Speeds and Feeds

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Drill Diameter header (second section):

METRIC	3.0	-	4.0	-	5.0	6.0	-	-	8.0
FRACTIONAL	-	1/8	-	3/16	-	-	1/4	5/16	-
DECIMAL	.1181	.1250	.1575	.1875	.1969	.2362	.2500	.3125	.3150

Recommended Cutting Values

ISO	VDI 3323	Sym	Material Description	HB	HRC	SFM (ft/min)	Type	1.0 (.0394)	2.0 (.0787)	SFM (ft/min)	3.0 (.1181)	4.0 (.1575)	5.0 (.1875-.1969)	6.0 (.2362)	8.0 (.3150)
P	2	◎	Non-alloy steel	190	13	230	RPM	22,280	11,140	329	10,610	7,960	6,370	5,310	3,980
P	2	◎	Non-alloy steel	190	13	230	FEED	.0008-.0016	.0016-.0024	329	.0016-.0039	.0024-.0047	.0047-.0071	.0055-.0079	.0063-.0087
P	3	○	Non-alloy steel	250	25	230	RPM	22,280	11,140	329	10,610	7,960	6,370	5,310	3,980
P	3	○	Non-alloy steel	250	25	230	FEED	.0008-.0016	.0016-.0024	329	.0016-.0039	.0024-.0047	.0047-.0071	.0055-.0079	.0063-.0087
P	6	◎	Low alloy steel	180	10	230	RPM	22,280	11,140	329	10,610	7,960	6,370	5,310	3,980
P	6	◎	Low alloy steel	180	10	230	FEED	.0008-.0016	.0016-.0024	329	.0016-.0039	.0024-.0047	.0047-.0071	.0055-.0079	.0063-.0087
P	7	○	Low alloy steel	275	29	160	RPM	15,920	7,960	230	7,430	5,570	4,460	3,710	2,790
P	7	○	Low alloy steel	275	29	160	FEED	.0008-.0016	.0016-.0024	230	.0016-.0039	.0024-.0047	.0047-.0071	.0055-.0079	.0063-.0087
M	12	◎	Stainless steel	200	15	130	RPM	12,730	6,370	165	5,310	3,980	3,180	2,650	1,990
M	12	◎	Stainless steel	200	15	130	FEED	.0008-.0016	.0008-.0016	165	.0012-.0020	.0020-.0035	.0028-.0043	.0031-.0047	.0035-.0051
M	13	◎	Stainless steel	240	23	80	RPM	7,960	3,980	132	4,240	3,180	2,550	2,120	1,590
M	13	◎	Stainless steel	240	23	80	FEED	.0008-.0016	.0008-.0016	132	.0012-.0020	.0020-.0035	.0028-.0043	.0031-.0047	.0035-.0051
M	14	◎	Stainless steel	180	10	150	RPM	14,320	7,160	198	6,370	4,770	3,820	3,180	2,390
M	14	◎	Stainless steel	180	10	150	FEED	.0008-.0016	.0008-.0016	198	.0016-.0024	.0024-.0039	.0031-.0047	.0035-.0051	.0039-.0055
N	21	◎	Aluminum-wrought alloy	60		430	RPM	41,380	20,690	659	21,220	15,920	12,730	10,610	7,960
N	21	◎	Aluminum-wrought alloy	60		430	FEED	.0016-.0039	.0031-.0055	659	.0055-.0079	.0075-.0098	.0079-.0102	.0087-.0110	.0094-.0118
N	22	◎	Aluminum-wrought alloy	100		430	RPM	41,380	20,690	659	21,220	15,920	12,730	10,610	7,960
N	22	◎	Aluminum-wrought alloy	100		430	FEED	.0016-.0039	.0031-.0055	659	.0055-.0079	.0075-.0098	.0079-.0102	.0087-.0110	.0094-.0118
N	23	○	Aluminum-cast, alloyed	75		360	RPM	35,010	17,510	593	19,100	14,320	11,460	9,550	7,160
N	23	○	Aluminum-cast, alloyed	75		360	FEED	.0016-.0039	.0031-.0055	593	.0055-.0079	.0075-.0098	.0079-.0102	.0087-.0110	.0094-.0118
N	24	○	Aluminum-cast, alloyed	90		360	RPM	35,010	17,510	593	19,100	14,320	11,460	9,550	7,160
N	24	○	Aluminum-cast, alloyed	90		360	FEED	.0016-.0039	.0031-.0055	593	.0055-.0079	.0075-.0098	.0079-.0102	.0087-.0110	.0094-.0118
N	25	○	Aluminum-cast, alloyed	130		300	RPM	28,650	14,320	494	15,920	11,940	9,550	7,960	5,970
N	25	○	Aluminum-cast, alloyed	130		300	FEED	.0016-.0031	.0024-.0039	494	.0047-.0071	.0063-.0087	.0067-.0091	.0075-.0098	.0083-.0106
S	37	○	Titanium alloys	1050 Rm		80	RPM	7,960	3,980	132	4,240	3,180	2,550	2,120	1,590
S	37	○	Titanium alloys	1050 Rm		80	FEED	.0004-.0012	.0004-.0012	132	.0008-.0016	.0016-.0031	.0024-.0039	.0028-.0043	.0031-.0047

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Material							Recommended Cutting Values										
Group		Material Description	HB	HRC		SFM (ft/min)		Drill Diameter									
ISO	VDI 3323							METRIC: - / FRACTIONAL: 3/8 / DECIMAL: .3750	10.0 / - / .3937	12.0 / - / .4724	- / 1/2 / .5000	14.0 / - / .5512	- / 9/16 / .5625	- / 5/8 / .6250	16.0 / - / .6299	18.0 / - / .7087	- / 3/4 / .7500	20.0 / - / .7874

ISO	VDI	Material Description	HB	HRC	sym	SFM	Row	.3750	.3937	.4724	.5000	.5512	.5625	.6250	.6299	.7087	.7500	.7874
P	2	Non-alloy steel	190	13	◎	329	RPM	3,180	2,650	2,510	2,270		1,990		1,770	1,680		1,590
							FEED	.0071-.0094	.0075-.0106	.0075-.0106	.0083-.0154		.0091-.0122		.0102-.0142	.0102-.0142		.0110-.0150
	3		250	25	○	329	RPM	3,180	2,650	2,510	2,270		1,990		1,770	1,680		1,590
							FEED	.0071-.0094	.0075-.0106	.0075-.0106	.0083-.0154		.0091-.0122		.0102-.0142	.0102-.0142		.0110-.0150
	6	Low alloy steel	180	10	◎	329	RPM	3,180	2,650	2,510	2,270		1,990		1,770	1,680		1,590
							FEED	.0071-.0094	.0075-.0106	.0075-.0106	.0083-.0154		.0091-.0122		.0102-.0142	.0102-.0142		.0110-.0150
	7		275	29	○	230	RPM	2,230	1,860	1,760	1,590		1,390		1,240	1,170		1,110
							FEED	.0071-.0094	.0075-.0106	.0075-.0106	.0083-.0154		.0091-.0122		.0102-.0142	.0102-.0142		.0110-.0150
M	12	Stainless steel	200	15	◎	165	RPM	1,590	1,330	1,260	1,140		990		880	840		800
							FEED	.0039-.0059	.0043-.0063	.0043-.0063	.0047-.0067		.0051-.0071		.0055-.0075	.0055-.0075		.0059-.0079
	13		240	23	◎	132	RPM	1,270	1,060	1,010	910		800		710	670		640
							FEED	.0039-.0059	.0043-.0063	.0043-.0063	.0047-.0067		.0051-.0071		.0055-.0075	.0055-.0075		.0059-.0079
	14		180	10	◎	198	RPM	1,910	1,590	1,510	1,360		1,190		1,060	1,010		950
							FEED	.0043-.0063	.0047-.0067	.0047-.0067	.0051-.0071		.0055-.0075		.0059-.0079	.0059-.0079		.0063-.0083
N	21	Aluminum-wrought alloy	60		◎	659	RPM	6,370	5,310	5,030	4,550		3,980		3,540	3,360		3,180
							FEED	.0102-.0126	.0110-.0134	.0110-.0134	.0118-.0142		.0126-.0150		.0130-.0169	.0130-.0169		.0138-.0177
	22		100		◎	659	RPM	6,370	5,310	5,030	4,550		3,980		3,540	3,360		3,180
							FEED	.0102-.0126	.0110-.0134	.0110-.0134	.0118-.0142		.0126-.0150		.0130-.0169	.0130-.0169		.0138-.0177
	23	Aluminum-cast, alloyed	75		○	593	RPM	5,730	4,770	4,530	4,090		3,580		3,180	3,020		2,860
							FEED	.0102-.0126	.0110-.0134	.0110-.0134	.0118-.0142		.0126-.0150		.0130-.0169	.0130-.0169		.0138-.0177
	24		90		○	593	RPM	5,730	4,770	4,530	4,090		3,580		3,180	3,020		2,860
							FEED	.0102-.0126	.0110-.0134	.0110-.0134	.0118-.0142		.0126-.0150		.0130-.0169	.0130-.0169		.0138-.0177
	25		130		○	494	RPM	4,770	3,980	3,770	3,410		2,980		2,650	2,520		2,390
							FEED	.0091-.0114	.0098-.0122	.0098-.0122	.0106-.0130		.0110-.0134		.0110-.0150	.0110-.0150		.0118-.0157
S	37	Titanium alloys	1050 Rm		○	132	RPM	1,270	1,060	1,010	910		800		710	670		640
							FEED	.0035-.0055	.0039-.0059	.0039-.0059	.0043-.0063		.0047-.0067		.0051-.0071	.0051-.0071		.0055-.0075

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Speeds and Feeds

Penetration Rate (in/min)

$$v_f = f_n \cdot n$$

Feed Per Revolution (in/rev)

$$f_n = \frac{v_f}{n}$$

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 (in³/min)

$$MRR = D_{tool} \cdot f_n \cdot v_c \cdot 3$$

Inch

Symbol	Definition	Unit
v_f	Penetration rate	in/min
f_n	Feed per revolution	in/rev
v_c	Cutting speed	ft/min (SFM)
n	Spindle speed	rev/min (RPM)
D_{tool}	Tool cutting diameter	in
MRR	Material removal rate	(in³/min)

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