


RAMPING

	VDI 3323	Ø D <sub>1</sub> 0.30 - 1.50		Ø D <sub>1</sub> 1.60 - 4.50		Ø D <sub>1</sub> 4.60 - 10.00	
		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]
<b>P</b>	Unalloyed steel, leaded steel	1 - 5	25 - 50		50 - 125		100 - 190
	Low alloyed steel < 800 N/mm <sup>2</sup>	6 - 9	20 - 40		50 - 100		75 - 155
	High-alloy steel > 800 N/mm <sup>2</sup> , stainless steel ferr.- marten.	10 - 13	20 - 25		50 - 60		75 - 90
<b>M</b>	Austenitic stainless steel < 700 N/mm <sup>2</sup>	14.1-14.2	20 - 40		50 - 100		85 - 155
	Nickel-free stainless steel/DUPLEX > 700 N/mm <sup>2</sup>	14.3-14.4	15 - 30		40 - 80		65 - 120
<b>K</b>	Ductile, malleable, nodular cast iron > 250HB	17 - 20	15 - 30	25 - 45	35 - 80	50 - 110	50 - 120
<b>N</b>	Copper alloy good machinability with Pb	26	20 - 35	30 - 50	45 - 90	50 - 135	70 - 140
	Copper alloy with difficult machinability	27 - 28	15 - 30	30 - 50	35 - 80	50 - 125	50 - 120
	Gold, silver	-	15 - 35	30 - 50	40 - 95	50 - 145	65 - 145
<b>S</b>	Refractory alloy, Fe, Ni, Co base	31 - 35		15 - 20		30 - 50	
	Titanium, titanium alloy	36 - 37	10 - 25	25 - 35	30 - 65	50 - 75	45 - 100



$$n \text{ [rpm]} = \frac{Vc \text{ [m/min]} \times 1000}{\pi \times D_1 \text{ [mm]}}$$

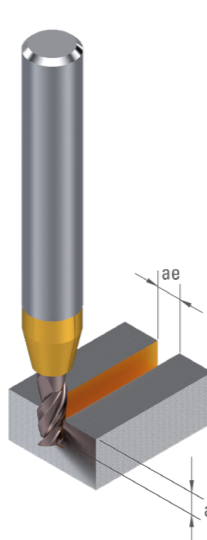
$$Vf \text{ [mm/min]} = n \text{ [rpm]} \times fz \text{ [mm]} \times Z$$

Feed per tooth fz [mm]

Ø D <sub>1</sub> 0.30 - 0.50		Ø D <sub>1</sub> 0.50 - 0.80		Ø D <sub>1</sub> 0.80 - 1.60		Ø D <sub>1</sub> 1.60 - 3.00		Ø D <sub>1</sub> 3.00 - 5.00		Ø D <sub>1</sub> *5.00 - 10.00	
fz	α(°)	fz	α(°)	fz	α(°)	fz	α(°)	fz	α(°)	fz	α(°)
0.0017-0.0034	<25°	0.003-0.005	<25°	0.005-0.011	<25°	0.009-0.021	<25°	0.017-0.034	<25°	0.025-0.048	<20°
0.0015-0.0030	<25°	0.003-0.005	<25°	0.004-0.010	<25°	0.008-0.018	<25°	0.015-0.030	<25°	0.023-0.044	<20°
0.0015-0.0030	<25°	0.002-0.005	<25°	0.004-0.009	<25°	0.008-0.017	<25°	0.015-0.030	<25°	0.021-0.040	<20°
0.0015-0.0030	<20°	0.002-0.005	<20°	0.004-0.009	<20°	0.008-0.017	<20°	0.015-0.030	<20°	0.021-0.040	<15°
0.0014-0.0028	<15°	0.002-0.004	<15°	0.004-0.009	<15°	0.007-0.016	<15°	0.014-0.028	<15°	0.020-0.038	<10°
0.0019-0.0038	<25°	0.003-0.006	<25°	0.005-0.012	<25°	0.010-0.023	<25°	0.019-0.038	<25°	0.028-0.052	<20°
0.0026-0.0052	<30°	0.004-0.008	<30°	0.007-0.016	<30°	0.014-0.031	<30°	0.026-0.052	<30°	0.038-0.072	<25°
0.0021-0.0042	<30°	0.003-0.007	<30°	0.005-0.013	<30°	0.011-0.025	<30°	0.021-0.042	<30°	0.030-0.058	<25°
0.0019-0.0038	<30°	0.003-0.006	<30°	0.005-0.012	<30°	0.010-0.023	<30°	0.019-0.038	<30°	0.028-0.052	<25°
0.0009-0.0018	<10°	0.001-0.003	<10°	0.002-0.005	<10°	0.005-0.010	<10°	0.009-0.018	<10°	0.013-0.024	<5°
0.0021-0.0042	<20°	0.003-0.007	<20°	0.005-0.013	<20°	0.011-0.025	<20°	0.021-0.042	<20°	0.030-0.058	<15°

SLOTING

	VDI 3323	Ø D <sub>1</sub> 0.30 - 1.50		Ø D <sub>1</sub> 1.60 - 4.50		Ø D <sub>1</sub> 4.60 - 10.00	
		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]
<b>P</b>	Unalloyed steel, leaded steel	1 - 5	25 - 50		50 - 150		100 - 240
	Low alloyed steel < 800 N/mm <sup>2</sup>	6 - 9	20 - 50		50 - 125		75 - 195
	High-alloy steel > 800 N/mm <sup>2</sup> , stainless steel ferr.- marten.	10 - 13	20 - 30		50 - 70		75 - 110
<b>M</b>	Austenitic stainless steel < 700 N/mm <sup>2</sup>	14.1-14.2	20 - 50		50 - 125		85 - 195
	Nickel-free stainless steel/DUPLEX > 700 N/mm <sup>2</sup>	14.3-14.4	15 - 40		40 - 100		65 - 155
<b>K</b>	Ductile, malleable, nodular cast iron > 250HB	17 - 20	15 - 30	25 - 50	35 - 80	50 - 140	50 - 120
<b>N</b>	Copper alloy good machinability with Pb	26	20 - 35	30 - 50	45 - 90	50 - 150	70 - 140
	Copper alloy with difficult machinability	27 - 28	15 - 35	30 - 50	35 - 80	50 - 150	50 - 120
	Gold, silver	-	15 - 30	30 - 50	40 - 95	50 - 150	65 - 145
<b>S</b>	Refractory alloy, Fe, Ni, Co base	31 - 35		15 - 25		30 - 65	
	Titanium, titanium alloy	36 - 37	10 - 25	25 - 35	30 - 65	50 - 95	45 - 100



Feed per tooth fz [mm]

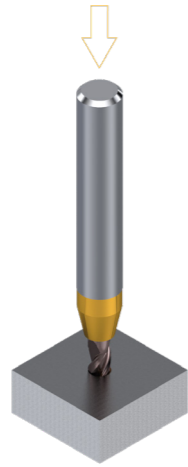
Ø D <sub>1</sub> 0.30 - 0.50		Ø D <sub>1</sub> 0.50 - 0.80		Ø D <sub>1</sub> 0.80 - 1.60		Ø D <sub>1</sub> 1.60 - 3.00		Ø D <sub>1</sub> 3.00 - 5.00		Ø D <sub>1</sub> *5.00 - 10.00	
fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)
0.0015 - 0.0030	< 0.50 × Ø	0.003 - 0.005	< 1.00 × Ø	0.004 - 0.010	< 2.00 × Ø	0.008 - 0.018	< 2.00 × Ø	0.015 - 0.030	< 0.50 × Ø	0.025 - 0.048	< 0.50 × Ø
0.0014 - 0.0028	< 0.50 × Ø	0.002 - 0.004	< 1.00 × Ø	0.004 - 0.009	< 2.00 × Ø	0.007 - 0.017	< 2.00 × Ø	0.014 - 0.028	< 0.50 × Ø	0.023 - 0.044	< 0.50 × Ø
0.0013 - 0.0026	< 0.50 × Ø	0.002 - 0.004	< 1.00 × Ø	0.003 - 0.008	< 2.00 × Ø	0.007 - 0.016	< 2.00 × Ø	0.013 - 0.026	< 0.50 × Ø	0.021 - 0.040	< 0.50 × Ø
0.0013 - 0.0026	< 0.50 × Ø	0.002 - 0.004	< 1.00 × Ø	0.003 - 0.008	< 2.00 × Ø	0.007 - 0.016	< 2.00 × Ø	0.013 - 0.026	< 0.50 × Ø	0.021 - 0.040	< 0.50 × Ø
0.0012 - 0.0024	< 0.50 × Ø	0.002 - 0.004	< 1.00 × Ø	0.003 - 0.008	< 1.50 × Ø	0.007 - 0.015	< 1.00 × Ø	0.012 - 0.024	< 0.50 × Ø	0.020 - 0.038	< 0.50 × Ø
0.0017 - 0.0034	< 0.50 × Ø	0.003 - 0.005	< 1.00 × Ø	0.004 - 0.011	< 2.00 × Ø	0.009 - 0.020	< 2.00 × Ø	0.017 - 0.034	< 0.50 × Ø	0.028 - 0.052	< 0.50 × Ø
0.0023 - 0.0046	< 0.50 × Ø	0.004 - 0.007	< 1.00 × Ø	0.006 - 0.015	< 2.00 × Ø	0.009 - 0.020	< 2.00 × Ø	0.017 - 0.034	< 0.50 × Ø	0.038 - 0.072	< 0.50 × Ø
0.0018 - 0.0036	< 0.50 × Ø	0.003 - 0.006	< 1.00 × Ø	0.005 - 0.012	< 2.00 × Ø	0.004 - 0.009	< 2.00 × Ø	0.008 - 0.016	< 0.50 × Ø	0.030 - 0.058	< 0.50 × Ø
0.0017 - 0.0034	< 0.25 × Ø	0.003 - 0.005	< 1.00 × Ø	0.004 - 0.011	< 2.00 × Ø	0.010 - 0.022	< 2.00 × Ø	0.018 - 0.036	< 0.50 × Ø	0.028 - 0.052	< 0.50 × Ø
0.0008 - 0.0016	< 0.25 × Ø	0.001 - 0.002	< 0.50 × Ø	0.002 - 0.005	< 1.00 × Ø	0.004 - 0.009	< 1.00 × Ø	0.008 - 0.016	< 0.50 × Ø	0.013 - 0.024	< 0.50 × Ø
0.0018 - 0.0036	< 0.50 × Ø	0.003 - 0.006	< 1.00 × Ø	0.005 - 0.012	< 2.00 × Ø	0.010 - 0.022	< 2.00 × Ø	0.018 - 0.036	< 0.50 × Ø	0.030 - 0.058	< 0.50 × Ø

\*D1 > 5.00mm --> Increase the cutting parameters if your spindle and workpiece support allow it.



DRILLING

	VDI 3323	Ø D <sub>1</sub> 0.30 - 1.50		Ø D <sub>1</sub> 1.60 - 4.50		Ø D <sub>1</sub> 4.60 - 10.00	
		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]
		<b>P</b>	Unalloyed steel, leaded steel	1 - 5	25 - 50	50 - 125	100 - 190
	Low alloyed steel < 800 N/mm <sup>2</sup>	6 - 9	20 - 40	50 - 100	75 - 155		
	High-alloy steel > 800 N/mm <sup>2</sup> , stainless steel ferr.- marten.	10 - 13	20 - 25	50 - 60	75 - 90		
<b>M</b>	Austenitic stainless steel < 700 N/mm <sup>2</sup>	14.1-14.2	20 - 40	50 - 100	85 - 155		
	Nickel-free stainless steel/DUPLEX >700 N/mm <sup>2</sup>	14.3-14.4	15 - 30	40 - 80	65 - 120		
<b>K</b>	Ductile, malleable, nodular cast iron>250HB	17 - 20	15 - 30	25 - 45	35 - 80	50 - 110	50 - 120
	Copper alloy good machinability with Pb	26	20 - 35	30 - 50	45 - 90	50 - 135	70 - 140
<b>N</b>	Copper alloy with difficult machinability	27 - 28	15 - 30	30 - 50	35 - 80	50 - 125	50 - 120
	Gold, silver	-	15 - 35	30 - 50	40 - 95	50 - 145	65 - 145
<b>S</b>	Refractory alloy, Fe, Ni, Co base	31 - 35	15 - 20	30 - 50	30 - 50	50 - 80	50 - 80
	Titanium, titanium alloy	36 - 37	10 - 25	25 - 30	30 - 65	50 - 75	45 - 100



$$n \text{ [rpm]} = \frac{Vc \text{ [m/min]} \times 1000}{\pi \times D_1 \text{ [mm]}}$$

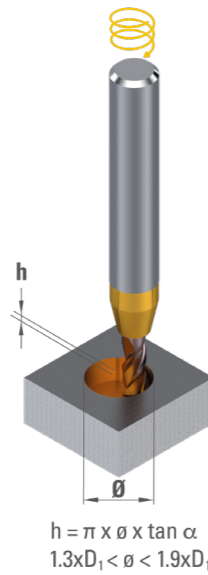
$$Vf \text{ [mm/min]} = n \text{ [rpm]} \times fz \text{ [mm]} \times Z$$

Feed per tooth fz [mm]

Ø D <sub>1</sub> 0.30 - 0.50		Ø D <sub>1</sub> 0.50 - 0.80		Ø D <sub>1</sub> 0.80 - 1.60		Ø D <sub>1</sub> 1.60 - 3.00		Ø D <sub>1</sub> 3.00 - 5.00		Ø D <sub>1</sub> *5.00 - 10.00	
fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)
0.0008 - 0.0016	<0.75×Ø	0.0014 - 0.0026	<1.00×Ø	0.0022 - 0.0052	<1.25×Ø	0.0035 - 0.008	<1.25×Ø	0.006 - 0.012	<1.25×Ø	0.007 - 0.016	<1.25×Ø
0.0008 - 0.0016	<0.50×Ø	0.0012 - 0.0024	<0.75×Ø	0.0020 - 0.0048	<1.00×Ø	0.0035 - 0.008	<1.00×Ø	0.005 - 0.010	<1.00×Ø	0.005 - 0.014	<1.00×Ø
0.0007 - 0.0014	<0.50×Ø	0.0012 - 0.0022	<0.75×Ø	0.0018 - 0.0044	<1.00×Ø	0.0030 - 0.007	<1.00×Ø	0.005 - 0.010	<1.00×Ø	0.004 - 0.010	<1.00×Ø
0.0005 - 0.0010	<0.25×Ø	0.0008 - 0.0016	<0.50×Ø	0.0014 - 0.0032	<0.75×Ø	0.0025 - 0.005	<0.75×Ø	0.004 - 0.008	<0.75×Ø	0.004 - 0.010	<0.75×Ø
0.0005 - 0.0010	<0.25×Ø	0.0008 - 0.0016	<0.50×Ø	0.0014 - 0.0032	<0.75×Ø	0.0025 - 0.005	<0.75×Ø	0.004 - 0.008	<0.75×Ø	0.004 - 0.010	<0.75×Ø
0.0007 - 0.0014	<0.75×Ø	0.0012 - 0.0022	<1.00×Ø	0.0018 - 0.0044	<1.25×Ø	0.0030 - 0.007	<1.25×Ø	0.005 - 0.010	<1.25×Ø	0.006 - 0.014	<1.25×Ø
0.0009 - 0.0018	<1×Ø	0.0016 - 0.0030	<1.25×Ø	0.0026 - 0.0060	<1.5×Ø	0.0045 - 0.010	<1.5×Ø	0.007 - 0.014	<1.5×Ø	0.008 - 0.018	<1.5×Ø
0.0008 - 0.0016	<0.75×Ø	0.0012 - 0.0024	<1×Ø	0.0020 - 0.0048	<1.25×Ø	0.0035 - 0.008	<1.25×Ø	0.005 - 0.010	<1.25×Ø	0.006 - 0.014	<1.25×Ø
0.0007 - 0.0014	<0.75×Ø	0.0012 - 0.0022	<1×Ø	0.0018 - 0.0044	<1.25×Ø	0.0030 - 0.007	<1.25×Ø	0.005 - 0.010	<1.25×Ø	0.006 - 0.014	<1.25×Ø
0.0003 - 0.006	<0×ØD1	0.0006 - 0.0010	<0.25×Ø	0.0008 - 0.0020	<0.5×Ø	0.0015 - 0.003	<0.5×Ø	0.002 - 0.004	<0.5×Ø	0.003 - 0.006	<0.5×Ø
0.0006 - 0.0012	<0.5×Ø	0.0001 - 0.0020	<0.75×Ø	0.0016 - 0.0040	<1×Ø	0.0030 - 0.006	<1×Ø	0.005 - 0.010	<1×Ø	0.005 - 0.012	<1×Ø

HELICAL MILLING

	VDI 3323	Ø D <sub>1</sub> 0.30 - 1.50		Ø D <sub>1</sub> 1.60 - 4.50		Ø D <sub>1</sub> 4.60 - 10.00	
		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]	CARBIDE Vc [m/min]	C-TOP Vc [m/min]
		<b>P</b>	Unalloyed steel, leaded steel	1 - 5	25 - 50	50 - 125	100 - 190
	Low alloyed steel < 800 N/mm <sup>2</sup>	6 - 9	20 - 40	50 - 100	75 - 155		
	High-alloy steel > 800 N/mm <sup>2</sup> , stainless steel ferr.- marten.	10 - 13	20 - 25	50 - 60	75 - 90		
<b>M</b>	Austenitic stainless steel < 700 N/mm <sup>2</sup>	14.1-14.2	20 - 40	50 - 100	85 - 155		
	Nickel-free stainless steel/DUPLEX >700 N/mm <sup>2</sup>	14.3-14.4	15 - 30	40 - 80	65 - 120		
<b>K</b>	Ductile, malleable, nodular cast iron>250HB	17 - 20	15 - 30	25 - 45	35 - 80	50 - 110	50 - 120
	Copper alloy good machinability with Pb	26	20 - 35	30 - 50	45 - 90	50 - 135	70 - 140
<b>N</b>	Copper alloy with difficult machinability	27 - 28	15 - 30	30 - 50	35 - 80	50 - 125	50 - 120
	Gold, silver	-	15 - 35	30 - 50	40 - 95	50 - 145	65 - 145
<b>S</b>	Refractory alloy, Fe, Ni, Co base	31 - 35	15 - 20	30 - 50	30 - 50	50 - 80	50 - 80
	Titanium, titanium alloy	36 - 37	10 - 25	25 - 35	30 - 65	50 - 75	45 - 100



Feed per tooth fz [mm]

Ø D <sub>1</sub> 0.30 - 0.50		Ø D <sub>1</sub> 0.50 - 0.80		Ø D <sub>1</sub> 0.80 - 1.60		Ø D <sub>1</sub> 1.60 - 3.00		Ø D <sub>1</sub> 3.00 - 5.00		Ø D <sub>1</sub> *5.00 - 10.00	
fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)
0.0017 - 0.0034	<20°	0.003 - 0.005	<25°	0.005 - 0.011	<25°	0.009 - 0.021	<25°	0.017 - 0.034	<25°	0.025 - 0.048	<20°
0.0015 - 0.0030	<20°	0.003 - 0.005	<25°	0.004 - 0.010	<25°	0.008 - 0.018	<25°	0.015 - 0.030	<25°	0.023 - 0.044	<20°
0.0015 - 0.0030	<20°	0.002 - 0.005	<25°	0.004 - 0.009	<25°	0.008 - 0.017	<25°	0.015 - 0.030	<25°	0.021 - 0.040	<20°
0.0015 - 0.0030	<15°	0.002 - 0.005	<20°	0.004 - 0.009	<20°	0.008 - 0.017	<20°	0.015 - 0.030	<20°	0.021 - 0.040	<15°
0.0014 - 0.0028	<10°	0.002 - 0.004	<15°	0.004 - 0.009	<15°	0.007 - 0.016	<15°	0.014 - 0.028	<15°	0.020 - 0.038	<10°
0.0022 - 0.0044	<20°	0.003 - 0.006	<25°	0.005 - 0.012	<25°	0.010 - 0.023	<25°	0.019 - 0.038	<25°	0.028 - 0.052	<20°
0.0026 - 0.0052	<25°	0.004 - 0.008	<30°	0.007 - 0.016	<30°	0.014 - 0.031	<30°	0.026 - 0.052	<30°	0.038 - 0.072	<25°
0.0021 - 0.0042	<25°	0.003 - 0.007	<30°	0.005 - 0.013	<30°	0.011 - 0.025	<30°	0.021 - 0.042	<30°	0.030 - 0.058	<25°
0.0019 - 0.0038	<25°	0.003 - 0.006	<30°	0.005 - 0.012	<30°	0.010 - 0.023	<30°	0.019 - 0.038	<30°	0.028 - 0.052	<25°
0.0009 - 0.0018	<5°	0.001 - 0.003	<10°	0.002 - 0.005	<10°	0.005 - 0.010	<10°	0.009 - 0.018	<10°	0.013 - 0.024	<5°
0.0021 - 0.0042	<15°	0.003 - 0.007	<20°	0.005 - 0.013	<20°	0.011 - 0.025	<20°	0.021 - 0.042	<20°	0.030 - 0.058	<15°

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