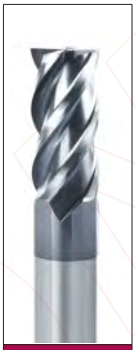
Hard-cut

High-performance end mills for HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 65 HRc

Hochleistungs-Schaftfräser für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

								
Tool code		HE 235	HE 445	HELS 435	HELN 235	HELN 435	HB 235	HB 435
Number of teeth		Z=2	Z=4	Z=4	Z=2	Z=4	Z=2	Z=4
Page		30	31	32	33	33	34	34
		VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20
		New Al-X Coating	New Al-X Coating	New Al-X Coating	New AlCr-X Coating	New AlCr-X Coating	AlTiN Coating	AlTiN Coating
		HRc 62	HRc 62	HRc 62	HRc 65	HRc 65	HRc 65	HRc 65
		35°	45°	35°	35°	35°	35°	35°
		90°	90°	90°	90°	90°		
		HSC	HSC	HSC	HSC	HSC	HSC	HSC
P	HRc < 24				○	○		
P	HRc 24 - 35	○	○	○	◎	◎	○	○
P	HRc > 35	◎	◎	◎	◎	◎	◎	◎
H	HRc 45 - 55	◎	◎	◎	◎	◎	◎	◎
H	HRc 56 - 60	◎	◎	◎	◎	◎	◎	◎
H	HRc > 60	○	○	○	○	○	○	○
M	Stainless steel	○	○		◎	◎		
K	Cast iron	○	○	○	○	○	○	○
N	Copper alloy				○	○		
S	Titanium alloy	○	○		◎	◎		
S	High-temperature alloy				○	○		

								
Tool code		HBLS 235	HBLS 435	HBLN 2359	HBTN 2359	HR 230	HR 430	HRLS 430
Number of teeth		Z=2	Z=4	Z=2	Z=2	Z=2	Z=4	Z=4
Page		35	35	36	37	38	38	39
		VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20	VHM K05-K20
		AlTiN Coating	AlTiN Coating	New AlCr-X Coating	New AlCr-X Coating	AlTiN Coating	AlTiN Coating	AlTiN Coating
		HRc 65	HRc 65	HRc 65	HRc 65	HRc 65	HRc 65	HRc 65
		35°	35°	35°	35°	30°	30°	30°
						R	R	R
		HSC	HSC	HSC	HSC	HSC	HSC	HSC
P	HRc < 24			○	○			
P	HRc 24 - 35	○	○	◎	◎	○	○	○
P	HRc > 35	◎	◎	◎	◎	◎	◎	◎
H	HRc 45 - 55	◎	◎	◎	◎	◎	◎	◎
H	HRc 56 - 60	◎	◎	◎	◎	◎	◎	◎
H	HRc > 60	○	○	◎	◎	○	○	○
M	Stainless steel			◎	◎			
K	Cast iron	○	○	○	○	○	○	○
N	Copper alloy			○	○			
S	Titanium alloy			◎	◎			
S	High-temperature alloy			○	○			

VHM K05-K20 | 35° | HSC

New Al-X Coating | 90°

HRc 62

End mills

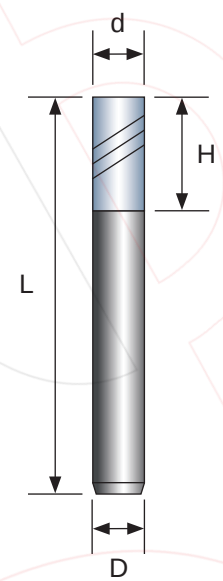
For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 62 HRc

Schaftfräser

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 – 62 HRc

P	HRc < 24	
	HRc 24 - 35	○
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	○
M	Stainless steel	○
K	Cast iron	○
N	Copper alloy	
S	Titanium alloy	○
	High-temperature alloy	

Cutting data, P40 - P41



Tolerance / Toleranz

Range	Diameter
d < 1	0 / -0.015
1 ≤ d < 8	0 / -0.02
8 ≤ d < 18	0 / -0.03

Example: Order code HE 235 002-00404

d-Code	d x H x D	L	HE 235 Z=2	
002-00404	0.2 x 0.4 x C 4	50	●	
003-00604	0.3 x 0.6 x C 4	50	●	
004-00804	0.4 x 0.8 x C 4	50	●	
005-01004	0.5 x 1.0 x C 4	50	●	
006-01204	0.6 x 1.2 x C 4	50	●	
007-01404	0.7 x 1.4 x C 4	50	◇	
008-01604	0.8 x 1.6 x C 4	50	●	
009-01804	0.9 x 1.8 x C 4	50	◇	
010-03004	1.0 x 3.0 x C 4	50	●	
015-04004	1.5 x 4.0 x C 4	50	●	
020-06004	2.0 x 6.0 x C 4	50	●	
025-07004	2.5 x 7.0 x C 4	50	●	
030-08004	3.0 x 8.0 x C 4	50	●	
030-08006	3.0 x 8.0 x C 6	50	◇	
040-11004	4.0 x 11.0 x C 4	50	●	
040-11006	4.0 x 11.0 x C 6	50	◇	
050-13006	5.0 x 13.0 x C 6	50	◇	
060-15006	6.0 x 15.0 x C 6	50	●	
080-20008	8.0 x 20.0 x C 8	60	●	
100-25010	10.0 x 25.0 x C10	75	●	
120-30012	12.0 x 30.0 x C12	75	◇	

● Stock item, subject to confirmation ◇ On request

VHM K05-K20	45°	HSC
New Al-X Coating	90°	
HRc 62		

End mills

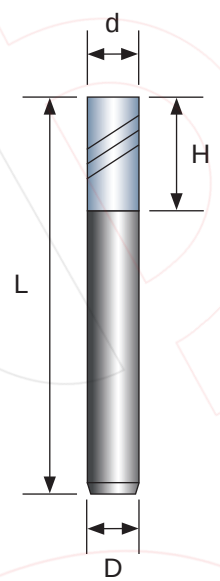
For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 62 HRc

Schaftfräser

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 62 HRc

P	HRc < 24	
	HRc 24 - 35	○
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	○
M	Stainless steel	○
K	Cast iron	○
N	Copper alloy	
S	Titanium alloy	○
	High-temperature alloy	

Cutting data, P40 - P41



Tolerance / Toleranz

Range	Diameter
1 ≤ d < 8	0 / -0.02
8 ≤ d < 18	0 / -0.03

Example: Order code HE 445 010-03004

d-Code	d x H x D	L	HE 445 Z=4	
010-03004	1.0 x 3.0 x C 4	50	●	
015-04004	1.5 x 4.0 x C 4	50	●	
020-06004	2.0 x 6.0 x C 4	50	●	
025-07004	2.5 x 7.0 x C 4	50	●	
030-08004	3.0 x 8.0 x C 4	50	●	
030-08006	3.0 x 8.0 x C 6	50	◇	
040-11004	4.0 x 11.0 x C 4	50	●	
040-11006	4.0 x 11.0 x C 6	50	◇	
050-13006	5.0 x 13.0 x C 6	50	●	
060-15006	6.0 x 15.0 x C 6	50	●	
080-20008	8.0 x 20.0 x C 8	60	●	
100-25010	10.0 x 25.0 x C10	75	●	
120-30012	12.0 x 30.0 x C12	75	●	
160-40016	16.0 x 40.0 x C16	100	◇	
200-40020	20.0 x 40.0 x C20	100	◇	

Long cut length / Lange schneidkantenlänge

060-24006	6.0 x 24.0 x C 6	75	●	
080-32008	8.0 x 32.0 x C 8	75	●	
100-40010	10.0 x 40.0 x C10	100	●	
120-45010	12.0 x 45.0 x C12	100	●	

VHM K05-K20 | 35° | HSC

New Al-X Coating | 90°

HRc 62

End mills, long shank

For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 62 HRc

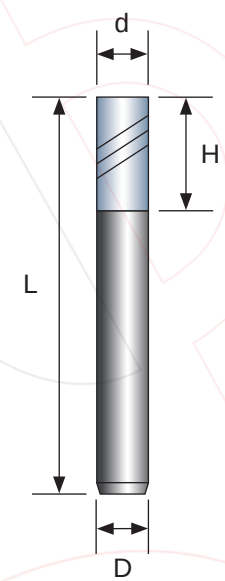
Schaftfräser, langer schaft

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 62 HRc

Example: Order code HELS 435 020-05104

			d-Code	d x L x D	H	HELS 435 Z=4	
P	HRc < 24		020-05104	2.0 x L 75 x C 4	5.0	◇	
	HRc 24 - 35	○	030-08104	3.0 x L 75 x C 4	8.0	◇	
	HRc > 35	◎	040-11104	4.0 x L 75 x C 4	11.0	●	
H	HRc 45 - 55	◎	060-15106	6.0 x L 75 x C 6	15.0	●	
	HRc 56 - 60	◎	060-15306	6.0 x L100 x C 6	15.0	●	
	HRc > 60	○	080-20108	8.0 x L 75 x C 8	20.0	◇	
M	Stainless steel		080-20308	8.0 x L100 x C 8	20.0	●	
K	Cast iron	○	100-25310	10.0 x L100 x C10	25.0	●	
N	Copper alloy		100-25510	10.0 x L150 x C10	25.0	◇	
S	Titanium alloy		120-30312	12.0 x L100 x C12	30.0	●	
	High-temperature alloy		120-30512	12.0 x L150 x C12	30.0	◇	

Cutting data, P40 - P41



Tolerance / Toleranz

Range	Diameter
1 ≤ d < 8	0 / -0.02
8 ≤ d < 18	0 / -0.03

● Stock item, subject to confirmation ◇ On request

VHM K05-K20	35°	HSC
New AlCr-X Coating	90°	
HRc 65		

End mills, long neck

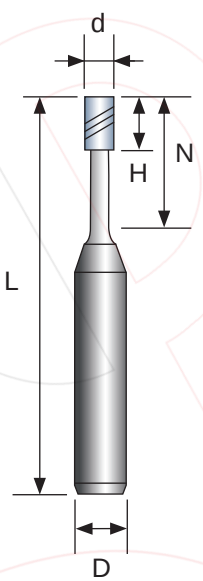
For HSC of steels, stainless steels, titanium alloys, heat-treated and hardened steels 45 - 65 HRc

Schaftfräser, überlaufhals

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

P	HRc < 24	○
	HRc 24 - 35	◎
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	○
M	Stainless steel	◎
K	Cast iron	○
N	Copper alloy	○
S	Titanium alloy	◎
	High-temperature alloy	○

Cutting data, P42



Tolerance / Toleranz

Range	Diameter
d < 1	0 / -0.015
1 ≤ d < 8	0 / -0.02

Example: Order code HELN 235 003-01004

d-Code	d x N x D	H	L	HELN 235 Z=2	HELN 435 Z=4
003-01004	0.3 x N 1 x C 4	0.4	50	◇	
003-02004	0.3 x N 2 x C 4	0.4	50	◇	
003-03004	0.3 x N 3 x C 4	0.4	50	◇	
004-02004	0.4 x N 2 x C 4	0.6	50	◇	
004-04004	0.4 x N 4 x C 4	0.6	50	◇	
005-02004	0.5 x N 2 x C 4	0.7	50	●	
005-04004	0.5 x N 4 x C 4	0.7	50	●	
005-06004	0.5 x N 6 x C 4	0.7	50	◇	
006-04004	0.6 x N 4 x C 4	0.9	50	●	
006-06004	0.6 x N 6 x C 4	0.9	50	●	
008-04004	0.8 x N 4 x C 4	1.2	50	●	
008-06004	0.8 x N 6 x C 4	1.2	50	●	
008-08004	0.8 x N 8 x C 4	1.2	50	◇	
010-04004	1.0 x N 4 x C 4	1.5	50	●	●
010-06004	1.0 x N 6 x C 4	1.5	50	●	●
010-08004	1.0 x N 8 x C 4	1.5	50	●	●
010-10004	1.0 x N 10 x C 4	1.5	50	◇	◇
010-12004	1.0 x N 12 x C 4	1.5	50	◇	◇
015-06004	1.5 x N 6 x C 4	2.3	50	●	●
015-08004	1.5 x N 8 x C 4	2.3	50	●	●
015-12004	1.5 x N 12 x C 4	2.3	50	●	●
015-16004	1.5 x N 16 x C 4	2.3	60	◇	◇
020-08004	2.0 x N 8 x C 4	3.0	50	●	●
020-10004	2.0 x N 10 x C 4	3.0	50	◇	◇
020-12004	2.0 x N 12 x C 4	3.0	50	●	●
020-16004	2.0 x N 16 x C 4	3.0	60	●	●
020-20004	2.0 x N 20 x C 4	3.0	60	◇	◇
030-12006	3.0 x N 12 x C 6	4.5	50		●
030-16006	3.0 x N 16 x C 6	4.5	60		●
030-20006	3.0 x N 20 x C 6	4.5	60		●
030-25006	3.0 x N 25 x C 6	4.5	60		◇
040-12006	4.0 x N 12 x C 6	6.0	50		●
040-16006	4.0 x N 16 x C 6	6.0	60		●
040-20006	4.0 x N 20 x C 6	6.0	60		●
040-25006	4.0 x N 25 x C 6	6.0	60		◇

VHM K05-K20	35°	HSC
AlTiN Coating		
HRc 65		

Ball nose end mills

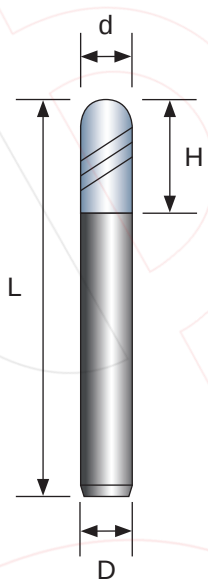
For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 65 HRc

Kugelkopffräser

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

P	HRc < 24	
	HRc 24 - 35	○
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	○
M	Stainless steel	
K	Cast iron	○
N	Copper alloy	
S	Titanium alloy	
	High-temperature alloy	

Cutting data, P43 -P 44



Tolerance / Toleranz

Range	Diameter
d < 1	0 / -0.015
1 ≤ d < 8	0 / -0.02
8 ≤ d < 18	0 / -0.03

Example: Order code HB 235 010-02003

d-Code	d x H x D	L	HB 235 Z=2	HB 435 Z=4
002-00404	R0.1 x 0.4 x C 4	50	●	
003-00604	R0.15 x 0.6 x C 4	50	●	
004-00804	R0.2 x 0.8 x C 4	50	●	
005-01004	R0.25 x 1.0 x C 4	50	●	
006-01204	R0.3 x 1.2 x C 4	50	●	
008-01604	R0.4 x 1.6 x C 4	50	●	
010-02003	R0.5 x 2.0 x C 3	50	◇	
010-02004	R0.5 x 2.0 x C 4	50	●	
010-02006	R0.5 x 2.0 x C 6	50	◇	
015-03003	R0.75 x 3.0 x C 3	50	◇	
015-03004	R0.75 x 3.0 x C 4	50	●	
015-03006	R0.75 x 3.0 x C 6	50	◇	
020-04003	R1.0 x 4.0 x C 3	50	◇	
020-04004	R1.0 x 4.0 x C 4	50	●	
020-04006	R1.0 x 4.0 x C 6	50	◇	
025-05004	R1.25 x 5.0 x C 4	50	◇	
030-06003	R1.5 x 6.0 x C 3	50	◇	
030-06004	R1.5 x 6.0 x C 4	50	●	◇
030-06006	R1.5 x 6.0 x C 6	50	●	◇
040-08004	R2.0 x 8.0 x C 4	50	●	◇
040-08006	R2.0 x 8.0 x C 6	50	●	◇
050-10006	R2.5 x 10.0 x C 6	50	●	◇
060-12006	R3.0 x 12.0 x C 6	50	●	●
080-16008	R4.0 x 16.0 x C 8	60	●	●
100-20010	R5.0 x 20.0 x C10	75	●	●
120-24012	R6.0 x 24.0 x C12	75	●	●
160-30016	R8.0 x 30.0 x C16	100	◇	◇

● Stock item, subject to confirmation ◇ On request

VHM K05-K20	35°	HSC
AlTiN Coating		
HRc 65		

Ball nose end mills, long shank

For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 65 HRc

Kugelkopffräser, langer schaft

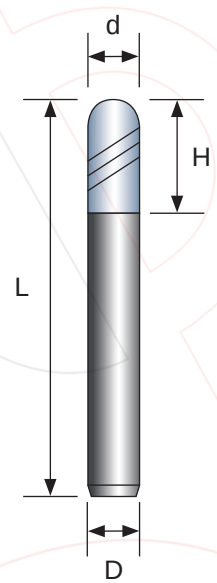
Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

P	HRc < 24	
	HRc 24 - 35	○
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	○
M	Stainless steel	
K	Cast iron	○
N	Copper alloy	
S	Titanium alloy	
	High-temperature alloy	

Example: Order code HBLS 235 010-02104

d-Code	d x L x D	H	HBLS 235 Z=2	HBLS 435 Z=4
010-02104	R0.5 x L 75 x C 4	2.0	◇	
015-03104	R0.75 x L 75 x C 4	3.0	◇	
020-04106	R1.0 x L 75 x C 6	4.0	●	
020-04306	R1.0 x L100 x C 6	4.0	◇	
030-06106	R1.5 x L 75 x C 6	6.0	●	
030-06306	R1.5 x L100 x C 6	6.0	◇	
040-08104	R2.0 x L 75 x C 4	8.0	●	
040-08306	R2.0 x L100 x C 6	8.0	●	
050-10106	R2.5 x L 75 x C 6	10.0	●	
050-10306	R2.5 x L100 x C 6	10.0	●	
060-12106	R3.0 x L 75 x C 6	12.0	●	●
060-12306	R3.0 x L100 x C 6	12.0	●	●
060-12506	R3.0 x L150 x C 6	12.0	◇	◇
080-16108	R4.0 x L 75 x C 8	16.0	●	◇
080-16308	R4.0 x L100 x C 8	16.0	●	●
080-16508	R4.0 x L150 x C 8	16.0	◇	◇
100-20310	R5.0 x L100 x C10	20.0	●	●
100-20510	R5.0 x L150 x C10	20.0	◇	◇
120-24312	R6.0 x L100 x C12	24.0	●	●
120-24512	R6.0 x L150 x C12	24.0	◇	◇

Cutting data, P43 - P44



Tolerance / Toleranz

Range	Diameter
1 ≤ d < 8	0 / -0.02
8 ≤ d < 18	0 / -0.03

VHM K05-K20	35°	HSC
New AlCrN Coating		
HRc 65		

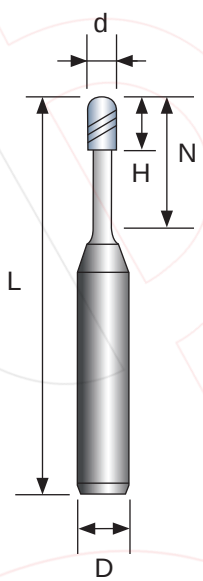
Ball nose end mills, long neck

For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 65 HRc

Kugelkopffräser, überlaufhals

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

P	HRc < 24	○
	HRc 24 - 35	◎
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	◎
M	Stainless steel	◎
K	Cast iron	○
N	Copper alloy	○
S	Titanium alloy	◎
	High-temperature alloy	○



Tolerance / Toleranz

Range	Diameter
d < 1	0 / -0.015
1 ≤ d < 8	0 / -0.02

Example: Order code HBLN 235 004-02004

d-Code	d x N x D	H	L	HBLN 235 Z=2	
004-02004	R0.2 x N 2 x C 4	0.4	50	●	
004-03004	R0.2 x N 3 x C 4	0.4	50	●	
004-04004	R0.2 x N 4 x C 4	0.4	50	◇	
005-02004	R0.25 x N 2 x C 4	0.5	50	●	
005-04004	R0.25 x N 4 x C 4	0.5	50	●	
005-06004	R0.25 x N 6 x C 4	0.5	50	◇	
006-02004	R0.3 x N 2 x C 4	0.6	50	●	
006-04004	R0.3 x N 4 x C 4	0.6	50	●	
006-06004	R0.3 x N 6 x C 4	0.6	50	◇	
008-04004	R0.4 x N 4 x C 4	0.8	50	●	
008-06004	R0.4 x N 6 x C 4	0.8	50	●	
008-08004	R0.4 x N 8 x C 4	0.8	50	◇	
010-04004	R0.5 x N 4 x C 4	1.0	50	●	
010-06004	R0.5 x N 6 x C 4	1.0	50	●	
010-08004	R0.5 x N 8 x C 4	1.0	50	●	
010-10004	R0.5 x N 10 x C 4	1.0	50	◇	
010-12004	R0.5 x N 12 x C 4	1.0	50	●	
015-06004	R0.75 x N 6 x C 4	1.5	50	●	
015-08004	R0.75 x N 8 x C 4	1.5	50	●	
015-12004	R0.75 x N 12 x C 4	1.5	50	●	
015-16004	R0.75 x N 16 x C 4	1.5	60	◇	
015-20004	R0.75 x N 20 x C 4	1.5	60	◇	
020-06004	R1.0 x N 6 x C 4	2.0	50	●	
020-08004	R1.0 x N 8 x C 4	2.0	50	●	
020-10004	R1.0 x N 10 x C 4	2.0	50	●	
020-12004	R1.0 x N 12 x C 4	2.0	50	●	
020-16004	R1.0 x N 16 x C 4	2.0	60	◇	
020-20004	R1.0 x N 20 x C 4	2.0	60	◇	
030-16006	R1.5 x N 16 x C 6	3.0	60	●	
030-20006	R1.5 x N 20 x C 6	3.0	60	●	
030-25006	R1.5 x N 25 x C 6	3.0	60	◇	
030-30006	R1.5 x N 30 x C 6	3.0	75	◇	
040-16006	R2.0 x N 16 x C 6	4.0	60	●	
040-20006	R2.0 x N 20 x C 6	4.0	60	●	
040-25006	R2.0 x N 25 x C 6	4.0	60	◇	
040-30006	R2.0 x N 30 x C 6	4.0	75	◇	

● Stock item, subject to confirmation ◇ On request

VHM K05-K20	35°	HSC
New AlCr-X Coating		
HRc 65		

Ball nose end mills, conic neck 0.9°

For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 65 HRc

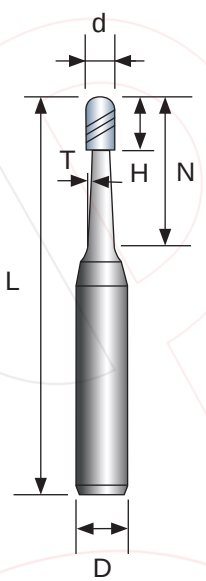
Kugelkopffräser, 0.9° konisch zum Schaft

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

P	HRc < 24	○
	HRc 24 - 35	◎
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	◎
M	Stainless steel	◎
K	Cast iron	○
N	Copper alloy	○
S	Titanium alloy	◎
	High-temperature alloy	○

Example: Order code HBTN 2359 006-06094

d-Code	d x N x T x D	H	L	HBTN 2359 Z=2	
006-06094	R0.3 x N 6 x T0.9 x C 4	0.6	50	◇	
006-08094	R0.3 x N 8 x T0.9 x C 4	0.6	50	◇	
008-08094	R0.4 x N 8 x T0.9 x C 4	0.8	50	◇	
008-12094	R0.4 x N12 x T0.9 x C 4	0.8	50	◇	
010-10094	R0.5 x N10 x T0.9 x C 4	1.0	50	◇	
010-15094	R0.5 x N15 x T0.9 x C 4	1.0	50	◇	
015-15094	R0.75 x N15 x T0.9 x C 4	2.0	60	◇	
015-20094	R0.75 x N20 x T0.9 x C 4	2.0	60	◇	
020-20096	R1.0 x N20 x T0.9 x C 6	3.0	75	◇	
020-25096	R1.0 x N25 x T0.9 x C 6	3.0	75	◇	
020-30096	R1.0 x N30 x T0.9 x C 6	3.0	75	◇	
030-30096	R1.5 x N30 x T0.9 x C 6	5.0	75	◇	
030-40096	R1.5 x N40 x T0.9 x C 6	5.0	75	◇	
030-50096	R1.5 x N50 x T0.9 x C 6	5.0	100	◇	



Tolerance / Toleranz

Range	Diameter
d < 1	0 / -0.015
1 ≤ d < 8	0 / -0.02

VHM K05-K20	30°	HSC
AlTiN Coating	R	
HRc 65		

Corner radius end mills

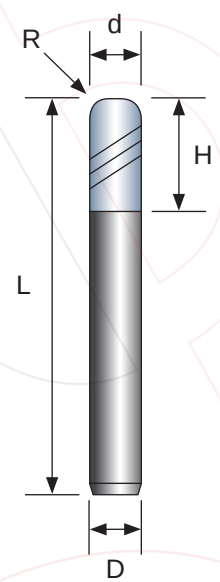
For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 65 HRc

Eckradiusfräser

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

P	HRc < 24	
	HRc 24 - 35	○
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	○
M	Stainless steel	
K	Cast iron	○
N	Copper alloy	
S	Titanium alloy	
	High-temperature alloy	

Cutting data, P45 - P46



Tolerance / Toleranz

Range	Diameter
1 ≤ d < 8	0 / -0.02
8 ≤ d < 18	0 / -0.03

Example: Order code HR 230 010-02004

d-Code	d x R x H x D	L	HR 230 Z=2	HR 430 Z=4
010-02004	1.0 x R0.2 x 2.0 x C 4	50	●	●
015-02004	1.5 x R0.2 x 3.0 x C 4	50	●	●
015-05004	1.5 x R0.5 x 3.0 x C 4	50	◇	◇
020-02004	2.0 x R0.2 x 4.0 x C 4	50	●	●
020-05004	2.0 x R0.5 x 4.0 x C 4	50	●	●
025-02004	2.5 x R0.2 x 5.0 x C 4	50	◇	◇
025-05004	2.5 x R0.5 x 5.0 x C 4	50	◇	◇
030-02003	3.0 x R0.2 x 6.0 x C 3	50	◇	◇
030-05003	3.0 x R0.5 x 6.0 x C 3	50	◇	◇
030-02004	3.0 x R0.2 x 6.0 x C 4	50	●	●
030-05004	3.0 x R0.5 x 6.0 x C 4	50	●	●
030-10004	3.0 x R1.0 x 6.0 x C 4	50	◇	◇
040-02004	4.0 x R0.2 x 8.0 x C 4	50	◇	◇
040-05004	4.0 x R0.5 x 8.0 x C 4	50	●	●
040-10004	4.0 x R1.0 x 8.0 x C 4	50	◇	◇
050-05006	5.0 x R0.5 x 10.0 x C 6	50	◇	●
050-10006	5.0 x R1.0 x 10.0 x C 6	50	◇	●
060-02006	6.0 x R0.2 x 12.0 x C 6	50	◇	◇
060-05006	6.0 x R0.5 x 12.0 x C 6	50	●	●
060-10006	6.0 x R1.0 x 12.0 x C 6	50	●	●
080-05008	8.0 x R0.5 x 16.0 x C 8	60	◇	●
080-10008	8.0 x R1.0 x 16.0 x C 8	60	◇	●
100-05010	10.0 x R0.5 x 20.0 x C10	75	◇	●
100-10010	10.0 x R1.0 x 20.0 x C10	75	◇	●
100-20010	10.0 x R2.0 x 20.0 x C10	75	◇	◇
120-05012	12.0 x R0.5 x 24.0 x C12	75	◇	◇
120-10012	12.0 x R1.0 x 24.0 x C12	75	◇	●
120-20012	12.0 x R2.0 x 24.0 x C12	75	◇	◇

● Stock item, subject to confirmation ◇ On request

VHM K05-K20	30°	HSC
AlTiN Coating	R	
HRc 65		

Corner radius end mills, long shank

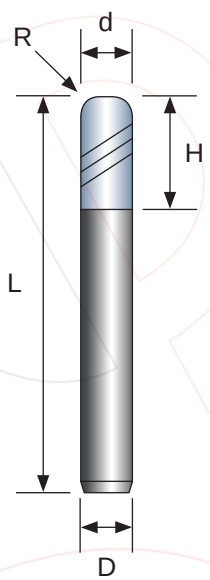
For HSC of tool steels, hard cast materials, tempered and hardened steels 45 - 65 HRc

Eckradiusfräser, langer schaft

Für die HSC von Werkzeugstählen, harten Gusswerkstoffen, gehärtetem und vergütetem Stählen mit Härten von 45 - 65 HRc

P	HRc < 24	
	HRc 24 - 35	○
	HRc > 35	◎
H	HRc 45 - 55	◎
	HRc 56 - 60	◎
	HRc > 60	○
M	Stainless steel	
K	Cast iron	○
N	Copper alloy	
S	Titanium alloy	
	High-temperature alloy	

Cutting data, P46



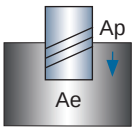
Tolerance / Toleranz

Range	Diameter
1 ≤ d < 8	0 / -0.02
8 ≤ d < 18	0 / -0.03

Example: Order code HRLS 430 020-02104

d-Code	d x R x L x D	H	HRLS 430 Z=4	
020-05104	2.0 x R0.2 x L 75 x C 4	4.0	◇	
020-10104	2.0 x R0.5 x L 75 x C 4	4.0	◇	
030-05104	3.0 x R0.2 x L 75 x C 4	6.0	◇	
030-10104	3.0 x R0.5 x L 75 x C 4	6.0	◇	
040-05104	4.0 x R0.5 x L 75 x C 4	8.0	●	
040-10104	4.0 x R1.0 x L 75 x C 4	8.0	●	
060-05106	6.0 x R0.5 x L 75 x C 6	12.0	●	
060-05306	6.0 x R0.5 x L100 x C 6	12.0	●	
060-10106	6.0 x R1.0 x L 75 x C 6	12.0	●	
060-10306	6.0 x R1.0 x L100 x C 6	12.0	●	
080-05308	8.0 x R0.5 x L100 x C 8	16.0	●	
080-10308	8.0 x R1.0 x L100 x C 8	16.0	●	
100-05310	10.0 x R0.5 x L100 x C10	20.0	◇	
100-10310	10.0 x R1.0 x L100 x C10	20.0	●	
100-20310	10.0 x R2.0 x L100 x C10	20.0	◇	
120-05312	12.0 x R0.5 x L100 x C12	24.0	◇	
120-10312	12.0 x R1.0 x L100 x C12	24.0	●	
120-20312	12.0 x R2.0 x L100 x C12	24.0	◇	

Hard-cut — Slotting / Finishing (General milling)

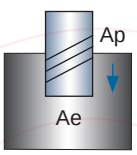


HE 235

	P		H		
	HRc 24 - 35	HRc > 35	HRc < 52	HRc 52 - 55	HRc 56 - 60
Ap [mm]	0.05 x d	0.04 x d	0.03 x d	0.02 x d	0.02 x d
Ae [mm]	1 x d	1 x d	1 x d	1 x d	1 x d
Vc [m / min]	30 - 110	30 - 92	30 - 76	28 - 63	18 - 42

d	n	Vf	n	Vf	n	Vf	n	Vf	n	Vf
[mm]	[min^{-1}]	[mm/min]	[min^{-1}]	[mm/min]	[min^{-1}]	[mm/min]	[min^{-1}]	[mm/min]	[min^{-1}]	[mm/min]
0.4	25000	110	25000	104	25000	90	22500	76	15000	44
0.5	25000	138	25000	130	25000	112	22500	94	15000	54
0.6	25000	166	25000	156	25000	136	22500	114	15000	64
0.8	25000	222	24100	202	21700	156	19300	130	12738	74
1.0	25000	276	21500	224	19400	174	17200	144	11352	82
1.5	19000	314	15800	248	13100	176	11500	144	7590	82
2.0	17400	384	14500	302	12100	218	10000	168	6600	96

Hard-cut — Slotting / Finishing (HSC)



Ap = 0.02 x d [mm]
Ae = 1 x d [mm]

HE 235, HE 445
HELS 435 (#1)

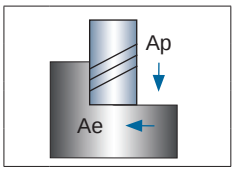
		Vc [m / min]	fz feed [mm / tooth] by diameter								
			1	2	3	4	6	8	10	12	16
P	HRc 24 - 35	135 - 175	0.007	0.014	0.021	0.029	0.046	0.055	0.072	0.086	0.114
	HRc > 35	110 - 150	0.006	0.013	0.019	0.026	0.042	0.049	0.065	0.077	0.102
H	HRc < 52	100 - 130	0.006	0.012	0.017	0.024	0.038	0.045	0.059	0.070	0.093
	HRc 52 - 55	80 - 105	0.005	0.010	0.015	0.021	0.033	0.039	0.051	0.060	0.080
	HRc 56 - 60	55 - 75	0.004	0.008	0.012	0.017	0.028	0.033	0.043	0.051	0.068
M	Stainless steels	70 - 90	0.006	0.012	0.018	0.025	0.040	0.047	0.062	0.073	0.097
K	Cast iron	100 - 150	0.007	0.015	0.022	0.032	0.050	0.060	0.078	0.093	0.123
N	Copper alloy	150 - 180	0.007	0.015	0.022	0.032	0.050	0.060	0.078	0.093	0.123
S	Titanium alloy	50 - 80	0.006	0.012	0.018	0.025	0.040	0.047	0.062	0.073	0.097
	High-temperature alloy	30 - 50	0.006	0.012	0.018	0.025	0.040	0.047	0.062	0.073	0.097

Notes

#1 For HELS 435, adjust feed (fz) and cutting speed (Vc) 10% - 50% lower according to the ratio of overhang length / cutting diameter.

- ► The maxinum spindle speed (n) for diameter 1.0 should be below 30000 rpm.
- ► These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.
- ► Reduce both spindle speed and feed rate at same rate for chattering and also for insufficient spindle speed of a machine.

Hard-cut — Side milling / Pre-finishing (HSC)

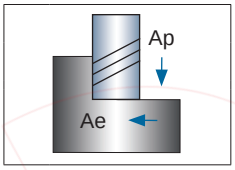


Ap = 1 x d [mm]
Ae = 0.1 x d [mm]

HE 235, HE 445
HELS 435 (#1)

		Vc [m / min]	fz feed [mm / tooth] by diameter								
			1	2	3	4	6	8	10	12	16
P	HRc 24 - 35	140 - 185	0.007	0.011	0.016	0.023	0.037	0.044	0.057	0.068	0.082
	HRc > 35	120 - 155	0.006	0.010	0.015	0.021	0.033	0.040	0.052	0.062	0.074
H	HRc < 52	105 - 135	0.006	0.008	0.013	0.019	0.030	0.036	0.047	0.056	0.067
	HRc 52 - 55	85 - 110	0.005	0.007	0.012	0.016	0.026	0.031	0.041	0.048	0.058
M	Stainless steels	85 - 110	0.006	0.009	0.014	0.020	0.032	0.038	0.049	0.059	0.071
K	Cast iron	150 - 195	0.007	0.012	0.018	0.025	0.040	0.048	0.062	0.074	0.089
N	Copper alloy	190 - 250	0.007	0.012	0.018	0.025	0.040	0.048	0.062	0.074	0.089
S	Titanium alloy	70 - 90	0.006	0.009	0.014	0.020	0.032	0.038	0.049	0.059	0.071
	High-temperature alloy	30 - 50	0.006	0.009	0.014	0.020	0.032	0.038	0.049	0.059	0.071

Hard-cut — Side milling / Finishing (HSC)



Ap = 1 x d [mm]
Ae = 0.02 x d [mm]

HE 235, HE 445
HELS 435 (#1)

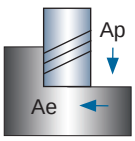
		Vc [m / min]	fz feed [mm / tooth] by diameter								
			1	2	3	4	6	8	10	12	16
P	HRc 24 - 35	190 - 250	0.008	0.016	0.025	0.035	0.055	0.066	0.086	0.103	0.123
	HRc > 35	165 - 215	0.007	0.015	0.022	0.031	0.050	0.059	0.078	0.093	0.111
H	HRc < 52	145 - 190	0.006	0.013	0.020	0.028	0.045	0.054	0.070	0.084	0.100
	HRc 52 - 55	120 - 155	0.006	0.011	0.017	0.025	0.039	0.046	0.061	0.073	0.087
	HRc 56 - 60	80 - 110	0.005	0.010	0.015	0.021	0.033	0.039	0.052	0.061	0.074
M	Stainless steels	100 - 130	0.007	0.014	0.021	0.030	0.048	0.056	0.074	0.088	0.106
K	Cast iron	200 - 260	0.009	0.018	0.027	0.038	0.060	0.071	0.094	0.112	0.134
N	Copper alloy	250 - 320	0.009	0.018	0.027	0.038	0.060	0.071	0.094	0.112	0.134
S	Titanium alloy	90 - 110	0.007	0.014	0.021	0.030	0.048	0.056	0.074	0.088	0.106
	High-temperature alloy	30 - 60	0.007	0.014	0.021	0.030	0.048	0.056	0.074	0.088	0.106

Notes

#1 For HELS 435, adjust feed (fz) and cutting speed (Vc) 10% - 50% lower according to the ratio of overhang length / cutting diameter.

- ▶ The maxinum spindle speed (n) for diameter 1.0 should be below 30000 rpm.
- ▶ These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.
- ▶ Reduce both spindle speed and feed rate at same rate for chattering and also for insufficient spindle speed of a machine.

Hard-cut | **Side milling**



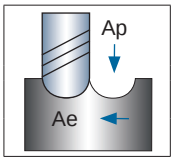
HELN 235 (#1), HELN 435 (#1 and #2)

		P			H						N		
		HRc > 35			HRc < 56			HRc 56 - 60			Copper alloy		
Ae [mm]		0.6 x d			0.5 x d			0.4 x d			0.8 x d		
Diameter d [mm]	Effective length N [mm]	Spindle speed n [min^{-1}]	Feed rate Vf [mm/min]	Radial depth Ap [mm]	Spindle speed n [min^{-1}]	Feed rate Vf [mm/min]	Radial depth Ap [mm]	Spindle speed n [min^{-1}]	Feed rate Vf [mm/min]	Radial depth Ap [mm]	Spindle speed n [min^{-1}]	Feed rate Vf [mm/min]	Radial depth Ap [mm]
0.5	2	30000	520	0.021	25000	420	0.014	16800	250	0.011	30000	600	0.035
	4	25000	380	0.012	25000	280	0.008	16800	160	0.006	26000	500	0.020
	6	22000	190	0.008	22000	170	0.005	14700	90	0.004	24000	200	0.013
0.6	4	25000	420	0.014	25000	350	0.010	16800	170	0.007	30000	600	0.024
	6	20000	200	0.009	20000	160	0.006	13400	80	0.005	26700	300	0.015
0.8	4	25000	800	0.034	25000	700	0.022	16800	400	0.017	30000	1100	0.056
	6	20000	620	0.019	20000	550	0.013	13400	300	0.010	26700	1000	0.032
	8	16000	500	0.012	16000	400	0.008	10700	200	0.006	21300	800	0.020
1.0	4	25000	1000	0.042	23000	900	0.028	15400	540	0.021	30000	1400	0.070
	6	20000	800	0.024	18000	700	0.016	12100	400	0.012	26700	1300	0.040
	8	18000	700	0.024	16000	600	0.016	10700	340	0.012	24000	1100	0.040
	10	16000	500	0.015	14000	500	0.010	9400	270	0.008	21300	800	0.025
	12	14200	390	0.012	12000	320	0.008	8000	170	0.006	18900	600	0.025
1.5	6	23000	1000	0.066	20000	800	0.044	13400	470	0.033	30000	1600	0.110
	8	20000	800	0.048	18000	600	0.032	12100	400	0.024	26700	1300	0.060
	12	16000	600	0.036	14000	450	0.024	9400	290	0.018	21300	900	0.060
	16	14000	420	0.022	12000	320	0.014	8200	200	0.011	18600	630	0.036
2.0	8	18000	900	0.084	16000	800	0.056	10700	400	0.042	24000	1400	0.140
	10	16000	800	0.072	14000	700	0.048	9400	340	0.036	21300	1200	0.140
	12	14000	700	0.048	12000	600	0.032	8000	340	0.024	18700	1100	0.080
	16	12000	600	0.036	10000	500	0.024	6700	270	0.018	16000	900	0.080
3.0	12	14000	900	0.126	12000	800	0.084	8000	470	0.063	18700	1400	0.210
	16	12000	800	0.072	10000	700	0.048	6700	400	0.036	16000	1200	0.120
	20	10000	800	0.072	9000	700	0.048	6000	400	0.036	13300	1300	0.120
	25	9000	700	0.060	8200	600	0.040	5500	340	0.030	12000	1100	0.080
4.0	12	12000	1000	0.240	9500	1000	0.160	6400	540	0.120	16000	1600	0.400
	16	10000	1000	0.168	8000	900	0.112	5400	470	0.084	13300	1600	0.280
	20	8500	900	0.132	7000	800	0.088	4700	400	0.066	11300	1400	0.280
	25	8000	800	0.096	6000	700	0.064	4000	400	0.048	10700	1300	0.160

Notes

#1 For slotting, adjust feed rate(Vf) and radial depth (Ap) 50% lower.
#2 For HELN 435, adjust feed rate(Vf) 60% higher for side milling.
► These cutting conditions should be adjusted according to milling shape and machine type.
► Recommend to apply herical or ramping for approaching into axial direction.
► Adjust feed rate Vf 50% lower and cutting depth Ap 30% lower for milling deep wall area.

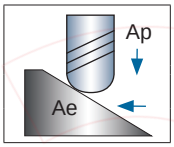
Hard-cut — Contour line / Roughing (HSC)



HB 235

R [mm]	H											
	HRc < 52				HRc 52 - 55				HRc 56 - 60			
	n [min^{-1}]	Vf [mm/min]	Ap [mm]	Ae [mm]	n [min^{-1}]	Vf [mm/min]	Ap [mm]	Ae [mm]	n [min^{-1}]	Vf [mm/min]	Ap [mm]	Ae [mm]
R0.5	28000	1898	0.050	0.18	24600	1534	0.045	0.17	19700	975	0.036	0.15
R0.75	21000	1963	0.075	0.27	18500	1586	0.068	0.26	14800	1040	0.054	0.23
R1.0	17600	2197	0.120	0.39	15500	1768	0.100	0.36	12400	1157	0.072	0.30
R1.5	23400	2798	0.210	0.45	17700	2025	0.165	0.56	13100	1329	0.108	0.45
R2.0	17500	2821	0.280	0.85	13300	2005	0.240	0.78	11100	1500	0.144	0.60
R2.5	15900	3102	0.350	1.06	12100	2202	0.300	0.98	8900	1388	0.180	0.76
R3.0	13300	3250	0.420	1.27	10100	2311	0.360	1.18	7400	1443	0.216	0.91
R4.0	10000	2938	0.560	1.69	7600	2075	0.480	1.57	5600	1310	0.288	1.21
R5.0	8000	2662	0.700	2.12	6100	1888	0.600	1.96	4500	1193	0.360	1.52
R6.0	6600	2506	0.840	2.54	5000	1781	0.720	2.35	3700	1126	0.432	1.82

Hard-cut — Copy milling / Pre-Finishing (HSC)



HB 235, HB 435 (#1), HBLS 235 (#2), HBLS 435 (#3)

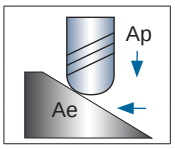
	P		H		
	HRc 24 - 35	HRc > 35	HRc < 52	HRc 52 - 55	HRc 56 - 60
Ap [mm]	0.10 x d	0.10 x d	0.08 x d	0.06 x d	0.05 x d
Ae [mm]	0.10 x d	0.10 x d	0.08 x d	0.06 x d	0.05 x d
Vc [m / min]	94 - 210	94 - 180	80 - 150	60 - 110	50 - 80

R [mm]	P				H					
	HRc 24 - 35		HRc > 35		HRc < 52		HRc 52 - 55		HRc 56 - 60	
	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]
R0.5	30000	960	30000	840	25400	650	19100	460	15900	360
R0.75	30000	1440	25700	1080	21400	850	15700	560	11400	380
R1.0	26400	1690	22600	1260	18800	990	13800	660	10000	450
R1.5	22300	2140	19100	1610	15900	1260	11700	870	8500	570
R2.0	16700	2610	14300	1990	11900	1570	8800	1100	6400	710
R2.5	13400	2350	11500	1770	9600	1410	7000	970	5100	620
R3.0	11100	2100	9600	1610	8000	1270	5800	880	4200	560
R4.0	8400	1860	7200	1400	6000	1110	4400	770	3200	500
R5.0	6700	1620	5700	1220	4800	980	3500	670	2500	430
R6.0	5600	1600	4800	1200	4000	950	2900	660	2100	420

Notes

#1 For HB435, adjust feed rate (Vf) 60% higher .
#2 For HBLS235, adjust feed rate (Vf) and spindle speed (n) 10% - 50% lower according to the ratio of overhang length / cutting diameter.
#3 For HBLS435, adjust feed rate (Vf) 60% higher then adjust feed rate (Vf) and spindle speed (n) 10% - 50% lower according to the ratio of overhang length / cutting diameter.

Hard-cut | **Copy milling / Finishing (HSC)**



HB 235, HB 435 (#1), HBLS 235 (#2), HBLS 435 (#3)

	P				H					
	HRc 24 - 35		HRc > 35		HRc < 52		HRc 52 - 55		HRc 56 - 60	
Ap [mm]	0.02 x d		0.02 x d		0.02 x d		0.02 x d		0.02 x d	
Ae [mm]	0.015 x d		0.015 x d		0.015 x d		0.015 x d		0.015 x d	
Vc [m / min]	94 - 315		94 - 280		94 - 220		84 - 180		56 - 120	
R [mm]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]
R0.2	30000	360	30000	360	30000	360	30000	360	30000	360
R0.25	30000	450	30000	450	30000	450	30000	450	30000	450
R0.3	30000	540	30000	540	30000	540	30000	540	30000	540
R0.4	30000	720	30000	720	30000	720	27800	670	21800	520
R0.5	30000	900	30000	900	30000	900	26700	801	17800	534
R0.75	30000	1350	30000	1350	30000	1350	25600	1152	17000	765
R1.0	30000	1800	30000	1800	27400	1644	22400	1344	14900	894
R1.5	30000	2700	29700	2673	23400	2106	19100	1719	12700	1143
R2.0	24700	2964	22300	2676	17500	2100	14300	1716	9600	1152
R2.5	19700	2955	17800	2670	14000	2100	11500	1725	7600	1140
R3.0	16500	2970	14900	2682	11700	2106	9600	1728	6400	1152
R4.0	12300	2952	11100	2664	8800	2112	7200	1728	4800	1152
R5.0	9900	2970	8900	2670	7000	2100	5700	1710	3800	1140
R6.0	8200	2952	7400	2664	5800	2088	4800	1728	3200	1152

Notes

#1 For HB435, adjust feed rate (Vf) 60% higher .

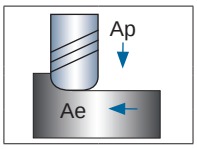
#2 For HBLS235, adjust feed rate (Vf) and spindle speed (n) 10% - 50% lower according to the ratio of overhang length / cutting diameter.

#3 For HBLS435, adjust feed rate (Vf) 60% higher then adjust feed rate (Vf) and spindle speed (n) 10% - 50% lower according to the ratio of overhang length / cutting diameter.

► These recommended cutting conditions indicate just reference. It should be adjusted according to milling shape and machine type.

► Reduce both spindle speed and feed rate at same rate for chattering and also for insufficient spindle speed of a machine.

Hard-cut — Contour line / Roughing (HSC)

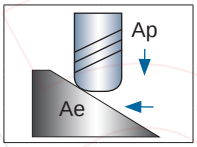


HR 230

	P		H		
	HRc 24 - 35	HRc > 35	HRc < 52	HRc 52 - 55	HRc 56 - 60
Ap [mm]	0.05 x d	0.04 x d	0.03 x d	0.02 x d	0.02 x d
Ae [mm]	0.20 x d	0.20 x d	0.20 x d	0.20 x d	0.20 x d
Vc [m / min]	94 - 190	85 - 150	68 - 120	60 - 102	48 - 78

d	R	P				H					
		HRc 24 - 35		HRc > 35		HRc < 52		HRc 52 - 55		HRc 56 - 60	
[mm]	[mm]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]
1	0.2	30000	882	27100	790	21600	490	19100	410	15200	270
1.5	0.2	25800	1270	20400	890	16300	550	14300	460	11400	310
2	0.2,0.5	21600	1410	17000	990	13700	620	12000	510	9600	340
3	0.2,0.5	20200	1980	15900	1400	12700	864	10800	692	8300	448
4	0.2,0.5	15100	1662	11900	1190	9600	748	8100	584	6200	372
5	0.5,1.0	12100	1476	9600	1056	7600	654	6500	520	5000	330
6	0.5,1.0	10100	1516	8000	1072	6400	678	5400	530	4100	336
8	0.5,1.0	7600	1338	6000	960	4800	596	4100	476	3100	298
10	0.5,1.0	6100	1330	4800	950	3800	586	3200	454	2500	300
12	0.5,1.0	5000	1210	4000	880	3200	550	2700	426	2100	278

Hard-cut — Inclined surface milling / Finishing (HSC)

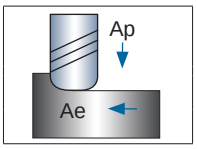


HR 230

	P		H		
	HRc 24 - 35	HRc > 35	HRc < 52	HRc 52 - 55	HRc 56 - 60
Ap [mm]	0.03 x d	0.03 x d	0.03 x d	0.02 x d	0.02 x d
Ae [mm]	0.03 x d	0.03 x d	0.03 x d	0.03 x d	0.03 x d
Vc [m / min]	94 - 243	94 - 223	73 - 176	65 - 142	42 - 72

d	R	P				H					
		HRc 24 - 35		HRc > 35		HRc < 52		HRc 52 - 55		HRc 56 - 60	
[mm]	[mm]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]
1	0.2	30000	825	30000	750	23400	527	20600	432	13500	243
1.5	0.2	30000	1238	30000	1125	23400	790	20600	649	13500	365
2	0.2,0.5	30000	1650	30000	1500	23400	1054	20600	865	12500	450
3	0.2,0.5	25800	2172	23700	1756	18700	1267	15100	948	10100	544
4	0.2,0.5	19900	2186	17800	1780	14000	1262	11300	946	7600	545
5	0.5,1.0	15900	2100	14300	1713	11300	1216	9000	903	6000	518
6	0.5,1.0	13200	2145	11900	1732	9400	1237	7600	939	5000	528
8	0.5,1.0	9900	2136	8900	1735	7100	1242	5700	931	3800	530
10	0.5,1.0	7900	2105	7100	1713	5600	1219	4600	931	3000	525
12	0.5,1.0	6600	2133	5900	1722	4600	1216	3800	931	2500	525

Hard-cut — Contour line / Roughing (HSC)

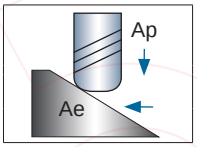


HR 430, HRLS 430 (#1)

	P		H		
	HRc 24 - 35	HRc > 35	HRc < 52	HRc 52 - 55	HRc 56 - 60
Ap [mm]	0.05 x d	0.04 x d	0.03 x d	0.02 x d	0.02 x d
Ae [mm]	0.20 x d	0.20 x d	0.20 x d	0.20 x d	0.20 x d
Vc [m / min]	94 - 190	85 - 150	68 - 120	60 - 102	48 - 78

d	R	P				H					
		HRc 24 - 35		HRc > 35		HRc < 52		HRc 52 - 55		HRc 56 - 60	
[mm]	[mm]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]
1	0.2	30000	1410	27100	1330	21600	820	19100	690	15200	450
1.5	0.2	25800	2130	20400	1490	16300	930	14300	770	11400	530
2	0.2,0.5	21600	2370	17000	1660	13700	1040	12000	860	9600	580
3	0.2,0.5	20200	3170	15900	2240	12700	1380	10800	1110	8300	720
4	0.2,0.5	15100	2660	11900	1900	9600	1200	8100	930	6200	600
5	0.5,1.0	12100	2360	9600	1690	7600	1050	6500	830	5000	530
6	0.5,1.0	10100	2430	8000	1720	6400	1080	5400	850	4100	540
8	0.5,1.0	7600	2140	6000	1540	4800	950	4100	760	3100	480
10	0.5,1.0	6100	2130	4800	1520	3800	940	3200	730	2500	480
12	0.5,1.0	5000	1940	4000	1410	3200	880	2700	680	2100	440

Hard-cut — Inclined surface milling / Finishing (HSC)



HR 430, HRLS 430 (#1)

	P		H		
	HRc 24 - 35	HRc > 35	HRc < 52	HRc 52 - 55	HRc 56 - 60
Ap [mm]	0.03 x d	0.03 x d	0.03 x d	0.02 x d	0.02 x d
Ae [mm]	0.03 x d	0.03 x d	0.03 x d	0.03 x d	0.03 x d
Vc [m / min]	94 - 243	94 - 223	73 - 176	65 - 142	42 - 72

d	R	P				H					
		HRc 24 - 35		HRc > 35		HRc < 52		HRc 52 - 55		HRc 56 - 60	
[mm]	[mm]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]	n [min^{-1}]	Vf [mm/min]
1	0.2	30000	1320	30000	1200	23400	843	20600	691	13500	389
1.5	0.2	30000	1981	30000	1800	23400	1264	20600	1038	13500	584
2	0.2,0.5	30000	2640	30000	2400	23400	1686	20600	1384	12500	720
3	0.2,0.5	25800	4042	23700	3267	18700	2357	15100	1763	10100	1011
4	0.2,0.5	19900	4067	17800	3312	14000	2349	11300	1760	7600	1014
5	0.5,1.0	15900	3907	14300	3187	11300	2262	9000	1680	6000	963
6	0.5,1.0	13200	3990	11900	3222	9400	2301	7600	1747	5000	982
8	0.5,1.0	9900	3974	8900	3229	7100	2310	5700	1731	3800	986
10	0.5,1.0	7900	3917	7100	3187	5600	2269	4600	1731	3000	976
12	0.5,1.0	6600	3968	5900	3203	4600	2262	3800	1731	2500	976

Notes

#1: For HRLS 430, adjust feed rate (Vf) and spindle speed (n) 10% - 50% lower according to the ratio of overhang length / cutting diameter.