



**FRANKEN**

HIGH PERFORMANCE END MILLS

# 100 years of precision milling and innovation.



Ever since its foundation, Franken, as part of the EMUGE-FRANKEN

Company, has been developing and manufacturing milling tools — a wide range of solid carbide and HSS end mills, PCD and CBN inserts and milling cutters with indexable inserts, characterized by precision and innovation.

The EMUGE-FRANKEN production facility is located in Rückersdorf, Germany and is dedicated to the manufacturing of high precision end mills and indexable cutters as well as special design form and profile milling tools. With an extensive variety of tool types in a wide range of materials, EMUGE-FRANKEN manufactures only the highest quality cutting tools for discerning customers.




**EMUGE-FRANKEN**, Rückersdorf, Germany

The newly expanded 50,000 sq.ft. EMUGE-FRANKEN U.S.A. headquarters include end mill manufacturing, tool reconditioning, a new PVD Coating Center and a Technology and Training Center. The expanded facility provides the capacity to manufacture standard solutions within the EMUGE-FRANKEN milling tools portfolio, special solid carbide tooling, chamfer mills and carbide step drills, to serve EMUGE-FRANKEN U.S.A. and Canadian customers.



**EMUGE-FRANKEN**, West Boylston, MA U.S.A.

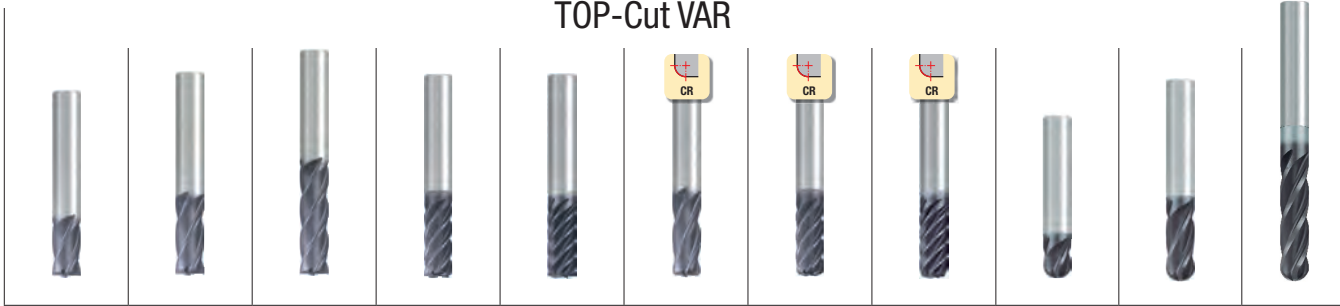
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Choose the end mills most suitable for your applications / materials:

	Steel	Stainless Steel	Cast Iron	Aluminum	Ti / Nickel Alloys	Hardened Materials
Tool Type	High Performance End Mill Program					
Rougher	Multi-Cut	Multi-Cut	Multi-Cut	Alu-Cut		
Semi-Finisher		TiNox-Cut			TiNox-Cut	
	Trochoidal	Trochoidal			Trochoidal	
Rougher & Finisher	Top-Cut	Top-Cut	Top-Cut	Top-Cut	Top-Cut	Top-Cut
	Circle Segment	Circle Segment	Circle Segment	Circle Segment	Circle Segment	Circle Segment
	Turbine	Turbine		Turbine	Turbine	Turbine
	Micro	Micro	Micro	Micro	Micro	Micro
						Hard-Cut
Finisher	Circle Segment	Circle Segment		Circle Segment	Circle Segment	Hard-Cut
				Alu-Cut		
Fine Finisher				Cut & Form		Hard-Cut

Applications / Materials		Hardness Range			Material Examples
		HRC	BHN	N/mm <sup>2</sup>	
<b>P</b>	<b>Steel materials</b>				
	1.1 Cold-extrusion steels, Construction steels, Free-cutting steels, etc.		≤ 180	≤ 600	1010 / 1018 / 1020 / 12L14 / 12L15 / A36 / T1
	2.1 Construction steels, Cementation steels, Steel castings, etc.	≤ 22	≤ 235	≤ 800	A36 / T1 / 1030-1095 / 4140 / 4340 / 8620
	3.1 Cementation steels, Heat-treatable steels, Cold work steels, etc.	≤ 31	≤ 295	≤ 1000	4140 / 4340 / 8620 / P20 / H13 / D2 / A2 / S7 / H1150
	4.1 Heat-treatable steels, Cold work steels, Nitriding steels, etc.	≤ 38	≤ 355	≤ 1200	4140 / 4340 / 8620 / P20 / H13 / D2 / 300M / 52100 / M1-M42
5.1 High-alloyed steels, Cold work steels, Hot work steels, etc.	≤ 44	≤ 415	≤ 1400	4140 / 4340 / 8620 / P20 / H13 / D2 / 300M / 52100	
<b>M</b>	<b>Stainless steel materials</b>				
	1.1 Ferritic, martensitic	≤ 29	≤ 280	≤ 950	410 / 440 / 440C / 17-4 PH
	2.1 Austenitic	≤ 29	≤ 280	≤ 950	303 / 304 / 316 / 316L / 321
	3.1 Austenitic-ferritic (Duplex)	≤ 35	≤ 325	≤ 1100	
	4.1 Austenitic-ferritic heat-resistant (Super Duplex)	≤ 39	≤ 370	≤ 1250	
<b>K</b>	<b>Cast materials</b>				
	1.1 Cast iron with lamellar graphite (GJL)		30 - 75	100 - 250	Grey cast irons G10-GG40
	1.2		75 - 135	250 - 450	
	2.1 Cast iron with nodular graphite (GJS)		105 - 150	350 - 500	Nodular GGG40-GGG70
	2.2		150 - 265	500 - 900	
	3.1 Cast iron with vermicular graphite (GJV)		90 - 120	300 - 400	
	3.2		120 - 150	400 - 500	Compact graphite iron (CGI)
4.1		70 - 145	250 - 500		
4.2 Malleable cast iron (GTMW, GTMB)		150 - 235	500 - 800	White iron	
<b>N</b>	<b>Non ferrous materials</b>				
	<b>Aluminum alloys</b>				
	1.1 Aluminum wrought alloys		≤ 60	≤ 200	7075
	1.2		≤ 105	≤ 350	6061-T6 / 2024-T4
	1.3		≤ 165	≤ 550	
	1.4 Aluminum cast alloys Si ≤ 7%				
	1.5 Aluminum cast alloys 7% < Si ≤ 12%				
	1.6 Aluminum cast alloys 12% < Si ≤ 17%				
	<b>Copper alloys</b>				
	2.1 Pure copper, low-alloyed copper		≤ 120	≤ 400	
	2.2 Copper-zinc alloys (brass, long-chipping)		≤ 165	≤ 550	
	2.3 Copper-zinc alloys (brass, short-chipping)		≤ 165	≤ 550	
	2.4 Copper-aluminum alloys (alu bronze, long-chipping)		≤ 235	≤ 800	
	2.5 Copper-tin alloys (tin bronze, long-chipping)		≤ 205	≤ 700	
	2.6 Copper-tin alloys (tin bronze, short-chipping)		≤ 120	≤ 400	
	2.7 Special copper alloys		≤ 180	≤ 600	
	2.8	≤ 44	≤ 415	≤ 1400	
	<b>Magnesium alloys</b>				
	3.1 Magnesium wrought alloys		≤ 150	≤ 500	
	3.2 Magnesium cast alloys		≤ 150	≤ 500	
<b>Synthetics</b>					
4.1 Duroplastics (short-chipping)					
4.2 Thermoplastics (long-chipping)					
4.3 Fiber-reinforced synthetics (fiber content ≤ 30%)					
4.4 Fiber-reinforced synthetics (fiber content > 30%)					
<b>Special materials</b>					
5.1 Graphite					
5.2 Tungsten-copper alloys					
5.3 Composite materials					
<b>S</b>	<b>Special materials</b>				
	<b>Titanium alloys</b>				
	1.1 Pure titanium		≤ 135	≤ 450	CP1 / CP2
	1.2 Titanium alloys	≤ 27	≤ 265	≤ 900	6AL4V
	1.3	≤ 39	≤ 370	≤ 1250	
	<b>Nickel alloys, cobalt alloys and iron alloys</b>				
	2.1 Pure nickel		≤ 180	≤ 600	
	2.2 Nickel-base alloys	≤ 31	≤ 295	≤ 1000	Monel 500 / Hastelloy / 625 Inconel
	2.3	≤ 49	≤ 475	≤ 1600	718 Inconel
	2.4 Cobalt-base alloys	≤ 31	≤ 295	≤ 1000	
	2.5	≤ 49	≤ 475	≤ 1600	Haynes 25
2.6 Iron-base alloys	≤ 46	≤ 445	≤ 1500	Incoloy 925	
<b>H</b>	<b>Hard materials</b>				
	1.1 High strength steels, hardened steels, hard castings	44 - 50			Weldox 1100
	1.2	50 - 55			Hardox 550
	1.3	55 - 60			Armox 600T
	1.4	60 - 63			Ferro-Titanit
	1.5	63 - 66			HSSE

# TOP-Cut VAR



**TOP-Cut VAR** **Ball Nose**

**N**

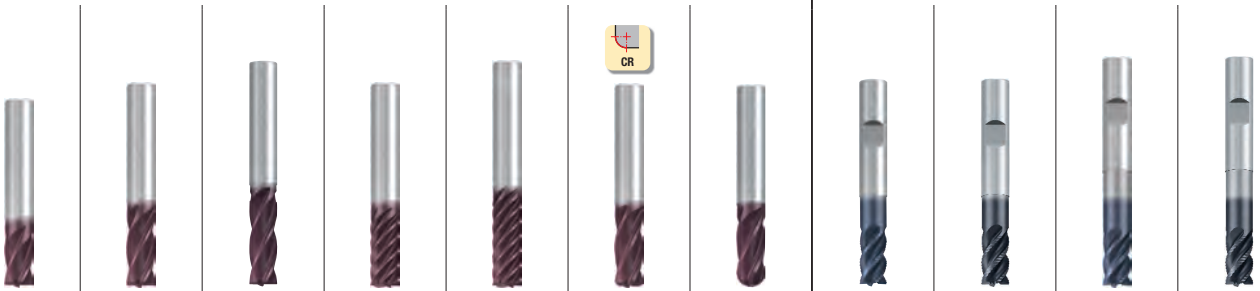
1/16 - 3/4"	1/8 - 1"	1/8 - 1"	1/4 - 1"	1/4 - 1"	1/8 - 1"	1/4 - 1"	1/4 - 1"	1/8 - 1"			d <sub>1</sub>
4	4	4	5	6	4	5	6	4			# Flutes
2992L	2994L	2996L	2946L	2948L	2998L	3902L	2947L	2919L	2974L	3900L	
2993L	2995L	2997L	2920L	3908L	2999L	3903L	3909L	-	-	-	
17	17	18	19	20	21	22	23	24			Page
105	106	107	108	109	106	108	109	110			V <sub>c</sub> / f <sub>z</sub>

											1.1	<b>P</b>
											2.1	
											3.1	
											4.1	
											5.1	
											1.1	<b>M</b>
											2.1	
											3.1	
											4.1	
											1.1	<b>K</b>
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											1.1	<b>H</b>
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											1.5	

■ = very suitable    □ = suitable

**TOP-Cut Metric**

**Multi-Cut**








d <sub>1</sub>	Top-Cut Metric						Multi-Cut					
	N					Ball Nose	Multi-Cut					
	N		NR <small>fine</small>									
	ø 3 - 20 mm		ø 5 - 20 mm	ø 6 - 20 mm	ø 3 - 20 mm	ø 2 - 16 mm	1/8 - 1" ø 3 - 20 mm		1/8 - 1" ø 3 - 20 mm			
# Flutes	4		4 - 5		6 - 8		4	3 - 4	3 - 5		3 - 5	
	1916A	1998A	2526A	2522A	2524A	2698A	2502A	-	-	-	-	
	1917A	1999A	2527A	-	-	2699A	-	2869A	2869L	2875A	2875L	
Page	27	27	28	29		30	31	33		34		
v <sub>c</sub> / f <sub>z</sub>	105	106	107	109		106	110	111		112		
<b>P</b>	1.1	■	■	■	■	■	■	■	■	■	■	
	2.1	■	■	■	■	■	■	■	■	■	■	
	3.1	■	■	■	■	■	■	■	■	■	■	
	4.1	■	■	■	■	■	■	■	■	■	■	
	5.1	■	■	■	■	■	■	■	■	■	■	
<b>M</b>	1.1	■	■	■	■	■	■		□		□	
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	4.1	■	■	■	□	□	■				□	
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	2.2	■	■	■	□	□	■	■	■	■	■	
	3.1	■	■	■	■	■	■	■	■	■	■	
	3.2	■	■	■	■	■	■	■	■	■	■	
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	1.3	■	■	■	■	■	■					
	1.4	■	■	■	■	■	■					
	1.5			□		□						
	1.6			□		□						
	2.1	■	■	■	■	■	■	■	■	■	■	
	2.2	■	■	■	■	■	■	■	■	■	■	
	2.3	■	■	■	■	■	■	■	■	■	■	
	2.4	■	■	■	■	■	■	■	■	■	■	
	2.5	■	■	■	■	■	■	■	■	■	■	
	2.6	■	■	■	■	■	■	■	■	■	■	
	2.7	■	■	■	■	■	■	■	■	■	■	
	2.8	■	■	■	■	■	■	■	■	■	■	
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3.2	■	■	■	■	■	■	■					
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	1.3	■	■	■	■	■	■					
	2.1	■	■	□	■	■	■	■				
	2.2	■	■	□	■	■	■	■				
	2.6	■	■	□	□	□	■	■				
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	1.3	□	□				□					
	1.4											
	1.5											

**Multi-Cut**

**DUPLEX**

**TiNox-Cut**

Multi-Cut		Ball Nose		Multi-Cut DUPLEX		Jet-Cut DUPLEX		TiNox-Cut N		TiNox-Cut NF		d <sub>1</sub>
NR 				NR 		N		N		NF 		
1/8 - 1" ø3-20 mm		ø3-20 mm		ø6-16 mm	ø8-16 mm	ø3-16 mm	ø8-16 mm	1/4 - 1"		1/4 - 1"		# Flutes
3 - 5		3 - 4		4		4		5		4 - 5		
2869AZ	2869LZ	2667A	2667L	2614AZ	2616AZ	2610AZ	2612AZ	2962LZ	2966LZ	2648TZ	2958T	
35		36		37		38		42	42	43		
113		114		115		116		117		118		
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												1.5

	TiNox-Cut		Trochoidal								Jet-Cut Trochoidal							
	TiNox-Cut Base		TiNox-Cut Trochoidal								Jet-Cut Trochoidal							
	N		NF <small>medium</small>								NF <small>medium</small>							
d <sub>1</sub>	1/8 - 3/4"		1/4 - 3/4" ø6 - 20 mm				1/4 - 3/4"				1/4 - 3/4" ø6 - 20 mm				ø10 - 20 mm			
# Flutes	4		4 - 5				4 - 5				4 - 5		4 - 5	4 - 7	4 - 5	4 - 7	5	
	2975T	2977T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	2976T	2978T	2577TZ	2537TZ	2579TZ	2539TZ	2581TZ	2541TZ	3911TZ	3913TZ	2571L	2531L	2573L	2533L	2575L	2535L	-	2557L
Page	44		47		48				49		50			51				
v <sub>c</sub> / f <sub>z</sub>	119	120	121	121				121		122								
<b>P</b>	1.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	4.1	□	□	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■
	5.1	□	□	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■
<b>M</b>	1.1	■	■	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
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	4.1	■	■	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
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	2.2	■	■	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
	3.1	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
	3.2	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
	4.1	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■
4.2	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■	
<b>N</b>	1.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.4	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2.3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2.4	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2.5	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2.6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
2.7	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
2.8	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3.1																		
3.2																		
4.1																		
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4.3																		
4.4																		
5.1																		
5.2	□	□	■	■	■	■	■	■	■	■	□	□	□	□	□	□	□	
5.3																		
<b>S</b>	1.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.2	□	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	1.3	□	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
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	2.2	□	□	■	■	■	■	■	■	■	□	□	□	□	□	□	□	
	2.3	□	□	■	■	■	■	■	■	■	□	□	□	□	□	□	□	
2.4	□	□	■	■	■	■	■	■	■	□	□	□	□	□	□	□		
2.5	□	□	■	■	■	■	■	■	■	□	□	□	□	□	□	□		
2.6	□	□	■	■	■	■	■	■	■	□	□	□	□	□	□	□		
<b>H</b>	1.1	■	■															
	1.2	□	□															
	1.3																	
	1.4																	
	1.5																	



**Hard-Cut**

**Chamfer Mills**

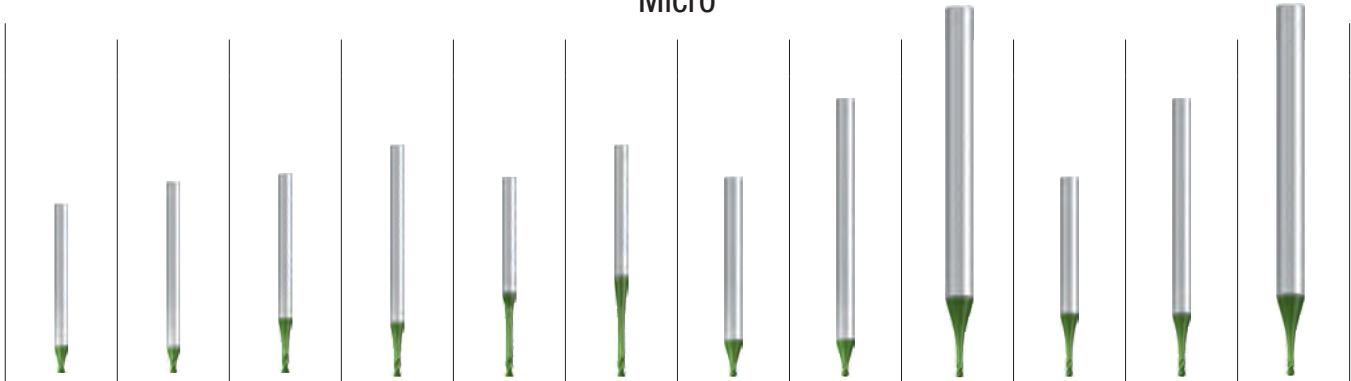


Hard-Cut				Jet-Cut	Ball Nose		Chamfer Mills			
H				H	H		N			
1/4 - 1" ø6 - 20 mm	1/4 - 1" ø6 - 25 mm	1/4 - 3/4" ø5 - 16 mm	1/4 - 3/4" ø6 - 16 mm	1/4 - 3/4" ø6 - 20 mm	1/4 - 1/2" ø0.5 - 16 mm	ø8 - 16 mm	1/8 - 5/8" ø4 - 12 mm	1/8 - 5/8" ø4 - 12 mm	ø5.7-7.7 mm	d <sub>1</sub>
6 - 10	6 - 10	6 - 8	6 - 8	6 - 20	2	2	4	4	4	# Flutes
1827A	1828A	2813A	2817A	2887A	1976A	1974A	1715A	1715A	1700L	
-		-		-	-		-		-	
53		54		55	56		60		61	Page
123		123		124	125		-		-	v <sub>c</sub> / f <sub>z</sub>

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1.1	<b>P</b>
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<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3.1	
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				<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.1	<b>M</b>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2.1	
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	3.1	
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	4.1	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1.1	<b>K</b>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1.2	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2.1	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2.2	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	3.1	
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<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	4.1	
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							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.1	<b>N</b>
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.2	
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.3	
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.4	
							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.5	
							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.6	
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							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2.2	
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2.3	
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2.4	
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2.5	
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2.6	
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							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.1	
							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.2	
							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.1	
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							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	5.2	
							<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	5.3	
				<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.1	<b>S</b>
				<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.2	
				<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.3	
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				<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.3	
				<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.4	
				<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.5	
				<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.6	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				1.1	<b>H</b>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				1.2	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				1.3	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				1.4	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				1.5	

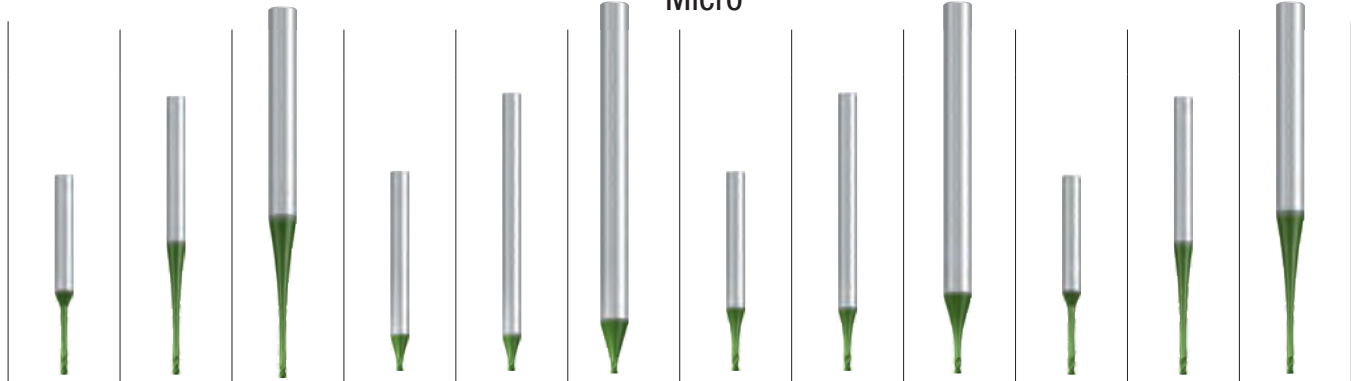
■ = very suitable □ = suitable

Micro



l <sub>3</sub>	Micro						Ball Nose					
	N											
d <sub>1</sub>	2.2 x d <sub>1</sub>		5 x d <sub>1</sub>		10 x d <sub>1</sub>		2.2 x d <sub>1</sub>			5 x d <sub>1</sub>		
# Flutes	2		2		2		2			2		
	2760L	2763L	2761L	2764L	2762L	2765L	2770L	2773L	2776L	2771L	2774L	2777L
Page	63		64		65		66			67		
v <sub>c</sub> / f <sub>z</sub>	126		127		128		129			130		
P	1.1	■	■	■	■	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■	■	■	■	■
	5.1	■	■	■	■	■	■	■	■	■	■	■
M	1.1	■	■	■	■	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■	■	■	■	■
	3.1	□	□	□	□	□	□	□	□	□	□	□
	4.1	□	□	□	□	□	□	□	□	□	□	□
K	1.1	■	■	■	■	■	■	■	■	■	■	■
	1.2	■	■	■	■	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■	■	■	■	■
	2.2	■	■	■	■	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■	■	■	■	■
	3.2	■	■	■	■	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■	■	■	■	■
	4.2	■	■	■	■	■	■	■	■	■	■	■
N	1.1	■	■	■	■	■	■	■	■	■	■	■
	1.2	■	■	■	■	■	■	■	■	■	■	■
	1.3	■	■	■	■	■	■	■	■	■	■	■
	1.4	■	■	■	■	■	■	■	■	■	■	■
	1.5	■	■	■	■	■	■	■	■	■	■	■
	1.6	■	■	■	■	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■	■	■	■	■
	2.2	■	■	■	■	■	■	■	■	■	■	■
	2.3	■	■	■	■	■	■	■	■	■	■	■
	2.4	■	■	■	■	■	■	■	■	■	■	■
	2.5	■	■	■	■	■	■	■	■	■	■	■
	2.6	■	■	■	■	■	■	■	■	■	■	■
	2.7	■	■	■	■	■	■	■	■	■	■	■
	2.8	■	■	■	■	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■	■	■	■	■
	3.2	■	■	■	■	■	■	■	■	■	■	■
4.1	■	■	■	■	■	■	■	■	■	■	■	
4.2	■	■	■	■	■	■	■	■	■	■	■	
4.3												
4.4												
5.1	■	■	■	■	■	■	■	■	■	■	■	
5.2	■	■	■	■	■	■	■	■	■	■	■	
5.3	■	■	■	■	■	■	■	■	■	■	■	
S	1.1	□	□	□	□	□	□	□	□	□	□	□
	1.2	□	□	□	□	□	□	□	□	□	□	□
	1.3	□	□	□	□	□	□	□	□	□	□	□
	2.1	□	□	□	□	□	□	□	□	□	□	□
	2.2											
	2.3											
2.4												
2.5												
2.6												
H	1.1	□	□	□	□	□	□	□	□	□	□	□
	1.2	□	□	□	□	□	□	□	□	□	□	□
	1.3											
	1.4											
	1.5											

**Micro**














**Ball Nose**

**Torus**

**N**

10 x d <sub>1</sub>		2.2 x d <sub>1</sub>			5 x d <sub>1</sub>			10 x d <sub>1</sub>			l <sub>3</sub>	
ø0.2 - 2mm		ø0.5 - 2mm			ø0.5 - 2mm			ø0.5 - 2mm			d <sub>1</sub>	
2		2			2			2			# Flutes	
2772L	2775L	2778L	2780L	2783L	2786L	2781L	2784L	2787L	2782L	2785L	2788L	
68		69			70			71			Page	
131		132			133			134			v <sub>c</sub> / f <sub>z</sub>	
											<b>P</b>	
<input checked="" type="checkbox"/>											1.1	
<input checked="" type="checkbox"/>											2.1	
<input checked="" type="checkbox"/>											3.1	
<input checked="" type="checkbox"/>											4.1	
<input checked="" type="checkbox"/>											5.1	
											<b>M</b>	
<input checked="" type="checkbox"/>											1.1	
<input checked="" type="checkbox"/>											2.1	
<input type="checkbox"/>											3.1	
<input type="checkbox"/>											4.1	
											<b>K</b>	
<input checked="" type="checkbox"/>											1.1	
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<input checked="" type="checkbox"/>											2.1	
<input checked="" type="checkbox"/>											2.2	
<input checked="" type="checkbox"/>											3.1	
<input checked="" type="checkbox"/>											3.2	
<input checked="" type="checkbox"/>											4.1	
<input checked="" type="checkbox"/>											4.2	
											<b>N</b>	
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<input checked="" type="checkbox"/>											1.3	
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<input checked="" type="checkbox"/>											2.8	
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											<b>S</b>	
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<input type="checkbox"/>											2.3	
<input type="checkbox"/>											2.4	
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<input type="checkbox"/>											2.6	
											<b>H</b>	
<input type="checkbox"/>											1.1	
<input type="checkbox"/>											1.2	
<input type="checkbox"/>											1.3	
<input type="checkbox"/>											1.4	
<input type="checkbox"/>											1.5	

Circle Segment

								
	Oval Form	Barrel Form	Barrel Form	Oval Form	Oval Form	Taper Form	Taper Form	Lens Form
	NR 	N						
$d_1$	$\varnothing 8 - 16 \text{ mm}$	$\varnothing 8 - 16 \text{ mm}$	$r_2 = 50 \text{ mm}$	$r_2 = 50 - 75 \text{ mm}$	$\varnothing 10 - 16 \text{ mm}$	$\alpha_{f_2} = 12.5 - 70^\circ$ $r_2 = 50 - 1500 \text{ mm}$	$\alpha_{f_2} = 12.5 - 70^\circ$ $r_2 = 200 - 1500 \text{ mm}$	$r_2 = 6 - 25 \text{ mm}$
# Flutes	4	4	4	3 - 4	6	2 - 3	4 - 6	3
	3552LZ	3554LZ	3542L	3538L	3539L	3540L	3541L	3544L
	-	-	-	-	-	-	-	-
Page	73	74	75	76	77	78	79	80
$v_c / f_z$	135	135	136	137	138	139	140	141
<b>P</b>	1.1	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■
	5.1	■	■	■	■	■	■	■
<b>M</b>	1.1	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■
	3.1	■	■	□	□	□	□	□
	4.1	■	■	□	□	□	□	□
<b>K</b>	1.1			■	■	■	■	■
	1.2			■	■	■	■	■
	2.1			■	■	■	■	■
	2.2			□	□	□	□	□
	3.1			■	■	■	■	■
	3.2			■	■	■	■	■
	4.1			■	■	■	■	■
4.2			□	□	□	□	□	
<b>N</b>	1.1	■	■	■	■	■	■	■
	1.2	■	■	■	■	■	■	■
	1.3	■	■	■	■	■	■	■
	1.4			■	■	■	■	■
	1.5				■	■	■	■
	1.6				■	■	■	■
	2.1			■	■	■	■	■
	2.2			■	■	■	■	■
	2.3			■	■	■	■	■
	2.4			■	■	■	■	■
	2.5			■	■	■	■	■
	2.6			■	■	■	■	■
	2.7			■	■	■	■	■
	2.8			■	■	■	■	■
	3.1			■	■	■	■	■
3.2			■	■	■	■	■	
4.1			□	□	□	□	□	
4.2			□	□	□	□	□	
4.3								
4.4								
5.1								
5.2			□	□	□	□	□	
5.3								
<b>S</b>	1.1	■	■	■	■	■	■	■
	1.2	■	■	■	■	■	■	■
	1.3	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■
	2.2	■	■	■	■	■	■	■
	2.3	■	■	□	□	□	□	□
2.4	■	■	■	■	■	■	■	
2.5	■	■	□	□	□	□	□	
2.6	■	■	□	□	□	□	□	
<b>H</b>	1.1			□	□	■	■	
	1.2			□	□	■	■	
	1.3					■	■	
	1.4					■	■	
	1.5					■	■	

Turbine

Tapered Ball Nose								
NR <small>fine</small>	NF <small>fine</small>		N					
$\alpha/2=4^\circ$ $r=2-4\text{mm}$	$\alpha/2=3-8^\circ$ $r=0.5-2\text{mm}$		$\alpha/2=3-8^\circ$ $r=1.5-3\text{mm}$		$\alpha/2=3-17.5^\circ$ $r=0.5-3\text{mm}$		$\alpha/2=4^\circ$ $r=2-4\text{mm}$	$d_1$
3	2		2		3		3	# Flutes
3546L	3446 / 3447	3446L	3442 / 3443	3442L	3440 / 3441	3440L	3550L	
-	-	-	-	-	-	-	-	Page
83	84		85		86		87	$v_c / f_z$
142	143		144		145		146	
								1.1
								2.1
								3.1
								4.1
								5.1
								1.1
								2.1
								3.1
								4.1
								1.1
								1.2
								2.1
								2.2
								3.1
								3.2
								4.1
								4.2
								1.1
								1.2
								1.3
								1.4
								1.5
								1.6
								2.1
								2.2
								2.3
								2.4
								2.5
								2.6
								2.7
								2.8
								3.1
								3.2
								4.1
								4.2
								4.3
								4.4
								5.1
								5.2
								5.3
								1.1
								1.2
								1.3
								2.1
								2.2
								2.3
								2.4
								2.5
								2.6
								1.1
								1.2
								1.3
								1.4
								1.5



Turbine

	Tapered Ball Nose		Hard-Cut				Top-Cut	Lollipop	Tapered Torus		Tapered Torus	
	N		H				N		NR <small>fine</small>		N	
$d_1$	$\alpha/2 = 4^\circ$ $r = 2 - 4 \text{ mm}$	$\alpha/2 = 4^\circ$ $r = 3 - 8 \text{ mm}$	$1/8'' - 1/2''$ $\phi 3 - 12 \text{ mm}$		$1/8'' - 1/2''$ $\phi 6 - 12 \text{ mm}$		$\phi 2 - 12 \text{ mm}$	$\phi 4 - 10 \text{ mm}$	$\alpha/2 = 3^\circ$ $\phi 6.5 - 8.5 \text{ mm}$	$\alpha/2 = 3^\circ$ $\phi 5 - 6 \text{ mm}$	$\alpha/2 = 3 - 8^\circ$ $\phi 3 - 5 \text{ mm}$	
# Flutes	3/6	3/6	4		4		2	4	4	3	2	
	3548L	2679A	2942A	2834A	2943A	2842A	1935A	2564L	-	-	3444 / 3445	3444L
Page	88	89	90		91		92	93	94		95	
$v_c / f_z$	146	147	148		149		150	151	152		153	
P	1.1	■	■	□	□	■	■	■	■	■	■	■
	2.1	■	■	□	□	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■	■	■	■	□
	5.1	■	■	■	■	■	■	■	■	■	■	□
M	1.1	■	■					■	■	■		■
	2.1	■	■					■	■	■		■
	3.1	■	■					■	■	■		■
	4.1	■	■					■	■	■		■
K	1.1		■	■	■	■	■	□				■
	1.2		■	■	■	■	■	□				■
	2.1		■	■	■	■	■	□				■
	2.2		■	■	■	■	■	□				■
	3.1		■	■	■	■	■	□				□
	3.2		■	■	■	■	■	□				□
	4.1		■	■	■	■	■	□				□
	4.2		■	■	■	■	■	□				□
N	1.1								■	■	■	■
	1.2						□		■	■	■	■
	1.3	■					□		■	■	■	■
	1.4	■					□		■	■	■	■
	1.5	■										□
	1.6											
	2.1		■				■	■				■
	2.2		■	□	□	■	■					■
	2.3		■	■	■	■	■					■
	2.4		■	□	□	■	■					■
	2.5		■	□	□	■	■					■
	2.6		■	■	■	■	■					■
	2.7		■	■	■	■	■					□
	2.8		■	■	■	■	■					□
	3.1											■
	3.2											■
4.1										■	■	
4.2										■	■	
4.3											■	
4.4											■	
5.1											■	
5.2						□					■	
5.3											■	
S	1.1	■	■		■		■	■	■	■		■
	1.2	■	■		■		■	■	■	■		■
	1.3	■	■		■		■	■	■	■		□
	2.1	■	■		■		■	■	■	■		■
	2.2	■	■		■		■	■	■	■		■
	2.3	■	■		■		■	■	■	■		□
	2.4	■	■		■		■	■	■	■		□
2.5	■	■		■		■	■	■	■		□	
2.6	■	■		■		■	■	■	■		□	
H	1.1		■	■	■	■	■	□				
	1.2		■	■	■	■	■	□				
	1.3		■	■	■	■	■	□				
	1.4		■	■	■	■	■					
	1.5		■	■	■	■	■					

Turbine

Alu-Cut

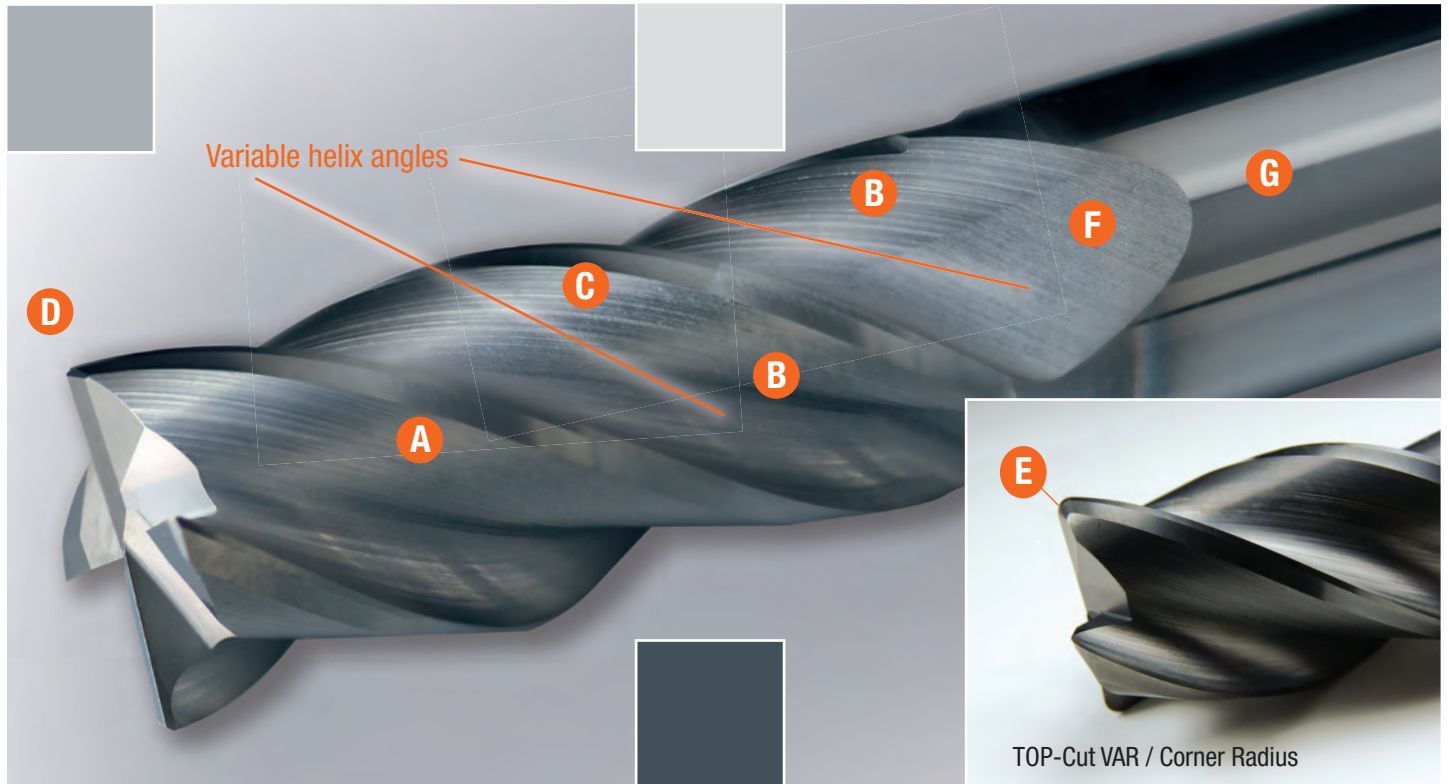
Cut & Form

Tapered Torus			Rougher		Finisher		Ball Nose		Cut & Form		d <sub>1</sub>
N			WR 		W		W		W		
α <sub>1/2</sub> =8° ø8-11 mm	α <sub>1/2</sub> =8° ø9-19 mm	ø8-16 mm	1/4-1"		1/4-1"		3/32-3/4"		ø6-12 mm		# Flutes
7-9	5-13	5-9	3		3-4		2		3/6		
2677AZ	2678AZ	2676AZ	2888_Z	2888RZ	2889_Z	2889RZ	1921	1921R	2506	2507	
-	-	-	-	-	-	-	-	-	-	-	Page
96	97	97	99	100	101	103	154	155	156	157	158
154	155	155	156	156	157	158	V <sub>c</sub> / f <sub>z</sub>				
											1.1
											2.1
											3.1
											4.1
											5.1
											1.1
											2.1
											3.1
											4.1
											1.1
											1.2
											2.1
											2.2
											3.1
											3.2
											4.1
											4.2
											1.1
											1.2
											1.3
											1.4
											1.5
											1.6
											2.1
											2.2
											2.3
											2.4
											2.5
											2.6
											2.7
											2.8
											3.1
											3.2
											4.1
											4.2
											4.3
											4.4
											5.1
											5.2
											5.3
											1.1
											1.2
											1.3
											2.1
											2.2
											2.3
											2.4
											2.5
											2.6
											1.1
											1.2
											1.3
											1.4
											1.5

■ = very suitable □ = suitable

# TOP-Cut VAR High Performance End Mills

## For Universal Milling Applications



**TOP-Cut VAR** end mills are the most versatile variable helix carbide tool in the industry. Featuring unique geometry and coating, it can be used in virtually all materials and applications. TOP-Cut VAR is the best choice for manufacturers who need flexibility and high performance.

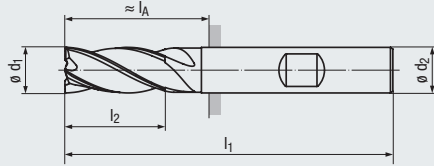
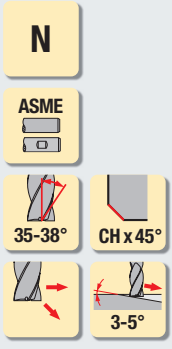
- A Unique flute and profile geometries** optimized for extended tool life, provide superior performance in both roughing and finishing applications
- B Variable helix angle flutes** provide vibration dampening milling
- C Precision ground flutes and advanced edge preparation** provide maximum chip evacuation
- D Chamfer feature** protects cutting edges to prevent tool chipping
- E Fully blended corner radius** extends tool life and delivers improved surface finishes
- F Advanced ALCR PVD coating** enables outstanding performance in higher operating temperatures
- G Proprietary sub-micro grain carbide grade** for maximum abrasion resistance and durability, providing consistent, high performance levels

*German engineered  
EMUGE-FRANKEN quality*



**4 Flutes**

- Variable helix angle flutes
- Vibration dampening
- Chamfer to stabilize the cutting edge
- ALCR PVD coating
- Sub-micro grain carbide
- Center cutting



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 5)

Cutting Data (see pages 105-106)

- Ideal for most materials
- Suitable for roughing and finishing operations

**ALCR**

- P** 1.1-5.1
- M** 1.1-4.1
- K** 1.1-4.2
- N** 1.2-1.4
- N** 2.1-4.1, 5.2
- S** 1.1-2.6
- H** 1.1 1.2-1.3

**Stub length**

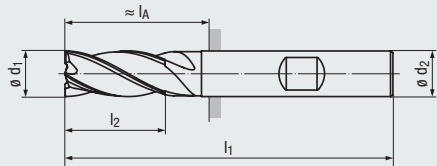
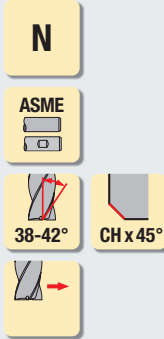
$\varnothing d_1$ h10	$l_2$	$l_1$	$\varnothing d_2$ h6	$l_A$ 	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/16	1/8	1 1/2	1/8	–	0.002	4	2992L.00625	–
3/32	3/16	1 1/2	1/8	–	0.003	4	2992L.009375	–
1/8	1/4	1 1/2	1/8	–	0.003	4	2992L.0125	–
5/32	5/16	2	3/16	–	0.003	4	2992L.015625	–
3/16	3/8	2	3/16	–	0.003	4	2992L.01875	–
7/32	7/16	2	1/4	5/8	0.003	4	2992L.021875	2993L.021875
1/4	1/2	2	1/4	5/8	0.005	4	2992L.0250	2993L.0250
5/16	1/2	2	5/16	5/8	0.005	4	2992L.03125	2993L.03125
3/8	5/8	2	3/8	7/16	0.008	4	2992L.0375	2993L.0375
7/16	5/8	2 1/2	7/16	–	0.008	4	2992L.04375	–
1/2	5/8	2 1/2	1/2	23/32	0.008	4	2992L.0500	2993L.0500
5/8	3/4	3	5/8	1 3/32	0.008	4	2992L.0625	2993L.0625
3/4	1	3	3/4	31/32	0.012	4	2992L.0750	2993L.0750

**Standard length**

$\varnothing d_1$ h10	$l_2$	$l_1$	$\varnothing d_2$ h6	$l_A$ 	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/8	3/8	1 1/2	1/8	–	0.003	4	2994L.0125	–
3/16	7/16	2	3/16	–	0.003	4	2994L.01875	–
1/4	1/2	2 1/2	1/4	1 1/8	0.005	4	2994L.0250	2995L.0250
1/4	3/4	2 1/2	1/4	1 1/8	0.005	4	2994L.A250	2995L.A250
5/16	13/16	2 1/2	5/16	1 1/8	0.005	4	2994L.03125	2995L.03125
3/8	7/8	2 1/2	3/8	15/16	0.008	4	2994L.0375	2995L.0375
7/16	1	2 3/4	7/16	–	0.008	4	2994L.04375	–
1/2	1	3	1/2	1 7/32	0.008	4	2994L.0500	2995L.0500
1/2	1 1/4	3 1/4	1/2	1 15/32	0.008	4	2994L.A500	2995L.A500
5/8	1 1/4	3 1/2	5/8	1 19/32	0.008	4	2994L.0625	2995L.0625
3/4	1 1/2	4	3/4	1 31/32	0.012	4	2994L.0750	2995L.0750
1	1 1/2	4	1	1 23/32	0.012	4	2994L.1000	2995L.1000

**4 Flutes**

- Variable helix angle flutes
- Vibration dampening
- Chamfer to stabilize the cutting edge
- ALCR PVD coating
- Sub-micro grain carbide
- Center cutting



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 5)

Cutting Data (see page 107)

- Ideal for most materials
- Suitable for roughing and finishing operations

**ALCR**

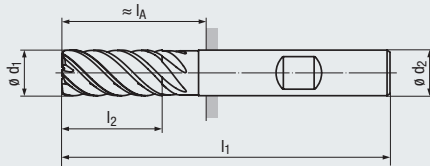
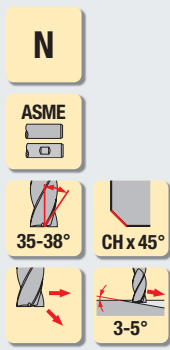
<b>P</b>	1.1-5.1
<b>M</b>	1.1-4.1
<b>K</b>	1.1-4.2
<b>N</b>	1.1-1.4 1.5-1.6
<b>N</b>	2.1-2.8, 5.2
<b>S</b>	1.1-1.3 2.1-2.6

**Long length**

$\varnothing d_1$ h10	$l_2$	$l_1$	$\varnothing d_2$ h6	$l_A$	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/8	3/4	2 1/4	1/8	—	0.003	4	2996L.0125	—
3/16	3/4	2 1/2	3/16	—	0.003	4	2996L.01875	—
1/4	1 1/8	3	1/4	1 5/8	0.005	4	2996L.0250	2997L.0250
5/16	1 1/8	3	5/16	1 5/8	0.005	4	2996L.03125	2997L.03125
3/8	1 1/8	3	3/8	1 7/16	0.008	4	2996L.0375	2997L.0375
7/16	2	4 1/2	7/16	—	0.008	4	2996L.04375	—
1/2	2	4 1/2	1/2	2 23/32	0.008	4	2996L.0500	2997L.0500
5/8	2 1/4	5	5/8	3 3/32	0.008	4	2996L.0625	2997L.0625
3/4	2 1/4	5	3/4	2 31/32	0.012	4	2996L.0750	2997L.0750
1	2 1/4	5	1	2 23/32	0.012	4	2996L.1000	2997L.1000

**5 Flutes**

- Variable pitch helix angle
- Vibration dampening
- Increased feed rates
- Chamfer to stabilize corner
- ALCR PVD coating
- Sub-micro grain carbide
- Center cutting



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 5)

Cutting Data (see page 108)

- Well suited for most materials including aerospace alloys
- Suitable for finishing and light roughing
- Suitable for trochoidal style machining strategies

**ALCR**

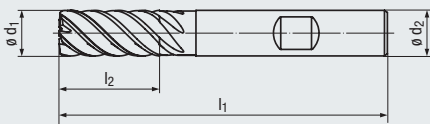
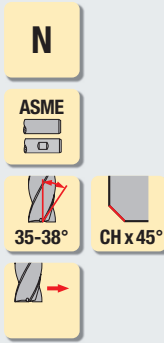
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<b>M</b>	1.1-4.1
<b>K</b>	1.1-4.2
<b>N</b>	1.2-1.4
<b>N</b>	2.1-4.1, 5.2
<b>S</b>	1.1-2.6
<b>H</b>	1.1 1.2-1.3

**Standard length**

$\phi d_1$ h10	$l_2$	$l_1$	$\phi d_2$ h6	$l_A$ 	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	3/4	2 1/2	1/4	–	0.005	5	2946L.0250	–
5/16	13/16	2 1/2	5/16	–	0.005	5	2946L.03125	–
3/8	7/8	2 3/4	3/8	–	0.008	5	2946L.0375	–
7/16	1	3	7/16	–	0.008	5	2946L.04375	–
1/2	1	3	1/2	1 7/32	0.008	5	2946L.0500	2920L.0500
5/8	1 1/4	3 1/2	5/8	1 19/32	0.008	5	2946L.0625	2920L.0625
3/4	1 1/2	4	3/4	1 31/32	0.012	5	2946L.0750	2920L.0750
1	2	5	1	2 23/32	0.012	5	2946L.1000	2920L.1000

**6 Flutes**

- Variable pitch helix angle
- Vibration dampening
- Increased feed rates
- Chamfer to stabilize corner
- ALCR PVD coating
- Sub-micro grain carbide



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 5)

Cutting Data (see page 109)

- Well suited for most materials including aerospace alloys
- Suitable for finishing and light roughing
- Suitable for trochoidal style machining strategies

**ALCR**

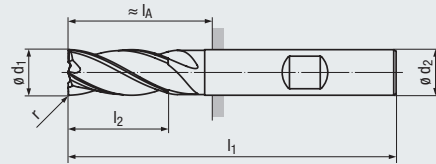
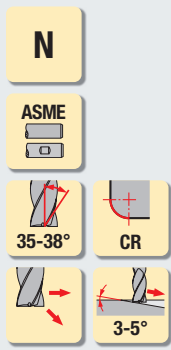
P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.2-1.4
N	2.1-4.1, 5.2
S	1.1-2.6
H	1.1 1.2-1.3

**Standard length**

$\varnothing d_1$ h10	$l_2$	$l_1$	$\varnothing d_2$ h6	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	3/4	2 1/2	1/4	0.005	6	2948L.0250	-
5/16	13/16	2 1/2	5/16	0.005	6	2948L.03125	-
3/8	7/8	2 3/4	3/8	0.008	6	2948L.0375	-
7/16	1	3	7/16	0.008	6	2948L.04375	-
1/2	1	3	1/2	0.008	6	2948L.0500	3908L.0500
5/8	1 1/4	3 1/2	5/8	0.008	6	2948L.0625	3908L.0625
3/4	1 1/2	4	3/4	0.012	6	2948L.0750	3908L.0750
1	2	5	1	0.012	6	2948L.1000	3908L.1000

**4 Flutes**

- Variable helix angle flutes
- Vibration dampening
- Corner radius options
- ALCR PVD coating
- Sub-micro grain carbide
- Center cutting



Icon descriptions (see pages 160-161)

**Corner Radius**



**Coating**

Applications – Materials (see page 5)

Cutting Data (see pages 106)

- Ideal for most materials including high tensile strength applications
- Suitable for roughing and finishing operations

**ALCR**

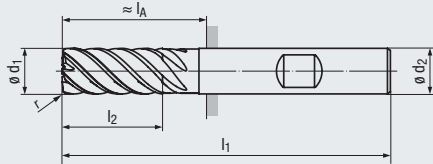
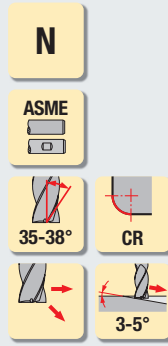
P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.2-1.4
N	2.1-4.1, 5.2
S	1.1-2.6
H	1.1 1.2-1.3

**Standard length**

$\theta d_1$ h10	r ±0.0008	$l_2$	$l_1$	$l_A$ 	$\theta d_2$ h6	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/8	0.010	3/8	1 1/2	–	1/8	4	2998L.012010	–
1/8	0.015	3/8	1 1/2	–	1/8	4	2998L.012015	–
3/16	0.010	7/16	2	–	3/16	4	2998L.018010	–
3/16	0.015	7/16	2	–	3/16	4	2998L.018015	–
3/16	0.030	7/16	2	–	3/16	4	2998L.018030	–
1/4	0.010	1/2	2 1/2	1 1/8	1/4	4	2998L.025010	2999L.025010
1/4	0.015	1/2	2 1/2	1 1/8	1/4	4	2998L.025015	2999L.025015
1/4	0.020	1/2	2 1/2	1 1/8	1/4	4	2998L.025020	2999L.025020
1/4	0.030	1/2	2 1/2	1 1/8	1/4	4	2998L.025030	2999L.025030
5/16	0.015	13/16	2 1/2	1 1/8	5/16	4	2998L.031015	2999L.031015
5/16	0.020	13/16	2 1/2	1 1/8	5/16	4	2998L.031020	2999L.031020
5/16	0.030	13/16	2 1/2	1 1/8	5/16	4	2998L.031030	2999L.031030
3/8	0.010	7/8	2 1/2	15/16	3/8	4	2998L.037010	2999L.037010
3/8	0.015	7/8	2 1/2	15/16	3/8	4	2998L.037015	2999L.037015
3/8	0.020	7/8	2 1/2	15/16	3/8	4	2998L.037020	2999L.037020
3/8	0.030	7/8	2 1/2	15/16	3/8	4	2998L.037030	2999L.037030
3/8	0.060	7/8	2 1/2	15/16	3/8	4	2998L.037060	2999L.037060
7/16	0.010	1	2 3/4	15/16	7/16	4	2998L.043010	–
7/16	0.015	1	2 3/4	15/16	7/16	4	2998L.043015	–
1/2	0.010	1	3	1 7/32	1/2	4	2998L.050010	2999L.050010
1/2	0.010	1 1/4	3 1/2	1 7/32	1/2	4	2998L.A50010	2999L.A50010
1/2	0.015	1	3	1 7/32	1/2	4	2998L.050015	2999L.050015
1/2	0.015	1 1/4	3 1/2	1 7/32	1/2	4	2998L.A50015	2999L.A50015
1/2	0.030	1	3	1 7/32	1/2	4	2998L.050030	2999L.050030
1/2	0.030	1 1/4	3 1/4	1 15/32	1/2	4	2998L.A50030	2999L.A50030
1/2	0.060	1	3	1 7/32	1/2	4	2998L.050060	2999L.050060
1/2	0.060	1 1/4	3 1/4	1 15/32	1/2	4	2998L.A50060	2999L.A50060
5/8	0.030	1 1/4	3 1/2	1 19/32	5/8	4	2998L.062030	2999L.062030
5/8	0.040	1 1/4	3 1/2	1 19/32	5/8	4	2998L.062040	2999L.062040
5/8	0.060	1 1/4	3 1/2	1 19/32	5/8	4	2998L.062060	2999L.062060
3/4	0.030	1 1/2	4	1 31/32	3/4	4	2998L.075030	2999L.075030
3/4	0.040	1 1/2	4	1 31/32	3/4	4	2998L.075040	2999L.075040
3/4	0.060	1 1/2	4	1 31/32	3/4	4	2998L.075060	2999L.075060
1	0.030	1 1/2	4	1 23/32	1	4	2998L.100030	2999L.100030
1	0.040	1 1/2	4	1 23/32	1	4	2998L.100040	2999L.100040
1	0.060	1 1/2	4	1 23/32	1	4	2998L.100060	2999L.100060

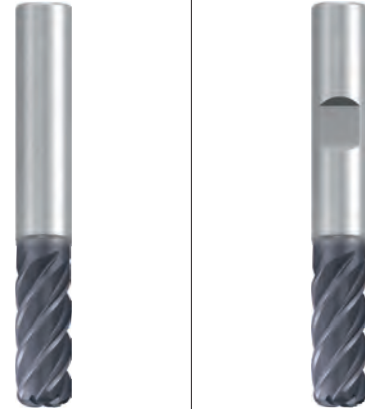
**5 Flutes**

- Variable pitch helix angle
- Vibration dampening
- Increased feed rates
- Fully blended corner radius
- ALCR PVD coating
- Sub-micro grain carbide
- Center cutting



Icon descriptions (see pages 160-161)

**Corner Radius**



**Coating**

Applications – Materials (see page 5)

Cutting Data (see page 108)

- Well suited for most materials including aerospace alloys
- Suitable for finishing and light roughing
- Suitable for trochoidal style machining strategies

**ALCR**

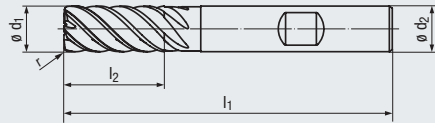
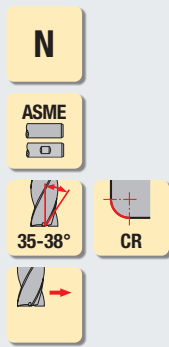
P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.2-1.4
N	2.1-4.1, 5.2
S	1.1-2.6
H	1.1 1.2-1.3

**Standard length**

$\varnothing d_1$ h10	r ±0.0008	$l_2$	$l_1$	$\varnothing d_2$ h6	$l_A$ 	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	0.010	3/4	2 1/2	1/4	1 1/8	5	3902L.025010	–
1/4	0.015	3/4	2 1/2	1/4	1 1/8	5	3902L.025015	–
1/4	0.020	3/4	2 1/2	1/4	1 1/8	5	3902L.025020	–
1/4	0.030	3/4	2 1/2	1/4	1 1/8	5	3902L.025030	–
1/4	0.060	3/4	2 1/2	1/4	1 1/8	5	3902L.025060	–
3/8	0.010	7/8	2 3/4	3/8	1 3/16	5	3902L.037010	–
3/8	0.015	7/8	2 3/4	3/8	1 3/16	5	3902L.037015	–
3/8	0.020	7/8	2 3/4	3/8	1 3/16	5	3902L.037020	–
3/8	0.030	7/8	2 3/4	3/8	1 3/16	5	3902L.037030	–
3/8	0.060	7/8	2 3/4	3/8	1 3/16	5	3902L.037060	–
3/8	0.090	7/8	2 3/4	3/8	1 3/16	5	3902L.037090	–
1/2	0.010	1	3	1/2	1 7/32	5	3902L.050010	3903L.050010
1/2	0.015	1	3	1/2	1 7/32	5	3902L.050015	3903L.050015
1/2	0.015	1 1/4	3 1/4	1/2	–	5	3902L.A50015	3903L.A50015
1/2	0.020	1	3	1/2	1 7/32	5	3902L.050020	3903L.050020
1/2	0.030	1	3	1/2	1 7/32	5	3902L.050030	3903L.050030
1/2	0.030	1 1/4	3 1/4	1/2	–	5	3902L.A50030	3903L.A50030
1/2	0.060	1	3	1/2	1 7/32	5	3902L.050060	3903L.050060
1/2	0.060	1 1/4	3 1/4	1/2	–	5	3902L.A50060	3903L.A50060
1/2	0.090	1	3	1/2	1 7/32	5	3902L.050090	3903L.050090
1/2	0.120	1	3	1/2	1 7/32	5	3902L.050120	3903L.050120
5/8	0.030	1 1/4	3 1/2	5/8	1 19/32	5	3902L.062030	3903L.062030
5/8	0.060	1 1/4	3 1/2	5/8	1 19/32	5	3902L.062060	3903L.062060
5/8	0.090	1 1/4	3 1/2	5/8	1 19/32	5	3902L.062090	3903L.062090
5/8	0.120	1 1/4	3 1/2	5/8	1 19/32	5	3902L.062120	3903L.062120
3/4	0.015	1 1/2	4	3/4	1 31/32	5	3902L.075015	3903L.075015
3/4	0.020	1 1/2	4	3/4	1 31/32	5	3902L.075020	3903L.075020
3/4	0.030	1 1/2	4	3/4	1 31/32	5	3902L.075030	3903L.075030
3/4	0.060	1 1/2	4	3/4	1 31/32	5	3902L.075060	3903L.075060
3/4	0.090	1 1/2	4	3/4	1 31/32	5	3902L.075090	3903L.075090
3/4	0.120	1 1/2	4	3/4	1 31/32	5	3902L.075120	3903L.075120
3/4	0.190	1 1/2	4	3/4	1 31/32	5	3902L.075190	3903L.075190
3/4	0.250	1 1/2	4	3/4	1 31/32	5	3902L.075250	3903L.075250
1	0.030	2	5	1	2 23/32	5	3902L.100030	3903L.100030
1	0.060	2	5	1	2 23/32	5	3902L.100060	3903L.100060
1	0.090	2	5	1	2 23/32	5	3902L.100090	3903L.100090
1	0.120	2	5	1	2 23/32	5	3902L.100120	3903L.100120

**6 Flutes**

- Variable pitch helix angle
- Vibration dampening
- Increased feed rates
- Fully blended corner radius
- ALCR PVD coating
- Sub-micro grain carbide



Icon descriptions (see pages 160-161)

**Corner Radius**



**Coating**

Applications – Materials (see page 5)

Cutting Data (see page 109)

- Well suited for most materials including aerospace alloys
- Suitable for finishing and light roughing
- Suitable for trochoidal style machining strategies

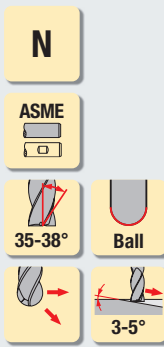
**ALCR**

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.2-1.4
N	2.1-4.1, 5.2
S	1.1-2.6
H	1.1 1.2-1.3

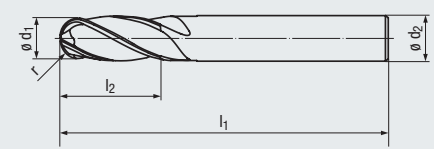
**Standard length**

$\phi d_1$ h10	r ±0.0008	$l_2$	$l_1$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	0.010	3/4	2 1/2	1/4	6	2947L.025010	—
1/4	0.015	3/4	2 1/2	1/4	6	2947L.025015	—
1/4	0.020	3/4	2 1/2	1/4	6	2947L.025020	—
1/4	0.030	3/4	2 1/2	1/4	6	2947L.025030	—
1/4	0.060	3/4	2 1/2	1/4	6	2947L.025060	—
3/8	0.010	7/8	2 3/4	3/8	6	2947L.037010	—
3/8	0.015	7/8	2 3/4	3/8	6	2947L.037015	—
3/8	0.020	7/8	2 3/4	3/8	6	2947L.037020	—
3/8	0.030	7/8	2 3/4	3/8	6	2947L.037030	—
3/8	0.060	7/8	2 3/4	3/8	6	2947L.037060	—
3/8	0.090	7/8	2 3/4	3/8	6	2947L.037090	—
1/2	0.010	1	3	1/2	6	2947L.050010	3909L.050010
1/2	0.015	1	3	1/2	6	2947L.050015	3909L.050015
1/2	0.015	1 1/4	3 1/4	1/2	6	2947L.A50015	3909L.A50015
1/2	0.020	1	3	1/2	6	2947L.050020	3909L.050020
1/2	0.030	1	3	1/2	6	2947L.050030	3909L.050030
1/2	0.030	1 1/4	3 1/4	1/2	6	2947L.A50030	3909L.A50030
1/2	0.060	1	3	1/2	6	2947L.050060	3909L.050060
1/2	0.060	1 1/4	3 1/4	1/2	6	2947L.A50060	3909L.A50060
1/2	0.090	1	3	1/2	6	2947L.050090	3909L.050090
1/2	0.120	1	3	1/2	6	2947L.050120	3909L.050120
5/8	0.030	1 1/4	3 1/2	5/8	6	2947L.062030	3909L.062030
5/8	0.060	1 1/4	3 1/2	5/8	6	2947L.062060	3909L.062060
5/8	0.090	1 1/4	3 1/2	5/8	6	2947L.062090	3909L.062090
5/8	0.120	1 1/4	3 1/2	5/8	6	2947L.062120	3909L.062120
3/4	0.015	1 1/2	4	3/4	6	2947L.075015	3909L.075015
3/4	0.020	1 1/2	4	3/4	6	2947L.075020	3909L.075020
3/4	0.030	1 1/2	4	3/4	6	2947L.075030	3909L.075030
3/4	0.060	1 1/2	4	3/4	6	2947L.075060	3909L.075060
3/4	0.090	1 1/2	4	3/4	6	2947L.075090	3909L.075090
3/4	0.120	1 1/2	4	3/4	6	2947L.075120	3909L.075120
3/4	0.190	1 1/2	4	3/4	6	2947L.075190	3909L.075190
3/4	0.250	1 1/2	4	3/4	6	2947L.075250	3909L.075250
1	0.030	2	5	1	6	2947L.100030	3909L.100030
1	0.060	2	5	1	6	2947L.100060	3909L.100060
1	0.090	2	5	1	6	2947L.100090	3909L.100090
1	0.120	2	5	1	6	2947L.100120	3909L.100120

- Variable helix flutes
- Vibration dampening
- ALCR PVD coating
- Sub-micro grain carbide
- 2 center cutting edges



**Ball Nose**



Icon descriptions (see pages 160-161)

<b>Coating</b>	<b>ALCR</b>
<b>Applications – Materials (see page 5)</b>	<b>P</b> 1.1-5.1
<b>Cutting Data (see page 110)</b>	<b>M</b> 1.1-2.1 3.1-4.1
• Ideal for most materials	<b>K</b> 1.1-2.2 3.1-4.2
• Suitable for high speed cutting and finishing	<b>N</b> 2.1-2.8, 4.1-4.2
	<b>N</b> 5.2-5.3
	<b>S</b> 1.1-2.6

<b>Stub length</b>								
$\phi d_1$ h10	r	$l_2$	$l_1$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank		
1/8	1/16	1/4	1 1/2	1/8	4	2919L.0125		
3/16	3/32	3/8	2	3/16	4	2919L.01875		
1/4	1/8	1/2	2	1/4	4	2919L.0250		
5/16	5/32	9/16	2 1/4	5/16	4	2919L.03125		
3/8	3/16	5/8	2 1/2	3/8	4	2919L.0375		
7/16	7/32	5/8	2 1/2	7/16	4	2919L.04375		
1/2	1/4	5/8	2 3/4	1/2	4	2919L.0500		
5/8	5/16	3/4	3	5/8	4	2919L.0625		
3/4	3/8	1	3 1/2	3/4	4	2919L.0750		
1	1/2	1	4	1	4	2919L.1000		

<b>Standard length</b>								
$\phi d_1$ h10	r	$l_2$	$l_1$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank		
1/8	1/16	3/8	1 1/2	1/8	4	2974L.0125		
3/16	3/32	7/16	2	3/16	4	2974L.01875		
1/4	1/8	1/2	2 1/2	1/4	4	2974L.0250		
1/4	1/8	3/4	2 1/2	1/4	4	2974L.A250		
5/16	5/32	13/16	2 1/2	5/16	4	2974L.03125		
3/8	3/16	7/8	2 1/2	3/8	4	2974L.0375		
7/16	7/32	1	2 3/4	7/16	4	2974L.04375		
1/2	1/4	1	3	1/2	4	2974L.0500		
1/2	1/4	1 1/4	3 1/4	1/2	4	2974L.A500		
5/8	5/16	1 1/4	3 1/2	5/8	4	2974L.0625		
3/4	3/8	1 1/2	4	3/4	4	2974L.0750		
1	1/2	2	5	1	4	2974L.1000		

<b>Long length</b>								
$\phi d_1$ h10	r	$l_2$	$l_1$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank		
1/8	1/16	3/4	2 1/4	1/8	4	3900L.0125		
3/16	3/32	3/4	2 1/2	3/16	4	3900L.01875		
1/4	1/8	1 1/8	3	1/4	4	3900L.0250		
5/16	5/32	1 1/8	3	5/16	4	3900L.03125		
3/8	3/16	1 1/8	3	3/8	4	3900L.0375		
7/16	7/32	2	4	7/16	4	3900L.04375		
1/2	1/4	2	4 1/2	1/2	4	3900L.0500		
5/8	5/16	2 1/4	4 3/4	5/8	4	3900L.0625		
3/4	3/8	2 1/4	5	3/4	4	3900L.0750		
1	1/2	3	6	1	4	3900L.1000		





Strong clamping force via internal worm gear design, along with optional Pin-Lock System, provides guaranteed holding power and pull-out protection.

## EMUGE-FRANKEN High Precision / Performance FPC Milling / Drilling Chucks

EMUGE-FRANKEN FPC Chucks provide unprecedented rigidity, vibration dampening, concentricity, machining speed and tool life vs. conventional chuck technologies for thread milling, milling and drilling applications. Available in a wide range of styles, internal and peripheral coolant collet options, and MQL-adaptable.

# TOP-Cut Metric High Performance End Mills

## *For Universal Milling for Both Roughing and Finishing Applications*



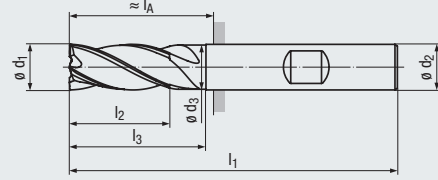
**TOP-Cut Metric** tools are highly versatile end mills that can be used in nearly all materials and milling strategies due to their special geometric properties. They are ideal for both roughing and finishing operations.

*German engineered  
EMUGE-FRANKEN quality*

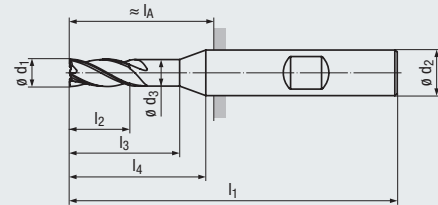
- **Variable helix angle flutes**
- **High-performance TiAlN PVD coating** for long tool life
- **Chamfer** to stabilize the cutting edge
- **Corner radius** optional for improved surface finishes, extended tool life
- Also available with **internal coolant feature**
- **Sub-micro grain carbide**

**4 Flutes**

- Variable helix angle flutes
- Vibration dampening
- Chamfer to stabilize the cutting edge
- TiAlN PVD coating
- Sub-micro grain carbide
- Center cutting



**Design I<sub>4</sub>:**



**N**

**DIN**

**35-38°** **CH x 45°**

**3-5°**



Icon descriptions (see pages 160-161)

**Coating**

Applications – Materials (see page 6)

Cutting Data (see pages 105-106)

- Ideal for most materials
- Suitable for roughing and finishing operations

**Tool Dimensions / mm**

**Stub length**

$\phi d_1$ f8	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h5	$l_A$ 	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3	5	9	50	2.9	14	6	14	0.07	4	1916A.003	1917A.003
4	8	12	54	3.8	18	6	18	0.07	4	1916A.004	1917A.004
5	9	16	54	4.8	18	6	18	0.12	4	1916A.005	1917A.005
6	10	16	54	5.8	–	6	18	0.12	4	1916A.006	1917A.006
8	12	20	58	7.7	–	8	22	0.12	4	1916A.008	1917A.008
10	15	24	66	9.5	–	10	26	0.20	4	1916A.010	1917A.010
12	18	26	73	11.5	–	12	28	0.20	4	1916A.012	1917A.012
16	24	32	82	15.5	–	16	34	0.20	4	1916A.016	1917A.016
18	27	34	84	17.5	–	18	36	0.20	4	1916A.018	1917A.018
20	30	40	92	19.5	–	20	42	0.30	4	1916A.020	1917A.020

**Standard length**

$\phi d_1$ f8	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h5	$l_A$ 	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3	8	14	57	2.9	20	6	21	0.07	4	1998A.003	1999A.003
4	11	18	57	3.8	20	6	21	0.07	4	1998A.004	1999A.004
5	13	19	57	4.8	20	6	21	0.12	4	1998A.005	1999A.005
6	13	20	57	5.8	–	6	21	0.12	4	1998A.006	1999A.006
8	19	25	63	7.7	–	8	27	0.12	4	1998A.008	1999A.008
10	22	30	72	9.5	–	10	32	0.20	4	1998A.010	1999A.010
12	26	35	83	11.5	–	12	38	0.20	4	1998A.012	1999A.012
14	26	35	83	13.5	–	14	38	0.20	4	1998A.014	1999A.014
16	32	40	92	15.5	–	16	44	0.20	4	1998A.016	1999A.016
18	32	50	100	17.5	–	18	52	0.20	4	1998A.018	1999A.018
20	38	50	104	19.5	–	20	54	0.30	4	1998A.020	1999A.020

**TiAlN**

**P** 1.1-5.1

**M** 1.1-4.1

**K** 1.1-4.2

**N** 1.2-1.4

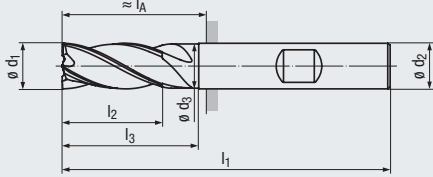
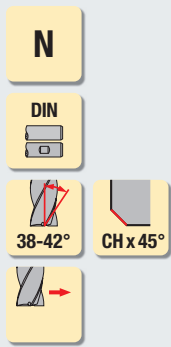
**N** 2.1-4.1, 5.2

**S** 1.1-2.6

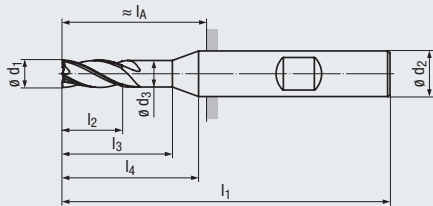
**H** 1.1 1.2-1.3

**4 & 5 Flutes**

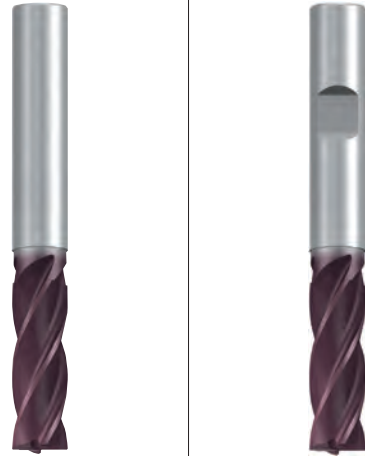
- Variable helix angle flutes
- Vibration dampening
- Chamfer to stabilize the cutting edge
- TiALN PVD coating
- Sub-micro grain carbide
- Center cutting



**Design I<sub>4</sub>:**



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 6)

Cutting Data (see page 107)

- Ideal for most materials
- Suitable for roughing and finishing operations

Tool Dimensions / mm

**Long length**

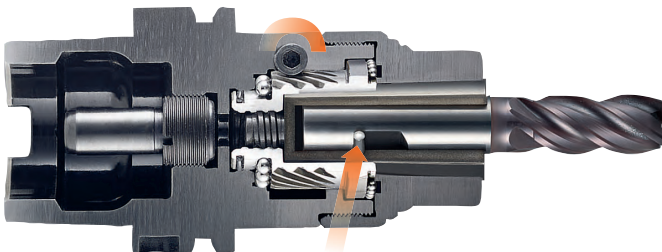
$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$d_3$	$l_4$	$\varnothing d_2$ h6	$l_A$	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
<b>3</b>	9	12	62	2.9	23	6	26	0.07	<b>4</b>	2526A.003	2527A.003
<b>4</b>	12	16	62	3.8	25	6	26	0.07	<b>4</b>	2526A.004	2527A.004
<b>5</b>	15	20	62	4.8	25	6	26	0.12	<b>4</b>	2526A.005	2527A.005
<b>6</b>	18	25	62	5.8	—	6	26	0.12	<b>4</b>	2526A.006	2527A.006
<b>8</b>	24	30	68	7.7	—	8	32	0.12	<b>5</b>	2526A.008	2527A.008
<b>10</b>	30	35	80	9.5	—	10	40	0.20	<b>5</b>	2526A.010	2527A.010
<b>12</b>	36	45	93	11.5	—	12	48	0.20	<b>5</b>	2526A.012	2527A.012
<b>16</b>	48	60	112	15.5	—	16	64	0.20	<b>5</b>	2526A.016	2527A.016
<b>20</b>	60	75	130	19.5	—	20	80	0.30	<b>5</b>	2526A.020	2527A.020

**TIALN**

<b>P</b>	1.1-5.1
<b>M</b>	1.1-4.1
<b>K</b>	1.1-4.2
<b>N</b>	1.1-1.4 1.5-1.6
<b>N</b>	2.1-2.8, 5.2
<b>S</b>	1.1-1.3 2.1-2.6

**EMUGE-FRANKEN high precision / performance FPC Mill / Drill Chucks**

Mechanical drive actuated with a hex wrench. Simple design, highly accurate.



Optimal Pull-Out Protection via optional Pin-Lock Collet System.

World's only chuck with 1:16 worm gear, a patented design delivering 3 tons of traction force.

Maximum dampening collet-cone assembly absorbs virtually all vibration.

High rigidity patented design and body provides 100% holding power.

**6 & 8 Flutes**

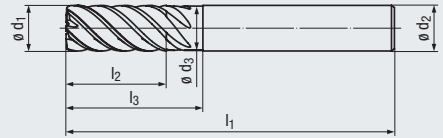
- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Flute length up to 3 x d<sub>1</sub>
- 2 lengths available

**N**

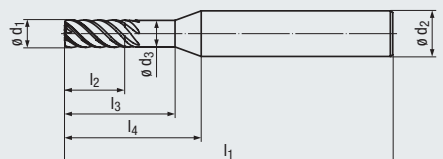
**DIN**

**35-38°**

**CH x 45°**



**Design I<sub>4</sub>:**



Icon descriptions (see pages 160-161)



**Coating**

**TIALN**

Applications – Materials (see page 6)

Cutting Data (see page 109)

- For all materials
- Suitable for high speed cutting and finishing

<b>P</b>	1.1-5.1		<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1	<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-2.1	2.2	<b>K</b>	1.1-2.1	2.2
<b>K</b>	3.1-4.1	4.2	<b>K</b>	3.1-4.1	4.2
<b>N</b>	1.1-1.4		<b>N</b>	1.1-1.4	1.5-1.6
<b>N</b>	2.1-3.2	4.1-4.2, 5.2	<b>N</b>	2.1-2.8	5.2
<b>S</b>	1.1-2.2	2.3	<b>S</b>	1.1-2.2	2.3
<b>S</b>	2.4	2.5-2.6	<b>S</b>	2.4	2.5-2.6
<b>H</b>		1.1			

**Tool Dimensions / mm**

**Standard length**

$\varnothing d_1$ f8	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	Chamfer	# Flutes	Tool No. Straight Shank
5	13	18	57	4.8	20	6	0.12	6	2522A.005
6	13	20	57	5.8	–	6	0.12	6	2522A.006
8	19	25	63	7.7	–	8	0.12	6	2522A.008
10	22	30	72	9.7	–	10	0.20	6	2522A.010
12	26	35	83	11.6	–	12	0.20	6	2522A.012
16	32	40	92	15.5	–	16	0.20	6	2522A.016
20	38	50	104	19.5	–	20	0.30	8	2522A.020

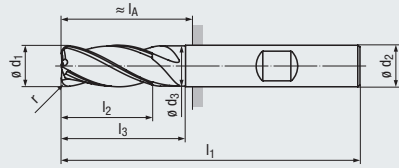
**Long length**

$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	Chamfer	# Flutes	Tool No. Straight Shank
6	18	25	62	5.8	–	6	0.12	6	2524A.006
8	24	30	68	7.7	–	8	0.12	6	2524A.008
10	30	35	80	9.7	–	10	0.20	6	2524A.010
12	36	45	93	11.6	–	12	0.20	6	2524A.012
16	48	55	108	15.5	–	16	0.20	6	2524A.016
20	60	70	126	19.5	–	20	0.30	8	2524A.020

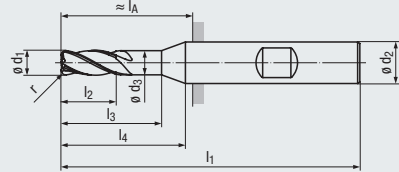
**4 Flutes**

- Variable helix angle flutes
- Vibration dampening

- Corner radius feature
- TiAlN PVD coating
- Sub-micro grain carbide
- Center cutting



Design I<sub>4</sub>:



**N**

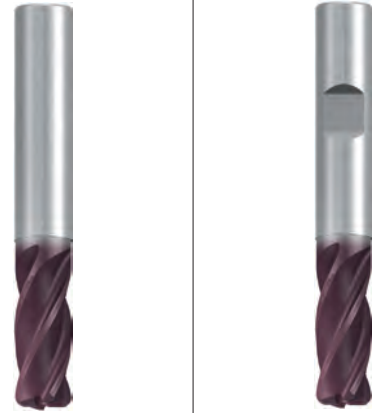
**DIN**

**35-38°**

**CR**

**3-5°**

**Corner Radius**



Icon descriptions (see pages 160-161)

**Coating**

**TiAlN**

Applications – Materials (see page 6)

Cutting Data (see page 106)

- Ideal for most materials including high tensile strength applications
- Suitable for roughing and finishing operations

<b>P</b>	1.1-5.1
<b>M</b>	1.1-4.1
<b>K</b>	1.1-4.2
<b>N</b>	1.2-1.4
<b>N</b>	2.1-4.1, 5.2
<b>S</b>	1.1-2.6
<b>H</b>	1.1 1.2-1.3

Tool Dimensions / mm

**Standard length**

$\phi d_1$ f8	r +/- 0.01	$l_2$	$l_3$	$l_1$	$d_3$	$l_4$	$\phi d_2$	$l_A$	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3	0.1	8	14	57	2.9	20	6	21	4	2698A.003001	2699A.003001
3	0.3	8	14	57	2.9	20	6	21	4	2698A.003003	2699A.003003
3	0.5	8	14	57	2.9	20	6	21	4	2698A.003005	2699A.003005
4	0.1	11	18	57	3.8	20	6	21	4	2698A.004001	2699A.004001
4	0.3	11	18	57	3.8	20	6	21	4	2698A.004003	2699A.004003
4	0.4	11	18	57	3.8	20	6	21	4	2698A.004004	2699A.004004
4	0.5	11	18	57	3.8	20	6	21	4	2698A.004005	2699A.004005
5	0.1	13	19	57	4.8	20	6	21	4	2698A.005001	2699A.005001
5	0.3	13	19	57	4.8	20	6	21	4	2698A.005003	2699A.005003
5	0.5	13	19	57	4.8	20	6	21	4	2698A.005005	2699A.005005
5	1	13	19	57	4.8	20	6	21	4	2698A.005010	2699A.005010
6	0.1	13	20	57	5.8	-	6	21	4	2698A.006001	2699A.006001
6	0.5	13	20	57	5.8	-	6	21	4	2698A.006005	2699A.006005
6	1	13	20	57	5.8	-	6	21	4	2698A.006010	2699A.006010
6	1.5	13	20	57	5.8	-	6	21	4	2698A.006015	2699A.006015
8	0.15	19	25	63	7.7	-	8	27	4	2698A.008001	2699A.008001
8	0.5	19	25	63	7.7	-	8	27	4	2698A.008005	2699A.008005
8	1	19	25	63	7.7	-	8	27	4	2698A.008010	2699A.008010
8	1.5	19	25	63	7.7	-	8	27	4	2698A.008015	2699A.008015
8	2	19	25	63	7.7	-	8	27	4	2698A.008020	2699A.008020
10	0.15	22	30	72	9.5	-	10	32	4	2698A.010001	2699A.010001
10	0.5	22	30	72	9.5	-	10	32	4	2698A.010005	2699A.010005
10	1	22	30	72	9.5	-	10	32	4	2698A.010010	2699A.010010
10	1.5	22	30	72	9.5	-	10	32	4	2698A.010015	2699A.010015
10	2	22	30	72	9.5	-	10	32	4	2698A.010020	2699A.010020
12	0.2	26	35	83	11.5	-	12	38	4	2698A.012002	2699A.012002
12	0.5	26	35	83	11.5	-	12	38	4	2698A.012005	2699A.012005
12	1	26	35	83	11.5	-	12	38	4	2698A.012010	2699A.012010
12	1.5	26	35	83	11.5	-	12	38	4	2698A.012015	2699A.012015
12	2	26	35	83	11.5	-	12	38	4	2698A.012020	2699A.012020
12	3	26	35	83	11.5	-	12	38	4	2698A.012030	2699A.012030
14	1	26	35	83	13.5	-	14	38	4	2698A.014010	2699A.014010
16	0.3	32	40	92	15.5	-	16	44	4	2698A.016003	2699A.016003
16	0.5	32	40	92	15.5	-	16	44	4	2698A.016005	2699A.016005
16	1	32	40	92	15.5	-	16	44	4	2698A.016010	2699A.016010
16	1.5	32	40	92	15.5	-	16	44	4	2698A.016015	2699A.016015
16	2	32	40	92	15.5	-	16	44	4	2698A.016020	2699A.016020
16	3	32	40	92	15.5	-	16	44	4	2698A.016030	2699A.016030
16	4	32	40	92	15.5	-	16	44	4	2698A.016040	2699A.016040
20	0.3	38	50	104	19.5	-	20	54	4	2698A.020003	2699A.020003
20	0.5	38	50	104	19.5	-	20	54	4	2698A.020005	2699A.020005
20	1	38	50	104	19.5	-	20	54	4	2698A.020010	2699A.020010
20	1.5	38	50	104	19.5	-	20	54	4	2698A.020015	2699A.020015
20	2	38	50	104	19.5	-	20	54	4	2698A.020020	2699A.020020
20	3	38	50	104	19.5	-	20	54	4	2698A.020030	2699A.020030

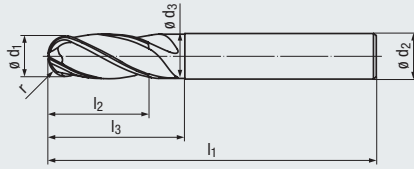
- Variable helix flutes
- Vibration dampening
- TIALN PVD coating
- Sub-micro grain carbide
- 2 center cutting edges

**N**

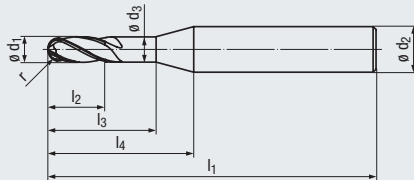
**DIN**

**35-38°** **Ball**

**3-5°**



**Design I<sub>4</sub>:**



Icon descriptions (see pages 160-161)

**Ball Nose**



**Coating**

Applications – Materials (see page 6)

Cutting Data (see page 110)

- Ideal for most materials
- Suitable for HSC finishing

Tool Dimensions / mm

**Standard length**

$\varnothing d_1$ h10	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
2	1	6	10	57	1.9	20	6	3	2502A.002
3	1.5	8	14	57	2.9	20	6	3	2502A.003
4	2	11	18	57	3.8	20	6	3	2502A.004
5	2.5	13	19	57	4.8	20	6	3	2502A.005
6	3	13	20	57	5.8	–	6	4	2502A.006
8	4	19	25	63	7.7	–	8	4	2502A.008
10	5	22	30	72	9.5	–	10	4	2502A.010
12	6	26	35	83	11.5	–	12	4	2502A.012
16	8	32	40	92	15.5	–	16	4	2502A.016

**TIALN**

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-2.2	3.1-4.2
<b>N</b>	2.1-2.8, 4.1-4.2	
<b>N</b>	5.2-5.3	
<b>S</b>		1.1-2.6

# Multi-Cut High Performance End Mills

## *For Universal Milling Applications*



**Multi-Cut** end mills can achieve metal removal rates 5 to 10 times that of conventional end mills in a full range of materials. With its progressive edge profile, variable helix and flute technology, Multi-Cut totally redefines high performance milling.

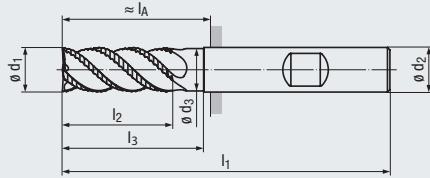
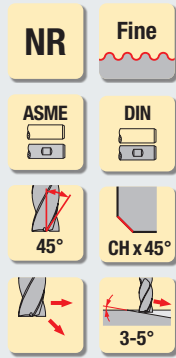
### High Productivity Cutting Parameters

- **Variable flute spacing and pitch** to minimize vibrations, even at high speeds and aggressive cutting depths
- **Unique chip-breaker technology** provides optimum chip evacuation
- **Patented roughing profile** enables short-duration chip contact
- At maximum speed, chip load per tooth may be increased by up to **60% to achieve maximum material removal**
- Made from **select micro-grain carbide** to provide maximum cutting performance and tool life
- **Weldon flat** ensures stability in tool clamping, for enhanced milling processes

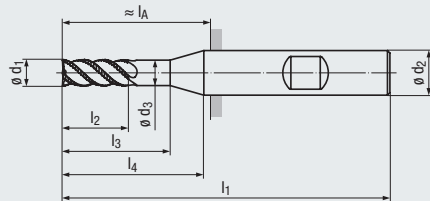
*German engineered  
EMUGE-FRANKEN quality*



- Low cutting forces
- Fine tooth roughing profile
- ALCR PVD coating for heat & wear resistance
- TIALN PVD coating for wear resistance
- Sub-micro grain carbide
- H6 shank tolerance for precision tool holders
- Short flute length



Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 6)

Cutting Data (see page 111)

- High volume machining
- Suitable for many materials and for roughing in unstable conditions

**TIALN**

P	1.1-5.1
K	1.1-4.2
N	2.1-2.8, 5.2 4.1
H	1.1

**ALCR**

P	1.1-5.1
M	1.1-2.1
K	1.1-4.2
N	2.1-2.8, 5.2 4.1
H	1.1

**Standard length**

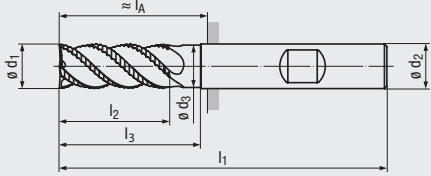
	$\varnothing d_1$ h11	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	$l_A$ G6	# Flutes	Tool No. Weldon Shank	Tool No. Weldon Shank
[inch]	1/8	3/16	5/8	2 1/2	0.118	7/8	3/8	15/16	3	2869A.0125	2869L.0125
	3/16	9/32	11/16	2 1/2	0.177	7/8	3/8	15/16	3	2869A.01875	2869L.01875
	1/4	3/8	3/4	2 1/2	0.236	7/8	3/8	15/16	4	2869A.0250	2869L.0250
	5/16	15/32	7/8	2 1/2	0.295	15/16	3/8	15/16	4	2869A.03125	2869L.03125
	3/8	9/16	1 1/8	2 3/4	0.358	–	3/8	1 3/16	4	2869A.0375	2869L.0375
	1/2	3/4	1 3/8	3 1/4	0.480	–	1/2	1 15/32	4	2869A.0500	2869L.0500
	5/8	7/8	1 1/2	3 1/2	0.605	–	5/8	1 19/32	4	2869A.0625	2869L.0625
	3/4	1 1/8	1 7/8	4	0.730	–	3/4	1 31/32	4	2869A.0750	2869L.0750
1	1 1/2	2 5/8	5	0.969	–	1	2 23/32	5	2869A.1000	2869L.1000	
[mm]	1	1.5	3	38	0.9	9	3*	–	3	2869A.001	2869L.001
	2	3	8	57	1.9	15	6	21	3	2869A.002	2869L.002
	3	5	14	57	2.9	18	6	21	3	2869A.003	2869L.003
	4	8	18	57	3.8	20	6	21	3	2869A.004	2869L.004
	5	9	19	57	4.8	20	6	21	3	2869A.005	2869L.005
	6	10	20	57	5.8	–	6	21	4	2869A.006	2869L.006
	8	12	25	63	7.7	–	8	27	4	2869A.008	2869L.008
	10	15	30	72	9.5	–	10	32	4	2869A.010	2869L.010
	12	18	35	83	11.5	–	12	38	4	2869A.012	2869L.012
	14	21	35	83	13.5	–	14	38	4	2869A.014	2869L.014
	16	24	40	92	15.5	–	16	44	4	2869A.016	2869L.016
	20	30	50	104	19.5	–	20	54	4	2869A.020	2869L.020

\* straight shank

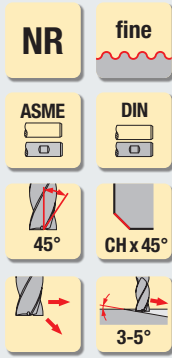
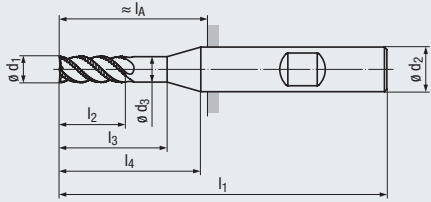
The newest version of the Multi-Cut end mill is available with our heat resistant ALCR coating.

ALCR coating allows the user to operate at higher cutting speeds in materials that naturally generate an excessive amount of heat during the milling process.

- Low cutting forces
- Fine tooth roughing profile
- ALCR PVD coating for heat & wear resistance
- TIALN PVD coating for wear resistance
- Sub-micro grain carbide
- H6 shank tolerance for precision tool holders
- Short flute length



Design  $l_4$ :



Icon descriptions (see pages 160-161)



### Coating

Applications – Materials (see page 6)

Cutting Data (see page 112)

- High volume machining
- Suitable for many materials and for roughing in unstable conditions

### TIALN

P	1.1-5.1
K	1.1-4.2
N	2.1-2.8, 5.2 4.1
H	1.1

### ALCR

P	1.1-5.1
M	1.1-2.1
K	1.1-4.2
N	2.1-2.8
N	5.2 4.1
H	1.1

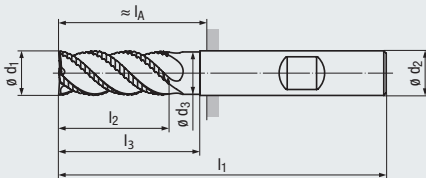
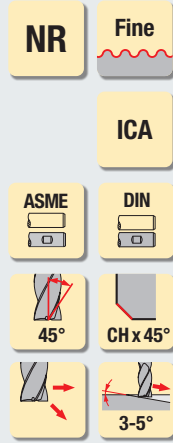
### Long length

	$\phi d_1$ h11	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h6	$l_A$ 	# Flutes	Tool No. Weldon Shank	Tool No. Weldon Shank
	1/8	3/16	3/4	3	0.118	1 1/4	3/8	1 7/16	3	2875A.0125	2875L.0125
	3/16	9/32	7/8	3	0.177	1 1/4	3/8	1 7/16	3	2875A.01875	2875L.01875
	1/4	3/8	1	3	0.236	1 1/4	3/8	1 7/16	4	2875A.0250	2875L.0250
	5/16	15/32	1 1/4	3	0.295	1 3/8	3/8	1 7/16	4	2875A.03125	2875L.03125
	3/8	9/16	1 5/8	3 1/4	0.358	–	3/8	1 11/16	4	2875A.0375	2875L.0375
	1/2	3/4	1 7/8	3 3/4	0.480	–	1/2	1 31/32	4	2875A.0500	2875L.0500
	5/8	7/8	2 1/4	4 1/4	0.605	–	5/8	2 11/32	4	2875A.0625	2875L.0625
	3/4	1 1/8	2 3/4	5	0.730	–	3/4	2 31/32	4	2875A.0750	2875L.0750
	1	1 1/2	3 5/8	6	0.969	–	1	3 23/32	5	2875A.1000	2875L.1000
	3	5	19	62	2.9	23	6	26	3	2875A.003	2875L.003
	4	8	23	62	3.8	25	6	26	3	2875A.004	2875L.004
	5	9	24	62	4.8	25	6	26	3	2875A.005	2875L.005
	6	10	25	62	5.8	–	6	26	4	2875A.006	2875L.006
	8	12	30	68	7.7	–	8	32	4	2875A.008	2875L.008
	10	15	35	80	9.5	–	10	40	4	2875A.010	2875L.010
	12	18	45	93	11.5	–	12	48	4	2875A.012	2875L.012
	14	21	50	99	13.5	–	14	54	4	2875A.014	2875L.014
	16	24	55	108	15.5	–	16	60	4	2875A.016	2875L.016
	20	30	70	126	19.5	–	20	76	4	2875A.020	2875L.020

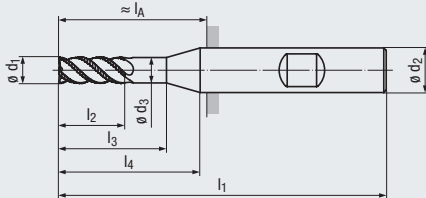
The newest version of the Multi-Cut end mill is available with our heat resistant ALCR coating.

ALCR coating allows the user to operate at higher cutting speeds in materials that naturally generate an excessive amount of heat during the milling process.

- Low cutting forces
- Fine tooth roughing profile
- Coolant fed for enhanced chip evacuation
- ALCR PVD coating for heat & wear resistance
- TIALN PVD coating for wear resistance
- Sub-micro grain carbide
- H6 shank tolerance for precision tool holders
- Short flute length



Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 7)

Cutting Data (see page 113)

- High volume machining
- Suitable for many materials and for roughing in unstable conditions

**TIALN**

**ALCR**

P	1.1-5.1
K	1.1-4.2
N	2.1-2.8 1.2-1.4
N	5.2 4.1
S	1.1-1.3
H	1.1

P	1.1-5.1
M	1.1-2.1
K	1.1-4.2
N	2.1-2.8 1.2-1.4
N	5.2 4.1
S	1.1-1.3
H	1.1

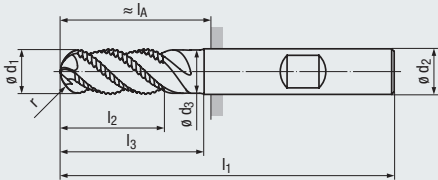
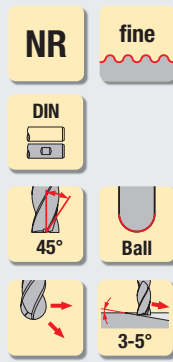
**Standard length**

	$\phi d_1$ h11	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h6	$l_A$ h6	# Flutes	Tool No. Weldon Shank	Tool No. Weldon Shank
[inch]	1/8	3/16	5/8	2 1/2	0.118	7/8	3/8	15/16	3	2869AZ.0125	2869LZ.0125
	3/16	9/32	11/16	2 1/2	0.177	7/8	3/8	15/16	3	2869AZ.01875	2869LZ.01875
	1/4	3/8	3/4	2 1/2	0.236	7/8	3/8	15/16	4	2869AZ.0250	2869LZ.0250
	5/16	15/32	7/8	2 1/2	0.295	15/16	3/8	15/16	4	2869AZ.03125	2869LZ.03125
	3/8	9/16	1 1/8	2 3/4	0.358	–	3/8	1 3/16	4	2869AZ.0375	2869LZ.0375
	1/2	3/4	1 3/8	3 1/4	0.480	–	1/2	1 15/32	4	2869AZ.0500	2869LZ.0500
	5/8	7/8	1 1/2	3 1/2	0.605	–	5/8	1 19/32	4	2869AZ.0625	2869LZ.0625
	3/4	1 1/8	1 7/8	4	0.730	–	3/4	1 31/32	4	2869AZ.0750	2869LZ.0750
1	1 1/2	2 5/8	5	0.969	–	1	2 23/32	5	2869AZ.1000	2869LZ.1000	
[mm]	3	5	14	57	2.9	18	6	21	3	2869AZ.003	2869LZ.003
	4	8	18	57	3.8	20	6	21	3	2869AZ.004	2869LZ.004
	5	9	19	57	4.8	20	6	21	3	2869AZ.005	2869LZ.005
	6	10	20	57	5.8	–	6	21	4	2869AZ.006	2869LZ.006
	8	12	25	63	7.7	–	8	27	4	2869AZ.008	2869LZ.008
	10	15	30	72	9.5	–	10	32	4	2869AZ.010	2869LZ.010
	12	18	35	83	11.5	–	12	38	4	2869AZ.012	2869LZ.012
	14	21	35	83	13.5	–	14	38	4	2869AZ.014	2869LZ.014
	16	24	40	92	15.5	–	16	44	4	2869AZ.016	2869LZ.016
	20	30	50	104	19.5	–	20	54	4	2869AZ.020	2869LZ.020

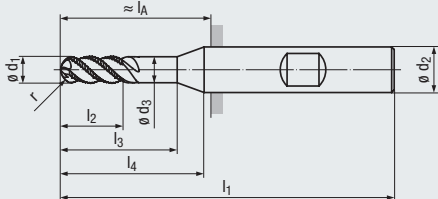
The newest version of the Multi-Cut end mill is available with our heat resistant ALCR coating.

ALCR coating allows the user to operate at higher cutting speeds in materials that naturally generate an excessive amount of heat during the milling process.

- Low cutting forces
- Fine tooth roughing profile
- Chip-breakers also in the radius section
- ALCR PVD coating for heat & wear resistance
- TIALN PVD coating for wear resistance
- Sub-micro grain carbide
- h6 shank tolerance for precision tool holders

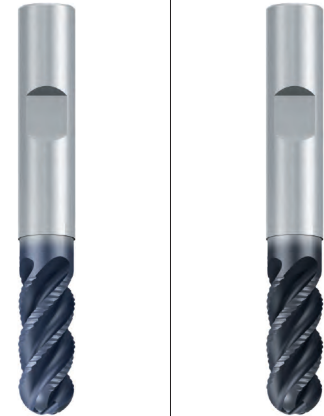


Design  $l_4$ :



Icon descriptions (see pages 160-161)

**Ball Nose**



**Coating**



**Applications – Materials (see page 7)**

**Cutting Data (see page 114)**

- For almost all materials
- Suitable for roughing in unstable conditions
- Suitable for 3D-roughing

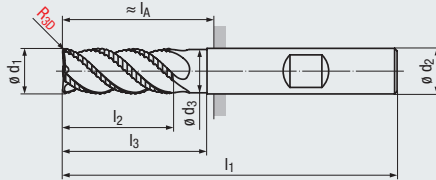
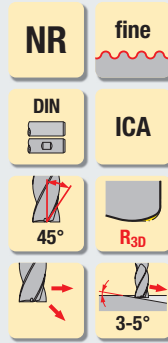
P	1.1-5.1
K	1.1-4.2
N	2.1-2.8, 5.2 4.1
S	1.1-1.3
H	1.1

**Tool Dimensions / mm**

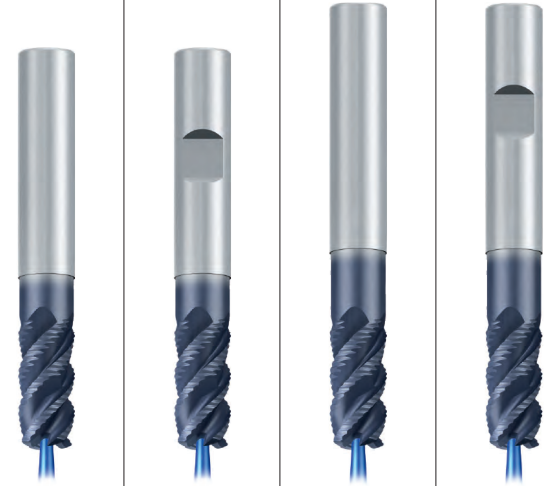
**Standard length**

$\varnothing d_1$ h11	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	$l_A$	# Flutes	Tool No. Weldon Shank	Tool No. Weldon Shank
3	1.5	8	14	57	2.9	18	6	21	3	2667A.003	2667L.003
4	2	11	18	57	3.8	20	6	21	3	2667A.004	2667L.004
5	2.5	13	19	57	4.8	20	6	21	3	2667A.005	2667L.005
6	3	13	20	57	5.8	–	6	21	4	2667A.006	2667L.006
8	4	19	25	63	7.7	–	8	27	4	2667A.008	2667L.008
10	5	22	30	72	9.5	–	10	32	4	2667A.010	2667L.010
12	6	26	35	83	11.5	–	12	38	4	2667A.012	2667L.012
14	7	26	35	83	13.5	–	14	38	4	2667A.014	2667L.014
16	8	32	40	92	15.5	–	16	44	4	2667A.016	2667L.016
20	10	38	50	104	19.5	–	20	54	4	2667A.020	2667L.020

- Multi-functional, high performance tool
- With DUPLEX geometry
- Combination of HPC- and high-feed end mill
- Coolant fed for enhanced chip evacuation
- Extra long length with standard flute length



Icon descriptions (see pages 160-161)



### Coating

Applications – Materials (see page 7)

Cutting Data (see page 115)

- For almost all materials
- Suitable for roughing under unstable conditions
- 2D and 3D contours can be produced

Tool Dimensions / mm

### Standard length

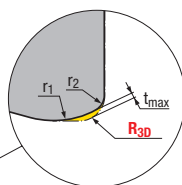
$\phi d_1$ h11	$R_{3D}$	$r_1 / r_2$	$t_{max}$	$l_2$	$l_3$	$l_1$	$\phi d_3$	$\phi d_2$ h6	$l_A$	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
6	0.8	2.9 / 0.6	0.2	13	20	57	5.8	6	21	4	2614AZ.006	2615AZ.006
8	1	3.9 / 0.8	0.3	19	25	63	7.7	8	27	4	2614AZ.008	2615AZ.008
10	1.2	4.9 / 1	0.4	22	30	72	9.5	10	32	4	2614AZ.010	2615AZ.010
12	1.6	5.9 / 1.2	0.4	26	35	83	11.5	12	38	4	2614AZ.012	2615AZ.012
16	2.2	7.8 / 1.6	0.5	32	40	92	15.5	16	44	4	2614AZ.016	2615AZ.016

### Long length

$\phi d_1$ h11	$R_{3D}$	$r_1 / r_2$	$t_{max}$	$l_2$	$l_3$	$l_1$	$\phi d_3$	$\phi d_2$ h6	$l_A$	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
8	1	3.9 / 0.8	0.3	19	30	68	7.7	8	32	4	2616AZ.008	2617AZ.008
10	1.2	4.9 / 1	0.4	22	35	80	9.5	10	40	4	2616AZ.010	2617AZ.010
12	1.6	5.9 / 1.2	0.4	26	45	93	11.5	12	48	4	2616AZ.012	2617AZ.012
16	2.2	7.8 / 1.6	0.5	32	55	108	15.5	16	60	4	2616AZ.016	2617AZ.016

### TIALN

P	1.1-5.1	
K	1.1-4.2	
N	5.2	2.3, 2.6
H	1.1	1.2



### DUPLEX-Geometry

- $t_{max}$  = Maximum residual material resulting from radius deviation from  $R_{3D}$
- $R_{3D}$  = Radius to be programmed in CAM
- $r_1$  = Face radius
- $r_2$  = Tangential radius between face radius and circumference cutting edge

- High performance tool
- With DUPLEX geometry
- Combination of HPC- and high-feed end mill
- Coolant fed for enhanced chip evacuation
- Extra long length with standard flute length

**N**

**DIN**

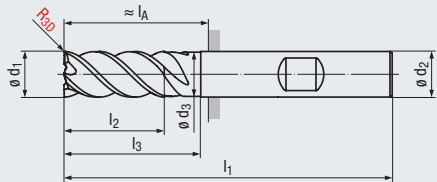
**ICA**

**50°**

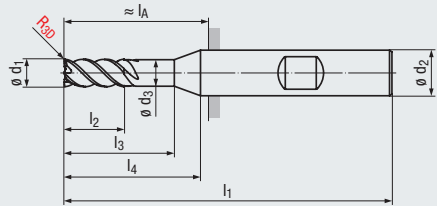
**R<sub>3D</sub>**

**3-5°**

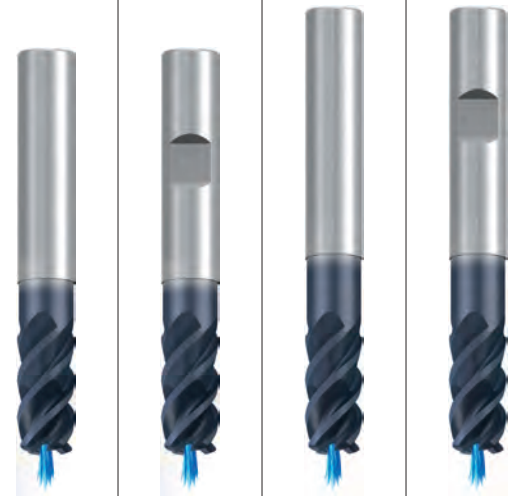
**≤ 60 HRC**



Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)



### Coating

Applications – Materials (see page 7)

Cutting Data (see page 116)

- For almost all materials
- Suitable for roughing under unstable conditions
- 2D and 3D contours can be produced

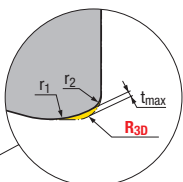
Tool Dimensions / mm

### Standard length

$\varnothing d_1$ -0.04	R <sub>3D</sub>	r <sub>1</sub> / r <sub>2</sub>	t <sub>max</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>1</sub>	$\varnothing d_3$	l <sub>4</sub>	$\varnothing d_2$ h5	l <sub>A</sub>	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3	0.4	1.5 / 0.3	0.1	3	14	57	2.9	20	6	21	4	2610AZ.103	2611AZ.103
4	0.5	2 / 0.4	0.15	4	18	57	3.8	20	6	21	4	2610AZ.104	2611AZ.104
5	0.6	2.5 / 0.5	0.2	5	18	57	4.8	20	6	21	4	2610AZ.105	2611AZ.105
6	0.8	2.9 / 0.6	0.2	13	20	57	5.8	–	6	21	4	2610AZ.006	2611AZ.006
8	1.0	3.9 / 0.8	0.3	19	25	63	7.7	–	8	27	4	2610AZ.008	2611AZ.008
10	1.2	4.9 / 1	0.4	22	30	72	9.5	–	10	32	4	2610AZ.010	2611AZ.010
12	1.6	5.9 / 1.2	0.4	26	35	83	11.5	–	12	38	4	2610AZ.012	2611AZ.012
16	2.2	7.8 / 1.6	0.5	32	40	92	15.5	–	16	44	4	2610AZ.016	2611AZ.016

### Long length

$\varnothing d_1$ -0.04	R <sub>3D</sub>	r <sub>1</sub> / r <sub>2</sub>	t <sub>max</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>1</sub>	$\varnothing d_3$	l <sub>4</sub>	$\varnothing d_2$ h5	l <sub>A</sub>	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
8	1.0	3.9 / 0.8	0.3	19	30	68	7.7	–	8	32	4	2612AZ.008	2613AZ.008
10	1.2	4.9 / 1.0	0.4	22	35	80	9.5	–	10	40	4	2612AZ.010	2613AZ.010
12	1.6	5.9 / 1.2	0.4	26	45	93	11.5	–	12	48	4	2612AZ.012	2613AZ.012
16	2.2	7.8 / 1.6	0.5	32	55	108	15.5	–	16	60	4	2612AZ.016	2613AZ.016



### DUPLEX-Geometry

- t<sub>max</sub> = Maximum residual material resulting from radius deviation from R<sub>3D</sub>
- R<sub>3D</sub> = Radius to be programmed in CAM
- r<sub>1</sub> = Face radius
- r<sub>2</sub> = Tangential radius between face radius and circumference cutting edge



# TiNox-Cut High Performance End Mills

## *For Aerospace Materials and Other Demanding Applications*



**TiNox-Cut** end mills are application-specific for the machining of tough materials and are guaranteed to deliver unmatched metal removal rates and tool life.

### **TiNox-Cut N:**

- Made specifically for Titanium alloys
- 5 flutes for high feed rates
- Raised land increases chip clearance

### **TiNox-Cut NF:**

- Preferable in Inconel and Titanium
- Fine chip breaker reduces chip size, while reducing cutting forces

### **TiNox-Cut Base:**

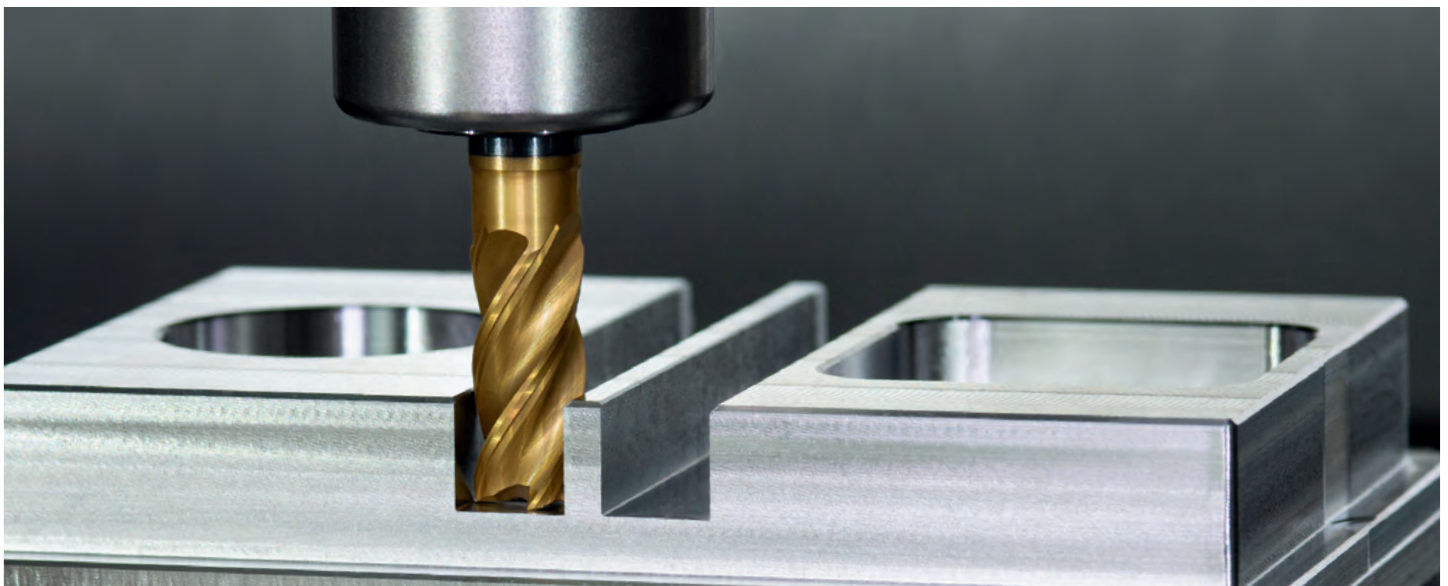
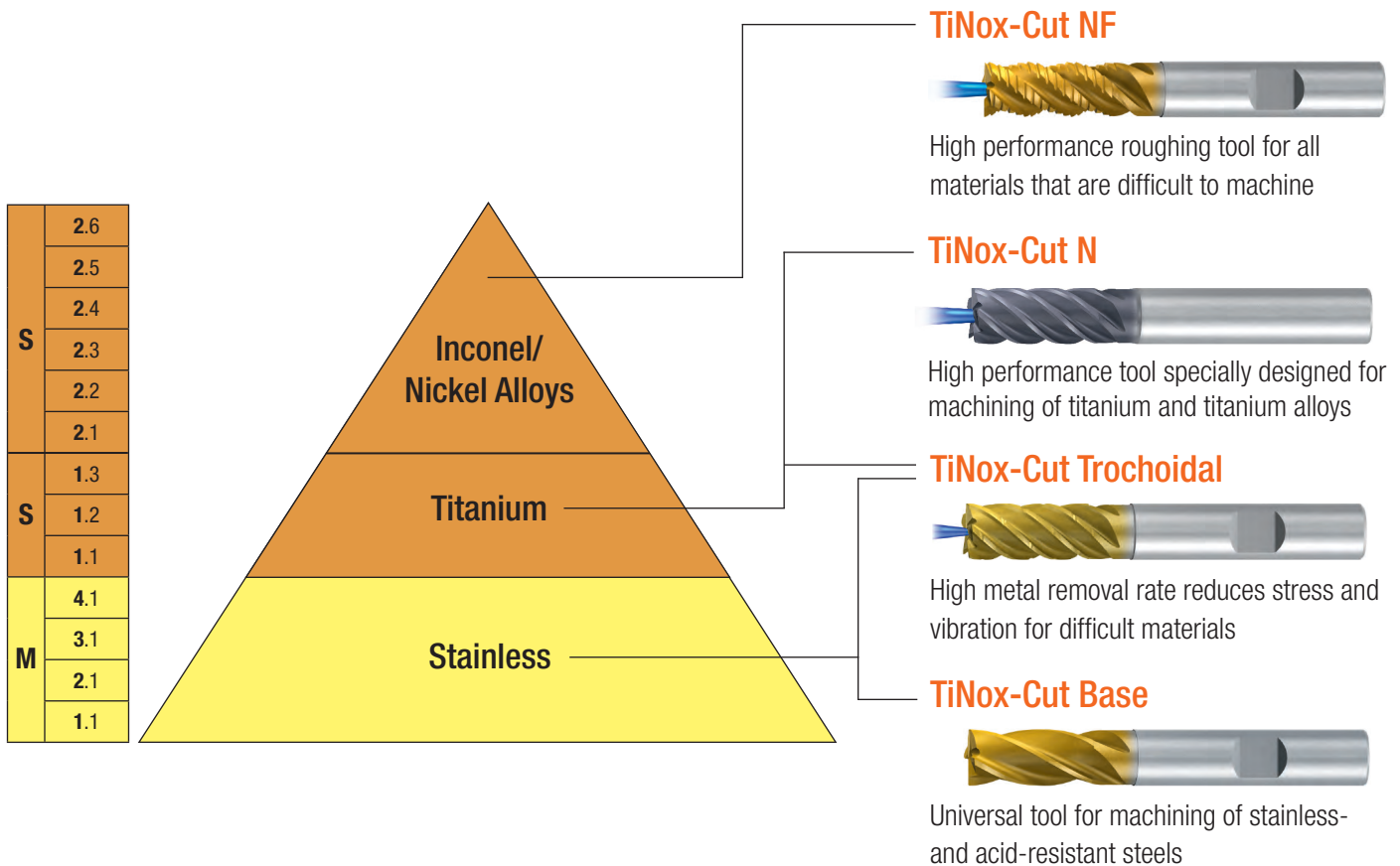
- Entry-level universal solution
- Preferable in stainless steels and acid-resistant steels
- Roughing and finishing

*German engineered  
EMUGE-FRANKEN quality*



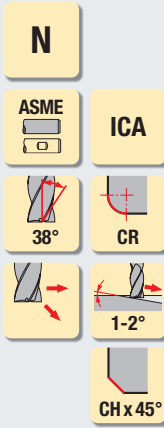
## Four end mill types for semi-roughing and finishing applications

- **Impressive surface roughness results** when compared to traditional end mills
- **Advanced PVD applied coatings** for heat and wear resistance
- **Made from premium ultra-fine grade carbide** with a maximized transverse rupture strength for high impact applications
- **Axial internal coolant** channel design for maximum chip evacuation performance and chip cooling ability
- **Weldon flat** shank construction that mates with an anti-pullout pin lock system available in EMUGE-FRANKEN FPC Milling Chucks
- **Standard corner radius** offering available along with modification service located in the U.S.A.



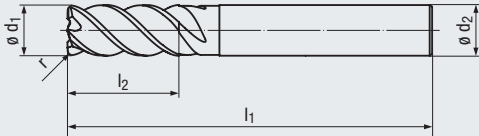
**Rougher-Finisher**

- High performance tool for roughing and finishing
- 5 flutes for high feed rates
- Raised land increases chip clearance
- Special geometry prevents vibration
- Axial coolant hole for better chip evacuation
- Internal coolant (ICA)



**Rougher-Finisher with Corner Radius**

- Different corner radii per diameter



Icon descriptions (see pages 160-161)

**Corner Radius**



**Coating**

**ALCR**

Applications – Materials (see page 7)

Cutting Data (see page 117)

- Especially made for Titanium Alloys
- Suitable for HPC roughing and finishing

<b>P</b>	1.1-3.1	4.1-5.1
<b>M</b>	1.1-4.1	
<b>N</b>	2.1-2.8, 5.2	
<b>S</b>	1.1-1.3	2.1-2.6

**Standard length**

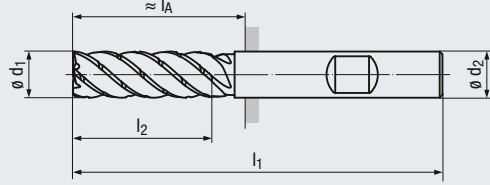
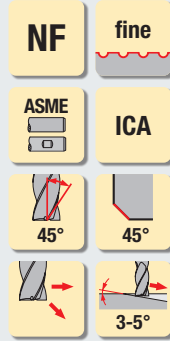
$\varnothing d_1$ h10	$l_2$	$l_1$	$\varnothing d_2$ h6	Chamfer	# Flutes	Tool No. Straight Shank
1/4	3/4	2 1/2	1/4	0.005	5	2962LZ.0250
5/16	3/4	2 1/2	5/16	0.005	5	2962LZ.03125
3/8	7/8	2 1/2	3/8	0.008	5	2962LZ.0375
1/2	1 1/4	3	1/2	0.008	5	2962LZ.0500
5/8	1 1/4	3 1/2	5/8	0.008	5	2962LZ.0625
3/4	1 1/2	4	3/4	0.012	5	2962LZ.0750
1	1 3/4	4 1/2	1	0.012	5	2962LZ.1000

**Standard length - Corner Radius**

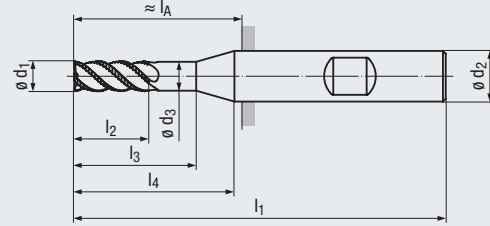
$\varnothing d_1$ h11	$l_2$	$l_1$	$\varnothing d_2$ h6	r $\pm 0.0004$	# Flutes	Tool No. Straight Shank
1/4	3/4	2 1/2	1/4	0.015	5	2966LZ.025015
1/4	3/4	2 1/2	1/4	0.030	5	2966LZ.025030
5/16	3/4	2 1/2	5/16	0.015	5	2966LZ.031015
5/16	3/4	2 1/2	5/16	0.030	5	2966LZ.031030
3/8	7/8	2 1/2	3/8	0.015	5	2966LZ.037015
3/8	7/8	2 1/2	3/8	0.030	5	2966LZ.037030
1/2	1 1/4	3	1/2	0.015	5	2966LZ.050015
1/2	1 1/4	3	1/2	0.030	5	2966LZ.050030
1/2	1 1/4	3	1/2	0.060	5	2966LZ.050060
1/2	1 1/4	3	1/2	0.090	5	2966LZ.050090
1/2	1 1/4	3	1/2	0.120	5	2966LZ.050120
5/8	1 1/4	3 1/2	5/8	0.015	5	2966LZ.062015
5/8	1 1/4	3 1/2	5/8	0.030	5	2966LZ.062030
5/8	1 1/4	3 1/2	5/8	0.060	5	2966LZ.062060
3/4	1 1/2	4	3/4	0.015	5	2966LZ.075015
3/4	1 1/2	4	3/4	0.030	5	2966LZ.075030
3/4	1 1/2	4	3/4	0.060	5	2966LZ.075060
3/4	1 1/2	4	3/4	0.090	5	2966LZ.075090
3/4	1 1/2	4	3/4	0.120	5	2966LZ.075120
1	1 3/4	4 1/2	1	0.015	5	2966LZ.100015
1	1 3/4	4 1/2	1	0.030	5	2966LZ.100030
1	1 3/4	4 1/2	1	0.060	5	2966LZ.100060
1	1 3/4	4 1/2	1	0.090	5	2966LZ.100090
1	1 3/4	4 1/2	1	0.120	5	2966LZ.100120

**Semi-Finisher**

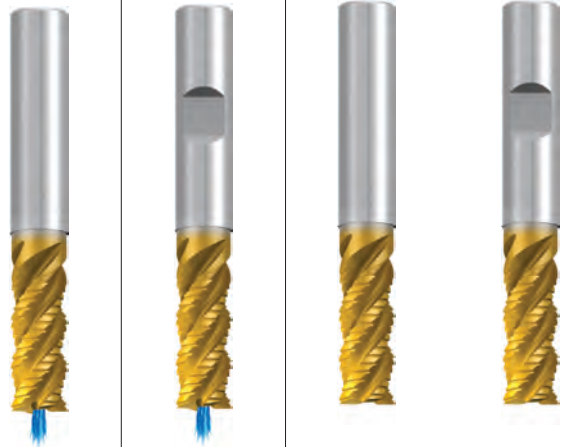
- Fine semi-finishing profile
- Variable index
- TiN/TiAlN PVD multi-layer coating increases tool life
- Sub-micro grain carbide
- Axial coolant hole for better chip evacuation
- Axial internal coolant supply (ICA)



**Design I<sub>4</sub>:**



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 7)

Cutting Data (see page 118)

- Ideal for difficult to cut materials such as nickel alloys and Titanium, preferable in Inconel
- Suitable for high productivity cutting, roughing

**TIN / TIALN**

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	2.1-2.8, 5.2
S	1.1-2.6

**Standard length - with Coolant thru**

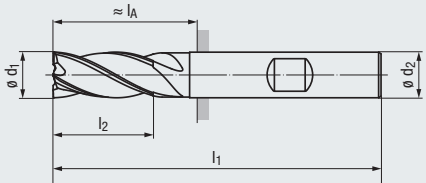
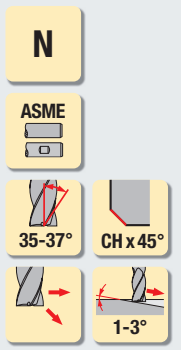
$\phi d_1$ h11	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h6	$l_A$	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	17/32	3/4	2 1/2	0.236	7/8	3/8	15/16	4	2648TZ.0250	2649TZ.0250
5/16	3/4	7/8	2 1/2	0.295	15/16	3/8	15/16	4	2648TZ.03125	2649TZ.03125
3/8	7/8	1 1/8	2 3/4	0.358	–	3/8	1 3/16	4	2648TZ.0375	2649TZ.0375
1/2	1 1/8	1 3/8	3 1/4	0.480	–	1/2	1 15/32	4	2648TZ.0500	2649TZ.0500
5/8	1 1/4	1 1/2	3 1/2	0.605	–	5/8	1 19/32	4	2648TZ.0625	2649TZ.0625
3/4	1 1/2	1 7/8	4	0.730	–	3/4	1 31/32	4	2648TZ.0750	2649TZ.0750
1	1 3/4	2 5/8	5	0.969	–	1	2 23/32	5	2648TZ.1000	2649TZ.1000

**Standard length - Solid**

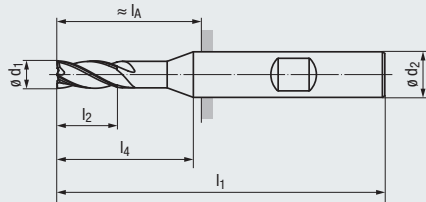
$\phi d_1$ h11	$l_2$	$l_1$	$\phi d_3$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	17/32	2 1/2	0.236	1/4	4	2958T.0250	–
5/16	3/4	2 1/2	0.295	5/16	4	2958T.03125	–
3/8	7/8	2 3/4	0.358	3/8	4	2958T.0375	–
1/2	1 1/8	3 1/4	0.480	1/2	4	2958T.0500	2959T.0500
5/8	1 1/4	3 1/2	0.605	5/8	4	2958T.0625	2959T.0625
3/4	1 1/2	4	0.730	3/4	4	2958T.0750	2959T.0750
1	1 3/4	5	0.969	1	5	2958T.1000	2959T.1000

## Rougher-Finisher

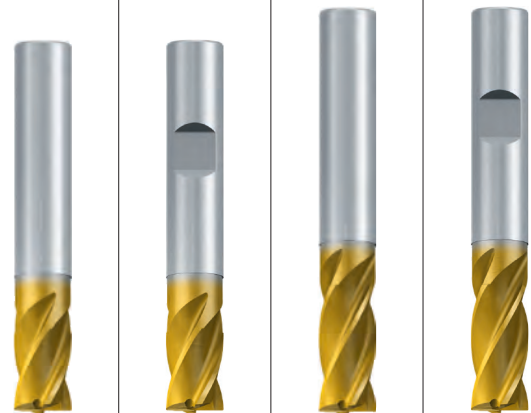
- Ideal entry-level universal tool solution
- High performance tool
- Finishing end mill for tough materials
- Special geometry prevents vibration
- Variable spacing



### Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)



## Coating

Applications – Materials (see page 8)

Cutting Data (see pages 119-120)

- Especially suitable for Stainless Steel materials
- Suitable for Titanium, Alloyed Steels, HPC roughing and finishing

## TiN / TiAlN

P	1.1-3.1	4.1-5.1
M	1.1-4.1	
K	1.1-2.2	3.1-4.2
N	1.1-1.3	
N	2.1-2.8	5.2
S	1.1	1.2-1.3
S	2.1	2.2-2.6
H	1.1	1.2

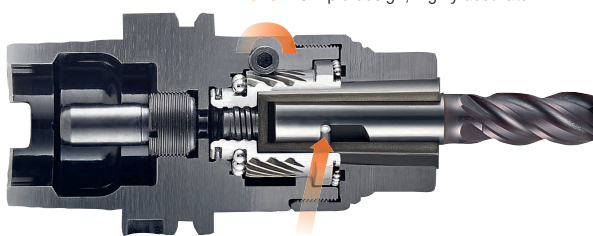
## Stub length

$\phi d_1$ h10	$l_2$	$l_1$	$l_4$	$\phi d_2$ h6	$l_A$ 	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/8	1/4	2	5/8	1/4	5/8	0.003	4	2975T.0125	–
3/16	3/8	2	5/8	1/4	5/8	0.005	4	2975T.01875	–
1/4	1/2	2	–	1/4	5/8	0.005	4	2975T.0250	–
5/16	9/16	2 1/4	–	5/16	7/8	0.005	4	2975T.03125	–
3/8	5/8	2 1/2	–	3/8	15/16	0.008	4	2975T.0375	–
1/2	5/8	2 3/4	–	1/2	31/32	0.008	4	2975T.0500	2976T.0500
5/8	3/4	3	–	5/8	1 3/32	0.008	4	2975T.0625	2976T.0625
3/4	1	3 1/2	–	3/4	1 15/32	0.012	4	2975T.0750	2976T.0750

## Standard length

$\phi d_1$ h10	$l_2$	$l_1$	$l_4$	$\phi d_2$ h6	$l_A$ 	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/8	3/8	2 1/4	7/8	1/4	7/8	0.003	4	2977T.0125	–
3/16	9/16	2 1/4	7/8	1/4	7/8	0.005	4	2977T.01875	–
1/4	3/4	2 1/2	–	1/4	1 1/8	0.005	4	2977T.0250	–
5/16	13/16	2 1/2	–	5/16	1 1/8	0.005	4	2977T.03125	–
3/8	7/8	2 3/4	–	3/8	1 3/16	0.008	4	2977T.0375	–
1/2	1	3	–	1/2	1 7/32	0.008	4	2977T.0500	2978T.0500
5/8	1 1/4	3 1/2	–	5/8	1 19/32	0.008	4	2977T.0625	2978T.0625
3/4	1 1/2	4	–	3/4	1 31/32	0.012	4	2977T.0750	2978T.0750

## EMUGE-FRANKEN high precision / performance FPC Mill / Drill Chucks



Mechanical drive actuated with a hex wrench. Simple design, highly accurate.

Optimal Pull-Out Protection via optional Pin-Lock Collet System.

World's only chuck with 1:16 worm gear, a patented design delivering 3 tons of traction force.

Maximum dampening collet-cone assembly absorbs virtually all vibration.

High rigidity patented design and body provides 100% holding power.



# Trochoidal High Performance End Mills

## For Difficult Materials and Thin-walled Components



**Trochoidal Milling** is the overlapping of a circular path with a linear movement and thus the conversion of slot milling into contour milling. High metal removal rates can be generated even on low-powered machines and wear is reduced during full slot milling, particularly in difficult to machine materials. Plus, the end mill is utilized over the entire flute length, and as a result **wear is evenly spaced over the full cutting edge length, increasing tool life.**

### Advantages of EMUGE-FRANKEN Trochoidal Milling

- Particularly suitable for difficult to machine materials and thin-walled components
- **Reduced stress** on tools and machine
- **Increased metal removal rate on low-powered, trochoidal machining**
- Suitable for unstable workpiece clamping conditions
- Enables **high axial depth** of cut up to 4 x D

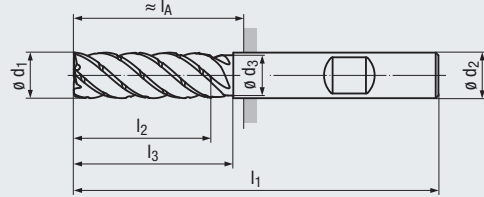
*German engineered  
EMUGE-FRANKEN quality*

- High performance tool for trochoidal milling
- Newly developed geometry with chip breaker
- Low-vibration machining
- Axial depth of cut 2 x D
- Axial internal coolant supply (ICA)

**NF** **medium**

**ASME** **ICA**

**38-42°** **CH x 45°**



Icon descriptions (see pages 160-161)



**Coating**

**Applications – Materials (see page 8)**

**Cutting Data (see page 121)**

- For process-reliable trochoidal roughing operations
- Suitable for finishing
- Especially suitable for difficult-to-cut materials

**TIN/TIALN**

<b>P</b>	1.1-3.1	4.1-5.1
<b>M</b>	1.1-4.1	
<b>K</b>		1.1-4.2
<b>N</b>	1.1-1.3	
<b>N</b>	2.1-2.8, 5.2	
<b>S</b>	1.1-2.6	

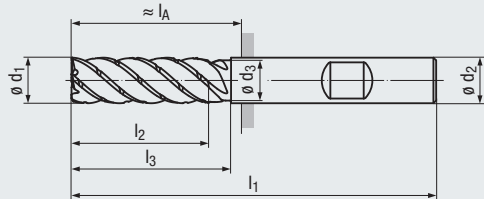
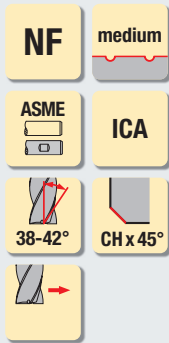
**2 x D – Standard length**

	$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$	Chamfer	# Flutes	Tool No. Weldon Shank
[inch]	1/4	1/2	–	2 1/4	–	1/4	7/8	0.005	4	2577TZ.0250
	5/16	13/16	–	2 1/2	–	5/16	1 1/8	0.005	5	2577TZ.03125
	3/8	7/8	–	3	–	3/8	1 7/16	0.008	5	2577TZ.0375
	1/2	1	–	3 1/4	–	1/2	1 15/32	0.008	5	2577TZ.0500
	5/8	1 1/4	–	3 3/4	–	5/8	1 27/32	0.008	5	2577TZ.0625
	3/4	1 1/2	–	4 1/4	–	3/4	2 7/32	0.012	5	2577TZ.0750
[mm]	6	13	20	57	5.8	6	21	0.12	4	2537TZ.006
	8	19	25	63	7.7	8	27	0.12	5	2537TZ.008
	10	22	30	72	9.5	10	32	0.20	5	2537TZ.010
	12	26	35	83	11.5	12	38	0.20	5	2537TZ.012
	16	32	40	92	15.5	16	44	0.20	5	2537TZ.016
	20	40	50	104	19.5	20	54	0.30	5	2537TZ.020

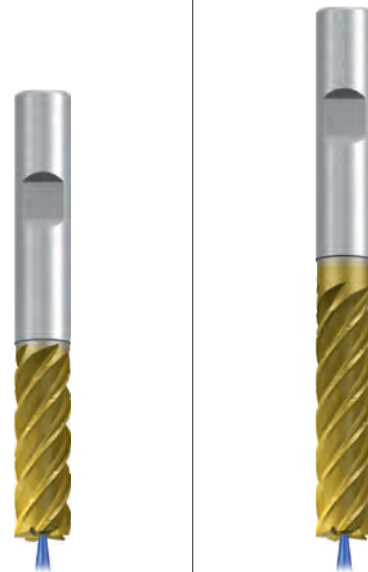
**Slot Milling Strategy Comparisons – Standard End Mills vs. Trochoidal (Slot = 18"L x 3/4"W x 1 3/4"H)**

HPC Slot Milling with standard solid carbide end mill	Trochoidal Slot Milling with standard solid carbide end mill	Trochoidal Slot Milling with FRANKEN Trochoidal Solid Carbide End Mill
<p>Material: 4140 Steel Cutting length: 1-1/4" Flutes: 4 Cutting speed (V<sub>c</sub>): 490 SFM Feed per tooth (f<sub>z</sub>): .003" Axial depth of cut (a<sub>p</sub>): .60" Radial depth of cut (a<sub>e</sub>): 5/8"</p> <p>Machining time: 3:13 Minutes</p>	<p>Material: 4140 Steel Cutting length: 1-1/4" Flutes: 4 Cutting speed (V<sub>c</sub>): 655 SFM Feed per tooth (f<sub>z</sub>): .005" Axial depth of cut (a<sub>p</sub>): 7/8" Radial depth of cut (a<sub>e</sub>): .090"</p> <p>Machining time: 2:57 Minutes</p>	<p>Material: 4140 Steel Cutting length: 1-1/4" Flutes: 5 Cutting speed (V<sub>c</sub>): 655 SFM Feed per tooth (f<sub>z</sub>): .005" Axial depth of cut (a<sub>p</sub>): 1-3/4" Radial depth of cut (a<sub>e</sub>): .050"</p> <p>Machining time: 2:07 Minutes</p> <p><b>EMUGE</b> <b>FRANKEN</b></p>
Milling Strategy requires 3 passes	Milling Strategy requires 2 passes	Milling Strategy requires only 1 pass

- High performance tool for trochoidal milling
- Newly developed geometry with chip breaker
- Low-vibration machining
- Axial depths of cut up to 4 x D
- Axial internal coolant supply (ICA)



Icon descriptions (see pages 160-161)



**Coating**

**TIN/TIALN**

Applications – Materials (see page 8)

Cutting Data (see page 121)

- For process-reliable trochoidal roughing operations
- Suitable for finishing
- Especially suitable for difficult-to-cut materials such as Titanium

<b>P</b>	1.1-3.1	4.1-5.1
<b>M</b>	1.1-4.1	
<b>K</b>		1.1-4.2
<b>N</b>	1.1-1.3	
<b>N</b>	2.1-2.8, 5.2	
<b>S</b>	1.1-2.6	

**3 x D – Long length**

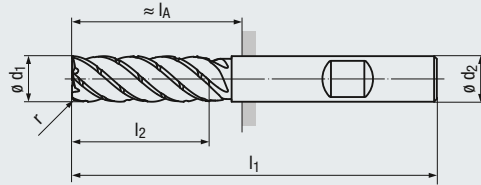
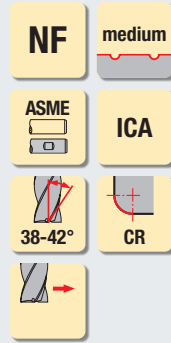
	$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$	Chamfer	# Flutes	Tool No. Weldon Shank
	1/4	3/4	–	2 1/2	–	1/4	1 1/8	0.005	4	2579TZ.0250
	5/16	1	–	2 3/4	–	5/16	1 3/8	0.005	5	2579TZ.03125
[inch]	3/8	1 1/8	–	3 1/4	–	3/8	1 11/16	0.008	5	2579TZ.0375
	1/2	1 1/2	–	3 3/4	–	1/2	1 31/32	0.008	5	2579TZ.0500
	5/8	1 7/8	–	4 1/4	–	5/8	2 11/32	0.008	5	2579TZ.0625
	3/4	2 1/4	–	5	–	3/4	2 31/32	0.012	5	2579TZ.0750
	6	18	25	62	5.8	6	26	0.12	4	2539TZ.006
	8	24	30	68	7.7	8	32	0.12	5	2539TZ.008
	10	30	35	80	9.5	10	40	0.20	5	2539TZ.010
	10	30	35	80	9.5	10	40	0.20	6	2539TZ.010006
[mm]	12	36	45	93	11.5	12	48	0.20	5	2539TZ.012
	12	36	45	93	11.5	12	48	0.20	6	2539TZ.012006
	16	48	55	108	15.5	16	64	0.20	5	2539TZ.016
	16	48	55	108	15.5	16	64	0.20	7	2539TZ.016007
	20	60	70	126	19.5	20	80	0.30	5	2539TZ.020
	20	60	70	126	19.5	20	80	0.30	7	2539TZ.020007

**4 x D – Extra Long length**

	$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$	Chamfer	# Flutes	Tool No. Weldon Shank
	1/4	1	–	2 3/4	–	1/4	1 3/8	0.005	4	2581TZ.0250
	5/16	1 1/4	–	3	–	5/16	1 5/8	0.005	5	2581TZ.03125
[inch]	3/8	1 1/2	–	3 3/4	–	3/8	2 3/16	0.008	5	2581TZ.0375
	1/2	2	–	4 1/4	–	1/2	2 15/32	0.008	5	2581TZ.0500
	5/8	2 1/2	–	5	–	5/8	3 3/32	0.008	5	2581TZ.0625
	3/4	3	–	6	–	3/4	3 31/32	0.012	5	2581TZ.0750
	6	24	30	68	5.8	6	32	0.12	4	2541TZ.006
	8	32	40	80	7.7	8	44	0.12	5	2541TZ.008
	10	40	50	95	9.5	10	55	0.20	5	2541TZ.010
	10	40	50	95	9.5	10	55	0.20	6	2541TZ.010006
[mm]	12	48	60	107	11.5	12	62	0.20	5	2541TZ.012
	12	48	60	107	11.5	12	62	0.20	6	2541TZ.012006
	16	64	75	128	15.5	16	80	0.20	5	2541TZ.016
	16	64	75	128	15.5	16	80	0.20	7	2541TZ.016007
	20	80	90	150	19.5	20	100	0.30	5	2541TZ.020
	20	80	90	150	19.5	20	100	0.30	7	2541TZ.020007



- High performance tool for trochoidal milling
- Newly developed geometry with chip breaker
- Low-vibration machining
- Axial depths of cut up to 4 x D
- Axial internal coolant supply (ICA)



Icon descriptions (see pages 160-161)

Corner Radius



Coating

TIN / TIALN

Applications – Materials (see page 8)

Cutting Data (see page 121)

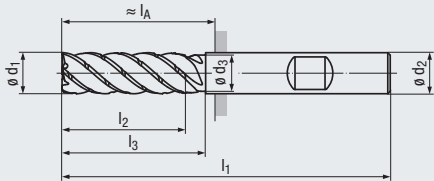
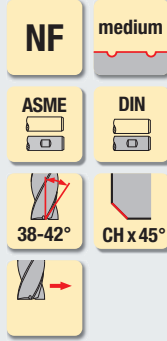
- For process-reliable trochoidal roughing operations
- Suitable for finishing
- Especially suitable for difficult-to-cut materials such as Titanium

P	1.1-3.1	4.1-5.1
M	1.1-4.1	
K		1.1-4.2
N	1.1-1.3	
N	2.1-2.8, 5.2	
S	1.1-2.6	

3 x D and 4 x D

$\phi d_1$ h10	r	Long length 3 x D			Extra long length 4 x D			$\phi d_2$ h6	# Flutes	Tool No. Weldon Shank	Tool No. Weldon Shank
		$l_1$	$l_2$	$l_A$	$l_1$	$l_2$	$l_A$				
1/4	0.010	2 1/2	3/4	1 1/8	2 3/4	1	1 3/8	1/4	4	3911TZ.025010	3913TZ.025010
1/4	0.015	2 1/2	3/4	1 1/8	2 3/4	1	1 3/8	1/4	4	3911TZ.025015	3913TZ.025015
1/4	0.020	2 1/2	3/4	1 1/8	2 3/4	1	1 3/8	1/4	4	3911TZ.025020	3913TZ.025020
1/4	0.030	2 1/2	3/4	1 1/8	2 3/4	1	1 3/8	1/4	4	3911TZ.025030	3913TZ.025030
1/4	0.060	2 1/2	3/4	1 1/8	2 3/4	1	1 3/8	1/4	4	3911TZ.025060	3913TZ.025060
5/16	0.015	2 3/4	1	1 3/8	3	1 1/4	1 5/8	5/16	5	3911TZ.031015	3913TZ.031015
5/16	0.030	2 3/4	1	1 3/8	3	1 1/4	1 5/8	5/16	5	3911TZ.031030	3913TZ.031030
5/16	0.060	2 3/4	1	1 3/8	3	1 1/4	1 5/8	5/16	5	3911TZ.031060	3913TZ.031060
3/8	0.010	3 1/4	1 1/8	1 11/16	3 3/4	1 1/2	2 3/16	3/8	5	3911TZ.037010	3913TZ.037010
3/8	0.015	3 1/4	1 1/8	1 11/16	3 3/4	1 1/2	2 3/16	3/8	5	3911TZ.037015	3913TZ.037015
3/8	0.020	3 1/4	1 1/8	1 11/16	3 3/4	1 1/2	2 3/16	3/8	5	3911TZ.037020	3913TZ.037020
3/8	0.030	3 1/4	1 1/8	1 11/16	3 3/4	1 1/2	2 3/16	3/8	5	3911TZ.037030	3913TZ.037030
3/8	0.060	3 1/4	1 1/8	1 11/16	3 3/4	1 1/2	2 3/16	3/8	5	3911TZ.037060	3913TZ.037060
3/8	0.090	3 1/4	1 1/8	1 11/16	3 3/4	1 1/2	2 3/16	3/8	5	3911TZ.037090	3913TZ.037090
1/2	0.010	3 3/4	1 1/2	1 31/32	4 1/4	2	2 15/32	1/2	5	3911TZ.050010	3913TZ.050010
1/2	0.015	3 3/4	1 1/2	1 31/32	4 1/4	2	2 15/32	1/2	5	3911TZ.050015	3913TZ.050015
1/2	0.020	3 3/4	1 1/2	1 31/32	4 1/4	2	2 15/32	1/2	5	3911TZ.050020	3913TZ.050020
1/2	0.030	3 3/4	1 1/2	1 31/32	4 1/4	2	2 15/32	1/2	5	3911TZ.050030	3913TZ.050030
1/2	0.060	3 3/4	1 1/2	1 31/32	4 1/4	2	2 15/32	1/2	5	3911TZ.050060	3913TZ.050060
1/2	0.090	3 3/4	1 1/2	1 31/32	4 1/4	2	2 15/32	1/2	5	3911TZ.050090	3913TZ.050090
1/2	0.120	3 3/4	1 1/2	1 31/32	4 1/4	2	2 15/32	1/2	5	3911TZ.050120	3913TZ.050120
5/8	0.030	4 1/4	1 7/8	2 11/32	5	2 1/2	3 3/32	5/8	5	3911TZ.062030	3913TZ.062030
5/8	0.060	4 1/4	1 7/8	2 11/32	5	2 1/2	3 3/32	5/8	5	3911TZ.062060	3913TZ.062060
5/8	0.090	4 1/4	1 7/8	2 11/32	5	2 1/2	3 3/32	5/8	5	3911TZ.062090	3913TZ.062090
5/8	0.120	4 1/4	1 7/8	2 11/32	5	2 1/2	3 3/32	5/8	5	3911TZ.062120	3913TZ.062120
3/4	0.020	5	2 1/4	2 31/32	6	3	3 31/32	3/4	5	3911TZ.075020	3913TZ.075020
3/4	0.030	5	2 1/4	2 31/32	6	3	3 31/32	3/4	5	3911TZ.075030	3913TZ.075030
3/4	0.060	5	2 1/4	2 31/32	6	3	3 31/32	3/4	5	3911TZ.075060	3913TZ.075060
3/4	0.090	5	2 1/4	2 31/32	6	3	3 31/32	3/4	5	3911TZ.075090	3913TZ.075090
3/4	0.120	5	2 1/4	2 31/32	6	3	3 31/32	3/4	5	3911TZ.075120	3913TZ.075120
3/4	0.190	5	2 1/4	2 31/32	6	3	3 31/32	3/4	5	3911TZ.075190	3913TZ.075190

- High performance tool for trochoidal milling
- Well suited for steel and cast iron
- ALCR coating for additional heat resistance
- Newly developed chip breaker geometry
- Low vibration machining



Icon descriptions (see pages 160-161)



### Coating

**ALCR**

Applications – Materials (see page 8)

Cutting Data (see page 122)

- For process-reliable trochoidal roughing operations
- Suitable for finishing
- Especially suitable for difficult-to-cut materials

P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-4.2	
N	1.1-1.3	
N	2.1-2.8, 5.2	
S	1.1-1.3	2.1-2.6

### 2 x D – Standard length

	$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$	Chamfer	# Flutes	Tool No. Weldon Shank
[inch]	1/4	1/2	–	2 1/4	–	1/4	7/8	0.005	4	2571L.0250
	5/16	13/16	–	2 1/2	–	5/16	1 1/8	0.005	5	2571L.03125
	3/8	7/8	–	3	–	3/8	1 7/16	0.008	5	2571L.0375
	1/2	1	–	3 1/4	–	1/2	1 15/32	0.008	5	2571L.0500
	5/8	1 1/4	–	3 3/4	–	5/8	1 27/32	0.008	5	2571L.0625
	3/4	1 1/2	–	4 1/4	–	3/4	2 7/32	0.012	5	2571L.0750
[mm]	6	13	20	57	5.8	6	21	0.12	4	2531L.006
	8	19	25	63	7.7	8	27	0.12	5	2531L.008
	10	22	30	72	9.5	10	32	0.20	5	2531L.010
	12	26	35	83	11.5	12	38	0.20	5	2531L.012
	16	32	40	92	15.5	16	44	0.20	5	2531L.016
	20	40	50	104	19.5	20	54	0.30	5	2531L.020

### 3 x D – Long length

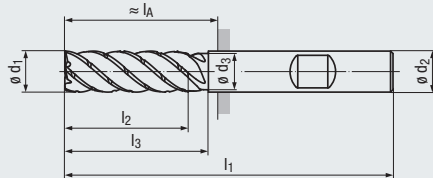
	$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$	Chamfer	# Flutes	Tool No. Weldon Shank
[inch]	1/4	3/4	–	2 1/2	–	1/4	1 1/8	0.005	4	2573L.0250
	5/16	1	–	2 3/4	–	5/16	1 3/8	0.005	5	2573L.03125
	3/8	1 1/8	–	3 1/4	–	3/8	1 11/16	0.008	5	2573L.0375
	1/2	1 1/2	–	3 3/4	–	1/2	1 31/32	0.008	5	2573L.0500
	5/8	1 7/8	–	4 1/4	–	5/8	2 11/32	0.008	5	2573L.0625
	3/4	2 1/4	–	5	–	3/4	2 31/32	0.012	5	2573L.0750
[mm]	6	18	25	62	5.8	6	26	0.12	4	2533L.006
	8	24	30	68	7.7	8	32	0.12	5	2533L.008
	10	30	35	80	9.5	10	40	0.20	5	2533L.010
	12	36	45	93	11.5	12	48	0.20	5	2533L.012
	12	36	45	93	11.5	12	48	0.20	6	2533L.012006
	16	48	55	108	15.5	16	60	0.20	5	2533L.016
	16	48	55	108	15.5	16	60	0.20	7	2533L.016007
	20	60	70	126	19.5	20	76	0.30	5	2533L.020
	20	60	70	126	19.5	20	76	0.30	7	2533L.020007

- High performance tool for trochoidal milling
- Well suited for steel and cast iron
- ALCR coating for additional heat resistance
- Newly developed chip breaker geometry
- Low vibration machining

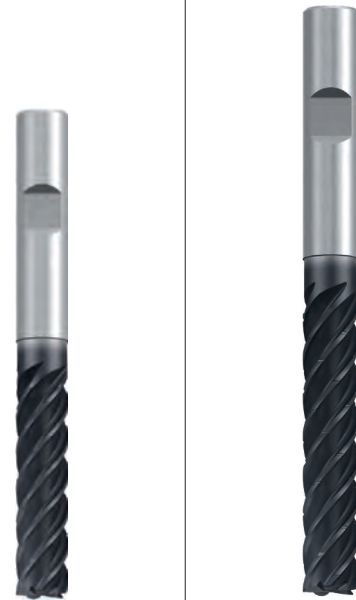
**NF** medium

ASME DIN

38-42° CH x 45°



Icon descriptions (see pages 160-161)



**Coating**

**ALCR**

Applications – Materials (see page 8)

Cutting Data (see page 122)

- For process-reliable trochoidal roughing operations
- Suitable for finishing
- Especially suitable for difficult-to-cut materials

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-4.2	
<b>N</b>	1.1-1.3	
<b>N</b>	2.1-2.8, 5.2	
<b>S</b>	1.1-1.3	2.1-2.6

**4 x D – Long length**

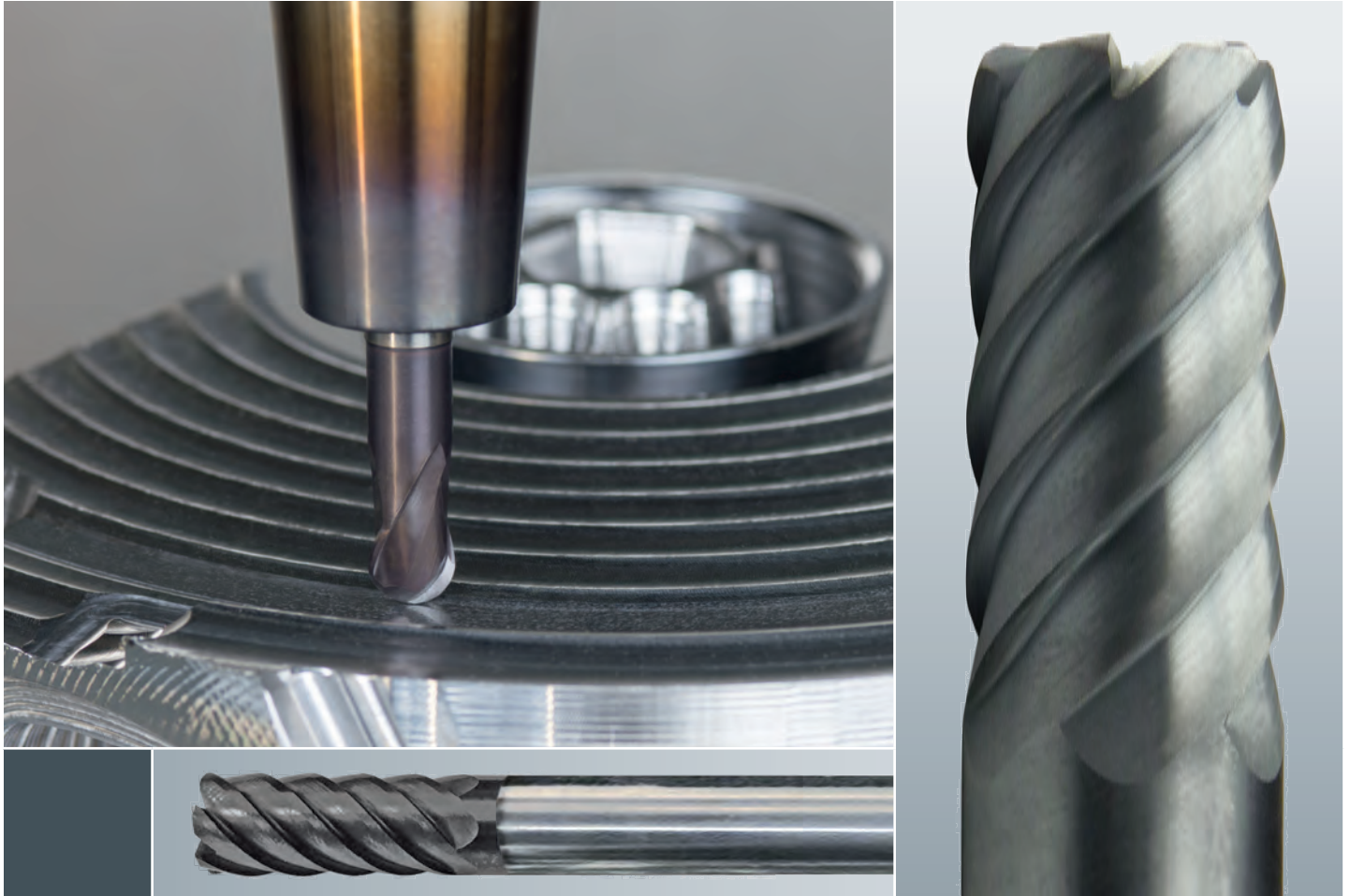
	$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$ 	Chamfer	# Flutes	Tool No. Weldon Shank
[inch]	1/4	1	–	2 3/4	–	1/4	1 3/8	0.005	4	2575L.0250
	5/16	1 1/4	–	3	–	5/16	1 5/8	0.005	5	2575L.03125
	3/8	1 1/2	–	3 3/4	–	3/8	2 3/16	0.008	5	2575L.0375
	1/2	2	–	4 1/4	–	1/2	2 15/32	0.008	5	2575L.0500
	5/8	2 1/2	–	5	–	5/8	3 3/32	0.008	5	2575L.0625
	3/4	3	–	6	–	3/4	2 31/32	0.012	5	2575L.0750
[mm]	6	24	30	68	5.8	6	32	0.12	4	2535L.006
	8	32	40	80	7.7	8	44	0.12	5	2535L.008
	10	40	50	95	9.5	10	55	0.20	5	2535L.010
	10	40	50	95	9.5	10	55	0.20	6	2535L.010006
	12	48	60	107	11.5	12	62	0.20	5	2535L.012
	12	48	60	107	11.5	12	62	0.20	6	2535L.012006
	16	64	75	128	15.5	16	80	0.20	5	2535L.016
	16	64	75	128	15.5	16	80	0.20	7	2535L.016007
	20	80	90	150	19.5	20	100	0.30	5	2535L.020
	20	80	90	150	19.5	20	100	0.30	7	2535L.020007

**5 x D – Long length**

	$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$ 	Chamfer	# Flutes	Tool No. Weldon Shank
[mm]	10	50	60	105	9.5	10	65	0.20	5	2557L.010
	12	60	70	118	11.5	12	73	0.20	5	2557L.012
	16	80	90	142	15.5	16	94	0.20	5	2557L.016
	20	100	110	163	19.5	20	113	0.30	5	2557L.020

# Hard-Cut High Performance End Mills

## *For Hard Milling Applications*



**Hard-Cut** end mills were specifically developed for the machining of hardened materials up to 66 HRC.

- **Unique proprietary geometry**
- **Variable flute spacing** minimizes vibrations and improves tool life
- **High flute count** enables high feed rates
- **Large core diameter** provides an extremely stable design
- **Tighter cutting diameter tolerances** assure more accurate milling
- Made from a special **high-wear resistant carbide substrate** for maximum tool life
- **High heat-resistant TiAlN coating**
- Can be used with EMUGE-FRANKEN's Cold-Air Nozzle (see page 57) for maximum cooling efficiency in hard milling

*German engineered  
EMUGE-FRANKEN quality*

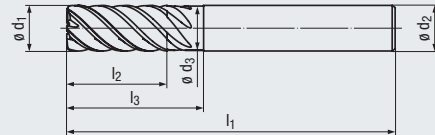
- Hard milling geometry
- Variable index
- High number of flutes
- Chamfer to stabilize the cutting edge
- Tighter cutting diameter tolerance
- TIALN PVD coating
- Sub-micro grain carbide

**H**

ASME DIN

50° CH x 45°

44-66 HRC



Icon descriptions (see pages 160-161)



**Coating**

**TIALN**

**Applications – Materials (see page 9)**

**Cutting Data (see page 123)**

- Ideal for all high strength materials
- Hard milling up to 66 HRC
- Suitable for high speed cutting, finishing

P	3.1-5.1	1.1-2.1
K	1.1-4.2	
H	1.1-1.5	

**Standard length**

	$\phi d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\phi d_3$	$\phi d_2$ h5	Chamfer	# Flutes	Tool No. Straight Shank
[inch]	1/4	-0.0016	3/8	–	2	–	1/4	0.003	6	1827A.0250
	3/8	-0.0016	7/8	–	2 3/4	–	3/8	0.004	6	1827A.0375
	1/2	-0.0016	1	–	3 1/4	–	1/2	0.005	6	1827A.0500
	5/8	-0.0016	1 1/4	–	3 1/2	–	5/8	0.007	8	1827A.0625
	3/4	-0.0016	1 1/2	–	4	–	3/4	0.008	8	1827A.0750
1	-0.0016	1 3/4	–	4 1/2	–	1	0.010	10	1827A.1000	
[mm]	6	-0.02	13	20	57	5.8	6	0.08	6	1827A.006
	8	-0.04	19	25	63	7.7	8	0.10	6	1827A.008
	10	-0.04	22	30	72	9.5	10	0.12	6	1827A.010
	12	-0.04	26	35	83	11.5	12	0.14	6	1827A.012
	14	-0.04	26	35	83	13.5	14	0.16	6	1827A.014
	16	-0.04	32	40	92	15.5	16	0.18	8	1827A.016
	18	-0.04	32	40	92	17.5	18	0.20	8	1827A.018
	20	-0.04	38	50	104	19.5	20	0.22	8	1827A.020

**Long length**

	$\phi d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\phi d_3$	$\phi d_2$ h5	Chamfer	# Flutes	Tool No. Straight Shank
[inch]	1/4	-0.0016	7/8	–	2 1/2	–	1/4	0.003	6	1828A.0250
	3/8	-0.0016	1 3/8	–	3 1/4	–	3/8	0.004	6	1828A.0375
	1/2	-0.0016	1 1/2	–	3 3/4	–	1/2	0.005	6	1828A.0500
	5/8	-0.0016	2	–	4 1/4	–	5/8	0.007	8	1828A.0625
	3/4	-0.0016	2 1/2	–	5	–	3/4	0.008	8	1828A.0750
1	-0.0016	3	–	6	–	1	0.010	10	1828A.1000	
[mm]	6	-0.02	18	25	62	5.8	6	0.08	6	1828A.006
	8	-0.04	24	30	68	7.7	8	0.10	6	1828A.008
	10	-0.04	30	35	80	9.5	10	0.12	6	1828A.010
	12	-0.04	36	45	93	11.5	12	0.14	6	1828A.012
	14	-0.04	42	50	99	13.5	14	0.16	6	1828A.014
	16	-0.04	48	55	108	15.5	16	0.18	8	1828A.016
	18	-0.04	54	60	114	17.5	18	0.20	8	1828A.018
	20	-0.04	60	70	126	19.5	20	0.22	8	1828A.020
25	-0.04	75	90	150	24.2	25	0.27	10	1828A.025	

- Hard milling geometry
- Variable spacing
- High number of flutes
- Corner radius feature
- Tighter cutting diameter tolerance
- TiAlN PVD coating
- Sub-micro grain carbide

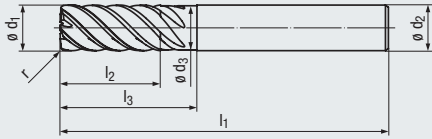
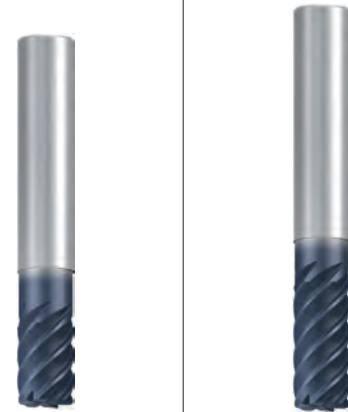
**H**

ASME DIN

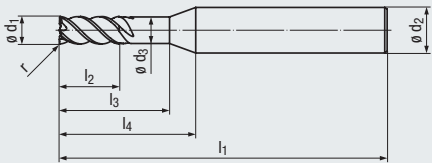
50° CR

44-66 HRC

**Corner Radius**



**Design I<sub>4</sub>:**



Icon descriptions (see pages 160-161)

**Coating**

**TiAlN**

Applications – Materials (see page 9)

Cutting Data (see page 123)

- Ideal for all high strength materials
- Hard milling up to 66 HRC
- Suitable for high speed cutting, finishing

**P** 3.1-5.1 1.1-2.1

**K** 1.1-4.2

**H** 1.1-1.5

**Standard length**

	$\phi d_1$	tolerance	r	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h5	# Flutes	Tool No. Straight Shank
[inch]	1/4	-0.0016	0.025	1/2	–	2	–	–	1/4	6	2813A.0250
	5/16	-0.0016	0.025	1/2	–	2	–	–	5/16	6	2813A.03125
	3/8	-0.0016	0.025	5/8	–	2 1/4	–	–	3/8	6	2813A.0375
	7/16	-0.0016	0.025	5/8	–	2 1/2	–	–	7/16	6	2813A.04375
	1/2	-0.0016	0.050	5/8	–	2 1/2	–	–	1/2	6	2813A.0500
	5/8	-0.0016	0.050	3/4	–	3	–	–	5/8	8	2813A.0625
[mm]	3/4	-0.0016	0.050	7/8	–	3	–	–	3/4	8	2813A.0750
	5	-0.02	0.5	9	16	54	4.8	18	6	6	2813A.005
	6	-0.02	0.5	10	16	54	5.8	–	6	6	2813A.006
	8	-0.04	0.5	12	20	58	7.7	–	8	6	2813A.008
	10	-0.04	0.5	14	24	66	9.5	–	10	6	2813A.010
	12	-0.04	1	16	26	73	11.5	–	12	6	2813A.012
	16	-0.04	1	22	32	82	15.5	–	16	8	2813A.016

**Long length**

	$\phi d_1$	tolerance	r	$l_2$	$l_3$	$l_1$	$d_3 \phi$	$l_4$	$\phi d_2$ h5	# Flutes	Tool No. Straight Shank
[inch]	1/4	-0.0016	0.025	17/32	–	2	–	–	1/4	6	2817A.0250
	5/16	-0.0016	0.025	3/4	–	2 1/2	–	–	5/16	6	2817A.03125
	3/8	-0.0016	0.025	7/8	–	2 3/4	–	–	3/8	6	2817A.0375
	7/16	-0.0016	0.025	15/16	–	3	–	–	7/16	6	2817A.04375
	1/2	-0.0016	0.050	1	–	3 1/4	–	–	1/2	6	2817A.0500
	5/8	-0.0016	0.050	1 1/4	–	3 1/2	–	–	5/8	8	2817A.0625
[mm]	3/4	-0.0016	0.050	1 1/2	–	4	–	–	3/4	8	2817A.0750
	6	-0.02	0.5	13	20	57	5.8	–	6	6	2817A.006
	8	-0.04	0.5	19	25	63	7.7	–	8	6	2817A.008
	10	-0.04	0.5	22	30	72	9.5	–	10	6	2817A.010
	12	-0.04	1	26	35	83	11.5	–	12	6	2817A.012
	16	-0.04	1	32	40	92	15.5	–	16	8	2817A.016

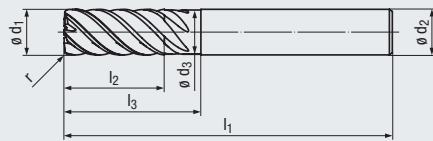
- High performance tool
- Multi-tooth end mill
- Newly developed, low-vibration geometry
- Very stable tool design
- Tighter cutting diameter tolerance

**H**

ASME DIN

40° CH x 45°

44-66 HRC



Icon descriptions (see pages 160-161)



**Coating**

**TIALN**

**Applications – Materials (see page 9)**

**Cutting Data (see page 124)**

- For almost all materials
- Hard milling up to 66 HRC
- Very suitable for HSC finishing

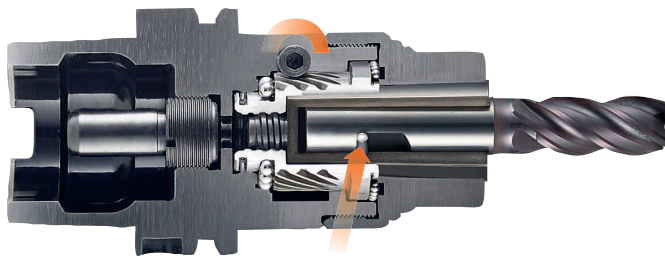
<b>P</b>	1.1-5.1	3.1-4.1
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-2.1	2.2
<b>K</b>	3.1-4.1	4.2
<b>S</b>	1.1-2.6	
<b>H</b>	1.1-1.5	

**Long length**

	$\phi d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\phi d_3$	$\phi d_2$ h5	Chamfer	# Flutes	Tool No. Straight Shank
[inch]	1/4	-0.0016	17/32	3/4	2 1/4	0.242	1/4	0.003	6	2887A.0250
	5/16	-0.0016	3/4	1	2 1/2	0.301	5/16	0.003	8	2887A.03125
	3/8	-0.0016	7/8	1 1/8	2 3/4	0.358	3/8	0.003	10	2887A.0375
	1/2	-0.0016	1 1/8	1 3/8	3 1/4	0.480	1/2	0.004	12	2887A.0500
	5/8	-0.0016	1 1/4	1 1/2	3 1/2	0.605	5/8	0.004	16	2887A.0625
	3/4	-0.0016	1 1/2	1 7/8	4	0.730	3/4	0.004	18	2887A.0750
[mm]	6	-0.02	13	20	57	5.8	6	0.080	6	2887A.006
	8	-0.04	19	25	63	7.7	8	0.080	8	2887A.008
	10	-0.04	22	30	72	9.5	10	0.080	10	2887A.010
	12	-0.04	26	35	83	11.5	12	0.080	12	2887A.012
	16	-0.04	32	40	92	15.5	16	0.100	16	2887A.016
	20	-0.04	38	50	104	19.5	20	0.100	20	2887A.020

**EMUGE-FRANKEN high precision / performance FPC Mill / Drill Chucks**

**Mechanical drive actuated with a hex wrench.** Simple design, highly accurate.



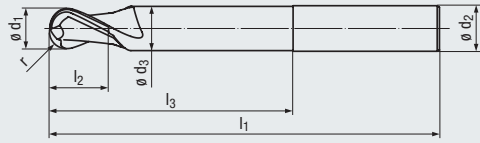
**Optimal Pull-Out Protection** via optional Pin-Lock Collet System.

**World's only chuck with 1:16 worm gear,** a patented design delivering 3 tons of traction force.

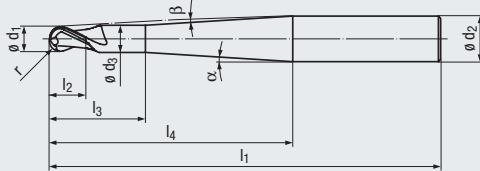
**Maximum dampening** collet-cone assembly absorbs virtually all vibration.

**High rigidity** patented design and body provides 100% holding power.

- High performance tool
- Patented chisel edge
- 2 lengths available



Design I<sub>4</sub>:



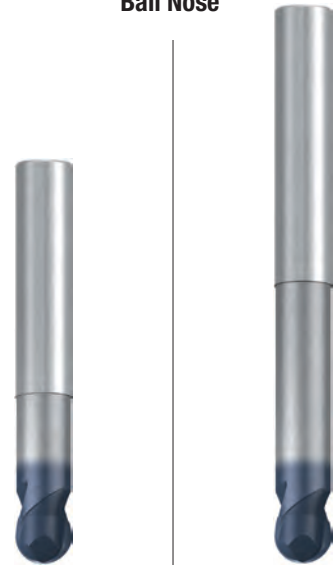
**H**

ASME DIN

30° Ball

**≥ 63 HRC**

Ball Nose



Icon descriptions (see pages 160-161)

**Coating**

**TIALN**

Applications – Materials (see page 9)

Cutting Data (see page 125)

- For hardened materials
- Suitable for roughing, finishing and HSC finishing

<b>P</b>	3.1-5.1	1.1-2.1
<b>K</b>	1.1-4.2	
<b>H</b>	1.1-1.4	

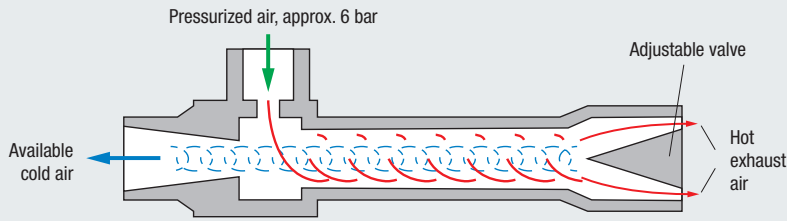
**Stub length**

	$\phi d_1$ ±0.0004	r ±0.0002	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
[inch]	1/4	0.1250	1/4	1/2	2	0.236	–	1/4	–	–	2	1976A.0250
	5/16	0.1562	9/32	1	2 1/2	0.295	–	5/16	–	–	2	1976A.03125
	3/8	0.1875	5/16	1 1/8	2 3/4	0.358	–	3/8	–	–	2	1976A.0375
	7/16	0.2188	11/32	1 1/8	3	0.417	–	7/16	–	–	2	1976A.04375
	1/2	0.2500	3/8	1 3/8	3 1/4	0.480	–	1/2	–	–	2	1976A.0500
[mm]	0.5	0.25	1	2	57	0.45	20	6	10°	8.5°	2	1976A.0005
	1	0.5	2	4	57	0.95	20	6	10°	8°	2	1976A.001
	1.5	0.75	2.5	7.5	57	1.4	20	6	12.5°	7°	2	1976A.0015
	2	1	3	8	57	1.8	20	6	12°	6.5°	2	1976A.002
	3	1.5	3.5	10	57	2.8	20	6	11.5°	5°	2	1976A.003
	4	2	4	12	57	3.8	20	6	11°	3.5°	2	1976A.004
	5	2.5	5	14	57	4.7	20	6	10°	2°	2	1976A.005
	6	3	6	20	57	5.6	–	6	–	–	2	1976A.006
	8	4	7	25	63	7.6	–	8	–	–	2	1976A.008
	10	5	8	30	72	9.6	–	10	–	–	2	1976A.010
	12	6	10	35	83	11.5	–	12	–	–	2	1976A.012
	12	6	10	35	92	11.5	40	16	35°	3.5°	2	1976A.01216
16	8	12	40	92	15.5	–	16	–	–	2	1976A.016	

**Long length**

	$\phi d_1$ ±0.01	r ±0.005	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
[mm]	8	4	7	40	90	7.6	–	8	–	–	2	1974A.008
	10	5	8	50	100	9.6	–	10	–	–	2	1974A.010
	12	6	10	65	120	11.5	–	12	–	–	2	1974A.012
	16	8	12	80	140	15.5	–	16	–	–	2	1974A.016





Cooled air reduces temperatures in the cutting area, which in turn permits higher cutting speeds and longer tool life. This type of cooling enables modern coatings to achieve their full potential, as damage to the cutting edge resulting from thermal shock is avoided.

Moreover, the cold-air nozzle helps to remove the tiny chips produced in copy milling even from deep recesses or cavities.

The function of the cold-air nozzle is based on the principle of the vortex tube, in which two opposed, rotating air streams are generated (without any moving parts). The internal air stream exits from one end, in the form of useable cold air with a temperature as low as  $-8^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ). All that is required is a normal pressurized air connection.

**Cold-Air Nozzle**

Delivery includes:

- Flexible hose (length approx. 12" (300 mm) for cold air)
- Silencer (SN14) for hot exhaust air
- Ball-valve with fitting for inlet hose .236" (6 mm) with quick-change attachment .285" (7.2 mm)



Spare hose in additional lengths available upon request

<b>Overall length</b>	<b>Tool no.</b>
8.85" (225mm) without hose	6910.15

**Holders for Cold-Air Nozzle**

Individual socket and holder components available upon request.

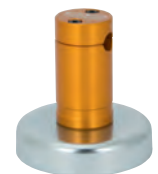


**Socket with basic holder**



**Tool no.**  
6910.24

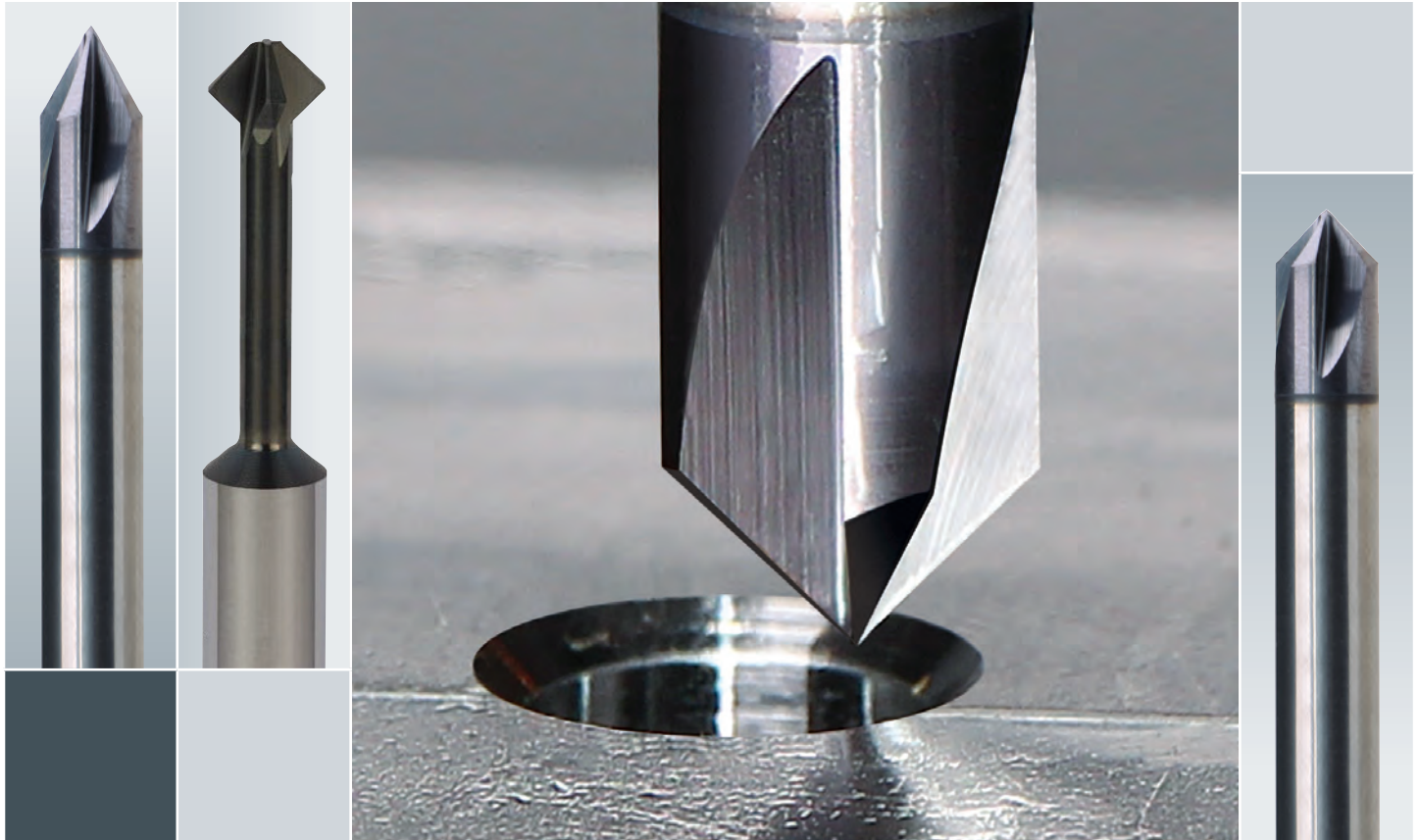
**Socket with magnetic shoe**



**Tool no.**  
6910.25

# Solid Carbide Chamfer Mills

*For Chamfering, Countersinking and Deburring*



**Chamfer Mills** are multi-functional – used for chamfering, countersinking and deburring. For optimum performance this style of tool is used in a milling pass and not as a plunging tool.

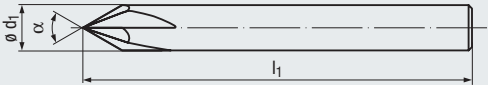
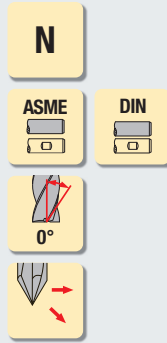
Quickly mill linear chamfer angles and create chamfer angles for threaded holes.

- **Multi-functional tools**
- Suitable for a wide variety of materials
- Ultra-fine grain carbide
- **TIALN coated** for wear and heat resistance
- **60° and 90° chamfer angles** for chamfering edges and threaded hole chamfers
- **45° chamfer angle** for front and back deburring of edges, grooves and drill holes
- Straight cylindrical shank ground to an h6 tolerance

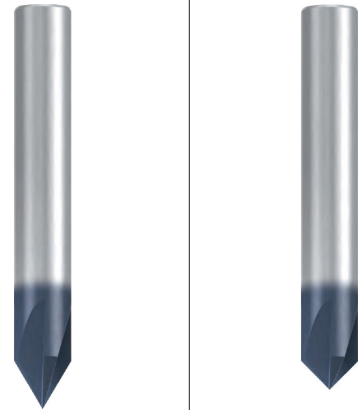
*German engineered  
EMUGE-FRANKEN quality*



- Multi-functional tool
- With 4 flutes
- Taper angle 60° or 90°



Icon descriptions (see pages 160-161)



**Coating**

**Applications – Materials (see page 9)**

- Ideal for most materials
- For materials with a tensile strength of up to 1400 N/mm<sup>2</sup>
- For chamfering edges and slots

**TIAN**

<b>P</b>	1.1-4.1	5.1
<b>M</b>	1.1-4.1	
<b>K</b>	1.1-2.1	2.2-3.2
<b>K</b>	4.1	4.2
<b>N</b>	1.2-4.3	
<b>N</b>	5.1-5.3	
<b>S</b>	1.1-2.2	

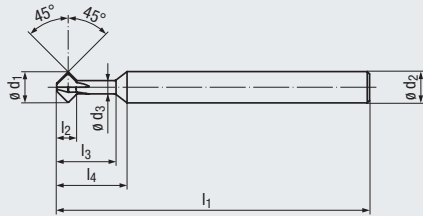
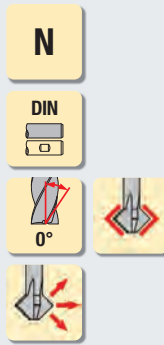
**60° Angle**

	$\varnothing d_1$ h6	$l_1$	# Flutes	Tool No. Straight Shank
[inch]	1/8	2	4	1715A.060125
	1/4	2 1/2	4	1715A.060250
	3/8	3	4	1715A.060375
	1/2	3	4	1715A.060500
	5/8	4	4	1715A.060625
[mm]	4	54	4	1715A.06004
	6	54	4	1715A.06006
	8	58	4	1715A.06008
	10	66	4	1715A.06010
	12	73	4	1715A.06012

**90° Angle**

	$\varnothing d_1$ h6	$l_1$	# Flutes	Tool No. Straight Shank
[inch]	1/8	2	4	1715A.090125
	1/4	2 1/2	4	1715A.090250
	3/8	3	4	1715A.090375
	1/2	3	4	1715A.090500
	5/8	4	4	1715A.090625
[mm]	4	54	4	1715A.09004
	6	54	4	1715A.09006
	8	58	4	1715A.09008
	10	66	4	1715A.09010
	12	73	4	1715A.09012

- Multi-functional tool
- 3 different machining lengths
- 4 flutes
- Chamfering angle 45°



Icon descriptions (see pages 160-161)



**Coating**

**ALCR**

**Applications – Materials (see page 9)**

- For almost all materials
- For materials with a tensile strength of up to 1400 N/mm<sup>2</sup>
- For front and back deburring of edges, grooves and drill holes

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.1-1.4	1.5-1.6
N	2.1-2.8, 5.2	
S	1.1-1.3	2.1-2.6

**Tool Dimensions / mm**

**45° Angle**

$\varnothing d_1$ h10	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	# Flutes	Tool No.
5.7	3.3	10	68	2.8	12	6	4	1700L.05710A
5.7	3.3	20	68	2.8	22	6	4	1700L.05720A
5.7	3.3	30	68	2.8	32	6	4	1700L.05730A
7.7	5	15	80	3.4	18	8	4	1700L.07715A
7.7	5	25	80	3.4	28	8	4	1700L.07725A
7.7	5	35	80	3.4	38	8	4	1700L.07735A

# High Performance Micro End Mills

## *For Small, Difficult, High Precision Machining*



**Micro** end mills with newly developed neck geometry enable the optimal application of these tools, even in deep contours. Their high radial bending strength withstands alternating radial stress on the cutting edge and thus on the relieved neck during the machining process. The end mills feature a newly developed ALCR coating to provide the best possible wear resistance and to maximize the service life of the tools.

*German engineered  
EMUGE-FRANKEN quality*

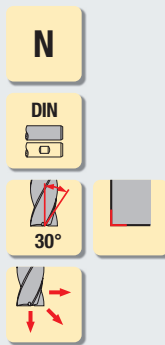
### **Advantages and Applications:**

- High precision machining
- High precision cutting geometry and large range of dimensions
- For machining smallest engravings, electrodes and components
- For almost all materials including hardened steels up to 55 HRC
- For HSC finishing of 2D and 3D contours
- Cavities with different depths can be machined

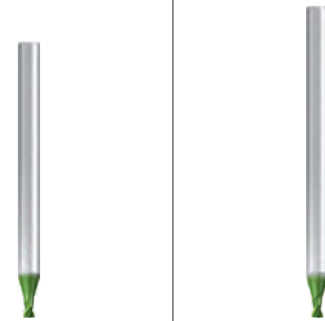
### **Types of tools:**

- Solid carbide micro and mini end mills, in addition to ball nose and torus configurations
- CBN micro and mini end mills also available upon request

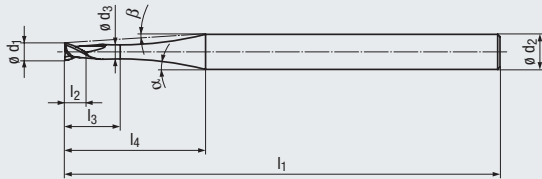
- Multi-functional tool
- Special neck designs
- Center cutting
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- No edge chamfer generates sharp corner at the workpiece



Sharp-edged



$L_3 = 2.2 \times d_1$



Icon descriptions (see pages 160-161)

**Coating**

**ALCR**

Applications – Materials (see page 10)

Cutting Data (see pages 126)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-4.2	
<b>N</b>	1.1-4.2, 5.2-5.3	
<b>S</b>		1.1-2.1
<b>H</b>		1.1-1.2

**Tool Dimensions / mm**

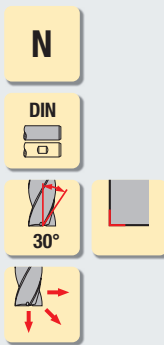
**Standard length**

$\emptyset d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\emptyset d_3$	$l_4$	$\emptyset d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.12	0.44	38	0.16	5.7	3	15°	14°	2	2760L.0002
0.3	-0.019	0.18	0.66	38	0.24	5.8	3	16.5°	14°	2	2760L.0003
0.4	-0.022	0.24	0.88	38	0.32	5.8	3	16.5°	13.5°	2	2760L.0004
0.5	-0.025	0.3	1.1	38	0.4	5.8	3	15°	13°	2	2760L.0005
0.6	-0.028	0.36	1.32	38	0.48	5.9	3	16.5°	12°	2	2760L.0006
0.7	-0.031	0.42	1.54	38	0.56	5.9	3	16.5°	11.5°	2	2760L.0007
0.8	-0.034	0.48	1.76	38	0.64	5.9	3	15°	11°	2	2760L.0008
0.9	-0.037	0.54	1.98	38	0.72	5.9	3	17°	10.5°	2	2760L.0009
1	-0.040	0.6	2.2	38	0.8	5.9	3	15°	10°	2	2760L.0010
1.1	-0.040	0.66	2.42	38	0.88	6	3	17°	9.5°	2	2760L.0011
1.2	-0.040	0.72	2.64	38	0.96	6	3	17°	9°	2	2760L.0012
1.3	-0.040	0.78	2.86	38	1.04	6	3	17°	8.5°	2	2760L.0013
1.4	-0.040	0.84	3.08	38	1.12	6.1	3	17°	8°	2	2760L.0014
1.5	-0.040	0.9	3.3	38	1.2	6.1	3	15°	8°	2	2760L.0015
1.6	-0.040	0.96	3.52	38	1.28	6.2	3	16.5°	7°	2	2760L.0016
1.7	-0.040	1.02	3.74	38	1.36	6.2	3	17°	6.5°	2	2760L.0017
1.8	-0.040	1.08	3.96	38	1.44	6.2	3	15°	6°	2	2760L.0018
1.9	-0.040	1.14	4.18	38	1.52	6.2	3	17.5°	5.5°	2	2760L.0019
2	-0.040	1.2	4.4	50	1.6	11.9	6	15°	10°	2	2760L.0020

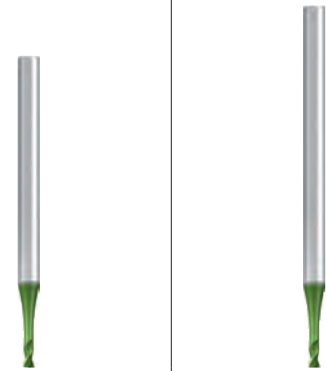
**Long length**

$\emptyset d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\emptyset d_3$	$l_4$	$\emptyset d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	0.6	43	0.16	5.7	3	15°	14°	2	2763L.0002
0.5	-0.025	0.5	1.1	43	0.4	5.8	3	15°	13°	2	2763L.0005
0.8	-0.034	0.8	1.76	43	0.64	5.9	3	15°	11°	2	2763L.0008
1	-0.040	1	2.2	43	0.8	5.9	3	15°	10°	2	2763L.0010
1.5	-0.040	1.5	3.3	43	1.2	6.1	3	15°	8°	2	2763L.0015
1.8	-0.040	1.8	3.96	43	1.44	6.2	3	15°	6°	2	2763L.0018
2	-0.040	2	4.4	57	1.6	11.9	6	15°	10°	2	2763L.0020

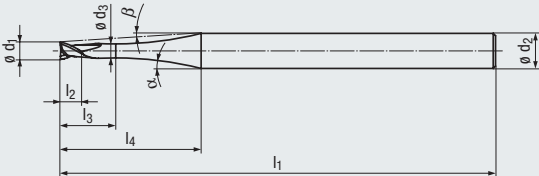
- Multi-functional tool
- Special neck designs
- Center cutting
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- No edge chamfer generates sharp corner at the workpiece



**Sharp-edged**



$L_3 = 5 \times d_1$



Icon descriptions (see pages 160-161)

**Coating**

**ALCR**

Applications – Materials (see page 10)

Cutting Data (see page 127)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-4.2	
<b>N</b>	1.1-4.2, 5.2-5.3	
<b>S</b>		1.1-2.1
<b>H</b>		1.1-1.2

**Tool Dimensions / mm**

**Short length**

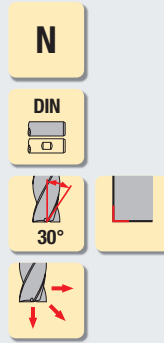
$\varnothing d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	1	38	0.16	6.4	3	15°	13°	2	2761L.0002
0.3	-0.019	0.3	1.5	38	0.24	6.9	3	16°	11.5°	2	2761L.0003
0.4	-0.022	0.4	2	38	0.32	7.4	3	15.5°	10.5°	2	2761L.0004
0.5	-0.025	0.5	2.5	38	0.4	7.8	3	15°	10°	2	2761L.0005
0.6	-0.028	0.6	3	38	0.48	8.3	3	15°	9°	2	2761L.0006
0.7	-0.031	0.7	3.5	38	0.56	8.8	3	14.5°	8°	2	2761L.0007
0.8	-0.034	0.8	4	38	0.64	9	3	15°	8°	2	2761L.0008
0.9	-0.037	0.9	4.5	38	0.72	9.5	3	14°	7°	2	2761L.0009
1	-0.040	1	5	43	0.8	9.7	3	15°	6°	2	2761L.0010
1.1	-0.040	1.1	5.5	43	0.88	10	3	14°	6°	2	2761L.0011
1.2	-0.040	1.2	6	43	0.96	10.5	3	13.5°	5.5°	2	2761L.0012
1.3	-0.040	1.3	6.5	43	1.04	11	3	12.5°	5°	2	2761L.0013
1.4	-0.040	1.4	7	43	1.12	11.5	3	12°	4.5°	2	2761L.0014
1.5	-0.040	1.5	7.5	43	1.2	11.8	3	14°	4°	2	2761L.0015
1.6	-0.040	1.6	8	43	1.28	12	3	12°	4°	2	2761L.0016
1.7	-0.040	1.7	8.5	43	1.36	12.5	3	11°	3.5°	2	2761L.0017
1.8	-0.040	1.8	9	43	1.44	12.9	3	12°	3°	2	2761L.0018
1.9	-0.040	1.9	9.5	43	1.52	13.2	3	10°	3°	2	2761L.0019
2	-0.040	2	10	50	1.6	19.7	6	15°	6°	2	2761L.0020

**Long length**

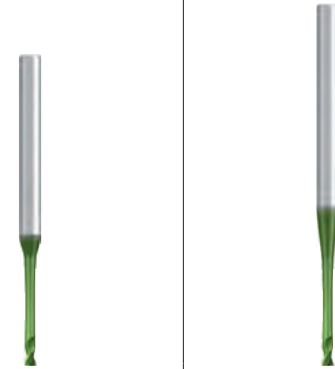
$\varnothing d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	1	43	0.16	6.4	3	15°	13°	2	2764L.0002
0.5	-0.025	0.5	2.5	43	0.4	7.8	3	15°	10°	2	2764L.0005
0.8	-0.034	0.8	4	43	0.64	9	3	15°	8°	2	2764L.0008
1	-0.040	1	5	50	0.8	9.7	3	15°	6°	2	2764L.0010
1.5	-0.040	1.5	7.5	50	1.2	11.8	3	14°	4°	2	2764L.0015
1.8	-0.040	1.8	9	50	1.44	12.9	3	12°	3°	2	2764L.0018
2	-0.040	2	10	57	1.6	19.7	6	15°	6°	2	2764L.0020



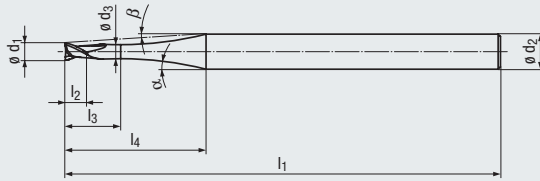
- Multi-functional tool
- Special neck designs
- Center cutting
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- No edge chamfer generates sharp corner at the workpiece



Sharp-edged



$L_3 = 10 \times d_1$



Icon descriptions (see pages 160-161)

**Coating**

Applications – Materials (see page 10)

Cutting Data (see page 128)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

**ALCR**

P	1.1-5.1
M	1.1-2.1 3.1-4.1
K	1.1-4.2
N	1.1-4.2, 5.2-5.3
S	1.1-2.1
H	1.1-1.2

**Tool Dimensions / mm**

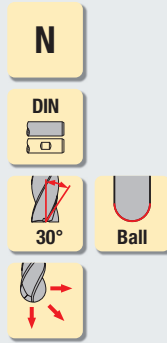
**Standard length**

$\emptyset d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\emptyset d_3$	$l_4$	$\emptyset d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	2	38	0.16	9.2	3	15°	9°	2	2762L.0002
0.3	-0.019	0.3	3	38	0.24	9.7	3	13.5°	8.5°	2	2762L.0003
0.4	-0.022	0.4	4	38	0.32	10.2	3	14°	8°	2	2762L.0004
0.5	-0.025	0.5	5	38	0.4	10.7	3	13°	6°	2	2762L.0005
0.6	-0.028	0.6	6	38	0.48	11.6	3	14°	6.5°	2	2762L.0006
0.7	-0.031	0.7	7	38	0.56	12.5	3	14°	6°	2	2762L.0007
0.8	-0.034	0.8	8	38	0.64	13.5	3	12°	4°	2	2762L.0008
0.9	-0.037	0.9	9	38	0.72	14.4	3	13°	5°	2	2762L.0009
1	-0.040	1	10	43	0.8	15.3	3	11°	3°	2	2762L.0010
1.1	-0.040	1.1	11	43	0.88	15.9	3	13°	4°	2	2762L.0011
1.2	-0.040	1.2	12	43	0.96	16.5	3	13.5°	4°	2	2762L.0012
1.3	-0.040	1.3	13	43	1.04	17.1	3	14°	3.5°	2	2762L.0013
1.4	-0.040	1.4	14	43	1.12	17.6	3	15°	3.5°	2	2762L.0014
1.5	-0.040	1.5	15	43	1.2	18.1	3	14.6°	3°	2	2762L.0015
1.6	-0.040	1.6	16	43	1.28	18.7	3	17°	3°	2	2762L.0016
1.7	-0.040	1.7	17	43	1.36	19.3	3	18.5°	2.5°	2	2762L.0017
1.8	-0.040	1.8	18	43	1.44	20	3	19.8°	2°	2	2762L.0018
1.9	-0.040	1.9	19	43	1.52	20.5	3	23.5°	2.5°	2	2762L.0019
2	-0.040	2	20	50	1.6	25	6	22.1°	6°	2	2762L.0020

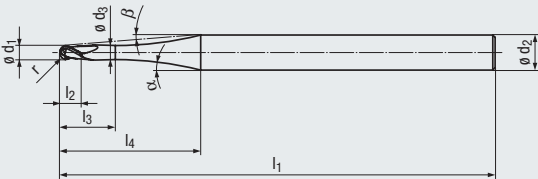
**Long length**

$\emptyset d_1$	tolerance	$l_2$	$l_3$	$l_1$	$\emptyset d_3$	$l_4$	$\emptyset d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	2	43	0.16	9.2	3	15°	9°	2	2765L.0002
0.5	-0.025	0.5	5	43	0.4	14.5	3	13°	6°	2	2765L.0005
0.8	-0.034	0.8	8	43	0.64	15.5	3	9.8°	4°	2	2765L.0008
1	-0.040	1	10	50	0.8	20.6	3	8.5°	3°	2	2765L.0010
1.5	-0.040	1.5	15	50	1.2	22	3	6.2°	2°	2	2765L.0015
1.8	-0.040	1.8	18	50	1.44	22	3	5.3°	2°	2	2765L.0018
2	-0.040	2	20	57	1.6	29	6	7.8°	4°	2	2765L.0020

- Multi-functional tool
- Optimized chisel edge
- Special neck designs
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- Highly accurate dimensional tolerance  $\pm 5 \mu\text{m}$



$L_3 = 2.2 \times d_1$



Icon descriptions (see pages 160-161)

**Ball Nose**



**ALCR**

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-4.2	
<b>N</b>	1.1-4.2, 5.2-5.3	
<b>S</b>		1.1-2.1
<b>H</b>		1.1-1.2

**Coating**

Applications – Materials (see page 10)

Cutting Data (see page 129)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

**Tool Dimensions / mm**

**Standard length**

$\phi d_1$ $\pm 0.01$	r $\pm 0.005$	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	0.1	0.12	0.44	38	0.16	5.7	3	15°	14°	2	2770L.0002
0.3	0.15	0.18	0.66	38	0.24	5.8	3	16.5°	14°	2	2770L.0003
0.4	0.2	0.24	0.88	38	0.32	5.8	3	16.5°	13.5°	2	2770L.0004
0.5	0.25	0.3	1.1	38	0.4	5.8	3	15°	13°	2	2770L.0005
0.6	0.3	0.36	1.32	38	0.48	5.9	3	16.5°	12°	2	2770L.0006
0.7	0.35	0.42	1.54	38	0.56	5.9	3	16.5°	11.5°	2	2770L.0007
0.8	0.4	0.48	1.76	38	0.64	5.9	3	15°	11°	2	2770L.0008
0.9	0.45	0.54	1.98	38	0.72	5.9	3	17°	10.5°	2	2770L.0009
1	0.5	0.6	2.2	43	0.8	7.8	4	15°	11°	2	2770L.0010
1.1	0.55	0.66	2.42	43	0.88	7.9	4	16.5°	11°	2	2770L.0011
1.2	0.6	0.72	2.64	43	0.96	7.9	4	15°	11°	2	2770L.0012
1.3	0.65	0.78	2.86	43	1.04	8	4	16.5°	10.5°	2	2770L.0013
1.4	0.7	0.84	3.08	43	1.12	8	4	16.5°	10°	2	2770L.0014
1.5	0.75	0.9	3.3	43	1.2	8	4	15°	9°	2	2770L.0015
1.6	0.8	0.96	3.52	43	1.28	8.1	4	16.5°	9°	2	2770L.0016
1.7	0.85	1.02	3.74	43	1.36	8.1	4	16.5°	9°	2	2770L.0017
1.8	0.9	1.08	3.96	43	1.44	8.1	4	15°	8°	2	2770L.0018
1.9	0.95	1.14	4.18	43	1.52	8.2	4	16.5°	8°	2	2770L.0019
2	1	1.2	4.4	57	1.6	11.9	6	15°	10°	2	2770L.0020

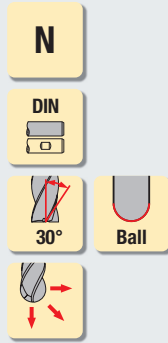
**Long length**

$\phi d_1$	r	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	0.1	0.12	0.6	50	0.16	5.7	3	15°	14°	2	2773L.0002
0.5	0.25	0.3	1.1	50	0.4	5.8	3	15°	13°	2	2773L.0005
0.8	0.4	0.48	1.76	50	0.64	5.9	3	15°	11°	2	2773L.0008
1	0.5	0.6	2.2	60	0.8	7.8	4	15°	11°	2	2773L.0010
1.2	0.6	0.72	2.64	60	0.96	7.9	4	15°	11°	2	2773L.0012
1.5	0.75	0.9	3.3	60	1.2	8	4	15°	9°	2	2773L.0015
1.8	0.9	1.08	3.96	60	1.44	8.1	4	15°	8°	2	2773L.0018
2	1	1.2	4.4	70	1.6	11.9	6	15°	10°	2	2773L.0020

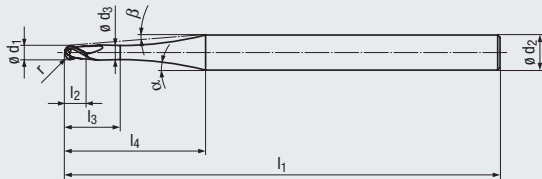
**Extra long length**

$\phi d_1$	r	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	0.1	0.12	0.6	80	0.16	11.3	6	15°	15°	2	2776L.0002
0.5	0.25	0.3	1.1	80	0.4	11.4	6	15°	14°	2	2776L.0005
0.8	0.4	0.48	1.76	80	0.64	11.5	6	15°	13°	2	2776L.0008
1	0.5	0.6	2.2	80	0.8	11.5	6	15°	13°	2	2776L.0010
1.2	0.6	0.72	2.64	80	0.96	11.6	6	15°	12°	2	2776L.0012
1.5	0.75	0.9	3.3	80	1.2	11.7	6	15°	11°	2	2776L.0015
1.8	0.9	1.08	3.96	80	1.44	11.8	6	15°	11°	2	2776L.0018
2	1	1.2	4.4	80	1.6	11.9	6	15°	10°	2	2776L.0020

- Multi-functional tool
- Optimized chisel edge
- Special neck designs
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- Highly accurate dimensional tolerance  $\pm 5 \mu\text{m}$

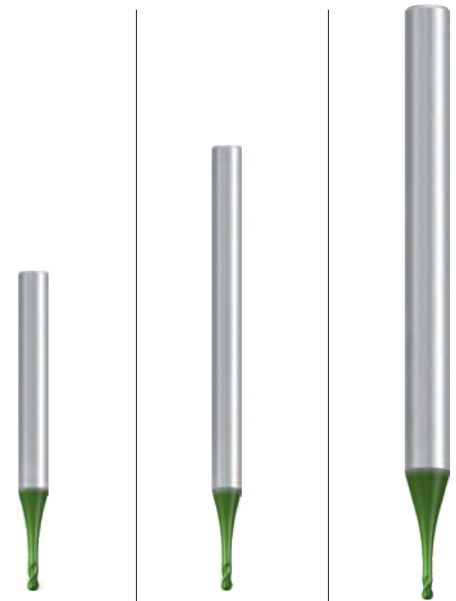


$L_3 = 5 \times d_1$



Icon descriptions (see pages 160-161)

Ball Nose



Coating

Applications – Materials (see page 10)

Cutting Data (see page 130)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

Tool Dimensions / mm

Standard length

$\varnothing d_1$ $\pm 0.01$	r $\pm 0.005$	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	0.1	0.2	1	38	0.16	6.4	3	15°	13°	2	2771L.0002
0.3	0.15	0.3	1.5	38	0.24	6.9	3	16°	11.5°	2	2771L.0003
0.4	0.2	0.4	2	38	0.32	7.4	3	15.5°	10.5°	2	2771L.0004
0.5	0.25	0.5	2.5	38	0.4	7.8	3	15°	10°	2	2771L.0005
0.6	0.3	0.6	3	38	0.48	8.3	3	15°	9°	2	2771L.0006
0.7	0.35	0.7	3.5	38	0.56	8.8	3	14°	8°	2	2771L.0007
0.8	0.4	0.8	4	38	0.64	9	3	15°	8°	2	2771L.0008
0.9	0.45	0.9	4.5	38	0.72	9.5	3	14°	7°	2	2771L.0009
1	0.5	1	5	43	0.8	11.6	4	15°	8°	2	2771L.0010
1.1	0.55	1.1	5.5	43	0.88	12	4	14.5°	7.5°	2	2771L.0011
1.2	0.6	1.2	6	43	0.96	12.4	4	15°	7°	2	2771L.0012
1.3	0.65	1.3	6.5	43	1.04	12.8	4	14°	6.5°	2	2771L.0013
1.4	0.7	1.4	7	43	1.12	13.2	4	14°	6.5°	2	2771L.0014
1.5	0.75	1.5	7.5	43	1.2	13.7	4	15°	6°	2	2771L.0015
1.6	0.8	1.6	8	43	1.28	14.1	4	13°	5.5°	2	2771L.0016
1.7	0.85	1.7	8.5	43	1.36	14.5	4	12.5°	5°	2	2771L.0017
1.8	0.9	1.8	9	43	1.44	15	4	15°	5°	2	2771L.0018
1.9	0.95	1.9	9.5	43	1.52	15.5	4	11.5°	4.5°	2	2771L.0019
2	1	2	10	57	1.6	19.7	6	15°	6°	2	2771L.0020

Long length

											Tool No. Straight Shank
0.2	0.1	0.2	1	50	0.16	6.4	3	15°	13°	2	2774L.0002
0.5	0.25	0.5	2.5	50	0.4	7.8	3	15°	10°	2	2774L.0005
0.8	0.4	0.8	4	50	0.64	9	3	15°	8°	2	2774L.0008
1	0.5	1	5	60	0.8	11.6	4	15°	8°	2	2774L.0010
1.2	0.6	1.2	6	60	0.96	12.4	4	15°	7°	2	2774L.0012
1.5	0.75	1.5	7.5	60	1.2	13.7	4	15°	6°	2	2774L.0015
1.8	0.9	1.8	9	60	1.44	15	4	15°	5°	2	2774L.0018
2	1	2	10	70	1.6	19.7	6	15°	6°	2	2774L.0020

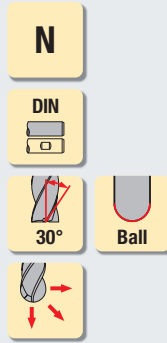
Extra long length

											Tool No. Straight Shank
0.2	0.1	0.2	1	80	0.16	12	6	15°	14°	2	2777L.0002
0.5	0.25	0.5	2.5	80	0.4	13.4	6	15°	12°	2	2777L.0005
0.8	0.4	0.8	4	80	0.64	14.6	6	15°	11°	2	2777L.0008
1	0.5	1	5	80	0.8	15.3	6	15°	10°	2	2777L.0010
1.2	0.6	1.2	6	80	0.96	16.2	6	15°	9°	2	2777L.0012
1.5	0.75	1.5	7.5	80	1.2	17.4	6	15°	8°	2	2777L.0015
1.8	0.9	1.8	9	80	1.44	18.7	6	15°	7°	2	2777L.0018
2	1	2	10	80	1.6	19.7	6	15°	6°	2	2777L.0020

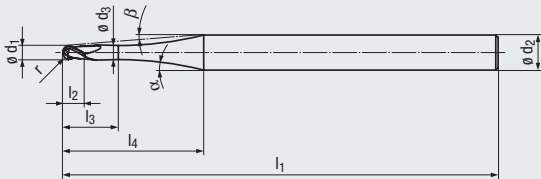
ALCR

P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-4.2	
N	1.1-4.2, 5.2-5.3	
S		1.1-2.1
H		1.1-1.2

- Multi-functional tool
- Optimized chisel edge
- Special neck designs
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- Highly accurate dimensional tolerance  $\pm 5 \mu\text{m}$

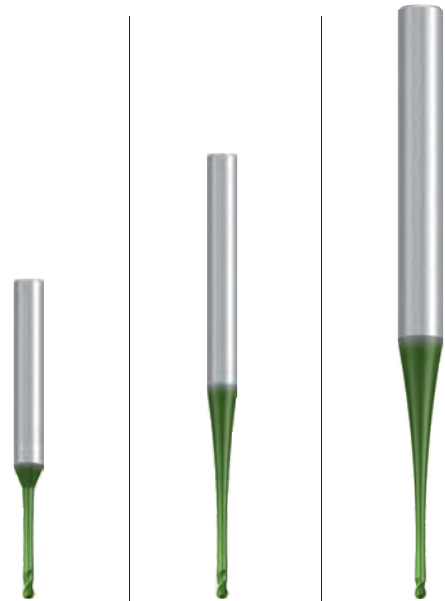


$L_3 = 10 \times d_1$



Icon descriptions (see pages 160-161)

**Ball Nose**



**Coating**

**ALCR**

Applications – Materials (see page 11)

Cutting Data (see page 131)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

Tool Dimensions / mm

**Standard length**

$\varnothing d_1$ $\pm 0.01$	r $\pm 0.005$	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.2	0.1	0.2	2	38	0.16	9.2	3	15°	9°	2	2772L.0002
0.3	0.15	0.3	3	38	0.24	9.7	3	13.5°	8.5°	2	2772L.0003
0.4	0.2	0.4	4	38	0.32	10.2	3	14°	8°	2	2772L.0004
0.5	0.25	0.5	5	38	0.4	10.7	3	13°	6°	2	2772L.0005
0.6	0.3	0.6	6	38	0.48	10.6	3	17°	7°	2	2772L.0006
0.7	0.35	0.7	7	38	0.56	10.6	3	20.5°	7°	2	2772L.0007
0.8	0.4	0.8	8	38	0.64	10.5	3	8.2°	4°	2	2772L.0008
0.9	0.45	0.9	9	38	0.72	10.5	3	39.5°	6.5°	2	2772L.0009
1	0.5	1	10	43	0.8	18.3	4	8°	5°	2	2772L.0010
1.1	0.55	1.1	11	43	0.88	18.3	4	13.5°	5.5°	2	2772L.0011
1.2	0.6	1.2	12	43	0.96	18.2	4	9.3°	4°	2	2772L.0012
1.3	0.65	1.3	13	43	1.04	18.2	4	17°	5°	2	2772L.0013
1.4	0.7	1.4	14	43	1.12	18.1	4	20.5°	5°	2	2772L.0014
1.5	0.75	1.5	15	43	1.2	18.1	4	13.5°	4°	2	2772L.0015
1.6	0.8	1.6	16	43	1.28	18.5	4	29.5°	4.5°	2	2772L.0016
1.7	0.85	1.7	17	43	1.36	18.9	4	35.5°	4°	2	2772L.0017
1.8	0.9	1.8	18	43	1.44	19.5	4	31.1°	3°	2	2772L.0018
1.9	0.95	1.9	19	43	1.52	19.9	4	54.5°	3.5°	2	2772L.0019
2	1	2	20	57	1.6	32	6	9.5°	4°	2	2772L.0020

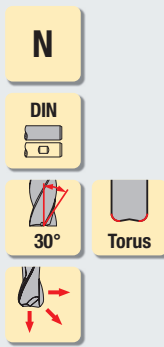
**Long length**

											Tool No. Straight Shank
0.2	0.1	0.2	2	50	0.16	9.2	3	15°	9°	2	2775L.0002
0.5	0.25	0.5	5	50	0.4	14.5	3	13°	6°	2	2775L.0005
0.8	0.4	0.8	8	50	0.64	18.7	3	9.8°	4°	2	2775L.0008
1	0.5	1	10	60	0.8	23.7	4	10.2°	4°	2	2775L.0010
1.2	0.6	1.2	12	60	0.96	26.1	4	9.1°	4°	2	2775L.0012
1.5	0.75	1.5	15	60	1.2	29.2	4	7.8°	3°	2	2775L.0015
1.8	0.9	1.8	18	60	1.44	31.9	4	6.8°	2°	2	2775L.0018
2	1	2	20	70	1.6	41.4	6	8.5°	3°	2	2775L.0020

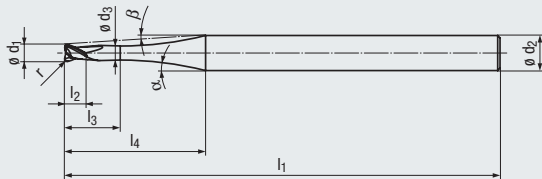
**Extra long length**

											Tool No. Straight Shank
0.2	0.1	0.2	2	80	0.16	14.8	6	15°	12°	2	2778L.0002
0.5	0.25	0.5	5	80	0.4	20.2	6	15°	8°	2	2778L.0005
0.8	0.4	0.8	8	80	0.64	25.9	6	14.8°	6°	2	2778L.0008
1	0.5	1	10	80	0.8	28.7	6	13°	6°	2	2778L.0010
1.2	0.6	1.2	12	80	0.96	31.8	6	11.7°	5°	2	2778L.0012
1.5	0.75	1.5	15	80	1.2	35.8	6	10.2°	4°	2	2778L.0015
1.8	0.9	1.8	18	80	1.44	39.3	6	9.1°	4°	2	2778L.0018
2	1	2	20	80	1.6	41.4	6	8.5°	3°	2	2778L.0020

- Multi-functional tool
- Optimized neck designs
- High-precision corner radius
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- Highly accurate dimensional tolerance  $\pm 5 \mu\text{m}$

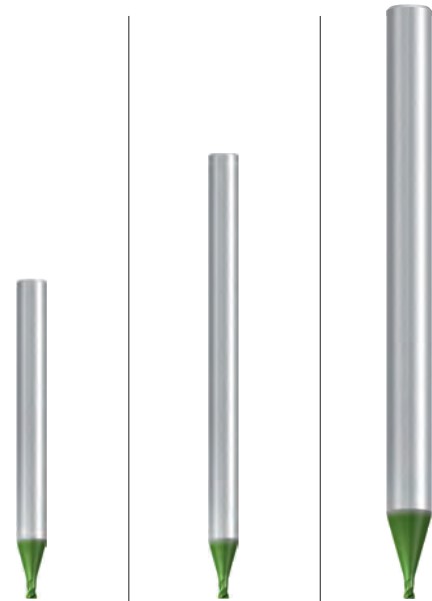


$L_3 = 2.2 \times d_1$



Icon descriptions (see pages 160-161)

**Torus**



**Coating**

**Applications – Materials** (see page 11)

**Cutting Data** (see page 132)

**Technical Data** (see page 166)

- For almost all materials
- For machining smallest engravings and components

**Tool Dimensions / mm**

**Standard length**

$\varnothing d_1$	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank	
<b>0.5</b>	$\pm 0.01$	$\pm 0.005$	0.3	1.1	38	0.4	5.8	3	15°	13°	<b>2</b>	<b>2780L.0005</b>
<b>0.6</b>	0.1	0.36	1.32	38	0.48	5.9	3	16.5°	12°	<b>2</b>	<b>2780L.0006</b>	
<b>0.8</b>	0.2	0.48	1.76	38	0.64	5.9	3	16.5°	11°	<b>2</b>	<b>2780L.0008</b>	
<b>1</b>	0.2	0.6	2.2	43	0.8	7.8	4	15°	11°	<b>2</b>	<b>2780L.0010</b>	
<b>1.2</b>	0.2	0.72	2.64	43	0.96	8	4	16.5°	10.5°	<b>2</b>	<b>2780L.0012</b>	
<b>1.5</b>	0.3	0.9	3.3	43	1.2	8	4	15°	9°	<b>2</b>	<b>2780L.0015</b>	
<b>1.6</b>	0.3	0.96	3.52	43	1.28	8.1	4	16.5°	9°	<b>2</b>	<b>2780L.0016</b>	
<b>1.8</b>	0.4	1.08	3.96	43	1.44	8.1	4	16.5°	8.5°	<b>2</b>	<b>2780L.0018</b>	
<b>2</b>	0.5	1.2	4.4	57	1.6	11.9	6	15°	10°	<b>2</b>	<b>2780L.0020</b>	

**Long length**

$\varnothing d_1$	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
<b>0.5</b>	0.1	0.3	1.1	50	0.4	5.8	3	15°	13°	<b>2</b>	<b>2783L.0005</b>
<b>1</b>	0.2	0.6	2.2	60	0.8	7.8	4	15°	11°	<b>2</b>	<b>2783L.0010</b>
<b>1.5</b>	0.3	0.9	3.3	60	1.2	8	4	15°	9°	<b>2</b>	<b>2783L.0015</b>
<b>2</b>	0.5	1.2	4.4	70	1.6	11.9	6	15°	10°	<b>2</b>	<b>2783L.0020</b>

**Extra long length**

$\varnothing d_1$	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
<b>0.5</b>	0.1	0.3	1.1	80	0.4	11.4	6	15°	14°	<b>2</b>	<b>2786L.0005</b>
<b>1</b>	0.2	0.6	2.2	80	0.8	11.5	6	15°	13°	<b>2</b>	<b>2786L.0010</b>
<b>1.5</b>	0.3	0.9	3.3	80	1.2	11.7	6	15°	11°	<b>2</b>	<b>2786L.0015</b>
<b>2</b>	0.5	1.2	4.4	80	1.6	11.9	6	15°	10°	<b>2</b>	<b>2786L.0020</b>

**ALCR**

<b>P</b>	1.1-5.1	3.1-4.1
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-4.2	
<b>N</b>	1.1-4.2, 5.2-5.3	
<b>S</b>	1.1-2.1	
<b>H</b>	1.1-1.2	



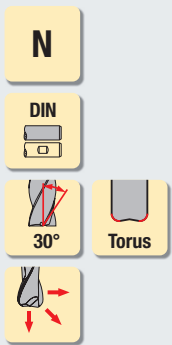
**EMUGE-FRANKEN high precision / performance FPC Mill / Drill Chucks**

provide unprecedented rigidity, vibration dampening, concentricity, machining speed, and tool life vs. conventional chuck technologies for milling and drilling applications. Available in a wide range of styles. Internal and peripheral coolant options, and MQL-adaptable.

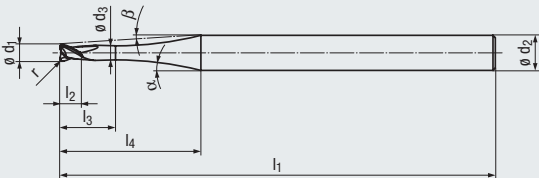
**CAT 40 MICRO**

FPC Micro Chucks slim design enables access to hard to reach areas, has high gripping torque and accuracy and special coated collets. For tool shank diameters 1-6 mm.

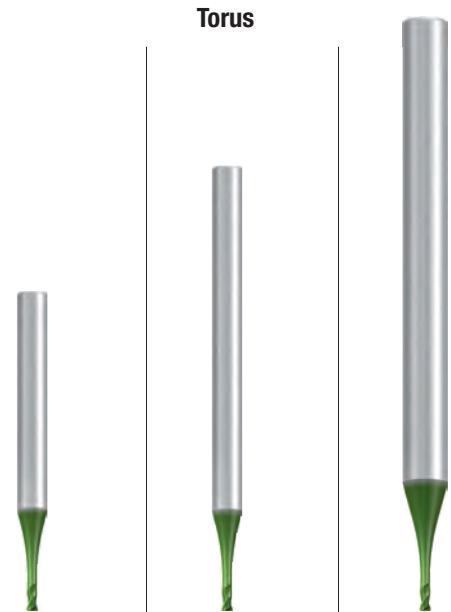
- Multi-functional tool
- Optimized neck designs
- High-precision corner radius
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- Highly accurate dimensional tolerance  $\pm 5 \mu\text{m}$



$L_3 = 5 \times d_1$



Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 11)

Cutting Data (see page 133)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

**Tool Dimensions / mm**

**Standard length**

$\phi d_1$	r	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank	
0.5	±0.01	±0.005	0.5	2.5	38	0.4	7.8	3	15°	10°	2	2781L.0005
0.6	0.1	0.6	3	38	0.48	8.3	3	15°	9°	2	2781L.0006	
0.8	0.2	0.8	4	38	0.64	9	3	14.5°	7.5°	2	2781L.0008	
1	0.2	1	5	43	0.8	11.6	4	15°	8°	2	2781L.0010	
1.2	0.2	1.2	6	43	0.96	12.4	4	14.5°	7°	2	2781L.0012	
1.5	0.3	1.5	7.5	43	1.2	13.7	4	15°	6°	2	2781L.0015	
1.6	0.3	1.6	8	43	1.28	14.1	4	13°	5.5°	2	2781L.0016	
1.8	0.4	1.8	9	43	1.44	15	4	12°	5°	2	2781L.0018	
2	0.5	2	10	57	1.6	19.7	6	15°	6°	2	2781L.0020	

**Long length**

$\phi d_1$	r	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.5	0.1	0.5	2.5	50	0.4	7.8	3	15°	10°	2	2784L.0005
1	0.2	1	5	60	0.8	11.6	4	15°	8°	2	2784L.0010
1.5	0.3	1.5	7.5	60	1.2	13.7	4	15°	6°	2	2784L.0015
2	0.5	2	10	70	1.6	19.7	6	15°	6°	2	2784L.0020

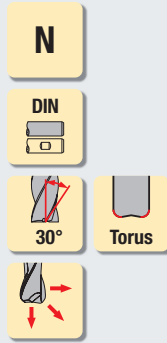
**Extra long length**

$\phi d_1$	r	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.5	0.1	0.5	2.5	80	0.4	13.4	6	15°	12°	2	2787L.0005
1	0.2	1	5	80	0.8	15.3	6	15°	10°	2	2787L.0010
1.5	0.3	1.5	7.5	80	1.2	17.4	6	15°	8°	2	2787L.0015
2	0.5	2	10	80	1.6	19.7	6	15°	6°	2	2787L.0020

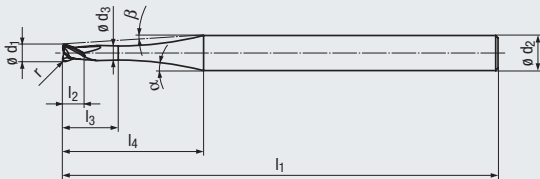
**ALCR**

P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-4.2	
N	1.1-4.2, 5.2-5.3	
S		1.1-2.1
H		1.1-1.2

- Multi-functional tool
- Optimized neck designs
- High-precision corner radius
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- Highly accurate dimensional tolerance  $\pm 5 \mu\text{m}$

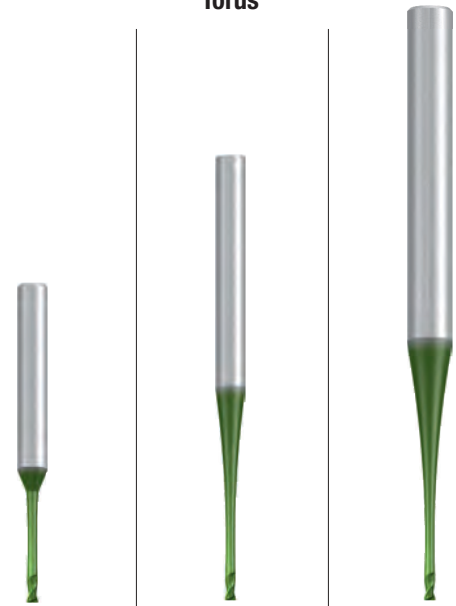


$L_3 = 10 \times d_1$



Icon descriptions (see pages 160-161)

**Torus**



**Coating**

Applications – Materials (see page 11)

Cutting Data (see page 134)

Technical Data (see page 166)

- For almost all materials
- For machining smallest engravings and components

**ALCR**

<b>P</b>	1.1-5.1
<b>M</b>	1.1-2.1 3.1-4.1
<b>K</b>	1.1-4.2
<b>N</b>	1.1-4.2, 5.2-5.3
<b>S</b>	1.1-2.1
<b>H</b>	1.1-1.2

**Tool Dimensions / mm**

**Standard length**

$\phi d_1$	$r$	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
$\pm 0.01$	$\pm 0.005$						h5				
0.5	0.1	0.5	5	38	0.4	10.7	3	13°	6°	2	2782L.0005
0.6	0.1	0.6	6	38	0.48	10.6	3	17°	7°	2	2782L.0006
0.8	0.2	0.8	8	38	0.64	10.5	3	27°	6.5°	2	2782L.0008
1	0.2	1	10	43	0.8	18.3	4	8°	5°	2	2782L.0010
1.2	0.2	1.2	12	43	0.96	18.2	4	15°	5°	2	2782L.0012
1.5	0.3	1.5	15	43	1.2	18.1	4	13.5°	4°	2	2782L.0015
1.6	0.3	1.6	16	43	1.28	18.5	4	29.5°	4.5°	2	2782L.0016
1.8	0.4	1.8	18	43	1.44	19.5	4	41°	4°	2	2782L.0018
2	0.5	2	20	57	1.6	32	6	9.5°	4°	2	2782L.0020

**Long length**

$\phi d_1$	$r$	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.5	0.1	0.5	5	50	0.4	14.5	3	13°	6°	2	2785L.0005
1	0.2	1	10	60	0.8	23.7	4	10.2°	4°	2	2785L.0010
1.5	0.3	1.5	15	60	1.2	29.2	4	7.8°	3°	2	2785L.0015
2	0.5	2	20	70	1.6	41.4	6	8.5°	3°	2	2785L.0020

**Extra long length**

$\phi d_1$	$r$	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
0.5	0.1	0.5	5	80	0.4	20.2	6	15°	8°	2	2788L.0005
1	0.2	1	10	80	0.8	28.7	6	13°	6°	2	2788L.0010
1.5	0.3	1.5	15	80	1.2	35.8	6	10.2°	4°	2	2788L.0015
2	0.5	2	20	80	1.6	41.4	6	8.5°	3°	2	2788L.0020

# Circle Segment High Performance End Mills

## For Aerospace and Turbine Machining Strategies



### Unique Geometry Designed for High Performance Machining

**Circle Segment** end mills, an EMUGE-FRANKEN innovation, feature unique design forms with large radii, allowing a much larger axial depth of cut during pre-finish and finishing. This generates higher cutting forces than conventional ball-nose cutters due to the large radii on the face and radial cutting edges. These tools enable substantially more material removal with fewer passes in 5-Axis machining, generating cycle time reductions of up to 90% and up to 50% smoother surface finishes.

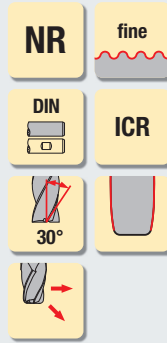
Circle Segment solid-carbide end mills are ideal for mold making, machining turbine blades, impellers and blisks, and are offered in four geometries. Oval and taper form mills are ideal for curved shapes, freely engaging more of the cutting edge. Barrel design mills provide highly effective flank milling to the sides of spiral grooves and similar applications, while lens shape mills excel in narrow channels or in lands on molds. Each type is available in various diameters and lengths. Specific CAM system software such as *hyperMill*® or *Mastercam*® is required to support and compute the geometries of Circle Segment end mills to achieve optimum performance.

**Up to 90%  
Cycle Time  
Reductions!**

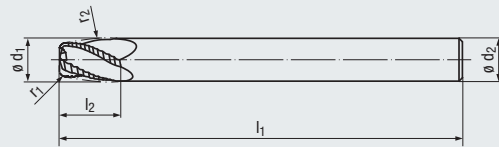
*German engineered  
EMUGE-FRANKEN quality*



- High performance tool
- With 4 flutes
- Variable spacing
- Low-vibration machining
- Highly efficient roughing



Oval Form



Icon descriptions (see pages 160-161)

**Coating**

Applications – Materials (see page 12)

Cutting Data (see page 135)

- Especially suitable for high-strength materials
- Also suitable in Nickel-based alloys
- For the machining of titanium alloys
- Suitable in all turbine materials
- Optimized for pre-finishing Impellers and Integrated Bladed Rotors (IBR) made from aluminum, titanium and Inconel

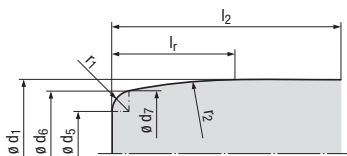
**Tool Dimensions / mm**

$\varnothing d_1$	$r_1$	$r_2$	$l_2$	$l_1$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
<b>8</b>	1	40	12	80	8	<b>4</b>	<b>3552LZ.08040A</b>
<b>10</b>	1.5	45	12	95	10	<b>4</b>	<b>3552LZ.10045A</b>
<b>12</b>	2	50	14	100	12	<b>4</b>	<b>3552LZ.12050A</b>
<b>16</b>	2	60	18	128	16	<b>4</b>	<b>3552LZ.16060A</b>

**ALCR**

- P** 1.1-5.1
- M** 1.1-4.1
- N** 1.1-1.3
- S** 1.1-1.3
- S** 2.2-2.6

**Dimensions for tool database**



- $l_r = r_2$  is tangential to  $d_1$
- $d_6$  = Tangent point of  $r_1$  and  $r_2$
- $d_7 = d_5 + 2 \times r_1$

$\varnothing d_1$	$r_1$	$r_2$	$l_2$	$l_r$	$\varnothing d_5$	$\varnothing d_6$	$\varnothing d_7$
<b>8</b>	1	40	12	10	3.895	5.841	5.895
<b>10</b>	1.5	45	12	10	5.323	8.265	8.323
<b>12</b>	2	50	14	12	5.894	9.806	9.894
<b>16</b>	2	60	18	16	8.570	12.452	12.570

- High performance tool
- With 4 flutes
- Variable spacing
- Low-vibration machining
- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm

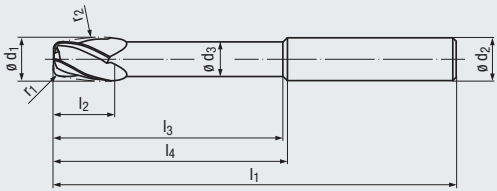
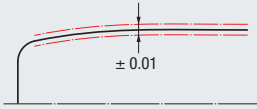
**N**

**DIN**

**ICR**

**30°**

**Form**  
 $\pm 0.01$



Icon descriptions (see pages 160-161)

Oval Form



**Coating**

**ALCR**

Applications – Materials (see page 12)

Cutting Data (see page 135)

- Especially suitable for high-strength materials
- Also suitable in Nickel-based alloys
- For the machining of titanium alloys
- Suitable in all turbine materials
- Optimized for finishing Impellers and Integrated Bladed Rotors (IBR) made from aluminum, titanium and Inconel

**P** 1.1-5.1

**M** 1.1-4.1

**N** 1.1-1.3

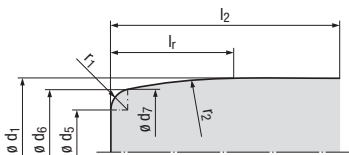
**S** 1.1-1.3

**S** 2.2-2.6

**Tool Dimensions / mm**

$\varnothing d_1$	$r_1$	$r_2$	$l_2$	$l_1$	$l_3$	$l_4$	$\varnothing d_3$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
8	1	40	12	80	42	44	7	8	4	3554LZ.08040A
10	1.5	45	12	95	52	55	8.5	10	4	3554LZ.10045A
12	2	50	14	100	61	65	10	12	4	3554LZ.12050A
16	2	60	18	128	76	80	14	16	4	3554LZ.16060A

**Dimensions for tool database**



$\varnothing d_1$	$r_1$	$r_2$	$l_2$	$l_r$	$\varnothing d_5$	$\varnothing d_6$	$\varnothing d_7$
8	1	40	12	10	3.895	5.841	5.895
10	1.5	45	12	10	5.323	8.265	8.323
12	2	50	14	12	5.894	9.806	9.894
16	2	60	18	16	8.570	12.452	12.570

$l_r = r_2$  is tangential to  $d_1$

$d_6 =$  Tangent point of  $r_1$  and  $r_2$

$d_7 = d_5 + 2 \times r_1$

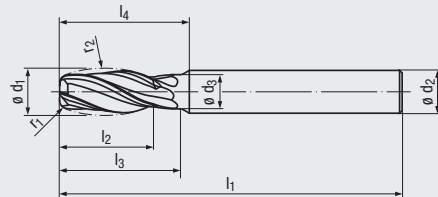
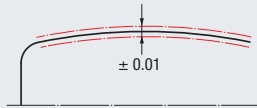
- High performance tool
- With 4 flutes
- Low-vibration machining
- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm

**N**

**DIN**

**30°**

**Form**  
 $\pm 0.01$



Icon descriptions (see pages 160-161)

**Barrel Form**



**Coating**

Applications – Materials (see page 12)

Cutting Data (see page 136)

- Especially suitable for high-strength materials
- For almost all materials
- Suitable for HSC finishing

**Tool Dimensions / mm**

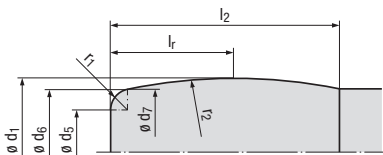
$\emptyset d_1$	$r_1$	$r_2$	$l_2$	$l_3$	$l_1$	$\emptyset d_3$	$l_4$	$\emptyset d_2$ h6	# Flutes
10	2	50	21	28	80	8	30	10	4

**ALCR**

P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-2.1	2.2
K	3.1-4.1	4.2
N	1.1-1.4	
N	2.1-3.2	4.1-4.2, 5.2
S	1.1-2.2	2.3
S	2.4	2.5-2.6
H		1.1-1.2

**Tool No.**  
**Straight Shank**  
**3542L.10050A**

**Dimensions for tool database**



$\emptyset d_1$	$r_1$	$r_2$	$l_2$	$l_r$	$\emptyset d_5$	$\emptyset d_6$	$\emptyset d_7$
10	2	50	21	11.747	4	7.917	8

$l_r = r_2$  is (theoretically) tangential to  $d_1$

$d_6$  = Tangent point of  $r_1$  and  $r_2$

$d_7 = d_5 + 2 \times r_1$

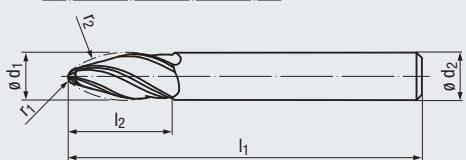
- High performance tool
- With 3 or 4 flutes
- Low-vibration machining
- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm

**N**

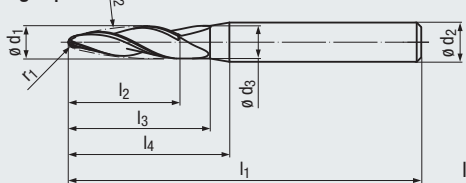
**DIN**

**30°**

**Form**  
 $\pm 0.01$



Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)

Oval Form



Coating

**ALCR**

Applications – Materials (see page 12)

Cutting Data (see page 137)

- Especially suitable for high-strength materials
- For almost all materials
- Suitable for HSC finishing

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-2.1	2.2
<b>K</b>	3.1-4.1	4.2
<b>N</b>	1.1-1.4	
<b>N</b>	2.1-3.2	4.1-4.2, 5.2
<b>S</b>	1.1-2.2	2.3
<b>S</b>	2.4	2.5-2.6
<b>H</b>		1.1-1.2

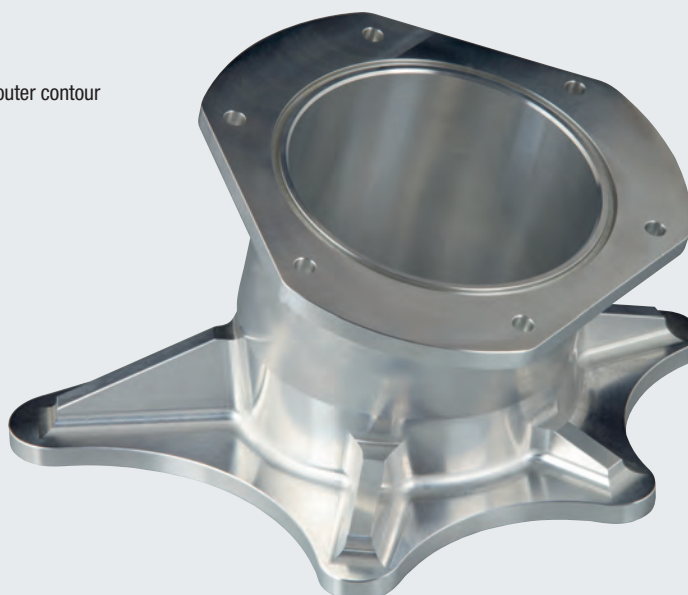
Tool Dimensions / mm

$\varnothing d_1$	$r_1$	$r_2$	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
3	0.75	50	11	14	62	3	25	6	3	3538L.03050A
4	0.75	60	14	18	62	4	25	6	3	3538L.04060A
5	1	75	17	22	62	5	25	6	3	3538L.05075A
6	1	95	22	–	62	–	–	6	3	3538L.06095A
8	1	90	25	–	68	–	–	8	3	3538L.08090A
10	2	85	26	–	72	–	–	10	4	3538L.10085A
12	2	80	28	–	83	–	–	12	4	3538L.12080A
16	3	75	31	–	92	–	–	16	4	3538L.16075A

Machining example

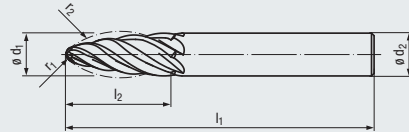
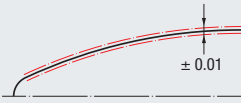
Component: Flange of a fuel pipe from the aerospace industry

Application: Finishing of the round inner contour and parts of the outer contour



- High performance tool
- With 6 flutes
- Low-vibration machining
- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm

Icon descriptions (see pages 160-161)



**N**

**DIN**

**30°**

**Form**  
 $\pm 0.01$

$\leq 60$   
**HRC**

Oval Form



**Coating**

Applications – Materials (see page 12)

Cutting Data (see page 138)

- Especially suitable for high-strength materials
- For almost all materials
- Hard machining of up to 60 HRC
- Suitable for HSC finishing

**Tool Dimensions / mm**

$\phi d_1$	$r_1$	$r_2$	$l_2$	$l_1$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank
10	2	85	26	72	10	6	3539L.10085A
12	2	80	28	83	12	6	3539L.12080A
16	3	75	31	92	16	6	3539L.16075A

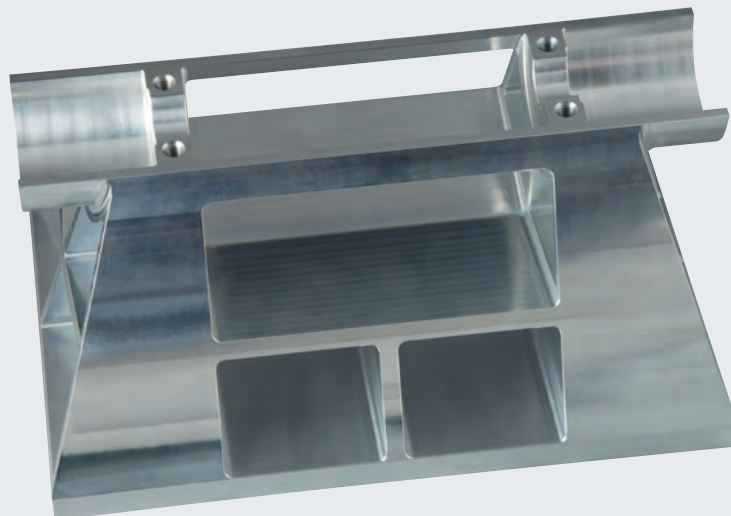
**ALCR**

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-2.1	2.2
<b>K</b>	3.1-4.1	4.2
<b>N</b>	1.1-1.4	
<b>N</b>	2.1-3.2	4.1-4.2, 5.2
<b>S</b>	1.1-2.2	2.3
<b>S</b>	2.4	2.5-2.6
<b>H</b>	1.1-1.3	

**Machining example**

**Component:** Bearing block from mechanical engineering

**Application:** Complete finishing of the the outer contour, inner contour and the pockets



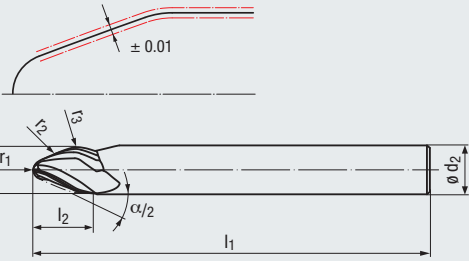
- High performance tool
- With 2 or 3 flutes
- Low-vibration machining
- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm

**N**

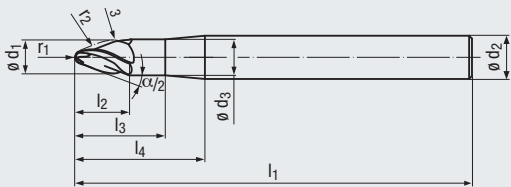
**DIN**

**20-30°**

**Form**  
 $\pm 0.01$



Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)

**Taper Form**

< 45°

≥ 45°



**Coating**

Applications – Materials (see page 12)

Cutting Data (see page 139)

- Especially suitable for high-strength materials
- For almost all materials
- Suitable for HSC finishing

**Tool Dimensions / mm**

$\alpha/2$	$\varnothing d_1$	$r_1$	$r_2$	$r_3$	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
12.5°	16	2	1000	5	31	–	108	–	–	16	3	3540L.1610AA	–
	16	4	1000	5	24	–	108	–	–	16	3	3540L.1610AB	–
17.5°	3	0.75	50	1.5	4	7	62	3	14	6	3	3540L.03050A	–
	4	0.75	125	2	5.5	9.5	62	4	18	6	3	3540L.04125A	–
	5	1	150	2.5	7.5	12.5	62	5	18	6	3	3540L.05150A	–
	6	1	250	3	9.5	–	62	–	–	6	3	3540L.06250A	–
20°	8	1.5	250	4	10.5	–	68	–	–	8	3	3540L.08250A	–
	10	2	250	5	12.5	–	80	–	–	10	3	3540L.10250A	–
	12	3	250	6	13.5	–	93	–	–	12	3	3540L.12250A	–
	16	4	500	8	18.5	–	108	–	–	16	3	3540L.16500A	–
42.5°	16	4	1500	8	18.5	–	108	–	–	16	3	3540L.1615AA	–
	12	1	200	1	8	–	93	–	–	12	3	3540L.12200A	–
60°	10	1	200	1.5	6	–	80	–	–	10	2	–	3540L.10200A
70°	10	1	200	2	6	–	80	–	–	10	2	–	3540L.10200B

**ALCR**

P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-2.1	2.2
K	3.1-4.1	4.2
N	1.1-1.4	
N	2.1-3.2	4.1-4.2, 5.2
S	1.1-2.2	2.3
S	2.4	2.5-2.6
H		1.1-1.2

**NOTE:** only use with tilt angle  $\alpha/2$ ! See page 79.

- High performance tool
- With 4 or 6 flutes
- Low-vibration machining
- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm

**N**

**DIN**

**20-30°**

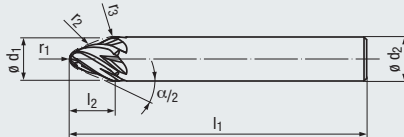
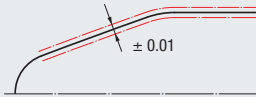
**Form**  
 $\pm 0.01$

$\leq 60$   
**HRC**

**Taper Form**

< 45°

$\geq 45^\circ$



Icon descriptions (see pages 160-161)

**Coating**

Applications – Materials (see page 12)

Cutting Data (see page 140)

- Especially suitable for high-strength materials
- For almost all materials
- Hard machining of up to 60 HRC
- Suitable for HSC finishing

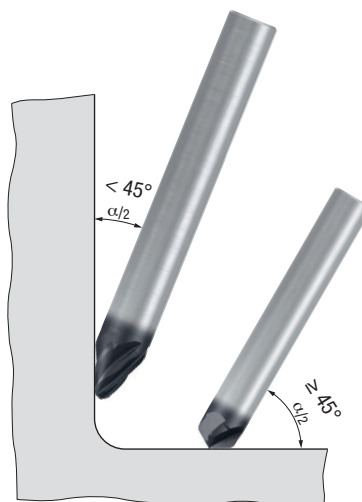
**Tool Dimensions / mm**

$\alpha/2$	$\varnothing d_1$	$r_1$	$r_2$	$r_3$	$l_2$	$l_1$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
12.5°	16	2	1000	5	31	108	16	6	3541L.1610AA	–
	16	4	1000	5	24	108	16	6	3541L.1610AB	–
20°	10	2	250	5	12.5	80	10	6	3541L.10250A	–
	12	3	250	6	13.5	93	12	6	3541L.12250A	–
	16	4	500	8	18.5	108	16	6	3541L.16500A	–
	16	4	1500	8	18.5	108	16	6	3541L.1615AA	–
42.5°	12	1	200	1	8	93	12	6	3541L.12200A	–
60°	10	1	200	1.5	6	80	10	4	–	3541L.10200A
70°	10	1	200	2	6	80	10	4	–	3541L.10200B

**ALCR**

P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-2.1	2.2
K	3.1-4.1	4.2
N	1.1-1.4	
N	2.1-3.2	4.1-4.2, 5.2
S	1.1-2.2	2.3
S	2.4	2.5-2.6
H	1.1-1.3	

Only use with tilt angle  $\alpha/2$ !



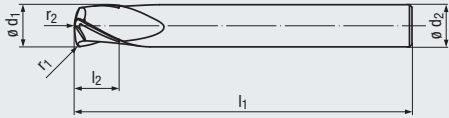
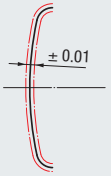
- High performance tool
- With 3 flutes
- Low-vibration machining
- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm

**N**

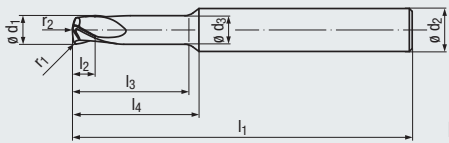
**DIN**

**30°**

**Form**  
 $\pm 0.01$



**Design I4:**



Icon descriptions (see pages 160-161)

**Lens Form**



**Coating**

**ALCR**

**Applications – Materials (see page 12)**

**Cutting Data (see page 141)**

- Especially suitable for high-strength materials
- For almost all materials
- Suitable for HSC finishing

<b>P</b>	1.1-5.1	
<b>M</b>	1.1-2.1	3.1-4.1
<b>K</b>	1.1-2.1	2.2
<b>K</b>	3.1-4.1	4.2
<b>N</b>	1.1-1.4	
<b>N</b>	2.1-3.2	5.2
<b>S</b>	1.1-2.1	

**Tool Dimensions / mm**

$\varnothing d_1$	$r_1$	$r_2$	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
<b>4</b>	0.25	6	4	18	62	4	20	6	<b>3</b>	<b>3544L.04006A</b>
<b>6</b>	0.5	10	6	–	62	–	–	6	<b>3</b>	<b>3544L.06010A</b>
<b>8</b>	0.75	15	8	–	68	–	–	8	<b>3</b>	<b>3544L.08015A</b>
<b>10</b>	1	20	10	–	80	–	–	10	<b>3</b>	<b>3544L.10020A</b>
<b>12</b>	1.25	25	12	–	93	–	–	12	<b>3</b>	<b>3544L.12025A</b>

**Machining example**

**Component:** Integral component from the aerospace industry

**Application:** Finishing of the deep pockets and the bottom surfaces







# Turbine High Performance End Mills

## *For Complex Component Machining*



**Turbine** solid carbide end mills were developed to meet the requirements of materials and complex component geometry design found in aerospace and turbine industries. In addition to turbine parts, these tools are also widely used in the die and mold industry.

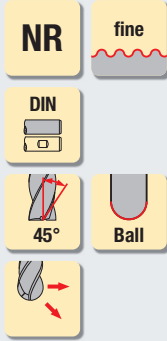
Complex shapes including wide sweeping radii and deep pocketed cavities present a broad range of challenges for machinists and programmers. The EMUGE-FRANKEN turbine milling program was developed to provide standard solutions to special problems.

Realize unprecedented cycle time reductions and tool life in challenging forms and materials, including Ti, Ni and more.

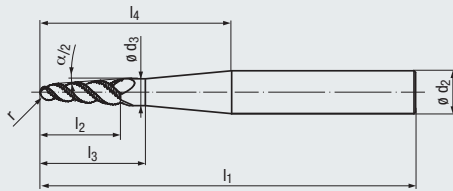
This innovative combination of roughing with pre-finishing and subsequent finishing enables **time savings in milling operations of up to 50%.**

*German engineered  
EMUGE-FRANKEN quality*

- High performance tool
- With 3 flutes
- Roughing profile
- Variable spacing
- Low-vibration machining
- Taper angle 4°



**Tapered Ball Nose**



Icon descriptions (see pages 160-161)

**Coating**

Applications – Materials (see page 13)

Cutting Data (see page 142)

- Especially suitable for difficult to cut materials
- For all tough materials
- Optimized for machining Impellers and Integrated Bladed Rotors (IBR) made from aluminum, titanium and Inconel

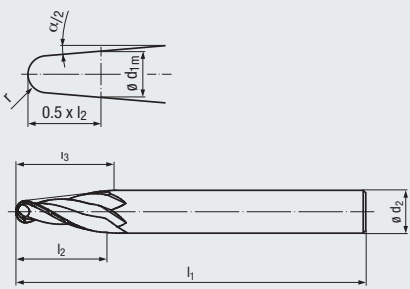
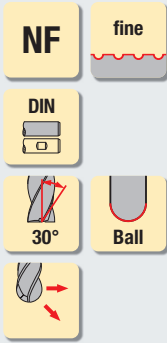
**Tool Dimensions / mm**

$\alpha/2$	r	$l_2$	$l_3$	$l_1$	$l_4$	$\phi d_3$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank
<b>4°</b>	<b>2</b>	20	27	80	37.7	6.5	8	<b>3</b>	<b>3546L.04020C</b>
	<b>2</b>	25	32	95	52	7.2	10	<b>3</b>	<b>3546L.04020B</b>
	<b>2</b>	30	37	120	66	7.9	12	<b>3</b>	<b>3546L.04020A</b>
	<b>3</b>	35	42	140	81	10.6	16	<b>3</b>	<b>3546L.04030A</b>
	<b>4</b>	40	46	155	96	13	20	<b>3</b>	<b>3546L.04040A</b>

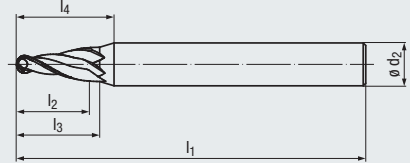
**ALCR**

- P** 1.1-5.1
- M** 1.1-4.1
- N** 1.1-1.3
- S** 1.1-1.3
- S** 2.2-2.6

- Multi-functional tool
- Fine semi-finishing profile
- With 2 flutes
- Various taper angles
- Also available with polished chip space



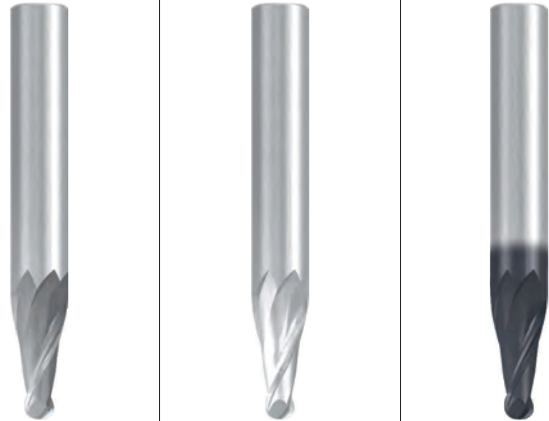
Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)

**Tapered Ball Nose**

WITH POLISHED  
CHIP SPACE



**Coating**

Applications – Materials (see page 13)

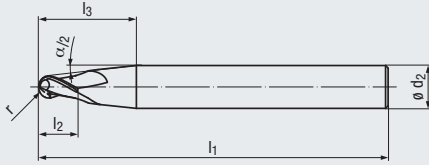
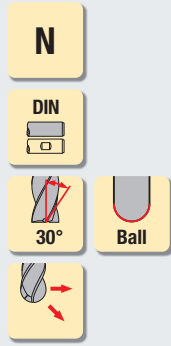
Cutting Data (see page 143)

- For almost all materials
- Suitable for roughing and finishing

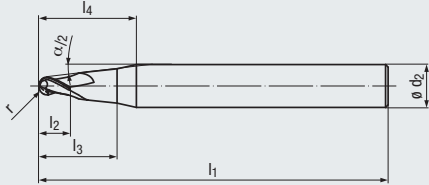
**Tool Dimensions / mm**

$\alpha/2$	r $\pm 0.01$	l <sub>2</sub>	l <sub>3</sub>	l <sub>1</sub>	l <sub>4</sub>	d <sub>1m</sub>	ø d <sub>2</sub> h6	# Flutes	Coating		
									N 1.1-1.3	N 4.1-4.2	ALCR
3°	1.5	20	20	62	24	3.90	6	2	3446.03015A 3446.03020B	3447.03015A 3447.03020B	3446L.03015A 3446L.03020B
	2	31	31	80	35	5.42	8	2			
4°	0.5	20	20	62	24	2.33	6	2	3446.04005A 3446.04010A 3446.04015A 3446.04020B	3447.04005A 3447.04010A 3447.04015A 3447.04020B	3446L.04005A 3446L.04010A 3446L.04015A 3446L.04020B
	1	20	20	62	24	3.26	6	2			
	1.5	20	20	63	25	4.20	8	2			
	2	30	30	72	–	5.83	8	2			
6°	0.5	20	24	62	–	3.00	6	2	3446.06005A 3446.06010A 3446.06015A 3446.06015B 3446.06020A 3446.06020B	3447.06005A 3447.06010A 3447.06015A 3447.06015B 3447.06020A 3447.06020B	3446L.06005A 3446L.06010A 3446L.06015A 3446L.06015B 3446L.06020A 3446L.06020B
	1	19	19	62	–	3.80	6	2			
	1.5	15	15	62	–	4.28	6	2			
	1.5	25	25	68	–	5.33	8	2			
	2	20	20	68	–	5.70	8	2			
8°	0.5	18	18	62	–	3.40	6	2	3446.08005A 3446.08010A 3446.08015A 3446.08020A	3447.08005A 3447.08010A 3447.08015A 3447.08020A	3446L.08005A 3446L.08010A 3446L.08015A 3446L.08020A
	1	15	15	62	–	3.85	6	2			
	1.5	19	19	63	–	5.28	8	2			
	2	23	23	72	–	6.71	10	2			

- Multi-functional tool
- With 2 flutes
- Various taper angles
- Also available with polished chip space



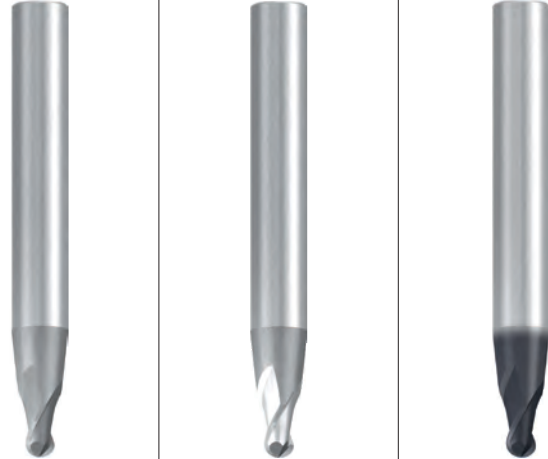
Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)

**Tapered Ball Nose**

WITH POLISHED CHIP SPACE



**Coating**

Applications – Materials (see page 13)

Cutting Data (see page 144)

- For almost all materials
- Suitable for roughing and finishing

**ALCR**

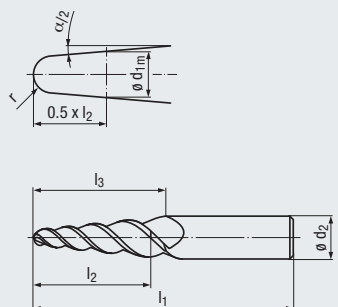
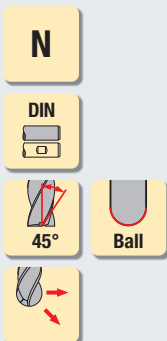
- N 1.1-1.3
- N 4.1-4.2

- P 1.1-3.1 4.1-5.1
- M 1.1-2.1
- K 1.1-2.2 3.1-4.2
- N 1.1-1.4 1.5
- N 2.1-2.6 2.7-2.8
- N 3.1-4.4, 5.2-5.3
- S 1.1-1.2 1.3
- S 2.1-2.2 2.3-2.6

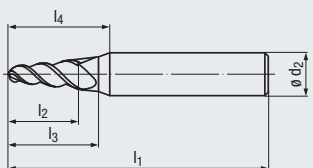
**Tool Dimensions / mm**

$\alpha/2$	r ±0.01	l <sub>2</sub>	l <sub>3</sub>	l <sub>1</sub>	l <sub>4</sub>	∅ d <sub>2</sub> h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank	Tool No. Straight Shank
3°	1.5	4	24	63	26	8	2	3442.03015A	3443.03015A	3442L.03015A
	3	7	38	80	39	10	2	3442.03030A	3443.03030A	3442L.03030A
4°	1.5	4	24	63	26	8	2	3442.04015A	3443.04015A	3442L.04015A
	3	7	33	80	–	10	2	3442.04030A	3443.04030A	3442L.04030A
6°	1.5	4	26	63	–	8	2	3442.06015A	3443.06015A	3442L.06015A
	3	7	23	80	–	10	2	3442.06030A	3443.06030A	3442L.06030A
8°	1.5	4	27	80	–	10	2	3442.08015A	3443.08015A	3442L.08015A
	3	7	25	83	–	12	2	3442.08030A	3443.08030A	3442L.08030A

- Multi-functional tool
- With 3 flutes
- Various taper angles
- Also available with polished chip space



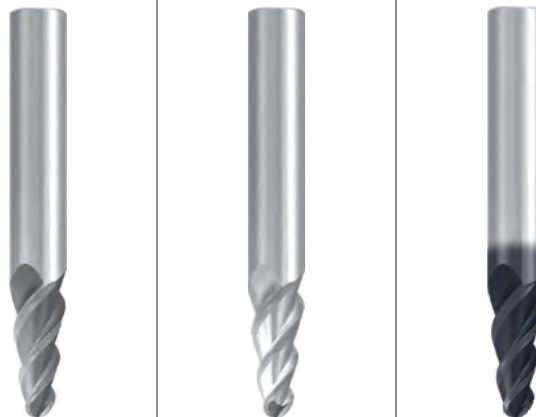
Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)

## Tapered Ball Nose

WITH POLISHED CHIP SPACE



### Coating

Applications – Materials (see page 13)

Cutting Data (see page 145)

- For almost all materials
- Suitable for finishing

### Tool Dimensions / mm

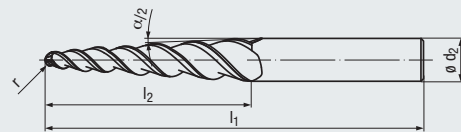
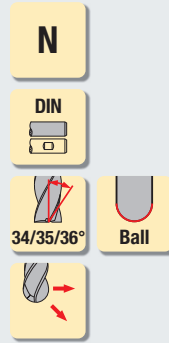
$\alpha/2$	r $\pm 0.01$	l <sub>2</sub>	l <sub>3</sub>	l <sub>1</sub>	l <sub>4</sub>	d <sub>1m</sub>	$\phi$ d <sub>2</sub> h <sub>6</sub>	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank	Tool No. Straight Shank
3°	1.5	20	20	62	24	3.90	6	3	3440.03015A	3441.03015A	3440L.03015A
	2	21	21	66	–	4.90	6	3	3440.03020A	3441.03020A	3440L.03020A
	2	31	31	80	35	5.42	8	3	3440.03020B	3441.03020B	3440L.03020B
	3	22	22	72	–	6.85	8	3	3440.03030A	3441.03030A	3440L.03030A
	3	31	31	80	35	7.32	10	3	3440.03030B	3441.03030B	3440L.03030B
4°	0.5	20	20	62	24	2.33	6	3	3440.04005A	3441.04005A	3440L.04005A
	1	20	20	62	24	3.26	6	3	3440.04010A	3441.04010A	3440L.04010A
	1.5	20	20	63	25	4.20	8	3	3440.04015A	3441.04015A	3440L.04015A
	2	20	30	68	–	5.13	8	3	3440.04020A	3441.04020A	3440L.04020A
	2	30	30	72	–	5.83	8	3	3440.04020B	3441.04020B	3440L.04020B
	3	25	31	72	–	7.34	10	3	3440.04030A	3441.04030A	3440L.04030A
6°	3	31	31	80	–	7.76	10	3	3440.04030B	3441.04030B	3440L.04030B
	0.5	20	24	62	–	3.00	6	3	3440.06005A	3441.06005A	3440L.06005A
	1	19	19	62	–	3.80	6	3	3440.06010A	3441.06010A	3440L.06010A
	1	29	29	72	–	4.85	8	3	3440.06010B	3441.06010B	3440L.06010B
	1.5	15	15	62	–	4.28	6	3	3440.06015A	3441.06015A	3440L.06015A
	1.5	25	25	68	–	5.33	8	3	3440.06015B	3441.06015B	3440L.06015B
	2	20	20	68	–	5.70	8	3	3440.06020A	3441.06020A	3440L.06020A
	2	30	30	80	–	6.76	10	3	3440.06020B	3441.06020B	3440L.06020B
8°	3	21	21	72	–	7.61	10	3	3440.06030A	3441.06030A	3440L.06030A
	3	31	31	83	–	8.66	12	3	3440.06030B	3441.06030B	3440L.06030B
	0.5	18	18	62	–	3.40	6	3	3440.08005A	3441.08005A	3440L.08005A
	1	15	15	62	–	3.85	6	3	3440.08010A	3441.08010A	3440L.08010A
	1	22	22	63	–	4.83	8	3	3440.08010B	3441.08010B	3440L.08010B
	1.5	19	19	63	–	5.28	8	3	3440.08015A	3441.08015A	3440L.08015A
17.5°	1.5	26	26	72	–	6.26	10	3	3440.08015B	3441.08015B	3440L.08015B
	2	23	23	72	–	6.71	10	3	3440.08020A	3441.08020A	3440L.08020A
17.5°	0.5	8	8	57	–	3.26	6	3	3440.17505A	3441.17505A	3440L.17505A

ALCR

N 1.1-1.3  
N 4.1-4.2

P 1.1-3.1 4.1-5.1  
M 1.1-2.1  
K 1.1-2.2 3.1-4.2  
N 1.1-1.4 1.5  
N 2.1-2.6 2.7-2.8  
N 3.1-4.4, 5.2-5.3  
S 1.1-1.2 1.3  
S 2.1-2.2 2.3-2.6

- High performance tool
- With 3 flutes
- Finishing geometry



Icon descriptions (see pages 160-161)

**Tapered Ball Nose**



**Coating**

Applications – Materials (see page 13)

Cutting Data (see page 146)

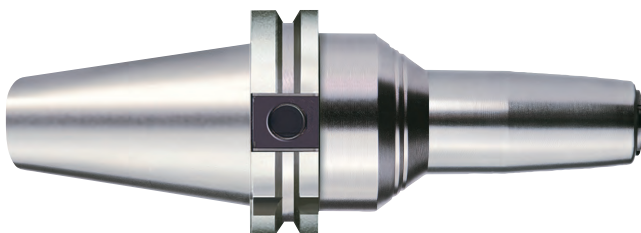
- Especially suitable for difficult to cut materials
- For all tough materials

**Tool Dimensions / mm**

$\alpha/2$	r <b>±0.01</b>	$l_2$	$l_1$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank
<b>4°</b>	<b>2</b>	59	120	12	<b>3</b>	<b>3550L.04020A</b>
	<b>2</b>	87	150	16	<b>3</b>	<b>3550L.04020B</b>
	<b>3</b>	74	140	16	<b>3</b>	<b>3550L.04030A</b>
	<b>3</b>	103	165	20	<b>3</b>	<b>3550L.04030B</b>
	<b>4</b>	89	155	20	<b>3</b>	<b>3550L.04040A</b>

**ALCR**

- P** 1.1-5.1
- M** 1.1-4.1
- N** 1.3-1.5
- S** 1.1-1.3
- S** 2.2-2.6

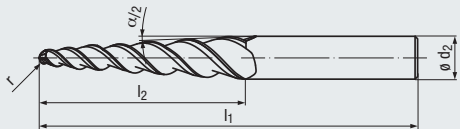
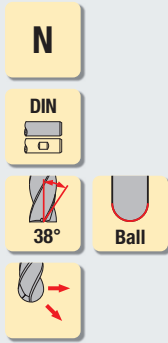


**CAT 40 SLIM LINE**

*Slim Line Design - Ideal for 5-Axis machining*

**EMUGE-FRANKEN high precision / performance FPC Mill / Drill Chucks** provide unprecedented rigidity, vibration dampening, concentricity, machining speed, and tool life vs. conventional chuck technologies for milling and drilling applications. Available in a wide range of styles. Internal and peripheral coolant options, and MQL-adaptable.

- High performance tool
- 3 flutes in the ball nose section
- 6 radial flutes



Icon descriptions (see pages 160-161)

**Tapered Ball Nose**



**Coating**

**ALCR**

**Applications – Materials (see page 14)**

**Cutting Data (see page 146)**

- Especially suitable for difficult to cut materials
- For all tough materials

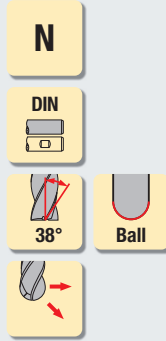
<b>P</b>	1.1-5.1
<b>M</b>	1.1-4.1
<b>N</b>	1.3-1.5
<b>S</b>	1.1-1.3
<b>S</b>	2.2-2.6

**Tool Dimensions / mm**

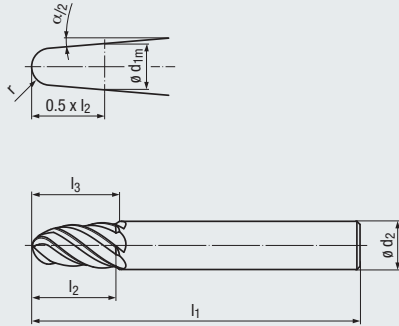
$\alpha/2$	r <b>±0.01</b>	$l_2$	$l_1$	$\phi d_2$ h6	# Flutes	Tool No. Straight Shank
<b>4°</b>	<b>2</b>	59	120	12	<b>3/6</b>	<b>3548L.04020A</b>
	<b>2</b>	87	150	16	<b>3/6</b>	<b>3548L.04020B</b>
	<b>3</b>	74	140	16	<b>3/6</b>	<b>3548L.04030A</b>
	<b>3</b>	103	165	20	<b>3/6</b>	<b>3548L.04030B</b>
	<b>4</b>	89	155	20	<b>3/6</b>	<b>3548L.04040A</b>



- High performance tool
- 3 flutes in the ball nose section
- 6 radial flutes



**Tapered Ball Nose**



Icon descriptions (see pages 160-161)



**Coating**

**TIALN**

**Applications – Materials (see page 14)**

**Cutting Data (see page 147)**

- Especially suitable for high-strength materials
- Also suitable in Nickel-based alloys
- For the machining of titanium alloys
- Suitable in all turbine materials

<b>P</b>	<b>1.1-5.1</b>
<b>M</b>	<b>1.1-4.1</b>
<b>K</b>	<b>1.1-4.2</b>
<b>N</b>	<b>2.1-2.8</b>
<b>S</b>	<b>1.1-2.6</b>

**Tool Dimensions / mm**

$\alpha/2$	r	l <sub>2</sub>	l <sub>3</sub>	l <sub>1</sub>	d <sub>1</sub>	$\emptyset$ d <sub>2</sub> h6	# Flutes	Tool No. Straight Shank
<b>4°</b>	<b>3</b>	30	47	108	7.89	12	<b>3/6</b>	<b>2679A.04030A</b>
	<b>3.5</b>	39	39	108	9.26	12	<b>3/6</b>	<b>2679A.04035A</b>
	<b>4</b>	32	32	108	9.70	12	<b>3/6</b>	<b>2679A.04040A</b>
	<b>5</b>	35	49	108	11.77	16	<b>3/6</b>	<b>2679A.04050A</b>
	<b>6</b>	34	34	108	13.57	16	<b>3/6</b>	<b>2679A.04060A</b>
	<b>8</b>	36	36	108	17.44	20	<b>3/6</b>	<b>2679A.04080A</b>

- High performance tool
- Patented chisel edge
- With 4 flutes
- 2 center cutting edges
- Short, stable flute length

**H**

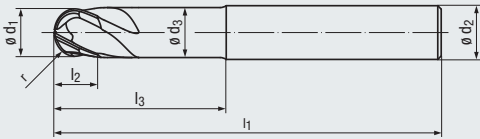
ASME DIN

30° Ball

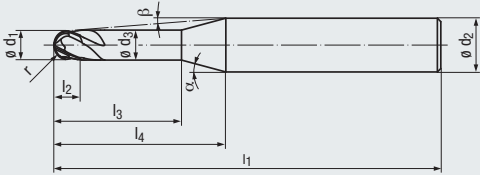
3-5°

≤ 66 HRC

Ball Nose



Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)

Coating

**TIALN**

Applications – Materials (see page 14)

Cutting Data (see page 148)

- For machining hard materials up to 66 HRC
- For finishing with very high surface quality
- Suitable for HSC finishing

**P** 3.1-5.1 1.1-2.1

**K** 1.1-4.2

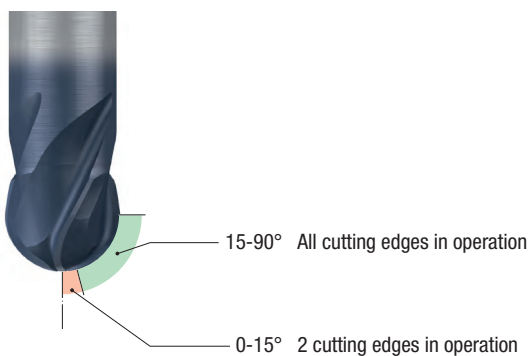
**N** 2.3, 2.6-2.8

**N** 2.2, 2.4-2.5

**H** 1.1-1.5

**Standard length**

	$\phi d_1$	r	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
	±0.0004	±0.0002						h5				
[inch]	1/8	0.0625	5/32	7/16	2	0.118	1/2	1/4	–	9°	4	2942A.0125
	3/16	0.0938	3/16	1/2	2	0.177	1/2	1/4	–	5°	4	2942A.01875
	1/4	0.1250	1/4	1/2	2	0.236	–	1/4	–	–	4	2942A.0250
	5/16	0.1563	9/32	1	2 1/2	0.295	–	5/16	–	–	4	2942A.03125
	3/8	0.1875	5/16	1 1/8	2 3/4	0.358	–	3/8	–	–	4	2942A.0375
	7/16	0.2188	11/32	1 1/8	3	0.417	–	7/16	–	–	4	2942A.04375
	1/2	0.2500	3/8	1 3/8	3 1/4	0.480	–	1/2	–	–	4	2942A.0500
	±0.01	±0.005						h5				
[mm]	3	1.5	3.5	10	57	2.8	20	6	11.5°	5°	4	2834A.003
	4	2	4	12	57	3.8	20	6	11°	3.5°	4	2834A.004
	5	2.5	5	14	57	4.7	20	6	10°	2°	4	2834A.005
	6	3	6	20	57	5.6	–	6	–	–	4	2834A.006
	8	4	7	25	63	7.6	–	8	–	–	4	2834A.008
	10	5	8	30	72	9.6	–	10	–	–	4	2834A.010
	12	6	10	35	83	11.5	–	12	–	–	4	2834A.012



- High performance tool
- Patented chisel edge
- With 4 flutes
- 4 center cutting edges
- Short, stable flute length

**H**

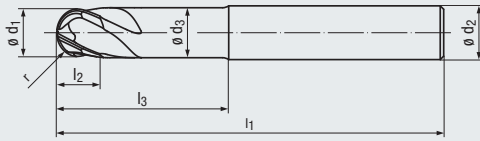
ASME DIN

30° Ball

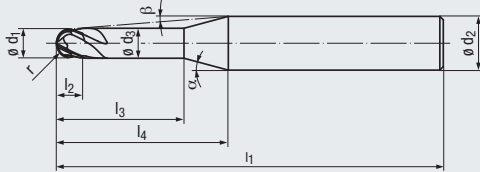
3-5°

≤ 66 HRC

Ball Nose



Design I<sub>4</sub>:



Icon descriptions (see pages 160-161)

Coating

**TIALN**

Applications – Materials (see page 14)

Cutting Data (see page 149)

- For machining hard materials up to 66 HRC
- For finishing with very high surface quality
- Suitable for HSC finishing

<b>P</b>	3.1-5.1	1.1-2.1
<b>K</b>	1.1-4.2	
<b>N</b>	2.3, 2.6-2.8	
<b>N</b>		2.2, 2.4-2.5
<b>S</b>	1.1-2.6	
<b>H</b>	1.1-1.5	

**Long length**

	$\varnothing d_1$	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
	$\pm 0.004$	$\pm 0.0002$						$h_5$				
[inch]	1/8	0.0625	5/32	7/16	3 1/2	0.118	2	1/4	2.5°	2°	4	2943A.0125
	3/16	0.0938	3/16	1/2	3 1/2	0.177	2	1/4	1.5°	1°	4	2943A.01875
	1/4	0.1250	1/4	2	3 1/2	0.236	–	1/4	–	–	4	2943A.0250
	5/16	0.1563	9/32	2 1/2	4	0.295	–	5/16	–	–	4	2943A.03125
	3/8	0.1875	5/16	2 7/8	4 1/2	0.358	–	3/8	–	–	4	2943A.0375
	7/16	0.2188	11/32	3 1/8	5	0.417	–	7/16	–	–	4	2943A.04375
	1/2	0.2500	3/8	4 1/8	6	0.480	–	1/2	–	–	4	2943A.0500
[mm]	6	3	6	30	80	5.6	–	6	–	–	4	2842A.006
	8	4	7	35	80	7.6	–	8	–	–	4	2842A.008
	10	5	8	45	100	9.6	–	10	–	–	4	2842A.010
	12	6	10	50	100	11.5	–	12	–	–	4	2842A.012

- Multi-functional. high performance tool
- Patented chisel edge
- With 220-240° ball nose

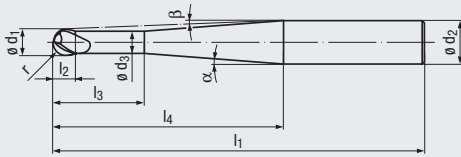
**N**

**DIN**

**15°** **220-240°**

**3-5°**

**≤ 55 HRC**



Icon descriptions (see pages 160-161)

**Lollipop**



**Coating**

**TIALN**

Applications – Materials (see page 14)

Cutting Data (see page 150)

- For many materials
- Suitable for roughing and finishing
- Machining of undercuts

<b>P</b>	<b>1.1-5.1</b>
<b>K</b>	<b>1.1-4.2</b>
<b>N</b>	<b>2.1-2.8</b>   1.2-1.4, 5.2
<b>H</b>	<b>1.1-1.2</b>

Tool Dimensions / mm

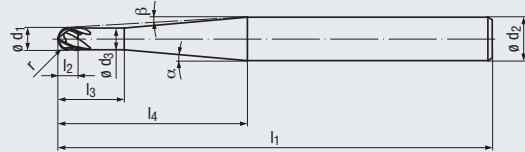
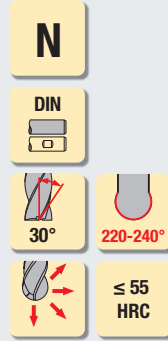
**Extra long length**

$\varnothing d_1$ $\pm 0.01$	$r$ $\pm 0.005$	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
<b>2</b>	1	1.3	17	80	1.8	40	6	6°	3°	<b>2</b>	<b>1935A.002</b>
<b>3</b>	1.5	2	17	80	2.7	40	6	4.5°	2.5°	<b>2</b>	<b>1935A.003</b>
<b>4</b>	2	2.8	18	80	3.2	40	6	4°	1.5°	<b>2</b>	<b>1935A.004</b>
<b>6</b>	3	4.3	20	80	5	40	6	2°	–	<b>2</b>	<b>1935A.006</b>
<b>8</b>	4	5.7	26	100	6.8	60	8	1.5°	–	<b>2</b>	<b>1935A.008</b>
<b>10</b>	5	7	28	120	8	75	10	1.5°	–	<b>2</b>	<b>1935A.010</b>
<b>12</b>	6	9	30	120	8	75	12	3°	–	<b>2</b>	<b>1935A.012</b>
<b>12</b>	6	9	40	160	8	110	12	2°	–	<b>2</b>	<b>1935A.012160</b>



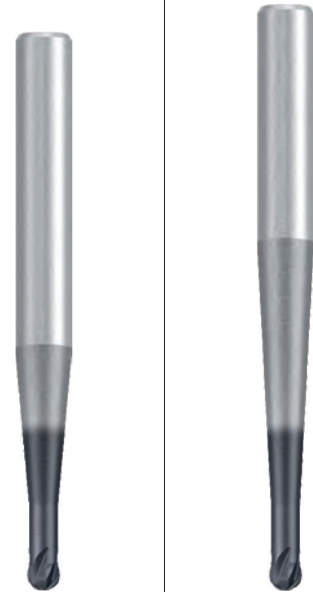
Ball nose with fully functional cutting edge up to 240°

- Multi-functional, high performance tool
- With 220-240° ball nose
- 4 center cutting edges
- 2 lengths available



Icon descriptions (see pages 160-161)

**Lollipop**



**Coating**

Applications – Materials (see page 14)

Cutting Data (see page 151)

- For many materials up to 55 HRC
- Machining of undercuts
- Suitable for High-Speed finishing of turbine blades
- Especially suitable for difficult to cut materials

**ALCR**

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	2.1-2.8
S	1.1-2.6
H	1.1-1.3

**Tool Dimensions / mm**

**Long length**

$\varnothing d_1$	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
-0.04	-0.002						h5				
4	2	3.3	10	90	3	38.6	8	5°	3.5°	4	2564L.04010B
6	3	4.6	15	100	5	43.6	10	5°	3°	4	2564L.06015B
8	4	6.6	20	108	6	54.3	12	5°	2.5°	4	2564L.08020B
10	5	8.3	25	125	7.5	73.6	16	5°	2°	4	2564L.10025B

**Extra long length**

$\varnothing d_1$	r	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$l_4$	$\varnothing d_2$	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank
-0.04	-0.002						h5				
4	2	3.3	10	95	3	57.7	8	3°	2.5°	4	2564L.04010A
6	3	4.6	15	105	5	62.7	10	3°	2°	4	2564L.06015A
8	4	6.6	20	125	6	77.2	12	3°	2°	4	2564L.08020A
10	5	8.3	25	160	7.5	106.1	16	3°	2°	4	2564L.10025A



Ball nose with fully functional cutting edge up to 240°

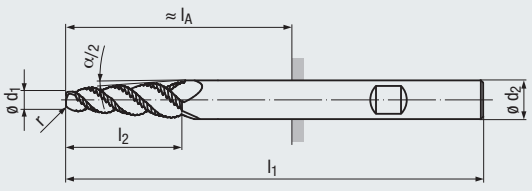
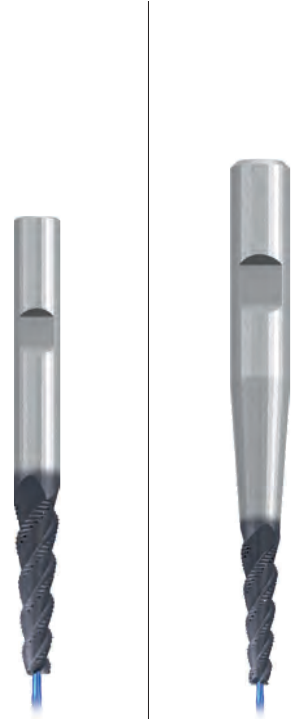
- High performance tool
- With 3 and 4 flutes
- Roughing profile
- Variable spacing
- Low-vibration machining
- Taper angle 3°

**NR** **fine**

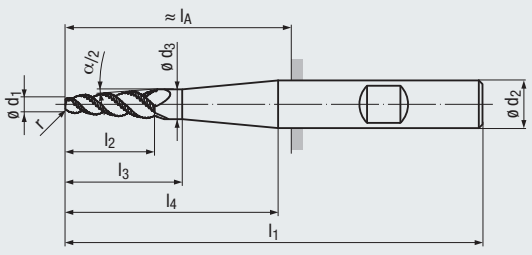
**DIN** **ICA**

**45°** **Torus**

**Tapered Torus**



**Design I<sub>4</sub>:**

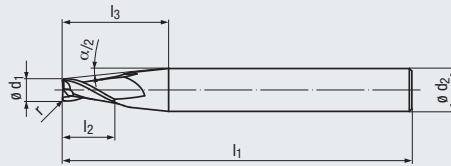
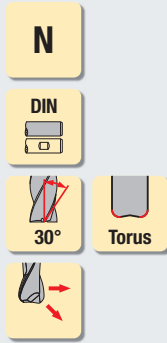


Icon descriptions (see pages 160-161)

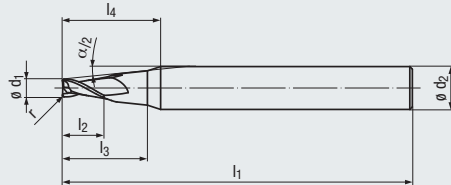
<b>Coating</b>	<b>ALCR</b>										
<b>Applications – Materials (see page 14)</b>											
<b>Cutting Data (see page 152)</b>											
<ul style="list-style-type: none"> <li>• Especially suitable for high-strength materials</li> <li>• Also suitable in Nickel-based alloys</li> <li>• For the machining of titanium alloys</li> <li>• Suitable in all turbine materials</li> <li>• Optimized for machining Impellers and Integrated Bladed Rotors (IBR) made from aluminum, titanium and Inconel</li> </ul>	<table border="1"> <tr><td><b>P</b></td><td>1.1-5.1</td></tr> <tr><td><b>M</b></td><td>1.1-4.1</td></tr> <tr><td><b>N</b></td><td>1.1-1.3</td></tr> <tr><td><b>S</b></td><td>1.1-1.3</td></tr> <tr><td><b>S</b></td><td>2.2-2.6</td></tr> </table>	<b>P</b>	1.1-5.1	<b>M</b>	1.1-4.1	<b>N</b>	1.1-1.3	<b>S</b>	1.1-1.3	<b>S</b>	2.2-2.6
<b>P</b>	1.1-5.1										
<b>M</b>	1.1-4.1										
<b>N</b>	1.1-1.3										
<b>S</b>	1.1-1.3										
<b>S</b>	2.2-2.6										
<b>Tool Dimensions / mm</b>											

<b>Standard length</b>											Tool No. Weldon Shank
$\alpha/2$	$\varnothing d_1$ -0.05	r	$l_2$	$l_3$	$l_1$	$l_4$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$ 	# Flutes	
<b>3°</b>	6.5	1	14	–	68	–	–	8	32	4	3534LZ.03065A
	7.5	1	23.5	–	80	–	–	10	40	4	3534LZ.03075A
	8.5	1	33	–	93	–	–	12	48	4	3534LZ.03085A
<b>Long length</b>											Tool No. Weldon Shank
$\alpha/2$	$\varnothing d_1$ -0.05	r	$l_2$	$l_3$	$l_1$	$l_4$	$\varnothing d_3$	$\varnothing d_2$ h6	$l_A$ 	# Flutes	
<b>3°</b>	5	1	20	29.5	80	38	7.1	8	44	3	3532LZ.03050A
	5.5	1	25	34.5	95	52.5	8.1	10	55	3	3532LZ.03055A
	6	1	30	39.5	120	67	9.1	12	72	3	3532LZ.03060A

- Multi-functional tool
- With 2 flutes
- Various taper angles
- Also available with polished chip space



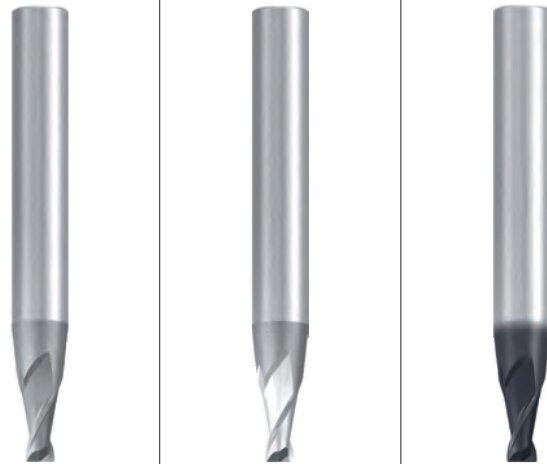
Design I4:



Icon descriptions (see pages 160-161)

**Tapered Torus**

WITH POLISHED  
CHIP SPACE



**Coating**

Applications – Materials (see page 14)

Cutting Data (see page 153)

- For almost all materials
- Suitable for roughing

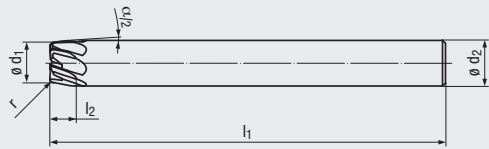
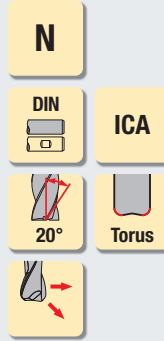
**Tool Dimensions / mm**

$\alpha/2$	$\varnothing d_1$	r $\pm 0.01$	$l_2$	$l_3$	$l_1$	$l_4$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank	Tool No. Straight Shank
3°	3	0.3	6	24	63	26	8	2	3444.03003A	3445.03003A	3444L.03003A
	4	0.4	8	24	63	26	8	2	3444.03004A	3445.03004A	3444L.03004A
	5	0.5	10	25	63	26	8	2	3444.03005A	3445.03005A	3444L.03005A
4°	3	0.3	6	24	63	26	8	2	3444.04003A	3445.04003A	3444L.04003A
	4	0.4	8	25	63	26	8	2	3444.04004A	3445.04004A	3444L.04004A
	5	0.5	10	23	63	–	8	2	3444.04005A	3445.04005A	3444L.04005A
6°	3	0.3	6	25	63	–	8	2	3444.06003A	3445.06003A	3444L.06003A
	4	0.4	8	20	63	–	8	2	3444.06004A	3445.06004A	3444L.06004A
	5	0.5	10	25	80	–	10	2	3444.06005A	3445.06005A	3444L.06005A
8°	3	0.3	6	25	80	–	10	2	3444.08003A	3445.08003A	3444L.08003A
	4	0.4	8	22	80	–	10	2	3444.08004A	3445.08004A	3444L.08004A
	5	0.5	10	25	83	–	12	2	3444.08005A	3445.08005A	3444L.08005A

**ALCR**

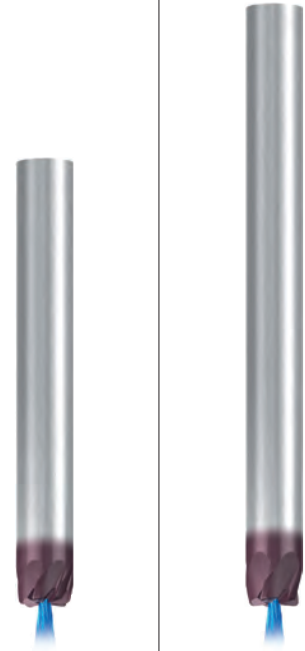
N	1.1-1.3	
N	4.1-4.2	
P	1.1-3.1	4.1-5.1
M	1.1-2.1	
K	1.1-2.2	3.1-4.2
N	1.1-1.4	1.5
N	2.1-2.6	2.7-2.8
N	3.1-4.4, 5.2-5.3	
S	1.1-1.2	1.3
S	2.1-2.2	2.3-2.6

- High performance tool
- With 5-13 flutes
- Variable spacing
- Low-vibration machining
- Internal coolant supply, axial exit (ICA)



Icon descriptions (see pages 160-161)

**Tapered Torus**



**Coating**

**TIALN**

Applications – Materials (see page 15)

Cutting Data (see page 154)

- Especially suitable for high-strength materials
- Also suitable in Nickel-based alloys
- For the machining of titanium alloys
- Suitable in all turbine materials

- P** 1.1-5.1
- M** 1.1-4.1
- K** 1.1-4.2
- N** 2.1-2.8
- S** 1.1-2.6

Tool Dimensions / mm

**Long length**

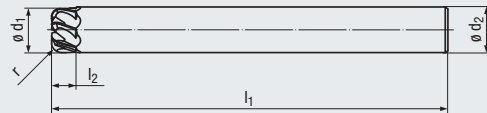
$\alpha/2$	$\varnothing d_1$	$r$ $\pm 0.01$	$l_2$	$l_1$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
<b>8°</b>	<b>8</b>	0.8	7.5	80	10	<b>7</b>	<b>2677AZ.008008</b>
	<b>9</b>	1	3.5	80	10	<b>7</b>	<b>2677AZ.009010</b>
	<b>10</b>	1	7.5	80	12	<b>9</b>	<b>2677AZ.010010</b>
	<b>11</b>	1	3.5	80	12	<b>9</b>	<b>2677AZ.011010</b>

**Extra long length**

$\alpha/2$	$\varnothing d_1$	$r$ $\pm 0.01$	$l_2$	$l_1$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
<b>8°</b>	<b>9</b>	1	3.5	108	10	<b>5</b>	<b>2678AZ.009010</b>
	<b>10</b>	1	7.5	108	12	<b>7</b>	<b>2678AZ.010010</b>
	<b>11</b>	1	3.5	108	12	<b>7</b>	<b>2678AZ.011010</b>
	<b>15</b>	1	3.5	108	16	<b>9</b>	<b>2678AZ.015010</b>
	<b>15</b>	1	3.5	108	16	<b>13</b>	<b>2678AZ.115010</b>
	<b>19</b>	1	3.5	108	20	<b>9</b>	<b>2678AZ.019010</b>
	<b>19</b>	1	3.5	108	20	<b>13</b>	<b>2678AZ.119010</b>



- High performance tool
- With 5-9 flutes
- Variable spacing
- Low-vibration machining
- Internal coolant supply, axial exit (ICA)



Icon descriptions (see pages 160-161)

Torus



**Coating**

**TIALN**

**Applications – Materials** (see page 15)

**P** 1.1-5.1

**Cutting Data** (see page 155)

**M** 1.1-4.1

- Especially suitable for high-strength materials
- Also suitable in Nickel-based alloys
- For the machining of titanium alloys
- Suitable in all turbine materials

**K** 1.1-4.2

**N** 2.1-2.8

**S** 1.1-2.6

**Tool Dimensions / mm**

$\varnothing d_1$ f8	r ±0.01	$l_2$	$l_1$	$\varnothing d_2$ h6	# Flutes	Tool No. Straight Shank
8	1	3	80	8	5	2676AZ.008010
8	2	4	80	8	5	2676AZ.008020
10	1	3	80	10	7	2676AZ.010010
10	2	4	80	10	7	2676AZ.010020
12	1	3	108	12	7	2676AZ.012010
12	2	4	108	12	7	2676AZ.012020
16	1	3	108	16	9	2676AZ.016010
16	2	4	108	16	9	2676AZ.016020

# Alu-Cut High Performance End Mills

## For High-Volume Machining in Aluminum Materials



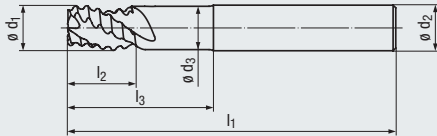
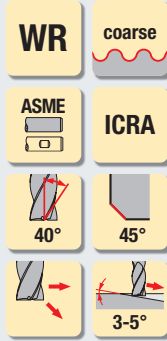
**The Alu-Cut** series includes tools made from solid carbide and HSS particularly developed for the process-reliable volume machining of wrought aluminum alloys with up to 5% silicon content and non-ferrous metals. Materials with higher silicon content should preferably be machined with coated tools. The new, very smooth coating protects the tool against built-up edge and wear. Due to the combination of an optimum cutting material with a newly developed cutting geometry and optimized grinding processes, machining volumes which would have been considered impossible until now can be achieved with the Alu-Cut.

*German engineered*  
**EMUGE-FRANKEN quality**

### Characteristics

- Variable spacing
- Available with WR profile for roughing
- Special geometry for machining aluminum
- Optionally available with internal coolant supply, radial and axial (ICRA)
- Highest metal removal rates

- High performance tool
- Special geometry for high-volume machining of aluminum
- Low-vibration machining
- Very smooth CRN coating for 2888RZ tools
- Internal coolant supply, radial and axial exit (ICRA)
- Short flute length



Icon descriptions (see pages 160-161)

**Rougher**



**Coating**

Applications – Materials (see page 15)

Cutting Data (see page 156)

- For wrought aluminum alloys
- For aluminum alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

N 1.1-1.3 1.4

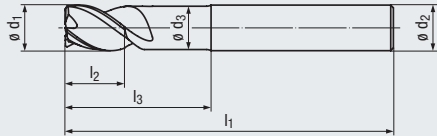
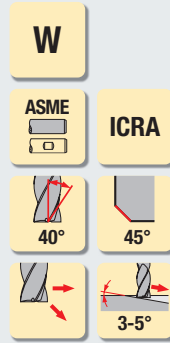
N 1.1-1.4 2.1-2.7

**Standard Length**

$\varnothing d_1$ h11	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h5	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
1/4 *	3/8	13/16	2 1/4	0.234	1/4	3	2888_Z.0250	2888RZ.0250
5/16	7/16	1	2 1/2	0.297	5/16	3	2888_Z.03125	2888RZ.03125
3/8	1/2	1 1/8	2 3/4	0.354	3/8	3	2888_Z.0375	2888RZ.0375
1/2	5/8	1 3/8	3 1/4	0.476	1/2	3	2888_Z.0500	2888RZ.0500
5/8	3/4	1 7/8	3 3/4	0.594	5/8	3	2888_Z.0625	2888RZ.0625
3/4	1	2 3/16	4 1/4	0.711	3/4	3	2888_Z.0750	2888RZ.0750
1	1 1/4	2 5/8	5	0.960	1	3	2888_Z.1000	2888RZ.1000

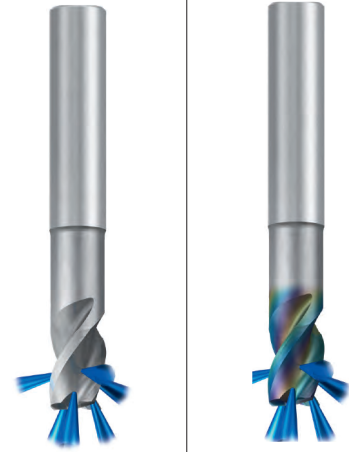
\* Internal coolant supply, axial exit (ICA)

- High performance tool
- Special geometry for high-volume machining of aluminum
- Low-vibration machining
- Very smooth CRN coating for 2889RZ tools
- Internal coolant supply, radial and axial exit (ICRA)
- Short flute length



Icon descriptions (see pages 160-161)

**Finisher**

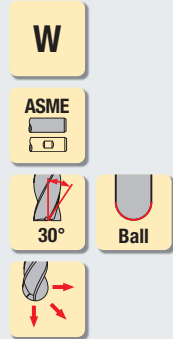


<b>Coating</b>		<b>CRN</b>
<b>Applications – Materials (see page 15)</b>		
<b>Cutting Data (see page 156)</b>		
<ul style="list-style-type: none"> <li>• For wrought aluminum alloys</li> <li>• For aluminum alloys with a silicon content of up to 7%</li> <li>• With CRN coating also for copper alloys</li> </ul>	<b>N 1.1-1.3 1.4</b>	<b>N 1.1-1.4 2.1-2.7</b>

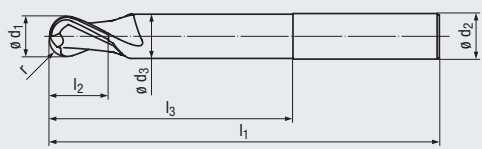
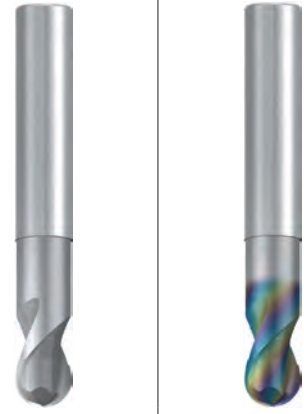
<b>Standard Length</b>									<b>Tool No. Straight Shank</b>	<b>Tool No. Straight Shank</b>
$\varnothing d_1$ h11	tolerance	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h5	Chamfer	# Flutes		
<b>1/4*</b>	-0.0016	3/8	13/16	2 1/4	0.234	1/4	0.12	<b>3</b>	<b>2889 Z.0250</b>	<b>2889RZ.0250</b>
<b>5/16</b>	-0.0016	7/16	1	2 1/2	0.297	5/16	0.12	<b>3</b>	<b>2889 Z.03125</b>	<b>2889RZ.03125</b>
<b>3/8</b>	-0.0016	1/2	1 1/8	2 3/4	0.354	3/8	0.20	<b>4</b>	<b>2889 Z.0375</b>	<b>2889RZ.0375</b>
<b>1/2</b>	-0.0016	5/8	1 3/8	3 1/4	0.476	1/2	0.20	<b>4</b>	<b>2889 Z.0500</b>	<b>2889RZ.0500</b>
<b>5/8</b>	-0.0016	3/4	1 7/8	3 3/4	0.594	5/8	0.20	<b>4</b>	<b>2889 Z.0625</b>	<b>2889RZ.0625</b>
<b>3/4</b>	-0.0016	1	2 3/16	4 1/4	0.711	3/4	0.30	<b>4</b>	<b>2889 Z.0750</b>	<b>2889RZ.0750</b>
<b>1</b>	-0.0016	1 1/4	2 5/8	5	0.960	1	0.30	<b>4</b>	<b>8889 Z.1000</b>	<b>2889RZ.1000</b>

\* Internal coolant supply, axial exit (ICA)

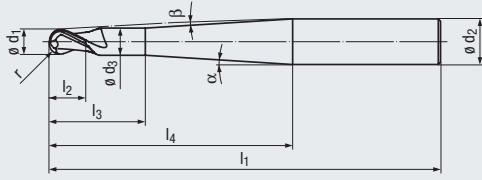
- High performance tool
- Patented chisel edge
- Sharp cutting edges
- Very smooth CRN coating for 1921R tools



**Ball Nose**



**Design I<sub>4</sub>:**



Icon descriptions (see pages 160-161)

**Coating**

Applications – Materials (see page 15)

Cutting Data (see page 157)

- For wrought aluminum alloys
- For aluminum alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

**CRN**

N	1.1-1.3		N	1.1-1.4	
N	4.1-4.2	5.3	N	2.1-2.3	2.4-2.8
			N	3.1-4.4, 5.3	

**Stub Length**

$\phi d_1$ ±0.0004	r ±0.0002	$l_2$	$l_3$	$l_1$	$\phi d_3$	$l_4$	$\phi d_2$ h5	$\alpha$	$\beta$	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
3/32	0.0469	1/8	5/16	2 1/4	0.087	3/4	1/4	13°	7°	2	1921.009375	1921R.009375
1/8	0.0625	5/32	3/8	2 1/4	0.118	3/4	1/4	12.5°	6°	2	1921.0125	1921R.0125
3/16	0.0937	3/16	9/16	2 1/4	0.177	3/4	1/4	18.5°	3°	2	1921.01875	1921R.01875
1/4	0.1250	1/4	3/4	2 1/4	0.236	–	1/4	–	–	2	1921.0250	1921R.0250
5/16	0.1562	9/32	1	2 1/2	0.295	–	5/16	–	–	2	1921.03125	1921R.03125
3/8	0.1875	5/16	1	2 3/4	0.358	–	3/8	–	–	2	1921.0375	1921R.0375
7/16	0.2188	11/32	1 1/8	3	0.417	–	7/16	–	–	2	1921.04375	1921R.04375
1/2	0.2500	3/8	1 3/8	3 1/4	0.480	–	1/2	–	–	2	1921.0500	1921R.0500
5/8	0.3125	1/2	1 1/2	3 1/2	0.605	–	5/8	–	–	2	1921.0625	1921R.0625
3/4	0.3750	9/16	1 7/8	4	0.730	–	3/4	–	–	2	1921.0750	1921R.0750



# Cut & Form High Performance End Mills

## For Cutting and Polishing in One Operation



**Cut & Form** solid carbide finishing end mills feature a patented tool geometry that performs two functions simultaneously, generating significant manufacturing time and cost savings!

### Advantages:

- Enables the production of polished surfaces in a single milling operation with surface grades of N1-N3
- No rework of workpiece required
- **Significant reduction of manufacturing costs**

### Types of tools:

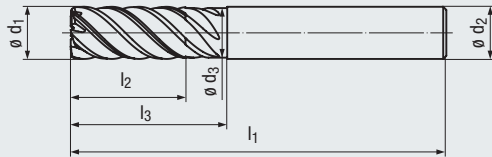
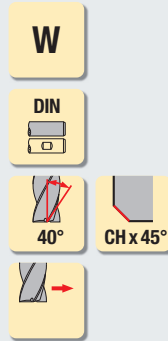
- Cutting diameter 6-12 mm
- Stub and standard lengths

### Applications:

- High performance tool for finishing operations only
- Trimming visible 2D contoured surfaces in non-ferrous materials; wrought aluminum alloys, copper and copper alloys
- Production of design surfaces in medical technology, jewelry industry, food and electronics sector

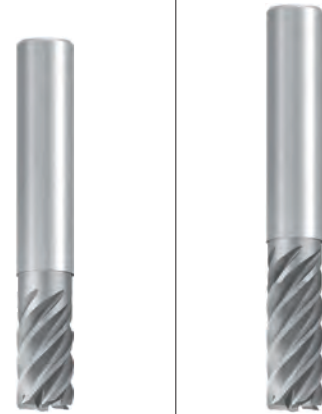
*German engineered  
EMUGE-FRANKEN quality*

- High performance tool for finishing
- Patented tool geometry
- 3 cutting edges and 3 pressure ridges
- Production of polished and compacted surfaces
- Production of surfaces with surface roughness grades N1-N3
- 2 lengths available



For the purpose of calculating the feed rate, multiply by 3 flutes

Icon descriptions (see pages 160-161)



**Coating**

Applications – Materials (see page 15)

Cutting Data (see page 158)

- Suitable for trimming 2D contours
- For wrought aluminum alloys
- For copper and copper alloys
- Only suitable for finishing

N 1.1-1.3  
N 2.1-2.6

Tool Dimensions / mm

**Stub length**

$\varnothing d_1$ h5	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h5	Chamfer	# Flutes	Tool No. Straight Shank
6	10	16	54	5.8	6	0.12	3/6	2506.006
8	12	20	58	7.7	8	0.12	3/6	2506.008
10	14	24	66	9.5	10	0.20	3/6	2506.010
12	16	26	73	11.5	12	0.20	3/6	2506.012

**Standard length**

$\varnothing d_1$ h5	$l_2$	$l_3$	$l_1$	$\varnothing d_3$	$\varnothing d_2$ h5	Chamfer	# Flutes	Tool No. Straight Shank
6	13	20	57	5.8	6	0.12	3/6	2507.006
8	19	25	63	7.7	8	0.12	3/6	2507.008
10	22	30	72	9.5	10	0.20	3/6	2507.010
12	26	35	83	11.5	12	0.20	3/6	2507.012

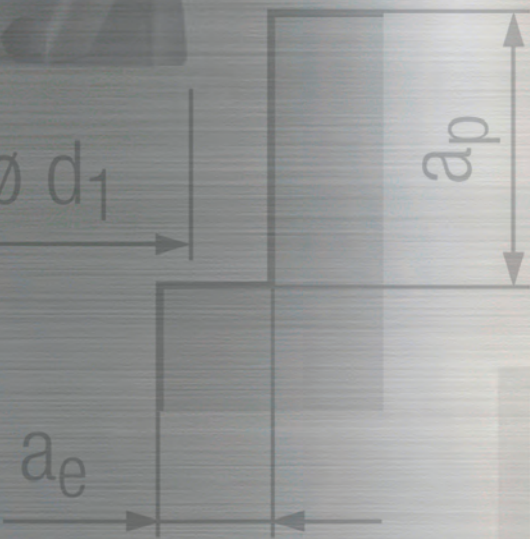
# Applications / Materials Cutting Data

$$a_e = 0.4$$

$f_z$

[inch]

$$a_p = d_1$$

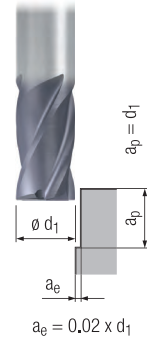
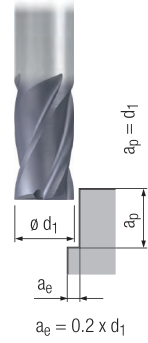
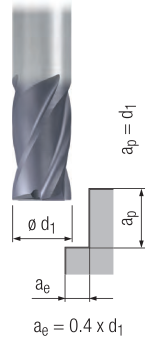
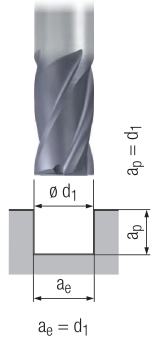


$$a_e = 0.4 \times d_1$$



**Stub length (4 flutes)**

**N**



**Valid for Tool Nos.:**

- 2992L
- 2993L
- 1916A
- 1917A

	$V_c$ [sfm]		$f_z$ [inch]		$V_c$ [sfm]		$f_z$ [inch]						
	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$					
<b>P</b>	1.1	615	0.005 x d <sub>1</sub>	685	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	865	0.008 x d <sub>1</sub>	□	■	□	■
	2.1	540	0.004 x d <sub>1</sub>	615	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	760	0.007 x d <sub>1</sub>	□	■	□	■
	3.1	470	0.004 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	575	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	□	■	□	■
	4.1	435	0.003 x d <sub>1</sub>	470	0.004 x d <sub>1</sub>	505	0.004 x d <sub>1</sub>	615	0.005 x d <sub>1</sub>	□	■		
	5.1	360	0.003 x d <sub>1</sub>	395	0.003 x d <sub>1</sub>	435	0.004 x d <sub>1</sub>	505	0.004 x d <sub>1</sub>	□	■		
<b>M</b>	1.1	290	0.003 x d <sub>1</sub>	325	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>			□	■
	2.1	255	0.003 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>			□	■
	3.1	180	0.002 x d <sub>1</sub>	215	0.003 x d <sub>1</sub>	215	0.003 x d <sub>1</sub>	255	0.004 x d <sub>1</sub>			□	■
	4.1	110	0.002 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>	145	0.003 x d <sub>1</sub>	145	0.004 x d <sub>1</sub>			□	■
<b>K</b>	1.1	615	0.005 x d <sub>1</sub>	685	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	865	0.008 x d <sub>1</sub>	□	■		
	1.2	615	0.005 x d <sub>1</sub>	685	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	865	0.008 x d <sub>1</sub>	□	■		
	2.1	540	0.004 x d <sub>1</sub>	615	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	760	0.006 x d <sub>1</sub>	□	■		
	2.2	540	0.004 x d <sub>1</sub>	615	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	760	0.006 x d <sub>1</sub>	□	■		
	3.1	470	0.004 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	575	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	□	■		
	3.2	470	0.004 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	575	0.006 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	□	■		
	4.1	360	0.003 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	435	0.004 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	□	■		
	4.2	290	0.003 x d <sub>1</sub>	325	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>	□	■		
<b>N</b>	1.1	795	0.009 x d <sub>1</sub>	900	0.010 x d <sub>1</sub>	1010	0.011 x d <sub>1</sub>	1085	0.013 x d <sub>1</sub>			□	■
	1.2	795	0.008 x d <sub>1</sub>	900	0.009 x d <sub>1</sub>	1010	0.010 x d <sub>1</sub>	1085	0.011 x d <sub>1</sub>			□	■
	1.3	795	0.007 x d <sub>1</sub>	900	0.008 x d <sub>1</sub>	1010	0.009 x d <sub>1</sub>	1085	0.010 x d <sub>1</sub>			□	■
	1.4	720	0.008 x d <sub>1</sub>	900	0.009 x d <sub>1</sub>	1010	0.010 x d <sub>1</sub>	1085	0.011 x d <sub>1</sub>			□	■
	1.5	720											
	1.6	720											
	2.1	540	0.005 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>	650	0.007 x d <sub>1</sub>	760	0.008 x d <sub>1</sub>			□	■
	2.2	540	0.005 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>	650	0.007 x d <sub>1</sub>	760	0.008 x d <sub>1</sub>			□	■
	2.3	540	0.005 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>	650	0.007 x d <sub>1</sub>	760	0.008 x d <sub>1</sub>			□	■
	2.4	470	0.004 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	575	0.006 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	□	■	□	■
	2.5	470	0.004 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	575	0.006 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	□	■	□	■
	2.6	470	0.004 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	575	0.006 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	□	■	□	■
	2.7	290	0.003 x d <sub>1</sub>	325	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>			□	■
	2.8	290	0.003 x d <sub>1</sub>	325	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>			□	■
	3.1	1225	0.009 x d <sub>1</sub>	1335	0.011 x d <sub>1</sub>	1480	0.013 x d <sub>1</sub>	1730	0.014 x d <sub>1</sub>			□	■
	3.2	1225	0.007 x d <sub>1</sub>	1335	0.008 x d <sub>1</sub>	1480	0.010 x d <sub>1</sub>	1730	0.011 x d <sub>1</sub>			□	■
4.1	1225	0.008 x d <sub>1</sub>	1335	0.009 x d <sub>1</sub>	1480	0.011 x d <sub>1</sub>	1730	0.012 x d <sub>1</sub>			□	■	
4.2	1805	0.008 x d <sub>1</sub>	1985	0.009 x d <sub>1</sub>	2165	0.011 x d <sub>1</sub>	2525	0.012 x d <sub>1</sub>			□	■	
4.3													
4.4													
5.1													
5.2	290	0.003 x d <sub>1</sub>	325	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>				■	
5.3													
<b>S</b>	1.1	290	0.004 x d <sub>1</sub>	325	0.004 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>	395	0.006 x d <sub>1</sub>				■
	1.2	255	0.003 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>				■
	1.3	145	0.003 x d <sub>1</sub>	145	0.003 x d <sub>1</sub>	180	0.004 x d <sub>1</sub>	215	0.004 x d <sub>1</sub>				■
	2.1	255	0.002 x d <sub>1</sub>	290	0.002 x d <sub>1</sub>	290	0.003 x d <sub>1</sub>	360	0.003 x d <sub>1</sub>				■
	2.2	110	0.002 x d <sub>1</sub>	110	0.002 x d <sub>1</sub>	125	0.003 x d <sub>1</sub>	145	0.003 x d <sub>1</sub>				■
	2.3	70	0.002 x d <sub>1</sub>	90	0.002 x d <sub>1</sub>	90	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				■
	2.4	70	0.002 x d <sub>1</sub>	90	0.002 x d <sub>1</sub>	90	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				■
2.5	70	0.002 x d <sub>1</sub>	70	0.002 x d <sub>1</sub>	70	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				■	
2.6	70	0.002 x d <sub>1</sub>	70	0.002 x d <sub>1</sub>	70	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				■	
<b>H</b>	1.1	360	0.003 x d <sub>1</sub>	395	0.003 x d <sub>1</sub>	435	0.004 x d <sub>1</sub>	505	0.004 x d <sub>1</sub>	□	■		
	1.2	290	0.003 x d <sub>1</sub>	325	0.003 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	□	■		
	1.3			325	0.003 x d <sub>1</sub>	360	0.003 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	□	■		
	1.4												
	1.5												

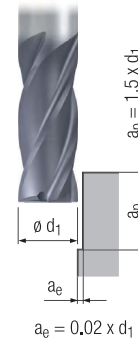
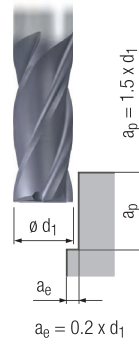
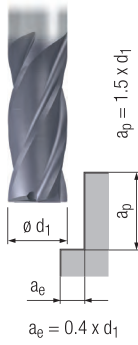
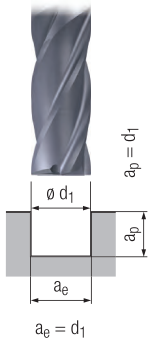
$v_c$  = Cutting speed    ■ = very suitable  
 $f_z$  = Feed per tooth    □ = suitable

**Standard length (4 flutes) - for Regular and Corner Radius tools**

**N**

**Valid for Tool Nos.:**

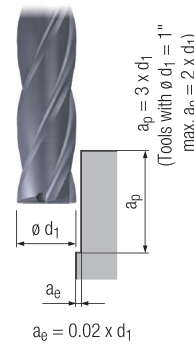
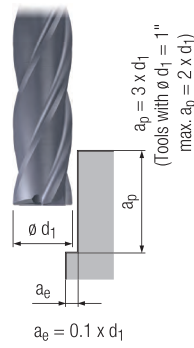
2994L 2698A  
2995L 2699A  
  
2998L 1998A  
2999L 1999A



	$V_c$ [sfm]		$f_z$ [inch]		$V_c$ [sfm]		$f_z$ [inch]				MMS MQL		
	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$					
<b>P</b>	1.1	505	0.005 x $d_1$	540	0.005 x $d_1$	615	0.006 x $d_1$	720	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	470	0.004 x $d_1$	505	0.005 x $d_1$	575	0.005 x $d_1$	650	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	395	0.004 x $d_1$	435	0.004 x $d_1$	470	0.005 x $d_1$	540	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	360	0.003 x $d_1$	395	0.003 x $d_1$	435	0.004 x $d_1$	505	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	5.1	325	0.003 x $d_1$	360	0.003 x $d_1$	395	0.003 x $d_1$	470	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>M</b>	1.1	255	0.003 x $d_1$	290	0.003 x $d_1$	290	0.004 x $d_1$	360	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	215	0.003 x $d_1$	255	0.003 x $d_1$	255	0.004 x $d_1$	290	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	145	0.002 x $d_1$	145	0.003 x $d_1$	180	0.003 x $d_1$	215	0.003 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	110	0.002 x $d_1$	110	0.003 x $d_1$	145	0.003 x $d_1$	145	0.003 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	505	0.005 x $d_1$	540	0.006 x $d_1$	615	0.006 x $d_1$	720	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	505	0.005 x $d_1$	540	0.006 x $d_1$	615	0.006 x $d_1$	720	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	470	0.004 x $d_1$	505	0.005 x $d_1$	575	0.005 x $d_1$	650	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	470	0.004 x $d_1$	505	0.005 x $d_1$	575	0.005 x $d_1$	650	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	395	0.004 x $d_1$	435	0.005 x $d_1$	470	0.005 x $d_1$	540	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	395	0.004 x $d_1$	435	0.005 x $d_1$	470	0.005 x $d_1$	540	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	325	0.003 x $d_1$	360	0.003 x $d_1$	395	0.004 x $d_1$	470	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.2	255	0.003 x $d_1$	290	0.003 x $d_1$	290	0.004 x $d_1$	360	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
<b>N</b>	1.1	795	0.009 x $d_1$	900	0.010 x $d_1$	1010	0.011 x $d_1$	1085	0.013 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	795	0.008 x $d_1$	900	0.009 x $d_1$	1010	0.010 x $d_1$	1085	0.011 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	795	0.007 x $d_1$	900	0.008 x $d_1$	1010	0.009 x $d_1$	1085	0.010 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	720	0.008 x $d_1$	900	0.009 x $d_1$	1010	0.010 x $d_1$	1085	0.011 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5												
	1.6												
	2.1	470	0.005 x $d_1$	505	0.006 x $d_1$	575	0.006 x $d_1$	650	0.007 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	470	0.005 x $d_1$	505	0.006 x $d_1$	575	0.006 x $d_1$	650	0.007 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	470	0.005 x $d_1$	505	0.006 x $d_1$	575	0.006 x $d_1$	650	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	435	0.004 x $d_1$	470	0.005 x $d_1$	505	0.005 x $d_1$	615	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	435	0.004 x $d_1$	470	0.005 x $d_1$	505	0.005 x $d_1$	615	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	435	0.004 x $d_1$	470	0.005 x $d_1$	505	0.005 x $d_1$	615	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	255	0.003 x $d_1$	290	0.003 x $d_1$	290	0.004 x $d_1$	360	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	255	0.003 x $d_1$	290	0.003 x $d_1$	290	0.004 x $d_1$	360	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	1045	0.009 x $d_1$	1155	0.010 x $d_1$	1265	0.011 x $d_1$	1480	0.013 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	1045	0.007 x $d_1$	1155	0.008 x $d_1$	1265	0.009 x $d_1$	1480	0.010 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	1045	0.008 x $d_1$	1155	0.009 x $d_1$	1265	0.009 x $d_1$	1480	0.011 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2	1550	0.008 x $d_1$	1695	0.009 x $d_1$	1875	0.009 x $d_1$	2165	0.011 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3													
4.4													
5.1													
5.2	255	0.003 x $d_1$	290	0.003 x $d_1$	290	0.004 x $d_1$	360	0.004 x $d_1$				<input checked="" type="checkbox"/>	
5.3													
<b>S</b>	1.1	255	0.004 x $d_1$	290	0.004 x $d_1$	290	0.004 x $d_1$	360	0.005 x $d_1$				<input checked="" type="checkbox"/>
	1.2	215	0.003 x $d_1$	255	0.003 x $d_1$	255	0.004 x $d_1$	290	0.004 x $d_1$				<input checked="" type="checkbox"/>
	1.3	145	0.003 x $d_1$	145	0.003 x $d_1$	180	0.003 x $d_1$	215	0.004 x $d_1$				<input checked="" type="checkbox"/>
	2.1	215	0.002 x $d_1$	255	0.002 x $d_1$	255	0.003 x $d_1$	290	0.003 x $d_1$				<input checked="" type="checkbox"/>
	2.2	70	0.002 x $d_1$	70	0.002 x $d_1$	55	0.003 x $d_1$	110	0.003 x $d_1$				<input checked="" type="checkbox"/>
	2.3	70	0.002 x $d_1$	90	0.002 x $d_1$	90	0.003 x $d_1$	110	0.003 x $d_1$				<input checked="" type="checkbox"/>
	2.4	70	0.002 x $d_1$	90	0.002 x $d_1$	90	0.003 x $d_1$	110	0.003 x $d_1$				<input checked="" type="checkbox"/>
2.5	70	0.002 x $d_1$	70	0.002 x $d_1$	70	0.003 x $d_1$	110	0.003 x $d_1$				<input checked="" type="checkbox"/>	
2.6	70	0.002 x $d_1$	70	0.002 x $d_1$	70	0.003 x $d_1$	110	0.003 x $d_1$				<input checked="" type="checkbox"/>	
<b>H</b>	1.1	325	0.003 x $d_1$	360	0.003 x $d_1$	395	0.003 x $d_1$	470	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	255	0.003 x $d_1$	290	0.003 x $d_1$	290	0.003 x $d_1$	360	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3			255	0.003 x $d_1$	255	0.003 x $d_1$	290	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.4												
	1.5												

Long length (4-5 flutes)

N



Valid for Tool Nos.:

- 2996L
- 2997L
- 2526A
- 2527A

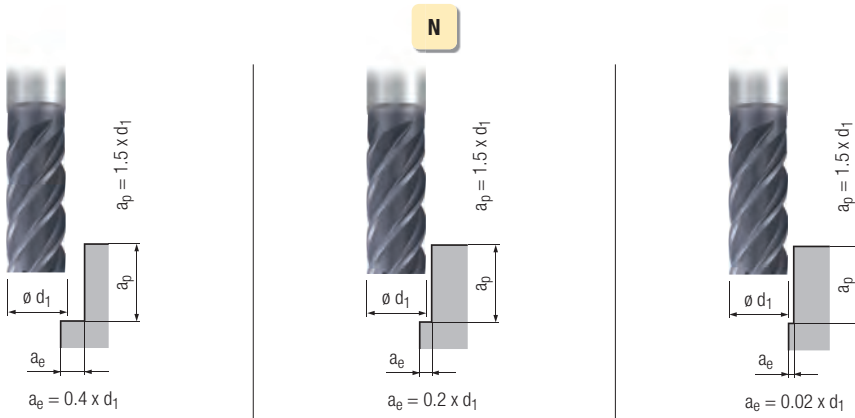
	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]			MMS MQL		
<b>P</b>	1.1	435	0.005 x $d_1$	505	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	395	0.004 x $d_1$	470	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	325	0.004 x $d_1$	395	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	255	0.003 x $d_1$	290	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	5.1	215	0.003 x $d_1$	255	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>M</b>	1.1	435	0.003 x $d_1$	505	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	360	0.003 x $d_1$	435	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	255	0.003 x $d_1$	290	0.003 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	180	0.003 x $d_1$	215	0.003 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	435	0.005 x $d_1$	505	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	435	0.005 x $d_1$	505	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	395	0.004 x $d_1$	470	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	395	0.004 x $d_1$	470	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	325	0.004 x $d_1$	395	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	325	0.004 x $d_1$	395	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	255	0.003 x $d_1$	290	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2	215	0.003 x $d_1$	255	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>N</b>	1.1	1300	0.009 x $d_1$	1550	0.011 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	1300	0.008 x $d_1$	1550	0.010 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	1300	0.007 x $d_1$	1550	0.008 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	865	0.008 x $d_1$	1045	0.010 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5	830	0.007 x $d_1$	1010	0.008 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6	575	0.006 x $d_1$	685	0.007 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	395	0.005 x $d_1$	470	0.006 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	395	0.005 x $d_1$	470	0.006 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	395	0.005 x $d_1$	470	0.006 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>
	2.4	360	0.004 x $d_1$	435	0.005 x $d_1$		<input type="checkbox"/>		<input checked="" type="checkbox"/>
	2.5	360	0.004 x $d_1$	435	0.005 x $d_1$		<input type="checkbox"/>		<input checked="" type="checkbox"/>
	2.6	360	0.004 x $d_1$	435	0.005 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>
	2.7	215	0.003 x $d_1$	255	0.004 x $d_1$		<input type="checkbox"/>		<input checked="" type="checkbox"/>
	2.8	215	0.003 x $d_1$	255	0.004 x $d_1$		<input type="checkbox"/>		<input checked="" type="checkbox"/>
	3.1								
	3.2								
4.1									
4.2									
4.3									
4.4									
5.1									
5.2	215	0.003 x $d_1$	255	0.004 x $d_1$				<input checked="" type="checkbox"/>	
5.3									
<b>S</b>	1.1	325	0.004 x $d_1$	360	0.005 x $d_1$				<input checked="" type="checkbox"/>
	1.2	255	0.003 x $d_1$	290	0.004 x $d_1$				<input checked="" type="checkbox"/>
	1.3	255	0.003 x $d_1$	290	0.003 x $d_1$				<input checked="" type="checkbox"/>
	2.1	255	0.004 x $d_1$	290	0.004 x $d_1$				<input checked="" type="checkbox"/>
	2.2	110	0.003 x $d_1$	145	0.004 x $d_1$				<input checked="" type="checkbox"/>
	2.3	70	0.002 x $d_1$	90	0.002 x $d_1$				<input checked="" type="checkbox"/>
	2.4	110	0.003 x $d_1$	160	0.003 x $d_1$				<input checked="" type="checkbox"/>
2.5	70	0.002 x $d_1$	70	0.002 x $d_1$				<input checked="" type="checkbox"/>	
2.6	70	0.003 x $d_1$	70	0.003 x $d_1$				<input checked="" type="checkbox"/>	
<b>H</b>	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

$v_c$  = Cutting speed  = very suitable  
 $f_z$  = Feed per tooth  = suitable

Standard length (5 Flutes) - for Regular and Corner Radius tools

Valid for Tool Nos.:

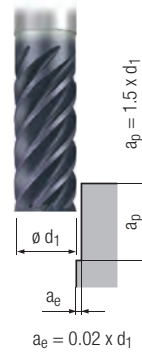
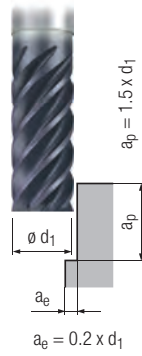
2946L 3902L  
2920L 3903L



	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]			MMS MQL		
<b>P</b>	1.1	540	0.005 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	505	0.005 x d <sub>1</sub>	575	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	435	0.004 x d <sub>1</sub>	470	0.005 x d <sub>1</sub>	540	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	395	0.003 x d <sub>1</sub>	435	0.004 x d <sub>1</sub>	505	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	5.1	360	0.003 x d <sub>1</sub>	395	0.003 x d <sub>1</sub>	470	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>M</b>	1.1	290	0.003 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	255	0.003 x d <sub>1</sub>	255	0.004 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	145	0.003 x d <sub>1</sub>	180	0.003 x d <sub>1</sub>	215	0.003 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	110	0.003 x d <sub>1</sub>	145	0.003 x d <sub>1</sub>	145	0.003 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	540	0.006 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	540	0.006 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	505	0.005 x d <sub>1</sub>	575	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	505	0.005 x d <sub>1</sub>	575	0.005 x d <sub>1</sub>	650	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	435	0.005 x d <sub>1</sub>	470	0.005 x d <sub>1</sub>	540	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	435	0.005 x d <sub>1</sub>	470	0.005 x d <sub>1</sub>	540	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	360	0.003 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	470	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2	290	0.003 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	<b>N</b>	1.1	900	0.010 x d <sub>1</sub>	1010	0.011 x d <sub>1</sub>	1085	0.013 x d <sub>1</sub>			<input type="checkbox"/>
1.2		900	0.009 x d <sub>1</sub>	1010	0.010 x d <sub>1</sub>	1085	0.011 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
1.3		900	0.008 x d <sub>1</sub>	1010	0.009 x d <sub>1</sub>	1085	0.010 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
1.4		900	0.009 x d <sub>1</sub>	1010	0.010 x d <sub>1</sub>	1085	0.011 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
1.5											
1.6											
2.1		505	0.006 x d <sub>1</sub>	575	0.006 x d <sub>1</sub>	650	0.007 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.2		505	0.006 x d <sub>1</sub>	575	0.006 x d <sub>1</sub>	650	0.007 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.3		505	0.006 x d <sub>1</sub>	575	0.006 x d <sub>1</sub>	650	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.4		470	0.005 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5		470	0.005 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.6		470	0.005 x d <sub>1</sub>	505	0.005 x d <sub>1</sub>	615	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.7		290	0.003 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.8		290	0.003 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.1		1155	0.010 x d <sub>1</sub>	1265	0.011 x d <sub>1</sub>	1480	0.013 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.2		1155	0.008 x d <sub>1</sub>	1265	0.009 x d <sub>1</sub>	1480	0.010 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1		1155	0.009 x d <sub>1</sub>	1265	0.009 x d <sub>1</sub>	1480	0.011 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2										<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.3									<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4									<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1											
5.2	290	0.003 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>				<input checked="" type="checkbox"/>	
5.3											
<b>S</b>	1.1	290	0.004 x d <sub>1</sub>	290	0.004 x d <sub>1</sub>	1180	0.005 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	1.2	255	0.003 x d <sub>1</sub>	255	0.004 x d <sub>1</sub>	950	0.004 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	1.3	145	0.003 x d <sub>1</sub>	180	0.003 x d <sub>1</sub>	705	0.004 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.1	255	0.002 x d <sub>1</sub>	255	0.003 x d <sub>1</sub>	290	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.2	70	0.002 x d <sub>1</sub>	55	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.3	90	0.002 x d <sub>1</sub>	90	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.4	90	0.002 x d <sub>1</sub>	90	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
2.5	70	0.002 x d <sub>1</sub>	70	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>	
2.6	70	0.002 x d <sub>1</sub>	70	0.003 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>	
<b>H</b>	1.1	360	0.003 x d <sub>1</sub>	395	0.003 x d <sub>1</sub>	470	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	290	0.003 x d <sub>1</sub>	290	0.003 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3	255	0.003 x d <sub>1</sub>	255	0.003 x d <sub>1</sub>	290	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.4										
	1.5										

Standard length (6-8 Flutes) - for Regular and Corner Radius tools

N



Valid for Tool Nos.:

- 2948L    2947L
- 3908L    3909L
  
- 2522A
- 2524A

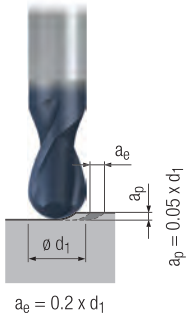
		$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]			MMS MQL	
P	1.1	615	$0.006 \times d_1$	720	$0.007 \times d_1$	□	■	□	■
	2.1	575	$0.005 \times d_1$	650	$0.006 \times d_1$	□	■	□	■
	3.1	470	$0.005 \times d_1$	540	$0.005 \times d_1$	□	■	□	■
	4.1	435	$0.004 \times d_1$	505	$0.004 \times d_1$	□	■		
	5.1	395	$0.003 \times d_1$	470	$0.004 \times d_1$	□	■		
M	1.1	290	$0.004 \times d_1$	360	$0.004 \times d_1$			□	■
	2.1	255	$0.004 \times d_1$	290	$0.004 \times d_1$			□	■
	3.1	180	$0.003 \times d_1$	215	$0.003 \times d_1$			□	■
	4.1	145	$0.003 \times d_1$	145	$0.003 \times d_1$			□	■
K	1.1	615	$0.006 \times d_1$	720	$0.007 \times d_1$	□	■		
	1.2	615	$0.006 \times d_1$	720	$0.007 \times d_1$	□	■		
	2.1	575	$0.005 \times d_1$	650	$0.006 \times d_1$	□	■		
	2.2	575	$0.005 \times d_1$	650	$0.006 \times d_1$	□	■		
	3.1	470	$0.005 \times d_1$	540	$0.006 \times d_1$	□	■		
	3.2	470	$0.005 \times d_1$	540	$0.006 \times d_1$	□	■		
	4.1	395	$0.004 \times d_1$	470	$0.004 \times d_1$	□	■		
	4.2	290	$0.004 \times d_1$	360	$0.004 \times d_1$	□	■		
N	1.1	1010	$0.011 \times d_1$	1085	$0.013 \times d_1$			□	■
	1.2	1010	$0.010 \times d_1$	1085	$0.011 \times d_1$			□	■
	1.3	1010	$0.009 \times d_1$	1085	$0.010 \times d_1$			□	■
	1.4	1010	$0.010 \times d_1$	1085	$0.011 \times d_1$			□	■
	1.5								
	1.6								
	2.1	575	$0.006 \times d_1$	650	$0.007 \times d_1$			□	■
	2.2	575	$0.006 \times d_1$	650	$0.007 \times d_1$			□	■
	2.3	575	$0.006 \times d_1$	650	$0.007 \times d_1$	□	■	□	■
	2.4	505	$0.005 \times d_1$	615	$0.006 \times d_1$			□	■
	2.5	505	$0.005 \times d_1$	615	$0.006 \times d_1$			□	■
	2.6	505	$0.005 \times d_1$	615	$0.006 \times d_1$	□	■	□	■
	2.7	290	$0.004 \times d_1$	360	$0.004 \times d_1$			□	■
	2.8	290	$0.004 \times d_1$	360	$0.004 \times d_1$			□	■
	3.1	1265	$0.011 \times d_1$	1480	$0.013 \times d_1$			□	■
	3.2	1265	$0.009 \times d_1$	1480	$0.010 \times d_1$			□	■
4.1	1265	$0.009 \times d_1$	1480	$0.011 \times d_1$			□	■	
4.2	1875	$0.009 \times d_1$	2165	$0.011 \times d_1$			□	■	
4.3									
4.4									
5.1									
5.2	290	$0.004 \times d_1$	360	$0.004 \times d_1$				■	
5.3									
S	1.1	290	$0.004 \times d_1$	360	$0.005 \times d_1$				■
	1.2	255	$0.004 \times d_1$	290	$0.004 \times d_1$				■
	1.3	180	$0.003 \times d_1$	215	$0.004 \times d_1$				■
	2.1	255	$0.003 \times d_1$	290	$0.003 \times d_1$				■
	2.2	55	$0.003 \times d_1$	110	$0.003 \times d_1$				■
	2.3	90	$0.003 \times d_1$	110	$0.003 \times d_1$				■
	2.4	90	$0.003 \times d_1$	110	$0.003 \times d_1$				■
2.5	70	$0.003 \times d_1$	110	$0.003 \times d_1$				■	
2.6	70	$0.003 \times d_1$	110	$0.003 \times d_1$				■	
H	1.1	395	$0.003 \times d_1$	470	$0.004 \times d_1$	□	■		
	1.2								
	1.3								
	1.4								
	1.5								

$v_c$  = Cutting speed    ■ = very suitable  
 $f_z$  = Feed per tooth    □ = suitable

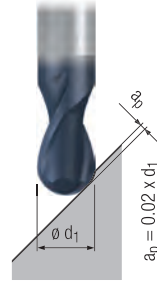
Standard length with ball nose

N

Roughing



Finishing



Valid for Tool Nos.:

- 2919L 2502A
- 2974L
- 3900L

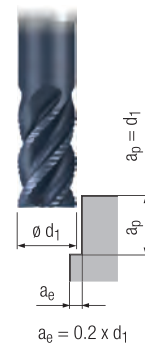
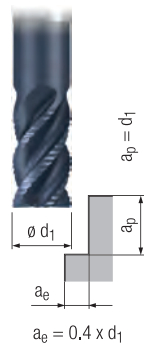
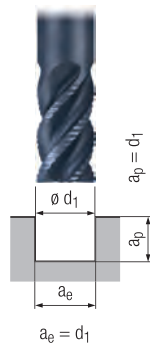
	$v_c$ [sfm]	$f_z$ [inch]	$v_c$ [sfm]	$v_c$ [sfm]			MMS MLQ		
<b>P</b>	1.1	655	$0.014 \times d_1$	885	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	555	$0.013 \times d_1$	755	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	460	$0.011 \times d_1$	655	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	360	$0.010 \times d_1$	525	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	325	$0.008 \times d_1$	425	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1	325	$0.008 \times d_1$	425	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	260	$0.008 \times d_1$	360	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	195	$0.006 \times d_1$	260	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	130	$0.006 \times d_1$	195	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	655	$0.014 \times d_1$	855	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	1.2	655	$0.014 \times d_1$	855	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	2.1	590	$0.011 \times d_1$	755	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	2.2	590	$0.011 \times d_1$	755	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	3.1	460	$0.011 \times d_1$	655	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	3.2	460	$0.011 \times d_1$	655	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	4.1	360	$0.008 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	4.2	325	$0.008 \times d_1$	425	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	<b>N</b>	1.1							
1.2									
1.3									
1.4									
1.5									
1.6									
2.1		590	$0.014 \times d_1$	755	$0.010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.2		590	$0.014 \times d_1$	755	$0.010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.3		590	$0.014 \times d_1$	755	$0.010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.4		460	$0.011 \times d_1$	655	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5		460	$0.011 \times d_1$	655	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.6		460	$0.011 \times d_1$	655	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.7		295	$0.008 \times d_1$	395	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.8		295	$0.008 \times d_1$	395	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.1		1310	$0.025 \times d_1$	1640	$0.018 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.2		1310	$0.020 \times d_1$	1640	$0.014 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1		950	$0.020 \times d_1$	1310	$0.015 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2		1410	$0.020 \times d_1$	1900	$0.015 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.3									
4.4									
5.1									
5.2	325	$0.008 \times d_1$	425	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3	590	$0.017 \times d_1$	885	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
<b>S</b>	1.1	325	$0.010 \times d_1$	425	$0.007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	260	$0.008 \times d_1$	360	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	130	$0.007 \times d_1$	195	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	230	$0.008 \times d_1$	325	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	80	$0.006 \times d_1$	130	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	80	$0.006 \times d_1$	100	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	80	$0.006 \times d_1$	100	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	50	$0.006 \times d_1$	80	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6	80	$0.006 \times d_1$	100	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

Standard length with short flute design

NR

Valid for Tool Nos.:

2869A 2869L



ALCR

TIALN

MMS MQL

	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	ALCR				
							TIALN	MMS MQL			
P	1.1	525	$0.007 \times d_1$	590	$0.008 \times d_1$	660	$0.009 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		525	$0.007 \times d_1$	590	$0.008 \times d_1$	660	$0.009 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	525	$0.007 \times d_1$	590	$0.008 \times d_1$	660	$0.009 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		495	$0.007 \times d_1$	560	$0.008 \times d_1$	625	$0.009 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	495	$0.007 \times d_1$	560	$0.007 \times d_1$	625	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		460	$0.006 \times d_1$	525	$0.007 \times d_1$	590	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	460	$0.006 \times d_1$	525	$0.006 \times d_1$	590	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		395	$0.005 \times d_1$	460	$0.006 \times d_1$	495	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	395	$0.005 \times d_1$	460	$0.005 \times d_1$	495	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		330	$0.004 \times d_1$	395	$0.005 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		330	$0.004 \times d_1$	395	$0.004 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	M	1.1	$0.004 \times d_1$	295	$0.005 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.1		$0.004 \times d_1$	230	$0.005 \times d_1$	265	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
3.1											
4.1											
K	1.1	$0.007 \times d_1$	590	$0.008 \times d_1$	660	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	$0.007 \times d_1$	590	$0.008 \times d_1$	660	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	$0.006 \times d_1$	525	$0.006 \times d_1$	590	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	$0.006 \times d_1$	525	$0.006 \times d_1$	590	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	$0.006 \times d_1$	460	$0.006 \times d_1$	495	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2	$0.006 \times d_1$	460	$0.006 \times d_1$	495	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1	$0.004 \times d_1$	395	$0.005 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.2	$0.004 \times d_1$	295	$0.005 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
N	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1	460	$0.007 \times d_1$	525	$0.008 \times d_1$	590	$0.009 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	460	$0.007 \times d_1$	525	$0.008 \times d_1$	590	$0.009 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3	460	$0.007 \times d_1$	525	$0.008 \times d_1$	590	$0.009 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4	430	$0.006 \times d_1$	495	$0.006 \times d_1$	525	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.5	430	$0.006 \times d_1$	495	$0.006 \times d_1$	525	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.6	430	$0.006 \times d_1$	495	$0.006 \times d_1$	525	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.7	265	$0.004 \times d_1$	295	$0.005 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.8	265	$0.004 \times d_1$	295	$0.005 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1										
	3.2										
4.1	1050	$0.011 \times d_1$	1215	$0.012 \times d_1$	1315	$0.014 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.2											
4.3											
4.4											
5.1											
5.2	265	0.004	295	$0.005 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.3											
S	1.1	265	$0.005 \times d_1$	295	$0.006 \times d_1$	330	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	200	$0.004 \times d_1$	230	$0.005 \times d_1$	265	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3	135	$0.004 \times d_1$	165	$0.004 \times d_1$	165	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1										
	2.2										
	2.3										
	2.4										
H	1.1	265	$0.004 \times d_1$	295	$0.004 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.2										
	1.3										
	1.4										
	1.5										

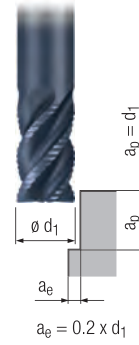
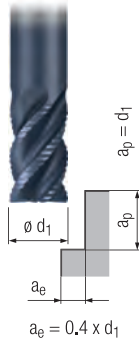
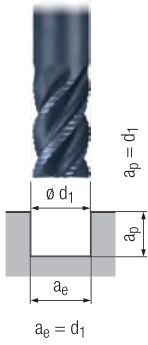
$v_c$  = Cutting speed  = very suitable  
 $f_z$  = Feed per tooth  = suitable

**Long length with short flute design**

**NR**

**Valid for Tool Nos.:**

2875A 2875L



**ALCR**

**TIALN**

	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	ALCR				
									MMS MQL		
<b>P</b>	1.1	430	$0.005 \times d_1$	460	$0.006 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		430	$0.005 \times d_1$	460	$0.006 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	430	$0.005 \times d_1$	460	$0.005 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		395	$0.005 \times d_1$	430	$0.005 \times d_1$	460	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	395	$0.005 \times d_1$	430	$0.005 \times d_1$	460	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		395	$0.004 \times d_1$	430	$0.005 \times d_1$	460	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	360	$0.004 \times d_1$	395	$0.005 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		360	$0.004 \times d_1$	395	$0.004 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	295	$0.004 \times d_1$	330	$0.004 \times d_1$	360	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		295	$0.004 \times d_1$	330	$0.004 \times d_1$	360	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	295	$0.003 \times d_1$	330	$0.003 \times d_1$	360	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		265	$0.003 \times d_1$	295	$0.003 \times d_1$	330	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	265	$0.003 \times d_1$	295	$0.003 \times d_1$	330	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		265	$0.003 \times d_1$	295	$0.003 \times d_1$	330	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1										
	2.1										
	3.1										
	4.1										
<b>K</b>	1.1	430	$0.005 \times d_1$	460	$0.006 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	430	$0.005 \times d_1$	460	$0.006 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	385	$0.004 \times d_1$	430	$0.004 \times d_1$	460	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	385	$0.004 \times d_1$	430	$0.004 \times d_1$	460	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	330	$0.004 \times d_1$	360	$0.004 \times d_1$	395	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	330	$0.004 \times d_1$	360	$0.004 \times d_1$	395	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	265	$0.003 \times d_1$	295	$0.003 \times d_1$	330	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	230	$0.003 \times d_1$	265	$0.003 \times d_1$	265	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1	395	$0.005 \times d_1$	430	$0.006 \times d_1$	460	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	395	$0.005 \times d_1$	430	$0.006 \times d_1$	460	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	395	$0.005 \times d_1$	430	$0.006 \times d_1$	460	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	360	$0.004 \times d_1$	395	$0.004 \times d_1$	430	$0.005 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	360	$0.004 \times d_1$	395	$0.004 \times d_1$	430	$0.005 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	360	$0.004 \times d_1$	395	$0.004 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	230	$0.003 \times d_1$	265	$0.003 \times d_1$	265	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	230	$0.003 \times d_1$	265	$0.003 \times d_1$	265	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1										
	3.2										
4.1	890	$0.008 \times d_1$	985	$0.008 \times d_1$	1050	$0.009 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2											
4.3											
4.4											
5.1	890	$0.010 \times d_1$	985	$0.011 \times d_1$	1050	$0.013 \times d_1$				<input checked="" type="checkbox"/>	
5.2	230	$0.003 \times d_1$	265	$0.003 \times d_1$	265	$0.004 \times d_1$				<input checked="" type="checkbox"/>	
5.3	430	$0.006 \times d_1$	460	$0.007 \times d_1$	525	$0.008 \times d_1$				<input checked="" type="checkbox"/>	
<b>S</b>	1.1										
	1.2										
	1.3										
	2.1										
	2.2										
	2.3										
<b>H</b>	1.1	230	$0.003 \times d_1$	265	$0.003 \times d_1$	265	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2										
	1.3										
	1.4										
	1.5										

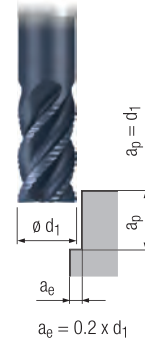
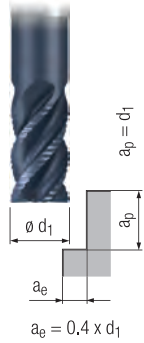
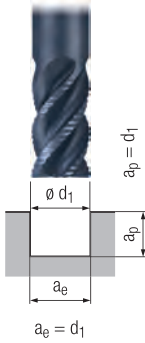


Standard length with short flute design

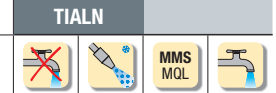
NR

Valid for Tool Nos.:

2869AZ 2869LZ



ALCR



	V <sub>C</sub> [sfm]	f <sub>Z</sub> [inch]	V <sub>C</sub> [sfm]	f <sub>Z</sub> [inch]	V <sub>C</sub> [sfm]	f <sub>Z</sub> [inch]	ALCR					
							TIALN	MMS MQL				
<b>P</b>	1.1	525	0.007 x d <sub>1</sub>	590	0.008 x d <sub>1</sub>	660	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		525	0.007 x d <sub>1</sub>	590	0.008 x d <sub>1</sub>	660	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	495	0.007 x d <sub>1</sub>	560	0.008 x d <sub>1</sub>	625	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		495	0.006 x d <sub>1</sub>	560	0.007 x d <sub>1</sub>	625	0.008 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	460	0.006 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	590	0.008 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		460	0.005 x d <sub>1</sub>	525	0.006 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1	395	0.005 x d <sub>1</sub>	460	0.006 x d <sub>1</sub>	495	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		395	0.004 x d <sub>1</sub>	460	0.005 x d <sub>1</sub>	495	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	5.1	330	0.004 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>	430	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		330	0.004 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	430	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	<b>M</b>	1.1	265	0.004 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		2.1	200	0.004 x d <sub>1</sub>	230	0.005 x d <sub>1</sub>	265	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		3.1							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		4.1							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>K</b>	1.1	525	0.007 x d <sub>1</sub>	590	0.008 x d <sub>1</sub>	660	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	525	0.007 x d <sub>1</sub>	590	0.008 x d <sub>1</sub>	660	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	460	0.006 x d <sub>1</sub>	525	0.006 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	460	0.006 x d <sub>1</sub>	525	0.006 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	395	0.006 x d <sub>1</sub>	460	0.006 x d <sub>1</sub>	495	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2	395	0.006 x d <sub>1</sub>	460	0.006 x d <sub>1</sub>	495	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1	330	0.004 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>	430	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.2	265	0.004 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>N</b>	1.1							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1.2	1575	0.009 x d <sub>1</sub>	1800	0.010 x d <sub>1</sub>	1920	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3	1575	0.009 x d <sub>1</sub>	1800	0.010 x d <sub>1</sub>	1920	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.4	1050	0.009 x d <sub>1</sub>	1215	0.010 x d <sub>1</sub>	1310	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.5							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1.6							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	2.1	460	0.007 x d <sub>1</sub>	525	0.008 x d <sub>1</sub>	590	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	460	0.007 x d <sub>1</sub>	525	0.008 x d <sub>1</sub>	590	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3	460	0.007 x d <sub>1</sub>	525	0.008 x d <sub>1</sub>	590	0.009 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4	430	0.006 x d <sub>1</sub>	495	0.006 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.5	430	0.006 x d <sub>1</sub>	495	0.006 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.6	430	0.006 x d <sub>1</sub>	495	0.006 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.7	265	0.004 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.8	265	0.004 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	3.2							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4.1	1050	0.011 x d <sub>1</sub>	1215	0.012 x d <sub>1</sub>	1315	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.2							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4.3							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
4.4							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
5.1							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
5.2	265	0.004	295	0.005 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.3							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<b>S</b>	1.1	265	0.005 x d <sub>1</sub>	295	0.006 x d <sub>1</sub>	330	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	200	0.004 x d <sub>1</sub>	230	0.005 x d <sub>1</sub>	265	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3	135	0.004 x d <sub>1</sub>	165	0.004 x d <sub>1</sub>	165	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	2.2							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	2.3							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	2.4							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>H</b>	1.1	265	0.004 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1.2							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1.3							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1.4							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1.5							<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

v<sub>c</sub> = Cutting speed ■ = very suitable  
f<sub>Z</sub> = Feed per tooth □ = suitable

**Standard length with ball nose**



Valid for Tool Nos.:

2667A  
2667L

			ALCR				
			TIALN		MMS MQL		
	$V_c$ [sfm]	$f_z$ [inch]					
<b>P</b>	1.1	460	0.004 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	430	0.003 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	360	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	295	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	755	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1						
	2.1						
	3.1						
	4.1						
<b>K</b>	1.1	460	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	460	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	430	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	430	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	360	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	360	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	295	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	755	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1						
	1.2						
	1.3						
	1.4						
	1.5						
	1.6						
	2.1	430	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	430	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	430	0.004 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	395	0.003 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	395	0.003 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	395	0.003 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	755	0.002 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	755	0.002 x $d_1$				<input checked="" type="checkbox"/>
	3.1						
3.2							
4.1	950	0.006 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2							
4.3							
4.4							
5.1							
5.2	230	0.002 x $d_1$				<input checked="" type="checkbox"/>	
5.3							
<b>S</b>	1.1	230	0.003 x $d_1$				<input checked="" type="checkbox"/>
	1.2	195	0.002 x $d_1$				<input checked="" type="checkbox"/>
	1.3	130	0.002 x $d_1$				<input checked="" type="checkbox"/>
	2.1						
	2.2						
	2.3						
	2.4						
2.5							
2.6							
<b>H</b>	1.1	230	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2						
	1.3						
	1.4						
	1.5						

**DUPLEX – Standard and Long length**

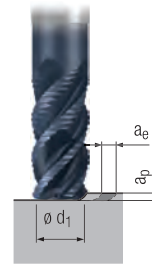
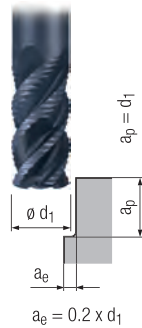
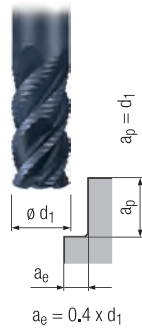
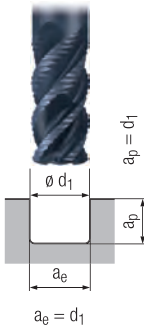
**NR**

**Valid for Tool Nos.:**

- 2614AZ    2616AZ
- 2615AZ    2617AZ

**HPC**  
Roughing with circumference cutting edge

**HSC**  
High feed roughing with face cutting edge



		HPC		NR		HSC		$a_p$ [mm]	$a_e$ [mm]			MMS MQL			
		$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]							$V_c$ [m/min]	$f_z$ [mm]
<b>P</b>	1.1	170	$0.005 \times d_1$	190	$0.006 \times d_1$	200	$0.007 \times d_1$	220	$0.038 \times d_1$	$0.05 \times d_1$	$0.5 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	150	$0.005 \times d_1$	170	$0.005 \times d_1$	180	$0.006 \times d_1$	200	$0.034 \times d_1$	$0.05 \times d_1$	$0.5 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	130	$0.004 \times d_1$	140	$0.005 \times d_1$	160	$0.005 \times d_1$	170	$0.030 \times d_1$	$0.04 \times d_1$	$0.4 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	120	$0.003 \times d_1$	130	$0.004 \times d_1$	140	$0.004 \times d_1$	160	$0.024 \times d_1$	$0.03 \times d_1$	$0.3 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	110	$0.003 \times d_1$	120	$0.003 \times d_1$	130	$0.004 \times d_1$	140	$0.022 \times d_1$	$0.03 \times d_1$	$0.3 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1														
	2.1														
	3.1														
	4.1														
<b>K</b>	1.1	170	$0.006 \times d_1$	190	$0.006 \times d_1$	200	$0.007 \times d_1$	220	$0.040 \times d_1$	$0.06 \times d_1$	$0.6 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	170	$0.006 \times d_1$	190	$0.006 \times d_1$	200	$0.007 \times d_1$	220	$0.040 \times d_1$	$0.06 \times d_1$	$0.6 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	150	$0.005 \times d_1$	170	$0.005 \times d_1$	180	$0.006 \times d_1$	200	$0.032 \times d_1$	$0.05 \times d_1$	$0.5 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	150	$0.005 \times d_1$	170	$0.005 \times d_1$	180	$0.006 \times d_1$	200	$0.032 \times d_1$	$0.05 \times d_1$	$0.5 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	130	$0.005 \times d_1$	140	$0.005 \times d_1$	160	$0.006 \times d_1$	170	$0.032 \times d_1$	$0.05 \times d_1$	$0.5 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	130	$0.005 \times d_1$	140	$0.005 \times d_1$	160	$0.006 \times d_1$	170	$0.032 \times d_1$	$0.05 \times d_1$	$0.5 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	100	$0.003 \times d_1$	110	$0.004 \times d_1$	120	$0.004 \times d_1$	130	$0.024 \times d_1$	$0.03 \times d_1$	$0.3 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	80	$0.003 \times d_1$	90	$0.004 \times d_1$	100	$0.004 \times d_1$	100	$0.024 \times d_1$	$0.03 \times d_1$	$0.3 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1														
	1.2														
	1.3														
	1.4														
	1.5														
	1.6														
	2.1														
	2.2														
	2.3	150	$0.006 \times d_1$	170	$0.006 \times d_1$	180	$0.007 \times d_1$	200	$0.040 \times d_1$	$0.06 \times d_1$	$0.6 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4														
	2.5														
	2.6	130	$0.005 \times d_1$	140	$0.005 \times d_1$	160	$0.006 \times d_1$	170	$0.032 \times d_1$	$0.05 \times d_1$	$0.5 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7														
	2.8														
	3.1														
	3.2														
4.1															
4.2															
4.3															
4.4															
5.1															
5.2	80	$0.003 \times d_1$	90	$0.004 \times d_1$	100	$0.004 \times d_1$	100	$0.024 \times d_1$	$0.03 \times d_1$	$0.3 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3															
<b>S</b>	1.1														
	1.2														
	1.3														
	2.1														
	2.2														
	2.3														
	2.4														
2.5															
2.6															
<b>H</b>	1.1	80	$0.003 \times d_1$	90	$0.003 \times d_1$	100	$0.004 \times d_1$	100	$0.022 \times d_1$	$0.03 \times d_1$	$0.3 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	80	$0.003 \times d_1$	90	$0.003 \times d_1$	100	$0.004 \times d_1$	100	$0.020 \times d_1$	$0.03 \times d_1$	$0.3 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3														
	1.4														
	1.5														

$v_c$  = Cutting speed     = very suitable  
 $f_z$  = Feed per tooth     = suitable

**DUPLEX – Standard and long length**

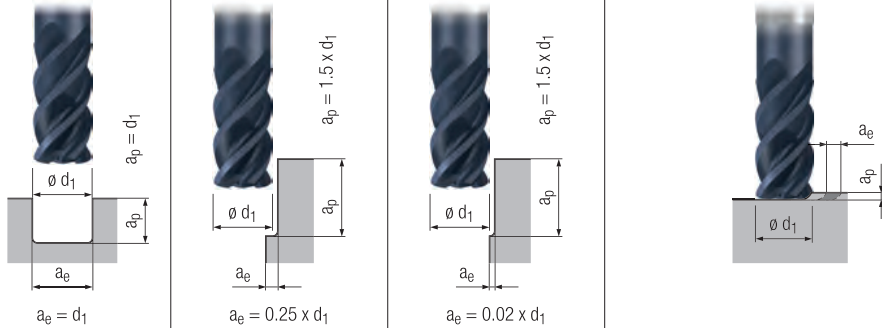
**Valid for Tool Nos.:**

- 2610AZ    2612AZ
- 2611AZ    2613AZ

**HPC / HSC**  
Roughing with circumference cutting edge

**N**

**HSC**  
High feed roughing with face cutting edge



		HPC / HSC		N		HSC		ap [mm]	ae [mm]	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>			
		Vc [m/min]	fz [mm]	Vc [m/min]	fz [mm]	Vc [m/min]	fz [mm]						Vc [m/min]	fz [mm]	
<b>P</b>	1.1	170	0.005 x d <sub>1</sub>	190	0.006 x d <sub>1</sub>	200	0.007 x d <sub>1</sub>	240	0.038 x d <sub>1</sub>	0.05 x d <sub>1</sub>	0.6 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	160	0.005 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>	190	0.006 x d <sub>1</sub>	220	0.034 x d <sub>1</sub>	0.04 x d <sub>1</sub>	0.5 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	150	0.004 x d <sub>1</sub>	170	0.005 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>	210	0.030 x d <sub>1</sub>	0.04 x d <sub>1</sub>	0.5 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	140	0.003 x d <sub>1</sub>	150	0.004 x d <sub>1</sub>	170	0.004 x d <sub>1</sub>	200	0.024 x d <sub>1</sub>	0.03 x d <sub>1</sub>	0.4 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	130	0.003 x d <sub>1</sub>	140	0.003 x d <sub>1</sub>	160	0.004 x d <sub>1</sub>	180	0.022 x d <sub>1</sub>	0.03 x d <sub>1</sub>	0.3 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1														
	2.1														
	3.1														
	4.1														
<b>K</b>	1.1	170	0.006 x d <sub>1</sub>	190	0.006 x d <sub>1</sub>	200	0.007 x d <sub>1</sub>	240	0.040 x d <sub>1</sub>	0.05 x d <sub>1</sub>	0.6 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	170	0.006 x d <sub>1</sub>	190	0.006 x d <sub>1</sub>	200	0.007 x d <sub>1</sub>	240	0.040 x d <sub>1</sub>	0.05 x d <sub>1</sub>	0.6 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	150	0.005 x d <sub>1</sub>	170	0.005 x d <sub>1</sub>	180	0.006 x d <sub>1</sub>	210	0.032 x d <sub>1</sub>	0.04 x d <sub>1</sub>	0.5 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	150	0.005 x d <sub>1</sub>	170	0.005 x d <sub>1</sub>	180	0.006 x d <sub>1</sub>	210	0.032 x d <sub>1</sub>	0.04 x d <sub>1</sub>	0.5 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	130	0.005 x d <sub>1</sub>	140	0.005 x d <sub>1</sub>	160	0.006 x d <sub>1</sub>	180	0.032 x d <sub>1</sub>	0.04 x d <sub>1</sub>	0.5 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	130	0.005 x d <sub>1</sub>	140	0.005 x d <sub>1</sub>	160	0.006 x d <sub>1</sub>	180	0.032 x d <sub>1</sub>	0.04 x d <sub>1</sub>	0.5 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	100	0.003 x d <sub>1</sub>	110	0.004 x d <sub>1</sub>	120	0.004 x d <sub>1</sub>	140	0.024 x d <sub>1</sub>	0.03 x d <sub>1</sub>	0.4 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	80	0.003 x d <sub>1</sub>	90	0.004 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>	110	0.024 x d <sub>1</sub>	0.03 x d <sub>1</sub>	0.4 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1														
	1.2														
	1.3														
	1.4														
	1.5														
	1.6														
	2.1														
	2.2														
	2.3	150	0.006 x d <sub>1</sub>	170	0.006 x d <sub>1</sub>	180	0.007 x d <sub>1</sub>	210	0.040 x d <sub>1</sub>	0.05 x d <sub>1</sub>	0.6 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4														
	2.5														
	2.6	130	0.005 x d <sub>1</sub>	140	0.005 x d <sub>1</sub>	160	0.006 x d <sub>1</sub>	180	0.032 x d <sub>1</sub>	0.04 x d <sub>1</sub>	0.5 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7														
	2.8														
3.1															
3.2															
4.1															
4.2															
4.3															
4.4															
5.1															
5.2	80	0.003 x d <sub>1</sub>	90	0.004 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>	110	0.024 x d <sub>1</sub>	0.03 x d <sub>1</sub>	0.4 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3															
<b>S</b>	1.1														
	1.2														
	1.3														
	2.1														
	2.2														
	2.3														
2.4															
2.5															
2.6															
<b>H</b>	1.1	100	0.003 x d <sub>1</sub>	110	0.004 x d <sub>1</sub>	120	0.004 x d <sub>1</sub>	140	0.024 x d <sub>1</sub>	0.03 x d <sub>1</sub>	0.4 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	80	0.003 x d <sub>1</sub>	90	0.003 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>	110	0.020 x d <sub>1</sub>	0.03 x d <sub>1</sub>	0.3 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	70	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.016 x d <sub>1</sub>	0.02 x d <sub>1</sub>	0.3 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4			80	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.014 x d <sub>1</sub>	0.02 x d <sub>1</sub>	0.2 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5			70	0.002 x d <sub>1</sub>	70	0.002 x d <sub>1</sub>	80	0.012 x d <sub>1</sub>	0.02 x d <sub>1</sub>	0.2 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

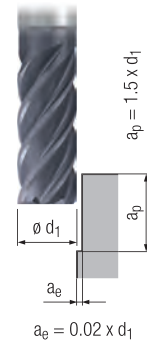
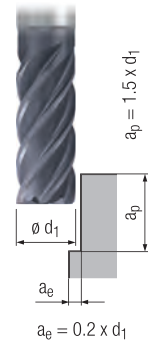
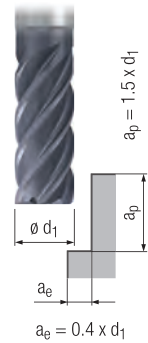
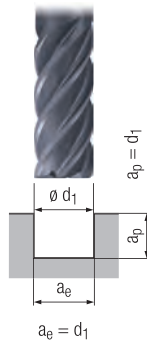
Standard length - for Regular and Corner Radius

N

Valid for Tool Nos.:

2962LZ

2966LZ



		V <sub>c</sub> [sfm]		f <sub>z</sub> [inch]		V <sub>c</sub> [sfm]		f <sub>z</sub> [inch]				MMS MQL	
<b>P</b>	1.1	895	0.005 x d <sub>1</sub>	490	0.006 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	460	0.007 x d <sub>1</sub>	☐	■	☐	■
	2.1	430	0.004 x d <sub>1</sub>	460	0.005 x d <sub>1</sub>	490	0.006 x d <sub>1</sub>	425	0.006 x d <sub>1</sub>	☐	■	☐	■
	3.1	395	0.004 x d <sub>1</sub>	430	0.004 x d <sub>1</sub>	460	0.005 x d <sub>1</sub>	195	0.005 x d <sub>1</sub>	☐	■	☐	■
	4.1	360	0.003 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	430	0.004 x d <sub>1</sub>	165	0.004 x d <sub>1</sub>	☐	■	☐	■
	5.1	330	0.003 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	165	0.004 x d <sub>1</sub>	☐	■		
<b>M</b>	1.1	295	0.004 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>	460	0.005 x d <sub>1</sub>				■
	2.1	260	0.004 x d <sub>1</sub>	330	0.004 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>	425	0.004 x d <sub>1</sub>				■
	3.1	230	0.003 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>	195	0.005 x d <sub>1</sub>				■
	4.1	195	0.003 x d <sub>1</sub>	230	0.004 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	165	0.005 x d <sub>1</sub>				■
<b>K</b>	1.1												
	1.2												
	2.1												
	2.2												
	3.1												
	3.2												
	4.1												
<b>N</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												
	1.6												
	2.1	655	0.007 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	790	0.008 x d <sub>1</sub>	855	0.008 x d <sub>1</sub>			☐	■
	2.2	655	0.007 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	790	0.008 x d <sub>1</sub>	855	0.008 x d <sub>1</sub>			☐	■
	2.3	655	0.007 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	790	0.008 x d <sub>1</sub>	855	0.008 x d <sub>1</sub>	☐		☐	■
	2.4	590	0.006 x d <sub>1</sub>	655	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	790	0.007 x d <sub>1</sub>			☐	■
	2.5	590	0.006 x d <sub>1</sub>	655	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	790	0.007 x d <sub>1</sub>			☐	■
	2.6	590	0.006 x d <sub>1</sub>	655	0.006 x d <sub>1</sub>	720	0.007 x d <sub>1</sub>	790	0.007 x d <sub>1</sub>	☐		☐	■
	2.7	395	0.004 x d <sub>1</sub>	460	0.004 x d <sub>1</sub>	525	0.005 x d <sub>1</sub>	590	0.005 x d <sub>1</sub>			☐	■
	2.8	330	0.003 x d <sub>1</sub>	395	0.003 x d <sub>1</sub>	460	0.004 x d <sub>1</sub>	525	0.004 x d <sub>1</sub>			☐	■
	3.1												
	3.2												
4.1													
4.2													
4.3													
4.4													
5.1													
5.2	230	0.003 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	260	0.005 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>				■	
5.3													
<b>S</b>	1.1	230	0.005 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	330	0.006 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>				■
	1.2	195	0.003 x d <sub>1</sub>	230	0.003 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>				■
	1.3	165	0.002 x d <sub>1</sub>	195	0.002 x d <sub>1</sub>	230	0.003 x d <sub>1</sub>	260	0.003 x d <sub>1</sub>				■
	2.1	195	0.003 x d <sub>1</sub>	230	0.003 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>				■
	2.2	65	0.002 x d <sub>1</sub>	80	0.002 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>				■
	2.3	50	0.002 x d <sub>1</sub>	65	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>				■
	2.4	65	0.002 x d <sub>1</sub>	80	0.002 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>	115	0.003 x d <sub>1</sub>				■
2.5	50	0.002 x d <sub>1</sub>	65	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>				■	
2.6	50	0.002 x d <sub>1</sub>	65	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>				■	
<b>H</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

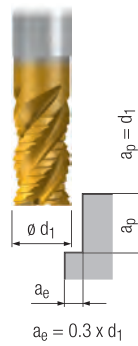
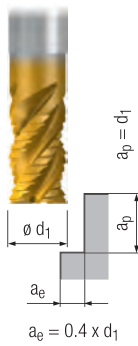
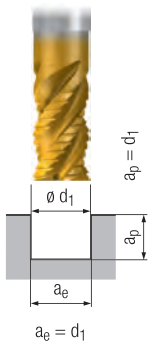
v<sub>c</sub> = Cutting speed      ■ = very suitable  
f<sub>z</sub> = Feed per tooth      ☐ = suitable

Standard length

NF

Valid for Tool Nos.:

- 2648TZ
- 2649TZ
- 2958T
- 2959T



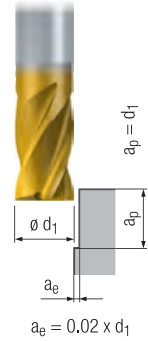
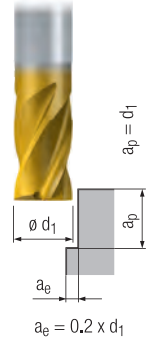
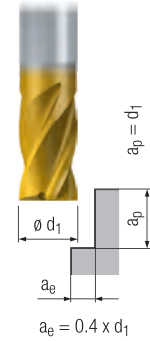
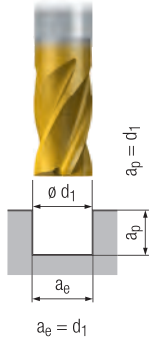
	$V_c$ [sfm]		$f_z$ [inch]		$V_c$ [sfm]		$f_z$ [inch]				MMS	MLQ		
	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$						
<b>P</b>	1.1	395	$0.005 \times d_1$	460	$0.006 \times d_1$	560	$0.007 \times d_1$	625	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		395	$0.005 \times d_1$	460	$0.006 \times d_1$	560	$0.007 \times d_1$	625	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	395	$0.005 \times d_1$	460	$0.006 \times d_1$	560	$0.007 \times d_1$	625	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		360	$0.005 \times d_1$	430	$0.006 \times d_1$	495	$0.007 \times d_1$	590	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	360	$0.005 \times d_1$	430	$0.005 \times d_1$	495	$0.006 \times d_1$	590	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		295	$0.004 \times d_1$	360	$0.005 \times d_1$	430	$0.006 \times d_1$	460	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1	295	$0.004 \times d_1$	360	$0.005 \times d_1$	430	$0.006 \times d_1$	460	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		230	$0.004 \times d_1$	265	$0.005 \times d_1$	330	$0.005 \times d_1$	360	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	5.1	230	$0.004 \times d_1$	265	$0.004 \times d_1$	330	$0.005 \times d_1$	360	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		200	$0.003 \times d_1$	230	$0.004 \times d_1$	265	$0.004 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
			200	$0.003 \times d_1$	230	$0.003 \times d_1$	265	$0.004 \times d_1$	330	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
			200	$0.003 \times d_1$	230	$0.003 \times d_1$	265	$0.004 \times d_1$	330	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	<b>M</b>	1.1	330	$0.004 \times d_1$	395	$0.004 \times d_1$	460	$0.005 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		2.1	265	$0.004 \times d_1$	330	$0.004 \times d_1$	360	$0.005 \times d_1$	430	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.1		165	$0.003 \times d_1$	200	$0.003 \times d_1$	230	$0.004 \times d_1$	265	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.1		135	$0.003 \times d_1$	165	$0.003 \times d_1$	200	$0.004 \times d_1$	200	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>K</b>	1.1	395	$0.005 \times d_1$	460	$0.006 \times d_1$	560	$0.007 \times d_1$	625	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	395	$0.005 \times d_1$	460	$0.006 \times d_1$	560	$0.007 \times d_1$	625	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	360	$0.004 \times d_1$	460	$0.005 \times d_1$	495	$0.006 \times d_1$	590	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	360	$0.004 \times d_1$	430	$0.005 \times d_1$	495	$0.006 \times d_1$	590	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	295	$0.004 \times d_1$	360	$0.005 \times d_1$	430	$0.006 \times d_1$	460	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2	295	$0.004 \times d_1$	360	$0.005 \times d_1$	430	$0.006 \times d_1$	460	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1	230	$0.003 \times d_1$	265	$0.004 \times d_1$	330	$0.004 \times d_1$	360	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.2	200	$0.003 \times d_1$	230	$0.004 \times d_1$	265	$0.004 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>N</b>	1.1													
	1.2													
	1.3													
	1.4													
	1.5													
	1.6													
	2.1	360	$0.005 \times d_1$	430	$0.006 \times d_1$	495	$0.007 \times d_1$	590	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	360	$0.005 \times d_1$	430	$0.006 \times d_1$	495	$0.007 \times d_1$	590	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3	360	$0.005 \times d_1$	430	$0.006 \times d_1$	495	$0.007 \times d_1$	590	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4	330	$0.004 \times d_1$	395	$0.005 \times d_1$	460	$0.006 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.5	330	$0.004 \times d_1$	395	$0.005 \times d_1$	460	$0.006 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.6	330	$0.004 \times d_1$	395	$0.005 \times d_1$	460	$0.006 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.7	200	$0.003 \times d_1$	230	$0.004 \times d_1$	265	$0.004 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.8	200	$0.003 \times d_1$	230	$0.004 \times d_1$	265	$0.004 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1													
	3.2													
4.1														
4.2														
4.3														
4.4														
5.1														
5.2	200	$0.003 \times d_1$	230	$0.004 \times d_1$	265	$0.004 \times d_1$	330	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.3														
<b>S</b>	1.1	230	$0.005 \times d_1$	265	$0.005 \times d_1$	330	$0.006 \times d_1$	360	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	200	$0.004 \times d_1$	230	$0.004 \times d_1$	265	$0.005 \times d_1$	330	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3	100	$0.003 \times d_1$	135	$0.003 \times d_1$	135	$0.004 \times d_1$	165	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	230	$0.004 \times d_1$	265	$0.004 \times d_1$	330	$0.005 \times d_1$	360	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	65	$0.003 \times d_1$	65	$0.004 \times d_1$	85	$0.004 \times d_1$	100	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3	35	$0.002 \times d_1$	50	$0.002 \times d_1$	50	$0.003 \times d_1$	65	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4	65	$0.003 \times d_1$	85	$0.003 \times d_1$	115	$0.004 \times d_1$	100	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.5	35	$0.002 \times d_1$	35	$0.002 \times d_1$	35	$0.003 \times d_1$	65	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.6	35	$0.003 \times d_1$	35	$0.003 \times d_1$	35	$0.004 \times d_1$	65	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>H</b>	1.1													
	1.2													
	1.3													
	1.4													
	1.5													

**Base - stub length**

**N**

**Valid for Tool Nos.:**

2975T  
2976T



	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]					
<b>P</b>	1.1	560	0.005 x d <sub>1</sub>	625	0.006 x d <sub>1</sub>	655	0.007 x d <sub>1</sub>	790	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	490	0.004 x d <sub>1</sub>	560	0.005 x d <sub>1</sub>	590	0.006 x d <sub>1</sub>	690	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	430	0.004 x d <sub>1</sub>	460	0.004 x d <sub>1</sub>	525	0.005 x d <sub>1</sub>	590	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	395	0.003 x d <sub>1</sub>	430	0.004 x d <sub>1</sub>	460	0.004 x d <sub>1</sub>	560	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	330	0.003 x d <sub>1</sub>	360	0.003 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	460	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	295	0.004 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>	395	0.005 x d <sub>1</sub>	430	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	260	0.003 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	230	0.003 x d <sub>1</sub>	260	0.003 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>	330	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	195	0.002 x d <sub>1</sub>	230	0.002 x d <sub>1</sub>	260	0.003 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	490	0.005 x d <sub>1</sub>	525	0.006 x d <sub>1</sub>	590	0.006 x d <sub>1</sub>	655	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	490	0.005 x d <sub>1</sub>	525	0.006 x d <sub>1</sub>	590	0.006 x d <sub>1</sub>	655	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	460	0.004 x d <sub>1</sub>	490	0.005 x d <sub>1</sub>	560	0.005 x d <sub>1</sub>	590	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	460	0.004 x d <sub>1</sub>	490	0.005 x d <sub>1</sub>	560	0.005 x d <sub>1</sub>	590	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	395	0.004 x d <sub>1</sub>	430	0.005 x d <sub>1</sub>	460	0.005 x d <sub>1</sub>	490	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	395	0.004 x d <sub>1</sub>	430	0.005 x d <sub>1</sub>	460	0.005 x d <sub>1</sub>	490	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	330	0.003 x d <sub>1</sub>	360	0.003 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	430	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	260	0.003 x d <sub>1</sub>	295	0.003 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>	330	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<b>N</b>	1.1	720	0.009 x d <sub>1</sub>	820	0.010 x d <sub>1</sub>	920	0.011 x d <sub>1</sub>	985	0.008 x d <sub>1</sub>			
1.2		720	0.008 x d <sub>1</sub>	820	0.009 x d <sub>1</sub>	920	0.010 x d <sub>1</sub>	985	0.008 x d <sub>1</sub>				<input checked="" type="checkbox"/>
1.3		720	0.007 x d <sub>1</sub>	820	0.008 x d <sub>1</sub>	920	0.009 x d <sub>1</sub>	985	0.007 x d <sub>1</sub>				<input checked="" type="checkbox"/>
1.4													
1.5													
1.6													
2.1		560	0.007 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	655	0.008 x d <sub>1</sub>	720	0.008 x d <sub>1</sub>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.2		560	0.007 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	655	0.008 x d <sub>1</sub>	720	0.008 x d <sub>1</sub>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.3		560	0.007 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	655	0.008 x d <sub>1</sub>	720	0.008 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.4		525	0.006 x d <sub>1</sub>	560	0.006 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	655	0.007 x d <sub>1</sub>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5		525	0.006 x d <sub>1</sub>	560	0.006 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	655	0.007 x d <sub>1</sub>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.6		525	0.006 x d <sub>1</sub>	560	0.006 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	655	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.7		395	0.004 x d <sub>1</sub>	430	0.004 x d <sub>1</sub>	460	0.005 x d <sub>1</sub>	525	0.005 x d <sub>1</sub>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.8		330	0.003 x d <sub>1</sub>	360	0.003 x d <sub>1</sub>	395	0.004 x d <sub>1</sub>	460	0.004 x d <sub>1</sub>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.1													
3.2													
4.1													
4.2													
4.3													
4.4													
5.1													
5.2	230	0.003 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	260	0.005 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3													
<b>S</b>	1.1	230	0.005 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	330	0.006 x d <sub>1</sub>	330	0.005 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	1.2	195	0.003 x d <sub>1</sub>	230	0.003 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	1.3	165	0.002 x d <sub>1</sub>	195	0.002 x d <sub>1</sub>	230	0.003 x d <sub>1</sub>	260	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.1	195	0.003 x d <sub>1</sub>	230	0.003 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.2	65	0.002 x d <sub>1</sub>	80	0.002 x d <sub>1</sub>	30	0.003 x d <sub>1</sub>	115	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.3	50	0.002 x d <sub>1</sub>	65	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.4	65	0.002 x d <sub>1</sub>	80	0.002 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>	115	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
	2.5	50	0.002 x d <sub>1</sub>	65	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>
2.6	50	0.002 x d <sub>1</sub>	65	0.002 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>				<input checked="" type="checkbox"/>	
<b>H</b>	1.1	295	0.003 x d <sub>1</sub>	330	0.003 x d <sub>1</sub>	360	0.003 x d <sub>1</sub>	130	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	230	0.002 x d <sub>1</sub>	260	0.003 x d <sub>1</sub>	295	0.003 x d <sub>1</sub>	360	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3												
	1.4												
	1.5												

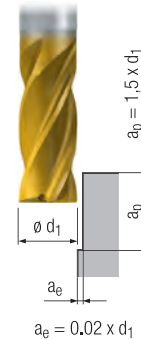
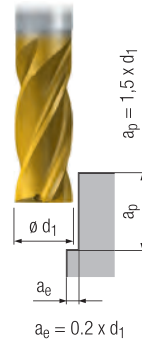
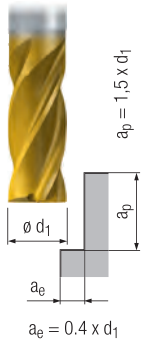
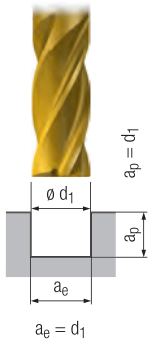
$v_c$  = Cutting speed     = very suitable  
 $f_z$  = Feed per tooth     = suitable

Base - standard length

N

Valid for Tool Nos.:

2977T  
2978T



	$V_c$ [sfm]		$f_z$ [inch]		$V_c$ [sfm]		$f_z$ [inch]				MMS MQL		
	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$					
<b>P</b>	1.1	460	0.005 x $d_1$	490	0.006 x $d_1$	560	0.007 x $d_1$	655	0.007 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	430	0.004 x $d_1$	460	0.005 x $d_1$	525	0.006 x $d_1$	590	0.006 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	360	0.004 x $d_1$	395	0.004 x $d_1$	430	0.005 x $d_1$	490	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	330	0.003 x $d_1$	360	0.004 x $d_1$	395	0.004 x $d_1$	460	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	295	0.003 x $d_1$	330	0.003 x $d_1$	360	0.004 x $d_1$	430	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1	260	0.004 x $d_1$	330	0.005 x $d_1$	360	0.005 x $d_1$	395	0.005 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	230	0.003 x $d_1$	360	0.004 x $d_1$	295	0.005 x $d_1$	330	0.005 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	195	0.003 x $d_1$	230	0.004 x $d_1$	260	0.004 x $d_1$	295	0.004 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	165	0.002 x $d_1$	195	0.003 x $d_1$	230	0.003 x $d_1$	260	0.004 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	460	0.005 x $d_1$	490	0.006 x $d_1$	560	0.006 x $d_1$	655	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	460	0.005 x $d_1$	490	0.006 x $d_1$	560	0.006 x $d_1$	655	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	430	0.004 x $d_1$	460	0.005 x $d_1$	525	0.005 x $d_1$	590	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	430	0.004 x $d_1$	460	0.005 x $d_1$	525	0.005 x $d_1$	590	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	360	0.004 x $d_1$	395	0.005 x $d_1$	430	0.005 x $d_1$	490	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	360	0.004 x $d_1$	295	0.005 x $d_1$	430	0.005 x $d_1$	490	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	295	0.003 x $d_1$	330	0.003 x $d_1$	360	0.004 x $d_1$	430	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	230	0.003 x $d_1$	260	0.003 x $d_1$	260	0.004 x $d_1$	330	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1	720	0.009 x $d_1$	820	0.010 x $d_1$	920	0.011 x $d_1$	985	0.008 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	720	0.008 x $d_1$	820	0.009 x $d_1$	920	0.010 x $d_1$	985	0.008 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	720	0.007 x $d_1$	820	0.008 x $d_1$	920	0.009 x $d_1$	985	0.007 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	560	0.007 x $d_1$	590	0.007 x $d_1$	655	0.008 x $d_1$	720	0.008 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	560	0.007 x $d_1$	590	0.007 x $d_1$	655	0.008 x $d_1$	720	0.008 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	560	0.007 x $d_1$	590	0.007 x $d_1$	655	0.008 x $d_1$	720	0.008 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	525	0.006 x $d_1$	560	0.006 x $d_1$	590	0.007 x $d_1$	655	0.007 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	525	0.006 x $d_1$	560	0.006 x $d_1$	590	0.007 x $d_1$	655	0.007 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	525	0.006 x $d_1$	560	0.006 x $d_1$	590	0.007 x $d_1$	655	0.007 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	395	0.004 x $d_1$	430	0.004 x $d_1$	460	0.005 x $d_1$	525	0.005 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	330	0.003 x $d_1$	360	0.003 x $d_1$	395	0.004 x $d_1$	460	0.004 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2	230	0.003 x $d_1$	260	0.004 x $d_1$	260	0.005 x $d_1$	330	0.005 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>S</b>	1.1	230	0.005 x $d_1$	295	0.005 x $d_1$	330	0.006 x $d_1$	330	0.005 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	195	0.003 x $d_1$	230	0.003 x $d_1$	260	0.004 x $d_1$	295	0.004 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	165	0.002 x $d_1$	195	0.002 x $d_1$	230	0.003 x $d_1$	260	0.003 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	195	0.003 x $d_1$	230	0.003 x $d_1$	260	0.004 x $d_1$	295	0.004 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	65	0.002 x $d_1$	80	0.002 x $d_1$	100	0.003 x $d_1$	115	0.003 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	50	0.002 x $d_1$	65	0.002 x $d_1$	80	0.003 x $d_1$	100	0.003 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	65	0.002 x $d_1$	80	0.002 x $d_1$	100	0.003 x $d_1$	115	0.003 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	50	0.002 x $d_1$	65	0.002 x $d_1$	80	0.003 x $d_1$	100	0.003 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6	50	0.002 x $d_1$	65	0.002 x $d_1$	80	0.003 x $d_1$	100	0.003 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1	295	0.003 x $d_1$	330	0.003 x $d_1$	360	0.003 x $d_1$	430	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	230	0.002 x $d_1$	260	0.003 x $d_1$	295	0.003 x $d_1$	360	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>



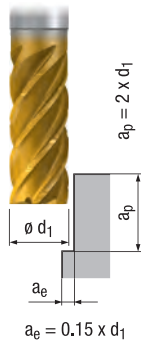
NF

Valid for Tool Nos.

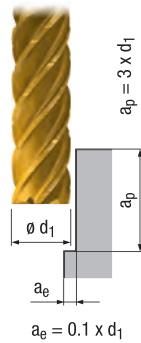
2577TZ 2579TZ 2581TZ  
2537TZ 2539TZ 2541TZ

3911TZ  
3913TZ

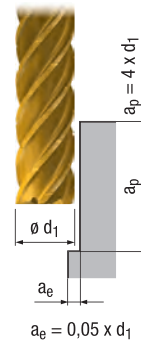
**2 X D**



**3 X D**



**4 X D**



	V <sub>C</sub> [sfm]	f <sub>Z</sub> [inch]	V <sub>C</sub> [sfm]	f <sub>Z</sub> [inch]	V <sub>C</sub> [sfm]	f <sub>Z</sub> [inch]			MMS MQL		
<b>P</b>	1.1	1115	0.012 x d <sub>1</sub>	1050	0.012 x d <sub>1</sub>	980	0.012 x d <sub>1</sub>	□	■	□	■
	2.1	1050	0.011 x d <sub>1</sub>	980	0.011 x d <sub>1</sub>	885	0.011 x d <sub>1</sub>	□	■	□	■
	3.1	980	0.010 x d <sub>1</sub>	915	0.010 x d <sub>1</sub>	820	0.010 x d <sub>1</sub>	□	■	□	■
	4.1	885	0.009 x d <sub>1</sub>	820	0.009 x d <sub>1</sub>	755	0.009 x d <sub>1</sub>	□	■	□	■
	5.1	820	0.008 x d <sub>1</sub>	755	0.008 x d <sub>1</sub>	655	0.008 x d <sub>1</sub>	□	■	□	■
<b>M</b>	1.1	490	0.008 x d <sub>1</sub>	455	0.008 x d <sub>1</sub>	425	0.008 x d <sub>1</sub>				■
	2.1	425	0.008 x d <sub>1</sub>	390	0.008 x d <sub>1</sub>	360	0.008 x d <sub>1</sub>				■
	3.1	360	0.007 x d <sub>1</sub>	325	0.007 x d <sub>1</sub>	295	0.007 x d <sub>1</sub>				■
	4.1	325	0.007 x d <sub>1</sub>	295	0.007 x d <sub>1</sub>	260	0.007 x d <sub>1</sub>				■
<b>K</b>	1.1	685	0.009 x d <sub>1</sub>	655	0.009 x d <sub>1</sub>	620	0.009 x d <sub>1</sub>	□	■	□	■
	1.2	685	0.009 x d <sub>1</sub>	655	0.009 x d <sub>1</sub>	620	0.009 x d <sub>1</sub>	□	■	□	■
	2.1	655	0.007 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	555	0.007 x d <sub>1</sub>	□	■	□	■
	2.2	655	0.007 x d <sub>1</sub>	590	0.007 x d <sub>1</sub>	555	0.007 x d <sub>1</sub>	□	■	□	■
	3.1	525	0.007 x d <sub>1</sub>	490	0.007 x d <sub>1</sub>	455	0.007 x d <sub>1</sub>	□	■	□	■
	3.2	525	0.007 x d <sub>1</sub>	490	0.007 x d <sub>1</sub>	455	0.007 x d <sub>1</sub>	□	■	□	■
	4.1	455	0.005 x d <sub>1</sub>	425	0.005 x d <sub>1</sub>	390	0.005 x d <sub>1</sub>	□	■	□	■
	4.2	325	0.005 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	260	0.005 x d <sub>1</sub>	□	■	□	■
<b>N</b>	1.1	1145	0.014 x d <sub>1</sub>	1050	0.014 x d <sub>1</sub>	980	0.014 x d <sub>1</sub>			□	■
	1.2	1145	0.013 x d <sub>1</sub>	1050	0.013 x d <sub>1</sub>	980	0.013 x d <sub>1</sub>			□	■
	1.3	1145	0.012 x d <sub>1</sub>	1050	0.012 x d <sub>1</sub>	980	0.012 x d <sub>1</sub>			□	■
	1.4										
	1.5										
	1.6										
	2.1	655	0.009 x d <sub>1</sub>	625	0.009 x d <sub>1</sub>	590	0.009 x d <sub>1</sub>			□	■
	2.2	655	0.009 x d <sub>1</sub>	625	0.009 x d <sub>1</sub>	590	0.009 x d <sub>1</sub>			□	■
	2.3	655	0.009 x d <sub>1</sub>	625	0.009 x d <sub>1</sub>	590	0.009 x d <sub>1</sub>			□	■
	2.4	590	0.007 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	490	0.007 x d <sub>1</sub>	□	■	□	■
	2.5	590	0.007 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	490	0.007 x d <sub>1</sub>			□	■
	2.6	590	0.007 x d <sub>1</sub>	525	0.007 x d <sub>1</sub>	490	0.007 x d <sub>1</sub>			□	■
	2.7	325	0.005 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	260	0.005 x d <sub>1</sub>	□	■	□	■
	2.8	325	0.005 x d <sub>1</sub>	295	0.005 x d <sub>1</sub>	260	0.005 x d <sub>1</sub>			□	■
	3.1										
	3.2										
4.1											
4.2											
4.3											
4.4											
5.1											
5.2	395	0.005 x d <sub>1</sub>	360	0.005 x d <sub>1</sub>	325	0.005 x d <sub>1</sub>				■	
5.3											
<b>S</b>	1.1	460	0.007 x d <sub>1</sub>	425	0.007 x d <sub>1</sub>	395	0.007 x d <sub>1</sub>				■
	1.2	425	0.007 x d <sub>1</sub>	395	0.007 x d <sub>1</sub>	360	0.007 x d <sub>1</sub>				■
	1.3	395	0.006 x d <sub>1</sub>	360	0.006 x d <sub>1</sub>	325	0.006 x d <sub>1</sub>				■
	2.1	325	0.004 x d <sub>1</sub>	295	0.004 x d <sub>1</sub>	260	0.004 x d <sub>1</sub>				■
	2.2	100	0.004 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>	80	0.004 x d <sub>1</sub>				■
	2.3	130	0.004 x d <sub>1</sub>	130	0.004 x d <sub>1</sub>	115	0.004 x d <sub>1</sub>				■
	2.4	130	0.004 x d <sub>1</sub>	130	0.004 x d <sub>1</sub>	115	0.004 x d <sub>1</sub>				■
2.5	130	0.004 x d <sub>1</sub>	115	0.004 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>				■	
2.6	100	0.004 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>	80	0.004 x d <sub>1</sub>				■	
<b>H</b>	1.1										
	1.2										
	1.3										
	1.4										
	1.5										

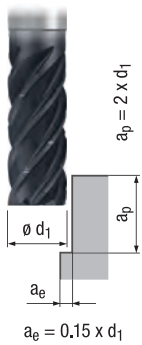
v<sub>C</sub> = Cutting speed    ■ = very suitable  
f<sub>Z</sub> = Feed per tooth    □ = suitable

NF

Valid for Tool Nos.:

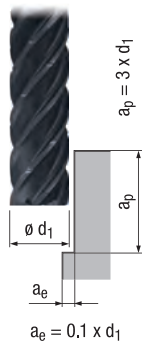
2571L 2573L 2575L  
 2531L 2533L 2535L  
 2557L

**2 X D**



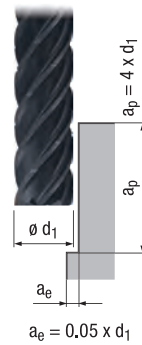
$a_e = 0.15 \times d_1$

**3 X D**



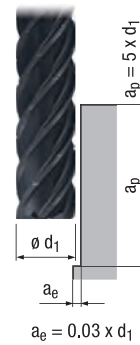
$a_e = 0.1 \times d_1$

**4 X D**



$a_e = 0.05 \times d_1$

**5 X D**

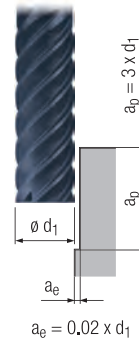
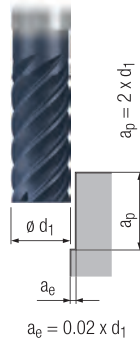
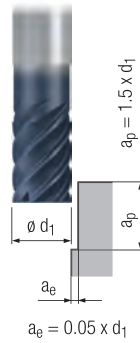
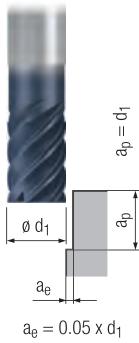


$a_e = 0.03 \times d_1$

		2 X D		3 X D		4 X D		5 X D				MMS MQL	
		$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]	$V_c$ [sfm]	$f_z$ [inch]				
<b>P</b>	1.1	1115	$0.012 \times d_1$	1050	$0.012 \times d_1$	985	$0.011 \times d_1$	855	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	1050	$0.011 \times d_1$	985	$0.011 \times d_1$	885	$0.010 \times d_1$	755	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	985	$0.010 \times d_1$	920	$0.010 \times d_1$	820	$0.009 \times d_1$	690	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	885	$0.009 \times d_1$	820	$0.009 \times d_1$	755	$0.008 \times d_1$	655	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	820	$0.008 \times d_1$	755	$0.008 \times d_1$	655	$0.007 \times d_1$	590	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	460	$0.008 \times d_1$	425	$0.008 \times d_1$	120	$0.008 \times d_1$	360	$0.007 \times d_1$				<input checked="" type="checkbox"/>
	2.1	395	$0.008 \times d_1$	360	$0.008 \times d_1$	110	$0.008 \times d_1$	295	$0.007 \times d_1$				<input checked="" type="checkbox"/>
	3.1	325	$0.007 \times d_1$	295	$0.007 \times d_1$	80	$0.007 \times d_1$	230	$0.006 \times d_1$				<input checked="" type="checkbox"/>
	4.1	295	$0.007 \times d_1$	260	$0.007 \times d_1$	70	$0.007 \times d_1$	195	$0.006 \times d_1$				<input checked="" type="checkbox"/>
	<b>K</b>	1.1	820	$0.009 \times d_1$	755	$0.009 \times d_1$	690	$0.009 \times d_1$	590	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
1.2		820	$0.009 \times d_1$	755	$0.009 \times d_1$	690	$0.009 \times d_1$	590	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.1		755	$0.007 \times d_1$	690	$0.007 \times d_1$	655	$0.007 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.2		755	$0.007 \times d_1$	690	$0.007 \times d_1$	655	$0.007 \times d_1$	525	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1		655	$0.007 \times d_1$	590	$0.007 \times d_1$	525	$0.007 \times d_1$	430	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.2		655	$0.007 \times d_1$	590	$0.007 \times d_1$	525	$0.007 \times d_1$	430	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.1		560	$0.005 \times d_1$	525	$0.005 \times d_1$	460	$0.005 \times d_1$	360	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2		460	$0.005 \times d_1$	395	$0.005 \times d_1$	325	$0.005 \times d_1$	230	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1	1050	$0.014 \times d_1$	985	$0.014 \times d_1$	885	$0.014 \times d_1$	820	$0.012 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	1050	$0.013 \times d_1$	985	$0.013 \times d_1$	885	$0.013 \times d_1$	820	$0.011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	1050	$0.012 \times d_1$	985	$0.012 \times d_1$	885	$0.012 \times d_1$	820	$0.010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4												
	1.5												
	1.6												
	2.1	655	$0.009 \times d_1$	625	$0.009 \times d_1$	590	$0.009 \times d_1$	560	$0.009 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	655	$0.009 \times d_1$	625	$0.009 \times d_1$	590	$0.009 \times d_1$	560	$0.009 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	655	$0.009 \times d_1$	625	$0.009 \times d_1$	590	$0.009 \times d_1$	560	$0.009 \times d_1$	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	590	$0.007 \times d_1$	525	$0.007 \times d_1$	490	$0.007 \times d_1$	460	$0.007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	590	$0.007 \times d_1$	525	$0.007 \times d_1$	490	$0.007 \times d_1$	460	$0.007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	590	$0.007 \times d_1$	525	$0.007 \times d_1$	490	$0.007 \times d_1$	460	$0.007 \times d_1$	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	490	$0.005 \times d_1$	460	$0.005 \times d_1$	425	$0.005 \times d_1$	230	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	425	$0.005 \times d_1$	395	$0.005 \times d_1$	395	$0.005 \times d_1$	230	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1												
3.2													
4.1													
4.2													
4.3													
4.4													
5.1													
5.2	330	$0.005 \times d_1$	295	$0.005 \times d_1$	260	$0.005 \times d_1$	230	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3													
<b>S</b>	1.1	330	$0.005 \times d_1$	295	$0.005 \times d_1$	260	$0.005 \times d_1$	230	$0.006 \times d_1$				<input checked="" type="checkbox"/>
	1.2	330	$0.005 \times d_1$	295	$0.005 \times d_1$	260	$0.005 \times d_1$	195	$0.006 \times d_1$				<input checked="" type="checkbox"/>
	1.3	330	$0.005 \times d_1$	295	$0.005 \times d_1$	260	$0.005 \times d_1$	165	$0.005 \times d_1$				<input checked="" type="checkbox"/>
	2.1	325	$0.004 \times d_1$	295	$0.004 \times d_1$	260	$0.004 \times d_1$	195	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	2.2	100	$0.004 \times d_1$	100	$0.004 \times d_1$	80	$0.004 \times d_1$	65	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	2.3	130	$0.004 \times d_1$	130	$0.004 \times d_1$	115	$0.004 \times d_1$	100	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	2.4	130	$0.004 \times d_1$	130	$0.004 \times d_1$	115	$0.004 \times d_1$	100	$0.004 \times d_1$				<input checked="" type="checkbox"/>
2.5	130	$0.004 \times d_1$	115	$0.004 \times d_1$	100	$0.004 \times d_1$	80	$0.004 \times d_1$				<input checked="" type="checkbox"/>	
2.6	100	$0.004 \times d_1$	100	$0.004 \times d_1$	80	$0.004 \times d_1$	65	$0.004 \times d_1$				<input checked="" type="checkbox"/>	
<b>H</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

### Standard and long lengths

**N**



Valid for Tool Nos.:

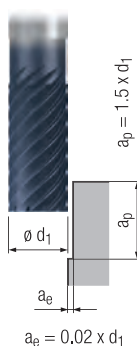
1827A  
1828A  
2813A  
2817A

	$V_c$ [sfm]		$f_z$ [inch]		$V_c$ [sfm]		$f_z$ [inch]				
	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$	$V_c$	$f_z$			
<b>P</b>	1.1	690	$0.005 \times d_1$	560	$0.005 \times d_1$	780	$0.006 \times d_1$	495	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		690	$0.005 \times d_1$	560	$0.005 \times d_1$	780	$0.006 \times d_1$	495	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		690	$0.005 \times d_1$	560	$0.004 \times d_1$	780	$0.005 \times d_1$	495	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	625	$0.005 \times d_1$	495	$0.004 \times d_1$	725	$0.005 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		625	$0.005 \times d_1$	495	$0.004 \times d_1$	725	$0.005 \times d_1$	430	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		625	$0.004 \times d_1$	495	$0.004 \times d_1$	725	$0.005 \times d_1$	430	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	560	$0.004 \times d_1$	460	$0.004 \times d_1$	660	$0.004 \times d_1$	395	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		560	$0.004 \times d_1$	460	$0.003 \times d_1$	660	$0.004 \times d_1$	395	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		495	$0.004 \times d_1$	395	$0.003 \times d_1$	560	$0.004 \times d_1$	360	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	495	$0.004 \times d_1$	395	$0.003 \times d_1$	560	$0.004 \times d_1$	360	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		495	$0.003 \times d_1$	395	$0.003 \times d_1$	560	$0.003 \times d_1$	360	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
		430	$0.003 \times d_1$	330	$0.003 \times d_1$	495	$0.003 \times d_1$	295	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
5.1	430	$0.003 \times d_1$	330	$0.003 \times d_1$	495	$0.003 \times d_1$	295	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	
	430	$0.003 \times d_1$	330	$0.003 \times d_1$	495	$0.003 \times d_1$	295	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	
	430	$0.003 \times d_1$	330	$0.003 \times d_1$	495	$0.003 \times d_1$	295	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	
<b>M</b>	1.1										
	2.1										
	3.1										
	4.1										
<b>K</b>	1.1	690	$0.005 \times d_1$	560	$0.005 \times d_1$	780	$0.006 \times d_1$	495	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	690	$0.005 \times d_1$	560	$0.005 \times d_1$	780	$0.006 \times d_1$	495	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	590	$0.004 \times d_1$	460	$0.004 \times d_1$	690	$0.004 \times d_1$	430	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	590	$0.004 \times d_1$	460	$0.004 \times d_1$	690	$0.004 \times d_1$	430	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	525	$0.004 \times d_1$	430	$0.004 \times d_1$	590	$0.004 \times d_1$	360	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	525	$0.004 \times d_1$	430	$0.004 \times d_1$	590	$0.004 \times d_1$	360	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	430	$0.003 \times d_1$	330	$0.003 \times d_1$	495	$0.003 \times d_1$	295	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	360	$0.003 \times d_1$	295	$0.003 \times d_1$	430	$0.003 \times d_1$	265	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1										
	2.2										
	2.3										
	2.4										
	2.5										
	2.6										
	2.7										
	2.8										
	3.1										
	3.2										
4.1											
4.2											
4.3											
4.4											
5.1											
5.2											
5.3											
<b>S</b>	1.1										
	1.2										
	1.3										
	2.1										
	2.2										
	2.3										
	2.6										
<b>H</b>	1.1	430	$0.004 \times d_1$	330	$0.003 \times d_1$	495	$0.004 \times d_1$	295	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	360	$0.003 \times d_1$	295	$0.003 \times d_1$	495	$0.003 \times d_1$	265	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	1.3	295	$0.003 \times d_1$	230	$0.002 \times d_1$	330	$0.003 \times d_1$	200	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	1.4	265	$0.002 \times d_1$	200	$0.002 \times d_1$	295	$0.002 \times d_1$	200	$0.002 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>
	1.5	230	$0.002 \times d_1$	200	$0.001 \times d_1$	265	$0.002 \times d_1$	165	$0.002 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>

Valid for Tool No.:

2887A

**H**



		$v_c$ [sfm]	$f_z$ [inch]			MMS MQL	
<b>P</b>	1.1	855	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	720	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	625	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	525	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	430	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	430	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	2.1	330	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	3.1	265	$0.003 \times d_1$				<input checked="" type="checkbox"/>
	4.1	165	$0.003 \times d_1$				<input checked="" type="checkbox"/>
<b>K</b>	1.1	855	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	855	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	720	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	720	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	625	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	625	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	525	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2	430	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>N</b>	1.1						
	1.2						
	1.3						
	1.4						
	1.5						
	1.6						
	2.1						
	2.2						
	2.3						
	2.4						
	2.5						
	2.6						
	2.7						
	2.8						
	3.1						
3.2							
4.1							
4.2							
4.3							
4.4							
5.1							
5.2							
5.3							
<b>S</b>	1.1	430	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	1.2	330	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	1.3	195	$0.003 \times d_1$				<input checked="" type="checkbox"/>
	2.1	330	$0.003 \times d_1$				<input checked="" type="checkbox"/>
	2.2	165	$0.003 \times d_1$				<input checked="" type="checkbox"/>
	2.3	100	$0.003 \times d_1$				<input checked="" type="checkbox"/>
	2.4	100	$0.003 \times d_1$				<input checked="" type="checkbox"/>
2.5	100	$0.003 \times d_1$				<input checked="" type="checkbox"/>	
2.6	100	$0.003 \times d_1$				<input checked="" type="checkbox"/>	
<b>H</b>	1.1	525	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	430	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3	365	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.4	260	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.5	195	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

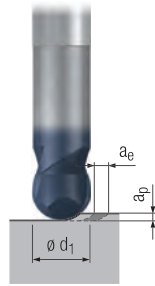
Ball nose – stub and long lengths (2 flutes)

Valid for Tool Nos.:

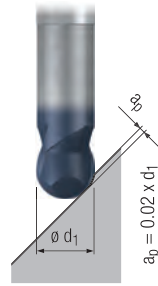
1974A 1976A

H

Roughing



Finishing



		$V_c$ [m/min]	$f_z$ [mm]	$a_e$ [mm]	$a_p$ [mm]	$V_c$ [m/min]	$f_z$ [mm]			MMS MQL	
P	1.1	240	$0.014 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	320	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	220	$0.013 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	280	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	180	$0.011 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	240	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	150	$0.010 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	200	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	130	$0.008 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	160	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
M	1.1										
	2.1										
	3.1										
	4.1										
K	1.1	240	$0.014 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	320	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	1.2	240	$0.014 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	320	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	2.1	210	$0.011 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	280	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	2.2	210	$0.011 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	280	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	3.1	180	$0.011 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	240	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	3.2	180	$0.011 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	240	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	4.1	150	$0.008 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	180	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	4.2	130	$0.008 \times d_1$	$0.2 \times d_1$	$0.075 \times d_1$	160	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
N	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1										
	2.2										
	2.3										
	2.4										
	2.5										
	2.6										
	2.7										
	2.8										
	3.1										
	3.2										
4.1											
4.2											
4.3											
4.4											
5.1											
5.2											
5.3											
S	1.1										
	1.2										
	1.3										
	2.1										
	2.2										
	2.6										
H	1.1	110	$0.008 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	150	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	1.2	100	$0.007 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	130	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	1.3					120	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	1.4					100	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	1.5					80	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>

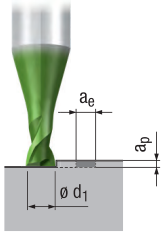
$v_c$  = Cutting speed ■ = very suitable  
 $f_z$  = Feed per tooth □ = suitable

**Standard and long lengths**

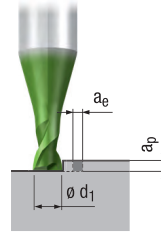
$L_3 = 2.2 \times D_1$

**N**

Roughing



Finishing



Valid for Tool Nos.:

2760L 2763L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

	0.03 x d <sub>1</sub>		0.025 x d <sub>1</sub>		0.02 x d <sub>1</sub>		0.06 x d <sub>1</sub>		0.05 x d <sub>1</sub>		0.045 x d <sub>1</sub>		0.04 x d <sub>1</sub>						
	a <sub>p</sub>	a <sub>e</sub>	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]					
<b>P</b>	1.1		160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1		160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1		160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1						120	0.008 x d <sub>1</sub>				120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1						120	0.008 x d <sub>1</sub>				120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1		120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1		95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1										95	0.013 x d <sub>1</sub>	95	0.013 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1										75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>K</b>	1.1		175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2		175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1				120	0.006 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>		120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2				120	0.006 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>		120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1						95	0.005 x d <sub>1</sub>							<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2						95	0.005 x d <sub>1</sub>				95	0.011 x d <sub>1</sub>	95	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1					175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>		175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.2					120	0.006 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>		120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>N</b>	1.1		240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2		240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3				195	0.008 x d <sub>1</sub>	195	0.008 x d <sub>1</sub>		195	0.015 x d <sub>1</sub>	195	0.015 x d <sub>1</sub>	195	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4				175	0.006 x d <sub>1</sub>	175	0.006 x d <sub>1</sub>		175	0.013 x d <sub>1</sub>	175	0.013 x d <sub>1</sub>	175	0.013 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5												140	0.011 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.6												95	0.011 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1		140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2		140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3		140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4				120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>		120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5				120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>		120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6				120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>		120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7						75	0.007 x d <sub>1</sub>					75	0.014 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.8						55	0.006 x d <sub>1</sub>					55	0.012 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1				175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>		175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2				140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>		140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1		175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.2		160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.3																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.4																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.1																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.2				95	0.005 x d <sub>1</sub>	95	0.005 x d <sub>1</sub>		95	0.010 x d <sub>1</sub>	95	0.010 x d <sub>1</sub>	95	0.010 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3				120	0.005 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>		120	0.010 x d <sub>1</sub>	120	0.010 x d <sub>1</sub>	120	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>S</b>	1.1				180	0.005 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>		180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2				140	0.005 x d <sub>1</sub>	140	0.005 x d <sub>1</sub>		140	0.011 x d <sub>1</sub>	140	0.011 x d <sub>1</sub>	140	0.011 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3						120	0.005 x d <sub>1</sub>					120	0.011 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1				180	0.005 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>		180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2																<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3																<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.4																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.5																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.6																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>H</b>	1.1										120	0.014 x d <sub>1</sub>	120	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2												75	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3															<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.4															<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.5															<input type="checkbox"/>	<input checked="" type="checkbox"/>		

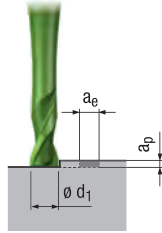


Standard and long lengths

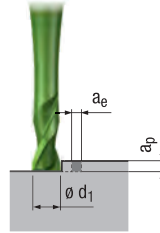
$$L_3 = 5 \times D_1$$

N

Roughing



Finishing



Valid for Tool Nos.:

2761L 2764L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

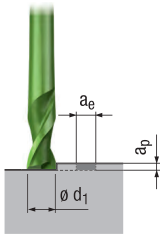
	ap		ae		vc		fz		vc		fz		MMS MOL	MMS MOL		
	0.03 x d1	0.02 x d1	0.045 x d1	0.04 x d1	0.035 x d1	0.03 x d1	vc [m/min]	fz [mm]	vc [m/min]	fz [mm]	vc [m/min]	fz [mm]				
P	1.1	140	0.008 x d1	140	0.008 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	140	0.008 x d1	140	0.008 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	140	0.008 x d1	140	0.008 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1			95	0.008 x d1				95	0.015 x d1	95	0.015 x d1	95	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1			95	0.008 x d1				95	0.015 x d1	95	0.015 x d1	95	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
M	1.1	95	0.008 x d1	95	0.008 x d1	95	0.015 x d1	95	0.015 x d1	95	0.015 x d1	95	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	75	0.008 x d1	75	0.008 x d1	75	0.015 x d1	75	0.015 x d1	75	0.015 x d1	75	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1									75	0.013 x d1	75	0.013 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1									40	0.010 x d1	40	0.010 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
K	1.1	160	0.007 x d1	160	0.007 x d1	160	0.014 x d1	160	0.014 x d1	160	0.014 x d1	160	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	160	0.007 x d1	160	0.007 x d1	160	0.014 x d1	160	0.014 x d1	160	0.014 x d1	160	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1			95	0.007 x d1			95	0.014 x d1	95	0.014 x d1	95	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2			95	0.007 x d1			95	0.014 x d1	95	0.014 x d1	95	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1			75	0.005 x d1			75	0.010 x d1	75	0.010 x d1	75	0.010 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2			75	0.005 x d1			75	0.010 x d1	75	0.010 x d1	75	0.010 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1			160	0.006 x d1			160	0.012 x d1	160	0.012 x d1	160	0.012 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.2			95	0.007 x d1			95	0.014 x d1	95	0.014 x d1	95	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
N	1.1	195	0.007 x d1	195	0.007 x d1	195	0.014 x d1	195	0.014 x d1	195	0.014 x d1	195	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	195	0.007 x d1	195	0.007 x d1	195	0.014 x d1	195	0.014 x d1	195	0.014 x d1	195	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3			175	0.006 x d1			175	0.013 x d1	175	0.013 x d1	175	0.013 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.4			175	0.006 x d1			175	0.011 x d1	175	0.011 x d1	175	0.011 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.5									120	0.010 x d1	120	0.010 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.6									75	0.014 x d1	75	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	120	0.007 x d1	120	0.007 x d1	120	0.015 x d1	120	0.015 x d1	120	0.015 x d1	120	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	120	0.007 x d1	120	0.007 x d1	120	0.015 x d1	120	0.015 x d1	120	0.015 x d1	120	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3	120	0.007 x d1	120	0.007 x d1	120	0.015 x d1	120	0.015 x d1	120	0.015 x d1	120	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4			95	0.007 x d1			95	0.015 x d1	95	0.015 x d1	95	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.5			95	0.007 x d1			95	0.015 x d1	95	0.015 x d1	95	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.6			95	0.007 x d1			95	0.015 x d1	95	0.015 x d1	95	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.7			70	0.006 x d1			70	0.012 x d1	70	0.012 x d1	70	0.012 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.8			45	0.005 x d1			45	0.010 x d1	45	0.010 x d1	45	0.010 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1			160	0.006 x d1			160	0.013 x d1	160	0.013 x d1	160	0.013 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2			120	0.007 x d1			120	0.014 x d1	120	0.014 x d1	120	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.1	140	0.007 x d1	140	0.007 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	140	0.015 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.2	95	0.008 x d1	95	0.008 x d1	95	0.016 x d1	95	0.016 x d1	95	0.016 x d1	95	0.016 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.3																
4.4																
5.1																
5.2			75	0.005 x d1			75	0.010 x d1	75	0.010 x d1	75	0.010 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.3			120	0.004 x d1			120	0.008 x d1	120	0.008 x d1	120	0.008 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
S	1.1	120	0.005 x d1	120	0.005 x d1			120	0.011 x d1	120	0.011 x d1	120	0.011 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	95	0.006 x d1	95	0.006 x d1			95	0.012 x d1	95	0.012 x d1	95	0.012 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3			95	0.005 x d1			95	0.011 x d1	95	0.011 x d1	95	0.011 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	120	0.005 x d1	120	0.005 x d1			120	0.011 x d1	120	0.011 x d1	120	0.011 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2															
	2.3															
	2.4															
H	1.1							95	0.014 x d1	95	0.014 x d1	95	0.014 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2									70	0.010 x d1	70	0.010 x d1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3															
	1.4															
	1.5															

**Standard and long lengths**

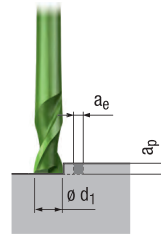
**$L_3 = 10 \times D_1$**

**N**

Roughing



Finishing



**Valid for Tool Nos.:**

2762L 2765L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

	$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$		MMS	MQL	Coolant	
	$V_C$ [m/min]	$f_z$ [mm]	$V_C$ [m/min]	$f_z$ [mm]	$V_C$ [m/min]	$f_z$ [mm]	$V_C$ [m/min]	$f_z$ [mm]	$V_C$ [m/min]	$f_z$ [mm]	$V_C$ [m/min]	$f_z$ [mm]	$V_C$ [m/min]	$f_z$ [mm]	$V_C$ [m/min]	$f_z$ [mm]				
<b>P</b>	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	☐	■	☐	■
<b>M</b>	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	☐	■	☐	■
<b>K</b>	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	☐	■	☐	■
<b>N</b>	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	☐	■	☐	■
<b>S</b>	95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	☐	■	☐	■
<b>H</b>	75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	☐	■	☐	■

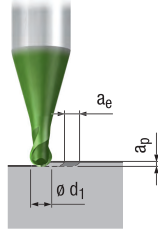


**Ball nose – standard, long and extra long lengths**

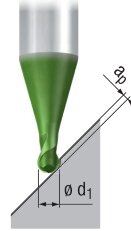
**$L_3 = 2.2 \times D_1$**

**N**

**Roughing**



**Finishing**



**Valid for Tool Nos.:**

2770L 2773L 2776L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

	a <sub>p</sub>		0.025 x d <sub>1</sub>		0.02 x d <sub>1</sub>		0.06 x d <sub>1</sub>		0.05 x d <sub>1</sub>		0.045 x d <sub>1</sub>		0.04 x d <sub>1</sub>		MMS MQL	Coolant	
	a <sub>e</sub>		0.3 - 1 x d <sub>1</sub>		0.3 - 1 x d <sub>1</sub>		0.06 x d <sub>1</sub>		0.05 x d <sub>1</sub>		0.045 x d <sub>1</sub>		0.04 x d <sub>1</sub>				
	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]			
<b>P</b>	1.1	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1					120	0.008 x d <sub>1</sub>					120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1					120	0.008 x d <sub>1</sub>					120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1										95	0.013 x d <sub>1</sub>	95	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1										75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	5.1														<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>K</b>	1.1	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			120	0.006 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>			120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2			120	0.006 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>			120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1					95	0.005 x d <sub>1</sub>					95	0.011 x d <sub>1</sub>	95	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2					95	0.005 x d <sub>1</sub>					95	0.011 x d <sub>1</sub>	95	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>			175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2			120	0.006 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>			120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	120	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1	240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.008 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	240	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3			195	0.008 x d <sub>1</sub>	195	0.008 x d <sub>1</sub>			195	0.015 x d <sub>1</sub>	195	0.015 x d <sub>1</sub>	195	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4			175	0.006 x d <sub>1</sub>	175	0.006 x d <sub>1</sub>			175	0.013 x d <sub>1</sub>	175	0.013 x d <sub>1</sub>	175	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5												140	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.6												95	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4			120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>			120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5			120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>			120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6			120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>			120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7					75	0.007 x d <sub>1</sub>						75	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.8					55	0.006 x d <sub>1</sub>						55	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1			175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>			175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2			140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>			140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.008 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	175	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	160	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3														<input type="checkbox"/>	<input checked="" type="checkbox"/>		
4.4														<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.1														<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.2			95	0.005 x d <sub>1</sub>	95	0.005 x d <sub>1</sub>			95	0.010 x d <sub>1</sub>	95	0.010 x d <sub>1</sub>	95	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3			120	0.005 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>			120	0.010 x d <sub>1</sub>	120	0.010 x d <sub>1</sub>	120	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>S</b>	1.1			180	0.005 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>			180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2			140	0.005 x d <sub>1</sub>	140	0.005 x d <sub>1</sub>			140	0.011 x d <sub>1</sub>	140	0.011 x d <sub>1</sub>	140	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3					120	0.005 x d <sub>1</sub>					120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			180	0.005 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>			180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>	180	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2														<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3														<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4														<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1										120	0.014 x d <sub>1</sub>	120	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2												75	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3														<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.4														<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.5														<input type="checkbox"/>	<input checked="" type="checkbox"/>	
															<input type="checkbox"/>	<input checked="" type="checkbox"/>	

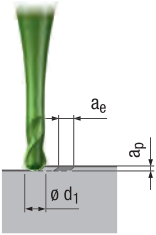
v<sub>c</sub> = Cutting speed ■ = very suitable  
f<sub>z</sub> = Feed per tooth □ = suitable

**Ball nose – standard, long and extra long lengths**

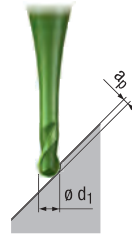
$L_3 = 5 \times D_1$

**N**

**Roughing**



**Finishing**



**Valid for Tool Nos.:**

2771L 2774L 2777L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

	0.03 x d <sub>1</sub>		0.02 x d <sub>1</sub>		0.045 x d <sub>1</sub>		0.04 x d <sub>1</sub>		0.035 x d <sub>1</sub>		0.03 x d <sub>1</sub>						
	a <sub>p</sub>	a <sub>e</sub>	a <sub>p</sub>	a <sub>e</sub>	a <sub>p</sub>	a <sub>e</sub>	a <sub>p</sub>	a <sub>e</sub>	a <sub>p</sub>	a <sub>e</sub>	a <sub>p</sub>	a <sub>e</sub>					
	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	v <sub>c</sub> [m/min]	f <sub>z</sub> [mm]					
<b>P</b>	1.1	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			95	0.008 x d <sub>1</sub>					95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1			95	0.008 x d <sub>1</sub>					95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	75	0.008 x d <sub>1</sub>	75	0.008 x d <sub>1</sub>	75	0.015 x d <sub>1</sub>	75	0.015 x d <sub>1</sub>	75	0.015 x d <sub>1</sub>	75	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1									75	0.013 x d <sub>1</sub>	75	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1									40	0.010 x d <sub>1</sub>	40	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	160	0.007 x d <sub>1</sub>	160	0.007 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	160	0.007 x d <sub>1</sub>	160	0.007 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			95	0.007 x d <sub>1</sub>					95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2			95	0.007 x d <sub>1</sub>					95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1			75	0.005 x d <sub>1</sub>					75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2			75	0.005 x d <sub>1</sub>					75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			160	0.006 x d <sub>1</sub>					160	0.012 x d <sub>1</sub>	160	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2			95	0.007 x d <sub>1</sub>					95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1	195	0.007 x d <sub>1</sub>	195	0.007 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	195	0.007 x d <sub>1</sub>	195	0.007 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3			175	0.006 x d <sub>1</sub>					175	0.013 x d <sub>1</sub>	175	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4			175	0.006 x d <sub>1</sub>					175	0.011 x d <sub>1</sub>	175	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									120	0.010 x d <sub>1</sub>	120	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6									75	0.014 x d <sub>1</sub>	75	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	0.007 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	120	0.007 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	120	0.007 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4			95	0.007 x d <sub>1</sub>					95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5			95	0.007 x d <sub>1</sub>					95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6			95	0.007 x d <sub>1</sub>					95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7			70	0.006 x d <sub>1</sub>					70	0.012 x d <sub>1</sub>	70	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8			45	0.005 x d <sub>1</sub>					45	0.010 x d <sub>1</sub>	45	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1			160	0.006 x d <sub>1</sub>					160	0.013 x d <sub>1</sub>	160	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2			120	0.007 x d <sub>1</sub>					120	0.014 x d <sub>1</sub>	120	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	140	0.007 x d <sub>1</sub>	140	0.007 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2	95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.016 x d <sub>1</sub>	95	0.016 x d <sub>1</sub>	95	0.016 x d <sub>1</sub>	95	0.016 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2			75	0.005 x d <sub>1</sub>					75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3			120	0.004 x d <sub>1</sub>					120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>S</b>	1.1	120	0.005 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>			120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	95	0.006 x d <sub>1</sub>	95	0.006 x d <sub>1</sub>			95	0.012 x d <sub>1</sub>	95	0.012 x d <sub>1</sub>	95	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3			95	0.005 x d <sub>1</sub>					95	0.011 x d <sub>1</sub>	95	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	0.005 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>			120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>H</b>	1.1								95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2								70	0.010 x d <sub>1</sub>	70	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.4												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.5												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

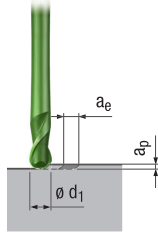


Ball nose – standard, long and extra long lengths

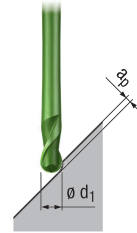
$L_3 = 10 \times D_1$

N

Roughing



Finishing



Valid for Tool Nos.:

2772L 2775L 2778L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

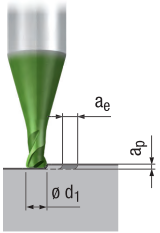
	$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$						
	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$							
	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]					
<b>P</b>	1.1	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$					75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1			75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$					75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	55	$0.008 \times d_1$	55	$0.008 \times d_1$	55	$0.008 \times d_1$	55	$0.008 \times d_1$	55	$0.015 \times d_1$	55	$0.015 \times d_1$	55	$0.012 \times d_1$	55	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1													55	$0.012 \times d_1$	55	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1													45	$0.012 \times d_1$	45	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1					55	$0.005 \times d_1$	55	$0.005 \times d_1$					55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2					55	$0.005 \times d_1$	55	$0.005 \times d_1$					55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$			140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3			160	$0.006 \times d_1$	160	$0.006 \times d_1$	160	$0.006 \times d_1$			160	$0.011 \times d_1$	160	$0.011 \times d_1$	160	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4			160	$0.005 \times d_1$	160	$0.005 \times d_1$	160	$0.005 \times d_1$			160	$0.010 \times d_1$	160	$0.010 \times d_1$	160	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5													95	$0.011 \times d_1$	95	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6													55	$0.015 \times d_1$	55	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7					55	$0.005 \times d_1$	55	$0.005 \times d_1$					55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8					40	$0.005 \times d_1$	40	$0.005 \times d_1$					40	$0.010 \times d_1$	40	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1							140	$0.005 \times d_1$					140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2							95	$0.007 \times d_1$					95	$0.014 \times d_1$	95	$0.014 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1					120	$0.006 \times d_1$	120	$0.006 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2					75	$0.005 \times d_1$	75	$0.005 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2							55	$0.005 \times d_1$					55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3							120	$0.004 \times d_1$					120	$0.008 \times d_1$	120	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>S</b>	1.1				95	$0.005 \times d_1$	95	$0.005 \times d_1$			95	$0.010 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2				75	$0.005 \times d_1$	75	$0.005 \times d_1$			75	$0.010 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3						75	$0.005 \times d_1$					75	$0.010 \times d_1$	75	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1					95	$0.005 \times d_1$	95	$0.005 \times d_1$			95	$0.009 \times d_1$	95	$0.009 \times d_1$	95	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>H</b>	1.1										75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2												55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

## Torus – standard, long and extra long lengths

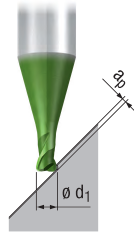
$$L_3 = 2.2 \times D_1$$

**N**

Roughing



Finishing



Valid for Tool Nos.:  
2780L 2783L 2786L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

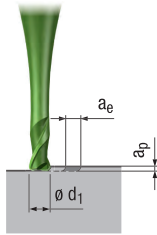
	$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$		MMS	MLQ	MQL		
	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$	$a_p$	$a_e$					
	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]					
<b>P</b>	1.1	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.1	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	3.1	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	4.1					120	$0.008 \times d_1$					120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	5.1					120	$0.008 \times d_1$					120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>M</b>	1.1	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.1	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.015 \times d_1$	95	$0.015 \times d_1$	95	$0.015 \times d_1$	95	$0.015 \times d_1$	95	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	3.1										95	$0.013 \times d_1$	95	$0.013 \times d_1$	95	$0.013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
	4.1										75	$0.010 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
<b>K</b>	1.1	175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.2	175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.1			120	$0.006 \times d_1$	120	$0.006 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.2			120	$0.006 \times d_1$	120	$0.006 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	3.1					95	$0.005 \times d_1$				95	$0.011 \times d_1$	95	$0.011 \times d_1$	95	$0.011 \times d_1$	95	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.2					95	$0.005 \times d_1$				95	$0.011 \times d_1$	95	$0.011 \times d_1$	95	$0.011 \times d_1$	95	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1			175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	4.2			120	$0.006 \times d_1$	120	$0.006 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>N</b>	1.1	240	$0.008 \times d_1$	240	$0.008 \times d_1$	240	$0.008 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.2	240	$0.008 \times d_1$	240	$0.008 \times d_1$	240	$0.008 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	240	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.3			195	$0.008 \times d_1$	195	$0.008 \times d_1$	195	$0.015 \times d_1$	195	$0.015 \times d_1$	195	$0.015 \times d_1$	195	$0.015 \times d_1$	195	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.4			175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.013 \times d_1$	175	$0.013 \times d_1$	175	$0.013 \times d_1$	175	$0.013 \times d_1$	175	$0.013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.5												140	$0.011 \times d_1$		$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
	1.6												95	$0.011 \times d_1$		$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
	2.1	140	$0.008 \times d_1$	140	$0.008 \times d_1$	140	$0.008 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.2	140	$0.008 \times d_1$	140	$0.008 \times d_1$	140	$0.008 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.3	140	$0.008 \times d_1$	140	$0.008 \times d_1$	140	$0.008 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.4			120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.5			120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.6			120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.7					75	$0.007 \times d_1$					75	$0.014 \times d_1$		75	$0.014 \times d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.8					55	$0.006 \times d_1$					55	$0.012 \times d_1$		55	$0.012 \times d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	3.1			175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	3.2			140	$0.008 \times d_1$	140	$0.008 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	140	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4.1	175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.008 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	175	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
4.2	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.008 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	160	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
4.3																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
4.4																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
5.1																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
5.2			95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
5.3			120	$0.005 \times d_1$	120	$0.005 \times d_1$	120	$0.010 \times d_1$	120	$0.010 \times d_1$	120	$0.010 \times d_1$	120	$0.010 \times d_1$	120	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
<b>S</b>	1.1			180	$0.005 \times d_1$	180	$0.005 \times d_1$			180	$0.010 \times d_1$	180	$0.010 \times d_1$	180	$0.010 \times d_1$	180	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.2			140	$0.005 \times d_1$	140	$0.005 \times d_1$			140	$0.011 \times d_1$	140	$0.011 \times d_1$	140	$0.011 \times d_1$	140	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	1.3					120	$0.005 \times d_1$					120	$0.011 \times d_1$		120	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
	2.1			180	$0.005 \times d_1$	180	$0.005 \times d_1$			180	$0.010 \times d_1$	180	$0.010 \times d_1$	180	$0.010 \times d_1$	180	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.2																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	2.3																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>H</b>	1.1										120	$0.014 \times d_1$	120	$0.014 \times d_1$	120	$0.014 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
	1.2												75	$0.011 \times d_1$	75	$0$					

### Torus – standard, long and extra long lengths

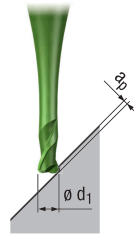
$$L_3 = 5 \times D_1$$

N

Roughing



Finishing



Valid for Tool Nos.:

2781L 2784L 2787L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

	0.03 x d <sub>1</sub>		0.02 x d <sub>1</sub>		0.045 x d <sub>1</sub>		0.04 x d <sub>1</sub>		0.035 x d <sub>1</sub>		0.03 x d <sub>1</sub>				MMS MQL		
	a <sub>p</sub>	a <sub>e</sub>	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]					
<b>P</b>	1.1	0.03 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	0.03 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	0.03 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.008 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1			95	0.008 x d <sub>1</sub>					95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1			95	0.008 x d <sub>1</sub>					95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	0.03 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	0.03 x d <sub>1</sub>	75	0.008 x d <sub>1</sub>	75	0.008 x d <sub>1</sub>	75	0.015 x d <sub>1</sub>	75	0.015 x d <sub>1</sub>	75	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1								75	0.013 x d <sub>1</sub>	75	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1								40	0.010 x d <sub>1</sub>	40	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>K</b>	1.1	0.03 x d <sub>1</sub>	160	0.007 x d <sub>1</sub>	160	0.007 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	0.03 x d <sub>1</sub>	160	0.007 x d <sub>1</sub>	160	0.007 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	160	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1			95	0.007 x d <sub>1</sub>				95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2			95	0.007 x d <sub>1</sub>				95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1			75	0.005 x d <sub>1</sub>				75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2			75	0.005 x d <sub>1</sub>				75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1			160	0.006 x d <sub>1</sub>				160	0.012 x d <sub>1</sub>	160	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.2			95	0.007 x d <sub>1</sub>				95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>N</b>	1.1	0.03 x d <sub>1</sub>	195	0.007 x d <sub>1</sub>	195	0.007 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	0.03 x d <sub>1</sub>	195	0.007 x d <sub>1</sub>	195	0.007 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	195	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3			175	0.006 x d <sub>1</sub>				175	0.013 x d <sub>1</sub>	175	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.4			175	0.006 x d <sub>1</sub>				175	0.011 x d <sub>1</sub>	175	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.5									120	0.010 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6									75	0.014 x d <sub>1</sub>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	0.03 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	0.03 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3	0.03 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.007 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	120	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4			95	0.007 x d <sub>1</sub>				95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.5			95	0.007 x d <sub>1</sub>				95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.6			95	0.007 x d <sub>1</sub>				95	0.015 x d <sub>1</sub>	95	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.7			70	0.006 x d <sub>1</sub>				70	0.012 x d <sub>1</sub>	70	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.8			45	0.005 x d <sub>1</sub>				45	0.010 x d <sub>1</sub>	45	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1			160	0.006 x d <sub>1</sub>				160	0.013 x d <sub>1</sub>	160	0.013 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2			120	0.007 x d <sub>1</sub>				120	0.014 x d <sub>1</sub>	120	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.1			140	0.007 x d <sub>1</sub>	140	0.007 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	140	0.015 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2			95	0.008 x d <sub>1</sub>	95	0.008 x d <sub>1</sub>	95	0.016 x d <sub>1</sub>	95	0.016 x d <sub>1</sub>	95	0.016 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1													<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2			75	0.005 x d <sub>1</sub>				75	0.010 x d <sub>1</sub>	75	0.010 x d <sub>1</sub>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
5.3			120	0.004 x d <sub>1</sub>				120	0.008 x d <sub>1</sub>	120	0.008 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>S</b>	1.1	0.03 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	0.03 x d <sub>1</sub>	95	0.006 x d <sub>1</sub>	95	0.006 x d <sub>1</sub>	95	0.012 x d <sub>1</sub>	95	0.012 x d <sub>1</sub>	95	0.012 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3			95	0.005 x d <sub>1</sub>				95	0.011 x d <sub>1</sub>	95	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	0.03 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	120	0.011 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1								95	0.014 x d <sub>1</sub>	95	0.014 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2								70	0.010 x d <sub>1</sub>	70	0.010 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.4												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.5												<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

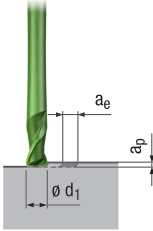
v<sub>c</sub> = Cutting speed    ■ = very suitable  
f<sub>z</sub> = Feed per tooth    □ = suitable

Torus – standard, long and extra long lengths

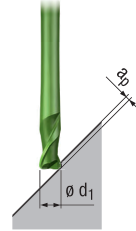
$$L_3 = 10 \times D_1$$

N

Roughing



Finishing



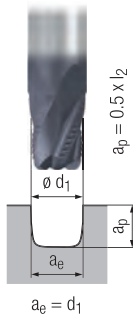
Valid for Tool Nos.:  
2782L 2785L 2788L

Please note:  
Calculation of the feed rate (vf) with the effective spindle speed (n), see page 166.

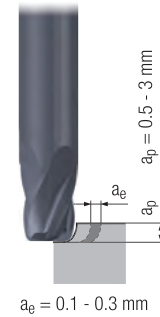
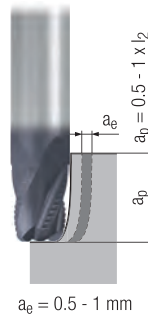
	$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$		$a_p$		$a_e$		MMS MQL	Coolant	
	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]			
P	1.1	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	120	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1			75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$			75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
M	1.1	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.008 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	55	$0.008 \times d_1$	55	$0.008 \times d_1$	55	$0.008 \times d_1$	55	$0.008 \times d_1$	55	$0.015 \times d_1$	55	$0.015 \times d_1$	55	$0.015 \times d_1$	55	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1											55	$0.012 \times d_1$	55	$0.012 \times d_1$	55	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1													45	$0.012 \times d_1$	45	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
K	1.1	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1					55	$0.005 \times d_1$	55	$0.005 \times d_1$	55	$0.005 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2					55	$0.005 \times d_1$	55	$0.005 \times d_1$	55	$0.005 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
N	1.1	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.006 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	175	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3			160	$0.006 \times d_1$	160	$0.006 \times d_1$	160	$0.006 \times d_1$	160	$0.006 \times d_1$	160	$0.011 \times d_1$	160	$0.011 \times d_1$	160	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4			160	$0.005 \times d_1$	160	$0.005 \times d_1$	160	$0.005 \times d_1$	160	$0.005 \times d_1$	160	$0.010 \times d_1$	160	$0.010 \times d_1$	160	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5													95	$0.011 \times d_1$	95	$0.011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6													55	$0.015 \times d_1$	55	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.008 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	95	$0.017 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6			75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.007 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	75	$0.015 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7					55	$0.005 \times d_1$	55	$0.005 \times d_1$	55	$0.005 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8							40	$0.005 \times d_1$	40	$0.005 \times d_1$	40	$0.010 \times d_1$	40	$0.010 \times d_1$	40	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1							140	$0.005 \times d_1$	140	$0.005 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	140	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2							95	$0.007 \times d_1$	95	$0.007 \times d_1$	95	$0.014 \times d_1$	95	$0.014 \times d_1$	95	$0.014 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1					120	$0.006 \times d_1$	120	$0.006 \times d_1$	120	$0.006 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	120	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2					75	$0.005 \times d_1$	75	$0.005 \times d_1$	75	$0.005 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1																	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2							55	$0.005 \times d_1$	55	$0.005 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3							120	$0.004 \times d_1$	120	$0.004 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	120	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
S	1.1				95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	95	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2				75	$0.005 \times d_1$	75	$0.005 \times d_1$	75	$0.005 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3						75	$0.005 \times d_1$	75	$0.005 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	75	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1					95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.005 \times d_1$	95	$0.009 \times d_1$	95	$0.009 \times d_1$	95	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2																<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3																<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.4																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.5																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.6																<input type="checkbox"/>	<input checked="" type="checkbox"/>		
H	1.1											75	$0.013 \times d_1$	75	$0.013 \times d_1$	75	$0.013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2													55	$0.010 \times d_1$	55	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3																<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.4																<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.5																<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Oval form

NR



N



Valid for Tool Nos.:

3552LZ (NR) 3554LZ (N)

	V <sub>C</sub> [m/min]	f <sub>z</sub> [mm]	NR		N				MQL		
			V <sub>C</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>C</sub> [m/min]	f <sub>z</sub> [mm]					
<b>P</b>	1.1	100	0.004 x d <sub>1</sub>	140	0.005 x d <sub>1</sub>	200	0.005 x d <sub>1</sub>		■	□	■
	2.1	90	0.004 x d <sub>1</sub>	130	0.004 x d <sub>1</sub>	180	0.004 x d <sub>1</sub>		■	□	■
	3.1	90	0.003 x d <sub>1</sub>	120	0.004 x d <sub>1</sub>	160	0.004 x d <sub>1</sub>		■	□	■
	4.1	80	0.002 x d <sub>1</sub>	110	0.003 x d <sub>1</sub>	140	0.003 x d <sub>1</sub>		■	□	■
	5.1	70	0.002 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>	120	0.003 x d <sub>1</sub>		■	□	■
<b>M</b>	1.1	80	0.004 x d <sub>1</sub>	100	0.005 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>				■
	2.1	70	0.003 x d <sub>1</sub>	80	0.004 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>				■
	3.1	60	0.002 x d <sub>1</sub>	70	0.003 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>				■
	4.1	60	0.002 x d <sub>1</sub>	70	0.003 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>				■
<b>K</b>	1.1										
	1.2										
	2.1										
	2.2										
	3.1										
	3.2										
	4.1										
<b>N</b>	1.1	280	0.006 x d <sub>1</sub>	400	0.006 x d <sub>1</sub>	400	0.006 x d <sub>1</sub>				■
	1.2	200	0.005 x d <sub>1</sub>	280	0.005 x d <sub>1</sub>	280	0.005 x d <sub>1</sub>				■
	1.3	140	0.004 x d <sub>1</sub>	200	0.004 x d <sub>1</sub>	200	0.004 x d <sub>1</sub>				■
	1.4										
	1.5										
	1.6										
	2.1										
	2.2										
	2.3										
	2.4										
	2.5										
	2.6										
	2.7										
	2.8										
	3.1										
	3.2										
4.1											
4.2											
4.3											
4.4											
5.1											
5.2											
5.3											
<b>S</b>	1.1	90	0.002 x d <sub>1</sub>	120	0.004 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>				■
	1.2	75	0.002 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>				■
	1.3	45	0.002 x d <sub>1</sub>	60	0.002 x d <sub>1</sub>	60	0.003 x d <sub>1</sub>				■
	2.1										
	2.2	25	0.002 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>	30	0.003 x d <sub>1</sub>				■
	2.3	25	0.002 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>				■
	2.4	25	0.002 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>	30	0.003 x d <sub>1</sub>				■
2.5	15	0.002 x d <sub>1</sub>	20	0.002 x d <sub>1</sub>	20	0.002 x d <sub>1</sub>				■	
2.6	25	0.002 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>	20	0.002 x d <sub>1</sub>				■	
<b>H</b>	1.1										
	1.2										
	1.3										
	1.4										
	1.5										

v<sub>C</sub> = Cutting speed ■ = very suitable  
f<sub>z</sub> = Feed per tooth □ = suitable

## Barrel form

N



Allowance  
0.05 - 0.1 mm



Allowance  
0.1 - 0.2 mm

Valid for Tool No.:

3542L

In order to calculate the rotational speed  $n$ , the diameter  $d_1$  has to be used.

		$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]			
<b>P</b>	1.1	420	$0.004 \times d_1$	420	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	375	$0.004 \times d_1$	375	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	315	$0.003 \times d_1$	315	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	300	$0.003 \times d_1$	300	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	5.1	270	$0.003 \times d_1$	270	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1	150	$0.005 \times d_1$	150	$0.003 \times d_1$			<input type="checkbox"/>
	2.1	120	$0.005 \times d_1$	120	$0.003 \times d_1$			<input type="checkbox"/>
	3.1	90	$0.004 \times d_1$	90	$0.002 \times d_1$			<input type="checkbox"/>
	4.1	60	$0.004 \times d_1$	60	$0.002 \times d_1$			<input type="checkbox"/>
<b>K</b>	1.1	280	$0.005 \times d_1$	280	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	280	$0.005 \times d_1$	280	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1	250	$0.004 \times d_1$	250	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2	250	$0.004 \times d_1$	250	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1	210	$0.004 \times d_1$	210	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.2	210	$0.004 \times d_1$	210	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1	180	$0.003 \times d_1$	180	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.2	140	$0.003 \times d_1$	140	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>N</b>	1.1	600	$0.004 \times d_1$	600	$0.003 \times d_1$			<input type="checkbox"/>
	1.2	600	$0.004 \times d_1$	600	$0.003 \times d_1$			<input type="checkbox"/>
	1.3	600	$0.003 \times d_1$	600	$0.002 \times d_1$			<input type="checkbox"/>
	1.4	410	$0.004 \times d_1$	410	$0.003 \times d_1$			<input type="checkbox"/>
	1.5							
	1.6							
	2.1	270	$0.005 \times d_1$	270	$0.004 \times d_1$			<input type="checkbox"/>
	2.2	270	$0.005 \times d_1$	270	$0.004 \times d_1$			<input type="checkbox"/>
	2.3	270	$0.005 \times d_1$	270	$0.004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.4	255	$0.004 \times d_1$	255	$0.003 \times d_1$			<input type="checkbox"/>
	2.5	255	$0.004 \times d_1$	255	$0.003 \times d_1$			<input type="checkbox"/>
	2.6	255	$0.004 \times d_1$	255	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.7	150	$0.003 \times d_1$	150	$0.002 \times d_1$			<input type="checkbox"/>
	2.8	150	$0.003 \times d_1$	150	$0.002 \times d_1$			<input type="checkbox"/>
	3.1	410	$0.005 \times d_1$	410	$0.004 \times d_1$			<input type="checkbox"/>
	3.2	410	$0.005 \times d_1$	410	$0.004 \times d_1$			<input type="checkbox"/>
4.1	410	$0.005 \times d_1$	410	$0.004 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	
4.2	600	$0.005 \times d_1$	600	$0.004 \times d_1$			<input type="checkbox"/>	
4.3								
4.4								
5.1								
5.2	150	$0.005 \times d_1$	150	$0.003 \times d_1$			<input checked="" type="checkbox"/>	
5.3								
<b>S</b>	1.1	100	$0.006 \times d_1$	100	$0.004 \times d_1$			<input checked="" type="checkbox"/>
	1.2	80	$0.005 \times d_1$	80	$0.003 \times d_1$			<input checked="" type="checkbox"/>
	1.3	60	$0.005 \times d_1$	60	$0.003 \times d_1$			<input checked="" type="checkbox"/>
	2.1	80	$0.004 \times d_1$	80	$0.002 \times d_1$			<input checked="" type="checkbox"/>
	2.2	30	$0.004 \times d_1$	30	$0.002 \times d_1$			<input checked="" type="checkbox"/>
	2.3	30	$0.004 \times d_1$	30	$0.002 \times d_1$			<input checked="" type="checkbox"/>
	2.4	30	$0.004 \times d_1$	30	$0.002 \times d_1$			<input checked="" type="checkbox"/>
	2.5	30	$0.004 \times d_1$	30	$0.002 \times d_1$			<input checked="" type="checkbox"/>
2.6	30	$0.004 \times d_1$	30	$0.002 \times d_1$			<input checked="" type="checkbox"/>	
<b>H</b>	1.1	130	$0.005 \times d_1$	130	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2	100	$0.005 \times d_1$	100	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3							
	1.4							
	1.5							



Oval form

N

Valid for Tool No.:

3538L



Allowance  
0.05 - 0.1 mm



Allowance  
0.1 - 0.2 mm



Allowance  
0.2 - 0.3 mm

In order to calculate the rotational speed  $n$ , the diameter  $d_1$  has to be used.

	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]				
<b>P</b>	1.1	$0.004 \times d_1$	420	$0.003 \times d_1$	420	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	$0.004 \times d_1$	375	$0.003 \times d_1$	375	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	$0.003 \times d_1$	315	$0.003 \times d_1$	315	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	$0.003 \times d_1$	300	$0.002 \times d_1$	300	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	$0.003 \times d_1$	270	$0.002 \times d_1$	270	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	$0.005 \times d_1$	150	$0.004 \times d_1$	150	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	$0.005 \times d_1$	120	$0.004 \times d_1$	120	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	$0.004 \times d_1$	90	$0.003 \times d_1$	90	$0.002 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	$0.004 \times d_1$	60	$0.003 \times d_1$	60	$0.002 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	$0.005 \times d_1$	280	$0.004 \times d_1$	280	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	$0.005 \times d_1$	280	$0.004 \times d_1$	280	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	$0.004 \times d_1$	250	$0.003 \times d_1$	250	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	$0.004 \times d_1$	250	$0.003 \times d_1$	250	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	$0.004 \times d_1$	210	$0.003 \times d_1$	210	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	$0.004 \times d_1$	210	$0.003 \times d_1$	210	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	$0.003 \times d_1$	180	$0.002 \times d_1$	180	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2	$0.003 \times d_1$	140	$0.002 \times d_1$	140	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>N</b>	1.1	$0.004 \times d_1$	600	$0.003 \times d_1$	600	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	$0.004 \times d_1$	600	$0.003 \times d_1$	600	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	$0.003 \times d_1$	600	$0.002 \times d_1$	600	$0.002 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	$0.004 \times d_1$	410	$0.003 \times d_1$	410	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									
	1.6									
	2.1	$0.005 \times d_1$	270	$0.004 \times d_1$	270	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	$0.005 \times d_1$	270	$0.004 \times d_1$	270	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	$0.005 \times d_1$	270	$0.004 \times d_1$	270	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	$0.004 \times d_1$	255	$0.003 \times d_1$	255	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	$0.004 \times d_1$	255	$0.003 \times d_1$	255	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	$0.004 \times d_1$	255	$0.003 \times d_1$	255	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	$0.003 \times d_1$	150	$0.002 \times d_1$	150	$0.002 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	$0.003 \times d_1$	150	$0.002 \times d_1$	150	$0.002 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	$0.005 \times d_1$	410	$0.004 \times d_1$	410	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	$0.005 \times d_1$	410	$0.004 \times d_1$	410	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1	$0.005 \times d_1$	410	$0.004 \times d_1$	410	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2	$0.005 \times d_1$	600	$0.004 \times d_1$	600	$0.003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3										
4.4										
5.1										
5.2	$0.005 \times d_1$	150	$0.004 \times d_1$	150	$0.003 \times d_1$				<input checked="" type="checkbox"/>	
5.3										
<b>S</b>	1.1	$0.006 \times d_1$	100	$0.005 \times d_1$	100	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	1.2	$0.005 \times d_1$	80	$0.004 \times d_1$	80	$0.003 \times d_1$				<input checked="" type="checkbox"/>
	1.3	$0.005 \times d_1$	60	$0.004 \times d_1$	60	$0.003 \times d_1$				<input checked="" type="checkbox"/>
	2.1	$0.004 \times d_1$	80	$0.003 \times d_1$	80	$0.002 \times d_1$				<input checked="" type="checkbox"/>
	2.2	$0.004 \times d_1$	30	$0.003 \times d_1$	30	$0.002 \times d_1$				<input checked="" type="checkbox"/>
	2.3	$0.004 \times d_1$	30	$0.003 \times d_1$	30	$0.002 \times d_1$				<input checked="" type="checkbox"/>
	2.4	$0.004 \times d_1$	30	$0.003 \times d_1$	30	$0.002 \times d_1$				<input checked="" type="checkbox"/>
2.5	$0.004 \times d_1$	30	$0.003 \times d_1$	30	$0.002 \times d_1$				<input checked="" type="checkbox"/>	
2.6	$0.004 \times d_1$	30	$0.003 \times d_1$	30	$0.002 \times d_1$				<input checked="" type="checkbox"/>	
<b>H</b>	1.1	$0.005 \times d_1$	130	$0.004 \times d_1$	130	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	$0.005 \times d_1$	100	$0.004 \times d_1$	100	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3									
	1.4									
	1.5									

**Oval form**

**N**

Valid for Tool No.:

3539L



Allowance  
0.05 - 0.1 mm



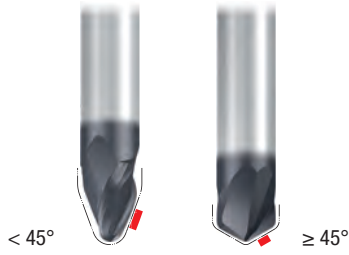
Allowance  
0.1 - 0.2 mm

In order to calculate the rotational speed n, the diameter d<sub>1</sub> has to be used.

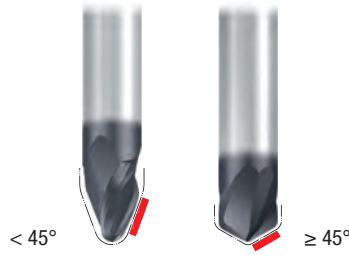
	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]	V <sub>c</sub> [m/min]	f <sub>z</sub> [mm]				
<b>P</b>	1.1	420	0.003 x d <sub>1</sub>	420	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	375	0.003 x d <sub>1</sub>	375	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	315	0.002 x d <sub>1</sub>	315	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	300	0.002 x d <sub>1</sub>	300	0.001 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	5.1	270	0.002 x d <sub>1</sub>	270	0.001 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1	150	0.003 x d <sub>1</sub>	150	0.002 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	0.003 x d <sub>1</sub>	120	0.002 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	0.002 x d <sub>1</sub>	90	0.001 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	60	0.002 x d <sub>1</sub>	60	0.001 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	280	0.004 x d <sub>1</sub>	280	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.2	280	0.004 x d <sub>1</sub>	280	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	250	0.003 x d <sub>1</sub>	250	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.2	250	0.003 x d <sub>1</sub>	250	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	210	0.003 x d <sub>1</sub>	210	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.2	210	0.003 x d <sub>1</sub>	210	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	180	0.002 x d <sub>1</sub>	180	0.001 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.2	140	0.002 x d <sub>1</sub>	140	0.001 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1	600	0.003 x d <sub>1</sub>	600	0.002 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	600	0.003 x d <sub>1</sub>	600	0.002 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	600	0.002 x d <sub>1</sub>	600	0.001 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	410	0.003 x d <sub>1</sub>	410	0.002 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5							
	1.6							
	2.1	270	0.004 x d <sub>1</sub>	270	0.003 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	270	0.004 x d <sub>1</sub>	270	0.003 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	270	0.004 x d <sub>1</sub>	270	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	255	0.003 x d <sub>1</sub>	255	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	255	0.003 x d <sub>1</sub>	255	0.002 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	255	0.003 x d <sub>1</sub>	255	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	150	0.002 x d <sub>1</sub>	150	0.001 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	150	0.002 x d <sub>1</sub>	150	0.001 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	410	0.004 x d <sub>1</sub>	410	0.003 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	410	0.004 x d <sub>1</sub>	410	0.003 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1	410	0.004 x d <sub>1</sub>	410	0.003 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2	600	0.004 x d <sub>1</sub>	600	0.003 x d <sub>1</sub>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3								
4.4								
5.1								
5.2	150	0.003 x d <sub>1</sub>	150	0.002 x d <sub>1</sub>			<input checked="" type="checkbox"/>	
5.3								
<b>S</b>	1.1	100	0.005 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>			<input checked="" type="checkbox"/>
	1.2	80	0.004 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>			<input checked="" type="checkbox"/>
	1.3	60	0.004 x d <sub>1</sub>	60	0.003 x d <sub>1</sub>			<input checked="" type="checkbox"/>
	2.1	80	0.003 x d <sub>1</sub>	80	0.002 x d <sub>1</sub>			<input checked="" type="checkbox"/>
	2.2	30	0.003 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>			<input checked="" type="checkbox"/>
	2.3	30	0.003 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>			<input checked="" type="checkbox"/>
2.4	30	0.003 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>			<input checked="" type="checkbox"/>	
2.5	30	0.003 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>			<input checked="" type="checkbox"/>	
2.6	30	0.003 x d <sub>1</sub>	30	0.002 x d <sub>1</sub>			<input checked="" type="checkbox"/>	
<b>H</b>	1.1	130	0.004 x d <sub>1</sub>	130	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.2	100	0.004 x d <sub>1</sub>	100	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.3	80	0.003 x d <sub>1</sub>	80	0.002 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.4							
	1.5							

## Taper form

N



Allowance  
0.05 - 0.1 mm



Allowance  
0.1 - 0.2 mm

Valid for Tool No.:

3540L

In order to calculate the rotational speed  $n$ , the diameter  $d_1$  has to be used.

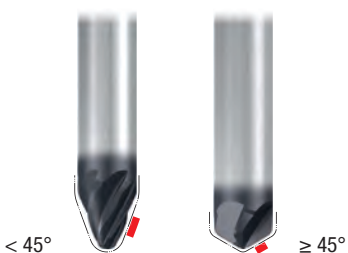
		$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]				
<b>P</b>	1.1	420	$0.004 \times d_1$	420	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	375	$0.004 \times d_1$	375	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	315	$0.003 \times d_1$	315	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	300	$0.003 \times d_1$	300	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	270	$0.003 \times d_1$	270	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	150	$0.004 \times d_1$	150	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	$0.004 \times d_1$	120	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	$0.003 \times d_1$	90	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	60	$0.003 \times d_1$	60	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	280	$0.007 \times d_1$	280	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	280	$0.007 \times d_1$	280	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	250	$0.006 \times d_1$	250	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	250	$0.006 \times d_1$	250	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	210	$0.006 \times d_1$	210	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	210	$0.006 \times d_1$	210	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	180	$0.004 \times d_1$	180	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	140	$0.003 \times d_1$	140	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1	600	$0.004 \times d_1$	600	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	600	$0.004 \times d_1$	600	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	600	$0.003 \times d_1$	600	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	410	$0.004 \times d_1$	410	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	270	$0.005 \times d_1$	270	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	270	$0.005 \times d_1$	270	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	270	$0.005 \times d_1$	270	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	255	$0.004 \times d_1$	255	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	255	$0.004 \times d_1$	255	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	255	$0.004 \times d_1$	255	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	150	$0.003 \times d_1$	150	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	150	$0.003 \times d_1$	150	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	410	$0.005 \times d_1$	410	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	410	$0.005 \times d_1$	410	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	410	$0.005 \times d_1$	410	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	600	$0.005 \times d_1$	600	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.4					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.1					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2	150	$0.004 \times d_1$	150	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>S</b>	1.1	100	$0.005 \times d_1$	100	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	80	$0.004 \times d_1$	80	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	60	$0.004 \times d_1$	60	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	80	$0.003 \times d_1$	80	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	$0.003 \times d_1$	30	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	30	$0.003 \times d_1$	30	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	30	$0.003 \times d_1$	30	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	30	$0.003 \times d_1$	30	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.6	30	$0.003 \times d_1$	30	$0.002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1	130	$0.005 \times d_1$	130	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	100	$0.005 \times d_1$	100	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**Taper form**

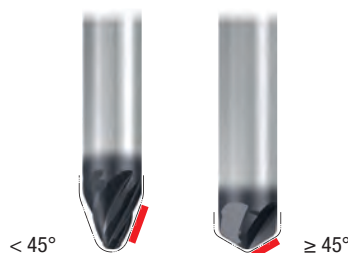
**N**

Valid for Tool No.:

3541L



Allowance  
0.05 - 0.1 mm



Allowance  
0.1 - 0.2 mm

In order to calculate the rotational speed  $n$ , the diameter  $d_1$  has to be used.

	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]					
					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>P</b>	1.1	420	0.003 x $d_1$	420	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	375	0.003 x $d_1$	375	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	315	0.002 x $d_1$	315	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	300	0.002 x $d_1$	300	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	270	0.002 x $d_1$	270	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	150	0.003 x $d_1$	150	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	0.003 x $d_1$	120	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	0.002 x $d_1$	90	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	60	0.002 x $d_1$	60	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	280	0.004 x $d_1$	280	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	280	0.004 x $d_1$	280	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	250	0.003 x $d_1$	250	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	250	0.003 x $d_1$	250	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	210	0.003 x $d_1$	210	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	210	0.003 x $d_1$	210	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	180	0.002 x $d_1$	180	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	140	0.002 x $d_1$	140	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1	600	0.003 x $d_1$	600	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	600	0.003 x $d_1$	600	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	600	0.002 x $d_1$	600	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	410	0.003 x $d_1$	410	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5								
	1.6								
	2.1	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	255	0.003 x $d_1$	255	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	255	0.003 x $d_1$	255	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	255	0.003 x $d_1$	255	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	150	0.002 x $d_1$	150	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	150	0.002 x $d_1$	150	0.001 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	410	0.004 x $d_1$	410	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	410	0.004 x $d_1$	410	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1	410	0.004 x $d_1$	410	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2	600	0.004 x $d_1$	600	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3									
4.4									
5.1									
5.2	150	0.003 x $d_1$	150	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3									
<b>S</b>	1.1	100	0.005 x $d_1$	100	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	80	0.004 x $d_1$	80	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	60	0.004 x $d_1$	60	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	80	0.003 x $d_1$	80	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	0.003 x $d_1$	30	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	30	0.003 x $d_1$	30	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	30	0.003 x $d_1$	30	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	30	0.003 x $d_1$	30	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6	30	0.003 x $d_1$	30	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1	130	0.004 x $d_1$	130	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	100	0.004 x $d_1$	100	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	80	0.003 x $d_1$	80	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4								
	1.5								

Lens form

N



Allowance  
0.05 - 0.1 mm



Allowance  
0.1 - 0.2 mm

Valid for Tool No.:

3544L

In order to calculate the rotational speed  $n$ , the diameter  $d_1$  has to be used.

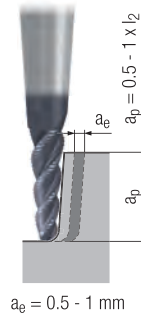
	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]			
<b>P</b>	1.1	420	0.004 x $d_1$	420	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	375	0.004 x $d_1$	375	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	315	0.003 x $d_1$	315	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	300	0.003 x $d_1$	300	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	270	0.003 x $d_1$	270	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	150	0.005 x $d_1$	150	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	0.005 x $d_1$	120	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	0.004 x $d_1$	90	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	60	0.004 x $d_1$	60	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	300	0.005 x $d_1$	300	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	300	0.005 x $d_1$	300	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	220	0.004 x $d_1$	220	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	220	0.004 x $d_1$	220	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	200	0.003 x $d_1$	200	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	150	0.003 x $d_1$	150	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1	900	0.004 x $d_1$	900	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	900	0.004 x $d_1$	900	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	900	0.003 x $d_1$	900	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	600	0.004 x $d_1$	600	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5						
	1.6						
	2.1	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	270	0.004 x $d_1$	270	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	255	0.003 x $d_1$	255	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	255	0.003 x $d_1$	255	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	255	0.003 x $d_1$	255	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	150	0.003 x $d_1$	150	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	150	0.003 x $d_1$	150	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	600	0.004 x $d_1$	600	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	600	0.004 x $d_1$	600	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1							
4.2							
4.3							
4.4							
5.1							
5.2	150	0.005 x $d_1$	150	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3							
<b>S</b>	1.1	150	0.006 x $d_1$	150	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	120	0.005 x $d_1$	120	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	90	0.005 x $d_1$	90	0.003 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	0.004 x $d_1$	120	0.002 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2						
	2.3						
2.4							
2.5							
2.6							
<b>H</b>	1.1						
	1.2						
	1.3						
	1.4						
	1.5						

**Tapered ball nose**

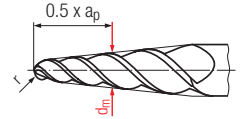
NR

Valid for Tool No.:

3546L



For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).

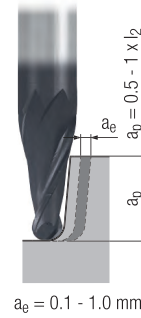
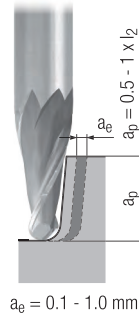
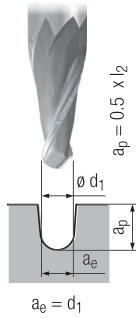


$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]			MLQ	
<b>P</b>	1.1	100	0.014 x r	120	0.018 x r	■	□	■
	2.1	90	0.012 x r	110	0.016 x r	■	□	■
	3.1	90	0.010 x r	100	0.014 x r	■	□	■
	4.1	80	0.010 x r	100	0.012 x r	■	□	■
	5.1	70	0.010 x r	90	0.012 x r	■	□	■
<b>M</b>	1.1	100	0.014 x r	120	0.018 x r			■
	2.1	100	0.013 x r	100	0.016 x r			■
	3.1	70	0.012 x r	70	0.014 x r			■
	4.1	70	0.010 x r	70	0.012 x r			■
<b>K</b>	1.1							
	1.2							
	2.1							
	2.2							
	3.1							
	3.2							
	4.1							
	4.2							
<b>N</b>	1.1	280	0.020 x r	400	0.030 x r			■
	1.2	200	0.025 x r	280	0.030 x r			■
	1.3	140	0.030 x r	200	0.030 x r			■
	1.4							
	1.5							
	1.6							
	2.1							
	2.2							
	2.3							
	2.4							
	2.5							
	2.6							
	2.7							
	2.8							
	3.1							
3.2								
4.1								
4.2								
4.3								
4.4								
5.1								
5.2								
5.3								
<b>S</b>	1.1	90	0.015 x r	100	0.020 x r			■
	1.2	75	0.012 x r	80	0.017 x r			■
	1.3	45	0.010 x r	60	0.015 x r			■
	2.1							
	2.2	25	0.010 x r	30	0.018 x r			■
	2.3	25	0.010 x r	30	0.016 x r			■
2.4	25	0.010 x r	30	0.014 x r			■	
2.5	15	0.010 x r	20	0.012 x r			■	
2.6	25	0.010 x r	30	0.012 x r			■	
<b>H</b>	1.1							
	1.2							
	1.3							
	1.4							
	1.5							

## Tapered ball nose

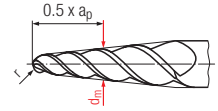
NF



Valid for Tool Nos.:

3446  
3446L  
3447

For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).



$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

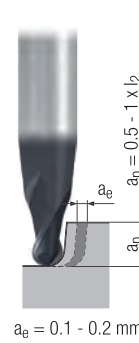
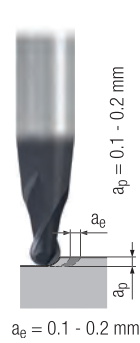
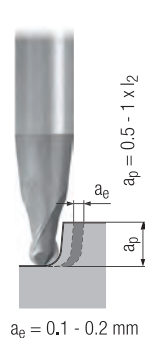
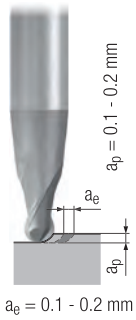
Uncoated

ALCR

	Uncoated		ALCR		MQL	Coolant			
	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]					
<b>P</b>	1.1				<input type="checkbox"/>	<input type="checkbox"/>			
	2.1				<input type="checkbox"/>	<input type="checkbox"/>			
	3.1				<input type="checkbox"/>	<input type="checkbox"/>			
	4.1				<input type="checkbox"/>	<input type="checkbox"/>			
	5.1				<input type="checkbox"/>	<input type="checkbox"/>			
<b>M</b>	1.1					<input type="checkbox"/>			
	2.1					<input type="checkbox"/>			
	3.1					<input type="checkbox"/>			
	4.1					<input type="checkbox"/>			
<b>K</b>	1.1				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	1.2				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.1				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.2				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	3.1				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	3.2				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.1				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.2				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
<b>N</b>	1.1	350	0.040 x r	300	0.020 x r	350	0.016 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	350	0.040 x r	300	0.020 x r	350	0.014 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	320	0.035 x r	270	0.017 x r	350	0.012 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4					280	0.014 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5					240	0.012 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6							<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1					140	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2					140	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3					140	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4					120	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5					120	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6					120	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7					70	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8					70	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1					320	0.018 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2					320	0.014 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			180	0.016 x r	240	0.016 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2			160	0.016 x r	350	0.016 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.3					180	0.012 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4					90	0.012 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1							<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2					80	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3					160	0.012 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>S</b>	1.1				80	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2				60	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3				40	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1				50	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.2				20	0.004 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.3				20	0.004 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.4				20	0.004 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.5				15	0.004 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
2.6				20	0.004 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<b>H</b>	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

Tapered ball nose

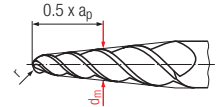
N



Valid for Tool Nos.:

- 3442
- 3442L
- 3443

For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).



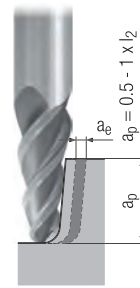
$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

		Uncoated				ALCR							
		$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P	1.1					300	0.010 x r	160	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1					260	0.010 x r	140	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1					220	0.008 x r	120	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1					180	0.008 x r	100	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1					150	0.006 x r	80	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
M	1.1					150	0.006 x r	80	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1					120	0.006 x r	70	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1											<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1											<input type="checkbox"/>	<input checked="" type="checkbox"/>
K	1.1					300	0.010 x r	160	0.010 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2					300	0.010 x r	160	0.010 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1					260	0.008 x r	140	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2					260	0.008 x r	140	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1					220	0.008 x r	120	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2					220	0.008 x r	120	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1					180	0.006 x r	100	0.006 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2					150	0.006 x r	80	0.006 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
N	1.1	490	0.016 x r	250	0.016 x r	700	0.016 x r	350	0.016 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	490	0.014 x r	250	0.014 x r	700	0.014 x r	350	0.014 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	490	0.012 x r	250	0.012 x r	700	0.012 x r	350	0.012 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4					500	0.014 x r	280	0.014 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5					450	0.012 x r	240	0.012 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6											<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1					260	0.010 x r	140	0.010 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2					260	0.010 x r	140	0.010 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3					260	0.010 x r	140	0.010 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4					220	0.008 x r	120	0.008 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5					220	0.008 x r	120	0.008 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6					220	0.008 x r	120	0.008 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7					140	0.006 x r	70	0.006 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8					140	0.006 x r	70	0.006 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1					600	0.018 x r	320	0.018 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2					600	0.014 x r	320	0.014 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	320	0.016 x r	170	0.016 x r	460	0.016 x r	240	0.016 x r		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	460	0.016 x r	250	0.016 x r	650	0.016 x r	350	0.016 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3					250	0.012 x r	180	0.012 x r		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.4					180	0.012 x r	90	0.012 x r		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.1											<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2					180	0.006 x r	80	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3					300	0.012 x r	160	0.012 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
S	1.1					150	0.008 x r	80	0.008 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2					120	0.006 x r	60	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3					70	0.006 x r	40	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1					110	0.006 x r	50	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2					30	0.004 x r	20	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3					30	0.004 x r	20	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.4					30	0.004 x r	20	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.5					20	0.004 x r	15	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6					30	0.004 x r	20	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

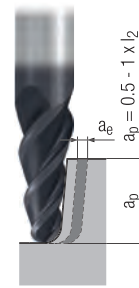


Tapered ball nose

N



$a_e = 0.1 - 0.2 \text{ mm}$

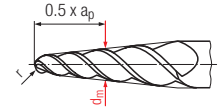


$a_e = 0.1 - 0.2 \text{ mm}$

Valid for Tool Nos.:

- 3440
- 3440L
- 3441

For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).



$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

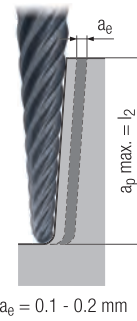
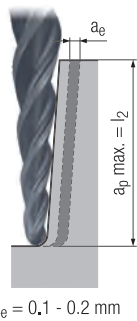
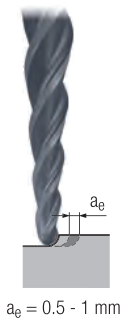
		Uncoated		ALCR					
		$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]				
P	1.1			120	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			100	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1			90	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1			70	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1			60	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
M	1.1			60	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			50	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1							<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1							<input type="checkbox"/>	<input checked="" type="checkbox"/>
K	1.1			120	0.010 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2			120	0.010 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1			100	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2			100	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1			90	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2			90	0.008 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1			70	0.006 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2			60	0.006 x r	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
N	1.1	180	0.016 x r	260	0.016 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	180	0.014 x r	260	0.014 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	180	0.012 x r	260	0.012 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4			200	0.014 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5			180	0.012 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6							<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			100	0.010 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2			100	0.010 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3			100	0.010 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4			80	0.008 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5			80	0.008 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6			80	0.008 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7			50	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8			50	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1			240	0.018 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2			240	0.014 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	130	0.016 x r	180	0.016 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	110	0.016 x r	160	0.016 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3			100	0.012 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.4			70	0.012 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.1							<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2			60	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3			120	0.012 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
S	1.1			60	0.008 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2			50	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3			30	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1			40	0.006 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2			15	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3			15	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4			15	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5			10	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.6			15	0.004 x r			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

## Tapered ball nose

**N**

3550L

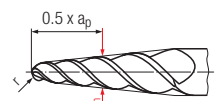
3548L



Valid for Tool Nos.:

3550L 3548L

For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).



$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

		3550L		3548L						
		$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]		$v_c$ [m/min]	$f_z$ [mm]		
<b>P</b>	1.1	120	0.07	80	0.05	80	0.05	■	□	■
	2.1	110	0.06	70	0.05	70	0.05	■	□	■
	3.1	100	0.05	60	0.04	60	0.04	■	□	■
	4.1	90	0.04	60	0.04	60	0.04	■		
	5.1	80	0.04	50	0.03	50	0.03	■		
<b>M</b>	1.1	90	0.07	60	0.03	60	0.03			■
	2.1	90	0.07	60	0.03	60	0.03			■
	3.1	70	0.07	50	0.03	50	0.03			■
	4.1	70	0.07	50	0.03	50	0.03			■
<b>N</b>	1.3	280	0.12	200	0.06	200	0.06			■
	1.4	200	0.12	140	0.06	140	0.06			■
	1.5	140	0.12	100	0.06	100	0.06			■
<b>S</b>	1.1	90	0.07	60	0.03	60	0.03			■
	1.2	75	0.07	50	0.03	50	0.03			■
	1.3	45	0.07	30	0.03	30	0.03			■
	2.2	25	0.07	15	0.03	15	0.03			■
	2.3	25	0.07	15	0.03	15	0.03			■
	2.4	25	0.07	15	0.03	15	0.03			■
2.5	15	0.07	10	0.03	10	0.03			■	
2.6	25	0.07	15	0.03	15	0.03			■	

Tapered ball nose

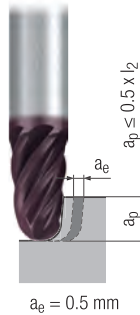
N

Valid for Tool No.:

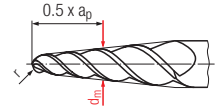
2679A

Pre-finishing

Finishing



For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).



$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

	Pre-finishing		Finishing		Pre-finishing		Finishing						
	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]					
<b>P</b>	1.1	130	0.008 x r	100	0.007 x r	160	0.011 x r	120	0.009 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	120	0.007 x r	90	0.006 x r	150	0.010 x r	110	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	110	0.006 x r	90	0.006 x r	140	0.009 x r	100	0.007 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	110	0.006 x r	80	0.005 x r	130	0.008 x r	100	0.006 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	100	0.005 x r	80	0.004 x r	120	0.007 x r	90	0.005 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	70	0.006 x r	60	0.005 x r	90	0.008 x r	70	0.006 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	60	0.005 x r	50	0.004 x r	80	0.007 x r	60	0.005 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	50	0.004 x r	40	0.004 x r	60	0.006 x r	40	0.005 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	0.004 x r	30	0.003 x r	40	0.005 x r	30	0.004 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	150	0.010 x r	120	0.008 x r	190	0.013 x r	140	0.011 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	150	0.010 x r	120	0.008 x r	190	0.013 x r	140	0.011 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	140	0.009 x r	110	0.008 x r	170	0.012 x r	130	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	140	0.009 x r	110	0.008 x r	170	0.012 x r	130	0.010 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	130	0.008 x r	100	0.007 x r	160	0.011 x r	120	0.009 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	130	0.008 x r	100	0.007 x r	160	0.011 x r	120	0.009 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	110	0.007 x r	90	0.006 x r	140	0.010 x r	100	0.008 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	100	0.006 x r	80	0.006 x r	120	0.009 x r	90	0.007 x r	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												
	1.6												
	2.1	160	0.008 x r	130	0.007 x r	200	0.011 x r	150	0.009 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	160	0.008 x r	130	0.007 x r	200	0.011 x r	150	0.009 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	160	0.008 x r	130	0.007 x r	200	0.011 x r	150	0.009 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	140	0.006 x r	110	0.006 x r	170	0.009 x r	130	0.007 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	140	0.006 x r	110	0.006 x r	170	0.009 x r	130	0.007 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	140	0.006 x r	110	0.006 x r	170	0.009 x r	130	0.007 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	90	0.006 x r	70	0.005 x r	110	0.008 x r	80	0.006 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	90	0.006 x r	70	0.005 x r	110	0.008 x r	80	0.006 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1												
	3.2												
4.1													
4.2													
4.3													
4.4													
5.1													
5.2													
5.3													
<b>S</b>	1.1	100	0.008 x r	80	0.007 x r	120	0.011 x r	90	0.009 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	0.007 x r	60	0.006 x r	90	0.010 x r	70	0.008 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	50	0.006 x r	40	0.006 x r	60	0.009 x r	40	0.007 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	70	0.007 x r	50	0.006 x r	90	0.010 x r	60	0.008 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	0.006 x r	20	0.005 x r	40	0.008 x r	30	0.006 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	0.005 x r	20	0.004 x r	30	0.007 x r	20	0.005 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	30	0.006 x r	20	0.005 x r	40	0.008 x r	30	0.006 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	20	0.005 x r	10	0.004 x r	20	0.007 x r	20	0.005 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6	20	0.004 x r	20	0.004 x r	30	0.006 x r	20	0.005 x r	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

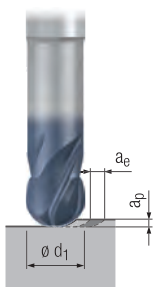
Ball nose – standard length (4 flutes)

H

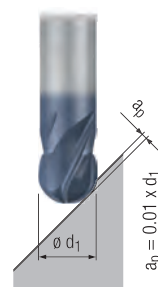
Valid for Tool Nos.:

2834A  
2942A

Roughing



Finishing



		$v_c$ [m/min]	$f_z$ [mm]	$a_e$ [mm]	$a_p$ [mm]	$v_c$ [m/min]	$f_z$ [mm]			MLQ	
P	1.1	280	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	360	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	240	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	170	$0.008 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	220	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	140	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	180	$0.0054 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
M	1.1										
	2.1										
	3.1										
	4.1										
K	1.1	280	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	360	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	280	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	360	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	250	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	250	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	170	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	220	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	150	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	180	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
N	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1										
	2.2	250	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	250	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	130	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	170	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	130	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	170	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1										
	3.2										
4.1											
4.2											
4.3											
4.4											
5.1											
5.2											
5.3											
S	1.1										
	1.2										
	1.3										
	2.1										
	2.2										
	2.3										
H	1.1	130	$0.008 \times d_1$	$0.05 \times d_1$	$0.02 \times d_1$	180	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	120	$0.007 \times d_1$	$0.05 \times d_1$	$0.02 \times d_1$	160	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3					140	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4					110	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.5					90	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

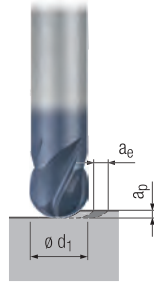
Ball nose – long length (4 flutes)

H

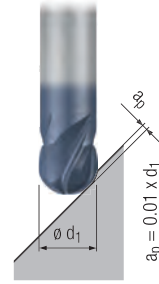
Valid for Tool Nos.:

2842A  
2943A

Roughing



Finishing



		$V_c$ [m/min]	$f_z$ [mm]	$a_e$ [mm]	$a_p$ [mm]	$V_c$ [m/min]	$f_z$ [mm]			
<b>P</b>	1.1	280	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	360	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	240	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	170	$0.008 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	220	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	5.1	140	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	180	$0.0054 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1									
	2.1									
	3.1									
	4.1									
<b>K</b>	1.1	280	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	360	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.2	280	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	360	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	250	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.2	250	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.2	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	170	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	220	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.2	150	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	180	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1									
	1.2									
	1.3									
	1.4									
	1.5									
	1.6									
	2.1									
	2.2	250	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.3	250	$0.011 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	320	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	210	$0.009 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	270	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	130	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	170	$0.006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	130	$0.006 \times d_1$	$0.1 \times d_1$	$0.05 \times d_1$	170	$0.005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1									
3.2										
4.1										
4.2										
4.3										
4.4										
5.1										
5.2										
5.3										
<b>S</b>	1.1					150	$0.006 \times d_1$			<input checked="" type="checkbox"/>
	1.2					120	$0.005 \times d_1$			<input checked="" type="checkbox"/>
	1.3					70	$0.005 \times d_1$			<input checked="" type="checkbox"/>
	2.1					110	$0.006 \times d_1$			<input checked="" type="checkbox"/>
	2.2					50	$0.004 \times d_1$			<input checked="" type="checkbox"/>
	2.3					40	$0.004 \times d_1$			<input checked="" type="checkbox"/>
	2.4					40	$0.004 \times d_1$			<input checked="" type="checkbox"/>
2.5					30	$0.003 \times d_1$			<input checked="" type="checkbox"/>	
2.6					40	$0.003 \times d_1$			<input checked="" type="checkbox"/>	
<b>H</b>	1.1	130	$0.008 \times d_1$	$0.05 \times d_1$	$0.02 \times d_1$	180	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.2	120	$0.007 \times d_1$	$0.05 \times d_1$	$0.02 \times d_1$	160	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.3					140	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.4					110	$0.004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.5					90	$0.003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

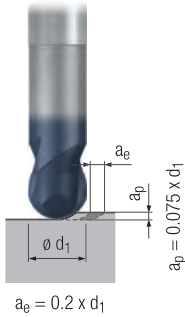
Ball nose "Lollipop" – extra long length (2 flutes)

Valid for Tool No.:

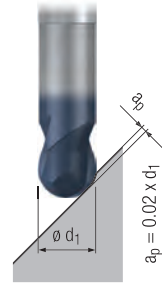
1935A

N

Roughing



Finishing



	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]			MMS MQL	
<b>P</b>	1.1	220	0.014 x $d_1$	300	0.010 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	190	0.013 x $d_1$	260	0.009 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	160	0.011 x $d_1$	220	0.008 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	130	0.010 x $d_1$	180	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	5.1	110	0.008 x $d_1$	150	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>M</b>	1.1	110	0.008 x $d_1$	150	0.006 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	90	0.008 x $d_1$	120	0.006 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	70	0.006 x $d_1$	90	0.005 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	50	0.006 x $d_1$	70	0.005 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	220	0.014 x $d_1$	300	0.010 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.2	220	0.014 x $d_1$	300	0.010 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	200	0.011 x $d_1$	260	0.008 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.2	200	0.011 x $d_1$	260	0.008 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	160	0.011 x $d_1$	220	0.008 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.2	160	0.011 x $d_1$	220	0.008 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	130	0.008 x $d_1$	180	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.2	110	0.008 x $d_1$	150	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1							
	1.2	900	0.020 x $d_1$	1200	0.014 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	900	0.017 x $d_1$	1200	0.012 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	600	0.020 x $d_1$	800	0.014 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5							
	1.6							
	2.1	200	0.014 x $d_1$	260	0.010 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	200	0.014 x $d_1$	260	0.010 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	200	0.014 x $d_1$	260	0.010 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	160	0.011 x $d_1$	220	0.008 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	160	0.011 x $d_1$	220	0.008 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	160	0.011 x $d_1$	220	0.008 x $d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	100	0.008 x $d_1$	130	0.006 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	100	0.008 x $d_1$	130	0.006 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1							
	3.2							
4.1								
4.2								
4.3								
4.4								
5.1								
5.2	110	0.008 x $d_1$	150	0.006 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3								
<b>S</b>	1.1	110	0.010 x $d_1$	150	0.007 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	90	0.008 x $d_1$	120	0.006 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	50	0.007 x $d_1$	70	0.005 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	80	0.008 x $d_1$	110	0.006 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	0.006 x $d_1$	50	0.004 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	30	0.006 x $d_1$	40	0.004 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.4	30	0.006 x $d_1$	40	0.004 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.5	20	0.006 x $d_1$	30	0.004 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6	30	0.006 x $d_1$	40	0.004 x $d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1			150	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.2			130	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	1.3							
	1.4							
	1.5							

Ball nose "Lollipop" – long length (4 flutes)

Valid for Tool No.:

2564L



		$v_c$ [m/min]	$f_z$ [mm]			MLQ	
<b>P</b>	1.1	280	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	260	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	240	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	220	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	180	$0.0054 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	130	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	110	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	80	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	80	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	280	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	1.2	260	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	2.1	240	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	2.2	220	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	3.1	200	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	3.2	200	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	4.1	180	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
	4.2	150	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>
<b>N</b>	1.1						
	1.2						
	1.3						
	1.4						
	1.5						
	1.6						
	2.1	260	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	260	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	260	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	220	$0.007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	220	$0.007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	220	$0.007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	130	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	130	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1						
3.2							
4.1							
4.2							
4.3							
4.4							
5.1							
5.2							
5.3							
<b>S</b>	1.1	150	$0.006 \times d_1$				<input checked="" type="checkbox"/>
	1.2	120	$0.005 \times d_1$				<input checked="" type="checkbox"/>
	1.3	70	$0.005 \times d_1$				<input checked="" type="checkbox"/>
	2.1	110	$0.006 \times d_1$				<input checked="" type="checkbox"/>
	2.2	50	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	2.3	40	$0.004 \times d_1$				<input checked="" type="checkbox"/>
	2.4	40	$0.004 \times d_1$				<input checked="" type="checkbox"/>
2.5	30	$0.003 \times d_1$				<input checked="" type="checkbox"/>	
2.6	40	$0.003 \times d_1$				<input checked="" type="checkbox"/>	
<b>H</b>	1.1	160	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	140	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3	120	$0.005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.4						
	1.5						

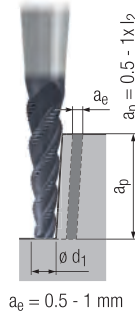
$v_c$  = Cutting speed     = very suitable  
 $f_z$  = Feed per tooth     = suitable

**Tapered torus**

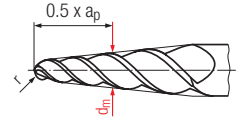
NR

Valid for Tool Nos.:

3532LZ  
3534LZ



For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).



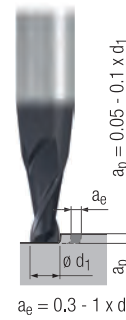
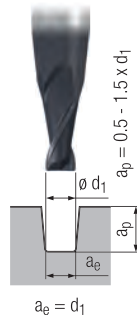
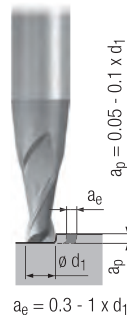
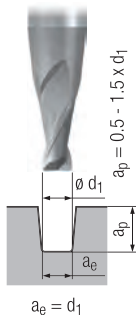
$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]			MLQ	
<b>P</b>	1.1	$100$	$0.005 \times d_1$	$140$	$0.005 \times d_1$	■	□	■
	2.1	$90$	$0.004 \times d_1$	$130$	$0.004 \times d_1$	■	□	■
	3.1	$90$	$0.004 \times d_1$	$120$	$0.004 \times d_1$	■	□	■
	4.1	$80$	$0.003 \times d_1$	$110$	$0.003 \times d_1$	■	□	■
	5.1	$70$	$0.003 \times d_1$	$100$	$0.003 \times d_1$	■	□	■
<b>M</b>	1.1	$100$	$0.004 \times d_1$	$110$	$0.004 \times d_1$			■
	2.1	$80$	$0.003 \times d_1$	$90$	$0.003 \times d_1$			■
	3.1	$60$	$0.002 \times d_1$	$80$	$0.002 \times d_1$			■
	4.1	$50$	$0.002 \times d_1$	$60$	$0.002 \times d_1$			■
<b>K</b>	1.1							
	1.2							
	2.1							
	2.2							
	3.1							
	3.2							
	4.1							
<b>N</b>	1.1	$280$	$0.006 \times d_1$	$400$	$0.006 \times d_1$			■
	1.2	$200$	$0.005 \times d_1$	$280$	$0.005 \times d_1$			■
	1.3	$140$	$0.004 \times d_1$	$200$	$0.004 \times d_1$			■
	1.4							
	1.5							
	1.6							
	2.1							
	2.2							
	2.3							
	2.4							
	2.5							
	2.6							
	2.7							
	2.8							
	3.1							
3.2								
4.1								
4.2								
4.3								
4.4								
5.1								
5.2								
5.3								
<b>S</b>	1.1	$90$	$0.002 \times d_1$	$120$	$0.002 \times d_1$			■
	1.2	$75$	$0.002 \times d_1$	$100$	$0.002 \times d_1$			■
	1.3	$45$	$0.002 \times d_1$	$60$	$0.002 \times d_1$			■
	2.1							
	2.2	$25$	$0.002 \times d_1$	$30$	$0.002 \times d_1$			■
	2.3	$25$	$0.002 \times d_1$	$30$	$0.002 \times d_1$			■
2.4	$25$	$0.002 \times d_1$	$30$	$0.002 \times d_1$			■	
2.5	$15$	$0.002 \times d_1$	$20$	$0.002 \times d_1$			■	
2.6	$25$	$0.002 \times d_1$	$30$	$0.002 \times d_1$			■	
<b>H</b>	1.1							
	1.2							
	1.3							
	1.4							
	1.5							



Tapered torus

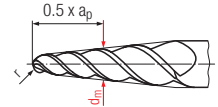
N



Valid for Tool Nos.:

- 3444
- 3444L
- 3445

For the calculation of rpm (n), use the average diameter  $d_m$  (measuring point at  $0.5 \times a_p$ ).



$$n = \frac{v_c \times 1000}{d_m \times \pi} \text{ [rpm]}$$

	Uncoated				ALCR								
	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]	$v_c$ [m/min]	$f_z$ [mm]					
<b>P</b>	1.1						220	$0.010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1						200	$0.009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1						160	$0.008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1						130	$0.007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	5.1						110	$0.006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>M</b>	1.1						110	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	2.1						90	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3.1										<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4.1										<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>K</b>	1.1						220	$0.010 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	1.2						220	$0.010 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.1						190	$0.008 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.2						190	$0.008 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	3.1						160	$0.008 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	3.2						160	$0.008 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.1						130	$0.006 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.2						110	$0.006 \times d_1$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
<b>N</b>	1.1	280	$0.010 \times d_1$	350	$0.016 \times d_1$	400	$0.010 \times d_1$	500	$0.016 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	280	$0.008 \times d_1$	350	$0.014 \times d_1$	400	$0.008 \times d_1$	500	$0.014 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	250	$0.006 \times d_1$	350	$0.012 \times d_1$	350	$0.006 \times d_1$	500	$0.012 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4							380	$0.014 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5							340	$0.012 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6											<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1							200	$0.010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2							200	$0.010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3							200	$0.010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4							160	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5							160	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6							160	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7							100	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8							100	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1							450	$0.018 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2							450	$0.014 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.1			220	$0.015 \times d_1$			320	$0.015 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.2			350	$0.015 \times d_1$			500	$0.015 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.3							200	$0.012 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
4.4							140	$0.012 \times d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.1											<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.2							120	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
5.3							220	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
<b>S</b>	1.1					50	$0.004 \times d_1$	110	$0.007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2					40	$0.003 \times d_1$	90	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3					30	$0.003 \times d_1$	50	$0.005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1							80	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2							30	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3							30	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.4							30	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.5							20	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6							30	$0.004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

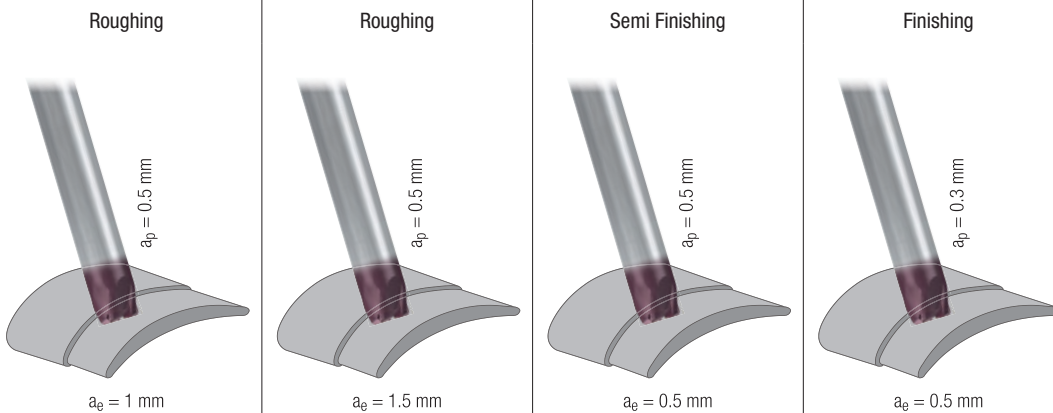
$v_c$  = Cutting speed ■ = very suitable  
 $f_z$  = Feed per tooth □ = suitable

**Tapered torus – long and extra long lengths**

**N**

**Valid for Tool Nos.:**

2677AZ  
2678AZ



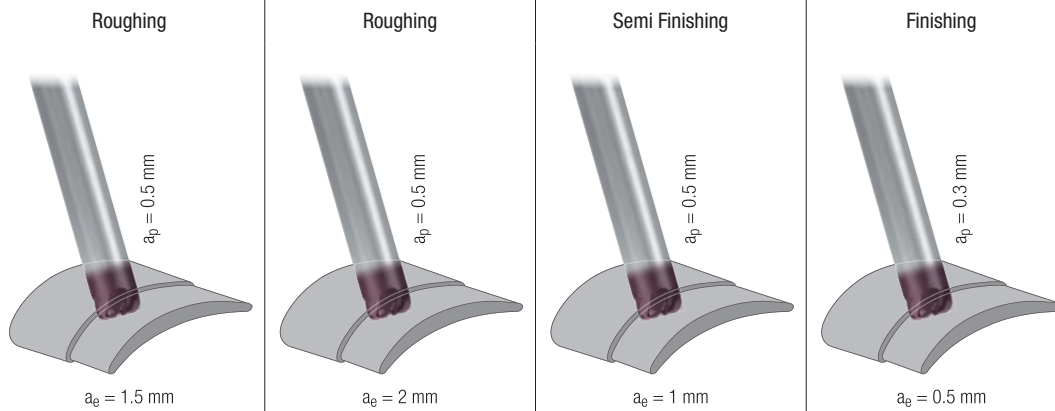
	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	$V_c$ [m/min]	$f_z$ [mm]	MQL				
<b>P</b>	1.1	160	0.005 x $d_1$	140	0.004 x $d_1$	180	0.008 x $d_1$	200	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	150	0.005 x $d_1$	130	0.004 x $d_1$	170	0.007 x $d_1$	190	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	140	0.004 x $d_1$	120	0.003 x $d_1$	160	0.006 x $d_1$	180	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	130	0.004 x $d_1$	110	0.003 x $d_1$	150	0.006 x $d_1$	170	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	120	0.003 x $d_1$	110	0.002 x $d_1$	140	0.005 x $d_1$	160	0.004 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	90	0.004 x $d_1$	80	0.003 x $d_1$	100	0.006 x $d_1$	120	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	80	0.003 x $d_1$	70	0.002 x $d_1$	90	0.005 x $d_1$	100	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	60	0.003 x $d_1$	50	0.002 x $d_1$	70	0.004 x $d_1$	80	0.003 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	40	0.002 x $d_1$	40	0.002 x $d_1$	50	0.004 x $d_1$	60	0.003 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	190	0.006 x $d_1$	160	0.005 x $d_1$	210	0.01 x $d_1$	240	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	190	0.006 x $d_1$	160	0.005 x $d_1$	210	0.01 x $d_1$	240	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	170	0.006 x $d_1$	150	0.004 x $d_1$	190	0.009 x $d_1$	220	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	170	0.006 x $d_1$	150	0.004 x $d_1$	190	0.009 x $d_1$	220	0.007 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	160	0.005 x $d_1$	140	0.004 x $d_1$	180	0.008 x $d_1$	200	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	160	0.005 x $d_1$	140	0.004 x $d_1$	180	0.008 x $d_1$	200	0.006 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	140	0.005 x $d_1$	120	0.004 x $d_1$	160	0.007 x $d_1$	180	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	120	0.004 x $d_1$	110	0.003 x $d_1$	140	0.006 x $d_1$	160	0.005 x $d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>N</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												
	1.6												
	2.1	200	0.005 x $d_1$	180	0.004 x $d_1$	230	0.008 x $d_1$	260	0.006 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	200	0.005 x $d_1$	180	0.004 x $d_1$	230	0.008 x $d_1$	260	0.006 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	200	0.005 x $d_1$	180	0.004 x $d_1$	230	0.008 x $d_1$	260	0.006 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	170	0.004 x $d_1$	150	0.003 x $d_1$	190	0.006 x $d_1$	220	0.005 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	170	0.004 x $d_1$	150	0.003 x $d_1$	190	0.006 x $d_1$	220	0.005 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	170	0.004 x $d_1$	150	0.003 x $d_1$	190	0.006 x $d_1$	220	0.005 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	110	0.004 x $d_1$	90	0.003 x $d_1$	120	0.006 x $d_1$	140	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	110	0.004 x $d_1$	90	0.003 x $d_1$	120	0.006 x $d_1$	140	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1												
	3.2												
4.1													
4.2													
4.3													
4.4													
5.1													
5.2													
5.3													
<b>S</b>	1.1	120	0.005 x $d_1$	110	0.004 x $d_1$	140	0.008 x $d_1$	160	0.006 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	90	0.005 x $d_1$	80	0.004 x $d_1$	100	0.007 x $d_1$	120	0.005 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	60	0.004 x $d_1$	50	0.003 x $d_1$	70	0.006 x $d_1$	80	0.005 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	90	0.005 x $d_1$	80	0.004 x $d_1$	100	0.007 x $d_1$	110	0.005 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	40	0.004 x $d_1$	30	0.003 x $d_1$	50	0.006 x $d_1$	50	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	30	0.003 x $d_1$	30	0.002 x $d_1$	30	0.005 x $d_1$	40	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	40	0.004 x $d_1$	30	0.003 x $d_1$	50	0.006 x $d_1$	50	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	20	0.003 x $d_1$	20	0.002 x $d_1$	30	0.005 x $d_1$	30	0.004 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6	30	0.003 x $d_1$	30	0.002 x $d_1$	30	0.004 x $d_1$	40	0.003 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

Torus

N

Valid for Tool No.:

2676AZ

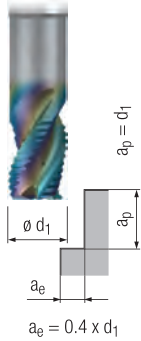
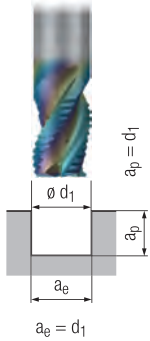


	Roughing (ae = 1.5 mm)		Roughing (ae = 2 mm)		Semi Finishing (ae = 1 mm)		Finishing (ae = 0.5 mm)				
	Vc [m/min]	fz [mm]	Vc [m/min]	fz [mm]	Vc [m/min]	fz [mm]	Vc [m/min]	fz [mm]			
<b>P</b>	1.1	160	0.008 x d <sub>1</sub>	140	0.007 x d <sub>1</sub>	180	0.009 x d <sub>1</sub>	200	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	150	0.007 x d <sub>1</sub>	130	0.006 x d <sub>1</sub>	170	0.008 x d <sub>1</sub>	190	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	140	0.006 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>	160	0.007 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	130	0.006 x d <sub>1</sub>	110	0.005 x d <sub>1</sub>	150	0.006 x d <sub>1</sub>	170	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.1	120	0.005 x d <sub>1</sub>	110	0.004 x d <sub>1</sub>	140	0.005 x d <sub>1</sub>	160	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>M</b>	1.1	90	0.006 x d <sub>1</sub>	80	0.005 x d <sub>1</sub>	100	0.006 x d <sub>1</sub>	120	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	80	0.005 x d <sub>1</sub>	70	0.004 x d <sub>1</sub>	90	0.005 x d <sub>1</sub>	100	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	60	0.004 x d <sub>1</sub>	50	0.004 x d <sub>1</sub>	70	0.005 x d <sub>1</sub>	80	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	40	0.004 x d <sub>1</sub>	40	0.003 x d <sub>1</sub>	50	0.004 x d <sub>1</sub>	60	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>K</b>	1.1	190	0.01 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	210	0.011 x d <sub>1</sub>	240	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	190	0.01 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	210	0.011 x d <sub>1</sub>	240	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	170	0.009 x d <sub>1</sub>	150	0.008 x d <sub>1</sub>	190	0.01 x d <sub>1</sub>	220	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	170	0.009 x d <sub>1</sub>	150	0.008 x d <sub>1</sub>	190	0.01 x d <sub>1</sub>	220	0.007 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	160	0.008 x d <sub>1</sub>	140	0.007 x d <sub>1</sub>	180	0.009 x d <sub>1</sub>	200	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	160	0.008 x d <sub>1</sub>	140	0.007 x d <sub>1</sub>	180	0.009 x d <sub>1</sub>	200	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	140	0.007 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>	160	0.008 x d <sub>1</sub>	180	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	120	0.006 x d <sub>1</sub>	110	0.006 x d <sub>1</sub>	140	0.007 x d <sub>1</sub>	160	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>N</b>	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1	200	0.008 x d <sub>1</sub>	180	0.007 x d <sub>1</sub>	230	0.009 x d <sub>1</sub>	260	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	200	0.008 x d <sub>1</sub>	180	0.007 x d <sub>1</sub>	230	0.009 x d <sub>1</sub>	260	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	200	0.008 x d <sub>1</sub>	180	0.007 x d <sub>1</sub>	230	0.009 x d <sub>1</sub>	260	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	170	0.006 x d <sub>1</sub>	150	0.006 x d <sub>1</sub>	190	0.007 x d <sub>1</sub>	220	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	170	0.006 x d <sub>1</sub>	150	0.006 x d <sub>1</sub>	190	0.007 x d <sub>1</sub>	220	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	170	0.006 x d <sub>1</sub>	150	0.006 x d <sub>1</sub>	190	0.007 x d <sub>1</sub>	220	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	110	0.006 x d <sub>1</sub>	90	0.005 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>	140	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	110	0.006 x d <sub>1</sub>	90	0.005 x d <sub>1</sub>	120	0.006 x d <sub>1</sub>	140	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1										
	3.2										
4.1											
4.2											
4.3											
4.4											
5.1											
5.2											
5.3											
<b>S</b>	1.1	120	0.008 x d <sub>1</sub>	110	0.007 x d <sub>1</sub>	140	0.009 x d <sub>1</sub>	160	0.006 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	90	0.007 x d <sub>1</sub>	80	0.006 x d <sub>1</sub>	100	0.008 x d <sub>1</sub>	120	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	60	0.006 x d <sub>1</sub>	50	0.006 x d <sub>1</sub>	70	0.007 x d <sub>1</sub>	80	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	90	0.007 x d <sub>1</sub>	80	0.006 x d <sub>1</sub>	100	0.008 x d <sub>1</sub>	110	0.005 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	40	0.006 x d <sub>1</sub>	30	0.005 x d <sub>1</sub>	50	0.006 x d <sub>1</sub>	50	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	30	0.005 x d <sub>1</sub>	30	0.004 x d <sub>1</sub>	30	0.005 x d <sub>1</sub>	40	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	40	0.006 x d <sub>1</sub>	30	0.005 x d <sub>1</sub>	50	0.006 x d <sub>1</sub>	50	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.5	20	0.005 x d <sub>1</sub>	20	0.004 x d <sub>1</sub>	30	0.005 x d <sub>1</sub>	30	0.004 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.6	30	0.004 x d <sub>1</sub>	30	0.004 x d <sub>1</sub>	30	0.005 x d <sub>1</sub>	40	0.003 x d <sub>1</sub>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>H</b>	1.1										
	1.2										
	1.3										
	1.4										
	1.5										

**Standard length**

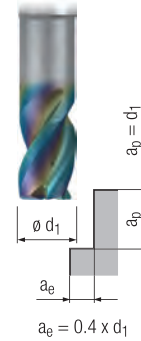
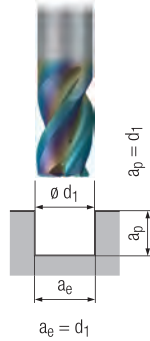
**WR**

Roughing



**W**

Finishing



**Valid for Tool Nos.:**

2888\_Z 2889\_Z  
2888RZ 2889RZ

**Please note:**  
For uncoated design, please reduce cutting speed  $v_c$  by 30%!

	WR		W		WR		W				MMS	MQL	
	$v_c$ [sfm]	$f_z$ [inch]	$v_c$ [sfmm]	$f_z$ [inch]	$v_c$ [sfm]	$f_z$ [inch]	$v_c$ [sfm]	$f_z$ [inch]					
<b>P</b>	1.1												
	2.1												
	3.1												
	4.1												
	5.1												
<b>M</b>	1.1												
	2.1												
	3.1												
	4.1												
<b>K</b>	1.1												
	1.2												
	2.1												
	2.2												
	3.1												
	3.2												
	4.1												
	4.2												
<b>N</b>	1.1	1378	0.009 x $d_1$	2066	0.011 x $d_1$	1378	0.008 x $d_1$	2493	0.011 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	2034	0.008 x $d_1$	3050	0.010 x $d_1$	2034	0.007 x $d_1$	3676	0.010 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	1804	0.007 x $d_1$	2722	0.008 x $d_1$	1805	0.006 x $d_1$	3247	0.008 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	1246	0.008 x $d_1$	1870	0.010 x $d_1$	1246	0.007 x $d_1$	2230	0.010 x $d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5												
	1.6												
	2.1	394	0.005 x $d_1$	590	0.006 x $d_1$	394	0.005 x $d_1$	722	0.006 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	394	0.005 x $d_1$	590	0.006 x $d_1$	394	0.005 x $d_1$	722	0.006 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	394	0.005 x $d_1$	590	0.006 x $d_1$	394	0.005 x $d_1$	722	0.006 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	361	0.004 x $d_1$	558	0.005 x $d_1$	361	0.004 x $d_1$	656	0.005 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	381	0.004 x $d_1$	558	0.005 x $d_1$	361	0.004 x $d_1$	656	0.005 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	361	0.004 x $d_1$	558	0.005 x $d_1$	361	0.004 x $d_1$	656	0.005 x $d_1$		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	230	0.003 x $d_1$	361	0.004 x $d_1$	230	0.003 x $d_1$	426	0.004 x $d_1$				<input checked="" type="checkbox"/>
	2.8												
	3.1												
	3.2												
4.1													
4.2													
4.3													
4.4													
5.1													
5.2													
5.3													
<b>S</b>	1.1												
	1.2												
	1.3												
	2.1												
	2.2												
	2.3												
2.4													
2.5													
2.6													
<b>H</b>	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

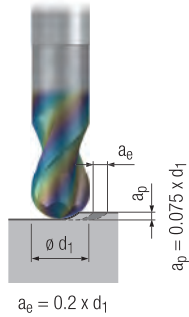
Ball nose – stub length

W

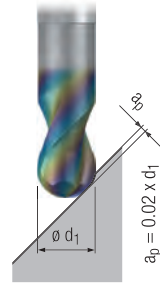
Valid for Tool Nos.:

1921 1921R

Roughing



Finishing



**Please note:**  
For uncoated design, please reduce cutting speed  $v_c$  by 30%!

	$v_c$ [sfm]	$f_z$ [inch]	$v_c$ [sfm]	$f_z$ [inch]					
					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>P</b>	1.1								
	2.1								
	3.1								
	4.1								
	5.1								
<b>M</b>	1.1								
	2.1								
	3.1								
	4.1								
<b>K</b>	1.1								
	1.2								
	2.1								
	2.2								
	3.1								
	3.2								
	4.1								
	4.2								
<b>N</b>	1.1	2950	$0.022 \times d_1$	3935	$0.016 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	2950	$0.020 \times d_1$	3935	$0.014 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	2950	$0.017 \times d_1$	3935	$0.012 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	1970	$0.020 \times d_1$	2625	$0.014 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5								
	1.6								
	2.1	655	$0.014 \times d_1$	855	$0.010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	655	$0.014 \times d_1$	855	$0.010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	655	$0.014 \times d_1$	855	$0.010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	525	$0.011 \times d_1$	720	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	525	$0.011 \times d_1$	720	$0.008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	525	$0.011 \times d_1$	720	$0.008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	330	$0.008 \times d_1$	460	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	330	$0.008 \times d_1$	460	$0.006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	1475	$0.025 \times d_1$	1970	$0.018 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	1475	$0.020 \times d_1$	1970	$0.014 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	1150	$0.021 \times d_1$	1475	$0.015 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	1640	$0.021 \times d_1$	2130	$0.015 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3	655	$0.017 \times d_1$	820	$0.012 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.4	460	$0.017 \times d_1$	590	$0.012 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.1									
5.2									
5.3	720	$0.017 \times d_1$	300	$0.012 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
<b>S</b>	1.1								
	1.2								
	1.3								
	2.1								
	2.2								
	2.3								
	2.6								
<b>H</b>	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

**Stub and standard lengths**

W



**Valid for Tool Nos.:**

2506    2507

Applications – Materials		Hardness Range			Material Examples	V <sub>c</sub> [sfm]	f <sub>z</sub> [inch]
		HRC	BHN	N/mm <sup>2</sup>			
<b>Non ferrous materials</b>							
<b>Aluminum alloys</b>							
1.1	Aluminum wrought alloys		≤ 60	≤ 200	7075		
1.2	Aluminum wrought alloys		≤ 105	≤ 350	6061-T6 / 2024-T4		
1.3	Aluminum wrought alloys		≤ 165	≤ 550			
1.4	Aluminum cast alloys Si ≤ 7%						
1.5	Aluminum cast alloys 7% < Si ≤ 12%						
1.6	Aluminum cast alloys 12% < Si ≤ 17%						
<b>Copper alloys</b>							
2.1	Pure copper, low-alloyed copper		≤ 120	≤ 400			
2.2	Copper-zinc alloys (brass, long-chipping)		≤ 165	≤ 550			
2.3	Copper-zinc alloys (brass, short-chipping)		≤ 165	≤ 550			
2.4	Copper-aluminum alloys (alu bronze, long-chipping)		≤ 235	≤ 800			
2.5	Copper-tin alloys (tin bronze, long-chipping)		≤ 205	≤ 700			
2.6	Copper-tin alloys (tin bronze, short-chipping)		≤ 120	≤ 400			
2.7	Special copper alloys		≤ 180	≤ 600			
2.8	Special copper alloys	≤ 44	≤ 415	≤ 1400			
<b>Magnesium alloys</b>							
3.1	Magnesium wrought alloys		≤ 150	≤ 500			
3.2	Magnesium cast alloys		≤ 150	≤ 500			
<b>Synthetics</b>							
4.1	Duroplastics (short-chipping)						
4.2	Thermoplastics (long-chipping)						
4.3	Fiber-reinforced synthetics (fiber content ≤ 30%)						
4.4	Fiber-reinforced synthetics (fiber content > 30%)						
<b>Special materials</b>							
5.1	Graphite						
5.2	Tungsten-copper alloys						
5.3	Composite materials						

The cutting data must be adapted to the material being machined taking into consideration the tool clamping and workpiece set-up. Contact Emuge technical support for assistance in developing the proper operating parameters.

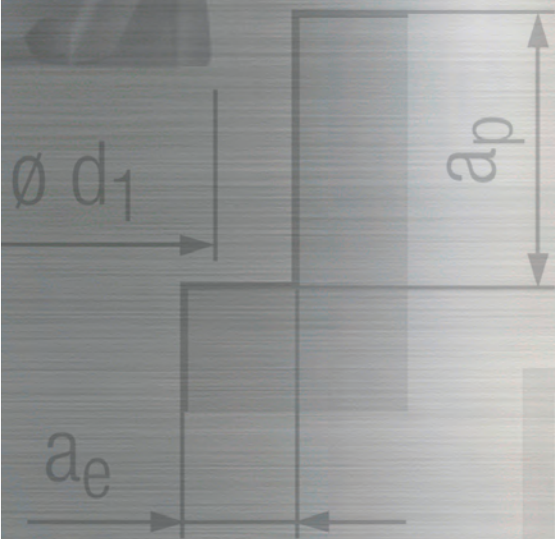
# Technical Information

$$a_e = 0.4$$

$f_z$

[inch]







$$a_p = d_1$$



$$a_e = 0.4 \times d_1$$







Icon Descriptions

**Tool Type**




-  **N** Finishing end mill design without chip breaker
-  **NF** Semi-finishing end mill design with flat chip breaker
-  **NR** Roughing end mill design with smooth chip breaker
-  **WR** Roughing end mill with round chip breaker
-  **W** Finishing end mill without chip breaker
-  **H** For Hard materials

**Shank design**





The shank designs to be found on the respective page are marked in grey.

-  **DIN**
-  **DIN** Shank design for metric tools
-  **DIN**
-  **ASME**
-  **ASME** Shank design for inch tools
-  **ASME**

**Internal coolant supply**

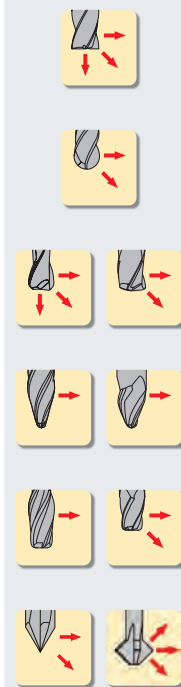
-  **ICA** ICA = Internal coolant supply, axial exit
-  **ICR** ICR = Internal coolant supply, radial exit
-  **ICRA** ICRA = Internal coolant supply, radial and axial exit

**Coolant and lubrication**

-  Dry machining
-  Cold-air nozzle
-  **MMS MQL** Minimum-quantity lubrication (MQL)
-  Emulsion

**Feed direction**





The red arrows mark the recommended feed directions of the respective cutters.













Icon Descriptions

**Circle Segment cutting edge design and face geometry**





-  Taper
-  Oval
-  Lens
-  Barrel

**Cutting edge design and face geometry**

-  Sharp-edged
-  Bevelled edge
-  Corner radius
-  Radius to be programmed in CAM
-  Ball nose
-  Torus
-  Lollipop
-  Front / back chamfer

**Chip breaker**

Depending on form (e.g. round or flat) and size (coarse, medium, fine) of the chip breakers, these end mills generate appropriate milling marks.

-  coarse
-  medium
-  fine
-  fine

**Form Tolerance**

 Form  
± 0.01


**Hard milling**

These tools are suitable for hard milling. The hardness range or the maximum hardness of the material to be machined is indicated in Rockwell (HRC).

 44-66  
HRC


**Helix angle**

The helix angle of these tools is shown. If there are variable helix angles, these are all shown.

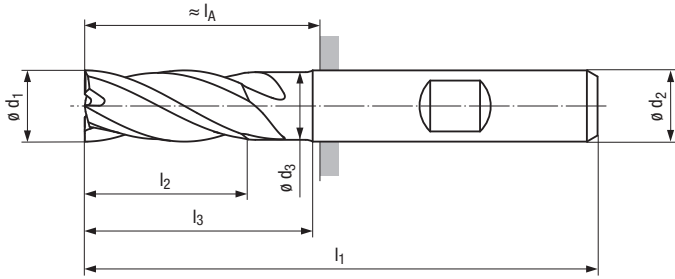
 30°

**Ramping angle**

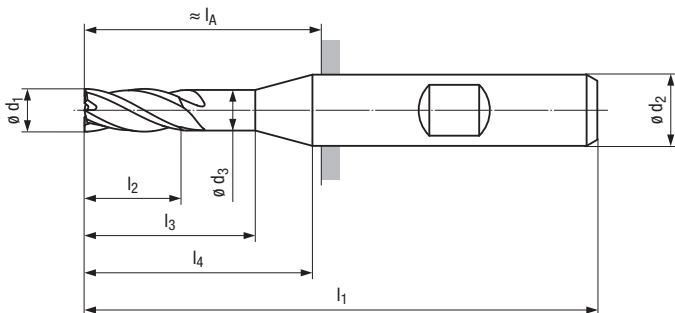
The specified angle is the recommended angle for ramping applications.

 3-5°

Descriptions and definitions of the end mill

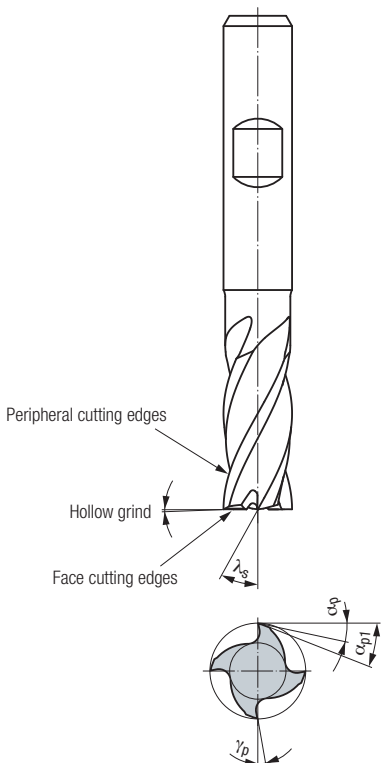


Design I<sub>4</sub>:



$l_1$	Overall length
$l_2$	Cutting length
$l_3$	Neck length
$l_4$	Length of shank connection
$l_A$	Projecting length
$d_1$	Cutting diameter
$d_2$	Shank diameter
$d_3$	Neck diameter

Important angles of the end mill



$\alpha_p$	1. Relief angle of the peripheral cutting edge
$\alpha_{p1}$	2. Relief angle of the peripheral cutting edge
$\gamma_p$	Rake angle of the peripheral cutting edge
$\lambda_s$	Helix angle

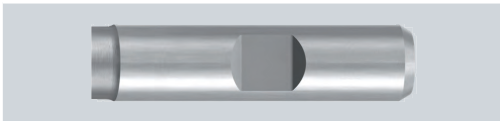
**Straight shank**



**DIN 6535 HA**

For solid carbide end mills with a shank diameter from 2 mm to 32 mm

**Straight shank with Weldon flat**

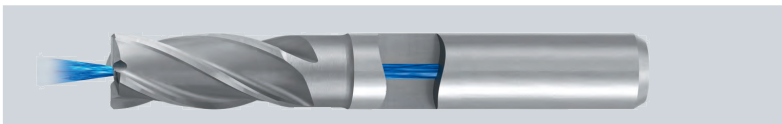


**DIN 6535 HB** – For solid carbide end mills with a shank diameter from 2 mm to 32 mm

**ASME B94.19 HB** – For solid carbide end mills with a shank diameter from 3/8" - 1"

**Emuge internal standard HB** – For solid carbide end mills with a shank diameter from 1/8"-5/16"

**Internal coolant supply, axial exit (ICA)**

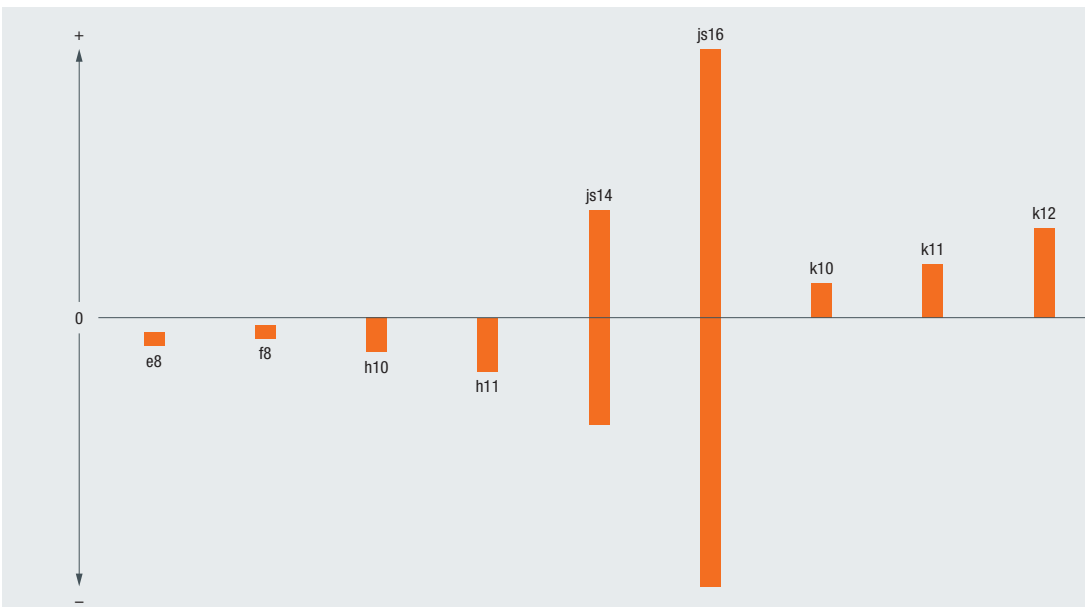


Axial exit of the coolant-lubricant for machining of pockets and grooves. The stability of the tool is not affected by the continuous bore in the center of the tool.

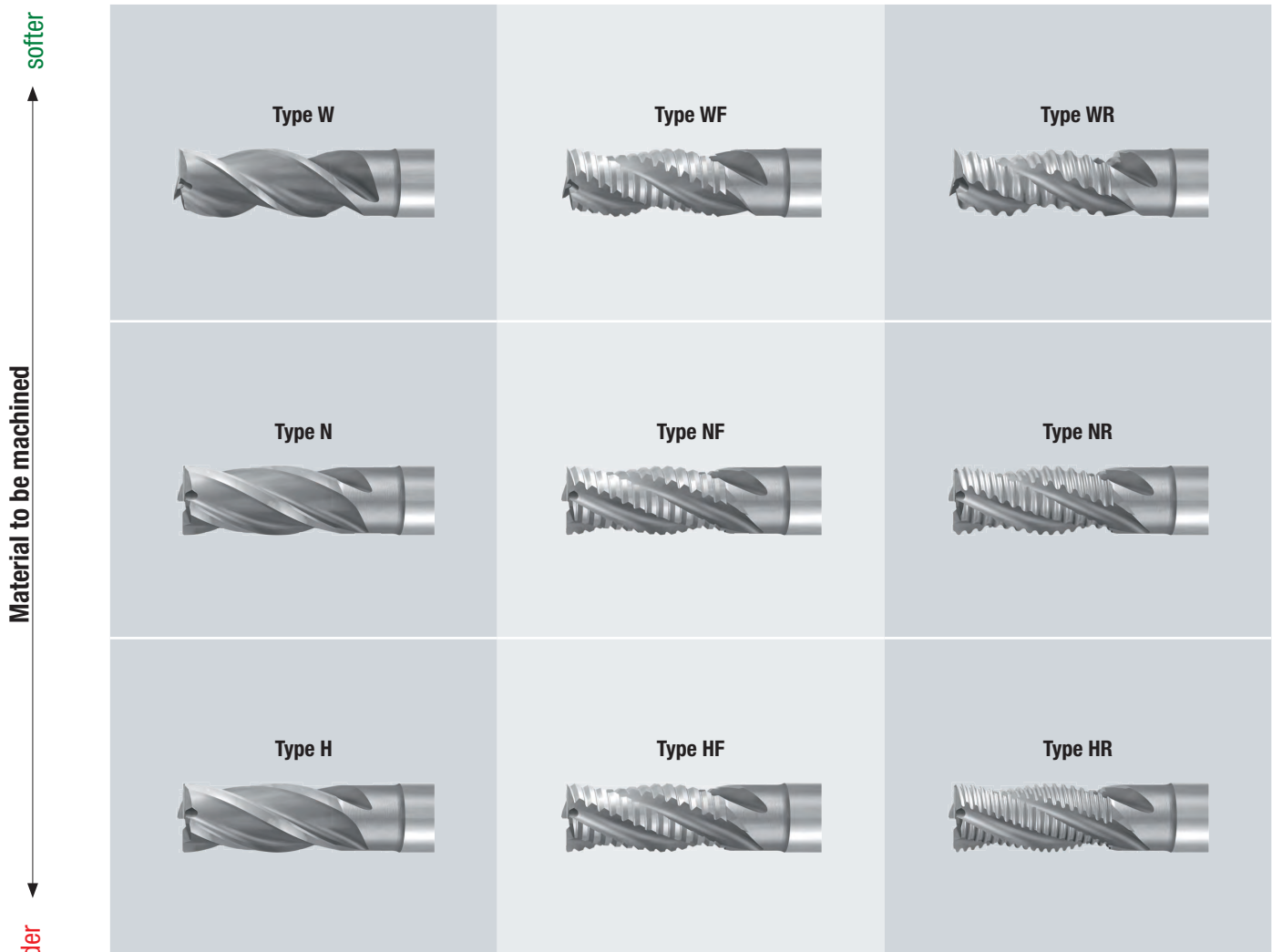
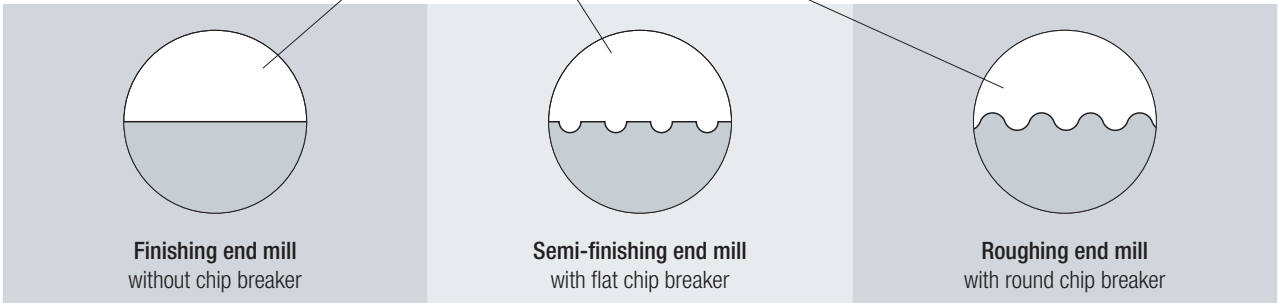
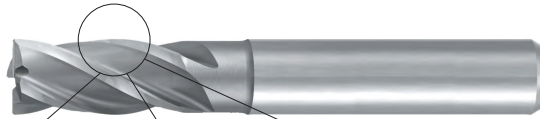
**Tolerance fields**

	e8	f8	h10	h11	js14	js16	k10	k11	k12	
Dimensions in µm										
Nominal value range in millimeters	≤ 3	- 14 - 28	- 6 - 20	- 0 - 40	- 0 - 60	+ 125 - 125	+ 300 - 300	+ 40 0	+ 60 0	+ 100 0
	> 3	- 20 - 38	- 10 - 28	- 0 - 48	- 0 - 75	+ 150 - 150	+ 375 - 375	+ 48 0	+ 75 0	+ 120 0
	≤ 6	- 25 - 47	- 13 - 35	- 0 - 58	- 0 - 90	+ 180 - 180	+ 450 - 450	+ 58 0	+ 90 0	+ 150 0
	> 6	- 32 - 59	- 16 - 43	- 0 - 70	- 0 - 110	+ 215 - 215	+ 550 - 550	+ 70 0	+ 110 0	+ 180 0
	≤ 10	- 40 - 73	- 20 - 53	- 0 - 84	- 0 - 130	+ 260 - 260	+ 650 - 650	+ 84 0	+ 130 0	+ 210 0
	> 10	- 50 - 89	- 25 - 64	- 0 - 100	- 0 - 160	+ 310 - 310	+ 800 - 800	+ 100 0	+ 160 0	+ 250 0
	≤ 18	- 60 - 106	- 30 - 76	- 0 - 120	- 0 - 190	+ 370 - 370	+ 950 - 950	+ 120 0	+ 190 0	+ 300 0
	> 18	- 72 - 126	- 36 - 90	- 0 - 140	- 0 - 220	+ 435 - 435	+ 1100 - 1100	+ 140 0	+ 220 0	+ 350 0
	≤ 30	- 85 - 148	- 43 - 106	- 0 - 160	- 0 - 250	+ 500 - 500	+ 1250 - 1250	+ 160 0	+ 250 0	+ 400 0
	> 30	- 100 - 172	- 50 - 122	- 0 - 185	- 0 - 290	+ 575 - 575	+ 1450 - 1450	+ 185 0	+ 290 0	+ 460 0

**Position of the tolerance fields relative to the zero line**



Types of End Mills for desired machining results



Surface quality ← better ————— worse →

Removal rate ← less ————— more →

## Note with regard to determining rotational speed and feed speed for Micro end mills

If the rotational speed  $n$  calculated with the recommended cutting speed  $v_c$  and the cutting diameter  $d_1$  exceeds the maximum spindle speed  $n_{max}$ , the effective feed speed  $v_f$  must be calculated with the maximum spindle speed  $n_{max}$ !



### Example

#### Calculation of spindle speed $n$

Cutting diameter  $d_1$ : 0.2 mm  
Cutting speed  $v_c$ : 240 m/min

$$n = \frac{v_c \times 1000}{d_1 \times \pi} \quad [\text{rpm}]$$

$$n = \frac{240 \times 1000}{0.2 \times \pi} \quad [\text{rpm}]$$

Calculated spindle speed  $n$ : 381 972 rpm

**Maximum spindle speed  $n_{max}$ : 42 000 rpm**



#### Calculation of effective feed speed $v_f$

Spindle speed  $n_{max}$ : 42 000 rpm  
Feed per tooth  $f_z$ : 0.003 mm  
Flutes  $Z$ : 2

$$v_f = f_z \times Z \times n \quad [\text{mm/min}]$$

$$v_f = 0.003 \times 2 \times 42\,000 \quad [\text{mm/min}]$$

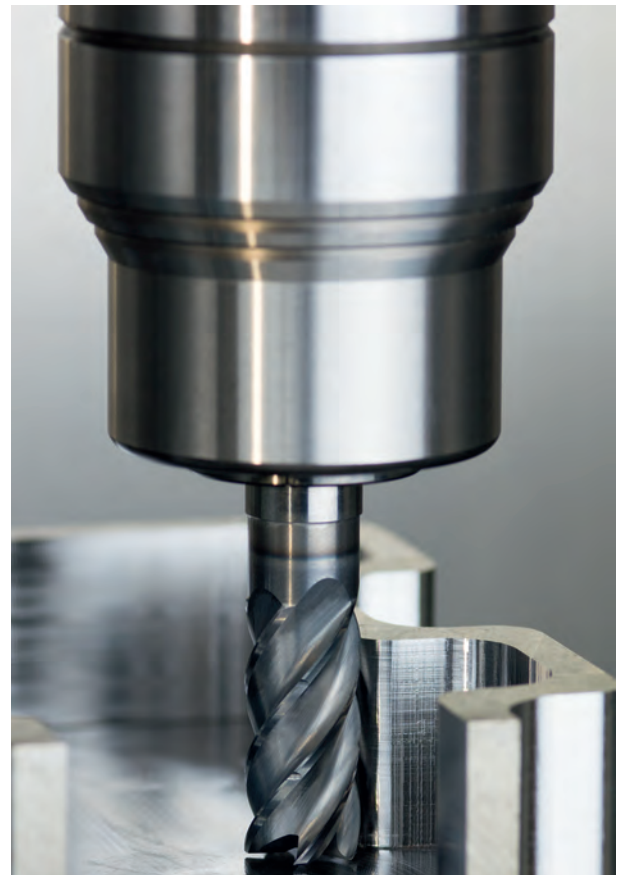
**Effective feed speed  $v_f$ : 252 mm/min**



## Increase your machining speed and tool life to the highest possible levels.

### EMUGE-FRANKEN FPC Chuck Advantages:

- Reliability**  
 Extremely high transferable torque provides maximum process reliability. Transferred torque on a tool shank diameter of 20mm is 600 Nm.
- More accurate**  
 With a 3XD tool length, concentricity is  $\leq 3 \mu\text{m}$ , guaranteeing long tool life and quality surface finishes.
- Longer tool life**  
 Special holder design reduces vibration, dramatically improving workpiece surface finishes and providing exceptionally long tool life.
- Fast tool change**  
 Simple, highly accurate design enables quick tool change in seconds via hex wrench.



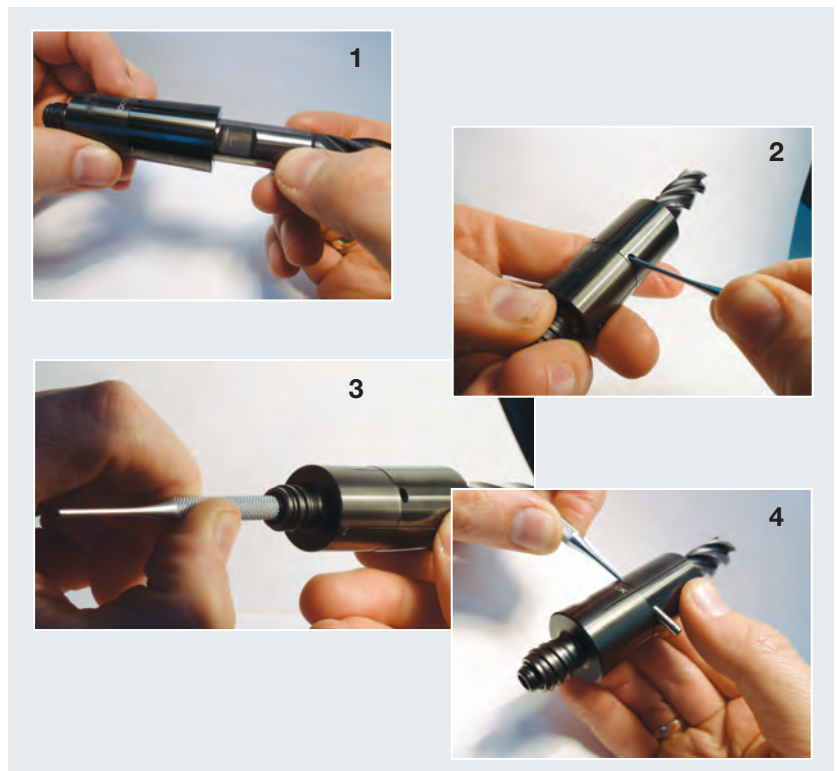
### FPC Pin-Lock Operation

**1. Positioning tool:** Remove the length setting screw, then position the Weldon-clamping surface on the side of the bore. Now insert the tool into the collet until the Weldon-clamping surface lies in the range of the bore.

**2. Positioning pin:** The locking-pin has to be inserted with the help of the pin punch into the bore of the collet up to the block. Caution: The Pin must not stick out of the collet.

**3. Free from backlash:** With the assembly tool, the length stop screw must be set forward, pushing the Weldon flat of the cutting tool against the locking pin. Caution: Mounting without axial pressure can result in tool pullout. The collet with the secured tool can now be placed into the FPC chuck (see FPC operation manual).

**4. Removing the tool:** The length setting screw has to be unscrewed. The pin can be pressed out of the bore with the smallest diameter in the direction of the large diameter. Then the tool can be removed.



U.S.A. units into SI units			SI units into U.S.A. units		
<b>Length</b>					
1 inch (in)	= 25.4 mm	= 2.54 cm	1 millimeter (mm)	= 0.03937 in	
1 foot (ft)	= 12 in	= 0.3048 m	1 centimeter (cm)	= 10 mm	= 0.3937 in
1 yard (yd)	= 3 ft	= 0.9144 m	1 meter (m)	= 100 cm = 3.2808 ft = 1.0936 yd	
1 statute mile	= 1760 yd	= 1.60934 km	1 kilometer (km)	= 1000 m	= 0.62137 statute mile
<b>Area</b>					
1 in <sup>2</sup>	= 645.16 mm <sup>2</sup>	= 6.4516 cm <sup>2</sup>	1 mm <sup>2</sup>	= 0.00155 in <sup>2</sup>	
1 ft <sup>2</sup>	= 144 in <sup>2</sup>	= 0.0929 m <sup>2</sup>	1 cm <sup>2</sup>	= 100 mm <sup>2</sup>	= 0.155 in <sup>2</sup>
1 yd <sup>2</sup>	= 9 ft <sup>2</sup>	= 0.8361 m <sup>2</sup>	1 m <sup>2</sup>	= 10000 cm <sup>2</sup> = 10.7642 ft <sup>2</sup> = 1.196 yd <sup>2</sup>	
1 mile <sup>2</sup>		= 2.590 km <sup>2</sup>	1 km <sup>2</sup>	= 10 <sup>6</sup> m <sup>2</sup>	= 0.3861 mile <sup>2</sup>
<b>Volume</b>					
1 in <sup>3</sup>	= 16387.064 mm <sup>3</sup>	= 16.387 cm <sup>3</sup>	1 mm <sup>3</sup>	= 0.000061 in <sup>3</sup>	
1 ft <sup>3</sup>	= 1728 in <sup>3</sup>	= 0.0283 m <sup>3</sup>	1 cm <sup>3</sup>	= 1000 mm <sup>3</sup>	= 0.0610 in <sup>3</sup>
1 yd <sup>3</sup>	= 27 ft <sup>3</sup>	= 0.765 m <sup>3</sup>	1 m <sup>3</sup>	= 10 <sup>6</sup> cm <sup>3</sup> = 35.3146 ft <sup>3</sup> = 1.3080 yd <sup>3</sup>	
1 Quart / US	= 1/4 gal	= 0.946 l	1 Liter (l)	= 1 dm <sup>3</sup> = 0.2642 gal / US = 2.11 US pt	
1 gallon (gal) / US	= 4 quarts	= 3.784 l	1 l	= 1.761 UK pt	
1 gallon (gal) / UK		= 4.546 l			
1 US pint (pt)	= 0.8327 UK pt	= 0.473 l			
1 UK pt	= 1.201 US pt	= 0.568 l			
1 barrel / US (Oil)	= 42 gal	= 158.98 l			
1 barrel / UK	= 36 gal	= 163.66 l			
<b>Weight</b>					
1 ounce (oz)	= 16 drams	= 28.35 g	1 gram (g)	= 0.03527 oz	
1 pound (lb)	= 16 oz	= 453.592 g	1 kilogram (kg)	= 1000 g	= 2.20462 lb
1 short ton / US		= 0.907 t	1 ton (t)	= 1000 kg	= 1.1025 short tons / US
1 long ton / UK		= 1.016 t	1 ton (t)	= 1000 kg	= 0.984 long tons / UK
<b>Force</b>					
1 pound force (lbf)	= 4.448 N		1 Newton (N)	= 0.2248 lbf	
<b>Pressure/Tensile strength</b>					
1 lbf/ft <sup>2</sup>	= 47.8803 Pa		1 Pascal (Pa)	= 10 <sup>6</sup> N/mm <sup>2</sup>	= 0.02089 lbf/ft <sup>2</sup>
1 lbf/in <sup>2</sup>	= 6.89476 kPa	= 6.895 · 10 <sup>-3</sup> N/mm <sup>2</sup>	1 N/mm <sup>2</sup>	= 0.1 bar	= 145 psi
1 psi (pound-force per sq.in)	= lbwt/in <sup>2</sup>	= 6.895 · 10 <sup>-3</sup> N/mm <sup>2</sup>	1 bar	= 10 N/mm <sup>2</sup>	= 14.5 psi
1 psi		= 6.895 · 10 <sup>-2</sup> bar			
<b>Power</b>					
1 foot-pounds per second (ft lb/s)	= 1.356 W		1 Watt (W)	= 1 J/s = 1 Nm/s	= 0.7376 ft lb/s
<b>Energy/Torque</b>					
1 foot pound-force (ft·lbf)	= 1.356 J		1 Joule (J)	= 1 Nm	= 0.7376 ft lb
<b>Cutting/Circumferential speed</b>					
1 surface feet per minute (SFM)	= 0.3048 m/min		1 m/min		= 3.2808 SFM
<b>Cutting/Circumferential speed</b>					
in degree Fahrenheit (°F)	= 9/5 Temp.[°C]+32		in degree Celsius (°C)	= (Temp.[°F]-32) · 5/9	



From screen to spindle, EMUGE-FRANKEN experts work closely with today's leading CNC machinery and CAD/CAM suppliers to offer manufacturers the latest cutting tool strategies.

## Test Cuts Program

Exploring new technology and tooling designs is the best way for progressive manufacturers to stay ahead of the competition. New tooling solutions can sometimes be the best way to reduce cycle times and improve product quality. But breaking into production or tying up critical machines for testing new tool styles is not always an option.

**EMUGE-FRANKEN's Technology Center offers a test cut service that allows manufacturers to run test cuts on actual piece parts or sample materials and also 3-Axis and 5-Axis programming assistance along with programming simulations when required.**

### The Process

- Customers provide EMUGE-FRANKEN with sample piece parts and drawings that are then evaluated by trained EMUGE-FRANKEN tooling engineers.
- Tool process and application improvements are recommended and submitted to the customer.
- Once approved, a series of test cuts are performed and documented.
- Once an optimum solution is identified and approved, EMUGE-FRANKEN develops the solution.

## CNC Programming Assistance

On-staff CNC programmers develop machining cycles in conjunction with the most popular CAD/CAM providers such as Mastercam, Open Mind and others. Manufacturers from a broad range of industries look to Emuge CNC programming assistance to enable cost-effective and efficient manufacturing solutions. Not just from a CAM programming perspective, but also incorporating tool designs that allow for optimum performance.

### The Outcome

- Full documentation of the operating parameters and CNC machining programs.
- Tool type recommendations for milling, drilling and threading.
- Full documentation of results.
- Video documentation of tooling solutions.
- EMUGE-FRANKEN field engineers will then work with the manufacturer to implement the solutions when requested.





**EMUGE-FRANKEN offers tool grinding/reconditioning for all end mill products at our West Boylston, MA USA facility.**

Reconditioning your EMUGE-FRANKEN tools through EMUGE-FRANKEN makes sense. EMUGE-FRANKEN has the knowledge and manufacturing expertise to refurbish an EMUGE-FRANKEN tool to its original condition and specification, providing maximum performance levels, predictable operation and longer life than any other method, all at a modest investment for the utmost value.

**EMUGE-FRANKEN reconditioning offers:**

- Complete inspection and quotation.
- Complete regrinding to the original geometry of the tool.
- Coating via state-of-the-art coating system.
- Corner radius, Weldon flats and other modifications to standard end mills.
- Prompt delivery of reground tools.



Rugged protective containers for shipping tools and individual or bulk packaging provided as needed.

**Reconditioning examples – End Mills**



<b>1000</b>		2617AZ	37	2887A	55	3538L	76		
1700L	61	2648TZ	43	2888_Z	99	3539L	77		
1715A	60	2649TZ	43	2888RZ	99	3540L	78		
1827A	53	2667A	36	2889_Z	100	3541L	79		
1828A	53	2667L	36	2889RZ	100	3542L	75		
1916A	27	2676AZ	97	2919L	24	3544L	80		
1917A	27	2677AZ	96	2920L	19	3546L	83		
1921	101	2678AZ	96	2942A	90	3548L	88		
1921R	101	2679A	89	2943A	91	3550L	87		
1935A	92	2698A	30	2946L	19	3552LZ	73		
1974A	56	2699A	30	2947L	23	3554LZ	74		
1976A	56	2760L	63	2948L	20	3900L	24		
1998A	27	2761L	64	2958T	43	3902L	22		
1999A	27	2762L	65	2959T	43	3903L	22		
<b>2000</b>		2763L	63	2962LZ	42	3908L	20		
2502A	31	2764L	64	2966LZ	42	3909L	23		
2506	103	2765L	65	2974L	24	3911TZ	49		
2507	103	2770L	66	2975T	44	3913TZ	49		
2522A	29	2771L	67	2976T	44	<b>6000</b>			
2524A	29	2772L	68	2977T	44	6910	57		
2526A	28	2773L	66	2978T	44	<b>3000</b>			
2527A	28	2774L	67	2992L	17	3440	86		
2531L	50	2775L	68	2993L	17	3440L	86		
2533L	50	2776L	66	2994L	17	3441	86		
2535L	51	2777L	67	2995L	17	3442	85		
2537TZ	47	2778L	68	2996L	18	3442L	85		
2539TZ	48	2780L	69	2997L	18	3443	85		
2541TZ	48	2781L	70	2998L	21	3444	95		
2557L	51	2782L	71	2999L	21	3444L	95		
2564L	93	2783L	69					3445	95
2571L	50	2784L	70					3446	84
2573L	50	2785L	71					3446L	84
2575L	51	2786L	69					3447	84
2577TZ	47	2787L	70					3447	84
2579TZ	48	2788L	71					3532LZ	94
2581TZ	48	2813A	54					3534LZ	94
2610AZ	38	2817A	54						
2611AZ	38	2834A	90						
2612AZ	38	2842A	91						
2613AZ	38	2869A	33						
2614AZ	37	2869AZ	35						
2615AZ	37	2869L	33						
2616AZ	37	2869LZ	35						
		2875A	34						
		2875L	34						

## Warranty

EMUGE Corp. warrants to original equipment manufacturers, distributors and industrial users of its products that each new product manufactured or supplied by EMUGE Corp. shall be free from defects in material and workmanship. EMUGE Corp.'s obligation under this warranty is limited to furnishing without additional charge a replacement, or at its option, repairing or issuing credit for any product which shall within one year from the date of sale be returned freight prepaid to the location designated by an EMUGE Corp. representative and which upon inspection is determined by EMUGE Corp. to be defective in materials or workmanship. Complete information as to operating conditions, machine setup, and application of cutting fluid should accompany any product returned for inspection. The provisions of this warranty shall not apply to any EMUGE Corp. product which has been subjected to misuse, improper operation conditions, machine setup or application of cutting fluid or which has been repaired or altered if such repair or alteration in the judgment of EMUGE Corp. would adversely affect performance of the product. This warranty is in lieu of all other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose. EMUGE Corp. shall have no liability or responsibility on any claim of any kind, whether in contract, tort or otherwise, for any loss or damaging arising out of, connected with, or resulting from the manufacture, sale, delivery or use of any product sold hereunder, in excess of the cost of replacement or repair as provided herein. In no event shall EMUGE Corp. be liable for any special, incidental or consequential damages. EMUGE Corp. makes no other warranty, express or implied, except as set forth above, and EMUGE Corp. neither assumes nor authorized any other person or entity to assume for it any other obligation or liability in connection with any of its products.

## Warning

- Any cutting tool may break or shatter if improperly used. Government regulations require use of safety glasses and other appropriate safety equipment at all times in the vicinity of use.
- Grinding of taps or dies may produce hazardous dust and should only be done under established safety guidelines.
- Tapping fluids may contain hazardous materials. Always consult the appropriate material safety data sheets before the use of any EMUGE products.

## Notice

Because we are constantly engaged in a program of product improvement, tool specifications are subject to change at any time. All EMUGE Corp. terms and conditions are subject to change without notice.



## Technology Center

EMUGE-FRANKEN's Technology Center is a manufacturing, research and development facility for North American manufacturers, designed to be a resource for applying cutting tool application strategies.

The Technology Center specializes in taking actual end user applications and developing milling, drilling and threading machining strategies to optimize tool performance and reduce cycle times. The Technology Center allows manufacturers to test new machining concepts and tools without tying up their valuable machines and manufacturing hours. EMUGE-FRANKEN tooling engineers work directly with the manufacturer to replicate actual machining processes and develop new tooling and application parameters with complete documentation.

EMUGE-FRANKEN provides customers and distributors a selection of training and development classes. The Technology Center has an interactive classroom supported by CNC machining equipment for seminars and hands-on, real-time training. Training classes and seminars are offered throughout the year on various machining topics or they can be tailored to meet the needs of individual companies.



*Emuge Corp. newly expanded facility.*



**EMUGE Corp.**  
1800 Century Drive, West Boylston, MA 01583  
800-323-3013 • [www.emuge.com](http://www.emuge.com) •

EMUGE-FRANKEN has been the product technology and performance leader in their field for over 100 years. EMUGE-FRANKEN manufactures an extensive line of taps, drills, thread mills, end mills, toolholders, clamping devices and other rotary cutting tools, over 40,000 items sold through distributors worldwide.