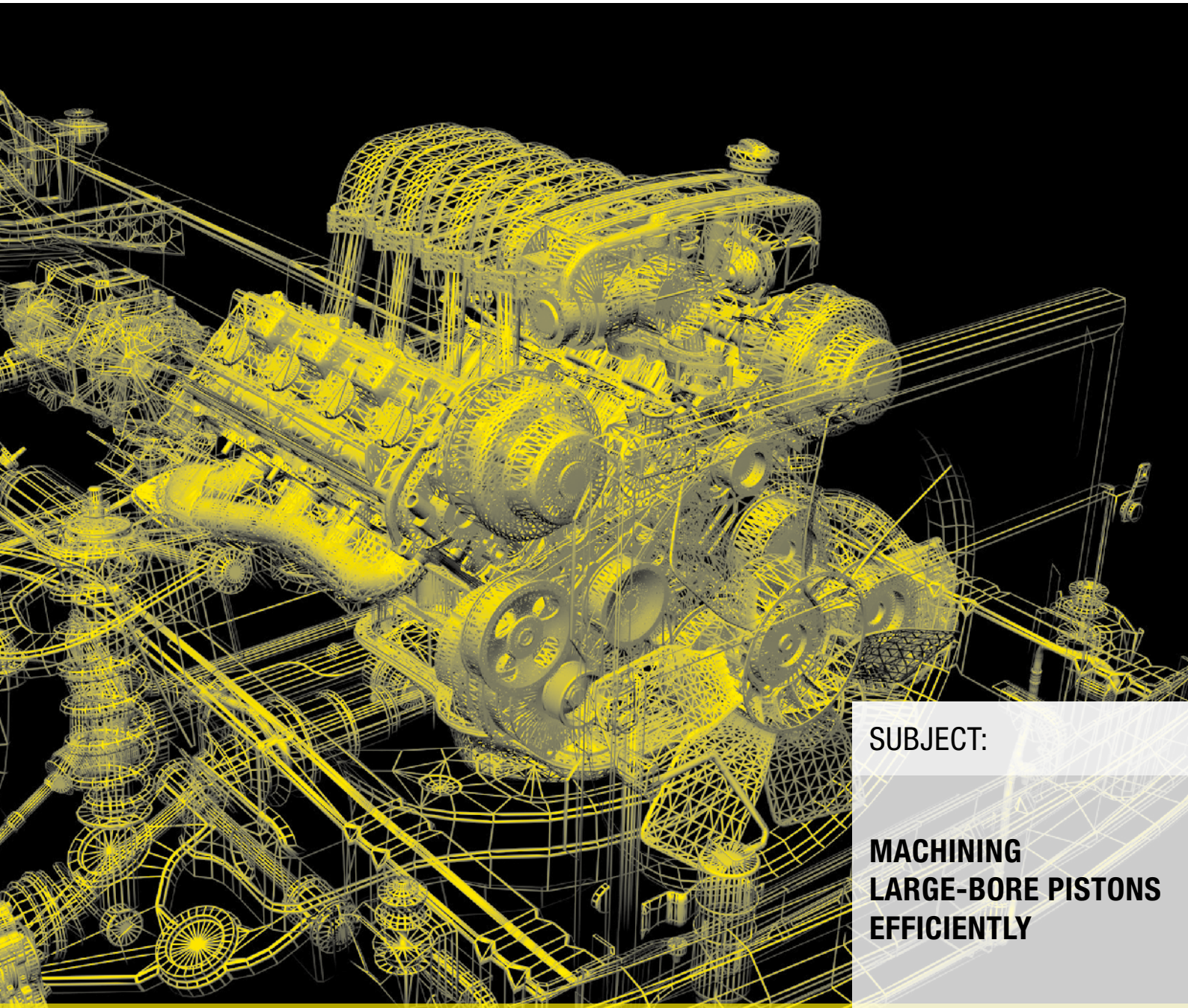
Edition 1/10

world of tools

HORN

HORN´S CUSTOMER MAGAZINE



SUBJECT:

MACHINING LARGE-BORE PISTONS EFFICIENTLY

- Ball running track milling on constant velocity joints
- Milling by circular interpolation in boundary areas
- Newest developments for high-feed milling and high performance reaming
- Czech Republic – successful in the market for 15 years

Dear Readers,

Quality has its value – and its price! This statement is supported by a survey of German medium sized companies where the quality factor occupies first place on a scale of values – coming before innovation, customer service and others. Therefore, problems with product and service quality always influence corporate values and ultimately determine the success of the company. The current financial and economic crisis and the recent recall actions and production problems at various automotive manufacturers demonstrate the serious consequences that can arise from the neglect of these factors.

In this issue, we aim to demonstrate how we safeguard our global good reputation as a tool manufacturer and ensure the quality level of the HORN brand for applications in various sectors.

You are also welcome to personally acquaint yourself with the performance and quality of our products at our Technology Days in Tübingen on April 20 - 23. Information about this event can be found on page 22. We are pleased to invite you and look forward to your visit and your feedback regarding our products and services.

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

world of tools
HORN´S CUSTOMER MAGAZINE

Practical matters

Products

About us

Exhibitions

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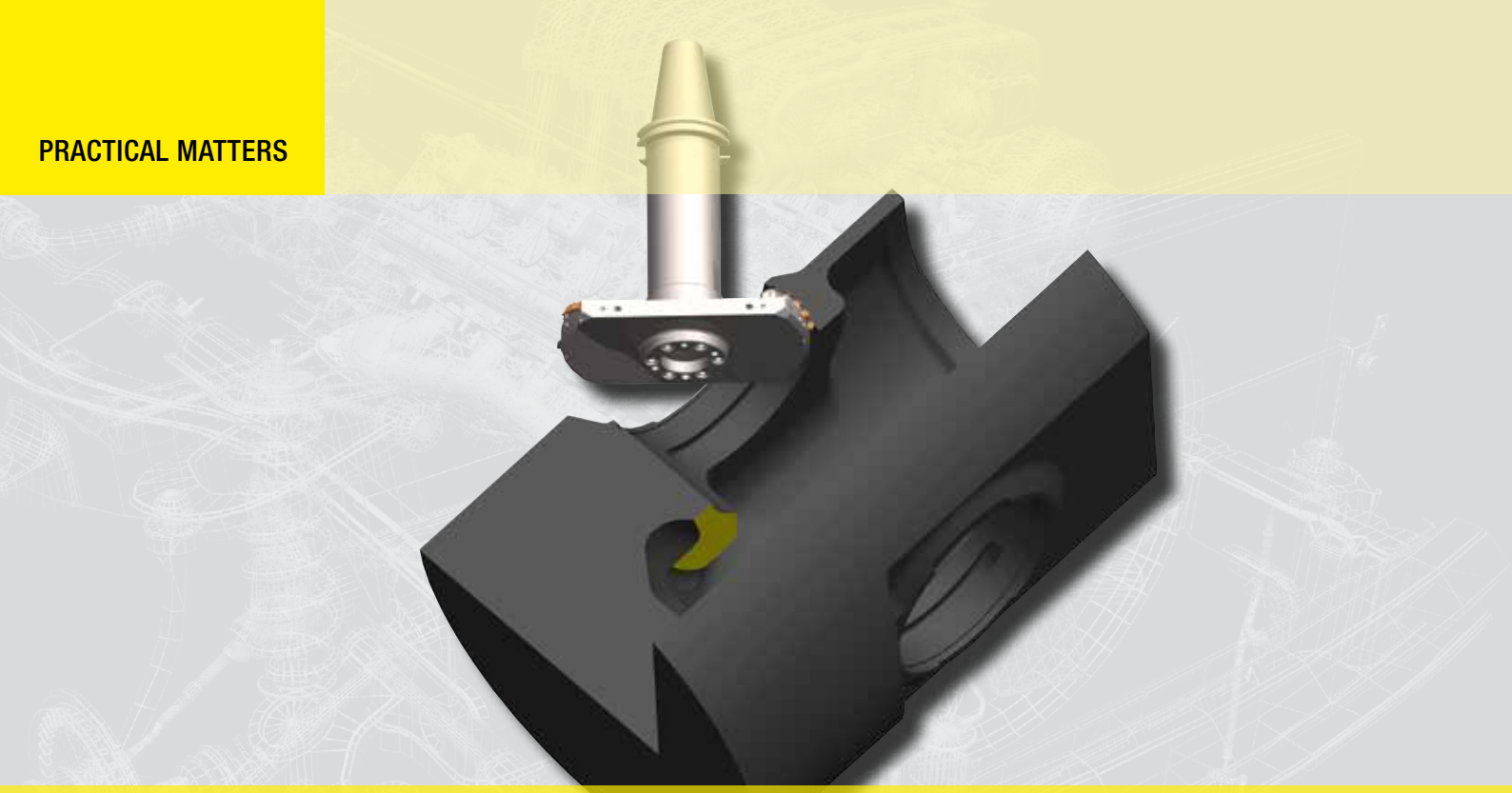


MILLING THE PISTON PIN BOSS CLEARANCE OF LARGE-BORE PISTONS

The bridge tool is swivelled in for the entry and put into the working position through the piston pin bore hole.

Bridge tool solves milling and positioning problems

Face milling of the gudgeon (wrist) pin boss clearances including an outlet in pistons for marine diesel engines had particular machine, clamping and cycle time requirements. Our specialists solved the task with two special tools.

Model view of the bridge tool. Cutting edge diameter 260 mm (10.315"), bridge width 114 mm (4.488"), tool holder SK 50 DIN69871-B with internal cooling, throat depth approx. 230 mm (9.055").

Large-bore pistons for marine diesel engines are one of the product lines produced by KS Kolbenschmidt GmbH in Neckarsulm. In the course of the modernisation of the machining facilities, the machining of the piston pin bosses also had to be replanned as the previously used impact turning method was no longer available. Impact turning of the faces and the runout radius of 16 mm (0.63") in several work operations with a single-cutter tool no longer complied with the efficiency requirements.

Wanted: future-proof machining

The solution of this complex task – face and clearance milling pin bosses with bevel caused by casting of Ø 218 mm (8.583") to Ø 398 mm (15.669"), apply runout r = 16 mm (0.63") in the piston head – was the responsibility of Wolfgang Köhler, manager of the Tool Management Department, and thus responsible for the construction, design and procurement of special tools. For this complex task as in other cases, he relied on close collaboration with our technical consultant, Armin Jaud. Both specialists combined their expertise and developed a promising strategy for the pin boss clearance milling in pistons > Ø 400 mm (15.748") made of EN-GJS-700-2 (GGG70) where

the tool accesses the cutting zone on the inner side of a piston clamped on a rotary table via the piston pin bore hole.

Machine situation determines tool design

After checking various alternatives, the machining specialists decided on internal milling by circular interpolation with a side milling cutter and a bridge milling cutter. The side milling cutter should first face mill the pin boss surfaces from Ø 218 mm (8.583") to Ø 363 mm (14.291"), then the bridge milling cutter should finish mill the surface and apply a radius of 16 mm (0.63") to a diameter of 398 mm (15.669"). The strategy with the bridging tools posed particular challenges for our designers. On the one hand due to need to access the cutting zone though the piston pin bore hole and on the other hand due to the particular cutter arrangement for milling the faces and the radius.

Bridge design enables entry from the side

They selected the bridge design and also on account of the large milling depth of 90 mm (3.543"). This enables the entry under a part-specific pivot angle into the piston pin bore hole and positioning behind the collar in the working position. The requirements were taken account of with the internal cooling and adapted cutter arrangement and geometry. The five indexable inserts each arranged one after the other on the tool for finish milling is particularly noteworthy. Compiled to a segment, they each form one tooth. The radius 16 mm (0.63") is simultaneously applied during the finish milling due to their arrangement in five different levels.

Dieter Krämer, CNC Programming at KS Kolbenschmidt, was responsible for the movement processes of the tools. He programmed the entry and machining strategy which depends on the various piston pin diameters. Thereby, the tool performs the X/Y movements while the piston clamped on the rotary table is swivelled for the entry and moves in the Z and B direction for the machining.

Cutting data proven in series production

	Face from Ø 218 (8.583") to Ø 366 mm (14.409") in 2 cuts		
	Rough-milling	Finish milling, including milling r = 16 mm (0.63")	
Tool	Side milling cutter	Bridge milling cutter	
Cutting edge Ø Ds mm (")	215 (8.465")	262 (10.315")	
Number of teeth Z	2 x 5 (Z = 5 eff.)	5 (Z = 4 eff.)	
Cutting speed v_c (m/min)	100	200 (1st cut)	200 (2nd cut)
Average chip thickness hm mm (")	0,07 (0.0028")	0,045 (0.0015")	
Feed rate per tooth f_z (mm/Z) ("/Z)	0,14 (0.0055")	0,3 (0.012")	
Feed rate v_f (mm/min) ("/min)	74 (2.913")	109 (4.291")	99 (3.898")

After the first tests, the number of teeth for the side milling cutter designed with 10 teeth was reduced to 5. This resulted in a clearly better smooth operation. This also distinguishes the bridge milling cutter as well as a surface quality well within the requirements.

Higher tool life and reliable series production

The pistons have been successfully machined using this strategy for about three years, as Wolfgang Köhler confirms: "We have achieved our most important objectives such as shorter machining times and a reliable production. We are also pleased about the high tool life of the HORN tools. Batch sizes with 50 to 100 pistons are machined with high measurement consistency without need for insert replacement".

Wolfgang Köhler (left) and Dieter Krämer (right), both from KS Kolbenschmidt GmbH, jointly developed the new strategy for pin boss clearance milling with our technical consultant, Armin Jaud.

TOOLS FOR HARD MACHINING

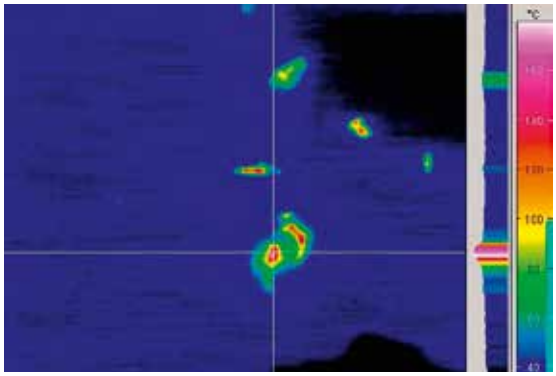
Tools for milling final contours matched to hard milling.

Milling and grooving in workpieces ≥ HRC 54

We provide a wide range of tools for hard machining by milling or turning/grooving for workpieces with hardness in the range 54 to 65 (70) HRC. Our variety of cutting materials, geometries and coatings simplify your task-related selection.

Hard milling with great potential

In addition to machines and tools, the upstream and intermediate processes like hardening significantly influence production cycle times. Therefore, hard milling is increasingly popular, especially in tool making and mould making where parts with different hardness penetration depths have to be machined.



Thermal image for investigation of the chip temperature after the brittle fracture from the workpiece material has occurred.

We recommend our DS solid carbide milling cutters with diameters from 0,2 (0.0079") to 16 mm (0.63") for this. Manual reworking such as polishing and the removal of edge zones caused by electrical discharge machining can be significantly reduced or eliminated using these high quality tools.

Matched: substrate, coating, geometry

Our carbide grades reliably support high dynamic and thermal loads and mechanical impact loads. We can match the elements of a tool in our own carbide production and coating department so that optimum results with respect to tool life, cutting speed, surface quality, contour accuracy, heat resistance and toughness are achieved.

The matching of the three main components of a tool is critical, particularly for hard milling. According to our experience, the milling result is influenced 60% by the geometry, 30% by the coating and 10% by the substrate.
As high temperature gradients, particularly for hard milling, are produced at the cutting edge, particular attention must also be paid to the cooling and/or lubrication of the tool.

Carbide grades increase tool life

We recommend the carbide grade TS3K for soft/hard milling up to approx. 40 HRC, carbide grade TS3H for the milling in the range 38 to 53 HRC. and the new TS3E grade for hard milling and finish machining of parts with 50 to 70 HRC. Here the combination of a new geometry stabilising the cutting and a new coating, approx. 3 times higher tool life is achieved in comparison with competing makes.

Our recommended cutting data for different usage conditions for hard grooving and turning:

	Full cut	**Partial cut** (allowance 0.15)	**Full cut** interrupted
Cutting speed v_c (m/min)	120	120	250-300
Feed rate f (mm/revolution) (")	0,03-0,04 (0.0012"-0.0016")	0,06-0,08 (0.0024"-0.0031")	0,03-0,04 (0.0012"-0.0016")

Hard grooving and turning, external and internal

For turned parts, the design of the grooving tool is mainly oriented to the size of the series, the geometry, the part-dependent work operations and the pre-machining. Our range includes tools for boring within drilled holes from 1,8 mm (0.071") diameter. Single- or multi-edge tools with bolted or clamped inserts are available for grooving.

Grooving tools with CBN insert

We always recommend CBN inserts for workpieces from 54 to 65 HRC. Our CBN grades provide capability to machine a range of materials. Geometries developed for the application are available including various negative protective chamfers and sharp-edged, rounded, not rounded and with wiper.

Requirements for efficient hard machining

In addition to robust, powerful machines, tools with high quality inserts are required for reliable working. Short throat depths, largest possible corner radii, negative chamfers and bevelled and rounded cutters are also recommended. Coolants should only be used for long engagement times in an uninterrupted cut.

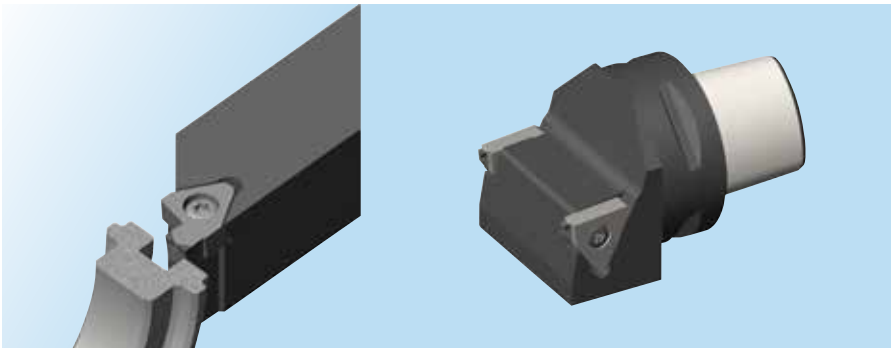
Careful matching of the geometry, the tool, the clamping and the environment of the cutting zone significantly increases the tool life to be expected. Without electronic thermal compensation, high passive forces and heating of the machine by chips could result in dimensional deviations of the workpiece.

Hard grooving and turning process benefits

Low production costs, low energy consumption and the usually less expensive machine investments recommend this process. As grind overheat and surface cracks are not encountered, workpiece quality is secured. However, how a changeover to this process will affect process reliability, machine inventory, personnel requirements, the organisation, the workpieces and other things must be considered in advance.

Is classification into hard or soft machining sufficient?

In our opinion, this simple categorization will lose importance as new materials such as composite fibre materials, plastics, superalloys and others cannot be so easily defined. More helpful would be a machinability index as is already defined for steel. We also prefer this classification with regard to the growing importance of plastics and biocompatible materials.



Picture left: sliding sleeve – hard turning flanks
Picture right: Capto holder with bolted CBN insert.

REAMING WITH HIGH PERFORMANCE

The DR reaming system extends our tool range in the direction of precision machining.

Precision machining of bore holes from diameter 11.9 (0.469") to 100.6 mm (3.961")

For precision machining of bore holes, which is frequently the last in a long sequence of machining operation, process reliability is mainly decided by the choice of reaming tools. As compared with conventional reamers, our patented DR reaming system sets new standards here as its extremely stiff reaming inserts absorb the radial forces produced during reaming without distorting.

The many DR variants make adaptation to the respective reaming task easier.

New cutting edge width provides benefits

Evaluation of numerous tests with commercially available reaming tools led to development of cutting elements with a previously unusual width for reaming inserts of only 4.3 mm (0.169"). The attachment and positioning of the narrow carbide or cermet cutters on the base carrier is performed using a precision-ground short conical clamping where the non-yielding part sits in the cutter and the outer taper is placed on the tool shank. The outer taper is designed so that it deforms elastically when tightening the cutter. This simple and precise clamping process guarantees consistency of concentricity of < 3 µm. Tolerance combinations of the interface determined exactly using the Finite Elements Method (FEM) enable almost unlimited cutter replacements without significant wear at the interface.

Precision in every respect

In addition to an exactly dimensioned bore hole and precision finished surface, precise cylindricity and roundness should be achieved by reaming. These process requirements are fulfilled by the System DR with its many variants which is unique on the market.

Cylindrical reaming insert holders made of steel or carbide are available for bore holes from 11.9 (0.469") to 35.6 mm (1.402") diameter. Depending on the application, they can be shortened to the required length. Shanks made of carbide provide maximum stability as they exhibit virtually no deformation and provide a vibration damping effect on the reaming process. A hydraulic expansion chuck developed jointly with the Schunk company enables the µm-exact adjustment of the concentricity and its damping characteristics positively influence the machining process.

The tool shanks for bore holes from 35.6 (1.402") to 100.6 mm (3.961") diameter have an integrated adjustment or alignment interface which enables optimum tool implementation with extensions as well as in the direct holder.

An internal coolant supply is standard for all shanks, whilst purpose-designed shanks for reaming either blind holes or through-bores up to 35.6 mm (1.402") diameter are available.

The DR reaming system is described in the information flyer 14/09.

Many variants and combinations

Coated and uncoated cutting materials both in fine grain carbide as well as in Cermet are also available for the precision machining on bore holes from 11.9 (0.469") to 100.6 mm (3.961") diameter. In addition to numerous cutting geometries adapted to the application case, three chamfer angles for reaming through-bores and blind holes and two for through-bores are available.
In combination with various coatings, the optimum combination of substrate, geometry and coating can thus be selected for practically every reaming task in order to achieve an efficient, technically faultless result for machining bore holes.

Impressive time saving

Coated fine-grain carbide or Cermet grades in combination with the stiff toolholder system and cleverly thought out geometry enable cutting speeds and feed rates which are exceptional for reaming. If you regard reaming as slow in comparison with milling, the following cutting values of the System DR demonstrate the opposite.

Workpiece:
- tempered steel 42CrMo4, No.1.7225, tensile strength R_m ~800 N/mm²
- bore hole diameter 28 H7
- bore hole length 40 mm (1.575")

Reaming insert:
- HL3H coated carbide

Machining data:
- cutting speed v_c = 180 m/min.
- speed n = 2046 rpm
- feed rate per tooth f_Z = 0.18 mm (0.007") per tooth
- number of teeth of the reaming insert Z = 8
- feed rate per revolution f = 1.44 mm (0.057") per revolution
- feed rate f = 2946 mm (115.984")/min

Primary processing time:
- Tc = 0.92 s/bore hole including safety distance 5 mm (0.197")

The DR tool system enables the reaming of bore holes with the smallest use of cutting materials efficiently and precisely at maximum speed. The efficient use of carbide or Cermet guarantees the reduction of costs per bore hole.

HIGH-FEED MILLING WITH SYSTEM DAH

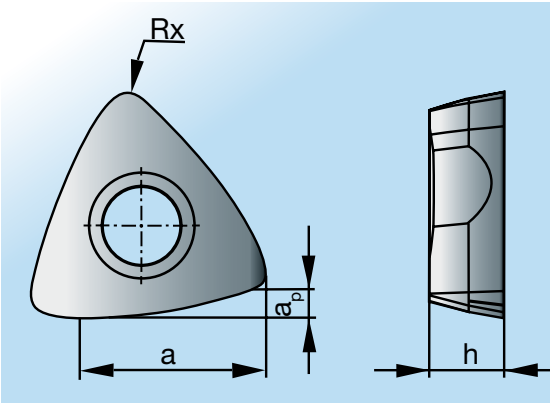
High feed rate milling cutter system DAH.

Removing high chip volumes efficiently

Innovative solutions based on time and cost saving tools are always in demand, particularly in difficult economic times. High-feed milling with our System DAH provides an impressive response to this requirement.

High chipping time capacities due to high-feed milling

The high chipping time capacities mainly required in tool making and mould making place onerous requirements on the stability and tool life of the tool.



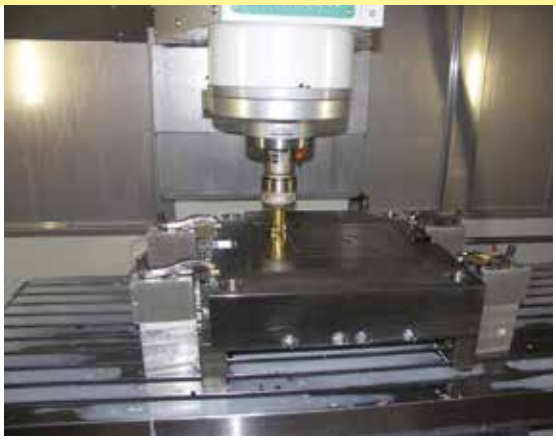
Indexable insert for the system DAH.

Combining skillful tool selection with the high-feed milling process strategy allows these requirements to be met, deriving significant benefits from high cutting depths at low feed rates in comparison with conventional milling.

As the high-feed mill cuts on the face side, the load is directed in the axial direction and the spindle is mainly under pressure. Shear forces are relatively low. Improved vibration control allows the tool to absorb very high loads using usual tooth feeds of 1 mm (0.03973") per tooth, comparing favourably with the relatively low cutting depths of 0.5 (0.0197") to 0.8 mm (0.0315") for conventional tools.
HORN DAH milling cutters provide significantly better values. Their special cutting geometry enables cutting depths up to 1.2 mm (0.0472") and thus a clear distinction to many competing tools.

System development from the process analysis

A key feature on the three cutting edge indexable insert developed for the DAH milling system is the extremely complex cutting geometry. The very large radius on the main cutter results in a soft cut which



The 230 x 250 mm (9.055" x 9.843") pocket of an injection moulding tool is first rough milled dry (left picture) to 5 mm (0.197") and then rough milled wet to 44 mm (1.732") depth (right picture) with a 32 mm (1.26") diameter DAH milling cutter.

ensures an even distribution of the chipping forces and enhances tool life. A smaller cutting radius on the inner side provides easy and fast plunging, whilst a primary and secondary relief angle results in a stable wedge angle and optimum cutter stability. The insert is available with the SA4B substrate already proven for the DA System. Together with the optimum combination of cutter geometry and coating, maximum tool life and efficiency are achieved.

Numerous variants for a wide range of possible applications

The milling cutters are available in four diameters: Ø 20 mm (0.787") with 2 indexable inserts, Ø 25 mm (0.984") with 3, Ø 32 mm (1.25") with 4 and Ø 40 mm (1.575") with 5 indexable inserts. As well as end mills with Weldon toolholder for reliable torque transmission, industry standard threaded connection versions for MD toolholders analogous to the DA System are available. All milling cutters have internal cooling as standard and the cutter bodies are TiN-coated for protection against corrosion and adhering chips.

With these features, the DAH milling cutters provide the best prerequisites for machining steel, cast iron, stainless steel and aluminium. We recommend the following machining parameters for this:

Material	Cutting speed v_c m/min	Feed per tooth f_z mm/tooth (f_z "/tooth)
Steel, low alloy	200-300	up to 2.2 (0.087")
Steel, high alloy	250	up to 2.2 (0.087")
Cast iron	320	up to 2.5 (0.098")
Aluminium	1.500	up to 3 (0.118")

The main application area of the DAH milling cutters is rough machining with high material removal in a short time. In doing so, the milling cutters also show their versatility and strength for face milling, pocket milling and milling by circular interpolation. It must only be noted that a cutting corner radius of 2 mm (0.079") must be programmed due to the cutter geometry which results in maximum excess material of 0.83 mm (0.033") in the corner.

Practical use demonstrates the performance potential

The information flyer 08/09 gives information about the most important data of the System DAH.

The first practical results of the new generation of milling cutters are impressive. For the face milling in material 1.2767 with a 20 mm (0.787") diameter DAH milling cutter, the tool life in comparison with a competing tool with the same cutting parameters could be doubled. The tool shows itself to be just as impressive for the machining of stainless steel No. 1.4539. With a cutting speed v_c = 160m/min, a feed rate of 0.4 mm (0.0157") per tooth and a cutting depth of 1 mm, this resulted in a machining time of 52 minutes. The competition needed 25% more time. The DAH milling cutter also showed its strengths with a chipping time capacity of 114 cm^3/min for the dry and wet machining of a pocket in an injection moulding tool. With v_c = 250 m/min, f_z = 1.2 mm (0.047")/Z and ap = 0.7 mm (0.027") the time for the excavation of the rectangular pocket was 65% less than for a competing make.

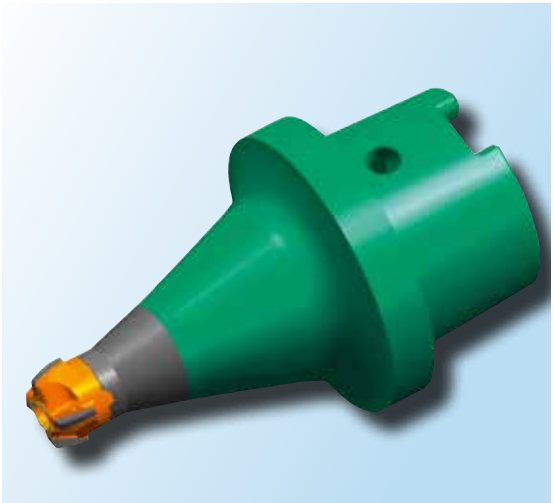
MILLING OF BALL RUNNING TRACKS IN CONSTANT VELOCITY JOINTS

Example presentation of the milling of the ball tracks. The HORN tool plunges from below into the inner part of the bell-shaped case and mills the six ball running tracks.

Hard milling substitutes for grinding

Automotive drive shafts must fulfil stringent requirements for efficiency, quality and cost. Automotive manufacturers and their suppliers have addressed these requirements related to machining of ball running tracks in CV joint assemblies using our milling tools.

On vehicles with front wheel drive and/or independent suspension, the drive shafts must compensate for length and angle changes for the efficient transmission of power and torque to the wheels while maintaining constant rotational speed. A modern CV joint comprises an inboard plunging joint which compensates angle and length variation at the differential, connected by the shaft to a hub mounted joint that allows angular variation.



Example of CBN tipped insert and shank for ball track milling.

The challenge for manufacturers is to develop and manufacture a high quality, reliable assembly at minimal cost. The plunging joint usually consists of a bell shaped outer part and an inner hub, mechanically connected by ball bearings. A cage which usually holds six balls and keeps the balls on the joint outer side secures their movement to each other. The running tracks for the balls are incorporated on the inner side of the hot forged bell blank and the outer surface of the hub. They are shaped elliptically, providing rigid four-point support for the connection between hub and outer part. Three righthand and three lefthand spiral running tracks guarantee the required mobility.

New machining technique looked for

The ball running tracks have been ground on special machines for many years due to the surface hardness of the bell-shaped outer part – depending on the part, this is between 57 and 63 HRC. Nevertheless, the growing process reliability and performance of hard milling resulted in the consideration of replacing the grinding with machining tools using customised hard milling cutters. HORN process specialist,

Thomas Kühn, working with his colleagues Thomas Peter and Uli Allgaier, recommended specially developed mills with three or four cutting edges for the machining of the ball running tracks. The tooling was developed to mill six running tracks in the bell for 600 to 800 parts per shift.

HORN special tool for hard and soft milling

The tool consists of the main body with toolholder, the brazed carrier and the milling head with the indexable inserts bolted to it. The three or four cutting edge inserts are CBN tipped. Thanks to the basic concept of the tools and the simple insert replacement, carbide indexable inserts can also be used on the same main body to satisfy a lesser requirement for soft machining. Cooling for soft milling is performed using minimal lubrication or air; however dry milling is also partially performed. By contrast, hard milling is only performed dry or with air cooling.

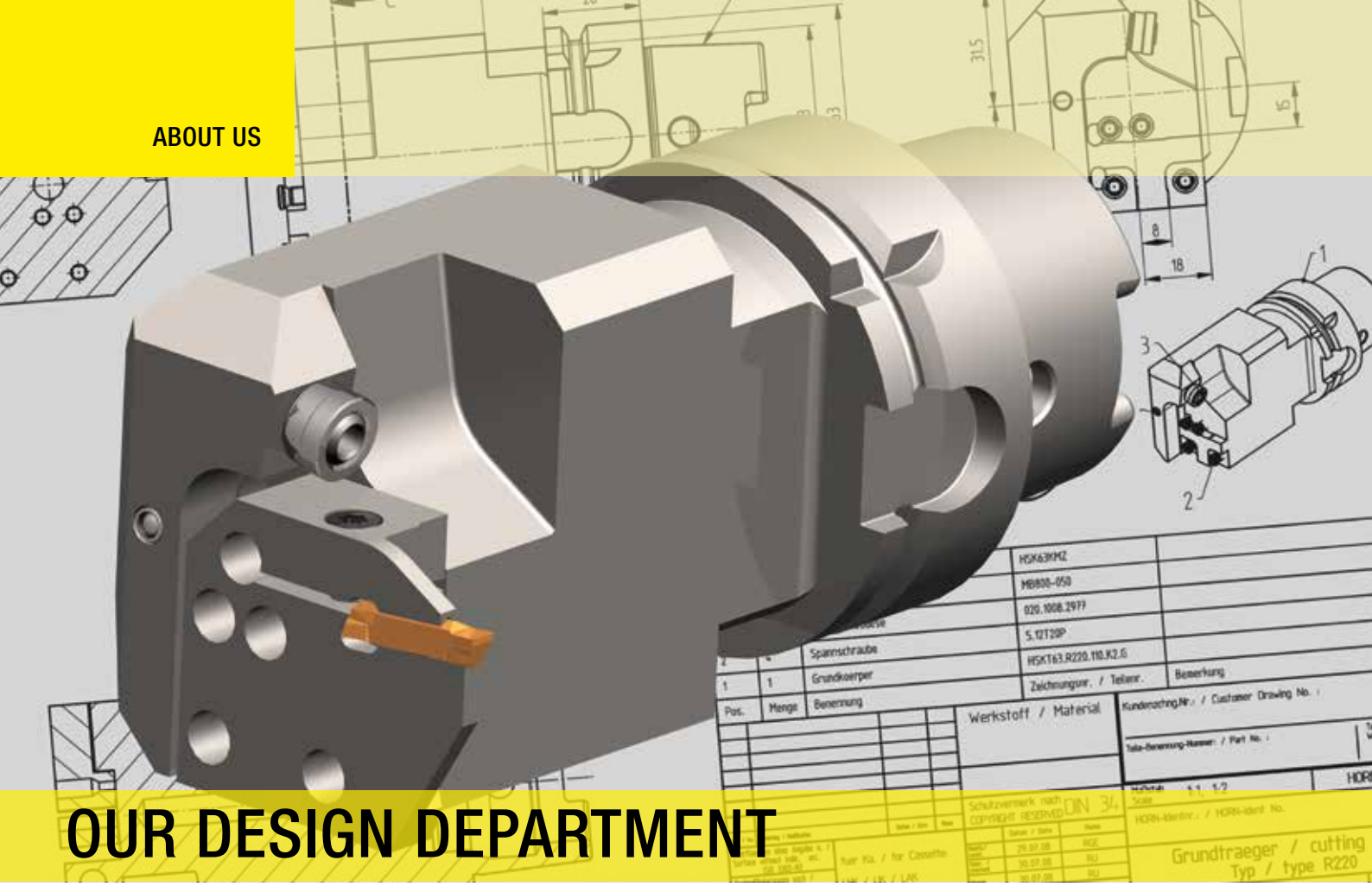
The forged blanks are clamped on a special machine with the bell opening facing downwards. The Horn tool then plunges from below at an angle into the bell and mills the ball running track to the form determined by the CNC program. The movement process is interpolated by the controller in accordance with the ball running track bevel.

Process change meets expectations

A cutting speed v_c = 200 to 250 m/min and a feed rate f_Z = 0.1 (0.0039") to 0.15 mm (0.0059") per tooth are usually used. The cutting depth a_p = 0.2 (0.007") to 0.3 mm (0.0118") thereby. The requirements such as surface roughness and diverse tolerances are best achieved with these values.

Our tools satisfied the end user's expectations over several months of use. The tool life is two to three shifts whilst process reliability has proved to be particularly impressive. Very high savings in the "drive shaft manufacture" process chain could be achieved by the changeover from grinding to milling thanks to the reduced machining time and the simpler clamping concept and elimination of the costs associated with abrasives effluent disposal.

Our specialists from the Automotive Group: Thomas Peter, Technical Support and Sales, Uli Allgaier, Technical Support and Application Engineer, Thomas Kühn, specialist for the manufacture of ball running tracks (from left).



OUR DESIGN DEPARTMENT

3D model and the 2D drawing derived from it.

Creativity and efficiency are not contradictory

Early recognition of customer requirements is a critical factor in any company's success. This information must be converted by the Design Department into economically viable tools and projects so that we can react quickly. Therefore, the effectiveness of this department determines our standing as a technology leader.

Twenty seven engineers, technicians and technical draftsmen in the Design Department (assigned to Markus Kannwischer, Technical Director and member of the management board) are dedicated to realising the requirements of customers and developing suggestions from our field-based employees. The department managed by Hans Schäfer comprises three groups which each process specific tool types.

Group 1, group leader Karl-Heinz Hertkorn:
Triple cutting edge tools, stationary and turning.

Group 2, group leader Heinz Thurau:
Mini tools, circular milling cutters, tools bolted on the face side, peeling tools, Type S 117, solid carbide tools.

Group 3, group leader Bernd Ruch:
Supermini® tools, two-cutter and single cutter tools, stationary.

From the idea to the three-dimensional model

Orders or enquiries pass through two different processing paths in the technical office. Customer orders recorded by the Sales Department are realised in a 3D model and a 2D drawing and forwarded to the production department after approval by the customer. Enquiries coming from field-based employees – usually with sketched design and machining proposals – are checked for their feasibility using CAD and then passed on to the Sales Department for the preparation of a quotation.

All design tasks are recorded in the SAP enterprise software. For example, the Sales Department can see at any time which group and which designer is working on which task, and its status.

Knowledge-based engineering

We examine the strength and load capacity of tools using the FEM method. We use NX from Siemens PLM for the modelling and drawing production of the tools, inserts and holders. This so-called knowledge-based engineering uses models which already contain de-

The management team of the Design Department (from left): Karl-Heinz Hertkorn, Bernd Ruch (sitting), Heinz Thurau, Markus Kannwischer, member of the management board, Hans Schäfer, Department Manager.

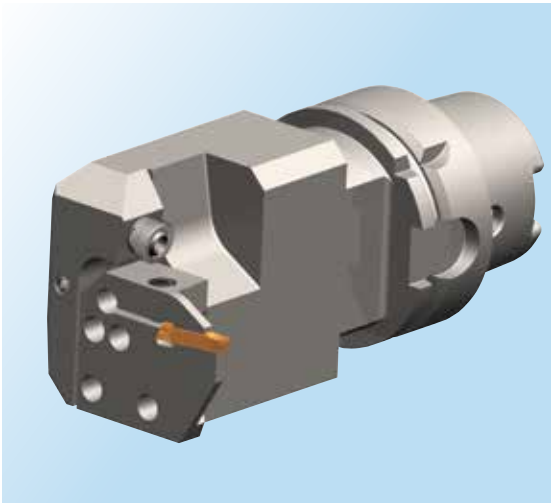
sign knowledge in the form of rules and checks. For example, for the selection of a specific insert seat and type. Other factors such as clamping element, relief cuts, clamping bolt and the parts list are determined automatically by the CAD system. These functions and the data stored in the computer of available tools, standards and our technical expertise accelerate and simplify the drafting, modification and changing of models and drawings. The relevant data for the variant design can also be queried interactively or read in from files.

The three-dimensional CAD model also supports our manufacturing operation for the CAM programming of its NC machines and measuring machines. In order for the linking of CAD and CAM data to function without errors, the designers must specify all geometry data including tolerances so that no misunderstandings can occur during programming of the machining processes. The structure of the CAD model depends on the current manufacturing technologies. Installation of our new turning and milling centres, for instance, demanded a revised structure of the CAD model with additional information.

Creativity and efficiency

In 2009, the Design Department processed approximately the same number of orders as in the 2008 boom year. However, the growing number of special tools and variants required a significantly greater drawing and design complexity which we aim to address with new appointments in the current year.

If we define the design hours as 100 percent, the share for the production of the 3D models is around 45 percent. The remaining time is accounted for by the (still) necessary derivations of 2D drawings for the machine operators and the customer drawings. Reducing the effort for the production of the manufacturing drawings requires that various work tasks for the completely automated process – for example measuring and inspection – must be recorded in the 3D models. In this way, many parameters currently on the drawing will become unnecessary, allowing production to react significantly more quickly and flexibly. In order to be able to react quickly to the requirements of our customers and to minimise the time, we see this rationalisation objective as an important element to reduce the lead time for delivery of a tool.



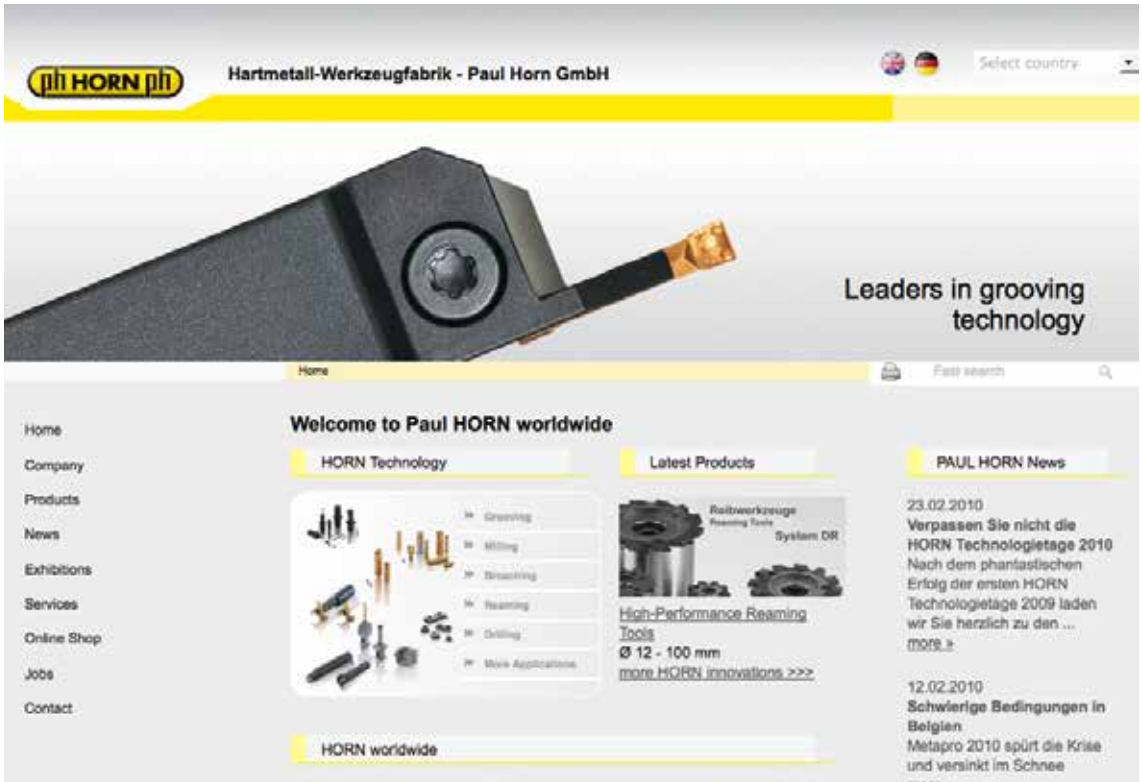
3D model of a special HSK63T grooving tool with modular option.

NEW HORN eShop

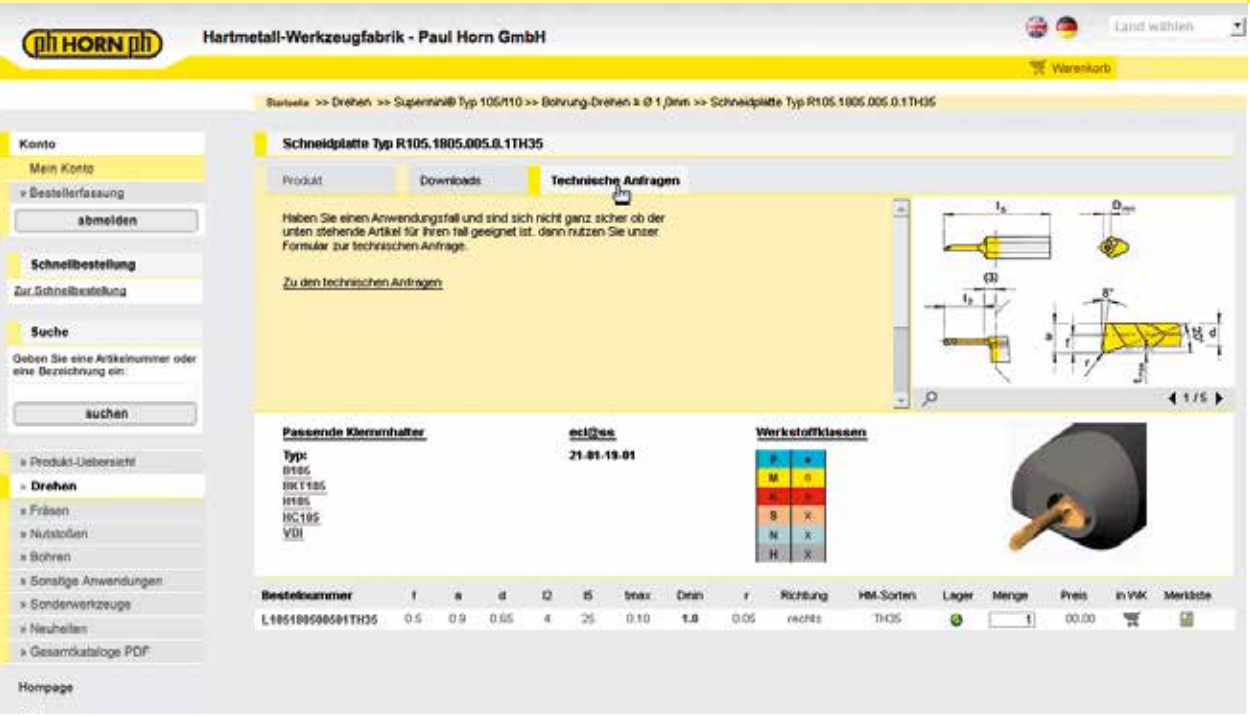
New HORN eShop goes online

Online procurement is increasingly being used by industry and HORN tools have been available for purchase via our online portal for a long time. Our new eShop, with its additional functions, provides further possibilities to streamline the process and make tool procurement more efficient and faster.

Customer satisfaction and service have had top priority for this project so the new web shop offers simple handling and user-friendly menu navigation. The benefits for our customers are obvious: in a clearly designed and easy to use online portal, you can not only select the products but also learn everything about their availability, order and delivery status and all of this round the clock in real time. The order can



Our new website – online since March 2009.



At a glance:
Technical information about our products.

be composed both from the online catalogue as well as directly in the shopping cart and via a fast entry screen. We have also implemented an upload function which allows the user to put together orders created offline with the corresponding product data.

Fast entry and offline orders

The fast entry screen provides significant benefits in urgent cases. Order data such as the HORN item number, the customer material number and order quantity can be input directly there. Additional information per position for more precise allocation of the order positions can be stored in the "Commission" field. Order data from the materials management or purchasing system of the customer can be loaded directly into the HORN eShop using a special upload file without having to register this a second time in the shop. Data input errors are avoided by detection and omission of duplicate data entries.

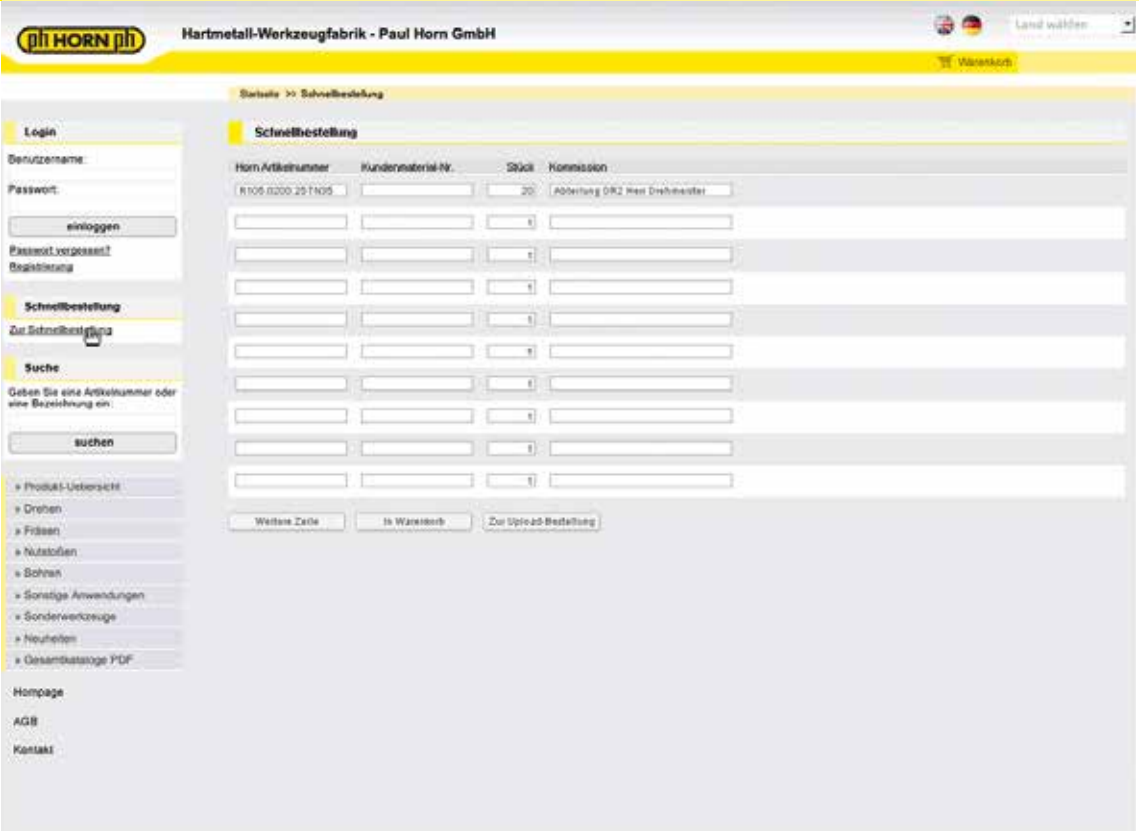
Customised customer services

The special features of the new eShop include the display of customer-specific conditions and the calculation of the respective prices of the products stored in the shopping cart. If the item is stored by us, the customer can also find the required product by entering the customer item number. A series of templates are also available for repeat ordering or the management of customer-specific assortments. Documents such as orders, deliveries and invoices can be retrieved in the "My Account" area. "Our customers should be able to order both standard products and proven special solutions as easily and as quickly as possible. Moreover, the capability to retrieve status and history of orders, invoices and deliveries online will increase the usefulness of, and customer enthusiasm for, our eShop", is how Lothar Horn, Managing Director of Paul Horn GmbH, assesses the basic objectives and expectations.

There are several ways to the appropriate tool

Indexable inserts for grooving, milling and other machining including associated holders and shanks; all components are easy to find via intuitive navigation and convenient selection functions for the specification of the respective sizes or machining tasks. There are diverse filters 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. As an additional service, we provide a CAD download per item in the form of DXF and STEP files.

Fast ordering with upload function for Excel order templates created offline.



My Account Area

Using the new "My Account" area, the respective eShop administrator of the customer can create and manage several users with special user roles and levels of access. For example, special users can be defined who can only download CAD data or others who can only retrieve information about orders and deliveries. With the extended scope of services, the online shop has been upgraded to a customer-oriented and efficient, electronic purchasing system. Currently customers from Germany and Belgium can access more than 15,000 tools and components for turning, milling, broaching, reaming and threading.

The benefits of the new HORN eShop at a glance

- meets the growing requirements for procurement
- streamlines the processes
- tool procurement is even more efficient and faster
- easy handling
- user-friendly menu navigation
- current information about availability, order and delivery status
- available round the clock
- fast entry screen
- upload function for order data of the customers
- display of customer-specific conditions
- convenient selection functions
- optimised find functions

The VK5 Team:
Jürgen Maier, Iva Radic,
Sibylle Lehnert,
Richard Walter (from left).

Sales Department VK5

The centre of Baden-Württemberg, Hessen, Berlin and the new federal states – without the Western Mecklenburg-Vorpommern – are the sales territories of VK5. In addition to some large companies, the customer profile is particularly marked by small and medium size companies.

The diverse production ranges of these companies – which are mainly active in mechanical engineering, medical technology and as automotive suppliers – require the technical knowledge and flexibility of the VK5 team and its seven field-based employees. These analyse the requirements on-site and provide the data with their recommendations and reports for the preparation of the quotation. Requirements which can only be met using special tools are previously discussed with our technical personnel – from the development to the design to the production. The associated measures such as the production of quotation drawings, the description of the tool concept and other factors are arranged and coordinated by VK5.

The order processing, especially of products in stock, is the area of responsibility of Sybille Lehnert and Iva Radic. Both ladies maintain the customer contact by telephone or email and ensure the smooth exchange of information, from the enquiry to the after-sales service. Ms. Lehnert, a trained industrial clerk, has been employed in our company for 20 years. Her hobbies include world tours, jogging, cycling and plant cultivation in her own home. As a trained foreign language correspondent for French and English, Ms. Radic who has been employed by us for four years makes learning further languages one of her hobbies. She also loves city tours, reading and different fitness activities.

Jürgen Maier is responsible for the technical support, preparing quotations and the calculation of special tools. The mechanical engineering technician with the additional qualification for technical business management has been employed by us for twelve years. In his leisure time, he maintains different sporting activities and likes to use his holidays for travelling nationally and abroad.

Richard Walter as manager of VK5 is mainly responsible for the commercial activities in his group together with management and coordination tasks. The mechanical engineering technician started his activities in VK1 twelve years ago. In his leisure time, his interests are hiking and cycling and his bees, the buzzing honey producers.

IN THE HEART OF EUROPE WITH DEDICATION

From the hotel room to the Horn Sales Partner in the Czech Republic and Slovakia

The Czech Republic and Slovakia emerged from the division of Czechoslovakia in 1993. Both countries have been members of the European Union since 2004. After centuries of eventful history at the flashpoints between East and West with all their effects on culture, language and economic development, they are today important members of the EU in the centre of Europe. SK Technik spol. s.r.o. has been our representative there for 15 years.

The offices of SK Technik are located in the centre of Brno in a representative building from the year 1909.

Successful in the market for 15 years

Dr. phil. Jaromira Kirstein, Dipl. Ing. Ottokar Kirstein and Dipl. Ing. Milan Simak founded the trading company SK Technik spol. s.r.o. in Brno at the beginning of 1995. A hotel room in Brno served as company headquarters in the starting phase of the young company. With growing success, the requirements for supporting the customers also increased; the customer base ranges from the two-man business to the large enterprise. Therefore, the company purchased its own premises in 1998 which met the market position of the company and the increasing number of employees. In order to satisfy the local requirements of the Czech Republic and Slovakia an office was established in Pilsen in the Czech Republic in the year 2000 and two years later an office was opened in Cadca to service the Slovakian market.

Fifteen years after its founding, SK Technik with its headquarters in Brno is presenting itself as a distribution company with modern product and distribution structure. The home offices of its field-based employees guarantee the important customer proximity with short communication paths. SK Technik has been presenting the current sales portfolio and its competence as a distribution company at the annually occurring

The SK Technik team. Standing from left to right: Michael Stryk, Roman Bukovy, Ludek Dvorak, Jiri Jaspar, Dusan Chodur, Milan Simak, Karel Sustr, Michal Konecny, Jiri Kubat, Milan Dolezal, Miroslav Vecera. Sitting from left to right: Martina Pantuckova, Monika Blahova, Jarmila Puklova, Aneta Konecna.

International Mechanical Engineering trade fair MSV in Brno since 1995.

The employees: heart and pulse of SK Technik

As with every company, the employees at SK Technik also decide about the functioning of the organisation and the contacts to customers, interested parties and suppliers. The in-house ladies also have a decisive share. They co-ordinate enquiries from customers with the suppliers, pass on the results and provide short communication paths due to the close collaboration with the sales partners and a business process which should satisfy the customers from the initial contact to the after-sales service. Jarmila Puklova, Martina Pantuckova and Aneta Konecna work in the Commercial Department. Ludek Dvorak is responsible for marketing and machine service. He is supported in this task by Monika Blahova. Ludek Dvorak is also responsible for IT and telecommunications. Milan Dolezal and Jiri Jaspar (in addition to his Brno sales territory) are responsible for the internal technical service and sales support. Michal Konecny is responsible for the logistics with purchasing and shipment.

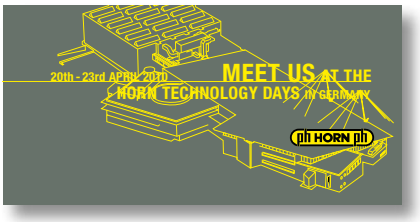
Six field-based employees work on the market, all of them qualified sales engineers. Moravia and the bordering Slovakia are the territories of Miroslav Vecera. Roman Bukovy supports Slovakia, Michal Stryk looks after North Moravia and North Bohemia and Karel Sustr works on West and South Bohemia. Jiri Kubat is responsible for the sale of machines and components in all territories. The field personnel are supported by our Technical Director, Milan Simak. The Managing Director, Dusan Chodur, is responsible for the commercial and technical administration requirements.

Quality products for machining

The guarantors of the recognised market presence are 23 trade partners, mostly family businesses, who SK Technik has been closely collaborating with for many years. All trade partners are technology pioneers and leaders in their market segment. Together with their competence, the objective of the three company founders to provide products with comprehensive service for complex and efficient solutions can be realised. With the wide sales portfolio of tooling, clamping material, accessories for CNC machines, tool grinding and precision machining machines, the sales company is considered as a competent business partner by its customers. Thanks to the product range, he product and market knowledge of our Czech colleagues and the close collaboration with the sales partners, SK Technik can also provide solutions beyond the standard applications at short notice for different machining tasks and production alternatives which help the customer to strengthen his competitiveness.

SK-Technik presents its wide sales portfolio every year at the International Mechanical Engineering fair MSV in Brno.

Theory and/or practice – our Technology Days give both



Please refer to our invitation for further information.

Cost-saving tools, efficient process technology, innovative machining approaches, the newest products and trends and developments for the tool and its environment are the essential themes of our Technology Days.

You decide whether we can build on the great success of our event in May last year. We have selected the themes of our **Technology Days from April 20 - 23 in Tübingen** so that you obtain basic information about current daily tasks as well as information about future developments. The introduction to the topics is performed using technical presentations; what is heard is then implemented in practice on our machines.

We have prepared the following **technical presentations** of 30 minutes each for you:

Grooving, grooving/longitudinal turning, parting off
Chip shape geometries, their tasks and applications

Bore hole precision machining with the DR reaming system
Design and technical application features of our patented reaming system

Machining stainless steels on CNC lathes
Influences on a reliable process and cost-optimised machining

Machining HRC 45 to HRC 70 without problems
Hard machining from the groove to the free-form surface. Substitution of grinding and erosion work

Threading – precise and cost-effective
Thread turning, milling, whirling. Process benefits and applications.

Bell cutters, combination and moulding tools
High precision, partially modular tool systems for series production

CNC machining, global developments in machining technology
Trends and requirements for machining processes, machines and tools

Machining on multi-spindle machines
Concepts for cost-effective series production

During tours through our production, you will see flexible and highly automated production processes for small series, one of the world's largest and most modern grinding shops for carbide tools and our environmentally-compatible and efficient energy concepts.

We look forward to your registration which is possible immediately at **www.horn-technologydays.com**

Products like the DAH high-feed milling cutter, presented in new exhibition showcases, opened up very promising contacts.

Review

12th trade fair for production technology, January 27 - 30, 2010, Hamburg

The trade fair for production technology strengthens its reputation as the sales and contact platform in the North.

Around 12,000 technical visitors were able to assess the product ranges of the 400 exhibitors over the four days of the exhibition. The successful alignment of the exhibition with the manufacturing profile of North German key industries was also reflected in the structure and quality of the technical visitors .

The HORN company exhibited on its own stand in the Hall A4 for the first time. Our innovations and recent developments such as the sintered Mini inserts, the System 100 parting off tools for cutting widths up to 12 mm (0.472") and groove depths up to 65 mm (2.56"), the DR reaming system and the DAH high-feed milling cutter particularly interested the visitors with respect to new machining strategies, process reliability and cost reduction.

According to the assessment of the VDMA, Landesverband Nord, the Nortec has more than met expectations. Most companies expressed themselves very satisfied with the contacts and 86% of the visitors rated their exhibition visit with "excellent" to "good" – results which we can confirm.

NORTEC

12. Fachmesse
für Produktionstechnik
27.–30. Januar 2010
www.nortec-hamburg.de

Metapro, International Trade Fair for the Metalworking Industry, February 9 - 12, 2010, Brussels

Not only the problems of the automotive industry and mechanical engineering in Belgium dampened the expectations for the Metapro; the Winter weather also made the journey difficult for the visitors.

The largest exhibition in Belgium for mechanical engineering and tool making is held every two years on the Expo grounds at the feet of the Atomium. After the successful figures of 2008, this year with 143 exhibitors on 8,900 m², about 17% fewer companies exhibited their products. Only one Dutch company and ourselves were represented as tool manufacturers. Together with Siemens, we were also the only manufacturers with our own stands representing German industry.

Prof. Dr. Bettzuege, the German ambassador to Belgium visited us on the first day of the exhibition. He underlined the importance of the Belgian market for Europe and congratulated us on the exhibition participation.

Our 88 m² stand open on three sides clearly stood out from other stands. The new butlers and the theme boards with their application videos were particularly well received by the visitors. 10,000 visitors gave the exhibition management a still satisfactory result. Our summary is somewhat more positive.

METAPRO 2010

Ambassador Prof. Dr. Bettzuege (red tie) and an employee of the German Embassy (with hat) on our exhibition stand. Our stand personnel from left to right: Andreas Jenter, Roger Kasper, Birgit Müller, Harald Haug, Andreas Vollmer.

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HORN is at home in over 70 countries across the world

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