Issue 2/13

world of tools

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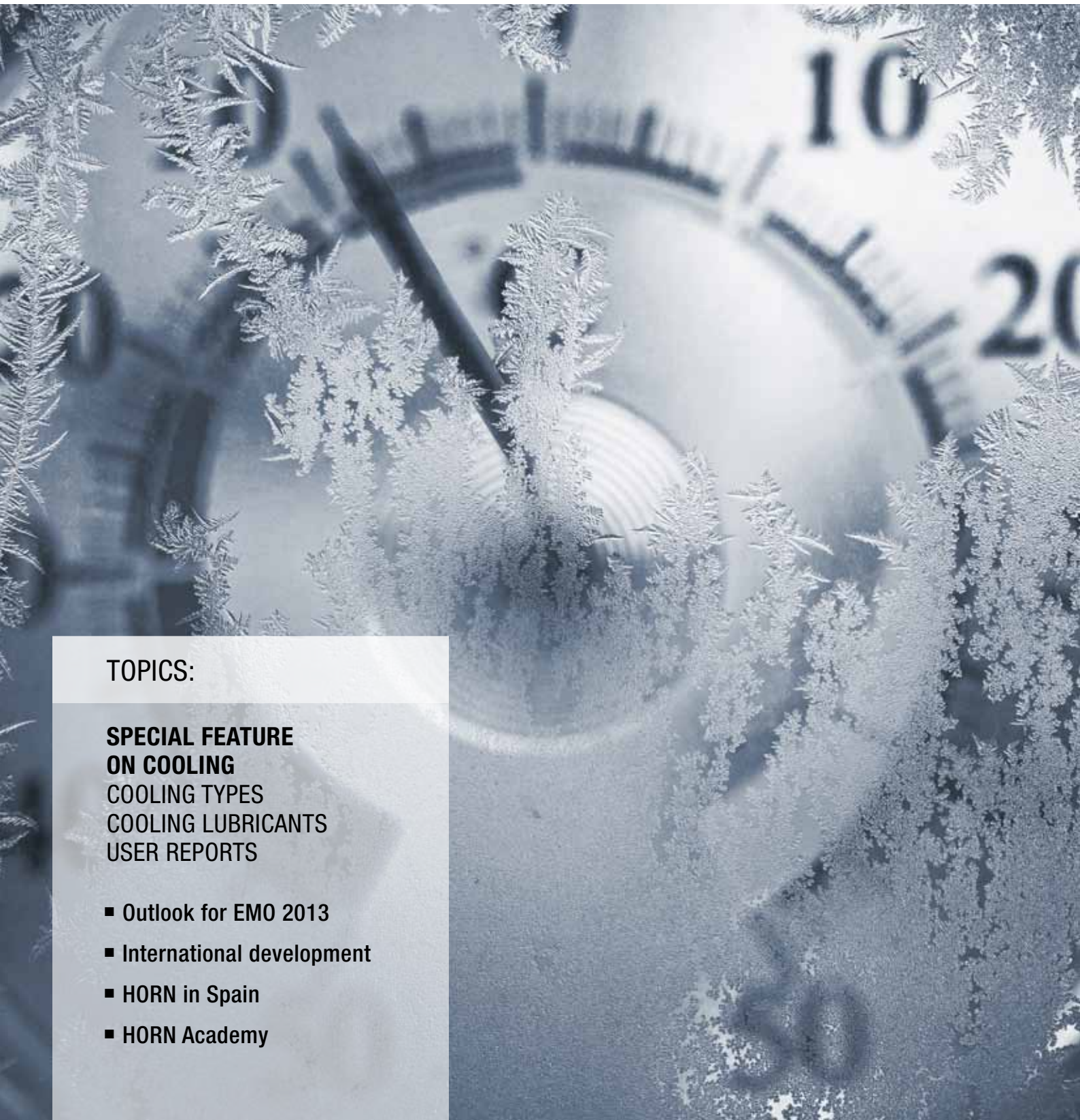
THE CUSTOMER MAGAZINE FROM HORN



TOPICS:

SPECIAL FEATURE ON COOLING
COOLING TYPES
COOLING LUBRICANTS
USER REPORTS

- Outlook for EMO 2013
- International development
- HORN in Spain
- HORN Academy

EDITORIAL

Dear Readers,

We deal with cutting solutions day after day. We consider geometries, cutting speeds, feed rates and all sorts of other parameters. The subject of cooling is often central to our work. Cooling, whether it is achieved using air, oil, emulsion, nitrogen or minimal lubrication, is no longer used merely for temperature control. Today it can also be used to remove chips, for example by being directed to the cutting zone with great precision at high pressures.

At HORN, we are constantly optimising our tools and we are on the way to achieving the ideal solution. Depending on the type of machining used by the customer, cooling can take place through the holder, the clamping finger or directly through the insert. In some cases – hard machining, for example – it can be omitted altogether. In the following articles, we intend to examine the subject of cooling and how we approach it, as well as giving an overview and illustrating some practical examples.

2013 is an EMO year once again. In this edition of world of tools, you can get a sneak preview of the new products and developments that we will be showcasing at the leading global trade fair in Hanover. Furthermore, the topics of education, qualifications and information, which are covered to a great extent both internally and externally by the HORN Academy, continue to be extremely important. Our guests at the 2013 Technology Days had the chance to experience this for themselves at eight different technical presentations.

When letters become words, words become sentences and sentences become useful information, the result is the copy of "world of tools" that you are reading now.

I hope you find this magazine both informative and enjoyable.

Lothar Horn
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Hartmetall-Werkzeugfabrik Paul Horn GmbH
Tübingen, Germany

world of tools

THE CUSTOMER MAGAZINE FROM HORN

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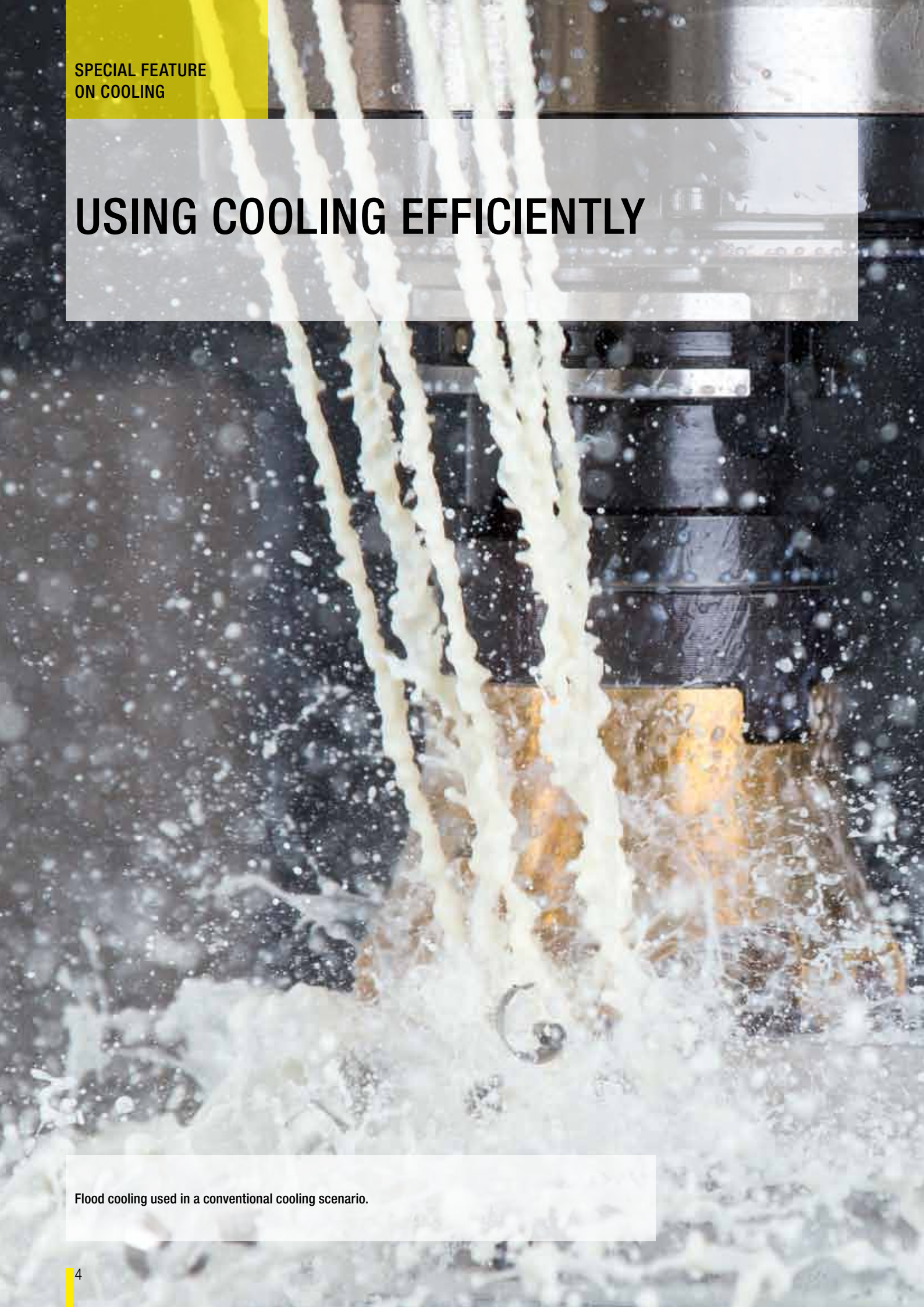
USING COOLING EFFICIENTLY



Flood cooling used in a conventional cooling scenario.

The application is crucial

When machining materials, cooling lubricants are used to reduce friction through lubrication, dissipate heat through cooling, transport chips through rinsing, increase the tool life, improve the surfaces of the workpieces, increase the potential material removal rate, optimise chip control and guidance, increase process reliability, clean the machining area and prevent corrosion. In other words, a whole host of tasks. Germany's 200,000 metalworking plants use more than a million tonnes of these cooling lubricants every year – enough to fill two supertankers.

Choosing the right kind of cooling lubricant to use means looking at two different areas: the formulation of the cooling lubricant and the application in which it is being used.

Types of cooling lubricant

Cooling lubricants that are not water-soluble, such as oils (either with or without additives), are used in cases where maintaining the quality of the surface and achieving a lubricating effect are the topmost priorities. On the other hand, those that are water-soluble – like oil-in-water emulsions or soapy solutions that are free from mineral oil – are best suited to applications that require a cooling effect above all else.
Mixed friction occurs during cutting processes. Thanks to their lubricating effect, cooling lubricants reduce friction on the cutting edge; in turn, this combined with the cooling effect controls wear on tool cutting edges, reduces temperature rises on workpieces, and lowers energy consumption. Cooling lubricants designed for applications that have high to exceptionally high demands contain special additives, which react with the material at high cutting pressure levels and temperatures and thus prevent peak areas of roughness in the tool and workpiece from fusing (adhesive wear and build-up edges).
Coolants that do not have a lubricating effect include ambient air (such as the type used mainly for the dry machining of cast materials), compressed air and, in recent times, cryogenic gases like liquid nitrogen or CO_2 fed in liquid form during snow-jet processes.

Types of cooling lubricant application

There are many different applications in this case: flush cooling or flood cooling, targeted jet cooling that uses external hoses to achieve different pressure levels, and minimum quantity lubrication either from the outside or in the form of internal cooling through the tool. Modern tool systems that accommodate internal cooling through the holder, clamping finger or cutting insert – and achieve pressure levels of up to 80 bar, more than 80 bar in the case of high-pressure cooling, and 150 bar and up in the case of ultra-high-pressure cooling – have proven to be very effective in increasing tool life and productivity.

The basics:

- Even the very best method of cooling is useless if it doesn't reach the cutting edge
- Lubrication that reduces friction can be applied to maximum effect directly behind the cutting point.

Conventional cooling processes

Flush cooling, flood cooling and cooling that uses specifically directed jets of coolant (either oil or emulsion) are generally very adequate methods of achieving cooling, lubrication and effective chip removal in universal applications, provided a sufficient quantity of cooling lubricant is applied to the active zone on the cutting edge without any obstructions.

Minimum quantity lubrication

Using the minimum quantity lubrication method steers clear of the costly aspects associated with conventional flood cooling. This is because the method:
- reduces the amount of cooling lubricant used to just a few cubic centimetres per hour
- avoids the costs associated with monitoring and cooling lubricant maintenance
- does away with the costs required to dispose of used cooling lubricant
- reduces the time and cost required for cleaning the parts involved
- keeps the chips virtually dry, enabling them to be recycled without further treatment.

Feeding lubricant directly to the cutting zone (either using an external aerosol or an internal coolant supply) produces effective

Oil is often used in cases where a high surface quality has to be preserved.

CBN hard turning during dry machining.

lubrication – even in cases involving large bore hole depths, for example.

Air cooling

Efforts to drive down the cost of machining processes have led to dry machining becoming the method of choice in many cases. Years ago, the automotive industry calculated that around 14 to 16 percent of cutting costs could be attributed to using, maintaining and disposing of cooling lubricants. Now, state-of-the-art tools and coatings enable dry machining to be used with cast materials and much more besides. Compressed air, which achieves its cooling effect by the release that takes place after the nozzle, is primarily used when machining fibre-reinforced plastics, ceramic or carbide green compacts, and graphite. In this case, the aim is to blow the abrasive fibre dust, as well as the graphite, ceramic and carbide dust, away from the direct cutting zone efficiently and quickly before extracting it using suction.

Modern, efficient cooling methods

Steel materials with increasingly high levels of strength and toughness are being used more and more nowadays; this trend, combined with the improvement in cost structures thanks to the growing efficiency of manufacturing processes, is not only having an effect on the development of tools and machine tools that are suitable for these materials, but also improving cooling lubricant methods. Innovative tool manufacturers such as HORN were among the first to address the requirements of the market in this area, and developed new, modern cooling processes: cooling involving high-pressure cooling lubricant, tools with internal cooling, and, finally, the use of cryogenic liquid gases as coolants.

Internal cooling

Today, tools that feature an internal cooling supply are truly at the cutting edge of technology. Machine tools, interfaces and tools have been accommodating this method for some time now, enabling effective cooling to be carried out at cutting edges and chips to be removed reliably from drilling channels during drilling processes and much more besides. One type of manufacturing technology that has always been particularly demanding – and has always had a significant say in tool designs and cooling lubricant methods – is grooving and parting off. With the area in question sandwiched between two edges (the chip being peeled away at the top and the cutting insert providing a shield at the bottom), the only way to carry out efficient cooling is to direct it from an insert, clamping finger or clamping holder. The type of cooling used also depends on its objective. While it is possible to lessen crater wear by applying pressure from as little as 5 bar, levels of more than 20 bar are required if the aim is to reduce the formation of build-up edges. Levels of 40 bar and higher enable effective chip control, and ultra-high-pressure applications involving more than 150 bar ensure the required chip break even in cases involving long-chipping, high-strength nickel-based alloys.

Versions of cooled tools for grooving

Then there is the case of internal cooling that goes through the clamping holder and past the side of the cutting insert support until it reaches the cutting edge. During the process of grooving, the cutting insert support is always narrower than the contour being grooved, which means that cooling lubricant can flow through the resulting gap right up to the cutting edge. HORN offers two solutions for this application, involving cooling lubricant nozzles on either one side or both sides. Additional nozzles at the bottom also reinforce the effect of the cooling lubricant.

It is also possible to use internal cooling through the clamping finger, with the high-pressure cooling lubricant jet aimed directly at the cutting zone of the cutting edge. This is an efficient method of cooling that enables a defined level of chip formation as well as chip control with excellent process reliability. The high-pressure cooling lubricant jet that directly hits the cutting zone cools the cutting insert, lessens friction from the chip being peeled away, and reduces the formation of build-up edges. As a result, this type of internal cooling considerably increases not only the reliable tool life of the cutting edges, but also levels of productivity thanks to the higher cutting values that can be achieved.
Internal cooling through the cutting insert, meanwhile, can be an even more efficient method in many cases. This creates effective cooling directly at the cutting zone: the cooling lubricant jet is targeted to hit the zone precisely, significantly improving cutting conditions. A specially designed nozzle shape in the cutting insert guides the jet of coolant directly to the cutting zone, aids chip formation and prevents the risk of chip blockage. At the same time, the cooling lubricant keeps the cutting insert cool as it is flowing through it, and reduces not only the formation of build-up edges, but also premature cutting edge wear. This technique achieves considerably better tool life and cutting parameters when compared with conventional cooling processes. In the case of parting off on a 42CrMoS4 gear shaft with a tensile strength of up to 1,050 N/mm^2, for example, tool life can increase by as much as six times.

Clamping holder with internal coolant supply.

Type 220C basic holder with HORN polygon shaft conforming to ISO 26623 and cassette with internal cooling.

Cryogenic cooling

Cryogenic cooling techniques involving liquid nitrogen proved one of the technological highlights of the recent EMO trade fair. During cutting, controlling cryogenic processes that use liquid nitrogen with temperatures as low as -196°C requires special supply systems such as insulated storage flasks, vacuum-insulated hoses, and technology inside the machine tool and tool system that is designed to cope with processes of this kind. A cryogenic method that uses fewer resources is snow-jet cooling, which involves liquid CO_2 with a coolant temperature of -78°C.
This technique has some unparalleled advantages, particularly when it comes to processing titanium and nickel alloys or duplex steels – materials that create high thermal loads at the cutting edge, leading to rapid and significant cutting edge wear. In these cases, cryogenic cooling increases cutting parameters and tool life to a considerable degree.
When it comes to cooling, the requirements of the application itself are just as important as choosing the right tool; not only this, but it is also crucial to look at the possibilities offered by the machines in question and what the company's infrastructure is capable of achieving. In many cases, discussion between the customer and the sales force will help determine whether a cooling method is required at all; and if so, which one should be selected and which cooling lubricant should be used.

Cryogenic cooling. Liquid nitrogen can be used in cutting applications.

HIGH-PRESSURE INTERNAL COOLING FOR PISTON RING GROOVES

Pre-grooving and finishing the piston ring grooves with f = 0.25 mm (0.010")/revolution and a targeted 80 bar high-pressure coolant jet from the clamping finger ensures short chips and high process reliability.

Cooling is key

For KS Kolbenschmidt GmbH, based in the German city of Neckarsulm, creating grooves for piston rings is one of the most important elements of the company's work – and it just so happens that grooving is one area in which HORN has always proved a particularly strong contender too. Joining forces, therefore, was a logical next step: by combining their knowledge, experience and new ideas, the companies are hoping to take grooving technology to the next level.

KS Kolbenschmidt is one of the few piston manufacturers whose name is known across the globe. As a division of automotive supplier KSPG AG, it makes pistons with diameters between 160 (6.299") and 640 mm (25.197") in its large-scale piston production premises. These go on to be used in applications such as stationary diesel engines, ships, power stations and locomotives. With each cylinder subjected to as much as 2,000 kW, the pistons require the absolute utmost in production quality, and to achieve this, the company uses aluminium, aluminium/steel, GGG70/steel, and steel/steel as materials and material pairings. Today's engines require "assembled" pistons as a matter of course, and the material pairing that is chosen in each case is also based on the specific requirements of the application. With the exception of pistons made entirely from aluminium, the top part is always made from steel. For this, KS Kolbenschmidt uses the steel material 42CrMo4V; boasting a tensile strength of up to 1200 N/mm^2, it is tough, hard and difficult to cut – in other words, a material that proves a challenge to machine.

Problems with low-pressure cooling lubricant

Depending on the exact design, the grooves for the piston rings in the top part of the piston can be 3-10 mm (0.118"-0.393") wide and up to 25 mm (0.984") deep. The first stage in creating them involves pre-grooving in solid material; this is followed by edge and groove base finishing. For twelve years now, HORN has been KS Kolbenschmidt's tool partner for grooving processes. To begin with, the process of creating piston ring grooves on older machines without a high-pressure cooling lubricant pump or internal cooling capability caused problems. Long chips in the work area meant that the required process reliability could not be achieved. The machine had to be stopped repeatedly in order to remove the problematic chips with a hook. HORN, the company's tool partner, developed special geometries for this difficult application which improved chip control, but only when used with a precisely adjusted cooling lubricant nozzle. However, the 8 to 10 bar coolant pressure was simply too low for an optimal grooving process.

The clamping holder of type 218 on the VDI holder, equipped with indexable insert type S229 with geometry ".L", is used for pre-grooving.

The partnership between KS Kolbenschmidt and HORN for machining piston ring grooves for large-bore pistons led to the development of the high-pressure internal cooling system.

Two systems with internal cooling: The HSK 100 main body with cassette system is adapted to the turning/drilling/milling unit; the VDI holder to the turret. Both ensure short, controlled chips.

Cooling lubricant with high-pressure internal cooling solved the problem

Following investments in new, powerful mill-turning centres with high-pressure internal cooling equipment up to 80 bar, Wolfgang Köhler, who is responsible for tool management at KS Kolbenschmidt, approached HORN field sales employee Armin Jaud with a challenging request. In order to make full use of the technological possibilities of the new turning centres, HORN was asked to develop an integrated, internally controlled cooling lubricant system – from the machine interface to the basic holder and the cutting edge – without external cooling lubricant control. HORN and KS Kolbenschmidt formed a partnership to develop an integrated internal cooling system – with KS Kolbenschmidt as the pilot customer for the now standardised internal cooling system, which is based on the standard holding system 218 with indexable insert type S229.

Two systems – Same advantage

Since that time, KS Kolbenschmidt have been using two HORN systems to machine grooves: a HSK 100 main body with cassette system type 220 on the turning/drilling/milling unit, and a VDI holder with clamping holder type 218 for adaptation to the turret. A dead stop on the clamping holder 218 transfers the cooling lubricant and also stabilises the high cutting pressure when carrying out radial cutting. Indexable inserts of type S229 are used on both the HSK 100 holder and the VDI holder. The ".L" geometry has proven itself to be the optimal design for pre-grooving in solid material. Feed rates of f = 0.25 mm (0.010")/revolution ensure short, controlled chips in all width ranges. Geometry ".5" showed the best results for finishing the edges and the groove base. When a_p = 0.5 mm (0.019") and f = 0.25 mm (0.010")/revolution, only very short comma chips are produced. Both types of cutting insert are coated with the tried-and-tested HORN coating AS66.

Reliable chip control with high-pressure internal cooling

In both versions – HSK 100 and VDI – the internally controlled cooling lubricant comes out of the nozzle in the clamping finger in a targeted jet and hits the active zone on the cutting edge – where the friction is greatest and the temperature is highest – directly with a powerful 80 bar impact pressure. At the same time, the high-pressure jet lifts the chip and also encourages chip breaking – the chilling effect helps with this too.
The results were remarkable: the short, controlled chips define the required process reliability and make it possible to operate an automated work process. The tapering of the chip that is being peeled away prevents damage to the edges. The effective cooling process has extended the tool life for each cutting edge by 50 percent. With the introduction of internal cooling in the high-pressure range, KS Kolbenschmidt is now able to increase tool life with the same cutting parameters or increase productivity with higher cutting parameters – whilst maintaining the previous tool life. The process reliability achieved with internal cooling applies to both alternatives.

Armin Jaud (left) from HORN and Wolfgang Köhler, who is responsible for tool management in large-bore piston production at KS Kolbenschmidt, have taken grooving processes to the next level with the high-pressure internal cooling system.

A VDI 40 holder uses the standard cooling lubricant interface of the turret and guides the cooling lubricant through a sealed duct to the internally cooled S100 cutting insert.

INTERNALLY COOLED WITH FOUR TIMES THE TOOL LIFE

One of the key strengths of febi bilstein in Ennepetal, as a supplier of premium spare parts for the automotive sector which boast the same high quality as original equipment, is their manufacturing expertise with the "Made in Germany" quality seal. Febi's precision technology specialises in manufacturing ambitious, sophisticated products. Consistently meeting these high quality standards requires constant modernisation of the machining facilities, as well as steady improvements in the performance of the cutting methods and tools. Not a problem if you have an innovative partner like HORN on your side – constantly improving their solutions or developing new methods, such as a parting-off insert with internal cooling.

The bilstein group is an independent, family-run group of companies encompassing the febi, SWAG and Blue Print brands. As a leading specialist in the pattern spare parts market, the company offers a range of over 47,000 different spare parts for cars and commercial vehicles. With a total of 1,450 employees, the group generated a global turnover of 416 million euros in 2012. Febi bilstein has been active in the metal working industry since 1844 and has amassed a wealth of experience over that time. A combination of expertise and precision technology goes into the development of every single standard part. A total of 1,120 employees work at the Ennepetal site, of whom 130 work in the production area of febi precision technology. Thousands of spare parts for cars and commercial vehicles – many of which are safety-related parts – are manufactured in a production area covering 10,000 m². Between 500 and 200,000 pieces are produced every year for each item. The in-house manufacturing process comprises virtually every part of the production chain: from material procurement and analysis to toolmaking, cutting, hardening and assembly, right up to computer-aided documentation. The cutting sector is not lacking in important technology.

The S100 cutting insert with internal cooling is fixed safely into a prismatic mounting with screw clamping. With a cutting edge width of 4 mm (0.157"), the groove depth of the febi bilstein design can be up to 45 mm (1.771").

One gear shaft – Five tools

Employees in production at febi work on spare parts such as chain tensioners, axle bolts, wheel hubs, suspension arms and all other wearing parts used in vehicles. The most commonly used materials include C45, 42CrMo4V, cast iron or aluminium – from bar, as sections, tempered or forged.

Amongst other things, gear shafts are manufactured here in different versions. This process makes use of several HORN tools: Preliminary rough machining is carried out on the gear run out using a type S224 tool; type 312 takes care of the grooves. The S100 cutting insert is used for parting off and is internally cooled. These parts are completely machined from bar on a highly efficient Gildemeister CTX 1250 TC 4A using parallel machining on main and counter spindle, a fully-fledged milling spindle, bar loading and gripping portal. The material is tempered 42CrMoS4 with strengths between 980 and 1200 N/mm² – tough and not easy to cut.

The S100 cutting insert with internal cooling has a secure prismatic guide against shear forces on the top and bottom.

Initial tests after just a few weeks

In the beginning the S100 cutting insert type was used without internal cooling. The cutting width edge for larger gear shafts with diameters of 50-90 mm (1.968"-3.543") is 4 mm (0.157"); for smaller gear shafts with diameters of 20-50 mm (0.787"-1.968"), a cutting edge width of 3 mm (0.118") is sufficient. The results produced by the non-internally-cooled S100 had – according to Christian Erlenkötter, the master craftsman responsible – been "satisfactory to good" up to that point. From October 2012, however, the field sales employee Michael Ehmann had a new, improved trump card up his sleeve, which he played in conversation with Christian Erlenkötter: the S100 with internal cooling. "We had a look at it together," says Erlenkötter, "and decided straight away to carry out some tests to assess its potential. The test tools, a VDI 40 holder for a Sauter Trifix turret, were ordered in Tübingen and designed immediately, and in just a few weeks we were ready to start testing."

The special geometry of the nozzle shape ensures optimal cooling and chip removal as well as long tool lives for the cutting inserts.

Michael Krüsel, fitter at febi bilstein, observes the good chip flow, long tool lives and flawless, reliable cutting edge clamping even with the deepest of grooves.

Michael Ehmann from HORN (left) and Christian Erlenkötter, the responsible master craftsman at febi bilstein, are pleased with the outstanding results achieved by the new S100 with internal cooling in terms of both performance and costs.

Four times the tool life – Half the tool costs

Michael Ehmann from HORN describes the advantages of the S100 cutting insert with internal cooling as follows: "The VDI 40 holder uses the standard cooling lubricant connection of the turret and guides the coolant, which in this case is under 25 bar pressure, through a continuous cooling lubricant duct to the nozzle of the cutting insert. This cutting insert of carbide grade AS45 with EN geometry and chip former enables effective cooling directly at the cutting zone. The coolant jet hits the zone directly, significantly improving cutting conditions. The specially designed nozzle shape of the cooling lubricant duct ensures that the coolant jet is aimed precisely at the cutting zone, supporting chip removal and greatly reducing the risk of a chip blockage. The jet that is guided through the cutting insert cools the cutting edge at the same time and reduces the formation of built-up edges and premature cutting edge wear. Compared to the previous cooling system internal cooling increases the available cutting parameters and tool life. Christian Erlenkötter quantifies the advantages: "The new S100 cutting insert with internal cooling produced a 400 percent improvement in the reliable tool life of the cutting edges. And although the complete system is a bit more expensive with the new holder, the tool costs have more than halved. In addition, increased tool life means that far fewer tool changes are required, thereby increasing the primary processing time of the machine." The machine fitter Michael Krüsel praises the simple process for changing cutting inserts: "The clamping of the prismatic cutting insert, which is supported by a clamping screw, is completely reliable, even at the groove depths of up to 45 mm (1.771") that are often necessary. And even with long engagement times and high temperatures, the cutting inserts and their internal cooling guarantee an outstanding chip flow with long tool life."

Huge future potential

From Christian Erlenkötter's perspective, there is still huge potential to be explored with the use of the HORN cutting insert: "We are still in the trial period with a test tool and are still using the previous cutting parameters for cutting inserts without internal cooling. With the upcoming optimisation process and higher cutting parameters, I expect to see even more potential in terms of both performance and costs. For us, this initial application of the new, internally cooled S100 cutting insert with internal cooling for the gear shafts is also the test for many similar applications for other parts and on other machines. I can see huge future potential in this area beyond these initial results."
Future potential that HORN has already been demonstrating at febi bilstein for years: since the experiment with the first tool type, the number of types used grew to 15, each in different varieties and countless applications. The tools used include Mini and Supermini® versions of type 312, S224 and S100/S100 IK (internal cooling), the DR system for reaming tasks, plus a range of other HORN tools. Special tools are also used to cover the often very specific applications in febi bilstein production; for example, special tools for lubrication grooves with complex pitches and specially designed cutting contours.

S117 broaching plate as standard or special tool.

Various system solutions depending on the application.

MACHINING LONGITUDINAL GROOVES ON CNC MACHINES

Internal and external profiles in a primarily axial direction are produced with
- Broaching in single – or multi-pass hub groove broaching or short-stroke broaching or internal profile broaching
- Hobbing
- Shaping
- Broaching with a guided tool, with a self-centring tool or using keyseating.

The common procedures such as broaching, shaping and, to a certain extent, hobbing are not easily integrated with complete machining strategies. They require special machines and equipment with sometimes substantial costs for machines and tools, as well as a significant amount of setup work. If there is no in-house capacity available, these procedures are also linked to loss of time through reliance on external machining resources.

For the alternative – broaching on your own CNC machines – all you need is the relevant tools. The advantages of broaching on your own CNC lathes and CNC milling machines are particularly clear in small and medium-sized batches. New found flexibility, cost-effectiveness, integration into complete machining concepts and quick delivery times open up new possibilities.

With systems such as the Supermini® type 105 and Supermini® type 110 as well as the system type S117, HORN provides tools for generating:
- Catch grooves in line with DIN 138
- Keyways in line with DIN 6885
- Internal and external gears
- Hexagonal socket for key slots of 2.5 mm (0.098") or more
- Torx profiles for key slots of 0.7 mm (0.027") or more
- Any special profiles required by customers.

Groove profiles according to DIN 138 include catch grooves for cutting tools with cylindrical bores such as side milling cutters. Groove profiles from DIN 6881 to DIN 6889 include taper key connections, drive-type connections and keyways with straight edges. The most common standard is DIN 6885.
Broaching on CNC machines is divided into two different procedures: conventional broaching and broaching with driven tools.

Conventional broaching

The effort required for this procedure is comparatively low. It requires a clamping holder and the corresponding cutting insert

with the desired profile. A CNC lathe or CNC milling machine from existing machining facilities can be used for this purpose. During broaching, only two axes are active on the lathe: the X axis for infeed ap/stroke up to the groove depth and for raising during the back stroke, and the Z axis for the cut vc and back motion. With these two axes, the user can produce straight grooves if he does not overlap the two axis movements, and cone-shaped or half-moon grooves if he does overlap them. If, for example, the keyway is wider than the cutting edge width, the Y axis creates an offset to the required groove width. The cutting speed corresponds to the feed speed of the machine. The maximum cutting speed that can be achieved – for example, on a Traub TNA400 with v_f = 10,000 mm (393.700")/min – corresponds to a cutting speed of 10 m (393.700")/min during broaching.

Broaching with driven tools

Various manufacturers provide systems for this purpose with up to 3,000 strokes/min. With a driven tool, the rectangular motion is performed by the driven tool whilst the infeed motion in the X direction is carried out by the machine. With a stroke rate for the driven tool of 1,000 strokes/min, for example, which corresponds to 16 strokes per second, a groove of 3.2 mm (0.125") is machined and finished in 32 strokes or 2 seconds with an infeed of 0.1 mm (0.004")/stroke. The maximum groove width in this case is 8 (0.314") to 10 mm (0.393"); the maximum infeed per stroke is 0.15 mm (0.006") with a usable working stroke/broaching length of 32 mm (1.259"). Driven tools can be used for both internal and external machining.

Two different procedures

Conventional broaching is a solution which requires very little work, has no restrictions on stroke length and is possible on all CNC machines. As the machine axes carry out all movements, the procedure induces a major mass movement at high stroke rates. The procedure is universally applicable. The optimum areas of application are small and medium-sized batches.

Broaching using driven tools is a very fast process, which is combined with low mass movements. Higher acquisition costs, limited stroke length (30 (1.181") to 40 mm (1.574")).
and machine/turret-based designs make this procedure less universal. It is best suited to medium-sized and large batches.

Universal and individual

The Supermini® type 105 and type 110 systems and system S117 cover applications such as grooves, Torx, hexagonal sockets, chamfers and any other profiles requested with their standard carbide cutting edge shapes. Gears – both internal and external – can be broached using cutting inserts with a profile tooth, as well as cutting inserts with several more teeth for pre-cutting and finishing. Broaching is also individual because, for example, the subsequent distortion due to hardening in the cutting profile can be taken into account with very little extra work and the CNC control regulates the course of the profile with exact precision.

Important points when broaching

- Groove runout, undercut or radial bore at the groove end.
- Raising the tool before the back stroke (lift stroke).
- A sufficient coolant supply rinses chips out of the bore and has a positive effect on the surface quality and tool life.
- If possible, broaching should be carried out in the 12 o'clock position.
- Be careful with tight bores, as there is a risk of collision at the back.
- It is also important to pay attention to the measurement of the tool and to the starting dimension when programming the first stroke.

The key advantages

- Very high precision because complete machining is possible.
- Very low costs for conventional broaching.
- Very flexible and fast responses to changes in the groove tolerances possible.
- Relatively low machining forces.
- In-house solution with all of the advantages of flexibility and rapid responses.

Grooving system 209 for internal grooves in bores with D = 16 mm (0.630") or more.

Internal grooving with precision cooling at bore depth up to 30 mm (1.181")

HORN has developed system 209 for internal grooving applications in bores of 16 mm (0.630") diameter or more. For internal grooving in bores from 16 mm (0.630") diameter, a toolholder with a shaft diameter D = 16 mm (0.630") is used to provide grooving capability up to T_{max} = 3.5 mm (0.137") at bore depth up to 30 mm (1.181").

Coolant supply via clamping finger and additional bore in shank/neck for maximum tool life and effective chip transport.

For bores with diameter of 18 mm (0.708") or more, grooves with a depth of T_{max} = 5 mm (0.197") can be machined using a toolholder with shank diameter of D = 20 mm (0.787") at boredepth of up to 30 mm (1.181"). Clamping holders to h6 quality in a left- or right-hand design are available.

The stable shank with elliptical-shaped cross-section on the boring bar neck provides excellent damping characteristics. The system 209 consists of a clamping holder with internal cooling and an indexable insert with two cutting edges and a cutting edge width of 2 mm (0.078"). The coolant jet comes out of a nozzle in the clamping finger and out of the side of the clamping holder. The coolant jet from the clamping finger hits the active zone of the cutting edge precisely and ensures efficient cooling and longer tool life. The two cooling lubricant jets ensure that chips are removed from the inside of the workpiece in a controlled and effective manner.

The precision-sintered indexable insert with two cutting edges and a cutting edge width of 2 mm (0.078") from the substrate AS45 with the geometries ".5" and ".1A" ensures outstanding chip control and chip breakage, even for long-chipping materials. The cutting insert is clamped using a screw – a reliable connection with precise positioning.

The machining parameters in steel range from a feed rate of f = 0.06 mm (0.002")/revolution to f = 0.2 mm (0.007")/revolution at cutting speeds between 100 m (3,937.007")/min and 180 m (7,086.614")/min, depending on the strength.

Comprehensive range of gear milling tooling

With the expansion of the gear milling systems up to module 6, HORN now offers a complete range of tool systems for all module sizes from M 0.5 to M 6. The gear range includes:
– Milling spur gears
– Milling shaft/hub connections
– Broaching internal gears
– Milling worm gear shafts
– Milling customer-specific gear profiles

Different milling systems cover this area of application depending on the module size (DIN 3972, reference profile 1):
– Up to module 3: Cutting inserts type 606 to 636 (also as a three-cutting edge tool)
– Up to module 4: Milling systems M274 and M279 – single-row and double-row for wide profiles
– Up to module 6: the new milling system type M121

Version 613 – a new addition to the catalogue range for module 1 and module 1.5 (DIN 3972, reference profile 1) – offers the following advantages: 6 teeth ensure fast machining times when machining gears on shafts, even in tight spaces, with a diameter of only 21.7 mm (0.854"). The carbide grade AS45 enables a wide range of applications with long tool life.
The tool systems type 105 and type 110 Supermini®, type S117 and type 315 are used for broaching gears – both internal and external – in varying sizes. Pre-broaching and finishing with only one cutting insert significantly reduces the cycle times.

The addition of the new universal M121 gear and profile miller to the gear milling systems expands the range of applications upwards. As well as being used as a milling tool for gears up to module 6 (reference profile 1 according to DIN 3972), it can also be used for shaft/hub connections and for lots of other profiles, according to requirements. Adjusting the main body to suit the relevant cutting edge shape provides the cutting inserts with stable support. The inserts are screwed on directly without additional clamping elements. An integrated coolant supply cools the cutting inserts effectively with a direct cooling lubricant jet, thus ensuring longer tool life. The large dimensions that are possible with the S121 cutting insert cover profile depths up to 15.5 mm (0.610") and widths up to 19 mm (0.748"). The carbide grade AS45 provides a wide range of applications for different materials in this case too.

The various available versions – arbour milling cutter, side milling cutter or end mill – are equipped with 4 teeth for a diameter of D = 63 mm (2.480") and 6 teeth for D = 80 mm (3.149").

Milling cutter 613 for module 1 and module 1.5.

Gear broaching tool SH117 with pre-cutting and finishing profile to allow simultaneous pre-broaching and finishing of the gear.

DAH25 system – High-feed milling for cutting edge diameters of 12 mm (0.472") or more.

High-feed milling with high cutting performance

A new tool system for high-feed milling expands the previous DAH systems to include smaller diameter ranges.
Four new end mills with Weldon toolholder extend the lower limit of the DAH system with cutting edge diameters of 12 (0.472"), 16 (0.631"), 20 (0.787") and 25 mm (0.948"). They are equipped with two to four indexable inserts: Ø 12 mm (0.472") with 2 indexable inserts, Ø 16 mm (0.631") and Ø 20 mm (0.787") with 3 indexable inserts, Ø 25 mm (0.984") with 4 indexable inserts. All shanks include internal cooling; all holders are TiN-coated and have long-term protection against chip abrasion. A milling cutter of type DAH25 with a diameter of 16 mm (0.631"), equipped with 3 indexable inserts, produced very good cutting values when milling steel with material number 1.2379. The cutting values in detail:
v_c = 200 m (7,874.015")/min, f_z = 0.6 mm (0.023"), v_f = 7,200 mm (283.464")/min, a_p = 0.5 mm (0.019") and a_e = 10.4 mm (0.409").

High cutting edge number – For stable milling processes.

The newly developed indexable inserts for smaller milling cutters, each with two cutting edges, are clamped securely in place with a screw. The specially precision-sintered chip surface geometry and the large cutting edge radius on the face side ensure a soft cut and minimal load. The primary and secondary relief angles provide high stability. A small cutting edge radius on the inside supports quick and easy plunging. The surface contact of the cutting inserts in the basic holder ensures optimal transfer of the acting forces.

The maximum cutting depth is 0.8 mm (0.031"); the cutting edge corner radius is 0.4 mm (0.015"). The optimum feed rates are between 0.5 (0.019") and 2.5 mm (0.098") per tooth (between 0.5 (0.019") and 1.5 mm (0.059") for steel) when v_c is between 180 (7,086.614") and 260 m (10,236.220")/min. The tough substrate SA4B, which is very successful in high-feed milling, is equally well-suited to milling steel, stainless steel, cast iron, aluminium and titanium.

60 percent more tool life with rhombic tangential insert

The M409 tangential milling system, for which HORN has filed a patent, makes a strong impression with its rhombic-shaped indexable inserts. End mills (mounting: DIN 1835-B) with cutting edge diameters of 32 mm (1.259") and 40 mm (1.574"), as well as arbour milling cutters (mounting: DIN 8030-A) with cutting edge diameters of 40 mm (1.574"), 50 mm (1.968"), 63 mm (2.480") and 80 mm (3.149") are equipped with the new cutting insert type 409. The precision-ground rhombic indexable inserts achieve maximum accuracy with the best possible surface qualities. A positive cutting angle and axial angle ensure a soft cut, while the secondary cutting edge with integrated trailing chamfer produces the best face surfaces. An additional free-formed surface chamfer provides a stable wedge angle and a particularly smooth milling process. The milling cutters with a corner radius of r = 0.8 mm (0.031") achieve cutting depths of up to ap = 9.3 mm (0.366") and are suitable for milling 90° shoulders.

The indexable inserts are made from the new carbide grade AS4B, a tough basic substrate, coated with TiAlN and achieve long tool life for both rough machining and finishing. This is supported by effective internal cooling through the holder with cooling lubricant aimed at the active zone of the cutting edges. A cutting edge geometry which has been developed using chip shape simulation enables an optimal chip flow; "additions" attached to the cutting inserts produce an improved relief angle for the individual secondary cutting edges and, furthermore, provide extra protection on the flat side for the main cutting edge which is set back in the process. The surface-treated main milling cutter body has long-term protection against chip abrasion thanks to its hardness and strength.

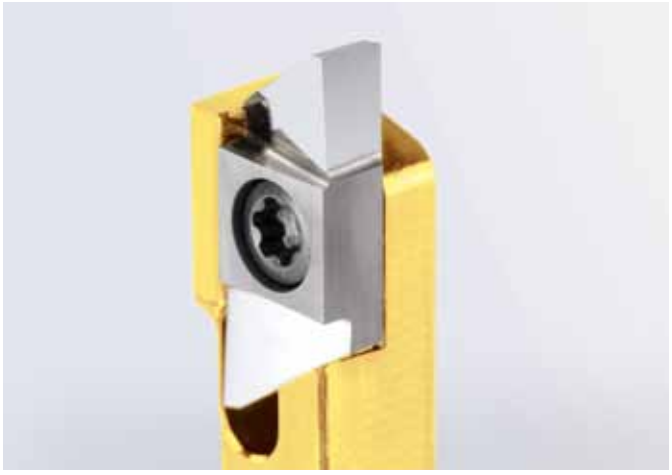
In tempered 42CrMo4, a tangential milling cutter of type 409 with rhombic indexable inserts achieved a 60 percent longer tool life than other comparable tools on the market.

Well-thought-out design – Milling 90° shoulders with pulling cut and integrated trailing chamfer: M409 tangential milling cutter.

µ-Finish: The S274 system for microturning

Microturning is a standard operation in the watch-making industry. The "µ-Finish" turning cutting insert system for microturning in the watch-making industry includes the most common cutting inserts for turning, grooving and parting off. All of the tools involved are precision-ground. The break-out-free cutting edges are fully checked under 200x magnification. The specially designed carbide grade and geometries are particularly well-suited to machining 20AP, all stainless steels – notably 4C27A – and brass.

A new, special coating significantly improves tool life and productivity. When tested, the HORN tool increased tool life by 15 times compared to the previous tool. The S274 system also significantly improved the cost-effectiveness. It minimises non-productive time due to tool changes as well as setup times and downtimes. After the initial tool setup, no further corrections are required for the tool offset. The µ-Finish system ensures that a highly precise centre height of ± 0.0025 mm (0.0001") is maintained. With the S274, there is no need for the customer to prepare and grind the cutting inserts either. This means better results with less work.
The S274 system minimises costs and downtimes for expensive, high-precision machines and noticeably improves tool life, product quality, process reliability and productivity.



S274 cutting inserts with special µ-Finish grinding for machining the smallest of parts.

Extended slotting cutter range

M101 slotting cutter.

The range of M101-type milling cutters, which are specially designed for milling grooves and slots, has been expanded to include cutting widths of 3 mm (0.118") and 4 mm (0.157") with groove depths of up to 59 mm (2.322"). The milling cutters with cutting widths of 1.6 mm (0.062"), 2 mm (0.078"), 3 mm (0.118") and 4 mm (0.157") with groove depths of 33 (1.299")/39 (1.535")/59 mm (2.322") are equipped with carbide indexable inserts. The inserts can be changed easily and with exceptional accuracy; the self-clamping insert seat is raised with a chuck key so that the cutting insert can be removed and a new one inserted. The precision-milled prism in the main body ensures a secure connection with maximum repeatability thanks to a limit stop in the main body.

Milling cutters with groove widths of 1.6 (0.062") and 2 mm (0.078") are available with cutting edge diameters of 80 (3.149"), 100 (3.937") and 125 mm (4.921") with 7, 9 and 11 teeth. With a groove width of 3 (0.118") or 4 mm (0.157"), the cutting edge diameter is 100 (3.937"), 125 (4.921") or 160 mm (6.299") with 8, 10 or 12 teeth. With a cutting width of 4 mm (0.157"), cutting edge diameters up to 200 mm (7.874") with 16 teeth are also available. The cutting edges of the milling cutters with a width of 1.6 (0.062") or 2 mm (0.078") are also available with geometry .3 (straight-cutting) and geometry .E3 (full radius). The cutting edges of the milling cutters with a width of 3 (0.118") or 4 mm (0.157") have a straight cutting edge with geometry .E3. The geometries are particularly well-suited to general steels, stainless steels and titanium materials.

Effective cutting zone cooling

A new addition to the range is the S100 cutting insert with internal cooling in the new HP65 grade with the ".3V" geometry and 3 mm (0.118") groove width. Its wear-resistant TiAlN coating is specially designed for grooving and parting off stainless steels. The cutting insert with 3 mm (0.118") groove width and internal coolant supply expands the previous areas of application of the S100 cutting insert series in the HORN range. The coolant jet works directly on the cutting zone, thus ensuring the best cutting conditions in the cutting zone. The funnel-shaped nozzle creates a coolant jet, which supports chip formation, and thus reduces the chance of chip build-up. Furthermore, this type of internal cooling largely prevents the formation of built-up edges and break-outs on the cutting edge. In comparison to conventional cooling systems, the new system achieves higher cutting parameters, which enable the tool to be used more cost-effectively. In particular, with hard-to-cut materials, the AS45 carbide grade and the ".EN" geometry shape with chip former also permits good chip flow with long tool life and reliability, even with long engagement times and at high temperatures.

The holders with internal cooling are available in both left- and right-hand designs. The screw clamp or self-clamping of the cutting inserts with limit stop make it easy to change cutting inserts and ensure high repeat accuracy.

No steam bubbles: coolant comes straight out of the S100 chip surface with internal cooling.

Modular threading die

The threading die for pipe threads, for which HORN has filed a patent, is constructed as a exchangeable system and consists of a basic holder and five individual cutting inserts. In the event of wear, only the cutting inserts are replaced, which eliminates the usual need for finish grinding. The solid carbide cutting rings which were previously used for cutting pipe threads weigh around 275 g in the construction size R ½ inch. The carbide weight of the 5 cutting inserts, on the other hand, is only 23 g. This makes it possible to conserve expensive raw materials. The basic holder has the same dimensions as solid carbide cutting rings and therefore fits into standard mountings.

The modular threading die is suitable for existing mountings.

The secure wedge clamping of the indexable inserts and the self-contained holder made from tool steel with outstanding strength and damping characteristics has resulted in a considerable improvement in tool life for the customer. When the tool life comes to an end, the user only has to replace the cutting inserts, rather than the entire threading die as before. Customer benefits therefore include increased productivity whilst conserving resources and reducing costs.

Quadrant milling cutter added to DG system

The new modular milling system has been further extended for edge machining with the DGV quadrant milling cutter. The patented interface of the DG system with a wide support and stable fixing – provided by a non-segmented, continuous thread – ensures optimum rigidity and concentricity in a huge range of milling operations, such as profile milling, groove milling with corner radius, chamfer milling, high-feed milling and many special milling options. The DG milling cutters are suitable for both rough machining and finishing. The combination of a carbide milling head and a stable shank made from tool steel minimises the carbide consumption and therefore meets the requirements for sustainability. In many cases, they are replacing the solid carbide milling cutters that have been used up to now, but they are significantly more economical.

The new DGV quadrant milling cutter fits into all DG shanks in system size 10. All corner radii between 0.2 (0.007") and 3 mm (0.118") can therefore be machined using a single holder. The angle of twist for the pulling cut generates low cutting forces and produces the best surfaces. The AN2P carbide coating combination ensures long tool life, while the four cutting edges of the DGV enable high feed rates.

Modular DG milling system with quadrant milling cutters.

Height-adjustable grooving tool holder with internal cooling

Flexibility combined with efficiency. Height-adjustable grooving tool holder 956 with quick-change system and maximum cooling.

The 956 system interface of the height-adjustable grooving tool holder is a precision interface for quick changes, specifically in multispindle lathes. It is intended for the S100, S224 and S229 grooving systems with groove widths from 2 (0.078") to 6 mm (0.236"). For workpiece diameters from 40 mm (1.574") to 125 mm (4.921"), there are specially coordinated cassettes available in a highly rigid design for maximum stability and the longest possible tool lives. The system enables an internal coolant supply with integrated coolant transfer from the holder to the cassette and onwards to the cooling lubricant nozzles in the clamping finger and the support. The universal holder range for the system includes VDI holders and square shanks as well as machine-specific holders for all common multispindle lathes from Schütte, DMG or Index.

LEADING GLOBAL TRADE FAIR EMO 2013

From 16 to 21 September 2013, EMO Hanover is opening its doors. The world's leading trade fair for metalworking will see international manufacturers of production technology present their products, solutions and services for everything to do with metal under the key theme of "Intelligence in Production". Over 2000 companies will use a net exhibition space of over 177,600 m² to show international trade visitors the best way to deal with the challenges they face in production.

The fair focuses on cutting and shaping machine tools, production systems, precision tools, automated material flow, computer technology, industrial electronic products and accessories. Trade visitors come to EMO from all of the major industry sectors, including mechanical engineering and plant construction, the automotive industry and its suppliers, aerospace technology, precision engineering and optics, shipbuilding, medical technology, tool and mould making, and steel and lightweight construction. Lothar Horn, Chairman of the Association of Precision Tools, comments on the upcoming trade fair: "The EMO is the highlight of our trade fair calendar. Many members of the VDMA are working flat out in their research and development departments so that they can present their results to the fair's visitors. I am convinced that the economic situation, which is currently performing well, will receive an additional boost from EMO 2013."

Expertise from Tübingen in Hanover

HORN is presenting its products to visitors in Hall 5, Stand B49. Along with product innovations in the HORN portfolio, the range is also expanding sideways in the core areas. This is reflected in product developments which significantly enhance the application options of familiar systems. With this parallel strategy, the company is targeting new areas of application and strengthening its position in existing applications. Developments are also focused on the topic of cooling. For example, in the field of parting off, there will soon be more products available with cooling through the insert. This enables the coolant to reach the cutting zone directly and supports chip removal. The new products that HORN will be introducing at EMO are detailed on pages 16 to 22.

The proportion of international visitors continues to rise.

TECHNOLOGY DAYS 2013

From 5 to 7 June 2013, over 2,100 visitors from 35 countries made their way to the HORN Technology Days 2013.

In Tübingen, they were given the opportunity to visit Paul Horn GmbH and Horn Hartstoffe GmbH and to discover more about current topics in eight technical presentations.

The presentations at a glance

- Ultra-hard cutting materials
- High-feed machining
- Parting off with internal cooling
- Broaching on CNC machines
- Tool and mould making
- Tools of today and tomorrow
- Customer-specific tool solutions
- From powder to indexable insert

The eight technical presentations were supplemented with practical application examples.

Fourteen exhibitor "partners" contributed to the success of the event. The Technology Days were rounded off with exhibits on a range of diverse topics including hybrid technology, optical industry, mould making and medical technology.

Over the course of the three-day event, HORN provided its visitors with specialist knowledge along with insights into manufacturing, procedures and pre-production.

Feedback from customers was consistently positive – particularly with regard to the communication of knowledge and the company tour where they were free to explore as they wished.

The participants are looking to speak to experts directly.

The tour was divided into different stations.

Top marks from visitors

Assessing your own performance is always difficult. For this reason, the feedback forms were analysed in great detail. As an overall average, the event scored nine out of a possible ten points.

Visitors' feedback was particularly positive regarding the accessibility and transparency of the production area, the employees' friendly attitudes when dealing with one another and the high level of expertise.

Testimonials from visitors:

"I was very impressed by the technical presentations, the company tours and the friendly employees who answered all questions with expert knowledge."

"For me, the entire production process at HORN was remarkable."

"The Technology Days gave me the chance to accumulate a wealth of diverse, new experiences. I was particularly interested to learn how an indexable insert is manufactured."

"Lots of contact people to discuss technical issues, engaging tours of both companies, well-timed and interesting technical presentations, very good catering."

"I particularly liked the references to tool production. I am taking away lots of background knowledge about new technologies."

"A pleasant day with lots of learning opportunities."

"Organisation at the highest level – we will be coming back."

Trade press presence

23 German and 16 international writers and journalists from different trade magazines proved that there is also a great deal of interest amongst the trade press in HORN products and solutions as well as the company itself, its philosophy and culture, and the wealth of information provided by the technical presentations. Press conferences held in German, English and French focused on development of the company, on going development of the product portfolio as well as the importance of qualifications, education and the Technology Days themselves. A tour of the company complemented the individual points.

The feedback showed how impressed the press were with the overall HORN package: "We are used to expecting a certain amount from HORN. But somehow they always manage to surprise us yet again."

The next HORN Technology Days will take place in 2015.

You can find a video about the event at:
www.phorn.com/technologydays2013video/

Spain – culture, Mediterranean flair and challenging cutting tasks.

SPECIAL TOOLS ARE IN VOGUE IN SPAIN

The Southern European country of Spain has an area of 505,370 km² and a population of 46.2 million people. Top-class football, orchards, Mediterranean beaches – these are the kind of things that come to mind straight away. More recently, however, in light of the economic crisis and the resulting Eurozone bailout fund, the country has been the focus of public interest for other reasons. Like many other sectors, the Spanish cutting tool industry felt the effects keenly.

HORN in Spain

Cutting Tools SL is the Spanish representative appointed by HORN to sell its tools to production facilities in Spain and Portugal. The company was founded on 11 March 1993. Since then, the team around the president, Miguel Mayor, has grown to 40 employees. The headquarters of the HORN representative is in Donostia-San Sebastián, where it has 800 m² available to respond to market requirements. Key industries include the automotive industry, mould making, mechanical engineering, aerospace technology, medical technology and the railway sector.

The Spanish economic crisis did affect Cutting Tools SL but, even in these difficult times, the company's strategy and organisation bore fruit. The company had advantages compared to its competitors thanks to its existing work philosophy, which is based on direct contact with customers, technical proficiency and intensive project support. This requires well-trained, qualified employees. Miguel Mayor remarks: "We have a clear line in our approach to the cutting tools market – increasing the benefits for customers. HORN tools provide us with the ideal basis for achieving this goal. We use our technical expertise and commercial understanding to realise these benefits for our customers on site." Julio Fernández, Managing Director of Cutting Tools SL, agrees, adding: "It is important to talk to customers and to stay in touch. That is often the only way to find the best solution."

The HORN representative Cutting Tools SL in Northern Spain.

Quick delivery to customers is important.

The team at Cutting Tools SL.

« No hay mal que por bien no venga. »

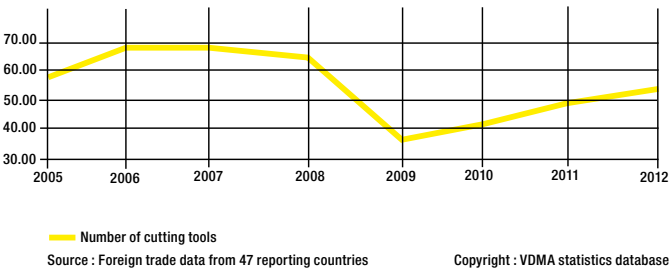
"Every cloud has a silver lining."

Special tools as a key skill

Special tools are in demand in Spain too. The applications in which precision tools are used are often very demanding and require exact adjustments to the workpiece and the process. In cases like these, Cutting Tools SL employees provide customers with comprehensive, targeted advice. This is crucial, because the customers are also anxious to find the right tool insert in order to achieve a competitive advantage, whether it is in terms of quality, speed or cost savings made by improving primary processing and non-productive time. Direct contact with Tübingen makes it possible to implement solutions quickly once they have been developed. The "green line" principle applies in Spain too, enabling special tools in certain batch sizes to be shipped within five days of approving the designs.

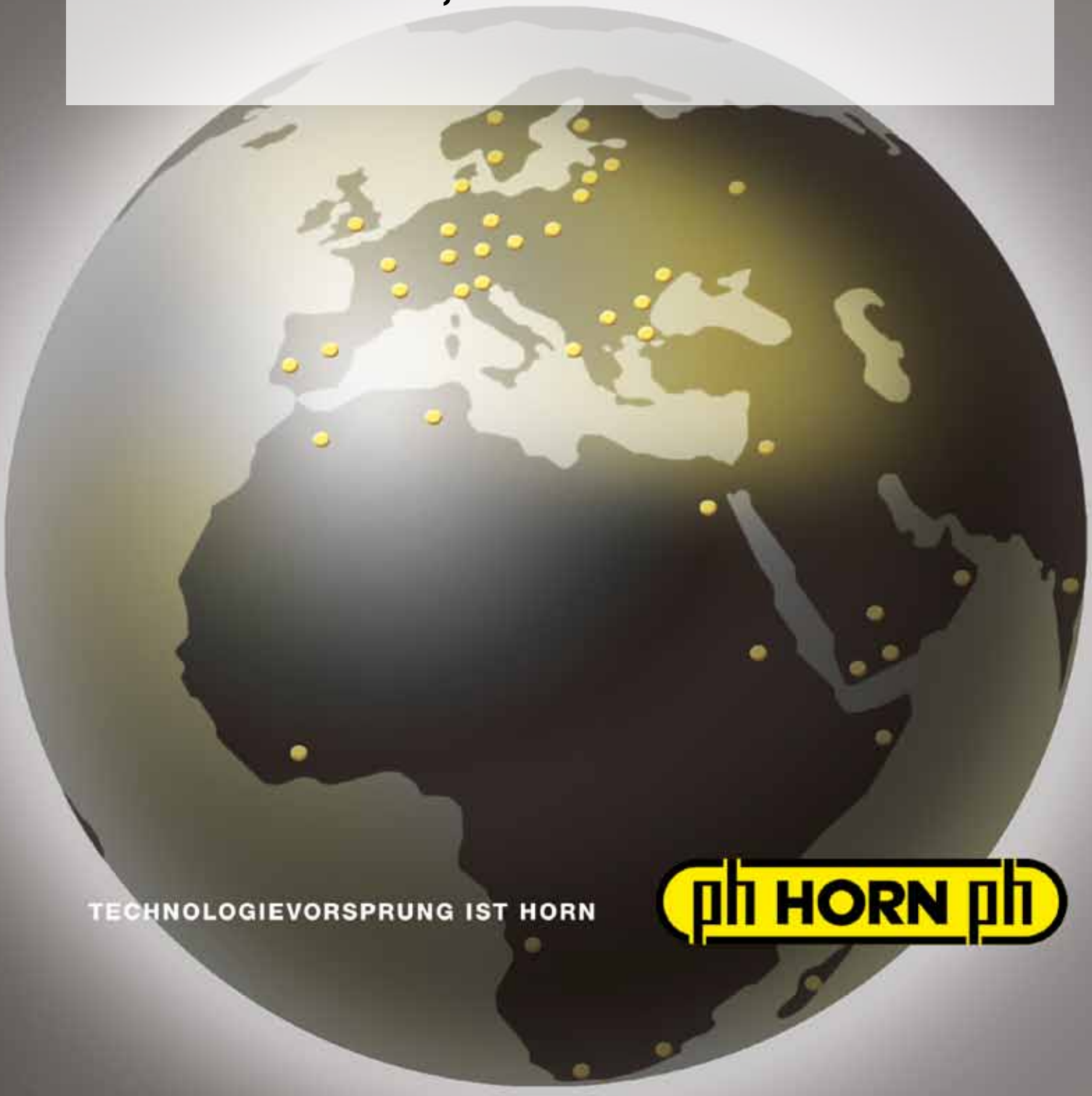
Spanish prospects

Although forecasts for the Spanish economy remain cautious, the signs are pointing in the right direction. Following another drop in GDP in 2013, forecasts for 2014 indicate a slight increase of 0.5 percent in real terms. This statement is underpinned by the political stability in the country, its excellent infrastructure and the way in which the Spanish government has put the reform agenda into action. Its links with Portugal and the expansion of its bridging function to Africa and Latin America are equally promising. In addition, medium-term investments have been made in research and development, demonstrating a forward-looking approach for the country and its economy.



German exports to Spain: Selected goods.
Cutting tools in millions of euros.

THINK GLOBAL, ACT LOCAL



Paul Horn GmbH is active in 70 countries around the world.

Activities in the HORN Group

Paul Horn GmbH is not just a well-known, successful name amongst precision tool manufacturers in Germany. On a global level too, the signs point to growth for the Tübingen precision tool manufacturer.

20 years of HORN France

HORN has had a separate branch office in France for the last 20 years. This offers an opportunity for the company to reflect on the past but, more importantly, to look to the future. France is one of the most important cutting tools markets in the world, and will remain so for the foreseeable future. Along with the energy sector, cutting tools are a widespread requirement among the country's major industries – which include the well-known French car and aerospace manufacturers as well as many small and medium-sized enterprises. More than 50 HORN employees are currently working in France to provide customers with the best results.

Italy

Febametal is the Italian partner of Paul Horn GmbH. As well as being responsible for sales in Italy, it also has its own production facilities currently comprising 25 machines. 2013 has seen a 100% increase in capacity. HORN's Italian colleagues focus on manufacturing products from the Supermini® series. In addition to the diverse Italian automotive industry, original equipment is also a significant area of production for Febametal. Three HORN employees provide on-site support for activities on the Italian market.

Czech Republic

In 2012, HORN opened the new SK Technik plant in Brno, Czech Republic. The new halls and offices cover an area of 1,402 m^2, of which 730 m^2 is used for production. The Czech Republic, like many other countries, has lots of customers in the cutting tools market with demanding applications. Typical HORN characteristics – speed combined with a focus on solutions and customer-specific needs – are also in evidence at SK Technik and on the Czech market. On-site production comprises 20 machines and aims to provide quick responses to local circumstances.

USA

In the USA, HORN is represented in Franklin, Tennessee – again with its own production facilities, which primarily use the non-metric system. The company's premises currently cover 2,200 m^2, of which 650 m^2 is used for production. There are plans to expand this area to 4,500 m^2, including 1,600 m^2 for production, in 2013. The American market could be said to have the largest potential for growth within the HORN Group and has been among the leaders in export statistics over the last few years.

China

The Chinese HORN sales subsidiary started business operations at the turn of the year 2012/2013. Even the company name, HORN (Shanghai) Trading Co. Ltd., shows the location of the branch office: Shanghai, the most important industrial city in China with roughly 23 million inhabitants. During the early phase, the HORN subsidiary is concentrating on existing customers from the car, energy and aerospace industries, as well as their suppliers. There are no limitations to the range of products and services for these customers. Despite the long distance between Shanghai and Tübingen, the company can still show its strength in short delivery times in the Far East, especially in the field of special tools. This makes HORN significantly faster even than companies with production facilities in China. For Lothar Horn, Managing Director of Paul Horn GmbH, the idea of having separate production facilities in China is not a key factor for market success. HORN: "The first half year alone shows that our concept is working."

United Kingdom

Despite the subdued development of the British cutting tools market, HORN Cutting Tools Ltd. has recorded a consistent double-digit percentage increase in its incoming orders in the years since 2009. The signs point to growth in 2013 too. This positive development is mainly down to the aerospace and oil & gas sectors. The advantages of HORN tools are particularly evident in challenging cutting tasks involving materials that are difficult to machine (titanium, fibre composites, etc.), and long tool life and precision. The ability to deliver products quickly is also crucial. Contrary to the market development, HORN is one of the few foreign investors in the industry who have invested steadily in buildings, machines and human resources over the last few years, and will continue to do so. HORN now has more than 60 employees in the UK.

Hungary

HORN Magyarország Kft., the Hungarian HORN subsidiary, acts as the gateway to Eastern Europe. From this vantage point, the company monitors the markets in Hungary, Romania, Bulgaria and the neighbouring Balkan states. Following a steady increase in incoming orders, the company passed the 2-million-euro mark in 2012. The long-standing customer base includes many familiar names from the automotive industry and its suppliers, mould making and the oil field industry.

Political visit to HORN.

Visit from Guido Wolf, head of the regional parliament

Guido Wolf, head of the Baden-Württemberg regional parliament, visited Paul Horn GmbH in Tübingen on 27 June 2013.

His visit focused on topics including qualifications and education, as well as cost-effective production at the Baden-Württemberg site. During a tour of the main factory, Lothar Horn explained the importance of optimised production, qualified staff and the constant development of processes.

He stressed that optimum results in all areas can only be guaranteed when all factors are perfectly coordinated with one another.

During the tour, Guido Wolf was visibly impressed by the state-of-the-art equipment, the cleanliness of the facilities and the attitude that colleagues had towards one another. The training centre, in which the new generation of HORN employees work towards qualifications, played a key part in the tour. It was also positive to see young women showing an interest in training for a technical profession.

The head of the regional parliament thanked HORN for its commitment and loyalty to the region and for its dedication to advancing education.

Tübingen Innovation Days

The Tübingen Innovation Days have been taking place for several years. The event that took place at the Chamber of Commerce and Industry (IHK) in Reutlingen on 3 July 2013 was hosted by Paul Horn GmbH.

Dr.-Ing. Matthias Luik, Head of Research & Development at HORN, gave a presentation on the subject of "Improving quality of life – Precision tools for medical products". His lecture focused on materials, production procedures and process solutions, and was supported by Dr Paul-Stefan Mauz, a senior consultant and director of the tumour conference at the ear, nose and throat clinic at Tübingen University Hospital. Dr Mauz supplied real-life examples on the subject of "the use of metallic and non-metallic osteosynthesis systems on the head". In the dialogue session following the presentations, interested parties from the field of medicine and the local area took the opportunity to find out about possible future developments. In the field of cutting tools, medical technology has seen an almost constant annual growth of 5 percent.

Helmuth Wiedmaier has worked for the company since 1980. He has been a member of the management board (responsible for human resources, finance, purchasing and IT) since 1992 and an authorised officer since 2002.

HELMUTH WIEDMAIER ON DEVELOPMENTS AT HEADQUARTERS

Mr Wiedmaier, Paul Horn GmbH is constantly changing and is always striving for growth. Are there any concrete plans for the future?

Yes, there are. We are planning another major expansion of our premises. In 2012 we purchased a piece of land between the headquarters and Horn Hartstoffe GmbH, our own carbide production facility, here in Tübingen. We are intending to use the piece of land, which measures around 16,000 m^2, to build premises covering 15,000 m^2 over two levels. The available space is still enough for now. As we think and plan in terms of years, rather than quarters, this step is the logical consequence of our planned growth. As things stand at the moment, we intend to move toolholder production, coating, logistics and the technical office to the new premises as of 2016. And of course, this will involve us taking on additional staff.

Staff being the keyword. The company's state-of-the-art equipment, which is constantly kept up-to-date, places corresponding demands on employees. How do you approach this challenge?

The founding of the HORN Academy a year and a half ago opened up completely new possibilities for us. We can focus specifically on the needs of our employees and the particular requirements in the workplace. The depth of training ranges from general seminar topics such as software sessions to much more specific seminars. Constant dialogue within the company is crucial here. It is enough to be one step ahead today, but we have to make sure that we do the same tomorrow.

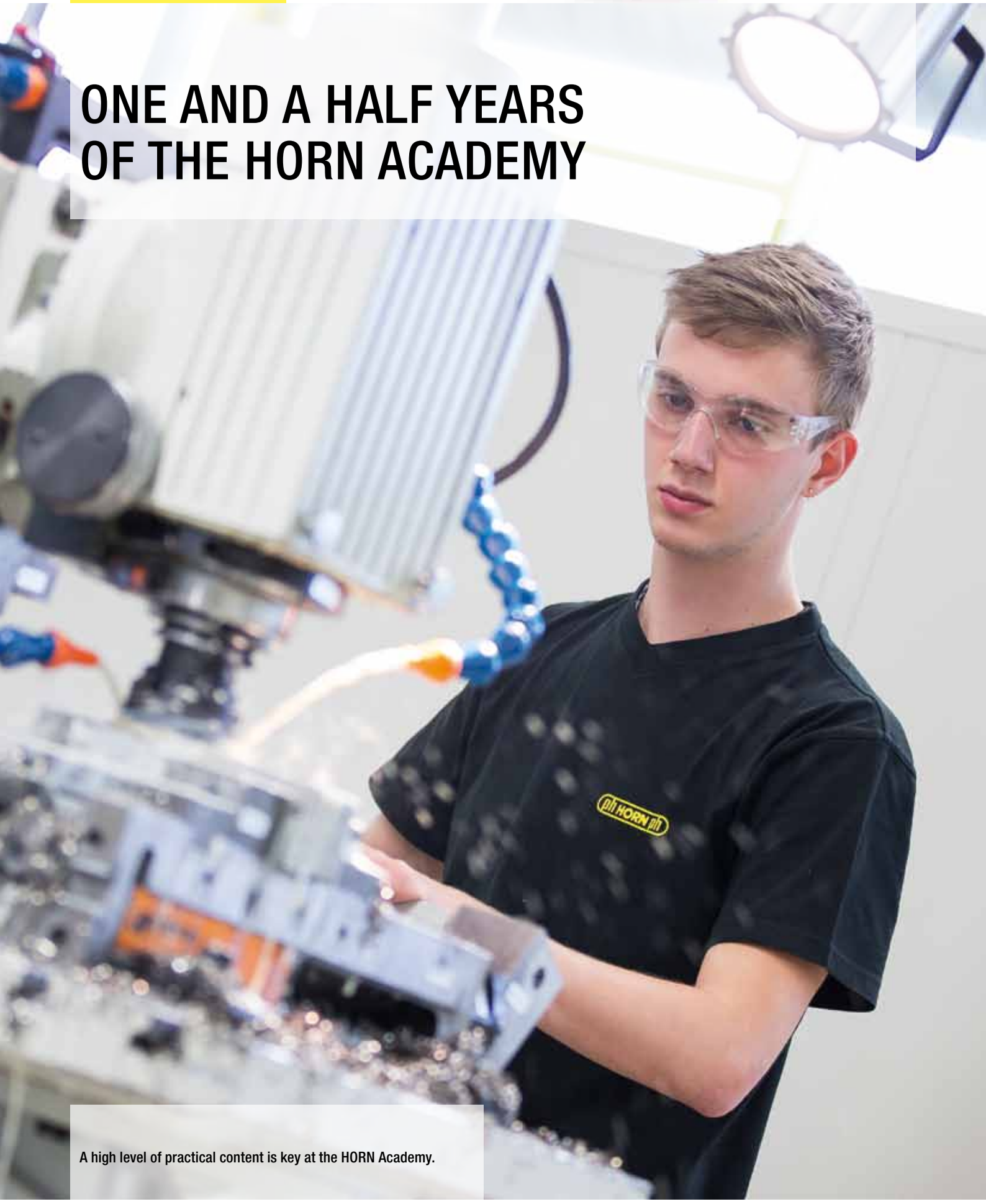
How was the HORN Academy integrated into the company and how have employees responded to the services offered?

The HORN Academy is a separate entity within the company which functions as a service provider. There are interfaces to the HR department and to the company management, but also to the specialist areas. The services have been incredibly well received. There are specialist seminars and seminars for personal development available which provide further training for our employees. They are tailored to HORN and really do provide added value. Subjects range from training courses for industrial specialists for cutting tools to healthcare and presentation skills. Customers and interested third parties are both represented with special subjects at the HORN Academy. As far as I am aware, there are hardly any comparable institutions in our industry.

You have been working for the company for 33 years. Could you ever have imagined this level of development when you first started?

This development could never have been predicted, in terms of the company or myself. The company can look back on years in which it took not just a few steps, but giant leaps in terms of progress. And the best thing is that I'm not just talking about the past, but about our future development too. There is a great deal still to come – we are right in the thick of it at the moment.

ONE AND A HALF YEARS OF THE HORN ACADEMY



A high level of practical content is key at the HORN Academy.

Intermediate results and outlook for the future

Education is a key priority at HORN. The company takes a target-group-focused approach to this ever-present challenge. This approach is based on the pillars of training, further education, retraining, studying and customer seminars.

"We have to be ready for the future, and not just in terms of machines and processes." With these words, Lothar Horn laid the foundation for the HORN Academy. After months of preparation, the basic programme and organisation were determined. This resulted in 8 specialist seminars for customers and advanced training to the level of industrial specialist for cutting tools (IHK-tested), as well as the opportunity for current and future employees to take the mechanical engineering course in the field of production technology with a focus on cutting tool technology at the DHBW Horb Cooperative State University .
Since then, 238 customers have already attended specialist seminars, 44 employees have completed the examination to become industrial specialists for cutting tools and the winter semester 2013 will see eight new students begin their studies, four of whom are from HORN. The next customer seminars will take place in the autumn and are already nearly fully booked. The Academy, along with its learning material and perspectives, has continued to develop over the last few months. This development has been supported and encouraged by the exchange of ideas and experiences, feedback, requirements and new technologies.

It is important for an institution like the HORN Academy to be a living, breathing environment and not to stand still. It should explore new avenues in dialogues with interest groups, whether they are customers, employees or future generations. Plans in this area have not only been made, but have already been implemented in some cases. Additional subjects are being planned for customer seminars that are geared towards existing core expertise, but also towards the products being presented at the upcoming EMO trade fair in Hanover. The internal training programme is currently being expanded to include not only technical and linguistic skills, but also sports activities aimed to strike a balance with work. Further ideas and visions are currently being discussed. As is the case with product developments, the future will show which of them can be implemented. Here, just as in the areas of products and consultations, the renowned HORN quality must be maintained.

Image caption: Training at HORN: From left: Andreas Elit (back, assistant head of training), Isabel Hermes (trainee, Germany), Alex Brown (trainee, UK), Lewis Francis (trainee, UK), Tom Morrison (trainee, UK), Felix Trescher (trainee, Germany).

THE DUAL SYSTEM – A GERMAN SUCCESS STORY

The new mechanical engineering degree programme in the field of production technology with a focus on cutting tool technology starts on 1 October 2013. Four of the eight new students are from HORN. The programme continues the targeted educational concept which is also implemented through further training aimed at becoming an industrial specialist for cutting tools.

"It is important for the industry of precision tool manufacturers to make long-term plans for the future. This applies to the field of skilled workers as well as to academic fields." With these words Lothar Horn, Managing Director of Paul Horn GmbH, set the course for special educational programmes in the field of precision tools. The demographic change, the ever-increasing presence of technology and the low levels of awareness among the general public support this venture. It often takes months or years for young skilled workers or academics to become acquainted with the field of cutting tool technology. After a brief initial period of familiarisation, their knowledge base is further expanded by "learning by doing". This approach does not guarantee that they learn all of the required information and skills, nor does it specify a time frame for reaching the expected or required level.

Due to the intensive nature of studying cutting tool technology, both the theoretical qualifications and the practical components are so important that a link with the relevant company is crucial. For this reason, when preparing the degree programme, it was vital to establish a link with a university of cooperative education – specifically, with the DHBW Cooperative State University in Stuttgart and its Horb campus. This ensures that the students can apply and try out what they have learned over an extended period of time in a parallel organisational structure. They go through the processes step-by-step, including powder, shaping, grinding and coating, but also the subsequent application. They alternate between three-month theory phases and practical phases in the company. The degree programme has a duration of three years, and students receive a Bachelor of Engineering (B. Eng.) degree with 210 ECTS credits on completion.

Combination of theory and practice

Further training to become an industrial specialist for cutting tools follows a similar principle. This additional qualification is obtained by passing an IHK examination. In order to take the examination, participants must have completed a professional qualification in a technical discipline. The training mate-

Principles and application orientation in the theory section.

Understanding through touch – The introduction to the practical section.

rial, such as safety technology, occupational health and safety and accident prevention, lubrication and cooling, cutting tool technology and the manufacturing technique for grinding cutting tools is imparted over 240 hours with both theoretical and practical components. The same objectives apply to both the degree programme and the further training: obtaining a high level of knowledge and the ability to use it quickly in order to achieve the best possible results.

Three trainees from the British subsidiary HORN Cutting Tools Ltd. have also had a taste of this system. Between 8 July and 2 August 2013, they had the opportunity to experience the dual system with their fellow trainees from Tübingen at the Paul Horn GmbH training centre. Manual work stations, including the manual machines and mill-turning centres, were incorporated into the practical programme. Alex Brown: "The German training system is impressive. I think this is the right way to train for a profession. I wouldn't have missed the experiences and impressions that I have gained here for the world."

Concrete implementation in projects

In return, the Tübingen trainees built a pedal car in the second year of their training – just as they did in 2012 – which they entered in a race in the UK. They had to implement the entire project by themselves. Budgeting, purchasing, design, production, assembly and communication – everything that they had learned up to that point came together for this challenge. The result: 15th place in their class, 16th place overall (out of 48 participants). The trainees achieved this outstanding result after two hours of racing at the British Pedal Car Grand Prix 2013 in New Milton in Hampshire with no technical defects or accident-related damage. The top positions in the race were almost all taken by competitive athletes. And in 2014, another trainee team will be on the starting line with a new pedal car. With the use of fibre composites along with slight adjustments based on experience, the third generation of racing car should be better equipped for success than ever before. The race is set to take place in Germany next year.

Alongside the fields of qualifications and further training, the idea of the dual system – the combination of theory and practice – is also being incorporated into the customer seminars at the HORN Academy. The next seminar block is scheduled from 17 to 28 November 2013. Throughout this period, the HORN Academy will be focusing on the following topics:

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

The aim: imparting knowledge, demonstrating possibilities and discovering new perspectives by exchanging experiences.

The dual system provides a globally competitive platform for achieving educational and informational objectives in the best possible way – and in the long term too.

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

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

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