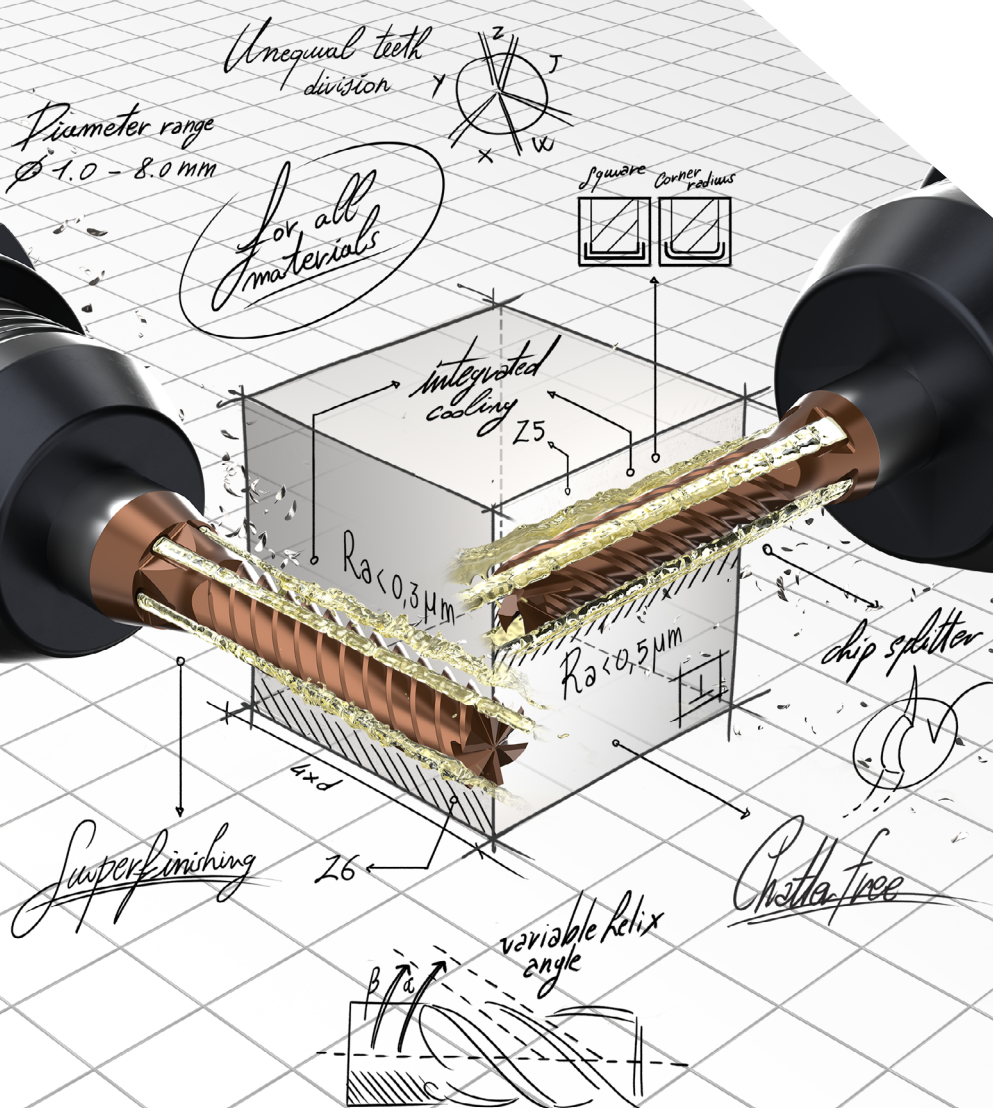


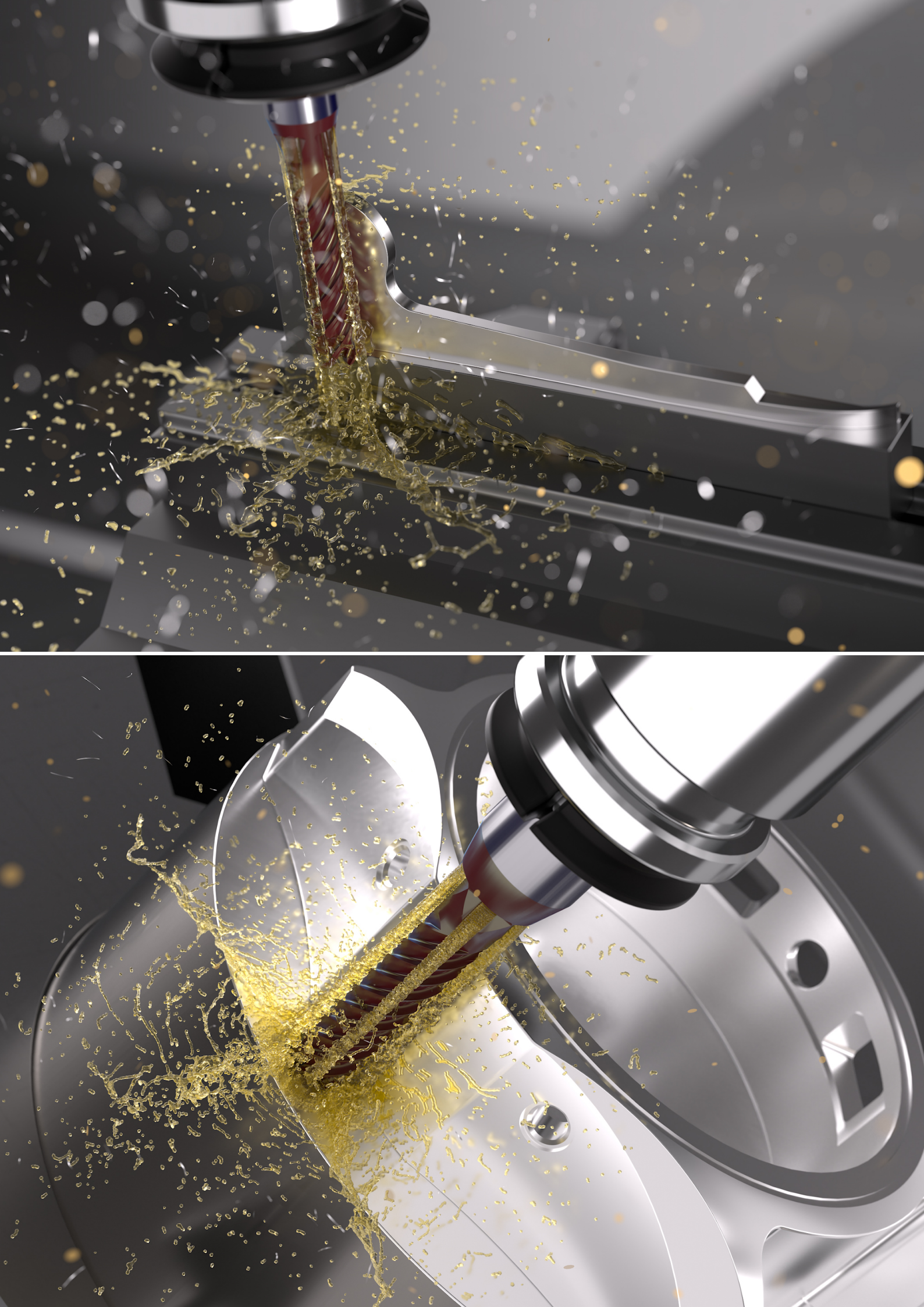
crazy about

new endmills

- CHATTER FREE ENDMILL
- SUPER FINISHING ENDMILL



NEW



A GREAT YEAR FOR THE MIKRON TOOL R&D DEPARTMENT!

Sensational high-performance tools straight from Mikron Tool's R&D department!
Mikron Tool, leading solution provider for the machining of high-performance materials, presents three new high-end solid carbide tools.

- **CrazyMill Cool CF:** A high-performance end mill for high-efficiency milling that delivers excellent surface quality of Ra 0.5 µm or better. Available in two types:
 - Square
 - Corner radius **NEW**
- **CrazyMill Cool SF:** A superfinishing square end mill that achieves grinding / polishing surface quality up to Ra 0.3 µm or better. Both endmills are available in diameters from 1 to 8 mm, with two cutting lengths of 3 × d and 4 × d

Let's discover those products!!!

INDEX

1	OVERVIEW OF NEW TOOLS	4
2	CRAZYMILL COOL CF Milling depth 3 x d and 4 x d, Ø 1.0 - 8.0 mm, Z4 and Z5	6
3	CRAZYMILL COOL SF Milling depth 3 x d and 4 x d, Ø 1.0 - 8.0 mm, Z5 and Z6	34

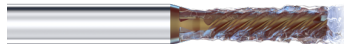
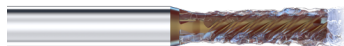
NEW

Overview of new tools

RECOMMENDATION FOR USE
● Excellent | ● Good | ○ Acceptable | ☒ Not recommended

3 NEW PRODUCTS

NEW

			ø - range [mm]	max. depth	Cooling		P	M	K	N	S ₁	S ₂		S ₃	H ₁	H ₂	Page
		Unalloyed and alloyed steel					Stainless steel	Cast iron	Non ferrous metals	Super alloys	Alloyed titanium	Pure titanium	CrCo alloys	Hardened steel <55 HRC	Hardened steel ≥55 HRC		
Int.	Ext.																
 Cool CF  Square Z4 / Z5 			1.0 – 8.0	3 x d 4 x d	✓	–	●	●	●	●	●	●	●	●	☒	☒	6
 Cool CF  Corner radius Z4 / Z5 			1.0 – 8.0	3 x d 4 x d	✓	–	●	●	●	●	●	●	●	●	☒	☒	6
 Cool SF  Square Z5 / Z6 			1.0 – 8.0	3 x d 4 x d	✓	–	●	●	●	●	●	●	●	●	☒	☒	34

NEW

CrazyMill Cool CF

NEW



REVOLUTION IN CHATTER FREE MACHINING



CrazyMill Cool CF, the latest generation of milling cutters from Mikron Tool, works with minimal side milling cutting pressure and act completely chatter-free.

This is made possible by an ingenious cutting edge geometry that enables highly dynamic milling processes. The milling cutter really comes into its own with thin-walled, delicate workpieces that tend to vibrate or when unstable clamping situations prevail. Pockets and grooves can also be produced highly efficiently, precisely and with extremely smooth running. It is available in the diameter range Ø1.0 – 8.0 mm in two different cutting lengths 3 x d and 4 x d to perform in all materials.

Regrinding: This product is not suitable for regrinding.

Please note: You couldn't find your suitable version of the CrazyMill Cool CF (diameter, length, cutting direction...)? Ask us about our customized versions!

NEW

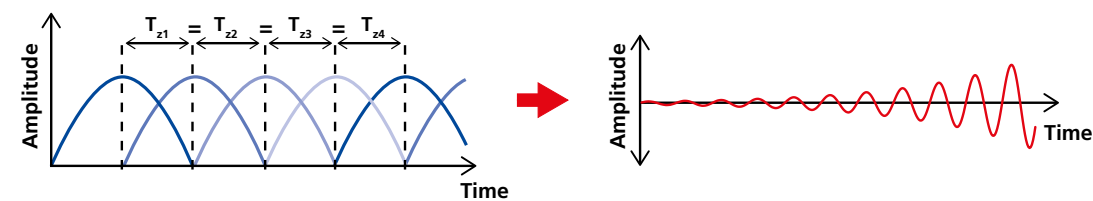
CrazyMill Cool CF

NEW

THE NEW HIGH-PERFORMANCE MILLS FOR SEMI-FINISHING AND FINISHING

1. Challenge

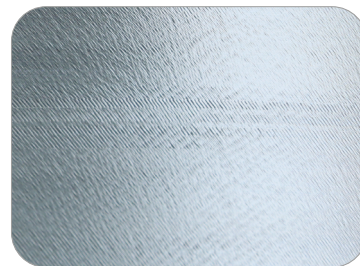
Avoid chatter when milling



Milling is a cutting process with a continuous interrupted cut. Each cutting edge applies a certain amount of pressure to the material. When the cutting edge exits the material, the pressure is released again.

This happens with all the cutting edges of symmetrically designed endmills at a predetermined frequency depending on the "number of cutting edges" x "speed".

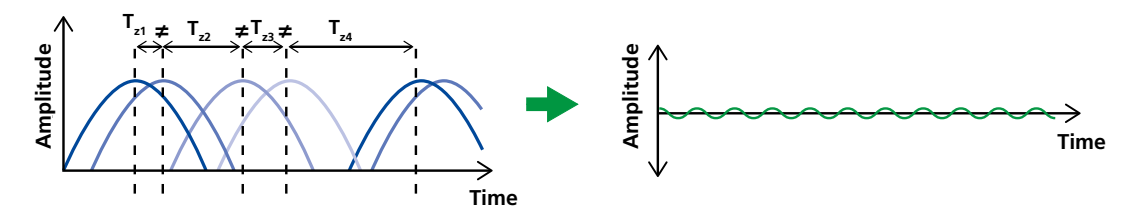
If the frequency is kept uniform (see diagram) ($T_{z1} = T_{z2} = T_{z3} = T_{z4}$), it can lead to an increase in the maximum deflection in the resonance frequency, resulting in vibrations and consequently chatter marks on the workpiece.



Surface with vibrations
 $R_a = 0.7 \mu\text{m}$

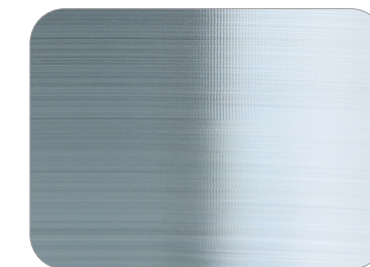
Solution

Avoidance of resonance frequencies

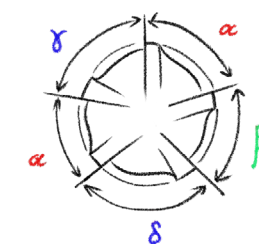


The new CrazyMill Cool CF has been specifically developed, to interrupt this resonance frequency. Using unequal angular teeth division, and a variable helix angle (every cutting edge has a different helix angle) every cutting edge generates a different frequency wave that occur in an irregular timing to the next or the previous cutting edge ($T_{z1} \neq T_{z2} \neq T_{z3} \neq T_{z4}$).

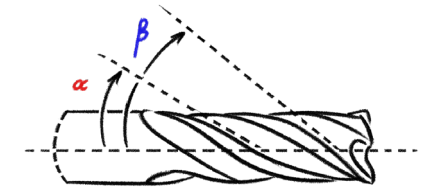
This results, as shown in the graph, in a resonant frequency amplitude reduction, and guarantees a vibration free surface.



Surface without vibrations
 $R_a = 0.35 \mu\text{m}$



Unequal angular teeth
 division



Variable helix angle

NEW

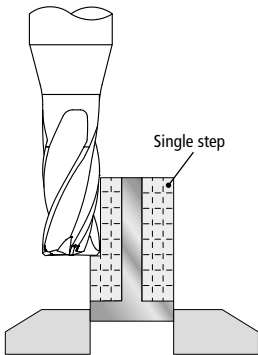
CrazyMill Cool CF

NEW

THE NEW HIGH-PERFORMANCE MILLS FOR SEMI-FINISHING AND FINISHING

2. Challenge

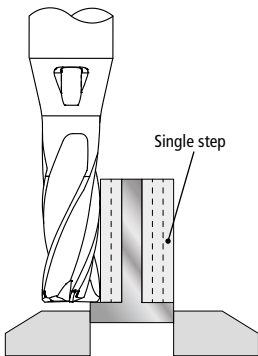
High Removal Rate for thin-walled and unstable workpieces



Thin-walled workpieces such as blades, medical bone plates, and others, are among the most difficult components to machine. The reason for this is that with "unstable workpieces", the cutting forces exerted by an endmill during side milling lead to deformations and vibrations. The result are irregular profiles and chatter marks. To avoid such consequences, low axial and radial engagement are typically set and a low feed rate is also used. The disadvantage is a very low removal rate (Q).

Solution

Low radial pressure



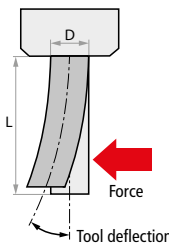
With the new endmill, particular attention has been placed to finding a perfect balance between cutting angle, a relive angle and the cutting edge conditioning.

An extremely high cutting ability ensures a very low lateral cutting pressure, so that the endmill can cut reliably even at its maximum axial engagement (4 x d).

A large, or maximum, axial engagement, combined with a highly dynamic milling strategy (HDM), enables a very high removal rate (Q).

3. Challenge

High shape tolerance - perpendicularity

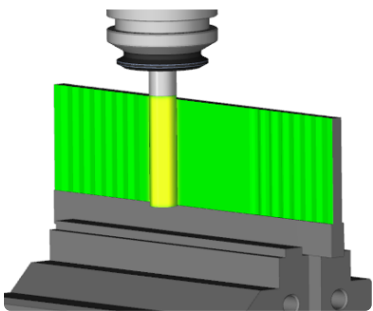


Profile milling with the side milling strategy over the maximum engagement length of the milling cutter (4 x d) must enable a perfectly perpendicular profile within the specified tolerance fields. This must also be possible when using high-speed and highly dynamic milling strategies.

Solution

Low radial cutting forces

Thanks to its specifically designed micro and macro cutting geometries, the CrazyMill Cool CF ensures a very low lateral cutting pressure, which is crucial for keeping the cutting forces perpendicular to the component low. This is a prerequisite for limiting the deflection of the milling cutter to a minimum and thus guaranteeing the shape tolerances and squareness in accordance with the required tolerance values, even at the maximum depth of engagement of the milling cutter.



Material: X2CrNiMo17-12-2 / 1.4404 / AISI 316L

Diameter: 6 mm; Milling depth: 24 mm;

Coolant: cutting oil;

Cutting data: $v_c = 220$ m/min;

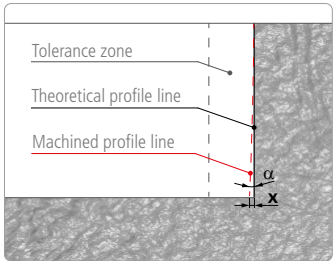
$f_z = 0.03$ mm;

$a_p = 24$ mm;

$a_e = 0.05$ mm

Roughness: $R_a = 0.35$ μ m

■ Perpendicularity



Perpendicularity precision	
x	0.012 mm
α	- 0.03°

NEW

CrazyMill Cool CF

NEW

THE NEW HIGH-PERFORMANCE MILLS FOR SEMI-FINISHING AND FINISHING

4. Challenge

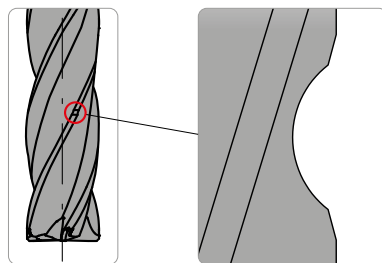
High surface quality – Process reliable chip management

For a reliable machining process, short chips are required. The more axial engagement of the endmill the longer become the chips. Long chips are very hard to manage and evacuate generating a high risk of "chip double-cut", leading to cutting edge chipping and/or to a low surface's quality.

Solution

Optimized chip-splitting for short chips and perfect surface quality

■ Chip-splitting design



The shape of the chip-splitting has been optimized to ensure short chips and optimum removal. The result is a perfect surface quality.

■ Surface quality

Conventional endmill



CrazyMill Cool



Thanks to the chip-splitting, no groove is visible, as would be the case when using a conventional milling cutter. The result is the best surface quality.

5. Challenge

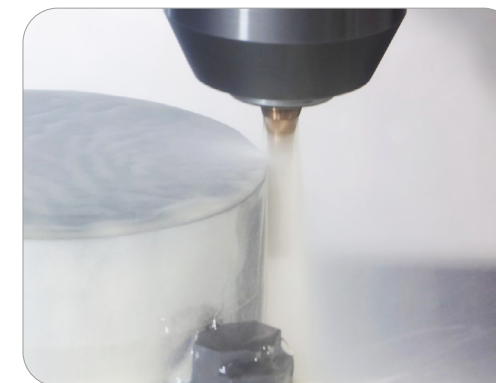
High temperature & chips in the cutting zone



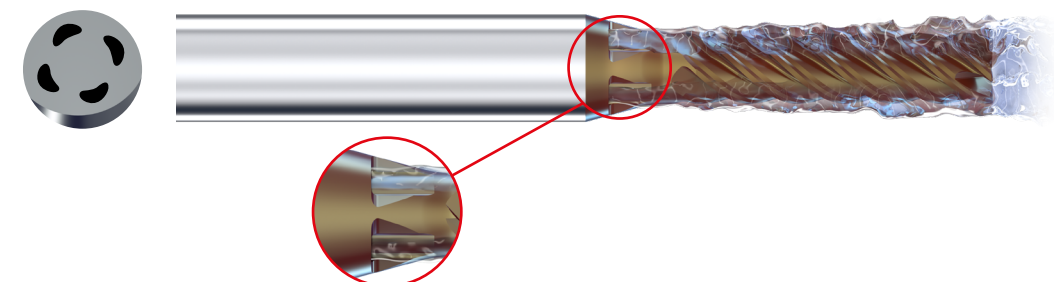
The machining of metals requires a high energy input into the cutting zones. A large proportion of this is converted directly into thermal energy. The higher the heat generated in the cutting zone, the shorter the tool life. It is therefore essential to keep the temperature in the cutting zone as low as possible. A high machining temperature also leads to poorer chip formation, poor chip flow and poor chip evacuation due to the higher plasticity of the chip, which can result in chip jam. These phenomena are exacerbated in materials that are difficult to machine, such as titanium, stainless steel and heat-resistant alloys.

Solution

Integrated cooling in shank



The patented cooling channels of the Mikron Tool milling cutters, which run through the shank, ensure constant and massive cooling of the cutting edges. The excellent cooling performance directly in the cutting area enables a high cutting speed and also reduces wear enormously. The massive coolant jet (from just 15 bar) also guarantees a chip-free machining zone and prevents the chips double cut. High cutting speeds, in combination with an HDM strategy, lead to a reliable milling process with a high removal rate while maintaining excellent surface quality.



Your benefits

The most important features

- Allround endmill geometry: Semi-finishing and finishing
- Innovative flute geometry: Unequal angular teeth division and variable helix angle
- Specific designed cooling concept

Your advantages

- Exploitation of HEM milling
- Mitigated chatter milling
- Very low cutting forces and bending moment
- Controlled low temperature
- Perfect perpendicularity and low roughness
- High performance in difficult-to-machine materials

Your benefits

- Up to 60% higher chip removal rate = reduced machining time
- Excellent surface quality with Ra 0.5 µm or better
- Process reliability
- Very long tool life

NEW

Maximum performance guaranteed

EXAMPLE OF STAINLESS STEEL MACHINING IN COMPARISON

■ Example

Higher chip removal rate = faster machining time

Machining: Side milling
Milling depth: 12 mm;
Coolant: Emulsion 8%

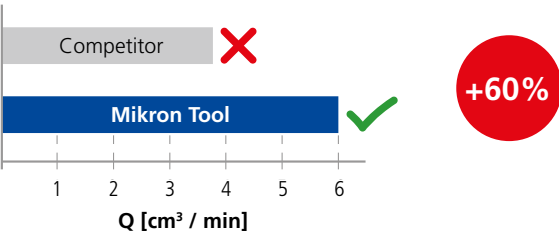
Stainless steel: 1.4435 / X2CrNiMo 18-14-3 / 316L **M**

Tool: CrazyMill Cool CF
Diameter: 3.0 mm

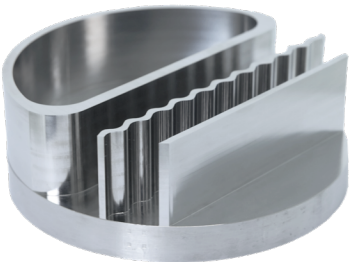
Cutting data:

Generical endmill		CrazyMill Cool CF	
$v_c = 120 \text{ m/min}$	$f_z = 0.020 \text{ mm}$	$v_c = 130 \text{ m/min}$	$f_z = 0.024 \text{ mm}$
$a_p = 12 \text{ mm}$	$a_e = 0.3 \text{ mm}$	$a_p = 12 \text{ mm}$	$a_e = 0.3 \text{ mm}$
Z = 4 Flutes		Z = 5 Flutes	

Result:



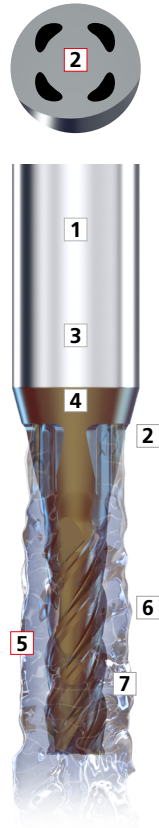
Movie:



3 x d

Type M

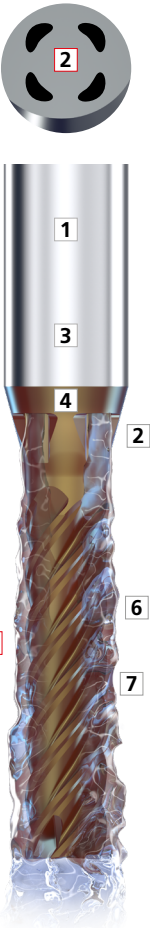
- Coated
- Integrated cooling
- l₁ (Effective length): 3xd
- l₂ (Cutting length): 3xd



4 x d

Type N

- Coated
- Integrated cooling
- l₁ (Effective length): 4xd
- l₂ (Cutting length): 4xd



NEW

1 | SHANK

The robust solid carbide shank guarantees stable and vibration-free milling. High precision and extraordinary surface quality are reached.

2 | INTEGRATED COOLING - PATENTED

The integrated cooling channels guarantee constant and maximal cooling of the cutting edges and optimal chip removal. The result is higher cutting speed as well as an excellent surface quality.

3 | CARBIDE

The specially developed micro-grain carbide meets all requirements in terms of mechanical properties.

4 | COATING

The high-performance eXedur SNP coating is heat and wear resistant, prevents buildup edges and guarantees optimum chip flushing. The result is a long tool life.

5 | SPECIFIC CHATTER-FREE GEOMETRY

The specific new cutting geometry with unequal angular teeth division and a variable helix angle, leads to an interruption of the resonance frequency allowing a vibration-free machining.

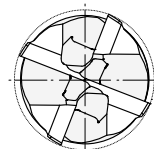
6 | LATERAL CUTTING GEOMETRY

Thanks to the high tool rigidity and the specific designed cutting edges, lower radial machining force are achieved. The result is high perpendicularity precision and high surface quality.

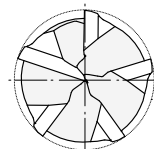
7 | CHIP-SPLITTING

An optimized chip-splitting guarantees short chips and highest surface quality. The chip-splitting is implemented in version M for Ød₁ ≥ 4 mm and N for Ød₁ ≥ 3 mm.

Endmill tip



4 - Flute
Diameter range
Ø1 - 2.5 mm



5 - Flute
Diameter range
Ø3 - 8 mm

NEW

Type M - 3 x d - Square / Corner radius - Z4/Z5

Carbide



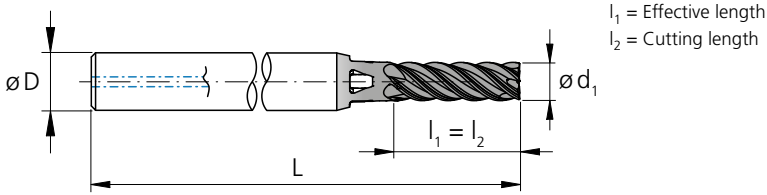
Z
4-5



MILLING WITH INTEGRATED COOLING

Ø d _i	0.1 - 3.0 mm	3.1 - 6.0 mm	6.1 - 10.0 mm
Tolerance	- 0.014 mm - 0.028 mm	- 0.020 mm - 0.038 mm	- 0.025 mm - 0.047 mm

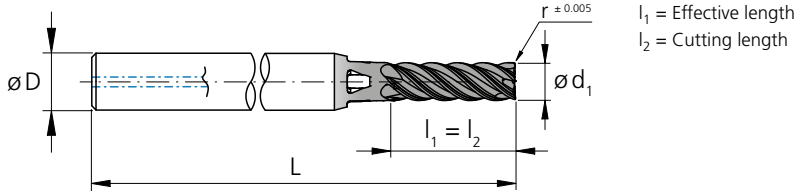
Square



d _i	d _i	I ₁	I ₂	D (h6)	L	Z	Item number	Availability
[mm]	[inch]	[mm]	[mm]	[mm]	[mm]	[flutes]		
1.0		3.0	3.0	4	40	4	2.CMCCF.M1Z4.100.1	■
1.2		3.6	3.6	4	40	4	2.CMCCF.M1Z4.120.1	■
1.5		4.5	4.5	4	40	4	2.CMCCF.M1Z4.150.1	■
1.587	1/16	4.8	4.8	4	40	4	2.CMC.SCFM1Z4.F116	■
1.8		5.4	5.4	4	40	4	2.CMCCF.M1Z4.180.1	■
2.0		6.0	6.0	4	40	4	2.CMCCF.M1Z4.200.1	■
2.381	3/32	7.1	7.1	4	44	4	2.CMC.SCFM1Z4.F332	■
2.5		7.5	7.5	6	55	4	2.CMCCF.M1Z4.250.1	■
3.0		9.0	9.0	6	55	5	2.CMCCF.M1Z5.300.1	■
3.175	1/8	9.5	9.5	6	55	5	2.CMC.SCFM1Z5.F18	■
3.5		10.5	10.5	6	55	5	2.CMCCF.M1Z5.350.1	■
3.968	5/32	11.9	11.9	6	55	5	2.CMC.SCFM1Z5.F532	■
4.0		12.0	12.0	6	55	5	2.CMCCF.M1Z5.400.1	■
4.5		13.5	13.5	8	65	5	2.CMCCF.M1Z5.450.1	■
4.762	3/16	14.3	14.3	8	65	5	2.CMC.SCFM1Z5.F316	■
5.0		15.0	15.0	8	65	5	2.CMCCF.M1Z5.500.1	■
5.560	7/32	16.7	16.7	10	70	5	2.CMC.SCFM1Z5.F732	■
6.0		18.0	18.0	10	70	5	2.CMCCF.M1Z5.600.1	■
6.350	1/4	19.1	19.1	10	70	5	2.CMC.SCFM1Z5.F14	■
8.0		24.0	24.0	12	80	5	2.CMCCF.M1Z5.800.1	Δ

■ Stock item
Δ Delivery term upon request, minimum purchase order quantity 3 pcs.

Corner radius



d _i	d _i	I ₁	I ₂	D (h6)	L	Z	r	r	Item number	Availability
[mm]	[inch]	[mm]	[mm]	[mm]	[mm]	[flutes]	[mm]	[inch]		
1.0		3.00	3.00	4	40	4	0.10		2.CMCCF.M2Z4.100.1	■
1.0		3.00	3.00	4	40	4	0.20		2.CMCCF.M3Z4.100.1	■
1.2		3.60	3.60	4	40	4	0.10		2.CMCCF.M2Z4.120.1	■
1.2		3.60	3.60	4	40	4	0.20		2.CMCCF.M3Z4.120.1	■
1.5		4.50	4.50	4	40	4	0.10		2.CMCCF.M2Z4.150.1	■
1.5		4.50	4.50	4	40	4	0.30		2.CMCCF.M3Z4.150.1	■
1.587	1/16	4.76	4.76	4	40	4	0.254	.0100	2.CMC.RCFM2Z4.F116	■
1.587	1/16	4.76	4.76	4	40	4	0.508	.0200	2.CMC.RCFM3Z4.F116	■
1.8		5.40	5.40	4	40	4	0.10		2.CMCCF.M2Z4.180.1	■
1.8		5.40	5.40	4	40	4	0.30		2.CMCCF.M3Z4.180.1	■
2.0		6.00	6.00	4	40	4	0.10		2.CMCCF.M2Z4.200.1	■
2.0		6.00	6.00	4	40	4	0.20		2.CMCCF.M3Z4.200.1	■
2.0		6.00	6.00	4	40	4	0.50		2.CMCCF.M4Z4.200.1	■
2.381	3/32	7.14	7.14	4	44	4	0.127	.0050	2.CMC.RCFM2Z4.F332	■
2.381	3/32	7.14	7.14	4	44	4	0.254	.0100	2.CMC.RCFM3Z4.F332	■
2.381	3/32	7.14	7.14	4	44	4	0.508	.0200	2.CMC.RCFM4Z4.F332	■
2.5		7.50	7.50	6	55	4	0.20		2.CMCCF.M2Z4.250.1	■
2.5		7.50	7.50	6	55	4	0.50		2.CMCCF.M3Z4.250.1	■
3.0		9.00	9.00	6	55	5	0.20		2.CMCCF.M2Z5.300.1	■
3.0		9.00	9.00	6	55	5	0.50		2.CMCCF.M3Z5.300.1	■
3.175	1/8	9.53	9.53	6	55	5	0.127	.0050	2.CMC.RCFM0Z5.F18	■
3.175	1/8	9.53	9.53	6	55	5	0.254	.0100	2.CMC.RCFM2Z5.F18	■
3.175	1/8	9.53	9.53	6	55	5	0.508	.0200	2.CMC.RCFM3Z5.F18	■
3.175	1/8	9.53	9.53	6	55	5	0.762	.0300	2.CMC.RCFM4Z5.F18	■
3.5		10.50	10.50	6	55	5	0.20		2.CMCCF.M2Z5.350.1	■
3.5		10.50	10.50	6	55	5	0.50		2.CMCCF.M3Z5.350.1	■
3.968	5/32	11.90	11.90	6	55	5	0.254	.0100	2.CMC.RCFM2Z5.F532	■
3.968	5/32	11.90	11.90	6	55	5	0.508	.0200	2.CMC.RCFM3Z5.F532	■
4.0		12.00	12.00	6	55	5	0.20		2.CMCCF.M2Z5.400.1	■
4.0		12.00	12.00	6	55	5	0.50		2.CMCCF.M3Z5.400.1	■
4.5		13.50	13.50	8	65	5	0.20		2.CMCCF.M2Z5.450.1	■
4.5		13.50	13.50	8	65	5	0.50		2.CMCCF.M3Z5.450.1	■
4.762	3/16	14.29	14.29	8	65	5	0.254	.0100	2.CMC.RCFM2Z5.F316	■
4.762	3/16	14.29	14.29	8	65	5	0.762	.0300	2.CMC.RCFM3Z5.F316	■
5.0		15.00	15.00	8	65	5	0.20		2.CMCCF.M2Z5.500.1	■
5.0		15.00	15.00	8	65	5	0.50		2.CMCCF.M3Z5.500.1	■
5.560	7/32	16.68	16.68	10	70	5	0.254	.0100	2.CMC.RCFM2Z5.F732	■
5.560	7/32	16.68	16.68	10	70	5	0.762	.0300	2.CMC.RCFM3Z5.F732	■
6.0		18.00	18.00	10	70	5	0.20		2.CMCCF.M2Z5.600.1	■
6.0		18.00	18.00	10	70	5	0.50		2.CMCCF.M3Z5.600.1	■
6.0		18.00	18.00	10	70	5	1.00		2.CMCCF.M4Z5.600.1	■
6.350	1/4	19.05	19.05	10	70	5	0.254	.0100	2.CMC.RCFM2Z5.F14	■
6.350	1/4	19.05	19.05	10	70	5	0.508	.0200	2.CMC.RCFM3Z5.F14	■
6.350	1/4	19.05	19.05	10	70	5	0.762	.0300	2.CMC.RCFM4Z5.F14	■
8.0		24.00	24.00	12	80	5	0.20		2.CMCCF.M2Z5.800.1	Δ
8.0		24.00	24.00	12	80	5	0.50		2.CMCCF.M3Z5.800.1	Δ
8.0		24.00	24.00	12	80	5	1.00		2.CMCCF.M4Z5.800.1	Δ

■ Stock item
Δ Delivery term upon request, minimum purchase order quantity 3 pcs.

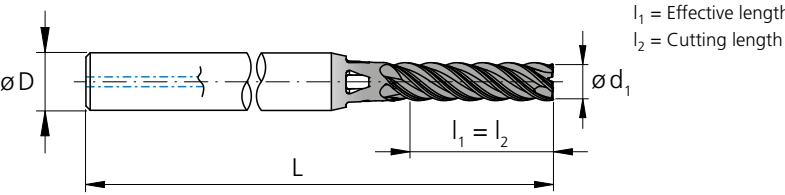
NEW

Type N - 4 x d - Square / Corner radius - Z4 / Z5

Carbide											
Ø d ₁		0.1 - 3.0 mm		3.1 - 6.0 mm		6.1 - 10.0 mm					
Tolerance		- 0.014 mm - 0.028 mm		- 0.020 mm - 0.038 mm		- 0.025 mm - 0.047 mm					

MILLING WITH INTEGRATED COOLING

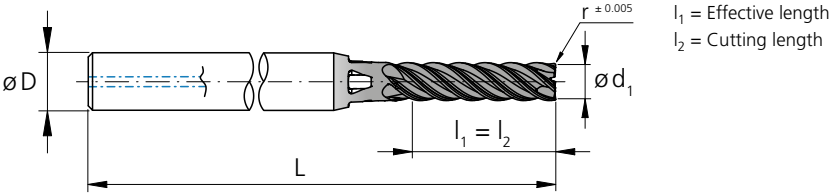
Square



d ₁	d ₁	l ₁	l ₂	D (h6)	L	Z	Item number	Availability
[mm]	[inch]	[mm]	[mm]	[mm]	[mm]	[flutes]		
1.0		4.0	4.0	4	40	4	2.CMCCFN1Z4.100.1	■
1.2		4.8	4.8	4	40	4	2.CMCCFN1Z4.120.1	■
1.5		6.0	6.0	4	40	4	2.CMCCFN1Z4.150.1	■
1.587	1/16	6.3	6.3	4	40	4	2.CMC.SCFN1Z4.F116	■
1.8		7.2	7.2	4	40	4	2.CMCCFN1Z4.180.1	■
2.0		8.0	8.0	4	44	4	2.CMCCFN1Z4.200.1	■
2.381	3/32	9.5	9.5	4	44	4	2.CMC.SCFN1Z4.F332	■
2.5		10.0	10.0	6	55	4	2.CMCCFN1Z4.250.1	■
3.0		12.0	12.0	6	55	5	2.CMCCFN1Z5.300.1	■
3.175	1/8	12.7	12.7	6	60	5	2.CMC.SCFN1Z5.F18	■
3.5		14.0	14.0	6	60	5	2.CMCCFN1Z5.350.1	■
3.968	5/32	15.9	15.9	6	60	5	2.CMC.SCFN1Z5.F532	■
4.0		16.0	16.0	6	60	5	2.CMCCFN1Z5.400.1	■
4.5		18.0	18.0	8	70	5	2.CMCCFN1Z5.450.1	■
4.762	3/16	19.0	19.0	8	70	5	2.CMC.SCFN1Z5.F316	■
5.0		20.0	20.0	8	70	5	2.CMCCFN1Z5.500.1	■
5.560	7/32	22.2	22.2	10	75	5	2.CMC.SCFN1Z5.F732	■
6.0		24.0	24.0	10	75	5	2.CMCCFN1Z5.600.1	■
6.350	1/4	25.4	25.4	10	80	5	2.CMC.SCFN1Z5.F14	■
8.0		32.0	32.0	12	90	5	2.CMCCFN1Z5.800.1	Δ

■ Stock item
Δ Delivery term upon request, minimum purchase order quantity 3 pcs.

Corner radius



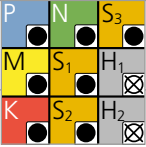
d ₁	d ₁	l ₁	l ₂	D (h6)	L	Z	r	r	Item number	Availability
[mm]	[inch]	[mm]	[mm]	[mm]	[mm]	[flutes]	[mm]	[inch]		
1.0		4.00	4.00	4	40	4	0.10		2.CMCCFN2Z4.100.1	■
1.0		4.00	4.00	4	40	4	0.20		2.CMCCFN3Z4.100.1	■
1.2		4.80	4.80	4	40	4	0.10		2.CMCCFN2Z4.120.1	■
1.2		4.80	4.80	4	40	4	0.20		2.CMCCFN3Z4.120.1	■
1.5		6.00	6.00	4	40	4	0.10		2.CMCCFN2Z4.150.1	■
1.5		6.00	6.00	4	40	4	0.30		2.CMCCFN3Z4.150.1	■
1.587	1/16	6.35	6.35	4	40	4	0.254	.0100	2.CMC.RCFN2Z4.F116	■
1.587	1/16	6.35	6.35	4	40	4	0.508	.0200	2.CMC.RCFN3Z4.F116	■
1.8		7.20	7.20	4	40	4	0.10		2.CMCCFN2Z4.180.1	■
1.8		7.20	7.20	4	40	4	0.30		2.CMCCFN3Z4.180.1	■
2.0		8.00	8.00	4	44	4	0.10		2.CMCCFN2Z4.200.1	■
2.0		8.00	8.00	4	44	4	0.20		2.CMCCFN3Z4.200.1	■
2.0		8.00	8.00	4	44	4	0.50		2.CMCCFN4Z4.200.1	■
2.381	3/32	9.52	9.52	4	44	4	0.127	.0050	2.CMC.RCFN2Z4.F332	■
2.381	3/32	9.52	9.52	4	44	4	0.254	.0100	2.CMC.RCFN3Z4.F332	■
2.381	3/32	9.52	9.52	4	44	4	0.508	.0200	2.CMC.RCFN4Z4.F332	■
2.5		10.00	10.00	6	55	4	0.20		2.CMCCFN2Z4.250.1	■
2.5		10.00	10.00	6	55	4	0.50		2.CMCCFN3Z4.250.1	■
3.0		12.00	12.00	6	55	5	0.20		2.CMCCFN2Z5.300.1	■
3.0		12.00	12.00	6	55	5	0.50		2.CMCCFN3Z5.300.1	■
3.175	1/8	12.70	12.70	6	60	5	0.127	.0050	2.CMC.RCFN0Z5.F18	■
3.175	1/8	12.70	12.70	6	60	5	0.254	.0100	2.CMC.RCFN2Z5.F18	■
3.175	1/8	12.70	12.70	6	60	5	0.508	.0200	2.CMC.RCFN3Z5.F18	■
3.175	1/8	12.70	12.70	6	60	5	0.762	.0300	2.CMC.RCFN4Z5.F18	■
3.5		14.00	14.00	6	60	5	0.20		2.CMCCFN2Z5.350.1	■
3.5		14.00	14.00	6	60	5	0.50		2.CMCCFN3Z5.350.1	■
3.968	5/32	15.87	15.87	6	60	5	0.254	.0100	2.CMC.RCFN2Z5.F532	■
3.968	5/32	15.87	15.87	6	60	5	0.508	.0200	2.CMC.RCFN3Z5.F532	■
4.0		16.00	16.00	6	60	5	0.20		2.CMCCFN2Z5.400.1	■
4.0		16.00	16.00	6	60	5	0.50		2.CMCCFN3Z5.400.1	■
4.5		18.00	18.00	8	70	5	0.20		2.CMCCFN2Z5.450.1	■
4.5		18.00	18.00	8	70	5	0.50		2.CMCCFN3Z5.450.1	■
4.762	3/16	19.05	19.05	8	70	5	0.254	.0100	2.CMC.RCFN2Z5.F316	■
4.762	3/16	19.05	19.05	8	70	5	0.762	.0300	2.CMC.RCFN3Z5.F316	■
5.0		20.00	20.00	8	70	5	0.20		2.CMCCFN2Z5.500.1	■
5.0		20.00	20.00	8	70	5	0.50		2.CMCCFN3Z5.500.1	■
5.560	7/32	22.24	22.24	10	75	5	0.254	.0100	2.CMC.RCFN2Z5.F732	■
5.560	7/32	22.24	22.24	10	75	5	0.762	.0300	2.CMC.RCFN3Z5.F732	■
6.0		24.00	24.00	10	75	5	0.20		2.CMCCFN2Z5.600.1	■
6.0		24.00	24.00	10	75	5	0.50		2.CMCCFN3Z5.600.1	■
6.0		24.00	24.00	10	75	5	1.00		2.CMCCFN4Z5.600.1	■
6.350	1/4	25.40	25.40	10	80	5	0.254	.0100	2.CMC.RCFN2Z5.F14	■
6.350	1/4	25.40	25.40	10	80	5	0.508	.0200	2.CMC.RCFN3Z5.F14	■
6.350	1/4	25.40	25.40	10	80	5	0.762	.0300	2.CMC.RCFN4Z5.F14	■
8.0		32.00	32.00	12	90	5	0.20		2.CMCCFN2Z5.800.1	Δ
8.0		32.00	32.00	12	90	5	0.50		2.CMCCFN3Z5.800.1	Δ
8.0		32.00	32.00	12	90	5	1.00		2.CMCCFN4Z5.800.1	Δ

■ Stock item
Δ Delivery term upon request, minimum purchase order quantity 3 pcs.

Type M - Semi-finishing

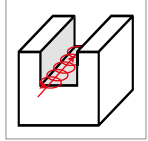
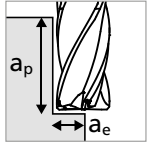
V_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ● Good | ○ Acceptable | ☒ Not recommended



MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

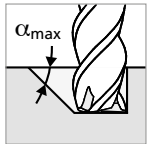
Semi-finishing



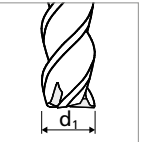
- ①
■ a_p = 3 x d₁
■ a_e = 0.15 x d₁

- ②
■ a_p = 3 x d₁
■ a_e = 0.1 x d₁

- ③
■ a_p = 3 x d₁
■ a_e = 0.05 x d₁



Note:
In case of linear ramp
or helical interpolation
milling reduce f_z by
20% and use α = 3°
for all materials

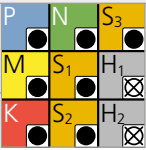


Materials group	Material	Mat. No.	DIN	AISI/ASTM/UNS	1.0 mm						1.5 mm 1/16"						Ød ₁																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
					①		②		③		①		②		③		2.0 mm 3/32"			3.0 mm 1/8"			4.0 mm 5/32"			5.0 mm 3/16" - 7/32"			6.0 mm 1/4"			8.0 mm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
					v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

Type M - Finishing

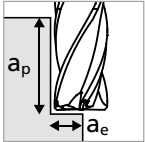
v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ● Good | ○ Acceptable | ☒ Not recommended

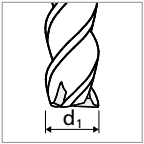


MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



■ **a_p = 3 x d₁**
■ **a_e = 0.02 x d₁**

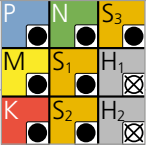


Materials group	Material	Mat.No.	DIN	AISI/ASTM/UNS	1.0 mm			1.5 mm 1/16"		2.0 mm 3/32"		3.0 mm 1/8"		Ød ₁ 4.0 mm 5/32"		5.0 mm 3/16" - 7/32"		6.0 mm 1/4"		8.0 mm	
					v _c	f _z		v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z
P	Unalloyed carbon steel R _m < 800 N/mm²	1.0301	C10	AISI 1010	130	0.009		180	0.014	200	0.020	210	0.026	220	0.029	220	0.032	220	0.038	220	0.044
		1.0401	C15	AISI 1015																	
		1.1191	C45E/CK45	AISI 1045																	
		1.0044	S275JR	AISI 1020																	
		1.0715	11SMn30	AISI 1215																	
	Low alloyed steel R _m > 900 N/mm²	1.5752	15NiCr13	ASTM 3415 / AISI 3310	130	0.008		180	0.013	200	0.018	210	0.025	220	0.028	220	0.030	220	0.033	220	0.040
		1.7131	16MnCr5	AISI 5115																	
		1.3505	100Cr6	AISI 52100																	
		1.7225	42CrMo4	AISI 4140																	
		1.2842	90MnCrV8	AISI O2																	
	High alloyed tool steel R _m < 1200 N/mm²	1.2379	X153CrMoV12	AISI D2	130	0.007		180	0.012	200	0.017	210	0.023	220	0.024	220	0.026	220	0.029	220	0.035
		1.2436	X210CrW12	AISI D4/D6																	
		1.3343	HS6-5-2C	AISI M2 / UNS T11302																	
		1.3355	HS18-0-1	AISI T1 / UNS T12001																	
M	Stainless steel ferritic	1.4016	X6Cr17	AISI 430 / UNS S43000	130	0.009		180	0.014	200	0.020	210	0.025	220	0.028	220	0.030	220	0.033	260	0.040
		1.4105	X6CrMoS17	AISI 430F																	
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	130	0.009		180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
		1.4112	X90CrMoV18	AISI 440B																	
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	130	0.009		180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH																	
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	130	0.007		180	0.009	200	0.017	210	0.023	220	0.025	220	0.028	220	0.030	260	0.037
		1.4435	X2CrNiMo18-14-3	AISI 316L																	
		1.4441	X2CrNiMo18-15-3	AISI 316LM																	
1.4539		X1NiCrMoCu25-20-5	AISI 904L																		
K	Cast iron	0.6020	GG20	ASTM 30	110	0.007		130	0.014	150	0.016	160	0.025	170	0.029	170	0.033	170	0.036	200	0.042
		0.6030	GG30	ASTM 40B																	
		0.7040	GGG40	ASTM 60-40-18																	
		0.7060	GGG60	ASTM 80-60-03																	
N	Aluminium alloy wrought	3.2315	AlMgSi1	ASTM 6351	130	0.010		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		3.4365	AlZnMgCu1.5	ASTM 7075																	
	Aluminium alloy cast	3.2163	GD-AISI9Cu3	ASTM A380	130	0.010		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		3.2381	GD-AISI10Mg	UNS A03590																	
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	130	0.012		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		2.0065	Cu-ETP / CW004A	UNS C11000																	
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	130	0.012		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		2.0360	CuZn40 CW509L	UNS C28000																	
	Brass, Bronze R _m < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	130	0.012		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		2.1020	CuSn6	UNS C51900																	
Bronze R _m < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	130	0.010		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047	
	2.0960	CuAl9Mn2	UNS C63200																		
S ₁	Super alloys	2.4856		Inconel 625	110	0.005		120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020
		2.4668		Inconel 718																	
		2.4617	NiMo28	Hastelloy B-2																	
		2.4665	NiCr22Fe18Mo	Hastelloy X																	
S ₂	Titanium pure	3.7035	Gr.2	ASTM B348 / F67	110	0.009		120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
		3.7065	Gr.4	ASTM B348 / F68																	
S ₃	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	110	0.009		120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
		9.9367	TiAl6Nb7	ASTM F1295																	
	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	110	0.005		120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020
			CrCoMo28	ASTM F1537																	
H ₁ H ₂	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1																	
	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2																	

Type N - Semi-finishing

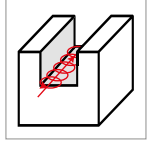
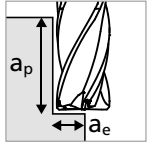
v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ● Good | ○ Acceptable | ⊗ Not recommended



MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Semi-finishing

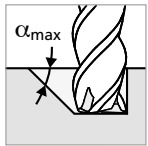


①

■ **a_p** = 4 x **d_i**
■ **a_e** = 0.1 x **d_i**

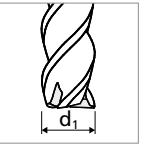
②

■ **a_p** = 4 x **d_i**
■ **a_e** = 0.05 x **d_i**



Note:

In case of linear ramp or helical interpolation milling reduce f_z by 20% and use α = 3° for all materials

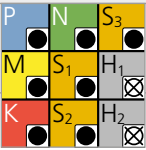


Materials group	Material	Mat. No.	DIN	AISI/ASTM/UNS	1.0 mm				1.5 mm 1/16"					2.0 mm 3/32"				3.0 mm 1/8"				4.0 mm 5/32"				5.0 mm 3/16" - 7/32"				6.0 mm 1/4"				8.0 mm																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
					①		②		①		②			①		②		①		②		①		②		①		②		①		②		①		②																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
					v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z		v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	145	0.008	200	0.012	170	0.011	220	0.018		170	0.020	220	0.030	200	0.027	260	0.041	210	0.030	280	0.046	210	0.035	280	0.052	230	0.042	300	0.064	230	0.054	300	0.083																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		1.0401	C15	AISI 1015																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.1191	C45E/CK45	AISI 1045																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.0044	S275JR	AISI 1020																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.0715	11SMn30	AISI 1215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Low alloyed steel Rm > 900 N/mm²	1.5752	15NiCr13	ASTM 3415 / AISI 3310	145	0.008	200	0.012	170	0.011	220	0.018		170	0.020	220	0.030	200	0.027	260	0.041	210	0.030	280	0.046	210	0.035	280	0.052	230	0.042	300	0.064	230	0.054	300	0.083																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		1.7131	16MnCr5	AISI 5115																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.3505	100Cr6	AISI 52100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.7225	42CrMo4	AISI 4140																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.2842	90MnCrV8	AISI O2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	High alloyed tool steel Rm < 1200 N/mm²	1.2379	X153CrMoV12	AISI D2	130	0.007	180	0.010	140	0.011	190	0.015		160	0.017	210	0.025	160	0.024	210	0.036	185	0.028	240	0.043	185	0.033	240	0.050	185	0.036	240	0.056	185	0.043	240	0.067																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		1.2436	X210CrW12	AISI D4/D6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.3343	HS6-5-2C	AISI M2 / UNS T11302																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
1.3355		HS18-0-1	AISI T1 / UNS T12001																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
M	Stainless steel ferritic	1.4016	X6Cr17	AISI 430 / UNS S43000	100	0.008	145	0.011	120	0.011	160	0.017		130	0.018	180	0.027	145	0.025	190	0.038	170	0.028	210	0.044	170	0.032	210	0.051	170	0.038	210	0.061	170	0.048	210	0.077																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		1.4105	X6CrMoS17	AISI 430F																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	100	0.008	145	0.011	120	0.011	160	0.017		130	0.018	180	0.027	145	0.025	190	0.038	170	0.028	210	0.044	170	0.032	210	0.051	170	0.038	210	0.061	170	0.048	210	0.077																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		1.4112	X90CrMoV18	AISI 440B																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	100	0.007	130	0.010	110	0.010	140	0.015		110	0.016	140	0.025	130	0.022	160	0.035	145	0.025	180	0.041	145	0.031	180	0.049	145	0.034	180	0.056	145	0.042	180	0.067																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	100	0.007	130	0.010	110	0.010	140	0.015		110	0.015	140	0.024	130	0.024	160	0.038	145	0.027	180	0.044	145	0.029	180	0.048	145	0.032	180	0.053	145	0.039	180	0.064																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		1.4435	X2CrNiMo18-14-3	AISI 316L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.4441	X2CrNiMo18-15-3	AISI 316LM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		1.4539	X1NiCrMoCu25-20-5	AISI 904L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
K	Cast iron	0.6020	GG20	ASTM 30	100	0.008	130	0.012	110	0.011	145	0.017		120	0.020	170	0.029	140	0.027	190	0.040	180	0.030	230	0.048	190	0.034	240	0.053	220	0.040	270	0.065	220	0.054	270	0.086																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		0.6030	GG30	ASTM 40B																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		0.7040	GGG40	ASTM 60-40-18																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		0.7060	GGG60	ASTM 80-60-03																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

Type N - Finishing

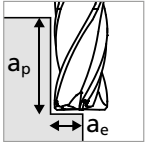
v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ● Good | ○ Acceptable | ☒ Not recommended

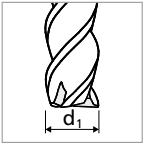


MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



■ **a_p = 4 x d₁**
■ **a_e = 0.02 x d₁**



Materials group	Material	Mat.No.	DIN	AISI/ASTM/UNS	1.0 mm			1.5 mm 1/16"		2.0 mm 3/32"		3.0 mm 1/8"		Ød ₁ 4.0 mm 5/32"		5.0 mm 3/16" - 7/32"		6.0 mm 1/4"		8.0 mm	
					v _c	f _z		v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	130	0.009		180	0.014	200	0.020	210	0.026	220	0.029	220	0.032	220	0.038	220	0.044
		1.0401	C15	AISI 1015																	
		1.1191	C45E/CK45	AISI 1045																	
		1.0044	S275JR	AISI 1020																	
		1.0715	11SMn30	AISI 1215																	
	Low alloyed steel Rm > 900 N/mm²	1.5752	15NiCr13	ASTM 3415 / AISI 3310	130	0.008		180	0.013	200	0.018	210	0.025	220	0.028	220	0.030	220	0.033	220	0.040
		1.7131	16MnCr5	AISI 5115																	
		1.3505	100Cr6	AISI 52100																	
		1.7225	42CrMo4	AISI 4140																	
		1.2842	90MnCrV8	AISI O2																	
	High alloyed tool steel Rm < 1200 N/mm²	1.2379	X153CrMoV12	AISI D2	130	0.007		180	0.012	200	0.017	210	0.023	220	0.024	220	0.026	220	0.029	220	0.035
		1.2436	X210CrW12	AISI D4/D6																	
		1.3343	HS6-5-2C	AISI M2 / UNS T11302																	
	1.3355	HS18-0-1	AISI T1 / UNS T12001																		
M	Stainless steel ferritic	1.4016	X6Cr17	AISI 430 / UNS S43000	130	0.009		180	0.014	200	0.020	210	0.025	220	0.028	220	0.030	220	0.033	260	0.040
		1.4105	X6CrMoS17	AISI 430F																	
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	130	0.009		180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
		1.4112	X90CrMoV18	AISI 440B																	
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	130	0.009		180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH																	
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	130	0.007		180	0.009	200	0.017	210	0.023	220	0.025	220	0.028	220	0.030	260	0.037
		1.4435	X2CrNiMo18-14-3	AISI 316L																	
		1.4441	X2CrNiMo18-15-3	AISI 316LM																	
1.4539		X1NiCrMoCu25-20-5	AISI 904L																		
K	Cast iron	0.6020	GG20	ASTM 30	110	0.007		130	0.014	150	0.016	160	0.025	170	0.029	170	0.033	170	0.036	200	0.042
		0.6030	GG30	ASTM 40B																	
		0.7040	GGG40	ASTM 60-40-18																	
		0.7060	GGG60	ASTM 80-60-03																	
N	Aluminium alloy wrought	3.2315	AlMgSi1	ASTM 6351	130	0.010		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		3.4365	AlZnMgCu1.5	ASTM 7075																	
	Aluminium alloy cast	3.2163	GD-AISI9Cu3	ASTM A380	130	0.010		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		3.2381	GD-AISI10Mg	UNS A03590																	
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	130	0.012		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		2.0065	Cu-ETP / CW004A	UNS C11000																	
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	130	0.012		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		2.0360	CuZn40 CW509L	UNS C28000																	
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	130	0.012		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
		2.1020	CuSn6	UNS C51900																	
Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	130	0.010		180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047	
	2.0960	CuAl9Mn2	UNS C63200																		
S ₁	Super alloys	2.4856		Inconel 625	110	0.005		120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020
		2.4668		Inconel 718																	
		2.4617	NiMo28	Hastelloy B-2																	
		2.4665	NiCr22Fe18Mo	Hastelloy X																	
S ₂	Titanium pure	3.7035	Gr.2	ASTM B348 / F67	110	0.009		120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
		3.7065	Gr.4	ASTM B348 / F68																	
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	110	0.009		120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
9.9367		TiAl6Nb7	ASTM F1295																		
S ₃	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	110	0.005		120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020
			CrCoMo28	ASTM F1537																	
H ₁ H ₂	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1																	
	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2																	

NEW

Process CrazyMill Cool CF

ACCURATE AND EFFICIENT MILLING

Coolant type, pressure and filtration

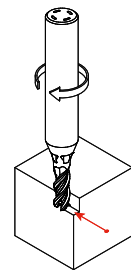
Coolant: for best results, Mikron Tool recommends the use of cutting oil as coolant. Alternatively, water base coolant with EP-Additives (Extreme-Pressure-Additives) can be used as well.

Filter: the large cooling channels permit the use of a standard filter with filter quality of ≤ 0.05 mm.

Coolant pressure: at least 15 bar coolant pressure is required to achieve reliable milling. High pressure is generally better for the cooling and flushing effect.

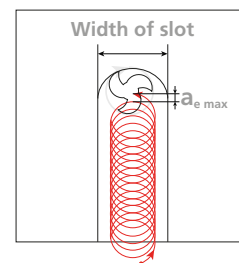
Revolution	[rpm]	$\leq 10'000$	$> 10'000$
Minimal pressure	[bar]	15	30

Climb milling and conventional milling



Mikron tool recommends climb milling for the machining of side and pocket milling. The chip thickness here is greater at the beginning and decreases continuously; the cutting forces remain low. With conventional milling, however, high cutting forces would push the milling tool away from the part. Thus surface quality decreases.

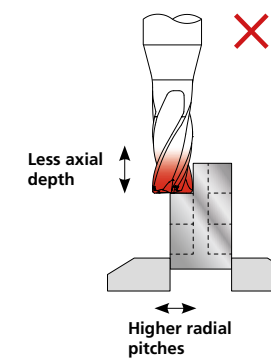
Trochoidal slot milling



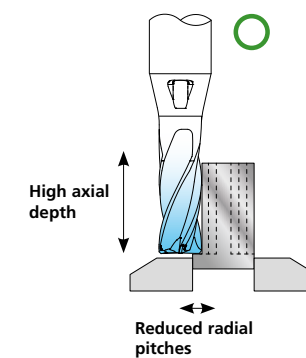
Cutting values: see cutting data chart "Semi-finishing" at page 22 and 26!

MILLING PROCESS

Traditional vs. High efficiency milling (HEM)

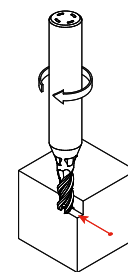


Traditional Milling
Work, heat and wear are concentrated along a smaller portion of the cutting edge.



High Efficiency Milling
Work, heat and wear are spread over entire cutting edge.

Semi-finishing

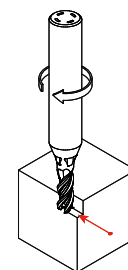


Recommended cutting parameters

v_c and f_z = as specified in the cutting data table

Strategy	Type M	Type N
①	$a_p = 3 \times d$ $a_e = 0.15 \times d$	$a_p = 4 \times d$ $a_e = 0.1 \times d$
②	$a_p = 3 \times d$ $a_e = 0.1 \times d$	$a_p = 4 \times d$ $a_e = 0.05 \times d$
③	$a_p = 3 \times d$ $a_e = 0.05 \times d$	-

Finishing



Recommended cutting parameters

v_c and f_z = as specified in the cutting data table

Strategy	Type M	Type N
①	$a_p = z$ $a_e = 0.02 \times d$	$a_p = 4 \times d$ $a_e = 0.02 \times d$

Mastercam

News: Tool libraries of all Mikron Tool catalog products are available on Mastercam's Tech Exchange, ready for download!



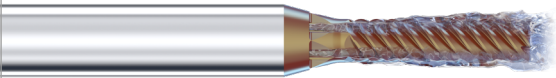
NEW

CrazyMill Cool SF

NEW



IT'S TIME TO SUPER FINISH!



Our "Crazy" R&D department developed a new high-performance endmill for super finishing operation, which once again sets a benchmark in terms of surface quality.

The latest development CrazyMill Cool SF mills surfaces in grinding quality and replaces subsequent grinding operations! This is made possible by the perfect coordination of a completely new milling concept, such as a tailored carbide substrate based on ultra-fine grains, a highly efficient integrated high-performance cooling concept and a cutting edge conditioning system developed specifically for super finishing. In addition, there is a new cutting edge geometry with a variable helix angle and unequal angular teeth division. The new endmill guarantees a completely crazy surface finish in grinding quality - what's more, it mills in the narrowest tolerance ranges.

CrazyMill Cool SF keeps surfaces constantly below Ra 0.3 µm for more than seven (!) hours machining time on stainless steel 316L!

Available in different diameters between Ø1 mm - 8 mm in two full cutting lengths of 3 and 4 times diameter.

Regrinding: This product is not suitable for regrinding.

Please note: You couldn't find your suitable version of the CrazyMill Cool SF (diameter, length, cutting direction...)? Ask us about our customized versions!

NEW

CrazyMill Cool SF

NEW

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

1. Challenge

Avoid and/or reduce subsequent polishing operation

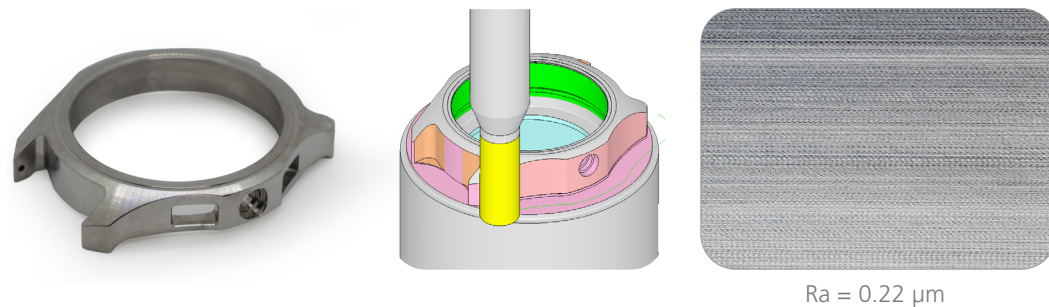
Most of the machined components, need a post surface treatment like grinding, polishing, tumbling and others. Those manufacturing steps can be very costly and very time consuming. Improving the surface quality through the super finishing milling process could avoid or reduce subsequent finishing operations (grinding, tumbling, polishing).

Solution

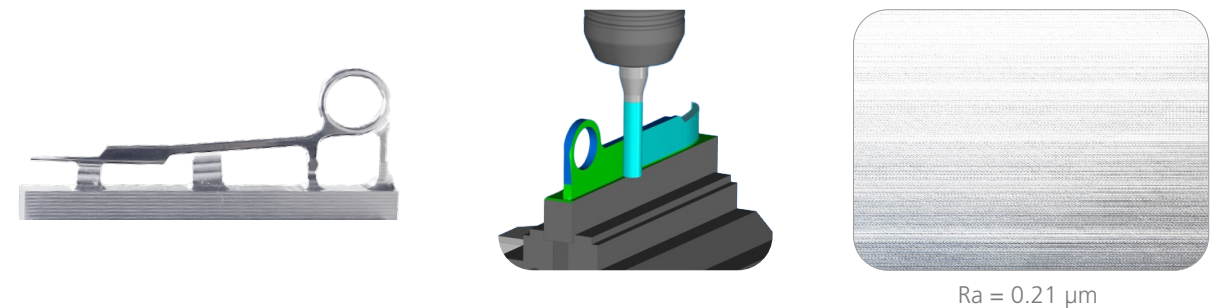
Surface milling below Ra 0.3 µm

The new CrazyMill Cool SF milling cutter is characterized by extremely smooth and sharply ground cutting edges, variable helix angle and unequal angular teeth division and a high number of teeth. These features enable low radial cutting pressure and extremely smooth running, resulting in milling surfaces of grinding quality. After machining, the surfaces have an astonishing roughness value of Ra 0.3 µm or better in milling direction (Ra parallel), and endmill axis direction (Ra perpendicular). This allows to shorten the manufacturing process, by avoiding or reducing significantly the post-surface treatment.

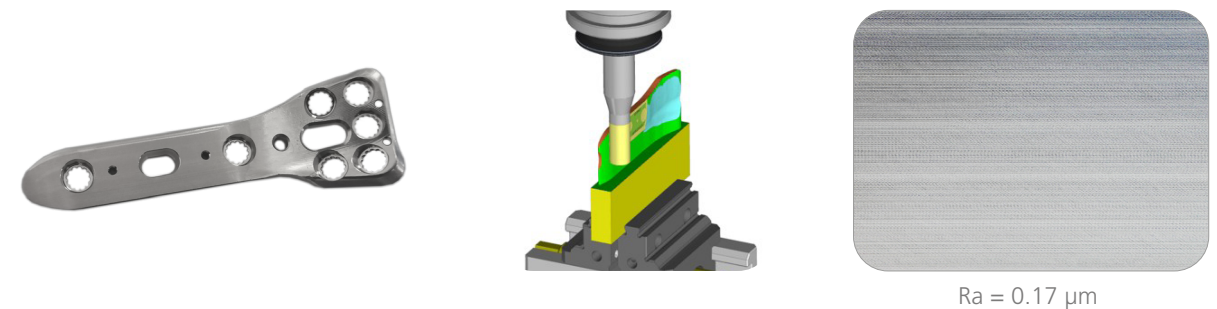
■ Real case: Watch Ti Gr.5 (3.7165)



■ Real case: Hemostatic clamp 17-4 PH



■ Real case: Radius compression plate Ti Gr.2 (3.7035)



NEW

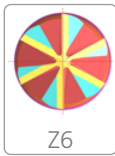
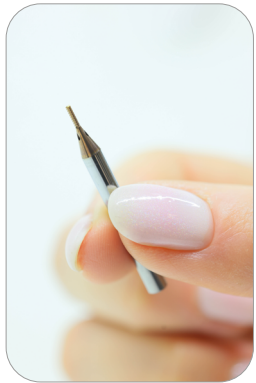
CrazyMill Cool SF

NEW

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

2. Challenge

Tool miniaturization



The miniaturization of milling tools brings with it the challenge of realizing the highly complex cutting geometries of milling tools even with diameters of less than $d = 3\text{ mm}$. The greatest challenge is to grind these complex geometries on small milling cutter cross-sections with a high number of flutes and at the same time to meet the highest quality requirements for the milling cutters in series with process reliability.

Solution

Highly skilled machine operators and suitable production equipment



State-of-the-art grinding machines with hydrostatic bearings and grinding wheel technologies that are state of the art, are crucial for the production of the latest micro-tools. High-precision digital measuring devices that detect deviations of up to one micrometer are also indispensable. The madmen at Mikron Tool have mastered these production processes and are excellently trained in the use of state-of-the-art tool grinding machines and processes in the micro range. The quality standard of the high-performance milling cutters is correspondingly high, producing the exact workpiece quality guaranteed by Mikron Tool.

3. Challenge

High performance endmill for all materials

Different materials present different mechanical characteristics. Different toughness, different hardness, different structure, that is different machinability. The best result can be achieved with a macro and micro geometry of the milling cutter cutting edges that is specifically tailored to the respective material. It is far more difficult to develop a cutting edge geometry that is suitable for the most important types of material in the machining sector and at the same time can achieve an outstanding surface quality in grinding quality.

Solution

Mikron Tool's last innovative product

Our "crazy" R&D department developed the new endmill CrazyMill Cool SF for super finishing with one unique cutting geometry. Thanks to this "crazy" development, the CrazyMill Cool SF achieves a surface roughness (perpendicular) of less than $Ra\ 0.3\ \mu\text{m}$ and also delivers outstanding shape accuracy on the workpiece. In addition, the CrazyMill Cool SF guarantees a remarkable tool life and extremely fast machining in all the materials shown below.

■ Stainless Steel	■ Titanium Gr.5	■ Titanium Gr.2	■ Aluminium
Ra = 0,18 μm	Ra = 0,22 μm	Ra = 0,20 μm	Ra = 0,16 μm
■ CrCo Alloys	■ Inconel	■ Copper	
Ra = 0,23 μm	Ra = 0,30 μm	Ra = 0,15 μm	

NEW

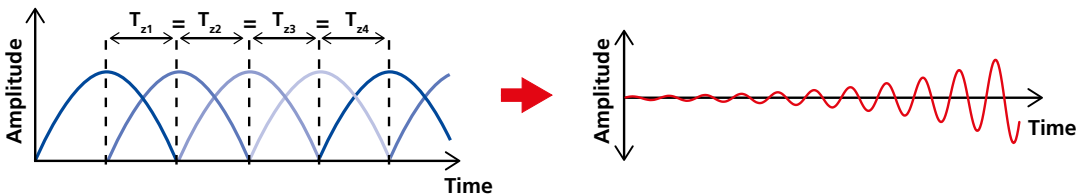
CrazyMill Cool SF

NEW

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

4. Challenge

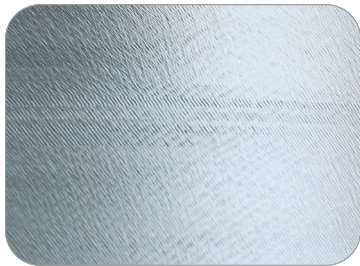
Avoid chatter when milling



Milling is a cutting process with a continuous interrupted cut. Each cutting edge applies a certain amount of pressure to the material. When the cutting edge exits the material, the pressure is released again.

This happens with all the cutting edges of symmetrically designed endmills at a predetermined frequency depending on the “number of cutting edges” x “speed”.

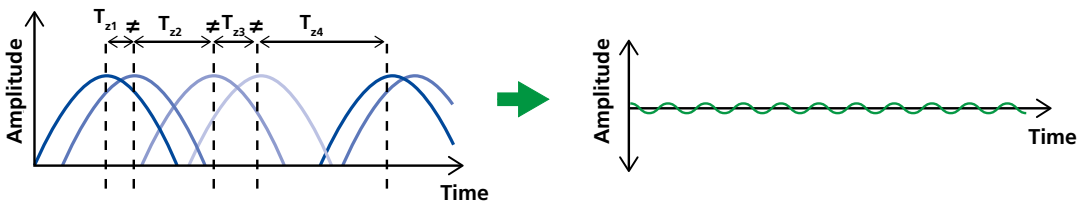
If the frequency is kept uniform (see diagram) ($T_{z1} = T_{z2} = T_{z3} = T_{z4}$), it can lead to an increase in the maximum deflection in the resonance frequency, resulting in vibrations and consequently chatter marks on the workpiece.



Surface with vibrations

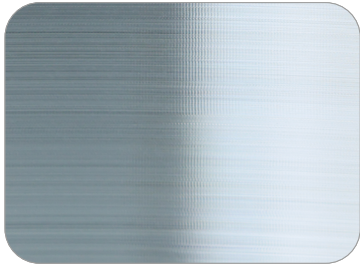
Solution

Avoidance of resonance frequencies

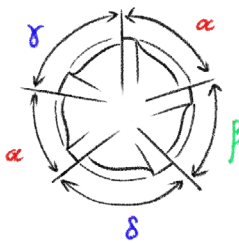


The new CrazyMill Cool SF has been specifically developed, to interrupt this resonance frequency. Using unequal angular teeth division, and a variable helix angle (every cutting edge has a different helix angle) every cutting edge generates a different frequency wave that occur in an irregular timing to the next or the previous cutting edge ($T_{z1} \neq T_{z2} \neq T_{z3} \neq T_{z4}$).

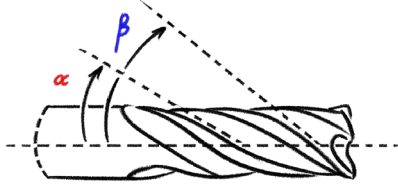
This results, as shown in the graph, in a resonant frequency amplitude reduction, and guarantees a vibration free surface.



Surface without vibrations



Unequal angular teeth division



Variable helix angle

NEW

CrazyMill Cool SF

NEW

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

5. Challenge

High temperature & chips in the cutting zone



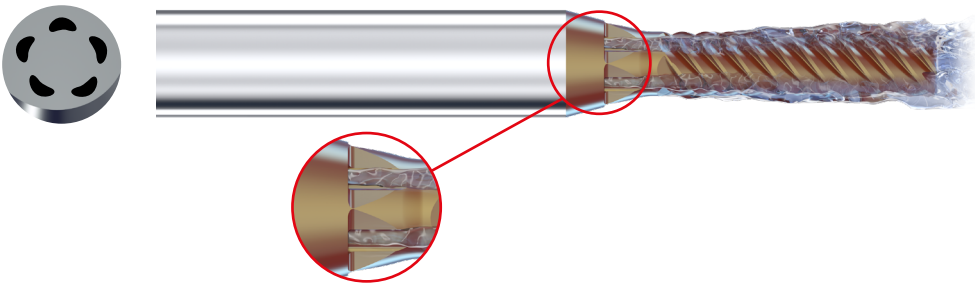
The machining of metals requires a high energy input into the cutting zones. A large proportion of this is converted directly into thermal energy. The higher the heat generated in the cutting zone, the shorter the tool life. It is therefore essential to keep the temperature in the cutting zone as low as possible. A high machining temperature also leads to poorer chip formation, poor chip flow and poor chip evacuation due to the higher plasticity of the chip, which can result in chip jam. These phenomena are exacerbated in materials that are difficult to machine, such as titanium, stainless steel and heat-resistant alloys.

Solution

Integrated cooling in shaft



The patented cooling channels of the Mikron Tool milling cutters, which run through the shank, ensure constant and massive cooling of the cutting edges. The excellent cooling performance directly in the cutting area enables a much high cutting speed and also reduces wear enormously. The massive coolant jet (from just 15 bar) also guarantees a chip-free machining zone and prevents the chips double cut. High cutting speeds, in combination with a higher feed pro flutes, lead to a reliable milling process with a high removal rate while maintaining excellent surface quality.



6. Challenge

A super finishing milling cutter for all materials?

Milling of high-quality and high-precision workpieces, with the highest demands on surface quality with an Ra (both directions) of less than 0.3µm is a major challenge. In addition, very high feed rates combined with excellent tool life and universal application in various materials seems possible.

Solution

The new CrazyMill Cool SF

The development goal for the CrazyMill Cool SF super finishing milling cutter was to develop an all-rounder that achieves surface finishes in grinding quality below 0.3µm in a wide range of materials. Thanks to the technical features of the milling cutter, the result is simply outstanding. See also the overview!

The CrazyMill Cool SF super finishing milling cutter is the new benchmark in super finishing precision micro milling.
CrazyMill Cool SF: Developed and produced by the madmen from Agno.

Characteristic	Maximum	CrazyMill Cool SF	Competitor 1	Competitor 2	Competitor 3
Ra perpendicular, based on Ra 0.15 - 0.3 µm	10	9	8	6	7
Ra parallel, based on Ra 0.15 - 0.3 µm	10	10	7	6	4
A (mm²/min)	10	10	6	7	8
Perpendicularity	10	9	5	4	6
Similar performance in stainless steel, titanium, steel, other material	10	8	4	1	3
Tool life, based on Ra 0.3 µm	10	10	8	4	5
Overall rating	10	9	7	5	4



Your benefits

The most important features

- Specific Super Finishing geometry
- Innovative flute geometry: Unequal angular teeth division and variable helix angle
- Specially designed cooling concept

Your advantages

- Mitigated chatter milling
- Very low cutting forces: perfect for side milling of thin-wall parts
- Controlled low temperature
- Reduced post machining process (polishing and tumbling)
- High performance in various materials

Your benefits

- Reduced machining time
- Excellent surface quality with Ra 0.3 µm or better
- Process reliability
- Very long tool life

NEW

Maximum performance guaranteed

EXAMPLE OF TITANIUM GR.2 MACHINING IN COMPARISON

■ Example

Faster machining time for the best roughness

Machining: Side milling
Milling depth: 24 mm
Coolant: Emulsion 8%

Pure titanium: 3.7035 / Ti Gr.2 / ASTM B348 S2

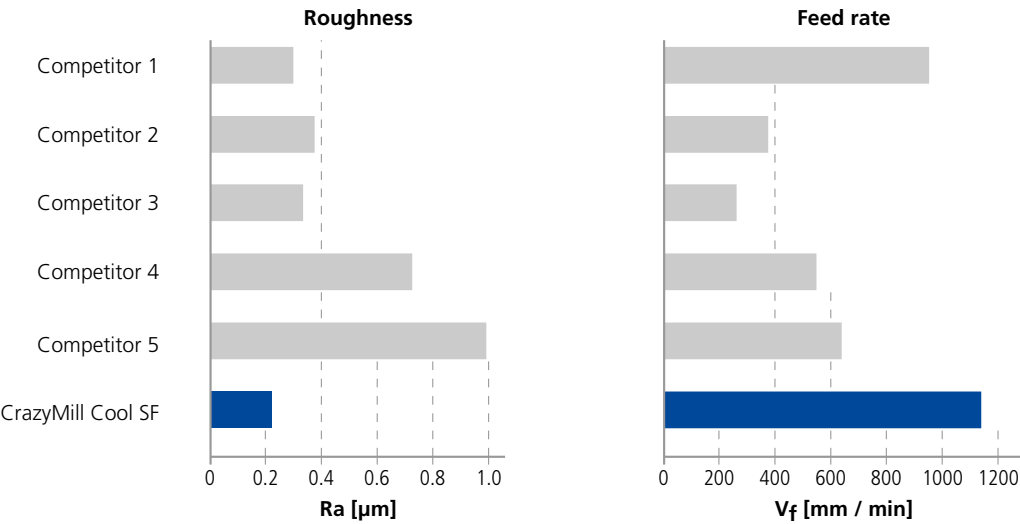
Tool: CrazyMill Cool SF
Diameter: 6.0 mm



Cutting data:

	v_c [m/min]	f_z [mm]	a_e [mm]	a_p [mm]	Z [flutes]
Competitor 1	100	0.026	0.18	24	7
Competitor 2	52	0.024	0.05	24	6
Competitor 3	46	0.014	0.60	24	7
Competitor 4	74	0.024	0.05	24	6
Competitor 5	80	0.030	0.05	24	5
CrazyMill Cool SF	140	0.025	0.05	24	6

Results:



3 x d

Type M

- Coated
- Integrated cooling
- I₁ (Effective length): 3xd
- I₂ (Cutting length): 3xd



4 x d

Type N

- Coated
- Integrated cooling
- I₁ (Effective length): 4xd
- I₂ (Cutting length): 4xd



NEW

1 | SHANK

The robust solid carbide shank guarantees stable and vibration-free milling. High precision and extraordinary surface quality are reached.

2 | INTEGRATED COOLING - PATENTED

The integrated cooling channels guarantee constant and maximal cooling of the cutting edges and optimal chip removal. The result is higher cutting speed as well as an excellent surface quality.

3 | CARBIDE

The specially developed micro-grain carbide meets all requirements in terms of mechanical properties.

4 | COATING

The high-performance eXedur SNP coating is heat and wear resistant, prevents buildup edges and guarantees optimum chip flushing. The result is a long tool life.

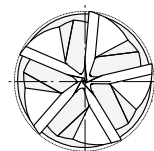
5 | SPECIFIC CHATTER-FREE GEOMETRY

The specific new cutting geometry with unequal angular teeth division and a variable helix angle, leads to an interruption of the resonance frequency allowing a vibration-free machining.

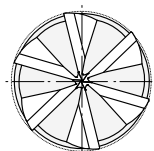
6 | LATERAL CUTTING GEOMETRY

Thanks to the high tool rigidity and the specific designed cutting edges lower radial machining force are achieved. The result is high perpendicularity precision and high surface quality.

Endmill tip



5 - Flute
Diameter range
Ø1 - 2.5 mm



6 - Flute
Diameter range
Ø3 - 8 mm

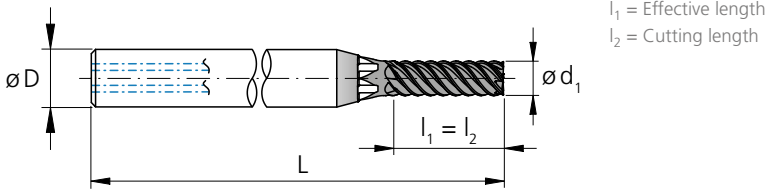
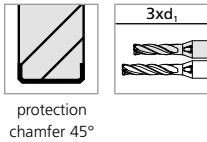
Type M - 3 x d - Square - Z5 / Z6

Type N - 4 x d - Square - Z5 / Z6

Carbide	Z 5-6							
		Ø d ₁	0.1 - 3.0 mm	3.1 - 6.0 mm	6.1 - 10.0 mm			
		Tolerance	- 0.014 mm - 0.028 mm	- 0.020 mm - 0.038 mm	- 0.025 mm - 0.047 mm			

Carbide	Z 5-6							
		Ø d ₁	0.1 - 3.0 mm	3.1 - 6.0 mm	6.1 - 10.0 mm			
		Tolerance	- 0.014 mm - 0.028 mm	- 0.020 mm - 0.038 mm	- 0.025 mm - 0.047 mm			

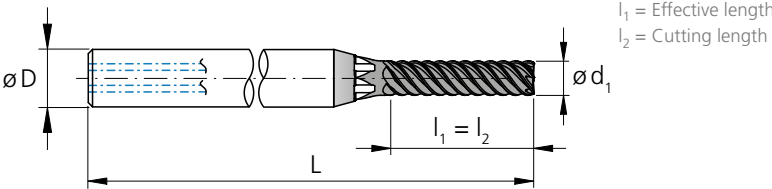
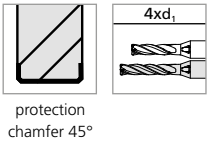
Square



d ₁	d ₁	I ₁	I ₂	D (h6)	L	Z	Item number	Availability
[mm]	[inch]	[mm]	[mm]	[mm]	[mm]	[flutes]		
1.0		3.0	3.0	4	40	5	2.CMCSF.M1Z5.100.1	■
1.2		3.6	3.6	4	40	5	2.CMCSF.M1Z5.120.1	■
1.5		4.5	4.5	4	40	5	2.CMCSF.M1Z5.150.1	■
1.587	1/16	4.8	4.8	4	40	5	2.CMC.SSFM1Z5.F116	■
1.8		5.4	5.4	4	40	5	2.CMCSF.M1Z5.180.1	■
2.0		6.0	6.0	4	40	5	2.CMCSF.M1Z5.200.1	■
2.381	3/32	7.1	7.1	4	40	5	2.CMC.SSFM1Z5.F332	■
2.5		7.5	7.5	6	55	5	2.CMCSF.M1Z5.250.1	■
3.0		9.0	9.0	6	55	6	2.CMCSF.M1Z6.300.1	■
3.175	1/8	9.5	9.5	6	55	6	2.CMC.SSFM1Z6.F18	■
3.5		10.5	10.5	6	55	6	2.CMCSF.M1Z6.350.1	■
3.968	5/32	11.9	11.9	6	55	6	2.CMC.SSFM1Z6.F532	■
4.0		12.0	12.0	6	55	6	2.CMCSF.M1Z6.400.1	■
4.5		13.5	13.5	8	65	6	2.CMCSF.M1Z6.450.1	■
4.762	3/16	14.3	14.3	8	65	6	2.CMC.SSFM1Z6.F316	■
5.0		15.0	15.0	8	65	6	2.CMCSF.M1Z6.500.1	■
5.560	7/32	16.7	16.7	10	70	6	2.CMC.SSFM1Z6.F732	■
6.0		18.0	18.0	10	70	6	2.CMCSF.M1Z6.600.1	■
6.350	1/4	19.1	19.1	10	70	6	2.CMC.SSFM1Z6.F14	■
8.0		24.0	24.0	12	80	6	2.CMCSF.M1Z6.800.1	Δ

■ Stock item
Δ Delivery term upon request, minimum purchase order quantity 3 pcs.

Square



d ₁	d ₁	I ₁	I ₂	D (h6)	L	Z	Item number	Availability
[mm]	[inch]	[mm]	[mm]	[mm]	[mm]	[flutes]		
1.0		4.0	4.0	4	40	5	2.CMCSFN1Z5.100.1	■
1.2		4.8	4.8	4	40	5	2.CMCSFN1Z5.120.1	■
1.5		6.0	6.0	4	40	5	2.CMCSFN1Z5.150.1	■
1.587	1/16	6.3	6.3	4	40	5	2.CMC.SSFN1Z5.F116	■
1.8		7.2	7.2	4	40	5	2.CMCSFN1Z5.180.1	■
2.0		8.0	8.0	4	44	5	2.CMCSFN1Z5.200.1	■
2.381	3/32	9.5	9.5	4	44	5	2.CMC.SSFN1Z5.F332	■
2.5		10.0	10.0	6	55	5	2.CMCSFN1Z5.250.1	■
3.0		12.0	12.0	6	55	6	2.CMCSFN1Z6.300.1	■
3.175	1/8	12.7	12.7	6	60	6	2.CMC.SSFN1Z6.F18	■
3.5		14.0	14.0	6	60	6	2.CMCSFN1Z6.350.1	■
3.968	5/32	15.9	15.9	6	60	6	2.CMC.SSFN1Z6.F532	■
4.0		16.0	16.0	6	60	6	2.CMCSFN1Z6.400.1	■
4.5		18.0	18.0	8	70	6	2.CMCSFN1Z6.450.1	■
4.762	3/16	19.0	19.0	8	70	6	2.CMC.SSFN1Z6.F316	■
5.0		20.0	20.0	8	70	6	2.CMCSFN1Z6.500.1	■
5.560	7/32	22.2	22.2	10	75	6	2.CMC.SSFN1Z6.F732	■
6.0		24.0	24.0	10	75	6	2.CMCSFN1Z6.600.1	■
6.350	1/4	25.4	25.4	10	80	6	2.CMC.SSFN1Z6.F14	■
8.0		32.0	32.0	12	90	6	2.CMCSFN1Z6.800.1	Δ

■ Stock item
Δ Delivery term upon request, minimum purchase order quantity 3 pcs.

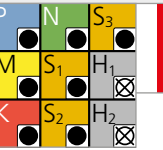
Type M - Finishing

$$\mathbf{v}_c \text{ [m/min]}$$

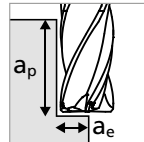
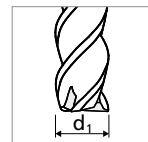
$$\mathbf{f}_z \text{ [mm]}$$

RECOMMENDATION FOR USE

● Excellent | ● Good | ○ Acceptable | ⊗ Not recommended



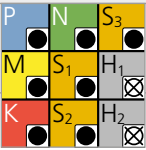
MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

	Materials group	Material	Mat.No.	DIN	AISI/ASTM/UNS	a _e	1.0 mm		1.5 mm		2.0 mm		3.0 mm		Ød ₁		5.0 mm		6.0 mm		8.0 mm		
							v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	
																							1/16"
Finishing  ■ a_p=3 x d₁	P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C 10	AISI 1010	0.010 - 0.020 x d1	120	0.005-0.010		140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080
			1.0401	C 15	AISI 1015																		
			1.1191	C 45E/CK45	AISI 1045																		
			1.0044	S 275JR	AISI 1020																		
			1.0715	11SMn30	AISI 1215																		
			1.5752	15NiCr13	ASTM 3415 / AISI 3310																		
		Low alloyed steel Rm > 900 N/mm²	1.7131	16MnCr5	AISI 5115	120	0.005-0.010	140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080		
			1.3505	100Cr6	AISI 52100																		
			1.7225	42CrMo4	AISI 4140																		
			1.2842	90MnCrV8	AISI O2																		
			1.2379	X 153CrMoV12	AISI D2																		
			1.2436	X 210CrW12	AISI D4/D6																		
High alloyed tool steel Rm < 1200 N/mm²	1.3343	H 56-5-2C	AISI M2 / UNS T11302	120	0.005-0.010	140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080				
	1.3355	H S18-0-1	AISI T1 / UNS T12001																				
	M	Stainless steel ferritic	1.4016	X 6Cr17	AISI 430 / UNS S43000	0.010 - 0.015 x d1	80	0.005-0.007		100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
			1.4105	X 6CrMoS17	AISI 430F																		
		Stainless steel martensitic	1.4034	X 46Cr13	AISI 420C		80	0.005-0.007		100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
			1.4112	X 90CrMoV18	AISI 440B																		
		Stainless steel martensitic – PH	1.4542	X 5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH		80	0.005-0.007		100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
			1.4545	X 5CrNiCuNb15-5	ASTM 15-5 PH																		
		Stainless steel austenitic	1.4301	X 5CrNi18-10	AISI 304		80	0.005-0.007		100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
			1.4435	X 2CrNiMo18-14-3	AISI 316L																		
			1.4441	X 2CrNiMo18-15-3	AISI 316LM																		
1.4539	X 1NiCrMoCu25-20-5	AISI 904L																					
K	Cast iron	0.6020	GG 20	ASTM 30	0.010 - 0.020 x d1	120	0.005-0.010		140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080	
		0.6030	GG 30	ASTM 40B																			
		0.7040	GGG 40	ASTM 60-40-18																			
		0.7060	GGG 60	ASTM 80-60-03																			
N	Aluminium alloy wrought	3.2315	AlMgSi1	ASTM 6351	0.010 - 0.020 x d1	200	0.005-0.010		220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080	
		3.4365	AlZnMgCu1.5	ASTM 7075																			
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380		200	0.005-0.010		220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080	
		3.2381	GD-AlSi10Mg	UNS A03590																			
	Copper	2.0040	Cu-OF / CW008A	UNS C 10100		200	0.005-0.010		220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080	
		2.0065	Cu-ETP / CW004A	UNS C 11000																			
	Brass lead free	2.0321	CuZn37 CW508L	UNS C 27400		200	0.005-0.010		220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080	
		2.0360	CuZn40 CW509L	UNS C 28000																			
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C 38500		200	0.005-0.010		220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080	
		2.1020	CuSn6	UNS C 51900																			
Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C 63000	200	0.005-0.010	220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080				
	2.0960	CuAl9Mn2	UNS C 63200																				
S ₁	Super alloys	2.4856		Inconel 625	0.005 - 0.010 x d1	40	0.005-0.007		60	0.007-0.012	60	0.010-0.015	80	0.015-0.025	80	0.020-0.030	80	0.025-0.035	100	0.030-0.045	100	0.040-0.060	
		2.4668		Inconel 718																			
		2.4617	NiMo28	Hastelloy B-2																			
		2.4665	NiCr22Fe18Mo	Hastelloy X																			
S ₂	Titanium pure	3.7035	Gr.2	ASTM B348 / F67	0.007 - 0.015 x d1	60	0.005-0.010		80	0.006-0.012	80	0.008-0.016	100	0.011-0.022	120	0.012-0.024	120	0.014-0.028	140	0.015-0.030	140	0.020-0.040	
		3.7065	Gr.4	ASTM B348 / F68																			
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136		60	0.005-0.010		80	0.006-0.012	80	0.008-0.016	100	0.011-0.022	120	0.012-0.024	120	0.014-0.028	140	0.015-0.030	140	0.020-0.040	
		9.9367	TiAl6Nb7	ASTM F1295																			
S ₃	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	0.005 - 0.010 x d1	80	0.005-0.007		100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	120	0.020-0.030	120	0.025-0.035	140	0.030-0.045	140	0.040-0.060	
			CrCoMo28	ASTM F1537																			
H ₁ H ₂	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1																			
		1.2379	X 153CrMoV12	AISI D2																			

Type N - Finishing

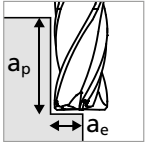
v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ● Good | ○ Acceptable | ☒ Not recommended

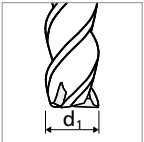


MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



$a_p = 4 \times d_1$



Materials group	Material	Mat.No.	DIN	AISI/ASTM/UNS	a _e	1.0 mm		1.5 mm		2.0 mm		3.0 mm		Ød ₁ 4.0 mm		5.0 mm		6.0 mm		8.0 mm	
						v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C 10	AISI 1010	0.010 - 0.020 x d1	120	0.005-0.010	140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080
		1.0401	C 15	AISI 1015																	
		1.1191	C 45E/CK45	AISI 1045																	
		1.0044	S 275JR	AISI 1020																	
		1.0715	11SMn30	AISI 1215																	
	Low alloyed steel Rm > 900 N/mm²	1.5752	15NiCr13	ASTM 3415 / AISI 3310		120	0.005-0.010	140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080
		1.7131	16MnCr5	AISI 5115																	
		1.3505	100Cr6	AISI 52100																	
		1.7225	42CrMo4	AISI 4140																	
		1.2842	90MnCrV8	AISI O2																	
	High alloyed tool steel Rm < 1200 N/mm²	1.2379	X153CrMoV12	AISI D2		120	0.005-0.010	140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080
		1.2436	X210CrW12	AISI D4/D6																	
		1.3343	HS6-5-2C	AISI M2 / UNS T11302																	
		1.3355	HS18-0-1	AISI T1 / UNS T12001																	
M	Stainless steel ferritic	1.4016	X6Cr17	AISI 430 / UNS S43000	0.010 - 0.015 x d1	80	0.005-0.007	100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
		1.4105	X6CrMoS17	AISI 430F																	
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C		80	0.005-0.007	100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
		1.4112	X90CrMoV18	AISI 440B																	
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH		80	0.005-0.007	100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH																	
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304		80	0.005-0.007	100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	140	0.020-0.030	140	0.025-0.035	160	0.030-0.045	160	0.040-0.060
		1.4435	X2CrNiMo18-14-3	AISI 316L																	
		1.4441	X2CrNiMo18-15-3	AISI 316LM																	
		1.4539	X1NiCrMoCu25-20-5	AISI 904L																	
K	Cast iron	0.6020	GG20	ASTM 30	0.010 - 0.020 x d1	120	0.005-0.010	140	0.007-0.015	140	0.010-0.020	160	0.015-0.030	180	0.020-0.040	180	0.025-0.050	200	0.030-0.060	200	0.040-0.080
		0.6030	GG30	ASTM 40B																	
		0.7040	GGG40	ASTM 60-40-18																	
		0.7060	GGG60	ASTM 80-60-03																	
N	Aluminium alloy wrought	3.2315	AlMgSi1	ASTM 6351	0.010 - 0.020 x d1	200	0.005-0.010	220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080
		3.4365	AlZnMgCu1.5	ASTM 7075																	
	Aluminium alloy cast	3.2163	GD-AISI9Cu3	ASTM A380		200	0.005-0.010	220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080
		3.2381	GD-AISI10Mg	UNS A03590																	
	Copper	2.0040	Cu-OF / CW008A	UNS C10100		200	0.005-0.010	220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080
		2.0065	Cu-ETP / CW004A	UNS C11000																	
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400		200	0.005-0.010	220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080
		2.0360	CuZn40 CW509L	UNS C28000																	
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500		200	0.005-0.010	220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080
		2.1020	CuSn6	UNS C51900																	
Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	200	0.005-0.010	220	0.007-0.015	240	0.010-0.020	260	0.015-0.030	280	0.020-0.040	280	0.025-0.050	300	0.030-0.060	300	0.040-0.080		
	2.0960	CuAl9Mn2	UNS C63200																		
S ₁	Super alloys	2.4856		Inconel 625	0.005 - 0.010 x d1	40	0.005-0.007	60	0.007-0.012	60	0.010-0.015	80	0.015-0.025	80	0.020-0.030	80	0.025-0.035	100	0.030-0.045	100	0.040-0.060
		2.4668		Inconel 718																	
		2.4617	NiMo28	Hastelloy B-2																	
		2.4665	NiCr22Fe18Mo	Hastelloy X																	
S ₂	Titanium pure	3.7035	Gr.2	ASTM B348 / F67	0.007 - 0.015 x d1	60	0.005-0.010	80	0.006-0.012	80	0.008-0.016	100	0.011-0.022	120	0.012-0.024	120	0.014-0.028	140	0.015-0.030	140	0.020-0.040
		3.7065	Gr.4	ASTM B348 / F68																	
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136		60	0.005-0.010	80	0.006-0.012	80	0.008-0.016	100	0.011-0.022	120	0.012-0.024	120	0.014-0.028	140	0.015-0.030	140	0.020-0.040
		9.9367	TiAl6Nb7	ASTM F1295																	
S ₃	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	0.005 - 0.010 x d1	80	0.005-0.007	100	0.007-0.012	100	0.010-0.015	120	0.015-0.025	120	0.020-0.030	120	0.025-0.035	140	0.030-0.045	140	0.040-0.060
			CrCoMo28	ASTM F1537																	
H ₁ H ₂	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1																	
	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2																	

NEW Process CrazyMill Cool SF

ACCURATE AND EFFICIENT MILLING

Coolant type, pressure and filtration

Coolant: for best results, Mikron Tool recommends the use of cutting oil as coolant. Alternatively, water base coolant with EP-Additives (Extreme-Pressure-Additives) can be used as well.

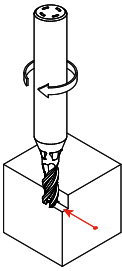
Filter: the large cooling channels permit the use of a standard filter with filter quality of $\leq 0.05\text{ mm}$.

Coolant pressure: at least 15 bar coolant pressure is required to achieve reliable milling. High pressure is generally better for the cooling and flushing effect.

Revolution	[rpm]	$\leq 10'000$	$> 10'000$
Minimal pressure	[bar]	15	30

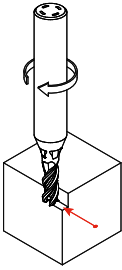
MILLING PROCESS

Climb milling and conventional milling



Mikron tool recommends climb milling for the machining of side milling. The chip thickness here is greater at the beginning and decreases continuously; the cutting forces remain low. With conventional milling, however, high cutting forces would push the milling tool away from the part. Thus surface quality decreases.

Finishing



Recommended cutting parameters

v_c and f_z = as specified in the cutting data table

Strategy	Type M	Type N
①	$a_p = 3 \times d$ $a_e = 0.005 - 0.020 \times d$	$a_p = 4 \times d$ $a_e = 0.005 - 0.020 \times d$



News: Tool libraries of all Mikron Tool catalog products are available on Mastercam's Tech Exchange, ready for download!

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