

**HARD METALS FOR
PRECISION TOOLS**

Competence in hard metal. Uncompromising in quality and service for your quality products.



Hard metal is our world. We have a profound understanding of this area right down to the smallest detail.

For this reason, we are not only your supplier, but your expertly qualified partner for problem solutions.

*Dr. Frank Ilgen
Managing Director*

Highly effective production lines and technologies are extremely important preconditions in order to remain globally successful in competition. The appropriate material in best quality and efficient tools constitute the decisive basis for that.

We offer you both.

Together with our ISO certified partners are the distribution and the machining of consultation-intensive metallurgical products forms our core business. Since 2005 we have been reliable partner for our Europe-wide customer network as a supplier of raw materials and semi-finished products made of hard metal in a constantly high quality.

We will advise you if you wish with regard to the selection of materials, the optimization of tools and cost potentials, design and build tools and develop operating programmes.

You will obtain the most suitable hard metal for your product from us - reliably and with the best service.



**Qualitätsmanagementsystem
ISO 9001**

- Kundenorientierung
- Kundenzufriedenheit
- Fortlaufende Verbesserung
- System- bzw. Prozesswirksamkeit

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Grade specification

Composition and physical data

PCG Grade	ISO Group	Structure	Grain size μm	Co $\pm 0,5\%$	Hardness HV30	Hardness HRA	Density g/cm^3	TRS N/mm^2	Fracture toughness K_{IC} ($\text{MPa}\text{m}^{1/2}$)
F06D	K05-K10	ultrafine	$\leq 0,6$	6,0	1840	93,4	14,80	3500	8,0
F06	K10	ultrafine	$\leq 0,6$	7,5	1770	93,0	14,60	3600	9,0
F10	K20-K30	submicron	0,7	10,0	1580	92,0	14,35	3800	10,7
F10S	K20-K40	submicron	0,8	10,0	1510	91,3	14,40	4000	10,9
U12	K40	ultrafine	$\leq 0,6$	12,0	1640	92,2	14,15	3800	9,8
U12S	K40	ultrafine	$\leq 0,6$	11,0	1660	92,3	14,15	3800	10,0
U08	K01-K05	ultrafine	$\leq 0,6$	8,0	2010	94,4	14,50	3700	8,6

Grade recommendation & Application areas

Grade	Application area
F06D	K05 / K10- standard grade for HSC application drilling, milling, reaming Steel, cast iron, non-ferrous metal, graphite, plastics, fiber-reinforced too Hard machining until 60 HRC Especially suitable for diamond coating
F06	K10 grade for HSC application drilling, milling and reaming Steel, cast iron, non-ferrous metal, graphite and plastics Hard machining until 60 HRC
F10	K20/K30 - standard multiple application grade for HPC application drilling and milling Steel, cast iron, stainless steel, special alloys Main grade for central and helical coolant bores (twice /triple, 30° / 40°)
F10S	K20/K40 - grade for HPC application drilling and milling with very good toughness Steel, cast iron, stainless steel and special alloy (titanium / nickel) High feeds, also suitable for unstable machine conditions
U12	K40- standard grade for HPC application especially milling Low and high-alloyed steel, cast iron, cast steel, stainless steel and special alloys Hard machining until 42 HRC
U12S	K40- grade for HPC application especially milling High-alloyed steel, cast iron, cast steel, stainless steel, Ti / Ni / Co- base alloys Hard machining until 50 HRC
U08	K01 / K05- grade for HSC application drilling and milling with very high wear resistance Especially suitable for glass / carbon fiber- reinforced plastics, graphite, Al- alloys > 6% Si Hard machining > 60 HRC and analogous reaming applications



Classification WC-crystallites after sintering

Grain sizes and definitions

Grain size	Definition	Grain size	Definition
< 0,2 µm	Nano	1,3 - 2,5 µm	Medium
0,2 - 0,5 µm	Ultrafine	2,5 - 6,0 µm	Coarse
0,5 - 0,8 µm	Submicron	> 6,0 µm	Extracoarse
0,8 - 1,3 µm	Fine		

Work Material - Grade recommendation

● optimal ○ suitable

ISO Norm	Work Material Group	Material Selection	F06D	F06	F10	F10S	U12	U12S	U08
P	Steel	Non Alloy Steel	●	●	●	●	○	○	
		Low / Medium Alloy Steel	●	●	●	●	○	○	
		High Alloy Steel	○	○	●	○	●	●	
		Tool Steel	○	○	●	●	●	●	
		Cast Steel	○	○	●	●	○	○	
M	Stainless Steel	Austenitic, Ferritic, Martensitic			○	●	●	●	
		Cast Steel			○	○	●	●	
		Duplex Steel			○	○	○	●	
K	Cast iron	Gray Cast Iron	●	●	●	●	○	○	
		Malleable Cast Iron	●	●	●	●	○	○	
		Ductil Graphite Iron	●	●	●	●	○	○	
		Nodular Graphite Iron	○	○	●	●	○	○	
N	Nonferrous Metals	Aluminium < 6% Si	●	●	○	○	○	○	
		Copper	●	●	○	○	○	○	
		Brass	●	●	○	○	○	○	
		Plastics, fiber-reinforced	●	○					●
		Composite, Aluminium > 6% Si	●	○					●
S	Super Alloy	Ni- Base Alloy			○	○	●	●	
		Co-Base Alloy			○	○	●	●	
		Titanium and Ti-Base Alloy			○	●	○	●	
H	Hard Materials	Steel 45-65 HRC	●	○	○	○	○	●	●
		Chilled Cast Iron 400-600 HB	○	○	○	○	○	●	
		Manganese Steel	○	○	○	○	●	●	

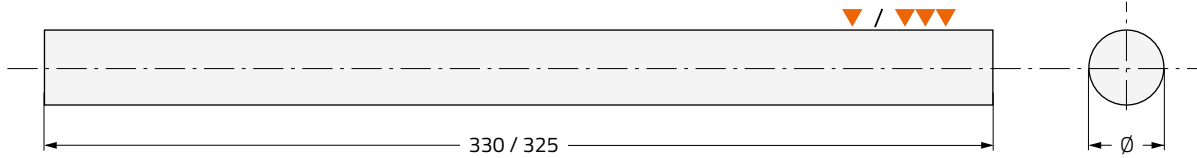
i Grade recommendation is a preselection only. Performance of cutting is dependent on cutting edge geometry, coating and specific machine operations additionally.

Solid rods / 330 and 325 mm

Article group **0110** / Sintered plus grinding stock

Article group **0111** / Ground h6

F06D K10	F10 K30	U12 K40
Cobalt 6% Ultrafine HV30 1840 3500 N/mm ²	Cobalt 10% Submicron HV30 1580 3800 N/mm ²	Cobalt 12% Ultrafine HV30 1640 3800 N/mm ²
325 mm	330 mm	330 mm



▽ Ø mm (sintered)	▽▽▽ Ø mm (ground)	▽ Ø mm (sintered)	▽▽▽ Ø mm (ground)
Ø 2,2 +0,2	Ø 2,0 h6	Ø 16,2 +0,4	Ø 16,0 h6
Ø 2,7 +0,2	Ø 2,5 h6	Ø 16,7 +0,4	Ø 16,5 h6
Ø 3,2 +0,2	Ø 3,0 h6	Ø 17,2 +0,4	Ø 17,0 h6
Ø 3,7 +0,2	Ø 3,5 h6	Ø 17,7 +0,4	Ø 17,5 h6
Ø 4,2 +0,2	Ø 4,0 h6	Ø 18,2 +0,4	Ø 18,0 h6
Ø 4,7 +0,2	Ø 4,5 h6	Ø 18,7 +0,4	Ø 18,5 h6
Ø 5,2 +0,2	Ø 5,0 h6	Ø 19,2 +0,4	Ø 19,0 h6
Ø 5,7 +0,2	Ø 5,5 h6	Ø 19,7 +0,4	Ø 19,5 h6
Ø 6,2 +0,2	Ø 6,0 h6	Ø 20,2 +0,5	Ø 20,0 h6
Ø 6,7 +0,2	Ø 6,5 h6	Ø 20,7 +0,5	Ø 20,5 h6
Ø 7,2 +0,2	Ø 7,0 h6	Ø 21,2 +0,5	Ø 21,0 h6
Ø 7,7 +0,2	Ø 7,5 h6	Ø 21,7 +0,5	Ø 21,5 h6
Ø 8,2 +0,3	Ø 8,0 h6	Ø 22,2 +0,5	Ø 22,0 h6
Ø 8,7 +0,3	Ø 8,5 h6	Ø 22,7 +0,5	Ø 22,5 h6
Ø 9,2 +0,3	Ø 9,0 h6	Ø 23,2 +0,5	Ø 23,0 h6
Ø 9,7 +0,3	Ø 9,5 h6	Ø 23,7 +0,5	Ø 23,5 h6
Ø 10,2 +0,3	Ø 10,0 h6	Ø 24,2 +0,5	Ø 24,0 h6
Ø 10,7 +0,3	Ø 10,5 h6	Ø 25,2 +0,5	Ø 25,0 h6
Ø 11,2 +0,3	Ø 11,0 h6	Ø 25,7 +0,5	Ø 25,5 h6
Ø 11,7 +0,3	Ø 11,5 h6	Ø 26,2 +0,5	Ø 26,0 h6
Ø 12,2 +0,3	Ø 12,0 h6	Ø 27,2 +0,5	Ø 27,0 h6
Ø 12,7 +0,3	Ø 12,5 h6	Ø 28,2 +0,5	Ø 28,0 h6
Ø 13,2 +0,3	Ø 13,0 h6	Ø 29,2 +0,5	Ø 29,0 h6
Ø 13,7 +0,3	Ø 13,5 h6	Ø 30,2 +0,5	Ø 30,0 h6
Ø 14,2 +0,3	Ø 14,0 h6	Ø 31,2 +0,5	Ø 31,0 h6
Ø 14,7 +0,3	Ø 14,5 h6	Ø 32,2 +0,5	Ø 32,0 h6
Ø 15,2 +0,3	Ø 15,0 h6		
Ø 15,7 +0,3	Ø 15,5 h6		



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Other sizes and grades on request.

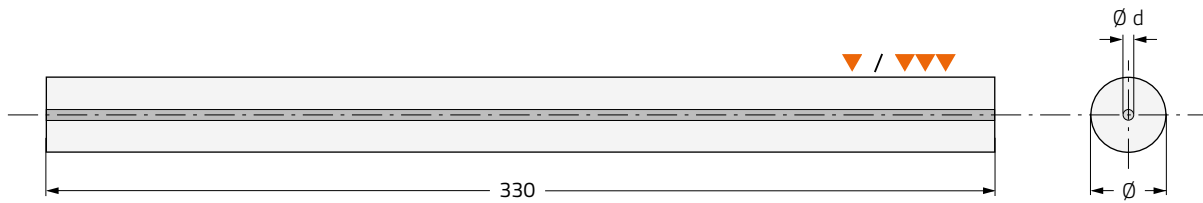


Coolant hole rods / Single central hole / 330 mm

Article group **0120** / Sintered plus grinding stock

Article group **0121** / Ground h6

F10 **K30**
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²



\varnothing mm (sintered)	\varnothing mm (ground)	$\varnothing d$ mm
$\varnothing 4,2 +0,3$	$\varnothing 4,0 h6$	$1,0 \pm 0,10$
$\varnothing 6,2 +0,3$	$\varnothing 6,0 h6$	$1,0 \pm 0,10$
$\varnothing 8,2 +0,3$	$\varnothing 8,0 h6$	$1,5 \pm 0,15$
$\varnothing 10,2 +0,3$	$\varnothing 10,0 h6$	$2,0 \pm 0,25$
$\varnothing 12,2 +0,3$	$\varnothing 12,0 h6$	$2,5 \pm 0,30$
$\varnothing 14,2 +0,3$	$\varnothing 14,0 h6$	$2,8 \pm 0,30$
$\varnothing 16,2 +0,3$	$\varnothing 16,0 h6$	$4,0 \pm 0,30$
$\varnothing 18,2 +0,3$	$\varnothing 18,0 h6$	$3,0 \pm 0,30$
$\varnothing 20,2 +0,3$	$\varnothing 20,0 h6$	$4,0 \pm 0,30$
$\varnothing 25,2 +0,3$	$\varnothing 25,0 h6$	$4,0 \pm 0,30$

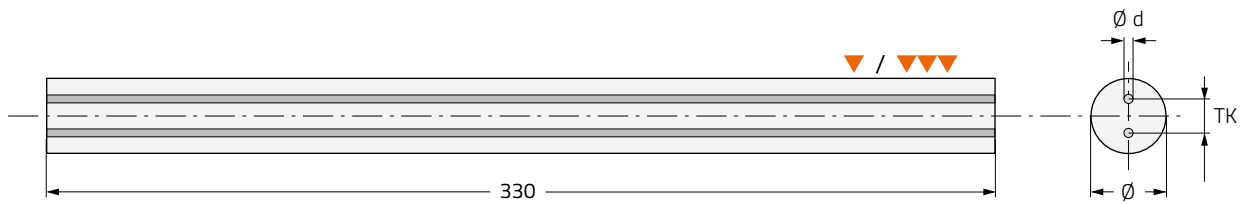
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Other sizes and grades on request.

Coolant hole rods / Double parallel holes / 330 mm

Article group **0130** / Sintered plus grinding stock

Article group **0131** / Ground h6

F06 **K10**
Cobalt 7,5%
Ultrafine
HV30 1770
3600 N/mm²



▽			▽▽▽		
\varnothing mm (sintered)	TK mm	$\varnothing d$ mm	\varnothing mm (ground)	TK mm	$\varnothing d$ mm
$\varnothing 6,3 +0,3$	$1,5 \pm 0,20$	$0,8 \pm 0,15$	$\varnothing 6,0 h6$	$1,5 \pm 0,20$	$0,8 \pm 0,10$
$\varnothing 6,3 +0,3$	$2,2 \pm 0,20$	$1,0 \pm 0,15$	$\varnothing 6,0 h6$	$2,2 \pm 0,30$	$1,0 \pm 0,10$
$\varnothing 8,3 +0,3$	$1,5 \pm 0,20$	$0,8 \pm 0,15$	$\varnothing 8,0 h6$	$1,5 \pm 0,20$	$0,8 \pm 0,10$
$\varnothing 8,3 +0,3$	$2,2 \pm 0,20$	$1,0 \pm 0,15$	$\varnothing 8,0 h6$	$2,2 \pm 0,30$	$1,0 \pm 0,10$
$\varnothing 8,3 +0,3$	$3,5 \pm 0,20$	$1,2 \pm 0,15$	$\varnothing 8,0 h6$	$3,5 \pm 0,30$	$1,2 \pm 0,15$
$\varnothing 10,3 +0,3$	$2,6 \pm 0,30$	$1,0 \pm 0,15$	$\varnothing 10,0 h6$	$2,6 \pm 0,30$	$1,0 \pm 0,15$
$\varnothing 10,3 +0,3$	$3,5 \pm 0,30$	$1,2 \pm 0,15$	$\varnothing 10,0 h6$	$3,5 \pm 0,30$	$1,2 \pm 0,15$
$\varnothing 10,3 +0,3$	$4,3 \pm 0,30$	$1,6 \pm 0,15$	$\varnothing 10,0 h6$	$4,3 \pm 0,40$	$1,6 \pm 0,15$
$\varnothing 12,3 +0,3$	$3,5 \pm 0,30$	$1,2 \pm 0,15$	$\varnothing 12,0 h6$	$3,5 \pm 0,30$	$1,2 \pm 0,15$
$\varnothing 12,3 +0,3$	$5,0 \pm 0,40$	$1,8 \pm 0,15$	$\varnothing 12,0 h6$	$5,0 \pm 0,40$	$1,8 \pm 0,15$
$\varnothing 14,3 +0,3$	$5,0 \pm 0,40$	$2,0 \pm 0,20$	$\varnothing 14,0 h6$	$5,0 \pm 0,50$	$2,0 \pm 0,25$
$\varnothing 16,3 +0,3$	$5,0 \pm 0,40$	$2,0 \pm 0,20$	$\varnothing 16,0 h6$	$5,0 \pm 0,50$	$2,0 \pm 0,25$
$\varnothing 18,3 +0,3$	$6,0 \pm 0,40$	$2,0 \pm 0,25$	$\varnothing 18,0 h6$	$6,0 \pm 0,50$	$2,0 \pm 0,25$
$\varnothing 18,3 +0,3$	$9,15 \pm 0,40$	$2,0 \pm 0,25$	$\varnothing 18,0 h6$	$9,15 \pm 0,50$	$2,0 \pm 0,25$
$\varnothing 20,3 +0,3$	$6,0 \pm 0,50$	$2,0 \pm 0,25$	$\varnothing 20,0 h6$	$6,0 \pm 0,50$	$2,0 \pm 0,25$
$\varnothing 20,3 +0,3$	$10,0 \pm 0,50$	$2,5 \pm 0,25$	$\varnothing 20,0 h6$	$10,0 \pm 0,50$	$2,5 \pm 0,25$
$\varnothing 25,3 +0,3$	$7,5 \pm 0,50$	$2,0 \pm 0,25$	$\varnothing 22,0 h6$	$6,0 \pm 0,50$	$2,0 \pm 0,25$
$\varnothing 25,3 +0,3$	$10,5 \pm 0,50$	$2,8 \pm 0,25$	$\varnothing 24,0 h6$	$7,5 \pm 0,50$	$2,0 \pm 0,25$
			$\varnothing 25,0 h6$	$7,5 \pm 0,50$	$2,0 \pm 0,25$
			$\varnothing 25,0 h6$	$10,5 \pm 0,50$	$2,8 \pm 0,25$
			$\varnothing 26,0 h6$	$10,5 \pm 0,50$	$2,8 \pm 0,30$

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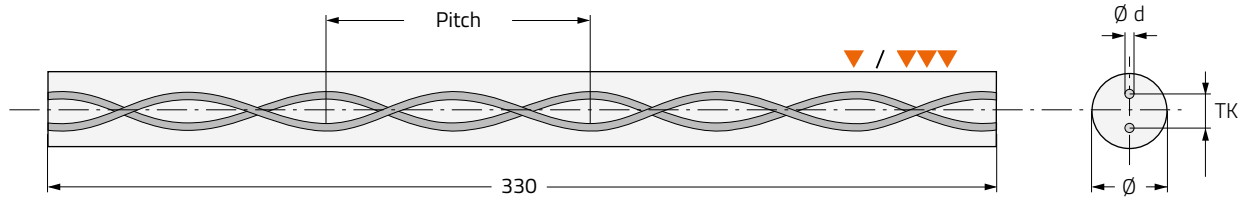


Coolant hole rods / Double helical 30° / 330 mm

Article group **0140** / Sintered plus grinding stock

Article group **0141** / Ground h6

F10 **H30**
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²



▽ Ø mm (sintered)	▽▽▽ Ø mm (ground)	TK mm	Ø d mm	Pitch mm
Ø 3,3 +0,6	Ø 3,0 h6	1,6 ±0,15	0,4 ±0,10	16,32 -0,64/+0,21
Ø 4,3 +0,6	Ø 4,0 h6	1,6 ±0,15	0,4 ±0,15	21,77 -0,85/+0,29
Ø 5,3 +0,6	Ø 5,0 h6	2,4 ±0,20	0,7 ±0,15	27,21 -1,06/+0,37
Ø 6,3 +1,0	Ø 6,0 h6	1,8 ±0,20	0,5 ±0,15	32,65 -1,28/+0,43
Ø 6,3 +1,0	Ø 6,0 h6	2,4 ±0,20	0,7 ±0,15	32,65 -1,28/+0,43
Ø 8,3 +1,0	Ø 8,0 h6	2,8 ±0,20	0,6 ±0,15	43,53 -1,70/+0,57
Ø 8,3 +1,0	Ø 8,0 h6	3,8 ±0,20	1,0 ±0,15	43,53 -1,70/+0,57
Ø 10,3 +1,0	Ø 10,0 h6	4,5 ±0,30	1,4 ±0,15	54,41 -2,13/+0,71
Ø 12,3 +1,1	Ø 12,0 h6	5,85 ±0,40	1,4 ±0,15	65,30 -2,55/+0,85
Ø 14,3 +1,1	Ø 14,0 h6	6,7 ±0,40	1,75 ±0,20	76,18 -2,98/+1,00
Ø 16,3 +1,3	Ø 16,0 h6	7,9 ±0,40	1,75 ±0,25	87,06 -3,40/+1,14
Ø 18,3 +1,4	Ø 18,0 h6	9,15 ±0,40	2,0 ±0,25	97,95 -3,83/+1,28
Ø 20,3 +1,4	Ø 20,0 h6	9,9 ±0,50	2,0 ±0,25	108,83 -4,25/+1,42
Ø 25,3 +1,4	Ø 25,0 h6	12,8 ±0,50	2,0 ±0,25	136,03 -5,32/+1,78
Ø 28,3 +1,6	Ø 28,0 h6	14,1 ±0,50	2,5 ±0,25	152,36 -5,96/+2,05
Ø 30,3 +1,6	Ø 30,0 h6	14,5 ±0,50	2,5 ±0,25	163,24 -6,39/+2,19
Ø 32,3 +1,6	Ø 32,0 h6	16,6 ±0,50	2,5 ±0,25	174,12 -6,81/+2,34



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Other sizes and grades on request.

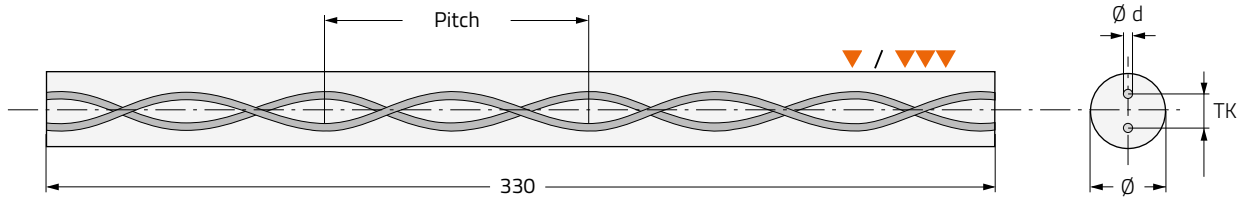


Coolant hole rods / Double helical 40° / 330 mm

Article group **0160** / Sintered plus grinding stock

Article group **0161** / Ground h6

F10 **K30**
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²



▽ Ø mm (sintered)	▽▽▽ Ø mm (ground)	TK mm	Ø d mm	Pitch mm
Ø 6,3 +1,0	Ø 6,0 h6	2,0 ±0,20	0,5 ±0,15	22,46 -0,78/+0,26
Ø 8,3 +1,0	Ø 8,0 h6	2,4 ±0,20	0,65 ±0,15	29,95 -1,04/+0,34
Ø 10,3 +1,0	Ø 10,0 h6	3,2 ±0,30	1,0 ±0,15	37,44 -1,30/+0,43
Ø 12,3 +1,1	Ø 12,0 h6	3,8 ±0,40	1,2 ±0,15	44,92 -1,56/+0,51
Ø 14,3 +1,1	Ø 14,0 h6	4,3 ±0,40	1,2 ±0,20	52,41 -1,82/+0,60
Ø 16,3 +1,3	Ø 16,0 h6	5,1 ±0,40	1,2 ±0,20	59,90 -2,08/+0,69
Ø 18,3 +1,4	Ø 18,0 h6	5,9 ±0,40	1,4 ±0,25	67,39 -2,34/+0,77
Ø 20,3 +1,4	Ø 20,0 h6	6,6 ±0,50	1,5 ±0,25	74,88 -2,60/+0,86
Ø 25,3 +1,4	Ø 25,0 h6	7,6 ±0,50	1,75 ±0,25	93,60 -3,25/+1,07



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Other sizes and grades on request.

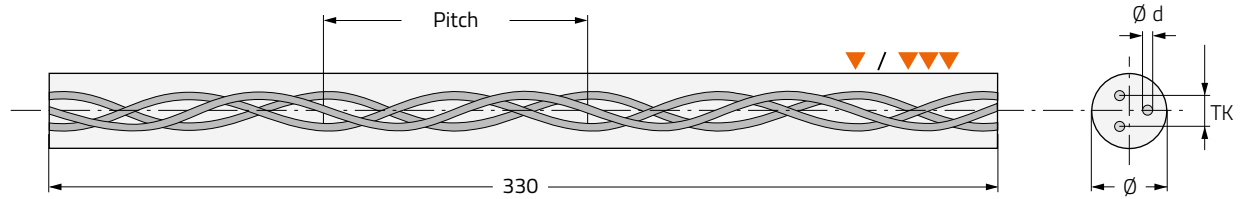


Coolant hole rods / Triple helical 30° / 330 mm

Article group **0150** / Sintered plus grinding stock

Article group **0151** / Ground h6

F10 **K30**
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²



▽ Ø mm (sintered)	▽▽▽ Ø mm (ground)	TK mm	Ø d mm	Pitch mm
Ø 6,3 +1,0	Ø 6,0 h6	3,0 ±0,20	0,6 ±0,15	32,65 -1,28/+0,43
Ø 8,3 +1,0	Ø 8,0 h6	4,0 ±0,20	0,7 ±0,15	43,53 -1,70/+0,57
Ø 10,3 +1,0	Ø 10,0 h6	4,9 ±0,30	1,0 ±0,15	54,41 -2,13/+0,71
Ø 12,3 +1,1	Ø 12,0 h6	6,0 ±0,40	1,1 ±0,15	65,30 -2,55/+0,85
Ø 14,3 +1,1	Ø 14,0 h6	7,1 ±0,40	1,3 ±0,20	76,18 -2,98/+1,00
Ø 16,3 +1,3	Ø 16,0 h6	8,3 ±0,40	1,5 ±0,20	87,06 -3,40/+1,14
Ø 18,3 +1,4	Ø 18,0 h6	9,7 ±0,40	1,7 ±0,25	97,95 -3,83/+1,28
Ø 20,3 +1,4	Ø 20,0 h6	10,4 ±0,50	2,0 ±0,25	108,83 -5,32/+1,78
Ø 25,3 +1,4	Ø 25,0 h6	12,5 ±0,50	2,0 ±0,25	136,03 -5,32/+1,78

Coolant hole rods / Triple helical 40° / 330 mm

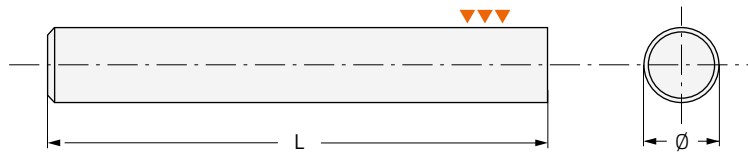
Article group **0161** / Ground h6

F10 **K30**
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²

▽▽▽ Ø mm (ground)	TK mm	Ø d mm	Pitch mm
Ø 6,0 h6	2,3 ±0,20	0,5 ±0,15	22,46-0,78/+0,26
Ø 8,0 h6	2,7 ±0,20	0,5 ±0,15	29,95 1,04/+0,34
Ø 10,0 h6	4,0 ±0,30	1,0 ±0,15	37,44 1,30/+0,43
Ø 12,0 h6	4,0 ±0,40	1,0 ±0,15	44,92 1,56/+0,51
Ø 14,0 h6	6,0 ±0,40	1,1 ±0,20	52,41 1,82/+0,60
Ø 16,0 h6	7,1 ±0,40	1,4 ±0,20	59,90-2,08/+0,69
Ø 18,0 h6	9,7 ±0,40	1,75 ±0,25	67,39-2,34/+0,77
Ø 20,0 h6	10,4 ±0,50	2,0 ±0,25	74,88-2,60/+0,86
Ø 25,0 h6	12,5 ±0,50	2,0 ±0,25	93,60-3,25/+1,07
Ø 28,0 h6	12,5 ±0,50	2,5 ±0,25	152,36-5,96/+2,05
Ø 30,0 h6	12,5 ±0,50	2,5 ±0,25	163,24-6,39/+2,19

i Delivery from stock; Subject to prior sale!
Other sizes and grades on request.





Ø mm	L +0,8 / +0,5 mm	Chamfer ± 0,1 mm	Ø mm	L +0,8 / +0,5 mm	Chamfer ± 0,1 mm
Ø 2,0 h6	33	0,2 x 45°	Ø 8,0 h6	63	0,8 x 45°
Ø 3,0 h6	32	0,3 x 45°	Ø 8,0 h6	68	0,8 x 45°
Ø 3,0 h6	39,5	0,3 x 45°	Ø 8,0 h6	70	0,8 x 45°
Ø 3,0 h6	50	0,3 x 45°	Ø 8,0 h6	75	0,8 x 45°
Ø 3,0 h6	55	0,3 x 45°	Ø 8,0 h6	80	0,8 x 45°
Ø 3,0 h6	60	0,3 x 45°	Ø 8,0 h6	100	0,8 x 45°
Ø 3,0 h6	100	0,3 x 45°	Ø 10,0 h6	60	1,0 x 45°
Ø 4,0 h6	40	0,4 x 45°	Ø 10,0 h6	66	1,0 x 45°
Ø 4,0 h6	50	0,4 x 45°	Ø 10,0 h6	70	1,0 x 45°
Ø 4,0 h6	54	0,4 x 45°	Ø 10,0 h6	72	1,0 x 45°
Ø 5,0 h6	50	0,5 x 45°	Ø 10,0 h6	90	1,0 x 45°
Ø 5,0 h6	60	0,5 x 45°	Ø 10,0 h6	100	1,0 x 45°
Ø 6,0 h6	38	0,6 x 45°	Ø 10,0 h6	110	1,0 x 45°
Ø 6,0 h6	40	0,6 x 45°	Ø 10,0 h6	120	1,0 x 45°
Ø 6,0 h6	50	0,6 x 45°	Ø 10,0 h6	150	1,0 x 45°
Ø 6,0 h6	54	0,6 x 45°	Ø 12,0 h6	55	1,0 x 45°
Ø 6,0 h6	57	0,6 x 45°	Ø 12,0 h6	58	1,0 x 45°
Ø 6,0 h6	60	0,6 x 45°	Ø 12,0 h6	70	1,0 x 45°
Ø 6,0 h6	63	0,6 x 45°	Ø 12,0 h6	73	1,0 x 45°
Ø 6,0 h6	68	0,6 x 45°	Ø 12,0 h6	83	1,0 x 45°
Ø 6,0 h6	75	0,6 x 45°	Ø 12,0 h6	90	1,0 x 45°
Ø 6,0 h6	80	0,6 x 45°	Ø 12,0 h6	93	1,0 x 45°
Ø 6,0 h6	100	0,6 x 45°	Ø 12,0 h6	100	1,0 x 45°
Ø 8,0 h6	43	0,8 x 45°	Ø 12,0 h6	110	1,0 x 45°
Ø 8,0 h6	58	0,8 x 45°	Ø 12,0 h6	120	1,0 x 45°
Ø 8,0 h6	60	0,8 x 45°	Ø 12,0 h6	150	1,0 x 45°

i Delivery from stock; Subject to prior sale!
Other sizes and grades on request.



Fixlengths / Solid / Ground h6
 Article group **0113** / One side chamfered

F10 K30
 Cobalt 10%
 Submicron
 HV30 1580
 3800 N/mm²



Ø mm	L +0,8 / +0,5 mm	Chamfer ± 0,1 mm
Ø 14,0 h6	58	1,0 x 45°
Ø 14,0 h6	75	1,0 x 45°
Ø 14,0 h6	83	1,0 x 45°
Ø 14,0 h6	100	1,0 x 45°
Ø 16,0 h6	82	1,0 x 45°
Ø 16,0 h6	92	1,0 x 45°
Ø 16,0 h6	100	1,0 x 45°
Ø 16,0 h6	108	1,0 x 45°
Ø 16,0 h6	114	1,0 x 45°
Ø 16,0 h6	120	1,0 x 45°
Ø 16,0 h6	123	1,0 x 45°
Ø 16,0 h6	150	1,0 x 45°
Ø 18,0 h6	84	1,5 x 45°
Ø 18,0 h6	92	1,5 x 45°
Ø 18,0 h6	100	1,5 x 45°
Ø 20,0 h6	75	1,5 x 45°
Ø 20,0 h6	92	1,5 x 45°
Ø 20,0 h6	100	1,5 x 45°
Ø 20,0 h6	104	1,5 x 45°
Ø 20,0 h6	110	1,5 x 45°
Ø 20,0 h6	115	1,5 x 45°
Ø 20,0 h6	120	1,5 x 45°
Ø 20,0 h6	126	1,5 x 45°
Ø 20,0 h6	135	1,5 x 45°
Ø 20,0 h6	141	1,5 x 45°
Ø 20,0 h6	150	1,5 x 45°

Ø mm	L +0,8 / +0,5 mm	Chamfer ± 0,1 mm
Ø 25,0 h6	100	1,5 x 45°
Ø 25,0 h6	121	1,5 x 45°
Ø 25,0 h6	125	1,5 x 45°
Ø 25,0 h6	150	1,5 x 45°
Ø 32,0 h6	110	2,0 x 45°
Ø 32,0 h6	151	2,0 x 45°

i Delivery from stock; Subject to prior sale!
 Other sizes and grades on request.



Fixlengths / One side chamfered / Ground h6
Article group 0113 / With Weldon shank DIN 6535 HB

F10 **K30**
 Cobalt 10%
 Submicron
 HV30 1580
 3800 N/mm²



Ø mm	L +0,5 / +0,8 mm	Chamfer ± 0,1 mm
Ø 6,0 h6	54	0,6 x 45°
Ø 6,0 h6	57	0,6 x 45°
Ø 8,0 h6	58	0,8 x 45°
Ø 8,0 h6	63	0,8 x 45°
Ø 10,0 h6	66	1,0 x 45°
Ø 10,0 h6	72	1,0 x 45°
Ø 12,0 h6	73	1,0 x 45°
Ø 12,0 h6	83	1,0 x 45°
Ø 14,0 h6	75	1,0 x 45°
Ø 14,0 h6	83	1,0 x 45°
Ø 16,0 h6	82	1,0 x 45°
Ø 16,0 h6	93	1,0 x 45°
Ø 18,0 h6	84	1,5 x 45°
Ø 18,0 h6	92	1,5 x 45°
Ø 20,0 h6	92	1,5 x 45°
Ø 20,0 h6	104	1,5 x 45°

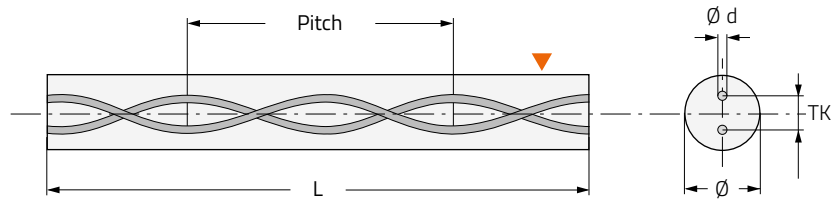
i Delivery from stock; Subject to prior sale!
 Other sizes and grades on request.



Fixlengths / Double helical 30°

Article group **0142** / Sintered plus grinding stock

F10 **K30**
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²



Ø mm (sintered)	L +0,8 / +0,5 mm	TK mm	Ø d mm	Pitch mm
Ø 6,3 +1,0	67	2,4 ±0,2	Ø0,7 ±0,15	32,65 -1,28/+0,43
Ø 6,3 +1,0	82	2,4 ±0,2	Ø0,7 ±0,15	32,65 -1,28/+0,43
Ø 8,3 +1,0	80	3,8 ±0,2	Ø1,0 ±0,15	43,53 -1,70/+0,57
Ø 8,3 +1,0	92	3,8 ±0,2	Ø1,0 ±0,15	43,53 -1,70/+0,57
Ø 10,3 +1,0	90	4,5 ±0,3	Ø1,4 ±0,15	54,41 -2,13/+0,71
Ø 10,3 +1,0	104	4,5 ±0,3	Ø1,4 ±0,15	54,41 -2,13/+0,71
Ø 12,3 +1,1	103	5,85 ±0,4	Ø1,4 ±0,20	65,30 -2,55/+0,85
Ø 12,3 +1,1	119	5,85 ±0,4	Ø1,4 ±0,20	65,30 -2,55/+0,85
Ø 14,3 +1,1	109	6,7 ±0,4	Ø2,0 ±0,20	76,18 -2,98/+1,00
Ø 14,3 +1,1	125	6,7 ±0,4	Ø2,0 ±0,20	76,18 -2,98/+1,00
Ø 16,3 +1,3	134	7,9 ±0,40	Ø2,0 ±0,25	87,06 -3,40/+1,14
Ø 16,3 +1,3	300	7,9 ±0,40	Ø2,0 ±0,25	87,06 -3,40/+1,14
Ø 18,3 +1,4	124	9,15 ±0,4	Ø2,5 ±0,25	97,95 -3,83/+1,28
Ø 18,3 +1,4	144	9,15 ±0,4	Ø2,5 ±0,25	97,95 -3,83/+1,28
Ø 20,3 +1,4	132	9,9 ±0,5	Ø2,5 ±0,25	108,83 -4,25/+1,42
Ø 20,3 +1,4	154	9,9 ±0,5	Ø2,5 ±0,25	108,83 -4,25/+1,42

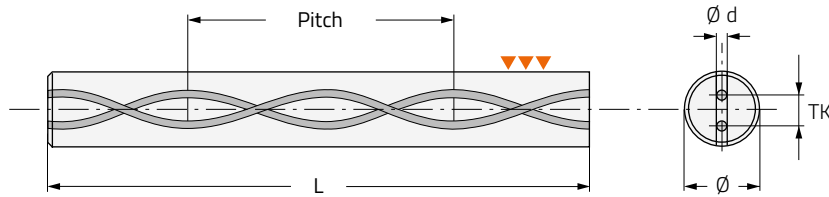
i No stock standard!
Delivery on request only!




Fixlengths / Double helical 30° / One side chamfered / Connection slot

Article group **0143** / Ground h6 / 30°

F10 K30
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²



Ø mm (ground)	L +0,5 / +0,8 mm	TK mm	Ø d mm	Pitch mm
Ø 6,0 h6	67	1,7 ±0,2	Ø 0,55 ±0,15	23,00 -0,80/+0,27 (40°)
Ø 6,0 h6	67	2,4 ±0,2	Ø 0,7 ±0,15	32,65 -1,28/+0,43
Ø 6,0 h6	75	2,4 ±0,2	Ø 0,7 ±0,15	29,00 -1,08/+0,37 (33°)
Ø 6,0 h6	82	2,4 ±0,2	Ø 0,7 ±0,15	32,65 -1,28/+0,43
Ø 6,0 h6	115	2,4 ±0,2	Ø 0,7 ±0,15	32,65 -1,28/+0,43
Ø 8,0 h6	80	3,8 ±0,2	Ø 1,0 ±0,15	43,53 -1,70/+0,57
Ø 8,0 h6	92	3,8 ±0,2	Ø 1,0 ±0,15	43,53 -1,70/+0,57
Ø 10,0 h6	90	4,5 ±0,3	Ø 1,4 ±0,15	54,41 -2,13/+0,71
Ø 10,0 h6	104	4,5 ±0,3	Ø 1,4 ±0,15	54,41 -2,13/+0,71
Ø 12,0 h6	103	5,85 ±0,4	Ø 1,4 ±0,20	65,30 -2,55/+0,85
Ø 12,0 h6	119	5,85 ±0,4	Ø 1,4 ±0,20	65,30 -2,55/+0,85
Ø 14,0 h6	109	6,7 ±0,4	Ø 1,75 ±0,20	76,18 -2,98/+1,00
Ø 14,0 h6	125	6,7 ±0,4	Ø 1,75 ±0,20	76,18 -2,98/+1,00
Ø 16,0 h6	116	7,9 ±0,40	Ø 2,0 ±0,25	87,06 -3,40/+1,14
Ø 16,0 h6	134	7,9 ±0,40	Ø 2,0 ±0,25	87,06 -3,40/+1,14
Ø 18,0 h6	124	9,15 ±0,4	Ø 2,5 ±0,25	97,95 -3,83/+1,28
Ø 18,0 h6	144	9,15 ±0,4	Ø 2,5 ±0,25	97,95 -3,83/+1,28
Ø 20,0 h6	132	9,9 ±0,5	Ø 2,5 ±0,25	108,83 -4,25/+1,42
Ø 20,0 h6	154	9,9 ±0,5	Ø 2,5 ±0,25	108,83 -4,25/+1,42

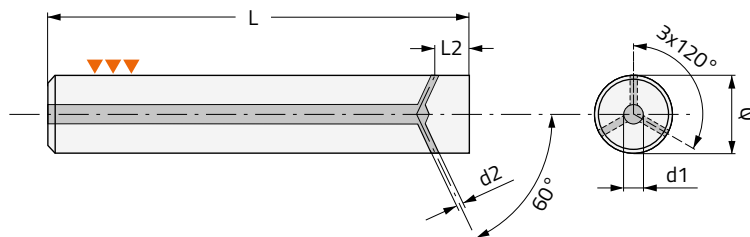
 Delivery from stock; Subject to prior sale!
Other sizes and grades on request.



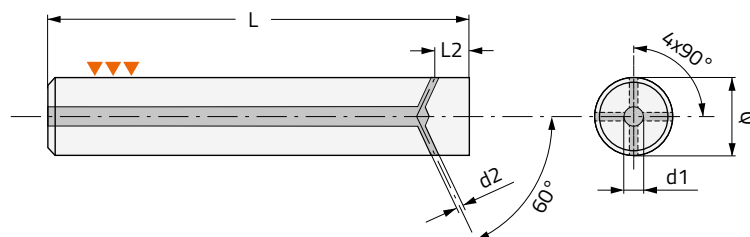
Fixlengths / Radial Y-exit / 60° / Ground h6

Article group **0314** / 3 and 4 Y-exits

F10 K30
Cobalt 10%
Submicron
HV30 1580
3800 N/mm²



Ø mm (ground)	L mm	d1 mm	d2 mm	L2 mm
6,0 h6	58	1,75	1,0	3
8,0 h6	64	1,75	1,2	4
10,0 h6	73	2,0	1,2	5
12,0 h6	84	2,0	1,5	6
14,0 h6	84	2,0	1,5	7
16,0 h6	93	4,0	1,5	8
18,0 h6	93	4,0	2,0	9
20,0 h6	105	4,0	2,0	10
25,0 h6	122	4,0	2,0	12



Ø mm (ground)	L mm	d1 mm	d2 mm	L2 mm
6,0 h6	58	1,75	1,0	3
8,0 h6	64	1,75	1,2	4
10,0 h6	73	2,0	1,2	5
12,0 h6	84	2,0	1,5	6
14,0 h6	84	2,0	1,5	7
16,0 h6	93	4,0	1,5	8
18,0 h6	93	4,0	2,0	9
20,0 h6	105	4,0	2,0	10
25,0 h6	122	4,0	2,0	12



Other sizes, grades and additional Weldon shank on request.



Preforms

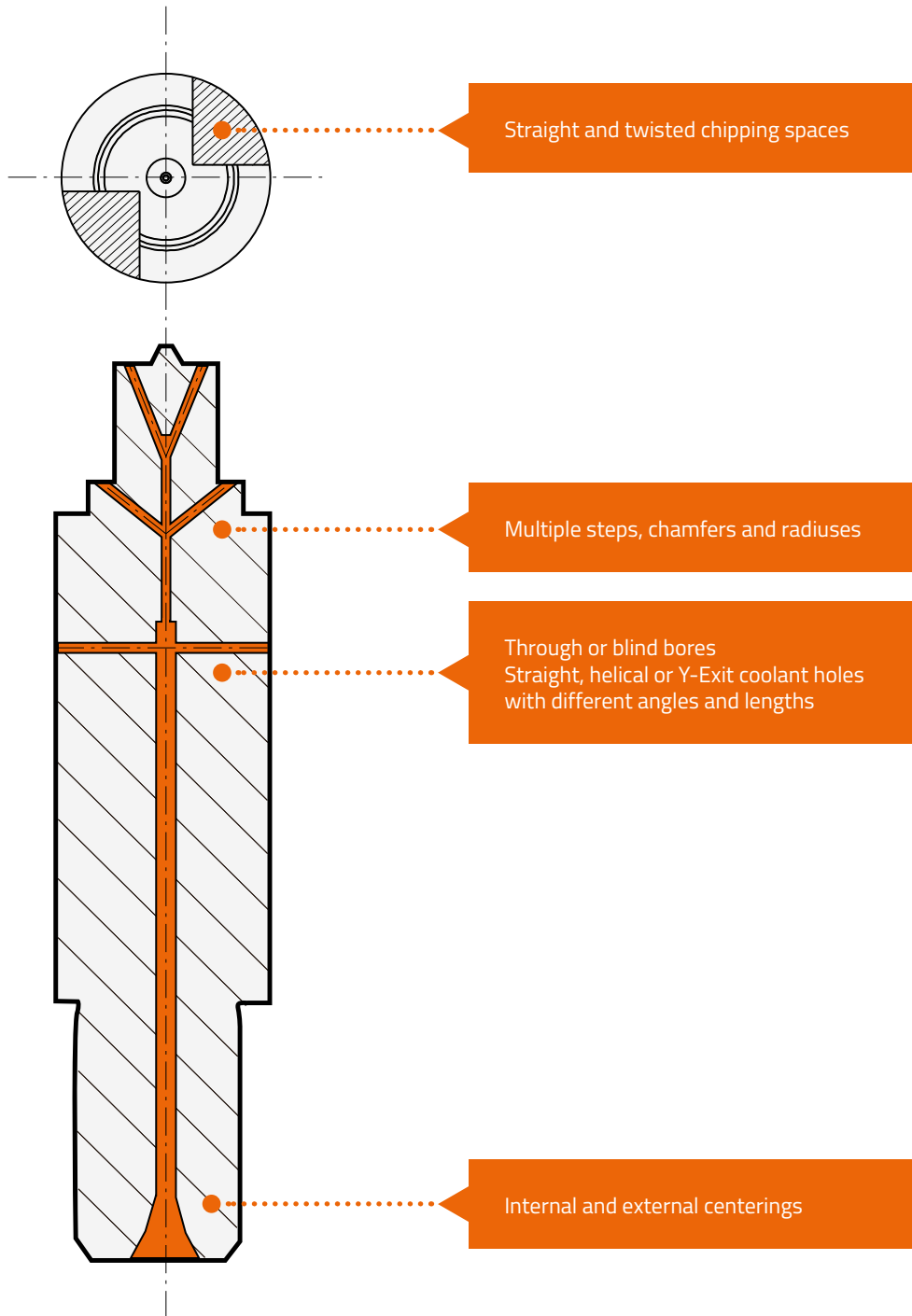
Article group **0320** / Sintered plus grinding stock

Article group **0321** / Ground h6

F06	K10	F10	K30	U12	K40
Cobalt	7.5%	Cobalt	10%	Cobalt	12%
Ultrafine		Submicron		Ultrafine	
HV30	1770	HV30	1580	HV30	1640
3600 N/mm ²		3800 N/mm ²		3800 N/mm ²	

For reduction of grinding time and production costs PCG GmbH offers a comprehensive selection of near-net shape preforms.

Based on our manufacturing process we are able to supply complex geometries corresponding to the customer's specifications.

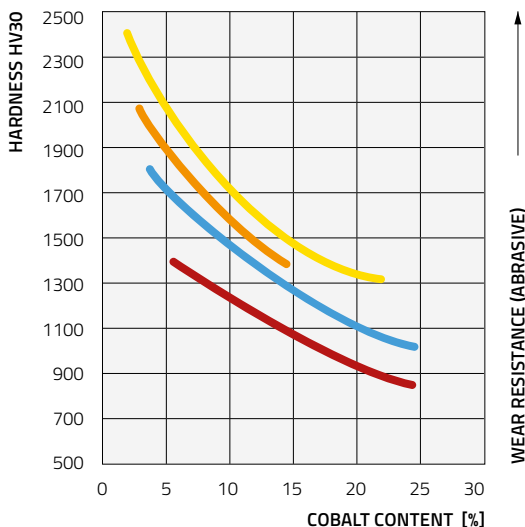


i Other grades on request.



Technical information

Mechanical properties

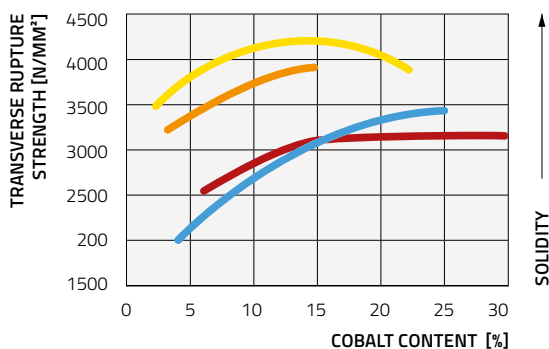


Hardness [HV / HRA]

The hardness of cemented carbide is a very important characteristic. It is determined by the chemical consistence and the grain size of the hard components. Tungsten carbide (WC) as hard component and Cobalt (Co) as ductile auxiliary metal are preferably used. The hardness values of cemented carbide are measured by the methods of Vickers (HV30) or Rockwell (HRA), according to ISO 3738. The hardness is often used as reference of the wear resistance.

- Ultrafine
- Submicron
- Fine / Medium
- Coarse

Figure: Hardness as function of Co content and WC grain size

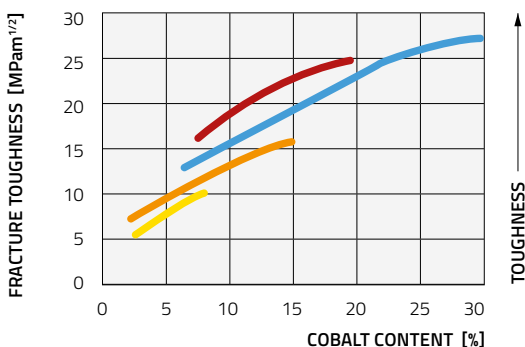


Transverse Rupture Strength [N/mm²]

The T.R.S. testing is a method for identification of the solidity of cemented carbide. The test pieces with defined length are deposited on two prism and get certain stress in the middle up to crack. The examination of the T.R.S. are realised on precision ground cemented carbide rods contrary to the general test method.

- Ultrafine
- Submicron
- Fine / Medium
- Coarse

Figure: T.R.S. as function of Co content and WC grain size



Fracture toughness [MPam^{1/2}]

The fracture toughness of cemented carbide is defined as resistance of materials against crack growth. This material parameter is the critical stress intensity factor K_{IC} . This factor selects the start of the unstable crack growth. The fracture toughness, also referred as to crack resistance, is an important value of the toughness of hard metal.

- Ultrafine
- Submicron
- Fine / Medium
- Coarse

Figure: Fracture toughness as function of Co content and WC grain size



Technical information

Definitions and explanations

Straightness

The tolerance range of the straightness is limited by two parallel straight lines with constant distance in the measuring plane (ISO 1101). With cylindrical pieces the surface line is limited by two parallel lines with constant distance. The measurement of the cemented carbide rods is done between two contact points in the middle of test pieces by a dial gauge. The contact points are placed approx 10 mm from each end of the cylinders. The maximum peak (deviation) vertically to the centre line in one direction of rotation is the straightness or deflection.

*Note: TC rods $\varnothing \leq 3\text{mm}$ are measured also in the middle between two contact points but with distance of 100 mm!

Circular Run-Out

The tolerance range of the run-out is limited by two concentric circles with constant distance. Both circles have one combined centre on the centre line of the test piece. The measuring plane is vertical to the reference axis (ISO 1101).

The centre of both circles is fixed to the reference axis during the measurement of the circular run-out. The circular run-out of one rotational element equals the difference of the distances of the surface A_{max} and A_{min} from the reference axis. The measurement of the maximum and minimum distance is done especially for fixlength on special prisms or rolling equipments. During the measurement the cylinder is completely rotated by 360° around its own axis.

The measuring equipment consists of two contact points (A and B). Contact point A is placed approx 5 mm from one end. Contact point B is located in the middle of the fixlength. The measurement of A_{max} and A_{min} is made by dial gauge on one dimension line approx 2 mm from the other end of the fixlength.

Roundness

The tolerance range of the roundness is bordered of two concentric circles with constant distance t . The measuring plane is vertical to the reference axis (ISO 1101).

Unlike to the run-out both concentric circles have not a reference to the reference axis.

Both circles can moved independent from each other on the measuring plane.

The circumference of any cross section of the tolerated cylindrical surface must be between two concentric circles with distance t .

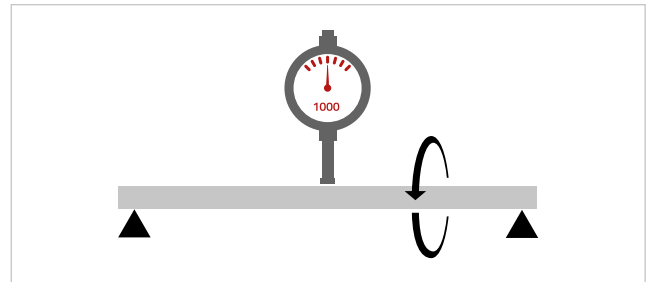


Technical information

Geometrical product specification

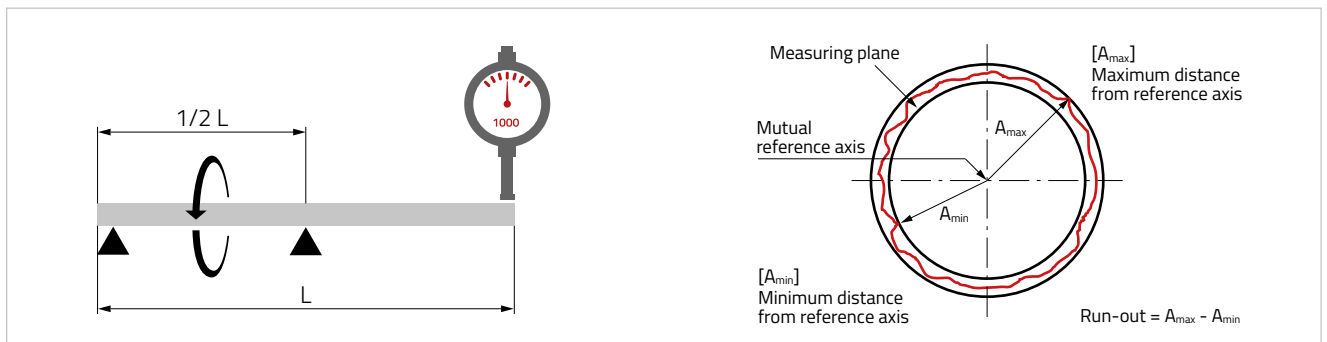
Straightness_{max} of ground rods L= 330 mm

∅ mm	Straightness _{max} (mm)
2,0 - 3,0	0,060*
> 3,0 - 6,0	0,060
> 6,0 - 10,0	0,050
> 10,0 - 16,0	0,045
> 16,0 - 32,0	< 0,045



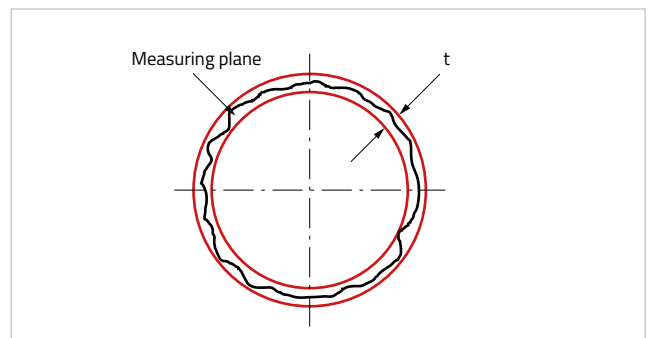
Run-out_{max} of ground fixlengths

∅ mm	L (mm)		
	< 60	> 60 - 100	> 100 - 160
2,0 - 3,0	0,020	0,030	0,050
> 3,0 - 6,0	0,012	0,025	0,030
> 6,0 - 10,0	0,010	0,020	0,025
> 10,0 - 16,0	0,009	0,015	0,020
> 16,0 - 32,0	< 0,009	< 0,015	0,020

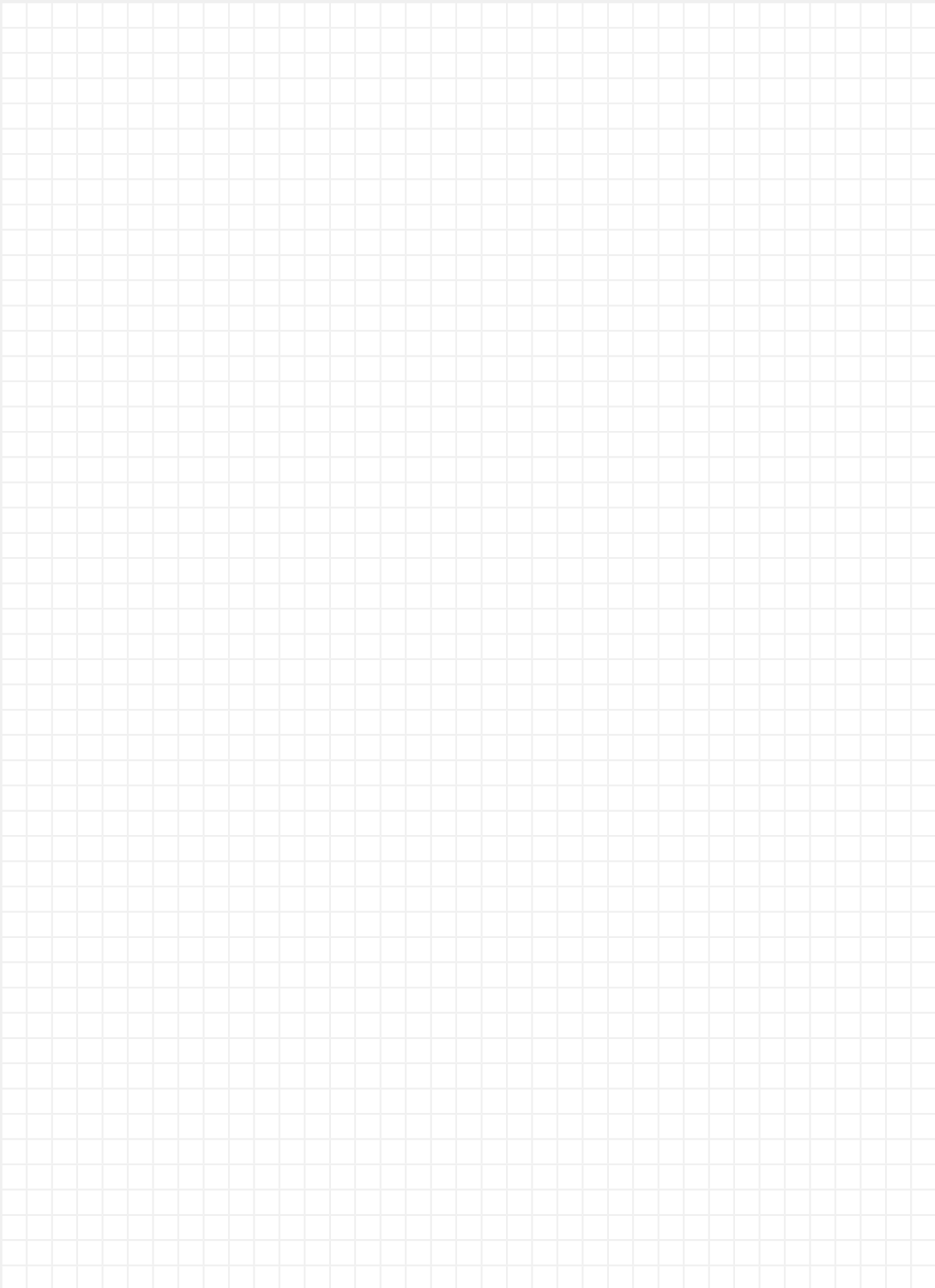


Roundness_{max} of ground rods L = 330 mm

∅ mm	Roundness _{max} (mm)
2,0 - 3,0	0,002
> 3,0 - 6,0	0,002
> 6,0 - 10,0	0,003
> 10,0 - 16,0	0,004
> 16,0 - 32,0	0,005



Your notes





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