

**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 is the distribution 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.

On request, within sale we advise you 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.



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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} ($\text{MPam}^{1/2}$)
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	0,7	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
U09	K01-K05	ultrafine	$\leq 0,6$	9,0	1970	94,1	14,34	3600	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
U09	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	U09
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.

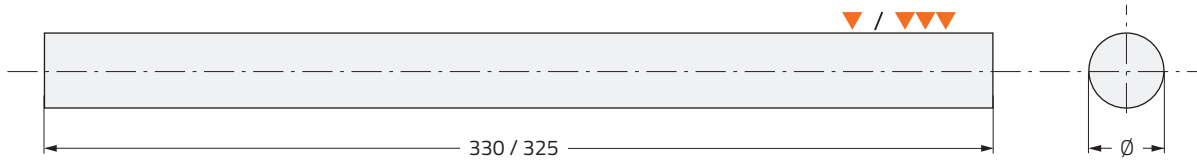


Solid rods / 330 and 325 mm

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

Article group **0111** / Ground h6

F06	K10	F06D	K10	F10	K30	U12	K40
Cobalt	7,5%	Cobalt	6%	Cobalt	10%	Cobalt	12%
Ultrafine		Ultrafine		Submicron		Ultrafine	
HV30	1770	HV30	1840	HV30	1580	HV30	1640
	3600 N/mm ²		3500 N/mm ²		3800 N/mm ²		3800 N/mm ²
325 mm		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		



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

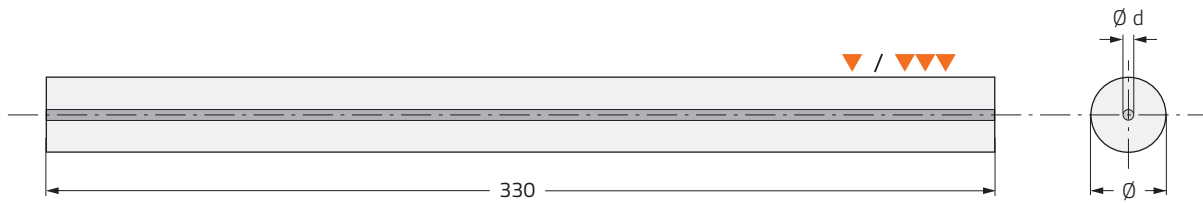


Coolant hole rods / Single central hole / 330 mm

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

Article group **0121** / Ground h6

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



▽ Ø mm (sintered)	▽▽▽ Ø mm (ground)	Ø d mm
Ø 4,2 +0,3	Ø 4,0 h6	1,0 ± 0,10
Ø 6,2 +0,3	Ø 6,0 h6	1,0 ± 0,10
Ø 8,2 +0,3	Ø 8,0 h6	1,5 ± 0,15
Ø 10,2 +0,3	Ø 10,0 h6	2,0 ± 0,25
Ø 12,2 +0,3	Ø 12,0 h6	2,5 ± 0,30
Ø 14,2 +0,3	Ø 14,0 h6	2,8 ± 0,30
Ø 16,2 +0,3	Ø 16,0 h6	4,0 ± 0,30
Ø 18,2 +0,3	Ø 18,0 h6	3,0 ± 0,30
Ø 20,2 +0,3	Ø 20,0 h6	4,0 ± 0,30
Ø 25,2 +0,3	Ø 25,0 h6	4,0 ± 0,30

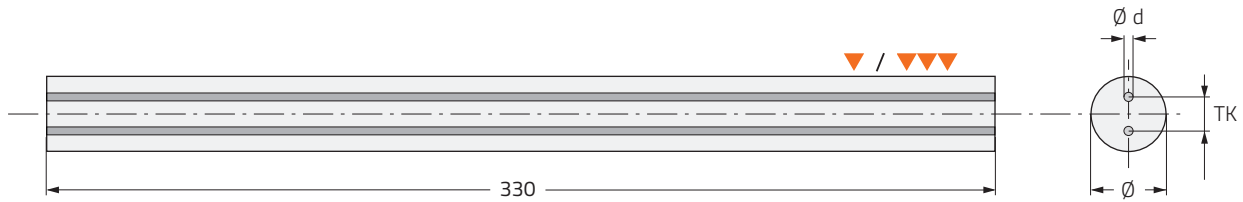
i Delivery from stock; Subject to prior sale!
Other sizes and grades on request.

Coolant hole rods / Double parallel holes / 330 mm

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

Article group **0131** / Ground h6

F06	K10	F06D	K10
Cobalt	7,5%	Cobalt	6%
Ultrafine		Ultrafine	
HV30	1770	HV30	1840
3600 N/mm ²		3500 N/mm ²	



▽			▽▽		
Ø mm (sintered)	TK mm	Ø d mm	Ø mm (ground)	TK mm	Ø d mm
Ø 6,3 +0,3	1,5 ±0,20	0,8 ±0,15	Ø 6,0 h6	1,5 ±0,20	0,8 ±0,10
Ø 6,3 +0,3	2,2 ±0,20	1,0 ±0,15	Ø 6,0 h6	2,2 ±0,30	1,0 ±0,10
Ø 8,3 +0,3	1,5 ±0,20	0,8 ±0,15	Ø 8,0 h6	1,5 ±0,20	0,8 ±0,10
Ø 8,3 +0,3	2,2 ±0,20	1,0 ±0,15	Ø 8,0 h6	2,2 ±0,30	1,0 ±0,10
Ø 8,3 +0,3	3,5 ±0,20	1,2 ±0,15	Ø 8,0 h6	3,5 ±0,30	1,2 ±0,15
Ø 10,3 +0,3	2,6 ±0,30	1,0 ±0,15	Ø 10,0 h6	2,6 ±0,30	1,0 ±0,15
Ø 10,3 +0,3	3,5 ±0,30	1,2 ±0,15	Ø 10,0 h6	3,5 ±0,30	1,2 ±0,15
Ø 10,3 +0,3	4,3 ±0,30	1,6 ±0,15	Ø 10,0 h6	4,3 ±0,40	1,6 ±0,15
Ø 12,3 +0,3	3,5 ±0,30	1,2 ±0,15	Ø 12,0 h6	3,5 ±0,30	1,2 ±0,15
Ø 12,3 +0,3	5,0 ±0,40	1,8 ±0,15	Ø 12,0 h6	5,0 ±0,40	1,8 ±0,15
Ø 14,3 +0,3	5,0 ±0,40	2,0 ±0,20	Ø 14,0 h6	5,0 ±0,50	2,0 ±0,25
Ø 16,3 +0,3	5,0 ±0,40	2,0 ±0,20	Ø 16,0 h6	5,0 ±0,50	2,0 ±0,25
Ø 18,3 +0,3	6,0 ±0,40	2,0 ±0,25	Ø 18,0 h6	6,0 ±0,50	2,0 ±0,25
Ø 18,3 +0,3	9,15 ±0,40	2,0 ±0,25	Ø 20,0 h6	6,0 ±0,50	2,0 ±0,25
Ø 20,3 +0,3	6,0 ±0,50	2,0 ±0,25	Ø 20,0 h6	9,9 ±0,50	1,75 ±0,30
Ø 20,3 +0,3	9,9 ±0,50	2,0 ±0,25	Ø 22,0 h6	6,0 ±0,50	2,0 ±0,25
Ø 20,3 +0,3	10,0 ±0,50	2,5 ±0,25	Ø 24,0 h6	7,5 ±0,50	2,0 ±0,25
Ø 25,3 +0,3	7,5 ±0,50	2,0 ±0,25	Ø 25,0 h6	7,5 ±0,50	2,0 ±0,25
Ø 25,3 +0,3	10,5 ±0,50	2,8 ±0,25	Ø 26,0 h6	10,5 ±0,50	2,8 ±0,30

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

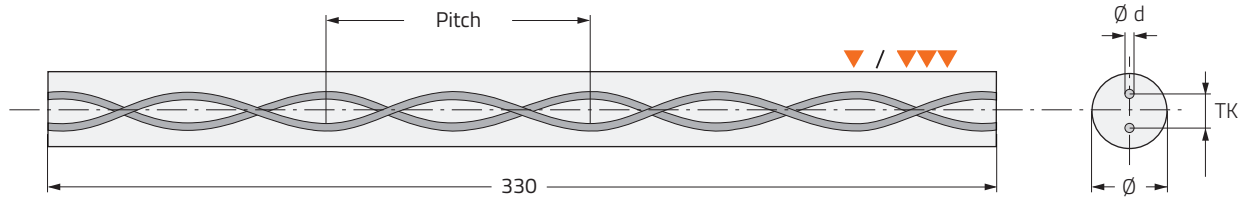


Coolant hole rods / Double helical 30° / 330 mm

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 +0,3	Ø 3,0 h6	1,6 ±0,15	0,4 ±0,10	16,32 -0,64/+0,21
Ø 4,3 +0,3	Ø 4,0 h6	1,6 ±0,15	0,4 ±0,15	21,77 -0,85/+0,29
Ø 5,3 +0,3	Ø 5,0 h6	2,4 ±0,20	0,7 ±0,15	27,21 -1,06/+0,37
Ø 6,3 +0,3	Ø 6,0 h6	1,8 ±0,20	0,5 ±0,15	32,65 -1,28/+0,43
Ø 6,3 +0,3	Ø 6,0 h6	2,4 ±0,20	0,7 ±0,15	32,65 -1,28/+0,43
Ø 8,3 +0,3	Ø 8,0 h6	2,8 ±0,20	0,6 ±0,15	43,53 -1,70/+0,57
Ø 8,3 +0,3	Ø 8,0 h6	3,8 ±0,20	1,0 ±0,15	43,53 -1,70/+0,57
Ø 10,3 +0,3	Ø 10,0 h6	4,5 ±0,30	1,4 ±0,15	54,41 -2,13/+0,71
Ø 12,3 +0,3	Ø 12,0 h6	5,85 ±0,40	1,4 ±0,15	65,30 -2,55/+0,85
Ø 14,3 +0,3	Ø 14,0 h6	6,7 ±0,40	1,75 ±0,20	76,18 -2,98/+1,00
Ø 16,3 +0,3	Ø 16,0 h6	7,9 ±0,40	1,75 ±0,25	87,06 -3,40/+1,14
Ø 18,3 +0,3	Ø 18,0 h6	9,15 ±0,40	2,0 ±0,25	97,95 -3,83/+1,28
Ø 20,3 +0,3	Ø 20,0 h6	9,9 ±0,50	2,0 ±0,25	108,83 -4,25/+1,42
Ø 25,3 +0,3	Ø 25,0 h6	12,8 ±0,50	2,0 ±0,25	136,03 -5,32/+1,78

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

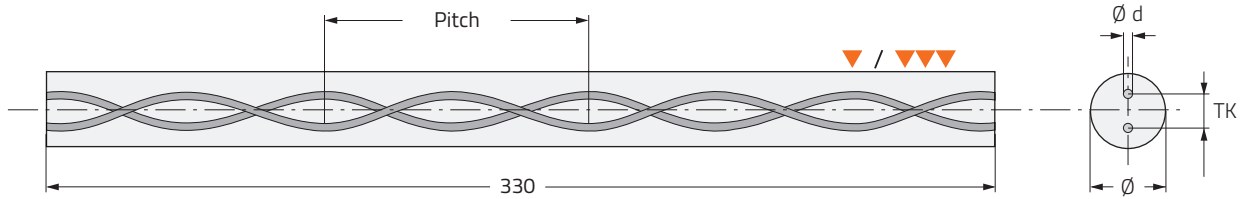


Coolant hole rods / Double helical 40° / 330 mm

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

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

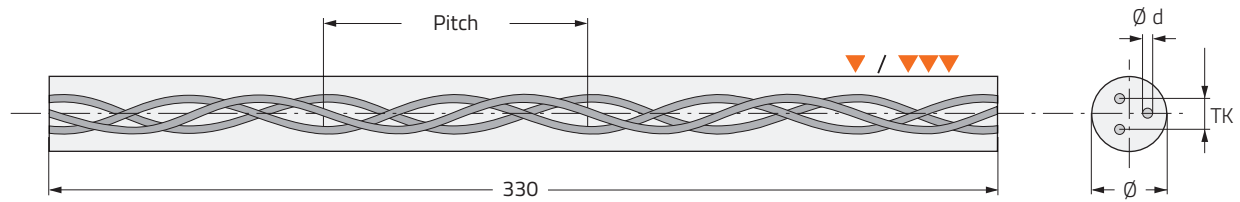


Coolant hole rods / Triple helical 30° / 330 mm

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

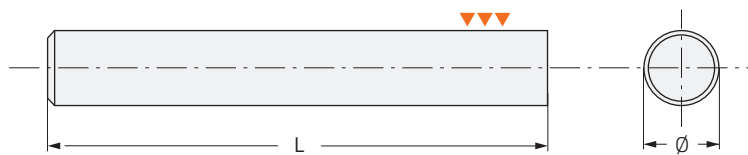
Article group **0151** / Ground h6

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

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

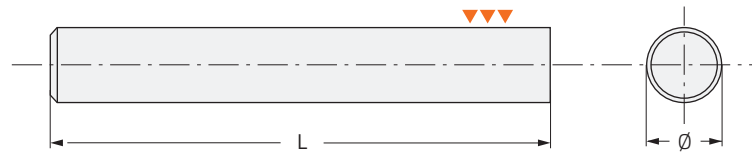


Ø mm	L +0,8 / +0,5 mm	Chamfer ± 0,1 mm	Ø mm	L +0,8 / +0,5 mm	Chamfer ± 0,1 mm
Ø 2,0 h6	33	0,2 x 45°	Ø 8,0 h6	63	0,8 x 45°
Ø 3,0 h6	32	0,3 x 45°	Ø 8,0 h6	68	0,8 x 45°
Ø 3,0 h6	39	0,3 x 45°	Ø 8,0 h6	70	0,8 x 45°
Ø 3,0 h6	50	0,3 x 45°	Ø 8,0 h6	75	0,8 x 45°
Ø 3,0 h6	55	0,3 x 45°	Ø 8,0 h6	80	0,8 x 45°
Ø 3,0 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 mm	L +0,8 / +0,5 mm	Chamfer ± 0,1 mm
Ø 14,0 h6	58	1,0 x 45°	Ø 25,0 h6	100	1,5 x 45°
Ø 14,0 h6	75	1,0 x 45°	Ø 25,0 h6	121	1,5 x 45°
Ø 14,0 h6	83	1,0 x 45°	Ø 25,0 h6	125	1,5 x 45°
Ø 14,0 h6	100	1,0 x 45°	Ø 25,0 h6	150	1,5 x 45°
Ø 16,0 h6	82	1,0 x 45°	Ø 32,0 h6	110	2,0 x 45°
Ø 16,0 h6	92	1,0 x 45°	Ø 32,0 h6	151	2,0 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°			

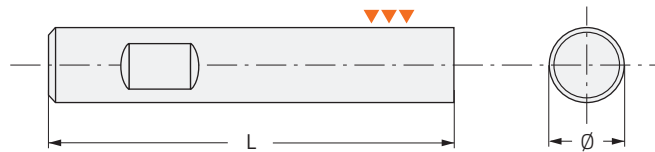
i Delivery from stock; Subject to prior sale!
 Other sizes and grades on request.




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	92	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°

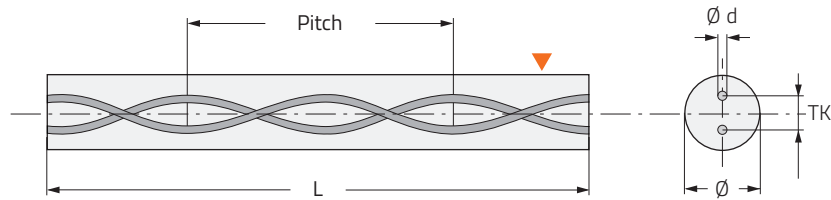
 Delivery from stock; Subject to prior sale!
Other sizes and grades on request.



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

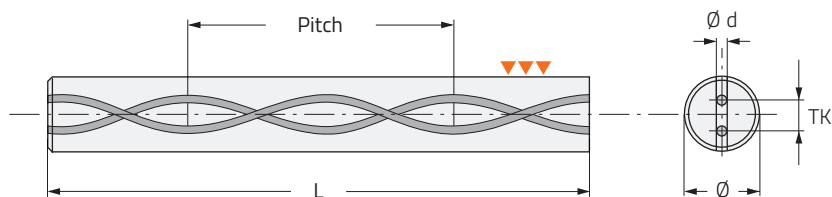
i Delivery from stock; Subject to prior sale!
Other sizes and grades on request.



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	95	2,4 ±0,2	Ø 0,7 ±0,15	32,65 -1,28/+0,43
Ø 6,0 h6	116	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 8,0 h6	114	3,8 ±0,2	Ø 1,0 ±0,15	43,53 -1,70/+0,57
Ø 8,0 h6	146	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 10,0 h6	142	4,5 ±0,3	Ø 1,4 ±0,15	54,41 -2,13/+0,71
Ø 10,0 h6	162	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 12,0 h6	162	5,85 ±0,4	Ø 1,4 ±0,20	65,30 -2,55/+0,85
Ø 12,0 h6	204	5,85 ±0,4	Ø 1,4 ±0,20	65,30 -2,55/+0,85
Ø 14,0 h6	108	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 14,0 h6	178	6,7 ±0,4	Ø 1,75 ±0,20	76,18 -2,98/+1,00
Ø 14,0 h6	230	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 16,0 h6	203	7,9 ±0,40	Ø 2,0 ±0,25	87,06 -3,40/+1,14
Ø 16,0 h6	260	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 18,0 h6	222	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
Ø 20,0 h6	243	9,9 ±0,5	Ø 2,5 ±0,25	108,83 -4,25/+1,42



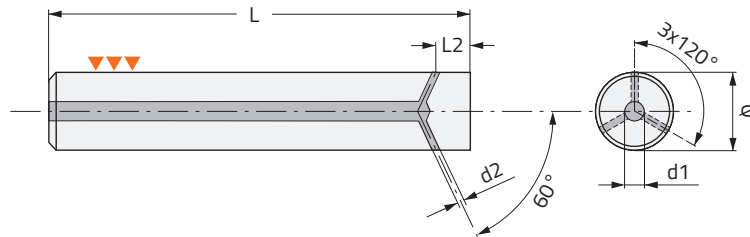
Delivery from stock; Subject to prior sale!
Other sizes and grades on request.



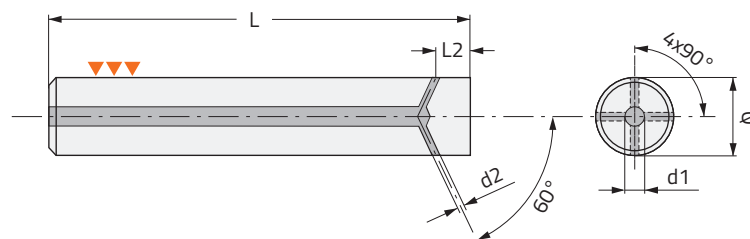
Fixlengths / Radial Y-exit / 60° / Ground h6

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	152	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	152	4,0	2,0	12



Other sizes, grades and additional Weldon shank on request.



Preforms

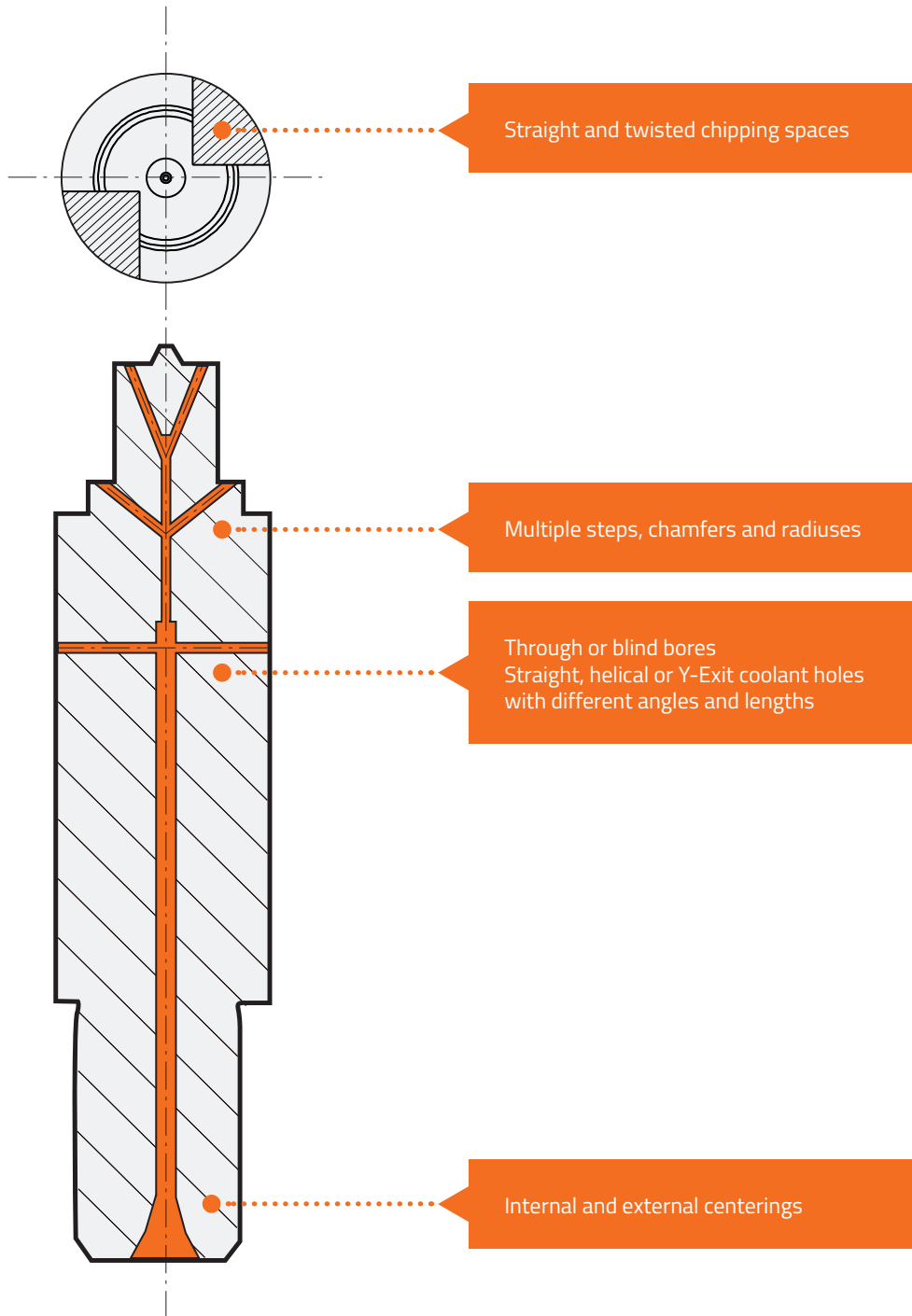
Article group **0320** / Sintered plus grinding stock

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.

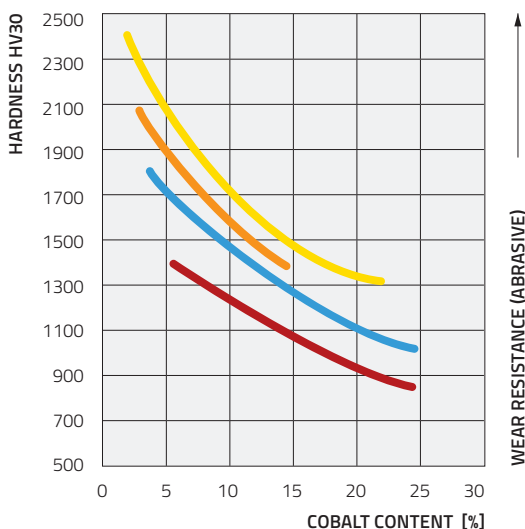


i Other grades on request.



Technical information

Mechanical properties

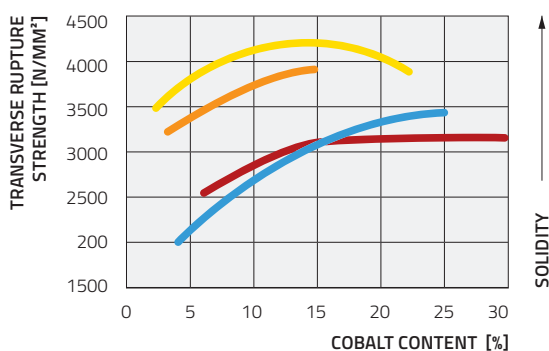


Hardness [HV / HRA]

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

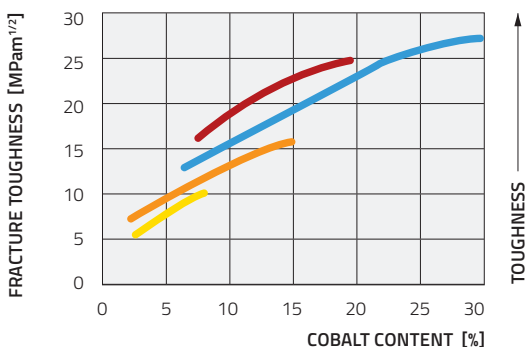


Transverse Rupture Strength [N/mm²]

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 limited by two concentric circles with constant distance. The measuring plane is vertical to the reference axis (ISO 1101).

Unlike to the run-out both concentric circles do not have a reference to the reference axis. Both circles can be moved independently from each other to find the minimum distance A_{min} on the measuring plane. A simplified measuring equipment similar to the measurement of the straightness is used for the roundness too. Unlike to the measurement of the straightness the measurement of the minimum distance A_{min} is done directly on one contact point. The test piece is completely rotated by 360° around its own axis. The value of the roundness is always significantly lower as the run-out.

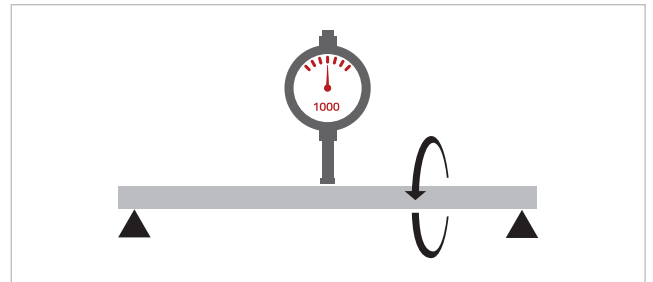


Technical information

Geometrical product specification

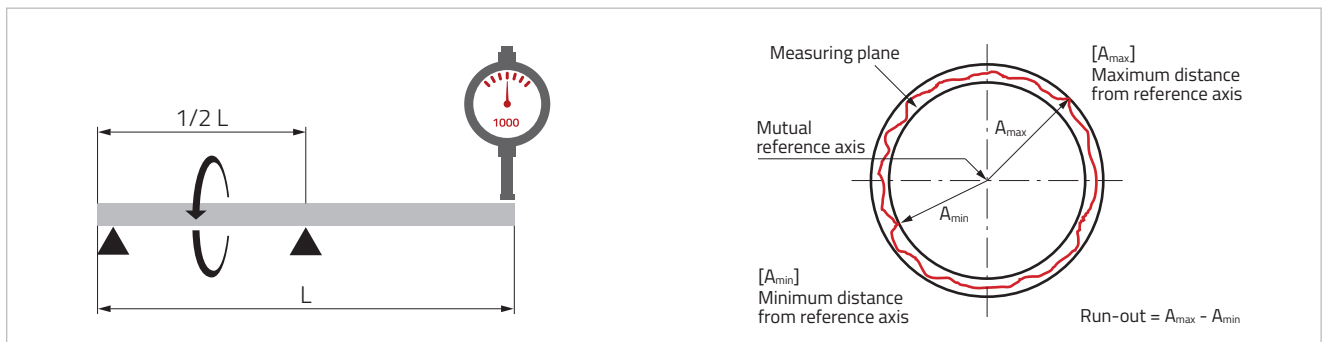
Straightness_{max} of ground rods L= 330 mm

∅ 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



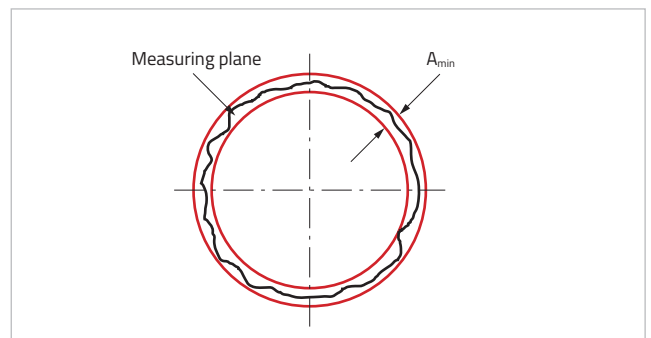
Run-out_{max} of ground fixlengths

∅ 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

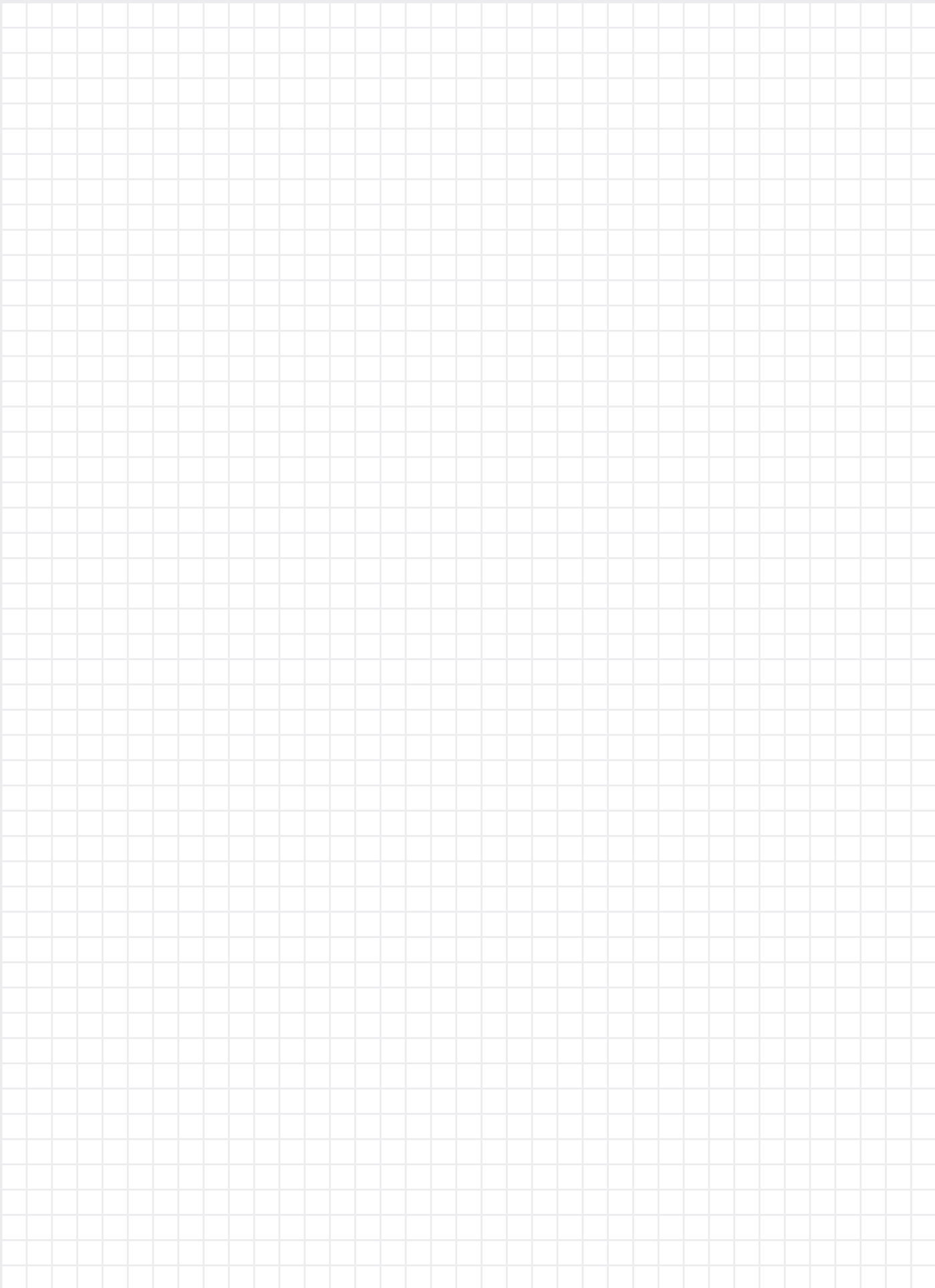


Roundness_{max} of ground rods L = 330 mm

∅ 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





Contact Germany

PCG GMBH

Hilderserstr. 9b
DE-98590 Schwallungen
phone: +49 (0) 36848 25880
fax: +49 (0) 36848 27243
email: info@pcg-gmbh.de
web: www.pcg-gmbh.de

REGIONAL MANAGER GERMANY CENTER/NORTH

Mr. Wolfgang Schilling
phone: +49 (0) 36848 25880
mobile: +49 (0) 162 7913624
email: w.schilling@pcg-gmbh.de

REGIONAL MANAGER GERMANY SOUTH

Mr. Rüdiger Schuy
phone: +49 (0) 36848 25880
mobile: +49 (0) 173 6659713
email: r.schuy@pcg-gmbh.de



Our Sales Partner in Europe

BELGIUM, NETHERLANDS, LUXEMBOURG

ICC bvba
Mr. Peter Cappuyns
Geertruimoer 27
BE-3128 Tremelo / Belgium
phone: +32 16532630
fax: +32 16531149
mobile: +32 475788429
email: icc@icc-carbide.be
web: www.icc-carbide.be

POLAND

ISOTEK Sp. z. o. o.
Mr. Krzysztof Balcer
ul. Sw. Szczepana 57
PL-61-465 Poznan / Poland
phone: +48 61 8350850
fax: +48 61 8350851
mobile: +48 603 778307
email: krzysztof.balcer@isotek.com.pl
web: www.isotek.com.pl

HUNGARY, ROMANIA

ROLATAST BT.
Mr. Róbert Papp
Balotoni út 46.
HU-2030 Érd / Hungaria
phone: +36 23 378544
fax: +36 23 378152
mobile: +36 20 3695800
email: info@rolatast.hu
web: www.rolatast.hu

RUSSIA, UKRAINE, BELARUS

ETC Technopolice Llc.
Dr. Dmitry Loktev
Dm. Ulyanova 42, Building 1
RU-117218 Moscow / Russia
phone: +7 800 7001635
+7 499 5179191
fax: +7 499 1259181
mobile: +7 985 7642789
email: info@technopolice.ru
web: www.technopolice.ru

CZECH REPUBLIC, SLOVAKIA

Stroje JMK s.r.o.
Mr. Jiří Macháček
Jánská 199
CZ-76701 Kroměříž / Czech Republic
phone: +420 573 350498
mobile: +420 602 658092
fax: +420 573 350495
email: info@strojejmk.cz
web: www.strojejmk.cz