cutting.

The profile tools of the D117 drilling system enable economical advantages in series production as well as a reduction in tool costs for drilling across a large range of diameters. With the tool system, HORN produces the profiled inserts according to customer requirements for use on turning and milling centres. The precision ground insert seat of system 117 guarantees high concentricity and axial run-out accuracy as well as changeover accuracy in the micron range. The precision-ground cutting edges enable high manufacturing precision to tolerances down to 0.02 mm as well as excellent surface finish. Cost savings are generated by recoating only the insert, lower tooling costs and reduced machine downtime due to quick insert changeover. Cooling of the contact zone and efficient removal of the chips



D117

HORN offers the D117 tool system in the form widths 16 mm [0.630"], 20 mm [0.787"] and 26 mm [1.024"]. The special shape required, depending on the application, is precision ground. The maximum depth is $t_{max} = 9$ mm [0.354], 12 mm [0.472"] and 13.5 mm [0.531"]. The tool coating is specially selected for each application and is available for the material groups P, M, K and N. The round shanks are available as standard in diameters of 16 mm [0.630"], 20 mm [0.787"] and 25 mm [0.984"] in designs A and E. In addition, HORN offers special holders with more support for the cutting inserts. All variants are equipped with internal coolant supply.

are ensured by the internal coolant supply through the round shank to both inserts.

The Knott factories mainly use machining centres from the Japanese machine manufacturer Mazak. "We have good contacts with Mazak in Japan," says Knott. Around 150 machining centres are installed at the various locations. In Eggstätt alone there are 50 Mazak machines. "We are convinced of their performance, precision and durability," says Knott. However, the manufacturer does not limit itself to just one machine tool supplier. Only recently, for example, a fully automated production cell from the Italian machine manufacturer Famar was put into operation in Eggstätt. "We use this cell for double-spindle machining of our brake calipers," says Neubauer.

One of the longest standing HORN customers

After more than 40 years of cooperation, the Knott company is one of the longest-standing HORN customers. Numerous tool systems from HORN contribute to the high quality of Knott products. In addition to the new drilling tools, Knott relies on systems for grooving, milling and reaming from Paul Horn GmbH. "We are glad to have such a long-standing

"WE ARE CONVINCED OF THE PERFORMANCE, PRECISION AND DURABILITY."

tooling partner at our side that supports us in our daily work and regularly provides us with new and even more productive tooling solutions," concludes Knott.



A long-standing collaboration: Andreas Neubauer, Valentin Knott, Michael Götze and Anton Schmid.

PRODUCT INNOVATION

MODULAR TOOLING SYSTEM FOR HIGH EFFICIENCY



Modular tooling system for high efficiency

Thanks to its precision and rigidity, HORN's modular tooling system offers a high degree of flexibility for adaptation to different machine types. Standardised modules bridge several interfaces at the same time. The modular system has a selection of tool holders for turrets and other tool carrier interfaces based on common machine types. The matching grooving tool holders with integral coolant supply allow height adjustment of the cassettes and their mounting in the normal or overhead position, on the left or right of the holder. For multi-spindle autos, height-adjustable tool carriers are available onto which the cassettes are screwed directly. The cassettes serve as an adapter for numerous HORN grooving insert systems. Parting off, grooving, sliding-head turning: the modular system can be flexibly adapted to the application.

HORN is adding further variants to the modular system especially for use on Schütte machines. The type 850 tooling system supersedes the system 849. Of more compact size, the holder offers high stability as well as targeted cooling of the flank and rake face. The holder system is suitable for all sizes of the 315 insert system. For other inserts, HORN of-

THE CASSETTES ARE COMPATIBLE WITH NUMEROUS HORN GROOVING INSERT SYSTEMS.

fers corresponding special solutions. The tool holders are available with and without angle adjustment. Height adjustment is simple and easily accessible from the front. The tool system is compatible with the Schütte series ECX, SCX and ACX.

PRODUCT INNOVATION

OPTIMISED FOR SWISS-TYPE LATHES



Optimised for Swiss-type lathes

HORN has never stopped developing and optimising its product portfolio. At the same time, it has integrated almost 100 percent of the added-value creation into its own production. The range of applications of the tool systems has grown considerably. Today's machining operations across a diverse range of materials constantly demand further development and adaptation of the tool systems. Grooving with indexable inserts has become indispensable in modern production. Radial grooving, parting-off, axial grooving and internal grooving to micron precision are now part of everyday life in industry. For such machining processes, HORN relies on the S224 insert system, among others.

HORN has revised the clamping of the S224 type indexable insert for use in Swiss-type lathes. In order not to have to remove the holder for indexing or changing the insert, the HORN engineers relocated the clamping screw to the side. Clamping now takes place via a camshaft. This allows the insert to be clamped quickly at either side of the holder without having to remove it. Furthermore, this type of insert also eliminates the need to invest in special quick-change systems. For the user, in addition to simple operation with a torque wrench, there is the advantage of reduced machine downtime due to faster set-up. HORN offers the holder system from stock in left and right versions as a 16 mm x 16 mm square shank. All variants of the holder are equipped with an interface for internal coolant supply from above and below.

WITH THIS TYPE OF INSERT, THERE IS NO NEED TO INVEST IN SPECIAL QUICK-CHANGE SYSTEMS.

PRODUCT INNOVATION

NINE CUTTING EDGES FOR HIGHER METAL REMOVAL RATE



Nine cutting edges for higher metal removal rate

Groove milling, cut-off milling or gear milling; these are just three milling processes that the circular interpolation milling system from Paul Horn GmbH carries out productively. As a true all-rounder, the extensive tool portfolio of this system tackles several other milling processes. It can be used from an inside diameter of 8 mm (0.315") for precise boring, for slot milling of narrow grooves down to a width of 0.2 mm (0.008"), or for milling splines: The system has proven to be a problem solver in numerous standard variants as well as in special designs for individual requirements.

In order to further increase the chip removal volume during milling, HORN is expanding the circular milling system to include inserts with nine cutting edges. The smaller diameters of the system were previously available with a maximum of six cutting edges. Three more teeth offer further advantages. On one hand, the production time is shortened due to the higher cutting feed rates that are possible, while on the other hand, tool life is increased. In addition, the inserts run more quietly and with less vibration than inserts with fewer teeth. These advantages, in addition

to the high milling performance of the tool system, contribute to higher overall efficiency and a reduction in tool costs.

The new nine-edged milling systems M911, M913 and M928 are stocked in cutting widths from 1.5 mm (0.059") to 3 mm (0.118") as standard. The maximum milling depth is 3.5 mm (0.138") (M911), 4.5 mm (0.177") (M913) and 6.5 mm (0.256") (M928). The inserts are available with

different coatings to suit the material to be machined. Due to its mass, the solid carbide tool shank ensures vibration damping during milling. All variants of the tool shanks are equipped with an internal coolant supply.

HORN IS EXPANDING THE CIRCULAR MILLING SYSTEM WITH INSERTS THAT HAVE NINE TEETH.

PRODUCT INNOVATION

POLISHED RAKE FACES FOR THE SYSTEM 409



Polished rake faces for the System 409

The patented M409 tangential milling system from HORN excels with its rhombic indexable inserts. The precision-ground inserts achieve a high surface quality at the bottom of the groove and on the flanks. Positive radial and axial rake angles as well as a flank chamfer ensure a stable wedge angle for particularly smooth milling. The system delivers high metal removal rate even with driven tool turrets and on less powerful machines. Together with the internal coolant supply, the tangential milling system covers a wide range of applications and thus increases performance and flexibility.

THE SPECIAL GRADE IS DESIGNED FOR MACHINING THE ISO N CUTTING GROUP.

Especially for milling aluminium alloys and plastics, HORN offers the indexable inserts with polished rake faces on all four edges from stock to counteract the formation of built-up edges. In conjunction with the positive chip breaker geometry, the sharp ground cutting edge produces a soft cut and high surface quality. The special grade is designed for use with the ISO N material group. The inserts can be used in all cutter body variants.

PREVIEW

HORN TECHNOLOGY DAYS 2023

The HORN Technology Days are back after four years. From 14th to 16th June 2023, HORN at its Tübingen site will offer unique insights into production and focus on the topic of "Mastering processes" where by the tool, workholding and machine make up a production process.

However, in most cases it is not as simple as it looks at first glance. Especially when it comes to cutting cycles or the properties and capabilities of machines, including synchronised spindles and much more, a lot happens before a process is up and running.

The process requires a holistic approach and understanding to make it viable for users and provide added value. For example, gear skiving, polygon turning, slotting, high-speed whirling and Swiss-type turning are all processes that are the focus of attention. "Our understanding of processes is key to holding our own in the top class of machining," says Markus Horn, Managing Director of Paul Horn GmbH.

Visitors can choose from numerous programme items: Technical lectures, live machining, exhibits, industry-specific exhibition areas, face-to-face discussions and extensive flexibility in production.

Speakers and experts will be available to provide advice. Philipp Dahlhaus, Head of Product Management: "We are looking forward once again to discussing projects with our customers, prospects and other visitors to jointly advance production technology." In addition, the carbide production facility will be open to visitors. State-of-the-art equipment for the production of carbide as well as different shaping processes – from axial pressing to extrusion - will be on display.

Come to Tübingen and experience HORN.

EACH PROCESS REQUIRES A HOLISTIC APPROACH AND UNDERSTANDING.



Special programme

On Thursday morning, 15th June 2023, the final presentation of the BMBF-funded project ZyκλοMed will take place. The topic is: functionally integrated implants through novel synchronised-cyclical machining processes. In addition to HORN, the project partners are INDEX-Werke, Hahn & Tessky, BEUTTER Präzisions-Komponenten, and the Karlsruhe Institute of Technology (KIT) incorporating the wbk Institute for Production Technology.



The lectures at a glance

01 HIPIMS

Quantum leap in tool coating

02 LEAD-FREE

Machining brass and steel with process reliability

03 POLYGON TURNING, HIGH-SPEED WHIRLING, ROTATIONAL TURNING

New processes using the medical industry as an example

04 GEAR TEETH THINKING AHEAD

Optimal processes for gear machining

05 E-MOBILITY

Tool solutions from HORN

06 FROM ENQUIRY TO DELIVERY IN 7 DAYS

Tools for profile grooving and profile broaching in networked manufacturing

07 TURNING, MILLING, DRILLING

Achieving the right results with ultra-hard grades

08 EXPERTISE IN SLIDING-HEAD TURNING

New tools and processes

ABOUT US

HORN THAILAND

From March 2023, the HORN Group will have a wholly-owned subsidiary in Thailand. Horn Cutting Tools (Thailand) Co. Ltd. will have its headquarters in Chonburi – approximately 80 kilometres (49.7 miles) south-east of Bangkok, the capital of the Kingdom of Thailand. The company will commence operations with six employees. In the short to medium term, a regrinding service for MCD tools will be set up in addition to the sales department.



The Asian country has about 70 million inhabitants. The main economic sectors are mining, manufacturing, utilities, wholesale, retail, restaurants and hotels, agriculture, hunting and forestry, fishing, transport, storage and communications. In 2021, the gross domestic product in Thailand was estimated at around 505.9 billion US dollars.

HORN's first trade fair in Thailand was Metalex 2022, which took place from 16th to 19th November in Bangkok. Over 86,000 trade fair visitors were recorded. In addition to domestic visitors, people came primarily from India and Singapore. HORN's 2022 innovations and various tool solutions such as Supermini, gear cutting, reaming and grooving were on display.

Michael Mellerup, General Manager of Horn Cutting Tools (Thailand) Co. Ltd.: "Thailand has a lot to offer in the field of

machining and in my opinion great potential, especially if you are familiar with the market and know where to start. Our tooling solutions will make a positive difference to our customers in the future. I am convinced that Thailand is a growth market for HORN in the short, medium and long term and that we can contribute significantly to the prosperity of our new and existing customers."

Sources: VDMA, The World Factbook, (CIA), IMF, The World Bank, Federal Statistical Office

“THAILAND HAS GREAT POTENTIAL IN THE FIELD OF MACHINING.”



The HORN Thailand Team from left to right: Uten Tonsirach/Production, Michael Mellerup/General Manager, Jakapt Udomporn/National Sales Manager.



Andreas Vollmer, Member of the Management Board at HORN is responsible for sales worldwide. Michael Mellerup is General Manager at HORN Thailand (from left to right).

ABOUT US

HORN THAILAND: INTERVIEW WITH ANDREAS VOLLMER AND MICHAEL MELLERUP

What was the intention behind founding a HORN branch in Thailand?

Andreas Vollmer: Essentially, the requirement came from the customer. The requirement was initially to set up a small service unit for the post-processing of diamond-tipped cutting inserts. When researching this, it quickly became clear that we are only partially active in this economic area and that there is very interesting potential for us in terms of various industrial sectors in Southeast Asia. That's why we decided not to take half a step, but to go all-in.

What challenges do you see in the Thai market?

Michael Mellerup: Above all, the requirements will be to respond to local conditions and to make the customer understand that we are a Thai company with a German background and German product quality. That's why we are starting with a team consisting mainly of Thai employees.

Which customer sectors will you target?

Andreas Vollmer: We see the same requirements in Thailand as in other markets. Automotive, general mechanical engineering, the electrical and computer industry, pneumatics and hydraulics, the medical sector, the oil and gas industry and optics. As already mentioned, the technical challenges and requirements are very similar to the other regions in which we are already active.

Which solutions are currently particularly in demand?

Michael Mellerup: Solutions that primarily bring economic savings. The above industries are currently well served by competing companies from Japan and China. It will therefore be important for us to convince customers that cheap does not equal economical.

What is your assessment of trends and future issues (in Thailand)?

Andreas Vollmer: These will come in very quickly. What we have seen so far and the discussions we had during the Metalex exhibition in Bangkok last year show that the machining strategies are identical to the existing requirements that we already know, not only in Thailand, but also in Vietnam, Singapore, Indonesia, Malaysia and the Philippines. The topic of gearing cutting is already a live discussion.

What can HORN Thailand bring to this market?

Michael Mellerup: A high level of technical expertise that our customers expect from us, including training facilities in our new offices where we can invite our customers for product training and in-depth analysis of their applications. HORN Thailand will also have a warehouse on-site to serve our Southeast Asian market to ensure quicker and safer deliveries. We are therefore very well prepared for the tasks ahead.

ABOUT US

RESPONSIBILITY FROM HORN – WHEN WORDS ARE FOLLOWED BY DEEDS

Sustainability is a central component of HORN's corporate philosophy. Quality assurance, environmental protection, energy efficiency and safety have always been the focus with regard to products and production.

On the product side sustainability is particularly evident, for example with the replaceable head and replaceable insert systems. In the case of grooving tools, the range includes inserts with up to six cutting edges that can be used for longer before they need to be replaced. Special and combination tools save process steps and thus also energy, while new substrates and coatings ensure longer tool life, which in turn saves material and energy. In the field of additive manufacturing, 3D-printed cooling attachments are used. Optimised structures ensure stability as well as material savings.

Quality management

As a manufacturer of precision tools, HORN has a very special responsibility. Fulfilling stringent customer requirements as well as high demands internally in respect of all services and products is a prerequisite for success and thus also for securing the existence of the company. In order to meet these demands, HORN operates a modern quality management system. It includes market-oriented planning as well as the fulfilment of customer quality requirements using all economically justifiable means in accordance with DIN EN ISO 9001 and VDA 6.4.

Sustainability in everyday life

Lothar Horn: "For me, sustainability is the most natural thing and is an integral part of our everyday life. You encounter this philosophy in all areas at our company. When you go into the production area, it is illuminated by energy-saving LED lights and the coolant is cleaned by filtration systems developed in-house. In this way, the cutting fluid can remain in use for up to ten years. Photovoltaic systems are of course installed on the roofs of the production buildings in Tübingen. In both plants, the production areas are on two levels. The focus is on economical use of the available space. Due to the heavy weight of the machines and equipment, it was not obvious that the use of two levels was feasible."

Environmental management

"Every company is part of society and, in order to secure its future, needs not only on turnover and profit, but also on the acceptance of the public and society. Irrespective of this, it has always been our attitude, especially as a

AS A MANUFACTURER OF PRECISION TOOLS, HORN HAS A VERY SPECIAL RESPONSIBILITY.



family business, to live sustainability in all areas," says Lothar Horn. Environmental protection is an important corporate goal and an indispensable part of corporate policy. The management system, which was validated in 1997 according to the EC Eco-Audit Regulation 1836/93, was adapted to the requirements of ISO 14001 in 1999 and has been certified since July 2000.

Energy management

The energy management system applies to all facilities and activities. Those responsible continuously optimise procedures and develop measures to improve energy efficiency.

Sustainability also means ensuring that operations are as resource-efficient as possible, focusing on the expansion of renewable energy sources and the optimisation of existing sources, as well as promoting on-site power generation. For example, modern lighting systems, a combined heat and power unit and photovoltaic systems are already in use and more are planned. All employees are regularly informed about the economical use of energy. The energy management system has been certified according to DIN EN ISO 50001 since 2013.

The human being in focus

The issue of sustainability must also be considered in relation to the workforce. Long tenures with the company are a hallmark of HORN. It is important to take people with us, to provide them with further qualifications and to prepare

LOTHAR HORN: "SUSTAINABILITY SHOULD BE SELF-EVIDENT – BUT UNFORTUNATELY IT IS NOT."



Lothar Horn, Managing Director of Paul Horn GmbH.



Insight into modern production at HORN.

THE COMPANY IS DISTINGUISHED BY ITS LONG SERVICE RECORD.

them for new challenges and technologies. Within the framework of the HORN Academy, the qualification of employees can be adapted to the requirements within the industry. In addition, the promotion of independence and personal responsibility in the thoughts and actions of all trainees is another important factor in achieving the goals they have set themselves.

The HORN Academy is designated a "Träger nach dem Recht der Arbeitsförderung" (institution according to the law of employment promotion) in accordance with § 178 SGB III. The accredited certification company for the labour market and educational services, CERTQUA, has granted this approval. It is the basic prerequisite for the implementation of retraining measures offered by the HORN Academy. Furthermore, the occupational health and safety of employees also represents an important factor from an economic point of view, which helps to improve the competitiveness of the company. HORN sees it as its task and challenge to question existing methodologies and to develop forward-looking solutions through continuous improvement of occupational health and safety. Issues related to products as

well as processes merge here. The focus is on taking into account the legal requirements for occupational health and safety of employees.

Management system

The management system at HORN ensures that all organisational, commercial and technical activities that have an impact on quality, the environment, energy efficiency and employee safety are planned, controlled and monitored. In addition, the management system ensures that contractually agreed requirements and the relevant regulations are met. The system is based on the requirements of DIN EN ISO 9001, DIN EN ISO 14001, ISO 50001 and ISO 45001 in their current versions and applies to all phases of product creation. By taking into account the results of internal system audits and periodic reporting on quality, energy efficiency, environmental protection and safety, the management assesses the effectiveness of the management system.



Andreas Loock is head of quality assurance at HORN.

ABOUT US

SUSTAINABILITY: INTERVIEW WITH ANDREAS LOOCK

Sustainability has an important place in mechanical engineering – currently more than ever. What are your different perspectives on this topic?

As an environmental and management officer, my first focus is on compliance with legal regulations. In addition, securing a long-term cooperation with business partners and employees comes into play. Furthermore, local and regional value creation have priority over everything in this context. Sustainability also includes fairness and ethically correct behaviour, the reduction or avoidance of environmental pollution and energy consumption, as well as the expansion of alternative energy generation and the use of non-fossil energy sources.

Are there any legal frameworks that are relevant currently or in the future?

There are quite a few: the Supply Chain Duty of Care Act, the EU Whistleblowing Directive/Whistleblower Protection Act, the Packaging Act and various international standards. These include, for example, measures to combat bribery and corruption as well as the prevention of antitrust violations, the REACH regulation, conflict minerals, CO2 footprint and the EU Energy Efficiency Directive, to name just a few.

What role do certifications play?

We consider certifications to be important. This enables us to ensure compliance with internationally recognised standards. These include, for example,

quality, environmental and energy management systems. The consequence of this is increased customer confidence in our company, especially since the verification of compliance with standards is carried out by third parties.

What expectations do customers have?

Our customers expect sustainable business practices from us. This includes, for example, saving resources and using sustainable materials for products and packaging. In addition, energy and cost efficiency also play an important role.

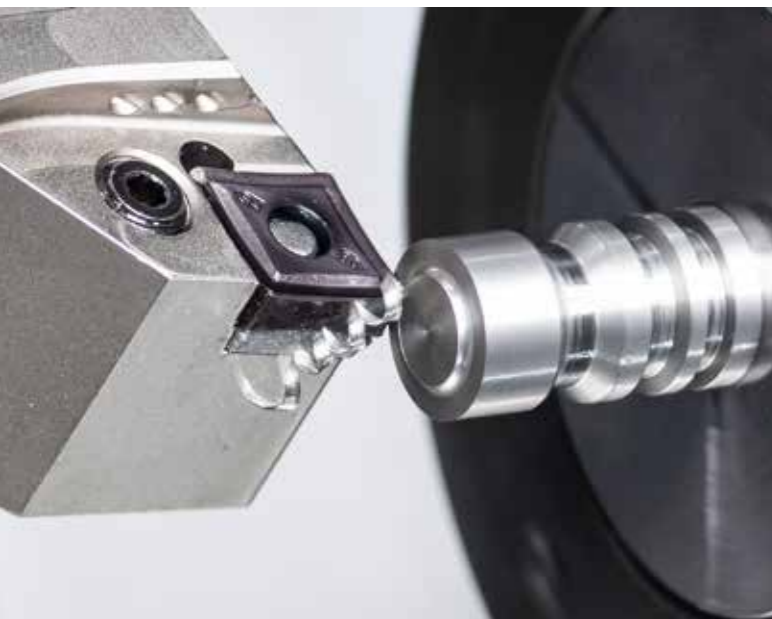
What are the next steps at HORN?

Next, we will further reduce our product carbon footprint. However, those who have lived sustainably in all areas for decades, as we have, find less potential for optimisation today. For example, we are refining our heat recovery systems and air conditioning, expanding the existing solar panels and reviewing new materials for sales packaging.

ABOUT US

MINIMUM QUANTITY LUBRICATION IS THE KEY TO SUSTAINABLE PRODUCTION

If you look at HORN's product portfolio, sustainability is immediately evident, for example with the replaceable head and replaceable insert systems. In the case of grooving inserts, HORN has tools in its range that have up to six cutting edges. Special and combination tools save process steps and thus also energy. Furthermore, new substrates and coatings ensure significant increases in tool life, which in turn saves material and energy. In the field of additive manufacturing, 3D-printed coolant attachments are used. Here, optimised structures ensure stability as well as material savings. Furthermore, in the area of coolant supply, there is potential for large savings and thus resource conservation, especially with minimum quantity lubrication. This is where HORN from Tübingen and HPM Technologie GmbH from Dettingen/Erms combine their expertise.



An ISO tooling solution from Boehlerit is used for longitudinal turning of the nozzle.

For more than 75 years, the name HPM Technologie has been synonymous worldwide with manufacturing state-of-the-art systems in the field of minimum quantity spray application, microdroplet application and lubricants. The highly technical minimum quantity spray systems and nozzles for internal and external lubrication applications, which are manufactured in our own factory, are characterised by their precise and consistent mode of operation. This ensures economical and environmentally friendly application of minimum quantity lubricants or minimum quantity coolants with different properties. One of the most prominent users of HPM is Tesa. At the adhesive roll manufacturer, the blades that cut the large rolls into smaller rolls of adhesive tape are lubricated with a special non-stick fluid. Additionally, a tyre manufacturer relies on HPM technology to reduce the forces on the blades when cutting its products.

When it comes to machining, there are basically two different application sce-

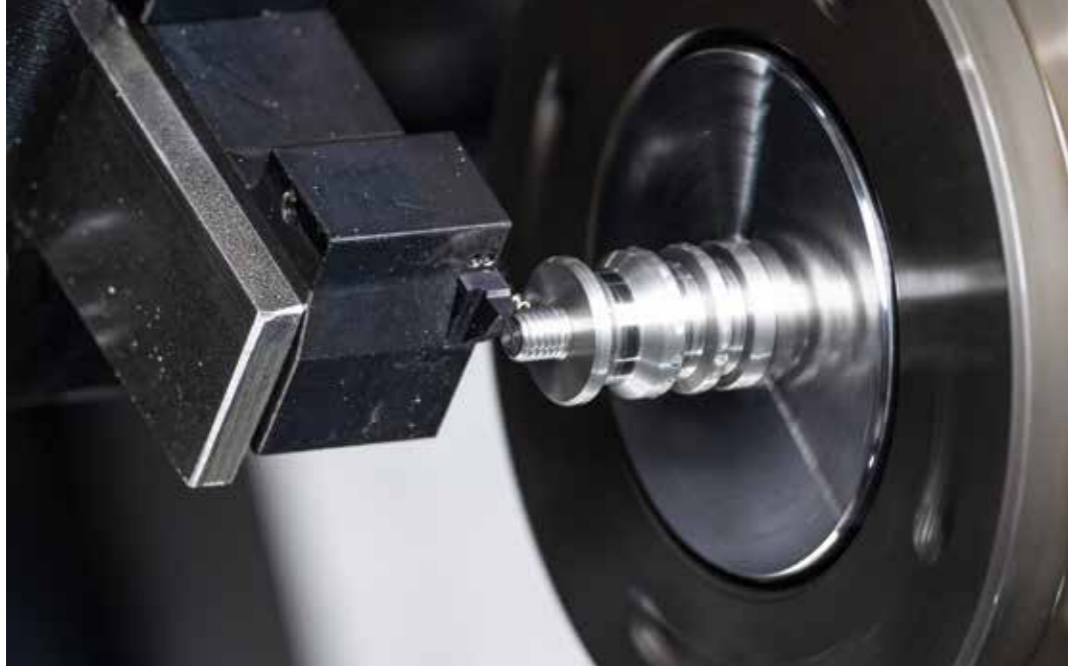


Minimum quantity lubrication enables higher cutting speeds than dry machining and also results in a better surface finish.

narios for MQL technology. "The simpler application is lubrication from the outside," explains Steffen Hoffmann, Managing Director at HPM. In this case, the MQL unit is mounted on the outside of the machine and the lubricant is brought close to the cutting edge via external pipes. "We have already implemented numerous projects very successfully with external lubrication, even in applications involving boring mills weighing several tonnes," Hoffmann enthuses. MQL internal lubrication through the tool is more demanding, but is usually the more rewarding application. Especially when machining aluminium in series production, significant increases in efficiency can be achieved. "Internal MQL lubrication is mainly deployed in the automotive industry, for example in the production of turbochargers, in crankshaft manufacture or wheel carrier machining," explains Hoffmann.

Hoffmann continues: "In our in-house CNC production, we can not only test our cooling lubrication solutions, but also quickly and easily produce special parts, fixtures and prototypes for ourselves and our customers. Our machines are 100 per cent equipped with HPM MQL solutions. Our systems are space-saving and can be easily combined with turning and machining centres." This is clearly illustrated by a nozzle manufactured with precision tools from HORN. The nozzle is made of 1.4301 stainless steel and is machined on an SMEC SL 2000SY lathe. HPM's own fluid HPM Econi FAE 46 is used as a lubricant. The component includes several machining operations, which are carried out with different tool systems. An ISO tool solution from Boehlerit is used for longitudinal turning of the nozzle. Lubrication is provided via coolant holes in the tool holder, just as it is during production of the external thread of the nozzle. The HORN grooving system 312 is used for this. Internal turning of the nozzle is

IN THE AREA OF LUBRICATION, LARGE SAVINGS ARE POSSIBLE.



Turning of the external thread is done by the System 312.

done with the Supermini system which, in contrast to the two aforementioned tool systems, has a coolant hole directly in the insert. Therefore the lubrication is directed through the insert to the cutting edge or into the cutting zone. Stefan Minder, application engineer at HORN: "The tools used are exclusively standard. All solutions are also designed for MQL and therefore require no further adaptation. At the tool selection stage, we make sure that the tool (substrate, geometry and coating), lubricant and workpiece material are optimally matched." The nozzle itself is used, for example, in punching and pressworking as a direct lubrication solution. As the name "minimum quantity lubrication" suggests, the focus is on lubrication. The technology reaches its limit as soon as the focus is on cooling and/or chip removal.

However, minimum quantity lubrication offers numerous ecological and economic advantages. Florian Christner, Business Development Manager at HPM, points out: "On one hand, the advantages of dry workpieces and dry chips are obvious, as it saves further operations like cleaning the workpieces and facilitates recycling the chips. Lubrication enables higher cutting speeds than dry machining and produces a better surface finish.

OUR MACHINES ARE ALL EQUIPPED WITH HPM MQL SOLUTIONS.

Furthermore, there are no costs for emulsion maintenance and one always has a fresh medium for the cutting process. Another advantage is a reduction in skin irritation. Lowering lubricant



Managing Director Steffen Hoffmann in conversation with Florian Christner.



For over 75 years, the name HPM Technologie has been synonymous worldwide with the manufacture of state-of-the-art systems in the field of minimum quantity spray application, microdroplet application and lubricants.

consumption by several-fold has a positive effect on health and costs, including with regard to energy usage, which in turn reduces the CO₂ footprint of manufacturing.

One sector of industry in particular has been using MQL in series production for a long time - automotive. "In addition to the environmental aspect in production, cost savings in the area of lubrication naturally plays a significant role," says Hoffmann. Stefan Minder adds: "Even if machining with MQL is still rather the exception, the subject is increasingly coming to the attention of customers, especially in terms of topicality and sustainability."

MINIMUM QUANTITY LUBRICATION OFFERS NUMEROUS ECOLOGICAL AND ECONOMIC ADVANTAGES.

Minimum quantity lubrication – the advantages at a glance:

Ecological advantages:

- Dry workpieces – dry chips
- Elimination of disposal costs for chips
- Higher cutting speeds
- No costs for emulsion care
- Better surface finish
- Lower energy demand

Economic advantages:

- Several-fold reduction of lubricant consumption
- Reduction of the cleaning
- Reduction of pollutants and emissions
- Reduction of skin irritation
- Always fresh medium for the machining process

ABOUT US

MASTERING PROCESSES: GROOVING

When Paul Horn introduced the type 312 indexable insert to the public in 1972, it was a small revolution in the grooving process. HORN was the first manufacturer ever to develop a tool system with a vertically mounted, three edged carbide insert for grooving. Today, the grooving process with indexable inserts is indispensable in modern manufacturing. Radial grooving, parting-off, face grooving and internal grooving to μ -precision are now part of everyday life in the machining industry. Paul Horn's incentive at the outset was for the technical perfection of his products and the HORN company continues to set similar standards in tool technology for this machining process.

HORN SETS STANDARDS IN TOOL TECHNOLOGY.

Trochoidal grooving is well suited to the production of deep, wide grooves.

The 312 insert is still popular with users today. HORN has not stopped developing and optimising successful product families. At the same time, HORN has completely integrated the value creation for its entire product range into its own production. The possible applications of the tool have grown considerably after the insert was originally used almost exclusively in the automotive industry. The "312" is intended for external machining and is used, among other things, for producing workpieces in the medical industry, in the manufacture of hydraulic components and for making everyday objects such as jewellery or ballpoint pens. However, it is not only the type 312 insert that has made

the precision tool manufacturer known as a specialist for machining between the flanks. Numerous other tool systems followed the idea from 1972, which are now successfully used for grooving worldwide.

Basically, the grooving process involves a narrow cutting edge that penetrates the workpiece in a radial or axial direction. The art of grooving is, among other things, controlling the chip flow. Chip sticking, jamming or long, stringy swarf must be avoided in practice, as they have a negative influence on process reliability and can lead to tool breakage and damaged flanks. Depending on the material to be machined and the type of machining, HORN has developed different chipbreaker geometries that ensure reliable chip formation, control and breakage. Another important point for economical grooving is a sufficient supply of coolant. Where in the past cooling was external with the classic flood coolant, today modern tool carriers are used, mostly with an internal coolant supply. This ensures effective cooling of the shear zone between the tool cutting edge and the workpiece. For parting-off, HORN

THE 312 INSERT IS STILL POPULAR WITH USERS TODAY.



HORN was the first manufacturer to develop a tool system with a vertically mounted, three edged carbide insert for grooving.

also offers a type S100 insert, which supplies the contact zone with coolant at high pressure directly through the insert. Tools are exposed to high loads during parting-off. The quality of the carbides used, the quality of the cutting edge and the insert coating all play an important role in reliable and economical parting-off.

Grooving in practice

A user produces a wide and deep groove in an aerospace component using the trochoidal grooving method. It is very well suited to the production of deep, wide grooves where high metal removal rate must be generated. The machinists produce the component from 1.4548 (X5CrNiCuNb17-4-4), a steel with high corrosion resistance, strength and toughness. Roughing is carried out using a full radius grooving insert S229 with a radius of 2 mm (0.087"). The grooving process is designed as follows: The 30 mm (1.181") wide and 15 mm (0.590") deep (incremental) recess is trochoidally roughed using the full radius indexable insert with a cutting

speed of $v_c = 140$ m/min (459.318 ft/min) at a cutting depth of $a_p = 1$ mm (0.039"). The programmed feed per revolution is $f_n = 0.25$ mm (0.010"). The finishing allowance is 0.2 mm (0.008"). Finishing also involves

THE TOTAL MACHINING TIME FOR THE GROOVE IS LESS THAN TWO MINUTES.

using an insert from the S229 system. The finishing operation is carried out from two sides with a 3 mm (0.118") wide grooving insert. The corner radius is 0.2 mm (0.008"). The total production time to complete the groove is less than two minutes.

Face grooving in the medical sector

For the production of a thin-wall valve cover made of titanium for a cerebrospinal fluid shunt, the Supermini system type 105 is used. On one hand, the customer uses a tool for the face grooves and, on



Face grooving of the medical component with the Supermini 105 system.



HORN has numerous tool systems in its portfolio for grooving.

the other, a special tool is used for finishing the cover. For the tight fit on the 0.5 mm (0.020") long cover, HORN had to design the Supermini tool with a corner radius of 0.05 mm (0.002"). The difficulty in machining titanium always arises from the dissipation of heat as well as the control of chips. For use as an implant, the user has strict criteria regarding the surface quality and the absence of burrs on the component. By optimising the cutting paths with a CAM system, the experienced colleagues in the machining department were able to double the tool life from 1,000 to 2,000 components.

Although HORN's tool portfolio has expanded considerably, not only in the area of grooving but for all applications in the field of demanding machining tasks, grooving and thus machining between two flanks is still considered the supreme discipline.



PRECISION GROOVE MILLING ENSURES GRIPPING HYDRAULIC PERFORMANCE

EXPLORE HORN

Exceptional performance comes from pairing the optimal machining process with the perfect tool. HORN combines cutting-edge technology with outstanding performance and reliability.



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