Jongen Werkzeugtechnik

Solid carbide end mills for the machining of aluminium

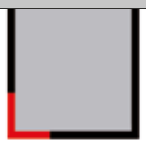
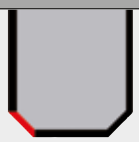
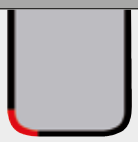
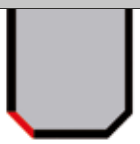
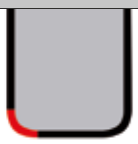
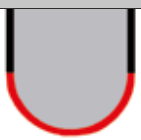


Products from Willich → North-Rhine Westphalia → Germany → Europe for Europe and the

Solid carbide end mills for the machining of aluminium

These Jongen solid carbide end mills have been specially developed for machining aluminium, non-ferrous metals and plastics.

Geometries:

VHM 209	VHM 309	VHM 309 R	VHM 389	VHM 389 R	VHM 308W	VHM 229
						
Flat faced	Flat faced with edge chamfer	Flat faced with edge radius	Flat faced with edge chamfer	Flat faced with edge radius	Flat faced with edge chamfer	Spherical
			long version	long version	with cord profile	
ø3 - ø20	ø3 - ø20	ø1 - ø20	ø1 - ø20	ø3 - ø16	ø6 - ø25	ø1 - ø20
Page 4	Page 6	Page 8	Page 10	Page 12	Page 14	Page 16

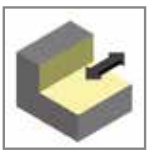
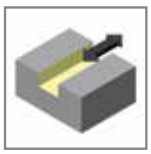
Characteristics	VHM 209	VHM 309	VHM 309 R	VHM 389	VHM 389 R	VHM 308W	VHM 229
Number of cutting edges	2	3	3	3	3	3	2
Optimal cutting performance at maximum productivity	✓	✓	✓	✓	✓	✓	✓
Universally applicable - for step milling - for slot milling - for pre-boring	✓	✓	✓	✓	✓	✓	✓
Applicable for roughing	✓	✓	✓	✓	✓	✓	✓
Applicable for finishing	✓	✓	✓	✓	✓		✓
Internal twisted cooling channels → coolant discharge on the front surface → optimal cooling → benefit to chip flow						✓	
Suitable for creating concave edge radii and contours							✓
Offers extremely stable, low-vibration cutting behavior during roughing operations, even at highest removal rates		✓	✓	✓	✓	✓	
In finishing operations, it delivers excellent surface quality		✓	✓	✓	✓		
Holding fixture made to DIN 6535-HA → compatible with collet chucks and hydro clamp chucks → also suitable for shrinking → subsequent application of Weldon clamping flats starting from diam.6 mm is possible	✓	✓	✓	✓	✓		✓
Holding fixture made to DIN 6535-HB → clamping in a Weldon holder is mandatory!						✓	
Neck relief → increased working length up to DIN-clamping length	✓	✓	✓	✓	✓	✓	✓

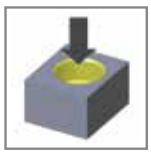
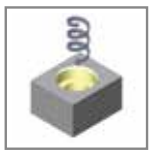
Solid carbide end mills for the machining of aluminium

Characteristics	VHM 209	VHM 309	VHM 309 R	VHM 389	VHM 389 R	VHM 308W	VHM 229
Differential tooth pitch → extremely smooth running also for slot milling operations		✓	✓	✓	✓	✓	
Dynamic spiral angle → extremely smooth running also with max. depth of cut		✓	✓	✓	✓	✓	
Optimized chip space → stable tool core → generously carried out chip spaces	✓	✓	✓	✓	✓		✓
Polished chip-forming geometry → improved chip flow → prevention of built-up edge formation	✓						✓
Optimized macro geometry → high cutting volume	✓	✓	✓	✓	✓	✓	✓
Optimized micro geometry → highest tool live	✓	✓	✓	✓	✓	✓	✓
Quality	MK10	AL05	AL05	AL05	AL05	AL05	MK10
Finest grain carbide, Iso-field K05-K10 for highest wearing quality	✓	✓	✓	✓	✓	✓	✓
Coating → low friction coefficient → prevention of gluing and build-up material → optimal chip flow → high cutting parameters → high protection against wearing		✓	✓	✓	✓	✓	
Reconditioning of the tools is possible → Hhgh cost-benefit ratio	✓ ø6-ø20	✓ ø4-ø20	✓ ø6-ø20	✓ ø6-ø20	✓ ø6-ø16	✓ ø8-ø25	✓ ø6-ø20



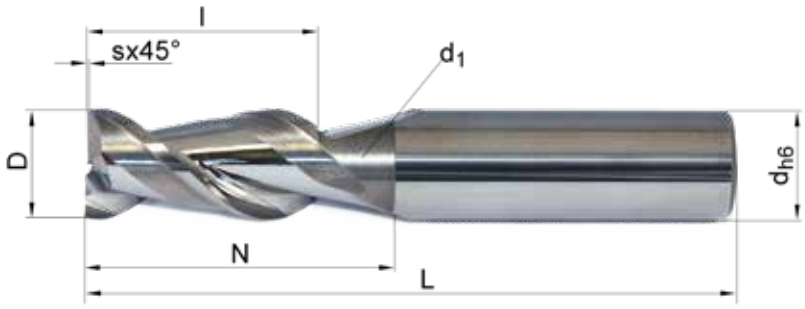
VHM 209 - Technical data

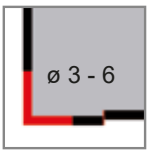
ALU

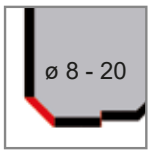


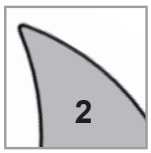


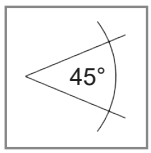
Tolerance D

ø3,0-20,0= $^{-0,02}_{-0,04}$







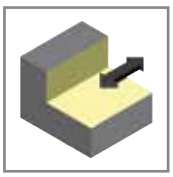


DIN 6535-HA

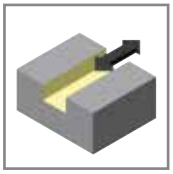
Order-No.	Article	D	s	l	N	d_1	d	L	Z
VA209M03A-MK10	**VHM 209-03 MK10**	3	-	6	21	2,7	3	38,5	2
VA209M04A-MK10	**VHM 209-04 MK10**	4	-	8	25	3,7	4	50,0	2
VA209M05A-MK10	**VHM 209-05 MK10**	5	-	10	25	4,6	5	50,0	2
VA209M06A-MK10	**VHM 209-06 MK10**	6	-	12	27	5,5	6	58,0	2
VA209M08A-MK10	**VHM 209-08 MK10**	8	0,2 x 45°	16	28	7,5	8	64,0	2
VA209M10A-MK10	**VHM 209-10 MK10**	10	0,2 x 45°	21	32	9,4	10	73,5	2
VA209M12A-MK10	**VHM 209-12 MK10**	12	0,2 x 45°	24	37	11,4	12	84,0	2
VA209M16A-MK10	**VHM 209-16 MK10**	16	0,2 x 45°	33	44	15,0	16	93,0	2
VA209M20A-MK10	**VHM 209-20 MK10**	20	0,3 x 45°	41	54	19,0	20	104,0	2

Key to symbols see page 19

VHM 209 - Cutting data recommendation

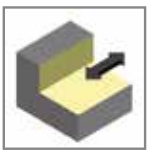
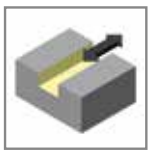


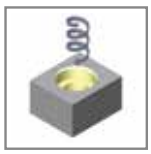
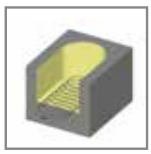
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	3	500 (460-560)	0,055 (0,030-0,070)	5,0	1,2	53.050	5.835	37,8
	4	500 (460-560)	0,055 (0,030-0,070)	7,0	1,6	39.790	4.375	50,4
	5	500 (460-560)	0,090 (0,070-0,110)	9,0	2,0	31.830	5.730	103,1
	6	500 (460-560)	0,090 (0,070-0,120)	11,0	2,4	26.530	4.775	123,8
	8	500 (460-560)	0,090 (0,070-0,130)	14,0	3,2	19.890	3.580	165,0
	10	500 (460-560)	0,110 (0,090-0,130)	18,0	4,0	15.920	3.500	252,0
	12	500 (460-560)	0,110 (0,090-0,130)	22,0	4,8	13.260	2.915	302,2
	16	500 (460-560)	0,145 (0,120-0,160)	29,0	6,4	9.950	2.885	531,8
	20	500 (460-560)	0,190 (0,170-0,210)	36,0	8,0	7.960	3.025	871,2
Aluminium short chipping >6% Si	3	480 (400-520)	0,055 (0,030-0,070)	5,0	1,2	50.930	5.600	36,3
	4	480 (400-520)	0,055 (0,030-0,070)	7,0	1,6	38.200	4.200	48,4
	5	480 (400-520)	0,090 (0,070-0,110)	9,0	2,0	30.560	5.500	99,0
	6	480 (400-520)	0,090 (0,070-0,120)	11,0	2,4	25.460	4.585	118,8
	8	480 (400-520)	0,090 (0,070-0,130)	14,0	3,2	19.100	3.440	158,5
	10	480 (400-520)	0,110 (0,090-0,130)	18,0	4,0	15.280	3.360	241,9
	12	480 (400-520)	0,110 (0,090-0,130)	22,0	4,8	12.730	2.800	290,3
	16	480 (460-560)	0,145 (0,120-0,160)	29,0	6,4	9.550	2.770	510,6
	20	480 (460-560)	0,190 (0,170-0,210)	36,0	8,0	7.640	2.905	836,6
Cast aluminium >10% Si	3	250 (200-300)	0,055 (0,030-0,070)	5,0	1,2	26.530	2.920	18,9
	4	250 (200-300)	0,055 (0,030-0,070)	7,0	1,6	19.890	2.190	25,2
	5	250 (200-300)	0,090 (0,070-0,110)	9,0	2,0	15.920	2.865	51,6
	6	250 (200-300)	0,090 (0,070-0,120)	11,0	2,4	13.260	2.385	61,8
	8	250 (200-300)	0,090 (0,070-0,130)	14,0	3,2	9.950	1.790	82,5
	10	250 (200-300)	0,110 (0,090-0,130)	18,0	4,0	7.960	1.750	126,0
	12	250 (200-300)	0,110 (0,090-0,130)	22,0	4,8	6.630	1.460	151,4
	16	250 (200-300)	0,145 (0,120-0,160)	29,0	6,4	4.970	1.440	265,4
	20	250 (200-300)	0,190 (0,170-0,210)	36,0	8,0	3.980	1.510	434,9
CuZn alloys	3	270 (230-300)	0,055 (0,030-0,070)	5,0	1,2	28.650	3.150	20,4
	4	270 (230-300)	0,055 (0,030-0,070)	7,0	1,6	21.490	2.365	27,2
	5	270 (230-300)	0,090 (0,070-0,110)	9,0	2,0	17.190	3.095	55,7
	6	270 (230-300)	0,090 (0,070-0,120)	11,0	2,4	14.320	2.580	66,9
	8	270 (230-300)	0,090 (0,070-0,130)	14,0	3,2	10.740	1.935	89,2
	10	270 (230-300)	0,110 (0,090-0,130)	18,0	4,0	8.590	1.890	136,1
	12	270 (230-300)	0,110 (0,090-0,130)	22,0	4,8	7.160	1.575	163,3
	16	270 (230-300)	0,145 (0,120-0,160)	29,0	6,4	5.370	1.555	286,6
	20	270 (230-300)	0,190 (0,170-0,210)	36,0	8,0	4.300	1.635	470,9
Thermoplastics	3	1.200 (1.100-1.300)	0,055 (0,030-0,070)	5,0	1,2	127.320	14.005	90,8
	4	1.200 (1.100-1.300)	0,055 (0,030-0,070)	7,0	1,6	95.490	10.505	121,0
	5	1.200 (1.100-1.300)	0,090 (0,070-0,110)	9,0	2,0	76.390	13.750	247,5
	6	1.200 (1.100-1.300)	0,090 (0,070-0,120)	11,0	2,4	63.660	11.460	297,0
	8	1.200 (1.100-1.300)	0,090 (0,070-0,130)	14,0	3,2	47.750	8.595	396,1
	10	1.200 (1.100-1.300)	0,110 (0,090-0,130)	18,0	4,0	38.200	8.405	605,2
	12	1.200 (1.100-1.300)	0,110 (0,090-0,130)	22,0	4,8	31.830	7.005	726,3
	16	1.200 (1.100-1.300)	0,145 (0,120-0,160)	29,0	6,4	23.870	6.920	1.275,5
	20	1.200 (1.100-1.300)	0,190 (0,170-0,210)	36,0	8,0	19.100	7.260	2.090,9



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	3	500 (460-560)	0,035 (0,020-0,050)	3,0	3,0	53.050	3.715	33,4
	4	500 (460-560)	0,035 (0,020-0,050)	4,0	4,0	39.790	2.785	44,6
	5	500 (460-560)	0,060 (0,045-0,075)	5,0	5,0	31.830	3.820	95,5
	6	500 (460-560)	0,060 (0,045-0,075)	6,0	6,0	26.530	3.185	114,7
	8	500 (460-560)	0,060 (0,045-0,075)	8,0	8,0	19.890	2.385	152,6
	10	500 (460-560)	0,070 (0,055-0,085)	10,0	10,0	15.920	2.230	223,0
	12	500 (460-560)	0,070 (0,055-0,085)	12,0	12,0	13.260	1.855	267,1
	16	500 (460-560)	0,090 (0,075-0,110)	16,0	16,0	9.950	1.790	458,2
	20	500 (460-560)	0,120 (0,100-0,140)	20,0	20,0	7.960	1.910	764,0
Aluminium short chipping >6% Si	3	480 (400-520)	0,035 (0,020-0,050)	3,0	3,0	50.930	3.565	32,1
	4	480 (400-520)	0,035 (0,020-0,050)	4,0	4,0	38.200	2.675	42,8
	5	480 (400-520)	0,060 (0,045-0,075)	5,0	5,0	30.560	3.665	91,6
	6	480 (400-520)	0,060 (0,045-0,075)	6,0	6,0	25.460	3.055	110,0
	8	480 (400-520)	0,060 (0,045-0,075)	8,0	8,0	19.100	2.290	146,6
	10	480 (400-520)	0,070 (0,055-0,085)	10,0	10,0	15.280	2.140	214,0
	12	480 (400-520)	0,070 (0,055-0,085)	12,0	12,0	12.730	1.780	256,3
	16	500 (460-560)	0,090 (0,075-0,110)	16,0	16,0	9.950	1.790	458,2
	20	500 (460-560)	0,120 (0,100-0,140)	20,0	20,0	7.960	1.910	764,0
Cast aluminium >10% Si	3	250 (200-300)	0,035 (0,020-0,050)	3,0	3,0	26.530	1.855	16,7
	4	250 (200-300)	0,035 (0,020-0,050)	4,0	4,0	19.890	1.390	22,2
	5	250 (200-300)	0,060 (0,045-0,075)	5,0	5,0	15.920	1.910	47,8
	6	250 (200-300)	0,060 (0,045-0,075)	6,0	6,0	13.260	1.590	57,2
	8	250 (200-300)	0,060 (0,045-0,075)	8,0	8,0	9.950	1.195	76,5
	10	250 (200-300)	0,070 (0,055-0,085)	10,0	10,0	7.960	1.115	111,5
	12	250 (200-300)	0,070 (0,055-0,085)	12,0	12,0	6.630	930	133,9
	16	250 (200-300)	0,090 (0,075-0,110)	16,0	16,0	4.970	895	229,1
	20	250 (200-300)	0,120 (0,100-0,140)	20,0	20,0	3.980	955	382,0
CuZn alloys	3	270 (230-300)	0,035 (0,020-0,050)	3,0	3,0	28.650	2.005	18,0
	4	270 (230-300)	0,035 (0,020-0,050)	4,0	4,0	21.490	1.505	24,1
	5	270 (230-300)	0,060 (0,045-0,075)	5,0	5,0	17.190	2.065	51,6
	6	270 (230-300)	0,060 (0,045-0,075)	6,0	6,0	14.320	1.720	61,9
	8	270 (230-300)	0,060 (0,045-0,075)	8,0	8,0	10.740	1.290	82,6
	10	270 (230-300)	0,070 (0,055-0,085)	10,0	10,0	8.590	1.205	120,5
	12	270 (230-300)	0,070 (0,055-0,085)	12,0	12,0	7.160	1.000	144,0
	16	270 (230-300)	0,090 (0,075-0,110)	16,0	16,0	5.370	965	247,0
	20	270 (230-300)	0,120 (0,100-0,140)	20,0	20,0	4.300	1.030	412,0
Thermoplastics	3	1.200 (1.100-1.300)	0,035 (0,020-0,050)	3,0	3,0	127.320	8.910	80,2
	4	1.200 (1.100-1.300)	0,035 (0,020-0,050)	4,0	4,0	95.490	6.685	107,0
	5	1.200 (1.100-1.300)	0,060 (0,045-0,075)	5,0	5,0	76.390	9.165	229,1
	6	1.200 (1.100-1.300)	0,060 (0,045-0,075)	6,0	6,0	63.660	7.640	275,0
	8	1.200 (1.100-1.300)	0,060 (0,045-0,075)	8,0	8,0	47.750	5.730	366,7
	10	1.200 (1.100-1.300)	0,070 (0,055-0,085)	10,0	10,0	38.200	5.350	535,0
	12	1.200 (1.100-1.300)	0,070 (0,055-0,085)	12,0	12,0	31.830	4.455	641,5
	16	1.200 (1.100-1.300)	0,090 (0,075-0,110)	16,0	16,0	23.870	4.295	1.099,5
	20	1.200 (1.100-1.300)	0,120 (0,100-0,140)	20,0	20,0	19.100	4.585	1.834,0

VHM 309 - Technical data

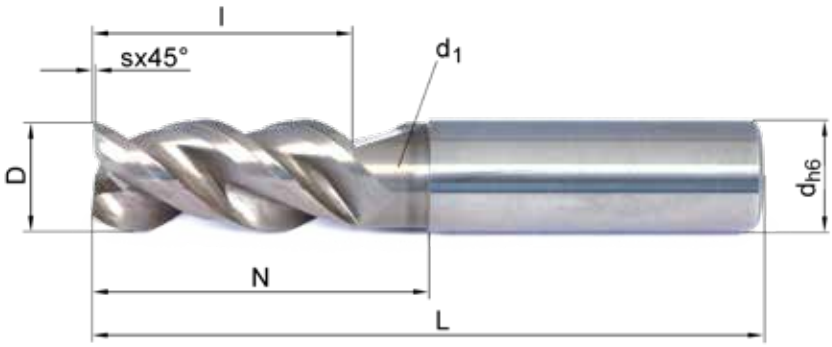



ALU

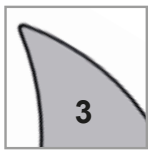


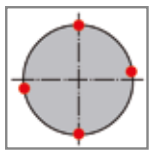
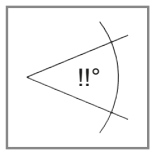




Tolerance D

ø3,0-20,0= $^{-0,02}_{-0,05}$

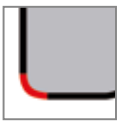





DIN 6535-HA

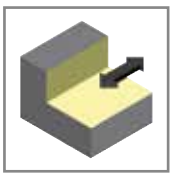
Order-No.	Article	D	s	l	N	d_1	d	L	Z
VA309M03A-AL05	**VHM 309-03 AL05**	3	0,10 x 45°	8	12	2,7	6	58,0	3
VA309M04A-AL05	**VHM 309-04 AL05**	4	0,10 x 45°	11	18	3,7	6	58,0	3
VA309M05A-AL05	**VHM 309-05 AL05**	5	0,10 x 45°	13	18	4,7	6	58,0	3
VA309M06A-AL05	**VHM 309-06 AL05**	6	0,10 x 45°	13	19	5,7	6	58,0	3
VA309M08A-AL05	**VHM 309-08 AL05**	8	0,15 x 45°	21	26	7,4	8	64,0	3
VA309M10A-AL05	**VHM 309-10 AL05**	10	0,15 x 45°	22	30	9,2	10	73,5	3
VA309M12A-AL05	**VHM 309-12 AL05**	12	0,20 x 45°	26	36	11,0	12	84,0	3
VA309M16A-AL05	**VHM 309-16 AL05**	16	0,20 x 45°	36	47	15,0	16	93,0	3
VA309M20A-AL05	**VHM 309-20 AL05**	20	0,25 x 45°	42	54	19,0	20	104,0	3



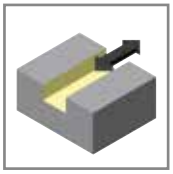
VHM 309 R AL05 ⇒ Page 8

Key to symbols see page 19

VHM 309 - Cutting data recommendation

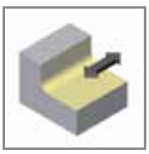
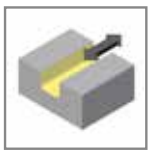
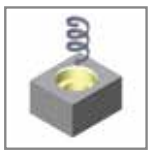


Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm³/min]
Aluminium long chipping	3	500 (460-560)	0,06 (0,040-0,080)	5,0	1,2	53.050	9.550	61,9
	4	500 (460-560)	0,06 (0,040-0,080)	7,0	1,6	39.790	7.160	82,5
	5	500 (460-560)	0,09 (0,070-0,100)	9,0	2,0	31.830	8.595	154,7
	6	500 (460-560)	0,10 (0,080-0,120)	11,0	2,4	26.530	7.960	206,3
	8	500 (460-560)	0,10 (0,080-0,120)	14,0	3,2	19.890	5.965	274,9
	10	500 (460-560)	0,11 (0,090-0,130)	18,0	4,0	15.920	5.255	378,4
	12	500 (460-560)	0,11 (0,090-0,130)	22,0	4,8	13.260	4.375	453,6
	16	500 (460-560)	0,13 (0,110-0,150)	29,0	6,4	9.950	3.880	715,2
	20	500 (460-560)	0,16 (0,140-0,180)	36,0	8,0	7.960	3.820	1.100,2
Aluminium short chipping >6% Si	3	480 (400-520)	0,06 (0,040-0,080)	5,0	1,2	50.930	9.165	59,4
	4	480 (400-520)	0,06 (0,040-0,080)	7,0	1,6	38.200	6.875	79,2
	5	480 (400-520)	0,09 (0,070-0,100)	9,0	2,0	30.560	8.250	148,5
	6	480 (400-520)	0,10 (0,080-0,120)	11,0	2,4	25.460	7.640	198,0
	8	480 (400-520)	0,10 (0,080-0,120)	14,0	3,2	19.100	5.730	264,0
	10	480 (400-520)	0,10 (0,080-0,120)	18,0	4,0	15.280	4.585	330,1
	12	480 (400-520)	0,10 (0,080-0,120)	22,0	4,8	12.730	3.820	396,1
	16	480 (460-560)	0,13 (0,110-0,150)	29,0	6,4	9.550	3.725	686,6
	20	480 (460-560)	0,22 (0,200-0,240)	36,0	8,0	7.640	5.040	1.451,5
Cast aluminium >10% Si	3	250 (200-300)	0,06 (0,040-0,080)	5,0	1,2	26.530	4.775	30,9
	4	250 (200-300)	0,06 (0,040-0,080)	7,0	1,6	19.890	3.580	41,2
	5	250 (200-300)	0,08 (0,080-0,120)	9,0	2,0	15.920	3.820	68,8
	6	250 (200-300)	0,09 (0,070-0,110)	11,0	2,4	13.260	3.580	92,8
	8	250 (200-300)	0,09 (0,070-0,110)	14,0	3,2	9.950	2.685	123,7
	10	250 (200-300)	0,09 (0,070-0,110)	18,0	4,0	7.960	2.150	154,8
	12	250 (200-300)	0,09 (0,070-0,110)	22,0	4,8	6.630	1.790	185,6
	16	250 (200-300)	0,15 (0,130-0,170)	29,0	6,4	4.970	2.235	412,0
	20	250 (200-300)	0,20 (0,180-0,220)	36,0	8,0	3.980	2.390	688,3
CuZn alloys	3	270 (230-300)	0,05 (0,040-0,080)	5,0	1,2	28.650	4.300	27,9
	4	270 (230-300)	0,05 (0,040-0,080)	7,0	1,6	21.490	3.225	37,2
	5	270 (230-300)	0,08 (0,070-0,100)	9,0	2,0	17.190	4.125	74,3
	6	270 (230-300)	0,08 (0,080-0,120)	11,0	2,4	14.320	3.435	89,0
	8	270 (230-300)	0,08 (0,080-0,120)	14,0	3,2	10.740	2.580	118,9
	10	270 (230-300)	0,08 (0,090-0,130)	18,0	4,0	8.590	2.060	148,3
	12	270 (230-300)	0,08 (0,090-0,130)	22,0	4,8	7.160	1.720	178,3
	16	270 (230-300)	0,12 (0,110-0,150)	29,0	6,4	5.370	1.935	356,7
	20	270 (230-300)	0,16 (0,140-0,180)	36,0	8,0	4.300	2.065	594,7



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm³/min]
Aluminium long chipping	3	500 (460-560)	0,05 (0,020-0,050)	3,0	3,0	53.050	7.960	71,6
	4	500 (460-560)	0,05 (0,020-0,050)	4,0	4,0	39.790	5.970	95,5
	5	500 (460-560)	0,07 (0,045-0,075)	5,0	5,0	31.830	6.685	167,1
	6	500 (460-560)	0,08 (0,045-0,075)	6,0	6,0	26.530	6.365	229,1
	8	500 (460-560)	0,08 (0,045-0,075)	8,0	8,0	19.890	4.775	305,6
	10	500 (460-560)	0,09 (0,055-0,085)	10,0	10,0	15.920	4.300	430,0
	12	500 (460-560)	0,09 (0,055-0,085)	12,0	12,0	13.260	3.580	515,5
	16	500 (460-560)	0,11 (0,075-0,110)	16,0	16,0	9.950	3.285	841,0
	20	500 (460-560)	0,14 (0,100-0,140)	20,0	20,0	7.960	3.345	1.338,0
Aluminium short chipping >6% Si	3	480 (400-520)	0,05 (0,030-0,070)	3,0	3,0	50.930	7.640	68,8
	4	480 (400-520)	0,05 (0,030-0,070)	4,0	4,0	38.200	5.730	91,7
	5	480 (400-520)	0,07 (0,050-0,090)	5,0	5,0	30.560	6.420	160,5
	6	480 (400-520)	0,08 (0,060-0,100)	6,0	6,0	25.460	6.110	220,0
	8	480 (400-520)	0,08 (0,060-0,100)	8,0	8,0	19.100	4.585	293,4
	10	480 (400-520)	0,08 (0,060-0,100)	10,0	10,0	15.280	3.665	366,5
	12	480 (400-520)	0,08 (0,060-0,100)	12,0	12,0	12.730	3.055	439,9
	16	500 (460-560)	0,11 (0,090-0,130)	16,0	16,0	9.950	3.285	841,0
	20	500 (460-560)	0,18 (0,160-0,200)	20,0	20,0	7.960	4.300	1.720,0
Cast aluminium >10% Si	3	250 (200-300)	0,05 (0,030-0,070)	3,0	3,0	26.530	3.980	35,8
	4	250 (200-300)	0,05 (0,030-0,070)	4,0	4,0	19.890	2.985	47,8
	5	250 (200-300)	0,06 (0,040-0,080)	5,0	5,0	15.920	2.865	71,6
	6	250 (200-300)	0,07 (0,050-0,090)	6,0	6,0	13.260	2.785	100,3
	8	250 (200-300)	0,07 (0,050-0,090)	8,0	8,0	9.950	2.090	133,8
	10	250 (200-300)	0,07 (0,050-0,090)	10,0	10,0	7.960	1.670	167,0
	12	250 (200-300)	0,07 (0,050-0,090)	12,0	12,0	6.630	1.390	200,2
	16	250 (200-300)	0,14 (0,120-0,160)	16,0	16,0	4.970	2.085	533,8
	20	250 (200-300)	0,18 (0,160-0,200)	20,0	20,0	3.980	2.150	860,0
CuZn alloys	3	270 (230-300)	0,04 (0,020-0,060)	3,0	3,0	28.650	3.440	31,0
	4	270 (230-300)	0,04 (0,020-0,060)	4,0	4,0	21.490	2.580	41,3
	5	270 (230-300)	0,06 (0,040-0,080)	5,0	5,0	17.190	3.095	77,4
	6	270 (230-300)	0,06 (0,040-0,080)	6,0	6,0	14.320	2.580	92,9
	8	270 (230-300)	0,06 (0,040-0,080)	8,0	8,0	10.740	1.935	123,8
	10	270 (230-300)	0,06 (0,040-0,080)	10,0	10,0	8.590	1.545	154,5
	12	270 (230-300)	0,06 (0,040-0,080)	12,0	12,0	7.160	1.290	185,8
	16	270 (230-300)	0,10 (0,080-0,120)	16,0	16,0	5.370	1.610	412,2
	20	270 (230-300)	0,14 (0,120-0,160)	20,0	20,0	4.300	1.805	722,0

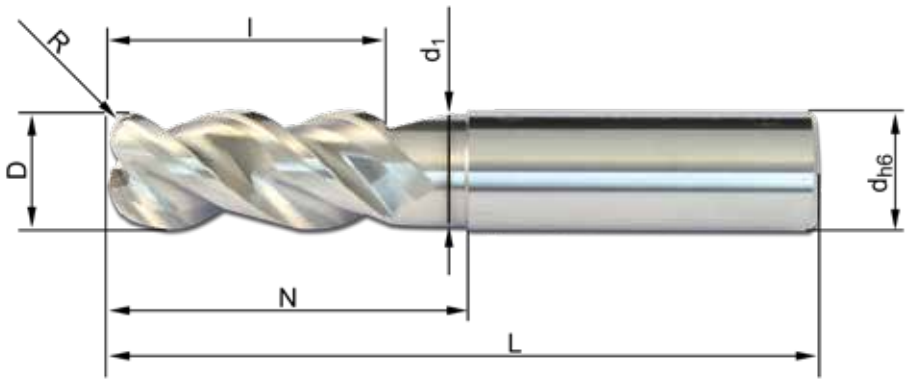
VHM 309 R - Technical data

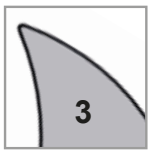
ALU

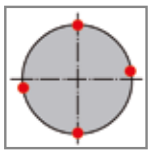
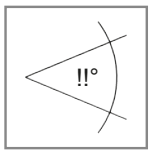






Tolerance D
ø1,0-20,0= $^{-0,02}_{-0,05}$
Tolerance R
ø1,0-20,0= $^{+0,025}_{-0,025}$

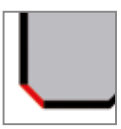





DIN 6535-HA

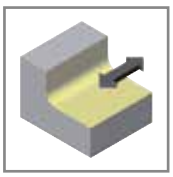
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VA309M02R02A-AL05	**VHM 309-02 R02 AL05**	2	0,2	6	6	-	6	58	3
VA309M03R03A-AL05	**VHM 309-03 R03 AL05**	3	0,3	8	12	2,7	6	58	3
VA309M04R04A-AL05	**VHM 309-04 R04 AL05**	4	0,4	11	18	3,7	6	58	3
VA309M05R05A-AL05	**VHM 309-05 R05 AL05**	5	0,5	13	18	4,7	6	58	3
VA309M06R05A-AL05	**VHM 309-06 R05 AL05**	6	0,5	13	19	5,7	6	58	3
VA309M06R10A-AL05	**VHM 309-06 R10 AL05**	6	1,0	13	19	5,7	6	58	3
VA309M08R10A-AL05	**VHM 309-08 R10 AL05**	8	1,0	21	26	7,4	8	64	3
VA309M08R15A-AL05	**VHM 309-08 R15 AL05**	8	1,5	21	26	7,4	8	64	3
VA309M08R20A-AL05	**VHM 309-08 R20 AL05**	8	2,0	21	26	7,4	8	64	3
VA309M10R10A-AL05	**VHM 309-10 R10 AL05**	10	1,0	22	30	9,2	10	73	3
VA309M10R15A-AL05	**VHM 309-10 R15 AL05**	10	1,5	22	30	9,2	10	73	3
VA309M10R20A-AL05	**VHM 309-10 R20 AL05**	10	2,0	22	30	9,2	10	73	3
VA309M12R10A-AL05	**VHM 309-12 R10 AL05**	12	1,0	26	36	11,0	12	84	3
VA309M12R15A-AL05	**VHM 309-12 R15 AL05**	12	1,5	26	36	11,0	12	84	3
VA309M12R20A-AL05	**VHM 309-12 R20 AL05**	12	2,0	26	36	11,0	12	84	3
VA309M12R25A-AL05	**VHM 309-12 R25 AL05**	12	2,5	26	36	11,0	12	84	3
VA309M16R10A-AL05	**VHM 309-16 R10 AL05**	16	1,0	36	47	15,0	16	93	3
VA309M16R20A-AL05	**VHM 309-16 R20 AL05**	16	2,0	36	47	15,0	16	93	3
VA309M16R25A-AL05	**VHM 309-16 R25 AL05**	16	2,5	36	47	15,0	16	93	3
VA309M16R30A-AL05	**VHM 309-16 R30 AL05**	16	3,0	36	47	15,0	16	93	3
VA309M16R40A-AL05	**VHM 309-16 R40 AL05**	16	4,0	36	47	15,0	16	93	3
VA309M20R10A-AL05	**VHM 309-20 R10 AL05**	20	1,0	42	54	19,0	20	104	3
VA309M20R20A-AL05	**VHM 309-20 R20 AL05**	20	2,0	42	54	19,0	20	104	3
VA309M20R25A-AL05	**VHM 309-20 R25 AL05**	20	2,5	42	54	19,0	20	104	3
VA309M20R30A-AL05	**VHM 309-20 R30 AL05**	20	3,0	42	54	19,0	20	104	3
VA309M20R40A-AL05	**VHM 309-20 R40 AL05**	20	4,0	42	54	19,0	20	104	3



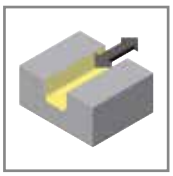
VHM 309 AL05 ⇒ Page 6

Key to symbols see page 19

VHM 309 R - Cutting data recommendation

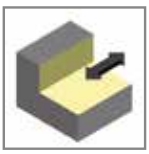
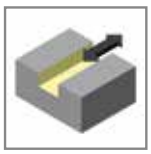


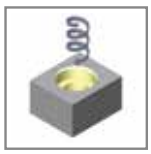
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium langspanend	1	500 (460-560)	0,03 (0,02-0,04)	1,50	0,34	159.000	14.310	7,3
	2	500 (460-560)	0,04 (0,02-0,05)	3,00	0,67	79.000	9.480	19,1
	3	500 (460-560)	0,06 (0,04-0,08)	5,00	1,20	53.050	9.550	61,9
	4	500 (460-560)	0,06 (0,04-0,08)	7,00	1,60	39.790	7.160	82,5
	5	500 (460-560)	0,09 (0,07-0,10)	9,00	2,00	31.830	8.590	154,6
	6	500 (460-560)	0,10 (0,08-0,12)	11,00	2,40	26.530	7.960	206,3
	8	500 (460-560)	0,10 (0,08-0,12)	14,00	3,20	19.890	5.970	275,1
	10	500 (460-560)	0,11 (0,09-0,13)	18,00	4,00	15.920	5.250	378,0
	12	500 (460-560)	0,11 (0,09-0,13)	22,00	4,80	13.260	4.380	454,1
	16	500 (460-560)	0,13 (0,11-0,15)	29,00	6,40	9.950	3.880	715,2
	20	500 (460-560)	0,16 (0,14-0,18)	36,00	8,00	7.960	3.820	1.100,2
Aluminium short chipping >6% Si	1	480 (400-520)	0,03 (0,02-0,04)	1,50	0,34	152.000	13.680	7,0
	2	480 (400-520)	0,04 (0,02-0,05)	3,00	0,67	76.000	9.120	18,3
	3	480 (400-520)	0,06 (0,04-0,08)	5,00	1,20	50.930	9.170	59,4
	4	480 (400-520)	0,06 (0,04-0,08)	7,00	1,60	38.200	6.880	79,3
	5	480 (400-520)	0,09 (0,07-0,10)	9,00	2,00	30.560	8.250	148,5
	6	480 (400-520)	0,10 (0,08-0,12)	11,00	2,40	25.460	7.640	198,0
	8	480 (400-520)	0,10 (0,08-0,12)	14,00	3,20	19.100	5.730	264,0
	10	480 (400-520)	0,10 (0,08-0,12)	18,00	4,00	15.280	4.580	329,8
	12	480 (400-520)	0,10 (0,08-0,12)	22,00	4,80	12.730	3.820	396,1
	16	480 (460-560)	0,13 (0,11-0,15)	29,00	6,40	9.550	3.720	685,7
	20	480 (460-560)	0,22 (0,20-0,24)	36,00	8,00	7.640	5.040	1.451,5
Cast aluminium >10% Si	1	250 (200-300)	0,03 (0,02-0,04)	1,50	0,34	79.000	7.110	3,6
	2	250 (200-300)	0,04 (0,02-0,05)	3,00	0,67	39.000	4.680	9,4
	3	250 (200-300)	0,06 (0,04-0,08)	5,00	1,20	26.530	4.780	31,0
	4	250 (200-300)	0,06 (0,04-0,08)	7,00	1,60	19.890	3.580	41,2
	5	250 (200-300)	0,08 (0,08-0,12)	9,00	2,00	15.920	3.820	68,8
	6	250 (200-300)	0,09 (0,07-0,11)	11,00	2,40	13.260	3.580	92,8
	8	250 (200-300)	0,09 (0,07-0,11)	14,00	3,20	9.950	2.690	124,0
	10	250 (200-300)	0,09 (0,07-0,11)	18,00	4,00	7.960	2.150	154,8
	12	250 (200-300)	0,09 (0,07-0,11)	22,00	4,80	6.630	1.790	185,6
	16	250 (200-300)	0,15 (0,13-0,17)	29,00	6,40	4.970	2.240	412,9
	20	250 (200-300)	0,20 (0,18-0,22)	36,00	8,00	3.980	2.390	688,3
CuZn alloys	1	270 (230-300)	0,02 (0,01-0,03)	1,50	0,34	85.000	5.100	2,6
	2	270 (230-300)	0,03 (0,02-0,04)	3,00	0,67	42.000	3.780	7,6
	3	270 (230-300)	0,05 (0,04-0,08)	5,00	1,20	28.650	4.300	27,9
	4	270 (230-300)	0,05 (0,04-0,08)	7,00	1,60	21.490	3.220	37,1
	5	270 (230-300)	0,08 (0,07-0,10)	9,00	2,00	17.190	4.130	74,3
	6	270 (230-300)	0,08 (0,08-0,12)	11,00	2,40	14.320	3.440	89,2
	8	270 (230-300)	0,08 (0,08-0,12)	14,00	3,20	10.740	2.580	118,9
	10	270 (230-300)	0,08 (0,09-0,13)	18,00	4,00	8.590	2.060	148,3
	12	270 (230-300)	0,08 (0,09-0,13)	22,00	4,80	7.160	1.720	178,3
	16	270 (230-300)	0,12 (0,11-0,15)	29,00	6,40	5.370	1.930	355,7
	20	270 (230-300)	0,16 (0,14-0,18)	36,00	8,00	4.300	2.060	593,3



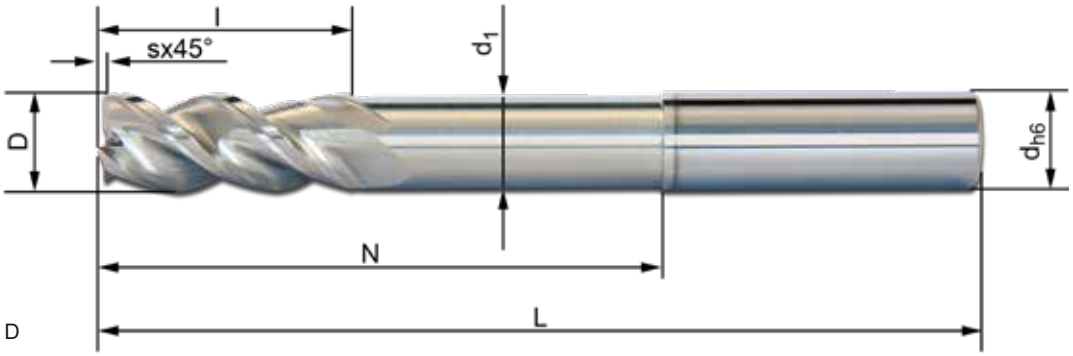
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium langspanend	1	500 (460-560)	0,03 (0,02-0,04)	0,7	1,0	159.154	14.323	10,0
	2	500 (460-560)	0,04 (0,02-0,05)	1,5	2,0	79.577	9.549	28,6
	3	500 (460-560)	0,05 (0,02-0,05)	3,0	3,0	53.050	7.960	71,6
	4	500 (460-560)	0,05 (0,02-0,05)	4,0	4,0	39.790	5.970	95,5
	5	500 (460-560)	0,07 (0,045-0,075)	5,0	5,0	31.830	6.680	167,0
	6	500 (460-560)	0,08 (0,045-0,075)	6,0	6,0	26.530	6.370	229,3
	8	500 (460-560)	0,08 (0,045-0,075)	8,0	8,0	19.890	4.770	305,3
	10	500 (460-560)	0,09 (0,055-0,085)	10,0	10,0	15.920	4.300	430,0
	12	500 (460-560)	0,09 (0,055-0,085)	12,0	12,0	13.260	3.580	515,5
	16	500 (460-560)	0,11 (0,075-0,11)	16,0	16,0	9.950	3.280	839,7
	20	500 (460-560)	0,14 (0,10-0,14)	20,0	20,0	7.960	3.340	1.336,0
Aluminium short chipping >6% Si	1	480 (400-520)	0,03 (0,02-0,04)	0,7	1,0	152.000	13.680	9,6
	2	480 (400-520)	0,04 (0,02-0,05)	1,5	2,0	76.000	9.120	27,4
	3	480 (400-520)	0,05 (0,03-0,07)	3,0	3,0	50.930	7.640	68,8
	4	480 (400-520)	0,05 (0,03-0,07)	4,0	4,0	38.200	5.730	91,7
	5	480 (400-520)	0,07 (0,05-0,09)	5,0	5,0	30.560	6.420	160,5
	6	480 (400-520)	0,08 (0,06-0,10)	6,0	6,0	25.460	6.110	220,0
	8	480 (400-520)	0,08 (0,06-0,10)	8,0	8,0	19.100	4.580	293,1
	10	480 (400-520)	0,08 (0,06-0,10)	10,0	10,0	15.280	3.670	367,0
	12	480 (400-520)	0,08 (0,06-0,10)	12,0	12,0	12.730	3.060	440,6
	16	500 (460-560)	0,11 (0,09-0,13)	16,0	16,0	9.950	3.280	839,7
	20	500 (460-560)	0,18 (0,16-0,20)	20,0	20,0	7.960	4.300	1.720,0
Cast aluminium >10% Si	1	250 (200-300)	0,03 (0,02-0,04)	0,7	1,0	79.000	7.110	5,0
	2	250 (200-300)	0,04 (0,02-0,05)	1,5	2,0	39.000	4.680	14,0
	3	250 (200-300)	0,05 (0,03-0,07)	3,0	3,0	26.530	3.980	35,8
	4	250 (200-300)	0,05 (0,03-0,07)	4,0	4,0	19.890	2.980	47,7
	5	250 (200-300)	0,06 (0,04-0,08)	5,0	5,0	15.920	2.870	71,8
	6	250 (200-300)	0,07 (0,05-0,09)	6,0	6,0	13.260	2.780	100,1
	8	250 (200-300)	0,07 (0,05-0,09)	8,0	8,0	9.950	2.090	133,8
	10	250 (200-300)	0,07 (0,05-0,09)	10,0	10,0	7.960	1.670	167,0
	12	250 (200-300)	0,07 (0,05-0,09)	12,0	12,0	6.630	1.390	200,2
	16	250 (200-300)	0,14 (0,12-0,16)	16,0	16,0	4.970	2.090	535,0
	20	250 (200-300)	0,18 (0,16-0,20)	20,0	20,0	3.980	2.150	860,0
CuZn alloys	1	270 (230-300)	0,02 (0,01-0,03)	0,7	1,0	85.000	5.100	3,6
	2	270 (230-300)	0,03 (0,02-0,04)	1,5	2,0	42.000	3.780	11,3
	3	270 (230-300)	0,04 (0,02-0,06)	3,0	3,0	28.650	3.440	31,0
	4	270 (230-300)	0,04 (0,02-0,06)	4,0	4,0	21.490	2.580	41,3
	5	270 (230-300)	0,06 (0,04-0,08)	5,0	5,0	17.190	3.090	77,3
	6	270 (230-300)	0,06 (0,04-0,08)	6,0	6,0	14.320	2.580	92,9
	8	270 (230-300)	0,06 (0,04-0,08)	8,0	8,0	10.740	1.930	123,5
	10	270 (230-300)	0,06 (0,04-0,08)	10,0	10,0	8.590	1.550	155,0
	12	270 (230-300)	0,06 (0,04-0,08)	12,0	12,0	7.160	1.290	185,8
	16	270 (230-300)	0,10 (0,08-0,12)	16,0	16,0	5.370	1.610	412,2
	20	270 (230-300)	0,14 (0,12-0,16)	20,0	20,0	4.300	1.810	724,0

VHM 389 - Technical data



ALU

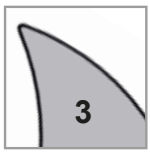


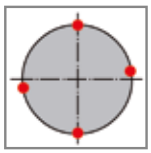
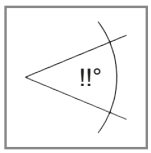




Tolerance D

ø1,0-20,0= $^{-0,02}_{-0,05}$

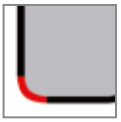





DIN 6535-HA

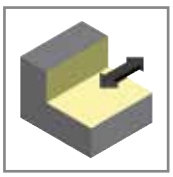
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VA309L01A-AL05	**VHM 389-01 AL05**	1	0,05 x 45°	3	12	0,85	6	73	3
VA309L02A-AL05	**VHM 389-02 AL05**	2	0,05 x 45°	6	23	1,85	6	73	3
VA309L03A-AL05	**VHM 389-03 AL05**	3	0,10 x 45°	9	34	2,70	6	73	3
VA309L04A-AL05	**VHM 389-04 AL05**	4	0,10 x 45°	12	35	3,70	6	73	3
VA309L05A-AL05	**VHM 389-05 AL05**	5	0,10 x 45°	15	35	4,70	6	73	3
VA309L06A-AL05	**VHM 389-06 AL05**	6	0,10 x 45°	18	35	5,70	6	73	3
VA309L08A-AL05	**VHM 389-08 AL05**	8	0,15 x 45°	24	46	7,40	8	84	3
VA309L10A-AL05	**VHM 389-10 AL05**	10	0,15 x 45°	27	51	9,20	10	93	3
VA309L12A-AL05	**VHM 389-12 AL05**	12	0,20 x 45°	33	63	11,00	12	110	3
VA309L16A-AL05	**VHM 389-16 AL05**	16	0,20 x 45°	40	90	15,00	16	140	3
VA309L20A-AL05	**VHM 389-20 AL05**	20	0,25 x 45°	50	90	19,00	20	150	3



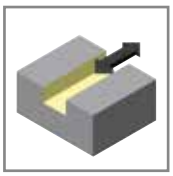
VHM 389 R AL05 ⇒ Page 12

Key to symbols see page 19

VHM 389 - Cutting data recommendation

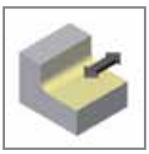
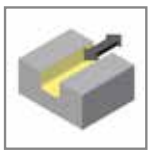


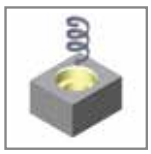
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	1	500 (460-560)	0,03 (0,02-0,04)	1,0	0,34	159.000	14.310	4,9
	2	500 (460-560)	0,04 (0,02-0,05)	2,0	0,67	79.000	9.480	12,7
	3	500 (460-560)	0,06 (0,04-0,08)	8,0	0,60	53.050	9.550	45,8
	4	500 (460-560)	0,06 (0,04-0,08)	11,0	0,80	39.790	7.160	63,0
	5	500 (460-560)	0,09 (0,07-0,10)	14,0	1,00	31.830	8.595	120,3
	6	500 (460-560)	0,10 (0,08-0,12)	17,0	1,20	26.530	7.960	162,4
	8	500 (460-560)	0,10 (0,08-0,12)	23,0	1,60	19.890	5.965	219,5
	10	500 (460-560)	0,11 (0,09-0,13)	26,0	2,00	15.920	5.255	273,3
	12	500 (460-560)	0,11 (0,09-0,13)	32,0	2,40	13.260	4.375	336,0
	16	500 (460-560)	0,13 (0,11-0,15)	39,0	3,20	9.950	3.880	484,2
	20	500 (460-560)	0,16 (0,14-0,18)	49,0	4,00	7.960	3.820	748,7
Aluminium short chipping >6% Si	1	480 (400-520)	0,03 (0,02-0,04)	1,0	0,34	152.000	13.680	4,7
	2	480 (400-520)	0,04 (0,02-0,05)	2,0	0,67	76.000	9.120	12,2
	3	480 (400-520)	0,06 (0,04-0,08)	8,0	0,60	50.930	9.165	44,0
	4	480 (400-520)	0,06 (0,04-0,08)	11,0	0,80	38.200	6.875	60,5
	5	480 (400-520)	0,09 (0,07-0,10)	14,0	1,00	30.560	8.250	115,5
	6	480 (400-520)	0,10 (0,08-0,12)	17,0	1,20	25.460	7.640	155,9
	8	480 (400-520)	0,10 (0,08-0,12)	23,0	1,60	19.100	5.730	210,9
	10	480 (400-520)	0,10 (0,08-0,12)	26,0	2,00	15.280	4.585	238,4
	12	480 (400-520)	0,10 (0,08-0,12)	32,0	2,40	12.730	3.820	293,4
	16	480 (460-560)	0,13 (0,11-0,15)	39,0	3,20	9.550	3.725	464,9
	20	480 (460-560)	0,22 (0,20-0,24)	49,0	4,00	7.640	5.040	987,8
Cast aluminium >10% Si	1	250 (200-300)	0,03 (0,02-0,04)	1,0	0,34	79.000	7.110	2,4
	2	250 (200-300)	0,04 (0,02-0,05)	2,0	0,67	39.000	4.680	6,3
	3	250 (200-300)	0,06 (0,04-0,08)	8,0	0,60	26.530	4.775	22,9
	4	250 (200-300)	0,06 (0,04-0,08)	11,0	0,80	19.890	3.580	31,5
	5	250 (200-300)	0,08 (0,08-0,12)	14,0	1,00	15.920	3.820	53,5
	6	250 (200-300)	0,09 (0,07-0,11)	17,0	1,20	13.260	3.580	73,0
	8	250 (200-300)	0,09 (0,07-0,11)	23,0	1,60	9.950	2.685	98,8
	10	250 (200-300)	0,09 (0,07-0,11)	26,0	2,00	7.960	2.150	111,8
	12	250 (200-300)	0,09 (0,07-0,11)	32,0	2,40	6.630	1.790	137,5
	16	250 (200-300)	0,15 (0,13-0,17)	39,0	3,20	4.970	2.235	278,9
	20	250 (200-300)	0,20 (0,18-0,22)	49,0	4,00	3.980	2.390	468,4
CuZn alloys	1	270 (230-300)	0,03 (0,02-0,04)	1,0	0,34	85.000	7.650	2,6
	2	270 (230-300)	0,03 (0,02-0,05)	2,0	0,67	42.000	3.780	5,1
	3	270 (230-300)	0,05 (0,04-0,08)	8,0	0,60	28.650	4.300	20,6
	4	270 (230-300)	0,05 (0,04-0,08)	11,0	0,80	21.490	3.225	28,4
	5	270 (230-300)	0,08 (0,07-0,10)	14,0	1,00	17.190	4.125	57,8
	6	270 (230-300)	0,08 (0,08-0,12)	17,0	1,20	14.320	3.435	70,1
	8	270 (230-300)	0,08 (0,08-0,12)	23,0	1,60	10.740	2.580	94,9
	10	270 (230-300)	0,08 (0,09-0,13)	26,0	2,00	8.590	2.060	107,1
	12	270 (230-300)	0,08 (0,09-0,13)	32,0	2,40	7.160	1.720	132,1
	16	270 (230-300)	0,12 (0,11-0,15)	39,0	3,20	5.370	1.935	241,5
	20	270 (230-300)	0,16 (0,14-0,18)	49,0	4,00	4.300	2.065	404,7



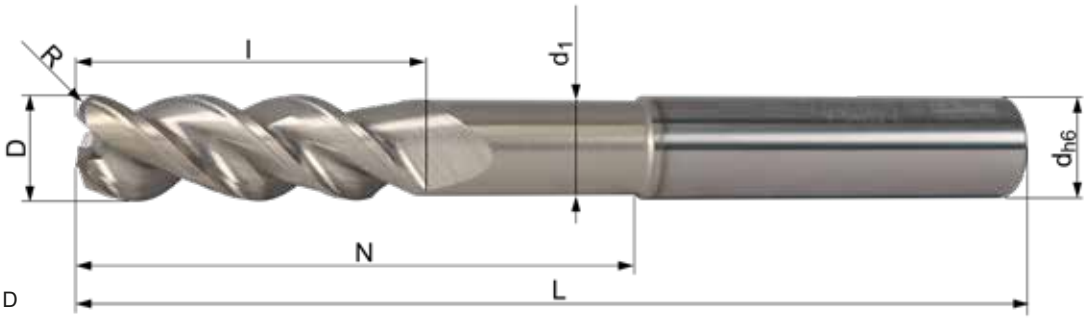
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	1	500 (460-560)	0,02 (0,01-0,03)	0,70	1,00	159.154	9.549	6,7
	2	500 (460-560)	0,03 (0,02-0,04)	1,50	2,00	79.577	7.161	21,5
	3	500 (460-560)	0,05 (0,03-0,07)	0,60	3,00	53.050	7.960	14,3
	4	500 (460-560)	0,05 (0,03-0,07)	0,80	4,00	39.790	5.970	19,1
	5	500 (460-560)	0,07 (0,05-0,09)	1,00	5,00	31.830	6.685	33,4
	6	500 (460-560)	0,08 (0,06-0,10)	1,20	6,00	26.530	6.365	45,8
	8	500 (460-560)	0,08 (0,06-0,10)	1,60	8,00	19.890	4.775	61,1
	10	500 (460-560)	0,09 (0,07-0,11)	2,00	10,00	15.920	4.300	86,0
	12	500 (460-560)	0,09 (0,07-0,11)	2,40	12,00	13.260	3.580	103,1
	16	500 (460-560)	0,11 (0,09-0,13)	3,20	16,00	9.950	3.285	168,2
	20	500 (460-560)	0,14 (0,12-0,16)	4,00	20,00	7.960	3.345	267,6
Aluminium short chipping >6% Si	1	480 (400-520)	0,02 (0,01-0,03)	0,70	1,00	152.000	9.120	6,4
	2	480 (400-520)	0,02 (0,01-0,03)	1,50	2,00	76.000	4.560	13,7
	3	480 (400-520)	0,03 (0,01-0,05)	0,60	3,00	50.930	4.585	8,3
	4	480 (400-520)	0,03 (0,01-0,05)	0,80	4,00	38.200	3.440	11,0
	5	480 (400-520)	0,05 (0,03-0,07)	1,00	5,00	30.560	4.585	22,9
	6	480 (400-520)	0,06 (0,04-0,08)	1,20	6,00	25.460	4.585	33,0
	8	480 (400-520)	0,06 (0,04-0,08)	1,60	8,00	19.100	3.440	44,0
	10	480 (400-520)	0,06 (0,04-0,08)	2,00	10,00	15.280	2.750	55,0
	12	480 (400-520)	0,06 (0,04-0,08)	2,40	12,00	12.730	2.290	66,0
	16	500 (460-560)	0,09 (0,07-0,11)	3,20	16,00	9.950	2.685	137,5
	20	500 (460-560)	0,16 (0,14-0,18)	4,00	20,00	7.960	3.820	305,6
Cast aluminium >10% Si	1	250 (200-300)	0,02 (0,01-0,03)	0,70	1,00	79.000	4.740	3,3
	2	250 (200-300)	0,02 (0,01-0,03)	1,50	2,00	39.000	2.340	7,0
	3	250 (200-300)	0,03 (0,01-0,05)	0,60	3,00	26.530	2.390	4,3
	4	250 (200-300)	0,03 (0,01-0,05)	0,80	4,00	19.890	1.790	5,7
	5	250 (200-300)	0,04 (0,02-0,06)	1,00	5,00	15.920	1.910	9,6
	6	250 (200-300)	0,05 (0,03-0,07)	1,20	6,00	13.260	1.990	14,3
	8	250 (200-300)	0,05 (0,03-0,07)	1,60	8,00	9.950	1.495	19,1
	10	250 (200-300)	0,05 (0,03-0,07)	2,00	10,00	7.960	1.195	23,9
	12	250 (200-300)	0,05 (0,03-0,07)	2,40	12,00	6.630	995	28,7
	16	250 (200-300)	0,12 (0,10-0,14)	3,20	16,00	4.970	1.790	91,6
	20	250 (200-300)	0,16 (0,14-0,18)	4,00	20,00	3.980	1.910	152,8
CuZn alloys	1	270 (230-300)	0,02 (0,01-0,03)	0,70	1,00	85.000	5.100	3,6
	2	270 (230-300)	0,02 (0,01-0,03)	1,50	2,00	42.000	2.520	7,6
	3	270 (230-300)	0,02 (0,01-0,04)	0,60	3,00	28.650	1.720	3,1
	4	270 (230-300)	0,02 (0,01-0,04)	0,80	4,00	21.490	1.290	4,1
	5	270 (230-300)	0,04 (0,02-0,06)	1,00	5,00	17.190	2.065	10,3
	6	270 (230-300)	0,04 (0,02-0,06)	1,20	6,00	14.320	1.720	12,4
	8	270 (230-300)	0,04 (0,02-0,06)	1,60	8,00	10.740	1.290	16,5
	10	270 (230-300)	0,04 (0,02-0,06)	2,00	10,00	8.590	1.030	20,6
	12	270 (230-300)	0,04 (0,02-0,06)	2,40	12,00	7.160	860	24,8
	16	270 (230-300)	0,08 (0,06-0,10)	3,20	16,00	5.370	1.290	66,0
	20	270 (230-300)	0,12 (0,10-0,14)	4,00	20,00	4.300	1.550	124,0

VHM 389 R - Technical data



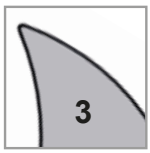
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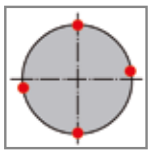
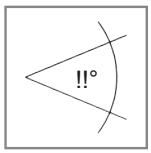






Tolerance D
ø3,0-16,0= $^{-0,02}_{-0,05}$
Tolerance R
ø3,0-16,0= $^{+0,025}_{-0,025}$



DIN 6535-HA

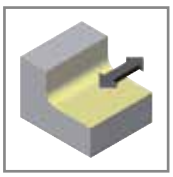
Order-No.	Article	D	R	l	N	d_1	d	L	Z
VA309L03R03A-AL05	**VHM 389-03 R03 AL05**	3	0,3	9	34	2,7	6	73	3
VA309L04R04A-AL05	**VHM 389-04 R04 AL05**	4	0,4	12	35	3,7	6	73	3
VA309L05R05A-AL05	**VHM 389-05 R05 AL05**	5	0,5	15	35	4,7	6	73	3
VA309L06R05A-AL05	**VHM 389-06 R05 AL05**	6	0,5	18	35	5,7	6	73	3
VA309L06R10A-AL05	**VHM 389-06 R10 AL05**	6	1,0	18	35	5,7	6	73	3
VA309L08R10A-AL05	**VHM 389-08 R10 AL05**	8	1,0	24	46	7,4	8	84	3
VA309L08R20A-AL05	**VHM 389-08 R20 AL05**	8	2,0	24	46	7,4	8	84	3
VA309L10R10A-AL05	**VHM 389-10 R10 AL05**	10	1,0	27	51	9,2	10	93	3
VA309L10R15A-AL05	**VHM 389-10 R15 AL05**	10	1,5	27	51	9,2	10	93	3
VA309L10R20A-AL05	**VHM 389-10 R20 AL05**	10	2,0	27	51	9,2	10	93	3
VA309L12R10A-AL05	**VHM 389-12 R10 AL05**	12	1,0	33	63	11,0	12	110	3
VA309L12R15A-AL05	**VHM 389-12 R15 AL05**	12	1,5	33	63	11,0	12	110	3
VA309L12R20A-AL05	**VHM 389-12 R20 AL05**	12	2,0	33	63	11,0	12	110	3
VA309L12R25A-AL05	**VHM 389-12 R25 AL05**	12	2,5	33	63	11,0	12	110	3
VA309L16R10A-AL05	**VHM 389-16 R10 AL05**	16	1,0	40	90	15,0	16	140	3
VA309L16R20A-AL05	**VHM 389-16 R20 AL05**	16	2,0	40	90	15,0	16	140	3
VA309L16R30A-AL05	**VHM 389-16 R30 AL05**	16	3,0	40	90	15,0	16	140	3
VA309L16R40A-AL05	**VHM 389-16 R40 AL05**	16	4,0	40	90	15,0	16	140	3



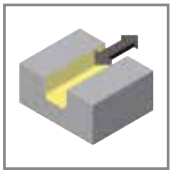
VHM 389 AL05 ⇒ Page 10

Key to symbols see page 19

VHM 389 R - Cutting data recommendation

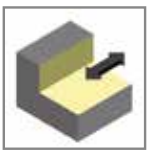
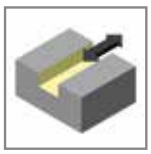


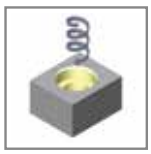
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	3	500 (460-560)	0,06 (0,04-0,08)	8,0	0,6	53.050	9.550	45,8
	4	500 (460-560)	0,06 (0,04-0,08)	11,0	0,8	39.790	7.160	63,0
	5	500 (460-560)	0,09 (0,07-0,10)	14,0	1,0	31.830	8.595	120,3
	6	500 (460-560)	0,10 (0,08-0,12)	17,0	1,2	26.530	7.960	162,4
	8	500 (460-560)	0,10 (0,08-0,12)	23,0	1,6	19.890	5.965	219,5
	10	500 (460-560)	0,11 (0,09-0,13)	26,0	2,0	15.920	5.255	273,3
	12	500 (460-560)	0,11 (0,09-0,13)	32,0	2,4	13.260	4.375	336,0
	16	500 (460-560)	0,13 (0,11-0,15)	39,0	3,2	9.950	3.880	484,2
Aluminium short chipping >6% Si	3	480 (400-520)	0,06 (0,04-0,08)	8,0	0,6	50.930	9.165	44,0
	4	480 (400-520)	0,06 (0,04-0,08)	11,0	0,8	38.200	6.875	60,5
	5	480 (400-520)	0,09 (0,07-0,10)	14,0	1,0	30.560	8.250	115,5
	6	480 (400-520)	0,10 (0,08-0,12)	17,0	1,2	25.460	7.640	155,9
	8	480 (400-520)	0,10 (0,08-0,12)	23,0	1,6	19.100	5.730	210,9
	10	480 (400-520)	0,10 (0,08-0,12)	26,0	2,0	15.280	4.585	238,4
	12	480 (400-520)	0,10 (0,08-0,12)	32,0	2,4	12.730	3.820	293,4
	16	480 (460-560)	0,13 (0,11-0,15)	39,0	3,2	9.550	3.725	464,9
Cast aluminium >10% Si	3	250 (200-300)	0,06 (0,04-0,08)	8,0	0,6	26.530	4.775	22,9
	4	250 (200-300)	0,06 (0,04-0,08)	11,0	0,8	19.890	3.580	31,5
	5	250 (200-300)	0,08 (0,08-0,12)	14,0	1,0	15.920	3.820	53,5
	6	250 (200-300)	0,09 (0,07-0,11)	17,0	1,2	13.260	3.580	73,0
	8	250 (200-300)	0,09 (0,07-0,11)	23,0	1,6	9.950	2.685	98,8
	10	250 (200-300)	0,09 (0,07-0,11)	26,0	2,0	7.960	2.150	111,8
	12	250 (200-300)	0,09 (0,07-0,11)	32,0	2,4	6.630	1.790	137,5
	16	250 (200-300)	0,15 (0,13-0,17)	39,0	3,2	4.970	2.235	278,9
CuZn alloys	3	270 (230-300)	0,05 (0,04-0,08)	8,0	0,6	28.650	4.300	20,6
	4	270 (230-300)	0,05 (0,04-0,08)	11,0	0,8	21.490	3.225	28,4
	5	270 (230-300)	0,08 (0,07-0,10)	14,0	1,0	17.190	4.125	57,8
	6	270 (230-300)	0,08 (0,08-0,12)	17,0	1,2	14.320	3.435	70,1
	8	270 (230-300)	0,08 (0,08-0,12)	23,0	1,6	10.740	2.580	94,9
	10	270 (230-300)	0,08 (0,09-0,13)	26,0	2,0	8.590	2.060	107,1
	12	270 (230-300)	0,08 (0,09-0,13)	32,0	2,4	7.160	1.720	132,1
	16	270 (230-300)	0,12 (0,11-0,15)	39,0	3,2	5.370	1.935	241,5



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	3	500 (460-560)	0,05 (0,03-0,07)	0,6	3,0	53.050	7.960	14,3
	4	500 (460-560)	0,05 (0,03-0,07)	0,8	4,0	39.790	5.970	19,1
	5	500 (460-560)	0,07 (0,05-0,09)	1,0	5,0	31.830	6.685	33,4
	6	500 (460-560)	0,08 (0,06-0,10)	1,2	6,0	26.530	6.365	45,8
	8	500 (460-560)	0,08 (0,06-0,10)	1,6	8,0	19.890	4.775	61,1
	10	500 (460-560)	0,09 (0,07-0,11)	2,0	10,0	15.920	4.300	86,0
	12	500 (460-560)	0,09 (0,07-0,11)	2,4	12,0	13.260	3.580	103,1
	16	500 (460-560)	0,11 (0,09-0,13)	3,2	16,0	9.950	3.285	168,2
Aluminium short chipping >6% Si	3	480 (400-520)	0,03 (0,01-0,05)	0,6	3,0	50.930	4.585	8,3
	4	480 (400-520)	0,03 (0,01-0,05)	0,8	4,0	38.200	3.440	11,0
	5	480 (400-520)	0,05 (0,03-0,07)	1,0	5,0	30.560	4.585	22,9
	6	480 (400-520)	0,06 (0,04-0,08)	1,2	6,0	25.460	4.585	33,0
	8	480 (400-520)	0,06 (0,04-0,08)	1,6	8,0	19.100	3.440	44,0
	10	480 (400-520)	0,06 (0,04-0,08)	2,0	10,0	15.280	2.750	55,0
	12	480 (400-520)	0,06 (0,04-0,08)	2,4	12,0	12.730	2.290	66,0
	16	500 (460-560)	0,09 (0,07-0,11)	3,2	16,0	9.950	2.685	137,5
Cast aluminium >10% Si	3	250 (200-300)	0,03 (0,01-0,05)	0,6	3,0	26.530	2.390	4,3
	4	250 (200-300)	0,03 (0,01-0,05)	0,8	4,0	19.890	1.790	5,7
	5	250 (200-300)	0,04 (0,02-0,06)	1,0	5,0	15.920	1.910	9,6
	6	250 (200-300)	0,05 (0,03-0,07)	1,2	6,0	13.260	1.990	14,3
	8	250 (200-300)	0,05 (0,03-0,07)	1,6	8,0	9.950	1.495	19,1
	10	250 (200-300)	0,05 (0,03-0,07)	2,0	10,0	7.960	1.195	23,9
	12	250 (200-300)	0,05 (0,03-0,07)	2,4	12,0	6.630	995	28,7
	16	250 (200-300)	0,12 (0,10-0,14)	3,2	16,0	4.970	1.790	91,6
CuZn alloys	3	270 (230-300)	0,02 (0,01-0,04)	0,6	3,0	28.650	1.720	3,1
	4	270 (230-300)	0,02 (0,01-0,04)	0,8	4,0	21.490	1.290	4,1
	5	270 (230-300)	0,04 (0,02-0,06)	1,0	5,0	17.190	2.065	10,3
	6	270 (230-300)	0,04 (0,02-0,06)	1,2	6,0	14.320	1.720	12,4
	8	270 (230-300)	0,04 (0,02-0,06)	1,6	8,0	10.740	1.290	16,5
	10	270 (230-300)	0,04 (0,02-0,06)	2,0	10,0	8.590	1.030	20,6
	12	270 (230-300)	0,04 (0,02-0,06)	2,4	12,0	7.160	860	24,8
	16	270 (230-300)	0,08 (0,06-0,10)	3,2	16,0	5.370	1.290	66,0

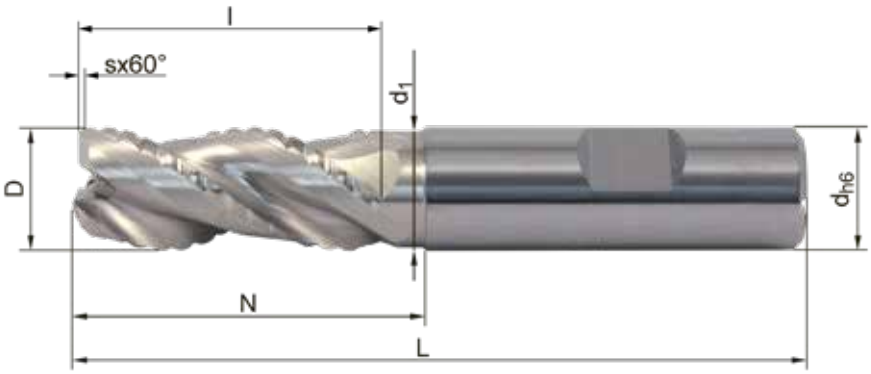
VHM 308W - Technical data



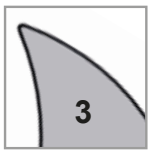

ALU

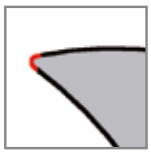
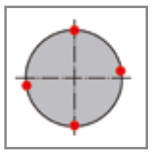
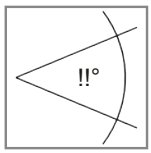




Tolerance D

ø6,0-25,0= $^{-0,03}_{-0,06}$

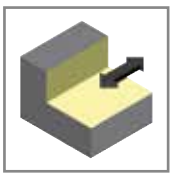






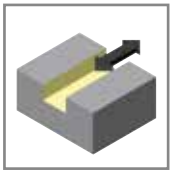
Order-No.	Article	D	s	l	N	d_1	d	L	Z
VA308M06B-AL05	**VHM 308W-06 AL05**	6	0,20 x 60°	14	20	5,7	6	58	3
VA308M08B-AL05	**VHM 308W-08 AL05**	8	0,25 x 60°	21	26	7,4	8	64	3
VA308M10B-AL05	**VHM 308W-10 AL05**	10	0,30 x 60°	23	31	9,2	10	73	3
VA308M12B-AL05	**VHM 308W-12 AL05**	12	0,35 x 60°	27	37	11,0	12	84	3
VA308M16B-AL05	**VHM 308W-16 AL05**	16	0,40 x 60°	36	43	15,0	16	93	3
VA308M20B-AL05	**VHM 308W-20 AL05**	20	0,50 x 60°	41	52	19,0	20	104	3
VA308M25B-AL05	**VHM 308W-25 AL05**	25	0,50 x 60°	51	67	24,0	25	125	3

Key to symbols see page 19

VHM 308W - Cutting data recommendation

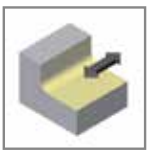
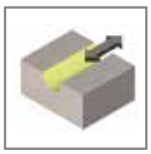


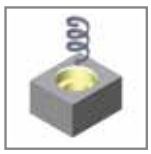
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	6	500 (460-600)	0,10 (0,07-0,15)	13	2,4	26.530	7.960	248,4
	8	500 (460-600)	0,10 (0,07-0,15)	20	3,2	19.890	5.965	381,8
	10	500 (460-600)	0,11 (0,08-0,16)	22	4,0	15.920	5.255	462,4
	12	500 (460-600)	0,11 (0,08-0,16)	26	4,8	13.260	4.375	546,0
	16	500 (460-600)	0,13 (0,10-0,18)	35	6,4	9.950	3.880	869,1
	20	500 (460-600)	0,16 (0,13-0,21)	40	8,0	7.960	3.820	1.222,4
	25	500 (460-600)	0,18 (0,15-0,23)	50	10,0	6.370	3.440	1.720,0
Aluminium short chipping >6% Si	6	480 (400-600)	0,10 (0,07-0,15)	13	2,4	25.460	7.640	238,4
	8	480 (400-600)	0,10 (0,07-0,15)	20	3,2	19.100	5.730	366,7
	10	480 (400-600)	0,11 (0,08-0,16)	22	4,0	15.280	5.040	443,5
	12	480 (400-600)	0,11 (0,08-0,16)	26	4,8	12.730	4.200	524,2
	16	480 (460-600)	0,13 (0,10-0,18)	35	6,4	9.550	3.725	834,4
	20	480 (460-600)	0,16 (0,13-0,21)	40	8,0	7.640	3.665	1.172,8
	25	480 (460-600)	0,18 (0,15-0,23)	50	10,0	6.110	3.300	1.650,0
Cast aluminium >10% Si	6	250 (200-400)	0,09 (0,06-0,14)	13	2,4	13.260	3.580	111,7
	8	250 (200-400)	0,09 (0,06-0,14)	20	3,2	9.950	2.685	171,8
	10	250 (200-400)	0,10 (0,07-0,15)	22	4,0	7.960	2.390	210,3
	12	250 (200-400)	0,10 (0,07-0,15)	26	4,8	6.630	1.990	248,4
	16	250 (200-400)	0,12 (0,09-0,17)	35	6,4	4.970	1.790	401,0
	20	250 (200-400)	0,15 (0,12-0,20)	40	8,0	3.980	1.790	572,8
	25	250 (200-400)	0,17 (0,14-0,22)	50	10,0	3.180	1.620	810,0
CuZn alloys	6	270 (230-400)	0,08 (0,05-0,13)	13	2,4	14.320	3.435	107,2
	8	270 (230-400)	0,08 (0,05-0,13)	20	3,2	10.740	2.580	165,1
	10	270 (230-400)	0,09 (0,06-0,14)	22	4,0	8.590	2.320	204,2
	12	270 (230-400)	0,09 (0,06-0,14)	26	4,8	7.160	1.935	241,5
	16	270 (230-400)	0,11 (0,08-0,16)	35	6,4	5.370	1.770	396,5
	20	270 (230-400)	0,14 (0,11-0,19)	40	8,0	4.300	1.805	577,6
	25	270 (230-400)	0,16 (0,13-0,21)	50	10,0	3.440	1.650	825,0



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	6	500 (460-600)	0,08 (0,05-0,13)	12	6	26.530	6.365	458,3
	8	500 (460-600)	0,08 (0,05-0,13)	16	8	19.890	4.775	611,2
	10	500 (460-600)	0,09 (0,06-0,14)	20	10	15.920	4.300	860,0
	12	500 (460-600)	0,09 (0,06-0,14)	24	12	13.260	3.580	1.031,0
	16	500 (460-600)	0,11 (0,08-0,16)	32	16	9.950	3.285	1.681,9
	20	500 (460-600)	0,14 (0,11-0,19)	40	20	7.960	3.345	2.676,0
	25	500 (460-600)	0,16 (0,13-0,21)	50	25	6.370	3.060	3.825,0
Aluminium short chipping >6% Si	6	480 (400-600)	0,06 (0,03-0,11)	12	6	25.460	4.585	330,1
	8	480 (400-600)	0,06 (0,03-0,11)	16	8	19.100	3.440	440,3
	10	480 (400-600)	0,06 (0,03-0,11)	20	10	15.280	2.750	550,0
	12	480 (400-600)	0,06 (0,03-0,11)	24	12	12.730	2.290	659,5
	16	500 (460-600)	0,09 (0,06-0,14)	32	16	9.950	2.685	1.374,7
	20	500 (460-600)	0,16 (0,13-0,21)	40	20	7.960	3.820	3.056,0
	25	500 (460-600)	0,18 (0,15-0,23)	50	25	6.370	3.440	4.300,0
Cast aluminium >10% Si	6	250 (200-400)	0,07 (0,04-0,12)	12	6	13.260	2.785	200,5
	8	250 (200-400)	0,07 (0,04-0,12)	16	8	9.950	2.090	267,5
	10	250 (200-400)	0,08 (0,05-0,13)	20	10	7.960	1.910	382,0
	12	250 (200-400)	0,08 (0,05-0,13)	24	12	6.630	1.590	457,9
	16	250 (200-400)	0,10 (0,07-0,15)	32	16	4.970	1.490	762,9
	20	250 (200-400)	0,13 (0,10-0,18)	40	20	3.980	1.550	1.240,0
	25	250 (200-400)	0,15 (0,12-0,20)	50	25	3.180	1.430	1.787,5
CuZn alloys	6	270 (230-400)	0,06 (0,03-0,11)	12	6	14.320	2.580	185,8
	8	270 (230-400)	0,06 (0,03-0,11)	16	8	10.740	1.935	247,7
	10	270 (230-400)	0,07 (0,04-0,12)	20	10	8.590	1.805	361,0
	12	270 (230-400)	0,07 (0,04-0,12)	24	12	7.160	1.505	433,4
	16	270 (230-400)	0,09 (0,06-0,14)	32	16	5.370	1.450	742,4
	20	270 (230-400)	0,12 (0,09-0,17)	40	20	4.300	1.550	1.240,0
	25	270 (230-400)	0,14 (0,11-0,19)	50	25	3.440	1.445	1.806,3

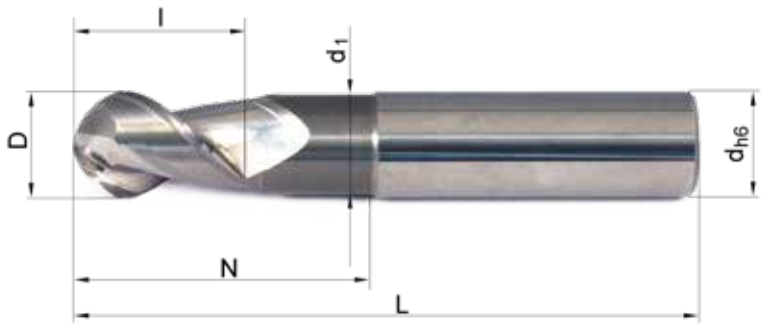
VHM 229 - Technical data

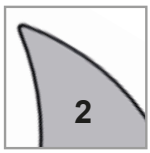


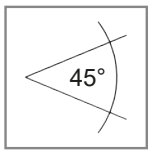

ALU





Tolerance D
ø1,0-20,0= $^{-0,02}_{-0,04}$
Tolerance R
ø1,0-20,0= $^{-0,01}_{-0,03}$

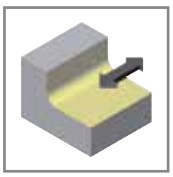


DIN 6535-HA

Order-No.	Article	D	l	N	d_1	d	L	Z
VA229M01A-MK10	**VHM 229-01 MK10**	1	2	7	0,85	6	58	2
VA229M02A-MK10	**VHM 229-02 MK10**	2	3	14	1,85	6	58	2
VA229M03A-MK10	**VHM 229-03 MK10**	3	5	21	2,70	6	58	2
VA229M04A-MK10	**VHM 229-04 MK10**	4	6	25	3,70	6	58	2
VA229M05A-MK10	**VHM 229-05 MK10**	5	8	25	4,60	6	58	2
VA229M06A-MK10	**VHM 229-06 MK10**	6	9	27	5,50	6	58	2
VA229M08A-MK10	**VHM 229-08 MK10**	8	12	28	7,50	8	64	2
VA229M10A-MK10	**VHM 229-10 MK10**	10	15	32	9,40	10	73	2
VA229M12A-MK10	**VHM 229-12 MK10**	12	18	37	11,40	12	84	2
VA229M16A-MK10	**VHM 229-16 MK10**	16	24	44	15,00	16	93	2
VA229M20A-MK10	**VHM 229-20 MK10**	20	30	54	19,00	20	104	2

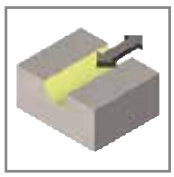
Key to symbols see page 19

VHM 229 - Cutting data recommendation



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm3/min]
Aluminium long chipping	1	500 (460-540)	0,02 (0,01-0,03)	1,00	0,34	159.000	9.540	1,9
	2	500 (460-540)	0,03 (0,02-0,04)	2,00	0,67	79.000	7.110	5,7
	3	500 (460-540)	0,04 (0,05-0,09)	3,00	1,35	53.050	4.245	9,6
	4	500 (460-540)	0,04 (0,06-0,10)	4,00	1,80	39.790	3.185	10,7
	5	500 (460-540)	0,07 (0,06-0,10)	5,00	2,25	31.830	4.455	20,7
	6	500 (460-540)	0,08 (0,07-0,11)	6,00	2,70	26.530	4.245	25,8
	8	500 (460-540)	0,08 (0,09-0,11)	8,00	3,60	19.890	3.180	30,1
	10	500 (460-540)	0,09 (0,10-0,14)	10,00	4,50	15.920	2.865	38,9
	12	500 (460-540)	0,09 (0,11-0,15)	12,00	5,40	13.260	2.385	43,7
	16	500 (460-540)	0,11 (0,13-0,17)	16,00	7,20	9.950	2.190	65,5
	20	500 (460-540)	0,14 (0,15-0,19)	20,00	9,00	7.960	2.230	98,7
Aluminium short chipping >6% Si	1	480 (400-520)	0,03 (0,02-0,04)	1,00	0,34	152.000	13.680	2,8
	2	480 (400-520)	0,04 (0,02-0,05)	2,00	0,67	76.000	9.120	7,3
	3	480 (400-520)	0,07 (0,05-0,09)	3,00	1,35	50.930	7.130	16,2
	4	480 (400-520)	0,08 (0,06-0,10)	4,00	1,80	38.200	6.110	20,6
	5	480 (400-520)	0,08 (0,06-0,10)	5,00	2,25	30.560	4.890	22,7
	6	480 (400-520)	0,09 (0,07-0,11)	6,00	2,70	25.460	4.585	27,9
	8	480 (400-520)	0,11 (0,09-0,11)	8,00	3,60	19.100	4.200	39,8
	10	480 (400-520)	0,12 (0,10-0,14)	10,00	4,50	15.280	3.665	49,7
	12	480 (400-520)	0,13 (0,11-0,15)	12,00	5,40	12.730	3.310	60,7
	16	480 (400-520)	0,15 (0,13-0,17)	16,00	7,20	9.550	2.865	85,7
	20	480 (400-520)	0,17 (0,15-0,19)	20,00	9,00	7.640	2.600	115,1
Cast aluminium >10% Si	1	250 (200-300)	0,03 (0,02-0,04)	1,00	0,34	79.000	7.110	1,4
	2	250 (200-300)	0,04 (0,02-0,05)	2,00	0,67	39.000	4.680	3,8
	3	250 (200-300)	0,07 (0,05-0,09)	3,00	1,35	26.530	3.715	8,4
	4	250 (200-300)	0,08 (0,06-0,10)	4,00	1,80	19.890	3.180	10,7
	5	250 (200-300)	0,08 (0,06-0,10)	5,00	2,25	15.920	2.545	11,8
	6	250 (200-300)	0,09 (0,07-0,11)	6,00	2,70	13.260	2.385	14,5
	8	250 (200-300)	0,11 (0,09-0,11)	8,00	3,60	9.950	2.190	20,8
	10	250 (200-300)	0,12 (0,10-0,14)	10,00	4,50	7.960	1.910	25,9
	12	250 (200-300)	0,13 (0,11-0,15)	12,00	5,40	6.630	1.725	31,6
	16	250 (200-300)	0,15 (0,13-0,17)	16,00	7,20	4.970	1.490	44,6
	20	250 (200-300)	0,17 (0,15-0,19)	20,00	9,00	3.980	1.355	60,0
CuZn alloys	1	270 (230-300)	0,03 (0,02-0,04)	1,00	0,34	85.000	7.650	1,6
	2	270 (230-300)	0,04 (0,02-0,05)	2,00	0,67	42.000	5.040	4,1
	3	270 (230-300)	0,07 (0,05-0,09)	3,00	1,35	28.650	4.010	9,1
	4	270 (230-300)	0,08 (0,06-0,10)	4,00	1,80	21.490	3.440	11,6
	5	270 (230-300)	0,08 (0,06-0,10)	5,00	2,25	17.190	2.750	12,8
	6	270 (230-300)	0,09 (0,07-0,11)	6,00	2,70	14.320	2.580	15,7
	8	270 (230-300)	0,11 (0,09-0,11)	8,00	3,60	10.740	2.365	22,4
	10	270 (230-300)	0,12 (0,10-0,14)	10,00	4,50	8.590	2.060	27,9
	12	270 (230-300)	0,13 (0,11-0,15)	12,00	5,40	7.160	1.860	34,1
	16	270 (230-300)	0,15 (0,13-0,17)	16,00	7,20	5.370	1.610	48,2
	20	270 (230-300)	0,17 (0,15-0,19)	20,00	9,00	4.300	1.460	64,6
Thermoplastics	1	1000 (800-1.100)	0,03 (0,02-0,04)	1,00	0,34	318.000	28.620	5,8
	2	1000 (800-1.100)	0,04 (0,02-0,05)	2,00	0,67	159.000	19.080	15,4
	3	1.000 (800-1.100)	0,07 (0,05-0,09)	3,00	1,35	106.100	14.855	33,7
	4	1.000 (800-1.100)	0,08 (0,06-0,10)	4,00	1,80	79.580	12.735	42,9
	5	1.000 (800-1.100)	0,08 (0,06-0,10)	5,00	2,25	63.660	10.185	47,3
	6	1.000 (800-1.100)	0,09 (0,07-0,11)	6,00	2,70	53.050	9.550	58,1
	8	1.000 (800-1.100)	0,11 (0,09-0,11)	8,00	3,60	39.790	8.755	83,0
	10	1.000 (800-1.100)	0,12 (0,10-0,14)	10,00	4,50	31.830	7.640	103,6
	12	1.000 (800-1.100)	0,13 (0,11-0,15)	12,00	5,40	26.530	6.900	126,5
	16	1.000 (800-1.100)	0,15 (0,13-0,17)	16,00	7,20	19.890	5.965	178,5
	20	1.000 (800-1.100)	0,17 (0,15-0,19)	20,00	9,00	15.920	5.415	239,6

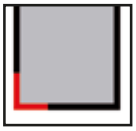
VHM 229 - Cutting data recommendation



Material	D [mm]	V_c [m/min]		f_z [mm]		a_p [mm]	a_e [mm]	n [min-1]	V_f [mm/min]	Q [cm³/min]
Aluminium long chipping	1	500	(460-540)	0,02	(0,010-0,030)	1,00	1,00	159.000	9.540	5,7
	2	500	(460-540)	0,03	(0,020-0,040)	2,00	2,00	79.000	7.110	17,0
	3	500	(460-540)	0,03	(0,020-0,050)	3,00	3,00	53.050	3.185	11,3
	4	500	(460-540)	0,03	(0,020-0,050)	4,00	4,00	39.790	2.385	15,0
	5	500	(460-540)	0,05	(0,045-0,075)	5,00	5,00	31.830	3.185	31,3
	6	500	(460-540)	0,06	(0,045-0,075)	6,00	6,00	26.530	3.185	45,0
	8	500	(460-540)	0,06	(0,045-0,075)	8,00	8,00	19.890	2.385	59,9
	10	500	(460-540)	0,07	(0,055-0,085)	10,00	10,00	15.920	2.230	87,5
	12	500	(460-540)	0,07	(0,055-0,085)	12,00	12,00	13.260	1.855	104,8
	16	500	(460-540)	0,09	(0,075-0,110)	16,00	16,00	9.950	1.790	179,9
	20	500	(460-540)	0,12	(0,100-0,140)	20,00	20,00	7.960	1.910	299,9
Aluminium short chipping >6% Si	1	480	(400-520)	0,02	(0,010-0,030)	1,00	1,00	152.000	9.120	5,5
	2	480	(400-520)	0,03	(0,020-0,040)	2,00	2,00	76.000	6.840	16,4
	3	480	(400-520)	0,03	(0,020-0,050)	3,00	3,00	50.930	3.055	10,8
	4	480	(400-520)	0,03	(0,020-0,050)	4,00	4,00	38.200	2.290	14,4
	5	480	(400-520)	0,05	(0,045-0,075)	5,00	5,00	30.560	3.055	30,0
	6	480	(400-520)	0,06	(0,045-0,075)	6,00	6,00	25.460	3.055	43,2
	8	480	(400-520)	0,06	(0,045-0,075)	8,00	8,00	19.100	2.290	57,5
	10	480	(400-520)	0,07	(0,055-0,085)	10,00	10,00	15.280	2.140	84,0
	12	480	(400-520)	0,07	(0,055-0,085)	12,00	12,00	12.730	1.780	100,6
	16	480	(400-520)	0,09	(0,075-0,110)	16,00	16,00	9.550	1.720	172,8
	20	480	(400-520)	0,12	(0,100-0,140)	20,00	20,00	7.640	1.835	288,1
Cast aluminium >10% Si	1	250	(200-300)	0,02	(0,010-0,030)	1,00	1,00	79.000	4.740	2,8
	2	250	(200-300)	0,03	(0,020-0,040)	2,00	2,00	39.000	3.510	8,4
	3	250	(200-300)	0,03	(0,020-0,050)	3,00	3,00	26.530	1.590	5,6
	4	250	(200-300)	0,03	(0,020-0,050)	4,00	4,00	19.890	1.195	7,5
	5	250	(200-300)	0,05	(0,045-0,075)	5,00	5,00	15.920	1.590	15,6
	6	250	(200-300)	0,06	(0,045-0,075)	6,00	6,00	13.260	1.590	22,5
	8	250	(200-300)	0,06	(0,045-0,075)	8,00	8,00	9.950	1.195	30,0
	10	250	(200-300)	0,07	(0,055-0,085)	10,00	10,00	7.960	1.115	43,8
	12	250	(200-300)	0,07	(0,055-0,085)	12,00	12,00	6.630	930	52,6
	16	250	(200-300)	0,09	(0,075-0,110)	16,00	16,00	4.970	895	89,9
	20	250	(200-300)	0,12	(0,100-0,140)	20,00	20,00	3.980	955	149,9
CuZn alloys	1	270	(230-300)	0,02	(0,010-0,030)	1,00	1,00	85.000	5.100	3,1
	2	270	(230-300)	0,03	(0,020-0,040)	2,00	2,00	42.000	3.780	9,1
	3	270	(230-300)	0,03	(0,020-0,050)	3,00	3,00	28.650	1.720	6,1
	4	270	(230-300)	0,03	(0,020-0,050)	4,00	4,00	21.490	1.290	8,1
	5	270	(230-300)	0,05	(0,045-0,075)	5,00	5,00	17.190	1.720	16,9
	6	270	(230-300)	0,06	(0,045-0,075)	6,00	6,00	14.320	1.720	24,3
	8	270	(230-300)	0,06	(0,045-0,075)	8,00	8,00	10.740	1.290	32,4
	10	270	(230-300)	0,07	(0,055-0,085)	10,00	10,00	8.590	1.205	47,3
	12	270	(230-300)	0,07	(0,055-0,085)	12,00	12,00	7.160	1.000	56,5
	16	270	(230-300)	0,09	(0,075-0,110)	16,00	16,00	5.370	965	97,0
	20	270	(230-300)	0,12	(0,100-0,140)	20,00	20,00	4.300	1.030	161,7
Thermoplastics	1	1.000	(800-1.100)	0,01	(0,010-0,020)	1,00	1,00	318.300	6.366	2,4
	2	1.000	(800-1.100)	0,02	(0,010-0,030)	2,00	2,00	159.100	6.364	9,9
	3	1.000	(800-1.100)	0,03	(0,020-0,050)	3,00	3,00	106.100	6.365	22,4
	4	1.000	(800-1.100)	0,03	(0,020-0,050)	4,00	4,00	79.580	4.775	29,9
	5	1.000	(800-1.100)	0,05	(0,045-0,075)	5,00	5,00	63.660	6.365	62,4
	6	1.000	(800-1.100)	0,06	(0,045-0,075)	6,00	6,00	53.050	6.365	89,8
	8	1.000	(800-1.100)	0,06	(0,045-0,075)	8,00	8,00	39.790	4.775	119,8
	10	1.000	(800-1.100)	0,07	(0,055-0,085)	10,00	10,00	31.830	4.455	174,7
	12	1.000	(800-1.100)	0,07	(0,055-0,085)	12,00	12,00	26.530	3.715	209,7
	16	1.000	(800-1.100)	0,09	(0,075-0,110)	16,00	16,00	19.890	3.580	359,4
	20	1.000	(800-1.100)	0,12	(0,100-0,140)	20,00	20,00	15.920	3.820	599,2

Key to symbols

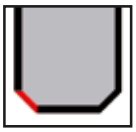
Geometry



Milling cutter geometry:
Flat faced with sharp edge



Milling cutter geometry:
Flat faced with edge radius



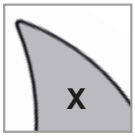
Milling cutter geometry:
Flat faced with edge chamfer



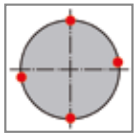
Milling cutter geometry:
Spherical



Milling cutter geometry:
Flat faced with with edge chamfer
and cord profile



Number of cutting edges



Uneven cutting pitch



Large chip spaces



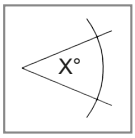
Expansion of chip space
at the front surface



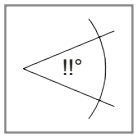
Polished cutting edge



The tool has multiple internal
cooling channels with front side
exit



Equal spiral angle



Unequal spiral angle



This tool is designed with
a middle-size length



This tool is designed with
a long-size length

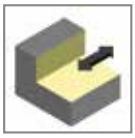


Shaft shape made to
DIN 6535-HA (cylindrical)

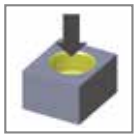


Shaft shape made to
DIN 6535-HB (Weldon)

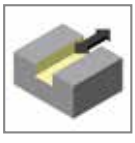
Machining



Step milling, Side milling



Boring



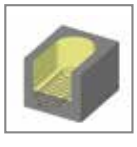
Slot milling



Helical milling



Slot milling by ramping



Milling with trochoidal strategy

Solid carbide end mills for the machining of aluminium



× The above mentioned parameters are starting values! Up and down corrections are possible depending on the machine type, the working piece and the holding fixture.
× If the specified spindle speeds cannot be achieved on your machine, the overall feed must be adjusted proportionally according to the required reduction in spindle speed.
For drilling operations, we recommend reducing the feed rate f_z by 50% compared to full slot milling.
× It is essential to respect the average chip thickness for the circumferential milling operations.

× Errors, omissions and technical modifications are reserved.

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