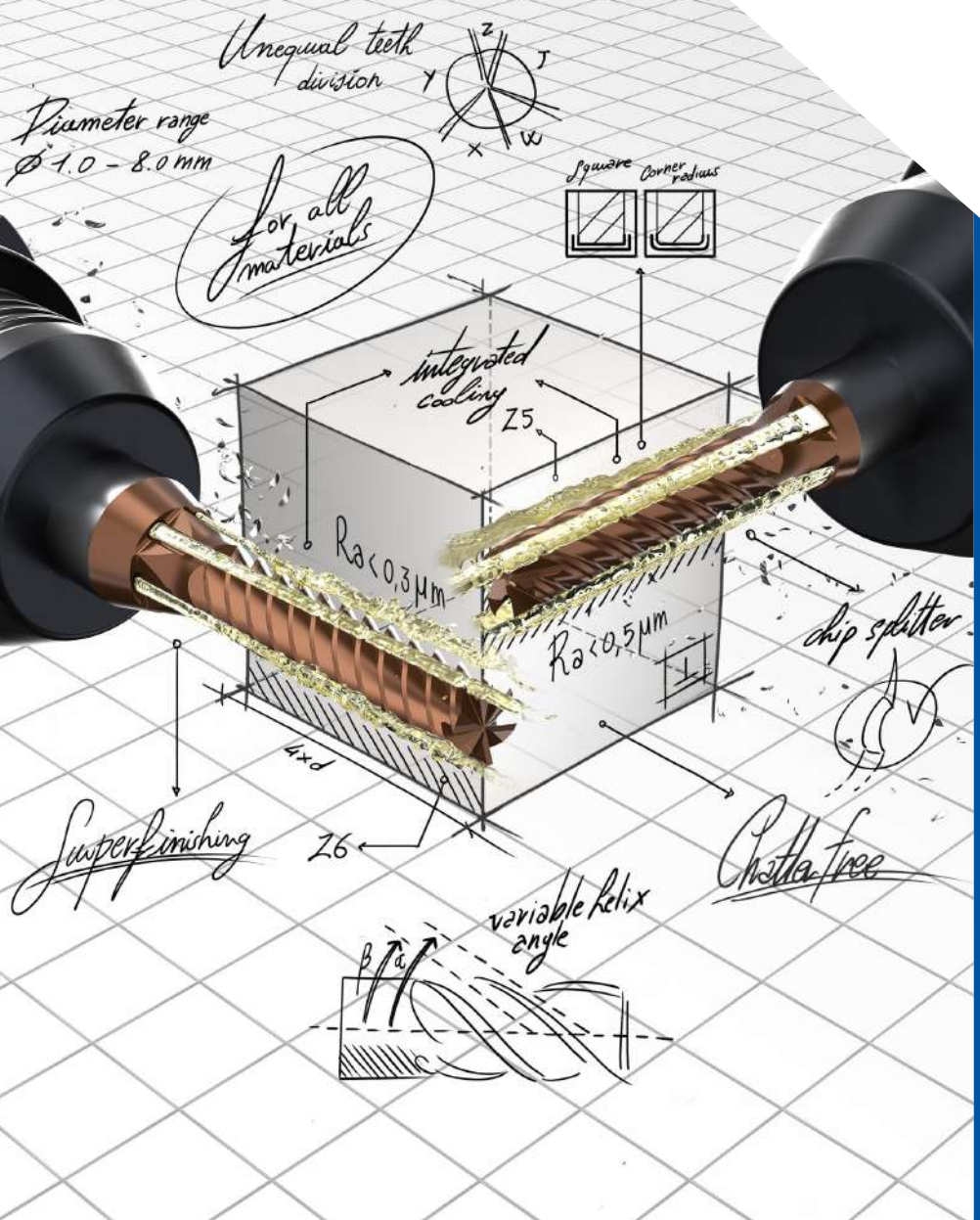
MIKRON TOOL

More than tools

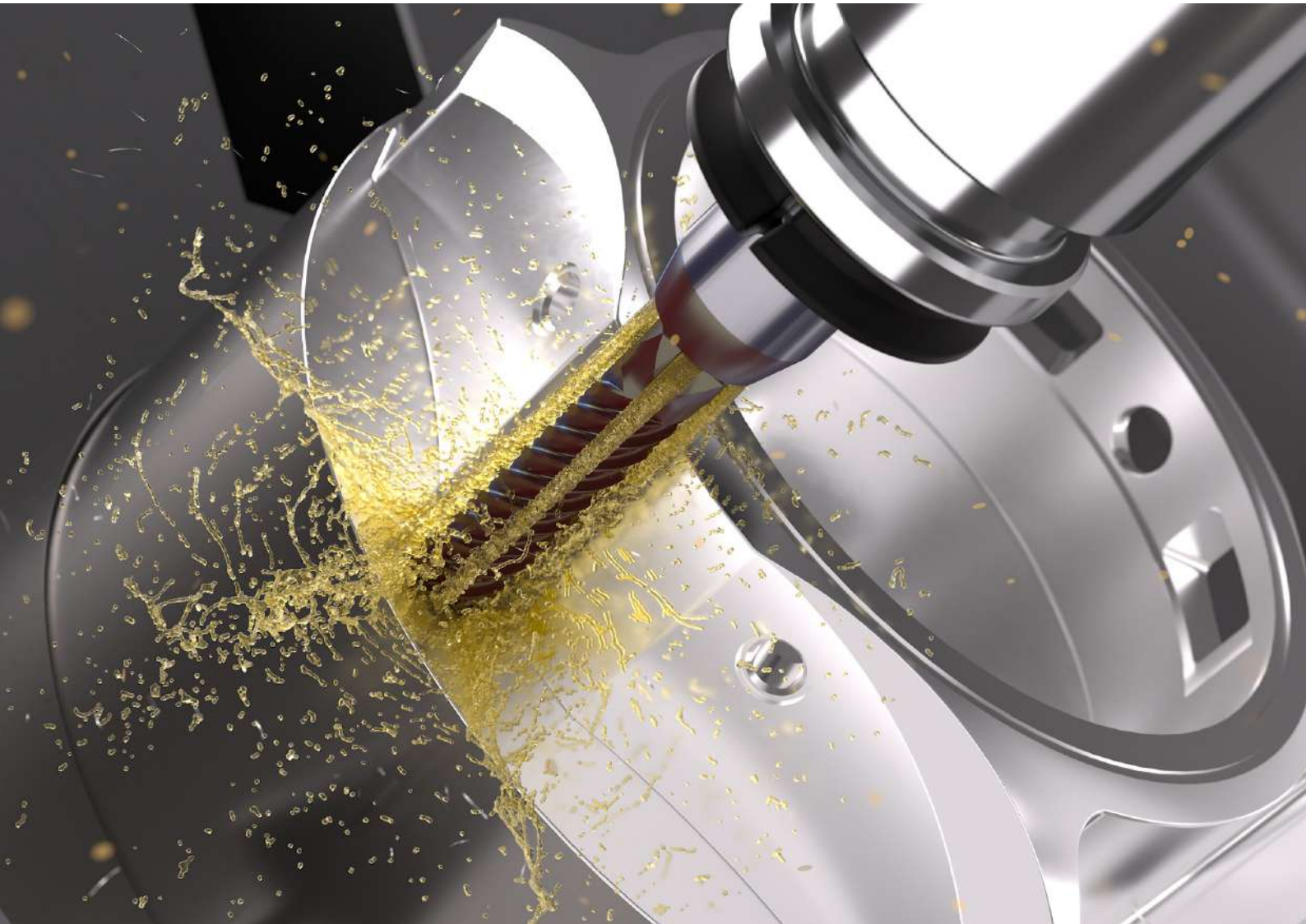
crazy about new endmills

- CHATTER FREE ENDMILL
- SUPER FINISHING ENDMILL



NEW

English



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 bette. 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

NEW Overview of new tools

3 NEW PRODUCTS

	CRAZYMILL Cool CF	Square Z4 / Z5	
NEW	CRAZYMILL Cool CF	Corner radius Z4 / Z5	
	CRAZYMILL Cool SF	Square Z5 / Z6	

RECOMMENDATION FOR USE

● Excellent | ◐ Good | ○ Acceptable | ⊠ Not recommended

ø - range [mm]	max. depth	Cooling		P	M	K	N	S_1	S_2		S_3	H_1	H_2	Page
		Int.	Ext.	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	
1.0 – 8.0	3 x d 4 x d	✔	–	●	●	●	●	●	●	●	●	⊠	⊠	**6**
1.0 – 8.0	3 x d 4 x d	✔	–	●	●	●	●	●	●	●	●	⊠	⊠	**6**
1.0 – 8.0	3 x d 4 x d	✔	–	●	●	●	●	●	●	●	●	⊠	⊠	**34**

NEW CrazyMill Cool CF

NEW

CRAZYMILL by Mikron Tool Cool CF

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.

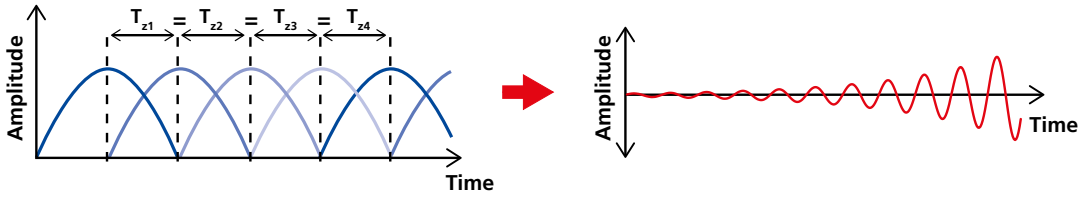
Please note: You couldn't find your suitable version of the CrazyMill Cool CF (diameter, length, cutting direction…)? Ask us about our customized versions!

NEW CrazyMill Cool CF

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

1. Challenge

Avoid chattering 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".

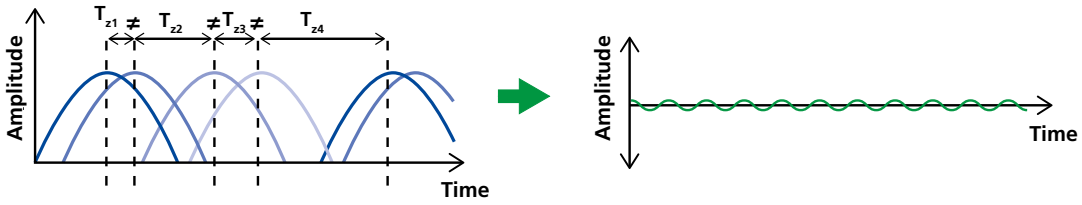
If the frequency is kept uniform (see diagram) ($T_{Z1} = T_{Z2} = T_{Z3} = T_{Z4}$), it can lead to an increase in the maximum deflection in the resonance frequency, resulting in vibrations and consequently chatter marks on the workpiece.

Surface with vibrations
Ra = 0.7 µm

NEW

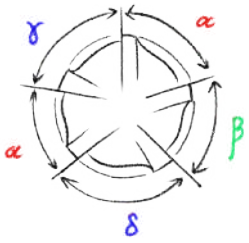
Solution

Avoidance of resonance frequencies

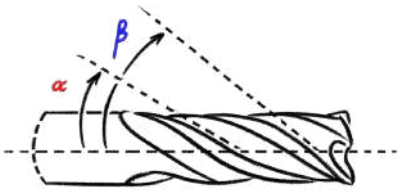


The new CrazyMill Cool CF has been specifically developed, to interrupt this resonance frequency. Using unequal angular teeth division, and a variable helix angle (every cutting edge has a different helix angle) every cutting edge generates a different frequency wave that occur in an irregular timing 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
Ra = 0.35 µm



Unequal angular teeth division



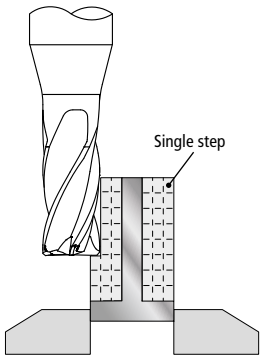
Variable helix angle

NEW CrazyMill Cool CF

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

2. Challenge

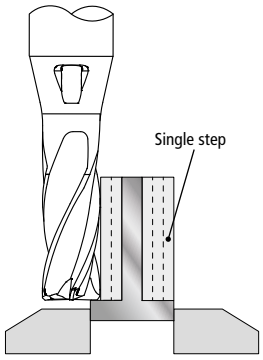
High Removal Rate for thin-walled and unstable workpieces



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

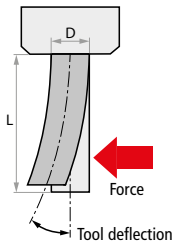


With the new endmill, particular attention has been placed to finding a perfect balance between cutting angle, a relive angle and the cutting edge conditioning.
An extremely high cutting ability ensures a very low lateral cutting pressure, so that the endmill can cut reliably even at its maximum axial 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).

NEW

3. Challenge

High shape tolerance - perpendicularity

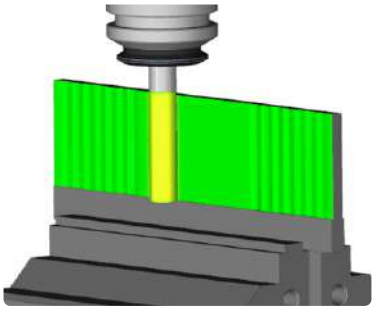


Profile milling with the side milling strategy over the maximum engagement length of the milling cutter (4 x d) must enable a perfectly perpendicular profile within the specified tolerance fields. This must also be possible when using high-speed and highly dynamic milling strategies.

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.

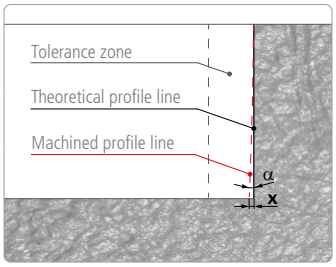


Material: X2CrNiMo17-12-2 / 1.4404 / AISI 316L

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: Ra = 0.35 µm

■ Perpendicularity



	Perpendicularity precision
x	0.012 mm
α	- 0.03°

NEW CrazyMill Cool CF

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

4. Challenge

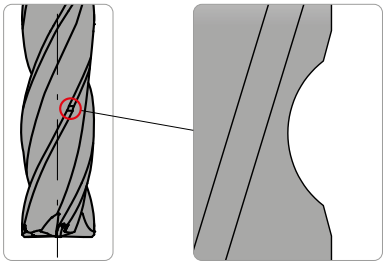
High surface qualitiy – Process reliable chip management

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.

NEW

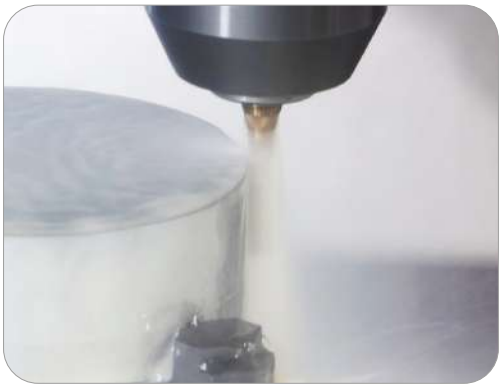
5. Challenge

High temperature & chips in the cutting zone

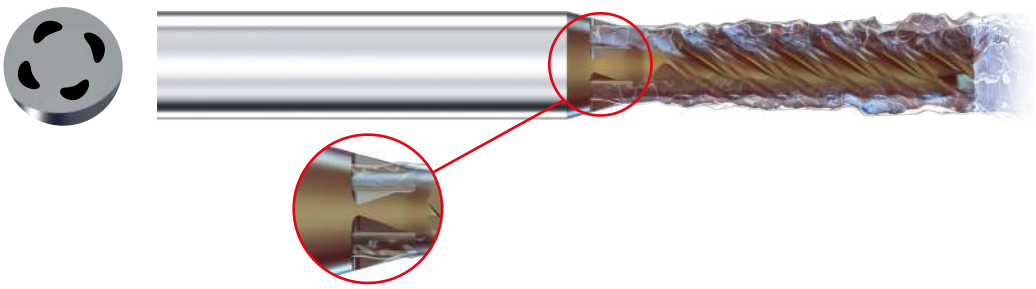
The machining of metals requires a high energy input into the cutting zones. A large proportion of this is converted directly into thermal energy. The higher the heat generated in the cutting zone, the shorter the tool life. It is therefore essential to keep the temperature in the cutting zone as low 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%

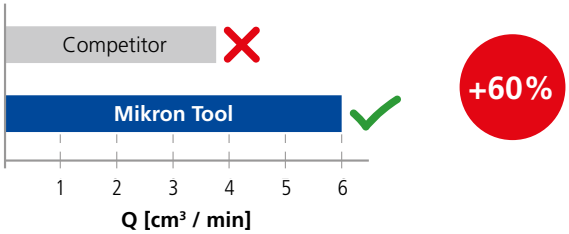
Steinless steel: 1.4435 / X2CrNiMo 18-14-3 / 316L **M**

Tool: CrazyMill Cool CF
Diameter: 3.0 mm

Cutting data:

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

Result:



Movie:

3 x d

Type M

- Coated
- Integrated cooling
- l_1 (Effective length): 3xd
  l_2 (Cutting length): 3xd

Page 18

4 x d

Type N

- Coated
- Integrated cooling
- l_1 (Effective length): 4xd
  l_2 (Cutting length): 4xd

Page 20

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 constantand 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.

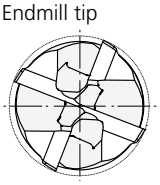
4 | COATING
The high-performance eXedur SNP coating is heat and wear resistant, prevents buildup edges and guarantees optimum chip flushing. The result is a long tool life.

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.

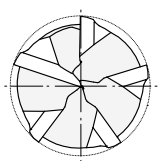
6 | LATERAL CUTTING GEOMETRY
Thanks to the high tool rigidity and the specific designed cutting edges, lower radial machining force are achieved. The result is high perpendicularity precision and high surface quality.

7 | CHIP-SPLITTING
An optimized chip-splitting guarantees short chips and highest surface quality. The chip-splitting is implemented in version M for Ø$d_1 \geq 4$ mm and N for Ø$d_1 \geq 3$ mm.

Endmill tip



4 - Flute
Diameter range
Ø1 - 2.5 mm



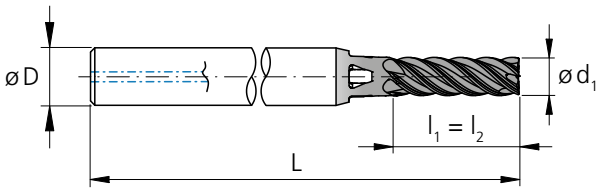
5 - Flute
Diameter range
Ø3 - 8 mm

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

MILLING WITH INTEGRATED COOLING

Square

protection chamfer 45°



l_1 = Effective length
l_2 = Cutting length

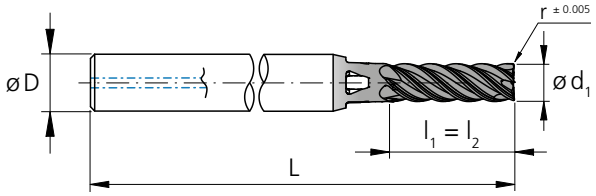
d_1 [mm]	d_1 [inch]	l_1 [mm]	l_2 [mm]	D (h6) [mm]	L [mm]	Z [flutes]	Item number	Availability
1.0		3.0	3.0	4	40	4	2.CMCCF.M1Z4.100.1	■
1.2		3.6	3.6	4	40	4	2.CMCCF.M1Z4.120.1	■
1.5		4.5	4.5	4	40	4	2.CMCCF.M1Z4.150.1	■
1.587	**1/16**	4.8	4.8	4	40	4	2.CMC.SCFM1Z4.F116	■
1.8		5.4	5.4	4	40	4	2.CMCCF.M1Z4.180.1	■
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, minumum purchase order quantity 3 pcs.

Carbide | 3xd$_1$ | Z 4-5 | Variable | eXedur SNP

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

Corner radius



l$_1$ = Effective length
l$_2$ = Cutting length

d$_1$ [mm]	d$_1$ [inch]	l$_1$ [mm]	l$_2$ [mm]	D (h6) [mm]	L [mm]	Z [flutes]	r [mm]	r [inch]	Item number	Availability
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

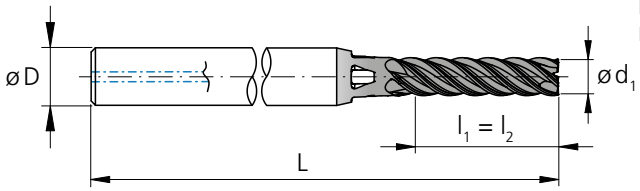
■ Stock item
Δ Delivery term upon request, minumum purchase order quantity 3 pcs.

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

MILLING WITH INTEGRATED COOLING

Square

protection chamfer 45°



l_1 = Effective length
l_2 = Cutting length

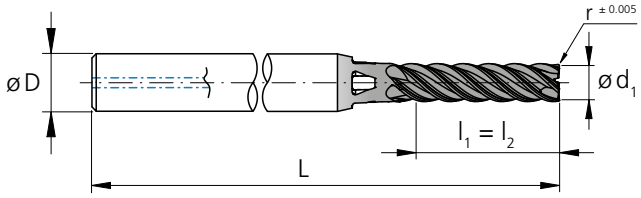
d_1 [mm]	d_1 [inch]	l_1 [mm]	l_2 [mm]	D (h6) [mm]	L [mm]	Z [flutes]	Item number	Availability
1.0		4.0	4.0	4	40	4	2.CMCCF.N1Z4.100.1	■
1.2		4.8	4.8	4	40	4	2.CMCCF.N1Z4.120.1	■
1.5		6.0	6.0	4	40	4	2.CMCCF.N1Z4.150.1	■
1.587	**1/16**	6.3	6.3	4	40	4	2.CMC.SCFN1Z4.F116	■
1.8		7.2	7.2	4	40	4	2.CMCCF.N1Z4.180.1	■
2.0		8.0	8.0	4	44	4	2.CMCCF.N1Z4.200.1	■
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.CMCCF.N1Z4.250.1	■
3.0		12.0	12.0	6	55	5	2.CMCCF.N1Z5.300.1	■
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.CMCCF.N1Z5.350.1	■
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.CMCCF.N1Z5.400.1	■
4.5		18.0	18.0	8	70	5	2.CMCCF.N1Z5.450.1	■
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.CMCCF.N1Z5.500.1	■
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.CMCCF.N1Z5.600.1	■
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.CMCCF.N1Z5.800.1	Δ

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

Carbide | 4xd$_1$ | Z 4-5 | Variable | eXedur SNP

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

Corner radius



l$_1$ = Effective length
l$_2$ = Cutting length

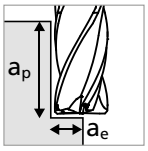
d$_1$ [mm]	d$_1$ [inch]	l$_1$ [mm]	l$_2$ [mm]	D (h6) [mm]	L [mm]	Z [flutes]	r [mm]	r [inch]	Item number	Availability
1.0		4.00	4.00	4	40	4	0.10		2.CMCCF.N2Z4.100.1	■
1.0		4.00	4.00	4	40	4	0.20		2.CMCCF.N3Z4.100.1	■
1.2		4.80	4.80	4	40	4	0.10		2.CMCCF.N2Z4.120.1	■
1.2		4.80	4.80	4	40	4	0.20		2.CMCCF.N3Z4.120.1	■
1.5		6.00	6.00	4	40	4	0.10		2.CMCCF.N2Z4.150.1	■
1.5		6.00	6.00	4	40	4	0.30		2.CMCCF.N3Z4.150.1	■
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.CMCCF.N2Z4.180.1	■
1.8		7.20	7.20	4	40	4	0.30		2.CMCCF.N3Z4.180.1	■
2.0		8.00	8.00	4	44	4	0.10		2.CMCCF.N2Z4.200.1	■
2.0		8.00	8.00	4	44	4	0.20		2.CMCCF.N3Z4.200.1	■
2.0		8.00	8.00	4	44	4	0.50		2.CMCCF.N4Z4.200.1	■
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.CMCCF.N2Z4.250.1	■
2.5		10.00	10.00	6	55	4	0.50		2.CMCCF.N3Z4.250.1	■
3.0		12.00	12.00	6	55	5	0.20		2.CMCCF.N2Z5.300.1	■
3.0		12.00	12.00	6	55	5	0.50		2.CMCCF.N3Z5.300.1	■
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.CMCCF.N2Z5.350.1	■
3.5		14.00	14.00	6	60	5	0.50		2.CMCCF.N3Z5.350.1	■
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.CMCCF.N2Z5.400.1	■
4.0		16.00	16.00	6	60	5	0.50		2.CMCCF.N3Z5.400.1	■
4.5		18.00	18.00	8	70	5	0.20		2.CMCCF.N2Z5.450.1	■
4.5		18.00	18.00	8	70	5	0.50		2.CMCCF.N3Z5.450.1	■
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.CMCCF.N2Z5.500.1	■
5.0		20.00	20.00	8	70	5	0.50		2.CMCCF.N3Z5.500.1	■
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.CMCCF.N2Z5.600.1	■
6.0		24.00	24.00	10	75	5	0.50		2.CMCCF.N3Z5.600.1	■
6.0		24.00	24.00	10	75	5	1.00		2.CMCCF.N4Z5.600.1	■
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.CMCCF.N2Z5.800.1	Δ
8.0		32.00	32.00	12	90	5	0.50		2.CMCCF.N3Z5.800.1	Δ
8.0		32.00	32.00	12	90	5	1.00		2.CMCCF.N4Z5.800.1	Δ

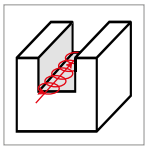
■ Stock item
Δ Delivery term upon request, minumum purchase order quantity 3 pcs.

Type M - Semi-finishing

MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Semi-finishing

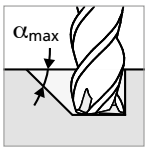




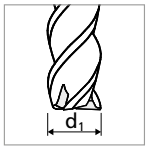
①
- $a_p = 3 \times d_1$
- $a_e = 0.15 \times d_1$

②
- $a_p = 3 \times d_1$
- $a_e = 0.1 \times d_1$

③
- $a_p = 3 \times d_1$
- $a_e = 0.05 \times d_1$



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



Materials group	Material	Mat. No.	DIN	AISI/ASTM/UNS	1.0 mm ① v_c	1.0 mm ① f_z	1.0 mm ② v_c	1.0 mm ② f_z	1.0 mm ③ v_c	1.0 mm ③ f_z	1.5 mm 1/16" ① v_c	1.5 mm 1/16" ① f_z	1.5 mm 1/16" ② v_c	1.5 mm 1/16" ② f_z	1.5 mm 1/16" ③ v_c	1.5 mm 1/16" ③ f_z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	140	0.010	180	0.012	250	0.016	180	0.012	210	0.016	280	0.024
		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	140	0.010	180	0.012	250	0.016	180	0.012	210	0.016	280	0.024
		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	140	0.008	160	0.010	220	0.015	160	0.011	180	0.015	240	0.022
		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	0.010	130	0.012	180	0.016	130	0.012	150	0.016	200	0.024
		1.4105	X6CrMoS17	AISI 430F												
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	100	0.010	130	0.012	180	0.016	130	0.012	150	0.016	200	0.024
		1.4112	X90CrMoV18	AISI 440B												
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	100	0.009	120	0.011	160	0.015	120	0.012	140	0.015	180	0.023
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH												
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	100	0.008	120	0.010	160	0.014	120	0.011	140	0.014	180	0.022
		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	0.010	120	0.012	160	0.017	120	0.012	140	0.015	180	0.024
		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	0.015	160	0.018	230	0.025	160	0.019	190	0.024	280	0.034
		3.4365	AlZnMgCu1.5	ASTM 7075												
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380	130	0.015	160	0.018	230	0.025	160	0.019	190	0.024	280	0.034
		3.2381	GD-AlSi10Mg	UNS A03590												
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	130	0.015	160	0.018	230	0.025	160	0.019	190	0.024	280	0.034
		2.0065	Cu-ETP / CW004A	UNS C11000												
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	130	0.015	160	0.018	230	0.025	160	0.019	190	0.024	280	0.034
		2.0360	CuZn40 CW509L	UNS C28000												
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	130	0.015	160	0.018	230	0.025	160	0.019	190	0.024	280	0.034
		2.1020	CuSn6	UNS C51900												
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	130	0.015	160	0.018	230	0.025	160	0.019	190	0.024	280	0.034
		2.0960	CuAl9Mn2	UNS C63200												
S_1	Super alloys	2.4856		Inconel 625	-	-	50	0.008	80	0.011	-	-	70	0.011	100	0.016
		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	75	0.009	90	0.012	120	0.018	75	0.012	90	0.015	120	0.022
		3.7065	Gr.4	ASTM B348 / F68												
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	75	0.009	90	0.012	120	0.018	75	0.012	90	0.015	120	0.022
		9.9367	TiAl6Nb7	ASTM F1295												
S_3	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	-	-	60	0.008	80	0.011	-	-	70	0.011	100	0.016
			CrCoMo28	ASTM F1537												
H_1	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1												
H_2	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2												

v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ◐ Good | ○ Acceptable | ⊠ Not recommended

P ●	N ●	S_3 ●
M ●	S_1 ●	H_1 ⊠
K ●	S_2 ●	H_2 ⊠

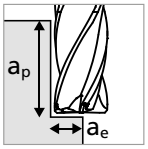
Ød₁

	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		③		①		②		③		①		②		③		①		②		③		①		②		③		①		②		③	
	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	v_c	f_z	v_c	f_z
	180	0.021	210	0.027	280	0.040	230	0.026	250	0.036	320	0.056	230	0.033	260	0.044	350	0.065	230	0.038	260	0.050	350	0.074	255	0.044	285	0.059	350	0.096	255	0.060	285	0.080	380	0.120
	180	0.021	210	0.027	280	0.040	230	0.026	250	0.036	320	0.056	230	0.033	260	0.044	350	0.065	230	0.038	260	0.050	350	0.074	255	0.044	285	0.059	350	0.096	255	0.060	285	0.080	380	0.120
	180	0.018	200	0.024	260	0.036	180	0.025	200	0.034	260	0.053	200	0.031	230	0.041	300	0.063	200	0.036	230	0.047	300	0.072	200	0.040	230	0.052	300	0.080	200	0.048	230	0.063	300	0.096
	140	0.020	160	0.026	220	0.038	160	0.025	180	0.033	240	0.050	180	0.032	210	0.041	260	0.064	180	0.038	210	0.049	260	0.074	190	0.040	210	0.054	260	0.088	190	0.050	210	0.068	260	0.110
	140	0.020	160	0.026	220	0.038	160	0.025	180	0.033	240	0.050	180	0.032	210	0.041	260	0.064	180	0.039	210	0.049	260	0.074	190	0.040	210	0.054	260	0.088	190	0.050	210	0.068	260	0.110
	120	0.018	140	0.023	180	0.036	140	0.024	160	0.031	200	0.050	160	0.029	180	0.038	220	0.063	160	0.033	180	0.044	220	0.072	160	0.036	180	0.049	220	0.080	160	0.046	180	0.061	220	0.100
	120	0.017	140	0.022	180	0.034	140	0.026	160	0.034	200	0.054	160	0.029	180	0.039	220	0.064	160	0.031	180	0.042	220	0.068	160	0.034	180	0.046	220	0.075	160	0.042	180	0.056	220	0.091
	140	0.022	160	0.029	220	0.042	160	0.028	180	0.038	240	0.057	200	0.033	230	0.043	290	0.068	210	0.037	240	0.048	300	0.077	230	0.045	260	0.060	320	0.097	240	0.060	280	0.077	340	0.127
	180	0.040	210	0.052	300	0.073	240	0.045	260	0.062	340	0.095	260	0.060	280	0.083	370	0.126	320	0.065	350	0.089	430	0.145	320	0.067	350	0.092	430	0.150	340	0.084	360	0.119	450	0.190
	180	0.040	210	0.052	300	0.073	240	0.045	260	0.062	340	0.095	260	0.060	280	0.083	370	0.126	320	0.065	350	0.089	430	0.145	320	0.067	350	0.092	430	0.150	340	0.084	360	0.119	450	0.190
	180	0.040	210	0.052	300	0.073	240	0.045	260	0.062	340	0.095	260	0.060	280	0.083	370	0.126	320	0.065	350	0.089	430	0.145	320	0.067	350	0.092	430	0.150	340	0.084	360	0.119	450	0.190
	180	0.040	210	0.052	300	0.073	240	0.045	260	0.062	340	0.095	260	0.060	280	0.083	370	0.126	320	0.065	350	0.089	430	0.145	320	0.067	350	0.092	430	0.150	340	0.084	360	0.119	450	0.190
	180	0.040	210	0.052	300	0.073	240	0.045	260	0.062	340	0.095	260	0.060	280	0.083	370	0.126	320	0.065	350	0.089	430	0.145	320	0.067	350	0.092	430	0.150	340	0.084	360	0.119	450	0.190
	180	0.040	210	0.052	300	0.073	240	0.045	260	0.062	340	0.095	260	0.060	280	0.083	370	0.126	320	0.065	350	0.089	430	0.145	320	0.067	350	0.092	430	0.150	340	0.084	360	0.119	450	0.190
	-	-	70	0.013	100	0.018	-	-	80	0.019	120	0.026	-	-	90	0.021	130	0.029	-	-	90	0.024	130	0.033	-	-	90	0.027	130	0.038	-	-	90	0.033	130	0.046
	75	0.016	90	0.021	130	0.029	75	0.018	90	0.022	130	0.030	90	0.031	110	0.038	160	0.053	90	0.033	110	0.040	160	0.055	90	0.034	110	0.042	160	0.058	100	0.037	120	0.046	170	0.065
	75	0.016	90	0.021	130	0.029	75	0.025	90	0.032	130	0.044	90	0.031	110	0.038	160	0.053	90	0.033	110	0.040	160	0.055	90	0.034	110	0.042	160	0.058	100	0.037	120	0.046	170	0.065
	-	-	70	0.013	100	0.018	-	-	80	0.019	120	0.026	-	-	90	0.021	130	0.029	-	-	90	0.024	130	0.033	-	-	90	0.027	130	0.038	-	-	90	0.033	130	0.046

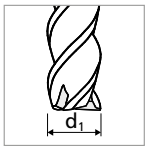
Type M - Finishing

MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



- $a_p = 3 \times d_1$
- $a_e = 0.02 \times d_1$



Materials group	Material	Mat.No.	DIN	AISI/ASTM/UNS	1.0 mm v_c	1.0 mm f_z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	130	0.009
		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
		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
		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
		1.4105	X6CrMoS17	AISI 430F		
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	130	0.009
		1.4112	X90CrMoV18	AISI 440B		
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	130	0.009
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH		
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	130	0.007
		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
		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
		3.4365	AlZnMgCu1.5	ASTM 7075		
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380	130	0.010
		3.2381	GD-AlSi10Mg	UNS A03590		
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	130	0.012
		2.0065	Cu-ETP / CW004A	UNS C11000		
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	130	0.012
		2.0360	CuZn40 CW509L	UNS C28000		
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	130	0.012
		2.1020	CuSn6	UNS C51900		
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	130	0.010
		2.0960	CuAl9Mn2	UNS C63200		
S_1	Super alloys	2.4856		Inconel 625	110	0.005
		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
		3.7065	Gr.4	ASTM B348 / F68		
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	110	0.009
		9.9367	TiAl6Nb7	ASTM F1295		
S_3	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	110	0.005
			CrCoMo28	ASTM F1537		
H_1	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1		
H_2	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2		

v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ◐ Good | ○ Acceptable | ⊠ Not recommended

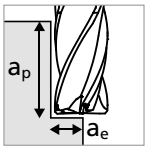
P ●	N ●	S_3 ●
M ●	S_1 ●	H_1 ⊠
K ●	S_2 ●	H_2 ⊠

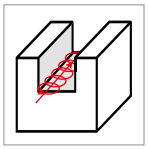
	1.5 mm 1/16"		2.0 mm 3/32"		3.0 mm 1/8"		Ød₁ 4.0 mm 5/32"		5.0 mm 3/16" - 7/32"		6.0 mm 1/4"		8.0 mm	
	v_c	f_z	v_c	f_z	v_c	f_z	v_c	f_z	v_c	f_z	v_c	f_z	v_c	f_z
	180	0.014	200	0.020	210	0.026	220	0.029	220	0.032	220	0.038	220	0.044
	180	0.013	200	0.018	210	0.025	220	0.028	220	0.030	220	0.033	220	0.040
	180	0.012	200	0.017	210	0.023	220	0.024	220	0.026	220	0.029	220	0.035
	180	0.014	200	0.020	210	0.025	220	0.028	220	0.030	220	0.033	260	0.040
	180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
	180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
	180	0.009	200	0.017	210	0.023	220	0.025	220	0.028	220	0.030	260	0.037
	130	0.014	150	0.016	160	0.025	170	0.029	170	0.033	170	0.036	200	0.042
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020
	120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
	120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
	120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020

Type N - Semi-finishing

MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

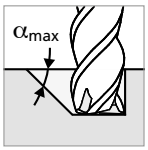
Semi-finishing



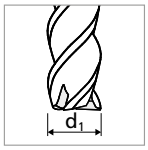


①
- $a_p = 4 \times d_1$
- $a_e = 0.1 \times d_1$

②
- $a_p = 4 \times d_1$
- $a_e = 0.05 \times d_1$



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



Materials group	Material	Mat. No.	DIN	AISI/ASTM/UNS	1.0 mm ① v_c	1.0 mm ① f_z	1.0 mm ② v_c	1.0 mm ② f_z	1.5 mm 1/16" ① v_c	1.5 mm 1/16" ① f_z	1.5 mm 1/16" ② v_c	1.5 mm 1/16" ② 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
		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
		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
		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
		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
		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
		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
		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
		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	150	0.013	180	0.018	150	0.017	220	0.024
		3.4365	AlZnMgCu1.5	ASTM 7075								
	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								
	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								
	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								
	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								
	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								
S_1	Super alloys	2.4856		Inconel 625	50	0.006	80	0.008	70	0.008	100	0.012
		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	90	0.009	120	0.014	90	0.011	120	0.017
		3.7065	Gr.4	ASTM B348 / F68								
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	90	0.009	120	0.014	90	0.011	120	0.017
		9.9367	TiAl6Nb7	ASTM F1295								
S_3	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	60	0.006	80	0.008	70	0.008	100	0.012
			CrCoMo28	ASTM F1537								
H_1	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1								
H_2	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2								

v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ◐ Good | ○ Acceptable | ⊠ Not recommended

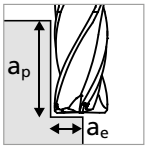
P ●	N ●	S_3 ●
M ●	S_1 ●	H_1 ⊠
K ●	S_2 ●	H_2 ⊠

	Ød₁ 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	
	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
	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
	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
	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
	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
	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
	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
	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
	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
	170	0.036	240	0.051	210	0.043	270	0.067	225	0.058	300	0.088	280	0.062	345	0.102	280	0.064	340	0.105	290	0.082	360	0.133
	170	0.036	240	0.051	210	0.043	270	0.067	225	0.058	300	0.088	280	0.062	345	0.102	280	0.064	340	0.105	290	0.082	360	0.133
	170	0.036	240	0.051	210	0.043	270	0.067	225	0.058	300	0.088	280	0.062	345	0.102	280	0.064	340	0.105	290	0.082	360	0.133
	170	0.036	240	0.051	210	0.043	270	0.067	225	0.058	300	0.088	280	0.062	345	0.102	280	0.064	340	0.105	290	0.082	360	0.133
	170	0.036	240	0.051	210	0.043	270	0.067	225	0.058	300	0.088	280	0.062	345	0.102	280	0.064	340	0.105	290	0.082	360	0.133
	170	0.036	240	0.051	210	0.043	270	0.067	225	0.058	300	0.088	280	0.062	345	0.102	280	0.064	340	0.105	290	0.082	360	0.133
	70	0.010	100	0.014	80	0.014	120	0.020	90	0.016	130	0.022	90	0.018	130	0.025	90	0.020	130	0.029	90	0.025	130	0.035
	90	0.016	130	0.022	90	0.017	130	0.023	100	0.028	140	0.040	100	0.029	140	0.041	100	0.031	140	0.044	110	0.035	155	0.049
	90	0.016	130	0.022	90	0.024	130	0.033	100	0.028	140	0.040	100	0.029	140	0.041	100	0.031	140	0.044	110	0.035	155	0.049
	70	0.010	100	0.014	80	0.014	120	0.020	90	0.016	130	0.022	90	0.018	130	0.025	90	0.020	130	0.029	90	0.025	130	0.035

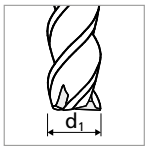
Type N - Finishing

MILLING WITH INTEGRATED COOLING | CUTTING DATA OVERVIEW

Finishing



- $a_p = 4 \times d_1$
- $a_e = 0.02 \times d_1$



Materials group	Material	Mat.No.	DIN	AISI/ASTM/UNS	1.0 mm v_c	1.0 mm f_z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	130	0.009
		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
		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
		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
		1.4105	X6CrMoS17	AISI 430F		
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C	130	0.009
		1.4112	X90CrMoV18	AISI 440B		
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH	130	0.009
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH		
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304	130	0.007
		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
		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
		3.4365	AlZnMgCu1.5	ASTM 7075		
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380	130	0.010
		3.2381	GD-AlSi10Mg	UNS A03590		
	Copper	2.0040	Cu-OF / CW008A	UNS C10100	130	0.012
		2.0065	Cu-ETP / CW004A	UNS C11000		
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400	130	0.012
		2.0360	CuZn40 CW509L	UNS C28000		
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500	130	0.012
		2.1020	CuSn6	UNS C51900		
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000	130	0.010
		2.0960	CuAl9Mn2	UNS C63200		
S_1	Super alloys	2.4856		Inconel 625	110	0.005
		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
		3.7065	Gr.4	ASTM B348 / F68		
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136	110	0.009
		9.9367	TiAl6Nb7	ASTM F1295		
S_3	CrCo alloys	2.4964	CoCr20W15Ni	Haynes 25	110	0.005
			CrCoMo28	ASTM F1537		
H_1	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1		
H_2	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2		

v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ◐ Good | ○ Acceptable | ⊠ Not recommended

P ●	N ●	S_3 ●
M ●	S_1 ●	H_1 ⊠
K ●	S_2 ●	H_2 ⊠

	1.5 mm 1/16"		2.0 mm 3/32"		3.0 mm 1/8"		Ød₁ 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
	180	0.014	200	0.020	210	0.026	220	0.029	220	0.032	220	0.038	220	0.044
	180	0.013	200	0.018	210	0.025	220	0.028	220	0.030	220	0.033	220	0.040
	180	0.012	200	0.017	210	0.023	220	0.024	220	0.026	220	0.029	220	0.035
	180	0.014	200	0.020	210	0.025	220	0.028	220	0.030	220	0.033	260	0.040
	180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
	180	0.013	200	0.018	210	0.025	220	0.027	220	0.029	220	0.032	260	0.038
	180	0.009	200	0.017	210	0.023	220	0.025	220	0.028	220	0.030	260	0.037
	130	0.014	150	0.016	160	0.025	170	0.029	170	0.033	170	0.036	200	0.042
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	180	0.015	200	0.021	210	0.033	220	0.035	220	0.038	220	0.041	270	0.047
	120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020
	120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
	120	0.012	130	0.016	130	0.023	140	0.025	140	0.028	150	0.030	160	0.036
	120	0.006	130	0.006	130	0.009	140	0.012	140	0.013	150	0.014	160	0.020

NEW Process CrazyMill Cool CF

ACCURATE AND EFFICIENT MILLING

Coolant type, pressure and filtration

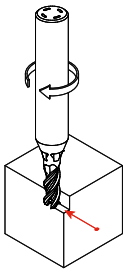
Coolant: for best results, Mikron Tool recommends the use of cutting oil as coolant. Alternatively, water base coolant with EP-Additives (Extreme-Pressure-Additives) can be used as well.

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.

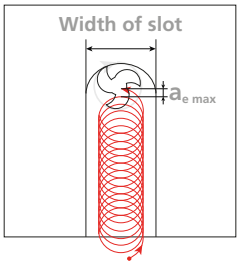
Revolution	[rpm]	≤ 10'000	> 10'000
Minimal pressure	[bar]	15	30

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.

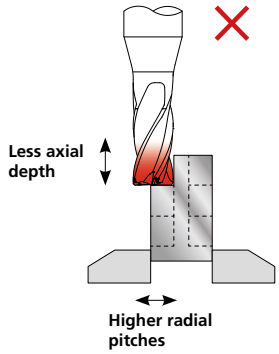
Trochoidal slot milling



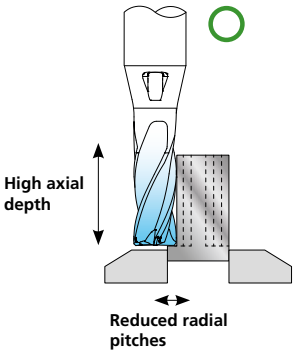
Cutting values: see cutting data chart "Semi-finishing" at page 22 and 26!

MILLING PROCESS

Traditional vs. High efficiency milling (HEM)

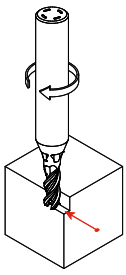


Traditional Milling
Work, heat and wear are concentrated along a smaller portion of the cutting edge.



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

Semi-finishing

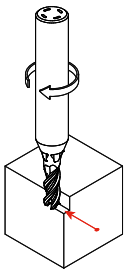


Recommended cutting parameters

v_c and f_z = as specified in the cutting data table

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

Finishing

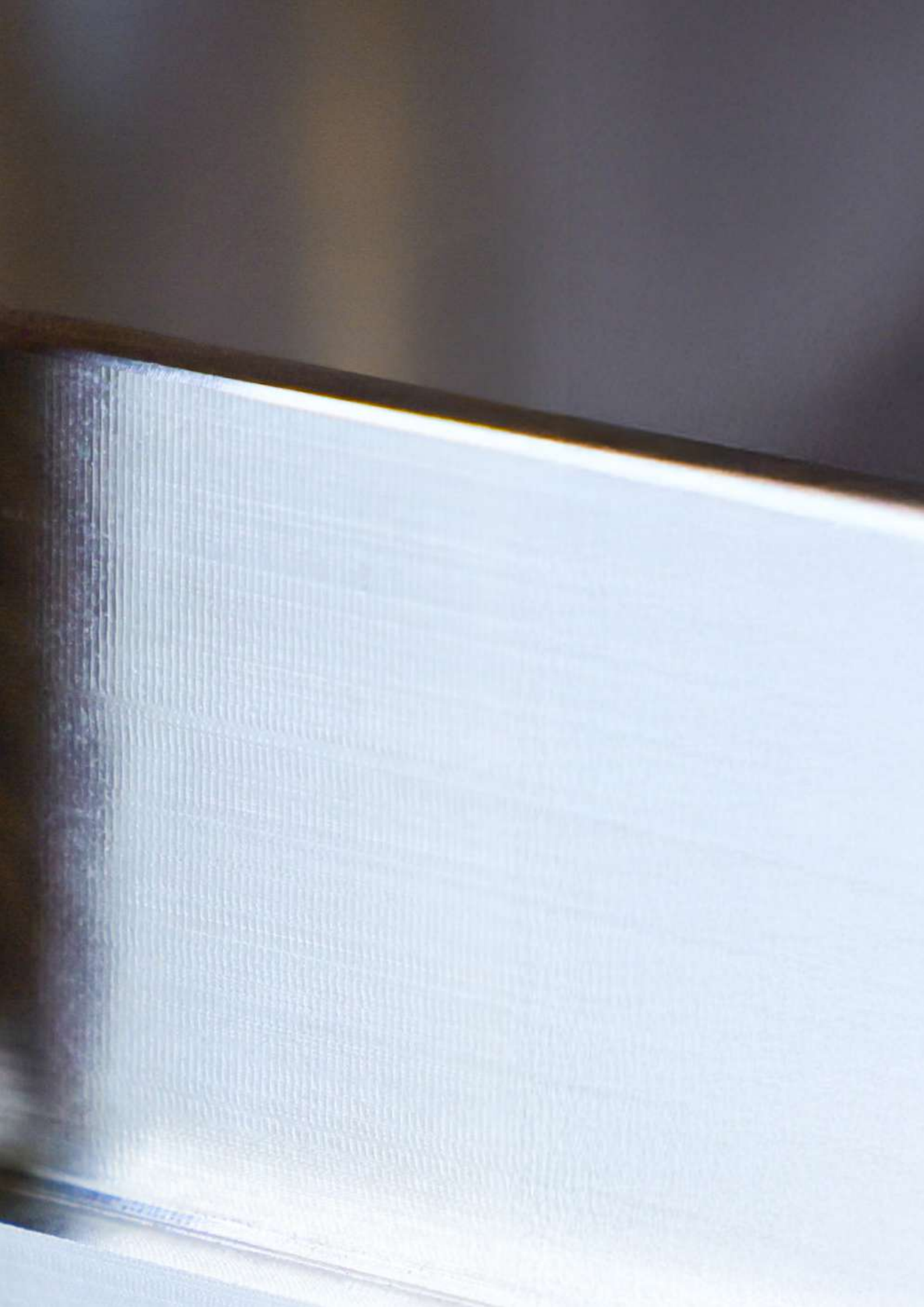


Recommended cutting parameters

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 x d	a_p = 4 x d a_e = 0.02 x 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 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

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

1. Challenge

Avoid and/or reduce subsequent polishing operation

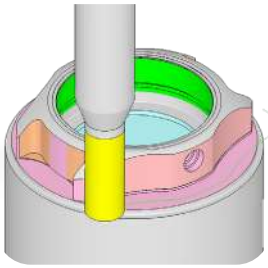
Most of the machined components, need a post surface treatment like grinding, polishing, tumbling and others. Those manufacturing steps can be very costly and very time consuming. Improving the surface quality through the super finishing milling process could avoid or reduce subsequent finishing operations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

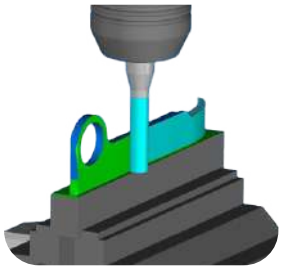
■ **Real case: Watch Ti Gr.5 (3.7165)**

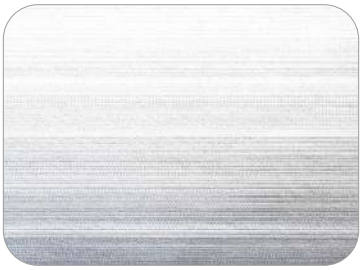


Ra = 0.22 µm

NEW

■ **Real case: Hemostatic clamp 17-4 PH**





Ra = 0.21 µm

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

Ra = 0.17 µm

NEW CrazyMill Cool SF

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

2. Challenge

Tool miniaturization

Z6

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 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.

NEW

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 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**

Ra = 0,18 µm

■ **Titanium Gr.5**

Ra = 0,22 µm

■ **Titanium Gr.2**

Ra = 0,20 µm

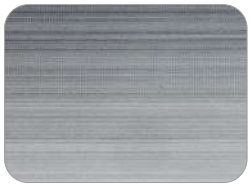
■ **Aluminium**

Ra = 0,16 µm

■ **CrCo Alloys**

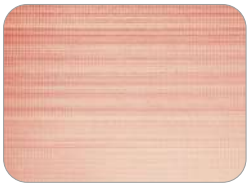
Ra = 0,23 µm

■ **Inconel**



Ra = 0,30 µm

■ **Copper**



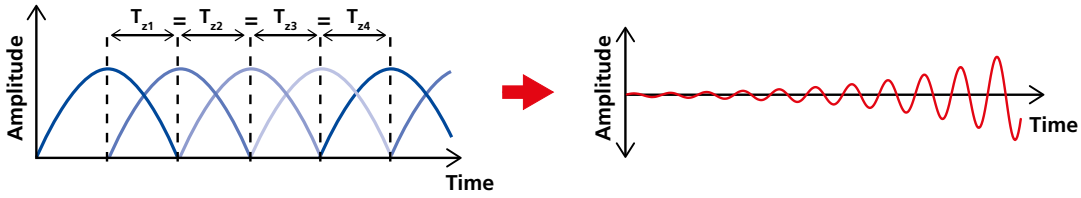
Ra = 0,15 µm

NEW CrazyMill Cool SF

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

4. Challenge

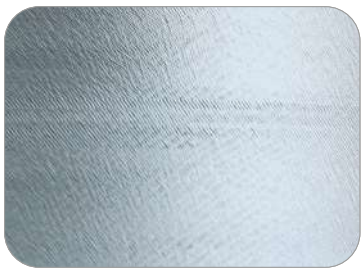
Avoid chattering when milling



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.

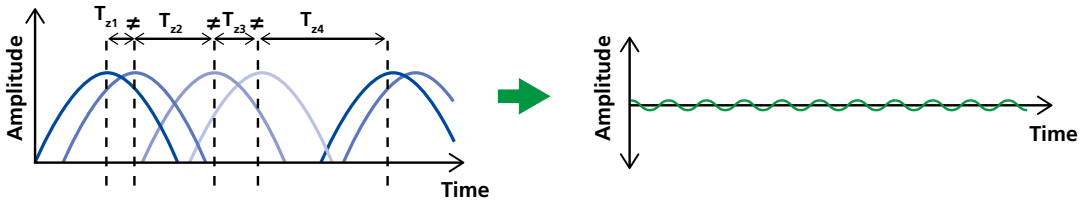


Surface with vibrations

NEW

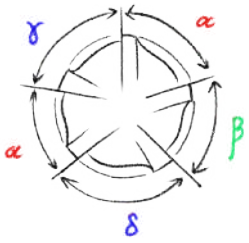
Solution

Avoidance of resonance frequencies

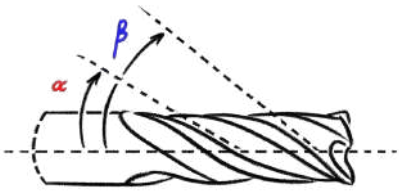


The new CrazyMill Cool SF has been specifically developed, to interrupt this resonance frequency. Using unequal angular teeth division, and a variable helix angle (every cutting edge has a different helix angle) every cutting edge generates a different frequency wave that occur in an irregular timing 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

THE NEW HIGH-PERFORMANCE ENDMILLS FOR SUPER FINISHING

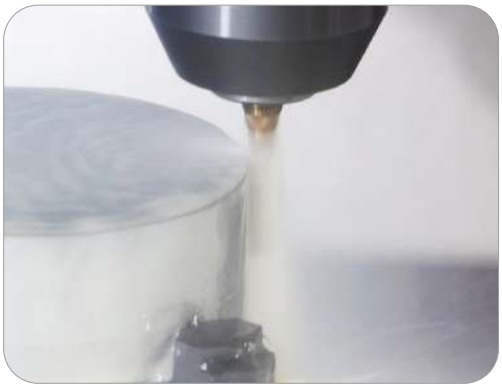
5. Challenge

High temperature & chips in the cutting zone

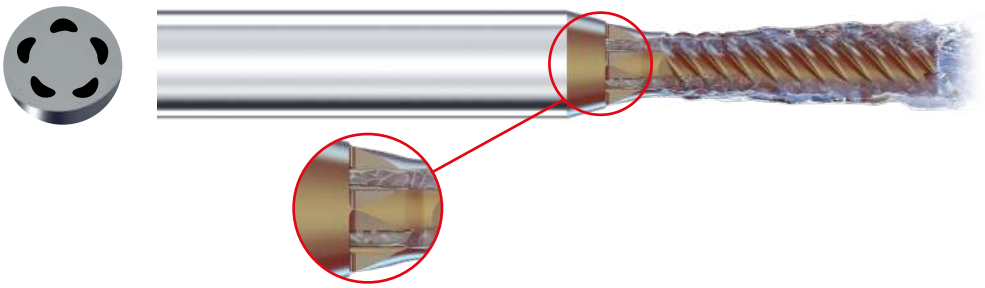
The machining of metals requires a high energy input into the cutting zones. A large proportion of this is converted directly into thermal energy. The higher the heat generated in the cutting zone, the shorter the tool life. It is therefore essential to keep the temperature in the cutting zone as low 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.



NEW

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 0.3 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 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 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 (mm^2/min)	10	10	6	7	8
Perpedicularity	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%

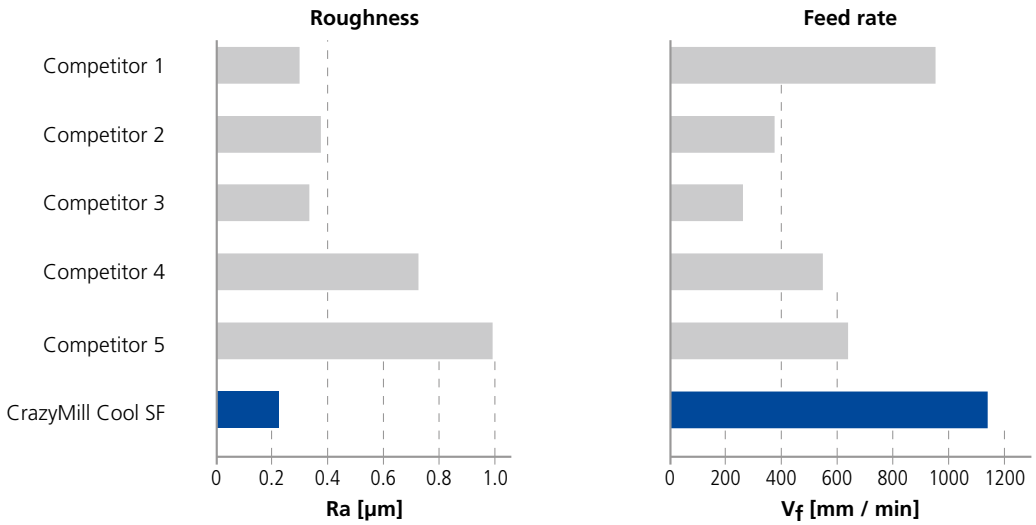
Pure titanium: 3.7035 / Ti Gr.2 / ASTM B348 S2

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
- l_1 (Effective length): 3xd
  l_2 (Cutting length): 3xd

Page 48

4 x d

Type N

- Coated
- Integrated cooling
- l_1 (Effective length): 4xd
  l_2 (Cutting length): 4xd

Page 49

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

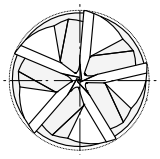
3 | CARBIDE
The specially developed micro-grain carbide meets all requirements in terms of mechanical properties.

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.

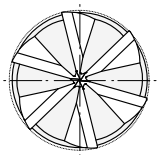
5 | SPECIFIC CHATTER-FREE GEOMETRY
The specific new cutting geometry with unequal angular teeth division and a variable helix angle, leads to an interruption of the resonance frequency allowing a vibration-free machining.

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



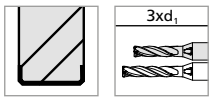
6 - Flute
Diameter range
Ø3 - 8 mm

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

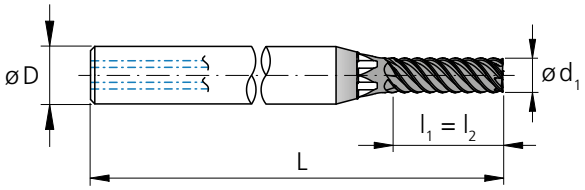
Carbide	Z 5-6	Variable		eXedur SNP			a_p a_e	

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



protection chamfer 45°



l_1 = Effective length
l_2 = Cutting length

d_1 [mm]	d_1 [inch]	l_1 [mm]	l_2 [mm]	D (h6) [mm]	L [mm]	Z [flutes]	Item number	Availability
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

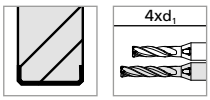
■ Stock item
Δ Delivery term upon request, minumum purchase order quantity 3 pcs.

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

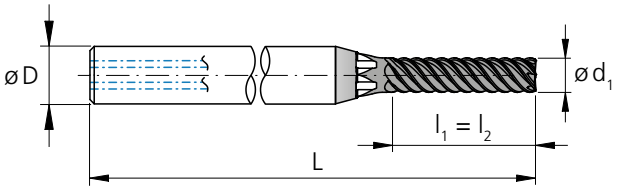
Carbide	Z 5-6	Variable		eXedur SNP				

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



protection chamfer 45°



l_1 = Effective length
l_2 = Cutting length

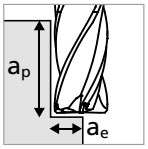
d_1 [mm]	d_1 [inch]	l_1 [mm]	l_2 [mm]	D (h6) [mm]	L [mm]	Z [flutes]	Item number	Availability
1.0		4.0	4.0	4	40	5	2.CMCSF.N1Z5.100.1	■
1.2		4.8	4.8	4	40	5	2.CMCSF.N1Z5.120.1	■
1.5		6.0	6.0	4	40	5	2.CMCSF.N1Z5.150.1	■
1.587	**1/16**	6.3	6.3	4	40	5	2.CMC.SSFN1Z5.F116	■
1.8		7.2	7.2	4	40	5	2.CMCSF.N1Z5.180.1	■
2.0		8.0	8.0	4	44	5	2.CMCSF.N1Z5.200.1	■
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.CMCSF.N1Z5.250.1	■
3.0		12.0	12.0	6	55	6	2.CMCSF.N1Z6.300.1	■
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.CMCSF.N1Z6.350.1	■
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.CMCSF.N1Z6.400.1	■
4.5		18.0	18.0	8	70	6	2.CMCSF.N1Z6.450.1	■
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.CMCSF.N1Z6.500.1	■
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.CMCSF.N1Z6.600.1	■
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.CMCSF.N1Z6.800.1	Δ

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

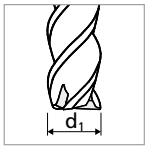
Type M - Finishing

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 v_c	1.0 mm f_z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	0.010 - 0.020 x d1	120	0.005 - 0.010
		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	0.005 - 0.010
		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
		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
		1.4105	X6CrMoS17	AISI 430F			
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C		80	0.005 - 0.007
		1.4112	X90CrMoV18	AISI 440B			
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH		80	0.005 - 0.007
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH			
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304		80	0.005 - 0.007
		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
		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
		3.4365	AlZnMgCu1.5	ASTM 7075			
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380		200	0.005 - 0.010
		3.2381	GD-AlSi10Mg	UNS A03590			
	Copper	2.0040	Cu-OF / CW008A	UNS C10100		200	0.005 - 0.010
		2.0065	Cu-ETP / CW004A	UNS C11000			
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400		200	0.005 - 0.010
		2.0360	CuZn40 CW509L	UNS C28000			
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500		200	0.005 - 0.010
		2.1020	CuSn6	UNS C51900			
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000		200	0.005 - 0.010
		2.0960	CuAl9Mn2	UNS C63200			
S_1	Super alloys	2.4856		Inconel 625	0.005 - 0.010 x d1	40	0.005 - 0.007
		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
		3.7065	Gr.4	ASTM B348 / F68			
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136		60	0.005 - 0.010
		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
			CrCoMo28	ASTM F1537			
H_1	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1			
H_2	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2			

v_c [m/min]
f_z [mm]

RECOMMENDATION FOR USE
● Excellent | ◐ Good | ○ Acceptable | ⊠ Not recommended

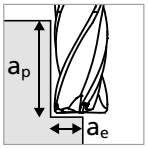
P ●	N ●	S_3 ●
M ●	S_1 ●	H_1 ⊠
K ●	S_2 ●	H_2 ⊠

Ød₁ 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	
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

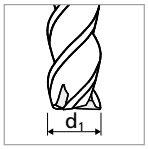
Type N - Finishing

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 v_c	1.0 mm f_z
P	Unalloyed carbon steel Rm < 800 N/mm²	1.0301	C10	AISI 1010	0.010 - 0.020 x d1	120	0.005 - 0.010
		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	0.005 - 0.010
		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
		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
		1.4105	X6CrMoS17	AISI 430F			
	Stainless steel martensitic	1.4034	X46Cr13	AISI 420C		80	0.005 - 0.007
		1.4112	X90CrMoV18	AISI 440B			
	Stainless steel martensitic – PH	1.4542	X5CrNiCuNb16-4	AISI 630 / ASTM 17-4 PH		80	0.005 - 0.007
		1.4545	X5CrNiCuNb15-5	ASTM 15-5 PH			
	Stainless steel austenitic	1.4301	X5CrNi18-10	AISI 304		80	0.005 - 0.007
		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
		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
		3.4365	AlZnMgCu1.5	ASTM 7075			
	Aluminium alloy cast	3.2163	GD-AlSi9Cu3	ASTM A380		200	0.005 - 0.010
		3.2381	GD-AlSi10Mg	UNS A03590			
	Copper	2.0040	Cu-OF / CW008A	UNS C10100		200	0.005 - 0.010
		2.0065	Cu-ETP / CW004A	UNS C11000			
	Brass lead free	2.0321	CuZn37 CW508L	UNS C27400		200	0.005 - 0.010
		2.0360	CuZn40 CW509L	UNS C28000			
	Brass, Bronze Rm < 400 N/mm²	2.0401	CuZn39Pb3 / CW614N	UNS C38500		200	0.005 - 0.010
		2.1020	CuSn6	UNS C51900			
	Bronze Rm < 600 N/mm²	2.0966	CuAl10Ni5Fe4	UNS C63000		200	0.005 - 0.010
		2.0960	CuAl9Mn2	UNS C63200			
S_1	Super alloys	2.4856		Inconel 625	0.005 - 0.010 x d1	40	0.005 - 0.007
		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
		3.7065	Gr.4	ASTM B348 / F68			
	Titanium alloys	3.7165	TiAl6V4	ASTM B348 / F136		60	0.005 - 0.010
		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
			CrCoMo28	ASTM F1537			
H_1	Hardened steel < 55 HRC	1.2510	100MnCrMoW4	AISI O1			
H_2	Hardened steel ≥ 55 HRC	1.2379	X153CrMoV12	AISI D2			

v$_c$ [m/min]
f$_z$ [mm]

RECOMMENDATION FOR USE
● Excellent | ◐ Good | ○ Acceptable | ⊠ Not recommended

P ●	N ●	S_3 ●
M ●	S_1 ●	H_1 ⊠
K ●	S_2 ●	H_2 ⊠

Ød₁ 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	
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

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.

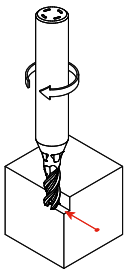
Filter: the large cooling channels permit the use of a standard filter with filter quality of ≤ 0.05 mm.

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]	≤ 10'000	> 10'000
Minimal pressure	[bar]	15	30

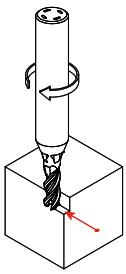
MILLING PROCESS

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 x d a_e = 0.005 - 0.020 x d	a_p = 4 x d a_e = 0.005 - 0.020 x d

MIKRON TOOL

Headquarter and Production
MIKRON SWITZERLAND AG, AGNO
Division Tool
Via Campagna 1
6982 Agno
Switzerland
Phone +41 91 610 40 00
mto@mikron.com

Production and Regrinding
MIKRON GERMANY GMBH
Abteilung Werkzeuge
Berner Feld 71
78628 Rottweil
Germany
Phone +49 741 5380 450
info.mtr@mikron.com

North and South America Sales
MIKRON CORP. MONROE
200 Main Street
Monroe, CT 06468
USA
Phone +1 203 261 3100
mmo@mikron.com

China Sales
MIKRON TOOL SHANGHAI LTD.
Room A209, Building 3,
No. 526, 3rd East Fu Te Road,
Shanghai, 200131
P. R. China
Phone +86 21 2076 5671
mtc@mikron.com
地址：中国（上海）自由贸易试验区
中国上海市富特东三路526号3号楼第二层
A209室
邮编: 200131

2.MKTG.00821 - 08.2025 - EU - EN