

HOFMANN & VRATNY — EXN1 SERIES EN



EXN1 SERIES





HOFMANN & VRATNY — EXPERTS IN CUTTING NON-FERROUS MATERIALS

THE NEW EXN1 SERIES

THE RIGHT MILLING CUTTER. AT ALL TIMES.

Welcome to Hofmann & Vratny. As the leading manufacturer of solid carbide milling cutters, we enable companies throughout the world to manufacture their products.

Every day, our strong team works on our collective goal of producing the best milling cutters in the world. Companies from the medical industry, semiconductor industry, machine and plant construction, aviation, aerospace engineering and, not least, the automotive industry have been using our milling cutters for many years now. Quality - Made in Bavaria.

The success of our company is built on innovation, a culture of cooperation, open dealings on an equal footing and many years of successful and trustful collaboration with our business partners. You can count on us, our milling cutters and our irrepressible drive to shape the future of the industry together. To us, that means shaping tomorrow.

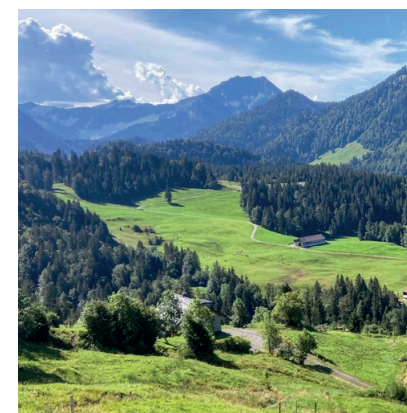
Andreas Vratny

Zdenek Vratny

Marius Heinemann-Grüder



OUR NEW
EXN1 Series



45
YEARS OF
EXPERIENCE

2 Mio.
MILLING
CUTTERS
PRODUCED
EVERY YEAR

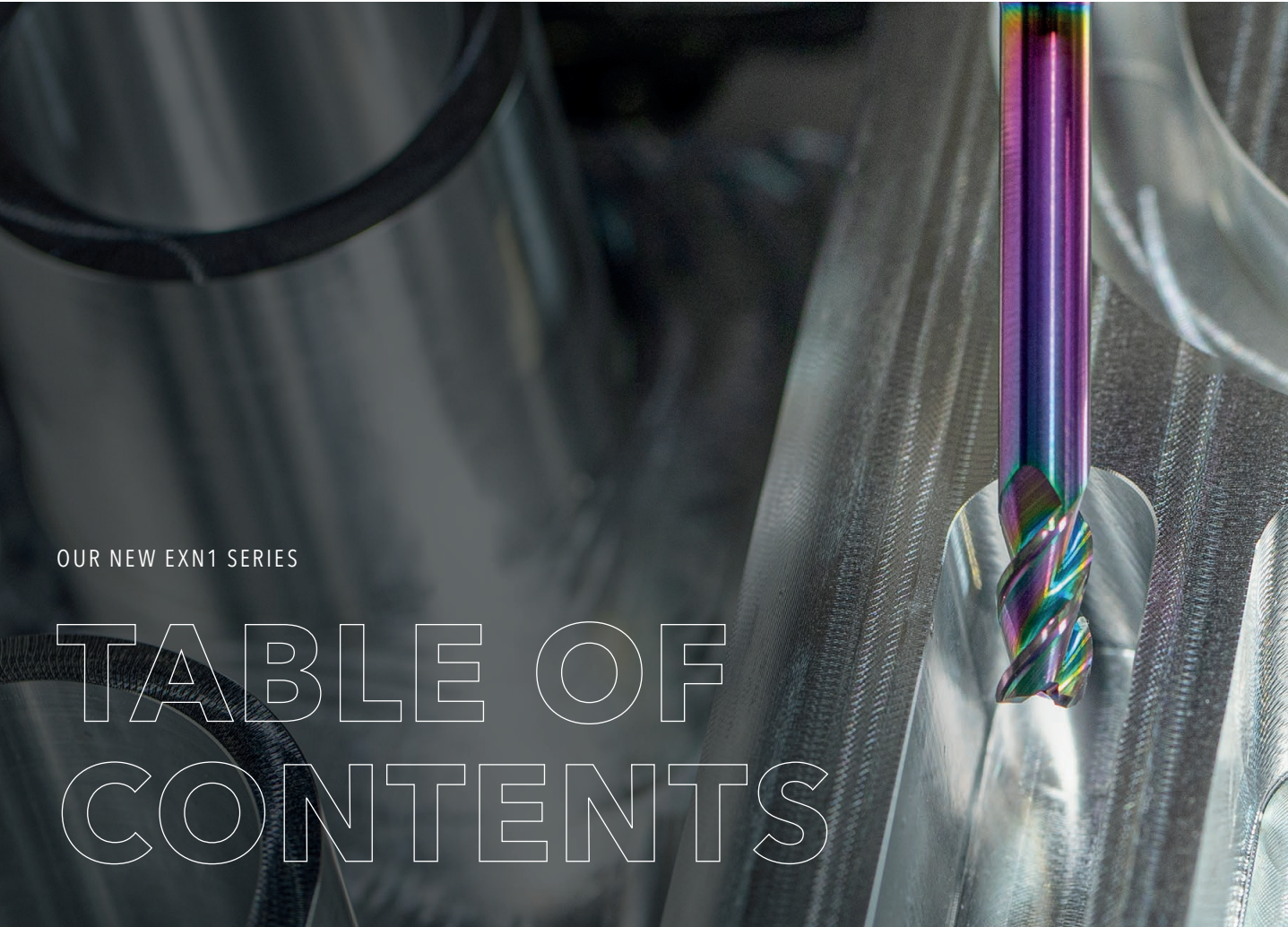
MADE IN BAVARIA

Our milling cutters are used by companies all over the world. Still they all have the same origin: Our production sites in Bavaria, Germany.

As a traditional company, we are proud of our strong connection to the region. Ever since we were founded, we have been firmly tied to our homeland, and our team works on producing the best milling cutters in the world in a familial environment. Genuine quality work, the highest-quality craftsmanship and a strong promotion and retention of our talent: This is what Made in Bavaria means to us.

**MADE IN
BAVARIA**

PROVEN QUALITY



OUR NEW EXN1 SERIES

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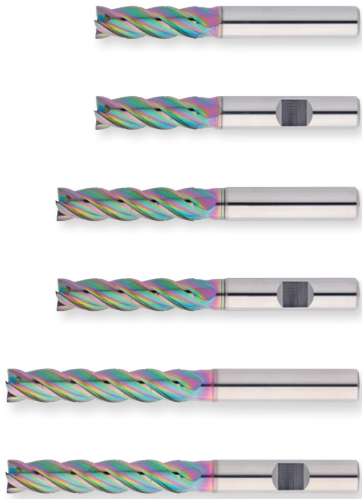
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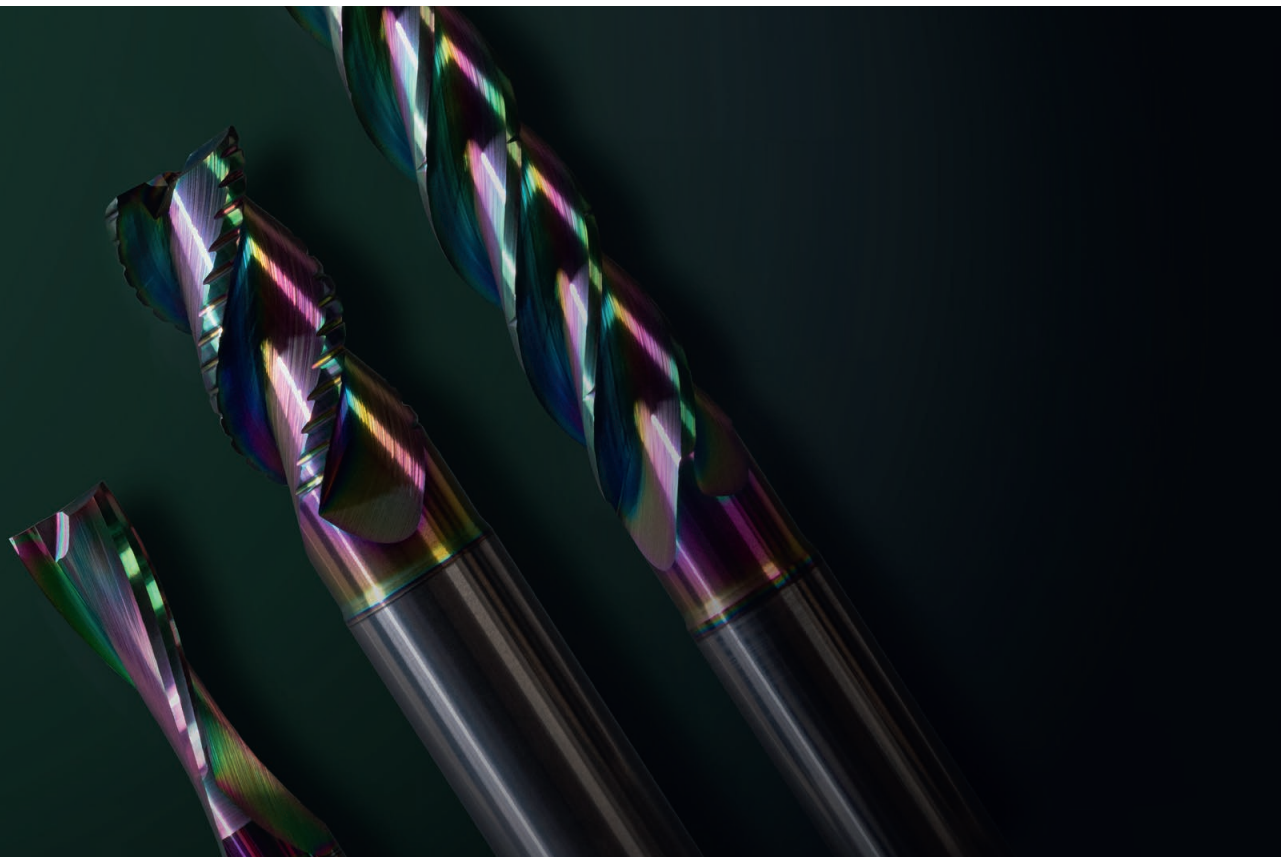
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THE NEW EXN1 SERIES

Experts in cutting non-ferrous materials



OUR NEW EXN1 SERIES IS
RENOWNED FOR ITS PARTICULARLY
IMPRESSIVE PERFORMANCE WHEN
MACHINING ALUMINIUM

Non-ferrous materials are very versatile and range from aluminium to plastic to multi-layered materials. In spite of their easy machinability, they make extra demands on the cutting tools due to their use as a composite material or their tendency to adhesion.

The H&V Expert EXN1 Series was developed to enable potentially easily machinable materials to be safely processed and to meet the specific requirements of non-ferrous material cutting.

- Fine-grain substrate, particularly suited to non-ferrous materials, for long-term retention of sharp edges and homogeneous wear
- Polished chip spaces for straightforward evacuation of chips
- High-performance geometry tailored to volume machining and surface quality

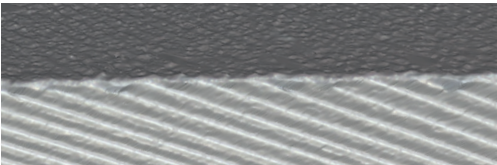
A SPECIAL EDGE PREPARATION PROCESS ENSURES:

- Entirely homogeneous cutting edges
- Even distribution of cutting forces
- Improved surface quality of the component
- Controlled and even wear

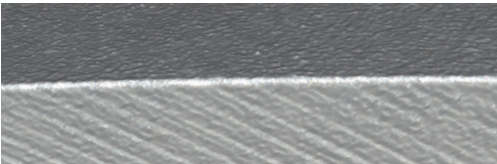


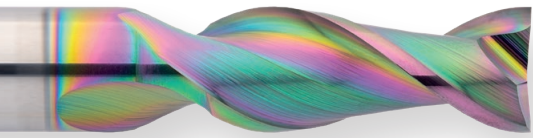
EXPERIENCE OUR NEW
EXN1 SERIES IN ACTION

BEFORE EDGE PREPARATION

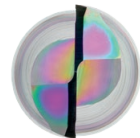


AFTER EDGE PREPARATION



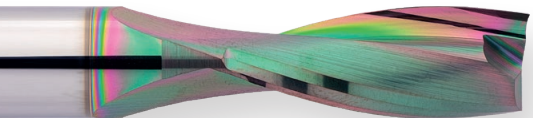


Customized face
for reliable ramping
and helical immersion

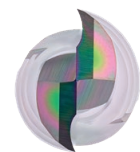


EXPERT N1 PERFORMMAKER (M01) Z2

- Defined clearance angle for improved stability with high cutting depths
- Special helical pitch for smooth running and cutting
- Expanded chip chambers for extremely high chip volumes
- Developed for use in the high-speed range
- Available as 2xD
- With ASR coating



Optimized face
for helical immersion
in all types of plastic

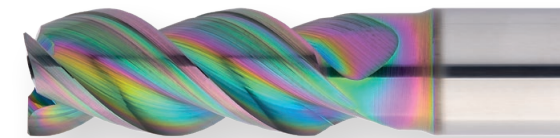


EXPERT N1 PERFORMMAKER (M01) Z2-3

- Extra sharp cutting edges for smooth and even cutting in all types of plastic
- Highly polished chip spaces for optimized chip evacuation
- Special helical pitch for smooth running
- Now with improved ASR coating

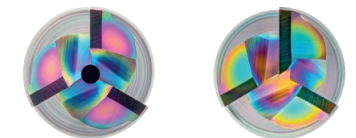
EXPERT N1 PERFORMMAKER (M01) Z3

- Defined clearance angle for improved stability with high cutting depths
- Special helical pitch for smooth running and cutting
- Expanded chip chambers for extremely high chip volumes
- Available in normal and long versions, as well as 3xD
- With ASR coating



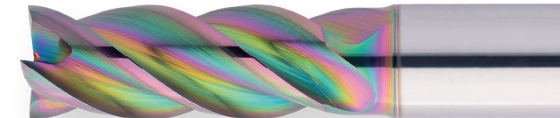
Customized face
for reliable ramping and
helical immersion

Available with and without
central internal cooling

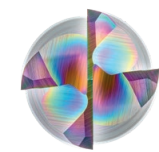


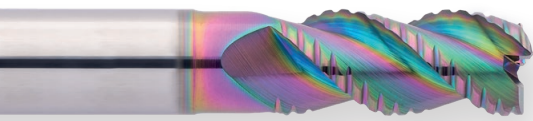
EXPERT N1 PERFORMMAKER (M01) Z4

- Extra large chip chambers for optimum chip disposal, even with full slots and high radial depth of cutting
- Variable helical pitch for smooth running
- Special unequal tooth pitch for smooth cutting
- With ASR coating



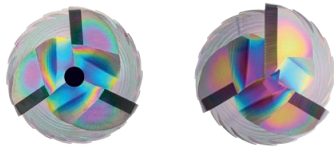
Reinforced face
with two cutting edges
cutting to the center,
for reliable ramping and
helical immersion





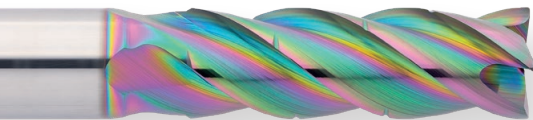
Customized face
for reliable ramping and
helical immersion

Available with and without
central internal cooling



EXPERT N1 SLOTMAKER (M02) Z3

- Roughing teeth for the smallest chips in volume machining
- Special helical pitch for smooth running and cutting
- Expanded chip chambers for extremely high chip volumes
- Available in 2xD and 3xD
- With ASR coating



Reinforced face
with two cutting edges
cutting to the center,
for reliable ramping and
helical immersion



EXPERT N1 CHIPMAKER (M03) Z4

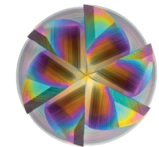
- Chip breaker for predefined chip length and preventing chip accumulations
- Customized chip chambers for optimum chip evacuation, even with high radial depth of cutting
- Variable helical pitch for smooth running
- Special unequal tooth pitch for smooth cutting
- Available in 3xD, 4xD and 5xD
- Available as HA and HB
- With ASR coating

EXPERT N1 MIRRORMAKER (M04) Z6

- Six ultra-sharp and lapped cutting edges ensure excellent surface finishes and perfect dimensional accuracy
- Special chip chambers designed for the evacuation of particularly long and fine chips
- Variable helical pitch for smooth running
- Special unequal tooth pitch for smooth cutting
- Available in 3xD, 4xD and 5xD
- ASR coating approved for use in the food industry



Face-finish-bevel
for smooth workpiece
surfaces



EXPERT N1 BALANCEMAKER (M05) Z1

- Defined clearance angle for improved stability with high cutting depths
- Optimized cutting geometry for smooth running and minimal imbalance
- Developed for use in the high-speed range
- Expanded chip chambers for extremely high chip volumes
- Available in normal and long versions
- With ASR coating



Customized face
for reliable grooving
and milling

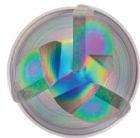




Customized face for reliable ramping and helical immersion

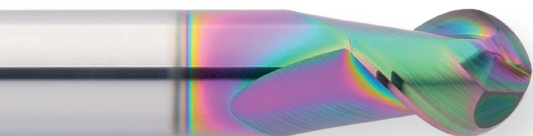
Corner radii up to R=4.0 available for contour milling

Radius tolerance is determined by the corner radius
 $\leq 1.5 \text{ mm} = \pm 0.003 \text{ mm}$
 $> 1.5 \text{ mm} = \pm 0.005 \text{ mm}$



EXPERT N1 FORMMAKER (M06) Z3

- Defined clearance angle for improved stability with high cutting depths
- Special helical pitch for smooth running and cutting
- Expanded chip chambers for extremely high chip volumes
- Available in normal and long versions
- With ASR coating



Optimized face design for excellent surface finishes and perfect dimensional accuracy when multipass milling

Radius tolerance is determined by the radius
 $\leq 2 \text{ mm} = \pm 0.003 \text{ mm}$
 $> 2 \text{ mm} = \pm 0.005 \text{ mm}$

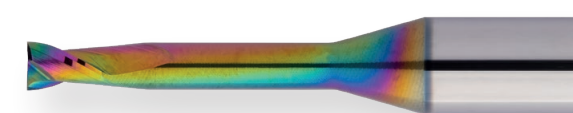


EXPERT N1 ROWMAKER (M08) Z2

- Developed for use in the high-speed range
- Defined microbevel for support and stabilisation
- Special chip chambers designed for optimal chip evacuation when roughing and finishing
- Available in normal and long versions
- With ASR coating

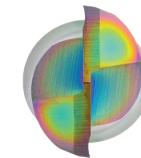
EXPERT N1 PERFORMMAKER MICRO (M15) Z2

- Defined microbevel for support and stabilisation
- Customized core for smooth running
- Polished chip spaces for optimum chip evacuation
- Now with improved ASR coating
- The tightest tolerances for high-precision manufacturing
 - Clearance diameter: 0/-0.02 mm
 - Cutting diameter: -0.001/-0.006 mm



Optimized face design for excellent surface finishes and perfect dimensional accuracy

Available with cutting edges
 $\varnothing 0.2 - 2.5 \text{ mm}$



EXPERT N1 FORMMAKER MICRO (M16) Z2

- Defined microbevel for support and stabilisation
- Customized core for smooth running
- Polished chip spaces for optimum chip evacuation
- Now with improved ASR coating
- The tightest tolerances for high-precision manufacturing
 - Clearance diameter: 0/-0.02 mm
 - Cutting diameter: -0.001/-0.006 mm

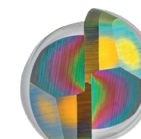


Optimized face design for excellent surface finishes and perfect dimensional accuracy when multipass milling

Available with cutting edges
 $\varnothing 0.2 - 3 \text{ mm}$

Available with R=0.05 mm to R=0.5 mm

Radius tolerance 0/-0.003 mm (measured from 0-90°)



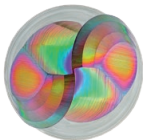


EXPERT N1 ROWMAKER MICRO (M17) Z2

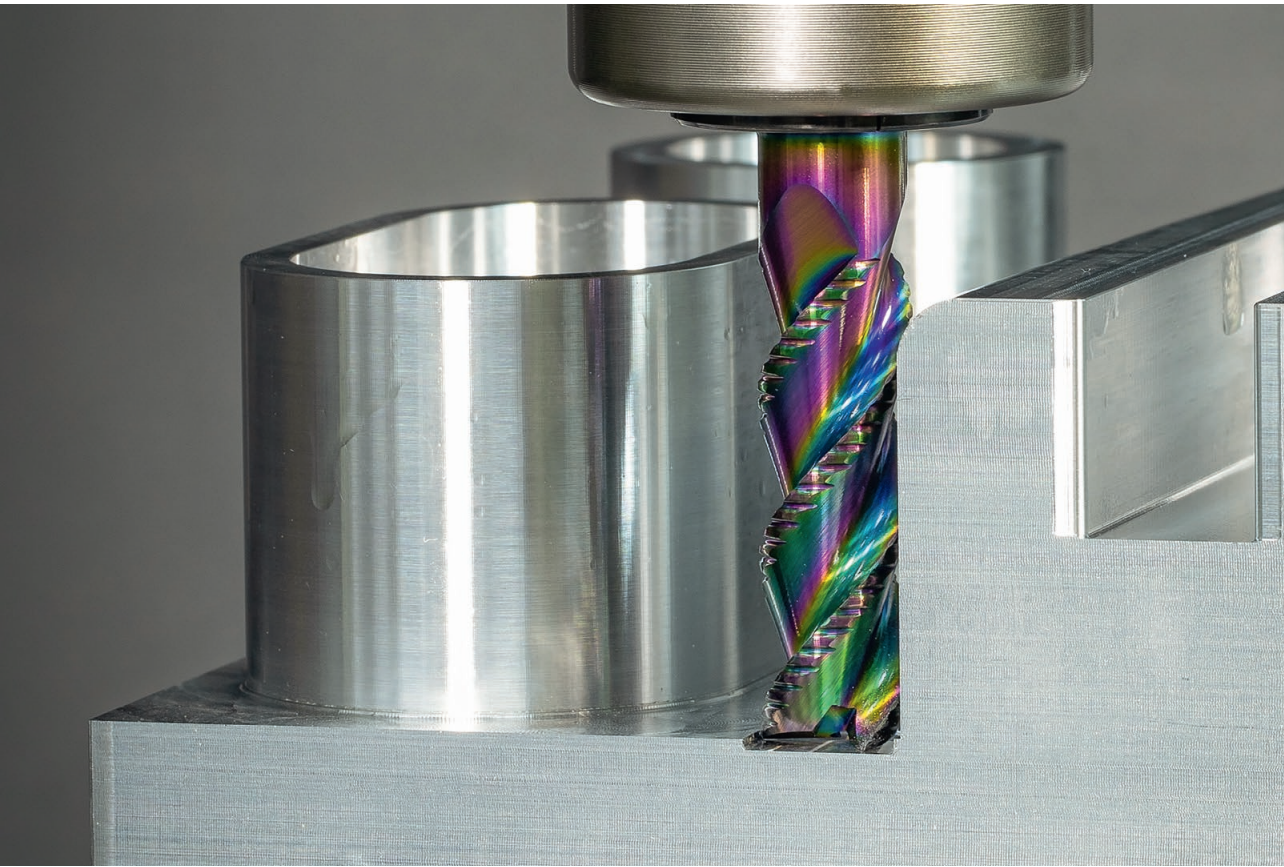
Optimized face design for excellent surface finishes and perfect dimensional accuracy when multipass milling

Available with cutting edges Ø 0.1 – 3 mm

Radius tolerance 0/-0.003 mm (measured from 0–90°)



- Defined microbevel for support and stabilisation
- Customized core for smooth running
- Polished chip spaces for optimum chip evacuation
- Now with improved ASR coating
- Available in normal and long versions
- The tightest tolerances for high-precision manufacturing
 - Clearance diameter: 0/-0.02 mm
 - Cutting diameter: -0.001/-0.006 mm



APPLICATION EXAMPLES

THE EXN1 SERIES IN OPERATION

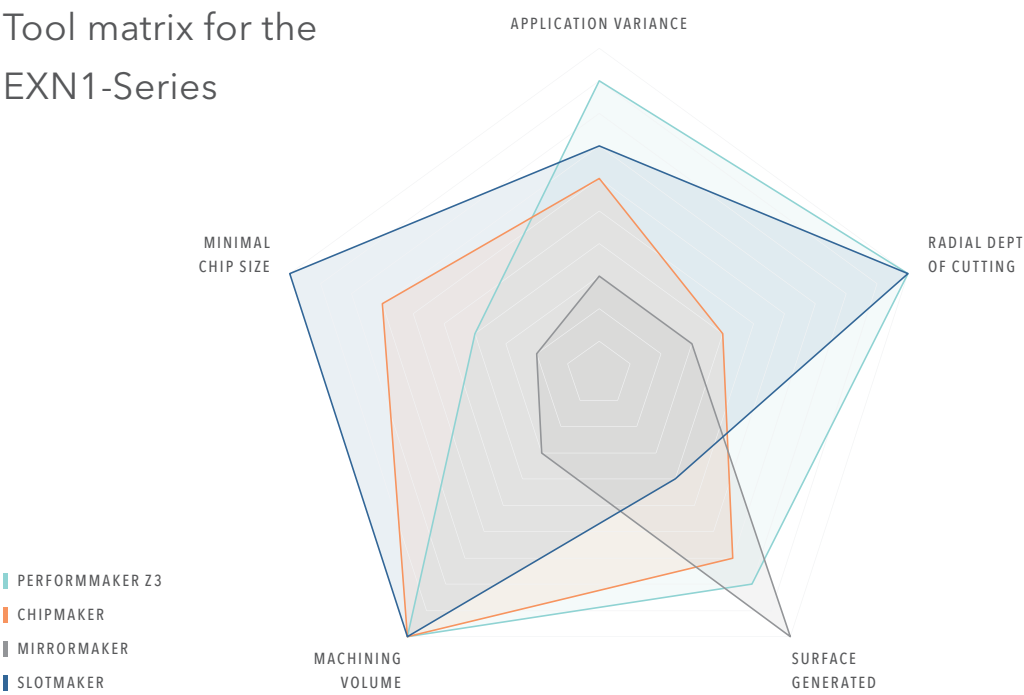
Manufacture of high-precision rails made of AlMg3 with 240 N/mm².

To date, the customer has been using standard aluminium milling cutters with a ZrN coating. By switching to the H&V EXN1 Series (PERFORMMAKER & MIRRORMAKER), the production time per component was able to be reduced by more than 50 %. Thanks to higher cutting depths and higher feed rates, the surface quality was also improved to a roughness (Ra) of less than 1 µm.

EXAMPLES OF MACHINING PARAMETERS WHEN ROUGHING WITH A FULL-SLOT
3-CUTTING EDGE END MILL CUTTER, Ø 12, 2XD

	Ae	Ap	Fz (mm/Z)	Vc (m(min)
EXN1 Performmaker Z3 2XD ASR	1xD	1.5xD	0.25	480
ZrN Z3 competitor	1xD	1.5xD	0.1	480
TAC Z3 competitor	1xD	1.5xD	0.12	480

Tool matrix for the EXN1-Series



ALPHA SLIDE RAINBOW

NEW

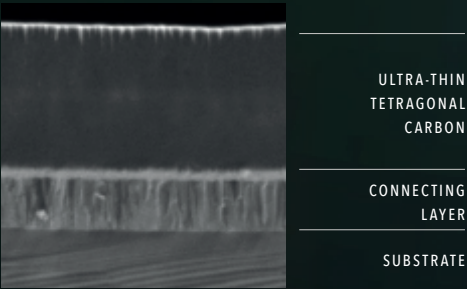
ASR | Innovative coating - Our new coating made of tetragonal carbon

Traditional TAC coatings are usually characterized by their high degree of hardness, very good wear resistance and stable slide characteristics. Our previous TAC Alpha coating met all of these criteria.

Now, our new AlphaSlide Rainbow (ASR) takes TAC coatings to the next level. Thanks to a new coating process that completely dispenses with hydrogen, among other things, we were able to:

- Increase sp3 bonds to over 85 %
- Reduce the coating thickness to less than 1 µm
- Reduce the coating hardness to approx. 4500 HV

STRUCTURE OF THE ALPHASLIDE RAINBOW (ASR)



ASR

Improvements to the traditional TAC coating (TAC Alpha)

- Increased tool life when roughing with full slots, trimming and multipass milling
- Better surface quality of the workpiece in finishing, trimming and multipass milling
- Increased smoothness (virtually free from droplets) and thus reduced friction coefficient. Ensures optimum chip evacuation, even in unpolished chip spaces
- Perfect retention of the sharp cutting edges thanks to the natural geometry and defined edge preparation
- High stability of the coating and cutting edges, even in unstable machining situations (e.g. vibrations)
- Prevention of built-up edges, even in unfavourable application scenarios involving adhesive alloys

ALPHASLIDE RAINBOW ASR AT A GLANCE

Structure	Completely hydrogen-free
Layer thickness	< 1 µm
Sp3 bonds	> 85 %
Layer hardness	approx. 4500 HV
Biocompatibility	100 % *
Friction coefficient	Friction coefficient: approx. 0.05 (dry on steel)
Max. operating temperature	approx. 420–450 °C, dry and wet
Main application	Aluminium (wrought alloys and cast alloys), plastic, copper

Secondary application (limited suitability)	CFRP/GFRP, graphite, Ti alloys and wood
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* Biocompatibility must be checked independently by the customer for the respective application

OUR NEW EXN1 SERIES

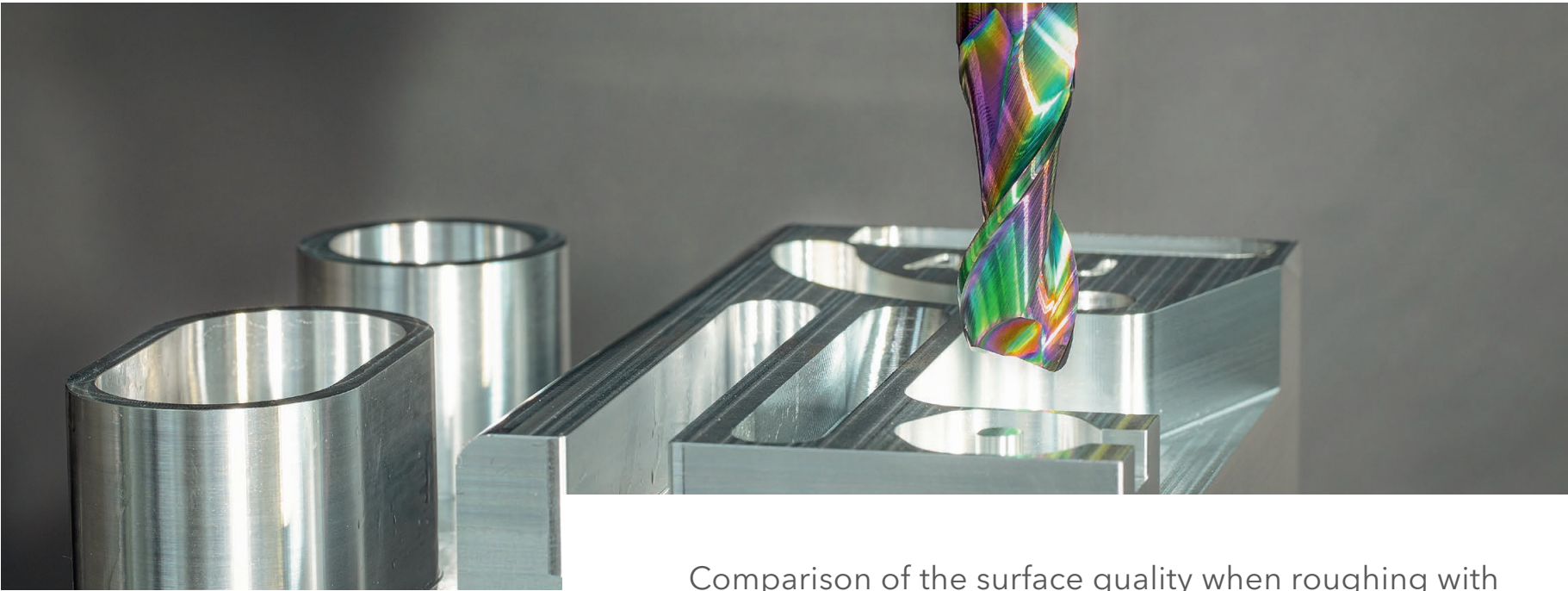
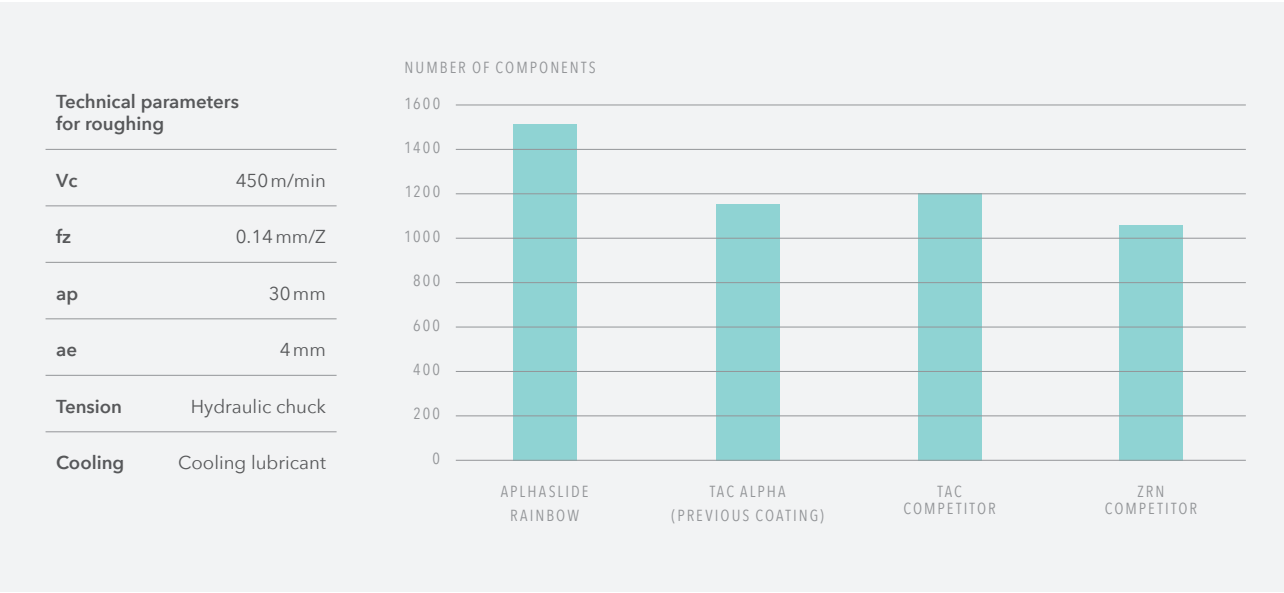
DETAILED COATING COMPARISON

Comparison of the tool life
when roughing in AlMg3

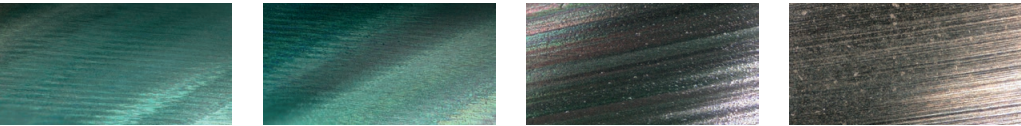
In addition, our new AlphaSlide Rainbow coating successfully prevailed over our previous TAC Alpha coating and the coatings of competitors in the comprehensive field test with regard to tool life.

TOOL LIFE CRITERION = BUILT-UP EDGE AND BREAKOUTS

EXN1-M01-0103-16 (3-cutting edge end mill cutter, Ø 16, 2xD)	Number of components
AlphaSlide Rainbow	1500
TAC Alpha (previous coating)	1150
TAC competitor	1200
ZrN competitor	1050



Comparison of the surface quality when roughing with
a subsequent finishing process in AlMg3



Measured value*	AlphaSlide Rainbow (ASR)	TAC Alpha (previous coating)	TAC competitor	ZrN competitor
Straightness	0.0012 mm	0.0026 mm	0.0097 mm	0.0092 mm
Roughness (Ra)	0.810 µm	1.06 µm	1.821 µm	2.133 µm

Technical parameters for roughing		Technical parameters for finishing	
Vc	450 m/min	Vc	450 m/min
fz	0.14 mm/Z	fz	0.05 mm/Z
ap	30 mm	ap	30 mm
ae	4 mm	ae	0.2 mm
Tension	Hydraulic chuck	Tension	Hydraulic chuck
Cooling	Cooling lubricant		

* Determined using a measuring sensor on the machined workpiece

DIGITAL SERVICES

DISTRIBUTION PARTNERS

We enable companies around the world to manufacture their products. To this end, we work with reliable partners at an international level to ensure that our milling cutters are always available exactly where they are needed and can be delivered straight into your hands.

FIND OUT MORE ABOUT OUR GLOBAL SALES PARTNERS



Browse all EXN1 Series products in our shop

Peruse the products in the EXN1 Series online or search for the ideal tool for your application based on various product features. We guarantee, that you will find the perfect milling cutter for your machining needs using our online platform.



WHAT ARE YOU WAITING FOR?

STILL CAN'T FIND A SUITABLE MILLING CUTTER?

No problem – simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST



UPDATE 2021

NUMBERING SYSTEM

DISTINGUISHING FEATURES

PRODUCT LINE	TOOL TYPE	MILLING CUTTER TYPE
BC Basic	D Drilling	01 End mill cutter PERFORMMAKER
EX Expert	M Milling	02 Roughing cutter SLOTMAKER
		03 Trochoidal cutter CHIPMAKER
		04 Finishing cutter MIRRORMAKER
		05 Single flute cutter BALANCEMAKER
		06 Torus cutter FORMMAKER
		07 Face torus cutter BLADEMAKER
		08 Full radius cutter ROWMAKER
		09 Deburring cutter CHAMFMAKER
		10 Forward and backward deburring cutter FB CHAMFMAKER
		11 Corner rounding cutter ROUNDMAKER
		12 Forward and backward corner rounding cutter FB ROUNDMAKER
		13 Engraving cutter TEXTMAKER
		14 Conical cutter SLOPEMAKER
		15 Micro end mill cutter PERFORMMAKER MICRO
		16 Micro torus cutter FORMMAKER MICRO
		17 Micro full radius cutter ROWMAKER MICRO

OTHER DISTINGUISHING FEATURES

PRODUCT IDENT	DIMENSION
e.g. 0023	3x10 Cutting diameter x length of undercut
	12/0,5 Cutting diameter / corner radius
	10 Diameter

Cooling

◊

◊°

Tolerance

e8

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

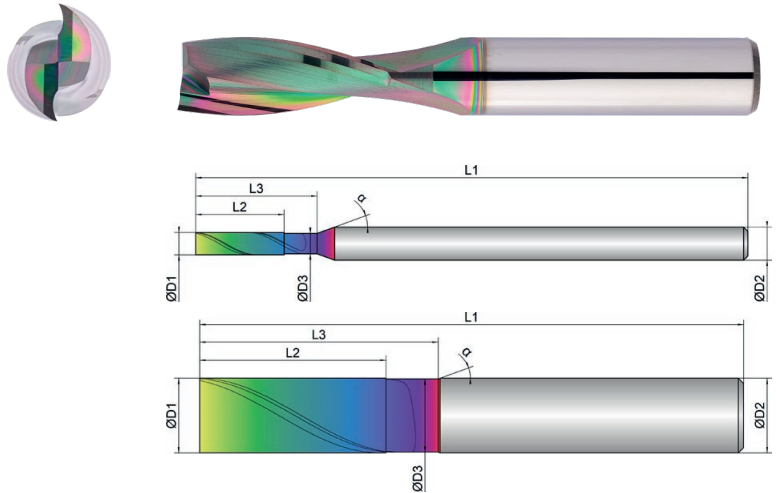
Application

Features

HA

Expert

- Extra sharp cutting edges for a smooth and soft cut in all plastics
- Highly polished chip space for optimized chip evacuation
- Special helical pitch for smooth running



Roughing					Finishing				
inappropriate					optimal				
EXN1-M01-0013	D1 mm Ø	D3 mm Ø	L2 mm	L3 mm	L1 mm	D2 mm Ø	z #	°	α °
1	1.0	0.9	5.0	8.0	50.0	3.0	2	20	20
2	2.0	1.85	8.0	11.0	50.0	3.0	2	20	20
3	3.0	2.8	11.0	14.0	50.0	3.0	2	20	20
4	4.0	3.8	13.0	16.0	54.0	4.0	2	20	20
5	5.0	4.8	15.0	18.0	54.0	5.0	2	20	20
6	6.0	5.8	16.0	21.0	65.0	6.0	2	20	20
8	8.0	7.8	22.0	27.0	70.0	8.0	2	20	20
10	10.0	9.8	25.0	32.0	73.0	10.0	2	20	20
12	12.0	11.8	28.0	38.0	84.0	12.0	3	20	20
14	14.0	13.8	30.0	42.0	84.0	14.0	3	20	20
16	16.0	15.8	36.0	44.0	93.0	16.0	3	20	20
20	20.0	19.8	41.0	54.0	104.0	20.0	3	20	20

Download Catalog Pages (PDF)

Dimension

Ø1

Ø2

Ø3

Ø4

Ø5

Ø6

Infeed in mm

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

Application

Feed (mm/Z)

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

Material

Strength (N/mm²)

Feed (mm/Z)

Vc (m/min)

N															
1.1	Aluminium, alloyed	<500													
1.2	Aluminium, alloyed	<600													
2.1-2.3	Aluminium, casted	<600													
3.1-3.3	Cooper, alloyed	<650													
4.1	Magnesium, alloyed	<250													
5.1	Thermoplastic	<100	480	0.004	0.007	0.006	0.01	0.008	0.012	0.012	0.02	0.015	0.025	0.025	0.04
5.2	Duroplastic	<150	420	0.003	0.006	0.005	0.009	0.006	0.01	0.01	0.016	0.01	0.02	0.02	0.035

Dimension

Ø8

Ø10

Ø12

Ø14

Ø16

Ø20

Infeed in mm

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ae=1xD

ae=0.4xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

ap=1xD

ap=2xD

Application

Feed (mm/Z)

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

Material

Strength (N/mm²)

Feed (mm/Z)

Vc (m/min)

N															
1.1	Aluminium, alloyed	<500													
1.2	Aluminium, alloyed	<600													
2.1-2.3	Aluminium, casted	<600													
3.1-3.3	Cooper, alloyed	<650													
4.1	Magnesium, alloyed	<250													
5.1	Thermoplastic	<100	480	0.03	0.05	0.04	0.055	0.048	0.075	0.05	0.085	0.055	0.09	0.06	0.11
5.2	Duroplastic	<150	420	0.025	0.045	0.035	0.05	0.044	0.065	0.04	0.075	0.045	0.08	0.05	0.1

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

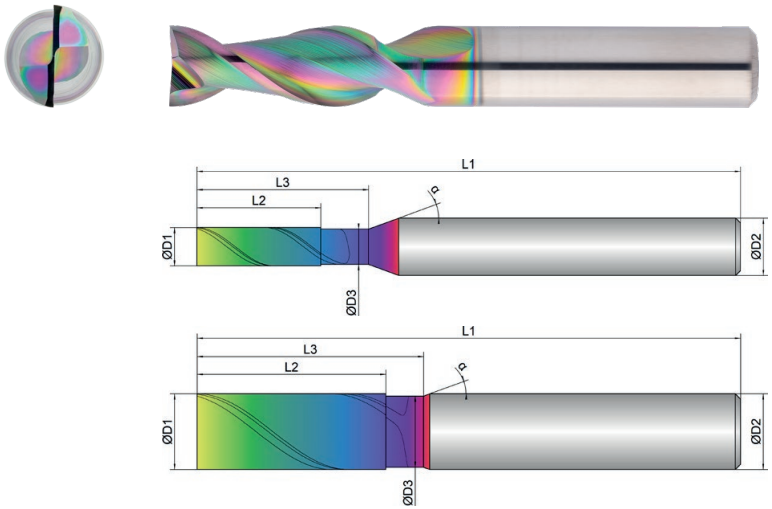
ETC HSC HPC

Application

Features

HA 2xD

- Defined clearance angle for ideal stabilization with high cutting depths
 - Special helical pitch for smooth running and soft cut
 - Extra large chip chambers for an extreme chip volume
- For roughing and finishing, up to 1.5xD full slot
 - For process reliable, helical diving and immersion
- For use in high speed milling machines



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M01-0043	D1 mm Ø	D3 mm Ø	L2 mm	L3 mm	L1 mm	D2 mm Ø	z #	 °	α °
4	4.0	3.7	13.0	18.0	57.0	6.0	2	38	20
6	6.0	5.5	16.0	21.0	57.0	6.0	2	38	20
8	8.0	7.5	22.0	27.0	63.0	8.0	2	38	20
10	10.0	9.4	25.0	30.0	72.0	10.0	2	38	20
12	12.0	11.4	28.0	33.0	83.0	12.0	2	38	20
16	16.0	15.4	36.0	41.0	92.0	16.0	2	38	20
20	20.0	19.4	41.0	51.0	104.0	20.0	2	38	20

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Dimension	Ø4		Ø6		Ø8		Ø10		Ø12		Ø16				
Infeed in mm	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD			
Application	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD			
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz			
Vc (m/min)															
1.1	Aluminium, alloyed	<500	500	0.05	0.06	0.06	0.08	0.08	0.09	0.09	0.12	0.1	0.14	0.14	0.18
1.2	Aluminium, alloyed	<600	480	0.05	0.06	0.06	0.08	0.08	0.09	0.09	0.12	0.1	0.14	0.14	0.18
2.1-2.3	Aluminium, casted	<600	450	0.045	0.055	0.055	0.075	0.07	0.08	0.08	0.11	0.09	0.13	0.12	0.16
3.1-3.3	Cooper, alloyed	<650	200	0.04	0.05	0.05	0.07	0.06	0.07	0.07	0.1	0.09	0.13	0.12	0.16
4.1	Magnesium, alloyed	<250	500	0.05	0.06	0.06	0.08	0.08	0.09	0.09	0.12	0.1	0.14	0.14	0.18
5.1	Thermoplastic	<100	400	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.11
5.2	Duroplastic	<150	350	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.1

Dimension	Ø20						
Infeed in mm	ae=1xD	ae=0.3xD					
Application	ap=1xD	ap=2xD					
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz			
Vc (m/min)							
1.1	Aluminium, alloyed	<500	500	0.18	0.22		
1.2	Aluminium, alloyed	<600	480	0.18	0.22		
2.1-2.3	Aluminium, casted	<600	450	0.16	0.2		
3.1-3.3	Cooper, alloyed	<650	200	0.16	0.2		
4.1	Magnesium, alloyed	<250	500	0.18	0.22		
5.1	Thermoplastic	<100	400	0.11	0.14		
5.2	Duroplastic	<150	350	0.1	0.13		

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

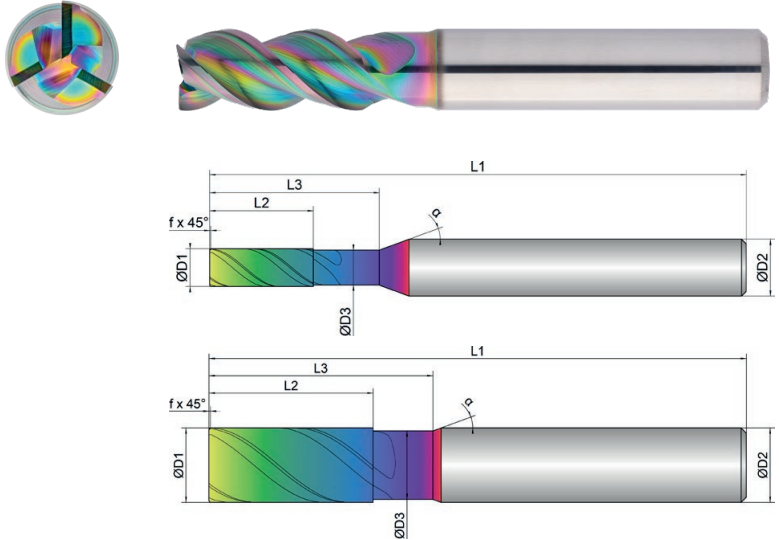
Application

Features

HA

≠

- Defined clearance angle for ideal stabilization with high cutting depths
 - Special helical pitch for smooth running and soft cut
 - Extra large chip chambers for an extreme chip volume
- For process reliable, helical diving and immersion
 - For roughing and finishing, up to 2xD full slot



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M01-0103	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	 mm	 °
3	3.0	2.7	8.0	12.0	57.0	6.0	3	0.10	45
4	4.0	3.7	11.0	18.0	57.0	6.0	3	0.10	45
5	5.0	4.7	13.0	18.0	57.0	6.0	3	0.10	45
6	6.0	5.7	13.0	18.0	57.0	6.0	3	0.20	45
8	8.0	7.4	21.0	25.0	63.0	8.0	3	0.20	45
10	10.0	9.2	22.0	30.0	72.0	10.0	3	0.20	45
12	12.0	11.0	26.0	36.0	83.0	12.0	3	0.20	45
16	16.0	15.0	36.0	42.0	92.0	16.0	3	0.20	45
20	20.0	19.0	41.0	52.0	104.0	20.0	3	0.20	45

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Dimension	Ø3		Ø4		Ø5		Ø6		Ø8		Ø10				
Infeed in mm	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD			
Application															
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz			
Vc (m/min)															
1.1	Aluminium, alloyed	<500	500	0.04	0.05	0.05	0.06	0.055	0.07	0.06	0.08	0.08	0.1	0.09	0.12
1.2	Aluminium, alloyed	<600	480	0.04	0.05	0.05	0.06	0.055	0.07	0.06	0.08	0.08	0.1	0.09	0.12
2.1-2.3	Aluminium, casted	<600	450	0.035	0.045	0.045	0.055	0.05	0.065	0.055	0.075	0.075	0.09	0.08	0.11
3.1-3.3	Cooper, alloyed	<650	200	0.03	0.04	0.04	0.05	0.045	0.06	0.05	0.07	0.07	0.085	0.075	0.1
4.1	Magnesium, alloyed	<250	500	0.04	0.05	0.05	0.06	0.055	0.07	0.06	0.08	0.08	0.1	0.09	0.12
5.1	Thermoplastic	<100	400	0.03	0.04	0.04	0.045	0.04	0.05	0.045	0.065	0.055	0.065	0.065	0.085
5.2	Duroplastic	<150	350	0.025	0.035	0.03	0.035	0.035	0.04	0.035	0.055	0.045	0.055	0.055	0.075

Dimension	Ø12		Ø16		Ø20				
Infeed in mm	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD			
Application									
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz			
Vc (m/min)									
1.1	Aluminium, alloyed	<500	500	0.1	0.14	0.14	0.18	0.18	0.22
1.2	Aluminium, alloyed	<600	480	0.1	0.14	0.14	0.18	0.18	0.22
2.1-2.3	Aluminium, casted	<600	450	0.09	0.13	0.13	0.17	0.17	0.2
3.1-3.3	Cooper, alloyed	<650	200	0.085	0.12	0.12	0.16	0.16	0.18
4.1	Magnesium, alloyed	<250	500	0.1	0.14	0.14	0.18	0.18	0.22
5.1	Thermoplastic	<100	400	0.075	0.11	0.11	0.13	0.13	0.17
5.2	Duroplastic	<150	350	0.065	0.1	0.1	0.12	0.12	0.16

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application

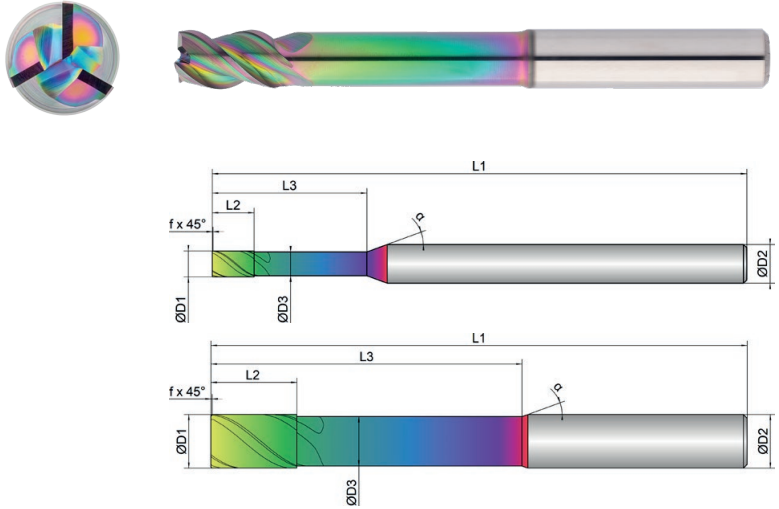
Features

HA

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Expert

- Defined clearance angle for ideal stabilization with high cutting depths
 - Special helical pitch for smooth running and soft cut
 - Extra large chip chambers for an extreme chip volume
- For process reliable, helical diving and immersion
 - For roughing and finishing
- Long version for deeper cavities



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M01-0113	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	 mm	 °
3	3.0	2.7	5.0	18.0	83.0	6.0	3	0.10	45
4	4.0	3.7	6.5	24.0	83.0	6.0	3	0.10	45
5	5.0	4.7	8.0	30.0	83.0	6.0	3	0.10	45
6	6.0	5.7	10.0	42.0	83.0	6.0	3	0.20	45
8	8.0	7.4	13.0	62.0	100.0	8.0	3	0.20	45
10	10.0	9.2	16.0	58.0	100.0	10.0	3	0.20	45
12	12.0	11.0	19.0	73.0	119.0	12.0	3	0.20	45
16	16.0	15.0	25.0	100.0	150.0	16.0	3	0.20	45
20	20.0	19.0	32.0	98.0	150.0	20.0	3	0.20	45

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Dimension		Ø3		Ø4		Ø5		Ø6		Ø8		Ø10			
Infeed in mm	Application	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD		
		ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD		
Application															
Material		Feed (mm/Z)		fz		fz		fz		fz		fz			
N		Vc (m/min)													
1.1	Aluminium, alloyed	<500	280	0.03	0.04	0.04	0.05	0.05	0.065	0.055	0.065	0.06	0.075	0.075	0.09
1.2	Aluminium, alloyed	<600	260	0.03	0.04	0.04	0.05	0.05	0.065	0.055	0.065	0.06	0.075	0.075	0.09
2.1-2.3	Aluminium, casted	<600	240	0.025	0.035	0.035	0.045	0.04	0.055	0.045	0.055	0.05	0.065	0.065	0.08
3.1-3.3	Cooper, alloyed	<650	120	0.02	0.03	0.03	0.035	0.03	0.045	0.035	0.045	0.04	0.055	0.055	0.07
4.1	Magnesium, alloyed	<250	280	0.03	0.04	0.04	0.05	0.05	0.065	0.055	0.065	0.06	0.075	0.075	0.09
5.1	Thermoplastic	<100	200	0.025	0.035	0.035	0.045	0.04	0.055	0.045	0.055	0.05	0.065	0.065	0.08
5.2	Duroplastic	<150	170	0.02	0.03	0.03	0.035	0.03	0.045	0.035	0.045	0.04	0.055	0.055	0.07

Dimension		Ø12		Ø16		Ø20						
Infeed in mm	Application	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD					
		ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD					
Application												
Material		Feed (mm/Z)		fz		fz		fz		fz		
N		Vc (m/min)										
1.1	Aluminium, alloyed	<500	280	0.08	0.1	0.1	0.12	0.12	0.14			
1.2	Aluminium, alloyed	<600	260	0.08	0.1	0.1	0.12	0.12	0.14			
2.1-2.3	Aluminium, casted	<600	240	0.07	0.09	0.09	0.11	0.11	0.13			
3.1-3.3	Cooper, alloyed	<650	120	0.06	0.08	0.08	0.1	0.1	0.12			
4.1	Magnesium, alloyed	<250	280	0.08	0.1	0.1	0.12	0.12	0.14			
5.1	Thermoplastic	<100	200	0.07	0.09	0.09	0.11	0.11	0.13			
5.2	Duroplastic	<150	170	0.06	0.08	0.08	0.1	0.1	0.12			

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application

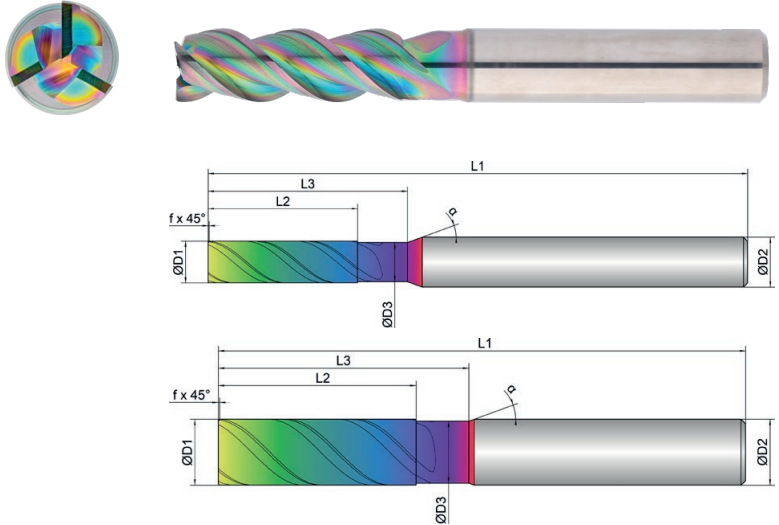
Features

HA

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3xD

- Defined clearance angle for ideal stabilization with high cutting depths
 - Special helical pitch for smooth running and soft cut
 - Extra large chip chambers for an extreme chip volume
-
- For process reliable, helical diving and immersion
 - For roughing and finishing



Roughing						Finishing				
inappropriate						optimal				
EXN1-M01-0123	D1	D3	L2	L3	L1	D2	z	45°	°	α
5	5.0	4.7	18.0	24.0	65.0	6.0	3	0.10	45	20
6	6.0	5.5	20.0	24.0	65.0	6.0	3	0.20	45	20
8	8.0	7.5	26.0	30.0	70.0	8.0	3	0.20	45	20
10	10.0	9.4	30.0	38.0	80.0	10.0	3	0.20	45	20
12	12.0	11.4	36.0	46.0	93.0	12.0	3	0.20	45	20
16	16.0	15.4	48.0	58.0	110.0	16.0	3	0.20	45	20
20	20.0	19.4	60.0	74.0	125.0	20.0	3	0.20	45	20



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Dimension		Ø5		Ø6		Ø8		Ø10		Ø12		Ø16			
Infeed in mm		ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD		
Application		ap=1xD	ap=3xD	ap=1xD	ap=3xD	ap=1xD	ap=3xD	ap=1xD	ap=3xD	ap=1xD	ap=3xD	ap=1xD	ap=3xD		
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.045	0.06	0.05	0.07	0.07	0.09	0.08	0.11	0.09	0.13	0.13	0.16
1.2	Aluminium, alloyed	<600	480	0.045	0.06	0.05	0.07	0.07	0.09	0.08	0.11	0.09	0.13	0.13	0.16
2.1-2.3	Aluminium, casted	<600	450	0.04	0.055	0.045	0.065	0.06	0.08	0.07	0.1	0.08	0.12	0.12	0.15
3.1-3.3	Cooper, alloyed	<650	200	0.035	0.05	0.04	0.06	0.05	0.07	0.06	0.09	0.07	0.11	0.11	0.14
4.1	Magnesium, alloyed	<250	500	0.045	0.06	0.05	0.07	0.07	0.09	0.08	0.11	0.09	0.13	0.13	0.16
5.1	Thermoplastic	<100	400	0.03	0.045	0.04	0.06	0.05	0.06	0.06	0.08	0.07	0.1	0.1	0.13
5.2	Duroplastic	<150	350	0.025	0.04	0.035	0.055	0.04	0.05	0.05	0.07	0.06	0.09	0.09	0.12
Dimension		Ø20													
Infeed in mm		ae=1xD	ae=0.3xD												
Application		ap=1xD	ap=3xD												
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz											
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.16	0.2										
1.2	Aluminium, alloyed	<600	480	0.16	0.2										
2.1-2.3	Aluminium, casted	<600	450	0.15	0.19										
3.1-3.3	Cooper, alloyed	<650	200	0.14	0.18										
4.1	Magnesium, alloyed	<250	500	0.16	0.2										
5.1	Thermoplastic	<100	400	0.13	0.17										
5.2	Duroplastic	<150	350	0.12	0.16										

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application

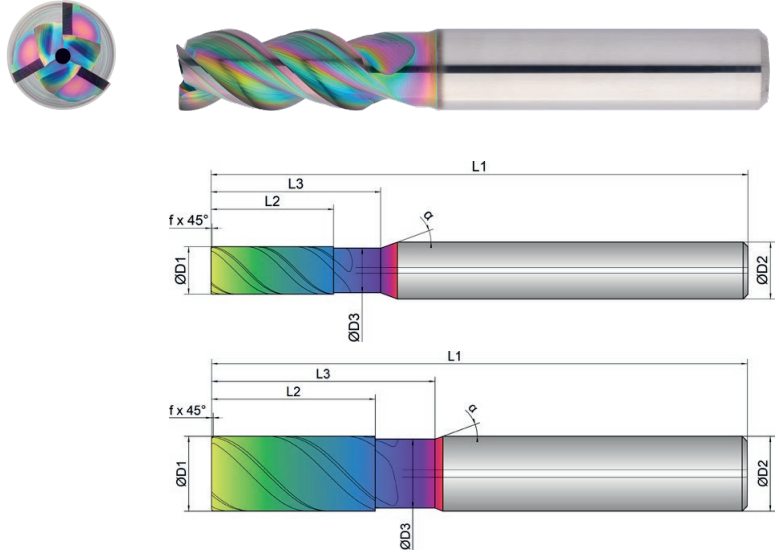
Features

HA

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Expert

- Defined clearance angle for ideal stabilization with high cutting depths
 - Special helical pitch for smooth running and soft cut
 - Extra large chip chambers for an extreme chip volume
- For process reliable, helical diving and immersion
 - For roughing and finishing, up to 2xD full slot
- With central inner cooling



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M01-0203	D1	D3	L2	L3	L1	D2	z		
5	5.0	4.7	13.0	18.0	57.0	6.0	3	0.10	45
6	6.0	5.7	13.0	18.0	57.0	6.0	3	0.20	45
8	8.0	7.4	21.0	25.0	63.0	8.0	3	0.20	45
10	10.0	9.2	22.0	30.0	72.0	10.0	3	0.20	45
12	12.0	11.0	26.0	36.0	83.0	12.0	3	0.20	45
16	16.0	15.0	36.0	42.0	92.0	16.0	3	0.20	45
20	20.0	19.0	41.0	52.0	104.0	20.0	3	0.20	45

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Dimension	Ø5		Ø6		Ø8		Ø10		Ø12		Ø16	
Infeed in mm	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD
Application												

Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz			
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.055	0.07	0.06	0.08	0.08	0.1	0.09	0.12	0.1	0.14	0.14	0.18
1.2	Aluminium, alloyed	<600	480	0.055	0.07	0.06	0.08	0.08	0.1	0.09	0.12	0.1	0.14	0.14	0.18
2.1-2.3	Aluminium, casted	<600	450	0.05	0.065	0.055	0.075	0.075	0.09	0.08	0.11	0.09	0.13	0.13	0.17
3.1-3.3	Cooper, alloyed	<650	200	0.045	0.06	0.05	0.07	0.07	0.085	0.075	0.1	0.085	0.12	0.12	0.16
4.1	Magnesium, alloyed	<250	500	0.055	0.07	0.06	0.08	0.08	0.1	0.09	0.12	0.1	0.14	0.14	0.18
5.1	Thermoplastic	<100	400	0.04	0.05	0.045	0.065	0.055	0.065	0.065	0.085	0.075	0.11	0.11	0.13
5.2	Duroplastic	<150	350	0.035	0.04	0.035	0.055	0.045	0.055	0.055	0.075	0.065	0.1	0.1	0.12

Dimension	Ø20						
Infeed in mm	ae=1xD	ae=0.3xD					
Application							

Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	
N	Vc (m/min)				
1.1	Aluminium, alloyed	<500	500	0.18	0.22
1.2	Aluminium, alloyed	<600	480	0.18	0.22
2.1-2.3	Aluminium, casted	<600	450	0.17	0.2
3.1-3.3	Cooper, alloyed	<650	200	0.16	0.18
4.1	Magnesium, alloyed	<250	500	0.18	0.22
5.1	Thermoplastic	<100	400	0.13	0.17
5.2	Duroplastic	<150	350	0.12	0.16

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application

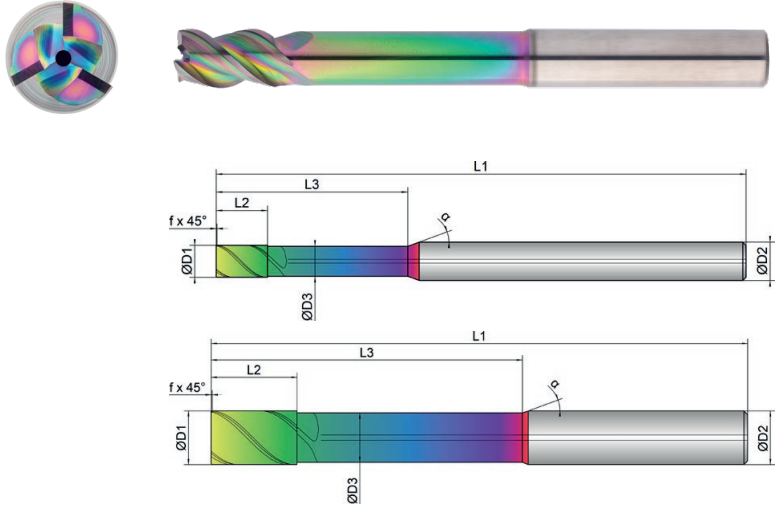
Features

HA

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Expert

- Defined clearance angle for ideal stabilization with high cutting depths
 - Special helical pitch for smooth running and soft cut
 - Extra large chip chambers for an extreme chip volume
- For process reliable, helical diving and immersion
 - For roughing and finishing
- With central inner cooling
 - Long version for deeper cavities



Roughing					Finishing				
inappropriate					inappropriate				
optimal					optimal				
EXN1-M01-0213	D1	D3	L2	L3	L1	D2	z		
	mm ø	mm ø	mm	mm	mm	mm ø	#	mm	
5	5.0	4.7	8.0	30.0	83.0	6.0	3	0.10	45
6	6.0	5.7	10.0	42.0	83.0	6.0	3	0.20	45
8	8.0	7.4	13.0	62.0	100.0	8.0	3	0.20	45
10	10.0	9.2	16.0	58.0	100.0	10.0	3	0.20	45
12	12.0	11.0	19.0	73.0	119.0	12.0	3	0.20	45
16	16.0	15.0	25.0	100.0	150.0	16.0	3	0.20	45
20	20.0	19.0	32.0	98.0	150.0	20.0	3	0.20	45

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Dimension	Ø5		Ø6		Ø8		Ø10		Ø12		Ø16	
Infeed in mm	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD
	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD
Application												

Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz			
N		Vc (m/min)													
1.1	Aluminium, alloyed	<500	280	0.05	0.065	0.055	0.065	0.06	0.075	0.075	0.09	0.08	0.1	0.1	0.12
1.2	Aluminium, alloyed	<600	260	0.05	0.065	0.055	0.065	0.06	0.075	0.075	0.09	0.08	0.1	0.1	0.12
2.1-2.3	Aluminium, casted	<600	240	0.04	0.055	0.045	0.055	0.05	0.065	0.065	0.08	0.07	0.09	0.09	0.11
3.1-3.3	Cooper, alloyed	<650	120	0.03	0.045	0.035	0.045	0.04	0.055	0.055	0.07	0.06	0.08	0.08	0.1
4.1	Magnesium, alloyed	<250	280	0.05	0.065	0.055	0.065	0.06	0.075	0.075	0.09	0.08	0.1	0.1	0.12
5.1	Thermoplastic	<100	200	0.04	0.055	0.045	0.055	0.05	0.065	0.065	0.08	0.07	0.09	0.09	0.11
5.2	Duroplastic	<150	170	0.03	0.045	0.035	0.045	0.04	0.055	0.055	0.07	0.06	0.08	0.08	0.1

Dimension	Ø20					
Infeed in mm	ae=1xD	ae=0.3xD				
	ap=1xD	ap=1xD				
Application						

Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	
N		Vc (m/min)			
1.1	Aluminium, alloyed	<500	280	0.12	0.14
1.2	Aluminium, alloyed	<600	260	0.12	0.14
2.1-2.3	Aluminium, casted	<600	240	0.11	0.13
3.1-3.3	Cooper, alloyed	<650	120	0.1	0.12
4.1	Magnesium, alloyed	<250	280	0.12	0.14
5.1	Thermoplastic	<100	200	0.11	0.13
5.2	Duroplastic	<150	170	0.1	0.12

Cooling









Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application









Features

HA

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2xD







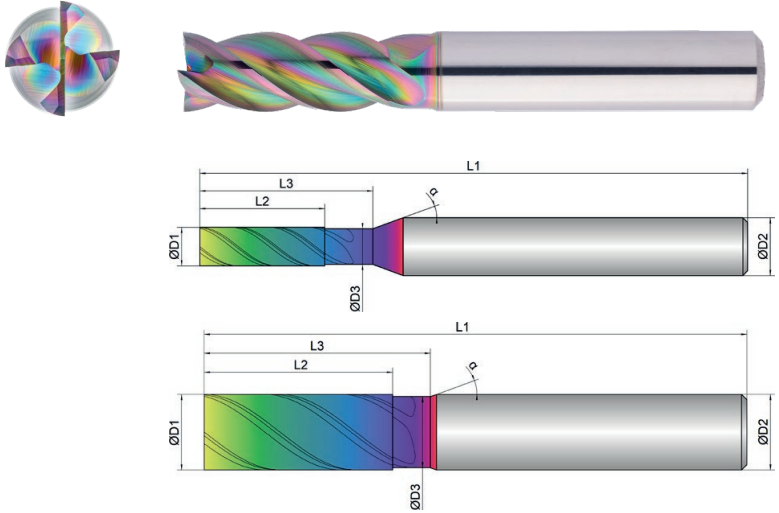


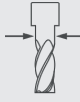
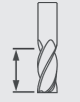
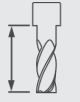
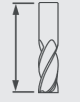
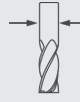
- Extra large chip chambers for ideal chip evacuation

■ Unequal tooth pitch combined with variable helical pitch for smooth running

■ Reinforced face with 2 cutting edges to the center
- For process reliable, helical diving and immersion

■ For roughing and finishing, up to 1.5xD full slot
- Perfected for high radial depth of cutting and full slot milling



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M01-0293	D1  mm Ø	D3  mm Ø	L2  mm	L3  mm	L1  mm	D2  mm Ø	z  #	 °	α  °
4	4.0	3.7	13.0	18.0	57.0	6.0	4	38	20
5	5.0	4.5	14.0	18.0	57.0	6.0	4	38	20
6	6.0	5.5	16.0	21.0	57.0	6.0	4	38	20
8	8.0	7.5	22.0	27.0	63.0	8.0	4	38	20
10	10.0	9.4	25.0	30.0	72.0	10.0	4	38	20
12	12.0	11.4	28.0	33.0	83.0	12.0	4	38	20
16	16.0	15.4	36.0	41.0	92.0	16.0	4	38	20
20	20.0	19.4	41.0	51.0	104.0	20.0	4	38	20



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Dimension	Ø4		Ø5		Ø6		Ø8		Ø10		Ø12				
Infeed in mm	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD			
	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD	ap=1xD	ap=2xD			
Application															
Material	Strength (N/mm²)		Feed (mm/Z)		fz		fz		fz		fz				
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.04	0.05	0.045	0.065	0.05	0.07	0.07	0.09	0.09	0.11	0.1	0.14
1.2	Aluminium, alloyed	<600	480	0.04	0.05	0.045	0.65	0.05	0.07	0.07	0.09	0.09	0.11	0.1	0.14
2.1-2.3	Aluminium, casted	<600	450	0.035	0.045	0.04	0.06	0.045	0.065	0.065	0.085	0.08	0.1	0.09	0.13
3.1-3.3	Cooper, alloyed	<650	200	0.03	0.04	0.035	0.055	0.035	0.055	0.055	0.075	0.07	0.09	0.08	0.12
4.1	Magnesium, alloyed	<250	500	0.04	0.05	0.045	0.065	0.05	0.07	0.07	0.09	0.09	0.11	0.1	0.14
5.1	Thermoplastic	<100	400	0.035	0.045	0.035	0.045	0.04	0.05	0.05	0.07	0.07	0.09	0.09	0.11
5.2	Duroplastic	<150	350	0.03	0.04	0.03	0.04	0.035	0.04	0.04	0.06	0.06	0.08	0.08	0.1

Dimension	Ø16		Ø20						
Infeed in mm	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD					
	ap=1xD	ap=2xD	ap=1xD	ap=2xD					
Application									
Material	Strength (N/mm²)		Feed (mm/Z)		fz		fz		
N	Vc (m/min)								
1.1	Aluminium, alloyed	<500	500	0.12	0.16	0.15	0.2		
1.2	Aluminium, alloyed	<600	480	0.12	0.16	0.15	0.2		
2.1-2.3	Aluminium, casted	<600	450	0.11	0.15	0.14	0.18		
3.1-3.3	Cooper, alloyed	<650	200	0.1	0.13	0.12	0.16		
4.1	Magnesium, alloyed	<250	500	0.12	0.16	0.15	0.2		
5.1	Thermoplastic	<100	400	0.1	0.13	0.13	0.17		
5.2	Duroplastic	<150	350	0.09	0.12	0.12	0.16		

Cooling

Tolerance

e8

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application

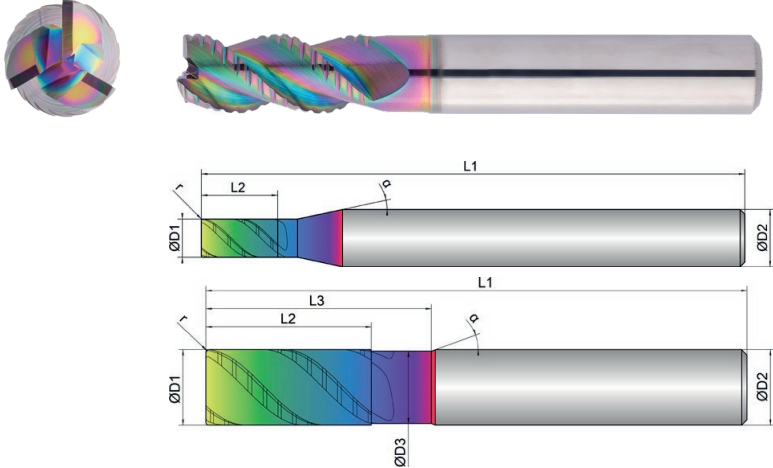
Features

HA

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2xD

- Roughing teeth for the smallest chips in volume machining
- Special helical pitch for smooth running and soft cut
- Extra large chip chambers for an extreme chip volume



Roughing						Finishing				
inappropriate						optimal				
EXN1-M02-0023	D1 mm Ø	D3 mm Ø	L2 mm	L3 mm	L1 mm	D2 mm Ø	z #	r mm	 °	α °
4	4.0	0.0	8.0	0.0	57.0	6.0	3	0.10	45	12
5	5.0	0.0	9.0	0.0	57.0	6.0	3	0.20	45	12
6	6.0	5.6	13.0	19.0	57.0	6.0	3	0.20	45	20
8	8.0	7.6	19.0	25.0	63.0	8.0	3	0.20	45	20
10	10.0	9.6	22.0	30.0	72.0	10.0	3	0.32	45	20
12	12.0	11.4	26.0	36.0	83.0	12.0	3	0.32	45	20
16	16.0	15.4	31.0	42.0	92.0	16.0	3	0.32	45	20
20	20.0	19.4	41.0	52.0	104.0	20.0	3	0.50	45	20

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Dimension	Ø4		Ø5		Ø6		Ø8		Ø10		Ø12	
Infeed in mm	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD
Application												

Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz			
Vc (m/min)															
1.1	Aluminium, alloyed	<500	500	0.035	0.05	0.05	0.07	0.07	0.09	0.09	0.11	0.11	0.13	0.13	0.15
1.2	Aluminium, alloyed	<600	480	0.035	0.05	0.05	0.07	0.07	0.09	0.09	0.11	0.11	0.13	0.13	0.15
2.1-2.3	Aluminium, casted	<600	450	0.03	0.045	0.045	0.065	0.065	0.085	0.085	0.1	0.1	0.12	0.12	0.14
3.1-3.3	Cooper, alloyed	<650	200	0.025	0.04	0.04	0.06	0.06	0.08	0.08	0.095	0.09	0.11	0.11	0.13
4.1	Magnesium, alloyed	<250	500	0.035	0.05	0.05	0.07	0.07	0.09	0.09	0.11	0.11	0.13	0.13	0.15
5.1	Thermoplastic	<100	350	0.03	0.045	0.035	0.05	0.05	0.07	0.06	0.07	0.07	0.09	0.07	0.11
5.2	Duroplastic	<150	300	0.025	0.04	0.03	0.045	0.045	0.06	0.05	0.06	0.06	0.08	0.06	0.1

Dimension	Ø16		Ø20					
Infeed in mm	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD				
Application								

Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	
Vc (m/min)							
1.1	Aluminium, alloyed	<500	500	0.14	0.16	0.18	0.22
1.2	Aluminium, alloyed	<600	480	0.14	0.16	0.18	0.22
2.1-2.3	Aluminium, casted	<600	450	0.13	0.15	0.16	0.2
3.1-3.3	Cooper, alloyed	<650	200	0.12	0.14	0.14	0.18
4.1	Magnesium, alloyed	<250	500	0.14	0.16	0.18	0.22
5.1	Thermoplastic	<100	350	0.11	0.14	0.14	0.18
5.2	Duroplastic	<150	300	0.1	0.13	0.13	0.17

NOTE | The values marked in turquoise are side applications!

Cooling









Tolerance

e8

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application









Features

HA

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3xD



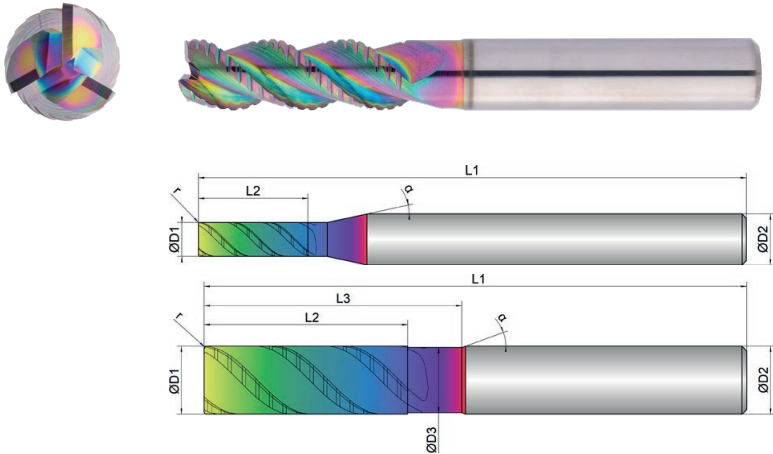

Expert



- Roughing teeth for the smallest chips in volume machining
- Special helical pitch for smooth running and soft cut
- Extra large chip chambers for an extreme chip volume

- For roughing, up to 3xD full slot
- For process reliable, helical diving and immersion

- Also ideally designed for trochoidal milling



Roughing						Finishing				
inappropriate						optimal				
EXN1-M02-0053	D1	D3	L2	L3	L1	D2	z	r		α
										
4	4.0	0.0	13.0	0.0	65.0	6.0	3	0.10	45	12
5	5.0	0.0	16.0	0.0	65.0	6.0	3	0.20	45	12
6	6.0	5.6	18.0	24.0	65.0	6.0	3	0.20	45	20
8	8.0	7.6	24.0	30.0	70.0	8.0	3	0.20	45	20
10	10.0	9.6	30.0	38.0	80.0	10.0	3	0.32	45	20
12	12.0	11.4	36.0	46.0	93.0	12.0	3	0.32	45	20
16	16.0	15.4	48.0	58.0	110.0	16.0	3	0.32	45	20
20	20.0	19.4	60.0	74.0	125.0	20.0	3	0.50	45	20


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Dimension		Ø4		Ø5		Ø6		Ø8		Ø10		Ø12			
Infeed in mm		ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD		
Application		ap=2xD	ap=3xD	ap=2xD	ap=3xD	ap=2xD	ap=3xD	ap=2xD	ap=3xD	ap=2xD	ap=3xD	ap=2xD	ap=3xD		
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.03	0.04	0.04	0.06	0.06	0.08	0.08	0.1	0.1	0.12	0.12	0.14
1.2	Aluminium, alloyed	<600	480	0.03	0.04	0.04	0.06	0.06	0.08	0.08	0.1	0.1	0.12	0.12	0.14
2.1-2.3	Aluminium, casted	<600	450	0.025	0.035	0.035	0.055	0.055	0.07	0.07	0.09	0.09	0.11	0.11	0.13
3.1-3.3	Cooper, alloyed	<650	200	0.015	0.025	0.025	0.045	0.045	0.06	0.06	0.08	0.08	0.1	0.1	0.12
4.1	Magnesium, alloyed	<250	500	0.03	0.04	0.04	0.06	0.06	0.08	0.08	0.1	0.1	0.12	0.12	0.14
5.1	Thermoplastic	<100	350	0.025	0.035	0.03	0.045	0.04	0.06	0.05	0.06	0.06	0.08	0.06	0.1
5.2	Duroplastic	<150	300	0.02	0.03	0.025	0.04	0.035	0.055	0.04	0.05	0.05	0.07	0.05	0.09

Dimension		Ø16		Ø20					
Infeed in mm		ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD				
Application		ap=2xD	ap=3xD	ap=2xD	ap=3xD				
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz			
N	Vc (m/min)								
1.1	Aluminium, alloyed	<500	500	0.13	0.15	0.16	0.2		
1.2	Aluminium, alloyed	<600	480	0.13	0.15	0.16	0.2		
2.1-2.3	Aluminium, casted	<600	450	0.12	0.14	0.14	0.18		
3.1-3.3	Cooper, alloyed	<650	200	0.11	0.13	0.13	0.16		
4.1	Magnesium, alloyed	<250	500	0.13	0.15	0.16	0.2		
5.1	Thermoplastic	<100	350	0.1	0.13	0.13	0.17		
5.2	Duroplastic	<150	300	0.09	0.12	0.12	0.16		

NOTE | The values marked in turquoise are side applications!

Cooling

Tolerance

e8

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application

Features

HA

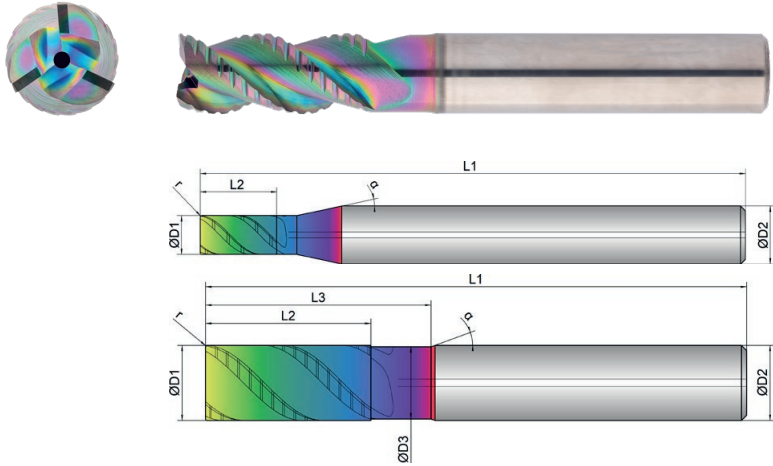
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Expert

- Roughing teeth for the smallest chips in volume machining
- Special helical pitch for smooth running and soft cut
- Extra large chip chambers for an extreme chip volume

- For roughing, up to 2xD full slot
- For process reliable, helical diving and immersion

- With central inner cooling
- Also ideally designed for trochoidal milling



Roughing					Finishing				
inappropriate					inappropriate				
optimal					optimal				

EXN1-M02-0123	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
4	4.0	0.0	8.0	0.0	57.0	6.0	3	0.10	45	12
5	5.0	0.0	9.0	0.0	57.0	6.0	3	0.20	45	12
6	6.0	5.6	13.0	19.0	57.0	6.0	3	0.20	45	20
8	8.0	7.6	19.0	25.0	63.0	8.0	3	0.20	45	20
10	10.0	9.6	22.0	30.0	72.0	10.0	3	0.32	45	20
12	12.0	11.4	26.0	36.0	83.0	12.0	3	0.32	45	20
16	16.0	15.4	31.0	42.0	92.0	16.0	3	0.32	45	20
20	20.0	19.4	41.0	52.0	104.0	20.0	3	0.50	45	20



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Pages (PDF)

		Dimension		Ø4		Ø5		Ø6		Ø8		Ø10		Ø12	
Infeed in mm				ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD	ae=1xD	ae=0.6xD
Application				ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD	ap=2xD
		Feed (mm/Z)		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
		Strength (N/mm²)													
		Material													
		N		Vc (m/min)											
1.1	Aluminium, alloyed	<500	500	0.035	0.05	0.05	0.07	0.07	0.09	0.09	0.11	0.11	0.13	0.13	0.15
1.2	Aluminium, alloyed	<600	480	0.035	0.05	0.05	0.07	0.07	0.09	0.09	0.11	0.11	0.13	0.13	0.15
2.1-2.3	Aluminium, casted	<600	450	0.03	0.045	0.045	0.065	0.065	0.085	0.085	0.1	0.1	0.12	0.12	0.14
3.1-3.3	Cooper, alloyed	<650	200	0.025	0.04	0.04	0.06	0.06	0.08	0.08	0.095	0.09	0.11	0.11	0.13
4.1	Magnesium, alloyed	<250	500	0.035	0.05	0.05	0.07	0.07	0.09	0.09	0.11	0.11	0.13	0.13	0.15
5.1	Thermoplastic	<100	350	0.03	0.045	0.035	0.05	0.05	0.07	0.06	0.07	0.07	0.09	0.07	0.11
5.2	Duroplastic	<150	300	0.025	0.04	0.03	0.045	0.045	0.06	0.05	0.06	0.06	0.08	0.06	0.1

			Dimension	Ø 16		Ø 20						
			Infeed in mm	ae= 1xD	ae= 0.6xD	ae= 1xD	ae= 0.6xD					
				ap= 2xD	ap= 2xD	ap= 2xD	ap= 2xD					
				Application								
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz						
N	Vc (m/min)											
1.1	Aluminium, alloyed	<500	500	0.14	0.16	0.18	0.22					
1.2	Aluminium, alloyed	<600	480	0.14	0.16	0.18	0.22					
2.1-2.3	Aluminium, casted	<600	450	0.13	0.15	0.16	0.2					
3.1-3.3	Cooper, alloyed	<650	200	0.12	0.14	0.14	0.18					
4.1	Magnesium, alloyed	<250	500	0.14	0.16	0.18	0.22					
5.1	Thermoplastic	<100	350	0.11	0.14	0.14	0.18					
5.2	Duroplastic	<150	300	0.1	0.13	0.13	0.17					

NOTE | The values marked in turquoise are side applications!

Cooling

Tolerance

e8

Coating

AlphaSlide Rainbow

Strategy

ETC

HPC

Application

Features

HA

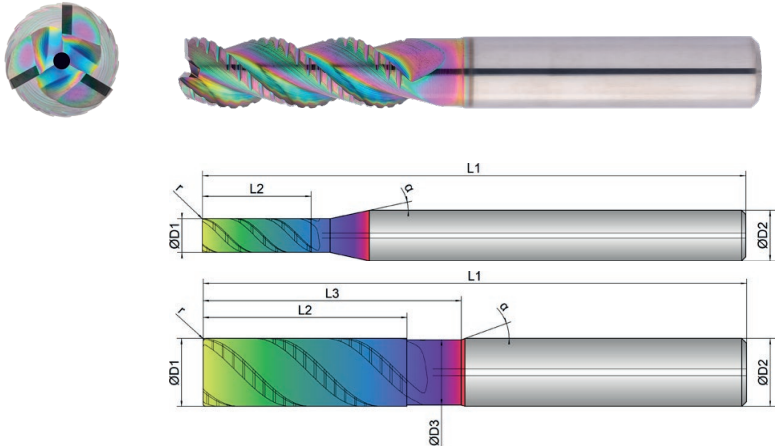
≠

3xD

- Roughing teeth for the smallest chips in volume machining
- Special helical pitch for smooth running and soft cut
- Extra large chip chambers for an extreme chip volume

- For roughing, up to 3xD full slot
- For process reliable, helical diving and immersion

- With central inner cooling
- Also ideally designed for trochoidal milling



Roughing						Finishing				
inappropriate						inappropriate				
EXN1-M02-0163	D1	D3	L2	L3	L1	D2	z	r		
	mm ø	mm ø	mm	mm	mm	mm ø	#	mm	°	°
	4	4.0	0.0	13.0	0.0	65.0	6.0	3	0.10	45
	5	5.0	0.0	16.0	0.0	65.0	6.0	3	0.20	45
	6	6.0	5.6	18.0	24.0	65.0	6.0	3	0.20	45
	8	8.0	7.6	24.0	30.0	70.0	8.0	3	0.20	45
	10	10.0	9.6	30.0	38.0	80.0	10.0	3	0.32	45
	12	12.0	11.4	36.0	46.0	93.0	12.0	3	0.32	45
	16	16.0	15.4	48.0	58.0	110.0	16.0	3	0.32	45
	20	20.0	19.4	60.0	74.0	125.0	20.0	3	0.50	45

Download Catalog Pages (PDF)

Dimension

Ø4

Ø5

Ø6

Ø8

Ø10

Ø12

Infeed in mm

ae=1xD

ae=0.3xD

ae=1xD

ae=0.3xD

ae=1xD

ae=0.3xD

ae=1xD

ae=0.3xD

ae=1xD

ae=0.3xD

ae=1xD

ae=0.3xD

ap=2xD

ap=3xD

ap=2xD

ap=3xD

ap=2xD

ap=3xD

ap=2xD

ap=3xD

ap=2xD

ap=3xD

ap=2xD

ap=3xD

Application

Material

Strength (N/mm²)

Feed (mm/Z)

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

fz

N

Vc (m/min)

1.1

Aluminium, alloyed

<500

500

0.03

0.04

0.04

0.06

0.06

0.08

0.08

0.1

0.1

0.12

0.12

0.14

1.2

Aluminium, alloyed

<600

480

0.03

0.04

0.04

0.06

0.06

0.08

0.08

0.1

0.1

0.12

0.12

0.14

2.1-2.3

Aluminium, casted

<600

450

0.025

0.035

0.035

0.055

0.055

0.07

0.07

0.09

0.09

0.11

0.11

0.13

3.1-3.3

Cooper, alloyed

<650

200

0.015

0.025

0.025

0.045

0.045

0.06

0.06

0.08

0.08

0.1

0.1

0.12

4.1

Magnesium, alloyed

<250

500

0.03

0.04

0.04

0.06

0.06

0.08

0.08

0.1

0.1

0.12

0.12

0.14

5.1

Thermoplastic

<100

350

0.025

0.035

0.03

0.045

0.04

0.06

0.05

0.06

0.06

0.06

0.08

0.06

0.1

5.2

Duroplastic

<150

300

0.02

0.03

0.025

0.04

0.035

0.055

0.04

0.05

0.05

0.05

0.07

0.05

0.09

Dimension

Ø16

Ø20

Infeed in mm

ae=1xD

ae=0.3xD

ae=1xD

ae=0.3xD

ap=2xD

ap=3xD

ap=2xD

ap=3xD

Application

Material

Strength (N/mm²)

Feed (mm/Z)

fz

fz

fz

fz

N

Vc (m/min)

1.1

Aluminium, alloyed

<500

500

0.13

0.15

0.16

0.2

1.2

Aluminium, alloyed

<600

480

0.13

0.15

0.16

0.2

2.1-2.3

Aluminium, casted

<600

450

0.12

0.14

0.14

0.18

3.1-3.3

Cooper, alloyed

<650

200

0.11

0.13

0.13

0.16

4.1

Magnesium, alloyed

<250

500

0.13

0.15

0.16

0.2

5.1

Thermoplastic

<100

350

0.1

0.13

0.13

0.17

5.2

Duroplastic

<150

300

0.09

0.12

0.12

0.16

NOTE |

The values marked in turquoise are side applications!

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

ETC

Application

Features

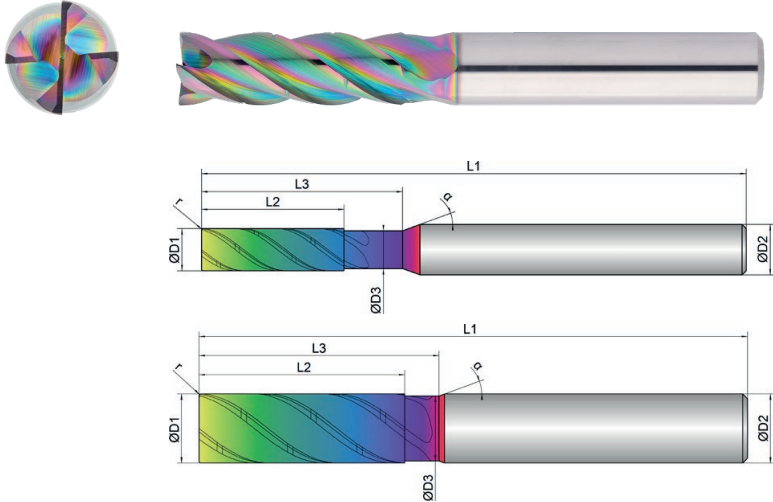
HA

≠

3xD

Expert

- Chip breaker for short, defined chip length
 - Unequal tooth pitch combined with variable helical pitch for smooth running
 - Reinforced face with 2 cutting edges to the center
- For roughing and finishing under ETC conditions
 - For process reliable, helical diving and immersion
- Ideal chip evacuation, even with high radial depth of cutting



Roughing

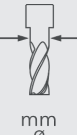
inappropriate

optimal

Finishing

inappropriate

optimal

EXN1-M03-0033	D1  mm ø	D3  mm ø	L2  mm	L3  mm	L1  mm	D2  mm ø	z  #	r  mm	 °	α  °
5	5.0	4.5	17.0	24.0	65.0	6.0	4	0.15	38	20
6	6.0	5.5	18.0	25.0	65.0	6.0	4	0.15	38	20
8	8.0	7.5	24.0	30.0	70.0	8.0	4	0.20	38	20
10	10.0	9.4	30.0	35.0	80.0	10.0	4	0.20	38	20
12	12.0	11.4	36.0	45.0	93.0	12.0	4	0.20	38	20
16	16.0	15.4	48.0	55.0	110.0	16.0	4	0.30	38	20
20	20.0	19.4	60.0	70.0	125.0	20.0	4	0.30	38	20



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Dimension	Ø5	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20			
Infeed in mm	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max			
Application										
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	
N	Vc (m/min)									
1.1	Aluminium, alloyed	<500	520	0.045	0.055	0.075	0.09	0.11	0.15	0.18
1.2	Aluminium, alloyed	<600	500	0.045	0.055	0.075	0.09	0.11	0.15	0.18
2.1-2.3	Aluminium, casted	<600	480	0.04	0.05	0.07	0.08	0.1	0.14	0.17
3.1-3.3	Cooper, alloyed	<650	220	0.03	0.04	0.06	0.07	0.09	0.13	0.16
4.1	Magnesium, alloyed	<250	520	0.045	0.055	0.075	0.09	0.11	0.15	0.18
5.1	Thermoplastic	<100								
5.2	Duroplastic	<150								

NOTE | From Ø 10 we recommend the use of HB shank and side lock arbor (EXN1-M03-0034).

STILL CAN'T FIND A SUITABLE MILLING CUTTER?

No problem - simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.



WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

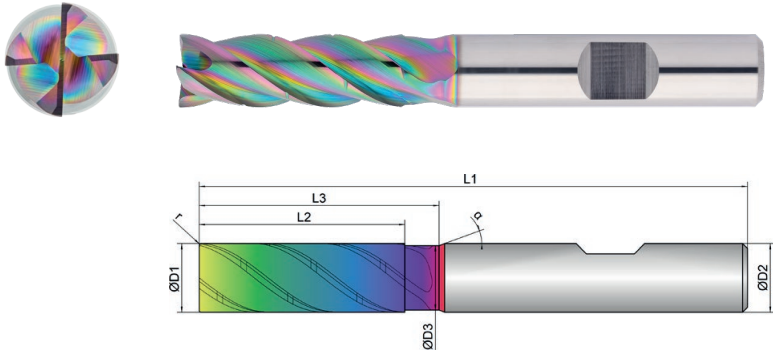
Strategy

ETC

Application

Features

- Chip breaker for short, defined chip length
 - Unequal tooth pitch combined with variable helical pitch for smooth running
 - Reinforced face with 2 cutting edges to the center
-
- For roughing and finishing under ETC conditions
 - For process reliable, helical diving and immersion
-
- Ideal chip evacuation, even with high radial depth of cutting



Roughing						Finishing				
inappropriate						optimal				

EXN1-M03-0034	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
10	10.0	9.4	30.0	35.0	80.0	10.0	4	0.20	38	20
12	12.0	11.4	36.0	45.0	93.0	12.0	4	0.20	38	20
16	16.0	15.4	48.0	55.0	110.0	16.0	4	0.30	38	20
20	20.0	19.4	60.0	70.0	125.0	20.0	4	0.30	38	20

Download Catalog Pages (PDF)

Dimension		Ø 10	Ø 12	Ø 16	Ø 20						
Infeed in mm		ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max	ae= 0.15xD ap= L2 max						
Application											
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz					
N Vc (m/min)											
1.1	Aluminium, alloyed	<500	520	0.09	0.11	0.15	0.18				
1.2	Aluminium, alloyed	<600	500	0.09	0.11	0.15	0.18				
2.1-2.3	Aluminium, casted	<600	480	0.08	0.1	0.14	0.17				
3.1-3.3	Cooper, alloyed	<650	220	0.07	0.09	0.13	0.16				
4.1	Magnesium, alloyed	<250	520	0.09	0.11	0.15	0.18				
5.1	Thermoplastic	<100									
5.2	Duroplastic	<150									

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

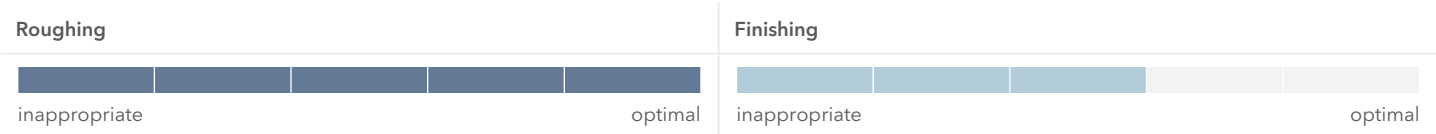
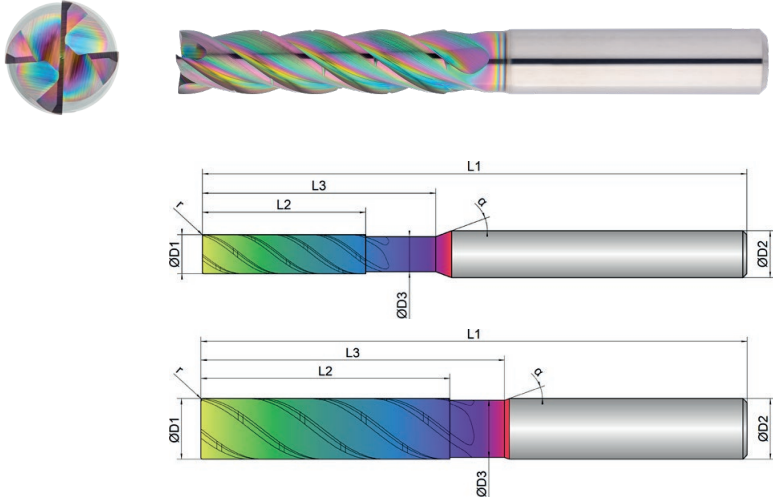
ETC

Application

Features

HA ≠ 4xD

- Chip breaker for short, defined chip length
 - Unequal tooth pitch combined with variable helical pitch for smooth running
 - Reinforced face with 2 cutting edges to the center
- For roughing and finishing under ETC conditions
 - For process reliable, helical immersion
- Ideal chip evacuation, even with high radial depth of cutting



EXN1-M03-0043	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
5	5.0	4.5	21.0	30.0	70.0	6.0	4	0.15	38	20
6	6.0	5.5	25.0	30.0	70.0	6.0	4	0.15	38	20
8	8.0	7.5	33.0	40.0	80.0	8.0	4	0.20	38	20
10	10.0	9.4	41.0	50.0	90.0	10.0	4	0.20	38	20
12	12.0	11.4	49.0	60.0	110.0	12.0	4	0.20	38	20
16	16.0	15.4	65.0	80.0	130.0	16.0	4	0.30	38	20
20	20.0	19.4	82.0	100.0	150.0	20.0	4	0.30	38	20

Download Catalog Pages (PDF)

Dimension	Ø5	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20			
Infeed in mm	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max			
Application										
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz		
N	Vc (m/min)									
1.1	Aluminium, alloyed	<500	520	0.04	0.05	0.07	0.085	0.1	0.14	0.17
1.2	Aluminium, alloyed	<600	500	0.04	0.05	0.07	0.085	0.1	0.14	0.17
2.1-2.3	Aluminium, casted	<600	480	0.035	0.045	0.065	0.08	0.09	0.13	0.16
3.1-3.3	Cooper, alloyed	<650	220	0.025	0.035	0.06	0.075	0.08	0.12	0.15
4.1	Magnesium, alloyed	<250	520	0.04	0.05	0.07	0.085	0.1	0.14	0.17
5.1	Thermoplastic	<100								
5.2	Duroplastic	<150								

NOTE | From Ø 10 we recommend the use of HB shank and side lock arbor (EXN1-M03-0044).

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

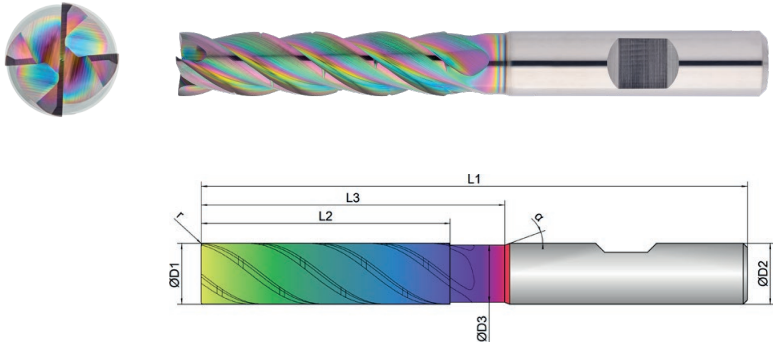
Strategy

ETC

Application

Features

- Chip breaker for short, defined chip length
 - Unequal tooth pitch combined with variable helical pitch for smooth running
 - Reinforced face with 2 cutting edges to the center
-
- For roughing and finishing under ETC conditions
 - For process reliable, helical immersion
-
- Ideal chip evacuation, even with high radial depth of cutting



Roughing						Finishing				
inappropriate						optimal				
EXN1-M03-0044	D1	D3	L2	L3	L1	D2	z	r		α
	mm ø	mm ø	mm	mm	mm	mm ø	#	mm	°	°
10	10.0	9.4	41.0	50.0	90.0	10.0	4	0.20	38	20
12	12.0	11.4	49.0	60.0	110.0	12.0	4	0.20	38	20
16	16.0	15.4	65.0	80.0	130.0	16.0	4	0.30	38	20
20	20.0	19.4	82.0	100.0	150.0	20.0	4	0.30	38	20

Download Catalog Pages (PDF)

Dimension		Ø 10	Ø 12	Ø 16	Ø 20						
Infeed in mm		ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max	ae= 0.1xD ap= L2 max						
Application											
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz					
N Vc (m/min)											
1.1	Aluminium, alloyed	<500	520	0.085	0.1	0.14	0.17				
1.2	Aluminium, alloyed	<600	500	0.085	0.1	0.14	0.17				
2.1-2.3	Aluminium, casted	<600	480	0.08	0.09	0.13	0.16				
3.1-3.3	Cooper, alloyed	<650	220	0.075	0.08	0.12	0.15				
4.1	Magnesium, alloyed	<250	520	0.085	0.1	0.14	0.17				
5.1	Thermoplastic	<100									
5.2	Duroplastic	<150									

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

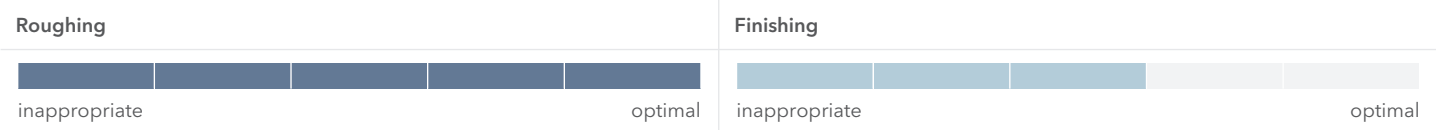
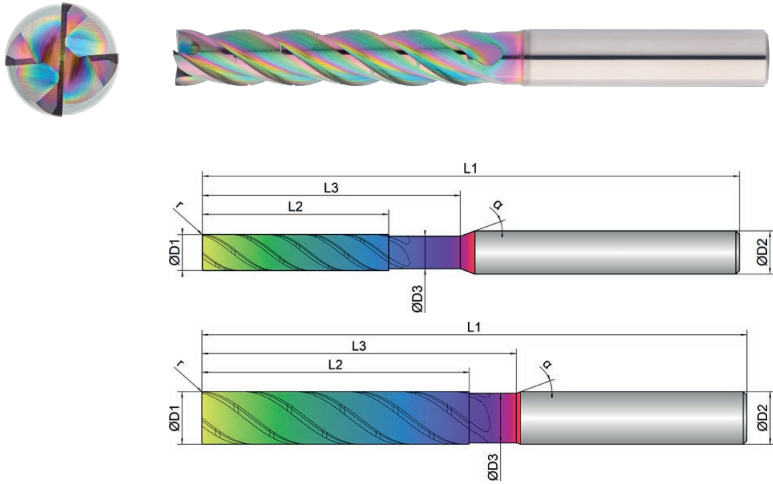
ETC

Application

Features

HA ≠ 5xD

- Chip breaker for short, defined chip length
 - Unequal tooth pitch combined with variable helical pitch for smooth running
 - Reinforced face with 2 cutting edges to the center
- For roughing and finishing under ETC conditions
 - For process reliable, helical immersion
- Ideal chip evacuation, even with high radial depth of cutting



	D1	D3	L2	L3	L1	D2	z	r		α
EXN1-M03-0053										
5	5.0	4.5	26.0	36.0	75.0	6.0	4	0.15	38	20
6	6.0	5.5	31.0	36.0	75.0	6.0	4	0.15	38	20
8	8.0	7.5	41.0	48.0	90.0	8.0	4	0.20	38	20
10	10.0	9.5	51.0	60.0	104.0	10.0	4	0.20	38	20
12	12.0	11.0	61.0	72.0	120.0	12.0	4	0.20	38	20
16	16.0	15.0	81.0	96.0	150.0	16.0	4	0.30	38	20
20	20.0	19.0	102.0	120.0	175.0	20.0	4	0.30	38	20



Download Catalog Pages (PDF)

		Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz			
Material										
1.1	Aluminium, alloyed	<500	500	0.035	0.05	0.065	0.08	0.095	0.13	0.16
1.2	Aluminium, alloyed	<600	480	0.035	0.05	0.065	0.08	0.095	0.13	0.16
2.1-2.3	Aluminium, casted	<600	460	0.03	0.045	0.06	0.07	0.085	0.12	0.15
3.1-3.3	Cooper, alloyed	<650	200	0.02	0.04	0.05	0.06	0.075	0.11	0.14
4.1	Magnesium, alloyed	<250	500	0.035	0.045	0.065	0.08	0.095	0.13	0.16
5.1	Thermoplastic	<100								
5.2	Duroplastic	<150								

NOTE | From Ø 10 we recommend the use of HB shank and side lock arbor (EXN1-M03-0054).

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

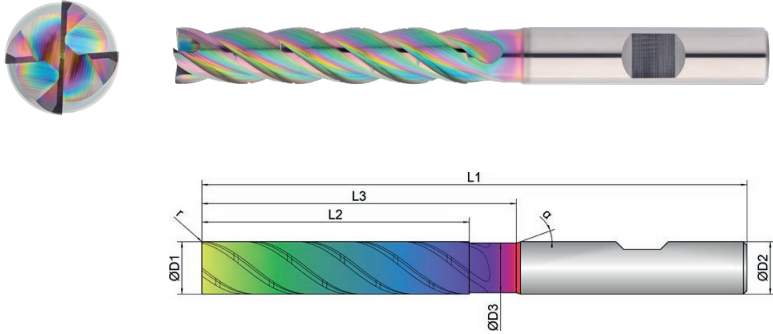
Strategy

ETC

Application

Features

- Chip breaker for short, defined chip length
 - Unequal tooth pitch combined with variable helical pitch for smooth running
 - Reinforced face with 2 cutting edges to the center
-
- For roughing and finishing under ETC conditions
 - For process reliable, helical immersion
-
- Ideal chip evacuation, even with high radial depth of cutting



Roughing						Finishing				
inappropriate						optimal				
EXN1-M03-0054	D1	D3	L2	L3	L1	D2	z	r		α
	mm ø	mm ø	mm	mm	mm	mm ø	#	mm	°	°
10	10.0	9.5	51.0	60.0	104.0	10.0	4	0.20	38	20
12	12.0	11.0	61.0	72.0	120.0	12.0	4	0.20	38	20
16	16.0	15.0	81.0	96.0	150.0	16.0	4	0.30	38	20
20	20.0	19.0	102.0	120.0	175.0	20.0	4	0.30	38	20

Download Catalog Pages (PDF)

Dimension		Ø 10	Ø 12	Ø 16	Ø 20						
Infeed in mm		ae= 0.07xD ap= L2 max	ae= 0.07xD ap= L2 max	ae= 0.07xD ap= L2 max	ae= 0.07xD ap= L2 max						
Application											
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz					
N Vc (m/min)											
1.1	Aluminium, alloyed	<500	500	0.08	0.095	0.13	0.16				
1.2	Aluminium, alloyed	<600	480	0.08	0.095	0.13	0.16				
2.1-2.3	Aluminium, casted	<600	460	0.07	0.085	0.12	0.15				
3.1-3.3	Cooper, alloyed	<650	200	0.06	0.075	0.11	0.14				
4.1	Magnesium, alloyed	<250	500	0.08	0.095	0.13	0.16				
5.1	Thermoplastic	<100									
5.2	Duroplastic	<150									

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

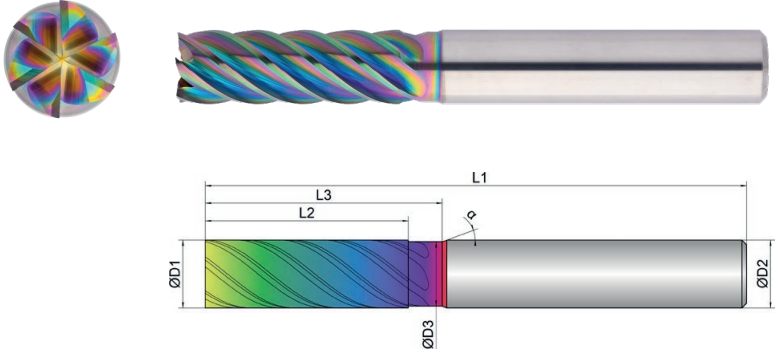
HPC

Application

Features

HA ≠ 3xD

- Ultra-sharp and lapped cutting edges
 - Special chip chambers designed for the evacuation of extra long and fine chips
 - Face-Finish-bevel for smooth workpiece surfaces
- For excellent surfaces and maximum dimensional accuracy
- 6 cutting edges for highest feed rates



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M04-0033	D1 mm Ø	D3 mm Ø	L2 mm	L3 mm	L1 mm	D2 mm Ø	z #	 °	α °
6	6.0	5.8	18.0	25.0	65.0	6.0	6	39	20
8	8.0	7.8	24.0	30.0	70.0	8.0	6	39	20
10	10.0	9.5	30.0	35.0	80.0	10.0	6	39	20
12	12.0	11.5	36.0	45.0	93.0	12.0	6	39	20
16	16.0	15.5	48.0	55.0	110.0	16.0	6	39	20
20	20.0	19.5	60.0	70.0	125.0	20.0	6	39	20

Download Catalog Pages (PDF)

Dimension	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20				
Infeed in mm	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max				
Application										
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz		
N	Vc (m/min)									
1.1	Aluminium, alloyed	<500	380	0.03	0.032	0.034	0.036	0.038	0.04	
1.2	Aluminium, alloyed	<600	360	0.03	0.032	0.034	0.036	0.038	0.04	
2.1-2.3	Aluminium, casted	<600	320	0.025	0.027	0.029	0.031	0.033	0.035	
3.1-3.3	Cooper, alloyed	<650	160	0.02	0.022	0.024	0.026	0.028	0.03	
4.1	Magnesium, alloyed	<250	350	0.03	0.032	0.034	0.036	0.038	0.04	
5.1	Thermoplastic	<100	300	0.025	0.027	0.029	0.031	0.033	0.035	
5.2	Duroplastic	<150	260	0.02	0.022	0.024	0.026	0.028	0.03	

NOTE | To achieve high surface quality, use ae = 0.2 mm for Ø 6 -10; ae = 0.3mm for Ø 12 -20.

STILL CAN'T FIND A SUITABLE MILLING CUTTER?

No problem - simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST



Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

HPC

Application

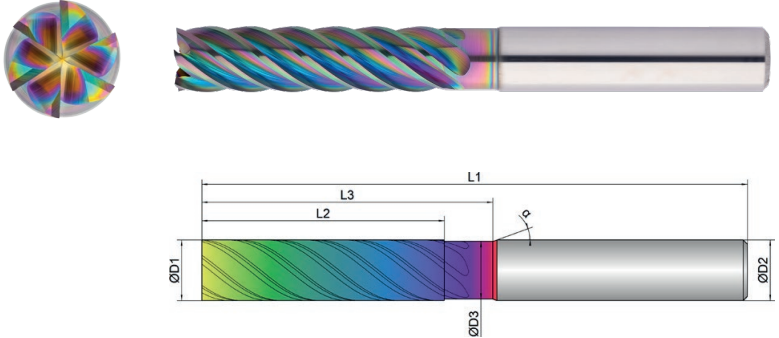
Features

HA

≠

4xD

- Ultra-sharp and lapped cutting edges
 - Special chip chambers designed for the evacuation of extra long and fine chips
 - Face-Finish-bevel for smooth workpiece surfaces
- For excellent surfaces and maximum dimensional accuracy
- 6 cutting edges for highest feed rates



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M04-0043	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	 °	α °
6	6.0	5.8	24.0	32.0	65.0	6.0	6	39	20
8	8.0	7.8	32.0	40.0	75.0	8.0	6	39	20
10	10.0	9.5	40.0	48.0	90.0	10.0	6	39	20
12	12.0	11.5	48.0	56.0	100.0	12.0	6	39	20
16	16.0	15.5	64.0	72.0	125.0	16.0	6	39	20
20	20.0	19.5	80.0	88.0	150.0	20.0	6	39	20

Download Catalog Pages (PDF)

Dimension	Ø6	Ø8	Ø10	Ø12	Ø16	Ø20				
Infeed in mm	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max				
Application										
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz		
N	Vc (m/min)									
1.1	Aluminium, alloyed	<500	380	0.03	0.032	0.034	0.036	0.038	0.04	
1.2	Aluminium, alloyed	<600	360	0.03	0.032	0.034	0.036	0.038	0.04	
2.1-2.3	Aluminium, casted	<600	320	0.025	0.027	0.029	0.031	0.033	0.035	
3.1-3.3	Cooper, alloyed	<650	160	0.02	0.022	0.024	0.026	0.028	0.03	
4.1	Magnesium, alloyed	<250	350	0.03	0.032	0.034	0.036	0.038	0.04	
5.1	Thermoplastic	<100	300	0.025	0.027	0.029	0.031	0.033	0.035	
5.2	Duroplastic	<150	260	0.02	0.022	0.024	0.026	0.028	0.03	

NOTE | To achieve high surface quality, use ae = 0.2 mm for Ø 6 -10; ae = 0.3mm for Ø 12 -20.

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

HPC

Application

Features

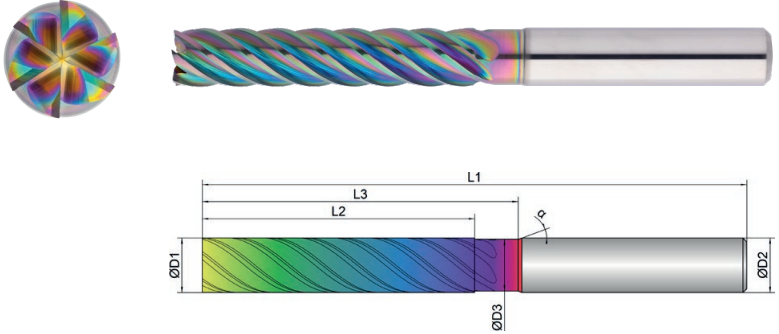
HA

≠

5xD

Expert

- Ultra-sharp and lapped cutting edges
 - Special chip chambers designed for the evacuation of extra long and fine chips
 - Face-Finish-bevel for smooth workpiece surfaces
- For excellent surfaces and maximum dimensional accuracy
- 6 cutting edges for highest feed rates



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M04-0053	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	 °	α °
6	6.0	5.8	30.0	38.0	75.0	6.0	6	39	20
8	8.0	7.8	40.0	48.0	80.0	8.0	6	39	20
10	10.0	9.5	50.0	58.0	100.0	10.0	6	39	20
12	12.0	11.5	60.0	68.0	120.0	12.0	6	39	20
16	16.0	15.5	80.0	88.0	134.0	16.0	6	39	20
20	20.0	19.5	100.0	108.0	175.0	20.0	6	39	20

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Dimension		Ø6	Ø8	Ø10	Ø12	Ø16	Ø20				
Infeed in mm		ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max	ae= 0.05xD ap= L2 max				
Application											
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz			
N	Vc (m/min)										
1.1	Aluminium, alloyed	<500	380	0.026	0.028	0.03	0.032	0.034	0.036		
1.2	Aluminium, alloyed	<600	360	0.026	0.028	0.03	0.032	0.034	0.036		
2.1-2.3	Aluminium, casted	<600	320	0.021	0.023	0.025	0.027	0.029	0.031		
3.1-3.3	Cooper, alloyed	<650	160	0.016	0.018	0.02	0.022	0.024	0.026		
4.1	Magnesium, alloyed	<250	350	0.026	0.028	0.03	0.032	0.034	0.036		
5.1	Thermoplastic	<100	300	0.021	0.023	0.025	0.027	0.029	0.031		
5.2	Duroplastic	<150	260	0.016	0.018	0.02	0.022	0.024	0.026		

NOTE | To achieve high surface quality, use ae = 0.2 mm for Ø 6 - 10; ae = 0.3mm for Ø 12 - 20.

Cooling

Tolerance

h10

Coating

AlphaSlide Rainbow

Strategy

HSC

HPC

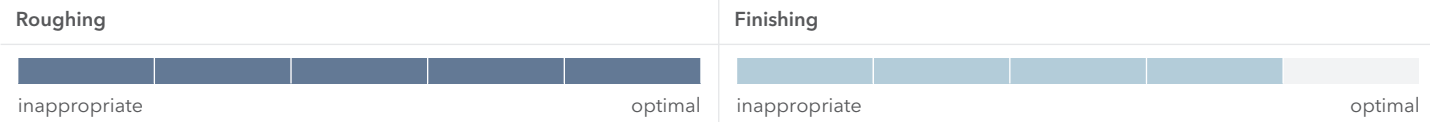
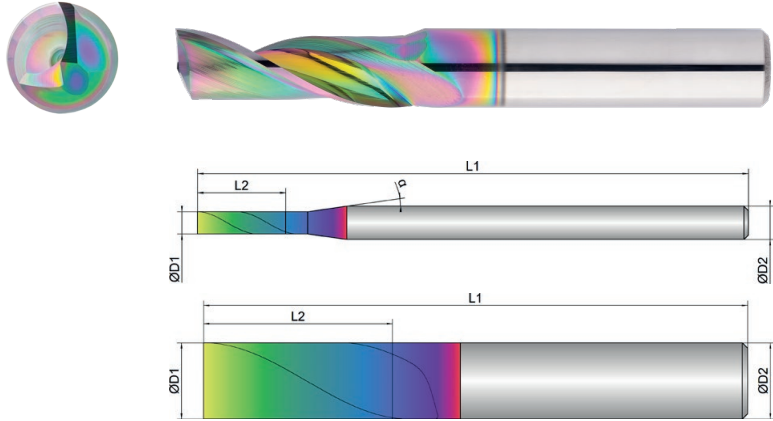
Application

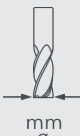
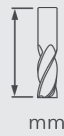
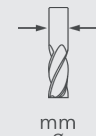
Features

HA

Expert

- Defined clearance angle for ideal stabilization with high cutting depths
- Special helical pitch for smooth running and soft cut
- Balanced for maximum smoothness

For roughing and finishing, up to 1.5xD full slotFor process reliable, helical diving and immersionFor use in high speed milling machines

EXN1-M05-0023	D1  mm ø	L2  mm	L1  mm	D2  mm ø	z  #	 °	α  °
1	1.0	4.0	50.0	3.0	1	30	8
1,5	1.5	6.0	50.0	3.0	1	30	8
2	2.0	8.0	50.0	3.0	1	30	8
3	3.0	12.0	50.0	3.0	1	30	0
4	4.0	15.0	54.0	4.0	1	30	0
5	5.0	17.0	54.0	5.0	1	30	0
6	6.0	20.0	65.0	6.0	1	30	0
8	8.0	22.0	63.0	8.0	1	30	0
10	10.0	25.0	72.0	10.0	1	30	0
12	12.0	30.0	83.0	12.0	1	30	0



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				Dimension		Ø1		Ø1.5		Ø2		Ø3		Ø4		Ø5	
				Infeed in mm	Application	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD
						ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD
																	
Material	Strength (N/mm²)	Feed (mm/Z)		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	
N		Vc (m/min)															
1.1	Aluminium, alloyed	<500	500	0.015	0.02	0.015	0.02	0.02	0.025	0.025	0.035	0.03	0.04	0.035	0.045		
1.2	Aluminium, alloyed	<600	480	0.015	0.02	0.015	0.02	0.02	0.025	0.025	0.035	0.03	0.04	0.035	0.045		
2.1-2.3	Aluminium, casted	<600	450	0.01	0.015	0.01	0.015	0.015	0.02	0.02	0.03	0.025	0.035	0.03	0.04		
3.1-3.3	Cooper, alloyed	<650	200	0.008	0.012	0.008	0.012	0.012	0.015	0.015	0.025	0.02	0.03	0.025	0.035		
4.1	Magnesium, alloyed	<250	500	0.015	0.02	0.015	0.02	0.02	0.025	0.025	0.035	0.03	0.04	0.035	0.045		
5.1	Thermoplastic	<100	400	0.01	0.015	0.01	0.015	0.015	0.02	0.02	0.03	0.025	0.035	0.03	0.04		
5.2	Duroplastic	<150	350	0.008	0.012	0.008	0.012	0.012	0.015	0.015	0.025	0.02	0.03	0.025	0.035		

				Dimension		Ø6		Ø8		Ø10		Ø12					
				Infeed in mm	Application	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD				
						ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD				
																	
Material	Strength (N/mm²)	Feed (mm/Z)		fz	fz	fz	fz	fz	fz	fz	fz						
N		Vc (m/min)															
1.1	Aluminium, alloyed	<500	500	0.045	0.055	0.05	0.06	0.06	0.07	0.075	0.1						
1.2	Aluminium, alloyed	<600	480	0.045	0.055	0.05	0.06	0.06	0.07	0.075	0.1						
2.1-2.3	Aluminium, casted	<600	450	0.04	0.05	0.045	0.055	0.055	0.065	0.07	0.09						
3.1-3.3	Cooper, alloyed	<650	200	0.035	0.045	0.04	0.05	0.05	0.06	0.06	0.08						
4.1	Magnesium, alloyed	<250	500	0.045	0.055	0.05	0.06	0.06	0.07	0.075	0.1						
5.1	Thermoplastic	<100	400	0.04	0.05	0.045	0.055	0.055	0.065	0.07	0.09						
5.2	Duroplastic	<150	350	0.035	0.045	0.04	0.05	0.05	0.06	0.06	0.08						

Cooling

Tolerance

h10

Coating

AlphaSlide Rainbow

Strategy

HSC

HPC

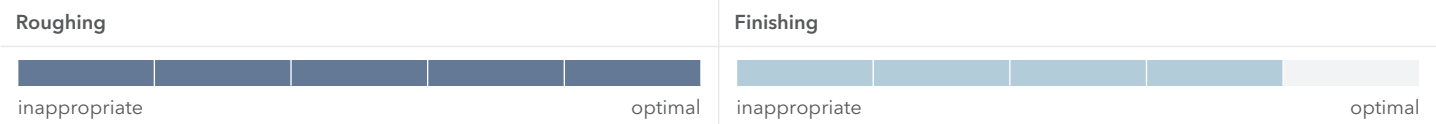
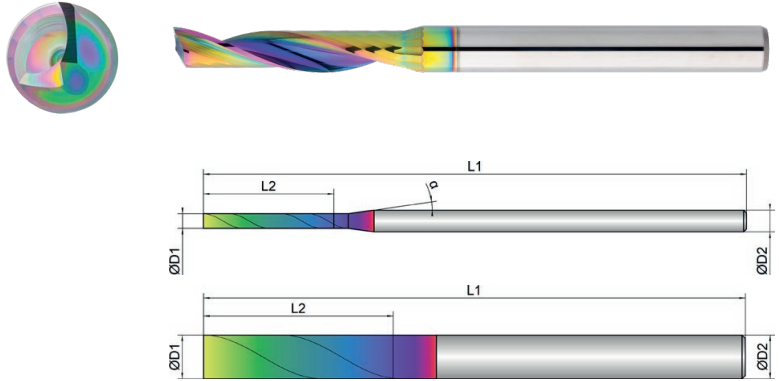
Application

Features

HA

Expert

- Defined clearance angle for ideal stabilization with high cutting depths
- Special helical pitch for smooth running and soft cut
- Balanced for maximum smoothness
- For roughing and finishing, up to 1.5xD full slot
- For process reliable, helical diving and immersion
- For use in high speed milling machines
- Long version with extra long cutting length



EXN1-M05-0053	D1 mm ø	L2 mm	L1 mm	D2 mm ø	z #	 °	α °
1	1.0	8.0	75.0	3.0	1	30	8
1,5	1.5	12.0	75.0	3.0	1	30	8
2	2.0	18.0	75.0	3.0	1	30	8
3	3.0	22.0	75.0	3.0	1	30	0
4	4.0	25.0	75.0	4.0	1	30	0
5	5.0	25.0	75.0	5.0	1	30	0
6	6.0	30.0	100.0	6.0	1	30	0
8	8.0	35.0	100.0	8.0	1	30	0
10	10.0	40.0	100.0	10.0	1	30	0
12	12.0	45.0	120.0	12.0	1	30	0



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		Dimension		Ø1		Ø1.5		Ø2		Ø3		Ø4		Ø5	
		Infeed in mm	Application	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD
				ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	
															
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	
N		Vc (m/min)													
1.1	Aluminium, alloyed	<500	450	0.008	0.012	0.008	0.012	0.015	0.02	0.02	0.025	0.025	0.03	0.03	0.038
1.2	Aluminium, alloyed	<600	425	0.008	0.012	0.008	0.012	0.015	0.02	0.02	0.025	0.025	0.03	0.03	0.038
2.1-2.3	Aluminium, casted	<600	400	0.006	0.01	0.006	0.01	0.01	0.015	0.015	0.02	0.02	0.025	0.025	0.033
3.1-3.3	Cooper, alloyed	<650	170	0.004	0.008	0.004	0.008	0.008	0.01	0.01	0.015	0.015	0.02	0.02	0.028
4.1	Magnesium, alloyed	<250	450	0.008	0.012	0.008	0.012	0.015	0.02	0.02	0.025	0.025	0.03	0.03	0.038
5.1	Thermoplastic	<100	350	0.006	0.01	0.006	0.01	0.01	0.015	0.015	0.02	0.02	0.025	0.025	0.033
5.2	Duroplastic	<150	300	0.004	0.008	0.004	0.008	0.008	0.01	0.01	0.015	0.015	0.02	0.02	0.028

		Dimension		Ø6		Ø8		Ø10		Ø12					
		Infeed in mm	Application	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD	ae=1xD	ae=0.3xD				
				ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD	ap=1xD				
															
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz					
N		Vc (m/min)													
1.1	Aluminium, alloyed	<500	450	0.038	0.048	0.043	0.053	0.05	0.06	0.065	0.09				
1.2	Aluminium, alloyed	<600	425	0.038	0.048	0.043	0.053	0.05	0.06	0.065	0.09				
2.1-2.3	Aluminium, casted	<600	400	0.033	0.043	0.038	0.048	0.045	0.055	0.06	0.08				
3.1-3.3	Cooper, alloyed	<650	170	0.028	0.038	0.033	0.043	0.04	0.05	0.055	0.07				
4.1	Magnesium, alloyed	<250	450	0.038	0.048	0.043	0.053	0.05	0.06	0.065	0.09				
5.1	Thermoplastic	<100	350	0.033	0.043	0.038	0.048	0.045	0.055	0.06	0.08				
5.2	Duroplastic	<150	300	0.028	0.038	0.033	0.043	0.04	0.05	0.055	0.07				

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

HSC

HPC

Application

Features

HA

≠

2xD

Expert

- Defined clearance angle for ideal stabilization with high cutting depths
- Special helical pitch for smooth running and soft cut
- Extra large chip chambers for an extreme chip volume

■

 For process reliable, helical diving and immersion

■

 For roughing and finishing, up to 1.5xD full slot

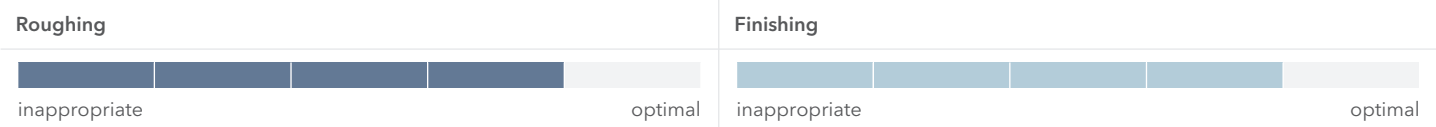
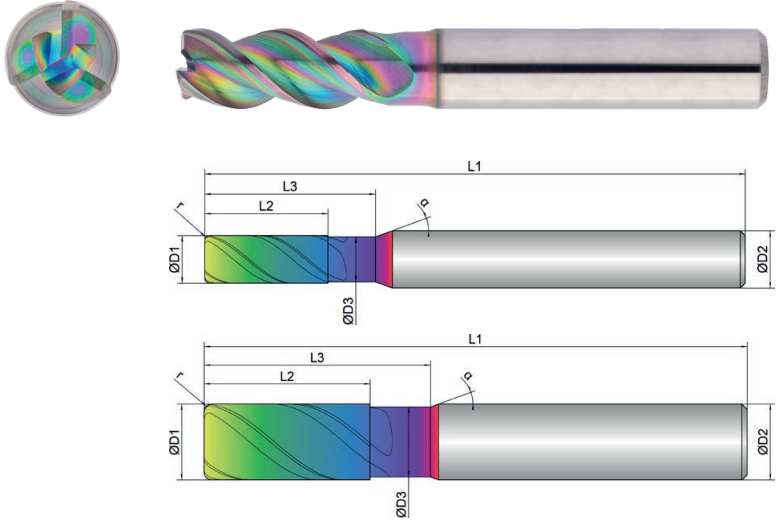
■

 Multipass milling of 3D contours

■

 Radius tolerance $r \leq 1.5\text{ mm}$: $\pm 0.003\text{ mm}$

■

 Radius tolerance $r > 1.5\text{ mm}$: $\pm 0.005\text{ mm}$ 

EXN1-M06-0003	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
5/0,5	5.0	4.7	13.0	18.0	57.0	6.0	3	0.50	45	20
5/1	5.0	4.7	13.0	18.0	57.0	6.0	3	1.00	45	20
6/0,5	6.0	5.7	13.0	18.0	57.0	6.0	3	0.50	45	20
6/1	6.0	5.7	13.0	18.0	57.0	6.0	3	1.00	45	20
8/0,5	8.0	7.4	21.0	25.0	63.0	8.0	3	0.50	45	20
8/1	8.0	7.4	21.0	25.0	63.0	8.0	3	1.00	45	20
10/0,5	10.0	9.2	22.0	30.0	72.0	10.0	3	0.50	45	20
10/1	10.0	9.2	22.0	30.0	72.0	10.0	3	1.00	45	20
10/2	10.0	9.2	22.0	30.0	72.0	10.0	3	2.00	45	20
12/0,5	12.0	11.0	26.0	36.0	83.0	12.0	3	0.50	45	20

EXN1-M06-0003	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
12/1	12.0	11.0	26.0	36.0	83.0	12.0	3	1.00	45	20
12/2	12.0	11.0	26.0	36.0	83.0	12.0	3	2.00	45	20
16/1	16.0	15.0	36.0	42.0	92.0	16.0	3	1.00	45	20
16/2	16.0	15.0	36.0	42.0	92.0	16.0	3	2.00	45	20
16/3	16.0	15.0	36.0	42.0	92.0	16.0	3	3.00	45	20
20/1	20.0	19.0	41.0	52.0	104.0	20.0	3	1.00	45	20
20/2	20.0	19.0	41.0	52.0	104.0	20.0	3	2.00	45	20
20/3	20.0	19.0	41.0	52.0	104.0	20.0	3	3.00	45	20
20/4	20.0	19.0	41.0	52.0	104.0	20.0	3	4.00	45	20



Download Catalog
Pages (PDF)

 Download Catalog Pages (PDF)				Dimension			Ø 5			Ø 6			Ø 8			Ø 10		
				Infeed in mm	ae=1xD ap=1xD	ae=0.3xD ap=1xD	ae=0.04xD ap=0.04xD	ae=1xD ap=1xD	ae=0.3xD ap=1xD	ae=0.04xD ap=0.04xD	ae=1xD ap=1xD	ae=0.3xD ap=1xD	ae=0.04xD ap=0.04xD	ae=1xD ap=1xD	ae=0.3xD ap=1xD	ae=0.04xD ap=0.04xD		
				Application														
		Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	
N		Vc (m/min)																
1.1	Aluminium, alloyed	<500	500	0.055	0.07	0.08	0.06	0.08	0.09	0.08	0.1	0.11	0.09	0.12	0.13			
1.2	Aluminium, alloyed	<600	480	0.055	0.07	0.08	0.06	0.08	0.09	0.08	0.1	0.11	0.09	0.12	0.13			
2.1-2.3	Aluminium, casted	<600	450	0.05	0.065	0.075	0.055	0.075	0.085	0.075	0.09	0.1	0.08	0.11	0.12			
3.1-3.3	Cooper, alloyed	<650	200	0.045	0.06	0.07	0.05	0.07	0.08	0.07	0.085	0.095	0.075	0.1	0.11			
4.1	Magnesium, alloyed	<250	500	0.055	0.07	0.08	0.06	0.08	0.09	0.08	0.1	0.11	0.09	0.12	0.13			
5.1	Thermoplastic	<100	400	0.04	0.05	0.06	0.045	0.065	0.075	0.055	0.065	0.075	0.065	0.085	0.095			
5.2	Duroplastic	<150	350	0.035	0.04	0.05	0.035	0.055	0.065	0.045	0.055	0.065	0.055	0.075	0.085			

				Dimension			Ø 12			Ø 16			Ø 20					
				Infeed in mm	ae=1xD ap=1xD	ae=0.3xD ap=1xD	ae=0.04xD ap=0.04xD	ae=1xD ap=1xD	ae=0.3xD ap=1xD	ae=0.04xD ap=0.04xD	ae=1xD ap=1xD	ae=0.3xD ap=1xD	ae=0.04xD ap=0.04xD					
				Application														
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz					
N		Vc (m/min)																
1.1	Aluminium, alloyed	<500	500	0.1	0.14	0.16	0.14	0.18	0.2	0.18	0.22	0.24						
1.2	Aluminium, alloyed	<600	480	0.1	0.14	0.16	0.14	0.18	0.2	0.18	0.22	0.24						
2.1-2.3	Aluminium, casted	<600	450	0.09	0.13	0.15	0.13	0.17	0.19	0.17	0.2	0.22						
3.1-3.3	Cooper, alloyed	<650	200	0.085	0.12	0.14	0.12	0.16	0.18	0.16	0.18	0.2						
4.1	Magnesium, alloyed	<250	500	0.1	0.14	0.16	0.14	0.18	0.2	0.18	0.22	0.24						
5.1	Thermoplastic	<100	400	0.075	0.11	0.12	0.11	0.13	0.14	0.13	0.17	0.18						
5.2	Duroplastic	<150	350	0.065	0.1	0.11	0.1	0.12	0.13	0.12	0.16	0.17						

NOTE | By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius!

Cooling

Tolerance

h6

Coating

AlphaSlide Rainbow

Strategy

HSC

HPC

Application

Features

HA

≠

Expert

- Defined clearance angle for ideal stabilization with high cutting depths

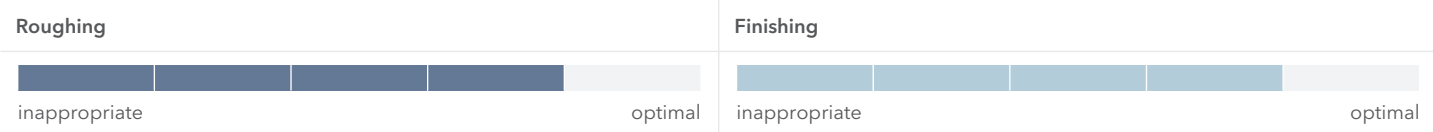
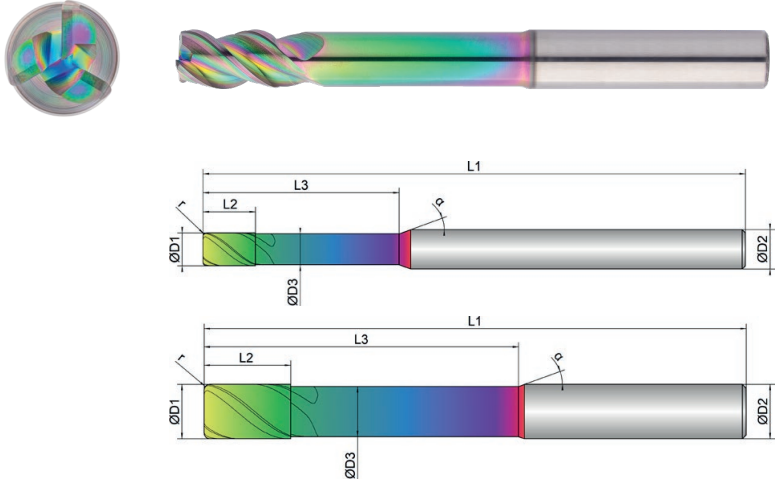
Special helical pitch for smooth running and soft cut

Extra large chip chambers for an extreme chip volume
- Long version for deeper cavities

For roughing and finishing

Multipass milling of 3D contours
- Radius tolerance $r \leq 1.5$ mm: ± 0.003 mm

Radius tolerance $r > 1.5$ mm: ± 0.005 mm



EXN1-M06-0013	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	 °
5/0,5	5.0	4.7	8.0	30.0	83.0	6.0	3	0.50	45	20
5/1	5.0	4.7	8.0	30.0	83.0	6.0	3	1.00	45	20
6/0,5	6.0	5.7	10.0	42.0	83.0	6.0	3	0.50	45	20
6/1	6.0	5.7	10.0	42.0	83.0	6.0	3	1.00	45	20
8/0,5	8.0	7.4	13.0	62.0	100.0	8.0	3	0.50	45	20
8/1	8.0	7.4	13.0	62.0	100.0	8.0	3	1.00	45	20
10/0,5	10.0	9.2	16.0	58.0	100.0	10.0	3	0.50	45	20
10/1	10.0	9.2	16.0	58.0	100.0	10.0	3	1.00	45	20
10/2	10.0	9.2	16.0	58.0	100.0	10.0	3	2.00	45	20
12/0,5	12.0	11.0	19.0	73.0	119.0	12.0	3	0.50	45	20

EXN1-M06-0013	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	 °
12/1	12.0	11.0	19.0	73.0	119.0	12.0	3	1.00	45	20
12/2	12.0	11.0	19.0	73.0	119.0	12.0	3	2.00	45	20
16/1	16.0	15.0	25.0	100.0	150.0	16.0	3	1.00	45	20
16/2	16.0	15.0	25.0	100.0	150.0	16.0	3	2.00	45	20
16/3	16.0	15.0	25.0	100.0	150.0	16.0	3	3.00	45	20
20/1	20.0	19.0	32.0	98.0	150.0	20.0	3	1.00	45	20
20/2	20.0	19.0	32.0	98.0	150.0	20.0	3	2.00	45	20
20/3	20.0	19.0	32.0	98.0	150.0	20.0	3	3.00	45	20
20/4	20.0	19.0	32.0	98.0	150.0	20.0	3	4.00	45	20



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			Dimension	Ø 5		Ø 6		Ø 8		Ø 10		Ø 12		Ø 16	
			Infeed in mm	ae= 0.3xD	ae= 0.04xD	ae= 0.3xD	ae= 0.04xD	ae= 0.3xD	ae= 0.04xD	ae= 0.3xD	ae= 0.04xD	ae= 0.3xD	ae= 0.04xD	ae= 0.3xD	ae= 0.04xD
				ap= 1xD	ap= 0.04xD	ap= 1xD	ap= 0.04xD	ap= 1xD	ap= 0.04xD	ap= 1xD	ap= 0.04xD	ap= 1xD	ap= 0.04xD	ap= 1xD	ap= 0.04xD
			Application												
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	280	0.065	0.075	0.065	0.075	0.075	0.085	0.09	0.1	0.1	0.12	0.12	0.14
1.2	Aluminium, alloyed	<600	260	0.065	0.075	0.065	0.075	0.075	0.085	0.09	0.1	0.1	0.12	0.12	0.14
2.1-2.3	Aluminium, casted	<600	240	0.055	0.065	0.055	0.065	0.065	0.075	0.08	0.09	0.09	0.11	0.11	0.13
3.1-3.3	Cooper, alloyed	<650	120	0.045	0.055	0.045	0.055	0.055	0.065	0.07	0.08	0.08	0.1	0.1	0.12
4.1	Magnesium, alloyed	<250	280	0.065	0.075	0.065	0.075	0.075	0.085	0.09	0.1	0.1	0.12	0.12	0.14
5.1	Thermoplastic	<100	200	0.055	0.065	0.055	0.065	0.065	0.075	0.08	0.09	0.09	0.11	0.11	0.13
5.2	Duroplastic	<150	170	0.045	0.055	0.045	0.055	0.055	0.065	0.07	0.08	0.08	0.1	0.1	0.12

			Dimension	Ø 20							
			Infeed in mm	ae= 0.3xD	ae= 0.04xD						
				ap= 1xD	ap= 0.04xD						
			Application								
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz							
N	Vc (m/min)										
1.1	Aluminium, alloyed	<500	280	0.14	0.16						
1.2	Aluminium, alloyed	<600	260	0.14	0.16						
2.1-2.3	Aluminium, casted	<600	240	0.13	0.15						
3.1-3.3	Cooper, alloyed	<650	120	0.12	0.14						
4.1	Magnesium, alloyed	<250	280	0.14	0.16						
5.1	Thermoplastic	<100	200	0.13	0.15						
5.2	Duroplastic	<150	170	0.12	0.14						

NOTE | By using multipass milling the maximum infeed (ae, ap) is 0.5x corner radius!

Cooling

Tolerance

f8

Coating

AlphaSlide Rainbow

Strategy

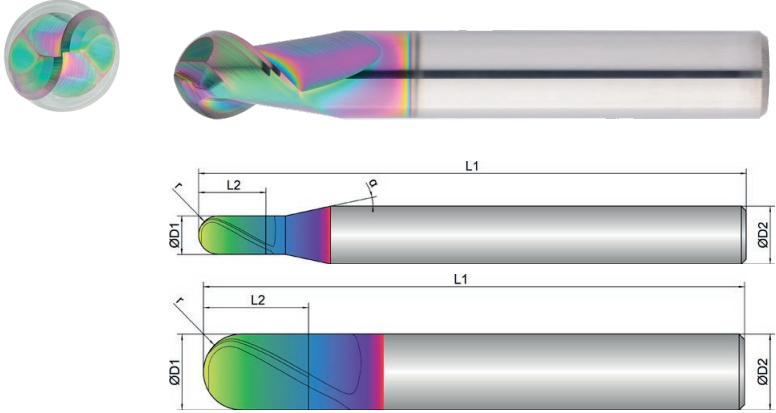
HSC

Application

Features

HA

- Optimized face geometry for excellent surfaces
 - Defined microlevel for support and stabilization
 - Special chip chambers designed for optimal chip evacuation
- For use in HSC milling
 - For roughing and finishing
- Radius tolerance $r \leq 2\text{ mm}$: $\pm 0.003\text{ mm}$
 - Radius tolerance $r > 2\text{ mm}$: $\pm 0.005\text{ mm}$



Roughing				Finishing				
inappropriate				inappropriate				
EXN1-M08-0003	D1	L2	L1	D2	z	r		α
	mm Ø	mm	mm	mm Ø	#	mm	°	°
	0,5	1.0	55.0	6.0	2	0.25	45	12
	1	2.0	55.0	6.0	2	0.50	45	12
	2	4.0	55.0	6.0	2	1.00	45	12
	3	6.0	55.0	6.0	2	1.50	45	12
	4	7.0	55.0	6.0	2	2.00	45	12
	5	8.0	55.0	6.0	2	2.50	45	12
	6	10.0	55.0	6.0	2	3.00	45	0
	8	12.0	63.0	8.0	2	4.00	45	0
	10	14.0	72.0	10.0	2	5.00	45	0
	12	16.0	74.0	12.0	2	6.00	45	0



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Pages (PDF)

		Dimension	Ø0.5	Ø1	Ø2	Ø3	Ø4	Ø5	Ø6	Ø8	Ø10	Ø12	
		Infeed in mm	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	ae=0.05xD ap=0.05xD	
		Application											
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	
N		Vc (m/min)											
1.1	Aluminium, alloyed	<500	650	0.01	0.015	0.02	0.025	0.03	0.05	0.06	0.07	0.08	0.09
1.2	Aluminium, alloyed	<600	620	0.01	0.015	0.02	0.025	0.03	0.05	0.06	0.07	0.08	0.09
2.1-2.3	Aluminium, casted	<600	550	0.008	0.012	0.018	0.022	0.026	0.045	0.055	0.065	0.075	0.08
3.1-3.3	Cooper, alloyed	<650	280	0.006	0.008	0.015	0.018	0.022	0.04	0.05	0.06	0.07	0.07
4.1	Magnesium, alloyed	<250	650	0.01	0.015	0.02	0.025	0.03	0.05	0.06	0.07	0.08	0.09
5.1	Thermoplastic	<100	500	0.008	0.012	0.018	0.022	0.026	0.045	0.055	0.065	0.075	0.08
5.2	Duroplastic	<150	400	0.006	0.008	0.015	0.018	0.022	0.04	0.05	0.06	0.07	0.07

STILL CAN'T FIND A SUITABLE MILLING CUTTER?

No problem - simply customize an existing tool. Using our configurator for special milling cutters, you can customize existing tools to your needs in an instant or create your own tools based on predefined types.

WE WILL RESPOND TO ALL REQUESTS SUBMITTED VIA THE CONFIGURATOR WITHIN ONE WORKING DAY AT THE LATEST

Cooling

Tolerance

f8

Coating

AlphaSlide Rainbow

Strategy

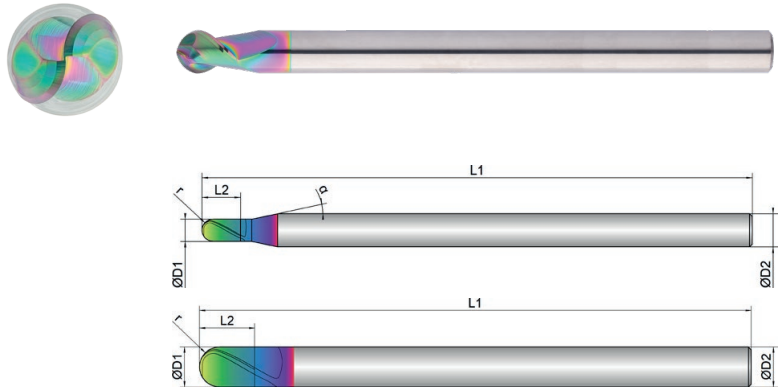
HSC

Application

Features

HA

- Optimized face geometry for excellent surfaces
 - Defined microbevel for support and stabilization
 - Special chip chambers designed for optimal chip evacuation
- Long version for deeper cavities
 - For use in HSC milling
 - For roughing and finishing
- Radius tolerance $r \leq 2\text{ mm}$: $\pm 0.003\text{ mm}$
 - Radius tolerance $r > 2\text{ mm}$: $\pm 0.005\text{ mm}$



Roughing					Finishing			
inappropriateoptimal					inappropriateoptimal			
EXN1-M08-0013	D1 mm Ø	L2 mm	L1 mm	D2 mm Ø	z #	r mm	 °	α °
0,5	0.5	1.0	75.0	6.0	2	0.25	45	12
1	1.0	2.0	75.0	6.0	2	0.50	45	12
2	2.0	4.0	75.0	6.0	2	1.00	45	12
3	3.0	6.0	75.0	6.0	2	1.50	45	12
4	4.0	7.0	75.0	6.0	2	2.00	45	12
5	5.0	8.0	100.0	6.0	2	2.50	45	12
6	6.0	10.0	100.0	6.0	2	3.00	45	0
8	8.0	12.0	100.0	8.0	2	4.00	45	0
10	10.0	14.0	100.0	10.0	2	5.00	45	0
12	12.0	16.0	100.0	12.0	2	6.00	45	0

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Dimension		Ø0.5	Ø1	Ø2	Ø3	Ø4	Ø5	Ø6	Ø8	Ø10	Ø12		
Infeed in mm		ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD	ae= 0.05xD ap= 0.05xD		
Application													
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz		
N Vc (m/min)													
1.1	Aluminium, alloyed	<500	550	0.008	0.013	0.018	0.022	0.025	0.045	0.055	0.06	0.07	0.08
1.2	Aluminium, alloyed	<600	525	0.008	0.013	0.018	0.022	0.025	0.045	0.055	0.06	0.07	0.08
2.1-2.3	Aluminium, casted	<600	460	0.006	0.01	0.016	0.019	0.022	0.04	0.05	0.055	0.065	0.07
3.1-3.3	Cooper, alloyed	<650	240	0.005	0.007	0.014	0.016	0.018	0.035	0.045	0.05	0.06	0.06
4.1	Magnesium, alloyed	<250	550	0.008	0.013	0.018	0.022	0.025	0.045	0.055	0.06	0.07	0.08
5.1	Thermoplastic	<100	420	0.006	0.01	0.016	0.019	0.022	0.04	0.05	0.055	0.065	0.07
5.2	Duroplastic	<150	340	0.005	0.007	0.014	0.016	0.018	0.035	0.045	0.05	0.06	0.06

Cooling

Tolerance

d04

Coating

AlphaSlide Rainbow

Strategy

HSC

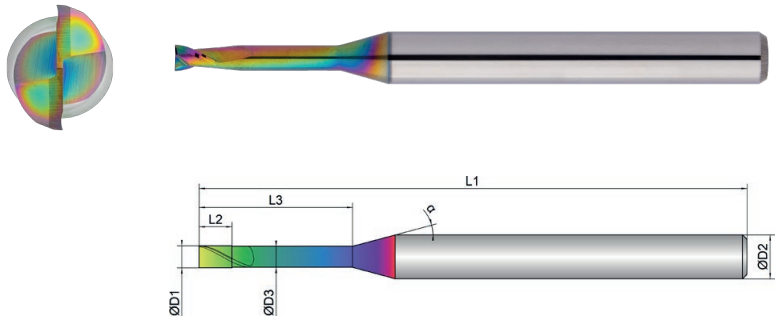
Application

Features

HA

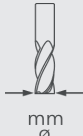
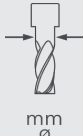
Expert

- Optimized face geometry for excellent surfaces
- Defined microlevel for support and stabilization
- Polished chip space for ideal chip evacuation



Roughing					Finishing				
inappropriateoptimal					inappropriateoptimal				
EXN1-M15-0003	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	 °	α °
0,2X0,5	0.2	0.18	0.3	0.5	45.0	4.0	2	30	16
0,2X1	0.2	0.18	0.3	1.0	45.0	4.0	2	30	16
0,2X1,5	0.2	0.18	0.3	1.5	45.0	4.0	2	30	16
0,3X1	0.3	0.28	0.4	1.0	45.0	4.0	2	30	16
0,3X2	0.3	0.28	0.4	2.0	45.0	4.0	2	30	16
0,4X2	0.4	0.38	0.6	2.0	45.0	4.0	2	30	16
0,4X3	0.4	0.38	0.6	3.0	45.0	4.0	2	30	16
0,5X2	0.5	0.48	0.7	2.0	45.0	4.0	2	30	16
0,5X4	0.5	0.48	0.7	4.0	45.0	4.0	2	30	16
0,5X6	0.5	0.48	0.7	6.0	45.0	4.0	2	30	16
0,6X2	0.6	0.58	0.9	2.0	45.0	4.0	2	30	16
0,6X4	0.6	0.58	0.9	4.0	45.0	4.0	2	30	16
0,6X6	0.6	0.58	0.9	6.0	45.0	4.0	2	30	16
0,7X2	0.7	0.68	1.0	2.0	45.0	4.0	2	30	16

EXN1-M15-0003	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	 °	α °
0,7X4	0.7	0.68	1.0	4.0	45.0	4.0	2	30	16
0,8X4	0.8	0.78	1.2	4.0	45.0	4.0	2	30	16
0,8X6	0.8	0.78	1.2	6.0	45.0	4.0	2	30	16
0,8X8	0.8	0.78	1.2	8.0	45.0	4.0	2	30	16
1X4	1.0	0.95	1.5	4.0	45.0	4.0	2	30	16
1X6	1.0	0.95	1.5	6.0	45.0	4.0	2	30	16
1X8	1.0	0.95	1.5	8.0	45.0	4.0	2	30	16
1X10	1.0	0.95	1.5	10.0	45.0	4.0	2	30	16
1X12	1.0	0.95	1.5	12.0	45.0	4.0	2	30	16
1X14	1.0	0.95	1.5	14.0	45.0	4.0	2	30	16
1X16	1.0	0.95	1.5	16.0	50.0	4.0	2	30	16
1X25	1.0	0.95	1.5	25.0	70.0	4.0	2	30	16
1,2X6	1.2	1.14	1.8	6.0	45.0	4.0	2	30	16
1,2X8	1.2	1.14	1.8	8.0	45.0	4.0	2	30	16
1,2X10	1.2	1.14	1.8	10.0	45.0	4.0	2	30	16
1,4X6	1.4	1.34	2.1	6.0	45.0	4.0	2	30	16
1,4X8	1.4	1.34	2.1	8.0	45.0	4.0	2	30	16
1,5X6	1.5	1.44	2.3	6.0	45.0	4.0	2	30	16
1,5X8	1.5	1.44	2.3	8.0	45.0	4.0	2	30	16
1,5X10	1.5	1.44	2.3	10.0	45.0	4.0	2	30	16
1,5X12	1.5	1.44	2.3	12.0	45.0	4.0	2	30	16
1,5X14	1.5	1.44	2.3	14.0	50.0	4.0	2	30	16
1,5X16	1.5	1.44	2.3	16.0	50.0	4.0	2	30	16
1,5X20	1.5	1.44	2.3	20.0	54.0	4.0	2	30	16
1,5X25	1.5	1.44	2.3	25.0	70.0	4.0	2	30	16

EXN1-M15-0003	D1	D3	L2	L3	L1	D2	z		α
									
1,6X6	1.6	1.51	2.4	6.0	45.0	4.0	2	30	16
1,6X10	1.6	1.51	2.4	10.0	45.0	4.0	2	30	16
1,8X6	1.8	1.71	2.7	6.0	45.0	4.0	2	30	16
1,8X8	1.8	1.71	2.7	8.0	45.0	4.0	2	30	16
1,8X10	1.8	1.71	2.7	10.0	45.0	4.0	2	30	16
2X6	2.0	1.91	3.0	6.0	45.0	4.0	2	30	16
2X8	2.0	1.91	3.0	8.0	45.0	4.0	2	30	16
2X10	2.0	1.91	3.0	10.0	45.0	4.0	2	30	16
2X12	2.0	1.91	3.0	12.0	45.0	4.0	2	30	16
2X14	2.0	1.91	3.0	14.0	50.0	4.0	2	30	16
2X16	2.0	1.91	3.0	16.0	50.0	4.0	2	30	16
2X20	2.0	1.91	3.0	20.0	54.0	4.0	2	30	16
2X25	2.0	1.91	3.0	25.0	60.0	4.0	2	30	16
2X30	2.0	1.91	3.0	30.0	70.0	4.0	2	30	16
2X35	2.0	1.91	3.0	35.0	80.0	4.0	2	30	16
2,5X8	2.5	2.41	3.7	8.0	45.0	4.0	2	30	16
2,5X12	2.5	2.41	3.7	12.0	45.0	4.0	2	30	16
2,5X16	2.5	2.41	3.7	16.0	50.0	4.0	2	30	16
2,5X20	2.5	2.41	3.7	20.0	54.0	4.0	2	30	16
2,5X25	2.5	2.41	3.7	25.0	60.0	4.0	2	30	16
2,5X30	2.5	2.41	3.7	30.0	70.0	4.0	2	30	16



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			Dimension		Ø 0.2x0.5		Ø 0.2x1.5		Ø 0.3x1		Ø 0.3x2		Ø 0.4x2		Ø 0.4x3	
			Infeed in mm		ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.2xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.23xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.23xD
			Application		ap= 0.2xD	ap= L2 max	ap= 0.18xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.18xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.18xD	ap= L2 max
																
			Feed (mm/Z)		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
			N	Vc (m/min)												
1.1	Aluminium, alloyed	<500	500		0.008	0.012	0.007	0.011	0.012	0.016	0.011	0.015	0.012	0.016	0.011	0.015
1.2	Aluminium, alloyed	<600	480		0.008	0.012	0.007	0.011	0.012	0.016	0.011	0.015	0.012	0.016	0.011	0.015
2.1-2.3	Aluminium, casted	<600	450		0.007	0.011	0.006	0.01	0.011	0.015	0.01	0.014	0.011	0.015	0.01	0.014
3.1-3.3	Cooper, alloyed	<650	220		0.006	0.01	0.005	0.009	0.01	0.014	0.009	0.013	0.01	0.014	0.009	0.013
4.1	Magnesium, alloyed	<250	500		0.008	0.012	0.007	0.011	0.012	0.016	0.011	0.015	0.012	0.016	0.011	0.015
5.1	Thermoplastic	<100	400		0.007	0.011	0.006	0.01	0.011	0.015	0.01	0.014	0.011	0.015	0.01	0.014
5.2	Duroplastic	<150	350		0.006	0.01	0.005	0.009	0.01	0.014	0.009	0.013	0.01	0.014	0.009	0.013

			Dimension		Ø 0.5x2		Ø 0.5x6		Ø 0.6x2		Ø 0.6x6		Ø 0.7x2		Ø 0.7x4	
			Infeed in mm		ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.12xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.12xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.23xD
			Application		ap= 0.2xD	ap= L2 max	ap= 0.1xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.1xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.18xD	ap= L2 max
																
			Feed (mm/Z)		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
			N	Vc (m/min)												
1.1	Aluminium, alloyed	<500	500		0.016	0.02	0.013	0.017	0.016	0.02	0.013	0.017	0.016	0.02	0.015	0.018
1.2	Aluminium, alloyed	<600	480		0.016	0.02	0.013	0.017	0.016	0.02	0.013	0.017	0.016	0.02	0.015	0.018
2.1-2.3	Aluminium, casted	<600	450		0.015	0.018	0.012	0.015	0.015	0.018	0.012	0.015	0.015	0.018	0.014	0.016
3.1-3.3	Cooper, alloyed	<650	220		0.014	0.016	0.011	0.013	0.014	0.016	0.011	0.013	0.014	0.016	0.013	0.014
4.1	Magnesium, alloyed	<250	500		0.016	0.02	0.013	0.017	0.016	0.02	0.013	0.017	0.016	0.02	0.015	0.018
5.1	Thermoplastic	<100	400		0.015	0.018	0.012	0.015	0.015	0.018	0.012	0.015	0.015	0.018	0.014	0.016
5.2	Duroplastic	<150	350		0.014	0.016	0.011	0.013	0.014	0.016	0.011	0.013	0.014	0.016	0.013	0.014

			Dimension		Ø 0.8x4		Ø 0.8x8		Ø 1x4		Ø 1x25		Ø 1.2x6		Ø 1.2x10	
			Infeed in mm		ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.2xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.025xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.2xD
			Application		ap= 0.2xD	ap= L2 max	ap= 0.16xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.02xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.16xD	ap= L2 max
																
			Feed (mm/Z)		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
			N	Vc (m/min)												
1.1	Aluminium, alloyed	<500	500		0.018	0.022	0.016	0.02	0.025	0.03	0.015	0.02	0.025	0.03	0.023	0.028
1.2	Aluminium, alloyed	<600	480		0.018	0.022	0.016	0.02	0.025	0.03	0.015	0.02	0.025	0.03	0.023	0.028
2.1-2.3	Aluminium, casted	<600	450		0.016	0.02	0.014	0.018	0.022	0.027	0.013	0.018	0.022	0.027	0.02	0.025
3.1-3.3	Cooper, alloyed	<650	220		0.014	0.018	0.012	0.016	0.019	0.024	0.011	0.016	0.019	0.024	0.017	0.022
4.1	Magnesium, alloyed	<250	500		0.018	0.022	0.016	0.02	0.025	0.03	0.015	0.02	0.025	0.03	0.023	0.028
5.1	Thermoplastic	<100	400		0.016	0.02	0.014	0.018	0.022	0.027	0.013	0.018	0.022	0.027	0.02	0.025
5.2	Duroplastic	<150	350		0.014	0.018	0.012	0.016	0.019	0.024	0.011	0.016	0.019	0.024	0.017	0.022

NOTE | Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.

			Dimension	Ø1.4x6		Ø1.4x8		Ø1.5x6		Ø1.5x25		Ø1.6x6		Ø1.6x10		
	Material	Strength (N/mm²)	Infeed in mm	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.23xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.04xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.23xD	
			Application	ap= 0.2xD	ap= L2 max	ap= 0.18xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.03xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.18xD	ap= L2 max	
Feed (mm/Z)			fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
N			Vc (m/min)													
1.1	Aluminium, alloyed	<500	500	0.025	0.03	0.024	0.028	0.025	0.03	0.018	0.023	0.03	0.035	0.028	0.033	
1.2	Aluminium, alloyed	<600	480	0.025	0.03	0.024	0.028	0.025	0.03	0.018	0.023	0.03	0.035	0.028	0.033	
2.1-2.3	Aluminium, casted	<600	450	0.022	0.027	0.021	0.025	0.022	0.027	0.015	0.02	0.027	0.031	0.025	0.03	
3.1-3.3	Cooper, alloyed	<650	220	0.019	0.024	0.018	0.022	0.019	0.024	0.012	0.017	0.024	0.027	0.022	0.027	
4.1	Magnesium, alloyed	<250	500	0.025	0.03	0.024	0.028	0.025	0.03	0.018	0.023	0.03	0.035	0.028	0.033	
5.1	Thermoplastic	<100	400	0.022	0.027	0.021	0.025	0.022	0.027	0.015	0.02	0.027	0.031	0.025	0.03	
5.2	Duroplastic	<150	350	0.019	0.024	0.018	0.022	0.019	0.024	0.012	0.017	0.024	0.027	0.022	0.027	

			Dimension	Ø1.8x6		Ø1.8x10		Ø2x6		Ø2x35		Ø2.5x8		Ø2.5x30		
	Material	Strength (N/mm²)	Infeed in mm	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.23xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.025xD	ae= 1xD	ae= 0.25xD	ae= 1xD	ae= 0.08xD	
			Application	ap= 0.2xD	ap= L2 max	ap= 0.18xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.02xD	ap= L2 max	ap= 0.2xD	ap= L2 max	ap= 0.06xD	ap= L2 max	
Feed (mm/Z)			fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
N			Vc (m/min)													
1.1	Aluminium, alloyed	<500	500	0.03	0.035	0.028	0.033	0.03	0.035	0.018	0.023	0.035	0.04	0.023	0.028	
1.2	Aluminium, alloyed	<600	480	0.03	0.035	0.028	0.033	0.03	0.035	0.018	0.023	0.035	0.04	0.023	0.028	
2.1-2.3	Aluminium, casted	<600	450	0.027	0.031	0.025	0.03	0.027	0.031	0.015	0.02	0.03	0.035	0.02	0.025	
3.1-3.3	Cooper, alloyed	<650	220	0.024	0.027	0.022	0.027	0.024	0.027	0.012	0.017	0.025	0.03	0.017	0.022	
4.1	Magnesium, alloyed	<250	500	0.03	0.035	0.028	0.033	0.03	0.035	0.018	0.023	0.035	0.04	0.023	0.028	
5.1	Thermoplastic	<100	400	0.027	0.031	0.025	0.03	0.027	0.031	0.015	0.02	0.03	0.035	0.02	0.025	
5.2	Duroplastic	<150	350	0.024	0.027	0.022	0.027	0.024	0.027	0.012	0.017	0.025	0.03	0.017	0.022	

NOTE | Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.

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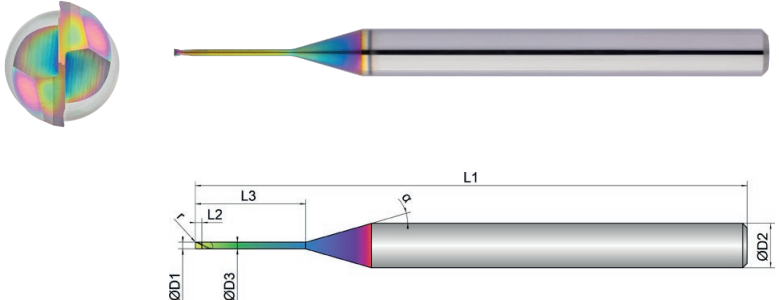
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Application

Features

HA

- Optimized face geometry for excellent surfaces and highest dimensional accuracy
- Defined microbevel for support and stabilization
- Polished chip space for ideal chip evacuation

Multipass milling of 3D contoursTolerance D1: -0.001/-0.006 mmTolerance D3: 0/-0.02 mmRadius tolerance r: 0/-0.003 mm (measured from 0-90°)

Roughing						Finishing				
inappropriateoptimal						inappropriateoptimal				
EXN1-M16-0023	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
0,2X0,5	0.2	0.18	0.2	0.5	50.0	4.0	2	0.05	30	16
0,2X1	0.2	0.18	0.2	1.0	50.0	4.0	2	0.05	30	16
0,2X2	0.2	0.18	0.2	2.0	50.0	4.0	2	0.05	30	16
0,2X3	0.2	0.18	0.2	3.0	50.0	4.0	2	0.05	30	16
0,3X1	0.3	0.28	0.3	1.0	50.0	4.0	2	0.05	30	16
0,3X2	0.3	0.28	0.3	2.0	50.0	4.0	2	0.05	30	16
0,3X3	0.3	0.28	0.3	3.0	50.0	4.0	2	0.05	30	16
0,3X4	0.3	0.28	0.3	4.0	50.0	4.0	2	0.05	30	16
0,3X6	0.3	0.28	0.3	6.0	50.0	4.0	2	0.05	30	16
0,4X1	0.4	0.38	0.4	1.0	50.0	4.0	2	0.05	30	16
0,4X2	0.4	0.38	0.4	2.0	50.0	4.0	2	0.05	30	16

EXN1-M16-0023	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
0,4X3	0.4	0.38	0.4	3.0	50.0	4.0	2	0.05	30	16
0,4X4	0.4	0.38	0.4	4.0	50.0	4.0	2	0.05	30	16
0,4X6	0.4	0.38	0.4	6.0	50.0	4.0	2	0.05	30	16
0,4X8	0.4	0.38	0.4	8.0	50.0	4.0	2	0.05	30	16
0,5X1	0.5	0.48	0.5	1.0	50.0	4.0	2	0.05	30	16
0,5X2	0.5	0.48	0.5	2.0	50.0	4.0	2	0.05	30	16
0,5X3	0.5	0.48	0.5	3.0	50.0	4.0	2	0.05	30	16
0,5X4	0.5	0.48	0.5	4.0	50.0	4.0	2	0.05	30	16
0,5X6	0.5	0.48	0.5	6.0	50.0	4.0	2	0.05	30	16
0,5X8	0.5	0.48	0.5	8.0	50.0	4.0	2	0.05	30	16
0,5X10	0.5	0.48	0.5	10.0	50.0	4.0	2	0.05	30	16
0,6X3	0.6	0.58	0.6	3.0	50.0	4.0	2	0.05	30	16
0,6X4	0.6	0.58	0.6	4.0	50.0	4.0	2	0.05	30	16
0,6X6	0.6	0.58	0.6	6.0	50.0	4.0	2	0.05	30	16
0,6X8	0.6	0.58	0.6	8.0	50.0	4.0	2	0.05	30	16
0,6X10	0.6	0.58	0.6	10.0	50.0	4.0	2	0.05	30	16



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Pages (PDF)

 Download Catalog Pages (PDF)			Strength (N/mm²)	Dimension	Ø 0.2x0.5			Ø 0.2x3			Ø 0.3x1			Ø 0.3x6		
				Infeed in mm	ae=1xD	ae=0.25xD	ae=0.1xD	ae=1xD	ae=0.05xD	ae=0.05xD	ae=1xD	ae=0.25xD	ae=0.1xD	ae=1xD	ae=0.03xD	ae=0.01xD
					ap=0.2xD	ap=L2 max	ae=0.1xD	ap=0.06xD	ap=L2 max	ae=0.05xD	ap=0.2xD	ap=L2 max	ae=0.1xD	ap=0.02xD	ap=L2 max	ae=0.01xD
					Application											
Material	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
N	Vc (m/min)															
1.1	Aluminium, alloyed	<500	500	0.008	0.012	0.014	0.005	0.007	0.009	0.008	0.012	0.014	0.005	0.007	0.009	
1.2	Aluminium, alloyed	<600	480	0.008	0.012	0.014	0.005	0.007	0.009	0.008	0.012	0.014	0.005	0.007	0.009	
2.1-2.3	Aluminium, casted	<600	450	0.007	0.011	0.013	0.004	0.006	0.008	0.007	0.011	0.013	0.004	0.006	0.008	
3.1-3.3	Cooper, alloyed	<650	220	0.006	0.01	0.012	0.003	0.005	0.007	0.006	0.01	0.012	0.003	0.005	0.007	
4.1	Magnesium, alloyed	<250	500	0.008	0.012	0.014	0.005	0.007	0.009	0.008	0.012	0.014	0.005	0.007	0.009	
5.1	Thermoplastic	<100	400	0.007	0.011	0.013	0.004	0.006	0.008	0.007	0.011	0.013	0.004	0.006	0.008	
5.2	Duroplastic	<150	350	0.006	0.01	0.012	0.003	0.005	0.007	0.006	0.01	0.012	0.003	0.005	0.007	

			Dimension	Ø0.4x1			Ø0.4x8			Ø0.5x1			Ø0.5x10		
			Infeed in mm	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.03xD	ae= 0.01xD	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.03xD	ae= 0.01xD
				ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.02xD	ap= L2 max	ae= 0.01xD	ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.02xD	ap= L2 max	ae= 0.01xD
			Application												
Feed (mm/Z)			fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.012	0.016	0.018	0.005	0.007	0.009	0.016	0.02	0.022	0.009	0.013	0.015
1.2	Aluminium, alloyed	<600	480	0.012	0.016	0.018	0.005	0.007	0.009	0.016	0.02	0.022	0.009	0.013	0.015
2.1-2.3	Aluminium, casted	<600	450	0.011	0.015	0.017	0.004	0.006	0.008	0.015	0.018	0.021	0.008	0.012	0.014
3.1-3.3	Cooper, alloyed	<650	220	0.01	0.014	0.016	0.003	0.005	0.007	0.014	0.016	0.02	0.007	0.011	0.013
4.1	Magnesium, alloyed	<250	500	0.012	0.016	0.018	0.005	0.007	0.009	0.016	0.02	0.022	0.009	0.013	0.015
5.1	Thermoplastic	<100	400	0.011	0.015	0.017	0.004	0.006	0.008	0.015	0.018	0.021	0.008	0.012	0.014
5.2	Duroplastic	<150	350	0.01	0.014	0.016	0.003	0.005	0.007	0.014	0.016	0.02	0.007	0.011	0.013

			Dimension	Ø0.6x3			Ø0.6x10									
			Infeed in mm	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.04xD	ae= 0.015xD							
				ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.03xD	ap= L2 max	ae= 0.015xD							
				Application												
			Feed (mm/Z)	fz	fz	fz	fz	fz	fz							
N				Vc (m/min)												
1.1	Aluminium, alloyed	<500	500	0.016	0.02	0.022	0.012	0.015	0.017							
1.2	Aluminium, alloyed	<600	480	0.016	0.02	0.022	0.012	0.015	0.017							
2.1-2.3	Aluminium, casted	<600	450	0.015	0.018	0.021	0.011	0.014	0.016							
3.1-3.3	Cooper, alloyed	<650	220	0.014	0.016	0.02	0.01	0.013	0.015							
4.1	Magnesium, alloyed	<250	500	0.016	0.02	0.022	0.012	0.015	0.017							
5.1	Thermoplastic	<100	400	0.015	0.018	0.021	0.011	0.014	0.016							
5.2	Duroplastic	<150	350	0.014	0.016	0.02	0.01	0.013	0.015							

NOTE | Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.
 ae/ap(max) = 0.5x corner radius!



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Cooling

Tolerance

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Coating

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Strategy

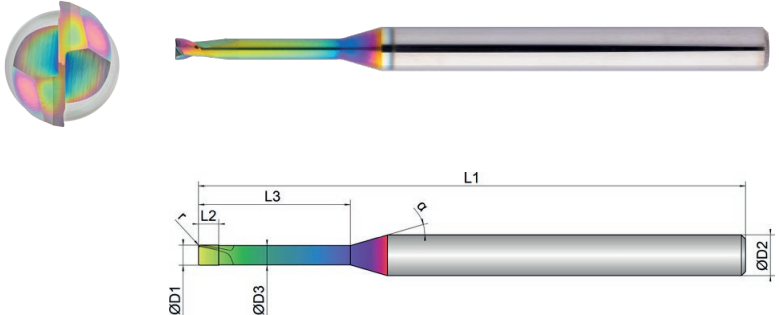
HSC

Application

Features

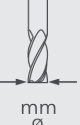
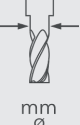
HA

- Optimized face geometry for excellent surfaces and highest dimensional accuracy
- Defined microbevel for support and stabilization
- Polished chip space for ideal chip evacuation
- Multipass milling of 3D contours
- Tolerance D1: -0.001/-0.006 mm
- Tolerance D3: 0/-0.02 mm
- Radius tolerance r: 0/-0.003 mm (measured from 0-90°)



Roughing						Finishing				
inappropriateoptimal						inappropriateoptimal				
EXN1-M16-0063	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
0,4X1	0.4	0.38	0.4	1.0	50.0	4.0	2	0.10	30	16
0,4X2	0.4	0.38	0.4	2.0	50.0	4.0	2	0.10	30	16
0,4X3	0.4	0.38	0.4	3.0	50.0	4.0	2	0.10	30	16
0,4X4	0.4	0.38	0.4	4.0	50.0	4.0	2	0.10	30	16
0,4X6	0.4	0.38	0.4	6.0	50.0	4.0	2	0.10	30	16
0,4X8	0.4	0.38	0.4	8.0	50.0	4.0	2	0.10	30	16
0,5X1	0.5	0.48	0.5	1.0	50.0	4.0	2	0.10	30	16
0,5X2	0.5	0.48	0.5	2.0	50.0	4.0	2	0.10	30	16
0,5X3	0.5	0.48	0.5	3.0	50.0	4.0	2	0.10	30	16
0,5X4	0.5	0.48	0.5	4.0	50.0	4.0	2	0.10	30	16
0,5X6	0.5	0.48	0.5	6.0	50.0	4.0	2	0.10	30	16
0,5X8	0.5	0.48	0.5	8.0	50.0	4.0	2	0.10	30	16
0,5X10	0.5	0.48	0.5	10.0	50.0	4.0	2	0.10	30	16

EXN1-M16-0063	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
0,6X3	0.6	0.58	0.6	3.0	50.0	4.0	2	0.10	30	16
0,6X4	0.6	0.58	0.6	4.0	50.0	4.0	2	0.10	30	16
0,6X6	0.6	0.58	0.6	6.0	50.0	4.0	2	0.10	30	16
0,6X8	0.6	0.58	0.6	8.0	50.0	4.0	2	0.10	30	16
0,6X10	0.6	0.58	0.6	10.0	50.0	4.0	2	0.10	30	16
0,8X2	0.8	0.78	0.8	2.0	50.0	4.0	2	0.10	30	16
0,8X4	0.8	0.78	0.8	4.0	50.0	4.0	2	0.10	30	16
0,8X6	0.8	0.78	0.8	6.0	50.0	4.0	2	0.10	30	16
0,8X8	0.8	0.78	0.8	8.0	50.0	4.0	2	0.10	30	16
0,8X10	0.8	0.78	0.8	10.0	50.0	4.0	2	0.10	30	16
0,8X12	0.8	0.78	0.8	12.0	50.0	4.0	2	0.10	30	16
1X2	1.0	0.95	1.0	2.0	50.0	4.0	2	0.10	30	16
1X3	1.0	0.95	1.0	3.0	50.0	4.0	2	0.10	30	16
1X4	1.0	0.95	1.0	4.0	50.0	4.0	2	0.10	30	16
1X5	1.0	0.95	1.0	5.0	50.0	4.0	2	0.10	30	16
1X6	1.0	0.95	1.0	6.0	50.0	4.0	2	0.10	30	16
1X8	1.0	0.95	1.0	8.0	50.0	4.0	2	0.10	30	16
1X10	1.0	0.95	1.0	10.0	50.0	4.0	2	0.10	30	16
1X12	1.0	0.95	1.0	12.0	54.0	4.0	2	0.10	30	16
1X15	1.0	0.95	1.0	15.0	60.0	4.0	2	0.10	30	16
1X20	1.0	0.95	1.0	20.0	60.0	4.0	2	0.10	30	16
1X25	1.0	0.95	1.0	25.0	70.0	4.0	2	0.10	30	16
1X30	1.0	0.95	1.0	30.0	70.0	4.0	2	0.10	30	16
1,2X5	1.2	1.14	1.2	5.0	50.0	4.0	2	0.10	30	16
1,2X10	1.2	1.14	1.2	10.0	50.0	4.0	2	0.10	30	16
1,2X15	1.2	1.14	1.2	15.0	54.0	4.0	2	0.10	30	16
1,2X20	1.2	1.14	1.2	20.0	60.0	4.0	2	0.10	30	16

EXN1-M16-0063	D1	D3	L2	L3	L1	D2	z	r		α
	 mm ø	 mm ø	 mm	 mm	 mm	 mm ø	 #	 mm	 °	 °
1,5X4	1.5	1.44	1.5	4.0	50.0	4.0	2	0.10	30	16
1,5X6	1.5	1.44	1.5	6.0	50.0	4.0	2	0.10	30	16
1,5X8	1.5	1.44	1.5	8.0	50.0	4.0	2	0.10	30	16
1,5X10	1.5	1.44	1.5	10.0	50.0	4.0	2	0.10	30	16
1,5X12	1.5	1.44	1.5	12.0	54.0	4.0	2	0.10	30	16
1,5X15	1.5	1.44	1.5	15.0	54.0	4.0	2	0.10	30	16
1,5X20	1.5	1.44	1.5	20.0	60.0	4.0	2	0.10	30	16
1,5X25	1.5	1.44	1.5	25.0	60.0	4.0	2	0.10	30	16
1,5X30	1.5	1.44	1.5	30.0	70.0	4.0	2	0.10	30	16
1,8X8	1.8	1.74	1.8	8.0	50.0	4.0	2	0.10	30	16
1,8X10	1.8	1.74	1.8	10.0	50.0	4.0	2	0.10	30	16
1,8X15	1.8	1.74	1.8	15.0	50.0	4.0	2	0.10	30	16
1,8X20	1.8	1.74	1.8	20.0	54.0	4.0	2	0.10	30	16
2X4	2.0	1.91	2.0	4.0	50.0	4.0	2	0.10	30	16
2X6	2.0	1.91	2.0	6.0	50.0	4.0	2	0.10	30	16
2X8	2.0	1.91	2.0	8.0	50.0	4.0	2	0.10	30	16
2X10	2.0	1.91	2.0	10.0	50.0	4.0	2	0.10	30	16
2X12	2.0	1.91	2.0	12.0	54.0	4.0	2	0.10	30	16
2X15	2.0	1.91	2.0	15.0	54.0	4.0	2	0.10	30	16
2X20	2.0	1.91	2.0	20.0	60.0	4.0	2	0.10	30	16
2X25	2.0	1.91	2.0	25.0	70.0	4.0	2	0.10	30	16
2X30	2.0	1.91	2.0	30.0	70.0	4.0	2	0.10	30	16
2X35	2.0	1.91	2.0	35.0	80.0	4.0	2	0.10	30	16
2X40	2.0	1.91	2.0	40.0	80.0	4.0	2	0.10	30	16



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Material	Strength (N/mm²)	Dimension	Infeed in mm	Application	Ø0.4x1			Ø0.4x8			Ø0.5x1			Ø0.5x10				
					ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ae=0.1xD	ae=1xD ap=0.02xD	ae=0.03xD ap=L2 max	ae=0.01xD ae=0.01xD	ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ae=0.1xD	ae=1xD ap=0.02xD	ae=0.03xD ap=L2 max	ae=0.01xD ae=0.01xD		
		Feed (mm/Z)																
		Vc (m/min)																
1.1	Aluminium, alloyed	<500	500		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
1.2	Aluminium, alloyed	<600	480		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
2.1-2.3	Aluminium, casted	<600	450		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
3.1-3.3	Cooper, alloyed	<650	220		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
4.1	Magnesium, alloyed	<250	500		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
5.1	Thermoplastic	<100	400		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
5.2	Duroplastic	<150	350		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		

Material	Strength (N/mm²)	Dimension	Infeed in mm	Application	Ø0.6x3			Ø0.6x10			Ø0.8x2			Ø0.8x12				
					ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ae=0.1xD	ae=1xD ap=0.03xD	ae=0.04xD ap=L2 max	ae=0.015xD ap=0.015xD	ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ae=0.1xD	ae=1xD ap=0.05xD	ae=0.06xD ap=L2 max	ae=0.03xD ap=0.03xD		
		Feed (mm/Z)																
		Vc (m/min)																
1.1	Aluminium, alloyed	<500	500		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
1.2	Aluminium, alloyed	<600	480		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
2.1-2.3	Aluminium, casted	<600	450		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
3.1-3.3	Cooper, alloyed	<650	220		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
4.1	Magnesium, alloyed	<250	500		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
5.1	Thermoplastic	<100	400		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
5.2	Duroplastic	<150	350		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		

Material	Strength (N/mm²)	Dimension	Infeed in mm	Application	Ø1x2			Ø1x30			Ø1.2x5			Ø1.2x20				
					ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ae=0.1xD	ae=1xD ap=0.01xD	ae=0.015xD ap=L2 max	ae=0.01xD ae=0.01xD	ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ae=0.1xD	ae=1xD ap=0.03xD	ae=0.04xD ap=L2 max	ae=0.015xD ap=0.015xD		
		Feed (mm/Z)																
		Vc (m/min)																
1.1	Aluminium, alloyed	<500	500		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
1.2	Aluminium, alloyed	<600	480		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
2.1-2.3	Aluminium, casted	<600	450		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
3.1-3.3	Cooper, alloyed	<650	220		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
4.1	Magnesium, alloyed	<250	500		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
5.1	Thermoplastic	<100	400		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		
5.2	Duroplastic	<150	350		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz		

NOTE | Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.
 ae/ap(max) = 0.5x corner radius!

			Dimension	Ø 1.5x4			Ø 1.5x30			Ø 1.8x8			Ø 1.8x20		
			Infeed in mm	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.03xD	ae= 0.01xD	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.13xD	ae= 0.05xD
				ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.02xD	ap= L2 max	ae= 0.01xD	ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.1xD	ap= L2 max	ae= 0.05xD
			Application												
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.025	0.03	0.035	0.015	0.02	0.025	0.03	0.035	0.04	0.025	0.03	0.035
1.2	Aluminium, alloyed	<600	480	0.025	0.03	0.035	0.015	0.02	0.025	0.03	0.035	0.04	0.025	0.03	0.035
2.1-2.3	Aluminium, casted	<600	450	0.022	0.027	0.032	0.013	0.017	0.022	0.027	0.031	0.035	0.022	0.026	0.03
3.1-3.3	Cooper, alloyed	<650	220	0.019	0.024	0.029	0.011	0.014	0.019	0.024	0.027	0.03	0.019	0.022	0.025
4.1	Magnesium, alloyed	<250	500	0.025	0.03	0.035	0.015	0.02	0.025	0.03	0.035	0.04	0.025	0.03	0.035
5.1	Thermoplastic	<100	400	0.022	0.027	0.032	0.013	0.017	0.022	0.027	0.031	0.035	0.022	0.026	0.03
5.2	Duroplastic	<150	350	0.019	0.024	0.029	0.011	0.014	0.019	0.024	0.027	0.03	0.019	0.022	0.025

			Dimension	Ø 2x4			Ø 2x40								
			Infeed in mm	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.015xD	ae= 0.01xD						
				ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.01xD	ap= L2 max	ae= 0.010xD						
			Application												
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz							
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.03	0.035	0.04	0.02	0.025	0.03						
1.2	Aluminium, alloyed	<600	480	0.03	0.035	0.04	0.02	0.025	0.03						
2.1-2.3	Aluminium, casted	<600	450	0.027	0.031	0.035	0.017	0.021	0.025						
3.1-3.3	Cooper, alloyed	<650	220	0.024	0.027	0.03	0.014	0.017	0.02						
4.1	Magnesium, alloyed	<250	500	0.03	0.035	0.04	0.02	0.025	0.03						
5.1	Thermoplastic	<100	400	0.027	0.031	0.035	0.017	0.021	0.025						
5.2	Duroplastic	<150	350	0.024	0.027	0.03	0.014	0.017	0.02						

NOTE |

Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.

ae/ap(max)= 0.5x corner radius!

Cooling

Tolerance

d04

Coating

AlphaSlide Rainbow

Strategy

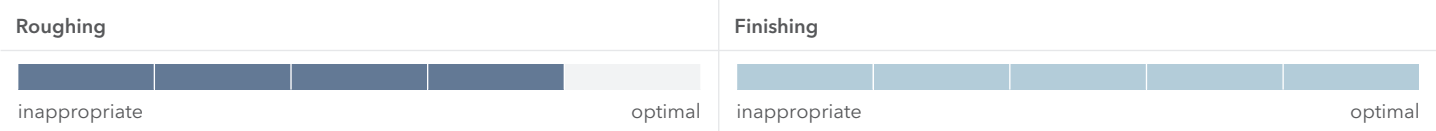
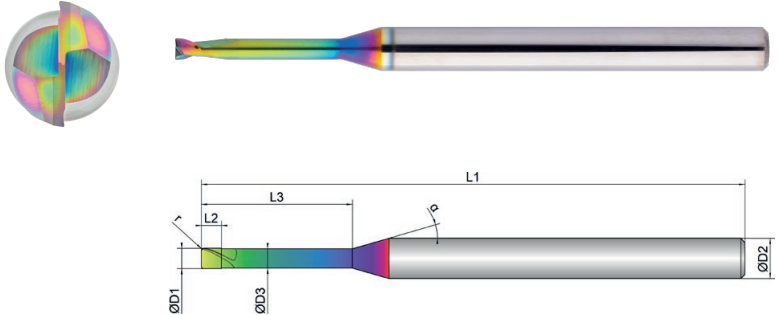
HSC

Application

Features

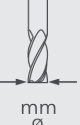
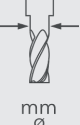
HA

- Optimized face geometry for excellent surfaces and highest dimensional accuracy
- Defined microbevel for support and stabilization
- Polished chip space for ideal chip evacuation

Multipass milling of 3D contoursTolerance D1: -0.001/-0.006 mmTolerance D3: 0/-0.02 mmRadius tolerance r: 0/-0.003 mm (measured from 0-90°)

EXN1-M16-0103	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
0,8X2	0.8	0.78	0.8	2.0	50.0	4.0	2	0.20	30	16
0,8X4	0.8	0.78	0.8	4.0	50.0	4.0	2	0.20	30	16
0,8X6	0.8	0.78	0.8	6.0	50.0	4.0	2	0.20	30	16
0,8X8	0.8	0.78	0.8	8.0	50.0	4.0	2	0.20	30	16
0,8X10	0.8	0.78	0.8	10.0	50.0	4.0	2	0.20	30	16
0,8X12	0.8	0.78	0.8	12.0	50.0	4.0	2	0.20	30	16
1X2	1.0	0.95	1.0	2.0	50.0	4.0	2	0.20	30	16
1X3	1.0	0.95	1.0	3.0	50.0	4.0	2	0.20	30	16
1X4	1.0	0.95	1.0	4.0	50.0	4.0	2	0.20	30	16
1X5	1.0	0.95	1.0	5.0	50.0	4.0	2	0.20	30	16
1X6	1.0	0.95	1.0	6.0	50.0	4.0	2	0.20	30	16
1X8	1.0	0.95	1.0	8.0	50.0	4.0	2	0.20	30	16
1X10	1.0	0.95	1.0	10.0	50.0	4.0	2	0.20	30	16

EXN1-M16-0103	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
1X12	1.0	0.95	1.0	12.0	54.0	4.0	2	0.20	30	16
1X15	1.0	0.95	1.0	15.0	60.0	4.0	2	0.20	30	16
1X20	1.0	0.95	1.0	20.0	60.0	4.0	2	0.20	30	16
1X25	1.0	0.95	1.0	25.0	70.0	4.0	2	0.20	30	16
1X30	1.0	0.95	1.0	30.0	70.0	4.0	2	0.20	30	16
1,2X5	1.2	1.14	1.2	5.0	50.0	4.0	2	0.20	30	16
1,2X10	1.2	1.14	1.2	10.0	50.0	4.0	2	0.20	30	16
1,2X15	1.2	1.14	1.2	15.0	54.0	4.0	2	0.20	30	16
1,2X20	1.2	1.14	1.2	20.0	60.0	4.0	2	0.20	30	16
1,5X4	1.5	1.44	1.5	4.0	50.0	4.0	2	0.20	30	16
1,5X6	1.5	1.44	1.5	6.0	50.0	4.0	2	0.20	30	16
1,5X8	1.5	1.44	1.5	8.0	50.0	4.0	2	0.20	30	16
1,5X10	1.5	1.44	1.5	10.0	50.0	4.0	2	0.20	30	16
1,5X12	1.5	1.44	1.5	12.0	54.0	4.0	2	0.20	30	16
1,5X15	1.5	1.44	1.5	15.0	54.0	4.0	2	0.20	30	16
1,5X20	1.5	1.44	1.5	20.0	60.0	4.0	2	0.20	30	16
1,5X25	1.5	1.44	1.5	25.0	60.0	4.0	2	0.20	30	16
1,5X30	1.5	1.44	1.5	30.0	70.0	4.0	2	0.20	30	16
1,8X8	1.8	1.74	1.8	8.0	50.0	4.0	2	0.20	30	16
1,8X10	1.8	1.74	1.8	10.0	50.0	4.0	2	0.20	30	16
1,8X15	1.8	1.74	1.8	15.0	50.0	4.0	2	0.20	30	16
1,8X20	1.8	1.74	1.8	20.0	54.0	4.0	2	0.20	30	16
2X4	2.0	1.91	2.0	4.0	50.0	4.0	2	0.20	30	16
2X6	2.0	1.91	2.0	6.0	50.0	4.0	2	0.20	30	16
2X8	2.0	1.91	2.0	8.0	50.0	4.0	2	0.20	30	16

EXN1-M16-0103	D1	D3	L2	L3	L1	D2	z	r		α
	 mm ø	 mm ø	 mm	 mm	 mm	 mm ø	 #	 mm	 °	 °
2X10	2.0	1.91	2.0	10.0	50.0	4.0	2	0.20	30	16
2X12	2.0	1.91	2.0	12.0	54.0	4.0	2	0.20	30	16
2X15	2.0	1.91	2.0	15.0	54.0	4.0	2	0.20	30	16
2X20	2.0	1.91	2.0	20.0	60.0	4.0	2	0.20	30	16
2X25	2.0	1.91	2.0	25.0	70.0	4.0	2	0.20	30	16
2X30	2.0	1.91	2.0	30.0	70.0	4.0	2	0.20	30	16
2X35	2.0	1.91	2.0	35.0	80.0	4.0	2	0.20	30	16
2X40	2.0	1.91	2.0	40.0	80.0	4.0	2	0.20	30	16
2,5X15	2.5	2.41	2.5	15.0	54.0	4.0	2	0.20	30	16
2,5X20	2.5	2.41	2.5	20.0	54.0	4.0	2	0.20	30	16
2,5X25	2.5	2.41	2.5	25.0	60.0	4.0	2	0.20	30	16
2,5X30	2.5	2.41	2.5	30.0	70.0	4.0	2	0.20	30	16
3X6	3.0	2.91	4.5	6.0	50.0	4.0	2	0.20	30	16
3X8	3.0	2.91	4.5	8.0	50.0	4.0	2	0.20	30	16
3X10	3.0	2.91	4.5	10.0	50.0	4.0	2	0.20	30	16
3X12	3.0	2.91	4.5	12.0	50.0	4.0	2	0.20	30	16
3X15	3.0	2.91	4.5	15.0	54.0	4.0	2	0.20	30	16
3X20	3.0	2.91	4.5	20.0	54.0	4.0	2	0.20	30	16
3X25	3.0	2.91	4.5	25.0	60.0	4.0	2	0.20	30	16
3X30	3.0	2.91	4.5	30.0	70.0	4.0	2	0.20	30	16
3X35	3.0	2.91	4.5	35.0	80.0	4.0	2	0.20	30	16
3X40	3.0	2.91	4.5	40.0	80.0	4.0	2	0.20	30	16
3X45	3.0	2.91	4.5	45.0	90.0	4.0	2	0.20	30	16



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		Strength (N/mm²)	Dimension	Infeed in mm	Ø 0.8x2			Ø 0.8x12			Ø 1x2			Ø 1x30					
Material	Feed (mm/Z)				ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.05xD	ae=0.06xD ap=L2 max	ae=0.03xD ap=0.03xD	ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.01xD	ae=0.015xD ap=L2 max	ae=0.01xD ap=0.01xD			
N		Strength (N/mm²)	Vc (m/min)																
1.1	Aluminium, alloyed	<500	500	0.016	0.02	0.022	0.012	0.015	0.017	0.025	0.03	0.035	0.01	0.015	0.02				
1.2	Aluminium, alloyed	<600	480	0.016	0.02	0.022	0.012	0.015	0.017	0.025	0.03	0.035	0.01	0.015	0.02				
2.1-2.3	Aluminium, casted	<600	450	0.015	0.018	0.021	0.011	0.014	0.016	0.022	0.027	0.032	0.008	0.013	0.017				
3.1-3.3	Cooper, alloyed	<650	220	0.014	0.016	0.02	0.01	0.013	0.015	0.019	0.024	0.029	0.006	0.011	0.014				
4.1	Magnesium, alloyed	<250	500	0.016	0.02	0.022	0.012	0.015	0.017	0.025	0.03	0.035	0.01	0.015	0.02				
5.1	Thermoplastic	<100	400	0.015	0.018	0.021	0.011	0.014	0.016	0.022	0.027	0.032	0.008	0.013	0.017				
5.2	Duroplastic	<150	350	0.014	0.016	0.02	0.01	0.013	0.015	0.019	0.024	0.029	0.006	0.011	0.014				

		Strength (N/mm²)	Dimension	Infeed in mm	Ø 1.2x5			Ø 1.2x20			Ø 1.5x4			Ø 1.5x30					
Material	Feed (mm/Z)				ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.03xD	ae=0.04xD ap=L2 max	ae=0.015xD ap=0.015xD	ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.02xD	ae=0.03xD ap=L2 max	ae=0.01xD ap=0.01xD			
N		Strength (N/mm²)	Vc (m/min)																
1.1	Aluminium, alloyed	<500	500	0.025	0.03	0.035	0.02	0.025	0.03	0.025	0.03	0.035	0.015	0.02	0.025				
1.2	Aluminium, alloyed	<600	480	0.025	0.03	0.035	0.02	0.025	0.03	0.025	0.03	0.035	0.015	0.02	0.025				
2.1-2.3	Aluminium, casted	<600	450	0.022	0.027	0.032	0.017	0.022	0.027	0.022	0.027	0.032	0.013	0.017	0.022				
3.1-3.3	Cooper, alloyed	<650	220	0.019	0.024	0.029	0.014	0.019	0.024	0.019	0.024	0.029	0.011	0.014	0.019				
4.1	Magnesium, alloyed	<250	500	0.025	0.03	0.035	0.02	0.025	0.03	0.025	0.03	0.035	0.015	0.02	0.025				
5.1	Thermoplastic	<100	400	0.022	0.027	0.032	0.017	0.022	0.027	0.022	0.027	0.032	0.013	0.017	0.022				
5.2	Duroplastic	<150	350	0.019	0.024	0.029	0.014	0.019	0.024	0.019	0.024	0.029	0.011	0.014	0.019				

		Strength (N/mm²)	Dimension	Infeed in mm	Ø 1.8x8			Ø 1.8x20			Ø 2x4			Ø 2x40					
Material	Feed (mm/Z)				ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.1xD	ae=0.13xD ap=L2 max	ae=0.05xD ap=0.05xD	ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.01xD	ae=0.015xD ap=L2 max	ae=0.01xD ap=0.01xD			
N		Strength (N/mm²)	Vc (m/min)																
1.1	Aluminium, alloyed	<500	500	0.03	0.035	0.04	0.025	0.03	0.035	0.03	0.035	0.04	0.02	0.025	0.03				
1.2	Aluminium, alloyed	<600	480	0.03	0.035	0.04	0.025	0.03	0.035	0.03	0.035	0.04	0.02	0.025	0.03				
2.1-2.3	Aluminium, casted	<600	450	0.027	0.031	0.035	0.022	0.026	0.03	0.027	0.031	0.035	0.017	0.021	0.025				
3.1-3.3	Cooper, alloyed	<650	220	0.024	0.027	0.03	0.019	0.022	0.025	0.024	0.027	0.03	0.014	0.017	0.02				
4.1	Magnesium, alloyed	<250	500	0.03	0.035	0.04	0.025	0.03	0.035	0.03	0.035	0.04	0.02	0.025	0.03				
5.1	Thermoplastic	<100	400	0.027	0.031	0.035	0.022	0.026	0.03	0.027	0.031	0.035	0.017	0.021	0.025				
5.2	Duroplastic	<150	350	0.024	0.027	0.03	0.019	0.022	0.025	0.024	0.027	0.03	0.014	0.017	0.02				

NOTE | Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.
 ae/ap(max) = 0.5x corner radius!

			Dimension	Ø2.5x15			Ø2.5x30			Ø3x6			Ø3x45		
			Infeed in mm	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.09xD	ae= 0.04xD	ae= 1xD	ae= 0.25xD	ae= 0.1xD	ae= 1xD	ae= 0.05xD	ae= 0.02xD
				ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.07xD	ap= L2 max	ae= 0.04xD	ap= 0.2xD	ap= L2 max	ae= 0.1xD	ap= 0.04xD	ap= L2 max	ae= 0.02xD
			Application												
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
N	Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.03	0.035	0.04	0.025	0.03	0.035	0.033	0.038	0.043	0.025	0.03	0.035
1.2	Aluminium, alloyed	<600	480	0.03	0.035	0.04	0.025	0.03	0.035	0.033	0.038	0.043	0.025	0.03	0.035
2.1-2.3	Aluminium, casted	<600	450	0.027	0.031	0.035	0.022	0.026	0.03	0.03	0.034	0.038	0.022	0.026	0.03
3.1-3.3	Cooper, alloyed	<650	220	0.024	0.027	0.03	0.019	0.022	0.025	0.027	0.03	0.033	0.019	0.022	0.025
4.1	Magnesium, alloyed	<250	500	0.03	0.035	0.04	0.025	0.03	0.035	0.033	0.038	0.043	0.025	0.03	0.035
5.1	Thermoplastic	<100	400	0.027	0.031	0.035	0.022	0.026	0.03	0.03	0.034	0.038	0.022	0.026	0.03
5.2	Duroplastic	<150	350	0.024	0.027	0.03	0.019	0.022	0.025	0.027	0.03	0.033	0.019	0.022	0.025
NOTE Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.  ae/ap(max)=0.5x corner radius!															

Cooling

Tolerance

d04

Coating

AlphaSlide Rainbow

Strategy

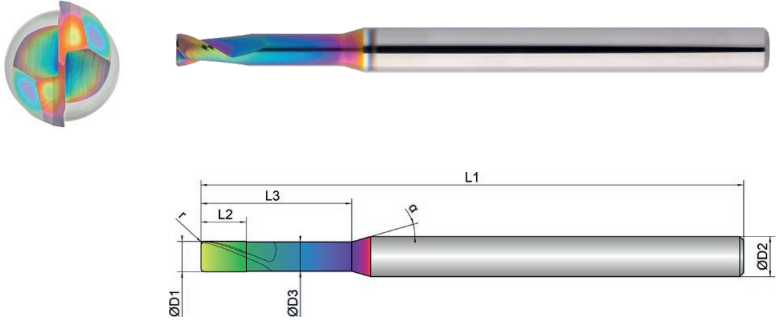
HSC

Application

Features

HA

- Optimized face geometry for excellent surfaces and highest dimensional accuracy
- Defined microbevel for support and stabilization
- Polished chip space for ideal chip evacuation

Multipass milling of 3D contoursTolerance D1: -0.001/-0.006 mmTolerance D3: 0/-0.02 mmRadius tolerance r: 0/-0.003 mm (measured from 0-90°)

Roughing						Finishing				
inappropriateoptimal						inappropriateoptimal				
EXN1-M16-0143	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
1X2	1.0	0.95	1.0	2.0	50.0	4.0	2	0.30	30	16
1X3	1.0	0.95	1.0	3.0	50.0	4.0	2	0.30	30	16
1X4	1.0	0.95	1.0	4.0	50.0	4.0	2	0.30	30	16
1X5	1.0	0.95	1.0	5.0	50.0	4.0	2	0.30	30	16
1X6	1.0	0.95	1.0	6.0	50.0	4.0	2	0.30	30	16
1X8	1.0	0.95	1.0	8.0	50.0	4.0	2	0.30	30	16
1X10	1.0	0.95	1.0	10.0	50.0	4.0	2	0.30	30	16
1X12	1.0	0.95	1.0	12.0	54.0	4.0	2	0.30	30	16
1X15	1.0	0.95	1.0	15.0	60.0	4.0	2	0.30	30	16
1X20	1.0	0.95	1.0	20.0	60.0	4.0	2	0.30	30	16
1X25	1.0	0.95	1.0	25.0	70.0	4.0	2	0.30	30	16
1X30	1.0	0.95	1.0	30.0	70.0	4.0	2	0.30	30	16
1,2X5	1.2	1.14	1.2	5.0	50.0	4.0	2	0.30	30	16
1,2X10	1.2	1.14	1.2	10.0	50.0	4.0	2	0.30	30	16
1,2X15	1.2	1.14	1.2	15.0	54.0	4.0	2	0.30	30	16
1,2X20	1.2	1.14	1.2	20.0	60.0	4.0	2	0.30	30	16
1,5X4	1.5	1.44	1.5	4.0	50.0	4.0	2	0.30	30	16
1,5X6	1.5	1.44	1.5	6.0	50.0	4.0	2	0.30	30	16
1,5X8	1.5	1.44	1.5	8.0	50.0	4.0	2	0.30	30	16

EXN1-M16-0143	D1 mm ø	D3 mm ø	L2 mm	L3 mm	L1 mm	D2 mm ø	z #	r mm	 °	α °
1,5X10	1.5	1.44	1.5	10.0	50.0	4.0	2	0.30	30	16
1,5X12	1.5	1.44	1.5	12.0	54.0	4.0	2	0.30	30	16
1,5X15	1.5	1.44	1.5	15.0	54.0	4.0	2	0.30	30	16
1,5X20	1.5	1.44	1.5	20.0	60.0	4.0	2	0.30	30	16
1,5X25	1.5	1.44	1.5	25.0	60.0	4.0	2	0.30	30	16
1,5X30	1.5	1.44	1.5	30.0	70.0	4.0	2	0.30	30	16
1,8X8	1.8	1.74	1.8	8.0	50.0	4.0	2	0.30	30	16
1,8X10	1.8	1.74	1.8	10.0	50.0	4.0	2	0.30	30	16
1,8X15	1.8	1.74	1.8	15.0	50.0	4.0	2	0.30	30	16
1,8X20	1.8	1.74	1.8	20.0	54.0	4.0	2	0.30	30	16
2X4	2.0	1.91	2.0	4.0	50.0	4.0	2	0.30	30	16
2X6	2.0	1.91	2.0	6.0	50.0	4.0	2	0.30	30	16
2X8	2.0	1.91	2.0	8.0	50.0	4.0	2	0.30	30	16
2X10	2.0	1.91	2.0	10.0	50.0	4.0	2	0.30	30	16
2X12	2.0	1.91	2.0	12.0	54.0	4.0	2	0.30	30	16
2X15	2.0	1.91	2.0	15.0	54.0	4.0	2	0.30	30	16
2X20	2.0	1.91	2.0	20.0	60.0	4.0	2	0.30	30	16
2X25	2.0	1.91	2.0	25.0	70.0	4.0	2	0.30	30	16
2X30	2.0	1.91	2.0	30.0	70.0	4.0	2	0.30	30	16
2X35	2.0	1.91	2.0	35.0	80.0	4.0	2	0.30	30	16
2X40	2.0	1.91	2.0	40.0	80.0	4.0	2	0.30	30	16
2,5X15	2.5	2.41	2.5	15.0	54.0	4.0	2	0.30	30	16
2,5X20	2.5	2.41	2.5	20.0	54.0	4.0	2	0.30	30	16
2,5X25	2.5	2.41	2.5	25.0	60.0	4.0	2	0.30	30	16
2,5X30	2.5	2.41	2.5	30.0	70.0	4.0	2	0.30	30	16
3X6	3.0	2.91	4.5	6.0	50.0	4.0	2	0.30	30	16
3X8	3.0	2.91	4.5	8.0	50.0	4.0	2	0.30	30	16
3X10	3.0	2.91	4.5	10.0	50.0	4.0	2	0.30	30	16
3X12	3.0	2.91	4.5	12.0	50.0	4.0	2	0.30	30	16
3X15	3.0	2.91	4.5	15.0	54.0	4.0	2	0.30	30	16
3X20	3.0	2.91	4.5	20.0	54.0	4.0	2	0.30	30	16
3X25	3.0	2.91	4.5	25.0	60.0	4.0	2	0.30	30	16
3X30	3.0	2.91	4.5	30.0	70.0	4.0	2	0.30	30	16
3X35	3.0	2.91	4.5	35.0	80.0	4.0	2	0.30	30	16
3X40	3.0	2.91	4.5	40.0	80.0	4.0	2	0.30	30	16
3X45	3.0	2.91	4.5	45.0	90.0	4.0	2	0.30	30	16



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		Strength (N/mm²)	Feed (mm/Z)	Dimension Ø1x2			Ø1x30			Ø1.2x5			Ø1.2x20				
Material	Infeed in mm			ae=	ae=	ae=	ae=	ae=	ae=	ae=	ae=	ae=	ae=				
				1xD	0.25xD	0.1xD	1xD	0.015xD	0.01xD	1xD	0.25xD	0.1xD	1xD	0.04xD	0.015xD		
		Application	Feed (mm/Z)	ap=	ap=	ap=	ap=	ap=	ap=	ap=	ap=	ap=	ap=	ap=			
				0.2xD	L2 max	0.1xD	0.01xD	L2 max	0.01xD	0.2xD	L2 max	0.1xD	0.03xD	L2 max	0.015xD		

Cooling

Tolerance

d04

Coating

AlphaSlide Rainbow

Strategy

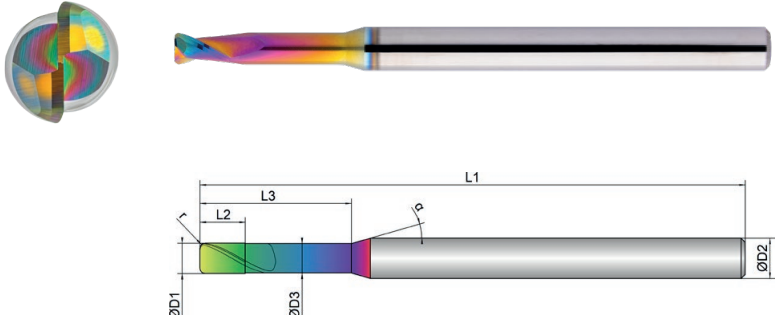
HSC

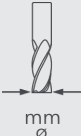
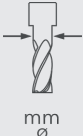
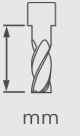
Application

Features

HA

- Optimized face geometry for excellent surfaces and highest dimensional accuracy
- Defined microbevel for support and stabilization
- Polished chip space for ideal chip evacuation

Multipass milling of 3D contoursTolerance D1: -0.001/-0.006 mmTolerance D3: 0/-0.02 mmRadius tolerance r: 0/-0.003 mm (measured from 0-90°)

Roughing						Finishing					
inappropriate						inappropriate					optimal
optimal											optimal
EXN1-M16-0183	D1	D3	L2	L3	L1	D2	z	r		α	
											
	mm ø	mm ø	mm	mm	mm	mm ø	#	mm	°	°	
	1,5X4	1.5	1.44	1.5	4.0	50.0	4.0	2	0.50	30	16
	1,5X6	1.5	1.44	1.5	6.0	50.0	4.0	2	0.50	30	16
	1,5X8	1.5	1.44	1.5	8.0	50.0	4.0	2	0.50	30	16
	1,5X10	1.5	1.44	1.5	10.0	50.0	4.0	2	0.50	30	16
	1,5X12	1.5	1.44	1.5	12.0	54.0	4.0	2	0.50	30	16
	1,5X15	1.5	1.44	1.5	15.0	54.0	4.0	2	0.50	30	16
	1,5X20	1.5	1.44	1.5	20.0	60.0	4.0	2	0.50	30	16
	1,5X25	1.5	1.44	1.5	25.0	60.0	4.0	2	0.50	30	16
	1,5X30	1.5	1.44	1.5	30.0	70.0	4.0	2	0.50	30	16
1,8X8	1.8	1.74	1.8	8.0	50.0	4.0	2	0.50	30	16	
1,8X10	1.8	1.74	1.8	10.0	50.0	4.0	2	0.50	30	16	
1,8X15	1.8	1.74	1.8	15.0	50.0	4.0	2	0.50	30	16	
1,8X20	1.8	1.74	1.8	20.0	54.0	4.0	2	0.50	30	16	

EXN1-M16-0183	D1	D3	L2	L3	L1	D2	z	r		α
	 mm ø	 mm ø	 mm	 mm	 mm	 mm ø	 #	 mm	 °	 °
2X4	2.0	1.91	2.0	4.0	50.0	4.0	2	0.50	30	16
2X6	2.0	1.91	2.0	6.0	50.0	4.0	2	0.50	30	16
2X8	2.0	1.91	2.0	8.0	50.0	4.0	2	0.50	30	16
2X10	2.0	1.91	2.0	10.0	50.0	4.0	2	0.50	30	16
2X12	2.0	1.91	2.0	12.0	54.0	4.0	2	0.50	30	16
2X15	2.0	1.91	2.0	15.0	54.0	4.0	2	0.50	30	16
2X20	2.0	1.91	2.0	20.0	60.0	4.0	2	0.50	30	16
2X25	2.0	1.91	2.0	25.0	70.0	4.0	2	0.50	30	16
2X30	2.0	1.91	2.0	30.0	70.0	4.0	2	0.50	30	16
2X35	2.0	1.91	2.0	35.0	80.0	4.0	2	0.50	30	16
2X40	2.0	1.91	2.0	40.0	80.0	4.0	2	0.50	30	16
2,5X12	2.5	2.41	2.5	12.0	54.0	4.0	2	0.50	30	16
2,5X15	2.5	2.41	2.5	15.0	54.0	4.0	2	0.50	30	16
2,5X20	2.5	2.41	2.5	20.0	54.0	4.0	2	0.50	30	16
2,5X25	2.5	2.41	2.5	25.0	60.0	4.0	2	0.50	30	16
2,5X30	2.5	2.41	2.5	30.0	70.0	4.0	2	0.50	30	16
3X6	3.0	2.91	4.5	6.0	50.0	4.0	2	0.50	30	16
3X8	3.0	2.91	4.5	8.0	50.0	4.0	2	0.50	30	16
3X10	3.0	2.91	4.5	10.0	50.0	4.0	2	0.50	30	16
3X12	3.0	2.91	4.5	12.0	50.0	4.0	2	0.50	30	16
3X15	3.0	2.91	4.5	15.0	54.0	4.0	2	0.50	30	16
3X20	3.0	2.91	4.5	20.0	54.0	4.0	2	0.50	30	16
3X25	3.0	2.91	4.5	25.0	60.0	4.0	2	0.50	30	16
3X30	3.0	2.91	4.5	30.0	70.0	4.0	2	0.50	30	16
3X35	3.0	2.91	4.5	35.0	80.0	4.0	2	0.50	30	16
3X40	3.0	2.91	4.5	40.0	80.0	4.0	2	0.50	30	16
3X45	3.0	2.91	4.5	45.0	90.0	4.0	2	0.50	30	16



Download Catalog
Pages (PDF)

 Download Catalog Pages (PDF)			Strength (N/mm²)	Material	Dimension Infeed in mm Application											
					Ø1.5x4			Ø1.5x30			Ø1.8x8			Ø1.8x20		
					ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.02xD	ae=0.03xD ap=L2 max	ae=0.01xD ap=0.01xD	ae=1xD ap=0.2xD	ae=0.25xD ap=L2 max	ae=0.1xD ap=0.1xD	ae=1xD ap=0.1xD	ae=0.13xD ap=L2 max	ae=0.05xD ap=0.05xD
																
					Feed (mm/Z)		fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
N		Vc (m/min)														
1.1	Aluminium, alloyed	<500	500	0.025	0.03	0.035	0.015	0.02	0.025	0.03	0.035	0.04	0.025	0.03	0.035	
1.2	Aluminium, alloyed	<600	480	0.025	0.03	0.035	0.015	0.02	0.025	0.03	0.035	0.04	0.025	0.03	0.035	
2.1-2.3	Aluminium, casted	<600	450	0.022	0.027	0.032	0.013	0.017	0.022	0.027	0.031	0.035	0.022	0.026	0.03	
3.1-3.3	Cooper, alloyed	<650	220	0.019	0.024	0.029	0.011	0.014	0.019	0.024	0.027	0.03	0.019	0.022	0.025	
4.1	Magnesium, alloyed	<250	500	0.025	0.03	0.035	0.015	0.02	0.025	0.03	0.035	0.04	0.025	0.03	0.035	
5.1	Thermoplastic	<100	400	0.022	0.027	0.032	0.013	0.017	0.022	0.027	0.031	0.035	0.022	0.026	0.03	
5.2	Duroplastic	<150	350	0.019	0.024	0.029	0.011	0.014	0.019	0.024	0.027	0.03	0.019	0.022	0.025	

Material			Strength (N/mm²)	Dimension	Ø2x4			Ø2x40			Ø2.5x12			Ø2.5x30		
				Infeed in mm	ae=1xD	ae=0.25xD	ae=0.1xD	ae=1xD	ae=0.015xD	ae=0.01xD	ae=1xD	ae=0.25xD	ae=0.1xD	ae=1xD	ae=0.09xD	ae=0.04xD
					ap=0.2xD	ap=L2 max	ae=0.1xD	ap=0.01xD	ap=L2 max	ae=0.01xD	ap=0.2xD	ap=L2 max	ae=0.1xD	ap=0.07xD	ap=L2 max	ae=0.04xD
					Application											
				Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
N			Vc (m/min)													
1.1	Aluminium, alloyed	<500	500	0.03	0.035	0.04	0.02	0.025	0.03	0.03	0.035	0.04	0.025	0.03	0.035	
1.2	Aluminium, alloyed	<600	480	0.03	0.035	0.04	0.02	0.025	0.03	0.03	0.035	0.04	0.025	0.03	0.035	
2.1-2.3	Aluminium, casted	<600	450	0.027	0.031	0.035	0.017	0.021	0.025	0.027	0.031	0.035	0.022	0.026	0.03	
3.1-3.3	Cooper, alloyed	<650	220	0.024	0.027	0.03	0.014	0.017	0.02	0.024	0.027	0.03	0.019	0.022	0.025	
4.1	Magnesium, alloyed	<250	500	0.03	0.035	0.04	0.02	0.025	0.03	0.03	0.035	0.04	0.025	0.03	0.035	
5.1	Thermoplastic	<100	400	0.027	0.031	0.035	0.017	0.021	0.025	0.027	0.031	0.035	0.022	0.026	0.03	
5.2	Duroplastic	<150	350	0.024	0.027	0.03	0.014	0.017	0.02	0.024	0.027	0.03	0.019	0.022	0.025	

Material		Strength (N/mm²)	Dimension		Ø 3x6			Ø 3x45						
			Infeed in mm	ae=	ae=	ae=	ae=	ae=	ae=					
				1xD	0.25xD	0.1xD	1xD	0.05xD	0.02xD					
				ap=	ap=	ap=	ap=	ap=	ap=					
			0.2xD	L2 max	0.1xD	0.04xD	L2 max	0.02xD						
														
														
														
														
														
														
														
														
														
														

NOTE | Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.
 ae/ap(max)= 0.5x corner radius!

Cooling



Tolerance

d04

Coating

AlphaSlide Rainbow

Strategy

HSC

Application



Features

HA

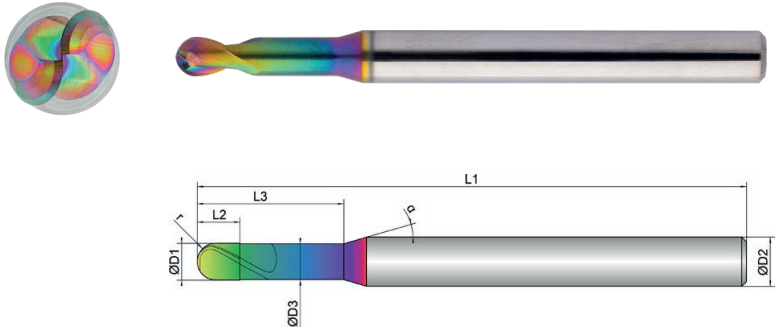


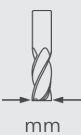
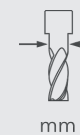
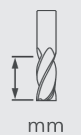
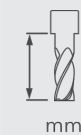


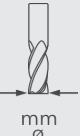
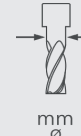
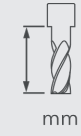


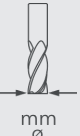
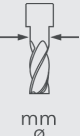
- Optimized face geometry for excellent surfaces and highest dimensional accuracy
- Defined microbevel for support and stabilization
- Polished chip space for ideal chip evacuation

- Tolerance D1: -0.001/-0.006 mm
- Tolerance D3: 0/-0.02 mm
- Radius tolerance r: 0/-0.003 mm (measured from 0-90°)



Roughing						Finishing				
inappropriateoptimal						inappropriateoptimal				
EXN1-M17-0003	D1	D3	L2	L3	L1	D2	z	r		α
										
	mm ø	mm ø	mm	mm	mm	mm ø	#	mm	°	°
	0,1X0,3	0.10.08	0.1	0.3	45.0	4.0	2	0.05	30	16
	0,1X0,5	0.10.08	0.1	0.5	45.0	4.0	2	0.05	30	16
	0,1X1	0.10.08	0.1	1.0	45.0	4.0	2	0.05	30	16
	0,2X0,5	0.20.17	0.2	0.5	45.0	4.0	2	0.10	30	16
	0,2X1	0.20.17	0.2	1.0	45.0	4.0	2	0.10	30	16
	0,2X2	0.20.17	0.2	2.0	45.0	4.0	2	0.10	30	16
	0,2X3	0.20.17	0.2	3.0	45.0	4.0	2	0.10	30	16
	0,3X0,5	0.30.27	0.2	0.5	45.0	4.0	2	0.15	30	16
	0,3X1	0.30.27	0.2	1.0	45.0	4.0	2	0.15	30	16
	0,3X2	0.30.27	0.2	2.0	45.0	4.0	2	0.15	30	16
	0,3X3	0.30.27	0.2	3.0	45.0	4.0	2	0.15	30	16
0,3X4	0.30.27	0.2	4.0	45.0	4.0	2	0.15	30	16	
0,3X6	0.30.27	0.2	6.0	45.0	4.0	2	0.15	30	16	
0,4X1	0.40.37	0.3	1.0	45.0	4.0	2	0.20	30	16	
0,4X2	0.40.37	0.3	2.0	45.0	4.0	2	0.20	30	16	

EXN1-M17-0003	D1  mm ø	D3  mm ø	L2  mm	L3  mm	L1  mm	D2  mm ø	z  #	r  mm	 °	α  °
0,4X3	0.4	0.37	0.3	3.0	45.0	4.0	2	0.20	30	16
0,4X4	0.4	0.37	0.3	4.0	45.0	4.0	2	0.20	30	16
0,4X6	0.4	0.37	0.3	6.0	45.0	4.0	2	0.20	30	16
0,4X8	0.4	0.37	0.3	8.0	45.0	4.0	2	0.20	30	16
0,5X1	0.5	0.47	0.4	1.0	45.0	4.0	2	0.25	30	16
0,5X1,5	0.5	0.47	0.4	1.5	45.0	4.0	2	0.25	30	16
0,5X2	0.5	0.47	0.4	2.0	45.0	4.0	2	0.25	30	16
0,5X3	0.5	0.47	0.4	3.0	45.0	4.0	2	0.25	30	16
0,5X4	0.5	0.47	0.4	4.0	45.0	4.0	2	0.25	30	16
0,5X6	0.5	0.47	0.4	6.0	45.0	4.0	2	0.25	30	16
0,5X8	0.5	0.47	0.4	8.0	45.0	4.0	2	0.25	30	16
0,6X2	0.6	0.57	0.5	2.0	45.0	4.0	2	0.30	30	16
0,6X3	0.6	0.57	0.5	3.0	45.0	4.0	2	0.30	30	16
0,6X4	0.6	0.57	0.5	4.0	45.0	4.0	2	0.30	30	16
0,6X6	0.6	0.57	0.5	6.0	45.0	4.0	2	0.30	30	16
0,6X8	0.6	0.57	0.5	8.0	45.0	4.0	2	0.30	30	16
0,8X2	0.8	0.77	0.6	2.0	45.0	4.0	2	0.40	30	16
0,8X3	0.8	0.77	0.6	3.0	45.0	4.0	2	0.40	30	16
0,8X4	0.8	0.77	0.6	4.0	45.0	4.0	2	0.40	30	16
0,8X6	0.8	0.77	0.6	6.0	45.0	4.0	2	0.40	30	16
0,8X8	0.8	0.77	0.6	8.0	45.0	4.0	2	0.40	30	16
1X2	1.0	0.96	0.8	2.0	45.0	4.0	2	0.50	30	16
1X3	1.0	0.96	0.8	3.0	45.0	4.0	2	0.50	30	16
1X4	1.0	0.96	0.8	4.0	45.0	4.0	2	0.50	30	16
1X5	1.0	0.96	0.8	5.0	45.0	4.0	2	0.50	30	16
1X6	1.0	0.96	0.8	6.0	45.0	4.0	2	0.50	30	16
1X8	1.0	0.96	0.8	8.0	45.0	4.0	2	0.50	30	16

EXN1-M17-0003	D1	D3	L2	L3	L1	D2	z	r		α
	 mm ø	 mm ø	 mm	 mm	 mm	 mm ø	 #	 mm		 °
1X10	1.0	0.96	0.8	10.0	50.0	4.0	2	0.50	30	16
1X12	1.0	0.96	0.8	12.0	50.0	4.0	2	0.50	30	16
1,2X3	1.2	1.16	1.0	3.0	45.0	4.0	2	0.60	30	16
1,2X4	1.2	1.16	1.0	4.0	45.0	4.0	2	0.60	30	16
1,2X6	1.2	1.16	1.0	6.0	45.0	4.0	2	0.60	30	16
1,2X8	1.2	1.16	1.0	8.0	45.0	4.0	2	0.60	30	16
1,2X10	1.2	1.16	1.0	10.0	45.0	4.0	2	0.60	30	16
1,2X12	1.2	1.16	1.0	12.0	50.0	4.0	2	0.60	30	16
1,2X20	1.2	1.16	1.0	20.0	54.0	4.0	2	0.60	30	16
1,5X3	1.5	1.44	1.2	3.0	45.0	4.0	2	0.75	30	16
1,5X4	1.5	1.44	1.2	4.0	45.0	4.0	2	0.75	30	16
1,5X6	1.5	1.44	1.2	6.0	45.0	4.0	2	0.75	30	16
1,5X8	1.5	1.44	1.2	8.0	45.0	4.0	2	0.75	30	16
1,5X10	1.5	1.44	1.2	10.0	45.0	4.0	2	0.75	30	16
1,5X12	1.5	1.44	1.2	12.0	50.0	4.0	2	0.75	30	16
1,8X8	1.8	1.74	1.4	8.0	45.0	4.0	2	0.90	30	16
1,8X10	1.8	1.74	1.4	10.0	45.0	4.0	2	0.90	30	16
1,8X12	1.8	1.74	1.4	12.0	50.0	4.0	2	0.90	30	16
2X4	2.0	1.94	1.6	4.0	45.0	4.0	2	1.00	30	16
2X6	2.0	1.94	1.6	6.0	45.0	4.0	2	1.00	30	16
2X8	2.0	1.94	1.6	8.0	45.0	4.0	2	1.00	30	16
2X10	2.0	1.94	1.6	10.0	45.0	4.0	2	1.00	30	16
2X12	2.0	1.94	1.6	12.0	45.0	4.0	2	1.00	30	16
3X6	3.0	2.92	3.5	6.0	45.0	4.0	2	1.50	30	16
3X8	3.0	2.92	3.5	8.0	45.0	4.0	2	1.50	30	16
3X10	3.0	2.92	3.5	10.0	45.0	4.0	2	1.50	30	16
3X12	3.0	2.92	3.5	12.0	45.0	4.0	2	1.50	30	16



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		Strength (N/mm²)	Dimension	Ø0.1x0.3	Ø0.1x1	Ø0.2x0.5	Ø0.2x3	Ø0.3x0.5	Ø0.3x6	Ø0.4x1	Ø0.4x8	Ø0.5x1	Ø0.5x8
Infeed in mm				ae=0.1xD ap=0.1xD	ae=0.05xD ap=0.05xD	ae=0.1xD ap=0.1xD	ae=0.02xD ap=0.02xD	ae=0.1xD ap=0.1xD	ae=0.01xD ap=0.01xD	ae=0.1xD ap=0.1xD	ae=0.01xD ap=0.01xD	ae=0.1xD ap=0.1xD	ae=0.015xD ap=0.015xD
Application													
Material		Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
N		Vc (m/min)											
1.1	Aluminium, alloyed	<500	500	0.012	0.007	0.014	0.008	0.014	0.008	0.018	0.009	0.016	0.012
1.2	Aluminium, alloyed	<600	480	0.012	0.007	0.014	0.008	0.014	0.008	0.018	0.009	0.016	0.012
2.1-2.3	Aluminium, casted	<600	450	0.011	0.006	0.013	0.007	0.013	0.007	0.017	0.008	0.015	0.011
3.1-3.3	Cooper, alloyed	<650	220	0.01	0.005	0.012	0.006	0.012	0.006	0.016	0.007	0.014	0.01
4.1	Magnesium, alloyed	<250	500	0.012	0.007	0.014	0.008	0.014	0.008	0.018	0.009	0.016	0.012
5.1	Thermoplastic	<100	400	0.011	0.006	0.013	0.007	0.013	0.007	0.017	0.008	0.015	0.011
5.2	Duroplastic	<150	350	0.01	0.005	0.012	0.006	0.012	0.006	0.016	0.007	0.014	0.01

		Dimension	Ø0.6x2	Ø0.6x8	Ø0.8x2	Ø0.8x8	Ø1x2	Ø1x12	Ø1.2x3	Ø1.2x20	Ø1.5x3	Ø1.5x12	
Infeed in mm			ae=0.1xD ap=0.1xD	ae=0.025xD ap=0.025xD	ae=0.1xD ap=0.1xD	ae=0.05xD ap=0.05xD	ae=0.1xD ap=0.1xD	ae=0.03xD ap=0.03xD	ae=0.1xD ap=0.1xD	ae=0.015xD ap=0.015xD	ae=0.1xD ap=0.1xD	ae=0.07xD ap=0.07xD	
Application													
Material		Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	
N		Vc (m/min)											
1.1	Aluminium, alloyed	<500	500	0.022	0.017	0.022	0.017	0.035	0.028	0.035	0.025	0.035	0.03
1.2	Aluminium, alloyed	<600	480	0.022	0.017	0.022	0.017	0.035	0.028	0.035	0.025	0.035	0.03
2.1-2.3	Aluminium, casted	<600	450	0.021	0.016	0.021	0.016	0.032	0.026	0.032	0.023	0.032	0.027
3.1-3.3	Cooper, alloyed	<650	220	0.02	0.015	0.02	0.015	0.029	0.024	0.029	0.021	0.029	0.024
4.1	Magnesium, alloyed	<250	500	0.022	0.017	0.022	0.017	0.035	0.028	0.035	0.025	0.035	0.03
5.1	Thermoplastic	<100	400	0.021	0.016	0.021	0.016	0.032	0.026	0.032	0.023	0.032	0.027
5.2	Duroplastic	<150	350	0.02	0.015	0.02	0.015	0.029	0.024	0.029	0.021	0.029	0.024

		Dimension	Ø1.8x8	Ø1.8x12	Ø2x4	Ø2x12	Ø3x6	Ø3x12				
Infeed in mm			ae=0.1xD ap=0.1xD	ae=0.09xD ap=0.09xD	ae=0.1xD ap=0.1xD	ae=0.09xD ap=0.09xD	ae=0.1xD ap=0.1xD	ae=0.1xD ap=0.1xD				
Application												
Material		Feed (mm/Z)	fz	fz	fz	fz	fz	fz				
N		Vc (m/min)										
1.1	Aluminium, alloyed	<500	500	0.04	0.035	0.04	0.035	0.043	0.04			
1.2	Aluminium, alloyed	<600	480	0.04	0.035	0.04	0.035	0.043	0.04			
2.1-2.3	Aluminium, casted	<600	450	0.035	0.032	0.035	0.032	0.038	0.035			
3.1-3.3	Cooper, alloyed	<650	220	0.03	0.029	0.03	0.029	0.033	0.03			
4.1	Magnesium, alloyed	<250	500	0.04	0.035	0.04	0.035	0.043	0.04			
5.1	Thermoplastic	<100	400	0.035	0.032	0.035	0.032	0.038	0.035			
5.2	Duroplastic	<150	350	0.03	0.029	0.03	0.029	0.033	0.03			

NOTE | Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.

Cooling

Tolerance

d04

Coating

AlphaSlide Rainbow

Strategy

HSC

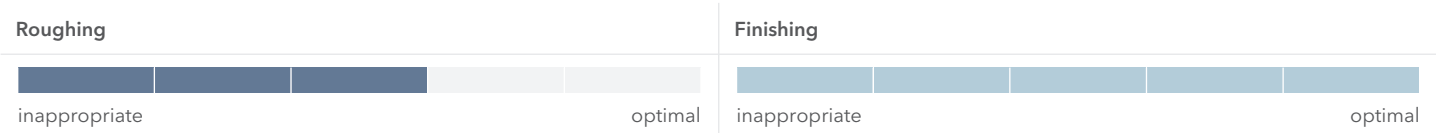
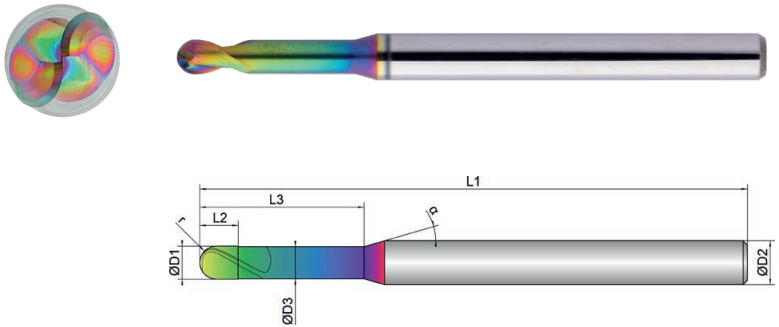
Application

Features

HA

Expert

- Optimized face geometry for excellent surfaces and highest dimensional accuracy
- Defined microbevel for support and stabilization
- Polished chip space for ideal chip evacuation

Tolerance D1: -0.001/-0.006 mmTolerance D3: 0/-0.02 mmRadius tolerance r: 0/-0.003 mm (measured from 0-90°)

EXN1-M17-0013	D1 	D3 	L2 	L3 	L1 	D2 	z 	r 		α
0,5X10	0.5	0.47	0.4	10.0	50.0	4.0	2	0.25	30	16
0,6X10	0.6	0.57	0.5	10.0	50.0	4.0	2	0.30	30	16
0,8X10	0.8	0.77	0.6	10.0	50.0	4.0	2	0.40	30	16
0,8X12	0.8	0.77	0.6	12.0	50.0	4.0	2	0.40	30	16
1X15	1.0	0.96	0.8	15.0	50.0	4.0	2	0.50	30	16
1X20	1.0	0.96	0.8	20.0	60.0	4.0	2	0.50	30	16
1X25	1.0	0.96	0.8	25.0	60.0	4.0	2	0.50	30	16
1X30	1.0	0.96	0.8	30.0	70.0	4.0	2	0.50	30	16
1,2X15	1.2	1.16	1.0	15.0	54.0	4.0	2	0.60	30	16
1,5X15	1.5	1.44	1.2	15.0	50.0	4.0	2	0.75	30	16
1,5X20	1.5	1.44	1.2	20.0	60.0	4.0	2	0.75	30	16
1,5X25	1.5	1.44	1.2	25.0	60.0	4.0	2	0.75	30	16
1,5X30	1.5	1.44	1.2	30.0	70.0	4.0	2	0.75	30	16
1,8X15	1.8	1.74	1.4	15.0	50.0	4.0	2	0.90	30	16

EXN1-M17-0013	D1 	D3 	L2 	L3 	L1 	D2 	z 	r 		α
1,8X20	1.8	1.74	1.4	20.0	54.0	4.0	2	0.90	30	16
2X12	2.0	1.94	1.6	12.0	50.0	4.0	2	1.00	30	16
2X15	2.0	1.94	1.6	15.0	50.0	4.0	2	1.00	30	16
2X20	2.0	1.94	1.6	20.0	60.0	4.0	2	1.00	30	16
2X25	2.0	1.94	1.6	25.0	60.0	4.0	2	1.00	30	16
2X30	2.0	1.94	1.6	30.0	70.0	4.0	2	1.00	30	16
2X35	2.0	1.94	1.6	35.0	80.0	4.0	2	1.00	30	16
2X40	2.0	1.94	1.6	40.0	80.0	4.0	2	1.00	30	16
2,5X15	2.5	2.41	2.0	15.0	50.0	4.0	2	1.25	30	16
2,5X20	2.5	2.41	2.0	20.0	54.0	4.0	2	1.25	30	16
2,5X25	2.5	2.41	2.0	25.0	60.0	4.0	2	1.25	30	16
2,5X30	2.5	2.41	2.0	30.0	70.0	4.0	2	1.25	30	16
3X15	3.0	2.92	3.5	15.0	50.0	4.0	2	1.50	30	16
3X20	3.0	2.92	3.5	20.0	54.0	4.0	2	1.50	30	16
3X25	3.0	2.92	3.5	25.0	60.0	4.0	2	1.50	30	16
3X30	3.0	2.92	3.5	30.0	70.0	4.0	2	1.50	30	16
3X35	3.0	2.92	3.5	35.0	70.0	4.0	2	1.50	30	16
3X40	3.0	2.92	3.5	40.0	80.0	4.0	2	1.50	30	16
3X45	3.0	2.92	3.5	45.0	80.0	4.0	2	1.50	30	16



Download Catalog
Pages (PDF)

 Download Catalog Pages (PDF)			Dimension		Ø0.5x10	Ø0.610	Ø0.8x10	Ø0.8x12	Ø1x15	Ø1x30	Ø1.2x15	Ø1.5x15	Ø1.5x30	Ø1.8x15
			Infeed in mm		ae=0.01xD	ae=0.015xD	ae=0.035xD	ae=0.02xD	ae=0.02xD	ae=0.01xD	ae=0.035xD	ae=0.05xD	ae=0.01xD	ae=0.07xD
			Application		ap=0.01xD	ap=0.015xD	ap=0.035xD	ap=0.02xD	ap=0.02xD	ap=0.01xD	ap=0.035xD	ap=0.05xD	ap=0.01xD	ap=0.07xD
														
Material	Strength (N/mm²)	Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
N			Vc (m/min)											
1.1	Aluminium, alloyed	<500	500	0.012	0.017	0.017	0.017	0.028	0.017	0.028	0.03	0.025	0.035	
1.2	Aluminium, alloyed	<600	480	0.012	0.017	0.017	0.017	0.028	0.017	0.028	0.03	0.025	0.035	
2.1-2.3	Aluminium, casted	<600	450	0.011	0.016	0.016	0.016	0.026	0.016	0.026	0.027	0.022	0.032	
3.1-3.3	Cooper, alloyed	<650	220	0.01	0.015	0.015	0.015	0.024	0.015	0.024	0.024	0.019	0.029	
4.1	Magnesium, alloyed	<250	500	0.012	0.017	0.017	0.017	0.028	0.017	0.028	0.03	0.025	0.035	
5.1	Thermoplastic	<100	400	0.011	0.016	0.016	0.016	0.026	0.016	0.026	0.027	0.022	0.032	
5.2	Duroplastic	<150	350	0.01	0.015	0.015	0.015	0.024	0.015	0.024	0.024	0.019	0.029	
			Dimension	Ø1.8x20	Ø2x12	Ø2x40	Ø2.5x15	Ø2.5x30	Ø3x15	Ø3x45				
			Infeed in mm	ae=0.05xD	ae=0.09xD	ae=0.01xD	ae=0.09xD	ae=0.035xD	ae=0.09xD	ae=0.02xD				
			Application	ap=0.05xD	ap=0.09xD	ap=0.01xD	ap=0.09xD	ap=0.035xD	ap=0.09xD	ap=0.02xD				
														
			Feed (mm/Z)	fz	fz	fz	fz	fz	fz	fz				
N			Vc (m/min)											
1.1	Aluminium, alloyed	<500	500	0.03	0.035	0.025	0.035	0.03	0.04	0.03				
1.2	Aluminium, alloyed	<600	480	0.03	0.035	0.025	0.035	0.03	0.04	0.03				
2.1-2.3	Aluminium, casted	<600	450	0.027	0.032	0.022	0.032	0.027	0.035	0.025				
3.1-3.3	Cooper, alloyed	<650	220	0.024	0.029	0.019	0.029	0.024	0.03	0.02				
4.1	Magnesium, alloyed	<250	500	0.03	0.035	0.025	0.035	0.03	0.04	0.03				
5.1	Thermoplastic	<100	400	0.027	0.032	0.022	0.032	0.027	0.035	0.025				
5.2	Duroplastic	<150	350	0.024	0.029	0.019	0.029	0.024	0.03	0.02				
NOTE Values in the table are the shortest and the longest overhang length (L3) of each dimension; please calculate fz, ap and ae depending on the given values.														



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CONFIGURATOR WITHIN ONE
WORKING DAY AT THE LATEST



EXPLANATION

APPLICATIONS

 Multipass milling	 Trimming	 Deburring	 Engraving
 Corner rounding	 Full slot milling	 Forward and backward deburring	

COOLINGS

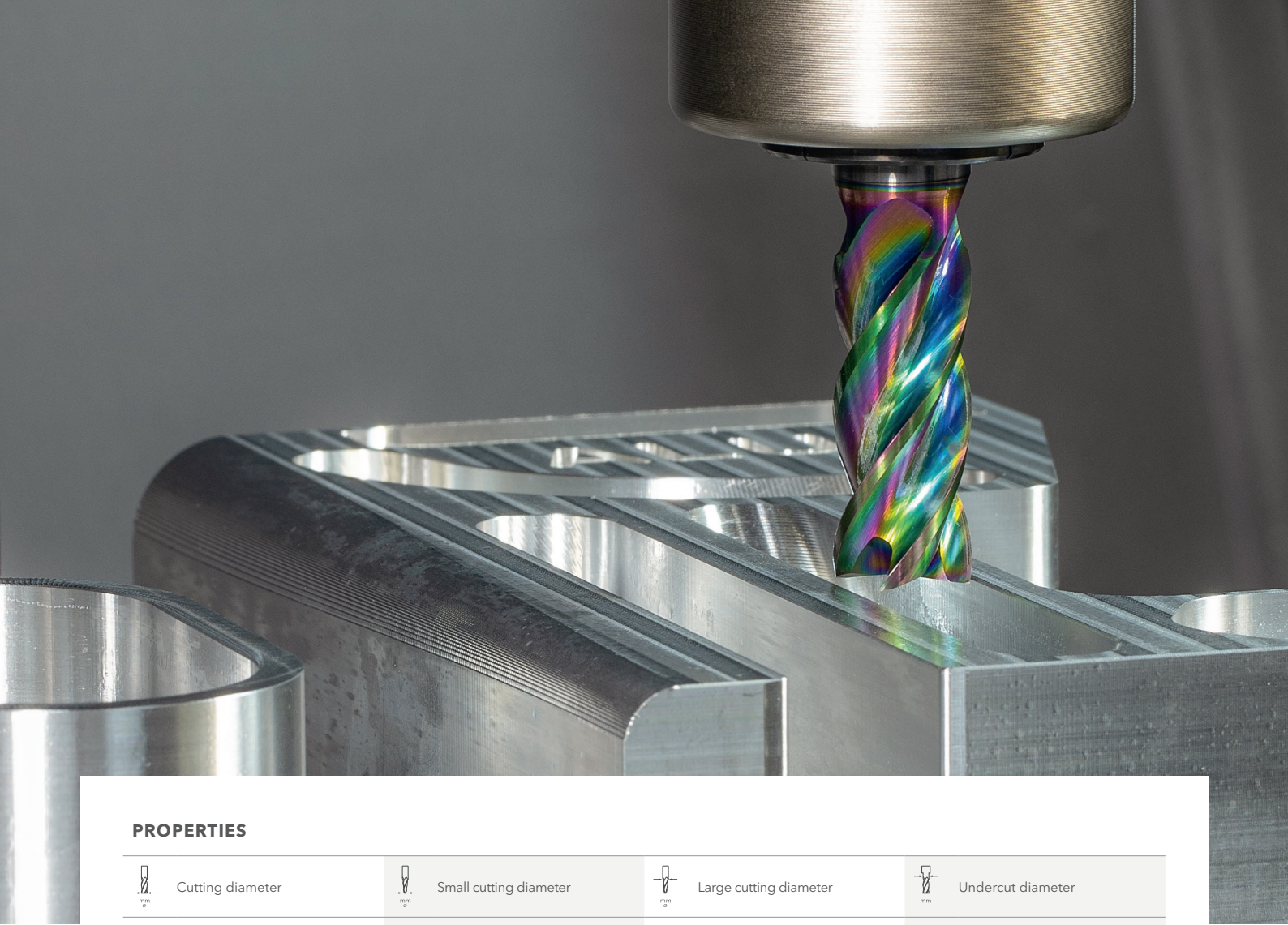
 Air-cooling	 Dry machining	 Oil cooling	 Cooling Lubricant
 Minimum quantity lubrication			

FEATURES

 2xD	 3xD	 4xD	 5xD
 Center cutting	 Non-center cutting	 Without Weldon	 With Weldon
 Internal cooling	 Dynamic helical pitch	 Chip breaker	 Unequal tooth pitch
 Roughing teeth	 Helical immersion	 Feed directions x,y	 Feed directions x, y, z
 Feed directions x, y, (z)			

STRATEGY

 Extended Trochoidal Cutting	 High Performance Cutting	 High Speed Cutting	 Multi Task Cutting
 Universal Machining			



PROPERTIES

 Cutting diameter	 Small cutting diameter	 Large cutting diameter	 Undercut diameter
 Length of cut	 Total bevel length	 Undercut length	 Total length
 Shank diameter	 Number of teeth	 Corner radius	 Corner bevel
 Programming radius	 Maximum depth of cut	 Helical pitch	 Alpha angle

APPLICATION TABLE

The values given in the application table are only guidelines. These values are largely dependent on the machining situation and application.

FIGURES

All technical drawings and photographs are given as an example. The product may deviate from the original in terms of colour and dimensions.

N 1.1ALUMINIUM | alloyed <500 N/mm²

Materialnumber	Germany DIN	Europe EN	France AFNOR	Great Britain BS	Italy UNI	Sweden SIS	Spain UNE	Japan JIS	USA AISI
3.0205	Al99	AW-1200	A 4	1 C	P-Al99.0	4010	L-3001	A1200	AA1200
3.0250	Al99.5H		A 59050 C	L 31					AA1000
3.0255	Al99.5	AW-1050 A	A 5	L 31	P-AlP99.5	4007	L-3051	A1050	AA1050 A
3.0275	Al99.7	AW-1070 A	A 7	2L 48	P-AlP99.7	4005	L-3071	A1070	AA1070 A
3.0280	Al99.8								
3.0285	Al99.8	AW-1080 A	A 8	1A	P-Al99.8	4004	L-3081	A1080	AA1080 A
3.0305	Al99.9	AW-1090							
3.0505	AlMn 0.5 Mg 0.5	AW-3105		N 31				A3105	AA3105
3.0506	AlMn 0.6	AW-3207							
3.0515	AlMn 1	AW-3103		N 3	P-AlMn 1.2	4067	L-3811	A3103	AA3103
3.0517	AlMn 1 Cu	AW-3003	A-M1		P-AlMn 1.2 Cu		L-3810	A3003	AA3003
3.0525	AlMn 1 Mg 0.5	AW-3005	A-MG0,5					A3005	AA3005
3.0526	AlMn 1 Mg 1	AW-3004	A-M1G		P-AlMn 1.2 Mg	GA/6511	L-3820	A3004	AA3004
3.0915	AlFeSi	AW-8011A							
3.1255	AlCu 4 SiMg	AW-2014	A-U4SG	H 15	P-AlCu 4.4 SiMnMg		L-3130	A2014	AA2014
3.1305	AlCu 2.5 Mg	AW-2117	A-U2G	L 86	P-AlCu 2.5 MgSi		L-3180	A2117	AA2117
3.1324	AlCu 4 MgSi	AW-2017 A							
3.1325	AlCuMg1	AW-2017 A	A-U4G	H 14	P-AlCu 4.5 MgMn	GA631	L-3120	A2017	AA2017 A
3.1355	AlCuMg2	AW-2024	A-U4G1	L 97 / L 98	P-AlCu 4.5 MgMn	5	L-3140	A2024	AA2024
3.1371	G-AlCu 4 TiMg	AC-21000							
3.1841	G-AlCu 4 Ti	AC-21100							
3.2134	G-AlSi 5 Cu 1,3 Mg	AC-45300							
3.2307	Al99.85 MgSi								
3.2315	AlMgSi 1	AW-6082	A-SGM0,7	H 30	P-AlMgSi	4212	L-3453		AA6082
3.3206	AlMgSi 0.5	AW-6060	A-GS	H 9	P-AlMgSi	4140	L-3442		AA6060
3.3208	Al99.9 MgSi	AW-6401							
3.3210	AlMgSi 0.7	AW-6005 A							
3.3211	AlMg 1 SiCu	AW-6061	A-GSUC	H 20	P-AlMg 1 SiCu		L-3420	A6061	AA6061
3.3241	G-AlMg 3 Si								
3.3261	G-AlMg 5 Si	AC-51400							
3.3292	GD-AlMg 9	AC-51200							
3.3307	Al99.85 Mg 0.5	AW-5110							
3.3308	Al99.9 Mg 0.5	AW-5210							
3.3315	AlMg1	AW-5005 A	A-G0,6	N 41	P-AlMg 0.9	4106	L-3350	A5005	AA5005 A
3.3316	AlMg 1.5	AW-5050	A-G1,5	3L 44	P-AlMg 1.5		L-3380		AA5050 B
3.3317	Al99.85 Mg 1	AW-5305							
3.3318	Al99.9 Mg 1	AW-5505							
3.3326	AlMg 1.8	AW-5051 A							
3.3345	AlMg 4.5	AW-5082	A-G4,5		P-AlMg 4.4			A5082	AA5082
3.3523	AlMg 2.5	AW-5052	A-G2,5C	L 80 / L 81	P-AlMg 2.5	4120	L-3360	A5052	AA5052
3.3525	AlMg 2 Mn 0.3	AW-5251	A-G2M	N4	P-AlMg 2 Mn		L-3361		AA5251
3.3527	AlMg 2 Mn 0.8	AW-5049	A-G2,5MC					A5049	AA5049
3.3535	AlMg 3	AW-5754	A-G3M		P-AlMg 3.5	4130	L-3390		AA5754
3.3537	AlMg 2.7 Mn	AW-5454	A-G2,5MC		P-AlMg 2.7 Mn	4130	L-3391		AA5454
3.3541	G-AlMg 3	AC-51100							
3.3545	AlMg 4 Mn	AW-5086	A-G4MC		P-AlMg 4.4		L-3382		AA5086
3.3547	AlMg 4,5 Mn	AW-5083	A-G4,5MC	N 8	P-AlMg 4.5	4140	L-3321	A5083	AA5083
3.3549	AlMg 5 Mn	AW-5182							
3.3555	AlMg 5	AW-5019							
3.3561	G-AlMg 5	AC-51300							

N 1.2ALUMINIUM | alloyed <600 N/mm²

Materialnumber	Germany DIN	Europe EN	France AFNOR	Great Britain BS	Italy UNI	Sweden SIS	Spain UNE	Japan JIS	USA AISI
3.0615	AlMgSiPb	AW-6012	A-SGPb		P-AlSiMgMn		L-3452		AA6012
3.1645	AlCu 4 PbMgMn	AW-2007				4355	L-3121	A2007	AA2007
3.1655	AlCu 6 BiPb	AW-2011	A-U5PbBi	FC 1	P-AlCu 5.5 PbBi	4338	L-3192	A2011	AA2011
3.4335	AlZn 4.5 Mg 1	AW-7020	A-Z5G	H 17		4425	L-3741		AA7020
3.4345	AlZnMgCu 0.5	AW-7022	A-Z4GU						AA7022
3.4365	AlZnMgCu 1.5	AW-7075	A-Z5GU	2L 95	P-AlZn 5.8 MgCu		L-3710	A7075	AA7075

N 2.1 - N 2.3ALUMINIUM | casted <600 N/mm²

Materialnumber	Germany DIN	Europe EN	France AFNOR	Great Britain BS	Italy UNI	Sweden SIS	Spain UNE	Japan JIS	USA AISI
3.1841	G-AlCu 4 Ti							AC1A	A 295.0
3.1871	G-AlCu 4 TiMg								
3.2131	G-AlSiCu1								
3.2151	G-AlSi 6 Cu 4	AC-45000	A-S5UZ	LM 4				AC4B	A 319.0
3.2161	G-AlSi 8 Cu 3	AC-46200	A-S9U3A-Y4	LM 24	5075			AC4D	A 328.0
3.2163	GD-AlSi 9 Cu 3								
3.2211	G-AlSi 11								
3.2341	G-AlSi 5 Mg								
3.2371	G-AlSi 7 Mg 0,3	AC-42100						AC4CH	A 356.0
3.2373	G-AlSi 9 Mg	AC-43300							
3.2381	G-AlSi 10 Mg	AC-43100							
3.2382	GD-AlSi 10 Mg								
3.2383	G-AlSi 10 Mg(Cu)	AC-43400	A-S10G	LM 9	3049	4253		ADC3	A 360.2
3.2581	G-AlSi 12	AC-47100	A-S13	LM 6	4514	4261		AC3A	A 413.2
3.2582	GD-AlSi 12					4247		ADC1	A 413.0
3.2583	G-AlSi 12 Cu	AC-44300	A-S12-Y4	LM 20	5079	4260		ADC1	A 413.1
3.2585	SG-AlSi12								
3.2982	GD-AlSi 12 Cu								
3.3241	G-AlMg 3 Si								
3.3261	G-AlMg 5 Si								
3.3561	G-AlMg 5							AC7A	A 514.0

N 3.1 - N 3.3COPPER | alloyed <600 N/mm²

Materialnumber	Germany DIN	Europe EN	France AFNOR	Great Britain BS	Italy UNI	Sweden SIS	Spain UNE	Japan JIS	USA AISI
2.0060	E-Cu 57	CW-004A							B-120
2.0065	E-Cu 58	CW-004A	Sn-a2	C 101					C 11000
2.0070	SE-Cu	CW-020A	Cu-c1	C 101					C 10300
2.0082	G-Cu L 45			HCC 1					C 81100
2.0085	G-Cu L 50	CC-040A		HCC 1					C 81100
2.0240	CuZn 15	CW-502L	CuZn 15	CZ 102				C 2300	C 23000
2.0265	CuZn 30	CW-505L	CuZn 30	CZ 102				C 2600	C 26000
2.0321	CuZn 37	CW-508L	CuZn 37	CZ 180	C 2720				C 27200
2.0340	G-CuZn 37 Pb	CC-754S-GM							
2.0492	G-CuZn 15 Si 4	CC-761S-GS							B-198
2.0592	G-CuZn 35 Al 1	CC-765S	U-Z 36 N 3	HTB 1					C 86500
2.0595	G-KCuZn 37 Al 1	CC-766S							
2.0596	G-CuZn 34 Al 2	CC-764S	U-Z 36 N 3						
2.0857	CuNi 3 Si	CW-112C							
2.0916	CuAl 5								
2.0927	SG-CuAl 9 Ni 5 Fe								
2.0936	CuAl 10 Fe 3 Mn 2	CW-306G	U-A 10 Fe	CA 103					
2.0966	CuAl 10 Ni 5 Fe 4	CW-307G	U-A 10 N	CA 104					C 63000
2.1006	SG-CuSn								
2.1050	G-CuSn 10	CC-480K-GS		CT 1					C 90700
2.1052	G-CuSn 12	CC-483K-GS	UE 12 P	Pb 2					C 91700
2.1060	G-CuSn 12 Ni 2	CC-484K-GS							C 91700
2.1090	G-CuSn 7 ZnPb		UE 7 Z5 Pb 4						C 93200
2.1093	G-CuSn 6 ZnNi			LG 4					
2.1096	G-CuSn 5 ZnPb		UE 5 Pb 5 Z 5	LG 2					C 83600
2.1176	G-CuPb 10 Sn	CC-495K-GS	UE 10 Pb 10	LB 2					C 93700
2.1182	G-CuPb 15 Sn	CC-496K-GS	U-Pb 15 E 8	LB 1					C 93800
2.1188	G-CuPb 20 Sn	CC-497K-GS	U-Pb 20	LB 5					C 94100
2.1266	CuCd 1								
2.1292	G-CuCrF 35	CC-140C		CC1-FF					C 81500
2.1293	CuCrZr	CW-106C	U-Cr 0.8 Zr	CC 102					C 81500
2.1322	CuMg 0,4								
2.1355	CuMn 2								
2.1461	SG-CuSi 3	CW-116C							

N 4.1 **MAGNESIUM** | alloyed <200 N/mm²

Materialnumber	Germany DIN	Europe EN	France AFNOR	Great Britain BS	Italy UNI	Sweden SIS	Spain UNE	Japan JIS	USA AISI
3.5101	G-MgZn 4 SE1 Zr 1	MC-35110	G-Z 4 Tr	MAG-5					ZE 41
3.5102	G-MgZn 5 Th2 Zr1								
3.5103	MgSE 3 Zn2 Zr1	MC-65120	G-Tr 3 Z 2	MAG-6					EZ 33
3.5105	G-MgTh 3 Zn2 Zr1								QE 22
3.5106	G-MgAg 3 SE2 Zr1	MC-65210	G-Ag 22.5	MAG-12					
3.5200	G-MgAl 8 Zn 1	MA-40020							
3.5312	MgAl 3 Zn	MA-21130							
3.5314	MgAl 3 Zn		G-A3 Z1	MAG-E-111					AZ 31 B
3.5470	GD-MgAl 4 Si 1	MC-21320							
3.5612	GD-MgAl 6 Zn 3	MC-21140							
3.5614	MgAl 6 Zn		G-A6 Z1	MAG-E-121					AZ 61 A
3.5662	GD-MgAl 6								
3.5812	G-MgAl 8 Zn 1	MC-21110	G-A9						AZ 81
3.5912	G-MgAl 9 Zn 1	MC-21120	G-A 9 Z 1						AZ 91

N 5.1 **PLASTICS** | thermoplastics <100 N/mm²

Materialnumber	Germany DIN	Europe EN	France AFNOR	Great Britain BS	Italy UNI	Sweden SIS	Spain UNE	Japan JIS	USA AISI
PC	Makralon		Orgalan	Sinvet					Lexan
PC	Nuclon								Merlon
PC	Plastocarbon								
PE	Baylon			Fertene	Carlona				Althon
PE	Dekalen			Eraclene	Escorene				Bakellite
PE	Lupolen								Chemplex
PE	Hostalen								Dylan
PF	Alberit			Fenachem					Biralit
PF	Bakelit			Moldesile					Biratex
PF	Bulitol								Birax
PF	Durax								
PF	Hiarex								
PF	Resinol								
PFTE	Hostaflon		Sorefflon						Halon; Teflon
PP	Vestolen PP		Eitex P	Moplen	Carola P				Profax
PP	Synalen PP		Napryl	Kastilen	Procom				Rexene
PP	Novolen								Tenite
PP	Hostalen PP								
PS	Hostylon			Sdistir	Lustrex				Carinex
PS	Lorkalen			Lastinol					Dylene
PS	Polystyrol								Toporex
PS	Styropor								
PVC	Coroplast								
PVC	Hostalit								
PVC	Mipolam								
PVC	Opalon								
PVC	Solvec								
PVC	Vinoflex								
PP-H	Homopolymer								
PP-C	Copolymer								
ABS	Acrylnitrid Butadien Styrol								
PMMA	Polymethyl metha Crylat								
PMMA	Plexiglas; Resarit; Degluan								
POMC	Polyoxymethylen								
POMC	Hostaform; ultraform								
PI	Polymid								
PEI	Polytherimid								
PVC-H	Polyvinylchlorid (hard)								
PA	Polyamide								

N 5.2 **PLASTICS** | duroplastics <150 N/mm²

Materialnumber	Germany DIN	Europe EN	France AFNOR	Great Britain BS	Italy UNI	Sweden SIS	Spain UNE	Japan JIS	USA AISI
PUR 5220									
PF 31									
MP 183									

Technical formulas

Calculate cutting speed (m/min)

$$V_c = \frac{D \cdot \pi \cdot n}{1000}$$

Calculate rotational speed (rpm)

$$n = \frac{V_c \cdot 1000}{D \cdot \pi}$$

Calculate feed rate (mm/min)

$$V_f = n \cdot z \cdot f_z$$

Calculate feed per tooth (mm/number of teeth)

$$f_z = \frac{V_f}{n \cdot z}$$

Calculate chip removal rate (cm³/min)

$$Q = \frac{a_p \cdot a_e \cdot V_f}{1000}$$

Calculate average chip thickness (mm)

$$h_m = \frac{\sqrt{a_e}}{n \cdot z}$$

Explanation of terms

Vc	Cutting speed	in m/min
n	Rotational speed	in rpm
Vf	Feed rate	in mm/min
Fz	Feed per tooth	in mm/number of teeth
z	Number of teeth (cutting)	
ap	Depth of cut	in mm
ae	Width of cut	in mm
hm	Average chip thickness	in mm
Q	Chip removal rate	in cm³/min

GENERAL TERMS OF SALE

§ 1 SCOPE

1. These General Terms of Sale apply to all business relationships between Hofmann & Vratny OHG (hereinafter referred to as “Hofmann & Vratny”) and its customers (hereinafter referred to individually as the “Ordering Party” and collectively as the “Ordering Parties”).
2. These General Terms of Sale only apply to Ordering Parties that are entrepreneurs pursuant to §§ 14 and 310 section 1 of the BGB (Civil Code of Germany), legal entities under public law, and/or special funds under public law.
3. The scope of application of these General Terms of Sale includes, but is not limited to, contracts regarding the sale and/or delivery of chattels (hereinafter referred to as “Goods”) regardless of whether they are produced by Hofmann & Vratny or procured from suppliers (§§ 433 and 651 of the BGB). Unless agreed upon otherwise, the version of these General Terms of Sale applicable at the time the Ordering Party places an order and in any case the most recent version of these General Terms of Sale provided to the Ordering Party in writing in the form of a master agreement also shall apply to similar contracts made at a later date without Hofmann & Vratny being required to make reference to them in every individual case.
4. These General Terms of Sale shall apply exclusively. Any of the Ordering Party’s terms of sale which contradict or deviate from these General Terms of Sale shall not be accepted. These General Terms of Sale also shall apply if and when Hofmann & Vratny executes a delivery despite having knowledge of the Ordering Party’s terms of sale which contradict or deviate from these General Terms of Sale.
5. If Hofmann & Vratny and the Ordering Party have entered into any individual agreements, such individual agreements shall prevail over these General Terms of Sale. The content of such individual agreements only can be substantiated by a written contract or by written confirmation from Hofmann & Vratny.
6. All legal declarations and notifications required to be made by the Ordering Party vis-à-vis Hofmann & Vratny after a contract has been signed (e.g., regarding deadlines, notices of defects, rescission or reduction) shall be made in writing to be effective.
7. All references to applicable laws shall be for the purpose of clarification only. Unless amended in or excluded from these General Terms of Sale, laws shall apply even without express reference.
- § 2 OFFERS AND ACCEPTANCE
1. All offers made by Hofmann & Vratny shall be subject to change and shall be non-binding including if and when images, drawings, technical documentation, calculations, other documents or product descriptions (hereinafter referred to as “Documents”) of whatever nature have been provided to the Ordering Party.
2. All orders for Goods placed by the Ordering Party shall constitute binding offers. Unless stated otherwise in the respective order, Hofmann & Vratny shall be entitled to accept an offer within two weeks after receipt of said offer.
3. Hofmann & Vratny shall accept offers in writing (e.g., in the form of an order confirmation) or by delivering the respective Goods to the Ordering Party.
4. All proprietary rights and copyrights to Documents shall remain with Hofmann & Vratny. Documents marked as confidential shall be forwarded to third parties only with the express written consent of Hofmann & Vratny.

§ 3 DELIVERY DEADLINES AND DEFAULT OF DELIVERY

1. Delivery deadlines shall be agreed upon by Hofmann & Vratny and the individual Ordering Party or shall be specified by Hofmann & Vratny upon acceptance of the order or in the order confirmation.

2. Hofmann & Vratny’s compliance with delivery obligations shall be conditional upon the Ordering Party’s on-time and proper compliance with the Ordering Party’s obligations including, but not limited to, the provision of the papers, permits and approvals required to be provided by the Ordering Party and the receipt by Hofmann & Vratny of the agreed-upon down payment, if any. In the event of delays, the delivery time shall be extended reasonably.
3. If Hofmann & Vratny is unable to meet any binding delivery deadlines for reasons beyond the control of Hofmann & Vratny (non-availability of services), the Ordering Party shall be notified without undue delay and shall be provided with an estimated new delivery deadline. If the agreed upon Goods do not become available before the new deadline expires, Hofmann & Vratny shall be entitled to rescind the contract in whole or in part and shall reimburse the Ordering Party without undue delay for any and all consideration paid up to that time. For the fulfillment of this clause, non-availability of services shall include, but shall not be limited to, delayed delivery from any of Hofmann & Vratny’s suppliers, reasons beyond the control of Hofmann & Vratny or its suppliers, or if Hofmann & Vratny is not responsible for procuring the Goods.
4. If failure to comply with a delivery deadline is due to an act of God, industrial dispute or other event beyond the control of Hofmann & Vratny, the delivery time shall be extended reasonably. The same shall apply if and when any such act of God, industrial dispute or other event has arisen at any of Hofmann & Vratny’s sub-suppliers which event can be demonstrated to have had an impact on compliance with the delivery deadline. Hofmann & Vratny shall notify the Ordering Party of such circumstances without undue delay. Events also shall be deemed to be beyond Hofmann & Vratny’s control if and when they occur during a delay. In this case, the delay shall be deemed to be suspended for the duration of the respective event.
5. The beginning of a period of delivery default shall be in accordance with the law, but shall in any case require a reminder issued by the Ordering Party.
6. If a contract regarding stand-by delivery has been signed, Hofmann & Vratny shall deliver and invoice the Goods no later than 12 months after the date of such contract (hereinafter referred to as the “Recall Period”), even if the Ordering Party has failed to recall the Goods by that time. After the Recall Period has expired, Hofmann & Vratny can notify the Ordering Party of Hofmann & Vratny’s readiness to deliver and can request that the Ordering Party recall the Goods within a reasonable period of time. If the Ordering Party fails to recall the Goods within such period, Hofmann & Vratny shall be entitled to demand an additional lumpsum compensation for warehousing costs (hereinafter referred to as the “Warehousing Allowance”). The Warehousing Allowance shall be 0.5% of the net value of the purchased Goods for every full week. The Ordering Party shall be free to prove that Hofmann & Vratny did not incur any damages or that any damages incurred were lower than the Warehousing Allowance. If the Ordering Party fails to recall the Goods within the Recall Period determined by Hofmann & Vratny, Hofmann & Vratny shall be entitled to dispose of the Goods as Hofmann & Vratny sees fit. The statutory provisions regarding rescission shall remain unaffected.
- § 4 DELIVERY AND DEFAULT OF ACCEPTANCE
1. Unless agreed upon otherwise, all deliveries shall be ex works, that is, the place of performance for deliveries and for all subsequent actions. Unless agreed upon otherwise, upon request and at the expense of the Ordering Party the Goods shall be delivered to another destination (hereinafter referred to as “Sales Involving the Carriage of Goods”). Unless agreed upon otherwise, Hofmann & Vratny shall be entitled to determine the shipment method (including, but not limited to, the forwarder, the type of shipment and the packaging).
2. Partial deliveries shall be admissible, provided the Ordering Party reasonably can be expected to accept them.
3. Delivered Goods shall be accepted by the Ordering Party even if the delivered Goods have minor defects provided the Ordering Party reasonably can be expected to accept such Goods.

4. The risk of accidental destruction and/or deterioration of the Goods shall transfer to the Ordering Party no later than upon surrender of the Goods. In the case of Sales Involving the Carriage of Goods, the risk of accidental destruction and/or deterioration of the Goods and the risk of delay shall transfer to the Ordering Party no later than at the time of delivery of the Goods to the forwarder, carrier, or any other person designated to execute shipment of the Goods. Delivery shall be deemed to have been effected even if the Ordering Party is in default of acceptance.
5. If the Ordering Party is in default of acceptance or fails to cooperate or if delivery is delayed for other reasons for which the Ordering Party is responsible, Hofmann & Vratny shall be entitled to demand reimbursement for the damages incurred in connection therewith including additional expenses (e.g., warehousing costs).
- § 5 TERMS OF PAYMENT
1. Unless agreed upon otherwise in individual cases, Hofmann & Vratny’s prices plus statutory sales tax valid at the time the contract is signed shall apply. The prices indicated in Hofmann & Vratny’s catalogs are non-binding and subject to change and/or correction.
2. Unless agreed upon otherwise, in the case of Sales Involving the Carriage of Goods the Ordering Party shall bear the costs of packaging and transportation ex works and the costs, if any, for transportation insurance if such insurance is requested by the Ordering Party. All customs and other fees, taxes and other public charges also shall be borne by the Ordering Party unless agreed upon otherwise. Ownership of the packaging for transportation and otherwise pursuant to the Packaging Ordinance of Germany shall transfer to the Ordering Party and such packaging shall not be returned to Hofmann & Vratny. Pallets shall be exempt from this rule.
3. Unless agreed upon otherwise in the order confirmation, the purchase price plus statutory sales tax shall be due and payable without any deductions within 14 days after the date of invoicing and delivery or acceptance of the Goods. However, Hofmann & Vratny reserves the right to make full or partial deliveries against cash in advance at any time including during an ongoing business relationship. The assertion of such right shall be communicated no later than at the time the order confirmation is issued. The Ordering Party shall be deemed to be in default of payment upon the expiration of the aforementioned payment deadline. The applicable rate of interest on the purchase price of the Goods shall become payable during the default period. The right to assert claims for more substantial compensation shall be reserved.
4. The Ordering Party’s rights of set-off and retention shall be limited to the extent the Ordering Party’s claim is determined in a court of law or is undisputed. The Ordering Party’s rights based on defects in the purchased Goods (see § 7 hereof) shall remain unaffected.
5. After the contract has been signed, if there is evidence that Hofmann & Vratny’s claim to the purchase price will be compromised due to lack of performance on the part of the Ordering Party, Hofmann & Vratny shall be entitled to refuse performance pursuant to the applicable laws and, after setting a deadline, if applicable, shall be entitled to rescind the contract. In the case of contracts regarding the production of customized items, Hofmann & Vratny shall be entitled to rescind the contract immediately and the laws regarding the expendability of setting deadlines shall remain unaffected.
- § 6 RETENTION OF TITLE
1. Until all pending and future receivables in connection with the business relationship between Hofmann & Vratny and the Ordering Party are paid in full, Hofmann & Vratny shall retain ownership of the Goods. If the Ordering Party violates the contract including, but not limited to, default of payment, Hofmann & Vratny shall be entitled to rescind the contract pursuant to the applicable laws and to demand the surrender of the Goods.
2. Goods subject to retention of title shall not be pledged or assigned as collateral before the Ordering Party has paid in full. The Ordering Party shall notify Hofmann & Vratny in writing without undue delay in the event of a filing for commencement of insolvency proceedings or if third parties gain access (e.g., seizures) to Goods belonging to Hofmann & Vratny.

3. If the Ordering Party violates the contract including, but not limited to, by failing to pay the purchase price when due, Hofmann & Vratny shall be entitled to rescind the contract pursuant to the applicable laws and to demand the surrender of the Goods due to the retention of title and the rescission.
4. Until further notice, the Ordering Party shall be entitled to resell/and or process in the ordinary course of business any Goods subject to retention of title. In this case, the provisions below also shall apply.
- a) The retention of title shall include title to the full value of work products resulting from processing, mixing or combining the Goods, in which case Hofmann & Vratny shall be deemed to be the manufacturer. If and when third-party goods are processed, mixed or combined and such third parties retain ownership, Hofmann & Vratny shall acquire coownership pro rata of the invoiced value of work products so processed, mixed or combined. In all other cases, the creation of work products shall be subject to the same provisions as the delivered Goods subject to retention of title.
- b) The Ordering Party hereby agrees to assign to Hofmann & Vratny as collateral any and all receivables against third parties resulting from the resale of the Goods or work results in full or in the amount of Hofmann & Vratny’s estimated share of co-ownership pursuant to a) above, and Hofmann & Vratny hereby accepts such assignment. The Ordering Party’s obligations under § 6 2) hereof also shall apply with respect to the receivables assigned.
- c) In addition to Hofmann & Vratny, the Ordering Party shall remain authorized to collect receivables. Hofmann & Vratny undertakes to refrain from collecting receivables as long as the Ordering Party meets its payment obligations vis-à-vis Hofmann & Vratny and does not fail to perform and Hofmann & Vratny does not assert its retention of title by asserting a right under § 6 3) hereof. Otherwise, Hofmann & Vratny shall be entitled to demand that the Ordering Party inform Hofmann & Vratny of such receivables assigned and of the names of the debtors, provide Hofmann & Vratny with all the information required for collecting such receivables and the pertinent documents, and inform the debtors (third parties) of the assignment. In addition, in this case Hofmann & Vratny shall be entitled to revoke the Ordering Party’s authorization to resell and/or process Goods which are subject to retention of title.
5. Upon request of the Ordering Party, Hofmann & Vratny shall release the collateral to which Hofmann & Vratny is entitled insofar as the realizable value of such collateral exceeds the receivables to be collateralized by more than 10%. Hofmann & Vratny shall be free in its decision regarding which collateral to release.
- § 7 LIABILITY FOR DEFECTS AND CLAIMS FOR DEFECTS
1. Unless agreed upon otherwise herein, the Ordering Party’s rights based on defects in quality and in title shall be subject to the applicable laws.
2. The assertion of claims by the Ordering Party regarding defects shall be conditional upon the Ordering Party’s meeting of its statutory duty to inspect and to give notice of defects (§§ 377 and 381 of the HGB (Commercial Code of Germany)). If a defect in the Goods becomes apparent during or after inspection, the Ordering Party shall give written notice to Hofmann & Vratny without undue delay. Such notice shall be deemed to have been given without undue delay if it is given within two weeks and is transmitted before the end of such period. Regardless of the Ordering Party’s duty to inspect and to give notice of defects, the Ordering Party shall give written notice of obvious defects within two weeks after delivery, which notice shall be deemed to have been given in a timely manner if it is transmitted before the end of such period. If the Ordering Party fails to inspect the Goods properly and/or to give proper notice of any defects, Hofmann & Vratny shall not assume liability for any defects for which no notice was given.
3. If any of the Goods are defective, Hofmann & Vratny shall be free to offer supplementary action to remedy the defect or defects (supplementary remedy) or to deliver defect-free Goods (replacement) to the Ordering Party. It is Hofmann & Vratny’s right to refuse to offer supplementary action under the applicable laws shall remain unaffected. The requirement for Hofmann & Vratny to provide any supplementary action owed shall be conditional upon the Ordering Party’s paying of the purchase price when due. However, the Ordering Party shall be entitled to retain a reasonable portion of the purchase price pro rata in consideration of the defect. The Ordering Party shall give Hofmann & Vratny the time and the opportunity to provide the supplementary

action owed including, but not limited to, providing Hofmann & Vratny the opportunity to inspect the Goods which are subject to complaint. If Hofmann & Vratny opts to replace the Goods, the Ordering Party shall return the defective Goods to Hofmann & Vratny in accordance with the applicable laws. Supplementary action shall not include the de-installation of defective Goods or installation of new Goods, provided Hofmann & Vratny originally was not obligated to install the Goods.

4. Any and all expenses incurred in connection with inspections and supplementary action including, but not limited to, transportation, road, labor and material costs shall be borne by Hofmann & Vratny if a defect actually is present. However, if the Ordering Party's demand for remedy of a defect is proven to be invalid, Hofmann & Vratny shall be entitled to demand reimbursement from the Ordering Party for any costs incurred therewith.

5. If the costs of supplementary remedy would be disproportionately high, the Ordering Party shall not be entitled to claim remedy of defects.

6. The Ordering Party's claims for damages or reimbursement for wasted expenses shall be limited by the provisions of § 9 below and shall be excluded in all other cases.

7. The statute of limitations for claims for defects shall be one year after the transfer of risk. This rule shall not apply if and when § 438 section 3 of the BGB (malice) stipulates longer terms.

§ 8 OTHER LIABILITIES

1. Unless agreed upon otherwise in these General Terms of Sale and in the provisions below, Hofmann & Vratny's liability for breach of contractual and non-contractual obligations shall be in accordance with the applicable laws.

2. Hofmann & Vratny's liability for damages, regardless of the legal reasons and of whether or not they are known, shall include intent and gross negligence. In the event of minor negligence, Hofmann & Vratny's liability shall be limited to damages resulting from harm to life, body or health and/or for damages resulting from the not-insignificant breach of a material contractual obligation, that is, an obligation which must be met to make the proper fulfillment of the contract possible and the meeting of which the Ordering Party relies upon and can rely upon on a regular basis. In this case, however, Hofmann & Vratny's liability shall be limited to reimbursement of the foreseeable damages typical in such cases.

3. The limitation of liability under § 8, 2) hereof shall not apply if and when Hofmann & Vratny is found to have failed to disclose a defect maliciously or has assumed a guarantee for the quality of the Goods and for the Ordering Party's claims under the Product Liability Act of Germany.

4. The Ordering Party can rescind or cancel a contract due to a breach of obligation other than a breach based on a defect only if and when Hofmann & Vratny is responsible for such breach of obligation. The Ordering Party shall not have an unrestricted right to terminate a contract. All other cases shall be subject to the applicable laws and legal consequences.

§ 9 APPLICABLE LAW AND JURISDICTION

1. These General Terms of Sale and all legal relationships between Hofmann & Vratny and the Ordering Party shall be subject to the laws of the Federal Republic of Germany under exclusion of the provisions of international private law. The CISG shall not apply.

2. These General Terms of Sale and all disputes arising directly or indirectly from the contractual relationship between Hofmann & Vratny and the Ordering Party shall be subject to the exclusive jurisdiction of Aßling if the Ordering Party is a businessperson. However, Hofmann & Vratny shall be entitled to sue the Ordering Party at the place of performance (see § 4 hereof) or at the Ordering Party's general jurisdiction.

Hofmann & Vratny OHG
January 2021

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HOFMANN & VRATNY EXN1 SERIES - EXPERTS IN CUTTING NON-FERROUS MATERIALS

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