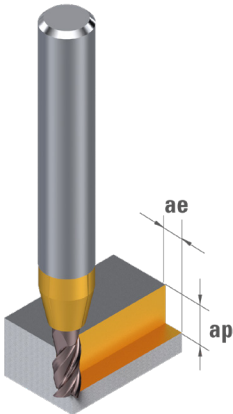




ROUTING / ROUGHING

			Ø D ₁ 0.30 - 1.50		Ø D ₁ 1.60 - 4.50		Ø D ₁ 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]
P	Unalloyed steel, leaded steel	1 - 5		30 - 50		50 - 150		120 - 280
	Low alloyed steel < 800 N/mm²	6 - 9		25 - 50		50 - 125		90 - 230
	High-alloy steel > 800 N/mm², stainless steel ferr.- marten.	10 - 13		25 - 35		50 - 85		90 - 130
M	Austenitic stainless steel < 700 N/mm²	14.1-14.2		25 - 50		50 - 150		100 - 230
	Nickel-free stainless steel/DUPLEX >700 N/mm²	14.3-14.4		20 - 45		50 - 115		75 - 180
K	Ductile, malleable, nodular cast iron>250HB	17 - 20	15 - 35	30 - 50	40 - 90	50 - 150	60 - 140	110 - 250
N	Copper alloy good machinability with Pb	26	20 - 40	30 - 50	50 - 105	50 - 150	80 - 165	150 - 300
	Copper alloy with difficult machinability	27 - 28	15 - 35	30 - 50	40 - 90	50 - 150	60 - 140	130 - 280
	Gold, silver	-	20 - 45	30 - 50	50 - 110	50 - 150	75 - 170	160 - 320
S	Refractory alloy, Fe, Ni, Co base	31 - 35		15 - 30		40 - 80		60 - 120
	Titanium, titanium alloy	36 - 37	15 - 30	30 - 45	35 - 80	50 - 110	55 - 120	120 - 170



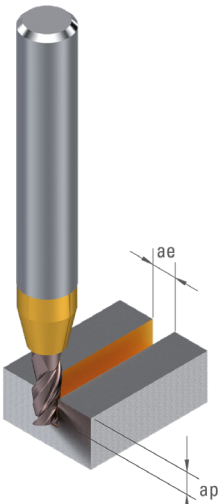
$$n \text{ [rpm]} = \frac{Vc \text{ [m/min]} \times 1000}{\pi \times D_1 \text{ [mm]}}$$

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

		Feed per tooth fz [mm]									
Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00		Ø D ₁ *5.00 - 10.00	
fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)
0.002 - 0.004	<0.90×Ø <2.00×Ø	0.003 - 0.006	<0.90×Ø <2.00×Ø	0.005 - 0.012	<0.90×Ø <2.00×Ø	0.010 - 0.022	<0.90×Ø <2.00×Ø	0.018 - 0.036	<0.90×Ø <2.00×Ø	0.025 - 0.060	<0.30×Ø <2.00×Ø
0.002 - 0.003	<2.00×Ø <0.90×Ø	0.003 - 0.005	<2.00×Ø <0.90×Ø	0.004 - 0.010	<2.00×Ø <0.90×Ø	0.009 - 0.019	<2.00×Ø <0.90×Ø	0.016 - 0.032	<2.00×Ø <0.90×Ø	0.023 - 0.054	<0.25×Ø <2.00×Ø
0.002 - 0.003	<0.90×Ø <0.90×Ø	0.003 - 0.005	<0.90×Ø <0.90×Ø	0.004 - 0.010	<0.90×Ø <0.90×Ø	0.008 - 0.018	<0.90×Ø <0.90×Ø	0.015 - 0.030	<0.90×Ø <0.90×Ø	0.021 - 0.052	<0.25×Ø <2.00×Ø
0.002 - 0.003	<2.00×Ø <0.90×Ø	0.003 - 0.005	<2.00×Ø <0.90×Ø	0.004 - 0.010	<2.00×Ø <0.90×Ø	0.008 - 0.018	<2.00×Ø <0.90×Ø	0.015 - 0.030	<2.00×Ø <0.90×Ø	0.021 - 0.052	<0.25×Ø <2.00×Ø
0.001 - 0.003	<0.90×Ø <0.90×Ø	0.002 - 0.005	<0.90×Ø <0.90×Ø	0.004 - 0.009	<0.90×Ø <0.90×Ø	0.008 - 0.017	<0.90×Ø <0.90×Ø	0.014 - 0.028	<0.90×Ø <0.90×Ø	0.020 - 0.048	<0.20×Ø <2.00×Ø
0.002 - 0.004	<0.90×Ø <0.90×Ø	0.003 - 0.006	<0.90×Ø <0.90×Ø	0.005 - 0.013	<0.90×Ø <0.90×Ø	0.011 - 0.024	<0.90×Ø <0.90×Ø	0.020 - 0.040	<0.90×Ø <0.90×Ø	0.028 - 0.066	<0.30×Ø <2.00×Ø
0.003 - 0.005	<2.00×Ø <0.90×Ø	0.005 - 0.009	<2.00×Ø <0.90×Ø	0.007 - 0.017	<2.00×Ø <0.90×Ø	0.014 - 0.032	<2.00×Ø <0.90×Ø	0.027 - 0.054	<2.00×Ø <0.90×Ø	0.038 - 0.090	<0.30×Ø <2.00×Ø
0.002 - 0.004	<0.90×Ø <0.90×Ø	0.004 - 0.007	<0.90×Ø <0.90×Ø	0.006 - 0.014	<0.90×Ø <0.90×Ø	0.012 - 0.026	<0.90×Ø <0.90×Ø	0.022 - 0.044	<0.90×Ø <0.90×Ø	0.030 - 0.072	<0.30×Ø <2.00×Ø
0.002 - 0.004	<2.00×Ø <0.90×Ø	0.003 - 0.006	<2.00×Ø <0.90×Ø	0.005 - 0.013	<2.00×Ø <0.90×Ø	0.011 - 0.024	<2.00×Ø <0.90×Ø	0.020 - 0.040	<2.00×Ø <0.90×Ø	0.028 - 0.066	<0.30×Ø <2.00×Ø
0.001 - 0.002	<0.90×Ø <0.90×Ø	0.002 - 0.003	<0.90×Ø <0.90×Ø	0.002 - 0.006	<0.90×Ø <0.90×Ø	0.005 - 0.011	<0.90×Ø <0.90×Ø	0.009 - 0.018	<0.90×Ø <0.90×Ø	0.013 - 0.030	<0.15×Ø <2.00×Ø
0.002 - 0.004	<2.00×Ø <0.90×Ø	0.004 - 0.007	<2.00×Ø <0.90×Ø	0.006 - 0.014	<2.00×Ø <0.90×Ø	0.012 - 0.026	<2.00×Ø <0.90×Ø	0.022 - 0.044	<2.00×Ø <0.90×Ø	0.030 - 0.072	<0.30×Ø <2.00×Ø

SLOTING

			Ø D ₁ 0.30 - 1.50		Ø D ₁ 1.60 - 4.50		Ø D ₁ 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]
P	Unalloyed steel, leaded steel	1 - 5		25 - 50		50 - 150		100 - 240
	Low alloyed steel < 800 N/mm²	6 - 9		20 - 50		50 - 125		75 - 195
	High-alloy steel > 800 N/mm², stainless steel ferr.- marten.	10 - 13		20 - 30		50 - 70		75 - 110
M	Austenitic stainless steel < 700 N/mm²	14.1-14.2		20 - 50		50 - 125		85 - 195
	Nickel-free stainless steel/DUPLEX >700 N/mm²	14.3-14.4		15 - 40		40 - 100		65 - 155
K	Ductile, malleable, nodular cast iron>250HB	17 - 20	15 - 30	25 - 50	35 - 80	50 - 140	50 - 120	95 - 215
N	Copper alloy good machinability with Pb	26	20 - 35	30 - 50	45 - 90	50 - 150	70 - 140	130 - 255
	Copper alloy with difficult machinability	27 - 28	15 - 35	30 - 50	35 - 80	50 - 150	50 - 120	110 - 240
	Gold, silver	-	15 - 30	30 - 50	40 - 95	50 - 150	65 - 145	135 - 270
S	Refractory alloy, Fe, Ni, Co base	31 - 35		15 - 25		30 - 65		50 - 100
	Titanium, titanium alloy	36 - 37	10 - 25	25 - 35	30 - 65	50 - 95	45 - 100	100 - 145



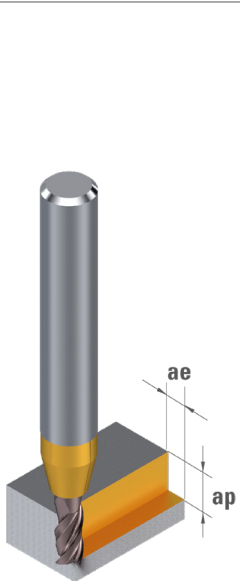
		Feed per tooth fz [mm]									
Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00		Ø D ₁ *5.00 - 10.00	
fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)	fz	ap (mm)
0.0015 - 0.0030	<0.50×Ø	0.003 - 0.005	<1.00×Ø	0.004 - 0.010	<2.00×Ø	0.008 - 0.018	<2.00×Ø	0.015 - 0.030	<2.00×Ø	0.025 - 0.048	<1.00×Ø
0.0014 - 0.0020	<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	<2.00×Ø	0.023 - 0.044	<1.00×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	<2.00×Ø	0.021 - 0.040	<1.00×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	<2.00×Ø	0.021 - 0.040	<1.00×Ø
0.0012 - 0.0024	<0.25×Ø	0.002 - 0.004	<0.50×Ø	0.003 - 0.008	<1.00×Ø	0.007 - 0.015	<1.00×Ø	0.012 - 0.024	<1.00×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	<2.00×Ø	0.028 - 0.052	<1.00×Ø
0.0023 - 0.0046	<0.50×Ø	0.004 - 0.007	<1.00×Ø	0.006 - 0.015	<2.00×Ø	0.012 - 0.028	<2.00×Ø	0.023 - 0.046	<2.00×Ø	0.013 - 0.024	<0.25×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	<2.00×Ø	0.030 - 0.058	<1.00×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	<2.00×Ø	0.038 - 0.072	<1.00×Ø
0.0008 - 0.0016	<0.25×Ø	0.001 - 0.002	<0.25×Ø	0.002 - 0.005	<0.50×Ø	0.004 - 0.009	<1.00×Ø	0.008 - 0.016	<1.00×Ø	0.030 - 0.058	<1.00×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	<2.00×Ø	0.028 - 0.052	<1.00×Ø

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



ROUTING / FINISHING

			Ø D ₁ 0.30 - 1.50		Ø D ₁ 1.60 - 4.50		Ø D ₁ 4.60 - 10.00	
	VDI 3323		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]
P	Unalloyed steel, leaded steel	1 - 5		30 - 50		50 - 150		150 - 350
	Low alloyed steel < 800 N/mm²	6 - 9		30 - 50		50 - 150		110 - 290
	High-alloy steel > 800 N/mm², stainless steel ferr.- marten.	10 - 13		30 - 40		50 - 105		110 - 160
M	Austenitic stainless steel < 700 N/mm²	14.1-14.2		30 - 50		50 - 150		130 - 290
	Nickel-free stainless steel/DUPLEX >700 N/mm²	14.3-14.4		25 - 50		50 - 150		90 - 230
K	Ductile, malleable, nodular cast iron>250HB	17 - 20	20 - 45	30 - 50	50 - 150	50 - 150	80 - 180	140 - 310
N	Copper alloy good machinability with Pb	26	25 - 50	30 - 50	50 - 150	50 - 150	100 - 210	190 - 380
	Copper alloy with difficult machinability	27 - 28	20 - 45	30 - 50	50 - 150	50 - 150	80 - 180	160 - 350
	Gold, silver	-	25 - 50	30 - 50	50 - 150	50 - 150	90 - 210	200 - 400
S	Refractory alloy, Fe, Ni, Co base	31 - 35		20 - 40		50 - 135		80 - 150
	Titanium, titanium alloy	36 - 37	20 - 40	30 - 50	45 - 150	50 - 110	70 - 150	150 - 210



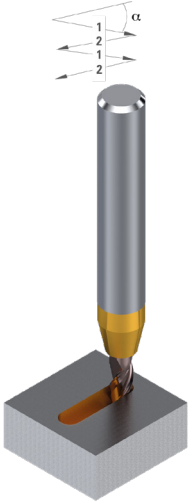
$$n \text{ [rpm]} = \frac{Vc \text{ [m/min]} \times 1000}{\pi \times D_1 \text{ [mm]}}$$

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

		Feed per tooth fz [mm]									
Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00		Ø D ₁ *5.00 - 10.00	
fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)	fz	ae ap (mm)
0.002 - 0.004	<0.20×Ø <2.00×Ø	0.003 - 0.006	<0.20×Ø <2.00×Ø	0.005 - 0.012	<0.20×Ø <2.00×Ø	0.010 - 0.022	<0.20×Ø <2.00×Ø	0.018 - 0.036	<0.20×Ø <2.00×Ø	0.030 - 0.060	<0.20×Ø <2.00×Ø
0.002 - 0.003	<0.15×Ø <2.00×Ø	0.003 - 0.005	<0.15×Ø <2.00×Ø	0.004 - 0.010	<0.15×Ø <2.00×Ø	0.009 - 0.019	<0.15×Ø <2.00×Ø	0.016 - 0.032	<0.15×Ø <2.00×Ø	0.027 - 0.054	<0.15×Ø <2.00×Ø
0.002 - 0.003	<0.15×Ø <2.00×Ø	0.003 - 0.005	<0.15×Ø <2.00×Ø	0.004 - 0.010	<0.15×Ø <2.00×Ø	0.008 - 0.018	<0.15×Ø <2.00×Ø	0.015 - 0.030	<0.15×Ø <2.00×Ø	0.026 - 0.052	<0.15×Ø <2.00×Ø
0.002 - 0.003	<0.15×Ø <2.00×Ø	0.003 - 0.005	<0.15×Ø <2.00×Ø	0.004 - 0.010	<0.15×Ø <2.00×Ø	0.008 - 0.018	<0.15×Ø <2.00×Ø	0.015 - 0.030	<0.15×Ø <2.00×Ø	0.026 - 0.052	<0.15×Ø <2.00×Ø
0.001 - 0.003	<0.10×Ø <2.00×Ø	0.002 - 0.005	<0.10×Ø <2.00×Ø	0.004 - 0.009	<0.10×Ø <2.00×Ø	0.008 - 0.017	<0.10×Ø <2.00×Ø	0.014 - 0.028	<0.10×Ø <2.00×Ø	0.024 - 0.048	<0.10×Ø <2.00×Ø
0.002 - 0.004	<0.20×Ø <2.00×Ø	0.003 - 0.006	<0.20×Ø <2.00×Ø	0.005 - 0.013	<0.20×Ø <2.00×Ø	0.011 - 0.024	<0.20×Ø <2.00×Ø	0.020 - 0.040	<0.20×Ø <2.00×Ø	0.033 - 0.066	<0.20×Ø <2.00×Ø
0.003 - 0.005	<0.20×Ø <2.00×Ø	0.005 - 0.009	<0.20×Ø <2.00×Ø	0.007 - 0.017	<0.20×Ø <2.00×Ø	0.014 - 0.032	<0.20×Ø <2.00×Ø	0.027 - 0.054	<0.20×Ø <2.00×Ø	0.045 - 0.090	<0.20×Ø <2.00×Ø
0.002 - 0.004	<0.20×Ø <2.00×Ø	0.004 - 0.007	<0.20×Ø <2.00×Ø	0.006 - 0.014	<0.20×Ø <2.00×Ø	0.012 - 0.026	<0.20×Ø <2.00×Ø	0.022 - 0.044	<0.20×Ø <2.00×Ø	0.036 - 0.072	<0.20×Ø <2.00×Ø
0.002 - 0.004	<0.20×Ø <2.00×Ø	0.003 - 0.006	<0.20×Ø <2.00×Ø	0.005 - 0.013	<0.20×Ø <2.00×Ø	0.011 - 0.024	<0.20×Ø <2.00×Ø	0.020 - 0.040	<0.20×Ø <2.00×Ø	0.033 - 0.066	<0.20×Ø <2.00×Ø
0.001 - 0.002	<0.08×Ø <2.00×Ø	0.002 - 0.003	<0.08×Ø <2.00×Ø	0.002 - 0.006	<0.08×Ø <2.00×Ø	0.005 - 0.011	<0.08×Ø <2.00×Ø	0.009 - 0.018	<0.08×Ø <2.00×Ø	0.015 - 0.030	<0.08×Ø <2.00×Ø
0.002 - 0.004	<0.20×Ø <2.00×Ø	0.004 - 0.007	<0.20×Ø <2.00×Ø	0.006 - 0.014	<0.20×Ø <2.00×Ø	0.012 - 0.026	<0.20×Ø <2.00×Ø	0.022 - 0.044	<0.20×Ø <2.00×Ø	0.036 - 0.072	<0.20×Ø <2.00×Ø

RAMPING

			Ø D ₁ 0.30 - 1.50		Ø D ₁ 1.60 - 4.50		Ø D ₁ 4.60 - 10.00	
	VDI 3323		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]
P	Unalloyed steel, leaded steel	1 - 5		25 - 50		50 - 125		100 - 190
	Low alloyed steel < 800 N/mm²	6 - 9		20 - 40		50 - 100		75 - 155
	High-alloy steel > 800 N/mm², stainless steel ferr.- marten.	10 - 13		20 - 25		50 - 60		75 - 90
M	Austenitic stainless steel < 700 N/mm²	14.1-14.2		20 - 40		50 - 100		85 - 155
	Nickel-free stainless steel/DUPLEX >700 N/mm²	14.3-14.4		15 - 30		40 - 80		65 - 120
K	Ductile, malleable, nodular cast iron>250HB	17 - 20	15 - 30	25 - 45	35 - 80	50 - 110	50 - 120	95 - 170
N	Copper alloy good machinability with Pb	26	20 - 35	30 - 50	45 - 90	50 - 135	70 - 140	130 - 205
	Copper alloy with difficult machinability	27 - 28	15 - 35	30 - 50	35 - 80	50 - 125	50 - 120	110 - 190
	Gold, silver	-	15 - 30	30 - 50	40 - 95	50 - 145	65 - 145	135 - 220
S	Refractory alloy, Fe, Ni, Co base	31 - 35		15 - 20		30 - 50		50 - 80
	Titanium, titanium alloy	36 - 37	10 - 25	25 - 35	30 - 65	50 - 75	45 - 100	100 - 115



		Feed per tooth fz [mm]									
Ø D ₁ 0.30 - 0.50		Ø D ₁ 0.50 - 0.80		Ø D ₁ 0.80 - 1.60		Ø D ₁ 1.60 - 3.00		Ø D ₁ 3.00 - 5.00		Ø D ₁ *5.00 - 10.00	
fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)	fz	α (°)
0.0010 - 0.0020	<30°	0.002 - 0.003	<30°	0.003 - 0.006	<30°	0.005 - 0.012	<30°	0.010 - 0.020	<30°	0.025 - 0.048	<20°
0.0009 - 0.0018	<30°	0.001 - 0.003	<30°	0.002 - 0.006	<30°	0.005 - 0.011	<30°	0.009 - 0.018	<30°	0.023 - 0.044	<20°
0.0008 - 0.0016	<30°	0.001 - 0.003	<30°	0.002 - 0.005	<30°	0.004 - 0.010	<30°	0.008 - 0.016	<30°	0.021 - 0.040	<20°
0.0008 - 0.0016	<30°	0.001 - 0.003	<30°	0.002 - 0.005	<30°	0.004 - 0.010	<30°	0.008 - 0.016	<30°	0.021 - 0.040	<15°
0.0008 - 0.0016	<15°	0.001 - 0.003	<15°	0.002 - 0.005	<15°	0.004 - 0.010	<15°	0.008 - 0.016	<15°	0.020 - 0.038	<10°
0.0011 - 0.0022	<30°	0.002 - 0.003	<30°	0.003 - 0.007	<30°	0.006 - 0.013	<30°	0.011 - 0.022	<30°	0.028 - 0.052	<20°
0.0015 - 0.0030	<35°	0.002 - 0.005	<35°	0.004 - 0.010	<35°	0.008 - 0.018	<35°	0.015 - 0.030	<35°	0.038 - 0.072	<25°
0.0012 - 0.0024	<35°	0.002 - 0.004	<35°	0.003 - 0.008	<35°	0.006 - 0.014	<35°	0.012 - 0.024	<35°	0.030 - 0.058	<25°
0.0011 - 0.0022	<35°	0.002 - 0.003	<35°	0.003 - 0.007	<35°	0.006 - 0.013	<35°	0.011 - 0.022	<35°	0.028 - 0.052	<25°
0.0005 - 0.0010	<8°	0.001 - 0.002	<8°	0.001 - 0.003	<8°	0.003 - 0.006	<8°	0.005 - 0.010	<8°	0.013 - 0.024	<5°
0.0012 - 0.0024	<15°	0.002 - 0.004	<15°	0.003 - 0.008	<15°	0.006 - 0.014	<15°	0.012 - 0.024	<15°	0.030 - 0.058	<15°

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