BOSS
Solid Carbide Tools
Catalogue

2.1

Jakob Boss Söhne GmbH & Co. KG
D-72445 Albstadt

Jakob Boss Söhne GmbH & Co. KG
D-72406 Thanheim

S.P.S.G. Kft. · Dorkói ut.1
H-3950 Sárospatak

Solid Carbide Tools

Jakob Boss Söhne GmbH & Co.KG developed new solid carbide cutting tools for short and long chipping steel, cast iron, and aluminium as well as for special applications in high-tensile material (more than 45 HRC).

They set standards in:
- **Tapping**
- **Roll tapping**
- **Thread milling**
- **Drilling**
- **Reaming**
- **Milling**

Performance characteristics of the new BOSS-tools are:
– Precise threads,
– High surface quality,
– Outstanding cutting performance.

The advantages to the user are:
- Guaranteed security during cutting,
- Far better tool life compared to HSSE-tools,
- Higher cutting speeds,
- Reduced poduction costs due to minimized tool changes.

Progressive and technically advanced solutions presented by BOSS are based on many years of experience. The new solid carbide cutting tools manufactured by BOSS again contribute to the success of our business partners producing threads.

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IMPRINT

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Contents

This price list replaces all previous price lists. They become obsolete. Reprinting, also partially, is only allowed with your written permission. All data included in this price list reflect the latest status. Errors or printing mistakes cannot be excluded, however, they do not justify any claims. BOSS is always trying to keep this catalogue up to date. Therefore the improvement of and additions to the extensive product range are unavoidable. This price list is published subject to changes.

Prices

If not explicidly mentioned otherwise all prices in this price list are in DM and EURO per piece excluding VAT.

Alloy Surcharge

The alloy surchage in effect on the day of shipment shall be applied.

Minimum Order Value

Orders up to a total value of DM 200,00 shall only be executed against an additional charge of DM 50,00 for low volume.
May we ask for your understanding

Material Main Group	Material Sub Group	Designation	Standard Designation	DIN-Number	Tensile Strength (N/mm²)	Hardness (HB)	AISI/ SAE/ ASTM
1. Steel	1.1. Unalloyed Steels; Tensile Strength ⩽ 800 N/mm²	Structural Steels	St37-3	1.0116	370 - 450	110 - 130	A 264
			St52-3	1.0570	450 - 680	140 - 210	
			St60-2	1.0060	600 - 720	180 - 210	A 572
		Carbon Steels	C10	1.0301	490 - 780	150 - 230	M 1010
			C22	1.0402	470 - 650	140 - 190	1020
			C35	1.0501	550 - 780	170 - 230	1035
			C40	1.0511	600 - 800	180 - 240	1040
		Free Cutting Steels	35S 20	1.0726	510 - 880	150 - 260	1140
			9S 20	1.0711	370 - 450	110 - 130	
			9SMn 28	1.0715	390 - 580	110 - 170	1213
			9SMn 36	1.0736	390 - 800	110 - 240	1215
			9SMnPb 28	1.0718	380 - 810	110 - 240	12L13
			9SMnPb 36	1.0737	390 - 800	110 - 240	12L14
		Cementation Steels	13Cr 3	1.7012	500 - 800	160 - 240	
			16MnCr 5	1.7131	500 - 700	160 - 210	5115
		Heat Treatable Steels	C15	1.0401	600 - 900	180 - 270	1015
	1.2. Unalloyed Steels; Tensile Strength ⩽ 1000 N/mm²	Structural Steels	Cf53	1.1213	650 - 800	190 - 240	1050
			Ck45	1.1191	650 - 850	190 - 250	1045
			Ck55	1.1203	700 - 950	210 - 280	1055
			Ck60	1.1221	750 - 1000	220 - 300	1060
		Heat Treatable Steels	15Cr 3	1.7015	690 - 1000	200 - 300	5015
			15CrMo 5	1.7262			
			25CrMo 4	1.7218	800 - 1000	240 - 300	4130
			32CrMo 12	1.7361	690 - 1000	200 - 300	
			34Cr 4	1.7033	700 - 1000	210 - 300	5132
			35CrMo 4	1.2330			4135
			35CrNiMo 6	1.6582	800 - 1000	240 - 300	4340
			40Mn 4	1.1157	800 - 1000	240 - 300	1039
			41Cr 4	1.7035	800 - 1000	240 - 300	5140
			41CrMo 4	1.7223	800 - 1000	240 - 300	4140
			42CrMo 4	1.7225	800 - 1000	240 - 300	4140
			47CrMo 4	1.2332			4142
			C35 E	1.1181	550 - 780	170 - 240	1035
			C45	1.0503	650 - 850	190 - 250	1045
			C55	1.0535	700 - 950	210 - 280	1055
			C60	1.0601	750 - 1000	220 - 300	1060
			Cf35	1.1183	540 - 780	160 - 230	1035
			Ck22	1.1151	470 - 650	150 - 200	1020
			Ck25	1.1158	500 - 700	150 - 210	1025
		Cementation Steels	14NiCr 14	1.5752	880 - 1000	260 - 300	3310
			16MnCr 5	1.7131	780 - 1000	230 - 300	5116
			Ck15	1.1141	590 - 880	180 - 260	1015
	1.3.1. Unalloyed and Alloyed Steels; Tensile Strength ⩽ 1200 N/mm²	Cementation Steels	14NiCr 14	1.5752	1000 - 1280	300 - 380	3310
			16MnCr 5 V	1.7131	1000 - 1200	300 - 360	5117
			17CrNiMo 6	1.6587	1080 - 1200	320 - 360	
			17CrNiMo 6	1.6587	1200 - 1400	320 - 410	
		Nitriding Steels	31CrMo V 9	1.8519	1000 - 1250	300 - 370	
			34CnAlNi 7	1.8550			
			35CrNiMo 6	1.6582	1000 - 1200	300 - 360	4340
			39CrMoV 13 9	1.8523	1000 - 1200	300 - 380	
		Heat Treatable Steels	100Cr 6	1.3505			52100
			25CrMo 4	1.7218	1000 - 1100	300 - 330	4130
			30CrNiMo 8	1.6580	1000 - 1200	300 - 360	
			32CrMo12	1.7361	1000 - 1100	300 - 330	
			34Cr 4	1.7033	1000 - 1100	300 - 330	5132
			40Mn4	1.1157	1000 - 1100	300 - 330	1039
			41CrMo 4	1.7223	1000 - 1200	300 - 360	4140
			42CrMo 4 V	1.7225	1000 - 1200	300 - 380	4141

Material Main Group	Material Sub Group	Designation	Standard Designation	DIN-Number	Tensile Strength (N/mm²)	Hardness (HB)	AISI/ SAE/ ASTM
1. Steel	1.3.1. Unalloyed and Alloyed Steels; Tensile Strength ⩽ 1200 N/mm²	Tool Steels	100Cr 6	1.2067			L3
		for Cold Work	100MnCrW 4	1.2510			O1
			100V 1	1.2833			W210
			115CrV 3	1.2210			L2
			50CrV 4	1.8159	1000 - 1200	300 - 360	6150
			58CrV 4	1.8161			
			60WCrV 7	1.2550			S1
			90MnCrV 8	1.2842			O2
			S10-4-3-10	1.3207			
			X100 CrMoV 5 1	1.2363			A2
			X165 CrMoV 12	1.2601			
			X210 Cr 12	1.2080			D3
			X210 CrW 12	1.2436			
			X50 CrMoW 9 11	1.2631			
		Tool Steels	35NiCrMo 16	1.2766			
		for Hot Work	40CrMnMo 7	1.2311			
			45WCrV 7	1.2542			S1
			55NiCrMoV 6	1.2713			L6
			60NiCrMoV 12 4	1.2743			
			X30WCrV 5 3	1.2567			
			X30WCrV 9 3	1.2581			H21
			X32CrMoV 3 3	1.2365			H10
			X36CrMo 17	1.2316			
			X38CrMoV 5 1	1.2343			H11
			X40CrMoV 5 1	1.2344			H13
			X42Cr 13	1.2083			420
	1.3.2. Unalloyed and Alloyed Steels; Tensile Strength ⩾ 1200 N/mm²	Heat Proof Steels	35CrNiMo 6	1.6582	1200 - 1400	380 - 410	4340
			NiCr19 CoMo	2.4973	1200 - 1320	360 - 380	
			X5NiCrTi 26 15	1.4980	930 - 1180	280 - 360	
		Tool Steels	50CrV 4	1.8159	1200 - 1300	360 - 380	6150
			56NiCrMoV 7	1.2714	1200 - 1400	360 - 410	
			X155CrVMo 12 1	1.2379	1200 - 1400	360 - 410	D2
	1.3.3. Hardened Steels; 42-60 HRC	Tool Steels	X155CrVMo 12 1	1.2379			D2
			X210CrW 12	1.2436			
			90MnCrV 8	1.2842			O2
		High Speed Steels	S6-5-2	1.3343			M2
			S6-5-3	1.3344			M3 Class 2
	1.4. Stainless Steels (V2A-Steels)	Normal Alloyed	GX10CrNi 18 8	1.4312			
			GX20Cr 14	1.4027	590 - 700	180 - 210	
			GX5CrNi 19 10	1.4308	460 - 640	140 - 190	CF-8
			GX8CrNi 13	1.4008	590 - 790	180 - 230	
			X10Cr 13	1.4006	450 - 650	130 - 190	410
			X10CrNiS 18 9	1.4305	500 - 750	160 - 220	303
			X105CrMo 17	1.4125	900	270	440C
			X12CrMoS 17	1.4104	540 - 840	160 - 250	430F
			X12CrNi 17 7	1.4310	700 - 950	210 - 280	301
			X12CrS 13	1.4005			416
			X15Cr 13	1.4024	650 - 800	190 - 240	
			X2CrNi 18 9	1.4306	460 - 850	140 - 250	304L
			X2CrNiN 18 10	1.4311	550 - 760	160 - 220	304LN
			X20Cr 13	1.4021	650 - 950	190 - 280	420
			X20CrNi 17 2	1.4057	800 - 950	240 - 280	431
			X22CrNi 17	1.4057	750 - 950	220 - 280	431
			X3CrNiN 17 8	1.4319			302
			X30Cr 13	1.4028	600 - 780	180 - 230	420F
			X39Cr 13	1.4031	560 - 800	170 - 240	

Material Main Group	Material Sub Group	Designation	Standard Designation	DIN-Number	Tensile Strength (N/mm²)	Hardness (HB)	AISI/ SAE/ ASTM
1. Steel	1.4. Stainless Steels (V2A-Steels)		X46Cr 13	1.4034	580 - 800	170 - 240	
			X5CrNi 13 4	1.4313	1000 - 1200	300 - 360	CA6-NM
			X5CrNi 13 4	1.4313	760 - 1000	220 - 300	CA6-NM
			X5CrNi 18 12	1.4303	490 - 690	150 - 210	305
			X5CrNi 18 9	1.4301	500 - 700	160 - 210	304
			X5CrNi 18 9	1.4350			304
			X6CrAl 13	1.4002	400 - 700	120 - 210	405
			X6CrMo 17	1.4113	450 - 650	130 - 190	434
			X7Cr 13	1.4000	400 - 700	120 - 210	403
			X8Cr 17	1.4016	450 - 600	130 - 180	430
	1.5. Stainless Steels with High Chromium-Nickel-Content (V4A-Steels)	High Alloyed	GX5CrNiMo 19 11	1.4408	460 - 640	140 - 190	CF-8M
			GX5CrNiNb 19 10	1.4552	440 - 640	130 - 190	
			X1NiCrMoCuN 25 20 5	1.4539	520 - 720	150 - 210	UNSN08904
			X10CrNiTi 18 9	1.4541	500 - 700	150 - 210	321
			X2CrMoTi 18 2	1.4521	450 - 650	130 - 190	443
			X2CrNiMo 17 13 2	1.4404	490 - 850	150 - 250	316L
			X2CrNiMo 18 12	1.4435	490 - 690	150 - 210	316L
			X2CrNiMo 18 16	1.4438	490 - 690	150 - 210	317L
			X2CrNiMoN 17 12 2	1.4406	580 - 800	170 - 240	316LN
			X2CrNiMoN 17 13 3	1.4429	580 - 800	170 - 240	316LN
			X2CrNiMoN 22 5 3	1.4462	680 - 880	200 - 260	
			X3NiCrCuMoTi 27 23	1.4503	500 - 700	160 - 210	
			X4CrNiMoN 27 5 2	1.4460	600 - 800	180 - 240	329
			X5CrNiCuNb 17 4	1.4542			630
			X5CrNiMo 17 1	1.4401	510 - 710	150 - 210	316
			X5CrNiMo 17 13	1.4449			317
			X5CrNiMo 17 13 3	1.4436	510 - 710	150 - 210	316
			X5CrNiNb 18 10	1.4546	410 - 610	130 - 190	348
			X5NiCrMoCuNb 20 18	1.4505	490 - 740	160 - 220	
			X6CrNb 17	1.4511	450 - 600	130 - 180	
			X6CrNiMoTi 17 12 2	1.4571	500 - 730	160 - 220	316Ti
			X6CrNiNb 18 10	1.4550	550 - 750	160 - 220	347
			X6CrTi 12	1.4512	330 - 560	100 - 170	409
			X6CrTi 17	1.4510	450 - 600	130 - 180	439
	1.6. High-Speed Steels	High-Speed Steels	S12-1-4-5	1.3202			T15
			S18-0-1	1.3355			T1
			S18-1-2-10	1.3265			T5
			S18-1-2-5	1.3255			T4
			S2-10-1-8	1.3247			M42
			S2-9-1	1.3346			M1
			S2-9-2	1.3348			M7
			S2-9-2-8	1.3249			M34
			S5-5-3	1.3344			M3 Class2
			S6-5-2	1.3343			M2
			S6-5-2-5	1.3243			
			S7-4-2-5	1.3246			M41
			SC6-5-2	1.3342			M3
2. Cast Iron	2.1. Grey Cast Iron	Grey Cast Iron	GG10	0.6010			A48-20 B
			GG15	0.6015	110 - 150	35 - 50	A48-25 B
			GG20	0.6020	150 - 200	50 - 60	A48-30 B
			GG25	0.6025	200 - 250	60 - 80	A48-35 B
			GG30	0.6030	240 - 270	75 - 85	A48-45 B
			GG35	0.6035	280 - 320	90 - 100	A48-50 B
			GG40	0.6040	350 - 450	110 - 130	A48-55 B
	2.2. Nodular and Malleable Cast Iron	Nodular Cast Iron	GGG40	0.7040	400	120	60-40-18
			GGG50	0.7050	500	160	80-55-06
			GGG60	0.7060	600	190	80-55-06
			GGG70	0.7070	700	210	100-70-03
		Malleable Cast Iron	GTS55-05	0.8055	550	170	50005
			GTW35-04	0.8035	350	110	

Material Main Group	Material Sub Group	Designation	Standard Designation	DIN-Number	Tensile Strength (N/mm²)	Hardness (HB)	AISI/ SAE/ ASTM
3. Non-Ferrous Metals	3.1. Aluminium, Copper, Copper Alloys	Unalloyed Aluminium	Al99	3.0205	75 - 140	20 - 50	
			Al99.9	3.0305	100 - 120	30 - 40	
			Al99.9 R	3.0400	60 - 120	20 - 40	
			E-Al	3.0257			
		Unalloyed Copper	SF-Cu	2.0090	300 - 350	90 - 110	
		Longchipping Brass	CuZn 37	2.0321	300 - 400	90 - 110	
		Bronze	G-CuSn 6 ZnNi	2.1093	400 - 450	120 - 130	
		Red Brass	G-CuSn 5 ZnPb	2.1096	200 - 250	60 - 80	
	3.2.1. Aluminium Alloys, Copper Alloys	Aluminium Alloys	G-AlSi 12	3.2581	160 - 210	50 - 70	A413.2
			G-AlSi 10 Mg	3.2383	170 - 220	50 - 70	
			G-AlSi 12 (Cu)	3.2583	150 - 220	50 - 70	
			G-AlSi 5 Mg	3.2341	140 - 300	50 - 90	
			G-AlSi 6 Cu	3.2151	160 - 200	50 - 60	
			G-AlSi 7 Mg	3.2371	170 - 300	50 - 90	
			G-AlSi 8 Cu 3	3.2161	160 - 200	50 - 60	
			G-AlSi 9 Mg	3.2373	250 - 300	80 - 90	
			G-CuAl 10 Ni	2.0975	650 - 750	190 - 220	
			GD-AlSi 12 (Cu)	3.2982	450 - 550	130 - 170	
		Bronze, Hard	CuSn 6 Zn 6	2.1080	550 - 700	170 - 210	
	3.2.2. Special Aluminium Alloys	Special Aluminium	AlCuMg 1	3.1325	215 - 395	70 - 120	
		Alloys	AlMg 1	3.3315	105 - 210	30 - 70	
			AlMg 1,5	3.3316	130 - 240	40 - 75	
			AlMg 1 SiCu	3.3211	150 - 290	50 - 90	
			AlMg 2,5	3.3523	170 - 290	50 - 90	
			AlMg 3	3.3535	190 - 305	60 - 100	
			AlMg 5	3.3555	250 - 280	80 - 90	
			AlMgSi 0,5	3.3206	140 - 200	40 - 60	
			AlMgSi 1	3.2315	150 - 315	50 - 100	
			AlMn 1 Mg 0,5	3.0525	125 - 205	40 - 70	
			AlMnCu	3.0517	125 - 210	40 - 70	
			AlZnMgCu 0,5	3.4345	400 - 460	120 - 180	
			AlZnMgCu 1,5	3.4365	480 - 530	150 - 170	
			G-AlMg 5	3.3561	160 - 220	50 - 70	
			G-AlMg 5Si	3.3261	160 - 200	50 - 60	
	3.3. Copper Alloys, Short Chipping	Short Chipping Brass	CuZn39Pb 2	2.0380	630	190	
			CuZn40MnPb	2.0580	400	120	
			CuZn44Pb 2	2.0410	630	190	
4. Special Alloys	4.1. Nickel Alloys	Nickel Alloys	Hastelloy C 276	2.4819			
			Hastelloy C 4	2.4610	700 - 900	220 - 280	
			Inconel 718	2.4668	1250	370	5383
			Nimonic 75	2.4630			
	4.2. Titanium Alloys	Titanium Alloys	TiAl 5 Sn 2	3.7115	790 - 980	230 - 290	
			TiAl 6 V 4	3.7165	980 - 1140	290 - 340	
	4.3. Cu-Al-Fe-Alloys	Chilled Cast Iron	Ampco 21		965 - 1060	285 - 311	
			Ampco 22		1090 - 1130	321 - 352	
			Ampco 25		1140 - 1280	356 - 394	
			Ampco 26		1290 - 1450	395 - 450	
5. Plastics	5.1. Thermoplastics	Thermoplastics	Polyamide				
			Polystyrole				
			Polyvinylchloride				
			Ultramide				
	5.2. Thermosetting Plastics and Fibre Reinforced Plastics	Thermosetting	Bakelite				
		Plastics	Ferrocell				
			Pertinax				
			Thermosetting	CFK	190 - 210	60 - 70	
			Plastics	GFK			

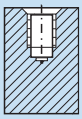
Recommendation Table for Solid Carbide Taps Metric ISO Thread DIN 13

Chamfer — **Form C** 2 - 3 Threads — **Form D** 3,5 - 5 Threads

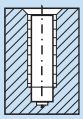
Type of Hole

1 Through Hole
Depth of Thread
up to 2 x d_1

2 Through Hole
Depth of Thread
up to 3 x d_1

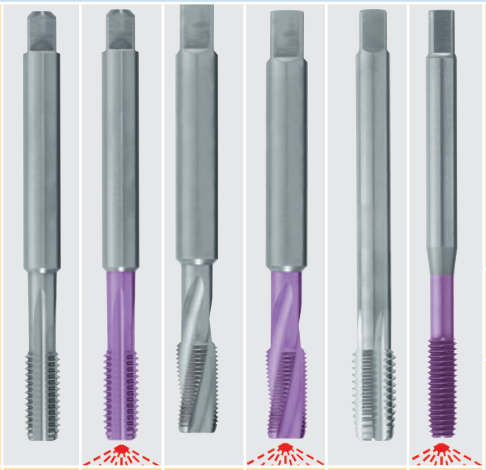


3 Blind Hole
Depth of Thread
up to 2 x d_1



4 Blind Hole
Depth of Thread
up to 3 x d_1

Material Groups



Coolant
Ö = Cutting Oil
E = Emulsion
T = Dry, Air

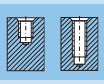
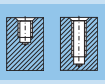
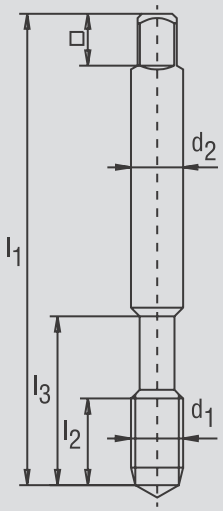
	Material Groups	Chamfer	C	C	C	C	D	C	Cutting Speed v_c = m/min		Coolant
		Catalogue-No.	4558	B4558	4555	B4555	4553	B4560	Uncoated	Coated	
1.	**Steel**										
1.1.	Unalloyed Steels; RM ⩽ 800 N/mm²							●	15 - 20	30 - 50	Ö/E
1.2.	Unalloyed Steels; RM ⩽ 1000 N/mm²		❍	❍				●	15 - 20	30 - 50	Ö/E
1.3.1.	Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²				●	●			5 - 10	10 - 20	Ö
1.3.2.	Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²				●	●			3 - 6	5 - 10	Ö
1.3.3.	Hardened Steels; 42 - 60 HRC						●			2 - 5	Ö
1.4.	Stainless Steels (V2A-Steels)										
1.5.	Stainless Steels with High Cr-Ni-Content (V4A-Steels)				●	●			6 - 10	10 - 20	Ö
1.6.	High Speed Steels										
2.	**Cast Iron**										
2.1.	Grey Cast Iron		●	●	❍	❍			10 - 20	20 - 50	T/Ö
2.2.	Nodular and Malleable Cast Iron		●	●	❍	❍			10 - 20	20 - 50	Ö/E
3.	**Non-Ferrous Metals**										
3.1.	Aluminium, Copper, Copper Alloys				●	●			20 - 30	30 - 50	Ö/E
3.2.1.	Aluminium Alloys, Copper Alloys		❍	❍	●	●			20 - 30	30 - 50	Ö/E
3.2.2.	Aluminium Special Alloys		●	●	❍	❍			20 - 30	30 - 50	Ö/E
3.3.	Copper Alloys, Short Chipping				●	●			20 - 30		T/Ö
4.	**Special Alloys**										
4.1.	Nickel Alloys										
4.2.	Titanium Alloys										
4.3.	Cu-Al-Fe-Alloys		●	●					5 - 10	10 - 20	Ö
5.	**Plastics**										
5.1.	Thermoplastics				●	●			20 - 30	30 - 50	T/E
5.2.	Thermosetting and Fibre Reinforced Plastics		●	●					10 - 15	15 - 20	T/E

Application: ● recommended ❍ suitable

M

Metric ISO Standard Thread DIN 13

VHM ≈ DIN 371 / 376 Works Standard Specification

Version	Form C, 2 - 3 Threads Chamfer	Form C, 2 - 3 Threads Chamfer KA = Axial Internal Cooling	Form C, 2 - 3 Threads Chamfer	Form C, 2 - 3 Threads Chamfer KA = Axial Internal Cooling
Type of Hole				
Surface Treatment		TiCN-Coating		TiCN-Coating
Catalogue-No.	4558	B4558/81	4555	B4555/81
Tolerance	6HX	6HX	ISO 2-6H	ISO 2-6H
			with KA M6 up 		with KA M6 up 
Application **Coolant** **Cutting Speed v_c**	see Table Page 11			

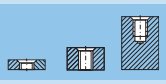
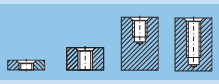
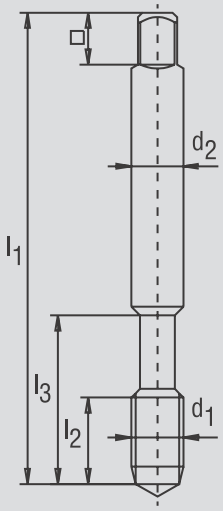
d_1	P	l_1	l_2	l_3	d_2	□	*	Price/Piece 4558		Price/Piece B4558/81		Price/Piece 4555		Price/Piece B4555/81	
	mm	mm	mm	mm	mm	mm	mm	EURO	DM	EURO	DM	EURO	DM	EURO	DM
M 3	0,5	56	10	18	3,5	2,7	2,5	74,14	145,00						
M 4	0,7	63	12	21	4,5	3,4	3,3	70,56	138,00			77,72	152,00		
M 5	0,8	70	14	25	6	4,9	4,2	80,27	157,00			86,92	170,00		
M 6	1	80	16	30	6	4,9	5	93,06	182,00	107,37	210,00	100,21	196,00	115,04	225,00
M 8	1,25	90	18	35	8	6,2	6,8	111,46	218,00	122,71	240,00	120,15	235,00	138,05	270,00
M 10	1,5	100	20	39	10	8	8,5	140,09	274,00	161,06	315,00	151,34	296,00	173,84	340,00
M 12	1,75	110	22		9	7	10,2	181,51	355,00	208,61	408,00	195,31	382,00	224,97	440,00

* The recommended core hole diameters are for reference purpose only.

M

Metric ISO Standard Thread DIN 13

VHM ≈ DIN 371 / 376 Works Standard Specification

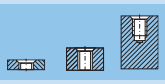
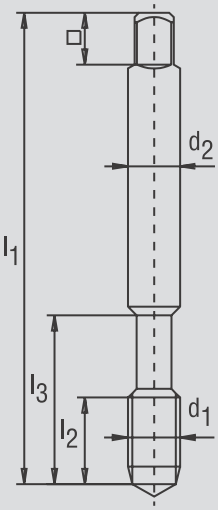
Version	Form D, 3,5 - 5 Threads Chamfer	Form C, 2 - 3 Threads Chamfer KA = Axial Internal Cooling		
Type of Hole				
Surface Treatment	TiCN-Coating	TiCN-Coating		
Catalogue-No.	4553	B4560/81		
Tolerance	ISO 2-6H	6HX		
		 Attention to core hole Ø !	with KA M6 up 	
Application **Coolant** **Cutting Speed v_c**	see Table Page 11			

d_1	P	l_1	l_2	l_3	d_2	□	⌀D1*	⌀D1*	Price/Piece 4553		Price/Piece B4560/81	
	mm	mm	mm	mm	mm	mm	mm 4553	mm B4560/81	EURO	DM	EURO	DM
M 3	0,5	56	10	18	3,5	2,7	2,7	2,75	81,81	160,00		
M 4	0,7	63	12	21	4,5	3,4	3,5	3,65	77,72	152,00		
M 5	0,8	70	14	25	6	4,9	4,4	4,6	88,45	173,00		
M 6	1	80	16	30	6	4,9	5,3	5,5	102,26	200,00	116,57	228,00
M 8	1,25	90	18	35	8	6,2	7,1	7,4	122,71	240,00	134,98	264,00
M 10	1,5	100	20	39	10	8	8,8	9,25	153,39	300,00	159,52	312,00
M 12	1,75	110	22		9	7	10,5	11,1	199,40	390,00	199,40	390,00

* The recommended core hole diameters are for reference purpose only.

Metric ISO Fine Thread DIN 13

VHM ≈ DIN 371 / 374 Works Standard Specification **MF**

Version	Form C, 2 - 3 Threads Chamfer KA = Axial Internal Cooling	Form C, 2 - 3 Threads Chamfer KA = Axial Internal Cooling	Form D, 3,5 - 5 Threads Chamfer
Type of Hole			
Surface Treatment	TiCN-Coating	TiCN-Coating	TiCN-Coating
Catalogue-No.	**B4558/81**	**B4555/81**	**4553**
Tolerance	6HX	ISO 2-6H	ISO 2-6H
	with KA	with KA	
			 Attention to core hole Ø!
Application **Coolant** **Cutting Speed v_c**	see Table Page 11		

d_1	P	l_1	l_2	l_3	d_2	□	* mm B4558/81 B4555/81	* mm 4553	Price/Piece B4558/81 EURO	Price/Piece B4558/81 DM	Price/Piece B4555/81 EURO	Price/Piece B4555/81 DM	Price/Piece 4553 EURO	Price/Piece 4553 DM
	mm	mm	mm	mm	mm	mm								
M 8 x	1	90	18	35	8	6,2	7,0	7,3	178,95	350,00	186,11	364,00	196,85	385,00
M 10 x	1	90	18	35	10	8	9,0	9,3	222,92	436,00	214,74	420,00	245,42	480,00
M 12 x	1,5	100	18		9	7	10,5	10,8	249,51	488,00	237,24	464,00	274,05	536,00

* The recommended core hole diameters are for reference purpose only.

Metric ISO Standard Thread DIN 13

Tap-Drill-Set

Catalogue-No. 3555

Contents
Machine Taps
(Catalogue-No.: 4553 Form D)
M5 - M6 - M8 - M10 - M12

Drills
Ø 4,4 - 5,3 - 7,1 - 8,8 - 10,5 mm

Price/Piece:
EURO 1.119,22
DM 2.189,00

How to choose the right solid carbide tap

Company visited:

Person contacted:

BOSS visitor: Date:

Type of thread / core hole

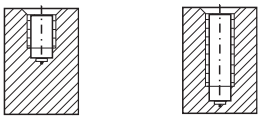
Dimension:

Tolerance:

Right hand ☐ Left hand ☐

Depth of core hole: mm Core hole-Ø: mm

Depth of thread: mm

Through hole	Blind hole
short Thread 2-3 x d	Depth of Thread 1,5 x d / 3 x d
	
☐ ☐	☐ ☐
Please, mark	Please, mark

Workpiece / Material

Material designation:

Material number:

Hardness / Tensile strength:

Application

Requirements / Limits to
cutting speed: m/min

Feed rate at center: mm/tooth

Feed rate at outline: mm/min

Coolant: ☐ Emulsion ☐ Dry ☐ Cutting Oil ☐ MKS

Machine:

Machine control:

Tool carrier / Chuck:

Tool presently used

BOSS tool recommendation

Further details:

Jakob Boss Söhne GmbH & Co. KG
Thread Technology
P.O. Box 130
D-72445 Albstadt

Phone +49-07432/9092-0
Fax +49-07432/22699
e-mail: jakob.boss@t-online.de

Thread Mills

Service and continuous development are guarantees for our future.

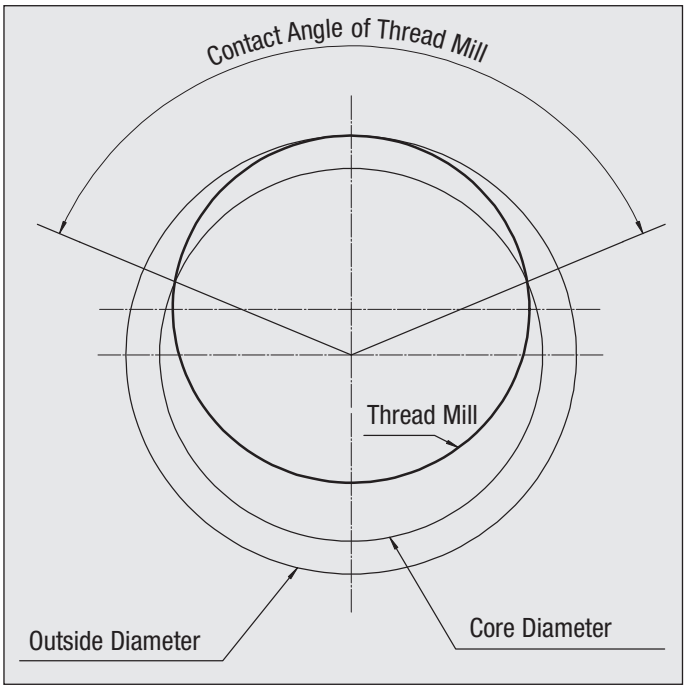
For a number of years we have been developing and improving tools for the manufacture of internal threads. There are three ways to manufacture threads: whilst tapping and thread forming have gained wide acceptance in the marketplace thread milling has only gained acceptance with the introduction of the new generation of 3-D CNC milling machines.

When applying thread interpolation the thread mill follows the motion of a given point on the outer diameter of a srew when tapped. Seen from the levels of the machine the circular motion follows a synchronous axial motion.

Advantages of Thread Milling:

- Excellent surface quality due to independant values of cutting speed and feed rate
- Improved process security due to short, controlled chips
- Problem-free thread manufacture in high strength, difficult to cut materials
- Reduction of tool variations
  - One tool for various thread diameters
  - One tool for various tolerances
  - One tool for right hand as well as left hand threads
  - One tool for various materials
- Short thread chamfer

Conditions of Contact



The diagram clearly shows that the size of the thread mill and the depth of the profile determine the contact angle for the thread diameter.

As long as the thread mill diameter is within 70% of the outer thread diameter a distortion of the profile can be excluded independant of the profile depth. This factor has proven to be correct in practical use and is also used in some CNC-controls.

Thread Interpolation

Thread interpolation is the superposition of circular and linear motions.

Based on the type of directional superposition of feed rate and circular motion different kinds of threads can be produced.

Counterrotation regarding Internal Threads:

circle clockwise
+ downward feed rate
= right hand thread

circle clockwise
+ upward feed rate
= left hand thread

Synchronism regarding Internal Threads:

circle counterclockwise
+ downward feed rate
= left hand thread

circle counterclockwise
+ upward feed rate
= right hand thread

Applications such as blind or through hole, horizontal or vertical, and the option to lubricate and flush the chips have an impact on the correct selection of the milling method.

Experience generally shows better tool life in the case of counterrotation milling.

Conditions Regarding Cutting Speed

The feed rate at the cutting edge of the thread mill is calculated using cutting speed (rpm) and feed rate/tooth.

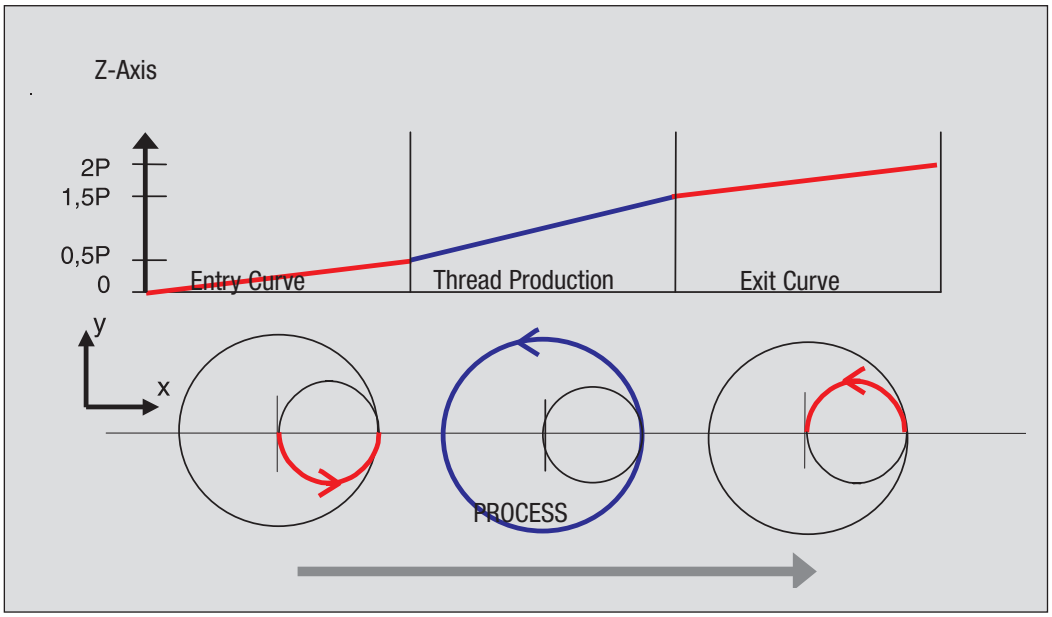
In a linear motion the feed rate at the cutting edge equals the feed rate in the center of the tool. The thread interpolation, however, follows a circle in the plane. Since machine tools are always calculated with reference to the center of the tool an instruction to convert the speed needs to be programmed (contour-related programs!).
If there is no such instruction or if the program refers to the center the feed rate needs to be calculated beforehand.

$$v_{f\ center} = v_{f\ contour} \times (\text{outer-Ø} - \text{tool-Ø}) / \text{outer-Ø}$$

The dialog control at the control desk always shows the speed at the center of the tool. This can easily be checked when dry-running the machine. If this fact is not taken into account the thread mill will run at a multiple feed rate and generally cause tool breakage!

Motion

BOSS thread mills are usually right hand cutting. The mill rotates at high rpm and enters the workpiece in the center axis of the existing core hole.



The entry into the material to the outer diameter of the thread can be effected in two ways:

a) Direct entry:
The thread mill heads for the programmed outer diameter in a linear motion. The advantage: ease of programming. Disadvantage: a directional change during the subsequent motion of more than 90°. Dwell marks at this point and side pressures cause tool wear.

b) Tangential entry:
The thread mill enters the material in a circular curve having its point of tangency at the programmed outer diameter of the thread. Advantage: a gradually increasing constant cutting pressure and constant continuation during the subsequent motion. More time has to be invested in programming especially considering injuries to the contour.

Thread milling is accomplished during a 360° circular motion superposed by the linear motion of pitch P. The process follows the thread interpolation.

Tangential exit from the workpiece.

Exit from the thread core hole through the center of the axis.

Cutting Speed and Feed Rate of Solid Carbide Thread Mills

Material Main Groups	Material Sub Groups	Cutting Speed v_c = m/min		Feed Rate v_f = mm/min
		Uncoated	Coated	
1. Steel	1.1. Unalloyed Steels; RM ⩽ 800 N/mm²	60 - 100	80 - 160	0,03 - 0,06
	1.2. Unalloyed Steels; RM ⩽ 1000 N/mm²	50 - 80	60 - 130	0,03 - 0,06
	1.3.1. Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²	40 - 70	50 - 100	0,01 - 0,05
	1.3.2. Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²	30 - 40	60 - 80	0,01 - 0,05
	1.3.3. Hardened Steels; 42 - 60 HRC			
	1.4. Stainless Steels (V2A-Steels)	40 - 70	50 - 100	0,03 - 0,06
	1.5. Stainless Steels with High Cr-Ni-Content (V4A-Steels)	30 - 40	60 - 80	0,03 - 0,06
	1.6. High Speed Steels	40 - 70	50 - 100	0,01 - 0,05
2. Cast Iron	2.1. Grey Cast Iron	60 - 100	80 - 160	0,03 - 0,06
	2.2. Nodular and Malleable Cast Iron	60 - 100	80 - 160	0,03 - 0,06
3. Non-Ferrous Metals	3.1. Aluminium, Copper, Copper Alloys	150 - 200	200 - 400	0,05 - 0,15
	3.2.1. Aluminium Alloys, Copper Alloys	150 - 200	200 - 400	0,05 - 0,15
	3.2.2. Aluminium Special Alloys	130 - 170	200 - 350	0,05 - 0,15
	3.3. Copper Alloys Short Chipping	150 - 200	200 - 400	0,05 - 0,15
4. Special Alloys	4.1. Nickel Alloys	20 - 30	40 - 50	0,01 - 0,05
	4.2. Titanium Alloys	30 - 40	50 - 60	0,01 - 0,03
	4.3. Cu-Al-Fe-Alloys	30 - 40	50 - 60	0,01 - 0,03
5. Plastics	5.1. Thermoplastics	150 - 200	250 - 300	0,05 - 0,15
	5.2. Thermosetting and Fibre Reinforced Plastics	150 - 200	250 - 300	0,05 - 0,15

Calculation of cutting data to be programmed for thread milling

The feed rate may be increased by 50% when working in materials easy to be machined, e.g. aluminium.

V_z = Feed Rate per Tooth (mm) (feed rate in the center)	
Mill Diameter	Feed Rate
> 3 - ≤ 4	0,005
> 4 - ≤ 6	0,01
> 6 - ≤ 8	0,02
> 8 - ≤10	0,03
>10 - ≤12	0,04
>12 - ≤16	0,06
>16 - ≤20	0,08
>20	0,1

RPM *n*

$$n = \frac{v_c \times 1000}{D \times 3{,}14} \text{ (rpm)}$$

Feed Rate at Cutting Edge v_f

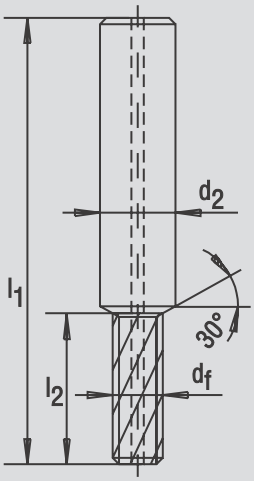
$v_f = v_z \times z \times n$ (mm/min)

z = no. of teeth of thread mill
D = nom. diameter of thread mill

Internal Metric ISO Standard Thread DIN 13

M

Version	Right Hand Spiral 25° Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° Countersink Chamfer KA = Axial Internal Cooling
Shank	acc. DIN 6535 - HA	acc. DIN 6535 - HB	acc. DIN 6535 - HE
Depth	$\leqslant 2xd_1$	$\leqslant 2xd_1$	$\leqslant 2xd_1$
Surface Treatment			
Catalogue-No.	**B5566**	**B5567**	**B5568**
	with KA M6 up	with KA M6 up	with KA M6 up



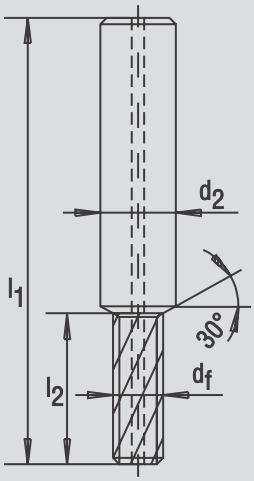
Application	All Material Groups											
Cutting Speed v_c Feed Rate	see Table Page 21											

Thread	P	d_f	l_1	l_2	d_2 h6	Teeth	Price/Piece B5566		Price/Piece B5567		Price/Piece B5568	
d_1	mm	mm	mm	mm	mm		EURO	DM	EURO	DM	EURO	DM
M 5	0,8	4,0	56	11,2	6	3	70,56	138,00	74,65	146,00	74,65	146,00
M 6	1	4,8	63	13,0	8	3	75,67	148,00	80,27	157,00	80,27	157,00
M 8	1,25	6,4	71	17,5	10	3	93,06	182,00	99,19	194,00	99,19	194,00
M 10	1,5	8,0	80	21,0	12	3	109,42	214,00	116,06	227,00	116,06	227,00
M 12	1,75	9,6	80	26,25	14	4	158,50	310,00	168,73	330,00	168,73	330,00
M 14	2	11,2	90	30,0	16	4	189,18	370,00	201,96	395,00	201,96	395,00
M 16	2	12,8	100	34,0	18	4	238,26	466,00	253,60	496,00	253,60	496,00

d_1 = nom. diameter of thread to be milled
d_f = max. outside diameter of thread mill

Internal Metric ISO Standard Thread DIN 13

M

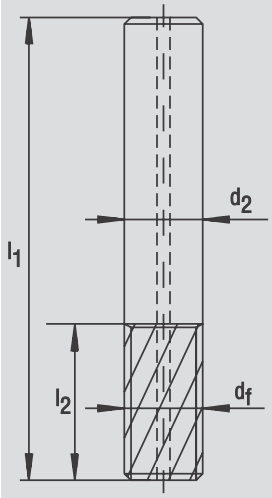
Version	Right Hand Spiral 25° Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° Countersink Chamfer KA = Axial Internal Cooling	
Shank	acc. DIN 6535 - HA	acc. DIN 6535 - HB	acc. DIN 6535 - HE	
Depth	⩽ 2xd_1	⩽ 2xd_1	⩽ 2xd_1	
Surface Treatment	TiCN-Coating	TiCN-Coating	TiCN-Coating	
Catalogue-No.	**B5566/81**	**B5567/81**	**B5568/81**	
	with KA M6 up 	with KA M6 up 	with KA M6 up 	
Application	All Material Groups			
Cutting Speed v_c Feed Rate	see Table Page 21			

Thread d_1	P mm	d_f mm	l_1 mm	l_2 mm	d_2 h6 mm	Teeth	Price/Piece B5566/81 EURO	Price/Piece B5566/81 DM	Price/Piece B5567/81 EURO	Price/Piece B5567/81 DM	Price/Piece B5568/81 EURO	Price/Piece B5568/81 DM
M 5	0,8	4,0	56	11,2	6	3	75,16	147,00	79,25	155,00	79,25	155,00
M 6	1	4,8	63	13,0	8	3	79,76	156,00	84,36	165,00	84,36	165,00
M 8	1,25	6,4	71	17,5	10	3	107,37	210,00	113,51	222,00	113,51	222,00
M 10	1,5	8,0	80	21,0	12	3	126,80	248,00	133,45	261,00	133,45	261,00
M 12	1,75	9,6	80	26,25	14	4	176,40	345,00	186,62	365,00	186,62	365,00
M 14	2	11,2	90	30,0	16	4	209,63	410,00	222,41	435,00	222,41	435,00
M 16	2	12,8	100	34,0	18	4	261,78	512,00	277,12	542,00	277,12	542,00

d_1 = nom. diameter of thread to be milled
d_f = max. outside diameter of thread mill

Internal Metric ISO Fine Thread DIN 13

MF

Version	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling
Shank	acc. DIN 6535 - HA	acc. DIN 6535 - HB	acc. DIN 6535 - HA	acc. DIN 6535 - HB
Depth	$\leqslant 1{,}5 \times d_1$	$\leqslant 1{,}5 \times d_1$	$\leqslant 1{,}5 \times d_1$	$\leqslant 1{,}5 \times d_1$
Surface Treatment			TiCN-Coating	TiCN-Coating
Catalogue-No.	**B5566**	**B5567**	**B5566/81**	**B5567/81**
	with KA 	with KA 	with KA 	with KA 
Application	All Material Groups			
Cutting Speed v_c Feed Rate	see Table Page 21			

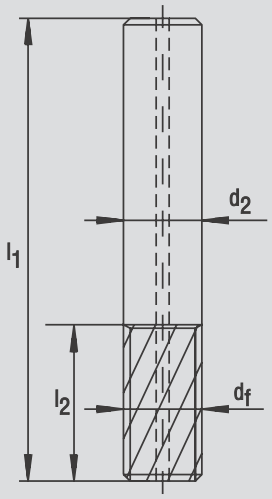
d_1		P	d_f	l_1	l_2	d_2 h6	Teeth	Price/Piece B5566		Price/Piece B5567		Price/Piece B5566/81		Price/Piece B5567/81	
		mm	mm	mm	mm	mm		EURO	DM	EURO	DM	EURO	DM	EURO	DM
⩾ M 10	x	1	8	63	16	8	3	120,66	236,00	127,82	250,00	135,49	265,00	142,65	279,00
⩾ M 14	x	1	10	71	16	10	4	199,40	390,00	219,86	430,00	224,97	440,00	245,42	480,00
⩾ M 14	x	1,5	10	71	16	10	4	196,34	384,00	206,56	404,00	214,74	420,00	224,97	440,00
⩾ M 16	x	1	12	80	20	12	4	248,49	486,00	266,89	522,00	279,17	546,00	297,57	582,00
⩾ M 16	x	1,5	12	80	20	12	4	245,42	480,00	254,62	498,00	265,87	520,00	275,08	538,00
⩾ M 18	x	1	14	90	25	14	4								
⩾ M 18	x	1,5	14	90	25	14	4								

d_1 = nom. diameter of thread to be milled

d_f = max. outside diameter of thread mill

Internal Pipe Thread DIN ISO 228 (G)

G

Version	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling	Right Hand Spiral 25° w/o Countersink Chamfer KA = Axial Internal Cooling
Shank	acc. DIN 6535 - HA	acc. DIN 6535 - HB	acc. DIN 6535 - HA	acc. DIN 6535 - HB
Depth	$\leqslant 1{,}5xd_1$	$\leqslant 1{,}5xd_1$	$\leqslant 1{,}5xd_1$	$\leqslant 1{,}5xd_1$
Surface Treatment			TiCN-Coating	TiCN-Coating
Catalogue-No.	**B5566**	**B5567**	**B5566/81**	**B5567/81**
	with KA 	with KA 	with KA 	with KA 
Application	All Material Groups			
Cutting Speed v_c Feed Rate	see Table Page 21			

d_1	Thr./1"	d_f	l_1	l_2	d_2 h6	Teeth	Price/Piece B5566		Price/Piece B5567		Price/Piece B5566/81		Price/Piece B5567/81	
		mm	mm	mm	mm		EURO	DM	EURO	DM	EURO	DM	EURO	DM
G1/4 - G3/8	19	10	71	16	10	4	156,45	306,00	178,95	350,00	175,88	344,00	198,38	388,00
G1/2 - G5/8 - G3/4	14	16	90	25	16	4	242,35	474,00	276,10	540,00	270,98	530,00	304,73	596,00

d_1 = nom. diameter of thread to be milled
d_f = max. outside diameter of thread mill

How to choose the right solid carbide thread mill

Company visited:

Person contacted:

BOSS visitor: Date:

Type of thread / core hole

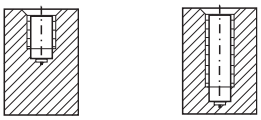
Dimension:

Tolerance:

Right hand ☐ Left hand ☐

Depth of core hole: mm Core hole-Ø: mm

Depth of thread: mm

Through hole	Blind hole
short Thread 2-3 x d	Depth of Thread 1,5 x d 3 x d
	
☐ ☐	☐ ☐
Please, mark	Please, mark

Workpiece / Material

Material designation:

Material number:

Hardness / Tensile Strength:

Tool presently used

BOSS tool recommendation

Further details:

Application

☐ Synchron. milling
☐ Counterrot. milling

Position of thread mill: ☐ tangential ☐ radial

Requirements / Limits to cutting speed: m/min

Feed rate at center: mm/tooth

Feed rate at outline: mm/min

Coolant: ☐ Emulsion ☐ Cutting oil ☐ dry ☐ MKS

Machine:

Machine control:

Tool carrier / Chuck:

Jakob Boss Söhne GmbH & Co. KG
Thread Technology
P.O. Box 130
D-72445 Albstadt

Phone +49-07432/9092-0
Fax +49-07432/22699
e-mail: jakob.boss@t-online.de

Advantages and Applications of Multi-Tooth Thread Milling Systems

Advantages:

- Short machining times
- No limitation to thread diameter
- **One** tool for right hand/left hand threads
- **One** thread milling cutter for different pitches
- Short chips, easy chip removal
- Tolerances can be altered
- Several dimensions possible with one pitch

Applications:

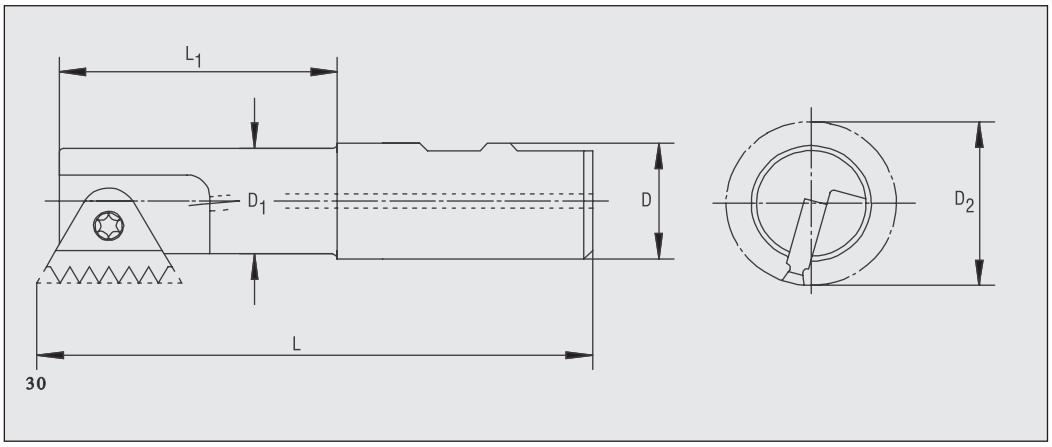
- Low cutting forces cause the thread of parts with thin walls to be accurate to gauge
- Easy to handle parts not being axially symmetrical
- Blind hole threads can be milled almost to the bottom of the hole
- No problem in milling interrupted threads

Cutting Speed and Feed Rate of Multi-Tooth Thread Milling Systems

Material Main Groups	Material Sub Groups	Cutting Speed v_c = m/min	Feed Rate mm/Tooth
1. Steel	1.1. Unalloyed Steels; RM ⩽ 800 N/mm²	160 - 200	0,1 - 0,3
	1.2. Unalloyed Steels; RM ⩽ 1000 N/mm²	150 - 180	0,1 - 0,3
	1.3.1. Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²	110 - 140	0,07 - 0,12
	1.3.2. Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²	100 - 120	0,07 - 0,12
	1.3.3. Hardened Steels; 42 - 60 HRC		
	1.4. Stainless Steels (V2A-Steels)	140 - 170	0,07 - 0,12
	1.5. Stainless Steels with High Cr-Ni-Content (V4A-Steels)	140 - 170	0,07 - 0,12
	1.6. High Speed Steels	110 - 140	0,07 - 0,12
2. Cast Iron	2.1. Grey Cast Iron	100 - 130	0,1 - 0,3
	2.2. Nodular and Malleable Cast Iron	100 - 130	0,1 - 0,3
3. Non-Ferrous Metals	3.1. Aluminium, Copper, Copper Alloys	200 - 250	0,15 - 0,3
	3.2.1. Aluminium Alloys, Copper Alloys	130 - 150	0,15 - 0,3
	3.2.2. Aluminium Special Alloys	130 - 150	0,15 - 0,3
	3.3. Copper Alloys Short Chipping	120 - 140	0,15 - 0,3
4. Special Alloys	4.1. Nickel Alloys		
	4.2. Titanium Alloys		
	4.3. Cu-Al-Fe-Alloys		
5. Plastics	5.1. Thermoplastics		
	5.2. Thermosetting and Fibre Reinforced Plastics		

Multi-Tooth Thread Milling Cutters

This system has been designed for fine thread milling.
It consists of milling cutter, insert and srew.
The gripping surface corresponds with DIN 1835.
All milling cutters have internal cooling with an exit at the cutting edge.



Catalogue-No.	Dimension mm					Price/Piece	
	L	L1	D	D1	D2	EURO	DM
5510 MZ1	69	12	12	6,8	9,0	111,97	219,00
5520 MZ2	85	20	20	8,9	11,5	120,15	235,00
5530 MZ3	95	43	20	16,6	20,0	130,89	256,00
5540 MZ4	110	52	25	24,0	30,0	165,66	324,00
	(additional milling cutters upon request)						

Milling Cutter Selection

The opposite table shall help determine the smallest thread diameter to be milled:

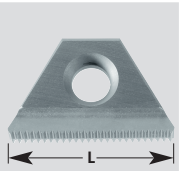
For milling cutters MZ 2 up to MZ 4 inserts may be used from both sides, on milling cutter MZ 1 from one side only.

Additional pitches are available upon request.

Pitch/ Cutter	0,5 mm	1,0 mm	1,5 mm	2 mm	BSP 14 Thr.	BSP 11 Thr.
MZ 1	⩾ M 10 x					
MZ 2		⩾ M 15 x	⩾ M 16 x			
MZ 3		⩾ M 24 x	⩾ M 25 x	⩾ M 26 x	⩾ G 3/4	⩾ G 1
MZ 4		⩾ M 33 x	⩾ M 35 x	⩾ M 38 x		

Multi-Tooth Inserts

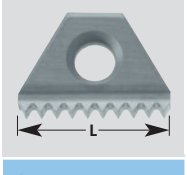
Internal* Metric ISO Fine Thread DIN 13 - TiN-Coating



	Catalogue-No.	Pitch mm	Teeth	Material Groups s. Table P. 29	Price/Piece (2 Inserts) EURO	Price/Piece (2 Inserts) DM	Price/Piece (5 Inserts) EURO	Price/Piece (5 Inserts) DM	Price/Piece (10 Inserts) EURO	Price/Piece (10 Inserts) DM
L = 10,4 mm for cutter MZ1	55101050180	0,5	20	1			34,36	67,20	30,65	59,95
	55101050280	0,5	20	2 + 3			34,36	67,20	30,65	59,95
L = 11 mm for cutter MZ2	55201100180	1,0	10	1			29,58	57,85	26,41	51,65
	55201100280	1,0	10	2 + 3			29,58	57,85	26,41	51,65
	55201150180	1,5	6	1			29,58	57,85	26,41	51,65
	55201150280	1,5	6	2 + 3			29,58	57,85	26,41	51,65
L = 16 mm for cutter MZ3	55301100180	1,0	15	1			33,77	66,05	30,17	59,00
	55301100280	1,0	15	2 + 3			33,77	66,05	30,17	59,00
	55301150180	1,5	10	1			33,77	66,05	30,17	59,00
	55301150280	1,5	10	2 + 3			33,77	66,05	30,17	59,00
	55301200180	2,0	7	1			33,77	66,05	30,17	59,00
	55301200280	2,0	7	2 + 3			33,77	66,05	30,17	59,00
L = 27 mm for cutter MZ4	55401100180	1,0	26	1	77,13	150,85	65,11	127,35	58,19	113,80
	55401100280	1,0	26	2 + 3	77,13	150,85	65,11	127,35	58,19	113,80
	55401150180	1,5	17	1	77,13	150,85	65,11	127,35	58,19	113,80
	55401150280	1,5	17	2 + 3	77,13	150,85	65,11	127,35	58,19	113,80
	55401200180	2,0	12	1	77,13	150,85	65,11	127,35	58,19	113,80
	55401200280	2,0	12	2 + 3	77,13	150,85	65,11	127,35	58,19	113,80

* external threads upon request

Internal BSP- and BSW-Thread - TiN-Coating



	Catalogue-No.	Pitch Thr./1“	Teeth	Material Groups s. Table P. 29	Price/Piece (2 Inserts) EURO	Price/Piece (2 Inserts) DM	Price/Piece (5 Inserts) EURO	Price/Piece (5 Inserts) DM	Price/Piece (10 Inserts) EURO	Price/Piece (10 Inserts) DM
L = 16 mm for cutter MZ3	55302140180	14	8	1			33,54	65,60	29,99	58,65
	55302140280	14	8	2 + 3			33,54	65,60	29,99	58,65
	55302110180	11	6	1			33,54	65,60	29,99	58,65
	55302110280	11	6	2 + 3			33,54	65,60	29,99	58,65

Advantages and Applications of Single-Tooth Thread Milling Systems

The use of several types of milling and programming the diameter determine why

- various threads (right hand - left hand),
- several dimensions (M 24x1,5 - M 30x1,5),
- various tolerances (ISO 1 - ISO 2 - ISO 3 - 7G),
- and multi-threads can be realized.

The BOSS Single-Tooth Thread Milling System adds another benefit:
As there is only one tooth at the circumference and thus one pitch of the tool in axial direction, different pitches can be milled!

A look at the profile of the insert and the definition of the mother thread is necessary:

Mother thread:

outer-Ø	min. dimension = nom.-Ø flattening max. H/8
flank-Ø	min. + max. according to standards
core hole-Ø	depending on preparation

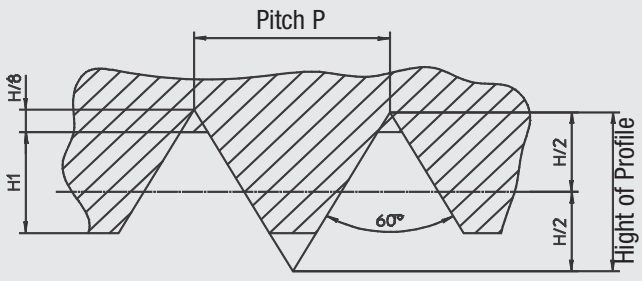
This determines the parameters.The inserts are grinded in such a way that hight H1 corresponds with the greatest pitch and the flattening H/8 corresponds with the smallest pitch.

This may “sound” understandable, however, it needs further explanation referring to the standards.

The flank diameter of a metric thread is at mid-point of the theoretical peak of profile H. At this point the flank diameter not only divides hight H but also pitch P of the thread!

The tooth of a thread with pitch 3 mm thus shows a width of P/2 = 1,5 mm at the flank diameter.

Metric ISO Thread DIN 13



The theoretical hight of the profile is calculated: H = 0,86603 x P
Hight of profile at the internal thread: H1 = 0,54127 x P
The profile reduction of an internal thread: H/8

Please, find below the calculated values for 3 pitches:

P 3	H = 2,598	H1 = 1,624	H/8 = 0,325 mm
P 4,5	H = 3,897	H1 = 2,436	H/8 = 0,487 mm
P 6	H = 5,196	H1 = 3,248	H/8 = 0,650 mm

Cutting Speed and Feed Rate of Single-Tooth Thread Milling Systems

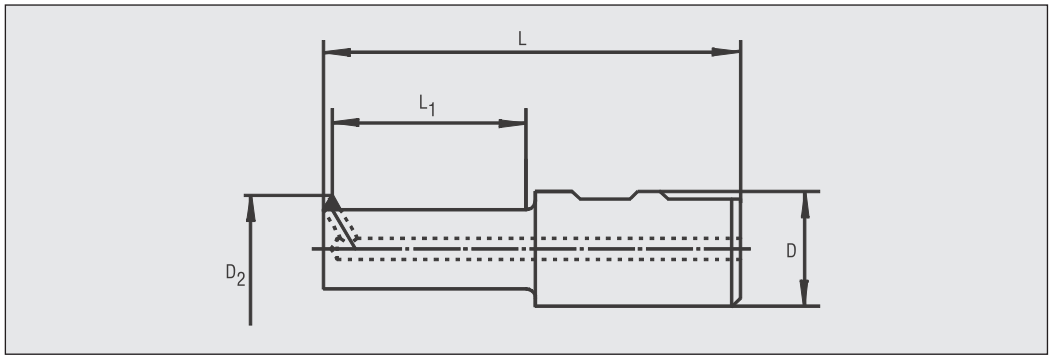
Material Main Groups	Material Sub Groups	Cutting Speed v_c = m/min	Feed Rate mm/Tooth
1. Steel	1.1. Unalloyed Steels; RM ⩽ 800 N/mm²	250 - 400	0,10 - 0,15
	1.2. Unalloyed Steels; RM ⩽ 1000 N/mm²	100 - 200	0,06 - 0,10
	1.3.1. Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²	100 - 200	0,06 - 0,10
	1.3.2. Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²		
	1.3.3. Hardened Steels; 42 - 60 HRC		
	1.4. Stainless Steels (V2A-Steels)	80 - 150	0,06 - 0,08
	1.5. Stainless Steels with High Cr-Ni-Content (V4A-Steels)		
	1.6. High Speed Steels	100 - 200	0,06 - 0,08
2. Cast Iron	2.1. Grey Cast Iron	200 - 400	0,08 - 0,15
	2.2. Nodular and Malleable Cast Iron	200 - 400	0,08 - 0,15
3. Non-Ferrous Metals	3.1. Aluminium, Copper, Copper Alloys	400 - 500	0,10 - 0,15
	3.2.1. Aluminium Alloys, Copper Alloys	250 - 400	0,08 - 0,12
	3.2.2. Aluminium Special Alloys	250 - 400	0,08 - 0,12
	3.3. Copper Alloys Short Chipping	250 - 400	0,08 - 0,15
4. Special Alloys	4.1. Nickel Alloys		
	4.2. Titanium Alloys		
	4.3. Cu-Al-Fe-Alloys		
5. Plastics	5.1. Thermoplastics		
	5.2. Thermosetting and Fibre Reinforced Plastics		

Single-Tooth Milling Cutters

This system is designed for milling of standard and fine threads.
It consists of milling cutter, insert, and screw.
Several pitches as well as multiple threads can be realized using one insert only.
Milling cutters generally have axial internal cooling with an exit at the cutting edge.
Inserts are freely interchangeable within one size.
American ANSI B 1.1 for UN - UNC - UNF threads also have a 60° profile and may be used with the corresponding pitch.
Special solutions for other tool carriers such as SK 50 and ABS are also available.

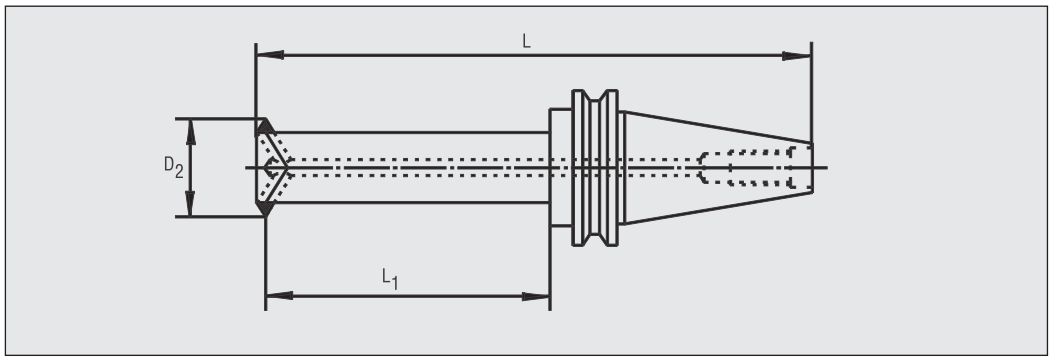
Inserts with pitches of 1,5 - 3,0 mm are not available ex stock for milling cutter EZ4.
Fine threads of 64 mm+ nominal diameter can be milled with a usable length of 110 mm using the same number of inserts on milling cutter EZ 3.

Cylindrical Version



Catal. No.	D_2	Minimum Thread-Ø	Pitch	No. of Inserts	Usable Leng. L_1	Total Length L	Tool Carrier	Price/Piece EURO	DM
5501 EZ1	24 mm	30 mm	1,5 - 2,5 2,5 - 4,0	3	70 mm	129 mm	Parallel Shank D = 25 h6 DIN 1835	285,30	558,00
5502 EZ2	34 mm	42 mm	1,5 - 2,5 2,5 - 5,0	3	100 mm	163 mm	Parallel Shank D = 32 h6 DIN 1835	316,49	619,00

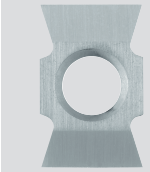
Tapered Version



Catal. No.	D_2	Minimum Thread-Ø	Pitch	No. of Inserts	Usable Leng. L_1	Total Length L	Tool Carrier	Price/Piece EURO	DM
5503 EZ3	41 mm	52 mm	1,5 - 3,0 3,0 - 5,0	4	120 mm	227 mm	SK 40 DIN 69871 Form AD - B	634,00	1.240,00
5504 EZ4	53 mm	64 mm	3,0 - 6,0	4	150 mm	258 mm	SK 40 DIN 69871 Form AD - B	715,81	1.400,00

Single-Tooth Inserts for Internal Threads

Metric ISO Standard and Fine Thread DIN 13 - TiN-Coating



	Catalogue-No.	Pitch mm	Material Groups s. Table P. 25	Price/Piece (3 Inserts)		Price/Piece (4 Inserts)		Price/Piece (12 Inserts)	
				EURO	DM	EURO	DM	EURO	DM
for cutter MZ1	55011250380	1,5-2,5	1 - 3	35,05	68,55			29,71	58,10
	55011400380	2,5-4,0	1 - 3	35,05	68,55			29,71	58,10
for cutter MZ2	55021250380	1,5-2,5	1 - 3	39,73	77,70			33,67	65,85
	55021500380	2,5-5,0	1 - 3	39,73	77,70			33,67	65,85
for cutter MZ3	55031300380	1,5-3,0	1 - 3			43,69	85,45	37,68	73,70
	55031550380	3,0-5,5	1 - 3			43,69	85,45	37,68	73,70
for cutter MZ4	55041600380	3,0-6,0	1 - 3			49,21	96,25	42,44	83,00

Choosing the right solid carbide thread milling system

Company visited:

Person contacted:

BOSS visitor: Date:

Type of thread / core hole

Dimension:

Tolerance:

Right hand ☐ Left hand ☐

Depth of core hole: mm Core hole-Ø: mm

Depth of thread: mm

Through hole

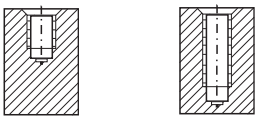
short Thread 2-3 x d

☐ ☐

Please, mark

Blind hole

Depth of Thread 1,5 x d 3 x d



☐ ☐

Please, mark

Workpiece / Material

Material designation:

Material number:

Hardness / Tensile strength:

Application

☐ Synchron. milling
☐ Counterrot. milling

Milling process:
☐ tangential curve
☐ radial
☐ tangential line

Requirements/Limits to cutting speed: m/min

Feed rate at center: mm/tooth

Feed rate at outline: mm/min

Coolant: ☐ Emulsion ☐ Cutting Oil ☐ Dry ☐ MKS

Machine:

Machine control:

Tool carrier / Chuck:

Tool presently used

BOSS tool recommendation

Further details:

Jakob Boss Söhne GmbH & Co. KG
Thread Technology
P.O. Box 130
D-72445 Albstadt

Phone +49-07432/9092-0
Fax +49- 07432/22699
e-mail: jakob.boss@t-online.de

Recommendation Table Drills

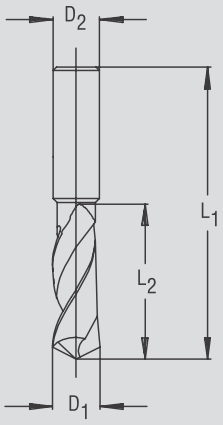
Material Main Groups	Material Sub Groups							Coolant Ö = Cutting Oil E = Emulsion P = Petroleum T = Dry, Air
	Catalogue-No.	601 602	604 605	606 607	609	610 611	612 613 614	
1. Steel	1.1. Unalloyed Steels; RM ⩽ 800 N/mm²	●	❍		●	●		E
	1.2. Unalloyed Steels; RM ⩽ 1000 N/mm²	●			●	●		E
	1.3.1. Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²	●			●	●		E
	1.3.2. Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²	●			●	●		E
	1.3.3. Hardened Steels; 42 - 60 HRC	●			●	●		E
	1.4. Stainless Steels (V2A-Steels)		●		●	●		E
	1.5. Stainless Steels with High Cr-Ni-Content (V4A-Steels)		●		●	●		E
	1.6. High Speed Steels		●		●	●		E
2. Cast Iron	2.1. Grey Cast Iron	●	●	❍	●	●	●	T/P
	2.2. Nodular and Malleable Cast Iron	●	●	❍	●	●	●	T/P
3. Non-Ferrous Metals	3.1. Aluminium, Copper, Copper Alloys			●	●	●		E
	3.2.1. Aluminium Alloys, Copper Alloys			●	●	●	●	E
	3.2.2. Aluminium Special Alloys			●	●	●	●	E
	3.3. Copper Alloys Short Chipping			●	●	●		E
4. Special Alloys	4.1. Nickel Alloys	●	●		●	●		E
	4.2. Titanium Alloys			●	●	●		E
	4.3. Cu-Al-Fe-Alloys	●	●		●	●		E
5. Plastics	5.1. Thermoplastics			●	●	●		
	5.2. Thermosetting and Fibre Reinforced Plastics			●	●	●		
	Application: ● recommended ❍ suitable							

Recommended Production Values Drills

Material Group	Materials	Tensile Strength (N/mm²)	Carb. Design.	Cutting Speed v_c (m/min) w/o KA	Cutting Speed v_c (m/min) with KA	Feed Rate per Rotation v_f (mm) Drill-Ø 3-5	5-8	8-12	12-16	16-18	Coolant
	Catalogue-No.: 601 to 605										
1. Steel	Unalloyed Steels	⩽ 600	K10	60 - 80	70 - 90	0,15-0,36	0,25-0,45	0,25-0,45	0,3 -0,55	0,40-0,6	E
	Unalloyed Steels	⩽ 700	K10	60 - 80	70 - 90	0,15-0,36	0,25-0,45	0,25-0,45	0,3 -0,55	0,40-0,6	E
	Cast Steel	⩾ 700	K10	60 - 80	70 - 90	0,15-0,3	0,22-0,40	0,27-0,52	0,3 -0,57	0,37-0,63	E
	Alloyed Steels	⩽ 900	K10	55 - 75	65 - 85	0,15-0,45	0,23-0,42	0,27-0,53	0,3 -0,57	0,38-0,63	E
	Alloyed Steels	⩽ 1000	K10	55 - 75	65 - 85	0,15-0,23	0,18-0,3	0,21-0,38	0,24-0,45	0,27-0,48	E
	Alloyed Steels	⩾ 1000	K10	55 - 75	65 - 85	0,15-0,23	0,18-0,3	0,21-0,38	0,24-0,45	0,27-0,48	E
	Stainless Steels		K10	KA only	30 - 50	0,06-0,12	0,08-0,15	0,1 -0,2	0,15-0,25	0,2 -0,3	E
2. Cast Iron	Cast Iron	⩽ 200	K10	60 - 85	70 - 95	0,23-0,33	0,3 -0,53	0,38-0,68	0,45-0,75	0,53-0,83	T
	Nod. Cast Iron	⩽ 250	K10	60 - 85	70 - 95	0,23-0,33	0,3 -0,53	0,38-0,68	0,45-0,75	0,53-0,83	E
	Nod. Cast Iron	⩾ 250	K10	60 - 85	70 - 95	0,18-0,3	0,21-0,33	0,3 -0,53	0,38-0,6	0,45-0,68	E
	Chilled Cast Iron	350-450	K10	40 - 50	50 - 60	0,09-0,15	0,12-0,18	0,15-0,21	0,18-0,24	0,21-0,27	E
	Catalogue-No.: 606 to 611										
1. Steel	Stainless Steels		K10*	30 - 60	50 - 70	0.02	0.04	0.06	0.08	0.1	E
3. Non-Ferrous Metals	Brass, Bronce		K10*	60 - 250	60 - 450	0,02	0,06	0,11	0,16	0,2	E
	Al / Al-Alloys		K10*	100 - 300	100 - 600	0,03	0,07	0,11	0,15	0,2	E
4. Special Alloys	Titanium, Titan. Alloys		K10*	20 - 40	20 - 90	0,01	0,03	0,06	0,08	0,1	E
5. Plastics	Fibre Reinforced Epoxy Resin		K10*	100 - 150		0,08	0,09	0,11	0,13	0,15	T
	Thermos. Plastics		K10*	80 - 150		0,04	0,06	0,09	0,12	0,15	T
	Catalogue-No.: 612 to 614										
2. Cast Iron	GG		K 10*	70 - 120		0,1 -0,15	0,15 -0,20	0,20-0,25	0,20-0,35	0,35-0,40	T
	GGG, GTS, GTW		P 40	70 - 120		0,08-0,12	0,12-0,18	0,18-0,22	0,20-0,30	0,30-0,35T	T
3. Non-Ferrous Metals	Al / Al-Alloys with Si < 12%		K 10*	100 - 250		0,10-0,18	0,18-0,25	0,25-0,30	0,30-0,40	0,40-0,50	E
	Al / Al-Alloys with Si > 12%		K10*	80 - 220		0,10-0,18	0,18-0,25	0,25-0,30	0,30-0,40	0,40-0,50	E
	*Universal Fine Grain										
	(Values are for reference purpose only and need to be adjusted according to outside conditions.)										

High Performance Drills DIN 6537

Version	DIN 6535 - HA Spiral Flutes σ = 140° Long KA = Axial Internal Cooling	DIN 6535 - HA Spiral Flutes σ = 140° Short	DIN 6535 - HA Spiral Flutes σ = 140° Long KA = Axial Internal Cooling	DIN 6535 - HA Spiral Flutes σ = 140° Short KA = Axial Internal Cooling
Surf. Treatment	TiAlN-Coating	TiAlN-Coating	TiN-Coating	TiN-Coating
Catalogue-No.	**601**	**602**	**604**	**605**
Tolerance	m7	m7	m7	m7
	with KA		with KA	with KA



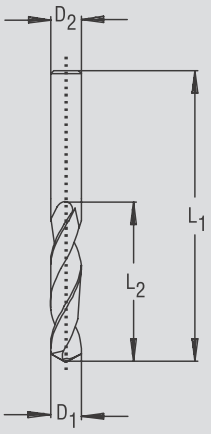
Application
Coolant
Cutting Speed v_c
see Recommendation Table Page 39

601/604				601		604	
D_1 m7 mm >/≤	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM	Price/Piece EURO	DM
5 / 6	6	82	44	65,45	128,00	70,30	137,50
6 / 8	8	91	53	84,36	165,00	88,71	173,50
8 / 10	10	103	61	99,29	194,20	109,16	213,50
10 / 12	12	118	71	139,33	272,50	152,88	299,00
12 / 14	14	124	77	200,68	392,50	219,60	429,50
14 / 16	16	133	83	217,61	425,60	240,05	469,50
16 / 18	18	143	93	334,64	654,50	367,87	719,50
18 / 20	20	153	101	359,95	704,00	397,79	778,00

602/605				602		605	
D1 m7 mm >/≤	D2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM	Price/Piece EURO	DM
5 / 6	6	66	28	36,56	71,50	50,36	98,50
6 / 7	8	79	34	43,20	84,50	67,23	131,50
7 / 8	8	79	41	50,46	98,70	67,23	131,50
8 / 10	10	89	47	50,46	98,70	81,30	159,00
10 / 12	12	102	55	73,88	144,50	117,34	229,50
12 / 14	14	107	60	106,45	208,20	151,34	296,00
14 / 16	16	115	65	120,87	236,40	180,23	352,50
16 / 18	18	123	73	214,18	418,90	296,29	579,50
18 / 20	20	131	79	219,04	428,40	318,79	623,50

High Performance Drills — DIN 6539 sim. DIN 1897

Version	With Equal Nominal and Shank-Ø σ = 118° Short
Surf. Treatment	
Catalogue-No.	606
Tolerance	m7



Application
Coolant
Cutting Speed v_c

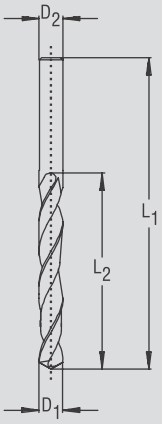
see Recommendation Table Page 39

606

$D_1 = D_2$ m7 mm >/≤	L_1 mm	L_2 mm	Price/Piece EURO	DM
0,5	20	3	4,09	8,00
0,6	21	3,5	4,09	8,00
0,7	23	4,5	4,09	8,00
0,8	24	5	4,09	8,00
0,9	25	5,5	4,09	8,00
1,0	26	6	4,09	8,00
1,1	28	7	4,09	8,00
1,2 /1,3	30	8	4,09	8,00
1,4 /1,5	32	9	4,09	8,00
1,6 /1,7	34	10	4,09	8,00
1,8 /1,9	36	11	4,09	8,00
2,0 /2,1	38	12	4,09	8,00
2,2 /2,3	40	13	4,09	8,00
2,4/2,6	43	14	4,09	8,00
2,7/3,0	46	16	5,91	11,50
3,1/3,3	49	18	6,34	12,40
3,4/3,7	52	20	7,67	15,00
3,8/4,2	55	22	8,44	16,50
4,3/4,7	58	24	8,95	17,50
4,8/5,3	62	26	9,46	18,50
5,4/6,0	66	28	13,19	25,80
6,1/6,7	70	31	17,13	33,50
6,8/7,5	74	34	23,26	45,50
7,6/8,5	79	37	31,96	62,50
8,6/9,5	84	40	38,35	75,00
9,6/10,5	89	43	43,97	86,00
11,0/11,5	95	47	57,52	112,50
12,0/13,0	102	51	69,28	135,50
14,0	107	54	92,80	181,50
15,0	111	56	102,77	201,00
16,0	115	58	115,30	225,50
18,0	123	62	156,35	305,80
20,0	131	66	208,04	406,90

Twist Drill — sim. DIN 338

Version	With Equal Nominal and Shank-Ø σ = 118° Short
Surf. Treatment	
Catalogue-No.	607
Tolerance	m7



Application
Coolant
Cutting Speed v_c

see Recommendation Table Page 39

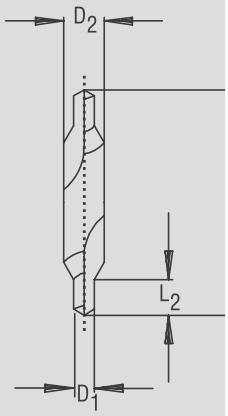
607

$D_1 = D_2$ m7 mm >/≤	L_1 mm	L_2 mm	Price/Piece EURO	DM
0,5	22	6	3,83	7,50
0,6	24	7	3,83	7,50
0,7	28	9	3,83	7,50
0,8	30	10	3,83	7,50
0,9	32	11	3,83	7,50
1,0	34	12	4,04	7,90
1,1	36	14	4,04	7,90
1,2/1,3	38	16	4,04	7,90
1,4/1,5	40	18	4,04	7,90
1,6/1,7	43	20	4,50	8,80
1,8/1,9	46	24	4,86	9,50
2,0/2,1	49	27	6,39	12,50
2,2/2,3	53	30	6,39	12,50
2,4/2,6	57	30	7,16	14,00
2,7/3,0	61	33	8,18	16,00
3,1/3,3	65	36	8,95	17,50
3,4/3,7	70	39	10,48	20,50
3,8/4,2	75	43	11,50	22,50
4,3/4,7	80	47	16,11	31,50
4,8/5,2	86	52	18,15	35,50
5,3/6,0	93	57	21,22	41,50
6,1/6,5	101	63	27,87	54,50
6,8/7,5	109	69	32,98	64,50
8,0/8,5	117	75	43,66	85,40
9,0/9,5	125	81	50,87	99,50
10,0/10,5	133	87	65,39	127,90
11,0/11,5	142	94	88,20	172,50
12,0/13,0	151	101	113,25	221,50
14,0	160	108	120,97	236,60
16,0	178	120	164,33	321,40

Center Bit

sim. DIN 333

Version	Countersink Angle 60° Form A Spiral Flutes σ = 120°
Surf. Treatment	
Catalogue-No.	609
Tolerance	k13



Application
Coolant
Cutting Speed v_c

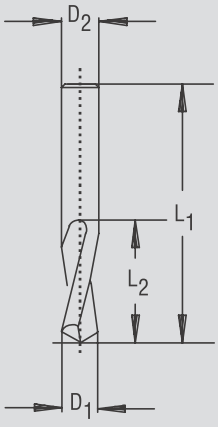
see Recommendation Table Page 39

609

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	Price/Piece DM
0,5	3,15	20,0	0,9	22,24	43,50
0,8	3,15	20,0	1,3	22,24	43,50
1,0	3,15	31,5	1,6	23,26	45,50
1,25	3,15	31,5	1,9	23,26	45,50
1,6	4,0	35,5	2,4	24,29	47,50
2,0	5,0	40,0	2,9	27,10	53,00
2,5	6,3	45,0	3,6	30,42	59,50
3,15	8,0	50,0	4,4	36,56	71,50
4,0	10,0	56,0	5,6	43,66	85,40
5,0	12,5	63,0	6,9	65,70	128,50
6,3	16,0	71,0	8,6	90,75	177,50

Center Drill

Version	Pointed Angle Spiral Flutes σ = 120°	Pointed Angle Spiral Flutes σ = 90°
Surf. Treatment		
Catalogue-No.	610	611
Tolerance	h7	h7



Application
Coolant
Cutting Speed v_c

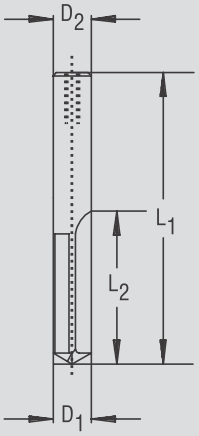
see Recommendation Table Page 39

610/611

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	Price/Piece DM
6	6	50	13	15,59	30,50
8	8	60	23	22,24	43,50
10	10	70	24	31,96	62,50
12	12	70	24	40,65	79,50
14	14	75	26	60,59	118,50
16	16	75	29	74,90	146,50
18	18	100	35	125,52	245,50
20	20	100	35	132,68	259,50

Four-In-One Drill

Version	DIN 1897 2 Flutes Straight Flutes σ = 120° KA = Axial Internal Cooling	sim. DIN 338 Long 2 Flutes Straight Flutes σ = 120° Long KA = Axial Internal Cooling
Surf. Treatment		
Catalogue-No.	612	613
Tolerance	h7	h7
	with 2KA	with 2KA



Application
Coolant
Cutting Speed v_c

see Recommendation Table Page 39

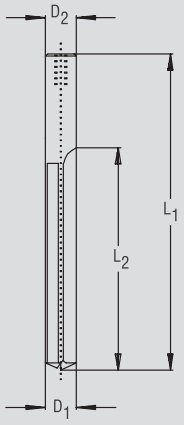
612

D_1 h7 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
4	4	55	22	24,80	48,50
6	6	66	28	34,51	67,50
8	8	79	37	49,85	97,50
10	10	89	43	64,37	125,90
12	12	102	51	94,54	184,90
14	14	107	54	130,28	254,80
16	16	115	58	147,51	288,50
18	18	123	62	181,25	354,50
20	20	131	66	222,67	435,50

613

D_1 h7 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
4	4	75	43	38,76	75,80
6	6	93	57	54,71	107,00
8	8	117	75	84,57	165,40
10	10	133	87	108,14	211,50
12	12	151	101	159,27	311,50
14	14	160	108	220,11	430,50
16	16	178	120	253,60	496,00

Version	2 Flutes Straight Flutes σ = 120° KA = Axial Internal Cooling
Surf. Treatment	
Catalogue-No.	614
Tolerance	h7
	with 2KA



Application
Coolant
Cutting Speed v_c

see Recommendation Table Page 39

614

D_1 h7 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
4	4	100	60	51,90	101,50
6	6	100	60	58,54	114,50
8	8	150	100	106,86	209,00
10	10	150	100	125,27	245,00
12	12	150	150	217,45	425,30
14	14	200	150	248,74	486,50
16	16	200	150	299,36	585,50
18	18	200	150	347,42	679,50
20	20	250	200	503,88	985,50

Recommendation Table Reamers

Material Main Groups	Material Sub Groups								Coolant Ö = Cutting Oil E = Emulsion P = Petroleum S = Spec. Cutting Oil T = Dry, Air
									
	Catalogue-No.	701	702						
1. Steel	1.1. Unalloyed Steels; RM ⩽ 800 N/mm²	●	●						E
	1.2. Unalloyed Steels; RM ⩽ 1000 N/mm²	●	●						E
	1.3.1. Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²	●	●						E
	1.3.2. Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²	●	●						E
	1.3.3. Hardened Steels; 42 - 60 HRC	●	●						Ö
	1.4. Stainless Steels (V2A-Steels)	●	●						Ö
	1.5. Stainless Steels with High Cr-Ni-Content (V4A-Steels)	●	●						Ö
	1.6. High Speed Steels	●	●						Ö
2. Cast Iron	2.1. Grey Cast Iron	●	●						T/E/P
	2.2. Nodular and Malleable Cast Iron	●	●						T/E/P
3. Non-Ferrous Metals	3.1. Aluminium, Copper, Copper Alloys	●	●						E
	3.2.1. Aluminium Alloys, Copper Alloys	●	●						E/P
	3.2.2. Aluminium Special Alloys	●	●						E/P
	3.3. Copper Alloys Short Chipping	●	●						E
4. Special Alloys	4.1. Nickel Alloys	●	●						Ö
	4.2. Titanium Alloys	●	●						S
	4.3. Cu-Al-Fe-Alloys	●	●						Ö
5. Plastics	5.1. Thermoplastics	●	●						T
	5.2. Thermosetting and Fibre Reinforced Plastics	●	●						T
		Application:		● recommended		❍ suitable			

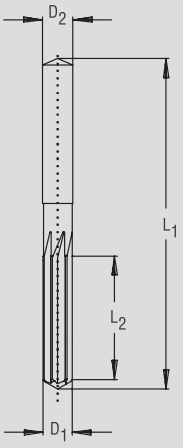
Recommended Production Values Reamers

Material Group	Materials	Tensile Strength (N/mm²)	Carbide Designation	Cutting Speed v_c (m/min)	Feed Rate per Rotation v_f (mm) Drill-Ø up to 10	Drill-Ø 10 - 20	Drill-Ø 20 - 40	Coolant
	Catalogue-No.: 701 bis 702							
1. Steel	Tool Steels	⩽ 1400	Fine Grain	6 - 10	0,1 - 0,2	0,15 - 0,25	0,2 - 0,35	E
	Tool Steels	⩾ 1400	Fine Grain	6 - 8	0,08 - 0,12	0,1 - 0,15	0,15 - 0,3	E
	Tool, Heat Treatable Steels	⩽ 500	Fine Grain	12 - 15	0,15 - 0,25	0,2 - 0,35	0,3 - 0,5	E
	Tool, Heat Treatable Steels	500 - 700	Fine Grain	10 - 12	0,12 - 0,2	0,17 - 0,3	0,25 - 0,4	E
	Tool, Heat Treatable Steels	⩾ 700	Fine Grain	8 - 10	0,1 - 0,2	0,15 - 0,25	0,2 - 0,35	E
	Special Steels, Heat Resisting, High Temperature, Stainless Steels		Fine Grain	8 - 12	0,1 - 0,15	0,15 - 0,2	0,2 - 0,3	E
	High Temperature Materials on Cr-Ni and Cr-Ni-Co-Basis			8 - 12	0,12 - 0,18	0,15 - 0,25		
	Cast Steel	⩽ 500	Fine Grain	10 - 15	0,15 - 0,25	0,2 - 0,4	0,3 - 0,5	E
	Cast Steel	⩾ 500	Fine Grain	8 - 12	0,12 - 0,2	0,15 - 0,3	0,2 - 0,4	E
2. Cast Iron	Grey Cast Iron	⩽ 220 HB	Fine Grain	12 - 15	0,2 - 0,3	0,3 - 0,5	0,4 - 0,7	T/E/P
	Grey Cast Iron	⩾ 220 HB	Fine Grain	8 - 12	0,15 - 0,25	0,2 - 0,35	0,3 - 0,5	E/P
	Nod., Malleable Cast Iron		Fine Grain	8 - 12	0,1 - 0,2	0,15 - 0,25	0,2 - 0,4	T/E/P
	Chilled Cast Iron	480 - 650 HB	Fine Grain	3 - 6	0,1 - 0,2	0,15 - 0,25	0,2 - 0,4	E
3. Non-Ferrous Metals	Brass, Bronce, Zinc, Red Brass		Fine Grain	20 - 40	0,1 - 0,2	0,15 - 0,25	0,2 - 0,3	E
	Copper		Fine Grain	20 - 40	0,15 - 0,25	0,2 - 0,35	0,3 - 0,5	E
	Al and Al-Alloys with Si < 7%		Fine Grain	25 - 40	0,15 - 0,25	0,2 - 0,35	0,3 - 0,6	E/P
	Al and Al-Alloys with Si > 7%		Fine Grain	20 - 30	0,12 - 0,18	0,15 - 0,25	0,25 - 0,4	E/P
4. Special Alloys	Titanium, Titanium Alloys		Fine Grain	15 - 20	0,08 - 0,12	0,1 - 0,15		S
5. Plastics	Thermoplastics		Fine Grain	20 - 35	0,15 - 0,3	0,25 - 0,4	0,3 - 0,6	T
	Fibre Reinforced Plastics		Fine Grain	20 - 35	0.15 - 0.3	0.25 - 0.4	0.3 - 0.6	T
	(Values are for reference purpose only and need to be adjusted depending on outside conditions.)							

Machine Reamers

sim. DIN 212

Version	Straight Flutes
Surf. Treatment	
Catalogue-No.	701
Tolerance	h7



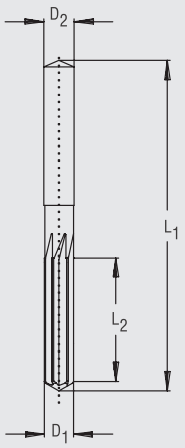
Application
Coolant
Cutting Speed v_c

see Recommendation Table Page 45

701

D_1 h7 mm	D_2 h6 mm	L_1 mm	L_2 mm	Teeth	Price/Piece EURO	DM
2,0	2,0	49	11	4	22,24	43,50
2,2	2,2	53	12	4	23,26	45,50
2,5	2,5	57	14	4	23,26	45,50
2,8	2,8	61	15	4	24,29	47,50
3,0	3,0	61	15	4	22,24	43,50
3,2	3,2	65	16	4	23,26	45,50
3,5	3,5	70	18	4	23,31	45,60
4,0	4,0	75	19	4	24,80	48,50
4,5	4,5	80	21	4	28,53	55,80
5,0	5,0	86	23	6	30,63	59,90
5,5	5,6	93	26	6	31,96	62,50
6,0	5,6	93	26	6	33,49	65,50
6,5	6,3	101	28	6	38,09	74,50
7,0	7,1	109	31	6	42,69	83,50
7,5	7,1	109	31	6	43,72	85,50
8,0	8,0	117	33	6	45,76	89,50
8,5	8,0	117	33	6	49,03	95,90
9,0	9,0	125	36	6	50,87	99,50
9,5	9,0	125	36	6	53,79	105,20
10,0	10,0	133	38	6	56,55	110,60
10,5	10,0	133	38	6	62,53	122,30
11,0	10,0	142	41	6	64,01	125,20
11,5	10,0	142	41	6	70,81	138,50
12,0	10,0	151	44	6	73,37	143,50

Version	Left Hand Spiral
Surf. Treatment	
Catalogue-No.	702
Tolerance	h7



Application
Coolant
Cutting Speed v_c

see Recommendation Table Page 45

702

D_1 h7 mm	D_2 h6 mm	L_1 mm	L_2 mm	Teeth	Price/Piece EURO	DM
2,0	2,0	49	11	4	22,24	43,50
2,2	2,2	53	12	4	23,26	45,50
2,5	2,5	57	14	4	23,26	45,50
2,8	2,8	61	15	4	24,29	47,50
3,0	3,0	61	15	4	22,24	43,50
3,2	3,2	65	16	4	23,26	45,50
3,5	3,5	70	18	4	23,31	45,60
4,0	4,0	75	19	4	24,80	48,50
4,5	4,5	80	21	4	28,53	55,80
5,0	5,0	86	23	6	30,63	59,90
5,5	5,6	93	26	6	31,96	62,50
6,0	5,6	93	26	6	33,49	65,50
6,5	6,3	101	28	6	38,09	74,50
7,0	7,1	109	31	6	42,69	83,50
7,5	7,1	109	31	6	43,72	85,50
8,0	8,0	117	33	6	45,76	89,50
8,5	8,0	117	33	6	49,03	95,90
9,0	9,0	125	36	6	50,87	99,50
9,5	9,0	125	36	6	53,79	105,20
10,0	10,0	133	38	6	56,55	110,60
10,5	10,0	133	38	6	62,53	122,30
11,0	10,0	142	41	6	64,01	125,20
11,5	10,0	142	41	6	78,81	138,50
12,0	10,0	151	44	6	73,37	143,50

Recommended Production Values Cutters

Material Group	Materials	Tensile Strength (N/mm²)	Carbide Designation	Cutting Speed v_c (m/min)	Medium Feed Rate per Tooth v_f (mm) Mill-Ø 5 - 8	9 - 12	13 - 16
	Catalogue-No. 801 to 820						
1. Steel	Structural Steels	⩽ 500	Univ.-Fine Grain	150 - 500	0,1	0,3	0,35
	Free Cutting Steels	500-700	Univ.-Fine Grain	150 - 500	0,1	0,25	0,3
	Cementation Steels	700-1000	Univ.-Fine Grain	150 - 500	0,15	0,2	0,3
	Heat Treat., Nitriding Steels	1000-1400	Univ.-Fine Grain	150 - 500	0,08	0,2	0,3
	Tool Steels Alloyed and Unalloyed	⩽ 1400 ⩾	Univ.-Fine Grain	150 - 500	0,07	0,2	0,3
	Stainless Cr-Mo-Steels		Univ.-Fine Grain	150 - 500	0,06	0,2	0,25
	Stainless Cr-Ni-Steels		Univ.-Fine Grain	150 - 500	0,06	0,2	0,25
	Cast Steel	⩽ 500 ⩾	Univ.-Fine Grain	150 - 500	0,1	0,3	0,35

Optimization of Production Values Cutters

sim. DIN 6527 long

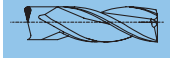
Factor = 1.0 for f_z and v_c

NC-short

Factor = 1.1 for f_z and v_c

extra long version

Factor = 0,8 for f_z and v_c



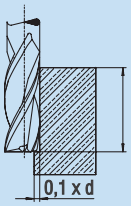
coated end mills

Factor = 1.2 for f_z and v_c

for finishing only

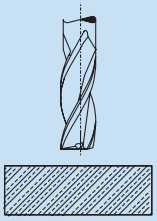
Factor = 1.3 for v_c

Please, note: Outside conditions are an important factor. Production values need to be corrected if chuck, machine or workpiece are not stable.

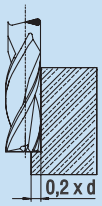


2-Flutes: f_z = mf x 1,5
3-Flutes: f_z = mf x 1,5
4-Flutes: f_z = mf x 1,5

Drilling

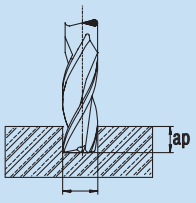


2-Flutes: f_z = mf x 0,4
3-Flutes: f_z = mf x 0,3
4-Flutes: f_z = mf x 0,2

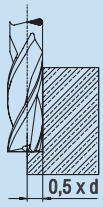


2-Flutes: f_z = mf x 1,0
3-Flutes: f_z = mf x 1,0
4-Flutes: f_z = mf x 1,0

Roughing

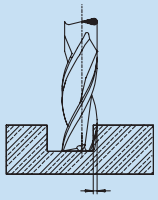


2-Flutes: f_z = mf x 0,8
3-Flutes: f_z = mf x 0,8



2-Flutes: f_z = mf x 0,85
3-Flutes: f_z = mf x 0,85
4-Flutes: f_z = mf x 0,85

Finishing



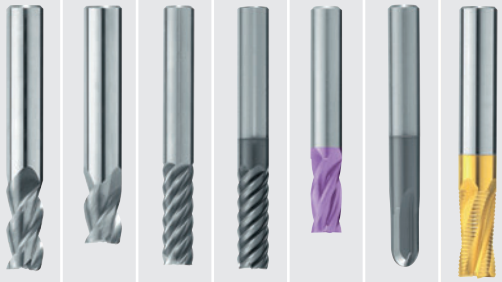
2-Flutes: f_z = mf x 2,0
3-Flutes: f_z = mf x 2,0
4-Flutes: f_z = mf x 2,0
6-8-Flutes: f_z = mf x 2,0

The medium feed rate mf to be taken from the table with recommended production values.

Recommendation Table End Mills

Material Main Groups	Material Sub Groups							Coolant Ö = Cutting Oil E = Emulsion P = Petroleum T = Dry, Air
	Catalogue-No.	801 802	803	804	808 809	810	811	
1. Steel	1.1. Unalloyed Steels; RM ⩽ 800 N/mm²	●	●		●		●	E
	1.2. Unalloyed Steels; RM ⩽ 1000 N/mm²	●	●		●		●	E
	1.3.1. Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²	●	●		●	●	●	E
	1.3.2. Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²	❍	❍	●	❍	●	❍	E
	1.3.3. Hardened Steels; 42 - 60 HRC		❍	●		●		Ö
	1.4. Stainless Steels (V2A-Steels)		●					Ö/E
	1.5. Stainless Steels with High Cr-Ni-Content (V4A-Steels)		●					Ö/E
	1.6. High Speed Steels		●					Ö/E
2. Cast Iron	2.1. Grey Cast Iron	●	●		●		●	T/P
	2.2. Nodular uad Malleable Cast Iron	●	●		●		●	T/P
3. Non-Ferrous Metals	3.1. Aluminium, Copper, Copper Alloys	●	●		●		●	E
	3.2.1. Aluminium Alloys, Copper Alloys	●	●		●		●	E
	3.2.2. Aluminium Special Alloys	●	●		●		●	E
	3.3. Copper Alloys Short Chipping	●	●		●		●	E
4. Special Alloys	4.1. Nickel Alloys		●					Ö/E
	4.2. Titanium Alloys		●					Ö/E
	4.3. Cu-Al-Fe-Alloys		●					Ö/E
5. Plastics	5.1. Thermoplastics	●	●		●		●	T
	5.2. Thermosetting and Fibre Reinforced Plastics	●	●		●		●	T
	Cutting speed and feed rate: see table of recommended production values on page 47	**Application:**			● recommended		❍ suitable	

Recommendation Table End Mills

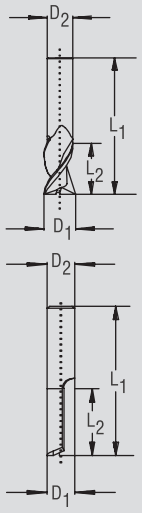
Material Main Groups	Material Sub Groups									Coolant Ö = Cutting Oil E = Emulsion P = Petroleum T = Dry, Air
		Catalogue-No.	812	813	815	816	818	819	820	
1. Steel	1.1.	Unalloyed Steels; RM ⩽ 800 N/mm²	●	●	●					E
	1.2.	Unalloyed Steels; RM ⩽ 1000 N/mm²	●	●	●				●	E
	1.3.1	Unalloyed and Alloyed Steels; RM ⩽ 1200 N/mm²	●	●	●			●	●	E
	1.3.2.	Unalloyed and Alloyed Steels; RM ⩾ 1200 N/mm²	❍	❍	❍	❍	●	●	●	E
	1.3.3.	Hardened Steels; 42 - 60 HRC				●		●		Ö
	1.4.	Stainless Steels (V2A-Steels)	●	●	●		●			Ö/E
	1.5.	Stainless Steels with High Cr-Ni-Content (V4A-Steels)	●	●	●		●			Ö/E
	1.6.	High Speed Steels	●	●	●		●			Ö/E
2. Cast Iron	2.1.	Grey Cast Iron	●	●	●				●	T/P
	2.2.	Nodular and Malleable Cast Iron	●	●	●				●	T/P
3. Non-Ferrous Metals	3.1.	Aluminium, Copper, Copper Alloys							●	E
	3.2.1.	Aluminium Alloys, Copper Alloys							●	E
	3.2.2.	Aluminium Special Alloys	●	●	●				●	E
	3.3.	Copper Alloys Short Chipping			●				●	E
4. Special Alloys	4.1.	Nickel Alloys								Ö/E
	4.2.	Titanium Alloys	●	●	❍					Ö/E
	4.3.	Cu-Al-Fe-Alloys								Ö/E
5. Plastics	5.1.	Thermoplastics								T
	5.2.	Thermosetting and Fibre Reinforced Plastics								T

Cutting speed and feed rate: see table of recommended production values on page 47

Application: ● recommended ❍ suitable

Slot Drills

Version	2 Flutes Straight Flutes 1 Flute Center Cutting	2 Flutes 30° Spiral Flutes 1 Flute Center Cutting
Shank	DIN 6535 - HA/*DIN 6535 - HB	DIN6535 - HA/*DIN 6535 - HB
Surf. Treatment		
Catalogue-No.	801	802



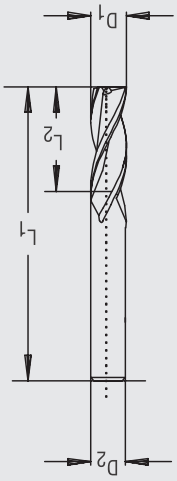
Application
Cast Iron, Chilled Cast Iron, Malleable Cast Iron, Bronce, Brass, Red Brass

Cutting Speed v_c
see Recommendation Table Page 48

801/802

D_1 h10 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
2,0	2,0	32	8	11,76	23,00
2,5	2,5	32	8	11,76	23,00
3,0	3,0	32	12	11,76	23,00
3,5	3,5	32	12	12,02	23,50
4,0	4,0	40	12	12,02	23,50
4,5	4,5	50	14	14,73	28,80
5,0	5,0	50	14	14,73	28,80
5,5	5,5	50	16	16,77	32,80
* 6,0	6,0	50	14	16,77	32,80
6,5	6,5	50	16	21,22	41,50
7,0	7,0	60	20	21,22	41,50
7,5	7,5	60	20	21,99	43,00
* 8,0	8,0	60	18	21,99	43,00
8,5	8,5	60	20	35,74	69,90
9,0	9,0	60	20	35,74	69,90
9,5	9,5	70	22	40,90	80,00
*10,0	10,0	70	20	40,90	80,00
11,0	11,0	70	22	55,22	108,00
*12,0	12,0	70	20	55,22	108,00
13,0	13,0	75	25	74,14	145,00
*14,0	14,0	75	22	70,56	138,00
15,0	15,0	75	25	96,63	189,00
*16,0	16,0	75	22	91,78	179,50
*18,0	18,0	100	30	127,57	249,50
*20,0	20,0	100	30	132,37	258,90

Version	3 Flutes Spiral Flutes 1 Flute Center Cutting
Shank	acc. DIN 6535 - HA/*DIN 6535 - HB
Surf. Treatment	
Catalogue-No.	811



Application
Cast Iron, Chilled Cast Iron, Malleable Cast Iron, Bronce, Brass, Red Brass

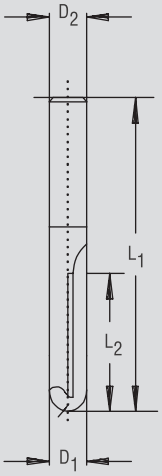
Cutting Speed v_c
see Recommendation Table Page 48

811

D_1 h10 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
2,0	2,0	32	8	10,99	21,50
2,5	2,5	32	8	10,99	21,50
3,0	3,0	32	12	10,99	21,50
3,5	3,5	32	12	11,20	21,90
4,0	4,0	40	12	11,20	21,90
4,5	4,5	50	14	14,06	27,50
5,0	5,0	50	14	14,06	27,50
5,5	5,5	50	16	16,36	32,00
*6,0	6,0	50	14	16,36	32,00
6,5	6,5	50	16	21,47	42,00
7,0	7,0	60	20	21,47	42,00
7,5	7,5	60	20	21,73	42,50
*8,0	8,0	60	20	21,73	42,50
8,5	8,5	60	20	28,38	55,50
9,0	9,0	60	20	28,38	55,50
9,5	9,5	70	22	34,51	67,50
*10,0	10,0	70	22	34,51	67,50
11,0	11,0	70	22	45,76	89,50
*12,0	12,0	70	22	45,76	89,50
13,0	13,0	75	25	66,21	129,50
*14,0	14,0	75	25	61,61	120,50
15,0	15,0	75	25	86,66	169,50
*16,0	16,0	75	22	81,04	158,50
*18,0	18,0	100	32	112,23	219,50
*20,0	20,0	100	32	119,90	234,50

Copying Mills

Version	2 Flutes Straight Flutes
Shank	
Surf. Treatment	TiAlN-Coating
Catalogue-No.	804



Application

High speed copy milling of tool steel up to 68 HRC in dry cutting

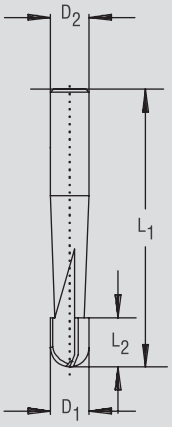
Cutting Speed v_c

see Recommendation Table Page 48

804

D_1 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
3	6	50	8	46,78	91,50
4	6	50	10	46,78	91,50
5	6	50	12	46,78	91,50
6	6	50	18	42,18	82,50
8	8	60	22	49,85	97,50
10	10	60	26	61,10	119,50
12	12	70	30	86,66	169,50

Version	4 Flutes Straight Flutes
Shank	acc. DIN 6535 - HA
Surf. Treatment	TiAlN-Coating
Catalogue-No.	819



Application

High speed copy milling of tool steel up to 68 HRC in dry cutting

Cutting Speed v_c

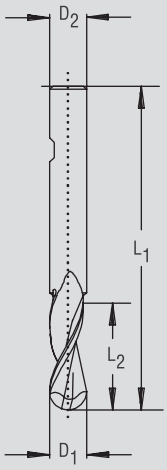
see Recommendation Table Page 49

819

D_1 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
3	6	60	6	55,58	108,70
4	6	60	8	55,58	108,70
5	6	70	10	55,58	108,70
6	6	70	12	49,52	96,85
8	8	75	12	53,71	105,05
10	10	80	16	69,08	135,10
12	12	90	16	92,59	181,10
12	12	120	16	117,70	230,20

End Mills

Version	2 Flutes 30° Spiral Flutes 2 Flutes Center Cutting
Shank	acc. DIN 6535 - HA/*DIN 6535 - HB
Surf. Treatment	TiCN-Coating
Catalogue-No.	808



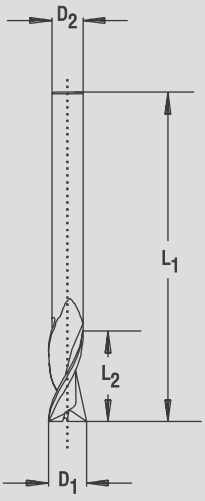
Application
Universal use
Particularly suitable for jobs in deep areas and those with difficult access.

Cutting Speed v_c
see Recommendation Table Page 48

808

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	Price/Piece DM
3	3	60	20	38,09	74,50
4	4	75	30	39,32	76,90
5	5	75	30	42,18	82,50
*6	6	100	40	48,88	95,60
*8	8	100	40	55,99	109,50
*10	10	100	40	75,67	148,00
*12	12	100	45	96,89	189,50
*14	14	100	45	138,82	271,50
*16	16	150	65	209,37	409,50
*18	18	150	65	233,92	457,50
*20	20	150	65	255,59	499,90

Version	2 Flutes 30° Spiral Flutes 1 Flute Center Cutting
Shank	acc. DIN 6535 - HA/*DIN 6535 - HB
Surf. Treatment	
Catalogue-No.	809



Application
Universal use
Particularly suitable for jobs in deep areas and those with difficult access.

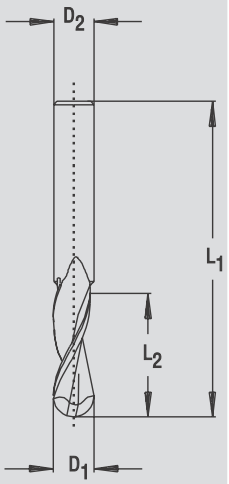
Cutting Speed v_c
see Recommendation Table Page 48

809

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	Price/Piece DM
3	3	60	20	26,33	51,50
4	4	75	30	28,89	56,50
5	5	75	30	31,44	61,50
*6	6	100	40	37,07	72,50
*8	8	100	40	40,39	79,00
*10	10	100	40	55,99	109,50
*12	12	100	45	74,55	145,80
*14	14	100	45	115,35	225,60
*16	16	150	65	178,70	349,50
*18	18	150	65	200,17	391,50
*20	20	150	65	220,62	431,50

End Mills — Long and Extra Long Version

Version	Ball Nose 2 Flutes 30° Spiral Flutes
Shank	acc. DIN 6535 - HA
Surf. Treatment	TiAlN-Coating
Catalogue-No.	**810**



Application
For high speed copy milling of tool steel from 30 HRC to 60 HRC

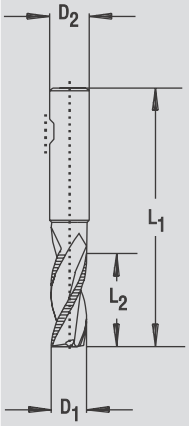
Cutting Speed v_c
see Recommendation Table Page 48

810

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
1,0	4	40	4	35,53	69,50
1,5	4	40	4	35,53	69,50
2,0	6	60	6	35,53	69,50
2,0	6	50	4	35,53	69,50
3,0	6	60	8	35,53	69,50
3,0	6	50	5	35,53	69,50
4,0	6	75	10	45,76	89,50
4,0	6	54	8	35,02	68,50
5,0	6	75	12	48,83	95,50
5,0	6	54	9	35,02	68,50
6,0	6	100	12	35,53	69,50
6,0	6	54	10	35,53	69,50
7,0	8	100	14	62,17	121,60
7,0	8	58	11	62,17	121,60
8,0	8	100	14	43,56	85,20
8,0	8	58	12	43,56	85,20
10,0	10	100	18	89,83	175,70
10,0	10	66	14	54,09	105,80
12,0	12	100	22	115,60	226,10
12,0	12	73	16	77,97	152,50
14,0	14	120	26	183,81	359,50
14,0	14	75	18	95,76	187,30
16,0	16	150	30	247,31	483,70
16,0	16	82	22	114,22	223,40
18,0	18	150	34	301,46	589,60
18,0	18	84	24	139,79	273,40
20,0	20	150	38	327,94	641,40
20,0	20	92	26	327,94	641,40

End Mills — sim. DIN 6527-long

Version	3 Flutes 45° Spiral Flutes 1 Flute Center Cutting Long
Shank	acc. DIN 6535 - HB
Surf. Treatment	TiCN-Coating
Catalogue-No.	**812**



Application
Milling of cast iron, chilled cast iron, malleable cast iron, cast steel, steel, nickel materials, high temperature materials

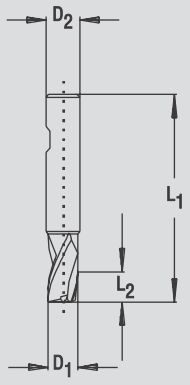
Cutting Speed v_c
see Recommendation Table Page 49

812

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
3,0	6	57	8	21,12	41,30
3,5	6	57	11	22,60	44,20
4,0	6	57	11	21,12	41,30
4,5	6	57	13	22,60	44,20
5,0	6	57	13	21,12	41,30
5,5	6	57	13	22,60	44,20
6,0	6	57	13	21,12	41,30
6,5	8	63	16	27,00	52,80
7,0	8	63	16	26,29	51,40
7,5	8	63	19	24,90	48,70
8,0	8	63	19	22,80	44,60
8,5	10	72	19	42,03	82,20
9,0	10	72	19	41,36	80,90
9,5	10	72	22	40,19	78,60
10,0	10	72	22	38,30	74,90
11,0	12	83	26	59,97	117,30
12,0	12	83	26	54,61	106,80
14,0	14	83	26	68,41	133,80
16,0	16	92	32	93,21	182,30
18,0	18	92	32	112,38	219,80
20,0	20	104	38	146,23	286,00

End Mills NC - Short

Version	3 Flutes 45° Spiral Flute 1 Flute Center Cutting
Shank	acc. DIN 6535 - HB
Surf. Treatment	TiCN-Coating
Catalogue-No.	813



Application
Milling of cast iron, chilled cast iron, malleable cast iron, cast steel, steel, nickel materials, high temperature materials

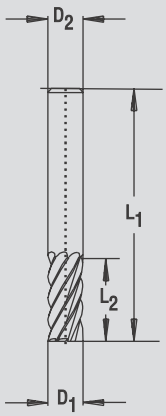
Cutting Speed v_c
see Recommendation Table Page 49

813

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	Price/Piece DM
3,0	6	50	5	23,62	46,20
3,5	6	50	6	24,95	48,80
4,0	6	54	8	23,62	46,20
4,5	6	54	8	24,95	48,80
5,0	6	54	9	23,62	46,20
5,5	6	54	10	24,95	48,80
6,0	6	54	10	23,62	46,20
6,5	8	58	11	30,88	60,40
7,0	8	58	11	30,47	59,60
7,5	8	58	12	30,17	59,00
8,0	8	58	12	28,17	55,10
8,5	10	66	13	38,91	76,10
9,0	10	66	13	38,65	75,60
9,5	10	66	14	38,40	75,10
10,0	10	66	14	36,05	70,50
11,0	12	73	16	57,06	111,60
12,0	12	73	16	50,87	99,50
14,0	14	75	18	66,42	129,90
16,0	16	82	22	78,13	152,80
18,0	18	84	24	105,79	206,90
20,0	20	92	26	128,44	251,20

End Mills sim. DIN 6527-long

Version	6 - 8 Flutes 45° Spiral Flutes 2 Flutes Center
Shank	acc. DIN 6535 - HB
Surf. Treatment	TiCN-Coating
Catalogue-No.	815



Application
Circumference milling as finishing operation (diving only with low cutting depths); universal use; suitable also for high strength materials as well as aluminium and non-ferrous metals

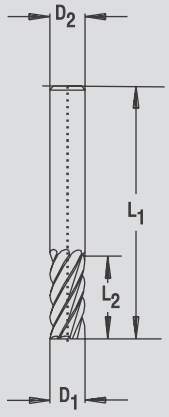
Cutting Speed v_c
see Recommendation Table Page 49

815

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Teeth	Price/Piece EURO	Price/Piece DM
6	6	57	13	6	27,90	54,60
6	6	62	18	6	33,34	65,20
7	8	63	16	6	33,34	65,20
7	8	68	21	6	41,62	81,40
8	8	63	19	6	32,88	64,30
8	8	68	24	6	38,55	75,40
9	10	72	19	6	52,15	102,00
9	10	80	27	6	64,83	126,80
10	10	72	22	6	50,87	99,50
10	10	80	30	6	62,74	122,70
12	12	83	26	6	66,21	129,50
12	12	93	36	6	82,98	162,30
14	14	83	26	6	81,81	160,00
14	14	99	42	6	111,51	218,10
16	16	92	32	6	113,20	221,40
16	16	108	48	6	151,29	295,90
18	18	92	32	8	122,86	240,30
18	18	114	54	8	175,02	342,30
20	20	104	38	8	159,06	311,10
20	20	126	60	8	221,44	433,10

End Mills — sim. DIN 6527-long

Version	5 - 8 Flutes 50° Spiral Flutes
Shank	acc. DIN 6535 - HB
Surf. Treatment	TiCN-Coating
Catalogue-No.	**816**



Application

High speed milling of tool steel as well as hardened steel up to 68 HRC in dry cutting

Cutting Speed v_c

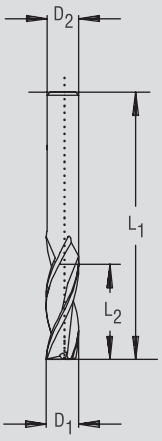
see Recommendation Table Page 49

816

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Teeth	Price/Piece EURO	DM
4	6	57	11	5	30,37	59,40
4	6	62	16	5	32,93	64,40
5	6	57	13	5	28,22	55,20
5	6	62	18	5	31,60	61,80
6	6	57	13	6	31,80	62,20
6	6	62	18	6	35,07	68,60
8	8	63	19	6	36,25	70,90
8	8	68	24	6	39,27	76,80
10	10	72	22	6	61,10	119,50
10	10	80	30	6	68,82	134,60
12	12	83	26	6	82,47	161,30
12	12	93	36	6	92,90	181,70
14	14	83	26	6	107,06	209,40
14	14	99	42	6	128,08	250,50
16	16	92	32	8	144,44	282,50
16	16	108	48	8	175,17	342,60
18	18	92	32	8	160,75	314,40
18	18	114	54	8	201,91	394,90
20	20	104	38	8	207,28	405,40
20	20	126	60	8	259,33	507,20

End Mills

Version	4 Flutes 30° Spiral Flutes 2 Center Flutes Double Radial Relief Angle
Shank	acc. DIN 6535 - HA/*DIN 6535 - HB
Surf. Treatment	TiCN-Coating
Catalogue-No.	**818**



Application

Milling of nickel, high temperature materials, stainless steels

Cutting Speed v_c

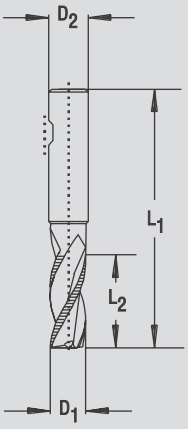
see Recommendation Table Page 49

818

D_1 h10 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
2,0	2,0	32	8	13,45	26,30
2,5	2,5	32	8	13,45	26,30
3,0	3,0	32	12	13,45	26,30
3,5	3,5	32	12	13,75	26,90
4,0	4,0	40	12	13,75	26,90
4,5	4,5	50	14	16,72	32,70
5,0	5,0	50	14	16,72	32,70
5,5	5,5	50	16	19,02	37,20
*6,0	6,0	50	14	19,02	37,20
6,5	6,5	50	16	24,70	48,30
7,0	7,0	60	20	24,70	48,30
7,5	7,5	60	20	25,00	48,90
*8,0	8,0	60	20	25,00	48,90
8,5	8,5	60	20	32,67	63,90
9,0	9,0	60	20	32,67	63,90
9,5	9,5	70	22	38,76	75,80
*10,0	10,0	70	22	38,76	75,80
11,0	11,0	70	22	50,92	99,60
*12,0	12,0	70	22	50,92	99,60
13,0	13,0	75	25	72,19	141,20
*14,0	14,0	75	25	68,21	133,40
15,0	15,0	75	25	94,84	185,50
*16,0	16,0	75	25	89,68	175,40
*18,0	18,0	100	32	124,40	243,30
*20,0	20,0	100	32	131,86	257,90

Roughing End Mill

Version	Profile-Shape Reliefed Roughing Teeth 4 Flutes 20° Spiral Flute 2 Center Flutes, Long
Shank	acc. DIN 6535 - HB
Surf. Treatment	TiN-Coating
Catalogue-No.	820



Application
Especially for roughing of steel, cast iron, aluminium, and non-ferrous metals

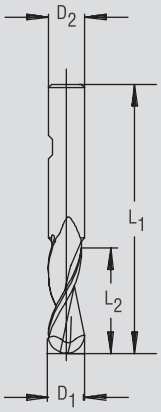
Cutting Speed v_c
see Recommendation Table Page 49

820

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
6	6	57	13	55,88	109,30
8	8	63	19	70,35	137,60
10	10	72	22	85,39	167,00
12	12	83	26	99,24	194,10
14	14	83	26	128,03	250,40
16	16	92	32	153,39	300,00
18	18	92	32	177,62	347,40
20	20	104	38	192,35	376,20

Slot Drills NC - Short

Version	Ball Nose 2 Flutes 30° Spiral Flutes 2 Center Flutes
Shank	acc. DIN 6535 - HB
Surf. Treatment	TiCN-Coating
Catalogue-No.	803



Application
Universal use; suitable also for high strength materials as well as aluminium and non-ferrous metals

Cutting Speed v_c
see Recommendation Table Page 49

803

D_1 e8 mm	D_2 h6 mm	L_1 mm	L_2 mm	Price/Piece EURO	DM
3	6	50	5	30,42	59,50
4	6	54	8	30,42	59,50
5	6	54	9	29,91	58,50
6	6	54	10	29,91	58,50
7	8	58	11	40,14	78,50
8	8	58	12	35,53	69,50
9	10	66	13	47,29	92,50
10	10	66	14	45,25	88,50
12	12	73	16	63,66	124,50
14	14	75	18	74,55	145,80
16	16	82	22	91,78	179,50
18	18	84	24	110,39	215,90
20	20	92	26	152,62	298,50

Terms of Sale, Delivery, and Payment

1. General
All orders hereunder are accepted subject to the following terms.
Any other conditions mentioned by the customer unless expressly accepted in writing are not binding. This also applies to those cases when we did not explicitly contradict.
Our terms only apply to business people and legal representatives of public law and property under public law.

2. Purchases
Purchases effected with us have to be accepted as agreed. Upon refusal of delivery we reserve the right to claim damages.
In case the delivery of samples or trials preceeded the purchase in which the purchaser had the chance to convince himself of the kind of goods, quality, design, and execution, the purchaser cannot object to the kind of goods, quality, design, and execution in any way.
We reserve the right to adjust or improve our goods compared with samples sent previously or previous deliveries.

3. Cost Estimates and Offers
We retain the unlimited property and copyright of the use of our cost estimates, drawings, and other documents; they shall not be disclosed to third parties. If the order is not placed drawings and documents have to be returned immediately.

4. Terms of Delivery
The beginning of the period of delivery set by us requires the final solution of all technical questions. Periods of delivery will be extended appropriately in case of labour disputes especially strike and lockout as well as in case of unforeseen events. This also applies when the corresponding circumstances happen to sub-suppliers. The event of such obstacles shall be reported to the customer immediately.
The right to claim damages due to delay or non-compliance only applies to the customer when our delayed delivery is based on intent or gross negligence.

5. Passing of Risk and Dispatch
Incoterms apply in their latest version. If the acknowledgement does not explicitly mention another clause of the Incoterms, clause EXW (the works acknowledging the order) shall apply.

6. Complaints
Complaints and other objections regarding obvious defects have to be raised in writing immediately, 10 days after receipt of the goods at the latest, hidden defects immediately as well, however, 10 days after their discovery at the latest and no later than 6 months after receipt of the goods. Upon expiration of the a.m. deadlines warranty claims of any kind are not possible.

7. Warranty
In general the obligation to examine and reproach according to §§ 377, 378 HGB (German Commercial Law) applies.
As far as a defect of the purchased goods appears we have the right and it is our choice either to repair or exchange the goods.
If we are not willing or not in the position to repair/exchange, or if this exceeds an appropriate timeframe based on reasons which we have to justify, or if we fail to repair/exchange in any other way, the customer has the right to decide whether to withdraw from the contract or ask for a corresponding reduction of the purchase price.
We have the option to try a repair twice before the customer may use the a.m. rights.
As far as there is no contradiction in the subsequent paragraphs, further claims - no matter of which legal base - are excluded. We are therefore not liable for damages which did not occur on the purchased goods themselves, especially we are not liable for missed profit or any other damage to the property of the customer.
The a.m exclusion of liability does not apply if the cause of damage is intent or gross negligence. Furthermore it does not apply if the customer enforces damage claims based on §§ 463, 480 section 2 BGB (German Civil Law) for non-performance due to lack of a confirmed feature.
As far as we negligently fail to meet an essential duty of the contract our liability to pay damages on goods or people is limited to the amount covered by our product liability insurance. We are prepared to show our policy to the customer on request.
The warranty period is 6 months effective with the transfer of risk except if we have agreed to longer warranty periods in the individual contract. Our warranty periods are prescription periods and also apply to claims for damages as a result of defects if no claims based on tortious act are put forward.

8. Delivery and Price
We generally dispatch from our respective works according to Incoterms "EXW", ex works, including packing if no other agreement has been made.
The value added tax with its official value at the time of invoicing shall be added to the price.
Partial shipments are permitted.
In case of special manufacture we have the right to ship plus/minus 10% of the ordered volume.

9. Terms of Payment
Upon cash payment within 8 days after date of invoice as well as cash payment in advance we grant a 2% cash discount; upon payment within 30 days of date of invoice the net invoice values are due. Cash discounts do not apply to payments by draft.
Drafts and cheques are only accepted if especially agreed to and for payment purposes including all collecting and discount expenses. We do not guarantee the timely presentation and submission of the protest of a bill. If a customer payment is delayed interest payments for delay used in banking will be charged, however, at least 4% above the discount rate of Deutsche Bundesbank (German Federal Bank).
This does not exclude the additional claim for damages due to delay.
Payments have to be effected directly to us; our commercial representatives are not authorized to receive payments. Invoices concerning partial deliveries are individually due according to their date of issue. If no terms of payment have been agreed to payment within 30 days of date of invoice shall apply.

10. Compensation/Right of Retention
The retention of payments or the compensation with possible counterclaims of the customer is only allowed if the counter-claims have been accepted by us or are legally confirmed.

11. Reservation of Title
We reserve the title of the purchased goods until the final payment of all payments resulting from the business relationship with the customer.
If the customer acts against the sense of the contract, especially in case of delayed payment, we have the right to take the goods back. This does not constitute our resignation from the contract unless we explicitly confirm this in writing. After taking the goods back we are free to utilize them. The proceeds from the utilization shall be credited against the customer´s liabilities reduced by appropriate utilization costs.
A distress or other interventions of a third party shall be immediately reported in writing by the customer. If the third party is not able to reimburse our legal and extra-legal costs of a claim concerning a release of our property (intervention claim according to § 771 ZPO) the customer is liable for the loss.
The customer has the right to resell the goods in an ordinary business relationship; he already transfers all claims amounting to the final value of the invoice (incl. value added tax) resulting from the resale to his customers or third parties independant of the fact whether the delivered goods were resold without or after processing. The customer has the right to collect the debt after the transfer of this debt to us. This does not affect our right to collect the debt ourselves. We are obliged, though, not to collect as long as the customer meets his payment obligations, has no delayed payments, and an application for bankruptcy or settlement proceedings is not pending. If this is the case we can ask the customer to present the transferred claims and their debtors, make the necessary statements, hand over the corresponding documents and advise the debtors (third parties) of the transfer.
If the goods delivered are processed to another mobile item this processing is done for us. The acquisition of property by the customer is excluded in accordance with § 950 BGB (German Civil Law). If the goods delivered are processed or mixed together with other items not belonging to us we acquire the property of the newly produced goods in relation to the value of our goods compared with the value of the remaining goods at the time of manufacture. For these new goods created by the process the same applies as for goods supplied with reservations.
Reservations and all other securing rights applying to us remain in existence up to the complete payment of all debts resulting from this business relationship. If these securities exceed all debts resulting from this business relationship by more than 20% we are obliged to release upon request by the customer.

12. Cession
We have the right to transfer our debts against our customers to third parties without the approval of our customers.

13. Liability
Our liability is exclusively based on these regulations. The claim for damages raised by the purchaser against us and our agents and executors for whatever legal reason, especially in case of fault when signing the contract, violation of contractual side duties and tortious act, is excluded unless they are a result of intent or gross negligence.
The a.m. limitations of liability do not apply to claims according to §§1, 4 of the Product Liability Law.

14. Place of Performance and Place of Jurisdiction
Place of performance are the premises of the seller. Jurisdiction is also at the premises of the seller as long as the customer is a business man or legal representatives of public law and property under public law. We have the right to sue the purchaser at the court of his residence.

15. Jurisdiction
German legislation only shall apply.

16. Legality
If any of the aforementioned regulations of the contract do not become part of the contract in part or in total or if they have become or are invalid the rest of the contract shall remain in full force.

January, 1999

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