Issue 1/12

world of tools

HORN

HORN´S CUSTOMER MAGAZINE

SUBJECT:

ULTRA-HARD CUTTING MATERIALS FOR THE MACHINING TASKS OF THE FUTURE

- Good things come in threes
- Innovations at METAV
- Thread milling for the highest demands
- Brazil – Potential for growth

Dear Readers,

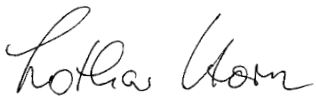
2011 was a successful year in which several sectors were able to chalk up record figures. And even if we do not expect to match last year's performance, the stage is now set for further growth in 2012. Despite this, or perhaps precisely because of this, it is important for us to keep promoting innovation and optimisation strategies as well as our work on developing solutions. Together with you, our customers, we are putting all our efforts into ensuring this happens successfully.

Everything we do is with a single aim in mind: customer satisfaction. That includes our new facilities at Horn Hartstoffe GmbH, which produces everything from carbide powder right through to finished blanks, and which since 2011 has been undergoing a process of extending its machine inventory to include more than 100 new machines. It also includes our efforts to extend our product range, and the real commitment shown by every single HORN employee.

To achieve this aim, we need to meet a whole range of different criteria, one of which is delivery speed – where we occupy a top spot in the industry. Our goal is to give our customers the most cost-effective service possible; indeed, achieving maximum cost-effectiveness is a task we have set ourselves in-house too.

Our tool solutions, expertise and tailored advice make us your perfect partner when it comes to performing tasks, facing challenges and completing projects.

We are looking forward to taking on this role yet again in 2012, and this latest issue of "World of Tools" will give you a little insight into how we intend to do this.



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

world of tools

HORN´S CUSTOMER MAGAZINE

Products

In practice

Innovations at METAV

About us

Trade fairs

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GOOD THINGS COME IN THREES

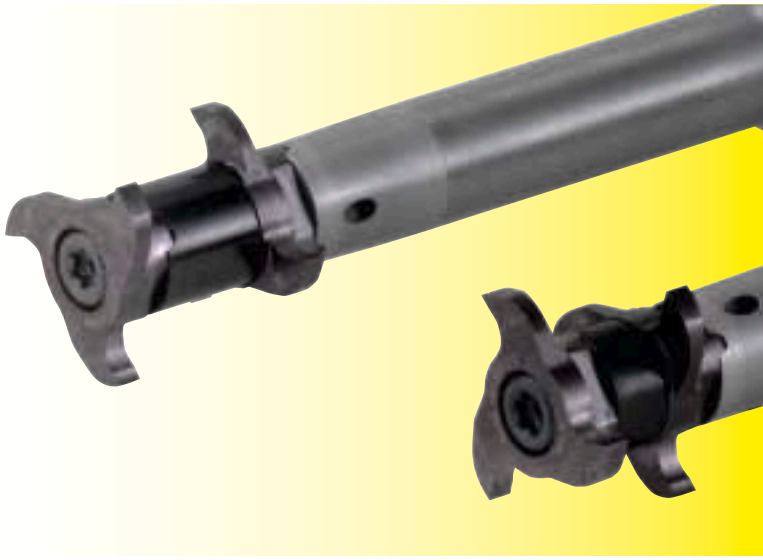
Three-cutting edge tools 313 in the turret of a lathe.

Three cutting edges for grooving and milling

One of the real keys to the success our company has had in its development work is our grooving system 312. Created in the early 1970s by Paul Horn, the system offers cost and application advantages which have influenced the development of other products – specifically, those used for groove milling – and are still in demand even today.

At the heart of successful product ranges

Back then, our company's founder had developed the insert system 312 (the 3 stands for three cutting edges and the 12 for the inner circle diameter) specifically for the purpose of grooving slots for circlips. However, as the tools began to demonstrate that they were also ideally suited to other types of groove and to external profiles, more systems and variants were created with this in mind. The system 315 was introduced as an addition to the standard system 312 versions and before long, these two product ranges had more company in the form of special versions such as the systems 302, 316 and 320.



Tandem tool 313 for milling groove intervals.

Standard inserts for grooving and thread-cutting

Production steps	System	Groove width in mm (")	Groove depth up to mm (")
Axial grooving	312	1.5 – 3 (0.059-0.118)	3 (0.118)
	315	1.5 – 3 (0.059-0.118)	3 (0.118)
Grooving and parting off, external	S312	2 – 5 (0.078-0.197)	6 (0.236)
	312	0.5 – 5.15 (0.020-0.203)	6 (0.236)
	315	0.5 – 4.15 (0.020-0.163)	5 (0.197)
	316	1.5 – 3 (0.060-0.118)	8 (0.315)
Grooving and longi-tudinal turning	312	3.29 (0.130)	3,5 cutting depth
Parting off	312	0.5 – 3.0 (0.020-0.118)	0.01 – 0.03 (0.0004- 0,0011)
Corner relieving	312	Full radius R0.5 – R2.5 (0.020-0.098)	
Grooving, external and internal	312	0.5 – 5.15 (0.020-0.208)	
	315	0.5 – 4.15 (0.020-0.163)	
Threading, partial and full profiles, metr. and trapez.	315	Pitch P: external: 1 – 6 (0.039-0.236) internal: 1 – 3.5 (0.039-0.138)	

Special tasks such as

- External grooving
- Grooving and profiling
- Grooving thread reliefs
- Grooving belt grooves
- Grooving special shapes with a profile width of up to 15 mm (0.5905")

We use a wide range of special inserts for carrying out all these and more.

How users benefit from three-cutting edge systems

Radial and axial grooving (internal and external) and parting off:

- High efficiency thanks to three cutting edges
- Low tool costs
- Standard holders and inserts reduce storage costs
- Complete machining with excellent process reliability
- Insert versions: coated carbide, CBN and PCD tips, Cermet, ceramic
- Sintered geometry for higher feed rates with reliable machining
- Unobstructed chip flow during grooving
- Secure, positive-fit attachment of insert in holder
- Inserts easy to replace thanks to screw/clamp connection
- Positioning repeatability ± 0.02 mm (0.0008")

From grooving to groove milling

Thanks to new substrates and coatings, narrow production tolerances for holders and inserts, sintered geometries, and much more besides, we have been able to fulfil a multitude of customer requirements with increasing success over the years – by harnessing the strengths of three cutting edges in milling applications, for instance.
The starting point in developing the milling tools designed for this purpose was the grooving system 315, as a large number of its blanks were suitable for milling and could be used with other geometries. The system 314 for side milling cutters and cutter heads came along first and was followed by the special systems 310, 316, 320 and 302.

Milling inserts with central threaded connection

The trend towards complete machining and combining production processes such as turning and milling in a single machine has led to machining centres being used more and more, with the result that bore machining is subject to increasing demands, particularly when it comes to circular tools. To accommodate these, we have developed three-cutter tools with different shank versions for bore holes with a diameter of 10 mm (0.394") and up. The inserts, which are screwed onto the front face, can be used for milling grooves, bore holes and threads, as well as for chamfering with diameters up to around 60 mm (2.362"); cutter heads and side milling cutters are brought into play for diameters that are larger than this.

Unlike the systems 314 and 310, where the inserts are screwed onto the front face of the milling body, the circular tools are made up of DIN HA/HB/HE-compliant solid carbide shanks of different lengths, plus a brazed-on steel head. The central fastening hole for the insert a brazed-on on the front face. Three central grooves with symmetrically profiled forms locate inserts in place in cases where smaller types need to be used, while asymmetrically profiled grooves are used for larger inserts. These tooth profiles ensure secure and stable clamping, particularly when it comes to wide profiles. Thanks to a holder with an internal coolant supply, plus a range of different cutting edges as well as variants for collet chucks, the tools can also be used with lathes.

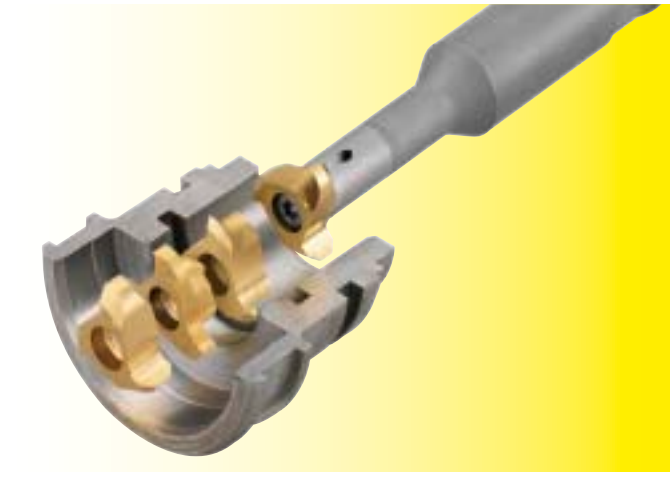
Milling inserts that are centrally screwed into place

Production steps	System	Cutting edge/ bore 0, mm (")	Cutting width mm (")	Groove depth up to mm (")
Groove milling, circular interpola-tion	306	9.7/10 (0.382-0.393)	0.57 – 2.5 (0.022-0.098)	2.5 (0.098)
	308	15.7/16 (0.618-0.630)	1.1 – 2.5 (0.043-0.098)	3.5 (0.137)
	311	17.7/18 (0.700-0.709)	1,1 – 3.0 (0.043-0.118)	3.5 (0.137)
	313	21.7/22 (0.854-0.866)	0.7 – 6.0 (0.027-0.236)	4.5 (0.177)
	328	27.7/28 (1.090-1.102)	0.8 –10.0 (0.031-0.393)	9.3 (0.366)
	332	31.7/32 (1.248-1.259)	1.5 – 4.0 (0.059-0.157)	10.0 (0.393)
	335	34.7/35 (0.059-0.118)	2.0 – 6.0 (0.078-0.236)	8.0 (0.314)
T-slot milling DIN 650	311	17.7 (0.697)	a = 7.2 (0.283)	
	313	20.0 (0.787)	a = 8.7 (0.342)	
	328	24.0 (0.944)	a = 9.2 (0.362)	

Production steps	System	Cutting edge diameter mm (")	Pitch P Metr.	Per inch
Thread milling	306	10.0 – 11.7 (0.393-0.460)	0.5 – 3.0 (0.019-0.118)	11 – 19
		9.7 – 11.7 (0.381-0.460)	11 (0.433)	
	308	13.2 – 15.7 (0.519-0.618)	1 – 3,0 (0.039-0.118)	
	311	17.7 (0.696)	0.5 – 3.5 (0.019-0.137)	11 – 14
	313	21.7 (0.854)	1 – 4,5 (0.039-0.177)	6 – 11
	328	27.7 (1.090)	1 – 6 (0.039-0.236)	

Three-cutting edge designs from our range:

Insert 312 for grooving



Inserts 313 for milling by circular interpolation

Insert 314 with cutter head

Inserts for cutter heads and side milling cutters

Production steps	System	Cutting edge Ø, mm (")	Groove width mm (")	Groove depth up to mm (")
Groove milling, circular interpolation	314 for cutter head 380/381	44 – 100 (1.732-3.937)	1.1 – 5.15 (0.043-0.202)	5 (0.393)
Groove milling	For milling cutters			
	382	80 – 200 (3.149-7.874)	6 – 12 (0.236-0.472)	
Slotting Cutter	M310	80 – 200 (3.149-7.874)	3 – 5 (0.118-0.196)	
Thread milling	314	44 – 100 (1.732-3.937)	Pitch 1,5 – 6 (0.059-0.236)	
Thread whirling	302	11 – 25 (0.433-0.984)		

Special insert versions for

- Milling circlips and chamfering the outside groove edge
- Milling metric fine-pitch and coarse-pitch threads with part and full profiles:
  Metric threads with a nominal diameter of 12 mm (0.472") and up Whitworth full-profile threads with a nominal diameter of 13 mm (0.511") and more
- DIN 650 T-slot milling with reinforced milling shanks and central coolant section for flushing out chips
- Thread and groove milling cutters for driven units on lathes
- Tandem tool for groove milling with defined distances between groove
- Whirling single and double threads, e.g. for bone screws

During maintenance work on jet engine turbines, a groove miller used as a cutter head with inserts from the system 314 mills the nickel coating sprayed on the low-pressure distributor down to size

The outstanding features of our three-cutting edge milling tools:

- High precision thanks to ground edges
- Excellent repeating accuracy and indexability
- Long projection lengths possible due to carbide shanks
- Internal cooling
- Range of substrates, suitable for the required toughness and thermal resistance
- Coating tailored to application
- Planing and grooving in one pass using special tool
- Internal and external groove milling in one pass
- Special tools for whirling threads used in medical technology
- Repair service for damaged carbide shanks

Cutting edge geometries for grooving and milling

Based on the application, the material to be machined and the specific conditions of the application, we can provide inserts with exactly the right geometry for the job.

Geometric forms for grooving tools:

Ground geometries:	.00 – for steel machining .40 – for aluminium machining
Sintered geometries:	.5 – for lower-strength and medium-strength steels .FY – for machining stainless steels .EN – for grooving and parting off at feed rates of 0.1 – 0.25 mm (0.004-0.010") per revolution

Geometric forms for milling tools:

Ground geometries:	.00 – for general machining .40 – for aluminium machining

Special inserts 302 for single and double threads in thread whirling head M302.

Brilliant finish components, machined with ultra precision using MCD.

ULTRA-HARD CUTTING MATERIALS

Cutting materials and technology solutions for the machining tasks of the future

The type of cutting material used in machining is key to the level of quality and efficiency the work will produce. In particular, it is the hardness and wear resistance demonstrated by the material that are crucial to ensuring process reliability during machining.

Machining processes that use geometrically defined cutting edges, such as those found in turning, milling, drilling or reaming applications, are based on a principle that involves penetrating the surface of the workpiece using the tool cutting edge and removing a chip as a result. This means that the cutting material always has to be harder than the workpiece material being machined. In this area, materials technology is shifting its focus more and more towards finding exactly the right materials and material combinations to suit the application in question, and, in the process, has begun turning with increasing frequency to lightweight materials, plastics and composites in addition to highly heat-resistant and high-strength materials. However, the abrasive wear and high temperatures created when machining these materials quickly take coated carbide cutting materials to their limits. What is more, it is not only the hardness and toughness of the cutting materials that need to be considered – chemical and physical properties also matter when selecting cutting edges. Figure 1 shows how the wear resistance and toughness of modern cutting materials compare with one another:

when it comes to wear resistance, nothing matches the structure or exceptionally high level of hardness that diamond offers. One result of all this is that the industry is increasingly looking to ultra-hard cutting materials whose design and geometry can be adapted specifically to suit the application concerned. This involves using both standard and special tools with different cutting material tips, based on the requirements of the application. In addition to our CBN and PCD tools, our product range includes CVD diamond and MCD-tipped tools. Inserts with CVD diamond tips in particular are extremely suitable for creating complex 3D chip breakers in cases where improved chip control is required. We presented our comprehensive range of inserts with lasered chip shape geometries at the EMO trade fair in Hanover.

HORN cutting materials, properties and applications

CBN: Cubic boron nitride. No chemical reaction with iron; high hot hardness. Mainly used for hard machining of steel or cast materials with hardness levels up to 68 HRC. Insert type S229 as well as inserts from the Mini and Supermini® systems are available.

PCD: Polycrystalline diamond, around 90 percent diamond with

Inserts from our range with MCD, PCD, CBN and CVD-D tips (left to right).

CVD diamond cutting edge (basic ISO shape) with lasered chip breaker.

metal bonding. Mainly used for machining aluminium alloys with a high silica content (ideally over 12 percent), as well as other non-ferrous metals and non-ferrous heavy metals, moulded laminated materials, highly wearing workpiece materials and cast materials. Thanks to the wide range available, inserts with PCD tips can be produced at short notice for almost any of our systems on request.

MCD: Monocrystalline diamond, Mohs hardness 10; the hardest material in the world. Principally used for precision and brilliant finish machining, as well as for ultra-precision machining of non-ferrous and carbonless materials, precious metals and plastics. An extensive range of standard insert types for boring and milling is available from stock in the form of types S117, 105 and VCGW16.

CVD-D: Chemical vapour deposition thick-film diamond, consisting of almost 100 percent diamond. The comparatively high diamond thickness of up to 1 mm (0.039") enables shaping and the creation of deep chip breakers using laser techniques. Mainly used for machining non-ferrous metals and non-ferrous heavy metals, carbon and fibre glass-reinforced plastics, as well as graphite.

Our standard range includes a large number of ISO inserts. A new addition is a comprehensive milling range for tool-making and mould-making, as well as machining composite fibre materials used in the aviation and automotive industries.

Cutting material applications

CBN is an indispensable material nowadays, particularly when it comes to hard machining of ferrous metals. Due to their affinity with carbon and iron, however, PCD, MCD and CVD-D tools are not the right choice for efficient machining of steel grades and alloys. CVD-D-tipped inserts or milling tools are ideally suited to lightweight materials such as CFRP and GFR, and to aluminium alloys, particularly those with a high silica content. Additionally, CVD-D-tipped millers have frequently demonstrated four times better durability compared with PCD tools in milling tests.

In cases where surface qualities well below Rz 1 are required for non-ferrous metal workpieces – in applications involving ultra-precision machining of optical engineering components, for example – then MCD-tipped tools are the only choice. The exceedingly fine cubic crystal structure of a monocrystalline diamond makes it possible to produce completely sharp cutting edges which have utterly flawless features, even under 200x magnification. It is only with these properties that it is possible to achieve the required surface qualities in the nanometre range and the desired outcome of production.

CVD diamond: a cutting material for special machining tasks

The use of "CVD" often causes references to this material to be mixed up with the CVD coating method for indexable inserts. CVD-D is a cutting material that is produced by means of CVD synthesis without a carbide base. The chemical vapour deposition process creates a polycrystalline substrate that is almost 100 percent diamond and has no metal bonding. The plates produced as part of this procedure, which are usually 1" x 1" in size and up to 1 mm (0.039") thick, can then be cut into shapes using lasers. Once they have been soldered onto carbide inserts or solid carbide millers, the final contour and (depending on the application) a chip breaker can be created by means of a laser process. CVD diamond enables perfectly sharp and flawless cutting. The cutting material is the ideal choice for anything from roughing work to precision final machining of all non-ferrous metals, overeutetic aluminium alloys, plastics with abrasive fillers, precious metal alloys as well as carbide and ceramic green compacts.

Choosing the right cutting material for the application concerned is crucial when it comes to machining today's materials and material combinations. At the same time, the need to satisfy the requirements of machining tasks in the future is resulting in an increasingly complex choice of suitable cutting materials.

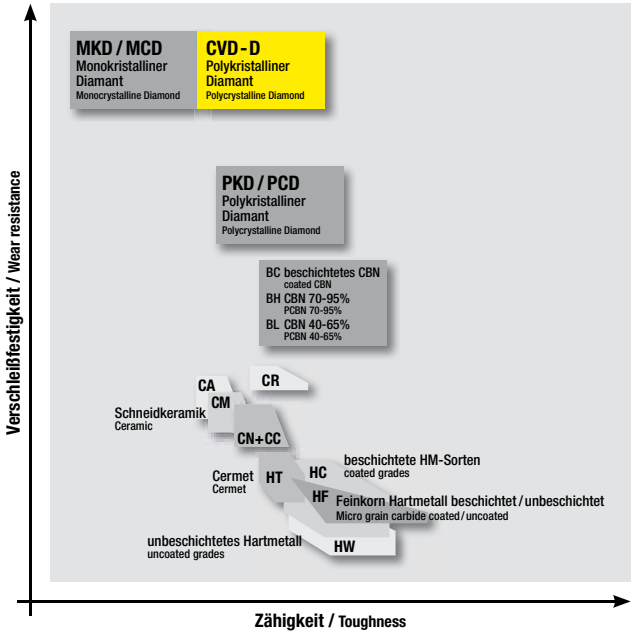


Fig. 1 Cutting materials graded according to wear resistance and toughness.

Insert 628 with part profile. As the insert does not have a runout, it is possible to mill right down to the base of the blind hole.

THREAD MILLING WITH DIAMETERS OF UP TO 220 MM (8.661")

Six cutting edges increase production reliability during cylinder processing

Heavy strain placed on spindles and narrow tolerances have stopped machine tap drills from standing up to the challenge of producing threads in horizontal hydraulic cylinders. Now our circular milling cutters are stepping in to provide the accuracy and process reliability these applications demand.

You will find Hydrosaar products wherever you find hydraulic systems that are subjected to extreme demands – under and on water, in open-cast and deep mining, in wind turbines, and in hydroelectric plants, thermal power stations, weirs and dams. Based in Sulzbach in the German state of Saarland, the company, which employs 135 members of staff, has been focusing on hydraulic systems as one of its areas of expertise since its founding in 1964. In 2001 it was incorporated into the Hydac Group, comprising 6,000 employees, and is now responsible for work involving cylinders and piston accumulators, which includes performing maintenance and general overhauls on both their own and third-party products.

The insert 628 with shank M328, held in a Weldon chuck, is able to mill a range of different thread sizes and types in the front faces of the hydraulic cylinders.

New requirements for hydraulic parts

The company currently constructs cylinders and piston accumulators with internal diameters of up to 1,000 mm (39.370"), stroke lengths of up to 15,000 mm (590.555") and weights of up to 20 tons. Over time, however, the products have been required to move increasingly large loads and accommodate a whole range of environmental influences. The production tasks associated with this work do not just affect the production machines themselves, but also have a particular impact on the tools – as demonstrated by the example of thread production in a cylinder with a 1,228 mm (48.346") external diameter. This process involved

Hydrosaar's dispatching area prepares "smaller" cylinders for delivery

Hydrosaar's Managing Director Hans-Georg Burkhart and Machining and Welding Master Craftsman Peter Kohler, shown here from left to right with our technical consultant Peter Bauer, look forward to successful milling tests.

creating 30 M64-6H threads, each 115 mm (4.527") deep, in the two faces of the cylinder. However, because of the heavy strain placed on spindles in the machining centre and the accuracy and quality issues associated with the approximately metre-long throat depth, the tap drills chosen to complete the task were able to offer little in the way of a future-proof solution. What is more, loose teeth or casting defects in the cylinder material led to repeated thread damage.

No thread experiments

The cylinders are exposed to pressure levels of up to 600 bar and have to comply with a number of different safety regulations, so it is essential that repairs to a damaged thread are signed off by the engineering department. Peter Kohler, Machining and Welding Master Craftsman, considered the time and money spent on this process to have reached unacceptable levels. Keen to find an alternative solution for producing metric and trapezoidal threads with diameters of 36 to 220 mm (1.417 to 8.661"), he once again turned to the expertise of our technical consultant Peter Bauer, who had previously helped him achieve perfect results in both grooving applications and circular milling of M42 threads. This time the task entailed very specific requirements, however: as a great deal of human and financial resources had already been invested in the cylinders, the thread-cutting process needed to start straight away. In other words, there was no leeway for cutting trials on experiments on individual specimens.

New strategy with six cutting edges

For thread milling on cylindrical pipes made from S355J2G4 (St 52-3), Peter Bauer recommended a milling shank of type M328 as well as a 628 insert coated with the carbide grade TI 25, with six cutting edges and a part profile. With its cutting edge diameter of D_s = 27.7 mm (1.090"), this tool can be used for pitches of P = 5 and 6 mm (0.196 and 0.236"). As the majority of the cylinders – measuring more than 10 metres in length – are machined horizontally, they also required our milling cutter to be pivoted about the A and C axes at the cutting zone.

Process reliability before cutting performance

Due to the throat depth of 200 mm (7.874") from the machine entry point, the M64 test thread was milled in the opposite direction (bottom to top) with a 6 mm (0.236") pitch, 20 turns, v_c = 80 m/min, n = 919 rpm, and a feed rate per tooth of f_z = 0,13 mm (0.005") with an average chip thickness of h_m = 0.035 mm (0.001"). As the tool vibrated slightly when it was held in a hydraulic expansion chuck, a Weldon holder was selected instead. This created a thread in around five minutes, including an entry loop of less than 45° and an exit loop of less than 5°. Based on this, it should take approximately 300 minutes to create 60 threads.

Thread milling with real benefits

In addition to their excellent process reliability and tolerance-compliant threads, the durability of these milling cutters make them extremely impressive tools. A 628 insert is able to create an average of 23 threads, which equates to a tool life of approximately 90 metres. These excellent credentials have led to the company deploying HORN tools for milling all threads whose size is above M36. With new investments scheduled in order to accommodate the growing cylinder dimensions – and two DMG and Mori Seiki turning/milling centres already installed – the range of applications that these milling cutters will face is growing. And Peter Kohler's intention to enlist our help in overcoming any future production challenges – such as groove milling – shows just how satisfied he is with both the tools and the advice he has received.

Extremely high centrifugal forces are exerted on the tree-shaped blade roots.

OPTIMISING GAS TURBINE MACHINING

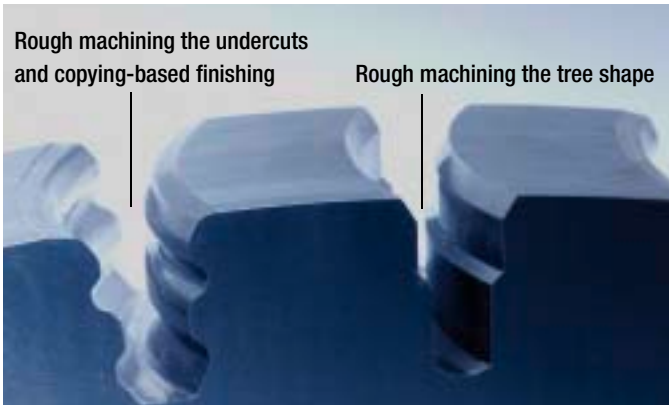
Trilateral cooperation creates more benefits for customers

When a Russian manufacturer of gas turbines was looking for a future-proof method of machining the blade receptacles in gas turbine wheel discs, our representatives in Italy and Russia joined forces with an Italian machine manufacturer to find the solution.

In this case, it was our Russian representative Intercos who established the necessary contacts to get the job done. The Intercos sales portfolio also includes machines from Trevisan Macchine Utensili – and thanks to this company's close ties with Febametal, our Italian partner, this resulted in a complete network of Italian, German and Russian companies repeatedly working together to create a proposal for this customer that was both financially sound and fit for the future.

Extreme pressure right at the roots

In addition to high operating temperatures and the hot, aggressive combustion gases in the turbine, extremely high centrifugal forces also have an impact on the blade roots. These forces might be no match for the special grades of stainless steel used, but machining the steel is an expensive, time-consuming process. In particular, manufacturing the blade root geometry in the wheel discs requires painstaking and reliable machining – regardless of whether onion shapes, T shapes or tree shapes are being created. In this case, the customer was looking for an alternative to the solid carbide monoblock milling cutters that they had been using up to that point. The solution had to deliver good results even when subjected to time and cost pressure during maintenance work. The requirements specification included the following details relating to the wheel discs: 1,380 mm (54.331") diameter; 184 mm (7.244") thickness; curved tree shape; 50 mm (1.968") depth with undercuts; and material 13CrMoV9-10.



Machining the blade roots. Right: Rough machining with insert S229. Left: Milling the undercuts using milling cutter 308, plus final tree shape copying using insert S229.

DS600/200C
Machining Centre.

Cassette K220 with hook-shaped insert S229. A Trevisan basic holder is used as a tool holder.

Trilateral strategy development

The specification also stipulated that it should be possible to machine different wheel disc dimensions, and it was here in particular that the trilateral team of experts identified the biggest opportunity to combine all the benefits offered by their products in a single package. The DS600/200C Horizontal Machining Centre from Trevisan Macchine Utensili proved to be the best choice for five-axis machining. A rotating dual holding fixture on the spindle head of the machine, plus a milling spindle located underneath this and a rotary table with the wheel disc clamped onto a pallet, create the axis motions required for the turbine roots. The two driven tool spindles are mounted in the dual holding fixture and hold the interchangeable tools (U axis) used for contour turning. We designed rough machining tools and tools for copying-based finishing that were suitable for the machine kinematics. The indexable inserts used for rough machining and finishing are clamped in a type K220 cassette, which in turn is held in a tool holder that has been developed and patented by Trevisan.

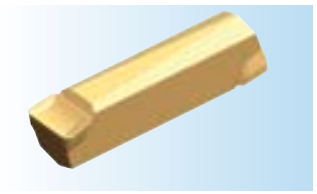
Production step	Rough machining	Rough machining undercuts	Copying-based finishing
Tool	Standard indexable insert S229	Circular groove miller, insert 308	Indexable inserts S229, special version
Cutting speed	180 m/min	180 m/min	180 m/min
Feed rate	0.18 mm (0.007")/ revolution Full cut 0.22 – 0.25 (0.008"-0.009") Partial cut	0.15 feed rate/ tooth	0.12 mm (0.004")/ revolution

Grooving and milling the tree shapes

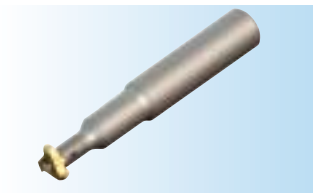
The wheel disc is clamped onto the rotary table pallet in a horizontal position. During the first production step, the curved contour of the root is rough-machined using a standard indexable insert S229, with an allowance of 0.6 mm (0.023") retained. The insert, which has a groove width of 6 mm (0.236") and a corner radius of R = 0.8 mm (0.031"), is held at less than 10° in the K220 cassette holder, which is switched from the tool changer to the dual holding fixture together with the Trevisan holder.
Following this, the undercuts are machined out using a type 308 milling cutter. This tool, which features three cutting edges, has a cutting edge diameter of 15.7 mm (0.618"), a width of 4 mm (0.157") and a radius of 2 mm (0.078"). It is screwed onto the milling shank M308, which is clamped in the milling spindle of the machining centre. The dual holding fixture then begins using another cassette with a hook-shaped full-radius indexable insert (type 229). Featuring a single cutting edge, this tool is used to finish the groove using a copying technique. Depending on the root shape, the insert (with a radius of R = 2.5 mm (0.098")) is available in both clockwise and anticlockwise versions.

Finding the right solution

The blade root strategy has proven to be the ideal choice in respect of tolerance compliance and process reliability. Additionally, the solution developed for grooving and milling is much more cost-effective and, above all, much more flexible as a range of different wheel discs can be machined using just one tool. Since the solution primarily involves standard tools, it also delivers benefits in terms of costs and delivery times. Not only can the machine be set up more quickly compared with the monoblock milling cutters, but it is also significantly easier to adapt it to the various wheel disc dimensions required. To top it all off, the close working relationship developed by the three companies involved in creating the solution means that any after-sales service needs this Russian customer may have are guaranteed to be satisfied too.



Indexable insert S229 for rough machining the root shape.



Milling cutter 308 and milling cutter shank M 308 for milling undercuts.

Indexable insert S229 (anticlockwise version) for copying the root shape.

CVD diamond-tipped milling cutters

Standard range for a wide variety of materials

Not only is the CVD diamond cutting material ideal for turning, it is also perfect for milling aluminium alloys and graphite, as well as plastics that have been reinforced with abrasive fillers such as CFRP and GFR. To help users executed all associated tasks perfectly, we plan to include a range of basic milling cutter forms in our standard range. These will be available from stock starting in autumn 2012.

To cater for tool-making and mould-making machining tasks, two-edged CVD-D-tipped full-radius or toroidal milling cutters with corner radii of 2 to 16 mm (0.078 to 0.629") diameter are available. Milling cutters with specially designed cutting edges have also been specifically developed for machining CFRP and GFR composite materials within the aviation and automotive industries. With diameters of 8 mm to 20 mm (0.314 to 0.787"), these feature between four and nine cutting edges. Depending on the nature of the machining task, you can choose between a pulling and a pushing cutting geometry. Similarly, it is possible to make use of combinations known as "up and down" milling cutters. But our real ground-breaking highlight comes in the form of coiled milling cutters with three or four cutting edges. These ensure exceptionally gentle and controlled cutting for composite materials.

CVD diamond milling cutter for CFRP composite materials, aluminium and graphite

Geometry 3V2

S100 indexable inserts with 3V2 geometry for grooving and parting off.

Optimum chip control for stainless steels

The new 3V2 precision-sintered geometry has been developed for the special conditions that apply when machining high-strength and long-chipping materials. The chip former, sharp cutting geometry and specially designed protective chamfer can be used to cut stainless steels with feed rates of 0.03 – 0.12 mm (0.0011 to 0.0047") per revolution. The chip forming process ensures extremely clean and highly precise groove flanks and the controlled chipping process makes for high production reliability.

As part of the first introduction phase, S100 indexable inserts will be available with the new 3V2 geometry. These can be used for creating grooves with a width of 2 to 4 mm (0.078 to 0.157") and for parting off workpieces measuring up to 65 mm (2.559")in diameter. Work is already under way to introduce further dimensions and transfer the new geometry to other insert designs.

New PH3 coating material

HiPIMS coating for improved hardness and toughness

Our new PH3 coating material (an AlTiN-based coating) cannot fail to impress by delivering greater durability and improved cost-effectiveness. The PH3 coating is applied using the new HiPIMS (high power impulse magnetron sputtering) technology and the metal ion-supported PVD method. This involves using pulsed plasma with short exposure times and relatively long periods of non-exposure. The very high pulse currents form an extremely dense plasma in front of the coating sources. The highly dense coating morphology results in increased hardness while at the same time reducing residual stresses.

It is this extreme toughness that makes the coating particularly suitable for milling. Tests have been carried out using machining parameters appropriate for the application concerned and oil as the coolant. These have revealed that tool life can be increased almost threefold, compared with previous coatings, when milling is performed on gear wheels.

We are one of the first tool manufacturers to use the new HiPIMS technology in serial production – providing further evidence of our leading position in the world of technology.

Groove miller with the new PH3 coating.

New products added for DA system

DA system basic holder, specially designed for driven tool holder applications

Basic holder with cylindrical shank diameter of 16 mm (0.629")

Before now, DA system milling cutters with a cylindrical shank diameter of 16 mm (0.629") were only available for DA31 inserts and could be equipped with two to five indexable inserts. But now we are extending this range to include three DAM32 basic holders, featuring a cylindrical shank with a 16 mm (0.629") diameter as well as internal cooling. They are available with cutting edge diameters of 20, 25 and 32 mm (0.787", 0.984" and 1.259") and can be equipped with either two or three type DA32 indexable inserts. The larger indexable inserts allow for a greater cutting depth and ensure improved stability.
The short, compact design of the new basic holders is absolutely ideal for the cramped workspaces often associated with lathes or turning/milling centres. In addition to the highly positive geometry, the component is only slightly loaded. The axial and radial cutters of the three-edged indexable inserts produce a very good surface at high chip capacity. Thanks to the positive geometry, they also guarantee gentle and quiet cutting combined with a high tool life. The geometry also supports precise milling of 90° shoulders. There are five different corner radii so the solution can be adequately tailored to the machining task and materials involved.

Partial view of the new injection moulding department. The machines perform their tasks fully automatically, from injecting the carbide mixture right through to placing the blanks on a graphite pallet.

HORN HARTSTOFFE'S NEW PREMISES

Exceptionally innovative carbide tool manufacturing

When he founded Horn Hartstoffe GmbH 20 years ago, Paul Horn was bringing to fruition a key element of his philosophy, which held that the only way to achieve the best possible results is to control the entire tool manufacturing process chain.

Today, our company can attribute the excellent position it has attained in the market to following this philosophy. But our efforts to do this have also been accompanied by an increase in quantities and variants, stretching HORN Hartstoffe's capacity to the limit. Building new premises was the only way to ensure the company could be fit for the future.

30 million euro investment

Located directly next door to the site of the previous carbide factory and just ten minutes' walk from head office, the new plant covers 5,000 m^2 – making it around four times the size of its predecessor. Over 30 million euro have been invested in the building, process technology, production equipment and environmental protection measures. Boasting new shaping processes and capacity expansions for extrusion, injection moulding, sintering and powder protection, our carbide production plant – which employs more than 60 people – is right at the cutting edge of technology.

View of one of the fully automated pre-sintering furnaces.

Isostatic press (left) and filling tower (right).

A staff member takes an automated piece of equipment to the new piston road extruder.

Partial view of the quality assurance department. The measuring machines used for dimensional inspections can be seen on the right.

Transparent production areas and work stations

You only have to look at the machines and systems, as well as the surrounding environment and work stations, to get a distinct picture of HORN Hartstoffe's forward-looking concept. The light-coloured floorboards, hall walls and partitions emphasise the ergonomic, clean nature of the work stations. Clearly arranged piping systems for operating materials and power enable information about the current processes to be obtained quickly, as well as making it easier to perform service tasks at, and navigate around, the work stations.

From powder to green compact

The manufacturing process starts with carbide alloys in powder form (grain sizes of 0.6 to 6 µm) being mixed and prepared using the pressing aids and additives required for shaping. This stage demands absolute precision, as even very slight irregularities can cause a significant change in the end product. The mixtures for pressing are prepared in vertical carousel storage areas based on the first-in/first-out principle. Other storage areas in this system ensure short access times and unobstructed transport routes and paths throughout the entire plant.

Extrusion and injection moulding

Two piston rod extruders – one a brand-new addition – press the mixture into dies whose cross-sections are the same as those of Supermini® tools. The green compacts are still porous and brittle at this point, although their consistency changes during the pre-sintering process thanks to gas evolution in the pressing aids. They are then ready for machining following this stage. Adding two new furnaces has enabled us to double our pre-sintering furnace capacity. Complex inserts with undercuts and free-form surfaces are created by means of injection moulding: for this process, we have installed additional injection moulding machines that are capable of automatic workpiece handling.

Final sintering of carbide green compacts

Temperatures between 1,300°C and 1,500°C are used to transform the porous green compacts into extremely strong and tough carbide inserts; this process reduces their volume by 20 to 25 percent. All process data is displayed digitally on the five Sinter HIP furnaces, whilst quality-critical data and parameters are recorded for final inspection further down the line.

New shaping processes

Investments in multi-stage powder presses also underline our commitment to using the very latest technology. Electrical drives and lateral press axes allow us to manufacture highly complex inserts extremely cost-effectively. Thanks to our new isostatic press, we are able to press large bar-shaped diameters both with and without bores. The individual shapes and geometries are then machined out of the rods.

Ongoing checks and in-process controls

By employing comprehensive checks and the latest measuring and testing systems, our quality control measures ensure that our carbide green compacts live up to the stringent quality requirements placed on them. All sintered carbide cutting tools are subjected to 100 percent checks in fully automated measuring machines.
In our carbide laboratory, we test and monitor the physical properties of carbides, from the starting material in powder form right through to the fully sintered carbide tool.

Capacity expansion for tool-making

Shaping processes require extremely precise tools that are produced by eight staff members in our tool-making department. The capacity of the equipment has been significantly expanded here as well. The addition of machines for milling, eroding and coordinate grinding, as well as operating equipment, demonstrates that carbide of the very highest quality is being produced in this link in the process chain too.

A model of a car, milled from a block of aluminium, shows how our tools can be used. Demonstrations of the strategies and tools used to do this never fail to impress visitors.

OUR DEMONSTRATION CENTRE:

Demonstrating HORN'S leading position in technology

Customer training, machining trials, prototype tests, development work and product presentations at trade fairs are the main areas where our demonstration centre staff can be found at work.

A large number of factors have an impact on the value-adding process of product manufacture. However, it is important that the effects they have can be predicted within certain limits and allow for the necessary level of certainty in planning ahead. That is why our demonstration centre works closely with our research and development department to test tools, largely under optimum conditions, both for our own purposes and for customers' applications. But the expert knowledge of our specialists doesn't stop there: they are also called upon in cases where the most suitable type of machining needs to be identified for sample parts, for instance.

Expertise and experience for effective testing

Five highly qualified staff members make up the regular crew in the demonstration centre. Not only are they responsible for operating and adjusting machines, but they also carry out programming tasks in a range of different control systems. Based on the nature of the tests being carried out, they work in close collaboration both with colleagues in the related product areas and with the technical consultant who is looking after the customer concerned.

The majority of the work involves prototype testing. Since only two to three tools are available for the tasks in many cases, an extremely methodical approach is essential so that it is still possible to produce informative cutting data in spite of these restrictions. Testing tools at a more advanced stage of development principally requires staff members to obtain material-related tool life results, with information about geometry, carbide grades and coatings taken into account. Performing these tests is key to upholding our philosophy that all of our production processes, including coating, should be carried out in-house. Not only does this approach ensure that tool production is more effective and flexible, it also creates a stronger demonstration centre.

Testing-related changes to cutting edges are analysed and documented using stereo microscopes.

The demonstration centre team: Ali Motawalli, Siegmund Binder, Hans-Jürgen Bender, Marcus Hintsch, Ramon Jetter (left to right).

Obtaining data on and around the tool

For each lathe turning test, we use a Traub TNA 400 CNC universal lathe as well as a DMG CTX Alpha 500. Five-axis machining centres are used with test series for milling: this involves general tests on a Deckel Maho DMU 50 Evolution as well as specialised tests (relating to tool-making and mould-making) on a Hermle C 40 U featuring a swivelling NC rotary table. Two CAD/CAM systems from different manufacturers are available for creating drawings and programming complex geometries.

A Kistler cutting force measuring device is among the equipment used for more advanced evaluation of specific tool properties and tool life. Two Olympus stereo microscopes with digital analysis facilities provide us with important information about the impact machining has on tools and workpieces. Additionally, a high-speed camera enables us to observe the behaviour of tool cutting edges and the resulting chip with high precision. Meanwhile, calculations relating to concentricity and vibration characteristics as well as balance quality provide us with yet more information about the tool/clamping equipment system.

Building relationships from the inside out

The demonstration centre stays in close contact with all internal departments as well as the field sales force and customers. In most cases, test conditions and specifications for performing tests are defined together with the relevant departments or technical consultants and with the customers. The key aim in lathe turning and milling tests is to use the tools in a way that produces reliable values, thus enabling strategies to be recommended and tool usage specifications to be set out.

Tailored customer training

The demonstration centre's customer-focused activities have also given it a proven track record in communicating theoretical information and following this up with putting theories into practice on the equipment in the centre. Customers' need for background information on special tools and combination tools is particularly on the rise. In the future, however, we intend to focus on more areas: as well as offering individually tailored training, on set days we will also be running courses that cover various tool systems as well as machining tasks and processes.

Presenting products and expertise

When trade fair time rolls around, the eyes of all our target audience members are firmly focused on the work of the demonstration centre team, which is managed by Hans-Jürgen Bender. As our appointed trade fair director, he designs our trade fair presences and decides which tools and strategies should be used on our demonstration parts. Not only this, but he also ensures that the required machines and staff members are ready for action – so that we can consistently demonstrate HORN's leading position in technology at trade fairs too.

Partial view of our demonstration centre.

Brazil – huge potential for growth

HORN GOES TO BRAZIL

Brazil: much more than football, coffee, samba and carnivals

South America's largest country, and one of the world's ten leading industrial nations, is increasingly finding itself at the centre of the worldwide attention thanks to the huge economic potential it offers. The industrial sector is reaping the benefits, and our Brazilian representative believes that huge opportunities are on the horizon thanks to the growing need for high-quality tools.

Brazil, the world's fifth largest country, has a workforce and raw materials resources that offer huge potential. The country is currently one of the biggest exporters of iron ore, minerals and agricultural products; and, using a solid industrial structure as its basis, it is also stepping up its efforts to become an international player in the intermediate goods and finished products sectors. What is more, its participation in the South American customs union Mercosul reinforces Brazil's important position within Latin America.

Economic stability, sinking rates of inflation, several state-run social programmes and affordable credit have all created the right conditions for millions of Brazilians to move up into the middle classes and become active market participants as a result. The rising rate of car sales – in 2011, Brazil was the world's sixth largest market for cars – as well as growing sales of white goods, higher-quality foodstuffs and improved white goods are testament to this trend.

An increasingly stable economic and political situation has led to international companies investing more in the country. Significant financial resources are set to pour in from large-scale projects by the oil company Petrobras, which is tapping the resources of new deep-sea oil fields, and from heavy investment in wind power plants, ethanol extraction, the 2014 World Cup and the 2016 Olympics.

The first HORN product training session in São Paulo. Oliver Filp from our export department (third from the right in the first row) ran a week-long training session for Brazilian colleagues.

The new building in Barueri.

Producing special tools in the new hall.

Sales department office.

Eugênio Saller, director of LMT Bohlerit Ltda. (left) and Eduardo Saltini, sales manager.

Our sales partner LMT Boehlerit Ltda.

LMT Boehlerit Ltda. was founded in 1997 in São Paulo. The state of the same name in which the city is located is home to around half the market potential that Brazil offers in the tools industry. Thanks to the products created by Boehlerit and Bilz as well as by alliance partner LMT Group members Fette, Kieninger, Onsrud and Belin, the company was soon able to extend its activities to every region of Brazil – no mean feat in a country of such a huge size.

Today, 35 employees are employed primarily in sales to the automotive and steel industries as well as heavy industry, pipe manufacturing and general mechanical engineering. However, the company is also active in tool-making, mould-making, medical technology and aviation. Their work is not restricted to selling standard products: they also collaborate with customers to create application-based solutions, with many of the necessary tools manufactured at the company's plant in São Paulo. Another production site, owned by group member Leitz Brasil, is located around 900 km from São Paulo in Rio Grande do Sul.

Partnership with Horn

Despite only a limited base of Brazilian customers using our products, they have still managed to earn an excellent reputation within the country. Not only do they represent a superb addition to LMT's sales portfolio, but we also take a keen interest in the markets in which LMT has a presence, such as the automotive industry, medical technology and mechanical engineering, so it was for these reasons that we decided to give LMT Boehlerit Ltda. exclusive selling rights in August 2011. Although we have only been working together for a short time, the initial sales success that has been achieved underlines the huge market potential our products have in Brazil. The successful outcome of FEIMAFE, South America's biggest trade fair and held in São Paulo, gave us further confirmation of this.

Since the partnership began, numerous training sessions and joint visits to customers have been carried out with the aim of enhancing LMT Boehlerit employees' knowledge of the products. We are extremely optimistic about the development of both this partnership and our sales figures in Brazil.

More opportunities for growth

In May 2011, LMT rented a new site in Barueri, located around 25 km north-west of São Paulo. Now, approximately 1,100 m^2 of sales, management and production space is available. And anyone who knows what it's like to negotiate traffic in São Paulo, home to 20 million people, will appreciate what a prime location the new site is in: just 1 km from the São Paulo Rodoanel ring road, it now means that the country's most important motorways can be accessed rapidly.

2012 will see us commence a range of activities designed to increase the level of Horn brand awareness on the Brazilian market. These include printed advertisements, PR activities, disseminating important journal publications to customers, technology seminars, and much more besides. As well as this, specialists from Tübingen will be holding additional training sessions for Brazilian colleagues and customers. We hope that FEIMAFE 2013 will bring us even more positive developments.

The founding members (from left to right): Ulrich Zierer/Bilz Werkzeugfabrik, Rocco Eisseler/IfW, Prof. Jürgen Fleischer/wbK, Dr.-Ing. Heiner Lang/ MAG Europe, Matthias Oettle/Paul Horn GmbH, Andree Fees/HPM Technologie, Prof. Uwe Heisel/IfW, Dr.-Ing. Jürgen Fronius/Komet GmbH, Dr.-Ing. Michael Schaal/IfW, Dr. Stefan Sattel/Gühring OHG.

Verein Zukunftsorientierte Zerspanung e.V. founded

Research and industry network

The primary aims of the Verein Zukunftsorientierte Zerspanung e.V. (Association for Future-Oriented Machining) – founded in Stuttgart in October 2011 – are based on an integrated view of machining that covers future production and machining processes, collaborative product development and research projects, enhancement of basic knowledge, transfer of expertise and information, development of new areas of business, access to new markets and services for members.

The board of directors is made up of chairman Matthias Oettle, (Paul Horn GmbH), deputy board members Prof. Dr.-Ing. Prof. E.h. Dr. h.c. mult. Uwe Heisel (Institute of Machine Tools at the University of Stuttgart (IfW)), Prof. Dr.-Ing. Jürgen Fleischer, (Institute of Production Science at Karlsruhe Institute of Technology (wbk)) and managing director Dr.-Ing. Michael Schaal (Institute of Machine Tools at the University of Stuttgart). Senior representatives of a range of different countries and institutes were brought on board to take up the treasurer position and other board roles.

BLUecoMPETENCE

VDMA commences wide-ranging sustainability initiative

They live in a basement, work on a three-shift basis, protect the environment and improve product quality. They don't create any hazardous waste, but instead generate potential recyclables, prevent health hazards for employees, save energy, and run and maintain themselves: our four cooling lubricant recycling systems, developed in-house.

Sustainability. One word is all it takes to convey a range of requirements and expectations for new energy concepts, resource conservation measures and green technologies. Today, the word comes up in discussions wherever you turn: in the media, within political spheres, among the general public and customers, and even among school pupils – who, after all, will make up the workforce of the future.

Yet sustainability is all too rarely associated with mechanical engineering or plant construction, despite the fact that these areas make significant efforts to promote energy-efficient and resource-efficient solutions based on innovative technology – and, indeed, are what make these solutions possible at all in many cases. BLUecoMPETENCE, the new sustainability initiative from the VDMA (German Engineering Federation) aims to find out more about this. Over 130 companies – of whom we were one of the first to sign up – as well as 27 trade associations and organisations have committed themselves to the initiative so far. The aim of this campaign is to consolidate our areas of strength and expertise so that we are able to not only take on the role of a technology leader in the area of sustainability worldwide, but also retain this title over the long term.

For more information, please go to www.bluecompetence.com.

METAV 2012
28. Februar – 3. März Düsseldorf

Our new innovations and developments ensured enthusiastic discussions.

METAV 2012, 28th February – 3rd March 2012

International trade fair for production technology and automation confirms real keenness to invest in European industry.

"As this year's first metalworking trade fair, METAV has shown convincingly that, despite an uncertain political environment, the industry is in good spirits and keenness to invest in customer industries is still high". Around 700 exhibitors from 26 countries, and 40,000 trade professionals visiting from 30 countries, were testament to how Dr Wilfried Schäfer, managing director of METAV organiser VDW, summed up the trade fair. METAV's significance was underlined by the distinctly positive mood of potential investors and the intention of more than 40 percent of visitors to make concrete investments – in areas including our specialist fields of measuring and testing technology as well as precision tools.

"We are set to reap significant benefits from investment projects. Given the high number of visitors to or stand in Hall 14 and the number of concrete requirements specifications we received, we don't see things going any other way", says sales manager and management board member Andreas Vollmer about Horn's successful visit to the trade fair. New innovations such as CVD diamond-tipped milling cutters, the new PH3 coating material, and new products for the DA system provided particularly good starting points for establishing promising customer contacts.

13 Trade fair for production technology, 25th – 28th January 2012, Hamburg

NORTEC
13. Fachmesse für Produktionstechnik
25. – 28. Januar 2012 | Hamburg
www.nortec-hamburg.de

Despite an onslaught of visitors, our staff even managed to find the time to cater to individual customer requirements.

Nortec confirms its position as northern Germany's most important meeting venue for decision-makers and experts.

More than 400 exhibitors presented new production methods, machines and services. The production technology added-value chain attracted the interest of more than 10,000 visiting experts.

Covering 80 m² in Hall 4, we presented new innovations and developments such as the 3V2 geometry for stainless steels, broaching on CNC machines using S117 with a diameter of 14 mm (0.551") and up, and high-feed milling using DAHM arbour cutters.
"Spirits in the industry are consistently high. The exhibitors are extremely satisfied with how the trade fair went and the contacts that were established", said a summary by the northern regional branch of the VDMA. We can only agree with this assessment.

GROVING · PARTING OFF · GROOVE MILLING · BROACHING · COPY MILLING · DRILLING · REAMING

HORN is at home in over 70 countries across the world

• Subsidiaries or agencies

Hartmetall-Werkzeugfabrik
Paul Horn GmbH
Postfach 17 20
72007 Tübingen
Tel.: 07071 7004-0
Fax: 07071 72893
E-Mail: info@phorn.de
www.phorn.de

BLUeCOMPETENCE Alliance Member
Partner of the Engineering Industry Sustainability Initiative

HORN France 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

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

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

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