Speeds and Feeds

1) Select your material in the ISO colored chart.
2) Start with the appropriate feed per tooth, f_z (in) for your application. Start with a middle/average value for cutting speed, V_c (ft/min). Adjust the cutting speeds and/or feed based on your cutting conditions.

Material			Recommended Cutting Values		
Group		Material Description	Parameter	Engraving Ball End Mill - Uncoated	
ISO	VDI 3323			Tool Diameter (mm)	
				3	
				Rough Profile	Finish Profile
N	23-24	Aluminum - Cast Alloys Hardened 75 - 90 HB	Vc, SMM	1300	1300
			Fz, MMPT	0.0039	0.0051
			n, RPM	42040	42040
			Vf, MMPM	328	429
	25	Aluminum - Cast Alloys 130 HB	Vc, SMM	650	650
			Fz, MMPT	0.0005	0.0007
			n, RPM	21020	19860
			Vf, MMPM	21	29
	26-28	Copper and Copper Alloys (Bronze/Brass) 90 - 110 HB	Vc, SMM	500	500
			Fz, MMPT	0.0004	0.0006
			n, RPM	16170	16170
			Vf, MMPM	13	19
	29.1	Non-Metallic Materials GFRP, CFRP (Glass fiber reinforced plastic, carbon fiber reinforced plastic)	Vc, SMM	650	650
			Fz, MMPT	0.0015	0.0018
			n, RPM	21020	21020
			Vf, MMPM	63	76
	29.2		Vc, SMM	650	650
			Fz, MMPT	0.002	0.002
			n, RPM	21020	21020
			Vf, MMPM	84	84
	29.3		Vc, SMM	450	450
			Fz, MMPT	0.0015	0.002
			n, RPM	14550	14550
			Vf, MMPM	44	58
	30		Vc, SMM	650	650
			Fz, MMPT	0.0015	0.0018
			n, RPM	21020	21020
			Vf, MMPM	63	76

Speeds and Feeds

Feed Rate, Per Revolution (mm/min)
$v_f = f_n \cdot n$

Feed Rate, Per Tooth (mm/min)
$v_f = f_z \cdot n \cdot Z$

Feed Per Revolution (mm/rev)
$f_n = \frac{v_f}{n}$

Feed Per Tooth (mm)
$f_z = \frac{v_f}{n \cdot Z}$

Cutting Speed (m/min)
$v_c = \frac{\pi \cdot D_{tool} \cdot n}{1000}$

Spindle Speed (rev/min)
$n = \frac{v_c \cdot 1000}{\pi \cdot D_{tool}}$

Material Removal Rate (cm^3/min)
$MMR = \frac{a_p \cdot a_e \cdot v_f}{1000}$

Metric

Symbol	Definition	Unit
v_f	Feed rate	*mm/min*
f_n	Feed per revolution	*mm/rev*
f_z	Feed per tooth	*mm*
v_c	Cutting speed	*m/min (SMM)*
n	Spindle speed	*rev/min (RPM)*
D_{tool}	Tool cutting diameter	*mm*
MMR	Material removal rate	*(cm^3/min)*
a_e	Radial depth of cut	*mm*
a_p	Axial depth of cut	*mm*
Z	Number of teeth/flutes	