

# 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 – **HSAM2**

Material		Recommended Cutting Values – <b>Slotting</b>												
Group ISO	VDI 3323	Material Description	Width of Cut, $a_e$	Depth of Cut, $a_p$	Parameter	Tool Diameter (mm)								
						3	4	5	6	8	10	12	16	20
<b>N</b>	21-22	Aluminum-Wrought Alloy	1.0D	1.0D	Vc, SMM	488	488	488	488	488	488	488	488	488
					Fz, MMPT	0.0254	0.03302	0.04318	0.0762	0.1016	0.1143	0.1524	0.16764	0.1905
					n, RPM	51740	38810	31050	25870	19400	15520	12940	9700	7760
					Vf, MMPM	3937	3835	4013	5918	5918	5334	5918	4877	4445
	23-25	Aluminum-Cast Alloy	1.0D	1.0D	Vc, SMM	183	183	183	183	183	183	183	183	183
					Fz, MMPT	0.0254	0.03302	0.04318	0.0762	0.1016	0.1143	0.1524	0.16764	0.1905
					n, RPM	19400	14550	11640	9700	7280	5820	4850	3640	2910
					Vf, MMPM	1473	1448	1499	2210	2210	2007	2210	1829	1651
	26-28	Copper and Copper Alloys (Bronze/Brass)	1.0D	1.0D	Vc, SMM	268	268	268	268	268	268	268	268	268
					Fz, MMPT	0.02032	0.02794	0.03302	0.0508	0.06858	0.1016	0.127	0.1397	0.1524
					n, RPM	28460	21340	17080	14230	10670	8540	7110	5340	4270
					Vf, MMPM	1727	1778	1702	2159	2184	2591	2718	2235	1956
29.1	Non-Metallic Materials (Duroplastic)	1.0D	1.0D	Vc, SMM	503	503	503	503	503	503	503	503	503	
				Fz, MMPT	0.0381	0.0508	0.0635	0.1016	0.13462	0.1905	0.254	0.2794	0.3048	
				n, RPM	53360	40020	32020	26680	20010	16010	13340	10010	8000	
				Vf, MMPM	6096	6096	6096	8128	8077	9144	10160	8382	7315	

NOTE: All cutting data are target values.

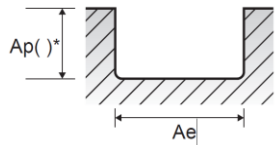
Maximum recommended depth shown.

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.

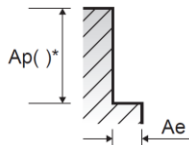
Reduce speed and feed recommendations for materials harder than listed.

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.



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:

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



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Group		Material Description	Width of Cut, $a_e$	Depth of Cut, $a_p$	Parameter	Tool Diameter (mm)								
ISO	VDI 3323					3	4	5	6	8	10	12	16	20
N	21-22	Aluminum-Wrought Alloy	1.0D	1.0D	Vc, SMM	610	610	610	610	610	610	610	610	610
					Fz, MMPT	0.0254	0.03302	0.04318	0.0762	0.1016	0.1143	0.1524	0.16764	0.1905
					n, RPM	64680	48510	38810	32340	24260	19400	16170	12130	9700
					Vf, MMPM	4928	4801	5029	7391	7391	6655	7391	6096	5537
	23-25	Aluminum-Cast Alloy	1.0D	1.0D	Vc, SMM	244	244	244	244	244	244	244	244	244
					Fz, MMPT	0.0254	0.03302	0.04318	0.0762	0.1016	0.1143	0.1524	0.16764	0.1905
					n, RPM	25870	19400	15520	12940	9700	7760	6470	4850	3880
					Vf, MMPM	1981	1930	2007	2946	2946	2667	2946	2438	2210
	26-28	Copper and Copper Alloys (Bronze/Brass)	1.0D	1.0D	Vc, SMM	351	351	351	351	351	351	351	351	351
					Fz, MMPT	0.02032	0.02794	0.03302	0.0508	0.06858	0.1016	0.127	0.1397	0.1524
					n, RPM	37190	27890	22310	18600	13950	11160	9300	6970	5580
					Vf, MMPM	2261	2337	2210	2845	2870	3404	3556	2921	2540
29.1	Non-Metallic Materials (Duroplastic)	1.0D	1.0D	Vc, SMM	625	625	625	625	625	625	625	625	625	
				Fz, MMPT	0.0381	0.0508	0.0635	0.1016	0.13462	0.1905	0.254	0.2794	0.3048	
				n, RPM	66300	49720	39780	33150	24860	19890	16570	12430	9940	
				Vf, MMPM	7569	7569	7569	10109	10033	11379	12624	10414	9093	

NOTE: All cutting data are target values.

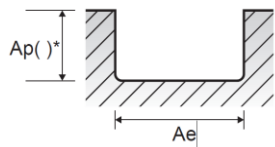
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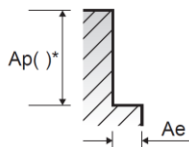
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# Speeds and Feeds



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 <sup>3</sup> /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 <sup>3</sup> /min)
$a_e$	Radial depth of cut	mm
$a_p$	Axial depth of cut	mm
$Z$	Number of teeth/flutes	