

Katalog
Catalogue

Präzisionswerkzeuge in Vollhartmetall und Diamant
zum Fräsen
Precision milling tools in solid carbide
and diamond



HAM Schaftfräser
Vollhartmetall-Hochleistungsfräser
für höchste Ansprüche

HAM End mills
solid carbide high performance
end mills for highest demands



HAM Schruppfräser
für die Vorbearbeitung mit
hohen Abtragsleistungen

HAM Roughing end mills
for pre-machining with high
chip removal



HAM Torusfräser
für die 3-D Bearbeitung
von Konturen

HAM Toric end mills
for 3-D machining of
contours



HAM Radiusfräser
für die 3-D Bearbeitung
von Konturen

HAM Ball nose end mills
for 3-D machining of
contours



HAM Spezialfräser
für individuelle
Bearbeitungsfälle

HAM Special end mills
for individual applications



HAM Diamant-Fräser
für optimale Standzeiten und hoch-
präzise Fräsoperationen

HAM Diamond end mills
for optimal tool life and highly precise
milling operations



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HAM Your reliable partner worldwide ...



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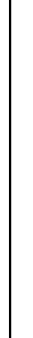




















































































Fräserbezeichnung ▶	Vollhartmetall-Schaftfräser													
DIN ▶	Werk	Werk	Werk	6527	Werk	Werk	6527	Werk	Werk	6527	6527	Werk/6527	Werk	Werk
kurz/lang ▶	kurz	extra lang	kurz/lang	lang	kurz	—	lang	—	—	lang	lang	lang	—	—
Artikelnummer	40-1001	40-5020	40-1041	40-1081	40-1121	40-1161	40-1201	40-1240	40-1281	40-1321	40-1361	40-1401	40-5040	40-1441
HAM Typ	491	—	480/482/484	410	420	421	412	425	401	434	435	430	—	400
siehe Seite	10	11	12	13	13	14	15	16	17	18	20	21	22	23
Fräsertyp	W	W	W	W	N	N	N	W	N	N	N	N	N	N
Schneidstoff	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM
Zähnezahl	1	2	2	2	2	2	2	2	3	3	3	3	3	4
Beschichtung	TA-AL	TA-AL	TA-AL	TA-AL	TA	TA	TA	—	TA	TA	TA	TA	TA	TA
Ø in mm	0,3 – 10	0,8 – 6	1 – 20	0,3 – 3	3 – 12	0,3 – 20	2 – 20	0,6 – 3	0,6 – 20	3 – 20	8 – 20	0,4 – 25	3 – 20	2 – 20
Innenkühlung	—	—	—	—	—	—	—	—	—	—	IK	—	—	—
Anwendung ▶														
		W+F											W+F	
▼ Werkstoffgruppe														
Alu	●	●	●	●	○	○	○	●	○	○	○	○	●	
Alu > 9% Si	●	●	●	●	○	○	○	●	○	○	○	○	○	
Stahl < 800 N/mm ²						●	●		●	●	●	●	●	●
Stahl < 1200 N/mm ²						●	●		●	●	●	●	●	●
Stahl < 1600 N/mm ²						○	○		●	●	●	○	●	●
Stahl < 55 HRC									○	○	○		●	●
Stahl < 60 HRC													○	
Stahl < 66 HRC														
INOX < 800 N/mm ²		○		○		○	○		○	○	○	●	○	○
INOX > 800 N/mm ²		○		○		○	○		○	○	○	●	○	
GG					●	●	●		●	●	●	●	●	●
GGG					●	●	●		●	●	●	●	●	●
hochwarmf. Leg.						○	○		○	○	○	○	○	○
Titan		○				○	○		○	○	○	○	●	○
NE-Metalle Cu-Leg.	●	●	●	●	●	○	○	●	○	○	○	○	●	
Graphit & Faserverb.	○	○	○	○				●						
UNI														

● sehr gut geeignet / very suitable ○ geeignet / suitable

Vollhartmetall-Schafffräser									Vollhartmetall-Schrupfräser							
6527	6527	6527	6527	Werk	Werk	Werk/6527	Werk/6527	Werk/6527	Werk	Werk/6527	Werk/6527	Werk	Werk	Werk	Werk	Werk
lang	kurz/lang	—	lang	lang	extra lang	extra lang	lang	lang	—	lang	—	kurz	kurz	kurz	kurz	kurz
40-1481	40-5151	40-5181	40-1521	40-5160	40-5120	40-1561	40-5200	40-5280	40-5331	40-1681	40-1721	40-1580	40-1590	40-1600	40-1610	40-1620
404	407/408	—	405	—	409	432/433/439	436/438	—	—	403/406	402	441	443	445	446	448
24	25	26	27	28	29	30	31	32	34	34	35	36	37	38	38	39
N	N	N	N	N	N	N	H	H	W	N	N	W	W	W	W	W
VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM
4-6	4	4	4	4	4-6	6-8	4-8	6-8	3	3-6	3-6	5-7	5-7	5-12	7-12	5-6
TA	TA	TA	TA	TA	TA	TA	TA-X	TA-X	TA-AL	TA-C	TA-C	—	—	—	—	—
3-32	4-25	4-25	3-25	3-20	6-32	6-32	3-32	6-25	3-25	4-32	6-32	0,8-3,175	0,8-3,175	0,8-12,7	1,6-2,4	0,8-3,175
—	—	—	—	—	—	—	—	—	—	—	IK	—	—	—	—	—
	○	○	○		○	●			●			○	○	○	○	○
	○	○	○		○	●			●			○	○	○	○	○
●	●	●	●	●	●	●				●	●					
●	●	●	●	●	●	●				●	●					
●	●	●	●	●	●	●				●	●					
●			○	●	○	●	●	●								
				○			●	●								
							●	●								
○	●	●	●	●	○	●			○	○	○					
	●	●	●	●	○	●			○	○	○					
●	●	●	●	●	●	●				●	●					
●	●	●	●	●	●	●				●	●					
○	○	○	○	○	○	●				●	●					
○	●	●	●	○	○	●			○							
	○	○	○	○	○	●			●							
									○				●	●	●	●
									○				●	●	●	●

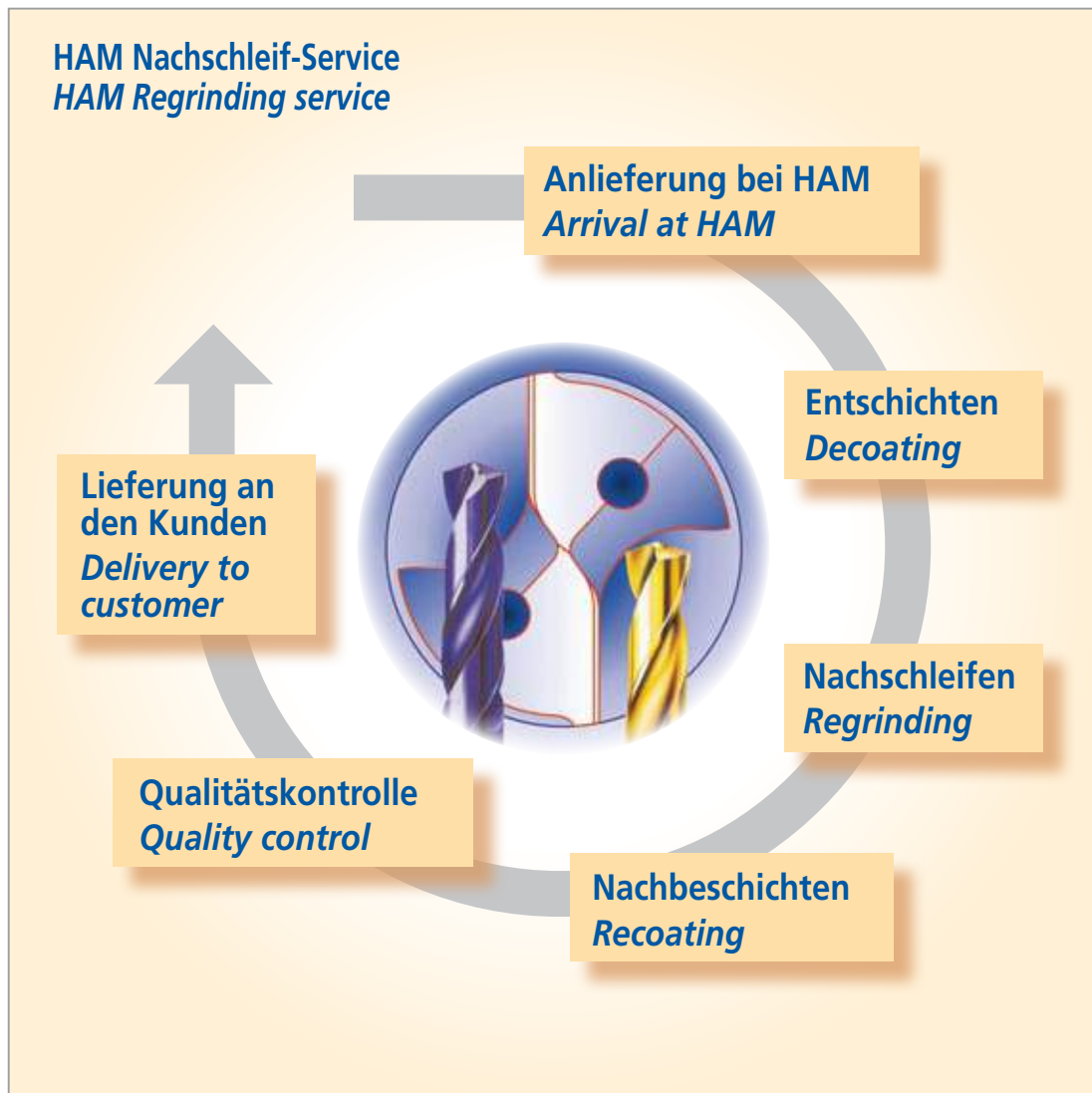
● sehr gut geeignet / very suitable ○ geeignet / suitable

															
Fräserbezeichnung ▶		Vollhartmetall-Torusfräser								Vollhartmetall-Radiusfräser					
DIN ▶	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk/6527	
kurz/lang ▶	kurz	lang	lang	extra lang	—	—	extra lang	—	lang	extra lang	kurz/lang	extra lang	kurz/lang	kurz/lang	
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HAM Typ	449	486	—	—	—	417	—	—	418/419	—	—	—	—	422/429	
siehe Seite	40	42	43	44	45	48	48	49	50	52	53	54	55	58	
Fräsertyp	W	W	W	W	H	H	W	H	H	W	W	W	H	N	
Schneidstoff	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	
Zähnezahl	5-6	2	2	2	2	2	2	4	3-4	4	2	2	2	2	
Beschichtung	—	TA-AL	TA-AL	Diamant	TA-X	TA-X	Diamant	TA-X	TA-X	TA-AL	TA-AL	Diamant	TA-X	TA	
Ø in mm	0,8 - 3,175	1 - 16	0,2 - 6	0,2 - 6	0,2 - 5	0,5 - 6	2 - 12	2 - 16	2 - 16	6 - 20	0,2 - 6	0,2 - 6	0,2 - 6	0,4 - 20	
Innenkühlung	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Anwendung ▶															
															
															
															
															
															
▼ Werkstoffgruppe															
Alu	○	●	●			○				●	●				
Alu > 9% Si	○	●	●	○	○	○	○			●	●	○			
Stahl < 800 N/mm ²					●	●		○	●				●	●	
Stahl < 1200 N/mm ²					●	●		●	●				●	●	
Stahl < 1600 N/mm ²					●	●		●	●				●	●	
Stahl < 55 HRC					●	○		●	○				●	○	
Stahl < 60 HRC					●			●					●		
Stahl < 66 HRC								●							
INOX < 800 N/mm ²			○		○	○		○	○	○	○		○	○	
INOX > 800 N/mm ²			○		○	○		○	○	○	○		○	○	
GG					●	●		●	●				●	●	
GGG					●	●		●	●				●	●	
hochwarmf. Leg.															
Titan			○							○	○				
NE-Metalle Cu-Leg.		●	●							●	●				
Graphit & Faserverb.	●	○	○	●			●			○	○	●			
UNI															

● sehr gut geeignet / very suitable ○ geeignet / suitable

Vollhartmetall-Radiusfräser						Vollhartmetall-Spezialfräser						Vollhartmetall-PKD-Fräser				
Werk/6527	Werk	Werk	Werk	6527/ Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk	Werk
kurz	lang	extra lang	lang	lang	lang	—	—	kurz	kurz	kurz	—	kurz	kurz	kurz/lang	extra lang	extra lang
40-5760	40-5781	40-5920	40-6000	40-5981	40-5800	40-5341	40-1880	40-1921	40-1961	40-2001	40-2041	43-1000	43-1040	43-1080	40-5640	40-6040
463/464	416	—	—	424/428	469	—	462	466	467	468	465	3460	3462/3463	3464-65/66	—	—
59	60	61	61	62	62	64	65	65	66	66	68	70	70	71	71	72
H	H	H	W	H	H	N	N	N	N	N	N	W	W	W	W	W
VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	VHM	PKD	PKD	PKD	PKD	PKD
2	2	3	4	4	2	4-6	1	4	4	4	4	1	1	2	2	2
TA-X	TA-X	TA-X	Diamant	TA-X	TA-X	TA	—	TA	TA	TA	TA	—	—	—	—	—
0,4 – 16	3 – 10	2 – 20	3 – 10	3 – 20	1 – 10	3 – 16	2 – 12	4 – 12	4 – 12	0,5 – 6	5,8 – 9,8	3 – 12	4 – 10	6 – 20	3 – 20	3 – 20
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
W+F	W+F	W+F	W+F	W+F	W+F	W+F									W+F	W+F
			○			●	●	●	●	●	●	●	●	●	●	●
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●	○			●	●	●	●	●	●	●	●					
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●	●	●		○	●	●		○	○	○	○					
●	●	●			○	○										
○				○	○	○		●	●	●	●					
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●	●	●		●	●	●	●	●	●	●	●					
○								○	○	○	○					
○								○	○	○	○	○	○	○	○	○
○						○	●	●	●	●	●	●	●	●	●	●
			●			○	○	○	○	○	○	●	●	●	●	●

● sehr gut geeignet/very suitable ○ geeignet/suitable



Messgerät zur Schneideneinstellung.
Measure machine for cutting edge adjustment.



HAM Beschichtungsanlagen.
HAM Coating machines.



Schaftfräser

solid carbide end mills

Vollhartmetall-Schaftfräser zum Nuten und Umfangfräsen in verschiedenen Ausführungen.

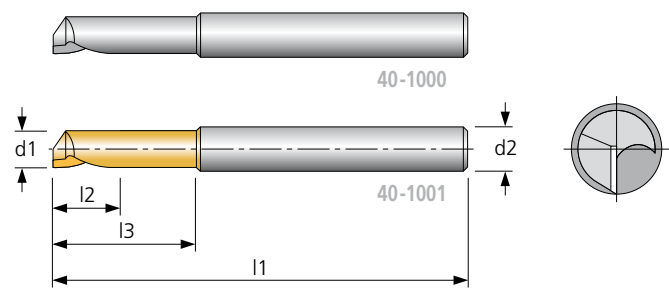
Solid carbide end mills for slot and periphery milling in different types.

HAM 491 Vollhartmetall-Schaftfräser
solid carbide end mill

VHM Z 1 30° rechts Werk Norm
Typ W HA
SHRINK FIT

- Konstruktions-Daten**
- Zentrumschneide
 - Spanwinkel stark positiv
 - großer Spanraum
 - speziell zum Fräsen von Kunststoff

- Engineering data**
- centre cutting
 - rake angle very positive
 - big chip space
 - especially for machining of plastics



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1000	●	●													●	○		●	●	○	○
40-1001	●	●													●	○		●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f10) mm	40-1000	40-1001	l2 mm	l3 mm	l1 mm	Ø d2 (h6) mm
	TA-AL					
0,3			2	3	38	3
0,4			2,5	3,5	38	3
0,6			2,5	3,5	38	3
0,8			4	5	38	3
1			4	5	38	3
1,2			5	6	38	3
1,5			6	7	38	3
1,6			6	7	38	3
1,8			7	10	38	3
2			8	11	38	3

Ø d1 (f10) mm	40-1000	40-1001	l2 mm	l3 mm	l1 mm	Ø d2 (h6) mm
	TA-AL					
2,5			9	12	38	3
2,8			12	13	38	3
3			12	13	38	3
4			12	15	50	6
5			14	17	50	6
6			16	17	50	6
8			20	21	60	8
10			22	23	70	10

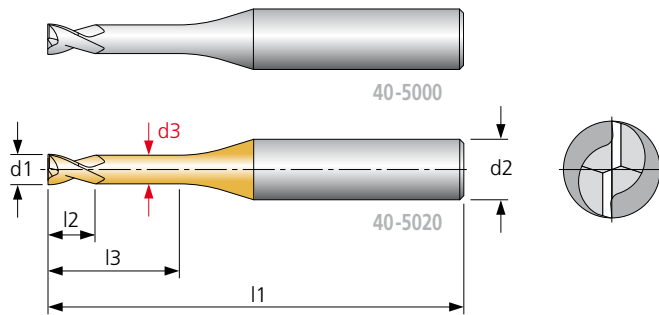
Bestellbeispiel / Order example: 40-1000-2,5

HAM

Vollhartmetall-Schaftfräser
solid carbide end mill

W+F VHM Z 2 30° rechts Werk Norm
 Typ W HA
 HSC SHRINK FIT
 HB HE

- Konstruktions-Daten**
- zentrumsschneidend
 - spezielle Ausspitzung
 - optimaler Übergang zum Schaft
- Engineering data**
- centre cutting
 - special web thinning
 - optimal neck geometrie



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5000	●	●							○	○				○	●	○		●	●	○	○
40-5020	●	●							○	○				○	●	○		●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-5000	40-5020	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL					
0,8			1,1	4	0,76	55	4
0,8			1,1	6	0,76	55	4
0,8			1,1	10	0,76	55	4
1			1,5	6	0,95	55	4
1			1,5	10	0,95	55	4
1			1,5	14	0,95	55	4
1,5			2	10	1,44	55	4
1,5			2	18	1,44	55	4
2			2,5	10	1,92	65	4
2			2,5	18	1,92	65	4
2			2,5	24	1,92	75	4
3			5	14	2,9	65	4

Ø d1 (e8) mm	40-5000	40-5020	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL					
3			5	24	2,9	75	4
3			5	30	2,9	75	4
4			6	14	3,9	65	6
4			6	24	3,9	75	6
4			6	30	3,9	75	6
5			7,5	20	4,9	65	6
5			7,5	30	4,9	75	6
5			7,5	40	4,9	90	6
6			10	20	5,9	65	6
6			10	40	5,9	90	6
6			10	50	5,9	90	6

Bestellbeispiel / Order example: HA-Schaft/shank 40-5000-6-50
 HB-Schaft/shank 40-5000-6-50-HB
 HE-Schaft/shank 40-5000-6-50-HE

HAM 480/482/484

Vollhartmetall-Schaftfräser solid carbide end mills

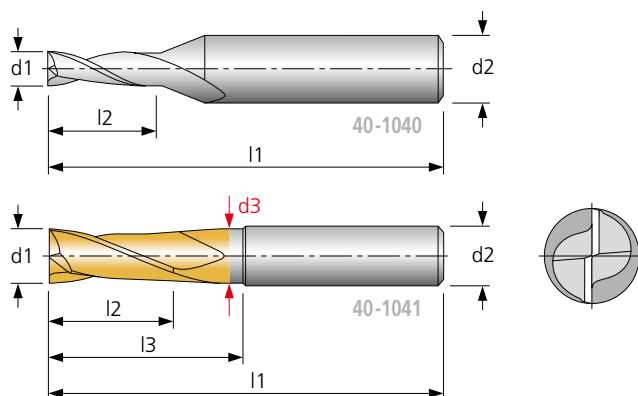
VHM	Z 2	30° rechts	Werk Norm
Typ W		DIN 6535 Werk	
HSC	SHRINK FIT		
DIN 6535 HB	DIN 6535 HE		

Konstruktions-Daten

- spezielle Geometrie für Alu
- großer Spanraum
- zentrumsschneidend

Engineering data

- special geometry for Alu
- big chip space
- centre cutting



Eckenfase	d1	b
	≤ Ø 8 ≥ Ø 10	— 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1040	●	●													●	○		●	●		○
40-1041	●	●													●	○		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1040	40-1041	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL					
1			6	—	—	57	6
2			8	—	—	57	6
3			5	—	—	50	6
3			8	—	—	57	6
3			12	—	—	60	6
4			8	—	—	54	6
4			11	—	—	57	6
4			16	—	—	60	6
5			9	—	—	54	6
5			13	—	—	57	6
5			20	—	—	60	6
6			10	—	—	54	6
6			13	—	—	57	6
6			25	40	5,8	100	6
8			12	—	—	58	8
8			16	—	—	63	8
8			30	50	7,7	100	8

Ø d1 (e8) mm	40-1040	40-1041	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL					
10			14	—	—	66	10
10			22	—	—	72	10
10			35	60	9,6	120	10
12			16	—	—	73	12
12			26	—	—	83	12
12			40	75	11,6	120	12
14			18	—	—	75	14
14			26	—	—	83	14
16			22	—	—	82	16
16			32	—	—	92	16
16			50	102	15,6	150	16
18			24	—	—	84	18
18			32	—	—	92	18
20			26	—	—	92	20
20			38	—	—	104	20
20			60	100	19,6	150	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-1040-10-14
 HB-Schaft/shank 40-1040-10-14-HB
 HE-Schaft/shank 40-1040-10-14-HE

HAM 410 Vollhartmetall-Schaftfräser solid carbide end mills

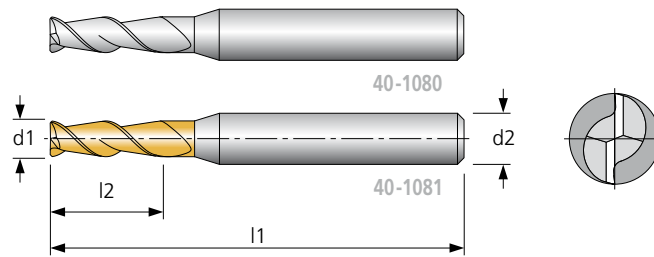
VHM Z 2 45° rechts DIN 6527
 Typ W 45° links
 HSC SHRINK FIT

Konstruktions-Daten

- zentrumsschneidend
- großer Spanraum
- Miniaturfräser

Engineering data

- centre cutting
- big chip space
- miniature end mill



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1080	●	●							○	○					●	○		●	●	○	○
40-1081	●	●							○	○					●	○		●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1080	40-1081	l2 mm	l1 mm	Ø d2 (h6) mm
		TA-AL			
0,3			1	38	3
0,4			1,5	38	3
0,6			2	38	3
0,8			3	38	3
1			3	38	3
1,2			4	38	3
1,5			5	38	3

Ø d1 (e8) mm	40-1080	40-1081	l2 mm	l1 mm	Ø d2 (h6) mm
		TA-AL			
1,6			5	38	3
1,8			6	38	3
2			6	38	3
2,5			7	38	3
3			7	38	3
3			7	57	6

Bestellbeispiel / Order example: 40-1080-1,6-38

HAM 420 Vollhartmetall-Schaftfräser solid carbide end mills

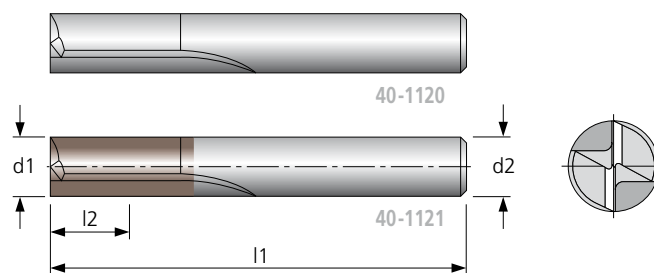
VHM Z 2 0° Nut Werk Norm
 Typ N 45° links
 SHRINK FIT

Konstruktions-Daten

- Eckenfase ab Ø 9,0 mm
- ideal zum Bearbeiten von dünnwandigen Werkstücken
- neutraler Spanwinkel
- zentrumsschneidend

Engineering data

- corner chamfer from Ø 9,0 mm
- ideal for machining very thin workpieces
- neutral rake angle
- centre cutting



Eckenfase	d1	b
	= Ø 9 ≥ Ø 10	0,05 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1120	○	○									●	●			●	○		●	●	○	●
40-1121	○	○									●	●			●	○		●	●	○	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1120	40-1121	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
3			12	40	3
3,5			12	40	3,5
4			12	40	4
4,5			14	50	4,5
5			14	50	5
6			16	50	6

Ø d1 (e8) mm	40-1120	40-1121	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
7			20	60	7
8			20	60	8
9			20	60	9
10			22	70	10
11			22	70	11
12			22	70	12

Bestellbeispiel / Order example: 40-1120-7

HAM 421 Vollhartmetall-Schaftfräser
solid carbide end mills

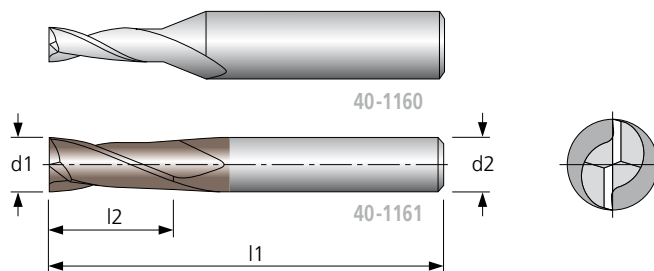
VHM Z 2 30° rechts Werk Norm
Typ N HSC SHRINK FIT

Konstruktions-Daten

- zentrumsschneidend
- universell einsetzbar

Engineering data

- centre cutting
- allround end mill



Eckenfase	d1	b
	≤ Ø 8 = Ø 9 ≥ Ø 10	— 0,05 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-1160	○	○	●	●	○				○	○	●	●	○	○	○			●	●	○	○
40-1161	○	○	●	●	○				○	○	●	●	○	○	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1160	40-1161	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
0,3			1	38	3
0,4			2,5	38	3
0,5			2,5	38	3
0,6			3	38	3
0,8			4	38	3
1			5	38	3
1,2			5	38	3
1,5			5	38	3
1,6			6	38	3
1,8			6	38	3
2			9	38	3
2,4			10	38	3
2,5			10	38	3
2,8			10	38	3
3			12	38	3

Ø d1 (e8) mm	40-1160	40-1161	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
3			7	57	6
3,5			12	40	3,5
4			12	40	4
5			14	50	5
6			16	50	6
7			20	60	7
8			20	60	8
9			22	70	9
10			22	70	10
11			22	70	11
12			22	70	12
14			25	75	14
16			25	75	16
18			30	100	18
20			30	100	20

Bestellbeispiel / Order example: 40-1160-3-57

HAM 412 Vollhartmetall-Schaftfräser
solid carbide end mills

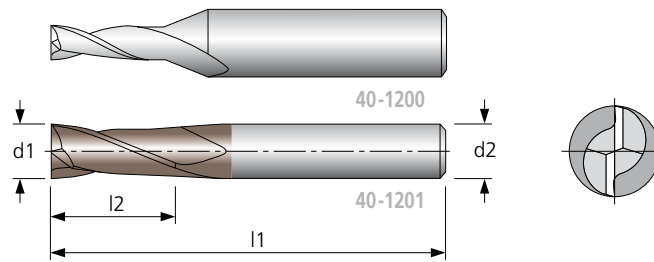
VHM Z 2 30° rechts DIN 6527
 Typ N DIN 6535 HA
 HSC SHRINK FIT
 DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zentrumsschneidend
- universell einsetzbar

Engineering data

- centre cutting
- allround end mill



Eckenfase	d1	b
	≤ Ø 8 = Ø 9 ≥ Ø 10	— 0,05 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-1200	○	○	●	●	○				○	○	●	●	○	○	○			●	●	○	○
40-1201	○	○	●	●	○				○	○	●	●	○	○	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1200	40-1201	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
2			6	57	6
3			7	57	6
4			8	57	6
5			10	57	6
6			10	57	6
7			13	63	8
8			16	63	8

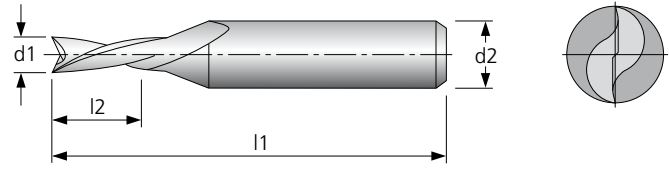
Ø d1 (e8) mm	40-1200	40-1201	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
9			16	72	10
10			19	72	10
12			22	83	12
14			22	83	14
16			26	92	16
18			26	92	18
20			32	104	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-1200-9
 HB-Schaft/shank 40-1200-9-HB
 HE-Schaft/shank 40-1200-9-HE

HAM 425 Vollhartmetall-Microfräser
solid carbide micro end mills

VHM Z 2 30° links Werk Norm
Typ W
SHRINK FIT

- Konstruktions-Daten**
- Stirn Fischschwanz-Anschliff B zum Schlitzfräsen
 - rechtsschneidend, linksspiralig
- Engineering data**
- fishtail-point form B
 - RH cutting, LH spiral fluted



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1240	●	●													●	●		●	●	○	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0,01/-0,02) mm	40-1240	l2 mm	l1 mm	Ø d2 (h6) mm
0,6		3	38	3
0,7		4	38	3
0,8		4	38	3
0,9		4	38	3
1		5	38	3
1,1		5	38	3
1,2		5	38	3
1,3		5	38	3
1,4		6	38	3

Ø d1 (0,01/-0,02) mm	40-1240	l2 mm	l1 mm	Ø d2 (h6) mm
1,5		6	38	3
1,6		6	38	3
1,7		6	38	3
1,8		6	38	3
1,9		6	38	3
2		9	38	3
2,4		10	38	3
2,5		10	38	3
3		12	38	3

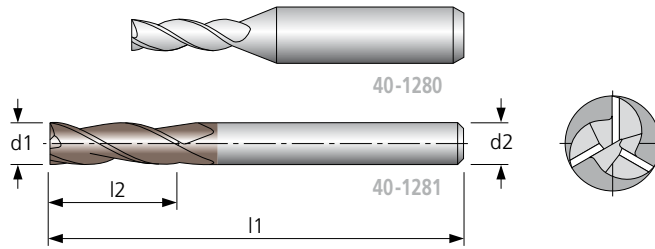
Bestellbeispiel / Order example: 40-1240-1,5

HAM 401 Vollhartmetall-Schaftfräser solid carbide end mills

VHM Z 3 30° rechts Werk Norm
 Typ N HA
 SHRINK FIT
 HB HE

- Konstruktions-Daten**
- bis Ø 3,0 mm, zentrumsschneidend
 - ab Ø 3,5 mm, eine Schneide über Mitte
 - universell einsetzbar

- Engineering data**
- up to Ø 3,0 mm centre cutting
 - from Ø 3,5 mm 1 cutting edge over centre
 - allround end mill



Eckenfase	d1	b
	≤ Ø 8 = Ø 9 ≥ Ø 10	— 0,05 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-1280	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○
40-1281	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1280	40-1281	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
0,6			2	38	3
0,8			3	38	3
1			3	38	3
1,2			4	38	3
1,5			5	38	3
1,6			5	38	3
2			6	38	3
2,5			7	38	3
3			9	38	3
3,5			12	40	3,5
4			12	40	4
4,5			14	50	4,5

Ø d1 (e8) mm	40-1280	40-1281	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
5			14	50	5
6			16	50	6
7			20	60	7
8			20	60	8
9			22	70	9
10			22	70	10
11			22	70	11
12			22	70	12
14			25	75	14
16			25	75	16
18			30	100	18
20			30	100	20

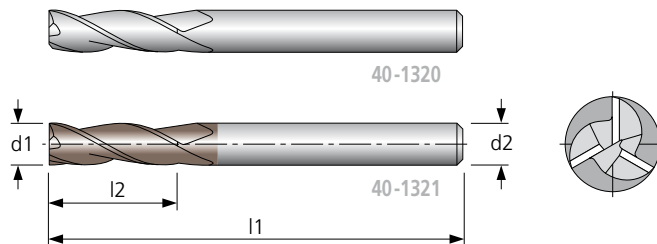
Bestellbeispiel / Order example: HA-Schaft/shank 40-1280-6
 HB-Schaft/shank 40-1280-6-HB
 HE-Schaft/shank 40-1280-6-HE

HAM 434 Vollhartmetall-Schaftfräser
solid carbide end mills

VHM Z 3 30° rechts DIN 6527
 Typ N DIN 6535 HA
 SHRINK FIT
 DIN 6535 HB DIN 6535 HE

- Konstruktions-Daten**
- eine Schneide über Mitte
 - verstärkter Kern

- Engineering data**
- 1 cutting edge over centre
 - web thickness enlarged



Eckenfase	d1	b
	≤ Ø 8 = Ø 9 ≥ Ø 10	— 0,05 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-1320	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○
40-1321	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1320	40-1321	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
3			7	57	6
4			8	57	6
5			10	57	6
6			10	57	6
7			13	63	8
8			16	63	8
9			16	72	10

Ø d1 (e8) mm	40-1320	40-1321	l2 mm	l1 mm	Ø d2 (h6) mm
		TA			
10			19	72	10
12			22	83	12
14			22	83	14
16			26	92	16
18			26	92	18
20			32	104	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-1320-10
 HB-Schaft/shank 40-1320-10-HB
 HE-Schaft/shank 40-1320-10-HE

Schaftfräser

solid carbide end mills



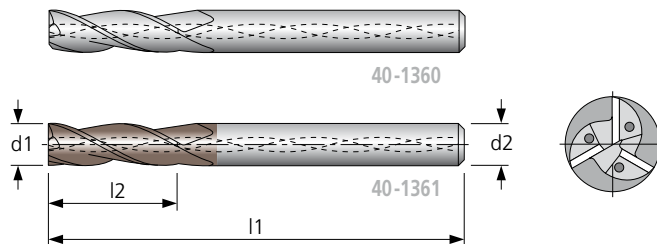
Besonders geeignet zur Feinstbearbeitung durch hohe Zähnezahl.

Especially useable for finishing machining according to many teeth.

HAM 435 Vollhartmetall-Schaftfräser mit verdralltem Kühlkanal
solid carbide end mills with interior coolant supply

VHM Z 3 30° rechts DIN 6527
 Typ N DIN 6535 HAK
 SHRINK FIT
 DIN 6535 HBK DIN 6535 HEK

- Konstruktions-Daten**
- eine Schneide über Mitte
 - verstärkter Kern
- Engineering data**
- 1 cutting edge over centre
 - web thickness reinforced



Eckenfase	d1	b
	≤ Ø 8 = Ø 9 ≥ Ø 10	— 0,05 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1360	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○
40-1361	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○

● sehr gut geeignet/very suitable ○ geeignet/suitable

Ø d1 (e8) mm	40-1360	40-1361	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
8			16	63	8
9			16	72	10
10			19	72	10
12			22	83	12

Ø d1 (e8) mm	40-1360	40-1361	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
14			22	83	14
16			26	92	16
18			26	92	18
20			32	104	20

Bestellbeispiel / Order example: HAK-Schaft/shank 40-1360-14
 HBK-Schaft/shank 40-1360-14-HBK
 HEK-Schaft/shank 40-1360-14-HEK

HAM 430 Vollhartmetall-Schaftfräser solid carbide end mills

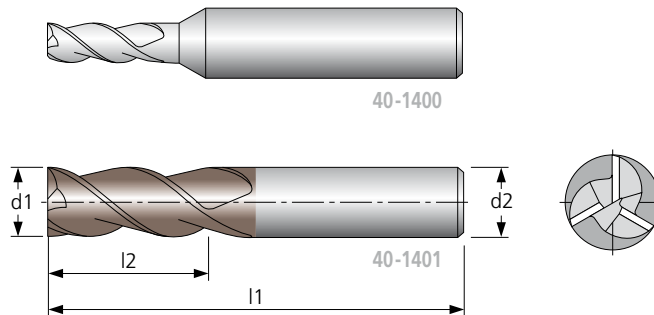
VHM Z 3 45° rechts Werk 6527
 Typ N DIN 6535 Werk
 SHRINK FIT
 DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- bis Ø 2,8 mm, 3 Schneiden bis Mitte schneidend
- ab Ø 3,0 mm, eine Schneide über Mitte schneidend

Engineering data

- up to Ø 2,8 mm, 3 cutting edge centre cutting
- from Ø 3,0 mm, 1 cutting edge over centre



Eckenfase	d1	b
	≤ Ø 6	0,05
	≥ Ø 8	0,10
	≥ Ø 14	0,15
	≥ Ø 18	0,20

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1400	●	○	●	●	○				●	●	●	●	○	●	●			●	●	○	○
40-1401	●	○	●	●	○				●	●	●	●	○	●	●			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1400	40-1401	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
0,4			2	38	3
0,6			2	38	3
0,8			3	38	3
1			3	38	3
1,2			4	38	3
1,5			5	38	3
1,6			5	38	3
1,8			6	38	3
2			6	38	3
2,4			7	38	3
2,5			7	38	3
2,8			7	38	3
3			7	38	3
3			7	57	6
3,5			7	57	6
4			8	57	6
4			12	40	4

Ø d1 (e8) mm	40-1400	40-1401	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
4,5			8	57	6
5			14	50	5
5			10	57	6
5,75			10	57	6
6			10	57	6
7			13	63	8
8			16	63	8
9			16	72	10
10			19	72	10
12			22	83	12
14			22	83	14
16			26	92	16
18			26	92	18
20			32	104	20
25			40	110	25

Bestellbeispiel / Order example: HA-Schaft/shank 40-1400-4,5-57
 HB-Schaft/shank 40-1400-4,5-57-HB
 HE-Schaft/shank 40-1400-4,5-57-HE

HAM

Vollhartmetall-Schaftfräser
solid carbide end mill

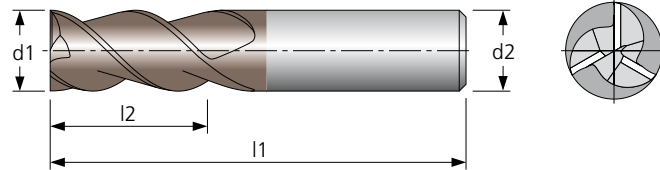
W+F VHM Z 3 45° rechts Werk Norm
Typ N HA SHRINK FIT
HB HE

Konstruktions-Daten

- Kern verstärkt
- 1 Schneide über Mitte

Engineering data

- web thickness reinforced
- 1 cutting edge over centre



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5040			●	●	●	●	○		○	○	●	●	○					●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-5040	l2 mm	l1 mm	Ø d2 (h6) mm
	TA			
3		4,5	50	6
4		6	50	6
5		7,5	50	6
6		9	50	6
8		12	60	8

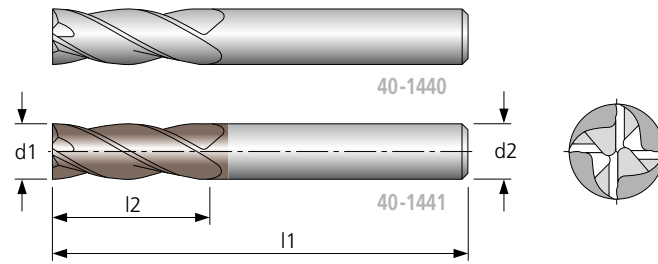
Ø d1 (e8) mm	40-5040	l2 mm	l1 mm	Ø d2 (h6) mm
	TA			
10		15	70	10
12		18	75	12
16		22	92	16
20		26	104	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-5040-10
 HB-Schaft/shank 40-5040-10-HB
 HE-Schaft/shank 40-5040-10-HE

HAM 400 Vollhartmetall-Schaftfräser
solid carbide end mills

VHM Z 4 30° rechts Werk Norm
Typ N
HSC SHRINK FIT

- Konstruktions-Daten**
- zentrumsschneidend
 - speziell zum Schlichten geeignet
- Engineering data**
- centre cutting
 - especially for finishing machining



Eckenfase	d1	b
	≤ Ø 8	—
	= Ø 9	0,05
	≥ Ø 10	0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1440			●	●	●	●			○		●	●	○	○				●	●	○	○
40-1441			●	●	●	●			○		●	●	○	○				●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1440	40-1441	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
2			6	38	3
2,5			6	38	3
3			10	38	3
3,5			12	40	3,5
4			12	40	4
4,5			14	50	4,5
5			14	50	5
6			16	50	6
7			20	60	7

Ø d1 (e8) mm	40-1440	40-1441	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
8			20	60	8
9			20	60	9
10			22	70	10
11			22	70	11
12			22	70	12
14			25	75	14
16			25	75	16
18			38	104	18
20			38	104	20

Bestellbeispiel / Order example: 40-1440-8

HAM 404 Vollhartmetall-Schaftfräser
solid carbide end mills

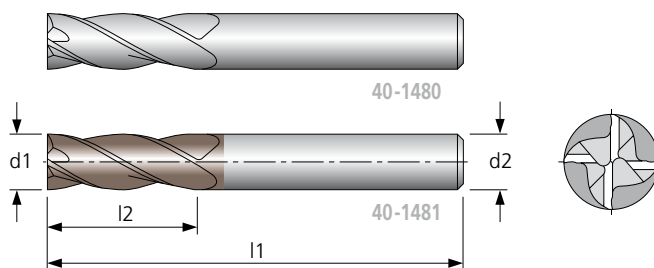
VHM	Z 4-6	30° rechts	DIN 6527
Typ N		DIN 6535 HA	
HSC	SHRINK FIT		
DIN 6535 HB	DIN 6535 HE		

Konstruktions-Daten

- zentrumsschneidend
- verstärkter Kern
- speziell zum Schlichten geeignet

Engineering data

- centre cutting
- web thickness reinforced
- especially for finishing machining



Eckenfase	d1	b
	≤ Ø 8 = Ø 9 ≥ Ø 10	— 0,05 0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legie- rung	Titan	NE Metalle Cu-Leg.	Graphit Faser- verbund	UNI				AIR	
40-1480			●	●	●	●			○		●	●	○	○					●	●	○	○
40-1481			●	●	●	●			○		●	●	○	○					●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1480	40-1481	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	TA					
3			8	57	4	6
3,5			10	57	4	6
4			11	57	4	6
4,5			11	57	4	6
5			13	57	4	6
6			13	57	4	6
7			16	63	4	8
8			19	63	4	8
9			19	72	4	10
10			22	72	4	10

Ø d1 (e8) mm	40-1480	40-1481	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	TA					
11			26	83	4	12
12			26	83	4	12
14			26	83	4	14
16			32	92	4	16
18			32	92	4	18
20			38	104	4	20
25			38	104	6	25
32			38	104	6	32

Bestellbeispiel / Order example: HA-Schaft/shank 40-1480-11
 HB-Schaft/shank 40-1480-11-HB
 HE-Schaft/shank 40-1480-11-HE

HAM 407/408

Vollhartmetall-Schaftfräser solid carbide end mill

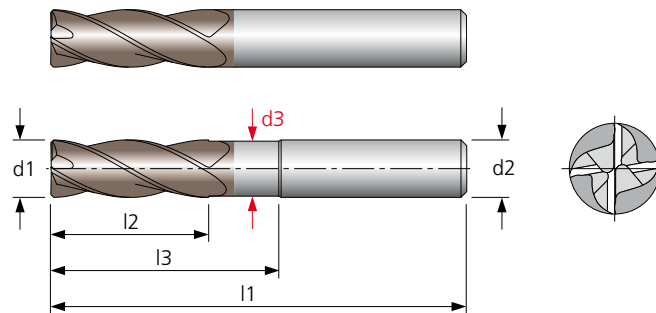
W+F VHM Z 4 35°/38° re DIN 6527
Typ N DIN 6535 HA
HSC SHRINK FIT
DIN 6535 HB DIN 6535 HB

Konstruktions-Daten

- zentrumsschneidend
- spezielle Geometrie mit ungleicher Drallsteigung
- hohes Zeitspanvolumen
- hohe Laufruhe

Engineering data

- centre cutting
- special geometry with unequal helix
- high time-per-chip volume
- very smooth running



Eckenfase	d1	b
	≥ Ø 4	0,02 x d1

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5151	○	○	●	●	●				●	●	●	●	○	●	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-5151	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA					
4		11	—	—	57	6
5		13	—	—	57	6
6		10	—	—	54	6
6		13	—	—	57	6
6		13	21	5,7	57	6
7		19	—	—	63	8
8		12	—	—	58	8
8		19	—	—	63	8
8		19	27	7,7	63	8
9		22	—	—	72	10
10		14	—	—	66	10
10		22	—	—	72	10
10		22	32	9,7	72	10
11		26	—	—	83	12
12		16	—	—	73	12
12		26	—	—	83	12
12		26	38	11,7	83	12
13		26	—	—	83	14

Ø d1 (e8) mm	40-5151	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA					
14		18	—	—	75	14
14		26	—	—	83	14
14		26	38	13,6	83	14
15		32	—	—	92	16
16		22	—	—	82	16
16		32	—	—	92	16
16		32	44	15,6	92	16
17		32	—	—	92	18
18		24	—	—	84	18
18		32	—	—	92	18
18		32	44	17,6	92	18
19		38	—	—	104	20
20		26	—	—	92	20
20		38	—	—	104	20
20		38	54	19,6	104	20
25		38	—	—	110	25
25		38	54	24,5	110	25

Bestellbeispiel / Order example: HA-Schaft/shank 40-5151-14-26-38
 HB-Schaft/shank 40-5151-14-26-38-HB
 HE-Schaft/shank 40-5151-14-26-38-HE

HAM

Vollhartmetall-Schaftfräser
solid carbide end mill

NEU

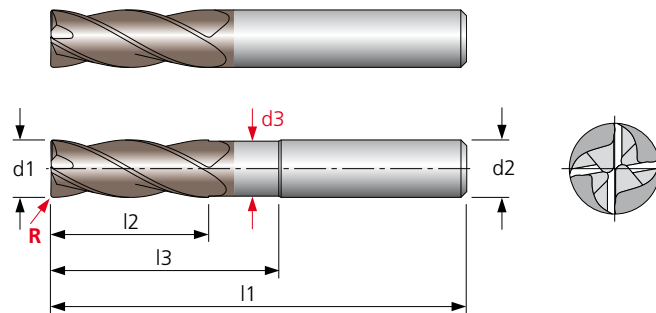
W+F VHM Z 4 35°/38° re DIN 6527
 Typ N DIN 6535 HA
 Eckradius HSC SHRINK FIT
 DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zentrumsschneidend
- spezielle Geometrie mit ungleicher Drallsteigung
- hohes Zeitspanvolumen
- hohe Laufruhe

Engineering data

- centre cutting
- special geometry with unequal helix
- high time-per-chip volume
- very smooth running



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5181	○	○	●	●	●				●	●	●	●	○	●	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (e8) mm	40-5181	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA					
4/0,5		11	—	—	57	6
5/0,5		13	—	—	57	6
6/0,5		13	21	5,7	57	6
6/1		13	21	5,7	57	6
8/0,5		19	27	7,7	63	8
8/1		19	27	7,7	63	8
10/0,5		22	32	9,7	72	10
10/1		22	32	9,7	72	10

Ø d1 (e8) mm	40-5181	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA					
12/0,5		26	38	11,7	83	12
12/1		26	38	11,7	83	12
16/1		32	44	15,6	92	16
16/2		32	44	15,6	92	16
20/1		38	54	19,6	104	20
20/2		38	54	19,6	104	20
25/2		38	54	24,5	110	25

Bestellbeispiel / Order example: HA-Schaft/shank 40-5181-12/0,5
 HB-Schaft/shank 40-5181-12/0,5-HB
 HE-Schaft/shank 40-5181-12/0,5-HE

HAM 405 Vollhartmetall-Schaftfräser solid carbide end mills

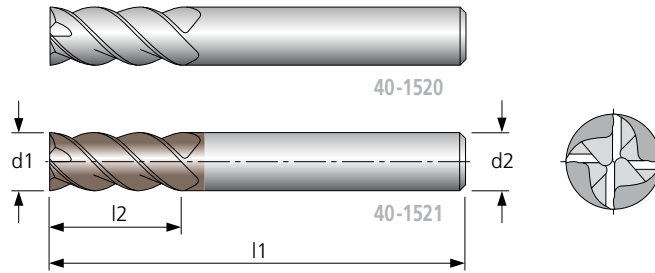
VHM Z 4 45° rechts DIN 6527
 Typ N DIN 6535 HA
 HSC SHRINK FIT
 DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zentrumsschneidend
- speziell zum Schlichten geeignet
- hohe Laufruhe

Engineering data

- centre cutting
- especially for finishing machining
- very smooth running



Eckenfase	d1	b
	≤ Ø 7	0,05
	≥ Ø 8	0,10
	≥ Ø 14	0,15
	≥ Ø 18	0,20

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1520	○	○	●	●	●	○			●	●	●	●	○	●	○			●	●	○	○
40-1521	○	○	●	●	●	○			●	●	●	●	○	●	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1520	40-1521	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
3			8	57	6
3,5			10	57	6
4			11	57	6
4,5			11	57	6
5			13	57	6
6			13	57	6
7			16	63	8
8			19	63	8
9			19	72	10
10			22	72	10

Ø d1 (e8) mm	40-1520	40-1521	l2 mm	l1 mm	Ø d2 (h6) mm
	TA				
11			26	83	12
12			26	83	12
13			26	83	14
14			26	83	14
16			32	92	16
18			32	92	18
20			38	104	20
25			38	110	25

Bestellbeispiel / Order example: HA-Schaft/shank 40-1520-11
 HB-Schaft/shank 40-1520-11-HB
 HE-Schaft/shank 40-1520-11-HE

HAM

Vollhartmetall-Schaftfräser
solid carbide end mill

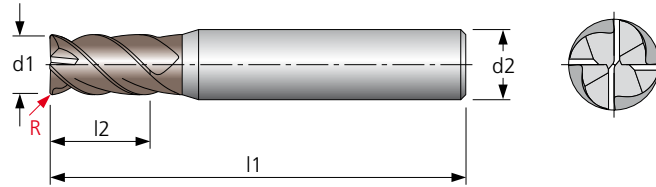
W+F VHM Z 4 45° rechts Werk Norm
 Typ N HA
 Eckradius HSC SHRINK FIT
 HB HE

Konstruktions-Daten

- zentrumsschneidend
- hohe Laufruhe
- spezielle Ausspitzung

Engineering data

- centre cutting
- very smooth running
- special web thinning



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5160			●	●	●	●	○		●	●	●	●	○	○				●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (e8) mm	40-5160	l2 mm	l1 mm	Ø d2 (h6) mm
	TA			
3/0,2		8	60	6
3/0,5		8	60	6
4/0,2		11	60	6
4/0,5		11	60	6
4/1		11	60	6
5/0,2		13	60	6
5/0,5		13	60	6
5/1		13	60	6
6/0,3		13	60	6
6/0,5		13	60	6
6/1		13	60	6
8/0,3		19	80	8
8/0,5		19	80	8
8/1		19	80	8
8/1,5		19	80	8
8/2		19	80	8
10/0,3		22	80	10
10/0,5		22	80	10

Ø d1/R (e8) mm	40-5160	l2 mm	l1 mm	Ø d2 (h6) mm
	TA			
10/1		22	80	10
10/1,5		22	80	10
10/2		22	80	10
10/3		22	80	10
12/0,5		26	100	12
12/1		26	100	12
12/1,5		26	100	12
12/2		26	100	12
12/3		26	100	12
16/1		32	115	16
16/1,5		32	115	16
16/2		32	115	16
16/3		32	115	16
20/1		38	125	20
20/1,5		38	125	20
20/2		38	125	20
20/3		38	125	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-5160-10/1
 HB-Schaft/shank 40-5160-10/1-HB
 HE-Schaft/shank 40-5160-10/1-HE

HAM 409 Vollhartmetall-Schaftfräser
solid carbide end mill

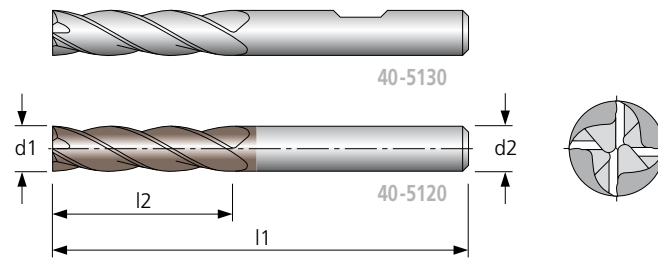
W+F VHM Z 4-6 40° rechts Werk Norm

Konstruktions-Daten

- zentrumsschneidend
- lange Schneidlänge
- verstärkter Kern

Engineering data

- centre cutting
- long cutting length
- web thickness reinforced



Typ N DIN 6535 HA

SHRINK FIT

DIN 6535 HB DIN 6535 HE

Eckenfase	d1	b
	= Ø 6	0,05
	≥ Ø 8	0,10
	≥ Ø 14	0,15
	≥ Ø 18	0,20

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5110 u. 40-5130	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○
40-5120 u. 40-5140	○	○	●	●	●	○			○	○	●	●	○	○	○			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-5110	40-5120	40-5130	40-5140	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	DIN 6535 HA	DIN 6535 HA TA	DIN 6535 HB	DIN 6535 HB TA				
6					40	100	4	6
8					40	100	4	8
10					40	100	4	10
12					45	100	4	12
14					45	100	4	14
14					65	150	4	14
16					45	100	4	16
16					65	150	4	16
18					50	125	4	18
18					65	150	4	18
20					55	125	4	20
20					80	150	4	20
20					110	180	4	20
25					55	125	6	25
25					80	150	6	25
25					110	180	6	25
25					150	230	6	25
32					110	180	6	32

Bestellbeispiel / Order example: HA-Schaft/shank 40-5110-6-40
 HB-Schaft/shank 40-5130-6-40
 HE-Schaft/shank 40-5110-6-40-HE

HAM 432/433/439

Vollhartmetall-Schaftfräser solid carbide end mills

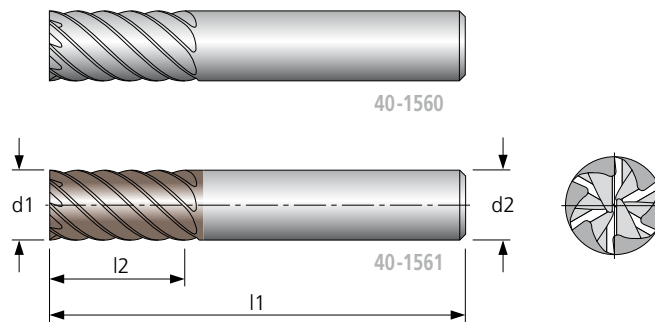
VHM	Z 6-8	45° rechts	Werk 6527
Typ N		DIN 6535 Werk	
HPC		SHRINK FIT	
DIN 6535 HB		DIN 6535 HE	

Konstruktions-Daten

- Spanwinkel 10° – 12°
- speziell zum Schlichten geeignet
- verstärkter Kern

Engineering data

- rake angle 10° – 12°
- especially for finishing machining
- web thickness reinforced



Eckenfase	d1	b
	= Ø 6	0,05
	≥ Ø 8	0,10
	≥ Ø 14	0,15
	≥ Ø 18	0,20

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legie- rung	Titan	NE Metalle Cu-Leg.	Graphit Faser- verbund	UNI	MMS	max.	ohne	AIR
40-1560	●	●	●	●	●	●			●	●	●	●	●	●	●			●	●	○	○
40-1561	●	●	●	●	●	●			●	●	●	●	●	●	●			●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-1560	40-1561	l2 mm	l1 mm	Z	Ø d2 (h6) mm
		TA				
6			13	57	6	6
6			18	62	6	6
8			19	63	6	8
8			24	68	6	8
10			22	72	6	10
10			30	80	6	10
10			45	95	6	10
12			26	83	6	12
12			36	93	6	12
12			53	110	6	12
14			26	83	6	14
14			42	99	6	14
16			32	92	6	16

Ø d1 (e8) mm	40-1560	40-1561	l2 mm	l1 mm	Z	Ø d2 (h6) mm
		TA				
16			48	108	6	16
16			63	123	8	16
16			80	135	8	16
18			32	92	8	18
18			54	114	8	18
20			38	104	8	20
20			60	125	8	20
20			75	141	8	20
20			100	166	8	20
20			125	191	8	20
25			40	110	8	25
25			75	150	8	25
32			40	110	8	32

Bestellbeispiel / Order example: HA-Schaft/shank 40-1560-16-48
 HB-Schaft/shank 40-1560-16-48-HB
 HE-Schaft/shank 40-1560-16-48-HE

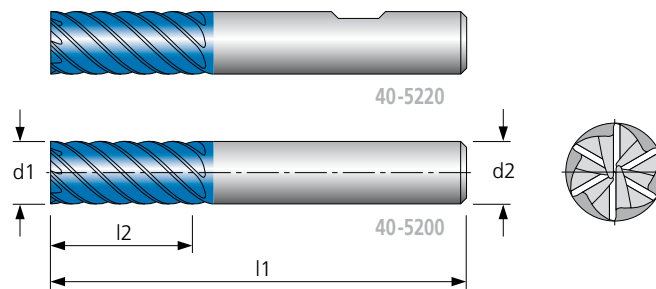
HAM 436/438

Vollhartmetall-Schaftfräser
solid carbide end mill

W+F VHM Z 4-8 45° rechts Werk 6527
Typ H DIN 6535 HA
HPC SHRINK FIT
DIN 6535 HB DIN 6535 HE

- Konstruktions-Daten**
- zum Hartfräsen bis 65 HRC
 - Spanwinkel negativ
 - verstärkter Kern

- Engineering data**
- for hard milling up to 65 HRC
 - rake angle negative
 - web thickness reinforced



Eckenfase	d1	b
	≤ Ø 12 > Ø 12	0,10 0,20

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5200 u. 40-5220						●	●	●										●		●	●
40-5240 u. 40-5260						●	●	●										●		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-5200	40-5220	40-5240	40-5260	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	DIN 6535 HA	DIN 6535 HB	DIN 6535 HA	DIN 6535 HB				
	TA-X	TA-X	TA-X	TA-X				
3					8	57	4	6
4					8	57	6	6
5					11	57	6	6
6					13	57	6	6
6					18	62	6	6
8					19	63	6	8
8					24	68	6	8
10					22	72	6	10
10					30	80	6	10
12					26	83	6	12
12					36	93	6	12
14					26	83	6	14
14					42	99	6	14
16					32	92	6	16
16					48	108	6	16
18					32	92	8	18
18					54	114	8	18
20					38	104	8	20
20					60	125	8	20
25					40	110	8	25
25					75	150	8	25
32					40	110	8	32

Bestellbeispiel / Order example: HA-Schaft/shank 40-5200-3-8
 HB-Schaft/shank 40-5220-3-8
 HE-Schaft/shank 40-5200-3-8-HE

HAM

Vollhartmetall-Schaftfräser
solid carbide end mill

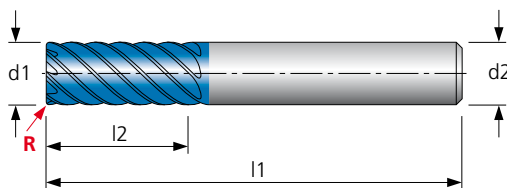
W+F VHM Z 6-8 45° rechts Werk 6527
Typ H DIN 6535 HA
Eckradius HPC SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zum Hartfräsen bis 65 HRC
- Schlichtfräser mit Eckenradius
- Spanwinkel negativ
- verstärkter Kern

Engineering data

- for hard milling up to 65 HRC
- finishing end mill with corner radius
- rake angle negative
- web thickness reinforced



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5280 u. 40-5320						●	●	●										●		●	●

● sehr gut geeignet/very suitable ○ geeignet/suitable

Ø d1 (e8) mm	40-5280	40-5320	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	TA-X	TA-X				
6/0,5			13	57	6	6
6/0,5			18	62	6	6
6/1			13	57	6	6
6/1			18	62	6	6
8/0,5			19	63	6	8
8/0,5			24	68	6	8
8/1			19	63	6	8
8/1			24	68	6	8
10/0,5			22	72	6	10
10/0,5			30	80	6	10
10/1			22	72	6	10
10/1			30	80	6	10
10/1,5			22	72	6	10
10/1,5			30	80	6	10
12/0,5			26	83	6	12
12/0,5			36	93	6	12
12/1			26	83	6	12
12/1			36	93	6	12
12/1,5			26	83	6	12
12/1,5			36	93	6	12

Ø d1 (e8) mm	40-5280	40-5320	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	TA-X	TA-X				
14/1			26	83	6	14
14/1			42	99	6	14
14/2			26	83	6	14
14/2			42	99	6	14
16/1			32	92	6	16
16/1			48	108	6	16
16/2			32	92	6	16
16/2			48	108	6	16
18/1			54	114	8	18
18/2			54	114	8	18
20/1			38	104	8	20
20/1			60	125	8	20
20/2			38	104	8	20
20/2			60	125	8	20
25/1			75	150	8	25
25/2			75	150	8	25

Bestellbeispiel / Order example: HA-Schaft/shank 40-5280-14/1-26
 HB-Schaft/shank 40-5280-14/1-26-HB
 HE-Schaft/shank 40-5280-14/1-26-HE



Schruppfräser

roughing end mills

Vollhartmetall-Schruppfräser zur
Vorbearbeitung.

*Solid carbide roughing end mills especially
for premachining.*

HAM

Vollhartmetall-Schruppschichtfräser
solid carbide roughing end mills

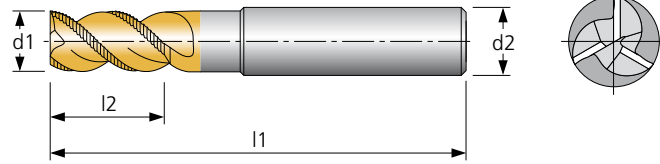
W+F VHM Z 3 45° rechts Werk Norm
Typ W 45° rechts DIN 6535 HA
HPC SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- scharfe und stabile Schneidkanten kordelverzahnt

Engineering data

- sharp cutting edges, flutes with knurling contour



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5331	●	●							○	○				○	●	○		●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f10) mm	40-5331	l2 mm	l1 mm	Ø d2 (h6) mm
	TA-AL			
3		7	57	6
4		12	57	6
5		14	57	6
6		16	57	6
8		22	64	8
10		25	72	10

Ø d1 (f10) mm	40-5331	l2 mm	l1 mm	Ø d2 (h6) mm
	TA-AL			
12		28	83	12
14		30	83	14
16		35	92	16
18		37	92	18
20		42	104	20
25		45	110	25

Bestellbeispiel / Order example: HA-Schaft/shank 40-5331-12
HB-Schaft/shank 40-5331-12-HB
HE-Schaft/shank 40-5331-12-HE

HAM 403/406

Vollhartmetall-Schrupffräser
solid carbide roughing end mills

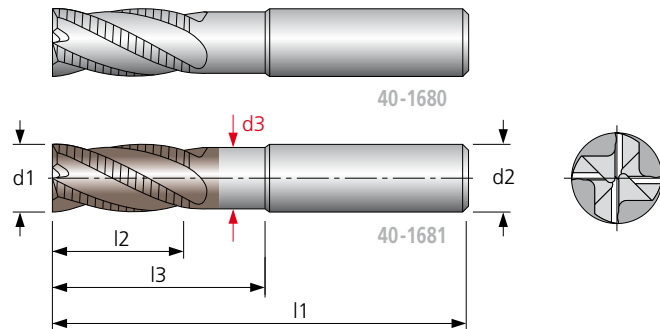
VHM Z 3-6 30° rechts Werk 6527
Typ N 30° rechts DIN 6535 Werk
HPC SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zentrumschneidend
- kordelverzahnt
- hohe Laufruhe

Engineering data

- centre cutting
- flute with knurling contour
- very smooth running



Eckenfase	d1	b
	≤ Ø 8	0,05
	≥ Ø 9	0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
40-1680			●	●	●				○	○	●	●	●						●	●	○	○
40-1681			●	●	●				○	○	●	●	●						●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f10) mm	40-1680	40-1681	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Z	Ø d2 (h6) mm
	TA-C	TA-C						
4			8	—	—	57	3	6
5			10	—	—	57	3	6
6			13	—	—	57	3	6
6			13	21	5,7	57	3	6
6			18	—	—	62	3	6

Ø d1 (f10) mm	40-1680	40-1681	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Z	Ø d2 (h6) mm
	TA-C	TA-C						
7			16	—	—	63	3	8
8			19	—	—	63	3	8
8			19	27	7,7	63	3	8
8			24	—	—	68	3	8
9			19	—	—	72	3	10

Bestellbeispiel / Order example: HA-Schaft/shank 40-1680-8-19-27
HB-Schaft/shank 40-1680-8-19-27-HB
HE-Schaft/shank 40-1680-8-19-27-HE

Ø d1 (f10) mm	40-1680	40-1681	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Z	Ø d2 (h6) mm
		TA						
10			22	—	—	72	4	10
10			22	32	9,7	72	4	10
10			30	—	—	80	4	10
12			26	—	—	83	4	12
12			26	38	11,7	83	4	12
12			36	—	—	93	4	12
14			26	—	—	83	4	14
14			26	38	13,6	83	4	14
14			42	—	—	99	4	14
16			32	—	—	92	4	16
16			32	44	15,6	92	4	16
16			48	—	—	108	4	16

Ø d1 (f10) mm	40-1680	40-1681	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Z	Ø d2 (h6) mm
		TA						
18			32	—	—	92	4	18
18			32	44	17,6	92	4	18
18			54	—	—	114	4	18
20			38	—	—	104	4	20
20			38	54	19,6	104	4	20
20			60	—	—	125	4	20
25			38	—	—	110	6	25
25			38	54	24,5	110	6	25
25			75	—	—	150	6	25
32			38	—	—	110	6	32
32			38	50	31,5	110	6	32

Bestellbeispiel / Order example: HA-Schaft/shank 40-1680-18-32-44
 HB-Schaft/shank 40-1680-18-32-44-HB
 HE-Schaft/shank 40-1680-18-32-44-HE

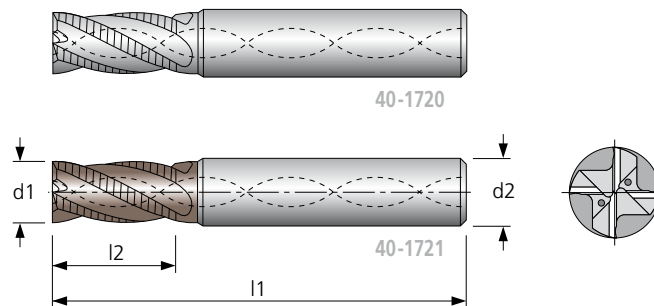
HAM 402 Vollhartmetall-Schrupfräser mit verdrehtem Kühlkanal solid carbide roughing end mills with interior coolant supply

Konstruktions-Daten

- zentrumsschneidend
- kordelverzahnt
- hohe Laufruhe

Engineering data

- centre cutting
- flute with knurling contour
- very smooth running



VHM	Z 3-6	30° rechts	Werk 6527
Typ N			DIN 6535 Werk
	HPC		SHRINK FIT
	DIN 6535 HBK		DIN 6535 HEK

Eckenfase	d1	b
	≤ Ø 8	0,05
	≥ Ø 10	0,10

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legie- rung	Titan	NE Metalle Cu-Leg.	Graphit Faser- verbund	UNI	MMS	max.	ohne	AIR	
40-1720			●	●	●				○	○	●	●	●							●		
40-1721			●	●	●				○	○	●	●	●							●		

● sehr gut geeignet/very suitable ○ geeignet/suitable

Ø d1 (f10) mm	40-1720	40-1721	l2 mm	l1 mm	Z	Ø d2 (h6) mm
		TA-C				
6			13	57	3	6
8			19	63	3	8
10			22	72	4	10
12			26	83	4	12
14			26	83	4	14

Ø d1 (f10) mm	40-1720	40-1721	l2 mm	l1 mm	Z	Ø d2 (h6) mm
		TA-C				
16			32	92	4	16
18			32	92	4	18
20			38	104	4	20
25			38	110	6	25
32			38	110	6	32

Bestellbeispiel / Order example: HAK-Schaft/shank 40-1720-16
 HBK-Schaft/shank 40-1720-16-HBK
 HEK-Schaft/shank 40-1720-16-HEK

HAM 441 Vollhartmetall-Konturenfräser (upcut)
solid carbide router (upcut)

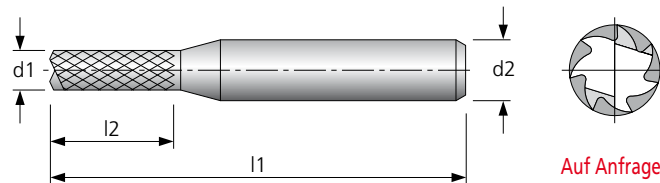
VHM Z 5-7 22°-25°re Werk Norm
Typ W Ø 3,175
G-Point

Konstruktions-Daten

- rechtsspiralig, rechtsschneidend (upcut)
- spezielle Diamantverzahnung

Engineering data

- right hand fluted, right hand cutting (upcut)
- special diamondprofiled teeth



Auf Anfrage Diamantbeschichtung für Graphitbearbeitung. Weitere Stirnanschliffe auf Anfrage (siehe Seite 40).

Diamond coating for machining of graphite on request. Further point geometries on request (see page 40).

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
40-1580	○	○														●					●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0,02/-0,02) mm	40-1580			Ø d1 (0,02/-0,02) mm	40-1580		
	l2 mm	l1 mm	Ø d2 (h6) mm		l2 mm	l1 mm	Ø d2 (h6) mm
0,8	5	38	3,175	1,7	8,5	38	3,175
0,8	7	38	3,175	1,8	8,5	38	3,175
0,9	5	38	3,175	1,9	8,5	38	3,175
0,9	7	38	3,175	2	9	38	3,175
1	5	38	3,175	2,1	9	38	3,175
1	7	38	3,175	2,2	9	38	3,175
1,1	5	38	3,175	2,3	9	38	3,175
1,1	7	38	3,175	2,4	10	38	3,175
1,2	5	38	3,175	2,4	12	38	3,175
1,2	7	38	3,175	2,6	10	38	3,175
1,3	5	38	3,175	2,7	10	38	3,175
1,3	7	38	3,175	2,8	10	38	3,175
1,4	6	38	3,175	2,9	10	38	3,175
1,4	8	38	3,175	3	12	38	3,175
1,5	6	38	3,175	3,1	12	38	3,175
1,5	8	38	3,175	3,175	12	38	3,175
1,6	8,5	38	3,175				

Bestellbeispiel / Order example: 40-1580 - 1,7-8,5

HAM 443 Vollhartmetall-Konturenfräser (downcut)
solid carbide router (downcut)

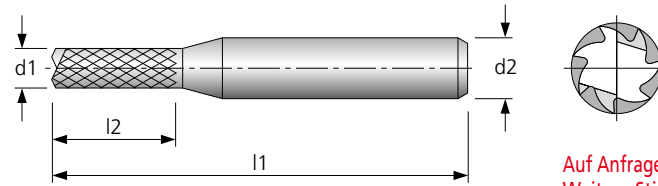
VHM Z 5-7 22°-25° li Werk Norm
Typ W Ø 3,175
G-Point

Konstruktions-Daten

- linksspiralig, rechtsschneidend (downcut)
- spezielle Diamantverzahnung

Engineering data

- left hand fluted, right hand cutting (downcut)
- special diamondprofiled teeth



Auf Anfrage Diamantbeschichtung für Graphitbearbeitung. Weitere Stirnanschliffe auf Anfrage (siehe Seite 40).

Diamond coating for machining of graphite on request. Further point geometries on request (see page 40).

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
40-1590	○	○														●					●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0,02/-0,02) mm	40-1590	l2 mm	l1 mm	Ø d2 (h6) mm
0,8		5	38	3,175
0,8		7	38	3,175
0,9		5	38	3,175
0,9		7	38	3,175
1		5	38	3,175
1		7	38	3,175
1,1		5	38	3,175
1,1		7	38	3,175
1,2		5	38	3,175
1,2		7	38	3,175
1,3		5	38	3,175
1,3		7	38	3,175
1,4		6	38	3,175
1,4		8	38	3,175
1,5		6	38	3,175

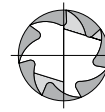
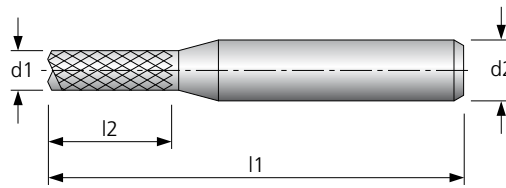
Ø d1 (0,02/-0,02) mm	40-1590	l2 mm	l1 mm	Ø d2 (h6) mm
1,5		8	38	3,175
1,6		8,5	38	3,175
1,7		8,5	38	3,175
1,8		8,5	38	3,175
1,9		8,5	38	3,175
2		9	38	3,175
2,1		9	38	3,175
2,2		9	38	3,175
2,3		9	38	3,175
2,4		10	38	3,175
2,5		10	38	3,175
3		12	38	3,175
3,1		12	38	3,175
3,175		12	38	3,175

Bestellbeispiel / Order example: 40-1590 - 1,5-8

HAM 445 Vollhartmetall-Konturenfräser (upcut)
solid carbide router (upcut)

VHM Z 5-12 22°-25°re Werk Norm
Typ W Ø 3,175 G-Point

- Konstruktions-Daten**
- rechtsspiralig, rechtsschneidend (upcut)
 - spezielle Diamantverzahnung
- Engineering data**
- right hand fluted, right hand cutting (upcut)
 - special diamondprofiled teeth



Auf Anfrage Diamantbeschichtung für Graphitbearbeitung. Weitere Stirnanschliffe auf Anfrage (siehe Seite 40).
Diamond coating for machining of graphit on request. Further point geometries on request (see page 40).

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
40-1600	○	○														●					●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0,02/-0,02) mm	40-1600	l2 mm	l1 mm	Ø d2 (h6) mm
0,8		4,5	38	3,175
0,9		5	38	3,175
1		5	38	3,175
1,1		6	38	3,175
1,2		6	38	3,175
1,5		8	38	3,175
1,6		8	38	3,175
2		9,5	38	3,175
2,4		10	38	3,175
3		12	38	3,175

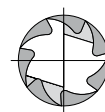
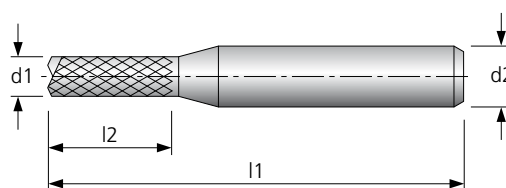
Ø d1 (0,02/-0,02) mm	40-1600	l2 mm	l1 mm	Ø d2 (h6) mm
3,175		12	38	3,175
4		15	40	4
5		20	50	5
6		20	50	6
6,35		25	60	6,35
8		25	60	8
9,52		25	60	9,52
10		30	90	10
12		36	120	12
12,7		40	120	12,7

Bestellbeispiel / Order example: 40-1600-3,175-12

HAM 446 Vollhartmetall-Konturenfräser (downcut)
solid carbide router (downcut)

VHM Z 7-12 22°-25°li Werk Norm
Typ W Ø 3,175 G-Point

- Konstruktions-Daten**
- linksspiralig, rechtsschneidend (downcut)
 - spezielle Diamantverzahnung
- Engineering data**
- left hand fluted, right hand cutting (downcut)
 - special diamondprofiled teeth



Auf Anfrage Diamantbeschichtung für Graphitbearbeitung. Weitere Stirnanschliffe auf Anfrage (siehe Seite 40).
Diamond coating for machining of graphit on request. Further point geometries on request (see page 40).

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
40-1610	○	○														●					●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0,02/-0,02) mm	40-1610	l2 mm	l1 mm	Ø d2 (h6) mm
1,6		8,5	38	3,175
2		9	38	3,175

Ø d1 (0,02/-0,02) mm	40-1610	l2 mm	l1 mm	Ø d2 (h6) mm
2,4		10	38	3,175

Bestellbeispiel / Order example: 40-1610-2,4

HAM 448 Vollhartmetall-Konturenfräser (upcut) solid carbide router (upcut)

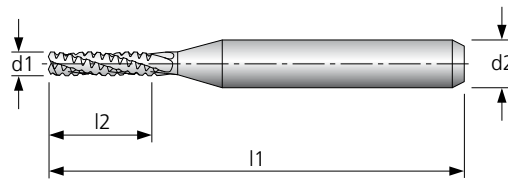
VHM Z 5-6 20° rechts Werk Norm
 Typ W Ø 3,175
 G-Point

Konstruktions-Daten

- rechtsspiralig, rechtsschneidend (upcut)
- spezielle Spiralverzahnung mit Spanbrecher

Engineering data

- right hand fluted, right hand cutting (upcut)
- special spiralprofiled teeth chip breaker



Auf Anfrage Diamantbeschichtung für Graphitbearbeitung. Weitere Stirnanschliffe auf Anfrage (siehe Seite 40).
 Diamond coating for machining of graphit on request. Further point geometries on request (see page 40).

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR	
40-1620	○	○														●					●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0,02/-0,02) mm	40-1620	l2 mm	l1 mm	Ø d2 (h6) mm	Ø d1 (0,02/-0,02) mm	40-1620	l2 mm	l1 mm	Ø d2 (h6) mm
0,8		5	38	3,175	1,7		8,5	38	3,175
0,8		7	38	3,175	1,8		8,5	38	3,175
0,9		5	38	3,175	1,9		8,5	38	3,175
0,9		7	38	3,175	2		9	38	3,175
1		5	38	3,175	2,1		9	38	3,175
1		7	38	3,175	2,2		9	38	3,175
1,1		5	38	3,175	2,3		9	38	3,175
1,1		7	38	3,175	2,4		10	38	3,175
1,2		5	38	3,175	2,6		10	38	3,175
1,2		7	38	3,175	2,7		10	38	3,175
1,3		5	38	3,175	2,8		10	38	3,175
1,3		7	38	3,175	2,9		10	38	3,175
1,4		6	38	3,175	3		12	38	3,175
1,4		8,5	38	3,175	3,1		12	38	3,175
1,5		6	38	3,175	3,175		12	38	3,175
1,5		8,5	38	3,175					
1,6		8,5	38	3,175					

Bestellbeispiel / Order example: 40-1620-1,7-8,5

HAM 449 Vollhartmetall-Konturenfräser (downcut)
solid carbide router (downcut)

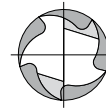
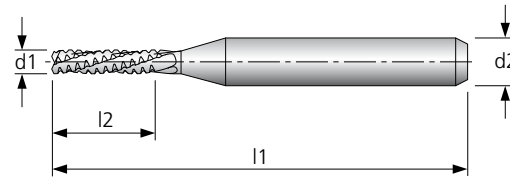
VHM Z 5-6 20° links Werk Norm
Typ W Ø 3,175 G-Point

Konstruktions-Daten

- linksspiralig, rechtsschneidend (downcut)
- spezielle Spiralverzahnung mit Spanbrecher

Engineering data

- left hand fluted, right hand cutting (downcut)
- special spiralprofiled teeth with chip breaker



Auf Anfrage Diamantbeschichtung für Graphitbearbeitung. Weitere Stirnanschliffe auf Anfrage (siehe unten).

Diamond coating for machining of graphite on request. Further point geometries on request (see below).

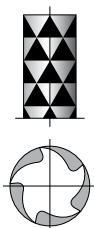
Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
40-1630	○	○														●					●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

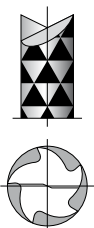
Ø d1 (0,02/-0,02) mm	40-1630	l2 mm	l1 mm	Ø d2 (h6) mm	Ø d1 (0,02/-0,02) mm	40-1630	l2 mm	l1 mm	Ø d2 (h6) mm
0,8		5	38	3,175	1,7		8,5	38	3,175
0,8		7	38	3,175	1,8		8,5	38	3,175
0,9		5	38	3,175	1,9		8,5	38	3,175
0,9		7	38	3,175	2		9	38	3,175
1		5	38	3,175	2,1		9	38	3,175
1		7	38	3,175	2,2		9	38	3,175
1,1		5	38	3,175	2,3		9	38	3,175
1,1		7	38	3,175	2,4		10	38	3,175
1,2		5	38	3,175	2,5		10	38	3,175
1,2		7	38	3,175	2,6		10	38	3,175
1,3		5	38	3,175	2,7		10	38	3,175
1,3		7	38	3,175	2,8		10	38	3,175
1,4		6	38	3,175	2,9		10	38	3,175
1,4		8	38	3,175	3		12	38	3,175
1,5		6	38	3,175	3,1		12	38	3,175
1,5		8	38	3,175	3,175		12	38	3,175
1,6		8,5	38	3,175					

Bestellbeispiel / Order example: 40-1630-1,7-8,5

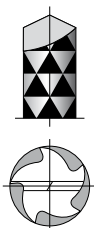
Weitere Stirnanschliffe auf Anfrage
Further point geometry on request



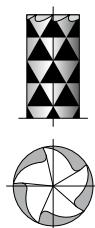
A-Spizze
Gerade Stirn ohne Anschlag
A-Point
straight end no end cut



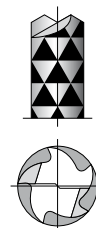
B-Spizze
Fischschwanz Anschlag
B-Point
fishtail end cut



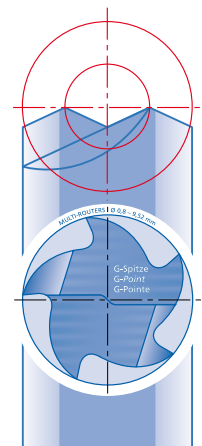
D-Spizze
Bohrspitze
D-Point
drill point



E-Spizze
Gerade 5 Stirnschneiden
E-Point
straight end 5 cutting edges



G-Spizze
Standard Anschlag
G-Point
standard end cut



Torusfräser

toric end mills



Vollhartmetall-Torusfräser in verschiedenen Ausführungen.

Solid carbide toric end mills in different types.

HAM 486 Vollhartmetall-Torusfräser
solid carbide toric end mill

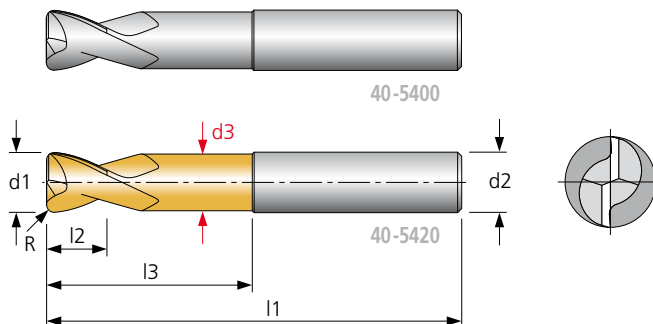
W+F VHM Z 2 30° rechts Werk Norm
 Typ W HA
 Eckradius HSC SHRINK FIT
 HB HE

Konstruktions-Daten

- spezielle Ausspitzung
- bis Ø 4 mm verstärkter Schaftübergang
- zentrumsschneidend

Engineering data

- special web thinning
- up to Ø 4 mm shank reinforced
- centre cutting



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5400	●	●													●	○		●	●		○
40-5420	●	●													●	○		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (e8) mm	40-5400	40-5420	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL					
1/0,1			2	15	0,9	60	4
2/0,2			3	20	1,8	60	4
3/0,3			5	20	2,7	60	4
4/0,4			5	20	3,7	60	4
5/0,5			6	20	4,6	60	6
6/0,3			7	25	5,5	65	6
6/1			7	25	5,5	65	6
8/0,3			9	30	7,4	70	8

Ø d1/R (e8) mm	40-5400	40-5420	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL					
8/1			9	30	7,4	70	8
10/0,3			11	40	9,2	85	10
10/1,5			11	40	9,2	85	10
12/0,5			12	45	11	93	12
12/1,5			12	45	11	93	12
16/0,5			16	55	15	110	16
16/2			16	55	15	110	16

Bestellbeispiel / Order example: HA-Schaft/shank 40-5400-8/1
 HB-Schaft/shank 40-5400-8/1-HB
 HE-Schaft/shank 40-5400-8/1-HE

HAM

Vollhartmetall-Torusfräser
solid carbide toric end mill

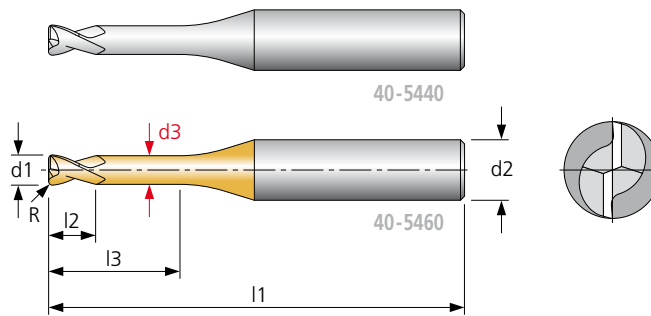
W+F VHM Z 2 30° rechts Werk Norm
 Typ W HA
 Eckradius HSC SHRINK FIT
 HB HE

Konstruktions-Daten

- für dünnwandige Konturen in Aluminium und Kunststoff
- spezielle Ausspitzung
- zentrumsschneidend

Engineering data

- for thin-walled contours of aluminium and synthetic material
- special web thinning
- centre cutting



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5440	●	●							○	○				○	●	○		●	●	○	○
40-5460	●	●							○	○				○	●	○		●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (e8) mm	40-5440	40-5460	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	Ø d1/R (e8) mm	40-5440	40-5460	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL								TA-AL					
0,2/0,05			0,3	0,5	0,18	55	4	1,5/0,15			2	18	1,44	55	4
0,2/0,05			0,3	1	0,18	55	4	1,5/0,15			2	24	1,44	60	4
0,2/0,05			0,3	1,5	0,18	55	4	2,0/0,2			2,5	6	1,92	65	4
0,3/0,05			0,45	1	0,28	55	4	2,0/0,2			2,5	10	1,92	65	4
0,3/0,05			0,45	2	0,28	55	4	2,0/0,2			2,5	14	1,92	65	4
0,3/0,05			0,45	3	0,28	55	4	2,0/0,2			2,5	18	1,92	65	4
0,4/0,05			0,6	2	0,37	55	4	2,0/0,2			2,5	24	1,92	75	4
0,4/0,05			0,6	3	0,37	55	4	2,0/0,2			2,5	30	1,92	75	4
0,4/0,05			0,6	4	0,37	55	4	2,5/0,25			3,5	10	2,4	65	4
0,5/0,05			0,7	3	0,47	55	4	2,5/0,25			3,5	20	2,4	65	4
0,5/0,05			0,7	5	0,47	55	4	2,5/0,25			3,5	30	2,4	75	4
0,5/0,05			0,7	8	0,47	55	4	3,0/0,3			5	6	2,9	65	4
0,6/0,06			0,9	3	0,57	55	4	3,0/0,3			5	10	2,9	65	4
0,6/0,06			0,9	5	0,57	55	4	3,0/0,3			5	14	2,9	65	4
0,6/0,06			0,9	8	0,57	55	4	3,0/0,3			5	18	2,9	65	4
0,8/0,08			1,1	4	0,76	55	4	3,0/0,3			5	24	2,9	75	4
0,8/0,08			1,1	6	0,76	55	4	3,0/0,3			5	30	2,9	75	4
0,8/0,08			1,1	8	0,76	55	4	4,0/0,4			6	10	3,9	65	6
0,8/0,08			1,1	10	0,76	55	4	4,0/0,4			6	14	3,9	65	6
1,0/0,1			1,5	6	0,95	55	4	4,0/0,4			6	18	3,9	65	6
1,0/0,1			1,5	10	0,95	55	4	4,0/0,4			6	24	3,9	75	6
1,0/0,1			1,5	14	0,95	55	4	4,0/0,4			6	30	3,9	75	6
1,0/0,1			1,5	18	0,95	55	4	5,0/0,5			7,5	10	4,9	65	6
1,0/0,1			1,5	24	0,95	60	4	5,0/0,5			7,5	20	4,9	65	6
1,2/0,12			1,6	6	1,15	55	4	5,0/0,5			7,5	30	4,9	75	6
1,2/0,12			1,6	10	1,15	55	4	5,0/0,5			7,5	40	4,9	90	6
1,2/0,12			1,6	14	1,15	55	4	6,0/0,6			10	12	5,9	65	6
1,2/0,12			1,6	18	1,15	55	4	6,0/0,6			10	20	5,9	65	6
1,2/0,12			1,6	24	1,15	60	4	6,0/0,6			10	30	5,9	75	6
1,5/0,15			2	6	1,44	55	4	6,0/0,6			10	40	5,9	90	6
1,5/0,15			2	10	1,44	55	4	6,0/0,6			10	50	5,9	90	6
1,5/0,15			2	14	1,44	55	4	6,0/0,6			10	50	5,9	90	6

Bestellbeispiel / Order example: HA-Schaft/shank 40-5440 - 6/0,6-10
 HB-Schaft/shank 40-5440 - 6/0,6-10-HB
 HE-Schaft/shank 40-5440 - 6/0,6-10-HE

HAM

Vollhartmetall-Torusfräser
solid carbide toric end mill

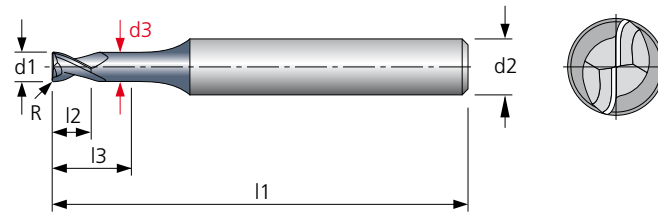
W+F VHM Z 2 35° rechts Werk Norm
Typ W HA
HSC SHRINK FIT

Konstruktions-Daten

- zentrumsschneidend
- abgesetzter Hals
- Diamantbeschichtung für abrasive Werkstoffe

Engineering data

- centre cutting
- reduced neck
- diamond coating for abrasive materials



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5480		○														●		○		●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (0/-0,01) mm	40-5480						Ø d2 (h6) mm	Ø d1/R (0/-0,01) mm	40-5480						Ø d2 (h6) mm
	Diamant	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Diamant			l2 mm	l3 mm	Hals Ø d3 mm	l1 mm			
0,2/0,05		0,3	0,5	0,18	55	4	1,5/0,15		2	18	1,44	55	4		
0,2/0,05		0,3	1	0,18	55	4	1,5/0,15		2	24	1,44	60	4		
0,2/0,05		0,3	1,5	0,18	55	4	2,0/0,2		2,5	6	1,92	65	4		
0,3/0,05		0,45	1	0,28	55	4	2,0/0,2		2,5	10	1,92	65	4		
0,3/0,05		0,45	2	0,28	55	4	2,0/0,2		2,5	14	1,92	65	4		
0,3/0,05		0,45	3	0,28	55	4	2,0/0,2		2,5	18	1,92	65	4		
0,4/0,05		0,6	2	0,37	55	4	2,0/0,2		2,5	24	1,92	75	4		
0,4/0,05		0,6	3	0,37	55	4	2,0/0,2		2,5	30	1,92	75	4		
0,4/0,05		0,6	4	0,37	55	4	2,5/0,25		3,5	10	2,4	65	4		
0,5/0,05		0,7	3	0,47	55	4	2,5/0,25		3,5	20	2,4	65	4		
0,5/0,05		0,7	5	0,47	55	4	2,5/0,25		3,5	30	2,4	75	4		
0,5/0,05		0,7	8	0,47	55	4	3,0/0,3		5	6	2,9	65	4		
0,6/0,06		0,9	3	0,57	55	4	3,0/0,3		5	10	2,9	65	4		
0,6/0,06		0,9	5	0,57	55	4	3,0/0,3		5	14	2,9	65	4		
0,6/0,06		0,9	8	0,57	55	4	3,0/0,3		5	18	2,9	65	4		
0,8/0,08		1,1	4	0,76	55	4	3,0/0,3		5	24	2,9	75	4		
0,8/0,08		1,1	6	0,76	55	4	3,0/0,3		5	30	2,9	75	4		
0,8/0,08		1,1	8	0,76	55	4	4,0/0,4		6	10	3,9	65	6		
0,8/0,08		1,1	10	0,76	55	4	4,0/0,4		6	14	3,9	65	6		
1,0/0,1		1,5	6	0,95	55	4	4,0/0,4		6	18	3,9	65	6		
1,0/0,1		1,5	10	0,95	55	4	4,0/0,4		6	24	3,9	75	6		
1,0/0,1		1,5	14	0,95	55	4	4,0/0,4		6	30	3,9	75	6		
1,0/0,1		1,5	18	0,95	55	4	5,0/0,5		7,5	10	4,9	65	6		
1,0/0,1		1,5	24	0,95	60	4	5,0/0,5		7,5	20	4,9	65	6		
1,2/0,12		1,6	6	1,15	55	4	5,0/0,5		7,5	30	4,9	75	6		
1,2/0,12		1,6	10	1,15	55	4	5,0/0,5		7,5	40	4,9	90	6		
1,2/0,12		1,6	14	1,15	55	4	6,0/0,6		10	12	5,9	65	6		
1,2/0,12		1,6	18	1,15	55	4	6,0/0,6		10	20	5,9	65	6		
1,2/0,12		1,6	24	1,15	60	4	6,0/0,6		10	30	5,9	75	6		
1,5/0,15		2	6	1,44	55	4	6,0/0,6		10	40	5,9	90	6		
1,5/0,15		2	10	1,44	55	4	6,0/0,6		10	50	5,9	90	6		
1,5/0,15		2	14	1,44	55	4									

Bestellbeispiel / Order example: 40-5480 - 1,5/0,15 - 18

HAM

Vollhartmetall-Torusfräser
solid carbide toric end mill

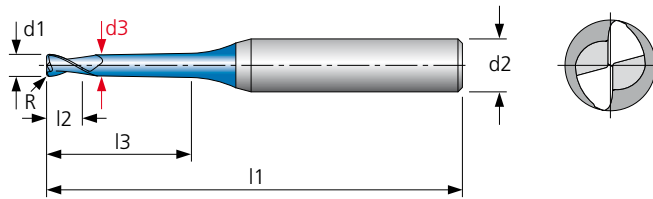
W+F VHM Z 2 30° rechts Werk Norm
Typ H HA
Eckradius HSC SHRINK FIT

Konstruktions-Daten

- Nenndurchmesser-Toleranz 0/-0,01
- konischer Hals 1°
- langer Hals zum Rippenfräsen
- extrem verstärkter Kern

Engineering data

- diameter tolerance 0/-0,01
- conical neck 1°
- long neck for rib milling
- web thickness reinforced



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-6120			○	●	●	●	●	●	○	○	●	●						●		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (0/-0,01) mm	40-6120 TA-X	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	Effektive Bearbeitungstiefe abhängig vom Konturwinkel (β) des Werkstückes. Effective machining depth depending on inclined angle (β) of workpiece.					
							0,5°	1°	1,5°	2°	2,5°	3°
							0,2/0,05	0,3	0,5	0,18	45	4
0,2/0,05	0,3	1	0,18	45	4	1,49	1,77	2,01	2,23	2,44	2,64	
0,2/0,05	0,3	1,5	0,18	45	4	1,86	2,27	2,56	2,82	3,06	3,28	
0,3/0,05	0,45	1	0,28	45	4	1,57	1,82	2,05	2,27	2,47	2,67	
0,3/0,05	0,45	2	0,28	45	4	2,33	2,82	3,15	3,44	3,7	3,94	
0,3/0,05	0,45	3	0,28	45	4	2,3	3,82	4,25	4,59	4,88	5,16	
0,4/0,05	0,6	2	0,37	45	4	2,57	2,94	3,24	3,51	3,76	3,99	
0,4/0,05	0,6	3	0,37	45	4	3,32	3,94	4,33	4,65	4,94	5,21	
0,4/0,05	0,6	4	0,37	45	4	3,27	4,94	5,41	5,78	6,1	6,4	
0,5/0,05	0,7	2	0,45	45	4	2,79	3,1	3,37	3,62	3,86	4,08	
0,5/0,05	0,7	4	0,45	45	4	4,47	5,1	5,52	5,87	6,18	6,47	
0,5/0,05	0,7	6	0,45	45	4	4,81	7,1	7,65	8,08	8,45	8,78	
0,5/0,05	0,7	8	0,45	45	4	8,81	9,1	9,77	10,26	10,68	11,06	
0,6/0,06	0,9	2	0,55	45	4	2,84	3,14	3,4	3,64	3,88	4,1	
0,6/0,06	0,9	4	0,55	45	4	4,55	5,14	5,54	5,89	6,2	6,48	
0,6/0,06	0,9	6	0,55	45	4	5,2	7,14	7,67	8,09	8,46	8,8	
0,6/0,06	0,9	8	0,55	45	4	5,2	9,14	9,79	10,28	10,7	11,07	
0,6/0,06	0,9	10	0,55	45	4	5,2	11,14	11,9	12,45	12,91	13,32	
0,7/0,07	1	2	0,65	45	4	2,88	3,17	3,43	3,67	3,9	4,12	
0,7/0,07	1	4	0,65	45	4	4,62	5,17	5,57	5,91	6,21	6,5	
0,7/0,07	1	6	0,65	45	4	5,59	7,17	7,69	8,11	8,48	8,81	
0,7/0,07	1	8	0,65	45	4	5,59	9,17	9,81	10,29	10,71	11,08	
0,7/0,07	1	10	0,65	45	4	5,59	11,17	11,91	12,46	12,92	13,33	
0,8/0,08	1,2	4	0,75	45	4	4,68	5,2	5,59	5,93	6,23	6,51	
0,8/0,08	1,2	6	0,75	45	4	6,16	7,2	7,71	8,13	8,49	8,82	
0,8/0,08	1,2	8	0,75	45	4	5,98	9,2	9,83	10,31	10,72	11,09	
0,8/0,08	1,2	10	0,75	45	4	5,98	11,2	11,93	12,48	12,93	13,34	
0,8/0,08	1,2	12	0,75	45	4	5,98	13,2	14,03	14,63	15,12	15,56	
0,9/0,09	1,35	6	0,85	45	4	6,36	7,23	7,74	8,15	8,51	8,83	
0,9/0,09	1,35	8	0,85	45	4	6,37	9,23	9,85	10,33	10,74	11,1	
0,9/0,09	1,35	10	0,85	45	4	6,37	11,23	11,95	12,49	12,94	13,35	
0,9/0,09	1,35	15	0,85	50	4	6,37	16,23	17,19	17,85	18,39	18,87	
1,0/0,1	1,5	6	0,95	45	4	6,46	7,26	7,76	8,16	8,52	8,85	
1,0/0,1	1,5	8	0,95	45	4	6,76	9,26	9,87	10,34	10,75	11,12	
1,0/0,1	1,5	10	0,95	45	4	6,76	11,26	11,97	12,5	12,96	13,36	

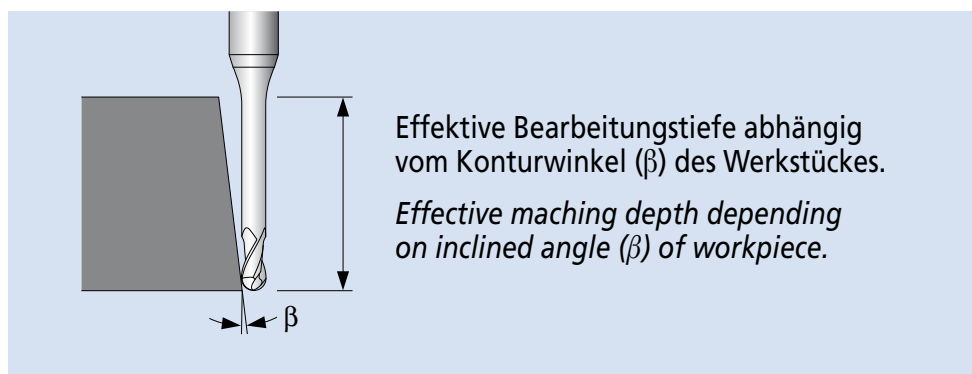
Bestellbeispiel / Order example: 40-6120-0,2/0,05-0,5

Ø d1/R (0/-0,01) mm	40-6120	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	Effektive Bearbeitungstiefe abhängig vom Konturwinkel (β) des Werkstückes. Effective machining depth depending on inclined angle (β) of workpiece.					
							TA-X	0,5°	1°	1,5°	2°	2,5°
	1,0/0,1							1,5	12	0,95	45	4
1,0/0,1		1,5	14	0,95	50	4	6,76	15,26	16,16	16,79	17,32	17,78
1,0/0,1		1,5	16	0,95	50	4	6,76	17,26	18,25	18,93	19,49	19,97
1,2/0,12		1,8	6	1,15	45	4	6,61	7,32	7,8	8,2	8,55	8,87
1,2/0,12		1,8	8	1,15	45	4	7,54	9,32	9,91	10,37	10,77	11,14
1,2/0,12		1,8	10	1,15	45	4	7,54	11,32	12,01	12,53	12,98	13,38
1,2/0,12		1,8	12	1,15	45	4	7,54	13,32	14,1	14,68	15,17	15,59
1,4/0,14		2,1	6	1,35	45	4	6,73	7,38	7,84	8,23	8,58	8,89
1,4/0,14		2,1	8	1,35	45	4	8,34	9,38	9,95	10,4	10,8	11,16
1,4/0,14		2,1	10	1,35	45	4	8,32	11,38	12,04	12,56	13	13,4
1,4/0,14		2,1	12	1,35	45	4	8,32	13,38	14,14	14,71	15,19	15,61
1,4/0,14		2,1	14	1,35	50	4	8,32	15,38	16,23	16,84	17,36	17,81
1,4/0,14		2,1	16	1,35	50	4	8,32	17,38	18,31	18,97	19,52	20
1,5/0,15		2,3	6	1,45	45	4	6,78	7,41	7,86	8,25	8,59	8,91
1,5/0,15		2,3	8	1,45	45	4	8,45	9,41	9,96	10,42	10,81	11,17
1,5/0,15		2,3	10	1,45	45	4	8,71	11,41	12,06	12,57	13,01	13,4
1,5/0,15		2,3	12	1,45	45	4	8,71	13,41	14,15	14,72	15,2	15,62
1,5/0,15		2,3	14	1,45	50	4	8,71	15,41	16,24	16,86	17,37	17,82
1,5/0,15		2,3	16	1,45	50	4	8,71	17,41	18,32	18,98	19,53	20,01
1,5/0,15		2,3	18	1,45	55	4	8,71	19,41	20,41	21,11	21,68	22,19
1,5/0,15		2,3	20	1,45	55	4	8,71	21,41	22,48	23,22	23,83	—
1,6/0,16		2,4	6	1,55	45	4	6,83	7,43	7,88	8,26	8,6	8,92
1,6/0,16		2,4	8	1,55	45	4	8,53	9,43	9,98	10,43	10,82	11,18
1,6/0,16		2,4	10	1,55	45	4	9,1	11,43	12,08	12,59	13,02	13,41
1,6/0,16		2,4	12	1,55	45	4	9,1	13,43	14,17	14,73	15,21	15,63
1,6/0,16		2,4	14	1,55	50	4	9,1	15,43	16,26	16,87	17,38	17,83
1,6/0,16		2,4	16	1,55	50	4	9,1	17,43	18,34	19	19,54	20,02
1,6/0,16		2,4	18	1,55	55	4	9,1	19,43	20,42	21,12	21,69	22,19
1,6/0,16		2,4	20	1,55	55	4	9,1	21,43	22,5	23,23	23,84	—
1,8/0,18		2,7	6	1,75	45	4	6,91	7,48	7,92	8,29	8,63	8,94
1,8/0,18		2,7	8	1,75	45	4	8,67	9,48	10,02	10,46	10,85	11,2
1,8/0,18		2,7	10	1,75	45	4	9,88	11,48	12,11	12,61	13,05	13,43
1,8/0,18		2,7	12	1,75	45	4	9,88	13,48	14,2	14,76	15,23	15,65
1,8/0,18		2,7	14	1,75	50	4	9,88	15,48	16,29	16,89	17,4	17,85
1,8/0,18		2,7	16	1,75	50	4	9,88	17,48	18,37	19,02	19,56	20,03
1,8/0,18		2,7	18	1,75	55	4	9,88	19,48	20,45	21,14	21,71	—
1,8/0,18		2,7	20	1,75	55	4	9,88	21,48	22,52	23,25	23,85	—
2,0/0,2		3	6	1,95	45	4	6,99	7,53	7,96	8,32	8,66	8,96
2,0/0,2		3	8	1,95	45	4	8,77	9,53	10,05	10,49	10,87	11,22
2,0/0,2		3	10	1,95	45	4	10,44	11,53	12,15	12,64	13,07	13,45
2,0/0,2		3	12	1,95	45	4	10,66	13,53	14,23	14,78	15,25	15,67
2,0/0,2		3	14	1,95	50	4	10,66	15,53	16,32	16,91	17,42	17,86
2,0/0,2		3	16	1,95	50	4	10,66	17,53	18,4	19,04	19,58	—
2,0/0,2		3	18	1,95	55	4	10,66	19,53	20,48	21,16	21,73	—
2,0/0,2		3	20	1,95	55	4	10,66	21,53	22,55	23,28	—	—
2,0/0,2		3	25	1,95	60	4	10,66	26,53	27,73	28,54	—	—
2,0/0,2		3	30	1,95	70	4	10,66	31,53	32,89	—	—	—
2,5/0,25		3,7	8	2,4	45	4	9,23	9,81	10,26	10,66	11,02	11,36
2,5/0,25		3,7	10	2,4	45	4	11,07	11,81	12,35	12,8	13,21	13,58
2,5/0,25		3,7	12	2,4	45	4	12,87	13,81	14,43	14,94	15,38	—
2,5/0,25		3,7	14	2,4	50	4	14,6	15,81	16,5	17,06	—	—
2,5/0,25		3,7	16	2,4	55	4	15,48	17,81	18,58	19,18	—	—
2,5/0,25		3,7	18	2,4	55	4	15,48	19,61	20,65	21,29	—	—
2,5/0,25		3,7	20	2,4	60	4	15,48	21,81	22,72	—	—	—
2,5/0,25		3,7	25	2,4	70	4	15,48	26,81	27,88	—	—	—



Bestellbeispiel / Order example: 40-6120 - 1,0/0,1-12

Ø d1/R (0/-0,01) mm	40-6120	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	Effektive Bearbeitungstiefe abhängig vom Konturwinkel (β) des Werkstückes. <i>Effective machining depth depending on inclined angle (β) of workpiece.</i>					
	TA-X						0,5°	1°	1,5°	2°	2,5°	3°
2,5/0,25		3,7	30	2,4	80	4	15,48	31,81	—	—	—	—
3,0/0,3		4,5	8	2,85	45	6	9,54	10,02	10,43	10,8	11,14	11,45
3,0/0,3		4,5	10	2,85	45	6	11,41	12,02	12,51	12,93	13,31	13,66
3,0/0,3		4,5	12	2,85	45	6	13,28	14,02	14,58	15,06	15,48	15,86
3,0/0,3		4,5	14	2,85	50	6	15,12	16,02	16,65	17,18	17,63	18,05
3,0/0,3		4,5	16	2,85	55	6	16,94	18,02	18,72	19,29	19,78	20,22
3,0/0,3		4,5	18	2,85	55	6	18,7	20,02	20,79	21,4	21,92	22,38
3,0/0,3		4,5	20	2,85	60	6	20,24	22,02	22,85	23,5	24,06	24,54
3,0/0,3		4,5	25	2,85	65	6	20,09	27,02	28,01	28,75	29,37	—
3,0/0,3		4,5	30	2,85	80	6	20,09	32,02	33,16	33,98	34,65	—
3,0/0,3		4,5	35	2,85	90	6	20,09	37,02	38,3	39,19	—	—
3,0/0,3		4,5	40	2,85	90	6	20,09	42,02	43,43	—	—	—
4,0/0,4		6	12	3,85	50	6	13,54	14,2	14,72	15,18	15,58	15,95
4,0/0,4		6	16	3,85	60	6	17,28	18,2	18,85	19,4	19,87	—
4,0/0,4		6	20	3,85	60	6	20,94	22,2	22,98	23,6	—	—
4,0/0,4		6	25	3,85	70	6	24,09	27,2	28,13	28,84	—	—
4,0/0,4		6	30	3,85	80	6	24,09	32,2	33,27	—	—	—
4,0/0,4		6	35	3,85	90	6	24,09	37,2	38,4	—	—	—
4,0/0,4		6	40	3,85	90	6	24,09	42,2	—	—	—	—
4,0/0,4		6	45	3,85	100	6	24,09	47,2	—	—	—	—
4,0/0,4		6	50	3,85	100	6	24,09	52,2	—	—	—	—
5,0/0,5		7,5	16	4,85	60	6	17,53	18,36	18,98	—	—	—
5,0/0,5		7,5	25	4,85	70	6	25,83	27,36	—	—	—	—
5,0/0,5		7,5	35	4,85	90	6	28,09	—	—	—	—	—
5,0/0,5		7,5	50	4,85	110	6	28,09	—	—	—	—	—

Bestellbeispiel / Order example: 40-6120 - 2,5/0,25-30



HAM 417 Vollhartmetall-Torusfräser
solid carbide toric end mill

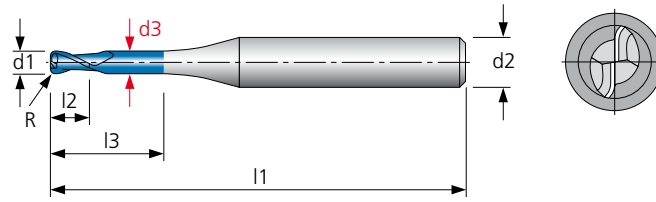
W+F
 VHM
 Z 2
 
 Werk Norm
 Typ H
 
 HA
 Eckradius
 HSC
 SHRINK FIT
 HB
 HE

Konstruktions-Daten

- Hals abgesetzt
- zentrumschneidend

Engineering data

- reduced neck
- centre cutting





Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5360	○	○	●	●	●	○			○	○	●	●						●	○	○	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (e8) mm	40-5360						Ø d2 (h6) mm	Ø d1/R (e8) mm	40-5360						Ø d2 (h6) mm
	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d3 mm	l1 mm			l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d3 mm	l1 mm	
0,5/0,05	0,7	2	0,48	45	4	4	2,0/0,2	2,8	10	1,95	60	4	4		
0,5/0,05	0,7	6	0,48	45	4	4	2,0/0,2	2,8	15	1,95	60	4	4		
0,6/0,06	0,9	2	0,57	45	4	4	2,0/0,2	2,8	20	1,95	60	4	4		
0,6/0,06	0,9	8	0,57	45	4	4	2,5/0,25	3,5	8	2,4	60	4	4		
0,8/0,08	1,2	4	0,77	45	4	4	2,5/0,25	3,5	15	2,4	60	4	4		
0,8/0,08	1,2	6	0,77	45	4	4	3,0/0,3	4	10	2,9	60	6	6		
0,8/0,08	1,2	8	0,77	45	4	4	3,0/0,3	4	15	2,9	60	6	6		
1,0/0,1	1,6	6	0,95	45	4	4	3,0/0,3	4	20	2,9	65	6	6		
1,0/0,1	1,6	10	0,95	45	4	4	3,0/0,3	4	25	2,9	65	6	6		
1,0/0,1	1,6	15	0,95	45	4	4	4,0/0,5	5	15	3,9	70	6	6		
1,2/0,12	1,9	6	1,15	50	4	4	4,0/0,5	5	20	3,9	70	6	6		
1,2/0,12	1,9	12	1,15	50	4	4	4,0/0,5	5	25	3,9	70	6	6		
1,5/0,15	2,4	6	1,45	55	4	4	5,0/0,5	6	15	4,9	70	6	6		
1,5/0,15	2,4	8	1,45	55	4	4	5,0/0,5	6	20	4,9	70	6	6		
1,5/0,15	2,4	15	1,45	55	4	4	5,0/0,5	6	25	4,9	70	6	6		
1,5/0,15	2,4	20	1,45	55	4	4	6,0/0,5	9	32	5,8	75	6	6		
2,0/0,2	2,8	6	1,95	60	4	4	6,0/1	9	32	5,8	75	6	6		

Bestellbeispiel / Order example: HA-Schaft/shank 40-5360-6/0,5
 HB-Schaft/shank 40-5360-6/0,5-HB
 HE-Schaft/shank 40-5360-6/0,5-HE

HAM Vollhartmetall-Torusfräser
solid carbide toric end mill

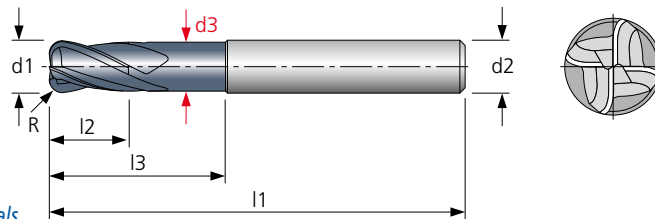
W+F
 VHM
 Z 4
 
 Werk Norm
 Typ W
 
 HA
 Eckradius
 HSC
 SHRINK FIT
 DIN 6535 HB
 DIN 6535 HE

Konstruktions-Daten

- zentrumschneidend
- verstärkter Kern
- für abrasive Werkstoffe

Engineering data

- centre cutting
- web thickness reinforced
- diamond coating for abrasive materials



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5600		○																○		○	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (0/-0,01) mm	40-5600						Ø d2 (h6) mm	Ø d1/R (0/-0,01) mm	40-5600						Ø d2 (h6) mm
	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d3 mm	l1 mm			l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d3 mm	l1 mm	
2/0,2	3	30	1,92	65	4	4	3/0,3	4	40	2,9	65	4	4		
2/0,5	3	30	1,92	65	4	4	3/0,5	4	40	2,9	65	4	4		

Ø d1/R (0/-0,01) mm	40-5600	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	Diamant					
4/0,3		5	50	3,9	80	4
4/0,5		5	50	3,9	80	4
6/0,3		8	60	5,8	100	6
6/0,5		8	60	5,8	100	6
6/1		8	60	5,8	100	6
8/1		10	84	7,8	120	8

Ø d1/R (0/-0,01) mm	40-5600	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	Diamant					
8/2		10	84	7,8	120	8
10/1		12	88	9,8	130	10
10/2		12	88	9,8	130	10
12/1		15	93	11,8	140	12
12/2		15	93	11,8	140	12
12/3		15	93	11,8	140	12

Bestellbeispiel / Order example: HA-Schaft/shank 40-5600-8/2
 HB-Schaft/shank 40-5600-8/2-HB
 HE-Schaft/shank 40-5600-8/2-HE

HAM

Vollhartmetall-Torusfräser solid carbide toric end mill

Konstruktions-Daten

- verstärkter Kern
- ideal geeignet für tiefe Konturen
- vibrationsarm
- zentrumsschneidend

Engineering data

- web thickness reinforced
- very good for deep contours
- low vibrations
- centre cutting

W+F

VHM

Z
3-4

0° Nut

Werk
Norm

Typ H

HA

Eckradius

HPC

HSC

SHRINK
FIT

HB

HE

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legie- rung	Titan	NE Metalle Cu-Leg.	Graphit Faser- verbund	UNI	MMS	max.	ohne	AIR
40-5500			○	●	●	●	●	●	○	○	●	●							●	○	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (e8) mm	40-5500	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Z	Ø d2 (h6) mm
	TA-X						
2/0,5		0,8	5	1,8	60	3	6
3/0,75		1,2	7,5	2,7	60	4	6
4/1		1,6	10	3,6	70	4	6
5/1,2		2	12,5	4,5	80	4	6
6/1,5		2,5	24	5,4	55	4	6
6/1,5		2,5	12	5,4	90	4	6
7/1,5		3	—	—	90	4	6
8/2		3,5	32	7,2	65	4	8
8/2		3,5	16	7,2	104	4	8
9/2		4	—	—	104	4	8

Ø d1/R (e8) mm	40-5500	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Z	Ø d2 (h6) mm
	TA-X						
10/2		4	40	9	75	4	10
10/2		4	20	9	104	4	10
11/2		4,5	—	—	104	4	10
12/3		5	48	11	83	4	12
12/3		5	24	11	104	4	12
13/3		5,5	—	—	104	4	12
16/4		6,5	28	14	104	4	16

Bestellbeispiel / Order example: HA-Schaft/shank 40-5500-10/2-40
 HB-Schaft/shank 40-5500-10/2-40-HB
 HE-Schaft/shank 40-5500-10/2-40-HE

HAM 418/419

Vollhartmetall-Torusfräser solid carbide toric end mill

W+F

VHM

Z 4

30° rechts

Werk Norm

Typ H

DIN 6535 Werk

Eckradius

HSC

SHRINK FIT

DIN 6535 HB

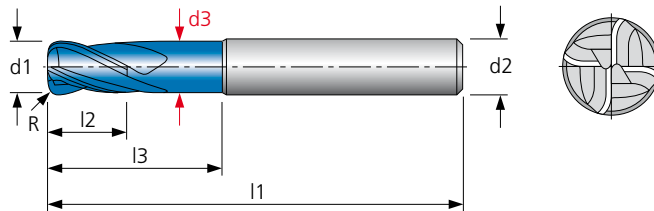
DIN 6535 HE

Konstruktions-Daten

- zentrumsschneidend
- spezielle Ausspitzung
- verstärkter Kern

Engineering data

- centre cutting
- special web thinning
- web thickness reinforced



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5520 u. 40-5560			●	●	●	○			○	○	●	●						●	○	●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (e8) mm	40-5520		40-5560		l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	40-5520		40-5560		l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA-X	TA-X	TA-X	TA-X						TA-X	TA-X							
2/0,2			3	13	1,9	50	3			6/1			7	44	5,5	80	6	
2/0,2			3	13	1,9	50	4			6/1,5			7	21	5,5	57	6	
2/0,2			3	27	1,9	75	3			6/1,5			7	44	5,5	80	6	
2/0,2			3	27	1,9	75	4			8/0,5			9	27	7,4	63	8	
3/0,3			4	14	2,7	50	3			8/0,5			9	54	7,4	100	8	
3/0,3			4	14	2,7	50	4			8/1			9	27	7,4	63	8	
3/0,3			4	32	2,7	75	3			8/1			9	54	7,4	100	8	
3/0,3			4	32	2,7	75	4			8/1,5			9	27	7,4	63	8	
3/0,5			4	32	2,7	75	3			8/1,5			9	54	7,4	100	8	
3/0,5			4	32	2,7	75	4			8/2			9	27	7,4	63	8	
3/1			4	14	2,7	50	3			8/2			9	54	7,4	100	8	
3/1			4	14	2,7	50	4			8/3			9	27	7,4	63	8	
3/1			4	32	2,7	75	3			10/0,5			11	32	9,2	72	10	
3/1			4	32	2,7	75	4			10/0,5			11	60	9,2	100	10	
4/0,4			5	16	3,7	50	4			10/1			11	32	9,2	72	10	
4/0,4			5	36	3,7	75	4			10/1			11	60	9,2	100	10	
4/0,5			5	36	3,7	75	4			10/1,5			11	32	9,2	72	10	
4/1			5	16	3,7	50	4			10/1,5			11	60	9,2	100	10	
4/1			5	36	3,7	75	4			10/2			11	32	9,2	72	10	
5/0,5			6	18	4,6	54	5			10/2			11	60	9,2	100	10	
5/0,5			6	18	4,6	54	6			12/0,5			12	38	11	83	12	
5/0,5			6	40	4,6	75	5			12/0,5			12	75	11	120	12	
5/0,5			6	40	4,6	75	6			12/1			12	38	11	83	12	
5/1			6	18	4,6	54	5			12/1			12	75	11	120	12	
5/1			6	18	4,6	54	6			12/1,5			12	38	11	83	12	
5/1			6	40	4,6	75	5			12/1,5			12	75	11	120	12	
5/1			6	40	4,6	75	6			12/2			12	38	11	83	12	
6/0,5			7	21	5,5	57	6			12/2			12	75	11	120	12	
6/0,5			7	44	5,5	80	6			16/2			16	47	15	105	16	
6/1			7	21	5,5	57	6			16/2			16	92	15	150	16	

Bestellbeispiel / Order example: HA-Schaft/shank 40-5520-6/1-44-6
 HB-Schaft/shank 40-5520-6/1-44-6-HB
 HE-Schaft/shank 40-5520-6/1-44-6-HE



Radiusfräser

ball nose end mills

Vollhartmetall-Radiusfräser in verschiedenen Ausführungen.

Solid carbide ball nose end mill in different types.

HAM

Vollhartmetall-Radiusfräser
solid carbide ball nose end mill

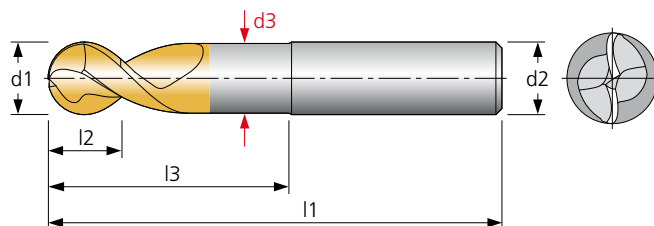
W+F
 VHM
 Z 2
 45° rechts
 Werk Norm
 Typ W
 HA
 HSC
 SHRINK FIT
 HB
 HE

Konstruktions-Daten

- zentrumsschneidend
- stark positiver Spanwinkel

Engineering data

- centre cutting
- positive rake angle



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5661	●	●							○	○				○	●	○		●	●	●	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f8) mm	40-5661	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA-AL					
6		6	20	5,8	54	6
6		16	43	5,8	100	6
6		16	93	5,8	150	6
8		8	26	7,8	59	8
8		22	53	7,8	100	8
8		22	103	7,8	150	8
10		10	31	9,7	67	10
10		25	59	9,7	100	10
10		25	105	9,7	150	10
12		12	37	11,6	73	12
12		26	59	11,6	100	12

Ø d1 (f8) mm	40-5661	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA-AL					
12		26	104	11,6	150	12
14		14	37	13,6	75	14
14		26	59	13,6	100	14
14		26	126	13,6	180	14
16		16	43	15,5	83	16
16		30	91	15,5	150	16
16		30	175	15,5	225	16
20		20	49	19,4	93	20
20		40	91	19,4	150	20
20		40	175	19,4	225	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-5661-12-104
 HB-Schaft/shank 40-5661-12-104-HB
 HE-Schaft/shank 40-5661-12-104-HE

HAM

Vollhartmetall-Radiusfräser
solid carbide ball nose end mill

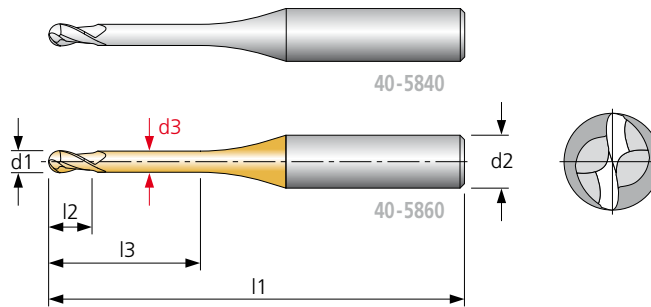
W+F VHM Z 2 30° rechts Werk Norm

Konstruktions-Daten

- besonders geeignet zum Kopierfräsen tiefer Konturbereiche
- zentrumsschneidend

Engineering data

- especially suitable for form copying of deep contours
- centre cutting



Typ W HA HSC SHRINK FIT HB HE

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5840	●	●							○	○				○	●	○		●	●	○	○
40-5860	●	●							○	○				○	●	○		●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f8) mm	40-5840		40-5860		Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	40-5840		40-5860		Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-AL	l2 mm	l3 mm					TA-AL	l2 mm	l3 mm			
0,2			0,3	0,5	0,18	55	4							
0,2			0,3	1	0,18	55	4							
0,2			0,3	1,5	0,18	55	4							
0,3			0,45	1	0,28	55	4							
0,3			0,45	2	0,28	55	4							
0,3			0,45	3	0,28	55	4							
0,4			0,6	2	0,37	55	4							
0,4			0,6	3	0,37	55	4							
0,4			0,6	4	0,37	55	4							
0,5			0,7	3	0,47	55	4							
0,5			0,7	5	0,47	55	4							
0,5			0,7	8	0,47	55	4							
0,6			0,9	3	0,57	55	4							
0,6			0,9	5	0,57	55	4							
0,6			0,9	8	0,57	55	4							
0,8			1,1	4	0,76	55	4							
0,8			1,1	6	0,76	55	4							
0,8			1,1	8	0,76	55	4							
0,8			1,1	10	0,76	55	4							
1			1,5	6	0,95	55	4							
1			1,5	10	0,95	55	4							
1			1,5	14	0,95	55	4							
1			1,5	18	0,95	55	4							
1			1,5	24	0,95	60	4							
1,2			1,6	6	1,15	55	4							
1,2			1,6	10	1,15	55	4							
1,2			1,6	14	1,15	55	4							
1,2			1,6	18	1,15	55	4							
1,2			1,6	24	1,15	60	4							
1,5			2	6	1,44	55	4							
1,5			2	10	1,44	55	4							
1,5			2	14	1,44	55	4							

Bestellbeispiel / Order example: HA-Schaft/shank 40-5840-6-10
 HB-Schaft/shank 40-5840-6-10-HB
 HE-Schaft/shank 40-5840-6-10-HE

HAM

Vollhartmetall-Radiusfräser
solid carbide ball nose end mill

W+F VHM Z 2 35° rechts Werk Norm

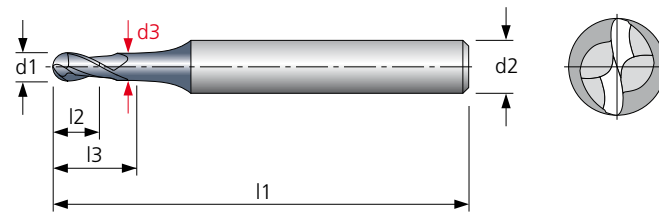
Typ W HA

Konstruktions-Daten

- diamantbeschichtet für abrasive Werkstoffe
- zentrumsschneidend
- verstärkter Kern

Engineering data

- diamond-coated for abrasive materials
- centre cutting
- web thickness reinforced



HSC SHRINK FIT

HB HE

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5880		○														●		○		●	

● sehr gut geeignet/very suitable ○ geeignet/suitable

Ø d1 (0/-0,01) mm	40-5880						Ø d1 (0/-0,01) mm	40-5880					
	Diamant	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm		Diamant	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
0,2		0,3	0,5	0,18	55	4	1,5	2	18	1,44	55	4	
0,2		0,3	1	0,18	55	4	1,5	2	24	1,44	60	4	
0,2		0,3	1,5	0,18	55	4	2	2,5	6	1,92	65	4	
0,3		0,45	1	0,28	55	4	2	2,5	10	1,92	65	4	
0,3		0,45	2	0,28	55	4	2	2,5	14	1,92	65	4	
0,3		0,45	3	0,28	55	4	2	2,5	18	1,92	65	4	
0,4		0,6	2	0,37	55	4	2	2,5	24	1,92	75	4	
0,4		0,6	3	0,37	55	4	2	2,5	30	1,92	75	4	
0,4		0,6	4	0,37	55	4	2,5	3,5	10	2,4	65	4	
0,5		0,7	3	0,47	55	4	2,5	3,5	20	2,4	65	4	
0,5		0,7	5	0,47	55	4	2,5	3,5	30	2,4	75	4	
0,5		0,7	8	0,47	55	4	3	5	6	2,9	65	4	
0,6		0,9	3	0,57	55	4	3	5	10	2,9	65	4	
0,6		0,9	5	0,57	55	4	3	5	14	2,9	65	4	
0,6		0,9	8	0,57	55	4	3	5	18	2,9	65	4	
0,8		1,1	4	0,76	55	4	3	5	24	2,9	75	4	
0,8		1,1	6	0,76	55	4	3	5	30	2,9	75	4	
0,8		1,1	8	0,76	55	4	4	6	10	3,9	65	6	
0,8		1,1	10	0,76	55	4	4	6	14	3,9	65	6	
1		1,5	6	0,95	55	4	4	6	18	3,9	65	6	
1		1,5	10	0,95	55	4	4	6	24	3,9	75	6	
1		1,5	14	0,95	55	4	4	6	30	3,9	75	6	
1		1,5	18	0,95	55	4	5	7,5	10	4,9	65	6	
1		1,5	24	0,95	60	4	5	7,5	20	4,9	65	6	
1,2		1,6	6	1,15	55	4	5	7,5	30	4,9	75	6	
1,2		1,6	10	1,15	55	4	5	7,5	40	4,9	90	6	
1,2		1,6	14	1,15	55	4	6	10	12	5,9	65	6	
1,2		1,6	18	1,15	55	4	6	10	20	5,9	65	6	
1,2		1,6	24	1,15	60	4	6	10	30	5,9	75	6	
1,5		2	6	1,44	55	4	6	10	40	5,9	90	6	
1,5		2	10	1,44	55	4	6	10	50	5,9	90	6	
1,5		2	14	1,44	55	4	6	10	50	5,9	90	6	

Bestellbeispiel / Order example: HA-Schaft/shank 40-5880-6-10
 HB-Schaft/shank 40-5880-6-10-HB
 HE-Schaft/shank 40-5880-6-10-HE

HAM

Vollhartmetall-Radiusfräser
solid carbide ball nose end mill

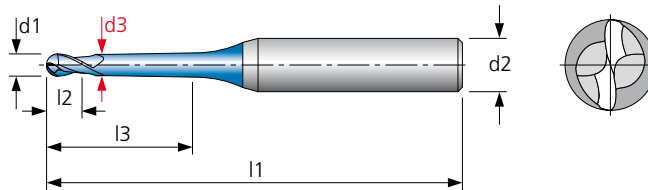
W+F VHM Z 2 30° rechts Werk Norm
Typ H HA
HSC SHRINK FIT

Konstruktions-Daten

- Nenndurchmesser-Toleranz 0/-0,01
- konischer Hals 1°
- langer Hals zum Rippenfräsen
- extrem verstärkter Kern

Engineering data

- diameter tolerance 0/-0,01
- conical neck 1°
- long neck for rib milling
- web thickness reinforced



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-6080			●	●	●	●	●		○	○	●	●						●		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0/-0,01) mm	40-6080						Effektive Bearbeitungstiefe abhängig vom Konturwinkel (β) des Werkstückes. Effective machining depth depending on inclined angle (β) of workpiece.					
	TA-X	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	0,5°	1°	1,5°	2°	2,5°	3°
0,2		0,16	0,5	0,18	45	4	1,08	1,25	1,43	1,6	1,77	1,94
0,2		0,16	1	0,18	45	4	1,48	1,75	1,99	2,21	2,41	2,62
0,2		0,16	1,5	0,18	45	4	1,85	2,25	2,55	2,8	3,04	3,26
0,3		0,24	1	0,28	45	4	1,55	1,8	2,02	2,23	2,43	2,62
0,3		0,24	1,5	0,28	45	4	1,95	2,3	2,57	2,82	3,05	3,27
0,3		0,24	2	0,28	45	4	2,29	2,8	3,12	3,41	3,66	3,9
0,4		0,3	1	0,37	45	4	1,7	1,91	2,11	2,3	2,49	2,67
0,4		0,3	1,5	0,37	45	4	2,13	2,41	2,66	2,89	3,1	3,31
0,4		0,3	2	0,37	45	4	2,54	2,91	3,2	3,47	3,71	3,94
0,4		0,3	2,5	0,37	45	4	2,93	3,41	3,75	4,04	4,31	4,56
0,4		0,3	3	0,37	45	4	3,26	3,91	4,29	4,61	4,9	5,16
0,5		0,4	2	0,45	45	4	2,77	3,06	3,32	3,57	3,79	4,01
0,5		0,4	3	0,45	45	4	3,62	4,06	4,4	4,7	4,97	5,23
0,5		0,4	4	0,45	45	4	4,43	5,06	5,48	5,82	6,13	5,51
0,5		0,4	5	0,45	45	4	4,61	6,06	6,54	6,93	7,27	6,75
0,5		0,4	6	0,45	45	4	4,61	7,06	7,61	8,04	8,41	7,99
0,5		0,4	8	0,45	45	4	4,61	9,06	9,73	10,23	10,65	10,48
0,6		0,5	2	0,55	45	4	2,81	3,09	3,34	3,58	3,8	4,02
0,6		0,5	3	0,55	45	4	3,68	4,09	4,42	4,71	4,98	5,23
0,6		0,5	4	0,55	45	4	4,51	5,09	5,49	5,83	6,14	6,42
0,6		0,5	5	0,55	45	4	5,12	6,09	6,56	6,94	7,28	7,59
0,6		0,5	6	0,55	45	4	4,96	7,09	7,63	8,05	8,41	8,74
0,6		0,5	8	0,55	45	4	4,96	9,09	9,75	10,24	10,65	11,02
0,8		0,6	2	0,75	45	4	2,89	3,15	3,38	3,61	3,82	4,03
0,8		0,6	4	0,75	45	4	4,63	5,15	5,53	5,86	6,15	6,43
0,8		0,6	5	0,75	45	4	5,44	6,15	6,59	6,96	7,29	7,6
0,8		0,6	6	0,75	45	4	5,66	7,15	7,66	8,07	8,43	8,75
0,8		0,6	7	0,75	45	4	5,66	8,15	8,72	9,16	9,55	9,9
0,8		0,6	8	0,75	45	4	5,66	9,15	9,77	10,25	10,66	11,03
0,8		0,6	10	0,75	45	4	5,66	11,15	11,88	12,42	12,88	13,28
1		0,8	3	0,95	45	4	3,86	4,2	4,49	4,76	5,01	5,25
1		0,8	4	0,95	45	4	4,74	5,2	5,56	5,88	6,17	6,44
1		0,8	5	0,95	45	4	5,58	6,2	6,63	6,99	7,31	7,6
1		0,8	6	0,95	45	4	6,35	7,2	7,69	8,09	8,44	8,76
1		0,8	7	0,95	45	4	6,36	8,2	8,75	9,18	9,56	9,9
1		0,8	8	0,95	45	4	6,36	9,2	9,8	10,27	10,68	11,04
1		0,8	9	0,95	45	4	6,36	10,2	10,86	11,36	11,78	12,17
1		0,8	10	0,95	45	4	6,36	11,2	11,91	12,44	12,89	13,29
1		0,8	12	0,95	45	4	6,36	13,2	14,01	14,6	15,08	15,51

Bestellbeispiel / Order example: 40-6080-0,2-0,5

Ø d1 (0/-0,01) mm	40-6080	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	Effektive Bearbeitungstiefe abhängig vom Konturwinkel (β) des Werkstückes. Effective machining depth depending on inclined angle (β) of workpiece.					
							TA-X	0,5°	1°	1,5°	2°	2,5°
	1		0,8	14	0,95	50	4	6,36	15,2	16,11	16,74	17,26
1		0,8	16	0,95	50	4	6,36	17,2	18,2	18,88	19,43	19,91
1		0,8	20	0,95	55	4	6,36	21,2	22,36	23,13	23,74	24,27
1,2		1	6	1,15	45	4	6,53	7,25	7,72	8,11	8,45	8,77
1,2		1	8	1,15	45	4	7,06	9,25	9,83	10,29	10,69	11,04
1,2		1	10	1,15	45	4	7,06	11,25	11,94	12,46	12,9	13,29
1,2		1	12	1,15	45	4	7,06	13,25	14,03	14,61	15,09	15,52
1,4		1,1	8	1,35	45	4	7,76	9,3	9,86	10,31	10,7	11,05
1,4		1,1	12	1,35	45	4	7,76	13,3	14,06	14,63	15,1	15,52
1,4		1,1	16	1,35	50	4	7,76	17,3	18,24	18,9	19,45	19,92
1,5		1,2	8	1,45	45	4	8,25	9,32	9,87	10,32	10,7	11,05
1,5		1,2	12	1,45	45	4	8,11	13,32	14,07	14,63	15,11	15,53
1,5		1,2	16	1,45	50	4	8,11	17,32	18,25	18,91	19,45	19,93
1,5		1,2	20	1,45	55	4	8,11	21,32	22,41	23,15	23,76	24,38
1,6		1,3	8	1,55	45	4	8,38	9,34	9,88	10,32	10,71	11,06
1,6		1,3	12	1,55	45	4	8,46	13,34	14,08	14,64	15,11	15,53
1,6		1,3	16	1,55	50	4	8,46	17,34	18,26	18,91	19,46	19,93
1,6		1,3	20	1,55	55	4	8,46	21,34	22,42	23,16	23,76	—
1,8		1,4	8	1,75	45	4	8,55	9,38	9,91	10,34	10,72	11,06
1,8		1,4	12	1,75	45	4	9,16	13,38	14,11	14,65	15,12	15,53
1,8		1,4	16	1,75	50	4	9,16	17,38	18,28	18,93	19,46	19,93
1,8		1,4	20	1,95	55	4	9,16	21,38	22,44	23,17	23,77	—
2		1,6	6	1,95	45	4	6,91	7,43	7,83	8,18	8,5	8,8
2		1,6	8	1,95	45	4	8,66	9,43	9,94	10,36	10,73	11,07
2		1,6	10	1,95	45	4	9,86	11,43	12,03	12,52	12,94	13,32
2		1,6	12	1,95	45	4	9,86	13,43	14,13	14,67	15,13	15,54
2		1,6	14	1,95	50	4	9,86	15,43	16,22	16,81	17,31	17,75
2		1,6	16	1,95	50	4	9,86	17,43	18,3	18,94	19,47	19,94
2		1,6	18	1,95	55	4	9,86	19,43	20,38	21,07	21,63	—
2		1,6	20	1,95	55	4	9,86	21,43	22,46	23,18	23,78	—
2		1,6	22	1,95	60	4	9,86	23,43	24,54	25,3	—	—
2		1,6	25	1,95	65	4	9,86	26,43	27,65	28,46	—	—
2		1,6	30	1,95	70	4	9,86	31,43	32,81	—	—	—
3		2,4	8	2,85	50	6	9,48	9,93	10,31	10,66	10,98	11,28
3		2,4	10	2,85	50	6	11,35	11,93	12,39	12,8	13,17	13,5
3		2,4	16	2,85	55	6	16,83	17,93	18,62	19,18	19,66	20,09
3		2,4	20	2,85	60	6	19,09	21,93	22,76	23,4	23,94	24,42
3		2,4	25	2,85	65	6	19,09	26,93	27,92	28,65	29,27	29,8
3		2,4	30	2,85	70	6	19,09	31,93	33,07	33,89	34,56	—
3		2,4	35	2,85	80	6	19,09	36,93	38,21	39,11	—	—
4		3,2	10	3,85	60	6	11,57	12,07	12,49	12,87	13,21	13,53
4		3,2	16	3,85	60	6	17,16	18,07	18,7	19,23	19,7	20,11
4		3,2	20	3,85	65	6	20,76	22,07	22,84	23,45	23,98	—
4		3,2	25	3,85	70	6	22,59	27,07	27,99	28,7	—	—
4		3,2	30	3,85	80	6	22,59	32,07	33,14	—	—	—
4		3,2	35	3,85	80	6	22,59	37,07	38,28	—	—	—
4		3,2	40	3,85	90	6	22,59	42,07	—	—	—	—
4		3,2	45	3,85	90	6	22,59	47,07	—	—	—	—
4		3,2	50	3,85	100	6	22,59	52,07	—	—	—	—
5		4	20	4,85	70	6	21,12	22,2	—	—	—	—
5		4	25	4,85	70	6	25,53	27,2	—	—	—	—
5		4	30	4,85	80	6	26,09	—	—	—	—	—
5		4	35	4,85	80	6	26,09	—	—	—	—	—
6		4,8	30	5,85	80	8	29,59	32,32	33,28	—	—	—
6		4,8	50	5,85	120	8	29,59	52,32	—	—	—	—

Bestellbeispiel / Order example: 40-6080-1-14



Kundenbetreuung von der Planung
bis zur Realisierung und darüber hinaus.

*Customer service from the planning period
till the realization and over that.*

HAM 422/429

Vollhartmetall-Radiusfräser
solid carbide ball nose end mill

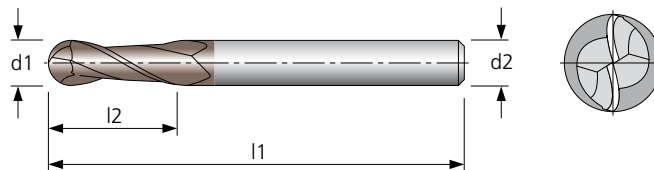
W+F VHM Z 2 30° rechts Werk 6527
Typ N DIN 6535 Werk
HSC SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- universell einsetzbar
- Kern verstärkt
- zentrumsschneidend

Engineering data

- allround end mill
- web thickness reinforced
- centre cutting



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5670 u. 40-5710			●	●	●	○			○	○	●	●						●			●
40-5680 u. 40-5720			●	●	●	○			○	○	●	●						●			●

● sehr gut geeignet/very suitable ○ geeignet/suitable

Ø d1 (f8) mm	40-5670	40-5680	40-5710	40-5720	l2 mm	l1 mm	Ø d2 (h6) mm
		TA		TA			
0,4					2	38	3
0,4					3	38	3
0,4					3	38	4
0,5					2	38	3
0,5					3	38	3
0,5					3	38	4
0,6					2	38	3
0,6					3	38	3
0,6					3	38	4
0,8					2	38	3
0,8					3	38	3
0,8					3	38	4
1					3	38	3
1					5	38	3
1					5	38	4
1,5					3	38	3
1,5					5	38	3
1,5					5	38	4
2					3	50	6
2					7	57	6
2,5					3	50	6
2,5					7	57	6
3					4	50	6
3					7	57	6
4					8	57	6
4					12	70	6
5					10	57	6
5					15	80	6
6					10	57	6
6					15	80	6
8					16	63	8
8					20	90	8
10					19	72	10
10					25	100	10
12					22	83	12

Bestellbeispiel / Order example: HA-Schaft/shank 40-5670-0,4-2-3
 HB-Schaft/shank 40-5670-0,4-2-3-HB
 HE-Schaft/shank 40-5670-0,4-2-3-HE

Ø d1 (f8) mm	40-5670	40-5680	40-5710	40-5720	l2 mm	l1 mm	Ø d2 (h6) mm
		TA		TA			
12					30	110	12
14					22	83	14
16					26	92	16
16					40	120	16
18					26	92	18
18					40	130	20
20					32	104	20
20					45	130	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-5670-12-30-12
 HB-Schaft/shank 40-5670-12-30-12-HB
 HE-Schaft/shank 40-5670-12-30-12-HE

HAM 463/464

Vollhartmetall-Radiusfräser solid carbide ball nose end mill

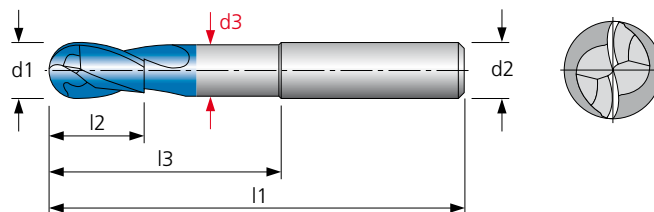
W+F VHM Z 2 30° rechts Werk 6527
Typ H DIN 6535 Werk
HSC SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zum Hartfräsen bis 65 HRC
- zentrumsschneidend
- verstärkter Kern

Engineering data

- for hard milling up to 65 HRC
- centre cutting
- web thickness reinforced



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5760			○	●	●	●	●	○	○	○	●	●	○	○				●	○	○	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f8) mm	40-5760	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm	Ø d1 (f8) mm	40-5760	l2 mm	l3 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	TA-X							TA-X					
0,4		0,6	1	0,38	38	3	5		5	32	4,8	70	6
0,5		0,75	1,3	0,48	38	3	5		5	42	4,8	80	6
0,6		0,9	1,5	0,57	38	3	5		5	52	4,8	90	6
0,8		1,2	2	0,76	38	3	6		6	21	5,7	57	6
1		1,5	2,5	0,95	38	3	6		6	34	5,7	70	6
1,2		1,6	2,8	1,14	38	3	6		6	44	5,7	80	6
1,5		2	3,5	1,43	38	3	6		6	64	5,7	100	6
2		2,2	4,2	1,9	38	3	8		8	27	7,6	63	8
2,5		2,5	5	2,38	38	3	8		8	64	7,6	100	8
3		3	6	2,9	57	6	8		8	84	7,6	120	8
3		3	22	2,9	50	3	10		10	32	9,5	72	10
4		4	8	3,85	57	6	10		10	80	9,5	120	10
4		4	26	3,9	54	4	10		10	100	9,5	140	10
4		4	30	3,85	70	6	12		12	38	11,4	83	12
4		4	40	3,85	80	6	12		12	75	11,4	120	12
4		4	50	3,85	90	6	12		12	105	11,4	150	12
5		5	10	4,8	57	6	16		16	112	15,4	160	16
5		5	26	4,8	54	5							

Bestellbeispiel / Order example: HA-Schaft/shank 40-5760-6-21
 HB-Schaft/shank 40-5760-6-21-HB
 HE-Schaft/shank 40-5760-6-21-HE

HAM 416 Vollhartmetall-Radiuskopierfräser
solid carbide ball nose end mill

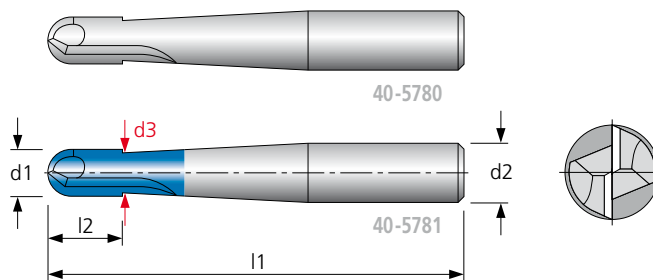
W+F VHM Z 2 0° Nut Werk Norm
Typ H DIN 6535 HA
SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- kurze gerade Nuten
- zentrumsschneidend
- verstärkter Kern

Engineering data

- short straight flutes
- centre cutting
- web thickness reinforced



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5780			○	○	●	●	●	●			●	●						●	○	●	●
40-5781			○	○	●	●	●	●			●	●						●	○	●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f8) mm	40-5780	40-5781	l2 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-X				
3			4	2,7	75	6
3			4	2,7	100	6
4			5	3,6	75	6
4			5	3,6	100	6
5			6	4,5	75	6
5			6	4,5	100	6
6			8	5,4	80	10

Ø d1 (f8) mm	40-5780	40-5781	l2 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
		TA-X				
6			8	5,4	100	10
8			12	7,2	85	10
8			12	7,2	110	10
8			12	7,2	140	10
10			16	9	100	12
10			16	9	150	12

Bestellbeispiel / Order example: HA-Schaft/shank 40-5780-6-100
 HB-Schaft/shank 40-5780-6-100-HB
 HE-Schaft/shank 40-5780-6-100-HE

HAM

Vollhartmetall-Radiuskopierfräser
solid carbide ball nose end mill

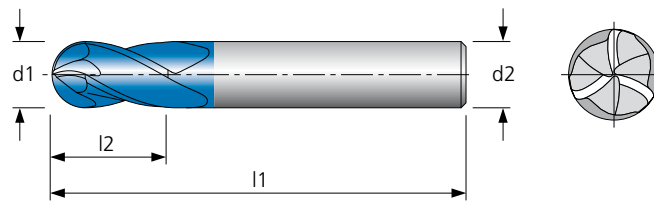
W+F VHM Z 3 30° rechts Werk Norm
Typ H HA
SHRINK FIT
HB HE

Konstruktions-Daten

- Spanwinkel negativ
- zentrumsschneidend
- verstärkter Kern

Engineering data

- rake angle negative
- centre cutting
- web thickness reinforced



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5920 u. 40-5960					○	●	●	●			●	●						●		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (f8) mm	40-5920	40-5960	l2 mm	l1 mm	Ø d2 (h6) mm
	TA-X	TA-X			
2			5	50	6
3			8	60	6
4			8	70	6
5			10	80	6
6			12	90	6
6			12	140	6
8			14	100	8
8			14	160	8

Ø d1 (f8) mm	40-5920	40-5960	l2 mm	l1 mm	Ø d2 (h6) mm
	TA-X	TA-X			
10			18	100	10
10			18	180	10
12			22	110	12
12			22	200	12
16			30	140	16
16			30	220	16
20			38	160	20
20			38	250	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-5920-10
HB-Schaft/shank 40-5920-10-HB
HE-Schaft/shank 40-5920-10-HE

HAM

Vollhartmetall-Radiusfräser
solid carbide ball nose end mill

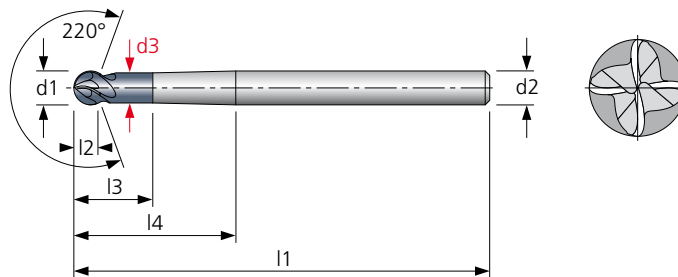
W+F VHM Z 4 15° rechts Werk Norm
Typ W HA
HSC SHRINK FIT
HB HE

Konstruktions-Daten

- zentrumsschneidend
- zum Fräsen von kleinen Hinterschnitten geeignet
- diamantbeschichtet für abrasive Werkstoffe

Engineering data

- centre cutting
- undercut machining
- diamond-coated for abrasive materials



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-6000																		○		●	

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (0/-0,01) mm	40-6000	l2 mm	l3 mm	l4 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	Diamant						
3		2	20	40	2,5	80	4
4		2,7	25	50	3,3	80	4
5		3,4	30	60	4,1	90	6

Ø d1 (0/-0,01) mm	40-6000	l2 mm	l3 mm	l4 mm	Hals Ø d3 mm	l1 mm	Ø d2 (h6) mm
	Diamant						
6		4,05	30	60	4,7	100	6
8		5,37	30	60	6,6	130	8
10		6,71	30	60	8,2	150	10

Bestellbeispiel / Order example: HA-Schaft/shank 40-6000-6
HB-Schaft/shank 40-6000-6-HB
HE-Schaft/shank 40-6000-6-HE

HAM 424/428

Vollhartmetall-Radiuskopierfräser solid carbide ball nose end mill

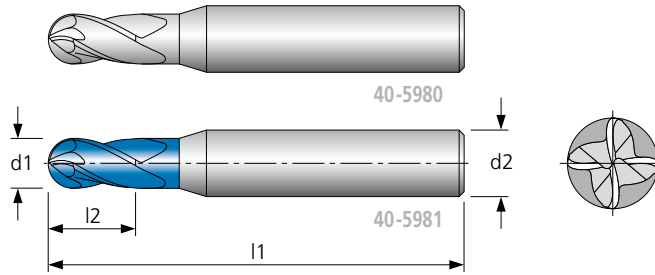
W+F VHM Z 4 30° rechts Werk 6527
Typ H DIN 6535 Werk
HSC SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zentrumsschneidend
- verstärkter Kern
- universell einsetzbar

Engineering data

- centre cutting
- web thickness reinforced
- allround end mill



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5980			●	●	●	○			○	○	●	●						●			●
40-5981			●	●	●	○			○	○	●	●						●			●

● sehr gut geeignet/very suitable ○ geeignet/suitable

Ø d1 (f8) mm	40-5980	40-5981	l2 mm	l1 mm	Ø d2 (h6) mm
		TA-X			
3			8	57	6
4			11	57	6
4			12	70	6
5			13	57	6
6			13	57	6
6			15	80	6
8			19	63	8
8			20	90	8
10			22	72	10

Ø d1 (f8) mm	40-5980	40-5981	l2 mm	l1 mm	Ø d2 (h6) mm
		TA-X			
10			25	100	10
12			26	83	12
12			30	110	12
14			26	83	14
16			32	92	16
16			40	120	16
20			38	104	20
20			45	130	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-5980-10-25
 HB-Schaft/shank 40-5980-10-25-HB
 HE-Schaft/shank 40-5980-10-25-HE

HAM 469

Vollhartmetall-Radiusfräser solid carbide ball nose end mill

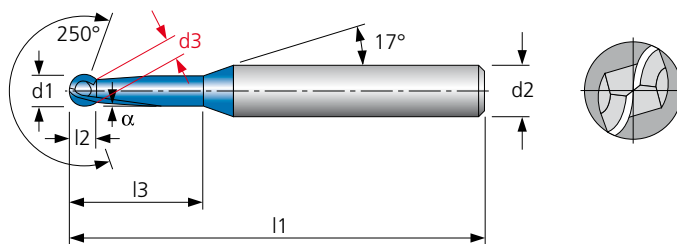
W+F VHM Z 2 15° rechts Werk Norm
Typ H HA
HSC SHRINK FIT
HB HE

Konstruktions-Daten

- zentrumsschneidend
- zum Fräsen von kleinen Hinterschnitten geeignet

Engineering data

- centre cutting
- undercut machining



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-5800			○	●	●	●	○		○	○	●	●						●			●

● sehr gut geeignet/very suitable ○ geeignet/suitable

Ø d1 (f8) mm	40-5800	l2 mm	α	l3 mm	Hals d3 mm	l1 mm	Ø d2 (h6) mm
	TA-X						
1		0,7	1,5°	20	0,7	80	6
2		1,35	1,5°	20	1,4	80	6
3		2	1,5°	30	2,1	80	6
4		2,7	3°	30	3,3	80	6

Ø d1 (f8) mm	40-5800	l2 mm	α	l3 mm	Hals d3 mm	l1 mm	Ø d2 (h6) mm
	TA-X						
5		3,4	1°	40	4,1	90	6
6		4,05	—	45	4,7	100	6
8		5,4	1°	45	6,5	100	8
10		6,75	1°	55	8,2	100	10

Bestellbeispiel / Order example: HA-Schaft/shank 40-5800-6
 HB-Schaft/shank 40-5800-6-HB
 HE-Schaft/shank 40-5800-6-HE

Spezialfräser

special end mills



Vollhartmetall-Spezialfräser zum Fräsen,
Gravieren, Runden und Rückwärtssenken.

*Solid carbide special end mills for sinking,
graving and rounding.*

HAM

Vollhartmetall-Gesenkfräser konisch 0,5° – 3°
solid carbide conical end mill 0,5° – 3°

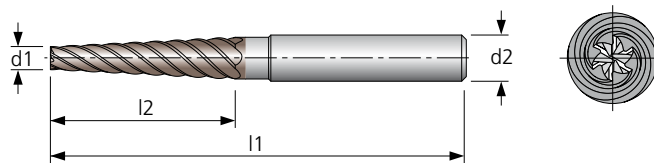
W+F VHM Z 4-6 45° rechts Werk Norm
Typ N DIN 6535 HA
SHRINK FIT
DIN 6535 HB DIN 6535 HE

Konstruktions-Daten

- zentrumsscheidend
- verstärkter Kern
- speziell zum Fräsen von schrägen Flächen

Engineering data

- centre cutting
- web thickness reinforced
- especially for milling of bevel surfaces



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faserverbund	UNI	MMS	max.	ohne	AIR
40-5341 bis 40-5357	●	●	●	●	●	●	○	○	○	○	●	●			○	○		●	●	○	○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (e8) mm	40-5341	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	0,5° TA				
3		20	60	4	4
4		24	65	4	5
5		30	75	4	6
6		35	80	6	8
8		40	85	6	10
10		45	95	6	12
12		50	105	6	14
14		60	120	6	16

Ø d1 (e8) mm	40-5345	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	1° TA				
3		28	60	4	4
4		28	65	4	5
5		28	75	4	6
6		35	80	6	8
8		40	85	6	10
10		45	95	6	12
12		57	105	6	14
14		57	120	6	16

Ø d1 (e8) mm	40-5349	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	1,5° TA				
3		19	60	4	4
4		24	65	4	6
5		30	75	4	8
6		38	80	6	8
8		38	85	6	10
10		38	95	6	12
12		38	105	6	14
16		60	125	6	20

Ø d1 (e8) mm	40-5353	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	2° TA				
3		28	65	4	5
4		28	65	4	6
5		30	75	4	8
6		28	75	6	8
8		28	75	6	10
10		28	85	6	12
12		57	120	6	16
16		57	125	6	20

Ø d1 (e8) mm	40-5357	l2 mm	l1 mm	Z	Ø d2 (h6) mm
	3° TA				
3		28	70	4	6
4		38	80	4	8
5		48	90	4	10
6		38	90	6	10
8		38	90	6	12
10		57	120	6	16
12		38	100	6	16
16		38	100	6	20

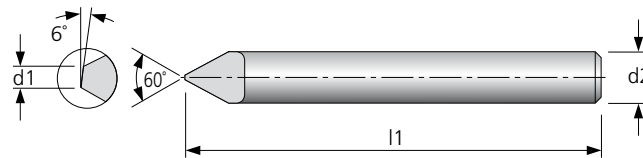
Bestellbeispiel / Order example: HA-Schaft/shank 40-5357-6
 HB-Schaft/shank 40-5357-6-HB
 HE-Schaft/shank 40-5357-6-HE

HAM 462 Vollhartmetall-Gravierstichel solid carbide engraving bits

VHM Z 1 0° Nut Werk Norm
Typ N SHRINK FIT

- Konstruktions-Daten**
- zentrumsschneidend
 - spezielles Werkzeug zum Gravieren und Kopieren

- Engineering data**
- centre cutting
 - special tool for engraving and copying



Andere Spitzenwinkel auf Anfrage.
Different cutting angles on request.

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1880	●	●	●	●	●						●	●			●	○		●	●	●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1	40-1880	l2	l1	Ø d2 (h6)
mm		mm	mm	mm
0,2		3	40	2
0,2		3	50	3
0,2		4	60	4
0,2		5	60	5
0,2		6	75	6

Ø d1	40-1880	l2	l1	Ø d2 (h6)
mm		mm	mm	mm
0,25		8	90	8
0,25		10	100	10
0,25		12	100	12

Bestellbeispiel / Order example: 40-1880-0,25-8-90

HAM 466 Vollhartmetall-Entgrat- und Fasfräser solid carbide deburring and chamfering mills

VHM Z 4 8° rechts Werk Norm
Typ N HA SHRINK FIT HB HE

- Konstruktions-Daten**
- zum Anfasen und Entgraten
- Engineering data**
- for chamfering and deburring



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1921	●	●	●	●	●	○			●	●	●	●	○	○	●	○		●	●	●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (h7)	40-1921	l2	l1	Ø d2 (h6)
mm	TA	mm	mm	mm
4		1,8	54	4
6		2,8	57	6
8		3,8	63	8

Ø d1 (h7)	40-1921	l2	l1	Ø d2 (h6)
mm	TA	mm	mm	mm
10		4,8	72	10
12		5,8	83	12

Bestellbeispiel / Order example: HA-Schaft/shank 40-1921-10
HB-Schaft/shank 40-1921-10-HB
HE-Schaft/shank 40-1921-10-HE

HAM 467 Vollhartmetall-Entgrat- und Fasrfräser solid carbide deburring and chamfering mills

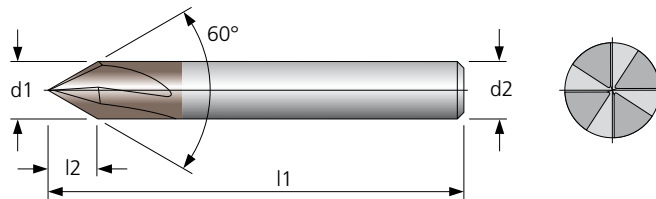
VHM Z 4 8° rechts Werk Norm
 Typ N HA
 60° SHRINK FIT
 HB HE

Konstruktions-Daten

• zum Anfasen und Entgraten

Engineering data

• for chamfering and deburring



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-1961	●	●	●	●	●	○			●	●	●	●	○	○	●	○		●	●	●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (h7) mm	40-1961	l2 mm	l1 mm	Ø d2 (h6) mm
	TA			
4		3,3	54	4
6		5,0	57	6
8		6,8	63	8

Ø d1 (h7) mm	40-1961	l2 mm	l1 mm	Ø d2 (h6) mm
	TA			
10		8,5	72	10
12		10,0	83	12

Bestellbeispiel / Order example: HA-Schaft/shank 40-1961-10
 HB-Schaft/shank 40-1961-10-HB
 HE-Schaft/shank 40-1961-10-HE

HAM 468 Vollhartmetall-Viertelkreisfräser konkav solid carbide rounding end mills

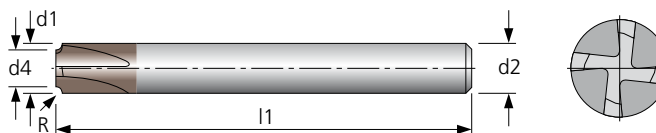
VHM Z 4 0° Nut Werk Norm
 Typ N HA
 SHRINK FIT
 HB HE

Konstruktions-Daten

• zum Verrunden von Kanten

Engineering data

• especially for chamfering



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-2001	●	●	●	●	●	○			●	●	●	●	○	○	●	○		●	●	●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	40-2001	l2 mm	l1 mm	r ± 0,05 mm	d4 - 0,1 mm	Ø d2 (h6) mm
	TA					
6		9	70	0,5	5	6
8		12	70	1	6	8
8		12	75	1,5	5	8
10		15	75	2	6	10
10		15	75	2,5	5	10

Ø d1 mm	40-2001	l2 mm	l1 mm	r ± 0,05 mm	d4 - 0,1 mm	Ø d2 (h6) mm
	TA					
12		18	75	3	6	12
12		18	80	3,5	5	12
16		24	80	4	8	16
16		24	80	5	6	16
20		30	80	6	8	20

Bestellbeispiel / Order example: HA-Schaft/shank 40-2001-12-3
 HB-Schaft/shank 40-2001-12-3-HB
 HE-Schaft/shank 40-2001-12-3-HE



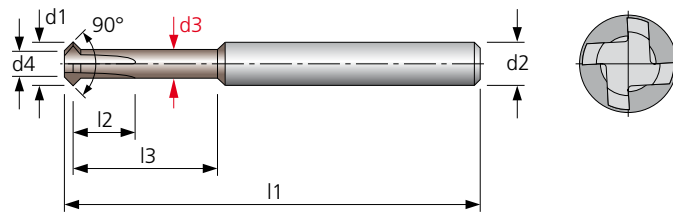
HAM Sonderfräswerkzeuge nach Zeichnung aus Vollhartmetall, Cermets, Diamant und CBN.

HAM Milling tools according drawings made from solid carbide, cermets, diamond and CBN.

HAM 465 Vollhartmetall-Entgrat- und Fasräser
solid carbide deburring and chamfering mills

VHM Z 4 0° Nut Werk Norm
Typ N HA
SHRINK FIT
HB HE

- Konstruktions-Daten**
• Vor- und Rückwärtsbearbeitung
Engineering data
• forward- and backward chamfering



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl > 1200 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-2041	●	●	●	●	●	○			●	●	●	●	○	●	●	○		●		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (h10) mm	40-2041	l2	l3	Hals d3	l1	d4	Ø d2 (h6) mm
	TA	mm	mm	mm	mm	mm	mm
5,8		6	20	4	100	3	6
7,8		8	25	5,4	100	3,5	6

Ø d1 (h10) mm	40-2041	l2	l3	Hals d3	l1	d4	Ø d2 (h6) mm
	TA	mm	mm	mm	mm	mm	mm
9,8		9	—	—	100	5	6

Bestellbeispiel / Order example: HA-Schaft/shank 40-2041-9,8
HB-Schaft/shank 40-2041-9,8-HB
HE-Schaft/shank 40-2041-9,8-HE



Diamant-Fräser

diamond end mills

Polikristalline Diamant-Fräswerkzeuge für optimale Standzeiten speziell in Aluminium, Graphit und Faserverbundwerkstoffen.

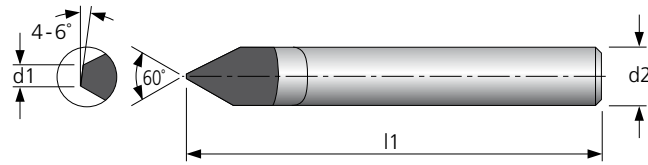
Polycrystalline diamond end mills for optimal tool life especially for aluminium, graphit, composite and glassfibre materials.

HAM 3460

Diamant-Gravierstichel diamond engraving bits

PKD Z 1 0° Nut Werk Norm
Typ W SHRINK FIT

- Konstruktions-Daten**
- zentrumsschneidend
 - spezielles Werkzeug zum Gravieren und Kopieren
- Engineering data**
- centre cutting
 - special tool for engraving and copying



Bitte geben Sie bei Ihrer Anfrage den gewünschten Spitzenwinkel an.
Please indicate the cutting angle on your request.

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
43-1000	●	●												○	●	●		○		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	43-1000	l1 mm	Ø d2 (h6) mm
	PKD		
0,2		38	3
0,2		38	3,175
0,3		50	4
0,4		50	5

Ø d1 mm	43-1000	l1 mm	Ø d2 (h6) mm
	PKD		
0,5		60	6
0,6		60	8
0,8		70	10
1		70	12

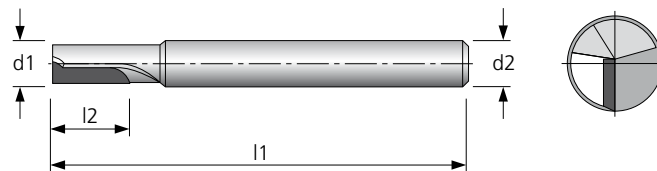
Bestellbeispiel / Order example: 43-1000-0,5-60-6

HAM 3462/3463

Diamant-Bohrnutenfräser diamond slot end mills

PKD Z 1 0° Nut Werk Norm
Typ W HA HSC SHRINK FIT

- Konstruktions-Daten**
- 1 Schneide über Mitte
- Engineering data**
- 1 cutting edge over centre



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
43-1040	●	●												○	●	●		○		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (h10) mm	43-1040	l2 mm	l1 mm	Ø d2 (h6) mm
	PKD			
4		5	54	6
4		10	54	6
5		5	54	6
5		10	54	6
6		7	54	6

Ø d1 (h10) mm	43-1040	l2 mm	l1 mm	Ø d2 (h6) mm
	PKD			
6		15	54	6
8		7	58	8
8		15	58	8
10		7	66	10
10		15	66	10

Bestellbeispiel / Order example: 43-1040-6-15

HAM 3464/3465/3466

Diamant-Bohrnutenfräser diamond slot end mills

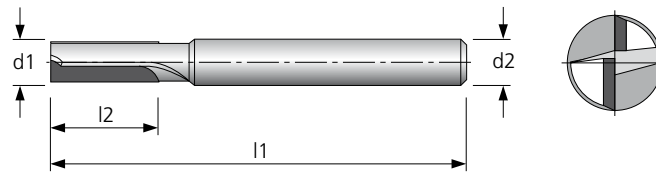
PKD Z 2 0° Nut Werk Norm
Typ W HA
HSC SHRINK FIT

Konstruktions-Daten

- 1 Schneide über Mitte

Engineering data

- 1 cutting edge over centre



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
43-1080	●	●												○	●	●		○			●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (h10) mm	43-1080	l2 mm	l1 mm	Ø d2 (h6) mm
	PKD			
6		7	54	6
6		15	54	6
6		20	54	6
8		7	58	8
8		15	58	8
8		20	58	8
10		7	66	10
10		15	66	10
10		20	66	10
12		7	73	12

Ø d1 (h10) mm	43-1080	l2 mm	l1 mm	Ø d2 (h6) mm
	PKD			
12		15	73	12
12		20	73	12
14		15	75	14
14		20	75	14
16		15	82	16
16		20	82	16
18		15	88	18
18		20	88	18
20		15	92	20
20		20	92	20

Bestellbeispiel / Order example: 43-1080-12-15

HAM

Vollhartmetall-PKD-Torusfräser solid carbide PKD toric end mill

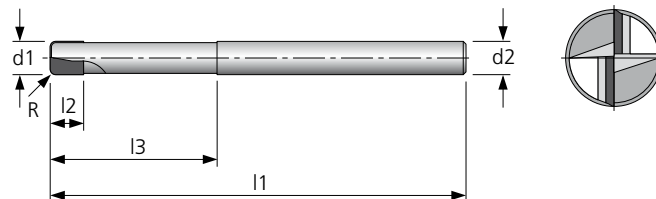
W+F PKD Z 2 0° Nut Werk Norm
Typ W HA
Eckradius HSC SHRINK FIT

Konstruktions-Daten

- 1 Schneide über Mitte

Engineering data

- 1 cutting edge over centre



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR	
40-5640	●	●												○	●	●		○			●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1/R (h7) mm	40-5640	l2 mm	l3 mm	l1 mm	Z	Ø d2 (h6) mm
	PKD					
4/0,3		2,5	12	75	2	6
4/0,3		2,5	20	75	2	6
4/0,3		2,5	28	75	2	6
4/0,3		2,5	35	75	2	6
4/0,5		2,5	20	75	2	6

Ø d1/R (h7) mm	40-5640	l2 mm	l3 mm	l1 mm	Z	Ø d2 (h6) mm
	PKD					
5/0,3		3	15	75	2	6
5/0,3		3	25	75	2	6
5/0,3		3	35	75	2	6
5/0,5		3	25	75	2	6
6/0,5		6	18	100	2	6

Bestellbeispiel / Order example: 40-5640-5/0,3-15

Ø d1/R (h7) mm	40-5640	l2 mm	l3 mm	l1 mm	Z	Ø d2 (h6) mm	Ø d1/R (h7) mm	40-5640	l2 mm	l3 mm	l1 mm	Z	Ø d2 (h6) mm
	PKD							PKD					
6/0,5		6	30	100	2	6	10/1,5		8	50	100	2	10
6/0,5		6	42	100	2	6	10/2		8	30	100	2	10
6/1		6	18	100	2	6	10/2		8	50	100	2	10
8/0,5		7	24	100	2	8	12/0,5		9	36	105	2	12
8/0,5		7	40	100	2	8	12/0,5		9	60	105	2	12
8/1		7	24	100	2	8	12/1		9	36	105	2	12
8/1		7	40	100	2	8	12/1		9	60	105	2	12
8/2		7	40	100	2	8	12/1,5		9	36	105	2	12
10/0,5		8	30	100	2	10	12/1,5		9	60	105	2	12
10/0,5		8	50	100	2	10	12/2		9	36	105	2	12
10/1		8	30	100	2	10	12/3		9	60	105	2	12
10/1		8	50	100	2	10	16/5		11	50	130	2	16
10/1,5		8	30	100	2	10	20/6		13	60	160	2	20

Bestellbeispiel / Order example: 40-5640-10/1,5-50

HAM Vollhartmetall-PKD-Radiusfräser
solid carbide PKD ball nose end mill

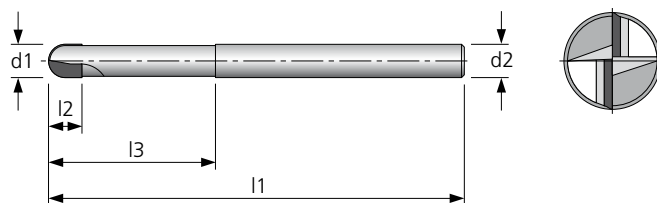
W+F PKD Z 2 0° Nut Werk Norm

Konstruktions-Daten

- 1 Schneide über Mitte

Engineering data

- 1 cutting edge over centre



Typ W HA HSC SHRINK FIT

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-6040	●	●												○	●	●		○		●	●

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 (h7) mm	40-6040	l2 mm	l3 mm	l1 mm	Z	Ø d2 (h6) mm	Ø d1 (h7) mm	40-6040	l2 mm	l3 mm	l1 mm	Z	Ø d2 (h6) mm
	PKD							PKD					
4		2,5	12	75	2	6	6		6	42	100	2	6
4		2,5	20	75	2	6	8		7	24	100	2	8
4		2,5	28	75	2	6	8		7	40	100	2	8
4		2,5	35	75	2	6	10		8	30	100	2	10
5		3	15	75	2	6	10		8	50	100	2	10
5		3	25	75	2	6	12		9	36	105	2	12
5		3	35	75	2	6	12		9	60	105	2	12
6		6	18	100	2	6	16		11	50	130	2	16
6		6	30	100	2	6	20		13	60	160	2	20

Bestellbeispiel / Order example: 40-6040-6-42



Produktivität am Maximum

- höchstmögliche Produktivität durch maximale Schneidenzahl
- PKD-Schneideinsatz garantiert höchste Präzision bei optimaler Oberflächengüte
- wesentlich höhere Standzeiten erreichbar als mit herkömmlichen Frässystemen
- Schneidenjustage – optimiert und vereinfacht durch seitliche Feineinstellung

Maximum Productivity

- *highest possible efficiency due to maximum number of teeth*
- *PCD-cutting insert guarantees highest precision and optimal surface quality*
- *considerably higher tool life is achieved compared to conventional cutter systems*
- *the cutting adjustment is optimised and simplified by edgewise (sidewise) fine adjustment*

Diamant-Messerkopf-Systeme
diamond milling cutter systems

HAM 763 1D-Hochleistungs-PKD-Diamant-Fräskopf 1D-Highspeed-PCD-Diamond Milling Cutter

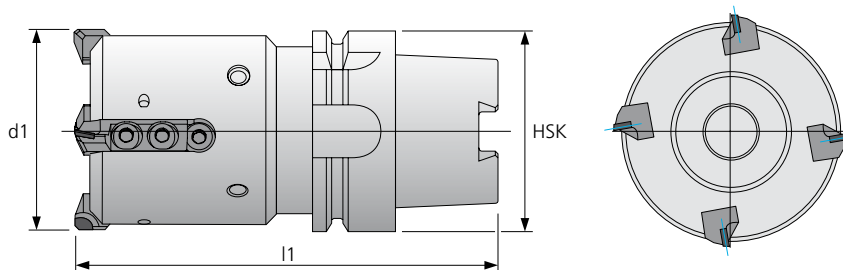
PKD Z 3-4 Werk Norm
Typ W HSK
HPC HSC

Konstruktions-Daten

- höchstmögliche Produktivität
- optimale Oberflächengüte und hohe Standzeiten
- sehr einfache Schneideneinstellung

Engineering data

- highest possible productivity
- optimal surface quality and high tool life
- very simple adjustment



Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-7630	●	●													●	●		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	40-7630	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
50		65	3	20.000	1,7	HSK 63

Ø d1 mm	40-7630	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
63		65	4	20.000	2,3	HSK 63

Bestellbeispiel / Order example: 40-7630-63

HAM 769 1D-Hochleistungs-PKD-Diamant-Fräskopf 1D-Highspeed-PCD-Diamond Milling Cutter

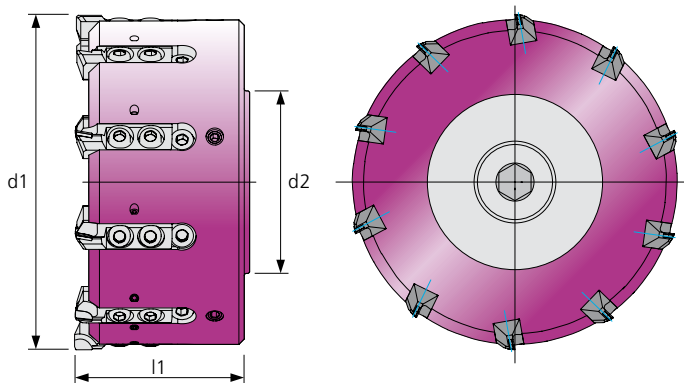
PKD Z 5-24 Werk Norm
Typ W HSK SK
HPC HSC

Konstruktions-Daten

- höchstmögliche Produktivität
- optimale Oberflächengüte und hohe Standzeiten
- sehr einfache Schneideneinstellung

Engineering data

- highest possible productivity
- optimal surface quality and high tool life
- very simple adjustment



Lieferumfang:

- montiert und gewuchtet
- Eck- oder Planschneiden
- Anzugschraube (mit IK)
- ohne Fräskopfaufnahme

Delivery Scale:

- mounted and balanced
- corner or face cutting edges
- tightening screw (with IC)
- without cutter adaptor

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-7690	●	●													●	●		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	40-7690	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
80		65	5	18.000	0,8	27
100		65	7	16.000	1,2	32
125		65	10	14.000	2,1	40
160		65	12	8.000	3,2	40

Ø d1 mm	40-7690	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
200		65	16	7.000	4,7	40
250		65	20	6.000	6,8	60
315		65	24	4.000	11,4	60

Bestellbeispiel / Order example: 40-7690-200

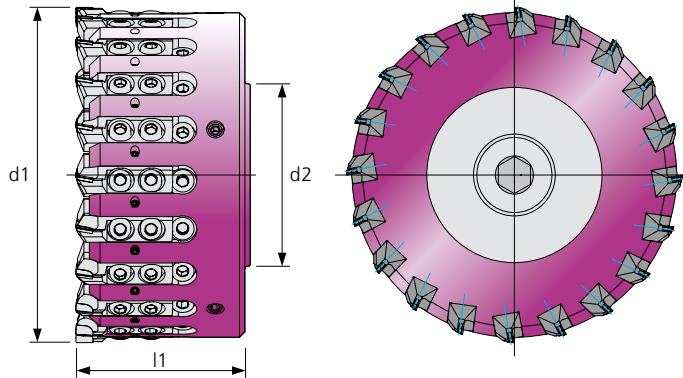
HAM 767 1D-Hochleistungs-PKD-Diamant-Fräskopf 1D-Highspeed-PCD-Diamond Milling Cutter

Konstruktions-Daten

- höchstmögliche Produktivität
- optimale Oberflächengüte und hohe Standzeiten
- sehr einfache Schneideneinstellung

Engineering data

- highest possible productivity
- optimal surface quality and high tool life
- very simple adjustment



PKD	Z 10-48	Werk Norm
Typ W		HSK SK
	HPC	HSC

Lieferumfang:

- montiert und gewuchtet
- Eck- oder Planschneiden
- Anzugschraube (mit IK)
- ohne Fräskopfaufnahme

Delivery Scale:

- mounted and balanced
- corner or face cutting edges
- tightening screw (with IC)
- without cutter adaptor

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-7670	●	●													●	●		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	40-7670	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
80		65	10	18.000	1	27
100		65	14	16.000	1,2	32
125		65	20	14.000	1,7	40
160		65	24	8.000	3,6	40

Ø d1 mm	40-7670	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
200		65	32	7.000	4,7	60
250		65	40	6.000	6,8	60
315		65	48	4.000	11,4	60

Bestellbeispiel / Order example: 40-7670-200

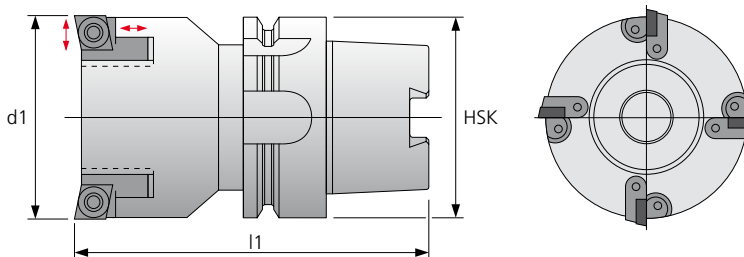
HAM 771 2D-Hochleistungs-PKD-Diamant-Fräskopf 2D-Highspeed-PCD-Diamond Milling Cutter

Konstruktions-Daten

- höchstmögliche Produktivität
- optimale Oberflächengüte und hohe Standzeiten
- sehr einfache Schneideneinstellung

Engineering data

- highest possible productivity
- optimal surface quality and high tool life
- very simple adjustment



PKD	Z 3-4	Werk Norm
Typ W		HSK
	HPC	HSC

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm²	Stahl < 1200 N/mm²	Stahl < 1600 N/mm²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm²	INOX > 800 N/mm²	GG	GGG	hochw. Legierung	Titan	NE Metalle Cu-Leg.	Graphit Faser-verbund	UNI	MMS	max.	ohne	AIR
40-7710	●	●													●	●		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	40-7710	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
50		105	3	25.000	1,7	HSK 63

Ø d1 mm	40-7710	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
63		105	4	22.000	2,3	HSK 63

Bestellbeispiel / Order example: 40-7710-63

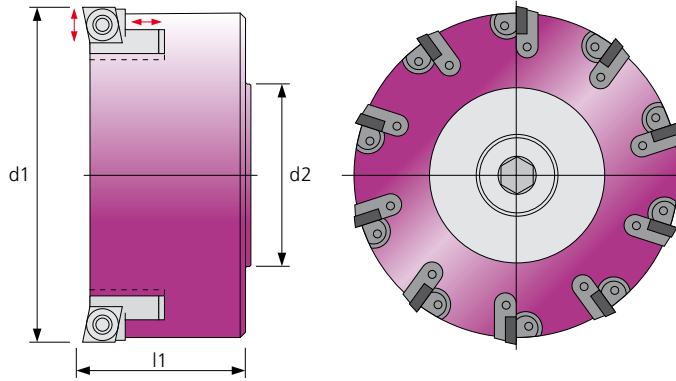
HAM 775 2D-Hochleistungs-PKD-Diamant-Fräskopf 2D-Highspeed-PCD-Diamond Milling Cutter

Konstruktions-Daten

- höchstmögliche Produktivität
- optimale Oberflächengüte und hohe Standzeiten
- sehr einfache Schneideneinstellung

Engineering data

- highest possible productivity
- optimal surface quality and high tool life
- very simple adjustment



PKD	Z 4-24	Werk Norm
Typ W		HSK SK
	HPC	HSC

Lieferumfang:

- montiert und gewuchtet
- Eck- oder Planschneiden
- Anzugschraube (mit IK)
- ohne Fräskopfaufnahme

Delivery Scale:

- mounted and balanced
- corner or face cutting edges
- tightening screw (with IC)
- without cutter adaptor

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legie- rung	Titan	NE Metalle Cu-Leg.	Graphit Faser- verbund	UNI				AIR
40-7750	●	●													●	●		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	40-7750	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
80		65	4	20.000	1,0	27
100		65	6	18.000	1,8	32
125		65	7	16.000	2,9	40
160		65	10	8.000	3,6	40

Ø d1 mm	40-7750	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
200		65	12	7.000	5,4	40
250		65	16	6.000	7,9	60
315		65	24	4.000	12,7	60

Bestellbeispiel / Order example: 40-7750-200

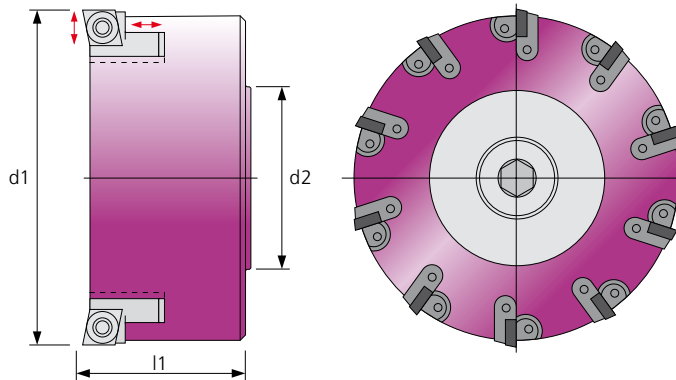
HAM 777 2D-Hochleistungs-PKD-Diamant-Fräskopf 2D-Highspeed-PCD-Diamond Milling Cutter

Konstruktions-Daten

- höchstmögliche Produktivität
- optimale Oberflächengüte und hohe Standzeiten
- sehr einfache Schneideneinstellung

Engineering data

- highest possible productivity
- optimal surface quality and high tool life
- very simple adjustment



PKD	Z 7-28	Werk Norm
Typ W		HSK SK
	HPC	HSC

Lieferumfang:

- montiert und gewuchtet
- Eck- oder Planschneiden
- Anzugschraube (mit IK)
- ohne Fräskopfaufnahme

Delivery Scale:

- mounted and balanced
- corner or face cutting edges
- tightening screw (with IC)
- without cutter adaptor

Material	Alu	Alu > 9% Si	Stahl < 800 N/mm ²	Stahl < 1200 N/mm ²	Stahl < 1600 N/mm ²	Stahl < 55 HRC	Stahl < 60 HRC	Stahl < 66 HRC	INOX < 800 N/mm ²	INOX > 800 N/mm ²	GG	GGG	hochw. Legie- rung	Titan	NE Metalle Cu-Leg.	Graphit Faser- verbund	UNI				AIR
40-7770	●	●													●	●		●	●		○

● sehr gut geeignet / very suitable ○ geeignet / suitable

Ø d1 mm	40-7770	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
100		65	7	18.000	1,5	32
125		65	10	16.000	2,5	40
160		65	12	8.000	3,7	40

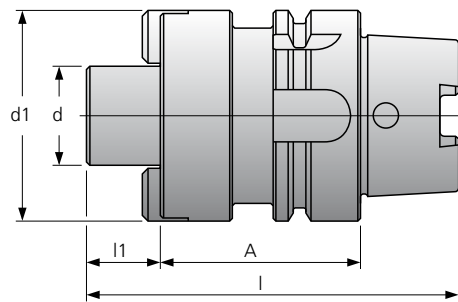
Ø d1 mm	40-7770	l1 mm	Z	n max. min ⁻¹	Gewicht weight ca. kg	Ø d2 mm
	PKD					
200		65	16	7.000	5,6	40
250		65	20	6.000	8,0	60
315		65	28	4.000	13,0	60

Bestellbeispiel / Order example: 40-7770-200

HAM 625 HSK-Fräskopfaufnahme HSK-Cutter adaptor

- Konstruktions-Daten**
- höchste Genauigkeit für Rund- und Planlauf
 - eingeschränkte Toleranz

- Engineering data**
- high concentricity
 - narrowed tolerance



*Zusätzlich 4 Befestigungsgewinde nach DIN 2079. Sonderabmessungen auf Anfrage.

*Additional 4 fastening screw threads acc. DIN 2079. Special measurements on request.

Ø d1 mm	40-6250	HSK DIN 69893-A	A mm	l mm	l1 mm	Gewicht weight ca. kg	Ø d mm
50		63	60	113	21	1,2	27
60		63	60	116	24	1,4	32
70		63	60	119	27	1,6	40

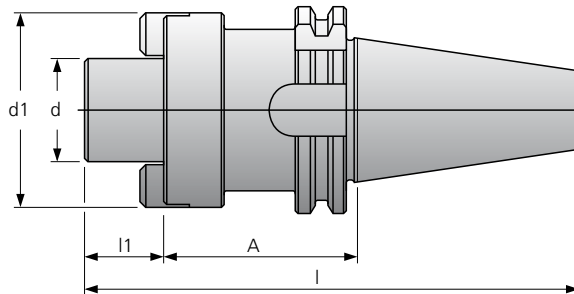
Ø d1 mm	40-6250	HSK DIN 69893-A	A mm	l mm	l1 mm	Gewicht weight ca. kg	Ø d mm
90*		63	60	120	28	2	40
130*		100	70	142	40	5,1	60

Bestellbeispiel / Order example: 40-6250-90

HAM 620 SK-Fräskopfaufnahme SK-Cutter adaptor

- Konstruktions-Daten**
- höchste Genauigkeit für Rund- und Planlauf
 - eingeschränkte Toleranz

- Engineering data**
- high concentricity
 - narrowed tolerance



*Zusätzlich 4 Befestigungsgewinde nach DIN 2079. Sonderabmessungen auf Anfrage.

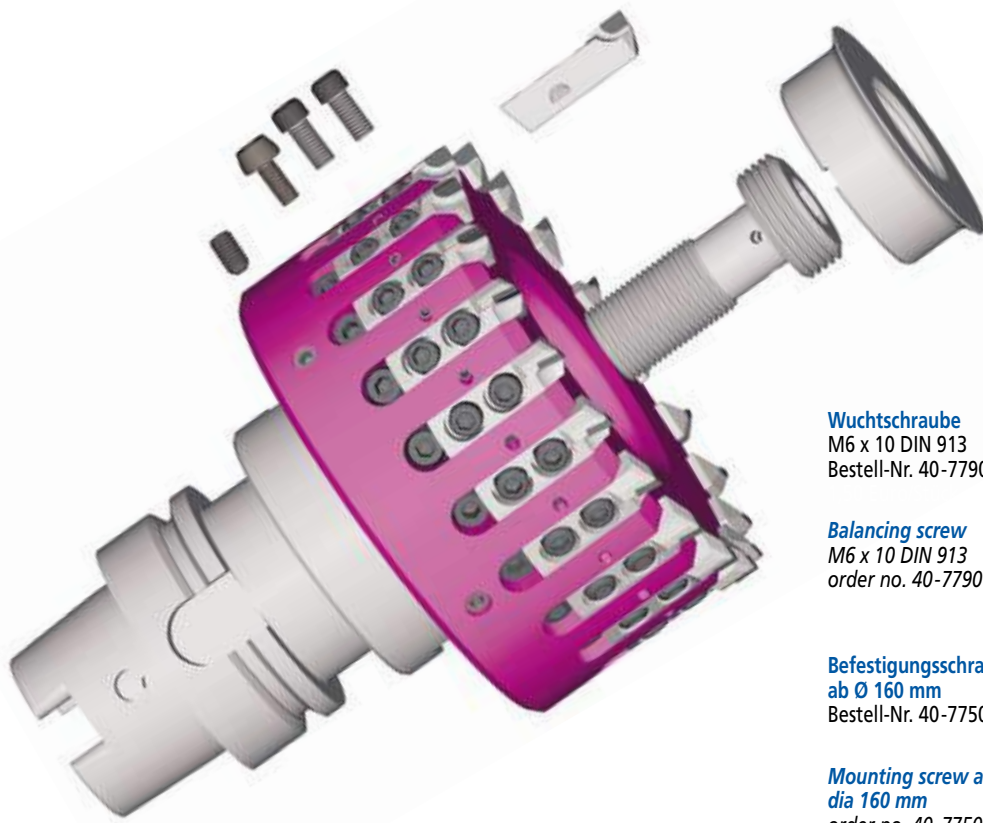
*Additional 4 fastening screw threads acc. DIN 2079. Special measurements on request.

Ø d1 mm	40-6200	SK DIN 69871-AD	A mm	l mm	l1 mm	Gewicht weight ca. kg	Ø d mm
50		40	60	149,4	21	1,5	27
60		40	60	152,4	24	1,7	32
70		40	60	155,4	27	2	40

Ø d1 mm	40-6200	SK DIN 69871-AD	A mm	l mm	l1 mm	Gewicht weight ca. kg	Ø d mm
90*		40	60	156,4	28	2,5	40
130*		50	70	211	40	6,1	60

Bestellbeispiel / Order example: 40-6200-90





Fräseranzugschraube mit Kühlmittelzufuhr
 Ø 80 mm
 Bestell-Nr. 40-7750-080-03

Ø 100 mm
 Bestell-Nr. 40-7750-100-03

Ø 125 mm
 Bestell-Nr. 40-7750-125-03

Turbokühlmittelzufuhr
 Ø 160 mm
 Bestell-Nr. 40-7670-160-05

Wuchtschraube
 M6 x 10 DIN 913
 Bestell-Nr. 40-7790-900-55

Balancing screw
 M6 x 10 DIN 913
 order no. 40-7790-900-55

Befestigungsschraube ab Ø 160 mm
 Bestell-Nr. 40-7750-912-16-00

Mounting screw as from dia 160 mm
 order no. 40-7750-912-16-00

Cutter tightening screw with internal coolant supply dia 80 mm
 order no. 40-7750-080-03

dia 100 mm
 order no. 40-7750-100-03

dia 125 mm
 order no. 40-7750-125-03

Turbo coolant supply
 dia 160 mm
 order no. 40-7670-160-05

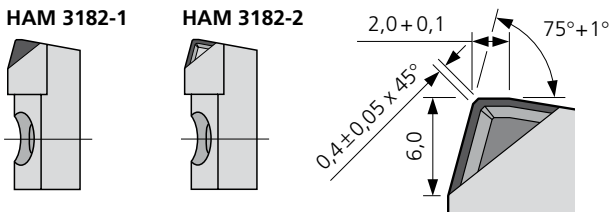
HAM 3182 1D-Diamant-Schneideinsatz 75°
 1D-Diamond cutting insert 75°

für Typ: HAM 40-7670
 HAM 40-7630
 HAM 40-7690

for Type: HAM 40-7670
 HAM 40-7630
 HAM 40-7690

- Konstruktions-Daten**
- PKD- oder CVD-bestückt
 - zum Planfräsen (75°)
 - ISO-Norm

- Engineering data**
- PCD- or CVD-tipped
 - for face milling (75°)
 - ISO standard



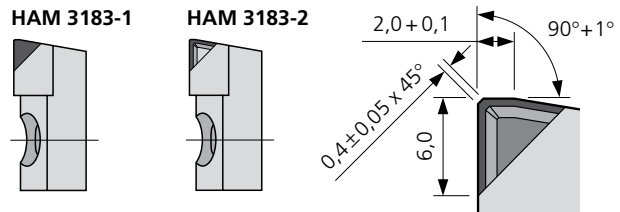
HAM 3183 1D-Diamant-Schneideinsatz 90°
 1D-Diamond cutting insert 90°

für Typ: HAM 40-7670
 HAM 40-7630
 HAM 40-7690

for Type: HAM 40-7670
 HAM 40-7630
 HAM 40-7690

- Konstruktions-Daten**
- PKD- oder CVD-bestückt
 - zum Absatzfräsen (90°)
 - ISO-Norm

- Engineering data**
- PCD- or CVD-tipped
 - for corner milling (90°)
 - ISO standard



40-7000			Schneidlänge cutting length mm	bestückt tipped
3182-1	—		6	PKD/PCD
3182-2	mit Spanbrecher		6	PKD/PCD
3182-4	10° diagonal		6	PKD/PCD
3182-5	6° diag. m. Spanbrecher		6	PKD/PCD
3182-3	—		6	CVD

40-7020			Schneidlänge cutting length mm	bestückt tipped
3183-1	—		6	PKD/PCD
3183-2	mit Spanbrecher		6	PKD/PCD
3183-4	10° diagonal		6	PKD/PCD
3183-5	6° diag. m. Spanbrecher		6	PKD/PCD
3183-6	2,5° hohl geschliffen		6	PKD/PCD
3183-3	—		6	CVD

Bestellbeispiel / Order example: 40-7000-3182-1

Bestellbeispiel / Order example: 40-7020-3183-1

HAM 3154 2D-Diamant-Schneideinsatz 75°
2D-Diamond cutting insert 75°

für Typ: HAM 40-7710

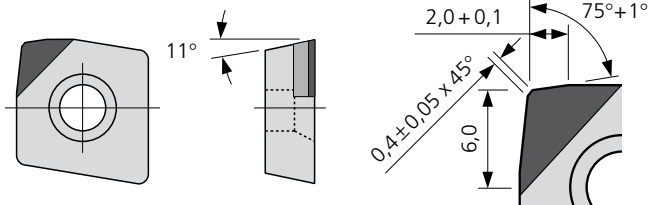
for Type: HAM 40-7710

Konstruktions-Daten

- PKD- oder CBN-bestückt
- zum Planfräsen (75°)
- ISO-Norm (CPMX 09T3 ED R/L)

Engineering data

- PCD- or CBN-tipped
- for face milling (75°)
- ISO standard (CPMX 09T3 ED R/L)



40-7040			Schneidlänge cutting length mm	bestückt tipped
3154-1	—		5	CBN
3154-2	—		4	PKD/PCD
3154-3	—		6	PKD/PCD
3154-5	6° axial Spanwinkel		6	PKD/PCD

Bestellbeispiel / Order example: 40-7040-3154-1

HAM 3155 2D-Diamant-Schneideinsatz 90°
2D-Diamond cutting insert 90°

für Typ: HAM 40-7710

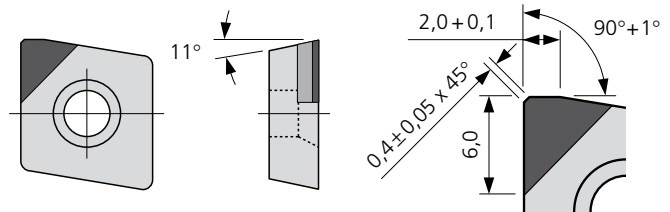
for Type: HAM 40-7710

Konstruktions-Daten

- PKD- oder CBN-bestückt
- zum Absatzfräsen (90°)
- ISO-Norm (CPMX 09T3 ED R/L)

Engineering data

- PCD- or CBN-tipped
- for corner milling (90°)
- ISO standard (CPMX 09T3 ED R/L)



40-7060			Schneidlänge cutting length mm	bestückt tipped
3155-1	—		5	CBN
3155-2	—		4	PKD/PCD
3155-3	—		6	PKD/PCD
3155-5	6° axial Spanwinkel		6	PKD/PCD

Bestellbeispiel / Order example: 40-7060-3155-1

HAM 3177 2D-Diamant-Schneideinsatz 75°
2D-Diamond cutting insert 75°

für Typ: HAM 40-7750
HAM 40-7770

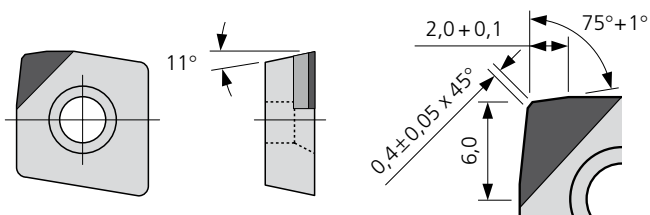
for Type: HAM 40-7750
HAM 40-7770

Konstruktions-Daten

- PKD- oder CBN-bestückt
- zum Planfräsen (75°)
- ISO-Norm (CPMX 09T3 ED R/L)

Engineering data

- PCD- or CBN-tipped
- for face milling (75°)
- ISO standard (CPMX 09T3 ED R/L)



40-7080			Schneidlänge cutting length mm	bestückt tipped
3177-1	—		5	CBN
3177-2	—		4	PKD/PCD
3177-3	—		6	PKD/PCD
3177-5	6° axial Spanwinkel		6	PKD/PCD
3177-4	—		6	CVD

Bestellbeispiel / Order example: 40-7080-3177-1

HAM 3178 2D-Diamant-Schneideinsatz 90°
2D-Diamond cutting insert 90°

für Typ: HAM 40-7750
HAM 40-7770

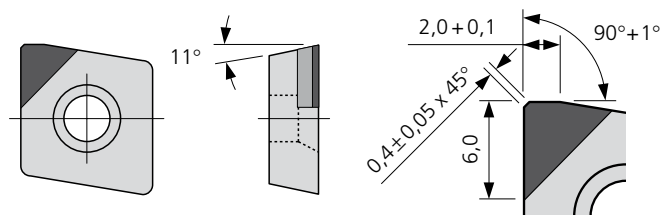
for Type: HAM 40-7750
HAM 40-7770

Konstruktions-Daten

- PKD- oder CBN-bestückt
- zum Absatzfräsen (90°)
- ISO-Norm (CPMX 09T3 ED R/L)

Engineering data

- PCD- or CBN-tipped
- for corner milling (90°)
- ISO standard (CPMX 09T3 ED R/L)



40-7100			Schneidlänge cutting length mm	bestückt tipped
3178-1	—		5	CBN
3178-2	—		4	PKD/PCD
3178-3	—		6	PKD/PCD
3178-5	6° axial Spanwinkel		6	PKD/PCD
3178-4	—		6	CVD

Bestellbeispiel / Order example: 40-7100-3178-1



Diamantmesserkopf mit montierten Schneideinsätzen im optischen Einstellgerät aufnehmen.

Adjust diamond milling head with mounted cutting inserts in the optical adjustment device.



Befestigungsschrauben mit 1 Nm anlegen.

Tighten fastening screws to 1 Nm.



PKD-Schneideinsätze mit den Justierschrauben auf Planlauf $\pm 0,003$ mm einstellen.

Adjust PKD cutting inserts with adjusting screws to axial runout $\pm 0,003$ mm.



Befestigungsschrauben mit Drehmomentschlüssel anziehen (6 Nm).

Tighten fastening screws with torque wrench to 6 Nm.



Planlauf kontrollieren, ggf. Vorgang wiederholen.

Einstellzeit pro Schneide ca. 2-3 Minuten.

Check axial runout and repeat procedure if necessary.

Adjustment time per cutting edge approximately 2-3 minutes.

Gewindefräser

thread milling cutters



Vollhartmetall-Gewindefräser
in verschiedenen Ausführungen erhalten
Sie auf Anfrage.

*Solid carbide thread mills in different shapes
are on request.*



Kreissägeblätter slitting saws



Kreissägeblätter in verschiedenen Ausführungen erhalten Sie auf Anfrage.

Slitting saws in different shapes are on request.

HAM Produkt- und Dienstleistungen

Wir bieten seit Jahren unseren Kunden eine gute und optimale Beratung.

Diese Dienstleistung unseres Unternehmens kostet viel Zeit und Geld. Für diese immer wichtigere Aufgabe wollen wir noch mehr qualifizierte Mitarbeiter einsetzen. Die anfallenden Kosten für solche entsprechenden Leistungen sollten jedoch nicht in die Werkzeugkalkulation eingehen, da bei Kostenvergleichen Wettbewerbsverzerrungen entstehen.

Wenn Sie bereit sind, bei mittleren und großen Projekten, die mit entsprechenden Beratungs- und Konstruktionskosten verbunden sind, unseren Aufwand zu vergüten, wie jede entsprechende Dienstleistung Ihres Hauses, können wir unsere Beratungsangebote weiter intensivieren und ausbauen.

Übliche Kurzberatungen werden natürlich weiterhin für unsere Kunden und Interessenten nicht berechnet.

- | | |
|--|---|
| 1) Beratung in Zerspanungsfragen und Werkzeugauslegung Bohren – Fräsen – Reiben | ▶ auf Anforderung des Kunden Berechnung nach Zeit und Aufwand |
| 2) Projekt-Bearbeitung und umfangreiche Beschreibung bei Angeboten | ▶ auf Anforderung des Kunden Berechnung nach Zeit und Aufwand |
| 3) Preis-Angebote und Kurzbeschreibungen | ▶ kostenlos |
| 4) Detailkonstruktion von Spezialwerkzeugen für Kunden mit CAD | ▶ auf Bestellung des Kunden Berechnung nach Zeit und Aufwand |
| 5) Lieferung von Spezialwerkzeugen aus Vollhartmetall, Cermets, Schneidkeramik, polykristallinem Diamant und anderen Produkten | ▶ auf Bestellung des Kunden entsprechend Angebot |
| 6) Prüfung mit Meßprotokoll auf Meßmaschine für komplizierte Werkzeuge | ▶ auf Bestellung des Kunden Berechnung nach Zeit und Aufwand |
| 7) Nachschleif-Service Bohrer, Fräser, Reibahlen | ▶ auf Bestellung des Kunden Berechnung nach Zeit und Aufwand |

Nachstehend unsere derzeit gültigen Verrechnungssätze:

- Als Reisekosten werden bei Benutzung öffentlicher Verkehrsmittel die tatsächlichen Ausgaben in Rechnung gestellt.
- Bei Benutzung eines firmeneigenen PKWs berechnen wir Euro 0,50 je km.
- Muß ein Mietwagen in Anspruch genommen werden, so werden die Ausgaben gemäß Rechnung berechnet.
- Die Auslösung je Kalendertag beträgt 26,00 Euro.
- Bei Übernachtung sind die anfallenden Hotelkosten zu erstatten.
- Arbeitsstunden, Wartestunden und Reisestunden für Servicetechniker und Monteure 50,00 Euro je Stunde, für Ingenieure 75,00 Euro je Stunde.
- Stundensätze
Preise für Beratung, Projekt-Bearbeitung, Beschreibung und Konstruktion
Dipl.-Ing. FH oder TH 65,00 bis 95,00 Euro je Stunde
Techniker oder Konstrukteur 50,00 bis 75,00 Euro je Stunde
CAD-Konstruktion 50,00 bis 75,00 Euro je Stunde
- Bei Überstunden- sowie Sonn- und Feiertagszuschlägen gelten die für uns gesetzlich gültigen Zuschläge.
- Für die Prozeßfunktion und für eventuell direkte oder indirekte Schäden aufgrund unserer Beratung kann keine Haftung übernommen werden. Bei Nichtfunktion haften wir nur in der Weise, daß wir eine weitere kostenlose Beratung anbieten. Weitere Ansprüche können von uns nicht berücksichtigt werden.

Für Montagefehler und die hieraus resultierenden direkten oder indirekten Schäden haften wir nur in der Weise, indem wir lediglich die Montage erneut kostenlos vornehmen. Ansprüche darüber hinaus können von uns nicht berücksichtigt werden.

Wir behalten uns vor, die aufgeführten Sätze zu erhöhen, falls sich die tariflichen Löhne und Gehälter ändern.

HAM Product- and customer service

We have been offering best and optimal advise to our customers already for many years.

This service of our company is very time and cost expensive. We would like to employ much more qualified staff for this very important task. However, the costs arised for this service should not effect the calculation of the tools, as cost comparisons will cause difficulties with the competition.

If you are willing to honour our costs for advise and design for medium and large projects, we can intensify and improve our consultation.

Other short consultion is naturally furtheron of no charge for our customers.

- | | |
|--|---|
| 1) Advise on cutting parameters and drilling-milling-reaming | ▶ on customer's request charges acc. to time and work |
| 2) Project handling and full advise for quotation | ▶ on customer's request charges acc. to time and work |
| 3) Quotations and short explanations | ▶ free of charge |
| 4) Detailed design of special tools for customers with CAD | ▶ on customer's order charges acc. to time and work |
| 5) Delivery of special tools in solid carbide, cermets, cutting cermets, poly crystalline diamond and other products | ▶ on customer's order acc. to quotation |
| 6) Inspection with data sheet for difficult tools on measuring machine | ▶ on customer's order charges acc. to time and work |
| 7) Regrinding service drills, end mills, reamers | ▶ on customer's order charges acc. to time and work |

Our service charges valid at the present time are as follows:

- The actual costs are invoiced as travelling allowance when using public transportation means.
- When using a company car we charge 0,50 Euro per km.
- If a rental car has to be used, the costs are charged acc. to invoice.
- The allowance chargeable per day is 26,00 Euro.
- When staying overnight the hotel costs have to be paid.
- Working hours, waiting hours and travelling hours for our service technicians and assembly persons are charged at a rate of 50,00 Euro per hour, for engineers at 75,00 Euro per hour.
- Daily rates
Prices for consultation, project revision, explanation and design
Grad. Engineer 65,00 – 95,00 Euro per hour
Technician or technical designer 50,00 – 75,00 Euro per hour
CAD design 50,00 – 75,00 Euro per hour
- The legal extra charges are valid for overtime, as well as for sundays and public holidays.
- We cannot be held liable for the process function, nor for possible direct or indirect damages caused as the result of our advise. In case of non-function, we can only offer some additional advise free of charge. Further claims cannot be accepted by us.

For assembly errors and for direct or indirect damages resulting thereof, we are only liable by doing the assembly again free of charge. Additional claims cannot be accepted by us.

We reserve the right to increase the above charges, if the tariff wages and salaries change.

Projektengineering
project engineering



Partnerschaft vom Projektengineering
bis zum Toolmanagement

*Partnership from Project Engineering
to Toolmanagement*

Mindestmengen, Zuschläge und Beschichtungen *minor quantities, extra charges and coatings*

Zuschläge für Zwischenabmessungen bei Vollhartmetallfräsern Netto-Zuschläge pro Stück <i>Extra charge for intermediate sizes of solid carbide end mills</i> <i>Extra charges net per piece</i>	Stück Quantity	bis up to Ø 8 mm Euro	bis up to Ø 12 mm Euro	bis up to Ø 15 mm Euro	bis up to Ø 20 mm Euro
	3				
	4 – 6				
	7 – 15				
	16 – 20				
	21 – 30				
	31 – 40				
	41 – 50				
	über 50				
	über 100				

Mindestabnahmemengen für Vollhartmetall-Fräser Abweichende Mindestabnahmemengen sind in der Preisliste aufgeführt. <i>Minimum order quantities for mills in solid carbide</i> <i>Deviating minimum order quantities are in the price-list.</i>	pro Abmessung und Type per size and type
	25 Stück / pieces bis / up to Ø 3,0 mm
	10 Stück / pieces ab / from Ø 3,1 mm
	5 Stück / pieces ab / from Ø 8,0 mm
	3 Stück / pieces ab / from Ø 16,0 mm

Zuschläge für Eckenradius und vollen Stirnradius bei Vollhartmetall-Fräsern Netto-Zuschläge pro Stück <i>Extra charge for radius on outer corner and ball nose radius for solid carbide end mills</i> <i>Extra charges net per piece</i>	Stück quantity	Stückpreis unit price Euro	Stück quantity	Stückpreis unit price Euro
	3		10 – 14	
	4		15 – 19	
	5		20 – 24	
	6		25 – 29	
	7		30 – 49	
	8		über 50	
	9		über 100	

Zuschläge für das Anschleifen der Spannfläche nach DIN 6535, Form HB, HBK und Form HE, HEK an Zylinderschäften bei Vollhartmetall-Fräsern Netto-Zuschläge pro Stück <i>Extra charge for grinding the clamping flat acc. DIN 6535, form HB, HBK and form HE, HEK on cylindrical shanks of solid carbide mills</i> <i>extra charges net per piece</i>	Stück quantity	Ø 6 mm Euro	Ø 8 mm Euro	Ø 10 mm Euro	Ø 12 mm Euro
	5 – 9				
	10 – 19				
	20 – 29				
	30 – 49				
	50 – 99				
	100 – 199				
	200 –				
	Stück quantity	Ø 14 mm Euro	Ø 16 mm Euro	Ø 18 mm Euro	Ø 32 mm Euro
	5 – 9				
	10 – 19				
	20 – 29				
	30 – 49				
	50 – 99				
	100 – 199				
	200 –				

Mindestabnahmemengen für PKD-Diamant-Katalogwerkzeuge

Bei kleineren Bestellmengen ist der in der Rabattliste aufgeführte Rabatt ungültig.

Wenn Werkzeuge unter der Mindestabnahme ab Lager lieferbar sind, werden diese zu Bruttopreisen verrechnet.

Minimum order quantities for PCD diamond catalog tools

The discount in the discount list is not valid for smaller order quantities. If tools below the minimum order quantity are available ex stock, these tools are charged at gross prices.

Ø / dia. 3,0 – 4,0 mm	5 Stück / pcs.
Ø / dia. 4,1 – 10,0 mm	3 Stück / pcs.
Ø / dia. 10,1 – 20,0 mm	2 Stück / pcs.

Preise für HAM-CVOC-Beschichtungen

Verschleißschutz „Neu“ Fräsen
besonders geeignet für Nichteisenwerkstoffe

Prices for HAM-CVOC-coating

*wear protective coating „new“ milling
specially suited for non ferrous material*

Ø / dia.	Euro / St.	Ø / dia.	Euro / St.
bis 4,0		14,1 – 16,0	
4,1 – 6,0		16,1 – 18,0	
6,1 – 8,0		18,1 – 20,0	
8,1 – 10,0		20,1 – 22,0	
10,1 – 12,0		22,1 – 26,0	
12,1 – 14,0		26,1 – 32,0	

Mindestabnahmemengen für HAM-CVOC

Weitere Beschichtungen auf Anfrage

Minimum order quantities for HAM-CVOC

Other coatings on request

Ø / dia.	Stück / pcs
0,25 – 2,50	200
2,60 – 4,50	100
4,60 – 5,90	50
6,00 – 9,90	30
10,00 – 14,90	20
15,00 – 20,00	10

Sonderwerkzeuge in allen Variationen



Preise auf Anfrage

Special tools in all variations



Prices on request

Piktogramm-Übersicht Survey of pictograms






Schneidstoff cutting material

 Feinstkorn Vollhartmetall solid carbide ultra micro grain	 PKD-Schneide PCD cutting edge
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Typ typ

 normal normal	 für weiche Werkstoffe for soft materials	 für harte Werkstoffe for hard materials
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






Zähnezahl number of teeth

 Z 2	 Z 3	 Z 4	 Z 3-4	 Z 4-8
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Norm standard

 Werknorm HAM Standard	 DIN 6527	 Werk 6527 von Ø bis Ø, ab Ø from Ø to Ø, from Ø
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








Schaft shank

 Zylinderschaft nach DIN cylindrical shank acc. DIN	 Spannfläche Weldon clamping fixture weldon	 Spannfläche Whistle Notch clamping fixture whistle notch	 Zylinderschaft cylindrical shank	 von Ø bis Ø, ab Ø from Ø to Ø, from Ø
 Schaft HA mit IK shank HA with IC	 Schaft HB mit IK shank HB with IC	 Schaft HE mit IK shank He with IC	 von Ø bis Ø, ab Ø from Ø to Ø, from Ø	 für Schrumpffutter geeignet shrink fit

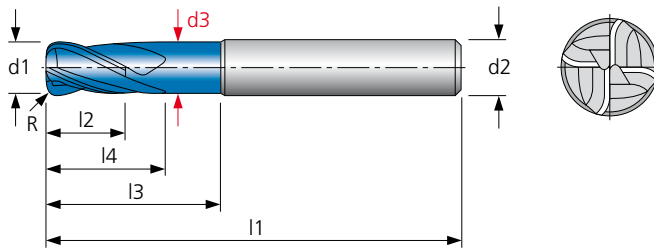
Spiralwinkel spiral angle

 0° Nut	 30° rechts	 45° rechts	 35°/38° re	 22°-25° re
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Anwendung application

 Werkzeug- und Formenbau tool design and mold and die production									
 Umfangfräsen periphery milling	 Nutfräsen slot milling	 Rippenfräsen rib milling	 Fasfräsen chamfer milling	 Kopierfräsen copy milling					
 Umfangfräsen milling	 Nutfräsen slot milling	 Gravieren engraving	 Fasfräsen chamfer milling	 Vor-/Rückwärtsbearbeitung forward-/backward chamfering					
 Umfangfräsen periphery milling	 Bearbeitungsrichtung machining direction	 HSC High Speed Cutting	 HPC High Performance Cutting	 Eckradius corner radius					

Bestellformular für Sonderwerkzeuge Ordering form for special tools



Stückzahl
pieces

Gewünschter Liefertermin
delivery

d1 Schneidendurchmesser
cutting diameter

R Eckenradius
R chamfer radius

d2 Schaftdurchmesser
shank diameter

Vollradius
radius

d3 Halsdurchmesser
neck diameter

stirnschneidend
centre cutting

l1 Gesamtlänge
over all length

Innenkühlung
interior coolant

l2 Schneidlänge
cutting length

Zähnezahl
teeth

l3 Halslänge
neck length

Drallwinkel
spiral angle

l4 Nutlänge
flute length

rechtsspiralig
right fluted linksspiralig
left fluted

zu bearbeitender Werkstoff
workpiece material

rechtsschneidend
right hand cutting linksschneidend
left hand cutting

Beschichtungen/coatings

Schaftform HA
shank HA

Ja
yes

Schaftform HB (Weldon)
shank HB

Nein
no

Schaftform HE (Whistle Notch)
shank HE

Bitte alle Punkte beantworten. Ohne diese Details ist eine Angebotsabgabe nicht möglich.
We need all information for a detailed quotation.

Absender
Dealer



HAM entwickelt und produziert Werkzeuge und Werkzeug-Systeme für den weltweiten Markt.

HAM – Ihr kompetenter Partner in der Präzisionswerkzeug-Technologie

- Vollhartmetall-, Cermets-, Keramik-Werkzeuge zum Bohren, Senken, Fräsen und Reiben
- Hartmetall-, Diamant- und CBN-Werkzeuge mit allen modularen Schnittstellen als Monoblockwerkzeuge, Wendeplatten- und Kassettenwerkzeuge (grob und fein einstellbar) zum Bohren und Senken, zum Fräsen und für die Vor- und Feinstbearbeitung
- Projektplanung und Projekt-Engineering
- Weltweiter TCM-Partner für Tool Management Systeme in der Automobil- und Flugzeug-industrie und ihren Zulieferbetrieben
- Vollhartmetall-Bohr- und Fräswerkzeuge für die Leiterplattenindustrie

HAM ist zertifiziert nach DIN EN ISO 9001, VDA 6.4. und DIN EN ISO 13485

HAM develops and manufactures tools and tooling-systems for the worldwide market.

HAM – Your competent partner in the precision tool technology

- *solid carbide-, cermet-, ceramic-tools for drilling, countersinking, milling and reaming*
- *carbide-, diamond- and CBN-tools with all modular interfaces as monoblock tools, indexable inserts- and cartridge-tools (adjustable rough and precisely) for drilling and countersinking, for milling and for pre- and precise machining*
- *Project Planning and Project Engineering*
- *worldwide TCM-partner for Tool Management Systems in automotive and aerospace industry and their suppliers*
- *solid carbide drilling- and routing tools for PCB industry*

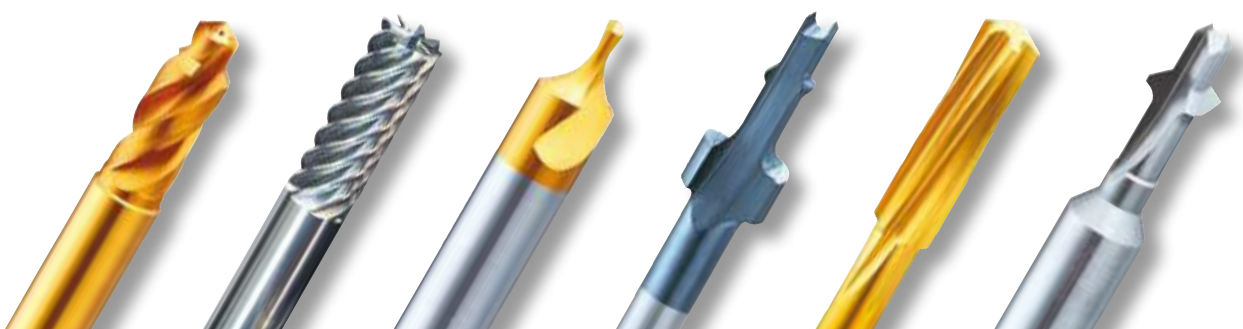
HAM is certified acc. to DIN EN ISO 9001, VDA 6.4. and DIN EN ISO 13485

sicher verpackt
safely packed



Die hochwertige Einzelverpackung bietet optimalen Schutz für hochempfindliche Werkzeuge in allen Abmessungen.

The high quality single package offers optimal protection for the sensitive tools in all measurements.



§ 1

General / Scope

- (1) All deliveries and benefits underlie these terms as well as possible separate contractual agreements. Different terms of purchasing of the purchaser do also not become subject matter of contract with order acceptance, unless the supplier has agreed to this separately in written form.
- (2) The supplier reserves to himself the property and copy right for samples, illustrations, drawings and similar things – in electronic form also – they must not be available for third persons. It is not allowed to the purchaser to make copies of documents and objects which are reserved with property and copy rights.
- (3) The supplier commits himself, not to make any information and documents available to third persons, which are referred to as confidential by the purchaser, without his agreement.
- (4) Price lists, which are handed over or sent by the supplier, are regarded as submittal of quotation. All quotations are subject to change without notice with regard to prices and possibility of delivery, subject to prior sales.
- (5) Concerning the construction of the standard tools, the catalogue details of the supplier are considered, which however are subject to a further technical development. Changes through the further development do not authorize the purchaser to complaints.
- (6) Verbal additional agreements do not exist. Changes need to be in written form in order to obtain validity.
- (7) With the new edition of this catalogue, the validity of our catalogue milling 2006/07 „precision milling tools in solid carbide and diamond“ will expire.

§ 2

Acceptance of an order

- (1) For want of special agreement a contract is accomplished with the order confirmation of the supplier in written form or with the delivery of the goods. The purchaser is liable for the correctness of the documents such as drawings, samples, models, templates and the like which he has to provide to the supplier. If no clear construction tolerances emanate from the drawings or the order of the purchaser, the supplier manufactures according to his experiences and norms which are usual in a line of business respectively within the tolerance limits given from the particular production process.
- (2) The supplier reserves to himself over- and under-deliveries on special tools of about 10% of the quantity, at least however at small quantities up to 4 pieces = 1 piece, from 5 pieces to 11 pieces = 2 pieces and from 12 pieces to 29 pieces = 3 pieces.
- (3) On tools made to order the minimum order value amounts to € 400,- concerning the charging of discounts on the catalogue items. Tools made to order wont be taken back by the supplier unless the good is defective.
- (4) The minimum net invoice value is € 60,-. Is the order value less than € 60,- the supplier is entitled to charge a mark-up for small-volume purchases of € 20,- lump-sum.
- (5) In case of a cancellation or return shipment we will invoice the pending costs, but at least € 40,-.

§ 3

Price and payment

- (1) The prices are without engagement and are valid for want of special agreements ex works exclusive of packing, dispatch, insurance as well as customs and customs additional costs. The fees for post and express deliveries are being charged separately. The dispatch occurs on account and risk of the purchaser. On the prices the sales tax in the particular compulsory level is being added separately.
- (2) For want of special agreements the payment has to be made without any deduction within 30 days free of costs to an account of the supplier. Payments to a representative of the supplier without whose presentation of a collecting power are illegal.
- (3) If nothing else is agreed, the supplier is entitled to correct the agreed prices accordingly in case of increase in price of material and raw material prices as well as the manufacturing costs between the contract conclusion and the delivery.
- (4) The right of holding back payments or accumulating counterclaims has the purchaser only insofar, as his counterclaims are unquestioned and legally assessed or accepted by us.
- (5) Payments by bill of exchange or cheque are only accepted on special agreement and when rediscountable, and when the customer always pays immediately in cash, the costs arising, in particular, discount, exchange and stamp costs and bank charges. If bills of exchange and cheques are accepted in payment credit is granted subject to their being honoured.
- (6) In case of delayed payment the supplier charges interest for delay in the amount of 3% above the particular discount rate of the German Federal Bank. The assertion of further damage caused by delay is not excluded through this.

§ 4

Delivery time, purchase and transfer of perils

- (1) The delivery time indications of the supplier result from the best discretion but without any binding character. They result from the agreements of the parties to the contract and assume for the supplier for its compliance, that all commercial and technical questions between the parties to the contract are cleared and that the purchaser has fulfilled all of his incumbent obligations such as adduction of approvals or required official certificates. The same is valid when as payment of the purchaser a down payment was agreed. If this is not the case, the delivery time will extend adequately. This is not valid as far as the supplier is responsible for the delay.
- (2) The compliance of the delivery date is subject to correct and accurately timed self-delivery. The supplier informs about delays which become apparent as soon as possible. If delivery dates are culpably exceeded by the supplier, the purchaser is obliged to set an adequate extension of time with menace of rejection in written form; this has to be addressed to the company management and must be confirmed by it. After an effectless expiry of the extension of time the purchaser is able to cancel the contract. This arrangement is not valid for parts with special design. The purchaser is only entitled to claims for damages against the supplier because of default if the delay can be put down to willful intention or gross negligence. The limitation of liability is not valid if in special cases the date is fixed by contract.
- (3) Is the breach of the delivery time to put down on act of God, industrial conflicts or other occasions, which are outside the sphere of the supplier, the delivery will extend adequately. The supplier will inform the purchaser about the beginning and the end of such circumstances as soon as possible.
- (4) Is the dispatch of the delivery item delayed because of reasons for which the purchaser is responsible for, he will be charged with the costs arisen by the delay from – starting one month after notice of readiness for dispatch. Is the dispatch delayed on request of the purchaser, the supplier is entitled to dispose of the delivery item ulterior after an appointment of a date and effectless expiry of an adequate period of time and to supply the purchaser with appropriate extension of time. The same is not valid for special designs. In this case the supplier is entitled to assert full claim for damages because of non-acceptance of the goods.
- (5) The delivery time is regarded as kept if the delivery item has left the suppliers company until its expiry or the readiness for dispatch was advised.
- (6) The risk passes to the customer in the moment when the delivery item has left the suppliers company, also in fact if partial shipments take place or the supplier has taken over any other services e.g. the dispatch costs or something like that. The customer is not allowed to refuse the purchase in case of a not substantial fault. If the dispatch delays or is omitted due to circumstances which can not be accused to the supplier, the risk passes to the customer from the day of the notice of readiness for dispatch on. The supplier commits himself to effect the required insurances on special request and for the account of the customer, which he is requesting for.

§ 5

Retention of title

- (1) The supplier reserves the right of ownership on the delivery item until all receivables of the supplier against the purchaser out of the business connection are balanced, including the in future up coming receivables also from concluded contracts of the same or a later time. This is also valid when several or all receivables of the supplier were added to a current invoice and the balance was stricken and accepted. For the case that the purchasers behaviour is contrary to contract especially in case of delayed payment, the supplier is entitled to take the delivery items back after dunning and the purchaser is committed to give the items out. Because of the retention of title the supplier is only able to reclaim the delivery item if he has withdrawn from the contract. In case of garnishments and other interferences of third persons, the purchaser has to inform the supplier immediately.
- (2) The supplier is entitled to resell the delivery item in the ordinary course of business. However, he already has to assign all claims to the supplier now, which have accrued because of the resale against the buyer or against third persons. The purchaser is authorised to collect this receivable also after the assignment. The authority of the supplier to collect the receivable by himself is untouched by this. However the supplier commits himself not to collect the receivable as long as the purchaser fulfils his payment obligations properly, the collecting authority is not cancelled or no request for opening of insolvency proceedings is placed. Otherwise the supplier is able to ask the purchaser to announce the assigned receivables and their debtors and to give all required information for the collection, to hand out the appropriate documents and to inform the debtor of the assignment as far as the supplier has not already informed him. Is the delivery item being sold together with other goods which do not belong to the supplier, the receivable of the purchaser against the buyer in the amount of the agreed delivery price of the supplier and the purchaser is regarded as assigned. An eventual processing or deformation of

the delivered goods by the purchaser is regarded as made for the supplier. If goods are being processed with other items which do not belong to the supplier, the supplier acquires the coownership of the new item in proportion of the value of the delivered goods to the other processed items at the time of the processing. For the produced items incidentally the same is valid as for the goods which were delivered under reserve.

- (3) The purchaser must neither mortgage the delivery item nor to assign it by security.
- (4) The supplier is entitled to insure the delivery item at the expense of the purchaser against theft, breakage, fire, water and other damages, unless the purchaser has not demonstrably effected the insurance by himself.
- (5) When cohesively to the payment of the sales price by the purchaser a liability by bill of exchange of the supplier is constituted, the retention of title including its agreed special forms or other securities which are agreed to secure payment, will not expire before the bill of exchange is discharged by the purchaser as drawee.
- (6) The request for opening of the insolvency proceedings entitles the supplier to withdraw from the contract and to insist on the immediate return of the delivery item.

§ 6

Claims because of defects

For defects of items and title concerning the shipment, excluding further claims and under reserve of liability according to § 7, the supplier guarantees as follows:

Defects of items

- (1) All those parts which turn out to be defective because of circumstances that happened before the transfer of perils, are to be repaired free of charge at supplier's option or to be replaced with parts without defects. The ascertainment of such defects has to be announced to the supplier immediately in written form. Replaced parts become property of the supplier.
- (2) For making all rectifications of defects and replacements which seem to be necessary for the supplier, the purchaser has to give him the required time and chance after agreement; otherwise the supplier is freed of the liability for any consequences which arise out of it. Only in urgent cases of danger of the operating safety respectively for blocking of relative great damages, in which the purchaser has to be informed immediately, the purchaser has the right to correct the defect by himself or by thirds and to demand damages of the supplier for the required expenses.
- (3) Of the direct cost which arose because of the rework or replacement delivery, the supplier bears the costs of the replacement piece including the despatch – as far as the complaints turn out as authorized.
- (4) The purchaser has a right to cancel the contract within the scope of the legal regulations, if the supplier lets the set adequate time limit for rework and replacement delivery because of a defect elapse effectless, under consideration of the legal exceptional cases. When there is only an irrelevant defect, the purchaser has solely the right of a price decrease. This right of price decrease is in other respects excluded.
- (5) Particularly in the following cases no warranty will be assumed: unsuitable or faulty usage, incorrect start-up or use by the purchaser or thirds, wear and tear, faulty or careless treatment, non-duly maintenance, the use of unsuitable equipment as well as chemical, electrochemical or electrical influences, as far as the supplier has not to take the responsibility for them. For defects of the material which was delivered by the purchaser, the supplier is only liable if he should have noticed the defects by the use of workmanlike carefulness.
- (6) When the production is according to the drawing of the purchaser, the supplier is only liable for the accomplishment as per drawing.
- (7) If the purchaser or a third person reworks in a faulty way, there is no liability of the supplier for the results which arise out of it. The same is valid for made changes of the delivery item without previous agreement of the supplier.

Defects of title

- (8) If the usage of the delivery item results in an infringement of the industrial property rights or copyright in the inland, the supplier will basically redress the further usage for the purchaser or he will modify the delivered item in a way which is reasonable for the purchaser at his own expenses so that the infringement of the property rights does not exist any longer. For the case that this is not possible by economically adequate circumstances or in an appropriate time period, the purchaser is entitled to cancel the contract. Provided that the mentioned case happens, the supplier is entitled to cancel the contract, also. Furthermore the supplier will release the purchaser of indisputable and legally determined claims of the concerned property right owner.
- (9) The obligations of the supplier mentioned in § 6 paragraph 8 are concluding under reserve of § 7 paragraph 2 for the case of the infringements of property right or copyright. They are only existing if:
 - a) the purchaser informs the supplier immediately about asserted infringements of property right or copyright
 - b) the purchaser supports the supplier with the blocking of asserted claims in an adequate scale respectively enables the supplier to execute the modification measurements according to § 6 paragraph 8,
 - c) all blocking measurements including extra-judicial regulations remain preserved to the supplier
 - d) the defect of title is not based upon instruction of the purchaser and
 - e) the infringements of right is not caused thereby, that the purchaser has modified the delivery item on his own authority or has used it in a non-conventinary way
 - f) The purchaser assumes the sole responsibility for the documents which have to be brought by him, such as drawings, templates, samples and suchlike. The purchaser has to vouch for it, that construction drawings which he provided, will not interfere in property rights of a third party. The supplier is opposite to the purchaser not obliged to verify, if any property rights of third persons were injured by the submittal of quotation because of its sent design. When there results a liability of the supplier out of claim-causal facts anyway, the purchaser has to reimburse him.

§ 7

Liability

- (1) If the delivery item can not be used contractually because of the fault of the supplier due to refrained or faulty design of suggestions and advices which are made before or after the conclusion of the contract or by the infringement of other contractually additional obligations – particularly instruction for handling and usage of the item – the regulations of §§ 6 and 7 paragraph 2 are accordingly valid excluding further claims of the purchaser.
- (2) For damages which did not come into existence at the delivery item itself, the supplier is only liable – for what reasons ever –
 - a) in case of intention
 - b) in case of gross carelessness of the owner respectively of the agencies or executive employees
 - c) in case of culpably injury of life, body and health
 - d) in case of defects, which he has fraudulent concealed or whose absence was guaranteed by him.
 - e) in case of defects of the delivery item as far as somebody is liable according to product liability law for damages to persons and of property for privately used items.

In case of culpable injury of substantial contractual obligations the supplier is not either liable in case of gross carelessness and in case of slight negligence, in this last case it is limited to the contract typical, reasonably predictable damage. Further claims are excluded.

§ 8

Limitation of time

- (1) All claims of the purchaser – for what justiceable reasons ever – prescribe in 12 months. For claims for damages according to § 7 paragraph 2a-e the legal periods of time are valid.

§ 9

Use of software

- (1) As far as there is software included in the delivery, the purchaser is entitled to a non-excluding right, to use the delivered software including its documentation. It is left for usage on the delivery item which is determined for it. A usage of the software on more than one system is forbidden. The purchaser is only allowed to clone, adapt, translate the software in the legally acceptable scope or commute the object code in the resource code. The purchaser commits himself not to remove or modify indications of the manufacturer without the explicit prior agreement of the supplier – particularly copyright notations. All other rights concerning the software and documentations including the copies remain with the supplier respectively the software supplier. The awarding of sublicenses is not allowed.

§ 10

Applicable right/ Place of jurisdiction/ Miscellaneous

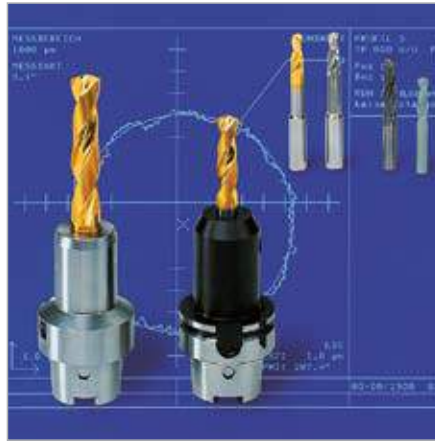
- (1) For all privities of contract between the supplier and the purchaser, the relevant right of the Federal Republic of Germany, for privities of contract of domestic parties among themselves, is solely valid, too.
- (2) Place of jurisdiction is the court which is responsible for the domicile of the supplier. The supplier however is entitled to file suit at the headquarters of the purchaser. If goods and services have to be rendered by the supplier outside the national territory of the Federal Republic of Germany, so German law applies also. The use of the UN - purchasing law (Agreement of the United Nations about contracts for the international sale of goods -CISG-) is excluded.

Status: January 2004



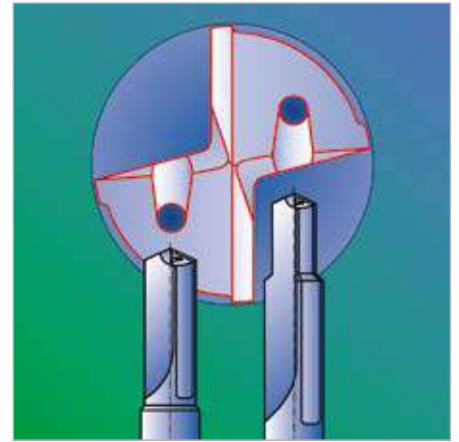
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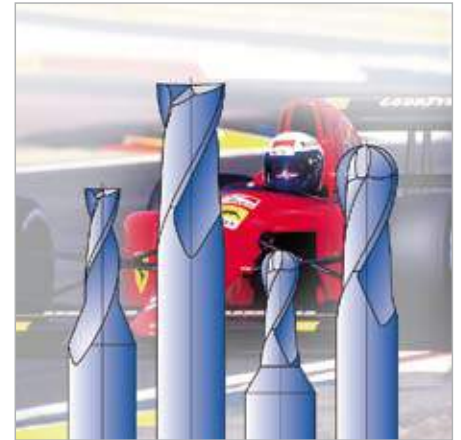
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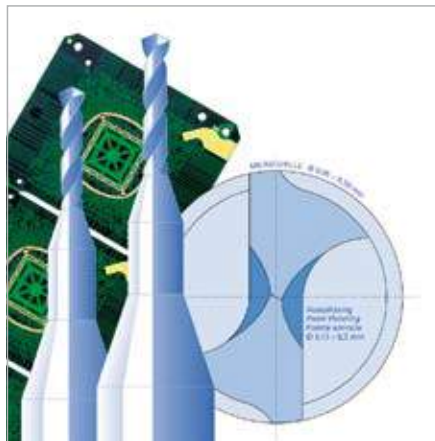
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