

Speeds and Feeds



ISO Material	Parameter	Series Name	Engraving Ball End Mill	
		Coating	Uncoated	
		Tool Diameter	3/16" Ø	
Wood	Cutting Speed, V_c	SFM MIN	500	
		SFM MAX	800	
	Feed per Tooth, f_z	Slotting	0.0023	
		Plunge/Ramp	0.0025	
		Rough Profile	0.0023	
		HEM	0.0023	
		Finish	0.0025	
	Composites	Cutting Speed, V_c	SFM MIN	300
			SFM MAX	600
		Feed per Tooth, f_z	Slotting	0.0018
			Plunge/Ramp	0.0023
Rough Profile			0.0018	
HEM			0.0018	
Plastics (3.0)	Cutting Speed, V_c	SFM MIN	500	
		SFM MAX	800	
	Feed per Tooth, f_z	Slotting	0.0023	
		Plunge/Ramp	0.0025	
		Rough Profile	0.0023	
		HEM	0.0023	
N	Cutting Speed, V_c	SFM MIN	500	
		SFM MAX	800	
	High Si Aluminum (>10%) (2.0)	Feed per Tooth, f_z	Slotting	0.0008
			Plunge/Ramp	0.0008
			Rough Profile	0.0013
			HEM	0.0009
	Low Si Aluminum (<10%) (3.0)	Cutting Speed, V_c	SFM MIN	1100
			SFM MAX	1500
		Feed per Tooth, f_z	Slotting	0.0041
			Plunge/Ramp	0.0055
			Rough Profile	0.0041
			HEM	0.0041
	Brass & Copper (3.0)	Cutting Speed, V_c	SFM MIN	400
			SFM MAX	600
		Feed per Tooth, f_z	Slotting	0.0006
			Plunge/Ramp	0.0009
			Rough Profile	0.0006
			HEM	0.0006
	Graphite (3.0)	Cutting Speed, V_c	SFM MIN	500
			SFM MAX	800
Feed per Tooth, f_z		Slotting	0.0023	
		Plunge/Ramp	0.0023	
		Rough Profile	0.003	
		HEM	0.003	

ISO Material	Parameter	Series Name	Engraving Ball End Mill	
		Coating	TiAlN	
		Tool Diameter	3/16" Ø	
P	Cutting Speed, V_c	SFM MIN	200	
		SFM MAX	500	
	Feed per Tooth, f_z	Slotting	0.0008	
		Plunge/Ramp	0.0012	
		Rough Profile	0.0008	
		HEM	0.0008	
M	Cutting Speed, V_c	SFM MIN	130	
		SFM MAX	260	
	Feed per Tooth, f_z	Slotting	0.0004	
		Plunge/Ramp	0.0006	
		Rough Profile	0.0004	
		HEM	0.0004	
K	Cutting Speed, V_c	SFM MIN	250	
		SFM MAX	400	
	Feed per Tooth, f_z	Slotting	0.0006	
		Plunge/Ramp	0.0014	
		Rough Profile	0.0006	
		HEM	0.0006	
S	Cutting Speed, V_c	SFM MIN	25	
		SFM MAX	115	
	Feed per Tooth, f_z	Slotting	0.0003	
		Plunge/Ramp	0.0006	
		Rough Profile	0.0003	
		HEM	0.0003	
	Titanium (.35)	Cutting Speed, V_c	SFM MIN	35
			SFM MAX	330
		Feed per Tooth, f_z	Slotting	0.0004
			Plunge/Ramp	0.0007
Rough Profile			0.0004	
HEM			0.0004	
H	Cutting Speed, V_c	SFM MIN	80	
		SFM MAX	130	
	Feed per Tooth, f_z	Slotting	0.001	
		Plunge/Ramp	0.0013	
		Rough Profile	0.0012	
		HEM	0.0012	

Speeds and Feeds



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

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

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

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

Cutting Speed (ft/min)
$v_c = \frac{\pi \cdot D_{tool} \cdot n}{12}$

Spindle Speed (rev/min)
$n = \frac{v_c \cdot 12}{\pi \cdot D_{tool}}$

Material Removal Rate (in ³ /min)
$MMR = a_p \cdot a_e \cdot v_f$

Inch

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