Issue 1/14

world of tools

HORN

THE CUSTOMER MAGAZINE FROM HORN

TOPICS:

LARGE PART MACHINING
INDUSTRIES
APPLICATIONS
SOLUTIONS

- Horn Hartstoffe GmbH
- The rising market in Poland
- HORN Academy
- A look back at Metav

EDITORIAL

Dear Readers,

Small part machining, miniaturisation and micro-production are the words on everybody's lips nowadays. This trend certainly illustrates one aspect of the huge field that is machining. However, there is another aspect at the opposite end of the spectrum that also plays an important role for manufacturers of precision tools and their customers: large part machining. The fact that precision can be crucial in the case of large parts is highlighted by the two user reports on this topic that you will find in this issue. However, before we get down to the practical details, there is an introductory section at the start of the special feature containing some key background information.

In addition to large part machining, this issue of world of tools also focuses on Horn Hartstoffe GmbH and its range of products. HORN has already established itself as a well-known supplier of precision tools, but the products of its wholly owned subsidiary are now opening up a brand new area in the form of "wear parts". In addition to the tool blanks and carbide rods that make up the standard range, the company also offers virtually unlimited options in terms of customised carbide product solutions. This is what makes HORN's products and services stand out from what the previous main players had to offer. The composition of the materials, the shaping process and the entire area of precision tools are all guided by the following motto: **"**HORN – leaders in grooving technology**"**.

In keeping with this motto, our employees – and also our customers – must be supported with appropriate training and advanced training, e. g. through seminars. The HORN Academy identifies the requirements of the relevant areas and is continually expanding its range of courses. Towards the end of the magazine, you will hear the latest news from the Academy and, in particular, learn about the new degree in cutting tool technology.

Size might not always matter, but in many cases it really does. I hope you enjoy reading this issue.

Lothar Horn
Managing Director,
Hartmetall-Werkzeugfabrik Paul Horn GmbH
Tübingen

world of tools

THE CUSTOMER MAGAZINE FROM HORN

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LARGE PART MACHINING WITH HORN

Size matters

Whatever the area of technology, the progression is always the same: big, bigger, biggest. Airliners such as the Airbus A380 with a take-off weight of almost 600 tonnes are already commonplace, as are ships with a length of 400 metres (15,748.0315") and a gross register tonnage of 500,000 or a loading capacity of 18,000 containers. Large equals cost-effective. So there is certainly a future for large components. Demand for them is also being fuelled by the global trend towards alternative energy generation based on wind and hydro power.

However, the machine tools required for these extremely large components are not available straight off the shelf. Several years ago, Waldrich Siegen built some portal machines for a Korean shipyard with passages measuring seven by eight metres and a machining length of more than 20 metres (787.4016"). Featuring clamping weights of 400 tonnes and a moving hydrostatic machine bed weighing another 270 tonnes, the machines are being used to produce large marine engines with more than 105,000 HP as well as motors for large decentralised energy supply systems in China. The order also included a lathe for turbine shafts with a clamping weight of more than 500 tonnes. Meanwhile, in the eastern Czech Republic, you will find an older Schiess vertical boring and turning mill with a turning diameter of 9 metres (354.3307") and a turning height of 18 metres (708.6614") for turning the bearings of cement mills following stress relief annealing. Portal milling machines are used to machine the profiles of aircraft wings, boat hulls or the blades of wind turbines measuring more than 50 metres (1968.5039") in length. Although the above represent extreme examples, parts weighing several tonnes are regularly being manufactured in relatively large quantities across the globe. Firstly, there are the parts for hydroelectric plants or steam and gas turbines; large generators; large petrochemical valves; wind turbine gearboxes; and large pressure vessels for water treatment, sewage treatment and the chemical/pharmaceutical industries. Many other large machine components are being produced as well – along with the huge machine tools needed to handle them.

In addition to the gearbox, the rotor blades of wind turbines also have to be machined.

The manufacture of large marine diesel engines involves machining on a similar scale.

Precision is always important

But size is relative. Take, for example, the many tool and mould makers who feel at home with a pallet size of 400 x 400 mm (15.7480" x 15.7480") or 800 x 800 mm (31.4961" x 31.4961"). As far as they are concerned, manufacturers of vehicle body tools or bumper moulds count as producers of large parts. Yet, there is plenty of overlap between them.

Even large machine parts, right up to the very largest of all, call for the same tight tolerances as smaller mechanical engineering applications in order to ensure the functionality, operational reliability and quality of the final product. SK50, SK60, HSK100 and HSK125 system tool holders can provide the level of stability and precision required to produce large machine components within the necessary tolerances. It is no longer impossible to achieve tolerances of 0.01 percent to 0.02 percent in two planes over a length of ten metres in air-conditioned rooms.

But in order for large parts to be machined, the machining process must be tailored to the specific requirements of the relevant workpiece and material. The dimensions and complexity of the parts mean that the machines and tools used must offer specially optimised performance characteristics to make the processes more efficient and productive. That is why leading tool manufacturers are developing powerful solutions that can accommodate the highly specialised requirements of large part machining. In this way, they can ensure high-quality machining that not only offers process reliability, but is also cost-effective. On top of this, maximum production reliability is required – large components are expensive and have long delivery times.

New milling strategies – New tool concepts

Key consumer industries such as toolmaking, aerospace and energy technology are seeing a rise in raw material prices and are constantly increasing the quality of the steel and cast alloys, high-strength nickel-based alloys, and titanium and special aluminium alloys they use. As a result, there is more and more demand for alternative milling strategies with a view to boosting cost effectiveness and competitiveness. This is particularly true within the tool and mould making industries with their machining rates of up to 70 percent or in the aviation industry, where the rate can be anything up to 95 percent in the case of titanium and aluminium materials. In light of all this, it is absolutely essential to increase process efficiency and boost productivity, including in the area of large component manufacture. In this respect,

innovative tool concepts can improve the long-term efficiency of large component machining with a view to reducing machining times while still achieving high levels of production reliability and quality. Given that milling and drilling easily outweigh any other kind of operation when machining large parts, tool innovations and more efficient machining strategies in these areas have a major impact in terms of cost factors.

Smaller diameter

An example: The advantages of using smaller tool diameters during the rough machining process are that the tool is more compact and more stable resulting in fewer stresses, the tool allows greater contour precision and less machining time is required for the subsequent finishing operations. Moreover, smaller tools can be used more cost-effectively and dynamically. Easy cutting geometries result in less heat being transferred to the workpiece and less warpage. In the case of large components, this is often crucial. The tool bodies do not necessarily have to be made from steel. Lighter materials such as aluminium and titanium or shank extensions made from high-strength, rigid fibre composite materials also reduce the weight of the tool in the case of larger diameters and longer throat depths.

With their lower machining moments, smaller tool diameters allow greater use of direct motor spindles, even in the case of large components. As a result, monitoring functions designed to safeguard the process can be implemented via the drive chain of the direct motor spindle, such as tool wear monitoring, adaptive feed control etc. With gear spindle concepts, such functions are difficult, if not impossible.

Whenever a process is optimised – regardless of whether it relates to the machining of small or large parts – attention must not only be paid to the manufacturing process itself, but also to ensuring the “right” tool, i.e. the optimum one. What Prof. Georg Schlesinger said back in 1904 still stands today: “On the cutting edge of the lathe tool sit the dividends of the company.” The only difference now is that Schlesinger's lathe tool has morphed into the modern high-performance tools we see today.

Precision tools are used for components of various sizes on opencast mining handling equipment.

LARGE BY NAME AND BY NATURE

The M279 cutter from HORN enables high cutting performance and precision when manufacturing a Hirth tooth system on a large drive pulley with an extension arm throat depth of more than 2,500 mm (98.4252").

Machining time dramatically reduced

Großbearbeitungs AG is a company in Flums (Switzerland), whose name translates roughly as "Large machining PLC" and which is owned by Bartholet, a globally active manufacturer of cable transit systems. It was here that a newly developed HORN side milling cutter from the M279 system was used to reduce the amount of time it takes to machine a large Hirth tooth system for a cable sheave drive coupling. By cutting it down from more than 20 hours per tooth system to just 2.5 hours per tooth system, it has saved almost 40 machining hours on a 14-metre (551.1811") turning and milling centre – which will certainly pay off.

Bartholet Maschinenbau AG, which is based in Flums in Switzerland, is a global company specialising in cable transit and amusement park systems. Drawing on its Swiss expertise to ensure Swiss standards of precision and reliability, BMF AG manufactures, assembles and installs coupleable and fixed chair lifts, gondola lifts, aerial tramways, circular group lifts, ski lifts, inclined lifts and special lifts. Over the past two years, its comfy six-seater chair lifts have proven very popular. These feature a weather protection canopy and heated seats and can pivot 45° away from the direction of travel so that passengers can enjoy the panorama to the full. Not only that, but the seats were designed by a renowned studio. These systems are manufactured in Flums and installed all over the world. However, these often spectacular cableways only take up 50 percent of the available machining capacity. The other 50 percent is dedicated to theme park systems, mechanical engineering based on complete systems or components, formwork construction, and solar and energy technology.

Safety without compromise

No sensitive or safety-related assembly is allowed to leave the assembly halls in Flums without undergoing extensive functional testing and safety checks. The company is fully aware that the lives of millions of users around the world are depending on the reliability of its products. Leisure time is to be enjoyed to the full – free from worry and fear.
In order to perform its machining operations, Bartholet is equipped with state-of-the-art production facilities. Running 24 hours a day in three-shift operation, its cutting-edge machines produce parts ranging from fairly small to large with a high degree of flexibility and short production times. There are around 40 powerful machining centres to accommodate every type of machining technology and size of component required. In the case of high order volumes, Bartholet is also able to draw on the capacity of almost 200 machine tools at 20 partner companies, who have come together within the region to form an association called Cobinet.
Back at its own factory buildings, it has around 200 highly qualified employees who produce and assemble prototypes, individual parts, serial parts, welded assemblies or component assemblies weighing up to 30 tonnes – with legendary Swiss precision and to the highest safety standards.

Nothing is too large

The autonomous department for large part machining, Großbearbeitungs AG, is dominated by a new Bimatec Soraluce travelling column machine with the following travel ranges: X = 14,000 mm (551.1811"), Y = 1,900 mm (74.8032") and 3,600 mm (141.7323"). There is a revolving table on the huge plate area, which allows turning operations on parts with a diameter of up to 6,000 mm (236.2205") and external machining on parts with a diameter of up to 7,000 mm (275.5906"). The performance features include a potential clamping weight of 50,000 kg, a tool magazine with 100 spaces, a fully automated universal swivel head, a head changing station with special heads, TCP calibration, interpolation turning, teleservice for external monitoring and remote system maintenance – to name but a few. In relation to this Soraluce machine, the other large machining centres in the factory hall look almost small, even though they offer travel distances of up to 6,000 mm (236.2205"). According to the Director of the Großbearbeitung company, Peter Hartmann, this version of the Soraluce represents "a unique vertical turning centre that is one of the most up-to-date within Switzerland".
The core components of the Bartholet cableway systems include, in particular, the large drive and guide pulleys. To act as the interface between the drive pinion and drive pulley, there is a functionally

Cableway pulley with a diameter of 6 metres (236.2205"). Although Edi Hurschler (left) from Großbearbeitungs AG sees this impressive size as perfectly normal, the same cannot necessarily be said of Christian Thiele from HORN (centre) and Wilfried Iseppi from Dihawag (right).

The compact and stable cutter from HORN's M279 system featuring 16 double-edged indexable inserts that have been precision-ground to handle specific parts reduces the machining time by 40 hours.

Because the milling head is set at a 30° angle, its interfering contour is lifted out of the machining plane, resulting in a stable cutter with a small diameter and short clamping area.

reliable Hirth tooth system with a positive and non-positive connection. The external and internal diameters of the Hirth tooth system are 800 mm (31.4961") and 680 mm (26.7717") respectively, resulting in a tooth length of 60 mm (2.3622"). A tooth is milled every 2° around the circumference to produce a total of 180 teeth. These teeth are rough machined to a depth of 7.1 mm (0.2795") in just one pass. By performing a further advance of 0.7 mm (0.0276"), the tool then finishes the teeth to the final depth of 7.8 mm (0.3071"). Once again, this happens in one pass. The machined drive pulley material corresponds to grade St 52 (S355 J2+N). The material used for the drive shaft pinion – 1.6582 (34CrNiMo6) – has a strength of 1,000 N/mm^2 and so is much harder to machine. The simultaneous positioning and centring of the Hirth tooth system calls for maximum precision. Yet, this coupling is subject to a torque of 530 kNm when the cable exerts a tensile force of 1,000 kN on the pulley.

Throat depth of 2.5 metres (98.4251")

The requirements stipulated that the teeth on the drive pulley and pinion (coupling) have to be machined with the same tool. This is not really a problem as regards the pinion, because it only measures 800 mm (31.4961") in diameter. However, the drive pulley has a diameter of 6,000 mm (236.2205"), which poses a major challenge for the production technology. In order for the Hirth tooth system to be machined directly on the 6 metre (236.2204") pulley, there has to be a throat depth of more than 2,500 mm (98.4252") on the compensated machine extension arm. The tooth angle of 60° across the entire tooth length is achieved using a HORN side milling cutter from the S279 system with a diameter of 125 mm (4.9213"). This is equipped with sixteen S279 double-edged indexable inserts set at an angle of 30° and travels along a pre-calculated inclined path that runs radially in relation to the pulley. The advantage of this method is that the interfering contour of the milling head is above the profile, resulting in a more stable compact cutter with the smallest possible diameter and a compact interface. The same cutter is used to mill the opposing contour on the drive pinion. Due to the large angle of contact associated with the full cut during down-cutting milling and finishing, the resulting heat must be dissipated by means of cooling lubricants.
The result is superb contour accuracy with an average roughness of R_a 1.6 µm corresponding to N7. The feed rate per tooth f_z is 0.12 mm (0.0047") and, at 500 mm (19.6850") /min, the feed rate is up to 15 times faster than with the previous tool, which stood at 35 – 60 mm (1.3780"-2.3622")/min. The amount of time required to machine the teeth on the drive pulley and pinion has been cut from more than 20 hours per part to just 2.5 hours. This equates to massive time and cost savings when multiplied by the hourly rate of the large Soraluce machine.

A major leap forwards

Wilfried Iseppi from Dihawag, a HORN sales partner based in Switzerland, has been successfully making sales at Bartholet since 1988 by offering a wide range of HORN tools that is constantly growing. He knew of the machining problems that Großbearbeitung were experiencing in relation to their Hirth tooth systems and so suggested the newly developed M279 side milling cutter as a potential solution. The need to adapt the equipment to suit the specific task was classed as an urgent project. The correct approach was then developed in conjunction with Großbearbeitungs AG, resulting in a major leap forwards in terms of costs and technology. The robust toolholder maximises the number of double-edged indexable inserts that can be used and provides plenty of chip space. The toolholder clamp, a cutter head holder with a diameter of 40 mm (1.5748") and a Haimer adaption, creates a stable system featuring vibration damping. The high concentricity and indexability ensure identical contact conditions for all cutting edges so that they enjoy a long life. The cutting bodies take the form of AS45 double-edged indexable inserts from HORN's S279 system. These have a part-specific precision-ground geometry with cutting edges set at a 60° angle and a corner radius of R 1.1 mm (0.0433"). They are ground straight and, to an extent, positively to avoid profile distortions. A high indexability of 2/100 mm (0.0008") is ensured by securing the cutting bodies in a precision insert seat. For this purpose, a torx screw from the Torx 20P system is used. For reasons of process reliability, the cutting edges are replaced well before the end of their tool life.
Edi Hurschler, another member of the Großbearbeitungs AG management team, is enthusiastic about “the high cutting capacity, the low cutting forces and the soft cutting, which are the key to achieving the high chip volume with a throat depth of 2,500 mm (98.4252") in the first place. The smooth surface of the inserts ensures good chip flow and low levels of heat transfer. The heat is swept out of the machining zone together with the chips.”
Wilfried Iseppi is also keen to emphasise the advantages of the solid insert: “it is ideal for the deep cutting depths required for a Hirth tooth system. And with a cutting depth of 7.1 mm (0.2795") during rough machining or 7.8 mm (0.3071") during finishing, the total length of the insert that makes contact with the material is 16 (0.6299") or 20 mm (0.7874") respectively. In fact, a maximum cutting depth of 8.5 mm (0.3346") could even be achieved.”

When used to mill slots in plates measuring up to 1,800 x 1,300 x 180 mm (70.8661" x 51.1811" x 7.0866"), the DAH milling cutter with a diameter of 25 mm (0.9843") fares just as well against the competition as the larger version with a diameter of 50 mm (1.9685") for mould inserts.

CUTTER CUTS THE MUSTARD

In an industry such as tool and mould making, word soon gets around about satisfied customers, high precision and short delivery times. That is certainly true of the metal services provided by Horlacher Applikationen in Kirchheim/Teck-Jesingen. Here, powerful machines and, in particular, high-performance tools from HORN in Tübingen are being used to cut the costs and machining times associated with large parts.

Tomas Horlacher, who only founded his company in 2002, employs a team of five to produce parts for special purpose machinery manufacturers, automotive suppliers, the aerospace industry, fuel cell technology, toolmaking and machine construction, as well as laser welding applications. Having started out with nothing but his experience and entrepreneurial spirit, Horlacher has now built up a substantial collection of machine tools for his machining operations.

The components handled range from small plates right through to complex 3D parts. The largest one processed to date was a large mould clamping plate measuring 2,800 x 1,600 x 150 mm (110.2362" x 62.9921" x 5.9055") and weighing 3.5 tonnes. Key products in the Horlacher range include mould clamping plates measuring up to 1,800 x 1300 x 180 mm (70.8661" x 51.1811" x 7.0866") (approx.), mould frames, complete mould superstructures and mould inserts for tool and mould making, as well as series-produced clamping equipment and clamping plates for two-component moulds. So that the materials covered by this range (such as aluminium, steel, powder steel, stainless steels, all casting grades and even hardened tool steel) can be machined in a cost-effective manner, Tomas Horlacher and his team are constantly looking for ways to improve their production facilities.

Optimisation required when rough machining large parts

"Increasingly, our orders are starting to include projects that involve technical feasibility studies, preliminary costing, materials analysis and many other tasks besides. However, what we like most are large parts that call for precision and short delivery times," explains Tomas Horlacher when asked about which orders he prefers. By way of a recent example, he cites an injection mould for a bumper with an indicator insert measuring 800 x 600 x 400 mm (31.4961" x 23.6220" x 15.7480") and weighing 2.5 tonnes. The material (1.2343 ESV.0) ensures good chip flow and is characterised by its natural hardness and high strength of 900 N/mm^2.

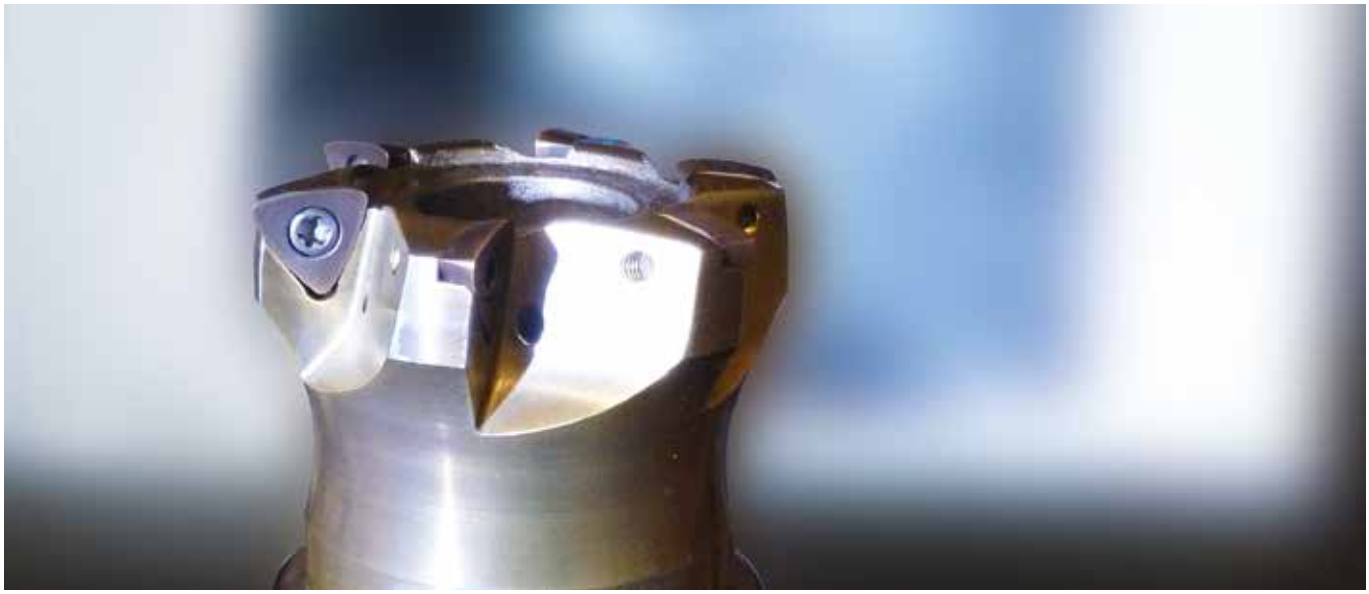
In the past, the company had always relied on cutters from our competitors for the rough machining of similar components. However, these resulted in a high failure rate because radial vibrations caused chipping of the inserts and because wear on the tool carrier led to total failure in some cases. An additional challenge faced was the fact that the central fastening screw with its M2.5 thread sometimes had to be knocked out with the chisel when changing inserts. That is why the company opted for our arbor milling cutters with a length of 200 mm (7.8740") and a diameter of 52 mm (2.0472") in conjunction with 6 five-edged inserts (although only three cutting edges are generally used).

DAH high-feed milling cutter: Versatility for the tool and mould making industries

Mirko Leonhardt, who works in Technical Advice and Sales at HORN, recommended the DAH high-feed milling cutter system for both this and similar applications. First and foremost, this system achieves the high material removal rates required in the tool and mould making industries while offering stability and a long tool life. Secondly, the versatility and strength of the various cutter designs with their different coatings and geometries really come to the fore when used for face, pocket, plunge, front and circular milling on steel, cast materials, titanium and aluminium.
The cutters in the DAH system are available as end mills with a Weldon toolholder, as industry standard threaded connection versions and as arbor milling cutters with cutting edge diameters ranging from 12 to 125 mm (0.4724" to 4.9213"). Other applications can be accommodated by using the cutter heads and screw-on milling cutters from the DAH37 series with diameters of 20 mm (0.7874"), 25 mm (0.9843"), 32 mm (1.2598") and 44 mm (1.7323"). The areas of application covered by this series can be expanded by means of the following: arbor milling cutters with cutting edge diameters of 40 mm (1.5748"), 50 mm (1.9685"), 63 mm (2.4803") and 80 mm (3.1496") mm and four clip-on cutter heads from the DAH62 series with cutting edge diameters of 63 mm (2.4803"), 80 mm (3.1496"), 100 mm (3.9370") and 125 mm (4.9213"). To cater for smaller diameters, the DAH25 series is available with four end mills featuring a Weldon toolholder and cutting edge diameters of 12 mm (0.4724"), 16 mm (0.6299"), 20 mm (0.7874") und 25 mm (0.9843"). It is also worth mentioning the cutting geometry of the double, triple and six-edged inserts. The large radius on the main cutting edge results in a soft cut, ensures even distribution of the cutting forces and, in turn, extends the tool life. On the inner side, a smaller cutting edge radius makes for quick and easy plunging. Optimum cutting edge stability is ensured by the stable wedge angle. Depending on the power and robustness of the machine or tools, feed rates of up to 3 mm (0.1181")/tooth can be achieved with a maximum cutting depth of 2 mm (0.0787").

Tool manages to impress

After revealing the diversity of the DAH product range, Mirko Leonhardt also wanted to demonstrate the practical benefits of the cutter on the actual mould insert that the company wanted to produce. For rough machining, he recommended a DAH cutter head in the form of a DAHM37 arbor milling cutter with a cutting edge diameter of 50 mm (1.9685"). With a head height of 40 mm (1.5748"), the total length of the tool is 200 mm (7.8740"). The cutter is equipped with 6 triple-edged, indexable inserts with a thickness of 3.18 mm (0.1252"). The M3 fastening screw with TX10PL ensures that the insert is securely seated and can be easily undone even after being subjected to the maximum load.
In view of the workpiece shape with its many free-form surfaces and the capacity of the machining centre, the following cutting values were selected for the rough machining of the mould insert (which measured 544 x 454 x 720 mm (21.4173" x 17.8740" x 28.3464") and weighed 1300 kg): v_f = 7,644 mm (300.9449")/min, n = 1,274 rpm, v_c = 250 m (9,842.5197") /min and a_p = 1 mm (0.0394"). Tomas Horlacher summed up his main impressions as follows even before the testing phase had finished: “The tool from HORN revealed itself to be much quieter and generated fewer vibrations. This also helped to protect the spindle system. What's more, we no longer experienced any premature chipping of the cutting edges as a result of vibrations.” Mirko Leonhardt from HORN believes that the reasons for this lie in the cutting edge geometry: “The combination of the cutting edges and the



The DAH milling cutter from HORN with its special high-feed geometry beat the competition hands down in a direct comparison: Time savings of 50 percent, tool life around 300 percent longer.

Tomas Horlacher (Horlacher Applikationen) and Mirko Leonhardt from HORN (shown on right) are both equally won over by the DAH milling cutter used.

blade angle meant that the resultant radial cutting force was lower, exerting less radial stress on the spindle bearings." These positive results were corroborated a bit later on when the same cutter was used for the rough machining of a mould clamping plate made from identical 1.2343 material. In this case, the workpiece was machined just as impressively as before with the following values: v_f = 9,000 mm 354.3307")/min, n = 1,600 rpm, v_c = 251 m (9,881.8898")/min and a_p = 1 mm (0.0394").

Sensational milling performance, a worthwhile investment

Ultimately, though, it is the overall system of tool combined with machine that determines whether a solution brings commercial success. This is what the Managing Director had to say about that: "The DAH high-feed milling cutter is enabling us to cut our tool costs considerably and we have managed to double our machine capacity." Even though the tool life is 300 percent longer than with the tools of our competitors, there has been no evidence of cutting edge chipping on the DAH milling cutters. The cutting edges of our competitors' inserts had to be changed after removing just 10 mm (0.3937") of material from the mould plane, compared with 30 mm (1.1811") in the case of the HORN inserts. Carbide grade SA4B is used for the high-feed cutting edges. This tough substrate with a TiAlN multi-layer coating has increased the material removal rate considerably when machining both the mould inserts and the injection mould. As a result, machining times have been reduced by more than 50 percent. While the competitor tool took 15 hours to machine one mould insert, the HORN milling cutter managed to handle the same amount of work in half the time. When the chip volume is compared, the HORN system clearly comes out on top with a volume of 229 cm^3/min in the case of the DAH cutter against just 98 cm^3/min in the case of the other tool. The performance limits of the DAH cutter were far from being reached, as it was the spindle output and speed of the largest machining centre (a Hurco DCX 22 with SK40) that imposed the constraints. Tomas Horlacher concludes by mentioning another aspect that has made him very happy: "Thanks to Mirko Leonhardt's expert advice, we are now using more than just the DAH milling cutters. Among other things, a solid carbide milling cutter from the DP system has proven ideal for finishing the various moulds."

Offering twice the material removal rate, the DAH milling cutter also impressed with its higher level of process reliability.

METAV 2014
11.–15. März Düsseldorf

metal meets MEDICAL

A look back at Metav, 11–15 March 2014, Düsseldorf

"Metav was the first international metalworking trade fair scheduled for 2014 and took place in a good economic climate," explained Dr Wilfried Schäfer, Executive Director of VDW (the German Machine Tool Builders' Association, which organises the fair). In total, over 31 000 visitors came to METAV 2014. HORN started with positive expectations in Düsseldorf, but even these were exceeded.

Among other things, HORN featured the following at Metav:

New HP65 coating
Available for S100 inserts with widths of 2 mm (0.0787") and 3 mm (0.1181") and .3V. and .FY. geometries. Excellent performance with stainless and high alloy steels.

Grooving system 315 for axial recesses
Triple-edged inserts for a slot external Ø of 8 – 20 mm (0.3150" – 0.7874"). Groove widths of 1.5/2/2.4 mm (0.0591"/0.0787"/0.0945"), groove depths of 1.6/1.8/2.0 mm (0.0630"/0.0709"/0.0787").

M382 slotting cutters
Cut-off Ø 80 – 200 mm (3.1496" – 7.8740"), cutting widths of 8 – 14 mm (0.3150" - 0.5512"). Up to Ø 800 mm (31.4961") and a width of 10 mm (0.3937") on request.

DA milling system expanded with arbor milling cutters
Cutting edge Ø 40/50/63 mm (1.5748"/1.9685"/2.4803") for steel, cast iron, stainless materials and aluminium.

Axial grooving from a slot external Ø of 15 mm (0.5906")
25A axial grooving system with toolholder, square shank and cassettes for groove widths of 2mm (0.0787") and 3 mm (0.1181") and a groove depth of up to 18 mm (0.7087").

DS milling system with new micro-milling cutters
VHM milling cutters for 50 – 70 HRC. Ball cutters from a cutting edge Ø of 0.2 mm (0.0079"), torus cutters from a cutting edge Ø of 0.1 mm (0.0039").

Looking ahead to Tube®, 7–11 April 2014, Düsseldorf

This year, HORN will be making its debut at the Tube® international trade fair for tube technology. At stand K40 in hall 6, the company will be exhibiting tools for the oil and gas industries as well as carbide wear parts.

Hall 06, Stand K40

Tube® Düsseldorf
join the best
7.–11. April 2014

Tools for the oil and gas industries

Tool systems for tubes up to Ø 25". Grooving and parting off: Groove widths of 10/12/16 mm (0.3937"/0.4724"/0.6299") with stationary and revolving tools. Chamfering and peeling. Thread turning, internal and external with pitches of 3/5/8/10 threads/". Increase in productivity thanks to our patented insert/chip former system.

Carbide wear parts

New product line for customers from various industries, manufactured at the ultramodern plant of Horn Hartstoffe GmbH. Examples from live orders: Hydraulic parts, nozzles, guide bars, wire guide rollers for wire eroding machines and much more besides.

Looking ahead to SÜDTEC in Stuttgart, 3–5 June 2014

Hall 3, Stand A10

SÜDTEC is the international supplier fair for the processing industry including, in particular, medical technology. The trade fair will take place in Stuttgart alongside MEDTEC Europe. At stand A10 in hall 3, visitors to the HORN stand (covering an area of 35 m²) will get a taste of the various applications covered by the company, its expert advice and its application-specific solutions. HORN's exhibit will focus on specific product groups that are suitable for machining medical devices. For example, the DCX system is used for machining grooves in surgical instruments, whirling heads are used for creating bone screw threads, the Supermini® system is used to produce pacemaker components and all kinds of milling cutters are used to machine artificial joints.

Medical technology is another key customer sector for HORN in addition to the automotive and mechanical engineering industries. Within this sector, we are seeing continuous progress in terms of machining with an annual market growth rate of approximately five percent. Owing to greater life expectancy and the "human spare parts" that are increasingly being used as a result, long-term growth is virtually guaranteed.

A look back at the HORN technology event

The HORN technology event, which was organised in conjunction with DMG MORI, WTO and WALTER, took place in Tübingen on 29 and 30 January 2014. In addition to the machine demonstrations, the other main highlights were the technical presentations and expert discussions.

The presentations and workshops covered the following topics:
- Complete machining on main and counter spindles
- Turning/milling operations on lathes
- Gear milling with hobbing function (polygon cutting)
- Polygon milling
- Precision holder with high machining capacity and long service life for greater productivity: How to manufacture workpieces cost-effectively and with a high degree of precision
- Maximum productivity during turning and milling thanks to a highly innovative CVD-AI203 coating technology
- Maximum process reliability and precision with deep drilling depths
- Modern grooving and turning tools and innovative geometries for internal and external machining

Around 140 visitors used the event as a way of finding out more and engaging in dialogue. More than 14,000 universal lathes from NL and NLX series have been installed and are in use around the world.

Lots of people wanted good advice in Hanover.
The “pick-up and touch” tools helped the conversation along.

EMO Hannover
16 - 21 · 9 · 2013

A LOOK BACK AT EMO 2013 IN HANOVER

“More visitors equals more business equals more international acclaim,” is how the General Commissioner of EMO summed up the results of the fair. Managing Director Lothar Horn had this to add from the perspective of Paul Horn GmbH: “With more than 20 innovations and product enhancements that showed a representative cross section of our product range, we more than lived up to the trade fair motto of 'Intelligence in Production'. To back this up, there was a rush of visitors to our stand in hall 5, the likes of which we had never seen before.”

Here is another brief summary of some of the HORN innovations exhibited at EMO:

System 209 for internal grooves
Tool holder with 16 mm shank (0.6299") Ø in grade h6, internal cooling, 2-edged indexable insert, cutting edge width of 2 mm (0.0787"). Working range with insertion depth of up to 30 mm (1.1811"): Drilled holes with a Ø of up to 18 mm (0.7087"), groove depth of up to 5 mm (0.1969").
Optimum chip control and chip breaking even with long-chipping materials.

There was a lot of interest in HORN's innovations.

60 percent longer tool life with rhombic tangential plate 409
Precision-ground indexable insert for tangential milling cutter M409. D_s = 32/40 mm (1.2598"/1.5748") with end mills, 40/50/63 and 80 mm (1.5748", 1.9685", 2.4803" and 3.1496") with arbor milling cutters.
Long tool lives for rough machining and finishing. Optimum chip flow, cutting depth of up to 9.3 mm (0.3661"). Milling of 90° shoulders.

µ-Finish: System 274 for micro-turning
Precision-ground inserts for turning, grooving and parting off. Specifically designed for materials in the watch-making industry, such as 20AP, 4C27A, stainless steels and brass. Guaranteed centre height ±0.0025 mm (0.000098").
Glossy surfaces with the smallest of diameters. Feed rates of a few hundredths of a millimetre per revolution.

Modular die for pipe threads
Changing system consisting of basic holder (same dimensions as solid carbide cutting rings) plus five inserts. Working range M3 to M60.
Straightforward method of changing inserts that cuts costs, basic holder fits existing VHM cutting rings, no need for finish grinding. Weight comparison R ½": VHM cutting rings 275 g compared to five cutting inserts weighing a total of 23 g.

Range extended in case of M101 slot millers and slotting cutters
New side milling cutters with cutting widths of 3 and 4 mm (0.1181" und 0.1575") for groove depths of up to 59 mm (2.3228").
The self-clamping carbide indexable inserts are easy to change. Geometries for standard steels, stainless steels and titanium materials.

High-feed milling cutters supplement the DAH system
End mills with a Weldon toolholder: D_s = 12/16/20/25 mm (0.4724"/0.6299"/0.7874"/0.9843") with 2/3/4 indexable inserts. a_p max. 1.0 mm (0.0394"), r_x = 0.4 mm (0.0157").
Soft cutting, quick and reliable plunging, internal cooling, for milling steel, stainless steel, cast iron, aluminium and titanium.

Height-adjustable grooving tool holder with internal cooling
Interface 956 for quick changeover of S100, S224 and S229 grooving systems with groove widths of 2 to 6 mm (0.0787" – 0.2362") on multi-spindle lathes. Specially coordinated cassettes for a workpiece Ø of 40 – 125 mm (1.5748" - 4.9213").
Extremely versatile thanks to the VDI holder, square shanks, machine-specific holders for multi-spindle lathes from Schütte, DMG and Index.

DG system expanded to include quadrant milling cutters
DGV quadrant milling cutters with D_s = 10 mm (0.3937") for edge machining, suitable for size 10 DG shanks.
Segmented thread connects carbide milling head and shank. Optimum rigidity and concentricity. More cost-effective than a solid carbide milling cutter.

EMO in Hanover – The world's leading trade fair for the metalworking industry.

A look back at NORTEC in Hamburg, 21–24 January 2014

Intensive dialog was one of the hallmarks of Nortec 2014.

"The mood within Northern Germany's mechanical engineering and plant construction industry is decidedly upbeat. NORTEC provided ample evidence of this. What's more, our associated conference and forum programme was very well received. Many participants praised the high quality of the content offered," says Bernd Aufderheide, Chairman of the Board at Hamburg Messe und Congress GmbH.

In fact, around 12,000 visitors and 430 exhibitors attended the 14th NORTEC in Hamburg, which meant it saw a further increase in visitors in 2014 and set a record for the number of exhibitors. HORN's recollection of the event is of high-quality conversations and the excellent visitor numbers who sought out its stand. "It is precisely the regional nature of this trade fair that makes it so special and the key industries within the region, i.e. aerospace, medical technology, shipyards and gear manufacturing, really come to the fore. We have been taking part in NORTEC for many years and will, once again, be represented in Hamburg in 2016," explains Lothar Horn, Managing Director of Paul Horn GmbH. The hot topics at NORTEC 2014 included the use of robots in automation as well as the issue of tool cooling.

Grooving system 315 for axial recesses

Grooving system 315 now also offers the possibility of axial recesses. With its 3 triple-edged inserts, the system covers slot external diameters of 8 mm (0.3150") and above. The corresponding groove widths of 1.5 mm (0.0591"), 2 mm (0.0787") and 2.4 mm (0.0945"), as well as the corner radii of 0.4 mm (0.0157"), 0.5 mm (0.0197") and 0.6 mm (0.0236"), and the maximum groove depths of 1.6 mm (0.0630"), 1.8 mm (0.0709") and 2.0 mm (0.0787") have all been designed in the same way as the machining diameters. To create the axial recess, there always has to be a radial recess. The TN35 and TH35 inserts are fixed securely and conveniently at 45° in a toolholder using clamping bolts. The 45° installation angle means that the cutting edges are aligned parallel with the axis.

Grooving system 315 for axial recesses.

Slot depths down to 230 mm (9.0551")

M382 slotting cutter in detail.

The M382 side milling cutter is ideal for slotting deep grooves or even for separating. With a diameter of 800 mm (31.4961"), milling depths down to 230 mm (9.0551") and cutting widths of up to 14 mm (0.5512") can be achieved. The stem disc of the milling cutter is stabilised with two receiving discs. Larger recesses in the stem disc and the receiving discs help to reduce the weight.

The type of carbide, geometry and coating for the associated carbide indexable inserts from the 314 system can be adapted to the material to be machined for optimised use. The screwed-on indexable inserts can be easily exchanged with a high repeat accuracy and result in much lower stocks and costs compared with regrindable tools.

The side milling cutters from the 382 system are available with diameters ranging from 80 to 200 mm (3.1496" to 7.8740") and cutting widths of 6 to 14 mm (0.2362" to 0.5512"). Larger diameters of 200 to 800 mm (7.8740" to 31.4961") with cutting widths of 8 to 14 mm (0.3150" to 0.5512") can be designed and produced for special applications on request.

Axial grooving from a diameter of 15 mm (0.5906")

The 25A axial grooving system contains toolholders with square shanks in dimensions of 12 x 12 mm (0.4724" x 0.4724"), 16 x 16 mm (0.6299" x 0.6299") und 20 x 20 mm (0.7874" x 0.7874"), plus round shanks and cassettes featuring internal cooling. The cassettes are designed for the K220 standard cassette interface and are compatible with all applicable basic holders from HORN. The internal coolant supply ensures efficient cooling that does not have a negative effect on chip flow. Cassettes and toolholders for groove widths of 2 mm and 3 mm (0.0787" and 0.1181") are designed for slot external diameters of 15 mm (0.5906") and above and for groove depths down to 18 mm (0.7087").

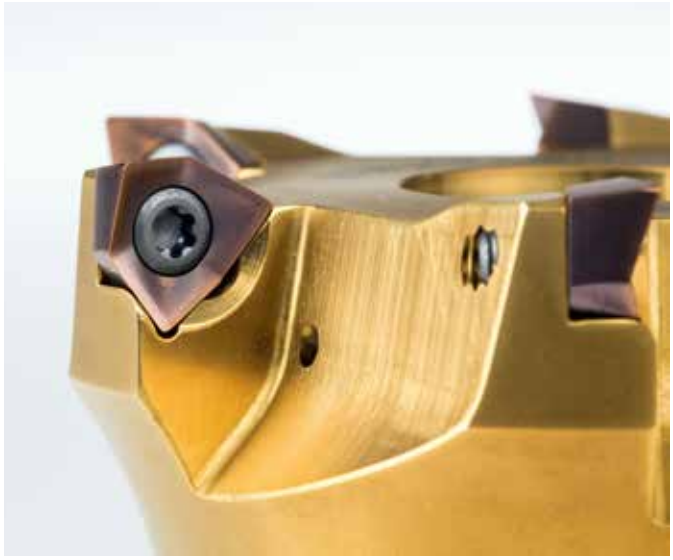
In addition to the type 25A double-edged insert, there is now a new single-edged variant available in the form of type 15A. This is used for grooving along an interfering contour such as a collar. In this instance, instead of using a second cutting edge, a recess is ground into the insert to ensure the rear freewheel runs as required. The dimensions of the single and double-edged inserts are the same, which means that the single-edged variant can also fit into all holders of the 25A system. The inserts are available in carbide grade TH35. The .10 geometric shape also ensures safe chip flow, even with large groove depths.

25A axial grooving system in a round shank and cassette design.

DA arbor milling cutter system expanded

The well-known and fully proven DA milling system now supports diameters of up to 63 mm (2.4803). There are three new arbor milling cutters with diameters of 40 mm (1.5748"), 50 mm (1.9685") and 63 mm (2.4803"). These can be equipped with up to six indexable inserts and ensure high productivity. The basic holders enable efficient internal cooling and also have a resistant TiN coating to protect them against chips and corrosion.

With their DA32 triple-edged indexable inserts, the cutters are suitable for numerous machining applications including face milling, plunge milling and circular milling – even angled plunging can be achieved with ease. The highly positive geometry of the insert ensures a soft cut with minimum stress being exerted on both the workpiece and the tool. The face-side wiper cut enables high levels of surface quality to be achieved. The radial-side curved cut results in an exact 90 ° shoulder and high cutting edge stability for a long tool life. The SA4B grade is ideally suited for rough machining with steel, cast iron and stainless materials. The TA45 grade is preferable for finishing and for machining aluminium.



DA arbor milling cutter system for corner milling, face milling and plunge milling.

DS system for hard milling up to 70 HRC

The well-known DS system has been further optimised, particularly in the area of micro-milling cutters. This series of millers features an optimised geometry plus a new TS3E coating that is specifically designed for hardness ranges from 50 to 70 HRC, making these tools an impressive choice.

The ball cutters (available with diameters ranging from 0.2 to 12 mm (0.0078" to 0.4724")) and the torus cutters (available with diameters from 0.1 mm to 12 mm (0.0039" bis 0.4724")) are centre cutting and have a helix angle of 30°. The variants with a diameter of 4 mm (0.1574") and up are available with either two or four cutting edges and with machining depths that are one and a half, three, five or seven times the nominal diameter. As regards the multi-edge tools with a 45° helix angle, the available diameters range from 3 mm to 12 mm (0.1181" to 0.4724"). This can be extended up to 16 mm (0.6299") without a corner radius.

From the DS range: Full radius milling cutter and multi-blade end mill.

Swiss-Finish becomes “µ-Finish”

S274 inserts with specially ground “µ-Finish” for machining precision parts.

The S274 insert system in the high-precision “ Swiss-Finish” design with precision-ground cutting edges was specially designed for machining precision parts in the watch-making industry. As Swiss companies from this industry made a significant contribution to the development of these products, the series was given the name “Swiss-Finish”. Following the launch of the product series, other industries and global companies also expressed an interest in this new development. This led to the name being changed from Swiss-Finish to “µ-Finish”.

The S274 system with the high-precision “µ-Finish” design includes inserts for turning, grooving and parting off and is designed for machining materials for the watch-making industry, including 20AP and 4C27A, stainless steels and brass. Practical applications have revealed that the tool life is 15 times longer than with other tools. A consistent centre height of ±0.0025 mm (0.0001") is ensured. This means that no further corrections are required once the tool has been set up for the first time and the customer does not need to prepare the cutting edges.

A selection of items from the wide range of HORN precision tools.

SERVICE IS A TOP PRIORITY

German sales territories reorganised

HORN is going to increase the size of its field sales force by 50 percent, taking the number of employees from 40 to 60. The product range has been growing constantly, as has the number of customers, and these factors have prompted the company to reorganise certain sales territories.

It is not just HORN's traditional area of machining between two flanks that has seen considerable expansion in terms of the number of products. There has also been clear progress in the areas of milling, broaching, reaming and other high-tech fields of machining. Currently, the standard range contains around 20,000 items. In addition, more than 120,000 special solutions have been put into operation at customer sites so far. Now, on top of all that, there is the new area of wear parts. The field sales employees already had plenty to keep them busy in the form of their day-to-day tasks, ongoing projects and start-up work. So that we can continue to provide customers with the optimum solution in the future by offering them existing products, new products and product enhancements, it is therefore very important that we consolidate the field sales network. Advice and dialog are essential ingredients, particularly when dealing with applications that are technically demanding. In this context, expertise, experience and on-site support are often crucial, whether that is while looking for a solution, carrying out tests or performing start-up work.

In addition to providing advice, service is also about being able to offer solutions for every conceivable product and application. Whether the focus is on consignment stock, tool management, a high level of delivery reliability or the use of special and combi-tools, every sales force assignment is unique. Another important issue for customers is delivery speed. But whatever aspect you are talking about, the field sales force always acts as the interface between the customer and order processing. This comprehensive approach is labour-intensive and so the only way to sustain and improve the current level of service is by increasing the size of the field sales force. The overall extent to which all these aspects are fulfilled determines the level of customer satisfaction, which is the yardstick by which HORN is measured as both a tool supplier and a solution partner. And, ultimately, satisfied customers are the key to successful collaboration in the long term.

Heinrich Kleine has worked at the company since 1990.
In 1992, he became the Plant Manager of Horn Hartstoffe GmbH.

SHAPING AND WEAR PARTS

Heinrich Kleine talks about the new product division and how it came about

HORN has always had a presence on the machining market. How do the areas of wear and shaping fit in with that?

More and more of our existing machining customers were coming to us with enquiries relating to the area of wear. The manufacturing processes for cutting tools are very similar to those for wear parts, which allows our existing machinery and technologies to be exploited to the full in this new context. We have decades of experience in the manufacture of precision tools including, in particular, within the area of shaping. This provides us with the perfect foundation for developing and further developing wear parts.

Horn Hartstoffe GmbH has now been producing products at its new premises for one and half years. Does the newly constructed production site provide enough capacity with its floor space of 5,000 m²?

The new product range was taken into account while we were still drawing up the plans for Horn Hartstoffe GmbH's new building. Currently, we are running at approximately 60 percent of maximum capacity. This gives us enough leeway for both the area of precision tools and the area of wear. Even the capacity levels within our in-house toolmaking shop have been conceived so that it can respond flexibly to bespoke enquiries.

What kinds of shaping processes do you use?

Four shaping processes come into play at our site: isostatic pressing, axial pressing, extrusion and injection moulding.

Why is it so important to have all four of these different processes available?

That's easy! So that we can manufacture all the relevant components efficiently and cost-effectively. The four shaping processes allow us to offer the best possible quality – as appropriate for the particular application and with due regard for economic factors. It is this flexibility that makes us stand out from the existing suppliers specialising in this area.

Does the "wear" process chain also include machining operations?

Yes, in the case of indirect shaping, the wear parts are machined as pre-sintered blanks in accordance with the customer's drawing. The relevant machining operations are already integrated into the process chain. By "machining operations", I mean milling, turning and grinding. For this purpose, our machinery includes CNC 5-axis milling machines, CNC lathes with driven tools and grinding machines that are specifically designed for machining pre-sintered blanks.

Shaping lies at the heart of what Horn Hartstoffe GmbH does.

Horn Hartstoffe GmbH uses the sales channels of Paul Horn GmbH to distribute its products. Why is that?

The existing customers of Paul Horn GmbH are already convinced by our products. They are familiar with and value our quality, our expertise and our many years of experience. Because we are a registered supplier and partner, the doors of these customers are open to us. However, we do not just limit ourselves to existing customers. As well as creating new internal structures in the areas of production and sales, the company has appointed Michael Kast as the product manager for the new “Wear” division at HORN.

The target customer group is expanding significantly as a result of the new product line. So are you appealing to specific industries?

As with precision tools, the main industries are toolmaking, the automotive sector and oil. However, the new products are also being used in the food and power tool industries. Due to the many ways in which carbides can be used, the potential applications cannot be divided up into neat categories.

How were you involved personally in implementing this additional range of products?

To address that, I need to take you back 20 years to a point when the issue of wear was not even on the table at HORN. It was around that time that Horn Hartstoffe GmbH was founded, ushering in the first shaping processes and injection moulding and extrusion technology. It was at this early stage that we laid the foundations for the position from which we are starting out today. Our many years of experience really benefited us as we progressed through the various stages – from the initial idea of producing wear parts right through to the implementation phase and the point where the products were ready for the market. Our initial foray into the area of wear parts was not geared toward the market but was driven by our own internal requirements. For example, not only did we have internal requirements in the area of measuring equipment but also of carbide resources for grinding equipment. In light of the positive feedback we received from within our own ranks and after polling some of our current customers, we came up with the idea of serving the existing market as well. I was involved in all the processes and in setting up this new division right from the very start. It has been, and continues to be, a fascinating challenge and I dare say it will come as no surprise if I tell you that there is still much that we wish to achieve.

The company's experience and further development work in the area of sintering also span more than 20 years.

Michael Kast shows off an isostatically pressed workpiece.

CARBIDE BLANKS AND WEAR PARTS

Ultramodern manufacturing facilities offer impressive production alternatives

At Horn Hartstoffe GmbH, a HORN subsidiary, production has been running at the planned level since September 2013. Although it was initially only producing parts to meet the requirements of Hartmetall-Werkzeugfabrik Paul Horn GmbH, external companies are now also benefiting from the new plant's exceptional technical facilities. For these companies, the subsidiary is busy producing carbide wear parts and blanks – quickly, flexibly and cost-effectively.

At the new plant, all the carbide manufacturing operations that relate specifically to production are organised on the basis of material flow principles and integrated with a series of downstream processes, all within a single building. The newly designed process chains mean that production can be adapted to suit the batch size even more quickly and flexibly than before. That applies as much to in-house tools as it does to the new product lines, such as blanks for precision tools and contract orders for complex wear parts and cutting tool blanks.

Lothar Horn, Managing Director of Paul Horn GmbH, recalls the objectives that were set on construction of the new plant: “New machines and processes must set technological trends in the tool manufacturing industry, e.g. in the form of new shaping processes. Without these (and other) technologies, we will not be able to deliver parts of our current product range or products that are in the pipeline such as the new contract manufacturing programme.”

Carbide blanks expand the range of available products

With the launch of its new “carbide blanks for precision tools” product line, HORN is making its expertise and ultramodern production equipment available to other companies as well. The range has been developed to enable the manufacture of rotating solid carbide milling, drilling and reaming tools and includes the following:

- Carbide rods (raw sintered or h6 ground, available with standard or fixed lengths and in customised designs)
- Carbide rods with straight or twisted cooling channels (raw sintered or h6 ground)
- Flat and square rods (raw sintered or ground)
- Cermet rods (h5 or h6 ground)
- Carbide blanks in accordance with customer drawings

Carbide wear parts for numerous customer groups

Another new addition to the product range are our carbide wear parts. By this, we mean non cutting-tool parts that are manufactured using direct or indirect shaping processes. The kinds of items currently being produced include hydraulic parts, nozzles, guide bars, wire guide rollers for wire eroding machines and much more besides.

Even though HORN's contract manufacturing business is still in the start-up phase, the company has noticed an increase in enquiries from end consumers and carbide processors such as grinding shops. Aside from the direct enquiries, the HORN technical consultants are also making contact with the relevant people with the assistance of Michael Kast, who is an expert in wear parts at HORN. Once the requirements have been identified, they are dealt with by an experienced team of specialists. This team determines the shaping process and production sequence that are appropriate for the batch size, as well as any machining operations that may be required. The resulting technical specification, which includes the manufacturing costs, is then used by the internal sales force at Paul Horn GmbH as the basis for a quote. This department is responsible for subsequent order processing and for clarifying all sales-related issues.

State-of-the-art carbide process chain

Thanks to its new production sequences, Horn Hartstoffe GmbH and its 70-strong workforce are equipped with state-of-the-art technology for manufacturing products from carbide metal. The in-house production facilities, which cover toolmaking, powder preparation, shaping processes, pre-sintering, sintering and surface treatment, are the perfect recipe for guaranteeing fast, high-quality and extremely cost-effective manufacturing of various quantities.

Quality stems from toolmaking

Cost-effective shaping would not even be possible in the first place without high-precision injection moulding or press tools. That is why the HORN toolmaking department is equipped with the latest machining centres, milling/vertical eroding/wire eroding/surface grinding/jig grinding machines and other types of operating equipment.

Innovative solutions for meeting stringent demands are produced using the electric axial presses and other equipment.

Carbide blanks for wear parts and round tools.

Powder preparation with weight tolerances of 0.01 g

The manufacturing process for an insert starts with mixing and preparing carbide alloys in the form of powders that range from superfine to coarse, along with pressing aids and additives, to create mixtures for pressing. Maximum precision is required during this process, as even slight differences (the pressing aids are weighed out with a tolerance of 0.01 g) can significantly change the final product.

Shaping with presses of the latest design

A mixture for pressing is turned into inserts, tool shanks, blanks or wear parts using extruders and isostatic presses, axial presses or injection moulding machines.

Piston rod extruders press the feedstock (a mixture of powder and binders) into lines of material whose cross sections are the same as those of Supermini® tools or various rotating shanks. Round and oval cross sections (with and without a bore) and rotating shanks are produced by an isostatic press, although extruders can also be used up to a diameter of 25 mm (0.9843"). With isostatic pressing, the mixture is poured into an elastic sleeve, radially compacted at high pressure with the help of a liquid and then shaped. The green compacts produced in this way are then pre-sintered, separated into sections appropriate for the tool, machined, cleaned and final-sintered.

The electric axial press (multi-level powder press) is another innovation in the area of shaping. With its six transverse press modules that act horizontally, this is capable of shaping highly complex inserts using an automated work process. In the case of this shaping method, the green compacts leave the machine in their final shape. Consequently, the only downstream operations required are pre-sintering, machining (where applicable) and final sintering.

Injection moulding of complex shapes

Back in 1992, HORN was the first tool manufacturer in the world to series-produce indexable inserts using injection moulding processes. This technology is used to create undercuts, free-form surfaces and chipping geometries. An automatic workpiece handling system removes the injection-moulded part from the machine and sets it down so that a laser can separate the sprue.

Pre-sintering removes pressing aids

After pressing or injection moulding, the green compacts are unstable and highly malleable. However, this changes during the pre-sintering process when the pressing aids are released at around 820 °C in a hydrogen atmosphere. The parts, which have changed from green compacts to brown parts (pre-sintered blanks), can then be machined using diamond tools.

Final sintering of carbide brown parts

The pre-sintering and machining processes turn the workpiece into a fully shaped brown part. This obtains its final strength by means of sintering, a time and temperature-controlled heat treatment method that takes place at between 1300 °C and 1500 °C. Liquid phase sintering (compression sintering) produces strong and tough carbide inserts and also reduces their volume by around 20 percent. The fact that this reduction is correctly taken into account while the mould itself is being produced is a sign of the expertise and quality of the toolmaking department.

Absolutely vital: Ongoing checks and in-process controls

Each manufacturing step is monitored and controlled. Final products such as carbide blanks pass through the latest measuring and testing systems. Fully automatic measuring machines check each sintered insert for damage and to make sure the dimensions are correct. The carbide laboratory monitors the physical and metallurgical properties of carbides, from the starting material in powder form right through to the final-sintered carbide tool. In addition to materials analysis plus testing and optimisation of the sintering process, it is here that batch-specific physical measurements are taken from the samples, and microscopic porosity and structure examinations are carried out.

New product lines already on the road to success

Even though the new products have only been on the market for a few weeks, they are already growing in popularity, primarily because they offer an alternative to established carbide manufacturers. These other suppliers mainly specialise in large-scale production. Therefore, customers truly appreciate the high level of technical competence that HORN can offer as a manufacturer of standard and special tools in small quantities. Currently, the company boasts the most up-to-date plant for manufacturing high-quality carbide products. The possibilities that this provides – along with all the advantages of a complete in-house process chain – are opening up new ways of producing individual or serial parts in a fast, highly flexible and cost-effective manner. As a rough guide, customers should allow 9 – 13 weeks for the delivery of wear parts in medium batch sizes, depending on the complexity of the parts involved. Express orders can be processed even more quickly than this. HORN is currently producing workpieces in various batch sizes on behalf of its customers, either for immediate delivery or in the form of call-off orders.

Horn Hartstoff GmbH stands for a high level of technical competence.

Poland is one of the emerging European economies.

THE RISING MARKET IN POLAND

Changes stemming from the 1989 Polish Round Table talks in Warsaw had significant economic, political and social implications for the Polish state. Prominent among these was the birth of the Polish free market in the 90s. This gave rise to an entrepreneurial spirit, providing people with an outlet for their ideas and enthusiasm and allowing them to play a part in the recovery and expansion of the Polish economy. It was also the time when Centrum Techniki Macro Sp.Z.o.o. was founded.

The development of Macro

From the beginning (1989), co-founders Maciej Ropelewski and Marek Szczepaniak had ambitions to develop one of the leading suppliers of cutting tools in Poland. By 1992, the workforce numbered five people, including two sales engineers. In 1991, Krzysztof Kujawa, who shared the ideals of the founders, joined the company. In 2000, Macro already had 27 employees and by 2007 they had reached a high of around 50 employees. In the year 2006, the company built a new main office with a floor space of 2000 m^2 in Suchy Las near Poznan. Today, after recovery from the economic crisis of 2009, Macro's personnel count comes to 35 employees and three owners.

Market and cooperation

Even before the 1990s, Poland had been an important and well-known source of agricultural products, which remains the case

The MACRO team on the winning track.

450 customers trust the MACRO local experts.

today. Heavy industry was also a prominent part of the Polish market. However, political change stimulated a transformation in Polish industry and many Western manufacturers started investing in the country, which is the gateway between Western and Eastern Europe. The automotive and aviation industries were the main targets of these investments. The fact that Poland offered large numbers of highly qualified engineers, technicians and factories made it a particularly attractive proposition for Western companies.

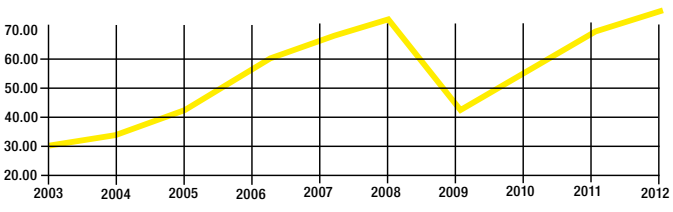
Rising customer expectations and the ambitions of Macro led to the search for a reliable manufacturer of cutting tools. Initial contact with HORN was made in 1999 and the two companies started cooperating in 2001. The real breakthrough for Macro and the Polish Market came in 2004, when Poland joined the EU. Among other things, this opened the country up to further overseas investment. Competition became stronger, including in the area of precision tools, and the requirements of customers increased, particularly with regard to quality. Under these new circumstances, Macro concentrated even harder on the automotive and aviation sectors. Between 2004 and 2013, Macro managed to double its inflow of orders with HORN products.

Currently, the company supplies 450 customers with HORN tools and has 12 sales engineers providing support and advice throughout Poland.

Macro plans to increase the proportion of HORN tools over the next three years until they account for 80 percent of its overall portfolio.

“There is a growing trend towards the machining of challenging and new materials. We also have a large group of customers who specialise in electromechanics and high-precision machining. Our customers always expect to receive the most effective and most productive solutions. The fact that special tools make up 60 percent speaks for itself. In this regard, we benefit from the high quality and short delivery times that we are able to offer in conjunction with HORN.”

Marek Szczepaniak.



Source: Foreign trade data from 52 reporting countries

Selection of various bore machining solutions.

ONE OF OUR STRENGTHS: BORE MACHINING

From pre-drilling to precision machining

Before machining any bore, it is important to spend some time thinking about bore quality, cost effectiveness and the drilling conditions. The breadth of the HORN tool range and the company's expertise make it easier to decide which tool is right for the task while also paying careful attention to the machine, workpiece, material, tool clamping method and tolerances.

The HORN tool systems for bore machining (from drilling into solid materials through to high-end machining) are compatible with the various types of machine tool.

Tool systems for making bores

DD drilling system with carbide exchangeable head:
The DD drilling system is available with nominal diameters of 10 – 20.5 mm (0.3937" to 0.8071") in increments of 0.1 mm (0.0039") and for drilling depths of 3 x D, 5 x D and 7 x D. It is suitable for machining both steel and cast iron. In the case of larger diameters, the DAH or DA system for circular milling should be used instead.

Machine tool	Machining centre, milling machine	Lathe
Making the bore	Drilling, milling	Drilling
Intermediate machining	Pre-milling, pre-drilling	Pre-turning, pre-drilling
Final machining	Thread tapping, thread milling, finish-boring, chamfering, reaming, precision machining with MCD, broaching	Contour turning, thread turning, thread tapping, chamfering, precision machining with MCD, broaching

System DA with indexable inserts:
The indexable inserts from the DA system have a highly positive geometry and result in a precise 90° corner angle. These tools are available as end mills and screw-in milling cutters with cutting edge diameters of 16/20/25/32 mm (0.6299"/0.7874"/0.9843"/1.2598") as well as clip-on cutter heads with cutting edge diameters of 40/50/63 mm (1.5748"/1.9685"/2.4803"). For chamfering, they are available with cutting edge diameters of 10.5/14.4/17.6 mm (0.4134"/0.5669"/0.6929").

DAH high-feed milling cutter system with indexable inserts:
The DAH37 milling system is available with a 3-edged indexable insert suitable for end mills and industry standard threaded connection milling cutters with cutting edge diameters of 20/25/32/40 mm (0.7874"/0.9843"/1.2598"/1.5748") and clip-on cutter heads with cutting edge diameters of 40/50/63/80 mm (1.5748"/1.9685"/2.4803"/3.1496"). The new DAH25 milling system features a 2-edged indexable insert for end mills with cutting edge diameters of 12/16/20/25 mm (0.4724"/0.6299"/0.7874"/0.9843"). Depending on the material and system, feed rates of up to 3 mm (0.1181")/tooth and cutting depths of up to 1.2 mm (0.0472") are possible.

Production of threads with turning and milling
Inserts for metric thread pitches of 0.5 – 6 mm (0.0197" - 0.2362") through to Whitworth sizes of 11–19 threads/".

Mini system for boring out.

Final machining of bore

When it comes to what is usually the final operation, the tool geometry must – above all – satisfy high requirements with regard to bore tolerance, surface quality, position, roundness, straightness/cylindricity, concentricity, parallelism and angularity.

Supermini® for boring out and grooving with bore diameters of 0.2 mm (0.0079") and above
The Supermini® tool system can be used with the following bore diameters: boring out and grooving >Ø 0.2 mm (0.0079"), thread cutting >Ø 3 mm (0.1181"), chamfering and pre-grooving > Ø 5 mm (0.1969") and broaching >Ø 6 mm (0.2362"). Special versions can also be supplied for milling, as can CBN and PCD tools. One tool carrier can be used for over 1,000 different standard inserts – in left or right-hand design. VDI, Capto and KM holders (among others) are available as standard.

Finish-boring with the Urma fine-boring head system
Depending on the insert, basic mounting and supporting bracket, bore machining operations ranging from 0.2 mm to 200 mm (0.0079" to 7.8740") are supported.

Precision machining with the DR reaming system
The cutting edges of the DR system are designed for diameters of 11.9 to 140.6 mm (0.4685" to 5.5354") in µm increments with standard tolerances H5, H6, H7. They are either 4.3 or 5.3 mm (0.1693" or 0.2087") thick. The positioning repeat accuracy of each cutting edge is less than 4 µm. The carbide or cermet cutters in coated and uncoated designs permit high cutting speeds and feed rates combined with long service lives. All reaming cutters are available with straight and left-helical toothed cutter geometry for through holes and blind bores, with five standard first cut geometries and more than 15 special first cuts.

Broaching on CNC machines
The Supermini® and S117 tool systems can be used to create grooves of various shapes, as well as teeth and profiles, in accordance with customer requirements. As a result, machining operations can be performed in one clamping. To cater for medium and large quantities, HORN provides tools for driven broaching units.

Bore machining with MCD tools
The surface accuracies that can be achieved with these tools eliminate the need for subsequent polishing. The resulting precise geometric contours with peak-to-valley heights of Rz ≤ 1 µm are not possible with conventional HM, CBN and PCD tools. The materials that can be machined include gold, silver, platinum, nickel, brass, aluminium, copper, bronze, acrylic, polycarbonate, polyvinylchloride, polyethylene and polyoxymethylene.

HORN Akademie

HORN ACADEMY HAS A BRIGHT FUTURE

The practical relevance of the seminars goes down very well with participants.

Bachelor of Engineering – three-year study programme specialising in cutting tool technology

When a group of forward-thinking individuals at HORN decided to set up a new mechanical engineering degree focusing on production technology and, more specifically, tool technology, they were motivated by many factors. These included the continued rapid growth of technology, the increasingly important role of metal-cutting tools in production, and the desire to create a launch pad for a career with a secure future.

Dual studies specialising in cutting tool technology

Culminating in the award of a Bachelor of Engineering (B.Eng.) qualification with 210 ECTS credits, this study programme starts in October and lasts for three years. It alternates practical experience in companies with three-month periods during which students focus on theoretical aspects at the Horb campus of DHBW (Baden-Württemberg Cooperative State University).

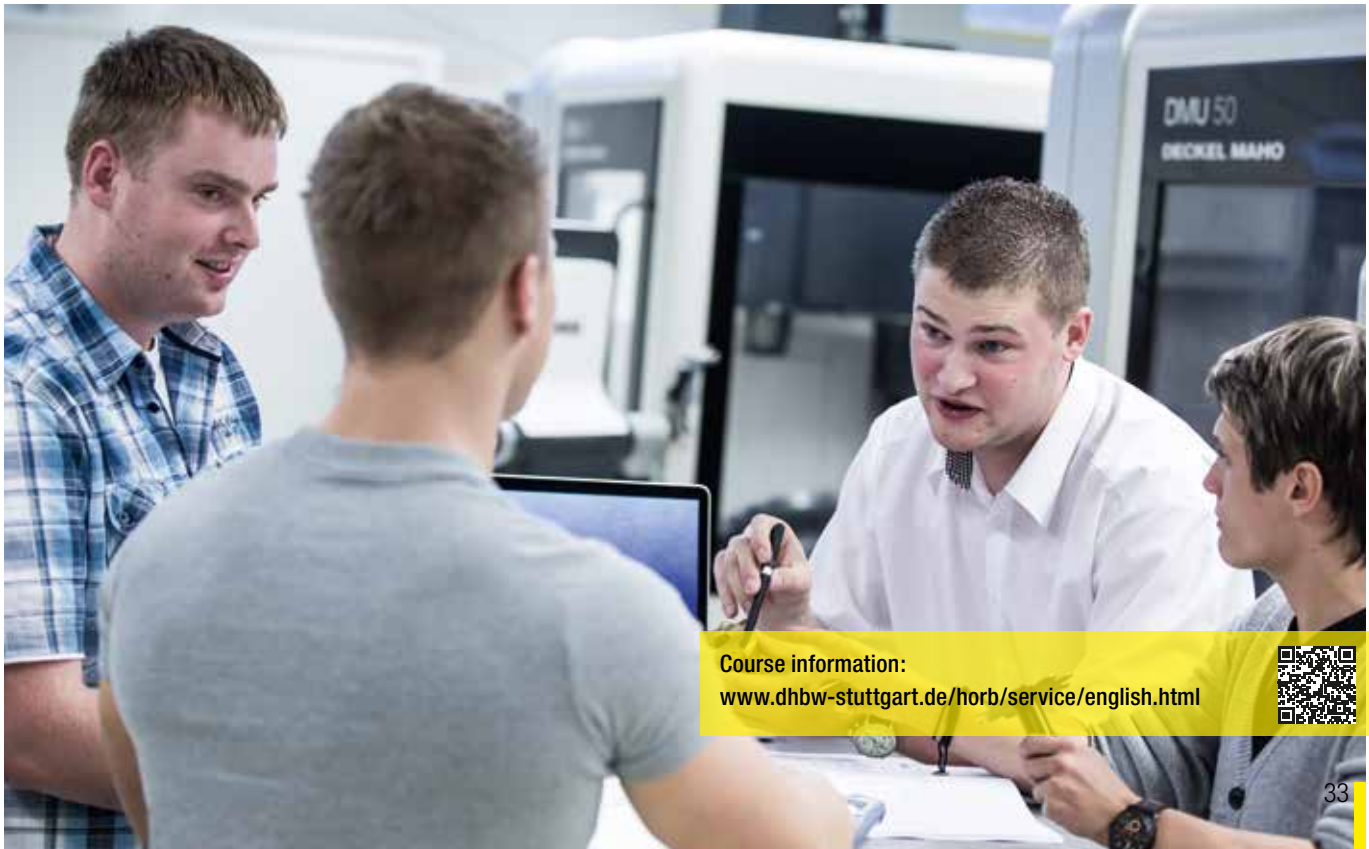
New programme of study gets off to a great start

October 2013 saw twelve young people commence their studies in this area. Eight came to the course primarily from tool manufacturers based in southern Germany, while the remaining four were from Paul Horn GmbH. What they all had in common was that they had met the entry requirements by passing the Abitur (German school leavers' qualification) or obtaining an entrance qualification for technical colleges; in the latter case, the students had to pass an aptitude test assessing their suitability for the course.

As well as lectures on fundamental aspects of mechanical engineering, the course looks more in-depth at the subject of cutting tools by covering aspects such as insert manufacturing using powder metallurgy, mixing and pressing powdery materials, furnace technology for heat treatment, heating process simulation, coating process technology, quality assurance, and quality management. The students learn from professors at the university, and then specialists in various fields during company placements. When they come to write their dissertations, they set the topic at the Horb campus but do most of the work on the paper through practical scenarios at their respective companies, where they have access to all the latest production materials for carbide applications.

New features of the dual studies programme

Following positive feedback from the first six months of the course, there is space for up to 20 candidates to enrol the next time it is run. The plan is to extend the qualification to master's level in the future, and to open up the course to those wishing to cross over into a new career path. Additionally, it is hoped that some parts of the course's practical component can be fulfilled at additional companies so that students can gain a wider insight into the industry.



Course information:
www.dhbw-stuttgart.de/horb/service/english.html

At the HORN Academy, personal interaction is just as important as the specialist topics covered.

HORN ACADEMY IN HIGH DEMAND

Training and advanced training for employees and customers

The focus of the HORN Academy is to provide training and advanced training leading to qualifications for those starting out in their careers, those already some way into their profession, and those interested in retraining. And the first 18 months since the Academy opened its doors have proven just how in demand these opportunities are.

For those responsible for training at HORN, significant demand from both outside the company and within demonstrates that the decision to offer yet more advanced training to their employees, and offer it to customers too, is the right one. Lothar Horn, Managing Director of Paul Horn GmbH, explained some of the thinking that led him and his team to it: “It's becoming increasingly difficult to find cutting tool specialists on the job market, no matter what the field is – development, production, sales or service. Therefore, we knew that ensuring the success of our company needed a proactive approach with investments in training and further training, as well as new paths for training or studies.”

Positive feedback shows the Academy is right on target

The first series of seminars for customers began in autumn 2012 and drew 100 participants from all over Germany. Both the number of participants and their positive feedback were testament to the work that those involved in the HORN Academy had put in. It also sparked invaluable ideas for subjects that future seminars could cover and approaches they could take. The content of this first seminar series was expanded as a result, and the series was given two more outings in March and November of last year.

Seminars tailored to customers

The seminars communicate expertise in the subject areas they deal with and showcase practical applications – looking at them from both a technical and commercial perspective. Experienced HORN experts give their presentations either in our seminar rooms or in the HORN demonstration centre. Seminars on theoretical subjects can also be held at external locations, with content that is specifically tailored to the requirements of the company concerned. The extent to which the practical component can be presented at these locations depends on the equipment available there.

Subjects of 2014 technology seminars:

Diamond as a cutting material
Hard machining of steel
Milling
Slot and profile broaching
Grooving
Bore machining
Circular, combination and special tools
Special applications

The seminars, which are free of charge, last for a day – or two days in the case of grooving – and are limited to 20 participants.

Experts go into detail.

HORN also insists on precision in the context of training.

A new career path: Industrial specialist in cutting tool technology

This additional qualification leads to the status of industrial specialist for cutting tools with German Chamber of Commerce (IHK) qualification. Professional training in a technical field is a prerequisite for enrolment. The 240 hours of the course cover training material such as safety technology plus occupational health and safety, lubrication and cooling, cutting tool production technology, and grinding in theory and practice. In spring 2013, all 14 participants in the pilot course passed their final exam with Reutlingen Chamber of Commerce (IHK). The next courses for skilled workers will commence in March and then October of 2014.

Basic and advanced courses for computer applications

Excel spreadsheet training covers a number of modules on subjects from basic functions right through to linking spreadsheets and filtering tables. The course lasts for a day. There are also plans for day-long courses on word processing in Word, as well as Outlook and PowerPoint.

Dual studies in mechanical engineering, specialising in cutting tools

Since October 2013, the Horb campus of DHBW (Baden-Württemberg Cooperative State University) has been running a new bachelor's degree in mechanical engineering, focusing on production technology and, specifically, cutting tool technology. Twelve students enrolled in the pilot course. To find out more, go to page 33.

Retraining opens up new career horizons

Participants in retraining courses have the opportunity to acquire skills in areas that they have never worked in before. Studies show that most people who choose to retrain in another career have a better chance of returning to employment and getting a job in a new field. The HORN Academy currently offers two retraining courses in conjunction with the German Federal Employment Agency:

– Machine and systems operator, 2 years culminating in Chamber of Commerce (IHK) examination
– IT office assistant, 40 hours with certificate awarded on completion

HORN employees get qualified

As part of its Academy courses, HORN considers it crucial to offer training for its own employees too. The focus here is on further technical and commercial qualifications, language skills, personal development and general knowledge. Options include a training course in industrial mechanics, as well as courses designed to help students prepare for studies and an advanced course that qualifies participants as industrial specialists in cutting tool technology. These activities help to boost employees' motivation levels and ensure that participants have a firm grip on new developments in technology. This makes certain that the company can continue to live up to its motto for years to come: HORN – leaders in grooving technology.

Competence Centre

The partner companies DMG Mori, Castrol, Tyrolit, 3M Winterthur, HORN and DHBW Stuttgart (Horb campus) have founded the Cutting Tool Technology Competence Centre as a means of lending support to these training activities.

For more information visit www.horn-akademie.de

HORN is at home in more than 70 countries in the world

GROOVING • PARTING OFF • GROOVE MILLING • BROACHING • PROFILE MILLING • DRILLING • REAMING

Subsidiaries or representatives

Hartmetall-Werkzeugfabrik
Paul Horn GmbH
Postfach 17 20
72007 Tübingen
Tel.: +49 7071 7004-0
Fax: +49 7071 72893
E-Mail: info@phorn.de
www.phorn.de

HORN S.A.S.
665, Av. Blaise Pascal
Bat Anagonda III
F-77127 Lieusaint
Tel.: +33 1 64885958
Fax: +33 1 64886049
E-Mail: infos@horn.fr
www.horn.fr

FEBAMETAL S.p.a.
Via Grandi, 15
I-10095 Grugliasco
Tel.: +39 011 7701412
Fax: +39 011 7701524
E-Mail: febametal@febametal.com
www.febametal.com

HORN CUTTING TOOLS LTD.
32 New Street
Ringwood, Hampshire
GB-BH24 3AD, England
Tel.: +44 1425 481800
Fax: +44 1425 481890
E-Mail: info@phorn.co.uk
www.phorn.co.uk

SK Technik spol. s.r.o.
Jarni 1052/44k
CZ-614 00 Brno
Tel.: +420 545 429 512
Fax: +420 545 211 275
E-Mail: info@sktechnik.cz
www.sktechnik.cz

HORN USA, Inc.
Suite 205
320, Premier Court
USA-Franklin, TN 37067
Tel.: +1 615 771-4100
Fax: +1 615 771-4101
E-Mail: sales@hornusa.com
www.hornusa.com

HORN (Shanghai) Trading Co. Ltd
Room 905, No. 518 Anyuan Rd.
CN-200060 Shanghai
Tel.: +86-21-52833505
Fax: +86-21-52832562
E-Mail: info@phorn.cn
www.phorn.com/chn

HORN Magyarország Kft.
Gesztenyefa u. 4
HU-9027 Györ
Tel.: +36 96 550531
Fax: +36 96 550532
E-Mail: technik@phorn.hu
www.phorn.hu