

Side-Cutting (HSM)

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 (in/min). Adjust the spindle speed and/or feed rate based on your cutting conditions.

End Mill Series – **HSA M1**

Material			Recommended Cutting Values – Side Cutting HSM (Light)											
Group	ISO	VDI 3323	Material Description	Width of Cut, a _e	Depth of Cut, a _p	Parameter	Tool Diameter (in)							
							1/8	1/4	3/8	1/2	5/8	3/4	1	
N	21-22		Aluminum-Wrought Alloy	0.05D	2.0D	Vc, SFM	8000	8000	8000	8000	8000	8000	8000	
						Fz, IPT	0.0021	0.0055	0.0105	0.014	0.015	0.0165	0.0195	
						n, RPM	244500	122200	81500	61100	48900	40700	30600	
						Vf, IPM	1540	2016	2567	2566	2201	2015	1790	
	23-25			Aluminum-Cast Alloy	0.05D	2.0D	Vc, SFM	1200	1200	1200	1200	1200	1200	1200
							Fz, IPT	0.0021	0.0055	0.0105	0.014	0.015	0.0165	0.0195
							n, RPM	36670	18340	12220	9170	7330	6110	4580
							Vf, IPM	231	303	385	385	330	303	268
	26-28			Copper and Copper Alloys (Bronze/Brass)	0.05D	2.0D	Vc, SFM	1850	1850	1850	1850	1850	1850	1850
							Fz, IPT	0.0017	0.0045	0.0085	0.0115	0.013	0.014	0.016
							n, RPM	56540	28270	18850	14130	11310	9420	7070
							Vf, IPM	288	382	481	488	441	396	339
29.1			Non-Metallic Materials (Duroplastic)	0.05D	2.0D	Vc, SFM	3350	3350	3350	3350	3350	3350	3350	
						Fz, IPT	0.0034	0.009	0.017	0.023	0.025	0.0275	0.032	
						n, RPM	102380	51190	34130	25590	20480	17060	12800	
						Vf, IPM	1044	1382	1740	1766	1536	1408	1229	

NOTE: All cutting data are target values.

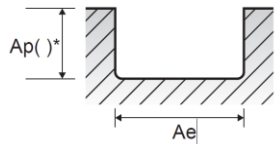
Maximum recommended depth shown.

Finish cuts typically require reduced feed rates and/or higher spindle speed, with a radial depth of cut, a_e of (2%)XD or less.

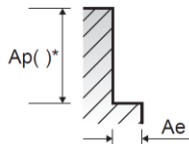
Reduce speed and feed recommendations for materials harder than listed.

Reduce cut depth and feed by 50% for long-flute or long-reach tools.

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



Slotting



Side Cutting

Tech Tips: The tables above are based on common machining calculators.

We realize that shops may not have the RPM capability shown in the tables.

To adapt the tables to the machining conditions available, use the following calculation:

$$(\text{Recommended Feed IPM} / \text{Recommended RPM}) \times \text{Available RPM} = \text{IPM}$$



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End Mill Series – **HSAM1**

Material			Recommended Cutting Values – Side Cutting											
Group	ISO	VDI 3323	Material Description	Width of Cut, a _e	Depth of Cut, a _p	Parameter	Tool Diameter (in)							
							1/8	1/4	3/8	1/2	5/8	3/4	1	
N	21-22		Aluminum-Wrought Alloy	0.5D	1.5D	Vc, SFM	3000	3000	3000	3000	3000	3000	3000	
						Fz, IPT	0.001	0.003	0.0045	0.006	0.0066	0.0075	0.01	
						n, RPM	91700	45800	30600	23000	18300	15300	11500	
						Vf, IPM	275	412	413	414	362	344	345	
						Vc, SFM	800	800	800	800	800	800	800	
						Fz, IPT	0.001	0.003	0.0045	0.006	0.0066	0.0075	0.01	
	23-25			Aluminum-Cast Alloy	0.5D	1.5D	n, RPM	24450	12220	8150	6110	4890	4080	3060
							Vf, IPM	73	110	110	110	97	92	92
							Vc, SFM	1150	1150	1150	1150	1150	1150	1150
							Fz, IPT	0.0008	0.002	0.004	0.005	0.0055	0.006	0.007
							n, RPM	35140	17570	11720	8790	7030	5860	4390
							Vf, IPM	84	105	141	132	116	105	92
26-28			Copper and Copper Alloys (Bronze/Brass)	0.5D	1.5D	Vc, SFM	2070	2070	2070	2070	2070	2070	2070	
						Fz, IPT	0.0015	0.004	0.0075	0.01	0.011	0.012	0.014	
						n, RPM	63260	31630	21090	15820	12650	10540	7910	
						Vf, IPM	285	380	474	474	418	380	332	
						Vc, SFM	2070	2070	2070	2070	2070	2070	2070	
						Fz, IPT	0.0015	0.004	0.0075	0.01	0.011	0.012	0.014	
29.1			Non-Metallic Materials (Duroplastic)	0.5D	1.5D	Vc, SFM	2070	2070	2070	2070	2070	2070	2070	
						Fz, IPT	0.0015	0.004	0.0075	0.01	0.011	0.012	0.014	
						n, RPM	63260	31630	21090	15820	12650	10540	7910	
						Vf, IPM	285	380	474	474	418	380	332	

NOTE: All cutting data are target values.

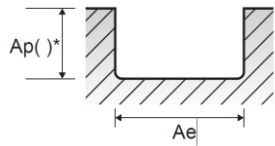
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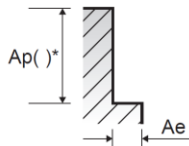
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End Mill Series – HSAM1

Material			Recommended Cutting Values – Slotting									
Group	Material Description	Width of Cut, a _e	Depth of Cut, a _p	Parameter	Tool Diameter (in)							
					1/8	1/4	3/8	1/2	5/8	3/4	1	
N	21-22 Aluminum-Wrought Alloy	1.0D	1.0D	Vc, SFM	2000	2000	2000	2000	2000	2000	2000	2000
				Fz, IPT	0.001	0.003	0.0045	0.006	0.0066	0.0075	0.01	
				n, RPM	61100	30500	20400	15300	12200	10200	7600	
				Vf, IPM	183	275	275	275	242	230	228	
	23-25 Aluminum-Cast Alloy	1.0D	1.0D	Vc, SFM	600	600	600	600	600	600	600	600
				Fz, IPT	0.001	0.003	0.0045	0.006	0.0066	0.0075	0.01	
				n, RPM	18340	9170	6110	4580	3670	3060	2290	
				Vf, IPM	55	83	83	83	73	69	69	
	26-28 Copper and Copper Alloys (Bronze/Brass)	1.0D	1.0D	Vc, SFM	880	880	880	880	880	880	880	880
				Fz, IPT	0.0008	0.002	0.004	0.005	0.0055	0.006	0.007	
				n, RPM	26890	13450	8960	6720	5380	4480	3360	
				Vf, IPM	65	81	108	101	89	81	71	
	29.1 Non-Metallic Materials (Duroplastic)	1.0D	1.0D	Vc, SFM	1670	1670	1670	1670	1670	1670	1670	1670
				Fz, IPT	0.0015	0.004	0.0075	0.01	0.011	0.012	0.014	
				n, RPM	51040	25520	17010	12760	10210	8510	6380	
				Vf, IPM	230	306	383	383	337	306	268	

NOTE: All cutting data are target values.

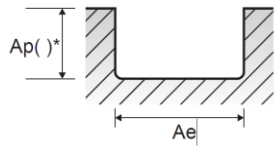
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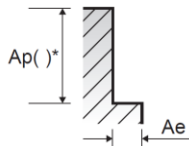
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Speeds and Feeds



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	