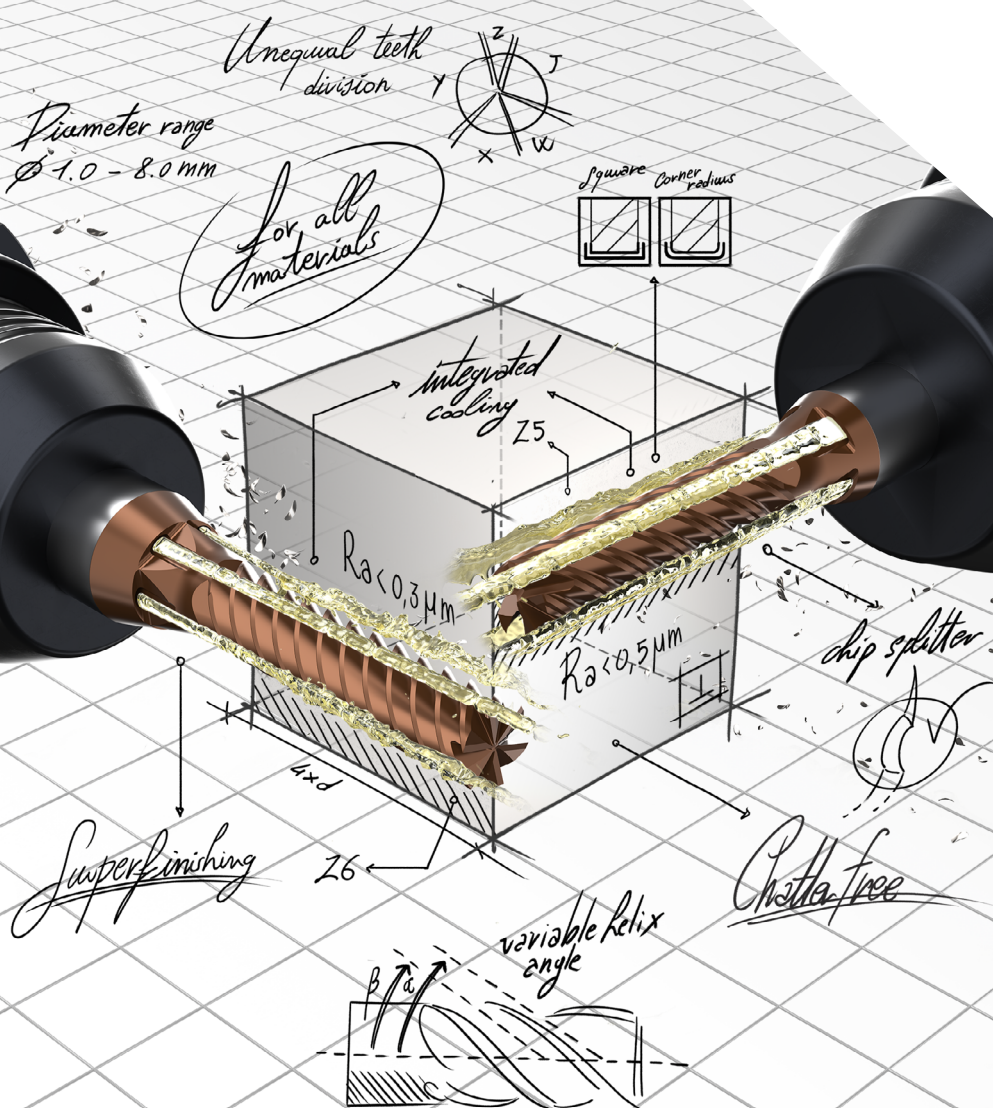


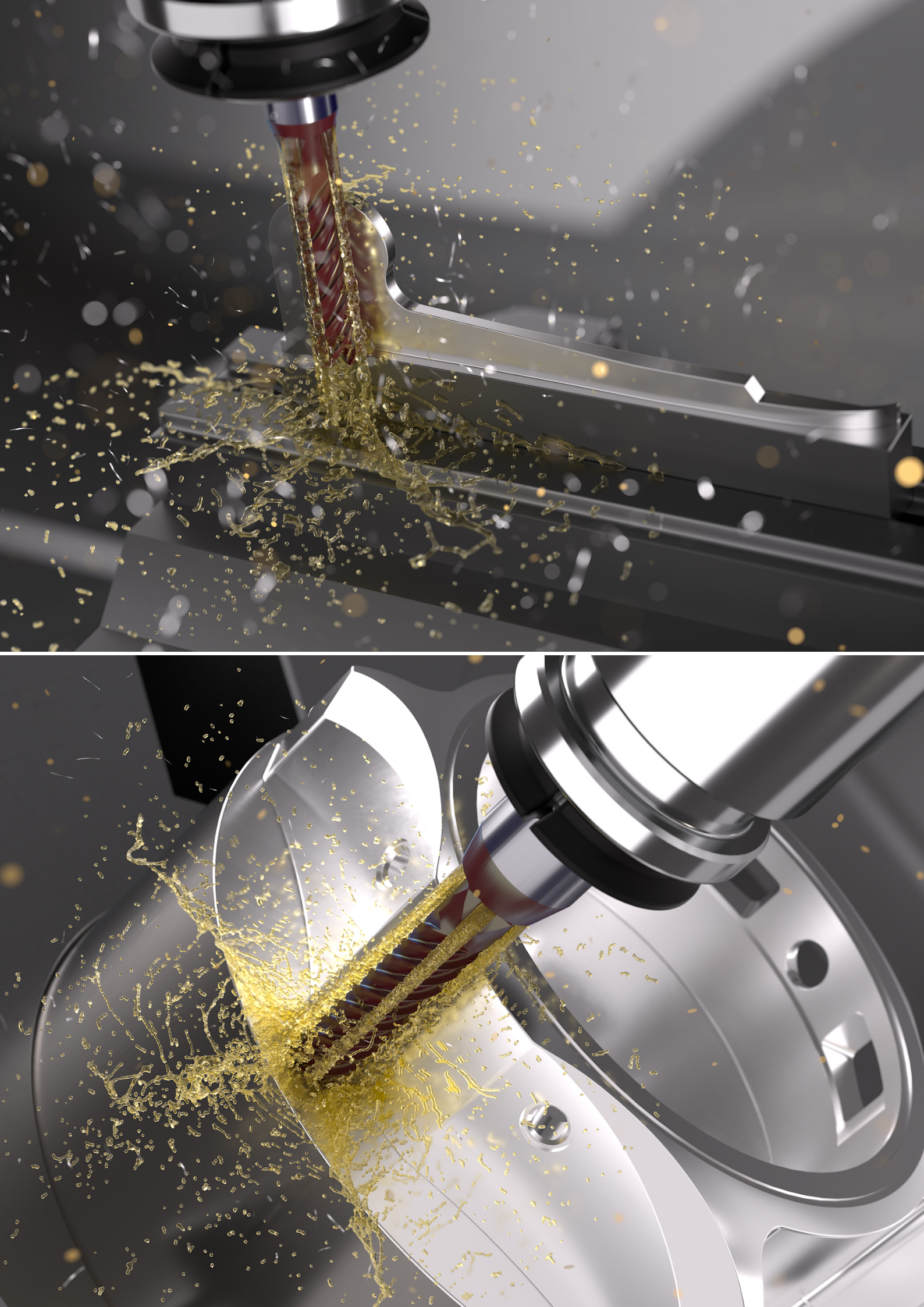
crazy about

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 **19.7 µin** (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 **11.8 µin** (0.3 µm) or better. Both endmills are available in diameters from **.039" to .315"** (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 .039" - .315" , Z4 and Z5	6
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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.																
  			1.0 – 8.0 .039" – .315"	3 x d 4 x d	✓	–	●	●	●	●	●	●	●	●	☒	☒	6
 Corner radius Z4 / Z5  			1.0 – 8.0 .039" – .315"	3 x d 4 x d	✓	–	●	●	●	●	●	●	●	●	☒	☒	6
 Square Z5 / Z6  			1.0 – 8.0 .039" – .315"	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 Ø.039" – .315" (1.0 – 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

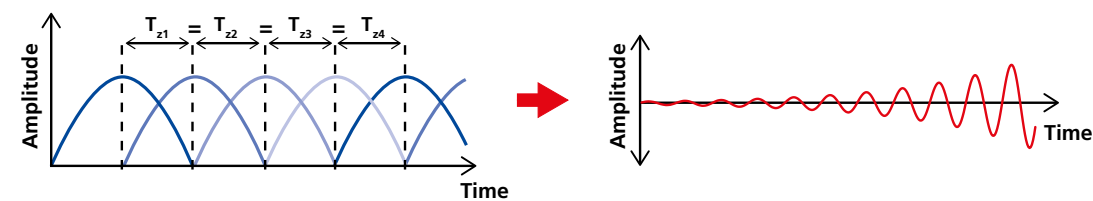
CrazyMill Cool CF

NEW

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

1. Challenge

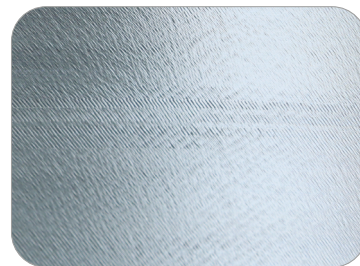
Avoid chatter when milling



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".

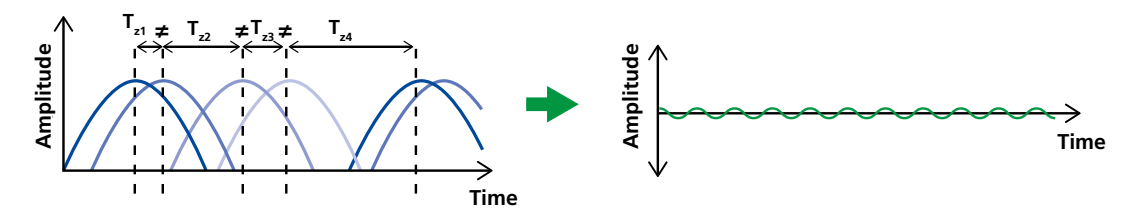
If the frequency is kept uniform (see diagram) ($T_{Z1} = T_{Z2} = T_{Z3} = T_{Z4}$), it can lead to an increase in the maximum deflection in the resonance frequency, resulting in vibrations and consequently chatter marks on the workpiece.



Surface with vibrations
 $R_a = 27.6 \mu\text{m}$ ($0.7 \mu\text{m}$)

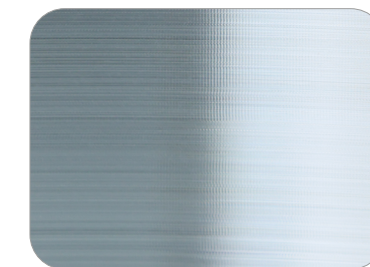
Solution

Avoidance of resonance frequencies

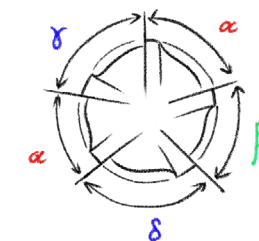


The new CrazyMill Cool CF has been specifically developed, to interrupt this resonance frequency. Using unequal angular teeth division, and a variable helix angle (every cutting edge has a different helix angle) every cutting edge generates a different frequency wave that occur in an irregular timing to the next or the previous cutting edge ($T_{Z1} \neq T_{Z2} \neq T_{Z3} \neq T_{Z4}$).

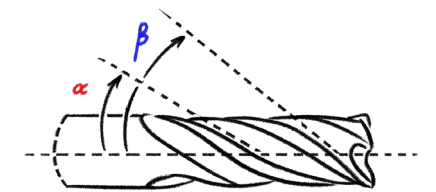
This results, as shown in the graph, in a resonant frequency amplitude reduction, and guarantees a vibration free surface.



Surface without vibrations
 $R_a = 13.8 \mu\text{m}$ ($0.35 \mu\text{m}$)



Unequal angular teeth
 division



Variable helix angle

NEW

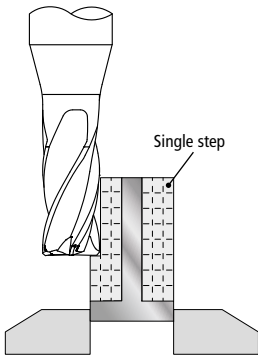
CrazyMill Cool CF

NEW

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

2. Challenge

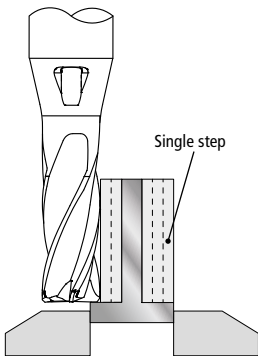
High Removal Rate for thin-walled and unstable workpieces



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



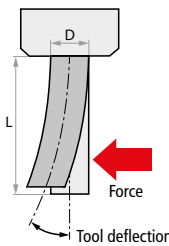
With the new endmill, particular attention has been placed to finding a perfect balance between cutting angle, a relive angle and the cutting edge conditioning.

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

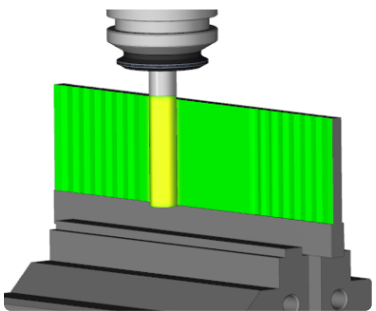


Profile milling with the side milling strategy over the maximum engagement length of the milling cutter (4 x d) must enable a perfectly perpendicular profile within the specified tolerance fields. This must also be possible when using high-speed and highly dynamic milling strategies.

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: .236" (6 mm); Milling depth: .945" (24 mm);

Coolant: cutting oil;

Cutting data: $v_c = 722$ SFM (220 m/min);

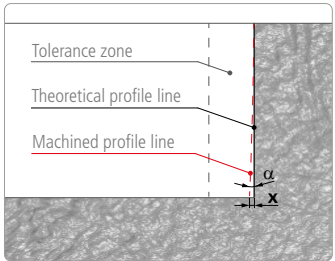
$f_z = .0012$ IPT (0.03 mm);

$a_p = .945$ " (24 mm);

$a_e = .0020$ " (0.05 mm)

Roughness: $R_a = 13.8 \mu\text{in}$ (0.35 μm)

■ Perpendicularity



Perpendicularity precision	
x	.00047" (0.012 mm)
α	- 0.03°

NEW

CrazyMill Cool CF

NEW

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

4. Challenge

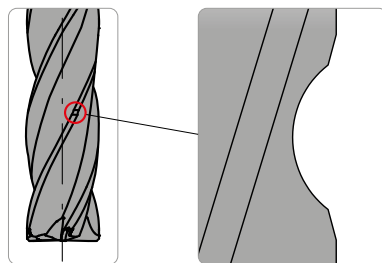
High surface quality – Process reliable chip management

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

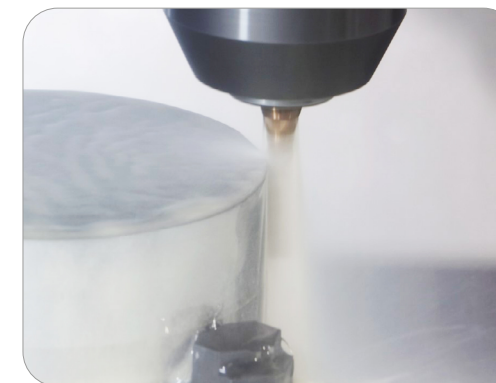
High temperature & chips in the cutting zone



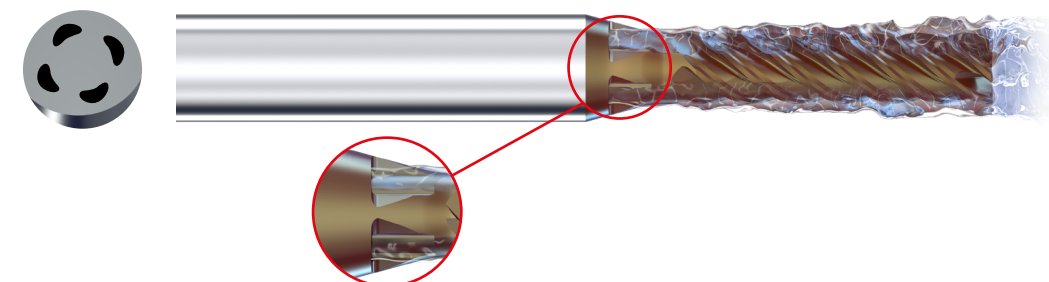
The machining of metals requires a high energy input into the cutting zones. A large proportion of this is converted directly into thermal energy. The higher the heat generated in the cutting zone, the shorter the tool life. It is therefore essential to keep the temperature in the cutting zone as low 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 218 psi (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 19.7 µin (0.5 µm) or better
- Process reliability
- Very long tool life

NEW

Maximum performance guaranteed

EXAMPLE OF STAINLESS STEEL MACHINING IN COMPARISON

3 x d
Type M

4 x d
Type N

NEW

■ Example

Higher chip removal rate = faster machining time

Machining: Side milling
Milling depth: .472" (12 mm);
Coolant: Emulsion 8%

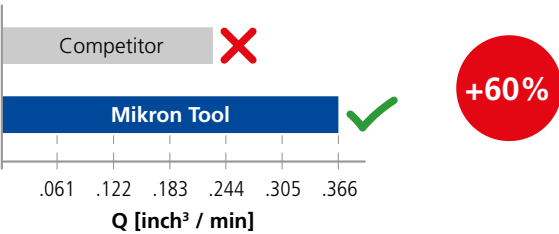
Stainless steel: 1.4435 / X2CrNiMo 18-14-3 / 316L **M**

Tool: CrazyMill Cool CF
Diameter: .118" (3.0 mm)

Cutting data:

Generical endmill		CrazyMill Cool CF	
$v_c = 394 \text{ SFM}$ 120 m/min	$f_z = .0008 \text{ IPT}$ 0.020 mm	$v_c = 427 \text{ SFM}$ 130 m/min	$f_z = .0009 \text{ IPT}$ 0.024 mm
$a_p = .472''$ 12 mm	$a_e = .0118''$ 0.3 mm	$a_p = .472''$ 12 mm	$a_e = .0118''$ 0.3 mm
Z = 4 Flutes		Z = 5 Flutes	

Result:



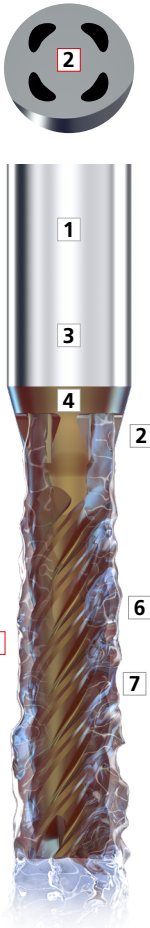
Movie:



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



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



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.

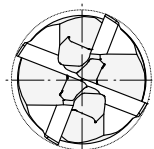
6 | LATERAL CUTTING GEOMETRY

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.

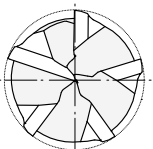
7 | CHIP-SPLITTING

An optimized chip-splitting guarantees short chips and highest surface quality. The chip-splitting is implemented in version M for Ød₁ ≥ .157" (4 mm) and N for Ød₁ ≥ .118" (3 mm).

Endmill tip



4 - Flute
Diameter range
Ø.039" - .098"
(Ø1 - 2.5 mm)



5 - Flute
Diameter range
Ø.118" - .315"
(Ø3 - 8 mm)

NEW

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

Carbide



Z

4-5

















Ø d_i

.004" - .118" (0.1 - 3.0 mm)

.122" - .236" (3.1 - 6.0 mm)

.240" - .394" (6.1 - 10.0 mm)

Tolerance

- .00055"
- .00110"

- 0.014 mm
- 0.028 mm

- .00079"
- .00150"

- 0.020 mm
- 0.038 mm

- .00098"
- .00185"

- 0.025 mm
- 0.047 mm

Square

d _i	d _i	d _i	l ₁	l ₁	l ₂	D (h6)	L	L	Z	Item number	Availability
[inch]	[inch]	[mm]	[inch]	[mm]	[mm]	[mm]	[inch]	[mm]	[flutes]		
	.039	1.0	.079	3.00	3.00	4	1.57	40	4	2.CMCCF.M1Z4.100.1	■
	.047	1.2	.094	3.60	3.60	4	1.57	40	4	2.CMCCF.M1Z4.120.1	■
	.059	1.5	.118	4.50	4.50	4	1.57	40	4	2.CMCCF.M1Z4.150.1	■
1/16	.0625	1.587	.122	4.76	4.76	4	1.57	40	4	2.CMC.SCFM1Z4.F116	■
	.071	1.8	.142	5.40	5.40	4	1.57	40	4	2.CMCCF.M1Z4.180.1	■
	.079	2.0	.157	6.00	6.00	4	1.57	40	4	2.CMCCF.M1Z4.200.1	■
3/32	.0937	2.381	.185	7.14	7.14	4	1.57	40	4	2.CMC.SCFM1Z4.F332	■
	.098	2.5	.197	7.50	7.50	6	2.17	55	4	2.CMCCF.M1Z4.250.1	■
	.118	3.0	.236	9.00	9.00	6	2.17	55	5	2.CMCCF.M1Z5.300.1	■
1/8	.1250	3.175	.252	9.53	9.53	6	2.17	55	5	2.CMC.SCFM1Z5.F18	■
	.138	3.5	.276	10.50	10.50	6	2.17	55	5	2.CMCCF.M1Z5.350.1	■
5/32	.1562	3.968	.312	11.90	11.90	6	2.17	55	5	2.CMC.SCFM1Z5.F532	■
	.157	4.0	.315	12.00	12.00	6	2.17	55	5	2.CMCCF.M1Z5.400.1	■
	.177	4.5	.354	13.50	13.50	8	2.56	65	5	2.CMCCF.M1Z5.450.1	■
3/16	.1875	4.762	.375	14.29	14.29	8	2.56	65	5	2.CMC.SCFM1Z5.F316	■
	.197	5.0	.394	15.00	15.00	8	2.56	65	5	2.CMCCF.M1Z5.500.1	■
7/32	.2189	5.560	.438	16.68	16.68	10	2.76	70	5	2.CMC.SCFM1Z5.F732	■
	.236	6.0	.472	18.00	18.00	10	2.76	70	5	2.CMCCF.M1Z5.600.1	■
1/4	.2500	6.350	.500	19.05	19.05	10	2.76	70	5	2.CMC.SCFM1Z5.F14	■
	.315	8.0	.630	24.00	24.00	12	3.15	80	5	2.CMCCF.M1Z5.800.1	Δ

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

Corner radius

d _i	d _i	d _i	l ₁	l ₁	l ₂	D (h6)	L	L	Z	r	r	Item number	Availability
[inch]	[inch]	[mm]	[inch]	[mm]	[mm]	[mm]	[inch]	[mm]	[flutes]	[inch]	[mm]		
	.039	1.0	.118	3.00	3.00	4	1.57	40	4	.0039	0.10	2.CMCCF.M2Z4.100.1	■
	.039	1.0	.118	3.00	3.00	4	1.57	40	4	.0079	0.20	2.CMCCF.M3Z4.100.1	■
	.047	1.2	.142	3.60	3.60	4	1.57	40	4	.0039	0.10	2.CMCCF.M2Z4.120.1	■
	.047	1.2	.142	3.60	3.60	4	1.57	40	4	.0079	0.20	2.CMCCF.M3Z4.120.1	■
	.059	1.5	.177	4.50	4.50	4	1.57	40	4	.0039	0.10	2.CMCCF.M2Z4.150.1	■
	.059	1.5	.177	4.50	4.50	4	1.57	40	4	.0118	0.30	2.CMCCF.M3Z4.150.1	■
1/16	.0625	1.587	.187	4.76	4.76	4	1.57	40	4	.0100	0.254	2.CMC.RCFM2Z4.F116	■
1/16	.0625	1.587	.187	4.76	4.76	4	1.57	40	4	.0200	0.508	2.CMC.RCFM3Z4.F116	■
	.071	1.8	.213	5.40	5.40	4	1.57	40	4	.0039	0.10	2.CMCCF.M2Z4.180.1	■
	.071	1.8	.213	5.40	5.40	4	1.57	40	4	.0118	0.30	2.CMCCF.M3Z4.180.1	■
	.079	2.0	.236	6.00	6.00	4	1.57	40	4	.0039	0.10	2.CMCCF.M2Z4.200.1	■
	.079	2.0	.236	6.00	6.00	4	1.57	40	4	.0079	0.20	2.CMCCF.M3Z4.200.1	■
	.079	2.0	.236	6.00	6.00	4	1.57	40	4	.0197	0.50	2.CMCCF.M4Z4.200.1	■
3/32	.0937	2.381	.281	7.14	7.14	4	1.73	44	4	.0050	0.127	2.CMC.RCFM2Z4.F332	■
3/32	.0937	2.381	.281	7.14	7.14	4	1.73	44	4	.0100	0.254	2.CMC.RCFM3Z4.F332	■
3/32	.0937	2.381	.281	7.14	7.14	4	1.73	44	4	.0200	0.508	2.CMC.RCFM4Z4.F332	■
	.098	2.5	.295	7.50	7.50	6	2.17	55	4	.0079	0.20	2.CMCCF.M2Z4.250.1	■
	.098	2.5	.295	7.50	7.50	6	2.17	55	4	.0197	0.50	2.CMCCF.M3Z4.250.1	■
	.118	3.0	.354	9.00	9.00	6	2.17	55	5	.0079	0.20	2.CMCCF.M2Z5.300.1	■
	.118	3.0	.354	9.00	9.00	6	2.17	55	5	.0197	0.50	2.CMCCF.M3Z5.300.1	■
1/8	.1250	3.175	.375	9.53	9.53	6	2.17	55	5	.0050	0.127	2.CMC.RCFM0Z5.F18	■
1/8	.1250	3.175	.375	9.53	9.53	6	2.17	55	5	.0100	0.254	2.CMC.RCFM2Z5.F18	■
1/8	.1250	3.175	.375	9.53	9.53	6	2.17	55	5	.0200	0.508	2.CMC.RCFM3Z5.F18	■
1/8	.1250	3.175	.375	9.53	9.53	6	2.17	55	5	.0300	0.762	2.CMC.RCFM4Z5.F18	■
	.138	3.5	.413	10.50	10.50	6	2.17	55	5	.0079	0.20	2.CMCCF.M2Z5.350.1	■
	.138	3.5	.413	10.50	10.50	6	2.17	55	5	.0197	0.50	2.CMCCF.M3Z5.350.1	■
5/32	.1562	3.968	.469	11.90	11.90	6	2.17	55	5	.0100	0.254	2.CMC.RCFM2Z5.F532	■
5/32	.1562	3.968	.469	11.90	11.90	6	2.17	55	5	.0200	0.508	2.CMC.RCFM3Z5.F532	■
	.157	4.0	.472	12.00	12.00	6	2.17	55	5	.0079	0.20	2.CMCCF.M2Z5.400.1	■
	.157	4.0	.472	12.00	12.00	6	2.17	55	5	.0197	0.50	2.CMCCF.M3Z5.400.1	■
	.177	4.5	.531	13.50	13.50	8	2.56	65	5	.0079	0.20	2.CMCCF.M2Z5.450.1	■
	.177	4.5	.531	13.50	13.50	8	2.56	65	5	.0197	0.50	2.CMCCF.M3Z5.450.1	■
3/16	.1875	4.762	.563	14.29	14.29	8	2.56	65	5	.0100	0.254	2.CMC.RCFM2Z5.F316	■
3/16	.1875	4.762	.563	14.29	14.29	8	2.56	65	5	.0300	0.762	2.CMC.RCFM3Z5.F316	■
	.197	5.0	.591	15.00	15.00	8	2.56	65	5	.0079	0.20	2.CMCCF.M2Z5.500.1	■
	.197	5.0	.591	15.00	15.00	8	2.56	65	5	.0197	0.50	2.CMCCF.M3Z5.500.1	■
7/32	.2189	5.560	.657	16.68	16.68	10	2.76	70	5	.0100	0.254	2.CMC.RCFM2Z5.F732	■
7/32	.2189	5.560	.657	16.68	16.68	10	2.76	70	5	.0300	0.762	2.CMC.RCFM3Z5.F732	■
	.236	6.0	.709	18.00	18.00	10	2.76	70	5	.0079	0.20	2.CMCCF.M2Z5.600.1	■
	.236	6.0	.709	18.00	18.00	10	2.76	70	5	.0197	0.50	2.CMCCF.M3Z5.600.1	■
	.236	6.0	.709	18.00	18.00	10	2.76	70	5	.0394	1.00	2.CMCCF.M4Z5.600.1	■
1/4	.2500	6.350	.750	19.05	19.05	10	2.76	70	5	.0100	0.254	2.CMC.RCFM2Z5.F14	■
1/4	.2500	6.350	.750	19.05	19.05	10	2.76	70	5	.0200	0.508	2.CMC.RCFM3Z5.F14	■
1/4	.2500	6.350	.750	19.05	19.05	10	2.76	70	5	.0300	0.762	2.CMC.RCFM4Z5.F14	■
	.315	8.0	.945	24.00	24.00	12	3.15	80	5	.0079	0.20	2.CMCCF.M2Z5.800.1	Δ
	.315	8.0	.945	24.00	24.00	12	3.15	80	5	.0197	0.50	2.CMCCF.M3Z5.800.1	Δ
	.315	8.0	.945	24.00	24.00	12	3.15	80	5	.0394	1.00	2.CMCCF.M4Z5.800.1	Δ

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

18 | MIKRON TOOL

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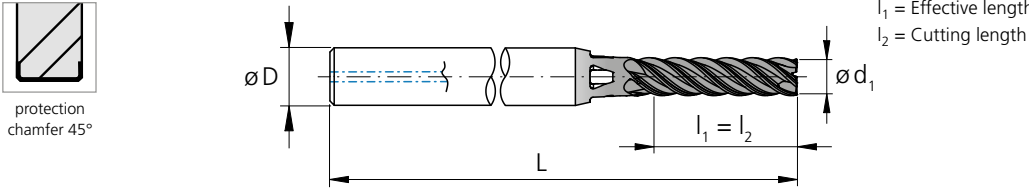
NEW

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

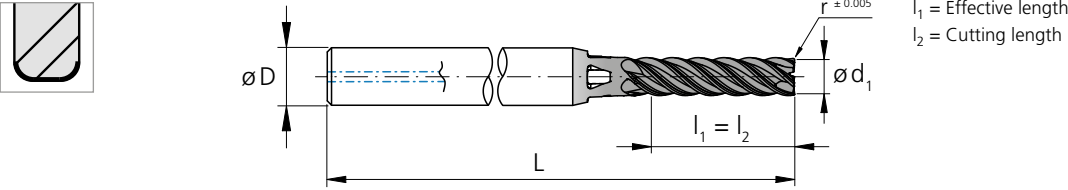
MILLING WITH INTEGRATED COOLING

Carbide											
	Ø d ₁	.004" - .118" (0.1 - 3.0 mm)	.122" - .236" (3.1 - 6.0 mm)	.240" - .394" (6.1 - 10.0 mm)							
	Tolerance	- .00055" - .00110"	- 0.014 mm - 0.028 mm	- .00079" - .00150"	- 0.020 mm - 0.038 mm	- .00098" - .00185"	- 0.025 mm - 0.047 mm				

Square



Corner radius



d ₁	d ₁	d ₁	I ₁	I ₁	I ₂	D (h6)	L	L	Z	Item number	Availability
[inch]	[inch]	[mm]	[inch]	[mm]	[mm]	[mm]	[inch]	[mm]	[flutes]		
	.039	1.0	.079	4.00	4.00	4	1.57	40	4	2.CMCCFN1Z4.100.1	■
	.047	1.2	.094	4.80	4.80	4	1.57	40	4	2.CMCCFN1Z4.120.1	■
	.059	1.5	.118	6.00	6.00	4	1.57	40	4	2.CMCCFN1Z4.150.1	■
1/16	.0625	1.587	.122	6.35	6.35	4	1.57	40	4	2.CMC.SCFN1Z4.F116	■
	.071	1.8	.142	7.20	7.20	4	1.57	40	4	2.CMCCFN1Z4.180.1	■
	.079	2.0	.157	8.00	8.00	4	1.73	44	4	2.CMCCFN1Z4.200.1	■
3/32	.0937	2.381	.185	9.52	9.52	4	1.73	44	4	2.CMC.SCFN1Z4.F332	■
	.098	2.5	.197	10.00	10.00	6	2.17	55	4	2.CMCCFN1Z4.250.1	■
	.118	3.0	.236	12.00	12.00	6	2.17	55	5	2.CMCCFN1Z5.300.1	■
1/8	.1250	3.175	.252	12.70	12.70	6	2.36	60	5	2.CMC.SCFN1Z5.F18	■
	.138	3.5	.276	14.00	14.00	6	2.36	60	5	2.CMCCFN1Z5.350.1	■
5/32	.1562	3.968	.312	15.87	15.87	6	2.36	60	5	2.CMC.SCFN1Z5.F532	■
	.157	4.0	.315	16.00	16.00	6	2.36	60	5	2.CMCCFN1Z5.400.1	■
	.177	4.5	.354	18.00	18.00	8	2.76	70	5	2.CMCCFN1Z5.450.1	■
3/16	.1875	4.762	.375	19.05	19.05	8	2.76	70	5	2.CMC.SCFN1Z5.F316	■
	.197	5.0	.394	20.00	20.00	8	2.76	70	5	2.CMCCFN1Z5.500.1	■
7/32	.2189	5.560	.438	22.24	22.24	10	2.95	75	5	2.CMC.SCFN1Z5.F732	■
	.236	6.0	.472	24.00	24.00	10	2.95	75	5	2.CMCCFN1Z5.600.1	■
1/4	.2500	6.350	.500	25.40	25.40	10	3.15	80	5	2.CMC.SCFN1Z5.F14	■
	.315	8.0	.630	32.00	32.00	12	3.54	90	5	2.CMCCFN1Z5.800.1	Δ

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

d ₁	d ₁	d ₁	I ₁	I ₁	I ₂	D (h6)	L	L	Z	r	r	Item number	Availability
[inch]	[inch]	[mm]	[inch]	[mm]	[mm]	[mm]	[inch]	[mm]	[flutes]	[inch]	[mm]		
	.039	1.0	.157	4.00	4.00	4	1.57	40	4	.0039	0.10	2.CMCCFN2Z4.100.1	■
	.039	1.0	.157	4.00	4.00	4	1.57	40	4	.0079	0.20	2.CMCCFN3Z4.100.1	■
	.047	1.2	.189	4.80	4.80	4	1.57	40	4	.0039	0.10	2.CMCCFN2Z4.120.1	■
	.047	1.2	.189	4.80	4.80	4	1.57	40	4	.0079	0.20	2.CMCCFN3Z4.120.1	■
	.059	1.5	.236	6.00	6.00	4	1.57	40	4	.0039	0.10	2.CMCCFN2Z4.150.1	■
	.059	1.5	.236	6.00	6.00	4	1.57	40	4	.0118	0.30	2.CMCCFN3Z4.150.1	■
1/16	.0625	1.587	.250	6.35	6.35	4	1.57	40	4	.0100	0.254	2.CMC.RCFN2Z4.F116	■
1/16	.0625	1.587	.250	6.35	6.35	4	1.57	40	4	.0200	0.508	2.CMC.RCFN3Z4.F116	■
	.071	1.8	.283	7.20	7.20	4	1.57	40	4	.0039	0.10	2.CMCCFN2Z4.180.1	■
	.071	1.8	.283	7.20	7.20	4	1.57	40	4	.0118	0.30	2.CMCCFN3Z4.180.1	■
	.079	2.0	.315	8.00	8.00	4	1.73	44	4	.0039	0.10	2.CMCCFN2Z4.200.1	■
	.079	2.0	.315	8.00	8.00	4	1.73	44	4	.0079	0.20	2.CMCCFN3Z4.200.1	■
	.079	2.0	.315	8.00	8.00	4	1.73	44	4	.0197	0.50	2.CMCCFN4Z4.200.1	■
3/32	.0937	2.381	.375	9.52	9.52	4	1.73	44	4	.0050	0.127	2.CMC.RCFN2Z4.F332	■
3/32	.0937	2.381	.375	9.52	9.52	4	1.73	44	4	.0100	0.254	2.CMC.RCFN3Z4.F332	■
3/32	.0937	2.381	.375	9.52	9.52	4	1.73	44	4	.0200	0.508	2.CMC.RCFN4Z4.F332	■
	.098	2.5	.394	10.00	10.00	6	2.17	55	4	.0079	0.20	2.CMCCFN2Z4.250.1	■
	.098	2.5	.394	10.00	10.00	6	2.17	55	4	.0197	0.50	2.CMCCFN3Z4.250.1	■
	.118	3.0	.472	12.00	12.00	6	2.17	55	5	.0079	0.20	2.CMCCFN2Z5.300.1	■
	.118	3.0	.472	12.00	12.00	6	2.17	55	5	.0197	0.50	2.CMCCFN3Z5.300.1	■
1/8	.1250	3.175	.500	12.70	12.70	6	2.36	60	5	.0050	0.127	2.CMC.RCFN0Z5.F18	■
1/8	.1250	3.175	.500	12.70	12.70	6	2.36	60	5	.0100	0.254	2.CMC.RCFN2Z5.F18	■
1/8	.1250	3.175	.500	12.70	12.70	6	2.36	60	5	.0200	0.508	2.CMC.RCFN3Z5.F18	■
1/8	.1250	3.175	.500	12.70	12.70	6	2.36	60	5	.0300	0.762	2.CMC.RCFN4Z5.F18	■
	.138	3.5	.551	14.00	14.00	6	2.36	60	5	.0079	0.20	2.CMCCFN2Z5.350.1	■
	.138	3.5	.551	14.00	14.00	6	2.36	60	5	.0197	0.50	2.CMCCFN3Z5.350.1	■
5/32	.1562	3.968	.625	15.87	15.87	6	2.36	60	5	.0100	0.254	2.CMC.RCFN2Z5.F532	■
5/32	.1562	3.968	.625	15.87	15.87	6	2.36	60	5	.0200	0.508	2.CMC.RCFN3Z5.F532	■
	.157	4.0	.630	16.00	16.00	6	2.36	60	5	.0079	0.20	2.CMCCFN2Z5.400.1	■
	.157	4.0	.630	16.00	16.00	6	2.36	60	5	.0197	0.50	2.CMCCFN3Z5.400.1	■
	.177	4.5	.709	18.00	18.00	8	2.76	70	5	.0079	0.20	2.CMCCFN2Z5.450.1	■
	.177	4.5	.709	18.00	18.00	8	2.76	70	5	.0197	0.50	2.CMCCFN3Z5.450.1	■
3/16	.1875	4.762	.750	19.05	19.05	8	2.76	70	5	.0100	0.254	2.CMC.RCFN2Z5.F316	■
3/16	.1875	4.762	.750	19.05	19.05	8	2.76	70	5	.0300	0.762	2.CMC.RCFN3Z5.F316	■
	.197	5.0	.787	20.00	20.00	8	2.76	70	5	.0079	0.20	2.CMCCFN2Z5.500.1	■
	.197	5.0	.787	20.00	20.00	8	2.76	70	5	.0197	0.50	2.CMCCFN3Z5.500.1	■
7/32	.2189	5.560	.876	22.24	22.24	10	2.95	75	5	.0100	0.254	2.CMC.RCFN2Z5.F732	■
7/32	.2189	5.560	.876	22.24	22.24	10	2.95	75	5	.0300	0.762	2.CMC.RCFN3Z5.F732	■
	.236	6.0	.945	24.00	24.00	10	2.95	75	5	.0079	0.20	2.CMCCFN2Z5.600.1	■
	.236	6.0	.945	24.00	24.00	10	2.95	75	5	.0197	0.50	2.CMCCFN3Z5.600.1	■
	.236	6.0	.945	24.00	24.00	10	2.95	75	5	.0394	1.00	2.CMCCFN4Z5.600.1	■
1/4	.2500	6.350	1.00	25.40	25.40	10	3.15	80	5	.0100	0.254	2.CMC.RCFN2Z5.F14	■
1/4	.2500	6.350	1.00	25.40	25.40	10	3.15	80	5	.0200	0.508	2.CMC.RCFN3Z5.F14	■
1/4	.2500	6.350	1.00	25.40	25.40	10	3.15	80	5	.0300	0.762	2.CMC.RCFN4Z5.F14	■
	.315	8.0	1.26	32.00	32.00	12	3.54	90	5	.0079	0.20	2.CMCCFN2Z5.800.1	Δ
	.315	8.0	1.26	32.00	32.00	12	3.54	90	5	.0197	0.50	2.CMCCFN3Z5.800.1	Δ
	.315	8.0	1.26	32.00	32.00	12	3.54	90	5	.0394	1.00	2.CMCCFN4Z5.800.1	Δ

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

Type M - Semi-finishing

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

RECOMMENDATION FOR USE

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



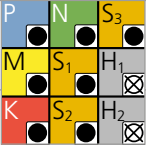
MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

[illegible]

Type M - Finishing

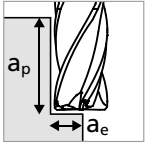
V_c [m/min] | [SFM]
f_z [mm] | [IPT]

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

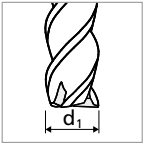


MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



- a_p = 3 x d₁
- a_e = 0.02 x d₁

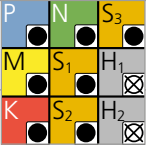


Materials group	Material	Mat. no.	DIN	AISI/ASTM/UNS	1.0 mm .039"		1/16"			3/32"		1/8"		Ød. 5/32"		3/16" - 7/32"		1/4"		8.0 mm .315"	
					v _c	f _z	v _c	f _z		v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	130 427	0.009 .00035	180 591	0.014 .00055		200 656	0.020 .00079	210 689	0.026 .00103	220 722	0.029 .00114	220 722	0.032 .00126	220 722	0.038 .00150	220 722	0.044 .00173
		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	130 427	0.008 .00032	180 591	0.013 .00051		200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.028 .00110	220 722	0.030 .00118	220 722	0.033 .00130	220 722	0.040 .00157
		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	130 427	0.007 .00028	180 591	0.012 .00047		200 656	0.017 .00067	210 689	0.023 .00091	220 722	0.024 .00094	220 722	0.026 .00102	220 722	0.029 .00114	220 722	0.035 .00138
		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	130 427	0.009 .00035	180 591	0.014 .00055	200 656	0.020 .00079	210 689	0.025 .00098	220 722	0.028 .00110	220 722	0.030 .00118	220 722	0.033 .00130	260 853	0.040 .00157	
		1.4105	X6CrMoS17	AISI 430F	130 427	0.009 .00035	180 591	0.013 .00051	200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.027 .00106	220 722	0.029 .00114	220 722	0.032 .00126	260 853	0.038 .00150	
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	130 427	0.009 .00035	180 591	0.013 .00051	200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.027 .00106	220 722	0.029 .00114	220 722	0.032 .00126	260 853	0.038 .00150	
		1.4112	X90CrMoV18	AISI 440B	130 427	0.009 .00035	180 591	0.013 .00051	200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.027 .00106	220 722	0.029 .00114	220 722	0.032 .00126	260 853	0.038 .00150	
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	130 427	0.009 .00035	180 591	0.013 .00051	200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.027 .00106	220 722	0.029 .00114	220 722	0.032 .00126	260 853	0.038 .00150	
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH	130 427	0.009 .00035	180 591	0.013 .00051	200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.027 .00106	220 722	0.029 .00114	220 722	0.032 .00126	260 853	0.038 .00150	
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	130 427	0.007 .00028	180 591	0.009 .00035	200 656	0.017 .00067	210 689	0.023 .00091	220 722	0.025 .00098	220 722	0.028 .00110	220 722	0.030 .00118	260 853	0.037 .00146	
		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	110 361	0.007 .00028	130 427	0.014 .00055	150 492	0.016 .00063	160 525	0.025 .00098	170 558	0.029 .00114	170 558	0.033 .00130	170 558	0.036 .00142	200 656	0.042 .00165	
		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	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		3.4365	AlZnMgCu1.5	ASTM 7075	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		3.2381	GD-AlSi10Mg	UNS A03590	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		2.0065	Cu-ETP / CW004A	UNS C11000	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		2.0360	CuZn40 CW509L	UNS C28000	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00162	270 886	0.047 .00186	
		2.1020	CuSn6	UNS C51900	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00162	270 886	0.047 .00186	
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		2.0960	CuAl9Mn2	UNS C63200	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
S ₁	Super alloys	2.4856		Inconel 625	110 361	0.005 .00020	120 394	0.006 .00024	130 427	0.006 .00024	130 427	0.009 .00035	140 459	0.012 .00047	140 459	0.013 .00051	150 492	0.014 .00055	160 525	0.020 .00079	
		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	110 361	0.009 .00035	120 394	0.012 .00047	130 427	0.016 .00063	130 427	0.023 .00091	140 459	0.025 .00098	140 459	0.028 .00110	150 492	0.030 .00118	160 525	0.036 .00142	
		3.7065	Gr.4	ASTM B348 / F68	110 361	0.009 .00035	120 394	0.012 .00047	130 427	0.016 .00063	130 427	0.023 .00091	140 459	0.025 .00098	140 459	0.028 .00110	150 492	0.030 .00118	160 525	0.036 .00142	
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	110 361	0.009 .00035	120 394	0.012 .00047	130 427	0.016 .00063	130 427	0.023 .00091	140 459	0.025 .00098	140 459	0.028 .00110	150 492	0.030 .00118	160 525	0.036 .00142	
9.9367		TiAl6Nb7	ASTM F1295	110 361	0.009 .00035	120 394	0.012 .00047	130 427	0.016 .00063	130 427	0.023 .00091	140 459	0.025 .00098	140 459	0.028 .00110	150 492	0.030 .00118	160 525	0.036 .00142		
S ₃	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	110 361	0.005 .00020	120 394	0.006 .00024	130 427	0.006 .00024	130 427	0.009 .00035	140 459	0.012 .00047	140 459	0.013 .00051	150 492	0.014 .00055	160 525	0.020 .00079	
			CrCoMo28	ASTM F1537	110 361	0.005 .00020	120 394	0.006 .00024	130 427	0.006 .00024	130 427	0.009 .00035	140 459	0.012 .00047	140 459	0.013 .00051	150 492	0.014 .00055	160 525	0.020 .00079	
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

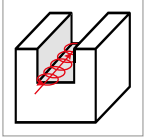
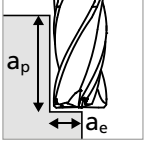
V_c [m/min] | [SFM]
f_z [mm] | [IPT]

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



MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Semi-finishing

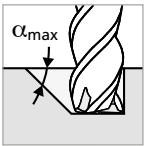


①

■ a_p = 4 x d_i
■ a_e = 0.1 x d_i

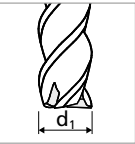
②

■ 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

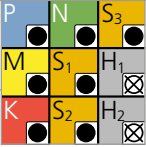


Materials group	Material	Mat. no.	DIN	AISI/ASTM/UNS	1.0 mm .039"				1/16"				3/32"				1/8"				Ød. 5/32"				3/16" - 7/32"				1/4"				8.0 mm .315"			
					①		②		①		②		①		②		①		②		①		②		①		②		①		②		①		②	
					v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	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																																
		1.0401	C15	AISI 1015																																
		1.1191	C45E/CK45	AISI 1045	145	0.008	200	0.012	170	0.011	220	0.018																								
		1.0044	S275JR	AISI 1020	476	.00032	656	.00047	558	.00044	722	.00071																								
		1.0715	11SMn30	AISI 1215																																
	Low alloyed steel Rm > 900 N/mm²	1.5752	15NiCr13	ASTM 3415 / AISI 3310																																
		1.7131	16MnCr5	AISI 5115																																
		1.3505	100Cr6	AISI 52100	145	0.008	200	0.012	170	0.011	220	0.018																								
		1.7225	42CrMo4	AISI 4140	476	.00032	656	.00047	558	.00044	722	.00071																								
		1.2842	90MnCrV8	AISI O2																																
	High alloyed tool steel Rm < 1200 N/mm²	1.2379	X153CrMoV12	AISI D2																																
		1.2436	X210CrW12	AISI D4/D6																																
		1.3343	HS6-5-2C	AISI M2 / UNS T11302	130	0.007	180	0.010	140	0.011	190	0.015																								
		1.3355	HS18-0-1	AISI T1 / UNS T12001	427	.00028	591	.00039	459	.00044	623	.00060																								
M	Stainless steel ferritic	1.4016	X6Cr17	AISI 430 / UNS S43000	100	0.008	145	0.011	120	0.011	160	0.017																								
		1.4105	X6CrMoS17	AISI 430F	328	.00032	476	.00044	394	.00044	525	.00067																								
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	100	0.008	145	0.011	120	0.011	160	0.017																								
		1.4112	X90CrMoV18	AISI 440B	328	.00032	476	.00044	394	.00044	525	.00067																								
	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																								
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH	328	.00028	427	.00039	361	.00039	459	.00060																								
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304																																
		1.4435	X2CrNiMo18-14-3	AISI 316L	100	0.007	130	0.010	110	0.010	140	0.015																								
		1.4441	X2CrNiMo18-15-3	AISI 316LM	328	.00028	427	.00039	361	.00039	459	.00060																								
		1.4539	X1NiCrMoCu25-20-5	AISI 904L																																
K	Cast iron	0.6020	GG20	ASTM 30																																
		0.6030	GG30	ASTM 40B																																
		0.7040	GGG40	ASTM 60-40-18	100	0.008	130	0.012	110	0.011	145	0.017																								
		0.7060	GGG60	ASTM 80-60-03	328	.00032	427	.00047	361	.00044	476	.00067																								
N	Aluminium alloy wrought	3.2315	AlMgSi1	ASTM 6351	150	0.013	180	0.018	150	0.017	220	0.024																								
		3.4365	AlZnMgCu1.5	ASTM 7075	492	.00051	591	.00071	492	.00067	722	.00094																								
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380	150	0.013	180	0.018	150	0.017	220	0.024																								
		3.2381	GD-AlSi10Mg	UNS A03590	492	.00051	591	.00071	492	.00067	722	.00094																								
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	150	0.013	180	0.018	150	0.017	220	0.024																								
		2.0065	Cu-ETP / CW004A	UNS C11000	492	.00051	591	.00071	492	.00067	722	.00094																								
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	150	0.013	180	0.018	150	0.017	220	0.024																								
		2.0360	CuZn40 CW509L	UNS C28000	492	.00051	591	.00071	492	.00067	722	.00094																								
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	150	0.013	180	0.018	150	0.017	220	0.024																								
		2.1020	CuSn6	UNS C51900	492	.00051	591	.00071	492	.00067	722	.00094																								
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	150	0.013	180	0.018	150	0.017	220	0.024																								
		2.0960	CuAl9Mn2	UNS C63200	492	.00051	591	.00071	492	.00067	722	.00094																								
S ₁	Super alloys	2.4856		Inconel 625																																
		2.4668		Inconel 718																																
		2.4617	NiMo28	Hastelloy B-2	50	0.006	80	0.008	70	0.008	100	0.012																								
		2.4665	NiCr22Fe18Mo	Hastelloy X	164	.00024	262	.00032	230	.00032	328	.00047																								
		3.7035	Gr.2	ASTM B348 / F67	90	0.009	120	0.014	90	0.011	120	0.017																								
S ₂	Titanium pure	3.7065	Gr.4	ASTM B348 / F68	295	.00035	394	.00055	295	.00044	394	.00067																								
		3.7165	TiAl6V4	ASTM B348 / F136	90	0.009	120	0.014	90	0.011	120	0.017																								
S ₃	Titanium alloys	9.9367	TiAl6Nb7	ASTM F1295	295	.00035	394	.00055	295	.00044	394	.00067																								
		2.4964	CoCr20W15Ni	Haynes 25	60	0.006	80	0.008	70	0.008	100	0.012																								
H ₁ H ₂			CrCoMo28	ASTM F1537	197	.00024	262	.00032	230	.00032	328	.00047																								
H ₁ H ₂	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1																																

Type N - Finishing

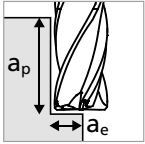
V_c [m/min] | [SFM]
f_z [mm] | [IPT]

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

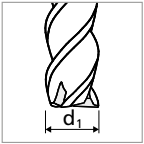


MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



■ a_p = 4 x d_i
■ a_e = 0.02 x d_i



Materials group	Material	Mat. no.	DIN	AISI/ASTM/UNS	1.0 mm .039"		1/16"			3/32"		1/8"		Ød. 5/32"		3/16" - 7/32"		1/4"		8.0 mm .315"	
					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	130 427	0.009 .00035	180 591	0.014 .00055		200 656	0.020 .00079	210 689	0.026 .00103	220 722	0.029 .00114	220 722	0.032 .00126	220 722	0.038 .00150	220 722	0.044 .00173
		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	130 427	0.008 .00032	180 591	0.013 .00051		200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.028 .00110	220 722	0.030 .00118	220 722	0.033 .00130	220 722	0.040 .00157
		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	130 427	0.007 .00028	180 591	0.012 .00047		200 656	0.017 .00067	210 689	0.023 .0091	220 722	0.024 .00094	220 722	0.026 .00102	220 722	0.029 .00114	220 722	0.035 .00138
		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	130 427	0.009 .00035	180 591	0.014 .00055	200 656	0.020 .00079	210 689	0.025 .00098	220 722	0.028 .00110	220 722	0.030 .00118	220 722	0.033 .00130	260 853	0.040 .00157	
		1.4105	X6CrMoS17	AISI 430F																	
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	130 427	0.009 .00035	180 591	0.013 .00051	200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.027 .00106	220 722	0.029 .00114	220 722	0.032 .00126	260 853	0.038 .00150	
		1.4112	X90CrMoV18	AISI 440B																	
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	130 427	0.009 .00035	180 591	0.013 .00051	200 656	0.018 .00071	210 689	0.025 .00098	220 722	0.027 .00106	220 722	0.029 .00114	220 722	0.032 .00126	260 853	0.038 .00150	
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH																	
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	130 427	0.007 .00028	180 591	0.009 .00035	200 656	0.017 .00067	210 689	0.023 .0091	220 722	0.025 .00098	220 722	0.028 .00110	220 722	0.030 .00118	260 853	0.037 .00146	
		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	110 361	0.007 .00028	130 427	0.014 .00055	150 492	0.016 .00063	160 525	0.025 .00098	170 558	0.029 .00114	170 558	0.033 .00130	170 558	0.036 .00142	200 656	0.042 .00165	
		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	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		3.4365	AlZnMgCu1.5	ASTM 7075																	
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		3.2381	GD-AlSi10Mg	UNS A03590																	
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		2.0065	Cu-ETP / CW004A	UNS C11000																	
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		2.0360	CuZn40 CW509L	UNS C28000																	
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	130 427	0.012 .00047	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00162	270 886	0.047 .00186	
		2.1020	CuSn6	UNS C51900																	
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	130 427	0.010 .00039	180 591	0.015 .00060	200 656	0.021 .00083	210 689	0.033 .00130	220 722	0.035 .00138	220 722	0.038 .00150	220 722	0.041 .00161	270 886	0.047 .00185	
		2.0960	CuAl9Mn2	UNS C63200																	
S ₁	Super alloys	2.4856		Inconel 625	110 361	0.005 .00020	120 394	0.006 .00024	130 427	0.006 .00024	130 427	0.009 .00035	140 459	0.012 .00047	140 459	0.013 .00051	150 492	0.014 .00055	160 525	0.020 .00079	
		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	110 361	0.009 .00035	120 394	0.012 .00047	130 427	0.016 .00063	130 427	0.023 .00091	140 459	0.025 .00098	140 459	0.028 .00110	150 492	0.030 .00118	160 525	0.036 .00142	
		3.7065	Gr.4	ASTM B348 / F68																	
S ₃	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	110 361	0.009 .00035	120 394	0.012 .00047	130 427	0.016 .00063	130 427	0.023 .00091	140 459	0.025 .00098	140 459	0.028 .00110	150 492	0.030 .00118	160 525	0.036 .00142	
		9.9367	TiAl6Nb7	ASTM F1295																	
	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	110 361	0.005 .00020	120 394	0.006 .00024	130 427	0.006 .00024	130 427	0.009 .00035	140 459	0.012 .00047	140 459	0.013 .00051	150 492	0.014 .00055	160 525	0.020 .00079	
			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

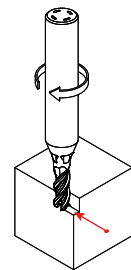
Coolant: for best results, Mikron Tool recommends the use of cutting oil as coolant. Alternatively, water base coolant with EP-Additives (Extreme-Pressure-Additives) can be used as well.

Filter: the large cooling channels permit the use of a standard filter with filter quality of $\leq .002''$ (0.05 mm).

Coolant pressure: at least 15 bar (218 psi) coolant pressure is required to achieve reliable milling. High pressure is generally better for the cooling and flushing effect.

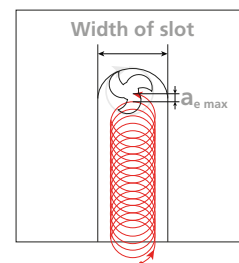
Revolution	[rpm]	$\leq 10'000$	$> 10'000$
Minimal pressure	[bar]	15	30
	[psi]	218	435

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.

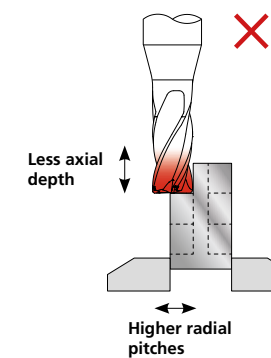
Trochoidal slot milling



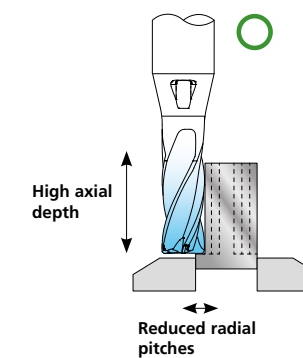
Cutting values: see cutting data chart "Semi-finishing" at page 22 and 26!

MILLING PROCESS

Traditional vs. High efficiency milling (HEM)

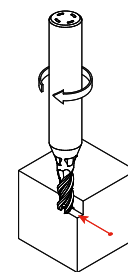


Traditional Milling
Work, heat and wear are concentrated along a smaller portion of the cutting edge.



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

Semi-finishing

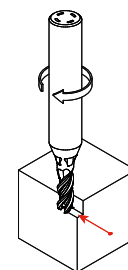


Recommended cutting parameters

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!

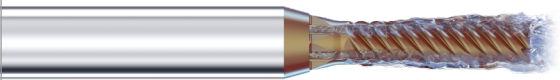


NEW CrazyMill Cool SF

NEW

CRAZYMILL™
by Mikron Tool
Cool SF

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 11.8 µin (0.3 µm) for more than seven (!) hours machining time on stainless steel 316L!

Available in different diameters between Ø.039" and .315" (1 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

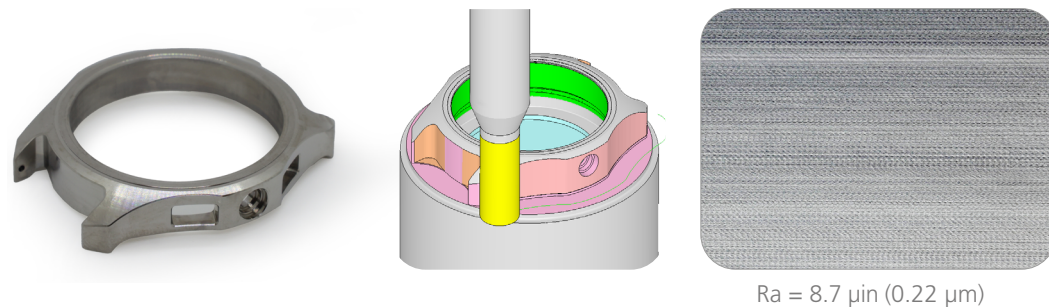
Most of the machined components, need a post surface treatment like grinding, polishing, tumbling and others. Those manufacturing steps can be very costly and very time consuming. Improving the surface quality through the super finishing milling process could avoid or reduce subsequent finishing operations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

Solution

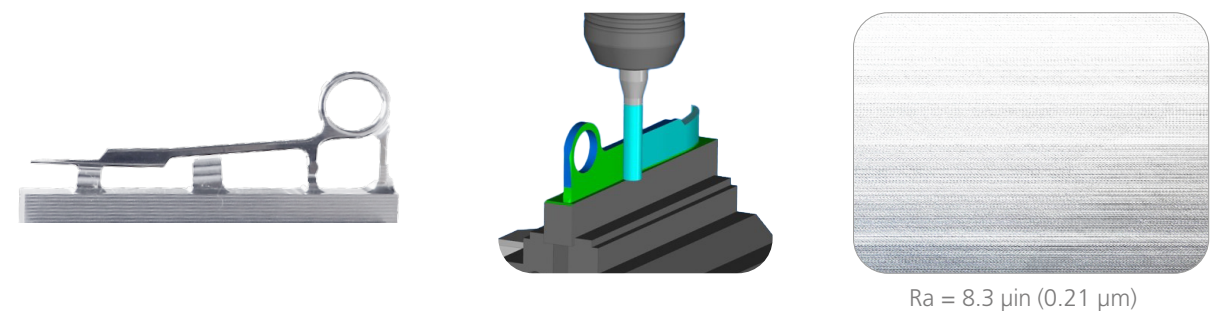
Surface milling below Ra 11.8 µin (0.3 µm)

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 11.8 µin (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.

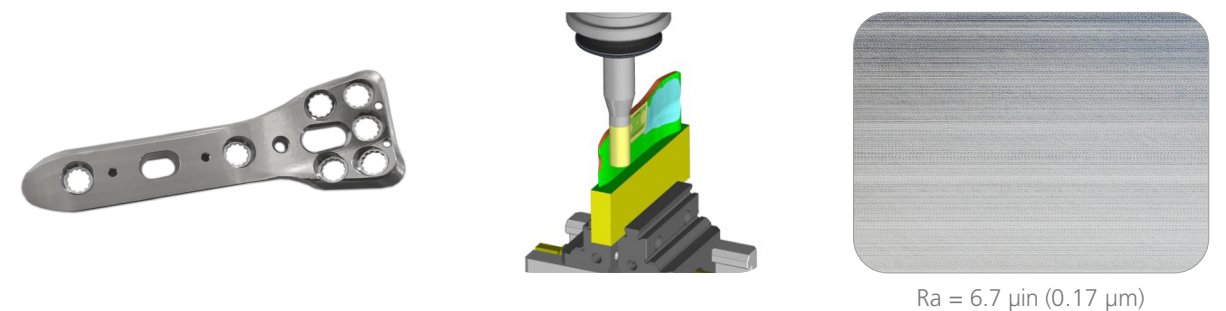
■ Real case: Watch Ti Gr.5 (3.7165)



■ Real case: Hemostatic clamp 17-4 PH



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



NEW

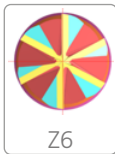
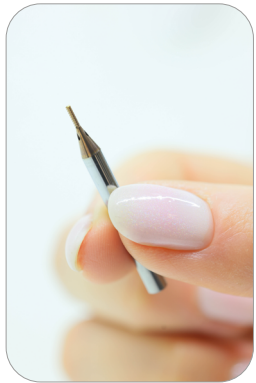
CrazyMill Cool SF

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 $d = .118''$ (3 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 $Ra\ 11.8\ \mu\text{in}$ (0.3 μm) 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 = 7.1 μin (0.18 μm)	Ra = 8.7 μin (0.22 μm)	Ra = 7.9 μin (0.20 μm)	Ra = 6.3 μin (0.16 μm)
■ CrCo Alloys	■ Inconel	■ Copper	
Ra = 9.1 μin (0.23 μm)	Ra = 11.8 μin (0.30 μm)	Ra = 5.9 μin (0.15 μm)	

NEW

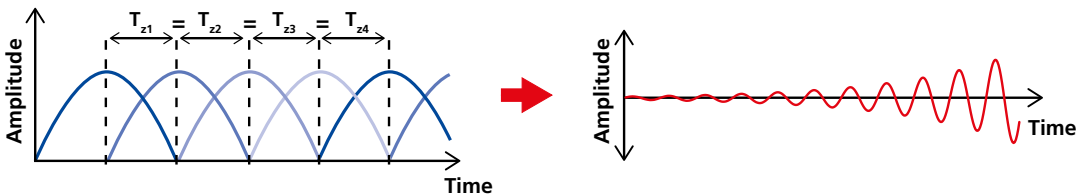
CrazyMill Cool SF

NEW

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

4. Challenge

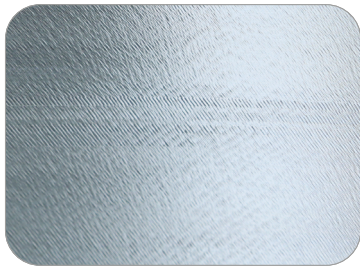
Avoid chatter when milling



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”.

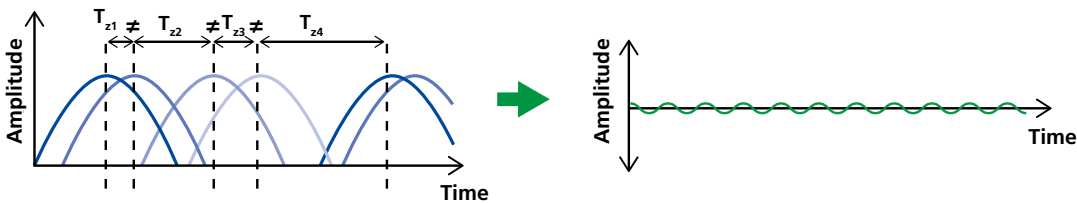
If the frequency is kept uniform (see diagram) ($T_{z1} = T_{z2} = T_{z3} = T_{z4}$), it can lead to an increase in the maximum deflection in the resonance frequency, resulting in vibrations and consequently chatter marks on the workpiece.



Surface with vibrations

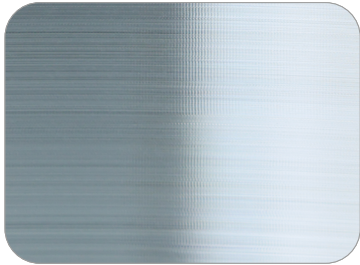
Solution

Avoidance of resonance frequencies

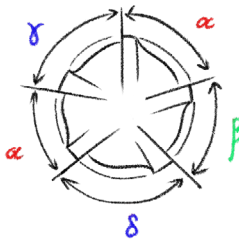


The new CrazyMill Cool SF has been specifically developed, to interrupt this resonance frequency. Using unequal angular teeth division, and a variable helix angle (every cutting edge has a different helix angle) every cutting edge generates a different frequency wave that occur in an irregular timing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

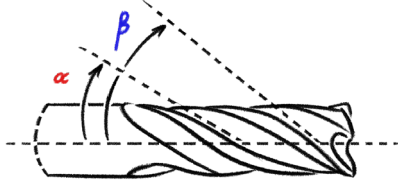
This results, as shown in the graph, in a resonant frequency amplitude reduction, and guarantees a vibration free surface.



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



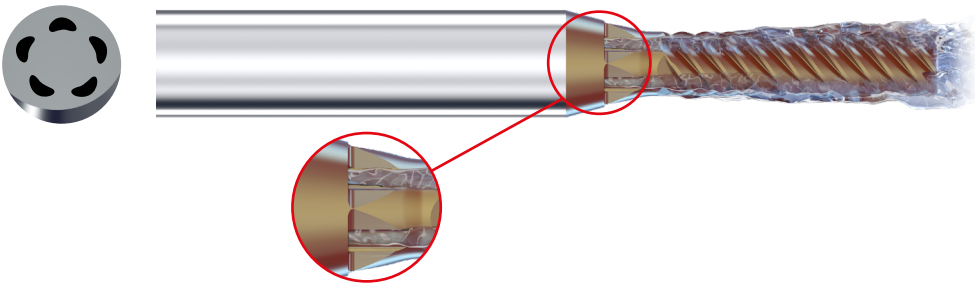
The machining of metals requires a high energy input into the cutting zones. A large proportion of this is converted directly into thermal energy. The higher the heat generated in the cutting zone, the shorter the tool life. It is therefore essential to keep the temperature in the cutting zone as low 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 217 psi, 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 11.8 µin (0.3 µm) 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 11.8 µin (0.3 µm) 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 5.9 - 11.8 µin (0.15 - 0.3 µm)	10	9	8	6	7
Ra parallel, based on Ra 5.9 - 11.8 µin (0.15 - 0.3 µm)	10	10	7	6	4
A (inch²/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 11.8 µin (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 11.8 µin (0.3 µm) or better
- Process reliability
- Very long tool life

NEW

Maximum performance guaranteed

3 x d
Type M

4 x d
Type N

NEW

EXAMPLE OF TITANIUM GR.2 MACHINING IN COMPARISON

■ Example
Faster machining time for the best roughness

Machining: Side milling
Milling depth: .945" (24 mm);
Coolant: Emulsion 8%

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

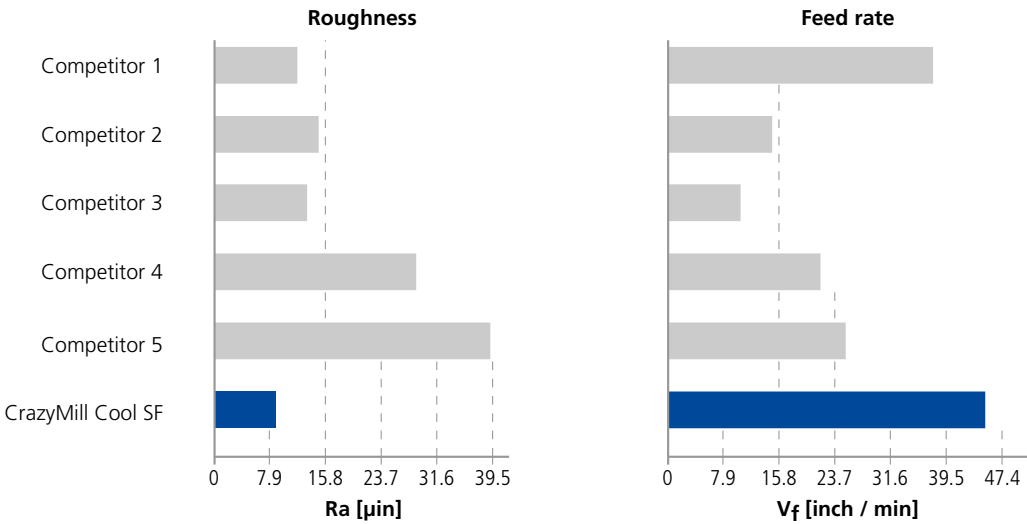
Tool: CrazyMill Cool SF
Diameter: .236" (6.0 mm)



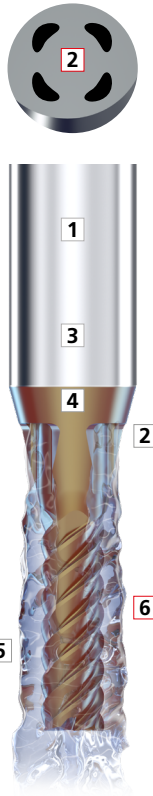
Cutting data:

	V_c [SFM] [m/min]	f_z [inch] [mm]	a_e [inch] [mm]	a_p [inch] [mm]	Z [flutes]
Competitor 1	328 100	.00102 0.026	.0071 0.18	.945 24	7
Competitor 2	171 52	.00094 0.024	.0020 0.05	.945 24	6
Competitor 3	151 46	.00055 0.014	.0236 0.60	.945 24	7
Competitor 4	243 74	.00094 0.024	.0020 0.05	.945 24	6
Competitor 5	263 80	.00118 0.030	.0020 0.05	.945 24	5
CrazyMill Cool SF	459 140	.00098 0.025	.0020 0.05	.945 24	6

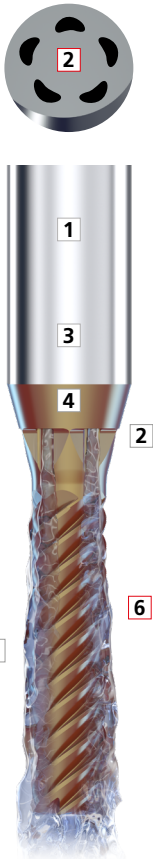
Results:



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



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



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.

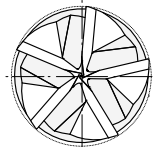
5 | SPECIFIC CHATTER-FREE GEOMETRY

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.

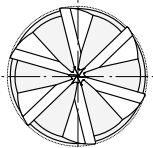
6 | LATERAL CUTTING GEOMETRY

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
Ø.039" - .098"
(Ø1 - 2.5 mm)



6 - Flute
Diameter range
Ø.118" - .315"
(Ø3 - 8 mm)

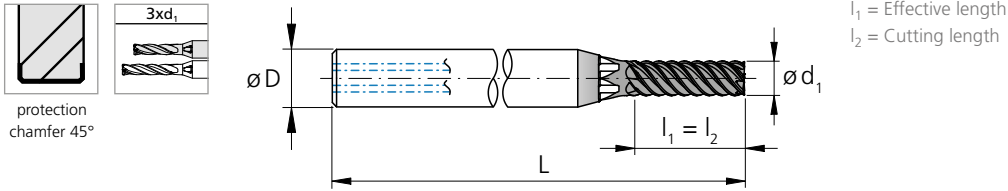
Type M - 3 x d - Square - Z5 / Z6

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

Carbide	Z 5-6							
Ø d ₁		.004" - .118" (0.1 - 3.0 mm)		.122" - .236" (3.1 - 6.0 mm)		.240" - .394" (6.1 - 10.0 mm)		
Tolerance		- .00055" - .00110"		- 0.014 mm - 0.028 mm		- .00079" - .00150"		- 0.020 mm - 0.038 mm

Carbide	Z 5-6							
Ø d ₁		.004" - .118" (0.1 - 3.0 mm)		.122" - .236" (3.1 - 6.0 mm)		.240" - .394" (6.1 - 10.0 mm)		
Tolerance		- .00055" - .00110"		- 0.014 mm - 0.028 mm		- .00079" - .00150"		- 0.020 mm - 0.038 mm

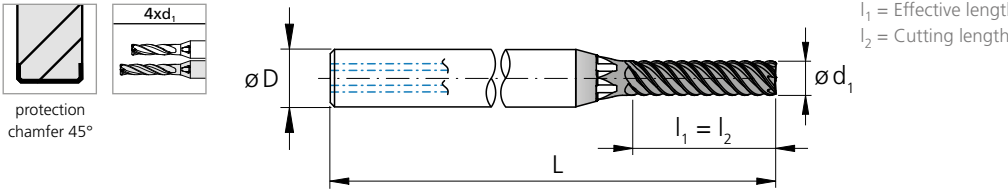
Square



d ₁	d ₁	d ₁	l ₁	l ₁	l ₂	D (h6)	L	L	Z	Item number	Availability
[inch]	[inch]	[mm]	[inch]	[mm]	[mm]	[mm]	[inch]	[mm]	[flutes]		
	.039	1.0	.079	3.00	3.00	4	1.57	40	5	2.CMCSF.M1Z5.100.1	■
	.047	1.2	.094	3.60	3.60	4	1.57	40	5	2.CMCSF.M1Z5.120.1	■
	.059	1.5	.118	4.50	4.50	4	1.57	40	5	2.CMCSF.M1Z5.150.1	■
1/16	.0625	1.587	.122	4.76	4.76	4	1.57	40	5	2.CMC.SSFM1Z5.F116	■
	.071	1.8	.142	5.40	5.40	4	1.57	40	5	2.CMCSF.M1Z5.180.1	■
	.079	2.0	.157	6.00	6.00	4	1.57	40	5	2.CMCSF.M1Z5.200.1	■
3/32	.0937	2.381	.185	7.14	7.14	4	1.57	40	5	2.CMC.SSFM1Z5.F332	■
	.098	2.5	.197	7.50	7.50	6	2.17	55	5	2.CMCSF.M1Z5.250.1	■
	.118	3.0	.236	9.00	9.00	6	2.17	55	6	2.CMCSF.M1Z6.300.1	■
1/8	.1250	3.175	.252	9.53	9.53	6	2.17	55	6	2.CMC.SSFM1Z6.F18	■
	.138	3.5	.276	10.50	10.50	6	2.17	55	6	2.CMCSF.M1Z6.350.1	■
5/32	.1562	3.968	.312	11.90	11.90	6	2.17	55	6	2.CMC.SSFM1Z6.F532	■
	.157	4.0	.315	12.00	12.00	6	2.17	55	6	2.CMCSF.M1Z6.400.1	■
	.177	4.5	.354	13.50	13.50	8	2.56	65	6	2.CMCSF.M1Z6.450.1	■
3/16	.1875	4.762	.375	14.29	14.29	8	2.56	65	6	2.CMC.SSFM1Z6.F316	■
	.197	5.0	.394	15.00	15.00	8	2.56	65	6	2.CMCSF.M1Z6.500.1	■
7/32	.2189	5.560	.438	16.68	16.68	10	2.76	70	6	2.CMC.SSFM1Z6.F732	■
	.236	6.0	.472	18.00	18.00	10	2.76	70	6	2.CMCSF.M1Z6.600.1	■
1/4	.2500	6.350	.500	19.05	19.05	10	2.76	70	6	2.CMC.SSFM1Z6.F14	■
	.315	8.0	.630	24.00	24.00	12	3.15	80	6	2.CMCSF.M1Z6.800.1	Δ

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

Square



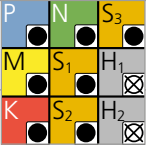
d ₁	d ₁	d ₁	l ₁	l ₁	l ₂	D (h6)	L	L	Z	Item number	Availability
[inch]	[inch]	[mm]	[inch]	[mm]	[mm]	[mm]	[inch]	[mm]	[flutes]		
	.039	1.0	.079	4.00	4.00	4	1.57	40	5	2.CMCSFN1Z5.100.1	■
	.047	1.2	.094	4.80	4.80	4	1.57	40	5	2.CMCSFN1Z5.120.1	■
	.059	1.5	.118	6.00	6.00	4	1.57	40	5	2.CMCSFN1Z5.150.1	■
1/16	.0625	1.587	.122	6.35	6.35	4	1.57	40	5	2.CMC.SSFN1Z5.F116	■
	.071	1.8	.142	7.20	7.20	4	1.57	40	5	2.CMCSFN1Z5.180.1	■
	.079	2.0	.157	8.00	8.00	4	1.73	44	5	2.CMCSFN1Z5.200.1	■
3/32	.0937	2.381	.185	9.52	9.52	4	1.73	44	5	2.CMC.SSFN1Z5.F332	■
	.098	2.5	.197	10.00	10.00	6	2.17	55	5	2.CMCSFN1Z5.250.1	■
	.118	3.0	.236	12.00	12.00	6	2.17	55	6	2.CMCSFN1Z6.300.1	■
1/8	.1250	3.175	.252	12.70	12.70	6	2.36	60	6	2.CMC.SSFN1Z6.F18	■
	.138	3.5	.276	14.00	14.00	6	2.36	60	6	2.CMCSFN1Z6.350.1	■
5/32	.1562	3.968	.312	15.87	15.87	6	2.36	60	6	2.CMC.SSFN1Z6.F532	■
	.157	4.0	.315	16.00	16.00	6	2.36	60	6	2.CMCSFN1Z6.400.1	■
	.177	4.5	.354	18.00	18.00	8	2.76	70	6	2.CMCSFN1Z6.450.1	■
3/16	.1875	4.762	.375	19.05	19.05	8	2.76	70	6	2.CMC.SSFN1Z6.F316	■
	.197	5.0	.394	20.00	20.00	8	2.76	70	6	2.CMCSFN1Z6.500.1	■
7/32	.2189	5.560	.438	22.24	22.24	10	2.95	75	6	2.CMC.SSFN1Z6.F732	■
	.236	6.0	.472	24.00	24.00	10	2.95	75	6	2.CMCSFN1Z6.600.1	■
1/4	.2500	6.350	.500	25.40	25.40	10	3.15	80	6	2.CMC.SSFN1Z6.F14	■
	.315	8.0	.630	32.00	32.00	12	3.54	90	6	2.CMCSFN1Z6.800.1	Δ

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

Type M - Finishing

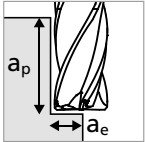
V_c [m/min] | [SFM]
f_z [mm] | [IPT]

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

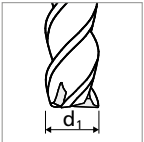


MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



■ $a_p = 3 \times d_1$

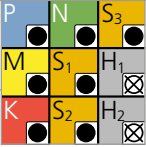


Materials group	Material	Mat. no.	DIN	AISI/ASTM/UNS	a _e	1.0 mm .039"		1/16"		3/32"		1/8"		5/32"		3/16" - 7/32"		1/4"		8.0 mm .315"			
						v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z	v _c	f _z		
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	0.010 - 0.020 x d1	120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315		
		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		120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315		
		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		120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315		
		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	80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236		
		1.4105	X6CrMoS17	AISI 430F																			
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C		80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236		
		1.4112	X90CrMoV18	AISI 440B																			
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH		80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236		
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH																			
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304		80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236		
		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	120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315		
		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	200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315		
		3.4365	AlZnMgCu1.5	ASTM 7075																			
	Aluminium alloy cast	3.2163	GD-AISI9Cu3	ASTM A380		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315		
		3.2381	GD-AISI10Mg	UNS A03590																			
	Copper	2.0040	Cu-OF / CW008A	UNS C10100		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315		
		2.0065	Cu-ETP / CW004A	UNS C11000																			
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315		
		2.0360	CuZn40 CW509L	UNS C28000																			
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315		
		2.1020	CuSn6	UNS C51900																			
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315		
		2.0960	CuAl9Mn2	UNS C63200																			
	S ₁	Super alloys	2.4856			Inconel 625	0.005 - 0.010 x d1	40 131	0.005-0.007 .00020 - .00028	60 197	0.007-0.012 .00028 - .00047	60 197	0.010-0.015 .00039 - .00059	80 262	0.015-0.025 .00059 - .00098	80 262	0.020-0.030 .00079 - .00118	80 262	0.025-0.035 .00098 - .00138	100 328	0.030-0.045 .00118 - .00177	100 328	0.040-0.060 .00157 - .00236
			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	60 197	0.005-0.010 .00020 - .00039	80 262	0.006-0.012 .00024 - .00047	80 262	0.008-0.016 .00031 - .00063	130 427	0.011-0.022 .00043 - .00087	120 394	0.012-0.024 .00047 - .00094	120 394	0.014-0.028 .00055 - .00110	140 459	0.015-0.030 .00059 - .00118	140 459	0.020-0.040 .00079 - .00157		
		3.7065	Gr.4	ASTM B348 / F68																			
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136		60 197	0.005-0.010 .00020 - .00039	80 262	0.006-0.012 .00024 - .00047	80 262	0.008-0.016 .00031 - .00063	130 427	0.011-0.022 .00043 - .00087	120 394	0.012-0.024 .00047 - .00094	120 394	0.014-0.028 .00055 - .00110	140 459	0.015-0.030 .00059 - .00118	140 459	0.020-0.040 .00079 - .00157		
9.9367		TiAl6Nb7	ASTM F1295																				
S ₃	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	0.005 - 0.010 x d1	80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	130 427	0.015-0.025 .00059 - .00098	120 394	0.020-0.030 .00079 - .00118	120 394	0.025-0.035 .00098 - .00138	140 459	0.030-0.045 .00118 - .00177	140 459	0.040-0.060 .00157 - .00236		
			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 - Finishing

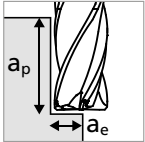
V_c [m/min] | [SFM]
f_z [mm] | [IPT]

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

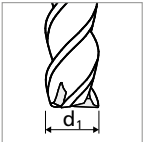


MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



■ $a_p = 4 \times d_1$



Materials group	Material	Mat. no.	DIN	AISI/ASTM/UNS	a _e	1.0 mm .039"		1/16"		3/32"		1/8"		5/32"		3/16" - 7/32"		1/4"		8.0 mm .315"	
						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	0.010 - 0.020 x d1	120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315
		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		120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315
		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		120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315
		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	80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236
		1.4105	X6CrMoS17	AISI 430F																	
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C		80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236
		1.4112	X90CrMoV18	AISI 440B																	
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH		80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH																	
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304		80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	120 394	0.015-0.025 .00059 - .00098	140 459	0.020-0.030 .00079 - .00118	140 459	0.025-0.035 .00098 - .00138	160 525	0.030-0.045 .00118 - .00177	160 525	0.040-0.060 .00157 - .00236
		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	120 394	0.005-0.010 .00020 - .00039	140 459	0.007-0.015 .00028 - .00059	140 459	0.010-0.020 .00039 - .00079	160 525	0.015-0.030 .00059 - .00118	180 591	0.020-0.040 .00079 - .00157	180 591	0.025-0.050 .00098 - .00197	200 656	0.030-0.060 .00118 - .00236	200 656	0.040-0.080 .00157 - .00315
		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	200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315
		3.4365	AlZnMgCu1.5	ASTM 7075																	
	Aluminium alloy cast	3.2163	GD-AISI9Cu3	ASTM A380		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315
		3.2381	GD-AISI10Mg	UNS A03590																	
	Copper	2.0040	Cu-OF / CW008A	UNS C10100		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315
		2.0065	Cu-ETP / CW004A	UNS C11000																	
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315
		2.0360	CuZn40 CW509L	UNS C28000																	
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315
		2.1020	CuSn6	UNS C51900																	
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000		200 656	0.005-0.010 .00020 - .00039	220 722	0.007-0.015 .00028 - .00059	220 722	0.010-0.020 .00039 - .00079	260 853	0.015-0.030 .00059 - .00118	280 919	0.020-0.040 .00079 - .00157	280 919	0.025-0.050 .00098 - .00197	300 984	0.030-0.060 .00118 - .00236	300 984	0.040-0.080 .00157 - .00315
		2.0960	CuAl9Mn2	UNS C63200																	
	S ₁	Super alloys	2.4856			Inconel 625	0.005 - 0.010 x d1	40 131	0.005-0.007 .00020 - .00028												
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		60 197	0.005-0.010 .00020 - .00039	80 262	0.006-0.012 .00024 - .00047	80 262	0.008-0.016 .00031 - .00063	130 427	0.011-0.022 .00043 - .00087	120 394	0.012-0.024 .00047 - .00094	120 394	0.014-0.028 .00055 - .00110	140 459	0.015-0.030 .00059 - .00118
	3.7065		Gr.4	ASTM B348 / F68																	
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	60 197		0.005-0.010 .00020 - .00039	80 262	0.006-0.012 .00024 - .00047	80 262	0.008-0.016 .00031 - .00063	130 427	0.011-0.022 .00043 - .00087	120 394	0.012-0.024 .00047 - .00094	120 394	0.014-0.028 .00055 - .00110	140 459	0.015-0.030 .00059 - .00118	140 459	0.020-0.040 .00079 - .00157
		9.9367	TiAl6Nb7	ASTM F1295																	
S ₃	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	0.005 - 0.010 x d1	80 262	0.005-0.007 .00020 - .00028	100 328	0.007-0.012 .00028 - .00047	100 328	0.010-0.015 .00039 - .00059	130 427	0.015-0.025 .00059 - .00098	120 394	0.020-0.030 .00079 - .00118	120 394	0.025-0.035 .00098 - .00138	140 459	0.030-0.045 .00118 - .00177	140 459	0.040-0.060 .00157 - .00236
			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.

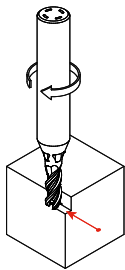
Filter: the large cooling channels permit the use of a standard filter with filter quality of ≤ .002" (0.05 mm).

Coolant pressure: at least 15 bar (218 psi) coolant pressure is required to achieve reliable milling. High pressure is generally better for the cooling and flushing effect.

Revolution	[rpm]	≤ 10'000	> 10'000
Minimal pressure	[bar]	15	30
	[psi]	218	435

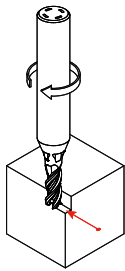
MILLING PROCESS

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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