MILLING TOOLS
CRAZYMILL COOL SQUARE / CORNER RADIUS - Z2

PATENTED

CrazyMill Cool Square / Corner radius - Z2

CRAZYMILL Cool

HSPC-END MILL FOR DIFFICULT TO MACHINE MATERIALS

With CrazyMill Cool, Mikron Tool has achieved a quantum leap in the milling of stainless steel, titanium, chromium cobalt alloys, and superalloys. Three versions of cylindrical micro-cutters (sharp-edged with minimum protection phase of 45°) or with corner radius are available in diameters of 0.3 - 6.35 mm and with milling depths of up to 5 x d.

The strength of this solid carbide end mill with integrated cooling is the milling of grooves, pockets and walls with regard to cutting speeds, a_p, performance, service life, and surface quality. It combines HSC (high-speed cutting) and HPC (high-performance cutting), thus becoming an HSPC (high-speed performance cutting) milling tool. Due to its special cutting geometry and the continuous and extensive cooling of its cutting edges, this milling tool is a quantum leap for the machining of stainless steel, titanium, chromium-cobalt alloys, and superalloys.

CRAZYMILL Cool

CRAZYMILL Cool

MILLING TOOLS
CRAZYMILL COOL SQUARE / CORNER RADIUS - Z2

A quantum leap in milling

ROUGHING AND FINISHING CUTTER WITH INTEGRATED COOLING

With CrazyMill Cool, Mikron Tool has achieved a quantum leap in the milling of stainless steel, titanium, chromium cobalt alloys, and superalloys. Three versions of cylindrical micro-cutters (sharp-edged with minimum protection phase of 45°) or with corner radius are available in diameters of 0.3 - 6.35 mm and with milling depths of up to 5 x d. The cutting length is always 1.5 x d.

- CrazyMill Cool Square, type A – milling depth 1.5 x d, through shank coolant, Z = 2
- CrazyMill Cool Square, type B – milling depth 3 x d, through shank coolant, Z = 2
- CrazyMill Cool Square, type C – milling depth 5 x d, through shank coolant, Z = 2

- CrazyMill Cool Corner radius, type A – milling depth 1.5 x d, through shank coolant, Z = 2
- CrazyMill Cool Corner radius, type B – milling depth 3 x d, through shank coolant, Z = 2
- CrazyMill Cool Corner radius, type C – milling depth 5 x d, through shank coolant, Z = 2

1.5 x d	3 x d	5 x d
Type A	Type B	Type C
Coated Integrated cooling	Coated Integrated cooling	Coated Integrated cooling
		
		
page 468	page 474	page 480

PATENTED

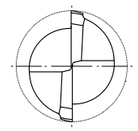
1 | SHANK
The robust carbide shank guarantees stable and vibration-free milling. A high degree of precision and excellent surface quality are achieved.

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 and depth as well as improved surface quality.

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

4 | COATING
The high-performance RIP coating is heat-resistant and wear-resistant, prevents build up edges and guarantees optimum chip flushing. The result is long tool life.

5 | CUTTING GEOMETRY
Developed for the machining of difficult-to-machine materials such as stainless steels, titanium, titanium alloys and heat-resistant alloys. Ensures roughing and finishing with high surface quality. Due to its highly smooth running, it will work with no vibration.

Mill tip 

CRAZYMILL Cool

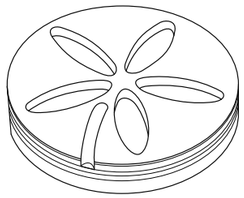
CRAZYMILL Cool

MILLING TOOLS
CRAZYMILL COOL SQUARE / CORNER RADIUS - Z2

Benefits and applications

ROUGHING AND FINISHING CUTTER WITH THROUGH-TOOL COOLING, FROM 0.3 MM (.012")

- **SHORT MACHINING TIME** | highest chip removal rate
- **LONG TOOL LIFE** | due to efficient patented cooling
- **HIGH DEGREE OF PROCESS RELIABILITY** | due to internal cooling
- **HIGH SURFACE QUALITY** | due to special geometry



COMPONENT
Demo flower

MATERIAL
X2CrNiMo 18-14-3 / 1.4435 / AISI 316L

MACHINING
- Slot milling
- d = 1.5 mm

MILLING TOOL
Mikron Tool - CrazyMill Cool Corner radius Z2 - Type A

DATA	MIKRON TOOL
Tool type	CrazyMill Cool Corner radius - Z2 - Carbide - Coated - Internal cooling
Item number	2.CMC30.A3Z2.150.1
Cutting data	v_c = 180 m/min f_z = 0.016 mm a_p = 1.5 mm r = 0.2 mm

APPLICATION DOMAINS	COMPONENTS EXAMPLES
Dental	Tooth crown
Medical technology	Component for endoscope
Automotive industry	Components for injection system
Mechanical engineering	Machine components
Watches	Watch housing
Food industry	Nozzle
Aerospace industry	Engine parts
Power industry	Blade

MATERIALS GROUPS	EXAMPLES		
	Mat. no.	DIN	AISI / ASTM / UNS
Group P Unalloyed and alloyed steel	1.0401	C15	1015
	1.3505	100Cr6	52100
	1.2436	X210CrW12	D4 / D6
Group M Stainless steel	1.4105	X6CrMoS17	430F
	1.4112	X90CrMoV18	440B
	1.4301	X5CrNi 18-10	304
Group K Cast iron	0.7040	GGG40	60-40-18
Group N Non ferrous metals	3.2315	AlMgSi1	6351
	3.2163	GD-AlSi9Cu3	A380
	2.004	Cu-OF / CW008A	C10100
	2.0321	CuZn37 CW508L	C27400
	2.102	CuSn6	C51900
	2.096	CuAl9Mn2	C63200
Group S1 Super alloys	2.4856		INCONEL 625
	2.4665	NiCr22Fe18Mo	HASTELLOY X
Group S2 Titanium (pure and alloyed)	3.7035	Gr.2	B348 / F67
	3.7165	TiAl6V4	B348 / F136
Group S3 CrCo alloys	2.4964	CoCr20W15Ni	HAYNES 25
Group H1 Hardened steel <55 HRC	1.2510	100MnCrMoW4	O1

CRAZYMILL Cool

CRAZYMILL Cool

MILLING TOOLS
CRAZYMILL COOL SQUARE / CORNER RADIUS - Z2

CrazyMill Cool Square / Corner radius - Z2

MILLING WITH INTEGRATED COOLING

Square

1.5 x d
page 468

3 x d
page 474

5 x d
page 480

Corner radius

1.5 x d
page 469

3 x d
page 475

5 x d
page 481

CrazyMill Cool is setting new standards for the milling of grooves, pockets and walls with regard to cutting speeds, feed, performance, tool life, and surface quality. The new features of this roughing and finishing cutter include not only the solid carbide, coating, and geometry, but especially the unique cooling system with cooling channels integrated in the shaft, which achieve constant and extensive cooling of the cutting edges, thus enabling the highest cutting speeds and maximum feed.

The milling tools have three to five integrated cooling channels depending on the shaft diameter.

Mikron Tool developed two different variants:

- **Variant square** - sharp-edged with small, defined protection phase of 45°, for a maximum machining depth of 5 x d and with a cutting length of 1.5 x d.
- **Variant corner radius** - sharp-edged with a corner radius for a maximum machining depth of 5 x d and with a cutting length of 1.5 x d.

Coolant type, pressure and filtration

Detailed recommendations for coolant type, pressure and filtration are on page "milling process".

Please note

You couldn't find your suitable version of the CrazyMill Cool Square / Corner radius - Z2 (diameter, length, cutting direction…)? Ask us about our customized versions!

Regrinding: This product is not suitable for regrinding.

MILLING TOOLS
CRAZYMILL COOL SQUARE / CORNER RADIUS - Z2

Process CrazyMill Cool Square / Corner radius - Z2

ACCURATE AND EFFICIENT MILLING

Coolant type, pressure and filtration

Coolant: for best results, Mikron Tool recommends the use of cutting oil as coolant. Alternatively, emulsion of 8% or more 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.

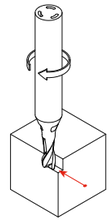
Revolution	[rpm]	≤ 10'000	> 10'000
Minimal pressure	[bar]	15	30

Tool holders

For detailed indications for tool holders see chapter "Technical information".

MLLING PROCESS

Climb milling and conventional milling

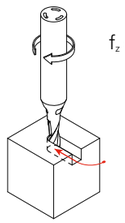


When milling pockets or walls, for example, Mikron Tool recommends climb milling since chip thickness in conventional milling is zero at the beginning and increases up to the exit. In this case, high cutting forces push the milling tool and the workpiece away from each other. Thus, surface quality decreases.

Entry for milling into the material

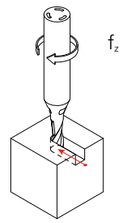
During milling with direct entry into the material, very thick chips are produced and the milling tool is subject to asymmetrical stress until it is working with its entire diameter in the material. These stresses can affect the service life of cutting edges, especially in hard and tough materials such as heat-resistant steel or titanium. We, therefore, recommend two other more gentle types of entry apart from direct entry with full feeding:

1. Indirect entry



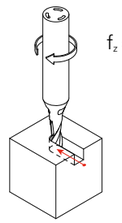
Indirect milling (also referred to as rolling entry) into the material (clockwise entry into the material in one radius) and 30% less feed in hard and tough materials such as heat-resistant steels or titanium.

2. Reduced feed



Direct milling into the material with approx. 50% less feed in hard and tough materials, such as heat-resistant steels or titanium.

3. Direct milling



Without reducing the feed for general steels (material group P), aluminum, etc. (material group N).

MILLING TOOLS
CRAZYMILL COOL SQUARE / CORNER RADIUS - Z2

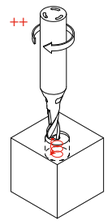
Process CrazyMill Cool Square / Corner radius - Z2

MILLING PROCESS

Immersion

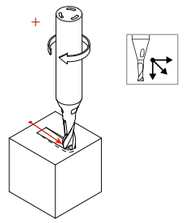
Spiral interpolation offers the best and most gentle method of immersion. The methods of immersion using a linear ramp can also be used with milling tools such as CrazyMill Cool (milling tool cuts over center).

1. Spiral interpolation



Note that the minimum diameter to be produced must be 1.3 x d_1. The minimum and maximum immersion angle α and the feed correction v_f must be maintained depending on the material (see tables).

2. Linear ramp



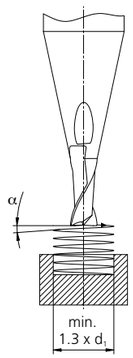
A milling tool that can be immersed axially is needed for the immersion (milling tool must cut above center). The minimum and maximum immersion angle α and the feed correction v_f must be maintained depending on the material (see tables).

Suggested ramp angle

Material		Ramp angle α min	Ramp angle α max
P	Unalloyed and alloyed Steel	5°	15°
M	Stainless steels	5°	10°
K	Cast iron	5°	15°
N	Aluminum and non-ferrous metals	10°	30°
S_1	Super alloys	2°	8°
S_2	Titanium and titanium alloys	2°	8°
S_3	CrCo alloys	2°	8°
H_1	Hardened steel < 55 HRC	5°	10°

Suggested feed correction v_f

Ramp angle α - Feed correction v_f				
α	5°	10°	20°	30°
V_f	80%	70%	60%	50%



MILLING PROCESS

Conventional slot milling

Cutting values: see cutting data chart "Conventional slot milling"!

Advantages

- Conventional 3-axis CNC machines can be used
- High metal removal rates if the conditions are stable (stable tool and workpiece clamping)
- Simple programming

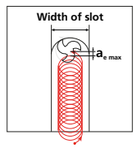
Drawbacks

- Sensitive to vibrations (several milling steps may be needed)
- Limited precision when flute milling (for example, perpendicularity or surface), sometimes must be machined in several milling steps a_p
- Produces high radial forces

Trochoidal slot milling

Cutting values: see cutting data chart "Side milling" / "Trochoidal slot milling"!

Additional parameter recommendation



- Milling tool diameter d_1 as compared to the groove: d_1 = max. 70% of the groove width
- Cutting width a_e = max. 10% of milling tool's diameter d_1
- Cutting depth a_p = depending on material and milling tool type, see cutting data chart
- Cutting speed = depending on material and milling tool type, see cutting data chart
- Feed per tooth f_z = depending on material and milling tool type, see cutting data chart

Advantages

- Generates smaller radial forces and fewer vibrations
- Higher precision due to smaller tool deflection (because of small radial forces)
- Better chip evacuation
- Less heat development
- Gentle on the tool, especially with stainless, acid-resistant and heat-resistant steel, and titanium alloys, resulting in longer service lives

Drawbacks

- A dynamic machining center and modern machine control are necessary
- More programming effort
- Longer processing time