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 cutting speed, V_c (ft/min) and feed, f_n (in/rev). Adjust the cutting speed and/or feed based on your cutting conditions.

ISO	VDI 3323	Material Description	Composition / Structure / Heat Treatment		HB	HRC		SFM	Drill Diameter											
									METRIC	-	5.0	6.0	-	-	8.0	-	10.0	12.0	-	14.0	-
									FRACTIONAL	3/16	-	-	1/4	5/16	-	3/8	-	-	1/2	-	9/16
									DECIMAL	.1875	.1969	.2362	.2500	.3125	.3150	.3750	.3937	.4724	.5000	.5512	.5625
P	1	Non-alloy steel	About 0.15% C	Annealed	125																
P	2		About 0.45% C	Annealed	190	13	◉	329	RPM	6370		5310		3980		3180		2650	2510	2270	
									FEED	.0079 - .0098		.0094 - .0118		.0126 - .0157		.0157 - .0197		.0189 - .0236	.0189 - .0236	.022 - .0276	
P	3		About 0.45% C	Quenched & tempered	250	25	◉	329	RPM	6370		5310		3980		3180		2650	2510	2270	
									FEED	.0079 - .0098		.0094 - .0118		.0126 - .0157		.0157 - .0197		.0189 - .0236	.0189 - .0236	.022 - .0276	
P	4		About 0.75% C	Annealed	270	28	◉	329	RPM	6370		5310		3980		3180		2650	2510	2270	
									FEED	.0063 - .0083		.0079 - .0102		.0102 - .0134		.0134 - .0165		.0161 - .0185	.0161 - .0185	.0185 - .0213	
P	5		About 0.75% C	Quenched & tempered	300	32	○	263	RPM	5090		4240		3180		2550		2120	2010	1820	
									FEED	.0063 - .0083		.0079 - .0102		.0102 - .0134		.0134 - .0165		.0161 - .0185	.0161 - .0185	.0185 - .0213	
P	6	Low alloy steel		Annealed	180	10	◉	329	RPM	6370		5310		3980		3180		2650	2510	2270	
									FEED	.0079 - .0098		.0094 - .0118		.0126 - .0157		.0157 - .0197		.0189 - .0213	.0189 - .0213	.022 - .0248	
P	7			Quenched & tempered	275	29	◉	263	RPM	5090		4240		3180		2550		2120	2010	1820	
									FEED	.0079 - .0098		.0094 - .0118		.0126 - .0157		.0157 - .0197		.0189 - .0213	.0189 - .0213	.022 - .0248	
P	8			Quenched & tempered	300	32	○	263	RPM	5090		4240		3180		2550		2120	2010	1820	
									FEED	.0063 - .0083		.0079 - .0102		.0102 - .0134		.0134 - .0165		.0161 - .0185	.0161 - .0185	.0185 - .0213	
P	9			Quenched & tempered	350	38	○	132	RPM	2550		2120		1590		1270		1060	1010	910	
									FEED	.0051 - .0071		.0063 - .0087		.0083 - .0114		.0102 - .0142		.0126 - .015	.0126 - .015	.0142 - .0169	
P	10	High alloyed steel, and tool steel		Annealed	200	15	◉	230	RPM	4460		3710		2790		2230		1860	1760	1590	
									FEED	.0063 - .0083		.0079 - .0102		.0102 - .0134		.0134 - .0165		.0161 - .0185	.0161 - .0185	.0185 - .0213	
P	11			Quenched & Tempered	325	35	○	132	RPM	2550		2120		1590		1270		1060	1010	910	
									FEED	.0051 - .0071		.0063 - .0087		.0083 - .0114		.0102 - .0142		.0126 - .015	.0126 - .015	.0142 - .0169	
K	15	Grey cast iron	Pearlitic / ferritic		180	10	◉	329	RPM	6370		5310		3980		3180		2650	2510	2270	
									FEED	.0091 - .0118		.0106 - .0142		.0142 - .0189		.0177 - .0236		.0213 - .0283	.0213 - .0283	.0248 - .0331	
K	16		Pearlitic (Martensitic)		260	26	○	263	RPM	5090		4240		3180		2550		2120	2010	1820	
									FEED	.0079 - .0098		.0094 - .0118		.0126 - .0157		.0157 - .0197		.0189 - .0236	.0189 - .0236	.022 - .0276	
K	17	Nodular cast iron	Ferritic		160	3	◉	329	RPM	6370		5310		3980		3180		2650	2510	2270	
									FEED	.0091 - .0118		.0106 - .0142		.0142 - .0189		.0177 - .0236		.0213 - .0283	.0213 - .0283	.0248 - .0331	
K	18		Pearlitic		250	25	○	230	RPM	4460		3710		2790		2230		1860	1760	1590	
									FEED	.0079 - .0098		.0094 - .0118		.0126 - .0157		.0157 - .0197		.0189 - .0236	.0189 - .0236	.022 - .0276	
K	19	Malleable cast iron	Ferritic		130		◉	263	RPM	5090		4240		3180		2550		2120	2010	1820	
									FEED	.0091 - .0118		.0106 - .0142		.0142 - .0189		.0177 - .0236		.0213 - .0283	.0213 - .0283	.0248 - .0331	
K	20		Pearlitic		230	21	○	230	RPM	4460		3710		2790		2230		1860	1760	1590	
									FEED	.0079 - .0098		.0094 - .0118		.0126 - .0157		.0157 - .0197		.0189 - .0236	.0189 - .0236	.022 - .0276	

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 (in^3/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	*(in^3/min)*