

Fräswerkzeuge

aus Vollhartmetall

Fraises

en carbure monobloc



Unsere Spezialisten

Nos spécialistes



Die Profis in der Werkzeug- und Spanntechnik!
Erstklassige Lösungen und Beratungskompetenz
aus einer Hand.

Les pros de l'outillage et de la technique de serrage!
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High-Performance Programm

TuffCut® XR

für alle Materialien

pour tous les matériaux

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TuffCut® XT

Stainless

speziell für rostfreie Materialien
und Titan

spécialement pour aciers Inox
et titane

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TuffCut® DM

Die & Mould

Werkzeug- und Formenbau
bis 65 HRC

Construction d'outillage et de moules
jusqu'à 65 HRC

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TuffCut® X-AL

Aluminium

speziell für Leichtmetalle

spécialement pour des métaux légers

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Economy-Programm

Standard

Economy

Universal-Fräser
Fasenfräser
Vor- Rückwärtssenkern

Fraise universelle
Fraise à chanfrein
Fraise biconique à chanfreiner avant et arrière

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Schnittdaten Valeurs indicatives

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Piktogramme / Pictogrammes

	Werkzeugmaterial Matière outil		Materialhärte Dureté de la matière
	Zähnezahl Nombre de dents		Beschichtung Revêtements
	Spiralwinkel Angle d'hélice		abgesetzter Schaft Queue dégagée
	Zentrumschneidend Coupe au centre		Eckradius Rayon
	Fräsrichtung Cinétique		mit Kühlmittelzufuhr avec liquide de refroidissement
	Umfangfräsen Contournage		Schnittdaten Valeurs indicatives
	Nutenfräsen Rainurage		

TuffCut® XR-XT

Geometrie, Hartmetall und Beschichtung perfekt abgestimmt auf Höchstleistung.

Coordination parfaite de géométrie, carbure et revêtement pour un rendement optimal.



 **M.A. FORD®**
High Performance Cutting Tools

Eigenschaften

- Ungleiche Teilung und Spiralwinkel
- Eigenes Feinstkorn-Hartmetallsubstrat
- Exzentrischer Hinterschliff
- ALTIMA® und ALTIMA® BLAZE Beschichtung

Vorteile

- Höchste Vorschübe und Drehzahlen
- Reduzierte Vibrationsneigung
- Äusserst stabile Schneidkanten
- Sehr breiter Anwendungsbereich in fast allen Materialien
- ALTIMA® BLAZE für höchste Standzeiten speziell in rostfreie Materialien, Titan und Stahl (Trockenbearbeitung).

Caractéristique

- Denture et angle d'hélice inégale
- Propre micrograin-substrat carbure
- Angle de dépouille primaire excentrique
- Revêtement ALtima® et ALTIMA® BLAZE

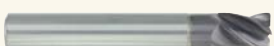
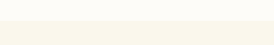
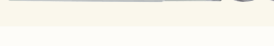
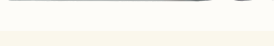
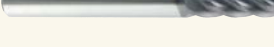
Avantage

- Vitesses et avances maximale
- Réduction des vibrations
- Arête de coupe extrêmement stable
- Une très large gamme d'applications pour presque tous les matériaux
- ALtima® BLAZE pour une durée de vie supérieure en particulier dans matériaux inoxydables, le titane et acier (usinage à sec)

TuffCut® XR



High-Performance Fräser / Fraises

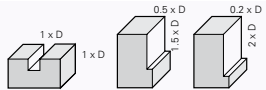
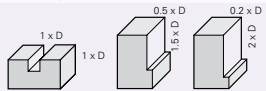
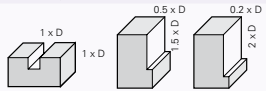
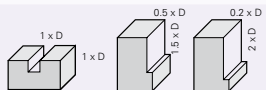
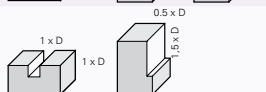
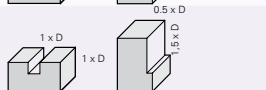
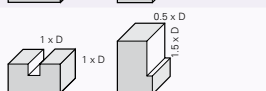
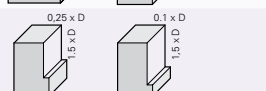
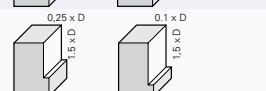
Artikel-Nr. No. Art.		Durchmesser Diamètre	Zähne Dents	Eckradius Rayon	Absetzung Queue dégagée	Anwendungsbereich Domaine d'utilisation	Seite Page
46066 46067		Ø 3 - 20	4			 	8
46068 46069		Ø 3 - 20	4	 R0,2 - 1,0		 	8
46076 46077		Ø 3 - 20	4			 	9
46078 46079		Ø 3 - 20	4	 1,0		 	9
46080		Ø 6 - 20	4	 R0,25 - 3,0		 	10
46104		Ø 1,5 - 3	4			  	10
46110 46111		Ø 3 - 25	4			  	11
46112 46113		Ø 6 - 20	4			 	11
46120 46121		Ø 3 - 25	4	 R0,1 - 1,0		  	12
46122 46123		Ø 6 - 20	4	 R0,25 - 1,0		  	13
46130 46131		Ø 1,5 - 16	4			  	13
46134		Ø 3 - 16	4			  	14
46140 46141		Ø 3 - 20	5			 	14
46150-SC 46151-SC		Ø 3 - 20	5	 R0,5			15
46160 46161		Ø 6 - 20	5	 R0,5 - 1,0		 	15
46162 46163		Ø 3 - 20	5				16
46166		Ø 3 - 20	6				16
46170 46171		Ø 12 - 20	7	 R1,0 - 4,0			17
46172 46172-SC 46173 46173-SC		Ø 6 - 20	7	 R0,5 - 4,0			17

TuffCut® XT

Stainless



High-Performance Fräser / Fraises

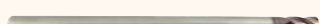
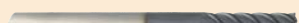
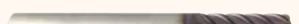
Artikel-Nr. No. Art.		Durchmesser Diamètre	Zähne Dents	Eckradius Rayon	Absetzung Queue dégagée	Anwendungsbereich Domaine d'utilisation	Seite Page
46410 46411		Ø 3 - 20	4				18
46412 46413		Ø 3 - 20	4				18
46420 46421		Ø 3 - 20	4	 R0,25 - 0,8			18
46422 46423		Ø 3 - 20	4	 R0,25 - 6,0			19
46460 46461		Ø 12 - 20	5	 R0,5 - 4,0			20
46460-SC		Ø 12 - 16	5	 R0,5			21
46470 46471		Ø 12 - 25	5	 R0,5 - 3,0			21
46480 46481		Ø 16 - 25	5	 R1,0 - 3,0			22
46484 46485		Ø 12	5	 R0,5 - 4,0			22

TuffCut® DM

Die & Mould



High-Performance Fräser / Fraises

46860		Ø 0,5 - 12	2			≤ 65 HRC	23
46872		Ø 1 - 12	4	 R0,2 - 2,0		≤ 55 HRC	24
46876		Ø 3 - 20	4	 R0,3 - 3,0		≤ 65 HRC	24
46890		Ø 3 - 16	4-6			≤ 65 HRC	25
46894		Ø 3 - 16	4-6	 R0,5 - 3,0		≤ 65 HRC	25

46066.3 / 46067.3

TuffCut® XR

Schaftfräser

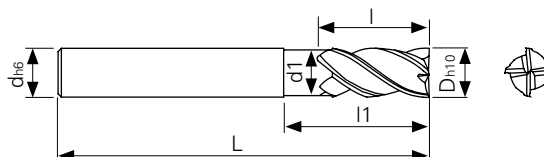
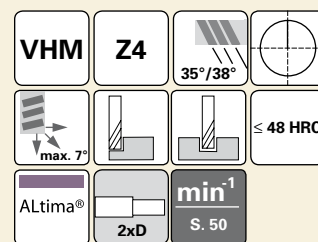
extra kurz

2xD abgesetzter Schaft

Fraise en bout

extra courte

2xD queue dégaagée



177S

D	L	l	l1	d1	d	46066.3 zyl. Schaft / queue cylindrique			46067.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
3	46	5	9	2,9	6	54.90	46.70	43.90	—	—	—
4	49	6	12	3,9	6	45.30	38.50	36.20	—	—	—
5	52	7	15	4,9	6	33.40	28.40	26.70	—	—	—
6	52	8	15	5,8	6	33.00	28.10	26.40	36.20	30.80	29.00
8	54	10	17	7,8	8	40.90	34.80	32.70	44.00	37.40	35.20

D	L	l	l1	d1	d	46066.3 zyl. Schaft / queue cylindrique			46067.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
10	62	12	21	9,8	10	69.20	58.80	55.40	72.40	61.50	57.90
12	71	14	25	11,6	12	82.30	70.00	65.80	125.00	106.00	100.00
16	82	18	33	15,6	16	148.00	126.00	118.00	188.00	160.00	150.00
20	92	22	41	19,6	20	309.00	263.00	247.00	307.00	261.00	246.00

46068.3 / 46069.3

TuffCut® XR

Torusfräser

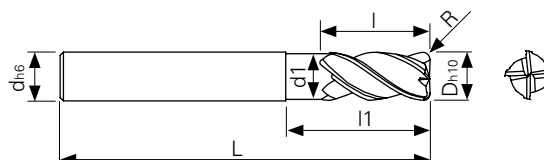
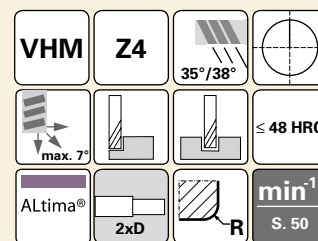
extra kurz

2xD abgesetzter Schaft

Fraise en bout torique

extra courte

2xD queue dégaagée



177S

D x R	L	l	l1	d1	d	46068.3 zyl. Schaft / queue cylindrique			46069.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
3xR0,2	46	5	9	2,9	6	55.10	46.80	44.10	—	—	—
4xR0,2	49	6	12	3,9	6	45.50	38.70	36.40	—	—	—
5xR0,2	52	7	15	4,9	6	36.30	30.90	29.00	—	—	—
6xR0,3	52	8	15	5,8	6	34.70	29.50	27.80	36.60	31.10	29.30
8xR0,5	54	10	17	7,8	8	43.00	36.60	34.40	46.10	39.20	36.90

D x R	L	l	l1	d1	d	46068.3 zyl. Schaft / queue cylindrique			46069.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
10xR0,5	62	12	21	9,8	10	70.60	60.00	56.50	74.00	62.90	59.20
12xR0,5	71	14	25	11,6	12	86.50	73.50	69.20	89.80	76.30	71.80
16xR1,0	82	18	33	15,6	16	150.00	128.00	120.00	156.00	133.00	125.00
20xR1,0	92	22	41	19,6	20	316.00	269.00	253.00	322.00	274.00	258.00

46076.3 / 46077.3

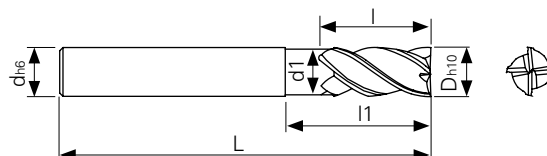
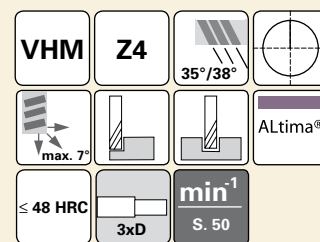
TuffCut® XR

Schaftfräser

3xD abgesetzter Schaft

Fraise en bout

3xD queue dégagée



177S

D	L	l	l1	d1	d	46076.3 zyl. Schaft / queue cylindrique			46077.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	50	5	11	2,9	6	38.80	33.00	31.00	–	–	–
4	50	6	14	3,9	6	38.80	33.00	31.00	–	–	–
5	57	8	17	4,9	6	34.50	29.30	27.60	–	–	–
6	57	9	20	5,8	6	34.10	29.00	27.30	37.30	31.70	29.80
8	63	12	26	7,6	8	42.20	35.90	33.80	45.40	38.60	36.30

D	L	l	l1	d1	d	46076.3 zyl. Schaft / queue cylindrique			46077.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	72	15	32	9,6	10	69.30	58.90	55.40	72.90	62.00	58.30
12	83	18	38	11,4	12	85.00	72.30	68.00	88.30	75.10	70.60
16	98	24	50	15,2	16	146.00	124.00	117.00	150.00	128.00	120.00
20	112	30	62	19,2	20	303.00	258.00	242.00	307.00	261.00	246.00

46078.3 / 46079.3

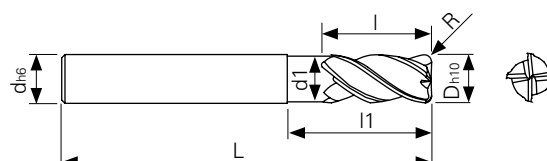
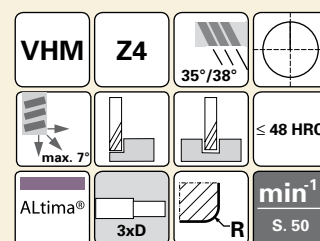
TuffCut® XR

Torusfräser

3xD abgesetzter Schaft

Fraise en bout torique

3xD queue dégagée



177S

D x R	L	l	l1	d1	d	46078.3 zyl. Schaft / queue cylindrique			46079.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,2	50	5	11	2,9	6	44.70	38.00	35.80	–	–	–
4xR0,2	50	6	14	3,9	6	44.70	38.00	35.80	–	–	–
5xR0,2	57	8	17	4,9	6	36.30	30.90	29.00	–	–	–
6xR0,3	57	9	20	5,8	6	35.80	30.40	28.60	39.00	33.20	31.20
8xR0,5	63	12	26	7,6	8	44.50	37.80	35.60	47.60	40.50	38.10

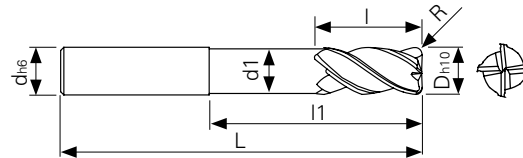
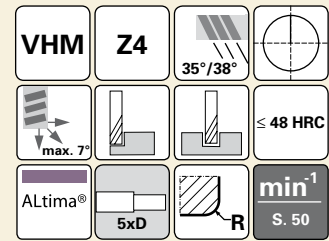
D x R	L	l	l1	d1	d	46078.3 zyl. Schaft / queue cylindrique			46079.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR0,5	72	15	32	9,6	10	72.80	61.90	58.20	76.20	64.80	61.00
12xR0,5	83	18	38	11,4	12	89.20	75.80	71.40	92.60	78.70	74.10
16xR1,0	98	24	50	15,2	16	155.00	132.00	124.00	161.00	137.00	129.00
20xR1,0	112	30	62	19,2	20	318.00	270.00	254.00	322.00	274.00	258.00

46080.3**TuffCut® XR****Torusfräser****extra lang**

5xD abgesetzter Schaft

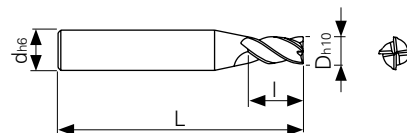
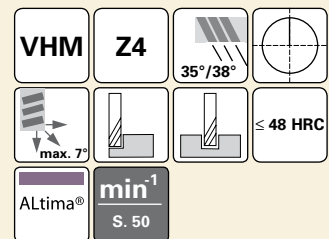
Fraise en bout torique**extra long**

5xD queue dégagée

**177LR N5**

D x R	L	l	l1	d1	d	46080.3 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6xR0,25	101	12	30	5,8	6	48.00	40.80	38.40
6xR0,5	101	12	30	5,8	6	48.00	40.80	38.40
6xR1,0	101	12	30	5,8	6	48.00	40.80	38.40
8xR0,5	101	16	40	7,6	8	60.50	51.40	48.40
8xR1,0	101	16	40	7,6	8	60.50	51.40	48.40
8xR2,0	101	16	40	7,6	8	60.50	51.40	48.40
8xR3,0	101	16	40	7,6	8	60.50	51.40	48.40
10xR0,5	127	20	50	9,6	10	101.00	85.90	80.80
10xR1,0	127	20	50	9,6	10	101.00	85.90	80.80
10xR2,0	127	20	50	9,6	10	101.00	85.90	80.80
10xR3,0	127	20	50	9,6	10	101.00	85.90	80.80
12xR0,5	152	24	60	11,4	12	127.00	108.00	102.00

D x R	L	l	l1	d1	d	46080.3 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12xR1,0	152	24	60	11,4	12	127.00	108.00	102.00
12xR2,0	152	24	60	11,4	12	127.00	108.00	102.00
12xR3,0	152	24	60	11,4	12	127.00	108.00	102.00
12xR4,0	152	24	60	11,4	12	127.00	108.00	102.00
16xR0,5	152	32	80	15,2	16	227.00	193.00	182.00
16xR1,0	152	32	80	15,2	16	227.00	193.00	182.00
16xR2,0	152	32	80	15,2	16	227.00	193.00	182.00
16xR3,0	152	32	80	15,2	16	227.00	193.00	182.00
20xR0,5	152	40	100	19,2	20	423.00	360.00	338.00
20xR1,0	152	40	100	19,2	20	423.00	360.00	338.00
20xR3,0	152	40	100	19,2	20	423.00	360.00	338.00

46104.3**TuffCut® XR****Micro-Schaftfräser****Micro-Fraise en bout****177**

D	L	l	d	46104.3 zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1,5	38	3	3	29.10	24.70	23.30
2	38	4	3	26.70	22.70	21.40

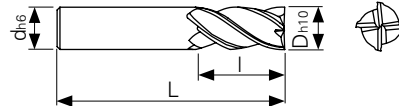
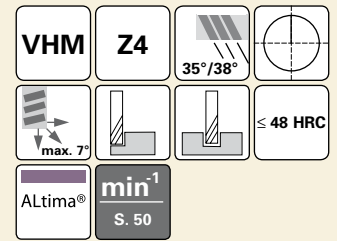
D	L	l	d	46104.3 zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
2,5	38	5	3	26.70	22.70	21.40
3	38	6	3	23.20	19.70	18.60

46110.3 / 46111.3

TuffCut® XR

Schaftfräser

Fraise en bout



177

D	L	I	d	46110.3 zyl. Schaft / queue cylindrique			46111.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
3	57	8	6	36.20	30.80	29.00	—	—	—
3,5	57	7	6	36.20	30.80	29.00	—	—	—
4	57	11	6	36.20	30.80	29.00	—	—	—
4,5	57	9	6	36.20	30.80	29.00	—	—	—
5	57	13	6	34.50	29.30	27.60	—	—	—
6	57	13	6	34.10	29.00	27.30	37.30	31.70	29.80
8	63	19	8	42.20	35.90	33.80	45.40	38.60	36.30

D	L	I	d	46110.3 zyl. Schaft / queue cylindrique			46111.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
10	72	22	10	69.30	58.90	55.40	72.60	61.70	58.10
12	83	26	12	84.90	72.20	67.90	88.30	75.10	70.60
14	83	26	14	132.00	112.00	106.00	136.00	116.00	109.00
16	92	32	16	146.00	124.00	117.00	150.00	128.00	120.00
18	92	32	18	217.00	184.00	174.00	221.00	188.00	177.00
20	104	38	20	303.00	258.00	242.00	307.00	261.00	246.00
25	104	38	25	387.00	329.00	310.00	391.00	332.00	313.00

46112.3 / 46113.3

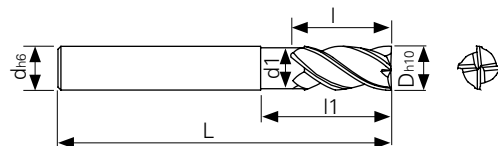
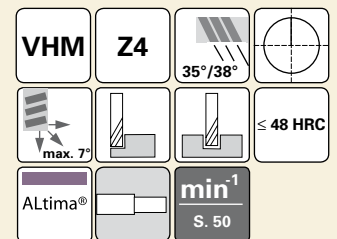
TuffCut® XR

Schaftfräser

abgesetzter Schaft

Fraise en bout

queue dégagée



177S

D	L	I	I1	d1	d	46112.3 zyl. Schaft / queue cylindrique			46113.3 Weldon		
						1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
6	57	13	22	5,8	6	37.80	32.10	30.20	41.00	34.90	32.80
8	63	19	28	7,8	8	45.90	39.00	36.70	49.10	41.70	39.30
10	72	22	31	9,8	10	73.30	62.30	58.60	76.50	65.00	61.20

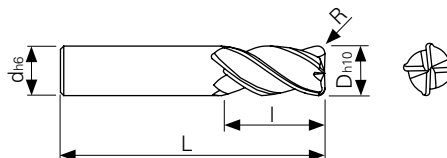
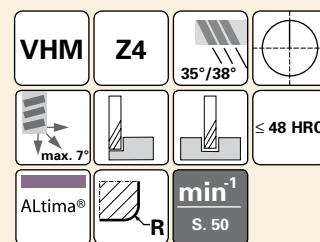
D	L	I	I1	d1	d	46112.3 zyl. Schaft / queue cylindrique			46113.3 Weldon		
						1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
12	83	26	38	11,6	12	89.10	75.70	71.30	93.30	79.30	74.60
16	92	32	46	15,6	16	151.00	128.00	121.00	155.00	132.00	124.00
20	104	38	55	19,6	20	309.00	263.00	247.00	313.00	266.00	250.00

46120.3 / 46121.3

TuffCut® XR

Torusfräser

Fraise en bout torique



177R

D x R	L	l	d	46120.3 zyl. Schaft / queue cylindrique			46121.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,1	57	8	6	52.00	44.20	41.60	-	-	-
3xR0,25	57	8	6	52.00	44.20	41.60	-	-	-
3xR0,5	57	8	6	52.00	44.20	41.60	-	-	-
4xR0,1	57	11	6	44.90	38.20	35.90	-	-	-
4xR0,25	57	11	6	45.00	38.30	36.00	-	-	-
4xR0,5	57	11	6	45.00	38.30	36.00	-	-	-
5xR0,1	57	13	6	36.30	30.90	29.00	-	-	-
5xR0,25	57	13	6	36.30	30.90	29.00	-	-	-
5xR0,5	57	13	6	36.30	30.90	29.00	-	-	-
6xR0,1	57	13	6	35.80	30.40	28.60	39.00	33.20	31.20
6xR0,25	57	13	6	35.80	30.40	28.60	39.00	33.20	31.20
6xR0,5	57	13	6	35.80	30.40	28.60	39.00	33.20	31.20
6xR1,0	57	13	6	35.80	30.40	28.60	39.00	33.20	31.20
6xR1,5	57	13	6	35.80	30.40	28.60	39.00	33.20	31.20
6xR2,0	57	13	6	35.80	30.40	28.60	39.00	33.20	31.20
8xR0,2	63	19	8	44.50	37.80	35.60	47.60	40.50	38.10
8xR0,5	63	19	8	44.50	37.80	35.60	47.60	40.50	38.10
8xR1,0	63	19	8	44.50	37.80	35.60	47.60	40.50	38.10
8xR1,5	63	19	8	44.50	37.80	35.60	47.60	40.50	38.10
8xR2,0	63	19	8	44.50	37.80	35.60	47.60	40.50	38.10
8xR3,0	63	19	8	44.50	37.80	35.60	47.60	40.50	38.10
10xR0,2	72	22	10	72.90	62.00	58.30	76.10	64.70	60.90
10xR0,5	72	22	10	70.80	60.20	56.60	76.10	64.70	60.90
10xR1,0	72	22	10	72.80	61.90	58.20	76.10	64.70	60.90
10xR1,5	72	22	10	72.80	61.90	58.20	76.10	64.70	60.90
10xR2,0	72	22	10	72.80	61.90	58.20	76.10	64.70	60.90
10xR3,0	72	22	10	72.80	61.90	58.20	76.10	64.70	60.90
12xR0,2	83	26	12	89.30	75.90	71.40	92.50	78.60	74.00
12xR0,5	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00

D x R	L	l	d	46120.3 zyl. Schaft / queue cylindrique			46121.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12xR0,75	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
12xR1,0	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
12xR1,5	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
12xR2,0	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
12xR2,5	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
12xR3,0	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
12xR4,0	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
14xR0,2	83	26	14	138.00	117.00	110.00	142.00	121.00	114.00
14xR0,75	83	26	14	138.00	117.00	110.00	142.00	121.00	114.00
16xR0,2	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
16xR0,5	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
16xR1,0	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
16xR1,5	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
16xR2,0	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
16xR2,5	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
16xR3,0	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
16xR4,0	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
18xR0,2	92	32	18	229.00	195.00	183.00	235.00	200.00	188.00
18xR1,0	92	32	18	229.00	195.00	183.00	235.00	200.00	188.00
20xR0,2	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
20xR1,0	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
20xR1,5	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
20xR2,0	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
20xR3,0	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
20xR4,0	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
20xR5,0	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
20xR6,0	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
25xR0,2	104	38	25	409.00	348.00	327.00	413.00	351.00	330.00
25xR1,0	104	38	25	409.00	348.00	327.00	413.00	351.00	330.00

46122.3 / 46123.3

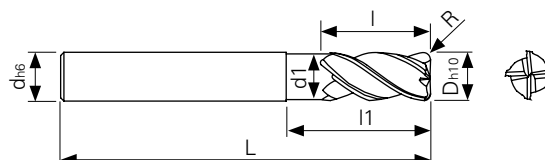
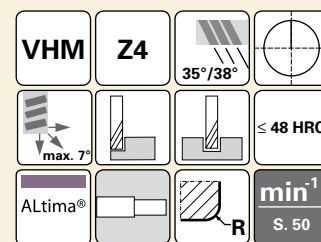
TuffCut® XR

Torusfräser

abgesetzter Schaft

Fraise en bout torique

queue dégagée



177R

D x R	L	l	l1	d1	d	46122.3 zyl. Schaft / queue cylindrique			46123.3 Weldon		
						1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.
3xR0,1	57	8	11	3	6	55.10	46.80	44.10	-	-	-
3xR0,25	57	8	11	3	6	55.10	46.80	44.10	-	-	-
4xR0,1	57	11	14	4	6	48.30	41.10	38.60	-	-	-
4xR0,25	57	11	14	4	6	48.30	41.10	38.60	-	-	-
5xR0,1	57	13	17	5	6	40.00	34.00	32.00	-	-	-
5xR0,25	57	13	17	5	6	40.00	34.00	32.00	-	-	-
6xR0,1	57	13	22	5,8	6	39.60	33.70	31.70	42.70	36.30	34.20
6xR0,25	57	13	22	5,8	6	39.60	33.70	31.70	42.70	36.30	34.20
8xR0,2	63	19	28	7,6	8	48.20	41.00	38.60	51.40	43.70	41.10
8xR0,5	63	19	28	7,6	8	48.20	41.00	38.60	51.40	43.70	41.10
10xR0,2	72	22	31	9,6	10	76.90	65.40	61.50	80.10	68.10	64.10
10xR0,5	72	22	31	9,6	10	76.90	65.40	61.50	80.10	68.10	64.10
12xR0,2	83	26	38	11,5	12	93.40	79.40	74.70	97.70	83.00	78.20

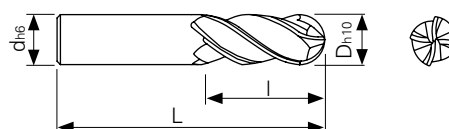
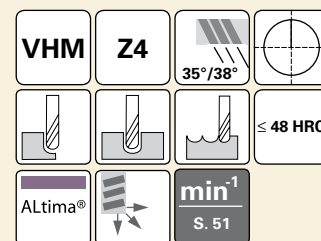
D x R	L	l	l1	d1	d	46122.3 zyl. Schaft / queue cylindrique			46123.3 Weldon		
						1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.
12xR0,5	83	26	38	11,5	12	93.40	79.40	74.70	97.70	83.00	78.20
14xR0,2	83	26	38	13,5	14	144.00	122.00	115.00	148.00	126.00	118.00
14xR0,75	83	26	38	13,5	14	144.00	122.00	115.00	148.00	126.00	118.00
16xR0,2	92	32	44	15,5	16	162.00	138.00	130.00	166.00	141.00	133.00
16xR0,5	92	32	44	15,5	16	162.00	138.00	130.00	166.00	141.00	133.00
16xR1,0	92	32	44	15,5	16	162.00	138.00	130.00	166.00	141.00	133.00
18xR0,2	92	32	44	17,5	18	235.00	200.00	188.00	239.00	203.00	191.00
18xR1,0	92	32	44	17,5	18	235.00	200.00	188.00	239.00	203.00	191.00
20xR0,2	104	38	55	19,5	20	325.00	276.00	260.00	330.00	281.00	264.00
20xR1,0	104	38	55	19,5	20	325.00	276.00	260.00	330.00	281.00	264.00
25xR0,2	104	38	48	24,5	25	397.00	337.00	318.00	401.00	341.00	321.00
25xR1,0	104	38	48	24,5	25	397.00	337.00	318.00	401.00	341.00	321.00

46130.3 / 46131.3

TuffCut® XR

Radiusfräser

Fraise hémisphérique



179

D	L	l	d	46130.3 zyl. Schaft / queue cylindrique			46131.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.
1,5	38	3	3	30.80	26.20	24.60	-	-	-
2	38	4	3	28.20	24.00	22.60	-	-	-
2,5	38	5	3	28.20	24.00	22.60	-	-	-
3	57	8	6	41.60	35.40	33.30	-	-	-
3,5	57	7	6	41.00	34.90	32.80	-	-	-
4	57	11	6	41.00	34.90	32.80	-	-	-
4,5	57	9	6	41.00	34.90	32.80	-	-	-

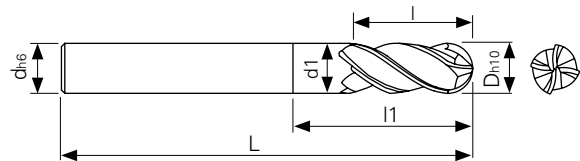
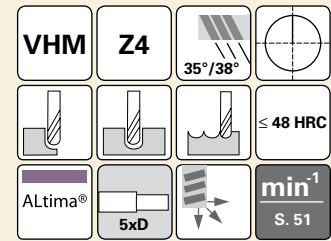
D	L	l	d	46130.3 zyl. Schaft / queue cylindrique			46131.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p.
5	57	13	6	41.50	35.30	33.20	-	-	-
6	57	13	6	40.90	34.80	32.70	44.00	37.40	35.20
8	63	19	8	50.70	43.10	40.60	53.90	45.80	43.10
10	72	22	10	83.20	70.70	66.60	86.40	73.40	69.10
12	83	26	12	102.00	86.70	81.60	105.00	89.30	84.00
16	92	32	16	208.00	177.00	166.00	212.00	180.00	170.00

46134.3**TuffCut® XR****Radiusfräser****extra lang**

5xD abgesetzter Schaft

Fraise hémisphérique**extra long**

5xD queue dégagée

**179L**

D	L	l	l1	d1	d	46134.3 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	75	4,5	17	2,9	6	50.60	43.00	40.50
4	75	6	22	3,9	6	50.00	42.50	40.00
5	75	7,5	27	4,9	6	50.40	42.80	40.30
6	101	9	32	5,8	6	55.50	47.20	44.40

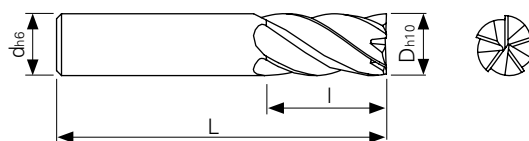
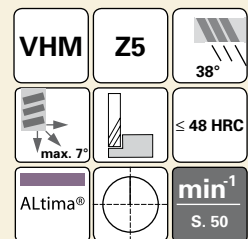
D	L	l	l1	d1	d	46134.3 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
8	101	12	42	7,6	8	70.30	59.80	56.20
10	127	15	52	9,6	10	115.00	97.80	92.00
12	152	18	62	11,4	12	143.00	122.00	114.00
16	152	24	82	15,2	16	288.00	245.00	230.00

46140.3 / 46141.3**TuffCut® XR****Schaftfräser**

5-lippig

Fraise en bout

5 dents

**178**

D	L	l	d	46140.3 zyl. Schaft / queue cylindrique			46141.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	57	8	6	36.20	30.80	29.00	—	—	—
4	57	11	6	36.20	30.80	29.00	—	—	—
5	57	13	6	34.50	29.30	27.60	—	—	—
6	57	13	6	34.10	29.00	27.30	37.30	31.70	29.80
8	63	19	8	42.20	35.90	33.80	45.40	38.60	36.30
10	72	22	10	69.30	58.90	55.40	72.60	61.70	58.10

D	L	l	d	46140.3 zyl. Schaft / queue cylindrique			46141.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12	83	26	12	84.90	72.20	67.90	89.30	75.90	71.40
14	83	26	14	132.00	112.00	106.00	136.00	116.00	109.00
16	92	32	16	146.00	124.00	117.00	150.00	128.00	120.00
18	92	32	18	217.00	184.00	174.00	221.00	188.00	177.00
20	104	38	20	303.00	258.00	242.00	307.00	261.00	246.00
25	104	38	20	387.00	329.00	310.00	392.00	333.00	314.00

46150.3-SC / 46151.3-SC

TuffCut® XR

Torusfräser

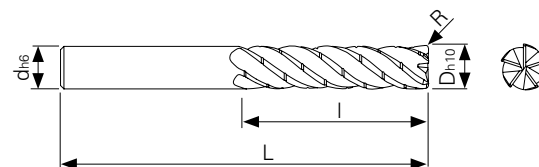
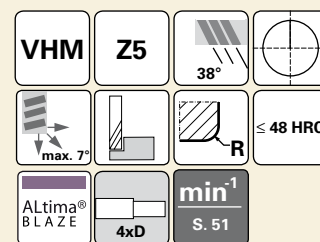
Spilt-Cut

5-lippig

Fraise en bout torique

Spilt-Cut

5 dents



V5LCB

D x R	L	I	d	46150.3-SC Spilt-Cut zyl. Schaft / queue cylindrique			46151.3-SC Spilt-Cut Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
6xR0,5	75	24	6	65.70	55.80	52.60	—	—	—
8xR0,5	75	32	8	85.00	72.30	68.00	87.20	74.10	69.80
10xR0,5	90	40	10	118.00	100.00	94.40	122.00	104.00	97.60

D x R	L	I	d	46150.3-SC Spilt-Cut zyl. Schaft / queue cylindrique			46151.3-SC Spilt-Cut Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
12xR0,5	100	48	12	164.00	139.00	131.00	169.00	144.00	135.00
16xR0,5	120	64	16	267.00	227.00	214.00	272.00	231.00	218.00

46160.3 / 46161.3

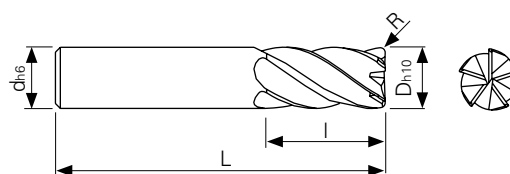
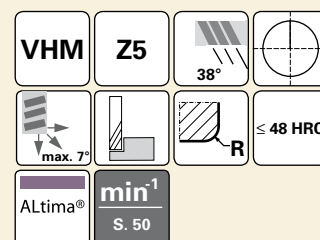
TuffCut® XR

Torusfräser

5-lippig

Fraise en bout torique

5 dents



178R

D x R	L	I	d	46160.3 zyl. Schaft / queue cylindrique			46161.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
6xR0,5	57	13	6	35.80	30.40	28.60	39.00	33.20	31.20
8xR0,5	63	19	8	44.50	37.80	35.60	47.60	40.50	38.10
10xR0,5	72	22	10	72.80	61.90	58.20	76.10	64.70	60.90
12xR0,75	83	26	12	89.20	75.80	71.40	92.50	78.60	74.00
14xR0,75	83	26	14	138.00	117.00	110.00	142.00	121.00	114.00

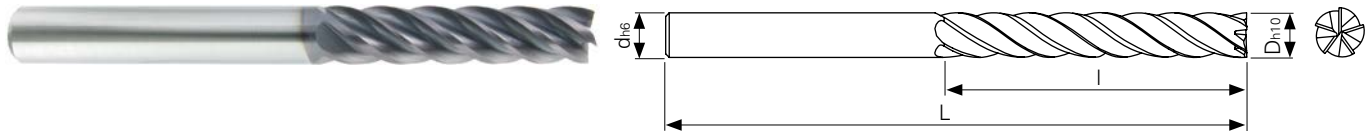
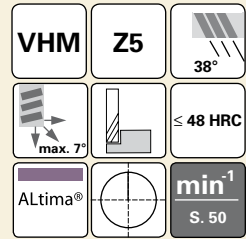
D x R	L	I	d	46160.3 zyl. Schaft / queue cylindrique			46161.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
16xR1,0	92	32	16	156.00	133.00	125.00	161.00	137.00	129.00
18xR1,0	92	32	18	229.00	195.00	183.00	235.00	200.00	188.00
20xR1,0	104	38	20	318.00	270.00	254.00	322.00	274.00	258.00
25xR1,0	104	38	25	409.00	348.00	327.00	413.00	351.00	330.00

46162.3 / 46163.3**TuffCut® XR****Schaftfräser****extra lange Schneide**

5-lippig

Fraise en bout**coupe extra longue**

5 dents

**178-1**

D	L	I	d	46162.3 zyl. Schaft / queue cylindrique			46163.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	75	25	3	62.00	52.70	49.60	–	–	–
4	75	25	4	55.60	47.30	44.50	–	–	–
5	75	25	5	49.20	41.80	39.40	–	–	–
6	75	25	6	52.40	44.50	41.90	55.60	47.30	44.50
8	75	30	8	69.50	59.10	55.60	72.70	61.80	58.20

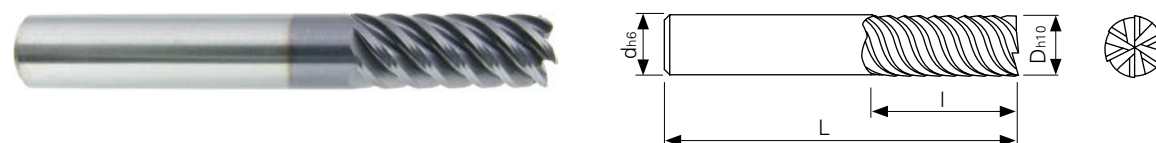
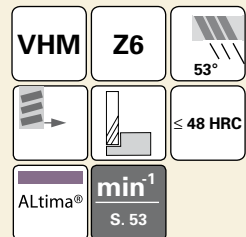
D	L	I	d	46162.3 zyl. Schaft / queue cylindrique			46163.3 Weldon		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	100	45	10	105.00	89.30	84.00	109.00	92.70	87.20
12	150	75	12	141.00	120.00	113.00	144.00	122.00	115.00
16	150	75	16	239.00	203.00	191.00	243.00	207.00	194.00
20	150	75	20	452.00	384.00	362.00	456.00	388.00	365.00

46166.3**TuffCut® XR****Schaftfräser**

6-lippig

Fraise en bout

6 dents

**113A**

D	L	I	d	46166.3 zyl. Schaft / queue cylindrique		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
3	38	12	3	25.80	21.90	20.60
4	51	14	4	36.10	30.70	28.90
5	51	20	5	38.30	32.60	30.60
6	64	20	6	43.80	37.20	35.00
8	64	20	8	53.10	45.10	42.50

D	L	I	d	46166.3 zyl. Schaft / queue cylindrique		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
10	70	25	10	89.70	76.20	71.80
12	76	25	12	109.00	92.70	87.20
16	89	30	16	190.00	162.00	152.00
20	102	38	20	345.00	293.00	276.00

46170.3 / 46171.3

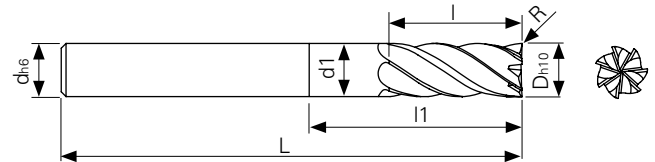
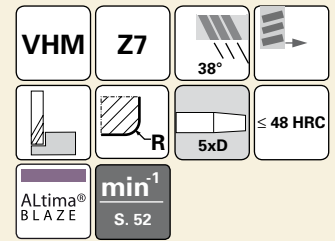
TuffCut® XR

Torusfräser

5xD abgesetzter Schaft
7-lippig

Fraise en bout torique

5xD queue dégaagée
7 dents



180R N5

D x R	L	l	l1	d1	d	46170.3 zyl. Schaft / queue cylindrique			46171.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
						-15%	-20%	-20%	-15%	-20%	-20%
12xR1,0	120	30	60	11,4	12	110.00	93.50	88.00	117.00	99.50	93.60
12xR2,0	120	30	60	11,4	12	110.00	93.50	88.00	117.00	99.50	93.60
12xR3,0	120	30	60	11,4	12	110.00	93.50	88.00	117.00	99.50	93.60
12xR4,0	120	30	60	11,4	12	110.00	93.50	88.00	117.00	99.50	93.60
16xR1,0	150	40	80	15,2	16	327.00	278.00	262.00	338.00	287.00	270.00
16xR2,0	150	40	80	15,2	16	327.00	278.00	262.00	338.00	287.00	270.00

D x R	L	l	l1	d1	d	46170.3 zyl. Schaft / queue cylindrique			46171.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
						-15%	-20%	-20%	-15%	-20%	-20%
16xR3,0	150	40	80	15,2	16	327.00	278.00	262.00	338.00	287.00	270.00
16xR4,0	150	40	80	15,2	16	327.00	278.00	262.00	338.00	287.00	270.00
20xR1,0	150	50	100	19,2	20	427.00	363.00	342.00	438.00	372.00	350.00
20xR2,0	150	50	100	19,2	20	427.00	363.00	342.00	438.00	372.00	350.00
20xR3,0	150	50	100	19,2	20	427.00	363.00	342.00	438.00	372.00	350.00
20xR4,0	150	50	100	19,2	20	427.00	363.00	342.00	438.00	372.00	350.00

46172.3 / 46172.3-SC (Split-Cut) / 46173.3/ 46173.3-SC (Split-Cut)

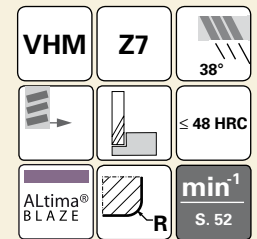
TuffCut® XR

Torusfräser

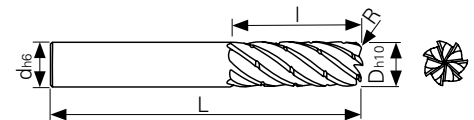
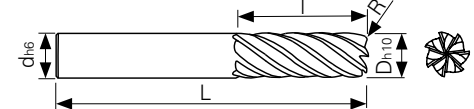
7-lippig

Fraise en bout torique

7 dents



46172.3-SC Split-Cut



180R

D x R	L	l	d	46172.3 zyl. Schaft / queue cylindrique			46172.3-SC Split-Cut zyl. Schaft / queue cylindrique			46173.3 Weldon			46173.3-SC Split-Cut Weldon		
				1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
				-15%	-20%	-20%	-15%	-20%	-20%	-15%	-20%	-20%	-15%	-20%	-20%
6xR0,5	57	13	6	43.30	36.80	34.60	58.40	49.60	46.70	-	-	-	-	-	-
8xR0,5	63	19	8	51.00	43.40	40.80	67.50	57.40	54.00	-	-	-	-	-	-
10xR0,5	72	22	10	71.30	60.60	57.00	88.20	75.00	70.60	-	-	-	95.40	81.10	76.30
12xR0,5	84	32	12	106.00	90.10	84.80	123.00	105.00	98.40	110.00	93.50	88.00	131.00	111.00	105.00
12xR1,0	84	32	12	106.00	90.10	84.80	-	-	-	110.00	93.50	88.00	-	-	-
12xR2,0	84	32	12	106.00	90.10	84.80	-	-	-	110.00	93.50	88.00	-	-	-
12xR3,0	84	32	12	106.00	90.10	84.80	-	-	-	110.00	93.50	88.00	-	-	-
12xR4,0	84	32	12	106.00	90.10	84.80	-	-	-	110.00	93.50	88.00	-	-	-
16xR0,5	92	42	16	186.00	158.00	149.00	200.00	170.00	160.00	191.00	162.00	153.00	206.00	175.00	165.00
16xR1,0	92	42	16	186.00	158.00	149.00	-	-	-	191.00	162.00	153.00	-	-	-
16xR2,0	92	42	16	186.00	158.00	149.00	-	-	-	191.00	162.00	153.00	-	-	-
16xR3,0	92	42	16	186.00	158.00	149.00	-	-	-	191.00	162.00	153.00	-	-	-
16xR4,0	92	42	16	186.00	158.00	149.00	-	-	-	191.00	162.00	153.00	-	-	-
20xR0,5	102	52	20	309.00	263.00	247.00	313.00	266.00	250.00	313.00	266.00	250.00	317.00	269.00	254.00
20xR1,0	102	52	20	309.00	263.00	247.00	-	-	-	313.00	266.00	250.00	-	-	-
20xR2,0	102	52	20	309.00	263.00	247.00	-	-	-	313.00	266.00	250.00	-	-	-
20xR3,0	102	52	20	309.00	263.00	247.00	-	-	-	313.00	266.00	250.00	-	-	-
20xR4,0	102	52	20	309.00	263.00	247.00	-	-	-	313.00	266.00	250.00	-	-	-

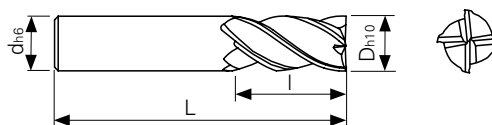
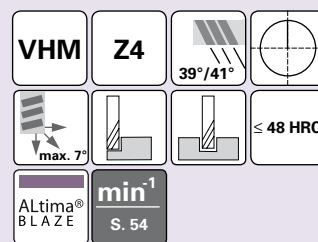
46410.3 / 46411.3

TuffCut® XT

Schaftfräser

Stainless

Fraise en bout



277

D	L	I	d	46410.3 zyl. Schaft / queue cylindrique			46411.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	57	8	6	41.30	35.10	33.00	-	-	-
4	57	11	6	41.30	35.10	33.00	-	-	-
5	57	13	6	39.30	33.40	31.40	-	-	-
6	57	13	6	38.80	33.00	31.00	42.00	35.70	33.60
8	63	19	8	48.10	40.90	38.50	51.20	43.50	41.00

D	L	I	d	46410.3 zyl. Schaft / queue cylindrique			46411.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	72	22	10	78.90	67.10	63.10	82.10	69.80	65.70
12	83	26	12	96.80	82.30	77.40	101.00	85.90	80.80
16	92	32	16	168.00	143.00	134.00	172.00	146.00	138.00
20	104	38	20	344.00	292.00	275.00	348.00	296.00	278.00

46412.3 / 46413.3

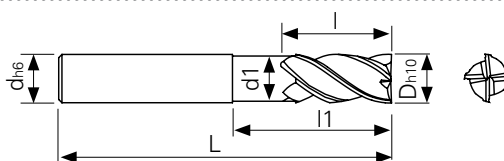
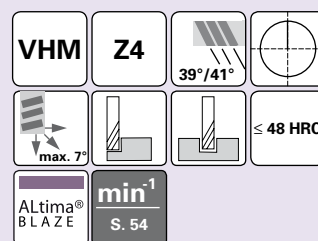
TuffCut® XT

Schaftfräser

abgesetzter Schaft

Fraise en bout

queue dégagée



277 N3

D	L	I	I1	d1	d	46412.3 zyl. Schaft / queue cylindrique			46413.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	57	8	10	2,9	6	45.50	38.70	36.40	-	-	-
4	57	11	12	3,9	6	45.50	38.70	36.40	-	-	-
5	57	13	16	4,9	6	43.60	37.10	34.90	-	-	-
6	57	13	22	5,8	6	43.10	36.60	34.50	46.20	39.30	37.00
8	63	19	28	7,8	8	52.30	44.50	41.80	55.50	47.20	44.40

D	L	I	I1	d1	d	46412.3 zyl. Schaft / queue cylindrique			46413.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	72	22	31	9,8	10	84.30	71.70	67.40	87.40	74.30	69.90
12	83	26	38	11,6	12	102.00	86.70	81.60	106.00	90.10	84.80
16	92	32	44	15,6	16	-	-	-	179.00	152.00	143.00
20	104	38	55	19,6	20	-	-	-	355.00	302.00	284.00

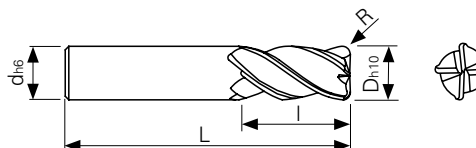
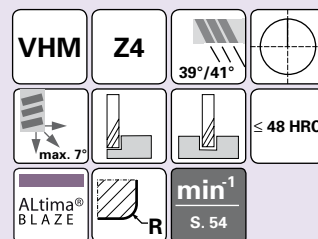
46420.3 / 46421.3

TuffCut® XT

Torusfräser

Stainless

Fraise en bout torique



277R

D x R	L	I	d	46420.3 zyl. Schaft / queue cylindrique			46421.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,25	57	8	6	47.40	40.30	37.90	-	-	-
4xR0,25	57	11	6	47.40	40.30	37.90	-	-	-
5xR0,25	57	13	6	41.30	35.10	33.00	-	-	-
6xR0,25	57	13	6	40.90	34.80	32.70	44.00	37.40	35.20
8xR0,80	63	19	8	50.60	43.00	40.50	53.80	45.70	43.00

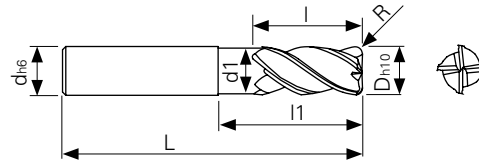
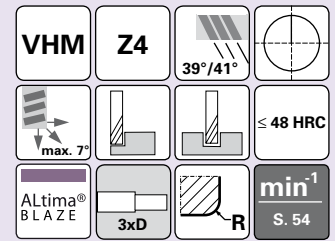
D x R	L	I	d	46420.3 zyl. Schaft / queue cylindrique			46421.3 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR0,8	72	22	10	82.90	70.50	66.30	86.10	73.20	68.90
12xR0,8	83	26	12	102.00	86.70	81.60	106.00	90.10	84.80
12xR3,0	83	26	12	102.00	86.70	81.60	106.00	90.10	84.80
16xR0,8	92	32	16	177.00	150.00	142.00	181.00	154.00	145.00
20xR0,8	104	38	20	363.00	309.00	290.00	367.00	312.00	294.00

46422.3 / 46423.3**TuffCut® XT****Torusfräser**

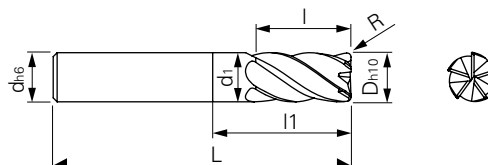
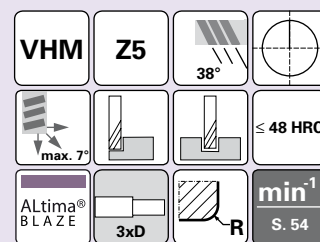
3xD abgesetzter Schaft

Stainless**Fraise en bout torique**

3xD queue dégagée

**277NR**

D x R	L	l	l1	d1	d	46422.3 zyl. Schaft / queue cylindrique			46423.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0.25	64	8	11	2.9	6	43.30	36.80	34.60	—	—	—
3xR0.3	64	8	11	2.9	6	43.30	36.80	34.60	—	—	—
3xR0.5	64	8	11	2.9	6	43.30	36.80	34.60	—	—	—
4xR0.25	64	11	14	3.9	6	43.30	36.80	34.60	—	—	—
4xR0.3	64	11	14	3.9	6	43.30	36.80	34.60	—	—	—
4xR0.5	64	11	14	3.9	6	43.30	36.80	34.60	—	—	—
5xR0.25	64	13	17	4.9	6	43.30	36.80	34.60	—	—	—
5xR0.3	64	13	17	4.9	6	43.30	36.80	34.60	—	—	—
5xR0.5	64	13	17	4.9	6	43.30	36.80	34.60	—	—	—
6xR0.25	64	13	20	5.9	6	43.30	36.80	34.60	46.50	39.50	37.20
6xR0.3	64	13	20	5.9	6	43.30	36.80	34.60	46.50	39.50	37.20
6xR0.5	64	13	20	5.9	6	43.30	36.80	34.60	46.50	39.50	37.20
6xR1.0	64	13	20	5.9	6	43.30	36.80	34.60	46.50	39.50	37.20
6xR1.5	64	13	20	5.9	6	43.30	36.80	34.60	46.50	39.50	37.20
6xR2.0	64	13	20	5.9	6	43.30	36.80	34.60	46.50	39.50	37.20
8xR0.5	64	19	26	7.8	8	53.70	45.60	43.00	56.90	48.40	45.50
8xR1.0	64	19	26	7.8	8	53.70	45.60	43.00	56.90	48.40	45.50
8xR1.5	64	19	26	7.8	8	53.70	45.60	43.00	56.90	48.40	45.50
8xR2.0	64	19	26	7.8	8	53.70	45.60	43.00	56.90	48.40	45.50
8xR3.0	64	19	26	7.8	8	53.70	45.60	43.00	56.90	48.40	45.50
10xR0.5	73	22	32	9.8	10	88.10	74.90	70.50	92.30	78.50	73.80
10xR1.0	73	22	32	9.8	10	88.10	74.90	70.50	92.30	78.50	73.80
10xR1.5	73	22	32	9.8	10	88.10	74.90	70.50	92.30	78.50	73.80
10xR2.0	73	22	32	9.8	10	88.10	74.90	70.50	92.30	78.50	73.80
10xR3.0	73	22	32	9.8	10	88.10	74.90	70.50	92.30	78.50	73.80
12xR0.5	84	26	38	11.4	12	116.00	98.60	92.80	121.00	103.00	96.80
12xR1.0	84	26	38	11.4	12	116.00	98.60	92.80	121.00	103.00	96.80
12xR1.5	84	26	38	11.4	12	116.00	98.60	92.80	121.00	103.00	96.80
12xR2.0	84	26	38	11.4	12	116.00	98.60	92.80	121.00	103.00	96.80
12xR2.5	84	26	38	11.4	12	116.00	98.60	92.80	121.00	103.00	96.80
12xR3.0	84	26	38	11.4	12	116.00	98.60	92.80	121.00	103.00	96.80
12xR4.0	84	26	38	11.4	12	116.00	98.60	92.80	121.00	103.00	96.80
16xR0.5	100	32	50	15.2	16	198.00	168.00	158.00	202.00	172.00	162.00
16xR1.0	100	32	50	15.2	16	198.00	168.00	158.00	202.00	172.00	162.00
16xR1.5	100	32	50	15.2	16	198.00	168.00	158.00	202.00	172.00	162.00
16xR2.0	100	32	50	15.2	16	198.00	168.00	158.00	202.00	172.00	162.00
16xR3.0	100	32	50	15.2	16	198.00	168.00	158.00	202.00	172.00	162.00
16xR4.0	100	32	50	15.2	16	198.00	168.00	158.00	202.00	172.00	162.00
20xR1.0	112	50	62	19.2	20	404.00	343.00	323.00	409.00	348.00	327.00
20xR1.5	112	50	62	19.2	20	404.00	343.00	323.00	409.00	348.00	327.00
20xR2.0	112	50	62	19.2	20	404.00	343.00	323.00	409.00	348.00	327.00
20xR3.0	112	40	62	19.2	20	404.00	343.00	323.00	409.00	348.00	327.00
20xR4.0	112	40	62	19.2	20	404.00	343.00	323.00	409.00	348.00	327.00
20xR5.0	112	40	62	19.2	20	404.00	343.00	323.00	409.00	348.00	327.00
20xR6.0	112	40	62	19.2	20	404.00	343.00	323.00	409.00	348.00	327.00

46460.3 / 46461.3**TuffCut® XT****Torusfräser**5-lippig
3xD abgesetzter Schaft**Stainless****Fraise en bout torique**5 dents
3xD queue dégagée**278R N3**

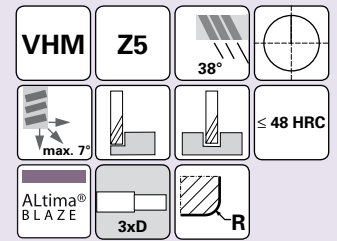
D x R	L	l	l1	d1	d	46460.3 zyl. Schaft / queue cylindrique			46461.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,25	57	8	10	2.9	6	49.50	42.10	39.60	—	—	—
3xR0,5	57	8	10	2.9	6	49.50	42.10	39.60	—	—	—
4xR0,25	57	11	13	3.9	6	49.50	42.10	39.60	—	—	—
4xR0,5	57	11	13	3.9	6	49.50	42.10	39.60	—	—	—
5xR0,25	57	13	16	4.9	6	43.20	36.70	34.60	46.40	39.40	37.10
5xR0,5	57	13	16	4.9	6	43.20	36.70	34.60	—	—	—
6xR0,25	57	13	19	5.9	6	42.60	36.20	34.10	45.80	38.90	36.60
6xR0,5	57	13	19	5.9	6	42.60	36.20	34.10	45.80	38.90	36.60
6xR1,0	57	13	19	5.9	6	42.60	36.20	34.10	45.80	38.90	36.60
8xR0,25	63	19	25	7.8	8	52.90	45.00	42.30	56.10	47.70	44.90
8xR0,5	63	19	25	7.8	8	52.90	45.00	42.30	56.10	47.70	44.90
8xR1,0	63	19	25	7.8	8	52.90	45.00	42.30	56.10	47.70	44.90
8xR1,5	63	19	25	7.8	8	54.10	46.00	43.30	57.30	48.70	45.80
8xR2,0	63	19	25	7.8	8	54.10	46.00	43.30	57.30	48.70	45.80
10xR0,5	72	22	31	9.8	10	86.80	73.80	69.40	89.90	76.40	71.90
10xR1,0	72	22	31	9.8	10	86.80	73.80	69.40	89.90	76.40	71.90
10xR2,0	72	22	31	9.8	10	86.80	73.80	69.40	89.90	76.40	71.90
12xR0,5	84	26	38	11.4	12	114.00	96.90	91.20	118.00	100.00	94.40
12xR1,0	84	26	38	11.4	12	114.00	96.90	91.20	118.00	100.00	94.40
12xR1,5	84	26	38	11.4	12	114.00	96.90	91.20	118.00	100.00	94.40
12xR2,5	84	26	38	11.4	12	114.00	96.90	91.20	118.00	100.00	94.40
12xR3,0	84	26	38	11.4	12	114.00	96.90	91.20	118.00	100.00	94.40
12xR4,0	84	26	38	11.4	12	114.00	96.90	91.20	118.00	100.00	94.40
16xR0,5	100	35	50	15.2	16	194.00	165.00	155.00	199.00	169.00	159.00
16xR1,0	100	35	50	15.2	16	194.00	165.00	155.00	199.00	169.00	159.00
16xR1,5	100	35	50	15.2	16	194.00	165.00	155.00	199.00	169.00	159.00
16xR2,5	100	35	50	15.2	16	194.00	165.00	155.00	199.00	169.00	159.00
16xR3,0	100	35	50	15.2	16	194.00	165.00	155.00	199.00	169.00	159.00
16xR4,0	100	35	50	15.2	16	194.00	165.00	155.00	199.00	169.00	159.00
20xR1,0	112	40	62	19.2	20	398.00	338.00	318.00	402.00	342.00	322.00
20xR3,0	112	40	62	19.2	20	398.00	338.00	318.00	402.00	342.00	322.00
20xR4,0	112	40	62	19.2	20	398.00	338.00	318.00	402.00	342.00	322.00

46460.3-SC (Split-Cut)**TuffCut® XT
Torusfräser**

5-lippig
3xD abgesetzter Schaft

Stainless**Fraise en bout torique**

5 dents
3xD queue dégagée

**278R N3**

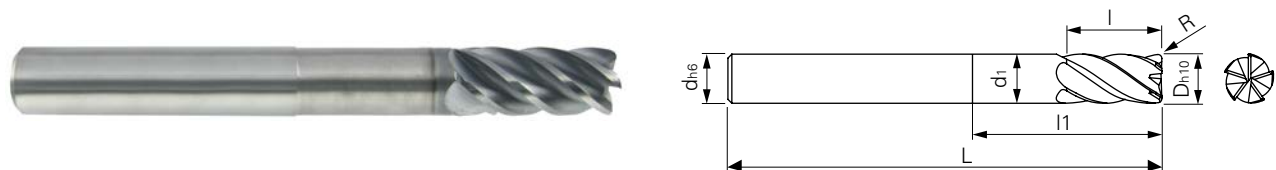
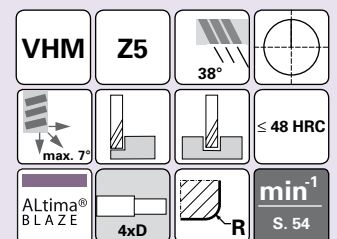
D x R	L	l	l1	d1	d	46460.3-SC Split-Cut zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12xR0,5	84	26	38	11.4	12	150.00	128.00	120.00
16xR0,5	100	35	50	15.2	16	218.00	185.00	174.00

46470.3 / 46471.3**TuffCut® XT
Torusfräser**

5-lippig
4xD abgesetzter Schaft

Stainless**Fraise en bout torique**

5 dents
4xD queue dégagée

**278R N4**

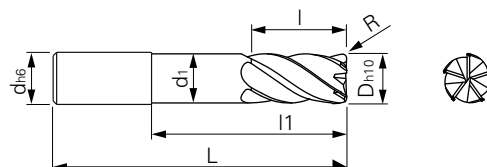
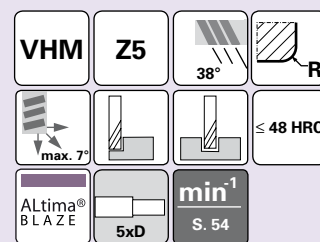
D x R	L	l	l1	d1	d	46470.3 zyl. Schaft / queue cylindrique			46471.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12xR0,5	100	18	50	11.4	12	157.00	133.00	126.00	161.00	137.00	129.00
12xR1,0	100	18	50	11.4	12	157.00	133.00	126.00	161.00	137.00	129.00
12xR1,5	100	18	50	11.4	12	157.00	133.00	126.00	161.00	137.00	129.00
12xR2,0	100	18	50	11.4	12	157.00	133.00	126.00	161.00	137.00	129.00
12xR3,0	100	18	50	11.4	12	157.00	133.00	126.00	161.00	137.00	129.00
12xR4,0	100	18	50	11.4	12	157.00	133.00	126.00	161.00	137.00	129.00
16xR1,0	120	35	65	15.6	16	281.00	239.00	225.00	285.00	242.00	228.00
16xR3,0	120	35	65	15.6	16	281.00	239.00	225.00	285.00	242.00	228.00
20xR1,0	133	40	82	19.6	20	481.00	409.00	385.00	485.00	412.00	388.00
20xR3,0	133	40	82	19.6	20	481.00	409.00	385.00	485.00	412.00	388.00
25xR1,0	152	40	102	24.6	25	662.00	563.00	530.00	666.00	566.00	533.00
25xR3,0	152	40	102	24.6	25	662.00	563.00	530.00	666.00	566.00	533.00

46480.3 / 46481.3**TuffCut® XT****Torusfräser**

5-lippig
5xD abgesetzter Schaft

Stainless**Fraise en bout torique**

5 dents
5xD queue dégagée

**278R N5**

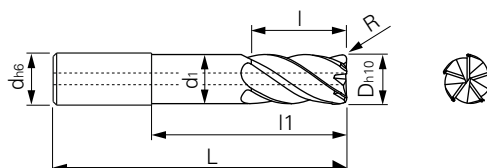
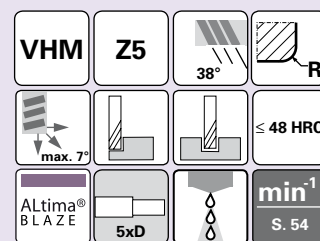
D x R	L	l	l ₁	d ₁	d	46480.3 zyl. Schaft / queue cylindrique			46481.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
16.0xR1,0	133	40	82	15.6	16	424.00	360.00	339.00	428.00	364.00	342.00
16.0xR3,0	133	40	82	15.6	16	424.00	360.00	339.00	428.00	364.00	342.00
20.0xR1,0	152	40	102	19.6	20	555.00	472.00	444.00	559.00	475.00	447.00
20.0xR3,0	152	40	102	19.6	20	555.00	472.00	444.00	559.00	475.00	447.00
25.0xR1,0	180	40	125	24.6	25	788.00	670.00	630.00	792.00	673.00	634.00
25.0xR3,0	180	40	125	24.6	25	788.00	670.00	630.00	792.00	673.00	634.00

46484.3 / 46485.3**TuffCut® XT****Torusfräser mit IK**

5-lippig
5xD abgesetzter Schaft

Stainless**Fraise en bout torique**

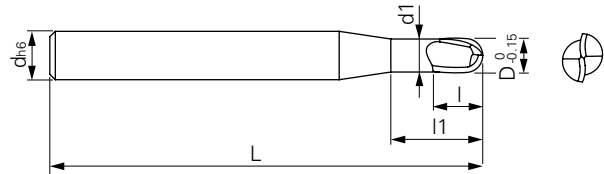
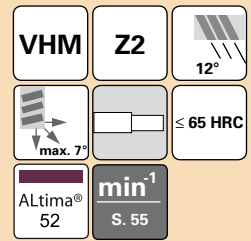
5 dents
5xD queue dégagée

**278R N5CT**

D x R	L	l	l ₁	d ₁	d	46484.3 zyl. Schaft / queue cylindrique			46485.3 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12.0xR0,5	110	18	62	11.4	12	233.00	198.00	186.00	237.00	201.00	190.00
12.0xR1,0	110	18	62	11.4	12	233.00	198.00	186.00	237.00	201.00	190.00
12.0xR1,5	110	18	62	11.4	12	233.00	198.00	186.00	237.00	201.00	190.00
12.0xR2,0	110	18	62	11.4	12	233.00	198.00	186.00	237.00	201.00	190.00
12.0xR3,0	110	18	62	11.4	12	233.00	198.00	186.00	237.00	201.00	190.00

46860.4**TuffCut® DM****Radiusfräser**

Die & Mould

Fraise hémisphérique**156**

D x l1	L	l	l1	d1	d	46860.4 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
0,5x1	50	0,35	1	0,47	4	84.40	71.70	67.50
0,5x2	50	0,35	2	0,47	4	85.20	72.40	68.20
0,5x3	50	0,35	3	0,47	4	86.00	73.10	68.80
0,5x4	50	0,35	4	0,47	4	86.90	73.90	69.50
0,5x5	50	0,35	5	0,47	4	87.80	74.60	70.20
0,5x6	50	0,35	6	0,47	4	88.60	75.30	70.90
0,6x2	50	0,4	2	0,57	4	56.70	48.20	45.40
0,6x4	50	0,4	4	0,57	4	59.10	50.20	47.30
0,6x6	50	0,4	6	0,57	4	61.30	52.10	49.00
0,6x8	50	0,4	8	0,57	4	63.60	54.10	50.90
0,6x10	50	0,4	10	0,57	4	65.90	56.00	52.70
0,8x2	50	0,5	2	0,77	4	56.80	48.30	45.40
0,8x4	50	0,5	4	0,77	4	59.10	50.20	47.30
0,8x6	50	0,5	6	0,77	4	61.30	52.10	49.00
0,8x8	50	0,5	8	0,77	4	63.60	54.10	50.90
0,8x10	50	0,5	10	0,77	4	65.90	56.00	52.70
1,0x2	50	0,8	2	0,96	4	54.70	46.50	43.80
1,0x3	50	0,8	3	0,96	4	55.30	47.00	44.20
1,0x4	50	0,8	4	0,96	4	55.80	47.40	44.60
1,0x6	50	0,8	6	0,96	4	56.90	48.40	45.50
1,0x10	50	0,8	10	0,96	4	59.10	50.20	47.30
1,0x12	63	0,8	12	0,96	4	60.20	51.20	48.20
1,0x14	63	0,8	14	0,96	4	61.20	52.00	49.00
1,0x16	63	0,8	16	0,96	4	62.40	53.00	49.90
1,0x18	63	0,8	18	0,96	4	63.40	53.90	50.70
1,0x20	63	0,8	20	0,96	4	64.60	54.90	51.70
1,2x8	50	1,1	8	1,15	4	79.00	67.20	63.20
1,2x12	63	1,1	12	1,15	4	85.30	72.50	68.20
1,4x8	50	1,3	8	1,34	4	85.10	72.30	68.10
1,4x12	63	1,3	12	1,34	4	91.90	78.10	73.50
1,4x16	63	1,3	16	1,34	4	98.70	83.90	79.00
1,5x4	50	1,35	4	1,44	4	55.50	47.20	44.40
1,5x8	50	1,35	8	1,44	4	57.70	49.00	46.20
1,5x16	63	1,35	16	1,44	4	62.20	52.90	49.80
1,5x20	63	1,35	20	1,44	4	64.40	54.70	51.50
1,6x8	50	1,4	8	1,54	4	85.10	72.30	68.10
1,6x12	63	1,4	12	1,54	4	88.50	75.20	70.80
1,6x16	63	1,4	16	1,54	4	91.90	78.10	73.50
1,6x20	63	1,4	20	1,54	4	95.30	81.00	76.20

D x l1	L	l	l1	d1	d	46860.4 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1,8x8	50	1,6	8	1,73	4	85.10	72.30	68.10
1,8x12	63	1,6	12	1,73	4	88.50	75.20	70.80
1,8x16	63	1,6	16	1,73	4	91.90	78.10	73.50
1,8x20	63	1,6	20	1,73	4	95.30	81.00	76.20
2,0x3	50	1,7	3	1,92	4	54.70	46.50	43.80
2,0x4	50	1,7	4	1,92	4	55.30	47.00	44.20
2,0x6	50	1,7	6	1,92	4	56.30	47.90	45.00
2,0x8	50	1,7	8	1,92	4	57.50	48.90	46.00
2,0x10	50	1,7	10	1,92	4	58.60	49.80	46.90
2,0x12	63	1,7	12	1,92	4	59.60	50.70	47.70
2,0x16	63	1,7	16	1,92	4	61.80	52.50	49.40
2,0x20	63	1,7	20	1,92	4	64.00	54.40	51.20
2,0x25	80	1,7	25	1,92	4	66.70	56.70	53.40
2,0x30	80	1,7	30	1,92	4	69.50	59.10	55.60
2,0x35	80	1,7	35	1,92	4	72.20	61.40	57.80
2,0x40	80	1,7	40	1,92	4	75.00	63.80	60.00
3,0x8	75	2,5	8	2,88	6	59.60	50.70	47.70
3,0x10	75	2,5	10	2,88	6	60.80	51.70	48.60
3,0x16	75	2,5	16	2,88	6	64.40	54.70	51.50
3,0x25	75	2,5	25	2,88	6	69.70	59.20	55.80
3,0x30	75	2,5	30	2,88	6	72.80	61.90	58.20
3,0x35	75	2,5	35	2,88	6	75.70	64.30	60.60
4,0x10	75	3	10	3,9	6	60.90	51.80	48.70
4,0x16	75	3	16	3,9	6	68.20	58.00	54.60
4,0x25	75	3	25	3,9	6	79.10	67.20	63.30
4,0x35	75	3	35	3,9	6	91.40	77.70	73.10
4,0x40	75	3	40	3,9	6	97.40	82.80	77.90
4,0x50	100	3	50	3,9	6	109.00	92.70	87.20
5,0x25	75	3,5	25	4,9	6	142.00	121.00	114.00
5,0x40	75	3,5	40	4,9	6	184.00	156.00	147.00
6,0x30	75	4,5	30	5,9	6	102.00	86.70	81.60
6,0x50	100	4,5	50	5,9	6	142.00	121.00	114.00
8,0x30	102	5,5	30	7,9	8	126.00	107.00	101.00
8,0x50	102	5,5	50	7,9	8	144.00	122.00	115.00
10,0x30	102	6,5	30	9,9	10	142.00	121.00	114.00
10,0x50	102	6,5	50	9,9	10	156.00	133.00	125.00
12,0x30	102	7,5	30	11,9	12	177.00	150.00	142.00
12,0x50	102	7,5	50	11,9	12	204.00	173.00	163.00

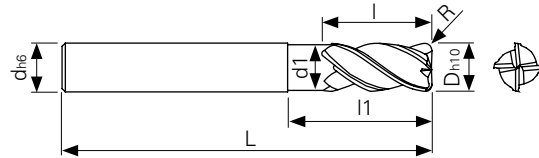
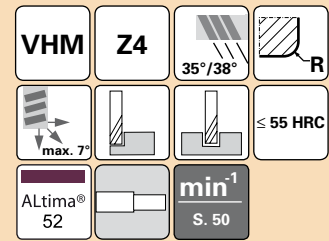
46872.4
TuffCut® DM
Torusfräser

3xD abgesetzter Schaft

Die & Mould

Fraise en bout torique

3xD queue dégagée

**177x**

D x R	L	l	l1	d1	d	46872.4 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1xR0,2	50	1	3	0,9	4	53.50	45.50	42.80
1xR0,3	50	1	3	0,9	4	53.50	45.50	42.80
2xR0,2	50	2	6	1,9	4	45.40	38.60	36.30
2xR0,3	50	2	6	1,9	4	45.40	38.60	36.30
3xR0,2	50	3	9	2,9	6	66.20	56.30	53.00
3xR0,3	50	3	9	2,9	6	66.20	56.30	53.00
3xR0,5	50	3	9	2,9	6	66.20	56.30	53.00
4xR0,2	50	4	12	3,9	6	50.60	43.00	40.50
4xR0,3	50	4	12	3,9	6	50.60	43.00	40.50
4xR0,5	50	4	12	3,9	6	50.60	43.00	40.50
5xR0,2	57	5	15	4,9	6	39.10	33.20	31.30
5xR0,3	57	5	15	4,9	6	39.10	33.20	31.30
5xR0,5	57	5	15	4,9	6	39.10	33.20	31.30

D x R	L	l	l1	d1	d	46872.4 zyl. Schaft / queue cylindrique		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6xR0,2	57	6	18	5,8	6	39.80	33.80	31.80
6xR0,3	57	6	18	5,8	6	39.80	33.80	31.80
6xR0,5	57	6	18	5,8	6	39.80	33.80	31.80
6xR1,0	57	6	18	5,8	6	39.80	33.80	31.80
8xR0,2	63	8	24	7,8	8	49.40	42.00	39.50
8xR0,3	63	8	24	7,8	8	49.40	42.00	39.50
8xR0,5	63	8	24	7,8	8	49.40	42.00	39.50
8xR1,0	63	8	24	7,8	8	49.40	42.00	39.50
10xR0,5	72	10	30	9,8	10	84.40	71.70	67.50
10xR1,0	72	10	30	9,8	10	84.40	71.70	67.50
12xR0,5	83	12	36	11,6	12	100.00	85.00	80.00
12xR1,0	83	12	36	11,6	12	100.00	85.00	80.00

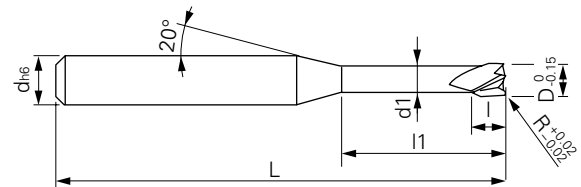
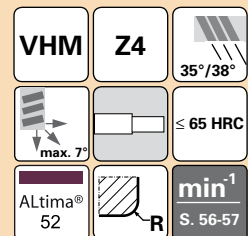
46876.4
TuffCut® DM
Torusfräser

3-5xD abgesetzter Schaft

Die & Mould

Fraise en bout torique

3-5xD queue dégagée

**158**

D x R	L	l	l1	d1	d	l1/D	46876.4 zyl. Schaft / queue cylindrique		
							1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,3	50	5	9	2,9	6	3xD	83.70	71.10	67.00
3xR0,3L	50	5	15	2,9	6	5xD	83.70	71.10	67.00
3xR0,8	50	5	15	2,9	6	5xD	83.70	71.10	67.00
6xR0,3	100	9	18	5,8	6	3xD	80.00	68.00	64.00
6xR0,3L	100	9	30	5,8	6	5xD	80.00	68.00	64.00
6xR1,5	100	9	30	5,8	6	5xD	80.00	68.00	64.00
8xR0,3	100	12	24	7,6	8	3xD	93.90	79.80	75.10
8xR0,3L	100	12	40	7,6	8	5xD	93.90	79.80	75.10
8xR2,0	100	12	40	7,6	8	5xD	93.90	79.80	75.10
10xR0,3	100	15	30	9,6	10	3xD	137.00	116.00	110.00

D x R	L	l	l1	d1	d	l1/D	46876.4 zyl. Schaft / queue cylindrique		
							1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR0,3L	100	15	50	9,6	10	5xD	137.00	116.00	110.00
10xR2,0	100	15	50	9,6	10	5xD	137.00	116.00	110.00
12xR0,3	100	18	36	11,4	12	3xD	161.00	137.00	129.00
12xR0,3L	130	18	60	11,4	12	5xD	209.00	178.00	167.00
12xR2,0	130	18	60	11,4	12	5xD	209.00	178.00	167.00
16xR0,3	130	24	48	15,2	16	3xD	306.00	260.00	245.00
16xR0,3L	150	24	80	15,2	16	5xD	312.00	265.00	250.00
16xR3,0	150	24	80	15,2	16	5xD	312.00	265.00	250.00
20xR0,3	150	30	100	19,2	20	5xD	579.00	492.00	463.00
20xR3,0	150	30	100	19,2	20	5xD	571.00	485.00	457.00

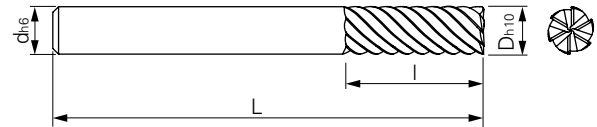
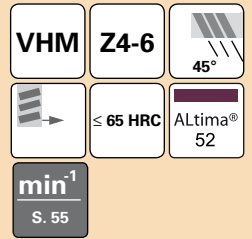
46890.4**TuffCut® DM**
Schaftfräser

4-6-lippig

Die & Mould

Fraise en bout

4-6 dents

**157**

D	L	l	d	Z	46890.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	75	9	6	4	86.40	73.40	69.10
4	75	12	6	4	86.40	73.40	69.10
5	90	15	6	4	86.40	73.40	69.10
6	90	15	6	6	86.40	73.40	69.10
8	100	20	8	6	108.00	91.80	86.40

D	L	l	d	Z	46890.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	100	25	10	6	147.00	125.00	118.00
12	100	30	12	6	192.00	163.00	154.00
16	150	40	16	6	405.00	344.00	324.00
20	150	45	20	6	496.00	422.00	397.00

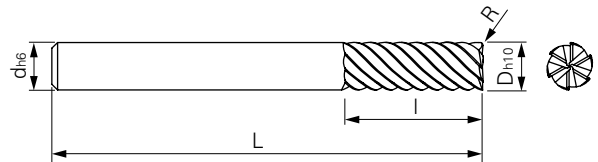
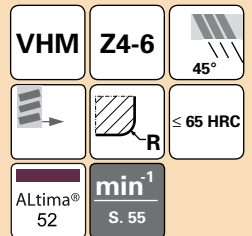
46894.4**TuffCut® DM**
Torusfräser

4-6-lippig

Die & Mould

Fraise en bout torique

4-6 dents

**157**

D x R	L	l	d	Z	46894.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,5	75	9	6	4	99.50	84.60	79.60
4xR0,5	75	12	6	4	99.50	84.60	79.60
5xR0,5	90	15	6	4	99.50	84.60	79.60
6xR0,5	90	15	6	6	99.50	84.60	79.60
6xR1,0	90	15	6	6	99.50	84.60	79.60
8xR0,5	100	20	8	6	126.00	107.00	101.00
8xR1,0	100	20	8	6	126.00	107.00	101.00
8xR2,0	100	20	8	6	126.00	107.00	101.00
10xR0,5	100	25	10	6	170.00	145.00	136.00
10xR1,0	100	25	10	6	170.00	145.00	136.00
10xR1,5	100	25	10	6	170.00	145.00	136.00

D x R	L	l	d	Z	46894.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR2,0	100	25	10	6	170.00	145.00	136.00
12xR0,5	100	30	12	6	221.00	188.00	177.00
12xR1,0	100	30	12	6	221.00	188.00	177.00
12xR1,5	100	30	12	6	221.00	188.00	177.00
12xR2,0	100	30	12	6	221.00	188.00	177.00
12xR3,0	100	30	12	6	221.00	188.00	177.00
16xR0,5	150	40	16	6	450.00	383.00	360.00
16xR1,0	150	40	16	6	450.00	383.00	360.00
16xR1,5	150	40	16	6	450.00	383.00	360.00
16xR2,0	150	40	16	6	450.00	383.00	360.00
16xR3,0	150	40	16	6	450.00	383.00	360.00

Fordern Sie unseren Sonderkatalog speziell für den Werkzeug- und Formenbau an.
Demandez notre catalogue pour la fabrication d'outillage et de moule spéciaux.

Vischer & Bolli
Werkzeug- und Spanntechnik



Zerspanungswerkzeuge für den **Werkzeug- und Formenbau**



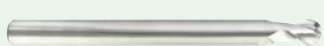
 **M.A. FORD®**
High Performance Cutting Tools

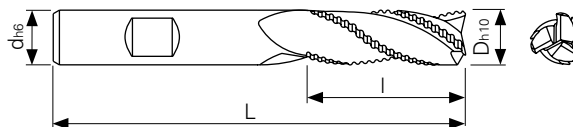
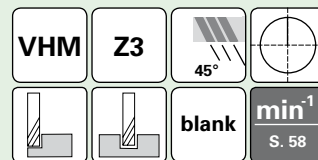
 **DIJET®**

TuffCut® X-AL

Aluminium


High-Performance Fräser / Fraise

Artikel-Nr. No. Art.		Durchmesser Diamètre	Zähne Dents	Eckradius Rayon	Absetzung Queue dégagée		Seite Page
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46912.0 46913.0		Ø 12 - 20	3	 R1,0			28
46922.0		Ø 3 - 16	2				29
46924.0		Ø 3 - 20	2	 R0,5 - 2,0			29
46926.0		Ø 3 - 8	2				30
46928.0		Ø 3 - 20	2	 R0,5 - 2,0			30
46942.0		Ø 3 - 16	2				31
46944.0		Ø 2 - 16	2				31
46950.0		Ø 3 - 20	3				32
46952.0		Ø 3 - 20	3	 R0,2 - 2,0			33
46954.0		Ø 3 - 20	3				34
46956.0		Ø 3 - 20	3	 R0,2 - 4,0			34
46958.0		Ø 3 - 20	3				35
46960.0		Ø 3 - 20	3	 R0,2 - 2,0			35
46970.0		Ø 6 - 20	3				36
46972.0		Ø 6 - 20	3	 R0,2 - 2,0			37
46962.0		Ø 3 - 16	3				38
46964.0		Ø 2 - 16	3				38

46910.0**TuffCut® X-AL****Schruppfräser****Aluminium****Fraise ébauche****134W**

D	L	I	d	46910.0 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6	64	20	6	42.40	36.00	33.90
8	64	20	8	43.60	37.10	34.90
10	70	25	10	79.70	67.70	63.80
12	76	25	12	96.10	81.70	76.90

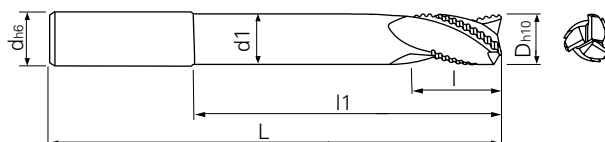
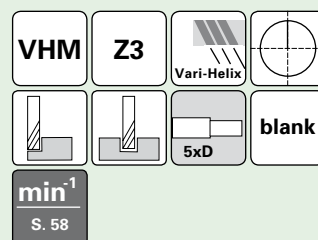
D	L	I	d	46910.0 Weldon		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
14	89	30	14	151.00	128.00	121.00
16	89	30	16	170.00	145.00	136.00
20	102	38	20	338.00	287.00	270.00
25	102	50	25	435.00	370.00	348.00

46912.0 / 46913.0**TuffCut® X-AL****Schruppfräser**

5xD abgesetzter Schaft

Aluminium**Fraise ébauche**

5xD queue dégagée

**137VR-N5**

D x R	L	I	I1	d1	d	46912.0 zyl. Schaft / queue cylindrique			46913.0 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12xR1,0	110	18	62	11,8	12	190.00	162.00	152.00	213.00	181.00	170.00
16xR1,0	130	24	82	15,8	16	208.00	177.00	166.00	234.00	199.00	187.00

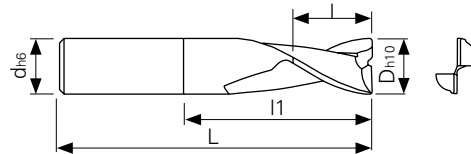
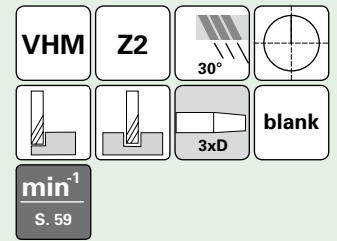
D x R	L	I	I1	d1	d	46912.0 zyl. Schaft / queue cylindrique			46913.0 Weldon		
						1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
20xR1,0	150	30	102	19,8	20	441.00	375.00	353.00	446.00	379.00	357.00

46922.0**TuffCut® X-AL****Schaftfräser**

3xD abgesetzter Schaft

Aluminium**Fraise en bout**

3xD queue dégagée

**135-N3**

D	L	l	l1	d	46922.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	38	3,5	11	3	24.50	20.80	19.60
4	51	4,8	14	4	32.80	27.90	26.20
5	64	6,0	17	6	42.80	36.40	34.20
6	64	7,0	20	6	46.20	39.30	37.00

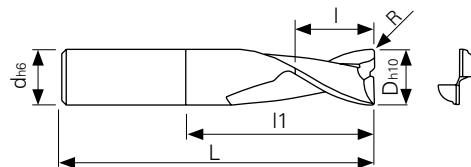
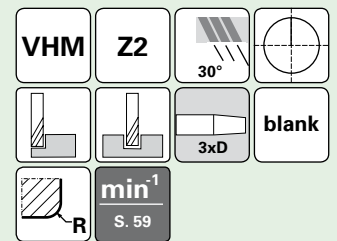
D	L	l	l1	d	46922.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
8	64	9,5	26	8	56.70	48.20	45.40
10	76	12,0	34	10	103.00	87.60	82.40
12	76	14,0	38	12	115.00	97.80	92.00
16	117	18,0	53	16	228.00	194.00	182.00

46924.0**TuffCut® X-AL****Torusfräser**

3xD abgesetzter Schaft

Aluminium**Fraise en bout torique**

3xD queue dégagée

**135-N3**

D x R	L	l	l1	d	46924.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,5	38	3,5	11	3	24.50	20.80	19.60
3xR1,0	38	3,5	11	3	24.50	20.80	19.60
4xR0,5	51	4,8	14	4	32.80	27.90	26.20
4xR1,0	51	4,8	14	4	32.80	27.90	26.20
5xR0,5	64	6,0	17	6	42.80	36.40	34.20
5xR1,0	64	6,0	17	6	42.80	36.40	34.20
6xR0,5	64	7,0	20	6	46.20	39.30	37.00
6xR1,0	64	7,0	20	6	46.20	39.30	37.00
6xR1,5	64	7,0	20	6	46.20	39.30	37.00
6xR2,0	64	7,0	20	6	46.20	39.30	37.00
8xR0,5	64	9,5	26	8	56.70	48.20	45.40
8xR1,0	64	9,5	26	8	56.70	48.20	45.40
8xR1,5	64	9,5	26	8	56.70	48.20	45.40
8xR2,0	64	9,5	26	8	56.70	48.20	45.40
10xR0,5	76	12,0	34	10	103.00	87.60	82.40
10xR1,0	76	12,0	34	10	103.00	87.60	82.40
10xR1,5	76	12,0	34	10	103.00	87.60	82.40
10xR2,0	76	12,0	34	10	103.00	87.60	82.40

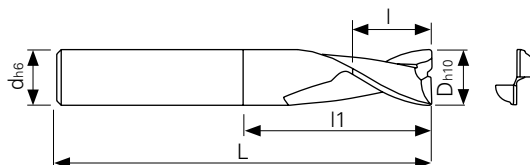
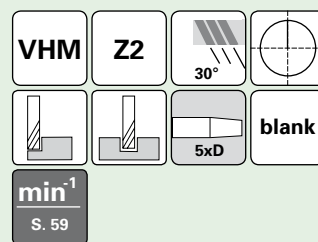
D x R	L	l	l1	d	46924.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR3,0	76	12,0	34	10	103.00	87.60	82.40
12xR0,5	76	14,0	38	12	115.00	97.80	92.00
12xR1,0	76	14,0	38	12	115.00	97.80	92.00
12xR1,5	76	14,0	38	12	115.00	97.80	92.00
12xR2,0	76	14,0	38	12	115.00	97.80	92.00
12xR3,0	76	14,0	38	12	115.00	97.80	92.00
12xR4,0	76	14,0	38	12	115.00	97.80	92.00
16xR0,5	117	18,0	53	16	228.00	194.00	182.00
16xR1,0	117	18,0	53	16	228.00	194.00	182.00
16xR1,5	117	18,0	53	16	228.00	194.00	182.00
16xR2,0	117	18,0	53	16	228.00	194.00	182.00
16xR3,0	117	18,0	53	16	228.00	194.00	182.00
16xR4,0	117	18,0	53	16	228.00	194.00	182.00
20xR0,5	127	22,0	65	20	467.00	397.00	374.00
20xR1,0	127	22,0	65	20	467.00	397.00	374.00
20xR1,5	127	22,0	65	20	467.00	397.00	374.00
20xR2,0	127	22,0	65	20	467.00	397.00	374.00
20xR3,0	127	22,0	65	20	467.00	397.00	374.00
20xR4,0	127	22,0	65	20	467.00	397.00	374.00

46926.0**TuffCut® X-AL****Schaftfräser**

5xD abgesetzter Schaft

Aluminium**Fraise en bout**

5xD queue dégagée

**135-N5**

D	L	l	l1	d	46926.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	38	3,5	16	3	24.50	20.80	19.60
4	51	4,8	22	4	32.80	27.90	26.20
5	64	6,0	27	6	42.80	36.40	34.20

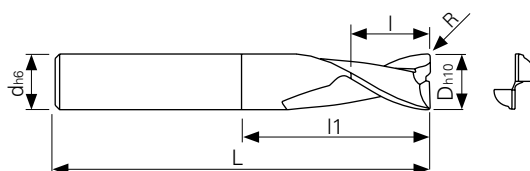
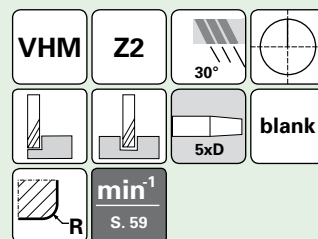
D	L	l	l1	d	46926.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6	64	7,0	32	6	46.20	39.30	37.00
8	75	9,5	42	8	57.80	49.10	46.20

46928.0**TuffCut® X-AL****Torusfräser**

5xD abgesetzter Schaft

Aluminium**Fraise en bout torique**

5xD queue dégagée

**135-N5**

D x R	L	l	l1	d	46928.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,5	38	3,5	16	3	24.50	20.80	19.60
3xR1,0	38	3,5	16	3	24.50	20.80	19.60
4xR0,5	51	4,8	22	4	32.80	27.90	26.20
4xR1,0	51	4,8	22	4	32.80	27.90	26.20
5xR0,5	64	6,0	27	6	42.80	36.40	34.20
5xR1,0	64	6,0	27	6	42.80	36.40	34.20
6xR0,5	64	7,0	32	6	46.20	39.30	37.00
6xR1,0	64	7,0	32	6	46.20	39.30	37.00
6xR1,5	64	7,0	32	6	46.20	39.30	37.00
6xR2,0	64	7,0	32	6	46.20	39.30	37.00
8xR0,5	75	9,5	42	8	57.80	49.10	46.20
8xR1,0	75	9,5	42	8	57.80	49.10	46.20
8xR1,5	75	9,5	42	8	57.80	49.10	46.20
8xR2,0	75	9,5	42	8	57.80	49.10	46.20
8xR3,0	75	9,5	42	8	57.80	49.10	46.20
10xR0,5	89	12,0	52	10	107.00	91.00	85.60
10xR1,0	89	12,0	52	10	107.00	91.00	85.60
10xR1,5	89	12,0	52	10	107.00	91.00	85.60
10xR2,0	89	12,0	52	10	107.00	91.00	85.60
10xR3,0	89	12,0	52	10	107.00	91.00	85.60

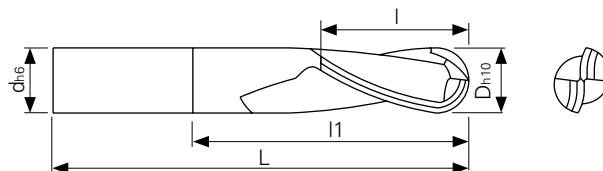
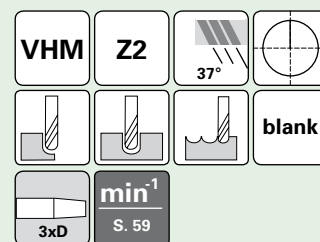
D x R	L	l	l1	d	46928.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12xR0,5	110	14,0	62	12	129.00	110.00	103.00
12xR1,0	110	14,0	62	12	129.00	110.00	103.00
12xR1,5	110	14,0	62	12	129.00	110.00	103.00
12xR2,0	110	14,0	62	12	129.00	110.00	103.00
12xR3,0	110	14,0	62	12	129.00	110.00	103.00
12xR4,0	110	14,0	62	12	129.00	110.00	103.00
12xR5,0	110	14,0	62	12	129.00	110.00	103.00
16xR0,5	127	18,0	85	16	235.00	200.00	188.00
16xR1,0	127	18,0	85	16	235.00	200.00	188.00
16xR1,5	127	18,0	85	16	235.00	200.00	188.00
16xR2,0	127	18,0	85	16	235.00	200.00	188.00
16xR3,0	127	18,0	85	16	235.00	200.00	188.00
16xR4,0	127	18,0	85	16	235.00	200.00	188.00
20xR0,5	152	22,0	105	20	484.00	411.00	387.00
20xR1,0	152	22,0	105	20	484.00	411.00	387.00
20xR1,5	152	22,0	105	20	484.00	411.00	387.00
20xR2,0	152	22,0	105	20	484.00	411.00	387.00
20xR3,0	152	22,0	105	20	484.00	411.00	387.00
20xR4,0	152	22,0	105	20	484.00	411.00	387.00
20xR5,0	152	22,0	105	20	484.00	411.00	387.00

46942.0**TuffCut® X-AL****Radiusfräser**

3xD abgesetzter Schaft

Aluminium**Fraise hémisphérique**

3xD queue dégagée

**135B-N3**

D	L	l	l1	d	46942.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	38	5	11	3	41.30	35.10	33.00
4	51	6	14	4	46.90	39.90	37.50
5	64	7	17	5	50.30	42.80	40.20
6	64	8	20	6	54.10	46.00	43.30

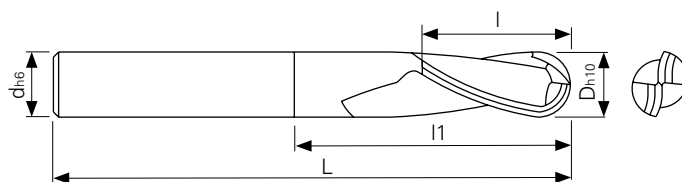
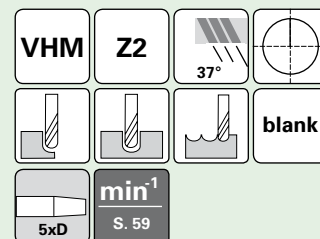
D	L	l	l1	d	46942.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
8	64	10	26	8	79.40	67.50	63.50
10	70	12	32	10	102.00	86.70	81.60
12	76	16	38	12	131.00	111.00	105.00
16	89	20	50	16	224.00	190.00	179.00

46944.0**TuffCut® X-AL****Radiusfräser**

5xD abgesetzter Schaft

Aluminium**Fraise hémisphérique**

5xD queue dégagée

**135B-N5**

D	L	l	l1	d	46944.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
2	75	4	12	6	43.40	36.90	34.70
3	75	5	17	6	43.40	36.90	34.70
4	75	6	22	6	48.20	41.00	38.60
5	75	7	27	6	52.50	44.60	42.00
6	110	8	32	6	71.60	60.90	57.30

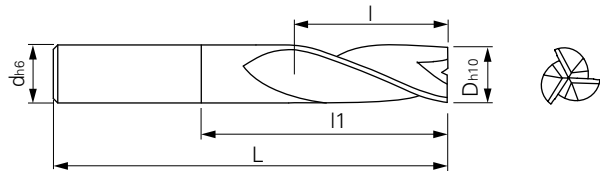
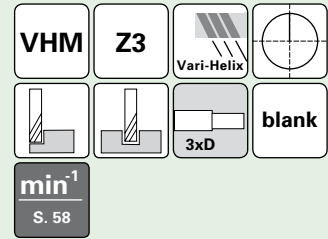
D	L	l	l1	d	46944.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
8	110	10	42	8	88.60	75.30	70.90
10	110	12	52	10	123.00	105.00	98.40
12	120	16	62	12	175.00	149.00	140.00
16	130	20	82	16	274.00	233.00	219.00

46950.0**TuffCut® X-AL****Schaftfräser**

3xD abgesetzter Schaft

Aluminium**Fraise en bout**

3xD queue dégagée

**137V-N3**

D	L	l	l1	d	46950.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	51	8	11	3	28.50	24.20	22.80
4	51	11	14	4	33.00	28.10	26.40
5	57	13	17	5	41.90	35.60	33.50
6	64	13	20	6	45.70	38.80	36.60
8	64	19	26	8	55.80	47.40	44.60

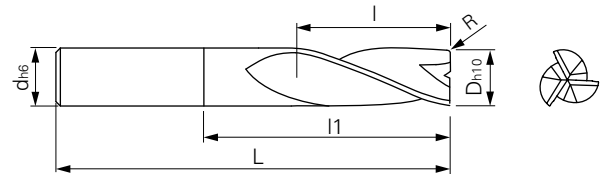
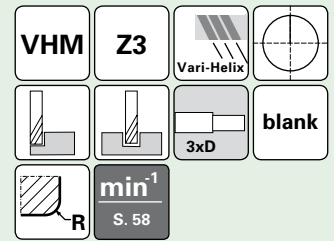
D	L	l	l1	d	46950.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	73	22	32	10	76.10	64.70	60.90
12	84	26	38	12	115.00	97.80	92.00
16	93	32	50	16	190.00	162.00	152.00
20	105	38	62	20	305.00	259.00	244.00

46952.0**TuffCut® X-AL****Torusfräser**

3xD abgesetzter Schaft

Aluminium**Fraise en bout torique**

3xD queue dégagée

**137V-N3**

D x R	L	l	l1	d	46952.0		
					zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,2	51	8	11	3	33.00	28.10	26.40
3xR0,5	51	8	11	3	33.00	28.10	26.40
3xR1,0	51	8	11	3	33.00	28.10	26.40
4xR0,2	51	11	14	4	36.80	31.30	29.40
4xR0,5	51	11	14	4	36.80	31.30	29.40
4xR1,0	51	11	14	4	36.80	31.30	29.40
5xR0,2	57	13	17	5	44.50	37.80	35.60
5xR0,5	57	13	17	5	44.50	37.80	35.60
5xR1,0	57	13	17	5	44.50	37.80	35.60
6xR0,2	64	13	20	6	52.00	44.20	41.60
6xR0,5	64	13	20	6	52.00	44.20	41.60
6xR1,0	64	13	20	6	52.00	44.20	41.60
6xR1,5	64	13	20	6	52.00	44.20	41.60
6xR2,0	64	13	20	6	52.00	44.20	41.60
8xR0,2	64	19	26	8	64.70	55.00	51.80
8xR0,5	64	19	26	8	64.70	55.00	51.80
8xR1,0	64	19	26	8	64.70	55.00	51.80
8xR1,5	64	19	26	8	64.70	55.00	51.80
8xR2,0	64	19	26	8	64.70	55.00	51.80
8xR3,0	64	19	26	8	64.70	55.00	51.80
10xR0,2	73	22	32	10	88.80	75.50	71.00
10xR0,5	73	22	32	10	88.80	75.50	71.00
10xR1,0	73	22	32	10	88.80	75.50	71.00
10xR1,5	73	22	32	10	88.80	75.50	71.00
10xR2,0	73	22	32	10	88.80	75.50	71.00

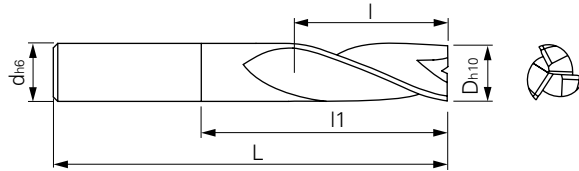
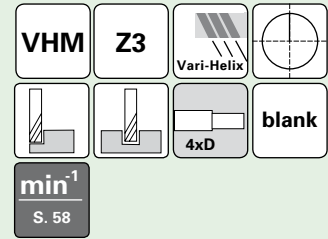
D x R	L	l	l1	d	46952.0		
					zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR3,0	73	22	32	10	88.80	75.50	71.00
10xR4,0	73	22	32	10	88.80	75.50	71.00
12xR0,2	84	26	38	12	130.00	111.00	104.00
12xR0,5	84	26	38	12	130.00	111.00	104.00
12xR1,0	84	26	38	12	130.00	111.00	104.00
12xR1,5	84	26	38	12	130.00	111.00	104.00
12xR2,0	84	26	38	12	130.00	111.00	104.00
12xR3,0	84	26	38	12	130.00	111.00	104.00
12xR4,0	84	26	38	12	130.00	111.00	104.00
16xR0,2	93	32	50	16	221.00	188.00	177.00
16xR0,5	93	32	50	16	221.00	188.00	177.00
16xR1,0	93	32	50	16	221.00	188.00	177.00
16xR1,5	93	32	50	16	221.00	188.00	177.00
16xR2,0	93	32	50	16	221.00	188.00	177.00
16xR3,0	93	32	50	16	221.00	188.00	177.00
16xR4,0	93	32	50	16	221.00	188.00	177.00
20xR0,2	105	38	62	20	365.00	310.00	292.00
20xR0,5	105	38	62	20	365.00	310.00	292.00
20xR1,0	105	38	62	20	365.00	310.00	292.00
20xR1,5	105	38	62	20	365.00	310.00	292.00
20xR2,0	105	38	62	20	365.00	310.00	292.00
20xR3,0	105	38	62	20	365.00	310.00	292.00
20xR4,0	105	38	62	20	365.00	310.00	292.00
20xR5,0	105	38	62	20	365.00	310.00	292.00

46954.0**TuffCut® X-AL****Schaftfräser**

4xD abgesetzter Schaft

Aluminium**Fraise en bout**

4xD queue dégagée

**137V-N4**

D	L	l	l1	d	46954.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	51	4.5	14	3	31.20	26.50	25.00
4	51	6	18	4	33.30	28.30	26.60
5	57	7.5	22	5	50.00	42.50	40.00
6	64	9	26	6	54.10	46.00	43.30
8	70	12	34	8	68.00	57.80	54.40

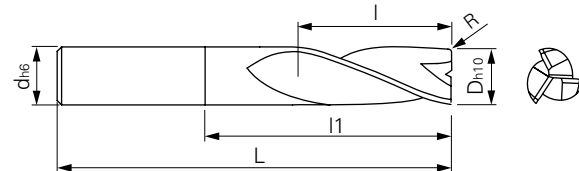
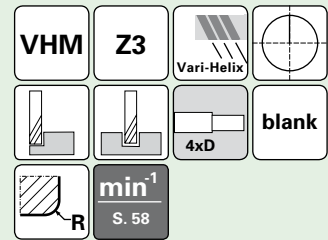
D	L	l	l1	d	46954.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	90	15	42	10	104.00	88.40	83.20
12	100	18	50	12	167.00	142.00	134.00
16	120	24	66	16	258.00	219.00	206.00
20	135	30	82	20	437.00	371.00	350.00

46956.0**TuffCut® X-AL****Torusfräser**

4xD abgesetzter Schaft

Aluminium**Fraise en bout torique**

4xD queue dégagée

**137V-N4**

D x R	L	l	l1	d	46956.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,2	51	4.5	14	3	38.80	33.00	31.00
3xR0,5	51	4.5	14	3	38.80	33.00	31.00
3xR1,0	51	4.5	14	3	38.80	33.00	31.00
4xR0,2	51	6	18	4	43.10	36.60	34.50
4xR0,5	51	6	18	4	43.10	36.60	34.50
4xR1,0	51	6	18	4	43.10	36.60	34.50
5xR0,2	57	7.5	22	5	52.70	44.80	42.20
5xR0,5	57	7.5	22	5	52.70	44.80	42.20
5xR1,0	57	7.5	22	5	52.70	44.80	42.20
6xR0,2	64	9	26	6	62.50	53.10	50.00
6xR0,5	64	9	26	6	62.50	53.10	50.00
6xR1,0	64	9	26	6	62.50	53.10	50.00
6xR2,0	64	9	26	6	62.50	53.10	50.00
8xR0,2	70	12	34	8	77.70	66.00	62.20
8xR0,5	70	12	34	8	77.70	66.00	62.20
8xR1,0	70	12	34	8	77.70	66.00	62.20
8xR1,5	70	12	34	8	77.70	66.00	62.20
8xR2,0	70	12	34	8	77.70	66.00	62.20
8xR3,0	70	12	34	8	77.70	66.00	62.20
10xR0,2	90	15	42	10	117.00	99.50	93.60
10xR0,5	90	15	42	10	117.00	99.50	93.60
10xR1,0	90	15	42	10	117.00	99.50	93.60
10xR1,5	90	15	42	10	117.00	99.50	93.60

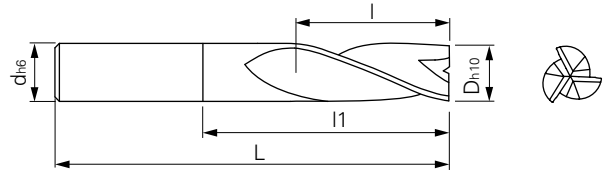
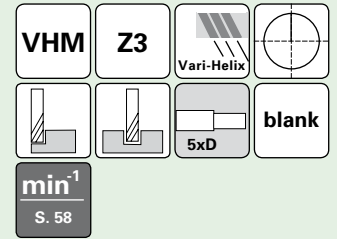
D x R	L	l	l1	d	46956.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR2,0	90	15	42	10	117.00	99.50	93.60
10xR3,0	90	15	42	10	117.00	99.50	93.60
10xR4,0	90	15	42	10	117.00	99.50	93.60
12xR0,2	100	18	50	12	180.00	153.00	144.00
12xR0,5	100	18	50	12	180.00	153.00	144.00
12xR1,0	100	18	50	12	180.00	153.00	144.00
12xR1,5	100	18	50	12	180.00	153.00	144.00
12xR2,0	100	18	50	12	180.00	153.00	144.00
12xR3,0	100	18	50	12	180.00	153.00	144.00
12xR4,0	100	18	50	12	180.00	153.00	144.00
16xR0,2	120	24	66	16	291.00	247.00	233.00
16xR0,5	120	24	66	16	291.00	247.00	233.00
16xR1,0	120	24	66	16	291.00	247.00	233.00
16xR1,5	120	24	66	16	291.00	247.00	233.00
16xR2,0	120	24	66	16	291.00	247.00	233.00
16xR3,0	120	24	66	16	291.00	247.00	233.00
16xR4,0	120	24	66	16	291.00	247.00	233.00
20xR0,2	135	30	82	20	486.00	413.00	389.00
20xR0,5	135	30	82	20	486.00	413.00	389.00
20xR1,0	135	30	82	20	486.00	413.00	389.00
20xR1,5	135	30	82	20	486.00	413.00	389.00
20xR2,0	135	30	82	20	486.00	413.00	389.00
20xR3,0	135	30	82	20	486.00	413.00	389.00
20xR4,0	135	30	82	20	486.00	413.00	389.00

46958.0**TuffCut® X-AL**
Schaftfräser

5xD abgesetzter Schaft

Aluminium**Fraise en bout**

5xD queue dégagée

**137V-N5**

D	L	l	l1	d	46958.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	51	4.5	17	3	33.00	28.10	26.40
4	51	6	22	4	38.10	32.40	30.50
5	57	7.5	27	5	48.20	41.00	38.60
6	64	9	32	6	57.10	48.50	45.70
8	75	12	42	8	66.00	56.10	52.80

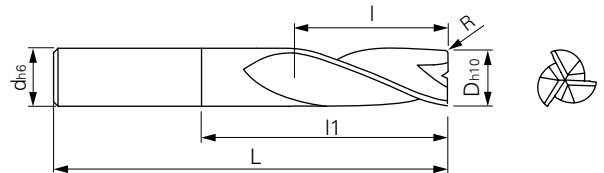
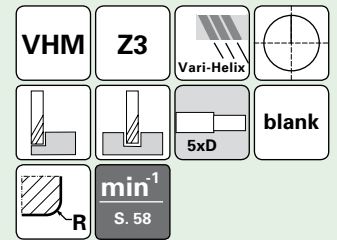
D	L	l	l1	d	46958.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10	90	15	52	10	108.00	91.80	86.40
12	110	18	62	12	160.00	136.00	128.00
16	130	24	82	16	273.00	232.00	218.00
20	150	30	102	20	450.00	383.00	360.00

46960.0**TuffCut® X-AL**
Torusfräser

5xD abgesetzter Schaft

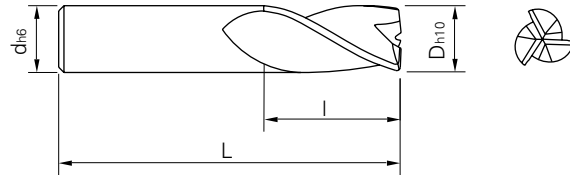
Aluminium**Fraise en bout torique**

5xD queue dégagée

**137V-N5**

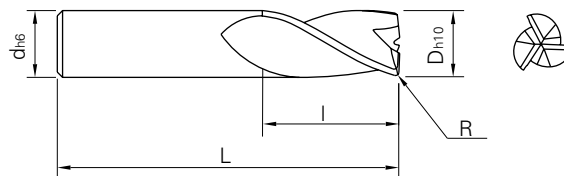
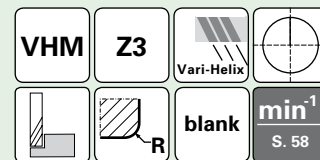
D x R	L	l	l1	d	46960.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3xR0,2	51	4.5	17	3	40.60	34.50	32.50
3xR0,5	51	4.5	17	3	40.60	34.50	32.50
3xR1,0	51	4.5	17	3	40.60	34.50	32.50
4xR0,2	51	6	22	4	43.20	36.70	34.60
4xR0,5	51	6	22	4	43.20	36.70	34.60
4xR1,0	51	6	22	4	43.20	36.70	34.60
5xR0,2	57	7.5	27	5	50.70	43.10	40.60
5xR0,5	57	7.5	27	5	50.70	43.10	40.60
5xR1,0	57	7.5	27	5	50.70	43.10	40.60
6xR0,2	64	9	32	6	63.40	53.90	50.70
6xR0,5	64	9	32	6	63.40	53.90	50.70
6xR1,0	64	9	32	6	63.40	53.90	50.70
6xR2,0	64	9	32	6	63.40	53.90	50.70
8xR0,2	75	12	42	8	73.60	62.60	58.90
8xR0,5	75	12	42	8	73.60	62.60	58.90
8xR1,0	75	12	42	8	73.60	62.60	58.90
8xR1,5	75	12	42	8	73.60	62.60	58.90
8xR2,0	75	12	42	8	73.60	62.60	58.90
8xR3,0	75	12	42	8	73.60	62.60	58.90
10xR0,2	90	15	52	10	121.00	103.00	96.80
10xR0,5	90	15	52	10	121.00	103.00	96.80
10xR1,0	90	15	52	10	121.00	103.00	96.80
10xR1,5	90	15	52	10	121.00	103.00	96.80

D x R	L	l	l1	d	46960.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
10xR2,0	90	15	52	10	121.00	103.00	96.80
10xR3,0	90	15	52	10	121.00	103.00	96.80
10xR4,0	90	15	52	10	121.00	103.00	96.80
12xR0,2	110	18	62	12	171.00	145.00	137.00
12xR0,5	110	18	62	12	171.00	145.00	137.00
12xR1,0	110	18	62	12	171.00	145.00	137.00
12xR1,5	110	18	62	12	171.00	145.00	137.00
12xR2,0	110	18	62	12	171.00	145.00	137.00
12xR3,0	110	18	62	12	171.00	145.00	137.00
12xR4,0	110	18	62	12	171.00	145.00	137.00
16xR0,2	130	24	82	16	285.00	242.00	228.00
16xR0,5	130	24	82	16	285.00	242.00	228.00
16xR1,0	130	24	82	16	285.00	242.00	228.00
16xR1,5	130	24	82	16	285.00	242.00	228.00
16xR2,0	130	24	82	16	285.00	242.00	228.00
16xR3,0	130	24	82	16	285.00	242.00	228.00
16xR4,0	130	24	82	16	285.00	242.00	228.00
20xR0,2	150	30	102	20	475.00	404.00	380.00
20xR0,5	150	30	102	20	475.00	404.00	380.00
20xR1,0	150	30	102	20	475.00	404.00	380.00
20xR1,5	150	30	102	20	475.00	404.00	380.00
20xR2,0	150	30	102	20	475.00	404.00	380.00
20xR3,0	150	30	102	20	475.00	404.00	380.00
20xR4,0	150	30	102	20	475.00	404.00	380.00

46970.0**TuffCut® X-AL****Schaftfräser****extra lange Schneide****Aluminium****Fraise en bout****coupe extra longue****VHM****Z3****Vari-Helix****blank****min⁻¹**
S. 58**137VF**

D	L	l	d	46970.0 zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6,0	64	20	6	66.00	56.10	52.80
6,0L	64	32	6	80.40	68.30	64.30
8,0	64	26	8	89.60	76.20	71.70
8,0L	75	42	8	99.90	84.90	79.90
10,0	73	32	10	119.00	101.00	95.20
10,0L	90	52	10	140.00	119.00	112.00

D	L	l	d	46970.0 zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12,0	84	38	12	149.00	127.00	119.00
12,0L	110	62	12	192.00	163.00	154.00
16,0	93	50	16	233.00	198.00	186.00
16,0L	130	82	16	288.00	245.00	230.00
20,0	105	62	20	330.00	281.00	264.00
20,0L	150	102	20	446.00	379.00	357.00

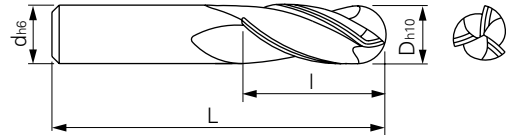
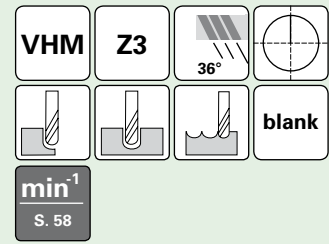
46972.0**TuffCut® X-AL****Torusfräser****extra lange Schneide****Aluminium****Fraise en bout torique****coupe extra longue****137VF**

D x R	L	I	d	46972.0		
				zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6xR0,2	64	20	6	66.00	56.10	52.80
6xR0,5	64	20	6	66.00	56.10	52.80
6xR0,2L	64	32	6	80.40	68.30	64.30
6xR0,5L	64	32	6	80.40	68.30	64.30
6xR1,0	64	32	6	80.40	68.30	64.30
8xR0,2	64	26	8	89.60	76.20	71.70
8xR0,5	64	26	8	89.60	76.20	71.70
8xR1,0	64	26	8	89.60	76.20	71.70
8xR0,2L	75	42	8	90.80	77.20	72.60
8xR0,5L	75	42	8	90.80	77.20	72.60
8xR1,0L	75	42	8	90.80	77.20	72.60
10xR0,2	73	32	10	119.00	101.00	95.20
10xR0,5	73	32	10	119.00	101.00	95.20
10xR1,0	73	32	10	119.00	101.00	95.20
10xR2,0	73	32	10	119.00	101.00	95.20
10xR0,2L	90	52	10	140.00	119.00	112.00
10xR0,5L	90	52	10	140.00	119.00	112.00
10xR1,0L	90	52	10	140.00	119.00	112.00
10xR2,0L	90	52	10	140.00	119.00	112.00
12xR0,2	84	38	12	149.00	127.00	119.00
12xR0,5	84	38	12	149.00	127.00	119.00
12xR1,0	84	38	12	149.00	127.00	119.00

D x R	L	I	d	46972.0		
				zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
12xR2,0	84	38	12	149.00	127.00	119.00
12xR0,2L	110	62	12	192.00	163.00	154.00
12xR0,5L	110	62	12	192.00	163.00	154.00
12xR1,0L	110	62	12	192.00	163.00	154.00
12xR2,0L	110	62	12	192.00	163.00	154.00
16xR0,2	93	50	16	233.00	198.00	186.00
16xR0,5	93	50	16	233.00	198.00	186.00
16xR1,0	93	50	16	233.00	198.00	186.00
16xR2,0	93	50	16	233.00	198.00	186.00
16xR0,2L	130	82	16	288.00	245.00	230.00
16xR0,5L	130	82	16	288.00	245.00	230.00
16xR1,0L	130	82	16	288.00	245.00	230.00
16xR2,0L	130	82	16	288.00	245.00	230.00
20xR0,2	105	62	20	330.00	281.00	264.00
20xR0,5	105	62	20	330.00	281.00	264.00
20xR1,0	105	62	20	330.00	281.00	264.00
20xR2,0	105	62	20	330.00	281.00	264.00
20xR0,2L	150	102	20	460.00	391.00	368.00
20xR0,5L	150	102	20	460.00	391.00	368.00
20xR1,0L	150	102	20	460.00	391.00	368.00
20xR2,0L	150	102	20	460.00	391.00	368.00

46962.0
TuffCut® X-AL
Radiusfräser

Aluminium

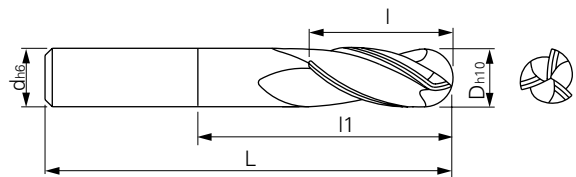
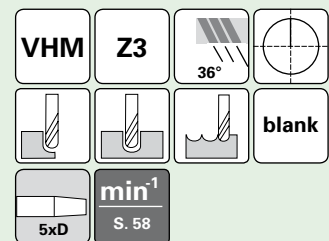
Fraise hémisphérique
**138B**

D	L	I	d	46962.0 zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	38	12	3	41.40	35.20	33.10
4	51	15	4	43.30	36.80	34.60
5	64	20	5	46.80	39.80	37.40
6	64	20	6	51.10	43.40	40.90

D	L	I	d	46962.0 zyl. Schaft / queue cylindrique		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
8	64	20	8	74.60	63.40	59.70
10	70	25	10	99.70	84.70	79.80
12	76	25	12	123.00	105.00	98.40
16	89	35	16	226.00	192.00	181.00

46964.0
TuffCut® X-AL
Schrupfräser
extra lang
 5xD abgesetzter Schaft

Aluminium

Fraise ébauche
extra long
 5xD queue dégagée
**138B-N5**

D	L	I	I1	d	46964.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
2	75	4	12	6	43.40	36.90	34.70
3	75	5	17	6	43.40	36.90	34.70
4	75	6	22	6	48.10	40.90	38.50
5	75	7	27	6	52.50	44.60	42.00
6	110	8	32	6	71.50	60.80	57.20

D	L	I	I1	d	46964.0 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
8	110	10	42	8	88.60	75.30	70.90
10	110	12	52	10	123.00	105.00	98.40
12	120	16	62	12	175.00	149.00	140.00
16	130	20	82	16	274.00	233.00	219.00

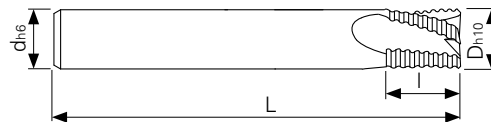
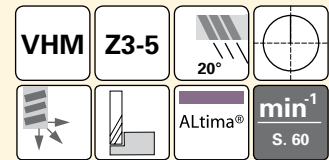
"Standard"**Economy****Universal-Fräser / Fraises universelle**

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4603		Ø 0,5 - 20	3		42
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4623		Ø 1 - 20	3		44
4624		Ø 1 - 25	4		44
4625		Ø 3 - 20	2		45
4626		Ø 3 - 20	4		45
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4671.4**Economy****Schruppfräser****Fraise ébauche**

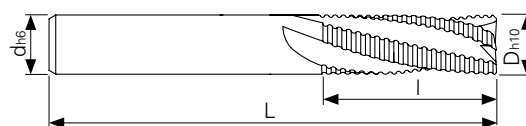
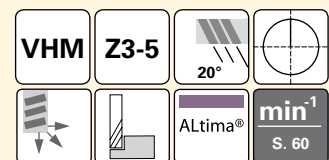
kurz

courte

**1483**

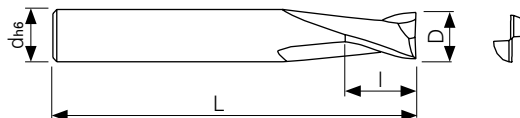
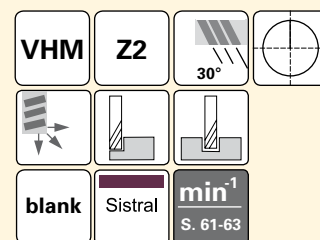
D	L	I	d	Z	4671.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6	54	7	6	3	48.30	41.10	38.60
7	58	8	8	3	56.50	48.00	45.20
8	58	9	8	3	56.50	48.00	45.20
9	66	13	10	4	84.60	71.90	67.70
10	66	14	10	4	84.60	71.90	67.70
12	73	16	12	4	108.00	91.80	86.40

D	L	I	d	Z	4671.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
14	75	18	14	4	132.00	112.00	106.00
16	82	22	16	4	177.00	150.00	142.00
18	84	24	18	4	228.00	194.00	182.00
20	92	26	20	4	284.00	241.00	227.00
25	110	25	25	5	500.00	425.00	400.00

4672.4**Economy****Schruppfräser****Fraise ébauche****1473**

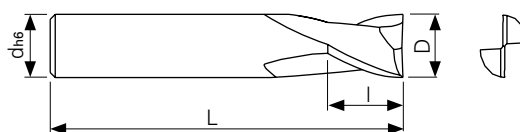
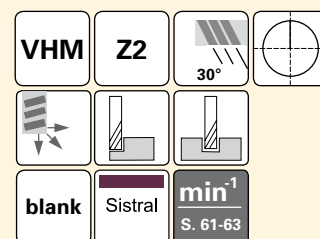
D	L	I	d	Z	4672.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6	57	16	6	3	52.00	44.20	41.60
7	63	16	8	3	60.90	51.80	48.70
8	63	16	8	3	60.90	51.80	48.70
9	72	19	10	4	90.80	77.20	72.60
10	72	22	10	4	90.80	77.20	72.60
12	83	26	12	4	116.00	98.60	92.80

D	L	I	d	Z	4672.4 zyl. Schaft / queue cylindrique		
					1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
14	83	26	14	4	142.00	121.00	114.00
16	92	32	16	4	191.00	162.00	153.00
18	92	32	18	4	243.00	207.00	194.00
20	104	38	20	4	306.00	260.00	245.00
25	121	45	25	5	537.00	456.00	430.00

4601**Economy****Miniatrurfräser****Fraise miniature**kurz
2-lippigcourte
2 dents**121**

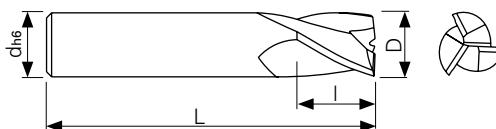
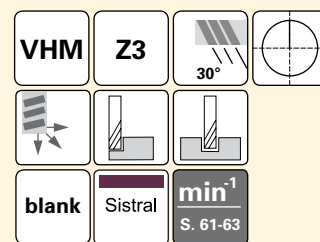
D	L	l	d	4601.0 blank / blanc			4601.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
0,3	38	0,45	3	42.20	35.90	33.80	45.50	38.70	36.40
0,4	38	0,6	3	23.80	20.20	19.00	28.50	24.20	22.80
0,5	38	0,75	3	23.80	20.20	19.00	28.50	24.20	22.80
0,6	38	0,9	3	23.80	20.20	19.00	28.50	24.20	22.80
0,7	38	1,05	3	23.80	20.20	19.00	28.50	24.20	22.80
0,8	38	1,2	3	23.80	20.20	19.00	28.50	24.20	22.80
0,9	38	1,35	3	23.80	20.20	19.00	28.50	24.20	22.80
1,0	38	1,5	3	23.80	20.20	19.00	28.50	24.20	22.80
1,1	38	1,65	3	23.80	20.20	19.00	28.50	24.20	22.80
1,2	38	1,95	3	23.80	20.20	19.00	28.50	24.20	22.80

D	L	l	d	4601.0 blank / blanc			4601.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
1,3	38	1,95	3	23.80	20.20	19.00	28.50	24.20	22.80
1,4	38	2,1	3	21.20	18.00	17.00	26.20	22.30	21.00
1,5	38	2,25	3	21.20	18.00	17.00	26.20	22.30	21.00
1,6	38	2,4	3	21.20	18.00	17.00	26.20	22.30	21.00
1,7	38	2,55	3	21.20	18.00	17.00	26.20	22.30	21.00
1,8	38	2,7	3	21.20	18.00	17.00	26.20	22.30	21.00
1,9	38	2,85	3	21.20	18.00	17.00	26.20	22.30	21.00
2,0	38	3,0	3	21.20	18.00	17.00	26.20	22.30	21.00
2,5	38	3,75	3	21.20	18.00	17.00	26.20	22.30	21.00

4602**Economy****Schaftfräser****Fraise en bout**kurz
2-lippigcourte
2 dents**164**

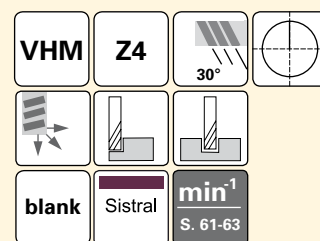
D	L	l	d	4602.0 blank / blanc			4602.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
0,2	38	0,4	3	48.80	41.50	39.00	56.00	47.60	44.80
0,3	38	0,6	3	42.20	35.90	33.80	42.40	36.00	33.90
0,4	38	0,8	3	25.00	21.30	20.00	32.20	27.40	25.80
0,5	38	1	3	25.00	21.30	20.00	32.20	27.40	25.80
0,6	38	1,2	3	25.00	21.30	20.00	32.20	27.40	25.80
0,7	38	1,4	3	25.00	21.30	20.00	32.20	27.40	25.80
0,8	38	1,6	3	19.40	16.50	15.50	26.80	22.80	21.40
0,9	38	1,8	3	21.60	18.40	17.30	28.80	24.50	23.00
1,0	38	2	3	19.00	16.20	15.20	24.20	20.60	19.40
1,1	38	2,2	3	21.60	18.40	17.30	26.70	22.70	21.40
1,2	38	2,4	3	20.70	17.60	16.60	25.60	21.80	20.50
1,3	38	2,6	3	20.70	17.60	16.60	25.60	21.80	20.50
1,4	38	2,8	3	21.60	18.40	17.30	26.70	22.70	21.40
1,5	38	3	3	17.30	14.70	13.80	22.60	19.20	18.10
1,6	38	3,2	3	16.60	14.10	13.30	21.80	18.50	17.40
1,7	38	3,4	3	17.30	14.70	13.80	22.60	19.20	18.10
1,8	38	3,6	3	16.60	14.10	13.30	21.80	18.50	17.40
1,9	38	3,8	3	17.30	14.70	13.80	22.60	19.20	18.10
2,0	38	4	3	15.20	12.90	12.20	20.70	17.60	16.60

D	L	l	d	4602.0 blank / blanc			4602.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.	1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
2,5	38	5	3	15.50	13.20	12.40	20.90	17.80	16.70
3,0	38	6	3	14.40	12.20	11.50	20.00	17.00	16.00
3,5	51	7	4	20.70	17.60	16.60	26.30	22.40	21.00
4,0	51	8	4	20.10	17.10	16.10	25.60	21.80	20.50
4,5	51	9	5	21.40	18.20	17.10	27.20	23.10	21.80
5,0	51	11	5	21.40	18.20	17.10	27.20	23.10	21.80
5,5	51	12	6	26.80	22.80	21.40	32.00	27.20	25.60
6,0	51	13	6	24.50	20.80	19.60	30.00	25.50	24.00
7,0	51	13	8	32.70	27.80	26.20	40.10	34.10	32.10
8,0	51	13	8	30.00	25.50	24.00	37.80	32.10	30.20
9,0	51	14	9	44.90	38.20	35.90	53.50	45.50	42.80
10,0	51	14	10	50.20	42.70	40.20	58.40	49.60	46.70
11,0	64	16	11	61.40	52.20	49.10	70.90	60.30	56.70
12,0	64	16	12	61.50	52.30	49.20	71.00	60.40	56.80
14,0	70	18	14	98.90	84.10	79.10	107.00	91.00	85.60
16,0	76	20	16	110.00	93.50	88.00	118.00	100.00	94.40
18,0	76	25	18	164.00	139.00	131.00	174.00	148.00	139.00
20,0	76	25	20	227.00	193.00	182.00	243.00	207.00	194.00

4603**Economy****Schaftfräser****Fraise en bout****kurz**
3-lippig**courte**
3 dents**169**

D	L	l	d	4603.0 blank / blanc			4603.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
0,5	38	1	3	43.60	37.10	34.90	46.90	39.90	37.50
0,8	38	1,6	3	36.70	31.20	29.40	40.40	34.30	32.30
1,0	38	2	3	19.00	16.20	15.20	24.20	20.60	19.40
1,5	38	3	3	17.30	14.70	13.80	22.60	19.20	18.10
2,0	38	4	3	15.20	12.90	12.20	20.70	17.60	16.60
2,5	38	5	3	15.50	13.20	12.40	20.90	17.80	16.70
3,0	38	6	3	14.40	12.20	11.50	20.00	17.00	16.00
3,5	51	7	4	20.70	17.60	16.60	26.30	22.40	21.00
4,0	51	8	4	20.10	17.10	16.10	25.60	21.80	20.50
4,5	51	9	5	21.40	18.20	17.10	27.20	23.10	21.80
5,0	51	11	5	21.40	18.20	17.10	27.20	23.10	21.80
5,5	51	12	6	26.80	22.80	21.40	32.00	27.20	25.60

D	L	l	d	4603.0 blank / blanc			4603.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6,0	51	13	6	24.50	20.80	19.60	30.00	25.50	24.00
7,0	51	13	8	32.70	27.80	26.20	40.10	34.10	32.10
8,0	51	13	8	30.00	25.50	24.00	37.80	32.10	30.20
9,0	51	14	9	44.90	38.20	35.90	53.50	45.50	42.80
10,0	51	14	10	50.20	42.70	40.20	58.40	49.60	46.70
11,0	64	16	11	61.40	52.20	49.10	70.90	60.30	56.70
12,0	64	16	12	61.50	52.30	49.20	71.00	60.40	56.80
14,0	70	18	14	98.90	84.10	79.10	107.00	91.00	85.60
16,0	76	20	16	110.00	93.50	88.00	118.00	100.00	94.40
18,0	76	25	18	164.00	139.00	131.00	174.00	148.00	139.00
20,0	76	25	20	227.00	193.00	182.00	243.00	207.00	194.00

4604**Economy****Schaftfräser****Fraise en bout****kurz**
4-lippig**courte**
4 dents**163**

D	L	l	d	4604.0 blank / blanc			4604.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1	38	2	3	19.00	16.20	15.20	24.20	20.60	19.40
1,5	38	3	3	17.30	14.70	13.80	22.60	19.20	18.10
2	38	4	3	15.20	12.90	12.20	20.70	17.60	16.60
2,5	38	5	3	15.50	13.20	12.40	20.90	17.80	16.70
3	51	6	3	14.40	12.20	11.50	20.00	17.00	16.00
3,5	51	7	4	20.70	17.60	16.60	26.30	22.40	21.00
4	51	8	4	20.10	17.10	16.10	25.60	21.80	20.50
4,5	51	9	5	21.40	18.20	17.10	27.20	23.10	21.80
5	51	11	5	21.40	18.20	17.10	27.20	23.10	21.80
5,5	51	12	6	26.80	22.80	21.40	32.00	27.20	25.60
6	51	13	6	24.50	20.80	19.60	30.00	25.50	24.00

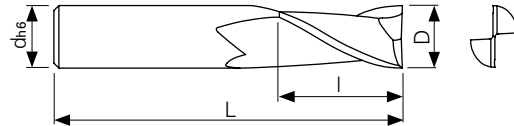
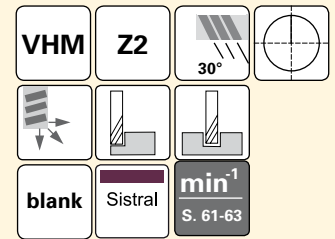
D	L	l	d	4604.0 blank / blanc			4604.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
7	51	13	8	32.70	27.80	26.20	40.10	34.10	32.10
8	51	13	8	30.00	25.50	24.00	37.80	32.10	30.20
9	51	14	9	44.90	38.20	35.90	53.50	45.50	42.80
10	51	14	10	50.20	42.70	40.20	58.40	49.60	46.70
11	64	16	11	61.40	52.20	49.10	70.90	60.30	56.70
12	64	16	12	61.50	52.30	49.20	71.00	60.40	56.80
14	70	18	14	98.90	84.10	79.10	107.00	91.00	85.60
16	76	20	16	110.00	93.50	88.00	118.00	100.00	94.40
18	76	25	18	164.00	139.00	131.00	174.00	148.00	139.00
20	76	25	20	227.00	193.00	182.00	243.00	207.00	194.00

4622**Economy****Schaftfräser**

2-lippig

Fraise en bout

2 dents

**121**

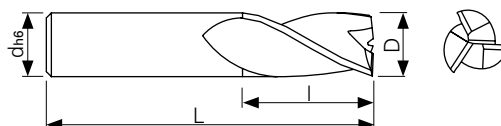
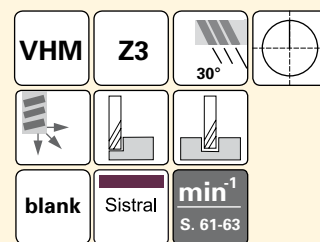
D	L	I	d	4622.0 blank / blanc			4622.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1	38	3	3	20.60	17.50	16.50	25.50	21.70	20.40
1,5	38	6	3	18.60	15.80	14.90	23.90	20.30	19.10
2	38	9	3	16.80	14.30	13.40	22.10	18.80	17.70
2,5	38	12	3	16.80	14.30	13.40	22.10	18.80	17.70
3	38	12	3	15.70	13.30	12.60	21.10	17.90	16.90
3,5	51	12	4	22.40	19.00	17.90	27.90	23.70	22.30
4	51	14	4	21.80	18.50	17.40	27.40	23.30	21.90
4,5	51	14	5	23.30	19.80	18.60	28.80	24.50	23.00
5	51	20	5	23.30	19.80	18.60	28.80	24.50	23.00
5,5	64	20	6	28.90	24.60	23.10	34.20	29.10	27.40

D	L	I	d	4622.0 blank / blanc			4622.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6	64	20	6	26.80	22.80	21.40	32.00	27.20	25.60
7	64	20	8	35.50	30.20	28.40	42.80	36.40	34.20
8	4	20	8	31.20	26.50	25.00	38.80	33.00	31.00
9	64	20	9	48.70	41.40	39.00	57.00	48.50	45.60
10	70	25	10	54.50	46.30	43.60	62.40	53.00	49.90
12	76	25	12	66.80	56.80	53.40	75.90	64.50	60.70
14	89	30	14	107.00	91.00	85.60	114.00	96.90	91.20
16	89	30	16	119.00	101.00	95.20	129.00	110.00	103.00
18	102	35	18	177.00	150.00	142.00	187.00	159.00	150.00
20	102	38	20	246.00	209.00	197.00	261.00	222.00	209.00

4623**Economy****Schaftfräser****Fraise en bout**

3-lippig

3 dents



116

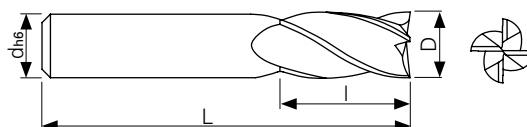
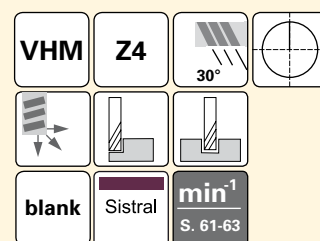
D	L	l	d	4623.0 blank / blanc			4623.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1	38	3	3	20.60	17.50	16.50	25.50	21.70	20.40
1,5	38	6	3	18.60	15.80	14.90	23.90	20.30	19.10
2	38	9	3	16.80	14.30	13.40	22.10	18.80	17.70
2,5	38	12	3	16.80	14.30	13.40	22.10	18.80	17.70
3	38	12	3	15.70	13.30	12.60	21.10	17.90	16.90
3,5	51	12	4	22.40	19.00	17.90	27.90	23.70	22.30
4	51	14	4	21.80	18.50	17.40	27.40	23.30	21.90
4,5	51	14	5	23.30	19.80	18.60	28.80	24.50	23.00
5	51	20	5	23.30	19.80	18.60	28.80	24.50	23.00
5,5	64	20	6	28.90	24.60	23.10	34.20	29.10	27.40

D	L	l	d	4623.0 blank / blanc			4623.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6	64	20	6	26.80	22.80	21.40	32.00	27.20	25.60
7	64	20	8	35.50	30.20	28.40	42.80	36.40	34.20
8	64	20	8	31.20	26.50	25.00	38.80	33.00	31.00
9	64	20	9	48.70	41.40	39.00	57.00	48.50	45.60
10	70	25	10	54.50	46.30	43.60	62.40	53.00	49.90
12	76	25	12	66.80	56.80	53.40	75.90	64.50	60.70
14	89	30	14	107.00	91.00	85.60	114.00	96.90	91.20
16	89	30	16	119.00	101.00	95.20	129.00	110.00	103.00
18	102	35	18	177.00	150.00	142.00	187.00	159.00	150.00
20	102	38	20	246.00	209.00	197.00	261.00	222.00	209.00

4624**Economy****Schaftfräser****Fraise en bout**

4-lippig

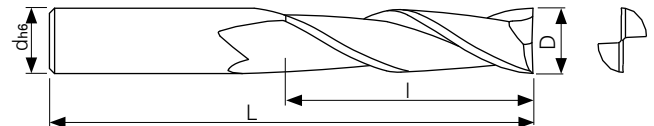
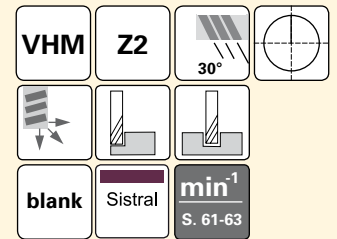
4 dents



111

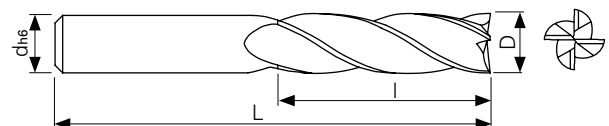
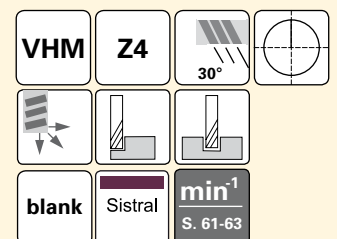
D	L	l	d	4624.0 blank / blanc			4624.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1	38	3	3	20.60	17.50	16.50	25.50	21.70	20.40
1,5	38	6	3	18.60	15.80	14.90	23.90	20.30	19.10
2	38	9	3	16.80	14.30	13.40	22.10	18.80	17.70
2,5	38	12	3	16.80	14.30	13.40	22.10	18.80	17.70
3	38	12	3	15.70	13.30	12.60	21.10	17.90	16.90
3,5	51	12	4	22.40	19.00	17.90	27.90	23.70	22.30
4	51	14	4	21.80	18.50	17.40	27.40	23.30	21.90
4,5	51	14	5	23.30	19.80	18.60	28.80	24.50	23.00
5	51	20	5	23.30	19.80	18.60	28.80	24.50	23.00
5,5	64	20	6	28.90	24.60	23.10	34.20	29.10	27.40

D	L	l	d	4624.0 blank / blanc			4624.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
6	64	20	6	26.80	22.80	21.40	32.00	27.20	25.60
7	64	20	8	35.50	30.20	28.40	42.80	36.40	34.20
8	64	20	8	31.20	26.50	25.00	38.80	33.00	31.00
9	64	20	9	48.70	41.40	39.00	57.00	48.50	45.60
10	70	25	10	54.50	46.30	43.60	62.40	53.00	49.90
12	76	25	12	66.80	56.80	53.40	75.90	64.50	60.70
14	89	30	14	107.00	91.00	85.60	114.00	96.90	91.20
16	89	30	16	119.00	101.00	95.20	129.00	110.00	103.00
18	102	35	18	177.00	150.00	142.00	187.00	159.00	150.00
20	102	38	20	246.00	209.00	197.00	261.00	222.00	209.00

4625**Economy****Schaftfräser****Fraise en bout**lang
2-lippiglong
2 dents**123**

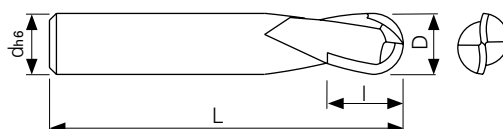
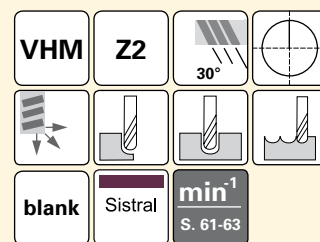
D	L	l	d	4625.0 blank / blanc			4625.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	60	12	6	74.40	63.20	59.50	75.90	64.50	60.70
4	60	17	6	74.40	63.20	59.50	75.90	64.50	60.70
5	70	20	6	74.50	63.30	59.60	76.10	64.70	60.90
6	76	30	6	40.00	34.00	32.00	44.40	37.70	35.50
7	83	30	8	53.10	45.10	42.50	59.10	50.20	47.30
8	83	35	8	48.80	41.50	39.00	55.20	46.90	44.20

D	L	l	d	4625.0 blank / blanc			4625.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
9	89	35	10	73.00	62.10	58.40	79.30	67.40	63.40
10	89	40	10	81.80	69.50	65.40	87.60	74.50	70.10
11	102	40	12	100.00	85.00	80.00	107.00	91.00	85.60
12	102	50	12	100.00	85.00	80.00	107.00	91.00	85.60
16	117	65	16	181.00	154.00	145.00	184.00	156.00	147.00
20	133	80	20	370.00	315.00	296.00	375.00	319.00	300.00

4626**Economy****Schaftfräser****Fraise en bout**lang
4-lippiglong
4 dents**122**

D	L	l	d	4626.0 blank / blanc			4626.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
3	60	12	6	51.20	43.50	41.00	54.70	46.50	43.80
4	60	17	6	51.20	43.50	41.00	54.70	46.50	43.80
5	70	20	6	74.50	63.30	59.60	76.10	64.70	60.90
6	76	30	6	40.00	34.00	32.00	44.40	37.70	35.50
7	83	30	8	53.10	45.10	42.50	59.10	50.20	47.30
8	83	35	8	48.80	41.50	39.00	55.20	46.90	44.20

D	L	l	d	4626.0 blank / blanc			4626.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
9	89	35	10	73.00	62.10	58.40	79.30	67.40	63.40
10	89	40	10	81.80	69.50	65.40	87.60	74.50	70.10
11	102	40	12	100.00	85.00	80.00	107.00	91.00	85.60
12	102	50	12	100.00	85.00	80.00	107.00	91.00	85.60
16	117	65	16	181.00	154.00	145.00	184.00	156.00	147.00
20	133	80	20	370.00	315.00	296.00	375.00	319.00	300.00

4642**Economy****Radiusfräser****Fraise hémisphérique**kurz
2-lippigcourte
2 dents

166

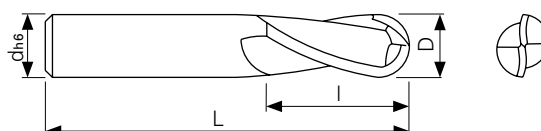
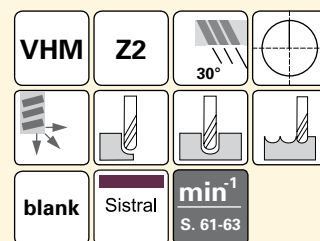
D	L	l	d	4642.0 blank / blanc			4642.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1	38	2	3	24.10	20.50	19.30	28.80	24.50	23.00
1,5	38	3	3	21.90	18.60	17.50	27.00	23.00	21.60
2	38	4	3	19.30	16.40	15.40	24.50	20.80	19.60
2,5	38	5	3	19.70	16.70	15.80	24.80	21.10	19.80
3	38	6	3	18.30	15.60	14.60	23.60	20.10	18.90
3,5	51	7	4	26.30	22.40	21.00	31.40	26.70	25.10
4	51	8	4	25.50	21.70	20.40	30.80	26.20	24.60
4,5	51	9	5	27.20	23.10	21.80	32.40	27.50	25.90
5	51	11	5	27.20	23.10	21.80	32.40	27.50	25.90
6	51	13	6	31.20	26.50	25.00	36.20	30.80	29.00

D	L	l	d	4642.0 blank / blanc			4642.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
7	51	13	8	41.50	35.30	33.20	48.30	41.10	38.60
8	51	13	8	36.50	31.00	29.20	43.70	37.10	35.00
9	51	14	9	54.50	46.30	43.60	62.40	53.00	49.90
10	51	14	10	61.20	52.00	49.00	68.50	58.20	54.80
12	64	16	12	74.80	63.60	59.80	83.30	70.80	66.60
14	70	18	14	119.00	101.00	95.20	127.00	108.00	102.00
16	76	20	16	136.00	116.00	109.00	142.00	121.00	114.00
18	76	25	18	200.00	170.00	160.00	208.00	177.00	166.00
20	76	25	20	277.00	235.00	222.00	288.00	245.00	230.00

4643**Economy****Radiusfräser****Fraise hémisphérique**

2-lippig

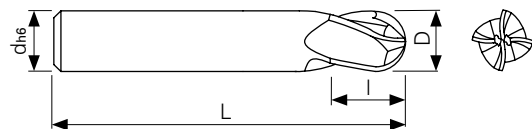
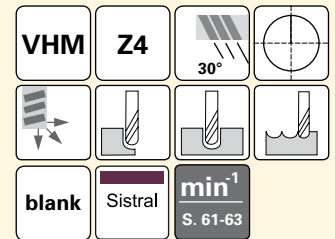
2 dents



150

D	L	l	d	4643.0 blank / blanc			4643.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
1	38	3	3	25.80	21.90	20.60	30.50	25.90	24.40
1,5	38	6	3	23.50	20.00	18.80	28.20	24.00	22.60
2	38	9	3	20.60	17.50	16.50	26.00	22.10	20.80
2,5	38	12	3	21.00	17.90	16.80	24.70	21.00	19.80
3	38	12	3	19.60	16.70	15.70	32.40	27.50	25.90
3,5	51	12	4	28.10	23.90	22.50	32.40	27.50	25.90
4	51	14	4	27.40	23.30	21.90	30.60	26.00	24.50
5	51	20	5	28.90	24.60	23.10	34.20	29.10	27.40
6	64	20	6	33.30	28.30	26.60	38.20	32.50	30.60

D	L	l	d	4643.0 blank / blanc			4643.3 beschichtet / revêtue		
				1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%	1-4 Stk/p.	5-9 Stk/p. -15%	≥10Stk/p. -20%
7	64	20	8	44.40	37.70	35.50	51.00	43.40	40.80
8	64	20	8	39.10	33.20	31.30	46.10	39.20	36.90
9	64	20	9	58.40	49.60	46.70	65.90	56.00	52.70
10	70	25	10	65.50	55.70	52.40	72.40	61.50	57.90
12	76	25	12	80.30	68.30	64.20	88.30	75.10	70.60
16	89	30	16	145.00	123.00	116.00	150.00	128.00	120.00
18	102	35	18	214.00	182.00	171.00	220.00	187.00	176.00
20	102	38	20	296.00	252.00	237.00	307.00	261.00	246.00

4644**Economy****Radiusfräser****Fraise hémisphérique**kurz
4-lippigcourte
4 dents**165**

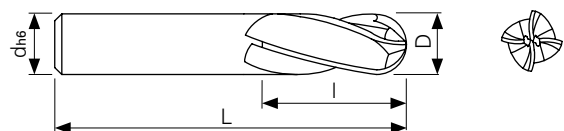
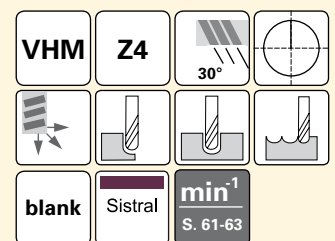
D	L	l	d	4644.0 blank / blanc			4644.3 beschichtet / revêtue		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
1	38	2	3	24.10	20.50	19.30	28.80	24.50	23.00
1,5	38	3	3	21.90	18.60	17.50	27.00	23.00	21.60
2	38	4	3	19.30	16.40	15.40	24.50	20.80	19.60
2,5	38	5	3	19.70	16.70	15.80	24.80	21.10	19.80
3	38	6	3	18.30	15.60	14.60	23.60	20.10	18.90
3,5	51	7	4	26.30	22.40	21.00	31.40	26.70	25.10
4	51	8	4	25.50	21.70	20.40	30.80	26.20	24.60
4,5	51	9	5	27.20	23.10	21.80	32.40	27.50	25.90
5	51	11	5	27.20	23.10	21.80	32.40	27.50	25.90
6	51	13	6	31.20	26.50	25.00	36.20	30.80	29.00

D	L	l	d	4644.0 blank / blanc			4644.3 beschichtet / revêtue		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
7	51	13	8	41.50	35.30	33.20	48.30	41.10	38.60
8	51	13	8	36.50	31.00	29.20	43.70	37.10	35.00
9	51	14	9	54.50	46.30	43.60	62.40	53.00	49.90
10	51	14	10	61.20	52.00	49.00	68.50	58.20	54.80
12	64	16	12	74.80	63.60	59.80	83.30	70.80	66.60
14	70	18	14	119.00	101.00	95.20	127.00	108.00	102.00
16	76	20	16	136.00	116.00	109.00	142.00	121.00	114.00
18	76	25	18	200.00	170.00	160.00	208.00	177.00	166.00
20	76	25	20	277.00	235.00	222.00	288.00	245.00	230.00

4645**Economy****Radiusfräser****Fraise hémisphérique**

4-lippig

4 dents

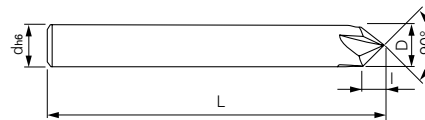
**140**

D	L	l	d	4645.0 blank / blanc			4645.3 beschichtet / revêtue		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
1	38	3	3	25.80	21.90	20.60	30.50	25.90	24.40
1,5	38	6	3	23.50	20.00	18.80	28.20	24.00	22.60
2	38	9	3	20.60	17.50	16.50	25.50	21.70	20.40
2,5	38	12	3	21.00	17.90	16.80	26.00	22.10	20.80
3	38	12	3	19.60	16.70	15.70	24.70	21.00	19.80
3,5	51	12	4	28.10	23.90	22.50	33.10	28.10	26.50
4	51	14	4	27.40	23.30	21.90	32.40	27.50	25.90
5	51	20	5	28.90	24.60	23.10	34.20	29.10	27.40
6	64	20	6	33.30	28.30	26.60	38.20	32.50	30.60

D	L	l	d	4645.0 blank / blanc			4645.3 beschichtet / revêtue		
				1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%	1-4 Stk/p. -15%	5-9 Stk/p. -20%	≥10Stk/p. -20%
7	64	20	8	44.40	37.70	35.50	51.00	43.40	40.80
8	64	20	8	39.10	33.20	31.30	46.10	39.20	36.90
9	64	20	9	58.40	49.60	46.70	65.90	56.00	52.70
10	70	25	10	65.50	55.70	52.40	72.40	61.50	57.90
12	76	25	12	80.30	68.30	64.20	88.30	75.10	70.60
16	89	30	16	145.00	123.00	116.00	150.00	128.00	120.00
18	102	35	18	214.00	182.00	171.00	220.00	187.00	176.00
20	102	38	20	296.00	252.00	237.00	307.00	261.00	246.00

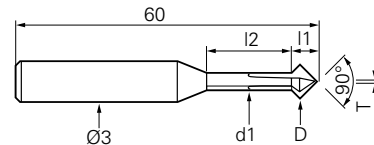
4795.3**Economy****VHM****Z4,6****Fasenfräser 90°****Fraise à chanfrein 90°**

Sistral

**VCM90**

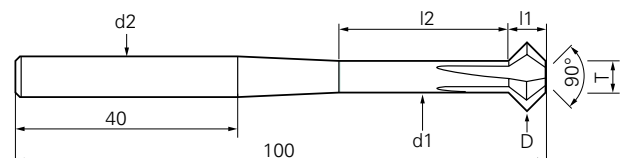
D	L	I	d	Z	4795.3		
					beschichtet / revêtue		
					1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
3	51	1,4	3	4	25.50	21.70	20.40
4	51	1,8	4	4	26.20	22.30	21.00
6	64	2,8	6	4	30.50	25.90	24.40
8	64	3,8	8	4	37.90	32.20	30.30

D	L	I	d	Z	4795.3		
					beschichtet / revêtue		
					1-4 Stk/p.	5-9 Stk/p.	≥10Stk/p.
10	73	4,8	10	6	49.00	41.70	39.20
12	84	5,8	12	6	67.10	57.00	53.70
16	93	7.8	16	6	102.00	86.70	81.60

4797.4**Economy****VHM****Z3****Hard'X****min⁻¹**
S. 60**Vor- und Rückwärtssenker
mini 90°****Fraise biconique mini 90°
à chanfreiner avant et arrière**

D	↘	d1	T	l1	l2	4797.4 beschichtet / revêtue
1,0	90°	0,7	0,30	0,50	5	58.50
1,5	90°	1,1	0,45	0,73	6	56.30
1,8	90°	1,5	0,60	0,75	8	54.30

D	↘	d1	T	l1	l2	4797.4 beschichtet / revêtue
2,0	90°	1,5	0,60	0,95	8	54.30
2,8	90°	2,1	0,90	1,30	10	54.30
3,0	90°	2,1	0,90	1,50	10	54.30

4798.4**Economy****VHM****Z4****Hard'X****min⁻¹**
S. 60**Vor- und Rückwärtssenker
90°****Fraise biconique 90°
à chanfreiner avant et arrière**

D	↘	d1	T	d2	l1	l2	4798.4 beschichtet / revêtue
2,8	90°	2,2	1,2	6	1,10	10	67.10
3,0	90°	2,2	1,2	6	1,30	10	67.10
3,8	90°	2,9	1,6	6	1,55	12	69.10
4,0	90°	2,9	1,6	6	1,75	12	69.10
4,8	90°	3,4	2,0	6	2,10	15	73.40
5,0	90°	3,4	2,0	6	2,30	15	73.40
5,8	90°	3,8	2,4	6	2,70	18	76.50
6,0	90°	3,8	2,4	6	2,90	18	76.50

D	↘	d1	T	d2	l1	l2	4798.4 beschichtet / revêtue
7,8	90°	4,9	4,9	6	2,80	34	100.00
8,0	90°	4,9	4,9	6	3,10	34	100.00
9,8	90°	5,9	5,9	6	3,80	34	123.00
10,0	90°	5,9	5,9	6	4,10	34	123.00
11,8	90°	5,9	5,9	6	5,80	34	147.00
12,0	90°	5,9	5,9	6	6,10	34	147.00
15,8	90°	7,9	7,9	10	7,80	34	195.00
16,0	90°	7,9	7,9	10	8,10	34	195.00

TuffCut® XR

High-Performance Fräser / Fraises

Richtwerte für 46066 - 46163, 46872

Valeurs indicatives pour 46066 - 46163, 46872

Werkstoff gruppe	Werkstoff Art	Kühlmittel									
		Fluide de refroidissement									
Groupe matière	Type de matière	Max	Luft Air	MMS	Vc m/min.						
Stähle Aciers	Kohlenstoffarm Carbone bas	●	●	●	210	200	450	350	300	250	200
	mittlerer Kohlenstoffgehalt Carbone moyenne	●	●	●	180	170	270	250	230	200	170
	Legierte Stähle Aciers alliés	●	●	●	160	150	250	230	210	180	150
	Werkzeugstähle Aciers outils	●	●	●	130	120	225	200	170	130	120
Rostfreie Stähle Aciers inoxydables	Automatenstähle Aciers pour automates	●	–	○	110	100	150	150	120	105	100
	Austenitisch austénitique	●	–	○	100	90	130	120	110	100	90
	schwerer Edelstahl Aciers inoxydables lourd	●	–	○	70	60	100	90	80	70	60
	PH Edelstahl Aciers inoxydables PH	●	–	○	100	90	130	120	110	100	90
	Kobalt-Chrom Legierungen Alliés cobalt-chrome	●	–	○	70	60	100	90	80	70	60
	Duplex (22%)	●	–	○	70	60	100	90	80	70	60
	Super Duplex (25%)	●	–	○	50	40	60	55	50	45	40
	Hitzebeständige Legierungen Alliages résistants à la chaleur	●	–	–	30	25	50	40	35	30	25
Sonder- legierungen	Titanlegierungen Alliages de titane	●	–	–	70	60	120	120	90	75	60
Guss	Grauguss / Fonte grise	●	○	○	180	160	360	360	240	190	160
Fonte	Sphäroguss / Fonte ductile	●	○	○	170	150	270	270	190	170	150
	Temperguss / Fonte malléable	●	○	○	130	120	160	150	140	130	120
Gehärtete Stähle	45 - 50 HRC	●	○	○	50	45	135	135	90	50	45
Aciers trempés	50 - 55 HRC	●	○	○	45	40	115	115	75	45	40

● Bevorzugt / préféré ○ möglich / possible – nicht möglich / pas possible.

Werkstoff Matière	Bearbeitungsart Type d'usinage	Durchmesser / Diamètre									
		1,5mm	3mm	5mm	6mm	8mm	10mm	12mm	16mm	20mm	25mm
		fz									
Stähle Aciers	Umfangfräsen Contournage	0.005	0.018	0.025	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Nutenfräsen Rainurage	0.003	0.009	0.012	0.030	0.040	0.050	0.060	0.080	0.100	0.125
Rostfreie Stähle Aciers inoxydables	Umfangfräsen Contournage	0.005	0.018	0.025	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Nutenfräsen Rainurage	0.003	0.009	0.012	0.030	0.040	0.050	0.060	0.080	0.100	0.125
Sonder- legierungen Alliages spéciaux	Umfangfräsen Contournage	0.003	0.009	0.013	0.032	0.038	0.044	0.064	0.076	0.089	0.127
	Nutenfräsen Rainurage	0.0015	0.0045	0.007	0.016	0.019	0.022	0.032	0.038	0.045	0.065
Titan Titane	Umfangfräsen Contournage	0.005	0.018	0.025	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Nutenfräsen Rainurage	0.003	0.009	0.013	0.030	0.040	0.050	0.060	0.080	0.100	0.125
Guss Fonte	Umfangfräsen Contournage	0.005	0.018	0.025	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Nutenfräsen Rainurage	0.003	0.009	0.013	0.030	0.040	0.050	0.060	0.080	0.100	0.125
Gehärtete Stähle Aciers trempés	Umfangfräsen <50HRC Contournage <50HRC	0.005	0.016	0.023	0.057	0.069	0.080	0.114	0.137	0.160	0.229
	Nutenfräsen <50HRC Rainurage <50HRC	0.003	0.008	0.013	0.028	0.035	0.040	0.065	0.070	0.080	0.115
	Umfangfräsen >50HRC Contournage >50HRC	0.003	0.010	0.015	0.041	0.051	0.058	0.084	0.102	0.119	0.170
	Nutenfräsen >55HRC Rainurage >55HRC	0.002	0.005	0.008	0.020	0.025	0.028	0.042	0.050	0.060	0.080

Bitte beachten Sie - Fräser mit 5 Zähnen sollten nicht zum Vollnutenfräsen verwendet werden (Art.Nr. 46140 - 46163).

Beim Profilfräsen mit Ae < 50% des Fräserdurchmessers kann der Zahnvorschub fz erhöht werden.

Multiplizieren Sie fz gemäss dem Spandicken-Kompensationsfaktor (links in der Tabelle ersichtlich).

A observer - Les fraises à 5 dents ne doivent être utilisées que pour le contournage (N° art. 46140 - 46163).

Lors du profilage avec moins de 50 % de la largeur radiale du diamètre de fraise, l'épaisseur de copeau effective sur le tranchant est plus faible que la charge programmée. Le tableau ci-contre montre l'augmentation de la charge sur la dent pour un pourcentage de pénétration radiale donné. Multiplier l'avance par dent par ce facteur avant de déterminer définitivement votre avance de table.

Radialschnitt Coupe radiale (Ae)	Spandicken- Kompensationsfaktor Facteur de compensation d'épaisseur de copeau
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Beim Fräser 46080 folgenden Faktoren benutzen
Pour la fraise 46080, veuillez utiliser les facteurs suivants.

Ap	1 x D	0,25 x D
Ae	0,1 x D	1,0 x D

Bei der Verwendung von 46162 und 46163
Geschwindigkeit um 20 % reduzieren
Lors de l'utilisation des fraises 46162 et 46163,
réduire la vitesse de 20 %.

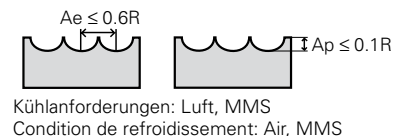
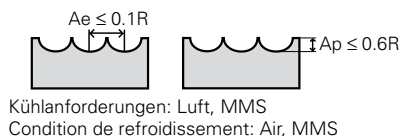
TuffCut® XR

High-Performance Fräser / Fraises

Richtwerte 46130, 46131, 46134

Valeurs indicatives pour 46130, 46131, 46134

D mm	R mm	U/min	Schruppbearbeitung von Stahl (25-48 HRC) Ebauche d'acier (25-48 HRC)				Schlichtbearbeitung von Stahl (25-48 HRC) Finintion d'acier (25-48 HRC)			
			f mm/min	fz mm/z	Ae max. mm	ap max mm	f mm/min	fz mm/z	Ae max. mm	ap max mm
1.5	R 0.75	35'000	1,950 - 3,300	0.0139 - 0.0235	0.075	0.450	1,950 - 3,300	0.0139 - 0.0235	0.450	0.075
2.0	R 1.0	30'000	2,100 - 3,600	0.0175 - 0.0300	0.100	0.600	2,100 - 3,600	0.0175 - 0.0300	0.600	0.100
2.5	R 1.25	28'000	2,100 - 3,600	0.0185 - 0.0320	0.125	0.750	2,100 - 3,600	0.0185 - 0.0320	0.750	0.125
3.0	R 1.5	26'500	2,100 - 3,600	0.0198 - 0.0330	0.150	0.900	2,100 - 3,600	0.0198 - 0.0330	0.900	0.150
3.5	R 1.75	24'000	2,250 - 3,900	0.0230 - 0.0400	0.175	1.000	2,250 - 3,900	0.0230 - 0.0400	1.000	0.175
4.0	R 2.0	23'000	2,250 - 3,900	0.0240 - 0.0420	0.200	1.200	2,250 - 3,900	0.0240 - 0.0420	1.200	0.200
4.5	R 2.25	22'000	2,250 - 3,900	0.0250 - 0.0440	0.220	1.350	2,250 - 3,900	0.0250 - 0.0440	1.350	0.220
5.0	R 2.5	20'000	1,800 - 5,500	0.0225 - 0.0687	0.250	1.500	1,800 - 5,500	0.0225 - 0.0687	1.500	0.250
6.0	R 3.0	20'000	1,800 - 5,500	0.0225 - 0.0687	0.300	1.800	1,800 - 5,500	0.0225 - 0.0687	1.800	0.300
8.0	R 4.0	15'000	2,200 - 5,000	0.0366 - 0.0833	0.400	2.400	2,200 - 5,000	0.0366 - 0.0833	2.400	0.400
10.0	R 5.0	12'000	2,300 - 4,600	0.0479 - 0.0958	0.500	3.000	2,300 - 4,600	0.0479 - 0.0958	3.000	0.500
12.0	R 6.0	10'000	1,900 - 4,100	0.0475 - 0.1025	0.600	3.600	1,900 - 4,100	0.0475 - 0.1025	3.600	0.600
16.0	R 8.0	7'500	1,600 - 3,200	0.0533 - 0.1066	0.800	4.800	1,600 - 3,200	0.0533 - 0.1066	4.800	0.800



Titan Titane				
D mm	R mm	U/min	f mm/min	fz mm/z
1.5	R 0.75	32'000	2'700	0.020
2.0	R 1.0	24'000	2'400	0.025
2.5	R 1.25	24'000	2'400	0.025
3.0	R 1.5	16'000	1'950	0.030
3.5	R 1.75	16'000	1'950	0.030
4.0	R 2.0	12'000	1'950	0.040
4.5	R 2.25	12'000	1'950	0.040
5.0	R 2.5	10'000	1'650	0.040
6.0	R 3.0	8'000	1'500	0.046
8.0	R 4.0	6'000	1'650	0.068
10.0	R 5.0	5'000	1'650	0.080
12.0	R 6.0	4'000	1'500	0.093
16.0	R 8.0	3'000	1'200	0.100

Hochtemperatur-Legierungen Alliages à haute température						
D mm	R mm	U/min	f mm/min	fz mm/z	Ae max. mm	ap max mm
1.5	R 0.75	10'000	825	0.020	0.075	0.05
2.0	R 1.0	7'300	750	0.025	0.100	0.06
2.5	R 1.25	6'000	700	0.029	0.125	0.08
3.0	R 1.5	5'000	630	0.030	0.150	0.09
3.5	R 1.75	4'100	575	0.035	0.175	0.11
4.0	R 2.0	3'600	555	0.040	0.200	0.12
4.5	R 2.25	3'200	510	0.040	0.220	0.14
5.0	R 2.5	3'000	510	0.040	0.250	0.15
6.0	R 3.0	2'500	495	0.046	0.300	0.18
8.0	R 4.0	1'900	510	0.068	0.400	0.24
10.0	R 5.0	1'500	510	0.080	0.500	0.30
12.0	R 6.0	1'200	450	0.093	0.600	0.36
16.0	R 8.0	900	360	0.100	0.800	0.48



Kühlanforderungen: Maximaler Kühlmittelfluss / -druck
Condition de refroidissement: Débit / pression du liquide de refroidissement maximale

Richtwerte 46150-SC, 46151-SC

Valeurs indicatives pour 46150-SC, 46151-SC

Werkstoff gruppe Groupe matière	Vc m/min.		Ø6.0	Ø8.0	Ø10.0	Ø12.0	Ø16.0
			ae 10% 0.1 x D	ae 10% 0.1 x D	ae 10% 0.1 x D	ae 10% 0.1 x D	ae 10% 0.1 x D
			ae 0.6mm	ae 0.8mm	ae 1.0mm	ae 1.2mm	ae 1.6mm
Kohlenstoffarme Stähle, Automatenstähle Carbone bas, Aciers pour automates	300	n (min ⁻¹)	15'900	11'925	9'540	7'950	5'963
		vf (mm/min)	5'724	5'724	5'724	5'724	5'724
Legierte Stähle, Werkzeugstähle & Nitrierstähle Aciers alliés, Aciers outils & Aciers nitruants	200	n (min ⁻¹)	10'600	7'950	5'300	3'975	3'180
		vf (mm/min)	3'816	3'816	3'816	3'816	3'816
Automatenstähle, Rostfreie Stähle austenitisch ≤ 32 HRC Aciers pour automates, Aciers inoxydables austénitiques ≤ 32 HRC	150	n (min ⁻¹)	7'950	5'963	4'770	3'975	2'981
		vf (mm/min)	2'862	2'862	2'862	2'862	2'862
Moderate Stahl Bearbeitung, PH Rostfreie Stähle Aciers inoxydables PH	130	n (min ⁻¹)	6'890	5'168	4'134	3'445	2'584
		vf (mm/min)	2'480	2'480	2'480	2'480	2'480
Rostfreie Stähle Duplex & Super Duplex Aciers inoxydables Duplex & Super Duplex	80	n (min ⁻¹)	4'240	3'180	2'544	2'120	1'590
		vf (mm/min)	1'526	1'526	1'526	1'526	1'526
Titanlegierungen Alliages de titane	80	n (min ⁻¹)	4'240	3'180	2'544	2'120	1'590
		vf (mm/min)	1'526	1'526	1'526	1'526	1'526

ap ≤ 4xD

TuffCut® XR

High-Performance Fräser / Fraises

Richtwerte für 46170 - 46173

Valeurs indicatives pour 46170 - 46173

Werkstoff gruppe	Werkstoff Art	Kühlmittel Fluide de refroidissement					
		Max	Luft Air	MMS	Vc m/min.		
Stähle Aciers	Kohlenstoffarm Carbone bas	●	●	●	480	385	330
	mittlerer Kohlenstoffgehalt Carbone moyenne	●	●	●	345	275	255
	Legierte Stähle Aciers alliés	●	●	●	315	255	230
	Werkzeugstähle Aciers outils	●	●	●	275	220	187
Rostfreie Stähle Aciers inoxydables	Automatenstähle Aciers pour automates	●	–	○	205	165	130
	Austenitisch austénitique	●	–	○	160	130	120
	schwerer Edelstahl Aciers inoxydables lourd	●	–	○	125	100	90
	PH Edelstahl Aciers inoxydables PH	●	–	○	160	130	120
	Kobalt-Chrom Legierungen Alliés cobalt-chrome	●	–	○	125	100	90
	Duplex (22%)	●	–	○	125	100	90
	Super Duplex (25%)	●	–	○	75	60	55
	Hitzebeständige Legierungen Alliages résistants à la chaleur	●	–	–	55	45	40
	Inconel	●	–	–	55	45	40
Sonder- legierungen Alliages spéciaux	Titanlegierungen Alliages de titane	●	–	–	160	130	100
	Grauguss / Fonte grise	●	○	○	495	395	265
Guss Fonte	Sphäroguss / Fonte ductile	●	○	○	370	300	210
	Temperguss / Fonte malléable	●	○	○	205	165	155
Gehärtete Stähle	45 - 50 HRC	●	○	○	185	150	100
Aciers trempés	50 - 55 HRC	●	○	○	155	125	85

● Bevorzugt / préféré ○ möglich / possible – nicht möglich / pas possible.

Werkstoff gruppe Groupe matière	Werkstoff Art Type de matière	Durchmesser / Diamètre			
		12mm	16mm	20mm	25mm
		Umfangfräsen / Contournage fz			
Stähle Aciers	Kohlenstoffarm Carbone bas	0.120	0.160	0.200	0.250
	mittlerer Kohlenstoffgehalt Carbone moyenne				
	Legierte Stähle Aciers alliés				
	Werkzeugstähle Aciers outils				
Rostfreie Stähle Aciers inoxydables	Automatenstähle Aciers pour automates	0.120	0.160	0.200	0.250
	Austenitisch austénitique				
	schwerer Edelstahl Aciers inoxydables lourd				
	PH Edelstahl Aciers inoxydables PH				
	Kobalt-Chrom Legierungen Alliés cobalt-chrome	0.095	0.114	0.133	0.191
	Duplex (22%)				
	Super Duplex (25%)				
Sonder- legierungen Alliages spéciaux	Hitzebeständige Legierungen Alliages résistants à la chaleur	0.064	0.076	0.089	0.127
	Inconel				
	Titanlegierungen Alliages de titane				
Guss Fonte	Grauguss / Fonte grise Sphäroguss / Fonte ductile Temperguss / Fonte malléable	0.120	0.160	0.200	0.250
Gehärtete Stähle Aciers trempés	45 - 50 HRC	0.114	0.137	0.160	0.229
	50 - 55 HRC	0.084	0.102	0.119	0.170

Bitte beachten Sie - Nur Umfangfräsen

Beim Profilfräsen mit Ae < 50% des Fräserdurchmessers kann der Zahnvorschub fz erhöht werden.
Multiplizieren Sie fz gemäss dem Spandicken-Kompensationsfaktor (links in der Tabelle ersichtlich).

A observer - uniquement contournage

Lors du profilage avec moins de 50 % de la largeur radiale du diamètre de fraise, l'épaisseur de copeau effective sur le tranchant est plus faible que la charge programmée. Le tableau ci-contre montre l'augmentation de la charge sur la dent pour un pourcentage de pénétration radiale donné. Multiplier l'avance par dent par ce facteur avant de déterminer définitivement votre avance de table.

Radialschnitt Coupe radiale	Spandicken- Kompensationsfaktor Facteur de compensation d'épaisseur de copeau
(Ae)	
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

TuffCut® XR

High-Performance Fräser / Fraises

Richtwerte für 46166

Valeurs indicatives pour 46166

Werkstoff gruppe	Werkstoff Art	Kühlmittel Fluide de refroidissement						
		Max	Luft Air	MMS				
					Vc m/min.			
Stähle Aciers	Kohlenstoffarm	●	●	●	280	240	200	160
	Carbone bas	●	●	●	200	185	160	135
	mittlerer Kohlenstoffgehalt	●	●	●	185	170	145	120
	Carbone moyenne	●	●	●	160	135	105	100
Rostfreie Stähle Aciers inoxydables	Legierte Stähle	●	●	●				
	Aciers alliés	●	●	●				
	Werkzeugstähle	●	●	●				
	Aciers outils	●	●	●				
	Automatenstähle	●	–	○	120	100	85	80
	Aciers pour automates	●	–	○	95	90	80	70
	Austenitisch	●	–	○	75	65	55	50
	austénitique	●	–	○	95	90	80	70
	schwerer Edelstahl	●	–	○	70	65	55	50
	Aciers inoxydables lourd	●	–	○	70	65	55	50
Sonder- legierungen	PH Edelstahl	●	–	○	45	40	35	30
	Aciers inoxydables PH	●	–	○	35	30	25	20
	Kobalt-Chrom Legierungen	●	–	○	30	25	20	15
	Alliés cobalt-chrome	●	–	○	95	70	60	50
	Duplex (22%)	●	–	○				
Alliages spéciaux	Super Duplex (25%)	●	–	○				
	Hitzebeständige Legierungen	●	–	–	35	30	25	20
	Alliages résistants à la chaleur	●	–	–	35	30	25	20
Guss Fonte	Inconel	●	–	–	95	70	60	50
	Titanlegierungen	●	–	–				
	Alliages de titane	●	○	○	290	190	150	130
	Grauguss / Fonte grise	●	○	○	215	150	135	120
Gehärtete Stähle	Sphäroguss / Fonte ductile	●	○	○	120	110	105	95
	Temperguss / Fonte malléable	●	○	○	110	70	40	35
Aciers trempés	45 - 50 HRc	●	○	○	90	60	35	30
	50 - 55 HRc	●	○	○				

● Bevorzugt / préféré ○ möglich / possible – nicht möglich / pas possible.

Werkstoff gruppe Groupe matière	Werkstoff Art Type de matière	Durchmesser / Diamètre								
		3mm	5mm	6mm	8mm	10mm	12mm	16mm	20mm	25mm
		Umfangfräsen / Contournage fz								
Stähle Aciers	Kohlenstoffarm	0.020	0.027	0.067	0.080	0.093	0.133	0.160	0.187	0.267
	Carbone bas									
	mittlerer Kohlenstoffgehalt									
	Carbone moyenne									
	Legierte Stähle									
	Aciers alliés									
	Werkzeugstähle									
	Aciers outils									
Rostfreie Stähle Aciers inoxydables	Automatenstähle	0.020	0.027	0.067	0.080	0.093	0.133	0.160	0.187	0.267
	Aciers pour automates									
	Austenitisch									
	austénitique									
	schwerer Edelstahl	0.014	0.020	0.050	0.060	0.070	0.100	0.120	0.140	0.200
	Aciers inoxydables lourd									
	PH Edelstahl									
	Aciers inoxydables PH									
	Kobalt-Chrom Legierungen									
	Alliés cobalt-chrome									
	Duplex (22%)									
	Super Duplex (25%)									
Sonder- legierungen Alliages spéciaux	Hitzebeständige Legierungen	0.009	0.013	0.033	0.040	0.047	0.067	0.080	0.093	0.133
	Alliages résistants à la chaleur									
	Inconel									
	Titanlegierungen									
	Alliages de titane									
Guss Fonte	Grauguss / Fonte grise	0.019	0.027	0.067	0.080	0.093	0.133	0.160	0.187	0.267
	Sphäroguss / Fonte ductile									
	Temperguss / Fonte malléable									
Gehärtete Stähle	45 - 50 HRc	0.017	0.024	0.060	0.072	0.084	0.120	0.144	0.168	0.240
Aciers trempés	50 - 55 HRc	0.010	0.018	0.043	0.053	0.061	0.089	0.107	0.124	0.178

Bitte beachten Sie - Nur Umfangfräsen

Beim Profilfräsen mit Ae < 50% des Fräserdurchmessers kann der Zahnvorschub fz erhöht werden.
Multiplizieren Sie fz gemäss dem Spandicken-Kompensationsfaktor (links in der Tabelle ersichtlich).

A observer - uniquement contournage

Lors du profilage avec moins de 50 % de la largeur radiale du diamètre de fraise, l'épaisseur de copeau effective sur le tranchant est plus faible que la charge programmée. Le tableau ci-contre montre l'augmentation de la charge sur la dent pour un pourcentage de pénétration radiale donné. Multiplier l'avance par dent par ce facteur avant de déterminer définitivement votre avance de table.

Radialschnitt Coupe radiale (Ae)	Spandicken- Kompensationsfaktor Facteur de compensation d'épaisseur de copeau
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

TuffCut® XT

Stainless

High-Performance Fräser / Fraises

Richtwerte für 46410 - 46485

Valeurs indicatives pour 46410 - 46485

Werkstoffgruppe Groupe matière	Werkstoff Art Type de matière	Kühlmittel Fluide de refroidissement			Vc m/min.						
		Max	Luft Air	MMS	1 x D 0,5 x D	1 x D 1 x D	0,05 x D 2 x D	0,1 x D 2 x D	0,2 x D 2 x D	0,3 x D 1,5 x D	0,5 x D 1,5 x D
Stähle Aciers	Kohlenstoffarm Carbone bas	●	●	●	230	220	480	385	330	275	220
	mittlerer Kohlenstoffgehalt Carbone moyenne	●	●	●	200	185	345	275	255	220	185
	Legierte Stähle Aciers alliés	●	●	●	175	165	315	255	230	200	165
	Werkzeugstähle Aciers outils	●	●	●	145	130	275	220	187	145	130
Rostfreie Stähle Aciers inoxydables	Automatenstähle Aciers pour automates	●	–	○	120	110	205	165	130	115	110
	Austenitisch austénitique	●	–	○	110	100	160	130	120	110	100
	schwerer Edelstahl Aciers inoxydables lourds	●	–	○	75	65	125	100	90	75	65
	PH Edelstahl Aciers inoxydables PH	●	–	○	110	100	160	130	120	110	100
	Kobalt-Chrom Legierungen Alliés cobalt-chrome	●	–	○	75	65	125	100	90	75	65
	Duplex (22%) Super Duplex (25%)	●	–	○	75	65	125	100	90	75	65
	Hitzebeständige Legierungen Alliages résistants à la chaleur	●	–	–	35	28	55	45	40	35	28
	Titanlegierungen Alliages spéciaux	●	–	–	75	66	160	130	100	85	65
Guss Fonte	Grauguss / Fonte grise	●	○	○	200	175	495	395	265	210	175
	Sphäroguss / Fonte ductile	●	○	○	185	165	370	300	210	185	165
	Temperguss / Fonte malléable	●	○	○	145	132	205	165	155	145	130
	45 - 50 HRC	●	○	○	60	50	185	150	100	55	50
Gehärtete Stähle Aciers trempés	50 - 55 HRC	●	○	○	50	45	155	125	85	50	45

● Bevorzugt / préféré ○ möglich / possible – nicht möglich / pas possible.

Werkstoff Matière	Bearbeitungsart Type d'usinage	Durchmesser / Diamètre								
		3mm	5mm	6mm	8mm	10mm	12mm	16mm	20mm	25mm
Stähle Aciers	Umfangfräsen	0.030	0.050	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Contournage	0.030	0.050	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Nutenfräsen	0.015	0.025	0.030	0.040	0.050	0.060	0.080	0.100	0.125
Rostfreie Stähle Aciers inoxydables	Rainurage	0.015	0.025	0.030	0.040	0.050	0.060	0.080	0.100	0.125
	Umfangfräsen	0.030	0.050	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Contournage	0.030	0.050	0.060	0.080	0.100	0.120	0.160	0.200	0.250
Sonder- legierungen Alliages spéciaux	Nutenfräsen	0.015	0.025	0.030	0.040	0.050	0.060	0.080	0.100	0.125
	Rainurage	0.015	0.025	0.030	0.040	0.050	0.060	0.080	0.100	0.125
	Umfangfräsen	0.009	0.013	0.032	0.038	0.044	0.064	0.076	0.089	0.127
Titan Titane	Contournage	0.005	0.007	0.016	0.019	0.022	0.032	0.038	0.045	0.065
	Nutenfräsen	0.030	0.050	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Rainurage	0.015	0.025	0.030	0.040	0.050	0.060	0.080	0.100	0.125
Guss Fonte	Umfangfräsen	0.030	0.050	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Contournage	0.030	0.050	0.060	0.080	0.100	0.120	0.160	0.200	0.250
	Nutenfräsen	0.015	0.025	0.030	0.040	0.050	0.060	0.080	0.100	0.125
Gehärtete Stähle Aciers trempés	Rainurage	0.015	0.025	0.030	0.040	0.050	0.060	0.080	0.100	0.125
	Umfangfräsen 35-45 HRC	0.016	0.023	0.057	0.069	0.080	0.114	0.137	0.160	0.229
	Contournage 35-45 HRC	0.016	0.023	0.057	0.069	0.080	0.114	0.137	0.160	0.229
	Nutenfräsen 35-45 HRC	0.010	0.015	0.025	0.035	0.045	0.065	0.070	0.075	0.100
	Rainurage 35-45 HRC	0.010	0.015	0.025	0.035	0.045	0.065	0.070	0.075	0.100
	Umfangfräsen 45-55 HRC	0.010	0.015	0.041	0.051	0.058	0.084	0.102	0.119	0.170
	Contournage 45-55 HRC	0.010	0.015	0.041	0.051	0.058	0.084	0.102	0.119	0.170
	Nutenfräsen >45-55 HRC	0.008	0.011	0.020	0.030	0.040	0.050	0.055	0.080	0.090
	Rainurage 45-55 HRC	0.008	0.011	0.020	0.030	0.040	0.050	0.055	0.080	0.090

Bitte beachten Sie - Fräser mit 5 Zähnen sollten nicht zum Vollnutenfräsen verwendet werden (Art.Nr. 46460 - 46485).

Beim Profilfräsen mit Ae < 50% des Fräserdurchmessers kann der Zahnvorschub fz erhöht werden.

Multiplizieren Sie fz gemäss dem Spandicken-Kompensationsfaktor (links in der Tabelle ersichtlich).

A observer - Les fraises à 5 dents ne doivent être utilisées que pour le contournage (N° art. 46460 - 46485).

Lors du profilage avec moins de 50 % de la largeur radiale du diamètre de fraise, l'épaisseur de copeau effective sur le tranchant est plus faible que la charge programmée. Le tableau ci-contre montre l'augmentation de la charge sur la dent pour un pourcentage de pénétration radiale donné. Multiplier l'avance par dent par ce facteur avant de déterminer définitivement votre avance de table.

Radialschnitt Coupe radiale	Spandicken- Kompensationsfaktor Facteur de compensation d'épaisseur de copeau
(Ae)	
30%	1.10
20%	1.20
15%	1.40
10%	1.80
5%	2.30
1%	5.00

Bei der Verwendung von 46470 und 46471
Geschwindigkeit um 10 % reduzieren

Lors de l'utilisation des fraises 46470 et 46471,
réduire la vitesse de 10 %.

Bei der Verwendung von 46480, 46481 und 46484, 46485
Geschwindigkeit um 30 % reduzieren

Lors de l'utilisation des fraises 46480, 46481 et 46484, 46485,
réduire la vitesse de 30 %.

TuffCut® DM

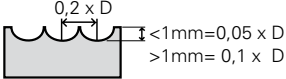
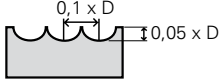
Die & Mould

High-Performance Fräser / Fraises

Richtwerte für 46860

Valeurs indicatives pour 46860

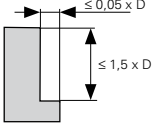
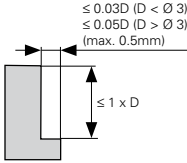
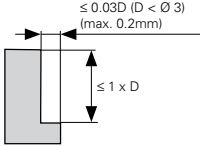
Werkstoffgruppe Groupe matière	Werkzeugstähle Aciers outils		ferritisch / martensitisch PH-Edelstahl ferritique / austénitique Aciers inoxydables PH		gehärteter Werkzeugstahl Aciers trempés		gehärteter Werkzeugstahl Aciers trempés		gehärteter Werkzeugstahl Aciers trempés	
	30-40 HRC		<40 HRC		40-45 HRC		45-55 HRC		55-60 HRC	
D	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)
0.5	30'000	508	30'000	508	30'000	508	30'000	308	30'000	250
1	30'000	683	30'000	683	30'000	608	30'000	458	30'000	383
1.5	30'000	1575	30'000	1575	23'500	1450	23'500	942	15'000	383
2	25'000	2133	25'000	2133	22'000	2442	20'000	892	10'000	383
3	17'500	2392	17'500	2392	14'500	2283	12'000	892	7'000	383
4	14'000	3050	14'000	3050	11'500	2233	9'600	942	5'600	508
6	8'750	3558	8'750	3558	7'250	1775	6'000	967	3'500	458
8	7'000	4267	7'000	4267	5'800	1725	4'800	892	2'800	383
10	5'800	3175	5'800	3175	4'800	1292	4'000	758	2'300	383
12	4'300	3558	4'300	3558	3'625	1167	3'000	633	1'750	250

Schnitttiefe Profondeur de coupe										

Richtwerte für 46890 und 46894

Valeurs indicatives pour 46890 et 46894

Werkstoff - Gruppe Groupe matière	gehärteter Werkzeugstahl Aciers trempés		gehärteter Werkzeugstahl Aciers trempés		gehärteter Werkzeugstahl Aciers trempés	
	40-45 HRC		45-55 HRC		55-60 HRC	
D	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)
3	14'500	2283	12'000	892	7'000	383
4	11'500	2233	9'600	942	5'600	508
6	7'250	1775	6'000	967	3'500	458
8	5'800	1725	4'800	892	2'800	383
10	4'800	1292	4'000	758	2'300	383
12	3'625	1167	3'000	633	1'750	250
16	3'625	1167	3'000	633	1'750	250

Schnitttiefe Profondeur de coupe						

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High-Performance Fräser / Fraises

Richtwerte für 46876

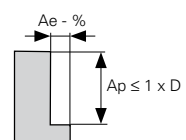
Valeurs indicatives pour 46876

Werkstoff gruppe	HRC	Bearbeitungs- art	Durchmesser Diamètre		Eckenradius Rayon		Durchmesser Diamètre		Eckenradius Rayon		Durchmesser Diamètre		Eckenradius Rayon	
			3		0,8		6		1,5		8		2	
			Ae	Ap	n (min ⁻¹)	vf (mm/min)	Ae	Ap	n (min ⁻¹)	vf (mm/min)	Ae	Ap	n (min ⁻¹)	vf (mm/min)
Gusseisen	15-25	1	0.7	0.24	8000	6000	1.5	0.45	4000	6700	2	0.6	3000	6700
Kohlenstoffstähle		2	0.7	0.192	13500	10000	1.5	0.36	6600	11000	2	0.48	5000	11200
Legierter Stahl		3	0.7	0.48	8000	2800	1.5	0.9	4000	3050	2	1.2	3000	3050
Fonte		4	0.7	0.24	10100	5900	1.5	0.45	5000	6500	2	0.6	3800	6600
Aciers au carbone		5	0.05-0.1	0.08	19100	2050	0.05-0.1	0.15	9500	2300	0.05-0.1	0.2	7200	230
Aciers alliés	25-35	1	0.7	0.24	7400	5100	1.5	0.45	3700	5700	2	0.6	2800	5700
Werkzeugstähle		2	0.7	0.192	11700	8100	1.5	0.36	5800	8900	2	0.48	4400	9000
PH Edelstahl		3	0.7	0.432	7400	2400	1.5	0.81	3700	2650	2	1.08	2800	2700
Aciers outils		4	0.7	0.24	9500	4950	1.5	0.45	4800	5550	2	0.6	3600	5550
Aciers inoxydables PH		5	0.05-0.1	0.08	16000	1370	0.05-0.1	0.15	8000	1600	0.05-0.1	0.2	6000	1550
Gehärteter Stähle PH Edelstahl	35-45	1	0.7	0.24	6900	3700	1.5	0.45	3400	4100	2	0.6	2600	4200
		2	0.7	0.168	10600	5700	1.5	0.315	5300	6350	2	0.42	4000	6400
		3	0.7	0.384	6900	1860	1.5	0.72	3400	2050	2	0.96	2600	2080
		4	0.7	0.24	9000	3700	1.5	0.45	4500	4100	2	0.6	3400	4150
		5	0.05-0.1	0.08	12700	820	0.05-0.1	0.15	6400	920	0.05-0.1	0.2	4800	920
Aciers trempés Aciers inoxydables PH	45-55	1	0.7	0.168	5300	2900	1.5	0.315	2700	3250	2	0.42	2000	3200
		2	0.7	0.144	8500	4600	1.5	0.27	4200	5050	2	0.36	3200	5150
		3	0.7	0.288	5300	1440	1.5	0.54	2700	1630	2	0.72	2000	1600
		4	0.7	0.168	6900	2600	1.5	0.315	3400	2900	2	0.42	2600	2900
		5	0.05-0.1	0.08	9500	510	0.05-0.1	0.15	4800	580	0.05-0.1	0.2	3600	580
Gehärtete Stähle	55-60	1	0.7	0.12	5300	1150	1.5	0.225	2700	1300	2	0.3	2000	1300
		2	0.7	0.096	7400	1600	1.5	0.18	3700	1790	2	0.24	2800	1800
		3	0.7	0.168	5300	690	1.5	0.315	2700	780	2	0.42	2000	770
		4	0.7	0.12	6400	1050	1.5	0.225	3200	1150	2	0.3	2400	1150
		5	0.05-0.1	0.08	7400	320	0.05-0.1	0.15	3700	360	0.05-0.1	0.2	2800	360
Aciers trempés		1	0.7	0.12	5300	1150	1.5	0.225	2700	1300	2	0.3	2000	1300
		2	0.7	0.096	7400	1600	1.5	0.18	3700	1790	2	0.24	2800	1800
		3	0.7	0.168	5300	690	1.5	0.315	2700	780	2	0.42	2000	770
		4	0.7	0.12	6400	1050	1.5	0.225	3200	1150	2	0.3	2400	1150
		5	0.05-0.1	0.08	7400	320	0.05-0.1	0.15	3700	360	0.05-0.1	0.2	2800	360

Bearbeitungsart

- 1 Standard-Schnittbedingungen. Bevorzugte Startbedingungen. Hohe Effizienz - längste Lebensdauer.
- 2 Bedingungen bei Hochgeschwindigkeit. Maschine stabil, kann hohe Vorschubgeschwindigkeiten, hohe Spindeldrehzahlen leisten. Ultrahohe Effizienz.
- 3 Hohe Schnitttiefe. Starre Maschinen ohne Hochgeschwindigkeitsspindeln.
- 4 Niedrige Lastbedingungen. Maschinen mit geringer Steifigkeit, daher geringere Drehzahl / Vorschub.
- 5 Endbearbeitungsbedingungen.

Werkstoff Gruppen Groupe matière	Durchmesser / Diamètre (mm)							
	3		4		5		6	
	Radialschnitt Coupe radiale		Radialschnitt Coupe radiale		Radialschnitt Coupe radiale		Radialschnitt Coupe radiale	
	Ae 10%	Ae 20%	Ae 10%	Ae 20%	Ae 10%	Ae 20%	Ae 10%	Ae 20%
Kohlenstoffarmer Baustahl - Legierung	37100		27825		22260		18550	
Acier de construction au carbone bas - Alliage	7791	5565	7791	5565	7791	5565	7791	5565
Form-/Werkzeugstähle	26500		19875		15900		13250	
Aciers de moule / Aciers à outils	2783	2783	5565	3975	5565	3976	5565	3975
Austenitische rostfreie Stähle und Niederschlag	15900		11925		9540		7950	
Gehärtete und martensitische rostfreie Stähle 32 HRC	1113	795	1002	716	1068	763	1169	835
Aciers inoxydables austénitiques								
Aciers inoxydables trempés et martensitique 32 HRC								



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High-Performance Fräser / Fraises

Richtwerte für 46876

Valeurs indicatives pour 46876

Durchmesser Diamètre		Eckenradius Rayon		Durchmesser Diamètre		Eckenradius Rayon		Durchmesser Diamètre		Eckenradius Rayon		Durchmesser Diamètre		Eckenradius Rayon	
10		2		12		2		16		3		20		3	
Ae	Ap	n (min ⁻¹)	vf (mm/min)	Ae	Ap	n (min ⁻¹)	vf (mm/min)	Ae	Ap	n (min ⁻¹)	vf (mm/min)	Ae	Ap	n (min ⁻¹)	vf (mm/min)
3	0.6	2400	6700	4	0.6	2000	6400	5	0.9	1500	5400	7	0.9	1200	4400
3	0.48	4000	11200	4	0.48	3300	10550	5	0.72	2500	9000	7	0.72	2000	7300
3	1.2	2400	3050	4	1.2	2000	2950	5	1.8	1500	2500	7	1.8	1200	2000
3	0.6	3000	6500	4	0.6	2500	6200	5	0.9	1900	5250	7	0.9	1500	4200
0.05-0.1	0.2	5700	2300	0.05-0.1	0.2	4800	2200	0.05-0.1	0.3	3600	1850	0.05-0.1	0.3	2900	1510
3	0.6	2200	5600	4	0.6	1900	5550	5	0.9	1400	4600	7	0.9	1100	3700
3	0.48	3500	9000	4	0.48	2900	8450	5	0.72	2200	7200	7	0.72	1800	6000
3	1.08	2200	2650	4	1.08	1900	2600	5	1.62	1400	2150	7	1.62	1100	1730
3	0.6	2900	5570	4	0.6	2400	5300	5	0.9	1800	4420	7	0.9	1400	3500
0.05-0.1	0.2	4800	1550	0.05-0.1	0.2	4000	1470	0.05-0.1	0.3	3000	1250	0.05-0.1	0.3	2400	1000
3	0.6	2100	4200	4	0.6	1700	3900	5	0.9	1300	3300	7	0.9	1000	2600
3	0.42	3200	6400	4	0.42	2700	6200	5	0.63	2000	5100	7	0.63	1600	4200
3	0.96	2100	2100	4	0.96	1700	1950	5	1.44	1300	1700	7	1.44	1000	1300
3	0.6	2700	4100	4	0.6	2300	4000	5	0.9	1700	3300	7	0.9	1400	2800
0.05-0.1	0.2	3800	910	0.05-0.1	0.2	3200	900	0.05-0.1	0.3	2400	740	0.05-0.1	0.3	1900	600
3	0.42	1600	3200	4	0.42	1300	3000	5	0.63	1000	2600	7	0.63	800	2100
3	0.36	2500	5000	4	0.36	2100	4800	5	0.54	1600	4100	7	0.54	1300	3400
3	0.72	1600	1600	4	0.72	1300	1500	5	1.08	1000	1280	7	1.08	800	1050
3	0.42	2100	2950	4	0.42	1700	2700	5	0.63	1300	2350	7	0.63	1000	1830
0.05-0.1	0.2	2900	580	0.05-0.1	0.2	2400	550	0.05-0.1	0.3	1800	460	0.05-0.1	0.3	1400	360
3	0.3	1600	1300	4	0.3	1300	1200	5	0.45	1000	1000	7	0.45	800	830
3	0.24	2200	1750	4	0.24	1900	1750	5	0.36	1400	1450	7	0.36	1100	1140
3	0.42	1600	770	4	0.42	1300	710	5	0.63	1000	610	7	0.63	800	500
3	0.3	1900	1150	4	0.3	1600	1100	5	0.45	1200	920	7	0.45	1000	780
0.05-0.1	0.2	2200	350	0.05-0.1	0.2	1900	350	0.05-0.1	0.3	1400	290	0.05-0.1	0.3	1100	230

Genre d'usinage

- 1 Conditions de coupe standard. Conditions de démarrage préférées. Grande efficacité – durée de vie maximale.
- 2 Conditions pour haute vitesse. Machine stable, capable de vitesses d'avance et de broche élevées. Très grande efficacité.
- 3 Profondeur de coupe élevée. Machines rigides, sans broches haute vitesse.
- 4 Conditions de faibles charges. Machines à rigidité limitée, donc vitesse / avance plus faibles.
- 5 Conditions d'usinage de finition.

Durchmesser / Diamètre (mm)									
8		10		12		16		20	
Radialschnitt Coupe radiale		Radialschnitt Coupe radiale		Radialschnitt Coupe radiale		Radialschnitt Coupe radiale		Radialschnitt Coupe radiale	
Ae 10%	Ae 20%	Ae 10%	Ae 20%	Ae 10%	Ae 20%	Ae 10%	Ae 20%	Ae 10%	Ae 20%
13913		11130		9275		6956		5565	
7791	5565	7791	5565	7791	5565	7791	5565	7791	5565
9938		7950		6625		4969		3975	
5565	3975	5565	3975	5565	3975	5565	3975	5565	3975
5963		4770		3975		2981		2385	
1043	745	1670	1193	2226	1590	1878	1342	1503	1073
Vorschub/Avance mm/min.									
n (min ⁻¹)									
Vorschub/Avance mm/min.									
n (min ⁻¹)									
Vorschub/Avance mm/min.									
n (min ⁻¹)									
Vorschub/Avance mm/min.									

TuffCut® X-AL

Aluminium

High-Performance Fräser / Fraises

Richtwerte für Al / Al-Si Legierungen

Valeurs indicatives pour Al / alliages Al-Si

Artikel Nr. No. Article				Vc m/min	Durchmesser / Diamètre (mm)									
					2-3	4	5	6	8	10	12	16	20	25
					fz	fz	fz	fz	fz	fz	fz	fz	fz	fz
46910.0		1 x D	0,5 x D	250-300	–	–	0.063	0.063	0.094	0.094	0.127	0.19	0.19	0.25
		1 x D	1 x D	250-300	–	–	0.052	0.052	0.084	0.084	0.10	0.14	0.14	0.21
		0,2 x D	1 x D	250-300	–	–	0.075	0.075	0.125	0.125	0.135	0.225	0.225	0.275
		0,5 x D	1 x D	250-300	–	–	0.063	0.063	0.094	0.094	0.127	0.19	0.19	0.25
46922.0		1 x D	0,5 x D	300-425	0.035	0.035	0.075-0.10	0.10-0.23	0.175-0.30	0.175-0.30	0.25-1.15	0.38-1.02	0.38-1.02	0.38-1.02
1 x D		1 x D	250-365	0.030	0.030	0.025-0.05	0.10-0.15	0.10-0.15	0.10-0.15	0.25-0.75	0.38-0.75	0.38-0.75	0.38-0.75	
46924.0		0,2 x D	1 x D	300-425	0.030	0.030	0.05-0.10	0.10-0.23	0.10-0.23	0.10-0.23	0.25-1.15	0.38-1.02	0.38-1.02	0.38-1.02
46926.0		0,5 x D	1 x D	300-425	0.030	0.030	0.05-0.10	0.10-0.23	0.10-0.23	0.10-0.23	0.25-0.89	0.38-0.89	0.38-0.89	0.38-0.89
46928.0		1 x D	1 x D	250-365	0.025	0.025	0.025-0.05	0.10-0.15	0.10-0.15	0.10-0.15	0.25-0.75	0.38-0.75	0.38-0.75	0.38-0.75
46942.0														
46944.0		1 x D	0,5 x D	150	0.050	0.080	0.12	0.16	0.20	0.25	0.50	0.50	–	–
46950.0		1 x D	0,25 x D		0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
		1 x D	0,5 x D	400-600	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
		1 x D	1 x D		0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.15	0.19	–
		0,75 x D	0,5 x D		0.045	0.06	0.075	0.09	0.12	0.15	0.18	0.24	0.30	–
		0,5 x D	1 x D	500 -700	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
		0,5 x D	1,5 x D		0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
														
		0,1 x D	0,9 x l	800-1000	0.036	0.054	0.072	0.09	0.126	0.162	0.20	0.27	0.342	–
46954.0		1 x D	0,25 x D		0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
		1 x D	0,5 x D	400-600	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
		1 x D	1 x D		0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.15	0.19	–
		0,75 x D	0,5 x D		0.045	0.06	0.075	0.09	0.12	0.15	0.18	0.24	0.30	–
		0,5 x D	1 x D	500 -700	0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
		0,5 x D	0,9 x l		0.03	0.04	0.05	0.06	0.08	0.10	0.12	0.16	0.20	–
														
		0,1 x D	0,9 x l	800-1000	0.036	0.054	0.072	0.09	0.126	0.162	0.20	0.27	0.342	–
46912.0														
45913.0		0,1 x D max	0,2 x D	300-500	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.13	0.15	–
46958.0														
46960.0		0,1-0,2 x D	1 x D max	300-500	0.03	0.06	0.08	0.10	0.14	0.16	0.18	0.20	0.23	–
46962.0														
46964.0		0,1 x D	1 x D	300	0.050	0.080	0.12	0.16	0.20	0.25	0.5	0.5	–	–

Profil Höhe X (µm) / Oberflächenrauheit

Hauteur de profile X (µm) finition de surface

Ae mm	Durchmesser / Diamètre (mm)							
	1	2	4	6	8	10	12	16
0.06	0.9	0.45	0.23	0.15	0.11	0.09	0.08	0.06
0.08	1.6	0.8	0.4	0.27	0.2	0.16	0.13	0.1
0.11	3	1.5	0.76	0.5	0.38	0.3	0.25	0.19
0.15	5.7	2.8	1.4	0.94	0.7	0.56	0.47	0.35
0.20	10	5	2.5	1.7	1.3	1	0.83	0.63
0.30	23	11	5.6	3.8	2.8	2.3	1.9	1.41
0.45	53	26	13	8.4	6.3	5.1	4.2	3.16



TuffCut® X-AL

Aluminium

High-Performance Fräser / Fraises

**Vorschubgeschwindigkeit bei Fräsen
mit abgesetztem Schaft**
46922.0 - 46944.0

**Capacité d'avance
pour fraises avec queue dégagée**
46922.0 - 46944.0

U/min	Durchmesser / Diamètre (mm)									
	3 fz 0.035	4 fz 0.035	5 fz 0.084	6 fz 0.12	8 fz 0.26	10 fz 0.61	12 fz 0.77	16 fz 0.79	20 fz 0.762	25 fz 0.76
4000	280	280	672	960	2080	4880	6110	6304	6096	6096
5000	350	350	840	1200	2600	6100	7700	7880	7620	7620
6000	420	420	1008	1440	3120	7320	9240	9456	9144	9144
7000	490	490	1176	1680	3640	8540	10780	11032	10668	10668
8000	560	560	1344	1920	4160	9760	12320	12608	12192	12192
9000	630	630	1512	2160	4680	10980	13860	14184	13716	13716
10000	700	700	1680	2400	5200	12200	15400	15760	15240	15240
11000	770	770	1848	2640	5720	13420	16940	17336	16764	16764
12000	840	840	2016	2880	6240	14640	18480	18912	18288	18288
13000	910	910	2184	3120	6760	15860	20020	20488	19812	19812
14000	980	980	2352	3360	7280	17080	21560	22064	21336	21336
15000	1050	1050	2520	3600	7800	18300	23100	23640	22860	22860
16000	1120	1120	2688	3840	8320	19520	24640	25216	24384	24384
17000	1190	1190	2856	4080	8840	20740	26180	26792	25908	25908
18000	1260	1260	3024	4320	9360	21960	27720	28368	27432	27432
19000	1330	1330	3192	4560	9880	23180	29260	29944	28956	28956
20000	1400	1400	3360	4800	10400	24400	30800	31520	30480	30480
21000	1470	1470	3528	5040	10920	25620	32340	33096	32004	32004
22000	1540	1540	3696	5280	11440	26840	33880	34672	33528	33528
23000	1610	1610	3864	5520	11960	28060	35420	36248	35052	35052
24000	1680	1680	4032	5760	12480	29280	36960	37824	36576	36576
25000	1750	1750	4200	6000	13000	30500	38500	39400	38100	38100
30000	2100	2100	5040	7200	15600	36600	46200	47280	45720	45720

Vorschub in mm/min

Avance indiquée en mm/min

Korrektur Faktor nach Auskrägung

Facteur de correction suivant porte-à-faux

Art. Nr.		fz	Ap	Ae
46922.0	kurz	x 1,0	1xD	1xD
46924.0	mittel	x 0.7	1xD	1xD
46926.0	lang	x 0.6	1xD	0.25xD

Für Fräser mit nicht abgesetztem Schaft können die mit obiger Tabelle ermittelten Werte wie folgt erhöht werden.

Pour fraises queue non-dégagé les valeurs obtenue avec le tableau ci-dessous peuvent être augmentés avec les facteurs ci-dessous.

D 3 – 8 mm Vorschub / Avance x 2.0
D 10 – 25 mm Vorschub / Avance x 1.35

“Standard”

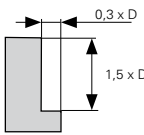
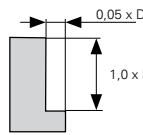
Economy

Universal-Fräser / Fraises universelle

Richtwerte für 4671.4 und 4672.4

Valeurs indicatives pour 4671.4 et 4672.4

Werkstoffgruppe Groupe matière	Stähle Gusseisen		legierte Stähle Hitzebeständige Stähle		legierte Stähle Hitzebeständige Stähle		gehärteter Werkzeugstahl		gehärteter Werkzeugstahl	
	Aciers Fonte		Aciers alliés Aciers résistants à la chaleur		Aciers alliés Aciers résistants à la chaleur		Aciers trempés		Aciers trempés	
	-30 HRC		30-38 HRC		38-45 HRC		45-55 HRC		55-65 HRC	
D	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)	n (min ⁻¹)	vf (mm/min)
6	15'600	2'320	12'400	840	8'400	570	3'400	260	2'400	190
8	11'600	2'320	9'200	840	6'300	570	2'400	240	1'800	180
10	9'200	2'320	7'600	840	5'100	570	2'000	290	1'300	190
12	8'000	2'400	6'000	800	4'200	570	1'680	260	1'200	190
14	6'800	2'400	5'200	840	3'600	570	1'400	200	900	130
16	6'000	2'400	4'800	760	3'300	510	1'200	160	800	110
18	5'200	2'320	4'400	720	2'700	420	1'100	150	700	100
20	4'800	2'160	3'600	560	2'400	360	1'000	150	660	100
25	4'300	2'150	3'200	620	2'160	410	900	160	600	100

Schnitttiefe Profondeur de coupe										

“Standard”

Economy

Vor- und Rückwärtssenker / Fraise biconique 90° à chanfreiner avant et arrière

Richtwerte für 4797.4 und 4798.4

Valeurs indicatives pour 4797.4 und 4798.4

Werkstoff Matériau	vc m/min	Durchmesser / Diamètre (mm)				
		1-2	3-4	6-8	10-12	16
		fz = Spandicke/ Épaisseur du copeau				
Stahl / Aciers < 500 N/mm ²	70 ~ 90	0,010	0,012	0,015	0,020	0,030
Stahl / Aciers 500 ~ 800 N/mm ²	50 ~ 80	0,010	0,012	0,015	0,020	0,030
Stahl / Aciers 800 ~ 1000 N/mm ²	45 ~ 60	0,010	0,012	0,013	0,017	0,025
Stahl / Aciers 1000 ~ 1300 N/mm ²	40 ~ 55	0,010	0,012	0,013	0,017	0,025
Rostfreier Stahl - Titanlegierungen Inox - Alliage titane	35 ~ 50	0,007	0,010	0,010	0,015	0,020
Inconel - Nimonic - Waspaloy	25 ~ 40	0,007	0,010	0,010	0,015	0,020
Guss / Fonte grise < 180 HB	45 ~ 60	0,010	0,012	0,013	0,017	0,025
Guss / Fonte grise > 180 HB	40 ~ 55	0,010	0,012	0,013	0,017	0,025
Kupferlegierungen - Bronze - Messing Alliage de cuivre - Bronze - Laiton	60 ~ 100	0,012	0,012	0,015	0,020	0,030
Aluminium ≤ 6% Si	80 ~ 120	0,012	0,012	0,015	0,020	0,030
Aluminium > 6% Si	110 ~ 180	0,012	0,012	0,015	0,020	0,030
Thermoplast Matières synthétiques	130 ~ 200	0,015	0,025	0,030	0,040	0,050

“Standard”

Economy

Universal-Fräser / Fraises universelle

Richtwerte für Universal-Fräser > Ø 6

Valeurs indicatives Fraise universelle > Ø 6

Länge / longueur	2 Zähne / dents		3 Zähne / dents	4 Zähne / dents	
kurz / courte	4602	4642	4603	4604	4644
standard	4622	4643	4623	4624	4645
lang / long	4625			4626	

Umfangfräsen

Contournage

Werkstoff gruppe Groupe matière	Werkstoff Art Type de matière	Härte Dureté	Kühlmittel Fluide de refroidissement			ae					Durchmesser / Diamètre (mm)					
											8	10	12	16	20	25
						5%	10%	20%	30%	50%	Multiplikationsfaktor für fz basierend auf ae					
						2,3	1,8	1,2	1,1	1	Facteur de multiplication pour fz sur base de ae					
			Max	Luft Air	MMS	vc m/mm Für .3 Sistral beschichtete Werkzeuge Werte um 30 % erhöhen Pour des outils .3 revêtement Sistral augmente la vitesse de 30 %					fz mm/Z					
Stähle Aciers	Kohlenstoffarm Carbone bas	< 28 HRC	●	●	●	320	215	120	115	110	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
	mittlerer Kohlenstoffgehalt Carbone moyenne	28-38 HRC	●	●	●	200	130	100	75	65	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
	Werkzeugstähle Aciers outils	28-44 HRC	●	●	●	160	110	90	85	75	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
Gehärtete Stähle Aciers trempés		45-50 HRC	●	○	○	75	73	70	65	60	0.0460	0.0530	0.0760	0.0910	0.1070	0.1520
		50-55 HRC	●	○	○	60	55	50	45	30	0.0330	0.0360	0.0530	0.0610	0.0740	0.1040
Rostfreie Stähle Aciers inoxydables	Leicht zerspanbar Facile à usiner	< 28 HRC	●	–	○	200	185	170	150	140	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
	Mittelschwer zerspanbar Usinabilité modérément facile	< 28 HRC	●	–	○	160	125	110	90	75	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
	Schwer zerspanbar Difficile à usiner	> 28 HRC	●	–	○	160	125	110	90	75	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
Sonder- legierungen Alliages spéciaux	Hitzebeständige Legierungen Alliages résistants à la chaleur	< 42 HRC	●	–	–	80	60	50	45	30	0.0360	0.0410	0.0580	0.0690	0.0810	0.1140
	Titanlegierungen Alliages de titane	< 42 HRC	●	–	–	70	60	55	45	35	0.0360	0.0410	0.0580	0.0690	0.0810	0.1140
Guss Fonte	Grauguss / Fonte grise	< 240 HB	●	○	○	130	125	115	110	90	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
	Sphäroguss / Fonte ductile Temperguss / Fonte malléable	> 240 HB	●	○	○	100	90	75	65	60	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290
Leichtmetalle Métaux légers			●			300	290	280	260	255	0.0690	0.0810	0.1140	0.1370	0.1600	0.2290

● Bevorzugt / préféré

○ möglich / possible

– nicht möglich / pas possible.

"Standard"

Economy

Universal-Fräser / Fraises universelle

Richtwerte für Universal-Fräser > Ø 6

Valeurs indicatives Fraise universelle > Ø 6

Länge / longueur	2 Zähne / dents		3 Zähne / dents	4 Zähne / dents	
kurz / courte	4602	4642	4603	4604	4644
standard	4622	4643	4623	4624	4645
lang / long	4625			4626	

Nutenfräsen

Rainurage

Werkstoff gruppe Groupe matière	Werkstoff Art Type de matière	Härte Dureté	Kühlmittel Fluide de refroidissement			Nutenfräsen			Durchmesser (mm)					
									8	10	12	16	20	25
						25%	50%	100%						
			Max	Luft Air	MMS	vc m/mm Für .3 Sistral beschichtete Werkzeuge Werte um 30 % erhöhen Pour des outils .3 revêtement Sistral Augmente la vitesse de 30 %			fz mm/Z					
Stähle Aciers	Kohlenstoffarm Carbone bas	< 28 HRC	●	●	●	120	110	107	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
	mittlerer Kohlenstoffgehalt Carbone moyenne	28-38 HRC	●	●	●	75	70	65	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
	Werkzeugstähle Aciers outils	28-44 HRC	●	●	●	65	60	55	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
Gehärtete Stähle Aciers trempés		35-45 HRC	●	○	○	55	50	45	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
		45-50 HRC	●	○	○	55	50	45	0.0200	0.0250	0.0300	0.0400	0.0500	0.0620
		50-55 HRC				50	45	40	0.0100	0.0120	0.0150	0.0200	0.0250	0.0300
Rostfreie Stähle Aciers inoxydables	Leicht zerspanbar Facile à usiner	< 28 HRC	●	–	○	120	115	110	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
	Mittelschwer zerspanbar Usinabilité modérément facile	< 28 HRC	●	–	○	75	65	55	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
	Schwer zerspanbar Difficile à usiner	> 28 HRC	●	–	○	65	60	55	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
Sonder- legierungen Alliages spéciaux	Hitzebeständige Legierungen Alliages résistants à la chaleur	< 42 HRC	●	–	–	40	35	30	0.0100	0.0120	0.0150	0.0200	0.0250	0.0300
	Titanlegierungen Alliages de titane	< 42 HRC	●	–	–	30	25	25	0.0100	0.0120	0.0150	0.0200	0.0250	0.0300
Guss Fonte	Grauguss / Fonte grise	< 240 HB	●	○	○	135	125	110	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
	Sphäroguss / Fonte ductile Temperguss / Fonte malléable	> 240 HB	●	○	○	90	75	70	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250
Leichtmetalle Métaux légers			●			230	180	140	0.0400	0.0500	0.0600	0.0800	0.1000	0.1250

● Bevorzugt / préféré ○ möglich / possible – nicht möglich / pas possible.

"Standard"

Economy

Universal-Fräser / Fraises universelle

Richtwerte für Universal-Fräser ≤ Ø 6

Valeurs indicatives Fraise universelle ≤ Ø 6

Länge / longueur	2 Zähne / dents		3 Zähne / dents	4 Zähne / dents	
kurz / courte	4602	4642	4603	4604	4644
standard	4622	4643	4623	4624	4645
lang / long	4625			4626	

Umfangfräsen

Contournage

Werkstoff gruppe Groupe matière	Werkstoff Art Type de matière	Härte Dureté	Kühlmittel Fluide de refroidissement			 vc m/mm *	Durchmesser (mm)								
			Max	Luft Air	MMS		0,4	0,8	1,2	1,6	2,0	2,5	3,0	5,0	6,0
							13% Dia. ae			25% Dia. ae					
							<2 Dia. ap			<2 Dia. ap					
							fz mm/Z								
Stähle Aciers	Kohlenstoffarm Carbone bas	< 28 HRC	●	●	●	122	0.0051	0.0152	0.0229	0.0584	0.0686	0.0813	0.1143	0.1372	0.1600
	mittlerer Kohlenstoffgehalt Carbone moyenne	28-38 HRC	●	●	●	92	0.0051	0.0152	0.0229	0.0584	0.0686	0.0813	0.1143	0.1372	0.1600
	Werkzeugstähle Aciers outils	28-44 HRC	●	●	●	60	0.0051	0.0152	0.0229	0.0584	0.0686	0.0813	0.1143	0.1372	0.1600
Gehärtete Stähle Aciers trempés		45-55HRC	●	○	○	30	0.0025	0.0076	0.0127	0.0356	0.0457	0.0533	0.0762	0.0914	0.1067
Rostfreie Stähle Aciers inoxydables	Leicht zerspanbar Facile à usiner	< 28 HRC	●	–	○	122	0.0051	0.0152	0.0229	0.0584	0.0686	0.0813	0.1143	0.1372	0.1600
	Mittelschwer zerspanbar Usinabilité modérément facile	< 28 HRC	●	–	○	61	0.0051	0.0152	0.0229	0.0584	0.0686	0.0813	0.1143	0.1372	0.1600
	Schwer zerspanbar Difficile à usiner	> 28 HRC	●	–	○	45	0.0051	0.0152	0.0229	0.0584	0.0686	0.0813	0.1143	0.1372	0.1600
Sonder- legierungen Alliages spéciaux	Hitzebeständige Legierungen Alliages résistants à la chaleur	< 42 HRC	●	–	–	120	0.0050	0.0150	0.0220	0.0580	0.0680	0.0810	0.1140	0.1370	0.1600
	Titanlegierungen Alliages de titane	< 42 HRC	●	–	–	76	0.0050	0.0150	0.0220	0.0580	0.0680	0.0810	0.1140	0.1370	0.1600
Guss Fonte	Grauguss / Fonte grise	< 240 HB	●	○	○	22	0.0025	0.0102	0.0127	0.0305	0.0356	0.0406	0.0584	0.0686	0.0813
	Sphäroguss / Fonte ductile Temperguss / Fonte malléable	> 240 HB	●	○	○	45	0.0025	0.0102	0.0127	0.0305	0.0356	0.0406	0.0584	0.0686	0.0813
Leichtmetalle Métaux légers	Aluminium < 10% Si Aluminium > 10% Si		●			228	0.0038	0.0078	0.0114	0.0139	0.0175	0.0208	0.0279	0.0419	0.0558

● Bevorzugt / préféré ○ möglich / possible – nicht möglich / pas possible.

* Für .3 Sistral beschichtete Werkzeuge Werte um 30 % erhöhen
Pour des outils .3 revêtement Sistral augmente la vitesse de 30 %

Nutenfräsen

Rainurage

Werkstoff gruppe	Werkstoff Art	Härte	Kühlmittel Fluide de refroidissement				Durchmesser (mm)												
			Max	Luft Air	MMS		vc m/mm *	0,4	0,8	1,2	1,6	2,0	2,5	3,0	5,0	6,0			
								14% Dia. ap			35% Dia. ap								
								fz mm/Z											
Stähle Aciers	Kohlenstoffarm Carbone bas	< 28 HRC	●	●	●	122	0.0018	0.0033	0.0051	0.0058	0.0074	0.0089	0.0119	0.0180	0.0241				
	mittlerer Kohlenstoffgehalt Carbone moyenne	28-38 HRC	●	●	●	100	0.0015	0.0030	0.0048	0.0053	0.0069	0.0081	0.0109	0.0165	0.0218				
	Werkzeugstähle Aciers outils	28-44 HRC	●	●	●	60	0.0013	0.0028	0.0043	0.0048	0.0061	0.0074	0.0098	0.0147	0.0198				
Gehärtete Stähle Aciers trempés		45-55HRC	●	○	○	30	0.0008	0.0015	0.0023	0.0028	0.0033	0.0041	0.0056	0.0081	0.0109				
Rostfreie Stähle Aciers inoxydables	Leicht zerspanbar Facile à usiner	< 28 HRC	●	–	○	122	0.0018	0.0033	0.0051	0.0058	0.0074	0.0089	0.0119	0.0180	0.0241				
	Mittelschwer zerspanbar Usinabilité modérément facile	< 28 HRC	●	–	○	60	0.0015	0.0030	0.0048	0.0053	0.0069	0.0081	0.0109	0.0165	0.0218				
	Schwer zerspanbar Difficile à usiner	> 28 HRC	●	–	○	45	0.0010	0.0020	0.0030	0.0033	0.0043	0.0051	0.0069	0.0102	0.0137				
Sonder- legierungen Alliages spéciaux	Hitzebeständige Legierungen Alliages résistants à la chaleur	< 42 HRC	●	–	–	120	0.0018	0.0033	0.0051	0.0058	0.0074	0.0089	0.0119	0.0180	0.0241				
	Titanlegierungen Alliages de titane	< 42 HRC	●	–	–	76	0.0015	0.0030	0.0048	0.0053	0.0069	0.0081	0.0109	0.0165	0.0218				
Guss Fonte	Grauguss / Fonte grise	< 240 HB	●	○	○	22	0.0010	0.0020	0.0030	0.0033	0.0043	0.0051	0.0069	0.0102	0.0137				
	Sphäroguss / Fonte ductile Temperguss / Fonte malléable	> 240 HB	●	○	○	45	0.0010	0.0020	0.0030	0.0033	0.0043	0.0051	0.0069	0.0102	0.0137				
Leichtmetalle Métaux légers	Aluminium < 10% Si Aluminium > 10% Si		●			228	0.0038	0.0078	0.0114	0.0139	0.0175	0.0208	0.0279	0.0419	0.0558				

● Bevorzugt / préféré ○ möglich / possible – nicht möglich / pas possible.

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