Edition 1/11

world of tools

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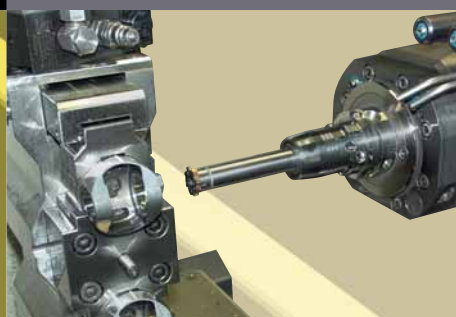
HORN´S CUSTOMER MAGAZINE

SUBJECT:

AUTOMOTIVE:

STEERING SYSTEMS, TAPPET CUP

- Interpolative turning of radial grooves
- Introducing the sales management team
- Minister Ursula von der Leyen visits HORN
- Denmark – High-tech tools in the land of the Vikings



Dear Readers,

The dramatic rise in the number of incoming orders we noticed at the start of last year was a surprise for us too. Having implemented the Green Line manufacturing philosophy and expanded our capacity at an early stage – more information can be found in earlier issues of World of Tools – we have been able to react faster than the sector as a whole.

That said, we will be continuing to significantly increase our manufacturing capacity up until 2013. Further information is provided on Page 18. In addition, our new building for carbide production will be complete by the end of the year. Likewise, many of what used to be special tools are being standardised whilst our procedures and products are being better adapted to our customers' needs and materials.

These and other measures apply especially for our most profitable area, the automotive sector. Here, we are focusing on the effects of alternative drives and the developments occurring on the raw material markets. Regardless of the momentum from this and other technology-driven industries, the service concept remains at the top of our agenda this year too. We continue to be your reliable partner for machining between two flanks and other high-tech applications.

Despite the risks that linger within the financial and raw material markets, and the budgetary problems some countries are facing, we are looking to the future with optimism.

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

world of tools
HORN´S CUSTOMER MAGAZINE

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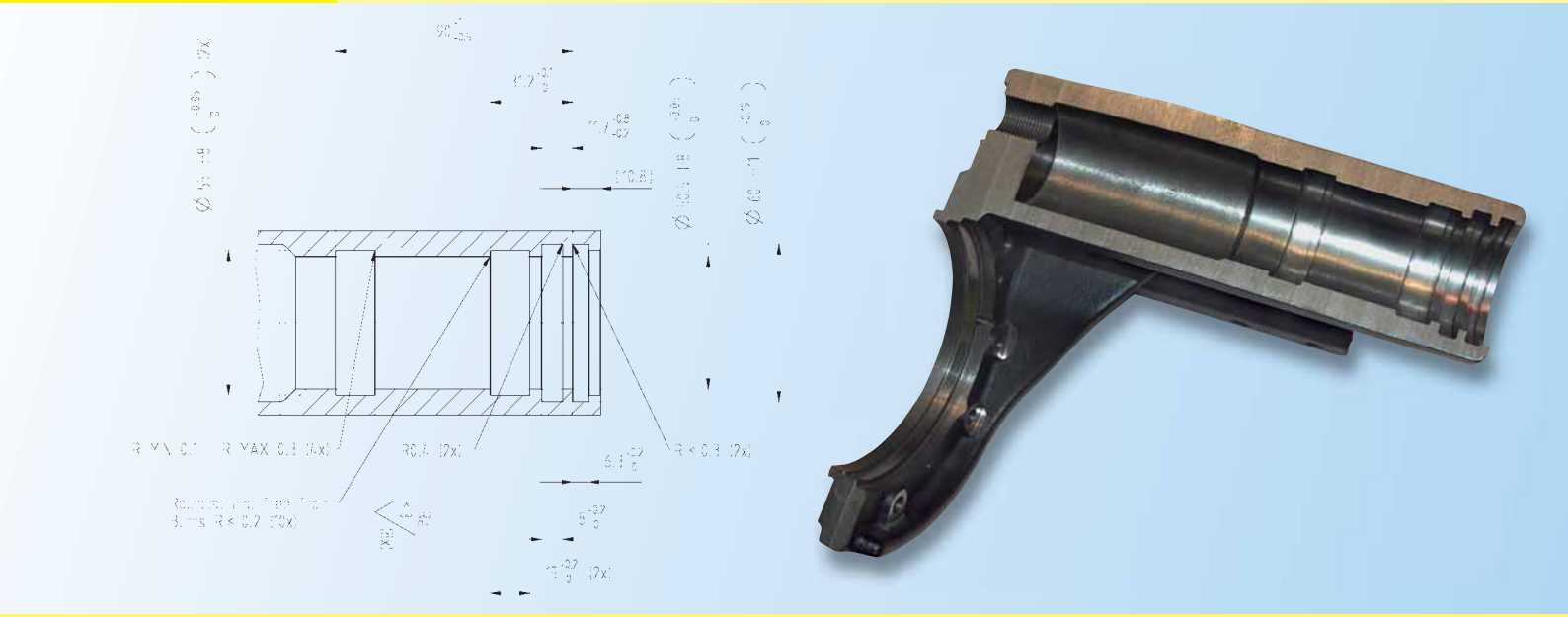


INTERPOLATIVE TURNING OF RADIAL GROOVES

The tough accuracy requirements for making the groove are shown on a simplified production drawing.

Section through the internal bore of the motor support bracket.

Breaking new ground in process technology

One of our key strengths is a swift reaction to customer requirements. Exactly what a Danish customer expected when enquiring about tools for interpolation turning. We met this expectation in just three weeks.

With 410 employees, Vald. Birn A/S, based in the Holstebro municipality of Denmark, is one of Europe's largest foundries for cast iron and grey cast iron. In addition to the Holstebro plant, the Birn Group encompasses two other factories in Denmark plus one in Sweden, one in Germany and one in China. In the Holstebro plant, workpieces weighing up to 75 kg are cast and machined, surface-treated and mounted as assemblies, depending on customer requirements. Customers include companies in the automotive sector, as well as manufacturers of pumps, gearboxes and hydraulic systems.

Machining challenge: motor support bracket for forklift truck

Birn's performance spectrum typically includes motor support brackets for forklift trucks. Some 10,000 units are cast from EN-GJS600-3 (GGG60) every year. In terms of machining, reliable generation of four grooves with depths of up to 90 mm (3,543") and Ra ≤ 1.6 in the console bore causes major problems: the 6.3 and 8 mm (0,248" and 0,315") wide grooves are toleranced to 60 H11 and the two 15 mm (0,591") wide grooves to 55 H8, a concentricity of ≤ 0.03 mm (0,0012") must be respected between groove base and bore and the outer edge of all four grooves are to be rounded to r ≤ 0.2 mm (0,008").

From circular milling to interpolative turning

Viggo Madsen, Technical Manager Machining and Michael Christiansen, Production Engineer and Programming sought an economical solution for this task. Initially they tested various competitor brands, and also our circular milling cutters. Although convincing in terms of cycle time and service life, the discontinuous cut meant that these tools were unable to satisfy all surface quality requirements.

The next step was therefore interpolative turning. Admittedly, turning on a machining centre using the products of a pioneer in this field was able to largely achieve the required tolerances. Primary processing times and service life, however, left much to be desired.

Three holders with HSK 63 fixture and exchangeable cartridges satisfy the tough accuracy requirements.

So Viggo Madsen contacted two other companies to find a process which, despite the tool's throat depth of approx. 110 mm (4,331"), was able to guarantee high concentricity and process reliability. Then in 2010 he contacted Jan Eilenberg from our Danish representative who promised him his enquiry would be dealt with without delay.

Interpolative turning tools redeveloped

Instead of the one-holder solution offered by the competition, our specialists preferred a concept comprising three tool holders, exchangeable cartridges and inserts. The holders with HSK 63 fixture were designed to match the groove arrangement with a length of 146 mm (5,748") and in two identical, 63 mm (2,480") long versions. Because our inserts already had the radii for the outer edges of the groove – the competitor required a second tool to achieve this – we were able to expect much improved primary processing time and positioning accuracy.

The machining strategy was defined independent of the groove width: Grooving in the centre of the groove, upward and downward processes with grooving of the lateral surfaces and turning of the radii. For the smaller grooves, type 229 indexable inserts were suggested, for the two wider ones, a type 315 triple-edged tool.

Premiere with top results

The four motor support brackets, clamped on a Hüller Hille NBH 135 machining centre, were machined at a speed of n = 100 to 150 rpm and at a feed rate of f = 0.1 mm (0,004")/revolution. In his planning, Viggo Madsen calculated a machining time of 2.5 to 3 minutes/component. Even during the initial attempts, our tools triumphed over a prolonged period with a primary processing time of 2.5 minutes. This provided a major advantage over the 5 minutes achieved by the competitor.

A minimum service life of 170 minutes was achieved for both the 6.3 mm (0,248") and 8 mm (0,315") wide groove. This is equivalent to 486 components or a usage time per insert of around two weeks. The 15 mm (0,591") wide groove achieved a service life of 160 minutes or 100 components per cutting edge, i.e. a total of 300 components per triple-edged tool.

Now, 240 motor support brackets /week are reliably machined to tolerance in a three-shift operation. Viggo Madsen remembers with a smile how he wanted to reject our offer with the three holders straightaway due to the tool costs. He quickly changed his made after a meeting with Jan Eilenberg and an analysis of all the costs. To the immense benefit of his company, as he today affirms.

Michael Christiansen, Production Engineer and Programming (left), and Viggo Madsen, Technical Manager Machining (right), are extremely satisfied with the results of the interpolation turning solution and also with our service. Jan Eilenberg (centre) from our Danish representative was responsible for technical consultation and on-site testing.

REAMING WITH ADJUSTABLE HYDRAULIC EXPANSION CHUCK

High process reliability and precision make the modular DR reamer a winning system for reaming discontinuous tappet cup bores.

Reliable finishing of discontinuous tappet cup bore holes

Our DR reaming tools mounted in hydraulic expansion chucks encountered the problem of radial adjustment with shanks for bores ≤ 35.6 mm (1,402"). Our suggestion of using four screws for simple adjustment was developed by Schunk and made available in various hydraulic expansion chucks.

Injection pumps for diesel engines rank among the most technically challenging pressure generators. High pressures call for robust pump drives, machining tolerances of up to 0.001 mm (0,000039"), maximum cleanliness in the production process, optimised clearance in the pump element, the use of high-strength steels and special heat treatment processes. The know-how required for all this is a core competence of the company L'Orange. The company is part of the Tognum Group and offers products ranging from conventional injection pumps to innovative common rail systems for engines from 1,000 to 40,000 kW. These enable extremely efficient applications in marine propulsion systems, rail traffic, power stations, drilling platforms and off-highway/construction vehicles.

Machine operator Martin Golly, L'Orange (right) and Matthias Oettle, Technical Marketing at HORN discuss further optimisation potentials.

Core issue: discontinuous tappet cup bore hole

One of the function-determining processes of tempered steel tappet cups is the production of a through hole with a diameter of 25 mm (0,984")and a length of 2 x 20 mm (0,787"). The pre-turned bore with a machining allowance of 0.1 mm (0,004") is reamed on a DMH horizontal milling centre DMC 60 H in the tolerance class H7. In this process, the discontinuous bore makes it difficult to maintain important tolerances such as deviation of the drilling axis from the vertical axis ≤ 8 µm and bore form accuracy of 4 to 9 µm.
In its search for alternatives, the team of Dieter Arbogast, CR Line and Connection Pieces Manager, first checked the use of honing tools and exchangeable

Image left:
Four adjustment screws in the hydraulic expansion chuck offset by 90° permit simple adjustment of the concentricity precision.

Image right:
The tappet cup bore hole 25 H7 is reamed with a concentricity precision ≤ 3 µm.

head reamers. For economic reasons honing turned out to be unsustainable whilst the exchangeable head reamer tended to "runout" during the double cut. Because the resultant reduced precision and service life affected the production sequence as a whole, we put forward a new solution, which was based on combining an adjustable hydraulic expansion chuck with a reamer from our DR system.

Reaming with indexable hydraulic expansion chuck

The system designed for L'Orange, comprises a MDR reaming shank, a special version of the DR eight-edged reaming insert and an indexable DRHD hydraulic expansion chuck from Schunk, model series Tendo Zero 204056 Z. Dieter Arbogast decided to use this system to ream the bore in one line boring style pass in a continuous full cut using the cutting data (see Table).
Although the internal cooling facility using oil injected at 80 bar proved highly beneficial to service life, the temperature rise caused by the greater reaming resistance meant having to dispense with higher cutting values.

Concentricity precision ≤ 3 µm

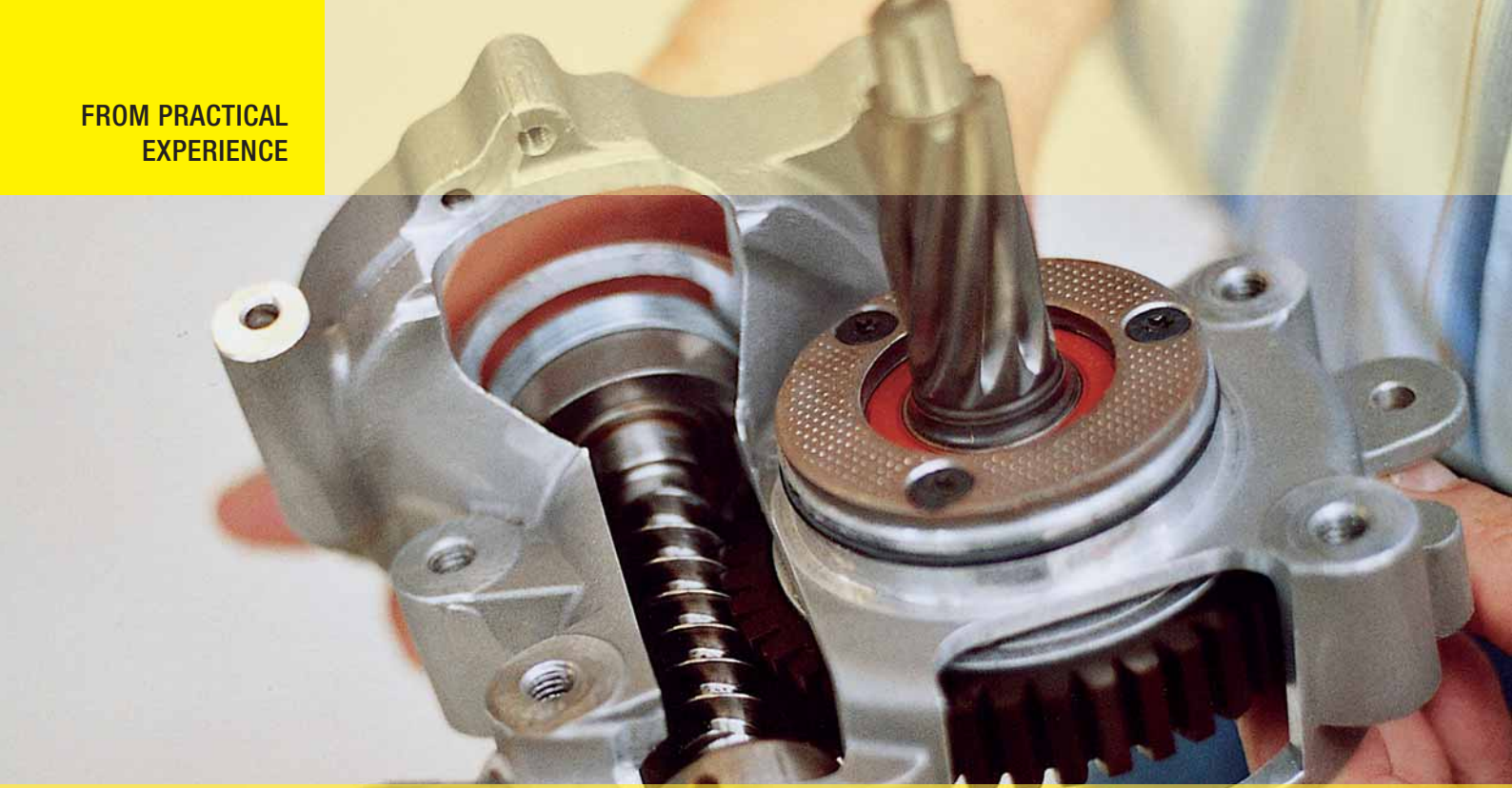
The four adjustment screws of the hydraulic expansion chuck offset by 90° allow the shank concentricity to be simply corrected by cross-wise tightening. This is preferably determined at the mounting taper using a precision measuring gauge. Once the reaming insert – ground to a diameter tolerance of ± 1 µm – has been mounted, the fixing screws are tightened using a torque wrench. The extremely rigid insert, just 5.3 mm (0,209") thickness, is fixed to the reaming shank by means of a precision-ground, short conical clamp similar to the HSK. This connection guarantees a concentricity-related indexability of ≤ 3 µm in the spindle of the machining centre.

Process-relevant data improved by 20 to 30 percent.

After more than 4,000 tappet cups, Dieter Arbogast and his team feel their decision to ream using adjustable hydraulic clamping chucks was the right one. In terms of process reliability, the reaming inserts are replaced after approx. 1,000 tappet cups although their tool life is a long way from being exhausted. During 100 percent inspection of the bores, an electronic measuring probe for a randomly selected workpiece documents the following values: R_a = 0.319 µm, R_z = 2.464 µm, R_{max} 3.91 µm, R_t = 3.91 µm. The DR reaming system thus improves all bore-relevant values – including tool costs – by 20 to 30 percent.

No. of revolutions n	2291 rpm
Cutting speed v_c	180 m/min
Feed rate per tooth f_z	0.08 mm (0,0031")
Feed rate/revolution f	0.64 mm (0,025")/revolution
Feed rate v_f	1466 mm (57,717")/min
Withdrawal speed	2565 mm (100,984")/min

Cutting data table



MILLING OF WORM GEARS FOR STEERING SYSTEMS

The quality of mechanical force transmission hinges on the worm/pinion gear pairing.

Indexable insert satisfies workpiece requirements

With electrical steering systems, the mechanical force transfer through the gear pairing of steel worm and plastic pinion has an effect on function. The edges of the steel worm must therefore exhibit a high geometric quality and a precisely defined roughness.

ZF Lenksysteme GmbH (ZFLS) – a joint venture between Robert Bosch GmbH and ZF Friedrichshafen AG – develops and produces steering systems for passenger cars and commercial vehicles at its Schwäbisch Gmünd site. Series production of the ZF-Servoelectric power steering system started in the Gügling plant in 2002. Thanks to modern control electronics, this energy efficient drive uses up to 0.4 litres of fuel per 100 km less than a hydraulic power steering system, cutting CO2 emissions and improving fuel economy.

Manufacturing challenge: Steel/plastic gear pairing

Due to the high force effect, the pinion is equipped with wide tooth bases and made from a special high-strength plastic that is able to withstand the damping action. Due to the high force and acceleration values, the double worm with narrow tooth bases is made from special high-strength steel. To prevent the plastic and steel gear rubbing against each other at the flanks, the flank surface of the worm must have a high geometric quality and a precisely defined roughness.

From grinding to milling

Although the first attempt to grind the worm with CBN wheels on a Gleason-Pfauter machine produced outstanding geometric results, the ground surface also acted on the plastic pinion like a grinding wheel – it was too abrasive. At the second attempt, a TiAlN-coated carbide milling cutter from a competitor replaced the grinding wheel. Although the operation was split into rough milling and finish milling, however, this tool's service life was inadequate. Furthermore, the milling cutter was capable of being reground only on the breast, limiting scope for repeated use. Although an optimised milling cutter did improve the result and the geometry was also in order, it lacked process reliability and acceptable costs for large-scale production.

The worm is milled with optimised geometric accuracy and a precisely-defined roughness.

Finish milling of profile using inserts

At the third attempt to solve the problem, HORN technical consultant Armin Jaud was also asked for suggestions. He recommended a standard milling cutter tipped with inserts for roughing and continued use of the carbide milling cutter for finishing. This did produce geometrically-perfect forms, but the wear was still too high and process reliability was unsatisfactory. What's more, the lack of free-formed surfaces at the tooth flank caused a high friction value between worm and pinion.
Using inserts to finish mill the worm profile promised to remedy the problem. However, before we could embark on what was for us a new path, numerous questions had to be answered. How does an insert need to be designed to be able to achieve the highest possible number of teeth with workpiece dimensions dictated by the machine. How can it be economically produced, how should it be coated and what is the precision geometry supposed to look like?

Questions answered in the shortest of time

There were other questions about the toolholder. Run-out and concentricity precision in particular place extremely tough requirements on the production process. Every insert seat therefore had to be reliably machined with even closer tolerances. Because the toolholder had to be made soft, only a minimum of distortion was allowed to occur.
We therefore designed the toolholder as a ring, which was clamped on a precision milling arbour. To minimise vibrations and axial run-out while optimising stability, the toolholder was designed with the maximum possible thickness allowed by the machine.

Convincing results

This milling system was optimised in collaboration with ZFLS. Cutting angle, coating type and thickness, geometry and precision geometry, all aspects were improved step-by-step. The result: reliable production with optimised geometric accuracy. The worm/pinion system can therefore function reliably for the life of the vehicle, even under extreme load. The overall process was made much more cost effective, continued use of the previous carbide milling cutter being a contributory factor. As a roughing mill, it now no longer has to cut accurate to a µm, only to a few 10ths of a millimeter.

Andre Schiffel, Business Unit Manager at ZF-Lenksysteme GmbH and Armin Jaud, Technical Consultant and Sales at HORN are pleased with the milling system's performance.

ACCURATE AND SMOOTH AS GLASS

Polishing and milling of brilliant surfaces

Brilliant workpieces are being used as decorative or functional components in an increasing number of industries. With the connector sleeve (2nd workpiece from the left), the cut interrupted by the tapped bore places special requirements on the geometry of the MKD insert.

Standardised, easy-changeover tool holders and fixtures, tipped with monocrystalline diamond inserts with various geometric forms simplify industrial brilliant finish machining.

Combined expertise of two specialists

For around three years now we have collaborated with the company H10, one of the world's leading manufacturers of diamond tools. We supply the supports and holders for the inserts and handle the global distribution of the tool systems. H10 is responsible for the manufacture of diamond inserts, grinding and regrinding. Dividing the work in this way has proved its worth in various brilliant finish machining applications.

Economy through standardisation

We supply type S117 MKD and VCGW 1604 inserts to ISO as a standard range in accordance with the catalogue, especially for the brilliant finish machining of aluminium with geometry A0 and brass – with the brass geometry of M0, gold can also be processed – and plastic with geometry K0 (preferably PMMA). The inserts fit into both the special H117.MD10 toolholders and into all H117 toolholders with a size 10 insert seat. The VCGW1604 inserts to ISO are suitable for all standard ISO toolholders.

Polishing functional and decorative surfaces

With a Ms 63 connector sleeve pre-turned with an allowance of 0.03 mm (0,012") and a diameter of 20 mm (0,787"), a radial tapped bore must not affect

Writing implement work example. A contour grooving tool and a moulding tool produce the differently-shaped grooves.

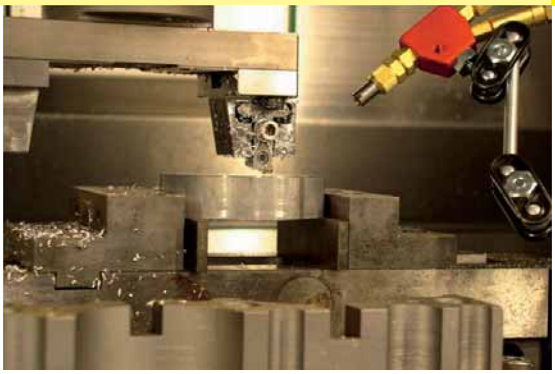


Image left:
VCGW insert to ISO (left) and S117 MKD insert in the H117 holder.

Image right:
During the polishing of an aluminium workpiece, the diamond insert is clamped in a boring head.

the diamond tool or the surface quality. The MKD insert soldered on a S117 holder is therefore given a protective chamfer. – With a continuous cut, the cutting edges are precisely and sharply ground. Where v_c = 180 m/min and f = 0.03 mm (0,0012")/revolution, the sleeve is reliably turned with the desired tolerance and surface quality.
The six plunge cuts on a writing implement made of Ms 63 calls for special expertise. To achieve the 1.5 mm (0,059") wide plunge cuts rounded to r = 1 at the end of the tapered tip, H10 has developed a contour grooving tool with several successively arranged diamonds and a die plate for the other five 0.3 mm (0,012") wide and 0.5 mm (0,020") deep plunge cuts. The complex contour grooving tool is housed in a special holder and makes the plunge cut in one feed adapted to the lathe's cycle.

Face milling

Due to the numerous enquiries for "Face milling", we initially tipped the S117 and Supermini 105 tool systems with diamond inserts. Faces can be produced only for "general" use, as a "jointless" face is technically unviable. The required glass-smooth surfaces are therefore face milled using a S117 single-edged insert. The axle movements of the turning workpiece and tool are coordinated so that the insert housed in a boring head creates the brilliant effect only in the forward stroke. Our TiN-coated standard holders therefore solve a host of clamping problems and significantly reduce tooling times. These benefits have superseded hand polishing solutions for numerous users.

Versatile, economic brilliant machining

Hardness, thermal conductivity, wear rates, reproducibility and process stability are creating for our diamond tools more and more applications with the same appearance, the same colours, surfaces and accuracy of fit. Thanks to the combination of various diamond types, roughing and finish machining can be realised in one pass. A good result, however, hinges on the close collaboration with the customer. These relationships must allow the geometric features of the workpiece to be "experienced" so that the expected results can be achieved using the designed tool system both at the cutting zone itself and with the machine.

Mirror turning and milling in keywords:
- Suitable materials: gold, silver, platinum, nickel, brass, aluminium, copper, bronze, acrylic, polycarbonate, polyvinylchloride, polyethylene and polyoxymethylene.
- Process benefits: Glass-smooth, precisely formed external and internal contours with r ≤ 0.1 mm (0,004") and R_z ≤ 0.01 µm.
- Pre-machining: with PCD or carbide inserts, dimensions 0.02 (0,0008") to 0.05 mm (0,0020")

Guide values for polishing

Material	v_c m/min	f mm (")/revolution	a_p mm (")	Cooling
Aluminium	200 – 250	0,02 – 0,1 (0,0008 – 0,004)	0,02 – 0,05 (0,0008 – 0,0020)	Yes
Silver	200 – 250	0,05 – 0,06 (0,0020 – 0,0024)	0,02 – 0,05 (0,0008 – 0,0020)	Yes
Gold	200 – 250	0,05 – 0,06 (0,0020 – 0,0024)	0,02 – 0,05 (0,0008 – 0,0020)	Yes
Platinum	100 – 125	0,02 – 0,04 (0,0008 – 0,0016)	0,01 – 0,03 (0,0004 – 0,0012)	Yes
Acrylic (PMMA)	100 – 150	0,05 – 0,10 (0,0020 – 0,004)	0,02 – 0,05 (0,0008 – 0,0020)	Yes/no

The machining data are largely identical to those for polishing.

Carbide Milling Cutter System DC

Carbide Milling Cutter System DC

Circular milling of threads, grooves and chamfers

Our new carbide milling cutters simplify the production of threads, grooves with round or square cross-sections and chamfers. With one row of teeth and 2, 3 or 4 cutting edges, they produce threads with full or part profile, conical threads, right and left-handed threads and threads with variable pitch. These multi-edge tools, available in several carbide grades, prove their economy especially for machining materials used in medical technology such as cobalt-chromium steels, titanium, stainless steels and plastic. The option of precisely defining the thread inlet and outlet, as well as the thread depth for milling or whirling internal threads, is especially beneficial. The DCG milling cutters are available as standard up to a thread length of 3 x D.

For applications of the DC standard versions, see the Table on the left.

Circular milling	Working range (mm)	Type
Thread with full and part profile	M3-M12, UNF, UNC, BSW, NPT	DCG
Grooves with full radius	Cutting edge -Ø 4 – 10 mm (0,157" – 0,394") Radius 0.5 – 1.5 mm (0,020" – 0,059")	DCR
Grooves	Cutting edge -Ø 4 – 10 mm (0,157" – 0,394") Groove width 0.5 – 3 mm (0,020" – 0,118")	DCN
Chamfering	Cutting edge -Ø 2 – 7.5 mm (0,079" – 0,295")	DCF
Special milling cutter for practically all thread and groove variants within these working ranges		DCS

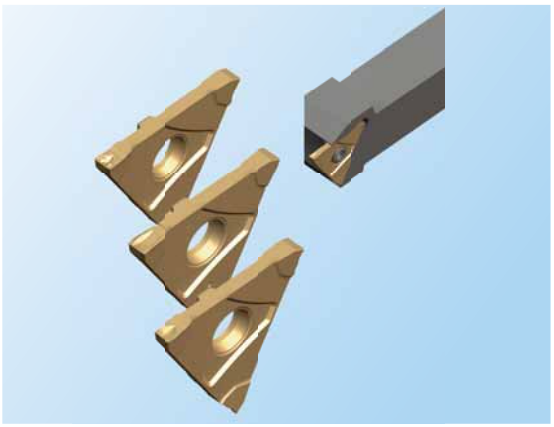
S316 system with precision-sintered geometries

S316 precision-sintered inserts for grooving and parting-off with geometry forms .5., .EN., .FY. (from top to bottom).

Groove depth increased to 8 mm (0,315")

Having further developed our sinter presses, we are now able to finish-sinter various geometries. Consequently, we can offer and also standardise inserts such as the S316 series with wider working ranges.

The S316 upright, three-edged inserts with the precision-ground relief angles at the main and auxiliary cutting edges are available for 1.5 to 3 mm (0,059" to 0,118") groove widths and 8 mm (0,315") groove depth, depending on the geometry.



All geometries impress with reliable chip control and outstanding chip forming. The left and right-hand versions of the inserts are housed in H316 toolholders. Four versions are available with shanks from 16 x 16 mm (0,630") to 32 x 25 mm (0,984"). The indexability is ± 0.02 mm (0,0008") in each case.

Geometry	Coatings	Application	Materials	Feed rate mm (")/revolution
.5.	AS45, Ti25	Grooving, longitudinal turning, copying of shaped grooves	Medium strength	0,06 – 0,25 (0,0024 – 0,010)
.EN.	AS6G		Higher strength	0,08 – 0,2 (0,0031 – 0,008)
.FY.	AS45, Ti25	Grooving, finish-grooving	Long-chipping	0,03 – 0,15 (0,0012 – 0,006)

End machining of oil field pipes and sleeves

Internal and external machining in one clamping

Our new tool systems enable the machining of rotating or stationary oil field pipes of diameter up to 25":
– Grooving and parting off: Groove widths 10, 12 and 16 mm (0,394", 0,472" and 0,630"), groove depths up to 65 mm (2,559").
– Chamfering and peeling with stock ISO inserts.

For threading, our patented system comprising insert and chip former offers numerous benefits. The insert is housed in the recess of the holder with undercut and given a chip-shaping cover. This eliminates the chip breaker. The cover and the insert can be installed and removed separately.

The end machining tools are now in use all over the world, their service life being especially impressive.

For turning an internal cone and a thread on a 10" pipe section, our combi-tool outstripped the established competitor with 2.1 times higher tool life. Machine operators in particular are impressed by the tool's simple construction, increasing acceptance of the tool system.

Sample tools.
Upper row, from left to right:
– S117 system for thread-cutting
– Combi-cartridge for clipping and parting off test sections
– Combi-tool for cone turning and thread-cutting in one pass

Lower row, from left to right:
– Cartridge with thread-cutting insert
– Cartridge with thread-cutting insert for premium joints

VDMA Association of Precision Tools Germany

Lothar Horn represents the Association of Precision Tools Germany

Our managing director has been the Chairman of the VDMA Association of Precision Tools Germany for around eighteen months. In this capacity, he represents some 200 manufacturers from the fields of machining, clamping tools, manufacturing, measuring and test technology with over 70,000 employees and sales of eight billion euros.

Lothar Horn – succeeding Mapal boss Dr. Dieter Kress in this honorary appointment – was elected for three years. He outlined to the trade press his primary tasks:
– to enhance the profile of precision tool manufacturers and their recognition in business and society.
– strengthen the position of predominantly medium-sized members against large customers.
– combat product piracy.
– support members in their search and preparation of new regional markets.
– bring training initiatives and careers in member companies of the association closer to young people.

Most of all, he wants an active exchange between suppliers and customers – a concept he has implemented in his company with great success.

The representatives of the VDMA Association of Precision Tools Germany: Dr. Wolfgang Sengebusch, Managing Director (left) and Lothar Horn, Chairman.

The Sales Management Team (from left to right): Reiner Wendt (Sales Manager South Germany), Andreas Vollmer (Sales Director, Member of the Executive Board), Harald Haug (Export Sales Manager), Volker Dahle-Schröder (Sales Manager North Germany).

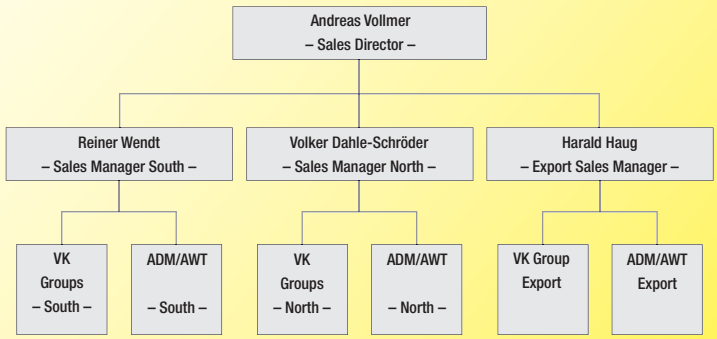
Introducing the sales management team

Sales activities both at home and abroad, including customer loyalty enhancement measures, are an intrinsic part of our future. The sales managers set the course.

After the sale is before the sale! This phrase that sales trainers so like to use means constant endeavours are required to win customers who can then be turned into satisfied customers. Andreas Vollmer, Sales Director and member of the Executive Board, is responsible for selecting and implementing these activities. He is supported by three sales managers: in export by Harald Haug, in southern Germany by Reiner Wendt and in northern and eastern Germany by Volker Dahle-Schröder. At their side are around 90 employees, half office-based and half field sales force.

Management structure of the sales division

Sales structure at Paul Horn GmbH



Distribution and export management

Andreas Vollmer was assigned his current sphere of responsibility as Sales Director in 2008. His tasks include management of our subsidiaries, internal logistics from the raw materials warehouse to shipping to customs clearance, the OEM department and – together with Lothar Horn – the marketing department. He gained the necessary experience in almost twenty years with our company as an administrator for quotations and from 1994 onwards as export department manager. As export manager, he was also responsible for establishing our subsidiaries in the USA, Britain and Hungary, as well as providing support for the Benelux states and the worldwide sales partners.

After a three year apprentice training to become a qualified mechanic, Andreas Vollmer went on to study automation technology as a field of mechanical engineering. As a young engineer, he began his career with a computer manufacturer as a developer of CAD programs and housings for electronic measuring devices.

Harald Haug's professional career has followed virtually the same time path as Andreas Vollmer's. After completing his apprenticeship and attending vocational college, he went on to study design engineering. It was in this field that he garnered important professional experience before joining our export department in 1994. Following various tasks with increasing responsibility, he took over the management of the export department from Andreas Vollmer.

South and North sales regions

Reiner Wendt has also built his career on a sound professional basis. Having completed his apprenticeship as a fitter, qualifying as a master of industry and REFA engineer, he managed the tool repair division of a large automotive manufacturer. After an in-service course in business administration, he held further responsible positions, one of which was in the purchasing department. After more than 30 years, he moved to the sales department for KeyAccount and OEM support for a global tool manufacturer. He has been sales manager south for our company since October 2010.

Volker Dahle-Schröder has been our sales manager in the "north" for around 10 years. His region starts at the north of the River Main and encompasses the new federal states. Due to the customer structure and concentration, he has a large sales region to look after. That's why the main focus of his activities is his home-office in Hannover-Garbsen. He learned the tools of the trade as a qualified mechanic and certified technician. His long-standing experience in the global sale of lathes and special machines stands him in good stead for this current responsibilities.

VIP visit: Minister Ursula von der Leyen at HORN

"I have seen an extremely strong company that is in tune with the time.“ Said the minister summarising her impressions. During his welcome address, Lothar Horn outlined important cornerstones, from the company's founding to its future prospects. He made it quite clear that the successful development was largely down to the highly-qualified employees, the loyalty to the site, the high technology production facility and the short decision paths.

During her tour, the minister appeared especially impressed by our production facility. Consistent with her own work, she was also interested in the training department and our efforts to interest more girls in the technical professions.

Ms. von der Leyen was invited to visit on 17.02.2011 by the CDU candidate for the Tübingen district, Dr. Lisa Federle.

Minister von der Leyen on the company tour.

TOOL PROCUREMENT FROM THE HORN eSHOP

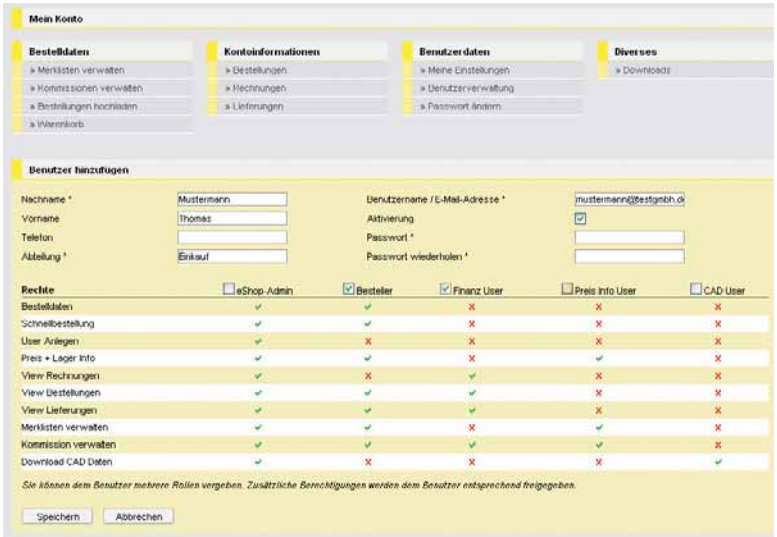
Even more efficient online ordering system

Our expanded eShop offers more than just ordering functions. Users can also call up realtime information about the availability of tools, the status of orders and deliveries – around the clock.

Individualised service for our customers

The number of customers using the benefits of the clearly arranged and easy-to-use online portal is growing on a daily basis. The portal's special features include the display of stock availability and customer-specific conditions and the price calculation function for the tools in the shopping cart. If we have these items in stock, the customer will also find them by entering a special customer code number. A series of templates are also available for repeat ordering or the management of customer-specific ranges. So all the requirements for ordering both standard and special tools as quickly and as simply as possible are satisfied.

User administration

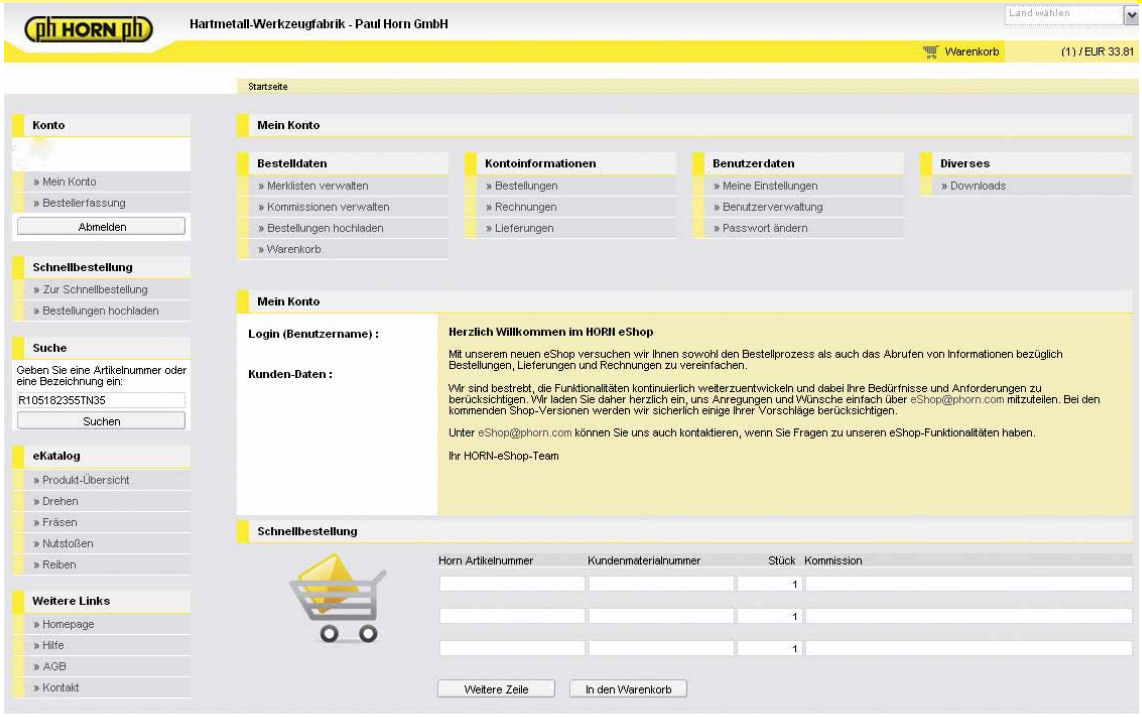


Fast recording and CSV upload

The new fast recording screen offers many benefits. Order data such as HORN item number, customer material number and order quantity can be entered directly. Alternatively, order data from the customer's merchandise management or purchasing system can be loaded straight into the eShop without having to record it a second time. Since there is no double data recording, data input errors are avoided.

There are several ways to the appropriate tool

Indexable inserts for grooving or milling, including associated holders and shanks are easy to find via



Homepage

intuitive navigation and convenient selection functions for the specification of the respective sizes or machining tasks. Various filters are available to the user in the electronic product catalogue for this. Items can be found more quickly and more easily using the optimised Find function.

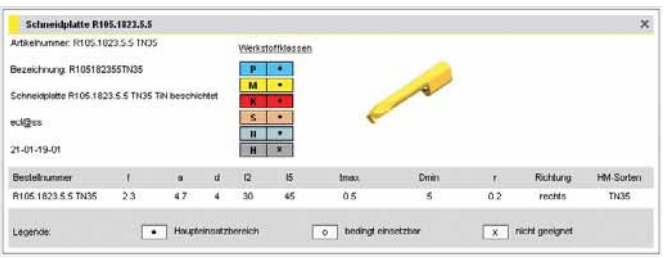
Flexible user roles

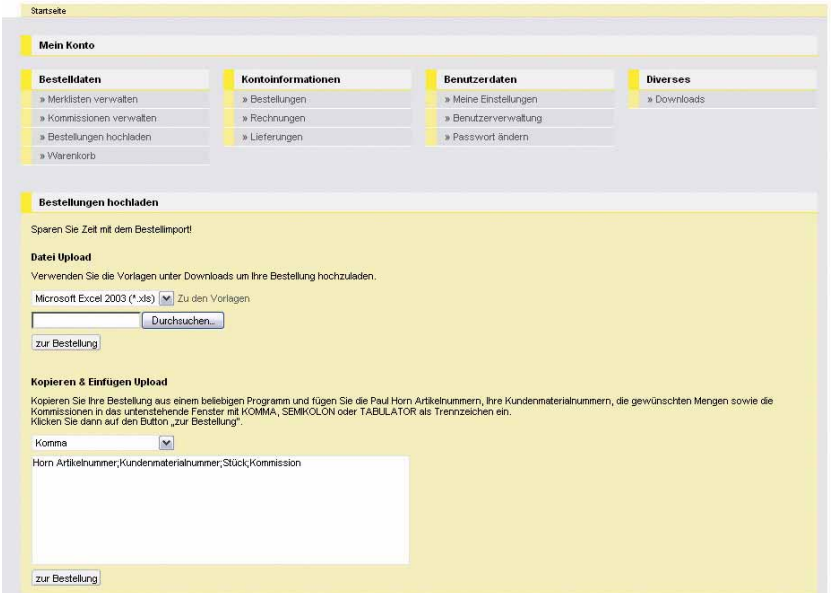
Using the new "My Account" area, the customer's eShop administrator can create and manage several users with special user roles. For example, special users can be defined who can only download CAD data or others who can only retrieve information about orders and deliveries, price and stock availability.

Function expansions for optimised procurement

Our OnlineShop currently comprises more than 15,000 tools and components for turning, milling, grooving, reaming and tapping. As well as our recognised short lead times, our aim is to make the organisation and administrative input as simple and therefore as effective as possible. That's why we will further expand and continuously improve our electronic procurement system and adapt it to latest operational requirements.

Image left: Item details
Picture right: CSV upload





OUR OWN IDEAS ON THE HIGH-TECH MACHINE

Upgrading a "basic machine"

Proprietary machine building and maintenance programme

There are no commercially produced machines on the market that suit our complex grinding processes. We therefore buy CNC machines with certain basic equipment and adapt them to suit our requirements in the maintenance department.

Every year, more than 6 million inserts with an average batch size of 100 and in tens of thousands of variants pass through our grinding shop. We can only manage this production volume and meet our extremely short lead times using automation – the degree of automation is currently 97 percent – and flexible processes. This manufacturing flexibility means having to continuously adapt increasingly complex manufacturing processes to the latest technical, logistical and organisational findings. Some of these tasks – the focus being on upgrading to multifunctional grinding machines for our proprietary grinding technology – falls under the responsibility of the maintenance department. Its remit includes upgrading and automating the 5-axis "basic machines" obtained from a world-renowned German manufacturer.

Machine maintenance in the grinding department.

HORN's proprietary grinding machines

Upgrading a basic machine to a high-tech machine essentially comprises the product-specific integration, matched to our automated grinding technology, of additional functions such as measuring, dressing, clamping, positioning, turning and transporting. One example of this is the grinding wheel changer. Its functions, magazine capacity and change speed are adapted to our grinding wheel dimensions and grinding packages. Another modular element on which function and quality hinges is the NC sub-unit. After our optimisation, it is set apart by the high positioning speed and a concentricity precision of 1 µm (!).

Because we design the stainless steel housings around the machines in collaboration with a renowned machine casing manufacturer, our equipment is easily integrated into the automatic machining cycle.

Image left:
The maintenance of the coolant preparation station falls under the maintenance department's remit.

Picture right:
Proprietary software being tested on the machine.

To be able to adapt to the inserts to be ground quickly and precisely, we have created standardised interfaces for the mounting of modular assemblies and the clamping equipment.

Component supply guarantees a fast reaction

The short times for upgrading grinding machines are also down to our close relationships with just a few suppliers. They manufacture and supply large batch quantities of the requisite components and assemblies. Thanks to this arrangement, we are also largely removed from delivery issues, with mechanical or electronic components for example. Because we enjoy long-term relationships with all our suppliers, they are able to better meet our requirements by drawing on the experience garnered over the years.

More than just maintenance

Upgrading and maintaining the machines are just two of the tasks required of the employees – currently 20 – in the maintenance department. They are also responsible for machine maintenance in production, building technology, energy supply, provision and preparation of lubricants. This broad range of activities calls for specialists in assembly technology and machine building, in design and software customizations, to whom we are giving increased consideration in our training and development concept.

The assemblies are created and developed and integrated into the machine in close collaboration with the equipment design department. We work with the software department to develop programs that permit the control of complex grinding processes, including control functions and automatic workpiece handling.

Long-term capacity expansion

We currently use over 170 CNC grinding machines. Over the next three years, this capacity will be significantly increased by an additional 100 grinding machines that are already on order. They will be delivered successively and "finished" and installed by the maintenance department. The requisite components will also be pre-delivered to the suppliers. This means we can build two to four machines at the same time and install new production machines or replace existing ones in a weekly cycle. The machine overcapacities this will cause are intended, enabling us to react swiftly to priority orders. If necessary, we can deploy the machines immediately in any grinding department and, thanks to these capacity adjustments, support our growth strategy.

HIGH-TECH TOOLS IN THE LAND OF THE VIKINGS

JR Tool ApS. – our sales partner in Denmark

The little mermaid, Smørrebrød and Lego are what we immediately associate with Denmark. Our northern neighbour's high degree of industrialisation is a lesser known fact. And our Danish representative in the metal removal sector is not exactly removed from this standard.

The Danish success story started with the idea to overtake and reorganize the company Arvid Rattenborg in Vejle, a port at the eastern point of Jutland. Jan Eilenberg and Rudy Bonde saw the well-respected distribution company for precision tools as an opportunity to realise their dream of independence. As they had the same ideas about building and managing a company and their previous professional activities went hand in glove, the most important criteria for establishing the company JR Tool ApS. in 2003 were satisfied. JR in the company logo are the first letters of the forenames of the two founders. One year later, Kaare Blak joined the young company as a field sales employee. At this time, the three machining specialists were supported in the company by two further employees.

In 2009 JR Tool ApS. purchased the functional and representative company building.

Acceptance and trust from expertise

As an employee of Arvid Rattenborg, Jan Eilenberg has been distributing our products in Denmark for 14 years and has drawn on his skills to successfully satisfy a number of challenging requirements. Word of commitment and expertise got around, which is why he was often referred to by customers simply as "Mister Horn". On the back of this respect, a customer arranged contact with Rudy Bone as he was looking for a partner to set up the company. Just like Jan Eilenberg, Rudy Bonde also had a sound commercial and technical background and many years of sales experience. They also attended training courses to familiarise themselves with the requirements that are placed today on managers, especially in sales and marketing.

The JR Tool team: Ole Damsgaard, internal sales; Heidi Gollnast, internal sales and PR; Jan Eilenberg, managing director; Jonas Knap, internal sales; Kirsten Erritsø, bookkeeping and administration; Annette Pedersen, purchasing and administration; Rudy Bonde, managing director; Kaare Blak, north Jutland sales – Yellow is the colour dominating the offices and corridors.

Danish operations, small but excellent

The highly-industrialised country – its focal points being the food and metalworking industries, printing and publishing, mechanical engineering, electronic goods, engines for ships and locomotives – is being forced, due to its small area and population, as well as its high wages and social benefits, to manufacture its products using the latest machinery and a high degree of automation. A skilled worker earns around 4,500 euros per month, 60 percent of which is tax. The Danes consider themselves important suppliers to the automotive industry, precision engineering and medical technology, turbine construction and to many companies in northern Germany. Most companies employ an average of five people. They are especially proud of their flexibility and the relaxed way in which they manage both their private and their professional lives is notable. Titles are secondary, the main thing is always what they (the title holder) achieve.

Looking to the future with justifiable optimism

JR Tools demonstrated its entrepreneurial courage and farsightedness by buying a new building in August of 2009, in the middle of the economic crisis. The architecturally stunning semi-circular, single-storied building in the new industrial area of Vejle is functional and designed for further growth. The warehouse takes up some 500 m² of 816 m² of developed area. The remainder accommodates offices.

The sales portfolio currently comprises sleeves, collet chucks and other accessories for Swiss type machines. This means JR Tools can upgrade the machines of all renowned manufacturers. The mainstay of the range, however, is our tools. They make up approx. 60 percent of turnover.

As part of the intense market development activities – customer advice and support being high up the agenda – Denmark was divided into three sales zones: Jan Eilenberg looks after the south and Kaare Blak the north of Jutland, Rudy Bonde takes care of Copenhagen and surrounding areas.

JR Tool ApS. currently has eight employees. The company's strengths are planning optimised economic production sequences with its customers and realising them. In this process, the quality tools and services geared towards the customer continue to help maintain and enhance our Danish representative's reputation as a machining specialist as the number 1 for quality and customer support.

The 28 page, landscape format brochure describes the range of services offered by our Danish representative.

	Kingdom of Denmark*	Federal Republic of Germany
Area in km²	43.094	356.854
Population in million	5,5	82
Population density, inhabitants/km²	119	230

* excluding the associated Greenland and Faroe Islands

The Team Future looks forward to welcoming you.

Turning-Days, 13 – 15 April 2011 in Villingen-Schwenningen, Germany

The one-time supplier fair for regional companies has developed to become a recognised trade fair for machines, tools, products and services for turning, milling and grinding technology and associated applications.

On the 5th Turning Day, the organisers will group the exhibitors by process chains. They will position their exhibition stands centrally in a hall and their cooperation partners around them. We are realising the new exhibition concept with our partners in Hall D, Stand 02-09+47. Under the motto "Team Future", we will demonstrate typical solutions for turning, milling and grooving.

Paul Horn GmbH
We offer the right solution for any machining task – be that between the flanks or for other high-tech applications. From the individual application to the management of entire projects.

DMG Stuttgart Vertriebs- und Service GmbH
From its broad product range, DMG will be showing the CNC multi-spindle lathe GMC 20 featuring the Siemens 840D Powerline and also the compact turning and milling centre, the CTX alpha 450 TC.

IEMCA
Bar loading magazine for feeding round and multi-edged material for single and multi-spindle machines.

HPM Technologie GmbH
Complete product range for all tasks in minimum volume technology – minimum volume spray application, drop application and clean room technology.

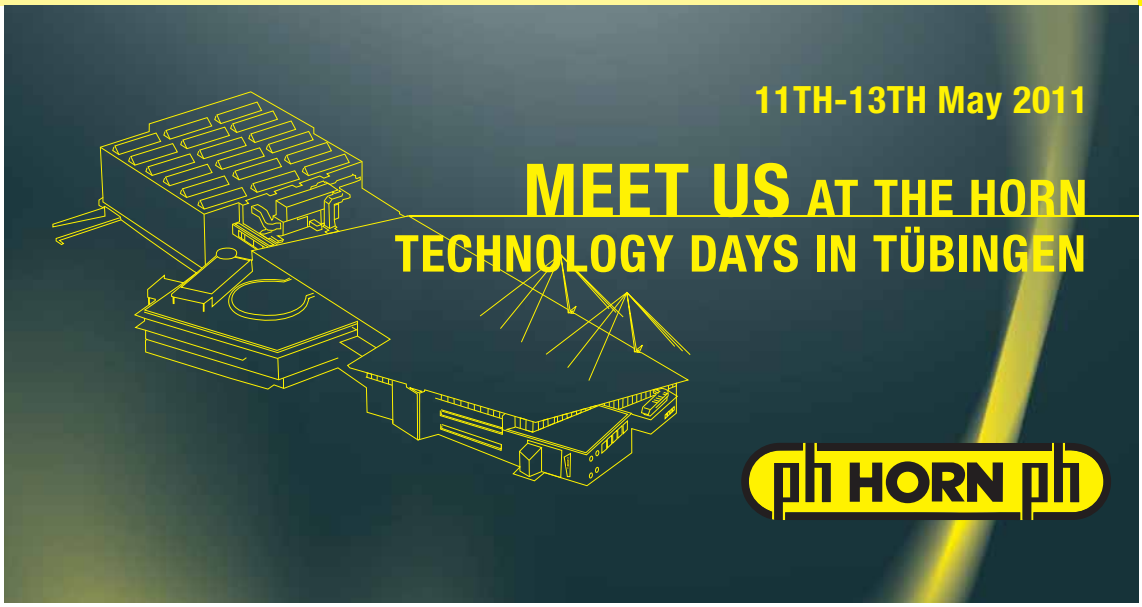
CONSYGMA AG
Tool management and systems for automatic and monitored material output around the clock.

GRAF Werkzeugsysteme GmbH
Tool systems and special tools for different designs and makes of lathe.

H10 Technische Diamanten GmbH
Tool systems for industrial brilliant machining. Diamond tools for polishing and finish-grooving, internal and external.

W&F Werkzeugtechnik GmbH
Modular units for long and short lathes. Clamping tools for milling technology.

Alongside the product presentations on the exhibition stand, various technical presentations will offer more detailed information on the topics concerned.



The invitation to our technology days will be sent out at the beginning of April.

Technology days in Tübingen, 11 – 13 May 2011

During this year's technology days too, we will be providing both theory and practice on new and established products, as well as trends and developments concerning the tool. For this purpose, we have prepared a mix of technical and practical presentations on our machines.

The **technical presentations** in keywords:

Grooving, grooving/longitudinal turning, parting off
The focal point is task-oriented geometries. The presentation describes their application and effect and offers application recommendations.

Special and combi-tools
What criteria for which tool? On what is the decision based and what are the requirements for economic and reliable series production for turning and milling?

Coatings – an insight into production
Starting from the processes we use, the coating procedure is explained paying particular attention to manufacture and set-up, including requirements for quality assurance.

Broaching on CNC machines
Tools and processes for longitudinal grooving in the broaching process are creating new potentials for the complete machining on CNC lathes and milling machines and on machining centres.

Turning and circular milling
Our tool systems for turning and circular milling on modern multi-task machines offer new methods for internal and external machining.

Reliable and precise machining of bores
Cost-effective, high-precision bores call for high-tech systems. We will be demonstration solutions and technical expertise for achieving the best possible result from our drilling systems.

We look forward to welcoming you in Tübingen.

Insights into the production sequences at Paul HORN.

PLUNGE CUTTING · CUTTING OF · GROOVING · BROACHING · COPY MILLING · DRILLING · REAMING

HORN is at home in over 70 countries across the world

• Subsidiaries or agencies

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