

Basic Spindle RPM for Drilling and Milling

Spindle RPM for Cutter Diameter											
Material	SFPM	1/8"	1/4"	1/2"	3/4"	1"	2"	3"	4"	5"	6"
Tool & SS Steel	30	900	450	220	150	110	60	40	30	45	20
Cast Steel	35	1000	530	260	180	130	70	45	33	27	22
Cast Iron	50	1500	760	380	250	190	95	64	48	38	32
Carbon Steel	60	1800	910	450	300	230	115	76	57	46	38
Mild Steel	70	2100	1000	530	350	260	130	90	67	53	44
Bronze	100	3000	1500	760	500	380	190	130	95	76	64
Brass	200	6000	3000	1500	1000	760	380	250	190	150	130
Aluminum	300	9100	4560	2280	1500	1140	570	380	280	220	190
Plastic	1000	30000	15000	7600	5000	3800	1900	1200	950	760	640

Speeds in Surface Feet per Minute are specified for High-Speed Steel drill bits, and are approximate for normal drilling operations.

Speeds should be halved when using Carbon Steel bits and can be doubled for Carbide bits. Use coolant judiciously.

For Milling operations speeds may be increased by 50%. Lathe turning speeds may be increased by 100%.

The best rule of thumb for proper cutting speed is the color of the chip when cutting steel.

- Using a high-speed steel drill bit the chips should never be turning brown or blue.
- Straw colored chips indicate that you are on the maximum edge of the cutting speed for your cutting conditions.
- When using Carbide bits, chip colors can range from amber to blue, but never black.
- A dark purple color will indicate that you are on the maximum edge of your cutting conditions.

Calculation of Spindle RPM

the formula for Spindle RPM, given Cutting Speed in feet-per-minute and Cutter Diameter in inches is:

$$(\text{Cutting-speed} \times 12\text{inches}) / (\text{Cutter-diameter} \times \text{Pi})$$

Simplified Calculation of Spindle RPM

conveniently enough the above formula approximately reduces to this:

$$(\text{Cutting-speed} \times 4) / \text{Cutter-diameter}$$

Depth of Cut

FLYCUTTING -- Depth of cut on flat surfaces with H.S.S. cutters.

- Mild steel -- .030 in.
- Brass -- .045 in.
- Alluminum -- .060 in.

END MILLING -- Spiral flute H.S.S. endmills.

Maximum depth of cut and tool offset into material when cutting along one edge.

The amount of material removed per pass is a box of this size in both directions.

- Cutters up to 1/4" diameter -- 1/8 of diameter
 - 1/8" cutter -- 1/64 or .016"
 - 3/16" cutter -- .024"
- Cutters 1/4" and over -- 1/4 of diameter
 - 1/4" cutter -- 1/16 or .063"
 - 1/2" cutter -- 1/8 or .125"

SLOT CUTTING -- H.S.S. spiral fluted endmills.

Incremental depth of cut when all edges of the cutter are in contact with material.

Spindle speed should be halved from that recommended for drilling.

Slotting Depth for Cutter Diameter							
Material	1/8"	3/16"	1/4"	3/8"	1/2"	5/8"	3/4"
Mild Steel	.025	.030	.045	.070	.100	.200	.250
Brass	.027	.040	.060	.100	.140	.250	.300
Aluminum	.030	.045	.065	.110	.150	.300	.350

KEYWAY CUTTING -- H.S.S. disc cutters (i.e. saw blades).

Spindle speed for Cisc Cutter Diameter					
Material	2"	2.5"	3"	3.5"	4"
Mild Steel	65	55	45	38	33
Brass	115	95	75	65	55
Aluminum	190	155	125	110	95