Jongen Werkzeugtechnik

VHM 231 HX74
VHM 232 HX74



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

The Tools

This new tool series, consisting of two-cutting-edges ball nose end mills in two length variants, has been specifically designed for reliable HSC machining of steel materials from 50–70 HRC.

The tools in this series are tailored to the demanding requirements of the mould and die making industry.

The design of these tools enables a high degree of application flexibility and perfect adaptation to a wide range of machining tasks.

The VHM 231 HX74 type, with its short neck-down shape and compact overall length, represents the extremely stable variant. The VHM 232 HX74 type enables the machining of extremely deep cavities.

Diameters from 2 mm to 5 mm feature a neck relief geometry designed for maximum stability in demanding applications, ensuring high rigidity and process reliability.

For both types, subsequent adjustment of the neck relief or effective cutting depth to match your specific machining task is available upon request.

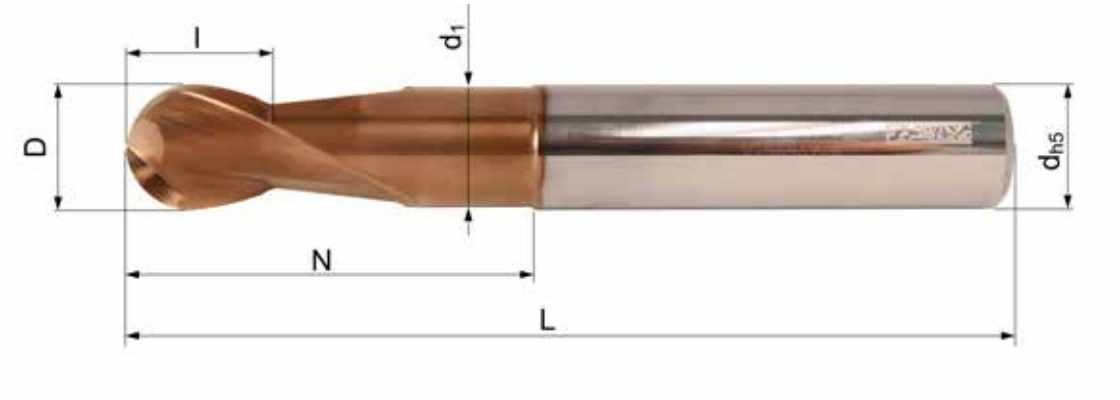


Product characteristics

Features	Advantages
High-performance full-radius end mill ø2 to ø16 mm	- Maximum process reliability with high productivity
Versatile application range	- HSC finishing - Semi finishing - Roughing - Steel materials 50–70 HRC
Shank according to DIN 6535 HA (cylindrical shank h5)	-Precise tool clamping = high runout accuracy
2 types with different neck reliefs and overall lengths	Optimized use in different cavity depths with excellent tool rigidity and stability. VHM 231: extremely stable variant for shallow cavities VHM 232: specially relieved variant for deep cavities
Optimized macro geometry	- 2 cutting edges - robust cutting wedge - soft-cutting end-face geometry = high process reliability and high productivity
Optimized micro geometry	- high coating adhesion - increased edge stability - improved cutting edge surface quality = high wear resistance and long service life
The carbide	- The ultra fine grain grade is specifically designed for HSC machining of hardened steels up to 70 HRC - grain size of 0.5 µm - ISO range K10–K20 - hardness of 1.930 HV30 and a transverse rupture strength of 4.400 MPa, ensuring high wear resistance combined with excellent fracture toughness
The coating	New silicon doped HiPIMS coating for cost efficient hard machining, even under extreme conditions. The exceptionally high silicon content, combined with a very dense structure, provides outstanding thermal stability (operating temperatures up to 1.100 °C). Thanks to HiPIMS technology, the coating offers very high surface quality and excellent adhesion
Carbide + coating = quality HX74	Fields of application include HSC fine finishing, semi finishing, and roughing of hardened steels (50–70 HRC) as well as general steel materials.
Reconditioning starting from ø4mm	- high cost-performance ratio

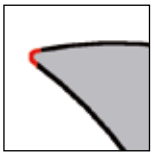
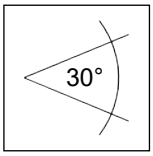
Technical Data VHM 231 HX74

HRC 50-70



Tolerance D
ø2,0- 5,0= -0,01
ø6,0-12,0= -0,02

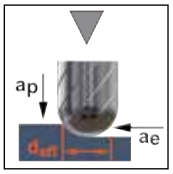
Contour preciseness
± 0,005

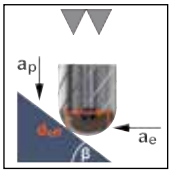
DIN 6535-HA


Order-No.	Article	D	l	N							d_1	d	L	Z
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VH231M02A-HX74	VHM 231-02 HX74	2	2	6,8	7,7	8,4	9,1	9,8	10,6	11,4	-	6	58	2
VH231M03A-HX74	VHM 231-03 HX74	3	3	10,3	11,5	12,5	13,3	14,2	15,3	16,4	-	6	58	2
VH231M04A-HX74	VHM 231-04 HX74	4	4	13,8	15,3	16,6	17,5	18,4	-	-	-	6	58	2
VH231M05A-HX74	VHM 231-05 HX74	5	5	17,2	18,8	19,8	-	-	-	-	-	6	58	2
VH231M06A-HX74	VHM 231-06 HX74	6	6	21,0	-	-	-	-	-	-	5,6	6	58	2
VH231M08A-HX74	VHM 231-08 HX74	8	8	27,0	-	-	-	-	-	-	7,6	8	64	2
VH231M10A-HX74	VHM 231-10 HX74	10	10	32,0	-	-	-	-	-	-	9,6	10	73	2
VH231M12A-HX74	VHM 231-12 HX74	12	12	38,0	-	-	-	-	-	-	11,6	12	84	2
VH231M16A-HX74	VHM 231-16 HX74	16	16	44,0	-	-	-	-	-	-	15,6	16	93	2

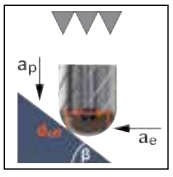
Cutting data recommendation VHM 231 HX74



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	β [°]	ø-eff [mm]	n [min^{-1}]	V_f [mm/min]
Tool steel Tempered steel 1200-1600 N/mm² 50-56 HRC	2	140 (130 - 160)	0,039 (0,035 - 0,044)	0,323	0,800	0	1,47	30.274	2.361
	3	140 (130 - 160)	0,052 (0,046 - 0,057)	0,494	1,200	0	2,23	20.028	2.082
	4	140 (130 - 160)	0,062 (0,055 - 0,068)	0,670	1,600	0	2,99	14.914	1.849
	5	140 (130 - 160)	0,069 (0,062 - 0,077)	0,854	2,000	0	3,76	11.839	1.633
	6	140 (130 - 160)	0,076 (0,068 - 0,084)	1,045	2,400	0	4,55	9.792	1.488
	8	140 (130 - 160)	0,086 (0,077 - 0,095)	1,450	3,200	0	6,16	7.230	1.243
	10	140 (130 - 160)	0,093 (0,084 - 0,103)	1,890	4,000	0	7,83	5.691	1.058
	12	140 (130 - 160)	0,099 (0,089 - 0,109)	2,368	4,800	0	9,55	4.665	923
	16	140 (130 - 160)	0,119 (0,107 - 0,131)	3,303	6,400	0	12,95	3.441	816
Tool steel Tempered steel 56-63 HRC	2	120 (110 - 135)	0,038 (0,034 - 0,042)	0,262	0,525	0	1,35	28.315	2.151
	3	120 (110 - 135)	0,050 (0,044 - 0,055)	0,398	0,787	0	2,04	18.761	1.876
	4	120 (110 - 135)	0,059 (0,053 - 0,066)	0,539	1,048	0	2,73	13.981	1.649
	5	120 (110 - 135)	0,067 (0,060 - 0,074)	0,684	1,309	0	3,44	11.114	1.489
	6	120 (110 - 135)	0,073 (0,066 - 0,081)	0,834	1,570	0	4,15	9.202	1.343
	8	120 (110 - 135)	0,083 (0,074 - 0,092)	1,148	2,090	0	5,61	6.809	1.130
	10	120 (110 - 135)	0,090 (0,081 - 0,100)	1,484	2,608	0	7,11	5.372	966
	12	120 (110 - 135)	0,096 (0,086 - 0,106)	1,845	3,125	0	8,66	4.413	847
	16	120 (110 - 135)	0,115 (0,104 - 0,127)	2,552	4,161	0	11,72	3.260	751
Tool steel Tempered steel 63-70 HRC	2	60 (55 - 65)	0,031 (0,028 - 0,035)	0,200	0,250	0	1,20	15.915	986
	3	60 (55 - 65)	0,039 (0,035 - 0,043)	0,303	0,374	0	1,81	10.569	824
	4	60 (55 - 65)	0,044 (0,040 - 0,049)	0,407	0,497	0	2,42	7.892	694
	5	60 (55 - 65)	0,049 (0,043 - 0,054)	0,514	0,619	0	3,04	6.289	616
	6	60 (55 - 65)	0,052 (0,046 - 0,058)	0,623	0,740	0	3,66	5.218	542
	8	60 (55 - 65)	0,057 (0,050 - 0,063)	0,846	0,980	0	4,92	3.881	442
	10	60 (55 - 65)	0,060 (0,053 - 0,066)	1,079	1,216	0	6,21	3.078	369
	12	60 (55 - 65)	0,062 (0,056 - 0,069)	1,321	1,450	0	7,51	2.543	315
	16	60 (55 - 65)	0,073 (0,065 - 0,080)	1,798	1,921	0	10,11	1.890	274



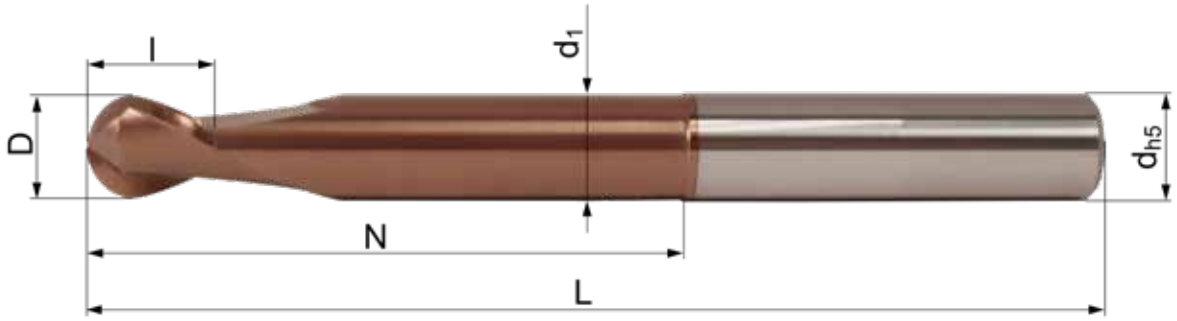
Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	β [°]	ø-eff [mm]	n [min^{-1}]	V_f [mm/min]
Tool steel Tempered steel 1200-1600 N/mm² 50-56 HRC	2	170 (160 - 190)	0,036 (0,031 - 0,040)	0,237	0,237	45	1,99	27.151	1.954
	3	170 (160 - 190)	0,045 (0,040 - 0,050)	0,355	0,355	45	2,99	18.098	1.628
	4	170 (160 - 190)	0,053 (0,047 - 0,059)	0,473	0,473	45	3,99	13.576	1.439
	5	170 (160 - 190)	0,059 (0,052 - 0,065)	0,591	0,591	45	4,98	10.859	1.281
	6	170 (160 - 190)	0,063 (0,057 - 0,070)	0,709	0,709	45	5,98	9.050	1.140
	8	170 (160 - 190)	0,070 (0,063 - 0,078)	0,944	0,944	45	7,97	6.788	950
	10	170 (160 - 190)	0,076 (0,067 - 0,084)	1,178	1,178	45	9,96	5.431	825
	12	170 (160 - 190)	0,079 (0,071 - 0,088)	1,412	1,412	45	11,96	4.526	715
	16	170 (160 - 190)	0,093 (0,083 - 0,103)	1,881	1,881	45	15,94	3.394	630
Tool steel Tempered steel 56-63 HRC	2	130 (120 - 145)	0,035 (0,031 - 0,039)	0,193	0,193	45	1,98	20.931	1.465
	3	130 (120 - 145)	0,044 (0,040 - 0,049)	0,289	0,289	45	2,96	13.961	1.228
	4	130 (120 - 145)	0,052 (0,046 - 0,058)	0,384	0,384	45	3,95	10.471	1.088
	5	130 (120 - 145)	0,058 (0,051 - 0,064)	0,479	0,479	45	4,94	8.378	971
	6	130 (120 - 145)	0,062 (0,056 - 0,069)	0,573	0,573	45	5,93	6.983	865
	8	130 (120 - 145)	0,069 (0,062 - 0,077)	0,759	0,759	45	7,90	5.239	722
	10	130 (120 - 145)	0,075 (0,067 - 0,082)	0,943	0,943	45	9,87	4.193	628
	12	130 (120 - 145)	0,078 (0,070 - 0,087)	1,124	1,124	45	11,84	3.495	545
	16	130 (120 - 145)	0,092 (0,083 - 0,101)	1,489	1,489	45	15,78	2.622	481
Tool steel Tempered steel 63-70 HRC	2	100 (90 - 110)	0,025 (0,022 - 0,028)	0,150	0,150	45	1,95	16.349	817
	3	100 (90 - 110)	0,032 (0,028 - 0,035)	0,223	0,223	45	2,92	10.905	697
	4	100 (90 - 110)	0,037 (0,033 - 0,041)	0,296	0,296	45	3,89	8.183	605
	5	100 (90 - 110)	0,041 (0,036 - 0,045)	0,367	0,367	45	4,86	6.550	537
	6	100 (90 - 110)	0,044 (0,039 - 0,049)	0,437	0,437	45	5,83	5.460	480
	8	100 (90 - 110)	0,049 (0,044 - 0,054)	0,574	0,574	45	7,77	4.099	401
	10	100 (90 - 110)	0,052 (0,047 - 0,058)	0,708	0,708	45	9,70	3.283	341
	12	100 (90 - 110)	0,055 (0,049 - 0,061)	0,837	0,837	45	11,63	2.738	301
	16	100 (90 - 110)	0,066 (0,059 - 0,072)	1,100	1,100	45	15,48	2.056	269



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	β [°]	ø-eff [mm]	n [min^{-1}]	V_f [mm/min]
Tool steel Tempered steel 1200-1600 N/mm² 50-56 HRC	2	260 (240 - 270)	0,032 (0,028 - 0,035)	0,050	0,050	45	1,79	46.364	2.967
	3	260 (240 - 270)	0,039 (0,035 - 0,043)	0,068	0,068	45	2,66	31.148	2.429
	4	260 (240 - 270)	0,044 (0,039 - 0,049)	0,083	0,083	45	3,52	23.518	2.069
	5	260 (240 - 270)	0,048 (0,043 - 0,053)	0,096	0,096	45	4,37	18.934	1.817
	6	260 (240 - 270)	0,051 (0,045 - 0,056)	0,107	0,107	45	5,22	15.870	1.618
	8	260 (240 - 270)	0,055 (0,049 - 0,061)	0,125	0,125	45	6,88	12.024	1.322
	10	260 (240 - 270)	0,058 (0,051 - 0,064)	0,139	0,139	45	8,53	9.702	1.125
	12	260 (240 - 270)	0,060 (0,053 - 0,066)	0,150	0,150	45	10,16	8.147	977
	16	260 (240 - 270)	0,070 (0,063 - 0,077)	0,182	0,182	45	13,45	6.151	864
Tool steel Tempered steel 56-63 HRC	2	220 (200 - 240)	0,031 (0,028 - 0,035)	0,050	0,050	45	1,79	39.231	2.432
	3	220 (200 - 240)	0,039 (0,035 - 0,043)	0,068	0,068	45	2,66	26.356	2.055
	4	220 (200 - 240)	0,044 (0,039 - 0,049)	0,083	0,083	45	3,52	19.900	1.751
	5	220 (200 - 240)	0,048 (0,043 - 0,054)	0,096	0,096	45	4,37	16.021	1.538
	6	220 (200 - 240)	0,051 (0,046 - 0,057)	0,107	0,107	45	5,22	13.428	1.369
	8	220 (200 - 240)	0,056 (0,050 - 0,062)	0,125	0,125	45	6,88	10.174	1.139
	10	220 (200 - 240)	0,059 (0,052 - 0,065)	0,139	0,139	45	8,53	8.210	968
	12	220 (200 - 240)	0,061 (0,054 - 0,068)	0,150	0,150	45	10,16	6.893	840
	16	220 (200 - 240)	0,071 (0,064 - 0,079)	0,182	0,182	45	13,45	5.205	743
Tool steel Tempered steel 63-70 HRC	2	140 (125 - 155)	0,019 (0,016 - 0,021)	0,050	0,050	45	1,79	24.965	948
	3	140 (125 - 155)	0,025 (0,022 - 0,027)	0,068	0,068	45	2,66	16.772	838
	4	140 (125 - 155)	0,029 (0,026 - 0,033)	0,083	0,083	45	3,52	12.664	734
	5	140 (125 - 155)	0,033 (0,029 - 0,037)	0,096	0,096	45	4,37	10.195	672
	6	140 (125 - 155)	0,036 (0,032 - 0,040)	0,107	0,107	45	5,22	8.545	615
	8	140 (125 - 155)	0,041 (0,037 - 0,046)	0,125	0,125	45	6,88	6.474	530
	10	140 (125 - 155)	0,045 (0,040 - 0,050)	0,139	0,139	45	8,53	5.224	470
	12	140 (125 - 155)	0,048 (0,043 - 0,053)	0,150	0,150	45	10,16	4.387	421
	16	140 (125 - 155)	0,058 (0,051 - 0,064)	0,182	0,182	45	13,45	3.312	381

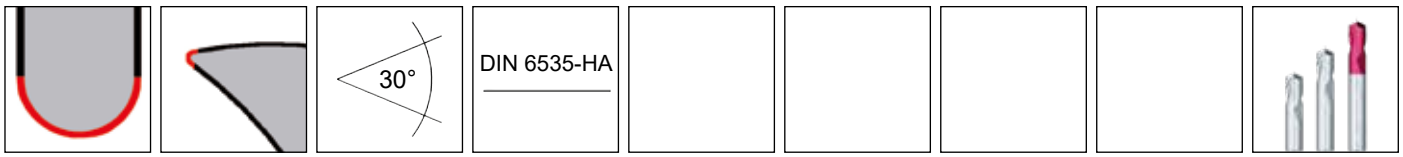
Technical Data VHM 232 HX74





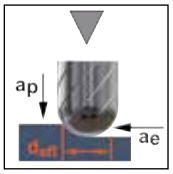
Tolerance D
ø2,0- 5,0= -0,01
ø6,0-12,0= -0,02

Contour preciseness
± 0,005

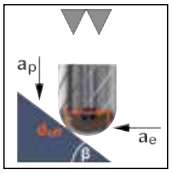


Order-No.	Article	D	l	N							d_1	d	L	Z
				ε=0°	ε=0,5°	ε=1°	ε=1,5°	ε=2°	ε=2,5°	ε=3°				
VH231L02A-HX74	VHM 232-02 HX74	2	2	10,9	13,7	15,8	18,4	21,0	25,8	31,5	-	6	73	2
VH231L03A-HX74	VHM 232-03 HX74	3	3	17,0	20,6	23,3	26,9	30,6	-	-	-	6	73	2
VH231L04A-HX74	VHM 232-04 HX74	4	4	22,8	27,2	30,4	-	-	-	-	-	6	73	2
VH231L05A-HX74	VHM 232-05 HX74	5	5	28,5	33,6	-	-	-	-	-	-	6	73	2
VH231L06A-HX74	VHM 232-06 HX74	6	6	36,0	-	-	-	-	-	-	5,6	6	73	2
VH231L08A-HX74	VHM 232-08 HX74	8	8	47,0	-	-	-	-	-	-	7,6	8	84	2
VH231L10A-HX74	VHM 232-10 HX74	10	10	52,0	-	-	-	-	-	-	9,6	10	93	2
VH231L12A-HX74	VHM 232-12 HX74	12	12	64,0	-	-	-	-	-	-	11,6	12	110	2
VH231L16A-HX74	VHM 232-16 HX74	16	16	91,0	-	-	-	-	-	-	15,6	16	140	2

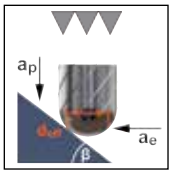
Cutting data recommendation VHM 232 HX74



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	β [°]	ø-eff [mm]	n [min^{-1}]	V_f [mm/min]
Tool steel Tempered steel 1200-1600 N/mm² 50-56 HRC	2	140 (130 - 160)	0,038 (0,034 - 0,043)	0,315	0,780	0	1,46	30.586	2.324
	3	140 (130 - 160)	0,050 (0,045 - 0,056)	0,481	1,170	0	2,20	20.238	2.023
	4	140 (130 - 160)	0,060 (0,054 - 0,067)	0,654	1,560	0	2,96	15.065	1.807
	5	140 (130 - 160)	0,068 (0,060 - 0,075)	0,833	1,950	0	3,73	11.960	1.626
	6	140 (130 - 160)	0,074 (0,066 - 0,082)	1,019	2,340	0	4,51	9.890	1.463
	8	140 (130 - 160)	0,084 (0,075 - 0,093)	1,414	3,120	0	6,10	7.302	1.226
	10	140 (130 - 160)	0,091 (0,081 - 0,101)	1,843	3,900	0	7,75	5.747	1.045
	12	140 (130 - 160)	0,097 (0,086 - 0,107)	2,309	4,680	0	9,46	4.710	913
	16	140 (130 - 160)	0,116 (0,104 - 0,129)	3,220	6,240	0	12,83	3.473	808
Tool steel Tempered steel 56-63 HRC	2	120 (110 - 135)	0,037 (0,033 - 0,041)	0,255	0,512	0	1,33	28.634	2.118
	3	120 (110 - 135)	0,049 (0,043 - 0,054)	0,388	0,767	0	2,01	18.966	1.858
	4	120 (110 - 135)	0,058 (0,052 - 0,064)	0,525	1,022	0	2,70	14.137	1.639
	5	120 (110 - 135)	0,065 (0,058 - 0,072)	0,667	1,277	0	3,40	11.234	1.460
	6	120 (110 - 135)	0,072 (0,064 - 0,079)	0,813	1,531	0	4,11	9.301	1.339
	8	120 (110 - 135)	0,081 (0,072 - 0,090)	1,120	2,038	0	5,55	6.881	1.114
	10	120 (110 - 135)	0,088 (0,079 - 0,097)	1,447	2,543	0	7,04	5.428	955
	12	120 (110 - 135)	0,093 (0,084 - 0,103)	1,798	3,047	0	8,57	4.459	829
	16	120 (110 - 135)	0,111 (0,099 - 0,122)	2,486	4,057	0	11,59	3.295	730
Tool steel Tempered steel 63-70 HRC	2	60 (55 - 65)	0,030 (0,027 - 0,034)	0,195	0,244	0	1,19	16.090	965
	3	60 (55 - 65)	0,038 (0,034 - 0,042)	0,295	0,364	0	1,79	10.688	812
	4	60 (55 - 65)	0,043 (0,039 - 0,048)	0,397	0,484	0	2,39	7.981	686
	5	60 (55 - 65)	0,047 (0,042 - 0,053)	0,501	0,603	0	3,00	6.360	597
	6	60 (55 - 65)	0,051 (0,045 - 0,056)	0,607	0,721	0	3,62	5.277	538
	8	60 (55 - 65)	0,055 (0,049 - 0,061)	0,825	0,955	0	4,87	3.924	431
	10	60 (55 - 65)	0,058 (0,052 - 0,065)	1,052	1,186	0	6,14	3.113	361
	12	60 (55 - 65)	0,061 (0,054 - 0,067)	1,288	1,414	0	7,43	2.571	313
	16	60 (55 - 65)	0,072 (0,065 - 0,080)	1,753	1,873	0	9,99	1.911	276



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	β [°]	ø-eff [mm]	n [min^{-1}]	V_f [mm/min]
Tool steel Tempered steel 1200-1600 N/mm² 50-56 HRC	2	170 (160 - 190)	0,035 (0,031 - 0,039)	0,227	0,227	45	1,99	27.192	1.903
	3	170 (160 - 190)	0,044 (0,039 - 0,049)	0,341	0,341	45	2,99	18.122	1.594
	4	170 (160 - 190)	0,052 (0,046 - 0,057)	0,454	0,454	45	3,98	13.593	1.413
	5	170 (160 - 190)	0,057 (0,051 - 0,063)	0,567	0,567	45	4,98	10.875	1.239
	6	170 (160 - 190)	0,062 (0,055 - 0,068)	0,680	0,680	45	5,97	9.063	1.123
	8	170 (160 - 190)	0,069 (0,061 - 0,076)	0,906	0,906	45	7,96	6.797	937
	10	170 (160 - 190)	0,074 (0,066 - 0,082)	1,131	1,131	45	9,95	5.438	804
	12	170 (160 - 190)	0,077 (0,069 - 0,086)	1,355	1,355	45	11,94	4.532	697
	16	170 (160 - 190)	0,091 (0,081 - 0,100)	1,804	1,804	45	15,92	3.399	616
Tool steel Tempered steel 56-63 HRC	2	130 (120 - 145)	0,034 (0,030 - 0,038)	0,186	0,186	45	1,97	20.984	1.426
	3	130 (120 - 145)	0,043 (0,039 - 0,048)	0,278	0,278	45	2,96	13.989	1.203
	4	130 (120 - 145)	0,051 (0,045 - 0,056)	0,369	0,369	45	3,94	10.492	1.070
	5	130 (120 - 145)	0,056 (0,050 - 0,062)	0,460	0,460	45	4,93	8.395	940
	6	130 (120 - 145)	0,061 (0,054 - 0,067)	0,550	0,550	45	5,91	6.998	853
	8	130 (120 - 145)	0,068 (0,060 - 0,075)	0,729	0,729	45	7,88	5.250	714
	10	130 (120 - 145)	0,073 (0,065 - 0,080)	0,905	0,905	45	9,85	4.201	613
	12	130 (120 - 145)	0,076 (0,068 - 0,085)	1,079	1,079	45	11,81	3.503	532
	16	130 (120 - 145)	0,089 (0,080 - 0,099)	1,429	1,429	45	15,75	2.628	470
Tool steel Tempered steel 63-70 HRC	2	100 (90 - 110)	0,024 (0,021 - 0,027)	0,144	0,144	45	1,94	16.391	786
	3	100 (90 - 110)	0,031 (0,027 - 0,035)	0,214	0,214	45	2,91	10.935	677
	4	100 (90 - 110)	0,036 (0,032 - 0,040)	0,284	0,284	45	3,88	8.206	590
	5	100 (90 - 110)	0,040 (0,035 - 0,044)	0,352	0,352	45	4,85	6.567	525
	6	100 (90 - 110)	0,043 (0,038 - 0,048)	0,419	0,419	45	5,81	5.476	470
	8	100 (90 - 110)	0,048 (0,042 - 0,053)	0,551	0,551	45	7,74	4.111	394
	10	100 (90 - 110)	0,051 (0,045 - 0,057)	0,679	0,679	45	9,67	3.292	335
	12	100 (90 - 110)	0,054 (0,048 - 0,060)	0,804	0,804	45	11,59	2.746	296
	16	100 (90 - 110)	0,064 (0,057 - 0,071)	1,058	1,058	45	15,44	2.062	265



Material	D [mm]	V_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	β [°]	ø-eff [mm]	n [min^{-1}]	V_f [mm/min]
Tool steel Tempered steel 1200-1600 N/mm² 50-56 HRC	2	260 (240 - 270)	0,031 (0,027 - 0,035)	0,049	0,049	45	1,78	46.469	6.198
	3	260 (240 - 270)	0,038 (0,034 - 0,042)	0,066	0,066	45	2,65	31.207	5.124
	4	260 (240 - 270)	0,043 (0,038 - 0,048)	0,081	0,081	45	3,51	23.565	4.374
	5	260 (240 - 270)	0,047 (0,042 - 0,052)	0,094	0,094	45	4,36	18.973	3.820
	6	260 (240 - 270)	0,050 (0,044 - 0,055)	0,104	0,104	45	5,21	15.900	3.393
	8	260 (240 - 270)	0,054 (0,048 - 0,059)	0,122	0,122	45	6,87	12.047	2.779
	10	260 (240 - 270)	0,056 (0,050 - 0,062)	0,135	0,135	45	8,51	9.721	2.357
	12	260 (240 - 270)	0,058 (0,052 - 0,065)	0,146	0,146	45	10,14	8.161	2.049
	16	260 (240 - 270)	0,068 (0,061 - 0,075)	0,177	0,177	45	13,43	6.162	838
Tool steel Tempered steel 56-63 HRC	2	220 (200 - 240)	0,031 (0,027 - 0,034)	0,049	0,049	45	1,78	39.320	4.820
	3	220 (200 - 240)	0,038 (0,034 - 0,042)	0,066	0,066	45	2,65	26.406	4.016
	4	220 (200 - 240)	0,043 (0,038 - 0,048)	0,081	0,081	45	3,51	19.940	3.447
	5	220 (200 - 240)	0,047 (0,042 - 0,052)	0,094	0,094	45	4,36	16.054	3.022
	6	220 (200 - 240)	0,050 (0,045 - 0,056)	0,104	0,104	45	5,21	13.454	2.693
	8	220 (200 - 240)	0,054 (0,048 - 0,060)	0,122	0,122	45	6,87	10.193	2.216
	10	220 (200 - 240)	0,057 (0,051 - 0,064)	0,135	0,135	45	8,51	8.225	1.885
	12	220 (200 - 240)	0,059 (0,053 - 0,066)	0,146	0,146	45	10,14	6.905	1.643
	16	220 (200 - 240)	0,069 (0,062 - 0,076)	0,177	0,177	45	13,43	5.214	721
Tool steel Tempered steel 63-70 HRC	2	140 (125 - 155)	0,018 (0,016 - 0,020)	0,049	0,049	45	1,78	25.022	1.807
	3	140 (125 - 155)	0,024 (0,021 - 0,027)	0,066	0,066	45	2,65	16.804	1.608
	4	140 (125 - 155)	0,029 (0,025 - 0,032)	0,081	0,081	45	3,51	12.689	1.449
	5	140 (125 - 155)	0,032 (0,029 - 0,036)	0,094	0,094	45	4,36	10.216	1.320
	6	140 (125 - 155)	0,035 (0,031 - 0,039)	0,104	0,104	45	5,21	8.562	1.213
	8	140 (125 - 155)	0,040 (0,036 - 0,045)	0,122	0,122	45	6,87	6.487	1.045
	10	140 (125 - 155)	0,044 (0,039 - 0,049)	0,135	0,135	45	8,51	5.234	918
	12	140 (125 - 155)	0,047 (0,041 - 0,052)	0,146	0,146	45	10,14	4.394	820
	16	140 (125 - 155)	0,056 (0,050 - 0,062)	0,177	0,177	45	13,43	3.318	374

Key to symbols


Roughing


Pre-finishing


Finishing


Tempered steel


Milling cutter's face design:
Full radius


Treated cutting edge



Spiral angle



Shaft shape made to
DIN 6535-HA (cylindrical)


Medium-size length,
Medium neck-down shape


long-size length,
long neck-down shape

The mentioned cutting parameters are standard values that may vary depending on processing, type of machine and material grade.

Errors, omissions and technical modifications are reserved.

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