



Your technology partner for economic machining

## TITANIUM MACHINING



# Markets and sectors

After many years of close cooperation with customers, MAPAL has acquired a profound understanding of almost all processes and applications in machining production. The fields of application in which machining solutions from MAPAL are used are found in a wide variety of industries.





**Germany**  
Headquarters of the group of companies

**Close to the customer – globally**

The close dialogue with customers and thus the early recognition of technological requirements and approaches for innovations are essential pillars of the MAPAL company policy. As a result, MAPAL is directly represented with production and sales branches in 25 countries. This ensures close proximity, personal contacts and long-term partnerships.

In addition to the main production facilities in Germany, local production facilities in strategically important markets worldwide guarantee short delivery times. They are responsible for the manufacture of selected products as well as for reconditioning, repairs and repeat orders for the local market.

In addition to its own branch offices, MAPAL products are available through sales agencies in a further 19 countries.



**No. 1**

Technology leader for the machining of cubic parts.

Subsidiaries with production, sales and service in

**25** countries.

Annual investment in research and development of

**6%** of turnover.

Over

**450**

technical consultants on the road.

More than

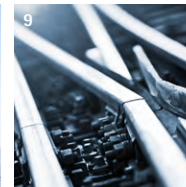
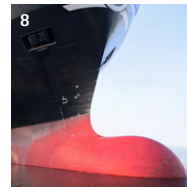
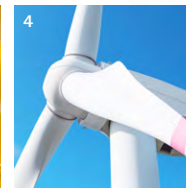
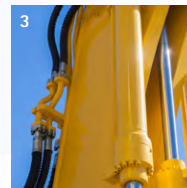
**300**

trainees worldwide.

**Our most important asset: More than**

**5,000**

employees worldwide.



- 1 Automotive
- 2 Aerospace
- 3 Fluid technology
- 4 Power generation
- 5 Electric mobility
- 6 Medical technology
- 7 Die & Mould sector
- 8 Shipbuilding
- 9 Rail transport

# Titanium machining with new tool technology

In medical technology, this workpiece material is used for implants because of its strength and compatibility with human tissue. High demands are placed on dimensional accuracy and high-quality surface finishes to ensure a long service life of hip prostheses and titanium implants.

Automotive manufacturers use it to create powerful sports cars. Application involves semi-machining and finishing of chassis components. The blades of large gas turbines, made of titanium, absorb enormous forces.

The aircraft industry is producing more and more highly stressed parts made of titanium. MAPAL is making drilling and milling of the ductile, high-strength workpiece material more productive, thereby reducing costs.



**AEROSPACE**



**AUTOMOTIVE**



**MEDICINE**

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# Competence in titanium machining



1

## Aerospace

Titanium and titanium alloys are predestined for use in aerospace. High demands are placed on workpiece material strength and corrosion resistance in relation to their specific weight. This results in a wide range of applications extending from small mechanically processed structural parts to load-bearing parts in the fuselage or blades in the engine.

**>> More from page 8**

2

## Automotive

Lower weight means lower fuel consumption resulting in fewer emissions. Therefore, many different applications for titanium materials can be found in automotive engineering. Starting with engine components, through to transmission parts and suspension elements as well as exhausts. The automotive manufacturers' objective is to make vehicles lighter and therefore more environmentally friendly.

**>> More from page 14**

3

## Medical technology

Titanium is practically the perfect workpiece material for medical technology as it can be implemented extensively due to its bio-compatibility (i.e., its stability in biological surrounding – anti-allergenic), low thermal conductivity and anti-magnetic behaviour.

**>> More from page 15**



**TITANIUM IS PARTICULARLY SUITABLE FOR APPLICATIONS IN WHICH HIGH CORROSION RESISTANCE, STRENGTH AND LOW WEIGHT ARE REQUIRED.**



#### PROPERTIES

- Low density (4.5 kg/dm<sup>3</sup>)
- High specific strength
- High temperature resistance
- Short thermal conductivity
- High ductility

#### MACHINABILITY

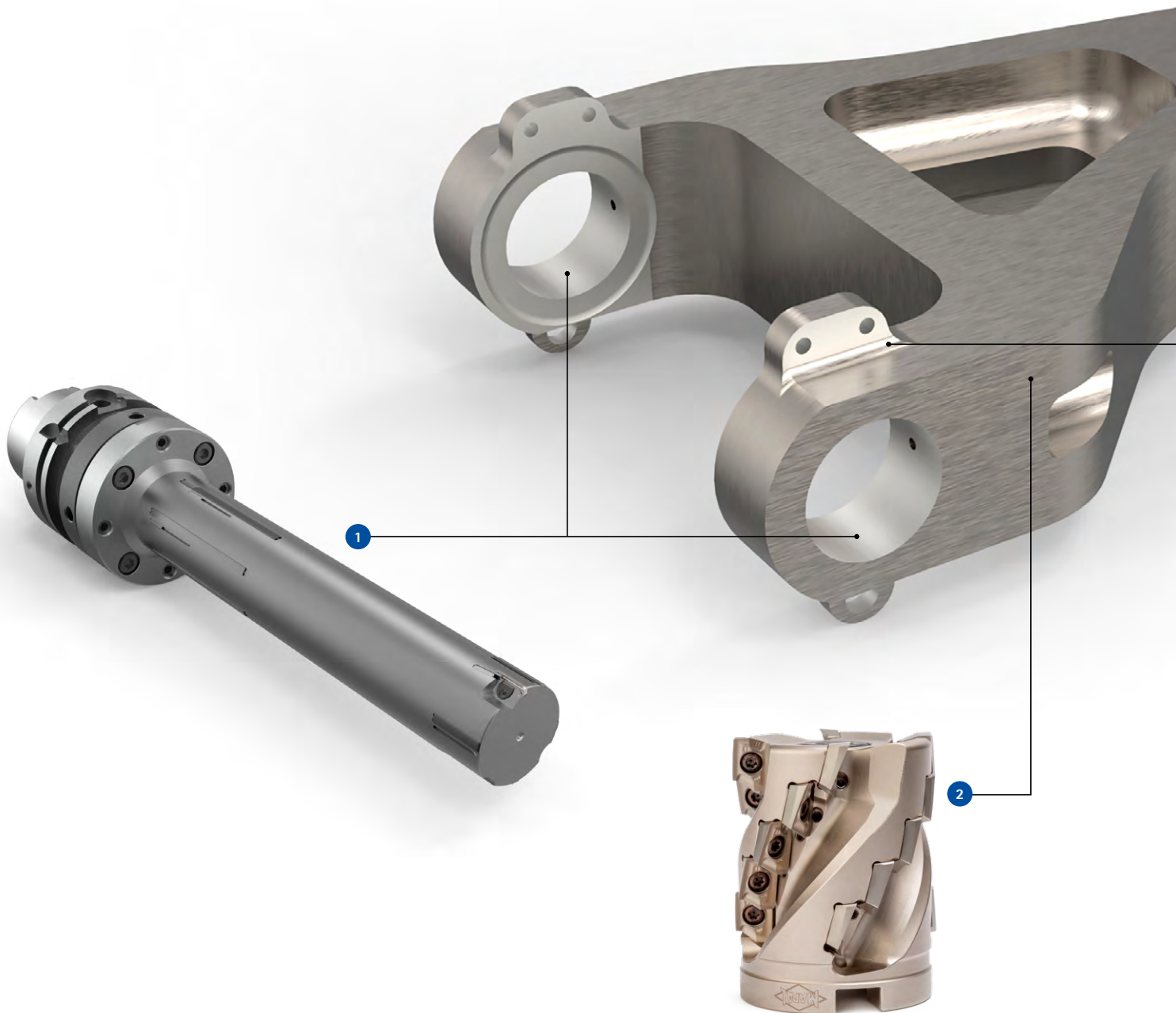
The low thermal conductivity of titanium and titanium alloys in conjunction with the high tensile strength of the workpiece material means that the tools are subjected to high thermal and mechanical stresses during machining and are therefore subject to high wear and tear. Adhesive effects between workpiece material and tool also lead to the formation of built-up edges. Therefore, tools with a high degree of hardness and thermal stability are particularly suitable for machining here.

# Aerospace

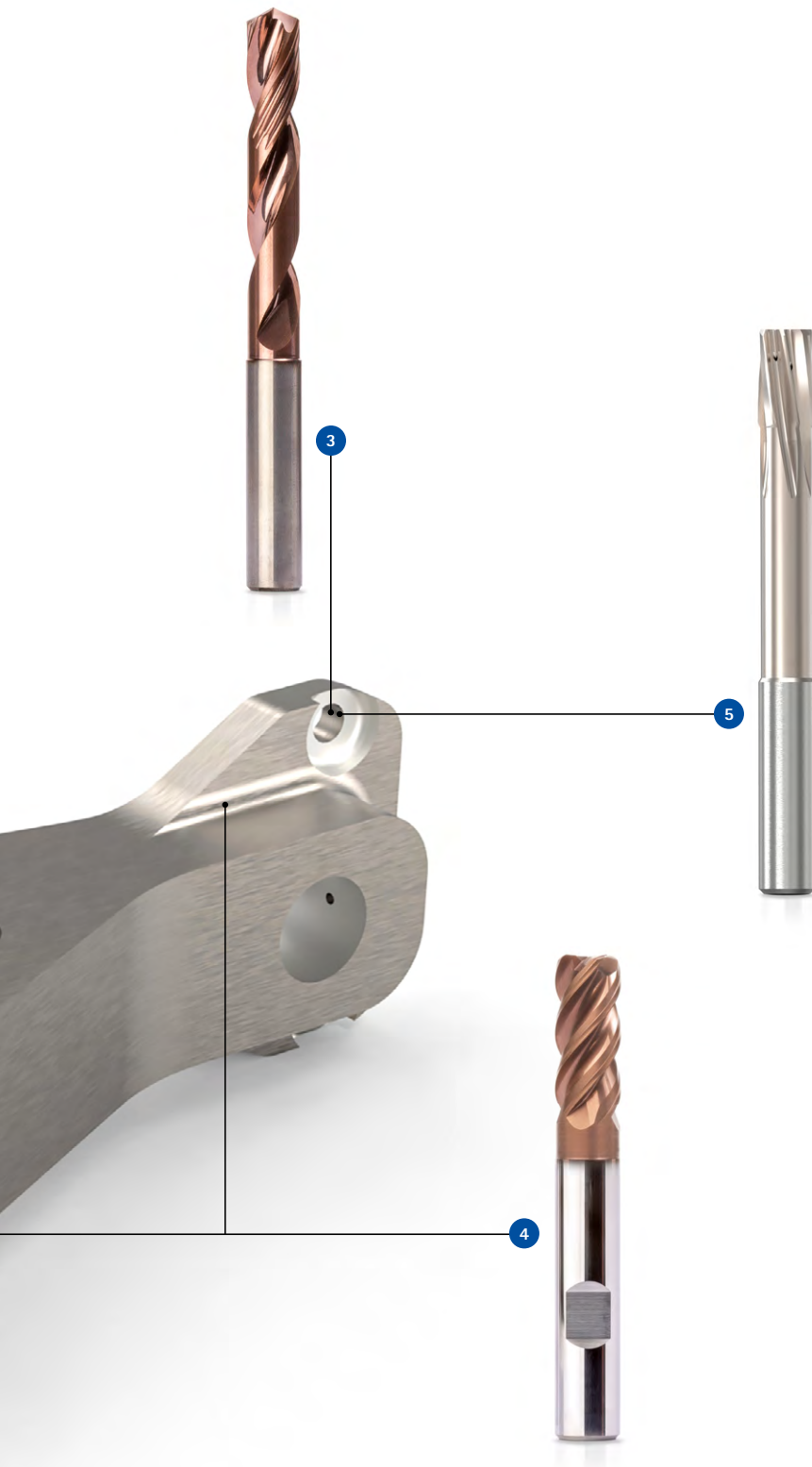
## Torsion link

### Highly stressed landing gear parts made of titanium

The torsion link is a component part of the main landing gear of aeroplanes. The top and bottom torsion links are attached to one another by a hinge. This design allows the damper cylinders to retract and extend without twisting. The torsion link thus maintains correct positioning of the wheels and in this way ensures the directional stability of the aeroplane when the landing gear is extended. As this is a highly stressed part, both the upper and lower torsion links are made of titanium.







### 1 Fine boring tool

- High-precision adjustment of the inserts
- Perfect concentricity of the bores
- Optimal surface roughness
- Perfect bore geometry
- Stable machining thanks to guide pads
- High accuracy of repetition and easy tool setting

### 2 NeoMill-Titan-2-Shell

- Maximum machining rates
- Optimum chip removal
- Very quiet running
- Variable cooling concept
- Cutting edges with various corner radii can be deployed
- Variety of cutting materials available

### 3 MEGA-Speed-Drill-Titan

- 140° point angle
- Little formation of built-up edge due to extremely smooth coating
- Four margin lands (best roundness values)
- Convex cutting edge
- Internal coolant supply
- Newly designed chip flute (optimal chip removal)
- Efficient coolant flow (avoids friction and heat at the cutting edge)

### 4 OptiMill-Titan-HPC

- Special edge preparation (stable cutting edge)
- Optimal pitch (stable cut, smooth running)
- Core rise for more stability

### 5 FixReam

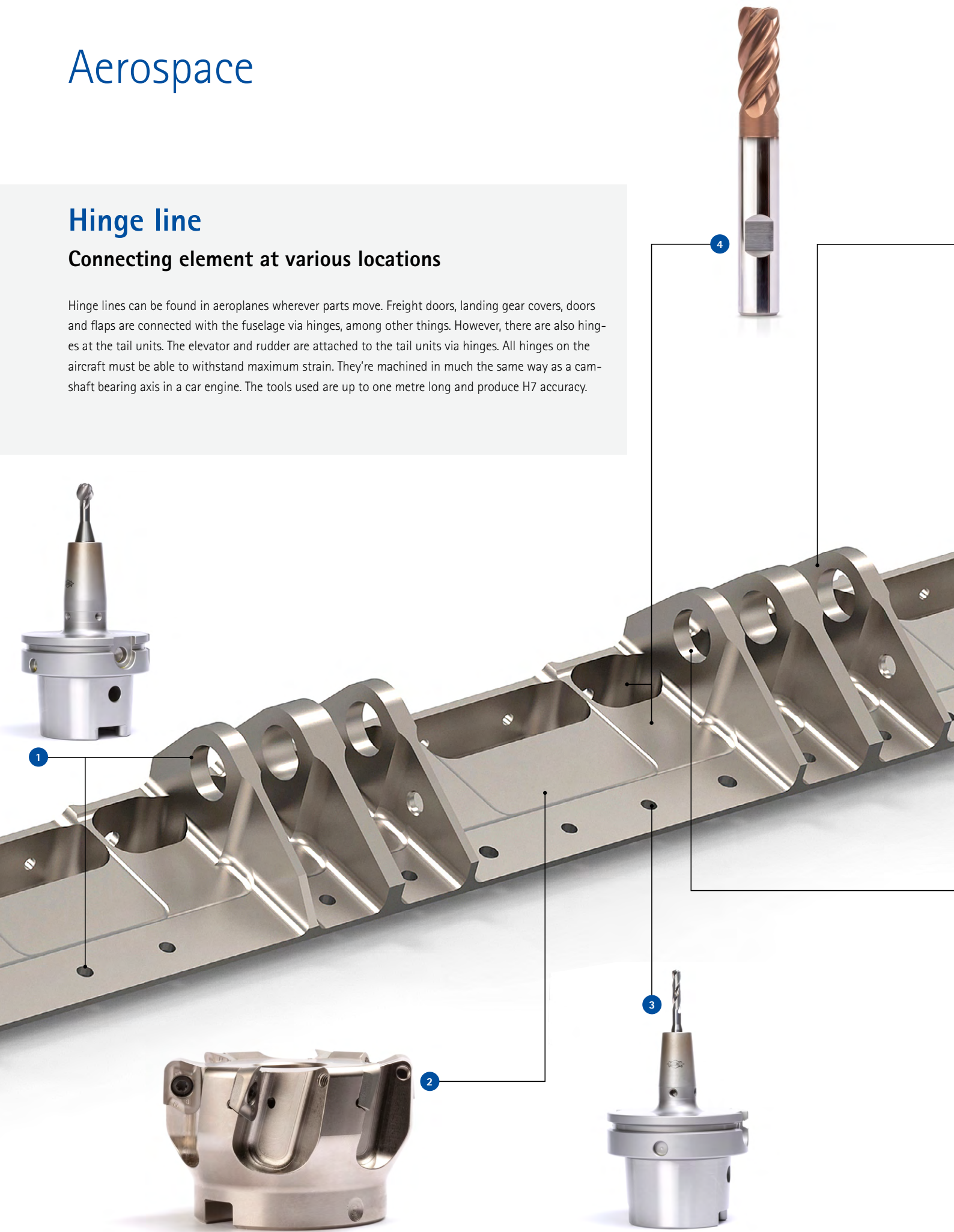
- Solid carbide or brazed design
- Bore quality: H7
- DLC coating for optimal performance
- Configurable diameter
- Design for through or blind bores
- Suitable for minimum quantity lubrication (MQL)

# Aerospace

## Hinge line

### Connecting element at various locations

Hinge lines can be found in aeroplanes wherever parts move. Freight doors, landing gear covers, doors and flaps are connected with the fuselage via hinges, among other things. However, there are also hinges at the tail units. The elevator and rudder are attached to the tail units via hinges. All hinges on the aircraft must be able to withstand maximum strain. They're machined in much the same way as a cam-shaft bearing axis in a car engine. The tools used are up to one metre long and produce H7 accuracy.





5



6



6



6



### 1 Deburring tools made from solid carbide

With these custom tools in a special spherical shape, the bore entrance and exit of the main bore as well as the fixing bore are deburred through circular milling.

### 2 NeoMill-Titan-2-Corner

- High machining rates
- Very quiet running
- Cutting edges with various corner radii can be deployed
- Variety of cutting materials available

### 3 MEGA-Speed-Drill-Titan

- Extends tool life by 30% compared to previous solutions
- Drilling specialist for high cutting speeds and feed rates
- Short cycle times

### 4 OptiMill-Titan-HPC

- Increases tool life by 35%
- Perfect solution for roughing, medium machining and finishing
- Excellent price-performance ratio
- Fits Mill Chuck, System HB
- Optimal pitch (stable cut, smooth running)
- Core rise for more stability

### 5 OptiMill-Tro-Titan

- Extends tool life by 10% compared to previous solutions
- High removal rates possible
- Unequal spacing of the cutting edges
- Special coating to avoid deposits
- Specially designed chip flute for optimum chip removal

### 6 TTD replaceable head drill, custom drill, boring bar

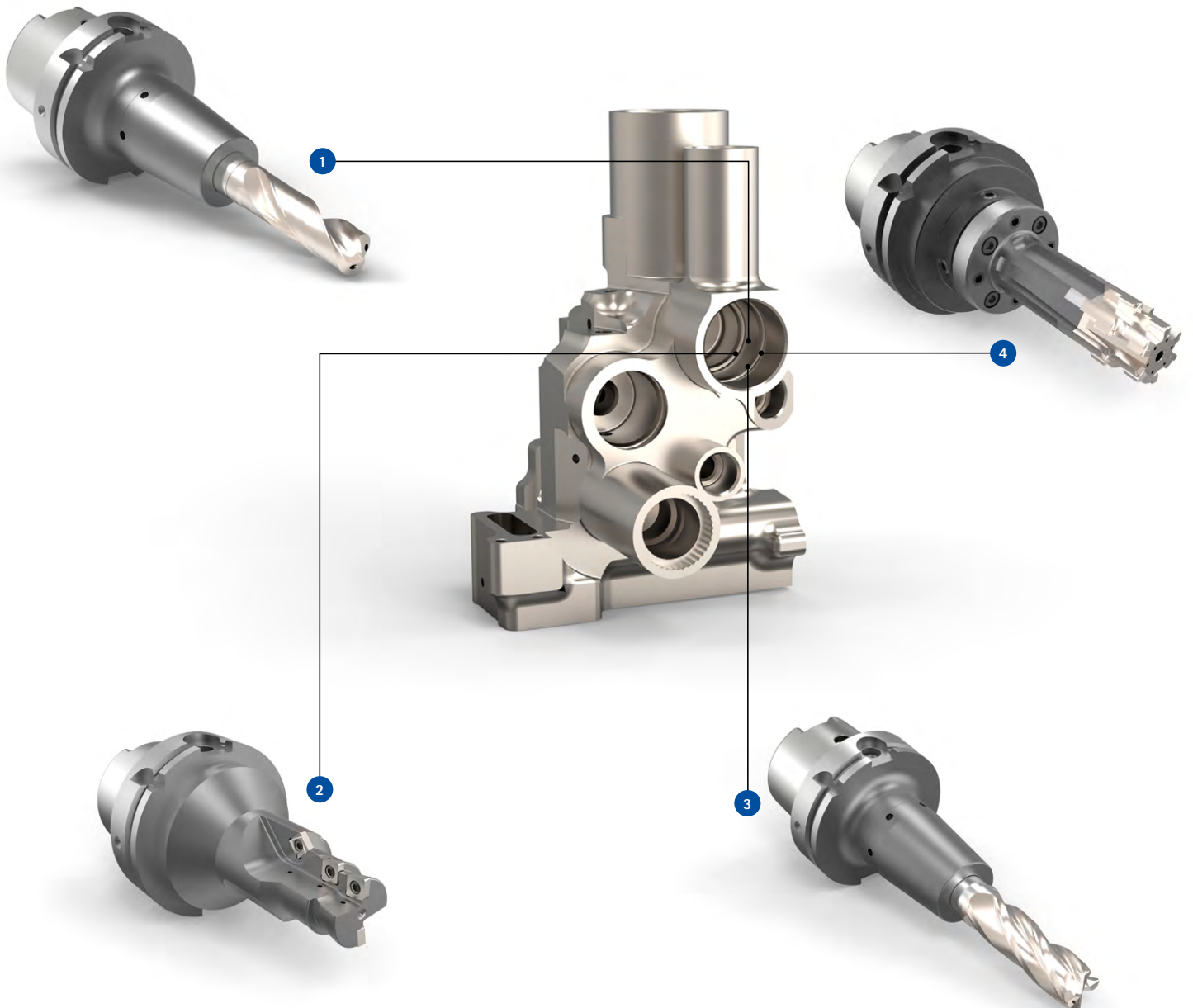
- TTD replaceable head drill for piloting the first lug
- Custom drill with additional guide element at the neck for medium machining of lugs from both sides
- Bearing-guided boring bar for precise finishing of the main bore from one side

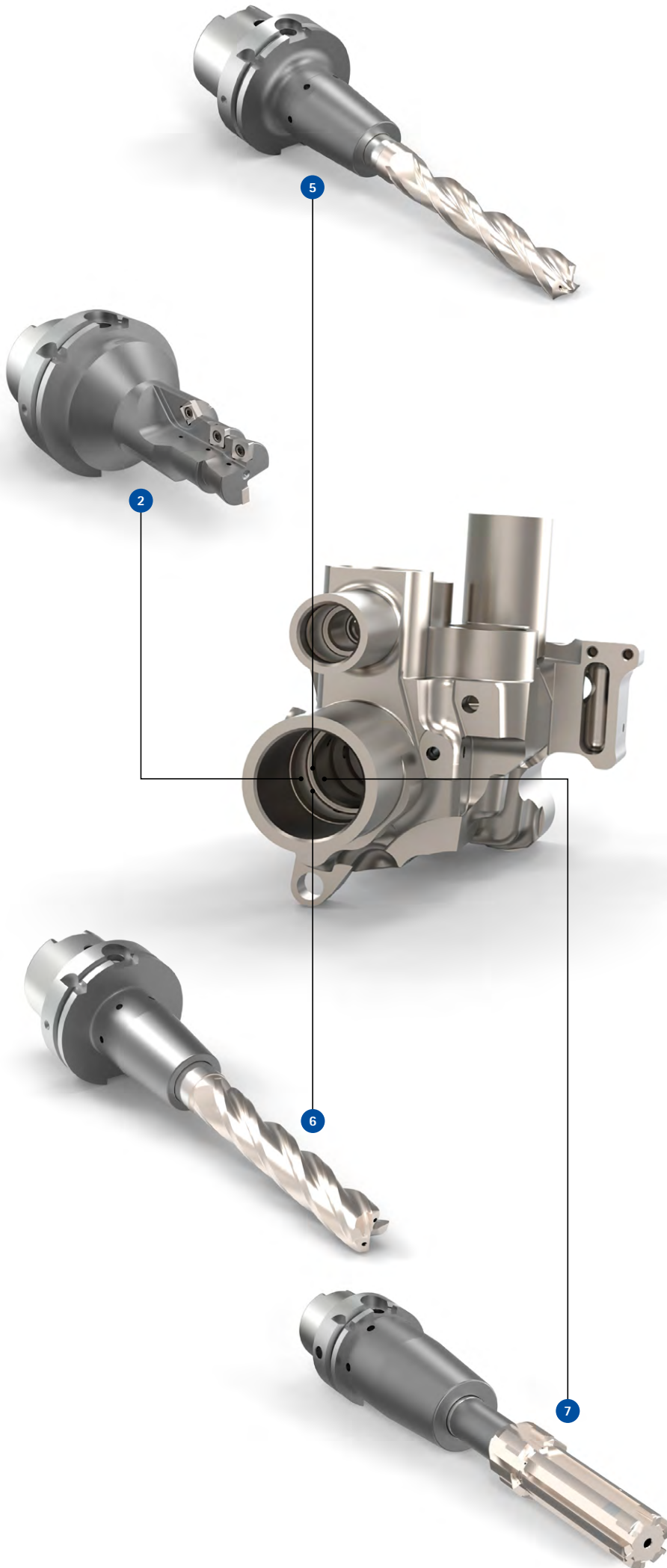
# Aerospace

## Valve housing

### Best surface finishes for optimal flow rate

Valve housings in aeroplanes are often made of titanium alloy due to its operational characteristics and low weight. The requirements related to quality and technology imposed on these parts are very high and call for a special approach that ensures high reproducibility in production and reliable processes. Complex and multi-stepped bores with slots or bores that cross each other can be efficiently machined with special or standard tools and in this way meet high quality demands.





### 1 Solid carbide drill

- For difficult drilling applications
- Innovative lead geometry for good chip removal and low cutting pressure
- Significantly more performance, up to twice the feed rate compared to previous solutions

### 2 Boring tool with changeable inserts

- Three-stepped boring tool for medium machining
- No setting of cutting edges necessary
- Economical tool concept for roughing bores
- High machining rates possible
- Indexable inserts with excellent thermal stability

### 3 Boring tool made of solid carbide with four edges

- Long tool life thanks to special coating
- Coating protects the cutting edges against high temperatures and excessive wear and tear
- The internal coolant supply and chip channel geometries ensure efficient chip removal

### 4 HPR replaceable head reamer with six edges

- Perfect concentricity of the bores
- High feed rate possible and therefore less machining time
- Adjustable adapter enables precise tool settings and eliminates spindle errors
- Complete finishing in a single step

### 5 Solid carbide drill with three edges

- Special triple-edge geometry
- Perfect positioning of the drill
- Highly suitable for inclined bore entrances or cross bores

### 6 Boring tool made of solid carbide with four edges

- Special geometry
- Stable machining
- Optimal guide into the bore
- Four cutting edges ensure the right geometry of the bore prior to finishing

### 7 HPR reamer with six edges

- Can be repaired by desoldering/soldering the blades
- Perfect roundness of the bore due to the matching multi-cutting-edge geometry
- Internal cooling ensures effective chip transport

# Automotive

## Control arm

### A lot of horsepower placed securely on the road

What works well in aircraft construction also applies in the production of sports cars, and even more so of supercars: titanium where it matters. The industry uses high-strength titanium alloys for control arms, brake calipers or chassis parts that are exposed to high loads. This often involves precision fit bores that connect parts, such as the control arm to the body.



#### 4 NeoMill-Titan-2-Shell

- Maximum machining rates
- Optimum chip removal
- Very quiet running
- Variable cooling concept
- Cutting edges with various corner radii can be deployed
- Variety of cutting materials available



#### 1 MEGA-Speed-Drill-Titan

- Extends tool life by 30% compared to previous solutions
- Drilling specialist for high cutting speeds and feed rates
- Short cycle times

#### 2 OptiMill-Titan-HPC

- Four-edge roughing milling cutter
- Polished chip flute
- Heat-resistant high-performance coating
- Unequal cutting edge (smooth cut)

#### 3 HPR replaceable head reamer

- Radial run-out and change-over accuracy less than 3  $\mu\text{m}$
- Easy to handle
- Maximum precision and productivity
- Internal coolant supply for direct cooling of the cutting edges
- Particularly economical (replaceable head)

# Medical technology

## Hip joint

### A second hip that lasts a lifetime

Dimensional accuracy is of elementary importance in medical technology. In addition, the surface finish of parts is decisive. For instance, hip prostheses require a defined surface roughness on one side to favour ingrowth into the bone. An absolutely smooth surface on the other socket side is also required to achieve a long service life with as little friction as possible.



#### 1 OptiMill-Tro-Titan

- Heat-resistant high-performance coating
- Specially designed chip flute for optimum chip removal
- Heat reduction in the cutting zone



#### 2 MEGA-Speed-Drill-Titan

- Extends tool life by 30% compared to previous solutions
- Drilling specialist for high cutting speeds and feed rates
- Short cycle times

## Bone plates

### Connection element in the prosthesis

Titanium is also employed for external prostheses, mainly where the workpiece material is used for moving parts of artificial limbs.



# SPECIAL SOLUTIONS

Features for tools for machining large parts



## Application examples for special solutions

- 1 Shell end face milling cutter in a monolithic design for milling very high shoulder dimensions.
- 2 Combination tool with tangential technology for boring as well as circular milling of chamfers on both sides on the large bore of a connecting rod.
- 3 Fine boring tool with minimum quantity lubrication (MQL) with PCD guide pads and module flange for setting radial run-out precisely. The adjustable cutting edge ensures a  $\mu\text{m}$ -accurate diameter on the bearing rib.
- 4 Six-edge special HNC reamer made of solid carbide for MQL machining with a back-flushing function for machining engine holders.
- 5 Solid carbide form-cutter head ( $z=2+2$ ) with CFS connection for deburring, chamfering and circular milling of inner contours or relief grooves.
- 6 Four-edge solid carbide end milling cutter with a neck for machining parts with deep pockets.





- 7 Fine boring tool with MQL, with insert and PCD guide pads for  $\mu\text{m}$ -accurate machining of valve bores.
- 8 Multi-stepped boring tool with ISO indexable inserts for machining bearing bores on housing parts.
- 9 HPR replaceable head reamer with brazed cutting edges for economical contour machining of diameter, chamfer and radii on hydraulic housings.

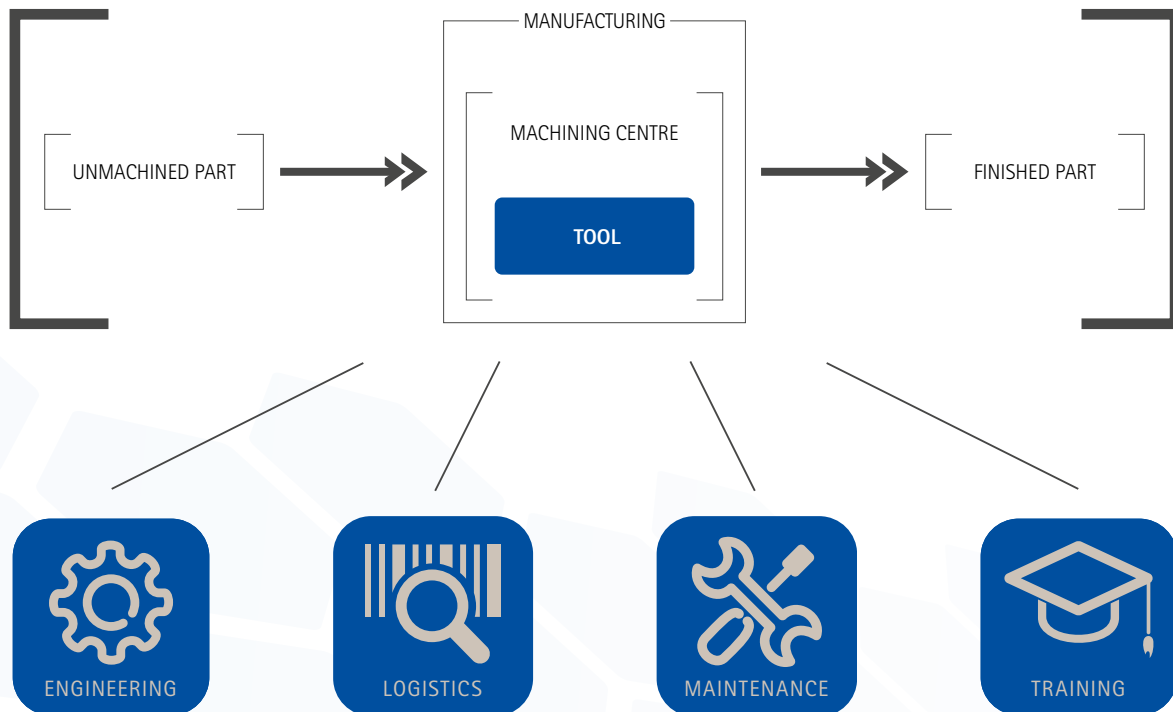
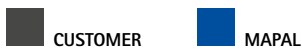
- 10 Circular milling tool with tangential technology for countersinking and circular milling of chamfers on bores.
- 11 Coated solid-carbide drill with internal cooling and three margin lands for precise milling of bores on pylons.
- 12 Boring bar with ISO indexable insert for machining the bearing ribs of hinge lines. These are used as fuselage connection elements for doors, landing gear covers and flaps on aeroplanes.

# Individual, needs-based service

MAPAL's roots lie in the manufacture of custom tools. The focus is therefore always on holistic advice and support for machining tasks and processes.

MAPAL provides support in all phases and areas of production with an extensive range of services. Regardless of whether a new production facility is to be set up, processes need to be optimised, new technologies need to be introduced, machines need to be converted to new parts, the tool inventory needs to be optimised or the know-how of employees needs to be expanded.



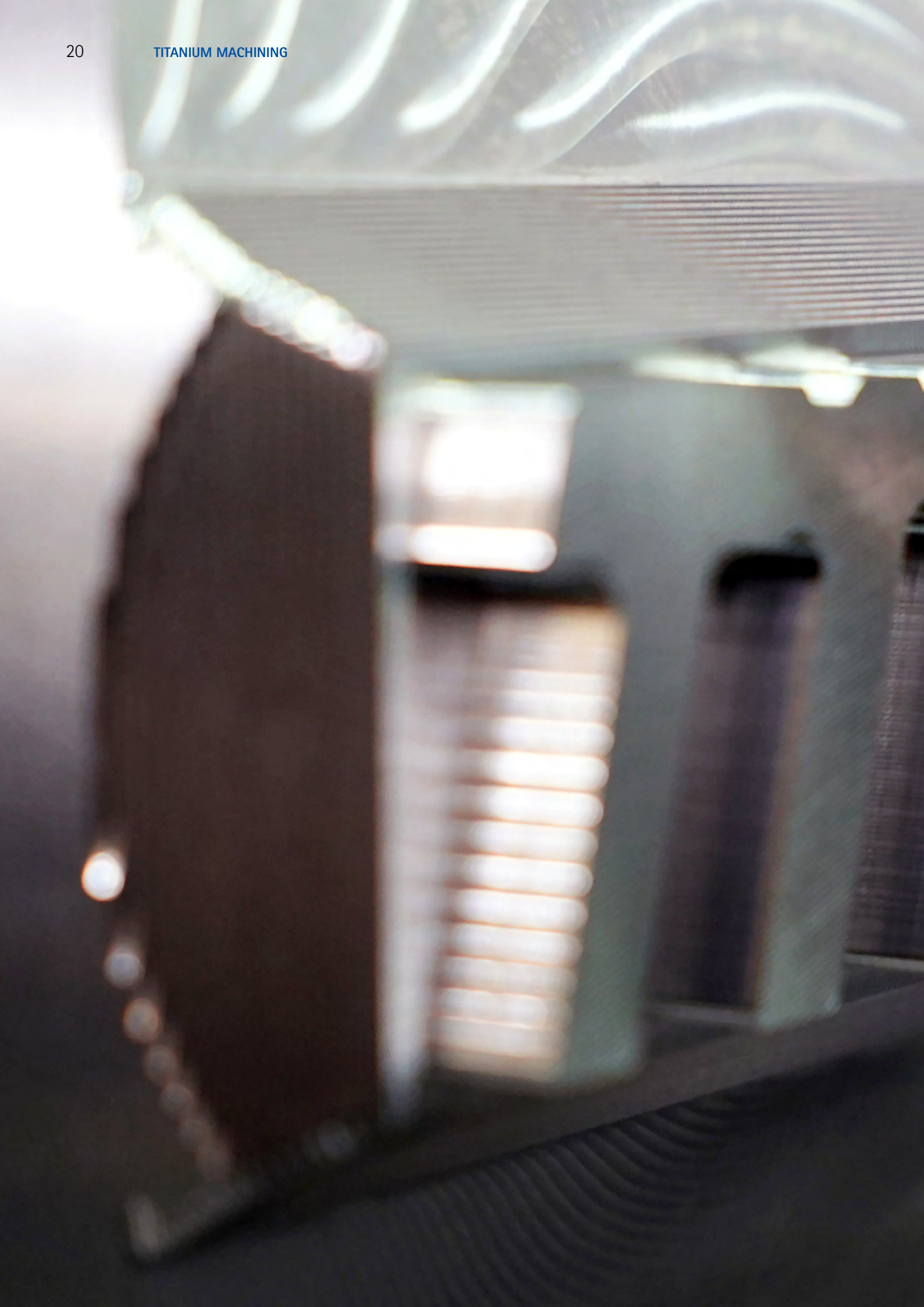


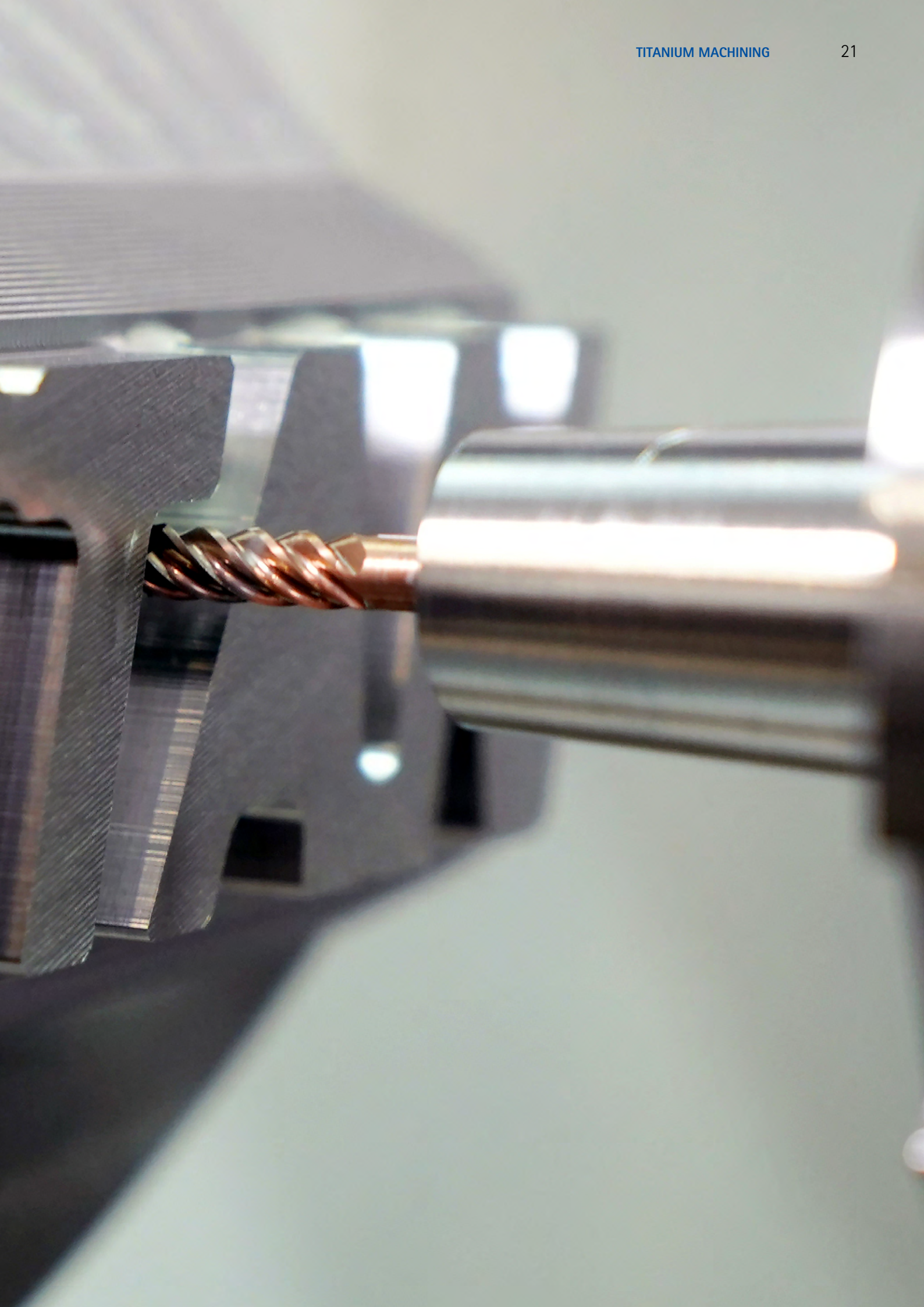
With the engineering service module, MAPAL guarantees fast, precise and safe manufacturing. Further savings potential can be tapped in the area of logistics and maintenance. And in the area of training, MAPAL ensures that the specialist know-how it has gathered is transparently and completely available to the customer – this gives customers a decisive lead over their competitors.

All of the services offered by MAPAL focus on optimal processes and comprehensive support on the way to Industry 4.0. The goal is to always significantly assist the customer in achieving smooth, productive and economical manufacturing.

## ADVANTAGES

- Solutions for complete workpieces including tools, fixtures, NC programs and commissioning
- Complete process design and implementation from a single source
- Fast and flexible on-site support worldwide
- Efficient and cost-optimised tool technology
- Optimal coordination of tool, workpiece, equipment and machine
- Highest product quality, process reliability and economic efficiency right from the start
- Fast throughput from planning to implementation with maximum planning security





# PRODUCT OVERVIEW

## Tools for titanium machining

MAPAL's highly capable product range ensures excellent and reliable results for all machining tasks in titanium. Cost-effectiveness and product quality are particularly important in meeting customer requirements.

### Processing titanium efficiently




The centrepiece of tool design is well thought-out heat removal and heat-resistant cutting material. In this way, relatively high cutting values can be achieved with high process reliability. Machining ductile, high-strength workpiece material becomes more productive and costs are reduced.

### Application-oriented


The portfolio includes drills and milling cutters made of solid carbide, milling cutters with indexable inserts, reamers for fine bore machining and indexable inserts for boring. In connection with application-oriented clamping technology, MAPAL offers everything from the spindle to the cutting edge from a single source, thus ensuring the maximum performance of the entire system.

### Wide range of available diameters

The range of available diameters is correspondingly broad. Starting with small sizes from 3 mm, as often required in medical technology, through to the large tools for aircraft construction and energy technology.

Milling		Drilling from solid
		
<p><b>Milling cutters with replaceable inserts</b></p> <p><b>NeoMill-Titan-2-Corner</b></p> <ul style="list-style-type: none"> <li>- Shoulder milling cutter with double-edge radial indexable inserts</li> <li>- Positive basic shape for parts susceptible to vibrations</li> <li>- Cutting depths from up to 10 mm</li> </ul> <p><b>NeoMill-Titan-2-Shell</b></p> <ul style="list-style-type: none"> <li>- Shell end face milling cutter with double-edge radial indexable inserts</li> <li>- Ideal for deep shoulder milling and trimming with high cutting depths of up to 75 mm</li> </ul> <p><b>NeoMill-4-HiFeed90</b></p> <ul style="list-style-type: none"> <li>- High-feed milling cutter with four-edge radial indexable inserts</li> <li>- Universal tool system to ensure maximum productivity</li> </ul> <p>Ø area: 16.00 - 200.00 mm</p>	<p><b>Milling with Fixed Cutting Edges</b></p> <p><b>OptiMill-Titan-HPC</b></p> <ul style="list-style-type: none"> <li>- Four-edge shoulder milling cutter for roughing and finishing titanium</li> <li>- Special cutting edge finish for the highest degree of resistant to wear</li> <li>- Highest degree of tool stability through maximum core dimension and core rise at the shank</li> <li>- Different corner radii available</li> </ul> <p><b>OptiMill-Tro-Titan</b></p> <ul style="list-style-type: none"> <li>- Five-edge trochoidal milling cutter</li> <li>- Maximum material removal rate while providing an excellent surface finish at the same time</li> <li>- Unequal spacing for quiet running during machining</li> <li>- Finely balanced cutting tool for protecting the machine spindle and a longer tool life</li> <li>- Cutting depth up to 3xD</li> </ul> <p>Ø area: 6.00 - 25.00 mm</p>	<p><b>Drilling from solid with solid carbide</b></p> <p><b>MEGA-Speed-Drill-Titan</b></p> <ul style="list-style-type: none"> <li>- Double-edge high-speed drill</li> <li>- Four margin lands for precise surface accuracy and cylindricity</li> <li>- Convex cutting edge with corner chamfer for high stability</li> <li>- Novel knurled profile to protect the margin lands</li> <li>- Maximum heat and wear resistance</li> </ul> <p>Ø area: 3.00 - 20.00 mm</p>
<p>Page 25</p>		<p>Page 55</p>



Boring	Reaming and fine boring	Clamping
		
<p><b>Boring with tangential technology</b></p> <p><b>Part-specific custom tools</b></p> <ul style="list-style-type: none"> <li>- Single- or multi-stepped tool with indexable inserts</li> <li>- Tangential technology for top performance</li> <li>- Defined chip formers</li> <li>- Highest productivity</li> <li>- Stable machining</li> </ul> <p><b>Tangential indexable inserts</b></p> <ul style="list-style-type: none"> <li>- Ground CTHQ and FTHQ inserts</li> <li>- Four usable cutting edges</li> <li>- Wide range of applications due to the three different sizes</li> <li>- High-performance PVD coating for maximum heat and wear resistance</li> <li>- Special arc shaped land for optimal machining results at a length-to-diameter ratio &gt;3.5xD</li> </ul>	<p><b>Fine bore machining</b></p> <p><b>FixReam FXR</b></p> <ul style="list-style-type: none"> <li>- High-performance reamer made from solid carbide</li> <li>- Ideal for implementing short cycle times</li> <li>- Variety of cutting materials and coatings available</li> </ul> <p><b>HPR replaceable head reamer</b></p> <ul style="list-style-type: none"> <li>- High-precision replaceable head system in a fixed design with brazed cutting edges</li> <li>- Precise radial run-out and changeover accuracy of &lt; 3 µm</li> <li>- Highest degree of economic efficiency due to modular system</li> <li>- Suitable for minimum quantity lubrication (MQL)</li> </ul> <p>∅ area: 2.80 - 65.00 mm</p>	<p><b>Hydraulic clamping technology and mechanical tool clamping technology</b></p> <p><b>Hydraulic clamping technology</b></p> <ul style="list-style-type: none"> <li>- UNIQ Mill Chuck, HA for highly dynamic milling applications</li> <li>- UNIQ DReAM Chuck for reaming and drilling applications as well as for finishing during milling operations</li> <li>- HydroChuck with an extensive standard range</li> </ul> <p><b>Mechanical tool clamping technology</b></p> <ul style="list-style-type: none"> <li>- Side lock chuck Mill Chuck, HB</li> <li>- MFS milling head holder for screw-in milling cutter</li> <li>- HFS replaceable head holders for HPR replaceable head reamer</li> </ul> <p><b>Milling cutter arbor</b></p> <ul style="list-style-type: none"> <li>- With enlarged face connection diameter</li> </ul> <p><b>Adapter</b></p> <ul style="list-style-type: none"> <li>- Alignment adapter for high-precision alignment of all flange modules</li> </ul>
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# MILLING

## Milling cutters with replaceable inserts

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## Milling cutter with fixed cutting edges

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# NeoMill®-Titan-2-Corner

## indexable insert milling cutters with a bite

NeoMill-Titan is the umbrella term for a whole family of tools with indexable inserts for titanium machining: Arbor, shank and shoulder milling cutters belong to the standard range. Chips are effectively ejected from the shear zone through optimally adapted indexable insert geometries and chip flutes. The unequal spacing of the inserts on the tool periphery ensures very quiet running.

### 1 Indexable inserts

- XPKT indexable insert with four different corner radii and three cutting material types

### 2 Coolant outlets

- Variably designed coolant outlets allow the flow rate to be regulated for each individual cutting edge (shell end face milling cutter)

### 3 Positive blade geometry

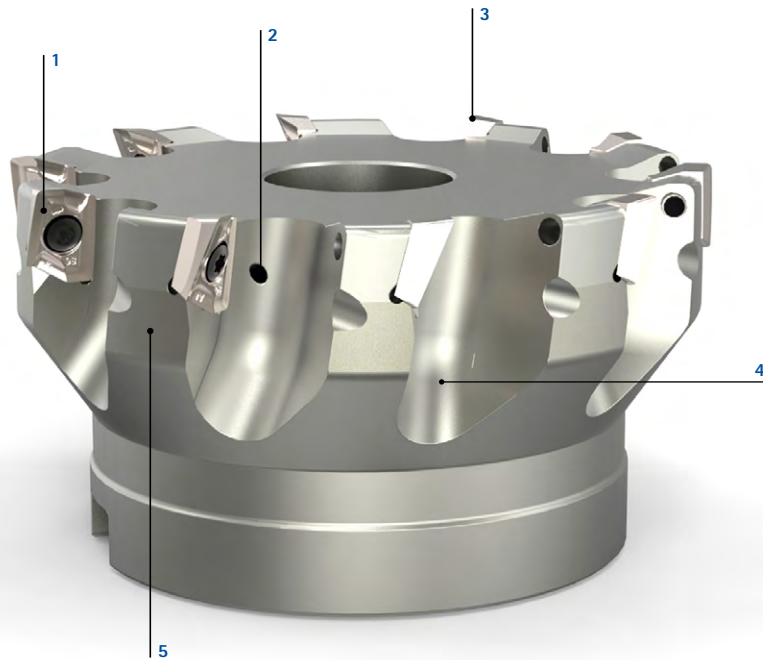
- The positive cutting edge geometry ensures soft cutting behaviour, which minimises thermal load on the cutting edges

### 4 Chip flute

- Chips are effectively ejected from the shear zone through optimally adapted chip flutes

### 5 Unequal spacing

- The unequal spacing of the inserts ensures very quiet running

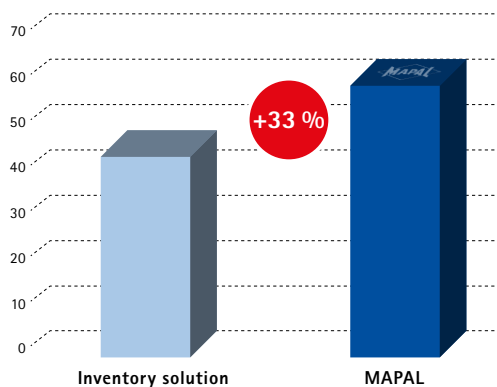


## Features

### Dimensions:

- Shoulder milling cutter as milling cutter head
- $\varnothing$  area: 40 mm up to 100 mm
- Standard corner radii of the indexable inserts: 0.8 / 2 / 3 and 4 mm
- Double-edge indexable insert
- $a_p$  max 10 mm
- Longer tool life
- Perfect solution for roughing and medium machining

## Tool life (min) \*



### TC6/TA15

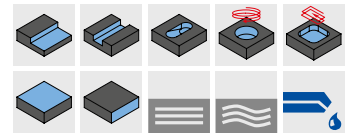
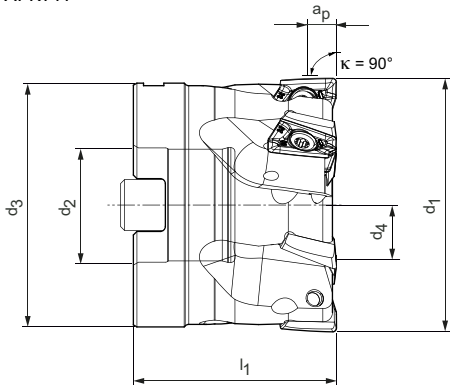
#### Tool with six cutting edges

Nominal  $\varnothing$ : 50 mm  
 $v_c$ : 47 m/min  
 $f_z$ : 0.14 mm  
 $a_p$ : 3 mm  
 $a_e$ : 30 mm

\* Tool life per milling unit (without changing the indexable inserts or use of additional cutting edges).

# NeoMill®-Titan-2-Corner

Shoulder milling cutter with radial technology  
XPKT11





## Milling cutter, medium spacing

Dimensions					Z <sub>eff</sub>	a <sub>p</sub> max. *	Weight [kg]	Max. operating speed [rpm]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>							
40	16	38	13,8	40	4	10	0,2	21.000	✓	ICM901-040-CA16-Z04R-XP_T11	31281086
50	22	48	18,5	40	4	10	0,3	20.000	✓	ICM901-050-CA22-Z04R-XP_T11	31281088
63	27	58	20,5	50	5	10	0,7	18.000	✓	ICM901-063-CA27-Z05R-XP_T11	31281110
80	32	78	27	55	7	10	1,5	16.000	✓	ICM901-080-CA32-Z07R-XP_T11	31281112
100	32	78	27	55	9	10	2,0	14.000	✓	ICM901-100-CA32-Z09R-XP_T11	31281114



## Milling cutter, close spacing

Dimensions					Z <sub>eff</sub>	a <sub>p</sub> max. *	Weight [kg]	Max. operating speed [rpm]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>							
40	16	38	13,8	40	5	10	0,2	21.000	✓	ICM901-040-CA16-Z05R-XP_T11	31281087
50	22	48	18,5	40	6	10	0,3	20.000	✓	ICM901-050-CA22-Z06R-XP_T11	31281089
63	27	58	20,5	50	7	10	0,7	18.000	✓	ICM901-063-CA27-Z07R-XP_T11	31281111
80	32	78	27	55	9	10	1,5	16.000	✓	ICM901-080-CA32-Z09R-XP_T11	31281113
100	32	78	27	55	11	10	2,0	14.000	✓	ICM901-100-CA32-Z11R-XP_T11	31281115

## Accessories

	XPKT1104	Indexable insert	Page 31
	MCA-...	Milling cutter arbor	Page 96

## Spare parts\*\*

	Clamping screw for indexable insert TORX PLUS M3.5X8.1-TX10-IP	Order no. 30979520
	Milling cutter clamping screws for milling cutter	Page 48

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* A cutting depth that is bigger or smaller than the corner radius of the indexable insert should be chosen for shoulder milling.

\*\* Included in scope of delivery.

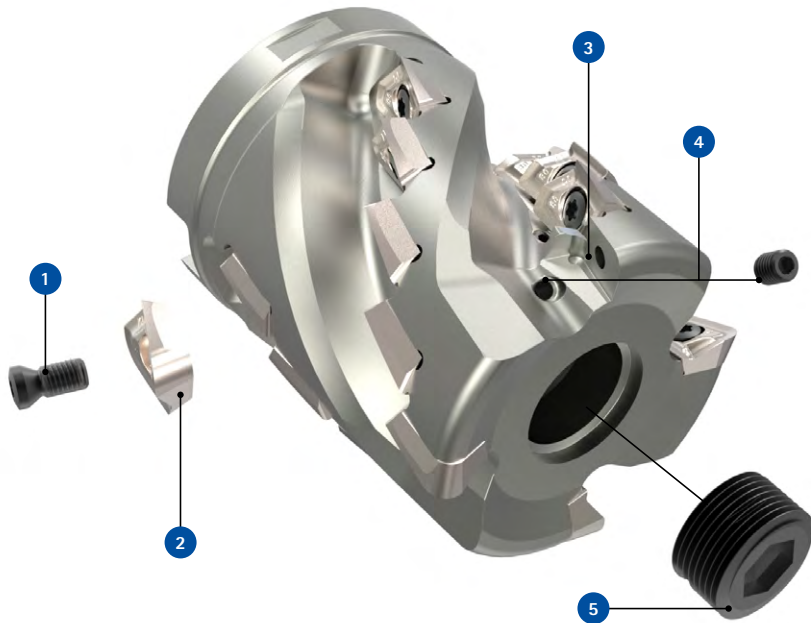
Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-Titan-2-Shell

## Shell end face milling cutter with individual coolant supply

The NeoMill shell end face milling cutters are available as arbor and shank versions. Due to the topography of the indexable insert, the chips are optimally formed and ejected from the shear zone via the ideally customised chip flutes. Variably designed coolant outlets allow the flow rate to be regulated for each individual cutting edge.

- 1 Clamping screw for indexable insert (TORX PLUS)**
- 2 Indexable inserts**
  - XPKT indexable insert with four different corner radii and three cutting material types
- 3 Indexable insert seat**
- 4 Threaded pin with coolant outlet**
  - Efficient and variable cooling concept increases tool life
  - Outlet diameters can be individually set and sealed
  - Easy regulation of the coolant supply at each cutting edge, whereby optimal heat removal is ensured at the cutting edge
- 5 Coolant sealing screw**

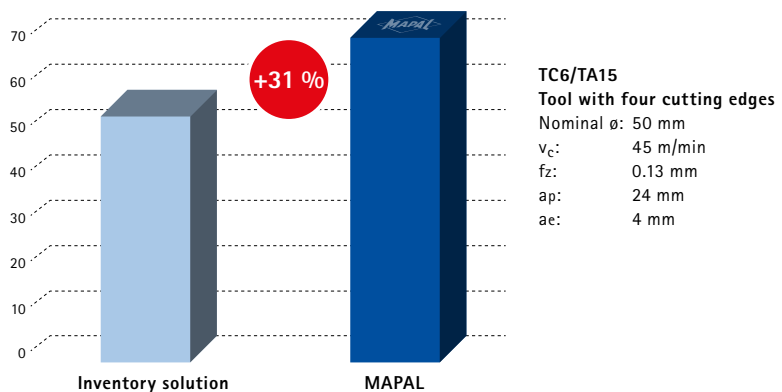


### Features

**Dimensions:**

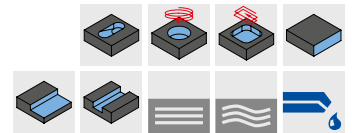
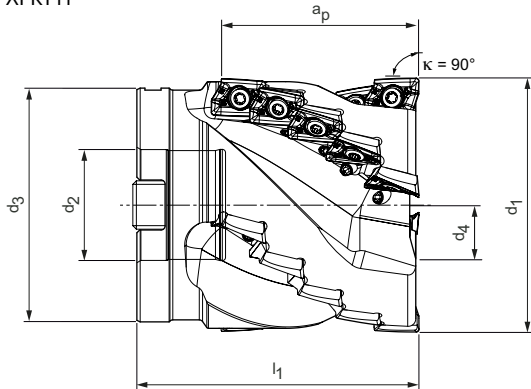
- $\varnothing$  area: 32 mm up to 80 mm
- Standard corner radii of the indexable inserts: 0.8 mm / 2 mm / 3 mm and 4 mm
- Improved chip removal
- Optimal heat removal in the cutting zone
- Longer tool life
- Perfect solution for roughing and medium machining

### Tool life [min]



# NeoMill®-Titan-2-Shell

Shell end face milling cutter with radial technology  
XPKT11



## Milling cutter, medium spacing

Dimensions					Z <sub>eff</sub>	No. of indexable inserts	a <sub>p</sub> max. *	Weight [kg]	Max. operating speed [rpm]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>								
50	22	48	21	65	4	20	47,5	0,6	20.000	✓	ISM901-050-CA22-Z04R-XP_T11	31281119
63	27	58	27	70	4	20	47,5	1,0	18.000	✓	ISM901-063-CA27-Z04R-XP_T11	31281121
80	32	78	32	85	5	30	57	2,2	16.000	✓	ISM901-080-CA32-Z05R-XP_T11	31281123

## Milling cutter, close spacing

Dimensions					Z <sub>eff</sub>	No. of indexable inserts	a <sub>p</sub> max. *	Weight [kg]	Max. operating speed [rpm]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>								
40	16	38	15	60	3	12	38	0,3	21.000	✓	ISM901-040-CA16-Z03R-XP_T11	31281118
50	22	48	21	65	5	25	47,5	0,5	20.000	✓	ISM901-050-CA22-Z05R-XP_T11	31281120
63	27	58	27	70	5	25	47,5	1,1	18.000	✓	ISM901-063-CA27-Z05R-XP_T11	31281122
80	32	78	32	85	6	36	57	2,3	16.000	✓	ISM901-080-CA32-Z06R-XP_T11	31281124

## Accessories

	XPKT1104	Indexable insert	Page 31
	MCA-...	Milling cutter arbor	Page 96
		Coolant sealing screw	Page 48
		Threaded pin	Order no.
		With coolant bore Internal ø = 1 mm Internal ø = 0.5 mm	31291814 31291816
		Without coolant bore	10003420

## Spare parts\*\*

	Clamping screw for indexable insert TORX PLUS M3.5X8.1-TX10-IP	Order no. 30979520
	Threaded pin with coolant bore Internal ø = 1.5 mm	Order no. 31291811
	Milling cutter clamping screws for milling cutter	Page 48

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* A cutting depth that is bigger or smaller than the corner radius of the indexable insert should be chosen for shoulder milling.

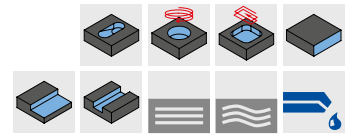
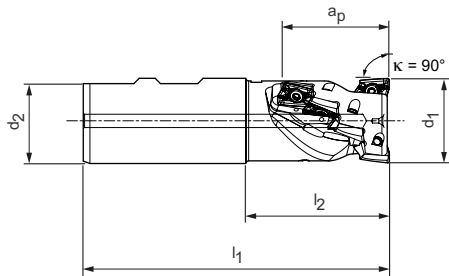
\*\* Included in scope of delivery.

\*\*\* Additional coolant nozzle to reduce the cross section of the coolant outlet, which results in increased coolant pressure (if there is not enough coolant pressure on the machine tool).

Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-Titan-2-Shell



Shell end face milling cutter with radial technology  
XPKT11




## End milling cutter

Dimensions				z <sub>eff</sub>	No. of indexable inserts	a <sub>p</sub> max. *	Weight [kg]	Max. operating speed [rpm]	Shank form	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>									
32	32	115	53	2	8	38	0,6	23.000	HB	✓	ISM901-032-115-HB32-Z2R-XP_T11	31281125
40	32	120	58	3	15	47,5	0,7	21.000	HB	✓	ISM901-040-120-HB32-Z3R-XP_T11	31281126

## Accessories

	XPKT1104	Indexable insert	Page 31
	MWC-...	MillChuck, HB	Page 94

## Spare parts\*\*

	Clamping screw for indexable insert TORX PLUS M3.5X8.1-TX10-IP	Order no. 30979520
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Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* A cutting depth that is bigger or smaller than the corner radius of the indexable insert should be chosen for shoulder milling.

\*\* Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# XPKT

Radial indexable insert, double edge



Workpiece material	<b>S</b>			
	Ni alloy ← Wear-resistant   Ti alloy → Toughened			
Substrate	Carbide			
Coating	PVD			
Cutting material type	HP990	HP993	HP995	
Cutting edge design	M33	M33	M33	
<b>XPKT11</b>	<b><math>a_p</math> max. [mm]</b>			
XPKT110408R-...-	*	31103767	31329348	31103766
XPKT110420R-...-	*	31160787	31343443	31160786
XPKT110430R-...-	*	31160789	31343444	31160788
XPKT110440R-...-	*	31160801	31343445	31160800

Dimensions [mm]				
l	d	s	d <sub>1</sub>	R
13,98	9,35	4,7	4,1	0,8
13,98	9,35	4,7	4,1	2,0
13,98	9,35	4,7	4,1	3,0
13,98	9,35	4,7	4,1	4,0

### Feed per tooth

MMG**	Cutting edges design	XPKT
		$f_z$ [mm/tooth]
<b>S</b>	<b>M33</b>	<b>0.1 - 0.25</b>

Legend: M33 = Medium machining

## Assembly note

### Tipping shell end face milling cutter NeoMill-Titan-2-Shell with XPKT indexable insert



Different indexable insert corner radii can be used in the foremost cutting edge row.  
**0.8 mm / 2.0 mm / 3.0 mm / 4.0 mm**

In the back cutting edge rows (from the 2nd row onwards) **only** indexable inserts with a corner radius smaller than or equal to **0.8 mm** may be used

\*\*  $a_p$  max. depends on the type of milling cutter and application.  
 \*\* MAPAL machining groups

See Pages 52/53 for associated clamping screws and screwdrivers.  
 For cutting data recommendations, see end of chapter.

## NeoMill®-4-HiFeed90

### Very high machining rates with good process reliability

The NeoMill-4-HiFeed90 high-feed milling cutter is a universal tool system that ensures maximum productivity and is characterised by top removal rates, extreme feed rates and big cutting depths. Offered as arbor, shank and screw-in milling cutters.

#### 1 Universal tool system

- Unequal spacing ensures high stability and quiet running
- Highest productivity
- Maximum rate of removal due to very high feed rates and large cutting depths

#### 2 Inserts

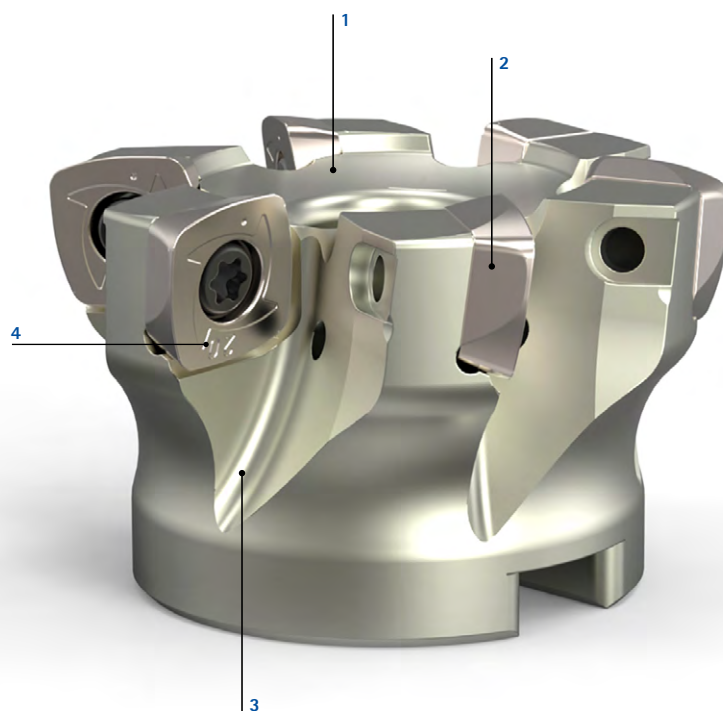
- Four blade sizes
- Four-edge indexable insert

#### 3 Slot geometry

- Effective chip transport out of the shear zone

#### 4 Cutting material

- Two different cutting material types with PVD coating

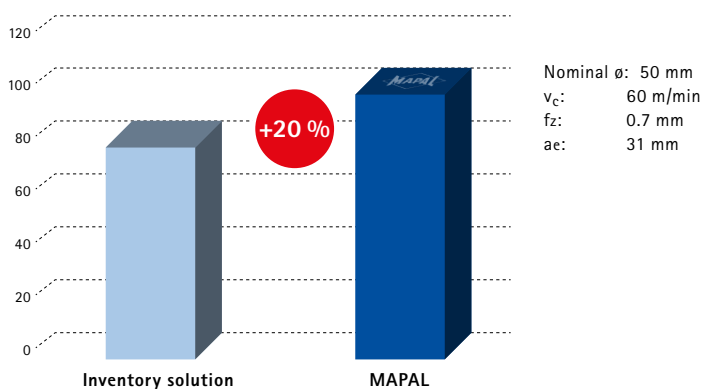


### Features

#### Dimensions:

- End milling cutter, screw-in milling cutter, arbor milling cutter
- $\varnothing$  area: 16 mm up to 200 mm
- Four-edge indexable insert
- $a_p$  max 1 mm to 3.5 mm
- zeff two to eleven cutting edges
- SD insert size of 06, 10, 14 and 18
- Easy cutting even in full slot milling

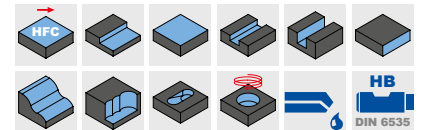
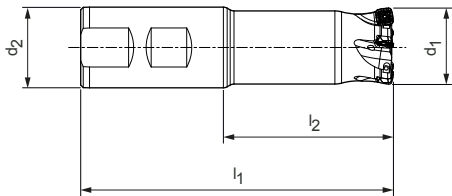
### Tool life [min]





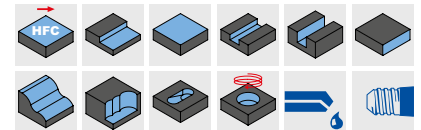
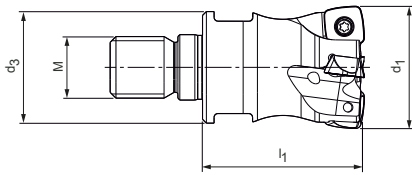
# NeoMill®-4-HiFeed90

High-feed milling cutter  
SDMT06



## End milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>		HFC				
16	16	85	37	2	1	0,10	✓	IMH901-016-085-HB16-Z2R-SD_06	31146632
20	20	90	40	3	1	0,17	✓	IMH901-020-090-HB20-Z3R-SD_06	31146633
25	25	106	50	4	1	0,33	✓	IMH901-025-106-HB25-Z4R-SD_06	31146634
32	32	124	64	5	1	0,66	✓	IMH901-032-124-HB32-Z5R-SD_06	31146635
35	32	124	64	5	1	0,67	✓	IMH901-035-124-HB35-Z5R-SD_06	31146636



## Screw-in milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	SW	Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	M	d <sub>3</sub>	l <sub>1</sub>		HFC					
16	8	13,8	31	2	1	12	0,03	✓	IMH901-016-M008-Z02R-SD_06	31146646
20	10	18	29,8	3	1	16	0,05	✓	IMH901-020-M010-Z03R-SD_06	31146647
25	12	21	32	4	1	18	0,09	✓	IMH901-025-M012-Z04R-SD_06	31146648
32	16	29	43	5	1	24	0,21	✓	IMH901-032-M016-Z05R-SD_06	31146649
35	16	29	43	5	1	24	0,23	✓	IMH901-035-M016-Z05R-SD_06	31146650

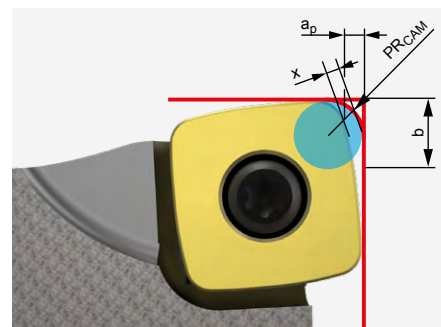
## Accessories

	SDMT0602	Indexable insert HFC	Page 38
	MWC-...	MillChuck, HB	Page 94
	MFS-101	MFS milling head holder for screw-in milling cutter	Page 99

## Spare parts\*

	SDMT0602	Clamping screw for indexable insert M2.2X5.2-TX7-IP	Order no. 31161853
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## CAM programming note



When using an HFC indexable insert, the programme radius PR<sub>CAM</sub> must be observed.

## SDMT06

Dimensions [mm]			
PR <sub>CAM</sub>	a <sub>p</sub>	x	b
1,77	1,0	0,45	5,12

Dimensions in mm.

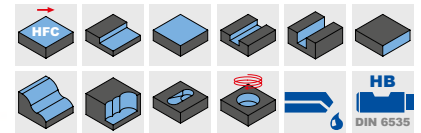
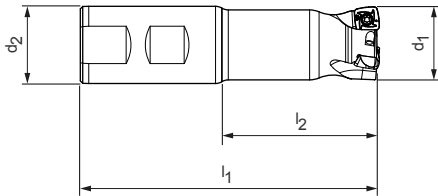
The maximum operating speeds refer only to the cutting edge system.

\*Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

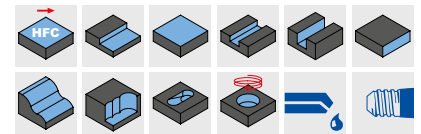
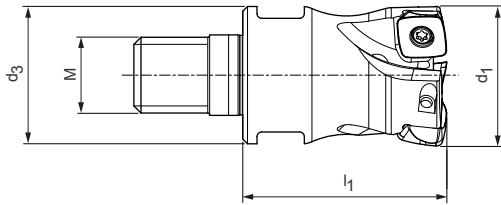
# NeoMill®-4-HiFeed90

High-feed milling cutter  
SD\_\_10



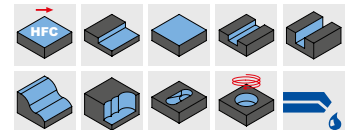
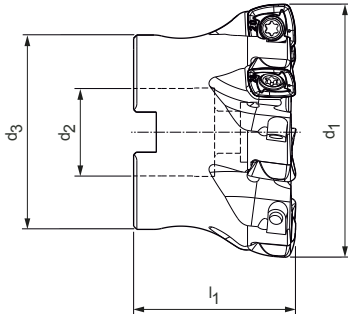
## End milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>		HFC				
25	25	106	50	2	1,5	0,31	✓	IMH901-025-106-HB25-Z2R-SD__10	31144156
25	25	106	50	3	1,5	0,30	✓	IMH901-025-106-HB25-Z3R-SD__10	31144157
32	32	124	64	3	1,5	0,64	✓	IMH901-032-124-HB32-Z3R-SD__10	31144158



## Screw-in milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	SW	Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	M	d <sub>3</sub>	l <sub>1</sub>		HFC					
25	12	21	32	2	1,5	18	0,08	✓	IMH901-025-M012-Z02R-SD__10	31144200
25	12	21	32	3	1,5	18	0,07	✓	IMH901-025-M012-Z03R-SD__10	31144201
32	16	29	42	3	1,5	24	0,20	✓	IMH901-032-M016-Z03R-SD__10	31144206
32	16	29	43	4	1,5	24	0,17	✓	IMH901-032-M016-Z04R-SD__10	31144202
40	16	29	43	4	1,5	24	0,21	✓	IMH901-040-M016-Z04R-SD__10	31144203



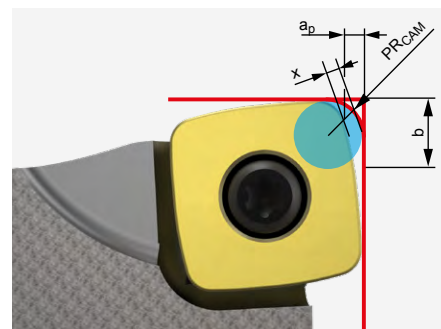
**Milling cutter**

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>		HFC				
40	16	35	40	4	1,5	0,17	✓	IMH901-040-CA16-Z04R-SD__10	31144056
40	16	35	40	6	1,5	0,17	✓	IMH901-040-CA16-Z06R-SD__10	31144057
50	22	43	40	5	1,5	0,26	✓	IMH901-050-CA22-Z05R-SD__10	31144059
50	22	43	40	7	1,5	0,25	✓	IMH901-050-CA22-Z07R-SD__10	31144060
52	22	43	40	5	1,5	0,30	✓	IMH901-052-CA22-Z05R-SD__10	31144061
63	22	48	40	6	1,5	0,42	✓	IMH901-063-CA22-Z06R-SD__10	31144062
63	22	48	40	8	1,5	0,42	✓	IMH901-063-CA22-Z08R-SD__10	31144063
66	22	48	40	5	1,5	0,46	✓	IMH901-066-CA22-Z05R-SD__10	31144085
80	27	60	50	8	1,5	0,91	✓	IMH901-080-CA27-Z08R-SD__10	31144064

**Accessories**

	SD__1004	Indexable insert HFC	Page 38
		Milling cutter clamping screws for milling cutter	Page 48
	MCA-...	Milling cutter arbor	Page 96
	MWC-...	MillChuck, HB	Page 94
	MFS-101	MFS milling head holder for screw-in milling cutter	Page 99

**CAM programming note**



When using an HFC indexable insert, the programme radius P<sub>RCAM</sub> must be observed.

**SD\_\_10**

Dimensions [mm]			
P <sub>RCAM</sub>	a <sub>p</sub>	x	b
2,25	1,5	0,62	8,033

**Spare parts\***

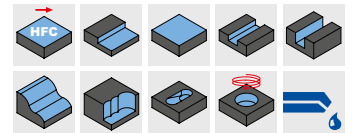
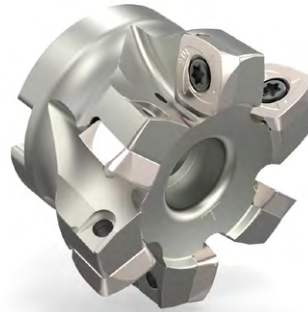
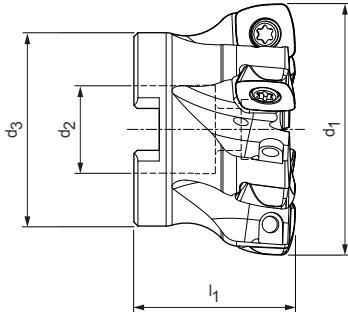
	SD__1004	Clamping screw for indexable insert M3X8.3-TX9-IP	Order no. 31161852
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Dimensions in mm.  
The maximum operating speeds refer only to the cutting edge system.  
\*Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-4-HiFeed90

High-feed milling cutter  
SDMT14



## Milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>		HFC				
50	22	43	40	5	2,4	0,22	✓	IMH901-050-CA22-Z05R-SD_14	31144065
52	22	43	40	5	2,4	0,28	✓	IMH901-052-CA22-Z05R-SD_14	31144067
63	22	48	40	6	2,4	0,38	✓	IMH901-063-CA22-Z06R-SD_14	31144068
66	22	48	40	6	2,5	0,43	✓	IMH901-066-CA22-Z06R-SD_14	31144069
80	27	60	50	7	2,4	0,85	✓	IMH901-080-CA27-Z07R-SD_14	31144070
100	32	78	50	7	2,4	1,49	✓	IMH901-100-CA32-Z07R-SD_14	31144071
100	32	78	50	9	2,4	1,49	✓	IMH901-100-CA32-Z09R-SD_14	31144072
125	40	90	60	11	2,4	2,79	✓	IMH901-125-CA40-Z11R-SD_14	31144073

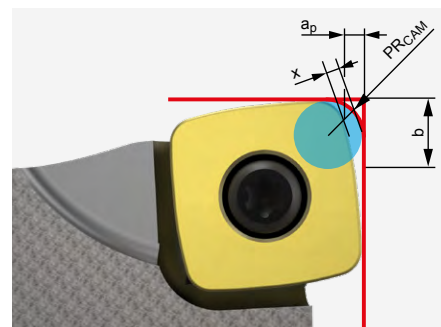
## Accessories

	SDMT1405	Indexable insert HFC	Page 38
	MCA-...	Milling cutter arbor	Page 96
		Milling cutter clamping screws for milling cutter	Page 48

## Spare parts\*

	SDMT1405	Clamping screw for indexable insert M5X10.8-TX20-IP	Order no. 31161851
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## CAM programming note



When using an HFC indexable insert, the programme radius PR<sub>CAM</sub> must be observed.

## SDMT14

Dimensions [mm]			
PR <sub>CAM</sub>	a <sub>p</sub>	x	b
3,45	2,4	0,93	10,868

Dimensions in mm.

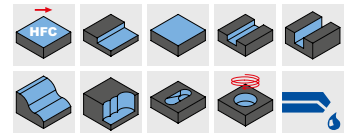
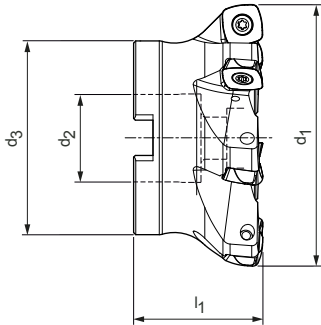
The maximum operating speeds refer only to the cutting edge system.

\*Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-4-HiFeed90




High-feed milling cutter  
SDMT18




## Milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>		HFC				
80	27	60	50	5	3,5	0,79	✓	IMH901-080-CA27-Z05R-SD__18	31144075
100	32	78	50	6	3,5	1,49	✓	IMH901-100-CA32-Z06R-SD__18	31144087
125	40	90	60	7	3,5	2,43	✓	IMH901-125-CA40-Z07R-SD__18	31144088
160	40	115	60	9	3,5	4,09	-	IMH900-160-CA40-Z09R-SD__18	31144089
200	60	140	65	11	3,5	5,83	-	IMH900-200-CA60-Z11R-SD__18	31144090

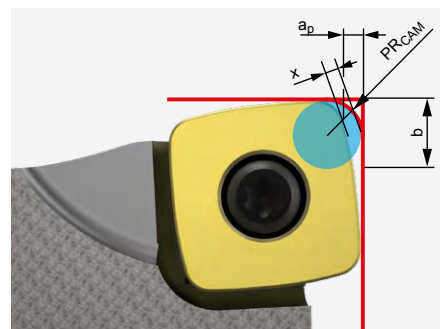
## Accessories

	SDMT1806	Indexable insert HFC	Page 38
	MCA-...	Milling cutter arbor	Page 96
		Milling cutter clamping screws for milling cutter	Page 48

## Spare parts\*

	SDMT1806	Clamping screw for indexable insert M6X15-T25	Order no. 31161862
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## CAM programming note



When using an HFC indexable insert, the programme radius  $PR_{CAM}$  must be observed.

## SDMT18

Dimensions [mm]			
$PR_{CAM}$	$a_p$	x	b
4,82	3,5	1,24	13,77

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\*Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# SDGT | SDMT

Radial indexable insert, four cutting edges



Workpiece material	<b>S</b>				
	Ni alloy ← Wear-resistant		Ti alloy → Toughened		
Substrate	Carbide				
Coating	PVD				
Cutting material type	HP990		HP995		
Cutting edge design	SMH	MLQ	SMH	MLQ	SMS
SD__	a <sub>p</sub> max. [mm]				
SDMT060212R-...-	*	31311724	31311727	31311725	31311729
SDMT100415R-...-	*	31311731	31311733	31311732	31311734
SDGT100415R-...-	*				31311736
SDMT140520R-...-	*	31311737	31311741	31311739	31311742
SDMT180630R-...-	*	31311745	31311748	31311746	31311749

Dimensions [mm]				
l	d	s	d <sub>1</sub>	R
1	6,75	2,5	2,5	1,2
1,1	10,2	4,86	3,5	1,5
1,1	10,2	4,86	3,5	1,5
2,2	14,7	5	5,5	2
3	18,7	6	6,5	3

### Feed per tooth (selection according to cutting edge design) and plunge angle

MMG**	Cutting edge design	SD_06			SD_10			SD_14			SD_18														
		a <sub>p</sub> max. [mm]			f <sub>z</sub> [mm/tooth]			a <sub>p</sub> max. [mm]			f <sub>z</sub> [mm/tooth]														
S	MLQ	0.3	<b>0.5</b>	1	0.3	<b>0.5</b>	1	0.5	<b>0.8</b>	1.3	0.5	<b>0.9</b>	1.4	0.6	<b>1.2</b>	2.2	0.8	<b>1.2</b>	2.2	1	<b>2</b>	3	1	<b>1.6</b>	2.5
	SMH	0.3	<b>0.5</b>	1	0.3	<b>0.5</b>	0.9	0.5	<b>0.7</b>	1.2	0.5	<b>0.7</b>	1.2	0.6	<b>1.2</b>	2	0.6	<b>1.2</b>	2.2	1	<b>2</b>	3	1	<b>1.5</b>	2.5
	SMS	-			-			0.5	<b>0.7</b>	1.2	0.5	<b>0.7</b>	1.2	-			-			-					

Legend: MLQ = General machining | SMH = Unstable machining | SMS = Precise machining

\*\* a<sub>p</sub> max. depends on the type of milling cutter and application.  
\*\* MAPAL machining groups

See Pages 52/53 for associated clamping screws and screwdrivers.  
For cutting data recommendations, see end of chapter.

# Cutting data recommendations for milling cutter with indexable inserts

Feed and cutting speed

## Cutting speed for milling cutter with indexable inserts

MMG*	Workpiece material		Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Carbide PVD-coated						
				HP990		HP993		HP995		
				>0.6	<0.6	>0.6	<0.6	>0.6	<0.6	
S	S1	S1.1	Titanium, titanium alloys	< 400	50	55	60	70	60	70
	S2	S2.1	Titanium, titanium alloys	< 1,200	35	45	45	55	45	55
		S2.2	Titanium, titanium alloys	> 1,200	30	35	40	50	40	50
	S3	S3.1	Nickel, unalloyed and alloyed	< 900	40	45	50	60	50	60
		S3.2	Nickel, unalloyed and alloyed	> 900	35	40	45	55	45	55
	S4	S4.1	High-temperature super alloy, Ni-, Co-, and Fe-based		30	35	40	50	40	50
	S5	S5.1	Molybdenum and tungsten alloys		60	65	70	80	70	80

## Cutting material overview: Types and type description

Cutting material	Name of cutting material	Coating composition	Colour of coating	Field of application	Recommended application	S High temperature alloys and titanium alloys										
						Wear-resistant					Toughened					
						05	15	25	35	45	01	10	20	30	40	50
Carbide PVD-coated	HP990	TiB2	Silver	●	PVD-coated universal carbide type for titanium machining <b>at low and medium cutting speeds</b> (30 – 50 m/min). The TiB2 coating is characterised by a high level of resistance to wear and excellent coating adhesion. In addition, the extremely smooth coating surface reduces the formation of built-up edges.											
	HP993				PVD-coated carbide types that are considered the <b>first choice in relation to price and performance</b> for titanium machining <b>at high cutting speeds</b> (40 – 70 m/min). The TiB2 coating is characterised by a high level of resistance to wear and excellent coating adhesion. In addition, the extremely smooth coating surface reduces the formation of built-up edges.											
	HP995				PVD-coated carbide types with high thermal stability that are considered the first choice in relation to price and performance for titanium machining <b>at high cutting speeds (40 – 70 m/min) together with maximum tool life</b> . The TiB2 coating is characterised by a high level of resistance to wear and excellent coating adhesion. In addition, the extremely smooth coating surface reduces the formation of built-up edges.											

Field of application: 🚫 Unstable machining   ● General machining   ● Stable machining

\* MAPAL machining groups  
The specified machining values are guide values.

**Note:**  
A cutting depth that is bigger or smaller than the corner radius of the insert chose be chosen for shoulder milling.

# OptiMill®-Titan-HPC

## Versatile roughing and finishing

The OptiMill-Titan-HPC four-edge shoulder milling cutter is a versatile tool. The end milling cutter made of solid carbide can be used for roughing as well as finishing. The special cutting edge preparation creates optimal surfaces.

### 1 Novel slot profile

- Very high stability and very good chip removal
- Optimal chip spaces for optimal chip transport

### 2 Unequal spacing and gradient

- Runs as quietly as possible due to varying helix angle design and cutting edge spacing
- Full slot milling up to a depth of 1.5xD possible

### 3 New coating technology

- AlTiN-based multi-layer coating for high thermal loads

### 4 Different corner radii variants available

- For machining of part as close to the contour as possible

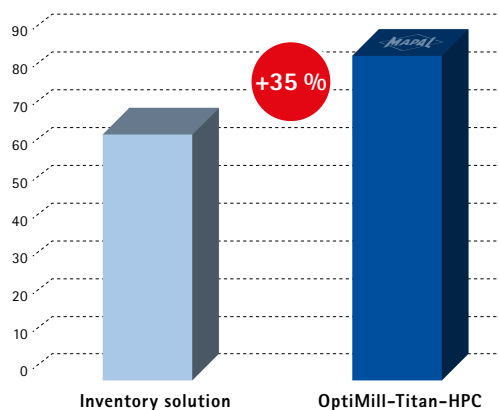


## Features

### Dimensions:

- Shoulder milling cutter shank form
- $\varnothing$  area: 6 mm up to 25 mm
- Number of cutting edges: 4
- Unequal spacing
- Shank connection 6, 8, 10, 12, 16, 20 and 25 mm
- Cutting edge preparation creates optimal surfaces

## Tool life [m]



### Ti6Al4V-1.1800

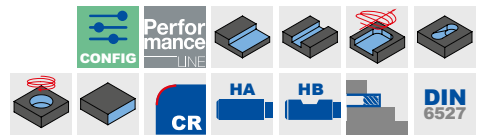
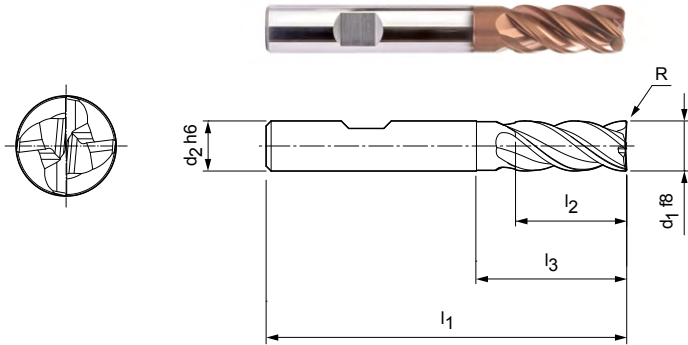
Tool $\varnothing$ :	12 mm
$v_c$ :	80 m/min
$f_z$ :	0.06 mm
$a_p$ :	12 mm
$a_e$ :	4.8 mm



# OptiMill®-Titan-HPC

Shoulder milling cutter, long design with neck  
SCM394

**Design:**  
 Diameter of milling cutter: 6.00 - 25.00 mm  
 Cutting material: HP826  
 Number of cutting edges: 4  
 Helix angle: 43°  
 Special feature: Unequal spacing



**Preferred series in stock**

Dimensions							Specification	Order no.
d <sub>1</sub> f8	d <sub>2</sub> h6	l <sub>1</sub>	l <sub>2</sub>	d <sub>3</sub>	l <sub>3</sub>	R		
6,00	6	57	13	5,8	20	0,50	SCM394-0600Z04R-R0050HB-HP826	31304509
6,00	6	57	13	5,8	20	1,00	SCM394-0600Z04R-R0100HB-HP826	31304544
8,00	8	63	21	7,8	25	0,50	SCM394-0800Z04R-R0050HB-HP826	31304547
8,00	8	63	21	7,8	25	1,00	SCM394-0800Z04R-R0100HB-HP826	31304549
10,00	10	72	22	9,8	30	0,50	SCM394-1000Z04R-R0050HB-HP826	31304552
10,00	10	72	22	9,8	30	1,00	SCM394-1000Z04R-R0100HB-HP826	31304554
12,00	12	83	26	11,8	36	0,50	SCM394-1200Z04R-R0050HB-HP826	31304557
12,00	12	83	26	11,8	36	1,00	SCM394-1200Z04R-R0100HB-HP826	31304558
16,00	16	92	36	15,8	42	1,00	SCM394-1600Z04R-R0100HB-HP826	31304573
16,00	16	92	36	15,8	42	2,00	SCM394-1600Z04R-R0200HB-HP826	31304575
20,00	20	104	41	19,7	55	1,00	SCM394-2000Z04R-R0100HB-HP826	31304580
20,00	20	104	41	19,7	55	2,00	SCM394-2000Z04R-R0200HB-HP826	31304582
25,00	25	136	50	24,7	65	2,00	SCM394-2500Z04R-R0200HB-HP826	31304586


**Available on request**

8,00	8	63	21	7,8	25	2,00	SCM394-0800Z04R-R0200HB-HP826	31304551
10,00	10	72	22	9,8	30	2,00	SCM394-1000Z04R-R0200HB-HP826	31304555
12,00	12	83	26	11,8	36	2,00	SCM394-1200Z04R-R0200HB-HP826	31304570
12,00	12	83	26	11,8	36	3,00	SCM394-1200Z04R-R0300HB-HP826	31304571
16,00	16	92	36	15,8	42	3,00	SCM394-1600Z04R-R0300HB-HP826	31304576
16,00	16	92	36	15,8	42	4,00	SCM394-1600Z04R-R0400HB-HP826	31304578
20,00	20	104	41	19,7	55	3,00	SCM394-2000Z04R-R0300HB-HP826	31304583
20,00	20	104	41	19,7	55	4,00	SCM394-2000Z04R-R0400HB-HP826	31304585
25,00	25	136	50	24,7	65	3,00	SCM394-2500Z04R-R0300HB-HP826	31304588
25,00	25	136	50	24,7	65	4,00	SCM394-2500Z04R-R0400HB-HP826	31304589

Continued on next page.

OptiMill-Titan-HPC | Solid-carbide shoulder milling cutter SCM394, external coolant supply

Configurable features

 **Shank form:**  
Shank form: HA

**Specification:**  
SCM394-1200Z04R-R0300[shank form]-HP826

Example:  
SCM394-1200Z04R-R0300HA-HP826

Shank form HA

Accessories

	MHC-...	UNIQ Mill Chuck, HA	Page 83
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# OptiMill®-Tro-Titan

## Five-edge trochoidal milling cutter for milling titanium workpiece material

The five-edge shoulder milling cutter OptiMill-Tro-Titan offers maximum material removal while providing an excellent surface finish at the same time. The unequal spacing and gradient prevents vibration, which results in quiet cutting behaviour. It is designed for trochoidal milling in part-contact cutting, trimming and for cutting depth up to 3xD.

### 1 Face geometry

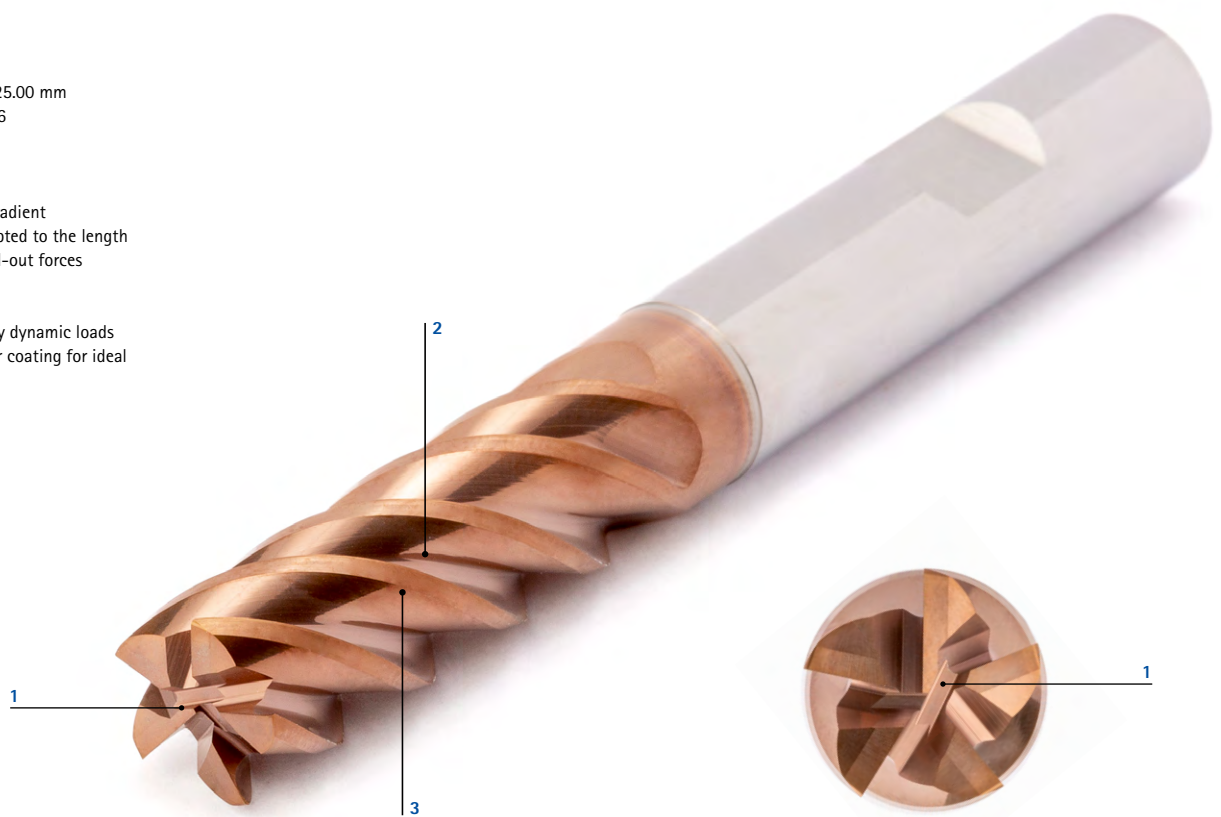
- 5 blades
- Diameter: 6.00 mm to 25.00 mm
- Cutting material: HP826

### 2 Helix angle

- Helix angle: 41° – 42°
- Unequal spacing and gradient
- Special helix angle adapted to the length ratio 3xD to reduce pull-out forces

### 3 Carbide & coating

- Tough carbide for highly dynamic loads
- AlTiN-based multi-layer coating for ideal thermal stability

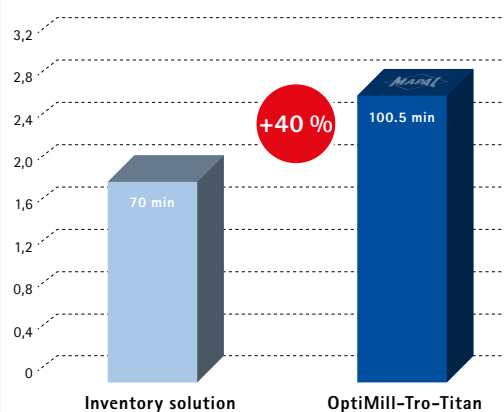


## Features

### Dimensions:

- Preferred series in stock:
  - Ø area: 6 mm up to 20 mm
- Available on request:
  - Diameter: 14 mm, 18 mm and 25 mm
- Number of cutting edges: 5
- Unequal spacing
- Especially for trochoidal milling
- For cutting depths up to 3xD
- Usage of the complete cutting length

## Cutting volumes [dm<sup>3</sup>]\*



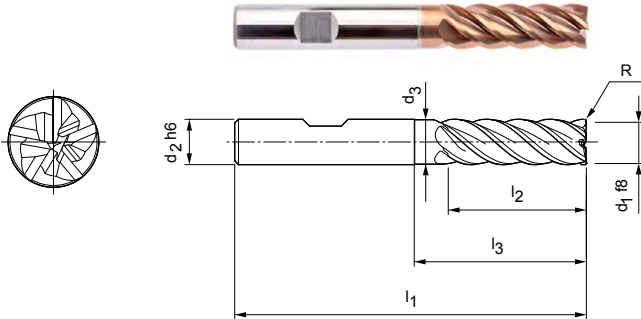
### Ti6Al4V

Nominal ø: 12 mm  
 fz: 0.09 mm  
 ap: 25 mm  
 ae: 1.2 mm  
 hmax: 0.08 mm

\* Until end of tool life

# OptiMill®-Tro-Titan

Shoulder milling cutter, design 3xD with neck  
SCM630

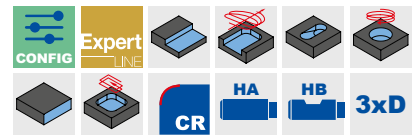


**Design:**

- Diameter of milling cutter: 6.00 - 25.00 mm
- Cutting material: HP826
- Number of cutting edges: 5
- Helix angle: 41°-42°
- Balancing quality: Cutting edge portion balanced on G2.5 according to DIN ISO1940-G2.5
- Special features: Unequal spacing

**Application:**

Especially for trochoidal milling – part-contact cutting/trimming. For cutting depths up to 3xD.




**Preferred series in stock**

Dimensions							z	Specification	Order no.
d <sub>1</sub> f8	d <sub>2</sub> h6	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	R			
6,00	6	5,8	62	18	25	0,1	5	SCM630-0600Z05R-R0010HB-HP826	30651032
8,00	8	7,8	68	24	30	0,2	5	SCM630-0800Z05R-R0020HB-HP826	30651033
10,00	10	9,8	80	30	35	0,2	5	SCM630-1000Z05R-R0020HB-HP826	30651034
12,00	12	11,8	93	36	45	0,3	5	SCM630-1200Z05R-R0030HB-HP826	30651035
16,00	16	15,8	108	48	55	0,3	5	SCM630-1600Z05R-R0030HB-HP826	30651037
20,00	20	19,8	126	60	70	0,3	5	SCM630-2000Z05R-R0030HB-HP826	30651039


**Available on request**

14,00	14	-	99	42	50	0,3	5	SCM630-1400Z05R-R0030HB-HP826	30651036
18,00	18	-	117	54	67	0,3	5	SCM630-1800Z05R-R0030HB-HP826	30651038
25,00	25	-	150	75	92	0,4	5	SCM630-2500Z05R-R0040HB-HP826	30651040

**Configurable features**



**Shank form:**  
Shank form: HA



**Specification:**  
SCM630-0600Z05R-R0010[shank form]-HP826

**Example:**

SCM630-0600Z05R-R0010HA-HP826

Shank form HA

**Accessories**

	MWC-...	MillChuck, HB	Page 94
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Dimensions in mm.

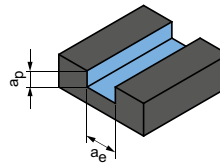
For cutting data recommendations, see end of chapter.

Special designs and other coatings available upon request.

# Cutting data recommendations for OptiMill®-Titan-HPC and OptiMill®-Tro-Titan

Feed and cutting speed

### Groove milling



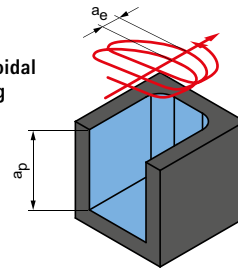
$$a_p = 1 \times D$$

$$a_e = 1 \times D$$

### OptiMill-Titan-HPC | SCM394

MMG*	Workpiece material		Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cooling			v <sub>c</sub> [m/min]	f <sub>z</sub> [mm/tooth]							
				MQL/Air	Dry	KSS		Diameter of milling cutter [mm]							
								6.00	8.00	10.00	12.00	16.00	20.00	25.00	
S	S1	S1.1	Titanium, titanium alloys	< 400			✓	85	0.035	0.045	0.054	0.062	0.075	0.086	0.096
	S2	S2.1	Titanium, titanium alloys	< 1,200			✓	80	0.029	0.037	0.044	0.050	0.061	0.070	0.078
	S2	S2.2	Titanium, titanium alloys	> 1,200			✓	50	0.025	0.033	0.039	0.045	0.055	0.062	0.070

### Trochoidal milling



$$a_p = \max. 3 \times D$$

$$a_e = \text{depending on the workpiece material}$$

### OptiMill-Tro-Titan | SCM630

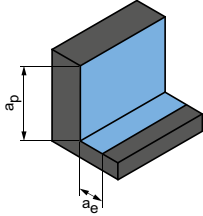
MMG*	Workpiece material		Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cooling			v <sub>c</sub> [m/min]	f <sub>z</sub> [mm] in % of D	a <sub>e</sub> [mm] in % of D	h <sub>m</sub> max. [mm] in % of D	
				MQL/Air	Dry	KSS					
S	S1	S1.1	Titanium, titanium alloys	< 400			✓	110 - 170	0.65 - 1.3	6 - 12	0.52 - 0.6
	S2	S2.1	Titanium, titanium alloys	< 1,200			✓	90 - 150	0.6 - 1.2	5 - 10	0.46 - 0.56
	S2	S2.2	Titanium, titanium alloys	> 1,200			✓	70 - 130	0.4 - 1.0	5 - 10	0.42 - 0.54

**Note:**

In the case of trochoidal milling, the specified cutting conditions change during the machining process. This also depends on the CAM software used and the machining position of the tool in the workpiece. The feed and cutting width or contact angle are constantly changing during machining in order to achieve, as far as is possible, the most constant average chip thickness depending on the contour.

\* MAPAL machining groups

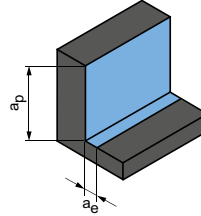
**Roughing**



$$a_p = 1,5xD$$

$$a_e = 0,25xD$$

**Finishing**



$$a_p = 1,5xD$$

$$a_e = 0,1xD$$

	$v_c$ [m/min]	$f_z$ [mm/tooth]							$v_c$ [m/min]	$f_z$ [mm/tooth]						
		Diameter of milling cutter [mm]								Diameter of milling cutter [mm]						
		6.00	8.00	10.00	12.00	16.00	20.00	25.00		6.00	8.00	10.00	12.00	16.00	20.00	25.00
	<b>135</b>	0.059	0.076	0.091	0.104	0.127	0.146	0.163	<b>160</b>	0.094	0.120	0.144	0.165	0.202	0.230	0.257
	<b>120</b>	0.049	0.062	0.074	0.085	0.104	0.119	0.133	<b>145</b>	0.077	0.098	0.117	0.135	0.165	0.189	0.210
	<b>80</b>	0.043	0.055	0.066	0.076	0.093	0.106	0.118	<b>95</b>	0.068	0.087	0.104	0.120	0.147	0.168	0.187

Machining example

**TiAl6V4**     $\phi = 12 \text{ mm}$      $a_e = 1.2 \text{ mm}$   
 $v_c = 140 \text{ m/min}$      $a_p = 30 \text{ mm}$   
 $f_z = 0.09 \text{ mm}$

The specified machining values are guide values.  
 The optimum data for the respective machining task should be determined during the test or machining.

# Accessories

## NeoMill®-Titan



### Milling cutter clamping screws and coolant sealing screw

Series		Diameter of milling cutter	Diameter of milling cutter arbor	Milling cutter clamping screw		Coolant sealing screw
				Without internal cooling*	With internal cooling	
<b>NeoMill-Titan-2-Corner</b> 	XPKT11	40	16			–
		50	22	10003660	31006800	–
		63	27	10003677	31008546	–
		80	32	10003691	31008547	–
		100	32	10003691	31008547	–
<b>NeoMill-Titan-2-Shell</b> 	XPKT11	40	16	10003638	31006779	31143577
		50	22	10003660	31006800	10033245
		63	27	10003677	31008546	31248082
		80	32	10003691	31008547	31248083
<b>NeoMill-4-Hi-Feed90</b> 	SD__10	40	16	31166231	–	–
		50 - 66	22	10003659	–	–
		80	27	10003677	31008546	–
	SD__14	50 - 52	22	31166232	–	–
		63 - 66	22	10003659	–	–
		80	27	10003677	31008546	–
		100	32	10003690	–	–
	SD__18	125	40	10081881	–	–
		80	27	10003677	31008546	–
		100	32	10003690	–	–
		125	40	10081881	–	–
		160	40	10006594 (x4)	–	–
200	60	10006594 (x4)	–	–		

Dimensions in mm.

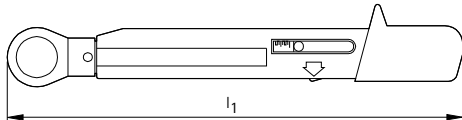
\* Included in scope of delivery for the tool body.

Note: Milling cutter clamping screw without internal cooling is the first choice when using milling cutter arbors with decentralised coolant delivery (see Page 96) as a higher coolant flow can be achieved. Milling cutter clamping screws with internal cooling may only be used if the coolant flow between the milling cutter arbor and milling cutter can only take place over a screw.



# Accessories

## Torque wrench and hexagonal inserts

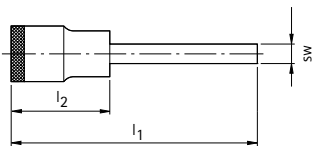


### Torque wrench

HSK-C	$l_1$	Torque range [Nm]	Order no.	Design reversible ratchet
32 - 40	210	4 - 20	30149002*	1/4"
32 - 40	210	4 - 20	10040125**	1/4"
50 - 80	240	8 - 40	30148986***	3/8"
50 - 80	240	8 - 40	10040126**	3/8"
100	333	10 - 60	30149001****	3/8"
-	333	10 - 60	10074788**	3/8"
-	435	25 - 130	30353267**	1/2"

### Scope of delivery:

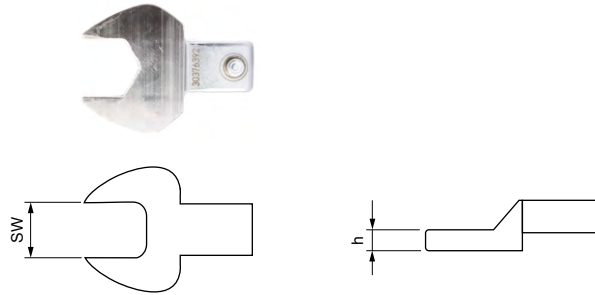
- \* As set with replaceable hexagonal insert (wrench size SW3).
- \*\* Torque wrench without hexagonal insert.
- \*\*\* As set with replaceable hexagonal inserts (wrench size SW4, 5, 6).
- \*\*\*\* As set with replaceable hexagonal insert (wrench size SW8).



### Hexagonal inserts

Nominal size	Dimensions			Order no.	Input variant
	$l_1$	$l_2$	SW		
32 - 40	55	25	3	10040122	1/4"
50	63	28	4	10040123	3/8"
63	73	28	5	10040124	3/8"
80	78	28	6	10074792	3/8"
100	95	32	8	10074793	3/8"
-	140	38	10	30353265	1/2"
-	140	38	12	30353266	1/2"
-	140	38	14	30707823	1/2"

# Accessories – mounting aids torque wrench, spanners and assembly tools

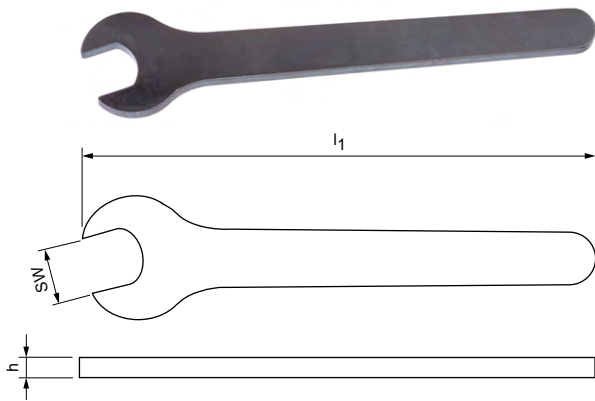


### Torque wrench

Attachment shank	Torque range [Nm]	Total length $l_1$	Order no.
9x12	2 - 25	274	30386735
14x18	20 - 200	470,5	30386736

### Open-ended spanner attachments for torque wrenches

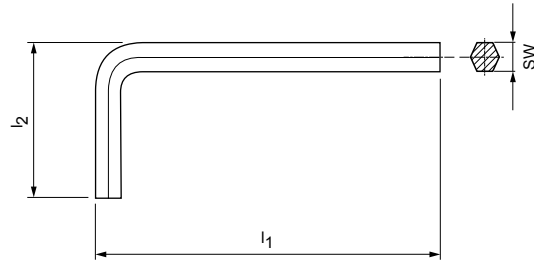
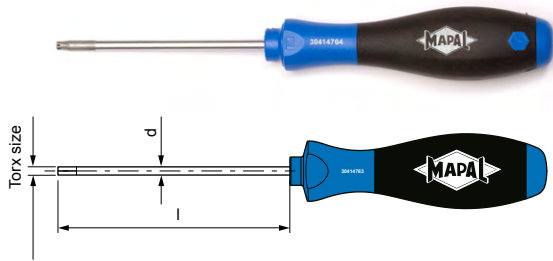
Dimensions			Order no.
SW	h	Attachment shank	
6	2,3	9 x 12	30376387
8	2,8	9 x 12	30376388
10	3,8	9 x 12	30376390
11	3,8	9 x 12	30672376
13	3,8	9 x 12	30376392
15	3,8	9 x 12	30376393
16	4,8	9 x 12	30376394
18	4,8	9 x 12	30673296
21	4,8	14 x 18	30376395



### Assembly tool

Connection size CFS	Dimensions			Order no.
	SW	$l_1$	h	
6	6	75	2,3	30352660
8	8	92	2,8	30352661
10	10	100	3,8	30352662
12	13	135	3,8	30352663
16	16	145	4,8	30352667
20	21	195	4,8	30352668

# General accessories: Screwdriver

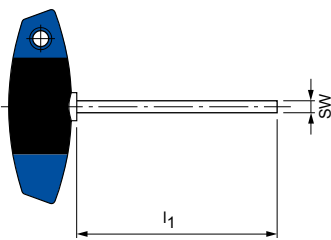


## Screwdriver

Dimensions			Name	Order no.
Torx size	l	d		
6IP	60	3,5	TORX PLUS®	30414758
7IP	60	3,5		30414759
8IP	60	3,5		30414760
9IP	60	4		30414761
10IP	80	4		30414763
15IP	80	4		30414764
20IP	100	4		30414766
25IP	100	4,5		30414767
TX8	60	3,5	TORX®	10019467
TX15	80	4		10019469

## Allen wrench

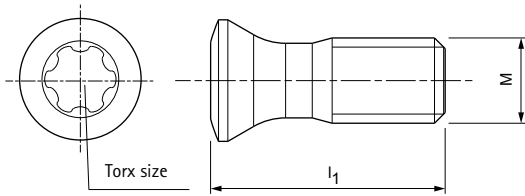
Dimensions			Name	Order no.
SW	l <sub>1</sub>	l <sub>2</sub>		
1,5	46,5	15,5	ISO2936-X	10004870
2	52	18		10004356



## Hexagonal T-key

HFS Size	Wrench size SW	Short design			Long design	
		l <sub>1</sub>	Specification	Order no.	l <sub>1</sub>	Order no.
10	2,5	100	-	10006233	200	10032722
12, 14	3	100	MN5221-31	10006234	200	10025313
16, 20	4	100	MN5221-32	10006235	200	10018010
24	5	100	MN5221-33	10006236	200	10013349
-	6	100	MN5221-34	10006237	-	-
-	8	100	MN5221-35	10006238	-	-
-	10	100	-	30353270	-	-
-	12	-	-	-	200	30353272

# List of spare parts for NeoMill milling tools, tightening torque and Torx extension



## Clamping screw for milling cutter NeoMill-Titan

Indexable insert	Size of indexable insert	Clamping screw				
		Dimension	Name	Tightening torque [Nm]	Torx size	Order no.
XPKT	1104	M3,5X8,1	TORX PLUS® - M3,5X8,1-TX10-IP	2,8	10IP	30979520


## Clamping screw for milling cutter NeoMill-4-HiFeed

Indexable insert	Size of indexable insert	Clamping screw				
		Dimension	Name	Tightening torque [Nm]	Torx size	Order no.
SD	06	M2,2X5,2	TORX PLUS® - M2,2X5,2-TX7-IP	1,2	7IP	31161853
	10	M3X8,3	TORX PLUS® - M3X8,3-TX9-IP	2	9IP	31161852
	14	M5X10,8	TORX PLUS® - M5X10,8-TX20-IP	5	20IP	31161851
	18	M6X15	TORX PLUS® - M6X15-T25	6	T25	31161862

## Tightening torque at threaded pins for coolant outlet

Threaded pin for coolant outlet	Order no.	Screw dimensions	Size	Tightening torque [Nm]
Closed variant	10003420	M3 x 4	ISO 4026-M3X4-45H	1.0
With inner diameter	31291811	M3 x 4	MN620-AD M3X4-Ø1.5	1.0
With inner diameter	31291814	M3 x 4	MN620-AD M3X4-Ø1.0	1.0
With inner diameter	31291816	M3 x 4	MN620-AD M3X4-Ø0.5	1.0

## Torx extension to mount the clamping screw with the torque wrench

	Indexable insert	Torx size	Order no.
	XPKT11	10IP	10102291
	SD__T06	7IP	30237488
	SD__T10	9IP	10102290
	SD__T14	20IP	30237490
	SD__T18	T25	30237491

# General accessories: Torque tool set



## TorqueVario®-S torque screwdriver set

Area	Scope of delivery	Features	Order no.
1.0 – 5.0 Nm	<ul style="list-style-type: none"> <li>• 1 TorqueVario-S torque screwdriver</li> <li>• 1 torque setter</li> </ul>	<ul style="list-style-type: none"> <li>• Accuracy ± 6%, can be traced to national standards</li> <li>• Numeric torque value indication on window scale</li> <li>• Torque continuously adjustable</li> <li>• Ergonomic multiple component handle</li> <li>• Click signal on reaching the set torque</li> </ul>	10103019
2.0 – 8.0 Nm			31363399



## TorqueVario®-STplus T-key torque wrench 11 pcs. set

Model: 5–14 Nm

Scope of delivery	Features	Order no.
<ul style="list-style-type: none"> <li>• 1 T-handle torque wrench</li> <li>• 1 Torque-Plus Setter</li> <li>• 1 Universal bit holder 1/4"</li> <li>• 3 TORX® standard bits T25x25 / T30x25 / T40x25</li> <li>• 3 hex standard bits 4.0x25 / 5.0x25 / 6.0x25</li> <li>• 2 adapter bits for the sockets                             <ul style="list-style-type: none"> <li>1 Torque-Plus adapter bit 1/4"</li> <li>1 Torque-Plus adapter bit 3/8"</li> </ul> </li> <li>• Stable metal box</li> </ul>	<ul style="list-style-type: none"> <li>• Accuracy ± 6%, can be traced to national standards</li> <li>• Numeric torque value indication on window scale</li> <li>• Torque continuously adjustable</li> <li>• Comfortable T-handle with soft zones</li> <li>• Click signal on reaching the set torque</li> </ul>	30415173



# DRILLING FROM SOLID

## Drilling from solid

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MEGA-Speed-Drill-Titan \_\_\_\_\_ 56

Cutting data recommendations \_\_\_\_\_ 59

## Technical appendix

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Product ID codes \_\_\_\_\_ 122



# MEGA-Speed-Drill-Titan

## Cost-efficient and productive

This double-edge high-speed drill is equipped with four margin lands for optimum bore roundness. The coolant is guided along the outside surface to the rear. In this way, optimal cooling is achieved for the margin lands, dissipating the heat generated.

### 1 Face geometry

- Convex cutting edge with corner chamfer for high stability

### 2 Innovative cooling ribs

- Protects the margin land
- Maximum coolant supply at the bore wall
- Maximum heat and wear resistance

### 3 Four margin lands

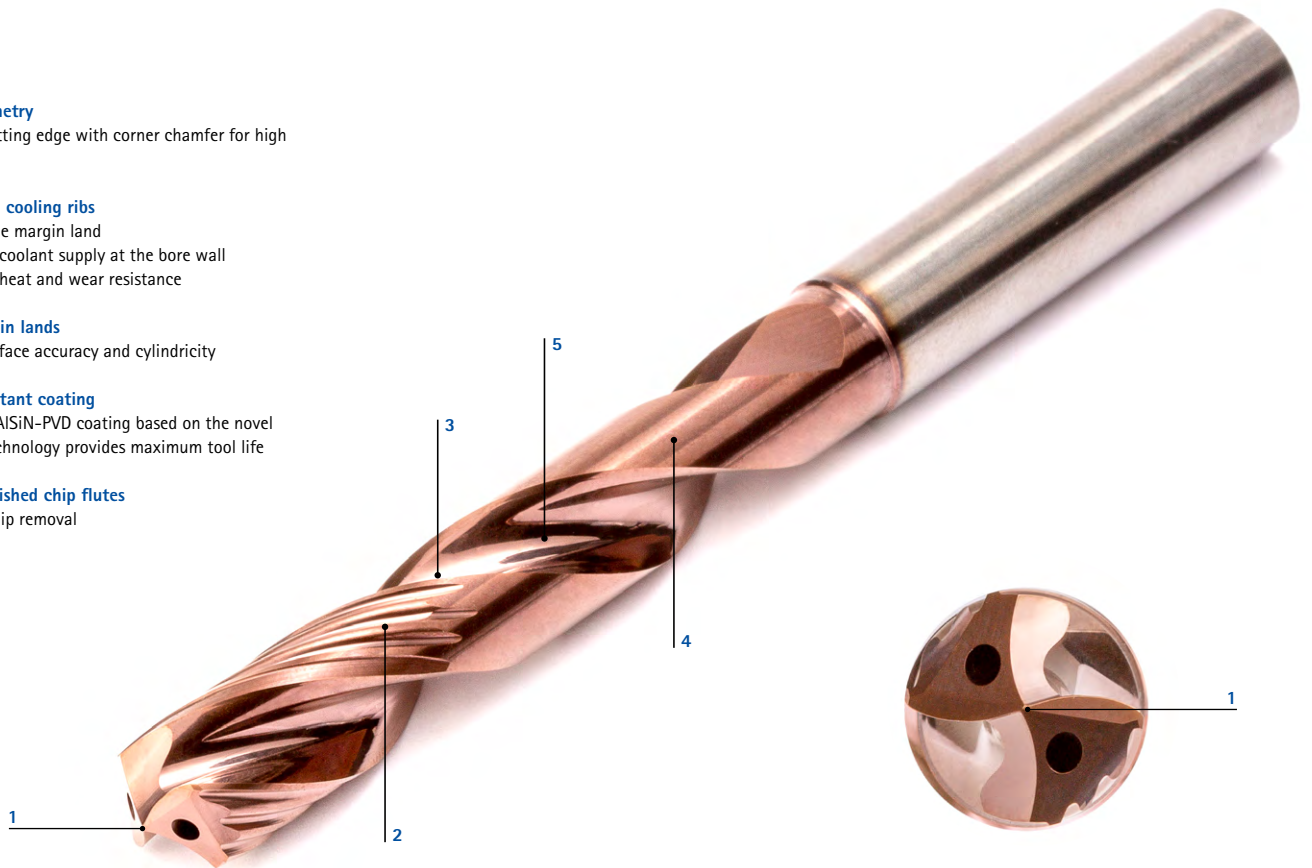
- Precise surface accuracy and cylindricity

### 4 Heat-resistant coating

- Smooth TiAlSiN-PVD coating based on the novel HiPIMS technology provides maximum tool life

### 5 Highly polished chip flutes

- Reliable chip removal

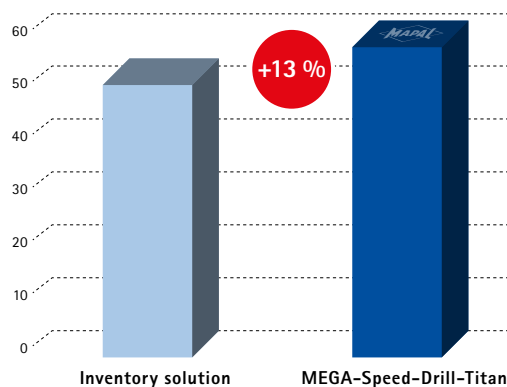


## Features

### Dimensions:

- Preferred series in stock:  
 $\varnothing$  area: 3.00 to 16.00 mm  
 Shank form HA
- Configurable diameter  
 $\varnothing$  area: 3.00 to 20.00 mm  
 Shank form HB, HE
- 5xD with internal coolant supply
- Short cycle times

## Tool life [m]



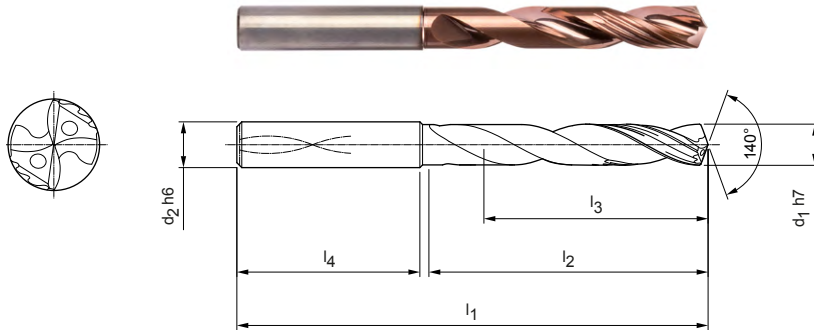
TiAl6V4-1.1800  
 Nominal  $\varnothing$ : 8.50 mm  
 $v_c$ : 40 m/min  
 $f_u$ : 0.2 mm/rev



# MEGA-Speed-Drill-Titan

Solid carbide twist drill  
SCD961 (5xD), internal coolant supply

**Design:**  
 Drill diameter: 3.00 – 20.00 mm  
 Bore tolerance: IT 9  
 Cutting material: HP184  
 Number of cutting edges: 2  
 Number of guiding chamfers: 4  
 Tip angle: 140°  
 Helix angle: 30°



**Preferred series in stock**

Dimensions						Shank form HA	
d <sub>1</sub> h7	d <sub>2</sub> h6	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	Specification	Order no.
3,00	6	66	28	23	36	SCD961-0300-2-4-140HA05-HP184	31315779
3,10	6	66	28	23	36	SCD961-0310-2-4-140HA05-HP184	31315820
3,20	6	66	28	23	36	SCD961-0320-2-4-140HA05-HP184	31315821
3,30	6	66	28	23	36	SCD961-0330-2-4-140HA05-HP184	31315822
3,40	6	66	28	23	36	SCD961-0340-2-4-140HA05-HP184	31315823
3,50	6	66	28	23	36	SCD961-0350-2-4-140HA05-HP184	31315824
3,60	6	66	28	23	36	SCD961-0360-2-4-140HA05-HP184	31315825
3,70	6	66	28	23	36	SCD961-0370-2-4-140HA05-HP184	31315826
3,80	6	74	36	29	36	SCD961-0380-2-4-140HA05-HP184	31315827
4,00	6	74	36	29	36	SCD961-0400-2-4-140HA05-HP184	31315828
4,10	6	74	36	29	36	SCD961-0410-2-4-140HA05-HP184	31315829
4,20	6	74	36	29	36	SCD961-0420-2-4-140HA05-HP184	31315830
4,30	6	74	36	29	36	SCD961-0430-2-4-140HA05-HP184	31315831
4,40	6	74	36	29	36	SCD961-0440-2-4-140HA05-HP184	31315832
4,50	6	74	36	29	36	SCD961-0450-2-4-140HA05-HP184	31315833
4,60	6	74	36	29	36	SCD961-0460-2-4-140HA05-HP184	31315834
4,70	6	74	36	29	36	SCD961-0470-2-4-140HA05-HP184	31315835
4,80	6	82	44	35	36	SCD961-0480-2-4-140HA05-HP184	31315836
5,00	6	82	44	35	36	SCD961-0500-2-4-140HA05-HP184	31315837
5,10	6	82	44	35	36	SCD961-0510-2-4-140HA05-HP184	31315838
5,20	6	82	44	35	36	SCD961-0520-2-4-140HA05-HP184	31315839
5,30	6	82	44	35	36	SCD961-0530-2-4-140HA05-HP184	31315840
5,40	6	82	44	35	36	SCD961-0540-2-4-140HA05-HP184	31315841
5,50	6	82	44	35	36	SCD961-0550-2-4-140HA05-HP184	31315842
5,80	6	82	44	35	36	SCD961-0580-2-4-140HA05-HP184	31315843
5,90	6	82	44	35	36	SCD961-0590-2-4-140HA05-HP184	31315844
6,00	6	82	44	35	36	SCD961-0600-2-4-140HA05-HP184	31315845
6,20	8	91	53	43	36	SCD961-0620-2-4-140HA05-HP184	31315846
6,50	8	91	53	43	36	SCD961-0650-2-4-140HA05-HP184	31315847
6,60	8	91	53	43	36	SCD961-0660-2-4-140HA05-HP184	31315848
6,80	8	91	53	43	36	SCD961-0680-2-4-140HA05-HP184	31315849
7,00	8	91	53	43	36	SCD961-0700-2-4-140HA05-HP184	31315850
7,10	8	91	53	43	36	SCD961-0710-2-4-140HA05-HP184	31315851
7,30	8	91	53	43	36	SCD961-0730-2-4-140HA05-HP184	31315852
7,40	8	91	53	43	36	SCD961-0740-2-4-140HA05-HP184	31315853

MEGA-Speed-Drill-Titan | Solid carbide twist drill SCD961 (5xD), internal coolant supply

Dimensions						Shank form HA	
d <sub>1</sub> h7	d <sub>2</sub> h6	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	Specification	Order no.
7,50	8	91	53	43	36	SCD961-0750-2-4-140HA05-HP184	31315854
7,80	8	91	53	43	36	SCD961-0780-2-4-140HA05-HP184	31315855
8,00	8	91	53	43	36	SCD961-0800-2-4-140HA05-HP184	31315856
8,10	10	103	61	49	40	SCD961-0810-2-4-140HA05-HP184	31315857
8,20	10	103	61	49	40	SCD961-0820-2-4-140HA05-HP184	31315858
8,30	10	103	61	49	40	SCD961-0830-2-4-140HA05-HP184	31315859
8,40	10	103	61	49	40	SCD961-0840-2-4-140HA05-HP184	31315860
8,50	10	103	61	49	40	SCD961-0850-2-4-140HA05-HP184	31315861
8,80	10	103	61	49	40	SCD961-0880-2-4-140HA05-HP184	31315862
9,00	10	103	61	49	40	SCD961-0900-2-4-140HA05-HP184	31315863
9,80	10	103	61	49	40	SCD961-0980-2-4-140HA05-HP184	31315864
10,00	10	103	61	49	40	SCD961-1000-2-4-140HA05-HP184	31315865
10,20	12	118	71	56	45	SCD961-1020-2-4-140HA05-HP184	31315866
10,50	12	118	71	56	45	SCD961-1050-2-4-140HA05-HP184	31315867
11,00	12	118	71	56	45	SCD961-1100-2-4-140HA05-HP184	31315868
11,80	12	118	71	56	45	SCD961-1180-2-4-140HA05-HP184	31315869
12,00	12	118	71	56	45	SCD961-1200-2-4-140HA05-HP184	31315870
12,50	14	124	77	60	45	SCD961-1250-2-4-140HA05-HP184	31315871
13,00	14	124	77	60	45	SCD961-1300-2-4-140HA05-HP184	31315872
13,50	14	124	77	60	45	SCD961-1350-2-4-140HA05-HP184	31315873
14,00	14	124	77	60	45	SCD961-1400-2-4-140HA05-HP184	31315874
15,80	16	133	83	63	48	SCD961-1580-2-4-140HA05-HP184	31315875
16,00	16	133	83	63	48	SCD961-1600-2-4-140HA05-HP184	31315876

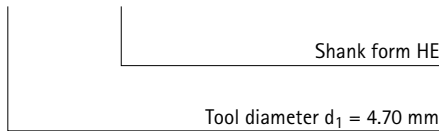
Configurable features

**Diameter:**  
Diameter in increments of 0.01 mm freely selectable

**Shank form:**  
Shank form: HB | HE

**Specification:**  
SCD961-[diameter]-2-4-140[shank form]05-HP184

**Example:**  
SCD961-0470-2-4-140HE05-HP184



Dimensions of configurable series

d <sub>1</sub> min.	d <sub>1</sub> max.	d <sub>2</sub> h6	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>
3,00	3,70	6	66	28	23	36
3,71	4,70	6	74	36	29	36
4,71	6,00	6	82	44	35	36
6,01	6,80	8	91	53	43	36
6,81	8,00	8	91	53	43	36
8,01	9,00	10	103	61	49	40
9,01	10,00	10	103	61	49	40
10,01	11,00	12	118	71	56	45
11,01	12,00	12	118	71	56	45
12,01	14,00	14	124	77	60	45
14,01	16,00	16	133	83	63	48
16,01	18,00	18	143	93	71	48
18,01	20,00	20	153	101	77	50

Accessories

	MHC-...	UNIQ-Dream Chuck	Page 86
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Dimensions in mm.  
For cutting data recommendations, see end of chapter.  
Special designs and other coatings available upon request.

# Cutting data recommendations for solid carbide drills

Feed and cutting speed

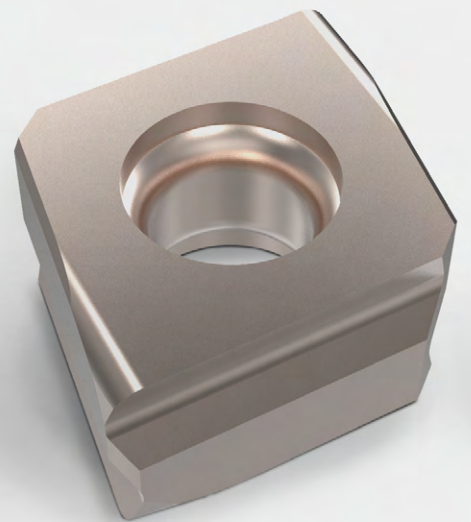
## MEGA-Speed-Drill-Titan | SCD961

MMG*	Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cutting speed $v_c$ [m/min]				Feed $f$ [mm] for drill diameter						
			IC	EC	MQL	Air	3.00	4.50	6.50	9.50	14.00	20.00	
S	S1 S1.1	Titanium, titanium alloys	< 400	<b>40</b>	<b>25</b>			0.077	0.103	0.134	0.173	0.219	0.259
	S2 S2.1	Titanium, titanium alloys	< 1,200	<b>30</b>	<b>20</b>			0.066	0.088	0.115	0.149	0.188	0.222
	S2 S2.2	Titanium, titanium alloys	> 1,200	<b>25</b>	<b>15</b>			0.055	0.073	0.095	0.124	0.157	0.185

\* MAPAL machining groups

The specified cutting values are guide values.

The optimum data for the respective machining task should be determined during the test or machining.

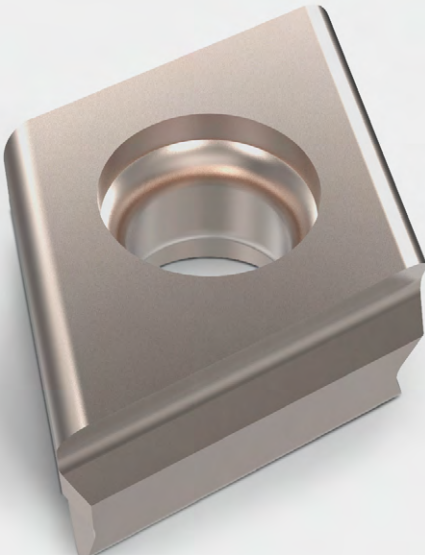


# BORING

## Boring

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Boring with tangential technology \_\_\_\_\_ 62



# Boring in titanium

## Tools with tangential technology

Part-specific custom tools are equipped with MAPAL's indexable inserts for machining titanium – for highest productivity, economic processes and stable machining concepts. Chips are ejected from the shear zone via the customised chip flutes, preventing wear and tear on the tool.

### 1 Part-specific custom tool body design

- Stable, vibration-free machining

### 2 Targeted coolant supply

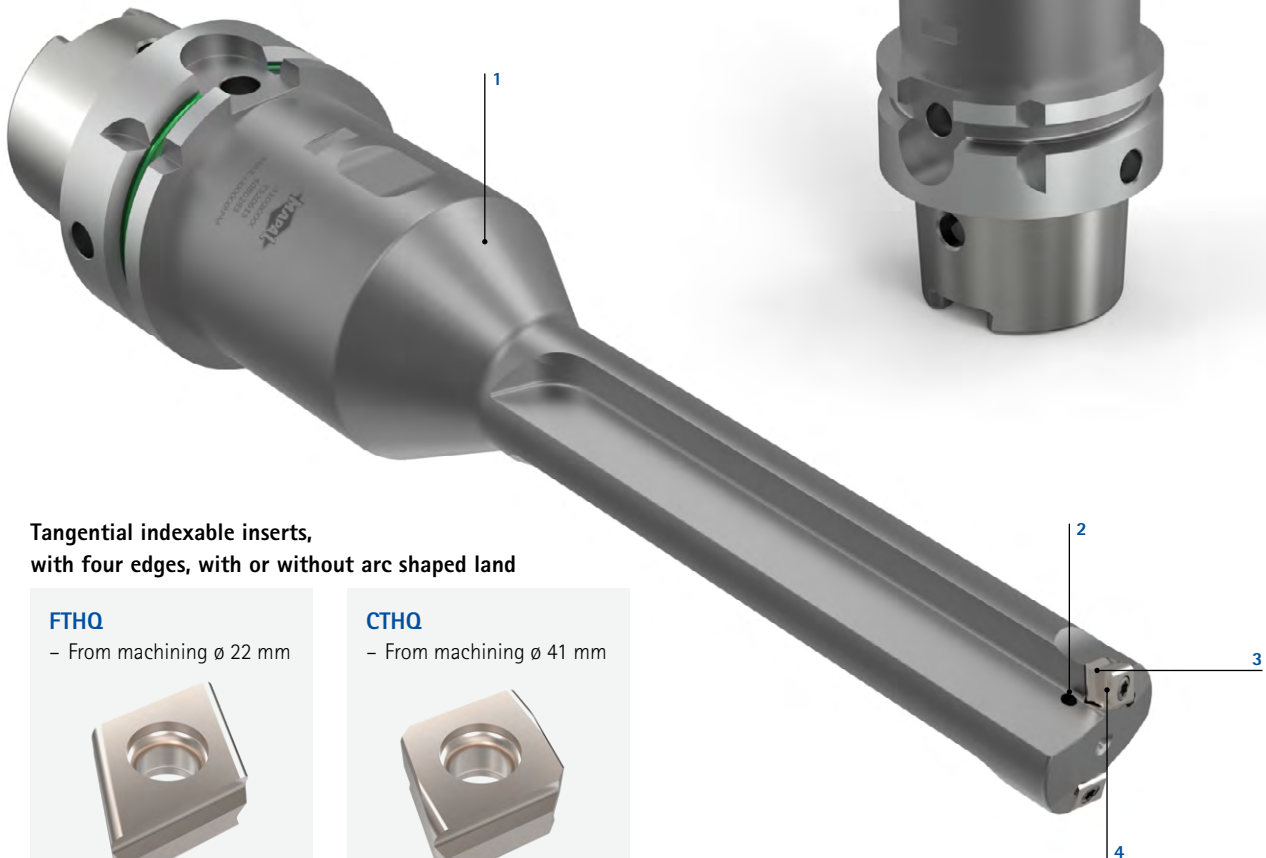
- Reduces high cutting temperatures

### 3 Defined chip formers

- For controlled chip formation

### 4 Tangential indexable inserts

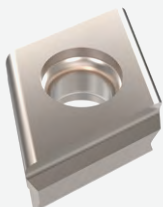
- Four-edge insert, with or without arc shaped land
- For through bores and blind bores
- FTHQ and CTHQ



### Tangential indexable inserts, with four edges, with or without arc shaped land

#### FTHQ

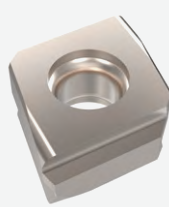
- From machining  $\varnothing$  22 mm



Through hole

#### CTHQ

- From machining  $\varnothing$  41 mm



Blind bore

## Boring – cost-efficient and productive

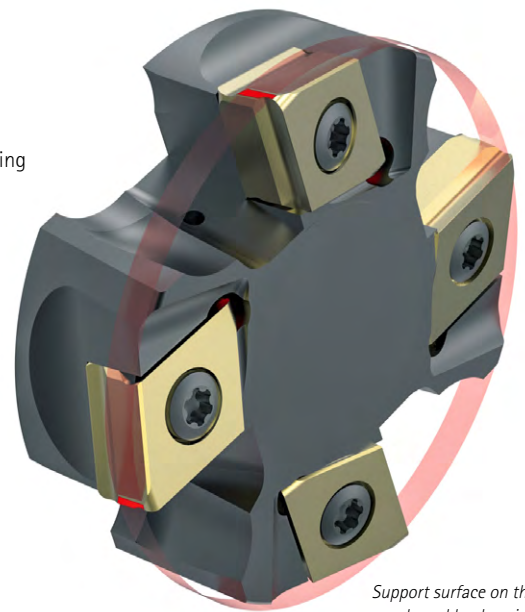
The indexable inserts for boring titanium impress due to their three usable cutting edges and a high-performance PVD coating. The cutting edges are available in three sizes. This allows their use in a very wide range of applications. The single- or multi-stepped custom tools are characterised by extremely high economic efficiency and simple handling.

## Tangential technology

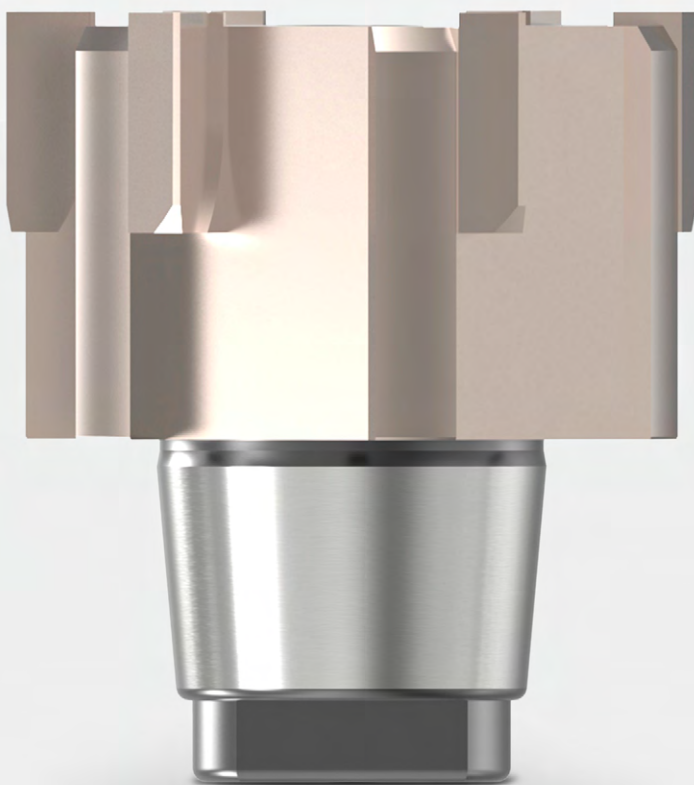
Tangential technology is the key to the excellent performance of MAPAL boring tools. Due to the stable indexable insert geometry, this technology makes higher machining values possible compared to radial indexable insert and, as a result, larger material removal rates. Tangential tools also run very quietly. As a result, excellent tool lives and very good part qualities are achieved.

## Optimal machining results at a length-to-diameter ratio $>3.5 \times D$ due to arc shaped lands

Due to the normal relief angle on ISO indexable inserts, there is only limited support for the tool during bore machining. Tools then tend to vibrate; this vibration degrades the surface finish and tool life achieved. To counteract this problem, MAPAL developed the arc shaped land. This special geometry is a support surface on the cutting edge that holds the tool in the bore and is comparable to an arc land chamfer on fixed reamers.



*Support surface on the arc shaped land against the bore wall.*







# REAMING | FINE BORING

## Reaming | Fine Boring

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# PRODUCT OVERVIEW

## Reaming and fine boring

Tools for the fine machining of bores represent the core competence of MAPAL. The "original reamer" produced in 1954 marked the beginning of the success story that MAPAL continues to write today in this area. Decades of experience and continuous further development and optimisation of the tool solutions ensure that MAPAL offers the right solution according to the complexity of the machining and the precision requirements.

In addition to customised special solutions, a diverse standard range of tools for reaming and fine boring is available. Reaming and fine boring are the most common methods for the fine machining of bores, yielding impressive, precise results. Whatever the complexity of the machining and the requirements placed on precision and surface finish, MAPAL has the appropriate solution: Single-bladed reamers, fine boring tools with guide pads and WP cutting inserts all deliver the highest levels of precision.

On top of that, the range also includes fixed multi-bladed reamers, HPR replaceable head reamers with high-precision clamping system, high-performance reamers made of carbide or cermet as well as systems for machining large diameters.



## Reaming

### First choice for ...

- ... machining at high feed rates
- ... high performance in series production
- ... machining without additional setting effort
- ... Machining operations with diameter >3 mm

### Bore tolerance

**IT6** up to **IT9**

Fixed multi-bladed reamers	Replaceable head reamers	Solutions for large diameters
 <p><b>High-performance reamers FixReam – FXR</b></p> <p>The high-performance reamers of the FXR series are available with different cutting materials and coatings. This means that almost all workpiece materials can be machined economically and reliably with them. They are the tool of choice when short cycle time are called for. Without any setting effort, the tools, which are available in the diameter range 2.800 to 20.200 mm, achieve IT6 tolerances.</p> <p>Ø area: 2.800 – 20.200 mm*</p>	 <p><b>HPR replaceable head reamers with HFS connection</b></p> <p>If maximum economic efficiency is required, the use of HPR replaceable head reamers is recommended in the small diameter range. The high-precision connection HFS guarantees (despite the replaceable head system) an exact radial run-out as well as a high changeover accuracy. Handling is very simple. The HPR reamers are available with fixed brazed cutting edges as well as with adjustable cutting edges.</p> <p>Ø area: 7.000 – 65.000 mm*</p>	 <p><b>Solutions for large diameters</b></p> <p>Multi-bladed high-performance reamers for large diameter ranges. HPR400: Quick change of cutting edges on site without long reconditioning. HPR400 plus: four instead of the previous single cutting edge. Indexable inserts are simple to rotate and change.</p> <p>Ø area: 63.000 – 319.999 mm*</p>
Page 68	Page 71	See the "BORE MACHINING" catalogue

\* The diameter range can vary, depending on the series.



Scan the QR code to download the new "BORE MACHINING" catalogue.

Further information is available at [www.mapal.com](http://www.mapal.com)



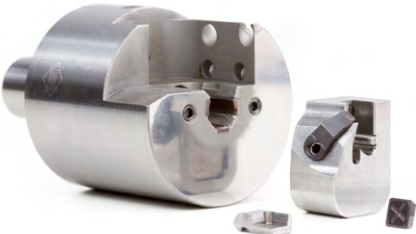
## Fine boring

### First choice for ...

- ... unstable machining conditions
- ... machining with a floating holder on a lathe
- ... interrupted machining and thin-walled parts
- ... unfavourable length-diameter ratios
- ... extremely high workpiece material requirements and position tolerances
- ... Machining operations with diameter >5 mm

### Bore tolerance

**IT4** up to **IT8**

Single-bladed reamers	EasyAdjust system	External machining tools
		
<p><b>Single bladed reamer</b></p> <p>When it comes to achieving the greatest possible precision, single bladed reamers with guide pads based on the MAPAL principle are virtually unrivalled. Their cutting inserts are available with two and six cutting edges. The indexable inserts with two cutting edges offer special leads. Maximum economic efficiency is guaranteed with the HX indexable inserts with six usable cutting edges.</p> <p>∅ area: 5.000 – 30.290 mm*</p>	<p><b>EasyAdjust system</b></p> <p>When developing the EasyAdjust system, the goal was to drastically reduce the setting effort for tools with guide pad technology. The heart of the system is an innovative cassette that holds the six- or four-edge indexable inserts securely without any play. The back taper of the minor cutting edge is already integrated into this cassette, thus eliminated the need for this adjustment. Due to the exact guidance of the cassette on a precision guide pin, the back taper remains unchanged even during diameter settings.</p>	<p><b>External machining tools</b></p> <p>The EasyAdjust system is integrated to make setting external reamers with small diameters as easy as possible. Thanks to greater changeover accuracy as well as the fact that the inserts can be set very easily, reliable compliance with the required tolerances for highly accurate fits is significantly easier using the new system, even in the small diameter range.</p>
<p>See the "BORE MACHINING" catalogue</p>		

# FixReam

## High-performance reamer made of solid carbide

With the new high-performance reamer FixReam, both through and blind bores can be machined in titanium workpiece material. The patented arc land chamfer ensures that the roundness and cylindrical form of the bore are improved by up to 30 per cent. Individually adapted chucks are made possible by innovative geometry. It is therefore suitable also for use with short and medium production runs.

### 1 Prime number spacing

- Less vibrations, better surfaces, smoother running and longer tool life

### 2 Innovative coolant outlets

- Optimal cooling lubricant supply at the blind and through bores

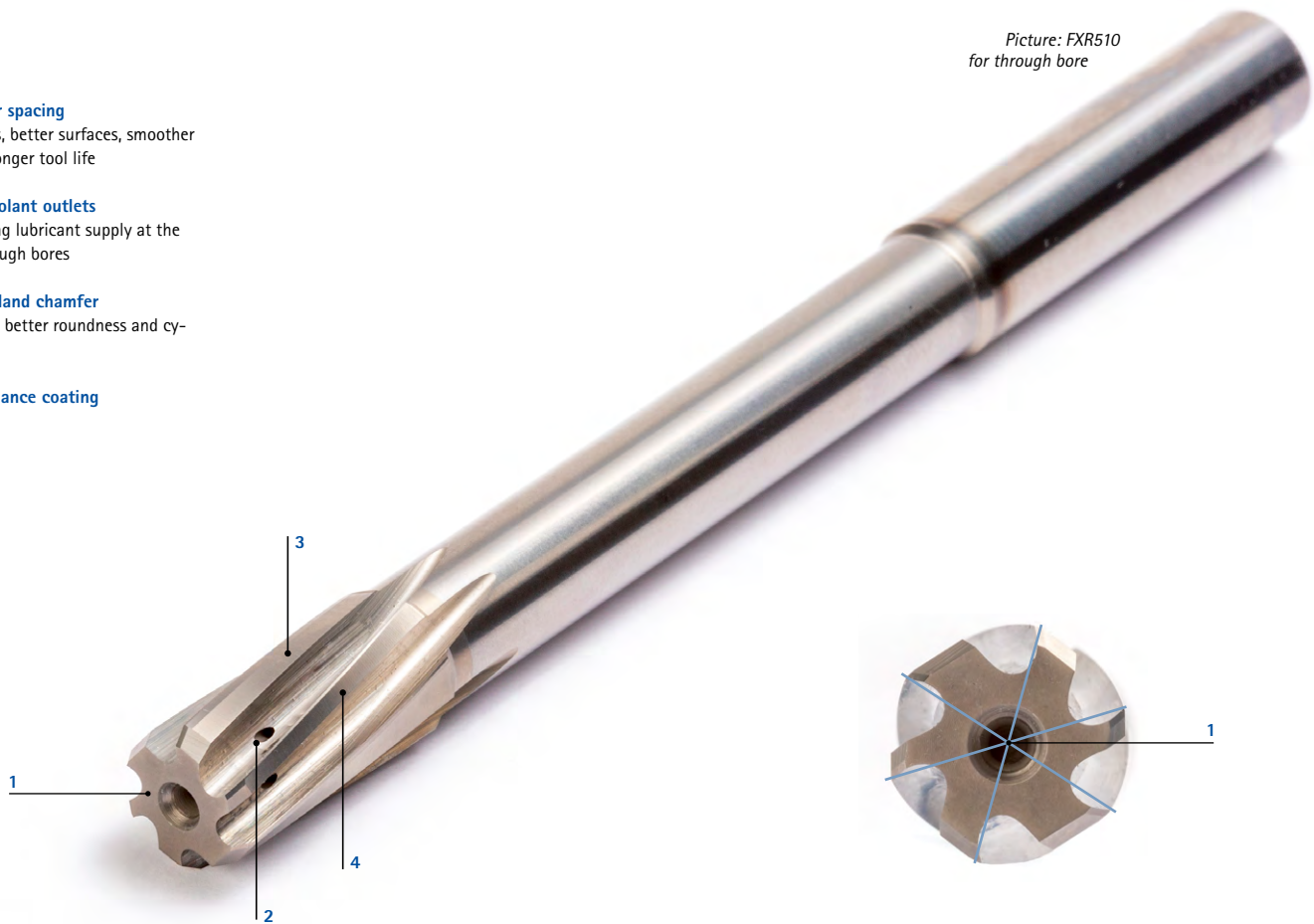
### 3 Patented arc land chamfer

- For up to 30% better roundness and cylindrical form

### 4 High-performance coating

- PVD coating

Picture: FXR510  
for through bore



## Features

### Dimensions:

- For through bore, left-hand fluted
- Straight-fluted blind bore
- Configurable diameter:  $\varnothing$  area: 2.80 to 20.20 mm
- Z4, Z6 and Z8
- Short design for more stability and higher feed rates
- Internal coolant supply
- High-performance tools for a wide range of applications
- High productivity in series production

## Available designs



FXR 510, left-hand fluted

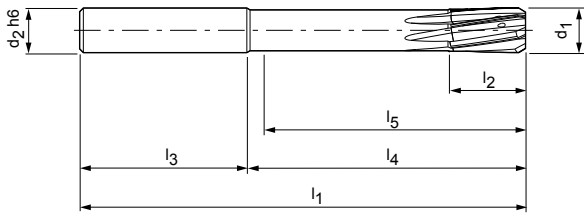


FXR 505, straight fluted

# FixReam

Fixed design, left-hand fluted, for through hole  
FXR510

**Design:**  
Reamer diameter: 2.800 - 20.200 mm  
Lead: MF1M  
Cutting material: Solid carbide  
HP625 (carbide PVD coated)



## Configurable features



**Bore diameter tolerance  $\geq$  IT6:**  
- Diameter freely selectable in increments of 0.001 mm  
- Can be ordered in tolerance  $\geq$  IT6

**Specification:**  
FXR510Ø[diameter][tolerance]MF1M-HP625

**G variants:**  
- Diameter freely selectable in increments of 0.001 mm  
- From tolerance  $\geq$  4  $\mu$ m orderable (G variant)

**G variant specification:**  
FXR510GØ[diameter][tolerance]MF1M-HP625

## Dimensions of configurable series IT6

d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>	z
2,800 - 3,700	4	65	12	28	37	34	4
3,701 - 4,700	6	75	12	36	39	34	4
4,701 - 6,200	6	75	12	36	39	35	4
6,201 - 7,200	8	100	16	36	64	59	6
7,201 - 8,200	8	100	16	36	64	60	6
8,201 - 9,200	10	100	20	40	60	55	6
9,201 - 10,200	10	120	20	40	80	76	6
10,201 - 11,200	12	120	20	45	75	70	6
11,201 - 12,200	12	120	20	45	75	71	6
12,201 - 14,200	14	130	22	45	85	80	6
14,201 - 15,200	16	130	22	48	82	77	6
15,201 - 16,200	16	150	25	48	102	97	6
16,201 - 18,200	18	150	25	48	102	97	8
18,201 - 20,200	20	150	25	50	100	95	8

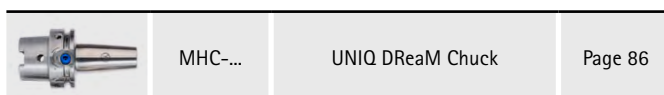
**IT6 tolerance example:**  
FXR510Ø16.350H6MF1M-HP625

Bore diameter d<sub>1</sub> = 16.350 H6

**G variant example:**  
FXR510GØ16.350-4MF1M-HP625

Special tool diameter d<sub>1</sub> = 16.350 -4  $\mu$ m

## Accessories

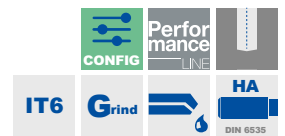
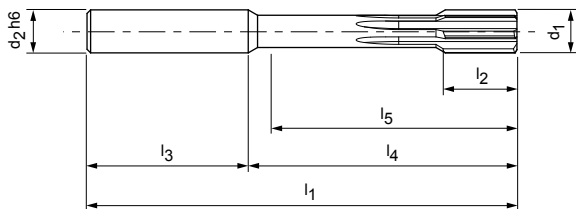


# FixReam

Fixed design, straight fluted, for blind bore  
FXR505

**Design:**  
Reamer diameter:  
Lead:  
Cutting material:

**Solid carbide**  
2.800 - 20.200 mm  
MT0A  
HP625 (carbide PVD coated)



### Configurable features



**Bore diameter tolerance ≥ IT6:**  
- Diameter freely selectable in increments of 0.001 mm  
- Can be ordered in tolerance ≥ IT6

**Specification:**  
FXR505Ø[diameter][tolerance]MT0A-HP625

**G variants:**  
- Diameter freely selectable in increments of 0.001 mm  
- From tolerance ≥ 4 µm orderable (G variant)

**G variant specification:**  
FXR505GØ[diameter][tolerance]MT0A-HP625

### Dimensions of configurable series IT6

d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>	z
2,800 - 3,350	4	65	12	37	28	33	4
3,351 - 3,700	4	65	12	28	37	33	4
3,701 - 6,200	6	75	12	36	39	34	4
6,201 - 8,200	8	100	16	36	64	58	6
8,201 - 9,200	10	100	20	40	60	54	6
9,201 - 10,200	10	120	20	40	80	74	6
10,201 - 12,200	12	120	20	45	75	68	6
12,201 - 14,200	14	130	22	45	85	78	6
14,201 - 15,200	16	130	22	48	82	75	6
15,201 - 16,200	16	150	25	48	102	95	6
16,201 - 18,200	18	150	25	48	102	95	6
18,201 - 20,200	20	150	25	50	100	92	6

**IT6 tolerance example:**  
FXR505Ø16.350H6MT0A-HP625

Bore diameter d<sub>1</sub> = 16.350 H6

**G variant example:**  
FXR505GØ16.350-4MT0A-HP625

Special tool diameter d<sub>1</sub> = 16.350 -4 µm

### Accessories



# HPR replaceable head reamer

**Taper and face connection provide the greatest possible stability and rigidity**

The HFS (Head Fitting System) forms the heart of the HPR reamer. It combines very easy and quick handling with absolute precision and a changeover accuracy of  $< 3 \mu\text{m}$ .

## 1 High-precision short tapered connection

- Changeover accuracy and concentricity  $< 3 \mu\text{m}$
- Face connection for high rigidity and accuracy

## 2 HPR replaceable head

- Replaceable head with brazed cutting edge
- Solid carbide heads

## 3 Cutting edge made of carbide

- Coated

## 4 Coolant outlets

- Direct on the cutting edge
- Optimal amount and direction of the coolant jet

## 5 Differential screw

- Clamping and releasing the replaceable head

## 6 Wrench surfaces

- Alignment of head and tool holder with each other



## Features

### Dimensions:

- For through bore, left-hand fluted
- Straight-fluted blind bore
- Configurable diameter
  - HPR 131:  $\varnothing$  area: 7.00 to 18.59 mm
  - HPR 150:  $\varnothing$  area: 16.60 to 65.00 mm
- Z4 and Z6
- Short design for more stability and higher feed rates
- Internal coolant supply

## Available designs

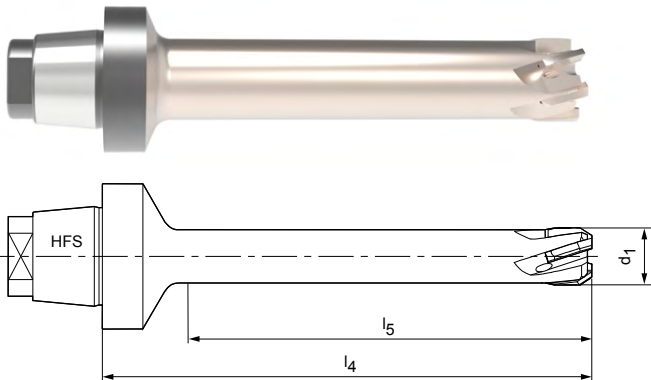


- 1 HPR replaceable head reamer, HPR131
- 2 HPR replaceable head reamer, HPR180
- 3 HPR replaceable head reamer, HPR110
- 4 HPR replaceable head reamer, HPR150

# HPR replaceable head reamer

Fixed design, left-hand grooved, for through hole  
HPR131

**Design:**  
Reamer diameter: 7.000 - 18.590 mm  
Lead: MF1G  
Cutting material: HP625 (carbide PVD coated)



## Configurable features



### Bore diameter tolerance IT7:

- Diameter freely selectable in increments of 0.001 mm
- Can be ordered in tolerance IT7

### Specification:

HPR131Ø[diameter][tolerance]MF1G-HP625

### Bore diameter tolerance < IT7:

- Tolerances smaller than IT7 can be ordered as a special tool diameter (G variant)

### G variant specification:

HPR131GØ[diameter][tolerance]MF1G-HP625

## Dimensions of configurable series IT7

d <sub>1</sub>	l <sub>4</sub>	l <sub>5</sub>	HFS-Größe	z
7,000 - 9,590	60	45	12	4
9,600 - 18,590	60	45	12	6

### IT7 tolerance example:

HPR131Ø16.350H7MF1G-HP625

Bore diameter d<sub>1</sub> = 16.350 H7

### G variant example:

HPR131GØ16.350-5MF1G-HP625

Special tool diameter d<sub>1</sub> = 16.350 -5 µm

## Tolerances for the G variant

Cutting material	Diameter range	
	Ø7 - <Ø60	≥Ø60 - Ø65
<b>Coated (Coating thickness 2-3 µm)</b>		
HP625	-0,005	-0,008

## Accessories

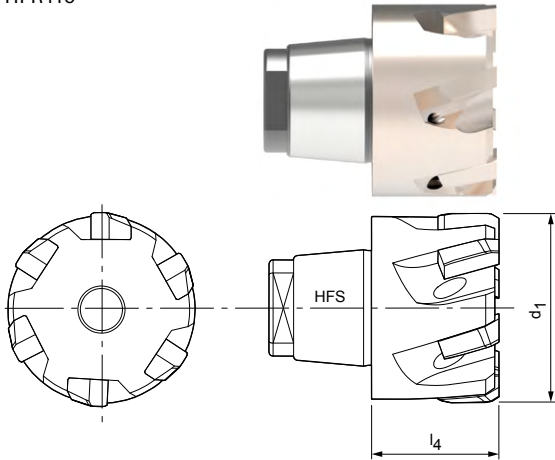
	HFS101SN-	HFS replaceable head holders	Page 103
	MHC-...	HydroChuck	Page 88



# HPR replaceable head reamer

Fixed design, left-hand fluted, for through hole  
HPR110

**Design:**  
Reamer diameter: 15.600 - 65.000 mm  
Lead: MF1G  
Cutting material: HP625 (carbide PVD coated)



## Configurable features



### Bore diameter tolerance IT6/IT7:

- Diameter freely selectable in increments of 0.001 mm
- Can be ordered from tolerance IT6/IT7 depending on the diameter range
- $\geq \text{Ø}30,000$  IT6 |  $\leq \text{Ø}30,000$  IT7

### Specification:

HPR110Ø[diameter][tolerance]MF1G-HP625

### Bore diameter tolerance < IT6/IT7:

- Tolerances smaller than IT6/IT7 can be ordered as a special tool diameter (G variant)

### G variant specification:

HPR110GØ[diameter][tolerance]MF1G-HP625

## Dimensions of configurable series

d1	l <sub>4</sub>	l <sub>5</sub>	HFS size	z	Tolerance
15.600 - 18.590	14	-	10	6	IT7
18.600 - 21.290	14.5	-	12	6	IT7
21.300 - 23.990	15.5	-	14	6	IT7
24.000 - 29.990	16	-	16	6	IT7
30.000 - 39.990	17	-	20	8	IT6
40.000 - 50.700	19	-	24	8	IT6
50.710 - 65.000	25	-	24	8	IT6

### IT6/IT7 tolerance example:

HPR110Ø16.350H7MF1G-HP625

Bore diameter d<sub>1</sub> = 16.350 H7

## Tolerances for the G variant

Cutting material	Diameter range	
	Ø7 - <Ø60	≥Ø60 - Ø65
Coated (Coating thickness 2-3 µm)	-0,005	-0,008
HP625		

### G variant example:

HPR110GØ16.350-5MF1G-HP625

Special tool diameter d<sub>1</sub> = 16.350 -5 µm

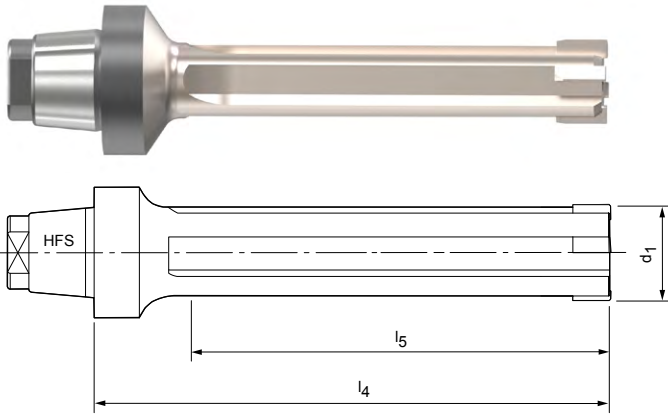
## Accessories

	HFS101SN-	HFS replaceable head holders	Page 103
	MHC-...	HydroChuck	Page 88

# HPR replaceable head reamer

Fixed design, straight fluted, for blind bore  
HPR180

**Design:**  
Reamer diameter: 7.000 - 21.290 mm  
Lead: M02G  
Cutting material: HP625 (carbide PVD coated)



## Configurable features



### Bore diameter tolerance IT7:

- Diameter freely selectable in increments of 0.001 mm
- Can be ordered from tolerance IT7

### Specification:

HPR180Ø[diameter][tolerance]M02G-HP625

### Bore diameter tolerance < IT7:

- Tolerances smaller than IT7 can be ordered as a special tool diameter (G variant)

### G variant specification:

HPR180GØ[diameter][tolerance]M02G-HP625

## Dimensions of configurable series IT7

d1	l4	l5	HFS size	z
7.000 - 14.590	60	40	12	4
14.600 - 21.290	60	40	12	6

### IT7 tolerance example:

HPR180Ø16.350H7M02G-HP625

Bore diameter d<sub>1</sub> = 16.350 H7

### G variant example:

HPR180GØ16.350-5M02G-HP625

Special tool diameter d<sub>1</sub> = 16.350 -5 µm

## Tolerances for the G variant

Cutting material	Diameter range	
	Ø7 - <Ø60	≥Ø60 - Ø65
<b>Coated (Coating thickness 2-3 µm)</b>		
HP625	-0,005	-0,008

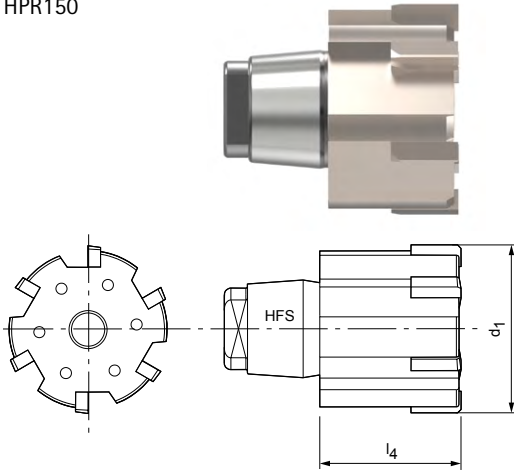
## Accessories

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# HPR replaceable head reamer

Fixed design, straight fluted, for blind bore  
HPR150

**Design:**  
Reamer diameter: 16.600 - 65.000 mm  
Lead: M02G  
Cutting material: HP625 (carbide PVD coated)



## Configurable features



### Bore diameter tolerance IT6/IT7:

- Diameter freely selectable in increments of 0.001 mm
- Can be ordered from tolerance IT6/IT7 depending on the diameter range
- $\geq \text{Ø}30,000$  IT6 |  $\leq \text{Ø}30,000$  IT7

### Specification:

HPR150Ø[diameter][tolerance]M02G-HP625

### Bore diameter tolerance < IT6/IT7:

- Tolerances smaller than IT6/IT7 can be ordered as a special tool diameter (G variant)

### G variant specification:

HPR150GØ[diameter][tolerance]M02G-HP625

## Dimensions of configurable series IT6/IT7

d1	l4	l5	HFS size	z	Tolerance
16.600 - 21.290	14	-	10	6	IT7
21.300 - 24.990	15.5	-	12	6	IT7
25.000 - 28.990	15.5	-	14	6	IT7
29.000 - 29.990	17	-	16	6	IT7
30.000 - 36.990	17	-	16	6	IT6
37.000 - 44.990	17	-	20	8	IT6
45.000 - 50.700	19	-	24	8	IT6
50.710 - 65.000	25	-	24	8	IT6

### IT6/IT7 tolerance example:

HPR150Ø37.350H7M02G-HP625

Bore diameter  $d_1 = 37.350$  H7

## Tolerances for the G variant

Cutting material	Diameter range	
	Ø7 - <Ø60	≥Ø60 - Ø65
<b>Coated (Coating thickness 2-3 µm)</b>		
HP625	-0,005	-0,008

### G variant example:

HPR150GØ37.350-5M02G-HP625

Special tool diameter  $d_1 = 37.350 - 5 \mu\text{m}$

## Accessories

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# Cutting data recommendations for FXR and HPR

Feed and cutting speed

## FXR510 | FXR505

Cutting material: HP625 | Lead: MF1M | MTOA

MMG*	Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cutting speed vc (m/min)			
			Internal cooling	External cooling	MQL	
S	S1 S1.1	Titanium, titanium alloys	< 400	25	10	15
	S2 S2.1	Titanium, titanium alloys	< 1,200	25	10	15
	S2 S2.2	Titanium, titanium alloys	> 1,200	25	10	15
	S3 S3.1	Nickel, unalloyed and alloyed	< 900	25	10	15
	S3 S3.2	Nickel, unalloyed and alloyed	> 900	25	10	15
	S4 S4.1	High-temperature super alloy, Ni-, Co-, and Fe-based		25	10	15
	S5 S5.1	Molybdenum and tungsten alloys		25	10	15

## HPR180 | HPR131

Cutting material: HP625 | Lead: MO2G | MF1G

MMG*	Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cutting speed vc (m/min)			
			Internal cooling	External cooling	MQL	
S	S1 S1.1	Titanium, titanium alloys	< 400	35	20	25
	S2 S2.1	Titanium, titanium alloys	< 1,200	35	20	25
	S2 S2.2	Titanium, titanium alloys	> 1,200	35	20	25
	S3 S3.1	Nickel, unalloyed and alloyed	< 900	30	15	25
	S3 S3.2	Nickel, unalloyed and alloyed	> 900	30	15	25
	S4 S4.1	High-temperature super alloy, Ni-, Co-, and Fe-based		25	15	20
	S5 S5.1	Molybdenum and tungsten alloys		25	15	20

## HPR110 | HPR150

Cutting material: HP625 | Lead: MO2G | MF1G

MMG*	Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cutting speed vc (m/min)			
			Internal cooling	External cooling	MQL	
S	S1 S1.1	Titanium, titanium alloys	< 400	35	20	25
	S2 S2.1	Titanium, titanium alloys	< 1,200	35	20	25
	S2 S2.2	Titanium, titanium alloys	> 1,200	35	20	25
	S3 S3.1	Nickel, unalloyed and alloyed	< 900	30	15	25
	S3 S3.2	Nickel, unalloyed and alloyed	> 900	30	15	25
	S4 S4.1	High-temperature super alloy, Ni-, Co-, and Fe-based		25	15	20
	S5 S5.1	Molybdenum and tungsten alloys		25	15	20

\* MAPAL machining groups







# CLAMPING

## Clamping

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# INDUSTRIAL DESIGN WITH ADDED VALUE – UNIQ<sup>®</sup> CHUCK

The newly-developed hydraulic expansion clamping system enables high machining parameters through excellent stability and accuracy. It minimises self-excited vibration so that clamped tools are not exposed to micro-vibration. This in turn leads to a reduced spindle load of up to 5 per cent, enables significantly longer tool life and guarantees optimal surface quality.

In addition, the brilliant surface which MAPAL creates using a specially developed polishing process ensures that the chucks are more resistant to dirt and corrosion than previous chucks. Users can safely clamp the tool in the holder with little force. This is ensured by "foolproof handling", i.e. simple and self-explanatory handling of the chucks. A lot of time is saved compared to other clamping mechanisms, especially with the UNIQ Hydro DReaM Chuck 4.5°.



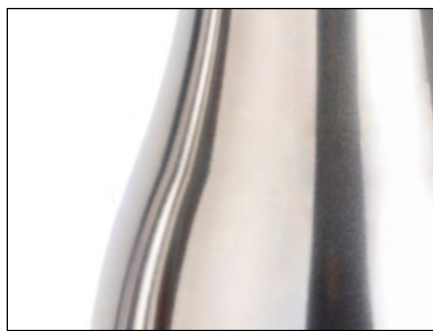


## Design features in detail



### Use of form | Bionic contours

- Higher stability and accuracy of the overall system
- Less displacement of the tool
- Less weight through minimal use of resources
- Good handling when setting up the tool magazine
- Self-excited vibrations are minimised



### Polished surfaces

- Dirt resistance (corrosion resistance) increased
- Highest balancing qualities due to compacted surfaces



### Blue actuator screw | Signature elements

- Actuator screw clearly identifiable and easier actuation of the tightening torque, which is reduced by up to 70%
- Clear arrangement on the product, important functional and product information immediately visible

## UNIQ<sup>®</sup> Mill Chuck, HA

### Dependable. Dynamic. Agile.

The UNIQ Mill Chuck is specially designed for clamping milling tools with an HA shank. Due to the high temperature resistance of 80 °C even during very long milling cycles, it impresses with highly dynamic milling applications such as SPM (Structural Part Machining), HSC (High Speed Cutting) or HPC (High Performance Cutting) of high-quality components with excellent process reliability and a high material removal rate. Universal application for roughing, semi-finished and finishing operations.

#### Hydraulic chuck

- For highly dynamic milling applications

#### Excellent results

- When using tools with HA shanks

#### High thermal stability

- 80 °C even with very long milling cycles (over 240 minutes)

#### For high-performance milling operations

- Up to 33,000 revolutions per minute

#### Highest process reliability

- Even on high-quality parts



### Features

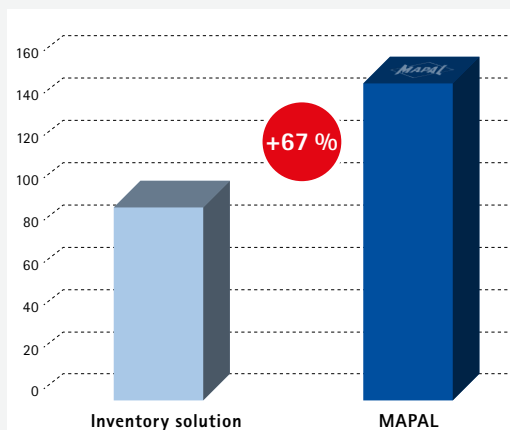
#### Connections:

- HSK-A063
- HSK-A100
- BT30

#### Mounting diameter:

- 6.0 mm up to 20.00 mm

### Tool life [m]



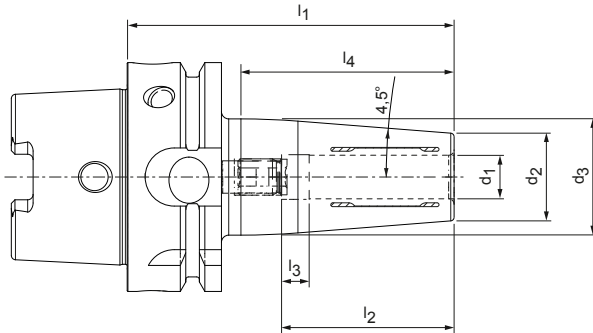
**MAPAL:**  
Higher tool lifes

**Inventory solution:**  
Hydro bushing burst before end of tool life

# UNIQ<sup>®</sup> Mill Chuck, HA

With axial tool length adjustment

HSK-A (hollow shank taper form A) shank according to DIN 69893-1



HSK-A	Dimensions							G	Torque* [Nm]	Specification	Order no.
	$d_1$	$d_2$	$d_3$	$l_1$	$l_2$	$l_3$	$l_4$				
63	6,0	26,0	50,0	65,0	37,0	10,0	35,2	M5	22	MHC-HSK-A063-06-065-1-0-A	31270591
63	8,0	28,0	50,0	65,0	37,0	10,0	35,2	M6	47	MHC-HSK-A063-08-065-1-0-A	31270593
63	10,0	30,0	50,0	75,0	41,0	10,0	45,2	M8x1	85	MHC-HSK-A063-10-075-1-0-A	31270595
63	12,0	32,0	52,5	75,0	46,0	10,0	45,2	M8x1	130	MHC-HSK-A063-12-075-1-0-A	31229418
63	16,0	38,0	52,5	79,0	49,0	10,0	49,2	M8x1	350	MHC-HSK-A063-16-079-1-0-A	31270598
63	20,0	38,0	52,5	79,0	51,0	10,0	49,2	M8x1	520	MHC-HSK-A063-20-079-1-0-A	31229438
100	6,0	26,0	50,0	73,0	37,0	10,0	40,3	M5	22	MHC-HSK-A100-06-073-1-0-A	31345192
100	8,0	28,0	50,0	73,0	37,0	10,0	40,3	M6	47	MHC-HSK-A100-08-073-1-0-A	31345193
100	10,0	30,0	50,0	83,0	41,0	10,0	50,3	M8x1	85	MHC-HSK-A100-10-083-1-0-A	31345194
100	12,0	32,0	52,5	83,0	46,0	10,0	50,3	M8x1	130	MHC-HSK-A100-12-083-1-0-A	31345195
100	16,0	38,0	52,5	87,0	49,0	10,0	54,3	M8x1	350	MHC-HSK-A100-16-087-1-0-A	31345197
100	20,0	38,0	52,5	87,0	51,0	10,0	54,3	M8x1	520	MHC-HSK-A100-20-087-1-0-A	31345199

\* Permissible transferable torque.

Dimensions in mm.

Additional dimensions available upon request.

Use: For clamping tools with smooth cylindrical shanks according to DIN 1835 form A, DIN 6535 form HA as well as with recesses according to DIN 1835 form B, E and DIN 6535 form HB, HE directly and with reducing sleeve in the clamping diameter. The clamping diameter is designed for a shank tolerance of h6.

Scope of delivery: With length adjustment screw, without coolant tube.

Design: Highest tool life and production quality when using smooth cylindrical shanks according to DIN 1835 form A and DIN 6535 form HA. With a projection length of 2.5xD (max. 50 mm), radial run-out accuracy 3  $\mu$ m. When using cylindrical shanks with an in-

clined clamping surface (form E and form HE), the accuracy may be impaired. Torque transmission perfectly tailored to the respective application.

Note: Coolant supply via central through hole. Coolant tubes, code carriers, reducing sleeves for reducing the clamping diameter (if the reducing sleeve is used, the accuracy may be impaired), see "CLAMPING" catalogue.

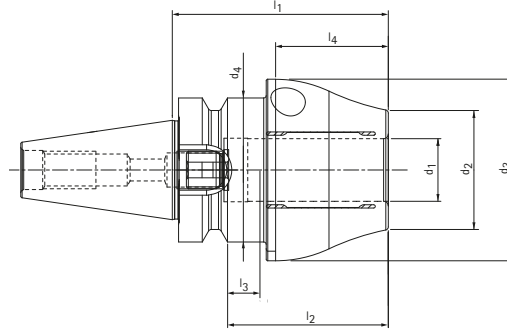
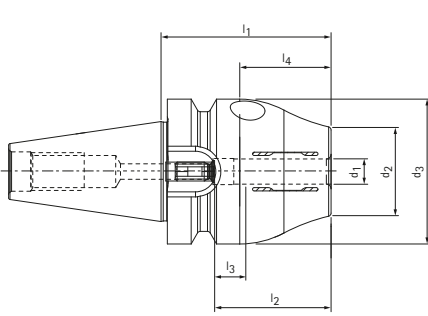
Length adjustment screws available on request.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# UNIQ<sup>®</sup> Mill Chuck, HA

With axial tool length adjustment

Shank BT according to ISO 7388-2 Form JD/JF (JIS B 6339)



BT	Dimensions								G	Torque* [Nm]	Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>				
30**	6,0	26,0	46,0	-	54,0	37,0	10,0	29,0	M5	22	MHC-BT030-06-054-1-0-A	31280342
30**	8,0	28,0	46,0	-	54,0	37,0	10,0	29,0	M6	47	MHC-BT030-08-054-1-0-A	31280343
30**	10,0	30,0	50,0	46,0	54,0	41,0	10,0	23,5	M8x1	85	MHC-BT030-10-054-1-0-A	31280344
30**	12,0	32,0	50,0	46,0	54,0	46,0	10,0	23,5	M10x1	130	MHC-BT030-12-054-1-0-A	31280345
30**	16,0	38,0	55,0	46,0	69,0	49,0	10,0	38,5	M12x1	350	MHC-BT030-16-069-1-0-A	31280346
30**	20,0	38,0	58,0	46,0	69,0	51,0	10,0	38,5	M12x1	520	MHC-BT030-20-069-1-0-A	31280347

\* Permissible transferable torque.

\*\* Design: Taper shank size is not available in the JD/JF combination design.

Dimensions in mm.

Additional dimensions available upon request.

Use: For clamping tools with smooth cylindrical shanks according to DIN 1835 form A, DIN 6535 form HA as well as with recesses according to DIN 1835 form B, E and DIN 6535 form HB, HE directly and with reducing sleeve in the clamping diameter. The clamping diameter is designed for a shank tolerance of h6.

Scope of delivery: With length adjustment screw, without pull stud.

Design: Highest tool life and production quality when using smooth cylindrical shanks according to DIN 1835 form A and DIN 6535 form HA. With a projection length of 2.5xD (max. 50 mm) radial run-out accuracy 3 µm. When using cylindrical shanks with an in-

clined clamping surface (form E and form HE), the accuracy may be impaired. Torque transmission perfectly tailored to the respective application.

Note: Coolant supply via central through hole. Pull stud, reducing sleeves for reducing the clamping diameter (if the reducing sleeve is used, the accuracy may be impaired), see "CLAMPING" catalogue.

Length adjustment screws available on request.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# UNIQ® DReaM Chuck

## High machining parameters through stability and accuracy

The UNIQ DReaM Chuck 4.5° is ideally suited for reaming and drilling applications as well as for use with finishing milling cutters. Thanks to the clamping initiation in the hollow shank taper collar, it enables maximum rigidity with minimal use of material at minimal tool restriction. The outer contour of the UNIQ DReaM Chuck is based one to one on DIN 69882-8 for heat shrink chucks. This means that the advantages of hydraulic clamping technology can be harnessed for these applications.

### Hydraulic chuck

- For reaming and drilling applications as well as for finishing during milling operations

### Application-oriented system design

- With the original dimensions of a shrink chuck (DIN contour with 4.5°)

### Excellent surfaces

- As well as improved handling

### Maximum flexibility and productivity

- During the machining of contour-critical parts



## Features

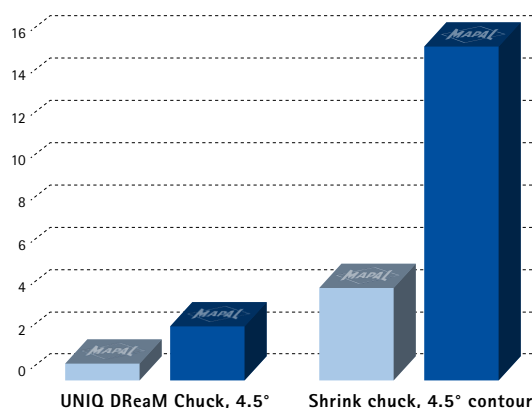
### Connections:

- HSK-A063
- HSK-A100
- BT30

### Mounting diameter:

- 6.0 mm up to 20.00 mm

## Surface finish [ $\mu\text{m}$ ]



Material: K720 1.2872 90MnCrV8  
 Milling cutter: OptiMill-Uni-HPC-Plus  
 Shank  $\phi$ : 20.00 mm

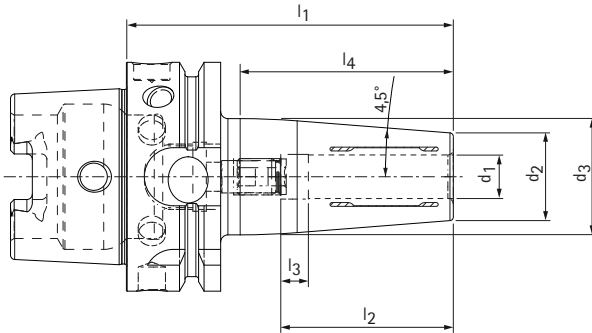
### Finish milling

$v_c$ : 140 m/min  
 $f_z$ : 0.13 mm  
 $a_p$ : 0.38 mm  
 $a_e$ : 0.07 mm

■ Average roughness depth (Rz)  
 ■ Arithmetic average roughness value (Ra)

## UNIQ® DReaM Chuck, 4.5°

With axial tool length adjustment, clamping initiation in collar  
HSK-A (hollow shank taper form A) shank according to DIN 69893-1



HSK-A	Dimensions							G	Torque* [Nm]	Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>				
63	6,0	21,0	27,0	80,0	37,0	10,0	48,9	M5	18	MHC-HSK-A063-06-080-1-0-A	31270515
63	8,0	21,0	27,0	80,0	37,0	10,0	48,9	M6	35	MHC-HSK-A063-08-080-1-0-A	31270525
63	10,0	24,0	32,0	85,0	41,0	10,0	53,7	M8x1	60	MHC-HSK-A063-10-085-1-0-A	31270550
63	12,0	24,0	32,0	90,0	46,0	10,0	58,6	M10x1	90	MHC-HSK-A063-12-090-1-0-A	31229439
63	16,0	27,0	34,0	95,0	49,0	10,0	63,1	M12x1	200	MHC-HSK-A063-16-095-1-0-A	31270555
63	20,0	33,0	42,0	100,0	51,0	10,0	68,9	M16x1	330	MHC-HSK-A063-20-100-1-0-A	31229440
100	6,0	21,0	27,0	85,0	37,0	10,0	38,7	M5	18	MHC-HSK-A100-06-085-1-0-A	31344789
100	8,0	21,0	27,0	85,0	37,0	10,0	38,7	M6	35	MHC-HSK-A100-08-085-1-0-A	31344860
100	10,0	24,0	32,0	90,0	41,0	10,0	53,8	M8x1	60	MHC-HSK-A100-10-090-1-0-A	31344862
100	12,0	24,0	32,0	95,0	46,0	10,0	58,7	M10x1	90	MHC-HSK-A100-12-095-1-0-A	31344863
100	16,0	27,0	34,0	100,0	49,0	10,0	63,1	M12x1	200	MHC-HSK-A100-16-100-1-0-A	31344865
100	20,0	33,0	42,0	105,0	51,0	10,0	69,0	M16x1	330	MHC-HSK-A100-20-105-1-0-A	31344867

\* Permissible transferable torque.

Dimensions in mm.

Additional dimensions available upon request.

Use: For clamping tools with smooth cylindrical shanks according to DIN 1835 form A, DIN 6535 form HA as well as with recesses according to DIN 1835 form B, E and DIN 6535 form HB, HE directly and with reducing sleeve in the clamping diameter. The clamping diameter is designed for a shank tolerance of h6.

Scope of delivery: With length adjustment screw, without coolant tube.

Design: Highest tool life and production quality when using smooth cylindrical shanks according to DIN 1835 form A and DIN 6535 form HA. With a projection length of 2.5xD (max. 50 mm) radial run-out accuracy 3 µm. When using cylindrical shanks with an in-

clined clamping surface (form E and form HE), the accuracy may be impaired. Torque transmission perfectly tailored to the respective application.

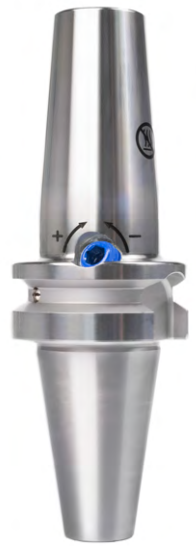
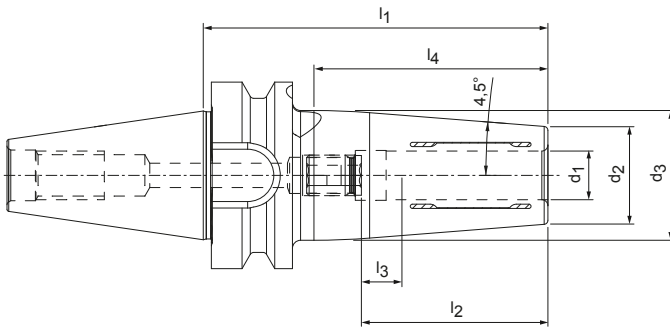
Note: Coolant supply via central through hole. Coolant tubes, code carriers, reducing sleeves for reducing the clamping diameter (if the reducing sleeve is used, the accuracy may be impaired), see "CLAMPING" catalogue.

Length adjustment screws available on request.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

## UNIQ<sup>®</sup> DReaM Chuck, 4.5°

With axial tool length adjustment, clamping initiation in collar  
Shank BT according to ISO 7388-2 Form JD/JF (JIS B 6339)



BT	Dimensions							G	Torque* [Nm]	Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>				
30**	6,0	21,0	27,0	85,0	37,0	10,0	57,7	M5	18	MHC-BT030-06-085-1-0-A	31280360
30**	8,0	21,0	27,0	85,0	37,0	10,0	57,7	M6	35	MHC-BT030-08-085-1-0-A	31280361
30**	10,0	24,0	32,0	85,0	41,0	10,0	57,7	M8x1	60	MHC-BT030-10-085-1-0-A	31280362
30**	12,0	24,0	32,0	85,0	46,0	10,0	57,7	M10x1	90	MHC-BT030-12-085-1-0-A	31280365
30**	16,0	27,0	34,0	85,0	49,0	10,0	57,2	M10x1	200	MHC-BT030-16-085-1-0-A	31280366
30**	20,0	33,0	42,0	85,0	51,0	10,0	57,5	M10x1	330	MHC-BT030-20-085-1-0-A	31280367

\* Permissible transferable torque.

\*\* Design: Taper shank size is not available in the JD/JF combination design

Dimensions in mm.

Additional dimensions available upon request.

Use: For clamping tools with smooth cylindrical shanks according to DIN 1835 form A, DIN 6535 form HA as well as with recesses according to DIN 1835 form B, E and DIN 6535 form HB, HE directly and with reducing sleeve in the clamping diameter. The clamping diameter is designed for a shank tolerance of h6.

Scope of delivery: With length adjustment screw, without pull stud.

Design: Highest tool life and production quality when using smooth cylindrical shanks according to DIN 1835 form A and DIN 6535 form HA. With a projection length of 2.5xD (max. 50 mm), radial run-out accuracy 3 µm. When using cylindrical shanks with an in-

clined clamping surface (form E and form HE), the accuracy may be impaired. Torque transmission perfectly tailored to the respective application.

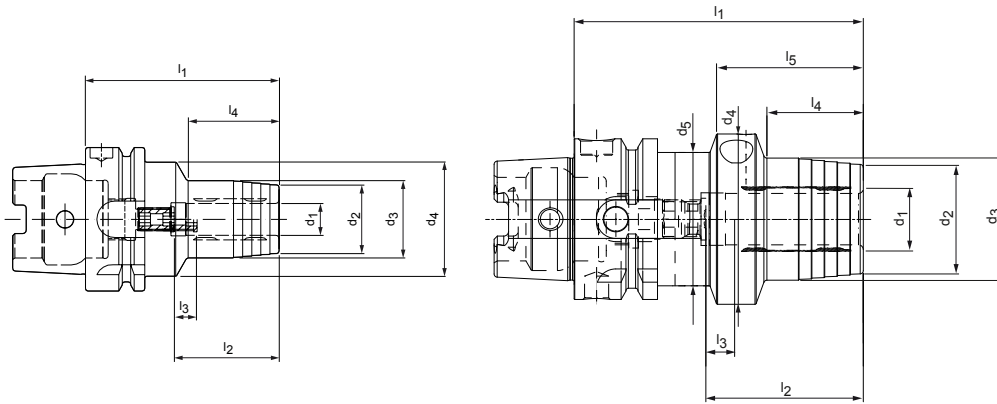
Note: Coolant supply via central through hole. Pull stud, reducing sleeves for reducing the clamping diameter (if the reducing sleeve is used, the accuracy may be impaired), see "CLAMPING" catalogue.

Length adjustment screws available on request.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# HydroChuck

In accordance with DIN 69882-7 with axial tool length adjustment  
 HSK-A (hollow shank taper form A) shank according to DIN 69893-1



HSK-A	Dimensions										G	Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>			
32	6,0	22,0	26,0	40,0	-	80,0	37,0	10,0	29,0	-	M5	MHC-HSK-A032-06-080-1-0-A	30250998
32	8,0	24,0	28,0	40,0	-	80,0	37,0	10,0	29,0	-	M6	MHC-HSK-A032-08-080-1-0-A	30250999
32	10,0	26,0	30,0	40,0	-	85,0	41,0	10,0	35,0	-	M6	MHC-HSK-A032-10-085-1-0-A	30251000
32	12,0	28,0	32,0	40,0	-	90,0	46,0	10,0	40,0	-	M6	MHC-HSK-A032-12-090-1-0-A	30251001
40	6,0	22,0	26,0	33,5	-	70,0	37,0	10,0	36,0	-	M5	MHC-HSK-A040-06-070-1-0-A	30251002
40	8,0	24,0	28,0	33,5	-	70,0	37,0	10,0	36,0	-	M6	MHC-HSK-A040-08-070-1-0-A	30251003
40	10,0	26,0	30,0	33,5	-	75,0	41,0	10,0	42,0	-	M6	MHC-HSK-A040-10-075-1-0-A	30251004
40	12,0	28,0	32,0	33,5	-	80,0	46,0	10,0	48,0	-	M6	MHC-HSK-A040-12-080-1-0-A	30251005
50	6,0	22,0	26,0	40,0	-	70,0	37,0	10,0	28,0	-	M5	MHC-HSK-A050-06-070-1-0-A	30251006
50	8,0	24,0	28,0	40,0	-	70,0	37,0	10,0	28,0	-	M6	MHC-HSK-A050-08-070-1-0-A	30251007
50	10,0	26,0	30,0	40,0	-	75,0	41,0	10,0	34,0	-	M8x1	MHC-HSK-A050-10-075-1-0-A	30251008
50	12,0	28,0	32,0	40,0	-	85,0	46,0	10,0	44,0	-	M10x1	MHC-HSK-A050-12-085-1-0-A	30251009
50	14,0	30,0	34,0	40,0	-	85,0	46,0	10,0	44,0	-	M10x1	MHC-HSK-A050-14-085-1-0-A	30251010
50	16,0	34,0	38,0	53,0	41,5	90,0	49,0	10,0	30,0	45,5	M12x1	MHC-HSK-A050-16-090-1-0-A	30251011
50	18,0	36,0	40,0	53,0	41,5	90,0	49,0	10,0	30,0	45,5	M12x1	MHC-HSK-A050-18-090-1-0-A	30251012
50	20,0	38,0	42,0	57,0	41,5	90,0	51,0	10,0	29,0	45,5	M16x1	MHC-HSK-A050-20-090-1-0-A	30251013
63	6,0	22,0	26,0	50,0	-	70,0	37,0	10,0	24,0	-	M5	MHC-HSK-A063-06-070-1-0-A	30251014
63	6,0	22,0	26,0	50,0	-	120,0	37,0	10,0	73,0	-	M5	MHC-HSK-A063-06-120-1-0-A	30273801
63	6,0	22,0	26,0	50,0	-	150,0	37,0	10,0	103,0	-	M5	MHC-HSK-A063-06-150-1-0-A	30251144
63	6,0	22,0	26,0	50,0	-	200,0	37,0	10,0	153,0	-	M5	MHC-HSK-A063-06-200-1-0-A	30251152
63	8,0	24,0	28,0	50,0	-	70,0	37,0	10,0	25,0	-	M6	MHC-HSK-A063-08-070-1-0-A	30251015
63	8,0	24,0	28,0	50,0	-	120,0	37,0	10,0	74,0	-	M6	MHC-HSK-A063-08-120-1-0-A	30273802
63	8,0	24,0	28,0	50,0	-	150,0	37,0	10,0	104,0	-	M6	MHC-HSK-A063-08-150-1-0-A	30251145
63	8,0	24,0	28,0	50,0	-	200,0	37,0	10,0	154,0	-	M6	MHC-HSK-A063-08-200-1-0-A	30251153
63	10,0	26,0	30,0	50,0	-	80,0	41,0	10,0	35,0	-	M8x1	MHC-HSK-A063-10-080-1-0-A	30251016
63	10,0	26,0	30,0	50,0	-	120,0	41,0	10,0	74,0	-	M8x1	MHC-HSK-A063-10-120-1-0-A	30273803
63	10,0	26,0	30,0	50,0	-	150,0	41,0	10,0	104,0	-	M8x1	MHC-HSK-A063-10-150-1-0-A	30251146
63	10,0	26,0	30,0	50,0	-	200,0	41,0	10,0	154,0	-	M8x1	MHC-HSK-A063-10-200-1-0-A	30251154
63	12,0	28,0	32,0	50,0	-	85,0	46,0	10,0	40,0	-	M10x1	MHC-HSK-A063-12-085-1-0-A	30251017
63	12,0	28,0	32,0	50,0	-	120,0	46,0	10,0	75,0	-	M10x1	MHC-HSK-A063-12-120-1-0-A	30273804
63	12,0	28,0	32,0	50,0	-	150,0	46,0	10,0	105,0	-	M10x1	MHC-HSK-A063-12-150-1-0-A	30251147
63	12,0	28,0	32,0	50,0	-	200,0	46,0	10,0	155,0	-	M10x1	MHC-HSK-A063-12-200-1-0-A	30251155
63	14,0	30,0	34,0	50,0	-	85,0	46,0	10,0	40,0	-	M10x1	MHC-HSK-A063-14-085-1-0-A	30251018
63	14,0	30,0	34,0	50,0	-	120,0	46,0	10,0	75,0	-	M10x1	MHC-HSK-A063-14-120-1-0-A	30273805
63	14,0	30,0	34,0	50,0	-	150,0	46,0	10,0	105,0	-	M10x1	MHC-HSK-A063-14-150-1-0-A	30251148
63	14,0	30,0	34,0	50,0	-	200,0	46,0	10,0	155,0	-	M10x1	MHC-HSK-A063-14-200-1-0-A	30251156
63	16,0	34,0	38,0	50,0	-	90,0	49,0	10,0	46,0	-	M12x1	MHC-HSK-A063-16-090-1-0-A	30251019
63	16,0	34,0	38,0	50,0	-	120,0	49,0	10,0	76,0	-	M12x1	MHC-HSK-A063-16-120-1-0-A	30273806
63	16,0	34,0	38,0	50,0	-	150,0	49,0	10,0	106,0	-	M12x1	MHC-HSK-A063-16-150-1-0-A	30251149



## HydroChuck | as per DIN 69882-7 with axial tool length adjustment | HSK-A shank as per DIN 69893-1

HSK-A	Dimensions										G	Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>			
63	16,0	34,0	38,0	50,0	-	200,0	49,0	10,0	156,0	-	M12x1	MHC-HSK-A063-16-200-1-0-A	30251157
63	18,0	36,0	40,0	50,0	-	90,0	49,0	10,0	47,0	-	M12x1	MHC-HSK-A063-18-090-1-0-A	30251020
63	18,0	36,0	40,0	50,0	-	120,0	49,0	10,0	77,0	-	M12x1	MHC-HSK-A063-18-120-1-0-A	30273807
63	18,0	36,0	40,0	50,0	-	150,0	49,0	10,0	107,0	-	M12x1	MHC-HSK-A063-18-150-1-0-A	30251150
63	18,0	36,0	40,0	50,0	-	200,0	49,0	10,0	157,0	-	M12x1	MHC-HSK-A063-18-200-1-0-A	30251158
63	20,0	38,0	42,0	50,0	-	90,0	51,0	10,0	48,0	-	M16x1	MHC-HSK-A063-20-090-1-0-A	30251021
63	20,0	38,0	42,0	50,0	-	120,0	51,0	10,0	78,0	-	M16x1	MHC-HSK-A063-20-120-1-0-A	30273808
63	20,0	38,0	42,0	50,0	-	150,0	51,0	10,0	108,0	-	M16x1	MHC-HSK-A063-20-150-1-0-A	30251151
63	20,0	38,0	42,0	50,0	-	200,0	51,0	10,0	158,0	-	M16x1	MHC-HSK-A063-20-200-1-0-A	30251159
63	25,0	53,0	57,0	52,5	-	120,0	57,0	10,0	63,0	-	M16x1	MHC-HSK-A063-25-120-1-0-A	30251022
63	25,0	53,0	57,0	52,5	-	150,0	57,0	10,0	63,0	-	M16x1	MHC-HSK-A063-25-150-1-0-A	30785029
63	25,0	53,0	57,0	52,5	-	200,0	57,0	10,0	63,0	-	M16x1	MHC-HSK-A063-25-200-1-0-A	30882168
63	32,0	59,0	63,0	59,0	52,5	125,0	61,0	10,0	61,0	77,0	M16x1	MHC-HSK-A063-32-125-1-0-A	30251023
63	32,0	59,0	63,0	59,0	52,5	150,0	61,0	10,0	65,0	77,0	M16x1	MHC-HSK-A063-32-150-1-0-A	30882169
63	32,0	59,0	63,0	59,0	52,2	200,0	61,0	10,0	65,0	77,0	M16x1	MHC-HSK-A063-32-200-1-0-A	30882171
80	6,0	22,0	26,0	50,0	-	70,0	37,0	10,0	24,0	-	M5	MHC-HSK-A080-06-070-1-0-A	30355067
80	8,0	24,0	28,0	50,0	-	70,0	37,0	10,0	24,0	-	M6	MHC-HSK-A080-08-070-1-0-A	30355068
80	10,0	26,0	30,0	50,0	-	80,0	41,0	10,0	35,0	-	M8x1	MHC-HSK-A080-10-080-1-0-A	30355069
80	12,0	28,0	32,0	50,0	-	85,0	46,0	10,0	40,0	-	M10x1	MHC-HSK-A080-12-085-1-0-A	30355071
80	14,0	30,0	34,0	50,0	-	85,0	46,0	10,0	40,0	-	M10x1	MHC-HSK-A080-14-085-1-0-A	30355072
80	16,0	34,0	38,0	50,0	-	95,0	49,0	10,0	51,0	-	M12x1	MHC-HSK-A080-16-095-1-0-A	30355074
80	18,0	36,0	40,0	50,0	-	95,0	49,0	10,0	51,0	-	M12x1	MHC-HSK-A080-18-095-1-0-A	30355075
80	20,0	38,0	42,0	50,0	-	95,0	51,0	10,0	51,0	-	M16x1	MHC-HSK-A080-20-095-1-0-A	30355077
80	25,0	53,0	57,0	63,0	-	110,0	57,0	10,0	65,0	-	M16x1	MHC-HSK-A080-25-110-1-0-A	30355078
80	32,0	59,0	63,0	66,5	-	125,0	61,0	10,0	63,0	-	M16x1	MHC-HSK-A080-32-125-1-0-A	30355080
100	6,0	22,0	26,0	50,0	-	75,0	37,0	10,0	26,0	-	M5	MHC-HSK-A100-06-075-1-0-A	30251024
100	6,0	22,0	26,0	50,0	-	120,0	37,0	10,0	71,0	-	M5	MHC-HSK-A100-06-120-1-0-A	30273809
100	6,0	22,0	26,0	50,0	-	165,0	37,0	10,0	116,0	-	M5	MHC-HSK-A100-06-165-1-0-A	30273810
100	8,0	24,0	28,0	50,0	-	75,0	37,0	10,0	26,0	-	M6	MHC-HSK-A100-08-075-1-0-A	30251025
100	8,0	24,0	28,0	50,0	-	120,0	37,0	10,0	71,0	-	M6	MHC-HSK-A100-08-120-1-0-A	30273811
100	8,0	24,0	28,0	50,0	-	165,0	37,0	10,0	116,0	-	M6	MHC-HSK-A100-08-165-1-0-A	30273812
100	10,0	26,0	30,0	50,0	-	90,0	41,0	10,0	42,0	-	M8x1	MHC-HSK-A100-10-090-1-0-A	30251026
100	10,0	26,0	30,0	50,0	-	120,0	41,0	10,0	72,0	-	M8x1	MHC-HSK-A100-10-120-1-0-A	30273813
100	10,0	26,0	30,0	50,0	-	165,0	41,0	10,0	117,0	-	M8x1	MHC-HSK-A100-10-165-1-0-A	30273814
100	12,0	28,0	32,0	50,0	-	95,0	46,0	10,0	47,0	-	M10x1	MHC-HSK-A100-12-095-1-0-A	30251027
100	12,0	28,0	32,0	50,0	-	120,0	46,0	10,0	72,0	-	M10x1	MHC-HSK-A100-12-120-1-0-A	30273816
100	12,0	28,0	32,0	50,0	-	165,0	46,0	10,0	117,0	-	M10x1	MHC-HSK-A100-12-165-1-0-A	30273817
100	14,0	30,0	34,0	50,0	-	95,0	46,0	10,0	47,0	-	M10x1	MHC-HSK-A100-14-095-1-0-A	30251028
100	16,0	34,0	38,0	50,0	-	100,0	49,0	10,0	53,0	-	M12x1	MHC-HSK-A100-16-100-1-0-A	30251029
100	16,0	34,0	38,0	50,0	-	135,0	49,0	10,0	88,0	-	M12x1	MHC-HSK-A100-16-135-1-0-A	30273818
100	16,0	34,0	38,0	50,0	-	165,0	49,0	10,0	118,0	-	M12x1	MHC-HSK-A100-16-165-1-0-A	30273819
100	18,0	36,0	40,0	50,0	-	100,0	49,0	10,0	53,0	-	M12x1	MHC-HSK-A100-18-100-1-0-A	30251030
100	20,0	38,0	42,0	50,0	-	105,0	51,0	10,0	59,0	-	M16x1	MHC-HSK-A100-20-105-1-0-A	30251031
100	20,0	38,0	42,0	50,0	-	135,0	51,0	10,0	89,0	-	M16x1	MHC-HSK-A100-20-135-1-0-A	30273820
100	20,0	38,0	42,0	50,0	-	165,0	51,0	10,0	119,0	-	M16x1	MHC-HSK-A100-20-165-1-0-A	30273821
100	25,0	53,0	57,0	63,0	-	110,0	57,0	10,0	62,0	-	M16x1	MHC-HSK-A100-25-110-1-0-A	30251032
100	25,0	53,0	57,0	63,0	-	165,0	57,0	10,0	117,0	-	M16x1	MHC-HSK-A100-25-165-1-0-A	30882185
100	32,0	59,0	63,0	67,0	-	110,0	61,0	10,0	62,0	-	M16x1	MHC-HSK-A100-32-110-1-0-A	30251033
100	32,0	59,0	63,0	67,0	-	165,0	61,0	10,0	117,0	-	M16x1	MHC-HSK-A100-32-165-1-0-A	30882187

Dimensions in mm.

Additional dimensions available upon request.

Use: For clamping tools with smooth cylindrical shanks according to DIN 1835 form A, DIN 6535 form HA as well as with recesses according to DIN 1835 form B, E and DIN 6535 form HB, HE directly and with reducing sleeve in the clamping diameter. The clamping diameter is designed for a shank tolerance of h6.

Scope of delivery: With length adjustment screw, without coolant tube.

Design: Highest tool life and production quality when using smooth cylindrical shanks according to DIN 1835 form A and DIN 6535 form HA. With a projection length of 2.5xD

(max. 50 mm) radial run-out accuracy 3 µm. When using cylindrical shanks with an inclined clamping surface (form E and form HE), the accuracy may be impaired.

Note: Coolant supply via central through hole. Coolant tubes, code carriers, reducing sleeves for reducing the clamping diameter (if the reducing sleeve is used, the accuracy may be impaired), see "CLAMPING" catalogue.

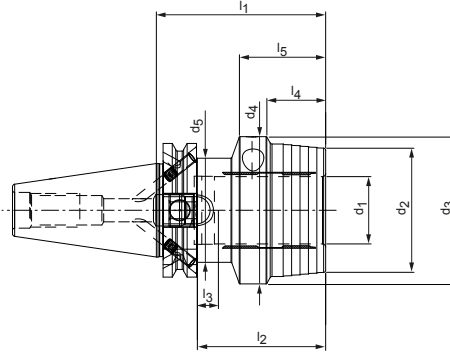
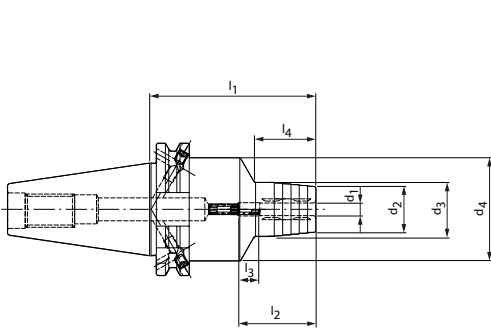
Length adjustment screws available on request.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# HydroChuck

With axial tool length adjustment

SK shank according to ISO 7388-1 Form AD/AF



Steep taper	Dimensions										G	Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	l <sub>5</sub>			
30*	6,0	23,0	26,0	44,5	-	55,0	37,0	10,0	20,0	-	M5	MHC-SK030-06-055-1-0-A	30559118
30*	8,0	24,0	28,0	44,5	-	55,0	37,0	10,0	20,0	-	M6	MHC-SK030-08-055-1-0-A	30559119
30*	10,0	27,0	30,0	44,5	-	55,0	41,0	10,0	21,0	-	M8x1	MHC-SK030-10-055-1-0-A	30559120
30*	12,0	28,0	32,0	44,5	-	55,0	46,0	10,0	22,0	-	M8x1	MHC-SK030-12-055-1-0-A	30559121
30*	14,0	30,0	34,0	44,5	-	90,0	46,0	10,0	42,0	-	M8x1	MHC-SK030-14-090-1-0-A	30559122
30*	16,0	34,0	38,0	44,5	-	90,0	49,0	10,0	50,0	-	M8x1	MHC-SK030-16-090-1-0-A	30559123
30*	18,0	36,0	40,0	44,5	-	90,0	49,0	10,0	50,0	-	M8x1	MHC-SK030-18-090-1-0-A	30559124
30*	20,0	38,0	42,0	44,5	-	90,0	51,0	10,0	50,0	-	M8x1	MHC-SK030-20-090-1-0-A	30559125
40	6,0	22,0	26,0	49,5	-	80,5	37,0	10,0	29,5	-	M5	MHC-SK040-06-081-3-0-A	30250958
40	8,0	24,0	28,0	49,5	-	80,5	37,0	10,0	30,0	-	M6	MHC-SK040-08-081-3-0-A	30250959
40	10,0	26,0	30,0	49,5	-	80,5	41,0	10,0	35,0	-	M8x1	MHC-SK040-10-081-3-0-A	30250960
40	12,0	28,0	32,0	49,5	-	80,5	46,0	10,0	40,0	-	M10x1	MHC-SK040-12-081-3-0-A	30250961
40	14,0	30,0	34,0	49,5	-	80,5	46,0	10,0	40,0	-	M10x1	MHC-SK040-14-081-3-0-A	30250962
40	16,0	34,0	38,0	49,5	-	80,5	49,0	10,0	45,0	-	M12x1	MHC-SK040-16-081-3-0-A	30250963
40	18,0	36,0	40,0	49,5	-	80,5	49,0	10,0	46,0	-	M12x1	MHC-SK040-18-081-3-0-A	30250964
40	20,0	38,0	42,0	49,5	-	80,5	51,0	10,0	47,0	-	M16x1	MHC-SK040-20-081-3-0-A	30250965
40	25,0	51,0	55,0	63,0	49,5	80,5	57,0	10,0	28,0	42,0	M16x1	MHC-SK040-25-081-3-0-A	30250966
40	32,0	59,0	63,0	70,0	49,5	80,5	61,0	10,0	20,0	41,0	M16x1	MHC-SK040-32-081-3-0-A	30250967
50	6,0	22,0	26,0	49,5	-	80,5	37,0	10,0	29,5	-	M5	MHC-SK050-06-081-3-0-A	30250968
50	8,0	24,0	28,0	49,5	-	80,5	37,0	10,0	30,0	-	M6	MHC-SK050-08-081-3-0-A	30250969
50	10,0	26,0	30,0	49,5	-	80,5	41,0	10,0	35,0	-	M8x1	MHC-SK050-10-081-3-0-A	30250970
50	12,0	28,0	32,0	49,5	-	80,5	46,0	10,0	40,0	-	M10x1	MHC-SK050-12-081-3-0-A	30250971
50	14,0	30,0	34,0	49,5	-	80,5	46,0	10,0	40,0	-	M10x1	MHC-SK050-14-081-3-0-A	30250972
50	16,0	34,0	38,0	49,5	-	80,5	49,0	10,0	45,0	-	M12x1	MHC-SK050-16-081-3-0-A	30250973
50	18,0	36,0	40,0	49,5	-	80,5	49,0	10,0	46,0	-	M12x1	MHC-SK050-18-081-3-0-A	30250974
50	20,0	38,0	42,0	49,5	-	80,5	51,0	10,0	42,0	-	M16x1	MHC-SK050-20-081-3-0-A	30250975
50	25,0	51,0	55,0	63,0	-	100,0	57,0	10,0	48,0	-	M16x1	MHC-SK050-25-100-3-0-A	30250976
50	32,0	59,0	63,0	70,0	-	100,0	61,0	10,0	61,0	-	M16x1	MHC-SK050-32-100-3-0-A	30250977

\* Design: Taper shank size is not available in the AD/AF combination design

Dimensions in mm.

Additional dimensions available upon request.

Use: For clamping tools with smooth cylindrical shanks according to DIN 1835 form A, DIN 6535 form HA as well as with recesses according to DIN 1835 form B, E and DIN 6535 form HB, HE directly and with reducing sleeve in the clamping diameter. The clamping diameter is designed for a shank tolerance of h6.

Scope of delivery: With length adjustment screw, without pull stud.

Design: Highest tool life and production quality when using smooth cylindrical shanks according to DIN 1835 form A and DIN 6535 form HA. With a projection length of 2.5xD (max. 50 mm) radial run-out accuracy 3 µm. When using cylindrical shanks with an in-

clined clamping surface (form E and form HE), the accuracy may be impaired. Basic setting Form AD, if Form AF is required, please specify this when placing your order.

Note: Coolant supply via central through hole. Pull stud, reducing sleeves for reducing the clamping diameter (if the reducing sleeve is used, the accuracy may be impaired), see "CLAMPING" catalogue.

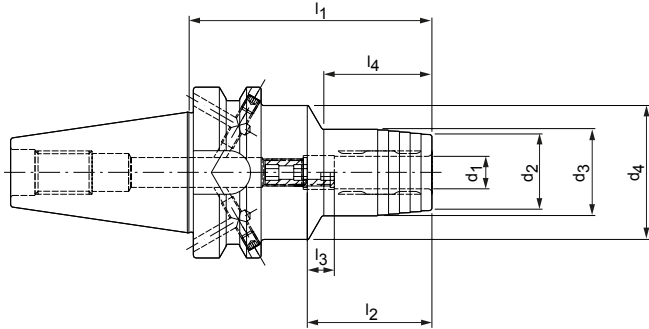
Length adjustment screws available on request.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# HydroChuck

With axial tool length adjustment

Shank BT according to ISO 7388-2 Form JD/JF (JIS B 6339)



BT	Dimensions								G	Specification	Order no.
	$d_1$	$d_2$	$d_3$	$d_4$	$l_1$	$l_2$	$l_3$	$l_4$			
30*	6,0	23,0	26,0	45,0	50,8	37,0	10,0	12,3	M5	MHC-BT030-06-051-1-0-A	30270438
30*	8,0	25,0	28,0	45,0	50,8	37,0	10,0	12,5	M6	MHC-BT030-08-051-1-0-A	30270439
30*	10,0	27,0	30,0	45,0	50,8	41,0	10,0	13,0	M8x1	MHC-BT030-10-051-1-0-A	30270440
30*	12,0	29,0	32,0	45,0	50,8	46,0	10,0	14,0	M8x1	MHC-BT030-12-051-1-0-A	30270441
30*	14,0	30,0	34,0	45,0	90,0	46,0	10,0	45,0	M8x1	MHC-BT030-14-090-1-0-A	30270442
30*	16,0	34,0	38,0	45,0	90,0	49,0	10,0	50,0	M8x1	MHC-BT030-16-090-1-0-A	30270443
30*	18,0	36,0	40,0	45,0	90,0	49,0	10,0	50,0	M8x1	MHC-BT030-18-090-1-0-A	30270444
30*	20,0	38,0	42,0	45,0	90,0	51,0	10,0	50,0	M8x1	MHC-BT030-20-090-1-0-A	30270445
40	6,0	22,0	26,0	49,5	90,0	37,0	10,0	29,0	M5	MHC-BT040-06-090-3-0-A	30251037
40	8,0	24,0	28,0	49,5	90,0	37,0	10,0	30,0	M6	MHC-BT040-08-090-3-0-A	30251038
40	10,0	26,0	30,0	49,5	90,0	41,0	10,0	35,0	M8x1	MHC-BT040-10-090-3-0-A	30251039
40	12,0	28,0	32,0	49,5	90,0	46,0	10,0	40,0	M10x1	MHC-BT040-12-090-3-0-A	30251040
40	14,0	30,0	34,0	49,5	90,0	46,0	10,0	40,0	M10x1	MHC-BT040-14-090-3-0-A	30251041
40	16,0	34,0	38,0	49,5	90,0	49,0	10,0	45,0	M12x1	MHC-BT040-16-090-3-0-A	30251042
40	18,0	36,0	40,0	49,5	90,0	49,0	10,0	46,0	M12x1	MHC-BT040-18-090-3-0-A	30251043
40	20,0	38,0	42,0	49,5	90,0	51,0	10,0	47,0	M16x1	MHC-BT040-20-090-3-0-A	30251044
40	25,0	51,0	55,0	52,0	90,0	57,0	10,0	50,0	M16x1	MHC-BT040-25-090-3-0-A	30251045
40	32,0	59,0	63,0	62,0	90,0	61,0	10,0	48,0	M16x1	MHC-BT040-32-090-3-0-A	30251046
50	6,0	22,0	26,0	49,5	90,0	37,0	10,0	29,0	M5	MHC-BT050-06-090-3-0-A	30251047
50	8,0	24,0	28,0	49,5	90,0	37,0	10,0	30,0	M6	MHC-BT050-08-090-3-0-A	30251048
50	10,0	26,0	30,0	49,5	90,0	41,0	10,0	34,0	M8x1	MHC-BT050-10-090-3-0-A	30251049
50	12,0	28,0	32,0	49,5	90,0	46,0	10,0	34,0	M10x1	MHC-BT050-12-090-3-0-A	30251050
50	14,0	30,0	34,0	49,5	90,0	46,0	10,0	35,0	M10x1	MHC-BT050-14-090-3-0-A	30251051
50	16,0	34,0	38,0	49,5	90,0	49,0	10,0	35,0	M12x1	MHC-BT050-16-090-3-0-A	30251052
50	18,0	36,0	40,0	49,5	90,0	49,0	10,0	35,0	M12x1	MHC-BT050-18-090-3-0-A	30251053
50	20,0	38,0	42,0	49,5	90,0	51,0	10,0	35,0	M16x1	MHC-BT050-20-090-3-0-A	30251054
50	25,0	51,0	55,0	63,0	110,0	57,0	10,0	48,0	M16x1	MHC-BT050-25-110-3-0-A	30251055
50	32,0	59,0	63,0	70,0	110,0	61,0	10,0	50,0	M16x1	MHC-BT050-32-110-3-0-A	30251056

\* Design: Taper shank size is not available in the JD/JF combination design

Dimensions in mm.

Additional dimensions available upon request.

Use: For clamping tools with smooth cylindrical shanks according to DIN 1835 form A, DIN 6535 form HA as well as with recesses according to DIN 1835 form B, E and DIN 6535 form HB, HE directly and with reducing sleeve in the clamping diameter. The clamping diameter is designed for a shank tolerance of h6.

Scope of delivery: With length adjustment screw, without pull stud.

Design: Highest tool life and production quality when using smooth cylindrical shanks according to DIN 1835 form A and DIN 6535 form HA. With a projection length of 2.5xD (max. 50 mm) radial run-out accuracy 3 µm. When using cylindrical shanks with an in-

clined clamping surface (form E and form HE), the accuracy may be impaired. Basic setting Form JD; if Form JF is required, please state with the order.

Note: Coolant supply via central through hole. Pull stud, reducing sleeves for reducing the clamping diameter (if the reducing sleeve is used, the accuracy may be impaired), see "CLAMPING" catalogue.

Length adjustment screws available on request.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# Mill Chuck, HB

## Side lock chuck for high-performance milling operations

The new side lock chuck from MAPAL impresses with its strong clamping ability, easy handling and significantly improved radial run-out. The location bore is created with significantly more precision than before. This reduces the radial play of the clamped tool and considerably improves the radial run-out. The large tolerance on the lateral clamping surface is also compensated for.

To achieve this, MAPAL uses a spring element in the connection that enables a defined form fit between the tool and connection. Coolant channels parallel to the axis in the clamping range also ensure an improved coolant supply.

A two-part clamping element is used to considerably simplify handling. This reduces the tightening torque while maintaining the same clamping force, allowing the tool to be clamped in the connection with manual force in a process-reliable manner.

### AT A GLANCE

- Significantly fewer location bores
- Available with clamping diameters from 6 to 32 mm for hollow shank taper form A (HSK-A) and steep taper (SK)
- Balancing quality of G 2.5 at 25,000 rpm
- Can be easily combined with MAPAL high performance milling cutters

### ADVANTAGES

- Easy to handle thanks to use of a differential screw
- Maximum cost-effectiveness and precision
- Axial tool positioning can be defined using a spring system
- Decentralised coolant outlets for maximum process reliability



# MillChuck, HB

## Mill chuck for high-performance milling operations

The Mill Chuck, HB impresses with its strong clamping ability, easy handling and significantly improved radial run-out. It is the perfect solution for machining with high pull-out forces and applications with material that is difficult to machine.

### 1 Decentralised coolant delivery

- Optimal coolant supply

### 2 Differential screw

- Simple handling with reduced force requirements

### 3 Spring system

- Defined axial tool positioning (no tool pull-out)

### 4 Contour

- Application-optimised contour for maximum rigidity

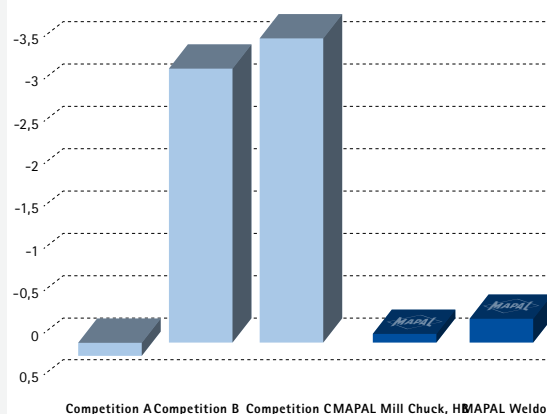


## Features

### Dimensions:

- Significantly more accurate location bore
- Easy to handle with reduced force requirements thanks to differential screw
- Axial tool positioning can be defined using a spring system (no tool pull-out)
- The best solution for machining with high pull-out forces (trochoidal milling)
- Currently available for HSK-A063/100 and SK040/050

## Milling cutter pull-out [mm]



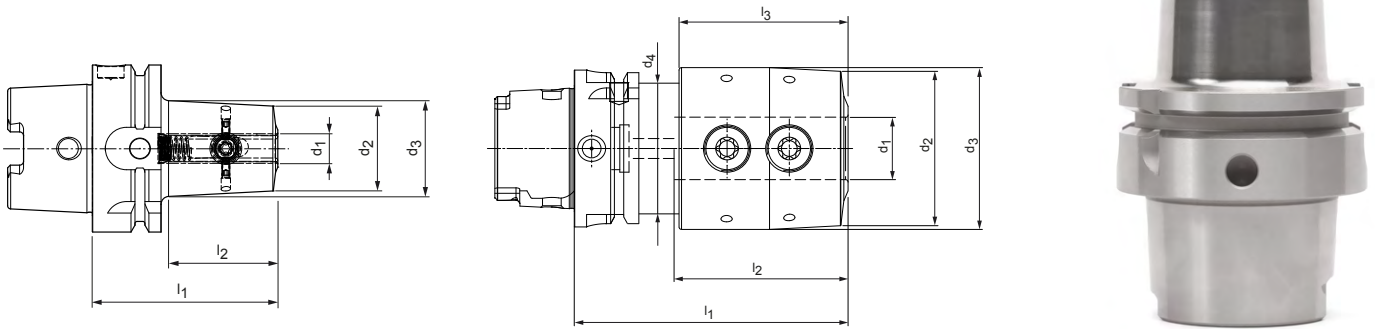
Material: K720 1.2872 90MnCrV8  
Milling cutter: OptiMill-Uni-HPC-Plus  
Shank ø: 20.00 mm

### Dry machining: Groove milling

$v_c$ : 120 m/min  
 $f_z$ : 0.1 mm  
 $a_p$ : 30 mm  
 $a_e$ : 20 mm

# MillChuck, HB

HSK-A (hollow shank taper form A) shank according to DIN 69893-1



HSK-A	Dimensions							Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
63	6,0	22,5	26,2	-	65,0	36,2	-	MWC-HSK-A063-06-065-1-0-W	30941344
63	8,0	25,0	28,7	-	65,0	36,2	-	MWC-HSK-A063-08-065-1-0-W	30941345
63	10,0	32,0	36,2	-	70,0	41,2	-	MWC-HSK-A063-10-070-1-0-W	30941346
63	12,0	37,5	42,7	-	80,0	51,2	-	MWC-HSK-A063-12-080-1-0-W	30941347
63	16,0	43,0	48,3	-	80,0	52,2	-	MWC-HSK-A063-16-080-1-0-W	30941349
63	20,0	46,5	52,0	-	80,0	54,0	-	MWC-HSK-A063-20-080-1-0-W	30941371
63	25,0	62,0	65,0	52,5	110,0	69,9	68,0	MWC-HSK-A063-25-110-1-0-W	30941372
63	32,0	69,0	72,0	52,5	110,0	69,9	68,0	MWC-HSK-A063-32-110-1-0-W	30941373
100	6,0	22,5	27,5	-	80,0	48,2	-	MWC-HSK-A100-06-080-1-0-W	30941374
100	8,0	25,0	30,0	-	80,0	48,2	-	MWC-HSK-A100-08-080-1-0-W	30941375
100	10,0	32,0	36,9	-	80,0	48,2	-	MWC-HSK-A100-10-080-1-0-W	30941376
100	12,0	37,5	42,9	-	85,0	53,2	-	MWC-HSK-A100-12-085-1-0-W	30941377
100	16,0	43,0	50,0	-	100,0	68,2	-	MWC-HSK-A100-16-100-1-0-W	30941379
100	20,0	46,5	53,5	-	100,0	68,2	-	MWC-HSK-A100-20-100-1-0-W	30941381
100	25,0	62,0	65,0	-	100,0	68,1	-	MWC-HSK-A100-25-100-1-0-W	30941382
100	32,0	69,0	72,0	-	110,0	78,1	-	MWC-HSK-A100-32-110-1-0-W	30925430

Dimensions in mm.

Additional dimensions available upon request.

Use: For connecting milling cutters with cylindrical shank and lateral drive area according to DIN 1835 Form B and DIN 6535 Form HB.

Scope of delivery: With built-in clamping screw, without coolant tube.

Design: Permissible run-out variation of the taper to the location bore  $d_1 = 3 \mu\text{m}$ .

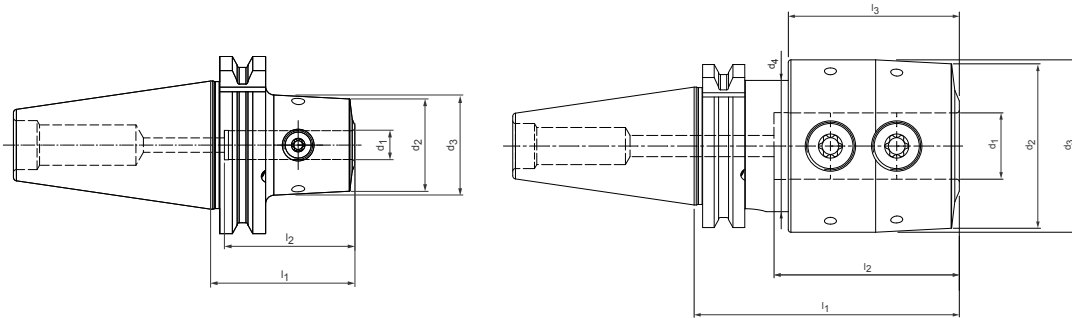
The bore tolerance is much more restricted than DIN 1835 in order to achieve machining accuracies of the highest quality.

Note: There are two clamping screws from clamping diameter  $d_1 = 25 \text{ mm}$ .

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# MillChuck, HB

SK shank according to ISO 7388-1 Form AD/AF



Steep taper	Dimensions							Specification	Order no.
	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
40	6,0	22,5	25,4	-	50,0	28,1	-	MWC-SK040-06-050-3-0-W	31059420
40	8,0	25,0	27,9	-	50,0	28,1	-	MWC-SK040-08-050-3-0-W	31059421
40	10,0	32,0	34,8	-	50,0	28,1	-	MWC-SK040-10-050-3-0-W	31059422
40	12,0	37,5	40,3	-	50,0	28,1	-	MWC-SK040-12-050-3-0-W	31059423
40	16,0	43,0	47,3	-	63,0	43,0	-	MWC-SK040-16-063-3-0-W	31059425
40	20,0	46,5	49,5	-	63,0	43,0	-	MWC-SK040-20-063-3-0-W	31059427
40	25,0	62,0	65,0	49,5	100,0	69,9	64,5	MWC-SK040-25-100-3-0-W	31059428
40	32,0	69,0	72,0	49,5	100,0	69,9	64,5	MWC-SK040-32-100-3-0-W	31059429
50	6,0	22,5	26,7	-	63,0	41,1	-	MWC-SK050-06-063-3-0-W	31059430
50	8,0	25,0	29,2	-	63,0	41,1	-	MWC-SK050-08-063-3-0-W	31059431
50	10,0	32,0	36,2	-	63,0	41,1	-	MWC-SK050-10-063-3-0-W	31059432
50	12,0	37,5	41,7	-	63,0	41,1	-	MWC-SK050-12-063-3-0-W	31059433
50	16,0	43,0	47,1	-	63,0	41,1	-	MWC-SK050-16-063-3-0-W	31059435
50	20,0	46,5	50,6	-	63,0	41,1	-	MWC-SK050-20-063-3-0-W	31059437
50	25,0	62,0	67,8	-	80,0	58,1	-	MWC-SK050-25-080-3-0-W	31059438
50	32,0	69,0	76,9	-	100,0	78,1	-	MWC-SK050-32-100-3-0-W	31059439

Dimensions in mm.

Additional dimensions available upon request.

Use: For connecting milling cutters with cylindrical shank and lateral drive area according to DIN 1835 Form B and DIN 6535 Form HB.

Scope of delivery: Built-in clamping screw, does not include pull stud.

Design: Permissible run-out variation of the taper to the location bore  $d_1 = 3 \mu\text{m}$ . The bore

tolerance is much more restricted than DIN 1835 in order to achieve machining accuracies of the highest quality.

Note: There are two clamping screws from clamping diameter  $d_1 = 25 \text{ mm}$ .

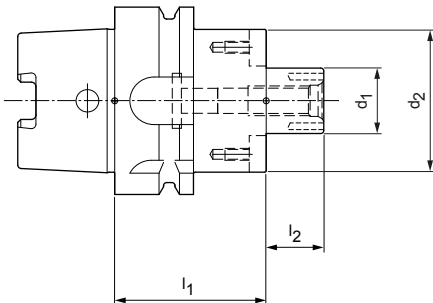
Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# Milling cutter arbor

Mechanical tool clamping

With enlarged face connection diameter according to DIN 69882-3

HSK-A (hollow shank taper form A) shank according to DIN 69893-1



## HSK-A (hollow shank taper form A) shank with decentralised coolant delivery

HSK-A	Dimensions				G	Specification	Order no.
	$d_1$	$d_2$	$l_1$	$l_2$			
63	16	38	50	17	M8	MCA-HSK-A063-16-050-1-0-W	31312171
63	16	38	100	17	M8	MCA-HSK-A063-16-100-1-0-W	31312176
63	16	38	160	17	M8	MCA-HSK-A063-16-160-1-0-W	31312191
63	22	48	50	19	M10	MCA-HSK-A063-22-050-1-0-W	31312172
63	22	48	100	19	M10	MCA-HSK-A063-22-100-1-0-W	31312177
63	22	48	160	19	M10	MCA-HSK-A063-22-160-1-0-W	31312192
63	27	60	60	21	M12	MCA-HSK-A063-27-060-1-0-W	31312173
63	27	60	100	21	M12	MCA-HSK-A063-27-100-1-0-W	31312178
63	27	60	160	21	M12	MCA-HSK-A063-27-160-1-0-W	31312193
63	32	78	60	24	M16	MCA-HSK-A063-32-060-1-0-W	31312174
63	32	78	100	24	M16	MCA-HSK-A063-32-100-1-0-W	31312179
63	32	78	160	24	M16	MCA-HSK-A063-32-160-1-0-W	31312194
63	40	89	60	27	M20	MCA-HSK-A063-40-060-1-0-W	31312175
63	40	89	100	27	M20	MCA-HSK-A063-40-100-1-0-W	31312190
100	16	38	50	17	M8	MCA-HSK-A100-16-050-1-0-W	31312195
100	16	38	100	17	M8	MCA-HSK-A100-16-100-1-0-W	31312200
100	16	38	160	17	M8	MCA-HSK-A100-16-160-1-0-W	31312205
100	22	48	50	19	M10	MCA-HSK-A100-22-050-1-0-W	31312196
100	22	48	100	19	M10	MCA-HSK-A100-22-100-1-0-W	31312201
100	22	48	160	19	M10	MCA-HSK-A100-22-160-1-0-W	31312206
100	27	60	50	21	M12	MCA-HSK-A100-27-050-1-0-W	31312197
100	27	60	100	21	M12	MCA-HSK-A100-27-100-1-0-W	31312202
100	27	60	160	21	M12	MCA-HSK-A100-27-160-1-0-W	31312207
100	32	78	50	24	M16	MCA-HSK-A100-32-050-1-0-W	31312198
100	32	78	100	24	M16	MCA-HSK-A100-32-100-1-0-W	31312203
100	32	78	160	24	M16	MCA-HSK-A100-32-160-1-0-W	31312208
100	40	89	60	27	M20	MCA-HSK-A100-40-060-1-0-W	31312199
100	40	89	100	27	M20	MCA-HSK-A100-40-100-1-0-W	31312204
100	40	89	160	27	M20	MCA-HSK-A100-40-160-1-0-W	31312209
100	60	140	70	40	M30	MCA-HSK-A100-60-070-1-0-W	31354755

Dimensions in mm.

Additional dimensions available upon request.

Scope of delivery: With screwed-on key blocks and milling cutter clamping screw according to DIN 6367. Without coolant tube.

Design: Permissible run-out variation on the taper in relation to the arbor diameter  $d_1 = 6 \mu\text{m}$ .

Note: Milling cutter clamping screw supplied without internal cooling. Coolant tubes and assembly tool, see "CLAMPING" catalogue.

Balancing quality: G 2.5 with 25,000 rpm in delivery status.

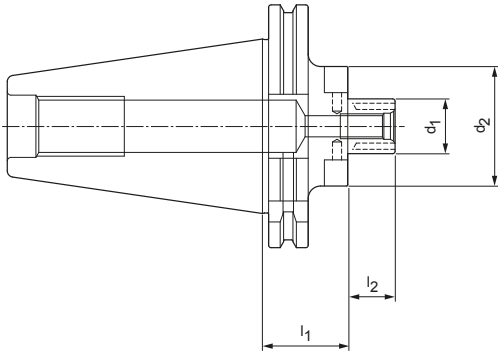


# Milling cutter arbor

Mechanical tool clamping

With enlarged face connection diameter according to DIN 69882-3

SK shank according to ISO 7388-1 Form AD/AF



## SK shank with decentralised coolant delivery

Steep taper	Dimensions				G	Specification	Order no.
	$d_1$	$d_2$	$l_1$	$l_2$			
40	16	38	35	17	M8	MCA-SK040-16-035-3-0-W	31369046
40	22	48	35	19	M10	MCA-SK040-22-035-3-0-W	31369047
40	27	50	35	21	M12	MCA-SK040-27-035-3-0-W	31369048
50	22	48	35	19	M10	MCA-SK050-22-035-3-0-W	31312229
50	22	48	100	19	M10	MCA-SK050-22-100-3-0-W	31312233
50	22	48	160	19	M10	MCA-SK050-22-160-3-0-W	31312237
50	27	60	35	21	M12	MCA-SK050-27-035-3-0-W	31312230
50	27	60	100	21	M12	MCA-SK050-27-100-3-0-W	31312234
50	27	60	160	21	M12	MCA-SK050-27-160-3-0-W	31312238
50	32	78	35	24	M16	MCA-SK050-32-035-3-0-W	31312231
50	32	78	100	24	M16	MCA-SK050-32-100-3-0-W	31312235
50	32	78	160	24	M16	MCA-SK050-32-160-3-0-W	31312239
50	40	89	50	27	M20	MCA-SK050-40-050-3-0-W	31312232
50	40	89	100	27	M20	MCA-SK050-40-100-3-0-W	31312236
50	40	89	160	27	M20	MCA-SK050-40-160-3-0-W	31312240

Dimensions in mm.

Additional dimensions available upon request.

Scope of delivery: With screwed-on key blocks and milling cutter clamping screw according to DIN 6367. Without pull stud.

Design: Permissible run-out variation on the taper in relation to the arbor diameter  $d_1 = 6$

$\mu\text{m}$ . Basic setting Form AD, if Form AF is required, please specify this when placing your order.

Note: Milling cutter clamping screw supplied without internal cooling. Coolant tubes and assembly tool, see "CLAMPING" catalogue.

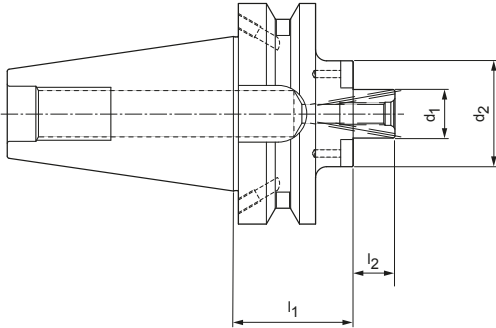
Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# Milling cutter arbor

Mechanical tool clamping

With enlarged face connection diameter according to DIN 69882-3

Shank BT according to ISO 7388-2 Form JD/JF (JIS B 6339)



## BT (steep taper) shank with decentralised coolant delivery

BT	Dimensions				G	Specification	Order no.
	$d_1$	$d_2$	$l_1$	$l_2$			
50	22	48	55	19	M8	MCA-BT050-22-055-3-0-W	31312241
50	22	48	100	19	M8	MCA-BT050-22-100-3-0-W	31312245
50	27	60	55	21	M10	MCA-BT050-27-055-3-0-W	31312242
50	27	60	100	21	M10	MCA-BT050-27-100-3-0-W	31312246
50	32	78	55	24	M12	MCA-BT050-32-055-3-0-W	31312243
50	32	78	100	24	M12	MCA-BT050-32-100-3-0-W	31312247
50	40	89	55	27	M16	MCA-BT050-40-055-3-0-W	31312244

Dimensions in mm.

Additional dimensions available upon request.

Scope of delivery: With screwed-on key blocks and milling cutter clamping screw according to DIN 6367. Without pull stud.

Design: Permissible run-out variation on the taper in relation to the arbor diameter  $d_1 = 6$

$\mu\text{m}$ . Basic setting Form JD; if Form JF is required, please state with the order.

Note: Milling cutter clamping screw supplied without internal cooling. Coolant tubes and assembly tool, see "CLAMPING" catalogue.

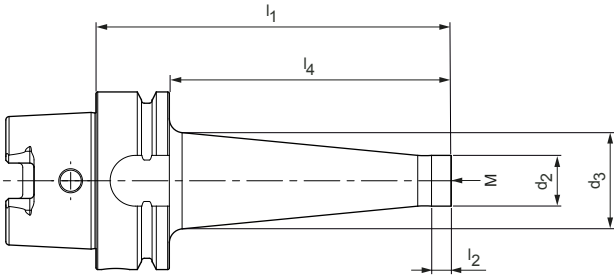
Balancing quality: G 2.5 with 25,000 rpm in delivery status.

# MFS milling head holder

Mechanical tool clamping

For screw-in milling cutter, made from steel

HSK-A (hollow shank taper form A) shank according to DIN 69893-1



HSK-A	Dimensions						Weight [kg]	Specification	Order no.
	M	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>4</sub>			
63	8	14	23	76	12	50	0,8	MFS201N-M08-076-HSK-A063-S	31184124
63	8	14	25	101	12	75	0,9	MFS201N-M08-101-HSK-A063-S	31227420
63	8	14	30	126	12	100	1,0	MFS201N-M08-126-HSK-A063-S	31184059
63	10	18	25	76	12	50	0,8	MFS201N-M10-076-HSK-A063-S	31184130
63	10	18	30	101	12	75	0,9	MFS201N-M10-101-HSK-A063-S	31227421
63	10	18	35	126	12	100	1,1	MFS201N-M10-126-HSK-A063-S	31184066
63	10	18	45	176	12	150	1,6	MFS201N-M10-176-HSK-A063-S	31227410
63	12	21	30	76	12	50	0,9	MFS201N-M12-076-HSK-A063-S	31184140
63	12	21	43	151	12	125	1,4	MFS201N-M12-151-HSK-A063-S	31184097
63	12	21	35	101	12	75	1,0	MFS201N-M12-101-HSK-A063-S	31227422
63	12	21	38	126	12	100	1,2	MFS201N-M12-126-HSK-A063-S	31184076
63	12	21	45	176	12	150	1,6	MFS201N-M12-176-HSK-A063-S	31227411
63	16	29	34	76	12	50	1,0	MFS201N-M16-076-HSK-A063-S	31184152
63	16	29	35	101	12	75	1,1	MFS201N-M16-101-HSK-A063-S	31227423
63	16	29	40	126	12	100	1,3	MFS201N-M16-126-HSK-A063-S	31184087
63	16	29	44	151	12	125	1,7	MFS201N-M16-151-HSK-A063-S	31184098
63	16	29	48	176	12	150	2,0	MFS201N-M16-176-HSK-A063-S	31227412
63	16	29	50	226	12	200	2,5	MFS201N-M16-226-HSK-A063-S	31227414
63	16	29	50	276	12	250	3,0	MFS201N-M16-276-HSK-A063-S	31227418
100	8	14	23	79	12	50	2,3	MFS201N-M08-079-HSK-A100-S	31227405
100	8	14	30	129	12	100	2,4	MFS201N-M08-129-HSK-A100-S	31227398
100	10	18	25	79	12	50	2,3	MFS201N-M10-079-HSK-A100-S	31227406
100	10	18	35	129	12	100	2,5	MFS201N-M10-129-HSK-A100-S	31227399
100	10	18	45	179	12	150	3,0	MFS201N-M10-179-HSK-A100-S	31227400
100	12	21	30	79	12	50	2,2	MFS201N-M12-079-HSK-A100-S	31184139
100	12	21	38	129	12	100	2,6	MFS201N-M12-129-HSK-A100-S	31184074
100	12	21	52	179	12	150	3,4	MFS201N-M12-179-HSK-A100-S	31184100
100	12	21	58	229	12	200	4,0	MFS201N-M12-229-HSK-A100-S	31227401
100	12	21	62	279	12	250	4,7	MFS201N-M12-279-HSK-A100-S	31227403
100	16	29	34	79	12	50	2,4	MFS201N-M16-079-HSK-A100-S	31184151
100	16	29	40	129	12	100	2,7	MFS201N-M16-129-HSK-A100-S	31184085
100	16	29	58	179	12	150	3,8	MFS201N-M16-179-HSK-A100-S	31184103
100	16	29	58	229	12	200	4,3	MFS201N-M16-229-HSK-A100-S	31227402
100	16	29	66	279	12	250	5,5	MFS201N-M16-279-HSK-A100-S	31227556

Dimensions in mm.

Additional dimensions available upon request.

Scope of delivery: Without coolant tube.

Design: Permissible run-out variation of the hollow taper shank to the clamping diameter

d<sub>1</sub> = 3 µm.

Note: Coolant tube, see "CLAMPING" catalogue.

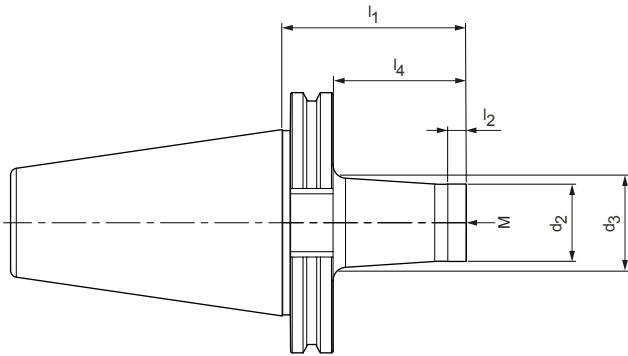
Balancing quality: G 6.3 with 25,000 rpm in delivery status.

# MFS milling head holder

Mechanical tool clamping

For screw-in milling cutter, made from steel

Shank SK according to ISO 7388-1 Form AD



Steep taper	Dimensions						Weight [kg]	Specification	Order no.
	M	$d_2$	$d_3$	$l_1$	$l_2$	$l_4$			
40	8	14	23	69,1	12	50	0,9	MFS201N-M08-069-SK040-S	31227376
40	8	14	25	94,1	12	75	1,1	MFS201N-M08-094-SK040-S	31227377
40	8	14	30	119,1	12	100	1,2	MFS201N-M08-119-SK040-S	31227363
40	10	18	25	69,1	12	50	1,0	MFS201N-M10-069-SK040-S	31184128
40	10	18	30	94,1	12	75	1,2	MFS201N-M10-094-SK040-S	31227378
40	10	18	35	119,1	12	100	1,3	MFS201N-M10-119-SK040-S	31184063
40	10	18	45	169,1	12	150	1,8	MFS201N-M10-169-SK040-S	31227367
40	12	21	30	69,1	12	50	1,0	MFS201N-M12-069-SK040-S	31184136
40	12	21	35	94,1	12	75	1,2	MFS201N-M12-094-SK040-S	31227379
40	12	21	38	119,1	12	100	1,3	MFS201N-M12-119-SK040-S	31184071
40	12	21	48	169,1	12	150	2,0	MFS201N-M12-169-SK040-S	31227368
40	16	29	34	69,1	12	50	1,2	MFS201N-M16-069-SK040-S	31184147
40	16	29	35	94,1	12	75	1,3	MFS201N-M16-094-SK040-S	31227380
40	16	29	40	119,1	12	100	1,5	MFS201N-M16-119-SK040-S	31184081
40	16	29	48	169,1	12	150	2,2	MFS201N-M16-169-SK040-S	31227369
50	10	18	25	69,1	12	50	2,8	MFS201N-M10-069-SK050-S	31227558
50	10	18	30	94,1	12	75	3,0	MFS201N-M10-094-SK050-S	31227559
50	10	18	35	119,1	12	100	3,1	MFS201N-M10-119-SK050-S	31227554
50	10	18	45	169,1	12	150	3,4	MFS201N-M10-169-SK050-S	31227555
50	12	21	30	69,1	12	50	3,0	MFS201N-M12-069-SK050-S	31184134
50	12	21	38	119,1	12	100	3,1	MFS201N-M12-119-SK050-S	31184069
50	12	21	52	169,1	12	150	4,0	MFS201N-M12-169-SK050-S	31184099
50	16	29	34	69,1	12	50	2,9	MFS201N-M16-069-SK050-S	31184145
50	16	29	40	119,1	12	100	3,3	MFS201N-M16-119-SK050-S	31184079
50	16	29	48	169,1	12	150	3,9	MFS201N-M16-169-SK050-S	31184101

Dimensions in mm.

Additional dimensions available upon request.

Scope of delivery: Without pull stud.

Design: Permissible run-out variation of the hollow taper shank to the clamping diameter

$d_1 = 3 \mu\text{m}$ .

Note: Pull stud, see "CLAMPING" catalogue.

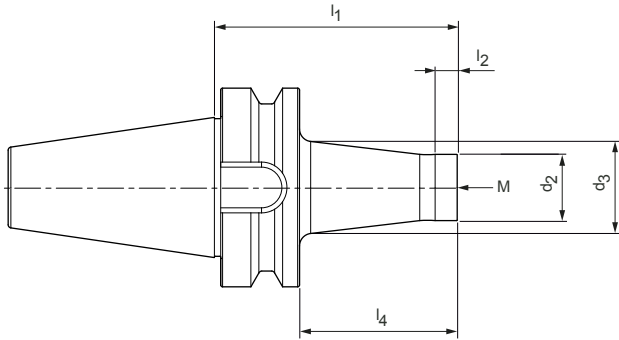
Balancing quality: G 16 with 8,000 rpm in delivery status.

# MFS milling head holder

Mechanical tool clamping

For screw-in milling cutter, made from steel

Shank BT according to ISO 7388-2 Form JD/JF (JIS B 6339)



BT	Dimensions						Weight [kg]	Specification	Order no.
	M	$d_2$	$d_3$	$l_1$	$l_2$	$l_4$			
40	8	14	23	77	12	50	1,2	MFS201N-M08-077-BT040-S	31227390
40	8	14	30	127	12	100	1,4	MFS201N-M08-127-BT040-S	31227381
40	10	18	25	77	12	50	1,2	MFS201N-M10-077-BT040-S	31227391
40	10	18	35	127	12	100	1,5	MFS201N-M10-127-BT040-S	31227382
40	12	21	30	77	12	50	1,2	MFS201N-M12-077-BT040-S	31227392
40	12	21	38	127	12	100	1,6	MFS201N-M12-127-BT040-S	31227383
40	16	29	34	77	12	50	1,3	MFS201N-M16-077-BT040-S	31227393
40	16	29	40	127	12	100	1,7	MFS201N-M16-127-BT040-S	31227384
50	12	21	30	88	12	50	4,0	MFS201N-M12-088-BT050-S	31227440
50	12	21	38	138	12	100	4,1	MFS201N-M12-138-BT050-S	31227430
50	16	29	34	88	12	50	3,9	MFS201N-M16-088-BT050-S	31227441
50	16	29	40	138	12	100	4,3	MFS201N-M16-138-BT050-S	31227431

Dimensions in mm.

Additional dimensions available upon request.

Scope of delivery: Without pull stud.

Design: Permissible run-out variation of the hollow taper shank to the clamping diameter

$d_1 = 3 \mu\text{m}$ .

Note: Pull stud, see "CLAMPING" catalogue.

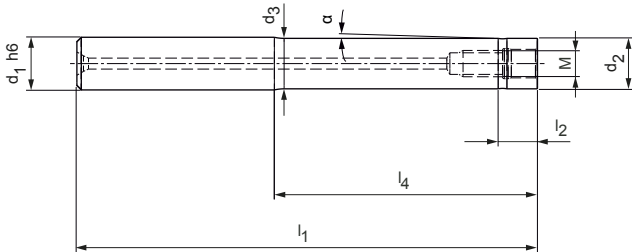
Balancing quality: G 16 with 8,000 rpm in delivery status.

# MFS milling head holder

Mechanical tool clamping

For screw-in milling cutter made from solid carbide



Cylindrical shank according to DIN 1835-A



## Solid carbide extension for screw-in milling cutter

Dimensions								Internal cooling	Specification	Order no.
M	d <sub>1</sub> h6	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>	l <sub>4</sub>	l <sub>2</sub>	α			
4,5	10	7,7	10	65	20	-	-	✓	MFS101-45-020-ZYL-HA10-H	31217761
4,5	10	7,7	10	85	40	-	1,65°	✓	MFS101-45-040-ZYL-HA10-H	31217755
4,5	10	7,7	10	105	60	-	1,1°	✓	MFS101-45-060-ZYL-HA10-H	31217757
4,5	10	7,7	10	130	80	-	0,82°	✓	MFS101-45-080-ZYL-HA10-H	31217758
4,5	10	7,7	10	150	100	-	0,66°	✓	MFS101-45-100-ZYL-HA10-H	31217760
6	10	9,5	10	60	20	9	0,72°	✓	MFS101-06-020-ZYL-HA10-H	31166769
6	10	9,5	10	80	40	9	0,36°	✓	MFS101-06-040-ZYL-HA10-H	31166770
6	10	9,5	10	100	60	9	0,24°	✓	MFS101-06-060-ZYL-HA10-H	31166771
6	10	9,5	10	120	80	9	0,18°	✓	MFS101-06-080-ZYL-HA10-H	31166772
8	16	12,8	16	95	40	-	2,29°	✓	MFS101-08-040-ZYL-HA16-H	31166749
8	16	12,8	16	115	60	-	1,53°	✓	MFS101-08-060-ZYL-HA16-H	31166750
8	16	12,8	16	135	80	-	1,15°	✓	MFS101-08-080-ZYL-HA16-H	31166751
8	16	12,8	16	155	100	-	0,92°	✓	MFS101-08-100-ZYL-HA16-H	31166752
8	16	12,8	16	175	120	-	0,76°	✓	MFS101-08-120-ZYL-HA16-H	31166753
10	20	17,8	20	100	40	-	1,58°	✓	MFS101-10-040-ZYL-HA20-H	31166754
10	20	17,8	20	120	60	-	1,05°	✓	MFS101-10-060-ZYL-HA20-H	31166755
10	20	17,8	20	140	80	-	0,79°	✓	MFS101-10-080-ZYL-HA20-H	31166756
10	20	17,8	20	160	100	-	0,63°	✓	MFS101-10-100-ZYL-HA20-H	31166757
10	20	17,8	20	180	120	-	0,53°	✓	MFS101-10-120-ZYL-HA20-H	31166758
12	25	23	24,3	136	80	9	0,591°	✓	MFS101-12-080-ZYL-HA25-H	31166759
12	25	23	24,3	156	100	9	0,449°	✓	MFS101-12-100-ZYL-HA25-H	31166760
12	25	23	24,3	176	120	9	0,362°	✓	MFS101-12-120-ZYL-HA25-H	31166761
12	25	23	24,3	196	140	9	0,303°	✓	MFS101-12-140-ZYL-HA25-H	31166762
12	25	23	24,3	216	160	9	0,260°	✓	MFS101-12-160-ZYL-HA25-H	31166763
16	32	29	31,5	160	100	9	0,828°	✓	MFS101-16-100-ZYL-HA32-H	31166764
16	32	29	31,5	210	150	9	0,517°	✓	MFS101-16-150-ZYL-HA32-H	31166765
16	32	29	31,5	260	200	9	0,376°	✓	MFS101-16-200-ZYL-HA32-H	31166766
16	32	29	31,5	310	250	9	0,295°	✓	MFS101-16-250-ZYL-HA32-H	31166767
16	32	29	31,5	360	300	9	0,243°	✓	MFS101-16-300-ZYL-HA32-H	31166768

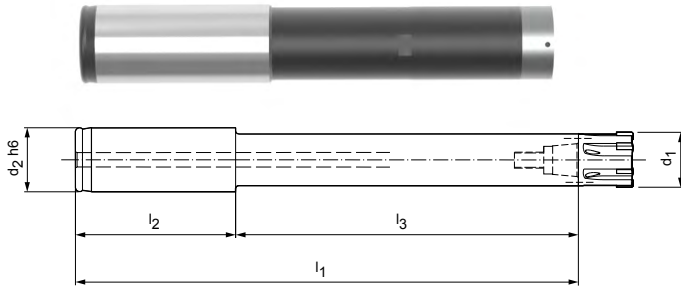
## Accessories

	d <sub>1</sub> 10, 16, 20 mm	MHC-...	UNIQ MillChuck, HA	Page 83
	d <sub>1</sub> 25, 32 mm	MHC-...	HydroChuck	Page 88

# HFS replaceable head holders

With axial clamping system

Shank to MN 623, similar to DIN 1835-A



## Long design with cylindrical shank

Dimensions						Specification	Order no.
d <sub>1</sub>	HFS size	d <sub>2</sub> h6	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
15,60 - 18,59	10	20	160	50	110	HFS101SN-10-110-ZYL-HA20-S	30010248
18,60 - 21,29	12	20	179,5	50	129,5	HFS101SN-12-130-ZYL-HA20-S	30010249
21,30 - 23,99	14	20	180,5	50	130,5	HFS101SN-14-131-ZYL-HA20-S	30010250
24,00 - 29,99	16	25	211	60	151	HFS101SN-16-151-ZYL-HA25-S	30010251
30,00 - 39,99	20	25	210	60	150	HFS101SN-20-150-ZYL-HA25-S	30010252
40,00 - 65,00	24	32	266	60	206	HFS101SN-24-206-ZYL-HA32-S	30010253


## Short design with cylindrical shank

Dimensions						Specification	Order no.
d <sub>1</sub>	HFS size	d <sub>2</sub> h6	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
15,60 - 18,59	10	20	99	50	49	HFS101SN-10-049-ZYL-HA20-S	30010256
18,60 - 21,29	12	20	118,5	50	68,5	HFS101SN-12-069-ZYL-HA20-S	30010257
21,30 - 23,99	14	20	119,5	50	69,5	HFS101SN-14-070-ZYL-HA20-S	30010258
24,00 - 29,99	16	25	150	60	90	HFS101SN-16-090-ZYL-HA25-S	30010259
30,00 - 39,99	20	25	149	60	89	HFS101SN-20-089-ZYL-HA25-S	30010260
40,00 - 65,00	24	32	167	60	107	HFS101SN-24-107-ZYL-HA32-S	30010261

## Extra short design with cylindrical shank

Dimensions						Specification	Order no.
d <sub>1</sub>	HFS size	d <sub>2</sub> h6	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
18,60 - 21,29	12	20	82	50	32	HFS101SN-12-032-ZYL-HA20-S	30078683

## Accessories

	MHC-...	HydroChuck	Page 88
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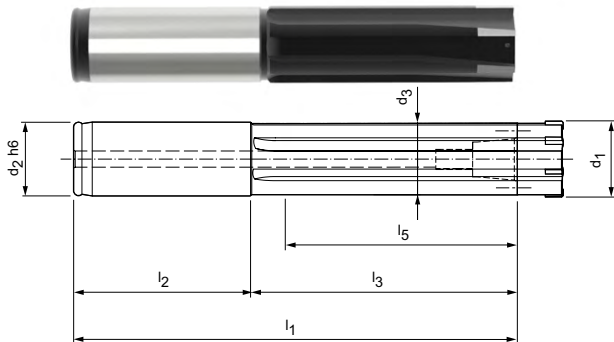
Dimensions in mm.

Scope of delivery: Tool holder with threaded spindle and hexagonal T-handle.

# HFS replaceable head holders

With axial clamping system

Shank to MN 623, similar to DIN 1835-A




## Long design with cylindrical shank

Dimensions								Specification	Order no.
d <sub>1</sub>	HFS size	d <sub>2</sub> h6	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>5</sub>		
16,60 - 19,39	10	20	16	160	50	110	94	HFS111SN-10A-110-ZYL-HA20-S	30026380
19,40 - 21,29	10	20	18,6	160	50	110	94	HFS111SN-10B-110-ZYL-HA20-S	30026488
21,30 - 24,99	12	20	20,5	180,5	50	130,5	114,5	HFS111SN-12-131-ZYL-HA20-S	30026489
25,00 - 28,99	14	25	24,2	211,5	60	151,5	132,5	HFS111SN-14-152-ZYL-HA25-S	30026510
29,00 - 32,29	16	25	28,2	210	60	150	131	HFS111SN-16A-150-ZYL-HA25-S	30026511
32,30 - 36,99	16	25	31,5	210	60	150	140	HFS111SN-16B-150-ZYL-HA25-S	30026512
37,00 - 41,19	20	25	36,2	210	60	150	140	HFS111SN-20A-150-ZYL-HA25-S	30026513
41,20 - 44,99	20	25	40,2	210	60	150	140	HFS111SN-20B-150-ZYL-HA25-S	30026514
45,00 - 65,00	24	32	44	266	60	206	195	HFS111SN-24-206-ZYL-HA32-S	30026515

## Short design with cylindrical shank

Dimensions								Specification	Order no.
d <sub>1</sub>	HFS size	d <sub>2</sub> h6	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>5</sub>		
16,60 - 19,39	10	20	16	99	50	49	33	HFS111SN-10A-049-ZYL-HA20-S	30026516
19,40 - 21,29	10	20	18,6	99	50	49	33	HFS111SN-10B-049-ZYL-HA20-S	30026521
21,30 - 24,99	12	20	20,5	117,5	50	67,5	51,5	HFS111SN-12-068-ZYL-HA20-S	30026522
25,00 - 28,99	14	25	24,2	150,5	60	90,5	71,5	HFS111SN-14-091-ZYL-HA25-S	30026523
29,00 - 32,29	16	25	28,2	149	60	89	70	HFS111SN-16A-089-ZYL-HA25-S	30026525
32,30 - 36,99	16	25	31,5	149	60	89	79	HFS111SN-16B-089-ZYL-HA25-S	30026526
37,00 - 41,19	20	25	36,2	149	60	89	79	HFS111SN-20A-089-ZYL-HA25-S	30026527
41,20 - 44,99	20	25	40,2	149	60	89	79	HFS111SN-20B-089-ZYL-HA25-S	30026528
45,00 - 65,00	24	32	44	167	60	107	96	HFS111SN-24-107-ZYL-HA32-S	30026529

## Accessories

	MHC-...	HydroChuck	Page 88
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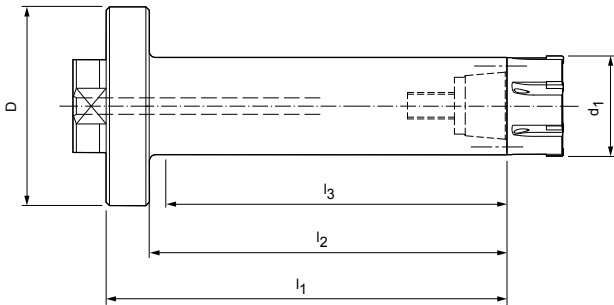
Dimensions in mm.

Scope of delivery: Tool holder with threaded spindle and hexagonal T-handle.



# HFS replaceable head holders

With axial clamping system with radial and angular alignment  
 Module connection sizes to MN 5000-14




## Long design with module adaptor (radial and angular alignment)

Dimensions						Specification	Order no.
d <sub>1</sub>	HFS size	D	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
15,60 - 18,59	10	60	81	68	61	HFS101SN-10-081-MOD-060-S	30010264
18,60 - 21,29	12	60	100,5	87,5	80,5	HFS101SN-12-101-MOD-060-S	30010265
21,30 - 23,99	14	60	101,5	88,5	79,5	HFS101SN-14-102-MOD-060-S	30010266
24,00 - 29,99	16	60	122	109	104	HFS101SN-16-122-MOD-060-S	30010267
30,00 - 39,99	20	60	121	108	103	HFS101SN-20-121-MOD-060-S	30010268
40,00 - 50,70	24	60	133	120	116	HFS101SN-24-133-MOD-060-S	30010269
50,71 - 65,00	24	80	133	116	112	HFS101SN-24-133-MOD-080-S	30190195

## List of spare parts for module adaptors

Module size D	Cylinder screw ISO 4762 (DIN 912)			Thrust pad		Threaded pin	
	Quantity required	Order no.	Size	Order no.	Size	Order no.	Size
60	4	M5x16-12,9	10003601	10,6x5	10040108	M8x1x8	10040109
80	4	M6x20-12,9	10003619	10,6x5	10040108	M8x1x11,5	10075074

## Accessories

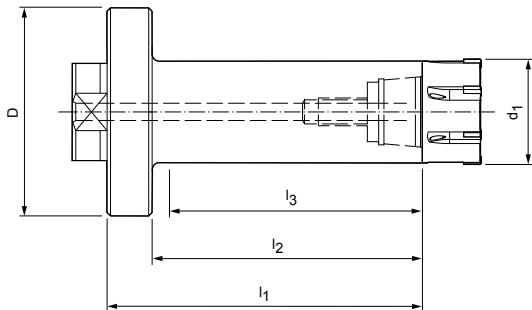
	OS-AD-...	Module adaptor	Page 109
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Dimensions in mm.

Scope of delivery: Tool holder with threaded spindle, screwdriver with T-handle, fastening screws for the module adaptor, and parts for the angular alignment of the module adaptor.

# HFS replaceable head holders

With axial clamping system with radial and angular alignment  
Module connection sizes to MN 5000-14




## Short design with module adaptor (radial and angular alignment)

Dimensions						Specification	Order no.
d <sub>1</sub>	HFS size	D	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
15,60 - 18,59	10	60	49	36	31	HFS101SN-10-049-MOD-060-S	30027896
18,60 - 21,29	12	60	58,5	45,5	40,5	HFS101SN-12-059-MOD-060-S	30027897
21,30 - 23,99	14	60	62,5	49,5	44,5	HFS101SN-14-063-MOD-060-S	30027898
24,00 - 29,99	16	60	72	59	54	HFS101SN-16-072-MOD-060-S	30027899
30,00 - 39,99	20	60	71	58	53	HFS101SN-20-071-MOD-060-S	30027900
40,00 - 50,70	24	60	84	71	66	HFS101SN-24-084-MOD-060-S	30027901
50,71 - 65,00	24	80	84	67	62	HFS101SN-24-084-MOD-080-S	30152510

## List of spare parts for module adaptors

Module size D	Cylinder screw ISO 4762 (DIN 912)			Thrust pad		Threaded pin	
	Quantity required	Order no.	Size	Order no.	Size	Order no.	Size
60	4	M5x16-12,9	10003601	10,6x5	10040108	M8x1x8	10040109
80	4	M6x20-12,9	10003619	10,6x5	10040108	M8x1x11,5	10075074

## Accessories

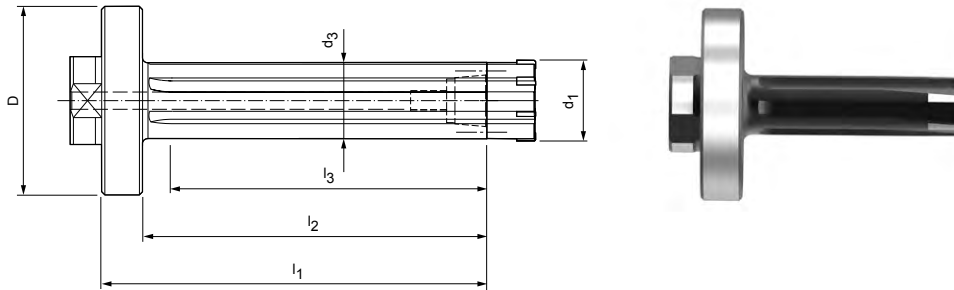
	OS-AD-...	Module adaptor	Page 109
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Dimensions in mm.

Scope of delivery: Tool holder with threaded spindle, screwdriver with T-handle, fastening screws for the module adaptor, and parts for the angular alignment of the module adaptor.

# HFS replaceable head holders

With axial clamping system with radial and angular alignment  
 Module connection sizes to MN 5000-14




## Long design with module adaptor (radial and angular alignment)

Dimensions							Specification	Order no.
d <sub>1</sub>	HFS size	D	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
16,60 - 19,39	10	60	16	81	68	48	HFS111SN-10A-081-MOD-060-S	30026562
19,40 - 21,29	10	60	18,6	81	68	48	HFS111SN-10B-081-MOD-060-S	30026563
21,30 - 24,99	12	60	20,5	101,5	88,5	69,5	HFS111SN-12-102-MOD-060-S	30026564
25,00 - 28,99	14	60	24,2	122,5	109,5	90,5	HFS111SN-14-123-MOD-060-S	30026565
29,00 - 32,29	16	60	28,2	121	108	89	HFS111SN-16A-121-MOD-060-S	30026566
32,30 - 36,99	16	60	31,5	121	108	89	HFS111SN-16B-121-MOD-060-S	30026567
37,00 - 41,19	20	60	36,2	121	108	89	HFS111SN-20A-121-MOD-060-S	30026568
41,20 - 44,99	20	60	40,2	121	108	89	HFS111SN-20B-121-MOD-060-S	30026569
45,00 - 50,70	24	60	44	123	110	95	HFS111SN-24-123-MOD-060-S	30026570
50,71 - 65,00	24	80	44	133	116	110	HFS111SN-24-133-MOD-080-S	30193167

## List of spare parts for module adaptors

Module size D	Cylinder screw ISO 4762 (DIN 912)			Thrust pad		Threaded pin	
	Quantity required	Order no.	Size	Order no.	Size	Order no.	Size
60	4	M5x16-12,9	10003601	10,6x5	10040108	M8x1x8	10040109
80	4	M6x20-12,9	10003619	10,6x5	10040108	M8x1x11,5	10075074

## Accessories

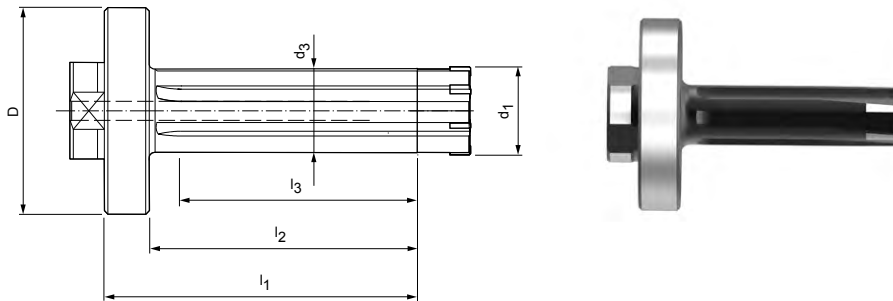
	OS-AD-...	Module adaptor	Page 109
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Dimensions in mm.

Scope of delivery: Tool holder with threaded spindle, screwdriver with T-handle, fastening screws for the module adaptor, and parts for the angular alignment of the module adaptor.

# HFS replaceable head holders

With axial clamping system with radial and angular alignment  
Module connection sizes to MN 5000-14




## Short design with module adaptor (radial and angular alignment)

Dimensions							Specification	Order no.
d <sub>1</sub>	HFS size	D	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>		
16,60 - 19,39	10	60	16	49	36	31	HFS111SN-10A-049-MOD-060-S	30027885
19,40 - 21,29	10	60	18,6	59	46	41	HFS111SN-10B-059-MOD-060-S	30027886
21,30 - 24,99	12	60	20,5	62,5	49,5	44,5	HFS111SN-12-063-MOD-060-S	30027887
25,00 - 28,99	14	60	24,2	72,5	59,5	54,5	HFS111SN-14-073-MOD-060-S	30027888
29,00 - 32,29	16	60	28,2	71	58	53	HFS111SN-16A-071-MOD-060-S	30027889
32,30 - 36,99	16	60	31,5	71	58	53	HFS111SN-16B-071-MOD-060-S	30027890
37,00 - 41,19	20	60	36,2	71	58	53	HFS111SN-20A-071-MOD-060-S	30027891
41,20 - 44,99	20	60	40,2	81	68	63	HFS111SN-20B-081-MOD-060-S	30027892
45,00 - 50,70	24	60	44	84	71	66	HFS111SN-24-084-MOD-060-S	30027893
50,71 - 65,00	24	80	44	84	67	64	HFS111SN-24-084-MOD-080-S	30193168

## List of spare parts for module adaptors

Module size D	Cylinder screw ISO 4762 (DIN 912)			Thrust pad		Threaded pin	
	Quantity required	Order no.	Size	Order no.	Size	Order no.	Size
60	4	M5x16-12,9	10003601	10,6x5	10040108	M8x1x8	10040109
80	4	M6x20-12,9	10003619	10,6x5	10040108	M8x1x11,5	10075074

## Accessories

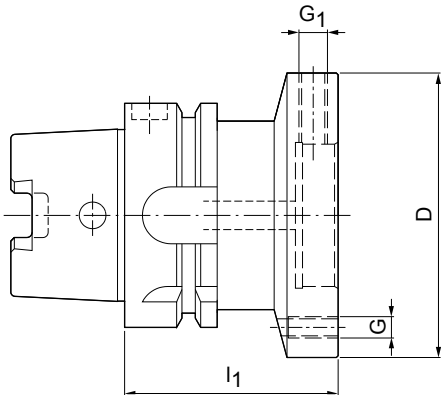
	OS-AD-...	Module adaptor	Page 109
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Dimensions in mm.

Scope of delivery: Tool holder with threaded spindle, screwdriver with T-handle, fastening screws for the module adaptor, and parts for the angular alignment of the module adaptor.

# HSK (hollow shank taper) adapters

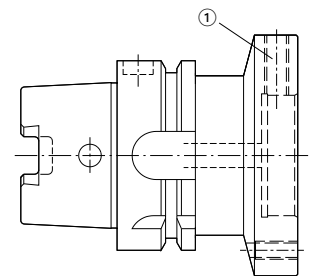
HSK-A (hollow shank taper form A) shank according to DIN 69893-1



HSK-A	Module size D	Dimensions			Specification	Order no.
		l <sub>1</sub>	G	G <sub>1</sub>		
40	60	60	M5	M8x1	OS-AD-HSK-A050-MOD060-060-11	30344525
50	60	60	M5	M8x1	OS-AD-HSK-A050-MOD060-060-11	30319384
50	70	60	M6	M8x1	OS-AD-HSK-A050-MOD070-060-11	30319385
50	80	60	M6	M8x1	OS-AD-HSK-A050-MOD080-060-11	30319386
63	60	60	M5	M8x1	OS-AD-HSK-A063-MOD060-060-11	30319387
63	70	60	M6	M8x1	OS-AD-HSK-A063-MOD070-060-11	30319388
63	80	60	M6	M8x1	OS-AD-HSK-A063-MOD080-060-11	30319389
63	100	65	M8	M10x1	OS-AD-HSK-A063-MOD100-065-11	30319390
63	117	65	M8	M10x1	OS-AD-HSK-A063-MOD117-065-11	30319391
80	60	50	M5	M8x1	OS-AD-HSK-A080-MOD060-050-11	30319392
80	70	60	M6	M8x1	OS-AD-HSK-A080-MOD070-060-11	30319393
80	80	60	M6	M8x1	OS-AD-HSK-A080-MOD080-060-11	30319394
80	100	65	M8	M10x1	OS-AD-HSK-A080-MOD100-065-11	30319395
80	117	65	M8	M10x1	OS-AD-HSK-A080-MOD117-065-11	30319396
80	140	75	M10	M10x1	OS-AD-HSK-A080-MOD140-075-11	30319397
100	60	55	M5	M8x1	OS-AD-HSK-A100-MOD060-055-11	30319398
100	70	55	M6	M8x1	OS-AD-HSK-A100-MOD070-055-11	30319399
100	80	55	M6	M8x1	OS-AD-HSK-A100-MOD080-055-11	30319400
100	100	65	M8	M10x1	OS-AD-HSK-A100-MOD100-065-11	30319401
100	117	65	M8	M10x1	OS-AD-HSK-A100-MOD117-065-11	30319402
100	140	75	M10	M10x1	OS-AD-HSK-A100-MOD140-075-11	30319403

## Spare parts

Module size D	Quantity re-quired	① Threaded pin		
		Size		Order no.
60 - 80	4	M8x1x16		10075355
100 - 140	4	M10x1x20	K2865-34	10075099



Dimensions in mm.

Use: For use in the machine spindle for mounting KS flange adapters, shrink chucks, hydraulic chucks, chucks for cylindrical shanks or tools with a module shank in accordance with MAPAL factory standard.

Design: The radial run-out of a fitted connection or a tool can be adjusted in relation to the hollow taper shank due over threaded pins.

Scope of delivery: With threaded pins for aligning the radial run-out, does not include

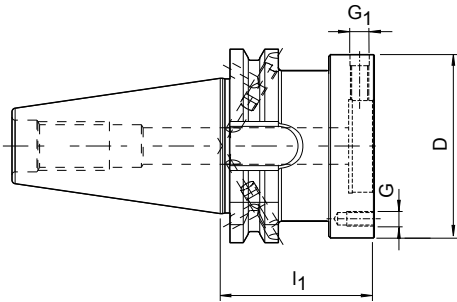
coolant tube.

Note: For coolant tube, code carrier and notes regarding coding system, see "CLAMPING" catalogue.

Balancing quality: G 2.5 with 16,000 rpm in delivery status.

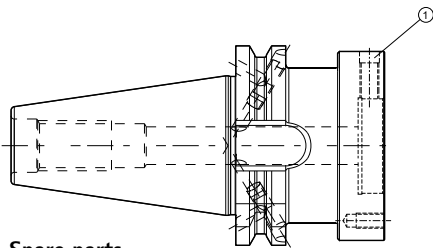
# Steep taper adapters

SK shank according to ISO 7388-1 Form AD/AF



Steep taper	Module size D	l <sub>1</sub>	G	G <sub>1</sub>	Shape	Specification	Order no.
30*	60	50	M5	M8x1	AD	OS-AD-SK030-MOD060-050-11	30319771
30*	60	50	M5	M8x1	AF	OS-AD-SK030-MOD060-050-12	30319772
30*	70	50	M6	M8x1	AD	OS-AD-SK030-MOD070-050-11	30319773
30*	70	50	M6	M8x1	AF	OS-AD-SK030-MOD070-050-12	30319774
40	60	50	M5	M8x1	AD/AF	OS-AD-SK040-MOD060-050-13	10058658
40	70	50	M6	M8x1	AD/AF	OS-AD-SK040-MOD070-050-13	10058660
40	80	55	M6	M8x1	AD/AF	OS-AD-SK040-MOD080-055-13	10058661
40	100	60	M8	M10x1	AD/AF	OS-AD-SK040-MOD100-060-13	10058662
50	60	50	M5	M8x1	AD/AF	OS-AD-SK050-MOD060-050-13	10058669
50	70	50	M6	M8x1	AD/AF	OS-AD-SK050-MOD070-050-13	10058670
50	80	50	M6	M8x1	AD/AF	OS-AD-SK050-MOD080-050-13	10058671
50	100	60	M8	M10x1	AD/AF	OS-AD-SK050-MOD100-060-13	10058672
50	117	60	M8	M10x1	AD/AF	OS-AD-SK050-MOD117-060-13	10058673
50	140	60	M10	M10x1	AD/AF	OS-AD-SK050-MOD140-060-13	10058675

\* Taper shank size SK30 is not available in combined design AD/AF.



## Spare parts

Module size D	Quantity required	Size	① Threaded pin Order no.
60 - 80	4	M8 x1x16	10075355
100 - 140	4	M10x1x20	10075099

Dimensions in mm.

Use: For use in the machine spindle for mounting KS flange adapters, shrink chucks, hydraulic chucks, chucks for cylindrical shanks or tools with a module shank in accordance with MAPAL factory standard.

Design: The radial run-out of a fitted connection or a tool can be adjusted in relation to the taper shank over threaded pins. Basic setting Form AD, if Form AF is required, please specify this when placing your order.

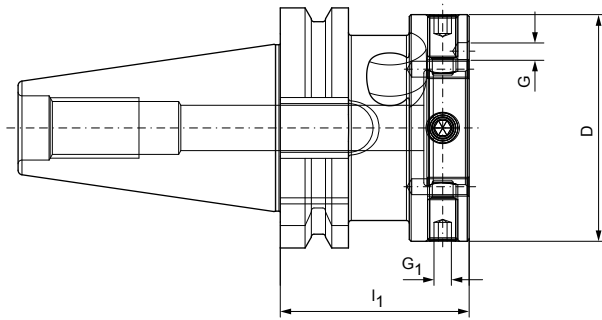
Scope of delivery: With threaded pins for aligning the radial run-out, without pull stud.

Note: For coolant tube and coding system, see "CLAMPING" catalogue.

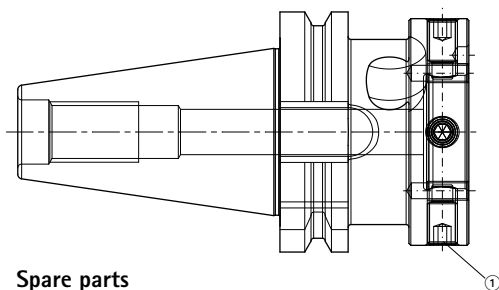
Balancing quality: G 6.3 with 3,000 rpm in delivery status.

# Steep taper adapters

Form AD similar to ISO 7388-1, with face connection



SK-FC	Module size D	l <sub>1</sub>	G	G <sub>1</sub>	Specification	Order no.
30	60	50	M5	M8x1	OS-AD-AD-FC030-MOD060-050-11	30630793
30	70	50	M6	M8x1	OS-AD-AD-FC030-MOD070-050-11	30630794
40	60	50	M5	M8x1	OS-AD-AD-FC040-MOD060-050-11	30630796
40	70	50	M6	M8x1	OS-AD-AD-FC040-MOD070-050-11	30630797
40	80	55	M6	M8x1	OS-AD-AD-FC040-MOD080-055-11	30630798
40	100	60	M8	M10x1	OS-AD-AD-FC040-MOD100-060-11	30630799
50	60	50	M5	M8x1	OS-AD-AD-FC050-MOD060-050-11	30630800
50	70	50	M6	M8x1	OS-AD-AD-FC050-MOD070-050-11	30630801
50	80	50	M6	M8x1	OS-AD-AD-FC050-MOD080-050-11	30630802
50	100	60	M8	M10x1	OS-AD-AD-FC050-MOD100-060-11	30630803
50	117	60	M8	M10x1	OS-AD-AD-FC050-MOD117-060-11	30630804
50	140	60	M10	M10x1	OS-AD-AD-FC050-MOD140-060-11	30630805



### Spare parts

Module size D	Quantity required	Size	① Threaded pin Order no.
60 - 80	4	M8x1x16	10075355
100 - 140	4	M10x1x20	10075099

Dimensions in mm.

Use: For use in the machine spindle for mounting KS flange adapters, shrink chucks, hydraulic chucks, chucks for cylindrical shanks or tools with a module shank in accordance with MAPAL factory standard.

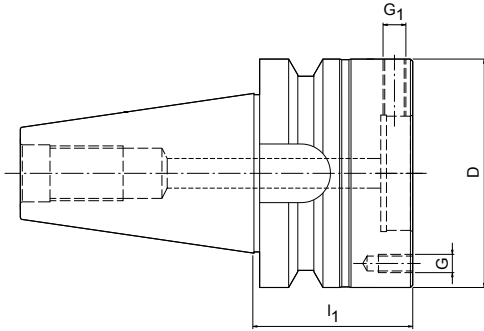
Design: The radial run-out of a fitted connection or a tool can be adjusted in relation to the taper shank over threaded pins. Basic setting Form AD, if Form AF is required, please specify this when placing your order.

Scope of delivery: With threaded pins for aligning the radial run-out, without pull stud. Note: For coolant tube, code carrier and notes regarding coding system, see "CLAMPING" catalogue.

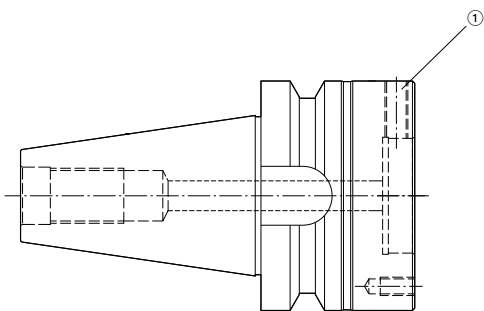
Balancing quality: G 6.3 with 3,000 rpm in delivery status.

# Steep taper adapters

Shank BT according to ISO 7388-2 Form JD (JIS B 6339)



BT	Module size D	Dimensions			Specification	Order no.
		l <sub>1</sub>	G	G <sub>1</sub>		
30	60	40	M5	M8x1	OS-AD-BT030-MOD060-040-11	30320084
30	70	40	M6	M8x1	OS-AD-BT030-MOD070-040-11	30320085
40	60	55	M5	M8x1	OS-AD-BT040-MOD060-055-11	30320086
40	70	55	M6	M8x1	OS-AD-BT040-MOD070-055-11	30320087
40	80	65	M6	M8x1	OS-AD-BT040-MOD080-065-11	30320088
40	100	70	M8	M10x1	OS-AD-BT040-MOD100-070-11	30320089
50	60	70	M5	M8x1	OS-AD-BT050-MOD060-070-11	30320095
50	70	70	M6	M8x1	OS-AD-BT050-MOD070-070-11	30320096
50	80	70	M6	M8x1	OS-AD-BT050-MOD080-070-11	30320097
50	100	70	M8	M10x1	OS-AD-BT050-MOD100-070-11	30320098
50	117	80	M8	M10x1	OS-AD-BT050-MOD117-080-11	30320099
50	140	80	M10	M10x1	OS-AD-BT050-MOD140-080-11	30320100



## Spare parts

Module size D	Quantity required	Size	① Threaded pin Order no.
60 - 80	4	M8x1x16	10075355
100	4	M10x1x20	10075099
117	4	M10x1x20	10075099
140	4	M10x1x20	10075099

Dimensions in mm.

Use: For use in the machine spindle for connecting to hollow shank taper tools.  
 Scope of delivery: With standard KS clamping cartridge and stop ring. Without pull stud.  
 Design: Permissible run-out variation on the taper shank in relation to the hollow shank

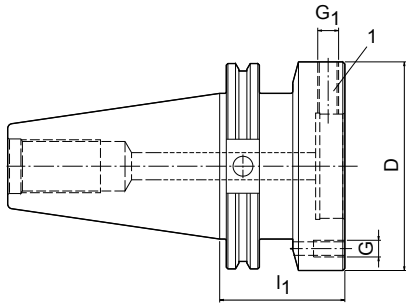
taper inner taper = 3 µm.

Note: For clamping cartridge, stop ring and pull stud, see "CLAMPING" catalogue.  
 Balancing quality: G 6.3 with 3,000 rpm in delivery status.



# Steep taper adapters

"CAT" shank in accordance with ASME B5.50-1994



CAT	Module size D	Dimensions			Specification	Order no.
		l <sub>1</sub>	G	G <sub>1</sub>		
30	60	50	M5	M8x1	OS-AD-CAT030-MOD060-050-11	30320124
30	70	50	M6	M8x1	OS-AD-CAT030-MOD070-050-11	30320125
40	60	50	M5	M8x1	OS-AD-CAT040-MOD060-050-11	30320126
40	70	50	M6	M8x1	OS-AD-CAT040-MOD070-050-11	30320127
40	80	55	M6	M8x1	OS-AD-CAT040-MOD080-055-11	30320128
40	100	60	M8	M10x1	OS-AD-CAT040-MOD100-060-11	30320129
50	60	50	M5	M8x1	OS-AD-CAT050-MOD060-050-11	30320135
50	70	50	M6	M8x1	OS-AD-CAT050-MOD070-050-11	30320136
50	80	50	M6	M8x1	OS-AD-CAT050-MOD080-050-11	30320137
50	100	60	M8	M10x1	OS-AD-CAT050-MOD100-060-11	30320138
50	117	60	M8	M10x1	OS-AD-CAT050-MOD117-060-11	30320139
50	140	60	M10	M10x1	OS-AD-CAT050-MOD140-060-11	30320140

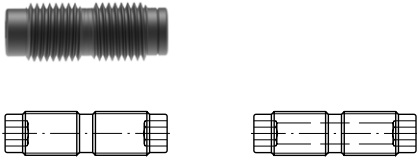
Dimensions in mm.

Use: For use in the machine spindle for connecting to hollow shank taper tools.  
 Scope of delivery: With standard KS clamping cartridge and stop ring. Without pull stud.  
 Design: Permissible run-out variation on the taper shank in relation to the hollow shank

taper inner taper = 3 µm.

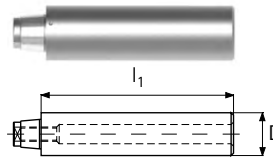
Note: For clamping cartridge, stop ring and pull stud, see "CLAMPING" catalogue.  
 Balancing quality: G 6.3 with 3,000 rpm in delivery status.

# Spare parts and accessories HFS system



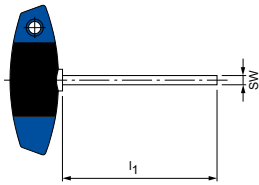
**Threaded spindle for axial clamping system**

HFS size	Without coolant through-bore Threaded spindle MN 618 Order no.	With coolant through-bore Threaded spindle MN 618 Order no.
10	10024720	10025194
12	10024721	10025195
14	10024721	10025195
16	10024722	10025196
20	10024722	10025196
24	10024723	10025198



**Test arbor (alignment aid)**

HFS size	l <sub>1</sub>	D	Order no.
10	70	15	30036468
12	80	20	30036469
14	80	20,5	30036470
16	80	23,2	30036471
20	80	29,3	30036472
24	80	39	30036473



**Hexagonal wrench with T-handle**

HFS size	Short design		Long design	
	Size	Order no.	Size	Order no.
10	SW2,5 x 100	10006233	SW2,5 x 200	10032722
12	SW3 x 100	10006234	SW3 x 200	10025313
14	SW3 x 100	10006234	SW3 x 200	10025313
16	SW4 x 100	10006235	SW4 x 200	10018010
20	SW4 x 100	10006235	SW4 x 200	10018010
24	SW5 x 100	10006236	SW5 x 200	10013350



**Taper wipers for HFS internal tapers**

HFS size	Order no.
10	10029989
12	10029990
14	10030002
16	10030003
20	10030004
24	10030005

**Torque wrench, blades and hexagonal inserts**

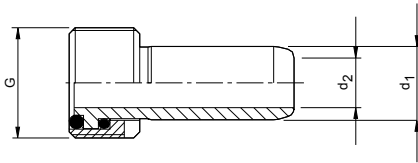
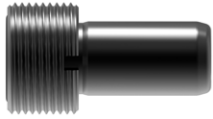
HFS size	SW	Torque wrench				Blades and hexagonal inserts for torque wrenches			
		Torque	Design	Input	Order no.	l [mm]	l <sub>1</sub> [mm]	Input	Order no.
10	2.5	4 Nm	fixed – with blade	–	10044842	175	70	Blade	10044839
12	3	6 Nm	adjustable – without element	1/4"	10040125	55	30	1/4" element	10040122
14	3	6 Nm	adjustable – without element	1/4"	10040125	55	30	1/4" element	10040122
16	4	15 Nm	adjustable – without element	3/8"	10040126	60	35	3/8" element	10040123
20	4	15 Nm	adjustable – without element	3/8"	10040126	60	35	3/8" element	10040123
24	5	20 Nm	adjustable – without element	3/8"	10040126	70	45	3/8" element	10040124

Torque wrench and hexagon inserts only from HFS size 12 or SW 3.

Dimensions in mm.

Design: Permissible run-out variation of the cylindrical part in relation to the HFS connection of max. 0.002 mm.

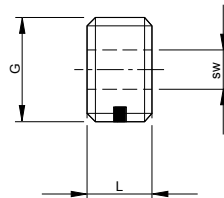
# Spare parts and accessories HSK-A 63



**Coolant tubes according to DIN 69895**

HSK	Dimensions			Order no.
	G	d <sub>1</sub>	d <sub>2</sub>	
63	M18x1	12	8	30326006
100	M24x1,5	16	12	30326008

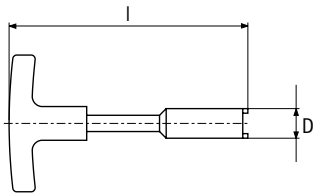
Scope of delivery: Coolant tube with two O-rings and clamping nut.  
 Design: Smooth angular movement 1° self-centering, axially sealed.  
 Note: Designed according to DIN 69895. Tightness tested to 80 bar.



**Blind screws**

HSK	Dimensions			Order no.
	G	L	SW	
63	M18x1	11,5	8	30326078
100	M24x1,5	15,5	12	30326074

Use: For closing the thread bore in hollow shank taper tool shanks if no coolant tube is used.  
 Design: With Nylok insert for screw retention.  
 Workpiece material: Corrosion-resistant steel.



**Assembly tool**

HSK	d <sub>1</sub>	For blanking plugs/adaptor tube on the KS clamping cartridges for MQL applications	
		Specification	Order no.
63	17	MAT-HSK-A063-1	10040110
100	22	MAT-HSK-A100-1	10074775

Use: For installation and removal of coolant tubes.



# TECHNICAL APPENDIX

## Product ID codes

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Milling _____	
Milling with indexable inserts _____	118
Radial indexable inserts _____	120
Solid carbide and replaceable milling cutter _____	122
Drilling _____	
Solid carbide drill _____	122
Reaming and fine boring _____	
FixReam reamer _____	124
HPR replaceable head reamer _____	124
Clamping _____	
Chucks _____	126
MFS milling head holder _____	128
HFS replaceable head holders _____	130

## Application notes

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Milling _____	
Two-axis angled entry _____	132
Trochoidal milling _____	134

## Handling notes

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Clamping _____	
Hydraulic chuck _____	136
KS flange adapter _____	137
Side lock chuck Mill Chuck, HB _____	138

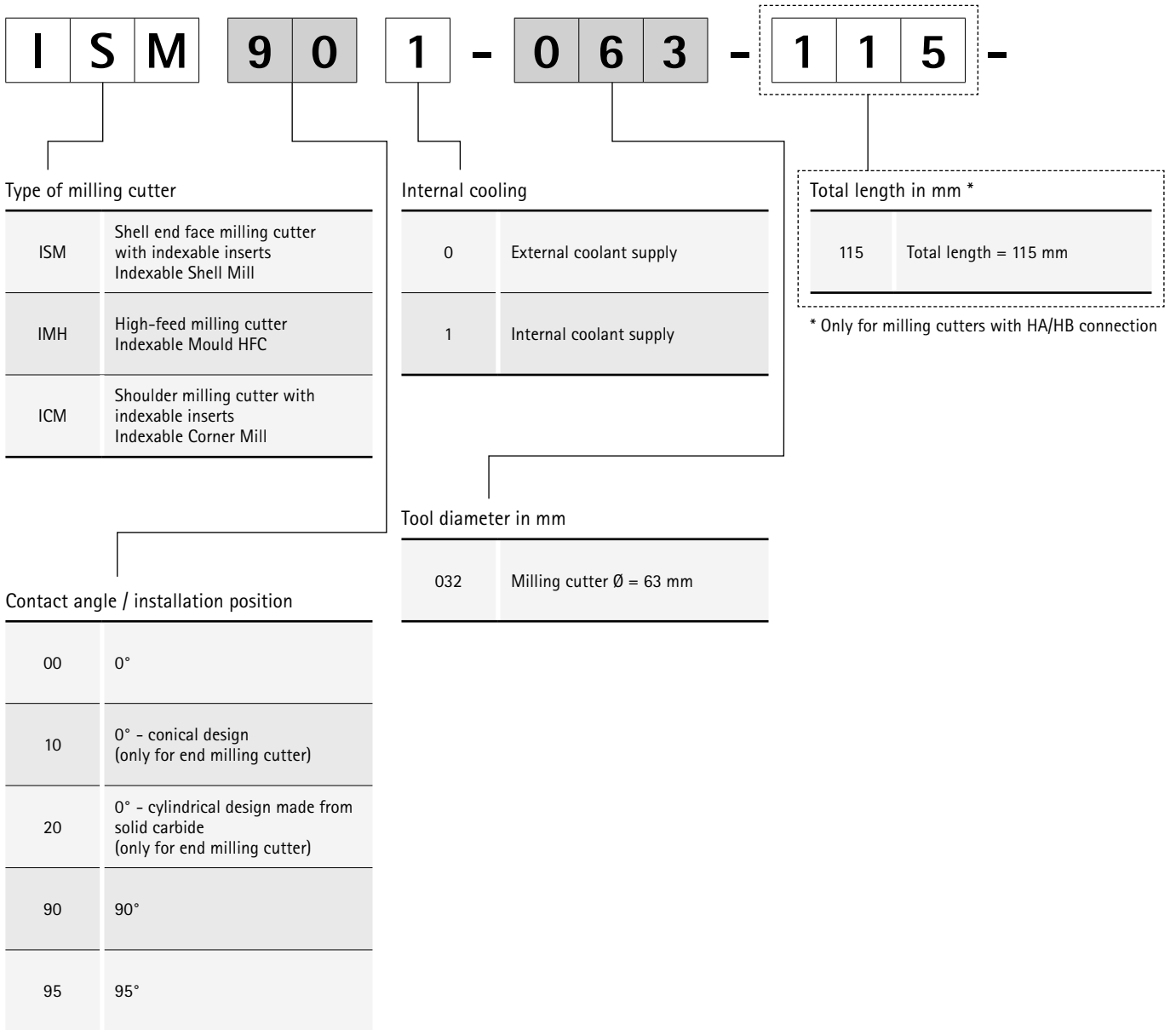
## Pictograms

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Pictograms _____	140
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# Product ID codes

## Milling cutter with indexable inserts





Connection (example)

CA16	Milling cutter arbor $\varnothing = 16$ mm
CA22	Milling cutter arbor $\varnothing = 22$ mm
CA27	Milling cutter arbor $\varnothing = 27$ mm
CA32	Milling cutter arbor $\varnothing = 32$ mm
HB16	Cylindrical shank $\varnothing = 16$ mm Shape HB
HB20	Cylindrical shank $\varnothing = 20$ mm Shape HB
HB25	Cylindrical shank $\varnothing = 25$ mm Shape HB
HB32	Cylindrical shank $\varnothing = 32$ mm Shape HB
HB35	Cylindrical shank $\varnothing = 35$ mm Shape HB

Effective number of teeth (eff.) (example)

Z2	Number of teeth eff. = 2 two-digit, with HA/HB connection
Z02	Number of teeth eff. = 2 three-digit

Rotational direction

R	Right
L	Left

Indexable insert

1st letter	Blade form
2nd letter	Clearance angle
3rd letter	Tolerance
4th letter	Insert type
5th & 6th digit	Insert size

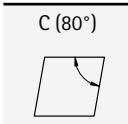
# Product ID codes

## Radial indexable inserts

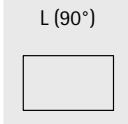
X
P
K
T
1
1
0
4
0
8

**Blade form**

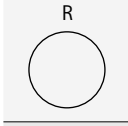
C (80°)



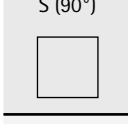
L (90°)



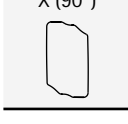
R






S (90°)



X (90°)



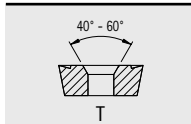
**Tolerance**

			
	d [mm]	m [mm]	s [mm]
G	±0,025	±0,025	±0,13
H	±0,013	±0,013	±0,025
K	from ±0.05 to ±0.15*	±0,013	±0,025
M	from ±0.05 to ±0.15*	from ±0.08 to ±0.20*	±0,13

\* Tolerance depends on the insert size

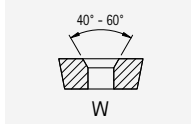
**Insert type**

40° - 60°



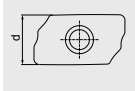
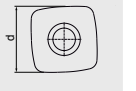
T

40° - 60°

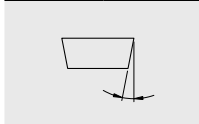


W

**Insert size**

Incircle		
d [mm]	X	S
6,75	-	06
9,35	11	-
10,2	-	10
14,7	-	14
18,7	-	18

**Clearance angle**



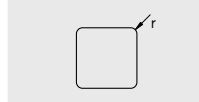
D	15°
P	11°

**Insert thickness**

Identification number	s [mm]	
	X	S
02	4,7	2,5*
04	4,7	4,86
05	4,7	5*/5,2
06	4,7	6*

\* High-feed machining

**Corner radius**

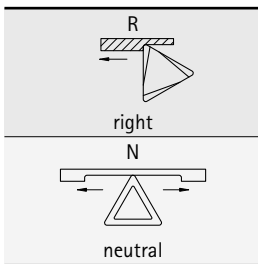


Identification number	r [mm]
04	0,4
08	0,8
10	1,0
12	1,2
15	1,5
16	1,6
20	2,0
30	3,0
40	4,0



**R** - **M 3 3** - **H P 9 9 0**

Cutting direction



Cutting edge design

Technology	Cutting edge design	Application
NeoMill-4-HiFeed90	MQL	General machining
	SMH	Unstable conditions
	SMS	Precise machining

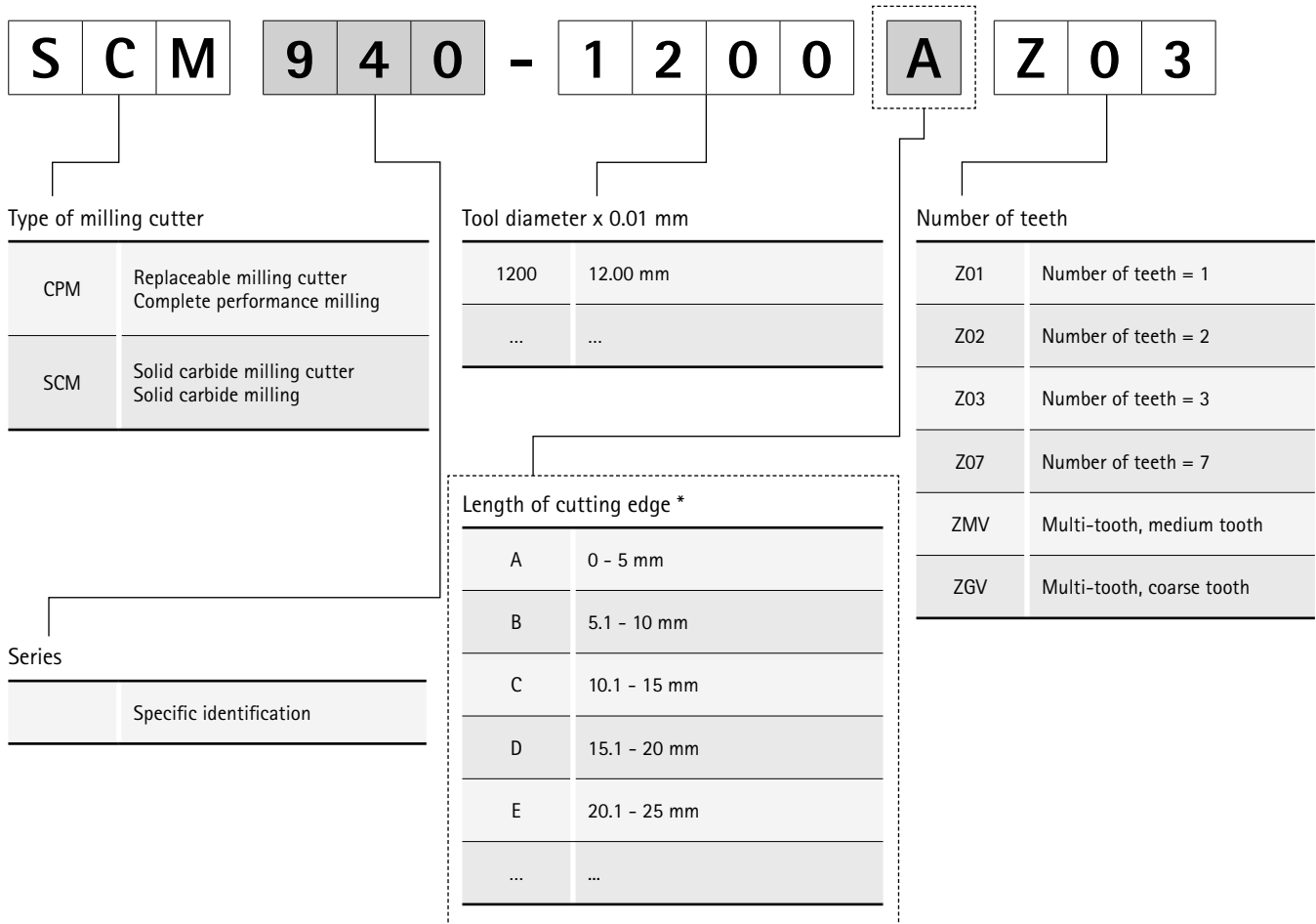
Technology	Cutting edge design	Application
NeoMill-Titan	M33	Medium machining

Cutting material

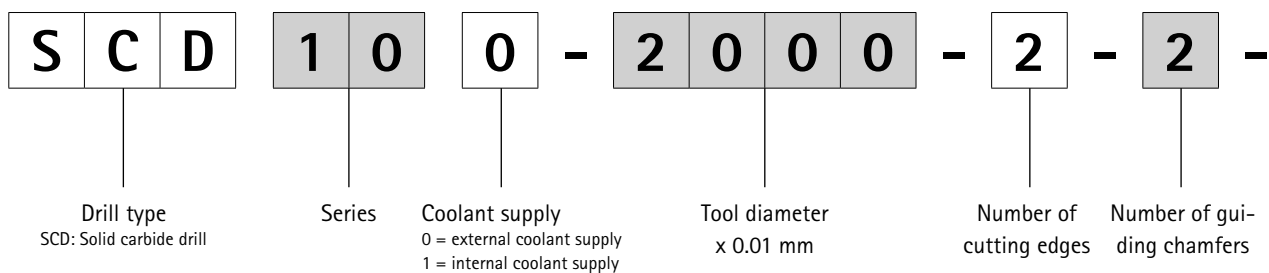
HP990 HP993 HP995
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# Product ID codes

## Solid carbide and replaceable milling cutter



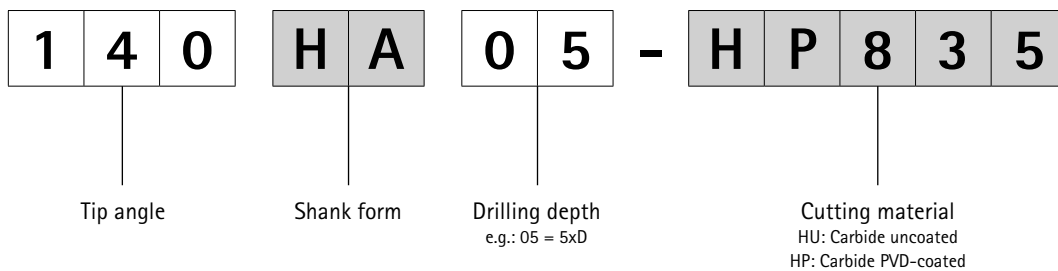
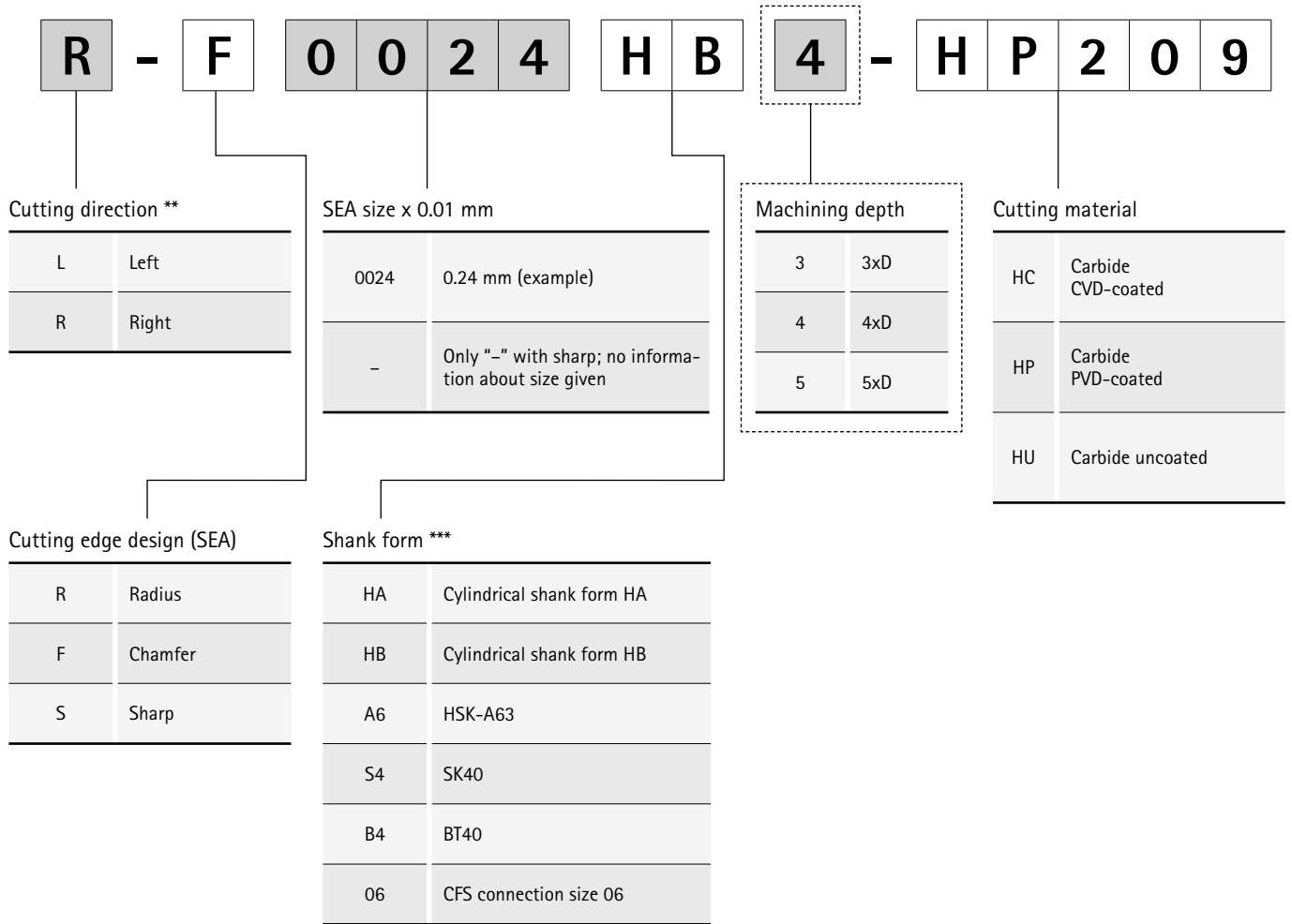
## Solid carbide drill product ID code



\* Only with milling cutter type SHM

\*\* Not applicable for milling cutter type CPM

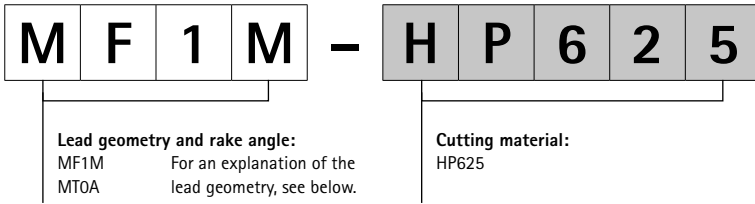
\*\*\* For milling cutter type CPM, the shank form corresponds to the CFS connection size





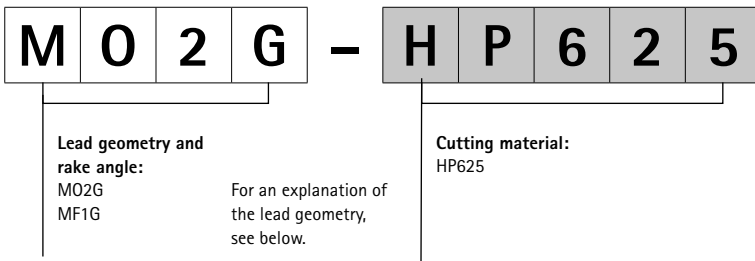
Lead

Cutting material



Lead

Cutting material

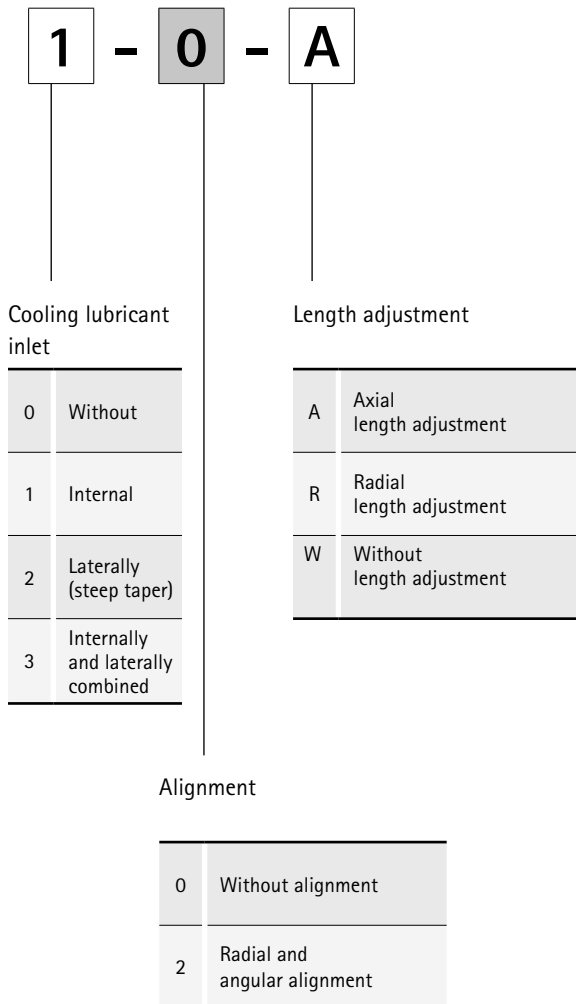


Series overview | diameter range | lead designation | lead length

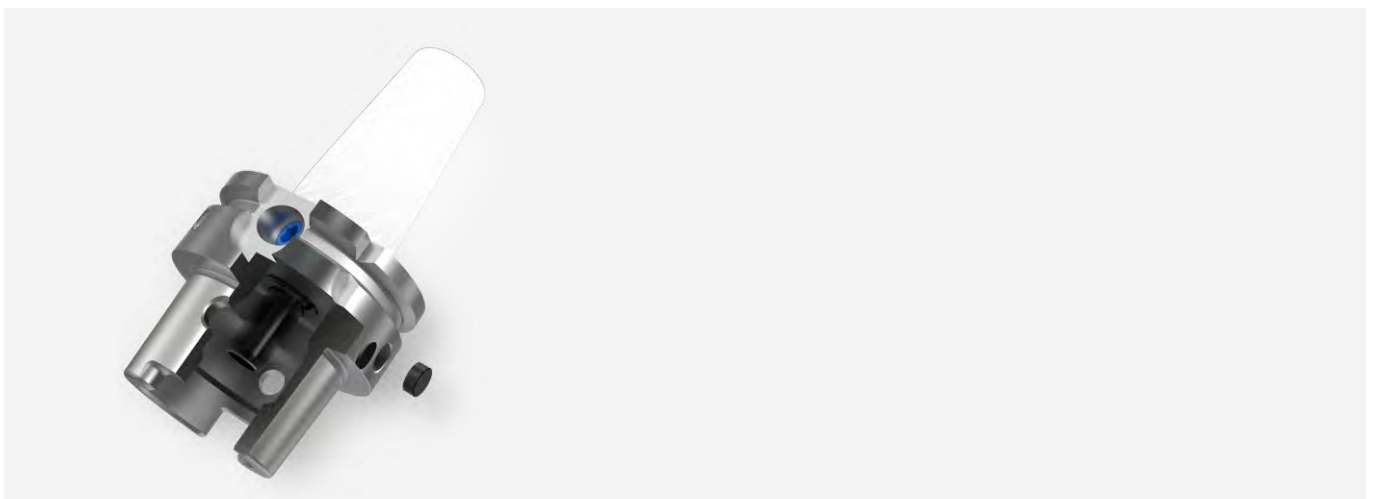
Series	Lead designation	Diameter range	Lead length x
FXR	MF	2,81 - 3,70	0,70
		3,71 - 6,20	0,90
		6,21 - 12,20	1,20
		12,21 - 20,20	1,50
	MT	2,81 - 6,20	0,30
		6,21 - 10,70	0,40
		10,71 - 16,20	0,50
		16,21 - 20,20	0,60

Series	Lead designation	Diameter range	Lead length x
HPR	MF	7,00 - 65,00	1,40
	MO	7,00 - 65,00	0,60



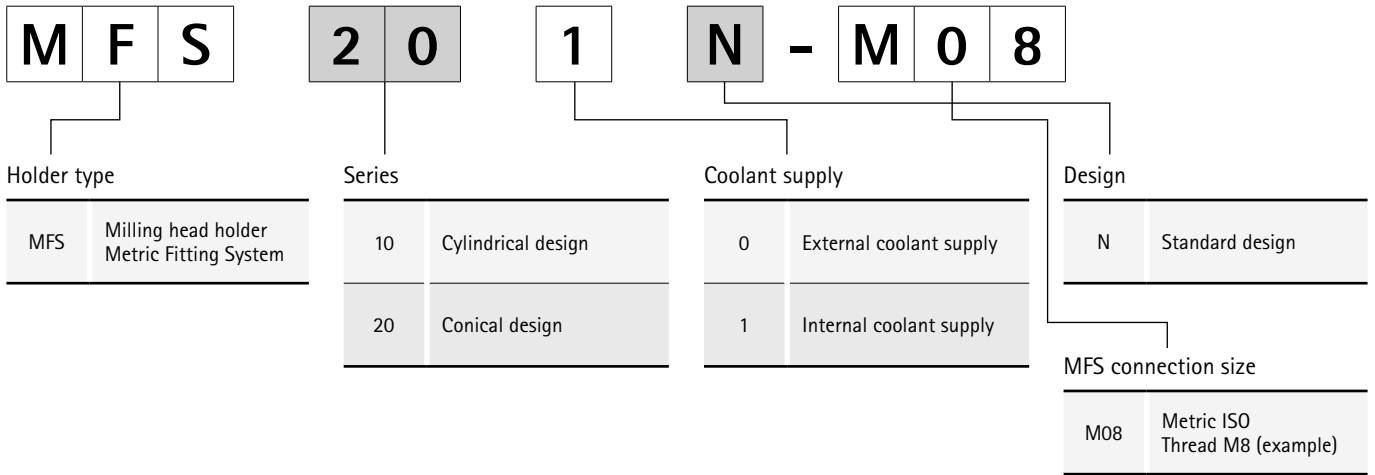


## Designs with code carrier

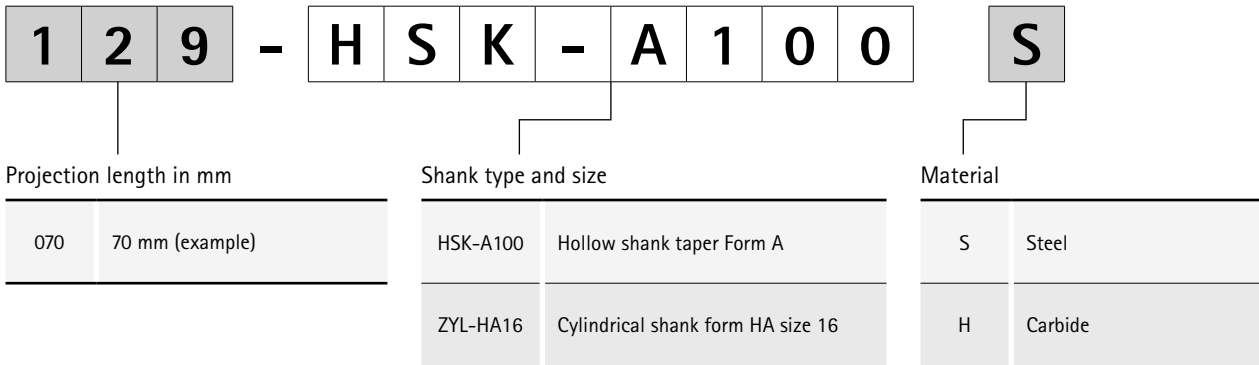


# Product ID codes

## MFS milling head holder

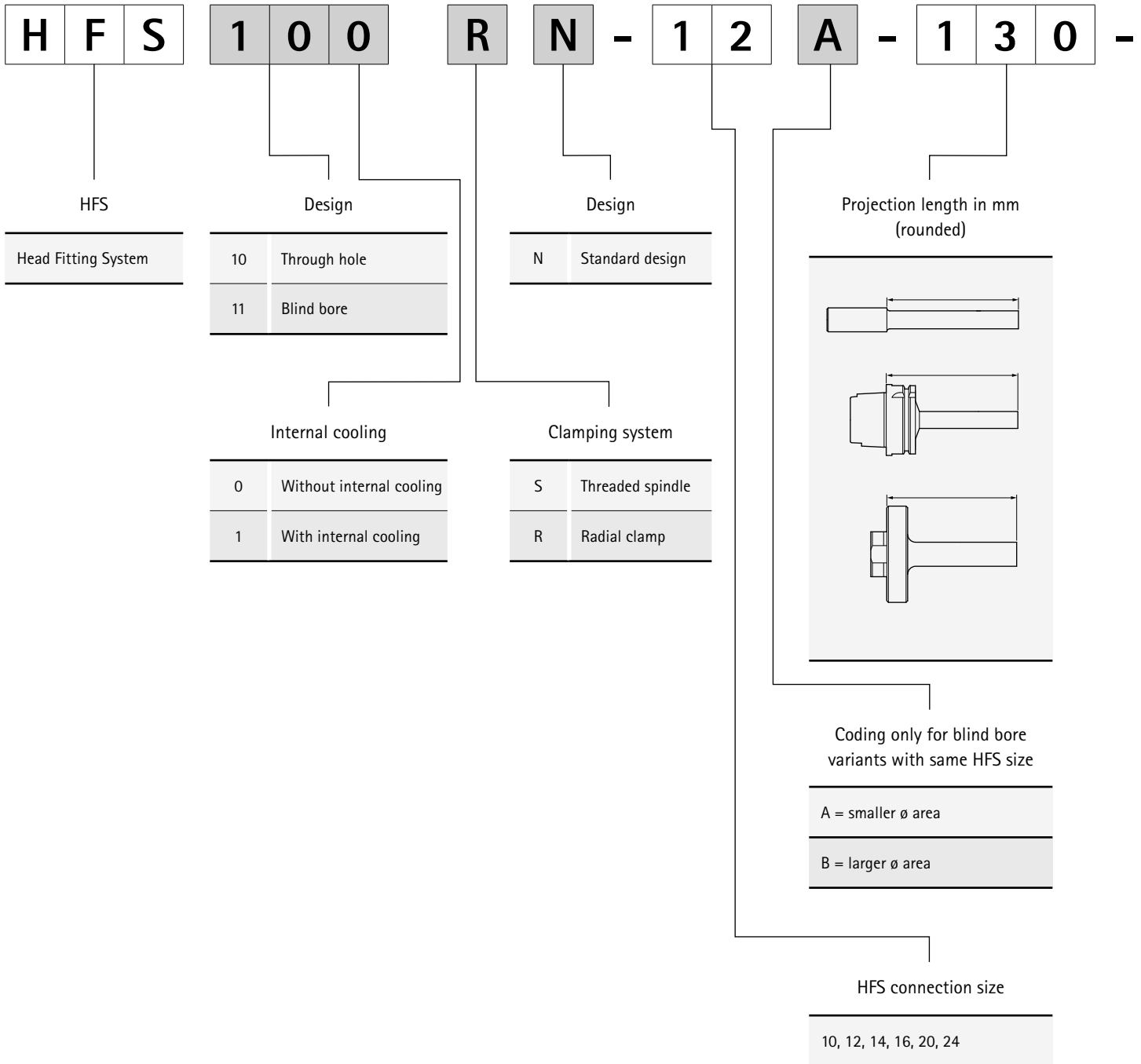


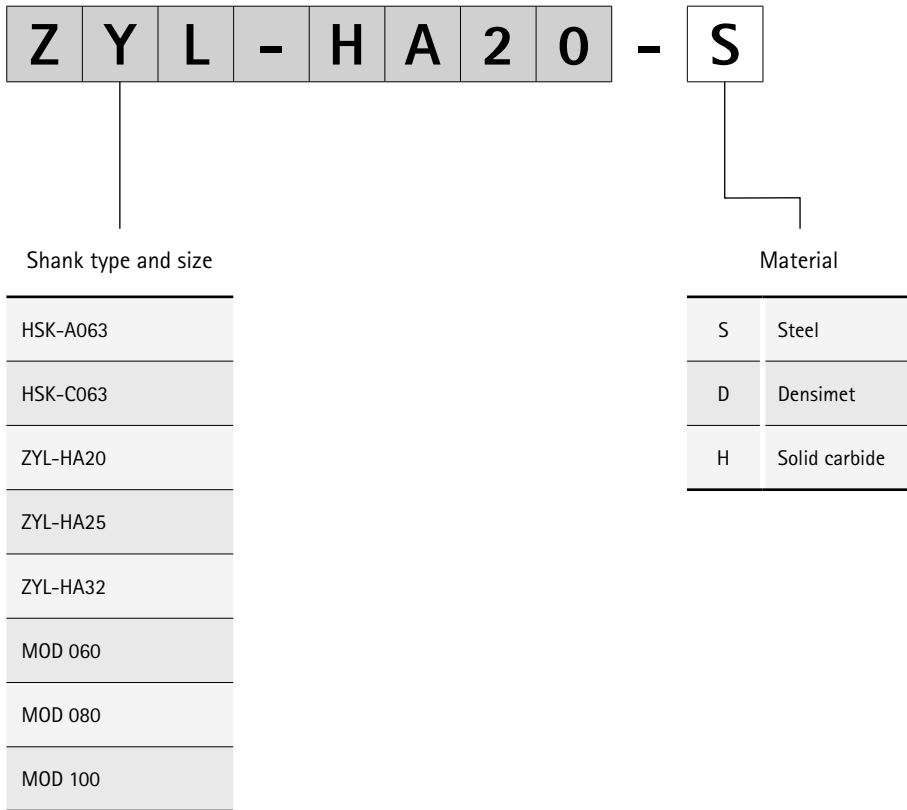




# Product ID codes

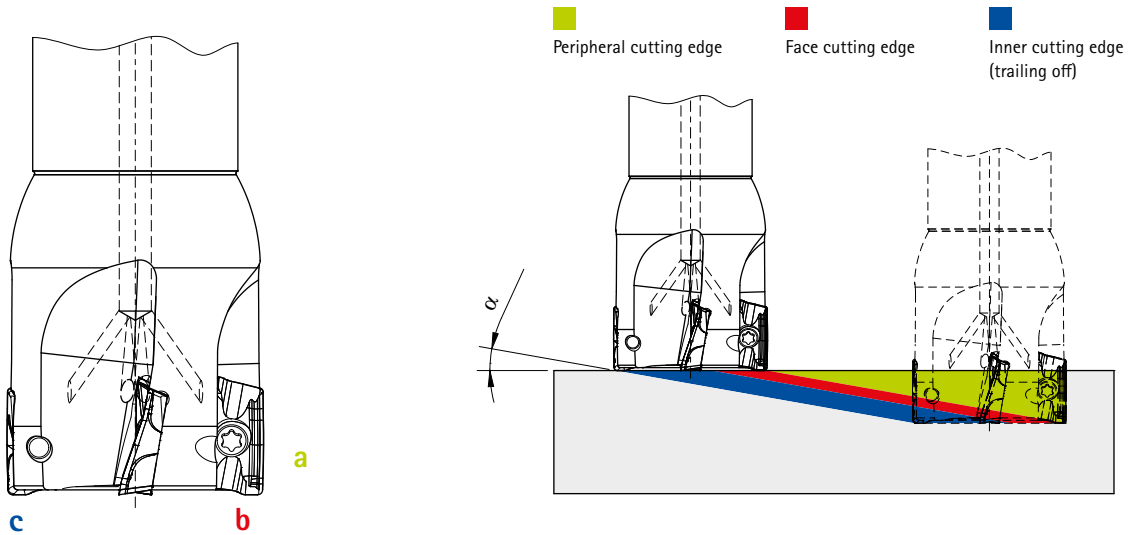
## HFS replaceable head holders





# Milling application notes – Two-axis angled entry

## Two-axis angled entry – linear (flute)



### Ramp angle $\alpha$ :

The maximum plunge angle  $\alpha$  is dependent on the tool.

In case of two-axis angled entry, various machining processes take place at the same time:

- Machining at the entire periphery of the tool (peripheral machining) with leading insert.
- Machining at the face of the milling cutter with leading insert.
- Machining at the face of the milling cutter with trailing insert.

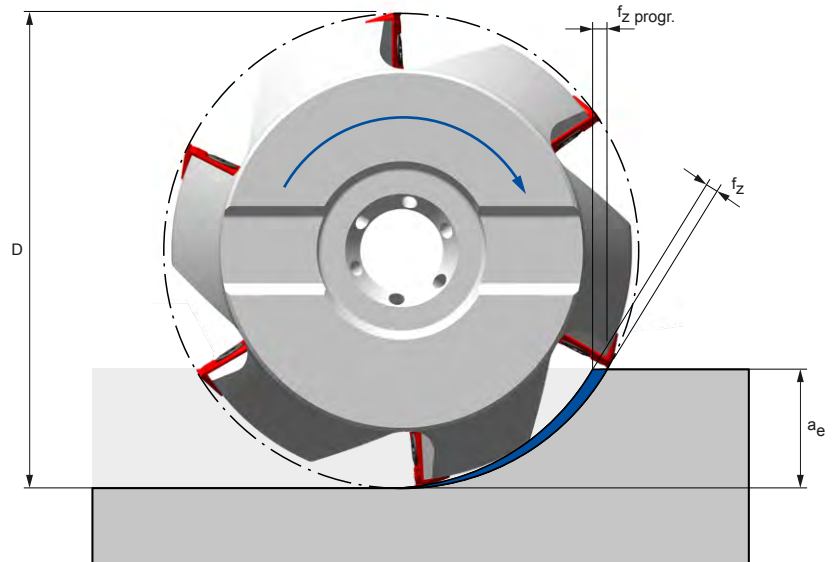
### Maximum plunge angle for NeoMill milling cutter

Plunge milling	Diameter of milling cutter [mm]	Maximum plunge angle [°]				
		XPKT11	SDMT06	SDMT10	SDMT14	SDMT18
	16	–	9	–	–	–
	20	–	4,8	–	–	–
	25	–	3	4,4	–	–
	32	4	2	2,9	–	–
	35	–	1,7	–	–	–
	40	3	–	2	–	–
	50	2,2	–	1,5	2,4	–
	52	–	–	1,1	1,7	–
	63	1,7	–	1,1	1,7	–
	66	–	–	0,8	1,3	–
	80	1,3	–	0,8	1,3	2,5
	100	1	–	–	1	2
	125	–	–	–	0,7	1,6
	160	–	–	–	–	1,3
	200	–	–	–	–	1

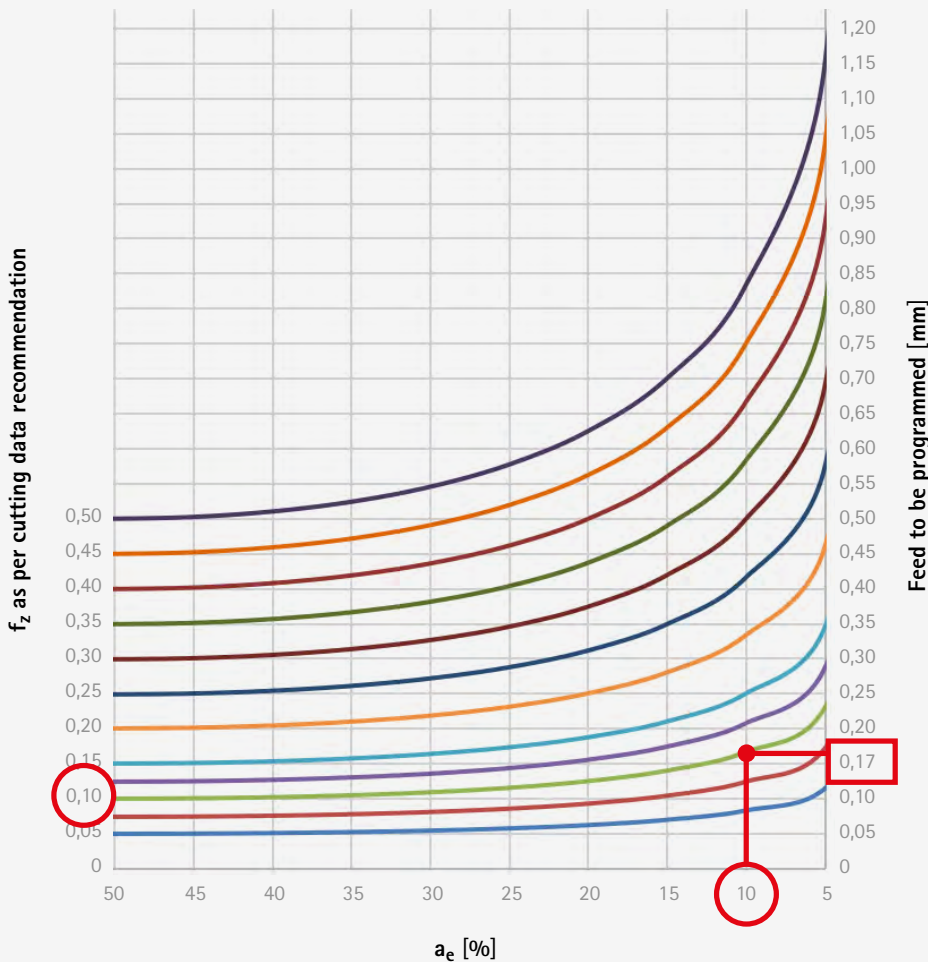
### Feed value compensation

Machining steps with low radial cutting depth, such as milling a shoulder, require correction of the feed at the cutting edge as it enters the workpiece.

The recommended feed per tooth  $f_z$  varies depending on milling cutter diameter and operational time, that is the radial contact ratio of the milling cutter  $a_e/D$ . If this is less than 50 per cent, the maximum chip thickness reduces relative to the feed  $f_z$ . The feed can be increased with the aid of the correction factor in the following diagram, depending on the  $a_e/D$  ratio.



### Feed value compensation



**Example:**  
 $D = 20 \text{ mm}$   
 $a_e = 2 \text{ mm}$   
 $f_z = 0.1 \text{ mm/tooth}$   
 $a_e/D = 10\%$   
 $f_z \text{ progr.} = 0.17 \text{ mm/tooth}$

# Milling application notes – Trochoidal milling – principles

## Definition

Trochoidal milling is a milling strategy with the aim of reducing process forces and simultaneously increasing material removal rates. By superimposing a circular movement of the tool on the feed movement, the contact conditions can be positively influenced. This results in cyclic material removal with variable contact conditions that can be adjusted to the tool application, as well as variable cutting widths along the circular path of the tool.

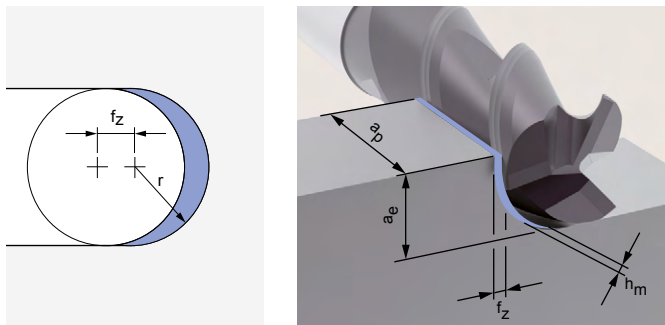


## Example of full slot milling

### Conventional milling

For roughing in a full cut, the contact conditions of the milling cutter are fixed at a wrapping angle of  $180^\circ$ .

In addition to the generation of long chips due to the long tooth contact, this leads to a comparatively high thermal load on the tool. The resulting large cutting cross section in turn results in high cutting forces, which limits process-stable infeed depths, feed rates and cutting speeds.

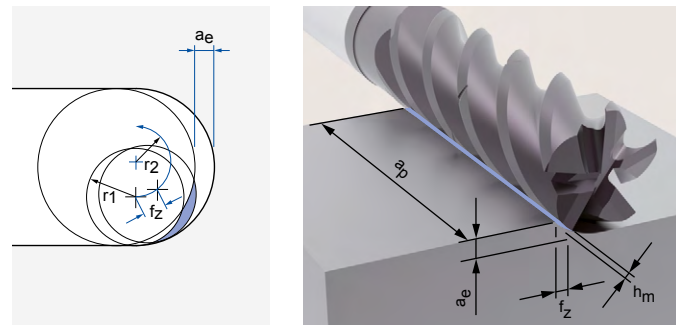


$a_p$ : small (cutting depth  $\sim 1 \times D$ )  
 $a_e$ : large ( $1 \times D$ )  
 $f_z$ : small  
 $v_c$ : low

### Trochoidal milling

The specific kinematics of trochoidal milling makes it possible to positively influence the contact conditions as a circular movement of the tool is superimposed on the feed movement. The contact angle is correspondingly low.

The result of this technological approach is that a reduced cutting width and cutting length lead to significantly reduced process forces. This in turn makes it possible to achieve greater cutting depths.



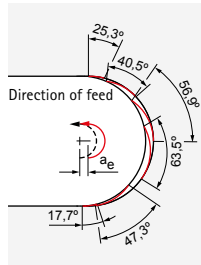
$a_p$ : large (full utilisation of the cutting edge length possible)  
 $a_e$ : small  
 $f_z$ : large  
 $v_c$ : high

# Trochoidal milling – in detail

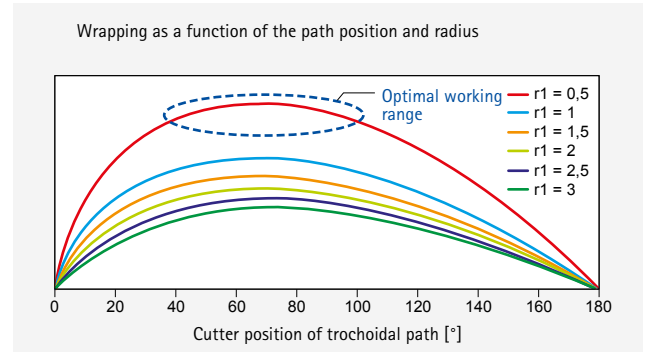
## Trochoidal milling – circular path

For the case of a circular path with a constant radius, the wrapping angles on the contact tool cutting edge vary depending on the absolute radial material removal rate within one revolution.

- Contact conditions are constantly changing
- Optimal working range of the milling cutter
- Limited to a small area
- Low material removal rate
- Tends to vibrate more
- Increased tool wear



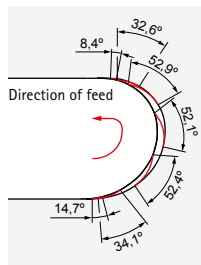
Wrapping as a function of the path position  
- Circular path



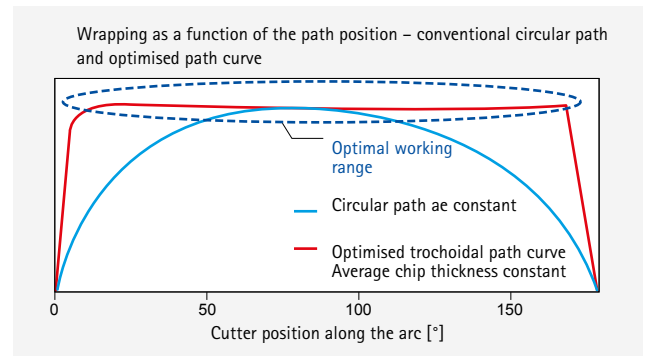
## Trochoidal milling – optimised path curve

Through an adapted path movement of the tool, the contact ratios of the milling cutter can be kept constant at every point of the path over almost the entire machining operation. This means that the milling process can always be operated at its optimum. Within a path, the feed rate is adjusted so that the average chip thickness remains constant.

- Constant contact condition
- Constant strength level
- Less tool wear
- Maximum material removal rate

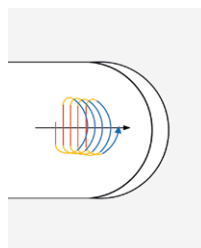


Wrapping as a function of the path position  
- optimised path curve



## Feed movement – optimised air cut

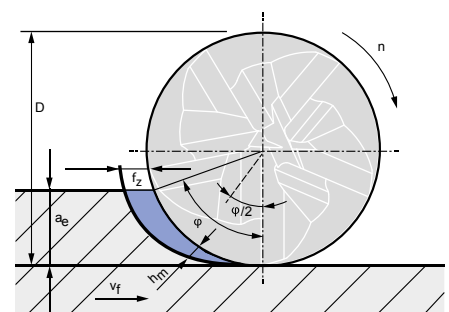
For holistic process optimisation, the traversing motion in the air cut must be considered in addition to the tool path during engagement. The aim is to realise the fastest possible movement to the next entry point after the milling cutter has exited the material. Since the design of a circular path is not advantageous at this point, the most direct approach path possible is selected depending on the dynamics of the machine.



■ Feed  
■ Ramp  
■ Rapid traverse

## Average chip thickness $h_m$ and contact angle $\varphi$

Contact angle	$\varphi = [^\circ]$	$\cos \varphi = 1 - \frac{2 \cdot a_e}{D}$	Depends on the contact ratio $a_e/D$ and is limited depending on the workpiece material.
Average chip thickness	$h_m = [mm]$	$h_m = f_z \cdot \sqrt{\frac{a_e}{D}}$	Is kept almost constant during trochoidal milling by dynamic feed rates. The average chip thickness is measured at $\varphi/2$ .
Feed per tooth	$f_z = \frac{[mm]}{\text{Tooth}}$		Restricted variable, is adjusted during machining by CAM system.
Cutting width	$a_e = [mm]$		Constantly recalculated by the CAM software and limits the contact angle $\varphi$ .
Tool diameter	$D = [mm]$		



## NOTES

- In addition to a modern CAM system or a modern machine control system, trochoidal milling also requires a machining centre that is as dynamic as possible.
- Full performance is achieved by using OptiMill cutters from the Trochoid series.

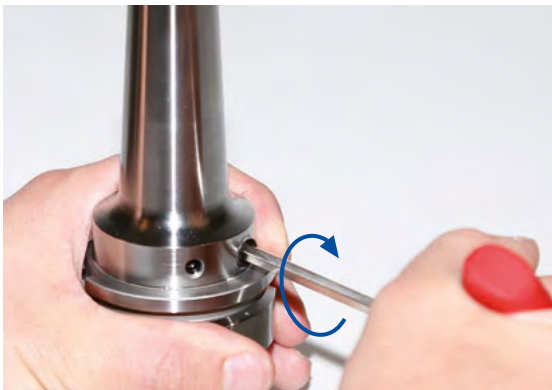
# Clamping instructions – Hydraulic chuck

## Checking the minimum number of rotations



**Figure 1:**  
Turn the clamping screw and the tool test piece.

1. Clean and degrease the tool test piece and the location bore (for more information see the brief instructions for the corresponding hydraulic chuck).
2. Insert the tool test piece into the chuck to be tested.
3. Turn the clamping screw with a hex-wrench until the tool test piece in the chuck can no longer be turned by hand (see figure 1).
4. Tighten the clamping screw as far as it will go with a hex-wrench. Refer to the corresponding table for the minimum revolutions.



**Figure 2:**  
Tighten the clamping screw and observe the minimum revolutions.

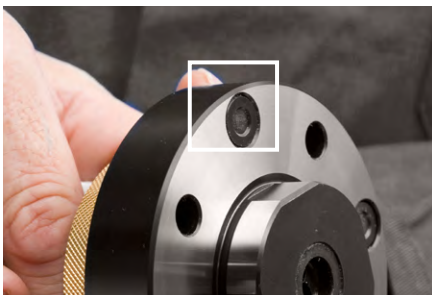
### Tool test piece

Order no.	Specification
31212898	Test arbor ø3x70 mm min. rotation TU cylindrical
31212910	Test arbor ø4x70 mm min. rotation TU cylindrical
31212911	Test arbor ø5x70 mm min. rotation TU cylindrical
30844163	Test arbor ø6x70 mm Drehmoment TU
30844164	Test arbor ø8x70 mm min. torque TU
30844166	Test arbor ø10x70 mm min. torque TU
30844167	Test arbor ø12x70 mm min. torque TU
30844168	Test arbor ø14x70 mm min. torque TU
30844170	Test arbor ø16x70 mm min. torque TU
30844171	Test arbor ø18x70 mm min. torque TU
30844173	Test arbor ø20x70 mm min. torque TU
30844174	Test arbor ø25x100 mm min. torque TU
30844175	Test arbor ø32x100 mm min. torque TU



# Clamping instructions – KS flange adapter

## Assembling and aligning KS flange adapters and MAPAL module adaptors with radial and angular alignment



1. Clean face surfaces on flange adapter and adapter. Ensure that the face surface on the alignment screw does not protrude beyond the face surface in the flange adapter.



2. Insert flange adapter. Place fastening screws in contact.



3. Clean taper and face surface on the test arbor or tool carefully. Insert test arbor or tool.



4. Position the dial gauge at radial run-out checkpoint. On MAPAL tools, it is also possible to use the HSK collar for alignment. Take lowest measuring point and set dial gauge to "zero". Align radially.



5. For the angular alignment, the dial gauge is positioned at the upper point to be checked or approx. 100 mm from the connection. Align angularly using alignment screws. Do not loosen the alignment screws after actuation.

6. Once the angular alignment is set to  $< 3 \mu\text{m}$ , check the radial alignment again at the radial run-out checkpoint on the collar and correct if necessary. Should it be necessary to correct the radial alignment, check the angular alignment again afterwards.

### Tightening torques

Nominal size	Module diameter [mm]	Fastening screw	Tightening torque [Nm]
HSK32	60	ISO 4762 – M5x16 – 12.9	8,7
HSK40	70	ISO 4762 – M6x20 – 12.9	15
HSK50	80	ISO 4762 – M6x20 – 12.9	15
HSK63	100	ISO 4762 – M8x25 – 12.9	36
HSK80	117	ISO 4762 – M8x25 – 12.9	36
HSK100	140	ISO 4762 – M10x30 – 12.9	72

The basis for the maximum tightening torque of the cylinder head screws in accordance with DIN 912 is the general DIN standard for property class 10.9.

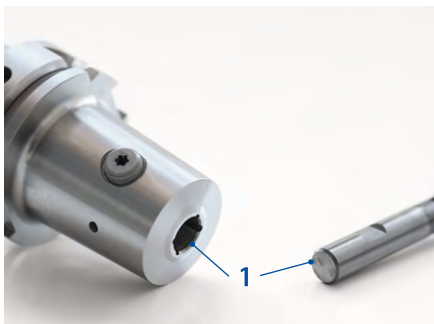
MAPAL only uses cylinder head screws in accordance with ISO 4762 with the property class 12.9.

# Clamping instructions – Side lock chuck Mill Chuck, HB

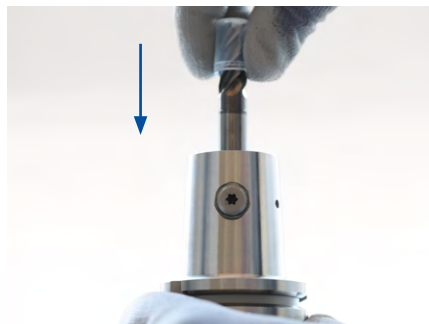
## Clamping a tool

### Note:

Only clamp undamaged tools and tools that are free from burrs.



1. Clean the location bore and the tool shank (position 1).



### Note:

To ensure correct tool clamping, the HB surface of the tool must face the clamping screw.

2. Push the tool, starting with the shank, into the location bore of the side lock chuck. The recess on the tool must be directed towards the clamping screw.



3. Press on the tool from above. At the same time, turn the clamping screw clockwise until it stops.
  - The clamping screw is abut with the HB surface of the tool.
4. Turn the clamping screw back half a turn.



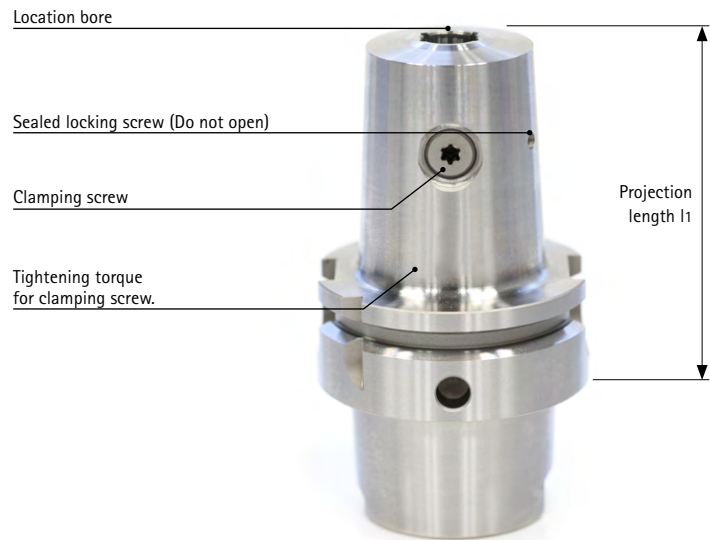
5. Set a torque wrench to the specified tightening torque (see Table "Tightening torques for the clamping screw").
6. Tighten the clamping screw until it stops using the torque wrench.

### Comment:

- Only for trained personnel.
- Wear protective gloves.
- It is recommended that you handle the tool with a protective cap.

### Result:

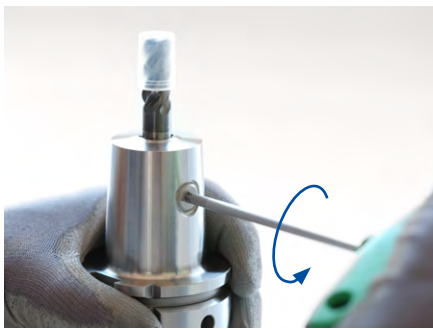
The tool is completely clamped in the mill chuck and can be used.



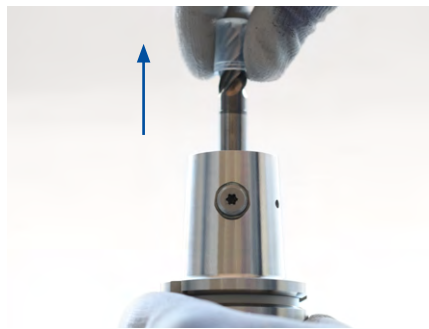
## Unclamping a tool

### Note:

The clamping screw is not secured from accidentally falling out.



1. Loosen the clamping screw by turning it anticlockwise.



2. Remove the tool from the side lock chuck's location bore.

### Result:

The tool has been removed.

## Tightening torques for clamping screw

Diameter tool shank [mm]	Tightening torque [Nm]	Torx size
6	10	T15
8	10	T25
10	7	T25
12	13	T30
14	13	T30
16	23	T40
18	23	T40
20	25	T40
25	47	T50
32	50	T50



# MAPAL machining groups

Machining group		Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Frequently machined workpiece materials
P	P1	P1.1 Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 700 N/mm <sup>2</sup>	1.0122 (S235/St 37), 1.0401 (C15), 1.0503 (C45), 1.0570 (S355/St 52), 1.1213 (Cf53)
		P1.2 Structural, free-cutting, case hardened and heat-treated steels, non-alloy	< 1.200 N/mm <sup>2</sup>	1.1249 (Cf70)
	P2	P2.1 Nitrided, case hardened and heat-treated steels, alloy	< 900 N/mm <sup>2</sup>	1.7131 (16MnCr5)
		P2.2 Nitrided, case hardened and heat-treated steels, alloy	< 1.400 N/mm <sup>2</sup>	1.7227 (42CrMo54)
	P3	P3.1 Tool, bearing, spring and high-speed steels*	< 800 N/mm <sup>2</sup>	1.2343 (X37CrMoV5-1), 1.2762 (75CrMoNiW6-7)
		P3.2 Tool, bearing, spring and high-speed steels*	< 1.000 N/mm <sup>2</sup>	1.2367 (X38CrMoV5-3), 1.2713 (55NiCrMoV6)
		P3.3 Tool, bearing, spring and high-speed steels*	< 1.500 N/mm <sup>2</sup>	1.2379 (X153CrMoV12), 1.2738 (40CrMnNiMo8-6-4)
P4	P4.1 Stainless steels, ferritic and martensitic		1.4510 (X3CrTi17), 1.4589 (X5CrNiMoTi15-2)	
P5	P5.1 Cast steel		1.7231 (G42CrMo4)	
P6	P6.1 Stainless cast steel, ferritic and martensitic			
M	M1	M1.1 Stainless steels, austenitic	< 700 N/mm <sup>2</sup>	1.4301 (V2A), 1.4571 (V4A)
		M1.2 Stainless steels, ferritic/austenitic (duplex)	< 1.000 N/mm <sup>2</sup>	1.4362 (Alloy 2304), 1.4501, 1.4662 (LDX 2404)
	M2	M2.1 Stainless/heat-resistant cast steel, austenitic	< 700 N/mm <sup>2</sup>	
M3	M3.1 Stainless cast steel, ferritic/austenitic (duplex)	< 1.000 N/mm <sup>2</sup>		
K	K1	K1.1 Cast iron with lamellar graphite (grey cast iron), GJL	< 300 N/mm <sup>2</sup>	GJL-250 (GG-25), GJL-260 (GG-26 Cr)
		K2.1 Cast iron with spheroidal graphite, GJS	< 500 N/mm <sup>2</sup>	GJS-400 (GGG-40), GJS-450 (GGG-45)
	K2	K2.2 Cast iron with spheroidal graphite, GJS	≤ 800 N/mm <sup>2</sup>	GJS-600 (GGG-60), GJS-800-2 (GGG-80), GJS-800-8 (ADI 800)
		K2.3 Cast iron with spheroidal graphite, GJS	> 800 N/mm <sup>2</sup>	GJS-900-2 (GGG-90), GJS-1000-5 (ADI 1000), GJS-1200-2 (ADI 1200), GJS-1400-1 (ADI 1400)
	K3	K3.1 Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	< 500 N/mm <sup>2</sup>	GJV-300, GJV-400, GJMW-400-5 (GTW-40)
		K3.2 Cast iron with spheroidal graphite, GJV; malleable cast iron, GJM	> 500 N/mm <sup>2</sup>	GJV-500, GJV-700
N	N1	N1.1 Aluminium, non-alloy and alloy < 3 % Si		Alloy 2024, Alloy 7075, Al99
		N1.2 Aluminium, alloy ≤ 7 % Si		AlSi7
		N1.3 Aluminium, alloy > 7-12 % Si		AlSi9, AlSi9Cu
		N1.4 Aluminium, alloy > 12 % Si		AlSi12, AlSi17
	N2	N2.1 Copper, non-alloy and low-alloy	< 300 N/mm <sup>2</sup>	SE-Cu
		N2.2 Copper, alloy	> 300 N/mm <sup>2</sup>	CuSn6
		N2.3 Brass, bronze, gunmetal	< 1.200 N/mm <sup>2</sup>	CuZn33, CuAl9Mn3
	N3	N3.1 Graphite, > 8 µm		
		N3.2 Graphite, ≤ 8 µm		
	N4	N4.1 Plastic, thermoplastics		PA, PE, PC, PS, PVC, PP, PTFE, POM, PMMA
N4.2 Plastic, thermosets			PU, PF, EP, UP, VE, CR	
N4.3 Plastic, foams			EPS, PUR, PVC-E, PS-E, PP-E	
C	C1	C1.1 Plastic matrix, aramide fibre-reinforced (AFRP)		Nomex, Kevlar, Twaron, KOREX
		C1.2 Plastic matrix (thermosetting), CFRP/GFRP		IMS, HTA
		C1.3 Plastic matrix (thermoplastic), CFRP/GFRP		GMT-PP, PEEK
	C2	C2.1 Carbon matrix, carbon fibre-reinforced (CFC)		CF222, CF225, CF226, CF227, CF260
		C3.1 Metal matrix (MMC)		CeramTec AO-403 (AlSi9MgMn-Al2O3), Al/Cu/Mg-SiO2/Al2O3/AlN/TiC/SiC/BN/TiB2
	C4	C4.1 Sandwich construction, honeycomb core		
		C4.2 Sandwich construction, foam core		PLASCORE PAMG-XR1 5052, PCGA-XR1 3003, PAMG-XR1 5056, Micro-Cell (core made of alloy 5052/5056)
	C5	C5.1 Composite (stack), non-metal - non-ferrous metal composite		CFK-aluminium, IMS/HTA + Alloy 2024/6061/7075
		C5.2 Composite (stack), non-metal - metal composite		CFK-titanium, IMS/HTA + TiAl6V4/AMS4905
		C5.3 Composite (stack), non-metal - non-metallic composite		CFK-CFK
		C5.4 Composite (stack), non-ferrous metal - non-ferrous metal composite		Aluminium-aluminium
		C5.5 Composite (stack), non-ferrous metal - metal composite		Aluminium-titanium
C5.6 Composite (stack), metal - metal composite			Titanium Inox	
S	S1	S1.1 Titanium, titanium alloys	< 400 N/mm <sup>2</sup>	
		S2.1 Titanium, titanium alloys	< 1.200 N/mm <sup>2</sup>	TiAl6V4
	S2	S2.2 Titanium, titanium alloys	> 1.200 N/mm <sup>2</sup>	
		S3.1 Nickel, non-alloy and alloy	< 900 N/mm <sup>2</sup>	1.3912 (Invar, Ni36)
	S3	S3.2 Nickel, non-alloy and alloy	> 900 N/mm <sup>2</sup>	
		S4.1 High-temperature super alloy Ni, Co and Fe-based		Hardox, Hastelloy, Incoloy, Inconel, NIMONIC, Stellite, Waspaloy
S5	S5.1 Tungsten and molybdenum alloys			
H	H1	H1.1 Hardened steel / cast steel	< 44 HRC	1.2738 HH, 1.2085, Toolox 33, Toolox 44
		H1.2 Hardened steel / cast steel	< 55 HRC	1.2343, 1.2311, 1.2312, 1.2714, 1.2083, 1.2738
	H2	H2.1 Hardened steel / cast steel	< 60 HRC	1.1730, 1.2379, 1.2358, 1.2767, 1.4112, ASP 2012
		H2.2 Hardened steel / cast steel	< 65 HRC	1.2379, 1.2363, 1.2436, 1.2842, ASP 2005, Vanadis 23
	H3	H3.1 Wear-resistant cast/chill casting, GJN	< 68 HRC	ASP 2017, ASP 2023, Vanadis 30, Vanadis 60

\* If the alloy parts Cr, Mo, Ni, V, W in total > 8 % then select the next highest MAPAL machining group.



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