

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 – HTPM

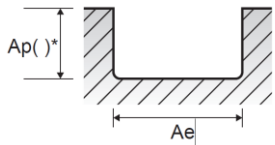
Material			Recommended Cutting Values – Slotting and Side Cutting																
ISO	Group VDI 3323	Material Description	Width of Cut, a_e		Depth of Cut, a_p		Parameter	Cutting Diameter (mm)											
			Side	Slotting	Side	Slotting		3	4	5	6	8	10	12	14	16	18	20	25
P	1-4	Non-Alloy Steel	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	152	152	152	152	152	168	168	168	168	168	168	168
							Fz, MMPT	0.0051	0.0076	0.0102	0.0152	0.0279	0.0381	0.0483	0.0483	0.0533	0.0584	0.066	0.0635
	n, RPM	16128	12096	9677	8064	6048	5348	4456	3820	3342	2971	2674	2139						
	Vf, MPPM	322.58	387.1	425.7	516.13	653.29	812.8	837.69	748.54	708.66	701.04	695.2	547.62						
	5	Low Alloy Steel	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	107	107	107	107	107	117	117	117	117	117	117	117
							Fz, MMPT	0.0051	0.0076	0.0102	0.0152	0.0279	0.0381	0.0457	0.0483	0.0533	0.0584	0.066	0.0635
	n, RPM	11353	8515	6812	5677	4257	3724	3104	2660	2328	2069	1862	1490						
	Vf, MPPM	227.08	272.03	299.97	362.97	459.99	565.91	582.93	520.95	493.01	487.93	484.12	381						
	6-7	Low Alloy Steel	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	152	152	152	152	152	168	168	168	168	168	168	168
							Fz, MMPT	0.0051	0.0076	0.0102	0.0152	0.0279	0.0381	0.0483	0.0483	0.0533	0.0584	0.066	0.0635
	n, RPM	16128	12096	9677	8064	6048	5348	4456	3820	3342	2971	2674	2139						
	Vf, MPPM	322.58	387.1	425.7	516.13	653.29	812.8	837.69	748.54	708.66	701.04	695.2	547.62						
	8-9	Low Alloy Steel	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	107	107	107	107	107	117	117	117	117	117	117	117
							Fz, MMPT	0.0051	0.0076	0.0102	0.0152	0.0279	0.0381	0.0457	0.0483	0.0533	0.0584	0.066	0.0635
	n, RPM	11353	8515	6812	5677	4257	3724	3104	2660	2328	2069	1862	1490						
	Vf, MPPM	227.08	272.03	299.97	362.97	459.99	565.91	582.93	520.95	493.01	487.93	484.12	381						
	10-11.1	High Alloy Steel, and Tool Steel	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	64	64	64	64	64	70	70	70	70	70	70	70
							Fz, MMPT	0.0025	0.0051	0.0076	0.0102	0.0203	0.0279	0.033	0.033	0.0381	0.0406	0.0457	0.0457
							n, RPM	6791	5093	4074	3395	2546	2228	1857	1592	1393	1238	1114	891
							Vf, MPPM	81.03	121.92	130.05	149.1	194.06	241.05	238	215.9	205.99	202.95	200.91	160.02

NOTE: Feed to be reduced by approximately 50% if LOC (length of cut) is over 3XD.

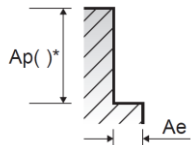
The above recommendations are based on ideal conditions; for smaller taper machining centers or less rigid conditions, please adjust parameters accordingly on diameters greater than 12mm.

In profile operations, engaging more than 2XD, reduce the radial depth of cut, a_e by 50%-60%.

Finish cuts typically require reduced cutting feeds and speeds; also, it is recommended the radial depth of cut, a_e should not exceed (2%)XD.



Slotting



Side Cutting



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End Mill Series – HTPM

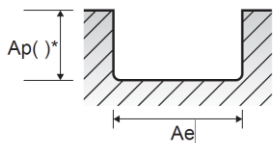
Material			Recommended Cutting Values – Slotting and Side Cutting																							
Group	VDI 3323	Material Description	Width of Cut, a_e		Depth of Cut, a_p		Parameter	Cutting Diameter (mm)																		
			Side	Slotting	Side	Slotting		3	4	5	6	8	10	12	14	16	18	20	25							
M	12-13	Stainless Steel	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	148	148	148	148	148	148	148	148	148	148	148	148	148						
							Fz, MMPT	0.0051	0.0051	0.0102	0.0127	0.0229	0.033	0.0381	0.0432	0.0457	0.0508	0.0559	0.0559							
							n, RPM	15703	11777	9422	7852	5889	4711	3926	3365	2944	2617	2355	1884							
							Vf, MPPM	250.95	282.96	339.09	407.92	517.91	641.1	611.89	564.9	530.1	522.99	517.91	415.04							
							Vc, SMM	107	107	107	107	107	107	107	107	107	107	107	107							
							Fz, MMPT	0.0051	0.0076	0.0127	0.0178	0.0279	0.0483	0.0559	0.0584	0.061	0.0711	0.0762	0.0762							
	14.1		0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	n, RPM	11247	8435	6748	5623	4218	3374	2812	2410	2109	1874	1687	1350							
							Vf, MPPM	225.04	270	351.03	404.88	471.93	647.95	619	568.96	522.99	525.02	519.94	416.05							
							Vc, SMM	94	94	94	94	94	94	94	94	94	94	94	94							
							Fz, MMPT	0.0051	0.0076	0.0127	0.0178	0.0279	0.0483	0.0559	0.0584	0.061	0.0686	0.0762	0.0762							
							n, RPM	10080	7560	6048	5040	3780	3024	2520	2160	1890	1680	1512	1210							
							Vf, MPPM	201.93	242.06	313.94	362.97	422.91	580.9	553.97	510.03	468.88	464.06	459.99	368.05							
14.2	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	111	111	111	111	111	123	123	123	123	123	123	123									
					Fz, MMPT	0.0051	0.0102	0.0152	0.0203	0.033	0.0483	0.0584	0.061	0.066	0.0737	0.0813	0.0787									
					n, RPM	11884	8913	7130	5942	4456	3915	3263	2797	2447	2175	1958	1566									
					Vf, MPPM	284.99	357.12	399.03	474.98	606.04	752.09	756.92	681.99	636.02	635	633.98	495.05									
					Vc, SMM	26	26	26	26	26	26	26	26	26	26	26	26									
					Fz, MMPT	0.0051	0.0076	0.0127	0.0178	0.0279	0.0483	0.0559	0.0584	0.061	0.0686	0.0762	0.0762									
K	15-20	Grey Cast Iron	0.5D	1.0D	1.5D (1.2D)	1.0D (0.8D)	Vc, SMM	111	111	111	111	111	123	123	123	123	123	123								
							Fz, MMPT	0.0051	0.0102	0.0152	0.0203	0.033	0.0483	0.0584	0.061	0.066	0.0737	0.0813	0.0787							
							n, RPM	11884	8913	7130	5942	4456	3915	3263	2797	2447	2175	1958	1566							
							Vf, MPPM	284.99	357.12	399.03	474.98	606.04	752.09	756.92	681.99	636.02	635	633.98	495.05							
							Vc, SMM	26	26	26	26	26	26	26	26	26	26	26	26							
							Fz, MMPT	0.0051	0.0076	0.0127	0.0178	0.0279	0.0483	0.0559	0.0584	0.061	0.0686	0.0762	0.0762							
							S	31-35	Heat Resistant Super Alloys	0.25D	1.0D	1.0D	0.5D	Vc, SMM	26	26	26	26	26	26	26	26	26	26	26	
														Fz, MMPT	0.0051	0.0076	0.0076	0.0127	0.0203	0.033	0.0381	0.0406	0.0432	0.0483	0.0533	0.0533
														n, RPM	2759	2069	1655	1379	1035	828	690	591	517	460	414	331
														Vf, MPPM	55.12	57.91	53.09	66.04	78.99	108.97	104.9	95	88.9	87.88	88.9	69.09
														Vc, SMM	58	58	58	58	58	58	58	58	58	58	58	58
														Fz, MMPT	0.0051	0.0076	0.0102	0.0152	0.0254	0.0432	0.0508	0.0533	0.0559	0.061	0.0686	0.0686
36-37	0.35D	1.0D	1.0D	0.5D	n, RPM	6154		4615		3692	3077	2308	1846	1538	1319	1154	1026	923	738							
					Vf, MPPM	98.04		129.03		162.05	197.1	230.89	309.88	308.1	279.91	254	254	250.95	203.96							

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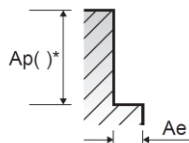
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Feed Rate, Per Revolution (mm/min)
$v_f = f_n \cdot n$

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	