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EMUGE
FRANKEN

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FRANKEN

HIGH PERFORMANCE END MILLS

100 years of precision milling and innovation.

EMUGE-FRANKEN, Rückersdorf, Germany

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

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 end mills 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.

The newly expanded 50,000 sq.ft. EMUGE-FRANKEN U.S.A. headquarters include end mill manufacturing, tool reconditioning, a 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.

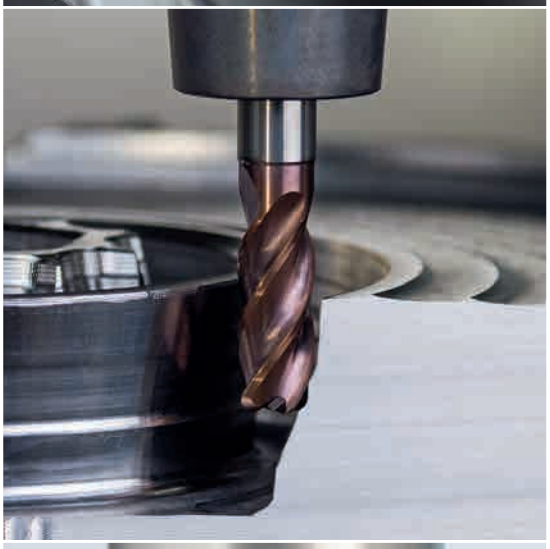
TABLE OF CONTENTS

MILLING TOOLS PORTFOLIO

Circle Segment

An industry-leading tool innovation first developed by EMUGE-FRANKEN in 2012, Circle Segment End Mills are a unique family of milling cutters designed for 5-Axis milling strategies.

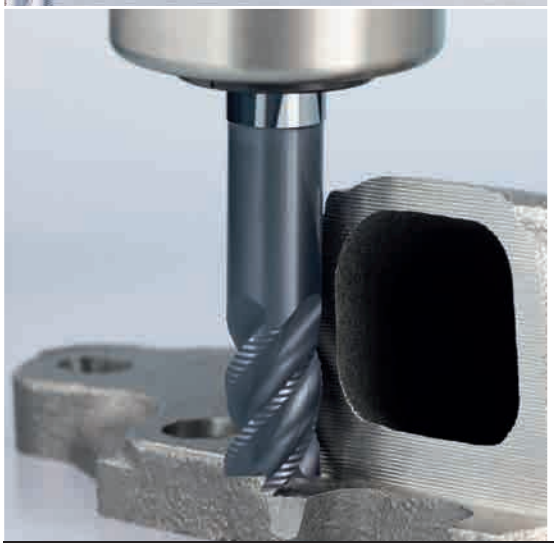
These tools are sometimes referred to as barrel cutters, but the EMUGE-FRANKEN offering is much more than that. Circle Segment milling cutters cover the entire range of advanced CAM milling strategies that ***drastically reduce cycle times in the most complex parts.***



TOP-Cut

TOP-Cut end mills are versatile solid carbide end mills which can be used in a wide range of materials.

These tools have a variable helix design with high performance surface coatings and are manufactured to the strictest tolerance and quality standards. TOP-Cut VAR tools are part of the broader TOP-Cut end mill offering from EMUGE-FRANKEN with the distinguishing characteristic that they are **Made in the USA** in our W. Boylston MA facility using the same equipment and manufacturing guidelines and specifications as our TOP-Cut end mills made in Germany.



Multi-Cut

Multi-Cut end mills were developed for high performance roughing applications.

All products have variable flute spacing combined with a roughing profile to reduce vibrations and maximize metal removal rates in a broad range of materials. Multi-Cut carbide end mills are typically coolant fed to improve evacuation and allow for accelerated feed rates. This family of high performance end mills provides the ultimate roughing tool solution for manufacturers looking to reduce cycle times.

TiNox-Cut

The TiNox-Cut offering of carbide end mills was developed for the machining of aerospace materials such as titanium, stainless steel and nickel alloys.

This family of milling products contains material-specific geometries to maximize performance and tool life. TiNox-Cut end mills are also available in specialized trochoidal milling designs for high feed milling applications.

Jet-Cut

Jet-Cut style carbide end mills were developed specifically for High Performance Cutting (HPC) and High Speed Cutting (HSC) machining strategies.

Some of the characteristics of an HPC milling cutter are variable flute spacing with enlarged chip forming gashes and radial chip formers. HSC milling cutters have increased flute counts and unique carbide substrate grades for high metal removal rates and improved surface finishes. Jet-Cut end mills are also available in specialized trochoidal milling designs for high feed milling applications.

DUPLEX Geometry

EMUGE-FRANKEN developed the term DUPLEX geometry to describe a unique double cutter profile which is used on some EMUGE high performance tools. The peripheral cutting edges are ground with HPC geometries while the face cutting edges have a high-feed geometry which allows very high feed rates at a low depth of cut.

Hard-Cut

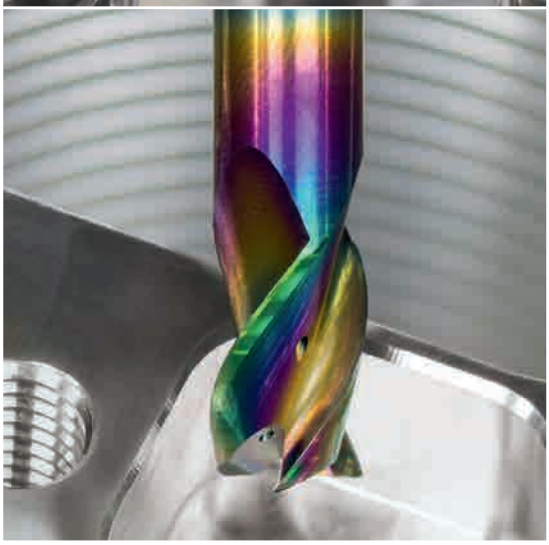
The Hard-Cut series of end mills was developed for machining hardened materials.

These solid carbide end mills use a specialized grade of carbide substrate for extreme wear resistance along with PVD coatings developed for high heat applications. Variable flute spacing along with higher flute counts are combined with larger core diameters for high tensile strength materials.

Micro

Micro milling tools are a complete family unto themselves with diameters starting at 0.2 mm.

Micro tools are used in a wide range of industries from medical to mold and die. All tools are manufactured to the highest dimensional tolerances to ensure repeatable results in demanding precision applications. The Micro family of carbide end mills are available in square end, ball nose and torus end profiles and various lengths. The perfect tool for precision machining.



Alu-Cut

The Alu-Cut offering of carbide end mills are developed for milling applications in aluminum alloys that require high process repeatability.

All Alu-Cut tools combine variable flute spacing and precision cutting edge preparation methods to obtain the highest metal removal rates. Many designs are offered with a coolant fed option to maximize cutting performance.

Turbine

Turbine tools with specialized geometries were developed for the requirements and materials used in the manufacturing of aircraft and turbine components.

Tapered tooling designs ideal for milling bladed parts are the hallmark of this family of tools which are also effective for applications in the mold and die industry. Turbine tools offer the broadest array of stocked-standard carbide end mill designs in the industry.

Cera-Cut

Cera-Cut milling cutters are ceramic end mills developed for the machining of Heat-Resistant Super Alloys.

Intensive research and development went into the design of these cutting-edge tools which can dramatically reduce manufacturing time in high nickel alloys. The brazed ceramic head design combined with EMUGE-FRANKEN's unique Duplex geometry helps increase tool life and performance when compared to traditional ceramic end mills.

Skiving Tools

The power-skiving milling process that combines gear hobbing and gear shaping for internal gears is fully covered by the EMUGE-FRANKEN product offering.

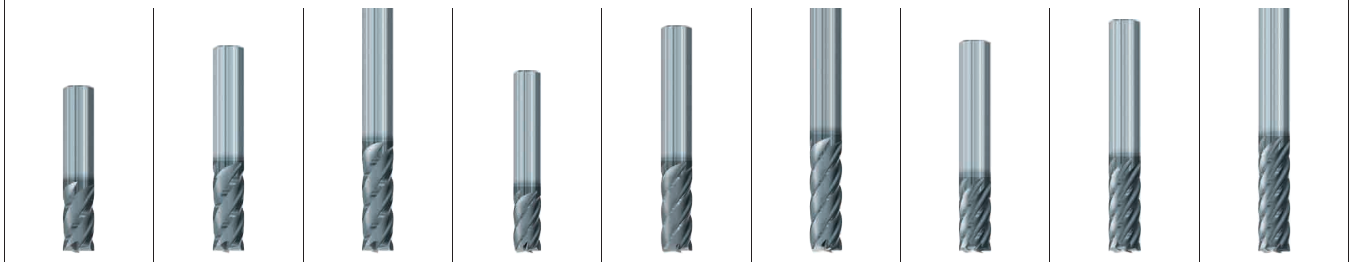
EMUGE-FRANKEN is unique in having the ability to not only manufacturer skiving cutters, but also tool holders and part clamping devices. EMUGE-FRANKEN engineers work directly with manufacturers to develop complete solutions to reduce cycle times and improve product quality. Each solution is tailored to meet the exact specifications of the application.

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	Cera-Cut	Cera-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 HRC	Hardness Range BHN	Hardness Range N/mm²	Material Examples
P		**Steel materials**				
	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
M		**Stainless steel materials**				
	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	
K		**Cast materials**				
	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	Malleable cast iron (GTMW, GTMB)		70 - 145	250 - 500	
	4.2			150 - 235	500 - 800	White iron
N		**Non ferrous materials**				
		Aluminum alloys				
	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%				
		Copper alloys				
	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	
		Magnesium alloys				
	3.1	Magnesium wrought alloys		≤ 150	≤ 500	
	3.2	Magnesium cast alloys		≤ 150	≤ 500	
		Synthetics				
	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%)				
		Special materials				
	5.1	Graphite				
	5.2	Tungsten-copper alloys				
	5.3	Composite materials				
S		**Special materials**				
		Titanium alloys				
	1.1	Pure titanium		≤ 135	≤ 450	CP1 / CP2
	1.2	Titanium alloys	≤ 27	≤ 265	≤ 900	6AL4V
	1.3		≤ 39	≤ 370	≤ 1250	
		Nickel alloys, cobalt alloys and iron alloys				
	2.1	Pure nickel		≤ 180	≤ 600	
	2.2	Nickel-based alloys	≤ 31	≤ 295	≤ 1000	Monel 500 / Hastelloy / 625 Inconel
	2.3		≤ 49	≤ 475	≤ 1600	718 Inconel
	2.4	Cobalt-based alloys	≤ 31	≤ 295	≤ 1000	
	2.5		≤ 49	≤ 475	≤ 1600	Haynes 25
	2.6	Iron-base alloys	≤ 46	≤ 445	≤ 1500	Incoloy 925
H		**Hard materials**				
	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									
N									
1/16 - 3/4"	1/8 - 1"	1/8 - 1"	1/4 - 1"	1/4 - 1"	1/4 - 1"	1/4 - 1"	1/4 - 1"	1/4 - 1"	d_1
	4			**5**			**6**		# Flutes
2992L	**2994L**	**2996L**	**3920L**	**2946L**	**3922L**	**3924L**	**2948L**	**3926L**	
2993L	**2995L**	**2997L**	**3921L**	**2920L**	**3923L**	**3925L**	**3908L**	**3927L**	
	27			28			29		Page
141	142	143		144		148	149	150	v_c / f_z
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■	■	■	■	■	■	■	■	■	4.1
■	■	■	■	■	■	■	■	■	5.1
■	■	■	■	■	■	■	■	■	1.1
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■	■	■	■	■	■	■	■	■	3.1
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■	■	■	■	■	■	■	■	■	2.2
■	■	■	■	■	■	■	■	■	3.1
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■	■	■	■	■	■	■	■	■	4.2
		■							1.1
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■	■	■	■	■	■	■	■	■	1.3
■	■	■	■	■	■	■	■	■	1.4
		□							1.5
		□							1.6
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■	■	■	■	■	■	■	■	■	2.2
■	■	■	■	■	■	■	■	■	2.3
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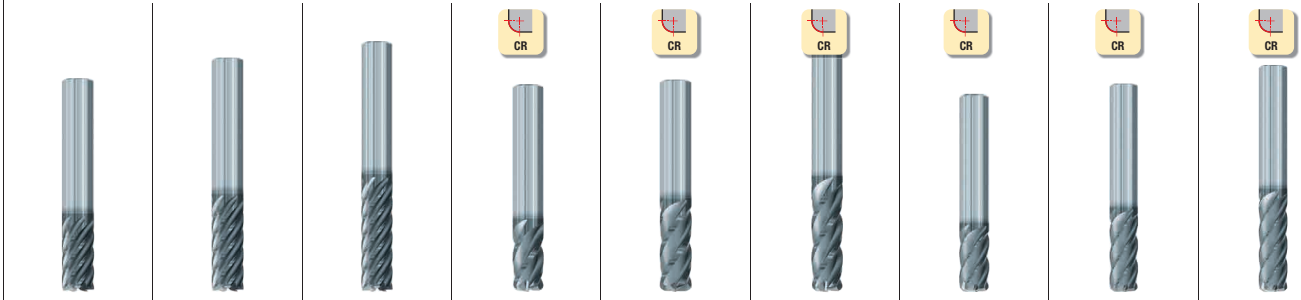
P M K N S H

■ = very suitable □ = suitable

TOP-Cut VAR



TOP-Cut VAR

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		3930L	**3931L**	**3932L**	**3946L**	**2999L**	**3948L**	**3929L**	**3903L**	**3934L**
	Page		30			31-33			34-36	
	v_c / f_z	151	152	153	145	146	147	146	145	147
P	1.1	■	■	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■	■	■
	5.1	■	■	■	■	■	■	■	■	■
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	3.1	■	■	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■	■	■
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	2.2	■	■	■	■	■	■	■	■	■
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	2.4	■	■	■	■	■	■	■	■	■
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	2.6	■	■	■	■	■	■	■	■	■
	2.7	■	■	■	■	■	■	■	■	■
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	2.5	■	■	■	■	■	■	■	■	■
	2.6	■	■	■	■	■	■	■	■	■
H	1.1	■	■	■	■	■	■	■	■	■
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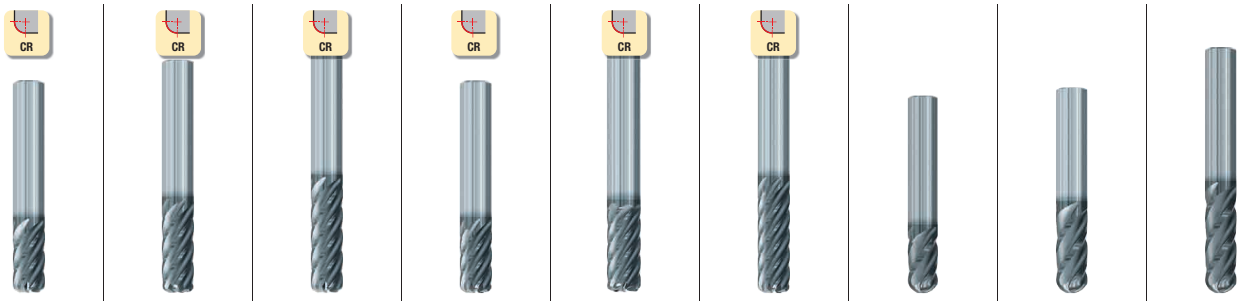
	1.4									
	1.5									

■ = very suitable □ = suitable

TOP-Cut VAR



	TOP-Cut VAR						Ball Nose			
	N						N			
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	3942L	3909L	3944L	3936L	3938L	3940L	–	–	–	
Page		37-38			39-41			42		
v_c / f_z	148	149	150	151	152	153		154		
P 1.1	■	■	■	■	■	■	■	■	■	
P 2.1	■	■	■	■	■	■	■	■	■	
P 3.1	■	■	■	■	■	■	■	■	■	
P 4.1	■	■	■	■	■	■	■	■	■	
P 5.1	■	■	■	■	■	■	■	■	■	
M 1.1	■	■	■	■	■	■	■	■	■	
M 2.1	■	■	■	■	■	■	■	■	■	
M 3.1	■	■	■	■	■	■	□	□	□	
M 4.1	■	■	■	■	■	■	□	□	□	
K 1.1	■	■	■	■	■	■	■	■	■	
K 1.2	■	■	■	■	■	■	■	■	■	
K 2.1	■	■	■	■	■	■	■	■	■	
K 2.2	■	■	■	■	■	■	■	■	■	
K 3.1	■	■	■	■	■	■	□	□	□	
K 3.2	■	■	■	■	■	■	□	□	□	
K 4.1	■	■	■	■	■	■	□	□	□	
K 4.2	■	■	■	■	■	■	□	□	□	
N 1.1										
N 1.2	■	■	■	■	■	■				
N 1.3	■	■	■	■	■	■				
N 1.4	■	■	■	■	■	■				
N 1.5										
N 1.6										
N 2.1	■	■	■	■	■	■	■	■	■	
N 2.2	■	■	■	■	■	■	■	■	■	
N 2.3	■	■	■	■	■	■	■	■	■	
N 2.4	■	■	■	■	■	■	■	■	■	
N 2.5	■	■	■	■	■	■	■	■	■	
N 2.6	■	■	■	■	■	■	■	■	■	
N 2.7	■	■	■	■	■	■	■	■	■	
N 2.8	■	■	■	■	■	■	■	■	■	
N 3.1	■	■	■	■	■	■				
N 3.2	■	■	■	■	■	■				
N 4.1	■	■	■	■	■	■	■	■	■	
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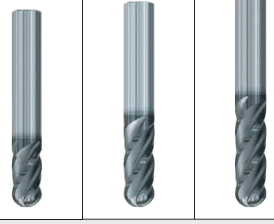
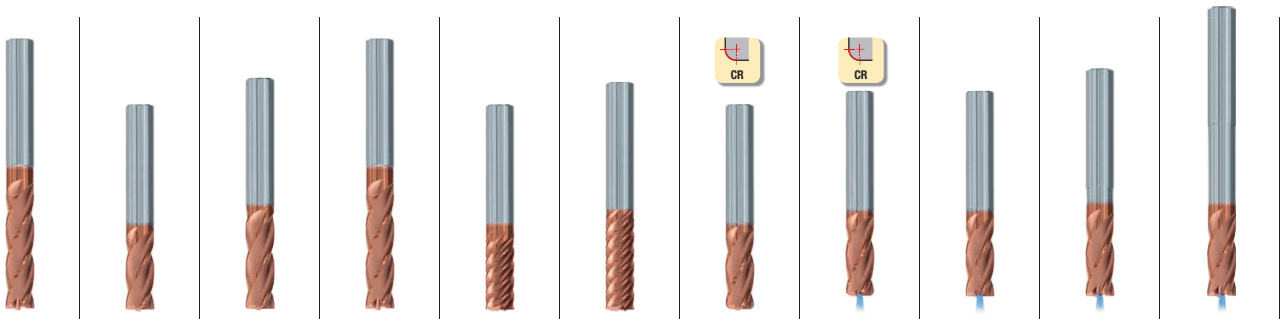
N 4.3										
N 4.4										
N 5.1										
N 5.2	■	■	■	■	■	■	■	■	■	
N 5.3							■	■	■	
S 1.1	■	■	■	■	■	■	□	□	□	
S 1.2	■	■	■	■	■	■	□	□	□	
S 1.3	■	■	■	■	■	■	□	□	□	
S 2.1	■	■	■	■	■	■	□	□	□	
S 2.2	■	■	■	■	■	■	□	□	□	
S 2.3	■	■	■	■	■	■	□	□	□	
S 2.4	■	■	■	■	■	■	□	□	□	
S 2.5	■	■	■	■	■	■	□	□	□	
S 2.6	■	■	■	■	■	■	□	□	□	
H 1.1	■	■	■	■	■	■				
H 1.2	□	□	□	□	□	□				
H 1.3	□	□	□	□	□	□				
H 1.4										
H 1.5										

■ = very suitable □ = suitable

	TOP-Cut VAR			TOP-Cut Metric								
												
	Ball Nose			TOP-Cut Metric								
	N			N								
d_1	1/8 - 1"			ø0.3 - 20 mm			ø1.5 - 20 mm			ø3 - 20 mm		
# Flutes	5			2			3			4		
	3949L	3950L	3951L	2510A	2512A	2514A	2516A	2518A	2520A	1916A	1998A	2526A
	–	–	–	2511A	2513A	2515A	2517A	2519A	2521A	1917A	1999A	2527A
Page	43			45			46			47		
v_c / f_z	154			155	156	157	155	156	157	155	156	157
P 1.1	■	■	■	■	■	■	■	■	■	■	■	■
P 2.1	■	■	■	■	■	■	■	■	■	■	■	■
P 3.1	■	■	■	■	■	■	■	■	■	■	■	■
P 4.1	■	■	■	■	■	■	■	■	■	■	■	■
P 5.1	■	■	■	■	■	■	■	■	■	■	■	■
M 1.1	■	■	■	■	■	■	■	■	■	■	■	■
M 2.1	■	■	■	■	■	■	■	■	■	■	■	■
M 3.1	□	□	□	■	■	■	■	■	■	■	■	■
M 4.1	□	□	□	■	■	■	■	■	■	■	■	■
K 1.1	■	■	■	■	■	■	■	■	■	■	■	■
K 1.2	■	■	■	■	■	■	■	■	■	■	■	■
K 2.1	■	■	■	■	■	■	■	■	■	■	■	■
K 2.2	■	■	■	■	■	■	■	■	■	■	■	■
K 3.1	□	□	□	■	■	■	■	■	■	■	■	■
K 3.2	□	□	□	■	■	■	■	■	■	■	■	■
K 4.1	□	□	□	■	■	■	■	■	■	■	■	■
K 4.2	□	□	□	■	■	■	■	■	■	■	■	■
N 1.1				■	■	■	■	■	■			■
N 1.2				■	■	■	■	■	■	■	■	■
N 1.3				■	■	■	■	■	■	■	■	■
N 1.4				□	□	□	■	■	■	■	■	■
N 1.5						□			■			□
N 1.6						□			■			□
N 2.1	■	■	■	■	■	■	■	■	■	■	■	■
N 2.2	■	■	■	■	■	■	■	■	■	■	■	■
N 2.3	■	■	■	■	■	■	■	■	■	■	■	■
N 2.4	■	■	■	■	■	■	■	■	■	■	■	■
N 2.5	■	■	■	■	■	■	■	■	■	■	■	■
N 2.6	■	■	■	■	■	■	■	■	■	■	■	■
N 2.7	■	■	■	■	■	■	■	■	■	■	■	■
N 2.8	■	■	■	■	■	■	■	■	■	■	■	■
N 3.1				■	■					■	■	
N 3.2				■	■					■	■	
N 4.1	■	■	■	■	■		□	□		■	■	
N 4.2	■	■	■	■	■		□	□				
N 4.3												
N 4.4												
N 5.1												
N 5.2	■	■	■	■	■	■	■	■	■	■	■	■
N 5.3	■	■	■									
S 1.1	□	□	□	■	■	■	■	■	■	■	■	■
S 1.2	□	□	□	■	■	■	□	□	□	■	■	■
S 1.3	□	□	□	■	■	■	□	□	□	■	■	■
S 2.1	□	□	□	■	■	■	■	■	■	■	■	□
S 2.2	□	□	□	□	□	□	□	□	□	■	■	□
S 2.3	□	□	□	□	□	□	□	□		■	■	□
S 2.4	□	□	□	□	□	□	□	□	□	■	■	□
S 2.5	□	□	□	□	□	□	□	□		■	■	□
S 2.6	□	□	□	□	□	□	□	□		■	■	□
H 1.1				■	■		■	■		■	■	
H 1.2				■	■		■	■		□	□	
H 1.3										□	□	
H 1.4												
H 1.5												

■ = very suitable □ = suitable

TOP-Cut Metric



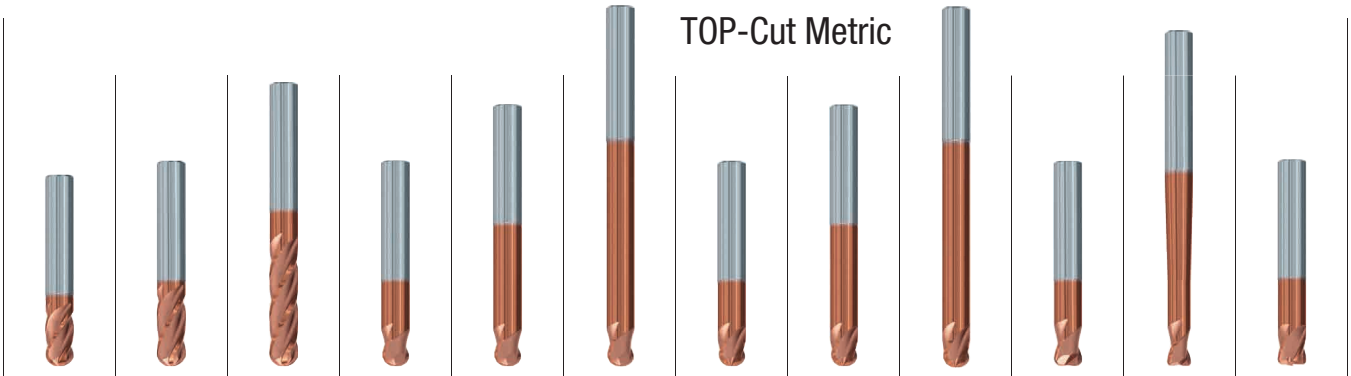
TOP-Cut Metric

N

ø3 - 6 mm	ø8 - 20 mm	ø8 - 20 mm	ø8 - 20 mm	ø5 - 20 mm	ø6 - 20 mm	ø3 - 20 mm	ø3 - 20 mm	ø3 - 20 mm	ø6 - 20 mm	ø3 - 20 mm	d_1	
4		5		6-8		4	4		4		# Flutes	
2528A	1998A	2526A	2528A	2522A	2524A	2698A	2698AZ	1998AZ	3806AZ	3808AZ		
2529A	1999A	2527A	2529A	2523A	2525A	2699A	2699AZ	1999AZ	3807AZ	3809AZ		
47		48		49		50	51		52		Page	
157	156	157	157	156	157	156	156	156	158	159	v_c / f_z	
■	■	■	■	■	■	■	■	■	■	■	1.1	P
■	■	■	■	■	■	■	■	■	■	■	2.1	
■	■	■	■	■	■	■	■	■	■	■	3.1	
■	■	■	■	■	■	■	■	■	■	■	4.1	
■	■	■	■	■	■	■	■	■	■	■	5.1	
■	■	■	■	■	■	■	■	■	■	■	1.1	M
■	■	■	■	■	■	■	■	■	■	■	2.1	
■	■	■	■	□	□	■	■	■	■	■	3.1	
■	■	■	■	□	□	■	■	■	■	■	4.1	
■	■	■	■	■	■	■	■	■	■	■	1.1	K
■	■	■	■	■	■	■	■	■	■	■	1.2	
■	■	■	■	■	■	■	■	■	■	■	2.1	
■	■	■	■	□	□	■	■	■	■	■	2.2	
■	■	■	■	■	■	■	■	■	■	■	3.1	
■	■	■	■	■	■	■	■	■	■	■	3.2	
■	■	■	■	■	■	■	■	■	■	■	4.1	
■	■	■	■	□	□	■	■	■	■	■	4.2	
■		■	■	■	■	■					1.1	N
■	■	■	■	■	■	■	■	■	■	■	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	S
■	■	■	■	■	■	■	■	■	■	■	1.2	
■	■	■	■	■	■	■	■	■	■	■	1.3	
□	■	□	□	■	■	■	■	■	■	■	2.1	
□	■	□	□	■	■	■	■	■	■	■	2.2	
□	■	□	□	□	□	■	■	■	■	■	2.3	
□	■	□	□	■	■	■	■	■	■	■	2.4	
□	■	□	□	□	□	■	■	■	■	■	2.5	
□	■	□	□	□	□	■	■	■	■	■	2.6	
	■			□		■	■	■	■	■	1.1	H
	□					□	□	□	□	□	1.2	
	□					□	□	□	□	□	1.3	
											1.4	
											1.5	

■ = very suitable □ = suitable

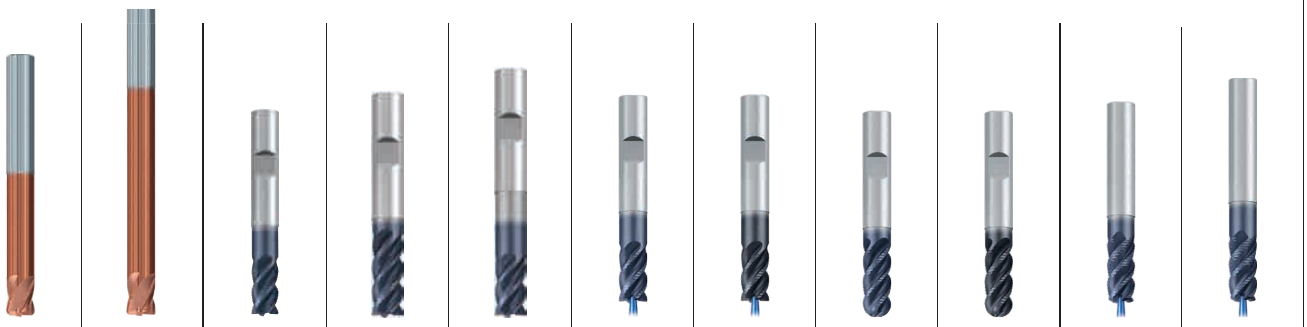
TOP-Cut Metric



	Ball Nose			Ball Nose - Mold & Die						Torus Nose		Torus / M&D
	N			N						N		N
d_1	ø3-16mm	ø2-16mm	ø6-16mm	ø0.5-12mm	ø0.5-12mm	ø0.5-8mm	ø2-12mm	ø2-12mm	ø2-8mm	ø 0.5-12mm	ø 1-12mm	ø2-12mm
# Flutes	3-4			2			4			2		4
	3840A	2502A	2504A	3820A	3821A	3822A	3823A	3824A	3825A	2552A	2553A	3835A
	–	–	–	–	–	–	–	–	–	–	–	–
Page	53			54			55			56-57		58-59
v_c / f_z	160	161	162	163	164	165	166	167	168	169	170	171
P 1.1	■	■	■	■	■	■	■	■	■	■	■	■
P 2.1	■	■	■	■	■	■	■	■	■	■	■	■
P 3.1	■	■	■	■	■	■	■	■	■	■	■	■
P 4.1	■	■	■	■	■	■	■	■	■	■	■	■
P 5.1	■	■	■	■	■	■	■	■	■	■	■	■
M 1.1	■	■	■	■	■	■	■	■	■	■	■	■
M 2.1	■	■	■	■	■	■	■	■	■	■	■	■
M 3.1	□	□	□	■	■	■	■	■	■	■	■	■
M 4.1	□	□	□	■	■	■	■	■	■	■	■	■
K 1.1	■	■	■	■	■	■	■	■	■	■	■	■
K 1.2	■	■	■	■	■	■	■	■	■	■	■	■
K 2.1	■	■	■	■	■	■	■	■	■	■	■	■
K 2.2	■	■	■	■	■	■	■	■	■	■	■	■
K 3.1	□	□	□	■	■	■	■	■	■	■	■	■
K 3.2	□	□	□	■	■	■	■	■	■	■	■	■
K 4.1	□	□	□	■	■	■	■	■	■	■	■	■
K 4.2	□	□	□	■	■	■	■	■	■	■	■	■
N 1.1												
N 1.2				□	□	□	□	□	□	□	□	
N 1.3				□	□	□	□	□	□	□	□	
N 1.4				□	□	□	□	□	□	□	□	
N 1.5												
N 1.6												
N 2.1	■	■	■	■	■	■	■	■	■	■	■	■
N 2.2	■	■	■	■	■	■	■	■	■	■	■	■
N 2.3	■	■	■	■	■	■	■	■	■	■	■	■
N 2.4	■	■	■	■	■	■	■	■	■	■	■	■
N 2.5	■	■	■	■	■	■	■	■	■	■	■	■
N 2.6	■	■	■	■	■	■	■	■	■	■	■	■
N 2.7	■	■	■	■	■	■	■	■	■	■	■	■
N 2.8	■	■	■	■	■	■	■	■	■	■	■	■
N 3.1												
N 3.2												
N 4.1	■	■	■									
N 4.2	■	■	■									
N 4.3												
N 4.4												
N 5.1												
N 5.2	■	■	■	■	■	■	■	■	■	■	■	■
N 5.3	■	■	■									
S 1.1	□	□	□	■	■	■	■	■	■			■
S 1.2	□	□	□	■	■	■	■	■	■			■
S 1.3	□	□	□	■	■	■	■	■	■			■
S 2.1	□	□	□	□	□	□	■	■	■	■	■	■
S 2.2	□	□	□	□	□	□	■	■	■	■	■	■
S 2.3	□	□	□	□	□	□	■	■	■	■	■	■
S 2.4	□	□	□	□	□	□	■	■	■	□	□	■
S 2.5	□	□	□	□	□	□	■	■	■	□	□	■
S 2.6	□	□	□	□	□	□	■	■	■	□	□	■
H 1.1	■	■	■	■	■	■	■	■	■	■	■	■
H 1.2	■	■	■	■	■	■	■	■	■	■	■	■
H 1.3												
H 1.4												
H 1.5												

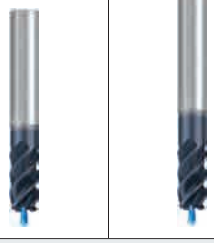
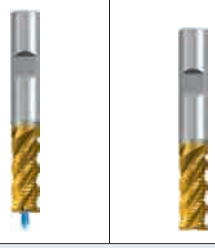
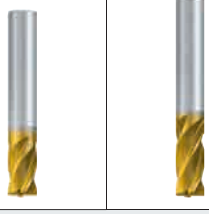
■ = very suitable □ = suitable

TOP-Cut Metric | Multi-Cut | DUPLEX

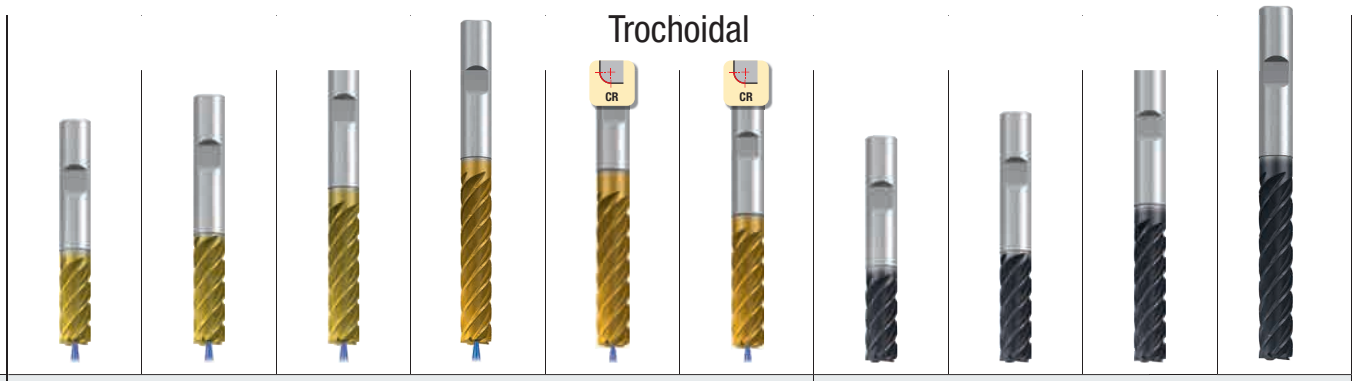


	Torus Nose / Mold & Die		Multi-Cut						Multi-Cut		Ball Nose		Multi-Cut DUPLEX		
	N		NR fine						NR fine				NR fine		
d_1	ø2 - 12 mm	ø2 - 8 mm	1/8 - 1" ø1 - 25 mm		ø1 - 25 mm		1/8 - 1" ø1 - 25 mm		1/8 - 1" ø3 - 20 mm		ø3 - 20 mm		ø6 - 16 mm	ø8 - 16 mm	
# Flutes	4		3 - 5						3 - 5		3 - 4		4		
	3836A	3837A	–	–	–	–	–	–	–	–	–	–	2614AZ	2616AZ	
	–	–	2869A / 2869L		2873A / 2873L		2875A / 2875L		2869AZ	2869LZ	2667A	2667L	2615AZ	2617AZ	
Page	58-59		61-62		62		61-62		64		65		66		
v_c / f_z	172	173	174		177		175		176		177		178		
P 1.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
P 2.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
P 3.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
P 4.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
P 5.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
M 1.1	■	■		□		□		□		□					
M 2.1	■	■		□		□		□		□					
M 3.1	■	■													
M 4.1	■	■													
K 1.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
K 1.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
K 2.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
K 2.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
K 3.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
K 3.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
K 4.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
K 4.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
N 1.1															
N 1.2									□	□					
N 1.3									□	□					
N 1.4									□	□					
N 1.5															
N 1.6															
N 2.1	■	■	■	■	■	■	■	■	■	■	■	■			
N 2.2	■	■	■	■	■	■	■	■	■	■	■	■			
N 2.3	■	■	■	■	■	■	■	■	■	■	■	■	□	□	
N 2.4	■	■	■	■	■	■	■	■	■	■	■	■			
N 2.5	■	■	■	■	■	■	■	■	■	■	■	■			
N 2.6	■	■	■	■	■	■	■	■	■	■	■	■	□	□	
N 2.7	■	■	■	■	■	■	■	■	■	■	■	■			
N 2.8	■	■	■	■	■	■	■	■	■	■	■	■			
N 3.1															
N 3.2															
N 4.1			□	□	□	□	□	□	□	□	□	□			
N 4.2															
N 4.3															
N 4.4															
N 5.1															
N 5.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
N 5.3															
S 1.1	■	■							□	□	□	□			
S 1.2	■	■							□	□	□	□			
S 1.3	■	■							□	□	□	□			
S 2.1	■	■													
S 2.2	■	■													
S 2.3	■	■													
S 2.4	■	■													
S 2.5	■	■													
S 2.6	■	■													
H 1.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
H 1.2	■	■											□	□	
H 1.3															
H 1.4															
H 1.5															

■ = very suitable □ = suitable

	DUPLEX		TiNox-Cut					
								
	Jet-Cut DUPLEX		**TiNox-Cut N**		**TiNox-Cut NF**		**TiNox-Cut Base**	
	N		**N**		**NF** fine		**N**	
d_1	ø3 - 16 mm	ø8 - 16 mm	1/4 - 1"		1/4 - 1"		1/8 - 3/4"	
# Flutes	4		5		4 - 5		4	
	2610AZ	**2612AZ**	**2962LZ**	**2966LZ**	**2648TZ**	**2958T**	**2975T**	**2977T**
	2611AZ	**2613AZ**	–	–	**2649TZ**	**2959T**	**2976T**	**2978T**
Page	66		70		71		72	
v_c / f_z	179		180		181		182	183
P 1.1	■	■	■	■	□	□	■	■
P 2.1	■	■	■	■	□	□	■	■
P 3.1	■	■	■	■	□	□	■	■
P 4.1	■	■	□	□	□	□	□	□
P 5.1	■	■	□	□	□	□	□	□
M 1.1			■	■	■	■	■	■
M 2.1			■	■	■	■	■	■
M 3.1			■	■	■	■	■	■
M 4.1			■	■	■	■	■	■
K 1.1	■	■			□	□	■	■
K 1.2	■	■			□	□	■	■
K 2.1	■	■			□	□	■	■
K 2.2	■	■			□	□	■	■
K 3.1	■	■			□	□	□	□
K 3.2	■	■			□	□	□	□
K 4.1	■	■			□	□	□	□
K 4.2	■	■			□	□	□	□
N 1.1							■	■
N 1.2							■	■
N 1.3							■	■
N 1.4								
N 1.5								
N 1.6								
N 2.1			■	■	■	■	■	■
N 2.2			■	■	■	■	■	■
N 2.3	□	□	■	■	■	■	■	■
N 2.4			■	■	■	■	■	■
N 2.5			■	■	■	■	■	■
N 2.6	□	□	■	■	■	■	■	■
N 2.7			■	■	■	■	■	■
N 2.8			■	■	■	■	■	■
N 3.1								
N 3.2								
N 4.1								
N 4.2								
N 4.3								
N 4.4								
N 5.1								
N 5.2	■	■	■	■	■	■	□	□
N 5.3								
S 1.1			■	■	■	■	■	■
S 1.2			■	■	■	■	□	□
S 1.3			■	■	■	■	□	□
S 2.1			□	□	■	■	■	■
S 2.2			□	□	■	■	□	□
S 2.3			□	□	■	■	□	□
S 2.4			□	□	■	■	□	□
S 2.5			□	□	■	■	□	□
S 2.6			□	□	■	■	□	□
H 1.1	■	■					■	■
H 1.2	■	■					□	□
H 1.3	■	■						
H 1.4	□	□						
H 1.5	□	□						

■ = very suitable □ = suitable



											Jet-Cut Trochoidal											
	NF medium										NF medium											
	1/4 - 3/4" ø6 - 20 mm						ø10 - 20 mm	1/4 - 3/4"			1/4 - 3/4" ø6 - 20 mm						ø10 - 20 mm					d_1
	4 - 5							4 - 5			4 - 5		4 - 5	4 - 7	4 - 5	4 - 7	5					# Flutes
	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–				
	2577TZ	2537TZ	2579TZ	2539TZ	2581TZ	2541TZ	2543TZ	3911TZ	3913TZ		2571L	2531L	2573L	2533L	2575L	2535L	–	2557L				
	75		76		76		76	77			78				79							Page
	184				185		185	184			186											v_c / f_z
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.1
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.1
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						3.1
	□	□	□	□	□	□	□	□	□		■	■	■	■	■	■						4.1
	□	□	□	□	□	□	□	□	□		■	■	■	■	■	■						5.1
																						P
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.1
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.1
	■	■	■	■	■	■	■	■	■		□	□	□	□	□	□						3.1
	■	■	■	■	■	■	■	■	■		□	□	□	□	□	□						4.1
																						M
	□	□	□	□	□	□	□	■	■		■	■	■	■	■	■						1.1
	□	□	□	□	□	□	□	■	■		■	■	■	■	■	■						1.2
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	□	□	□	□	□	□	□	■	■		■	■	■	■	■	■						3.1
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	□	□	□	□	□	□	□	■	■		■	■	■	■	■	■						4.1
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																						K
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.1
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.2
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.3
																						1.4
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	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.1
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.2
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.3
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.4
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.5
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.6
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.7
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						2.8
																						3.1
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																						5.1
	■	■	■	■	■	■	■	■	■		□	□	□	□	□	□						5.2
																						5.3
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	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.1
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.2
	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■						1.3
																						S
	■	■	■	■	■	■	■	■	■		□	□	□	□	□	□						2.1
	■	■	■	■	■	■	■	■	■		□	□	□	□	□	□						2.2
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	■	■	■	■	■	■	■	■	■		□	□	□	□	□	□						2.5
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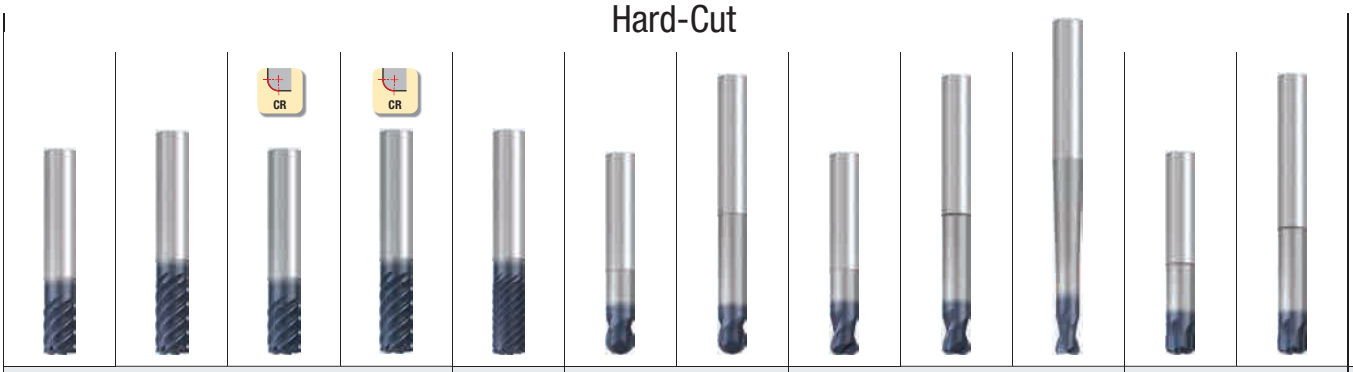
■ = very suitable □ = suitable

Hard-Cut



	Hard-Cut				Jet-Cut	Ball Nose		Torus Nose			Torus Nose	
	H				H	H		H			H	
d_1	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	ø 8 - 16 mm	1/4 - 1/2" ø0.5 - 16 mm	ø8 - 16 mm	1/4 - 1/2" ø1 - 16 mm	3/32 - 1" ø3 - 16 mm	ø 6 - 16 mm
# Flutes	6 - 10		6 - 8		6 - 20	2		2			4	
	1827A	1828A	2813A	2817A	2887A	1976A	1974A	1996A	1993A	1983A	1936A	2832A
	–		–		–	–		–				
Page	81		82		83	84		85			86	
v_c / f_z	187		187		188	189		189			190	
P 1.1	□	□	□	□	■	□	□	□	□	□	■	■
P 2.1	□	□	□	□	■	□	□	□	□	□	■	■
P 3.1	■	■	■	■	■	■	■	■	■	■	■	■
P 4.1	■	■	■	■	■	■	■	■	■	■	■	■
P 5.1	■	■	■	■	■	■	■	■	■	■	■	■
M 1.1					■							
M 2.1					■							
M 3.1					□							
M 4.1					□							
K 1.1	■	■	■	■	■	■	■	■	■	■	■	■
K 1.2	■	■	■	■	■	■	■	■	■	■	■	■
K 2.1	■	■	■	■	■	■	■	■	■	■	■	■
K 2.2	■	■	■	■	□	■	■	■	■	■	■	■
K 3.1	■	■	■	■	■	■	■	■	■	■	■	■
K 3.2	■	■	■	■	■	■	■	■	■	■	■	■
K 4.1	■	■	■	■	■	■	■	■	■	■	■	■
K 4.2	■	■	■	■	□	■	■	■	■	■	■	■
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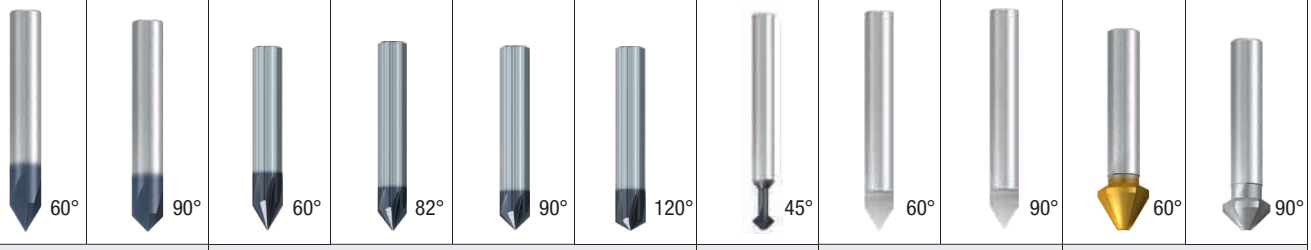
H 1.1	■	■	■	■	■	■	■	■	■	■	■	■
H 1.2	■	■	■	■	■	■	■	■	■	■	■	■
H 1.3	■	■	■	■	■	■	■	■	■	■	■	■
H 1.4	■	■	■	■	■	■	■	■	■	■	■	■
H 1.5	■	■	■	■	■						■	■

■ = very suitable □ = suitable

Chamfer Mills



Straight Flute		Helical Flute				Deburring	Engraving Stylus		Counter Sinks		
N											
1/8 - 5/8" ø 4 - 12 mm	1/8 - 5/8" ø 4 - 12 mm	1/8 - 5/8"			1/4 - 5/8"	ø 5.7-7.7 mm	ø 3 - 8 mm		ø 6.3-25 mm	ø 4.3-31 mm	d_1
4	4	3 & 5	3 & 5	3 & 5	3 & 5	4	1		3		# Flutes
1715A / 1711A	1715A	1708A - 3 Flutes		1709A - 5 Flutes		1700L	1710		7550 / 7550T	7560 / 7560T	
–		–				–	–		–	–	
89		90				91	92		93		Page
–		–				–	–		191		v_c / f_z

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■	■	■	■	■	■	■	■	■	■	■	2.1		
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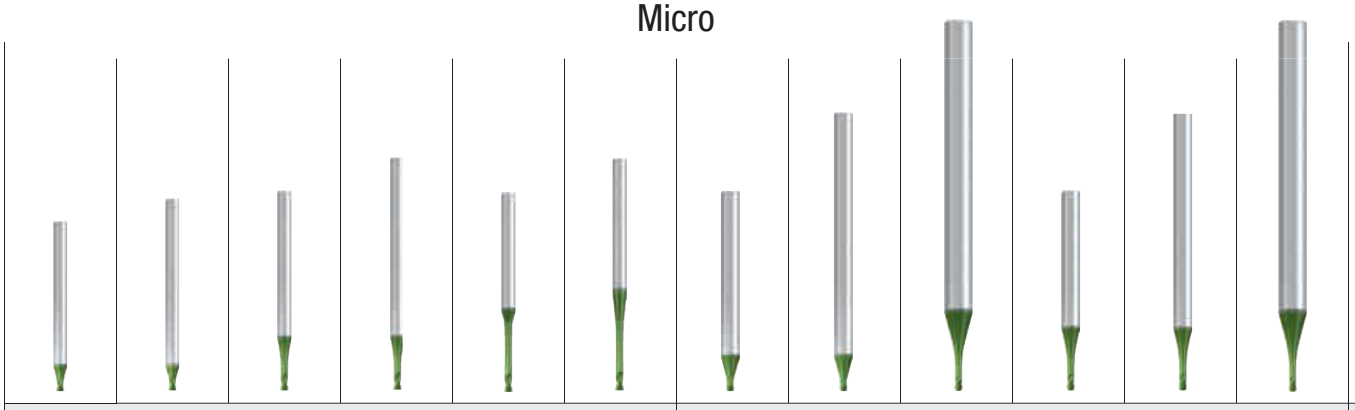
■ = very suitable □ = suitable

Micro



	Micro						Ball Nose					
	N											
l_3	2.2 x d_1		5 x d_1		10 x d_1		2.2 x d_1			5 x d_1		
d_1	ø0.2 - 2 mm		ø0.2 - 2 mm		ø0.2 - 2 mm		ø0.2 - 2 mm			ø0.2 - 2 mm		
# Flutes	2		2		2		2			2		
	2760L	2763L	2761L	2764L	2762L	2765L	2770L	2773L	2776L	2771L	2774L	2777L
Page	95		96		97		98			99		
v_c / f_z	192		193		194		195			196		
P 1.1	■	■	■	■	■	■	■	■	■	■	■	■
P 2.1	■	■	■	■	■	■	■	■	■	■	■	■
P 3.1	■	■	■	■	■	■	■	■	■	■	■	■
P 4.1	■	■	■	■	■	■	■	■	■	■	■	■
P 5.1	■	■	■	■	■	■	■	■	■	■	■	■
M 1.1	■	■	■	■	■	■	■	■	■	■	■	■
M 2.1	■	■	■	■	■	■	■	■	■	■	■	■
M 3.1	□	□	□	□	□	□	□	□	□	□	□	□
M 4.1	□	□	□	□	□	□	□	□	□	□	□	□
K 1.1	■	■	■	■	■	■	■	■	■	■	■	■
K 1.2	■	■	■	■	■	■	■	■	■	■	■	■
K 2.1	■	■	■	■	■	■	■	■	■	■	■	■
K 2.2	■	■	■	■	■	■	■	■	■	■	■	■
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N 2.1	■	■	■	■	■	■	■	■	■	■	■	■
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N 2.7	■	■	■	■	■	■	■	■	■	■	■	■
N 2.8	■	■	■	■	■	■	■	■	■	■	■	■
N 3.1	■	■	■	■	■	■	■	■	■	■	■	■
N 3.2	■	■	■	■	■	■	■	■	■	■	■	■
N 4.1	■	■	■	■	■	■	■	■	■	■	■	■
N 4.2	■	■	■	■	■	■	■	■	■	■	■	■
N 4.3												
N 4.4												
N 5.1												
N 5.2	■	■	■	■	■	■	■	■	■	■	■	■
N 5.3	■	■	■	■	■	■	■	■	■	■	■	■
S 1.1	□	□	□	□	□	□	□	□	□	□	□	□
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S 1.3	□	□	□	□	□	□	□	□	□	□	□	□
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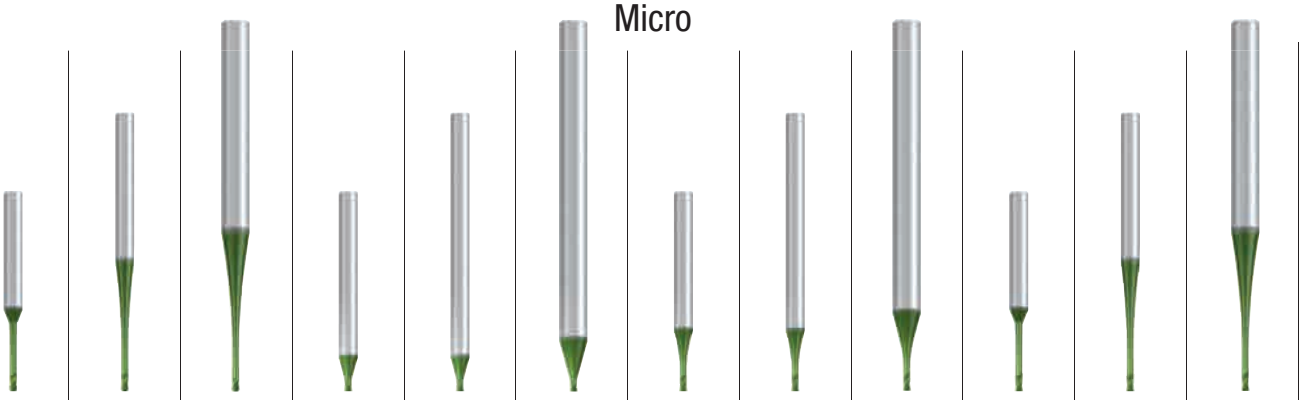
S 2.2												
S 2.3												
S 2.4												
S 2.5												
S 2.6												
H 1.1	□	□	□	□	□	□	□	□	□	□	□	□
H 1.2	□	□	□	□	□	□	□	□	□	□	□	□
H 1.3												
H 1.4												
H 1.5												

■ = very suitable □ = suitable

Micro



	Ball Nose			Torus									
	N												
l_3	10 x d_1			2.2 x d_1			5 x d_1			10 x d_1			
d_1	ø0.2 - 2 mm			ø0.5 - 2 mm			ø0.5 - 2 mm			ø0.5 - 2 mm			
# Flutes	2			2			2			2			
	2772L	2775L	2778L	2780L	2783L	2786L	2781L	2784L	2787L	2782L	2785L	2788L	
Page	100			101			102			103			
v_c / f_z	197			198			199			200			
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

■ = very suitable □ = suitable

Circle Segment

	Oval Form		Barrel Form	Oval Form		Taper Form		Lens Form
	NR fine		N					
d_1	ø 8 - 16 mm	ø 8 - 16 mm	r_2 = 50 mm	r_2 = 50 - 75 mm	ø 10 - 16 mm	$\alpha/2$=12.5 - 70° r_2=50 - 1500 mm	$\alpha/2$=12.5 - 70° r_2=200 - 1500 mm	r_2 = 6 - 25 mm
# Flutes	4	4	4	3 - 4	6	2 - 3	4 - 6	3
	3552LZ	3554LZ	3542L	3538L	3539L	3540L	3541L	3544L
	–	–	–	–	–	–	–	–
Page	105	106	107	108	109	110	111	112
v_c / f_z	201	201	202	203	204	205	206	207
P 1.1	■	■	■	■	■	■	■	■
P 2.1	■	■	■	■	■	■	■	■
P 3.1	■	■	■	■	■	■	■	■
P 4.1	■	■	■	■	■	■	■	■
P 5.1	■	■	■	■	■	■	■	■
M 1.1	■	■	■	■	■	■	■	■
M 2.1	■	■	■	■	■	■	■	■
M 3.1	■	■	□	□	□	□	□	□
M 4.1	■	■	□	□	□	□	□	□
K 1.1			■	■	■	■	■	■
K 1.2			■	■	■	■	■	■
K 2.1			■	■	■	■	■	■
K 2.2			□	□	□	□	□	□
K 3.1			■	■	■	■	■	■
K 3.2			■	■	■	■	■	■
K 4.1			■	■	■	■	■	■
K 4.2			□	□	□	□	□	□
N 1.1	■	■	■	■	■	■	■	■
N 1.2	■	■	■	■	■	■	■	■
N 1.3	■	■	■	■	■	■	■	■
N 1.4			■	■	■	■	■	■
N 1.5								
N 1.6								
N 2.1			■	■	■	■	■	■
N 2.2			■	■	■	■	■	■
N 2.3			■	■	■	■	■	■
N 2.4			■	■	■	■	■	■
N 2.5			■	■	■	■	■	■
N 2.6			■	■	■	■	■	■
N 2.7			■	■	■	■	■	■
N 2.8			■	■	■	■	■	■
N 3.1			■	■	■	■	■	■
N 3.2			■	■	■	■	■	■
N 4.1			□	□	□	□	□	□
N 4.2			□	□	□	□	□	□
N 4.3								
N 4.4								
N 5.1								
N 5.2			□	□	□	□	□	□
N 5.3								
S 1.1	■	■	■	■	■	■	■	■
S 1.2	■	■	■	■	■	■	■	■
S 1.3	■	■	■	■	■	■	■	■
S 2.1			■	■	■	■	■	■
S 2.2	■	■	■	■	■	■	■	■
S 2.3	■	■	□	□	□	□	□	□
S 2.4	■	■	■	■	■	■	■	■
S 2.5	■	■	□	□	□	□	□	□
S 2.6	■	■	□	□	□	□	□	□
H 1.1			□	□	■	□	■	
H 1.2			□	□	■	□	■	
H 1.3					■		■	
H 1.4								
H 1.5								

■ = very suitable □ = suitable

Turbine

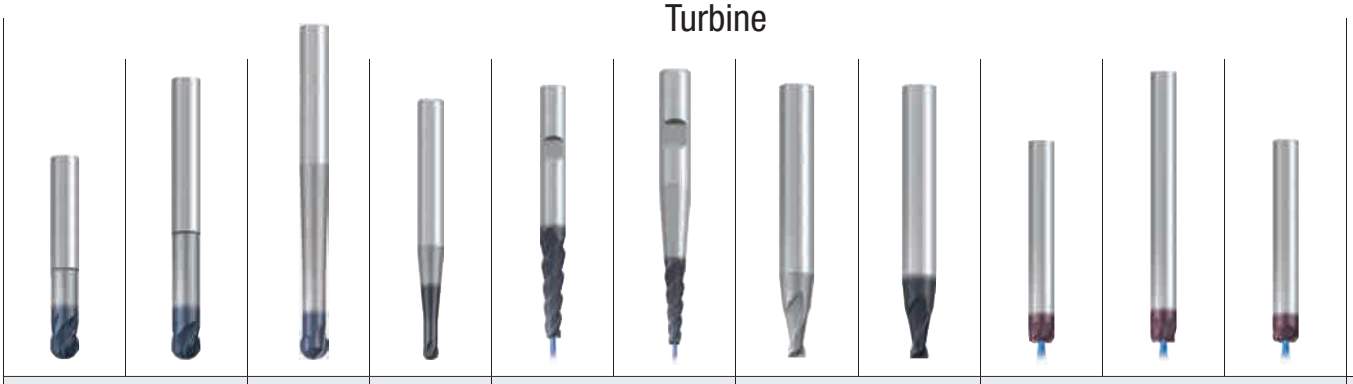
Tapered Ball Nose

NR fine	NF medium	N							
$\alpha/_2$=4° r=2-4mm	$\alpha/_2$=3 - 8° r=0.5-2mm		$\alpha/_2$=3 - 8° r=1.5-3mm		$\alpha/_2$=3 - 17.5° r=0.5-3mm		$\alpha/_2$= 4° r=2-4mm	$\alpha/_2$= 4° r=2-4mm	$\alpha/_2$= 4° r=3-8mm	d_1
3	2		2		3		3	3/6	3/6	# Flutes
3546L	3446 / 3447	3446L	3442 / 3443	3442L	3440 / 3441	3440L	3550L	3548L	2679A	
–	–	–	–	–	–	–	–	–	–	
115	116		117		118		119	120	121	Page
208	209		210		211		212	212	213	v_c / f_z
■		■		■		■	■	■	■	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

P M K N S H

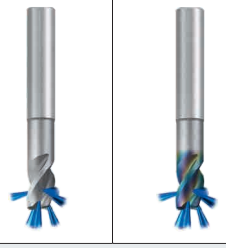
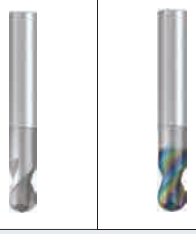
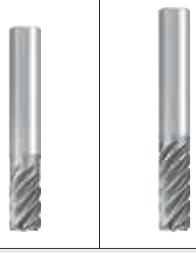
■ = very suitable □ = suitable

Turbine



	Hard-Cut		Top-Cut	Lollipop	Tapered Torus		Tapered Torus		Tapered Torus		
	H		N		NR fine		N		N		
d_1	1/8" - 1/2" ø3 - 12 mm	1/8" - 1/2" ø6 - 12 mm	ø2 - 12 mm	ø4 - 10 mm	$\alpha/_2 = 3°$ ø6.5 - 8.5 mm	$\alpha/_2 = 3°$ ø5 - 6 mm	$\alpha/_2 = 3\text{-}8°$ ø3 - 5 mm		$\alpha/_2 = 8°$ ø8 - 11 mm	$\alpha/_2 = 8°$ ø9 - 19 mm	ø8 - 16 mm
# Flutes	4	4	2	4	4	3	2		7 - 9	5 - 13	5 - 9
	2942A / 2834A	2943A / 2842A	1935A	2564L	–	–	3444 / 3445	3444L	2677AZ	2678AZ	2676AZ
	–	–	–	–	3534LZ	3532LZ	–	–	–	–	–
Page	122	123	124	125	126		127		128		129
v_c / f_z	214	215	216	217	218		219		220	220	221
P 1.1	□	□	■	■	■	■		■	■	■	■
P 2.1	□	□	■	■	■	■		■	■	■	■
P 3.1	■	■	■	■	■	■		■	■	■	■
P 4.1	■	■	■	■	■	■		□	■	■	■
P 5.1	■	■	■	■	■	■		□	■	■	■
M 1.1				■	■	■		■	■	■	■
M 2.1				■	■	■		■	■	■	■
M 3.1				■	■	■			■	■	■
M 4.1				■	■	■			■	■	■
K 1.1	■	■	■	□				■	■	■	■
K 1.2	■	■	■	□				■	■	■	■
K 2.1	■	■	■	□				■	■	■	■
K 2.2	■	■	■	□				■	■	■	■
K 3.1	■	■	■	□				□	■	■	■
K 3.2	■	■	■	□				□	■	■	■
K 4.1	■	■	■	□				□	■	■	■
K 4.2	■	■	■	□				□	■	■	■
N 1.1					■	■	■	■			
N 1.2			□		■	■	■	■			
N 1.3			□		■	■	■	■			
N 1.4			□					■			
N 1.5								□			
N 1.6											
N 2.1			■	■				■	■	■	■
N 2.2	□	□	■	■				■	■	■	■
N 2.3	■	■	■	■				■	■	■	■
N 2.4	□	□	■	■				■	■	■	■
N 2.5	□	□	■	■				■	■	■	■
N 2.6	■	■	■	■				■	■	■	■
N 2.7	■	■	■	■				□	■	■	■
N 2.8	■	■	■	■				□	■	■	■
N 3.1								■			
N 3.2								■			
N 4.1							■	■			
N 4.2							■	■			
N 4.3								■			
N 4.4								■			
N 5.1											
N 5.2			□					■			
N 5.3								■			
S 1.1		■		■	■	■		■	■	■	■
S 1.2		■		■	■	■		■	■	■	■
S 1.3		■		■	■	■		□	■	■	■
S 2.1		■		■				■	■	■	■
S 2.2		■		■	■	■		■	■	■	■
S 2.3		■		■	■	■		□	■	■	■
S 2.4		■		■	■	■		□	■	■	■
S 2.5		■		■	■	■		□	■	■	■
S 2.6		■		■	■	■		□	■	■	■
H 1.1	■	■	■	□							
H 1.2	■	■	■	□							
H 1.3	■	■		□							
H 1.4	■	■									
H 1.5	■	■									

■ = very suitable □ = suitable

	Cera-Cut	Alu-Cut						Cut & Form		
										
		Rougher		Finisher		Ball Nose		Cut & Form		
	N	WR coarse		W		W		W		
	1/4" - 5/8" ø6 - 16 mm	1/4 - 1"		1/4 - 1"		3/32 - 3/4"		ø6 - 12 mm		d_1
	5	3		3 - 4		2		3/6		# Flutes
	3915	3818	2888_Z	2888RZ	2889_Z	2889RZ	1921	1921R	2506	2507	
	–	–	–	–	–	–	–	–	–	–	
	131		133		134		135		137		Page
	222		223				224		225		v_c / f_z
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

■ = very suitable □ = suitable

TOP-Cut VAR High Performance End Mills

For Universal Milling Applications

The TOP-Cut VAR end mill is 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.

- **Unique flute and profile geometries** optimized for extended tool life, provide superior performance in both roughing and finishing applications
- **Variable helix angle flutes** provide vibration dampening milling
- **Precision ground flutes with advanced edge preparation processes** for repeatable performance
- **Fully blended corner radius** extends tool life and improves surface finishes
- **Advanced ALCR PVD coating** enables outstanding performance in higher operating temperatures
- **Proprietary sub-micro grain carbide grade** for maximum abrasion resistance and durability

V = Versatile: Designed to handle a wide range of materials and applications. Whether you're working in steel, aluminum, or other metals, this end mill can deliver precise cuts every time.

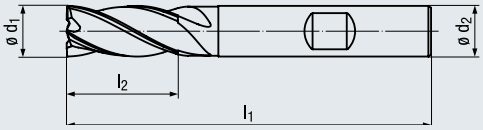
A = American-made with pride in the USA, ensuring quality, reliability, and consistency in every unit, and supporting local industries. Made to stringent EMUGE-FRANKEN German specifications and standards.

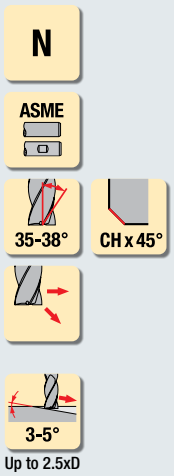
R = Reliable Performance: Despite its affordable price point, this end mill does not compromise on performance. Expect consistent, high-quality results every time.

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





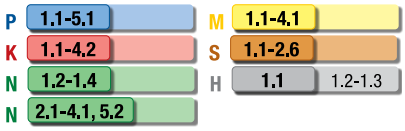
Icon descriptions
(see page 228-229)

Applications

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

Cutting Data (see pages 141-143)

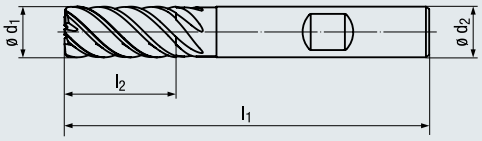
Materials - ISO Material Groups (see page 9)

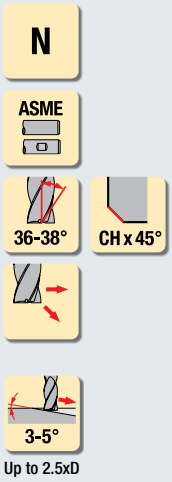


Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/16	1/8	1 1/2	1/8	0.002	4	2992L.00625	–
3/32	1/8	1 1/2	3/16	0.003	4	2992L.009375	–
1/8	1/8	1 1/2	1/4	0.003	4	2992L.0125	–
	1/8	1 1/2	3/8	0.003	4	2994L.0125	–
	1/8	2 1/4	3/4	0.003	4	2996L.0125	–
5/32	3/16	2	5/16	0.003	4	2992L.015625	–
3/16	3/16	2	3/8	0.005	4	2992L.01875	–
	3/16	2	7/16	0.005	4	2994L.01875	–
	3/16	2 1/2	3/4	0.005	4	2996L.01875	–
7/32	1/4	2	7/16	0.005	4	2992L.021875	2993L.021875
1/4	1/4	2	1/2	0.005	4	2992L.0250	2993L.0250
	1/4	2 1/2	1/2	0.005	4	2994L.0250	2995L.0250
	1/4	2 1/2	3/4	0.005	4	2994L.A250	2995L.A250
	1/4	3	1 1/8	0.005	4	2996L.0250	2997L.0250
5/16	5/16	2	1/2	0.005	4	2992L.03125	2993L.03125
	5/16	2 1/4	9/16	0.005	4	2992L.A3125	2993L.A3125
	5/16	2 1/2	13/16	0.005	4	2994L.03125	2995L.03125
	5/16	3	1 1/8	0.005	4	2996L.03125	2997L.03125
3/8	3/8	2	5/8	0.008	4	2992L.0375	2993L.0375
	3/8	2 1/2	5/8	0.008	4	2992L.A375	2993L.A375
	3/8	2 1/2	7/8	0.008	4	2994L.0375	2995L.0375
	3/8	2 3/4	7/8	0.008	4	2994L.A375	2995L.A375
	3/8	3	1 1/8	0.008	4	2996L.0375	2997L.0375
7/16	7/16	2 1/2	5/8	0.008	4	2992L.04375	–
	7/16	2 3/4	1	0.008	4	2994L.04375	–
	7/16	4	2	0.008	4	2994L.A4375	–
	7/16	4 1/2	2	0.008	4	2996L.04375	–
1/2	1/2	2 1/2	5/8	0.008	4	2992L.0500	2993L.0500
	1/2	2 3/4	5/8	0.008	4	2992L.A500	2993L.A500
	1/2	3	1	0.008	4	2994L.0500	2995L.0500
	1/2	3 1/4	1 1/4	0.008	4	2994L.A500	2995L.A500
	1/2	4 1/2	2	0.008	4	2996L.0500	2997L.0500
5/8	5/8	3	3/4	0.008	4	2992L.0625	2993L.0625
	5/8	3 1/2	1 1/4	0.008	4	2994L.0625	2995L.0625
	5/8	4	1 7/8	0.008	4	2994L.A625	2995L.A625
	5/8	4 3/4	2 1/4	0.008	4	2994L.B625	2995L.B625
	5/8	5	2 1/4	0.008	4	2996L.0625	2997L.0625
3/4	3/4	3	1	0.012	4	2992L.0750	2993L.0750
	3/4	3 1/2	1	0.012	4	2992L.A750	2993L.A750
	3/4	4	1 1/2	0.012	4	2994L.0750	2995L.0750
	3/4	5	2 1/4	0.012	4	2996L.0750	2997L.0750
1	1	4	1	0.012	4	2992L.1000	2993L.1000
	1	4	1 1/2	0.012	4	2994L.1000	2995L.1000
	1	5	2	0.012	4	2994L.A000	2995L.A000
	1	5	2 1/4	0.012	4	2996L.1000	2997L.1000
	1	6	3	0.012	4	2996L.A000	2997L.A000

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 page 228-229)

Applications

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

Cutting Data (see page 144)

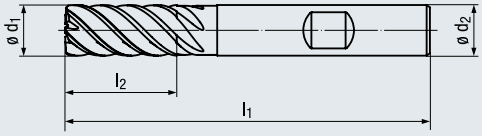
Materials - ISO Material Groups (see page 9)

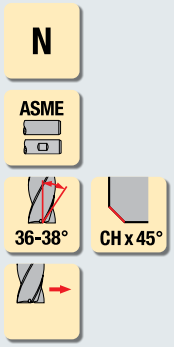
P	1.1-5.1	M	1.1-4.1
K	1.1-4.2	S	1.1-2.6
N	1.2-1.4	H	1.1 1.2-1.3
N	2.1-4.1, 5.2		

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/8	1/8	1 1/2	3/8	0.003	5	2946L.0125	–
3/16	3/16	2	9/16	0.003	5	2946L.01875	–
1/4	1/4	2	1/2	0.005	5	3920L.0250	–
	1/4	2 1/2	3/4	0.005	5	2946L.0250	–
	1/4	3	1 1/8	0.005	5	3922L.0250	–
5/16	5/16	2 1/4	9/16	0.005	5	3920L.03125	–
	5/16	2 1/2	13/16	0.005	5	2946L.03125	–
	5/16	3	1 1/8	0.005	5	3922L.03125	–
3/8	3/8	2 1/2	5/8	0.008	5	3920L.0375	–
	3/8	2 3/4	7/8	0.008	5	2946L.0375	–
	3/8	3	1 1/8	0.008	5	3922L.0375	–
7/16	7/16	2 1/2	5/8	0.008	5	3920L.04375	–
	7/16	3	1	0.008	5	2946L.04375	–
	7/16	4	2	0.008	5	3922L.04375	–
1/2	1/2	2 3/4	5/8	0.008	5	3920L.0500	3921L.0500
	1/2	3	1	0.008	5	2946L.0500	2920L.0500
	1/2	3 1/4	1 1/4	0.008	5	2946L.A500	2920L.A500
	1/2	4 1/2	2	0.008	5	3922L.0500	3923L.0500
5/8	5/8	3	3/4	0.008	5	3920L.0625	3921L.0625
	5/8	3 1/2	1 1/4	0.008	5	2946L.0625	2920L.0625
	5/8	4	1 7/8	0.008	5	2946L.A625	2920L.A625
	5/8	4 3/4	2 1/4	0.008	5	3922L.0625	3923L.0625
3/4	3/4	3 1/2	1	0.012	5	3920L.0750	3921L.0750
	3/4	4	1 1/2	0.012	5	2946L.0750	2920L.0750
	3/4	5	2 1/4	0.012	5	3922L.0750	3923L.0750
1	1	4	1	0.012	5	3920L.1000	3921L.1000
	1	5	2	0.012	5	2946L.1000	2920L.1000
	1	6	3	0.012	5	3922L.1000	3923L.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 page 228-229)

Applications

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

Cutting Data (see pages 148-150)

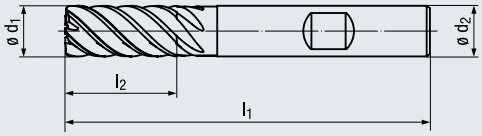
Materials - ISO Material Groups (see page 9)

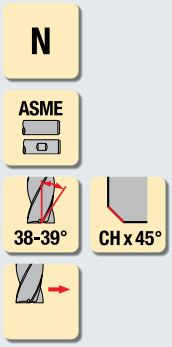
P 1.1-5.1 | M 1.1-4.1
K 1.1-4.2 | S 1.1-2.6
N 1.2-1.4 | H 1.1 1.2-1.3
N 2.1-4.1, 5.2

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	1/4	2	1/2	0.005	6	3924L.0250	–
	1/4	2 1/2	3/4	0.005	6	2948L.0250	–
	1/4	3	1 1/8	0.005	6	3926L.0250	–
5/16	5/16	2 1/4	9/16	0.005	6	3924L.03125	–
	5/16	2 1/2	13/16	0.005	6	2948L.03125	–
	5/16	3	1 1/8	0.005	6	3926L.03125	–
3/8	3/8	2 1/2	5/8	0.008	6	3924L.0375	–
	3/8	2 3/4	7/8	0.008	6	2948L.0375	–
	3/8	3	1 1/8	0.008	6	3926L.0375	–
7/16	7/16	2 1/2	5/8	0.008	6	3924L.04375	–
	7/16	3	1	0.008	6	2948L.04375	–
	7/16	4	2	0.008	6	3926L.04375	–
1/2	1/2	2 3/4	5/8	0.008	6	3924L.0500	3925L.0500
	1/2	3	1	0.008	6	2948L.0500	3908L.0500
	1/2	3 1/4	1 1/4	0.008	6	2948L.A500	3908L.A500
	1/2	4 1/2	2	0.008	6	3926L.0500	3927L.0500
5/8	5/8	3	3/4	0.008	6	3924L.0625	3925L.0625
	5/8	3 1/2	1 1/4	0.008	6	2948L.0625	3908L.0625
	5/8	4	1 7/8	0.008	6	2948L.A625	3908L.A625
	5/8	4 3/4	2 1/4	0.008	6	3926L.0625	3927L.0625
3/4	3/4	3 1/2	1	0.012	6	3924L.0750	3925L.0750
	3/4	4	1 1/2	0.012	6	2948L.0750	3908L.0750
	3/4	5	2 1/4	0.012	6	3926L.0750	3927L.0750
1	1	4	1	0.012	6	3924L.1000	3925L.1000
	1	5	2	0.012	6	2948L.1000	3908L.1000
	1	6	3	0.012	6	3926L.1000	3927L.1000

7 Flutes

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





Icon descriptions (see page 228-229)

Applications

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

Cutting Data (see pages 151-153)

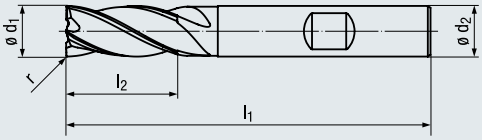
Materials - ISO Material Groups (see page 10)

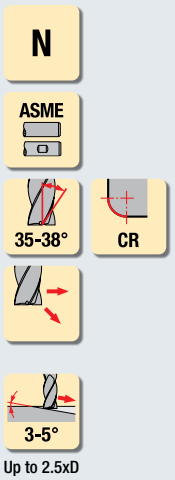
P	1.1-5.1	M	1.1-4.1
K	1.1-4.2	S	1.1-2.6
N	1.2-1.4	H	1.1 1.2-1.3
N	2.1-4.1, 5.2		

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	1/4	2	1/2	0.005	7	3916L.0250	–
	1/4	2 1/2	3/4	0.005	7	3917L.0250	–
	1/4	3	1 1/8	0.005	7	3918L.0250	–
5/16	5/16	2 1/4	9/16	0.005	7	3916L.03125	–
	5/16	2 1/2	13/16	0.005	7	3917L.03125	–
	5/16	3	1 1/8	0.005	7	3918L.03125	–
3/8	3/8	2 1/2	5/8	0.008	7	3916L.0375	–
	3/8	2 3/4	7/8	0.008	7	3917L.0375	–
	3/8	3	1 1/8	0.008	7	3918L.0375	–
7/16	7/16	2 1/2	5/8	0.008	7	3916L.04375	–
	7/16	3	1	0.008	7	3917L.04375	–
	7/16	4	2	0.008	7	3918L.04375	–
1/2	1/2	2 3/4	5/8	0.008	7	3916L.0500	3930L.0500
	1/2	3	1	0.008	7	3917L.0500	3931L.0500
	1/2	3 1/4	1 1/4	0.008	7	3917L.A500	3931L.A500
	1/2	4 1/2	2	0.008	7	3918L.0500	3932L.0500
5/8	5/8	3	3/4	0.008	7	3916L.0625	3930L.0625
	5/8	3 1/2	1 1/4	0.008	7	3917L.0625	3931L.0625
	5/8	4	1 7/8	0.008	7	3917L.A625	3931L.A625
	5/8	4 3/4	2 1/4	0.008	7	3918L.0625	3932L.0625
3/4	3/4	3 1/2	1	0.012	7	3916L.0750	3930L.0750
	3/4	4	1 1/2	0.012	7	3917L.0750	3931L.0750
	3/4	5	2 1/4	0.012	7	3918L.0750	3932L.0750
1	1	4	1	0.012	7	3916L.1000	3930L.1000
	1	5	2	0.012	7	3917L.1000	3931L.1000
	1	6	3	0.012	7	3918L.1000	3932L.1000

4 Flutes – Corner Radius

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





Icon descriptions (see page 228-229)

Applications

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

Cutting Data (see pages 145-147)

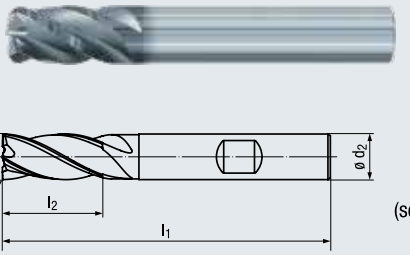
Materials - ISO Material Groups (see page 10)

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

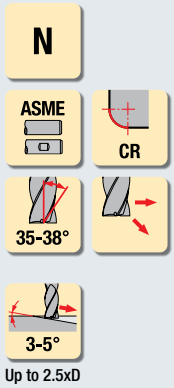
Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/8	1/8	1 1/2	1/4	0.010	4	3945L.012010	–
	1/8	1 1/2	1/4	0.015	4	3945L.012015	–
	1/8	1 1/2	3/8	0.010	4	2998L.012010	–
	1/8	1 1/2	3/8	0.015	4	2998L.012015	–
	1/8	2 1/4	3/4	0.010	4	3947L.012010	–
	1/8	2 1/4	3/4	0.015	4	3947L.012015	–
3/16	3/16	2	3/8	0.010	4	3945L.018010	–
	3/16	2	3/8	0.015	4	3945L.018015	–
	3/16	2	3/8	0.020	4	3945L.018020	–
	3/16	2	3/8	0.030	4	3945L.018030	–
	3/16	2	7/16	0.010	4	2998L.018010	–
	3/16	2	7/16	0.015	4	2998L.018015	–
	3/16	2	7/16	0.020	4	2998L.018020	–
	3/16	2	7/16	0.030	4	2998L.018030	–
	3/16	2 1/2	3/4	0.010	4	3947L.018010	–
	3/16	2 1/2	3/4	0.015	4	3947L.018015	–
	3/16	2 1/2	3/4	0.020	4	3947L.018020	–
	3/16	2 1/2	3/4	0.030	4	3947L.018030	–
1/4	1/4	2	1/2	0.010	4	3945L.025010	3946L.025010
	1/4	2	1/2	0.015	4	3945L.025015	3946L.025015
	1/4	2	1/2	0.020	4	3945L.025020	3946L.025020
	1/4	2	1/2	0.030	4	3945L.025030	3946L.025030
	1/4	2	1/2	0.060	4	3945L.025060	3946L.025060
	1/4	2 1/2	1/2	0.010	4	2998L.025010	2999L.025010
	1/4	2 1/2	1/2	0.015	4	2998L.025015	2999L.025015
	1/4	2 1/2	1/2	0.020	4	2998L.025020	2999L.025020
	1/4	2 1/2	1/2	0.030	4	2998L.025030	2999L.025030
	1/4	2 1/2	1/2	0.060	4	2998L.025060	2999L.025060
	1/4	2 1/2	3/4	0.010	4	2998L.A25010	2999L.A25010
	1/4	2 1/2	3/4	0.015	4	2998L.A25015	2999L.A25015
	1/4	2 1/2	3/4	0.020	4	2998L.A25020	2999L.A25020
	1/4	2 1/2	3/4	0.030	4	2998L.A25030	2999L.A25030
	1/4	2 1/2	3/4	0.060	4	2998L.A25060	2999L.A25060
	1/4	3	1 1/8	0.010	4	3947L.025010	3948L.025010
	1/4	3	1 1/8	0.015	4	3947L.025015	3948L.025015
	1/4	3	1 1/8	0.020	4	3947L.025020	3948L.025020
	1/4	3	1 1/8	0.030	4	3947L.025030	3948L.025030
	1/4	3	1 1/8	0.060	4	3947L.025060	3948L.025060
5/16	5/16	2 1/4	9/16	0.010	4	3945L.031010	3946L.031010
	5/16	2 1/4	9/16	0.015	4	3945L.031015	3946L.031015
	5/16	2 1/4	9/16	0.020	4	3945L.031020	3946L.031020
	5/16	2 1/4	9/16	0.030	4	3945L.031030	3946L.031030
	5/16	2 1/2	13/16	0.010	4	2998L.031010	2999L.031010
	5/16	2 1/2	13/16	0.015	4	2998L.031015	2999L.031015
	5/16	2 1/2	13/16	0.020	4	2998L.031020	2999L.031020
	5/16	2 1/2	13/16	0.030	4	2998L.031030	2999L.031030
	5/16	3	1 1/8	0.010	4	3947L.031010	3948L.031010
	5/16	3	1 1/8	0.015	4	3947L.031015	3948L.031015
	5/16	3	1 1/8	0.020	4	3947L.031020	3948L.031020
	5/16	3	1 1/8	0.030	4	3947L.031030	3948L.031030

4 Flutes – Corner Radius – tool sizes continue on page 32

4 Flutes – Corner Radius (continued from page 31)



Icon descriptions (see page 228-229)



Applications

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

Cutting Data (see pages 145-147)

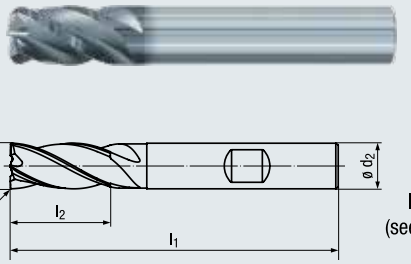
Materials - ISO Material Groups (see page 10)

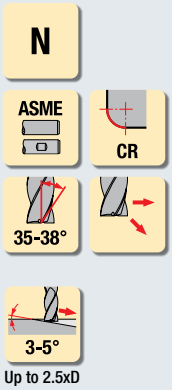
P	1.1-5.1	M	1.1-4.1	
K	1.1-4.2	S	1.1-2.6	
N	1.2-1.4	H	1.1	1.2-1.3
N	2.1-4.1, 5.2			

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3/8	3/8	2 1/2	5/8	0.010	4	3945L.037010	3946L.037010
	3/8	2 1/2	5/8	0.015	4	3945L.037015	3946L.037015
	3/8	2 1/2	5/8	0.020	4	3945L.037020	3946L.037020
	3/8	2 1/2	5/8	0.030	4	3945L.037030	3946L.037030
	3/8	2 1/2	5/8	0.060	4	3945L.037060	3946L.037060
	3/8	2 1/2	5/8	0.090	4	3945L.037090	3946L.037090
	3/8	2 1/2	7/8	0.010	4	2998L.037010	2999L.037010
	3/8	2 1/2	7/8	0.015	4	2998L.037015	2999L.037015
	3/8	2 1/2	7/8	0.020	4	2998L.037020	2999L.037020
	3/8	2 1/2	7/8	0.030	4	2998L.037030	2999L.037030
	3/8	2 1/2	7/8	0.060	4	2998L.037060	2999L.037060
	3/8	2 1/2	7/8	0.090	4	2998L.037090	2999L.037090
	3/8	2 3/4	7/8	0.010	4	2998L.A37010	2999L.A37010
	3/8	2 3/4	7/8	0.015	4	2998L.A37015	2999L.A37015
	3/8	2 3/4	7/8	0.020	4	2998L.A37020	2999L.A37020
	3/8	2 3/4	7/8	0.030	4	2998L.A37030	2999L.A37030
	3/8	2 3/4	7/8	0.060	4	2998L.A37060	2999L.A37060
	3/8	2 3/4	7/8	0.090	4	2998L.A37090	2999L.A37090
	3/8	3	1 1/8	0.010	4	3947L.037010	3948L.037010
	3/8	3	1 1/8	0.015	4	3947L.037015	3948L.037015
	3/8	3	1 1/8	0.020	4	3947L.037020	3948L.037020
	3/8	3	1 1/8	0.030	4	3947L.037030	3948L.037030
	3/8	3	1 1/8	0.060	4	3947L.037060	3948L.037060
	3/8	3	1 1/8	0.090	4	3947L.037090	3948L.037090
7/16	7/16	2 3/4	1	0.010	4	2998L.043010	–
	7/16	2 3/4	1	0.015	4	2998L.043015	–
1/2	1/2	2 3/4	5/8	0.010	4	3945L.050010	3946L.050010
	1/2	2 3/4	5/8	0.015	4	3945L.050015	3946L.050015
	1/2	2 3/4	5/8	0.020	4	3945L.050020	3946L.050020
	1/2	2 3/4	5/8	0.030	4	3945L.050030	3946L.050030
	1/2	2 3/4	5/8	0.060	4	3945L.050060	3946L.050060
	1/2	2 3/4	5/8	0.090	4	3945L.050090	3946L.050090
	1/2	2 3/4	5/8	0.120	4	3945L.050120	3946L.050120
	1/2	3	1	0.010	4	2998L.050010	2999L.050010
	1/2	3	1	0.015	4	2998L.050015	2999L.050015
	1/2	3	1	0.020	4	2998L.050020	2999L.050020
	1/2	3	1	0.030	4	2998L.050030	2999L.050030
	1/2	3	1	0.060	4	2998L.050060	2999L.050060
	1/2	3	1	0.090	4	2998L.050090	2999L.050090
	1/2	3	1	0.120	4	2998L.050120	2999L.050120
	1/2	3 1/4	1 1/4	0.010	4	2998L.A50010	2999L.A50010
	1/2	3 1/4	1 1/4	0.015	4	2998L.A50015	2999L.A50015
	1/2	3 1/4	1 1/4	0.020	4	2998L.A50020	2999L.A50020
	1/2	3 1/4	1 1/4	0.030	4	2998L.A50030	2999L.A50030
	1/2	3 1/4	1 1/4	0.060	4	2998L.A50060	2999L.A50060
	1/2	3 1/4	1 1/4	0.090	4	2998L.A50090	2999L.A50090
	1/2	3 1/4	1 1/4	0.120	4	2998L.A50120	2999L.A50120
	1/2	4 1/2	2	0.010	4	3947L.050010	3948L.050010
	1/2	4 1/2	2	0.015	4	3947L.050015	3948L.050015
	1/2	4 1/2	2	0.020	4	3947L.050020	3948L.050020
	1/2	4 1/2	2	0.030	4	3947L.050030	3948L.050030
	1/2	4 1/2	2	0.060	4	3947L.050060	3948L.050060
	1/2	4 1/2	2	0.090	4	3947L.050090	3948L.050090
	1/2	4 1/2	2	0.120	4	3947L.050120	3948L.050120

4 Flutes – Corner Radius – tool sizes continue on page 33

4 Flutes – Corner Radius (continued from page 32)





Icon descriptions (see page 228-229)

Applications

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

Cutting Data (see pages 145-147)

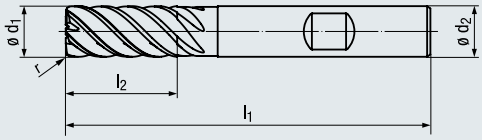
Materials - ISO Material Groups (see page 10)

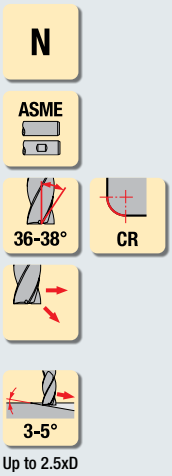
P 1.1-5.1 | M 1.1-4.1
K 1.1-4.2 | S 1.1-2.6
N 1.2-1.4 | H 1.1 1.2-1.3
N 2.1-4.1, 5.2

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
	5/8	3	3/4	0.030	4	3945L.062030	3946L.062030
	5/8	3	3/4	0.060	4	3945L.062060	3946L.062060
	5/8	3	3/4	0.090	4	3945L.062090	3946L.062090
	5/8	3	3/4	0.120	4	3945L.062120	3946L.062120
	5/8	3 1/2	1 1/4	0.030	4	2998L.062030	2999L.062030
	5/8	3 1/2	1 1/4	0.040	4	2998L.062040	2999L.062040
	5/8	3 1/2	1 1/4	0.060	4	2998L.062060	2999L.062060
	5/8	3 1/2	1 1/4	0.090	4	2998L.062090	2999L.062090
5/8	5/8	3 1/2	1 1/4	0.120	4	2998L.062120	2999L.062120
	5/8	4	1 7/8	0.030	4	2998L.A62030	2999L.A62030
	5/8	4	1 7/8	0.060	4	2998L.A62060	2999L.A62060
	5/8	4	1 7/8	0.090	4	2998L.A62090	2999L.A62090
	5/8	4	1 7/8	0.120	4	2998L.A62120	2999L.A62120
	5/8	4 3/4	2 1/4	0.030	4	3947L.062030	3948L.062030
	5/8	4 3/4	2 1/4	0.060	4	3947L.062060	3948L.062060
	5/8	4 3/4	2 1/4	0.090	4	3947L.062090	3948L.062090
	5/8	4 3/4	2 1/4	0.120	4	3947L.062120	3948L.062120
	3/4	3 1/2	1	0.015	4	3945L.075015	3946L.075015
	3/4	3 1/2	1	0.020	4	3945L.075020	3946L.075020
	3/4	3 1/2	1	0.030	4	3945L.075030	3946L.075030
	3/4	3 1/2	1	0.060	4	3945L.075060	3946L.075060
	3/4	3 1/2	1	0.090	4	3945L.075090	3946L.075090
	3/4	3 1/2	1	0.120	4	3945L.075120	3946L.075120
	3/4	3 1/2	1	0.190	4	3945L.075190	3946L.075190
	3/4	3 1/2	1	0.250	4	3945L.075250	3946L.075250
	3/4	4	1 1/2	0.015	4	2998L.075015	2999L.075015
	3/4	4	1 1/2	0.020	4	2998L.075020	2999L.075020
	3/4	4	1 1/2	0.030	4	2998L.075030	2999L.075030
	3/4	4	1 1/2	0.040	4	2998L.075040	2999L.075040
3/4	3/4	4	1 1/2	0.060	4	2998L.075060	2999L.075060
	3/4	4	1 1/2	0.090	4	2998L.075090	2999L.075090
	3/4	4	1 1/2	0.120	4	2998L.075120	2999L.075120
	3/4	4	1 1/2	0.190	4	2998L.075190	2999L.075190
	3/4	4	1 1/2	0.250	4	2998L.075250	2999L.075250
	3/4	5	2 1/4	0.015	4	3947L.075015	3948L.075015
	3/4	5	2 1/4	0.020	4	3947L.075020	3948L.075020
	3/4	5	2 1/4	0.030	4	3947L.075030	3948L.075030
	3/4	5	2 1/4	0.060	4	3947L.075060	3948L.075060
	3/4	5	2 1/4	0.090	4	3947L.075090	3948L.075090
	3/4	5	2 1/4	0.120	4	3947L.075120	3948L.075120
	3/4	5	2 1/4	0.190	4	3947L.075190	3948L.075190
	3/4	5	2 1/4	0.250	4	3947L.075250	3948L.075250
	1	4	1	0.030	4	3945L.100030	3946L.100030
	1	4	1	0.060	4	3945L.100060	3946L.100060
	1	4	1	0.090	4	3945L.100090	3946L.100090
	1	4	1	0.120	4	3945L.100120	3946L.100120
	1	4	1 1/2	0.030	4	2998L.100030	2999L.100030
	1	4	1 1/2	0.040	4	2998L.100040	2999L.100040
	1	4	1 1/2	0.060	4	2998L.100060	2999L.100060
1	1	5	2	0.030	4	2998L.A00030	2999L.A00030
	1	5	2	0.060	4	2998L.A00060	2999L.A00060
	1	5	2	0.090	4	2998L.A00090	2999L.A00090
	1	5	2	0.120	4	2998L.A00120	2999L.A00120
	1	6	3	0.030	4	3947L.100030	3948L.100030
	1	6	3	0.060	4	3947L.100060	3948L.100060
	1	6	3	0.090	4	3947L.100090	3948L.100090
	1	6	3	0.120	4	3947L.100120	3948L.100120

5 Flutes – Corner Radius

- 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 page 228-229)

Applications

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

Cutting Data (see pages 145-147)

Materials - ISO Material Groups (see page 10)

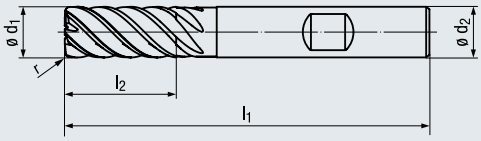
P	1.1-5.1	M	1.1-4.1
K	1.1-4.2	S	1.1-2.6
N	1.2-1.4	H	1.1 / 1.2-1.3
N	2.1-4.1, 5.2		

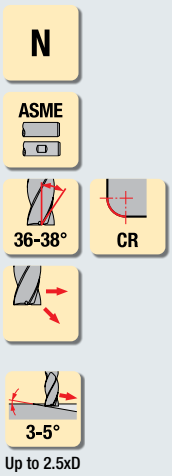
Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	1/4	2	1/2	0.010	5	3928L.025010	–
	1/4	2	1/2	0.015	5	3928L.025015	–
	1/4	2	1/2	0.020	5	3928L.025020	–
	1/4	2	1/2	0.030	5	3928L.025030	–
	1/4	2	1/2	0.060	5	3928L.025060	–
	1/4	2 1/2	3/4	0.010	5	3902L.025010	–
	1/4	2 1/2	3/4	0.015	5	3902L.025015	–
	1/4	2 1/2	3/4	0.020	5	3902L.025020	–
	1/4	2 1/2	3/4	0.030	5	3902L.025030	–
	1/4	2 1/2	3/4	0.060	5	3902L.025060	–
	1/4	3	1 1/8	0.010	5	3933L.025010	–
	1/4	3	1 1/8	0.015	5	3933L.025015	–
	1/4	3	1 1/8	0.020	5	3933L.025020	–
	1/4	3	1 1/8	0.030	5	3933L.025030	–
	1/4	3	1 1/8	0.060	5	3933L.025060	–
3/8	3/8	2 1/2	5/8	0.010	5	3928L.037010	–
	3/8	2 1/2	5/8	0.015	5	3928L.037015	–
	3/8	2 1/2	5/8	0.020	5	3928L.037020	–
	3/8	2 1/2	5/8	0.030	5	3928L.037030	–
	3/8	2 1/2	5/8	0.060	5	3928L.037060	–
	3/8	2 1/2	5/8	0.090	5	3928L.037090	–
	3/8	2 3/4	7/8	0.010	5	3902L.037010	–
	3/8	2 3/4	7/8	0.015	5	3902L.037015	–
	3/8	2 3/4	7/8	0.020	5	3902L.037020	–
	3/8	2 3/4	7/8	0.030	5	3902L.037030	–
	3/8	2 3/4	7/8	0.060	5	3902L.037060	–
	3/8	2 3/4	7/8	0.090	5	3902L.037090	–
	3/8	3	1 1/8	0.010	5	3933L.037010	–
	3/8	3	1 1/8	0.015	5	3933L.037015	–
	3/8	3	1 1/8	0.020	5	3933L.037020	–
	3/8	3	1 1/8	0.030	5	3933L.037030	–
	3/8	3	1 1/8	0.060	5	3933L.037060	–
	3/8	3	1 1/8	0.090	5	3933L.037090	–
1/2	1/2	2 3/4	5/8	0.010	5	3928L.050010	3929L.050010
	1/2	2 3/4	5/8	0.015	5	3928L.050015	3929L.050015
	1/2	2 3/4	5/8	0.020	5	3928L.050020	3929L.050020
	1/2	2 3/4	5/8	0.030	5	3928L.050030	3929L.050030
	1/2	2 3/4	5/8	0.060	5	3928L.050060	3929L.050060
	1/2	2 3/4	5/8	0.090	5	3928L.050090	3929L.050090
	1/2	2 3/4	5/8	0.120	5	3928L.050120	3929L.050120
	1/2	3	1	0.010	5	3902L.050010	3903L.050010
	1/2	3	1	0.015	5	3902L.050015	3903L.050015
	1/2	3	1	0.020	5	3902L.050020	3903L.050020
	1/2	3	1	0.030	5	3902L.050030	3903L.050030
	1/2	3	1	0.060	5	3902L.050060	3903L.050060
	1/2	3	1	0.090	5	3902L.050090	3903L.050090
	1/2	3	1	0.120	5	3902L.050120	3903L.050120

5 Flutes – Corner Radius – tool sizes continue on page 35

5 Flutes – Corner Radius (continued from page 34)

- 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 page 228-229)

Applications

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

Cutting Data (see pages 145-147)

Materials - ISO Material Groups (see page 10)

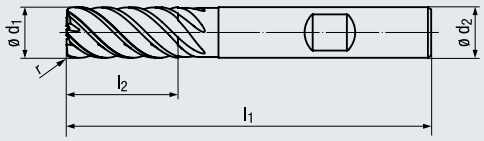
P 1.1-5.1 | M 1.1-4.1
K 1.1-4.2 | S 1.1-2.6
N 1.2-1.4 | H 1.1 1.2-1.3
N 2.1-4.1, 5.2

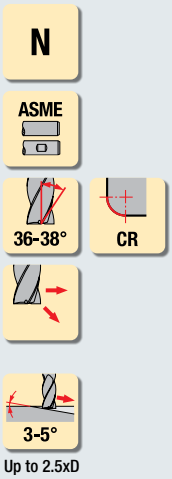
Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/2	1/2	3 1/4	1 1/4	0.010	5	3902L.A50010	3903L.A50010
	1/2	3 1/4	1 1/4	0.015	5	3902L.A50015	3903L.A50015
	1/2	3 1/4	1 1/4	0.020	5	3902L.A50020	3903L.A50020
	1/2	3 1/4	1 1/4	0.030	5	3902L.A50030	3903L.A50030
	1/2	3 1/4	1 1/4	0.060	5	3902L.A50060	3903L.A50060
	1/2	3 1/4	1 1/4	0.090	5	3902L.A50090	3903L.A50090
	1/2	3 1/4	1 1/4	0.120	5	3902L.A50120	3903L.A50120
	1/2	4 1/2	2	0.010	5	3933L.050010	3934L.050010
	1/2	4 1/2	2	0.015	5	3933L.050015	3934L.050015
	1/2	4 1/2	2	0.020	5	3933L.050020	3934L.050020
	1/2	4 1/2	2	0.030	5	3933L.050030	3934L.050030
	1/2	4 1/2	2	0.060	5	3933L.050060	3934L.050060
	1/2	4 1/2	2	0.090	5	3933L.050090	3934L.050090
	1/2	4 1/2	2	0.120	5	3933L.050120	3934L.050120
5/8	5/8	3	3/4	0.030	5	3928L.062030	3929L.062030
	5/8	3	3/4	0.060	5	3928L.062060	3929L.062060
	5/8	3	3/4	0.090	5	3928L.062090	3929L.062090
	5/8	3	3/4	0.120	5	3928L.062120	3929L.062120
	5/8	3 1/2	1 1/4	0.030	5	3902L.062030	3903L.062030
	5/8	3 1/2	1 1/4	0.060	5	3902L.062060	3903L.062060
	5/8	3 1/2	1 1/4	0.090	5	3902L.062090	3903L.062090
	5/8	3 1/2	1 1/4	0.120	5	3902L.062120	3903L.062120
	5/8	4	1 5/8	0.030	5	3902L.A62030	3903L.A62030
	5/8	4	1 5/8	0.060	5	3902L.A62060	3903L.A62060
	5/8	4	1 5/8	0.090	5	3902L.A62090	3903L.A62090
	5/8	4	1 5/8	0.120	5	3902L.A62120	3903L.A62120
	5/8	4	1 7/8	0.030	5	3902L.B62030	3903L.B62030
	5/8	4	1 7/8	0.060	5	3902L.B62060	3903L.B62060
	5/8	4	1 7/8	0.090	5	3902L.B62090	3903L.B62090
	5/8	4	1 7/8	0.120	5	3902L.B62120	3903L.B62120
	5/8	4 3/4	2 1/4	0.030	5	3933L.062030	3934L.062030
	5/8	4 3/4	2 1/4	0.060	5	3933L.062060	3934L.062060
	5/8	4 3/4	2 1/4	0.090	5	3933L.062090	3934L.062090
	5/8	4 3/4	2 1/4	0.120	5	3933L.062120	3934L.062120

5 Flutes – Corner Radius – tool sizes continue on page 36

5 Flutes – Corner Radius (continued from page 35)

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





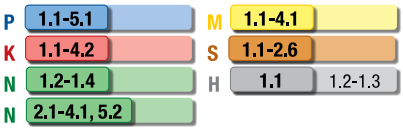
Icon descriptions (see page 228-229)

Applications

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

Cutting Data (see pages 145-147)

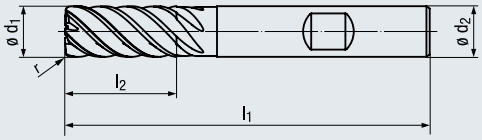
Materials - ISO Material Groups (see page 10)

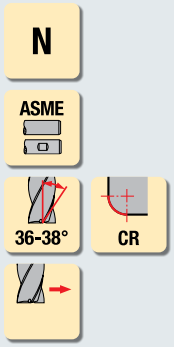


Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3/4	3/4	3 1/2	1	0.015	5	3928L.075015	3929L.075015
	3/4	3 1/2	1	0.020	5	3928L.075020	3929L.075020
	3/4	3 1/2	1	0.030	5	3928L.075030	3929L.075030
	3/4	3 1/2	1	0.060	5	3928L.075060	3929L.075060
	3/4	3 1/2	1	0.090	5	3928L.075090	3929L.075090
	3/4	3 1/2	1	0.120	5	3928L.075120	3929L.075120
	3/4	3 1/2	1	0.190	5	3928L.075190	3929L.075190
	3/4	3 1/2	1	0.250	5	3928L.075250	3929L.075250
	3/4	4	1 1/2	0.015	5	3902L.075015	3903L.075015
	3/4	4	1 1/2	0.020	5	3902L.075020	3903L.075020
	3/4	4	1 1/2	0.030	5	3902L.075030	3903L.075030
	3/4	4	1 1/2	0.060	5	3902L.075060	3903L.075060
	3/4	4	1 1/2	0.090	5	3902L.075090	3903L.075090
	3/4	4	1 1/2	0.120	5	3902L.075120	3903L.075120
	3/4	4	1 1/2	0.190	5	3902L.075190	3903L.075190
	3/4	4	1 1/2	0.250	5	3902L.075250	3903L.075250
	3/4	5	1 7/8	0.015	5	3902L.A75015	3903L.A75015
	3/4	5	1 7/8	0.020	5	3902L.A75020	3903L.A75020
	3/4	5	1 7/8	0.030	5	3902L.A75030	3903L.A75030
	3/4	5	1 7/8	0.060	5	3902L.A75060	3903L.A75060
	3/4	5	1 7/8	0.090	5	3902L.A75090	3903L.A75090
	3/4	5	1 7/8	0.120	5	3902L.A75120	3903L.A75120
	3/4	5	1 7/8	0.190	5	3902L.A75190	3903L.A75190
	3/4	5	1 7/8	0.250	5	3902L.A75250	3903L.A75250
	3/4	5	2 1/4	0.015	5	3933L.075015	3934L.075015
	3/4	5	2 1/4	0.020	5	3933L.075020	3934L.075020
	3/4	5	2 1/4	0.030	5	3933L.075030	3934L.075030
	3/4	5	2 1/4	0.060	5	3933L.075060	3934L.075060
	3/4	5	2 1/4	0.090	5	3933L.075090	3934L.075090
	3/4	5	2 1/4	0.120	5	3933L.075120	3934L.075120
	3/4	5	2 1/4	0.190	5	3933L.075190	3934L.075190
	3/4	5	2 1/4	0.250	5	3933L.075250	3934L.075250
1	1"	4	1	0.030	5	3928L.100030	3929L.100030
	1"	4	1	0.060	5	3928L.100060	3929L.100060
	1"	4	1	0.090	5	3928L.100090	3929L.100090
	1"	4	1	0.120	5	3928L.100120	3929L.100120
	1"	5	2	0.030	5	3902L.100030	3903L.100030
	1"	5	2	0.060	5	3902L.100060	3903L.100060
	1"	5	2	0.090	5	3902L.100090	3903L.100090
	1"	5	2	0.120	5	3902L.100120	3903L.100120
	1"	6	3	0.030	5	3933L.100030	3934L.100030
	1"	6	3	0.060	5	3933L.100060	3934L.100060
	1"	6	3	0.090	5	3933L.100090	3934L.100090
	1"	6	3	0.120	5	3933L.100120	3934L.100120

6 Flutes – Corner Radius

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





Icon descriptions (see page 228-229)

Applications

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

Cutting Data (see pages 148-150)

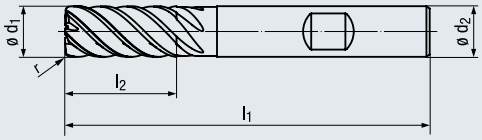
Materials - ISO Material Groups (see page 11)

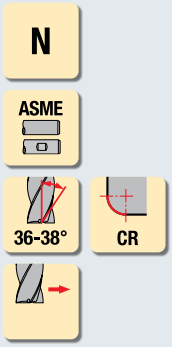
P 1.1-5.1 | M 1.1-4.1
K 1.1-4.2 | S 1.1-2.6
N 1.2-1.4 | H 1.1 1.2-1.3
N 2.1-4.1, 5.2

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
	1/4	2	1/2	0.010	6	3941L.025010	–
	1/4	2	1/2	0.015	6	3941L.025015	–
	1/4	2	1/2	0.020	6	3941L.025020	–
	1/4	2	1/2	0.030	6	3941L.025030	–
	1/4	2	1/2	0.060	6	3941L.025060	–
	1/4	2 1/2	3/4	0.010	6	2947L.025010	–
	1/4	2 1/2	3/4	0.015	6	2947L.025015	–
1/4	1/4	2 1/2	3/4	0.020	6	2947L.025020	–
	1/4	2 1/2	3/4	0.030	6	2947L.025030	–
	1/4	2 1/2	3/4	0.060	6	2947L.025060	–
	1/4	3	1 1/8	0.010	6	3943L.025010	–
	1/4	3	1 1/8	0.015	6	3943L.025015	–
	1/4	3	1 1/8	0.020	6	3943L.025020	–
	1/4	3	1 1/8	0.030	6	3943L.025030	–
	1/4	3	1 1/8	0.060	6	3943L.025060	–
	3/8	2 1/2	5/8	0.010	6	3941L.037010	–
	3/8	2 1/2	5/8	0.015	6	3941L.037015	–
	3/8	2 1/2	5/8	0.020	6	3941L.037020	–
	3/8	2 1/2	5/8	0.030	6	3941L.037030	–
	3/8	2 1/2	5/8	0.060	6	3941L.037060	–
	3/8	2 1/2	5/8	0.090	6	3941L.037090	–
	3/8	2 3/4	7/8	0.010	6	2947L.037010	–
	3/8	2 3/4	7/8	0.015	6	2947L.037015	–
3/8	3/8	2 3/4	7/8	0.020	6	2947L.037020	–
	3/8	2 3/4	7/8	0.030	6	2947L.037030	–
	3/8	2 3/4	7/8	0.060	6	2947L.037060	–
	3/8	2 3/4	7/8	0.090	6	2947L.037090	–
	3/8	3	1 1/8	0.010	6	3943L.037010	–
	3/8	3	1 1/8	0.015	6	3943L.037015	–
	3/8	3	1 1/8	0.020	6	3943L.037020	–
	3/8	3	1 1/8	0.030	6	3943L.037030	–
	3/8	3	1 1/8	0.060	6	3943L.037060	–
	3/8	3	1 1/8	0.090	6	3943L.037090	–
	1/2	2 3/4	5/8	0.010	6	3941L.050010	3942L.050010
	1/2	2 3/4	5/8	0.015	6	3941L.050015	3942L.050015
	1/2	2 3/4	5/8	0.020	6	3941L.050020	3942L.050020
	1/2	2 3/4	5/8	0.030	6	3941L.050030	3942L.050030
	1/2	2 3/4	5/8	0.060	6	3941L.050060	3942L.050060
	1/2	2 3/4	5/8	0.090	6	3941L.050090	3942L.050090
	1/2	2 3/4	5/8	0.120	6	3941L.050120	3942L.050120
	1/2	3	1	0.010	6	2947L.050010	3909L.050010
	1/2	3	1	0.015	6	2947L.050015	3909L.050015
1/2	1/2	3	1	0.020	6	2947L.050020	3909L.050020
	1/2	3	1	0.030	6	2947L.050030	3909L.050030
	1/2	3	1	0.060	6	2947L.050060	3909L.050060
	1/2	3	1	0.090	6	2947L.050090	3909L.050090
	1/2	3	1	0.120	6	2947L.050120	3909L.050120
	1/2	3 1/4	1 1/4	0.010	6	2947L.A50010	3909L.A50010
	1/2	3 1/4	1 1/4	0.015	6	2947L.A50015	3909L.A50015
	1/2	3 1/4	1 1/4	0.020	6	2947L.A50020	3909L.A50020
	1/2	3 1/4	1 1/4	0.030	6	2947L.A50030	3909L.A50030
	1/2	3 1/4	1 1/4	0.060	6	2947L.A50060	3909L.A50060
	1/2	3 1/4	1 1/4	0.090	6	2947L.A50090	3909L.A50090

6 Flutes – Corner Radius – tool sizes continue on page 38

6 Flutes – Corner Radius (continued from page 37)





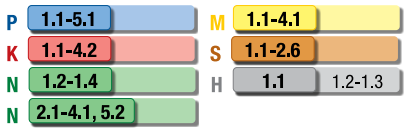
Icon descriptions (see page 228-229)

Applications

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

Cutting Data (see pages 148-150)

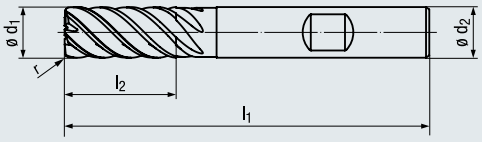
Materials - ISO Material Groups (see page 11)



Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
	1/2	3 1/4	1 1/4	0.120	6	2947L.A50120	3909L.A50120
	1/2	4 1/2	2	0.010	6	3943L.050010	3944L.050010
	1/2	4 1/2	2	0.015	6	3943L.050015	3944L.050015
1/2	1/2	4 1/2	2	0.020	6	3943L.050020	3944L.050020
	1/2	4 1/2	2	0.030	6	3943L.050030	3944L.050030
	1/2	4 1/2	2	0.060	6	3943L.050060	3944L.050060
	1/2	4 1/2	2	0.090	6	3943L.050090	3944L.050090
	1/2	4 1/2	2	0.120	6	3943L.050120	3944L.050120
	5/8	3	3/4	0.030	6	3941L.062030	3942L.062030
	5/8	3	3/4	0.060	6	3941L.062060	3942L.062060
	5/8	3	3/4	0.090	6	3941L.062090	3942L.062090
	5/8	3	3/4	0.120	6	3941L.062120	3942L.062120
	5/8	3 1/2	1 1/4	0.030	6	2947L.062030	3909L.062030
	5/8	3 1/2	1 1/4	0.060	6	2947L.062060	3909L.062060
	5/8	3 1/2	1 1/4	0.090	6	2947L.062090	3909L.062090
5/8	5/8	3 1/2	1 1/4	0.120	6	2947L.062120	3909L.062120
	5/8	4	1 7/8	0.030	6	2947L.A62030	3909L.A62030
	5/8	4	1 7/8	0.060	6	2947L.A62060	3909L.A62060
	5/8	4	1 7/8	0.090	6	2947L.A62090	3909L.A62090
	5/8	4	1 7/8	0.120	6	2947L.A62120	3909L.A62120
	5/8	4 3/4	2 1/4	0.030	6	3943L.062030	3944L.062030
	5/8	4 3/4	2 1/4	0.060	6	3943L.062060	3944L.062060
	5/8	4 3/4	2 1/4	0.090	6	3943L.062090	3944L.062090
	5/8	4 3/4	2 1/4	0.120	6	3943L.062120	3944L.062120
	3/4	3 1/2	1	0.015	6	3941L.075015	3942L.075015
	3/4	3 1/2	1	0.020	6	3941L.075020	3942L.075020
	3/4	3 1/2	1	0.030	6	3941L.075030	3942L.075030
	3/4	3 1/2	1	0.060	6	3941L.075060	3942L.075060
	3/4	3 1/2	1	0.090	6	3941L.075090	3942L.075090
	3/4	3 1/2	1	0.120	6	3941L.075120	3942L.075120
	3/4	3 1/2	1	0.190	6	3941L.075190	3942L.075190
	3/4	3 1/2	1	0.250	6	3941L.075250	3942L.075250
	3/4	4	1 1/2	0.015	6	2947L.075015	3909L.075015
	3/4	4	1 1/2	0.020	6	2947L.075020	3909L.075020
	3/4	4	1 1/2	0.030	6	2947L.075030	3909L.075030
3/4	3/4	4	1 1/2	0.060	6	2947L.075060	3909L.075060
	3/4	4	1 1/2	0.090	6	2947L.075090	3909L.075090
	3/4	4	1 1/2	0.120	6	2947L.075120	3909L.075120
	3/4	4	1 1/2	0.190	6	2947L.075190	3909L.075190
	3/4	4	1 1/2	0.250	6	2947L.075250	3909L.075250
	3/4	5	2 1/4	0.015	6	3943L.075015	3944L.075015
	3/4	5	2 1/4	0.020	6	3943L.075020	3944L.075020
	3/4	5	2 1/4	0.030	6	3943L.075030	3944L.075030
	3/4	5	2 1/4	0.060	6	3943L.075060	3944L.075060
	3/4	5	2 1/4	0.090	6	3943L.075090	3944L.075090
	3/4	5	2 1/4	0.120	6	3943L.075120	3944L.075120
	3/4	5	2 1/4	0.190	6	3943L.075190	3944L.075190
	3/4	5	2 1/4	0.250	6	3943L.075250	3944L.075250
	1	4	1	0.030	6	3941L.100030	3942L.100030
	1	4	1	0.060	6	3941L.100060	3942L.100060
	1	4	1	0.090	6	3941L.100090	3942L.100090
	1	4	1	0.120	6	3941L.100120	3942L.100120
	1	5	2	0.030	6	2947L.100030	3909L.100030
1	1	5	2	0.060	6	2947L.100060	3909L.100060
	1	5	2	0.090	6	2947L.100090	3909L.100090
	1	5	2	0.120	6	2947L.100120	3909L.100120
	1	6	3	0.030	6	3943L.100030	3944L.100030
	1	6	3	0.060	6	3943L.100060	3944L.100060
	1	6	3	0.090	6	3943L.100090	3944L.100090
	1	6	3	0.120	6	3943L.100120	3944L.100120

7 Flutes – Corner Radius

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



N

ASME

38-39°

CR

Icon descriptions
(see page 228-229)

Applications

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

Cutting Data (see pages 151-153)

Materials - ISO Material Groups (see page 11)

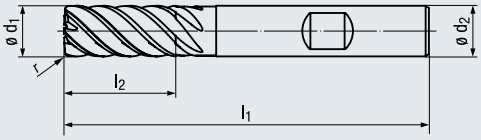
P 1.1-5.1 | M 1.1-4.1
K 1.1-4.2 | S 1.1-2.6
N 1.2-1.4 | H 1.1 1.2-1.3
N 2.1-4.1, 5.2

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
	1/4	2	1/2	0.010	7	3935L.025010	–
	1/4	2	1/2	0.015	7	3935L.025015	–
	1/4	2	1/2	0.020	7	3935L.025020	–
	1/4	2	1/2	0.030	7	3935L.025030	–
	1/4	2	1/2	0.060	7	3935L.025060	–
	1/4	2 1/2	3/4	0.010	7	3937L.025010	–
1/4	1/4	2 1/2	3/4	0.015	7	3937L.025015	–
	1/4	2 1/2	3/4	0.020	7	3937L.025020	–
	1/4	2 1/2	3/4	0.030	7	3937L.025030	–
	1/4	2 1/2	3/4	0.060	7	3937L.025060	–
	1/4	3	1 1/8	0.010	7	3939L.025010	–
	1/4	3	1 1/8	0.015	7	3939L.025015	–
	1/4	3	1 1/8	0.020	7	3939L.025020	–
	1/4	3	1 1/8	0.030	7	3939L.025030	–
	1/4	3	1 1/8	0.060	7	3939L.025060	–
	3/8	2 1/2	5/8	0.010	7	3935L.037010	–
	3/8	2 1/2	5/8	0.015	7	3935L.037015	–
	3/8	2 1/2	5/8	0.020	7	3935L.037020	–
	3/8	2 1/2	5/8	0.030	7	3935L.037030	–
	3/8	2 1/2	5/8	0.060	7	3935L.037060	–
	3/8	2 1/2	5/8	0.090	7	3935L.037090	–
	3/8	2 3/4	7/8	0.010	7	3937L.037010	–
	3/8	2 3/4	7/8	0.015	7	3937L.037015	–
3/8	3/8	2 3/4	7/8	0.020	7	3937L.037020	–
	3/8	2 3/4	7/8	0.030	7	3937L.037030	–
	3/8	2 3/4	7/8	0.060	7	3937L.037060	–
	3/8	2 3/4	7/8	0.090	7	3937L.037090	–
	3/8	3	1 1/8	0.010	7	3939L.037010	–
	3/8	3	1 1/8	0.015	7	3939L.037015	–
	3/8	3	1 1/8	0.020	7	3939L.037020	–
	3/8	3	1 1/8	0.030	7	3939L.037030	–
	3/8	3	1 1/8	0.060	7	3939L.037060	–
	3/8	3	1 1/8	0.090	7	3939L.037090	–
	1/2	2 3/4	5/8	0.010	7	3935L.050010	3936L.050010
	1/2	2 3/4	5/8	0.015	7	3935L.050015	3936L.050015
	1/2	2 3/4	5/8	0.020	7	3935L.050020	3936L.050020
	1/2	2 3/4	5/8	0.030	7	3935L.050030	3936L.050030
	1/2	2 3/4	5/8	0.060	7	3935L.050060	3936L.050060
	1/2	2 3/4	5/8	0.090	7	3935L.050090	3936L.050090
1/2	1/2	2 3/4	5/8	0.120	7	3935L.050120	3936L.050120
	1/2	3	1	0.010	7	3937L.050010	3938L.050010
	1/2	3	1	0.015	7	3937L.050015	3938L.050015
	1/2	3	1	0.020	7	3937L.050020	3938L.050020
	1/2	3	1	0.030	7	3937L.050030	3938L.050030
	1/2	3	1	0.060	7	3937L.050060	3938L.050060
	1/2	3	1	0.090	7	3937L.050090	3938L.050090
	1/2	3	1	0.120	7	3937L.050120	3938L.050120

7 Flutes – Corner Radius – tool sizes continue on page 40

7 Flutes – Corner Radius (continued from page 39)

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



N

ASME

38-39°

CR

Icon descriptions
(see page 228-229)

Applications

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

Cutting Data (see pages 151-153)

Materials - ISO Material Groups (see page 11)

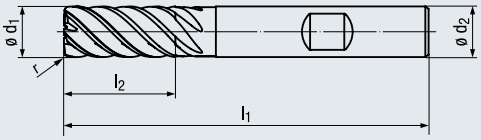
P 1.1-5.1 M 1.1-4.1
K 1.1-4.2 S 1.1-2.6
N 1.2-1.4 H 1.1 1.2-1.3
N 2.1-4.1, 5.2

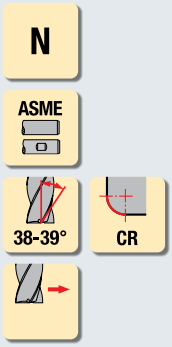
Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/2	1/2	3 1/4	1 1/4	0.010	7	3937L.A50010	3938L.A50010
	1/2	3 1/4	1 1/4	0.015	7	3937L.A50015	3938L.A50015
	1/2	3 1/4	1 1/4	0.020	7	3937L.A50020	3938L.A50020
	1/2	3 1/4	1 1/4	0.030	7	3937L.A50030	3938L.A50030
	1/2	3 1/4	1 1/4	0.060	7	3937L.A50060	3938L.A50060
	1/2	3 1/4	1 1/4	0.090	7	3937L.A50090	3938L.A50090
	1/2	3 1/4	1 1/4	0.120	7	3937L.A50120	3938L.A50120
	1/2	4 1/2	2	0.010	7	3939L.050010	3940L.050010
	1/2	4 1/2	2	0.015	7	3939L.050015	3940L.050015
	1/2	4 1/2	2	0.020	7	3939L.050020	3940L.050020
	1/2	4 1/2	2	0.030	7	3939L.050030	3940L.050030
	1/2	4 1/2	2	0.060	7	3939L.050060	3940L.050060
	1/2	4 1/2	2	0.090	7	3939L.050090	3940L.050090
	1/2	4 1/2	2	0.120	7	3939L.050120	3940L.050120
5/8	5/8	3	3/4	0.030	7	3935L.062030	3936L.062030
	5/8	3	3/4	0.060	7	3935L.062060	3936L.062060
	5/8	3	3/4	0.090	7	3935L.062090	3936L.062090
	5/8	3	3/4	0.120	7	3935L.062120	3936L.062120
	5/8	3 1/2	1 1/4	0.030	7	3937L.062030	3938L.062030
	5/8	3 1/2	1 1/4	0.060	7	3937L.062060	3938L.062060
	5/8	3 1/2	1 1/4	0.090	7	3937L.062090	3938L.062090
	5/8	3 1/2	1 1/4	0.120	7	3937L.062120	3938L.062120
	5/8	4	1 5/8	0.030	7	3937L.A62030	3938L.A62030
	5/8	4	1 5/8	0.060	7	3937L.A62060	3938L.A62060
	5/8	4	1 5/8	0.090	7	3937L.A62090	3938L.A62090
	5/8	4	1 5/8	0.120	7	3937L.A62120	3938L.A62120
	5/8	4	1 7/8	0.030	7	3937L.B62030	3938L.B62030
	5/8	4	1 7/8	0.060	7	3937L.B62060	3938L.B62060
	5/8	4	1 7/8	0.090	7	3937L.B62090	3938L.B62090
	5/8	4	1 7/8	0.120	7	3937L.B62120	3938L.B62120
	5/8	4 3/4	2 1/4	0.030	7	3939L.062030	3940L.062030
	5/8	4 3/4	2 1/4	0.060	7	3939L.062060	3940L.062060
	5/8	4 3/4	2 1/4	0.090	7	3939L.062090	3940L.062090
	5/8	4 3/4	2 1/4	0.120	7	3939L.062120	3940L.062120
3/4	3/4	3 1/2	1	0.015	7	3935L.075015	3936L.075015
	3/4	3 1/2	1	0.020	7	3935L.075020	3936L.075020
	3/4	3 1/2	1	0.030	7	3935L.075030	3936L.075030
	3/4	3 1/2	1	0.060	7	3935L.075060	3936L.075060
	3/4	3 1/2	1	0.090	7	3935L.075090	3936L.075090
	3/4	3 1/2	1	0.120	7	3935L.075120	3936L.075120
	3/4	3 1/2	1	0.190	7	3935L.075190	3936L.075190
	3/4	3 1/2	1	0.250	7	3935L.075250	3936L.075250

7 Flutes – Corner Radius – tool sizes continue on page 41

7 Flutes – Corner Radius (continued from page 40)

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





Icon descriptions (see page 228-229)

Applications

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

Cutting Data (see pages 151-153)

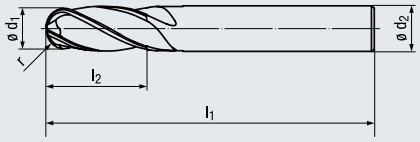
Materials - ISO Material Groups (see page 11)

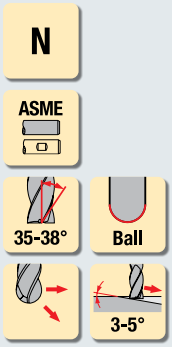
P 1.1-5.1 | M 1.1-4.1
K 1.1-4.2 | S 1.1-2.6
N 1.2-1.4 | H 1.1 1.2-1.3
N 2.1-4.1, 5.2

Cutter Dia.	Shank Dia.	Overall Length	Length of Cut		Coating	ALCR	
ø d_1 h10	ø d_2 h6	l_1	l_2	Radius	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3/4	3/4	4	1 1/2	0.015	7	3937L.075015	3938L.075015
	3/4	4	1 1/2	0.020	7	3937L.075020	3938L.075020
	3/4	4	1 1/2	0.030	7	3937L.075030	3938L.075030
	3/4	4	1 1/2	0.060	7	3937L.075060	3938L.075060
	3/4	4	1 1/2	0.090	7	3937L.075090	3938L.075090
	3/4	4	1 1/2	0.120	7	3937L.075120	3938L.075120
	3/4	4	1 1/2	0.190	7	3937L.075190	3938L.075190
	3/4	4	1 1/2	0.250	7	3937L.075250	3938L.075250
	3/4	5	1 7/8	0.015	7	3937L.A75015	3938L.A75015
	3/4	5	1 7/8	0.020	7	3937L.A75020	3938L.A75020
	3/4	5	1 7/8	0.030	7	3937L.A75030	3938L.A75030
	3/4	5	1 7/8	0.060	7	3937L.A75060	3938L.A75060
	3/4	5	1 7/8	0.090	7	3937L.A75090	3938L.A75090
	3/4	5	1 7/8	0.120	7	3937L.A75120	3938L.A75120
	3/4	5	1 7/8	0.190	7	3937L.A75190	3938L.A75190
	3/4	5	1 7/8	0.250	7	3937L.A75250	3938L.A75250
	3/4	5	2 1/4	0.015	7	3939L.075015	3940L.075015
	3/4	5	2 1/4	0.020	7	3939L.075020	3940L.075020
	3/4	5	2 1/4	0.030	7	3939L.075030	3940L.075030
	3/4	5	2 1/4	0.060	7	3939L.075060	3940L.075060
	3/4	5	2 1/4	0.090	7	3939L.075090	3940L.075090
	3/4	5	2 1/4	0.120	7	3939L.075120	3940L.075120
	3/4	5	2 1/4	0.190	7	3939L.075190	3940L.075190
	3/4	5	2 1/4	0.250	7	3939L.075250	3940L.075250
1	1	4	1	0.030	7	3935L.100030	3936L.100030
	1	4	1	0.060	7	3935L.100060	3936L.100060
	1	4	1	0.090	7	3935L.100090	3936L.100090
	1	4	1	0.120	7	3935L.100120	3936L.100120
	1	5	2	0.030	7	3937L.100030	3938L.100030
	1	5	2	0.060	7	3937L.100060	3938L.100060
	1	5	2	0.090	7	3937L.100090	3938L.100090
	1	5	2	0.120	7	3937L.100120	3938L.100120
	1	6	3	0.030	7	3939L.100030	3940L.100030
	1	6	3	0.060	7	3939L.100060	3940L.100060
	1	6	3	0.090	7	3939L.100090	3940L.100090
	1	6	3	0.120	7	3939L.100120	3940L.100120

4 Flutes – Ball Nose

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





Icon descriptions
(see page 228-229)

Applications

- Ideal for most materials
- Suitable for high speed cutting and finishing

Cutting Data (see page 154)

Materials - ISO Material Groups (see page 11)

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

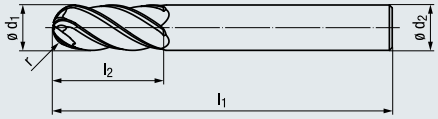
Cutter Dia.	Shank Dia.	Overall Length	Length of Cut	Coating	ALCR
ø d_1 h10	ø d_2 h6	l_1	l_2	# Flutes	Tool No. Straight Shank
1/8	1/8	1 1/2	1/4	4	2919L.0125
	1/8	1 1/2	3/8	4	2974L.0125
	1/8	2	3/8	4	2974L.A125
	1/8	2 1/4	3/4	4	3900L.0125
3/16	3/16	2	3/8	4	2919L.01875
	3/16	2	7/16	4	2974L.01875
	3/16	2	9/16	4	2974L.A1875
	3/16	2 1/2	3/4	4	3900L.01875
1/4	1/4	2	1/2	4	2919L.0250
	1/4	2 1/2	1/2	4	2974L.0250
	1/4	2 1/2	3/4	4	2974L.A250
	1/4	3	1 1/8	4	3900L.0250
5/16	5/16	2 1/4	1/2	4	2919L.03125
	5/16	2 1/2	13/16	4	2974L.03125
	5/16	3	1 1/8	4	3900L.03125
3/8	3/8	2 1/2	5/8	4	2919L.0375
	3/8	2 1/2	7/8	4	2974L.0375
	3/8	2 3/4	7/8	4	2974L.A375
	3/8	3	1 1/8	4	3900L.0375
7/16	7/16	2 1/2	5/8	4	2919L.04375
	7/16	2 3/4	1	4	2974L.04375
	7/16	4	2	4	3900L.04375
1/2	1/2	2 3/4	5/8	4	2919L.0500
	1/2	3	1	4	2974L.0500
	1/2	3	1 1/4	4	2974L.A500
	1/2	3 1/4	1 1/4	4	2974L.B500
	1/2	4 1/2	2	4	3900L.0500
5/8	5/8	3	3/4	4	2919L.0625
	5/8	3 1/2	1 1/4	4	2974L.0625
	5/8	4	1 7/8	4	2974L.A625
	5/8	4 3/4	2 1/4	4	3900L.0625
3/4	3/4	3 1/2	1	4	2919L.0750
	3/4	4	1 1/2	4	2974L.0750
	3/4	5	2 1/4	4	3900L.0750
1	1	4	1	4	2919L.1000
	1	5	2	4	2974L.1000
	1	6	3	4	3900L.1000

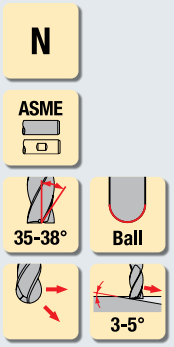
15-90° All cutting edges in operation

0-15° 2 cutting edges in operation

5 Flutes – Ball Nose

- Variable helix flutes
- Vibration dampening
- ALCR PVD coating
- Sub-micro grain carbide
- Center cutting





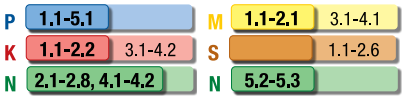
Icon descriptions
(see page 228-229)

Applications

- Ideal for most materials
- Suitable for high speed cutting and finishing

Cutting Data (see page 154)

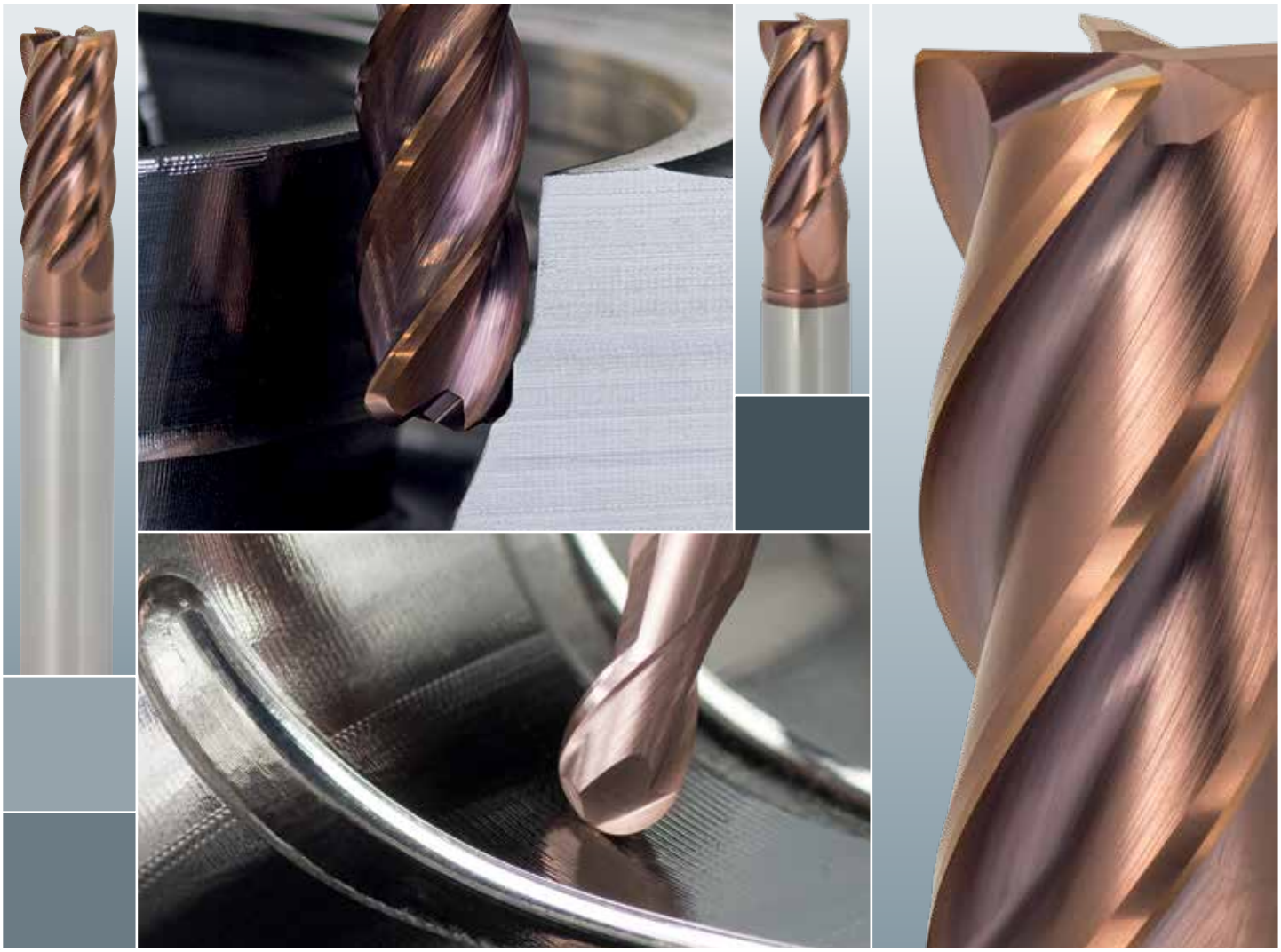
Materials - ISO Material Groups (see page 12)



Cutter Dia.	Shank Dia.	Overall Length	Length of Cut	Coating	ALCR
ø d_1 h10	ø d_2 h6	l_1	l_2	# Flutes	Tool No. Straight Shank
1/8	1/8	1 1/2	1/4	5	3949L.0125
	1/8	2	3/8	5	3950L.0125
	1/8	2 1/4	3/4	5	3951L.0125
3/16	3/16	2	3/8	5	3949L.01875
	3/16	2	9/16	5	3950L.01875
	3/16	2 1/2	3/4	5	3951L.01875
1/4	1/4	2	1/2	5	3949L.0250
	1/4	2 1/2	3/4	5	3950L.0250
	1/4	3	1 1/8	5	3951L.0250
5/16	5/16	2 1/4	9/16	5	3949L.03125
	5/16	2 1/2	13/16	5	3950L.03125
	5/16	3	1 1/8	5	3951L.03125
3/8	3/8	2 1/2	5/8	5	3949L.0375
	3/8	2 3/4	7/8	5	3950L.0375
	3/8	3	1 1/8	5	3951L.0375
1/2	1/2	2 3/4	5/8	5	3949L.0500
	1/2	3	1	5	3950L.0500
	1/2	3 1/4	1 1/4	5	3950L.A500
	1/2	4 1/2	2	5	3951L.0500
5/8	5/8	3	3/4	5	3949L.0625
	5/8	3 1/2	1 1/4	5	3950L.0625
	5/8	4	1 7/8	5	3950L.A625
	5/8	4 3/4	2 1/4	5	3951L.0625
3/4	3/4	3 1/2	1	5	3949L.0750
	3/4	4	1 1/2	5	3950L.0750
	3/4	5	2 1/4	5	3951L.0750
1	1	4	1	5	3949L.1000
	1	5	2	5	3950L.1000
	1	6	3	5	3951L.1000

TOP-Cut Metric High Performance End Mills

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.

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

German engineered
EMUGE-FRANKEN quality

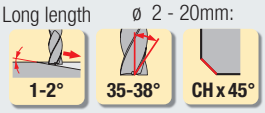
2 Flutes

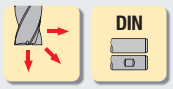
- Multi-functional, high performance tool
- Newly developed geometry
- Low vibration machining
- Center cutting

Icon descriptions (see pages 228-229)

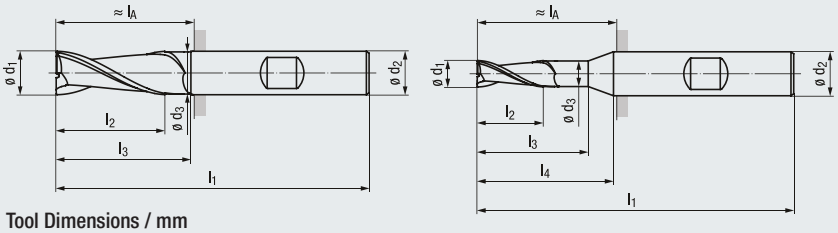
Stub length ø 0.3 - 1.8mm:

Long length ø 2 - 20mm:





Design l_4:



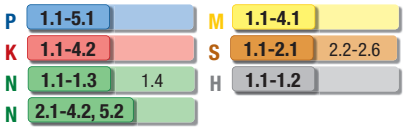
Tool Dimensions / mm

Applications

- For almost all materials
- Suitable for roughing and finishing

Cutting Data (see pages 155-157)

Materials - ISO Material Groups (see page 12)

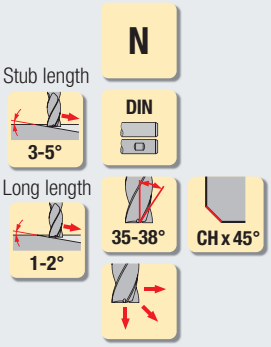


Coating TIALN

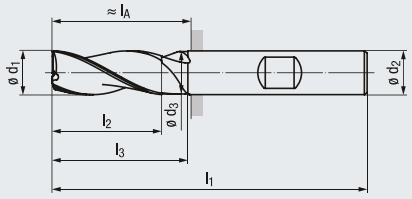
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
0.3	1	8	38	–	–	3	–	–	**2**	**2510A.0003**	**–**
0.5	1.5	9	38	–	–	3	–	–	**2**	**2510A.0005**	**–**
1	3	10	38	–	–	3	–	–	**2**	**2510A.001**	**–**
1.2	4	10	38	–	–	3	–	–	**2**	**2510A.0012**	**–**
1.3	4	10	38	–	–	3	–	–	**2**	**2510A.0013**	**–**
1.4	4	10	38	–	–	3	–	–	**2**	**2510A.0014**	**–**
1.5	4	10	38	–	–	3	–	–	**2**	**2510A.0015**	**–**
1.6	4	10	38	–	–	3	–	–	**2**	**2510A.0016**	**–**
1.8	5	10	38	–	–	3	–	–	**2**	**2510A.0018**	**–**
2	3	5	50	1.9	14	6	14	0.04	**2**	**2510A.002**	**2511A.002**
	6	8	57	1.9	20	6	21	0.04	**2**	**2512A.002**	**2513A.002**
2.5	3	5	50	2.4	14	6	14	0.07	**2**	**2510A.0025**	**2511A.0025**
2.8	4	7	50	2.7	14	6	14	0.07	**2**	**2510A.0028**	**2511A.0028**
3	4	7	50	2.9	14	6	14	0.07	**2**	**2510A.003**	**2511A.003**
	7	10	57	2.9	20	6	21	0.07	**2**	**2512A.003**	**2513A.003**
	9	12	62	2.9	23	6	26	0.07	**2**	**2514A.003**	**2515A.003**
3.5	4	7	50	3.3	14	6	14	0.07	**2**	**2510A.0035**	**2511A.0035**
3.8	5	9	54	3.6	18	6	18	0.07	**2**	**2510A.0038**	**2511A.0038**
4	5	9	54	3.8	18	6	18	0.07	**2**	**2510A.004**	**2511A.004**
	8	12	57	3.8	20	6	21	0.07	**2**	**2512A.004**	**2513A.004**
	12	16	62	3.8	25	6	26	0.07	**2**	**2514A.004**	**2515A.004**
4.5	5	9	54	4.3	18	6	18	0.12	**2**	**2510A.0045**	**2511A.0045**
4.8	6	11	54	4.6	18	6	18	0.12	**2**	**2510A.0048**	**2511A.0048**
5	6	11	54	4.8	18	6	18	0.12	**2**	**2510A.005**	**2511A.005**
	10	15	57	4.8	20	6	21	0.12	**2**	**2512A.005**	**2513A.005**
	15	20	62	4.8	25	6	26	0.12	**2**	**2514A.005**	**2515A.005**
5.75	7	16	54	5.55	–	6	18	0.12	**2**	**2510A.00575**	**2511A.00575**
6	7	16	54	5.8	–	6	18	0.12	**2**	**2510A.006**	**2511A.006**
	10	20	57	5.8	–	6	21	0.12	**2**	**2512A.006**	**2513A.006**
	18	25	62	5.8	–	6	26	0.12	**2**	**2514A.006**	**2515A.006**
7	8	18	58	6.7	20	8	22	0.12	**2**	**2510A.007**	**2511A.007**
	13	23	63	6.7	25	8	27	0.12	**2**	**2512A.007**	**2513A.007**
8	9	20	58	7.7	–	8	22	0.12	**2**	**2510A.008**	**2511A.008**
	16	25	63	7.7	–	8	27	0.12	**2**	**2512A.008**	**2513A.008**
	24	30	68	7.7	–	8	32	0.12	**2**	**2514A.008**	**2515A.008**
9	10	22	66	8.7	24	10	26	0.20	**2**	**2510A.009**	**2511A.009**
10	11	24	66	9.5	–	10	26	0.20	**2**	**2510A.010**	**2511A.010**
	19	30	72	9.5	–	10	32	0.20	**2**	**2512A.010**	**2513A.010**
	30	40	80	9.5	–	10	40	0.20	**2**	**2514A.010**	**2515A.010**
12	12	26	73	11.5	–	12	28	0.20	**2**	**2510A.012**	**2511A.012**
	22	35	83	11.5	–	12	38	0.20	**2**	**2512A.012**	**2513A.012**
	36	45	93	11.5	–	12	48	0.20	**2**	**2514A.012**	**2515A.012**
14	14	28	75	13.5	–	14	30	0.20	**2**	**2510A.014**	**2511A.014**
16	16	32	82	15.5	–	16	34	0.20	**2**	**2510A.016**	**2511A.016**
	26	40	92	15.5	–	16	44	0.20	**2**	**2512A.016**	**2513A.016**
	48	55	108	15.5	–	16	60	0.20	**2**	**2514A.016**	**2515A.016**
18	18	34	84	17.5	–	18	36	0.20	**2**	**2510A.018**	**2511A.018**
20	20	40	92	19.5	–	20	42	0.30	**2**	**2510A.020**	**2511A.020**
	32	50	104	19.5	–	20	54	0.30	**2**	**2512A.020**	**2513A.020**
	60	70	126	19.5	–	20	76	0.30	**2**	**2514A.020**	**2515A.020**

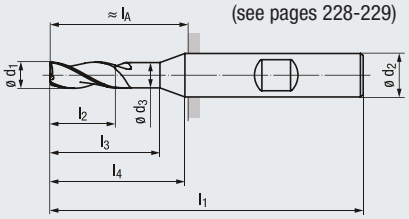
3 Flutes

- Multi-functional, high performance tool
- Newly developed geometry
- Variable helix flute design
- Low vibration machining
- Center cutting



Design l_4:





Icon descriptions (see pages 228-229)

Tool Dimensions / mm

Applications

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

Cutting Data (see pages 155-157)

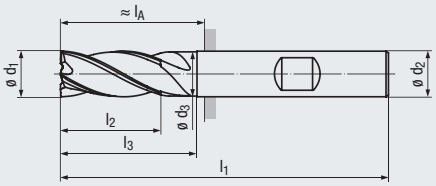
Materials - ISO Material Groups (see page 12)

P	1.1-5.1		M	1.1-4.1	
K	1.1-4.2		S	1.1	1.2-1.3
N	1.1-1.4		S	2.1	2.2-2.6
N	2.1-4.2, 5.2	4.1-4.2	H	1.1-1.2	

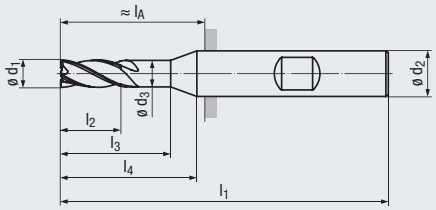
										Coating	TIALN	
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Chamfer	# Flutes		Tool No. Straight Shank	Tool No. Weldon Shank
1.5	3	–	50	–	14	6	14	0.40	**3**		**2516A.0015**	**2517A.0015**
2	3	5	50	1.9	14	6	14	0.40	**3**		**2516A.002**	**2517A.002**
	6	8	57	1.9	20	6	21	0.07	**3**		**2518A.002**	**2519A.002**
2.5	3	5	50	2.4	14	6	14	0.07	**3**		**2516A.0025**	**2517A.0025**
2.8	4	7	50	2.7	14	6	14	0.07	**3**		**2516A.0028**	**2517A.0028**
3	4	7	50	2.9	14	6	14	0.07	**3**		**2516A.003**	**2517A.003**
	7	10	57	2.9	20	6	21	0.07	**3**		**2518A.003**	**2519A.003**
	9	12	62	2.9	23	6	26	0.07	**3**		**2520A.003**	**2521A.003**
3.5	4	7	50	3.3	14	6	14	0.07	**3**		**2516A.0035**	**2517A.0035**
3.8	5	9	54	3.6	18	6	18	0.07	**3**		**2516A.0038**	**2517A.0038**
4	5	9	54	3.8	18	6	18	0.07	**3**		**2516A.004**	**2517A.004**
	8	12	57	3.8	20	6	21	0.07	**3**		**2518A.004**	**2519A.004**
	12	16	62	3.8	25	6	26	0.07	**3**		**2520A.004**	**2521A.004**
4.5	5	9	54	4.3	18	6	18	0.12	**3**		**2516A.0045**	**2517A.0045**
4.8	6	11	54	4.6	18	6	18	0.12	**3**		**2516A.0048**	**2517A.0048**
5	6	11	54	4.8	18	6	18	0.12	**3**		**2516A.005**	**2517A.005**
	10	15	57	4.8	20	6	21	0.12	**3**		**2518A.005**	**2519A.005**
	15	20	62	4.8	25	6	26	0.12	**3**		**2520A.005**	**2521A.005**
5.5	7	12	54	5.3	18	6	18	0.12	**3**		**2516A.0055**	**2517A.0055**
5.75	7	16	54	5.55	18	6	18	0.12	**3**		**2516A.00575**	**2517A.00575**
6	7	16	54	5.8	–	6	18	0.12	**3**		**2516A.006**	**2517A.006**
	10	20	57	5.8	–	6	21	0.12	**3**		**2518A.006**	**2519A.006**
	18	25	62	5.8	–	6	26	0.12	**3**		**2520A.006**	**2521A.006**
7	13	23	63	6.7	25	8	27	0.12	**3**		**2518A.007**	**2519A.007**
7.75	9	18	58	7.45	20	8	22	0.12	**3**		**2516A.00775**	**2517A.00775**
8	9	20	58	7.7	–	8	22	0.12	**3**		**2516A.008**	**2517A.008**
	16	25	63	7.7	–	8	27	0.12	**3**		**2518A.008**	**2519A.008**
	24	30	68	7.7	–	8	32	0.12	**3**		**2520A.008**	**2521A.008**
9.7	11	22	66	9.4	24	10	26	0.20	**3**		**2516A.0097**	**2517A.0097**
10	11	24	66	9.5	–	10	26	0.20	**3**		**2516A.010**	**2517A.010**
	19	30	72	9.5	–	10	32	0.20	**3**		**2518A.010**	**2519A.010**
	30	40	80	9.5	–	10	40	0.20	**3**		**2520A.010**	**2521A.010**
11.7	12	24	73	11.2	26	12	28	0.20	**3**		**2516A.0117**	**2517A.0117**
12	12	26	73	11.5	–	12	28	0.20	**3**		**2516A.012**	**2517A.012**
	22	35	83	11.5	–	12	38	0.20	**3**		**2518A.012**	**2519A.012**
	36	45	93	11.5	–	12	48	0.20	**3**		**2520A.012**	**2521A.012**
16	16	32	82	15.5	–	16	34	0.20	**3**		**2516A.016**	**2517A.016**
	26	40	92	15.5	–	16	44	0.20	**3**		**2518A.016**	**2519A.016**
	48	55	108	15.5	–	16	60	0.20	**3**		**2520A.016**	**2521A.016**
20	20	40	92	19.5	–	20	42	0.30	**3**		**2516A.020**	**2517A.020**
	32	50	104	19.5	–	20	54	0.30	**3**		**2518A.020**	**2519A.020**
	60	70	126	19.5	–	20	76	0.30	**3**		**2520A.020**	**2521A.020**

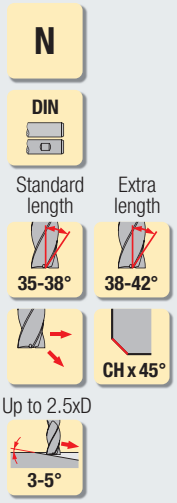
4 Flutes

- Multi-functional, high performance tool
- Newly developed geometry
- Variable helix flute design
- Low vibration machining
- Center cutting



Design l_4:





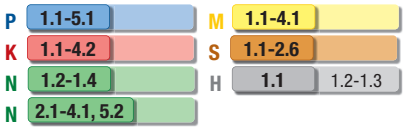
Icon descriptions (see pages 228-229)

Applications

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

Cutting Data (see pages 155-157)

Materials - ISO Material Groups (see page 12)

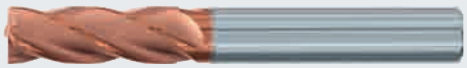


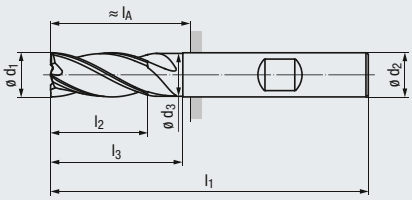
Tool Dimensions / mm

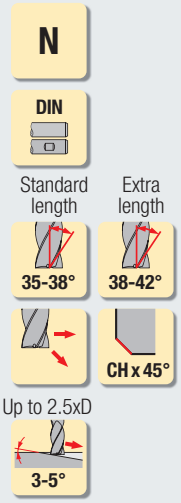
									Coating	TIALN	
ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
3	5	9	50	2.9	14	6	14	0.07	**4**	**1916A.003**	**1917A.003**
	8	14	57	2.9	20	6	21	0.07	**4**	**1998A.003**	**1999A.003**
	9	12	62	2.9	23	6	26	0.07	**4**	**2526A.003**	**2527A.003**
4	8	12	54	3.8	18	6	18	0.07	**4**	**1916A.004**	**1917A.004**
	11	18	57	3.8	20	6	21	0.07	**4**	**1998A.004**	**1999A.004**
	12	16	62	3.8	25	6	26	0.07	**4**	**2526A.004**	**2527A.004**
5	9	16	54	4.8	18	6	18	0.07	**4**	**1916A.005**	**1917A.005**
	13	19	57	4.8	20	6	21	0.12	**4**	**1998A.005**	**1999A.005**
	15	20	62	4.8	25	6	26	0.12	**4**	**2526A.005**	**2527A.005**
6	10	16	54	5.8	–	6	18	0.12	**4**	**1916A.006**	**1917A.006**
	13	20	57	5.8	–	6	21	0.12	**4**	**1998A.006**	**1999A.006**
	18	25	62	5.8	–	6	26	0.12	**4**	**2526A.006**	**2527A.006**
	24	30	68	5.8	–	6	32	0.12	**4**	**2528A.006**	**2529A.006**
8	12	20	58	7.7	–	8	22	0.12	**4**	**1916A.008**	**1917A.008**
	19	25	63	7.7	–	8	27	0.12	**4**	**1998A.008**	**1999A.008**
10	15	24	66	9.5	–	10	26	0.20	**4**	**1916A.010**	**1917A.010**
	22	30	72	9.5	–	10	32	0.20	**4**	**1998A.010**	**1999A.010**
12	18	26	73	11.5	–	12	28	0.20	**4**	**1916A.012**	**1917A.012**
	26	35	83	11.5	–	12	38	0.20	**4**	**1998A.012**	**1999A.012**
16	24	32	82	15.5	–	16	34	0.20	**4**	**1916A.016**	**1917A.016**
	32	40	92	15.5	–	16	44	0.20	**4**	**1998A.016**	**1999A.016**
18	27	34	84	17.5	–	18	36	0.20	**4**	**1916A.018**	**1917A.018**
	32	50	100	17.5	–	18	52	0.20	**4**	**1998A.018**	**1999A.018**
20	30	40	92	19.5	–	20	42	0.30	**4**	**1916A.020**	**1917A.020**
	38	50	104	19.5	–	20	54	0.30	**4**	**1998A.020**	**1999A.020**

5 Flutes

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







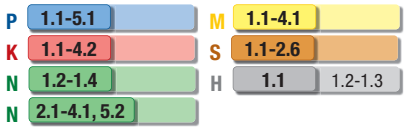
Icon descriptions (see pages 228-229)

Applications

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

Cutting Data (see pages 156-157)

Materials - ISO Material Groups (see page 13)

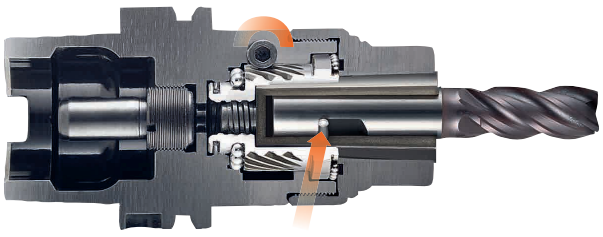


Tool Dimensions / mm

ø d_1 h10	l_2	l_3	l_1	ø d_3	ø d_2 h6	l_A	Chamfer	# Flutes	Coating: TIALN — Tool No. Straight Shank	Tool No. Weldon Shank
8	19	25	63	7.7	8	27	0.12	5	1998A.008005	1999A.008005
	24	30	68	7.7	8	32	0.12	5	2526A.008	2527A.008
	32	40	80	7.7	8	44	0.12	5	2528A.008	2529A.008
10	22	30	72	9.5	10	32	0.20	5	1998A.010005	1999A.010005
	30	35	80	9.5	10	40	0.20	5	2526A.010	2527A.010
	40	50	95	9.5	10	55	0.20	5	2528A.010	2529A.010
12	26	35	83	11.5	12	38	0.20	5	1998A.012005	1999A.012005
	36	45	93	11.5	12	48	0.20	5	2526A.012	2527A.012
	48	60	107	11.5	12	62	0.20	5	2528A.012	2529A.012
14	26	35	83	13.5	14	38	0.20	5	1998A.014005	1999A.014005
16	32	40	92	15.5	16	44	0.20	5	1998A.016005	1999A.016005
	48	60	112	15.5	16	64	0.20	5	2526A.016	2527A.016
	64	75	128	15.5	16	80	0.20	5	2528A.016	2529A.016
18	32	50	100	17.5	18	52	0.20	5	1998A.018005	1999A.018005
20	38	50	104	19.5	20	54	0.30	5	1998A.020005	1999A.020005
	60	75	130	19.5	20	80	0.30	5	2526A.020	2527A.020
	80	90	150	19.5	20	100	0.30	5	2528A.020	2529A.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.

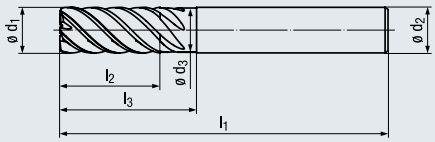
World's only chuck with 1:16 worm gear, a patented design delivering 3 tons of traction force.

Maximum dampening collet-cone assembly absorbs virtually all vibration.

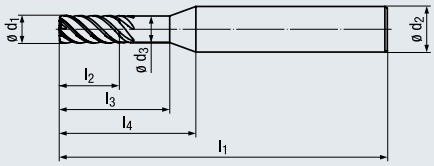
High rigidity patented design and body provides 100% holding power.

6-8 Flutes

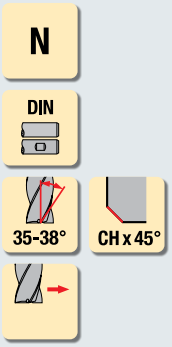
- Multi-functional, high performance tool
- Variable helix flute design
- Higher flute count for improved surface finish
- Low-vibration machining
- Flute length up to 3 x d_1



Design l_4:



Tool Dimensions / mm



Icon descriptions
(see pages 228-229)

Applications

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

Cutting Data
(see pages 156-157)

Materials - ISO Material Groups (see page 13)

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

Cutting Data
(see pages 156-157}

Materials - ISO Material Groups (see page 13)

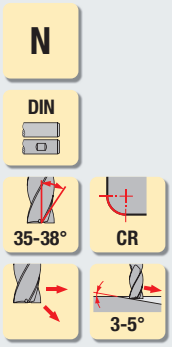
P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-2.1	2.2
K	3.1-4.1	4.2
N	1.1-1.4	1.5-1.6
N	2.1-2.8	5.2
S	1.1-2.2	2.3
S	2.4	2.5-2.6

Longer Length

										Coating	TIALN		TIALN	
ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Chamfer	# Flutes		Tool No. Straight Shank	Tool No. Weldon Shank	Tool No. Straight Shank	Tool No. Weldon Shank
5	13	18	57	4.8	20	6	21	0.12	**6**		**2522A.005**	**2523A.005**		
6	13	20	57	5.8	–	6	21	0.12	**6**		**2522A.006**	**2523A.006**		
	18	25	62	5.8	–	6	26	0.12	**6**				**2524A.006**	**2525A.006**
8	19	25	63	7.7	–	8	27	0.12	**6**		**2522A.008**	**2523A.008**		
	24	30	68	7.7	–	8	32	0.12	**6**				**2524A.008**	**2525A.008**
10	22	30	72	9.7	–	10	32	0.20	**6**		**2522A.010**	**2523A.010**		
	30	35	80	9.7	–	10	40	0.20	**6**				**2524A.010**	**2525A.010**
12	26	35	83	11.6	–	12	38	0.20	**6**		**2522A.012**	**2523A.012**		
	36	45	93	11.6	–	12	48	0.20	**6**				**2524A.012**	**2525A.012**
16	32	40	92	15.5	–	16	44	0.20	**6**		**2522A.016**	**2523A.016**		
	48	55	108	15.5	–	16	60	0.20	**6**				**2524A.016**	**2525A.016**
20	38	50	104	19.5	–	20	54	0.30	**8**		**2522A.020**	**2523A.020**		
	60	70	126	19.5	–	20	76	0.30	**8**				**2524A.020**	**2525A.020**

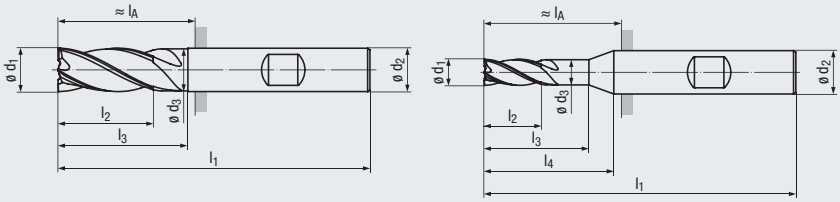
4 Flutes – Corner Radius

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



Icon descriptions (see pages 228-229)

Design l_4:



Tool Dimensions / mm

Applications

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

Cutting Data (see page 156)

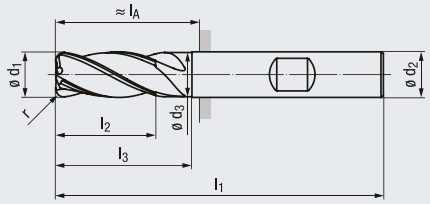
Materials - ISO Material Groups (see page 13)

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

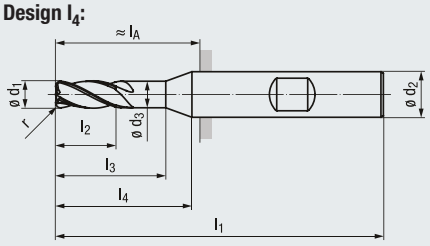
										Coating	TIALN	
ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Radius +/- 0.01	# Flutes		Tool No. Straight Shank	Tool No. Weldon Shank
3	8	14	57	2.9	20	6	21	0.1	4		2698A.003001	2699A.003001
	8	14	57	2.9	20	6	21	0.3	4		2698A.003003	2699A.003003
	8	14	57	2.9	20	6	21	0.5	4		2698A.003005	2699A.003005
4	11	18	57	3.8	20	6	21	0.1	4		2698A.004001	2699A.004001
	11	18	57	3.8	20	6	21	0.3	4		2698A.004003	2699A.004003
	11	18	57	3.8	20	6	21	0.4	4		2698A.004004	2699A.004004
	11	18	57	3.8	20	6	21	0.5	4		2698A.004005	2699A.004005
5	13	19	57	4.8	20	6	21	0.1	4		2698A.005001	2699A.005001
	13	19	57	4.8	20	6	21	0.3	4		2698A.005003	2699A.005003
	13	19	57	4.8	20	6	21	0.5	4		2698A.005005	2699A.005005
	13	19	57	4.8	20	6	21	1	4		2698A.005010	2699A.005010
6	13	20	57	5.8	–	6	21	0.1	4		2698A.006001	2699A.006001
	13	20	57	5.8	–	6	21	0.5	4		2698A.006005	2699A.006005
	13	20	57	5.8	–	6	21	0.8	4		2698A.006008	2699A.006008
	13	20	57	5.8	–	6	21	1	4		2698A.006010	2699A.006010
	13	20	57	5.8	–	6	21	1.5	4		2698A.006015	2699A.006015
8	19	25	63	7.7	–	8	27	0.15	4		2698A.008001	2699A.008001
	19	25	63	7.7	–	8	27	0.5	4		2698A.008005	2699A.008005
	19	25	63	7.7	–	8	27	1	4		2698A.008010	2699A.008010
	19	25	63	7.7	–	8	27	1.5	4		2698A.008015	2699A.008015
	19	25	63	7.7	–	8	27	2	4		2698A.008020	2699A.008020
10	22	30	72	9.5	–	10	32	0.15	4		2698A.010001	2699A.010001
	22	30	72	9.5	–	10	32	0.5	4		2698A.010005	2699A.010005
	22	30	72	9.5	–	10	32	1	4		2698A.010010	2699A.010010
	22	30	72	9.5	–	10	32	1.5	4		2698A.010015	2699A.010015
	22	30	72	9.5	–	10	32	2	4		2698A.010020	2699A.010020
	22	30	72	9.5	–	10	32	2.5	4		2698A.010025	2699A.010025
	22	30	72	9.5	–	10	32	3	4		2698A.010030	2699A.010030
12	26	35	83	11.5	–	12	38	0.2	4		2698A.012002	2699A.012002
	26	35	83	11.5	–	12	38	0.5	4		2698A.012005	2699A.012005
	26	35	83	11.5	–	12	38	1	4		2698A.012010	2699A.012010
	26	35	83	11.5	–	12	38	1.5	4		2698A.012015	2699A.012015
	26	35	83	11.5	–	12	38	2	4		2698A.012020	2699A.012020
	26	35	83	11.5	–	12	38	3	4		2698A.012030	2699A.012030
	26	35	83	11.5	–	12	38	4	4		2698A.012040	2699A.012040
14	26	35	83	13.5	–	14	38	1	4		2698A.014010	2699A.014010
16	32	40	92	15.5	–	16	44	0.3	4		2698A.016003	2699A.016003
	32	40	92	15.5	–	16	44	0.5	4		2698A.016005	2699A.016005
	32	40	92	15.5	–	16	44	1	4		2698A.016010	2699A.016010
	32	40	92	15.5	–	16	44	1.5	4		2698A.016015	2699A.016015
	32	40	92	15.5	–	16	44	2	4		2698A.016020	2699A.016020
	32	40	92	15.5	–	16	44	2.5	4		2698A.016025	2699A.016025
	32	40	92	15.5	–	16	44	3	4		2698A.016030	2699A.016030
	32	40	92	15.5	–	16	44	4	4		2698A.016040	2699A.016040
20	38	50	104	19.5	–	20	54	0.3	4		2698A.020003	2699A.020003
	38	50	104	19.5	–	20	54	0.5	4		2698A.020005	2699A.020005
	38	50	104	19.5	–	20	54	1	4		2698A.020010	2699A.020010
	38	50	104	19.5	–	20	54	1.5	4		2698A.020015	2699A.020015
	38	50	104	19.5	–	20	54	2	4		2698A.020020	2699A.020020
	38	50	104	19.5	–	20	54	2.5	4		2698A.020025	2699A.020025
	38	50	104	19.5	–	20	54	3	4		2698A.020030	2699A.020030

4 Flutes – Coolant Fed – Corner Radius

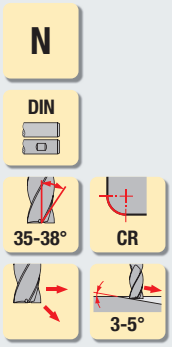
- Variable helix angle flutes
- Vibration dampening
- Corner radius feature
- TIALN PVD coating
- Sub-micro grain carbide
- Center cutting



Design l_4:



Tool Dimensions / mm



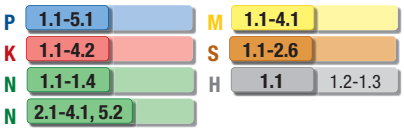
Icon descriptions
(see pages 228-229)

Applications

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

Cutting Data (see page 156)

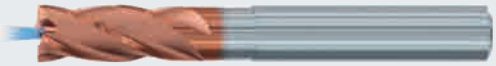
Materials - ISO Material Groups (see page 13)

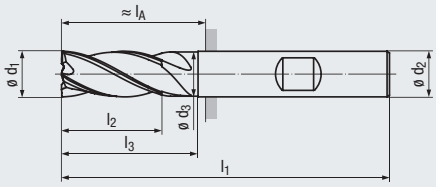


										Coating	TIALN	
ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Radius +/- 0.01	# Flutes		Tool No. Straight Shank	Tool No. Weldon Shank
3	8	14	57	2.9	20	6	21	0.3	4		2698AZ.003003	2699AZ.003003
	8	14	57	2.9	20	6	21	0.5	4		2698AZ.003005	2699AZ.003005
4	11	18	57	3.8	20	6	21	0.3	4		2698AZ.004003	2699AZ.004003
	11	18	57	3.8	20	6	21	0.5	4		2698AZ.004005	2699AZ.004005
5	13	19	57	4.8	20	6	21	0.3	4		2698AZ.005003	2699AZ.005003
	13	19	57	4.8	20	6	21	0.5	4		2698AZ.005005	2699AZ.005005
6	13	20	57	5.8	–	6	21	0.5	4		2698AZ.006005	2699AZ.006005
	13	20	57	5.8	–	6	21	1	4		2698AZ.006010	2699AZ.006010
	13	20	57	5.8	–	6	21	1.5	4		2698AZ.006015	2699AZ.006015
8	19	25	63	7.7	–	8	27	0.3	4		2698AZ.008003	2699AZ.008003
	19	25	63	7.7	–	8	27	0.5	4		2698AZ.008005	2699AZ.008005
	19	25	63	7.7	–	8	27	1	4		2698AZ.008010	2699AZ.008010
	19	25	63	7.7	–	8	27	1.5	4		2698AZ.008015	2699AZ.008015
	19	25	63	7.7	–	8	27	2	4		2698AZ.008020	2699AZ.008020
10	22	30	72	9.5	–	10	32	1	4		2698AZ.010010	2699AZ.010010
	22	30	72	9.5	–	10	32	1.5	4		2698AZ.010015	2699AZ.010015
	22	30	72	9.5	–	10	32	2	4		2698AZ.010020	2699AZ.010020
12	26	35	83	11.5	–	12	38	0.5	4		2698AZ.012005	2699AZ.012005
	26	35	83	11.5	–	12	38	0.9	4		2698AZ.012009	2699AZ.012009
	26	35	83	11.5	–	12	38	1	4		2698AZ.012010	2699AZ.012010
	26	35	83	11.5	–	12	38	1.5	4		2698AZ.012015	2699AZ.012015
	26	35	83	11.5	–	12	38	1.6	4		2698AZ.012016	2699AZ.012016
	26	35	83	11.5	–	12	38	2	4		2698AZ.012020	2699AZ.012020
	26	35	83	11.5	–	12	38	2.5	4		2698AZ.012025	2699AZ.012025
	26	35	83	11.5	–	12	38	3	4		2698AZ.012030	2699AZ.012030
	26	35	83	11.5	–	12	38	4	4		2698AZ.012040	2699AZ.012040
16	32	40	92	15.5	–	16	44	0.5	4		2698AZ.016005	2699AZ.016005
	32	40	92	15.5	–	16	44	1	4		2698AZ.016010	2699AZ.016010
	32	40	92	15.5	–	16	44	1.5	4		2698AZ.016015	2699AZ.016015
	32	40	92	15.5	–	16	44	2	4		2698AZ.016020	2699AZ.016020
	32	40	92	15.5	–	16	44	2.5	4		2698AZ.016025	2699AZ.016025
	32	40	92	15.5	–	16	44	3	4		2698AZ.016030	2699AZ.016030
	32	40	92	15.5	–	16	44	4	4		2698AZ.016040	2699AZ.016040
20	38	50	104	19.5	–	20	54	1	4		2698AZ.020010	2699AZ.020010
	38	50	104	19.5	–	20	54	1.5	4		2698AZ.020015	2699AZ.020015
	38	50	104	19.5	–	20	54	2	4		2698AZ.020020	2699AZ.020020
	38	50	104	19.5	–	20	54	2.5	4		2698AZ.020025	2699AZ.020025
	38	50	104	19.5	-	20	54	3	4		2698AZ.020030	2699AZ.020030
	38	50	104	19.5	–	20	54	4	4		2698AZ.020040	2699AZ.020040

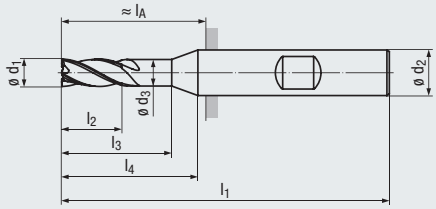
4 Flutes – Coolant Fed

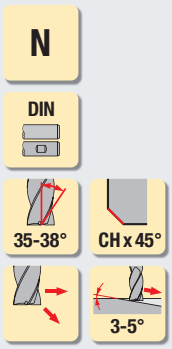
- Variable helix angle flutes
- Axial coolant hole for optimized chip evacuation
- With ENORM geometry
- Vibration dampening
- Corner radius feature
- TIALN PVD coating
- Sub-micro grain carbide





Design l_4:





Icon descriptions (see pages 228-229)

Note for series 3806AZ, 3807AZ, 3808AZ, 3809AZ

Applications

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

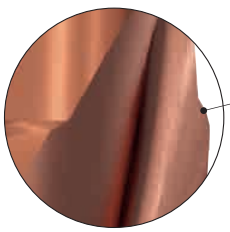
Cutting Data (see pages 156, 158-159)

Materials - ISO Material Groups (see page 13)

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

Tool Dimensions / mm

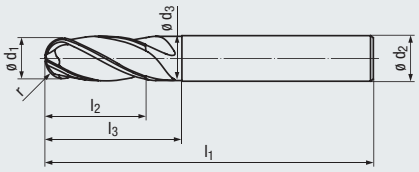
ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Chamfer	# Flutes	Coating TIALN Tool No. Straight Shank	Coating TIALN Tool No. Weldon Shank
3	8	14	57	2.9	20	6	21	0.07	4	1998AZ.003	1999AZ.003
	8	18	62	2.8	25	6	26	0.12	4	3808AZ.003	3809AZ.003
4	11	18	57	3.8	20	6	21	0.07	4	1998AZ.004	1999AZ.004
	11	24	62	3.8	25	6	26	0.12	4	3808AZ.004	3809AZ.004
5	13	19	57	4.8	20	6	21	0.12	4	1998AZ.005	1999AZ.005
	13	30	68	4.8	31	6	32	0.12	4	3808AZ.005	3809AZ.005
6	13	20	57	5.8	–	6	21	0.12	4	1998AZ.006	1999AZ.006
	13	25	62	5.8	–	6	26	0.12	4	3806AZ.006	3807AZ.006
	13	36	74	5.8	–	6	38	0.12	4	3808AZ.006	3809AZ.006
8	19	25	63	7.7	–	8	27	0.12	4	1998AZ.008	1999AZ.008
	19	30	68	7.7	–	8	32	0.12	4	3806AZ.008	3807AZ.008
	19	48	86	7.7	–	8	50	0.12	4	3808AZ.008	3809AZ.008
10	22	30	72	9.5	–	10	32	0.20	4	1998AZ.010	1999AZ.010
	22	38	80	9.5	–	10	40	0.20	4	3806AZ.010	3807AZ.010
	22	60	102	9.5	–	10	62	0.20	4	3808AZ.010	3809AZ.010
12	26	35	83	11.5	–	12	38	0.20	4	1998AZ.012	1999AZ.012
	26	46	93	11.5	–	12	48	0.20	4	3806AZ.012	3807AZ.012
	26	72	119	11.5	–	12	74	0.20	4	3808AZ.012	3809AZ.012
14	26	52	99	13.5	–	14	54	0.20	4	3806AZ.014	3807AZ.014
	26	84	131	13.5	–	14	86	0.20	4	3808AZ.014	3809AZ.014
16	32	40	92	15.5	–	16	44	0.20	4	1998AZ.016	1999AZ.016
	32	58	108	15.5	–	16	60	0.20	4	3806AZ.016	3807AZ.016
	32	96	146	15.5	–	16	98	0.20	4	3808AZ.016	3809AZ.016
18	32	68	118	17.5	–	18	70	0.20	4	3806AZ.018	3807AZ.018
	32	108	158	17.5	–	18	110	0.20	4	3808AZ.018	3809AZ.018
20	38	50	104	19.5	–	20	54	0.30	4	1998AZ.020	1999AZ.020
	38	74	126	19.5	–	20	76	0.30	4	3806AZ.020	3807AZ.020
	38	120	172	19.5	–	20	122	0.30	4	3808AZ.020	3809AZ.020



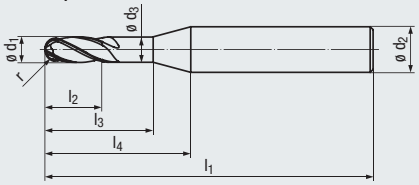
Transition radius from the peripheral cutting edge to the neck.
Axial infeeds produce stepless surfaces.

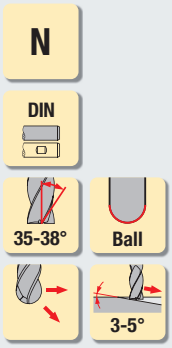
3-4 Flutes – Ball Nose

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



Design l_4:





Icon descriptions
(see pages 228-229)

Applications

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

Cutting Data (see pages 160-162)

Materials - ISO Material Groups (see page 14)

P	1.1-5.1		M	1.1-2.1	3.1-4.1
K	1.1-2.2	3.1-4.2	S		1.1-2.6
N	2.1-2.8, 4.1-4.2		H	1.1-1.2	
N	5.2-5.3				

Tool Dimensions / mm

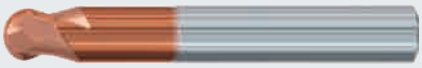
								Coating	TIALN	
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	Radius	# Flutes	Tool No. Straight Shank	
2	6	10	57	1.9	20	6	1	**3**	**2502A.002**	
3	5	9	50	2.9	14	6	1.5	**3**	**3840A.003**	
	8	14	57	2.9	20	6	1.5	**3**	**2502A.003**	
4	8	12	54	3.8	18	6	2	**3**	**3840A.004**	
	11	18	57	3.8	20	6	2	**3**	**2502A.004**	
5	9	16	54	4.8	18	6	2.5	**3**	**3840A.005**	
	13	19	57	4.8	20	6	2.5	**3**	**2502A.005**	
6	10	16	54	5.8	–	6	3	**4**	**3840A.006**	
	13	20	57	5.8	–	6	3	**4**	**2502A.006**	
	40	60	100	5.8	–	6	3	**4**	**2504A.006**	
8	12	20	58	7.7	–	8	4	**4**	**3840A.008**	
	19	25	63	7.7	–	8	4	**4**	**2502A.008**	
	40	60	100	7.7	–	8	4	**4**	**2504A.008**	
10	15	24	66	9.5	–	10	5	**4**	**3840A.010**	
	22	30	72	9.5	–	10	5	**4**	**2502A.010**	
	40	55	100	9.5	–	10	5	**4**	**2504A.010**	
12	18	26	73	11.5	–	12	6	**4**	**3840A.012**	
	26	35	83	11.5	–	12	6	**4**	**2502A.012**	
	45	50	100	11.5	–	12	6	**4**	**2504A.012**	
16	24	32	82	15.5	–	16	8	**4**	**3840A.016**	
	32	40	92	15.5	–	16	8	**4**	**2502A.016**	
	65	90	150	15.5	–	16	8	**4**	**2504A.016**	

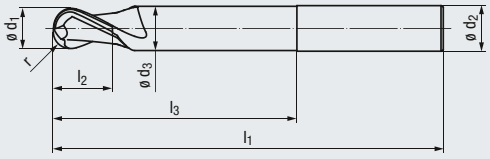
15-90° All cutting edges in operation

0-15° 2 cutting edges in operation

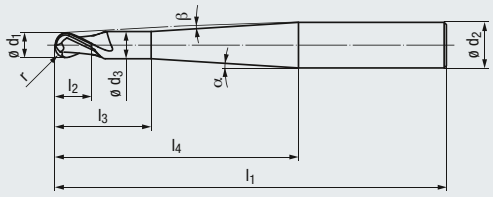
2 Flutes – Ball Nose – Mold & Die

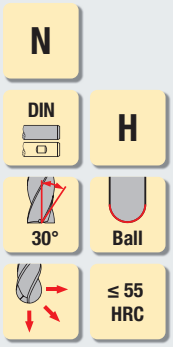
- Multi-functional, high performance tool
- Unique geometry for hardened materials found in the mold & die industry
- Optimized chisel edge
- 3 lengths available





Design l_4:





Icon descriptions (see pages 228-229)

Tool Dimensions / mm

Applications

- Ideal for almost all materials
- Suitable for roughing, finishing and HSC finishing

Cutting Data (see pages 163-165)

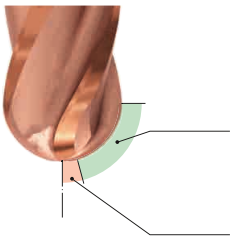
Materials - ISO Material Groups (see page 14)

P	1.1-5.1	M	1.1-4.1	
K	1.1-4.2	S	1.1-1.3	2.1-2.6
N	2.1-2.8, 5.2	1.2-1.4	H	1.1-1.2

For milling materials up to 66 HRC, see Hard-Cut end mills on page 85-86

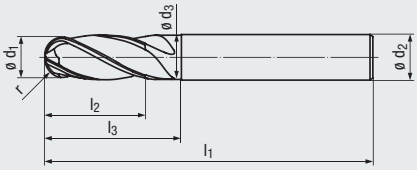
Coating: TIALN

ø d_1 -0.02	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	Radius -0.01	# Flutes	Tool No. Straight Shank
0.5	1	2	54	0.45	17.7	6	0.25	2	3820A.0005
	1	2.5	57	0.45	18.2	6	0.25	2	3821A.0005
	1	4	57	0.45	19.7	6	0.25	2	3822A.0005
1	2	4	57	0.95	18.3	6	0.5	2	3820A.001
	2	5	57	0.95	19.3	6	0.5	2	3821A.001
	2	8	60	0.95	22.3	6	0.5	2	3822A.001
1.5	2.5	4.5	57	1.4	17.5	6	0.75	2	3820A.0015
	2.5	7.5	57	1.4	20.5	6	0.75	2	3821A.0015
	2.5	12	63	1.4	25	6	0.75	2	3822A.0015
2	3	8	57	1.8	19.9	6	1	2	3820A.002
	3	10	63	1.8	21.9	6	1	2	3821A.002
	3	16	66	1.8	27.9	6	1	2	3822A.002
3	3.5	10	57	2.8	19	6	1.5	2	3820A.003
	3.5	15	63	2.8	24	6	1.5	2	3821A.003
	3.5	24	72	2.8	33	6	1.5	2	3822A.003
4	4	12	57	3.8	18.2	6	2	2	3820A.004
	4	20	63	3.8	26.2	6	2	2	3821A.004
	4	32	76	3.8	38.2	6	2	2	3822A.004
5	5	15	57	4.7	18.6	6	2.5	2	3820A.005
	5	25	66	4.7	28.6	6	2.5	2	3821A.005
	5	40	80	4.7	43.6	6	2.5	2	3822A.005
6	6	20	57	5.6	–	6	3	2	3820A.006
	6	30	68	5.6	–	6	3	2	3821A.006
	6	48	86	5.6	–	6	3	2	3822A.006
8	7	25	63	7.6	–	8	4	2	3820A.008
	7	40	78	7.6	–	8	4	2	3821A.008
	7	64	102	7.6	–	8	4	2	3822A.008
10	8	30	72	9.6	–	10	5	2	3820A.010
	8	50	92	9.6	–	10	5	2	3821A.010
12	10	36	83	11.5	–	12	6	2	3820A.012
	10	60	106	11.5	–	12	6	2	3821A.012

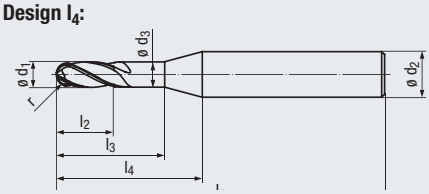


4 Flutes – Ball Nose – Mold & Die

- Multi-functional, high performance tool
- Unique geometry for hardened materials found in the mold & die industry
- 2 center cutting edges
- Optimized chisel edge
- 3 lengths available



Design l_4:



Tool Dimensions / mm

Icon descriptions
(see pages 228-229)

Applications

- Ideal for almost all materials
- Suitable for roughing, finishing and HSC finishing

Cutting Data (see pages 166-168)

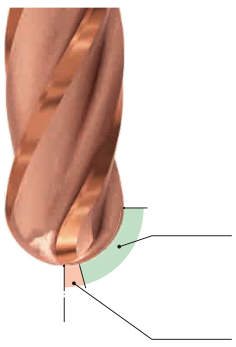
Materials - ISO Material Groups (see page 14)

P	1.1-5.1	M	1.1-4.1
K	1.1-4.2	S	1.1-2.6
N	2.1-2.8, 5.2 / 1.2-1.4	H	1.1-1.2

For milling materials up to 66 HRC,
see Hard-Cut end mills on page 85-86

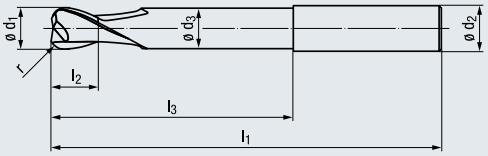
Coating: TIALN

ø d_1 -0.02	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	Radius -0.01	# Flutes	Tool No. Straight Shank
2	3	8	57	1.8	19.9	6	1	4	3823A.002
	3	10	63	1.8	21.9	6	1	4	3824A.002
	3	16	66	1.8	27.9	6	1	4	3825A.002
3	3.5	10	57	2.8	19	6	1.5	4	3823A.003
	3.5	15	63	2.8	24	6	1.5	4	3824A.003
	3.5	24	72	2.8	33	6	1.5	4	3825A.003
4	4	12	57	3.8	18.2	6	2	4	3823A.004
	4	20	63	3.8	26.2	6	2	4	3824A.004
	4	32	76	3.8	38.2	6	2	4	3825A.004
5	5	15	57	4.7	18.6	6	2.5	4	3823A.005
	5	25	66	4.7	28.6	6	2.5	4	3824A.005
	5	40	80	4.7	43.6	6	2.5	4	3825A.005
6	6	20	57	5.6	–	6	3	4	3823A.006
	6	30	68	5.6	–	6	3	4	3824A.006
	6	48	86	5.6	–	6	3	4	3825A.006
8	7	25	63	7.6	–	8	4	4	3823A.008
	7	40	78	7.6	–	8	4	4	3824A.008
	7	64	102	7.6	–	8	4	4	3825A.008
10	8	30	72	9.6	–	10	5	4	3823A.010
	8	50	92	9.6	–	10	5	4	3824A.010
12	10	36	83	11.5	–	12	6	4	3823A.012
	10	60	106	11.5	–	12	6	4	3824A.012

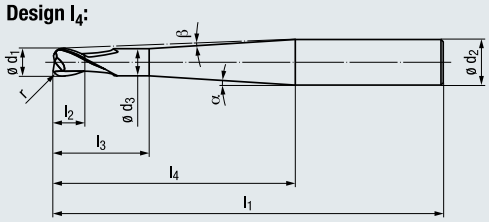


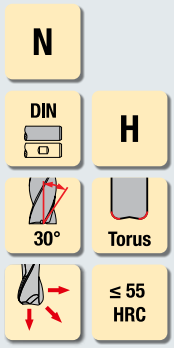
2 Flutes – Torus

- Multi-functional, high performance tool
- High-precision corner radius
- Dished nose design allows for increased step-over lengths
- Reduced cycle times



Design l_4:





Icon descriptions
(see pages 228-229)

Applications

- Ideal for almost all materials
- Suitable for roughing, finishing and HSC finishing

Cutting Data (see pages 169-170)

Materials - ISO Material Groups (see page 14)

P	1.1-5.1	M	1.1-4.1	
K	1.1-4.2	S	2.1-2.3	2.4-2.6
N	2.1-2.8, 5.2	1.2-1.4	H	1.1-1.2

For milling materials up to 66 HRC,
see Hard-Cut end mills on pages 85-86

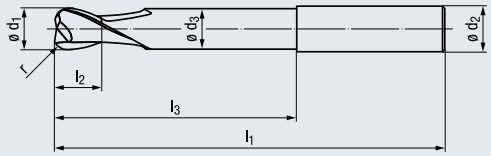
Tool Dimensions / mm

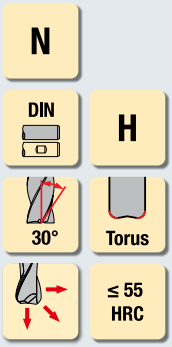
								Coating	TIALN	
ø d_1 ±0.01	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	Radius ±0.005	# Flutes	Tool No. Straight Shank	
0.5	1	2	57	0.45	20	6	0.10	2	2552A.0005	
1	2	4	57	0.95	20	6	0.20	2	2552A.101	
	2	4	57	0.95	20	6	0.25	2	2552A.001	
	2	4	80	0.95	40	6	0.20	2	2553A.101	
	2	4	80	0.95	40	6	0.25	2	2553A.001	
1.5	2.5	7.5	57	1.40	20	6	0.20	2	2552A.1015	
	2.5	7.5	57	1.40	20	6	0.30	2	2552A.0015	
	2.5	7.5	80	1.40	40	6	0.20	2	2553A.1015	
	2.5	7.5	80	1.40	40	6	0.30	2	2553A.0015	
2	3	8	57	1.80	20	6	0.20	2	2552A.102	
	3	8	57	1.80	20	6	0.50	2	2552A.002	
	3	8	80	1.80	40	6	0.20	2	2553A.102	
	3	8	80	1.80	40	6	0.50	2	2553A.002	
3	3.5	10	57	2.80	20	6	0.20	2	2552A.103	
	3.5	10	57	2.80	20	6	0.50	2	2552A.003	
	3.5	12	80	2.80	40	6	0.20	2	2553A.103	
	3.5	12	80	2.80	40	6	0.50	2	2553A.003	
4	4	12	57	3.80	20	6	0.30	2	2552A.204	
	4	12	57	3.80	20	6	0.50	2	2552A.104	
	4	12	57	3.80	20	6	1.00	2	2552A.004	
	4	20	80	3.80	40	6	0.30	2	2553A.204	
	4	20	80	3.80	40	6	0.50	2	2553A.104	
	4	20	80	3.80	40	6	1.00	2	2553A.004	
5	5	14	57	4.70	20	6	0.30	2	2552A.305	
	5	14	57	4.70	20	6	0.50	2	2552A.205	
	5	14	57	4.70	20	6	1.00	2	2552A.105	
	5	14	57	4.70	20	6	1.50	2	2552A.005	
	5	25	80	4.70	40	6	0.30	2	2553A.305	
	5	25	80	4.70	40	6	0.50	2	2553A.205	
	5	25	80	4.70	40	6	1.00	2	2553A.105	
	5	25	80	4.70	40	6	1.50	2	2553A.005	
6	6	20	57	5.60	–	6	0.30	2	2552A.306	
	6	20	57	5.60	–	6	0.50	2	2552A.206	
	6	20	57	5.60	–	6	1.00	2	2552A.106	
	6	20	57	5.60	–	6	2.00	2	2552A.006	
	6	40	80	5.60	–	6	0.30	2	2553A.306	
	6	40	80	5.60	–	6	0.50	2	2553A.206	
	6	40	80	5.60	–	6	1.00	2	2553A.106	
	6	40	80	5.60	–	6	2.00	2	2553A.006	

2 Flutes – Torus – tool sizes continue on page 57

2 Flutes – Torus (Continued from page 56)

- Multi-functional, high performance tool
- High-precision corner radius
- Dished nose design allows for increased step-over lengths
- Reduced cycle times





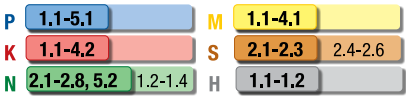
Icon descriptions (see pages 228-229)

Applications

- Ideal for almost all materials
- Suitable for roughing, finishing and HSC finishing

Cutting Data (see pages 169-170)

Materials - ISO Material Groups (see page 14)



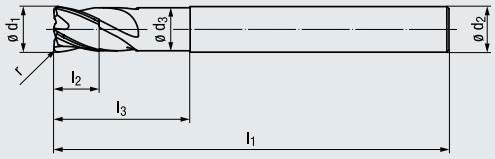
For milling materials up to 66 HRC, see Hard-Cut end mills on pages 85-86

Tool Dimensions / mm

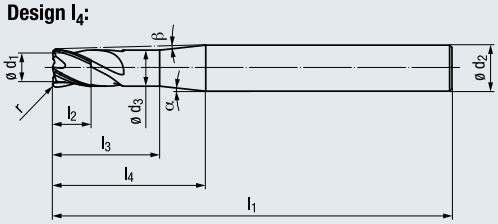
ø d_1 ±0.01	l_2	l_3	l_1	ø d_3	ø d_2 h5	Radius ±0.005	# Flutes	Coating TIALN Tool No. Straight Shank
	7	25	63	7.60	8	0.30	2	2552A.408
	7	25	63	7.60	8	0.50	2	2552A.308
	7	25	63	7.60	8	1.00	2	2552A.208
	7	25	63	7.60	8	2.00	2	2552A.008
8	7	60	100	7.60	8	0.30	2	2553A.408
	7	60	100	7.60	8	0.50	2	2553A.308
	7	60	100	7.60	8	1.00	2	2553A.208
	7	60	100	7.60	8	2.00	2	2553A.008
	7	60	100	7.60	8	2.50	2	2553A.108
	8	30	72	9.60	10	0.50	2	2552A.710
	8	30	72	9.60	10	1.00	2	2552A.610
	8	30	72	9.60	10	1.50	2	2552A.210
	8	30	72	9.60	10	2.00	2	2552A.410
	8	30	72	9.60	10	3.00	2	2552A.010
	8	50	100	9.60	10	0.50	2	2553A.710
10	8	50	100	9.60	10	1.00	2	2553A.610
	8	50	100	9.60	10	1.50	2	2553A.510
	8	75	120	9.60	10	1.50	2	2553A.210
	8	50	100	9.60	10	2.00	2	2553A.410
	8	75	120	9.60	10	2.50	2	2553A.110
	8	50	100	9.60	10	3.00	2	2553A.310
	8	75	120	9.60	10	3.00	2	2553A.010
	10	35	83	11.5	12	0.50	2	2552A.612
	10	35	83	11.5	12	1.00	2	2552A.512
	10	35	83	11.5	12	1.50	2	2552A.112
	10	35	83	11.5	12	2.00	2	2552A.312
	10	35	83	11.5	12	4.00	2	2552A.012
12	10	70	120	11.5	12	0.50	2	2553A.612
	10	70	120	11.5	12	1.00	2	2553A.512
	10	70	120	11.5	12	1.50	2	2553A.412
	10	70	160	11.5	12	1.50	2	2553A.112
	10	70	120	11.5	12	2.00	2	2553A.312
	8	70	120	11.5	12	4.00	2	2553A.212
	10	70	160	11.5	12	4.00	2	2553A.012

4 Flutes – Torus – Mold & Die

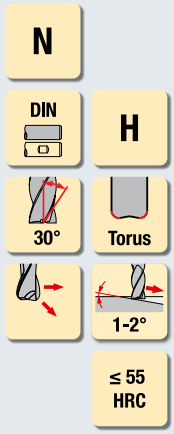
- Multi-functional, high performance tool
- High-precision corner radius
- Dished nose design allows for increased step-over lengths
- Reduced cycle times
- Widely used in mold materials



Design l_4:



Tool Dimensions / mm



Icon descriptions
(see pages 228-229)

Applications

- For difficult to cut materials
- Suitable for roughing, finishing and HSC finishing

Cutting Data (see pages 171-173)

Materials - ISO Material Groups (see pages 14-15)

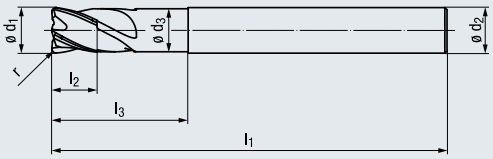
P	1.1-5.1	M	1.1-4.1
K	1.1-4.2	S	1.1-2.6
N	2.1-2.8, 5.2 2.1	H	1.1-1.2

								Coating	TIALN	
ø d_1 ±0.01	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	Radius ±0.005	# Flutes	Tool No. Straight Shank	
2	3	8	57	1.8	19.9	6	0.10	4	3835A.002001	
	3	8	57	1.8	19.9	6	0.20	4	3835A.002002	
	3	8	57	1.8	19.9	6	0.50	4	3835A.002005	
	3	10	63	1.8	21.9	6	0.10	4	3836A.002001	
	3	10	63	1.8	21.9	6	0.20	4	3836A.002002	
	3	10	63	1.8	21.9	6	0.50	4	3836A.002005	
	3	16	66	1.8	27.9	6	0.10	4	3837A.002001	
	3	16	66	1.8	27.9	6	0.20	4	3837A.002002	
	3	16	66	1.8	27.9	6	0.50	4	3837A.002005	
3	3.5	10	57	2.8	19.0	6	0.20	4	3835A.003002	
	3.5	10	57	2.8	19.0	6	0.50	4	3835A.003005	
	3.5	15	63	2.8	24.0	6	0.20	4	3836A.003002	
	3.5	15	63	2.8	24.0	6	0.50	4	3836A.003005	
	3.5	24	72	2.8	33.0	6	0.20	4	3837A.003002	
	3.5	24	72	2.8	33.0	6	0.50	4	3837A.003005	
4	4	12	57	3.8	18.2	6	0.30	4	3835A.004003	
	4	12	57	3.8	18.2	6	0.50	4	3835A.004005	
	4	12	57	3.8	18.2	6	1.00	4	3835A.004010	
	4	20	63	3.8	26.2	6	0.30	4	3836A.004003	
	4	20	63	3.8	26.2	6	0.50	4	3836A.004005	
	4	20	63	3.8	26.2	6	1.00	4	3836A.004010	
	4	32	76	3.8	38.2	6	0.30	4	3837A.004003	
	4	32	76	3.8	38.2	6	0.50	4	3837A.004005	
	4	32	76	3.8	38.2	6	1.00	4	3837A.004010	
5	5	15	57	4.7	18.6	6	0.30	4	3835A.005003	
	5	15	57	4.7	18.6	6	0.50	4	3835A.005005	
	5	15	57	4.7	18.6	6	1.00	4	3835A.005010	
	5	25	66	4.7	28.6	6	0.30	4	3836A.005003	
	5	25	66	4.7	28.6	6	0.50	4	3836A.005005	
	5	25	66	4.7	28.6	6	1.00	4	3836A.005010	
	5	40	80	4.7	43.6	6	0.30	4	3837A.005003	
	5	40	80	4.7	43.6	6	0.50	4	3837A.005005	
	5	40	80	4.7	43.6	6	1.00	4	3837A.005010	
6	6	20	57	5.6	–	6	0.30	4	3835A.006003	
	6	20	57	5.6	–	6	0.50	4	3835A.006005	
	6	20	57	5.6	–	6	1.00	4	3835A.006010	
	6	20	57	5.6	–	6	1.50	4	3835A.006015	
	6	20	57	5.6	–	6	2.00	4	3835A.006020	
	6	30	68	5.6	–	6	0.30	4	3836A.006003	
	6	30	68	5.6	–	6	0.50	4	3836A.006005	
	6	30	68	5.6	–	6	1.00	4	3836A.006010	
	6	30	68	5.6	–	6	1.50	4	3836A.006015	
	6	30	68	5.6	–	6	2.00	4	3836A.006020	

4 Flutes – Torus – Mold & Die – tool sizes continue on page 59

4 Flutes – Torus – Mold & Die (Continued from page 58)

- Multi-functional, high performance tool
- High-precision corner radius
- Dished nose design allows for increased step-over lengths
- Reduced cycle times
- Widely used in mold materials



N

DIN H

30° Torus

1-2°

≤ 55 HRC

Icon descriptions (see pages 228-229)

Applications

- For difficult to cut materials
- Suitable for roughing, finishing and HSC finishing

Cutting Data (see pages 171-173)

Materials - ISO Material Groups (see pages 14-15)

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

Tool Dimensions / mm

							Coating	TIALN	
ø d_1 ±0.01	l_2	l_3	l_1	ø d_3	ø d_2 h5	Radius ±0.005	# Flutes	Tool No. Straight Shank	
6	6	48	86	5.6	6	0.30	4	3837A.006003	
	6	48	86	5.6	6	0.50	4	3837A.006005	
	6	48	86	5.6	6	1.00	4	3837A.006010	
	6	48	86	5.6	6	1.50	4	3837A.006015	
	6	48	86	5.6	6	2.00	4	3837A.006020	
8	7	25	63	7.6	8	0.30	4	3835A.008003	
	7	25	63	7.6	8	0.50	4	3835A.008005	
	7	25	63	7.6	8	1.00	4	3835A.008010	
	7	25	63	7.6	8	2.00	4	3835A.008020	
	7	40	78	7.6	8	0.30	4	3836A.008003	
	7	40	78	7.6	8	0.50	4	3836A.008005	
	7	40	78	7.6	8	1.00	4	3836A.008010	
	7	40	78	7.6	8	2.00	4	3836A.008020	
	7	64	102	7.6	8	0.30	4	3837A.008003	
	7	64	102	7.6	8	0.50	4	3837A.008005	
	7	64	102	7.6	8	1.00	4	3837A.008010	
	7	64	102	7.6	8	2.00	4	3837A.008020	
10	8	30	72	9.6	10	0.50	4	3835A.010005	
	8	30	72	9.6	10	1.00	4	3835A.010010	
	8	30	72	9.6	10	1.50	4	3835A.010015	
	8	30	72	9.6	10	2.00	4	3835A.010020	
	8	30	72	9.6	10	2.50	4	3835A.010025	
	8	30	72	9.6	10	3.00	4	3835A.010030	
	8	50	92	9.6	10	0.50	4	3836A.010005	
	8	50	92	9.6	10	1.00	4	3836A.010010	
	8	50	92	9.6	10	1.50	4	3836A.010015	
	8	50	92	9.6	10	2.00	4	3836A.010020	
	8	50	92	9.6	10	2.50	4	3836A.010025	
	8	50	92	9.6	10	3.00	4	3836A.010030	
12	10	36	83	11.5	12	0.50	4	3835A.012005	
	10	36	83	11.5	12	1.00	4	3835A.012010	
	10	36	83	11.5	12	1.50	4	3835A.012015	
	10	36	83	11.5	12	2.00	4	3835A.012020	
	10	36	83	11.5	12	3.00	4	3835A.012030	
	10	36	83	11.5	12	4.00	4	3835A.012040	
	10	60	106	11.5	12	0.50	4	3836A.012005	
	10	60	106	11.5	12	1.00	4	3836A.012010	
	10	60	106	11.5	12	1.50	4	3836A.012015	
	10	60	106	11.5	12	2.00	4	3836A.012020	
	10	60	106	11.5	12	3.00	4	3836A.012030	
	10	60	106	11.5	12	4.00	4	3836A.012040	

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.

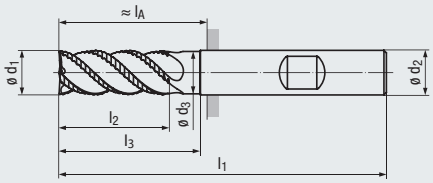
High Productivity Cutting Parameters

- **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

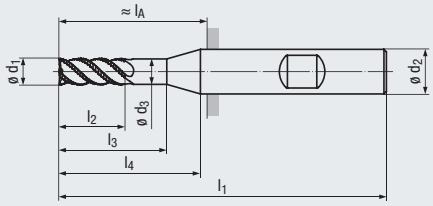
German engineered
EMUGE-FRANKEN quality

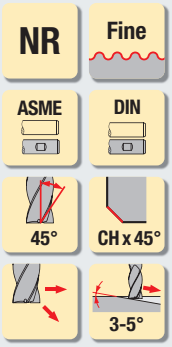
Multi-Cut Inch

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



Design l_4:





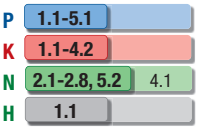
Icon descriptions
(see pages 228-229)

Applications

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

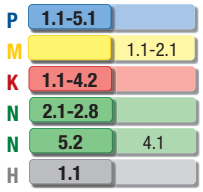
Cutting Data
(see pages 174-175)

Materials - ISO Material Groups
(see page 15)



Cutting Data
(see pages 174-175)

Materials - ISO Material Groups
(see page 15)

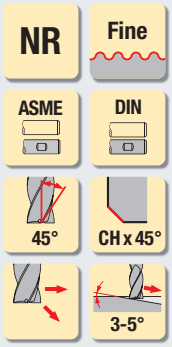


	ø d_1 h11	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	# Flutes	Coating: TIALN Tool No. Weldon Shank	Coating: ALCR Tool No. Weldon Shank
[inch]	1/8	3/16	5/8	2 1/2	0.118	7/8	3/8	15/16	3	2869A.0125	2869L.0125
		3/16	3/4	3	0.118	1 1/4	3/8	1 7/16	3	2875A.0125	2875L.0125
	3/16	9/32	1 1/16	2 1/2	0.177	7/8	3/8	15/16	3	2869A.01875	2869L.01875
		9/32	7/8	3	0.177	1 1/4	3/8	1 7/16	3	2875A.01875	2875L.01875
	1/4	3/8	3/4	2 1/2	0.236	7/8	3/8	15/16	4	2869A.0250	2869L.0250
		3/8	1	3	0.236	1 1/4	3/8	1 7/16	4	2875A.0250	2875L.0250
	5/16	15/32	7/8	2 1/2	0.295	15/16	3/8	15/16	4	2869A.03125	2869L.03125
		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 1/8	2 3/4	0.358	–	3/8	1 3/16	4	2869A.0375	2869L.0375
		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 3/8	3 1/4	0.480	–	1/2	1 15/32	4	2869A.0500	2869L.0500
		3/4	1 7/8	3 3/4	0.480	–	1/2	1 31/32	4	2875A.0500	2875L.0500
	5/8	7/8	1 1/2	3 1/2	0.605	–	5/8	1 19/32	4	2869A.0625	2869L.0625
		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	1 7/8	4	0.730	–	3/4	1 31/32	4	2869A.0750	2869L.0750
		1 1/8	2 3/4	5	0.730	–	3/4	2 31/32	4	2875A.0750	2875L.0750
	1	1 1/2	2 5/8	5	0.969	–	1	2 23/32	5	2869A.1000	2869L.1000
		1 1/2	3 5/8	6	0.969	–	1	3 23/32	5	2875A.1000	2875L.1000

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.

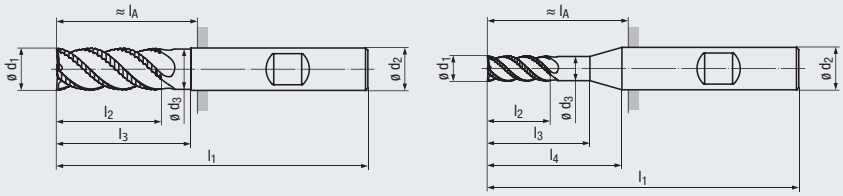
Multi-Cut Metric

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



Icon descriptions (see pages 228-229)

Design l_4:

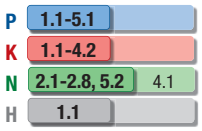


Applications

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

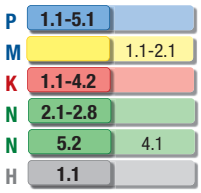
Cutting Data (see pages 174, 175 & 177)

Materials - ISO Material Groups (see page 15)



Cutting Data (see pages 174, 175 & 177)

Materials - ISO Material Groups (see page 15)



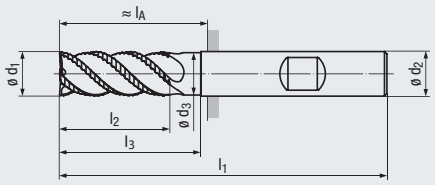
	ø d_1 h11	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	# Flutes	Coating: TIALN Tool No. Weldon Shank	Coating: ALCR Tool No. Weldon Shank
[mm]	1	1.5	3	38	0.9	9	3	–	3	–	2869L.001 **
	2	3	8	57	1.9	15	6	21	3	2869A.002	2869L.002
	3	5	14	57	2.9	18	6	21	3	2869A.003	2869L.003
		8	14	57	2.9	18	6	21	3	2873A.003	2873L.003
		5	19	62	2.9	23	6	26	3	2875A.003	2875L.003
	4	8	18	57	3.8	20	6	21	3	2869A.004	2869L.004
		11	18	57	3.8	20	6	21	3	2873A.004	2873L.004
		8	23	62	3.8	25	6	26	3	2875A.004	2875L.004
	5	9	19	57	4.8	20	6	21	3	2869A.005	2869L.005
		13	19	57	4.8	20	6	21	3	2873A.005	2873L.005
		9	24	62	4.8	25	6	26	4	2875A.005	2875L.005
	6	10	20	57	5.8	–	6	21	4	2869A.006	2869L.006
		13	20	57	5.8	–	6	21	4	2873A.006	2873L.006
		10	25	62	5.8	–	6	26	4	2875A.006	2875L.006
	8	12	25	63	7.7	–	8	27	4	2869A.008	2869L.008
		19	25	63	7.7	–	8	27	4	2873A.008	2873L.008005
		19	25	63	7.7	–	8	27	5	–	2873L.008005
		12	30	68	7.7	–	8	32	4	2875A.008	2875L.008
	10	15	30	72	9.5	–	10	32	4	2869A.010	2869L.010
		22	30	72	9.5	–	10	32	4	2873A.010	2873L.010
		22	30	72	9.5	–	10	32	5	–	2873L.010005
		15	35	80	9.5	–	10	40	4	2875A.010	2875L.010
	12	18	35	83	11.5	–	12	38	4	2869A.012	2869L.012
		26	35	83	11.5	–	12	38	4	2873A.012	2873L.012
		26	35	83	11.5	–	12	38	5	–	2873L.012005
		26	35	83	11.5	–	12	38	6	–	2873L.012006
		18	45	93	11.5	–	12	48	4	2875A.012	2875L.012
	14	21	35	83	13.5	–	14	38	4	2869A.014	2869L.014
		26	35	83	13.5	–	14	38	4	2873A.014	2873L.014
		26	35	83	13.5	–	14	38	5	–	2873L.014005
		21	50	99	13.5	–	14	54	4	2875A.014	2875L.014
	16	24	40	92	15.5	–	16	44	4	2869A.016	2869L.016
		32	40	92	15.5	–	16	44	4	2873A.016	2873L.016
		32	40	92	15.5	–	16	44	5	–	2873L.016005
		32	40	92	15.5	–	16	44	6	–	2873L.016006
		24	55	108	15.5	–	16	60	4	2875A.016	2875L.016
	20	30	50	104	19.5	–	20	54	4	2869A.020	2869L.020
		38	50	104	19.5	–	20	54	4	2873A.020	2873L.020
		38	50	104	19.5	–	20	54	5	–	2873L.020005
		38	50	104	19.5	–	20	54	6	–	2873L.020006
		30	70	126	19.5	–	20	76	4	2875A.020	2875L.020
	25	38	65	125	24.2	–	25	69	5	–	2869L.025
		45	65	125	24.2	–	25	69	6	–	2873L.025006
		38	65	150	24.2	–	25	69	5	–	2875L.025

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.

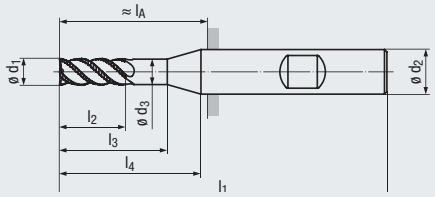
** Straight shank

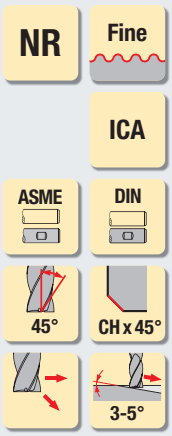
Multi-Cut Coolant Fed

- 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
- Short flute length



Design l_4:





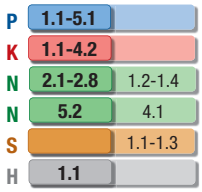
Icon descriptions
(see pages 228-229)

Applications

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

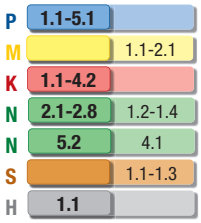
Cutting Data
(see page 176)

Materials - ISO Material Groups
(see page 15)



Cutting Data
(see page 176)

Materials - ISO Material Groups
(see page 15)

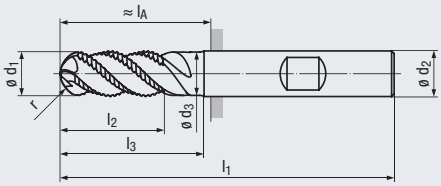


	ø d_1 h11	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	# Flutes	Coating TIALN Tool No. Weldon Shank	Coating ALCR Tool No. Weldon Shank
[inch]	**1/8**	3/16	5/8	2 1/2	0.118	7/8	3/8	15/16	**3**	**2869AZ.0125**	**2869LZ.0125**
	3/16	9/32	11/16	2 1/2	0.177	7/8	3/8	15/16	**3**	**2869AZ.01875**	**2869LZ.01875**
	1/4	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**

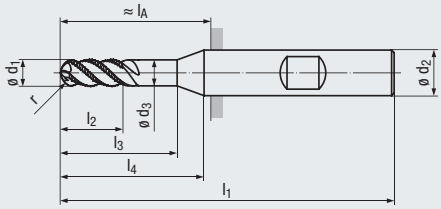
ALCR coating allows the user to operate at higher cutting speeds in materials that naturally generate an excessive amount of heat during the milling process.

Ball Nose

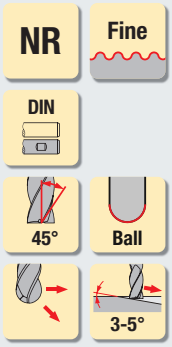
- Low cutting forces
- Fine tooth roughing profile
- Chip-breakers also in the radius section
- ALCR PVD coating for heat & wear resistance
- TIALN PVD coating for wear resistance
- Sub-micro grain carbide



Design l_4:



Tool Dimensions / mm



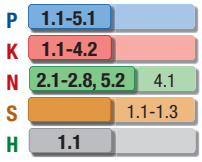
Icon descriptions
(see pages 228-229)

Applications

- For a range of materials
- Suitable for roughing in unstable conditions
- Suitable for 3D-roughing

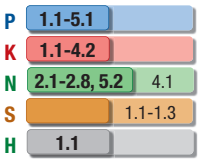
Cutting Data
(see page 177)

Materials - ISO Material Groups
(see page 15)



Cutting Data
(see page 177)

Materials - ISO Material Groups
(see page 15)

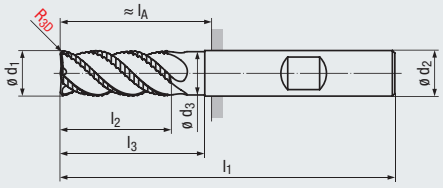


								Coating	TIALN	ALCR
ø d_1 h11	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	# Flutes	Tool No. Weldon Shank	Tool No. Weldon Shank
3	8	14	57	2.9	18	6	21	**3**	**2667A.003**	**2667L.003**
4	11	18	57	3.8	20	6	21	**3**	**2667A.004**	**2667L.004**
5	13	19	57	4.8	20	6	21	**3**	**2667A.005**	**2667L.005**
6	13	20	57	5.8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

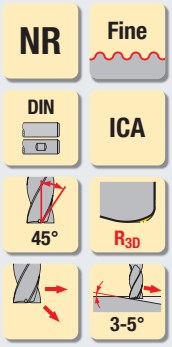
ALCR coating allows the user to operate at higher cutting speeds in materials that naturally generate an excessive amount of heat during the milling process.

DUPLEX – Coolant Fed – Rougher

- Multi-functional, high performance tool
- With DUPLEX geometry
- Combination of HPC- and high-feed end mill
- Coolant fed for enhanced chip evacuation



Tool Dimensions / mm



Icon descriptions
(see pages 228-229)

Applications

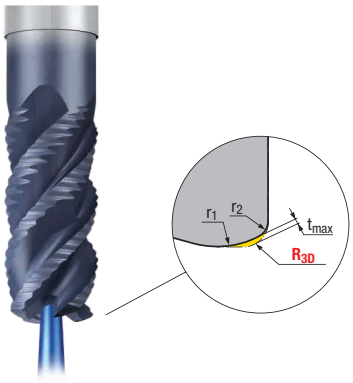
- Suitable for roughing under unstable conditions
- 2D and 3D contours can be produced

Cutting Data (see page 178)

Materials - ISO Material Groups (see page 15)

Coating TIALN

ø d_1 h11	R_{3D}	r_1 / r_2	t_{max}	l_2	l_3	l_1	ø d_3	ø 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**
	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	30	72	9.5	10	32	**4**	**2614AZ.010**	**2615AZ.010**
	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	35	83	11.5	12	38	**4**	**2614AZ.012**	**2615AZ.012**
	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	40	92	15.5	16	44	**4**	**2614AZ.016**	**2615AZ.016**
	2.2	7.8 / 1.6	0.5	32	55	108	15.5	16	60	**4**	**2616AZ.016**	**2617AZ.016**



DUPLEX-Geometry

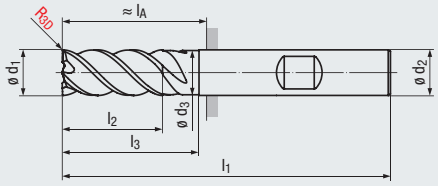
The term Duplex refers to a geometry that allows for a combination of High Performance Cutting (HPC) and High-Feed Cutting (HFC).

The peripheral cutting edges are fitted with an HPC geometry (increased flute space for chip evacuation, specialized chip forming cutting edges and larger core diameter for added stability). The face cutting edges are fitted with an HFC geometry (larger radius designs on the cutting-face in the axial and radial direction) which allow very high feed rates at a low depth of cut.

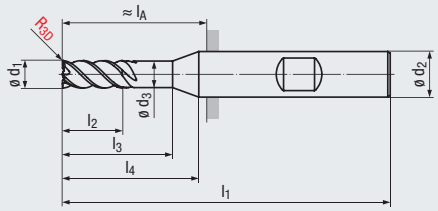
t_{max} = Maximum residual material resulting from radius deviation from R_{3D}
R_{3D} = Radius to be programmed in CAM
r_1 = Face radius
r_2 = Tangential radius between face radius and circumference cutting edge

Jet-Cut DUPLEX – Coolant Fed

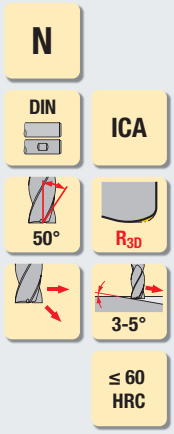
- High performance tool
- With DUPLEX geometry
- Combination of HPC- and high-feed end mill
- Coolant fed for enhanced chip evacuation
- Radial chip formers
- Variable flute spacing
- Jet-Cut provides the highest metal removal rates along with excellent surface finish



Design l_4:



Tool Dimensions / mm



Icon descriptions (see pages 228-229)

Applications

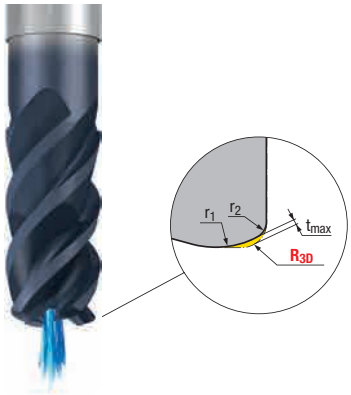
- Suitable for roughing under unstable conditions
- 2D and 3D contours can be produced

Cutting Data (see page 179)

Materials - ISO Material Groups (see page 16)

Coating TIALN

ø d_1 h11	R_{3D}	r_1 / r_2	t_{max}	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	# 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 /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**
	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	30	72	9.5	–	10	32	**4**	**2610AZ.010**	**2611AZ.010**
	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	35	83	11.5	–	12	38	**4**	**2610AZ.012**	**2611AZ.012**
	1.6	5.9 / 1.2	0.4	26	45	93	11.5	–	12	47	**4**	**2612AZ.012**	**2613AZ.012**
16	2.2	7.8 / 1.6	0.5	32	40	92	15.5	–	16	44	**4**	**2610AZ.016**	**2611AZ.016**
	2.2	7.8 / 1.6	0.5	32	55	108	15.5	–	16	60	**4**	**2612AZ.016**	**2613AZ.016**



DUPLEX-Geometry

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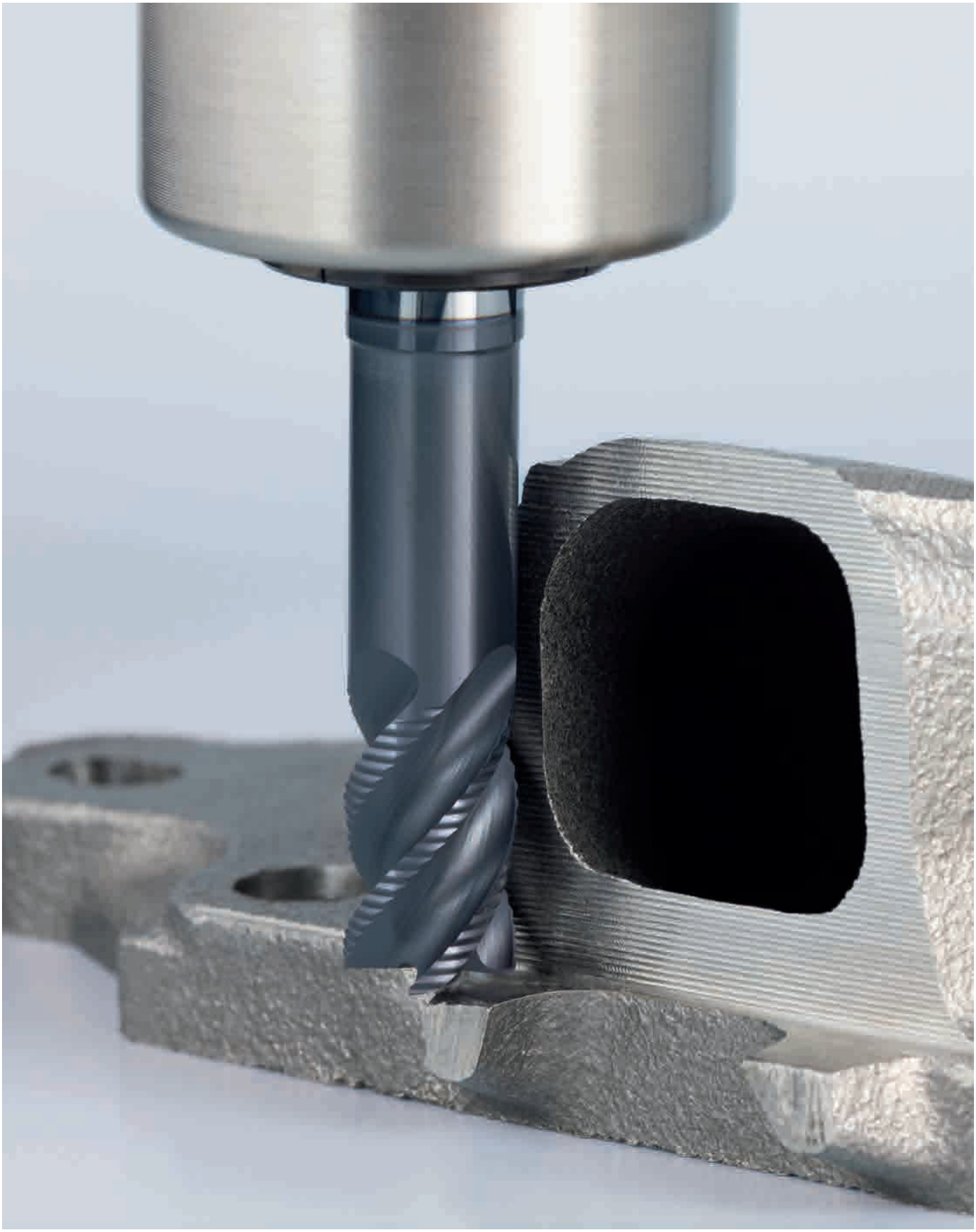
The peripheral cutting edges are fitted with an HPC geometry (increased flute space for chip evacuation, specialized chip forming cutting edges and larger core diameter for added stability). The face cutting edges are fitted with an HFC geometry (larger radius designs on the cutting-face in the axial and radial direction) which allow very high feed rates at a low depth of cut.

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



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

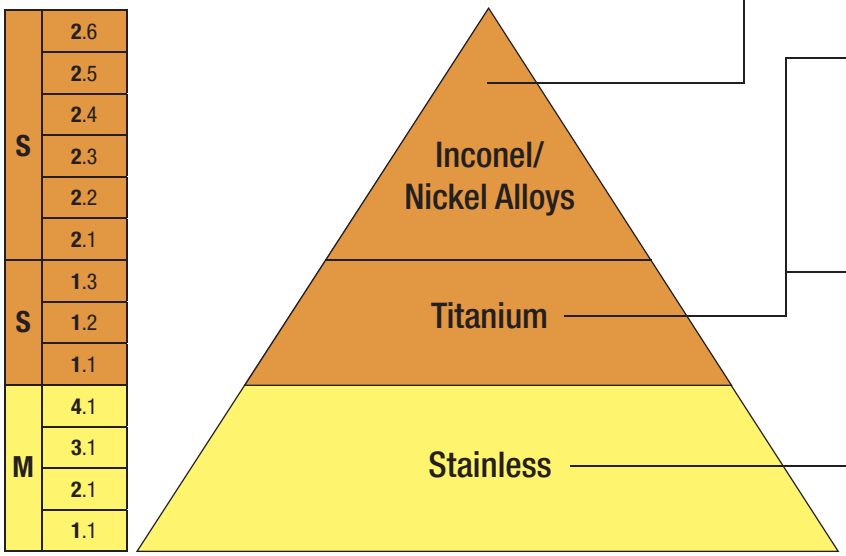
TiNox-Cut Base:

- 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.



TiNox-Cut NF

High performance roughing tool for all materials that are difficult to machine

TiNox-Cut N

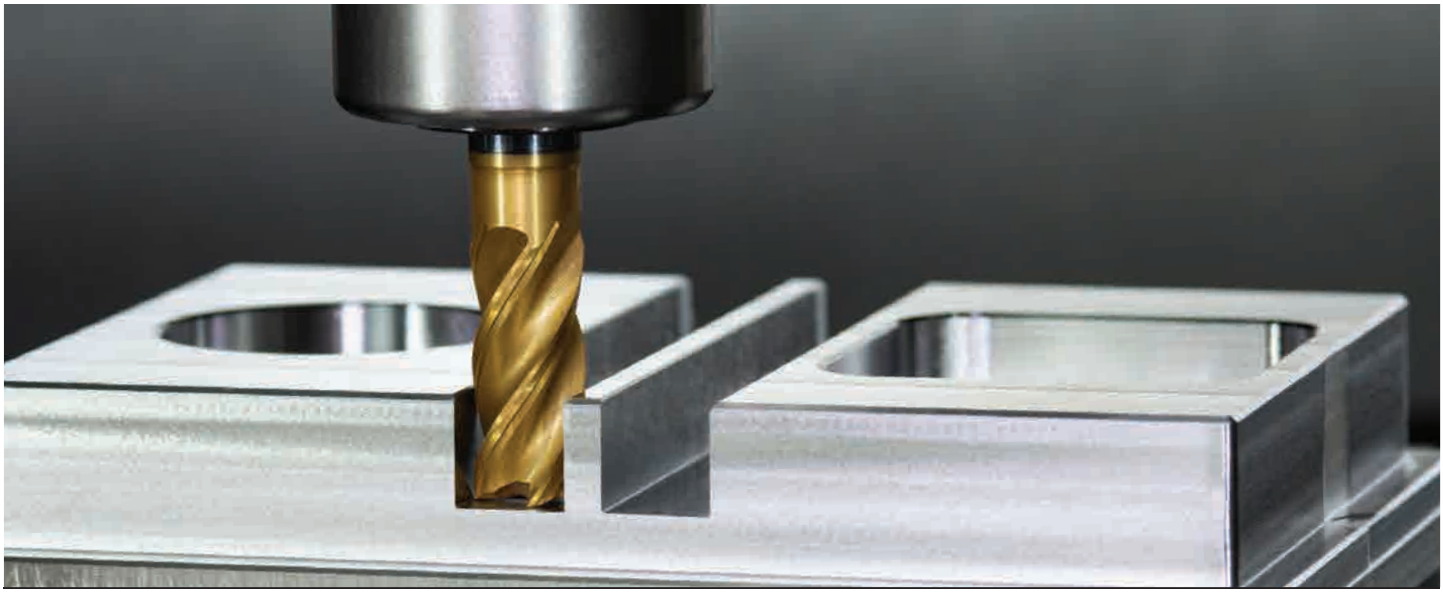
High performance tool specially designed for machining of titanium and titanium alloys

TiNox-Cut Trochoidal

High metal removal rate reduces stress and vibration for difficult materials

TiNox-Cut Base

Universal tool for machining of stainless- and acid-resistant steels

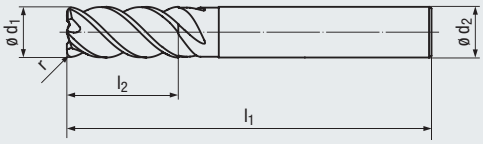


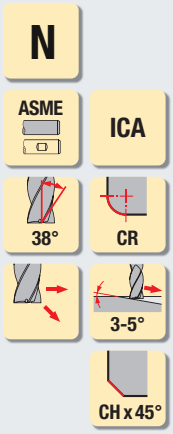
Rougher-Finisher

- 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

Rougher-Finisher with Corner Radius

- Different corner radii per diameter





Icon descriptions
(see pages 228-229)

Applications

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

Cutting Data (see page 180)

Materials - ISO Material Groups (see page 16)

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

Coating ALCR

Rougher-Finisher

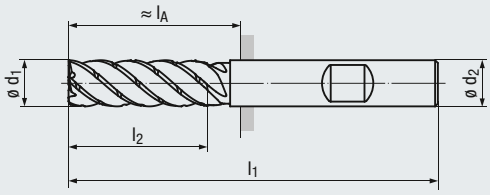
ø d_1 h10	l_2	l_1	ø d_3	ø d_2 h6	# Flutes	Tool No. Straight Shank
1/4	3/4	2 1/2	1/4	0.005	**5**	**2962LZ.0250**
5/16	3/4	2 1/2	5/16	0.005	**5**	**2962LZ.03125**
3/8	7/8	2 1/2	3/8	0.008	**5**	**2962LZ.0375**
1/2	1 1/4	3	1/2	0.008	**5**	**2962LZ.0500**
5/8	1 1/4	3 1/2	5/8	0.008	**5**	**2962LZ.0625**
3/4	1 1/2	4	3/4	0.012	**5**	**2962LZ.0750**
1	1 3/4	4 1/2	1	0.012	**5**	**2962LZ.1000**

Rougher-Finisher with Corner Radius

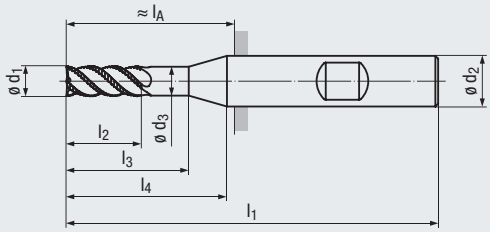
ø d_1 h10	l_2	l_1	ø d_2 h6	radius ± 0.0004	# Flutes	Tool No. Straight Shank
1/4	3/4	2 1/2	1/4	0.015	**5**	**2966LZ.025015**
	3/4	2 1/2	1/4	0.030	**5**	**2966LZ.025030**
5/16	3/4	2 1/2	5/16	0.015	**5**	**2966LZ.031015**
	3/4	2 1/2	5/16	0.030	**5**	**2966LZ.031030**
3/8	7/8	2 1/2	3/8	0.015	**5**	**2966LZ.037015**
	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 1/4	3	1/2	0.030	**5**	**2966LZ.050030**
	1 1/4	3	1/2	0.060	**5**	**2966LZ.050060**
	1 1/4	3	1/2	0.090	**5**	**2966LZ.050090**
	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**
	1 1/4	3 1/2	5/8	0.030	**5**	**2966LZ.062030**
	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**
	1 1/2	4	3/4	0.030	**5**	**2966LZ.075030**
	1 1/2	4	3/4	0.060	**5**	**2966LZ.075060**
	1 1/2	4	3/4	0.090	**5**	**2966LZ.075090**
	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 3/4	4 1/2	1	0.030	**5**	**2966LZ.100030**
	1 3/4	4 1/2	1	0.060	**5**	**2966LZ.100060**
	1 3/4	4 1/2	1	0.090	**5**	**2966LZ.100090**
	1 3/4	4 1/2	1	0.120	**5**	**2966LZ.100120**

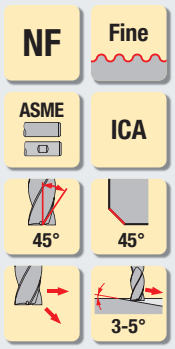
Semi-Finisher

- 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



Design l_4:





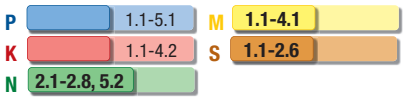
Icon descriptions
(see pages 228-229)

Applications

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

Cutting Data (see page 181)

Materials - ISO Material Groups (see page 16)



Coating — TIN / TIALN

Semi-Finisher

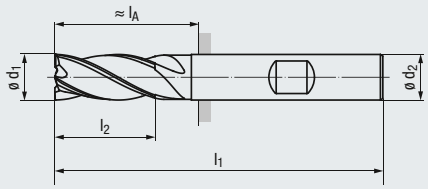
ø d_1 h11	l_2	l_1	ø d_3	ø d_2 h6	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	17/32	2 1/2	0.236	1/4	**4**	**2958T.0250**	**–**
5/16	3/4	2 1/2	0.295	5/16	**4**	**2958T.03125**	**–**
3/8	7/8	2 3/4	0.358	3/8	**4**	**2958T.0375**	**–**
1/2	1 1/8	3 1/4	0.480	1/2	**4**	**2958T.0500**	**2959T.0500**
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**

Semi-Finisher with Coolant thru

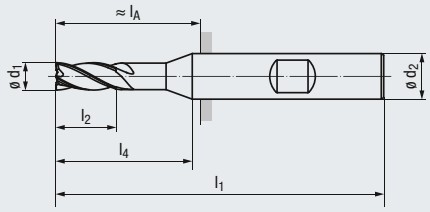
ø d_1 h11	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	# Flutes	Tool No. Straight Shank	Tool No. Weldon Shank
1/4	17/32	3/4	2 1/2	0.236	7/8	3/8	15/16	**4**	**2648TZ.0250**	**2649TZ.0250**
5/16	3/4	7/8	2 1/2	0.295	15/16	3/8	15/16	**4**	**2648TZ.03125**	**2649TZ.03125**
3/8	7/8	1 1/8	2 3/4	0.358	–	3/8	1 3/16	**4**	**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**

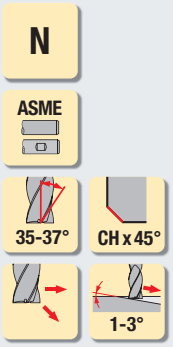
Rougher-Finisher

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



Design l_4:





Icon descriptions (see pages 228-229)

Applications

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

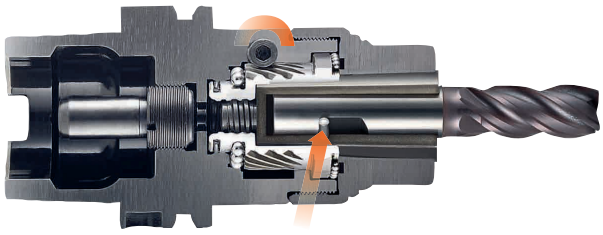
Cutting Data (see pages 182-183)

Materials - ISO Material Groups (see page 16)

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

							Coating	TiN / TiALN	
ø d_1 h10	l_2	l_1	l_4	ø 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	–
	3/8	2 1/4	7/8	1/4	7/8	0.003	4	2977T.0125	–
3/16	3/8	2	5/8	1/4	5/8	0.005	4	2975T.01875	–
	9/16	2 1/4	7/8	1/4	7/8	0.005	4	2977T.01875	–
1/4	1/2	2	–	1/4	5/8	0.005	4	2975T.0250	–
	3/4	2 1/2	–	1/4	1 1/8	0.005	4	2977T.0250	–
5/16	9/16	2 1/4	–	5/16	7/8	0.005	4	2975T.03125	–
	13/16	2 1/2	–	5/16	1 1/8	0.005	4	2977T.03125	–
3/8	5/8	2 1/2	–	3/8	15/16	0.008	4	2975T.0375	–
	7/8	2 3/4	–	3/8	1 3/16	0.008	4	2977T.0375	–
1/2	5/8	2 3/4	–	1/2	31/32	0.008	4	2975T.0500	2976T.0500
	1	3	–	1/2	1 7/32	0.008	4	2977T.0500	2978T.0500
5/8	3/4	3	–	5/8	1 3/32	0.008	4	2975T.0625	2976T.0625
	1 1/4	3 1/2	–	5/8	1 19/32	0.008	4	2977T.0625	2978T.0625
3/4	1	3 1/2	–	3/4	1 15/32	0.012	4	2975T.0750	2976T.0750
	1 1/2	4	–	3/5	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

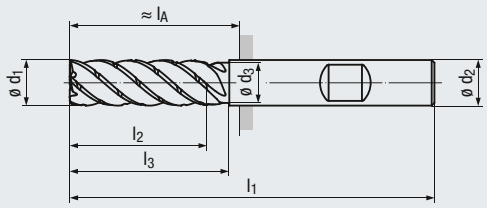
Trochoidal Milling is the overlapping of a circular path with a linear movement and thus the conversion of slot milling into contour milling. High metal removal rates can be generated even on low-powered machines and wear is reduced during full slot milling, particularly in difficult to machine materials. 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.***

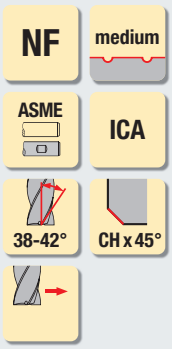
Advantages of EMUGE-FRANKEN Trochoidal Milling

- 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 style machining**
- Suitable for unstable workpiece clamping conditions
- Enables **high axial depth** of cut up to 5 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)





Icon descriptions
(see pages 228-229)

Coating TIN/TIALN

Applications – Materials (see page 17)

Cutting Data (see page 184)

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

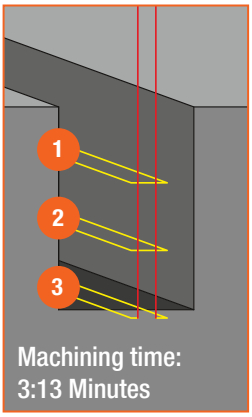
		1.1-3.1	4.1-5.1
P			
M		1.1-4.1	
K			1.1-4.2
N		1.1-1.3	
N		2.1-2.8, 5.2	
S		1.1-2.6	

2 x D – Stub length

	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø 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 = 18L x 3/4W x 1 3/4H)

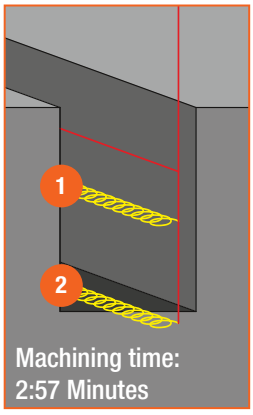
HPC Slot Milling with standard solid carbide end mill



Material: 4140 Steel
Cutting length: 1-1/4
Flutes: 4
Cutting speed (V_C): 490 SFM
Feed per tooth (f_Z): .003
Axial depth of cut (a_p): .60
Radial depth of cut (a_e): 5/8

Milling Strategy requires 3 passes

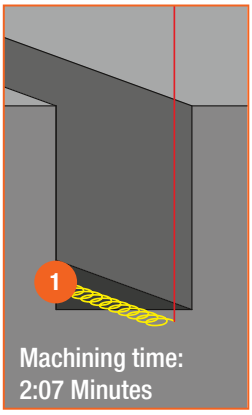
Trochoidal Slot Milling with standard solid carbide end mill



Material: 4140 Steel
Cutting length: 1-1/4
Flutes: 4
Cutting speed (V_C): 655 SFM
Feed per tooth (f_Z): .005
Axial depth of cut (a_p): 7/8
Radial depth of cut (a_e): .090

Milling Strategy requires 2 passes

Trochoidal Slot Milling with FRANKEN Trochoidal Solid Carbide End Mill

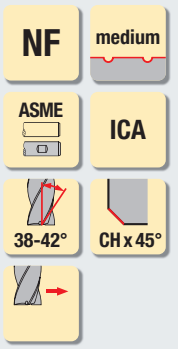


Material: 4140 Steel
Cutting length: 1-1/4
Flutes: 5
Cutting speed (V_C): 655 SFM
Feed per tooth (f_Z): .005
Axial depth of cut (a_p): 1-3/4
Radial depth of cut (a_e): .050

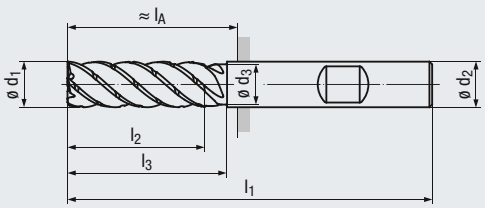
EMUGE FRANKEN

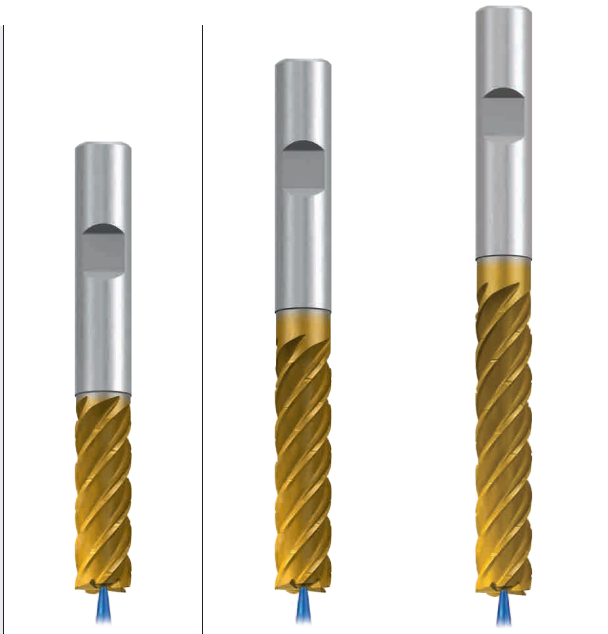
Milling Strategy requires only 1 pass

- 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 228-229)





Coating — TIN/TIALN

Applications – Materials (see page 17)

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

Cutting Data (3 x D see page 184, 4 x D and 5 x D see page 185)

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

3 x D – Standard length

	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø 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	2579TZ.0250
	5/16	1	–	2 3/4	–	5/16	1 3/8	0.005	5	2579TZ.03125
	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
[mm]	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
	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

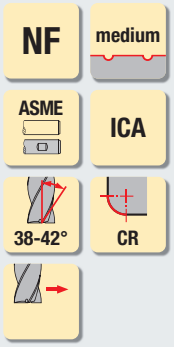
4 x D – Long length

	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø 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	2581TZ.0250
	5/16	1 1/4	–	3	–	5/16	1 5/8	0.005	5	2581TZ.03125
	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
[mm]	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
	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

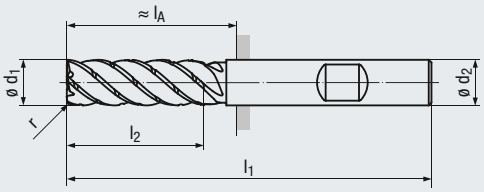
5 x D – Extra long length

	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø d_2 h6	l_A	Chamfer	# Flutes	Tool No. Weldon Shank
[mm]	10	50	60	105	9.5	10	65	0.20	5	2543TZ.010
	12	60	70	118	11.5	12	73	0.20	5	2543TZ.012
	16	80	90	142	15.5	16	94	0.20	5	2543TZ.016
	20	100	110	163	19.5	20	113	0.30	5	2543TZ.020

- 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 228-229)



Corner Radius

3 x D

4 x D

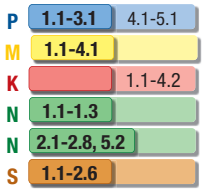
Coating

TIN / TIALN

Applications – Materials (see page 17)

Cutting Data (see page 184)

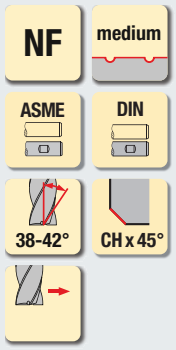
- For process-reliable trochoidal roughing operations
- Suitable for finishing
- Especially suitable for difficult-to-cut materials such as Titanium



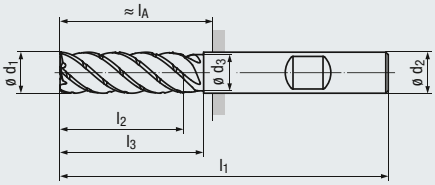
3 x D and 4 x D

ø d_1 h10	r	Standard length 3 x D l_1	l_2	l_A	Long length 4 x D l_1	l_2	l_A	ø d_2 h6	# Flutes	Tool No. Weldon Shank	Tool No. Weldon Shank
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
- Jet-Cut provides the highest metal removal rates along with excellent surface finish



Icon descriptions (see pages 228-229)



Coating: ALCR

Applications – Materials (see page 17)

Cutting Data (see page 186)

- 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

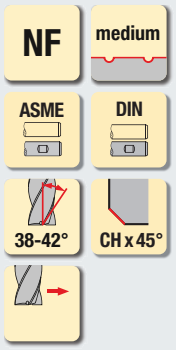
2 x D – Stub length

	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø 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

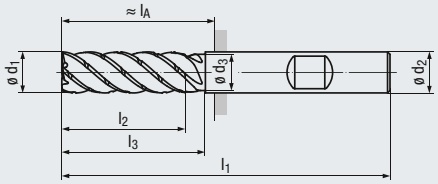
3 x D – Standard length

	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø 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
- Jet-Cut provides the highest metal removal rates along with excellent surface finish



Icon descriptions
(see pages 228-229)



Coating ALCR

Applications – Materials (see page 17)

Cutting Data (see page 186)

- 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

4 x D – Long length

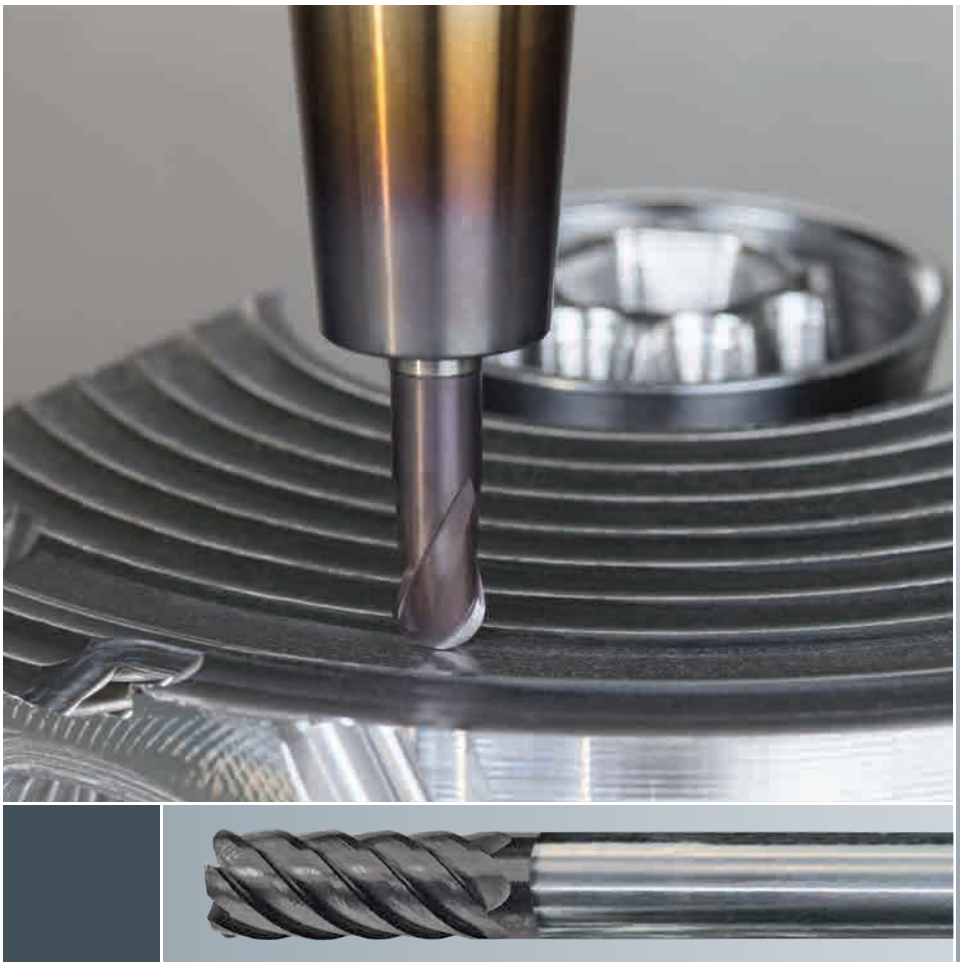
	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø d_2 h6	l_A	Chamfer	# Flutes	Tool No. Weldon Shank
[inch]	**1/4**	1	–	2 3/4	–	1/4	1 3/8	0.005	**4**	**2575L.0250**
	5/16	1 1/4	–	3	–	5/16	1 5/8	0.005	**5**	**2575L.03125**
	3/8	1 1/2	–	3 3/4	–	3/8	2 3/16	0.008	**5**	**2575L.0375**
	1/2	2	–	4 1/4	–	1/2	2 15/32	0.008	**5**	**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 – Extra long length

	ø d_1 h10	l_2	l_3	l_1	ø d_3	ø 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



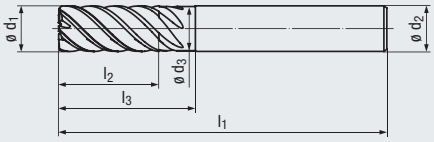
Hard-Cut end mills were specifically developed for the machining of hardened materials up to 66 HRC.

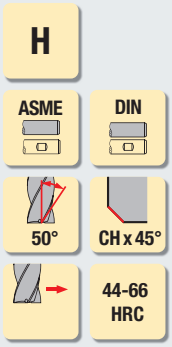
- **Unique proprietary geometry**
- **Variable flute spacing** minimizes vibrations and improves tool life
- **High flute count** enables high feed rates
- **Large core diameter** provides an extremely stable design
- **Tighter cutting diameter tolerances** assure more accurate milling
- Made from a 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 for maximum cooling efficiency in hard milling (see page 87)

German engineered
EMUGE-FRANKEN quality

6-10 Flutes

- 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





Icon descriptions
(see pages 228-229)

Applications

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

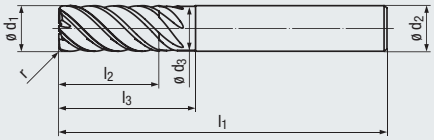
Cutting Data (see page 187)

Materials - ISO Material Groups (see page 18)

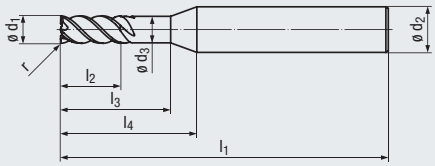
	ø d_1	tolerance	l_2	l_3	l_1	ø d_3	ø d_2 h5	Chamfer	Coating # Flutes	TIALN Tool No. Straight Shank	
[inch]	1/4	-0.0016	3/8	–	2	–	1/4	0.003	6	1827A.0250	
		-0.0016	7/8	–	2 1/2	–	1/4	0.003	6	1828A.0250	
	3/8	-0.0016	7/8	–	2 3/4	–	3/8	0.004	6	1827A.0375	
		-0.0016	1 3/8	–	3 1/4	–	3/8	0.004	6	1828A.0375	
	1/2	-0.0016	1	–	3 1/4	–	1/2	0.005	6	1827A.0500	
		-0.0016	1 1/2	–	3 3/4	–	1/2	0.005	6	1828A.0500	
	5/8	-0.0016	1 1/4	–	3 1/2	–	5/8	0.007	8	1827A.0625	
		-0.0016	2	–	4 1/4	–	5/8	0.007	8	1828A.0625	
	3/4	-0.0016	1 1/2	–	4	–	3/4	0.008	8	1827A.0750	
		-0.0016	2 1/2	–	5	–	3/4	0.008	8	1828A.0750	
	1	-0.0016	1 3/4	–	4 1/2	–	1	0.010	10	1827A.1000	
		-0.0016	3	–	6	–	1	0.010	10	1828A.1000	
[mm]	6	-0.02	13	20	57	5.8	6	0.08	6	1827A.006	
		-0.02	18	25	62	5.8	6	0.08	6	1828A.006	
	8	-0.04	19	25	63	7.7	8	0.10	6	1827A.008	
		-0.04	24	30	68	7.7	8	0.10	6	1828A.008	
	10	-0.04	22	30	72	9.5	10	0.12	6	1827A.010	
		-0.04	30	35	80	9.5	10	0.12	6	1828A.010	
	12	-0.04	26	35	83	11.5	12	0.14	6	1827A.012	
		-0.04	36	45	93	11.5	12	0.14	6	1828A.012	
	14	-0.04	26	35	83	13.5	14	0.16	6	1827A.014	
		-0.04	42	50	99	13.5	14	0.16	6	1828A.014	
	16	-0.04	32	40	92	15.5	16	0.18	8	1827A.016	
		-0.04	48	55	108	15.5	16	0.18	8	1828A.016	
	18	-0.04	32	40	92	17.5	18	0.20	8	1827A.018	
		-0.04	54	60	114	17.5	18	0.20	8	1828A.018	
	20	-0.04	38	50	104	19.5	20	0.22	8	1827A.020	
		-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	

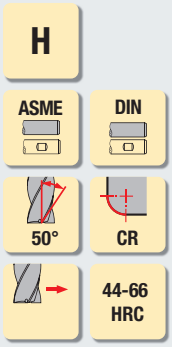
6 & 8 Flutes – Corner Radius

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



Design l_4:





Icon descriptions (see pages 228-229)

Applications

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

Cutting Data (see page 187)

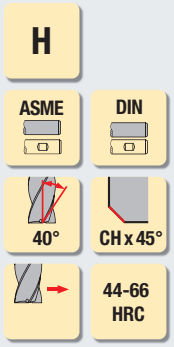
Materials - ISO Material Groups (see page 18)

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

											Coating	TIALN
	ø d_1	tolerance	r	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	# Flutes	Tool No. Straight Shank	
[inch]	1/4	-0.0016	0.025	1/2	–	2	–	–	1/4	6	2813A.0250	
		-0.0016	0.025	17/32	–	2	–	–	1/4	6	2817A.0250	
	5/16	-0.0016	0.025	1/2	–	2	–	–	5/16	6	2813A.03125	
		-0.0016	0.025	3/4	–	2 1/2	–	–	5/16	6	2817A.03125	
	3/8	-0.0016	0.025	5/8	–	2 1/4	–	–	3/8	6	2813A.0375	
		-0.0016	0.025	7/8	–	2 3/4	–	–	3/8	6	2817A.0375	
	7/16	-0.0016	0.025	5/8	–	2 1/2	–	–	7/16	6	2813A.04375	
		-0.0016	0.025	15/16	–	3	–	–	7/16	6	2817A.04375	
	1/2	-0.0016	0.050	5/8	–	2 1/2	–	–	1/2	6	2813A.0500	
		-0.0016	0.050	1	–	3 1/4	–	–	1/2	6	2817A.0500	
	5/8	-0.0016	0.050	3/4	–	3	–	–	5/8	8	2813A.0625	
		-0.0016	0.050	1 1/4	–	3 1/2	–	–	5/8	8	2817A.0625	
	3/4	-0.0016	0.050	7/8	–	3	–	–	3/4	8	2813A.0750	
		-0.0016	0.050	1 1/2	–	4	–	–	3/4	8	2817A.0750	
[mm]	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	
		-0.02	0.5	13	20	57	5.8	–	6	6	2817A.006	
	8	-0.04	0.5	12	20	58	7.7	–	8	6	2813A.008	
		-0.04	0.5	19	25	63	7.7	–	8	6	2817A.008	
	10	-0.04	0.5	14	24	66	9.5	–	10	6	2813A.010	
		-0.04	0.5	22	30	72	9.5	–	10	6	2817A.010	
	12	-0.04	1	16	26	73	11.5	–	12	6	2813A.012	
		-0.04	1	26	35	83	11.5	–	12	6	2817A.012	
	16	-0.04	1	22	32	82	15.5	–	16	8	2813A.016	
		-0.04	1	32	40	92	15.5	–	16	8	2817A.016	

High Flute Count

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



Icon descriptions (see pages 228-229)

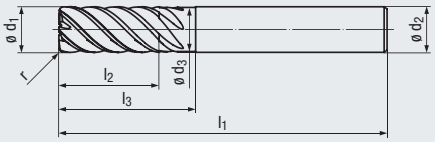
Applications

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

Cutting Data (see page 188)

Materials - ISO Material Groups (see page 18)

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
S	1.1-2.6		H	1.1-1.5	1.1

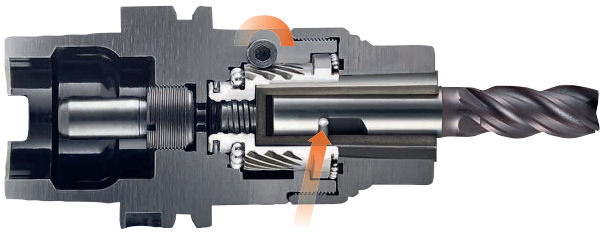


Coating TIALN

	ø d_1	tolerance	l_2	l_3	l_1	ø d_3	ø 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.

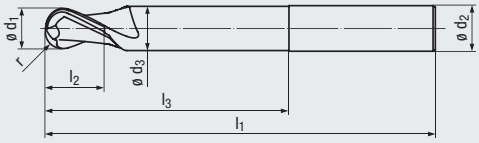
World's only chuck with 1:16 worm gear, a patented design delivering 3 tons of traction force.

Maximum dampening collet-cone assembly absorbs virtually all vibration.

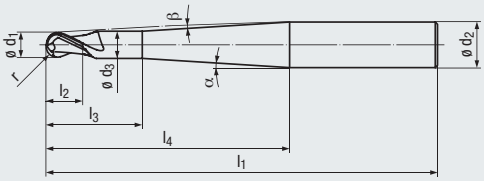
High rigidity patented design and body provides 100% holding power.

Ball Nose

- High performance tool
- Patented chisel edge
- Designed for high tensile strength materials up to 63 HRC



Design l_4:



H

ASME | DIN

30° | Ball

≤ 63 HRC

Icon descriptions
(see pages 228-229)

Applications

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

Cutting Data (see page 189)

Materials - ISO Material Groups (see page 18)

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

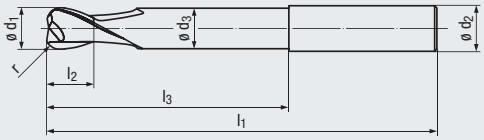
Coating TIALN

	ø d_1 ±0.0004	r ±0.0002	l_2	l_3	l_1	ø d_3	ø d_2 h5	# 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**	

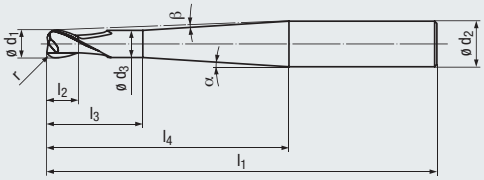
	ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank	
[mm]	**0.5**	0.25	1	2	57	0.45	20	6	10°	8.5°	**2**	**1976A.0005**	
	1	0.5	2	4	57	0.95	20	6	10°	8°	**2**	**1976A.001**	
	1.5	0.75	2.5	7.5	57	1.4	20	6	12.5°	7°	**2**	**1976A.0015**	
	2	1	3	8	57	1.8	20	6	12°	6.5°	**2**	**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**	
		4	7	40	90	7.6	–	8	–	–	**2**	**1974A.008**	
	10	5	8	30	72	9.6	–	10	–	–	**2**	**1976A.010**	
		5	8	50	100	9.6	–	10	–	–	**2**	**1974A.010**	
	12	6	10	35	83	11.5	–	12	–	–	**2**	**1976A.012**	
		6	10	65	120	11.5	–	12	–	–	**2**	**1974A.012**	
	16	8	12	40	92	15.5	–	16	–	–	**2**	**1976A.016**	
		8	12	80	140	15.5	–	16	–	–	**2**	**1974A.016**	

Torus - 2 Flutes

- High performance tool
- High-precision corner radius
- Designed for high tensile strength materials up to 66 HRC
- Corner radius dish nose design to reduce step-over length
- Reduce cycle times



Design l_4:



H

ASME | DIN

0° | Torus

3-5°

≤ 66 HRC

Icon descriptions
(see pages 228-229)

Applications

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

Cutting Data (see page 189)

Materials - ISO Material Groups (see page 18)

P 3.1-5.1 | 1.1-2.1 K 1.1-4.2
H 1.1-1.4

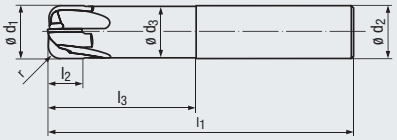
Coating: TIALN

	ø d_1 ±0.0004	r ±0.0002	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank	
[inch]	1/4	0.0625	1/4	1/2	2	0.2362	–	1/4	–	–	2	1996A.0250	
		0.0625	1/4	2	3 1/2	0.2362	–	1/4	–	–	2	1983A.0250	
	5/16	0.0781	9/32	1	2 1/2	0.2953	–	5/16	–	–	2	1996A.03125	
		0.0781	9/32	2 1/2	4	0.2953	–	5/16	–	–	2	1983A.03125	
	3/8	0.0937	5/16	1 1/8	2 3/4	0.3583	–	3/8	–	–	2	1996A.0375	
		0.0937	5/16	2 7/8	4 1/2	0.3583	–	3/8	–	–	2	1983A.0375	
	7/16	0.1094	11/32	1 1/8	3	0.4173	–	7/16	–	–	2	1996A.04375	
		0.1094	11/32	3 1/8	5	0.4173	–	7/16	–	–	2	1983A.04375	
	1/2	0.1250	3/8	1 3/8	3 1/4	0.4803	–	1/2	–	–	2	1996A.0500	
		0.1250	3/8	4 1/8	6	0.4803	–	1/2	–	–	2	1983A.0500	

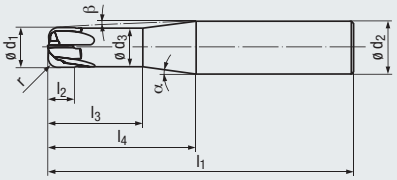
	ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank	
[mm]	0.5	0.1	1	2	57	0.45	20	6	10°	8.5°	2	1996A.0005	
	1	0.25	2	4	57	0.95	20	6	10°	8°	2	1996A.001	
		0.25	2	4	80	0.95	40	6	4.5°	4°	2	1983A.001	
	1.5	0.3	2.5	7.5	57	1.4	20	6	12.5°	7°	2	1996A.0015	
		0.3	2.5	7.5	80	1.4	40	6	4.5°	3.5°	2	1983A.0015	
	2	0.5	3	8	57	1.8	20	6	12°	6.5°	2	1996A.002	
		0.5	3	8	80	1.8	40	6	4°	3°	2	1983A.002	
	3	0.5	3.5	10	57	2.8	20	6	11.5°	5°	2	1996A.003	
		0.5	3.5	12	80	2.8	40	6	3.5°	2.5°	2	1983A.003	
	4	1	4	12	57	3.8	20	6	11°	3.5°	2	1996A.004	
		1	4	20	80	3.8	40	6	4°	1.5°	2	1983A.004	
	5	1.5	5	14	57	4.7	20	6	10°	2°	2	1996A.005	
		1.5	5	25	80	4.7	40	6	3°	1°	2	1983A.005	
	6	2	6	20	57	5.6	–	6	–	–	2	1996A.006	
		2	6	40	80	5.6	–	6	–	–	2	1983A.006	
		2	6	25	100	5.6	60	8	2°	1°	2	1983A.00608	
	8	2	7	25	63	7.6	–	8	–	–	2	1996A.008	
		2	7	40	90	7.6	–	8	–	–	2	1993A.008	
		2	7	60	100	7.6	–	8	–	–	2	1983A.008	
		2	7	30	120	7.6	75	10	2°	1°	2	1983A.00810	
		2.5	7	60	100	7.6	–	8	–	–	2	1983A.108	
	10	3	8	30	72	9.6	–	10	–	–	2	1996A.010	
		3	8	50	100	9.6	–	10	–	–	2	1993A.010	
		2.5	8	75	120	9.6	–	10	–	–	2	1983A.110	
		3	8	75	120	9.6	–	10	–	–	2	1983A.010	
		3	8	40	160	9.6	110	12	1°	0.5°	2	1983A.01012	
	12	4	10	35	83	11.5	–	12	–	–	2	1996A.012	
		4	10	35	92	11.5	40	16	35°	3.5°	2	1996A.01216	
		4	10	65	120	11.5	–	12	–	–	2	1993A.012	
		4	10	70	160	11.5	–	12	–	–	2	1983A.012	
		4	10	50	200	11.5	150	16	1.5°	1°	2	1983A.01216	
	16	5	12	40	92	15.5	–	16	–	–	2	1996A.016	
		5	12	80	140	15.5	–	16	–	–	2	1993A.016	
		5	12	80	200	15.5	–	16	–	–	2	1983A.016	

Torus - 4 Flutes

- High performance tool
- With 4 flutes
- High-precision corner radius
- Short, stable flute length
- Designed for high tensile strength materials up to 66 HRC



Design l_4:



H

ASME DIN

0° Torus

3-5°

≤ 66 HRC

Icon descriptions
(see pages 228-229)

Applications

- For machining hard materials
- For finishing with very high surface quality
- Suitable for HSC finishing

Cutting Data (see page 190)

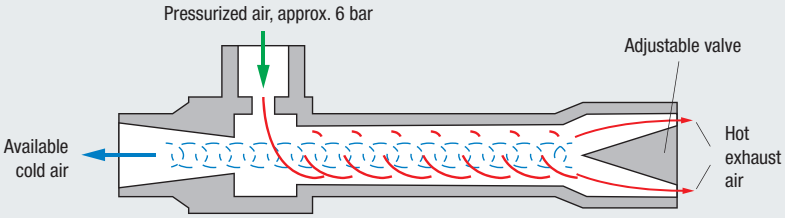
Materials - ISO Material Groups (see page 18)

P 1.1-5.1
N 2.3, 2.6-2.8
H 1.1-1.5
K 1.1-4.2
N 2.2, 2.4-2.5

Coating: TIALN

	ø d_1 ±0.0004	r ±0.0002	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank	
[inch]	**3/32**	0.023	0.0850	3/8	2	0.0866	1/2	1/4	33.3°	3.3°	**4**	**1936A.009375**	
	1/8	0.031	0.1000	7/16	2	0.1181	1/2	1/4	46.9°	7.6°	**4**	**1936A.0125**	
	3/16	0.047	0.1299	1/2	2 1/2	0.1772	7/8	1/4	5.5°	2.2°	**4**	**1936A.01875**	
	1/4	0.063	0.1693	1/2	2 1/2	0.2362	–	1/4	–	–	**4**	**1936A.0250**	
	5/16	0.078	0.2008	1	2 1/2	0.2953	–	5/16	–	–	**4**	**1936A.03125**	
	3/8	0.094	0.2283	1 1/8	2 3/4	0.3583	–	3/8	–	–	**4**	**1936A.0375**	
	7/16	0.109	0.2500	1 1/8	2 3/4	0.4173	–	7/16	–	–	**4**	**1936A.04375**	
	1/2	0.125	0.2500	1 3/8	3 1/4	0.4803	–	1/2	–	–	**4**	**1936A.0500**	
	5/8	0.156	0.3102	1 1/2	3 1/2	0.6051	–	5/8	–	–	**4**	**1936A.0625**	
	3/4	0.188	0.3799	1 7/8	4	0.7303	–	3/4	–	–	**4**	**1936A.0750**	
	1	0.250	0.5000	1 5/8	4	0.9803	–	1	–	–	**4**	**1936A.1000**	

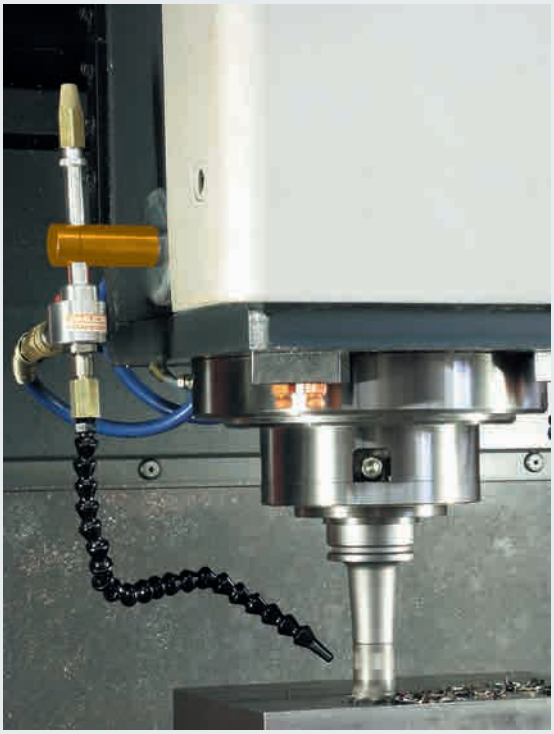
	ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank	
[mm]	**3**	0.75	2	10	57	2.8	20	6	11,5°	5°	**4**	**1936A.003**	
	4	1	2.5	12	57	3.8	20	6	11°	3.5°	**4**	**1936A.004**	
	5	1.25	3	14	57	4.7	20	6	10°	2°	**4**	**1936A.005**	
	6	1.5	4	20	57	5.6	–	6	–	–	**4**	**1936A.006**	
		1.5	4	30	80	5.6	–	6	–	–	**4**	**2832A.006**	
	8	2	5	25	63	7.6	–	8	–	–	**4**	**1936A.008**	
		1	5	25	63	7.6	–	8	–	–	**4**	**1936A.008010**	
		2	5	35	80	7.6	–	8	–	–	**4**	**2832A.008**	
		1	5	35	80	7.6	–	8	–	–	**4**	**2832A.08010**	
	10	2.5	6	30	72	9.6	–	10	–	–	**4**	**1936A.010**	
		1	6	30	72	9.6	–	10	–	–	**4**	**1936A.010010**	
		2.5	6	45	100	9.6	–	10	–	–	**4**	**2832A.010**	
		1	6	45	100	9.6	–	10	–	–	**4**	**2832A.010010**	
	12	3	7	35	83	11.5	–	12	–	–	**4**	**1936A.012**	
		1	7	35	83	11.5	–	12	–	–	**4**	**1936A.012010**	
		3	7	50	100	11.5	–	12	–	–	**4**	**2832A.012**	
		1	7	50	100	11.5	–	12	–	–	**4**	**2832A.012010**	
	16	4	8	40	92	15.5	–	16	–	–	**4**	**1936A.016**	
		4	8	60	120	15.5	–	16	–	–	**4**	**2832A.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° F (-40 °C). All that is required is a normal pressurized air connection.



Cold-Air Nozzle

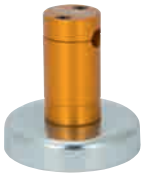
Delivery includes:
- Flexible hose (length approx. 12 (300 mm) for cold air
- Silencer (SN14) for hot exhaust air
- Ball-valve with fitting for inlet hose .236 (6 mm) with quick-change attachment .285 (7.2 mm)

Spare hose in additional lengths available upon request

Overall length	Tool no.
8.85 (225mm) without hose	**6910.15**

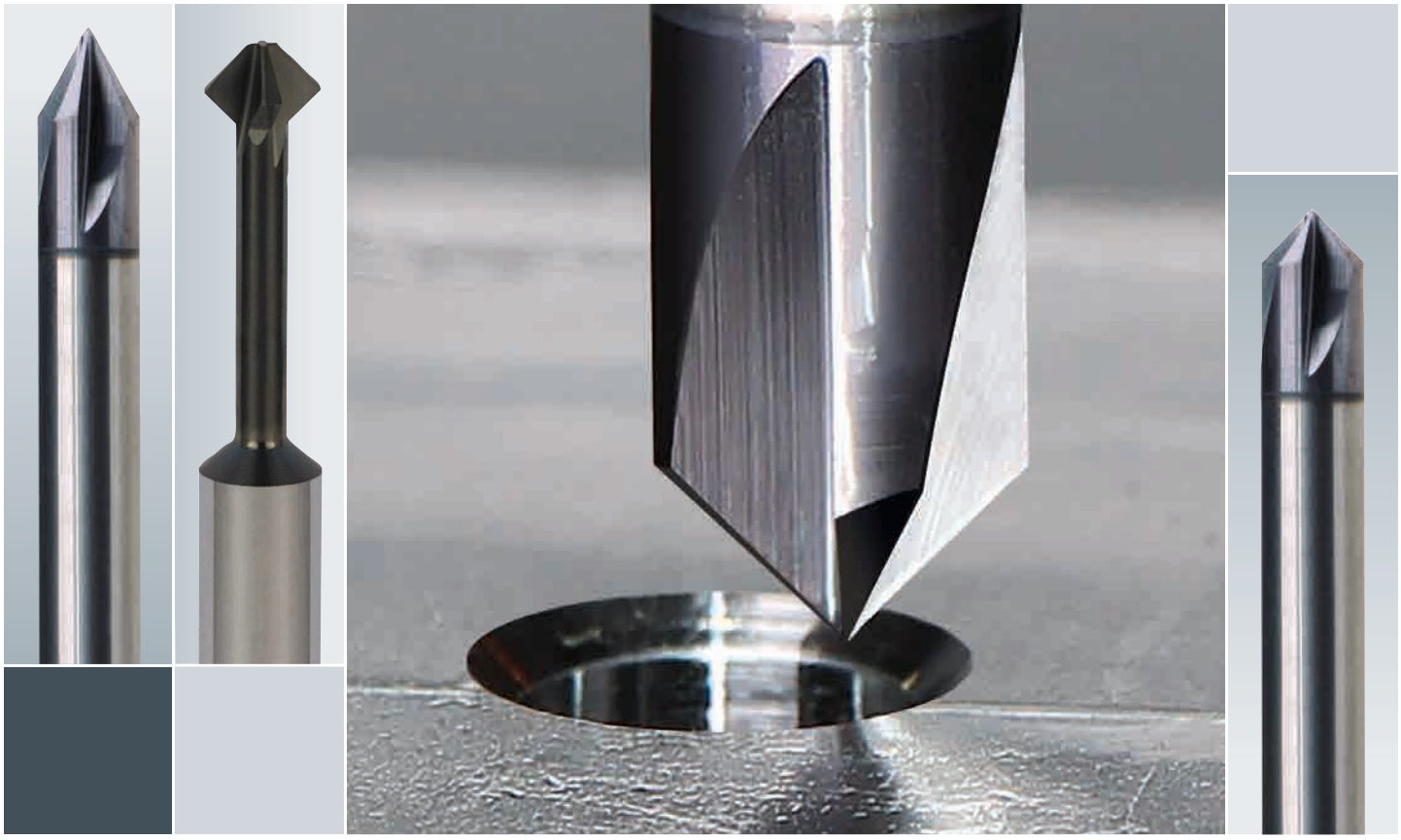
Holders for Cold-Air Nozzle

Individual socket and holder components available upon request.

	Socket with basic holder	**Socket with magnetic shoe**
		
	Tool no.	**Tool no.**
	6910.24	**6910.25**

Solid Carbide Chamfer Mills

For Chamfering, Countersinking and Deburring



Chamfer Mills are multi-functional – used for chamfering, countersinking, deburring and engraving. 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
- **Helical chamfer mills** are offered in 60°, 90°, 120° and also 82° for countersinking
- **Carbide engraving** tools for part etching
- **High speed steel countersinking** tools for threaded holes

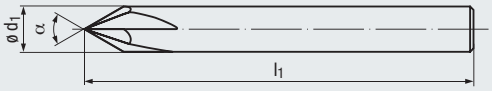
German engineered
EMUGE-FRANKEN quality

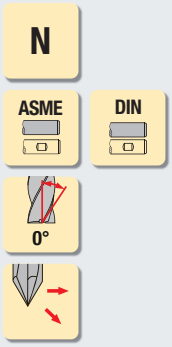
Straight Flute

- Multi-functional tool
- With 4 or 6 flutes
- Taper angle 60° or 90°
- Solid carbide substrate material
- Straight cylindrical shank ground to an h6 tolerance

60° Angle

90° Angle





Icon descriptions
(see pages 228-229)

Applications

- Ideal for most materials
- For materials with a tensile strength of up to 1400 N/mm²
- For chamfering edges and slots

Materials - ISO Material Groups (see page 19)

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

Coating TiAlN

60° Angle

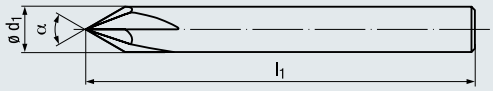
	ø d_1	l_1	# Flutes	Tool No. Straight Shank
[inch]	1/8	2	4	1715A.060125
	1/4	2 1/2	4	1715A.060250
		2 1/2	6	1711A.060250
	3/8	3	4	1715A.060375
		3	6	1711A.060375
	1/2	3	4	1715A.060500
		3	6	1711A.060500
	5/8	4	4	1715A.060625
		4	6	1711A.060625
[mm]	4	54	4	1715A.06004
	6	54	4	1715A.06006
	8	58	4	1715A.06008
	10	66	4	1715A.06010
	12	73	4	1715A.06012

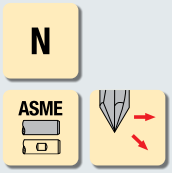
90° Angle

	ø d_1	l_1	# Flutes	Tool No. Straight Shank
[inch]	1/8	2	4	1715A.090125
	1/4	2 1/2	4	1715A.090250
		2 1/2	6	1711A.090250
	3/8	3	4	1715A.090375
		3	6	1711A.090375
	1/2	3	4	1715A.090500
		3	6	1711A.090500
	5/8	4	4	1715A.090625
		4	6	1711A.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

Helical Flute

- Multi-functional tool
- With 3 or 5 helical flutes
- Taper angle 60°, 82°, 90°, or 120°
- Helical cutting edge design for higher shearing action
- Increased tool life and vibration dampening
- Feed forces are reduced compared to straight edge chamfer mills
- Excellent choice for countersink operations
- Solid carbide substrate material
- Straight shank ground to h6 tolerance



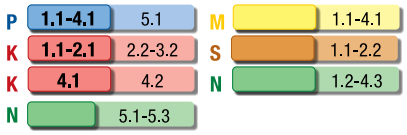


Icon descriptions
(see pages 228-229)

Applications

- Ideal for most materials
- For materials with a tensile strength of up to 1400 N/mm²

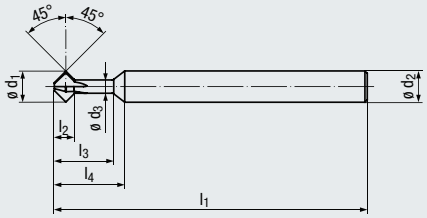
Materials - ISO Material Groups (see page 19)

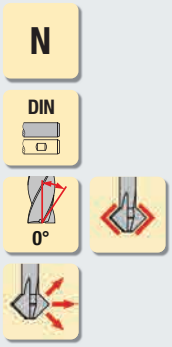


			Coating	TIALN
60° Angle				
ø d_1	d_2 h6	l_1	# Flutes	Tool No. Straight Shank
1/8	1/8	2	3	1708A.060125
	1/8	2	5	1709A.060125
1/4	1/4	2 1/2	3	1708A.060250
	1/4	2 1/2	5	1709A.060250
3/8	3/8	3	3	1708A.060375
	3/8	3	5	1709A.060375
1/2	1/2	3	3	1708A.060500
	1/2	3	5	1709A.060500
5/8	5/8	4	3	1708A.060625
	5/8	4	5	1709A.060625
82° Angle				
1/8	1/8	2	3	1708A.082125
	1/8	2	5	1709A.082125
1/4	1/4	2 1/2	3	1708A.082250
	1/4	2 1/2	5	1709A.082250
3/8	3/8	3	3	1708A.082375
	3/8	3	5	1709A.082375
1/2	1/2	3	3	1708A.082500
	1/2	3	5	1709A.082500
5/8	5/8	4	3	1708A.082625
	5/8	4	5	1709A.082625
90° Angle				
1/8	1/8	2	3	1708A.090125
	1/8	2	5	1709A.090125
1/4	1/4	2 1/2	3	1708A.090250
	1/4	2 1/2	5	1709A.090250
3/8	3/8	3	3	1708A.090375
	3/8	3	5	1709A.090375
1/2	1/2	3	3	1708A.090500
	1/2	3	5	1709A.090500
5/8	5/8	4	3	1708A.090625
	5/8	4	5	1709A.090625
120° Angle				
1/8	1/8	2	3	1708A.120125
	1/8	2	5	1709A.120125
1/4	1/4	2 1/2	3	1708A.120250
	1/4	2 1/2	5	1709A.120250
3/8	3/8	3	3	1708A.120375
	3/8	3	5	1709A.120375
1/2	1/2	3	3	1708A.120500
	1/2	3	5	1709A.120500
5/8	5/8	4	3	1708A.120625
	5/8	4	5	1709A.120625

Front / Back Chamfer

- Multi-functional tool
- 3 different machining lengths
- 4 flutes
- Chamfering angle 45°
- Front and back chamfering capabilities
- Solid carbide substrate material





Icon descriptions
(see pages 228-229)

Applications

- For almost all materials
- For materials with a tensile strength of up to 1400 N/mm²
- For front and back deburring of edges, grooves and drill holes

Materials - ISO Material Groups (see page 19)

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

Tool Dimensions / mm

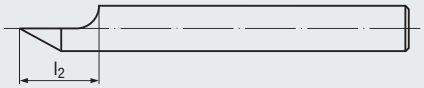
Coating: ALCR

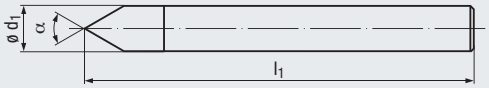
45° Angle

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

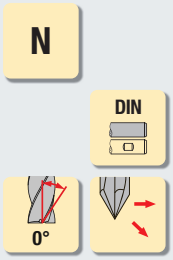
Single Flute

- Multi-functional tool
- With 1 effective cutting edge
- Taper angle 60° or 90°
- Solid carbide substrate material





Tool Dimensions / mm

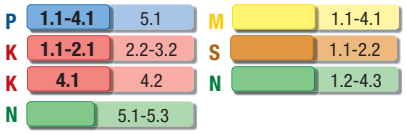


Icon descriptions
(see pages 228-229)

Applications

- For almost all materials
- For materials with a tensile strength of up to 1400 N/mm2
- For engraving letter markings

Materials - ISO Material Groups (see page 19)



	ø d_1 h6	l_2	l_1	Coating / # Flutes	TIAIN / Tool No. Straight Shank
60°	3	4	50	1	1710.06003
	4	5	55	1	1710.06004
	5	6	62	1	1710.06005
	6	7	66	1	1710.06006
	8	9	79	1	1710.06008
90°	3	4	50	1	1710.09003
	4	5	55	1	1710.09004
	5	6	62	1	1710.09005
	6	7	66	1	1710.09006
	8	9	79	1	1710.09008

3 Flutes

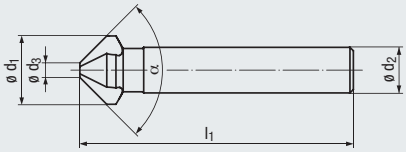
- Circumference radially and axially relieved
- Fully ground flutes
- Geometry for countersinks without shatter marks
- High speed steel substrate material
- TIN coated option for additional heat and wear resistance

90° 60° HSS DIN

Icon descriptions (see pages 228-229)

90° Angle

60° Angle - TIN Coated



Applications

- For almost all materials
- For materials with a tensile strength of up to 1000 N/mm² with TIN coating, of up to 1200 N/mm²
- For deburring and counterboring drilled holes and tap holes
- Countersink for screw heads

Cutting Data (see page 191)

Materials - ISO Material Groups (see page 19)

P 1.1-3.1 4.1 | M 1.1-2.1
K 1.1-2.1 2.2-3.1 | S 1.1
K 4.1-4.2 | N 1.1-1.5, 2.1-2.6
N 3.1-4.2

					Coating	Bright	TIN
	ø d_1	ø d_3	l_1	ø $d_{2\ h6}$	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
90°	4.3	1.3	40	4	3	7560.090043	7560T.090043
	5	1.5	40	4	3	7560.09005	7560T.09005
	5.3	1.5	40	4	3	7560.090053	7560T.090053
	5.8	1.5	45	5	3	7560.090058	7560T.090058
	6	1.5	45	5	3	7560.09006	7560T.09006
	6.3	1.5	45	5	3	7560.090063	7560T.090063
	7	1.8	50	6	3	7560.09007	7560T.09007
	7.3	1.8	50	6	3	7560.090073	7560T.090073
	8	2	50	6	3	7560.09008	7560T.09008
	8.3	2	50	6	3	7560.090083	7560T.090083
	9.4	2.2	50	6	3	7560.090094	7560T.090094
	10	2.5	50	6	3	7560.09010	7560T.09010
	10.4	2.5	50	6	3	7560.090104	7560T.090104
	11.5	2.8	56	8	3	7560.090115	7560T.090115
	12.4	2.8	56	8	3	7560.090124	7560T.090124
	13.4	2.9	56	8	3	7560.090134	7560T.090134
	15	3.2	60	10	3	7560.09015	7560T.09015
	16.5	3.2	60	10	3	7560.090165	7560T.090165
	19	3.5	63	10	3	7560.09019	7560T.09019
	20.5	3.5	63	10	3	7560.090205	7560T.090205
	23	3.8	67	10	3	7560.09023	7560T.09023
	25	3.8	67	10	3	7560.09025	7560T.09025
	28	4	71	12	3	7560.09028	7560T.09028
	31	4.2	71	12	3	7560.09031	7560T.09031
60°	6.3	1.6	45	5	3	7550.060063	7550T.060063
	8	2	50	6	3	7550.06008	7550T.06008
	12.5	3.2	56	8	3	7550.060125	7550T.060125
	16	4	63	10	3	7550.06016	7550T.06016
	20	5	67	10	3	7550.06020	7550T.06020
	25	6.3	71	10	3	7550.06025	7550T.06025

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

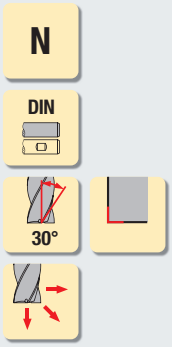
Advantages and Applications:

- 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:

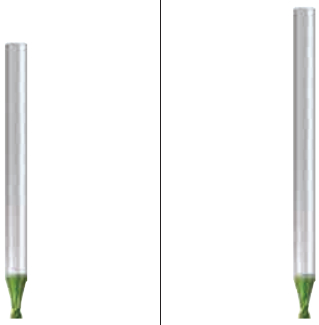
- Solid carbide micro and mini end mills, in addition to ball nose and torus configurations
- CBN micro and mini end mills also available upon request

- 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

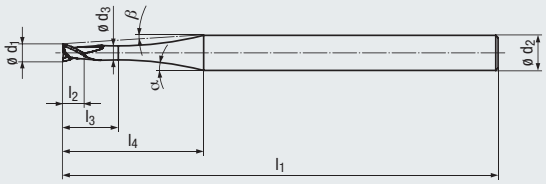


Icon descriptions
(see pages 228-229)

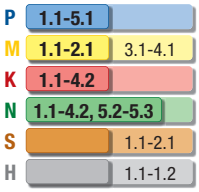
Sharp-edged



$L_3 = 2.2 \times d_1$



Coating ALCR



Applications – Materials (see page 20)

Cutting Data (see pags 192)

Technical Data (see page 232)

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

Tool Dimensions / mm

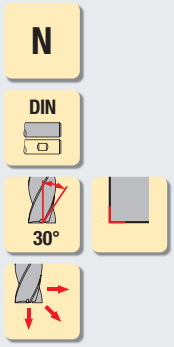
Standard length

ø d_1	tolerence	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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

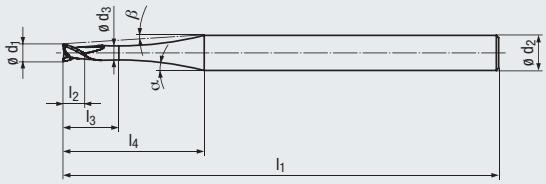
ø d_1	tolerence	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	0.6	43	0.16	5.7	3	15°	14°	**2**	**2763L.0002**
0.5	-0.025	0.5	1.1	43	0.4	5.8	3	15°	13°	**2**	**2763L.0005**
0.8	-0.034	0.8	1.76	43	0.64	5.9	3	15°	11°	**2**	**2763L.0008**
1	-0.040	1	2.2	43	0.8	5.9	3	15°	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

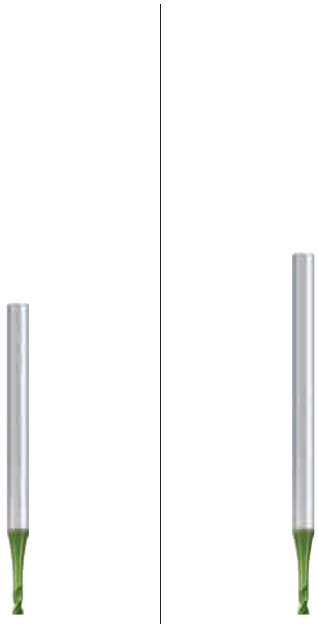


Icon descriptions (see pages 228-229)

$L_3 = 5 \times d_1$



Sharp-edged



Coating ALCR

Applications – Materials (see page 20)
Cutting Data (see page 193)
Technical Data (see page 232)

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

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

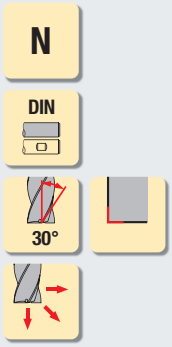
Short length

ø d_1	tolerance	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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

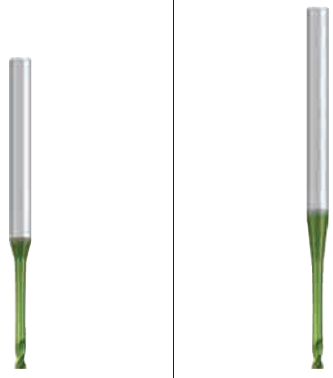
ø d_1	tolerance	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	1	43	0.16	6.4	3	15°	13°	**2**	**2764L.0002**
0.5	-0.025	0.5	2.5	43	0.4	7.8	3	15°	10°	**2**	**2764L.0005**
0.8	-0.034	0.8	4	43	0.64	9	3	15°	8°	**2**	**2764L.0008**
1	-0.040	1	5	50	0.8	9.7	3	15°	6°	**2**	**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

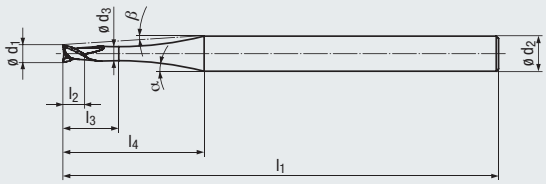


Icon descriptions
(see pages 228-229)

Sharp-edged



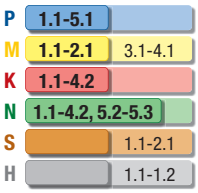
$L_3 = 10 \times d_1$



Coating ALCR

Applications – Materials (see page 20)
Cutting Data (see page 194)
Technical Data (see page 232)

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



Tool Dimensions / mm

Standard length

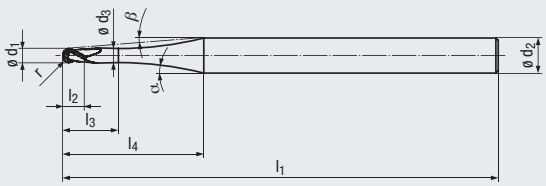
ø d_1	tolerance	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
0.2	-0.016	0.2	2	38	0.16	9.2	3	15°	9°	**2**	**2762L.0002**
0.3	-0.019	0.3	3	38	0.24	9.7	3	13.5°	8.5°	**2**	**2762L.0003**
0.4	-0.022	0.4	4	38	0.32	10.2	3	14°	8°	**2**	**2762L.0004**
0.5	-0.025	0.5	5	38	0.4	10.7	3	13°	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

ø d_1	tolerence	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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 ± 5 µm

$L_3 = 2.2 \times d_1$



N

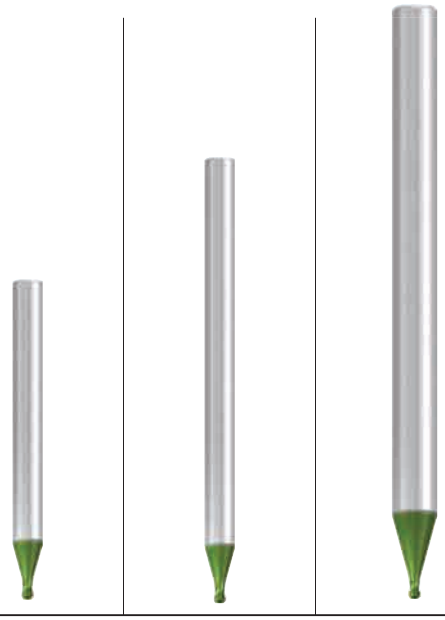
DIN

30°

Ball

Icon descriptions
(see pages 228-229)

Ball Nose



Coating ALCR

Applications – Materials (see page 20)

Cutting Data (see page 195)

Technical Data (see page 232)

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

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

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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

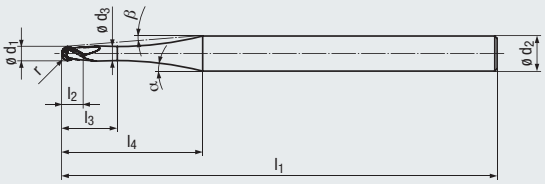
ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
0.2	0.1	0.12	0.6	50	0.16	5.7	3	15°	14°	**2**	**2773L.0002**
0.5	0.25	0.3	1.1	50	0.4	5.8	3	15°	13°	**2**	**2773L.0005**
0.8	0.4	0.48	1.76	50	0.64	5.9	3	15°	11°	**2**	**2773L.0008**
1	0.5	0.6	2.2	60	0.8	7.8	4	15°	11°	**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**

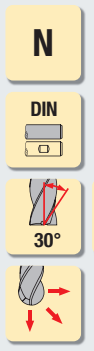
Extra long length

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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 ± 5 µm

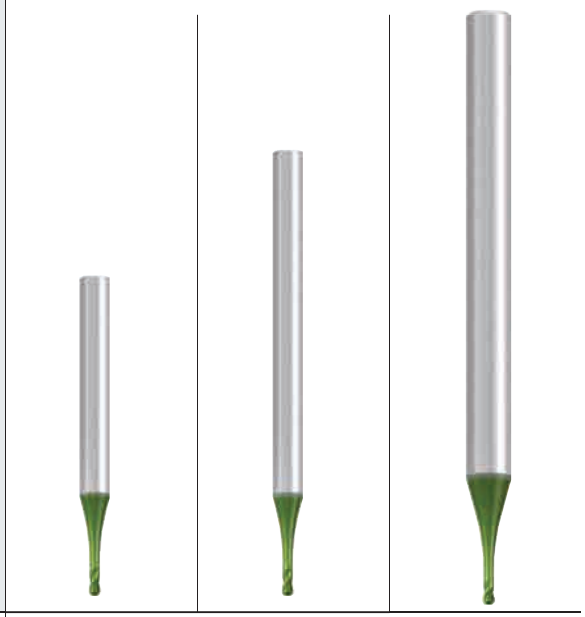
$L_3 = 5 \times d_1$





Icon descriptions
(see pages 228-229)

Ball Nose



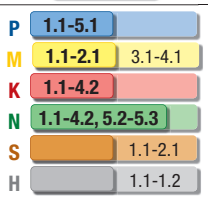
Coating ALCR

Applications – Materials (see page 20)

Cutting Data (see page 196)

Technical Data (see page 232)

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



Tool Dimensions / mm

Standard length

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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

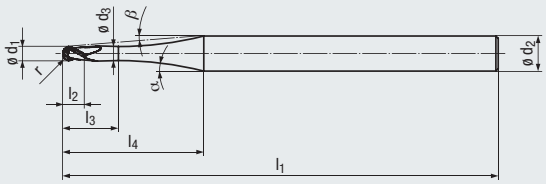
											Tool No. Straight Shank
0.2	0.1	0.2	1	50	0.16	6.4	3	15°	13°	**2**	**2774L.0002**
0.5	0.25	0.5	2.5	50	0.4	7.8	3	15°	10°	**2**	**2774L.0005**
0.8	0.4	0.8	4	50	0.64	9	3	15°	8°	**2**	**2774L.0008**
1	0.5	1	5	60	0.8	11.6	4	15°	8°	**2**	**2774L.0010**
1.2	0.6	1.2	6	60	0.96	12.4	4	15°	7°	**2**	**2774L.0012**
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**

- 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 ± 5 µm

$L_3 = 10 \times d_1$



N

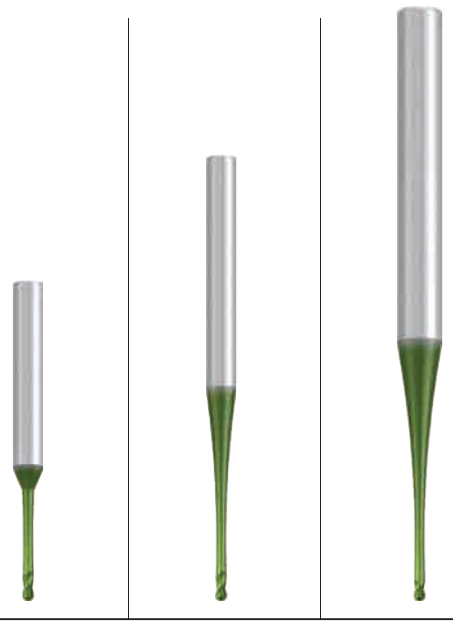
DIN

30°

Ball

Icon descriptions
(see pages 228-229)

Ball Nose



Coating ALCR

Applications – Materials (see page 21)

Cutting Data (see page 197)

Technical Data (see page 232)

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

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

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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

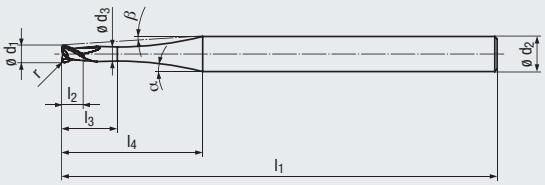
ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
0.2	0.1	0.2	2	50	0.16	9.2	3	15°	9°	**2**	**2775L.0002**
0.5	0.25	0.5	5	50	0.4	14.5	3	13°	6°	**2**	**2775L.0005**
0.8	0.4	0.8	8	50	0.64	18.7	3	9.8°	4°	**2**	**2775L.0008**
1	0.5	1	10	60	0.8	23.7	4	10.2°	4°	**2**	**2775L.0010**
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

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	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 ± 5 µm

$L_3 = 2.2 \times d_1$



N

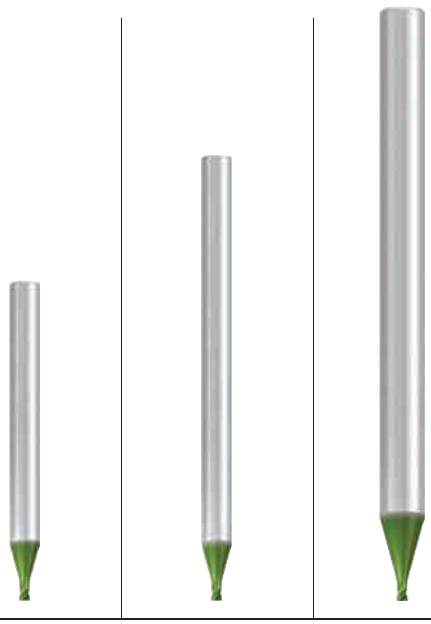
DIN

30°

Torus

Icon descriptions
(see pages 228-229)

Torus



Coating

ALCR

Applications – Materials (see page 21)

Cutting Data (see page 198)

Technical Data (see page 232)

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

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

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
0.5	0.1	0.3	1.1	38	0.4	5.8	3	15°	13°	**2**	**2780L.0005**
0.6	0.1	0.36	1.32	38	0.48	5.9	3	16.5°	12°	**2**	**2780L.0006**
0.8	0.2	0.48	1.76	38	0.64	5.9	3	16.5°	11°	**2**	**2780L.0008**
1	0.2	0.6	2.2	43	0.8	7.8	4	15°	11°	**2**	**2780L.0010**
1.2	0.2	0.72	2.64	43	0.96	8	4	16.5°	10.5°	**2**	**2780L.0012**
1.5	0.3	0.9	3.3	43	1.2	8	4	15°	9°	**2**	**2780L.0015**
1.6	0.3	0.96	3.52	43	1.28	8.1	4	16.5°	9°	**2**	**2780L.0016**
1.8	0.4	1.08	3.96	43	1.44	8.1	4	16.5°	8.5°	**2**	**2780L.0018**
2	0.5	1.2	4.4	57	1.6	11.9	6	15°	10°	**2**	**2780L.0020**

Long length

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

Extra long length

ø d_1	r	l_2	l_3	l_1	ø d_3	l_4	ø d_2	α	β	# Flutes	Tool No. Straight Shank
0.5	0.1	0.3	1.1	80	0.4	11.4	6	15°	14°	**2**	**2786L.0005**
1	0.2	0.6	2.2	80	0.8	11.5	6	15°	13°	**2**	**2786L.0010**
1.5	0.3	0.9	3.3	80	1.2	11.7	6	15°	11°	**2**	**2786L.0015**
2	0.5	1.2	4.4	80	1.6	11.9	6	15°	10°	**2**	**2786L.0020**

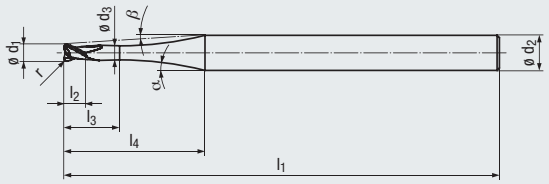
EMUGE-FRANKEN high precision / performance FPC Mill / Drill Chucks provide unprecedented rigidity, vibration dampening, concentricity, machining speed, and tool life vs. conventional chuck technologies for milling and drilling applications. Available in a wide range of styles. Internal and peripheral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

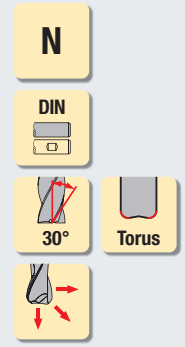
CAT 40 MICRO

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.

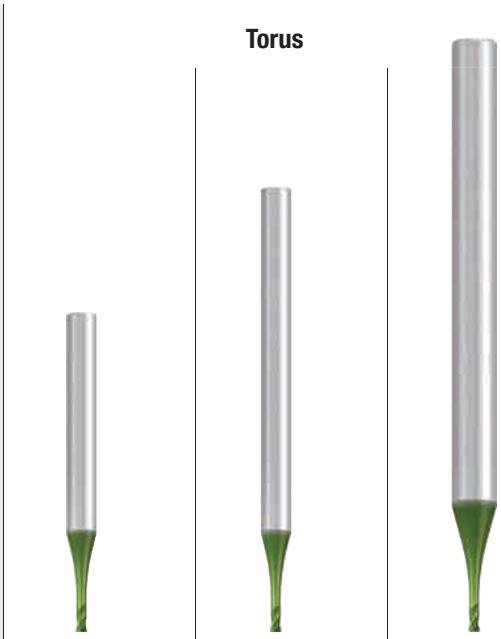
- Multi-functional tool
- Optimized neck designs
- High-precision corner radius
- 3 neck lengths available
- Newly developed high-performance coating significantly increases tool life
- Short, robust cutting edge design
- Highly accurate dimensional tolerance ± 5 µm

$L_3 = 5 \times d_1$





Icon descriptions
(see pages 228-229)



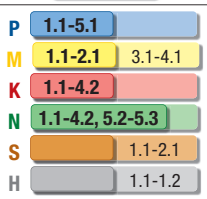
Coating ALCR

Applications – Materials (see page 21)

Cutting Data (see page 199)

Technical Data (see page 232)

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



Tool Dimensions / mm

Standard length

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
0.5	0.1	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

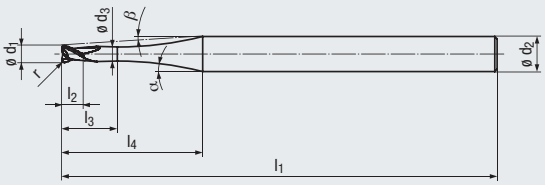
											Tool No. Straight Shank
0.5	0.1	0.5	2.5	50	0.4	7.8	3	15°	10°	**2**	**2784L.0005**
1	0.2	1	5	60	0.8	11.6	4	15°	8°	**2**	**2784L.0010**
1.5	0.3	1.5	7.5	60	1.2	13.7	4	15°	6°	**2**	**2784L.0015**
2	0.5	2	10	70	1.6	19.7	6	15°	6°	**2**	**2784L.0020**

Extra long length

											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**

- 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 ± 5 µm

$L_3 = 10 \times d_1$



N

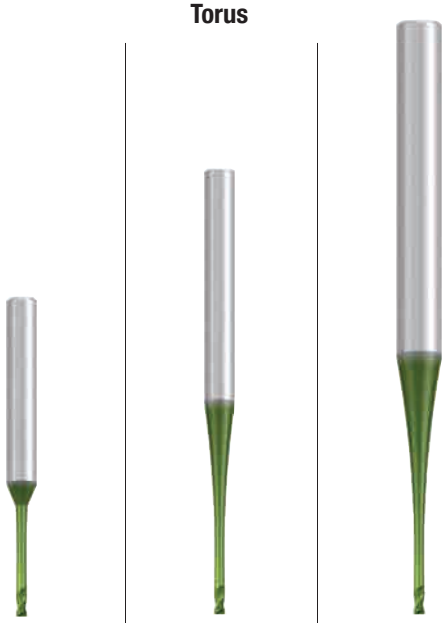
DIN

30°

Torus

Icon descriptions (see pages 228-229)

Torus



Coating ALCR

Applications – Materials (see page 21)

Cutting Data (see page 200)

Technical Data (see page 232)

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

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

ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
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

											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

											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

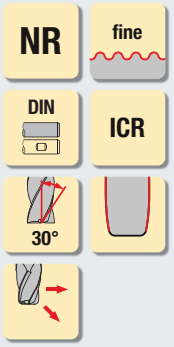
Circle Segment end mills, an EMUGE-FRANKEN innovation, feature unique design forms with large radii, allowing a much larger axial depth of cut during pre-finish and finishing. This generates higher cutting forces than conventional ball-nose cutters due to the large radii on the face and radial cutting 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.

Up to 90% Cycle Time Reductions!

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 *hyper*Mill® or Mastercam® is required to support and compute the geometries of Circle Segment end mills to achieve optimum performance.

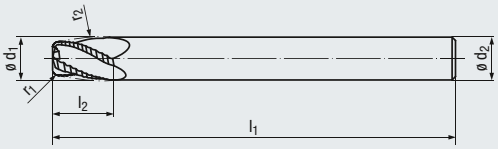
German engineered
EMUGE-FRANKEN quality

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



Icon descriptions
(see pages 228-229)

Oval Form



Coating — ALCR

Applications – Materials (see page 22)

Cutting Data (see page 201)

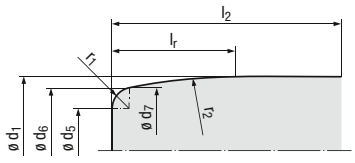
- P 1.1-5.1
- M 1.1-4.1
- N 1.1-1.3
- S 1.1-1.3
- S 2.2-2.6

- 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

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

Dimensions for tool database



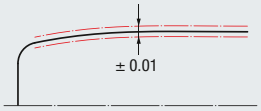
l_r = r_2 is tangential to d_1

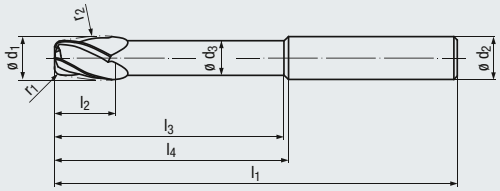
d_6 = Tangent point of r_1 and r_2

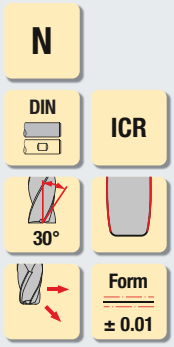
d_7 = $d_5 + 2 \times r_1$

ø d_1	r_1	r_2	l_2	l_r	ø d_5	ø d_6	ø 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

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







Icon descriptions
(see pages 228-229)

Oval Form

Coating ALCR

Applications – Materials (see page 22)

Cutting Data (see page 201)

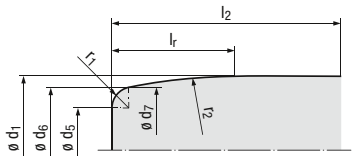
- Especially suitable for high-strength materials
- Also suitable in Nickel-based alloys
- For the machining of titanium alloys
- Suitable in all turbine materials
- Optimized for finishing Impellers and Integrated Bladed Rotors (IBR) made from aluminum, titanium and Inconel

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

ø d_1	r_1	r_2	l_2	l_1	l_3	l_4	ø d_3	ø 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



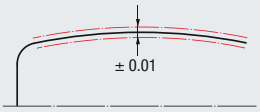
ø d_1	r_1	r_2	l_2	l_r	ø d_5	ø d_6	ø d_7
8	1	40	12	10	3.895	5.841	5.895
10	1.5	45	12	10	5.323	8.265	8.323
12	2	50	14	12	5.894	9.806	9.894
16	2	60	18	16	8.570	12.452	12.570

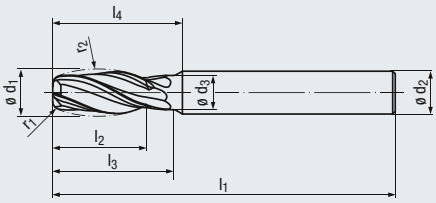
l_r = r_2 is tangential to d_1

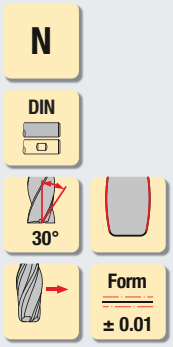
d_6 = Tangent point of r_1 and r_2

d_7 = $d_5 + 2 \times r_1$

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







Icon descriptions
(see pages 228-229)

Barrel Form

Coating ALCR

Applications – Materials (see page 22)

Cutting Data (see page 202)

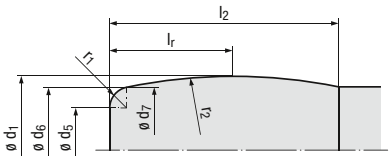
- Especially suitable for high-strength materials
- For almost all materials
- Suitable for HSC finishing

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 Dimensions / mm

ø d_1	r_1	r_2	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	# Flutes	Tool No. Straight Shank
10	2	50	21	28	80	8	30	10	**4**	**3542L.10050A**

Dimensions for tool database



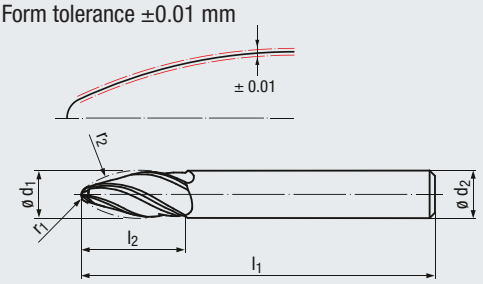
ø d_1	r_1	r_2	l_2	l_r	ø d_5	ø d_6	ø d_7
10	2	50	21	11.747	4	7.917	8

l_r = r_2 is (theoretically) tangential to d_1

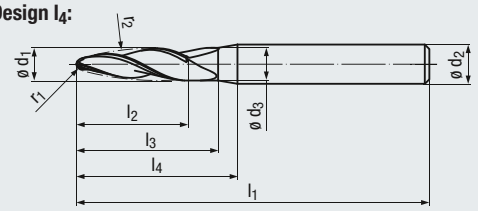
d_6 = Tangent point of r_1 and r_2

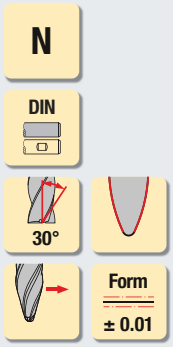
$d_7 = d_5 + 2 \times r_1$

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



Design l_4:





Icon descriptions
(see pages 228-229)

Oval Form

Coating ALCR

Applications – Materials (see page 22)

Cutting Data (see page 203)

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

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 Dimensions / mm

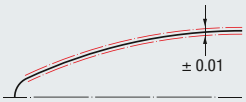
ø d_1	r_1	r_2	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	# Flutes	Tool No. Straight Shank
3	0.75	50	11	14	62	3	25	6	**3**	**3538L.03050A**
4	0.75	60	14	18	62	4	25	6	**3**	**3538L.04060A**
5	1	75	17	22	62	5	25	6	**3**	**3538L.05075A**
6	1	95	22	–	62	–	–	6	**3**	**3538L.06095A**
8	1	90	25	–	68	–	–	8	**3**	**3538L.08090A**
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**

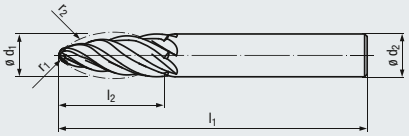
Machining example

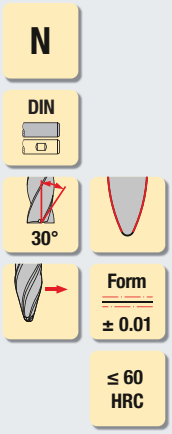
Component: Flange of a fuel pipe from the aerospace industry

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 ±0.01 mm







Icon descriptions
(see pages 228-229)

Oval Form

Coating ALCR

Applications – Materials (see page 22)

Cutting Data (see page 204)

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

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	

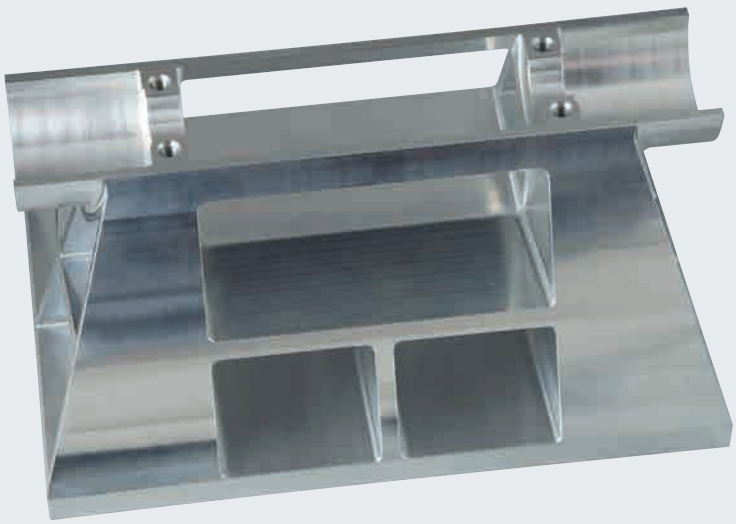
Tool Dimensions / mm

ø d_1	r_1	r_2	l_2	l_1	ø 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**

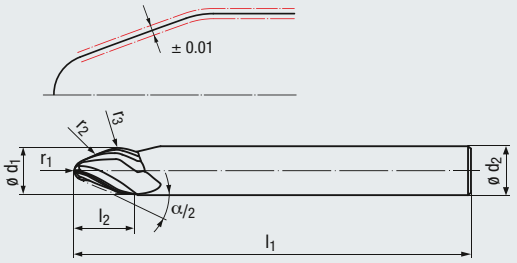
Machining example

Component: Bearing block from mechanical engineering

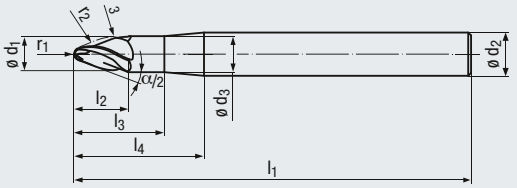
Application: Complete finishing of the the outer contour, inner contour and the pockets



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



Design l_4:



N

DIN

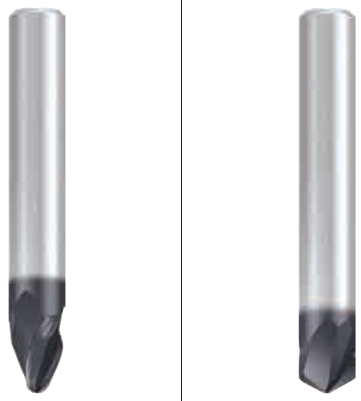
20-30°

Form ± 0.01

Icon descriptions (see pages 228-229)

Taper Form

< 45° ≥ 45°



Coating

Applications – Materials (see page 22)

Cutting Data (see page 205)

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

ALCR

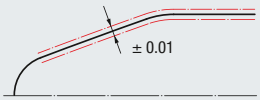
P	1.1-5.1	
M	1.1-2.1	3.1-4.1
K	1.1-2.1	2.2
K	3.1-4.1	4.2
N	1.1-1.4	
N	2.1-3.2	4.1-4.2, 5.2
S	1.1-2.2	2.3
S	2.4	2.5-2.6
H		1.1-1.2

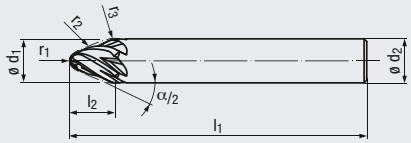
Tool Dimensions / mm

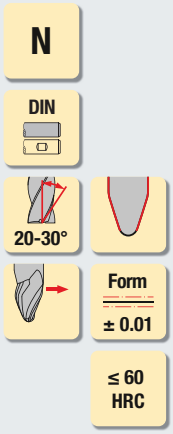
α/2	ø d_1	r_1	r_2	r_3	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
12.5°	**16**	2	1000	5	31	–	108	–	–	16	**3**	**3540L.1610AA**	**–**
	16	4	1000	5	24	–	108	–	–	16	**3**	**3540L.1610AB**	**–**
17.5°	**3**	0.75	50	1.5	4	7	62	3	14	6	**3**	**3540L.03050A**	**–**
	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**	**–**
	16	4	1500	8	18.5	–	108	–	–	16	**3**	**3540L.1615AA**	**–**
42.5°	**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**

NOTE: only use with tilt angle α/2! See page 79.

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







Icon descriptions
(see pages 228-229)

Taper Form

< 45° ≥ 45°

Coating ALCR

Applications – Materials (see page 22)

Cutting Data (see page 206)

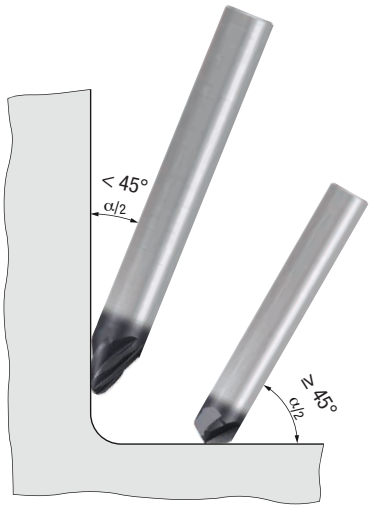
- Especially suitable for high-strength materials
- For almost all materials
- Hard machining of up to 60 HRC
- Suitable for HSC finishing

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	

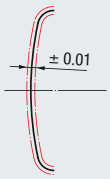
Tool Dimensions / mm

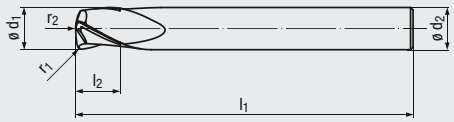
α/2	ø d_1	r_1	r_2	r_3	l_2	l_1	ø d_2 h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
12.5°	**16**	2	1000	5	31	108	16	**6**	**3541L.1610AA**	–
	16	4	1000	5	24	108	16	**6**	**3541L.1610AB**	–
20°	**10**	2	250	5	12.5	80	10	**6**	**3541L.10250A**	–
	12	3	250	6	13.5	93	12	**6**	**3541L.12250A**	–
	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**

Only use with tilt angle α/2!

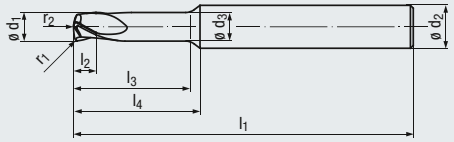


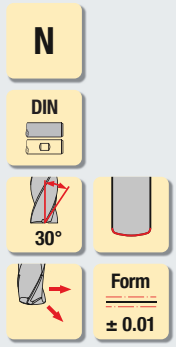
- High performance tool
- With 3 flutes
- Low-vibration machining
- Highly efficient finishing
- Form tolerance ±0.01 mm





Design l_4:





Icon descriptions
(see pages 228-229)

Lens Form

Coating ALCR

Applications – Materials (see page 22)

Cutting Data (see page 207)

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

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	5.2
S	1.1-2.1	

Tool Dimensions / mm

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

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.

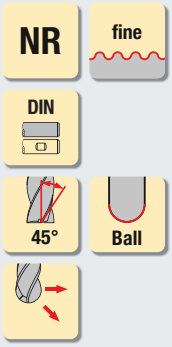
Realize unprecedented cycle time reductions and tool life in challenging forms and materials, including Ti, Ni and more.

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

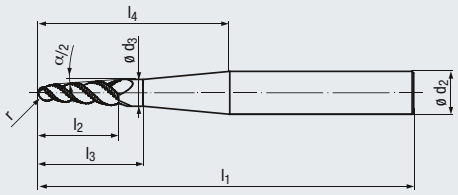
German engineered
EMUGE-FRANKEN quality

Rougher

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



Icon descriptions
(see pages 228-229)



Tapered Ball Nose

Coating ALCR

Applications – Materials (see page 23)

Cutting Data (see page 208)

- 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

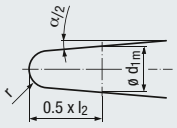
P 1.1-5.1
M 1.1-4.1
N 1.1-1.3
S 1.1-1.3
S 2.2-2.6

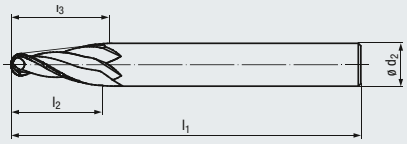
Tool Dimensions / mm

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

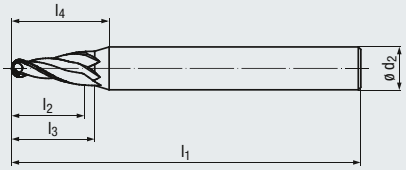
Rougher

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





Design l_4:



NF | medium | DIN | 30° | Ball

Icon descriptions (see pages 228-229)

Tapered Ball Nose

WITH POLISHED CHIP SPACE

Coating

N 1.1-1.3
N 4.1-4.2

ALCR

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

Applications – Materials (see page 23)

Cutting Data (see page 209)

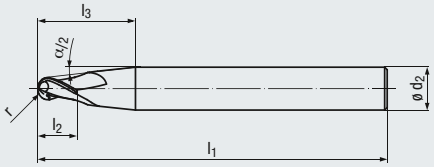
- For almost all materials
- Suitable for roughing and finishing

Tool Dimensions / mm

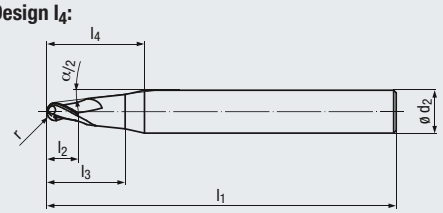
$\alpha/2$	r ±0.01	l_2	l_3	l_1	l_4	d_{1m}	ø d_2 h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank	Tool No. Straight Shank
3°	1.5	20	20	62	24	3.90	6	2	3446.03015A	3447.03015A	3446L.03015A
	2	31	31	80	35	5.42	8	2	3446.03020B	3447.03020B	3446L.03020B
4°	0.5	20	20	62	24	2.33	6	2	3446.04005A	3447.04005A	3446L.04005A
	1	20	20	62	24	3.26	6	2	3446.04010A	3447.04010A	3446L.04010A
	1.5	20	20	63	25	4.20	8	2	3446.04015A	3447.04015A	3446L.04015A
	2	30	30	72	–	5.83	8	2	3446.04020B	3447.04020B	3446L.04020B
6°	0.5	20	24	62	–	3.00	6	2	3446.06005A	3447.06005A	3446L.06005A
	1	19	19	62	–	3.80	6	2	3446.06010A	3447.06010A	3446L.06010A
	1.5	15	15	62	–	4.28	6	2	3446.06015A	3447.06015A	3446L.06015A
	1.5	25	25	68	–	5.33	8	2	3446.06015B	3447.06015B	3446L.06015B
	2	20	20	68	–	5.70	8	2	3446.06020A	3447.06020A	3446L.06020A
	2	30	30	80	–	6.76	10	2	3446.06020B	3447.06020B	3446L.06020B
8°	0.5	18	18	62	–	3.40	6	2	3446.08005A	3447.08005A	3446L.08005A
	1	15	15	62	–	3.85	6	2	3446.08010A	3447.08010A	3446L.08010A
	1.5	19	19	63	–	5.28	8	2	3446.08015A	3447.08015A	3446L.08015A
	2	23	23	72	–	6.71	10	2	3446.08020A	3447.08020A	3446L.08020A

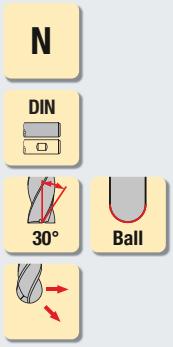
2 Flute Design

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



Design l_4:





Icon descriptions
(see pages 228-229)

Tapered Ball Nose

WITH POLISHED CHIP SPACE

Coating

Applications – Materials (see page 23)

Cutting Data (see page 210)

- For almost all materials
- Suitable for roughing and finishing

N 1.1-1.3
N 4.1-4.2

ALCR

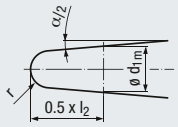
P 1.1-3.1 4.1-5.1
M 1.1-2.1
K 1.1-2.2 3.1-4.2
N 1.1-1.4 1.5
N 2.1-2.6 2.7-2.8
N 3.1-4.4, 5.2-5.3
S 1.1-1.2 1.3
S 2.1-2.2 2.3-2.6

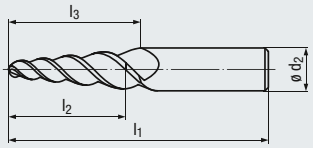
Tool Dimensions / mm

α/2	r ±0.01	l_2	l_3	l_1	l_4	ø d_2 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

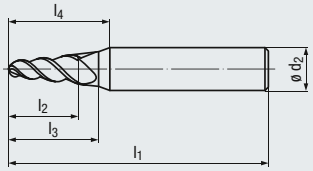
3 Flute Design

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





Design l_4:



N

DIN

45°

Ball

Icon descriptions (see pages 228-229)

Tapered Ball Nose

WITH POLISHED CHIP SPACE

Coating

N 1.1-1.3
N 4.1-4.2

ALCR

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

Applications – Materials (see page 23)

Cutting Data (see page 211)

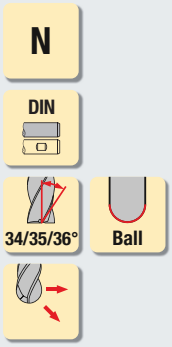
- For almost all materials
- Suitable for finishing

Tool Dimensions / mm

α/2	r ±0.01	l2	l3	l1	l4	d1m	ø d2 h6	# 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
	3	31	31	80	–	7.76	10	3	3440.04030B	3441.04030B	3440L.04030B
6°	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
	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
8°	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
	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

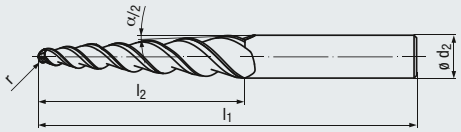
Long Reach

- High performance tool
- With 3 flutes
- Finishing geometry



Icon descriptions
(see pages 228-229)

Tapered Ball Nose



Coating ALCR

Applications – Materials (see page 23)

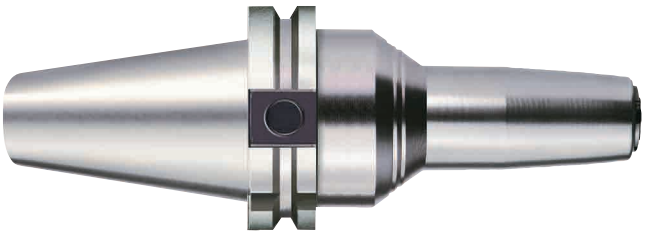
Cutting Data (see page 212)

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

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

Tool Dimensions / mm

α/2	r ±0.01	l2	l1	ø d2 h6	# Flutes	Tool No. Straight Shank
4°	2	59	120	12	3	3550L.04020A
	2	87	150	16	3	3550L.04020B
	3	74	140	16	3	3550L.04030A
	3	103	165	20	3	3550L.04030B
	4	89	155	20	3	3550L.04040A

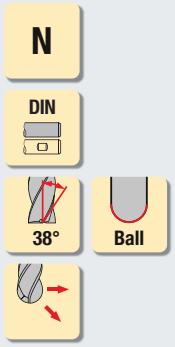


CAT 40 SLIM LINE
Slim Line Design - Ideal for 5-Axis machining

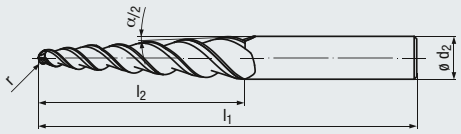
EMUGE-FRANKEN high precision / performance FPC Mill / Drill Chucks provide unprecedented rigidity, vibration dampening, concentricity, machining speed, and tool life vs. conventional chuck technologies for milling and drilling applications. Available in a wide range of styles. Internal and peripheral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

Combination Flute – Long

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



Icon descriptions (see pages 228-229)



Icon descriptions (see pages 228-229)

Tapered Ball Nose

Coating ALCR

Applications – Materials (see page 23)

Cutting Data (see page 212)

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

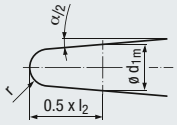
P 1.1-5.1
M 1.1-4.1
N 1.3-1.5
S 1.1-1.3
S 2.2-2.6

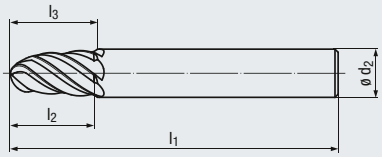
Tool Dimensions / mm

α/2	r ±0.01	l2	l1	ø d2 h6	# Flutes	Tool No. Straight Shank
4°	2	59	120	12	3/6	3548L.04020A
	2	87	150	16	3/6	3548L.04020B
	3	74	140	16	3/6	3548L.04030A
	3	103	165	20	3/6	3548L.04030B
	4	89	155	20	3/6	3548L.04040A

Combination Flute – Short

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





N

DIN

38°

Ball

Icon descriptions (see pages 228-229)

Icon descriptions (see pages 228-229)

Tapered Ball Nose

Coating TIALN

Applications – Materials (see page 23)

Cutting Data (see page 213)

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

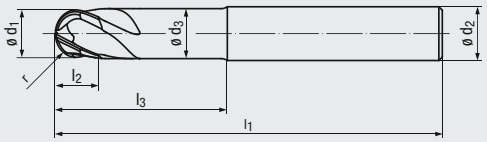
P 1.1-5.1
M 1.1-4.1
K 1.1-4.2
N 2.1-2.8
S 1.1-2.6

Tool Dimensions / mm

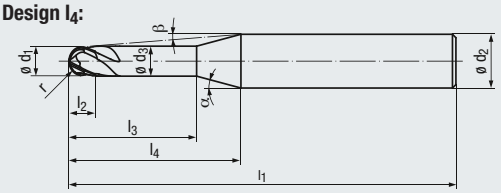
α/2	r ±0.01	l2	l3	l1	d1	ø d2 h6	# Flutes	Tool No. Straight Shank
4°	**3**	30	47	108	7.89	12	**3/6**	**2679A.04030A**
	3.5	39	39	108	9.26	12	**3/6**	**2679A.04035A**
	4	32	32	108	9.70	12	**3/6**	**2679A.04040A**
	5	35	49	108	11.77	16	**3/6**	**2679A.04050A**
	6	34	34	108	13.57	16	**3/6**	**2679A.04060A**
	8	36	36	108	17.44	20	**3/6**	**2679A.04080A**

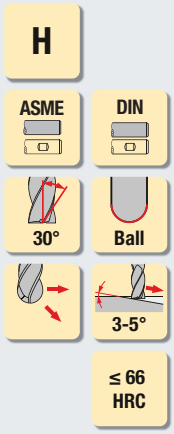
Ball Nose

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



Design l_4:





Icon descriptions
(see pages 228-229)

Coating TIALN

Applications – Materials (see page 24)

Cutting Data (see page 214)

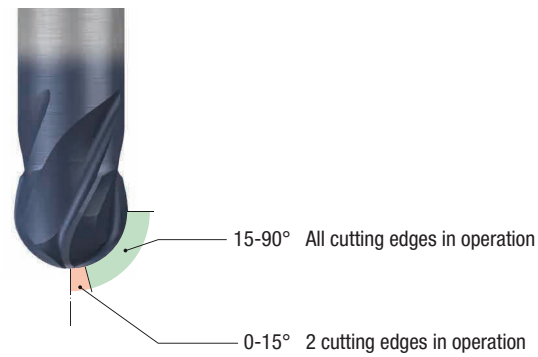
- For machining hard materials up to 66 HRC
- For finishing with very high surface quality
- Suitable for HSC finishing

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

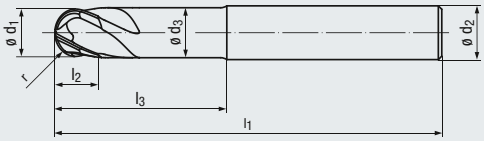
	ø d_1 ±0.0004	r ±0.0002	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
[inch]	**1/8**	0.0625	5/32	7/16	2	0.118	1/2	1/4	–	9°	**4**	**2942A.0125**
	3/16	0.0938	3/16	1/2	2	0.177	1/2	1/4	–	5°	**4**	**2942A.01875**
	1/4	0.1250	1/4	1/2	2	0.236	–	1/4	–	–	**4**	**2942A.0250**
	5/16	0.1563	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**

	ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
[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**

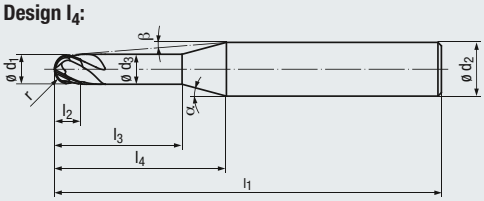


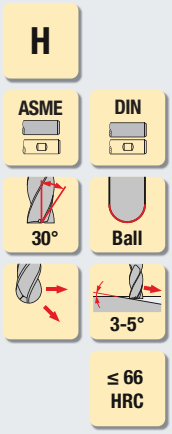
Ball Nose

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



Design l_4:





Icon descriptions (see pages 228-229)

Coating TIALN

Applications – Materials (see page 24)

Cutting Data (see page 215)

- 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										
S	1.1-2.6											
H	1.1-1.5											

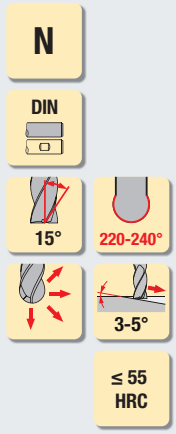
Long length

	ø d_1 ±0.004	r ±0.0002	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
[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**

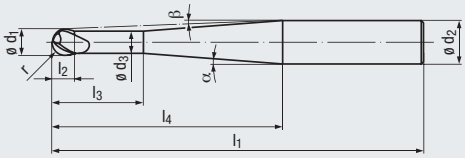
	ø d_1 ±0.01	r ±0.005	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
[mm]	**6**	3	6	30	80	5.6	–	6	–	–	**4**	**2842A.006**
	8	4	7	35	80	7.6	–	8	–	–	**4**	**2842A.008**
	10	5	8	45	100	9.6	–	10	–	–	**4**	**2842A.010**
	12	6	10	50	100	11.5	–	12	–	–	**4**	**2842A.012**

Lollipop – 2 Flutes

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



Icon descriptions
(see pages 228-229)



Coating TIALN

Applications – Materials (see page 24)

Cutting Data (see page 216)

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

P 1.1-5.1
K 1.1-4.2
N 2.1-2.8 1.2-1.4, 5.2
H 1.1-1.2

Tool Dimensions / mm

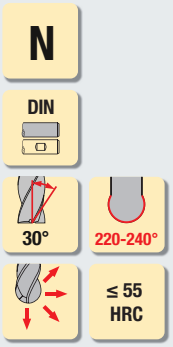
Extra long length

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

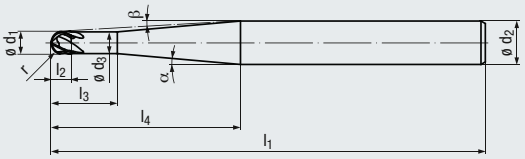
Ball nose with fully functional cutting edge up to 240°

Lollipop – 4 Flutes

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



Icon descriptions
(see pages 228-229)



Coating ALCR

Applications – Materials (see page 24)

Cutting Data (see page 217)

- 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

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

ø d_1 -0.04	r -0.002	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
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**

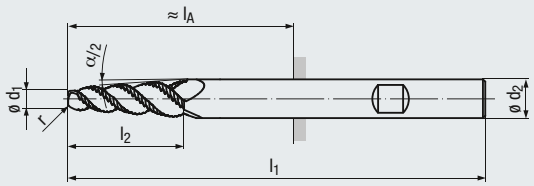
Extra long length

ø d_1 -0.04	r -0.002	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# Flutes	Tool No. Straight Shank
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**

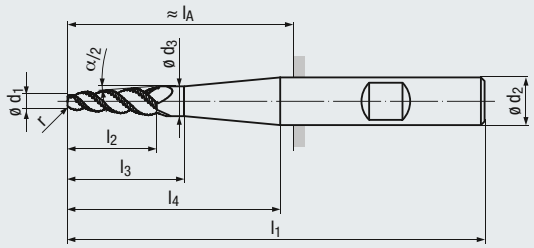
Ball nose with fully functional cutting edge up to 240°

Rougher – Coolant Fed

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



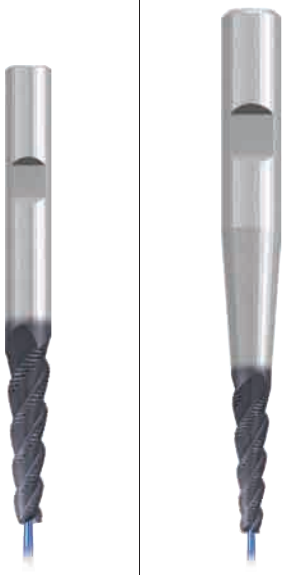
Design l_4:



NR | fine | DIN | ICA | 45° | Torus

Icon descriptions (see pages 228-229)

Tapered Torus



Coating ALCR

Applications – Materials (see page 24)

Cutting Data (see page 218)

- 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 machining 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

Standard length

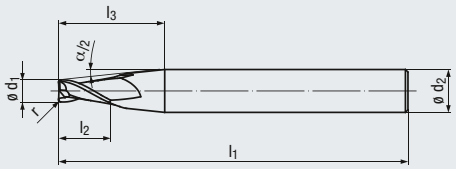
$\alpha/2$	ø d_1 -0.05	r	l_2	l_3	l_1	l_4	ø d_3	ø d_2 h6	l_A	# Flutes	Tool No. Weldon Shank
3°	**6.5**	1	14	–	68	–	–	8	32	**4**	**3534LZ.03065A**
	7.5	1	23.5	–	80	–	–	10	40	**4**	**3534LZ.03075A**
	8.5	1	33	–	93	–	–	12	48	**4**	**3534LZ.03085A**

Long length

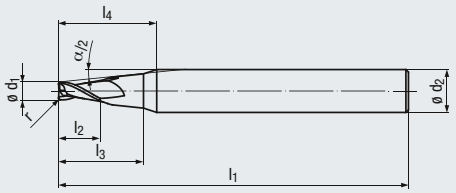
$\alpha/2$	ø d_1 -0.05	r	l_2	l_3	l_1	l_4	ø d_3	ø d_2 h6	l_A	# Flutes	Tool No. Weldon Shank
3°	**5**	1	20	29.5	80	38	7.1	8	44	**3**	**3532LZ.03050A**
	5.5	1	25	34.5	95	52.5	8.1	10	55	**3**	**3532LZ.03055A**
	6	1	30	39.5	120	67	9.1	12	72	**3**	**3532LZ.03060A**

2 Flute Design

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



Design l_4:



N

DIN

30°

Torus

Icon descriptions
(see pages 228-229)

Tapered Torus

WITH POLISHED CHIP SPACE

Coating

ALCR

Applications – Materials (see page 24)

Cutting Data (see page 219)

- For almost all materials
- Suitable for roughing

N 1.1-1.3
N 4.1-4.2

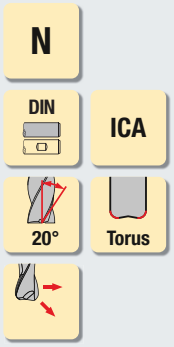
P 1.1-3.1 4.1-5.1
M 1.1-2.1
K 1.1-2.2 3.1-4.2
N 1.1-1.4 1.5
N 2.1-2.6 2.7-2.8
N 3.1-4.4, 5.2-5.3
S 1.1-1.2 1.3
S 2.1-2.2 2.3-2.6

Tool Dimensions / mm

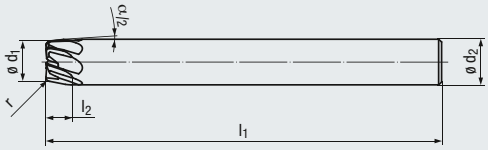
α/2	ø d1	r ±0.01	l2	l3	l1	l4	ø d2 h6	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank	Tool No. Straight Shank
3°	3	0.3	6	24	63	26	8	2	3444.03003A	3445.03003A	3444L.03003A
	4	0.4	8	24	63	26	8	2	3444.03004A	3445.03004A	3444L.03004A
	5	0.5	10	25	63	26	8	2	3444.03005A	3445.03005A	3444L.03005A
4°	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

Multiple Flutes – Coolant Fed

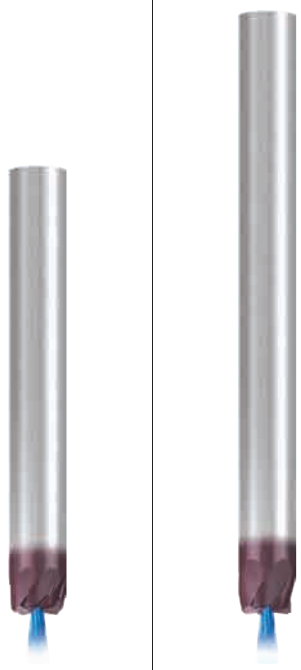
- High performance tool
- With 5-13 flutes
- Variable spacing
- Low-vibration machining
- Internal coolant supply, axial exit (ICA)



Icon descriptions (see pages 228-229)



Tapered Torus



Coating TIALN

Applications – Materials (see page 24)

Cutting Data (see page 220)

- 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

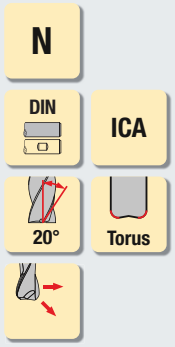
α/2	ø d1	r ±0.01	l2	l1	ø d2 h6	# Flutes	Tool No. Straight Shank
8°	8	0.8	7.5	80	10	7	2677AZ.008008
	9	1	3.5	80	10	7	2677AZ.009010
	10	1	7.5	80	12	9	2677AZ.010010
	11	1	3.5	80	12	9	2677AZ.011010

Extra long length

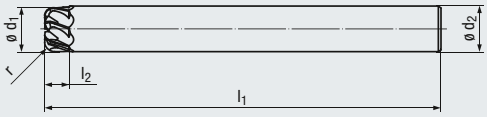
α/2	ø d1	r ±0.01	l2	l1	ø d2 h6	# Flutes	Tool No. Straight Shank
8°	9	1	3.5	108	10	5	2678AZ.009010
	10	1	7.5	108	12	7	2678AZ.010010
	11	1	3.5	108	12	7	2678AZ.011010
	15	1	3.5	108	16	9	2678AZ.015010
	15	1	3.5	108	16	13	2678AZ.115010
	19	1	3.5	108	20	9	2678AZ.019010
	19	1	3.5	108	20	13	2678AZ.119010

Multiple Flutes – Coolant Fed

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



Icon descriptions
(see pages 228-229)



Torus

Coating TIALN

Applications – Materials (see page 24)

Cutting Data (see page 221)

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

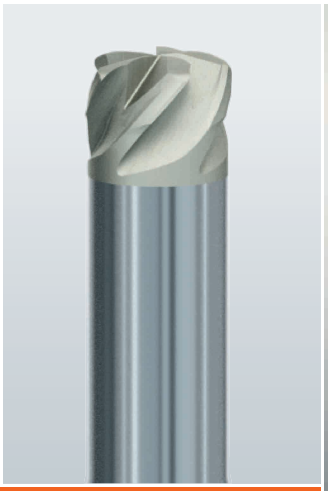
P 1.1-5.1
M 1.1-4.1
K 1.1-4.2
N 2.1-2.8
S 1.1-2.6

Tool Dimensions / mm

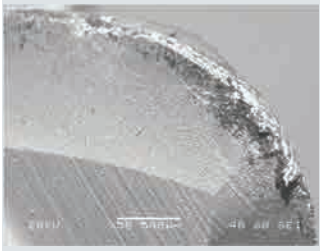
ø d_1 f8	r ±0.01	l_2	l_1	ø d_2 h6	# Flutes	Tool No. Straight Shank
8	1	3	80	8	**5**	**2676AZ.008010**
8	2	4	80	8	**5**	**2676AZ.008020**
10	1	3	80	10	**7**	**2676AZ.010010**
10	2	4	80	10	**7**	**2676AZ.010020**
12	1	3	108	12	**7**	**2676AZ.012010**
12	2	4	108	12	**7**	**2676AZ.012020**
16	1	3	108	16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

Cera-Cut Ceramic End Mills

For Cutting Nickel-based Alloys



SPEED COMPARISON

SFM = 820	CERA-CUT SFM = 3,280
	
Low cutting speed produces adhesion	High cutting speed reduces adhesion and greatly improves tool life

EMUGE-FRANKEN **Cera-Cut** Ceramic End Mills were developed to meet the requirements of high speed milling, while saving on tool life, specifically for heat resistant super alloys (HRSA). Cera-Cut tools have an advanced ceramic head brazed to a carbide shank for optimal vibration dampening and longer tool life compared to one-piece ceramic tools. Cera-Cut excels in machining flexibility for exotic alloys and complex aerospace parts.

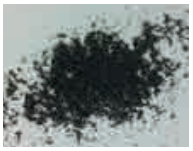
Scan for more information:

German engineered
EMUGE-FRANKEN quality

Machine parts **200 to 400% faster** than carbide end mills

Up to **5X** the tool life vs carbide end mills!

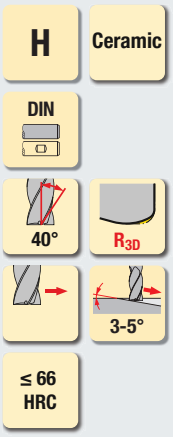
Regular curled chips from carbide end mills



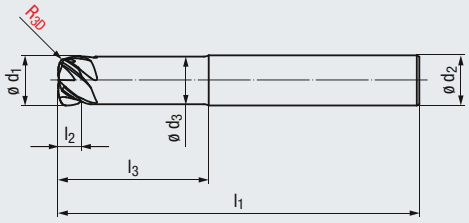
Dust-like chips from ceramic end mills

Ceramic – Corner Radius

- High performance tool
- High-speed end mill
- Tight cutting diameter tolerance
- Duplex cutting edge geometry for longer tool life
- Two piece construction with carbide shank reduces vibration
- Requires high spindle RPMs and rigid tool holders
- Dry machining only
- Suitable for roughing and pre-finishing
- 2D and 3D contours can be produced
- Suitable for high feed machining with face cutting edge



Icon descriptions (see pages 228-229)



Coating BRIGHT

Applications – Materials (see page 25)

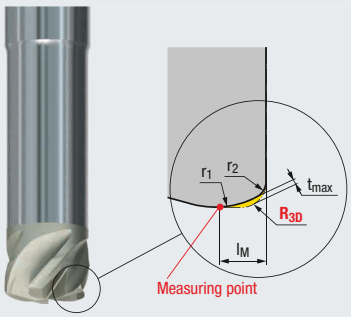
S 2.1-2.6
H 1.1-1.5

Cutting Data (see page 222)

- Suitable for difficult to cut materials
- For nickel alloys and some hardened steels

Tool Dimensions / mm

	ø d_1		R_{3D}	r_1 / r_2	l_M	t_{max}	l_2	l_3	l_1	ø d_3	ø d_2 h5	# Flutes	Tool No. Straight Shank
[inch]	1/4	-0.0008	0.035	0.1225/0.0250	0.0725	0.0075	5/32	3/4	2 1/4	0.236	1/4	5	3915.0250
	5/16	-0.0016	0.040	0.1531/0.0313	0.0906	0.0090	5/32	7/8	2 1/2	0.295	5/16	5	3915.03125
	3/8	-0.0016	0.045	0.1837/0.0375	0.1088	0.0120	5/32	1 1/8	2 3/4	0.358	3/8	5	3915.0375
	1/2	-0.0016	0.070	0.2450/0.0500	0.1450	0.0140	5/32	1 3/8	3 1/4	0.480	1/2	5	3915.0500
	5/8	-0.0016	0.085	0.3063/0.0625	0.1813	0.0180	15/64	1 1/2	3 1/2	0.605	5/8	5	3915.0625
[mm]	6	-0.02	0.8	2.9/0.6	1.74	0.2	4	20	57	5.8	6	5	3818.006
	8	-0.04	1	3.9/0.8	2.32	0.3	4	25	63	7.7	8	5	3818.008
	10	-0.04	1.2	4.9/1	2.9	0.4	4	30	72	9.5	10	5	3818.010
	12	-0.04	1.6	5.9/1.2	3.48	0.4	4	35	83	11.5	12	5	3818.012
	16	-0.04	2.2	7.8/1.6	4.64	0.5	6	40	92	15.5	16	5	3818.016



DUPLEX Geometry

t_{max} = Maximum rest 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

l_M = Measuring point definition for measuring length using a laser

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 paricularly 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.

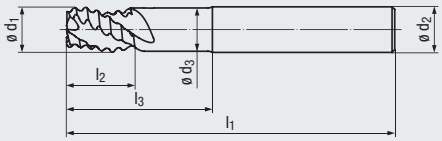
Characteristics

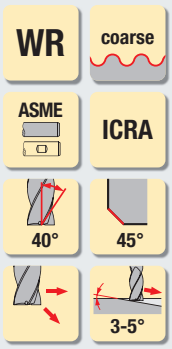
- Variable spacing
- Available with WR profile for roughing
- Special geometry for machining aluminum
- Optionally available with internal coolant supply, radial and axial (ICRA)
- Highest metal removal rates

German engineered
EMUGE-FRANKEN quality

Rougher

- 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 228-229)

Applications

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

Cutting Data **(see page 223)**

Materials - ISO Material Groups **(see page 25)**

N 1.1-1.3 1.4

Cutting Data **(see page 223)**

Materials - ISO Material Groups **(see page 25)**

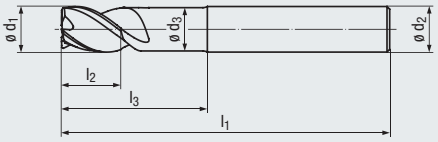
N 1.1-1.4 2.1-2.7

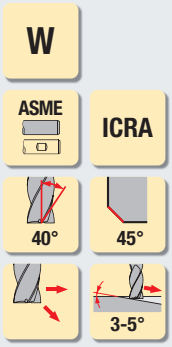
						Coating	Bright	CRN
ø d_1 h11	l_2	l_3	l_1	ø d_3	ø d_2 h5	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
1/4 *	3/8	13/16	2 1/4	0.234	1/4	**3**	**2888_Z.0250**	**2888RZ.0250**
5/16	7/16	1	2 1/2	0.297	5/16	**3**	**2888_Z.03125**	**2888RZ.03125**
3/8	1/2	1 1/8	2 3/4	0.354	3/8	**3**	**2888_Z.0375**	**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)

Finisher

- 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 228-229)

Applications

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

Cutting Data
(see page 223)

Materials - ISO Material Groups
(see page 25)

N 1.1-1.3 1.4

Cutting Data
(see page 223)

Materials - ISO Material Groups
(see page 25)

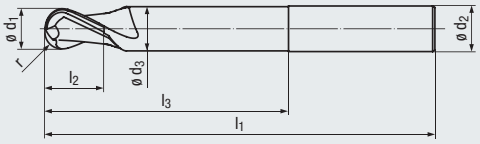
N 1.1-1.4 2.1-2.7

								Coating	Bright	CRN
ø d_1 h11	tolerance	l_2	l_3	l_1	ø d_3	ø d_2 h5	Chamfer	# Flutes	Tool No. Straight Shank	Tool No. Straight Shank
1/4 *	-0.0016	3/8	13/16	2 1/4	0.234	1/4	0.12	**3**	**2889_Z.0250**	**2889RZ.0250**
5/16	-0.0016	7/16	1	2 1/2	0.297	5/16	0.12	**3**	**2889_Z.03125**	**2889RZ.03125**
3/8	-0.0016	1/2	1 1/8	2 3/4	0.354	3/8	0.20	**4**	**2889_Z.0375**	**2889RZ.0375**
1/2	-0.0016	5/8	1 3/8	3 1/4	0.476	1/2	0.20	**4**	**2889_Z.0500**	**2889RZ.0500**
5/8	-0.0016	3/4	1 7/8	3 3/4	0.594	5/8	0.20	**4**	**2889_Z.0625**	**2889RZ.0625**
3/4	-0.0016	1	2 3/16	4 1/4	0.711	3/4	0.30	**4**	**2889_Z.0750**	**2889RZ.0750**
1	-0.0016	1 1/4	2 5/8	5	0.960	1	0.30	**4**	2889_Z.1000	**2889RZ.1000**

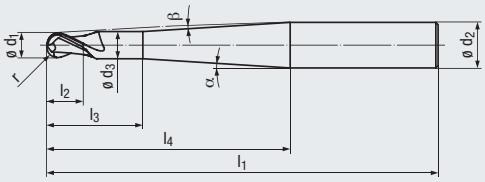
* Internal coolant supply, axial exit (ICA)

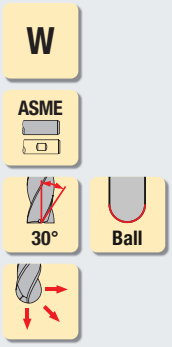
Ball Nose

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



Design l_4:





Icon descriptions (see pages 228-229)

Applications

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

Cutting Data (see page 224)

Materials - ISO Material Groups (see page 25)

N 1.1-1.3
N 4.1-4.2 5.3

Cutting Data (see page 224)

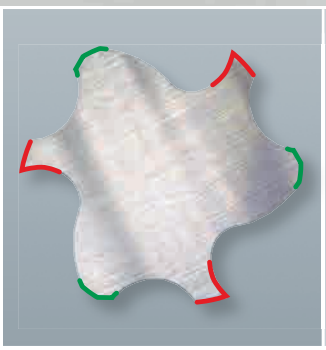
Materials - ISO Material Groups (see page 25)

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

										Coating	Bright	CRN
ø d_1 ±0.0004	r ±0.0002	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	α	β	# 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



Unique, patented tool geometry:

Combination of 3 cutting edges with 3 burnishing edges for smoothing and compacting non-ferrous materials.

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:

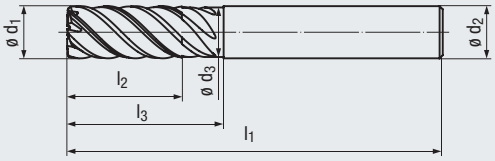
- Cutting diameter 6-12 mm
- Stub and standard lengths

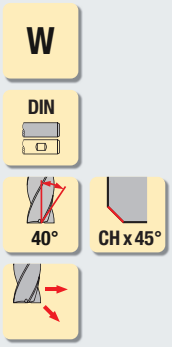
Applications:

- 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





Icon descriptions (see pages 228-229)

Applications

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

Cutting Data (see pages 225)

Materials - ISO Material Groups (see page 25)

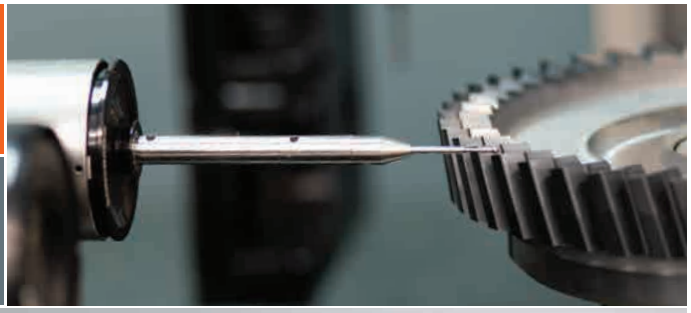
N 1.1-1.3 N 2.1-2.6

Coating Bright

ø d_1 f8	l_2	l_3	l_1	ø d_3	ø d_2 h5	Chamfer	# Flutes	Tool No. Straight Shank	
6	10	16	54	5.8	6	0.12	**3/6**	**2506.006**	
	13	20	57	5.8	6	0.12	**3/6**	**2507.006**	
8	12	20	58	7.7	8	0.12	**3/6**	**2506.008**	
	19	25	63	7.7	8	0.12	**3/6**	**2507.008**	
10	14	24	66	9.5	10	0.20	**3/6**	**2506.010**	
	22	30	72	9.5	10	0.20	**3/6**	**2507.010**	
12	16	26	73	11.5	12	0.20	**3/6**	**2506.012**	
	26	35	83	11.5	12	0.20	**3/6**	**2507.012**	

Complete Skiving Tool Solutions

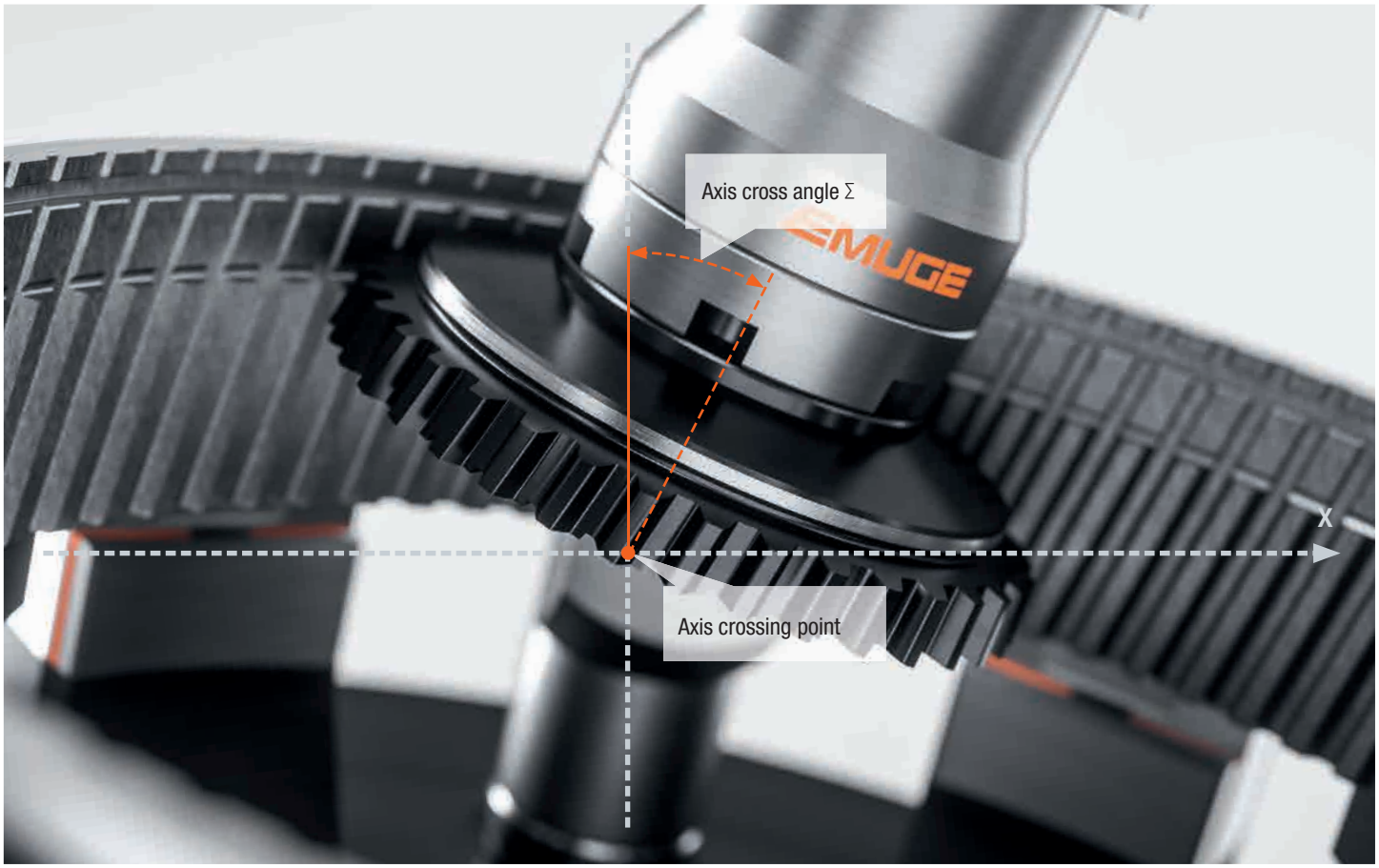
One Source for Skiving Tools, Tool Clamping and Workpiece Clamping Technology



EMUGE-FRANKEN has a full range of skiving wheels for internal and external gears as bell-type or shank tool variants in the module sizes m 0.4 to m 5. EMUGE-FRANKEN also offers support for repair of high-precision skiving tools.

High-precision Skiving tools are produced on state-of-the-art tool grinding machines with appropriate grinding software. A measurement report as well as corresponding technology data are supplied with every delivery of skiving tools. Our application engineering will be pleased to assist you with the initial use of the skiving tools.

For more information please visit:
https://ef-g.de/a/skiving



What is Skiving?

Skiving combines gear hobbing and gear shaping by continuous “rolling off” of material with axial feed. Skiving requires suitable machining centers and fully synchronized spindles for the highly dynamic conditions of the manufacturing process.

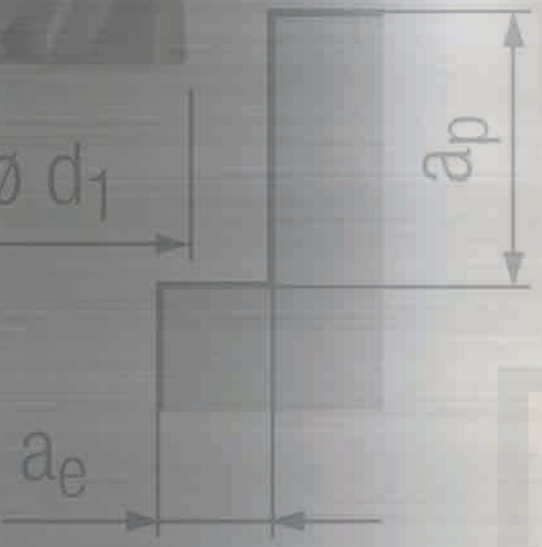
Axes of tool and workpiece cross during skiving. So-called axis cross angle is crucial for productivity. The crossed axis arrangement creates a relative speed between tool and workpiece. This relative movement is used as cutting movement with main cutting direction along the tooth space of the workpiece.

Applications:

- Production of ring gears, shafts with internal and external splines and splined shaft profiles
- Highly suitable for soft machining of internal and external gears as well as hard machining
- Use of the tools on turning /milling centers with B or A axes (swivel axes)
- No restrictions regarding the material to be machined

Clamping mandrel for mounting skiving tool

Applications / Materials
Cutting Data



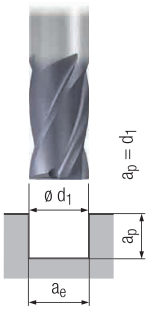
$a_e = 0.4 \times d_1$

Standard length (4 flutes)

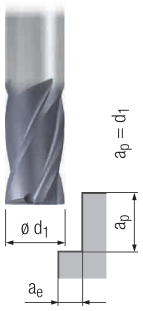
N

Valid for Tool Nos.:

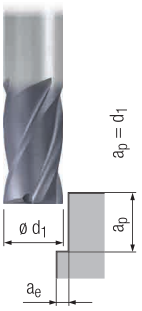
2992L
2993L



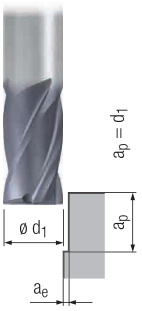
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	615	0.005 x d_1	685	0.006 x d_1	720	0.007 x d_1	865	0.008 x d_1	□	■	□	■
	2.1	540	0.004 x d_1	615	0.005 x d_1	650	0.006 x d_1	760	0.007 x d_1	□	■	□	■
	3.1	470	0.004 x d_1	505	0.005 x d_1	575	0.005 x d_1	650	0.006 x d_1	□	■	□	■
	4.1	435	0.003 x d_1	470	0.004 x d_1	505	0.004 x d_1	615	0.005 x d_1	□	■		
	5.1	360	0.003 x d_1	395	0.003 x d_1	435	0.004 x d_1	505	0.004 x d_1	□	■		
M	1.1	290	0.003 x d_1	325	0.004 x d_1	360	0.004 x d_1	395	0.005 x d_1			□	■
	2.1	255	0.003 x d_1	290	0.004 x d_1	290	0.004 x d_1	360	0.005 x d_1			□	■
	3.1	180	0.002 x d_1	215	0.003 x d_1	215	0.003 x d_1	255	0.004 x d_1			□	■
	4.1	110	0.002 x d_1	110	0.003 x d_1	145	0.003 x d_1	145	0.004 x d_1			□	■
K	1.1	615	0.005 x d_1	685	0.006 x d_1	720	0.007 x d_1	865	0.008 x d_1	□	■		
	1.2	615	0.005 x d_1	685	0.006 x d_1	720	0.007 x d_1	865	0.008 x d_1	□	■		
	2.1	540	0.004 x d_1	615	0.005 x d_1	650	0.006 x d_1	760	0.006 x d_1	□	■		
	2.2	540	0.004 x d_1	615	0.005 x d_1	650	0.006 x d_1	760	0.006 x d_1	□	■		
	3.1	470	0.004 x d_1	505	0.005 x d_1	575	0.006 x d_1	650	0.006 x d_1	□	■		
	3.2	470	0.004 x d_1	505	0.005 x d_1	575	0.006 x d_1	650	0.006 x d_1	□	■		
	4.1	360	0.003 x d_1	395	0.004 x d_1	435	0.004 x d_1	505	0.005 x d_1	□	■		
	4.2	290	0.003 x d_1	325	0.004 x d_1	360	0.004 x d_1	395	0.005 x d_1	□	■		
N	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			□	■
	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			□	■
	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			□	■
	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			□	■
	1.5	720											
	1.6	720											
	2.1	540	0.005 x d_1	615	0.006 x d_1	650	0.007 x d_1	760	0.008 x d_1			□	■
	2.2	540	0.005 x d_1	615	0.006 x d_1	650	0.007 x d_1	760	0.008 x d_1			□	■
	2.3	540	0.005 x d_1	615	0.006 x d_1	650	0.007 x d_1	760	0.008 x d_1		□	□	■
	2.4	470	0.004 x d_1	505	0.005 x d_1	575	0.006 x d_1	650	0.006 x d_1			□	■
	2.5	470	0.004 x d_1	505	0.005 x d_1	575	0.006 x d_1	650	0.006 x d_1			□	■
	2.6	470	0.004 x d_1	505	0.005 x d_1	575	0.006 x d_1	650	0.006 x d_1		□	□	■
	2.7	290	0.003 x d_1	325	0.004 x d_1	360	0.004 x d_1	395	0.005 x d_1			□	■
	2.8	290	0.003 x d_1	325	0.004 x d_1	360	0.004 x d_1	395	0.005 x d_1			□	■
	3.1	1225	0.009 x d_1	1335	0.011 x d_1	1480	0.013 x d_1	1730	0.014 x d_1			□	■
	3.2	1225	0.007 x d_1	1335	0.008 x d_1	1480	0.010 x d_1	1730	0.011 x d_1			□	■
	4.1	1225	0.008 x d_1	1335	0.009 x d_1	1480	0.011 x d_1	1730	0.012 x d_1		□	□	■
	4.2	1805	0.008 x d_1	1985	0.009 x d_1	2165	0.011 x d_1	2525	0.012 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	290	0.003 x d_1	325	0.004 x d_1	360	0.004 x d_1	395	0.005 x d_1				■
	5.3												
S	1.1	290	0.004 x d_1	325	0.004 x d_1	360	0.005 x d_1	395	0.006 x d_1				■
	1.2	255	0.003 x d_1	290	0.004 x d_1	290	0.004 x d_1	360	0.005 x d_1				■
	1.3	145	0.003 x d_1	145	0.003 x d_1	180	0.004 x d_1	215	0.004 x d_1				■
	2.1	255	0.002 x d_1	290	0.002 x d_1	290	0.003 x d_1	360	0.003 x d_1				■
	2.2	110	0.002 x d_1	110	0.002 x d_1	125	0.003 x d_1	145	0.003 x d_1				■
	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				■
	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				■
	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				■
	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				■
H	1.1	360	0.003 x d_1	395	0.003 x d_1	435	0.004 x d_1	505	0.004 x d_1	□	■		
	1.2	290	0.003 x d_1	325	0.003 x d_1	360	0.004 x d_1	395	0.004 x d_1	□	■		
	1.3			325	0.003 x d_1	360	0.003 x d_1	395	0.004 x d_1	□	■		
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

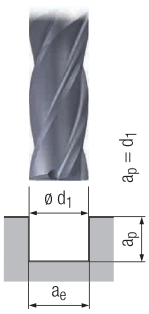
■ = very suitable
□ = suitable

Standard length (4 flutes)

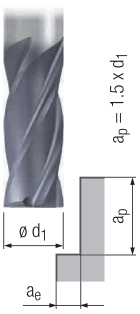
N

Valid for Tool Nos.:

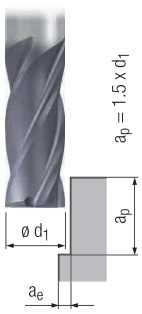
2994L
2995L



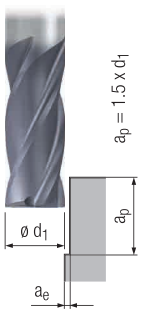
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

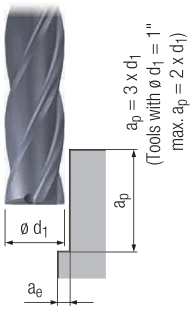
		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	505	0.005 x d_1	540	0.005 x d_1	615	0.006 x d_1	720	0.007 x d_1	□	■	□	■
	2.1	470	0.004 x d_1	505	0.005 x d_1	575	0.005 x d_1	650	0.006 x d_1	□	■	□	■
	3.1	395	0.004 x d_1	435	0.004 x d_1	470	0.005 x d_1	540	0.005 x d_1	□	■	□	■
	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	□	■		
	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	□	■		
M	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			□	■
	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			□	■
	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			□	■
	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			□	■
K	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	□	■		
	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	□	■		
	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	□	■		
	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	□	■		
	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	□	■		
	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	□	■		
	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	□	■		
	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	□	■		
N	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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		□	□	■
	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			□	■
	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			□	■
	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		□	□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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		□	□	■
	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			□	■
	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				■
	5.3												
S	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
H	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	□	■		
	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	□	■		
	1.3			255	0.003 x d_1	255	0.003 x d_1	290	0.003 x d_1	□	■		
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

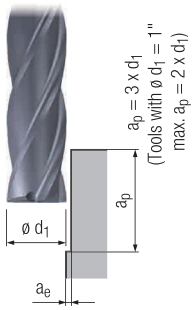
■ = very suitable
□ = suitable

Long length (4 flutes)

N



$a_e = 0.1 \times d_1$



$a_e = 0.02 \times d_1$

Valid for Tool Nos.:

2996L
2997L

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	435	0.005 x d_1	505	0.006 x d_1	□	■	□	■
	2.1	395	0.004 x d_1	470	0.005 x d_1	□	■	□	■
	3.1	325	0.004 x d_1	395	0.005 x d_1	□	■	□	■
	4.1	255	0.003 x d_1	290	0.004 x d_1	□	■		
	5.1	215	0.003 x d_1	255	0.003 x d_1	□	■		
M	1.1	435	0.003 x d_1	505	0.004 x d_1			□	■
	2.1	360	0.003 x d_1	435	0.004 x d_1			□	■
	3.1	255	0.003 x d_1	290	0.003 x d_1			□	■
	4.1	180	0.003 x d_1	215	0.003 x d_1			□	■
K	1.1	435	0.005 x d_1	505	0.006 x d_1	□	■		
	1.2	435	0.005 x d_1	505	0.006 x d_1	□	■		
	2.1	395	0.004 x d_1	470	0.005 x d_1	□	■		
	2.2	395	0.004 x d_1	470	0.005 x d_1	□	■		
	3.1	325	0.004 x d_1	395	0.005 x d_1	□	■		
	3.2	325	0.004 x d_1	395	0.005 x d_1	□	■		
	4.1	255	0.003 x d_1	290	0.004 x d_1	□	■		
	4.2	215	0.003 x d_1	255	0.004 x d_1	□	■		
N	1.1	1300	0.009 x d_1	1550	0.011 x d_1			□	■
	1.2	1300	0.008 x d_1	1550	0.010 x d_1			□	■
	1.3	1300	0.007 x d_1	1550	0.008 x d_1			□	■
	1.4	865	0.008 x d_1	1045	0.010 x d_1			□	■
	1.5	830	0.007 x d_1	1010	0.008 x d_1			□	■
	1.6	575	0.006 x d_1	685	0.007 x d_1			□	■
	2.1	395	0.005 x d_1	470	0.006 x d_1			□	■
	2.2	395	0.005 x d_1	470	0.006 x d_1			□	■
	2.3	395	0.005 x d_1	470	0.006 x d_1		□	□	■
	2.4	360	0.004 x d_1	435	0.005 x d_1			□	■
	2.5	360	0.004 x d_1	435	0.005 x d_1			□	■
	2.6	360	0.004 x d_1	435	0.005 x d_1		□	□	■
	2.7	215	0.003 x d_1	255	0.004 x d_1			□	■
	2.8	215	0.003 x d_1	255	0.004 x d_1			□	■
	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				■
	5.3								
S	1.1	325	0.004 x d_1	360	0.005 x d_1				■
	1.2	255	0.003 x d_1	290	0.004 x d_1				■
	1.3	255	0.003 x d_1	290	0.003 x d_1				■
	2.1	255	0.004 x d_1	290	0.004 x d_1				■
	2.2	110	0.003 x d_1	145	0.004 x d_1				■
	2.3	70	0.002 x d_1	90	0.002 x d_1				■
	2.4	110	0.003 x d_1	160	0.003 x d_1				■
	2.5	70	0.002 x d_1	70	0.002 x d_1				■
	2.6	70	0.003 x d_1	70	0.003 x d_1				■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

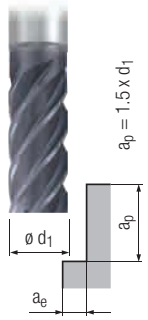
■ = very suitable
□ = suitable

Standard, long and extra long lengths (5 Flutes)

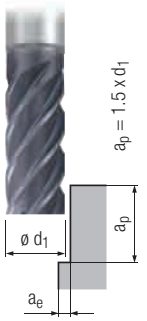
N

Valid for Tool Nos.:

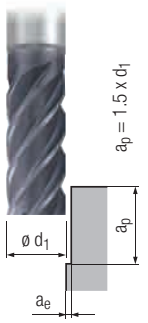
2946L 3920L 3922L
2920L 3921L 3923L



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	540	0.005 x d_1	615	0.006 x d_1	720	0.007 x d_1	□	■	□	■
	2.1	505	0.005 x d_1	575	0.005 x d_1	650	0.006 x d_1	□	■	□	■
	3.1	435	0.004 x d_1	470	0.005 x d_1	540	0.005 x d_1	□	■	□	■
	4.1	395	0.003 x d_1	435	0.004 x d_1	505	0.004 x d_1	□	■		
	5.1	360	0.003 x d_1	395	0.003 x d_1	470	0.004 x d_1	□	■		
M	1.1	290	0.003 x d_1	290	0.004 x d_1	360	0.004 x d_1			□	■
	2.1	255	0.003 x d_1	255	0.004 x d_1	290	0.004 x d_1			□	■
	3.1	145	0.003 x d_1	180	0.003 x d_1	215	0.003 x d_1			□	■
	4.1	110	0.003 x d_1	145	0.003 x d_1	145	0.003 x d_1			□	■
K	1.1	540	0.006 x d_1	615	0.006 x d_1	720	0.007 x d_1	□	■		
	1.2	540	0.006 x d_1	615	0.006 x d_1	720	0.007 x d_1	□	■		
	2.1	505	0.005 x d_1	575	0.005 x d_1	650	0.006 x d_1	□	■		
	2.2	505	0.005 x d_1	575	0.005 x d_1	650	0.006 x d_1	□	■		
	3.1	435	0.005 x d_1	470	0.005 x d_1	540	0.006 x d_1	□	■		
	3.2	435	0.005 x d_1	470	0.005 x d_1	540	0.006 x d_1	□	■		
	4.1	360	0.003 x d_1	395	0.004 x d_1	470	0.004 x d_1	□	■		
	4.2	290	0.003 x d_1	290	0.004 x d_1	360	0.004 x d_1	□	■		
N	1.1	900	0.010 x d_1	1010	0.011 x d_1	1085	0.013 x d_1			□	■
	1.2	900	0.009 x d_1	1010	0.010 x d_1	1085	0.011 x d_1			□	■
	1.3	900	0.008 x d_1	1010	0.009 x d_1	1085	0.010 x d_1			□	■
	1.4	900	0.009 x d_1	1010	0.010 x d_1	1085	0.011 x d_1			□	■
	1.5										
	1.6										
	2.1	505	0.006 x d_1	575	0.006 x d_1	650	0.007 x d_1			□	■
	2.2	505	0.006 x d_1	575	0.006 x d_1	650	0.007 x d_1			□	■
	2.3	505	0.006 x d_1	575	0.006 x d_1	650	0.007 x d_1		□	□	■
	2.4	470	0.005 x d_1	505	0.005 x d_1	615	0.006 x d_1			□	■
	2.5	470	0.005 x d_1	505	0.005 x d_1	615	0.006 x d_1			□	■
	2.6	470	0.005 x d_1	505	0.005 x d_1	615	0.006 x d_1		□	□	■
	2.7	290	0.003 x d_1	290	0.004 x d_1	360	0.004 x d_1			□	■
	2.8	290	0.003 x d_1	290	0.004 x d_1	360	0.004 x d_1			□	■
	3.1	1155	0.010 x d_1	1265	0.011 x d_1	1480	0.013 x d_1			□	■
	3.2	1155	0.008 x d_1	1265	0.009 x d_1	1480	0.010 x d_1			□	■
	4.1	1155	0.009 x d_1	1265	0.009 x d_1	1480	0.011 x d_1		□	□	■
	4.2									□	■
	4.3										
	4.4										
	5.1										
	5.2	290	0.003 x d_1	290	0.004 x d_1	360	0.004 x d_1				■
	5.3										
S	1.1	290	0.004 x d_1	290	0.004 x d_1	1180	0.005 x d_1				■
	1.2	255	0.003 x d_1	255	0.004 x d_1	950	0.004 x d_1				■
	1.3	145	0.003 x d_1	180	0.003 x d_1	705	0.004 x d_1				■
	2.1	255	0.002 x d_1	255	0.003 x d_1	290	0.003 x d_1				■
	2.2	70	0.002 x d_1	55	0.003 x d_1	110	0.003 x d_1				■
	2.3	90	0.002 x d_1	90	0.003 x d_1	110	0.003 x d_1				■
	2.4	90	0.002 x d_1	90	0.003 x d_1	110	0.003 x d_1				■
	2.5	70	0.002 x d_1	70	0.003 x d_1	110	0.003 x d_1				■
	2.6	70	0.002 x d_1	70	0.003 x d_1	110	0.003 x d_1				■
H	1.1	360	0.003 x d_1	395	0.003 x d_1	470	0.004 x d_1	□	■		
	1.2	290	0.003 x d_1	290	0.003 x d_1	360	0.004 x d_1	□	■		
	1.3	255	0.003 x d_1	255	0.003 x d_1	290	0.003 x d_1	□	■		
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

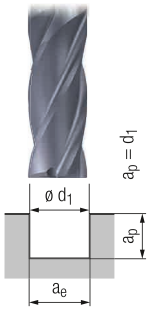
■ = very suitable
□ = suitable

Standard design (4 - 5 Flutes) with Corner Radius

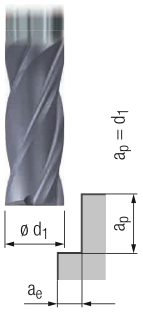
N

Valid for Tool Nos.:

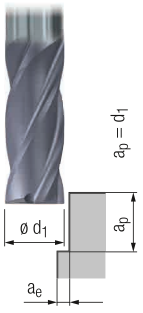
3945L 3902L
3946L 3903L



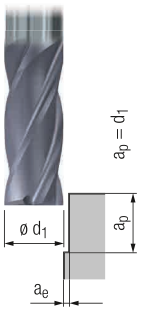
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	560	0.005 x d_1	620	0.006 x d_1	660	0.007 x d_1	785	0.008 x d_1	□	■	□	■
	2.1	490	0.004 x d_1	560	0.005 x d_1	590	0.006 x d_1	690	0.007 x d_1	□	■	□	■
	3.1	425	0.004 x d_1	460	0.005 x d_1	525	0.005 x d_1	590	0.006 x d_1	□	■	□	■
	4.1	395	0.003 x d_1	425	0.004 x d_1	460	0.004 x d_1	560	0.005 x d_1	□	■		
	5.1	330	0.003 x d_1	360	0.003 x d_1	395	0.004 x d_1	460	0.004 x d_1	□	■		
M	1.1	260	0.003 x d_1	295	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1			□	■
	2.1	230	0.003 x d_1	260	0.004 x d_1	260	0.004 x d_1	330	0.005 x d_1			□	■
	3.1	165	0.002 x d_1	195	0.003 x d_1	195	0.003 x d_1	230	0.004 x d_1			□	■
	4.1	110	0.002 x d_1	110	0.003 x d_1	130	0.003 x d_1	130	0.004 x d_1			□	■
K	1.1	560	0.005 x d_1	620	0.006 x d_1	660	0.007 x d_1	785	0.008 x d_1	□	■		
	1.2	560	0.005 x d_1	620	0.006 x d_1	660	0.007 x d_1	785	0.008 x d_1	□	■		
	2.1	490	0.004 x d_1	560	0.005 x d_1	590	0.006 x d_1	690	0.006 x d_1	□	■		
	2.2	490	0.004 x d_1	560	0.005 x d_1	590	0.006 x d_1	690	0.006 x d_1	□	■		
	3.1	425	0.004 x d_1	460	0.005 x d_1	525	0.006 x d_1	590	0.006 x d_1	□	■		
	3.2	425	0.004 x d_1	460	0.005 x d_1	525	0.006 x d_1	590	0.006 x d_1	□	■		
	4.1	330	0.003 x d_1	360	0.004 x d_1	395	0.004 x d_1	460	0.005 x d_1	□	■		
	4.2	260	0.003 x d_1	295	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1	□	■		
N	1.1	660	0.009 x d_1	820	0.010 x d_1	920	0.011 x d_1	985	0.013 x d_1			□	■
	1.2	660	0.008 x d_1	820	0.009 x d_1	920	0.010 x d_1	985	0.011 x d_1			□	■
	1.3	660	0.007 x d_1	820	0.008 x d_1	920	0.009 x d_1	985	0.010 x d_1			□	■
	1.4	660	0.008 x d_1	820	0.009 x d_1	920	0.010 x d_1	985	0.011 x d_1			□	■
	1.5												
	1.6												
	2.1	490	0.005 x d_1	560	0.006 x d_1	590	0.007 x d_1	690	0.008 x d_1			□	■
	2.2	490	0.005 x d_1	560	0.006 x d_1	590	0.007 x d_1	690	0.008 x d_1			□	■
	2.3	490	0.005 x d_1	560	0.006 x d_1	590	0.007 x d_1	690	0.008 x d_1		□	□	■
	2.4	425	0.004 x d_1	460	0.005 x d_1	525	0.006 x d_1	590	0.006 x d_1			□	■
	2.5	425	0.004 x d_1	460	0.005 x d_1	525	0.006 x d_1	590	0.006 x d_1			□	■
	2.6	425	0.004 x d_1	460	0.005 x d_1	525	0.006 x d_1	590	0.006 x d_1		□	□	■
	2.7	260	0.003 x d_1	295	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1			□	■
	2.8	260	0.003 x d_1	295	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1			□	■
	3.1	1115	0.009 x d_1	1215	0.011 x d_1	1345	0.013 x d_1	1575	0.014 x d_1			□	■
	3.2	1115	0.007 x d_1	1215	0.008 x d_1	1345	0.010 x d_1	1575	0.011 x d_1			□	■
	4.1	1115	0.008 x d_1	1215	0.009 x d_1	1345	0.011 x d_1	1575	0.012 x d_1		□	□	■
	4.2	1640	0.008 x d_1	1805	0.009 x d_1	2280	0.011 x d_1	2660	0.012 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	260	0.003 x d_1	295	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1				■
	5.3												
S	1.1	260	0.004 x d_1	295	0.004 x d_1	330	0.005 x d_1	360	0.006 x d_1				■
	1.2	230	0.003 x d_1	260	0.004 x d_1	260	0.004 x d_1	330	0.005 x d_1				■
	1.3	130	0.003 x d_1	130	0.003 x d_1	165	0.004 x d_1	195	0.004 x d_1				■
	2.1	230	0.002 x d_1	260	0.002 x d_1	260	0.003 x d_1	330	0.003 x d_1				■
	2.2	110	0.002 x d_1	110	0.002 x d_1	115	0.003 x d_1	130	0.003 x d_1				■
	2.3	65	0.002 x d_1	80	0.002 x d_1	80	0.003 x d_1	110	0.003 x d_1				■
	2.4	65	0.002 x d_1	80	0.002 x d_1	80	0.003 x d_1	110	0.003 x d_1				■
	2.5	65	0.002 x d_1	65	0.002 x d_1	65	0.003 x d_1	110	0.003 x d_1				■
	2.6	65	0.002 x d_1	65	0.002 x d_1	65	0.003 x d_1	110	0.003 x d_1				■
H	1.1	330	0.003 x d_1	360	0.003 x d_1	395	0.004 x d_1	460	0.004 x d_1	□	■		
	1.2	260	0.003 x d_1	295	0.003 x d_1	330	0.004 x d_1	360	0.004 x d_1	□	■		
	1.3			295	0.003 x d_1	330	0.003 x d_1	360	0.004 x d_1	□	■		
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

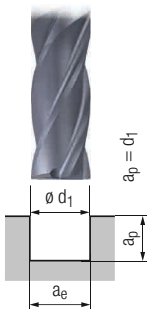
■ = very suitable
□ = suitable

Long design (4 - 5 Flutes) with Corner Radius

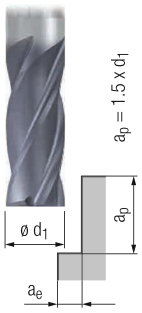
N

Valid for Tool Nos.:

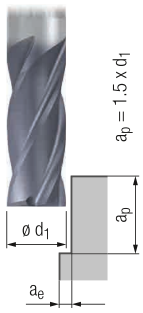
2998L 3928L
2999L 3929L



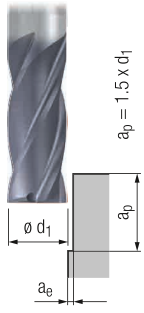
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

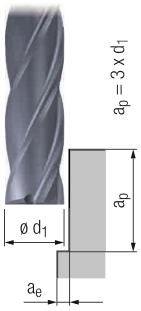
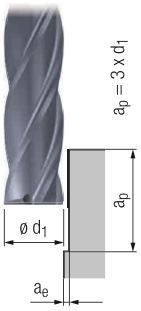
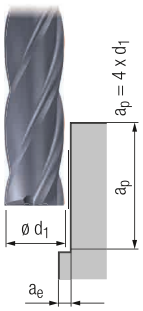
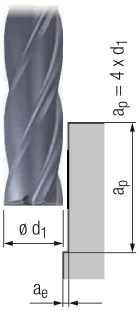
		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	460	0.005 x d_1	490	0.005 x d_1	560	0.006 x d_1	655	0.007 x d_1	□	■	□	■
	2.1	430	0.004 x d_1	460	0.005 x d_1	525	0.005 x d_1	590	0.006 x d_1	□	■	□	■
	3.1	360	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1	490	0.005 x d_1	□	■	□	■
	4.1	330	0.003 x d_1	360	0.003 x d_1	395	0.004 x d_1	460	0.004 x d_1	□	■		
	5.1	295	0.003 x d_1	330	0.003 x d_1	360	0.003 x d_1	430	0.004 x d_1	□	■		
M	1.1	230	0.003 x d_1	260	0.003 x d_1	260	0.004 x d_1	330	0.004 x d_1			□	■
	2.1	195	0.003 x d_1	230	0.003 x d_1	230	0.004 x d_1	260	0.004 x d_1			□	■
	3.1	130	0.002 x d_1	130	0.003 x d_1	165	0.003 x d_1	195	0.003 x d_1			□	■
	4.1	110	0.002 x d_1	110	0.003 x d_1	130	0.003 x d_1	130	0.003 x d_1			□	■
K	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	□	■		
	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	□	■		
	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	□	■		
	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	□	■		
	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	□	■		
	3.2	360	0.004 x d_1	395	0.005 x d_1	430	0.005 x d_1	490	0.006 x d_1	□	■		
	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	□	■		
	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	□	■		
N	1.1	720	0.009 x d_1	820	0.010 x d_1	920	0.011 x d_1	985	0.013 x d_1			□	■
	1.2	720	0.008 x d_1	820	0.009 x d_1	920	0.010 x d_1	985	0.011 x d_1			□	■
	1.3	720	0.007 x d_1	820	0.008 x d_1	920	0.009 x d_1	985	0.010 x d_1			□	■
	1.4	660	0.008 x d_1	820	0.009 x d_1	920	0.010 x d_1	985	0.011 x d_1			□	■
	1.5												
	1.6												
	2.1	430	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1			□	■
	2.2	430	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1			□	■
	2.3	430	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1		□	□	■
	2.4	395	0.004 x d_1	430	0.005 x d_1	460	0.005 x d_1	560	0.006 x d_1			□	■
	2.5	395	0.004 x d_1	430	0.005 x d_1	460	0.005 x d_1	560	0.006 x d_1			□	■
	2.6	395	0.004 x d_1	430	0.005 x d_1	460	0.005 x d_1	560	0.006 x d_1		□	□	■
	2.7	230	0.003 x d_1	260	0.003 x d_1	260	0.004 x d_1	330	0.004 x d_1			□	■
	2.8	230	0.003 x d_1	260	0.003 x d_1	260	0.004 x d_1	330	0.004 x d_1			□	■
	3.1	950	0.009 x d_1	1050	0.010 x d_1	1150	0.011 x d_1	1345	0.013 x d_1			□	■
	3.2	950	0.007 x d_1	1050	0.008 x d_1	1150	0.009 x d_1	1345	0.010 x d_1			□	■
	4.1	950	0.008 x d_1	1050	0.009 x d_1	1150	0.009 x d_1	1345	0.011 x d_1		□	□	■
	4.2	1410	0.008 x d_1	1540	0.009 x d_1	1705	0.009 x d_1	1970	0.011 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	230	0.003 x d_1	260	0.003 x d_1	260	0.004 x d_1	330	0.004 x d_1				■
	5.3												
S	1.1	230	0.004 x d_1	260	0.004 x d_1	260	0.004 x d_1	330	0.005 x d_1				■
	1.2	195	0.003 x d_1	230	0.003 x d_1	230	0.004 x d_1	260	0.004 x d_1				■
	1.3	130	0.003 x d_1	130	0.003 x d_1	165	0.003 x d_1	195	0.004 x d_1				■
	2.1	195	0.002 x d_1	230	0.002 x d_1	230	0.003 x d_1	260	0.003 x d_1				■
	2.2	65	0.002 x d_1	65	0.002 x d_1	50	0.003 x d_1	110	0.003 x d_1				■
	2.3	65	0.002 x d_1	80	0.002 x d_1	80	0.003 x d_1	110	0.003 x d_1				■
	2.4	65	0.002 x d_1	80	0.002 x d_1	80	0.003 x d_1	110	0.003 x d_1				■
	2.5	65	0.002 x d_1	65	0.002 x d_1	65	0.003 x d_1	110	0.003 x d_1				■
	2.6	65	0.002 x d_1	65	0.002 x d_1	65	0.003 x d_1	110	0.003 x d_1				■
H	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	□	■		
	1.2	230	0.003 x d_1	260	0.003 x d_1	260	0.003 x d_1	330	0.004 x d_1	□	■		
	1.3			230	0.003 x d_1	230	0.003 x d_1	260	0.003 x d_1	□	■		
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Extra long design (4 - 5 Flutes) with Corner Radius

Valid for Tool Nos.:
3947L 3933L
3948L 3934L

$L_2 = 3 \times D_1$		N	$L_2 = 4 \times D_1$	
				
$a_e = 0.1 \times d_1$	$a_e = 0.02 \times d_1$		$a_e = 0.05 \times d_1$	$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	395	0.005 x d_1	460	0.006 x d_1	330	0.005 x d_1	395	0.005 x d_1	□	■	□	■
	2.1	360	0.004 x d_1	430	0.005 x d_1	295	0.004 x d_1	360	0.005 x d_1	□	■	□	■
	3.1	295	0.004 x d_1	360	0.005 x d_1	230	0.004 x d_1	295	0.004 x d_1	□	■	□	■
	4.1	230	0.003 x d_1	260	0.004 x d_1	195	0.003 x d_1	230	0.003 x d_1	□	■		
	5.1	195	0.003 x d_1	230	0.003 x d_1	165	0.003 x d_1	195	0.003 x d_1	□	■		
M	1.1	395	0.003 x d_1	460	0.004 x d_1	330	0.003 x d_1	395	0.003 x d_1			□	■
	2.1	330	0.003 x d_1	395	0.004 x d_1	260	0.003 x d_1	330	0.003 x d_1			□	■
	3.1	230	0.003 x d_1	260	0.003 x d_1	195	0.003 x d_1	230	0.003 x d_1			□	■
	4.1	165	0.003 x d_1	195	0.003 x d_1	130	0.003 x d_1	165	0.003 x d_1			□	■
K	1.1	395	0.005 x d_1	460	0.006 x d_1	330	0.005 x d_1	395	0.006 x d_1	□	■		
	1.2	395	0.005 x d_1	460	0.006 x d_1	330	0.005 x d_1	395	0.006 x d_1	□	■		
	2.1	360	0.004 x d_1	430	0.005 x d_1	295	0.004 x d_1	360	0.004 x d_1	□	■		
	2.2	360	0.004 x d_1	430	0.005 x d_1	295	0.004 x d_1	360	0.004 x d_1	□	■		
	3.1	295	0.004 x d_1	360	0.005 x d_1	230	0.004 x d_1	295	0.004 x d_1	□	■		
	3.2	295	0.004 x d_1	360	0.005 x d_1	230	0.004 x d_1	295	0.004 x d_1	□	■		
	4.1	230	0.003 x d_1	260	0.004 x d_1	195	0.003 x d_1	230	0.003 x d_1	□	■		
	4.2	195	0.003 x d_1	230	0.004 x d_1	165	0.003 x d_1	195	0.003 x d_1	□	■		
N	1.1	1180	0.009 x d_1	1410	0.011 x d_1	985	0.009 x d_1	1410	0.009 x d_1			□	■
	1.2	1180	0.008 x d_1	1410	0.010 x d_1	985	0.008 x d_1	1410	0.009 x d_1			□	■
	1.3	1180	0.007 x d_1	1410	0.008 x d_1	985	0.007 x d_1	1410	0.008 x d_1			□	■
	1.4	785	0.008 x d_1	950	0.010 x d_1	660	0.008 x d_1	950	0.009 x d_1			□	■
	1.5	755	0.007 x d_1	920	0.008 x d_1	590	0.007 x d_1	920	0.008 x d_1			□	■
	1.6	525	0.006 x d_1	620	0.007 x d_1	430	0.006 x d_1	620	0.007 x d_1			□	■
	2.1	360	0.005 x d_1	430	0.006 x d_1	295	0.005 x d_1	360	0.006 x d_1			□	■
	2.2	360	0.005 x d_1	430	0.006 x d_1	295	0.005 x d_1	360	0.006 x d_1			□	■
	2.3	360	0.005 x d_1	430	0.006 x d_1	295	0.005 x d_1	360	0.006 x d_1		□	□	■
	2.4	330	0.004 x d_1	395	0.005 x d_1	260	0.004 x d_1	330	0.004 x d_1			□	■
	2.5	330	0.004 x d_1	395	0.005 x d_1	260	0.004 x d_1	330	0.004 x d_1			□	■
	2.6	330	0.004 x d_1	395	0.005 x d_1	260	0.004 x d_1	330	0.004 x d_1		□	□	■
	2.7	195	0.003 x d_1	230	0.004 x d_1	165	0.003 x d_1	195	0.003 x d_1			□	■
	2.8	195	0.003 x d_1	230	0.004 x d_1	165	0.003 x d_1	195	0.003 x d_1			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2	195	0.003 x d_1	230	0.004 x d_1	165	0.003 x d_1	195	0.003 x d_1				■
	5.3												
S	1.1	295	0.004 x d_1	330	0.005 x d_1	230	0.004 x d_1	260	0.004 x d_1				■
	1.2	230	0.003 x d_1	260	0.004 x d_1	195	0.003 x d_1	230	0.003 x d_1				■
	1.3	230	0.003 x d_1	260	0.003 x d_1	195	0.003 x d_1	230	0.003 x d_1				■
	2.1	230	0.004 x d_1	260	0.004 x d_1	195	0.004 x d_1	230	0.004 x d_1				■
	2.2	110	0.003 x d_1	130	0.004 x d_1	50	0.003 x d_1	110	0.003 x d_1				■
	2.3	65	0.002 x d_1	80	0.002 x d_1	80	0.002 x d_1	65	0.002 x d_1				■
	2.4	110	0.003 x d_1	150	0.003 x d_1	80	0.003 x d_1	110	0.003 x d_1				■
	2.5	65	0.002 x d_1	65	0.002 x d_1	65	0.002 x d_1	65	0.002 x d_1				■
	2.6	65	0.003 x d_1	65	0.003 x d_1	65	0.003 x d_1	65	0.003 x d_1				■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

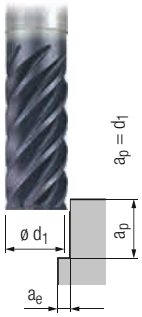
■ = very suitable
□ = suitable

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

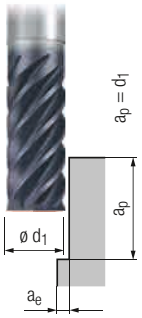
Valid for Tool Nos.:

3924L 2941L
3925L 2942L

N



$a_e = 0.2 \times d_1$



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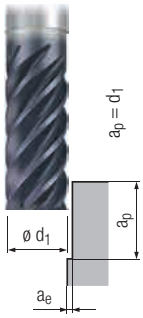


$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	720	0.007 x d_1	795	0.008 x d_1	865	0.008 x d_1	□	■	□	■
	2.1	650	0.006 x d_1	705	0.007 x d_1	760	0.007 x d_1	□	■	□	■
	3.1	757	0.005 x d_1	615	0.006 x d_1	650	0.006 x d_1	□	■	□	■
	4.1	505	0.004 x d_1	560	0.005 x d_1	615	0.005 x d_1	□	■		
	5.1	435	0.004 x d_1	470	0.004 x d_1	505	0.004 x d_1	□	■		
M	1.1	360	0.004 x d_1	380	0.005 x d_1	395	0.005 x d_1			□	■
	2.1	290	0.004 x d_1	325	0.005 x d_1	360	0.005 x d_1			□	■
	3.1	215	0.003 x d_1	235	0.004 x d_1	255	0.004 x d_1			□	■
	4.1	145	0.003 x d_1	145	0.004 x d_1	145	0.004 x d_1			□	■
K	1.1	720	0.007 x d_1	795	0.008 x d_1	865		□	■		
	1.2	720	0.007 x d_1	795	0.008 x d_1	865		□	■		
	2.1	650	0.006 x d_1	705	0.006 x d_1	760		□	■		
	2.2	650	0.006 x d_1	705	0.006 x d_1	760		□	■		
	3.1	575	0.006 x d_1	615	0.006 x d_1	650		□	■		
	3.2	575	0.006 x d_1	615	0.006 x d_1	650		□	■		
	4.1	435	0.004 x d_1	470	0.005 x d_1	505		□	■		
	4.2	360	0.004 x d_1	380	0.005 x d_1	395		□	■		
N	1.1	1010	0.011 x d_1	1085	0.013 x d_1	1085	0.013 x d_1			□	■
	1.2	1010	0.010 x d_1	1085	0.011 x d_1	1085	0.011 x d_1			□	■
	1.3	1010	0.009 x d_1	1085	0.010 x d_1	1085	0.010 x d_1			□	■
	1.4	1010	0.010 x d_1	1085	0.011 x d_1	1085	0.011 x d_1			□	■
	1.5										
	1.6										
	2.1	650	0.007 x d_1	760	0.008 x d_1	760	0.008 x d_1			□	■
	2.2	650	0.007 x d_1	760	0.008 x d_1	760	0.008 x d_1			□	■
	2.3	650	0.007 x d_1	760	0.008 x d_1	760	0.008 x d_1		□	□	■
	2.4	575	0.006 x d_1	650	0.006 x d_1	650	0.006 x d_1			□	■
	2.5	575	0.006 x d_1	650	0.006 x d_1	650	0.006 x d_1			□	■
	2.6	575	0.006 x d_1	650	0.006 x d_1	650	0.006 x d_1		□	□	■
	2.7	360	0.004 x d_1	395	0.005 x d_1	395	0.005 x d_1			□	■
	2.8	360	0.004 x d_1	395	0.005 x d_1	395	0.005 x d_1			□	■
	3.1	1480	0.013 x d_1	1730	0.014 x d_1	1730	0.014 x d_1			□	■
	3.2	1480	0.010 x d_1	1730	0.011 x d_1	1730	0.011 x d_1			□	■
	4.1	1480	0.013 x d_1	1730	0.014 x d_1	1730	0.014 x d_1		□	□	■
	4.2	1480	0.010 x d_1	1730	0.011 x d_1	1730	0.011 x d_1			□	■
	4.3										
	4.4										
	5.1										
	5.2	360	0.004 x d_1	395	0.005 x d_1	395	0.005 x d_1				■
	5.3										
S	1.1	360	0.005 x d_1	395	0.005 x d_1	395	0.006 x d_1				■
	1.2	290	0.004 x d_1	360	0.004 x d_1	360	0.005 x d_1				■
	1.3	180	0.004 x d_1	195	0.004 x d_1	215	0.004 x d_1				■
	2.1	290	0.003 x d_1	325	0.003 x d_1	360	0.003 x d_1				■
	2.2	125	0.003 x d_1	145	0.003 x d_1	145	0.003 x d_1				■
	2.3	90	0.003 x d_1	110	0.003 x d_1	110	0.003 x d_1				■
	2.4	90	0.003 x d_1	110	0.003 x d_1	110	0.003 x d_1				■
	2.5	70	0.003 x d_1	85	0.003 x d_1	110	0.003 x d_1				■
	2.6	70	0.003 x d_1	85	0.003 x d_1	110	0.003 x d_1				■
H	1.1	435	0.004 x d_1	470	0.004 x d_1	505	0.004 x d_1	□	■		
	1.2	360	0.004 x d_1	395	0.004 x d_1	395	0.004 x d_1	□	■		
	1.3	360	0.003 x d_1	395	0.004 x d_1	395	0.004 x d_1	□	■		
	1.4										
	1.5										

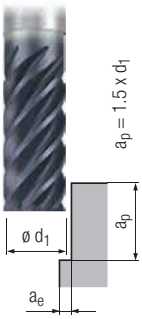
v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

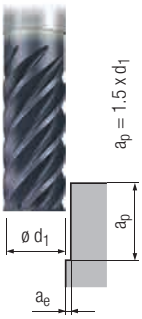
Long length (6 Flutes) - for Regular and Corner Radius tools

Valid for Tool Nos.:
2948L 2947L
3908L 3909L

N



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

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

v_c = Cutting speed
f_z = Feed per tooth

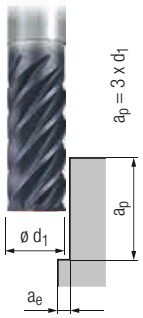
■ = very suitable
□ = suitable

Extra long length (6 Flutes) - for Regular and Corner Radius tools

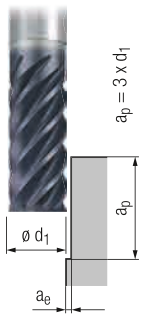
Valid for Tool Nos.:

3926L 3943L
3927L 3944L

N



$a_e = 0.1 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	435	0.005 x d_1	505	0.006 x d_1	□	■	□	■
	2.1	395	0.004 x d_1	470	0.005 x d_1	□	■	□	■
	3.1	325	0.004 x d_1	395	0.005 x d_1	□	■	□	■
	4.1	255	0.003 x d_1	290	0.004 x d_1	□	■		
	5.1	215	0.003 x d_1	255	0.003 x d_1	□	■		
M	1.1	435	0.003 x d_1	505	0.004 x d_1			□	■
	2.1	360	0.003 x d_1	435	0.004 x d_1			□	■
	3.1	255	0.003 x d_1	290	0.003 x d_1			□	■
	4.1	180	0.003 x d_1	215	0.003 x d_1			□	■
K	1.1	435	0.005 x d_1	505	0.006 x d_1	□	■		
	1.2	435	0.005 x d_1	505	0.006 x d_1	□	■		
	2.1	395	0.004 x d_1	470	0.005 x d_1	□	■		
	2.2	395	0.004 x d_1	470	0.005 x d_1	□	■		
	3.1	325	0.004 x d_1	395	0.005 x d_1	□	■		
	3.2	325	0.004 x d_1	395	0.005 x d_1	□	■		
	4.1	255	0.003 x d_1	290	0.004 x d_1	□	■		
	4.2	215	0.003 x d_1	255	0.004 x d_1	□	■		
N	1.1	865	0.009 x d_1	1030	0.011 x d_1			□	■
	1.2	865	0.008 x d_1	1030	0.010 x d_1			□	■
	1.3	865	0.007 x d_1	1030	0.008 x d_1			□	■
	1.4	865	0.008 x d_1	1030	0.010 x d_1			□	■
	1.5								
	1.6								
	2.1	490	0.005 x d_1	585	0.006 x d_1			□	■
	2.2	490	0.005 x d_1	585	0.006 x d_1			□	■
	2.3	490	0.005 x d_1	585	0.006 x d_1		□	□	■
	2.4	435	0.004 x d_1	515	0.005 x d_1			□	■
	2.5	435	0.004 x d_1	515	0.005 x d_1			□	■
	2.6	435	0.004 x d_1	515	0.005 x d_1		□	□	■
	2.7	245	0.003 x d_1	290	0.004 x d_1			□	■
	2.8	245	0.003 x d_1	290	0.004 x d_1			□	■
	3.1	1080	0.010 x d_1	1285	0.011 x d_1			□	■
	3.2	1080	0.008 x d_1	1285	0.010 x d_1			□	■
	4.1	1080	0.008 x d_1	1285	0.010 x d_1		□	□	■
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	215	0.003 x d_1	255	0.004 x d_1				■
	5.3								
S	1.1	325	0.004 x d_1	360	0.005 x d_1				■
	1.2	255	0.003 x d_1	290	0.004 x d_1				■
	1.3	255	0.003 x d_1	290	0.003 x d_1				■
	2.1	255	0.004 x d_1	290	0.004 x d_1				■
	2.2	110	0.003 x d_1	145	0.004 x d_1				■
	2.3	70	0.002 x d_1	90	0.002 x d_1				■
	2.4	110	0.003 x d_1	160	0.003 x d_1				■
	2.5	70	0.002 x d_1	70	0.002 x d_1				■
	2.6	70	0.003 x d_1	70	0.003 x d_1				■
H	1.1	340	0.002 x d_1	405	0.003 x d_1	□	■		
	1.2	245	0.002 x d_1	290	0.003 x d_1	□	■		
	1.3	215	0.002 x d_1	255	0.003 x d_1	□	■		
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

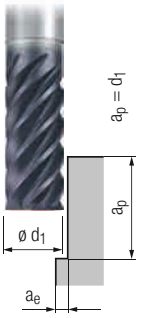
■ = very suitable
□ = suitable

Standard length (7 Flutes) - for Regular and Corner Radius tools

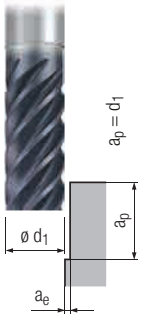
Valid for Tool Nos.:

3916L 3935L
3930L 3936L

N



$a_e = 0.1 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	795	0.008 x d_1	865	0.008 x d_1	□	■	□	■
	2.1	705	0.007 x d_1	760	0.007 x d_1	□	■	□	■
	3.1	615	0.006 x d_1	650	0.006 x d_1	□	■	□	■
	4.1	560	0.005 x d_1	615	0.005 x d_1	□	■		
	5.1	470	0.004 x d_1	505	0.004 x d_1	□	■		
M	1.1	380	0.005 x d_1	395	0.005 x d_1			□	■
	2.1	325	0.005 x d_1	360	0.005 x d_1			□	■
	3.1	235	0.004 x d_1	255	0.004 x d_1			□	■
	4.1	145	0.004 x d_1	145	0.004 x d_1			□	■
K	1.1	795	0.008 x d_1	865	0.008 x d_1	□	■		
	1.2	795	0.008 x d_1	865	0.008 x d_1	□	■		
	2.1	705	0.006 x d_1	760	0.006 x d_1	□	■		
	2.2	705	0.006 x d_1	760	0.006 x d_1	□	■		
	3.1	615	0.006 x d_1	650	0.006 x d_1	□	■		
	3.2	615	0.006 x d_1	650	0.006 x d_1	□	■		
	4.1	470	0.005 x d_1	505	0.005 x d_1	□	■		
	4.2	380	0.005 x d_1	395	0.005 x d_1	□	■		
N	1.1	1085	0.013 x d_1	1085	0.013 x d_1			□	■
	1.2	1085	0.011 x d_1	1085	0.011 x d_1			□	■
	1.3	1085	0.010 x d_1	1085	0.010 x d_1			□	■
	1.4	1085	0.011 x d_1	1085	0.011 x d_1			□	■
	1.5								
	1.6								
	2.1	760	0.008 x d_1	760	0.008 x d_1			□	■
	2.2	760	0.008 x d_1	760	0.008 x d_1			□	■
	2.3	760	0.008 x d_1	760	0.008 x d_1		□	□	■
	2.4	650	0.006 x d_1	650	0.006 x d_1			□	■
	2.5	650	0.006 x d_1	650	0.006 x d_1			□	■
	2.6	650	0.006 x d_1	650	0.006 x d_1		□	□	■
	2.7	395	0.005 x d_1	395	0.005 x d_1			□	■
	2.8	395	0.005 x d_1	395	0.005 x d_1			□	■
	3.1	1730	0.014 x d_1	1730	0.014 x d_1			□	■
	3.2	1730	0.011 x d_1	1730	0.011 x d_1			□	■
	4.1	1730	0.012 x d_1	1730	0.012 x d_1		□	□	■
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	395	0.005 x d_1	395	0.005 x d_1				■
	5.3								
S	1.1	395	0.005 x d_1	395	0.006 x d_1				■
	1.2	360	0.004 x d_1	360	0.005 x d_1				■
	1.3	195	0.004 x d_1	215	0.004 x d_1				■
	2.1	325	0.003 x d_1	360	0.003 x d_1				■
	2.2	145	0.003 x d_1	145	0.003 x d_1				■
	2.3	110	0.003 x d_1	110	0.003 x d_1				■
	2.4	110	0.003 x d_1	110	0.003 x d_1				■
	2.5	85	0.003 x d_1	110	0.003 x d_1				■
	2.6	85	0.003 x d_1	110	0.003 x d_1				■
H	1.1	470	0.004 x d_1	505	0.004 x d_1	□	■		
	1.2	395	0.004 x d_1	395	0.004 x d_1	□	■		
	1.3	395	0.004 x d_1	395	0.004 x d_1	□	■		
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

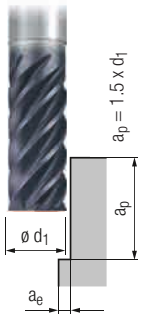
■ = very suitable
□ = suitable

Long length (7 Flutes) - for Regular and Corner Radius tools

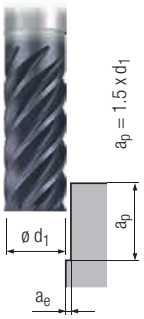
Valid for Tool Nos.:

3917L 3937L
3931L 3938L

N



$a_e = 0.1 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	670	0.007 x d_1	720	0.007 x d_1	□	■	□	■
	2.1	615	0.006 x d_1	650	0.006 x d_1	□	■	□	■
	3.1	505	0.005 x d_1	540	0.005 x d_1	□	■	□	■
	4.1	470	0.004 x d_1	505	0.004 x d_1	□	■		
	5.1	435	0.004 x d_1	470	0.004 x d_1	□	■		
M	1.1	325	0.004 x d_1	360	0.004 x d_1			□	■
	2.1	290	0.004 x d_1	290	0.004 x d_1			□	■
	3.1	215	0.003 x d_1	215	0.003 x d_1			□	■
	4.1	145	0.003 x d_1	145	0.003 x d_1			□	■
K	1.1	670	0.007 x d_1	720	0.007 x d_1	□	■		
	1.2	670	0.007 x d_1	720	0.007 x d_1	□	■		
	2.1	615	0.006 x d_1	650	0.006 x d_1	□	■		
	2.2	615	0.006 x d_1	650	0.006 x d_1	□	■		
	3.1	505	0.006 x d_1	540	0.006 x d_1	□	■		
	3.2	505	0.006 x d_1	540	0.006 x d_1	□	■		
	4.1	435	0.004 x d_1	470	0.004 x d_1	□	■		
	4.2	325	0.004 x d_1	360	0.004 x d_1	□	■		
N	1.1	1085	0.013 x d_1	1085	0.013 x d_1			□	■
	1.2	1085	0.011 x d_1	1085	0.011 x d_1			□	■
	1.3	1085	0.010 x d_1	1085	0.010 x d_1			□	■
	1.4	1085	0.011 x d_1	1085	0.011 x d_1			□	■
	1.5								
	1.6								
	2.1	650	0.007 x d_1	650	0.007 x d_1			□	■
	2.2	650	0.007 x d_1	650	0.007 x d_1			□	■
	2.3	650	0.007 x d_1	650	0.007 x d_1		□	□	■
	2.4	615	0.006 x d_1	615	0.006 x d_1			□	■
	2.5	615	0.006 x d_1	615	0.006 x d_1			□	■
	2.6	615	0.006 x d_1	615	0.006 x d_1		□	□	■
	2.7	360	0.004 x d_1	360	0.004 x d_1			□	■
	2.8	360	0.004 x d_1	360	0.004 x d_1			□	■
	3.1	1480	0.013 x d_1	1480	0.013 x d_1			□	■
	3.2	1480	0.010 x d_1	1480	0.010 x d_1			□	■
	4.1	1480	0.011 x d_1	1480	0.011 x d_1		□	□	■
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	360	0.004 x d_1	360	0.004 x d_1				■
	5.3								
S	1.1	360	0.004 x d_1	360	0.005 x d_1				■
	1.2	290	0.004 x d_1	290	0.004 x d_1				■
	1.3	215	0.003 x d_1	215	0.004 x d_1				■
	2.1	290	0.003 x d_1	290	0.003 x d_1				■
	2.2	85	0.003 x d_1	110	0.003 x d_1				■
	2.3	110	0.003 x d_1	110	0.003 x d_1				■
	2.4	110	0.003 x d_1	110	0.003 x d_1				■
	2.5	90	0.003 x d_1	110	0.003 x d_1				■
	2.6	90	0.003 x d_1	110	0.003 x d_1				■
H	1.1	435	0.004 x d_1	470	0.004 x d_1	□	■		
	1.2	325	0.004 x d_1	360	0.004 x d_1	□	■		
	1.3	290	0.003 x d_1	290	0.003 x d_1	□	■		
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

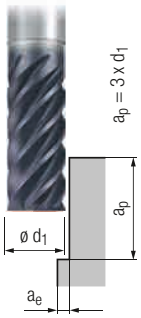
■ = very suitable
□ = suitable

Extra long length (7 Flutes) - for Regular and Corner Radius tools

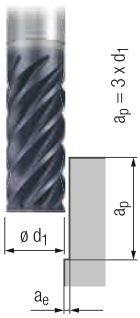
N

Valid for Tool Nos.:

3918L 3939L
3932L 3940L



$a_e = 0.1 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	435	0.005 x d_1	505	0.006 x d_1	□	■	□	■
	2.1	395	0.004 x d_1	470	0.005 x d_1	□	■	□	■
	3.1	325	0.004 x d_1	395	0.005 x d_1	□	■	□	■
	4.1	255	0.003 x d_1	290	0.004 x d_1	□	■		
	5.1	215	0.003 x d_1	255	0.003 x d_1	□	■		
M	1.1	435	0.003 x d_1	505	0.004 x d_1			□	■
	2.1	360	0.003 x d_1	435	0.004 x d_1			□	■
	3.1	255	0.003 x d_1	290	0.003 x d_1			□	■
	4.1	180	0.003 x d_1	215	0.003 x d_1			□	■
K	1.1	435	0.005 x d_1	505	0.006 x d_1	□	■		
	1.2	435	0.005 x d_1	505	0.006 x d_1	□	■		
	2.1	395	0.004 x d_1	470	0.005 x d_1	□	■		
	2.2	395	0.004 x d_1	470	0.005 x d_1	□	■		
	3.1	325	0.004 x d_1	395	0.005 x d_1	□	■		
	3.2	325	0.004 x d_1	395	0.005 x d_1	□	■		
	4.1	255	0.003 x d_1	290	0.004 x d_1	□	■		
	4.2	215	0.003 x d_1	255	0.004 x d_1	□	■		
N	1.1	865	0.009 x d_1	1030	0.011 x d_1			□	■
	1.2	865	0.008 x d_1	1030	0.010 x d_1			□	■
	1.3	865	0.007 x d_1	1030	0.008 x d_1			□	■
	1.4	865	0.008 x d_1	1030	0.010 x d_1			□	■
	1.5								
	1.6								
	2.1	490	0.005 x d_1	585	0.006 x d_1			□	■
	2.2	490	0.005 x d_1	585	0.006 x d_1			□	■
	2.3	490	0.005 x d_1	585	0.006 x d_1		□	□	■
	2.4	435	0.004 x d_1	515	0.005 x d_1			□	■
	2.5	435	0.004 x d_1	515	0.005 x d_1			□	■
	2.6	435	0.004 x d_1	515	0.005 x d_1		□	□	■
	2.7	245	0.003 x d_1	290	0.004 x d_1			□	■
	2.8	245	0.003 x d_1	290	0.004 x d_1			□	■
	3.1	1080	0.010 x d_1	1285	0.011 x d_1			□	■
	3.2	1080	0.008 x d_1	1285	0.010 x d_1			□	■
	4.1	1080	0.008 x d_1	1285	0.010 x d_1		□	□	■
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	215	0.003 x d_1	255	0.004 x d_1				■
	5.3								
S	1.1	325	0.004 x d_1	360	0.005 x d_1				■
	1.2	255	0.003 x d_1	290	0.004 x d_1				■
	1.3	255	0.003 x d_1	290	0.003 x d_1				■
	2.1	255	0.004 x d_1	290	0.004 x d_1				■
	2.2	110	0.003 x d_1	145	0.004 x d_1				■
	2.3	70	0.002 x d_1	90	0.002 x d_1				■
	2.4	110	0.003 x d_1	160	0.003 x d_1				■
	2.5	70	0.002 x d_1	70	0.002 x d_1				■
	2.6	70	0.003 x d_1	70	0.003 x d_1				■
H	1.1	340	0.002 x d_1	405	0.003 x d_1	□	■		
	1.2	245	0.002 x d_1	290	0.003 x d_1	□	■		
	1.3	215	0.002 x d_1	255	0.003 x d_1	□	■		
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

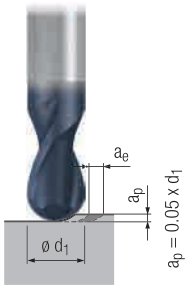
Standard, long and extra long lengths (4 - 5 Flutes) with ball nose

N

Valid for Tool Nos.:

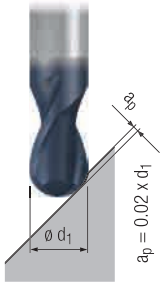
2919L 3949L
2974L 3950L
3900L 3951L

Roughing



$a_e = 0.2 \times d_1$

Finishing



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

v_c = Cutting speed
f_z = Feed per tooth

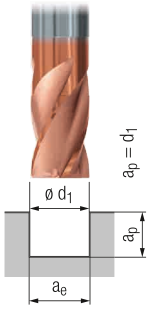
■ = very suitable
□ = suitable

Standard design (2 - 4 Flutes)

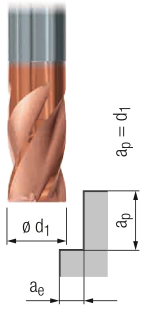
N

Valid for Tool Nos.:

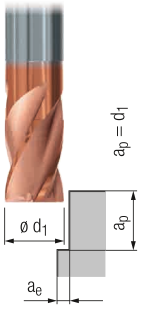
1916A 2510A 2516A
1917A 2511A 2517A



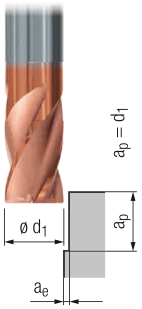
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

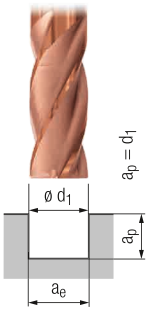
		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	170	0.005 x d_1	190	0.006 x d_1	200	0.007 x d_1	240	0.008 x d_1	□	■	□	■
	2.1	150	0.004 x d_1	170	0.005 x d_1	180	0.006 x d_1	210	0.007 x d_1	□	■	□	■
	3.1	130	0.004 x d_1	140	0.005 x d_1	160	0.005 x d_1	180	0.006 x d_1	□	■	□	■
	4.1	120	0.003 x d_1	130	0.004 x d_1	140	0.004 x d_1	170	0.005 x d_1	□	■		
	5.1	100	0.003 x d_1	110	0.003 x d_1	120	0.004 x d_1	140	0.004 x d_1	□	■		
M	1.1	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	110	0.005 x d_1			□	■
	2.1	70	0.003 x d_1	80	0.004 x d_1	80	0.004 x d_1	100	0.005 x d_1			□	■
	3.1	50	0.002 x d_1	60	0.003 x d_1	60	0.003 x d_1	70	0.004 x d_1			□	■
	4.1	30	0.002 x d_1	30	0.003 x d_1	40	0.003 x d_1	40	0.004 x d_1			□	■
K	1.1	170	0.005 x d_1	190	0.006 x d_1	200	0.007 x d_1	240	0.008 x d_1	□	■		
	1.2	170	0.005 x d_1	190	0.006 x d_1	200	0.007 x d_1	240	0.008 x d_1	□	■		
	2.1	150	0.004 x d_1	170	0.005 x d_1	180	0.006 x d_1	210	0.006 x d_1	□	■		
	2.2	150	0.004 x d_1	170	0.005 x d_1	180	0.006 x d_1	210	0.006 x d_1	□	■		
	3.1	130	0.004 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.006 x d_1	□	■		
	3.2	130	0.004 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.006 x d_1	□	■		
	4.1	100	0.003 x d_1	110	0.004 x d_1	120	0.004 x d_1	140	0.005 x d_1	□	■		
	4.2	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	110	0.005 x d_1	□	■		
N	1.1	220	0.009 x d_1	250	0.010 x d_1	280	0.011 x d_1	300	0.013 x d_1			□	■
	1.2	220	0.008 x d_1	250	0.009 x d_1	280	0.010 x d_1	300	0.011 x d_1			□	■
	1.3	220	0.007 x d_1	250	0.008 x d_1	280	0.009 x d_1	300	0.010 x d_1			□	■
	1.4	200	0.008 x d_1	250	0.009 x d_1	280	0.010 x d_1	300	0.011 x d_1			□	■
	1.5												
	1.6												
	2.1	150	0.005 x d_1	170	0.006 x d_1	180	0.007 x d_1	210	0.008 x d_1			□	■
	2.2	150	0.005 x d_1	170	0.006 x d_1	180	0.007 x d_1	210	0.008 x d_1			□	■
	2.3	150	0.005 x d_1	170	0.006 x d_1	180	0.007 x d_1	210	0.008 x d_1		□	□	■
	2.4	130	0.004 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.006 x d_1			□	■
	2.5	130	0.004 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.006 x d_1			□	■
	2.6	130	0.004 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.006 x d_1		□	□	■
	2.7	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	110	0.005 x d_1			□	■
	2.8	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	110	0.005 x d_1			□	■
	3.1	340	0.009 x d_1	370	0.011 x d_1	410	0.013 x d_1	480	0.014 x d_1			□	■
	3.2	340	0.007 x d_1	370	0.008 x d_1	410	0.010 x d_1	480	0.011 x d_1			□	■
	4.1	340	0.008 x d_1	370	0.009 x d_1	410	0.011 x d_1	480	0.012 x d_1		□	□	■
	4.2	500	0.008 x d_1	550	0.009 x d_1	600	0.011 x d_1	700	0.012 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	110	0.005 x d_1				■
	5.3												
S	1.1	80	0.004 x d_1	90	0.004 x d_1	100	0.005 x d_1	110	0.006 x d_1				■
	1.2	70	0.003 x d_1	80	0.004 x d_1	80	0.004 x d_1	100	0.005 x d_1				■
	1.3	40	0.003 x d_1	40	0.003 x d_1	50	0.004 x d_1	60	0.004 x d_1				■
	2.1	70	0.002 x d_1	80	0.002 x d_1	80	0.003 x d_1	100	0.003 x d_1				■
	2.2	30	0.002 x d_1	30	0.002 x d_1	35	0.003 x d_1	40	0.003 x d_1				■
	2.3	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.4	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.5	20	0.002 x d_1	20	0.002 x d_1	20	0.003 x d_1	30	0.003 x d_1				■
	2.6	20	0.002 x d_1	20	0.002 x d_1	20	0.003 x d_1	30	0.003 x d_1				■
H	1.1	100	0.003 x d_1	110	0.003 x d_1	120	0.004 x d_1	140	0.004 x d_1	□	■		
	1.2	80	0.003 x d_1	90	0.003 x d_1	100	0.004 x d_1	110	0.004 x d_1	□	■		
	1.3			90	0.003 x d_1	100	0.003 x d_1	110	0.004 x d_1	□	■		
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

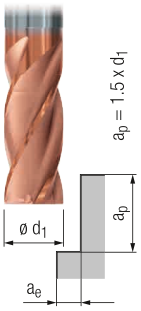
■ = very suitable
□ = suitable

Long design (2 - 8 Flutes)

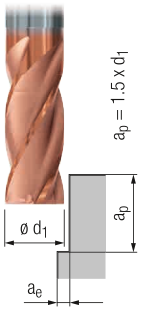
N



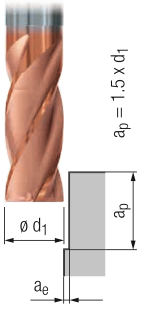
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

Valid for Tool Nos.:

1998A	2513A	2698A
1998AZ	2518A	2698AZ
1999A	2519A	2699A
1999AZ	2522A [1]	2699AZ
2512A	2523A [1]	

		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]			MMS MQL	
P	1.1	140	0.005 x d_1	150	0.005 x d_1	170	0.006 x d_1	200	0.007 x d_1	□	■	□	■
	2.1	130	0.004 x d_1	140	0.005 x d_1	160	0.005 x d_1	180	0.006 x d_1	□	■	□	■
	3.1	110	0.004 x d_1	120	0.004 x d_1	130	0.005 x d_1	150	0.005 x d_1	□	■	□	■
	4.1	100	0.003 x d_1	110	0.003 x d_1	120	0.004 x d_1	140	0.004 x d_1	□	■		
	5.1	90	0.003 x d_1	100	0.003 x d_1	110	0.003 x d_1	130	0.004 x d_1	□	■		
M	1.1	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.1	60	0.003 x d_1	70	0.003 x d_1	70	0.004 x d_1	80	0.004 x d_1			□	■
	3.1	40	0.002 x d_1	40	0.003 x d_1	50	0.003 x d_1	60	0.003 x d_1			□	■
	4.1	30	0.002 x d_1	30	0.003 x d_1	40	0.003 x d_1	40	0.003 x d_1			□	■
K	1.1	140	0.005 x d_1	150	0.006 x d_1	170	0.006 x d_1	200	0.007 x d_1	□	■		
	1.2	140	0.005 x d_1	150	0.006 x d_1	170	0.006 x d_1	200	0.007 x d_1	□	■		
	2.1	130	0.004 x d_1	140	0.005 x d_1	160	0.005 x d_1	180	0.006 x d_1	□	■		
	2.2	130	0.004 x d_1	140	0.005 x d_1	160	0.005 x d_1	180	0.006 x d_1	□	■		
	3.1	110	0.004 x d_1	120	0.005 x d_1	130	0.005 x d_1	150	0.006 x d_1	□	■		
	3.2	110	0.004 x d_1	120	0.005 x d_1	130	0.005 x d_1	150	0.006 x d_1	□	■		
	4.1	90	0.003 x d_1	100	0.003 x d_1	110	0.004 x d_1	130	0.004 x d_1	□	■		
	4.2	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1	□	■		
N	1.1	220	0.009 x d_1	250	0.010 x d_1	280	0.011 x d_1	300	0.013 x d_1			□	■
	1.2	220	0.008 x d_1	250	0.009 x d_1	280	0.010 x d_1	300	0.011 x d_1			□	■
	1.3	220	0.007 x d_1	250	0.008 x d_1	280	0.009 x d_1	300	0.010 x d_1			□	■
	1.4	200	0.008 x d_1	250	0.009 x d_1	280	0.010 x d_1	300	0.011 x d_1			□	■
	1.5												
	1.6												
	2.1	130	0.005 x d_1	140	0.006 x d_1	160	0.006 x d_1	180	0.007 x d_1			□	■
	2.2	130	0.005 x d_1	140	0.006 x d_1	160	0.006 x d_1	180	0.007 x d_1			□	■
	2.3	130	0.005 x d_1	140	0.006 x d_1	160	0.006 x d_1	180	0.007 x d_1		□	□	■
	2.4	120	0.004 x d_1	130	0.005 x d_1	140	0.005 x d_1	170	0.006 x d_1			□	■
	2.5	120	0.004 x d_1	130	0.005 x d_1	140	0.005 x d_1	170	0.006 x d_1			□	■
	2.6	120	0.004 x d_1	130	0.005 x d_1	140	0.005 x d_1	170	0.006 x d_1		□	□	■
	2.7	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.8	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	3.1	290	0.009 x d_1	320	0.010 x d_1	350	0.011 x d_1	410	0.013 x d_1			□	■
	3.2	290	0.007 x d_1	320	0.008 x d_1	350	0.009 x d_1	410	0.010 x d_1			□	■
	4.1	290	0.008 x d_1	320	0.009 x d_1	350	0.009 x d_1	410	0.011 x d_1		□	□	■
	4.2	430	0.008 x d_1	470	0.009 x d_1	520	0.009 x d_1	600	0.011 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1				■
	5.3												
S	1.1	70	0.004 x d_1	80	0.004 x d_1	80	0.004 x d_1	100	0.005 x d_1				■
	1.2	60	0.003 x d_1	70	0.003 x d_1	70	0.004 x d_1	80	0.004 x d_1				■
	1.3	40	0.003 x d_1	40	0.003 x d_1	50	0.003 x d_1	60	0.004 x d_1				■
	2.1	60	0.002 x d_1	70	0.002 x d_1	70	0.003 x d_1	80	0.003 x d_1				■
	2.2	20	0.002 x d_1	20	0.002 x d_1	15	0.003 x d_1	30	0.003 x d_1				■
	2.3	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.4	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.5	20	0.002 x d_1	20	0.002 x d_1	20	0.003 x d_1	30	0.003 x d_1				■
	2.6	20	0.002 x d_1	20	0.002 x d_1	20	0.003 x d_1	30	0.003 x d_1				■
H	1.1	90	0.003 x d_1	100	0.003 x d_1	110	0.003 x d_1	130	0.004 x d_1	□	■		
	1.2	70	0.003 x d_1	80	0.003 x d_1	80	0.003 x d_1	100	0.004 x d_1	□	■		
	1.3			70	0.003 x d_1	70	0.003 x d_1	80	0.003 x d_1	□	■		
	1.4												
	1.5												

[1] Not suitable for full slot milling!

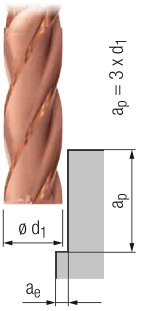
v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

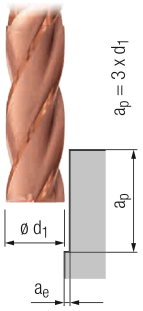
Extra long design (2 - 8 Flutes)

N

$L_2 = 3 \times D_1$

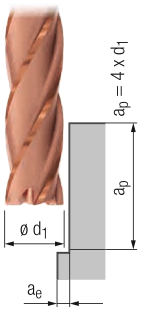


$a_e = 0.1 \times d_1$

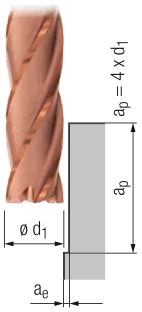


$a_e = 0.02 \times d_1$

$L_2 = 4 \times D_1$



$a_e = 0.05 \times d_1$



$a_e = 0.02 \times d_1$

Valid for Tool Nos.:

2514A, 2515A, 2520A, 2521A, 2524A, 2525A, 2526A, 2527A, 2528A, 2529A

		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]			MMS MQL	
P	1.1	120	0.005 x d_1	140	0.006 x d_1	100	0.005 x d_1	120	0.005 x d_1	□	■	□	■
	2.1	110	0.004 x d_1	130	0.005 x d_1	90	0.004 x d_1	110	0.005 x d_1	□	■	□	■
	3.1	90	0.004 x d_1	110	0.005 x d_1	70	0.004 x d_1	90	0.004 x d_1	□	■	□	■
	4.1	70	0.003 x d_1	80	0.004 x d_1	60	0.003 x d_1	70	0.003 x d_1	□	■		
	5.1	60	0.003 x d_1	70	0.003 x d_1	50	0.003 x d_1	60	0.003 x d_1	□	■		
M	1.1	120	0.003 x d_1	140	0.004 x d_1	100	0.003 x d_1	120	0.003 x d_1			□	■
	2.1	100	0.003 x d_1	120	0.004 x d_1	80	0.003 x d_1	100	0.003 x d_1			□	■
	3.1	70	0.003 x d_1	80	0.003 x d_1	60	0.003 x d_1	70	0.003 x d_1			□	■
	4.1	50	0.003 x d_1	60	0.003 x d_1	40	0.003 x d_1	50	0.003 x d_1			□	■
K	1.1	120	0.005 x d_1	140	0.006 x d_1	100	0.005 x d_1	120	0.006 x d_1	□	■		
	1.2	120	0.005 x d_1	140	0.006 x d_1	100	0.005 x d_1	120	0.006 x d_1	□	■		
	2.1	110	0.004 x d_1	130	0.005 x d_1	90	0.004 x d_1	110	0.004 x d_1	□	■		
	2.2	110	0.004 x d_1	130	0.005 x d_1	90	0.004 x d_1	110	0.004 x d_1	□	■		
	3.1	90	0.004 x d_1	110	0.005 x d_1	70	0.004 x d_1	90	0.004 x d_1	□	■		
	3.2	90	0.004 x d_1	110	0.005 x d_1	70	0.004 x d_1	90	0.004 x d_1	□	■		
	4.1	70	0.003 x d_1	80	0.004 x d_1	60	0.003 x d_1	70	0.003 x d_1	□	■		
	4.2	60	0.003 x d_1	70	0.004 x d_1	50	0.003 x d_1	60	0.003 x d_1	□	■		
N	1.1	360	0.009 x d_1	430	0.011 x d_1	300	0.009 x d_1	430	0.009 x d_1			□	■
	1.2	360	0.008 x d_1	430	0.010 x d_1	300	0.008 x d_1	430	0.009 x d_1			□	■
	1.3	360	0.007 x d_1	430	0.008 x d_1	300	0.007 x d_1	430	0.008 x d_1			□	■
	1.4	240	0.008 x d_1	290	0.010 x d_1	200	0.008 x d_1	290	0.009 x d_1			□	■
	1.5	230	0.007 x d_1	280	0.008 x d_1	180	0.007 x d_1	280	0.008 x d_1			□	■
	1.6	160	0.006 x d_1	190	0.007 x d_1	130	0.006 x d_1	190	0.007 x d_1			□	■
	2.1	110	0.005 x d_1	130	0.006 x d_1	90	0.005 x d_1	110	0.006 x d_1			□	■
	2.2	110	0.005 x d_1	130	0.006 x d_1	90	0.005 x d_1	110	0.006 x d_1			□	■
	2.3	110	0.005 x d_1	130	0.006 x d_1	90	0.005 x d_1	110	0.006 x d_1		□	□	■
	2.4	100	0.004 x d_1	120	0.005 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.5	100	0.004 x d_1	120	0.005 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.6	100	0.004 x d_1	120	0.005 x d_1	80	0.004 x d_1	100	0.004 x d_1		□	□	■
	2.7	60	0.003 x d_1	70	0.004 x d_1	50	0.003 x d_1	60	0.003 x d_1			□	■
	2.8	60	0.003 x d_1	70	0.004 x d_1	50	0.003 x d_1	60	0.003 x d_1			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2	60	0.003 x d_1	70	0.004 x d_1	50	0.003 x d_1	60	0.003 x d_1				■
	5.3												
S	1.1	90	0.004 x d_1	100	0.005 x d_1	70	0.004 x d_1	80	0.004 x d_1				■
	1.2	70	0.003 x d_1	80	0.004 x d_1	60	0.003 x d_1	70	0.003 x d_1				■
	1.3	70	0.003 x d_1	80	0.003 x d_1	60	0.003 x d_1	70	0.003 x d_1				■
	2.1	70	0.004 x d_1	80	0.004 x d_1	60	0.004 x d_1	70	0.004 x d_1				■
	2.2	30	0.003 x d_1	40	0.004 x d_1	15	0.003 x d_1	30	0.003 x d_1				■
	2.3	20	0.002 x d_1	25	0.002 x d_1	25	0.002 x d_1	20	0.002 x d_1				■
	2.4	30	0.003 x d_1	45	0.003 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.5	20	0.002 x d_1	20	0.002 x d_1	20	0.002 x d_1	20	0.002 x d_1				■
	2.6	20	0.003 x d_1	20	0.003 x d_1	20	0.003 x d_1	20	0.003 x d_1				■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

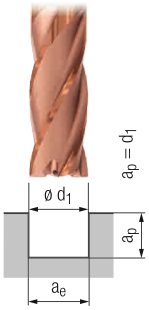
■ = very suitable
□ = suitable

Extra long design (4 Flutes)

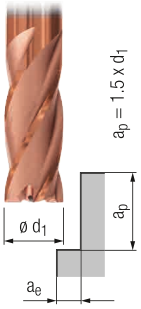
N

Valid for Tool Nos.:

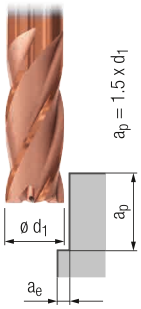
3806AZ
3807AZ



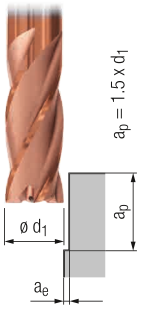
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		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]			MMS MQL	
P	1.1	120	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.006 x d_1	□	■	□	■
	2.1	110	0.004 x d_1	130	0.005 x d_1	150	0.005 x d_1	170	0.005 x d_1	□	■	□	■
	3.1	100	0.004 x d_1	120	0.004 x d_1	140	0.005 x d_1	160	0.005 x d_1	□	■	□	■
	4.1	80	0.003 x d_1	100	0.003 x d_1	120	0.004 x d_1	140	0.004 x d_1	□	■		
	5.1	70	0.003 x d_1	90	0.003 x d_1	110	0.003 x d_1	130	0.003 x d_1	□	■		
M	1.1	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.1	60	0.003 x d_1	70	0.003 x d_1	70	0.004 x d_1	80	0.004 x d_1			□	■
	3.1	40	0.002 x d_1	40	0.003 x d_1	50	0.003 x d_1	60	0.003 x d_1			□	■
	4.1	30	0.002 x d_1	30	0.003 x d_1	40	0.003 x d_1	40	0.003 x d_1			□	■
K	1.1	120	0.005 x d_1	140	0.006 x d_1	160	0.006 x d_1	180	0.006 x d_1	□	■		
	1.2	120	0.005 x d_1	140	0.006 x d_1	160	0.006 x d_1	180	0.006 x d_1	□	■		
	2.1	110	0.004 x d_1	130	0.005 x d_1	150	0.005 x d_1	170	0.005 x d_1	□	■		
	2.2	110	0.004 x d_1	130	0.005 x d_1	150	0.005 x d_1	170	0.005 x d_1	□	■		
	3.1	100	0.004 x d_1	110	0.005 x d_1	130	0.005 x d_1	150	0.005 x d_1	□	■		
	3.2	100	0.004 x d_1	110	0.005 x d_1	130	0.005 x d_1	150	0.005 x d_1	□	■		
	4.1	90	0.003 x d_1	100	0.003 x d_1	110	0.004 x d_1	130	0.004 x d_1	□	■		
	4.2	70	0.003 x d_1	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	□	■		
N	1.1	200	0.009 x d_1	220	0.010 x d_1	240	0.011 x d_1	260	0.013 x d_1			□	■
	1.2	200	0.008 x d_1	220	0.009 x d_1	240	0.010 x d_1	260	0.011 x d_1			□	■
	1.3	200	0.007 x d_1	220	0.008 x d_1	240	0.009 x d_1	260	0.010 x d_1			□	■
	1.4	180	0.008 x d_1	220	0.009 x d_1	240	0.010 x d_1	260	0.011 x d_1			□	■
	1.5												
	1.6												
	2.1	120	0.005 x d_1	130	0.006 x d_1	150	0.006 x d_1	170	0.007 x d_1			□	■
	2.2	120	0.005 x d_1	130	0.006 x d_1	150	0.006 x d_1	170	0.007 x d_1			□	■
	2.3	120	0.005 x d_1	130	0.006 x d_1	150	0.006 x d_1	170	0.007 x d_1		□	□	■
	2.4	110	0.004 x d_1	120	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1			□	■
	2.5	110	0.004 x d_1	120	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1			□	■
	2.6	110	0.004 x d_1	120	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1		□	□	■
	2.7	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.8	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	3.1	280	0.009 x d_1	300	0.010 x d_1	320	0.011 x d_1	350	0.013 x d_1			□	■
	3.2	280	0.007 x d_1	300	0.008 x d_1	320	0.009 x d_1	350	0.010 x d_1			□	■
	4.1	280	0.008 x d_1	300	0.009 x d_1	320	0.009 x d_1	350	0.011 x d_1		□	□	■
	4.2	420	0.008 x d_1	450	0.009 x d_1	480	0.009 x d_1	520	0.011 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	90	0.004 x d_1				■
	5.3												
S	1.1	70	0.004 x d_1	80	0.004 x d_1	80	0.004 x d_1	80	0.005 x d_1				■
	1.2	60	0.003 x d_1	70	0.003 x d_1	70	0.004 x d_1	70	0.004 x d_1				■
	1.3	40	0.003 x d_1	40	0.003 x d_1	50	0.003 x d_1	50	0.004 x d_1				■
	2.1	60	0.002 x d_1	70	0.002 x d_1	70	0.003 x d_1	70	0.003 x d_1				■
	2.2	20	0.002 x d_1	20	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.3	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.4	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.5	20	0.002 x d_1	20	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.6	20	0.002 x d_1	20	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
H	1.1	80	0.003 x d_1	90	0.003 x d_1	100	0.003 x d_1	110	0.004 x d_1	□	■		
	1.2	70	0.003 x d_1	80	0.003 x d_1	80	0.003 x d_1	90	0.004 x d_1	□	■		
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

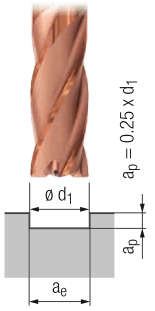
■ = very suitable
□ = suitable

Extra long design (4 Flutes)

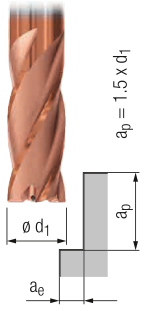
N $L_3 = 6 \times D_1$

Valid for Tool Nos.:

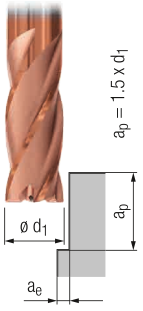
3808AZ
3809AZ



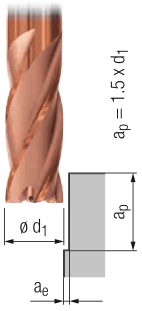
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		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]			MMS MQL	
P	1.1	80	0.005 x d_1	120	0.005 x d_1	140	0.006 x d_1	160	0.006 x d_1	□	■	□	■
	2.1	70	0.004 x d_1	110	0.005 x d_1	130	0.005 x d_1	150	0.005 x d_1	□	■	□	■
	3.1	60	0.004 x d_1	100	0.004 x d_1	120	0.005 x d_1	140	0.005 x d_1	□	■	□	■
	4.1	60	0.003 x d_1	80	0.003 x d_1	100	0.004 x d_1	120	0.004 x d_1	□	■		
	5.1	50	0.003 x d_1	80	0.003 x d_1	90	0.003 x d_1	110	0.003 x d_1	□	■		
M	1.1	70	0.003 x d_1	70	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.1	60	0.003 x d_1	60	0.003 x d_1	70	0.004 x d_1	80	0.004 x d_1			□	■
	3.1	40	0.002 x d_1	40	0.003 x d_1	50	0.003 x d_1	60	0.003 x d_1			□	■
	4.1	30	0.002 x d_1	30	0.003 x d_1	40	0.003 x d_1	40	0.003 x d_1			□	■
K	1.1	80	0.005 x d_1	120	0.006 x d_1	140	0.006 x d_1	160	0.006 x d_1	□	■		
	1.2	80	0.005 x d_1	120	0.006 x d_1	140	0.006 x d_1	160	0.006 x d_1	□	■		
	2.1	70	0.004 x d_1	110	0.005 x d_1	130	0.005 x d_1	150	0.005 x d_1	□	■		
	2.2	70	0.004 x d_1	110	0.005 x d_1	130	0.005 x d_1	150	0.005 x d_1	□	■		
	3.1	70	0.004 x d_1	100	0.005 x d_1	110	0.005 x d_1	130	0.005 x d_1	□	■		
	3.2	70	0.004 x d_1	100	0.005 x d_1	110	0.005 x d_1	130	0.005 x d_1	□	■		
	4.1	60	0.003 x d_1	90	0.003 x d_1	100	0.004 x d_1	110	0.004 x d_1	□	■		
	4.2	60	0.003 x d_1	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	□	■		
N	1.1	160	0.009 x d_1	180	0.010 x d_1	200	0.011 x d_1	220	0.013 x d_1			□	■
	1.2	160	0.008 x d_1	180	0.009 x d_1	200	0.010 x d_1	220	0.011 x d_1			□	■
	1.3	160	0.007 x d_1	180	0.008 x d_1	200	0.009 x d_1	220	0.010 x d_1			□	■
	1.4	140	0.008 x d_1	180	0.009 x d_1	200	0.010 x d_1	220	0.011 x d_1			□	■
	1.5												
	1.6												
	2.1	100	0.005 x d_1	110	0.006 x d_1	130	0.006 x d_1	150	0.007 x d_1			□	■
	2.2	100	0.005 x d_1	110	0.006 x d_1	130	0.006 x d_1	150	0.007 x d_1			□	■
	2.3	100	0.005 x d_1	110	0.006 x d_1	130	0.006 x d_1	150	0.007 x d_1		□	□	■
	2.4	90	0.004 x d_1	100	0.005 x d_1	120	0.005 x d_1	140	0.006 x d_1			□	■
	2.5	90	0.004 x d_1	100	0.005 x d_1	120	0.005 x d_1	140	0.006 x d_1			□	■
	2.6	90	0.004 x d_1	100	0.005 x d_1	120	0.005 x d_1	140	0.006 x d_1		□	□	■
	2.7	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	2.8	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1			□	■
	3.1	240	0.009 x d_1	260	0.010 x d_1	280	0.011 x d_1	300	0.013 x d_1			□	■
	3.2	240	0.007 x d_1	260	0.008 x d_1	280	0.009 x d_1	300	0.010 x d_1			□	■
	4.1	240	0.008 x d_1	260	0.009 x d_1	280	0.009 x d_1	300	0.011 x d_1		□	□	■
	4.2	380	0.008 x d_1	400	0.009 x d_1	420	0.009 x d_1	450	0.011 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	70	0.003 x d_1	80	0.003 x d_1	80	0.004 x d_1	90	0.004 x d_1				■
	5.3												
S	1.1	60	0.004 x d_1	70	0.004 x d_1	80	0.004 x d_1	80	0.005 x d_1				■
	1.2	50	0.003 x d_1	60	0.003 x d_1	70	0.004 x d_1	70	0.004 x d_1				■
	1.3	40	0.003 x d_1	40	0.003 x d_1	50	0.003 x d_1	50	0.004 x d_1				■
	2.1	50	0.002 x d_1	60	0.002 x d_1	70	0.003 x d_1	70	0.003 x d_1				■
	2.2	20	0.002 x d_1	20	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.3	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.4	20	0.002 x d_1	25	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.5	20	0.002 x d_1	20	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
	2.6	20	0.002 x d_1	20	0.002 x d_1	25	0.003 x d_1	30	0.003 x d_1				■
H	1.1	70	0.003 x d_1	80	0.003 x d_1	90	0.003 x d_1	100	0.004 x d_1	□	■		
	1.2	60	0.003 x d_1	70	0.003 x d_1	80	0.003 x d_1	90	0.004 x d_1	□	■		
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

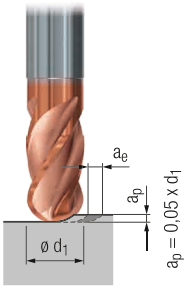
Standard design (3-4 Flutes) with ball nose

N

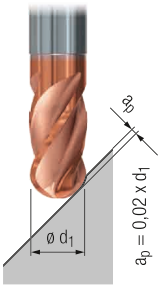
Valid for Tool No.:

3840A

Roughing



Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	200	0.014 x d_1	270	0.010 x d_1	□	■	□	■
	2.1	170	0.013 x d_1	230	0.009 x d_1	□	■	□	■
	3.1	140	0.011 x d_1	200	0.008 x d_1	□	■	□	
	4.1	110	0.010 x d_1	160	0.007 x d_1	□	■	□	
	5.1	100	0.008 x d_1	130	0.006 x d_1	□	■	□	
M	1.1	100	0.008 x d_1	130	0.006 x d_1			□	■
	2.1	80	0.008 x d_1	110	0.006 x d_1			□	■
	3.1	60	0.006 x d_1	80	0.005 x d_1			□	■
	4.1	40	0.006 x d_1	60	0.005 x d_1			□	■
K	1.1	200	0.014 x d_1	270	0.010 x d_1	□	■		□
	1.2	200	0.014 x d_1	270	0.010 x d_1	□	■		□
	2.1	180	0.011 x d_1	230	0.008 x d_1	□	■		□
	2.2	180	0.011 x d_1	230	0.008 x d_1	□	■		□
	3.1	140	0.011 x d_1	200	0.008 x d_1	□	■		
	3.2	140	0.011 x d_1	200	0.008 x d_1	□	■		
	4.1	110	0.008 x d_1	160	0.006 x d_1	□	■		
	4.2	100	0.008 x d_1	130	0.006 x d_1	□	■		
N	1.1								
	1.2								
	1.3								
	1.4								
	1.5								
	1.6								
	2.1	180	0.014 x d_1	230	0.010 x d_1			□	■
	2.2	180	0.014 x d_1	230	0.010 x d_1			□	■
	2.3	180	0.014 x d_1	230	0.010 x d_1	□	□	□	■
	2.4	140	0.011 x d_1	200	0.008 x d_1			□	■
	2.5	140	0.011 x d_1	200	0.008 x d_1			□	■
	2.6	140	0.011 x d_1	200	0.008 x d_1	□	□	□	■
	2.7	90	0.008 x d_1	120	0.006 x d_1			□	■
	2.8	90	0.008 x d_1	120	0.006 x d_1			□	■
	3.1								
	3.2								
	4.1	290	0.020 x d_1	400	0.015 x d_1		□	□	■
	4.2	430	0.020 x d_1	580	0.015 x d_1		□	□	■
	4.3								
	4.4								
	5.1								
	5.2	100	0.008 x d_1	130	0.006 x d_1			□	■
	5.3	180	0.017 x d_1	270	0.012 x d_1	□	■		■
S	1.1	100	0.010 x d_1	130	0.007 x d_1			□	■
	1.2	80	0.008 x d_1	110	0.006 x d_1			□	■
	1.3	40	0.007 x d_1	60	0.005 x d_1			□	■
	2.1	70	0.008 x d_1	100	0.006 x d_1			□	■
	2.2	25	0.006 x d_1	40	0.004 x d_1			□	■
	2.3	25	0.006 x d_1	30	0.004 x d_1			□	■
	2.4	25	0.006 x d_1	30	0.004 x d_1			□	■
	2.5	15	0.006 x d_1	25	0.004 x d_1			□	■
	2.6	25	0.006 x d_1	30	0.004 x d_1			□	■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

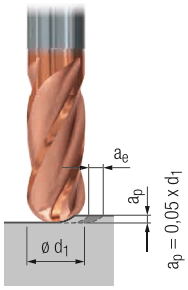
Long design (3-4 Flutes) with ball nose

N

Valid for Tool No.:

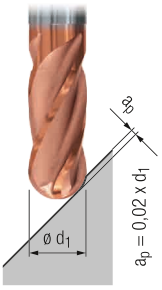
2502A

Roughing



$a_e = 0,2 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	200	0.014 x d_1	270	0.010 x d_1	□	■	□	■
	2.1	170	0.013 x d_1	230	0.009 x d_1	□	■	□	■
	3.1	140	0.011 x d_1	200	0.008 x d_1	□	■	□	
	4.1	110	0.010 x d_1	160	0.007 x d_1	□	■	□	
	5.1	100	0.008 x d_1	130	0.006 x d_1	□	■	□	
M	1.1	100	0.008 x d_1	130	0.006 x d_1			□	■
	2.1	80	0.008 x d_1	110	0.006 x d_1			□	■
	3.1	60	0.006 x d_1	80	0.005 x d_1			□	■
	4.1	40	0.006 x d_1	60	0.005 x d_1			□	■
K	1.1	200	0.014 x d_1	270	0.010 x d_1	□	■		□
	1.2	200	0.014 x d_1	270	0.010 x d_1	□	■		□
	2.1	180	0.011 x d_1	230	0.008 x d_1	□	■		□
	2.2	180	0.011 x d_1	230	0.008 x d_1	□	■		□
	3.1	140	0.011 x d_1	200	0.008 x d_1	□	■		
	3.2	140	0.011 x d_1	200	0.008 x d_1	□	■		
	4.1	110	0.008 x d_1	160	0.006 x d_1	□	■		
	4.2	100	0.008 x d_1	130	0.006 x d_1	□	■		
N	1.1								
	1.2								
	1.3								
	1.4								
	1.5								
	1.6								
	2.1	180	0.014 x d_1	230	0.010 x d_1			□	■
	2.2	180	0.014 x d_1	230	0.010 x d_1			□	■
	2.3	180	0.014 x d_1	230	0.010 x d_1	□	□	□	■
	2.4	140	0.011 x d_1	200	0.008 x d_1			□	■
	2.5	140	0.011 x d_1	200	0.008 x d_1			□	■
	2.6	140	0.011 x d_1	200	0.008 x d_1	□	□	□	■
	2.7	90	0.008 x d_1	120	0.006 x d_1			□	■
	2.8	90	0.008 x d_1	120	0.006 x d_1			□	■
	3.1								
	3.2								
	4.1	290	0.020 x d_1	400	0.015 x d_1		□	□	■
	4.2	430	0.020 x d_1	580	0.015 x d_1		□	□	■
	4.3								
	4.4								
	5.1								
	5.2	100	0.008 x d_1	130	0.006 x d_1			□	■
	5.3	180	0.017 x d_1	270	0.012 x d_1	□	■		■
S	1.1	100	0.010 x d_1	130	0.007 x d_1			□	■
	1.2	80	0.008 x d_1	110	0.006 x d_1			□	■
	1.3	40	0.007 x d_1	60	0.005 x d_1			□	■
	2.1	70	0.008 x d_1	100	0.006 x d_1			□	■
	2.2	25	0.006 x d_1	40	0.004 x d_1			□	■
	2.3	25	0.006 x d_1	30	0.004 x d_1			□	■
	2.4	25	0.006 x d_1	30	0.004 x d_1			□	■
	2.5	15	0.006 x d_1	25	0.004 x d_1			□	■
	2.6	25	0.006 x d_1	30	0.004 x d_1			□	■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

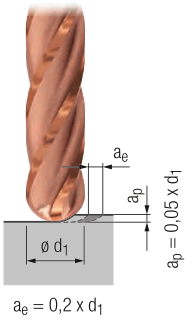
Extra long design (3-4 Flutes) with ball nose

N

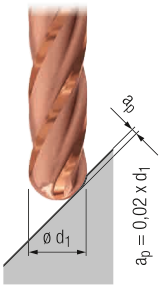
Valid for Tool No.:

2504A

Roughing



Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	140	0.014 x d_1	190	0.010 x d_1	□	■	□	■
	2.1	120	0.013 x d_1	160	0.009 x d_1	□	■	□	■
	3.1	100	0.011 x d_1	140	0.008 x d_1	□	■	□	
	4.1	80	0.010 x d_1	110	0.007 x d_1	□	■	□	
	5.1	70	0.008 x d_1	90	0.006 x d_1	□	■	□	
M	1.1	70	0.008 x d_1	90	0.006 x d_1			□	■
	2.1	60	0.008 x d_1	80	0.006 x d_1			□	■
	3.1	50	0.006 x d_1	60	0.005 x d_1			□	■
	4.1	30	0.006 x d_1	50	0.005 x d_1			□	■
K	1.1	140	0.014 x d_1	190	0.010 x d_1	□	■		□
	1.2	140	0.014 x d_1	190	0.010 x d_1	□	■		□
	2.1	120	0.011 x d_1	160	0.008 x d_1	□	■		□
	2.2	120	0.011 x d_1	160	0.008 x d_1	□	■		□
	3.1	100	0.011 x d_1	140	0.008 x d_1	□	■		
	3.2	100	0.011 x d_1	140	0.008 x d_1	□	■		
	4.1	80	0.008 x d_1	110	0.006 x d_1	□	■		
	4.2	70	0.008 x d_1	90	0.006 x d_1	□	■		
N	1.1								
	1.2								
	1.3								
	1.4								
	1.5								
	1.6								
	2.1	120	0.014 x d_1	160	0.010 x d_1			□	■
	2.2	120	0.014 x d_1	160	0.010 x d_1			□	■
	2.3	120	0.014 x d_1	160	0.010 x d_1	□	□	□	■
	2.4	100	0.011 x d_1	140	0.008 x d_1			□	■
	2.5	100	0.011 x d_1	140	0.008 x d_1			□	■
	2.6	100	0.011 x d_1	140	0.008 x d_1	□	□	□	■
	2.7	70	0.008 x d_1	90	0.006 x d_1			□	■
	2.8	70	0.008 x d_1	90	0.006 x d_1			□	■
	3.1								
	3.2								
	4.1	200	0.020 x d_1	280	0.015 x d_1		□	□	■
	4.2	300	0.020 x d_1	400	0.015 x d_1		□	□	■
	4.3								
	4.4								
	5.1								
	5.2	70	0.008 x d_1	130	0.006 x d_1			□	■
	5.3	120	0.017 x d_1	270	0.012 x d_1	□	■		■
S	1.1	70	0.010 x d_1	90	0.007 x d_1			□	■
	1.2	60	0.008 x d_1	80	0.006 x d_1			□	■
	1.3	30	0.007 x d_1	40	0.005 x d_1			□	■
	2.1	50	0.008 x d_1	70	0.006 x d_1			□	■
	2.2	20	0.006 x d_1	25	0.004 x d_1			□	■
	2.3	20	0.006 x d_1	25	0.004 x d_1			□	■
	2.4	20	0.006 x d_1	25	0.004 x d_1			□	■
	2.5	15	0.006 x d_1	20	0.004 x d_1			□	■
	2.6	20	0.006 x d_1	25	0.004 x d_1			□	■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Standard length (2 Flutes)

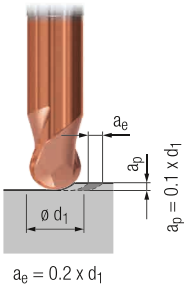
N

$l_3 = 3 \times d_1$

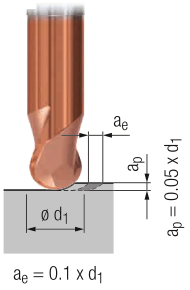
Valid for Tool No.:

3820A

Roughing

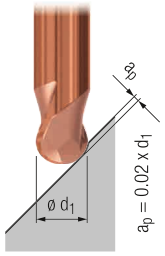


$a_e = 0.2 \times d_1$



$a_e = 0.1 \times d_1$

Finishing



		Roughing v_c [m/min]	Roughing f_z [mm]	Roughing v_c [m/min]	Roughing f_z [mm]	Finishing v_c [m/min]	Finishing f_z [mm]			MMS MQL	
P	1.1	260	0.013 x d_1	280	0.015 x d_1	300	0.013 x d_1	□	■	□	■
	2.1	240	0.012 x d_1	260	0.014 x d_1	280	0.012 x d_1	□	■	□	■
	3.1	220	0.011 x d_1	240	0.013 x d_1	260	0.011 x d_1	□	■	□	
	4.1	200	0.010 x d_1	220	0.012 x d_1	240	0.010 x d_1	□	■	□	
	5.1	180	0.009 x d_1	200	0.010 x d_1	220	0.009 x d_1	□	■	□	
M	1.1	140	0.008 x d_1	160	0.009 x d_1	180	0.010 x d_1			□	■
	2.1	120	0.008 x d_1	140	0.009 x d_1	160	0.010 x d_1			□	■
	3.1	100	0.006 x d_1	110	0.007 x d_1	120	0.008 x d_1			□	■
	4.1	80	0.006 x d_1	90	0.007 x d_1	100	0.008 x d_1			□	■
K	1.1	260	0.011 x d_1	280	0.013 x d_1	300	0.010 x d_1	□	■		□
	1.2	260	0.011 x d_1	280	0.013 x d_1	300	0.010 x d_1	□	■		□
	2.1	220	0.011 x d_1	240	0.013 x d_1	260	0.010 x d_1	□	■		□
	2.2	220	0.011 x d_1	240	0.013 x d_1	260	0.010 x d_1	□	■		□
	3.1	180	0.010 x d_1	200	0.011 x d_1	220	0.008 x d_1	□	■		
	3.2	180	0.010 x d_1	200	0.011 x d_1	220	0.008 x d_1	□	■		
	4.1	140	0.008 x d_1	160	0.009 x d_1	180	0.007 x d_1	□	■		
	4.2	130	0.008 x d_1	140	0.009 x d_1	150	0.007 x d_1	□	■		
N	1.1										
	1.2	400	0.015 x d_1	420	0.017 x d_1	450	0.014 x d_1			□	■
	1.3	350	0.014 x d_1	370	0.016 x d_1	400	0.013 x d_1			□	■
	1.4	280	0.013 x d_1	300	0.015 x d_1	350	0.012 x d_1			□	■
	1.5										
	1.6										
	2.1	200	0.012 x d_1	260	0.012 x d_1	280	0.010 x d_1			□	■
	2.2	200	0.012 x d_1	260	0.012 x d_1	280	0.010 x d_1			□	■
	2.3	200	0.012 x d_1	260	0.012 x d_1	280	0.010 x d_1	□	□	□	■
	2.4	160	0.010 x d_1	220	0.010 x d_1	250	0.008 x d_1			□	■
	2.5	160	0.010 x d_1	220	0.010 x d_1	250	0.008 x d_1			□	■
	2.6	160	0.010 x d_1	220	0.010 x d_1	250	0.008 x d_1	□	□	□	■
	2.7	150	0.008 x d_1	180	0.008 x d_1	200	0.006 x d_1			□	■
	2.8	120	0.008 x d_1	140	0.008 x d_1	160	0.006 x d_1			□	■
	3.1										
	3.2										
	4.1										
	4.2										
	4.3										
	4.4										
	5.1										
	5.2	130	0.008 x d_1	150	0.009 x d_1	180	0.007 x d_1			□	■
	5.3										
S	1.1	120	0.009 x d_1	140	0.010 x d_1	150	0.007 x d_1			□	■
	1.2	90	0.007 x d_1	100	0.008 x d_1	120	0.006 x d_1			□	■
	1.3	50	0.006 x d_1	70	0.007 x d_1	90	0.005 x d_1			□	■
	2.1	80	0.007 x d_1	100	0.008 x d_1	110	0.006 x d_1			□	■
	2.2	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.4	30	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.6	30	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1	160	0.008 x d_1	180	0.009 x d_1	200	0.010 x d_1	□	■		
	1.2	120	0.007 x d_1	150	0.008 x d_1	170	0.009 x d_1	□	■		
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Long design (2 Flutes) with ball nose

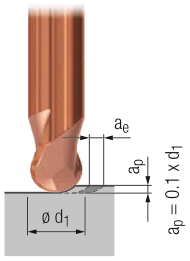
N

$l_3 = 5 \times d_1$

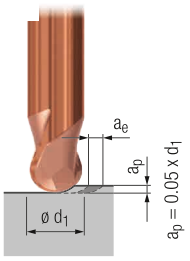
Valid for Tool No.:

3821A

Roughing

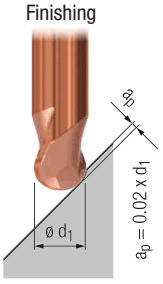


$a_e = 0.2 \times d_1$



$a_e = 0.1 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	240	0.013 x d_1	260	0.015 x d_1	280	0.013 x d_1	□	■	□	■
	2.1	220	0.012 x d_1	240	0.014 x d_1	260	0.012 x d_1	□	■	□	■
	3.1	200	0.011 x d_1	220	0.013 x d_1	240	0.011 x d_1	□	■	□	
	4.1	180	0.010 x d_1	200	0.012 x d_1	220	0.010 x d_1	□	■	□	
	5.1	160	0.009 x d_1	180	0.010 x d_1	200	0.009 x d_1	□	■	□	
M	1.1	120	0.008 x d_1	140	0.009 x d_1	160	0.010 x d_1			□	■
	2.1	100	0.008 x d_1	120	0.009 x d_1	140	0.010 x d_1			□	■
	3.1	80	0.006 x d_1	90	0.007 x d_1	100	0.008 x d_1			□	■
	4.1	70	0.006 x d_1	80	0.007 x d_1	90	0.008 x d_1			□	■
K	1.1	240	0.011 x d_1	260	0.013 x d_1	280	0.010 x d_1	□	■		□
	1.2	240	0.011 x d_1	260	0.013 x d_1	280	0.010 x d_1	□	■		□
	2.1	200	0.011 x d_1	220	0.013 x d_1	240	0.010 x d_1	□	■		□
	2.2	200	0.011 x d_1	220	0.013 x d_1	240	0.010 x d_1	□	■		□
	3.1	160	0.010 x d_1	180	0.011 x d_1	200	0.008 x d_1	□	■		
	3.2	160	0.010 x d_1	180	0.011 x d_1	200	0.008 x d_1	□	■		
	4.1	130	0.008 x d_1	140	0.009 x d_1	160	0.007 x d_1	□	■		
	4.2	120	0.008 x d_1	130	0.009 x d_1	140	0.007 x d_1	□	■		
N	1.1										
	1.2	380	0.015 x d_1	400	0.017 x d_1	420	0.014 x d_1			□	■
	1.3	340	0.014 x d_1	360	0.016 x d_1	380	0.013 x d_1			□	■
	1.4	280	0.013 x d_1	300	0.015 x d_1	320	0.012 x d_1			□	■
	1.5										
	1.6										
	2.1	180	0.012 x d_1	230	0.012 x d_1	260	0.010 x d_1			□	■
	2.2	180	0.012 x d_1	230	0.012 x d_1	260	0.010 x d_1			□	■
	2.3	180	0.012 x d_1	230	0.012 x d_1	260	0.010 x d_1	□	□	□	■
	2.4	150	0.010 x d_1	200	0.010 x d_1	220	0.008 x d_1			□	■
	2.5	150	0.010 x d_1	200	0.010 x d_1	220	0.008 x d_1			□	■
	2.6	150	0.010 x d_1	200	0.010 x d_1	220	0.008 x d_1	□	□	□	■
	2.7	140	0.008 x d_1	160	0.008 x d_1	180	0.006 x d_1			□	■
	2.8	110	0.008 x d_1	130	0.008 x d_1	140	0.006 x d_1			□	■
	3.1										
	3.2										
	4.1										
	4.2										
	4.3										
	4.4										
	5.1										
	5.2	120	0.008 x d_1	140	0.009 x d_1	160	0.007 x d_1			□	■
	5.3										
S	1.1	110	0.009 x d_1	130	0.010 x d_1	140	0.007 x d_1			□	■
	1.2	80	0.007 x d_1	90	0.008 x d_1	110	0.006 x d_1			□	■
	1.3	40	0.006 x d_1	60	0.007 x d_1	80	0.005 x d_1			□	■
	2.1	80	0.007 x d_1	90	0.008 x d_1	100	0.006 x d_1			□	■
	2.2	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.4	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.6	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1	150	0.008 x d_1	170	0.009 x d_1	190	0.010 x d_1	□	■		
	1.2	110	0.007 x d_1	140	0.008 x d_1	160	0.009 x d_1	□	■		
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Extra long design (2 Flutes) with ball nose

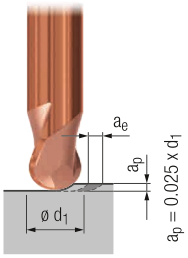
N

$l_3 = 8 \times d_1$

Valid for Tool No.:

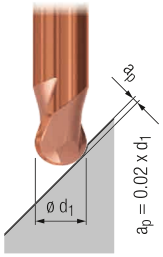
3822A

Roughing



$a_e = 0.05 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	220	0.013 x d_1	240	0.013 x d_1	□	■	□	■
	2.1	200	0.013 x d_1	220	0.013 x d_1	□	■	□	■
	3.1	180	0.012 x d_1	200	0.012 x d_1	□	■	□	
	4.1	160	0.012 x d_1	180	0.012 x d_1	□	■	□	
	5.1	150	0.010 x d_1	170	0.010 x d_1	□	■	□	
M	1.1	120	0.008 x d_1	140	0.009 x d_1			□	■
	2.1	100	0.008 x d_1	120	0.009 x d_1			□	■
	3.1	80	0.006 x d_1	90	0.007 x d_1			□	■
	4.1	70	0.006 x d_1	80	0.007 x d_1			□	■
K	1.1	220	0.011 x d_1	240	0.013 x d_1	□	■		□
	1.2	220	0.011 x d_1	240	0.013 x d_1	□	■		□
	2.1	180	0.011 x d_1	200	0.013 x d_1	□	■		□
	2.2	180	0.011 x d_1	200	0.013 x d_1	□	■		□
	3.1	150	0.010 x d_1	160	0.011 x d_1	□	■		
	3.2	150	0.010 x d_1	160	0.011 x d_1	□	■		
	4.1	120	0.008 x d_1	130	0.009 x d_1	□	■		
	4.2	110	0.008 x d_1	120	0.009 x d_1	□	■		
N	1.1								
	1.2	340	0.015 x d_1	360	0.017 x d_1			□	■
	1.3	300	0.014 x d_1	320	0.016 x d_1			□	■
	1.4	240	0.013 x d_1	260	0.015 x d_1			□	■
	1.5								
	1.6								
	2.1	160	0.012 x d_1	200	0.012 x d_1			□	■
	2.2	160	0.012 x d_1	200	0.012 x d_1			□	■
	2.3	160	0.012 x d_1	200	0.012 x d_1	□	□	□	■
	2.4	140	0.010 x d_1	160	0.010 x d_1			□	■
	2.5	140	0.010 x d_1	160	0.010 x d_1			□	■
	2.6	140	0.010 x d_1	160	0.010 x d_1	□	□	□	■
	2.7	130	0.008 x d_1	150	0.008 x d_1			□	■
	2.8	100	0.008 x d_1	110	0.008 x d_1			□	■
	3.1								
	3.2								
	4.1								
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	100	0.008 x d_1	120	0.009 x d_1			□	■
	5.3								
S	1.1	90	0.009 x d_1	110	0.010 x d_1			□	■
	1.2	70	0.007 x d_1	80	0.008 x d_1			□	■
	1.3	30	0.006 x d_1	40	0.007 x d_1			□	■
	2.1	90	0.007 x d_1	80	0.008 x d_1			□	■
	2.2	70	0.005 x d_1	40	0.006 x d_1			□	■
	2.3	30	0.005 x d_1	40	0.006 x d_1			□	■
	2.4	20	0.005 x d_1	30	0.006 x d_1			□	■
	2.5	20	0.005 x d_1	30	0.006 x d_1			□	■
	2.6	20	0.005 x d_1	30	0.006 x d_1			□	■
H	1.1	130	0.008 x d_1	150	0.009 x d_1	□	■		
	1.2	100	0.007 x d_1	120	0.008 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Standard design (4 Flutes) with ball nose

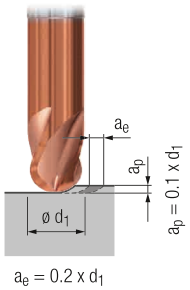
N

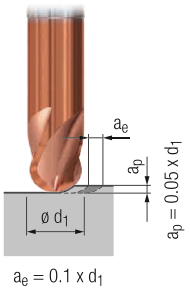
$l_3 = 3 \times d_1$

Valid for Tool No.:

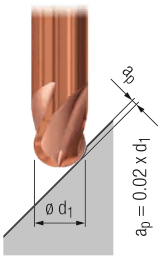
3823A

Roughing





Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	260	0.013 x d_1	280	0.015 x d_1	300	0.013 x d_1	□	■	□	■
	2.1	240	0.012 x d_1	260	0.014 x d_1	280	0.012 x d_1	□	■	□	■
	3.1	220	0.011 x d_1	240	0.013 x d_1	260	0.011 x d_1	□	■	□	
	4.1	200	0.010 x d_1	220	0.012 x d_1	240	0.010 x d_1	□	■	□	
	5.1	180	0.009 x d_1	200	0.010 x d_1	220	0.009 x d_1	□	■	□	
M	1.1	140	0.008 x d_1	160	0.009 x d_1	180	0.010 x d_1			□	■
	2.1	120	0.008 x d_1	140	0.009 x d_1	160	0.010 x d_1			□	■
	3.1	100	0.006 x d_1	110	0.007 x d_1	120	0.008 x d_1			□	■
	4.1	80	0.006 x d_1	90	0.007 x d_1	100	0.008 x d_1			□	■
K	1.1	260	0.011 x d_1	280	0.013 x d_1	300	0.010 x d_1	□	■		□
	1.2	260	0.011 x d_1	280	0.013 x d_1	300	0.010 x d_1	□	■		□
	2.1	220	0.011 x d_1	240	0.013 x d_1	260	0.010 x d_1	□	■		□
	2.2	220	0.011 x d_1	240	0.013 x d_1	260	0.010 x d_1	□	■		□
	3.1	180	0.010 x d_1	200	0.011 x d_1	220	0.008 x d_1	□	■		
	3.2	180	0.010 x d_1	200	0.011 x d_1	220	0.008 x d_1	□	■		
	4.1	140	0.008 x d_1	160	0.009 x d_1	180	0.007 x d_1	□	■		
	4.2	130	0.008 x d_1	140	0.009 x d_1	150	0.007 x d_1	□	■		
N	1.1										
	1.2	400	0.015 x d_1	420	0.017 x d_1	450	0.014 x d_1			□	■
	1.3	350	0.014 x d_1	370	0.016 x d_1	400	0.013 x d_1			□	■
	1.4	280	0.013 x d_1	300	0.015 x d_1	350	0.012 x d_1			□	■
	1.5										
	1.6										
	2.1	200	0.012 x d_1	260	0.012 x d_1	280	0.010 x d_1			□	■
	2.2	200	0.012 x d_1	260	0.012 x d_1	280	0.010 x d_1			□	■
	2.3	200	0.012 x d_1	260	0.012 x d_1	280	0.010 x d_1	□	□	□	■
	2.4	160	0.010 x d_1	220	0.010 x d_1	250	0.008 x d_1			□	■
	2.5	160	0.010 x d_1	220	0.010 x d_1	250	0.008 x d_1			□	■
	2.6	160	0.010 x d_1	220	0.010 x d_1	250	0.008 x d_1	□	□	□	■
	2.7	150	0.008 x d_1	180	0.008 x d_1	200	0.006 x d_1			□	■
	2.8	120	0.008 x d_1	140	0.008 x d_1	160	0.006 x d_1			□	■
	3.1										
	3.2										
	4.1										
	4.2										
	4.3										
	4.4										
	5.1										
	5.2	130	0.008 x d_1	150	0.009 x d_1	180	0.007 x d_1			□	■
	5.3										
S	1.1	120	0.009 x d_1	140	0.010 x d_1	150	0.007 x d_1			□	■
	1.2	90	0.007 x d_1	100	0.008 x d_1	120	0.006 x d_1			□	■
	1.3	50	0.006 x d_1	70	0.007 x d_1	90	0.005 x d_1			□	■
	2.1	90	0.007 x d_1	100	0.008 x d_1	110	0.006 x d_1			□	■
	2.2	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.4	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.6	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1	160	0.008 x d_1	180	0.009 x d_1	200	0.010 x d_1	□	■		
	1.2	120	0.007 x d_1	150	0.008 x d_1	170	0.009 x d_1	□	■		
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Long design (4 Flutes) with ball nose

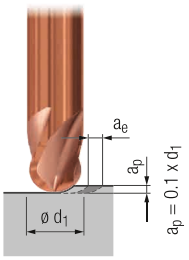
N

$l_3 = 5 \times d_1$

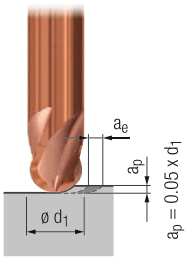
Valid for Tool No.:

3824A

Roughing

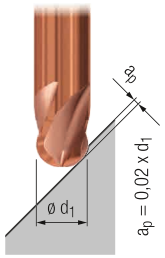


$a_e = 0.2 \times d_1$



$a_e = 0.1 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	240	0.013 x d_1	260	0.015 x d_1	280	0.013 x d_1	□	■	□	■
	2.1	220	0.012 x d_1	240	0.014 x d_1	260	0.012 x d_1	□	■	□	■
	3.1	200	0.011 x d_1	220	0.013 x d_1	240	0.011 x d_1	□	■	□	
	4.1	180	0.010 x d_1	200	0.012 x d_1	220	0.010 x d_1	□	■	□	
	5.1	160	0.009 x d_1	180	0.010 x d_1	200	0.009 x d_1	□	■	□	
M	1.1	120	0.008 x d_1	140	0.009 x d_1	160	0.010 x d_1			□	■
	2.1	100	0.008 x d_1	120	0.009 x d_1	140	0.010 x d_1			□	■
	3.1	80	0.006 x d_1	90	0.007 x d_1	100	0.008 x d_1			□	■
	4.1	70	0.006 x d_1	80	0.007 x d_1	90	0.008 x d_1			□	■
K	1.1	240	0.011 x d_1	260	0.013 x d_1	280	0.010 x d_1	□	■		□
	1.2	240	0.011 x d_1	260	0.013 x d_1	280	0.010 x d_1	□	■		□
	2.1	200	0.011 x d_1	220	0.013 x d_1	240	0.010 x d_1	□	■		□
	2.2	200	0.011 x d_1	220	0.013 x d_1	240	0.010 x d_1	□	■		□
	3.1	160	0.010 x d_1	180	0.011 x d_1	200	0.008 x d_1	□	■		
	3.2	160	0.010 x d_1	180	0.011 x d_1	200	0.008 x d_1	□	■		
	4.1	130	0.008 x d_1	140	0.009 x d_1	160	0.007 x d_1	□	■		
	4.2	120	0.008 x d_1	130	0.009 x d_1	140	0.007 x d_1	□	■		
N	1.1										
	1.2	380	0.015 x d_1	400	0.017 x d_1	420	0.014 x d_1			□	■
	1.3	340	0.014 x d_1	360	0.016 x d_1	380	0.013 x d_1			□	■
	1.4	280	0.013 x d_1	300	0.015 x d_1	320	0.012 x d_1			□	■
	1.5										
	1.6										
	2.1	180	0.012 x d_1	230	0.012 x d_1	260	0.010 x d_1			□	■
	2.2	180	0.012 x d_1	230	0.012 x d_1	260	0.010 x d_1			□	■
	2.3	180	0.012 x d_1	230	0.012 x d_1	260	0.010 x d_1	□	□	□	■
	2.4	150	0.010 x d_1	200	0.010 x d_1	220	0.008 x d_1			□	■
	2.5	150	0.010 x d_1	200	0.010 x d_1	220	0.008 x d_1			□	■
	2.6	150	0.010 x d_1	200	0.010 x d_1	220	0.008 x d_1	□	□	□	■
	2.7	140	0.008 x d_1	160	0.008 x d_1	180	0.006 x d_1			□	■
	2.8	110	0.008 x d_1	130	0.008 x d_1	140	0.006 x d_1			□	■
	3.1										
	3.2										
	4.1										
	4.2										
	4.3										
	4.4										
	5.1										
	5.2	120	0.008 x d_1	140	0.009 x d_1	160	0.007 x d_1			□	■
	5.3										
S	1.1	110	0.009 x d_1	130	0.010 x d_1	140	0.007 x d_1			□	■
	1.2	80	0.007 x d_1	90	0.008 x d_1	110	0.006 x d_1			□	■
	1.3	40	0.006 x d_1	60	0.007 x d_1	80	0.005 x d_1			□	■
	2.1	80	0.007 x d_1	90	0.008 x d_1	100	0.006 x d_1			□	■
	2.2	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.005 x d_1	40	0.006 x d_1	50	0.004 x d_1			□	■
	2.4	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.6	20	0.005 x d_1	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1	150	0.008 x d_1	170	0.009 x d_1	190	0.010 x d_1	□	■		
	1.2	110	0.007 x d_1	140	0.008 x d_1	160	0.009 x d_1	□	■		
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Extra long design (4 Flutes) with ball nose

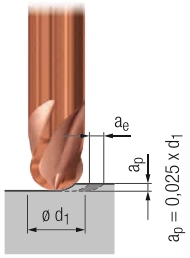
N

$l_3 = 8 \times d_1$

Valid for Tool No.:

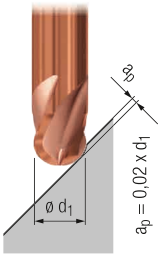
3825A

Roughing



$a_e = 0{,}05 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	170	0.011 x d_1	180	0.011 x d_1	□	■	□	■
	2.1	150	0.011 x d_1	160	0.011 x d_1	□	■	□	■
	3.1	130	0.010 x d_1	140	0.010 x d_1	□	■	□	
	4.1	130	0.010 x d_1	140	0.010 x d_1	□	■	□	
	5.1	120	0.009 x d_1	130	0.009 x d_1	□	■	□	
M	1.1	120	0.008 x d_1	130	0.009 x d_1			□	■
	2.1	100	0.008 x d_1	110	0.009 x d_1			□	■
	3.1	80	0.006 x d_1	90	0.007 x d_1			□	■
	4.1	70	0.006 x d_1	80	0.007 x d_1			□	■
K	1.1	200	0.011 x d_1	220	0.013 x d_1	□	■		□
	1.2	200	0.011 x d_1	220	0.013 x d_1	□	■		□
	2.1	170	0.011 x d_1	190	0.013 x d_1	□	■		□
	2.2	170	0.011 x d_1	190	0.013 x d_1	□	■		□
	3.1	150	0.010 x d_1	160	0.011 x d_1	□	■		
	3.2	150	0.010 x d_1	160	0.011 x d_1	□	■		
	4.1	120	0.008 x d_1	130	0.009 x d_1	□	■		
	4.2	110	0.008 x d_1	120	0.009 x d_1	□	■		
N	1.1								
	1.2	340	0.015 x d_1	360	0.017 x d_1			□	■
	1.3	300	0.014 x d_1	320	0.016 x d_1			□	■
	1.4	240	0.013 x d_1	260	0.015 x d_1			□	■
	1.5								
	1.6								
	2.1	160	0.012 x d_1	200	0.012 x d_1			□	■
	2.2	160	0.012 x d_1	200	0.012 x d_1			□	■
	2.3	160	0.012 x d_1	200	0.012 x d_1	□	□	□	■
	2.4	140	0.010 x d_1	160	0.010 x d_1			□	■
	2.5	140	0.010 x d_1	160	0.010 x d_1			□	■
	2.6	140	0.010 x d_1	160	0.010 x d_1	□	□	□	■
	2.7	130	0.008 x d_1	150	0.008 x d_1			□	■
	2.8	100	0.008 x d_1	110	0.008 x d_1			□	■
	3.1								
	3.2								
	4.1								
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	100	0.008 x d_1	120	0.009 x d_1			□	■
	5.3								
S	1.1	90	0.009 x d_1	110	0.010 x d_1			□	■
	1.2	70	0.007 x d_1	80	0.008 x d_1			□	■
	1.3	30	0.006 x d_1	40	0.007 x d_1			□	■
	2.1	70	0.007 x d_1	80	0.008 x d_1			□	■
	2.2	25	0.005 x d_1	40	0.006 x d_1			□	■
	2.3	25	0.005 x d_1	40	0.006 x d_1			□	■
	2.4	25	0.005 x d_1	30	0.006 x d_1			□	■
	2.5	25	0.005 x d_1	30	0.006 x d_1			□	■
	2.6	20	0.005 x d_1	30	0.006 x d_1			□	■
H	1.1	120	0.008 x d_1	130	0.009 x d_1	□	■		
	1.2	100	0.007 x d_1	110	0.008 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

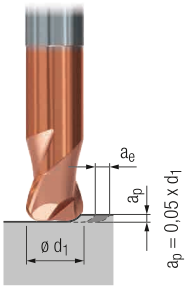
Torus – Standard design (2 Flutes)

N

Valid for Tool No.:

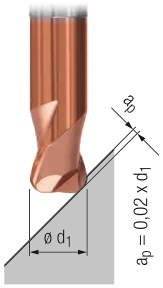
2552A

Roughing



$a_e = 0{,}4 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	220	0.014 x d_1	300	0.010 x d_1	□	■	□	■
	2.1	190	0.013 x d_1	260	0.009 x d_1	□	■	□	■
	3.1	160	0.011 x d_1	220	0.008 x d_1	□	■	□	
	4.1	130	0.010 x d_1	180	0.007 x d_1	□	■	□	
	5.1	110	0.008 x d_1	150	0.006 x d_1	□	■	□	
M	1.1	110	0.008 x d_1	150	0.006 x d_1			□	■
	2.1	90	0.008 x d_1	120	0.006 x d_1			□	■
	3.1	70	0.006 x d_1	90	0.005 x d_1			□	■
	4.1	50	0.006 x d_1	70	0.005 x d_1			□	■
K	1.1	220	0.014 x d_1	300	0.010 x d_1	□	■		□
	1.2	220	0.014 x d_1	300	0.010 x d_1	□	■		□
	2.1	200	0.011 x d_1	260	0.008 x d_1	□	■		□
	2.2	200	0.011 x d_1	260	0.008 x d_1	□	■		□
	3.1	160	0.011 x d_1	220	0.008 x d_1	□	■		
	3.2	160	0.011 x d_1	220	0.008 x d_1	□	■		
	4.1	130	0.008 x d_1	180	0.006 x d_1	□	■		
	4.2	110	0.008 x d_1	150	0.006 x d_1	□	■		
N	1.1								
	1.2	1000	0.020 x d_1	1350	0.014 x d_1			□	■
	1.3	1000	0.017 x d_1	1350	0.012 x d_1			□	■
	1.4	600	0.020 x d_1	800	0.014 x d_1			□	■
	1.5								
	1.6								
	2.1	200	0.014 x d_1	260	0.010 x d_1			□	■
	2.2	200	0.014 x d_1	260	0.010 x d_1			□	■
	2.3	200	0.014 x d_1	260	0.010 x d_1	□	□	□	■
	2.4	160	0.011 x d_1	220	0.008 x d_1			□	■
	2.5	160	0.011 x d_1	220	0.008 x d_1			□	■
	2.6	160	0.011 x d_1	220	0.008 x d_1	□	□	□	■
	2.7	100	0.008 x d_1	130	0.006 x d_1			□	■
	2.8	100	0.008 x d_1	130	0.006 x d_1			□	■
	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			□	■
	5.3								
S	1.1								
	1.2								
	1.3								
	2.1	80	0.008 x d_1	110	0.006 x d_1			□	■
	2.2	30	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.4	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.006 x d_1	30	0.004 x d_1			□	■
	2.6	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1			150	0.006 x d_1	□	■		
	1.2			130	0.005 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

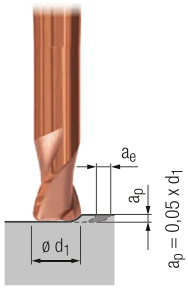
Torus – Extra long design (2 Flutes)

N

Valid for Tool No.:

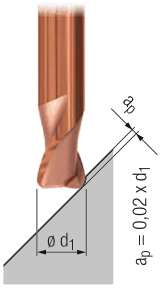
2553A

Roughing



$a_e = 0{,}4 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	220	0.014 x d_1	300	0.010 x d_1	□	■	□	■
	2.1	190	0.013 x d_1	260	0.009 x d_1	□	■	□	■
	3.1	160	0.011 x d_1	220	0.008 x d_1	□	■	□	
	4.1	130	0.010 x d_1	180	0.007 x d_1	□	■	□	
	5.1	110	0.008 x d_1	150	0.006 x d_1	□	■	□	
M	1.1	110	0.008 x d_1	150	0.006 x d_1			□	■
	2.1	90	0.008 x d_1	120	0.006 x d_1			□	■
	3.1	70	0.006 x d_1	90	0.005 x d_1			□	■
	4.1	50	0.006 x d_1	70	0.005 x d_1			□	■
K	1.1	220	0.014 x d_1	300	0.010 x d_1	□	■		□
	1.2	220	0.014 x d_1	300	0.010 x d_1	□	■		□
	2.1	200	0.011 x d_1	260	0.008 x d_1	□	■		□
	2.2	200	0.011 x d_1	260	0.008 x d_1	□	■		□
	3.1	160	0.011 x d_1	220	0.008 x d_1	□	■		
	3.2	160	0.011 x d_1	220	0.008 x d_1	□	■		
	4.1	130	0.008 x d_1	180	0.006 x d_1	□	■		
	4.2	110	0.008 x d_1	150	0.006 x d_1	□	■		
N	1.1								
	1.2	1000	0.020 x d_1	1350	0.014 x d_1			□	■
	1.3	1000	0.017 x d_1	1350	0.012 x d_1			□	■
	1.4	600	0.020 x d_1	800	0.014 x d_1			□	■
	1.5								
	1.6								
	2.1	200	0.014 x d_1	260	0.010 x d_1			□	■
	2.2	200	0.014 x d_1	260	0.010 x d_1			□	■
	2.3	200	0.014 x d_1	260	0.010 x d_1	□	□	□	■
	2.4	160	0.011 x d_1	220	0.008 x d_1			□	■
	2.5	160	0.011 x d_1	220	0.008 x d_1			□	■
	2.6	160	0.011 x d_1	220	0.008 x d_1	□	□	□	■
	2.7	100	0.008 x d_1	130	0.006 x d_1			□	■
	2.8	100	0.008 x d_1	130	0.006 x d_1			□	■
	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			□	■
	5.3								
S	1.1								
	1.2								
	1.3								
	2.1	80	0.008 x d_1	110	0.006 x d_1			□	■
	2.2	30	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.4	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.006 x d_1	30	0.004 x d_1			□	■
	2.6	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1			150	0.006 x d_1	□	■		
	1.2			130	0.005 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Torus – Standard design (4 Flutes)

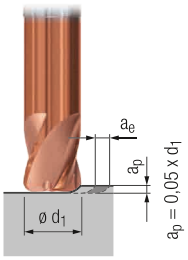
N

$l_3 = 3 \times d_1$

Valid for Tool No.:

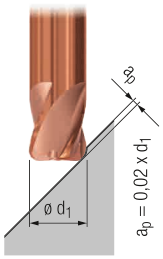
3835A

Roughing



$a_e = 0{,}4 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	250	0.013 x d_1	300	0.010 x d_1	□	■	□	■
	2.1	230	0.012 x d_1	260	0.009 x d_1	□	■	□	■
	3.1	200	0.010 x d_1	230	0.008 x d_1	□	■	□	
	4.1	170	0.009 x d_1	200	0.007 x d_1	□	■	□	
	5.1	150	0.008 x d_1	180	0.006 x d_1	□	■	□	
M	1.1	140	0.008 x d_1	180	0.006 x d_1			□	■
	2.1	120	0.008 x d_1	160	0.006 x d_1			□	■
	3.1	100	0.006 x d_1	120	0.005 x d_1			□	■
	4.1	80	0.006 x d_1	100	0.005 x d_1			□	■
K	1.1	250	0.014 x d_1	280	0.010 x d_1	□	■		□
	1.2	250	0.014 x d_1	280	0.010 x d_1	□	■		□
	2.1	230	0.011 x d_1	260	0.008 x d_1	□	■		□
	2.2	230	0.011 x d_1	260	0.008 x d_1	□	■		□
	3.1	190	0.011 x d_1	210	0.008 x d_1	□	■		
	3.2	190	0.011 x d_1	210	0.008 x d_1	□	■		
	4.1	160	0.008 x d_1	190	0.006 x d_1	□	■		
	4.2	140	0.008 x d_1	170	0.006 x d_1	□	■		
N	1.1								
	1.2								
	1.3								
	1.4								
	1.5								
	1.6								
	2.1	240	0.014 x d_1	280	0.010 x d_1			□	■
	2.2	240	0.014 x d_1	280	0.010 x d_1			□	■
	2.3	240	0.014 x d_1	280	0.010 x d_1	□	□	□	■
	2.4	200	0.011 x d_1	250	0.008 x d_1			□	■
	2.5	200	0.011 x d_1	250	0.008 x d_1			□	■
	2.6	200	0.011 x d_1	250	0.008 x d_1	□	□	□	■
	2.7	140	0.008 x d_1	170	0.006 x d_1			□	■
	2.8	140	0.008 x d_1	170	0.006 x d_1			□	■
	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			□	■
	5.3								
S	1.1	110	0.010 x d_1	150	0.007 x d_1			□	■
	1.2	90	0.008 x d_1	120	0.006 x d_1			□	■
	1.3	50	0.007 x d_1	70	0.005 x d_1			□	■
	2.1	80	0.008 x d_1	110	0.006 x d_1			□	■
	2.2	30	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.4	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.006 x d_1	30	0.004 x d_1			□	■
	2.6	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1	120	0.006 x d_1	150	0.006 x d_1	□	■		
	1.2	100	0.005 x d_1	130	0.005 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Torus – Long design (4 Flutes)

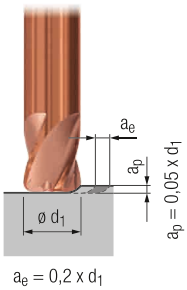
N

$l_3 = 5 \times d_1$

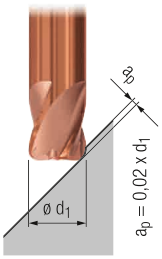
Valid for Tool No.:

3836A

Roughing



Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	250	0.013 x d_1	300	0.010 x d_1	□	■	□	■
	2.1	230	0.012 x d_1	260	0.009 x d_1	□	■	□	■
	3.1	200	0.010 x d_1	230	0.008 x d_1	□	■	□	
	4.1	170	0.009 x d_1	200	0.007 x d_1	□	■	□	
	5.1	150	0.008 x d_1	180	0.006 x d_1	□	■	□	
M	1.1	140	0.008 x d_1	180	0.006 x d_1			□	■
	2.1	120	0.008 x d_1	160	0.006 x d_1			□	■
	3.1	100	0.006 x d_1	120	0.005 x d_1			□	■
	4.1	80	0.006 x d_1	100	0.005 x d_1			□	■
K	1.1	250	0.014 x d_1	280	0.010 x d_1	□	■		□
	1.2	250	0.014 x d_1	280	0.010 x d_1	□	■		□
	2.1	230	0.011 x d_1	260	0.008 x d_1	□	■		□
	2.2	230	0.011 x d_1	260	0.008 x d_1	□	■		□
	3.1	190	0.011 x d_1	210	0.008 x d_1	□	■		
	3.2	190	0.011 x d_1	210	0.008 x d_1	□	■		
	4.1	160	0.008 x d_1	190	0.006 x d_1	□	■		
	4.2	140	0.008 x d_1	170	0.006 x d_1	□	■		
N	1.1								
	1.2								
	1.3								
	1.4								
	1.5								
	1.6								
	2.1	240	0.014 x d_1	280	0.010 x d_1			□	■
	2.2	240	0.014 x d_1	280	0.010 x d_1			□	■
	2.3	240	0.014 x d_1	280	0.010 x d_1	□	□	□	■
	2.4	200	0.011 x d_1	250	0.008 x d_1			□	■
	2.5	200	0.011 x d_1	250	0.008 x d_1			□	■
	2.6	200	0.011 x d_1	250	0.008 x d_1	□	□	□	■
	2.7	140	0.008 x d_1	170	0.006 x d_1			□	■
	2.8	140	0.008 x d_1	170	0.006 x d_1			□	■
	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			□	■
	5.3								
S	1.1	110	0.010 x d_1	150	0.007 x d_1			□	■
	1.2	90	0.008 x d_1	120	0.006 x d_1			□	■
	1.3	50	0.007 x d_1	70	0.005 x d_1			□	■
	2.1	80	0.008 x d_1	110	0.006 x d_1			□	■
	2.2	30	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.4	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.006 x d_1	30	0.004 x d_1			□	■
	2.6	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1	120	0.006 x d_1	150	0.006 x d_1	□	■		
	1.2	100	0.005 x d_1	130	0.005 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Torus – Extra long design (4 Flutes)

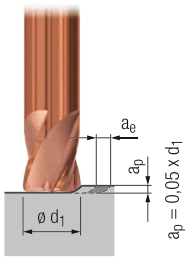
N

$l_3 = 8 \times d_1$

Valid for Tool No.:

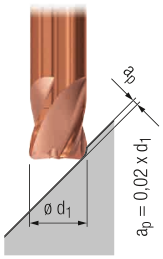
3837A

Roughing



$a_e = 0{,}2 \times d_1$

Finishing



		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	250	0.013 x d_1	300	0.010 x d_1	□	■	□	■
	2.1	230	0.012 x d_1	260	0.009 x d_1	□	■	□	■
	3.1	200	0.010 x d_1	230	0.008 x d_1	□	■	□	
	4.1	170	0.009 x d_1	200	0.007 x d_1	□	■	□	
	5.1	150	0.008 x d_1	180	0.006 x d_1	□	■	□	
M	1.1	140	0.008 x d_1	180	0.006 x d_1			□	■
	2.1	120	0.008 x d_1	160	0.006 x d_1			□	■
	3.1	100	0.006 x d_1	120	0.005 x d_1			□	■
	4.1	80	0.006 x d_1	100	0.005 x d_1			□	■
K	1.1	250	0.014 x d_1	280	0.010 x d_1	□	■		□
	1.2	250	0.014 x d_1	280	0.010 x d_1	□	■		□
	2.1	230	0.011 x d_1	260	0.008 x d_1	□	■		□
	2.2	230	0.011 x d_1	260	0.008 x d_1	□	■		□
	3.1	190	0.011 x d_1	210	0.008 x d_1	□	■		
	3.2	190	0.011 x d_1	210	0.008 x d_1	□	■		
	4.1	160	0.008 x d_1	190	0.006 x d_1	□	■		
	4.2	140	0.008 x d_1	170	0.006 x d_1	□	■		
N	1.1								
	1.2								
	1.3								
	1.4								
	1.5								
	1.6								
	2.1	240	0.014 x d_1	280	0.010 x d_1			□	■
	2.2	240	0.014 x d_1	280	0.010 x d_1			□	■
	2.3	240	0.014 x d_1	280	0.010 x d_1	□	□	□	■
	2.4	200	0.011 x d_1	250	0.008 x d_1			□	■
	2.5	200	0.011 x d_1	250	0.008 x d_1			□	■
	2.6	200	0.011 x d_1	250	0.008 x d_1	□	□	□	■
	2.7	140	0.008 x d_1	170	0.006 x d_1			□	■
	2.8	140	0.008 x d_1	170	0.006 x d_1			□	■
	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			□	■
	5.3								
S	1.1	110	0.010 x d_1	150	0.007 x d_1			□	■
	1.2	90	0.008 x d_1	120	0.006 x d_1			□	■
	1.3	50	0.007 x d_1	70	0.005 x d_1			□	■
	2.1	80	0.008 x d_1	110	0.006 x d_1			□	■
	2.2	30	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.4	30	0.006 x d_1	40	0.004 x d_1			□	■
	2.5	20	0.006 x d_1	30	0.004 x d_1			□	■
	2.6	30	0.006 x d_1	40	0.004 x d_1			□	■
H	1.1	120	0.006 x d_1	150	0.006 x d_1	□	■		
	1.2	100	0.005 x d_1	130	0.005 x d_1	□	■		
	1.3								
	1.4								
	1.5								

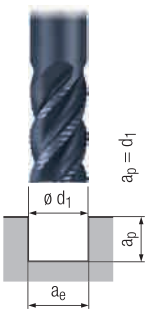
v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

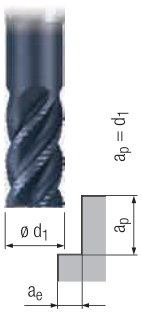
Standard length with short flute design

NR

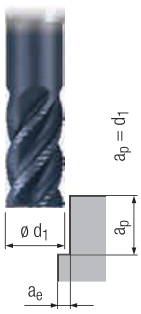
Valid for Tool Nos.:
2869A 2869L



$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	ALCR TIALN	ALCR TIALN	MMS MQL	
P	1.1	525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	□	□	■
		525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	□	□	■
		525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	□	□	■
	2.1	495	0.007 x d_1	560	0.008 x d_1	625	0.009 x d_1	□	□	□	■
		495	0.007 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	□	□	■
		495	0.006 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	□	□	■
	3.1	460	0.006 x d_1	525	0.007 x d_1	590	0.008 x d_1	□	■	□	■
		460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■	□	■
		460	0.005 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■	□	■
	4.1	395	0.005 x d_1	460	0.006 x d_1	495	0.007 x d_1	□	■		
		395	0.005 x d_1	460	0.006 x d_1	495	0.006 x d_1	□	■		
		395	0.004 x d_1	460	0.005 x d_1	495	0.005 x d_1	□	■		
	5.1	330	0.004 x d_1	395	0.005 x d_1	430	0.005 x d_1	□	■		
		330	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1	□	■		
		330	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1	□	■		
M	1.1	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1				■
	2.1	200	0.004 x d_1	230	0.005 x d_1	265	0.005 x d_1				■
	3.1										
	4.1										
K	1.1	525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	■		
	1.2	525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	■		
	2.1	460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■		
	2.2	460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■		
	3.1	395	0.006 x d_1	460	0.006 x d_1	495	0.007 x d_1	□	■		
	3.2	395	0.006 x d_1	460	0.006 x d_1	495	0.007 x d_1	□	■		
	4.1	330	0.004 x d_1	395	0.005 x d_1	430	0.005 x d_1	□	■		
	4.2	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1	□	■		
N	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1	460	0.007 x d_1	525	0.008 x d_1	590	0.009 x d_1			□	■
	2.2	460	0.007 x d_1	525	0.008 x d_1	590	0.009 x d_1			□	■
	2.3	460	0.007 x d_1	525	0.008 x d_1	590	0.009 x d_1		□	□	■
	2.4	430	0.006 x d_1	495	0.006 x d_1	525	0.007 x d_1			□	■
	2.5	430	0.006 x d_1	495	0.006 x d_1	525	0.007 x d_1			□	■
	2.6	430	0.006 x d_1	495	0.006 x d_1	525	0.007 x d_1		□	□	■
	2.7	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1				■
	2.8	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1				■
	3.1										
	3.2										
	4.1	1050	0.011 x d_1	1215	0.012 x d_1	1315	0.014 x d_1		□	□	■
	4.2										
	4.3										
	4.4										
	5.1										
	5.2	265	0.004	295	0.005 x d_1	330	0.005 x d_1				■
	5.3										
S	1.1	265	0.005 x d_1	295	0.006 x d_1	330	0.006 x d_1				■
	1.2	200	0.004 x d_1	230	0.005 x d_1	265	0.005 x d_1				■
	1.3	135	0.004 x d_1	165	0.004 x d_1	165	0.005 x d_1				■
	2.1										
	2.2										
	2.3										
	2.4										
	2.5										
	2.6										
H	1.1	265	0.004 x d_1	295	0.004 x d_1	330	0.005 x d_1	□	■		
	1.2										
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

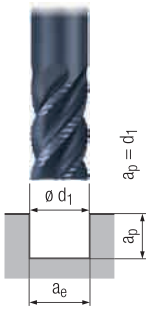
■ = very suitable
□ = suitable

Extra Long length with short flute design

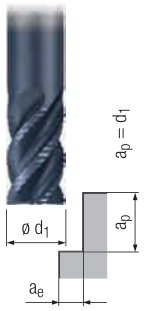
NR

Valid for Tool Nos.:

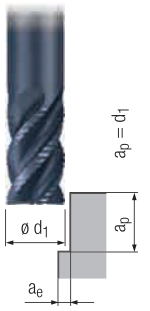
2875A 2875L



$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$

		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	430	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1	□	□	□	■
		430	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1	□	□	□	■
		430	0.005 x d_1	460	0.005 x d_1	525	0.006 x d_1	□	□	□	■
	2.1	395	0.005 x d_1	430	0.005 x d_1	460	0.006 x d_1	□	□	□	■
		395	0.005 x d_1	430	0.005 x d_1	460	0.006 x d_1	□	□	□	■
		395	0.004 x d_1	430	0.005 x d_1	460	0.005 x d_1	□	□	□	■
	3.1	360	0.004 x d_1	395	0.005 x d_1	430	0.005 x d_1	□	■	□	■
		360	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1	□	■	□	■
		360	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1	□	■	□	■
	4.1	295	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1	□	■		
		295	0.004 x d_1	330	0.004 x d_1	360	0.004 x d_1	□	■		
		295	0.003 x d_1	330	0.003 x d_1	360	0.004 x d_1	□	■		
	5.1	265	0.003 x d_1	295	0.003 x d_1	330	0.004 x d_1	□	■		
		265	0.003 x d_1	295	0.003 x d_1	330	0.003 x d_1	□	■		
		265	0.003 x d_1	295	0.003 x d_1	330	0.003 x d_1	□	■		
M	1.1										
	2.1										
	3.1										
	4.1										
K	1.1	430	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1	□	■		
	1.2	430	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1	□	■		
	2.1	385	0.004 x d_1	430	0.004 x d_1	460	0.005 x d_1	□	■		
	2.2	385	0.004 x d_1	430	0.004 x d_1	460	0.005 x d_1	□	■		
	3.1	330	0.004 x d_1	360	0.004 x d_1	395	0.005 x d_1	□	■		
	3.2	330	0.004 x d_1	360	0.004 x d_1	395	0.005 x d_1	□	■		
	4.1	265	0.003 x d_1	295	0.003 x d_1	330	0.004 x d_1	□	■		
	4.2	230	0.003 x d_1	265	0.003 x d_1	265	0.004 x d_1	□	■		
N	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1	395	0.005 x d_1	430	0.006 x d_1	460	0.006 x d_1			□	■
	2.2	395	0.005 x d_1	430	0.006 x d_1	460	0.006 x d_1			□	■
	2.3	395	0.005 x d_1	430	0.006 x d_1	460	0.006 x d_1		□	□	■
	2.4	360	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1			□	■
	2.5	360	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1			□	■
	2.6	360	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1		□	□	■
	2.7	230	0.003 x d_1	265	0.003 x d_1	265	0.004 x d_1				■
	2.8	230	0.003 x d_1	265	0.003 x d_1	265	0.004 x d_1				■
	3.1										
	3.2										
	4.1	890	0.008 x d_1	985	0.008 x d_1	1050	0.009 x d_1		□	□	■
	4.2										
	4.3										
	4.4										
	5.1	890	0.010 x d_1	985	0.011 x d_1	1050	0.013 x d_1				
	5.2	230	0.003 x d_1	265	0.003 x d_1	265	0.004 x d_1				■
	5.3	430	0.006 x d_1	460	0.007 x d_1	525	0.008 x d_1				
S	1.1										
	1.2										
	1.3										
	2.1										
	2.2										
	2.3										
	2.4										
	2.5										
	2.6										
H	1.1	230	0.003 x d_1	265	0.003 x d_1	265	0.003 x d_1	□	■		
	1.2										
	1.3										
	1.4										
	1.5										

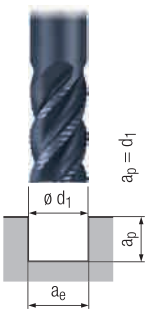
v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

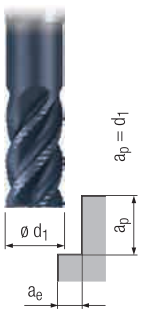
Standard length with short flute design - Coolant Fed

NR

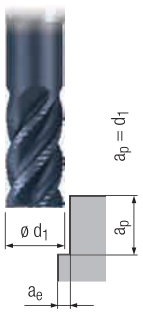
Valid for Tool Nos.: 2869AZ 2869LZ



$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$

		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 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	□	□	■
		525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	□	□	■
		525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	□	□	■
	2.1	495	0.007 x d_1	560	0.008 x d_1	625	0.009 x d_1	□	□	□	■
		495	0.007 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	□	□	■
		495	0.006 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	□	□	■
	3.1	460	0.006 x d_1	525	0.007 x d_1	590	0.008 x d_1	□	■	□	■
		460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■	□	■
		460	0.005 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■	□	■
	4.1	395	0.005 x d_1	460	0.006 x d_1	495	0.007 x d_1	□	■		
		395	0.005 x d_1	460	0.006 x d_1	495	0.006 x d_1	□	■		
		395	0.004 x d_1	460	0.005 x d_1	495	0.005 x d_1	□	■		
	5.1	330	0.004 x d_1	395	0.005 x d_1	430	0.005 x d_1	□	■		
		330	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1	□	■		
		330	0.004 x d_1	395	0.004 x d_1	430	0.005 x d_1	□	■		
M	1.1	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1				■
	2.1	200	0.004 x d_1	230	0.005 x d_1	265	0.005 x d_1				■
	3.1										
	4.1										
K	1.1	525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	■		
	1.2	525	0.007 x d_1	590	0.008 x d_1	660	0.009 x d_1	□	■		
	2.1	460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■		
	2.2	460	0.006 x d_1	525	0.006 x d_1	590	0.007 x d_1	□	■		
	3.1	395	0.006 x d_1	460	0.006 x d_1	495	0.007 x d_1	□	■		
	3.2	395	0.006 x d_1	460	0.006 x d_1	495	0.007 x d_1	□	■		
	4.1	330	0.004 x d_1	395	0.005 x d_1	430	0.005 x d_1	□	■		
	4.2	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1	□	■		
N	1.1										
	1.2	1575	0.009 x d_1	1800	0.010 x d_1	1920	0.011 x d_1				■
	1.3	1575	0.009 x d_1	1800	0.010 x d_1	1920	0.012 x d_1				■
	1.4	1050	0.009 x d_1	1215	0.010 x d_1	1310	0.011 x d_1				■
	1.5										
	1.6										
	2.1	460	0.007 x d_1	525	0.008 x d_1	590	0.009 x d_1			□	■
	2.2	460	0.007 x d_1	525	0.008 x d_1	590	0.009 x d_1			□	■
	2.3	460	0.007 x d_1	525	0.008 x d_1	590	0.009 x d_1		□	□	■
	2.4	430	0.006 x d_1	495	0.006 x d_1	525	0.007 x d_1			□	■
	2.5	430	0.006 x d_1	495	0.006 x d_1	525	0.007 x d_1			□	■
	2.6	430	0.006 x d_1	495	0.006 x d_1	525	0.007 x d_1		□	□	■
	2.7	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1				■
	2.8	265	0.004 x d_1	295	0.005 x d_1	330	0.005 x d_1				■
	3.1										
	3.2										
	4.1	1050	0.011 x d_1	1215	0.012 x d_1	1315	0.014 x d_1		□	□	■
	4.2										
	4.3										
	4.4										
	5.1										
	5.2	265	0.004	295	0.005 x d_1	330	0.005 x d_1				■
	5.3										
S	1.1	265	0.005 x d_1	295	0.006 x d_1	330	0.006 x d_1				■
	1.2	200	0.004 x d_1	230	0.005 x d_1	265	0.005 x d_1				■
	1.3	135	0.004 x d_1	165	0.004 x d_1	165	0.005 x d_1				■
	2.1										
	2.2										
	2.3										
	2.4										
	2.5										
	2.6										
H	1.1	265	0.004 x d_1	295	0.004 x d_1	330	0.005 x d_1	□	■		
	1.2										
	1.3										
	1.4										
	1.5										

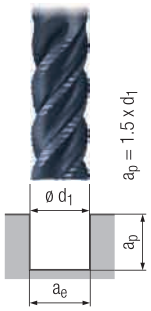
v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

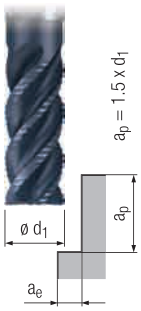
Long length | **Standard length with ball nose**

NR

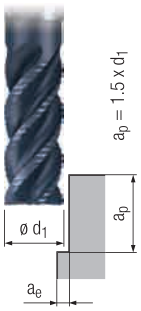
Valid for Tool Nos.:
2667A 2667L
2873A 2873L



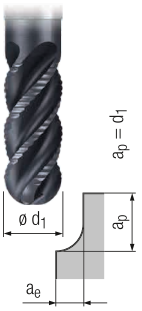
$a_e = d_1$



$a_e = 0,4 \times d_1$



$a_e = 0,2 \times d_1$



$a_e = 0.5 \times d_1$

		Long length				Standard length with ball nose				ALCR TIALN			
		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 [inch]			MMS MQL	
P	1.1	140	0.006 x d_1	160	0.007 x d_1	180	0.008 x d_1	140	0.004 x d_1	□	□	□	■
	2.1	130	0.006 x d_1	150	0.006 x d_1	170	0.007 x d_1	130	0.003 x d_1	□	□	□	■
	3.1	120	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	110	0.003 x d_1	□	■	□	■
	4.1	110	0.004 x d_1	130	0.004 x d_1	140	0.005 x d_1	90	0.002 x d_1	□	■	□	■
	5.1	100	0.004 x d_1	120	0.004 x d_1	130	0.004 x d_1	70	0.002 x d_1	□	■	□	■
M	1.1	70	0.004 x d_1	80	0.004 x d_1	90	0.005 x d_1						
	2.1	60	0.004 x d_1	70	0.004 x d_1	80	0.005 x d_1						
	3.1												
	4.1												
K	1.1	140	0.007 x d_1	160	0.007 x d_1	180	0.008 x d_1	140	0.004 x d_1	□	■	□	■
	1.2	140	0.007 x d_1	160	0.007 x d_1	180	0.008 x d_1	140	0.004 x d_1	□	■	□	■
	2.1	120	0.005 x d_1	140	0.006 x d_1	160	0.007 x d_1	130	0.003 x d_1	□	■	□	■
	2.2	120	0.005 x d_1	140	0.006 x d_1	160	0.007 x d_1	130	0.003 x d_1	□	■	□	■
	3.1	110	0.005 x d_1	130	0.006 x d_1	140	0.007 x d_1	110	0.003 x d_1	□	■	□	■
	3.2	110	0.005 x d_1	130	0.006 x d_1	140	0.007 x d_1	110	0.003 x d_1	□	■	□	■
	4.1	80	0.004 x d_1	90	0.004 x d_1	100	0.005 x d_1	90	0.002 x d_1	□	■	□	■
	4.2	70	0.004 x d_1	80	0.004 x d_1	90	0.005 x d_1	70	0.002 x d_1	□	■	□	■
N	1.1												
	1.2	420	0.008 x d_1	480	0.009 x d_1	550	0.010 x d_1						
	1.3	420	0.008 x d_1	480	0.009 x d_1	550	0.011 x d_1						
	1.4	280	0.008 x d_1	320	0.009 x d_1	360	0.010 x d_1						
	1.5												
	1.6												
	2.1	120	0.007 x d_1	140	0.007 x d_1	160	0.008 x d_1	130	0.004 x d_1			□	■
	2.2	120	0.007 x d_1	140	0.007 x d_1	160	0.008 x d_1	130	0.004 x d_1			□	■
	2.3	120	0.007 x d_1	140	0.007 x d_1	160	0.008 x d_1	130	0.004 x d_1		□	□	■
	2.4	110	0.005 x d_1	130	0.006 x d_1	140	0.007 x d_1	120	0.003 x d_1			□	■
	2.5	110	0.005 x d_1	130	0.006 x d_1	140	0.007 x d_1	120	0.003 x d_1			□	■
	2.6	110	0.005 x d_1	130	0.006 x d_1	140	0.007 x d_1	120	0.003 x d_1		□	□	■
	2.7	70	0.004 x d_1	80	0.004 x d_1	90	0.005 x d_1	70	0.002 x d_1				■
	2.8	70	0.004 x d_1	80	0.004 x d_1	90	0.005 x d_1	70	0.002 x d_1				■
	3.1												
	3.2												
	4.1	280	0.010 x d_1	320	0.011 x d_1	360	0.012 x d_1	290	0.006 x d_1		□	□	■
	4.2												
	4.3												
	4.4												
	5.1												
	5.2	70	0.004 x d_1	80	0.004 x d_1	90	0.005 x d_1	70	0.002 x d_1				■
	5.3												
S	1.1							70	0.003 x d_1				■
	1.2							60	0.002 x d_1				■
	1.3							40	0.002 x d_1				■
	2.1												
	2.2												
	2.3												
	2.4												
	2.5												
	2.6												
H	1.1	70	0.004 x d_1	80	0.004 x d_1	90	0.004 x d_1	70	0.002 x d_1	□	■		
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

DUPLEX – Standard and Long length

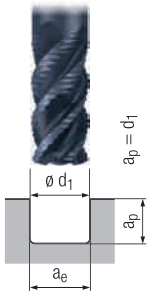
Valid for Tool Nos.:

2614AZ 2616AZ
2615AZ 2617AZ

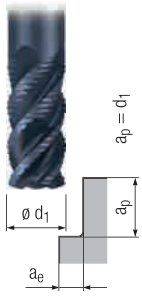
NR

HPC
Roughing with circumference cutting edge

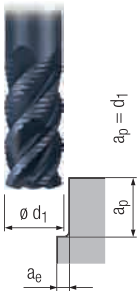
HSC
High feed roughing with face cutting edge



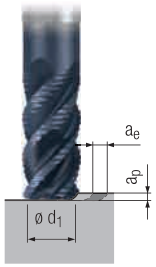
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



		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]	a_p [mm]	a_e [mm]			MMS MQL	
P	1.1	170	0.005 x d_1	190	0.006 x d_1	200	0.007 x d_1	220	0.038 x d_1	0.05 x d_1	0.5 x d_1	□	■	□	■
	2.1	150	0.005 x d_1	170	0.005 x d_1	180	0.006 x d_1	200	0.034 x d_1	0.05 x d_1	0.5 x d_1	□	■		■
	3.1	130	0.004 x d_1	140	0.005 x d_1	160	0.005 x d_1	170	0.030 x d_1	0.04 x d_1	0.4 x d_1	□	■		□
	4.1	120	0.003 x d_1	130	0.004 x d_1	140	0.004 x d_1	160	0.024 x d_1	0.03 x d_1	0.3 x d_1	□	■		□
	5.1	110	0.003 x d_1	120	0.003 x d_1	130	0.004 x d_1	140	0.022 x d_1	0.03 x d_1	0.3 x d_1	□	■		□
M	1.1														
	2.1														
	3.1														
	4.1														
K	1.1	170	0.006 x d_1	190	0.006 x d_1	200	0.007 x d_1	220	0.040 x d_1	0.06 x d_1	0.6 x d_1	□	■		□
	1.2	170	0.006 x d_1	190	0.006 x d_1	200	0.007 x d_1	220	0.040 x d_1	0.06 x d_1	0.6 x d_1	□	■		□
	2.1	150	0.005 x d_1	170	0.005 x d_1	180	0.006 x d_1	200	0.032 x d_1	0.05 x d_1	0.5 x d_1	□	■		□
	2.2	150	0.005 x d_1	170	0.005 x d_1	180	0.006 x d_1	200	0.032 x d_1	0.05 x d_1	0.5 x d_1	□	■		□
	3.1	130	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	170	0.032 x d_1	0.05 x d_1	0.5 x d_1	□	■		□
	3.2	130	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	170	0.032 x d_1	0.05 x d_1	0.5 x d_1	□	■		□
	4.1	100	0.003 x d_1	110	0.004 x d_1	120	0.004 x d_1	130	0.024 x d_1	0.03 x d_1	0.3 x d_1	□	■		□
	4.2	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	100	0.024 x d_1	0.03 x d_1	0.3 x d_1	□	■		□
N	1.1														
	1.2														
	1.3														
	1.4														
	1.5														
	1.6														
	2.1														
	2.2														
	2.3	150	0.006 x d_1	170	0.006 x d_1	180	0.007 x d_1	200	0.040 x d_1	0.06 x d_1	0.6 x d_1			□	■
	2.4														
	2.5														
	2.6	130	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	170	0.032 x d_1	0.05 x d_1	0.5 x d_1			□	■
	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_1	90	0.004 x d_1	100	0.004 x d_1	100	0.024 x d_1	0.03 x d_1	0.3 x d_1			□	■
	5.3														
S	1.1														
	1.2														
	1.3														
	2.1														
	2.2														
	2.3														
	2.4														
	2.5														
	2.6														
H	1.1	80	0.003 x d_1	90	0.003 x d_1	100	0.004 x d_1	100	0.022 x d_1	0.03 x d_1	0.3 x d_1	□	■		
	1.2	80	0.003 x d_1	90	0.003 x d_1	100	0.004 x d_1	100	0.020 x d_1	0.03 x d_1	0.3 x d_1	□	■		
	1.3														
	1.4														
	1.5														

v_c = Cutting speed
f_z = Feed per tooth

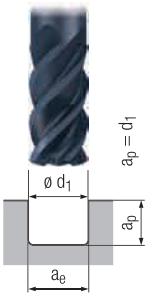
■ = very suitable
□ = suitable

DUPLEX – Standard and Long length

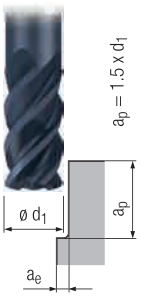
Valid for Tool Nos.:
2610AZ 2612AZ
2611AZ 2613AZ

N

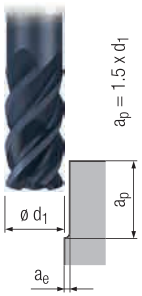
HPC / HSC
Roughing with circumference cutting edge



$a_e = d_1$

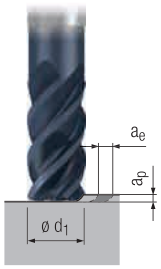


$a_e = 0.25 \times d_1$



$a_e = 0.02 \times d_1$

HSC
High feed roughing with face cutting edge



		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]	a_p [mm]	ae [mm]			MMS MQL	
P	1.1	170	0.005 x d_1	190	0.006 x d_1	200	0.007 x d_1	240	0.038 x d_1	0.05 x d_1	0.6 x d_1	□	■	□	■
	2.1	160	0.005 x d_1	180	0.005 x d_1	190	0.006 x d_1	220	0.034 x d_1	0.04 x d_1	0.5 x d_1	□	■		■
	3.1	150	0.004 x d_1	170	0.005 x d_1	180	0.005 x d_1	210	0.030 x d_1	0.04 x d_1	0.5 x d_1	□	■		□
	4.1	140	0.003 x d_1	150	0.004 x d_1	170	0.004 x d_1	200	0.024 x d_1	0.03 x d_1	0.4 x d_1	□	■		□
	5.1	130	0.003 x d_1	140	0.003 x d_1	160	0.004 x d_1	180	0.022 x d_1	0.03 x d_1	0.3 x d_1	□	■		□
M	1.1														
	2.1														
	3.1														
	4.1														
K	1.1	170	0.006 x d_1	190	0.006 x d_1	200	0.007 x d_1	240	0.040 x d_1	0.05 x d_1	0.6 x d_1	□	■		□
	1.2	170	0.006 x d_1	190	0.006 x d_1	200	0.007 x d_1	240	0.040 x d_1	0.05 x d_1	0.6 x d_1	□	■		□
	2.1	150	0.005 x d_1	170	0.005 x d_1	180	0.006 x d_1	210	0.032 x d_1	0.04 x d_1	0.5 x d_1	□	■		□
	2.2	150	0.005 x d_1	170	0.005 x d_1	180	0.006 x d_1	210	0.032 x d_1	0.04 x d_1	0.5 x d_1	□	■		□
	3.1	130	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.032 x d_1	0.04 x d_1	0.5 x d_1	□	■		□
	3.2	130	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.032 x d_1	0.04 x d_1	0.5 x d_1	□	■		□
	4.1	100	0.003 x d_1	110	0.004 x d_1	120	0.004 x d_1	140	0.024 x d_1	0.03 x d_1	0.4 x d_1	□	■		□
	4.2	80	0.003 x d_1	90	0.004 x d_1	100	0.004 x d_1	110	0.024 x d_1	0.03 x d_1	0.4 x d_1	□	■		□
N	1.1														
	1.2														
	1.3														
	1.4														
	1.5														
	1.6														
	2.1														
	2.2														
	2.3	150	0.006 x d_1	170	0.006 x d_1	180	0.007 x d_1	210	0.040 x d_1	0.05 x d_1	0.6 x d_1			□	■
	2.4														
	2.5														
	2.6	130	0.005 x d_1	140	0.005 x d_1	160	0.006 x d_1	180	0.032 x d_1	0.04 x d_1	0.5 x d_1			□	■
	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_1	90	0.004 x d_1	100	0.004 x d_1	110	0.024 x d_1	0.03 x d_1	0.4 x d_1			□	■
	5.3														
S	1.1														
	1.2														
	1.3														
	2.1														
	2.2														
	2.3														
	2.4														
	2.5														
	2.6														
H	1.1	100	0.003 x d_1	110	0.004 x d_1	120	0.004 x d_1	140	0.024 x d_1	0.03 x d_1	0.4 x d_1	□	■		
	1.2	80	0.003 x d_1	90	0.003 x d_1	100	0.004 x d_1	110	0.020 x d_1	0.03 x d_1	0.3 x d_1	□	■		
	1.3	70	0.002 x d_1	80	0.003 x d_1	80	0.003 x d_1	100	0.016 x d_1	0.02 x d_1	0.3 x d_1	□	■		
	1.4			80	0.002 x d_1	80	0.003 x d_1	100	0.014 x d_1	0.02 x d_1	0.2 x d_1	□	■		
	1.5			70	0.002 x d_1	70	0.002 x d_1	80	0.012 x d_1	0.02 x d_1	0.2 x d_1	□	■		

v_c = Cutting speed
f_z = Feed per tooth

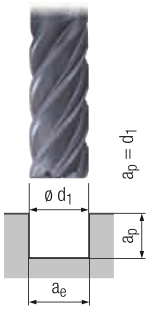
■ = very suitable
□ = suitable

Standard length - for Regular and Corner Radius

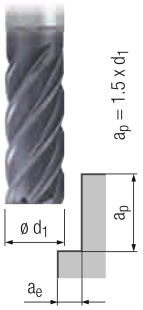
N

Valid for Tool Nos.:

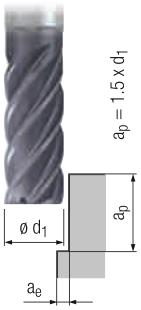
2962LZ
2966LZ



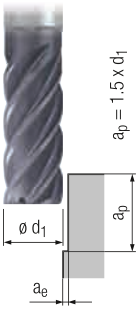
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	895	0.005 x d_1	490	0.006 x d_1	525	0.007 x d_1	460	0.007 x d_1	□	■	□	■
	2.1	430	0.004 x d_1	460	0.005 x d_1	490	0.006 x d_1	425	0.006 x d_1	□	■	□	■
	3.1	395	0.004 x d_1	430	0.004 x d_1	460	0.005 x d_1	195	0.005 x d_1	□	■	□	■
	4.1	360	0.003 x d_1	395	0.004 x d_1	430	0.004 x d_1	165	0.004 x d_1	□	■		
	5.1	330	0.003 x d_1	360	0.004 x d_1	395	0.004 x d_1	165	0.004 x d_1	□	■		
M	1.1	295	0.004 x d_1	360	0.005 x d_1	395	0.005 x d_1	460	0.005 x d_1				■
	2.1	260	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1	425	0.004 x d_1				■
	3.1	230	0.003 x d_1	260	0.004 x d_1	295	0.004 x d_1	195	0.005 x d_1				■
	4.1	195	0.003 x d_1	230	0.004 x d_1	260	0.004 x d_1	165	0.005 x d_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	655	0.007 x d_1	720	0.007 x d_1	790	0.008 x d_1	855	0.008 x d_1			□	■
	2.2	655	0.007 x d_1	720	0.007 x d_1	790	0.008 x d_1	855	0.008 x d_1			□	■
	2.3	655	0.007 x d_1	720	0.007 x d_1	790	0.008 x d_1	855	0.008 x d_1		□	□	■
	2.4	590	0.006 x d_1	655	0.006 x d_1	720	0.007 x d_1	790	0.007 x d_1			□	■
	2.5	590	0.006 x d_1	655	0.006 x d_1	720	0.007 x d_1	790	0.007 x d_1			□	■
	2.6	590	0.006 x d_1	655	0.006 x d_1	720	0.007 x d_1	790	0.007 x d_1		□	□	■
	2.7	395	0.004 x d_1	460	0.004 x d_1	525	0.005 x d_1	590	0.005 x d_1			□	■
	2.8	330	0.003 x d_1	395	0.003 x d_1	460	0.004 x d_1	525	0.004 x d_1			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	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				■
	5.3												
S	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				■
	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				■
	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				■
	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				■
	2.2	65	0.002 x d_1	80	0.002 x d_1	100	0.003 x d_1	100	0.003 x d_1				■
	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				■
	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				■
	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				■
	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				■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

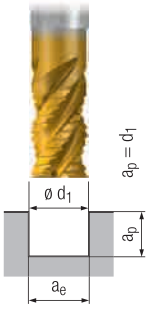
■ = very suitable
□ = suitable

Standard length

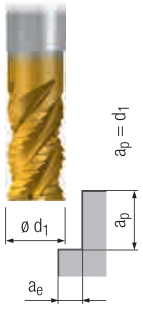
NF

Valid for Tool Nos.:

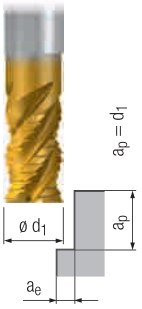
2648TZ
2649TZ
2958T
2959T



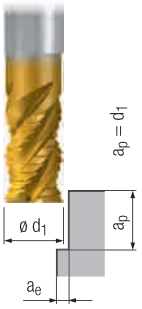
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.3 \times d_1$



$a_e = 0.2 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	395	0.005 x d_1	460	0.006 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	■	□	■
		395	0.005 x d_1	460	0.006 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	■	□	■
		395	0.005 x d_1	460	0.006 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	■	□	■
	2.1	360	0.005 x d_1	430	0.006 x d_1	495	0.007 x d_1	590	0.008 x d_1	□	■	□	■
		360	0.005 x d_1	430	0.005 x d_1	495	0.006 x d_1	590	0.007 x d_1	□	■	□	■
		360	0.004 x d_1	430	0.005 x d_1	495	0.006 x d_1	590	0.007 x d_1	□	■	□	■
	3.1	295	0.004 x d_1	360	0.005 x d_1	430	0.006 x d_1	460	0.007 x d_1	□	■	□	■
		295	0.004 x d_1	360	0.005 x d_1	430	0.006 x d_1	460	0.006 x d_1	□	■	□	■
		295	0.004 x d_1	360	0.005 x d_1	430	0.005 x d_1	460	0.006 x d_1	□	■	□	■
	4.1	230	0.004 x d_1	265	0.005 x d_1	330	0.005 x d_1	360	0.006 x d_1	□	■		
		230	0.004 x d_1	265	0.004 x d_1	330	0.005 x d_1	360	0.006 x d_1	□	■		
		230	0.003 x d_1	265	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1	□	■		
	5.1	200	0.003 x d_1	230	0.004 x d_1	265	0.004 x d_1	330	0.005 x d_1	□	■		
		200	0.003 x d_1	230	0.003 x d_1	265	0.004 x d_1	330	0.004 x d_1	□	■		
		200	0.003 x d_1	230	0.003 x d_1	265	0.004 x d_1	330	0.004 x d_1	□	■		
M	1.1	330	0.004 x d_1	395	0.004 x d_1	460	0.005 x d_1	525	0.006 x d_1				■
	2.1	265	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1	430	0.006 x d_1				■
	3.1	165	0.003 x d_1	200	0.003 x d_1	230	0.004 x d_1	265	0.004 x d_1				■
	4.1	135	0.003 x d_1	165	0.003 x d_1	200	0.004 x d_1	200	0.004 x d_1				■
K	1.1	395	0.005 x d_1	460	0.006 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	■		
	1.2	395	0.005 x d_1	460	0.006 x d_1	560	0.007 x d_1	625	0.008 x d_1	□	■		
	2.1	360	0.004 x d_1	460	0.005 x d_1	495	0.006 x d_1	590	0.006 x d_1	□	■		
	2.2	360	0.004 x d_1	430	0.005 x d_1	495	0.006 x d_1	590	0.006 x d_1	□	■		
	3.1	295	0.004 x d_1	360	0.005 x d_1	430	0.006 x d_1	460	0.006 x d_1	□	■		
	3.2	295	0.004 x d_1	360	0.005 x d_1	430	0.006 x d_1	460	0.006 x d_1	□	■		
	4.1	230	0.003 x d_1	265	0.004 x d_1	330	0.004 x d_1	360	0.005 x d_1	□	■		
	4.2	200	0.003 x d_1	230	0.004 x d_1	265	0.004 x d_1	330	0.005 x d_1	□	■		
N	1.1												
	1.2												
	1.3												
	1.4												
	1.5												
	1.6												
	2.1	360	0.005 x d_1	430	0.006 x d_1	495	0.007 x d_1	590	0.008 x d_1			□	■
	2.2	360	0.005 x d_1	430	0.006 x d_1	495	0.007 x d_1	590	0.008 x d_1			□	■
	2.3	360	0.005 x d_1	430	0.006 x d_1	495	0.007 x d_1	590	0.008 x d_1		□	□	■
	2.4	330	0.004 x d_1	395	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1			□	■
	2.5	330	0.004 x d_1	395	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1			□	■
	2.6	330	0.004 x d_1	395	0.005 x d_1	460	0.006 x d_1	525	0.006 x d_1		□	□	■
	2.7	200	0.003 x d_1	230	0.004 x d_1	265	0.004 x d_1	330	0.005 x d_1			□	■
	2.8	200	0.003 x d_1	230	0.004 x d_1	265	0.004 x d_1	330	0.005 x d_1			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2	200	0.003 x d_1	230	0.004 x d_1	265	0.004 x d_1	330	0.005 x d_1				■
	5.3												
S	1.1	230	0.005 x d_1	265	0.005 x d_1	330	0.006 x d_1	360	0.007 x d_1				■
	1.2	200	0.004 x d_1	230	0.004 x d_1	265	0.005 x d_1	330	0.006 x d_1				■
	1.3	100	0.003 x d_1	135	0.003 x d_1	135	0.004 x d_1	165	0.004 x d_1				■
	2.1	230	0.004 x d_1	265	0.004 x d_1	330	0.005 x d_1	360	0.006 x d_1				■
	2.2	65	0.003 x d_1	65	0.004 x d_1	85	0.004 x d_1	100	0.005 x d_1				■
	2.3	35	0.002 x d_1	50	0.002 x d_1	50	0.003 x d_1	65	0.003 x d_1				■
	2.4	65	0.003 x d_1	85	0.003 x d_1	115	0.004 x d_1	100	0.004 x d_1				■
	2.5	35	0.002 x d_1	35	0.002 x d_1	35	0.003 x d_1	65	0.003 x d_1				■
	2.6	35	0.003 x d_1	35	0.003 x d_1	35	0.004 x d_1	65	0.004 x d_1				■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

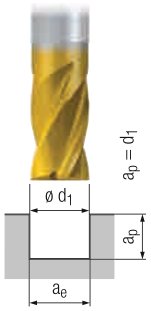
■ = very suitable
□ = suitable

Base - Standard length

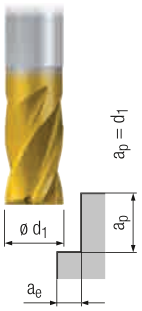
Valid for Tool Nos.:

2975T
2976T

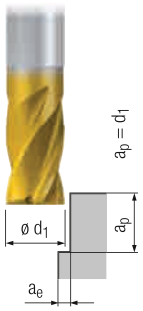
N



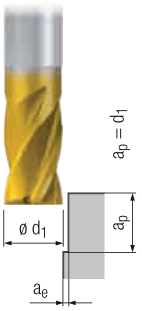
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	560	0.005 x d_1	625	0.006 x d_1	655	0.007 x d_1	790	0.007 x d_1	□	□	□	■
	2.1	490	0.004 x d_1	560	0.005 x d_1	590	0.006 x d_1	690	0.006 x d_1	□	□	□	■
	3.1	430	0.004 x d_1	460	0.004 x d_1	525	0.005 x d_1	590	0.005 x d_1	□	■	□	■
	4.1	395	0.003 x d_1	430	0.004 x d_1	460	0.004 x d_1	560	0.004 x d_1	□	■		
	5.1	330	0.003 x d_1	360	0.003 x d_1	395	0.004 x d_1	460	0.004 x d_1	□	■		
M	1.1	295	0.004 x d_1	360	0.005 x d_1	395	0.005 x d_1	430	0.005 x d_1	□	□	□	■
	2.1	260	0.003 x d_1	295	0.004 x d_1	330	0.005 x d_1	360	0.005 x d_1	□	□	□	■
	3.1	230	0.003 x d_1	260	0.003 x d_1	295	0.004 x d_1	330	0.004 x d_1			□	■
	4.1	195	0.002 x d_1	230	0.002 x d_1	260	0.003 x d_1	295	0.004 x d_1			□	■
K	1.1	490	0.005 x d_1	525	0.006 x d_1	590	0.006 x d_1	655	0.007 x d_1	□	■		□
	1.2	490	0.005 x d_1	525	0.006 x d_1	590	0.006 x d_1	655	0.007 x d_1	□	■		□
	2.1	460	0.004 x d_1	490	0.005 x d_1	560	0.005 x d_1	590	0.006 x d_1	□	■		□
	2.2	460	0.004 x d_1	490	0.005 x d_1	560	0.005 x d_1	590	0.006 x d_1	□	■		□
	3.1	395	0.004 x d_1	430	0.005 x d_1	460	0.005 x d_1	490	0.006 x d_1	□	■		□
	3.2	395	0.004 x d_1	430	0.005 x d_1	460	0.005 x d_1	490	0.006 x d_1	□	■		□
	4.1	330	0.003 x d_1	360	0.003 x d_1	395	0.004 x d_1	430	0.004 x d_1	□	■		□
	4.2	260	0.003 x d_1	295	0.003 x d_1	295	0.004 x d_1	330	0.004 x d_1	□	■		□
N	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				■
	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				■
	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				■
	1.4												
	1.5												
	1.6												
	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			□	■
	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			□	■
	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		□	□	■
	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			□	■
	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			□	■
	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		□	□	■
	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			□	■
	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			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	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			□	■
	5.3												
S	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				■
	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				■
	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				■
	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				■
	2.2	65	0.002 x d_1	80	0.002 x d_1	30	0.003 x d_1	115	0.003 x d_1				■
	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				■
	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				■
	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				■
	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				■
H	1.1	295	0.003 x d_1	330	0.003 x d_1	360	0.003 x d_1	130	0.004 x d_1	□	■		
	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	□	■		
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

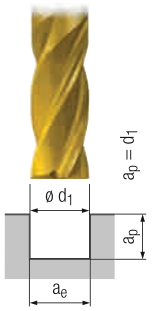
■ = very suitable
□ = suitable

Base - Standard length

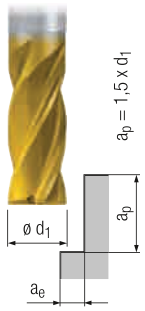
Valid for Tool Nos.:

2977T
2978T

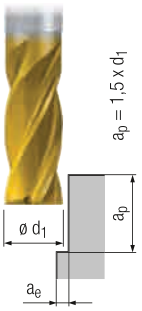
N



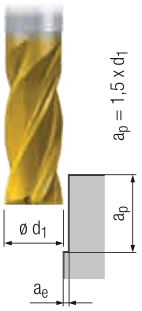
$a_e = d_1$



$a_e = 0.4 \times d_1$



$a_e = 0.2 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	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	□	□	□	■
	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	□	□	□	■
	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	□	■	□	■
	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	□	■		
	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	□	■		
M	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	□	□	□	■
	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	□	□	□	■
	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			□	■
	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			□	■
K	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
N	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				■
	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				■
	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				■
	1.4												
	1.5												
	1.6												
	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			□	■
	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			□	■
	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		□	□	■
	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			□	■
	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			□	■
	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		□	□	■
	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			□	■
	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			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	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			□	■
	5.3												
S	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
	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				■
H	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	□	■		
	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	□	■		
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

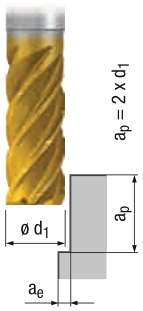
■ = very suitable
□ = suitable

NF

Valid for Tool Nos.

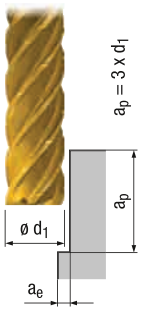
2577TZ 2579TZ 3911TZ
2537TZ 2539TZ 3913TZ

2 X D



$a_e = 0.15 \times d_1$

3 X D



$a_e = 0.1 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	1115	0.012 x d_1	1050	0.012 x d_1	□	■	□	■
	2.1	1050	0.011 x d_1	980	0.011 x d_1	□	■	□	■
	3.1	980	0.010 x d_1	915	0.010 x d_1	□	■	□	■
	4.1	885	0.009 x d_1	820	0.009 x d_1	□	■		
	5.1	820	0.008 x d_1	755	0.008 x d_1	□	■		
M	1.1	490	0.008 x d_1	455	0.008 x d_1				■
	2.1	425	0.008 x d_1	390	0.008 x d_1				■
	3.1	360	0.007 x d_1	325	0.007 x d_1				■
	4.1	325	0.007 x d_1	295	0.007 x d_1				■
K	1.1	685	0.009 x d_1	655	0.009 x d_1	□	■		□
	1.2	685	0.009 x d_1	655	0.009 x d_1	□	■		□
	2.1	655	0.007 x d_1	590	0.007 x d_1	□	■		□
	2.2	655	0.007 x d_1	590	0.007 x d_1	□	■		□
	3.1	525	0.007 x d_1	490	0.007 x d_1	□	■		□
	3.2	525	0.007 x d_1	490	0.007 x d_1	□	■		□
	4.1	455	0.005 x d_1	425	0.005 x d_1	□	■		□
	4.2	325	0.005 x d_1	295	0.005 x d_1	□	■		□
N	1.1	1145	0.014 x d_1	1050	0.014 x d_1			□	■
	1.2	1145	0.013 x d_1	1050	0.013 x d_1			□	■
	1.3	1145	0.012 x d_1	1050	0.012 x d_1			□	■
	1.4								
	1.5								
	1.6								
	2.1	655	0.009 x d_1	625	0.009 x d_1			□	■
	2.2	655	0.009 x d_1	625	0.009 x d_1			□	■
	2.3	655	0.009 x d_1	625	0.009 x d_1		□	□	■
	2.4	590	0.007 x d_1	525	0.007 x d_1			□	■
	2.5	590	0.007 x d_1	525	0.007 x d_1			□	■
	2.6	590	0.007 x d_1	525	0.007 x d_1		□	□	■
	2.7	325	0.005 x d_1	295	0.005 x d_1			□	■
	2.8	325	0.005 x d_1	295	0.005 x d_1			□	■
	3.1								
	3.2								
	4.1								
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	395	0.005 x d_1	360	0.005 x d_1				■
	5.3								
S	1.1	460	0.007 x d_1	425	0.007 x d_1				■
	1.2	425	0.007 x d_1	395	0.007 x d_1				■
	1.3	395	0.006 x d_1	360	0.006 x d_1				■
	2.1	325	0.004 x d_1	295	0.004 x d_1				■
	2.2	100	0.004 x d_1	100	0.004 x d_1				■
	2.3	130	0.004 x d_1	130	0.004 x d_1				■
	2.4	130	0.004 x d_1	130	0.004 x d_1				■
	2.5	130	0.004 x d_1	115	0.004 x d_1				■
	2.6	100	0.004 x d_1	100	0.004 x d_1				■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

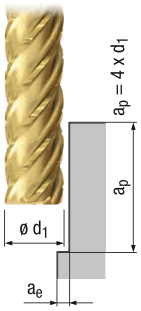
■ = very suitable
□ = suitable

NF

Valid for Tool Nos.

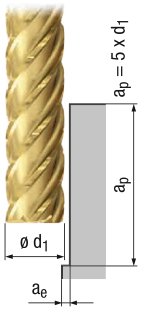
2581TZ 2543TZ
2541TZ

4 X D



$a_e = 0.05 \times d_1$

5 X D



$a_e = 0.03 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	980	0.011 x d_1	855	0.010 x d_1	□	■	□	■
	2.1	885	0.010 x d_1	755	0.009 x d_1	□	■	□	■
	3.1	820	0.009 x d_1	690	0.008 x d_1	□	■	□	■
	4.1	755	0.008 x d_1	655	0.007 x d_1	□	■		
	5.1	655	0.007 x d_1	590	0.006 x d_1	□	■		
M	1.1	425	0.008 x d_1	395	0.007 x d_1				■
	2.1	360	0.008 x d_1	330	0.007 x d_1				■
	3.1	295	0.007 x d_1	260	0.006 x d_1				■
	4.1	260	0.007 x d_1	230	0.006 x d_1				■
K	1.1	620	0.009 x d_1	590	0.008 x d_1	□	■		□
	1.2	620	0.009 x d_1	590	0.008 x d_1	□	■		□
	2.1	555	0.007 x d_1	525	0.006 x d_1	□	■		□
	2.2	555	0.007 x d_1	525	0.006 x d_1	□	■		□
	3.1	455	0.007 x d_1	425	0.006 x d_1	□	■		□
	3.2	455	0.007 x d_1	425	0.006 x d_1	□	■		□
	4.1	390	0.005 x d_1	360	0.005 x d_1	□	■		□
	4.2	260	0.005 x d_1	230	0.005 x d_1	□	■		□
N	1.1	980	0.014 x d_1	920	0.012 x d_1			□	■
	1.2	980	0.013 x d_1	920	0.011 x d_1			□	■
	1.3	980	0.012 x d_1	920	0.010 x d_1			□	■
	1.4								
	1.5								
	1.6								
	2.1	590	0.009 x d_1	590	0.009 x d_1			□	■
	2.2	590	0.009 x d_1	590	0.009 x d_1			□	■
	2.3	590	0.009 x d_1	590	0.009 x d_1		□	□	■
	2.4	490	0.007 x d_1	490	0.007 x d_1			□	■
	2.5	490	0.007 x d_1	490	0.007 x d_1			□	■
	2.6	490	0.007 x d_1	490	0.007 x d_1		□	□	■
	2.7	260	0.005 x d_1	260	0.005 x d_1			□	■
	2.8	260	0.005 x d_1	260	0.005 x d_1			□	■
	3.1								
	3.2								
	4.1								
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	325	0.005 x d_1	295	0.005 x d_1				■
	5.3								
S	1.1	395	0.007 x d_1	360	0.006 x d_1				■
	1.2	360	0.007 x d_1	330	0.006 x d_1				■
	1.3	325	0.006 x d_1	295	0.005 x d_1				■
	2.1	260	0.004 x d_1	195	0.004 x d_1				■
	2.2	80	0.004 x d_1	65	0.004 x d_1				■
	2.3	115	0.004 x d_1	100	0.004 x d_1				■
	2.4	115	0.004 x d_1	100	0.004 x d_1				■
	2.5	100	0.004 x d_1	80	0.004 x d_1				■
	2.6	80	0.004 x d_1	65	0.004 x d_1				■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

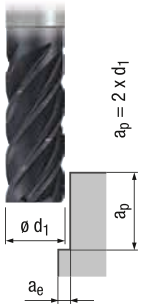
■ = very suitable
□ = suitable

NF

Valid for Tool Nos.:

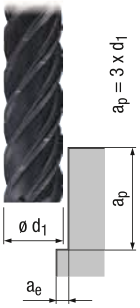
2571L 2573L 2575L
2531L 2533L 2535L
2557L

2 X D



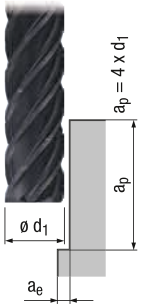
$a_e = 0.15 \times d_1$

3 X D



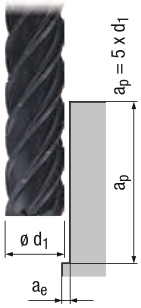
$a_e = 0.1 \times d_1$

4 X D



$a_e = 0.05 \times d_1$

5 X D



$a_e = 0.03 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	1115	0.012 x d_1	1050	0.012 x d_1	985	0.011 x d_1	855	0.010 x d_1	□	■	□	■
	2.1	1050	0.011 x d_1	985	0.011 x d_1	885	0.010 x d_1	755	0.009 x d_1	□	■	□	■
	3.1	985	0.010 x d_1	920	0.010 x d_1	820	0.009 x d_1	690	0.008 x d_1	□	■	□	■
	4.1	885	0.009 x d_1	820	0.009 x d_1	755	0.008 x d_1	655	0.007 x d_1	□	■		
	5.1	820	0.008 x d_1	755	0.008 x d_1	655	0.007 x d_1	590	0.006 x d_1	□	■		
M	1.1	460	0.008 x d_1	425	0.008 x d_1	120	0.008 x d_1	360	0.007 x d_1				■
	2.1	395	0.008 x d_1	360	0.008 x d_1	110	0.008 x d_1	295	0.007 x d_1				■
	3.1	325	0.007 x d_1	295	0.007 x d_1	80	0.007 x d_1	230	0.006 x d_1				■
	4.1	295	0.007 x d_1	260	0.007 x d_1	70	0.007 x d_1	195	0.006 x d_1				■
K	1.1	820	0.009 x d_1	755	0.009 x d_1	690	0.009 x d_1	590	0.008 x d_1	□	■		□
	1.2	820	0.009 x d_1	755	0.009 x d_1	690	0.009 x d_1	590	0.008 x d_1	□	■		□
	2.1	755	0.007 x d_1	690	0.007 x d_1	655	0.007 x d_1	525	0.006 x d_1	□	■		□
	2.2	755	0.007 x d_1	690	0.007 x d_1	655	0.007 x d_1	525	0.006 x d_1	□	■		□
	3.1	655	0.007 x d_1	590	0.007 x d_1	525	0.007 x d_1	430	0.006 x d_1	□	■		□
	3.2	655	0.007 x d_1	590	0.007 x d_1	525	0.007 x d_1	430	0.006 x d_1	□	■		□
	4.1	560	0.005 x d_1	525	0.005 x d_1	460	0.005 x d_1	360	0.005 x d_1	□	■		□
	4.2	460	0.005 x d_1	395	0.005 x d_1	325	0.005 x d_1	230	0.005 x d_1	□	■		□
N	1.1	1050	0.014 x d_1	985	0.014 x d_1	885	0.014 x d_1	820	0.012 x d_1			□	■
	1.2	1050	0.013 x d_1	985	0.013 x d_1	885	0.013 x d_1	820	0.011 x d_1			□	■
	1.3	1050	0.012 x d_1	985	0.012 x d_1	885	0.012 x d_1	820	0.010 x d_1			□	■
	1.4												
	1.5												
	1.6												
	2.1	655	0.009 x d_1	625	0.009 x d_1	590	0.009 x d_1	560	0.009 x d_1			□	■
	2.2	655	0.009 x d_1	625	0.009 x d_1	590	0.009 x d_1	560	0.009 x d_1			□	■
	2.3	655	0.009 x d_1	625	0.009 x d_1	590	0.009 x d_1	560	0.009 x d_1		■	□	■
	2.4	590	0.007 x d_1	525	0.007 x d_1	490	0.007 x d_1	460	0.007 x d_1			□	■
	2.5	590	0.007 x d_1	525	0.007 x d_1	490	0.007 x d_1	460	0.007 x d_1			□	■
	2.6	590	0.007 x d_1	525	0.007 x d_1	490	0.007 x d_1	460	0.007 x d_1		■	□	■
	2.7	490	0.005 x d_1	460	0.005 x d_1	425	0.005 x d_1	230	0.005 x d_1			□	■
	2.8	425	0.005 x d_1	395	0.005 x d_1	395	0.005 x d_1	230	0.005 x d_1			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2	330	0.005 x d_1	295	0.005 x d_1	260	0.005 x d_1	230	0.005 x d_1			□	■
	5.3												
S	1.1	330	0.005 x d_1	295	0.005 x d_1	260	0.005 x d_1	230	0.006 x d_1				■
	1.2	330	0.005 x d_1	295	0.005 x d_1	260	0.005 x d_1	195	0.006 x d_1				■
	1.3	330	0.005 x d_1	295	0.005 x d_1	260	0.005 x d_1	165	0.005 x d_1				■
	2.1	325	0.004 x d_1	295	0.004 x d_1	260	0.004 x d_1	195	0.004 x d_1				■
	2.2	100	0.004 x d_1	100	0.004 x d_1	80	0.004 x d_1	65	0.004 x d_1				■
	2.3	130	0.004 x d_1	130	0.004 x d_1	115	0.004 x d_1	100	0.004 x d_1				■
	2.4	130	0.004 x d_1	130	0.004 x d_1	115	0.004 x d_1	100	0.004 x d_1				■
	2.5	130	0.004 x d_1	115	0.004 x d_1	100	0.004 x d_1	80	0.004 x d_1				■
	2.6	100	0.004 x d_1	100	0.004 x d_1	80	0.004 x d_1	65	0.004 x d_1				■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

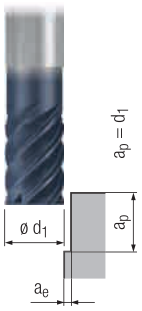
■ = very suitable
□ = suitable

Standard and Long lengths (6-10 Flutes)

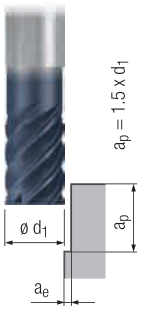
N

Valid for Tool Nos.:

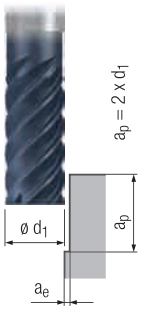
1827A
1828A
2813A
2817A



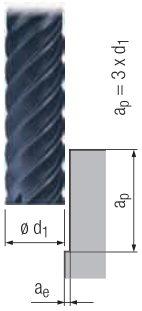
$a_e = 0.05 \times d_1$



$a_e = 0.05 \times d_1$



$a_e = 0.02 \times d_1$



$a_e = 0.02 \times d_1$

		v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	690	0.005 x d_1	560	0.005 x d_1	780	0.006 x d_1	495	0.005 x d_1	□	■		□
		690	0.005 x d_1	560	0.005 x d_1	780	0.006 x d_1	495	0.005 x d_1	□	■		□
		690	0.005 x d_1	560	0.004 x d_1	780	0.005 x d_1	495	0.005 x d_1	□	■		□
	2.1	625	0.005 x d_1	495	0.004 x d_1	725	0.005 x d_1	430	0.005 x d_1	□	■		□
		625	0.005 x d_1	495	0.004 x d_1	725	0.005 x d_1	430	0.005 x d_1	□	■		□
		625	0.004 x d_1	495	0.004 x d_1	725	0.005 x d_1	430	0.004 x d_1	□	■		□
	3.1	560	0.004 x d_1	460	0.004 x d_1	660	0.005 x d_1	395	0.004 x d_1	□	■		□
		560	0.004 x d_1	460	0.004 x d_1	660	0.004 x d_1	395	0.004 x d_1	□	■		□
		560	0.004 x d_1	460	0.003 x d_1	660	0.004 x d_1	395	0.004 x d_1	□	■		□
	4.1	495	0.004 x d_1	395	0.003 x d_1	560	0.004 x d_1	360	0.004 x d_1	□	■		
		495	0.004 x d_1	395	0.003 x d_1	560	0.004 x d_1	360	0.004 x d_1	□	■		
		495	0.003 x d_1	395	0.003 x d_1	560	0.003 x d_1	360	0.003 x d_1	□	■		
	5.1	430	0.003 x d_1	330	0.003 x d_1	495	0.003 x d_1	295	0.003 x d_1	□	■		
		430	0.003 x d_1	330	0.003 x d_1	495	0.003 x d_1	295	0.003 x d_1	□	■		
		430	0.003 x d_1	330	0.003 x d_1	495	0.003 x d_1	295	0.003 x d_1	□	■		
M	1.1												
	2.1												
	3.1												
	4.1												
K	1.1	690	0.005 x d_1	560	0.005 x d_1	780	0.006 x d_1	495	0.005 x d_1	□	■		
	1.2	690	0.005 x d_1	560	0.005 x d_1	780	0.006 x d_1	495	0.005 x d_1	□	■		
	2.1	590	0.004 x d_1	460	0.004 x d_1	690	0.004 x d_1	430	0.004 x d_1	□	■		
	2.2	590	0.004 x d_1	460	0.004 x d_1	690	0.004 x d_1	430	0.004 x d_1	□	■		
	3.1	525	0.004 x d_1	430	0.004 x d_1	590	0.004 x d_1	360	0.004 x d_1	□	■		
	3.2	525	0.004 x d_1	430	0.004 x d_1	590	0.004 x d_1	360	0.004 x d_1	□	■		
	4.1	430	0.003 x d_1	330	0.003 x d_1	495	0.003 x d_1	295	0.003 x d_1	□	■		
	4.2	360	0.003 x d_1	295	0.003 x d_1	430	0.003 x d_1	265	0.003 x d_1	□	■		
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	430	0.004 x d_1	330	0.003 x d_1	495	0.004 x d_1	295	0.004 x d_1	□	■		
	1.2	360	0.003 x d_1	295	0.003 x d_1	495	0.003 x d_1	265	0.003 x d_1	□	■		
	1.3	295	0.003 x d_1	230	0.002 x d_1	330	0.003 x d_1	200	0.003 x d_1	□	■		
	1.4	265	0.002 x d_1	200	0.002 x d_1	295	0.002 x d_1	200	0.002 x d_1	□	■		
	1.5	230	0.002 x d_1	200	0.001 x d_1	265	0.002 x d_1	165	0.002 x d_1	□	■		

v_c = Cutting speed
f_z = Feed per tooth

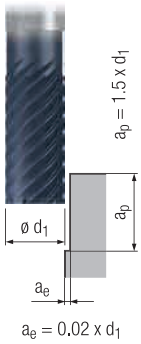
■ = very suitable
□ = suitable

Standard lengths (6-20 Flutes)

Valid for Tool No.:

2887A

H



		v_c [sfm]	f_z [inch]			MMS MQL	
P	1.1	855	0.006 x d_1	□	■	□	■
	2.1	720	0.005 x d_1	□	■	□	■
	3.1	625	0.005 x d_1	□	■	□	■
	4.1	525	0.004 x d_1	□	■		
	5.1	430	0.003 x d_1	□	■		
M	1.1	430	0.004 x d_1				■
	2.1	330	0.004 x d_1				■
	3.1	265	0.003 x d_1				■
	4.1	165	0.003 x d_1				■
K	1.1	855	0.006 x d_1	□	■		
	1.2	855	0.006 x d_1	□	■		
	2.1	720	0.005 x d_1	□	■		
	2.2	720	0.005 x d_1	□	■		
	3.1	625	0.005 x d_1	□	■		
	3.2	625	0.005 x d_1	□	■		
	4.1	525	0.004 x d_1	□	■		
	4.2	430	0.004 x d_1	□	■		
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	430	0.004 x d_1				■
	1.2	330	0.004 x d_1				■
	1.3	195	0.003 x d_1				■
	2.1	330	0.003 x d_1				■
	2.2	165	0.003 x d_1				■
	2.3	100	0.003 x d_1				■
	2.4	100	0.003 x d_1				■
	2.5	100	0.003 x d_1				■
	2.6	100	0.003 x d_1				■
H	1.1	525	0.003 x d_1	□	■		
	1.2	430	0.003 x d_1	□	■		
	1.3	365	0.003 x d_1	□	■		
	1.4	260	0.002 x d_1	□	■		
	1.5	195	0.002 x d_1	□	■		

v_c = Cutting speed
f_z = Feed per tooth

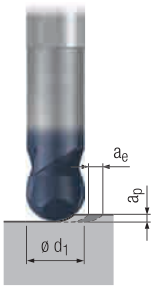
■ = very suitable
□ = suitable

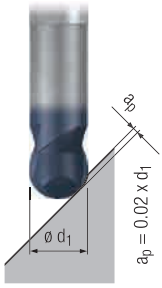
Ball Nose and Torus – Standard, long and extra long lengths (2 flutes)

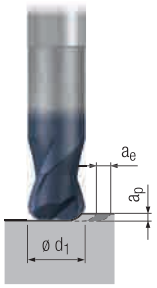
H

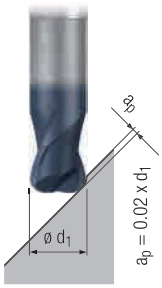
Valid for Tool Nos.:

1974A 1983A
1976A 1993A
1996A









		v_c [sfm]	f_z [mm]	a_e [mm]	a_p [mm]	v_c [sfm]	f_z [mm]	v_c [sfm]	f_z [mm]	a_e [mm]	a_p [mm]	v_c [sfm]	f_z [mm]			MMS MQL	
P	1.1	785	0.014 x d_1	0,2 x d_1	0.075 x d_1	1050	0.010 x d_1	785	0.014 x d_1	0,4 x d_1	0.05 x d_1	1050	0.010 x d_1	□	■	□	■
	2.1	755	0.013 x d_1	0,2 x d_1	0.075 x d_1	920	0.009 x d_1	755	0.013 x d_1	0,4 x d_1	0.05 x d_1	920	0.009 x d_1	□	■	□	■
	3.1	590	0.011 x d_1	0,2 x d_1	0.075 x d_1	785	0.008 x d_1	590	0.011 x d_1	0,4 x d_1	0.05 x d_1	785	0.008 x d_1	□	■	□	
	4.1	490	0.010 x d_1	0,2 x d_1	0.075 x d_1	655	0.007 x d_1	490	0.010 x d_1	0,4 x d_1	0.05 x d_1	655	0.007 x d_1	□	■	□	
	5.1	425	0.008 x d_1	0,2 x d_1	0.075 x d_1	525	0.006 x d_1	425	0.008 x d_1	0,4 x d_1	0.05 x d_1	525	0.006 x d_1	□	■	□	
M	1.1																
	2.1																
	3.1																
	4.1																
K	1.1	785	0.014 x d_1	0,2 x d_1	0.075 x d_1	1050	0.010 x d_1	785	0.014 x d_1	0,4 x d_1	0.05 x d_1	1050	0.010 x d_1	□	■		□
	1.2	785	0.014 x d_1	0,2 x d_1	0.075 x d_1	1050	0.010 x d_1	785	0.014 x d_1	0,4 x d_1	0.05 x d_1	1050	0.010 x d_1	□	■		□
	2.1	690	0.011 x d_1	0,2 x d_1	0.075 x d_1	920	0.008 x d_1	690	0.011 x d_1	0,4 x d_1	0.05 x d_1	920	0.008 x d_1	□	■		□
	2.2	690	0.011 x d_1	0,2 x d_1	0.075 x d_1	920	0.008 x d_1	690	0.011 x d_1	0,4 x d_1	0.05 x d_1	920	0.008 x d_1	□	■		□
	3.1	590	0.011 x d_1	0,2 x d_1	0.075 x d_1	785	0.008 x d_1	590	0.011 x d_1	0,4 x d_1	0.05 x d_1	785	0.008 x d_1	□	■		
	3.2	590	0.011 x d_1	0,2 x d_1	0.075 x d_1	785	0.008 x d_1	590	0.011 x d_1	0,4 x d_1	0.05 x d_1	785	0.008 x d_1	□	■		
	4.1	490	0.008 x d_1	0,2 x d_1	0.075 x d_1	590	0.006 x d_1	490	0.008 x d_1	0,4 x d_1	0.05 x d_1	590	0.006 x d_1	□	■		
	4.2	425	0.008 x d_1	0,2 x d_1	0.075 x d_1	525	0.006 x d_1	425	0.008 x d_1	0,4 x d_1	0.05 x d_1	525	0.006 x d_1	□	■		
N	1.1																
	1.2																
	1.3																
	1.4																
	1.5																
	1.6																
	2.1																
	2.2	720	0.014 x d_1	0,2 x d_1	0.075 x d_1	920	0.010 x d_1	720	0.014 x d_1	0,4 x d_1	0.05 x d_1	920	0.010 x d_1			□	■
	2.3	720	0.014 x d_1	0,2 x d_1	0.075 x d_1	920	0.010 x d_1	720	0.014 x d_1	0,4 x d_1	0.05 x d_1	920	0.010 x d_1	□	□	□	■
	2.4	590	0.011 x d_1	0,2 x d_1	0.075 x d_1	785	0.008 x d_1	590	0.011 x d_1	0,4 x d_1	0.05 x d_1	785	0.008 x d_1			□	■
	2.5	590	0.011 x d_1	0,2 x d_1	0.075 x d_1	785	0.008 x d_1	590	0.011 x d_1	0,4 x d_1	0.05 x d_1	785	0.008 x d_1			□	■
	2.6	590	0.011 x d_1	0,2 x d_1	0.075 x d_1	785	0.008 x d_1	590	0.011 x d_1	0,4 x d_1	0.05 x d_1	785	0.008 x d_1	□	□	□	■
	2.7	360	0.008 x d_1	0,2 x d_1	0.075 x d_1	490	0.006 x d_1	360	0.008 x d_1	0,4 x d_1	0.05 x d_1	490	0.006 x d_1			□	■
	2.8	360	0.008 x d_1	0,2 x d_1	0.075 x d_1	490	0.006 x d_1	360	0.008 x d_1	0,4 x d_1	0.05 x d_1	490	0.006 x d_1			□	■
	3.1																
	3.2																
	4.1																
	4.2																
	4.3																
	4.4																
	5.1																
	5.2	425	0.008 x d_1	0,2 x d_1	0.075 x d_1	560	0.006 x d_1	425	0.008 x d_1	0,4 x d_1	0.05 x d_1	560	0.006 x d_1			□	■
	5.3																
S	1.1																
	1.2																
	1.3																
	2.1																
	2.2																
	2.3																
	2.4																
	2.5																
	2.6																
H	1.1	360	0.008 x d_1	0,1 x d_1	0.05 x d_1	490	0.006 x d_1	360	0.008 x d_1	0,4 x d_1	0.05 x d_1	490	0.006 x d_1	□	■		
	1.2	330	0.007 x d_1	0,1 x d_1	0.05 x d_1	425	0.005 x d_1	330	0.007 x d_1	0,4 x d_1	0.05 x d_1	425	0.005 x d_1	□	■		
	1.3					395	0.005 x d_1	295	0.006 x d_1	0,2 x d_1	0.02 x d_1	395	0.005 x d_1	□	■		
	1.4					330	0.004 x d_1	230	0.005 x d_1	0,2 x d_1	0.02 x d_1	330	0.004 x d_1	□	■		
	1.5					260	0.003 x d_1	195	0.004 x d_1	0,2 x d_1	0.01 x d_1	260	0.003 x d_1	□	■		

v_c = Cutting speed
f_z = Feed per tooth

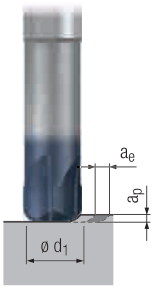
■ = very suitable
□ = suitable

Ball Nose and Torus – Standard and long lengths (4 flutes)

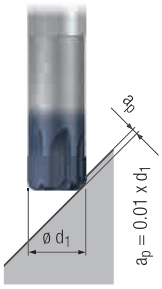
Valid for Tool Nos.:

1936A
2832A

Roughing



Finishing



		v_c [sfm]	f_z [mm]	a_e [mm]	a_p [mm]	v_c [sfm]	f_z [mm]			MMS MQL	
P	1.1	920	0.011 x d_1	0.4 x d_1	0.03 x d_1	1180	0.008 x d_1	□	■	□	■
	2.1	785	0.011 x d_1	0.4 x d_1	0.03 x d_1	1050	0.008 x d_1	□	■	□	■
	3.1	690	0.009 x d_1	0.4 x d_1	0.03 x d_1	885	0.007 x d_1	□	■	□	
	4.1	560	0.008 x d_1	0.4 x d_1	0.03 x d_1	720	0.006 x d_1	□	■	□	
	5.1	460	0.006 x d_1	0.4 x d_1	0.03 x d_1	590	0.005 x d_1	□	■	□	
M	1.1										
	2.1										
	3.1										
	4.1										
K	1.1	920	0.011 x d_1	0.4 x d_1	0.03 x d_1	1180	0.008 x d_1	□	■		□
	1.2	920	0.011 x d_1	0.4 x d_1	0.03 x d_1	1180	0.008 x d_1	□	■		□
	2.1	820	0.009 x d_1	0.4 x d_1	0.03 x d_1	1050	0.006 x d_1	□	■		□
	2.2	820	0.009 x d_1	0.4 x d_1	0.03 x d_1	1050	0.006 x d_1	□	■		□
	3.1	690	0.009 x d_1	0.4 x d_1	0.03 x d_1	885	0.006 x d_1	□	■		
	3.2	690	0.009 x d_1	0.4 x d_1	0.03 x d_1	885	0.006 x d_1	□	■		
	4.1	560	0.006 x d_1	0.4 x d_1	0.03 x d_1	720	0.005 x d_1	□	■		
	4.2	490	0.006 x d_1	0.4 x d_1	0.03 x d_1	590	0.005 x d_1	□	■		
N	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1										
	2.2	820	0.011 x d_1	0.4 x d_1	0.03 x d_1	1050	0.008 x d_1			□	■
	2.3	820	0.011 x d_1	0.4 x d_1	0.03 x d_1	1050	0.008 x d_1	□	□	□	■
	2.4	690	0.009 x d_1	0.4 x d_1	0.03 x d_1	885	0.007 x d_1			□	■
	2.5	690	0.009 x d_1	0.4 x d_1	0.03 x d_1	885	0.007 x d_1			□	■
	2.6	690	0.009 x d_1	0.4 x d_1	0.03 x d_1	885	0.007 x d_1	□	□	□	■
	2.7	425	0.006 x d_1	0.4 x d_1	0.03 x d_1	560	0.005 x d_1			□	■
	2.8	425	0.006 x d_1	0.4 x d_1	0.03 x d_1	560	0.005 x d_1			□	■
	3.1										
	3.2										
	4.1										
	4.2										
	4.3										
	4.4										
	5.1										
	5.2										
	5.3										
S	1.1					490	0.007 x d_1			□	■
	1.2					395	0.006 x d_1			□	■
	1.3					230	0.005 x d_1			□	■
	2.1					360	0.006 x d_1			□	■
	2.2					165	0.004 x d_1			□	■
	2.3					130	0.004 x d_1			□	■
	2.4					130	0.004 x d_1			□	■
	2.5					110	0.004 x d_1			□	■
	2.6					130	0.004 x d_1			□	■
H	1.1	425	0.008 x d_1	0.4 x d_1	0.03 x d_1	590	0.006 x d_1	□	■		
	1.2	395	0.007 x d_1	0.4 x d_1	0.03 x d_1	525	0.005 x d_1	□	■		
	1.3	360	0.006 x d_1	0.2 x d_1	0.02 x d_1	460	0.005 x d_1	□	■		
	1.4	260	0.005 x d_1	0.2 x d_1	0.02 x d_1	360	0.004 x d_1	□	■		
	1.5	230	0.004 x d_1	0.2 x d_1	0.01 x d_1	295	0.003 x d_1	□	■		

v_c = Cutting speed
f_z = Feed per tooth

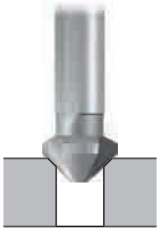
■ = very suitable
□ = suitable

Countersinks 60° and 90°

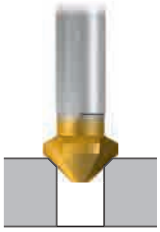
Valid for Tool Nos.:

7550 7560
7550T 7560T

HM



HSS



		v_c [m/min]	f [mm]	v_c [m/min]		f [mm]	HM HSS-TIN			HSS. Uncoated
		Uncoated	90°	Uncoated	TIN	60°, 90°			MMS MQL	
P	1.1	35	0.060	15	25	0.050	□	□	□	■
	2.1	25	0.060	12	15	0.050		□	□	■
	3.1	18	0.036	10	12	0.030			□	■
	4.1	12	0.036		8	0.030				■
	5.1	10	0.024							■
M	1.1	9	0.036	6	8	0.030				■
	2.1	8	0.036	4	6	0.030				■
	3.1	7	0.024							■
	4.1									
K	1.1	40	0.096	20	30	0.080	□	■	□	■
	1.2	30	0.096	15	20	0.080	□	■	□	■
	2.1	28	0.096	11	14	0.080		□	□	■
	2.2	20	0.096	10	12	0.080		□	□	■
	3.1	15	0.084	8	10	0.070			□	■
	3.2	12	0.084							■
	4.1	20	0.096	8	10	0.080		□	□	■
	4.2	18	0.096	7	9	0.080		□	□	■
N	1.1			40	50	0.060			□	■
	1.2	60	0.072	30	40	0.060			□	■
	1.3	50	0.072	25	30	0.060			□	■
	1.4	45	0.072	20	25	0.060			□	■
	1.5	30	0.072	15	20	0.060			□	■
	1.6	10	0.065							■
	2.1	45	0.096	25	30	0.080			□	■
	2.2	60	0.096	30	40	0.080			□	■
	2.3	80	0.096	35	55	0.080			□	■
	2.4	30	0.084	15	20	0.070			□	■
	2.5	45	0.084	20	30	0.070			□	■
	2.6	30	0.096	15	20	0.080			□	■
	2.7	15	0.078						□	■
	2.8									
	3.1	85	0,120	50	60	0,100	□	■		□
	3.2	75	0,120	45	50	0,100	□	■		□
	4.1	90	0.060	55	65	0.050	□	□	□	■
	4.2	100	0.060	60	70	0.050	□	□	□	■
	4.3									
	4.4									
	5.1									
	5.2	15	0.070							■
	5.3									
S	1.1	15	0.048	6	8	0.040				■
	1.2	10	0.048							■
	1.3									
	2.1	6	0.038							■
	2.2	5	0.033							■
	2.3									
	2.4									
	2.5									
	2.6									
H	1.1									
	1.2									
	1.3									
	1.4									
	1.5									

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

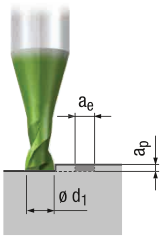
Standard and Long lengths

$L_3 = 2.2 \times D_1$

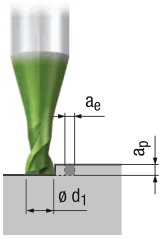
Valid for Tool Nos.:
2760L 2763L

N

Roughing



Finishing



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

		a_p	0.03 x d_1		0.025 x d_1		0.02 x d_1		0.06 x d_1		0.05 x d_1		0.045 x d_1		0.04 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.06 x d_1		0.05 x d_1		0.045 x d_1		0.04 x d_1					
			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]			MMS MQL	
P	1.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	■
	2.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	■
	3.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	
	4.1						120	0.008 x d_1					120	0.015 x d_1	120	0.015 x d_1	□	■	□	
	5.1						120	0.008 x d_1					120	0.015 x d_1	120	0.015 x d_1	□	■	□	
M	1.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.1		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1			□	■
	3.1												95	0.013 x d_1	95	0.013 x d_1			□	■
	4.1												75	0.010 x d_1	75	0.010 x d_1			□	■
K	1.1		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		□
	1.2		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		□
	2.1				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		□
	2.2				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		□
	3.1						95	0.005 x d_1									□	■		
	3.2						95	0.005 x d_1					95	0.011 x d_1	95	0.011 x d_1	□	■		
	4.1				175	0.008 x d_1	175	0.008 x d_1			175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		
	4.2				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		
N	1.1		240	0.008 x d_1	240	0.008 x d_1	240	0.008 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1			□	■
	1.2		240	0.008 x d_1	240	0.008 x d_1	240	0.008 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1			□	■
	1.3				195	0.008 x d_1	195	0.008 x d_1			195	0.015 x d_1	195	0.015 x d_1	195	0.015 x d_1			□	■
	1.4				175	0.006 x d_1	175	0.006 x d_1			175	0.013 x d_1	175	0.013 x d_1	175	0.013 x d_1			□	■
	1.5														140	0.011 x d_1			□	■
	1.6														95	0.011 x d_1			□	■
	2.1		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	2.2		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	2.3		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	□	□	■
	2.4				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.5				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.6				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	□	□	■
	2.7						75	0.007 x d_1							75	0.014 x d_1			□	■
	2.8						55	0.006 x d_1							55	0.012 x d_1			□	■
	3.1				175	0.008 x d_1	175	0.008 x d_1			175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1			□	■
	3.2				140	0.008 x d_1	140	0.008 x d_1			140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	4.1		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1		□	□	■
	4.2		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1		□	□	■
	4.3																			
	4.4																			
	5.1																			
	5.2				95	0.005 x d_1	95	0.005 x d_1			95	0.010 x d_1	95	0.010 x d_1	95	0.010 x d_1			□	■
	5.3				120	0.005 x d_1	120	0.005 x d_1			120	0.010 x d_1	120	0.010 x d_1	120	0.010 x d_1	□	■		■
S	1.1				180	0.005 x d_1	180	0.005 x d_1			180	0.010 x d_1	180	0.010 x d_1	180	0.010 x d_1			□	■
	1.2				140	0.005 x d_1	140	0.005 x d_1			140	0.011 x d_1	140	0.011 x d_1	140	0.011 x d_1			□	■
	1.3						120	0.005 x d_1							120	0.011 x d_1			□	■
	2.1				180	0.005 x d_1	180	0.005 x d_1			180	0.010 x d_1	180	0.010 x d_1	180	0.010 x d_1			□	■
	2.2																			
	2.3																			
	2.4																			
	2.5																			
	2.6																			
H	1.1												120	0.014 x d_1	120	0.014 x d_1	□	■		
	1.2														75	0.011 x d_1	□	■		
	1.3																			
	1.4																			
	1.5																			

v_c = Cutting speed
f_z = Feed per tooth

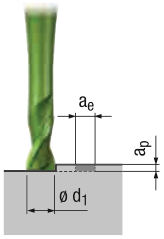
■ = very suitable
□ = suitable

Standard and Long lengths

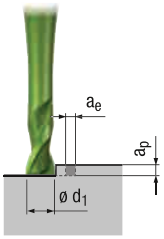
$L_3 = 5 \times D_1$

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.

		a_p	0.03 x d_1		0.02 x d_1		0.045 x d_1		0.04 x d_1		0.035 x d_1		0.03 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.045 x d_1		0.04 x d_1		0.035 x d_1		0.03 x d_1					
			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]			MMS MQL	
P	1.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	■
	2.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	■
	3.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	
	4.1				95	0.008 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	■	□	
	5.1				95	0.008 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	■	□	
M	1.1		95	0.008 x d_1	95	0.008 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1			□	■
	2.1		75	0.008 x d_1	75	0.008 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1			□	■
	3.1										75	0.013 x d_1	75	0.013 x d_1			□	■
	4.1												40	0.010 x d_1			□	■
K	1.1		160	0.007 x d_1	160	0.007 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	□	■		□
	1.2		160	0.007 x d_1	160	0.007 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	□	■		□
	2.1				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		□
	2.2				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		□
	3.1				75	0.005 x d_1							75	0.010 x d_1	□	■		
	3.2				75	0.005 x d_1							75	0.010 x d_1	□	■		
	4.1				160	0.006 x d_1					160	0.012 x d_1	160	0.012 x d_1	□	■		
	4.2				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		
N	1.1		195	0.007 x d_1	195	0.007 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1			□	■
	1.2		195	0.007 x d_1	195	0.007 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1			□	■
	1.3				175	0.006 x d_1					175	0.013 x d_1	175	0.013 x d_1			□	■
	1.4				175	0.006 x d_1					175	0.011 x d_1	175	0.011 x d_1			□	■
	1.5												120	0.010 x d_1			□	■
	1.6												75	0.014 x d_1			□	■
	2.1		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.2		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.3		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	□	□	■
	2.4				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1			□	■
	2.5				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1			□	■
	2.6				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	□	□	■
	2.7				70	0.006 x d_1							70	0.012 x d_1			□	■
	2.8				45	0.005 x d_1							45	0.010 x d_1			□	■
	3.1				160	0.006 x d_1					160	0.013 x d_1	160	0.013 x d_1			□	■
	3.2				120	0.007 x d_1					120	0.014 x d_1	120	0.014 x d_1			□	■
	4.1		140	0.007 x d_1	140	0.007 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1		□	□	■
	4.2		95	0.008 x d_1	95	0.008 x d_1	95	0.016 x d_1	95	0.016 x d_1	95	0.016 x d_1	95	0.016 x d_1		□	□	■
	4.3																	
	4.4																	
	5.1																	
	5.2				75	0.005 x d_1					75	0.010 x d_1	75	0.010 x d_1			□	■
	5.3				120	0.004 x d_1					120	0.008 x d_1	120	0.008 x d_1	□	■		■
S	1.1		120	0.005 x d_1	120	0.005 x d_1			120	0.011 x d_1	120	0.011 x d_1	120	0.011 x d_1			□	■
	1.2		95	0.006 x d_1	95	0.006 x d_1			95	0.012 x d_1	95	0.012 x d_1	95	0.012 x d_1			□	■
	1.3				95	0.005 x d_1							95	0.011 x d_1			□	■
	2.1		120	0.005 x d_1	120	0.005 x d_1			120	0.011 x d_1	120	0.011 x d_1	120	0.011 x d_1			□	■
	2.2																	
	2.3																	
	2.4																	
	2.5																	
	2.6																	
H	1.1										95	0.014 x d_1	95	0.014 x d_1	□	■		
	1.2												70	0.010 x d_1	□	■		
	1.3																	
	1.4																	
	1.5																	

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

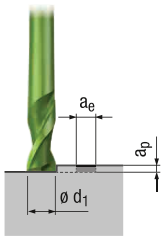
Standard and Long lengths

$L_3 = 10 \times D_1$

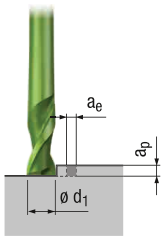
Valid for Tool Nos.:
2762L 2765L

N

Roughing



Finishing



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

		a_p	0.03 x d_1		0.025 x d_1		0.02 x d_1		0.01 x d_1		0.03 x d_1		0.025 x d_1		0.02 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.03 x d_1		0.025 x d_1		0.02 x d_1					
			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]			MMS MQL	
P	1.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	■
	2.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	■
	3.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	
	4.1				75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1					75	0.015 x d_1	□	■	□	
	5.1				75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1					75	0.015 x d_1	□	■	□	
M	1.1		75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1			□	■
	2.1		55	0.008 x d_1	55	0.008 x d_1	55	0.008 x d_1	55	0.008 x d_1	55	0.015 x d_1	55	0.015 x d_1	55	0.015 x d_1			□	■
	3.1												55	0.012 x d_1	55	0.012 x d_1			□	■
	4.1														45	0.012 x d_1			□	■
K	1.1		140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.010 x d_1	140	0.010 x d_1	140	0.010 x d_1	□	■		□
	1.2		140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.010 x d_1	140	0.010 x d_1	140	0.010 x d_1	□	■		□
	2.1				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		□
	2.2				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		□
	3.1						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1	□	■		
	3.2						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1	□	■		
	4.1				140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1			140	0.010 x d_1	140	0.010 x d_1	□	■		
	4.2				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		
N	1.1		175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.011 x d_1	175	0.011 x d_1	175	0.011 x d_1			□	■
	1.2		175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.011 x d_1	175	0.011 x d_1	175	0.011 x d_1			□	■
	1.3				160	0.006 x d_1	160	0.006 x d_1	160	0.006 x d_1			160	0.011 x d_1	160	0.011 x d_1			□	■
	1.4				160	0.005 x d_1	160	0.005 x d_1	160	0.005 x d_1			160	0.010 x d_1	160	0.010 x d_1			□	■
	1.5														95	0.011 x d_1			□	■
	1.6														55	0.015 x d_1			□	■
	2.1		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1			□	■
	2.2		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1			□	■
	2.3		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1	□	□	□	■
	2.4				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1			□	■
	2.5				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1			□	■
	2.6				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	□	□	■
	2.7						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1			□	■
	2.8								40	0.005 x d_1					40	0.010 x d_1			□	■
	3.1								140	0.005 x d_1					140	0.010 x d_1			□	■
	3.2								95	0.007 x d_1					95	0.014 x d_1			□	■
	4.1						120	0.006 x d_1	120	0.006 x d_1	120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1		□	□	■
	4.2						75	0.005 x d_1	75	0.005 x d_1	75	0.010 x d_1	75	0.010 x d_1	75	0.010 x d_1		□	□	■
	4.3																			
	4.4																			
	5.1																			
	5.2								55	0.005 x d_1					55	0.010 x d_1			□	■
	5.3								120	0.004 x d_1					120	0.008 x d_1	□	■		■
S	1.1						95	0.005 x d_1	95	0.005 x d_1			95	0.010 x d_1	95	0.010 x d_1			□	■
	1.2						75	0.005 x d_1	75	0.005 x d_1			75	0.010 x d_1	75	0.010 x d_1			□	■
	1.3								75	0.005 x d_1					75	0.010 x d_1			□	■
	2.1						95	0.005 x d_1	95	0.005 x d_1			95	0.009 x d_1	95	0.009 x d_1			□	■
	2.2																			
	2.3																			
	2.4																			
	2.5																			
	2.6																			
H	1.1												75	0.013 x d_1	75	0.013 x d_1	□	■		
	1.2														55	0.010 x d_1	□	■		
	1.3																			
	1.4																			
	1.5																			

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

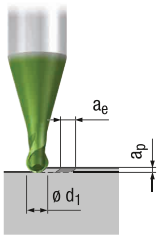
Ball nose – Standard, Long and Extra long lengths

$L_3 = 2.2 \times D_1$

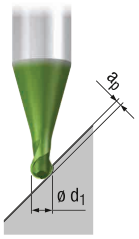
Valid for Tool Nos.:
2770L 2773L 2776L

N

Roughing



Finishing



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

		a_p	0.03 x d_1		0.025 x d_1		0.02 x d_1		0.06 x d_1		0.05 x d_1		0.045 x d_1		0.04 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.06 x d_1		0.05 x d_1		0.045 x d_1		0.04 x d_1					
			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]			MMS MQL	
P	1.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	■
	2.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	■
	3.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	
	4.1						120	0.008 x d_1					120	0.015 x d_1	120	0.015 x d_1	□	■	□	
	5.1						120	0.008 x d_1					120	0.015 x d_1	120	0.015 x d_1	□	■	□	
M	1.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.1		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1			□	■
	3.1												95	0.013 x d_1	95	0.013 x d_1			□	■
	4.1												75	0.010 x d_1	75	0.010 x d_1			□	■
K	1.1		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		□
	1.2		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		□
	2.1				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		□
	2.2				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		□
	3.1						95	0.005 x d_1					95	0.011 x d_1	95	0.011 x d_1	□	■		
	3.2						95	0.005 x d_1					95	0.011 x d_1	95	0.011 x d_1	□	■		
	4.1				175	0.008 x d_1	175	0.008 x d_1			175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		
	4.2				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		
N	1.1		240	0.008 x d_1	240	0.008 x d_1	240	0.008 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1			□	■
	1.2		240	0.008 x d_1	240	0.008 x d_1	240	0.008 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1			□	■
	1.3				195	0.008 x d_1	195	0.008 x d_1			195	0.015 x d_1	195	0.015 x d_1	195	0.015 x d_1			□	■
	1.4				175	0.006 x d_1	175	0.006 x d_1			175	0.013 x d_1	175	0.013 x d_1	175	0.013 x d_1			□	■
	1.5														140	0.011 x d_1			□	■
	1.6														95	0.011 x d_1			□	■
	2.1		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	2.2		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	2.3		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	□	□	■
	2.4				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.5				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.6				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	□	□	■
	2.7						75	0.007 x d_1							75	0.014 x d_1			□	■
	2.8						55	0.006 x d_1							55	0.012 x d_1			□	■
	3.1				175	0.008 x d_1	175	0.008 x d_1			175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1			□	■
	3.2				140	0.008 x d_1	140	0.008 x d_1			140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	4.1		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1		□	□	■
	4.2		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1		□	□	■
	4.3																			
	4.4																			
	5.1																			
	5.2				95	0.005 x d_1	95	0.005 x d_1			95	0.010 x d_1	95	0.010 x d_1	95	0.010 x d_1			□	■
	5.3				120	0.005 x d_1	120	0.005 x d_1			120	0.010 x d_1	120	0.010 x d_1	120	0.010 x d_1	□	■		■
S	1.1				180	0.005 x d_1	180	0.005 x d_1			180	0.010 x d_1	180	0.010 x d_1	180	0.010 x d_1			□	■
	1.2				140	0.005 x d_1	140	0.005 x d_1			140	0.011 x d_1	140	0.011 x d_1	140	0.011 x d_1			□	■
	1.3						120	0.005 x d_1							120	0.011 x d_1			□	■
	2.1				180	0.005 x d_1	180	0.005 x d_1			180	0.010 x d_1	180	0.010 x d_1	180	0.010 x d_1			□	■
	2.2																			
	2.3																			
	2.4																			
	2.5																			
	2.6																			
H	1.1												120	0.014 x d_1	120	0.014 x d_1	□	■		
	1.2														75	0.011 x d_1	□	■		
	1.3																			
	1.4																			
	1.5																			

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

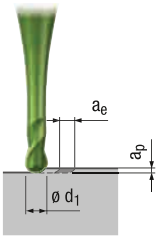
Ball nose – Standard, Long and Extra long lengths

$L_3 = 5 \times D_1$

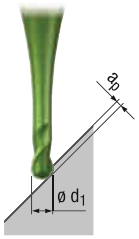
Valid for Tool Nos.:
2771L 2774L 2777L

N

Roughing



Finishing



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

		a_p	0.03 x d_1		0.02 x d_1		0.045 x d_1		0.04 x d_1		0.035 x d_1		0.03 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.045 x d_1		0.04 x d_1		0.035 x d_1		0.03 x d_1					
			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]			MMS MQL	
P	1.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	■
	2.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	■
	3.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	
	4.1				95	0.008 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	■	□	
	5.1				95	0.008 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	■	□	
M	1.1		95	0.008 x d_1	95	0.008 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1			□	■
	2.1		75	0.008 x d_1	75	0.008 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1			□	■
	3.1										75	0.013 x d_1	75	0.013 x d_1			□	■
	4.1												40	0.010 x d_1			□	■
K	1.1		160	0.007 x d_1	160	0.007 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	□	■		□
	1.2		160	0.007 x d_1	160	0.007 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	□	■		□
	2.1				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		□
	2.2				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		□
	3.1				75	0.005 x d_1							75	0.010 x d_1	□	■		
	3.2				75	0.005 x d_1							75	0.010 x d_1	□	■		
	4.1				160	0.006 x d_1					160	0.012 x d_1	160	0.012 x d_1	□	■		
	4.2				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		
N	1.1		195	0.007 x d_1	195	0.007 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1			□	■
	1.2		195	0.007 x d_1	195	0.007 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1			□	■
	1.3				175	0.006 x d_1					175	0.013 x d_1	175	0.013 x d_1			□	■
	1.4				175	0.006 x d_1					175	0.011 x d_1	175	0.011 x d_1			□	■
	1.5												120	0.010 x d_1			□	■
	1.6												75	0.014 x d_1			□	■
	2.1		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.2		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.3		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	□	□	■
	2.4				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1			□	■
	2.5				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1			□	■
	2.6				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	□	□	■
	2.7				70	0.006 x d_1							70	0.012 x d_1			□	■
	2.8				45	0.005 x d_1							45	0.010 x d_1			□	■
	3.1				160	0.006 x d_1					160	0.013 x d_1	160	0.013 x d_1			□	■
	3.2				120	0.007 x d_1					120	0.014 x d_1	120	0.014 x d_1			□	■
	4.1		140	0.007 x d_1	140	0.007 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1		□	□	■
	4.2		95	0.008 x d_1	95	0.008 x d_1	95	0.016 x d_1	95	0.016 x d_1	95	0.016 x d_1	95	0.016 x d_1		□	□	■
	4.3																	
	4.4																	
	5.1																	
	5.2				75	0.005 x d_1					75	0.010 x d_1	75	0.010 x d_1			□	■
	5.3				120	0.004 x d_1					120	0.008 x d_1	120	0.008 x d_1	□	■		■
S	1.1		120	0.005 x d_1	120	0.005 x d_1			120	0.011 x d_1	120	0.011 x d_1	120	0.011 x d_1			□	■
	1.2		95	0.006 x d_1	95	0.006 x d_1			95	0.012 x d_1	95	0.012 x d_1	95	0.012 x d_1			□	■
	1.3				95	0.005 x d_1							95	0.011 x d_1			□	■
	2.1		120	0.005 x d_1	120	0.005 x d_1			120	0.011 x d_1	120	0.011 x d_1	120	0.011 x d_1			□	■
	2.2																	
	2.3																	
	2.4																	
	2.5																	
	2.6																	
H	1.1										95	0.014 x d_1	95	0.014 x d_1	□	■		
	1.2												70	0.010 x d_1	□	■		
	1.3																	
	1.4																	
	1.5																	

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

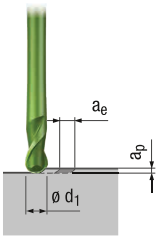
Ball nose – Standard, Long and Extra long lengths

$L_3 = 10 \times D_1$

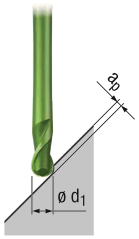
Valid for Tool Nos.:
2772L 2775L 2778L

N

Roughing



Finishing



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

		a_p	0.03 x d_1		0.025 x d_1		0.02 x d_1		0.01 x d_1		0.03 x d_1		0.025 x d_1		0.02 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.03 x d_1		0.025 x d_1		0.02 x d_1					
			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]			MMS MQL	
P	1.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	■
	2.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	■
	3.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	
	4.1				75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1					75	0.015 x d_1	□	■	□	
	5.1				75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1					75	0.015 x d_1	□	■	□	
M	1.1		75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1			□	■
	2.1		55	0.008 x d_1	55	0.008 x d_1	55	0.008 x d_1	55	0.008 x d_1	55	0.015 x d_1	55	0.015 x d_1	55	0.015 x d_1			□	■
	3.1												55	0.012 x d_1	55	0.012 x d_1			□	■
	4.1														45	0.012 x d_1			□	■
K	1.1		140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.010 x d_1	140	0.010 x d_1	140	0.010 x d_1	□	■		□
	1.2		140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.010 x d_1	140	0.010 x d_1	140	0.010 x d_1	□	■		□
	2.1				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		□
	2.2				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		□
	3.1						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1	□	■		
	3.2						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1	□	■		
	4.1				140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1			140	0.010 x d_1	140	0.010 x d_1	□	■		
	4.2				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		
N	1.1		175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.011 x d_1	175	0.011 x d_1	175	0.011 x d_1			□	■
	1.2		175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.011 x d_1	175	0.011 x d_1	175	0.011 x d_1			□	■
	1.3				160	0.006 x d_1	160	0.006 x d_1	160	0.006 x d_1			160	0.011 x d_1	160	0.011 x d_1			□	■
	1.4				160	0.005 x d_1	160	0.005 x d_1	160	0.005 x d_1			160	0.010 x d_1	160	0.010 x d_1			□	■
	1.5														95	0.011 x d_1			□	■
	1.6														55	0.015 x d_1			□	■
	2.1		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1			□	■
	2.2		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1			□	■
	2.3		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1	□	□	□	■
	2.4				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1			□	■
	2.5				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1			□	■
	2.6				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	□	□	■
	2.7						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1			□	■
	2.8								40	0.005 x d_1					40	0.010 x d_1			□	■
	3.1								140	0.005 x d_1					140	0.010 x d_1			□	■
	3.2								95	0.007 x d_1					95	0.014 x d_1			□	■
	4.1						120	0.006 x d_1	120	0.006 x d_1	120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1		□	□	■
	4.2						75	0.005 x d_1	75	0.005 x d_1	75	0.010 x d_1	75	0.010 x d_1	75	0.010 x d_1		□	□	■
	4.3																			
	4.4																			
	5.1																			
	5.2								55	0.005 x d_1					55	0.010 x d_1			□	■
	5.3								120	0.004 x d_1					120	0.008 x d_1	□	■		■
S	1.1						95	0.005 x d_1	95	0.005 x d_1			95	0.010 x d_1	95	0.010 x d_1			□	■
	1.2						75	0.005 x d_1	75	0.005 x d_1			75	0.010 x d_1	75	0.010 x d_1			□	■
	1.3								75	0.005 x d_1					75	0.010 x d_1			□	■
	2.1						95	0.005 x d_1	95	0.005 x d_1			95	0.009 x d_1	95	0.009 x d_1			□	■
	2.2																			
	2.3																			
	2.4																			
	2.5																			
	2.6																			
H	1.1												75	0.013 x d_1	75	0.013 x d_1	□	■		
	1.2														55	0.010 x d_1	□	■		
	1.3																			
	1.4																			
	1.5																			

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

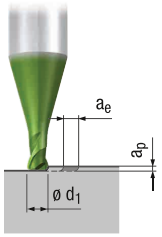
Torus – Standard, Long and Extra long lengths

$L_3 = 2.2 \times D_1$

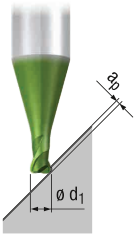
Valid for Tool Nos.:
2780L 2783L 2786L

N

Roughing



Finishing



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

		a_p	0.03 x d_1		0.025 x d_1		0.02 x d_1		0.06 x d_1		0.05 x d_1		0.045 x d_1		0.04 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.06 x d_1		0.05 x d_1		0.045 x d_1		0.04 x d_1					
			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]			MMS MQL	
P	1.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	■
	2.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	■
	3.1		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	□	■	□	
	4.1						120	0.008 x d_1					120	0.015 x d_1	120	0.015 x d_1	□	■	□	
	5.1						120	0.008 x d_1					120	0.015 x d_1	120	0.015 x d_1	□	■	□	
M	1.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.1		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1			□	■
	3.1												95	0.013 x d_1	95	0.013 x d_1			□	■
	4.1												75	0.010 x d_1	75	0.010 x d_1			□	■
K	1.1		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		□
	1.2		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		□
	2.1				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		□
	2.2				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		□
	3.1						95	0.005 x d_1					95	0.011 x d_1	95	0.011 x d_1	□	■		
	3.2						95	0.005 x d_1					95	0.011 x d_1	95	0.011 x d_1	□	■		
	4.1				175	0.008 x d_1	175	0.008 x d_1			175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	□	■		
	4.2				120	0.006 x d_1	120	0.006 x d_1			120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1	□	■		
N	1.1		240	0.008 x d_1	240	0.008 x d_1	240	0.008 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1			□	■
	1.2		240	0.008 x d_1	240	0.008 x d_1	240	0.008 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1	240	0.015 x d_1			□	■
	1.3				195	0.008 x d_1	195	0.008 x d_1			195	0.015 x d_1	195	0.015 x d_1	195	0.015 x d_1			□	■
	1.4				175	0.006 x d_1	175	0.006 x d_1			175	0.013 x d_1	175	0.013 x d_1	175	0.013 x d_1			□	■
	1.5														140	0.011 x d_1			□	■
	1.6														95	0.011 x d_1			□	■
	2.1		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	2.2		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	2.3		140	0.008 x d_1	140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	□	□	■
	2.4				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.5				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.6				120	0.008 x d_1	120	0.008 x d_1			120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	□	□	■
	2.7						75	0.007 x d_1							75	0.014 x d_1			□	■
	2.8						55	0.006 x d_1							55	0.012 x d_1			□	■
	3.1				175	0.008 x d_1	175	0.008 x d_1			175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1			□	■
	3.2				140	0.008 x d_1	140	0.008 x d_1			140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1			□	■
	4.1		175	0.008 x d_1	175	0.008 x d_1	175	0.008 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1	175	0.015 x d_1		□	□	■
	4.2		160	0.008 x d_1	160	0.008 x d_1	160	0.008 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1	160	0.015 x d_1		□	□	■
	4.3																			
	4.4																			
	5.1																			
	5.2				95	0.005 x d_1	95	0.005 x d_1			95	0.010 x d_1	95	0.010 x d_1	95	0.010 x d_1			□	■
	5.3				120	0.005 x d_1	120	0.005 x d_1			120	0.010 x d_1	120	0.010 x d_1	120	0.010 x d_1	□	■		■
S	1.1				180	0.005 x d_1	180	0.005 x d_1			180	0.010 x d_1	180	0.010 x d_1	180	0.010 x d_1			□	■
	1.2				140	0.005 x d_1	140	0.005 x d_1			140	0.011 x d_1	140	0.011 x d_1	140	0.011 x d_1			□	■
	1.3						120	0.005 x d_1							120	0.011 x d_1			□	■
	2.1				180	0.005 x d_1	180	0.005 x d_1			180	0.010 x d_1	180	0.010 x d_1	180	0.010 x d_1			□	■
	2.2																			
	2.3																			
	2.4																			
	2.5																			
	2.6																			
H	1.1												120	0.014 x d_1	120	0.014 x d_1	□	■		
	1.2														75	0.011 x d_1	□	■		
	1.3																			
	1.4																			
	1.5																			

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

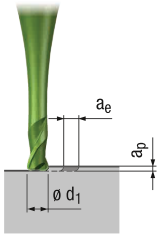
Torus – Standard, Long and Extra long lengths

$L_3 = 5 \times D_1$

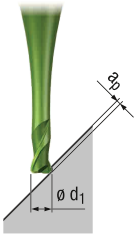
N

Valid for Tool Nos.:
2781L 2784L 2787L

Roughing



Finishing



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

		a_p	0.03 x d_1		0.02 x d_1		0.045 x d_1		0.04 x d_1		0.035 x d_1		0.03 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.045 x d_1		0.04 x d_1		0.035 x d_1		0.03 x d_1					
			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]			MMS MQL	
P	1.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	■
	2.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	■
	3.1		140	0.008 x d_1	140	0.008 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	□	■	□	
	4.1				95	0.008 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	■	□	
	5.1				95	0.008 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	■	□	
M	1.1		95	0.008 x d_1	95	0.008 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1	95	0.015 x d_1			□	■
	2.1		75	0.008 x d_1	75	0.008 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1			□	■
	3.1										75	0.013 x d_1	75	0.013 x d_1			□	■
	4.1												40	0.010 x d_1			□	■
K	1.1		160	0.007 x d_1	160	0.007 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	□	■		□
	1.2		160	0.007 x d_1	160	0.007 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	160	0.014 x d_1	□	■		□
	2.1				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		□
	2.2				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		□
	3.1				75	0.005 x d_1							75	0.010 x d_1	□	■		
	3.2				75	0.005 x d_1							75	0.010 x d_1	□	■		
	4.1				160	0.006 x d_1					160	0.012 x d_1	160	0.012 x d_1	□	■		
	4.2				95	0.007 x d_1					95	0.014 x d_1	95	0.014 x d_1	□	■		
N	1.1		195	0.007 x d_1	195	0.007 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1			□	■
	1.2		195	0.007 x d_1	195	0.007 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1	195	0.014 x d_1			□	■
	1.3				175	0.006 x d_1					175	0.013 x d_1	175	0.013 x d_1			□	■
	1.4				175	0.006 x d_1					175	0.011 x d_1	175	0.011 x d_1			□	■
	1.5												120	0.010 x d_1			□	■
	1.6												75	0.014 x d_1			□	■
	2.1		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.2		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1			□	■
	2.3		120	0.007 x d_1	120	0.007 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	□	□	■
	2.4				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1			□	■
	2.5				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1			□	■
	2.6				95	0.007 x d_1					95	0.015 x d_1	95	0.015 x d_1	□	□	□	■
	2.7				70	0.006 x d_1							70	0.012 x d_1			□	■
	2.8				45	0.005 x d_1							45	0.010 x d_1			□	■
	3.1				160	0.006 x d_1					160	0.013 x d_1	160	0.013 x d_1			□	■
	3.2				120	0.007 x d_1					120	0.014 x d_1	120	0.014 x d_1			□	■
	4.1		140	0.007 x d_1	140	0.007 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1	140	0.015 x d_1		□	□	■
	4.2		95	0.008 x d_1	95	0.008 x d_1	95	0.016 x d_1	95	0.016 x d_1	95	0.016 x d_1	95	0.016 x d_1		□	□	■
	4.3																	
	4.4																	
	5.1																	
	5.2				75	0.005 x d_1					75	0.010 x d_1	75	0.010 x d_1			□	■
	5.3				120	0.004 x d_1					120	0.008 x d_1	120	0.008 x d_1	□	■		■
S	1.1		120	0.005 x d_1	120	0.005 x d_1			120	0.011 x d_1	120	0.011 x d_1	120	0.011 x d_1			□	■
	1.2		95	0.006 x d_1	95	0.006 x d_1			95	0.012 x d_1	95	0.012 x d_1	95	0.012 x d_1			□	■
	1.3				95	0.005 x d_1							95	0.011 x d_1			□	■
	2.1		120	0.005 x d_1	120	0.005 x d_1			120	0.011 x d_1	120	0.011 x d_1	120	0.011 x d_1			□	■
	2.2																	
	2.3																	
	2.4																	
	2.5																	
	2.6																	
H	1.1										95	0.014 x d_1	95	0.014 x d_1	□	■		
	1.2												70	0.010 x d_1	□	■		
	1.3																	
	1.4																	
	1.5																	

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

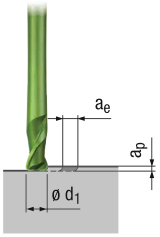
Torus – Standard, Long and Extra long lengths

$L_3 = 10 \times D_1$

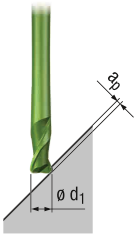
Valid for Tool Nos.:
2782L 2785L 2788L

N

Roughing



Finishing



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

		a_p	0.03 x d_1		0.025 x d_1		0.02 x d_1		0.01 x d_1		0.03 x d_1		0.025 x d_1		0.02 x d_1					
		a_e	0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.3 - 1 x d_1		0.03 x d_1		0.025 x d_1		0.02 x d_1					
			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]			MMS MQL	
P	1.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	■
	2.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	■
	3.1		120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.008 x d_1	120	0.015 x d_1	120	0.015 x d_1	120	0.015 x d_1	□	■	□	
	4.1				75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1					75	0.015 x d_1	□	■	□	
	5.1				75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1					75	0.015 x d_1	□	■	□	
M	1.1		75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1	75	0.008 x d_1	75	0.015 x d_1	75	0.015 x d_1	75	0.015 x d_1			□	■
	2.1		55	0.008 x d_1	55	0.008 x d_1	55	0.008 x d_1	55	0.008 x d_1	55	0.015 x d_1	55	0.015 x d_1	55	0.015 x d_1			□	■
	3.1												55	0.012 x d_1	55	0.012 x d_1			□	■
	4.1														45	0.012 x d_1			□	■
K	1.1		140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.010 x d_1	140	0.010 x d_1	140	0.010 x d_1	□	■		□
	1.2		140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1	140	0.010 x d_1	140	0.010 x d_1	140	0.010 x d_1	□	■		□
	2.1				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		□
	2.2				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		□
	3.1						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1	□	■		
	3.2						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1	□	■		
	4.1				140	0.005 x d_1	140	0.005 x d_1	140	0.005 x d_1			140	0.010 x d_1	140	0.010 x d_1	□	■		
	4.2				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	■		
N	1.1		175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.011 x d_1	175	0.011 x d_1	175	0.011 x d_1			□	■
	1.2		175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.006 x d_1	175	0.011 x d_1	175	0.011 x d_1	175	0.011 x d_1			□	■
	1.3				160	0.006 x d_1	160	0.006 x d_1	160	0.006 x d_1			160	0.011 x d_1	160	0.011 x d_1			□	■
	1.4				160	0.005 x d_1	160	0.005 x d_1	160	0.005 x d_1			160	0.010 x d_1	160	0.010 x d_1			□	■
	1.5														95	0.011 x d_1			□	■
	1.6														55	0.015 x d_1			□	■
	2.1		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1			□	■
	2.2		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1			□	■
	2.3		95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.008 x d_1	95	0.017 x d_1	95	0.017 x d_1	95	0.017 x d_1	□	□	□	■
	2.4				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1			□	■
	2.5				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1			□	■
	2.6				75	0.007 x d_1	75	0.007 x d_1	75	0.007 x d_1			75	0.015 x d_1	75	0.015 x d_1	□	□	□	■
	2.7						55	0.005 x d_1	55	0.005 x d_1					55	0.010 x d_1			□	■
	2.8								40	0.005 x d_1					40	0.010 x d_1			□	■
	3.1								140	0.005 x d_1					140	0.010 x d_1			□	■
	3.2								95	0.007 x d_1					95	0.014 x d_1			□	■
	4.1						120	0.006 x d_1	120	0.006 x d_1	120	0.012 x d_1	120	0.012 x d_1	120	0.012 x d_1		□	□	■
	4.2						75	0.005 x d_1	75	0.005 x d_1	75	0.010 x d_1	75	0.010 x d_1	75	0.010 x d_1		□	□	■
	4.3																			
	4.4																			
	5.1																			
	5.2								55	0.005 x d_1					55	0.010 x d_1			□	■
	5.3								120	0.004 x d_1					120	0.008 x d_1	□	■		■
S	1.1						95	0.005 x d_1	95	0.005 x d_1			95	0.010 x d_1	95	0.010 x d_1			□	■
	1.2						75	0.005 x d_1	75	0.005 x d_1			75	0.010 x d_1	75	0.010 x d_1			□	■
	1.3								75	0.005 x d_1					75	0.010 x d_1			□	■
	2.1						95	0.005 x d_1	95	0.005 x d_1			95	0.009 x d_1	95	0.009 x d_1			□	■
	2.2																			
	2.3																			
	2.4																			
	2.5																			
	2.6																			
H	1.1												75	0.013 x d_1	75	0.013 x d_1	□	■		
	1.2														55	0.010 x d_1	□	■		
	1.3																			
	1.4																			
	1.5																			

v_c = Cutting speed
f_z = Feed per tooth

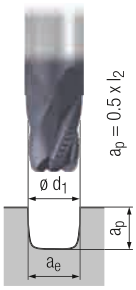
■ = very suitable
□ = suitable

Oval form

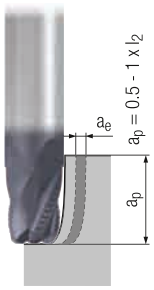
Valid for Tool Nos.:

3552LZ (NR) 3554LZ (N)

NR

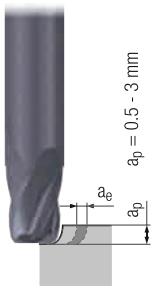


$a_e = d_1$



$a_e = 0.5 - 1$ mm

N



$a_e = 0.1 - 0.3$ mm

		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1	100	0.004 x d_1	140	0.005 x d_1	200	0.005 x d_1		■	□	■
	2.1	90	0.004 x d_1	130	0.004 x d_1	180	0.004 x d_1		■	□	■
	3.1	90	0.003 x d_1	120	0.004 x d_1	160	0.004 x d_1		■	□	■
	4.1	80	0.002 x d_1	110	0.003 x d_1	140	0.003 x d_1		■	□	■
	5.1	70	0.002 x d_1	100	0.003 x d_1	120	0.003 x d_1		■	□	■
M	1.1	80	0.004 x d_1	100	0.005 x d_1	120	0.005 x d_1				■
	2.1	70	0.003 x d_1	80	0.004 x d_1	100	0.004 x d_1				■
	3.1	60	0.002 x d_1	70	0.003 x d_1	80	0.003 x d_1				■
	4.1	60	0.002 x d_1	70	0.003 x d_1	80	0.003 x d_1				■
K	1.1										
	1.2										
	2.1										
	2.2										
	3.1										
	3.2										
	4.1										
	4.2										
N	1.1	280	0.006 x d_1	400	0.006 x d_1	400	0.006 x d_1				■
	1.2	200	0.005 x d_1	280	0.005 x d_1	280	0.005 x d_1				■
	1.3	140	0.004 x d_1	200	0.004 x d_1	200	0.004 x 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										
S	1.1	90	0.002 x d_1	120	0.004 x d_1	120	0.005 x d_1				■
	1.2	75	0.002 x d_1	100	0.003 x d_1	100	0.004 x d_1				■
	1.3	45	0.002 x d_1	60	0.002 x d_1	60	0.003 x d_1				■
	2.1										
	2.2	25	0.002 x d_1	30	0.002 x d_1	30	0.003 x d_1				■
	2.3	25	0.002 x d_1	30	0.002 x d_1	30	0.002 x d_1				■
	2.4	25	0.002 x d_1	30	0.002 x d_1	30	0.003 x d_1				■
	2.5	15	0.002 x d_1	20	0.002 x d_1	20	0.002 x d_1				■
	2.6	25	0.002 x d_1	30	0.002 x d_1	20	0.002 x d_1				■
H	1.1										
	1.2										
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = 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]			MQL	
P	1.1	420	0.004 x d_1	420	0.003 x d_1	□	■	□	■
	2.1	375	0.004 x d_1	375	0.003 x d_1	□	■	□	■
	3.1	315	0.003 x d_1	315	0.003 x d_1	□	■	□	■
	4.1	300	0.003 x d_1	300	0.002 x d_1	□	■		
	5.1	270	0.003 x d_1	270	0.002 x d_1	□	■		
M	1.1	150	0.005 x d_1	150	0.003 x d_1			□	■
	2.1	120	0.005 x d_1	120	0.003 x d_1			□	■
	3.1	90	0.004 x d_1	90	0.002 x d_1			□	■
	4.1	60	0.004 x d_1	60	0.002 x d_1			□	■
K	1.1	280	0.005 x d_1	280	0.004 x d_1	□	■		
	1.2	280	0.005 x d_1	280	0.004 x d_1	□	■		
	2.1	250	0.004 x d_1	250	0.003 x d_1	□	■		
	2.2	250	0.004 x d_1	250	0.003 x d_1	□	■		
	3.1	210	0.004 x d_1	210	0.003 x d_1	□	■		
	3.2	210	0.004 x d_1	210	0.003 x d_1	□	■		
	4.1	180	0.003 x d_1	180	0.002 x d_1	□	■		
	4.2	140	0.003 x d_1	140	0.002 x d_1	□	■		
N	1.1	600	0.004 x d_1	600	0.003 x d_1			□	■
	1.2	600	0.004 x d_1	600	0.003 x d_1			□	■
	1.3	600	0.003 x d_1	600	0.002 x d_1			□	■
	1.4	410	0.004 x d_1	410	0.003 x d_1			□	■
	1.5								
	1.6								
	2.1	270	0.005 x d_1	270	0.004 x d_1			□	■
	2.2	270	0.005 x d_1	270	0.004 x d_1			□	■
	2.3	270	0.005 x d_1	270	0.004 x d_1		□	□	■
	2.4	255	0.004 x d_1	255	0.003 x d_1			□	■
	2.5	255	0.004 x d_1	255	0.003 x d_1			□	■
	2.6	255	0.004 x d_1	255	0.003 x d_1		□	□	■
	2.7	150	0.003 x d_1	150	0.002 x d_1			□	■
	2.8	150	0.003 x d_1	150	0.002 x d_1			□	■
	3.1	410	0.005 x d_1	410	0.004 x d_1			□	■
	3.2	410	0.005 x d_1	410	0.004 x d_1			□	■
	4.1	410	0.005 x d_1	410	0.004 x d_1		□	□	■
	4.2	600	0.005 x d_1	600	0.004 x d_1			□	■
	4.3								
	4.4								
	5.1								
	5.2	150	0.005 x d_1	150	0.003 x d_1				■
	5.3								
S	1.1	100	0.006 x d_1	100	0.004 x d_1				■
	1.2	80	0.005 x d_1	80	0.003 x d_1				■
	1.3	60	0.005 x d_1	60	0.003 x d_1				■
	2.1	80	0.004 x d_1	80	0.002 x d_1				■
	2.2	30	0.004 x d_1	30	0.002 x d_1				■
	2.3	30	0.004 x d_1	30	0.002 x d_1				■
	2.4	30	0.004 x d_1	30	0.002 x d_1				■
	2.5	30	0.004 x d_1	30	0.002 x d_1				■
	2.6	30	0.004 x d_1	30	0.002 x d_1				■
H	1.1	130	0.005 x d_1	130	0.003 x d_1	□	■		
	1.2	100	0.005 x d_1	100	0.003 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Oval form

N

Allowance
0.05 - 0.1 mm

Allowance
0.1 - 0.2 mm

Allowance
0.2 - 0.3 mm

Valid for Tool No.:

3538L

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]			MQL	
P	1.1	420	0.004 x d_1	420	0.003 x d_1	420	0.003 x d_1	□	■	□	■
	2.1	375	0.004 x d_1	375	0.003 x d_1	375	0.003 x d_1	□	■	□	■
	3.1	315	0.003 x d_1	315	0.003 x d_1	315	0.002 x d_1	□	■	□	■
	4.1	300	0.003 x d_1	300	0.002 x d_1	300	0.002 x d_1	□	■		
	5.1	270	0.003 x d_1	270	0.002 x d_1	270	0.002 x d_1	□	■		
M	1.1	150	0.005 x d_1	150	0.004 x d_1	150	0.003 x d_1			□	■
	2.1	120	0.005 x d_1	120	0.004 x d_1	120	0.003 x d_1			□	■
	3.1	90	0.004 x d_1	90	0.003 x d_1	90	0.002 x d_1			□	■
	4.1	60	0.004 x d_1	60	0.003 x d_1	60	0.002 x d_1			□	■
K	1.1	280	0.005 x d_1	280	0.004 x d_1	280	0.003 x d_1	□	■		
	1.2	280	0.005 x d_1	280	0.004 x d_1	280	0.003 x d_1	□	■		
	2.1	250	0.004 x d_1	250	0.003 x d_1	250	0.003 x d_1	□	■		
	2.2	250	0.004 x d_1	250	0.003 x d_1	250	0.003 x d_1	□	■		
	3.1	210	0.004 x d_1	210	0.003 x d_1	210	0.003 x d_1	□	■		
	3.2	210	0.004 x d_1	210	0.003 x d_1	210	0.003 x d_1	□	■		
	4.1	180	0.003 x d_1	180	0.002 x d_1	180	0.002 x d_1	□	■		
	4.2	140	0.003 x d_1	140	0.002 x d_1	140	0.002 x d_1	□	■		
N	1.1	600	0.004 x d_1	600	0.003 x d_1	600	0.003 x d_1			□	■
	1.2	600	0.004 x d_1	600	0.003 x d_1	600	0.003 x d_1			□	■
	1.3	600	0.003 x d_1	600	0.002 x d_1	600	0.002 x d_1			□	■
	1.4	410	0.004 x d_1	410	0.003 x d_1	410	0.003 x d_1			□	■
	1.5										
	1.6										
	2.1	270	0.005 x d_1	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.2	270	0.005 x d_1	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.3	270	0.005 x d_1	270	0.004 x d_1	270	0.003 x d_1		□	□	■
	2.4	255	0.004 x d_1	255	0.003 x d_1	255	0.003 x d_1			□	■
	2.5	255	0.004 x d_1	255	0.003 x d_1	255	0.003 x d_1			□	■
	2.6	255	0.004 x d_1	255	0.003 x d_1	255	0.003 x d_1		□	□	■
	2.7	150	0.003 x d_1	150	0.002 x d_1	150	0.002 x d_1			□	■
	2.8	150	0.003 x d_1	150	0.002 x d_1	150	0.002 x d_1			□	■
	3.1	410	0.005 x d_1	410	0.004 x d_1	410	0.003 x d_1			□	■
	3.2	410	0.005 x d_1	410	0.004 x d_1	410	0.003 x d_1			□	■
	4.1	410	0.005 x d_1	410	0.004 x d_1	410	0.003 x d_1		□	□	■
	4.2	600	0.005 x d_1	600	0.004 x d_1	600	0.003 x d_1			□	■
	4.3										
	4.4										
	5.1										
	5.2	150	0.005 x d_1	150	0.004 x d_1	150	0.003 x d_1				■
	5.3										
S	1.1	100	0.006 x d_1	100	0.005 x d_1	100	0.004 x d_1				■
	1.2	80	0.005 x d_1	80	0.004 x d_1	80	0.003 x d_1				■
	1.3	60	0.005 x d_1	60	0.004 x d_1	60	0.003 x d_1				■
	2.1	80	0.004 x d_1	80	0.003 x d_1	80	0.002 x d_1				■
	2.2	30	0.004 x d_1	30	0.003 x d_1	30	0.002 x d_1				■
	2.3	30	0.004 x d_1	30	0.003 x d_1	30	0.002 x d_1				■
	2.4	30	0.004 x d_1	30	0.003 x d_1	30	0.002 x d_1				■
	2.5	30	0.004 x d_1	30	0.003 x d_1	30	0.002 x d_1				■
	2.6	30	0.004 x d_1	30	0.003 x d_1	30	0.002 x d_1				■
H	1.1	130	0.005 x d_1	130	0.004 x d_1	130	0.003 x d_1	□	■		
	1.2	100	0.005 x d_1	100	0.004 x d_1	100	0.003 x d_1	□	■		
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Oval form

N

Allowance
0.05 - 0.1 mm

Allowance
0.1 - 0.2 mm

Valid for Tool No.:

3539L

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]			MQL	
P	1.1	420	0.003 x d_1	420	0.002 x d_1	□	■	□	■
	2.1	375	0.003 x d_1	375	0.002 x d_1	□	■	□	■
	3.1	315	0.002 x d_1	315	0.002 x d_1	□	■	□	■
	4.1	300	0.002 x d_1	300	0.001 x d_1	□	■		
	5.1	270	0.002 x d_1	270	0.001 x d_1	□	■		
M	1.1	150	0.003 x d_1	150	0.002 x d_1			□	■
	2.1	120	0.003 x d_1	120	0.002 x d_1			□	■
	3.1	90	0.002 x d_1	90	0.001 x d_1			□	■
	4.1	60	0.002 x d_1	60	0.001 x d_1			□	■
K	1.1	280	0.004 x d_1	280	0.003 x d_1	□	■		
	1.2	280	0.004 x d_1	280	0.003 x d_1	□	■		
	2.1	250	0.003 x d_1	250	0.002 x d_1	□	■		
	2.2	250	0.003 x d_1	250	0.002 x d_1	□	■		
	3.1	210	0.003 x d_1	210	0.002 x d_1	□	■		
	3.2	210	0.003 x d_1	210	0.002 x d_1	□	■		
	4.1	180	0.002 x d_1	180	0.001 x d_1	□	■		
	4.2	140	0.002 x d_1	140	0.001 x d_1	□	■		
N	1.1	600	0.003 x d_1	600	0.002 x d_1			□	■
	1.2	600	0.003 x d_1	600	0.002 x d_1			□	■
	1.3	600	0.002 x d_1	600	0.001 x d_1			□	■
	1.4	410	0.003 x d_1	410	0.002 x d_1			□	■
	1.5								
	1.6								
	2.1	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.2	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.3	270	0.004 x d_1	270	0.003 x d_1		□	□	■
	2.4	255	0.003 x d_1	255	0.002 x d_1			□	■
	2.5	255	0.003 x d_1	255	0.002 x d_1			□	■
	2.6	255	0.003 x d_1	255	0.002 x d_1		□	□	■
	2.7	150	0.002 x d_1	150	0.001 x d_1			□	■
	2.8	150	0.002 x d_1	150	0.001 x d_1			□	■
	3.1	410	0.004 x d_1	410	0.003 x d_1			□	■
	3.2	410	0.004 x d_1	410	0.003 x d_1			□	■
	4.1	410	0.004 x d_1	410	0.003 x d_1		□	□	■
	4.2	600	0.004 x d_1	600	0.003 x d_1			□	■
	4.3								
	4.4								
	5.1								
	5.2	150	0.003 x d_1	150	0.002 x d_1				■
	5.3								
S	1.1	100	0.005 x d_1	100	0.004 x d_1				■
	1.2	80	0.004 x d_1	80	0.003 x d_1				■
	1.3	60	0.004 x d_1	60	0.003 x d_1				■
	2.1	80	0.003 x d_1	80	0.002 x d_1				■
	2.2	30	0.003 x d_1	30	0.002 x d_1				■
	2.3	30	0.003 x d_1	30	0.002 x d_1				■
	2.4	30	0.003 x d_1	30	0.002 x d_1				■
	2.5	30	0.003 x d_1	30	0.002 x d_1				■
	2.6	30	0.003 x d_1	30	0.002 x d_1				■
H	1.1	130	0.004 x d_1	130	0.003 x d_1	□	■		
	1.2	100	0.004 x d_1	100	0.003 x d_1	□	■		
	1.3	80	0.003 x d_1	80	0.002 x d_1	□	■		
	1.4								
	1.5								

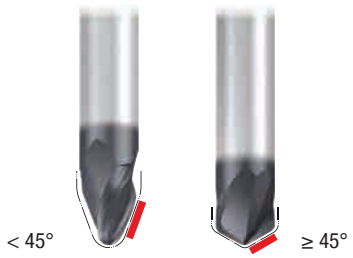
v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

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.

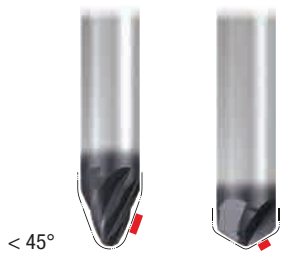
		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1	420	0.004 x d_1	420	0.003 x d_1	□	■	□	■
	2.1	375	0.004 x d_1	375	0.003 x d_1	□	■	□	■
	3.1	315	0.003 x d_1	315	0.003 x d_1	□	■	□	■
	4.1	300	0.003 x d_1	300	0.002 x d_1	□	■		
	5.1	270	0.003 x d_1	270	0.002 x d_1	□	■		
M	1.1	150	0.004 x d_1	150	0.003 x d_1			□	■
	2.1	120	0.004 x d_1	120	0.003 x d_1			□	■
	3.1	90	0.003 x d_1	90	0.002 x d_1			□	■
	4.1	60	0.003 x d_1	60	0.002 x d_1			□	■
K	1.1	280	0.007 x d_1	280	0.004 x d_1	□	■		
	1.2	280	0.007 x d_1	280	0.004 x d_1	□	■		
	2.1	250	0.006 x d_1	250	0.003 x d_1	□	■		
	2.2	250	0.006 x d_1	250	0.003 x d_1	□	■		
	3.1	210	0.006 x d_1	210	0.003 x d_1	□	■		
	3.2	210	0.006 x d_1	210	0.003 x d_1	□	■		
	4.1	180	0.004 x d_1	180	0.002 x d_1	□	■		
	4.2	140	0.003 x d_1	140	0.002 x d_1	□	■		
N	1.1	600	0.004 x d_1	600	0.003 x d_1			□	■
	1.2	600	0.004 x d_1	600	0.003 x d_1			□	■
	1.3	600	0.003 x d_1	600	0.002 x d_1			□	■
	1.4	410	0.004 x d_1	410	0.003 x d_1			□	■
	1.5								
	1.6								
	2.1	270	0.005 x d_1	270	0.004 x d_1			□	■
	2.2	270	0.005 x d_1	270	0.004 x d_1			□	■
	2.3	270	0.005 x d_1	270	0.004 x d_1		□	□	■
	2.4	255	0.004 x d_1	255	0.003 x d_1			□	■
	2.5	255	0.004 x d_1	255	0.003 x d_1			□	■
	2.6	255	0.004 x d_1	255	0.003 x d_1		□	□	■
	2.7	150	0.003 x d_1	150	0.002 x d_1			□	■
	2.8	150	0.003 x d_1	150	0.002 x d_1			□	■
	3.1	410	0.005 x d_1	410	0.004 x d_1			□	■
	3.2	410	0.005 x d_1	410	0.004 x d_1			□	■
	4.1	410	0.005 x d_1	410	0.004 x d_1		□	□	■
	4.2	600	0.005 x d_1	600	0.004 x d_1			□	■
	4.3								
	4.4								
	5.1								
	5.2	150	0.004 x d_1	150	0.003 x d_1				■
	5.3								
S	1.1	100	0.005 x d_1	100	0.004 x d_1				■
	1.2	80	0.004 x d_1	80	0.003 x d_1				■
	1.3	60	0.004 x d_1	60	0.003 x d_1				■
	2.1	80	0.003 x d_1	80	0.002 x d_1				■
	2.2	30	0.003 x d_1	30	0.002 x d_1				■
	2.3	30	0.003 x d_1	30	0.002 x d_1				■
	2.4	30	0.003 x d_1	30	0.002 x d_1				■
	2.5	30	0.003 x d_1	30	0.002 x d_1				■
	2.6	30	0.003 x d_1	30	0.002 x d_1				■
H	1.1	130	0.005 x d_1	130	0.003 x d_1	□	■		
	1.2	100	0.005 x d_1	100	0.003 x d_1	□	■		
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

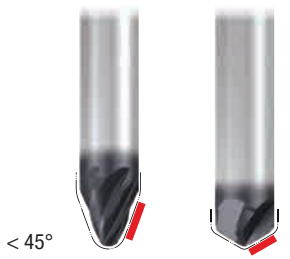
■ = very suitable
□ = suitable

Taper form

N



Allowance
0.05 - 0.1 mm



Allowance
0.1 - 0.2 mm

Valid for Tool No.:

3541L

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]			MQL	
P	1.1	420	0.003 x d_1	420	0.002 x d_1	□	■	□	■
	2.1	375	0.003 x d_1	375	0.002 x d_1	□	■	□	■
	3.1	315	0.002 x d_1	315	0.002 x d_1	□	■	□	■
	4.1	300	0.002 x d_1	300	0.001 x d_1	□	■		
	5.1	270	0.002 x d_1	270	0.001 x d_1	□	■		
M	1.1	150	0.003 x d_1	150	0.002 x d_1			□	■
	2.1	120	0.003 x d_1	120	0.002 x d_1			□	■
	3.1	90	0.002 x d_1	90	0.001 x d_1			□	■
	4.1	60	0.002 x d_1	60	0.001 x d_1			□	■
K	1.1	280	0.004 x d_1	280	0.003 x d_1	□	■		
	1.2	280	0.004 x d_1	280	0.003 x d_1	□	■		
	2.1	250	0.003 x d_1	250	0.002 x d_1	□	■		
	2.2	250	0.003 x d_1	250	0.002 x d_1	□	■		
	3.1	210	0.003 x d_1	210	0.002 x d_1	□	■		
	3.2	210	0.003 x d_1	210	0.002 x d_1	□	■		
	4.1	180	0.002 x d_1	180	0.001 x d_1	□	■		
	4.2	140	0.002 x d_1	140	0.001 x d_1	□	■		
N	1.1	600	0.003 x d_1	600	0.002 x d_1			□	■
	1.2	600	0.003 x d_1	600	0.002 x d_1			□	■
	1.3	600	0.002 x d_1	600	0.001 x d_1			□	■
	1.4	410	0.003 x d_1	410	0.002 x d_1			□	■
	1.5								
	1.6								
	2.1	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.2	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.3	270	0.004 x d_1	270	0.003 x d_1		□	□	■
	2.4	255	0.003 x d_1	255	0.002 x d_1			□	■
	2.5	255	0.003 x d_1	255	0.002 x d_1			□	■
	2.6	255	0.003 x d_1	255	0.002 x d_1		□	□	■
	2.7	150	0.002 x d_1	150	0.001 x d_1			□	■
	2.8	150	0.002 x d_1	150	0.001 x d_1			□	■
	3.1	410	0.004 x d_1	410	0.003 x d_1			□	■
	3.2	410	0.004 x d_1	410	0.003 x d_1			□	■
	4.1	410	0.004 x d_1	410	0.003 x d_1		□	□	■
	4.2	600	0.004 x d_1	600	0.003 x d_1			□	■
	4.3								
	4.4								
	5.1								
	5.2	150	0.003 x d_1	150	0.002 x d_1				■
	5.3								
S	1.1	100	0.005 x d_1	100	0.004 x d_1				■
	1.2	80	0.004 x d_1	80	0.003 x d_1				■
	1.3	60	0.004 x d_1	60	0.003 x d_1				■
	2.1	80	0.003 x d_1	80	0.002 x d_1				■
	2.2	30	0.003 x d_1	30	0.002 x d_1				■
	2.3	30	0.003 x d_1	30	0.002 x d_1				■
	2.4	30	0.003 x d_1	30	0.002 x d_1				■
	2.5	30	0.003 x d_1	30	0.002 x d_1				■
	2.6	30	0.003 x d_1	30	0.002 x d_1				■
H	1.1	130	0.004 x d_1	130	0.003 x d_1	□	■		
	1.2	100	0.004 x d_1	100	0.003 x d_1	□	■		
	1.3	80	0.003 x d_1	80	0.002 x d_1	□	■		
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

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]			MQL	
P	1.1	420	0.004 x d_1	420	0.003 x d_1	□	■	□	■
	2.1	375	0.004 x d_1	375	0.003 x d_1	□	■	□	■
	3.1	315	0.003 x d_1	315	0.003 x d_1	□	■	□	■
	4.1	300	0.003 x d_1	300	0.002 x d_1	□	■		
	5.1	270	0.003 x d_1	270	0.002 x d_1	□	■		
M	1.1	150	0.005 x d_1	150	0.003 x d_1			□	■
	2.1	120	0.005 x d_1	120	0.003 x d_1			□	■
	3.1	90	0.004 x d_1	90	0.002 x d_1			□	■
	4.1	60	0.004 x d_1	60	0.002 x d_1			□	■
K	1.1	300	0.005 x d_1	300	0.004 x d_1	□	■		
	1.2	300	0.005 x d_1	300	0.004 x d_1	□	■		
	2.1	270	0.004 x d_1	270	0.003 x d_1	□	■		
	2.2	270	0.004 x d_1	270	0.003 x d_1	□	■		
	3.1	220	0.004 x d_1	220	0.003 x d_1	□	■		
	3.2	220	0.004 x d_1	220	0.003 x d_1	□	■		
	4.1	200	0.003 x d_1	200	0.002 x d_1	□	■		
	4.2	150	0.003 x d_1	150	0.002 x d_1	□	■		
N	1.1	900	0.004 x d_1	900	0.003 x d_1			□	■
	1.2	900	0.004 x d_1	900	0.003 x d_1			□	■
	1.3	900	0.003 x d_1	900	0.002 x d_1			□	■
	1.4	600	0.004 x d_1	600	0.003 x d_1			□	■
	1.5								
	1.6								
	2.1	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.2	270	0.004 x d_1	270	0.003 x d_1			□	■
	2.3	270	0.004 x d_1	270	0.003 x d_1		□	□	■
	2.4	255	0.003 x d_1	255	0.002 x d_1			□	■
	2.5	255	0.003 x d_1	255	0.002 x d_1			□	■
	2.6	255	0.003 x d_1	255	0.002 x d_1		□	□	■
	2.7	150	0.003 x d_1	150	0.002 x d_1			□	■
	2.8	150	0.003 x d_1	150	0.002 x d_1			□	■
	3.1	600	0.004 x d_1	600	0.003 x d_1			□	■
	3.2	600	0.004 x d_1	600	0.003 x d_1			□	■
	4.1								
	4.2								
	4.3								
	4.4								
	5.1								
	5.2	150	0.005 x d_1	150	0.003 x d_1				■
	5.3								
S	1.1	150	0.006 x d_1	150	0.004 x d_1				■
	1.2	120	0.005 x d_1	120	0.003 x d_1				■
	1.3	90	0.005 x d_1	90	0.003 x d_1				■
	2.1	120	0.004 x d_1	120	0.002 x d_1				■
	2.2								
	2.3								
	2.4								
	2.5								
	2.6								
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

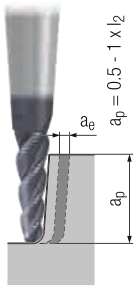
Tapered ball nose

NR

Valid for Tool No.:

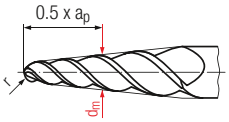
3546L

a_e < 100%



a_e = 0.5 - 1 mm

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



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

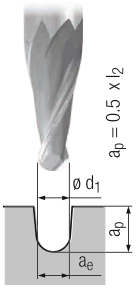
		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1	100	0.014 x r	120	0.018 x r		■	□	■
	2.1	90	0.012 x r	110	0.016 x r		■	□	■
	3.1	90	0.010 x r	100	0.014 x r		■	□	■
	4.1	80	0.010 x r	100	0.012 x r		■	□	■
	5.1	70	0.010 x r	90	0.012 x r		■	□	■
M	1.1	100	0.014 x r	120	0.018 x r				■
	2.1	100	0.013 x 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				■
K	1.1								
	1.2								
	2.1								
	2.2								
	3.1								
	3.2								
	4.1								
	4.2								
N	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								
S	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				■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

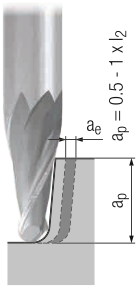
■ = very suitable
□ = suitable

Tapered ball nose

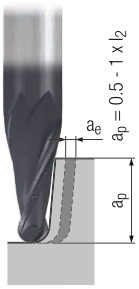
NF



$a_e = d_1$



a_e = 0.1 - 1.0 mm

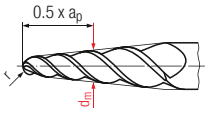


a_e = 0.1 - 1.0 mm

Valid for Tool Nos.:

3446
3446L
3447

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



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

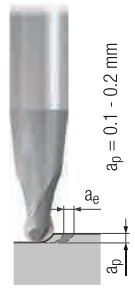
		Uncoated				ALCR					
		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1					160	0.010 x r	□	■	□	■
	2.1					140	0.010 x r	□	■	□	■
	3.1					120	0.008 x r	□	■	□	
	4.1					100	0.008 x r	□	■	□	
	5.1					80	0.006 x r	□	■	□	
M	1.1					80	0.006 x r			□	■
	2.1					70	0.006 x r			□	■
	3.1										
	4.1										
K	1.1					160	0.010 x r	■	■		
	1.2					160	0.010 x r	■	■		
	2.1					140	0.008 x r	■	■		
	2.2					140	0.008 x r	■	■		
	3.1					120	0.008 x r	■	■		
	3.2					120	0.008 x r	■	■		
	4.1					100	0.006 x r	■	■		
	4.2					80	0.006 x r	■	■		
N	1.1	350	0.040 x r	300	0.020 x r	350	0.016 x r			□	■
	1.2	350	0.040 x r	300	0.020 x r	350	0.014 x r			□	■
	1.3	320	0.035 x r	270	0.017 x r	350	0.012 x r			□	■
	1.4					280	0.014 x r			□	■
	1.5					240	0.012 x r			□	■
	1.6										
	2.1					140	0.010 x r			□	■
	2.2					140	0.010 x r			□	■
	2.3					140	0.010 x r	□	□	□	■
	2.4					120	0.008 x r			□	■
	2.5					120	0.008 x r			□	■
	2.6					120	0.008 x r	□	□	□	■
	2.7					70	0.006 x r			□	■
	2.8					70	0.006 x r			□	■
	3.1					320	0.018 x r			□	■
	3.2					320	0.014 x r			□	■
	4.1			180	0.016 x r	240	0.016 x r		□	□	■
	4.2			160	0.016 x r	350	0.016 x r		□	□	■
	4.3					180	0.012 x r		□	□	■
	4.4					90	0.012 x r		□	□	■
	5.1										
	5.2					80	0.006 x r			□	■
	5.3					160	0.012 x r	□	■		■
S	1.1					80	0.008 x r			□	■
	1.2					60	0.006 x r			□	■
	1.3					40	0.006 x r			□	■
	2.1					50	0.006 x r			□	■
	2.2					20	0.004 x r			□	■
	2.3					20	0.004 x r			□	■
	2.4					20	0.004 x r			□	■
	2.5					15	0.004 x r			□	■
	2.6					20	0.004 x r			□	■
H	1.1										
	1.2										
	1.3										
	1.4										
	1.5										

v_c = Cutting speed
f_z = Feed per tooth

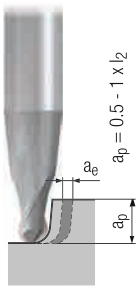
■ = very suitable
□ = suitable

Tapered ball nose

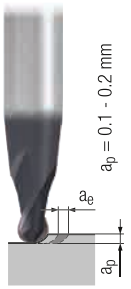
N



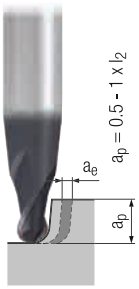
a_e = 0.1 - 0.2 mm



a_e = 0.1 - 0.2 mm



a_e = 0.1 - 0.2 mm

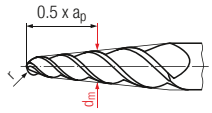


a_e = 0.1 - 0.2 mm

Valid for Tool Nos.:

3442
3442L
3443

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



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

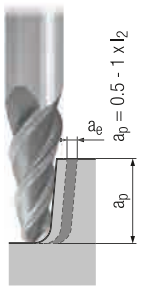
		Uncoated				ALCR							
		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1					300	0.010 x r	160	0.010 x r	□	■	□	■
	2.1					260	0.010 x r	140	0.010 x r	□	■	□	■
	3.1					220	0.008 x r	120	0.008 x r	□	■	□	
	4.1					180	0.008 x r	100	0.008 x r	□	■	□	
	5.1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

v_c = Cutting speed
f_z = Feed per tooth

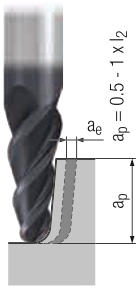
■ = very suitable
□ = suitable

Tapered ball nose

N



a_e = 0.1 - 0.2 mm

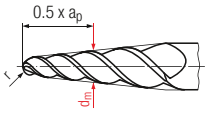


a_e = 0.1 - 0.2 mm

Valid for Tool Nos.:

3440
3440L
3441

For the calculation of rpm (n), use the average diameter d_m (measuring point at 0.5 x 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]			MQL	
P	1.1			120	0.010 x r	□	■	□	■
	2.1			100	0.010 x r	□	■	□	■
	3.1			90	0.008 x r	□	■	□	
	4.1			70	0.008 x r	□	■	□	
	5.1			60	0.006 x r	□	■	□	
M	1.1			60	0.006 x r			□	■
	2.1			50	0.006 x r			□	■
	3.1								
	4.1								
K	1.1			120	0.010 x r	■	■		
	1.2			120	0.010 x r	■	■		
	2.1			100	0.008 x r	■	■		
	2.2			100	0.008 x r	■	■		
	3.1			90	0.008 x r	■	■		
	3.2			90	0.008 x r	■	■		
	4.1			70	0.006 x r	■	■		
	4.2			60	0.006 x r	■	■		
N	1.1	180	0.016 x r	260	0.016 x r			□	■
	1.2	180	0.014 x r	260	0.014 x r			□	■
	1.3	180	0.012 x r	260	0.012 x r			□	■
	1.4			200	0.014 x r			□	■
	1.5			180	0.012 x r			□	■
	1.6								
	2.1			100	0.010 x r			□	■
	2.2			100	0.010 x r			□	■
	2.3			100	0.010 x r	□	□	□	■
	2.4			80	0.008 x r			□	■
	2.5			80	0.008 x r			□	■
	2.6			80	0.008 x r	□	□	□	■
	2.7			50	0.006 x r			□	■
	2.8			50	0.006 x r			□	■
	3.1			240	0.018 x r			□	■
	3.2			240	0.014 x r			□	■
	4.1	130	0.016 x r	180	0.016 x r		□	□	■
	4.2	110	0.016 x r	160	0.016 x r		□	□	■
	4.3			100	0.012 x r		□	□	■
	4.4			70	0.012 x r		□	□	■
	5.1								
	5.2			60	0.006 x r			□	■
	5.3			120	0.012 x r	□	■		■
S	1.1			60	0.008 x r			□	■
	1.2			50	0.006 x r			□	■
	1.3			30	0.006 x r			□	■
	2.1			40	0.006 x r			□	■
	2.2			15	0.004 x r			□	■
	2.3			15	0.004 x r			□	■
	2.4			15	0.004 x r			□	■
	2.5			10	0.004 x r			□	■
	2.6			15	0.004 x r			□	■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Tapered ball nose

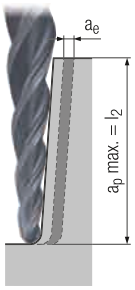
N

Valid for Tool Nos.:

3550L 3548L

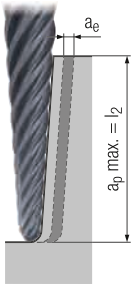
3550L

a_e = 0.5 - 1 mm



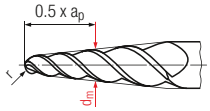
a_e = 0.1 - 0.2 mm

3548L



a_e = 0.1 - 0.2 mm

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



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

		3550L v_c [m/min]	3550L f_z [mm]	3548L v_c [m/min]	3548L f_z [mm]	3548L v_c [m/min]	3548L f_z [mm]			MQL	
P	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		■		
M	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				■
N	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				■
S	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				■

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

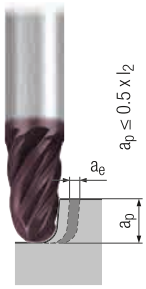
Tapered ball nose

N

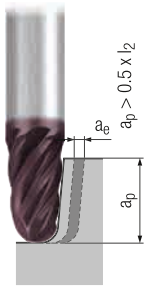
Valid for Tool No.:

2679A

Pre-finishing

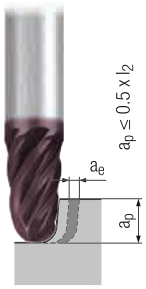


a_e = 0.5 mm

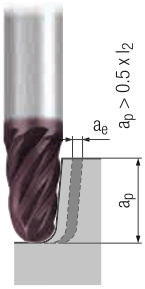


a_e = 0.5 mm

Finishing

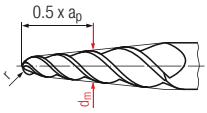


a_e = 0.2 mm



a_e = 0.2 mm

For the calculation of rpm (n), use the average diameter d_m (measuring point at 0.5 x 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]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1	130	0.008 x r	100	0.007 x r	160	0.011 x r	120	0.009 x r	□	■	□	■
	2.1	120	0.007 x r	90	0.006 x r	150	0.010 x r	110	0.008 x r	□	■	□	■
	3.1	110	0.006 x r	90	0.006 x r	140	0.009 x r	100	0.007 x r	□	■	□	
	4.1	110	0.006 x r	80	0.005 x r	130	0.008 x r	100	0.006 x r	□	■	□	
	5.1	100	0.005 x r	80	0.004 x r	120	0.007 x r	90	0.005 x r	□	■	□	
M	1.1	70	0.006 x r	60	0.005 x r	90	0.008 x r	70	0.006 x r			□	■
	2.1	60	0.005 x r	50	0.004 x r	80	0.007 x r	60	0.005 x r			□	■
	3.1	50	0.004 x r	40	0.004 x r	60	0.006 x r	40	0.005 x r			□	■
	4.1	30	0.004 x r	30	0.003 x r	40	0.005 x r	30	0.004 x r			□	■
K	1.1	150	0.010 x r	120	0.008 x r	190	0.013 x r	140	0.011 x r	□	■		□
	1.2	150	0.010 x r	120	0.008 x r	190	0.013 x r	140	0.011 x r	□	■		□
	2.1	140	0.009 x r	110	0.008 x r	170	0.012 x r	130	0.010 x r	□	■		□
	2.2	140	0.009 x r	110	0.008 x r	170	0.012 x r	130	0.010 x r	□	■		□
	3.1	130	0.008 x r	100	0.007 x r	160	0.011 x r	120	0.009 x r	□	■		□
	3.2	130	0.008 x r	100	0.007 x r	160	0.011 x r	120	0.009 x r	□	■		□
	4.1	110	0.007 x r	90	0.006 x r	140	0.010 x r	100	0.008 x r	□	■		□
	4.2	100	0.006 x r	80	0.006 x r	120	0.009 x r	90	0.007 x r	□	■		
N	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			□	■
	2.2	160	0.008 x r	130	0.007 x r	200	0.011 x r	150	0.009 x r			□	■
	2.3	160	0.008 x r	130	0.007 x r	200	0.011 x r	150	0.009 x r			□	■
	2.4	140	0.006 x r	110	0.006 x r	170	0.009 x r	130	0.007 x r			□	■
	2.5	140	0.006 x r	110	0.006 x r	170	0.009 x r	130	0.007 x r			□	■
	2.6	140	0.006 x r	110	0.006 x r	170	0.009 x r	130	0.007 x r			□	■
	2.7	90	0.006 x r	70	0.005 x r	110	0.008 x r	80	0.006 x r			□	■
	2.8	90	0.006 x r	70	0.005 x r	110	0.008 x r	80	0.006 x r			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2												
	5.3												
S	1.1	100	0.008 x r	80	0.007 x r	120	0.011 x r	90	0.009 x r			□	■
	1.2	70	0.007 x r	60	0.006 x r	90	0.010 x r	70	0.008 x r			□	■
	1.3	50	0.006 x r	40	0.006 x r	60	0.009 x r	40	0.007 x r			□	■
	2.1	70	0.007 x r	50	0.006 x r	90	0.010 x r	60	0.008 x r			□	■
	2.2	30	0.006 x r	20	0.005 x r	40	0.008 x r	30	0.006 x r			□	■
	2.3	20	0.005 x r	20	0.004 x r	30	0.007 x r	20	0.005 x r			□	■
	2.4	30	0.006 x r	20	0.005 x r	40	0.008 x r	30	0.006 x r			□	■
	2.5	20	0.005 x r	10	0.004 x r	20	0.007 x r	20	0.005 x r			□	■
	2.6	20	0.004 x r	20	0.004 x r	30	0.006 x r	20	0.005 x r			□	■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

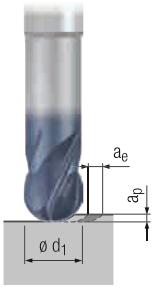
Ball nose – standard length (4 flutes)

H

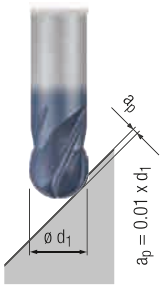
Valid for Tool Nos.:

2834A
2942A

Roughing



Finishing



		v_c [m/min]	f_z [mm]	a_e [mm]	a_p [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1	280	0.011 x d_1	0.1 x d_1	0.05 x d_1	360	0.008 x d_1	□	■	□	■
	2.1	240	0.011 x d_1	0.1 x d_1	0.05 x d_1	320	0.008 x d_1	□	■	□	■
	3.1	210	0.009 x d_1	0.1 x d_1	0.05 x d_1	270	0.007 x d_1	□	■	□	
	4.1	170	0.008 x d_1	0.1 x d_1	0.05 x d_1	220	0.006 x d_1	□	■	□	
	5.1	140	0.006 x d_1	0.1 x d_1	0.05 x d_1	180	0.0054 x d_1	□	■	□	
M	1.1										
	2.1										
	3.1										
	4.1										
K	1.1	280	0.011 x d_1	0.1 x d_1	0.05 x d_1	360	0.008 x d_1	□	■		□
	1.2	280	0.011 x d_1	0.1 x d_1	0.05 x d_1	360	0.008 x d_1	□	■		□
	2.1	250	0.009 x d_1	0.1 x d_1	0.05 x d_1	320	0.006 x d_1	□	■		□
	2.2	250	0.009 x d_1	0.1 x d_1	0.05 x d_1	320	0.006 x d_1	□	■		□
	3.1	210	0.009 x d_1	0.1 x d_1	0.05 x d_1	270	0.006 x d_1	□	■		
	3.2	210	0.009 x d_1	0.1 x d_1	0.05 x d_1	270	0.006 x d_1	□	■		
	4.1	170	0.006 x d_1	0.1 x d_1	0.05 x d_1	220	0.005 x d_1	□	■		
	4.2	150	0.006 x d_1	0.1 x d_1	0.05 x d_1	180	0.005 x d_1	□	■		
N	1.1										
	1.2										
	1.3										
	1.4										
	1.5										
	1.6										
	2.1										
	2.2	250	0.011 x d_1	0.1 x d_1	0.05 x d_1	320	0.008 x d_1			□	■
	2.3	250	0.011 x d_1	0.1 x d_1	0.05 x d_1	320	0.008 x d_1	□	□	□	■
	2.4	210	0.009 x d_1	0.1 x d_1	0.05 x d_1	270	0.007 x d_1			□	■
	2.5	210	0.009 x d_1	0.1 x d_1	0.05 x d_1	270	0.007 x d_1			□	■
	2.6	210	0.009 x d_1	0.1 x d_1	0.05 x d_1	270	0.007 x d_1	□	□	□	■
	2.7	130	0.006 x d_1	0.1 x d_1	0.05 x d_1	170	0.006 x d_1			□	■
	2.8	130	0.006 x d_1	0.1 x d_1	0.05 x d_1	170	0.005 x d_1			□	■
	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	130	0.008 x d_1	0.05 x d_1	0.02 x d_1	180	0.006 x d_1	□	■		
	1.2	120	0.007 x d_1	0.05 x d_1	0.02 x d_1	160	0.005 x d_1	□	■		
	1.3					140	0.005 x d_1	□	■		
	1.4					110	0.004 x d_1	□	■		
	1.5					90	0.003 x d_1	□	■		

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

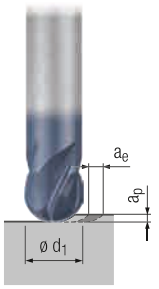
Ball nose – long length (4 flutes)

H

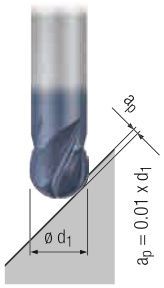
Valid for Tool Nos.:

2842A
2943A

Roughing



Finishing



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

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

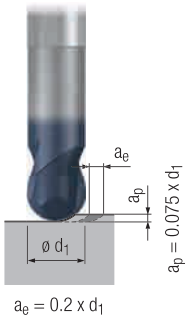
Ball nose “Lollipop” – extra long length (2 flutes)

Valid for Tool No.:

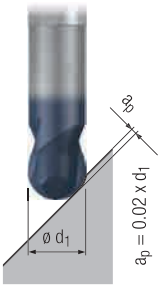
1935A

N

Roughing



Finishing



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

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

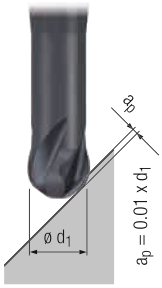
Ball nose “Lollipop” – long length (4 flutes)

Valid for Tool No.:

2564L

N

Finishing



		v_c [m/min]	f_z [mm]			MQL	
P	1.1	280	0.008 x d_1	□	■	□	■
	2.1	260	0.008 x d_1	□	■	□	■
	3.1	240	0.007 x d_1	□	■	□	
	4.1	220	0.006 x d_1	□	■	□	
	5.1	180	0.0054 x d_1	□	■	□	
M	1.1	130	0.006 x d_1			□	■
	2.1	110	0.006 x d_1			□	■
	3.1	80	0.005 x d_1			□	■
	4.1	80	0.005 x d_1			□	■
K	1.1	280	0.008 x d_1	□	■		□
	1.2	260	0.008 x d_1	□	■		□
	2.1	240	0.006 x d_1	□	■		□
	2.2	220	0.006 x d_1	□	■		□
	3.1	200	0.006 x d_1	□	■		
	3.2	200	0.006 x d_1	□	■		
	4.1	180	0.005 x d_1	□	■		
	4.2	150	0.005 x d_1	□	■		
N	1.1						
	1.2						
	1.3						
	1.4						
	1.5						
	1.6						
	2.1	260	0.008 x d_1			□	■
	2.2	260	0.008 x d_1			□	■
	2.3	260	0.008 x d_1	□	□	□	■
	2.4	220	0.007 x d_1			□	■
	2.5	220	0.007 x d_1			□	■
	2.6	220	0.007 x d_1	□	□	□	■
	2.7	130	0.006 x d_1			□	■
	2.8	130	0.005 x d_1			□	■
	3.1						
	3.2						
	4.1						
	4.2						
	4.3						
	4.4						
	5.1						
	5.2						
	5.3						
S	1.1	150	0.006 x d_1				■
	1.2	120	0.005 x d_1				■
	1.3	70	0.005 x d_1				■
	2.1	110	0.006 x d_1				■
	2.2	50	0.004 x d_1				■
	2.3	40	0.004 x d_1				■
	2.4	40	0.004 x d_1				■
	2.5	30	0.003 x d_1				■
	2.6	40	0.003 x d_1				■
H	1.1	160	0.006 x d_1	□	■		
	1.2	140	0.005 x d_1	□	■		
	1.3	120	0.005 x d_1	□	■		
	1.4						
	1.5						

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

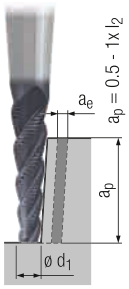
Tapered torus

NR

Valid for Tool Nos.:

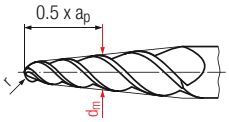
3532LZ
3534LZ

a_e < 100%



a_e = 0.5 - 1 mm

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



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

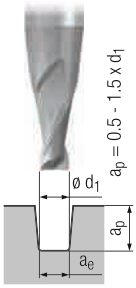
		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
P	1.1	100	0.005 x d_1	140	0.005 x d_1		■	□	■
	2.1	90	0.004 x d_1	130	0.004 x d_1		■	□	■
	3.1	90	0.004 x d_1	120	0.004 x d_1		■	□	■
	4.1	80	0.003 x d_1	110	0.003 x d_1		■	□	■
	5.1	70	0.003 x d_1	100	0.003 x d_1		■	□	■
M	1.1	100	0.004 x d_1	110	0.004 x d_1				■
	2.1	80	0.003 x d_1	90	0.003 x d_1				■
	3.1	60	0.002 x d_1	80	0.002 x d_1				■
	4.1	50	0.002 x d_1	60	0.002 x d_1				■
K	1.1								
	1.2								
	2.1								
	2.2								
	3.1								
	3.2								
	4.1								
	4.2								
N	1.1	280	0.006 x d_1	400	0.006 x d_1				■
	1.2	200	0.005 x d_1	280	0.005 x d_1				■
	1.3	140	0.004 x d_1	200	0.004 x 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								
S	1.1	90	0.002 x d_1	120	0.002 x d_1				■
	1.2	75	0.002 x d_1	100	0.002 x d_1				■
	1.3	45	0.002 x d_1	60	0.002 x d_1				■
	2.1								
	2.2	25	0.002 x d_1	30	0.002 x d_1				■
	2.3	25	0.002 x d_1	30	0.002 x d_1				■
	2.4	25	0.002 x d_1	30	0.002 x d_1				■
	2.5	15	0.002 x d_1	20	0.002 x d_1				■
	2.6	25	0.002 x d_1	30	0.002 x d_1				■
H	1.1								
	1.2								
	1.3								
	1.4								
	1.5								

v_c = Cutting speed
f_z = Feed per tooth

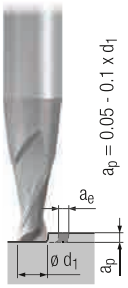
■ = very suitable
□ = suitable

Tapered torus

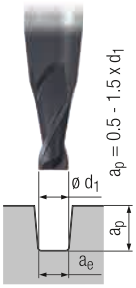
N



$a_e = d_1$



$a_e = 0.3 - 1 \times d_1$



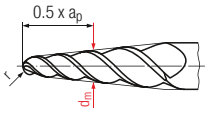
$a_e = d_1$

$a_e = 0.3 - 1 \times d_1$

Valid for Tool Nos.:

3444
3444L
3445

For the calculation of rpm (n), use the average diameter d_m (measuring point at 0.5 x 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]			MQL	
P	1.1							220	0.010 x d_1	□	■	□	■
	2.1							200	0.009 x d_1	□	■	□	■
	3.1							160	0.008 x d_1	□	■	□	
	4.1							130	0.007 x d_1	□	■	□	
	5.1							110	0.006 x d_1	□	■	□	
M	1.1							110	0.006 x d_1			□	■
	2.1							90	0.006 x d_1			□	■
	3.1												
	4.1												
K	1.1							220	0.010 x d_1	■	■		
	1.2							220	0.010 x d_1	■	■		
	2.1							190	0.008 x d_1	■	■		
	2.2							190	0.008 x d_1	■	■		
	3.1							160	0.008 x d_1	■	■		
	3.2							160	0.008 x d_1	■	■		
	4.1							130	0.006 x d_1	■	■		
	4.2							110	0.006 x d_1	■	■		
N	1.1	280	0.010 x d_1	350	0.016 x d_1	400	0.010 x d_1	500	0.016 x d_1			□	■
	1.2	280	0.008 x d_1	350	0.014 x d_1	400	0.008 x d_1	500	0.014 x d_1			□	■
	1.3	250	0.006 x d_1	350	0.012 x d_1	350	0.006 x d_1	500	0.012 x d_1			□	■
	1.4							380	0.014 x d_1			□	■
	1.5							340	0.012 x d_1			□	■
	1.6												
	2.1							200	0.010 x d_1			□	■
	2.2							200	0.010 x d_1			□	■
	2.3							200	0.010 x d_1	□	□	□	■
	2.4							160	0.008 x d_1			□	■
	2.5							160	0.008 x d_1			□	■
	2.6							160	0.008 x d_1	□	□	□	■
	2.7							100	0.006 x d_1			□	■
	2.8							100	0.006 x d_1			□	■
	3.1							450	0.018 x d_1			□	■
	3.2							450	0.014 x d_1			□	■
	4.1			220	0.015 x d_1			320	0.015 x d_1		□	□	■
	4.2			350	0.015 x d_1			500	0.015 x d_1		□	□	■
	4.3							200	0.012 x d_1		□	□	■
	4.4							140	0.012 x d_1		□	□	■
	5.1												
	5.2							120	0.006 x d_1			□	■
	5.3							220	0.012 x d_1	□	■		■
S	1.1					50	0.004 x d_1	110	0.007 x d_1			□	■
	1.2					40	0.003 x d_1	90	0.006 x d_1			□	■
	1.3					30	0.003 x d_1	50	0.005 x d_1			□	■
	2.1							80	0.006 x d_1			□	■
	2.2							30	0.004 x d_1			□	■
	2.3							30	0.004 x d_1			□	■
	2.4							30	0.004 x d_1			□	■
	2.5							20	0.004 x d_1			□	■
	2.6							30	0.004 x d_1			□	■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

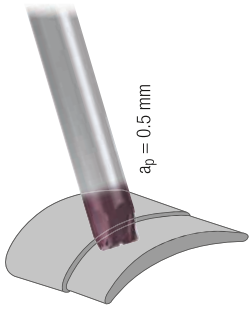
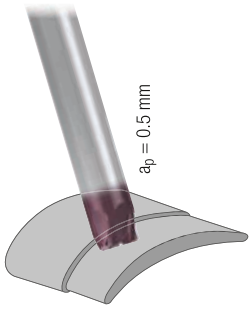
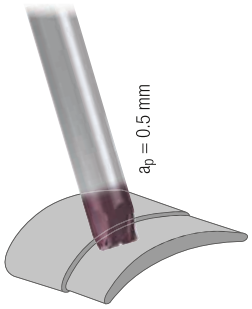
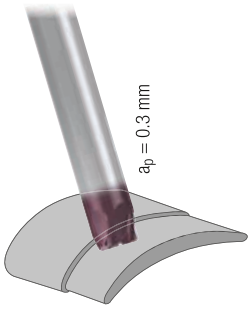
■ = very suitable
□ = suitable

Tapered torus – long and extra long lengths

N

Valid for Tool Nos.:

2677AZ
2678AZ

		Roughing		Roughing		Semi Finishing		Finishing					
		 a_e = 1 mm		 a_e = 1.5 mm		 a_e = 0.5 mm		 a_e = 0.5 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]			MQL	
P	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	□	■	□	■
	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	□	■	□	■
	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	□	■	□	
	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	□	■	□	
	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	□	■	□	
M	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			□	■
	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			□	■
	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			□	■
	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			□	■
K	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		□
	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	□	■		
N	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2												
	5.3												
S	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
	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			□	■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

v_c = Cutting speed
f_z = Feed per tooth

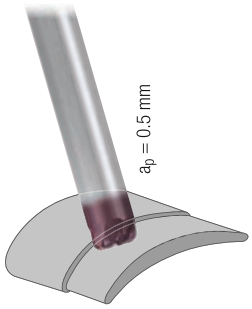
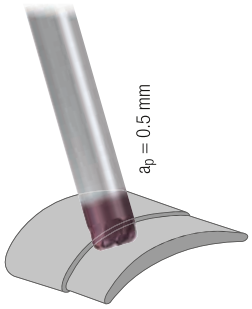
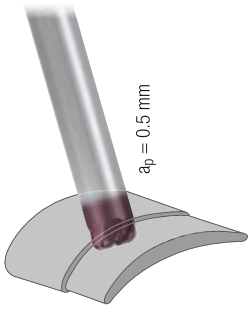
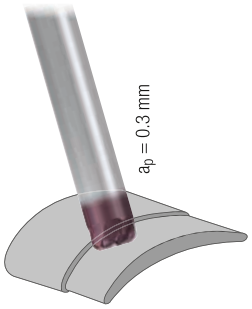
■ = very suitable
□ = suitable

Torus

N

Valid for Tool No.:

2676AZ

		Roughing		Roughing		Semi Finishing		Finishing					
		 a_e = 1.5 mm		 a_e = 2 mm		 a_e = 1 mm		 a_e = 0.5 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]			MQL	
P	1.1	160	0.008 x d_1	140	0.007 x d_1	180	0.009 x d_1	200	0.006 x d_1	□	■	□	■
	2.1	150	0.007 x d_1	130	0.006 x d_1	170	0.008 x d_1	190	0.005 x d_1	□	■	□	■
	3.1	140	0.006 x d_1	120	0.006 x d_1	160	0.007 x d_1	180	0.005 x d_1	□	■	□	
	4.1	130	0.006 x d_1	110	0.005 x d_1	150	0.006 x d_1	170	0.004 x d_1	□	■	□	
	5.1	120	0.005 x d_1	110	0.004 x d_1	140	0.005 x d_1	160	0.004 x d_1	□	■	□	
M	1.1	90	0.006 x d_1	80	0.005 x d_1	100	0.006 x d_1	120	0.004 x d_1			□	■
	2.1	80	0.005 x d_1	70	0.004 x d_1	90	0.005 x d_1	100	0.004 x d_1			□	■
	3.1	60	0.004 x d_1	50	0.004 x d_1	70	0.005 x d_1	80	0.003 x d_1			□	■
	4.1	40	0.004 x d_1	40	0.003 x d_1	50	0.004 x d_1	60	0.003 x d_1			□	■
K	1.1	190	0.01 x d_1	160	0.008 x d_1	210	0.011 x d_1	240	0.007 x d_1	□	■		□
	1.2	190	0.01 x d_1	160	0.008 x d_1	210	0.011 x d_1	240	0.007 x d_1	□	■		□
	2.1	170	0.009 x d_1	150	0.008 x d_1	190	0.01 x d_1	220	0.007 x d_1	□	■		□
	2.2	170	0.009 x d_1	150	0.008 x d_1	190	0.01 x d_1	220	0.007 x d_1	□	■		□
	3.1	160	0.008 x d_1	140	0.007 x d_1	180	0.009 x d_1	200	0.006 x d_1	□	■		□
	3.2	160	0.008 x d_1	140	0.007 x d_1	180	0.009 x d_1	200	0.006 x d_1	□	■		□
	4.1	140	0.007 x d_1	120	0.006 x d_1	160	0.008 x d_1	180	0.005 x d_1	□	■		□
	4.2	120	0.006 x d_1	110	0.006 x d_1	140	0.007 x d_1	160	0.005 x d_1	□	■		
N	1.1												
	1.2												
	1.3												
	1.4												
	1.5												
	1.6												
	2.1	200	0.008 x d_1	180	0.007 x d_1	230	0.009 x d_1	260	0.006 x d_1			□	■
	2.2	200	0.008 x d_1	180	0.007 x d_1	230	0.009 x d_1	260	0.006 x d_1			□	■
	2.3	200	0.008 x d_1	180	0.007 x d_1	230	0.009 x d_1	260	0.006 x d_1			□	■
	2.4	170	0.006 x d_1	150	0.006 x d_1	190	0.007 x d_1	220	0.005 x d_1			□	■
	2.5	170	0.006 x d_1	150	0.006 x d_1	190	0.007 x d_1	220	0.005 x d_1			□	■
	2.6	170	0.006 x d_1	150	0.006 x d_1	190	0.007 x d_1	220	0.005 x d_1			□	■
	2.7	110	0.006 x d_1	90	0.005 x d_1	120	0.006 x d_1	140	0.004 x d_1			□	■
	2.8	110	0.006 x d_1	90	0.005 x d_1	120	0.006 x d_1	140	0.004 x d_1			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2												
	5.3												
S	1.1	120	0.008 x d_1	110	0.007 x d_1	140	0.009 x d_1	160	0.006 x d_1			□	■
	1.2	90	0.007 x d_1	80	0.006 x d_1	100	0.008 x d_1	120	0.005 x d_1			□	■
	1.3	60	0.006 x d_1	50	0.006 x d_1	70	0.007 x d_1	80	0.005 x d_1			□	■
	2.1	90	0.007 x d_1	80	0.006 x d_1	100	0.008 x d_1	110	0.005 x d_1			□	■
	2.2	40	0.006 x d_1	30	0.005 x d_1	50	0.006 x d_1	50	0.004 x d_1			□	■
	2.3	30	0.005 x d_1	30	0.004 x d_1	30	0.005 x d_1	40	0.004 x d_1			□	■
	2.4	40	0.006 x d_1	30	0.005 x d_1	50	0.006 x d_1	50	0.004 x d_1			□	■
	2.5	20	0.005 x d_1	20	0.004 x d_1	30	0.005 x d_1	30	0.004 x d_1			□	■
	2.6	30	0.004 x d_1	30	0.004 x d_1	30	0.005 x d_1	40	0.003 x d_1			□	■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

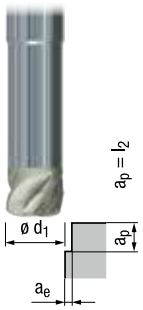
v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

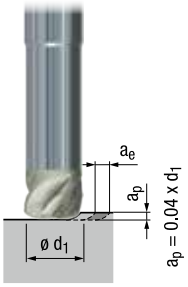
Ceramic – Long length

H

Valid for Tool No:
3815
3818



$a_e = 0.05 \times d_1$



$a_e = 0,7 \times d_1$

		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MQL	
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	400	0003 x d_1	400	0003 x d_1	■	□		
	2.2	400	0003 x d_1	400	0003 x d_1	■	□		
	2.3	400	0003 x d_1	400	0003 x d_1	■	□		
	2.4	400	0003 x d_1	400	0003 x d_1	■	□		
	2.5	400	0003 x d_1	400	0003 x d_1	■	□		
	2.6	400	0003 x d_1	400	0003 x d_1	■	□		
H	1.1	400	0003 x d_1	400	0003 x d_1	■	□		
	1.2	400	0003 x d_1	400	0003 x d_1	■	□		
	1.3	400	0003 x d_1	400	0003 x d_1	■	□		
	1.4	400	0003 x d_1	400	0003 x d_1	■	□		
	1.5	400	0003 x d_1	400	0003 x d_1	■	□		

v_c = Cutting speed
f_z = Feed per tooth

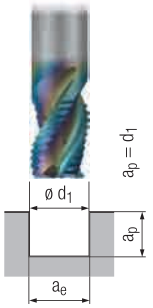
■ = very suitable
□ = suitable

Standard length

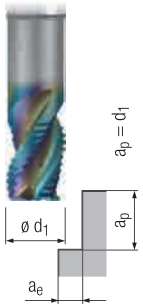
Valid for Tool Nos.:

2888_Z 2889_Z
2888RZ 2889RZ

WR Roughing

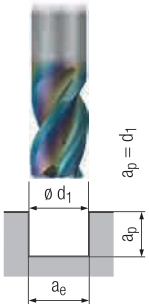


$a_e = d_1$

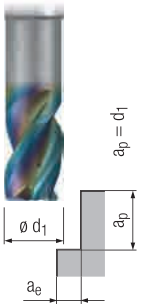


$a_e = 0.4 \times d_1$

W Finishing



$a_e = d_1$



$a_e = 0.4 \times d_1$

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

		v_c [sfm]	f_z [inch]	v_c [sfmn]	f_z [inch]	v_c [sfm]	f_z [inch]	v_c [sfm]	f_z [inch]			MMS MQL	
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	1378	0.009 x d_1	2066	0.011 x d_1	1378	0.008 x d_1	2493	0.011 x d_1			□	■
	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			□	■
	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			□	■
	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			□	■
	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		□	□	■
	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		□	□	■
	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		□	□	■
	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		□	□	■
	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		□	□	■
	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		□	□	■
	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				■
	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												

v_c = Cutting speed
f_z = Feed per tooth

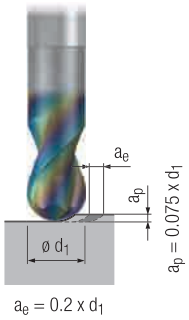
■ = very suitable
□ = suitable

Ball nose – Standard length

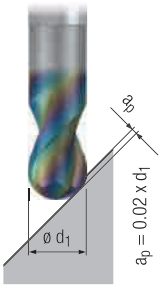
W

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]			MMS MQL	
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	2950	0.022 x d_1	3935	0.016 x d_1			□	■
	1.2	2950	0.020 x d_1	3935	0.014 x d_1			□	■
	1.3	2950	0.017 x d_1	3935	0.012 x d_1			□	■
	1.4	1970	0.020 x d_1	2625	0.014 x d_1			□	■
	1.5								
	1.6								
	2.1	655	0.014 x d_1	855	0.010 x d_1			□	■
	2.2	655	0.014 x d_1	855	0.010 x d_1			□	■
	2.3	655	0.014 x d_1	855	0.010 x d_1	□	□	□	■
	2.4	525	0.011 x d_1	720	0.008 x d_1			□	■
	2.5	525	0.011 x d_1	720	0.008 x d_1			□	■
	2.6	525	0.011 x d_1	720	0.008 x d_1	□	□	□	■
	2.7	330	0.008 x d_1	460	0.006 x d_1			□	■
	2.8	330	0.008 x d_1	460	0.006 x d_1			□	■
	3.1	1475	0.025 x d_1	1970	0.018 x d_1			□	■
	3.2	1475	0.020 x d_1	1970	0.014 x d_1			□	■
	4.1	1150	0.021 x d_1	1475	0.015 x d_1		□	□	■
	4.2	1640	0.021 x d_1	2130	0.015 x d_1		□	□	■
	4.3	655	0.017 x d_1	820	0.012 x d_1		□	□	■
	4.4	460	0.017 x d_1	590	0.012 x d_1		□	□	■
	5.1								
	5.2								
	5.3	720	0.017 x d_1	300	0.012 x d_1	□	■		■
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								

v_c = Cutting speed
f_z = Feed per tooth

■ = very suitable
□ = suitable

Standard and long lengths

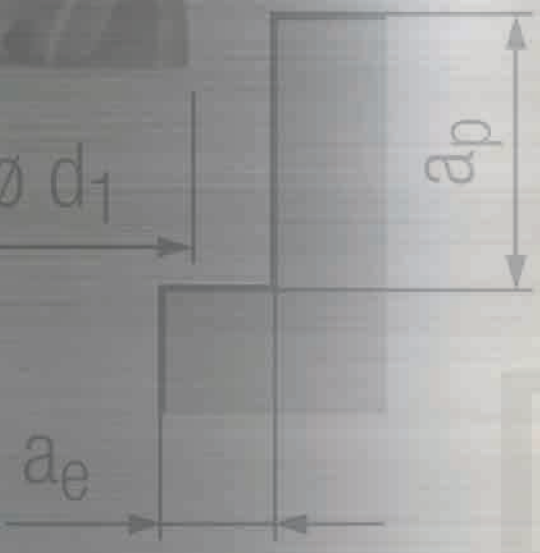
W

Valid for Tool Nos.:

2506 2507

		Applications – Materials	Hardness Range			Material Examples	v_c [sfm]	f_z [inch]
			HRC	BHN	N/mm²			
N		**Non ferrous materials**						
		Aluminum alloys						
	1.1	Aluminum wrought alloys		≤ 60	≤ 200	7075	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.	
	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%						
		Copper alloys						
	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			
		Magnesium alloys						
	3.1	Magnesium wrought alloys		≤ 150	≤ 500			
	3.2	Magnesium cast alloys		≤ 150	≤ 500			
		Synthetics						
	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%)						
		Special materials						
	5.1	Graphite						
	5.2	Tungsten-copper alloys						
	5.3	Composite materials						

Technical Information



$a_e = 0.4 \times d_1$

U.S.A. units into SI units			SI units into U.S.A. units		
Length					
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
Area					
1 in^2	= 645.16 mm^2	= 6.4516 cm^2	1 mm^2		= 0.00155 in^2
1 ft^2	= 144 in^2	= 0.0929 m^2	1 cm^2	= 100 mm^2	= 0.155 in^2
1 yd^2	= 9 ft^2	= 0.8361 m^2	1 m^2	= 10000 cm^2 = 10.7642 ft^2 = 1.196 yd^2	
1 $mile^2$		= 2.590 km^2	1 km^2	= 10^6 m^2	= 0.3861 $mile^2$
Volume					
1 in^3	= 16387.064 mm^3	= 16.387 cm^3	1 mm^3		= 0.000061 in^3
1 ft^3	= 1728 in^3	= 0.0283 m^3	1 cm^3	= 1000 mm^3	= 0.0610 in^3
1 yd^3	= 27 ft^3	= 0.765 m^3	1 m^3	= 10^6 cm^3 = 35.3146 ft^3 = 1.3080 yd^3	
1 Quart / US	= 1/4 gal	= 0.946 l	1 Liter (l)	= 1 dm^3 = 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			
Weight					
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
Force					
1 pound force (lbf)	= 4.448 N		1 Newton (N)		= 0.2248 lbf
Pressure/Tensile strength					
1 lbf/ft^2		= 47.8803 Pa	1 Pascal (Pa)	= 10^6 N/mm^2	= 0.02089 lbf/ft^2
1 lbf/in^2	= 6.89476 kPa	= 6.895 · 10^{-3} N/mm^2	1 N/mm^2	= 0.1 bar	= 145 psi
1 psi (pound-force per sq.in)	= lbwt/in^2	= 6.895 · 10^{-3} N/mm^2	1 bar	= 10 N/mm^2	= 14.5 psi
1 psi		= 6.895 · 10^{-2} bar			
Power					
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
Energy/Torque					
1 foot pound-force (ft·lbf)		= 1.356 J	1 Joule (J)	= 1 Nm	= 0.7376 ft lb
Cutting/Circumferential speed					
1 surface feet per minute (SFM)		= 0.3048 m/min	1 m/min		= 3.2808 SFM
Cutting/Circumferential speed					
in degree Fahrenheit (°F)		= 9/5 Temp.[°C]+32	in degree Celsius (°C)	= (Temp.[°F]-32) · 5/9	

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

Internal coolant supply

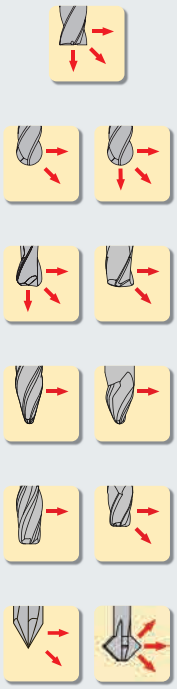
ICA	ICA = Internal coolant supply, axial exit
ICR	ICR = Internal coolant supply, radial exit
ICRA	ICRA = Internal coolant supply, radial and axial exit

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.

Form Tolerance

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).

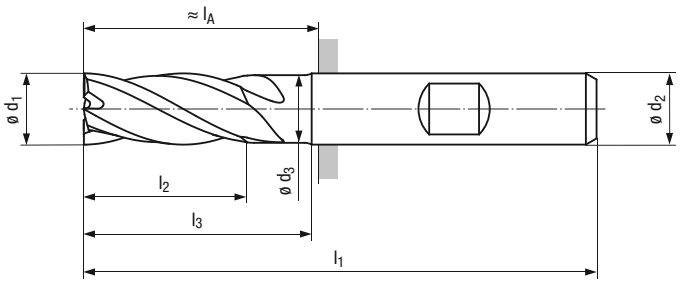
Helix angle

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

Ramping angle

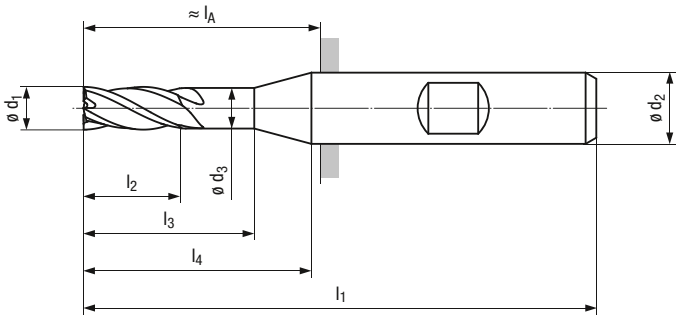
The specified angle is the recommended angle for ramping applications.

Descriptions and definitions of the end mill

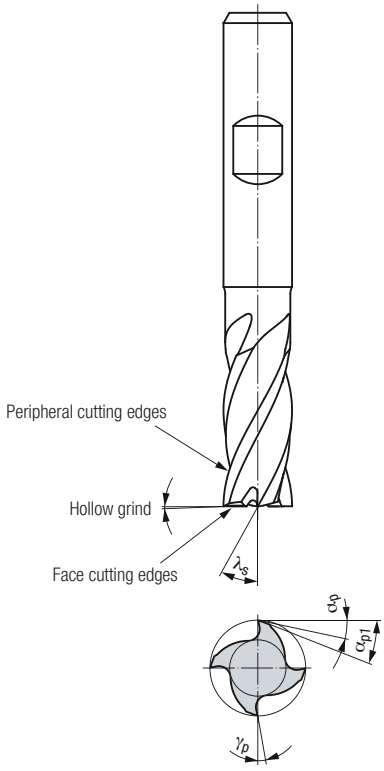


l_1	Overall length
l_2	Cutting length
l_3	Neck length
l_4	Length of shank connection
l_A	Projecting length
d_1	Cutting diameter
d_2	Shank diameter
d_3	Neck diameter

Design l_4:



Important angles of the end mill



α_p	1. Relief angle of the peripheral cutting edge
α_{p1}	2. Relief angle of the peripheral cutting edge
γ_p	Rake angle of the peripheral cutting edge
λ_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.

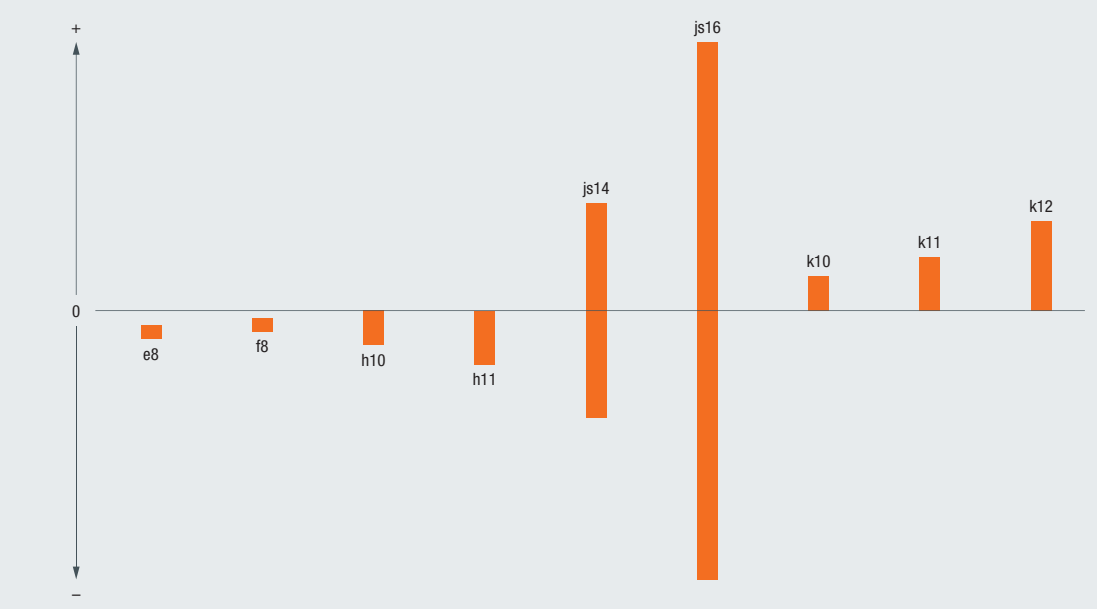
Tolerance fields

Nominal value range in millimeters

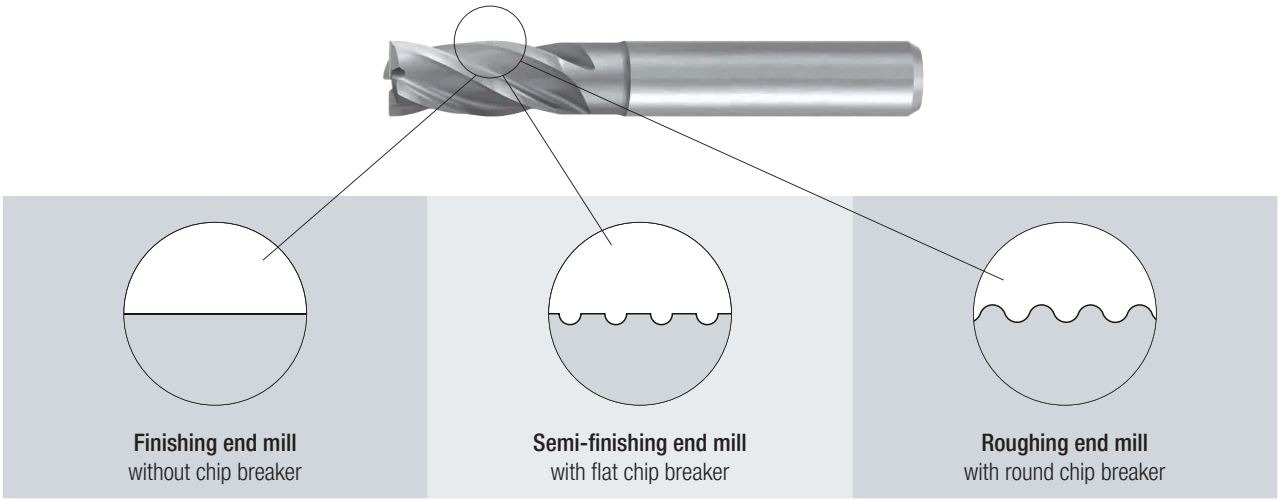
Dimensions in µm

	e8	f8	h10	h11	js14	js16	k10	k11	k12
≤ 3	– 14 – 28	– 6 – 20	0 – 40	0 – 60	+ 125 – 125	+ 300 – 300	+ 40 0	+ 60 0	+ 100 0
> 3 ≤ 6	– 20 – 38	– 10 – 28	0 – 48	0 – 75	+ 150 – 150	+ 375 – 375	+ 48 0	+ 75 0	+ 120 0
> 6 ≤ 10	– 25 – 47	– 13 – 35	0 – 58	0 – 90	+ 180 – 180	+ 450 – 450	+ 58 0	+ 90 0	+ 150 0
> 10 ≤ 18	– 32 – 59	– 16 – 43	0 – 70	0 – 110	+ 215 – 215	+ 550 – 550	+ 70 0	+ 110 0	+ 180 0
> 18 ≤ 30	– 40 – 73	– 20 – 53	0 – 84	0 – 130	+ 260 – 260	+ 650 – 650	+ 84 0	+ 130 0	+ 210 0
> 30 ≤ 50	– 50 – 89	– 25 – 64	0 – 100	0 – 160	+ 310 – 310	+ 800 – 800	+ 100 0	+ 160 0	+ 250 0
> 50 ≤ 80	– 60 – 106	– 30 – 76	0 – 120	0 – 190	+ 370 – 370	+ 950 – 950	+ 120 0	+ 190 0	+ 300 0
> 80 ≤ 120	– 72 – 126	– 36 – 90	0 – 140	0 – 220	+ 435 – 435	+ 1100 – 1100	+ 140 0	+ 220 0	+ 350 0
> 120 ≤ 180	– 85 – 148	– 43 – 106	0 – 160	0 – 250	+ 500 – 500	+ 1250 – 1250	+ 160 0	+ 250 0	+ 400 0
> 180 ≤ 250	– 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



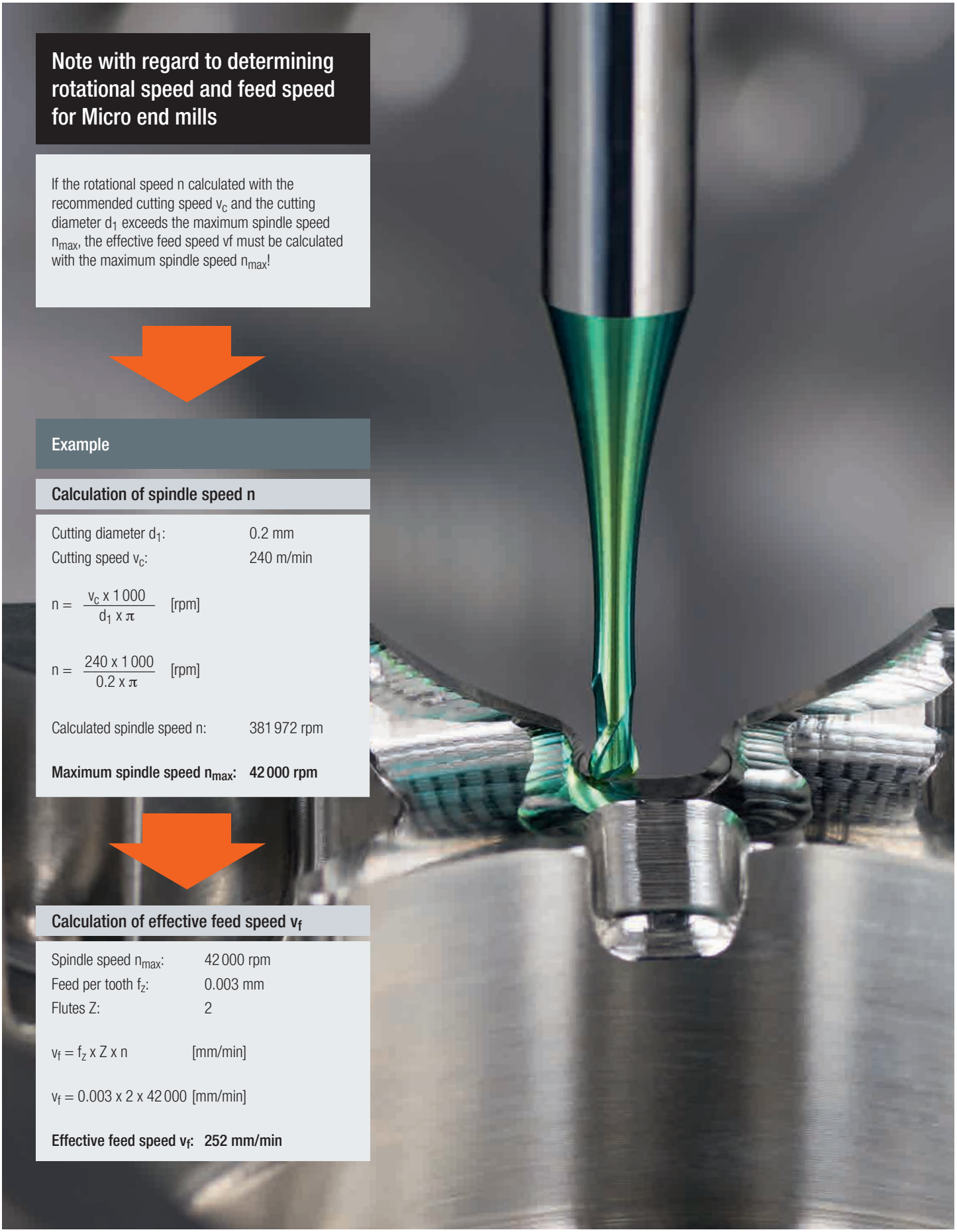
Finishing end mill without chip breaker	Semi-finishing end mill with flat chip breaker	Roughing end mill with round chip breaker

Material to be machined: softer ▲ harder

Type W	Type WF	Type WR
Type N	Type NF	Type NR
Type H	Type HF	Type HR

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 vf 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

$$n = \frac{v_c \times 1\,000}{d_1 \times \pi} \quad [\text{rpm}]$$

$$n = \frac{240 \times 1\,000}{0.2 \times \pi} \quad [\text{rpm}]$$

Calculated spindle speed n: 381 972 rpm

Maximum spindle speed n_{max}: 42 000 rpm

Calculation of effective feed speed v_f

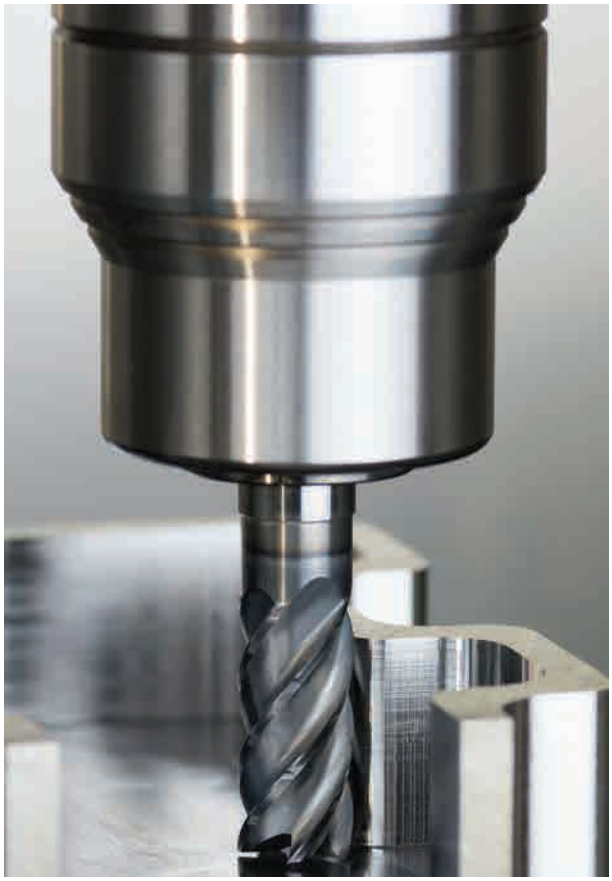
Spindle speed n_{max}: 42 000 rpm
Feed per tooth f_z: 0.003 mm
Flutes Z: 2

$v_f = f_z \times Z \times n$ [mm/min]

$v_f = 0.003 \times 2 \times 42\,000$ [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.
- **More accurate**
  With a 3XD tool length, concentricity is ≤ 3 µm, guaranteeing long tool life and quality surface finishes.
- **Longer tool life**
  Special holder design reduces vibration, dramatically improving work piece surface finishes and providing exceptionally long tool life.
- **Fast tool change**
  Simple, highly accurate design enables quick tool change in seconds, via hex wrench.

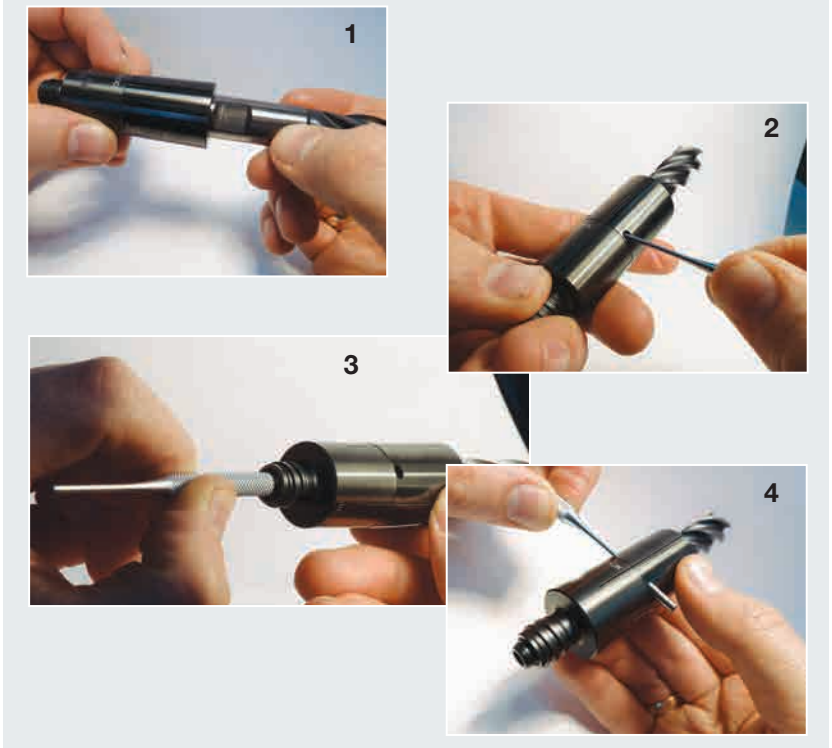
FPC Pin-Lock Operation

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.



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.

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.

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.

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.***

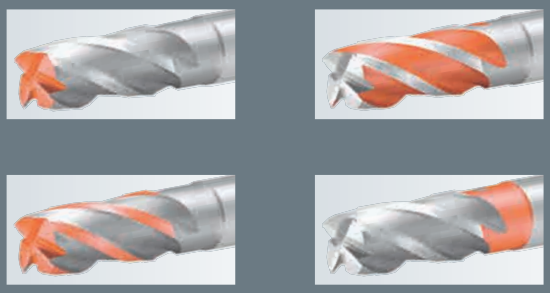
Reconditioning your EMUGE-FRANKEN tools through EMUGE-FRANKEN makes sense. EMUGE-FRANKEN has the knowledge and manufacturing expertise to refurbish an EMUGE-FRANKEN tool to its original condition and specification, providing maximum performance levels, predictable operation and longer life than any other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



Warranty

EMUGE-FRANKEN warrants to original equipment manufacturers, distributors and industrial users of its products that each new product manufactured or supplied by EMUGE-FRANKEN shall be free from defects in material and workmanship. EMUGE-FRANKEN'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-FRANKEN representative and which upon inspection is determined by EMUGE-FRANKEN 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-FRANKEN 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-FRANKEN 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-FRANKEN 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 sue of any product sold hereunder, in excess of the cost of replacement or repair as provided herein. In no event shall EMUGE-FRANKEN be liable for any special, incidental or consequential damages. EMUGE-FRANKEN makes no other warranty, express or implied, except as set forth above, and EMUGE-FRANKEN 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-FRANKEN products.

Notice

Because we are constantly engaged in a program of product improvement, tool specifications are subject to change at any time.

All EMUGE-FRANKEN terms and conditions are subject to change without notice.

EMUGE FRANKEN

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-FRANKEN newly expanded facility.

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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.