

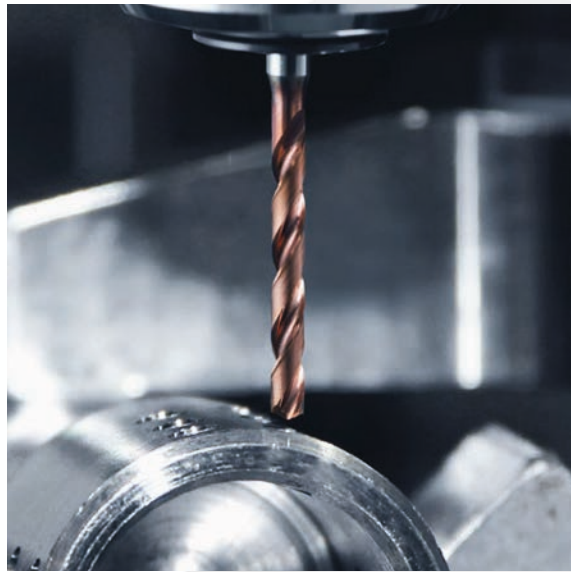


HARTNER

Precision Cutting Tools

MICRO PRECISION DRILLS

MADE OF HSS-E-PM OR SOLID CARBIDE



















+ Edition 2023 + NEW: TS 100 INOX micro

ISO code

P	Steel, high-alloyed steel
M	Stainless steel
K	Grey cast iron, spher. graphite iron and malleable cast iron
N	Aluminium and other non-ferrous metals
S	Special, super and titanium alloys
H	Hardened steel and chilled cast iron

Pictograms

Tool material	VHM Solid carbide	HSS-E-PM HSS-E-PM									
Surface	 bright	 AlTiN	 TiAlN	 TiN	 TiN-SiN-XP						
Type	N	TS 100 U micro	TS 100 INOX micro								
Machining depth	3xD	4xD	~5xD	5xD	6xD	7xD	8xD	10xD	15xD	20xD	GL 38
Standard	DIN 1899 to DIN	WN to Hartner Standard									
Point angle	 118°	 130°	 135°	 140°							
Tolerance on Ø	h7	m7	0/-0,004								
Cutting direction	 right	 left									
Shank form	 Cyl cylindrical	 ~HA ~ to DIN 6535									
Web thinning											
Internal coolant	 with IC	 without IC									





Hartner HSS-E-PM and Solid Carbide Micro Drills

Precision starting from Diameter 0.05 mm

Smallest borings require highest quality, as the least deviation in the straightness of the boring, in the tolerance or in the surface quality on the workpiece will already mean a defect or scrap in today's miniaturised productions. For micro productions, Hartner offers precision micro drills made of HSS-E-PM and solid carbide in nominal diameters from 0.05 and 0.2 mm respectively.

Point- and flute geometry, surfaces, shank types and cutting materials are perfectly concerted to match the application, so that smallest borings are worked out well and fabricated process-safe.









Our HSS-E-PM micro drills are especially applied for smallseries productions, where they offer high quality at a beneficial cost-performance ratio.

On the one hand, Hartner solid carbide micro drills, as drills with a long tool life, stand by for large-scale productions. On the other hand, with the article no. 89286 we also offer a specialist for processing glass fibre reinforced plastics (GRP) in the electric and electronic industry.






See the quality and performance of our micro drills for yourself. Numerous customers in the branches of precision mechanics, horology, medical technology, conductor board manufacturing and other fields of the micro production already rely on Hartner.

P	M	K	N	S	H	Standard	Type	Tool material	Surface	Cutting direction	Shank form	Drilling depth	d1/mm	Article no.	Progr. page
---	---	---	---	---	---	----------	------	---------------	---------	-------------------	------------	----------------	-------	-------------	-------------

Micro-precision drills without coolant ducts

		DIN 1899	N	HSS-E-PM		right-hand	cyl.	~5xD	0.050 - 1.900	87011	6
		DIN 1899	N	HSS-E-PM		left-hand	cyl.	~5xD	0.160 - 1.450	87016	8
		DIN 1899	N	HSS-E-PM		right-hand	cyl.	~5xD	0.200 - 1.500	84810	9
		Company std.	TS 100 U micro	Solid carbide		right-hand	cyl.	GL38	0.100 - 3.000	86402	10
		Company std.	TS 100 U micro	Solid carbide		right-hand	cyl.	4xD	0.500 - 3.000	86400	11
		Company std.	TS 100 U micro	Solid carbide		right-hand	cyl.	~5xD	0.200 - 1.300	89281	12
		Company std.	TS 100 U micro	Solid carbide		right-hand	cyl.	7xD	0.500 - 3.000	86401	13
		Company std.	TS 100 INOX micro	Solid carbide		right-hand	cyl.	3xD	0.500 - 3.000	86403	14

Micro-precision drills with coolant ducts

		Company std.	TS 100 U micro	Solid carbide		right-hand	cyl.	5xD	1.000 - 3.000	86405	15
		Company std.	TS 100 U micro	Solid carbide		right-hand	cyl.	8xD	1.000 - 3.000	86408	16
		Company std.	TS 100 U micro	Solid carbide		right-hand	cyl.	15xD	1.000 - 3.000	86412	17
		Company std.	TS 100 U micro	Solid carbide		right-hand	~HA	20xD	1.000 - 3.000	86410	18
		Company std.	TS 100 INOX micro	Solid carbide		right-hand	cyl.	3xD	1.000 - 3.000	86404	19

P	M	K	N	S	H	Standard	Type	Tool material	Surface	Cutting direction	Shank form	Drilling depth	d1/mm	Article no.	Progr. page
---	---	---	---	---	---	----------	------	---------------	---------	-------------------	------------	----------------	-------	-------------	-------------

Micro-precision drills with coolant ducts



○	●	○	●			Company std.	TS 100 INOX micro	Solid carbide	⊗	right-hand	cyl.	6xD	1.000 - 3.000	86406	20
---	---	---	---	--	--	--------------	-------------------	---------------	---	------------	------	-----	---------------	-------	----



○	●	○	●			Company std.	TS 100 INOX micro	Solid carbide	⊗	right-hand	cyl.	10xD	1.000 - 3.000	86407	21
---	---	---	---	--	--	--------------	-------------------	---------------	---	------------	------	------	---------------	-------	----



○	●	○	●			Company std.	TS 100 INOX micro	Solid carbide	⊗	right-hand	cyl.	15xD	1.000 - 3.000	86409	22
---	---	---	---	--	--	--------------	-------------------	---------------	---	------------	------	------	---------------	-------	----



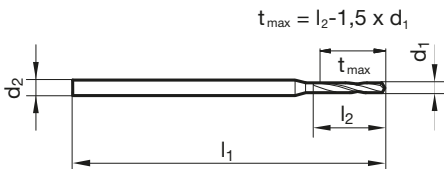
Micro-precision drills without coolant ducts

Article no. 87011

P	M	K	N	S	H
•	•	•	•	○	



facet point grind • $\varnothing 0.15\text{ mm}$ Co-alloyed high speed steel • with re-inforced shank
high-alloyed steels



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.050	1.000	25.000	0.400	0.345	1.000	25.000	2.400
0.060	1.000	25.000	0.400	0.350	1.000	25.000	2.400
0.080	1.000	25.000	0.500	0.355	1.000	25.000	2.400
0.090	1.000	25.000	0.500	0.360	1.000	25.000	2.400
0.100	1.000	25.000	0.500	0.362	1.000	25.000	2.400
0.110	1.000	25.000	0.500	0.365	1.000	25.000	2.400
0.120	1.000	25.000	0.500	0.366	1.000	25.000	2.400
0.130	1.000	25.000	0.800	0.370	1.000	25.000	2.400
0.140	1.000	25.000	0.800	0.375	1.000	25.000	2.400
0.150	1.000	25.000	0.800	0.380	1.000	25.000	2.400
0.160	1.000	25.000	1.100	0.385	1.000	25.000	3.000
0.170	1.000	25.000	1.100	0.390	1.000	25.000	3.000
0.180	1.000	25.000	1.100	0.395	1.000	25.000	3.000
0.190	1.000	25.000	1.100	0.400	1.000	25.000	3.000
0.200	1.000	25.000	1.500	0.405	1.000	25.000	3.000
0.205	1.000	25.000	1.500	0.410	1.000	25.000	3.000
0.210	1.000	25.000	1.500	0.415	1.000	25.000	3.000
0.215	1.000	25.000	1.500	0.420	1.000	25.000	3.000
0.220	1.000	25.000	1.500	0.425	1.000	25.000	3.000
0.225	1.000	25.000	1.500	0.430	1.000	25.000	3.000
0.230	1.000	25.000	1.500	0.435	1.000	25.000	3.000
0.235	1.000	25.000	1.500	0.440	1.000	25.000	3.000
0.240	1.000	25.000	1.500	0.450	1.000	25.000	3.000
0.245	1.000	25.000	1.900	0.455	1.000	25.000	3.000
0.250	1.000	25.000	1.900	0.460	1.000	25.000	3.000
0.255	1.000	25.000	1.900	0.470	1.000	25.000	3.000
0.260	1.000	25.000	1.900	0.480	1.000	25.000	3.000
0.265	1.000	25.000	1.900	0.485	1.000	25.000	3.400
0.270	1.000	25.000	1.900	0.490	1.000	25.000	3.400
0.275	1.000	25.000	1.900	0.495	1.000	25.000	3.400
0.280	1.000	25.000	1.900	0.500	1.000	25.000	3.400
0.285	1.000	25.000	1.900	0.505	1.000	25.000	3.400
0.290	1.000	25.000	1.900	0.510	1.000	25.000	3.400
0.295	1.000	25.000	1.900	0.515	1.000	25.000	3.400
0.300	1.000	25.000	1.900	0.520	1.000	25.000	3.400
0.310	1.000	25.000	2.400	0.525	1.000	25.000	3.400
0.315	1.000	25.000	2.400	0.530	1.000	25.000	3.400
0.320	1.000	25.000	2.400	0.535	1.000	25.000	3.900
0.325	1.000	25.000	2.400	0.540	1.000	25.000	3.900
0.330	1.000	25.000	2.400	0.545	1.000	25.000	3.900
0.335	1.000	25.000	2.400	0.550	1.000	25.000	3.900
0.340	1.000	25.000	2.400	0.555	1.000	25.000	3.900



Micro-precision drills without coolant ducts

d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.560	1.000	25.000	3.900	0.960	1.500	25.000	6.800
0.565	1.000	25.000	3.900	0.970	1.500	25.000	6.800
0.570	1.000	25.000	3.900	0.980	1.500	25.000	6.800
0.575	1.000	25.000	3.900	0.990	1.500	25.000	6.800
0.580	1.000	25.000	3.900	1.000	1.500	25.000	6.800
0.585	1.000	25.000	3.900	1.010	1.500	25.000	6.800
0.590	1.000	25.000	3.900	1.020	1.500	25.000	6.800
0.595	1.000	25.000	3.900	1.025	1.500	25.000	6.800
0.600	1.000	25.000	3.900	1.030	1.500	25.000	6.800
0.605	1.000	25.000	4.200	1.040	1.500	25.000	6.800
0.610	1.000	25.000	4.200	1.050	1.500	25.000	6.800
0.615	1.000	25.000	4.200	1.060	1.500	25.000	6.800
0.620	1.000	25.000	4.200	1.070	1.500	25.000	7.600
0.625	1.000	25.000	4.200	1.080	1.500	25.000	7.600
0.630	1.000	25.000	4.200	1.100	1.500	25.000	7.600
0.635	1.000	25.000	4.200	1.110	1.500	25.000	7.600
0.640	1.000	25.000	4.200	1.120	1.500	25.000	7.600
0.645	1.000	25.000	4.200	1.140	1.500	25.000	7.600
0.650	1.000	25.000	4.200	1.150	1.500	25.000	7.600
0.660	1.000	25.000	4.200	1.160	1.500	25.000	7.600
0.665	1.000	25.000	4.200	1.180	1.500	25.000	7.600
0.670	1.000	25.000	4.200	1.190	1.500	25.000	8.500
0.680	1.000	25.000	4.800	1.200	1.500	25.000	8.500
0.690	1.000	25.000	4.800	1.210	1.500	25.000	8.500
0.695	1.000	25.000	4.800	1.230	1.500	25.000	8.500
0.700	1.000	25.000	4.800	1.240	1.500	25.000	8.500
0.705	1.000	25.000	4.800	1.250	1.500	25.000	8.500
0.710	1.000	25.000	4.800	1.260	1.500	25.000	8.500
0.715	1.000	25.000	4.800	1.270	1.500	25.000	8.500
0.720	1.000	25.000	4.800	1.280	1.500	25.000	8.500
0.730	1.000	25.000	4.800	1.300	1.500	25.000	8.500
0.740	1.000	25.000	4.800	1.310	1.500	25.000	8.500
0.745	1.000	25.000	4.800	1.320	1.500	25.000	8.500
0.750	1.000	25.000	4.800	1.340	1.500	25.000	9.500
0.760	1.000	25.000	5.300	1.350	1.500	25.000	9.500
0.770	1.000	25.000	5.300	1.360	1.500	25.000	9.500
0.780	1.000	25.000	5.300	1.380	1.500	25.000	9.500
0.790	1.000	25.000	5.300	1.390	1.500	25.000	9.500
0.800	1.500	25.000	5.300	1.400	1.500	25.000	9.500
0.810	1.500	25.000	5.300	1.410	1.500	25.000	9.500
0.820	1.500	25.000	5.300	1.420	1.500	25.000	9.500
0.830	1.500	25.000	5.300	1.430	1.500	25.000	9.500
0.840	1.500	25.000	5.300	1.440	1.500	25.000	9.500
0.850	1.500	25.000	5.300	1.450	1.500	25.000	9.500
0.860	1.500	25.000	6.000	1.500	2.000	30.000	9.500
0.870	1.500	25.000	6.000	1.600	2.000	30.000	10.600
0.880	1.500	25.000	6.000	1.630	2.000	30.000	10.600
0.890	1.500	25.000	6.000	1.700	2.000	30.000	10.600
0.900	1.500	25.000	6.000	1.800	2.000	30.000	11.800
0.910	1.500	25.000	6.000	1.850	2.000	30.000	11.800
0.920	1.500	25.000	6.000	1.900	2.000	30.000	11.800
0.930	1.500	25.000	6.000				
0.940	1.500	25.000	6.000				
0.950	1.500	25.000	6.000				



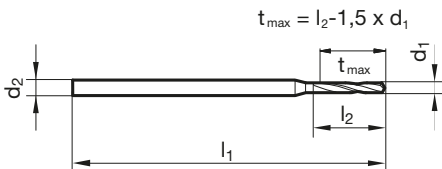
Micro-precision drills without coolant ducts

Article no. 87016

P	M	K	N	S	H
•	•	•	•	○	



facet point grind • $\varnothing 0.15\text{ mm}$ Co-alloyed high speed steel • with re-inforced shank
high-alloyed steels



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.160	1.000	25.000	1.100	0.740	1.000	25.000	4.800
0.170	1.000	25.000	1.100	0.750	1.000	25.000	4.800
0.200	1.000	25.000	1.500	0.760	1.000	25.000	5.300
0.210	1.000	25.000	1.500	0.780	1.000	25.000	5.300
0.220	1.000	25.000	1.500	0.790	1.000	25.000	5.300
0.230	1.000	25.000	1.500	0.800	1.500	25.000	5.300
0.240	1.000	25.000	1.500	0.810	1.500	25.000	5.300
0.280	1.000	25.000	1.900	0.820	1.500	25.000	5.300
0.300	1.000	25.000	1.900	0.830	1.500	25.000	5.300
0.310	1.000	25.000	2.400	0.840	1.500	25.000	5.300
0.330	1.000	25.000	2.400	0.870	1.500	25.000	6.000
0.350	1.000	25.000	2.400	0.890	1.500	25.000	6.000
0.360	1.000	25.000	2.400	0.900	1.500	25.000	6.000
0.370	1.000	25.000	2.400	0.910	1.500	25.000	6.000
0.380	1.000	25.000	2.400	0.920	1.500	25.000	6.000
0.390	1.000	25.000	3.000	0.930	1.500	25.000	6.000
0.400	1.000	25.000	3.000	0.940	1.500	25.000	6.000
0.410	1.000	25.000	3.000	0.950	1.500	25.000	6.000
0.420	1.000	25.000	3.000	0.960	1.500	25.000	6.800
0.430	1.000	25.000	3.000	0.970	1.500	25.000	6.800
0.440	1.000	25.000	3.000	0.980	1.500	25.000	6.800
0.450	1.000	25.000	3.000	0.990	1.500	25.000	6.800
0.460	1.000	25.000	3.000	1.000	1.500	25.000	6.800
0.470	1.000	25.000	3.000	1.010	1.500	25.000	6.800
0.480	1.000	25.000	3.000	1.040	1.500	25.000	6.800
0.490	1.000	25.000	3.400	1.050	1.500	25.000	6.800
0.500	1.000	25.000	3.400	1.060	1.500	25.000	6.800
0.510	1.000	25.000	3.400	1.080	1.500	25.000	7.600
0.520	1.000	25.000	3.400	1.100	1.500	25.000	7.600
0.530	1.000	25.000	3.400	1.140	1.500	25.000	7.600
0.540	1.000	25.000	3.900	1.150	1.500	25.000	7.600
0.550	1.000	25.000	3.900	1.250	1.500	25.000	8.500
0.570	1.000	25.000	3.900	1.300	1.500	25.000	8.500
0.600	1.000	25.000	3.900	1.340	1.500	25.000	9.500
0.610	1.000	25.000	4.200	1.350	1.500	25.000	9.500
0.620	1.000	25.000	4.200	1.370	1.500	25.000	9.500
0.660	1.000	25.000	4.200	1.450	1.500	25.000	9.500
0.670	1.000	25.000	4.200				
0.680	1.000	25.000	4.800				
0.690	1.000	25.000	4.800				
0.700	1.000	25.000	4.800				
0.710	1.000	25.000	4.800				



Micro-precision drills without coolant ducts

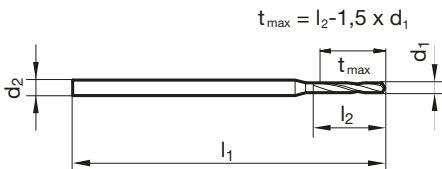
Article no. 84810



P	M	K	N	S	H
•	•	•	•	○	



facet point grind • with re-inforced shank • increased wear resistance
high-alloyed steels



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.200	1.000	25.000	1.500	1.050	1.500	25.000	6.800
0.300	1.000	25.000	1.900	1.100	1.500	25.000	7.600
0.450	1.000	25.000	3.000	1.150	1.500	25.000	7.600
0.490	1.000	25.000	3.400	1.180	1.500	25.000	7.600
0.500	1.000	25.000	3.400	1.200	1.500	25.000	8.500
0.510	1.000	25.000	3.400	1.250	1.500	25.000	8.500
0.520	1.000	25.000	3.400	1.300	1.500	25.000	8.500
0.590	1.000	25.000	3.900	1.400	1.500	25.000	9.500
0.600	1.000	25.000	3.900	1.450	1.500	25.000	9.500
0.700	1.000	25.000	4.800	1.500	2.000	30.000	9.500
0.760	1.000	25.000	5.300				
0.800	1.500	25.000	5.300				
0.880	1.500	25.000	6.000				
0.900	1.500	25.000	6.000				
0.920	1.500	25.000	6.000				
0.950	1.500	25.000	6.000				
0.980	1.500	25.000	6.800				
1.000	1.500	25.000	6.800				

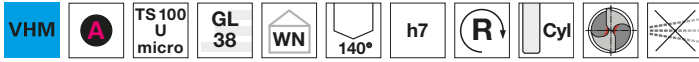


Micro-precision drills without coolant ducts

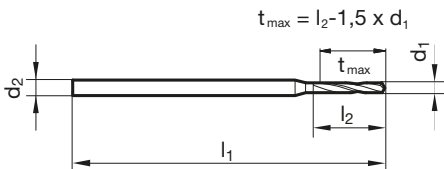
Article no. 86402



P	M	K	N	S	H
•		•			



web thinning $\geq \varnothing 0.800$ • facet point grind • uniform 3 mm shank • uniform 38 mm total length
 structural and case hardened steels • free-cutting steels, heat-treatable steels • alloyed steels up to 1200 N/mm² • cast materials
 • machining of circuit boards



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.100	3.000	38.000	1.200	0.980	3.000	38.000	10.000
0.150	3.000	38.000	2.000	0.990	3.000	38.000	10.000
0.200	3.000	38.000	2.500	1.000	3.000	38.000	10.000
0.250	3.000	38.000	3.000	1.100	3.000	38.000	10.000
0.300	3.000	38.000	5.000	1.110	3.000	38.000	10.000
0.310	3.000	38.000	5.000	1.150	3.000	38.000	10.000
0.350	3.000	38.000	6.000	1.200	3.000	38.000	10.000
0.370	3.000	38.000	6.000	1.210	3.000	38.000	10.000
0.400	3.000	38.000	7.000	1.400	3.000	38.000	10.000
0.450	3.000	38.000	7.000	1.450	3.000	38.000	10.000
0.500	3.000	38.000	7.000	1.500	3.000	38.000	10.000
0.550	3.000	38.000	7.000	1.510	3.000	38.000	10.000
0.600	3.000	38.000	7.000	1.520	3.000	38.000	10.000
0.640	3.000	38.000	7.000	1.550	3.000	38.000	10.000
0.650	3.000	38.000	7.000	1.600	3.000	38.000	12.000
0.700	3.000	38.000	8.000	1.650	3.000	38.000	12.000
0.710	3.000	38.000	8.000	1.700	3.000	38.000	12.000
0.720	3.000	38.000	8.000	1.800	3.000	38.000	12.000
0.740	3.000	38.000	8.000	1.810	3.000	38.000	12.000
0.750	3.000	38.000	8.000	1.830	3.000	38.000	12.000
0.760	3.000	38.000	8.000	1.850	3.000	38.000	12.000
0.770	3.000	38.000	8.000	1.900	3.000	38.000	12.000
0.780	3.000	38.000	8.000	1.920	3.000	38.000	12.000
0.790	3.000	38.000	8.000	1.950	3.000	38.000	12.000
0.800	3.000	38.000	10.000	1.980	3.000	38.000	12.000
0.810	3.000	38.000	10.000	2.000	3.000	38.000	12.000
0.820	3.000	38.000	10.000	2.050	3.000	38.000	12.000
0.830	3.000	38.000	10.000	2.100	3.000	38.000	12.000
0.840	3.000	38.000	10.000	2.400	3.000	38.000	12.000
0.850	3.000	38.000	10.000	2.500	3.000	38.000	12.000
0.860	3.000	38.000	10.000	2.600	3.000	38.000	12.000
0.870	3.000	38.000	10.000	2.750	3.000	38.000	12.000
0.880	3.000	38.000	10.000	2.950	3.000	38.000	12.000
0.890	3.000	38.000	10.000	3.000	3.000	38.000	12.000
0.900	3.000	38.000	10.000				
0.910	3.000	38.000	10.000				
0.920	3.000	38.000	10.000				
0.930	3.000	38.000	10.000				
0.940	3.000	38.000	10.000				
0.950	3.000	38.000	10.000				
0.960	3.000	38.000	10.000				
0.970	3.000	38.000	10.000				

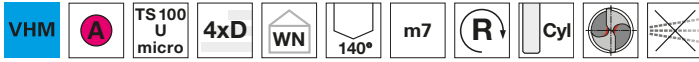


Micro-precision drills without coolant ducts

Article no. 86400

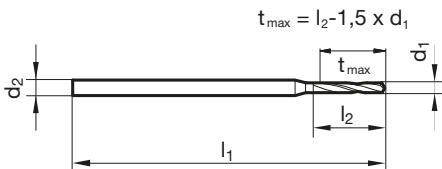


P	M	K	N	S	H
•	•	•	○	○	



web thinning $\geq \varnothing 0.500$ • facet point grind • main cutting edge form straight • edge preparation

structural and case hardened steels • free-cutting steels, heat-treatable steels • alloyed steels up to 1200 N/mm² • stainless steels • cast materials



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.500	3.000	47.000	3.000	1.950	3.000	52.000	11.700
0.550	3.000	47.000	3.300	1.980	4.000	59.000	12.000
0.600	3.000	47.000	3.600	2.000	4.000	59.000	12.000
0.650	3.000	47.000	3.900	2.050	4.000	59.000	12.300
0.700	3.000	47.000	4.200	2.100	4.000	59.000	12.600
0.750	3.000	47.000	4.500	2.150	4.000	59.000	12.900
0.800	3.000	47.000	4.800	2.200	4.000	59.000	13.200
0.850	3.000	47.000	5.100	2.250	4.000	59.000	13.500
0.900	3.000	47.000	5.400	2.300	4.000	59.000	13.800
0.950	3.000	47.000	5.700	2.350	4.000	59.000	14.100
1.000	3.000	47.000	6.000	2.380	4.000	59.000	14.400
1.050	3.000	47.000	6.300	2.400	4.000	59.000	14.400
1.100	3.000	47.000	6.600	2.450	4.000	59.000	14.700
1.150	3.000	47.000	6.900	2.500	4.000	59.000	15.000
1.200	3.000	47.000	7.200	2.550	4.000	59.000	15.300
1.250	3.000	47.000	7.500	2.600	4.000	59.000	15.600
1.300	3.000	47.000	7.800	2.650	4.000	59.000	15.900
1.350	3.000	47.000	8.100	2.700	4.000	59.000	16.200
1.400	3.000	47.000	8.400	2.750	4.000	59.000	16.500
1.450	3.000	47.000	8.700	2.780	4.000	59.000	16.800
1.500	3.000	47.000	9.000	2.800	4.000	59.000	16.800
1.550	3.000	47.000	9.300	2.850	4.000	59.000	17.100
1.590	3.000	47.000	9.600	2.900	4.000	59.000	17.400
1.600	3.000	47.000	9.600	2.950	4.000	59.000	17.700
1.650	3.000	47.000	9.900	3.000	4.000	59.000	18.000
1.700	3.000	47.000	10.200				
1.750	3.000	47.000	10.500				
1.800	3.000	52.000	10.800				
1.850	3.000	52.000	11.100				
1.900	3.000	52.000	11.400				

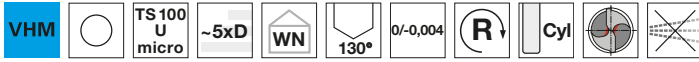


Micro-precision drills without coolant ducts

Article no. 89281

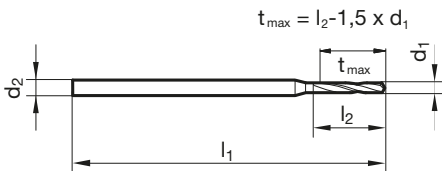


P	M	K	N	S	H
●	○	●	○	○	○



web thinning $\geq \varnothing 0.800$ • facet point grind • main cutting edge form straight

structural and case hardened steels • cast materials • bronze, brass • aluminium and Al alloys • magnesium and magnesium alloys
• plastics and fiber reinforced plastics



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.200	1.000	25.000	1.500	1.300	1.500	25.000	8.500
0.300	1.000	25.000	1.900				
0.350	1.000	25.000	2.400				
0.400	1.000	25.000	3.000				
0.450	1.000	25.000	3.000				
0.500	1.000	25.000	3.400				
0.600	1.000	25.000	3.900				
0.700	1.000	25.000	4.800				
0.800	1.500	25.000	5.300				
1.000	1.500	25.000	6.800				
1.100	1.500	25.000	7.600				
1.250	1.500	25.000	8.500				

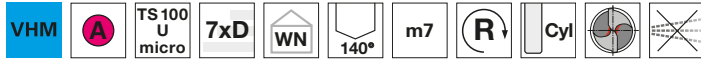


Micro-precision drills without coolant ducts

Article no. 86401

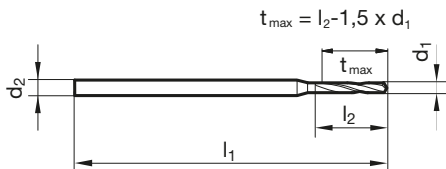


P	M	K	N	S	H
•	•	•	○	○	



web thinning $\geq \varnothing 0.500$ • facet point grind • main cutting edge form straight • edge preparation

structural and case hardened steels • free-cutting steels, heat-treatable steels • alloyed steels up to 1200 N/mm² • stainless steels • cast materials



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.500	3.000	47.000	4.000	1.950	3.000	52.000	17.600
0.550	3.000	47.000	4.400	1.980	4.000	63.000	18.000
0.600	3.000	47.000	4.800	2.000	4.000	63.000	18.000
0.650	3.000	47.000	5.200	2.050	4.000	63.000	18.500
0.700	3.000	47.000	5.600	2.100	4.000	63.000	18.900
0.750	3.000	47.000	6.000	2.150	4.000	63.000	19.400
0.800	3.000	47.000	6.400	2.200	4.000	63.000	19.800
0.850	3.000	47.000	6.800	2.250	4.000	63.000	20.300
0.900	3.000	47.000	7.200	2.300	4.000	63.000	20.700
0.950	3.000	47.000	7.600	2.350	4.000	63.000	21.200
1.000	3.000	47.000	8.000	2.380	4.000	63.000	21.600
1.050	3.000	47.000	8.400	2.400	4.000	63.000	21.600
1.100	3.000	47.000	8.800	2.450	4.000	63.000	22.100
1.150	3.000	47.000	9.200	2.500	4.000	63.000	22.500
1.200	3.000	52.000	10.800	2.550	4.000	63.000	23.000
1.250	3.000	52.000	11.300	2.600	4.000	67.000	23.400
1.300	3.000	52.000	11.700	2.650	4.000	67.000	23.900
1.350	3.000	52.000	12.200	2.700	4.000	67.000	24.300
1.400	3.000	52.000	12.600	2.750	4.000	67.000	24.800
1.450	3.000	52.000	13.100	2.780	4.000	67.000	25.200
1.500	3.000	52.000	13.500	2.800	4.000	67.000	25.200
1.550	3.000	52.000	14.000	2.850	4.000	67.000	25.700
1.590	3.000	52.000	14.400	2.900	4.000	67.000	26.100
1.600	3.000	52.000	14.400	2.950	4.000	67.000	26.600
1.650	3.000	52.000	14.900	3.000	4.000	67.000	27.000
1.700	3.000	52.000	15.300				
1.750	3.000	52.000	15.800				
1.800	3.000	52.000	16.200				
1.850	3.000	52.000	16.700				
1.900	3.000	52.000	17.100				

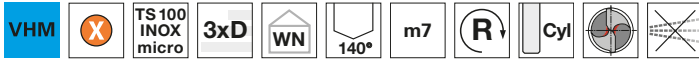


Micro-precision drills without coolant ducts

Article no. 86403

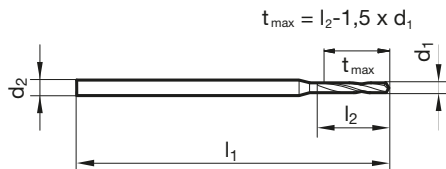


P	M	K	N	S	H
○	●	○	○	●	○



facet point grind • main cutting edge is slightly concave • optimised cutting geometry

stainless/acid-/heat-resistant steels • Titanium and Titanium alloys • Inconel, Hastelloy, Monel • copper, brass and bronze alloys



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
0.500	3.000	38.000	2.800	1.700	4.000	46.000	9.400
0.550	3.000	38.000	3.100	1.750	4.000	46.000	9.700
0.600	3.000	38.000	3.300	1.800	4.000	46.000	9.900
0.650	3.000	38.000	3.600	1.850	4.000	46.000	10.200
0.660	3.000	38.000	3.700	1.900	4.000	46.000	10.500
0.700	3.000	38.000	3.900	1.950	4.000	46.000	10.800
0.740	3.000	38.000	4.100	1.980	4.000	46.000	10.900
0.750	3.000	38.000	4.200	2.000	4.000	46.000	11.000
0.790	3.000	38.000	4.400	2.050	4.000	46.000	11.300
0.800	3.000	38.000	4.400	2.100	4.000	50.000	11.600
0.820	3.000	38.000	4.600	2.150	4.000	50.000	11.900
0.850	3.000	38.000	4.700	2.200	4.000	50.000	12.100
0.900	3.000	38.000	5.000	2.250	4.000	50.000	12.400
0.950	3.000	38.000	5.300	2.300	4.000	50.000	12.700
1.000	3.000	38.000	5.500	2.350	4.000	50.000	13.000
1.020	3.000	38.000	5.700	2.380	4.000	50.000	13.100
1.050	3.000	38.000	5.800	2.400	4.000	50.000	13.200
1.100	3.000	38.000	6.100	2.450	4.000	50.000	13.500
1.150	3.000	38.000	6.400	2.500	4.000	50.000	13.800
1.180	3.000	38.000	6.500	2.550	4.000	50.000	14.100
1.190	3.000	38.000	6.600	2.600	4.000	50.000	14.300
1.200	3.000	38.000	6.600	2.650	4.000	50.000	14.600
1.250	3.000	38.000	6.900	2.700	4.000	50.000	14.900
1.280	3.000	38.000	7.100	2.750	4.000	50.000	15.200
1.300	3.000	38.000	7.200	2.780	4.000	50.000	15.300
1.350	3.000	38.000	7.500	2.800	4.000	50.000	15.400
1.400	4.000	46.000	7.700	2.850	4.000	50.000	15.700
1.450	4.000	46.000	8.000	2.900	4.000	50.000	16.000
1.460	4.000	46.000	8.100	2.950	4.000	50.000	16.300
1.500	4.000	46.000	8.300	3.000	4.000	50.000	16.500
1.550	4.000	46.000	8.600				
1.560	4.000	46.000	8.600				
1.590	4.000	46.000	8.800				
1.600	4.000	46.000	8.800				
1.650	4.000	46.000	9.100				
1.660	4.000	46.000	9.200				

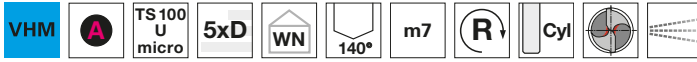


Micro-precision drills with coolant ducts

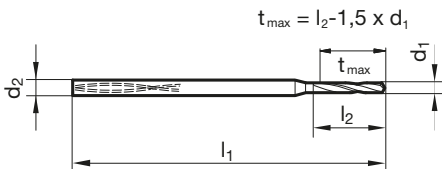
Article no. 86405



P	M	K	N	S	H
•	•	•	○	○	



web thinning $\geq \varnothing 1.400$ • facet point grind • main cutting edge form straight • edge preparation
 structural and case hardened steels • free-cutting steels, heat-treatable steels • alloyed steels up to 1200 N/mm² • stainless steels • cast materials



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	48.000	8.000	2.200	4.000	62.000	18.000
1.020	3.000	48.000	8.500	2.250	4.000	62.000	18.000
1.050	3.000	48.000	8.500	2.300	4.000	62.000	18.000
1.100	3.000	48.000	9.000	2.350	4.000	62.000	19.000
1.150	3.000	48.000	9.500	2.380	4.000	62.000	19.000
1.180	3.000	48.000	9.500	2.400	4.000	62.000	19.000
1.190	3.000	48.000	10.000	2.450	4.000	62.000	20.000
1.200	3.000	48.000	10.000	2.500	4.000	62.000	20.000
1.250	3.000	48.000	10.000	2.550	4.000	62.000	20.000
1.280	3.000	48.000	10.500	2.600	4.000	66.000	21.000
1.300	3.000	48.000	10.500	2.650	4.000	66.000	21.000
1.350	3.000	48.000	11.000	2.700	4.000	66.000	22.000
1.400	4.000	52.000	11.000	2.750	4.000	66.000	22.000
1.450	4.000	52.000	12.000	2.780	4.000	66.000	22.000
1.500	4.000	52.000	12.000	2.800	4.000	66.000	22.000
1.550	4.000	52.000	12.000	2.850	4.000	66.000	23.000
1.590	4.000	52.000	13.000	2.900	4.000	66.000	23.000
1.600	4.000	52.000	13.000	2.950	4.000	66.000	24.000
1.650	4.000	52.000	13.000	3.000	4.000	66.000	24.000
1.700	4.000	56.000	14.000				
1.750	4.000	56.000	14.000				
1.800	4.000	56.000	14.000				
1.850	4.000	56.000	15.000				
1.900	4.000	56.000	15.000				
1.950	4.000	56.000	16.000				
1.980	4.000	56.000	16.000				
2.000	4.000	56.000	16.000				
2.050	4.000	56.000	16.000				
2.100	4.000	62.000	17.000				
2.150	4.000	62.000	17.000				

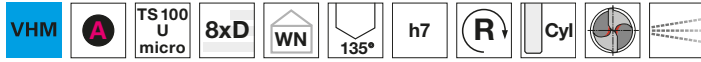


Micro-precision drills with coolant ducts

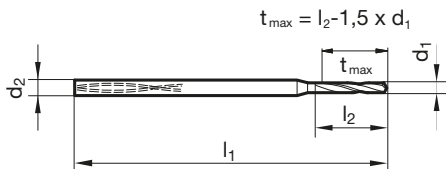
Article no. 86408



P	M	K	N	S	H
•	•	•	○	○	



web thinning $\geq \varnothing 1.400$ • facet point grind • main cutting edge form straight • edge preparation
 structural and case hardened steels • free-cutting steels, heat-treatable steels • alloyed steels up to 1200 N/mm² • stainless steels • cast materials



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	56.000	11.000	2.000	4.000	56.000	22.000
1.020	3.000	56.000	11.500	2.100	4.000	62.000	23.000
1.050	3.000	56.000	12.000	2.200	4.000	62.000	24.000
1.100	3.000	56.000	12.500	2.300	4.000	62.000	25.000
1.150	3.000	56.000	13.000	2.400	4.000	62.000	26.000
1.180	3.000	56.000	13.000	2.500	4.000	62.000	28.000
1.190	3.000	56.000	13.500	2.600	4.000	66.000	29.000
1.200	3.000	56.000	13.500	2.700	4.000	66.000	30.000
1.250	3.000	56.000	14.000	2.800	4.000	66.000	31.000
1.280	3.000	56.000	14.500	2.900	4.000	66.000	32.000
1.300	3.000	56.000	14.500	3.000	4.000	66.000	33.000
1.350	3.000	56.000	15.000				
1.400	4.000	52.000	15.000				
1.500	4.000	52.000	17.000				
1.600	4.000	52.000	18.000				
1.700	4.000	56.000	19.000				
1.800	4.000	56.000	20.000				
1.900	4.000	56.000	21.000				

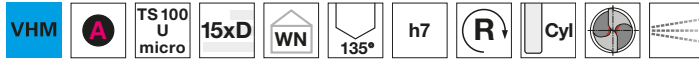


Micro-precision drills with coolant ducts

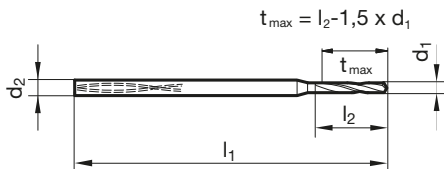
Article no. 86412



P	M	K	N	S	H
•	•	•	○	○	



web thinning $\geq \varnothing 1.400$ • facet point grind • main cutting edge form straight • edge preparation
 structural and case hardened steels • free-cutting steels, heat-treatable steels • alloyed steels up to 1200 N/mm² • stainless steels • cast materials



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	56.000	18.000	2.000	4.000	70.000	36.000
1.020	3.000	56.000	18.500	2.100	4.000	78.000	38.000
1.050	3.000	56.000	19.000	2.200	4.000	78.000	40.000
1.100	3.000	56.000	20.000	2.300	4.000	78.000	42.000
1.150	3.000	56.000	21.000	2.400	4.000	78.000	44.000
1.180	3.000	56.000	21.500	2.500	4.000	78.000	45.000
1.190	3.000	56.000	21.500	2.600	4.000	87.000	47.000
1.200	3.000	56.000	22.000	2.700	4.000	87.000	48.000
1.250	3.000	56.000	22.500	2.800	4.000	87.000	50.000
1.280	3.000	56.000	23.500	2.900	4.000	87.000	52.000
1.300	3.000	56.000	23.500	3.000	4.000	87.000	54.000
1.350	3.000	56.000	24.500				
1.400	4.000	62.000	25.000				
1.500	4.000	62.000	27.000				
1.600	4.000	62.000	29.000				
1.700	4.000	70.000	31.000				
1.800	4.000	70.000	32.000				
1.900	4.000	70.000	34.000				

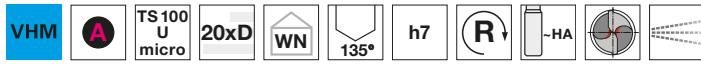


Micro-precision drills with coolant ducts

Article no. 86410

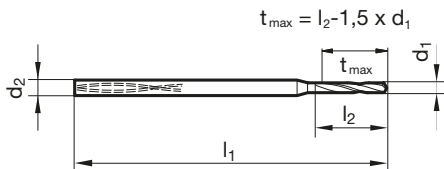


P	M	K	N	S	H
•	•	•	○	○	



facet point grind • main cutting edge form straight • with cutting lip honing

structural and case hardened steels • free-cutting steels, heat-treatable steels • alloyed steels up to 1200 N/mm² • stainless steels • cast materials



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	59.000	23.000	2.050	4.000	79.000	47.200
1.050	3.000	59.000	24.200	2.100	4.000	91.000	48.300
1.100	3.000	59.000	25.300	2.150	4.000	91.000	49.500
1.150	3.000	63.000	26.500	2.200	4.000	91.000	50.600
1.190	3.000	63.000	27.400	2.250	4.000	91.000	51.800
1.200	3.000	63.000	27.600	2.300	4.000	91.000	52.900
1.250	3.000	63.000	28.800	2.320	4.000	91.000	54.100
1.300	3.000	68.000	29.900	2.350	4.000	91.000	54.100
1.350	3.000	68.000	31.100	2.380	4.000	91.000	54.800
1.400	4.000	70.000	32.200	2.400	4.000	91.000	55.200
1.450	4.000	70.000	33.400	2.450	4.000	91.000	56.400
1.500	4.000	70.000	34.500	2.500	4.000	91.000	57.500
1.550	4.000	70.000	35.700	2.550	4.000	91.000	58.700
1.590	4.000	70.000	36.600	2.600	4.000	102.000	59.800
1.600	4.000	70.000	36.800	2.650	4.000	102.000	61.000
1.650	4.000	70.000	38.000	2.700	4.000	102.000	62.100
1.700	4.000	79.000	39.400	2.750	4.000	102.000	63.300
1.750	4.000	79.000	40.300	2.780	4.000	102.000	64.000
1.800	4.000	79.000	41.400	2.800	4.000	102.000	64.400
1.850	4.000	79.000	42.600	2.850	4.000	102.000	65.600
1.900	4.000	79.000	43.700	2.900	4.000	102.000	66.700
1.950	4.000	79.000	44.900	2.950	4.000	102.000	67.900
1.980	4.000	79.000	45.600	3.000	4.000	102.000	69.000
2.000	4.000	79.000	46.000				

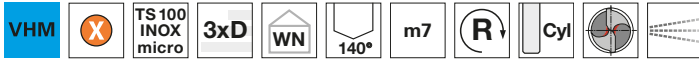


Micro-precision drills with coolant ducts

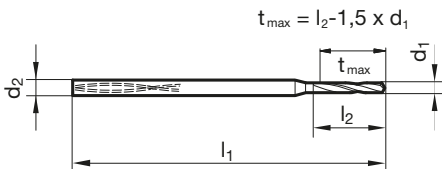
Article no. 86404



P	M	K	N	S	H
○	●		○	●	



facet point grind • main cutting edge is slightly concave • optimised cutting geometry
 stainless/acid-/heat-resistant steels • Titanium and Titanium alloys • Inconel, Hastelloy, Monel • copper, brass and bronze alloys



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	38.000	5.500	2.050	4.000	46.000	11.300
1.020	3.000	38.000	5.700	2.100	4.000	50.000	11.600
1.050	3.000	38.000	5.800	2.150	4.000	50.000	11.900
1.100	3.000	38.000	6.100	2.200	4.000	50.000	12.100
1.150	3.000	38.000	6.400	2.250	4.000	50.000	12.400
1.180	3.000	38.000	6.500	2.300	4.000	50.000	12.700
1.190	3.000	38.000	6.600	2.350	4.000	50.000	13.000
1.200	3.000	38.000	6.600	2.380	4.000	50.000	13.100
1.250	3.000	38.000	6.900	2.400	4.000	50.000	13.200
1.280	3.000	38.000	7.100	2.450	4.000	50.000	13.500
1.300	3.000	38.000	7.200	2.500	4.000	50.000	13.800
1.350	3.000	38.000	7.500	2.550	4.000	50.000	14.100
1.400	4.000	46.000	7.700	2.600	4.000	50.000	14.300
1.450	4.000	46.000	8.000	2.650	4.000	50.000	14.600
1.460	4.000	46.000	8.100	2.700	4.000	50.000	14.900
1.500	4.000	46.000	8.300	2.750	4.000	50.000	15.200
1.550	4.000	46.000	8.600	2.780	4.000	50.000	15.300
1.560	4.000	46.000	8.600	2.800	4.000	50.000	15.400
1.590	4.000	46.000	8.800	2.850	4.000	50.000	15.700
1.600	4.000	46.000	8.800	2.900	4.000	50.000	16.000
1.650	4.000	46.000	9.100	2.950	4.000	50.000	16.300
1.660	4.000	46.000	9.200	3.000	4.000	50.000	16.500
1.700	4.000	46.000	9.400				
1.750	4.000	46.000	9.700				
1.800	4.000	46.000	9.900				
1.850	4.000	46.000	10.200				
1.900	4.000	46.000	10.500				
1.950	4.000	46.000	10.800				
1.980	4.000	46.000	10.900				
2.000	4.000	46.000	11.000				

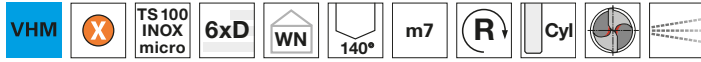


Micro-precision drills with coolant ducts

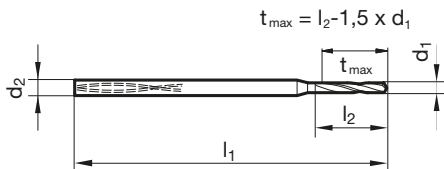
Article no. 86406



P	M	K	N	S	H
○	●	○	○	●	○



facet point grind • main cutting edge is slightly concave • optimised cutting geometry
 stainless/acid-/heat-resistant steels • Titanium and Titanium alloys • Inconel, Hastelloy, Monel • copper, brass and bronze alloys



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	48.000	9.000	2.050	4.000	61.000	18.500
1.050	3.000	48.000	9.500	2.100	4.000	66.000	18.900
1.100	3.000	48.000	9.900	2.150	4.000	66.000	19.400
1.150	3.000	48.000	10.400	2.200	4.000	66.000	19.800
1.190	3.000	48.000	10.800	2.250	4.000	66.000	20.300
1.200	3.000	51.000	10.800	2.300	4.000	66.000	20.700
1.250	3.000	51.000	11.300	2.350	4.000	66.000	21.200
1.300	3.000	51.000	11.700	2.380	4.000	66.000	21.500
1.350	3.000	51.000	12.200	2.400	4.000	66.000	21.600
1.400	4.000	56.000	12.600	2.450	4.000	66.000	22.100
1.450	4.000	56.000	13.100	2.500	4.000	66.000	22.500
1.500	4.000	56.000	13.500	2.550	4.000	66.000	23.000
1.550	4.000	56.000	14.000	2.600	4.000	71.000	23.400
1.590	4.000	56.000	14.400	2.650	4.000	71.000	23.900
1.600	4.000	56.000	14.400	2.700	4.000	71.000	24.300
1.650	4.000	56.000	14.900	2.750	4.000	71.000	24.800
1.700	4.000	61.000	15.300	2.780	4.000	71.000	25.100
1.750	4.000	61.000	15.800	2.800	4.000	71.000	25.200
1.800	4.000	61.000	16.200	2.850	4.000	71.000	25.700
1.850	4.000	61.000	16.700	2.900	4.000	71.000	26.100
1.900	4.000	61.000	17.100	2.950	4.000	71.000	26.600
1.950	4.000	61.000	17.600	3.000	4.000	71.000	27.000
1.980	4.000	61.000	17.900				
2.000	4.000	61.000	18.000				

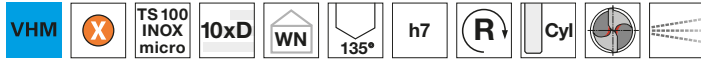


Micro-precision drills with coolant ducts

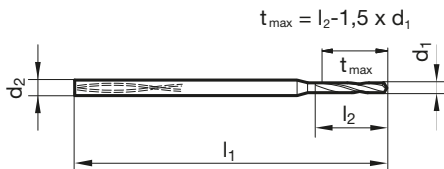
Article no. 86407



P	M	K	N	S	H
○	●	○	○	●	○



facet point grind • main cutting edge is slightly concave • optimised cutting geometry
 stainless/acid-/heat-resistant steels • Titanium and Titanium alloys • Inconel, Hastelloy, Monel • copper, brass and bronze alloys



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	48.000	13.000	2.050	4.000	61.000	26.700
1.050	3.000	48.000	13.700	2.100	4.000	66.000	27.300
1.100	3.000	48.000	14.300	2.150	4.000	66.000	28.000
1.150	3.000	48.000	15.000	2.200	4.000	66.000	28.600
1.190	3.000	48.000	15.500	2.250	4.000	66.000	29.300
1.200	3.000	51.000	15.600	2.300	4.000	66.000	29.900
1.250	3.000	51.000	16.300	2.350	4.000	66.000	30.600
1.300	3.000	51.000	16.900	2.380	4.000	66.000	31.000
1.350	3.000	51.000	17.600	2.400	4.000	66.000	31.200
1.400	4.000	56.000	18.200	2.450	4.000	66.000	31.900
1.450	4.000	56.000	18.900	2.500	4.000	66.000	32.500
1.500	4.000	56.000	19.500	2.550	4.000	66.000	33.200
1.550	4.000	56.000	20.200	2.600	4.000	71.000	33.800
1.590	4.000	56.000	20.700	2.650	4.000	71.000	34.500
1.600	4.000	56.000	20.800	2.700	4.000	71.000	35.100
1.650	4.000	56.000	21.500	2.750	4.000	71.000	35.800
1.700	4.000	61.000	22.100	2.780	4.000	71.000	36.200
1.750	4.000	61.000	22.800	2.800	4.000	71.000	36.400
1.800	4.000	61.000	23.400	2.850	4.000	71.000	37.100
1.850	4.000	61.000	24.100	2.900	4.000	71.000	37.700
1.900	4.000	61.000	24.700	2.950	4.000	71.000	38.400
1.950	4.000	61.000	25.400	3.000	4.000	71.000	39.000
1.980	4.000	61.000	25.800				
2.000	4.000	61.000	26.000				

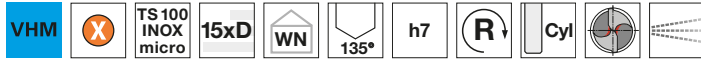


Micro-precision drills with coolant ducts

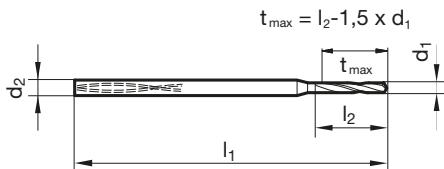
Article no. 86409



P	M	K	N	S	H
○	●	○	○	●	○



facet point grind • main cutting edge is slightly concave • optimised cutting geometry
 stainless/acid-/heat-resistant steels • Titanium and Titanium alloys • Inconel, Hastelloy, Monel • copper, brass and bronze alloys



d1 mm	d2 h6 mm	l1 mm	l2 mm	d1 mm	d2 h6 mm	l1 mm	l2 mm
1.000	3.000	54.000	18.000	2.050	4.000	71.000	36.900
1.050	3.000	54.000	18.900	2.100	4.000	79.000	37.800
1.100	3.000	54.000	19.800	2.150	4.000	79.000	38.700
1.150	3.000	54.000	20.700	2.200	4.000	79.000	39.600
1.190	3.000	54.000	21.500	2.250	4.000	79.000	40.500
1.200	3.000	58.000	21.600	2.300	4.000	79.000	41.400
1.250	3.000	58.000	22.500	2.350	4.000	79.000	42.300
1.300	3.000	58.000	23.400	2.380	4.000	79.000	42.900
1.350	3.000	58.000	24.300	2.400	4.000	79.000	43.200
1.400	4.000	64.000	25.200	2.450	4.000	79.000	44.100
1.450	4.000	64.000	26.100	2.500	4.000	79.000	45.000
1.500	4.000	64.000	27.000	2.550	4.000	79.000	45.900
1.550	4.000	64.000	27.900	2.600	4.000	87.000	46.800
1.590	4.000	64.000	28.700	2.650	4.000	87.000	47.700
1.600	4.000	64.000	28.800	2.700	4.000	87.000	48.600
1.650	4.000	64.000	29.700	2.750	4.000	87.000	49.500
1.700	4.000	71.000	30.600	2.780	4.000	87.000	50.100
1.750	4.000	71.000	31.500	2.800	4.000	87.000	50.400
1.800	4.000	71.000	32.400	2.850	4.000	87.000	51.300
1.850	4.000	71.000	33.300	2.900	4.000	87.000	52.200
1.900	4.000	71.000	34.200	2.950	4.000	87.000	53.100
1.950	4.000	71.000	35.100	3.000	4.000	87.000	54.000
1.980	4.000	71.000	35.700				
2.000	4.000	71.000	36.000				

APPLICATION RECOMMENDATIONS



APPLICATION RECOMMENDATIONS

Solid Carbide Micro Drills

Pilot drilling

For the application of solid carbide micro precision drills 15xD we recommend a pilot hole 1xD up to 2xD depth. For this pilot hole, the solid carbide micro precision drill 4xD is optimally suitable. Its point angle and its diameter tolerance are perfectly adapted.

Filter quality

When applying solid carbide micro precision drills, we recommend constant monitoring of the lubricant's filter quality due to the extremely small coolant duct diameters.

Centering

In order to achieve full performance with solid carbide micro precision drills from 8xD drilling depth, we recommend centering. The solid carbide micro precision drill up to 4xD, Hartner no. 86400, can be applied for this purpose. The centering diameter should be approximately $2/3xD$.

TS 100 Inox micro





Pilot drilling

When using the TS 100 Inox micro drills 10xD/15xD, we recommend pilot drilling a hole with 1xD to 2xD depth. The TS 100 Inox micro drills 3xD are ideally suited for this pilot drilling. The point angles and diameter tolerances are adapted accordingly.

Centering



Alternatively, the TS 100 Inox micro drill 10xD can also be centred to achieve full performance. The TS 100 Inox micro drills 3xD can be used for this. The centring diameter should be approx. $2/3xD$.

Micro-precision drills without coolant ducts, 87011 (~5xD) / 87016 (~5xD) / 84810 (~5xD)


Machining group			f (mm/U) with nom. Ø										
			v _c (m/min)		0.05	0.2	0.5	0.8	1	1.2	1.5	1.8	2
	P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	33	38	0.002	0.006	0.016	0.026	0.032	0.038	0.048	0.058	0.064	
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	28	32	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	28	32	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	28	32	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	25	28	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	23	26	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	20	23	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	20	23	0.001	0.004	0.010	0.016	0.020	0.025	0.031	0.037	0.041		
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	14	16	0.001	0.003	0.008	0.013	0.016	0.020	0.025	0.030	0.033		
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	12	14	0.001	0.003	0.008	0.013	0.016	0.020	0.025	0.030	0.033		
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	11	13	0.001	0.003	0.006	0.010	0.013	0.015	0.019	0.023	0.026		
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	15	17	0.001	0.004	0.010	0.016	0.020	0.025	0.031	0.037	0.041		
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	11	13	0.001	0.003	0.008	0.013	0.016	0.020	0.025	0.030	0.033		
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	12	13	0.001	0.003	0.008	0.013	0.016	0.019	0.024	0.029	0.032		
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	11	12	0.001	0.003	0.008	0.013	0.016	0.019	0.024	0.029	0.032		
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	10	11	0.001	0.003	0.006	0.010	0.013	0.015	0.019	0.023	0.026		
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	9	11	0.001	0.003	0.008	0.013	0.016	0.019	0.024	0.029	0.032		
M2.2.1 Duplex steel, high-strength stainless steels		8	0.001	0.003	0.006	0.010	0.013	0.015	0.019	0.023	0.026		
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB	35	40	0.002	0.006	0.016	0.026	0.032	0.038	0.048	0.058	0.064		
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB	28	32	0.002	0.006	0.016	0.026	0.032	0.038	0.048	0.058	0.064		
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB	30	34	0.002	0.006	0.016	0.026	0.032	0.038	0.048	0.058	0.064		
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB	23	26	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
K1.3.1 Malleable cast iron, ferritic, 130 HB	30	34	0.002	0.006	0.016	0.026	0.032	0.038	0.048	0.058	0.064		
K1.3.2 Malleable cast iron, pearlitic, 230 HB	23	26	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
K2.1.1 Vermicular graphite cast iron (GJV)	29	34	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)		17	0.001	0.003	0.006	0.010	0.013	0.015	0.019	0.023	0.026		
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	70		0.002	0.008	0.020	0.033	0.041	0.049	0.061	0.074	0.082		
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	70		0.002	0.008	0.020	0.033	0.041	0.049	0.061	0.074	0.082		
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	59	67	0.002	0.006	0.016	0.026	0.032	0.038	0.048	0.058	0.064		
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	47	54	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	41	47	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %	70	81	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
N3.1.2 Copper and copper alloys: CuZn, CuSnZn	42	48	0.001	0.004	0.010	0.016	0.020	0.025	0.031	0.037	0.041		
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte	56	65	0.001	0.004	0.010	0.016	0.020	0.025	0.031	0.037	0.041		
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics	23	27	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.	23	27	0.001	0.005	0.013	0.020	0.026	0.031	0.038	0.046	0.051		
N4.1.3 Non-metallic materials: Graphite													
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	7	8	0.001	0.003	0.006	0.010	0.013	0.015	0.019	0.023	0.026		
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	6	6	0.001	0.002	0.005	0.008	0.010	0.012	0.015	0.018	0.020		
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	6	7	0.001	0.003	0.006	0.010	0.013	0.015	0.019	0.023	0.026		
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	4	4	0.001	0.002	0.005	0.008	0.010	0.012	0.015	0.018	0.020		
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	4	5	0.001	0.002	0.005	0.008	0.010	0.012	0.015	0.018	0.020		
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	6	7	0.001	0.003	0.006	0.010	0.013	0.015	0.019	0.023	0.026		
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	4	4	0.001	0.002	0.005	0.008	0.010	0.012	0.015	0.018	0.020		
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC													
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC													
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC													
H2.1.1 Chilled cast iron, 400 HB													
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC													





Micro-precision drills with coolant ducts, 86402 (GL38)



Machining group		f (mm/U) with nom. Ø							
			0.2	0.5	0.8	1	1.5	2	2.5
	v_c (m/min)								
P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	80	0.0120	0.0300	0.0480	0.0600	0.0900	0.1200	0.1500	0.1800
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	70	0.0110	0.0270	0.0430	0.0540	0.0810	0.1080	0.1350	0.1620
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	70	0.0110	0.0270	0.0430	0.0540	0.0810	0.1080	0.1350	0.1620
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	70	0.0100	0.0255	0.0410	0.0510	0.0765	0.1020	0.1275	0.1530
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	70	0.0100	0.0255	0.0410	0.0510	0.0765	0.1020	0.1275	0.1530
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	65	0.0095	0.0240	0.0385	0.0480	0.0720	0.0960	0.1200	0.1440
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	60	0.0090	0.0225	0.0360	0.0450	0.0675	0.0900	0.1125	0.1350
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	70	0.0120	0.0300	0.0480	0.0600	0.0900	0.1200	0.1500	0.1800
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	70	0.0120	0.0300	0.0480	0.0600	0.0900	0.1200	0.1500	0.1800
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	60	0.0100	0.0255	0.0410	0.0510	0.0765	0.1020	0.1275	0.1530
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	55	0.0090	0.0225	0.0360	0.0450	0.0675	0.0900	0.1125	0.1350
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	40	0.0080	0.0200	0.0320	0.0400	0.0600	0.0800	0.1000	0.1200
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	35	0.0070	0.0170	0.0270	0.0340	0.0510	0.0680	0.0850	0.1020
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	25	0.0035	0.0090	0.0145	0.0180	0.0270	0.0360	0.0450	0.0540
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	25	0.0030	0.0080	0.0130	0.0160	0.0245	0.0325	0.0405	0.0485
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	20	0.0030	0.0075	0.0120	0.0155	0.0230	0.0305	0.0380	0.0460
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	15	0.0020	0.0050	0.0080	0.0100	0.0150	0.0200	0.0250	0.0300
M2.2.1 Duplex steel, high-strength stainless steels	15	0.0015	0.0045	0.0070	0.0085	0.0130	0.0170	0.0215	0.0255
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB	100	0.0080	0.0200	0.0320	0.0400	0.0600	0.0800	0.1000	0.1200
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB	85	0.0070	0.0170	0.0270	0.0340	0.0510	0.0680	0.0850	0.1020
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB	85	0.0070	0.0170	0.0270	0.0340	0.0510	0.0680	0.0850	0.1020
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB	80	0.0065	0.0160	0.0255	0.0320	0.0480	0.0640	0.0800	0.0960
K1.3.1 Malleable cast iron, ferritic, 130 HB	80	0.0065	0.0160	0.0255	0.0320	0.0480	0.0640	0.0800	0.0960
K1.3.2 Malleable cast iron, pearlitic, 230 HB	70	0.0055	0.0140	0.0225	0.0280	0.0420	0.0560	0.0700	0.0840
K2.1.1 Vermicular graphite cast iron (GJV)									
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)									
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	100	0.0120	0.0300	0.0480	0.0600	0.0900	0.1200	0.1500	0.1800
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	100	0.0120	0.0300	0.0480	0.0600	0.0900	0.1200	0.1500	0.1800
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	75	0.0100	0.0250	0.0400	0.0500	0.0750	0.1000	0.1250	0.1500
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	75	0.0100	0.0250	0.0400	0.0500	0.0750	0.1000	0.1250	0.1500
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	65	0.0085	0.0215	0.0340	0.0425	0.0640	0.0850	0.1065	0.1275
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %	55	0.0080	0.0200	0.0320	0.0400	0.0600	0.0800	0.1000	0.1200
N3.1.2 Copper and copper alloys: CuZn, CuSnZn	45	0.0070	0.0170	0.0270	0.0340	0.0510	0.0680	0.0850	0.1020
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte	45	0.0065	0.0160	0.0255	0.0320	0.0480	0.0640	0.0800	0.0960
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics									
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.									
N4.1.3 Non-metallic materials: Graphite									
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	15	0.0020	0.0050	0.0080	0.0100	0.0150	0.0200	0.0250	0.0300
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	10	0.0015	0.0040	0.0065	0.0080	0.0120	0.0160	0.0200	0.0240
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	15	0.0020	0.0050	0.0080	0.0100	0.0150	0.0200	0.0250	0.0300
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	10	0.0015	0.0035	0.0055	0.0070	0.0105	0.0140	0.0175	0.0210
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	10	0.0015	0.0035	0.0055	0.0070	0.0105	0.0140	0.0175	0.0210
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	10	0.0020	0.0050	0.0080	0.0100	0.0150	0.0200	0.0250	0.0300
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	10	0.0015	0.0040	0.0065	0.0080	0.0120	0.0160	0.0200	0.0240
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC									
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC									
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC									
H2.1.1 Chilled cast iron, 400 HB									
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC									



Micro-precision drills with/without coolant ducts, 86400 (4xD) / 86401 (7xD) / 86405 (5xD)



Machining group	 		f (mm/U) with nom. Ø									
	 		v _c (m/min)		0.5	0.8	1	1.2	1.5	2	2.5	3
P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	100	110	0.0400	0.0640	0.0800	0.0960	0.1200	0.1600	0.2000	0.2400		
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	90	100	0.0360	0.0575	0.0720	0.0865	0.1080	0.1440	0.1800	0.2160		
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	90	100	0.0360	0.0575	0.0720	0.0865	0.1080	0.1440	0.1800	0.2160		
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	85	95	0.0340	0.0545	0.0680	0.0815	0.1020	0.1360	0.1700	0.2040		
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	85	95	0.0340	0.0545	0.0680	0.0815	0.1020	0.1360	0.1700	0.2040		
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	80	90	0.0320	0.0510	0.0640	0.0770	0.0960	0.1280	0.1600	0.1920		
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	75	85	0.0300	0.0480	0.0600	0.0720	0.0900	0.1200	0.1500	0.1800		
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	80	90	0.0350	0.0560	0.0700	0.0840	0.1050	0.1400	0.1750	0.2100		
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	80	90	0.0350	0.0560	0.0700	0.0840	0.1050	0.1400	0.1750	0.2100		
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	70	70	0.0300	0.0475	0.0595	0.0715	0.0895	0.1190	0.1490	0.1785		
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	60	60	0.0265	0.0420	0.0525	0.0630	0.0790	0.1050	0.1315	0.1575		
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	45	45	0.0300	0.0480	0.0600	0.0720	0.0900	0.1200	0.1500	0.1800		
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	40	40	0.0255	0.0410	0.0510	0.0610	0.0765	0.1020	0.1275	0.1530		
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	30	70	0.0110	0.0175	0.0220	0.0265	0.0330	0.0440	0.0550	0.0660		
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	25	65	0.0100	0.0160	0.0200	0.0240	0.0295	0.0395	0.0495	0.0595		
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	25	60	0.0095	0.0150	0.0185	0.0225	0.0280	0.0375	0.0465	0.0560		
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	15	60	0.0060	0.0095	0.0120	0.0145	0.0180	0.0240	0.0300	0.0360		
M2.2.1 Duplex steel, high-strength stainless steels	15	50	0.0050	0.0080	0.0100	0.0120	0.0155	0.0205	0.0255	0.0305		
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB	130	150	0.0550	0.0880	0.1100	0.1320	0.1650	0.2200	0.2750	0.3300		
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB	110	130	0.0470	0.0750	0.0935	0.1120	0.1400	0.1870	0.2340	0.2805		
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB	110	130	0.0470	0.0750	0.0935	0.1120	0.1400	0.1870	0.2340	0.2805		
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB	105	120	0.0440	0.0705	0.0880	0.1055	0.1320	0.1760	0.2200	0.2640		
K1.3.1 Malleable cast iron, ferritic, 130 HB	105	120	0.0440	0.0705	0.0880	0.1055	0.1320	0.1760	0.2200	0.2640		
K1.3.2 Malleable cast iron, pearlitic, 230 HB	90	105	0.0385	0.0615	0.0770	0.0925	0.1155	0.1540	0.1925	0.2310		
K2.1.1 Vermicular graphite cast iron (GJV)												
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)												
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	100	150	0.0550	0.0880	0.1100	0.1320	0.1650	0.2200	0.2750	0.3300		
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	100	150	0.0550	0.0880	0.1100	0.1320	0.1650	0.2200	0.2750	0.3300		
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	135	135	0.0210	0.0335	0.0420	0.0505	0.0630	0.0840	0.1050	0.1260		
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	135	135	0.0210	0.0335	0.0420	0.0505	0.0630	0.0840	0.1050	0.1260		
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	115	115	0.0180	0.0285	0.0355	0.0430	0.0535	0.0715	0.0895	0.1070		
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %												
N3.1.2 Copper and copper alloys: CuZn, CuSnZn												
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte												
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics												
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.												
N4.1.3 Non-metallic materials: Graphite												
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	20	35	0.0060	0.0095	0.0120	0.0145	0.0180	0.0240	0.0300	0.0360		
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	15	30	0.0050	0.0075	0.0095	0.0115	0.0145	0.0190	0.0240	0.0290		
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	15	30	0.0060	0.0095	0.0120	0.0145	0.0180	0.0240	0.0300	0.0360		
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	10	20	0.0040	0.0065	0.0085	0.0100	0.0125	0.0170	0.0210	0.0250		
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	10	20	0.0040	0.0065	0.0085	0.0100	0.0125	0.0170	0.0210	0.0250		
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	15	35	0.0060	0.0095	0.0120	0.0145	0.0180	0.0240	0.0300	0.0360		
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	10	25	0.0050	0.0075	0.0095	0.0115	0.0145	0.0190	0.0240	0.0290		
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC												
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC												
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC												
H2.1.1 Chilled cast iron, 400 HB												
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC												



Micro-precision drills without coolant ducts, 89281 (~5xD)



Machining group		f (mm/U) with nom. Ø							
									
	v _c (m/min)	0.2	0.5	0.8	1	1.5	2	2.5	3
P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	50	0.0070	0.0175	0.0280	0.0350	0.0525	0.0700	0.0875	0.1050
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	45	0.0065	0.0160	0.0250	0.0315	0.0475	0.0630	0.0790	0.0945
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	45	0.0065	0.0160	0.0250	0.0315	0.0475	0.0630	0.0790	0.0945
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	45	0.0060	0.0150	0.0240	0.0300	0.0445	0.0595	0.0745	0.0895
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	45	0.0060	0.0150	0.0240	0.0300	0.0445	0.0595	0.0745	0.0895
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	40	0.0055	0.0140	0.0225	0.0280	0.0420	0.0560	0.0700	0.0840
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	40	0.0055	0.0130	0.0210	0.0265	0.0395	0.0525	0.0655	0.0790
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	30	0.0060	0.0145	0.0230	0.0290	0.0435	0.0580	0.0725	0.0870
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	30	0.0060	0.0145	0.0230	0.0290	0.0435	0.0580	0.0725	0.0870
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB									
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB									
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB									
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB									
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	20	0.0040	0.0100	0.0160	0.0200	0.0300	0.0400	0.0500	0.0600
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	20	0.0035	0.0090	0.0145	0.0180	0.0270	0.0360	0.0450	0.0540
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	15	0.0035	0.0085	0.0135	0.0170	0.0255	0.0340	0.0425	0.0510
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	15	0.0030	0.0075	0.0120	0.0150	0.0225	0.0300	0.0375	0.0450
M2.2.1 Duplex steel, high-strength stainless steels	15	0.0025	0.0065	0.0100	0.0130	0.0190	0.0255	0.0320	0.0385
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB	60	0.0070	0.0175	0.0280	0.0350	0.0525	0.0700	0.0875	0.1050
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB	50	0.0060	0.0150	0.0240	0.0300	0.0445	0.0595	0.0745	0.0895
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB	50	0.0060	0.0150	0.0240	0.0300	0.0445	0.0595	0.0745	0.0895
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB	50	0.0055	0.0140	0.0225	0.0280	0.0420	0.0560	0.0700	0.0840
K1.3.1 Malleable cast iron, ferritic, 130 HB	50	0.0055	0.0140	0.0225	0.0280	0.0420	0.0560	0.0700	0.0840
K1.3.2 Malleable cast iron, pearlitic, 230 HB	40	0.0050	0.0125	0.0195	0.0245	0.0370	0.0490	0.0615	0.0735
K2.1.1 Vermicular graphite cast iron (GJV)									
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)									
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	160	0.0120	0.0300	0.0480	0.0600	0.0900	0.1200	0.1500	0.1800
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	160	0.0120	0.0300	0.0480	0.0600	0.0900	0.1200	0.1500	0.1800
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	100	0.0100	0.0250	0.0400	0.0500	0.0750	0.1000	0.1250	0.1500
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	100	0.0100	0.0250	0.0400	0.0500	0.0750	0.1000	0.1250	0.1500
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	85	0.0085	0.0215	0.0340	0.0425	0.0640	0.0850	0.1065	0.1275
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %	80	0.0080	0.0205	0.0330	0.0410	0.0615	0.0820	0.1025	0.1230
N3.1.2 Copper and copper alloys: CuZn, CuSnZn	70	0.0070	0.0175	0.0280	0.0350	0.0525	0.0695	0.0870	0.1045
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte	65	0.0065	0.0165	0.0260	0.0330	0.0490	0.0655	0.0820	0.0985
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics	100	0.0060	0.0145	0.0230	0.0290	0.0435	0.0580	0.0725	0.0870
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.	100	0.0060	0.0145	0.0230	0.0290	0.0435	0.0580	0.0725	0.0870
N4.1.3 Non-metallic materials: Graphite									
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	15	0.0040	0.0100	0.0160	0.0200	0.0300	0.0400	0.0500	0.0600
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	10	0.0030	0.0080	0.0130	0.0160	0.0240	0.0320	0.0400	0.0480
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	15	0.0040	0.0100	0.0160	0.0200	0.0300	0.0400	0.0500	0.0600
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	10	0.0030	0.0070	0.0110	0.0140	0.0210	0.0280	0.0350	0.0420
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	10	0.0030	0.0070	0.0110	0.0140	0.0210	0.0280	0.0350	0.0420
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	10	0.0030	0.0075	0.0120	0.0150	0.0225	0.0300	0.0375	0.0450
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	10	0.0025	0.0060	0.0095	0.0120	0.0180	0.0240	0.0300	0.0360
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC									
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC									
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC									
H2.1.1 Chilled cast iron, 400 HB									
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC									


Micro-precision drills without coolant ducts, 86403 (3xD)



Machining group		f (mm/U) with nom. Ø								
			0.5	0.8	1	1.2	1.5	2	2.5	3
P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	90	0.0400	0.0640	0.0800	0.0960	0.1200	0.1600	0.2000	0.2400	
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	80	0.0360	0.0575	0.0720	0.0865	0.1080	0.1440	0.1800	0.2160	
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	80	0.0360	0.0575	0.0720	0.0865	0.1080	0.1440	0.1800	0.2160	
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	75	0.0340	0.0545	0.0680	0.0815	0.1020	0.1360	0.1700	0.2040	
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	75	0.0340	0.0545	0.0680	0.0815	0.1020	0.1360	0.1700	0.2040	
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	70	0.0320	0.0510	0.0640	0.0770	0.0960	0.1280	0.1600	0.1920	
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	70	0.0300	0.0480	0.0600	0.0720	0.0900	0.1200	0.1500	0.1800	
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	80	0.0350	0.0560	0.0700	0.0840	0.1050	0.1400	0.1750	0.2100	
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	80	0.0350	0.0560	0.0700	0.0840	0.1050	0.1400	0.1750	0.2100	
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	70	0.0300	0.0475	0.0595	0.0715	0.0895	0.1190	0.1490	0.1785	
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	60	0.0265	0.0420	0.0525	0.0630	0.0790	0.1050	0.1315	0.1575	
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	60	0.0350	0.0560	0.0700	0.0840	0.1050	0.1400	0.1750	0.2100	
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	50	0.0300	0.0475	0.0595	0.0715	0.0895	0.1190	0.1490	0.1785	
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	40	0.0125	0.0200	0.0250	0.0300	0.0375	0.0500	0.0625	0.0750	
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	35	0.0115	0.0180	0.0225	0.0270	0.0340	0.0450	0.0565	0.0675	
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	35	0.0105	0.0170	0.0215	0.0255	0.0320	0.0425	0.0530	0.0640	
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	25	0.0075	0.0120	0.0150	0.0180	0.0225	0.0300	0.0375	0.0450	
M2.2.1 Duplex steel, high-strength stainless steels	20	0.0065	0.0100	0.0130	0.0155	0.0190	0.0255	0.0320	0.0385	
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB										
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB										
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB										
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB										
K1.3.1 Malleable cast iron, ferritic, 130 HB										
K1.3.2 Malleable cast iron, pearlitic, 230 HB										
K2.1.1 Vermicular graphite cast iron (GJV)										
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)										
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	270	0.0300	0.0480	0.0600	0.0720	0.0900	0.1200	0.1500	0.1800	
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	270	0.0300	0.0480	0.0600	0.0720	0.0900	0.1200	0.1500	0.1800	
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	180	0.0400	0.0640	0.0800	0.0960	0.1200	0.1600	0.2000	0.2400	
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	180	0.0400	0.0640	0.0800	0.0960	0.1200	0.1600	0.2000	0.2400	
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	155	0.0340	0.0545	0.0680	0.0815	0.1020	0.1360	0.1700	0.2040	
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %	125	0.0300	0.0480	0.0600	0.0720	0.0900	0.1200	0.1500	0.1800	
N3.1.2 Copper and copper alloys: CuZn, CuSnZn	105	0.0255	0.0410	0.0510	0.0610	0.0765	0.1020	0.1275	0.1530	
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte	100	0.0240	0.0385	0.0480	0.0575	0.0720	0.0960	0.1200	0.1440	
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics										
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.										
N4.1.3 Non-metallic materials: Graphite										
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	30	0.0100	0.0160	0.0200	0.0240	0.0300	0.0400	0.0500	0.0600	
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	25	0.0080	0.0130	0.0160	0.0190	0.0240	0.0320	0.0400	0.0480	
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	25	0.0100	0.0160	0.0200	0.0240	0.0300	0.0400	0.0500	0.0600	
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	15	0.0070	0.0110	0.0140	0.0170	0.0210	0.0280	0.0350	0.0420	
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	20	0.0070	0.0110	0.0140	0.0170	0.0210	0.0280	0.0350	0.0420	
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	25	0.0075	0.0120	0.0150	0.0180	0.0225	0.0300	0.0375	0.0450	
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	15	0.0060	0.0095	0.0120	0.0145	0.0180	0.0240	0.0300	0.0360	
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC										
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC										
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC										
H2.1.1 Chilled cast iron, 400 HB										
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC										


Micro-precision drills without coolant ducts, 86408 (8xD) / 86412 (15xD)



Machining group		f (mm/U) with nom. Ø							
		v _c (m/min)	1	1.2	1.5	1.8	2	2.2	2.5
	P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB		105	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	95	0.0360	0.0430	0.0540	0.0650	0.0720	0.0790	0.0900	0.1080
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	95	0.0360	0.0430	0.0540	0.0650	0.0720	0.0790	0.0900	0.1080
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	90	0.0340	0.0410	0.0510	0.0610	0.0680	0.0750	0.0850	0.1020
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	90	0.0340	0.0410	0.0510	0.0610	0.0680	0.0750	0.0850	0.1020
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	85	0.0320	0.0385	0.0480	0.0575	0.0640	0.0705	0.0800	0.0960
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	80	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	90	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880	0.1000	0.1200
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	90	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880	0.1000	0.1200
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	75	0.0340	0.0410	0.0510	0.0610	0.0680	0.0750	0.0850	0.1020
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	70	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	50	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880	0.1000	0.1200
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	45	0.0340	0.0410	0.0510	0.0610	0.0680	0.0750	0.0850	0.1020
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	70	0.0220	0.0265	0.0330	0.0395	0.0440	0.0485	0.0550	0.0660
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	65	0.0200	0.0240	0.0295	0.0355	0.0395	0.0435	0.0495	0.0595
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	60	0.0185	0.0225	0.0280	0.0335	0.0375	0.0410	0.0465	0.0560
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	60	0.0150	0.0180	0.0225	0.0270	0.0300	0.0330	0.0375	0.0450
M2.2.1 Duplex steel, high-strength stainless steels	50	0.0130	0.0155	0.0190	0.0230	0.0255	0.0280	0.0320	0.0385
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB	150	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB	130	0.0510	0.0610	0.0765	0.0920	0.1020	0.1120	0.1275	0.1530
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB	130	0.0510	0.0610	0.0765	0.0920	0.1020	0.1120	0.1275	0.1530
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB	120	0.0480	0.0575	0.0720	0.0865	0.0960	0.1055	0.1200	0.1440
K1.3.1 Malleable cast iron, ferritic, 130 HB	120	0.0480	0.0575	0.0720	0.0865	0.0960	0.1055	0.1200	0.1440
K1.3.2 Malleable cast iron, pearlitic, 230 HB	105	0.0420	0.0505	0.0630	0.0755	0.0840	0.0925	0.1050	0.1260
K2.1.1 Vermicular graphite cast iron (GJV)									
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)									
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	150	0.0900	0.1080	0.1350	0.1620	0.1800	0.1980	0.2250	0.2700
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	150	0.0900	0.1080	0.1350	0.1620	0.1800	0.1980	0.2250	0.2700
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	135	0.0420	0.0505	0.0630	0.0755	0.0840	0.0925	0.1050	0.1260
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	135	0.0420	0.0505	0.0630	0.0755	0.0840	0.0925	0.1050	0.1260
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	115	0.0355	0.0430	0.0535	0.0645	0.0715	0.0785	0.0895	0.1070
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %									
N3.1.2 Copper and copper alloys: CuZn, CuSnZn									
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte									
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics									
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.									
N4.1.3 Non-metallic materials: Graphite									
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	35	0.0120	0.0145	0.0180	0.0215	0.0240	0.0265	0.0300	0.0360
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	30	0.0095	0.0115	0.0145	0.0175	0.0190	0.0210	0.0240	0.0290
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	30	0.0120	0.0145	0.0180	0.0215	0.0240	0.0265	0.0300	0.0360
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	20	0.0085	0.0100	0.0125	0.0150	0.0170	0.0185	0.0210	0.0250
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	20	0.0085	0.0100	0.0125	0.0150	0.0170	0.0185	0.0210	0.0250
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	35	0.0120	0.0145	0.0180	0.0215	0.0240	0.0265	0.0300	0.0360
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	25	0.0095	0.0115	0.0145	0.0175	0.0190	0.0210	0.0240	0.0290
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC									
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC									
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC									
H2.1.1 Chilled cast iron, 400 HB									
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC									



Micro-precision drills wit coolant ducts, 86410 (20xD)



Machining group		f (mm/U) with nom. Ø								
		A								
			v _c (m/min)	1	1.2	1.5	1.8	2	2.2	2.5
P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	100	0.0450	0.0540	0.0675	0.0810	0.0900	0.0990	0.1125	0.1350	
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	90	0.0405	0.0485	0.0610	0.0730	0.0810	0.0890	0.1015	0.1215	
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	90	0.0405	0.0485	0.0610	0.0730	0.0810	0.0890	0.1015	0.1215	
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	85	0.0385	0.0460	0.0575	0.0690	0.0765	0.0840	0.0955	0.1145	
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	85	0.0385	0.0460	0.0575	0.0690	0.0765	0.0840	0.0955	0.1145	
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	80	0.0360	0.0430	0.0540	0.0650	0.0720	0.0790	0.0900	0.1080	
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	75	0.0340	0.0405	0.0505	0.0610	0.0675	0.0745	0.0845	0.1015	
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	90	0.0350	0.0420	0.0525	0.0630	0.0700	0.0770	0.0875	0.1050	
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	90	0.0350	0.0420	0.0525	0.0630	0.0700	0.0770	0.0875	0.1050	
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	75	0.0300	0.0355	0.0445	0.0535	0.0595	0.0655	0.0745	0.0895	
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	70	0.0265	0.0315	0.0395	0.0475	0.0525	0.0580	0.0655	0.0790	
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	80	0.0250	0.0300	0.0375	0.0450	0.0500	0.0550	0.0625	0.0750	
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	70	0.0215	0.0255	0.0320	0.0385	0.0425	0.0470	0.0530	0.0640	
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	80	0.0200	0.0240	0.0300	0.0360	0.0400	0.0440	0.0500	0.0600	
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	70	0.0180	0.0215	0.0270	0.0325	0.0360	0.0395	0.0450	0.0540	
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	70	0.0170	0.0205	0.0255	0.0305	0.0340	0.0375	0.0425	0.0510	
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	80	0.0200	0.0240	0.0300	0.0360	0.0400	0.0440	0.0500	0.0600	
M2.2.1 Duplex steel, high-strength stainless steels	70	0.0170	0.0205	0.0255	0.0305	0.0340	0.0375	0.0425	0.0510	
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB	140	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800	
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB	120	0.0510	0.0610	0.0765	0.0920	0.1020	0.1120	0.1275	0.1530	
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB	120	0.0510	0.0610	0.0765	0.0920	0.1020	0.1120	0.1275	0.1530	
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB	110	0.0480	0.0575	0.0720	0.0865	0.0960	0.1055	0.1200	0.1440	
K1.3.1 Malleable cast iron, ferritic, 130 HB	110	0.0480	0.0575	0.0720	0.0865	0.0960	0.1055	0.1200	0.1440	
K1.3.2 Malleable cast iron, pearlitic, 230 HB	100	0.0420	0.0505	0.0630	0.0755	0.0840	0.0925	0.1050	0.1260	
K2.1.1 Vermicular graphite cast iron (GJV)										
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)										
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	135	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800	
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	135	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800	
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	135	0.0800	0.0960	0.1200	0.1440	0.1600	0.1760	0.2000	0.2400	
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	135	0.0800	0.0960	0.1200	0.1440	0.1600	0.1760	0.2000	0.2400	
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	115	0.0680	0.0815	0.1020	0.1225	0.1360	0.1495	0.1700	0.2040	
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %	130	0.0350	0.0420	0.0525	0.0630	0.0700	0.0770	0.0875	0.1050	
N3.1.2 Copper and copper alloys: CuZn, CuSnZn	110	0.0300	0.0355	0.0445	0.0535	0.0595	0.0655	0.0745	0.0895	
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte	105	0.0280	0.0335	0.0420	0.0505	0.0560	0.0615	0.0700	0.0840	
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics										
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.										
N4.1.3 Non-metallic materials: Graphite										
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	40	0.0150	0.0180	0.0225	0.0270	0.0300	0.0330	0.0375	0.0450	
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	30	0.0120	0.0145	0.0180	0.0215	0.0240	0.0265	0.0300	0.0360	
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	35	0.0150	0.0180	0.0225	0.0270	0.0300	0.0330	0.0375	0.0450	
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	20	0.0105	0.0125	0.0160	0.0190	0.0210	0.0230	0.0260	0.0315	
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	25	0.0105	0.0125	0.0160	0.0190	0.0210	0.0230	0.0260	0.0315	
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	35	0.0120	0.0145	0.0180	0.0215	0.0240	0.0265	0.0300	0.0360	
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	25	0.0095	0.0115	0.0145	0.0175	0.0190	0.0210	0.0240	0.0290	
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC										
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC										
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC										
H2.1.1 Chilled cast iron, 400 HB										
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC										



Micro-precision drills wit coolant ducts, 86404 (3xD) / 86406 (6xD)



Machining group		f (mm/U) with nom. Ø								
										
			v_c (m/min)	1	1.2	1.5	1.8	2	2.2	2.5
P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	100	0.0500	0.0600	0.0750	0.0900	0.1000	0.1100	0.1250	0.1500	
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	90	0.0450	0.0540	0.0675	0.0810	0.0900	0.0990	0.1125	0.1350	
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	90	0.0450	0.0540	0.0675	0.0810	0.0900	0.0990	0.1125	0.1350	
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	85	0.0425	0.0510	0.0640	0.0765	0.0850	0.0935	0.1065	0.1275	
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	85	0.0425	0.0510	0.0640	0.0765	0.0850	0.0935	0.1065	0.1275	
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	80	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880	0.1000	0.1200	
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	75	0.0375	0.0450	0.0565	0.0675	0.0750	0.0825	0.0940	0.1125	
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	90	0.0500	0.0600	0.0750	0.0900	0.1000	0.1100	0.1250	0.1500	
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	90	0.0500	0.0600	0.0750	0.0900	0.1000	0.1100	0.1250	0.1500	
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	75	0.0425	0.0510	0.0640	0.0765	0.0850	0.0935	0.1065	0.1275	
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	70	0.0375	0.0450	0.0565	0.0675	0.0750	0.0825	0.0940	0.1125	
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	70	0.0500	0.0600	0.0750	0.0900	0.1000	0.1100	0.1250	0.1500	
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	60	0.0425	0.0510	0.0640	0.0765	0.0850	0.0935	0.1065	0.1275	
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	100	0.0370	0.0445	0.0555	0.0665	0.0740	0.0815	0.0925	0.1110	
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	90	0.0335	0.0400	0.0500	0.0600	0.0665	0.0735	0.0830	0.1000	
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	85	0.0315	0.0375	0.0470	0.0565	0.0630	0.0690	0.0785	0.0945	
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	80	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900	
M2.2.1 Duplex steel, high-strength stainless steels	70	0.0255	0.0305	0.0385	0.0460	0.0510	0.0560	0.0640	0.0765	
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB										
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB										
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB										
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB										
K1.3.1 Malleable cast iron, ferritic, 130 HB										
K1.3.2 Malleable cast iron, pearlitic, 230 HB										
K2.1.1 Vermicular graphite cast iron (GJV)										
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)										
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	300	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800	
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	300	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800	
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	200	0.0800	0.0960	0.1200	0.1440	0.1600	0.1760	0.2000	0.2400	
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	200	0.0800	0.0960	0.1200	0.1440	0.1600	0.1760	0.2000	0.2400	
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	170	0.0680	0.0815	0.1020	0.1225	0.1360	0.1495	0.1700	0.2040	
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %	150	0.0500	0.0600	0.0750	0.0900	0.1000	0.1100	0.1250	0.1500	
N3.1.2 Copper and copper alloys: CuZn, CuSnZn	130	0.0425	0.0510	0.0640	0.0765	0.0850	0.0935	0.1065	0.1275	
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte	120	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880	0.1000	0.1200	
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics										
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.										
N4.1.3 Non-metallic materials: Graphite										
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	50	0.0200	0.0240	0.0300	0.0360	0.0400	0.0440	0.0500	0.0600	
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	40	0.0160	0.0190	0.0240	0.0290	0.0320	0.0350	0.0400	0.0480	
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	45	0.0200	0.0240	0.0300	0.0360	0.0400	0.0440	0.0500	0.0600	
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	30	0.0140	0.0170	0.0210	0.0250	0.0280	0.0310	0.0350	0.0420	
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	30	0.0140	0.0170	0.0210	0.0250	0.0280	0.0310	0.0350	0.0420	
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	45	0.0150	0.0180	0.0225	0.0270	0.0300	0.0330	0.0375	0.0450	
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	35	0.0120	0.0145	0.0180	0.0215	0.0240	0.0265	0.0300	0.0360	
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC										
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC										
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC										
H2.1.1 Chilled cast iron, 400 HB										
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC										

Micro-precision drills wit coolant ducts, 86407 (10xD) / 86409 (15xD)



Machining group	  v _c (m/min)	f (mm/U) with nom. Ø							
		1	1.2	1.5	1.8	2	2.2	2.5	3
		P1.1.1 Unalloyed steel, annealed, 0.15 % C, Rm 420 N/mm ² , 125 HB	100	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660
P1.1.2 Unalloyed steel, heat-treated, 0.15 % C, Rm 420 N/mm ² , 125 HB	90	0.0270	0.0325	0.0405	0.0485	0.0540	0.0595	0.0675	0.0810
P1.1.3 Unalloyed steel, annealed, 0.45 % C, Rm 640 N/mm ² , 190 HB	90	0.0270	0.0325	0.0405	0.0485	0.0540	0.0595	0.0675	0.0810
P1.1.4 Unalloyed steel, heat-treated, 0.45 % C, Rm 640 N/mm ² , 190 HB	85	0.0255	0.0305	0.0385	0.0460	0.0510	0.0560	0.0640	0.0765
P1.1.5 Unalloyed steel, heat-treated, 0.45 % C, Rm 850 N/mm ² , 250 HB	85	0.0255	0.0305	0.0385	0.0460	0.0510	0.0560	0.0640	0.0765
P1.1.6 Unalloyed steel, annealed, 0.75 % C, Rm 915 N/mm ² , 270 HB	80	0.0240	0.0290	0.0360	0.0430	0.0480	0.0530	0.0600	0.0720
P1.1.7 Unalloyed steel, heat-treated, 0.75 % C, Rm 1020 N/mm ² , 300 HB	75	0.0225	0.0270	0.0340	0.0405	0.0450	0.0495	0.0560	0.0675
P2.1.1 Low-alloy steel, annealed, Rm 610 N/mm ² , 180 HB	90	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900
P2.1.2 Low-alloy steel, heat-treated, Rm 930 N/mm ² , 275 HB	90	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900
P2.1.3 Low-alloy steel, heat-treated, Rm 1020 N/mm ² , 300 HB	75	0.0255	0.0305	0.0385	0.0460	0.0510	0.0560	0.0640	0.0765
P2.1.4 Low-alloy steel, heat-treated, Rm 1190 N/mm ² , 350 HB	70	0.0225	0.0270	0.0340	0.0405	0.0450	0.0495	0.0560	0.0675
P3.1.1 High-alloy steel and tool steel, annealed, Rm 680 N/mm ² , 200 HB	70	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900
P3.1.2 High-alloy steel and tool steel, hardened and tempered, Rm 1100 N/mm ² , 325 HB	60	0.0255	0.0305	0.0385	0.0460	0.0510	0.0560	0.0640	0.0765
M1.1.1 Stainless steel, ferritic/martensitic, with machining additives	100	0.0370	0.0445	0.0555	0.0665	0.0740	0.0815	0.0925	0.1110
M1.1.2 Stainless steel, ferritic/martensitic, annealed, Rm 680 N/mm ² , 200 HB	90	0.0335	0.0400	0.0500	0.0600	0.0665	0.0735	0.0830	0.1000
M1.1.3 Stainless steel, ferritic/martensitic, heat-treated, Rm 810 N/mm ² , 240 HB	85	0.0315	0.0375	0.0470	0.0565	0.0630	0.0690	0.0785	0.0945
M2.1.1 Stainless steel, austenitic, quenched, 180 HB	80	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900
M2.2.1 Duplex steel, high-strength stainless steels	70	0.0255	0.0305	0.0385	0.0460	0.0510	0.0560	0.0640	0.0765
K1.1.1 Grey cast iron, pearlitic/ferritic, 180 HB									
K1.1.2 Grey cast iron, pearlitic/martensitic, 260 HB									
K1.2.1 Cast iron with spheroidal graphite, ferritic, 160 HB									
K1.2.2 Cast iron with spheroidal graphite, pearlitic, 250 HB									
K1.3.1 Malleable cast iron, ferritic, 130 HB									
K1.3.2 Malleable cast iron, pearlitic, 230 HB									
K2.1.1 Vermicular graphite cast iron (GJV)									
K2.2.1 Austenitic-ferritic spheroidal graphite cast iron (ADI)									
N1.1.1 Wrought aluminium alloys, non-hardened, 60 HB	300	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880	0.1000	0.1200
N1.1.2 Wrought aluminium alloys, hardened, 100 HB	300	0.0400	0.0480	0.0600	0.0720	0.0800	0.0880	0.1000	0.1200
N2.1.1 Aluminium casting alloys, non-hardened, ≤ 12 % Si, 75 HB	200	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800
N2.1.2 Aluminium casting alloys, hardened, ≤ 12 % Si, 90 HB	200	0.0600	0.0720	0.0900	0.1080	0.1200	0.1320	0.1500	0.1800
N2.1.3 Aluminium casting alloys, non-hardened, > 12 % Si, 130 HB	170	0.0510	0.0610	0.0765	0.0920	0.1020	0.1120	0.1275	0.1530
N3.1.1 Copper and copper alloys: Free-machining alloy, Pb > 1 %	150	0.0300	0.0360	0.0450	0.0540	0.0600	0.0660	0.0750	0.0900
N3.1.2 Copper and copper alloys: CuZn, CuSnZn	130	0.0255	0.0305	0.0385	0.0460	0.0510	0.0560	0.0640	0.0765
N3.1.3 Copper and copper alloys: CuSn, lead-free copper and copper electrolyte	120	0.0240	0.0290	0.0360	0.0430	0.0480	0.0530	0.0600	0.0720
N4.1.1 Non-metallic materials: Duroplastics, fibre-reinforced plastics									
N4.1.2 Non-metallic materials: Hard rubber, wood, etc.									
N4.1.3 Non-metallic materials: Graphite									
S1.1.1 Heat-resistant alloys, Fe-based, annealed, 200 HB	50	0.0200	0.0240	0.0300	0.0360	0.0400	0.0440	0.0500	0.0600
S1.1.2 Heat-resistant alloys, Fe-based, hardened, 280 HB	40	0.0160	0.0190	0.0240	0.0290	0.0320	0.0350	0.0400	0.0480
S1.1.3 Heat-resistant alloys, Ni- or Co-based, annealed, 250 HB	45	0.0200	0.0240	0.0300	0.0360	0.0400	0.0440	0.0500	0.0600
S1.1.4 Heat-resistant alloys, Ni- or Co-based, hardened, 350 HB	30	0.0140	0.0170	0.0210	0.0250	0.0280	0.0310	0.0350	0.0420
S1.1.5 Heat-resistant alloys, Ni- or Co-based, cast, 320 HB	30	0.0140	0.0170	0.0210	0.0250	0.0280	0.0310	0.0350	0.0420
S2.1.1 Titanium alloys, pure titanium, Rm 400 N/mm ²	40	0.0120	0.0145	0.0180	0.0215	0.0240	0.0265	0.0300	0.0360
S2.1.2 Titanium alloys, Alpha and Beta alloys, hardened, Rm 1050 N/mm ²	30	0.0095	0.0115	0.0145	0.0175	0.0190	0.0210	0.0240	0.0290
H1.1.1 Hardened steel, hardened and tempered, < 55 HRC									
H1.1.2 Hardened steel, hardened and tempered, < 60 HRC									
H1.1.3 Hardened steel, hardened and tempered, > 60 HRC									
H2.1.1 Chilled cast iron, 400 HB									
H2.1.2 Chilled cast iron, hardened and tempered, < 55 HRC									

THE HARTNER PROGRAMME



▼ DRILLING TOOLS



▼ MULTISTEP



▼ COUNTERSINKS



▼ MICRO-PRECISION DRILLS



▼ THREADING TOOLS



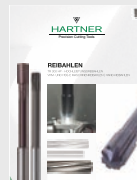
▼ TS-DRILLS



▼ THREAD MILLING CUTTERS



▼ SOLID CARBIDE MILLING CUTTERS



▼ REAMERS



▼ MULTIPLEX



▼ MULTIPLEX HPC



▼ TM VENDING MACHINES

HARTNER GMBH

P.O. Box 10 04 27 | 72425 Albstadt | Germany
Tel. +49 74 31 125-0 | Fax +49 74 31 125-21 547

www.hartner.de

No liability can be accepted for printing errors or technical changes of any kind.
Our Conditions of Sale and Terms of Payment apply. Available on request.

131 641/23017-X-05 | Printed in Germany | 2023