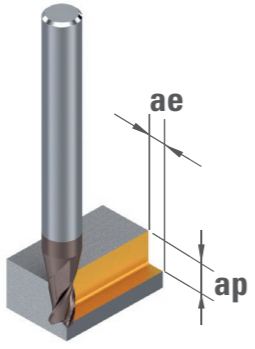


CUTTING CONDITIONS

Routing

	VDI 3323		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	ap [mm]	ae [mm]
P	Unalloyed steel	1 - 5		≈ 150	< 2 × D <sub>1</sub>	< 0.4 × D <sub>1</sub>
	Low alloyed steel - Rm < 800 N/mm <sup>2</sup>	6 - 9		≈ 125	< 2 × D <sub>1</sub>	< 0.3 × D <sub>1</sub>
	Martensitic stainless steel	10 - 13		≈ 100	< 2 × D <sub>1</sub>	< 0.3 × D <sub>1</sub>
M	Austenitic stainless steel	14.1 - 14.2		≈ 95	< 2 × D <sub>1</sub>	< 0.3 × D <sub>1</sub>
	DUPLEX stainless steel	14.3 - 14.4		≈ 65	< 2 × D <sub>1</sub>	< 0.25 × D <sub>1</sub>
K	Grey cast iron	15 - 16	≈ 135	≈ 180	< 2 × D <sub>1</sub>	< 0.4 × D <sub>1</sub>
	Malleable cast iron	19 - 20	≈ 115	≈ 150	< 2 × D <sub>1</sub>	< 0.3 × D <sub>1</sub>
N	Copper alloy good machinability (with Pb)	26	≈ 110		< 2 × D <sub>1</sub>	< 0.4 × D <sub>1</sub>
	Copper alloy difficult to machine	27 - 28	≈ 95		< 2 × D <sub>1</sub>	< 0.4 × D <sub>1</sub>
	Gold, silver	-	≈ 165		< 2 × D <sub>1</sub>	< 0.4 × D <sub>1</sub>
S	Special alloys / Heat resistant stainless steel	31 - 35	≈ 35	≈ 45	< 2 × D <sub>1</sub>	< 0.15 × D <sub>1</sub>
	Titanium, titanium alloys	36 - 37	≈ 60	≈ 70	< 2 × D <sub>1</sub>	< 0.3 × D <sub>1</sub>



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

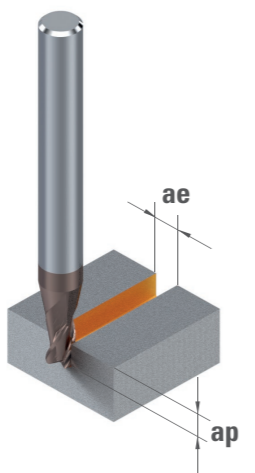
$$Vf \text{ [mm/min]} = n \text{ [rpm]} \times fz \text{ [mm]} \times Z$$

Feed per tooth fz [mm]

Ø D <sub>1</sub> 0.40 - 0.80	Ø D <sub>1</sub> 0.90 - 1.40	Ø D <sub>1</sub> 1.50 - 1.90	Ø D <sub>1</sub> 2.00 - 2.50	Ø D <sub>1</sub> 3.00 - 4.00	Ø D <sub>1</sub> 5.00 - 8.00	Ø D <sub>1</sub> 10.00 - 12.00
0.004 - 0.010	0.011 - 0.017	0.018 - 0.23	0.024 - 0.030	0.036 - 0.048	0.050 - 0.070	0.110 - 0.130
0.004 - 0.009	0.010 - 0.015	0.017 - 0.021	0.022 - 0.028	0.033 - 0.044	0.045 - 0.060	0.100 - 0.120
0.003 - 0.008	0.009 - 0.014	0.015 - 0.019	0.020 - 0.025	0.030 - 0.040	0.040 - 0.060	0.100 - 0.110
0.003 - 0.008	0.009 - 0.014	0.015 - 0.019	0.020 - 0.025	0.030 - 0.040	0.040 - 0.060	0.100 - 0.110
0.003 - 0.007	0.008 - 0.013	0.014 - 0.017	0.018 - 0.023	0.027 - 0.036	0.035 - 0.050	0.090 - 0.100
0.004 - 0.011	0.013 - 0.020	0.021 - 0.027	0.028 - 0.035	0.042 - 0.056	0.055 - 0.080	0.130 - 0.150
0.004 - 0.010	0.011 - 0.027	0.018 - 0.023	0.024 - 0.030	0.036 - 0.048	0.050 - 0.070	0.110 - 0.130
0.005 - 0.014	0.015 - 0.024	0.026 - 0.032	0.034 - 0.043	0.051 - 0.068	0.070 - 0.100	0.160 - 0.180
0.004 - 0.011	0.013 - 0.020	0.021 - 0.027	0.028 - 0.035	0.042 - 0.056	0.055 - 0.080	0.130 - 0.150
0.004 - 0.010	0.011 - 0.017	0.018 - 0.023	0.024 - 0.030	0.036 - 0.048	0.050 - 0.070	0.110 - 0.130
0.002 - 0.006	0.006 - 0.010	0.011 - 0.013	0.014 - 0.018	0.021 - 0.028	0.030 - 0.040	0.070 - 0.080
0.004 - 0.010	0.011 - 0.017	0.018 - 0.023	0.024 - 0.030	0.036 - 0.048	0.050 - 0.070	0.110 - 0.130

Slotting

	VDI 3323		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	ap [mm]	ae [mm]
P	Unalloyed steel	1 - 5		≈ 115	< 2 × D <sub>1</sub>	1 × D <sub>1</sub>
	Low alloyed steel - Rm < 800 N/mm <sup>2</sup>	6 - 9		≈ 95	< 1.5 × D <sub>1</sub>	1 × D <sub>1</sub>
	Martensitic stainless steel	10 - 13		≈ 75	< 1 × D <sub>1</sub>	1 × D <sub>1</sub>
M	Austenitic stainless steel	14.1 - 14.2		≈ 70	< 1 × D <sub>1</sub>	1 × D <sub>1</sub>
	DUPLEX stainless steel	14.3 - 14.4		≈ 50	< 0.8 × D <sub>1</sub>	1 × D <sub>1</sub>
K	Grey cast iron	15 - 16	≈ 100	≈ 135	< 2 × D <sub>1</sub>	1 × D <sub>1</sub>
	Malleable cast iron	19 - 20	≈ 115	≈ 115	< 1 × D <sub>1</sub>	1 × D <sub>1</sub>
N	Copper alloy good machinability (with Pb)	26	≈ 110		< 2 × D <sub>1</sub>	1 × D <sub>1</sub>
	Copper alloy difficult to machine	27 - 28	≈ 95		< 1.5 × D <sub>1</sub>	1 × D <sub>1</sub>
	Gold, silver	-	≈ 165		< 1 × D <sub>1</sub>	1 × D <sub>1</sub>
S	Special alloys / Heat resistant stainless steel	31 - 35	≈ 30	≈ 35	< 0.2 × D <sub>1</sub>	1 × D <sub>1</sub>
	Titanium, titanium alloys	36 - 37	≈ 60	≈ 55	< 1 × D <sub>1</sub>	1 × D <sub>1</sub>



Feed per tooth fz [mm]

Ø D <sub>1</sub> 0.40 - 0.80	Ø D <sub>1</sub> 0.90 - 1.40	Ø D <sub>1</sub> 1.50 - 1.90	Ø D <sub>1</sub> 2.00 - 2.50	Ø D <sub>1</sub> 3.00 - 4.00	Ø D <sub>1</sub> 5.00 - 8.00	Ø D <sub>1</sub> 10.00 - 12.00
0.003 - 0.007	0.008 - 0.012	0.013 - 0.16	0.017 - 0.021	0.025 - 0.034	0.035 - 0.050	0.080 - 0.090
0.003 - 0.006	0.007 - 0.011	0.012 - 0.015	0.015 - 0.020	0.023 - 0.030	0.030 - 0.040	0.070 - 0.080
0.002 - 0.006	0.006 - 0.010	0.011 - 0.013	0.014 - 0.018	0.021 - 0.028	0.030 - 0.040	0.070 - 0.080
0.002 - 0.005	0.005 - 0.008	0.009 - 0.011	0.012 - 0.015	0.018 - 0.024	0.025 - 0.040	0.060 - 0.070
0.002 - 0.004	0.005 - 0.008	0.008 - 0.010	0.011 - 0.014	0.016 - 0.022	0.020 - 0.030	0.050 - 0.060
0.003 - 0.009	0.010 - 0.016	0.017 - 0.022	0.022 - 0.028	0.034 - 0.044	0.045 - 0.060	0.100 - 0.120
0.003 - 0.008	0.009 - 0.014	0.014 - 0.018	0.019 - 0.024	0.029 - 0.038	0.040 - 0.060	0.090 - 0.100
0.004 - 0.011	0.012 - 0.019	0.021 - 0.026	0.027 - 0.034	0.041 - 0.054	0.055 - 0.080	0.130 - 0.140
0.003 - 0.009	0.010 - 0.016	0.017 - 0.022	0.022 - 0.028	0.034 - 0.044	0.045 - 0.060	0.100 - 0.120
0.003 - 0.008	0.009 - 0.014	0.014 - 0.018	0.014 - 0.018	0.029 - 0.038	0.040 - 0.060	0.090 - 0.100
0.001 - 0.004	0.004 - 0.006	0.007 - 0.008	0.007 - 0.008	0.013 - 0.016	0.020 - 0.020	0.040 - 0.050
0.003 - 0.007	0.008 - 0.012	0.013 - 0.016	0.013 - 0.016	0.025 - 0.034	0.035 - 0.050	0.080 - 0.090

Values based on oil use.

The cutting parameters are very strongly influenced by external parameters, especially the stability of the tool and the workpiece. The cutting conditions must be adapted to the operating conditions.

CUTTING CONDITIONS

Helical milling – Ramping

	VDI 3323		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	$\alpha$ [°]	Depth [mm]
P	Unalloyed steel	1 - 5		≈ 120	< 45	< 1 × D <sub>1</sub>
	Low alloyed steel - Rm < 800 N/mm <sup>2</sup>	6 - 9		≈ 100	< 35	< 1 × D <sub>1</sub>
	Martensitic stainless steel	10 - 13		≈ 80	< 35	< 1 × D <sub>1</sub>
M	Austenitic stainless steel	14.1 - 14.2		≈ 75	< 10	< 1 × D <sub>1</sub>
	DUPLEX stainless steel	14.3 - 14.4		≈ 50	< 10	< 0.8 × D <sub>1</sub>
K	Grey cast iron	15 - 16	≈ 110	≈ 145	< 45	< 1.5 × D <sub>1</sub>
	Malleable cast iron	19 - 20	≈ 90	≈ 120	< 45	< 1.2 × D <sub>1</sub>
N	Copper alloy good machinability (with Pb)	26	≈ 90		< 5	< 1.5 × D <sub>1</sub>
	Copper alloy difficult to machine	27 - 28	≈ 75		< 10	< 1.25 × D <sub>1</sub>
	Gold, silver	-	≈ 130		< 45	< 1 × D <sub>1</sub>
S	Special alloys / Heat resistant stainless steel	31 - 35	≈ 25	≈ 35	< 25	< 0.25 × D <sub>1</sub>
	Titanium, titanium alloys	36 - 37	≈ 50	≈ 55	< 25	< 1 × D <sub>1</sub>

$P = \varnothing \times \tan \alpha$

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

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

Feed per tooth fz [mm]

$\varnothing D_1$ 0.40 - 0.80	$\varnothing D_1$ 0.90 - 1.40	$\varnothing D_1$ 1.50 - 1.90	$\varnothing D_1$ 2.00 - 2.50	$\varnothing D_1$ 3.00 - 4.00	$\varnothing D_1$ 5.00 - 8.00	$\varnothing D_1$ 10.00 - 12.00
0.002 - 0.006	0.006 - 0.009	0.010 - 0.013	0.013 - 0.017	0.020 - 0.026	0.030 - 0.040	0.060 - 0.070
0.002 - 0.005	0.006 - 0.008	0.009 - 0.012	0.012 - 0.015	0.018 - 0.024	0.025 - 0.030	0.060 - 0.070
0.002 - 0.004	0.005 - 0.008	0.008 - 0.010	0.011 - 0.014	0.017 - 0.022	0.020 - 0.030	0.060 - 0.060
0.001 - 0.003	0.004 - 0.006	0.006 - 0.008	0.008 - 0.010	0.012 - 0.016	0.015 - 0.020	0.040 - 0.040
0.001 - 0.003	0.003 - 0.005	0.006 - 0.007	0.007 - 0.009	0.011 - 0.014	0.015 - 0.020	0.040 - 0.040
0.002 - 0.006	0.007 - 0.011	0.012 - 0.015	0.015 - 0.019	0.023 - 0.030	0.030 - 0.040	0.070 - 0.080
0.002 - 0.006	0.006 - 0.009	0.010 - 0.013	0.013 - 0.017	0.020 - 0.026	0.030 - 0.040	0.060 - 0.070
0.003 - 0.008	0.008 - 0.013	0.014 - 0.018	0.019 - 0.024	0.028 - 0.038	0.040 - 0.060	0.090 - 0.100
0.002 - 0.006	0.007 - 0.011	0.012 - 0.015	0.015 - 0.019	0.023 - 0.030	0.030 - 0.040	0.070 - 0.080
0.002 - 0.006	0.006 - 0.009	0.010 - 0.013	0.013 - 0.017	0.020 - 0.026	0.030 - 0.040	0.060 - 0.070
0.001 - 0.002	0.002 - 0.004	0.004 - 0.005	0.005 - 0.006	0.007 - 0.010	0.010 - 0.010	0.020 - 0.030
0.002 - 0.006	0.006 - 0.009	0.010 - 0.013	0.013 - 0.017	0.020 - 0.026	0.030 - 0.040	0.060 - 0.070

Axial ramping

	VDI 3323		CARBIDE Vc [m/min]	C-TOP Vc [m/min]	Depth [mm]
P	Unalloyed steel	1 - 5		≈ 105	< 1.5 × D <sub>1</sub>
	Low alloyed steel - Rm < 800 N/mm <sup>2</sup>	6 - 9		≈ 90	< 1 × D <sub>1</sub>
	Martensitic stainless steel	10 - 13		≈ 70	< 1 × D <sub>1</sub>
M	Austenitic stainless steel	14.1 - 14.2		≈ 65	< 0.2 × D <sub>1</sub>
	DUPLEX stainless steel	14.3 - 14.4		≈ 45	< 0.15 × D <sub>1</sub>
K	Grey cast iron	15 - 16	≈ 95	≈ 125	< 2 × D <sub>1</sub>
	Malleable cast iron	19 - 20	≈ 80	≈ 105	< 1 × D <sub>1</sub>
N	Copper alloy good machinability (with Pb)	26	≈ 75		< 2 × D <sub>1</sub>
	Copper alloy difficult to machine	27 - 28	≈ 65		< 1.5 × D <sub>1</sub>
	Gold, silver	-	≈ 115		< 1 × D <sub>1</sub>
S	Special alloys / Heat resistant stainless steel	31 - 35	≈ 25	≈ 30	< 0.15 × D <sub>1</sub>
	Titanium, titanium alloys	36 - 37	≈ 40	≈ 50	< 0.25 × D <sub>1</sub>

Feed per tooth fz [mm]

$\varnothing D_1$ 0.40 - 0.80	$\varnothing D_1$ 0.90 - 1.40	$\varnothing D_1$ 1.50 - 1.90	$\varnothing D_1$ 2.00 - 2.50	$\varnothing D_1$ 3.00 - 4.00	$\varnothing D_1$ 5.00 - 8.00	$\varnothing D_1$ 10.00 - 12.00
0.001 - 0.003	0.003 - 0.005	0.005 - 0.007	0.007 - 0.009	0.011 - 0.014	0.016 - 0.020	0.035 - 0.040
0.001 - 0.003	0.003 - 0.005	0.005 - 0.006	0.007 - 0.008	0.010 - 0.014	0.014 - 0.020	0.030 - 0.035
0.001 - 0.002	0.003 - 0.004	0.005 - 0.006	0.006 - 0.008	0.009 - 0.012	0.012 - 0.020	0.030 - 0.035
0.000 - 0.001	0.001 - 0.002	0.002 - 0.003	0.003 - 0.004	0.005 - 0.006	0.006 - 0.010	0.015 - 0.015
0.000 - 0.001	0.001 - 0.002	0.002 - 0.003	0.003 - 0.003	0.004 - 0.006	0.006 - 0.010	0.015 - 0.015
0.001 - 0.003	0.004 - 0.006	0.004 - 0.006	0.008 - 0.011	0.013 - 0.016	0.016 - 0.025	0.040 - 0.045
0.001 - 0.003	0.003 - 0.005	0.003 - 0.005	0.007 - 0.009	0.011 - 0.014	0.016 - 0.020	0.035 - 0.040
0.002 - 0.004	0.005 - 0.007	0.005 - 0.007	0.010 - 0.013	0.015 - 0.020	0.022 - 0.030	0.050 - 0.055
0.001 - 0.003	0.004 - 0.006	0.004 - 0.006	0.008 - 0.011	0.013 - 0.016	0.016 - 0.025	0.040 - 0.045
0.001 - 0.003	0.003 - 0.005	0.003 - 0.005	0.007 - 0.009	0.011 - 0.014	0.016 - 0.020	0.035 - 0.040
0.001 - 0.001	0.001 - 0.001	0.001 - 0.001	0.001 - 0.002	0.002 - 0.002	0.004 - 0.005	0.005 - 0.010
0.001 - 0.002	0.002 - 0.003	0.002 - 0.003	0.005 - 0.006	0.007 - 0.010	0.010 - 0.015	0.020 - 0.025

Values based on oil use.

The cutting parameters are very strongly influenced by external parameters, especially the stability of the tool and the workpiece. The cutting conditions must be adapted to the operating conditions.