EMUGE FRANKEN

Made in Germany

FRANKEN TOP-Cut

Universalfräser, für alle Werkstoffgruppen einsetzbar
Universal End Mill, for all Material Groups

Rund 100 Jahre Präzision und Innovation.
Nearly 100 years of precision and innovation.

FRANKEN als Teil der EMUGE-FRANKEN Unternehmensgruppe beschäftigt sich seit seiner Gründung mit der Entwicklung und Produktion von Fräswerkzeugen. Präzision und Innovation prägen das breite Angebot von Fräsern aus Hartmetall und HSS sowie PKD-, CBN- oder wendeplattenbestückten Fräskörpern.

Die Fertigung am deutschen Produktionsstandort in Rückersdorf reicht von Standard-Schaft- und Bohrungsfräsern bis hin zu hochgenauen Form- und Profil-Sonderfräsern. Mit seiner Typen- und Schneidstoff-vielfalt, dem hohen Standard und der kompromisslosen Präzision entspricht das Fräserprogramm den höchsten Qualitätsanforderungen.

Als Ergänzung zu den Fräswerkzeugen führen wir ein durchgängiges Programm an Fräserspannmitteln und Zubehör für die verschiedensten Adaptierungsmöglichkeiten.

EMUGE-FRANKEN ist nach ISO 9001:2008 und ISO 50001:2011 zertifiziert

EMUGE-FRANKEN is certified according ISO 9001:2008 and ISO 50001:2011

TÜVRheinland CERTIFIED

Management System
ISO 50001:2011
ISO 9001:2008

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ID 9105017121

Ever since its foundation FRANKEN as part of the EMUGE-FRANKEN company association has been developing and manufacturing milling tools. The wide range of end mills of solid carbide and HSS as well as PCD and CBN inserts or milling cutters with indexable inserts is characterised by precision and innovation.

The production in our German manufacturing plant in Rückersdorf includes standard end mills and bore cutters as well as highly precise special form and profile milling tools. With its large variety of tool types and cutting materials, the consistently high standards and uncompromising precision, our product range of milling cutters meets even the highest quality requirements.

In addition to our selection of milling tools, we also offer a comprehensive range of clamping systems, tool holders and accessories.

TOP-Cut-Fräser sind Universalfräser sowohl aus Hartmetall als auch HSS, die durch ihre speziellen Geometrieeigenschaften in nahezu allen Materialien und Fräsverfahren eingesetzt werden können.

Besonderheiten:

- Ungleicher Drallwinkel
- Konisch ansteigender Spannutengrund
- Hochleistungs-Beschichtung
- Optional mit innerer Kühlschmierstoff-Zufuhr mit axialem Austritt (ICA)

Hauptmerkmal:

Für alle Werkstoffgruppen einsetzbar.

Mit dieser Broschüre zeigen wir eine Auswahl der wichtigsten Hartmetall-TOP-Cut-Schaftfräser. Zu jedem Werkzeug geben wir, in Abhängigkeit zur jeweiligen Werkstoffgruppe, sichere Startbedingungen (v_c / f_z) und Hinweise zum empfohlenen Kühlschmierstoff an.

TOP-Cut tools are versatile end mills made from solid carbide or HSS which can be used in nearly all materials and milling strategies due to their special geometry properties.

Characteristics

- Variable helix angle
- Tapered core diameter
- High-performance coating
- Optionally available with internal coolant supply, axial exit (ICA)

Main feature:

Universal use, for all material groups.

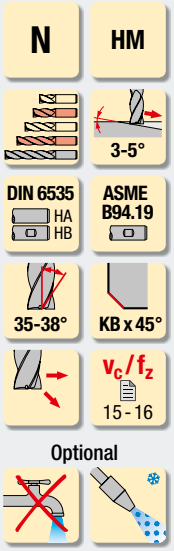
In this brochure we present a selection of the most important solid carbide TOP-Cut end mills. For every tool we give, depending on the respective material group safe starting conditions (v_c / f_z) and directions about the recommended coolant.

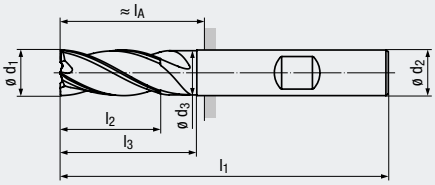
Inhalt

Content

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Schneiden zur Mitte
- 3 Baulängen verfügbar

- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Centre cutting
- 3 lengths available





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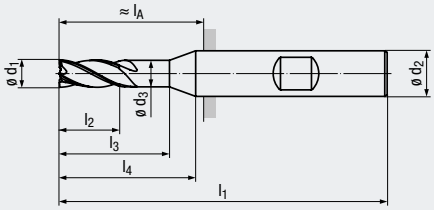


Allround

Allround

Beschichtung · Coating

TIALN

TIALN

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen einsetzbar
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 14)

- For almost all materials
- Suitable for roughing and finishing

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.2-1.4	
N	2.1-4.1, 5.2	
S	1.1-2.6	
H	1.1	1.2-1.3

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.2-1.4	
N	2.1-4.1, 5.2	
S	1.1-2.6	
H	1.1	1.2-1.3

DIN 6527 – Kurze Ausführung · Short design

Bestell-Code · Order code

ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	Dimens.-Code	1916A	1917A
3	5	9	50	2,9	14	6	14	0,07	**4**	**.003**	●	●
4	8	12	54	3,8	18	6	18	0,07	**4**	**.004**	●	●
5	9	16	54	4,8	18	6	18	0,07	**4**	**.005**	●	●
6	10	16	54	5,8	–	6	18	0,12	**4**	**.006**	●	●
8	12	20	58	7,7	–	8	22	0,12	**4**	**.008**	●	●
10	15	24	66	9,5	–	10	26	0,2	**4**	**.010**	●	●
12	18	26	73	11,5	–	12	28	0,2	**4**	**.012**	●	●
16	24	32	82	15,5	–	16	34	0,2	**4**	**.016**	●	●
18	27	34	84	17,5	–	18	36	0,2	**4**	**.018**	●	●
20	30	40	92	19,5	–	20	42	0,3	**4**	**.020**	●	●

DIN 6527 – Lange Ausführung · Long design

Bestell-Code · Order code

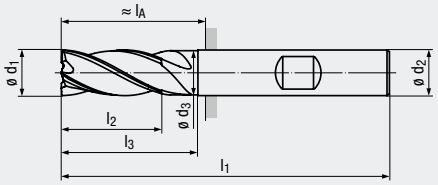
ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	Dimens.-Code	1998A	1999A
3	8	14	57	2,9	20	6	21	0,07	**4**	**.003**	●	●
4	11	18	57	3,8	20	6	21	0,07	**4**	**.004**	●	●
5	13	19	57	4,8	20	6	21	0,12	**4**	**.005**	●	●
6	13	20	57	5,8	–	6	21	0,12	**4**	**.006**	●	●
7	19	23	63	6,7	25	8	27	0,12	**4**	**.007**	●	●
8	19	25	63	7,7	–	8	27	0,12	**4**	**.008**	●	●
9	22	28	72	8,7	30	10	32	0,2	**4**	**.009**	●	●
10	22	30	72	9,5	–	10	32	0,2	**4**	**.010**	●	●
11	26	32	83	10,5	35	12	38	0,2	**4**	**.011**	●	●
12	26	35	83	11,5	–	12	38	0,2	**4**	**.012**	●	●
14	26	35	83	13,5	–	14	38	0,2	**4**	**.014**	●	●
15	32	38	92	14,5	40	16	44	0,2	**4**	**.015**	●	●
16	32	40	92	15,5	–	16	44	0,2	**4**	**.016**	●	●
18	32	50	100	17,5	–	18	52	0,2	**4**	**.018**	●	●
20	38	50	104	19,5	–	20	54	0,3	**4**	**.020**	●	●
25	45	65	125	24,2	–	25	69	0,3	**6**	**.025**	●	●

Bestell-Beispiel · Ordering example: **1916A.003**

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Innere Kühlschmierstoff-Zufuhr, Austritt axial (ICA)

- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Internal coolant supply, axial exit (ICA)

N | ICA | HM | DIN 6535 HA HB | 3-5° | 35-38° | KB x 45° | v_c/f_z 16



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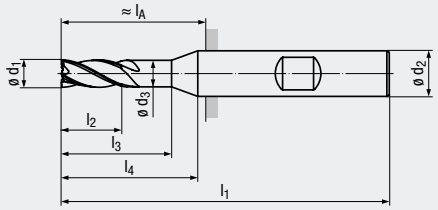
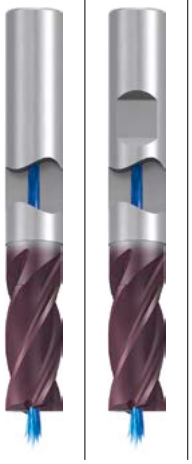




Allround

Beschichtung · Coating: **TIALN**

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen, inklusive zähe Werkstoffe, einsetzbar
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 14)

- For almost all materials, including tough materials
- Suitable for roughing and finishing

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.2-1.4	
N	2.1-4.1, 5.2	
S	1.1-2.6	
H	1.1	1.2-1.3

DIN 6527 – Lange Ausführung · Long design

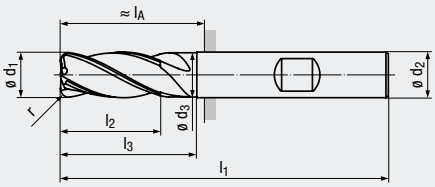
Bestell-Code · Order code

ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	Dimens.-Code	1998AZ	1999AZ
3	8	14	57	2,9	20	6	21	0,07	**4**	**.003**	●	●
4	11	18	57	3,8	20	6	21	0,07	**4**	**.004**	●	●
5	13	19	57	4,8	20	6	21	0,12	**4**	**.005**	●	●
6	13	20	57	5,8	–	6	21	0,12	**4**	**.006**	●	●
8	19	25	63	7,7	–	8	27	0,12	**4**	**.008**	●	●
10	22	30	72	9,5	–	10	32	0,2	**4**	**.010**	●	●
12	26	35	83	11,5	–	12	38	0,2	**4**	**.012**	●	●
16	32	40	92	15,5	–	16	44	0,2	**4**	**.016**	●	●
20	38	50	104	19,5	–	20	54	0,3	**4**	**.020**	●	●

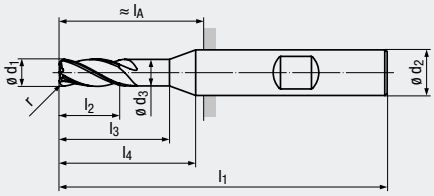
● = Lagerwerkzeug, siehe Preisliste · Stock tool, see price list

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Verschiedene Eckenradien pro Schneidendurchmesser
- Schneiden zur Mitte oder innere Kühlschmierstoff-Zufuhr, Austritt axial (ICA)

- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Several corner radii per cutting diameter
- Centre cutting or internal coolant supply, axial exit (ICA)



Design l_4:



N

ICA

HM

DIN 6535 HA HB

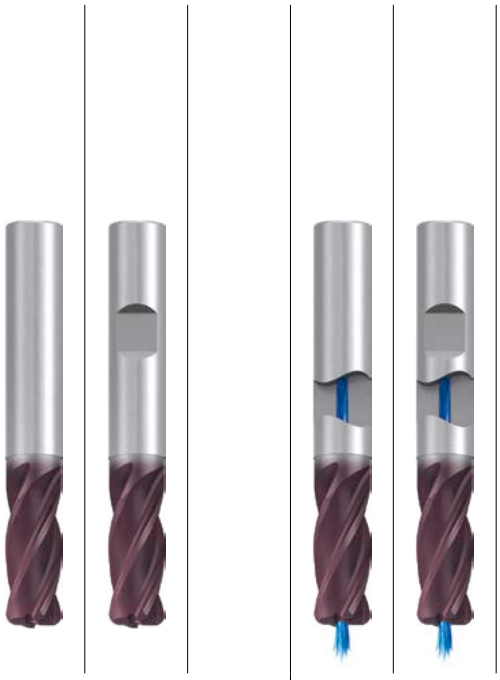
3-5°

35-38°

ER

v_c/f_z 16

Optional



Allround

Allround

Beschichtung · Coating

TIALN

TIALN

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen, inklusive zähe Werkstoffe, einsetzbar
- Sehr gut zum Schruppen und Schlichten geeignet

Applications – material (see page 14)

- For almost all materials, including tough materials
- Very suitable for roughing and finishing

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.2-1.4	
N	2.1-4.1, 5.2	
S	1.1-2.6	
H	1.1	1.2-1.3

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.2-1.4	
N	2.1-4.1, 5.2	
S	1.1-2.6	
H	1.1	1.2-1.3

DIN 6527 – Lange Ausführung · Long design

Eckenradius · Corner radius

Bestell-Code · Order code											2698A	2699A		2698AZ	2699AZ
ø d_1 f8	r ±0,01	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Z (Flutes)	Dimens.-Code					
3	0,1	8	14	57	2,9	20	6	21	**4**	**.003001**	●	●			
3	0,3	8	14	57	2,9	20	6	21	**4**	**.003003**	●	●		●	●
3	0,5	8	14	57	2,9	20	6	21	**4**	**.003005**	●	●		●	●
4	0,1	11	18	57	3,8	20	6	21	**4**	**.004001**	●	●			
4	0,3	11	18	57	3,8	20	6	21	**4**	**.004003**	●	●		●	●
4	0,4	11	18	57	3,8	20	6	21	**4**	**.004004**	●	●			
4	0,5	11	18	57	3,8	20	6	21	**4**	**.004005**	●	●		●	●
5	0,1	13	19	57	4,8	20	6	21	**4**	**.005001**	●	●			
5	0,3	13	19	57	4,8	20	6	21	**4**	**.005003**	●	●		●	●
5	0,5	13	19	57	4,8	20	6	21	**4**	**.005005**	●	●		●	●
5	1	13	19	57	4,8	20	6	21	**4**	**.005010**	●	●			
6	0,1	13	20	57	5,8	–	6	21	**4**	**.006001**	●	●			
6	0,5	13	20	57	5,8	–	6	21	**4**	**.006005**	●	●		●	●
6	1,0	13	20	57	5,8	–	6	21	**4**	**.006010**	●	●		●	●
6	1,5	13	20	57	5,8	–	6	21	**4**	**.006015**	●	●		●	●
8	0,15	19	25	63	7,7	–	8	27	**4**	**.008001**	●	●			
8	0,5	19	25	63	7,7	–	8	27	**4**	**.008005**	●	●		●	●
8	1	19	25	63	7,7	–	8	27	**4**	**.008010**	●	●		●	●
8	1,5	19	25	63	7,7	–	8	27	**4**	**.008015**	●	●		●	●
8	2	19	25	63	7,7	–	8	27	**4**	**.008020**	●	●		●	●
10	0,15	22	30	72	9,5	–	10	32	**4**	**.010001**	●	●			
10	0,5	22	30	72	9,5	–	10	32	**4**	**.010005**	●	●			
10	1	22	30	72	9,5	–	10	32	**4**	**.010010**	●	●		●	●
10	1,5	22	30	72	9,5	–	10	32	**4**	**.010015**	●	●		●	●
10	2	22	30	72	9,5	–	10	32	**4**	**.010020**	●	●		●	●
10	2,5	22	30	72	9,5	–	10	32	**4**	**.010025**	●	●		●	●
10	3	22	30	72	9,5	–	10	32	**4**	**.010030**	●	●		●	●
12	0,2	26	35	83	11,5	–	12	38	**4**	**.012002**	●	●			
12	0,5	26	35	83	11,5	–	12	38	**4**	**.012005**	●	●			
12	1	26	35	83	11,5	–	12	38	**4**	**.012010**	●	●		●	●
12	1,5	26	35	83	11,5	–	12	38	**4**	**.012015**	●	●		●	●
12	2	26	35	83	11,5	–	12	38	**4**	**.012020**	●	●		●	●
12	2,5	26	35	83	11,5	–	12	38	**4**	**.012025**	●	●		●	●
12	3	26	35	83	11,5	–	12	38	**4**	**.012030**	●	●		●	●
12	4	26	35	83	11,5	–	12	38	**4**	**.012040**	●	●		●	●
14	1	26	35	83	13,5	–	14	38	**4**	**.014010**	●	●			
16	0,3	32	40	92	15,5	–	16	44	**4**	**.016003**	●	●			
16	0,5	32	40	92	15,5	–	16	44	**4**	**.016005**	●	●			
16	1	32	40	92	15,5	–	16	44	**4**	**.016010**	●	●		●	●
16	1,5	32	40	92	15,5	–	16	44	**4**	**.016015**	●	●		●	●

Bestell-Beispiel · Ordering example: **2698A.003001**

FRANKEN TOP-Cut

- Multifunktionales Hochleistungswerkzeug
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- Vibrationsarme Bearbeitung
- Verschiedene Eckenradien pro Schneidendurchmesser
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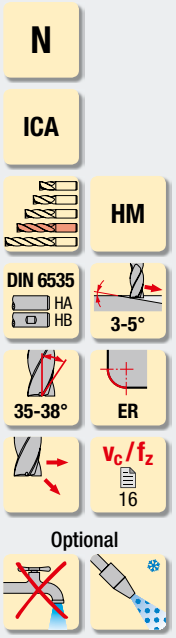
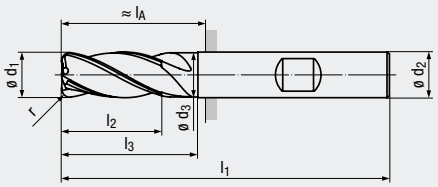
- Several corner radii per cutting diameter
- Centre cutting or internal coolant supply, axial exit (ICA)





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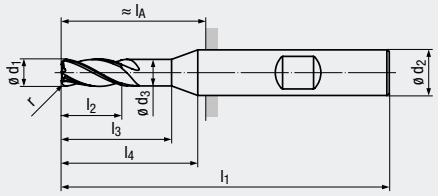
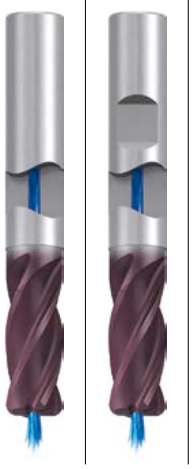


Allround



Allround

Beschichtung · Coating

TIALN

TIALN

Einsatzgebiete – Material (siehe Seite 14)

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Applications – material (see page 14)

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P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.2-1.4	
N	2.1-4.1, 5.2	
S	1.1-2.6	
H	1.1	1.2-1.3

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.2-1.4	
N	2.1-4.1, 5.2	
S	1.1-2.6	
H	1.1	1.2-1.3

DIN 6527 – Lange Ausführung · Long design

Eckenradius · Corner radius

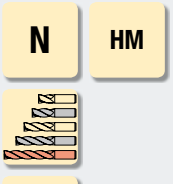
Bestell-Code · Order code											2698A	2699A		2698AZ	2699AZ	
ø d_1 f8	r ±0,01	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	Z (Flutes)	Dimens.-Code						
16	2	32	40	92	15,5	–	16	44	**4**	**.016020**	●	●		●	●	
16	2,5	32	40	92	15,5	–	16	44	**4**	**.016025**	●	●		●	●	
16	3	32	40	92	15,5	–	16	44	**4**	**.016030**	●	●		●	●	
16	4	32	40	92	15,5	–	16	44	**4**	**.016040**	●	●		●	●	
20	0,3	38	50	104	19,5	–	20	54	**4**	**.020003**	●	●				
20	0,5	38	50	104	19,5	–	20	54	**4**	**.020005**	●	●				
20	1	38	50	104	19,5	–	20	54	**4**	**.020010**	●	●		●	●	
20	1,5	38	50	104	19,5	–	20	54	**4**	**.020015**	●	●		●	●	
20	2	38	50	104	19,5	–	20	54	**4**	**.020020**	●	●		●	●	
20	2,5	38	50	104	19,5	–	20	54	**4**	**.020025**	●	●		●	●	
20	3	38	50	104	19,5	–	20	54	**4**	**.020030**	●	●		●	●	
20	4	38	50	104	19,5	–	20	54	**4**	**.020040**	●	●		●	●	

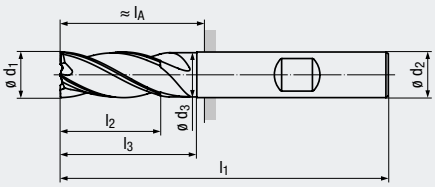
Andere Eckenradien auf Anfrage lieferbar
Other corner radii available on request

● = Lagerwerkzeug, siehe Preisliste · Stock tool, see price list

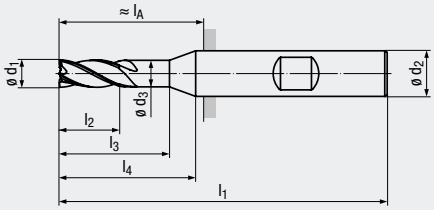
- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Schneiden zur Mitte
- 3 Baulängen verfügbar

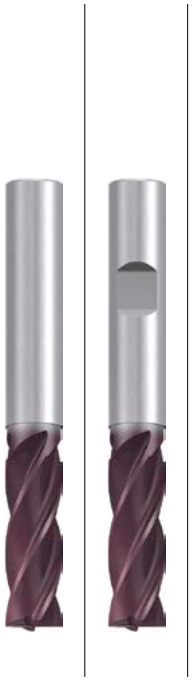
- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Centre cutting
- 3 lengths available



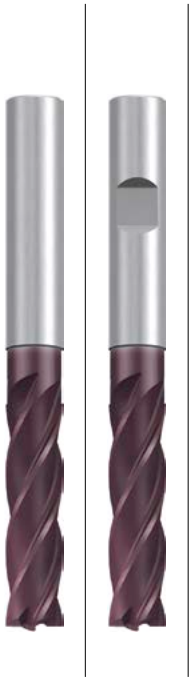


Design l_4:





Allround



Allround

Beschichtung · Coating

TIALN

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen einsetzbar
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 14)

- For almost all materials
- Suitable for roughing and finishing

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.1-1.4	1.5-1.6
N	2.1-2.8, 5.2	
S	1.1-1.3	2.1-2.6

3 x d_1 – Extra lange Ausführung · Extra long design

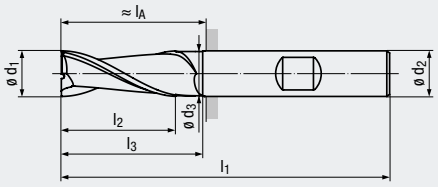
Bestell-Code · Order code											**2526A**	**2527A**				
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	KB	Z (Flutes)	**Dimens.-Code**						
3	9	12	62	2,9	23	6	26	0,07	**4**	**.003**	●	●				
4	12	16	62	3,8	25	6	26	0,07	**4**	**.004**	●	●				
5	15	20	62	4,8	25	6	26	0,12	**4**	**.005**	●	●				
6	18	25	62	5,8	–	6	26	0,12	**4**	**.006**	●	●				
8	24	30	68	7,7	–	8	32	0,12	**5**	**.008**	●	●				
10	30	35	80	9,5	–	10	40	0,2	**5**	**.010**	●	●				
12	36	45	93	11,5	–	12	48	0,2	**5**	**.012**	●	●				
16	48	60	112	15,5	–	16	64	0,2	**5**	**.016**	●	●				
20	60	75	130	19,5	–	20	80	0,3	**5**	**.020**	●	●				

4 x d_1 – Extra lange Ausführung · Extra long design

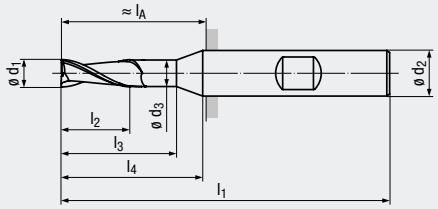
Bestell-Code · Order code														**2528A**	**2529A**	
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	KB	Z (Flutes)	**Dimens.-Code**						
6	24	30	68	5,8	–	6	32	0,12	**4**	**.006**				●	●	
8	32	40	80	7,7	–	8	44	0,12	**5**	**.008**				●	●	
10	40	50	95	9,5	–	10	55	0,2	**5**	**.010**				●	●	
12	48	60	107	11,5	–	12	62	0,2	**5**	**.012**				●	●	
16	64	75	128	15,5	–	16	80	0,2	**5**	**.016**				●	●	
20	80	90	150	19,5	–	20	100	0,3	**5**	**.020**				●	●	

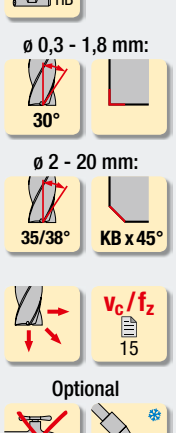
- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Schneiden zur Mitte
- 3 Baulängen verfügbar

- Multi-functional, high performance tool
- Newly developed geometry
- Low-vibration machining
- Centre cutting
- 3 lengths available



Design l_4:





Allround

Beschichtung · Coating

TIALN

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen einsetzbar
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 14)

- For almost all materials
- Suitable for roughing and finishing

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.1-1.3	1.4
N	2.1-4.2, 5.2	
S	1.1-2.1	2.2-2.6
H	1.1-1.2	

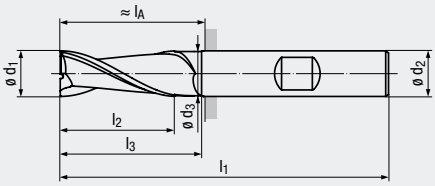
DIN 6527 – Kurze Ausführung · Short design

Bestell-Code · Order code												**2510A**	**2511A**
ø d_1 e8	ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	KB	Z (Flutes)	**Dimens.-Code**		
	0,3	1	–	38	–	8	3	–	–	**2**	**.0003**	●	
	0,5	1,5	–	38	–	9	3	–	–	**2**	**.0005**	●	
	1	3	–	38	–	10	3	–	–	**2**	**.001**	●	
	1,2	4	–	38	–	10	3	–	–	**2**	**.0012**	●	
	1,3	4	–	38	–	10	3	–	–	**2**	**.0013**	●	
	1,4	4	–	38	–	10	3	–	–	**2**	**.0014**	●	
	1,5	4	–	38	–	10	3	–	–	**2**	**.0015**	●	
	1,6	4	–	38	–	10	3	–	–	**2**	**.0016**	●	
	1,8	5	–	38	–	10	3	–	–	**2**	**.0018**	●	

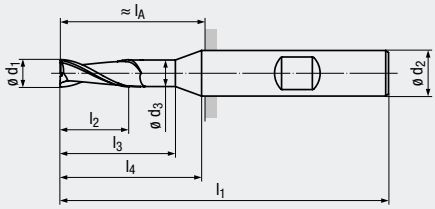
ø d_1 e8	ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	**Dimens.-Code**		
2		3	5	50	1,9	14	6	14	0,04	**2**	**.002**	●	●
2,5		3	5	50	2,4	14	6	14	0,07	**2**	**.0025**	●	●
	2,8	4	7	50	2,7	14	6	14	0,07	**2**	**.0028**	●	●
3		4	7	50	2,9	14	6	14	0,07	**2**	**.003**	●	●
	3,5	4	7	50	3,3	14	6	14	0,07	**2**	**.0035**	●	●
	3,8	5	9	54	3,6	18	6	18	0,07	**2**	**.0038**	●	●
4		5	9	54	3,8	18	6	18	0,07	**2**	**.004**	●	●
	4,5	5	9	54	4,3	18	6	18	0,12	**2**	**.0045**	●	●
	4,8	6	11	54	4,6	18	6	18	0,12	**2**	**.0048**	●	●
5		6	11	54	4,8	18	6	18	0,12	**2**	**.005**	●	●
	5,75	7	16	54	5,55	–	6	18	0,12	**2**	**.00575**	●	●
6		7	16	54	5,8	–	6	18	0,12	**2**	**.006**	●	●
7		8	18	58	6,7	20	8	22	0,12	**2**	**.007**	●	●
8		9	20	58	7,7	–	8	22	0,12	**2**	**.008**	●	●
	9	10	22	66	8,7	24	10	26	0,2	**2**	**.009**	●	●
10		11	24	66	9,5	–	10	26	0,2	**2**	**.010**	●	●
12		12	26	73	11,5	–	12	28	0,2	**2**	**.012**	●	●
14		14	28	75	13,5	–	14	30	0,2	**2**	**.014**	●	●
16		16	32	82	15,5	–	16	34	0,2	**2**	**.016**	●	●
18		18	34	84	17,5	–	18	36	0,2	**2**	**.018**	●	●
20		20	40	92	19,5	–	20	42	0,3	**2**	**.020**	●	●

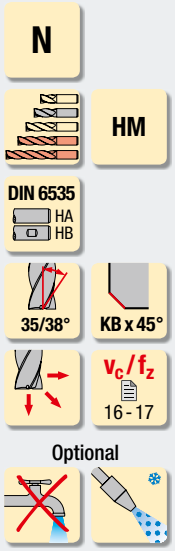
- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Schneiden zur Mitte
- 3 Baulängen verfügbar

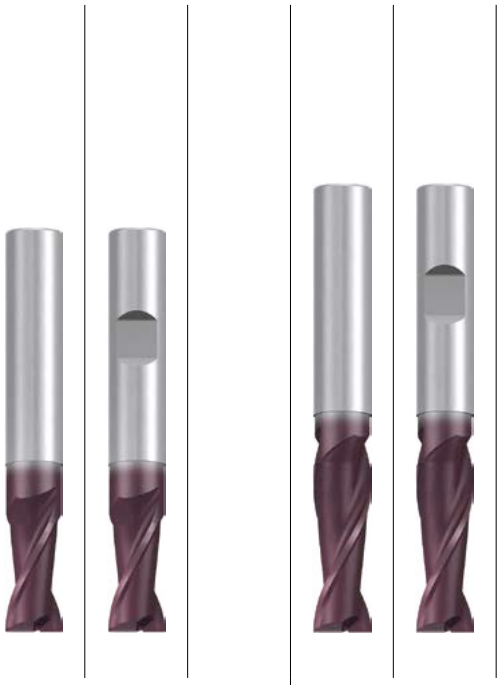
- Multi-functional, high performance tool
- Newly developed geometry
- Low-vibration machining
- Centre cutting
- 3 lengths available



Design l_4:







Allround

Allround

Beschichtung · Coating

TIALN

TIALN

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen einsetzbar
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 14)

- For almost all materials
- Suitable for roughing and finishing

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.1-1.3	1.4
N	2.1-4.2, 5.2	
S	1.1-2.1	2.2-2.6
H	1.1-1.2	

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.1-1.3	1.4-1.6
N	2.1-2.8, 5.2	
S	1.1-2.1	2.2-2.6

DIN 6527 – Lange Ausführung · Long design

Bestell-Code · Order code											**2512A**	**2513A**				
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	**Dimens.-Code**						
2	6	8	57	1,9	20	6	21	0,04	**2**	**.002**	●	●				
3	7	10	57	2,9	20	6	21	0,07	**2**	**.003**	●	●				
4	8	12	57	3,8	20	6	21	0,07	**2**	**.004**	●	●				
5	10	15	57	4,8	20	6	21	0,12	**2**	**.005**	●	●				
6	10	20	57	5,8	–	6	21	0,12	**2**	**.006**	●	●				
7	13	23	63	6,7	25	8	27	0,12	**2**	**.007**	●	●				
8	16	25	63	7,7	–	8	27	0,12	**2**	**.008**	●	●				
10	19	30	72	9,5	–	10	32	0,2	**2**	**.010**	●	●				
12	22	35	83	11,5	–	12	38	0,2	**2**	**.012**	●	●				
16	26	40	92	15,5	–	16	44	0,2	**2**	**.016**	●	●				
20	32	50	104	19,5	–	20	54	0,3	**2**	**.020**	●	●				

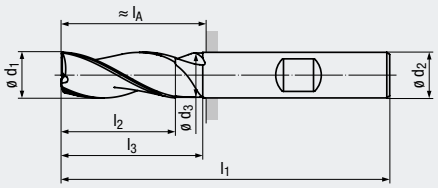
Extra lange Ausführung · Extra long design

Bestell-Code · Order code														**2514A**	**2515A**	
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	**Dimens.-Code**						
3	9	12	62	2,9	23	6	26	0,07	**2**	**.003**				●	●	
4	12	16	62	3,8	25	6	26	0,07	**2**	**.004**				●	●	
5	15	20	62	4,8	25	6	26	0,12	**2**	**.005**				●	●	
6	18	25	62	5,8	–	6	26	0,12	**2**	**.006**				●	●	
8	24	30	68	7,7	–	8	32	0,12	**2**	**.008**				●	●	
10	30	40	80	9,5	–	10	40	0,2	**2**	**.010**				●	●	
12	36	45	93	11,5	–	12	48	0,2	**2**	**.012**				●	●	
16	48	55	108	15,5	–	16	60	0,2	**2**	**.016**				●	●	
20	60	70	126	19,5	–	20	76	0,3	**2**	**.020**				●	●	

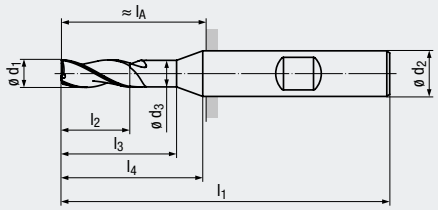
Bestell-Beispiel · Ordering example: **2512A.002**

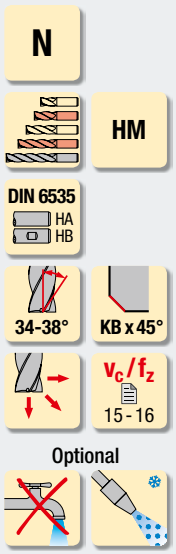
- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Schneiden zur Mitte
- 3 Baulängen verfügbar

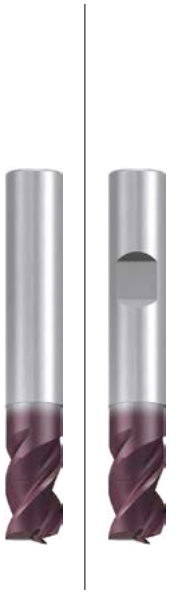
- Multi-functional, high performance tool
- Newly developed geometry
- Low-vibration machining
- Centre cutting
- 3 lengths available



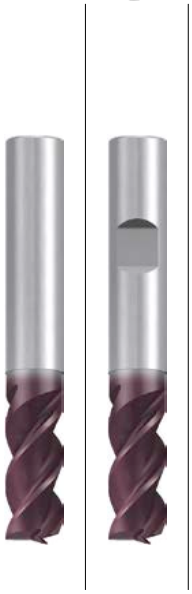
Design l_4:







Allround



Allround

Beschichtung · Coating

	TIALN	TIALN
P	1.1-5.1	1.1-5.1
M	1.1-4.1	1.1-4.1
K	1.1-4.2	1.1-4.2
N	1.1-1.4	1.1-1.4
N	2.1-2.8, 5.2 4.1-4.2	2.1-2.8, 5.2 4.1-4.2
S	1.1 1.2-1.3	1.1 1.2-1.3
S	2.1 2.2-2.6	2.1 2.2-2.6
H	1.1-1.2	1.1-1.2

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen einsetzbar
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 14)

- For almost all materials
- Suitable for roughing and finishing

DIN 6527 – Kurze Ausführung · Short design

Bestell-Code · Order code											**2516A**	**2517A**				
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	**Dimens.-Code**						
1,5	3	–	50	–	14	6	14	0,04	**3**	**.0015**	●	●				
2	3	5	50	1,9	14	6	14	0,04	**3**	**.002**	●	●				
2,5	3	5	50	2,4	14	6	14	0,07	**3**	**.0025**	●	●				
2,8	4	7	50	2,7	14	6	14	0,07	**3**	**.0028**	●	●				
3	4	7	50	2,9	14	6	14	0,07	**3**	**.003**	●	●				
3,5	4	7	50	3,3	14	6	14	0,07	**3**	**.0035**	●	●				
3,8	5	9	54	3,6	18	6	18	0,07	**3**	**.0038**	●	●				
4	5	9	54	3,8	18	6	18	0,07	**3**	**.004**	●	●				
4,5	5	9	54	4,3	18	6	18	0,12	**3**	**.0045**	●	●				
4,8	6	11	54	4,6	18	6	18	0,12	**3**	**.0048**	●	●				
5	6	11	54	4,8	18	6	18	0,12	**3**	**.005**	●	●				
5,5	7	12	54	5,3	18	6	18	0,12	**3**	**.0055**	●	●				
5,75	7	16	54	5,55	18	6	18	0,12	**3**	**.00575**	●	●				
6	7	16	54	5,8	–	6	18	0,12	**3**	**.006**	●	●				
7,75	9	18	58	7,45	20	8	22	0,12	**3**	**.00775**	●	●				
8	9	20	58	7,7	–	8	22	0,12	**3**	**.008**	●	●				
9,7	11	22	66	9,4	24	10	26	0,2	**3**	**.0097**	●	●				
10	11	24	66	9,5	–	10	26	0,2	**3**	**.010**	●	●				
11,7	12	24	73	11,2	26	12	28	0,2	**3**	**.0117**	●	●				
12	12	26	73	11,5	–	12	28	0,2	**3**	**.012**	●	●				
16	16	32	82	15,5	–	16	34	0,2	**3**	**.016**	●	●				
20	20	40	92	19,5	–	20	42	0,3	**3**	**.020**	●	●				

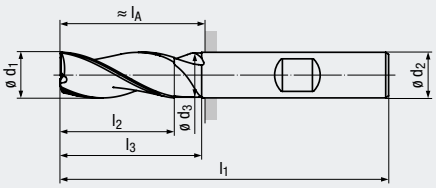
DIN 6527 – Lange Ausführung · Long design

Bestell-Code · Order code														**2518A**	**2519A**	
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	**Dimens.-Code**						
2	6	8	57	1,9	20	6	21	0,04	**3**	**.002**				●	●	
3	7	10	57	2,9	20	6	21	0,07	**3**	**.003**				●	●	
4	8	12	57	3,8	20	6	21	0,07	**3**	**.004**				●	●	
5	10	15	57	4,8	20	6	21	0,12	**3**	**.005**				●	●	
6	10	20	57	5,8	–	6	21	0,12	**3**	**.006**				●	●	
7	13	23	63	6,7	25	8	27	0,12	**3**	**.007**				●	●	
8	16	25	63	7,7	–	8	27	0,12	**3**	**.008**				●	●	
10	19	30	72	9,5	–	10	32	0,2	**3**	**.010**				●	●	
12	22	35	83	11,5	–	12	38	0,2	**3**	**.012**				●	●	
16	26	40	92	15,5	–	16	44	0,2	**3**	**.016**				●	●	
20	32	50	104	19,5	–	20	54	0,3	**3**	**.020**				●	●	

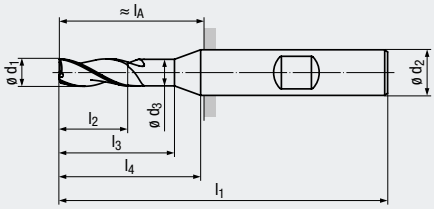
● = Lagerwerkzeug, siehe Preisliste · Stock tool, see price list

- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Schneiden zur Mitte
- Schneidenlänge 3 x d_1
- 3 Baulängen verfügbar

- Multi-functional, high performance tool
- Newly developed geometry
- Low-vibration machining
- Centre cutting
- Flute length 3 x d_1
- 3 lengths available



Design l_4:



N

HM

DIN 6535 HA HB

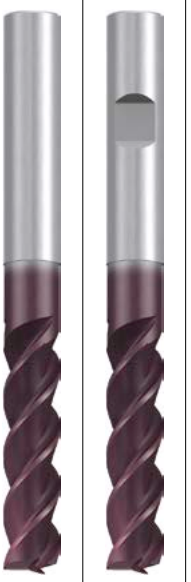
34-38°

KB x 45°

1-2°

v_c / f_z 17

Optional



Allround

Beschichtung · Coating

TIALN

Einsatzgebiete – Material (siehe Seite 14)

- In fast allen Werkstoffen einsetzbar
- Zum Schlichten geeignet

Applications – material (see page 14)

- For almost all materials
- Suitable for finishing

P	1.1-5.1	
M	1.1-4.1	
K	1.1-4.2	
N	1.1-2.8, 5.2	
S	1.1	1.2-1.3
S	2.1	2.2, 2.4

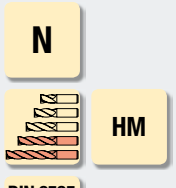
Extra lange Ausführung · Extra long design

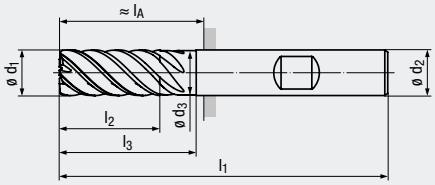
Bestell-Code · Order code											**2520A**	**2521A**				
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	**Dimens.-Code**						
3	9	12	62	2,9	23	6	26	0,07	**3**	**.003**	●	●				
4	12	16	62	3,8	25	6	26	0,07	**3**	**.004**	●	●				
5	15	20	62	4,8	25	6	26	0,12	**3**	**.005**	●	●				
6	18	25	62	5,8	–	6	26	0,12	**3**	**.006**	●	●				
8	24	30	68	7,7	–	8	32	0,12	**3**	**.008**	●	●				
10	30	40	80	9,5	–	10	40	0,2	**3**	**.010**	●	●				
12	36	45	93	11,5	–	12	48	0,2	**3**	**.012**	●	●				
16	48	55	108	15,5	–	16	60	0,2	**3**	**.016**	●	●				
20	60	70	126	19,5	–	20	76	0,3	**3**	**.020**	●	●				

FRANKEN TOP-Cut

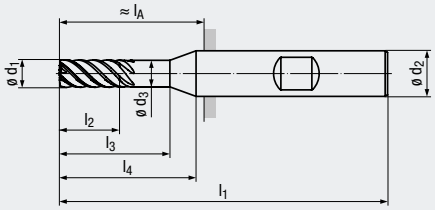
- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Schneidenlänge bis 3 x d_1
- 2 Baulängen verfügbar

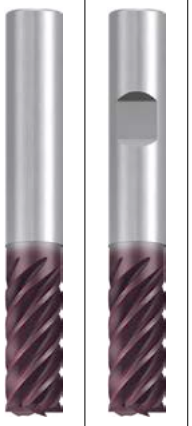
- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Flute length up to 3 x d_1
- 2 lengths available



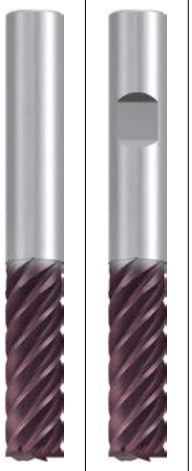


Design l_4:





Allround



Allround

Beschichtung · Coating

	TIALN	TIALN
P	1.1-5.1	1.1-5.1
M	1.1-2.1 3.1-4.1	1.1-2.1 3.1-4.1
K	1.1-2.1 2.2	1.1-2.1 2.2
K	3.1-4.1 4.2	3.1-4.1 4.2
N	1.1-1.4	1.1-1.4 1.5-1.6
N	2.1-3.2 4.1-4.2, 5.2	2.1-2.8 5.2
S	1.1-2.2 2.3	1.1-2.2 2.3
S	2.4 2.5-2.6	2.4 2.5-2.6
H	1.1	

Einsatzgebiete – Material (siehe Seite 14)

- In allen zähen Werkstoffen einsetzbar
- Zum HSC-Schlichten geeignet

Applications – material (see page 14)

- For all tough materials
- Suitable for HSC finishing

DIN 6527 – Lange Ausführung · Long design

Bestell-Code · Order code											**2522A**	**2523A**				
ø d_1 f8	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h5	l_A	KB	Z (Flutes)	**Dimens.-Code**						
5	13	18	57	4,8	20	6	21	0,12	**6**	**.005**	●	●				
6	13	20	57	5,8	–	6	21	0,12	**6**	**.006**	●	●				
8	19	25	63	7,7	–	8	27	0,12	**6**	**.008**	●	●				
10	22	30	72	9,7	–	10	32	0,2	**6**	**.010**	●	●				
12	26	35	83	11,6	–	12	38	0,2	**6**	**.012**	●	●				
16	32	40	92	15,5	–	16	44	0,2	**6**	**.016**	●	●				
20	38	50	104	19,5	–	20	54	0,3	**8**	**.020**	●	●				

Extra lange Ausführung · Extra long design

Bestell-Code · Order code														**2524A**	**2525A**	
ø d_1 h10	l_2	l_3	l_1	ø d_3	l_4	ø d_2 h6	l_A	KB	Z (Flutes)	**Dimens.-Code**						
6	18	25	62	5,8	–	6	26	0,12	**6**	**.006**				●	●	
8	24	30	68	7,7	–	8	32	0,12	**6**	**.008**				●	●	
10	30	35	80	9,7	–	10	40	0,2	**6**	**.010**				●	●	
12	36	45	93	11,6	–	12	48	0,2	**6**	**.012**				●	●	
16	48	55	108	15,5	–	16	60	0,2	**6**	**.016**				●	●	
20	60	70	126	19,5	–	20	76	0,3	**8**	**.020**				●	●	

● = Lagerwerkzeug, siehe Preisliste · Stock tool, see price list

Internationaler Werkstoffvergleich siehe Seite 416 - 429 im FRANKEN Katalog 250
International comparison of materials, see page 416 - 429 in FRANKEN Catalogue 250

		Einsatzgebiete – Material Applications – material			Material-Beispiele Material examples	Material-Nummern Material numbers
P		**Stahlwerkstoffe**	**Steel materials**			
	1.1	Kaltfließpressstähle, Baustähle, Automatenstähle, u.a.	Cold-extrusion steels, Construction steels, Free-cutting steels, etc.	≤ 600 N/mm²	Cq15	1.1132
					S235JR (St37-2)	1.0037
					10SPb20	1.0722
	2.1	Baustähle, Einsatzstähle, Stahlguss, u.a.	Construction steels, Case-hardened steels, Steel castings, etc.	≤ 800 N/mm²	E360 (St70-2)	1.0070
					16MnCr5	1.7131
					GS-25CrMo4	1.7218
	3.1	Einsatzstähle, Vergütungsstähle, Kaltarbeitsstähle, u.a.	Case-hardened steels, Heat-treatable steels, Cold work steels, etc.	≤ 1000 N/mm²	20MoCr3	1.7320
					42CrMo4	1.7225
					102Cr6	1.2067
	4.1	Vergütungsstähle, Kaltarbeitsstähle, Nitrierstähle, u.a.	Heat-treatable steels, Cold work steels, Nitriding steels, etc.	≤ 1200 N/mm²	50CrMo4	1.7228
					X45NiCrMo4	1.2767
					31CrMo12	1.8515
	5.1	Hochlegierte Stähle, Kaltarbeitsstähle, Warmarbeitsstähle, u.a.	High-alloyed steels, Cold work steels, Hot work steels, etc.	≤ 1400 N/mm²	X38CrMoV5-3	1.2367
					X100CrMoV8-1-1	1.2990
					X40CrMoV5-1	1.2344
M		**Nichtrostende Stahlwerkstoffe**	**Stainless steel materials**			
	1.1	Ferritisch, martensitisch	Ferritic, martensitic	≤ 950 N/mm²	X2CrTi12	1.4512
	2.1	Austenitisch	Austenitic	≤ 950 N/mm²	X6CrNiMoTi17-12-2	1.4571
	3.1	Austenitisch-ferritisch (Duplex)	Austenitic-ferritic (Duplex)	≤ 1100 N/mm²	X2CrNiMoN22-5-3	1.4462
	4.1	Austenitisch-ferritisch hitzebeständig (Super Duplex)	Austenitic-ferritic heat-resistant (Super Duplex)	≤ 1250 N/mm²	X2CrNiMoN25-7-4	1.4410
K		**Gusswerkstoffe**	**Cast materials**			
	1.1	Gusseisen mit Lamellengrafit (GJL)	Cast iron with lamellar graphite (GJL)	100-250 N/mm²	EN-GJL-200 (GG20)	EN-JL-1030
	1.2			250-450 N/mm²	EN-GJL-300 (GG30)	EN-JL-1050
	2.1	Gusseisen mit Kugelgrafit (GJS)	Cast iron with nodular graphite (GJS)	350-500 N/mm²	EN-GJS-400-15 (GGG40)	EN-JS-1030
	2.2			500-900 N/mm²	EN-GJS-700-2 (GGG70)	EN-JS-1070
	3.1	Gusseisen mit Vermicular grafit (GJV)	Cast iron with vermicular graphite (GJV)	300-400 N/mm²	GJV 300	
	3.2			400-500 N/mm²	GJV 450	
	4.1	Temperguss (GTMW, GTMB)	Malleable cast iron (GTMW, GTMB)	250-500 N/mm²	EN-GJMW-350-4 (GTW-35)	EN-JM-1010
	4.2			500-800 N/mm²	EN-GJMB-450-6 (GTS-45)	EN-JM-1140
N		**Nichteisenwerkstoffe**	**Non-ferrous materials**			
		Aluminium-Legierungen	**Aluminium alloys**			
	1.1	Aluminium-Knetlegierungen	Wrought aluminium alloys	≤ 200 N/mm²	EN AW-AlMn1	EN AW-3103
	1.2			≤ 350 N/mm²	EN AW-AlMgSi	EN AW-6060
	1.3			≤ 550 N/mm²	EN AW-AlZn5Mg3Cu	EN AW-7022
	1.4	Aluminium-Gusslegierungen	Aluminium cast alloys	Si ≤ 7%	EN AC-AlMg5	EN AC-51300
	1.5			7% < Si ≤ 12%	EN AC-AlSi9Cu3	EN AC-46500
	1.6			12% < Si ≤ 17%	GD-AlSi17Cu4FeMg	
		Kupfer-Legierungen	**Copper alloys**			
	2.1	Reinkupfer, niedriglegiertes Kupfer	Pure copper, low-alloyed copper	≤ 400 N/mm²	E-Cu 57	EN CW 004 A
	2.2	Kupfer-Zink-Legierungen (Messing, langspanend)	Copper-zinc alloys (brass, long-chipping)	≤ 550 N/mm²	CuZn37 (Ms63)	EN CW 508 L
	2.3	Kupfer-Zink-Legierungen (Messing, kurzspanend)	Copper-zinc alloys (brass, short-chipping)	≤ 550 N/mm²	CuZn36Pb3 (Ms58)	EN CW 603 N
	2.4	Kupfer-Aluminium-Legierungen (Alubronze, langspanend)	Copper-aluminium alloys (alu bronze, long-chipping)	≤ 800 N/mm²	CuAl10Ni5Fe4	EN CW 307 G
	2.5	Kupfer-Zinn-Legierungen (Zinnbronze, langspanend)	Copper-tin alloys (tin bronze, long-chipping)	≤ 700 N/mm²	CuSn8P	EN CW 459 K
	2.6	Kupfer-Zinn-Legierungen (Zinnbronze, kurzspanend)	Copper-tin alloys (tin bronze, short-chipping)	≤ 400 N/mm²	CuSn7 ZnPb (Rg7)	2.1090
	2.7	Kupfer-Sonderlegierungen	Special copper alloys	≤ 600 N/mm²	(AMPCO® 8)	
	2.8			≤ 1400 N/mm²	(AMPCO® 45)	
		Magnesium-Legierungen	**Magnesium alloys**			
	3.1	Magnesium-Knetlegierungen	Magnesium wrought alloys	≤ 500 N/mm²	MgAl6Zn	3.5612
	3.2	Magnesium-Gusslegierungen	Magnesium cast alloys	≤ 500 N/mm²	EN-MCMgAl9Zn1	EN-MC21120
		Kunststoffe	**Synthetics**			
	4.1	Duroplaste (kurzspanend)	Duroplastics (short-chipping)		Bakelit, Pertinax	
	4.2	Thermoplaste (langspanend)	Thermoplastics (long-chipping)		PMMA, POM, PVC	
	4.3	Faserverstärkte Kunststoffe (Faseranteil ≤ 30%)	Fibre-reinforced synthetics (fibre content ≤ 30%)		GFK, CFK, AFK	
	4.4	Faserverstärkte Kunststoffe (Faseranteil > 30%)	Fibre-reinforced synthetics (fibre content > 30%)		GFK, CFK, AFK	
		Besondere Werkstoffe	**Special materials**			
	5.1	Grafit	Graphite		C 8000	
	5.2	Wolfram-Kupfer-Legierungen	Tungsten-copper alloys		W-Cu 80/20	
	5.3	Verbundwerkstoffe	Composite materials		Hylite, Alucobond	
S		**Spezialwerkstoffe**	**Special materials**			
		Titan-Legierungen	**Titanium alloys**			
	1.1	Reintitan	Pure titanium	≤ 450 N/mm²	Ti1	3.7025
	1.2	Titan-Legierungen	Titanium alloys	≤ 900 N/mm²	TiAl6V4	3.7165
	1.3			≤ 1250 N/mm²	TiAl4Mo4Sn2	3.7185
		Nickel-, Kobalt- und Eisen-Legierungen	**Nickel alloys, cobalt alloys and iron alloys**			
	2.1	Reinnickel	Pure nickel	≤ 600 N/mm²	Ni 99,6	2.4060
	2.2	Nickel-Basis-Legierungen	Nickel-base alloys	≤ 1000 N/mm²	Monel 400	2.4360
	2.3			≤ 1600 N/mm²	Inconel 718	2.4668
	2.4	Kobalt-Basis-Legierungen	Cobalt-base alloys	≤ 1000 N/mm²	Udimet 605	
	2.5			≤ 1600 N/mm²	Haynes 25	2.4964
	2.6	Eisen-Basis-Legierungen	Iron-base alloys	≤ 1500 N/mm²	Incoloy 800	1.4958
H		**Harte Werkstoffe**	**Hard materials**			
	1.1	Hochfeste Stähle, gehärtete Stähle, Hartguss	High strength steels, hardened steels, hard castings	44 - 50 HRC	Weldox 1100	
	1.2			50 - 55 HRC	Hardox 550	
	1.3			55 - 60 HRC	Armox 600T	
	1.4			60 - 63 HRC	Ferro-Titanit	
	1.5			63 - 66 HRC	HSSE	

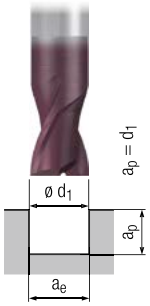
FRANKEN TOP-Cut

Hartmetall-Schaft- und Langlochfräser – kurze Ausführung
Solid carbide end mills and slot drills – short design

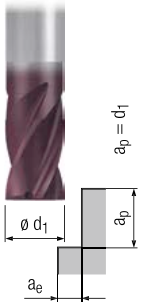
N

Gültig für · Valid for

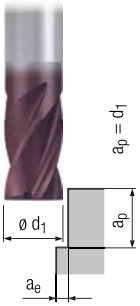
1916A	2510A	2516A
1917A	2511A	2517A



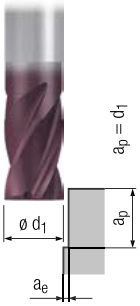
$a_e = d_1$



$a_e = 0{,}4 \times d_1$



$a_e = 0{,}2 \times d_1$



$a_e = 0{,}02 \times d_1$

		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	170	0,005 x d_1	190	0,006 x d_1	200	0,007 x d_1	240	0,008 x d_1	□	■	□	■
	2.1	150	0,004 x d_1	170	0,005 x d_1	180	0,006 x d_1	210	0,007 x d_1	□	■	□	■
	3.1	130	0,004 x d_1	140	0,005 x d_1	160	0,005 x d_1	180	0,006 x d_1	□	■	□	■
	4.1	120	0,003 x d_1	130	0,004 x d_1	140	0,004 x d_1	170	0,005 x d_1	□	■		
	5.1	100	0,003 x d_1	110	0,003 x d_1	120	0,004 x d_1	140	0,004 x d_1	□	■		
M	1.1	80	0,003 x d_1	90	0,004 x d_1	100	0,004 x d_1	110	0,005 x d_1			□	■
	2.1	70	0,003 x d_1	80	0,004 x d_1	80	0,004 x d_1	100	0,005 x d_1			□	■
	3.1	50	0,002 x d_1	60	0,003 x d_1	60	0,003 x d_1	70	0,004 x d_1			□	■
	4.1	30	0,002 x d_1	30	0,003 x d_1	40	0,003 x d_1	40	0,004 x d_1			□	■
K	1.1	170	0,005 x d_1	190	0,006 x d_1	200	0,007 x d_1	240	0,008 x d_1	□	■		
	1.2	170	0,005 x d_1	190	0,006 x d_1	200	0,007 x d_1	240	0,008 x d_1	□	■		
	2.1	150	0,004 x d_1	170	0,005 x d_1	180	0,006 x d_1	210	0,006 x d_1	□	■		
	2.2	150	0,004 x d_1	170	0,005 x d_1	180	0,006 x d_1	210	0,006 x d_1	□	■		
	3.1	130	0,004 x d_1	140	0,005 x d_1	160	0,006 x d_1	180	0,006 x d_1	□	■		
	3.2	130	0,004 x d_1	140	0,005 x d_1	160	0,006 x d_1	180	0,006 x d_1	□	■		
	4.1	100	0,003 x d_1	110	0,004 x d_1	120	0,004 x d_1	140	0,005 x d_1	□	■		
	4.2	80	0,003 x d_1	90	0,004 x d_1	100	0,004 x d_1	110	0,005 x d_1	□	■		
N	1.1	220	0,009 x d_1	250	0,010 x d_1	280	0,011 x d_1	300	0,013 x d_1			□	■
	1.2	220	0,008 x d_1	250	0,009 x d_1	280	0,010 x d_1	300	0,011 x d_1			□	■
	1.3	220	0,007 x d_1	250	0,008 x d_1	280	0,009 x d_1	300	0,010 x d_1			□	■
	1.4	200	0,008 x d_1	250	0,009 x d_1	280	0,010 x d_1	300	0,011 x d_1			□	■
	1.5												
	1.6												
	2.1	150	0,005 x d_1	170	0,006 x d_1	180	0,007 x d_1	210	0,008 x d_1			□	■
	2.2	150	0,005 x d_1	170	0,006 x d_1	180	0,007 x d_1	210	0,008 x d_1			□	■
	2.3	150	0,005 x d_1	170	0,006 x d_1	180	0,007 x d_1	210	0,008 x d_1		□	□	■
	2.4	130	0,004 x d_1	140	0,005 x d_1	160	0,006 x d_1	180	0,006 x d_1			□	■
	2.5	130	0,004 x d_1	140	0,005 x d_1	160	0,006 x d_1	180	0,006 x d_1			□	■
	2.6	130	0,004 x d_1	140	0,005 x d_1	160	0,006 x d_1	180	0,006 x d_1		□	□	■
	2.7	80	0,003 x d_1	90	0,004 x d_1	100	0,004 x d_1	110	0,005 x d_1			□	■
	2.8	80	0,003 x d_1	90	0,004 x d_1	100	0,004 x d_1	110	0,005 x d_1			□	■
	3.1	340	0,009 x d_1	370	0,011 x d_1	410	0,013 x d_1	480	0,014 x d_1			□	■
	3.2	340	0,007 x d_1	370	0,008 x d_1	410	0,010 x d_1	480	0,011 x d_1			□	■
	4.1	340	0,008 x d_1	370	0,009 x d_1	410	0,011 x d_1	480	0,012 x d_1		□	□	■
	4.2	500	0,008 x d_1	550	0,009 x d_1	600	0,011 x d_1	700	0,012 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	80	0,003 x d_1	90	0,004 x d_1	100	0,004 x d_1	110	0,005 x d_1				■
	5.3												
S	1.1	80	0,004 x d_1	90	0,004 x d_1	100	0,005 x d_1	110	0,006 x d_1				■
	1.2	70	0,003 x d_1	80	0,004 x d_1	80	0,004 x d_1	100	0,005 x d_1				■
	1.3	40	0,003 x d_1	40	0,003 x d_1	50	0,004 x d_1	60	0,004 x d_1				■
	2.1	70	0,002 x d_1	80	0,002 x d_1	80	0,003 x d_1	100	0,003 x d_1				■
	2.2	30	0,002 x d_1	30	0,002 x d_1	35	0,003 x d_1	40	0,003 x d_1				■
	2.3	20	0,002 x d_1	25	0,002 x d_1	25	0,003 x d_1	30	0,003 x d_1				■
	2.4	20	0,002 x d_1	25	0,002 x d_1	25	0,003 x d_1	30	0,003 x d_1				■
	2.5	20	0,002 x d_1	20	0,002 x d_1	20	0,003 x d_1	30	0,003 x d_1				■
	2.6	20	0,002 x d_1	20	0,002 x d_1	20	0,003 x d_1	30	0,003 x d_1				■
H	1.1	100	0,003 x d_1	110	0,003 x d_1	120	0,004 x d_1	140	0,004 x d_1	□	■		
	1.2	80	0,003 x d_1	90	0,003 x d_1	100	0,004 x d_1	110	0,004 x d_1	□	■		
	1.3			90	0,003 x d_1	100	0,003 x d_1	110	0,004 x d_1	□	■		
	1.4												
	1.5												

v_c = Schnittgeschwindigkeit · Cutting speed
f_z = Vorschub pro Zahn · Feed per tooth

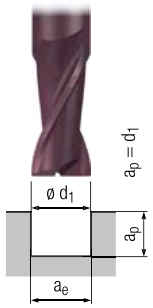
■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

Hartmetall-Schaftfräser – lange Ausführung
Solid carbide end mills – long design

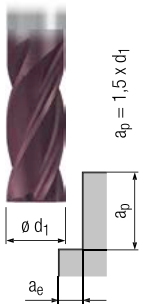
N

Gültig für · Valid for

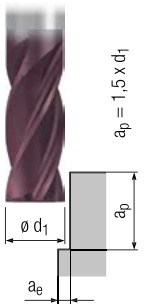
1998A	2513A	2698A
1998AZ	2518A	2698AZ
1999A	2519A	2699A
1999AZ	2522A	2699AZ
2512A	2523A	



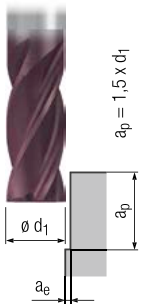
$a_e = d_1$



$a_e = 0{,}4 \times d_1$



$a_e = 0{,}2 \times d_1$



$a_e = 0{,}02 \times d_1$

		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	140	0,005 x d_1	150	0,005 x d_1	170	0,006 x d_1	200	0,007 x d_1	□	■	□	■
	2.1	130	0,004 x d_1	140	0,005 x d_1	160	0,005 x d_1	180	0,006 x d_1	□	■	□	■
	3.1	110	0,004 x d_1	120	0,004 x d_1	130	0,005 x d_1	150	0,005 x d_1	□	■	□	■
	4.1	100	0,003 x d_1	110	0,003 x d_1	120	0,004 x d_1	140	0,004 x d_1	□	■		
	5.1	90	0,003 x d_1	100	0,003 x d_1	110	0,003 x d_1	130	0,004 x d_1	□	■		
M	1.1	70	0,003 x d_1	80	0,003 x d_1	80	0,004 x d_1	100	0,004 x d_1			□	■
	2.1	60	0,003 x d_1	70	0,003 x d_1	70	0,004 x d_1	80	0,004 x d_1			□	■
	3.1	40	0,002 x d_1	40	0,003 x d_1	50	0,003 x d_1	60	0,003 x d_1			□	■
	4.1	30	0,002 x d_1	30	0,003 x d_1	40	0,003 x d_1	40	0,003 x d_1			□	■
K	1.1	140	0,005 x d_1	150	0,006 x d_1	170	0,006 x d_1	200	0,007 x d_1	□	■		
	1.2	140	0,005 x d_1	150	0,006 x d_1	170	0,006 x d_1	200	0,007 x d_1	□	■		
	2.1	130	0,004 x d_1	140	0,005 x d_1	160	0,005 x d_1	180	0,006 x d_1	□	■		
	2.2	130	0,004 x d_1	140	0,005 x d_1	160	0,005 x d_1	180	0,006 x d_1	□	■		
	3.1	110	0,004 x d_1	120	0,005 x d_1	130	0,005 x d_1	150	0,006 x d_1	□	■		
	3.2	110	0,004 x d_1	120	0,005 x d_1	130	0,005 x d_1	150	0,006 x d_1	□	■		
	4.1	90	0,003 x d_1	100	0,003 x d_1	110	0,004 x d_1	130	0,004 x d_1	□	■		
	4.2	70	0,003 x d_1	80	0,003 x d_1	80	0,004 x d_1	100	0,004 x d_1	□	■		
N	1.1	220	0,009 x d_1	250	0,010 x d_1	280	0,011 x d_1	300	0,013 x d_1			□	■
	1.2	220	0,008 x d_1	250	0,009 x d_1	280	0,010 x d_1	300	0,011 x d_1			□	■
	1.3	220	0,007 x d_1	250	0,008 x d_1	280	0,009 x d_1	300	0,010 x d_1			□	■
	1.4	200	0,008 x d_1	250	0,009 x d_1	280	0,010 x d_1	300	0,011 x d_1			□	■
	1.5												
	1.6												
	2.1	130	0,005 x d_1	140	0,006 x d_1	160	0,006 x d_1	180	0,007 x d_1			□	■
	2.2	130	0,005 x d_1	140	0,006 x d_1	160	0,006 x d_1	180	0,007 x d_1			□	■
	2.3	130	0,005 x d_1	140	0,006 x d_1	160	0,006 x d_1	180	0,007 x d_1		□	□	■
	2.4	120	0,004 x d_1	130	0,005 x d_1	140	0,005 x d_1	170	0,006 x d_1			□	■
	2.5	120	0,004 x d_1	130	0,005 x d_1	140	0,005 x d_1	170	0,006 x d_1			□	■
	2.6	120	0,004 x d_1	130	0,005 x d_1	140	0,005 x d_1	170	0,006 x d_1		□	□	■
	2.7	70	0,003 x d_1	80	0,003 x d_1	80	0,004 x d_1	100	0,004 x d_1			□	■
	2.8	70	0,003 x d_1	80	0,003 x d_1	80	0,004 x d_1	100	0,004 x d_1			□	■
	3.1	290	0,009 x d_1	320	0,010 x d_1	350	0,011 x d_1	410	0,013 x d_1			□	■
	3.2	290	0,007 x d_1	320	0,008 x d_1	350	0,009 x d_1	410	0,010 x d_1			□	■
	4.1	290	0,008 x d_1	320	0,009 x d_1	350	0,009 x d_1	410	0,011 x d_1		□	□	■
	4.2	430	0,008 x d_1	470	0,009 x d_1	520	0,009 x d_1	600	0,011 x d_1			□	■
	4.3												
	4.4												
	5.1												
	5.2	70	0,003 x d_1	80	0,003 x d_1	80	0,004 x d_1	100	0,004 x d_1				■
	5.3												
S	1.1	70	0,004 x d_1	80	0,004 x d_1	80	0,004 x d_1	100	0,005 x d_1				■
	1.2	60	0,003 x d_1	70	0,003 x d_1	70	0,004 x d_1	80	0,004 x d_1				■
	1.3	40	0,003 x d_1	40	0,003 x d_1	50	0,003 x d_1	60	0,004 x d_1				■
	2.1	60	0,002 x d_1	70	0,002 x d_1	70	0,003 x d_1	80	0,003 x d_1				■
	2.2	20	0,002 x d_1	20	0,002 x d_1	15	0,003 x d_1	30	0,003 x d_1				■
	2.3	20	0,002 x d_1	25	0,002 x d_1	25	0,003 x d_1	30	0,003 x d_1				■
	2.4	20	0,002 x d_1	25	0,002 x d_1	25	0,003 x d_1	30	0,003 x d_1				■
	2.5	20	0,002 x d_1	20	0,002 x d_1	20	0,003 x d_1	30	0,003 x d_1				■
	2.6	20	0,002 x d_1	20	0,002 x d_1	20	0,003 x d_1	30	0,003 x d_1				■
H	1.1	90	0,003 x d_1	100	0,003 x d_1	110	0,003 x d_1	130	0,004 x d_1	□	■		
	1.2	70	0,003 x d_1	80	0,003 x d_1	80	0,003 x d_1	100	0,004 x d_1	□	■		
	1.3			70	0,003 x d_1	70	0,003 x d_1	80	0,003 x d_1	□	■		
	1.4												
	1.5												

v_c = Schnittgeschwindigkeit · Cutting speed
f_z = Vorschub pro Zahn · Feed per tooth

Hartmetall-Schaftfräser – extra lange Ausführung

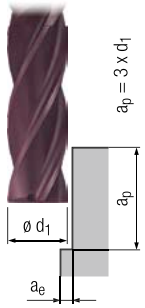
Solid carbide end mills – extra long design

N

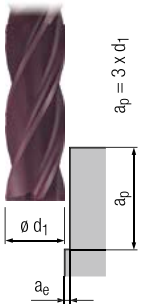
Gültig für · Valid for

2514A 2524A 2528A
2515A 2525A 2529A
2520A 2526A
2521A 2527A

3 x d_1

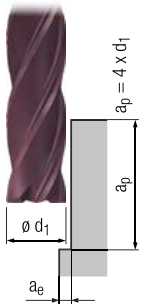


$a_e = 0{,}1 \times d_1$

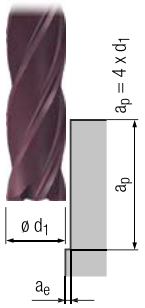


$a_e = 0{,}02 \times d_1$

4 x d_1



$a_e = 0{,}05 \times d_1$



$a_e = 0{,}02 \times d_1$

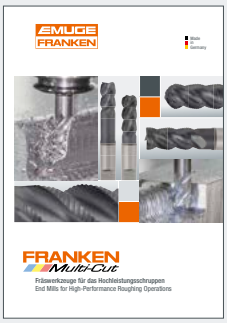
		v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]	v_c [m/min]	f_z [mm]			MMS MQL	
P	1.1	120	0,005 x d_1	140	0,006 x d_1	100	0,005 x d_1	120	0,005 x d_1	□	■	□	■
	2.1	110	0,004 x d_1	130	0,005 x d_1	90	0,004 x d_1	110	0,005 x d_1	□	■	□	■
	3.1	90	0,004 x d_1	110	0,005 x d_1	70	0,004 x d_1	90	0,004 x d_1	□	■	□	■
	4.1	70	0,003 x d_1	80	0,004 x d_1	60	0,003 x d_1	70	0,003 x d_1	□	■		
	5.1	60	0,003 x d_1	70	0,003 x d_1	50	0,003 x d_1	60	0,003 x d_1	□	■		
M	1.1	120	0,003 x d_1	140	0,004 x d_1	100	0,003 x d_1	120	0,003 x d_1			□	■
	2.1	100	0,003 x d_1	120	0,004 x d_1	80	0,003 x d_1	100	0,003 x d_1			□	■
	3.1	70	0,003 x d_1	80	0,003 x d_1	60	0,003 x d_1	70	0,003 x d_1			□	■
	4.1	50	0,003 x d_1	60	0,003 x d_1	40	0,003 x d_1	50	0,003 x d_1			□	■
K	1.1	120	0,005 x d_1	140	0,006 x d_1	100	0,005 x d_1	120	0,006 x d_1	□	■		
	1.2	120	0,005 x d_1	140	0,006 x d_1	100	0,005 x d_1	120	0,006 x d_1	□	■		
	2.1	110	0,004 x d_1	130	0,005 x d_1	90	0,004 x d_1	110	0,004 x d_1	□	■		
	2.2	110	0,004 x d_1	130	0,005 x d_1	90	0,004 x d_1	110	0,004 x d_1	□	■		
	3.1	90	0,004 x d_1	110	0,005 x d_1	70	0,004 x d_1	90	0,004 x d_1	□	■		
	3.2	90	0,004 x d_1	110	0,005 x d_1	70	0,004 x d_1	90	0,004 x d_1	□	■		
	4.1	70	0,003 x d_1	80	0,004 x d_1	60	0,003 x d_1	70	0,003 x d_1	□	■		
	4.2	60	0,003 x d_1	70	0,004 x d_1	50	0,003 x d_1	60	0,003 x d_1	□	■		
N	1.1	360	0,009 x d_1	430	0,011 x d_1	300	0,009 x d_1	430	0,009 x d_1			□	■
	1.2	360	0,008 x d_1	430	0,010 x d_1	300	0,008 x d_1	430	0,009 x d_1			□	■
	1.3	360	0,007 x d_1	430	0,008 x d_1	300	0,007 x d_1	430	0,008 x d_1			□	■
	1.4	240	0,008 x d_1	290	0,010 x d_1	200	0,008 x d_1	290	0,009 x d_1			□	■
	1.5	230	0,007 x d_1	280	0,008 x d_1	180	0,007 x d_1	280	0,008 x d_1			□	■
	1.6	160	0,006 x d_1	190	0,007 x d_1	130	0,006 x d_1	190	0,007 x d_1			□	■
	2.1	110	0,005 x d_1	130	0,006 x d_1	90	0,005 x d_1	110	0,006 x d_1			□	■
	2.2	110	0,005 x d_1	130	0,006 x d_1	90	0,005 x d_1	110	0,006 x d_1			□	■
	2.3	110	0,005 x d_1	130	0,006 x d_1	90	0,005 x d_1	110	0,006 x d_1		□	□	■
	2.4	100	0,004 x d_1	120	0,005 x d_1	80	0,004 x d_1	100	0,004 x d_1			□	■
	2.5	100	0,004 x d_1	120	0,005 x d_1	80	0,004 x d_1	100	0,004 x d_1			□	■
	2.6	100	0,004 x d_1	120	0,005 x d_1	80	0,004 x d_1	100	0,004 x d_1		□	□	■
	2.7	60	0,003 x d_1	70	0,004 x d_1	50	0,003 x d_1	60	0,003 x d_1			□	■
	2.8	60	0,003 x d_1	70	0,004 x d_1	50	0,003 x d_1	60	0,003 x d_1			□	■
	3.1												
	3.2												
	4.1												
	4.2												
	4.3												
	4.4												
	5.1												
	5.2	60	0,003 x d_1	70	0,004 x d_1	50	0,003 x d_1	60	0,003 x d_1				■
	5.3												
S	1.1	90	0,004 x d_1	100	0,005 x d_1	70	0,004 x d_1	80	0,004 x d_1				■
	1.2	70	0,003 x d_1	80	0,004 x d_1	60	0,003 x d_1	70	0,003 x d_1				■
	1.3	70	0,003 x d_1	80	0,003 x d_1	60	0,003 x d_1	70	0,003 x d_1				■
	2.1	70	0,004 x d_1	80	0,004 x d_1	60	0,004 x d_1	70	0,004 x d_1				■
	2.2	30	0,003 x d_1	40	0,004 x d_1	15	0,003 x d_1	30	0,003 x d_1				■
	2.3	20	0,002 x d_1	25	0,002 x d_1	25	0,002 x d_1	20	0,002 x d_1				■
	2.4	30	0,003 x d_1	45	0,003 x d_1	25	0,003 x d_1	30	0,003 x d_1				■
	2.5	20	0,002 x d_1	20	0,002 x d_1	20	0,002 x d_1	20	0,002 x d_1				■
	2.6	20	0,003 x d_1	20	0,003 x d_1	20	0,003 x d_1	20	0,003 x d_1				■
H	1.1												
	1.2												
	1.3												
	1.4												
	1.5												

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

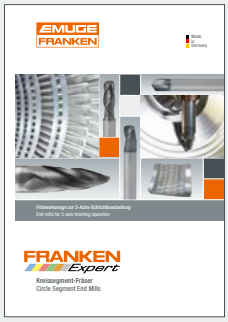
	P	M	K	N	S	H
Werkzeugtyp Tool type	**Hochleistungsfräser-Programm** High performance end mill programme					
NR	Multi-Cut	Multi-Cut	Multi-Cut			
NF	Jet-Cut	TiNox-Cut	Jet-Cut		TiNox-Cut	
N	Jet-Cut	TiNox-Cut	Jet-Cut		TiNox-Cut	
W				Alu-Cut		
W				Fiber-Cut		
WR				Alu-Cut		
H						Hard-Cut

Werkzeugtyp Tool type	**Hochleistungs-Universalfräser-Programm** High performance universal end mill programme					
N	TOP-Cut	TOP-Cut	TOP-Cut	TOP-Cut	TOP-Cut	TOP-Cut

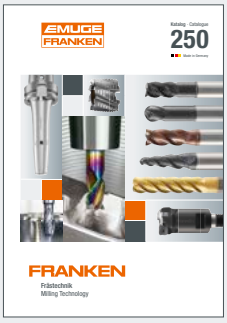
Druckerzeugnisse für Hochleistungswerkzeuge — Sales literature for high performance end mills



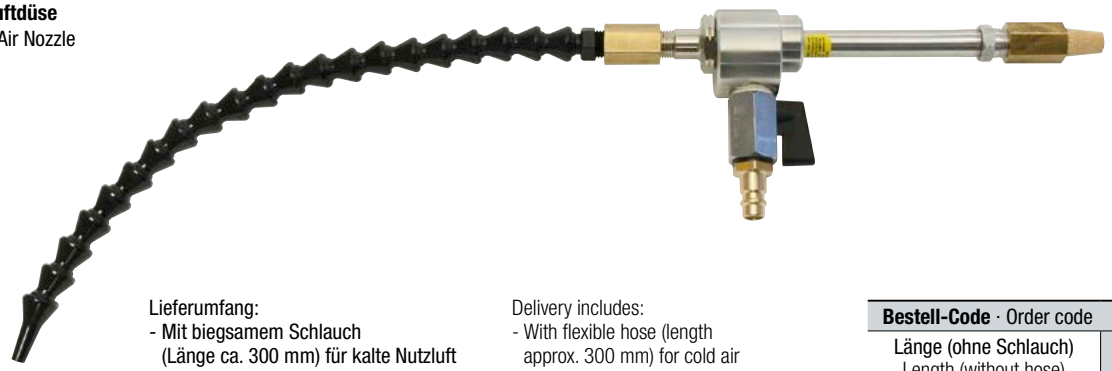
Druckerzeugnisse für Fräswerkzeuge mit besonderen Eigenschaften — Sales literature for milling tools with special characteristics



Hauptkatalog — Main catalogue



Kaltluftdüse
Cold-Air Nozzle



Lieferumfang:
- Mit biegsamem Schlauch (Länge ca. 300 mm) für kalte Nutzluft
- Schalldämpfer (SN14) für heiße Abluft
- Kugelhahn mit Anschlussstück (ST 1/4) für Zuluftschlauch (NW6) mit Schnellwechselkupplung (NW7.2)

Delivery includes:
- With flexible hose (length approx. 300 mm) for cold air
- Silencer (SN14) for hot exhaust air
- Ball-valve with fitting (1/4") for inlet hose (6 mm) with quick-change attachment (7.2 mm)

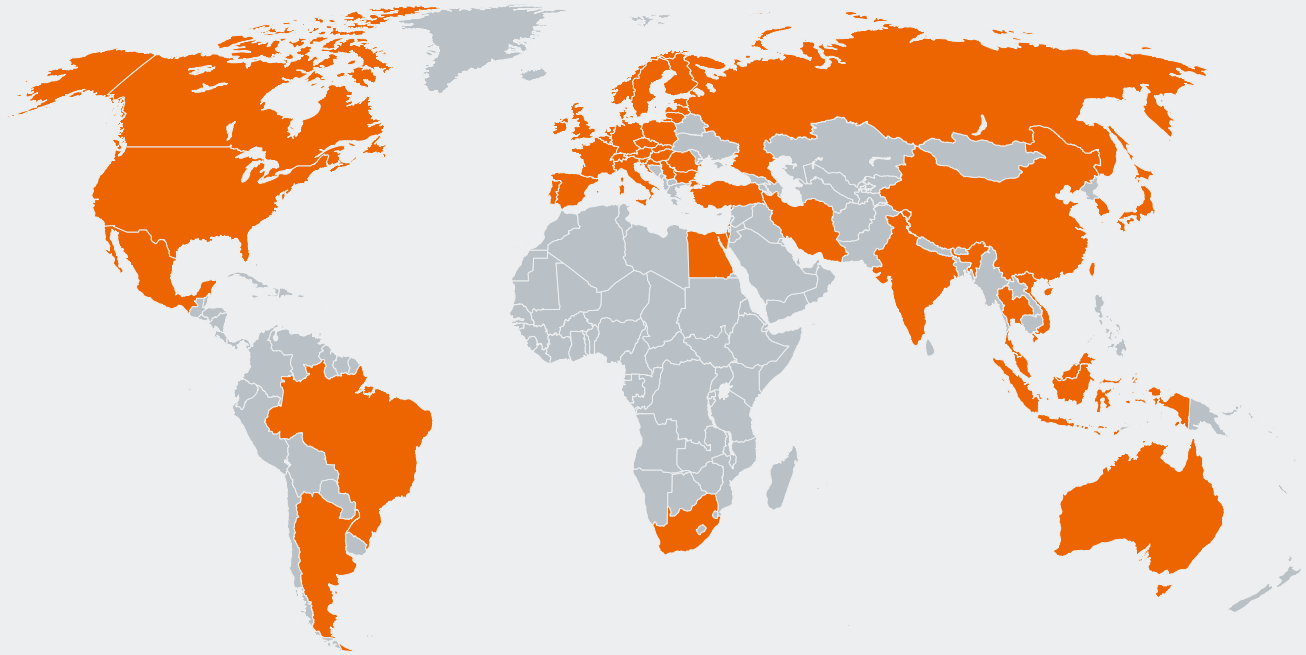
Bestell-Code · Order code		**6910**
Länge (ohne Schlauch) Length (without hose)	**Dimens.-Code**	
225 mm	**.15**	●

Ersatzschlauch
Spare Hose

Bestell-Code · Order code		**6910**
Länge Length	**Dimens.-Code**	
≈ 300 mm	**.20**	●
≈ 400 mm	**.22**	●
≈ 500 mm	**.21**	●

Halterungen für die Kaltluftdüse
Holders for the Cold-Air Nozzle

Bestell-Code · Order code		**6910**					
		Klemmarm mit Grundhalter Socket with basic holder	Klemmarm mit Magnethalter Socket with magnetic shoe	Klemmarm Socket	Grundhalter für Klemmarm Basic holder for socket	Magnethalter für Klemmarm Magnetic shoe for socket
Abmaße Dimensions	**Dimens.-Code**					
ø 45 x 68 mm	**.24**	●				
ø 80 x 80 mm	**.25**		●			
ø 80 x 17 mm	**.26**					●
ø 32 x 63 mm	**.27**			●		
ø 45 x 20 mm	**.32**				●	



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