

Speeds and Feeds



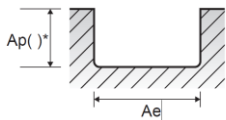
- 1) Select your material in the ISO colored chart with respect to material description.
- 2) Start with a middle/average value for spindle speed, n (RPM) and feed rate, V_f (mm/min). Adjust the spindle speed and/or feed rate based on your cutting conditions.

End Mill Series – **FPCLH**

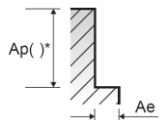
Material			Recommended Cutting Values – Side Cutting								
Group	Material Description	Width of Cut, a_e	Depth of Cut, a_p	Parameter	Tool Diameter (mm)						
					6	8	10	12	16	20	
ISO	VDI 3323										
P	1-4	Non-Alloy Steel	0.3D	1.5D	Vc, SMM	310	305	305	315	315	315
					Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113
					n, RPM	16446	12136	9708	8356	6267	5013
					Vf, MMPM	2467	2439	2447	2507	2507	2266
					Vc, SMM	245	245	250	240	255	240
					Fz, MMPT	0.023	0.03	0.028	0.033	0.04	0.039
	5	Non-Alloy Steel	0.3D	1.5D	Vc, SMM	245	245	250	240	255	240
					Fz, MMPT	0.023	0.03	0.028	0.033	0.04	0.039
					n, RPM	12998	9748	7958	6366	5073	3820
					Vf, MMPM	897	877	891	840	812	596
					Vc, SMM	310	305	305	315	315	315
					Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113
	6-7	Low Alloy Steel	0.3D	1.5D	Vc, SMM	310	305	305	315	315	315
					Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113
					n, RPM	16446	12136	9708	8356	6267	5013
					Vf, MMPM	2467	2439	2447	2507	2507	2266
					Vc, SMM	245	245	250	240	255	240
					Fz, MMPT	0.023	0.03	0.028	0.033	0.04	0.039
	8-9	Low Alloy Steel	0.3D	1.5D	n, RPM	12998	9748	7958	6366	5073	3820
					Vf, MMPM	897	877	891	840	812	596
					Vc, SMM	310	305	305	315	315	315
					Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113
					n, RPM	16446	12136	9708	8356	6267	5013
					Vf, MMPM	2467	2439	2447	2507	2507	2266
10	High Alloy Steel, and Tool Steel	0.3D	1.5D	Vc, SMM	245	245	250	240	255	240	
				Fz, MMPT	0.023	0.03	0.028	0.033	0.04	0.039	
				n, RPM	12998	9748	7958	6366	5073	3820	
				Vf, MMPM	897	877	891	840	812	596	
				Vc, SMM	310	305	305	315	315	315	
				Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113	
11.1	High Alloy Steel, and Tool Steel	0.3D	1.5D	n, RPM	16446	12136	9708	8356	6267	5013	
				Vf, MMPM	2467	2439	2447	2507	2507	2266	
				Vc, SMM	245	245	250	240	255	240	
				Fz, MMPT	0.023	0.03	0.028	0.033	0.04	0.039	
				n, RPM	12998	9748	7958	6366	5073	3820	
				Vf, MMPM	897	877	891	840	812	596	
11.2	High Alloy Steel, and Tool Steel	0.3D	1.5D	Vc, SMM	245	245	250	240	255	240	
				Fz, MMPT	0.023	0.03	0.028	0.033	0.04	0.039	
				n, RPM	12998	9748	7958	6366	5073	3820	
				Vf, MMPM	897	877	891	840	812	596	
				Vc, SMM	310	305	305	315	315	315	
				Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113	

NOTE: All cutting data are target values.
Maximum recommended depth shown.

Above recommendations are based on ideal conditions. Adjust parameters accordingly for smaller taper machining centers or less rigid conditions.



Slotting



Side Cutting



Speeds and Feeds



- 1) Select your material in the ISO colored chart with respect to material description.
- 2) Start with a middle/average value for spindle speed, n (RPM) and feed rate, V_f (mm/min). Adjust the spindle speed and/or feed rate based on your cutting conditions.

End Mill Series – **FPCLH**

Material			Recommended Cutting Values – Side Cutting								
Group		Material Description	Width of Cut, a_e	Depth of Cut, a_p	Parameter	Tool Diameter (mm)					
ISO	VDI 3323					6	8	10	12	16	20
M	14.1	Stainless Steel	0.3D	1.5D	Vc, SMM	165	165	170	165	175	160
					Fz, MMPT	0.023	0.03	0.028	0.034	0.039	0.038
					n, RPM	8754	6565	5411	4377	3482	2546
					Vf, MMPM	604	591	606	595	543	387
K	15-16	Grey Cast Iron	0.3D	1.5D	Vc, SMM	310	305	305	315	315	315
					Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113
					n, RPM	16446	12136	9708	8356	6267	5013
					Vf, MMPM	2467	2439	2447	2507	2507	2266
	17-18	Nodular Cast Iron	0.3D	1.5D	Vc, SMM	310	305	305	315	315	315
					Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113
					n, RPM	16446	12136	9708	8356	6267	5013
					Vf, MMPM	2467	2439	2447	2507	2507	2266
	19-20	Malleable Cast Iron	0.3D	1.5D	Vc, SMM	310	305	305	315	315	315
					Fz, MMPT	0.05	0.067	0.063	0.075	0.1	0.113
					n, RPM	16446	12136	9708	8356	6267	5013
					Vf, MMPM	2467	2439	2447	2507	2507	2266
H	38.1	Hardened Steel	0.05D	1.0D	Vc, SMM	65	65	65	65	65	65
					Fz, MMPT	0.026	0.033	0.036	0.039	0.034	0.038
					n, RPM	3448	2586	2069	1724	1293	1035
					Vf, MMPM	269	256	298	269	176	157
	38.2		1.0D	Vc, SMM	65	65	65	65	65	65	
				Fz, MMPT	0.026	0.033	0.036	0.039	0.034	0.038	
				n, RPM	3448	2586	2069	1724	1293	1035	
				Vf, MMPM	269	256	298	269	176	157	
	40	Chilled Cast Iron	0.3D	1.5D	Vc, SMM	245	245	250	240	255	240
					Fz, MMPT	0.023	0.03	0.028	0.033	0.04	0.039
					n, RPM	12998	9748	7958	6366	5073	3820
					Vf, MMPM	897	877	891	840	812	596
	41	Hardened Cast Iron	0.05D	1.0D	Vc, SMM	65	65	65	65	65	65
					Fz, MMPT	0.026	0.033	0.036	0.039	0.034	0.038
					n, RPM	3448	2586	2069	1724	1293	1035
					Vf, MMPM	269	256	298	269	176	157



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 (mm 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	(mm ³ /min)
a_e	Radial depth of cut	mm
a_p	Axial depth of cut	mm
Z	Number of teeth/flutes	