

FRANKEN
TOP-Cut

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



Mehr als 100 Jahre Präzision und Innovation. More than 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 Schneidstoffvielfalt, 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.

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 aus Hartmetall, die durch ihre speziellen Geometrieigenschaften 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.

Durch die Vielzahl an verschiedenen Ausführungen und Abmessungen wird ein sehr breites Anwendungsgebiet gewährleistet. Von 2-schneidigen Langlochfräsern über mehrschneidige Schlichtfräser bis zu Hochleistungsfräsern mit Einsatziefen von $6 \times d_1$ decken die TOP-Cut-Werkzeuge einen großen Einsatzbereich ab.

Schafffräser mit einer großen Anzahl an verschiedenen Eckenradien (bis zu 10 pro Durchmesser) runden das Lagerprogramm dieser Produktlinie perfekt ab.

Mit dieser Broschüre zeigen wir eine Auswahl der wichtigsten Hartmetall-TOP-Cut-Schafffräser. 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 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.

The huge number of different versions and dimensions guarantees a very wide range of applications. TOP-Cut tools cover a huge area of usage from 2-flute slot drills via multi-flute finishing end mills to high-performance end mills with insert depths of $6 \times d_1$.

End mills with a large number of different corner radii (up to 10 per diameter) perfectly round off the stock programme of this product line.

In this brochure we present a selection of the most important solid carbide TOP-Cut end mills. We provide reliable starting conditions (v_c / f_z) and guidelines concerning the recommended coolant for every tool depending on the respective material group.

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Wegweiser

Bitte beachten:

Die Eignung ist folgendermaßen gekennzeichnet:

- = sehr gut geeignet
- = gut geeignet

Product finder

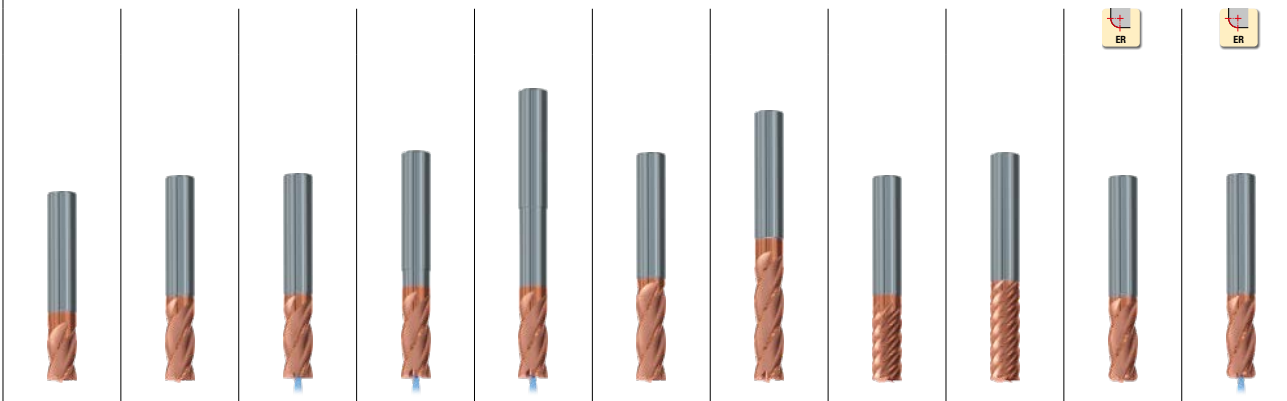
Please note:

The suitability is indicated as follows:

- = very suitable
- = suitable

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/mm ²	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/mm ²	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/mm ²	20MoCr3 1.7320 42CrMo4 1.7225 102Cr6 1.2067 50CrMo4 1.7228
	4.1 Vergütungsstähle, Kaltarbeitsstähle, Nitrierstähle, u.a.	Heat-treatable steels, Cold work steels, Nitriding steels, etc.	≤ 1200 N/mm ²	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/mm ²	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/mm ²	X2CrTi12 1.4512
	2.1 Austenitisch	Austenitic	≤ 950 N/mm ²	X6CrNiMoTi17-12-2 1.4571
	3.1 Austenitisch-ferritisch (Duplex)	Austenitic-ferritic (Duplex)	≤ 1100 N/mm ²	X2CrNiMoN22-5-3 1.4462
4.1 Austenitisch-ferritisch hitzebeständig (Super Duplex)	Austenitic-ferritic heat-resistant (Super Duplex)	≤ 1250 N/mm ²	X2CrNiMoN25-7-4 1.4410	
K	Gusswerkstoffe Cast materials			
	1.1 Gusseisen mit Lamellengrafit (GJL)	Cast iron with lamellar graphite (GJL)	100-250 N/mm ²	EN-GJL-200 (GG20) EN-JL-1030
	2.1 Gusseisen mit Kugelgrafit (GJS)	Cast iron with nodular graphite (GJS)	250-450 N/mm ²	EN-GJL-300 (GG30) EN-JL-1050
	2.2 Gusseisen mit Kugelgrafit (GJS)	Cast iron with nodular graphite (GJS)	350-500 N/mm ²	EN-GJS-400-15 (GGG40) EN-JS-1030
	3.1 Gusseisen mit Vermiculargrafit (GJV)	Cast iron with vermicular graphite (GJV)	500-900 N/mm ²	EN-GJS-700-2 (GGG70) EN-JS-1070
	3.2 Gusseisen mit Vermiculargrafit (GJV)	Cast iron with vermicular graphite (GJV)	300-400 N/mm ²	GJV 300
	4.1 Temperguss (GTMW, GTMB)	Malleable cast iron (GTMW, GTMB)	400-500 N/mm ²	GJV 450
4.2 Temperguss (GTMW, GTMB)	Malleable cast iron (GTMW, GTMB)	250-500 N/mm ²	EN-GJMW-350-4 (GTW-35) EN-JM-1010	
4.2 Temperguss (GTMW, GTMB)	Malleable cast iron (GTMW, GTMB)	500-800 N/mm ²	EN-GJMB-450-6 (GTS-45) EN-JM-1140	
N	Nichteisenwerkstoffe Non-ferrous materials			
	1.1 Aluminium-Legierungen	Aluminium alloys		
	1.2 Aluminium-Knetlegierungen	Wrought aluminium alloys	≤ 200 N/mm ²	EN AW-AIMn1 EN AW-3103
	1.3 Aluminium-Knetlegierungen	Wrought aluminium alloys	≤ 350 N/mm ²	EN AW-AIMgSi EN AW-6060
	1.4 Aluminium-Knetlegierungen	Wrought aluminium alloys	≤ 550 N/mm ²	EN AW-AlZn5Mg3Cu EN AW-7022
	1.5 Aluminium-Gusslegierungen	Aluminium cast alloys	Si ≤ 7%	EN AC-AIMg5 EN AC-51300
	1.6 Aluminium-Gusslegierungen	Aluminium cast alloys	7% < Si ≤ 12%	EN AC-AISi9Cu3 EN AC-46500
	1.6 Aluminium-Gusslegierungen	Aluminium cast alloys	12% < Si ≤ 17%	GD-AISi17Cu4FeMg
	2.1 Reinkupfer, niedriglegiertes Kupfer	Pure copper, low-alloyed copper	≤ 400 N/mm ²	E-Cu 57
	2.2 Kupfer-Zink-Legierungen (Messing, langspanend)	Copper-zinc alloys (brass, long-chipping)	≤ 550 N/mm ²	CuZn37 (Ms63) EN CW 508 L
	2.3 Kupfer-Zink-Legierungen (Messing, kurzspanend)	Copper-zinc alloys (brass, short-chipping)	≤ 550 N/mm ²	CuZn36Pb3 (Ms58) EN CW 603 N
	2.4 Kupfer-Aluminium-Legierungen (Alubronze, langspanend)	Copper-aluminium alloys (alu bronze, long-chipping)	≤ 800 N/mm ²	CuAl10Ni5Fe4 EN CW 307 G
	2.5 Kupfer-Zinn-Legierungen (Zinnbronze, langspanend)	Copper-tin alloys (tin bronze, long-chipping)	≤ 700 N/mm ²	CuSn8P EN CW 459 K
	2.6 Kupfer-Zinn-Legierungen (Zinnbronze, kurzspanend)	Copper-tin alloys (tin bronze, short-chipping)	≤ 400 N/mm ²	CuSn7ZnPb (Rg7) 2.1090
	2.7 Kupfer-Sonderlegierungen	Special copper alloys	≤ 600 N/mm ²	(AMPCO® 8)
	2.8 Kupfer-Sonderlegierungen	Special copper alloys	≤ 1400 N/mm ²	(AMPCO® 45)
3.1 Magnesium-Legierungen	Magnesium alloys			
3.2 Magnesium-Knetlegierungen	Magnesium wrought alloys	≤ 500 N/mm ²	MgAl6Zn 3.5612	
3.2 Magnesium-Gusslegierungen	Magnesium cast alloys	≤ 500 N/mm ²	EN-MCMgAl9Zn1 EN-MC21120	
4.1 Kunststoffe	Synthetics			
4.2 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	
5.1 Besondere Werkstoffe	Special materials			
5.2 Graphit	Graphite		C 8000	
5.2 Wolfram-Kupfer-Legierungen	Tungsten-copper alloys		W-Cu 80/20	
5.3 Verbundwerkstoffe	Composite materials		Hyllite, Alucobond	
S	Spezialwerkstoffe Special materials			
	1.1 Titan-Legierungen	Titanium alloys		
	1.2 Reintitan	Pure titanium	≤ 450 N/mm ²	Ti1 3.7025
	1.2 Titan-Legierungen	Titanium alloys	≤ 900 N/mm ²	TiAl6V4 3.7165
	1.3 Titan-Legierungen	Titanium alloys	≤ 1250 N/mm ²	TiAl4Mo4Sn2 3.7185
	2.1 Nickel-, Kobalt- und Eisen-Legierungen	Nickel alloys, cobalt alloys and iron alloys		
	2.1 Reinnickel	Pure nickel	≤ 600 N/mm ²	Ni 99.6 2.4060
	2.2 Nickel-Basis-Legierungen	Nickel-base alloys	≤ 1000 N/mm ²	Monel 400 2.4360
	2.3 Nickel-Basis-Legierungen	Nickel-base alloys	≤ 1600 N/mm ²	Inconel 718 2.4668
	2.4 Kobalt-Basis-Legierungen	Cobalt-base alloys	≤ 1000 N/mm ²	Udimet 605
2.5 Eisen-Basis-Legierungen	Iron-base alloys	≤ 1600 N/mm ²	Haynes 25 2.4964	
2.6 Eisen-Basis-Legierungen	Iron-base alloys	≤ 1500 N/mm ²	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 Hochfeste Stähle, gehärtete Stähle, Hartguss	High strength steels, hardened steels, hard castings	50 - 55 HRC	Hardox 550
	1.3 Hochfeste Stähle, gehärtete Stähle, Hartguss	High strength steels, hardened steels, hard castings	55 - 60 HRC	Armax 600T
	1.4 Hochfeste Stähle, gehärtete Stähle, Hartguss	High strength steels, hardened steels, hard castings	60 - 63 HRC	Ferro-Titanit
	1.5 Hochfeste Stähle, gehärtete Stähle, Hartguss	High strength steels, hardened steels, hard castings	63 - 66 HRC	HSSE

Hartmetall-Schafffräser „ENORM“
Solid Carbide End Mills "ENORM"



N

ø3 - 20 mm	ø3 - 25 mm	ø3 - 20 mm	ø6 - 20 mm	ø3 - 20 mm	ø3 - 20 mm	ø6 - 20 mm	ø5 - 20 mm	ø6 - 20 mm	ø3 - 20 mm	ø3 - 20 mm
4	4 - 6	4	4	4	4 - 5	4 - 5	6 - 8	6 - 8	4	4
1916A	1998A	1998AZ	3806AZ	3808AZ	2526A	2528A	2522A	2524A	2698A	2698AZ
1917A	1999A	1999AZ	3807AZ	3809AZ	2527A	2529A	2523A	2525A	2699A	2699AZ
8	10	10	12	14	16	16	18	20	22 - 24	22 - 24
9	11	11	13	15	17	17	19	21	23 - 25	23 - 25

Z (Flutes)
Seite · Page
 v_c / f_z

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■	■	■	■	■	■	■	■	■	■	■	4.1
■	■	■	■	■	■	■	■	■	■	■	5.1
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■	■	■	■	■	■	■	■	■	■	■	1.5

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

Hartmetall-Schaftfräser „ENORM“
Solid Carbide End Mills "ENORM"

Hartmetall-Schaft- und Langlochfräser
Solid Carbide End Mills and Slot Drills



e8



N

	ø5-25 mm	ø5-25 mm	ø0,3-20 mm	ø2-20 mm	ø3-20 mm	ø1,5-20 mm	ø1-20 mm	ø3-20 mm
Z (Flutes)	5	6	2	2	2	3	3	3
	3878A	3880A	2510A	2512A	2514A	2516A	2518A	2520A
	3879A	3881A	2511A	2513A	2515A	2517A	2519A	2521A
Seite - Page	26	28	30	32	34	36	38	40
v_c / f_z	27	29	31	33	35	37	39	41

P	1.1	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■
	5.1	■	■	■	■	■	■	■
M	1.1	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■
K	1.1	■	■	■	■	■	■	■
	1.2	■	■	■	■	■	■	■
	2.1	■	■	■	■	■	■	■
	2.2	■	■	■	■	■	■	■
	3.1	■	■	■	■	■	■	■
	3.2	■	■	■	■	■	■	■
	4.1	■	■	■	■	■	■	■
	4.2	■	■	■	■	■	■	■
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	1.2	■	■	■	■	■	■	■
	1.3	■	■	■	■	■	■	■
	1.4	■	■	□	□	□	■	■
	1.5					□		■
	1.6					□		■
	2.1	■	■	■	■	■	■	■
	2.2	■	■	■	■	■	■	■
	2.3	■	■	■	■	■	■	■
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	2.5	■	■	■	■	■	■	■
	2.6	■	■	■	■	■	■	■
	2.7	■	■	■	■	■	■	■
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	3.1	■	■	■	■		□	□
	3.2	■	■	■	■		□	□
4.1	■	■	■	■		□	□	
4.2	□	□	■	■		□	□	
4.3								
4.4								
5.1								
5.2	■	■	■	■	■	■	■	
5.3								
S	1.1	■	■	■	■	■	■	■
	1.2	■	■	■	■	■	□	□
	1.3	■	■	■	■	■	□	□
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	2.2	■	■	□	□	□	□	□
	2.3	■	■	□	□	□	□	□
	2.4	■	■	□	□	□	□	□
2.5	■	■	□	□	□	□	□	
2.6	■	■	□	□	□	□	□	
H	1.1	■	■	■	■	□	■	□
	1.2	□	□	■	■	□	■	□
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	1.4							
	1.5							

**24/7**

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Anmelden  Warenkorb
Unternehmen Kauf



Mit dem bei den Werkzeugen abgebildeten QR-Code gelangen Sie direkt zu den jeweiligen Artikeln in unserem Webshop. Dort finden Sie umfassende Werkzeuginformationen und Schnittdaten.

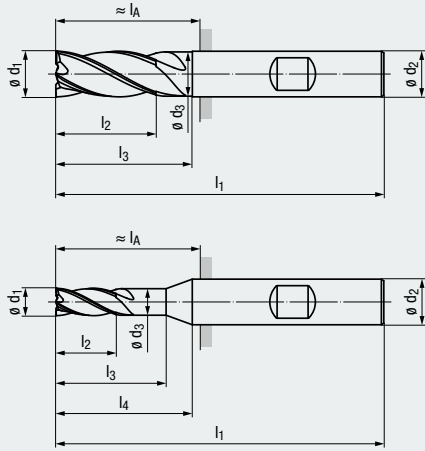
Bei Registrierung stehen Ihnen noch weitere Produktdaten und Funktionen zur Verfügung. Dazu zählen neben standardisierten Werkzeugdaten (2D / 3D / Sachmerkmale) auch eine Bestell- oder Angebotshistorie, individuelle Merklisten sowie weitere nützliche Funktionen.

The QR code shown with the tools will take you directly to the respective articles in our web store where you can find comprehensive tool information and cutting data.

Registration provides you with additional product data and functions. These include standardised tool data (2D / 3D / characteristics), an order or quotation history and individual watch lists as well as other useful functions.

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend
- 4 Baulängen verfügbar

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



N

HM

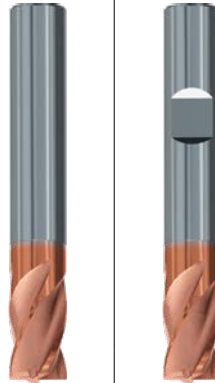
DIN 6535
HA
HB

3-5°

35-38°

KB x 45°

V_c / f_z
9



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

- For almost all materials
- Suitable for roughing and finishing

TIALN

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

DIN 6527 – Kurze Ausführung · Short design

Bestell-Code · Order code

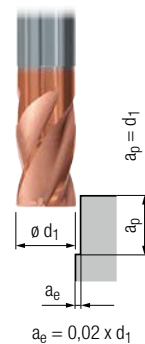
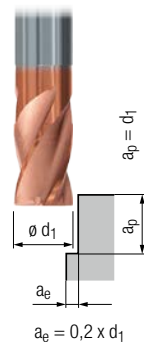
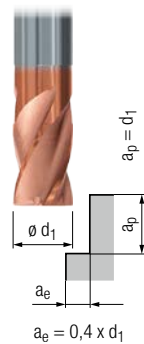
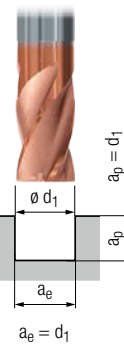
$\varnothing d_1$ f8	l_2	l_3	l_1	$\varnothing d_3$	l_4	$\varnothing d_2$ h5	l_A	KB	Z (Flutes)	Dimens.- Code	1916A	1917A
3	5	9	50	2,9	14	6	14	0,07	4	.003	●	●
4	8	12	54	3,8	18	6	18	0,07	4	.004	●	●
5	9	16	54	4,8	18	6	18	0,12	4	.005	●	●
6	10	16	54	5,8	–	6	18	0,12	4	.006	●	●
7	12	18	58	6,8	20	8	22	0,12	4	.007	●	●
8	12	20	58	7,7	–	8	22	0,12	4	.008	●	●
9	15	22	66	8,7	24	10	26	0,2	4	.009	●	●
10	15	24	66	9,5	–	10	26	0,2	4	.010	●	●
12	18	26	73	11,5	–	12	28	0,2	4	.012	●	●
14	21	28	75	13,5	–	14	30	0,2	4	.014	●	●
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	●	●

Hartmetall-Schafffräser „ENORM“ – kurze Ausführung (4 Schneiden)
Solid carbide end mills “ENORM” – short design (4 flutes)

Gültig für · Valid for
1916A
1917A



N



	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]				
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Stahlwerkstoffe · Steel materials

P	1.1	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	120	$0,003 \times d_1$	130	$0,004 \times d_1$	140	$0,004 \times d_1$	170	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Nichtrostende Stahlwerkstoffe · Stainless steel materials

M	1.1	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	50	$0,002 \times d_1$	60	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Gusswerkstoffe · Cast materials

K	1.1	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,004 \times d_1$	120	$0,004 \times d_1$	140	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Nichteisenwerkstoffe · Non-ferrous materials

Aluminium-Legierungen · Aluminium alloys

N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.6									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Kupfer-Legierungen · Copper alloys

N	2.1	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Magnesium-Legierungen · Magnesium alloys

N	3.1	340	$0,009 \times d_1$	370	$0,011 \times d_1$	410	$0,013 \times d_1$	480	$0,014 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	340	$0,007 \times d_1$	370	$0,008 \times d_1$	410	$0,010 \times d_1$	480	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Kunststoffe · Synthetics

N	4.1	340	$0,008 \times d_1$	370	$0,009 \times d_1$	410	$0,011 \times d_1$	480	$0,012 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	500	$0,008 \times d_1$	550	$0,009 \times d_1$	600	$0,011 \times d_1$	700	$0,012 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Besondere Werkstoffe · Special materials

N	5.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.2	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Spezialwerkstoffe · Special materials

Titan-Legierungen · Titanium alloys

S	1.1	80	$0,004 \times d_1$	90	$0,004 \times d_1$	100	$0,005 \times d_1$	110	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,004 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys

S	2.1	70	$0,002 \times d_1$	80	$0,002 \times d_1$	80	$0,003 \times d_1$	100	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	$0,002 \times d_1$	30	$0,002 \times d_1$	35	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Harte Werkstoffe · Hard materials

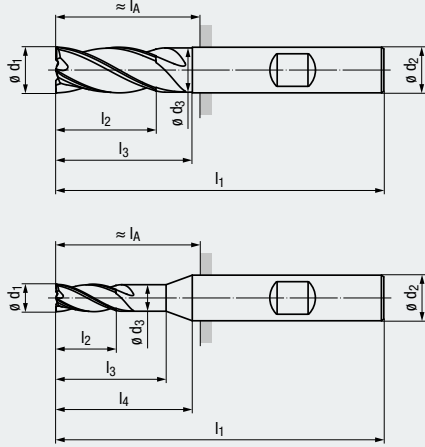
H	1.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	80	$0,003 \times d_1$	90	$0,003 \times d_1$	100	$0,004 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3			90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

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

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend oder innere Kühlschmierstoff-Zufuhr, Austritt axial (ICA)
- 4 Baulängen verfügbar

- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Centre cutting or internal coolant supply, axial exit (ICA)
- 4 lengths available



N

ICA

HM

DIN 6535
HA
HB

3-5°

35-38°

KB x 45°

Vc / fz
11



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

- For almost all materials
- Suitable for roughing and finishing

TIALN

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

TIALN

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

DIN 6527 – Lange Ausführung · Long design

Bestell-Code · Order code												1998A	1999A	1998AZ	1999AZ
ø d1 f8	l2	l3	l1	ø d3	l4	ø d2 h5	lA	KB	Z (Flutes)	Dimens.- Code					
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	●	●	●	●	
6	13	21	57	5,8	-	6	21	0,12	4	.306	● new	● new			
7	19	23	63	6,8	25	8	27	0,12	4	.007	●	●			
8	19	25	63	7,7	-	8	27	0,12	4	.008	●	●	●	●	
8	19	25	63	7,7	-	8	27	0,12	5	.008005	●	●			
8	21	27	63	7,7	-	8	27	0,12	4	.308	● new	● new			
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	●	●	●	●	
10	22	30	72	9,5	-	10	32	0,2	5	.010005	●	●			
10	22	32	72	9,5	-	10	32	0,2	4	.310	● new	● new			
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	●	●	●	●	
12	26	35	83	11,5	-	12	38	0,2	5	.012005	●	●			
12	26	38	83	11,5	-	12	38	0,2	4	.312	● new	● new			
14	26	35	83	13,5	-	14	38	0,2	4	.014	●	●			
14	26	35	83	13,5	-	14	38	0,2	5	.014005	●	●			
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	●	●	●	●	
16	32	40	92	15,5	-	16	44	0,2	5	.016005	●	●			
16	36	44	92	15,5	-	16	44	0,2	4	.316	● new	● new			
18	32	50	100	17,5	-	18	52	0,2	4	.018	●	●			
18	32	50	100	17,5	-	18	52	0,2	5	.018005	●	●			
20	38	50	104	19,5	-	20	54	0,3	4	.020	●	●	●	●	
20	38	50	104	19,5	-	20	54	0,3	5	.020005	●	●			
20	41	54	104	19,5	-	20	54	0,3	4	.320	● new	● new			
25	45	65	125	24,2	-	25	69	0,3	4	.025004	●	●			
25	45	65	125	24,2	-	25	69	0,3	6	.025	●	●			
25	51	69	125	24,2	-	25	69	0,3	4	.325004	● new	● new			

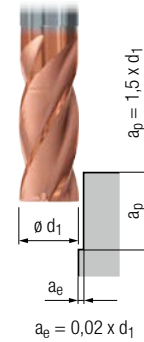
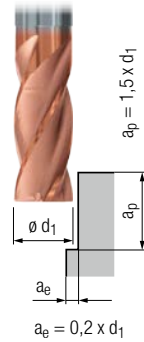
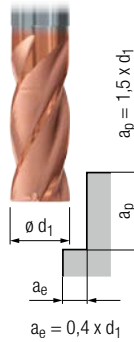
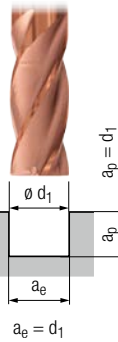
Hartmetall-Schafffräser „ENORM“ – lange Ausführung (4 - 6 Schneiden)
Solid carbide end mills “ENORM” – long design (4 - 6 flutes)

Gültig für · Valid for

1998A
1998AZ
1999A
1999AZ



N



	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]
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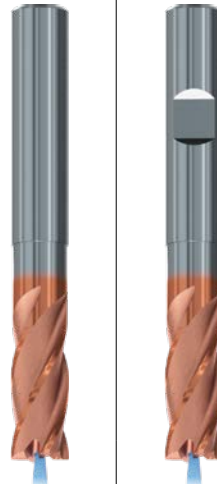
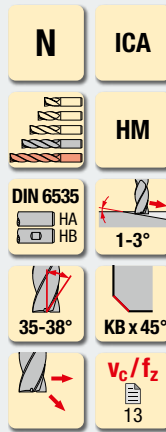
Stahlwerkstoffe · Steel materials													
P	1.1	140	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	40	$0,002 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
K	1.1	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.6										<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kupfer-Legierungen · Copper alloys													
N	2.1	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
N	3.1	290	$0,009 \times d_1$	320	$0,010 \times d_1$	350	$0,011 \times d_1$	410	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	290	$0,007 \times d_1$	320	$0,008 \times d_1$	350	$0,009 \times d_1$	410	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
N	4.1	290	$0,008 \times d_1$	320	$0,009 \times d_1$	350	$0,009 \times d_1$	410	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	430	$0,008 \times d_1$	470	$0,009 \times d_1$	520	$0,009 \times d_1$	600	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Besondere Werkstoffe · Special materials													
N	5.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
S	1.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	2.1	60	$0,002 \times d_1$	70	$0,002 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	20	$0,002 \times d_1$	20	$0,002 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
H	1.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3			70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

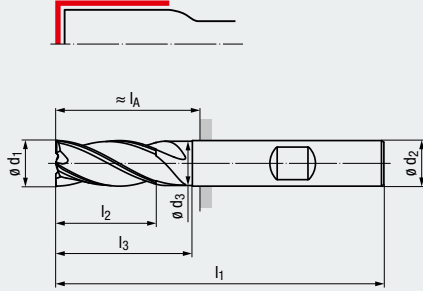
V_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

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

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



Schneidender Bereich
Cutting area of tool



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

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

TIALN

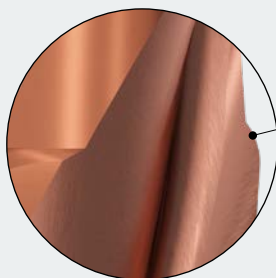
P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.2-1.4 1.1
N	2.1-4.1, 5.2 4.2
S	1.1-2.6
H	1.1 1.2-1.3

Extra lange Ausführung · Extra long design

Bestell-Code · Order code

$\varnothing d_1$ h10	l_2	l_3	l_1	$\varnothing d_3$	$\varnothing d_2$ h6	l_A 	KB	Z (Flutes)	Dimens.- Code	3806AZ	3807AZ		
6	13	25	62	5,8	6	26	0,12	4	.006	●	●		
8	19	30	68	7,7	8	32	0,12	4	.008	●	●		
10	22	38	80	9,5	10	40	0,2	4	.010	●	●		
12	26	46	93	11,5	12	48	0,2	4	.012	●	●		
14	26	52	99	13,5	14	54	0,2	4	.014	●	●		
16	32	58	108	15,5	16	60	0,2	4	.016	●	●		
18	32	68	118	17,5	18	70	0,2	4	.018	●	●		
20	38	74	126	19,5	20	76	0,3	4	.020	●	●		

Übergangsradius Transition radius

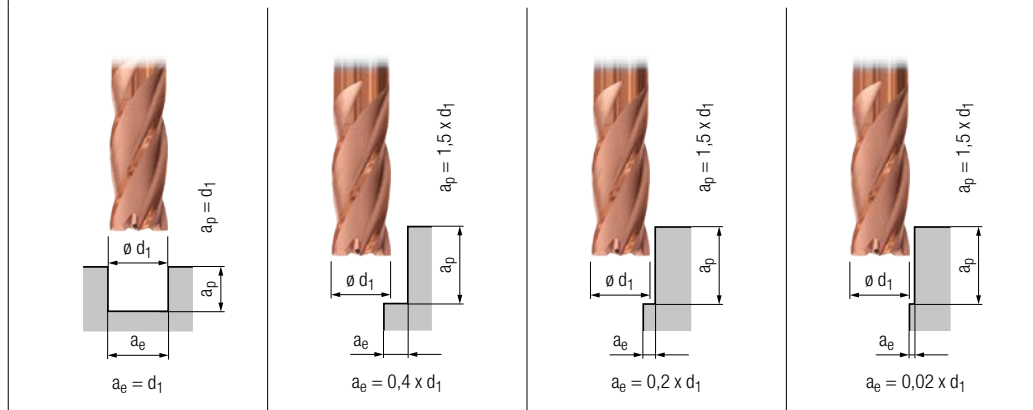


Übergangsradius von der Umfangsschneide in den Hals.
Bei axialen Zustellungen werden absatzfreie Oberflächen erzeugt.
Transition radius from the peripheral cutting edge to the neck.
Axial infeds produce stepless surfaces.

Hartmetall-Schaftfräser „ENORM“ – extra lange Ausführung (4 Schneiden)
Solid carbide end mills “ENORM” – extra long design (4 flutes)

N

Gültig für · Valid for
3806AZ
3807AZ



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]



Stahlwerkstoffe · Steel materials													
P	1.1	120	$0,005 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	100	$0,004 \times d_1$	120	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	80	$0,003 \times d_1$	100	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	5.1	70	$0,003 \times d_1$	90	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	40	$0,002 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
K	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	120	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	110	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	100	$0,004 \times d_1$	110	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	100	$0,004 \times d_1$	110	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	200	$0,009 \times d_1$	220	$0,010 \times d_1$	240	$0,011 \times d_1$	260	$0,013 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	200	$0,008 \times d_1$	220	$0,009 \times d_1$	240	$0,010 \times d_1$	260	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	200	$0,007 \times d_1$	220	$0,008 \times d_1$	240	$0,009 \times d_1$	260	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	180	$0,008 \times d_1$	220	$0,009 \times d_1$	240	$0,010 \times d_1$	260	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5												
	1.6												
Kupfer-Legierungen · Copper alloys													
N	2.1	120	$0,005 \times d_1$	130	$0,006 \times d_1$	150	$0,006 \times d_1$	170	$0,007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	120	$0,005 \times d_1$	130	$0,006 \times d_1$	150	$0,006 \times d_1$	170	$0,007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	120	$0,005 \times d_1$	130	$0,006 \times d_1$	150	$0,006 \times d_1$	170	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	110	$0,004 \times d_1$	120	$0,005 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	110	$0,004 \times d_1$	120	$0,005 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	110	$0,004 \times d_1$	120	$0,005 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
N	3.1	280	$0,009 \times d_1$	300	$0,010 \times d_1$	320	$0,011 \times d_1$	350	$0,013 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	280	$0,007 \times d_1$	300	$0,008 \times d_1$	320	$0,009 \times d_1$	350	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
N	4.1	280	$0,008 \times d_1$	300	$0,009 \times d_1$	320	$0,009 \times d_1$	350	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	420	$0,008 \times d_1$	450	$0,009 \times d_1$	480	$0,009 \times d_1$	520	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3												
	4.4												
Besondere Werkstoffe · Special materials													
N	5.1												
	5.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	90	$0,004 \times d_1$				<input checked="" type="checkbox"/>
	5.3												
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
S	1.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,005 \times d_1$				<input checked="" type="checkbox"/>
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	70	$0,004 \times d_1$				<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	50	$0,004 \times d_1$				<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	2.1	60	$0,002 \times d_1$	70	$0,002 \times d_1$	70	$0,003 \times d_1$	70	$0,003 \times d_1$				<input checked="" type="checkbox"/>
	2.2	20	$0,002 \times d_1$	20	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
H	1.1	80	$0,003 \times d_1$	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,003 \times d_1$	90	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3												
	1.4												
	1.5												

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

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

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

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

N

ICA

HM

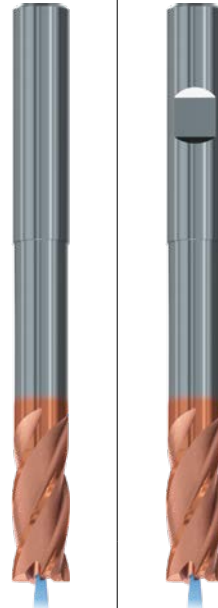
DIN 6535
 HA
 HB

1-2°

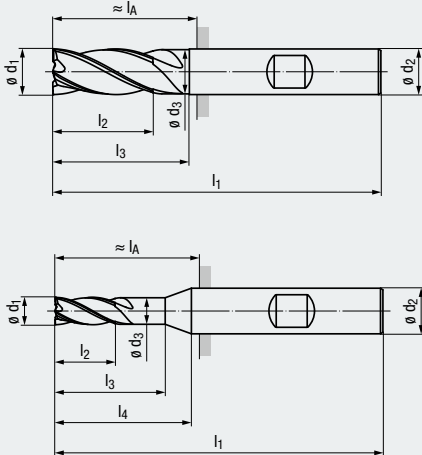
35-38°

KB x 45°

V_c / f_z
 15



Schneidender Bereich
Cutting area of tool



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

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

TIALN

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

$l_3 = 6 \times d_1$ – Extra lange Ausführung · Extra long design

Bestell-Code · Order code

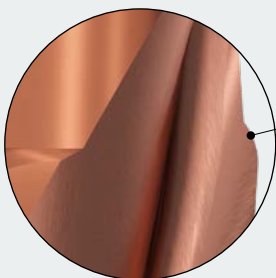
$\varnothing d_1$ h10	l_2	l_3	l_1	$\varnothing d_3$	l_4	$\varnothing d_2$ h6	l_A	KB	Z (Flutes)	Dimens.- Code
3	8	18	62	2,8	25	6	26	0,12	4	.003
4	11	24	62	3,8	25	6	26	0,12	4	.004
5	13	30	68	4,8	31	6	32	0,12	4	.005
6	13	36	74	5,8	–	6	38	0,12	4	.006
8	19	48	86	7,7	–	8	50	0,12	4	.008
10	22	60	102	9,5	–	10	62	0,2	4	.010
12	26	72	119	11,5	–	12	74	0,2	4	.012
14	26	84	131	13,5	–	14	86	0,2	4	.014
16	32	96	146	15,5	–	16	98	0,2	4	.016
18	32	108	158	17,5	–	18	110	0,2	4	.018
20	38	120	172	19,5	–	20	122	0,3	4	.020

3808AZ

3809AZ

Übergangsradius

Transition radius



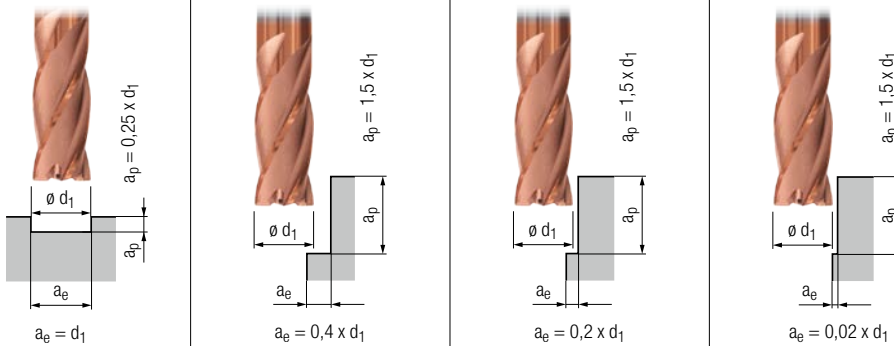
Übergangsradius von der Umfangsschneide in den Hals.
Bei axialen Zustellungen werden absatzfreie Oberflächen erzeugt.
Transition radius from the peripheral cutting edge to the neck.
Axial infeds produce stepless surfaces.



Hartmetall-Schafffräser „ENORM“ – extra lange Ausführung (4 Schneiden)
Solid carbide end mills “ENORM” – extra long design (4 flutes)

N

$l_3 = 6 \times d_1$



Gültig für · Valid for
3808AZ
3809AZ



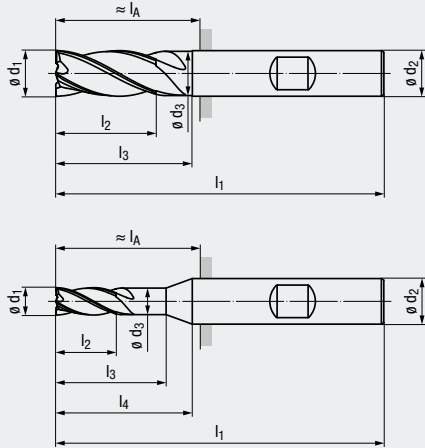
		V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]							
Stahlwerkstoffe · Steel materials																
P	1.1	80	$0,005 \times d_1$	120	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.1	70	$0,004 \times d_1$	110	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	3.1	60	$0,004 \times d_1$	100	$0,004 \times d_1$	120	$0,005 \times d_1$	140	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.1	60	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	120	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	5.1	50	$0,003 \times d_1$	80	$0,003 \times d_1$	90	$0,003 \times d_1$	110	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
Nichtrostende Stahlwerkstoffe · Stainless steel materials																
M	1.1	70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.1	60	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	3.1	40	$0,002 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Gusswerkstoffe · Cast materials																
K	1.1	80	$0,005 \times d_1$	120	$0,006 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	1.2	80	$0,005 \times d_1$	120	$0,006 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	2.1	70	$0,004 \times d_1$	110	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	2.2	70	$0,004 \times d_1$	110	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	3.1	70	$0,004 \times d_1$	100	$0,005 \times d_1$	110	$0,005 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	3.2	70	$0,004 \times d_1$	100	$0,005 \times d_1$	110	$0,005 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	4.1	60	$0,003 \times d_1$	90	$0,003 \times d_1$	100	$0,004 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	4.2	60	$0,003 \times d_1$	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
Nichteisenwerkstoffe · Non-ferrous materials																
Aluminium-Legierungen · Aluminium alloys																
	1.1	160	$0,009 \times d_1$	180	$0,010 \times d_1$	200	$0,011 \times d_1$	220	$0,013 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	1.2	160	$0,008 \times d_1$	180	$0,009 \times d_1$	200	$0,010 \times d_1$	220	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	1.3	160	$0,007 \times d_1$	180	$0,008 \times d_1$	200	$0,009 \times d_1$	220	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	1.4	140	$0,008 \times d_1$	180	$0,009 \times d_1$	200	$0,010 \times d_1$	220	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	1.5															
	1.6															
Kupfer-Legierungen · Copper alloys																
N	2.1	100	$0,005 \times d_1$	110	$0,006 \times d_1$	130	$0,006 \times d_1$	150	$0,007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.2	100	$0,005 \times d_1$	110	$0,006 \times d_1$	130	$0,006 \times d_1$	150	$0,007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.3	100	$0,005 \times d_1$	110	$0,006 \times d_1$	130	$0,006 \times d_1$	150	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.4	90	$0,004 \times d_1$	100	$0,005 \times d_1$	120	$0,005 \times d_1$	140	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.5	90	$0,004 \times d_1$	100	$0,005 \times d_1$	120	$0,005 \times d_1$	140	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.6	90	$0,004 \times d_1$	100	$0,005 \times d_1$	120	$0,005 \times d_1$	140	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.7	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	2.8	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Magnesium-Legierungen · Magnesium alloys																
	3.1	240	$0,009 \times d_1$	260	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	3.2	240	$0,007 \times d_1$	260	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
Kunststoffe · Synthetics																
	4.1	240	$0,008 \times d_1$	260	$0,009 \times d_1$	280	$0,009 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.2	380	$0,008 \times d_1$	400	$0,009 \times d_1$	420	$0,009 \times d_1$	450	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>			
	4.3															
	4.4															
Besondere Werkstoffe · Special materials																
	5.1															
	5.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	90	$0,004 \times d_1$				<input checked="" type="checkbox"/>			
	5.3															
Spezialwerkstoffe · Special materials																
Titan-Legierungen · Titanium alloys																
S	1.1	60	$0,004 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,005 \times d_1$				<input checked="" type="checkbox"/>			
	1.2	50	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,004 \times d_1$	70	$0,004 \times d_1$				<input checked="" type="checkbox"/>			
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	50	$0,004 \times d_1$				<input checked="" type="checkbox"/>			
	2.1	50	$0,002 \times d_1$	60	$0,002 \times d_1$	70	$0,003 \times d_1$	70	$0,003 \times d_1$				<input checked="" type="checkbox"/>			
	2.2	20	$0,002 \times d_1$	20	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>			
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>			
2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>				
2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>				
2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				<input checked="" type="checkbox"/>				
Harte Werkstoffe · Hard materials																
H	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	90	$0,003 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	90	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	1.3															
	1.4															
	1.5															

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

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

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend
- 4 Baulängen verfügbar

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



N

HM

DIN 6535
HA
HB

38-42° **KB x 45°**

Vc/fz
17



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)
- In fast allen Werkstoffen einsetzbar
- Zum Schlichten geeignet

Applications – material (see page 4)
- For almost all materials
- Suitable for finishing

TIALN

TIALN

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.1-1.4 1.5-1.6
S	1.1-1.3 2.1-2.6
H	1.1-1.2

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.1-1.4 1.5-1.6
S	1.1-1.3 2.1-2.6
H	1.1-1.2

l₂ = 3 x d₁ – Extra lange Ausführung · Extra long design

Bestell-Code · Order code											2526A	2527A		
∅ d ₁ h10	l ₂	l ₃	l ₁	∅ d ₃	l ₄	∅ 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	●	●		

l₂ = 4 x d₁ – Extra lange Ausführung · Extra long design

Bestell-Code · Order code													2528A	2529A
∅ d ₁ h10	l ₂	l ₃	l ₁	∅ d ₃	l ₄	∅ 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			●	●

Hartmetall-Schafffräser „ENORM“ – extra lange Ausführung (4 - 5 Schneiden)
Solid carbide end mills “ENORM” – extra long design (4 - 5 flutes)

Gültig für · Valid for

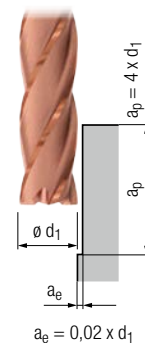
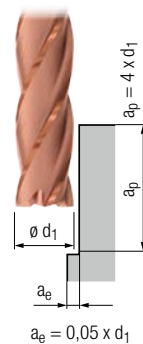
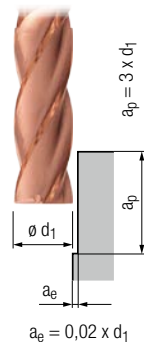
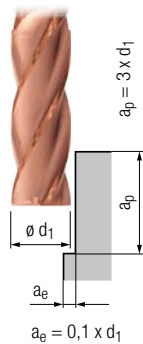
2526A
2527A
2528A
2529A



N

$l_2 = 3 \times d_1$

$l_2 = 4 \times d_1$



	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]
--	------------------	---------------	------------------	---------------	------------------	---------------	------------------	---------------



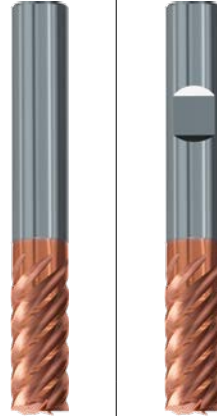
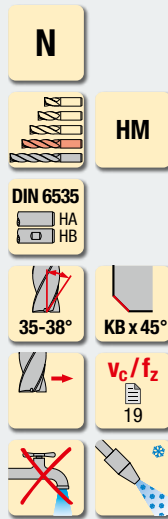
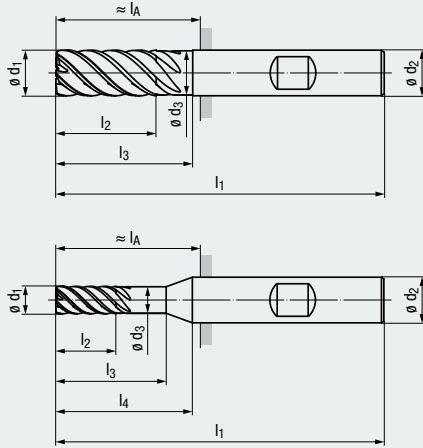
Stahlwerkstoffe · Steel materials													
P	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	100	$0,005 \times d_1$	120	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	70	$0,004 \times d_1$	90	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	120	$0,003 \times d_1$	140	$0,004 \times d_1$	100	$0,003 \times d_1$	120	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	100	$0,003 \times d_1$	120	$0,004 \times d_1$	80	$0,003 \times d_1$	100	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	50	$0,003 \times d_1$	60	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
K	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	100	$0,005 \times d_1$	120	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	120	$0,005 \times d_1$	140	$0,006 \times d_1$	100	$0,005 \times d_1$	120	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	90	$0,004 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	110	$0,004 \times d_1$	130	$0,005 \times d_1$	90	$0,004 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	70	$0,004 \times d_1$	90	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	90	$0,004 \times d_1$	110	$0,005 \times d_1$	70	$0,004 \times d_1$	90	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	60	$0,003 \times d_1$	70	$0,004 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	360	$0,009 \times d_1$	430	$0,011 \times d_1$	300	$0,009 \times d_1$	430	$0,009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	360	$0,008 \times d_1$	430	$0,010 \times d_1$	300	$0,008 \times d_1$	430	$0,009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	360	$0,007 \times d_1$	430	$0,008 \times d_1$	300	$0,007 \times d_1$	430	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	240	$0,008 \times d_1$	290	$0,010 \times d_1$	200	$0,008 \times d_1$	290	$0,009 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5	230	$0,007 \times d_1$	280	$0,008 \times d_1$	180	$0,007 \times d_1$	280	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6	160	$0,006 \times d_1$	190	$0,007 \times d_1$	130	$0,006 \times d_1$	190	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kupfer-Legierungen · Copper alloys													
N	2.1	110	$0,005 \times d_1$	130	$0,006 \times d_1$	90	$0,005 \times d_1$	110	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	110	$0,005 \times d_1$	130	$0,006 \times d_1$	90	$0,005 \times d_1$	110	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	110	$0,005 \times d_1$	130	$0,006 \times d_1$	90	$0,005 \times d_1$	110	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	100	$0,004 \times d_1$	120	$0,005 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	100	$0,004 \times d_1$	120	$0,005 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	100	$0,004 \times d_1$	120	$0,005 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	60	$0,003 \times d_1$	70	$0,004 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	60	$0,003 \times d_1$	70	$0,004 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
3.1										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.2										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
4.1										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.3										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.4										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Besondere Werkstoffe · Special materials													
5.1										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.2	60	$0,003 \times d_1$	70	$0,004 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.3										<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
S	1.1	90	$0,004 \times d_1$	100	$0,005 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,004 \times d_1$	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	70	$0,003 \times d_1$	80	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	2.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	60	$0,004 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	$0,003 \times d_1$	40	$0,004 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,002 \times d_1$	20	$0,002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	30	$0,003 \times d_1$	45	$0,003 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,003 \times d_1$	20	$0,003 \times d_1$	20	$0,003 \times d_1$	20	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
H	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3									<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4									<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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

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

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- 2 Baulängen verfügbar

- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- 2 lengths available



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

- For all tough materials
- Suitable for HSC finishing

TIALN

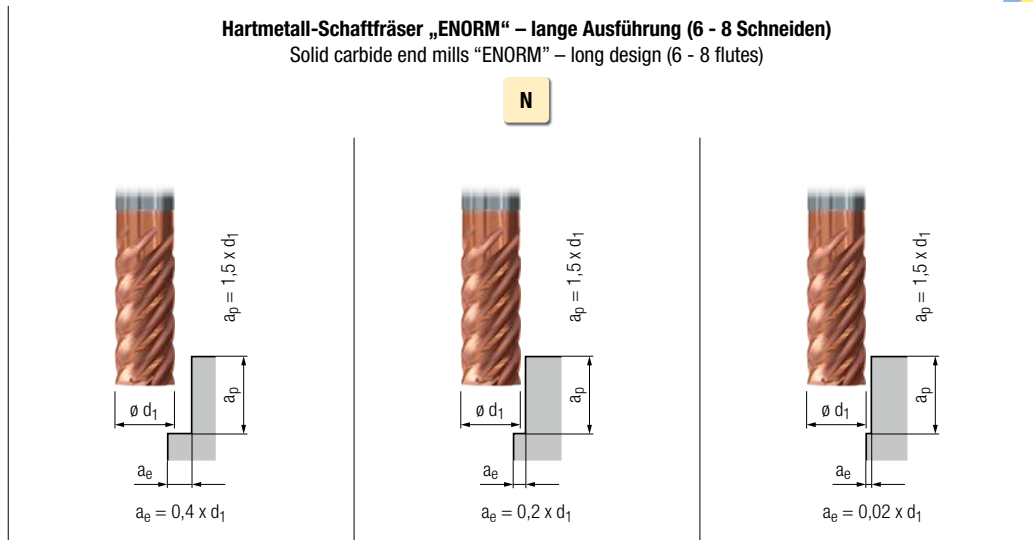
P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.1-1.4
N	2.1-3.2, 4.1-4.2, 5.2
S	1.1-2.2, 2.3
S	2.4, 2.5-2.6
H	1.1-1.3

DIN 6527 – Lange Ausführung · Long design

Bestell-Code · Order code											2522A	2523A		
$\varnothing d_1$ f8	l_2	l_3	l_1	$\varnothing d_3$	l_4	$\varnothing d_2$ h5	l_A h6	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	9,5	–	10	32	0,2	6	.010	●	●		
12	26	35	83	11,5	–	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	●	●		

Hartmetall-Schafffräser „ENORM“ – lange Ausführung (6 - 8 Schneiden)
Solid carbide end mills “ENORM” – long design (6 - 8 flutes)

Gültig für · Valid for
2522A
2523A



N

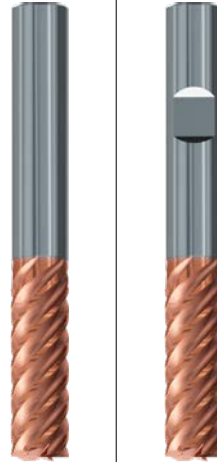
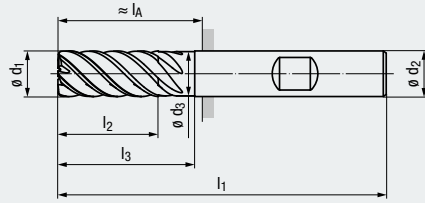
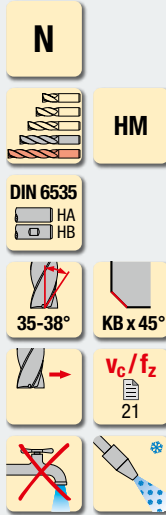
	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]					
Stahlwerkstoffe · Steel materials											
P	1.1	150	$0,005 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	120	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials											
M	1.1	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials											
K	1.1	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials											
Aluminium-Legierungen · Aluminium alloys											
N	1.1	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5										
	1.6										
Kupfer-Legierungen · Copper alloys											
N	2.1	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys											
N	3.1	320	$0,010 \times d_1$	350	$0,011 \times d_1$	410	$0,013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	320	$0,008 \times d_1$	350	$0,009 \times d_1$	410	$0,010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics											
N	4.1	320	$0,009 \times d_1$	350	$0,009 \times d_1$	410	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	470	$0,009 \times d_1$	520	$0,009 \times d_1$	600	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3										
	4.4										
Besondere Werkstoffe · Special materials											
N	5.1										
	5.2	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3										
Spezialwerkstoffe · Special materials											
Titan-Legierungen · Titanium alloys											
S	1.1	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys											
S	2.1	70	$0,002 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	20	$0,002 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials											
H	1.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	80	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4										
	1.5										

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

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

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Schneidlänge bis $3 \times d_1$
- 2 Baulängen verfügbar

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



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

- For all tough materials
- Suitable for HSC finishing

TIALN

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.1-1.4
N	2.1-3.2, 4.1-4.2, 5.2
S	1.1-2.2, 2.3
S	2.4, 2.5-2.6
H	1.1-1.3

$l_2 = 3 \times d_1$ – Extra lange Ausführung · Extra long design

Bestell-Code · Order code

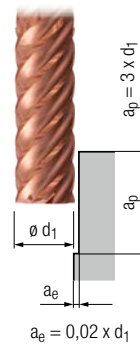
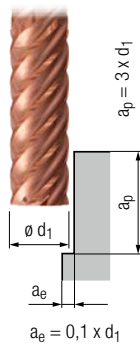
$\emptyset d_1$ h10	l_2	l_3	l_1	$\emptyset d_3$	$\emptyset d_2$ h6	l_A	KB	Z (Flutes)	Dimens.- Code	2524A	2525A
6	18	25	62	5,8	6	26	0,12	6	.006	●	●
8	24	30	68	7,7	8	32	0,12	6	.008	●	●
10	30	35	80	9,7	10	40	0,2	6	.010	●	●
12	36	45	93	11,6	12	48	0,2	6	.012	●	●
16	48	55	108	15,5	16	60	0,2	6	.016	●	●
20	60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



Hartmetall-Schafffräser „ENORM“ – extra lange Ausführung (6 - 8 Schneiden)
Solid carbide end mills “ENORM” – extra long design (6 - 8 flutes)

N

$l_2 = 3 \times d_1$



Gültig für · Valid for
2524A
2525A



	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Stahlwerkstoffe · Steel materials									
P	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials									
M	1.1	120	$0,003 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	100	$0,003 \times d_1$	120	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials									
K	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Nichteisenwerkstoffe · Non-ferrous materials								
Aluminium-Legierungen · Aluminium alloys									
N	1.1	360	$0,009 \times d_1$	430	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	360	$0,008 \times d_1$	430	$0,010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	360	$0,007 \times d_1$	430	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	240	$0,008 \times d_1$	290	$0,010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5	230	$0,007 \times d_1$	280	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6	160	$0,006 \times d_1$	190	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kupfer-Legierungen · Copper alloys									
N	2.1	110	$0,005 \times d_1$	130	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	110	$0,005 \times d_1$	130	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	110	$0,005 \times d_1$	130	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	100	$0,004 \times d_1$	120	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	100	$0,004 \times d_1$	120	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	100	$0,004 \times d_1$	120	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys									
3.1						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3.2						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics									
4.1						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.2						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.3						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4.4						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Besondere Werkstoffe · Special materials									
5.1						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.2	60	$0,003 \times d_1$		70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5.3						<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Spezialwerkstoffe · Special materials									
Titan-Legierungen · Titanium alloys									
S	1.1	90	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys									
S	2.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	$0,003 \times d_1$	40	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	30	$0,003 \times d_1$	45	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,003 \times d_1$	20	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials									
H	1.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

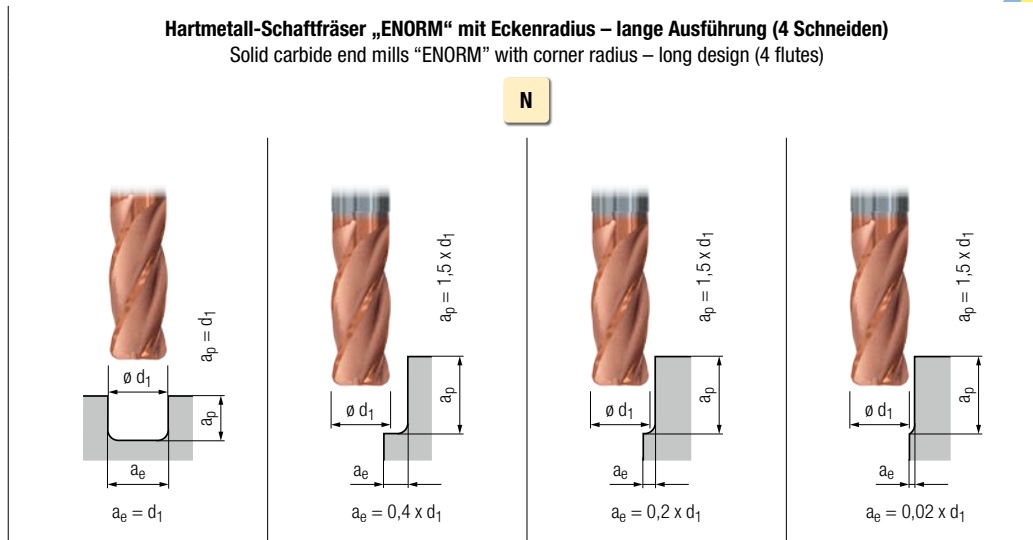
■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

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

Hartmetall-Schafffräser „ENORM“ mit Eckenradius – lange Ausführung (4 Schneiden)
Solid carbide end mills “ENORM” with corner radius – long design (4 flutes)

Gültig für · Valid for

- 2698A
- 2698AZ
- 2699A
- 2699AZ



N

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]
d_1	d_1	$0,4 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$



Stahlwerkstoffe · Steel materials													
P	1.1	140	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	40	$0,002 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
K	1.1	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.6										<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kupfer-Legierungen · Copper alloys													
N	2.1	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
N	3.1	290	$0,009 \times d_1$	320	$0,010 \times d_1$	350	$0,011 \times d_1$	410	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	290	$0,007 \times d_1$	320	$0,008 \times d_1$	350	$0,009 \times d_1$	410	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
N	4.1	290	$0,008 \times d_1$	320	$0,009 \times d_1$	350	$0,009 \times d_1$	410	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	430	$0,008 \times d_1$	470	$0,009 \times d_1$	520	$0,009 \times d_1$	600	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Besondere Werkstoffe · Special materials													
N	5.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
S	1.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	2.1	60	$0,002 \times d_1$	70	$0,002 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	20	$0,002 \times d_1$	20	$0,002 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
H	1.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3			70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

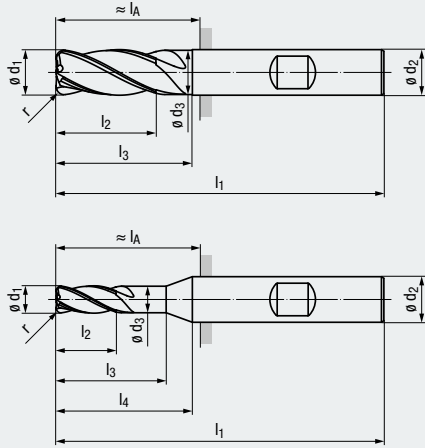
■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

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

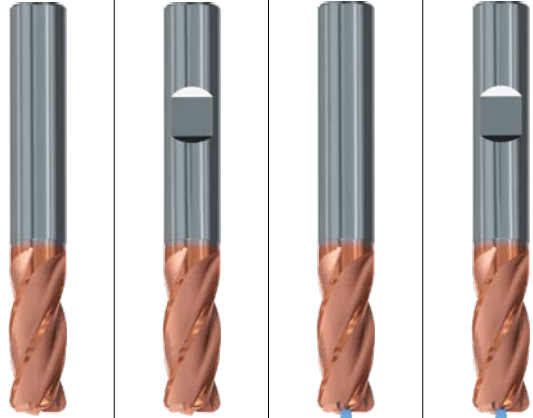


- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Verschiedene Eckenradien pro Schneiddurchmesser
- Zentrumschneidend oder innere Kühlschmierstoff-Zufuhr, Austritt axial (ICA)

- 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)



- N** **ICA**
- HM**
- DIN 6535** HA HB
- 3-5°**
- 35-38°**
- ER**
- Vc/fz** 25



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

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

TIALN

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

TIALN

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

DIN 6527 – Lange Ausführung · Long design

Bestell-Code · Order code

$\varnothing d_1$	r	l_2	l_3	l_1	$\varnothing d_3$	l_4	$\varnothing d_2$	l_A	Z	Dimens.-Code
f8	$\pm 0,01$						h5		(Flutes)	
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
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

Eckenradius · Corner radius

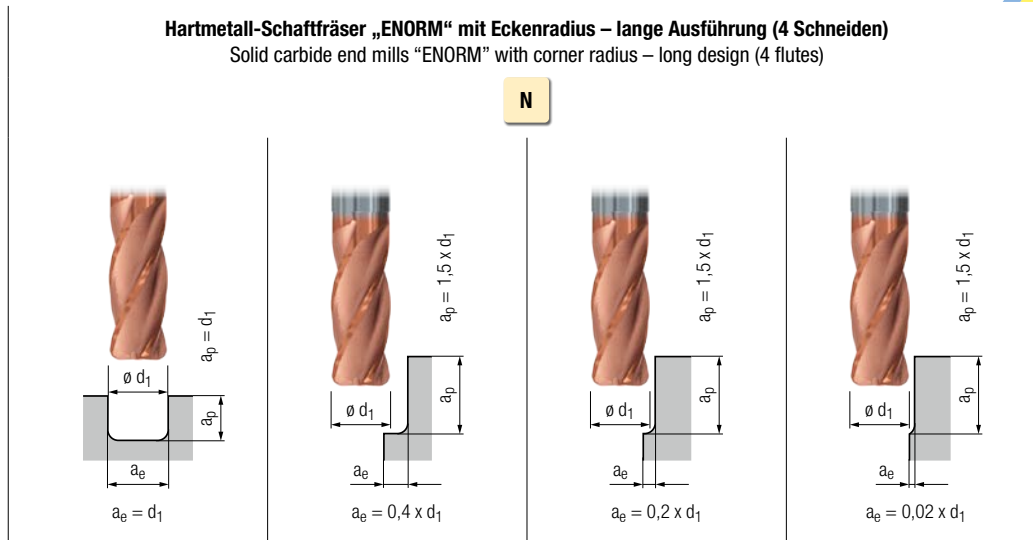
2698A	2699A	2698AZ	2699AZ
●	●		
●	●	●	●
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●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●

Andere Eckenradien auf Anfrage lieferbar
Other corner radii available on request

Hartmetall-Schafffräser „ENORM“ mit Eckenradius – lange Ausführung (4 Schneiden)
Solid carbide end mills “ENORM” with corner radius – long design (4 flutes)

Gültig für · Valid for

- 2698A
- 2698AZ
- 2699A
- 2699AZ



N

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]
d_1	d_1	$0,4 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$	$0,2 \times d_1$



Stahlwerkstoffe · Steel materials													
P	1.1	140	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	□	■	□	■
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	□	■	□	■
	3.1	110	$0,004 \times d_1$	120	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	□	■	□	■
	4.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	□	■		
	5.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	□	■		
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			□	■
	2.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$			□	■
	3.1	40	$0,002 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$			□	■
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$			□	■
Gusswerkstoffe · Cast materials													
K	1.1	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	□	■		
	1.2	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	□	■		
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	□	■		
	2.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	□	■		
	3.1	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	□	■		
	3.2	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	□	■		
	4.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	□	■		
4.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	□	■			
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$			□	■
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$			□	■
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$			□	■
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$			□	■
	1.5												
	1.6												
Kupfer-Legierungen · Copper alloys													
N	2.1	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$			□	■
	2.2	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$			□	■
	2.3	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	□	■		
	2.4	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$			□	■
	2.5	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$			□	■
	2.6	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$			□	■
	2.7	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			□	■
	2.8	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$			□	■
Magnesium-Legierungen · Magnesium alloys													
N	3.1	290	$0,009 \times d_1$	320	$0,010 \times d_1$	350	$0,011 \times d_1$	410	$0,013 \times d_1$			□	■
	3.2	290	$0,007 \times d_1$	320	$0,008 \times d_1$	350	$0,009 \times d_1$	410	$0,010 \times d_1$			□	■
Kunststoffe · Synthetics													
N	4.1	290	$0,008 \times d_1$	320	$0,009 \times d_1$	350	$0,009 \times d_1$	410	$0,011 \times d_1$	□	■		
	4.2	430	$0,008 \times d_1$	470	$0,009 \times d_1$	520	$0,009 \times d_1$	600	$0,011 \times d_1$			□	■
	4.3												
	4.4												
Besondere Werkstoffe · Special materials													
N	5.1												
	5.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$				■
	5.3												
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
S	1.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$				■
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$				■
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,004 \times d_1$				■
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	2.1	60	$0,002 \times d_1$	70	$0,002 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$				■
	2.2	20	$0,002 \times d_1$	20	$0,002 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$				■
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				■
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$				■
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$				■
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$				■
Harte Werkstoffe · Hard materials													
H	1.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	□	■		
	1.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	□	■		
	1.3			70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	□	■		
	1.4												
	1.5												

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

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

- Multifunktionales Hochleistungswerkzeug
- Mit ENORM-Geometrie
- Vibrationsarme Bearbeitung
- Verschiedene Eckenradien pro Schneidendurchmesser
- Zentrumschneidend

- Multi-functional, high performance tool
- With ENORM geometry
- Low-vibration machining
- Several corner radii per cutting diameter
- Centre cutting

N

HM

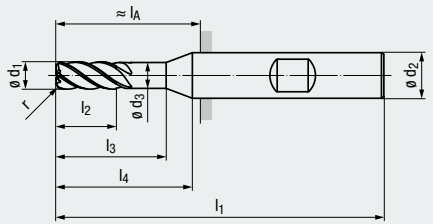
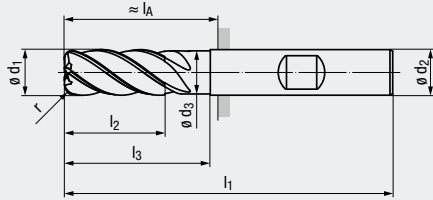
DIN 6535
HA
HB

1-2°

35-38°

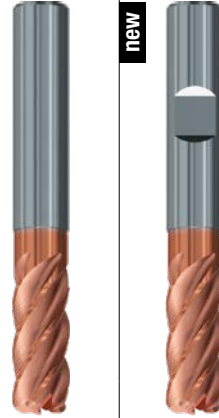
ER

V_c / f_z
27



new

new



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

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

TIALN

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.2-1.4 1.1
N	2.1-4.1, 5.2 4.2
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

3878A

3879A

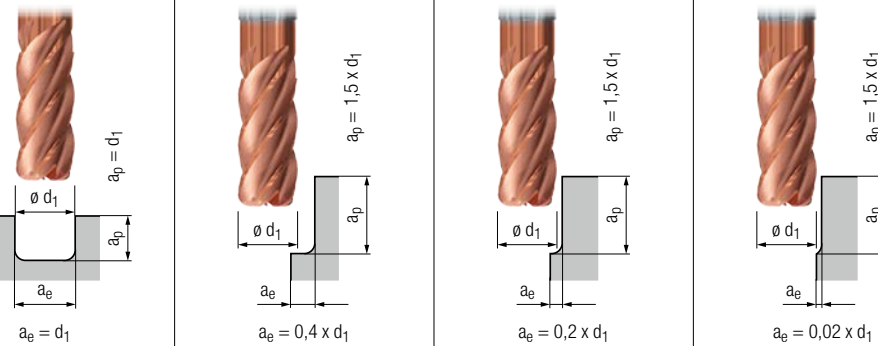
θd_1 f8	r $\pm 0,01$	l_2	l_3	l_1	θd_3	l_4	θd_2 h5	l_A h5	Z (Flutes)	Dimens.- Code	3878A	3879A
5	0,5	13	19	57	4,8	21	6	21	5	.005005	●	●
6	0,5	13	21	57	5,8	—	6	21	5	.006005	●	●
6	1	13	21	57	5,8	—	6	21	5	.006010	●	●
8	0,5	21	27	63	7,7	—	8	27	5	.008005	●	●
8	1	21	27	63	7,7	—	8	27	5	.008010	●	●
8	2	21	27	63	7,7	—	8	27	5	.008020	●	●
10	0,5	22	32	72	9,5	—	10	32	5	.010005	●	●
10	1	22	32	72	9,5	—	10	32	5	.010010	●	●
10	2	22	32	72	9,5	—	10	32	5	.010020	●	●
12	0,5	26	38	83	11,5	—	12	38	5	.012005	●	●
12	1	26	38	83	11,5	—	12	38	5	.012010	●	●
12	2	26	38	83	11,5	—	12	38	5	.012020	●	●
12	3	26	38	83	11,5	—	12	38	5	.012030	●	●
14	1	28	38	83	13,5	—	14	38	5	.014010	●	●
16	1	36	44	92	15,5	—	16	44	5	.016010	●	●
16	2	36	44	92	15,5	—	16	44	5	.016020	●	●
16	3	36	44	92	15,5	—	16	44	5	.016030	●	●
16	4	36	44	92	15,5	—	16	44	5	.016040	●	●
20	1	41	54	104	19,5	—	20	54	5	.020010	●	●
20	2	41	54	104	19,5	—	20	54	5	.020020	●	●
20	3	41	54	104	19,5	—	20	54	5	.020030	●	●
20	4	41	54	104	19,5	—	20	54	5	.020040	●	●
25	1	51	69	125	24,2	—	25	69	5	.025010	●	●
25	2	51	69	125	24,2	—	25	69	5	.025020	●	●
25	3	51	69	125	24,2	—	25	69	5	.025030	●	●
25	4	51	69	125	24,2	—	25	69	5	.025040	●	●

Hartmetall-Schafffräser „ENORM“ mit Eckenradius – lange Ausführung (5 Schneiden)
Solid carbide end mills “ENORM” with corner radius – long design (5 flutes)

Gültig für · Valid for
3878A
3879A



N



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]
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Stahlwerkstoffe · Steel materials													
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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.6									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kupfer-Legierungen · Copper alloys													
N	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
N	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
N	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Besondere Werkstoffe · Special materials													
N	5.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	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	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3			70	0,003 x d ₁	70	0,003 x d ₁	80	0,003 x d ₁	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

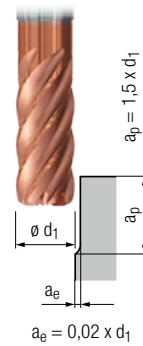
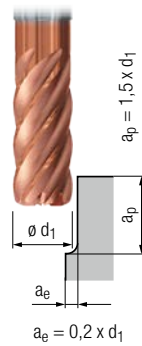
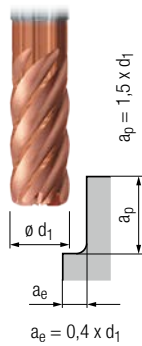
v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

Hartmetall-Schafffräser „ENORM“ mit Eckenradius – lange Ausführung (6 Schneiden)
Solid carbide end mills “ENORM” with corner radius – long design (6 flutes)

Gültig für · Valid for
3880A
3881A



N

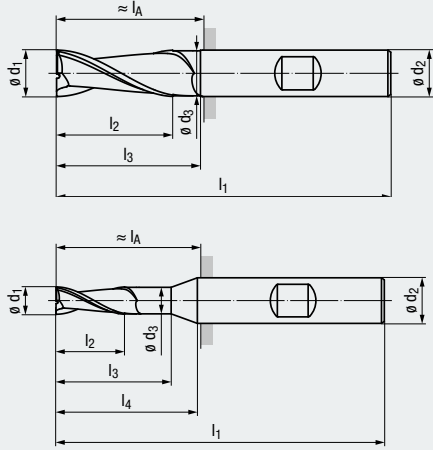


	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]					
Stahlwerkstoffe · Steel materials											
P	1.1	150	$0,005 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	120	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials											
M	1.1	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials											
K	1.1	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials											
Aluminium-Legierungen · Aluminium alloys											
N	1.1	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5										
	1.6										
Kupfer-Legierungen · Copper alloys											
N	2.1	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,00 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys											
N	3.1	320	$0,010 \times d_1$	350	$0,011 \times d_1$	410	$0,013 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	320	$0,008 \times d_1$	350	$0,009 \times d_1$	410	$0,010 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics											
N	4.1	320	$0,009 \times d_1$	350	$0,009 \times d_1$	410	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	470	$0,009 \times d_1$	520	$0,009 \times d_1$	600	$0,011 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3										
	4.4										
Besondere Werkstoffe · Special materials											
N	5.1										
	5.2	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3										
Spezialwerkstoffe · Special materials											
Titan-Legierungen · Titanium alloys											
S	1.1	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys											
S	2.1	70	$0,002 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	20	$0,002 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials											
H	1.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	80	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4										
	1.5										

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

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

- Langlochfräser mit 2 Schneiden
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend
- 3 Baulängen verfügbar
- Slot drill with 2 flutes
- Newly developed geometry
- Low-vibration machining
- Centre cutting
- 3 lengths available



N

HM

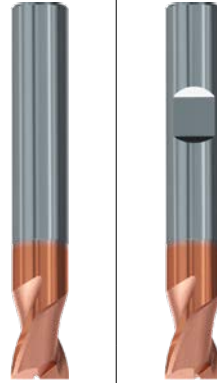
DIN 6535
HA
HB

3-5°

Ø 0,3 - 1,8 mm:
30°

Ø 2 - 20 mm:
35/38° KB x 45°

Vc / fz
31



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

- In fast allen Werkstoffen einsetzbar
- Zum Schrumpfen und Schlichten geeignet
- Zur Herstellung von Passfedernuten nach DIN 6885-1
- Gut zum Bohrfräsen geeignet

Applications – material (see page 4)

- For almost all materials
- Suitable for roughing and finishing
- For producing keyways acc. DIN 6885-1
- Suitable for z-axis milling

TIALN

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 1.3

DIN 6527 – Kurze Ausführung · Short design

Bestell-Code · Order code

Ø d ₁ e8	h ₁₀	l ₂	l ₃	l ₁	Ø d ₃	l ₄	Ø d ₂ h6	l _A	KB	Z (Flutes)	Dimens.- Code	2510A	2511A
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	●	

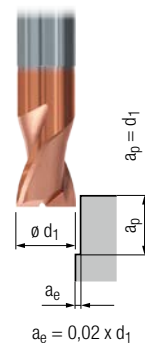
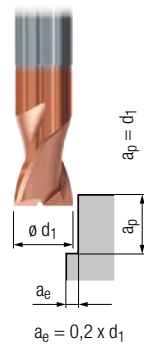
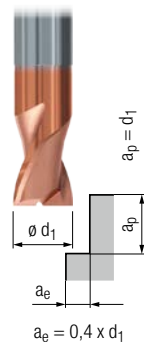
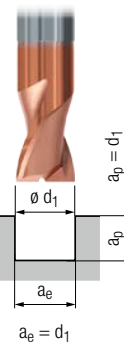
Ø d ₁ e8	h ₁₀	l ₂	l ₃	l ₁	Ø d ₃	l ₄	Ø d ₂ h5	l _A	KB	Z (Flutes)	Dimens.- Code	2510A	2511A
2		3	5	50	1,9	14	6	14	0,04	2	.002	●	●
2,5		3	5	50	2,4	14	6	14	0,07	2	.0025	●	●
	2,8	4	7	50	2,7	14	6	14	0,07	2	.0028	●	●
3		4	7	50	2,9	14	6	14	0,07	2	.003	●	●
	3,5	4	7	50	3,3	14	6	14	0,07	2	.0035	●	●
	3,8	5	9	54	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	●	●



Hartmetall-Langlochfräser – kurze Ausführung (2 Schneiden)
Solid carbide slot drills – short design (2 flutes)

N

Gültig für · Valid for
2510A
2511A



	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]
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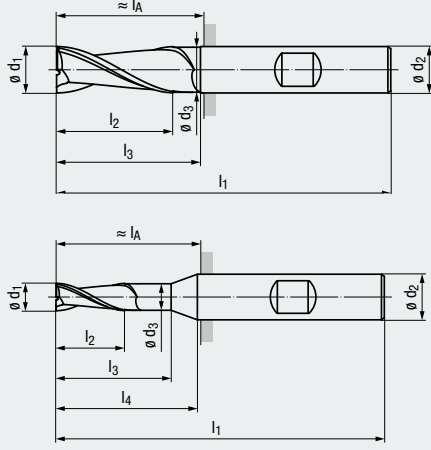
Stahlwerkstoffe · Steel materials													
P	1.1	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	120	$0,003 \times d_1$	130	$0,004 \times d_1$	140	$0,004 \times d_1$	170	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	50	$0,002 \times d_1$	60	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
K	1.1	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,004 \times d_1$	120	$0,004 \times d_1$	140	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.6										<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kupfer-Legierungen · Copper alloys													
N	2.1	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
N	3.1	340	$0,009 \times d_1$	370	$0,011 \times d_1$	410	$0,013 \times d_1$	480	$0,014 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	340	$0,007 \times d_1$	370	$0,008 \times d_1$	410	$0,010 \times d_1$	480	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
N	4.1	340	$0,008 \times d_1$	370	$0,009 \times d_1$	410	$0,011 \times d_1$	480	$0,012 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	500	$0,008 \times d_1$	550	$0,009 \times d_1$	600	$0,011 \times d_1$	700	$0,012 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Besondere Werkstoffe · Special materials													
N	5.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.2	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
S	1.1	80	$0,004 \times d_1$	90	$0,004 \times d_1$	100	$0,005 \times d_1$	110	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,004 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	2.1	70	$0,002 \times d_1$	80	$0,002 \times d_1$	80	$0,003 \times d_1$	100	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	$0,002 \times d_1$	30	$0,002 \times d_1$	35	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
H	1.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	80	$0,003 \times d_1$	90	$0,003 \times d_1$	100	$0,004 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3			90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

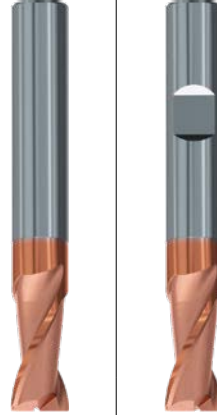
V_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend
- 3 Baulängen verfügbar

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



- N**
- HM**
- DIN 6535 HA HB
- 1-2°
- 35/38°
- KB x 45°
- Vc/fz 33
- Icons for coolant and chip removal



Beschichtung · Coating

- Einsatzgebiete – Material (siehe Seite 4)
- In fast allen Werkstoffen einsetzbar
 - Zum Schruppen und Schlichten geeignet

- Applications – material (see page 4)
- For almost all materials
 - Suitable for roughing and finishing

TIALN

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 1.3

DIN 6527 – Lange Ausführung · Long design

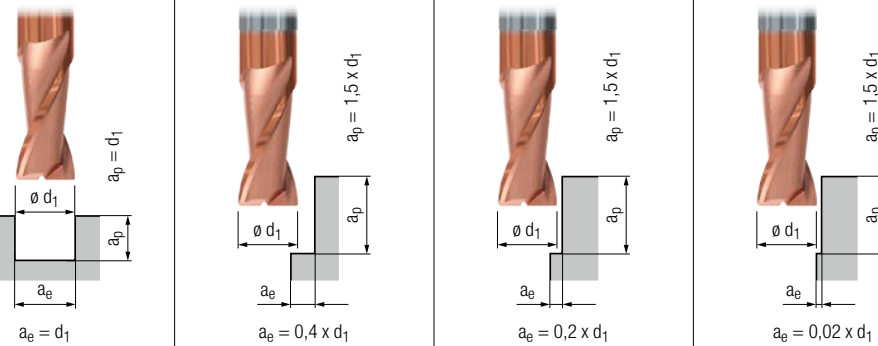
Bestell-Code · Order code											2512A	2513A		
∅ d ₁ h10	l ₂	l ₃	l ₁	∅ d ₃	l ₄	∅ d ₂ h5	l _A	KB	Z (Flutes)	Dimens.- Code				
2	6	8	57	1,9	20	6	21	0,04	2	.002	●	●		
3	7	10	57	2,9	20	6	21	0,07	2	.003	●	●		
4	8	12	57	3,8	20	6	21	0,07	2	.004	●	●		
5	10	15	57	4,8	20	6	21	0,12	2	.005	●	●		
6	10	20	57	5,8	–	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	●	●		



Hartmetall-Schaftfräser – lange Ausführung (2 Schneiden)
Solid carbide end mills – long design (2 flutes)

N

Gültig für · Valid for
2512A
2513A



	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]				
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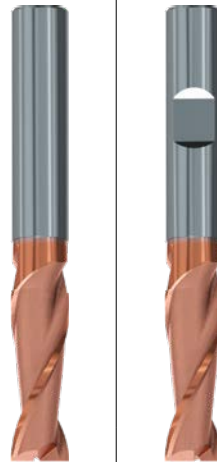
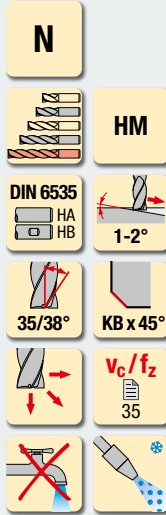
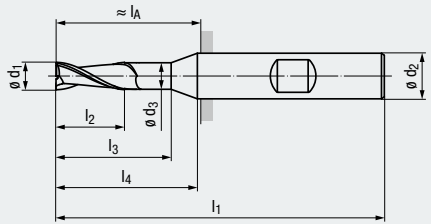
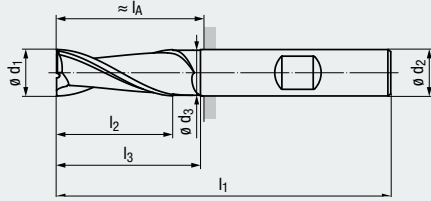
Stahlwerkstoffe · Steel materials													
P	1.1	140	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	40	$0,002 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
K	1.1	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.6										<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kupfer-Legierungen · Copper alloys													
N	2.1	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
N	3.1	290	$0,009 \times d_1$	320	$0,010 \times d_1$	350	$0,011 \times d_1$	410	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	290	$0,007 \times d_1$	320	$0,008 \times d_1$	350	$0,009 \times d_1$	410	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
N	4.1	290	$0,008 \times d_1$	320	$0,009 \times d_1$	350	$0,009 \times d_1$	410	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	430	$0,008 \times d_1$	470	$0,009 \times d_1$	520	$0,009 \times d_1$	600	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Besondere Werkstoffe · Special materials													
N	5.1									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spezialwerkstoffe · Special materials													
Titan-Legierungen · Titanium alloys													
S	1.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	2.1	60	$0,002 \times d_1$	70	$0,002 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	20	$0,002 \times d_1$	20	$0,002 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
H	1.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3			70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.5									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

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

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- Multi-functional, high performance tool
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Beschichtung · Coating

- Einsatzgebiete – Material (siehe Seite 4)
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 - Zum Schruppen und Schlichten geeignet

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- For almost all materials
 - Suitable for roughing and finishing

TIALN

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
H	1.1-1.2

$l_2 = 3 \times d_1$ – Extra lange Ausführung · Extra long design

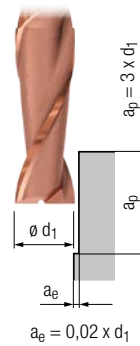
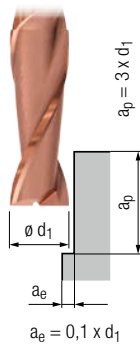
Bestell-Code · Order code											2514A	2515A		
$\varnothing d_1$ h10	l_2	l_3	l_1	$\varnothing d_3$	l_4	$\varnothing d_2$ h5	l_A □	KB	Z (Flutes)	Dimens.- Code				
3	9	12	62	2,9	23	6	26	0,07	2	.003	●	●		
4	12	16	62	3,8	25	6	26	0,07	2	.004	●	●		
5	15	20	62	4,8	25	6	26	0,12	2	.005	●	●		
6	18	25	62	5,8	–	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	●	●		



Hartmetall-Schafffräser – extra lange Ausführung (2 Schneiden)
Solid carbide end mills – extra long design (2 flutes)

N

$l_2 = 3 \times d_1$



Gültig für · Valid for
2514A
2515A



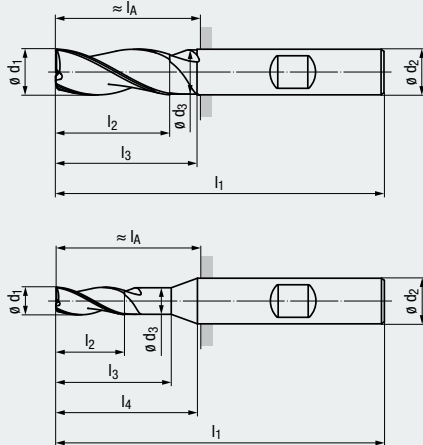
	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Stahlwerkstoffe · Steel materials									
P	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	5.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Nichtrostende Stahlwerkstoffe · Stainless steel materials									
M	1.1	120	$0,003 \times d_1$	140	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	100	$0,003 \times d_1$	120	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	50	$0,003 \times d_1$	60	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials									
K	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	Nichteisenwerkstoffe · Non-ferrous materials								
Aluminium-Legierungen · Aluminium alloys									
N	1.1	360	$0,009 \times d_1$	430	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	360	$0,008 \times d_1$	430	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	360	$0,007 \times d_1$	430	$0,008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	240	$0,008 \times d_1$	290	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5	230	$0,007 \times d_1$	280	$0,008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6	160	$0,006 \times d_1$	190	$0,007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kupfer-Legierungen · Copper alloys									
N	2.1	110	$0,005 \times d_1$	130	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	110	$0,005 \times d_1$	130	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	110	$0,005 \times d_1$	130	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	100	$0,004 \times d_1$	120	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	100	$0,004 \times d_1$	120	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	100	$0,004 \times d_1$	120	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	60	$0,003 \times d_1$	70	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys									
3.1									
3.2									
Kunststoffe · Synthetics									
4.1									
4.2									
4.3									
4.4									
Besondere Werkstoffe · Special materials									
5.1									
5.2	60	$0,003 \times d_1$		70	$0,004 \times d_1$			<input checked="" type="checkbox"/>	
5.3									
Spezialwerkstoffe · Special materials									
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys									
S	1.1	90	$0,004 \times d_1$	100	$0,005 \times d_1$			<input checked="" type="checkbox"/>	
	1.2	70	$0,003 \times d_1$	80	$0,004 \times d_1$			<input checked="" type="checkbox"/>	
	1.3	70	$0,003 \times d_1$	80	$0,003 \times d_1$			<input checked="" type="checkbox"/>	
	2.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$			<input checked="" type="checkbox"/>	
	2.2	30	$0,003 \times d_1$	40	$0,004 \times d_1$			<input checked="" type="checkbox"/>	
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$			<input checked="" type="checkbox"/>	
2.4	30	$0,003 \times d_1$	45	$0,003 \times d_1$			<input checked="" type="checkbox"/>		
2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$			<input checked="" type="checkbox"/>		
2.6	20	$0,003 \times d_1$	20	$0,003 \times d_1$			<input checked="" type="checkbox"/>		
Harte Werkstoffe · Hard materials									
H	1.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3								
	1.4								
	1.5								

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

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

- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend
- 3 Baulängen verfügbar

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



N

HM

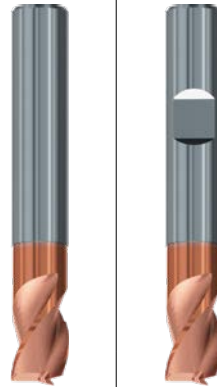
DIN 6535
HA
HB

3-5°

34-38°

KB x 45°

V_c/f_z
37



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 4)

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

Applications – material (see page 4)

- For almost all materials
- Suitable for roughing and finishing

TIALN

P	1.1-5.1
M	1.1-4.1
K	1.1-4.2
N	1.1-1.4
N	2.1-2.8, 5.2 3.1-4.2
S	1.1 1.2-1.3
S	2.1 2.2-2.6
H	1.1-1.2 1.3

DIN 6527 – Kurze Ausführung · Short design

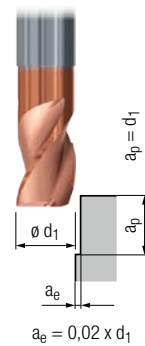
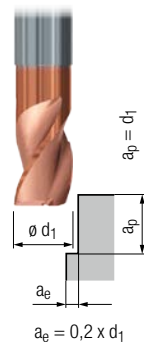
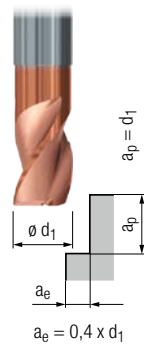
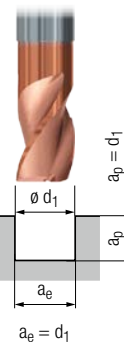
Bestell-Code · Order code											2516A	2517A		
$\varnothing d_1$ h10	l_2	l_3	l_1	$\varnothing d_3$	l_4	$\varnothing d_2$ h5	l_A 	KB	Z (Flutes)	Dimens.- Code				
1,5	3	—	50	—	14	6	14	0,04	3	.0015	●	●		
2	3	5	50	1,9	14	6	14	0,04	3	.002	●	●		
2,5	3	5	50	2,4	14	6	14	0,07	3	.0025	●	●		
2,8	4	7	50	2,7	14	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	●	●		
15,7	16	30	82	15,2	32	16	34	0,2	3	.0157	●	●		
16	16	32	82	15,5	—	16	34	0,2	3	.016	●	●		
20	20	40	92	19,5	—	20	42	0,3	3	.020	●	●		



Hartmetall-Schafffräser – kurze Ausführung (3 Schneiden)
Solid carbide end mills – short design (3 flutes)

N

Gültig für · Valid for
2516A
2517A



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]



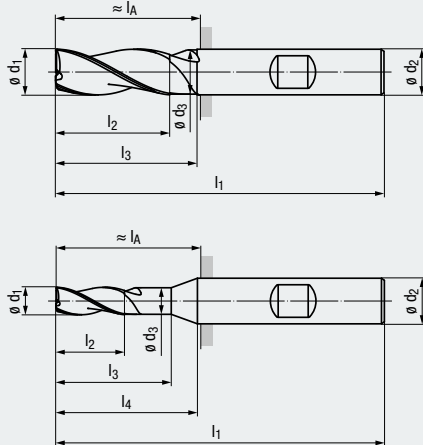
Stahlwerkstoffe · Steel materials													
P	1.1	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	120	$0,003 \times d_1$	130	$0,004 \times d_1$	140	$0,004 \times d_1$	170	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	5.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Nichtrostende Stahlwerkstoffe · Stainless steel materials													
M	1.1	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	50	$0,002 \times d_1$	60	$0,003 \times d_1$	60	$0,003 \times d_1$	70	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials													
K	1.1	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	170	$0,005 \times d_1$	190	$0,006 \times d_1$	200	$0,007 \times d_1$	240	$0,008 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	150	$0,004 \times d_1$	170	$0,005 \times d_1$	180	$0,006 \times d_1$	210	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	100	$0,003 \times d_1$	110	$0,004 \times d_1$	120	$0,004 \times d_1$	140	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Nichteisenwerkstoffe · Non-ferrous materials													
Aluminium-Legierungen · Aluminium alloys													
N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5											<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6											<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kupfer-Legierungen · Copper alloys													
N	2.1	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	150	$0,005 \times d_1$	170	$0,006 \times d_1$	180	$0,007 \times d_1$	210	$0,008 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,006 \times d_1$	180	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys													
N	3.1	340	$0,009 \times d_1$	370	$0,011 \times d_1$	410	$0,013 \times d_1$	480	$0,014 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	340	$0,007 \times d_1$	370	$0,008 \times d_1$	410	$0,010 \times d_1$	480	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics													
N	4.1	340	$0,008 \times d_1$	370	$0,009 \times d_1$	410	$0,011 \times d_1$	480	$0,012 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	500	$0,008 \times d_1$	550	$0,009 \times d_1$	600	$0,011 \times d_1$	700	$0,012 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3											<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.4											<input type="checkbox"/>	<input checked="" type="checkbox"/>
Besondere Werkstoffe · Special materials													
N	5.1											<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.2	80	$0,003 \times d_1$	90	$0,004 \times d_1$	100	$0,004 \times d_1$	110	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3											<input type="checkbox"/>	<input checked="" type="checkbox"/>
Spezialwerkstoffe · Special materials													
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys													
S	1.1	80	$0,004 \times d_1$	90	$0,004 \times d_1$	100	$0,005 \times d_1$	110	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,004 \times d_1$	60	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	70	$0,002 \times d_1$	80	$0,002 \times d_1$	80	$0,003 \times d_1$	100	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	30	$0,002 \times d_1$	30	$0,002 \times d_1$	35	$0,003 \times d_1$	40	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Harte Werkstoffe · Hard materials													
H	1.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	80	$0,003 \times d_1$	90	$0,003 \times d_1$	100	$0,004 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3			90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.4											<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5											<input type="checkbox"/>	<input checked="" type="checkbox"/>

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

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

- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend
- 3 Baulängen verfügbar

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



N

HM

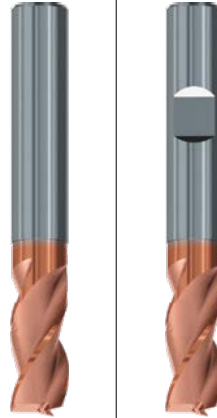
DIN 6535
HA
HB

3-5°

34-38°

KB x 45°

Vc / fz
39



Beschichtung · Coating

TIALN

Einsatzgebiete – Material (siehe Seite 4)

Applications – material (see page 4)

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

- 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
N	2.1-2.8, 5.2 3.1-4.2
S	1.1 1.2-1.3
S	2.1 2.2-2.6
H	1.1-1.2 1.3

DIN 6527 – Lange Ausführung · Long design

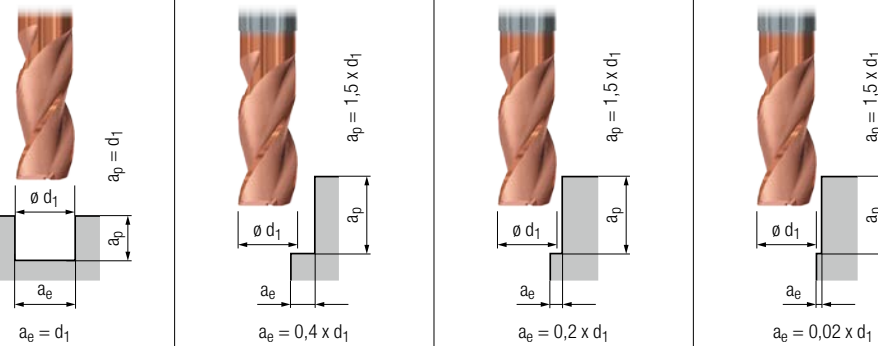
Bestell-Code · Order code											2518A	2519A
$\varnothing d_1$ h10	l_2	l_3	l_1	$\varnothing d_3$	l_4	$\varnothing d_2$ h5	l_A 	KB	Z (Flutes)	Dimens.- Code		
1	4	–	57	–	20	6	21	0,04	3	.00106	●	
2	6	8	57	1,9	20	6	21	0,04	3	.002	●	●
3	7	10	57	2,9	20	6	21	0,07	3	.003	●	●
4	8	12	57	3,8	20	6	21	0,07	3	.004	●	●
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	●	●



Hartmetall-Schaftfräser – lange Ausführung (3 Schneiden)
Solid carbide end mills – long design (3 flutes)

N

Gültig für · Valid for
2518A
2519A



	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]			
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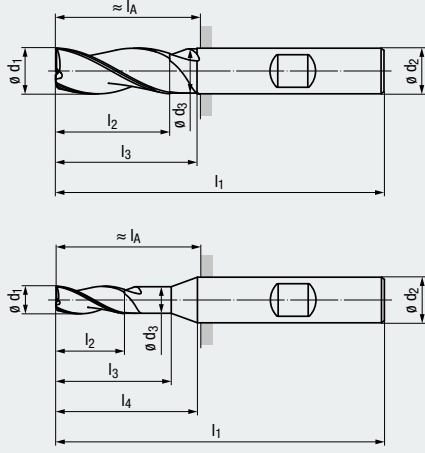
Stahlwerkstoffe · Steel materials												
P	1.1	140	$0,005 \times d_1$	150	$0,005 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,004 \times d_1$	130	$0,005 \times d_1$	150	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	100	$0,003 \times d_1$	110	$0,003 \times d_1$	120	$0,004 \times d_1$	140	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	5.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Nichtrostende Stahlwerkstoffe · Stainless steel materials												
M	1.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	40	$0,002 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	30	$0,002 \times d_1$	30	$0,003 \times d_1$	40	$0,003 \times d_1$	40	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials												
K	1.1	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.2	140	$0,005 \times d_1$	150	$0,006 \times d_1$	170	$0,006 \times d_1$	200	$0,007 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.1	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	2.2	130	$0,004 \times d_1$	140	$0,005 \times d_1$	160	$0,005 \times d_1$	180	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.1	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	3.2	110	$0,004 \times d_1$	120	$0,005 \times d_1$	130	$0,005 \times d_1$	150	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,004 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	4.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Nichteisenwerkstoffe · Non-ferrous materials												
Aluminium-Legierungen · Aluminium alloys												
N	1.1	220	$0,009 \times d_1$	250	$0,010 \times d_1$	280	$0,011 \times d_1$	300	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	220	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	220	$0,007 \times d_1$	250	$0,008 \times d_1$	280	$0,009 \times d_1$	300	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	200	$0,008 \times d_1$	250	$0,009 \times d_1$	280	$0,010 \times d_1$	300	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5											
	1.6											
Kupfer-Legierungen · Copper alloys												
N	2.1	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	130	$0,005 \times d_1$	140	$0,006 \times d_1$	160	$0,006 \times d_1$	180	$0,007 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	120	$0,004 \times d_1$	130	$0,005 \times d_1$	140	$0,005 \times d_1$	170	$0,006 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys												
N	3.1	290	$0,009 \times d_1$	320	$0,010 \times d_1$	350	$0,011 \times d_1$	410	$0,013 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.2	290	$0,007 \times d_1$	320	$0,008 \times d_1$	350	$0,009 \times d_1$	410	$0,010 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kunststoffe · Synthetics												
N	4.1	290	$0,008 \times d_1$	320	$0,009 \times d_1$	350	$0,009 \times d_1$	410	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.2	430	$0,008 \times d_1$	470	$0,009 \times d_1$	520	$0,009 \times d_1$	600	$0,011 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.3											
	4.4											
Besondere Werkstoffe · Special materials												
N	5.1											
	5.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,004 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	5.3											
Spezialwerkstoffe · Special materials												
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys												
S	1.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$	80	$0,004 \times d_1$	100	$0,005 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	60	$0,003 \times d_1$	70	$0,003 \times d_1$	70	$0,004 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	40	$0,003 \times d_1$	40	$0,003 \times d_1$	50	$0,003 \times d_1$	60	$0,004 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	60	$0,002 \times d_1$	70	$0,002 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	20	$0,002 \times d_1$	20	$0,002 \times d_1$	15	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	20	$0,002 \times d_1$	25	$0,002 \times d_1$	25	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2.6	20	$0,002 \times d_1$	20	$0,002 \times d_1$	20	$0,003 \times d_1$	30	$0,003 \times d_1$	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Harte Werkstoffe · Hard materials												
H	1.1	90	$0,003 \times d_1$	100	$0,003 \times d_1$	110	$0,003 \times d_1$	130	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,003 \times d_1$	80	$0,003 \times d_1$	100	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.3			70	$0,003 \times d_1$	70	$0,003 \times d_1$	80	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	1.4											
	1.5											

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

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

- Multifunktionales Hochleistungswerkzeug
- Neuentwickelte Geometrie
- Vibrationsarme Bearbeitung
- Zentrumschneidend
- Schneidlänge 3 x d₁
- 3 Baulängen verfügbar

- Multi-functional, high performance tool
- Newly developed geometry
- Low-vibration machining
- Centre cutting
- Flute length 3 x d₁
- 3 lengths available



N

HM

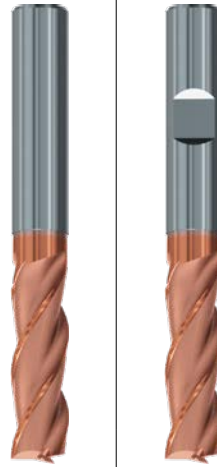
DIN 6535
HA
HB

1-2°

34-38°

KB x 45°

V_c/f_z
41



Beschichtung · Coating

- Einsatzgebiete – Material (siehe Seite 4)
- In fast allen Werkstoffen einsetzbar
 - Zum Schruppen und Schlichten geeignet

- Applications – material (see page 4)
- For almost all materials
 - Suitable for roughing and finishing

TIALN

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 2.2-2.6
H	1.1-1.2

l₂ = 3 x d₁ – Extra lange Ausführung · Extra long design

Bestell-Code · Order code											2520A	2521A		
∅ d ₁ h10	l ₂	l ₃	l ₁	∅ d ₃	l ₄	∅ 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	●	●		



Universalfräser für den Werkzeug- und Formenbau mit ausführlichen Informationen erhalten Sie in unserem anwendungsbezogenen FRANKEN TOP-Cut-Prospekt.

Bestell-Nr. ZP20099.DEGB

Universal end mills for the die and mould industry with detailed information can be found in our application-based FRANKEN TOP-Cut brochure.

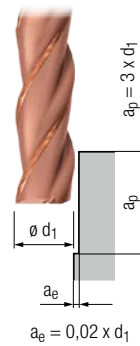
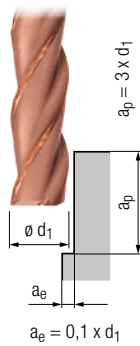
Order No. ZP20099.DEGB



Hartmetall-Schafffräser – extra lange Ausführung (3 Schneiden)
Solid carbide end mills – extra long design (3 flutes)

N

$l_2 = 3 \times d_1$



Gültig für · Valid for
2520A
2521A



	V_c [m/min]	f_z [mm]	V_c [m/min]	f_z [mm]	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Stahlwerkstoffe · Steel materials									
P	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	5.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Nichtrostende Stahlwerkstoffe · Stainless steel materials									
M	1.1	120	$0,003 \times d_1$	140	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.1	100	$0,003 \times d_1$	120	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	3.1	70	$0,003 \times d_1$	80	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	4.1	50	$0,003 \times d_1$	60	$0,003 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Gusswerkstoffe · Cast materials									
K	1.1	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	120	$0,005 \times d_1$	140	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.1	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	2.2	110	$0,004 \times d_1$	130	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.1	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	3.2	90	$0,004 \times d_1$	110	$0,005 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.1	70	$0,003 \times d_1$	80	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	4.2	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	Nichteisenwerkstoffe · Non-ferrous materials								
Aluminium-Legierungen · Aluminium alloys									
N	1.1	360	$0,009 \times d_1$	430	$0,011 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.2	360	$0,008 \times d_1$	430	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.3	360	$0,007 \times d_1$	430	$0,008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.4	240	$0,008 \times d_1$	290	$0,010 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.5	230	$0,007 \times d_1$	280	$0,008 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	1.6	160	$0,006 \times d_1$	190	$0,007 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Kupfer-Legierungen · Copper alloys									
N	2.1	110	$0,005 \times d_1$	130	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.2	110	$0,005 \times d_1$	130	$0,006 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.3	110	$0,005 \times d_1$	130	$0,006 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.4	100	$0,004 \times d_1$	120	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.5	100	$0,004 \times d_1$	120	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.6	100	$0,004 \times d_1$	120	$0,005 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.7	60	$0,003 \times d_1$	70	$0,004 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	2.8	60	$0,003 \times d_1$	70	$0,004 \times d_1$			<input type="checkbox"/>	<input checked="" type="checkbox"/>
Magnesium-Legierungen · Magnesium alloys									
3.1									
3.2									
Kunststoffe · Synthetics									
4.1									
4.2									
4.3									
4.4									
Besondere Werkstoffe · Special materials									
5.1									
5.2	60	$0,003 \times d_1$		70	$0,004 \times d_1$				<input checked="" type="checkbox"/>
5.3									
Spezialwerkstoffe · Special materials									
Nickel-, Kobalt- und Eisen-Legierungen · Nickel alloys, cobalt alloys and iron alloys									
S	1.1	90	$0,004 \times d_1$	100	$0,005 \times d_1$				<input checked="" type="checkbox"/>
	1.2	70	$0,003 \times d_1$	80	$0,004 \times d_1$				<input checked="" type="checkbox"/>
	1.3	70	$0,003 \times d_1$	80	$0,003 \times d_1$				<input checked="" type="checkbox"/>
	2.1	70	$0,004 \times d_1$	80	$0,004 \times d_1$				<input checked="" type="checkbox"/>
	2.2	30	$0,003 \times d_1$	40	$0,004 \times d_1$				<input checked="" type="checkbox"/>
	2.3	20	$0,002 \times d_1$	25	$0,002 \times d_1$				<input checked="" type="checkbox"/>
2.4	30	$0,003 \times d_1$	45	$0,003 \times d_1$				<input checked="" type="checkbox"/>	
2.5	20	$0,002 \times d_1$	20	$0,002 \times d_1$				<input checked="" type="checkbox"/>	
2.6	20	$0,003 \times d_1$	20	$0,003 \times d_1$				<input checked="" type="checkbox"/>	
Harte Werkstoffe · Hard materials									
H	1.1	60	$0,003 \times d_1$	70	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.2	50	$0,003 \times d_1$	60	$0,003 \times d_1$	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
	1.3								
	1.4								
	1.5								

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

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

Durch die Verwendung von gekühlter Luft wird die Temperatur im Schneidenbereich herabgesetzt, wodurch höhere Schnittgeschwindigkeiten und Standzeiten erreicht werden können. Moderne Beschichtungen können durch diese Art der Kühlung erst alle Vorteile ausspielen, da eine Schädigung der Schneide durch Thermoschock vermieden wird.

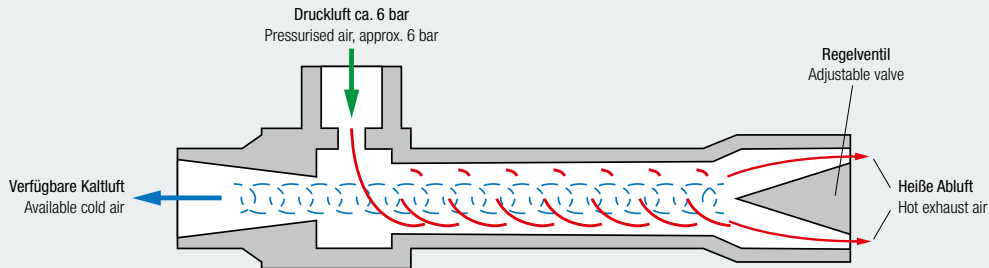
Darüber hinaus werden die beim Kopierfräsen anfallenden sehr leichten Späne auch aus tiefen Aussparungen oder Kavitäten mit Hilfe der Kaltluftdüse entfernt.

Die Wirkungsweise der Kaltluftdüse basiert auf dem Prinzip des Wirbelrohrs, in dem zwei gegenläufige, rotierende Luftströme (ohne bewegte Teile) erzeugt werden. An einem Ende tritt die innere Strömung als nutzbare Kaltluft mit bis zu -40 °C aus. Der Anschluss erfolgt über einen Druckluftanschluss.

Cooled air reduces temperatures in the cutting area, which in turn permits higher cutting speeds and longer tool life. This type of cooling enables modern coatings to achieve their full potential, as damage to the cutting edge resulting from thermal shock is avoided.

Moreover, the cold-air nozzle helps to remove the tiny chips produced in copy milling even from deep recesses or cavities.

The function of the cold-air nozzle is based on the principle of the vortex tube, in which two opposed, rotating air streams are generated (without any moving parts). The internal air stream exits from one end, in the form of useable cold air with a temperature as low as -40 °C. All that is required is a normal pressurised air connection.



Temperatur gemessen am effektiven Austritt des Wirbelrohrs (nicht Düsenende)
 Temperature, measured at the effective exit of the vortex tube (not the end of the nozzle)

Zuluft-Druck Supply air pressure [bar]	Temperatur der Nutzluft in °C bei einem Kaltluftanteil von Temperature of usable air in °C, with a cold air percentage of		
	25%	50%	75%
3	-31	-22	- 6
4	-35	-35	- 8
5	-39	-28	-10
6	-42	-31	-11
7	-46	-34	-13

Luftverbrauch bei Eingangstemperatur von 21 °C
 Air consumption, with supply air temperature of 21 °C

Eingangsdruck Input pressure [bar]	Luftverbrauch Air consumption	Kapazität Capacity
6,9	7,08 l/s \approx 25,5 m ³ /h	226 kcal/h \approx 263 W

**Anwendungsbeispiel:
 Standzeiterhöhung durch den Einsatz der Kaltluftdüse**

Werkstück: Formeinsatz gehärtet, Material K360 mit 63 HRC
Bearbeitung: Schichten des Formeinsatzes
Werkzeug: FRANKEN Hard-Cut
 Schneidendurchmesser 10 mm, 2 Schneiden

Schnittwerte: $v_c = 240 \text{ m/min} \cdot n = 7639 \text{ min}^{-1}$
 $f_z = 0,12 \text{ mm} \cdot v_f = 1833 \text{ mm/min}$
 $a_p = 0,2 \text{ mm} \cdot a_e = 0,2 \text{ mm}$

Standzeit ohne Kühlung	Standzeit mit Kaltluftdüse
98 Minuten	130 Minuten

Durch den Einsatz der Kaltluftdüse konnte die Standzeit um 33% erhöht werden.

**Application example:
 Increased tool life using the cold-air nozzle**

Workpiece: Hardened mould, material K360 with 63 HRC
Operation: Finishing the mould
Tool: FRANKEN Hard-Cut
 Cutting diameter 10 mm, 2 flutes

Cutting conditions: $v_c = 240 \text{ m/min} \cdot n = 7639 \text{ rpm}$
 $f_z = 0.12 \text{ mm} \cdot v_f = 1833 \text{ mm/min}$
 $a_p = 0.2 \text{ mm} \cdot a_e = 0.2 \text{ mm}$

Tool life without coolant	Tool life with cold-air nozzle
98 minutes	130 minutes

By using the cold-air nozzle, it was possible to increase the tool life by 33%.





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



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



Bestell-Code · Order code		6910				
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				●	

Kaltluftdüsen-Anbauset

Cold-Air Nozzle Attachment Set



Bestell-Code · Order code		6910
	Dimens.-Code	
	.12	●

Lieferumfang:

- 1 x Klemmarm mit Grundhalter (Art.-Nr.: 6910.24)
- 1 x Anschlussschlauch 300 mm
- 1 x Winkel-Verschraubung G 1/4
- 1 x Verschraubung G 1/4
- 2 x Blindstopfen G 1/4

Delivery includes:

- 1 x Socket with basic holder (art. No. 6910.24)
- 1 x Connecting hose 300 mm
- 1 x Elbow coupling G 1/4
- 1 x Screw G 1/4
- 2 x Sealing plugs G 1/4

Kaltluftdüsen-Montageset 1

Cold-Air Nozzle Assembly Set 1



Bestehend aus 1 Kaltluftdüse (Art.-Nr. 6910.15) und 1 Kaltluftdüsen-Anbauset (Art.-Nr. 6910.12)
Consists of 1 cold-air nozzle (art. no. 6910.15) and 1 cold-air nozzle attachment set (art. no. 6910.12)



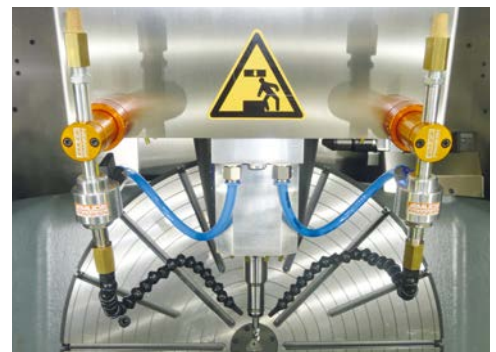
Bestell-Code · Order code		6910
	Dimens.-Code	
	.11	●

Kaltluftdüsen-Montageset 2

Cold-Air Nozzle Assembly Set 2



Bestehend aus 2 Kaltluftdüsen (Art.-Nr. 6910.15) und 2 Kaltluftdüsen-Anbausets (Art.-Nr. 6910.12)
Consists of 2 cold-air nozzles (art. no. 6910.15) and 2 cold-air nozzle attachment sets (art. no. 6910.12)

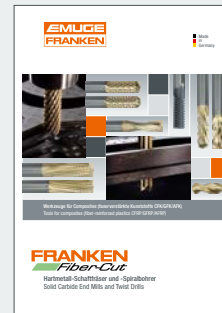
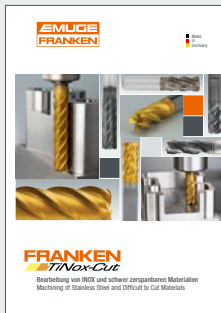


Bestell-Code · Order code		6910
	Dimens.-Code	
	.10	●

	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

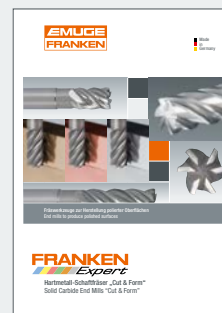
Druckerzeugnisse für Hochleistungswerkzeuge

Sales literature for high performance end mills



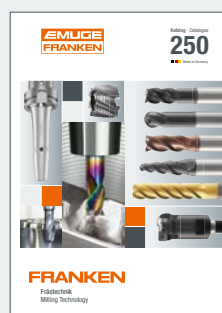
Druckerzeugnisse für Fräswerkzeuge mit besonderen Eigenschaften

Sales literature for milling tools with special characteristics



Hauptkatalog

Main catalogue



	<p>Baulänge</p>	<p>extra kurz kurz mittellang lang extra lang</p> <p>Die entsprechende Baulänge ist rot hervorgehoben. Alternativ-Baulängen des gleichen Typs sind grau unterlegt. Nicht gekennzeichnete Baulängen sind im Lieferprogramm nicht enthalten.</p>	<p>Constructional length</p>	<p>extra short short medium length long extra long</p> <p>The relevant length is marked in red. Alternative lengths of the same type are marked in grey. Lengths without any marking are not available as catalogue products.</p>
	<p>Schaftausführung</p>	<p>Die auf der jeweiligen Seite befindlichen Schaftausführungen sind grau unterlegt.</p>	<p>Shank design</p>	<p>The shank designs to be found on the respective page are marked in grey.</p>
	<p>Schneidstoff</p>	<p>Hartmetall</p>	<p>Cutting material</p>	<p>Solid carbide</p>
	<p>Drallwinkel</p>	<p>Angegeben ist der Drallwinkel dieser Werkzeuge. Bei unterschiedlichen Drallwinkeln sind alle Winkel aufgeführt.</p>	<p>Helix angle</p>	<p>The helix angle of these tools is shown. If there are variable helix angles, these are all shown.</p>
	<p>Schneideckenausführung und Stirnkontur</p>	<p>Scharfkantig</p>	<p>Cutting edge design and face geometry</p>	<p>Sharp-edged</p>
	<p>Schutzeckenfase (Kantenbruch)</p>	<p>Bevelled edge</p>		
	<p>Eckenradius</p>	<p>Corner radius</p>		
	<p>Innere Kühlschmierstoff-Zufuhr</p>	<p>ICA = Kühlschmierstoffaustritt axial</p>	<p>Internal coolant supply</p>	<p>ICA = Internal coolant supply, axial exit</p>
	<p>Kühlung und Schmierung</p>	<p>Trockenbearbeitung</p>	<p>Coolant and lubrication</p>	<p>Dry machining</p>
	<p>Kaltluftdüse</p>	<p>Cold-air nozzle</p>		
	<p>Minimalmengenschmierung (MMS)</p>	<p>Minimum-quantity lubrication (MQL)</p>		
	<p>Emulsion</p>	<p>Emulsion</p>		

Vorschubrichtung

Die roten Pfeile beschreiben die empfohlenen Vorschubrichtungen der abgebildeten Fräser.

Feed direction

The red arrows mark the recommended feed directions of the respective cutters.

Rampenwinkel

Der Rampenwinkel ist der empfohlene Winkel beim Eintauchen in das Werkstück.

Ramping angle

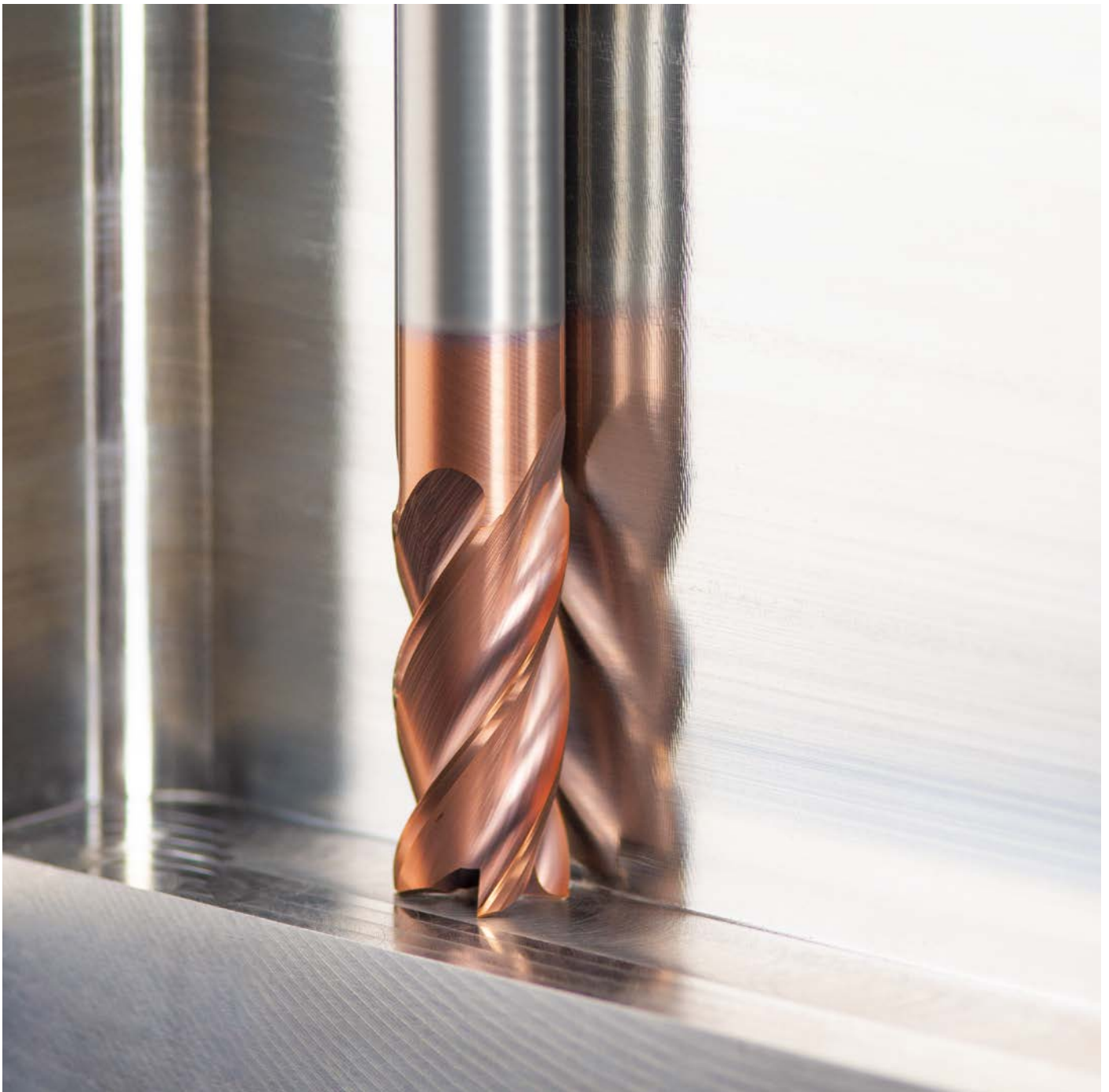
The specified angle is the recommended angle for ramping applications.

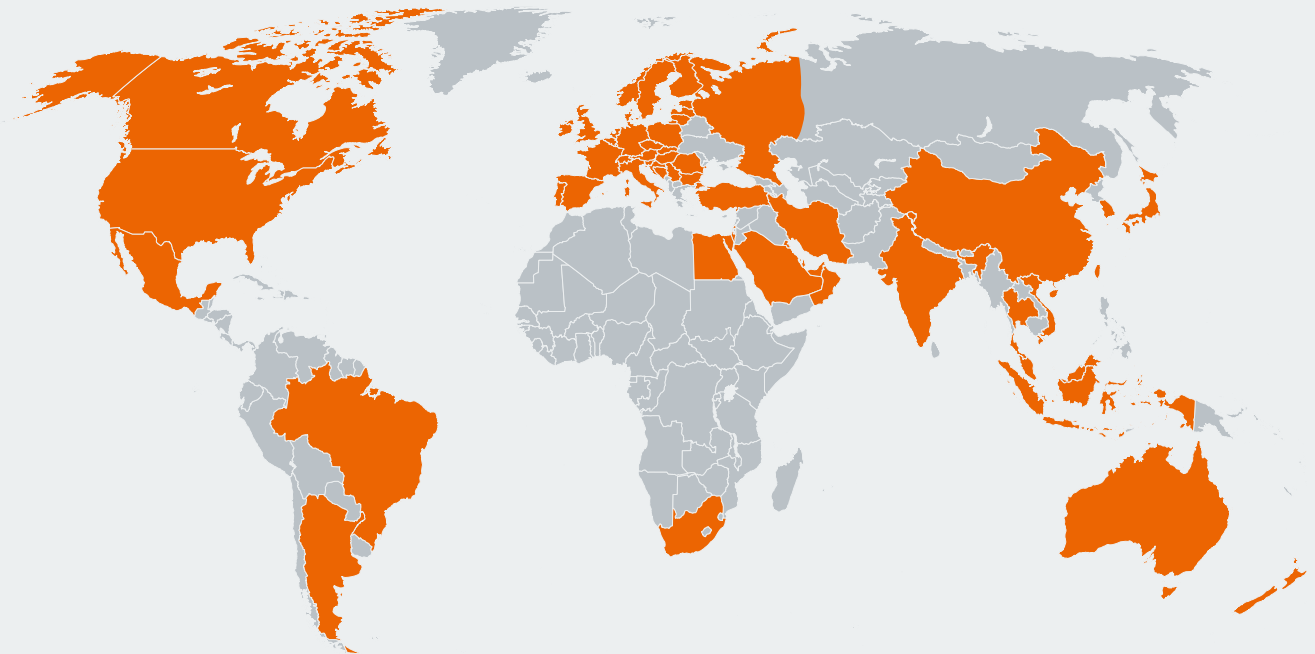
Schnittwerte

Die Schnittwerte und Einsatzparameter für diese Werkzeuge sind auf der im Symbol angegebenen Seite zu finden.

Cutting conditions

The cutting conditions and work parameters for these tools can be found on the page indicated in the symbol.





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