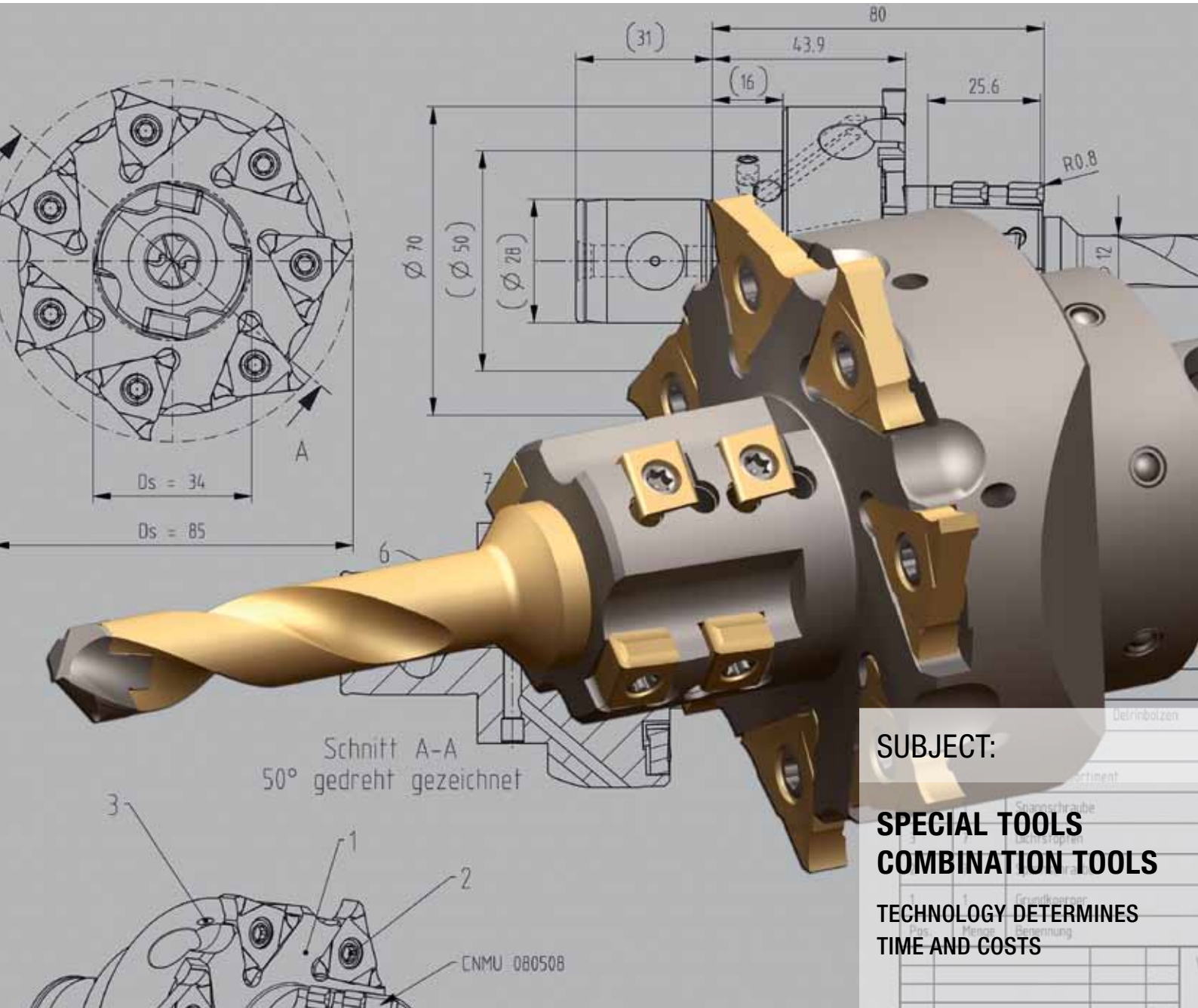




# world<sup>of</sup> tools

## HORN'S CUSTOMER MAGAZINE



SUBJECT:

**SPECIAL TOOLS  
COMBINATION TOOLS**

TECHNOLOGY DETERMINES  
TIME AND COSTS

- Interfaces for HORN tools
- Innovations for EMO
- Supermini®
- Coating centre

Wechselkopfbohrer  
DD120.L.1648.030

Ausführung: Rechtsschneid





Dear Readers,

The entire HORN team can be rightly proud of the response to our Technology Days. But what I was especially pleased about was the comments from many visitors after touring our production facilities: HORN stands for quality. When we add to this impression the very well received mix of theory and practical applications, we see confirmation for our belief that only powerful tools and the corresponding services offer users real improvements in production. Besides the very large depth of in-house manufacturing, for us this includes all services connected with the tool, from development to sales to service.

Our customer magazine offers you a brief look into the many products developed under these criteria, such as those in the category "special and combination tools". For a long time now, we have expanded our "processing between the edges" to other high-technology applications, as we describe

under "Innovations and New Developments for the EMO". You can see these and other products in Hall 5, stand A42. The world's leading trade fair in Hanover will show trends in metalworking. We show how we deal with these trends with our hardware and wide range of tool-related services.

We look forward to talking to you.

Lothar Horn  
General manager,  
Hartmetall-Werkzeugfabrik Paul Horn GmbH,  
Tübingen



# world<sup>of</sup> tools PH HORN PH HORN'S CUSTOMER MAGAZINE

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Tool interfaces from our programme

- ① PSC (HORN-Capto)
- ② HSK, HSK-T
- ③ KM
- ④ VDI
- ⑤ SK
- ⑥ Square and round shank
- ⑦ Regofix



## INTERFACES FOR HORN TOOL SYSTEMS

### Precise clamping, fast changing

Whether using process-specific or more flexible machines, efficient machining is not possible without a reliable tool holder and precise positioning of the cutter.

The variety of machines in which our tools can be used grows with the breadth of our tool programme for turning, milling, drilling, reaming and other cutting

processes. To meet these diverse requirements, we supply tooling systems as both standard and special tools, modular tooling systems with cassettes and in monoblock design, in various sizes and dimensions. All tools and tool holders distinguish themselves through their high quality, clamping security and reliability – characteristics that help you to optimise productivity.

#### Interfaces of our tools

- Tool holder with square shank
- Tool holder with round shank
- Machine-related tool holder
- VDI tool holder
- Short tool holder
- KM16 micro, Kennametal system
- HSK-T basic holder with cassette
- Collet chucks ER DIN 6499-A
- Polygon shank taper (HORN-Capto)
- HSK-A DIN 69839 for cutter heads
- HSK-A DIN 69839 system holder BH for Urma
- ABS Komet system for cutter heads
- SK DIN 69871 system holder Urma BT
- Arbour-mounted slotting cutter

Display of tool interfaces at our Technology Days.



## SPECIAL AND COMBI-TOOLS

### Technology determines time

With our special and combi-tools, complex workpieces can be processed in a single cycle. Their product-specific format increases productivity, raises product quality, reduces inspection effort and simplifies tool handling.

Increasing productivity and securing technological leadership is today also the basis for success in the global market. Our special and combi-tools make a decisive contribution to producing globally competitive products. The merging of processing operations in one special-tool insert or the combination of different inserts in one tool reduces tool changes, permits parallel working and helps achieve the old saying: 'Time is money.' **Technology determines costs.**

The pressure on our customers for ongoing innovation is reflected in the variety of our tools. Their features include multiple cutting operations united in one tool, extremely fine adjustment, integrated cooling for chip removal or design for minimal lubrication. All of these demand technological and design performance that ultimately serve one goal: reduction of cutting costs. Selected applications from various sectors illustrate why we claim technological leadership in this area.

#### Work process:

- Drilling with DD-drill Ø 12 mm (0.472")
- Milling of the inside contour with CNMU tangential inserts
- Circular milling of the inside groove with System 314
- Grooving of the axial groove and chamfering of the outside edge with axial groove inserts

#### Customer benefits:

- Tool magazine space saved in the machining centre
- Short cycle times
- Lower inspection effort
- High process reliability in serial production

### Examples of combination and special tools

#### 1 Task:

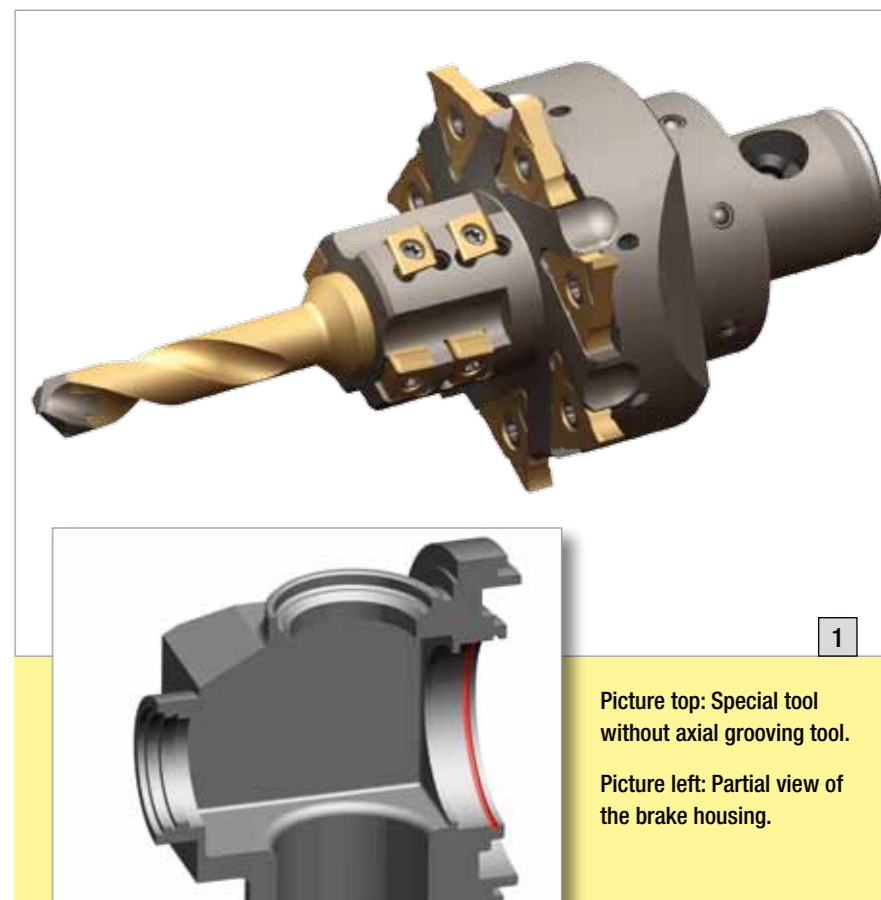
Processing of a brake housing made of GG25.

#### Customer instructions:

Only one tool, if possible, due to limited capacity in the tool magazine

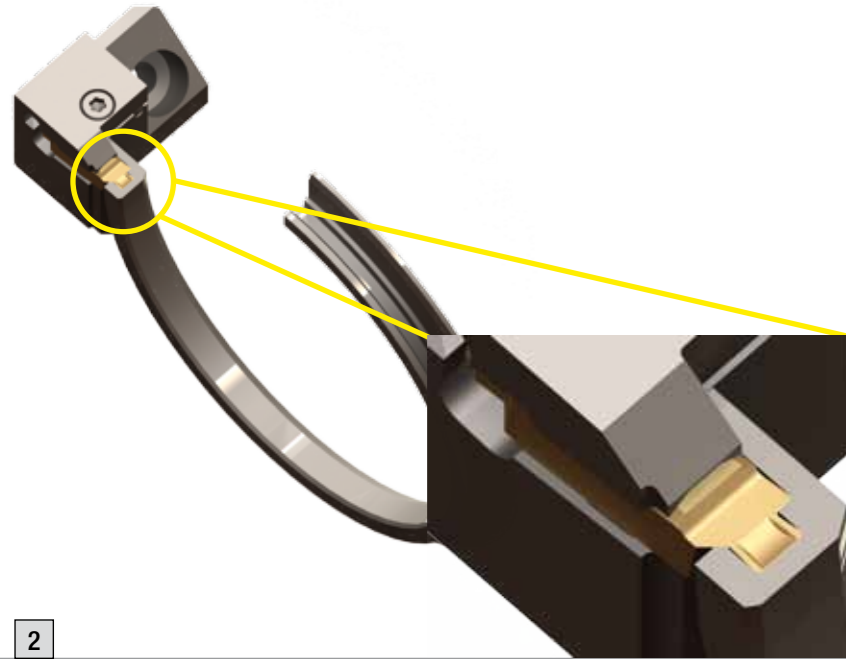
#### Solution:

Special tool with integrated axial grooving capability for four operations. Internal coolant feed.



Picture top: Special tool without axial grooving tool.

Picture left: Partial view of the brake housing.



2

Synchronizing ring with outside diameter 110 mm (4.331"), plunge depth max. 9 mm (0.354"). Profile grooving insert with ground geometry.

**2 Task:**  
Profile grooving in synchronizing ring for control sleeve, material 20MnCr5.

**Solution:**  
One profiled grooving insert for machining of three external features: turning of the shoulders, turning of the groove and generation of the outside chamfer.

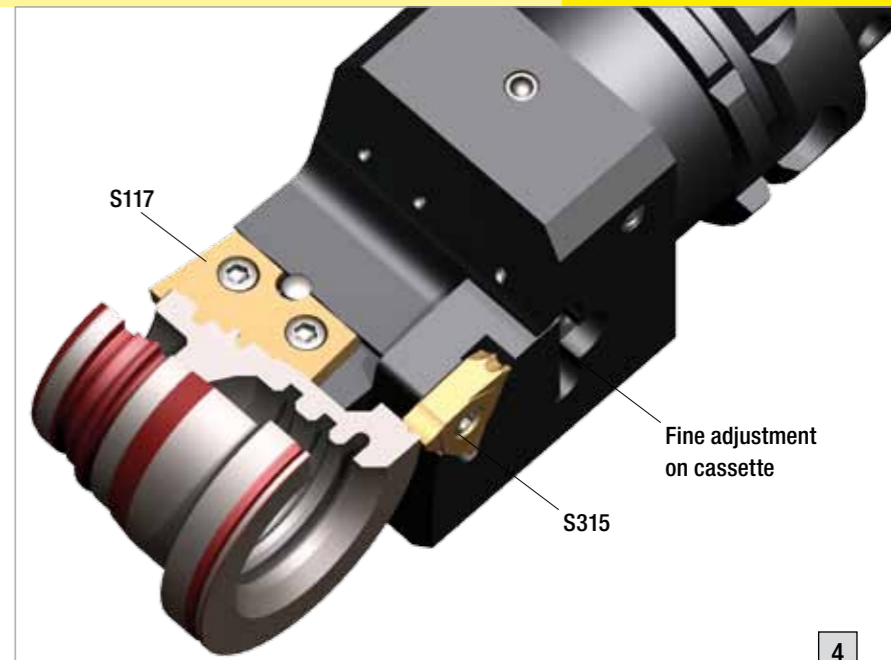
- Customer benefits:**
- high precision due to three form elements in a single profile grooving insert
  - Reduction of set-up time
  - Long tool life through use of the cutting edge over the complete width of the profile grooving insert
  - Shortening of processing time
  - More efficient manufacturing in large-scale serial production

**4 Task:**  
Plunge cuts of different forms and diameters in 50 mm-long turned parts (1.969") made of chrome nickel steel including chamfering of the outside contour.

**Customer benefits:**  
Diameter tolerance of all form and profile plunge cuts  $\pm 0.02$  mm (0.0008").

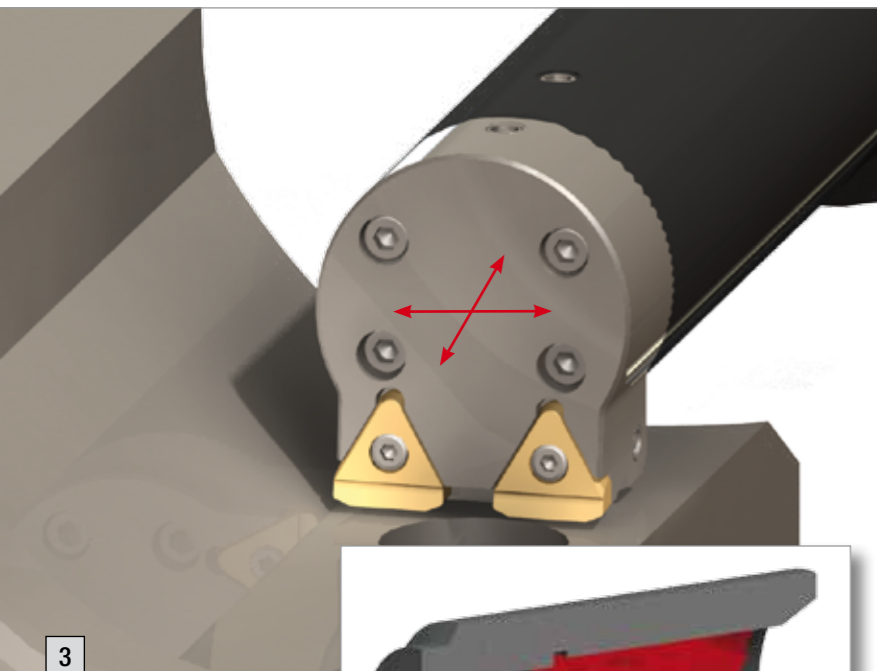
**Solution:**  
Special tool with form plunge cut insert S117 and form grooving insert S315, HSK-T holding fixture and internal coolant feed. The triple-edge, profiled form grooving insert is seated in a cassette and can be positioned relative to the cutting insert S117 in the  $\mu$ m-range.

- Customer benefits:**
- Parallel processing
  - High process reliability in serial production
  - Tight tolerances are maintained
  - Simple adjustment of the tools
  - Long tool life due to internal coolant feed and TH35-coating with high Al percentage



4

Special tool with finely adjustable form grooving insert.



3

Picture top: Two cutting edges permit staggered broaching and reduce cutting forces.  
Picture right: Cut through the component made of 42CrMo4.

**3 Task:**  
Generation of internal polygons in workpieces for the oil industry.

**Customer instructions:**  
Complete machining on a lathe with interface HSK 100. Max. dimensions of the inside polygon:  $l = 280$  mm (11.024"), key slot 180 mm (7.087").

**Solution:**  
Modular tool design with replaceable cassette, precision interface and internal coolant feed for broaching different profiles.  
Two inserts were arrayed side-by-side to reduce the cutting forces – the inside diameters are pre-milled – and produce small, easily rinsed-out chips. Lower cutting forces result from staggered broaching, first of the left and then of the right polygon surface, with an advance of 0.12 mm (0.0047").

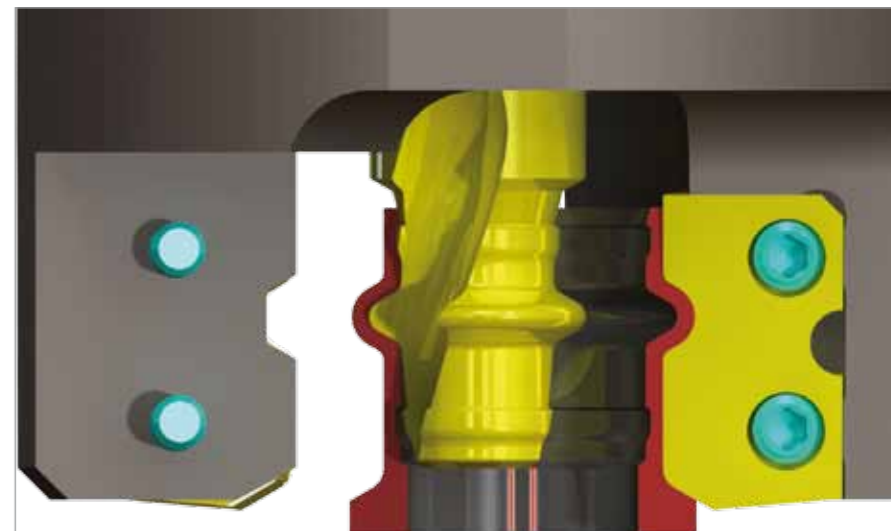
- Customer benefits:**
- Complete processing on one machine
  - Reclamping eliminated
  - Reliable manufacturing of polygon shapes of different lengths
  - Simple replaceable inserts

**5 Task:**  
Inside and outside machine of a connecting flange made of red brass. Wall thickness  $\leq 1.1$  mm (0.043").

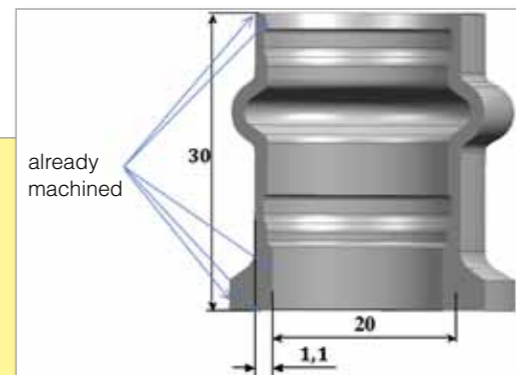
**Solution:**  
Bell cutter with profile insert S117 for outside machining and solid carbide shank cutter DS for inside machining. Its angle of twist and the blade angle of the profile insert allow a pulling cut with low pressure, which is essential for machining the small wall thicknesses. The steep spiral of the milling cutter transports the chips away from the component. The outside forms are cut one after another by setting the cutting insert.

**Work process:**  
The tool plunges centrally into the flange and then moves off-centre. The cutters for outside and inside machining come into action sequentially, and the workpiece is machined parallel on the opposite sides. The tool in action circulates once around the workpiece.

**Customer benefits:**  
The bell cutter's actions permit cycle times that cannot be achieved with conventional circular milling cutters.



5



Picture top: Inside and outside machining actions.  
Picture left: Flange with inside and outside contour.

# 100 MM (3.937") THROAT DEPTH SECURELY IN GRIP

## Reliable grooving and longitudinal turning

Cutting depth proved to be a production impediment in manufacturing rope pulleys and connectors. Our grooving tools removed this hurdle.

The Dutch company Heerbaart Jongman Metaal in Hengelo is a contract manufacturer known well beyond Holland; many companies worldwide use the expertise of this company, founded in 1994. A focus of the 20-employee company's business is on products for the petrochemical industry and rope pulleys for cranes.

### Rope pulleys weighing tons with high surface quality

The challenges are made clear by the manufacture of rope pulleys which weigh up to 7.5 tons. After welding they are tapered on the outside surface for weight reasons, then the central bore for the bearings is prepared, and then the running grooves are cut with ISO inserts. For rope pulleys above 1,000 mm (39.37") diameter, a die plate is also used. It finishes the groove profile after pre-grooving with the ISO insert to an average finish value  $R_a \leq 1.6 \mu\text{m}$ .

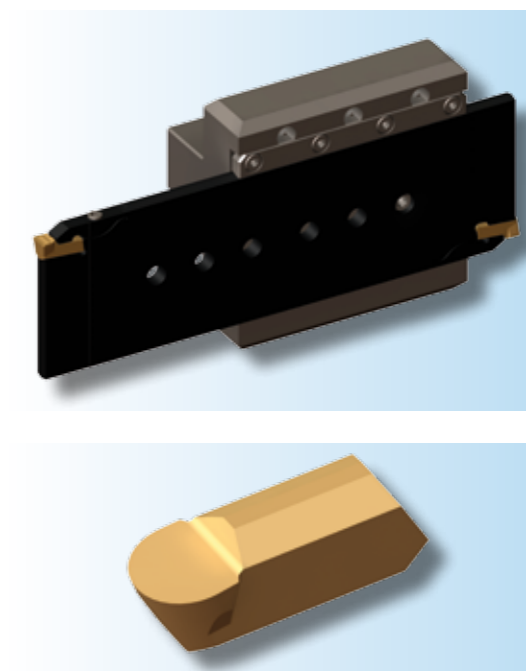
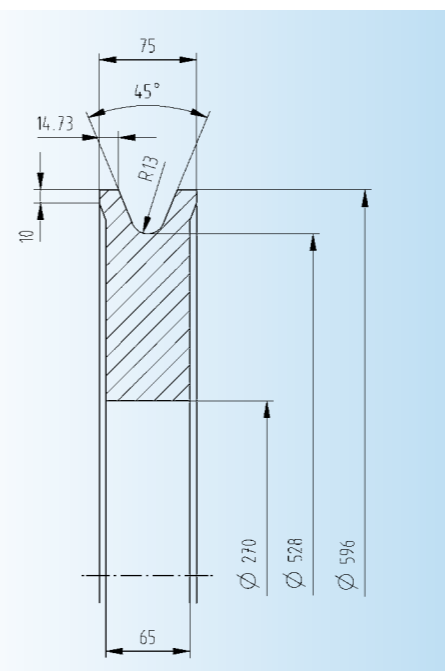
### Throat depth puts stress on the tool system

With the larger rope pulleys, the holders and ISO full-radius inserts of a well-known tool manufacturer frequently reached their limits. Cutter vibration regularly caused fracture of the cutting insert's fastening screw.

General manager Ton Heerbaart asked Joop Nijland from our representative Harry Hersbach Tools for advice. He recommended a different work cycle: Groove 2.5 mm (0.098") deep at the groove edge, side turn to the groove width, pull back the tool and a new work cycle with 2.5 mm (0.098") advance.

### Cutting insert with adjustable tool holder

The recommended S229 indexable insert, with chip former geometry, 8 mm (0.315") groove width, 4 mm (0.157") cutting radius and especially wear-resistant AS6G coating, proved suited to the task. The related 226 tool holder, 244 x 7.4 x 78 mm (9.606 x 0.291 x 3.071"), is designed to hold two



Drawing far left: Rope pulley with rope radius 13 mm (0.512"). A rope pulley with diameter of 2,150 mm (84.646") weighs about 7.5 tons.

Picture top left: The tool holder with two inserts is seated in the main body (light grey).

Picture bottom right: Indexable insert S 229. The insert is seated in the tool holder with a blade angle of 12°.

### Customer benefits:

- Axial plunge cutting of the rear side, without counter spindle
- Special tool avoids time-wasting reclamping
- No tool change
- Large time savings over previous production
- Compliance with the high precision specifications for sealing surfaces

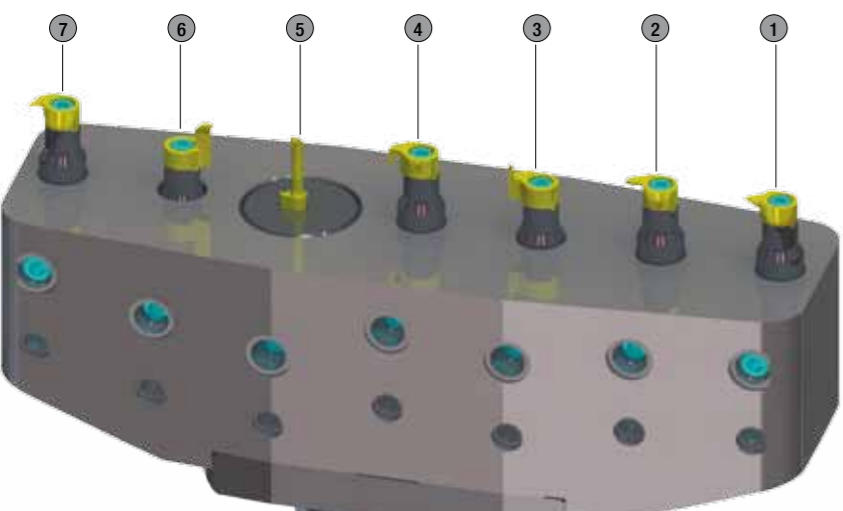
### Joint planning leads to success

Combination tools need to be adapted to the specific task, and frequently also to a machine whose kinematics and performance are designed for a specific operation. This requires close cooperation with the customer or the machine manufacturer. The latter is of decisive importance for our specialists, since the shared process know-how often results in approaches that can lead to completely new work processes.

In any case, our experience ensures achievement of a largely modular concept in the shortest time, adapted to the machine environment and the conditions of serial production, using standard cutting inserts whenever possible.

The advantages of the tools developed on this basis also have an impact on the machine environment. Tool management is simplified and the cost of storage and procurement are reduced.

Through these advantages and those of machine processing, the apparently high price receives a completely different weight, especially when multiple usage within a component family is included in the planning calculation.



6

Picture top: Special tool with tools of the Mini and Supermini® systems.

Picture right: Seal casing, outside diameter approx. 10 mm (0.394").



### 6 Task:

Manufacture of seal housings approx. 10 mm (0.394") in diameter, 7 mm (0.276") wide, out of very abrasive plastic.

### Customer instructions:

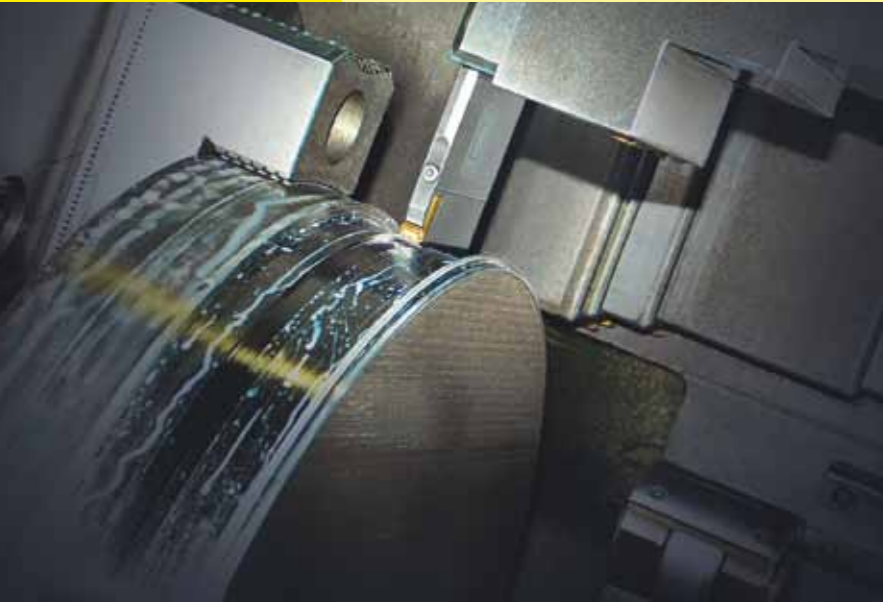
The bell cutter's actions permit cycle times that cannot be achieved with conventional circular milling cutters.

### Solution:

PCD-tipped special tools of the Mini and Supermini® systems. All tools are fastened to a lengthwise-adjustable tool carrier. The vertical spindle runs to the tools one after another. When machining the back, the tool penetrates radially and then performs the axial movement.

### Work process, tools 1 – 7

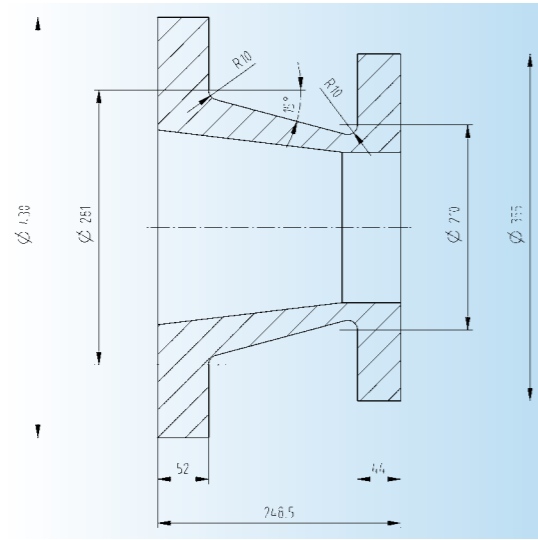
- 1 Rough machining of the outer contour (Mini system)
- 2 Finishing of the outer contour (Mini system)
- 3 Axial-plunge cutting, front side (Mini system)
- 4 Axial-plunge cutting, rear side (Mini system)
- 5 Pre-turning, internal bore (Supermini® system)
- 6 Finishing, inside bore (Mini system)
- 7 Parting off (Mini system)



Picture top: Successful grooving of the connectors with S100 insert

Drawing centre: For all connectors, a groove with conical inside diameter must be cut.

Picture bottom: Cutting insert S100 with geometry .EN. for cutting grooves in higher-strength materials. Cutter width 9.9 mm (0.39"), both sides radius 0.8 mm (0.031").



inserts. Its presetting in the Y-direction is simplified by 2 sets of 3 dowel holes with the grid dimensions 50 (1.969"), 75 (2.953") and 100 mm (3.937"). Since the tool holder with inserts is also used rotationally symmetrically, this fixing also applies after the 180° rotation.

### Tool with best results

The capability of the new strategy would be tested by cutting a 45° groove, 55 mm (2.165") wide,

34 mm (1.339") deep in a rope pulley with diameter of 600 mm (23.622"). In the first attempts with groove depth of 2 mm (0.079") and feed  $f = 0.28$  mm/rev (0.011"/rev), a continuous chip developed, which had to be manually removed. The cycle was then changed so that the tool, canted below 22.5° (half the rope pulley angle), initially cut 2.5 mm (0.098") deep at  $f = 0.25$  mm/rev (0.0098"/rev) but the feed was increased to 0.4 mm/rev (0.016"/rev) for longitudinal turning. After various optimisation attempts, the following setting proved to be especially economical: Cutting speed  $v_c = 230$  m/min (9,056.92"/min), cutting depth  $a_p = 2.5$  mm (0.098"), feed rate during grooving  $f = 0.28$  mm/rev (0.011"/rev) and during longitudinal turning  $f = 0.6$  mm/rev (0.024"/rev).

Using these data, the rope groove is completely machined in 25 minutes. One grooving insert permits machining of eight rope pulleys. The impact of these results on Heerbaart Jongman Metaal's competitiveness is easy to imagine, since 8 to 40 rope pulleys with different diameters, groove sizes and forms are needed, depending on the type and load of the crane.

### Throat depth, production impediment also with connectors

When manufacturing connectors from high strength carbon and stainless steel, the cylindrical raw material must be cut quickly, reliably and economically, despite cutting depths of up to 75 mm (2.953"). Ton Heerbaart and his team initially employed standard left and right copy inserts – not always with success, due to the large throat depth and load. In search of improved performance a parting tool with 10 mm (0.394") width and approx. 100 mm (3.937") throat depth was supposed to be the solution. But this product of a well-known tool manufacturer could not survive long under the load. Joop Nijland, whose help was also requested for this problem, recommended an S100 indexable insert S100 with the .EN8 geometry designed for high-strength steels.

### Work process and chip shape geometry determined incrementally

The first attempts with connectors made of quality steel S355J2G3 (St 52-3N) went positively. However a troublesome continuous chip developed when grooving 5 mm (0.197") deep and 10 mm (0.394") wide.

Then the work process was re-programmed so the chips broke under tension. Groove depths of 4 mm (0.158") and a traverse path of 8 mm (0.315") were now selected. With  $v_c = 250$  m/min (9,842.52"/min) and  $f = 0.5$  mm/rev (0.0196"/rev), machining of a connector took only about 9 minutes, and the tool life of a cutter allowed production of five workpieces. Unfortunately, this good result was not transferable to connectors made of stainless steel. And so the previously gained knowledge was applied with an S100 special insert with broad chip breaker, sharper cutter and the especially wear-resistant AS6G coating.

### Successful even with stainless steel

The cutting insert was tested at  $v_c = 150$  m/min (5,905.51"/min) and  $f = 0.23$  mm/rev (0.009"/rev) on a representative connector. Its key dimensions were; outside diameter 165 mm (6.496"), groove diameter 89 mm (3.504"), groove width 50 mm (1.969"). The process proved with quality steels – grooving 2.5 mm (0.098") in the groove centre, moving right and left by 8 mm (0.315") each, and with a cutting depth of 2.5 mm (0.098") – was adopted. Grooving took only 9 minutes with these settings, and the connector was completely machined in about 15 minutes, with a tool life of 9 to 10 workpieces.

In addition, an S 229 cutting insert with special geometry, chip former, cutting radius of 4 mm (0.158") and the AS65 coating for hard-to-cut materials was tested especially for the conical part of the connectors. With a groove depth of 2.5 mm (0.098"), cutting speed  $v_c = 150$  m/min (5,905.51"/min) and a feed  $f = 0.28$  mm/rev (0.011"/rev), very good results were achieved. The cutting data could have been selected even higher, but the originally selected data was maintained for reasons of process reliability and optimum tool life.

### Process reliability and efficiency

Use of the special insert reduced the primary processing time on average by 15 minutes with a tool life of 8 to 10 connectors per cutting insert. A further advantage results from the special geometry of the two inserts as previous very unpleasant whistling while cutting is gone. Operators can now work without hearing protection and, thanks to the reliable processes, also operate other machines while grooving takes place. The new strategy has also made an older inclined bed lathe Deawoo Puma 700L fit for the future, since the main bodies and tool holders of our system can be used on this machine for producing the rope groove as well.



Together, they developed the chip shape geometry and strategy for cutting the grooves and rope grooves (from the left): Roger Kasper, sales and technical consulting, export department, HORN Germany, Ton Heerbaart, director of Heerbaart Jongman Metaal, Marco Bern, machine operator, Heerbaart Jongman, and Joop Nijland from our representative Harry Hersbach Tools.

## EMO OUTLOOK

HALL 5, STAND A42

We will be showing numerous innovations and further developments, and we present a selection of them to you here:



### Milling cutter 713 with 12 cutters

**Milling cutter 713 with 12 teeth.**

These new tools were developed for milling of grooves up to 4.7 mm (0.185") deep and 1 (0.039") to 3 mm (0.118") wide in bore holes from 22 mm (0.866") diameter. Thanks to their 12 teeth, they offer a very smooth cut and so are especially suitable for use in driven lathe tools.

Two inserts with straight cutting edges are available for milling grooves with a width of 1 mm (0.039"). For groove widths of 2 (0.079"), 2.5 (0.098") and 3 mm (0.118"), three inserts with a staggered tooth system are available. The inserts are screwed on the front face to an M313 standard carbide shank and are initially being introduced in Grade TI 25 for processing general steels.



### Exchangeable head drills DD with larger working range

**Exchangeable head drill system DD for bore hole diameters of 10 – 20.5 mm (0.394 – 0.807").**



With new carbide exchangeable heads, the DD system is now available for bore holes from 10 to 20.5 mm (0.394 to 0.807") with diameter increments of 0.1 mm (0.0039"). Its basic holders permit bore depths of 3 x D, 5 x D and 7 x D. The larger working range and the aspect ratio increase to 7 x D offer new opportunities for use in producing through holes, blind holes and package holes.

High changeover accuracy ensures constant working conditions. The combination of exchangeable head and chip forming geometries for general steels, aluminium, cast materials and stainless steels as well as the high resistance to temperature and hardness of the TA 45 coating provide outstanding machining results. The cutting data correspond to those of solid carbide drill bits. For soft cutting with fast chip break, bore qualities of IT9 to IT8 are achieved.

### Tool systems for machining aluminium rims

The new tools are designed for rough machining, finishing and polishing of cast or forged aluminium rims. The supply programme encompasses tool holders with and without internal coolant feed and full radius inserts for external and internal machining (spokes) and mirror turning. The full radius cutting inserts based on System 229 are available as coated carbide-tipped and PCD-tipped inserts with laser-formed geometry.



Combi-holder for exterior and cap processing.

An additional product series is made up of ISO-carbide and PCD inserts with laser formed geometry for internal and external machining. The associated tool holders for processing the inside surface, planar support

surface, hub and cap of the wheels are standardised, but also available as special tools.

### Package tool 313 for milling groove intervals



With this new development, two grooves with an exact distance from each other can be milled in bore holes from 22 mm (0.866") in diameter. Since System 313 standard inserts for groove and radius

milling, for chamfering and thread tampering can be combined, it is possible to perform groove milling, chamfering and thread cutting and countersinking simultaneously. Spacer sleeves with 5.7/8.2 (0.224/0.323") and 10.7 mm (0.421") length ensure the exact distance of the two milling inserts with three cutting edges. Precise groove intervals can be adjusted by grinding up to 2.5 mm (0.098").

Package tool 313.

The combination of front face cutting insert, spacer sleeve and inside cutting insert is screwed with a clamping bolt to the M313 carbide shank. The connection between the sleeve and inside cutting insert is a new type of interface (patent applied for). Its essential characteristics are three triangular-shaped support and transport surfaces.

### Exchangeable head milling system DG

The modular milling system with patented quick-change interface is used for corner and groove milling, chamfering, copy and high-feed milling. It is available in four sizes of 10/12/16 and 20 mm (0.394/0.472/0.629 and 0.787") diameter. Currently, the predominant application is milling steels. Geometries for other materials are in preparation.

The two-piece design of shank and exchangeable head in a steel-carbide combination displays the highest level of rigidity and concentricity. Its secure connection ensures a segmented thread, which also allows an automatic tool change. The exchangeable heads are available in various designs with corner chamfer, corner radius or sharp corner cutter.



DG exchangeable head milling cutter.

### CVD-D tools

CVD-diamond-tipped inserts for inside and outside machining.



Since 2011, we have included CVD thick-film tools in our programme. The CVD cutting material is harder than PCD and twice as wear-resistant. Thanks to this

and other characteristics, it offers many advantages for milling and turning, especially for high-silica aluminium.

The segments for soldering onto the cutting inserts or milling cutters can only be economically cut out of the CVD-D inserts with a laser. The chip breakers and cutting edges are also laser formed. The newly developed undulating chip breaker reduces contact of the chip with the insert surface, which considerably reduces heat transmission. The extreme chip angle of up to 25° prevents burr formation, which increases tool life compared to PCD cutters and protects the spindle through reduced main cutting force. The sharp blade offers special advantages in processing CFRP, GFR and other composites.

### M101 side milling cutter

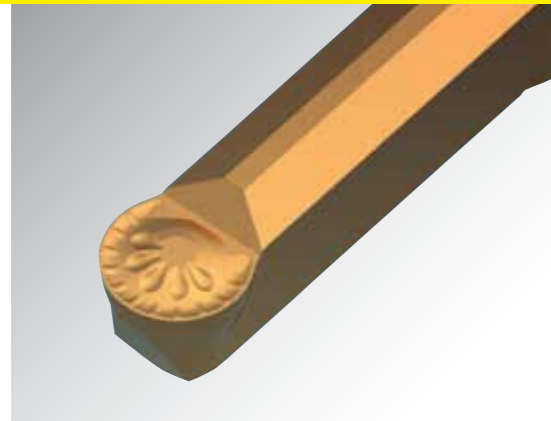
M101 side milling cutter.

The new side milling cutters, with a cutter width of only 1.6 and 2 mm (0.063 and 0.079") and a max. groove depth of 20 mm (0.787"), especially suited for groove and slot milling. For both groove widths, milling cutters are available with cutting edge diameters of 80, 100 and 125 mm (3.149, 3.937 and 4.921") with 7, 9 and 11 teeth. Inserts with full radius or straight cutting edge with geometry .3. are available. Changing the cutting insert is simple, but still very precise. The self-clamping insert seat is opened with a chuck key so that the cutting insert can be removed and a new one inserted. A prism in the cutting insert and the main body ensures a secure connection. The exact positioning is made over a stop in the main body.



### KF geometry for tempered steels

KF geometry.



The new geometry with chip formation simplifies cutting, longitudinal turning and copying of shaped grooves. It is available for the time being with the heat-resistant AS66 coating for the two-cutter inserts S224 and S229. They can be used especially for wet and dry machining of tempered steels with a tensile strength of 1,100 N/mm<sup>2</sup>.

The full-radius inserts are available with widths from 3 to 6 mm (0.118 to 0.236") for both cutting insert types. The maximum groove depth is 18 mm (0.708") for type S 224, and 25 mm (0.984") for type S229.

### Certification according to API Q1



In spring 2011, we were certified by the American Petroleum Institute (API) according to API Q1. The API is the largest association for the oil and gas industry, including the petrochemical industry, in the USA.

API Q1 certification.

With this certification, we are the first company worldwide so far in the APIQR's Composite List for development, manufacture and sale of turning and milling tools. With this, we can show proof of an additional international standard besides certification according to ISO 9001:2008. Our tool systems for machining oil field pipes and sleeves are designed for end processing of rotating and stationary oil field pipes of up to 25" in diameter. The product range currently includes tools for external and internal turning of API and special threads, internal and external chamfering, machining sealing seats, grooving, parting off and peeling.

### DCX solid carbide slot miller

The DCX milling cutters were developed for milling deep and narrow grooves in steel and stainless steels. Their main area of use is for manufacturing surgical instruments and forceps. With cutting edge diameters of 20/30 (0.787/1.181") and 40 mm (1.575"), the six- and eight-cutter mills can cut grooves 6.5/10 (0.256/0.394") and 13.5 mm (0.531") deep and 1.5 and 2 mm (0.059 and 0.078") wide. Special versions for other dimensions can be delivered at short notice.

Type ST35 is used as the cutting material. It is characterised by long service life and low cutting forces, especially when milling steel and tempered steels.

The DCX solid carbide millers expand the range of possible uses of the DC system, which was introduced at the beginning of the year. It is ideally suited for making threads, slots with radii or rectangular cross sections and for chamfering. The tools, available in several carbide types, show their special capabilities especially in processing cobalt-chromium steels, titanium, stainless steels and plastics.



DCX solid carbide slot miller.



### S315 thread-cutting insert for oil field pipes

**S315 thread-cutting insert with cassette.**

The main application area of the System 315 three-cutter thread-cutting insert is production of 3 TPI to 10 TPI threads for pipes and sleeves. Their special feature is integration of the chip former into the cutting insert which ensures a controlled chipping process even with long-chipping materials.

The thread-cutting insert is positively held in a cassette. Its secure positioning is ensured by a precision-ground contact surface with low tension and the clamping plate on the front face. The robust design also safely absorbs high radial and feed forces. Both the holders for external machining and those for internal machining have an internal coolant supply.



### Mini 107 cutting insert

**Mini 107 cutting insert.**



With the new 107 cutting insert, tools of the Mini system can now be used from 7 mm (0.276") bore hole diameter. Compared to the previous working range of = 8 mm (0.315"), this offers new possibilities for use in grooving and boring out.

For grooving from bore hole diameters of 7 mm (0.276"), cutting edges with widths of 1 and 1.5 mm (0.039 and 0.059") are available for a groove depth of up to 1 mm (0.039"), and for bore holes from 8 mm (0.315") diameter with widths of 1/1.5 (0.039/0.059") and 2 mm (0.079") for a groove depth of up to 2 mm (0.079"). The inserts are available with corner radii of 0.2 and 0.4 mm (0.008 and 0.016") for boring out.

The inserts in right-orientated design are screwed clamped as exchangeable heads onto the holders, which are available in different lengths.



## Supermini®, SMALL TOOLS – BIG POTENTIAL

### Processing capability from 0.2 mm (0.079") bore hole diameter

The smaller the workpiece, the greater the demands on the tools. In this work environment, the highly productive variant variety of our Supermini® tools sets special standards.

Since the beginning of the 90s, we have produced Supermini tools in standard and special versions. With far more than a thousand variants (inserts), starting at bore hold diameters of 0.2 mm (0.079") – whose cutting geometry can usually only be seen under a magnifying glass – they very successfully solve the most demanding tasks in the automotive and aircraft industry, in medical, communication and environmental technology, machine building, the watch industry, and many other sectors. A great many tasks in these sectors could only be solved successfully thanks to the product-specific features of our "smallest ones" and the technical advice related to them.



#### Two sizes

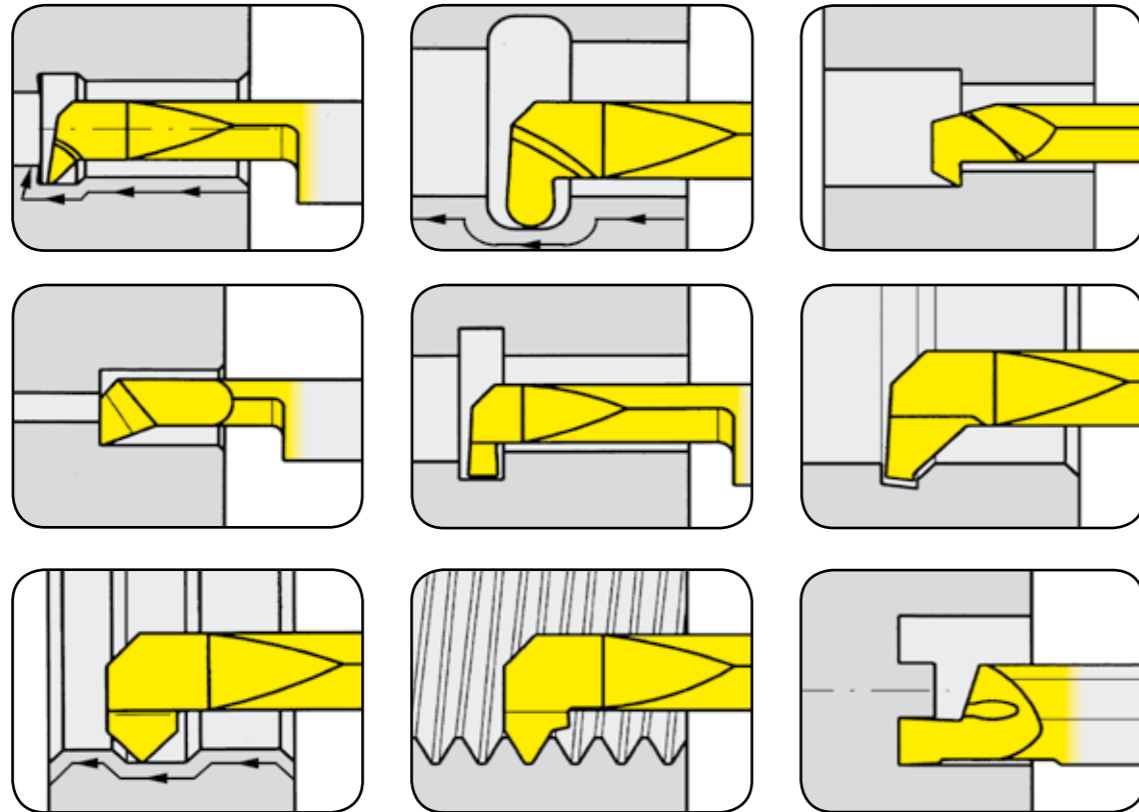
The Supermini® tool system consists of the model series 105 for bore holes  $\geq 0.2$  mm (0.079") and 110 for bore holes  $\geq 6$  mm (0.236"). Only one standard tool holder is required for clamping all inserts of a model series. These holders are available with and without internal cooling, and with various machine interfaces.

Machining	System 105	System 110
	For holes from ... Ø mm (")	
Grooving	2 mm (0.079")	8 mm (0.315")
Boring out	0.2 mm (0.0078")	6 mm (0.236")
Threading	3 mm (0.118")	
Polish turning and milling	13.5 mm (0.531")	
Chamfering	5 mm (0.197")	
Pre-grooving for parting	5 mm (0.197")	
Axial grooving	5 mm (0.197")	20 mm (0.787")
Finish boring	0.2 mm (0.0078")	
End facing	5 mm (0.197")	
Broaching	6 mm (0.236")	
Hard turning with CBN	3 mm (0.118")	

Supermini® for grooving, axial grooving, threading, boring out, finish boring.

Supermini® for processing the smallest diameters.

Supermini variants for a multitude of applications.



### Convincing system features

- 1 tool holder for all standard inserts of a model series
- Special tool holder (patented), diameter 10.5 mm (0.413") for especially tight work environment
- Inserts for machining steels, cast iron, nonferrous metals, exotic materials
- Carbide inserts in coated and uncoated versions
- Inserts with CBN, PCD or MCD tips
- Internal coolant supply through the insert
- Secure clamping of the cutting insert by ball pressure screw(s)
- Repeat accuracy (linear dimensions) 0.02 mm (0.0008")

Superminis stand for the highest precision, even in the tightest spaces

- f-dimension tolerance 0.02 mm (0.0008") without adjustment on the machine.
- Tool holder with VDI, HORN, KM 16 micro, Graf, Bk, square and other seats
- Tool combinations with Graf, Kennametal, Urma
- Interfaces suitable for Tornos, Star, Traub, Citizen, Hanwah, Manhurin, Gildemeister, Emco and other makes
- Inserts for broaching permit complete machining in a single clamping
- Standard profile inserts for broaching Torx profiles from T15, hexagonal profiles from 2.5 mm (0.098")

### Insert production in a single clamping

Initial material for both Supermini® models 105 and 110 are carbide blanks with sintered, drop-shaped cross-sections, produced at our subsidiary HORN Hartstoffe. The patented drop shape is the foundation for the extremely high repetition accuracy. The blanks run through all grinding work up to completion in a single clamping. The µm tolerances that must be maintained suggest the precision with which, for example, the decisive functional details of the chip shape geometry must be produced.



## INVESTMENT FOR THE FUTURE

### New building for HORN Hartstoffe almost completed

"Manufacturing of a tool only achieves optimum results if we can control the complete process chain." This philosophy of our company's founder Paul Horn is re-iterated with the new "Hartstoffe" building.

Back in 1992, he founded Horn Hartstoffe GmbH, a carbide-producing wholly owned subsidiary of Paul Horn GmbH. With the production of its own carbide materials, the company laid the foundation of the market position our tools enjoy today. Thanks to this successful development, HORN Hartstoffe has long been at the limits of its capacity. Only a new building with simultaneous investment in new machines and processes could relieve the situation.

The new production areas are being built right next to the current carbide factory, only 10 minutes by foot from the parent company. The new production facilities are about 4 times larger than the existing ones, and so reorganisation and conversion of production sequences are needed, from preparation of the metal powder to shaping and sintering to final inspection.

#### The most important changes within the process chain are:

- New shaping process
- Capacity expansions in extrusion and injection moulding
- Additional sintering HIP furnaces
- Expansion of powder preparation
- New machines for toolmaking

These and other measures will contribute to increasing our production flexibility, achieving and raising our quality targets, maintaining our shipment reliability and strengthening our company's future.

#### The "Hartstoffe" new building vital statistics:

- Groundbreaking: 03.01.2011
- Move starting in October 2011
- Full production start-up: January 2012
- Production area: 5,000 m²
- Investment "Hartstoffe": 20 million euros
- New jobs: 30
- Existing building: Conversion to social building

The new HORN Hartstoffe GmbH viewed from "Steinlachwasen Street". On the left can be seen part of the existing building.



# TECHNOLOGY DAYS, 11 – 13 MAY 2011

Practical demonstrations and detailed product information impressed the visitors.

## Theory and practice a magnet for visitors

Good to very good! That was how a representative cross-section of the 1,600 visitors – of which a remarkably high 50 percent were from abroad – rated our Technology Days.

This outstanding evaluation was earned by the organisation and visitor assistance, the practical demonstrations and technical presentations as well as the catering and logistics involved in the Technology Days. Especially the information about applications of both new and proven products – of which much can be implemented immediately in everyday work – provided in a mixture of practical demonstrations and technical presentations earned great approval. We have summarised the important practical information from the technical presentations:

The technical presentations enjoyed great interest with an average of 50 visitors.



### Chip shape geometries and their tasks

Due to the special conditions in grooving, longitudinal turning and parting off, our programme consists of 28 different standard geometry forms. They allow adjustments to the machining method, the material and the cutting distribution, with particular attention paid to the stability of the tool use.

### Special and combi-tools

An article on page 8 describes different machining tasks performed with combi-tools and the results achieved with them.

### Coatings – an insight into production

The article on page 22 discusses the importance of coating in our company and the process used.

### Broaching on CNC machines

With our systems, practically all groove shapes, internal and external, can be broached on universal lathes, lathes with programmable Y and C-axis, long and short lathes, multi-spindle lathes, 3/5-axis milling



Video to the Technology Days see:  
[www.phorn.com/technologydays2011](http://www.phorn.com/technologydays2011)



Company and product information were at the forefront at the press conference.

machines, machining centres, bar feed and other machines. For example, keyways according to DIN 138 and DIN 6885, taper and helical grooves, involute and special toothing, Torx or multi-edged profiles – all profiled without reclamping.

**Tornos Technologies Germany**, single-spindle automatic lathe EvoDECO 16, turning diameter 2 – 16 mm (0.079 – 0.629")

**Chiron-Werke GmbH & Co. KG**, machining a watch part with FZ08K S Magnum five axis

**AFS Airfilter Systeme GmbH**, exhaust performance 600 – 16,000 m<sup>3</sup>/h

**DMG**, lathe-milling centre CTX gamma 2000 TC and universal lathe CTX beta 800

### Economic bore machining

For production, pre- and final machining of bore holes, we offer a broad tool programme, suitable for machining centres, milling machines, lathes and other machines.

- Exchangeable head drills DD, Ø 10-20.5 mm (0.394-0.807")
- High feed rate milling cutter system DAH, Ø 20/25/32/40 mm (0.787/0.984/1.259/1.575")
- Clip-on cutter heads DAH, Ø 40/50/63/80 mm (1.575/1.969/2.480/3.149")
- Shank and screw head cutter DA, Ø 16/20/25/32 mm (0.629/0.787/0.984/1.259")
- Supermini for boring out holes > Ø 0.2 mm (0.008")
- Precision machining with reaming system DR
- Bore machining with MCD tools

For their assistance with the practical applications of our tool systems, we thank our **partner companies**: **Graf Werkzeugsysteme GmbH**, outer, inner and rear machining on automatic lathes

**HPM Technologie GmbH**, minimum quantity internal lubrication with high dissolution air/liquid mixture

**H10 technische diamanten GmbH**, diamond tools for mirror turning and milling

**LT Ultra GmbH**, ultra-precision milling machine MMC-900, roughness 2 nm

**Sauter Feinmechanik GmbH**, Trifix precision quick indexing system, compatible with VDI tools

### Press conference on 12 May 2011

The great interest of the trade press in our company was confirmed again by the attendance of 21 trade journalists. They accepted our invitation to the press conference and a company tour with special technical information about production, the tool programme and our services. The previous evening offered an opportunity to exchange views with a joint dinner with senior company managers.

The catering tent offered an opportunity for refreshment and exchanging views.





## THE DECISIVE COAT

Eight coating systems provide the basis for our high coating flexibility.

### Coating centre strengthens competitiveness

Coating in our own company is a vital link in our “tool production” process chain and a requirement for delivery of powerful, task-specialised tools on-time and at short notice.

A coating of only a few thousandths of a millimetre in thickness can decisively influence tool wear when cutting along with all the related effects on the machine, energy requirements, operating fluids and auxiliary materials. And so we have used coatings for over 20 years. The experience gained during this time was used in planning the coating systems supplied by the CemeCon company and implemented in the coating processes and system techniques that were specially customised to meet our needs.

#### Technologies for individual coatings

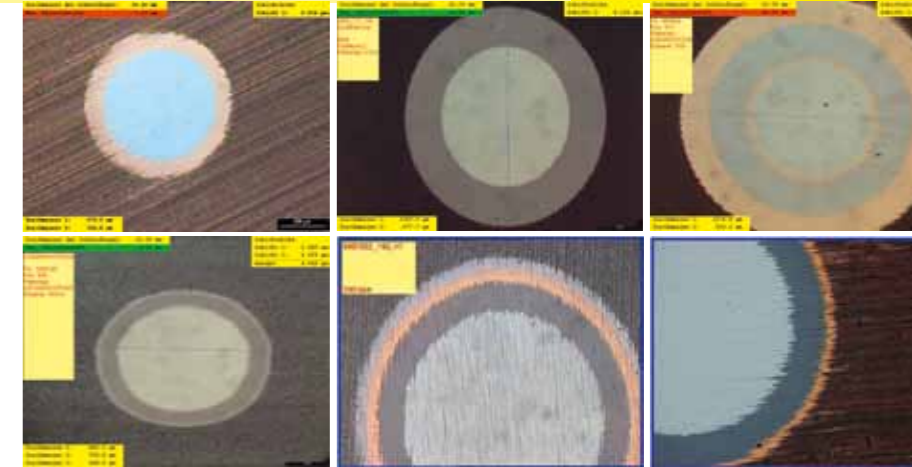
We use PVD sputter technology to enable us to adapt the coating to our variety of products and materials. The process of cathode sputtering prevents droplets and generates topographically even surfaces in the micro range. It also permits application of different coating materials. With our systems, we can apply all currently widely used coatings, such as TiAlN, TiN and TiAlCN. This takes place in the work chamber

under vacuum. After plasma cleaning, the inserts are coated at around 480 °C with a carbide coat 1.5 µm to 10 µm thick, depending on the tool. The coating process lasts 7 – 14 hours, depending on the coating thickness.

#### Type- and batch-related coating

First, the inserts coming from the grinding shop are grouped into batches: Inserts with hole on a round rod, inserts without hole on a clamping rod, and other forms, such as inserts with shank (e. g. Supermini®), on a rotary plate. After several rods are collected into cleaning towers, pre-treatment (cleaning) begins in ultrasonic cleaning systems, wet-pressure or dry jet systems.

Eight systems are available for the subsequent coating: six with an average volume of 1,400 and two with an average volume of 6,000 inserts. Thanks to this capacity – an overcapacity that follows our production philosophy – through combination we can produce all coatings needed daily with different coating thicknesses and so react correspondingly fast. The completion dates and inventory are constantly updated and adapted every hour to the company's internal shipping and pick-up rhythm.



### HORN coating know-how

Only an optimal combination of carbide, geometry and coating permits economical cutting. This requires continuous development in every production stage, especially in the coating department. Currently, 25 employees work there, normally in a 2-shift operation. They ensure on-time order processing with throughput times between 12 and 36 hours. Responsible for this is Maurizio Colecchia. He began his career in our company in 1990 with a training programme in industrial mechanics and then worked in various positions with increasing responsibility until, after gaining further qualifications, he became department manager for coating 5 years ago.

### Securing HORN quality

After coating, the result must be checked and documented. The coating thickness is examined using

either a dome-shaped section or via X-ray fluorescent radiation. Information on layer adhesion is provided by a Rockwell impression or a scratch test. Recently, we added an ultramodern system, which can perform a micro-scratch test and can also determine the micro-hardness. A dome-shaped section is also used to examine the coating construction and its structure. For more in-depth examination, we use a scanning electron microscope. The coating composition can also be quantified with the EDX method.

### “Own” coatings offer security

With coating processes oriented on our requirements, we can apply coating thicknesses and types that fit the characteristics of the tool and the application. These also include the types developed in our coating department, such as HG45 and AS45. They help us meet even better the demands from new materials, dry machining, higher speeds, cost pressure and energy efficiency. For us, this “individualization” is an important element in the targeted achievement of our own requirements to permit economical cutting of the most modern materials both today and in the future.

Picture left: They are responsible for the coat: Maurizio Colecchia, coating manager (left) and Walter Wiedenhöfer, production manager and member of the company's top management.

Picture right: Quality control: Checking thickness of coating and layer construction by calotte grinding.



Shift supervisor Philipp Höhne removes a coated batch from the system.

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