Speeds and Feeds

Feed: inch/rev
RPM: rev/min

ISO	VDI 3323	Material Description	Composition / Structure / Heat Treatment		HB	HRC		Drill Diameter																			
								SFM	1.0		SFM	METRIC	2.0	3.0	-	4.0	6.0	-	-	8.0	-	10.0	-	13			
									-			FRACTIONAL	-	-	1/8	-	-	1/4	5/16	-	3/8	-	1/2			
									.0394			DECIMAL	.0787	.1181	.1250	.1575	.2362	.2500	.3125	.3150	.3750	.3937	.5000	.5118			
P	1	Non-alloy steel	About 0.15% C	Annealed	125		•	92	RPM	8910	132	RPM	6370	4240		3180	2120		1590		1,270		980			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
P	2		About 0.45% C	Annealed	190	13	•	82	RPM	7960	115	RPM	5570	3710		2790	1860		1390		1110		860			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
P	3		About 0.45% C	Quenched & tempered	250	25	•	66	RPM	6370	99	RPM	4770	3180		2390	1590		1190		950.000		730			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
P	4		About 0.75% C	Annealed	270	28	○	49	RPM	4770	66	RPM	3180	2120		1590	1060		800		640.000		490			
									FEED	.0004 - .0008		FEED	.0008 - .002	.0008 - .0024		.0016 - .0031	.0016 - .0039		.0024 - .0047		.0031 - .0055		.0047 - .0071			
P	6	Low alloy steel		Annealed	180	10	•	82	RPM	7960	115	RPM	5570	3710		2790	1860		1390		1110.000		860			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
P	7			Quenched & tempered	275	29	○	66	RPM	6370	99	RPM	4770	3180		2390	1590		1190		950.000		730			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
P	8			Quenched & tempered	300	32	○	66	RPM	6370	99	RPM	4770	3180		2390	1590		1190		950.000		730			
									FEED	.0004 - .0008		FEED	.0008 - .002	.0008 - .0024		.0016 - .0031	.0016 - .0039		.0024 - .0047		.0031 - .0055		.0047 - .0071			
P	10	High alloyed steel, and tool steel		Annealed	200	15	○	49	RPM	4770	66	RPM	3180	2120		1590	1060		800		640.000		490			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
M	12	Stainless steel	Ferritic / Martensitic	Annealed	200	15	•	59	RPM	5730	82	RPM	3980	2650		1990	1330		990		800.000		610			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
M	13		Martensitic	Quenched & Tempered	240	23	○	49	RPM	4770	66	RPM	3180	2120		1590	1060		800		640.000		490			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
M	14			Austenitic	180	10	○	33	RPM	3180	49	RPM	2390	1590		1190	800		600		480.000		370			
									FEED	.0004 - .0008		FEED	.0008 - .002	.0008 - .0024		.0016 - .0031	.0016 - .0039		.0024 - .0047		.0031 - .0055		.0047 - .0071			
K	15	Grey cast iron	Pearlitic / ferritic		180	10	○	92	RPM	8910	132	RPM	6370	4240		3180	2120		1590		1270.000		980			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
K	16		Pearlitic (Martensitic)		260	26	○	82	RPM	7960	115	RPM	5570	3710		2790	1860		1390		1110.000		860			
									FEED	.0004 - .0008		FEED	.0008 - .002	.0008 - .0024		.0016 - .0031	.0016 - .0039		.0024 - .0047		.0031 - .0055		.0047 - .0071			
K	17	Nodular cast iron	Ferritic		160	3	○	92	RPM	8910	132	RPM	6370	4240		3180	2120		1590		1270.000		980			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
K	18		Pearlitic		250	25		66	RPM	6370	99	RPM	4770	3180		2390	1590		1190		950.000		730			
									FEED	.0004 - .0008		FEED	.0008 - .002	.0008 - .0024		.0016 - .0031	.0016 - .0039		.0024 - .0047		.0031 - .0055		.0047 - .0071			
K	19	Malleable cast iron	Ferritic		130		○	82	RPM	7960	115	RPM	5570	3710		2790	1860		1390		1110.000		860			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
K	20		Pearlitic		230	21		66	RPM	6370	99	RPM	4770	3180		2390	1590		1190		950.000		730			
									FEED	.0004 - .0008		FEED	.0008 - .002	.0008 - .0024		.0016 - .0031	.0016 - .0039		.0024 - .0047		.0031 - .0055		.0047 - .0071			
N	21	Aluminum-wrought alloy	Not Curable		60		○	148	RPM	14320	214	RPM	10350	6900		5170	3450		2590		2070.000		1590			
									FEED	.0008 - .0020		FEED	.002 - .0035	.0028 - .0043		.0047 - .0063	.0047 - .0071		.0055 - .0079		.0063 - .0087		.0087 - .011			
N	22		Curable	Hardened	100		○	148	RPM	14320	214	RPM	10350	6900		5170	3450		2590		2070.000		1590			
									FEED	.0008 - .0020		FEED	.002 - .0035	.0028 - .0043		.0047 - .0063	.0047 - .0071		.0055 - .0079		.0063 - .0087		.0087 - .011			
N	23	Aluminum-cast, alloyed	≤ 12% Si, Not Curable		75		○	115	RPM	11140	165	RPM	7960	5310		3980	2650		1990		1590.000		1220			
									FEED	.0008 - .0020		FEED	.002 - .0035	.0028 - .0043		.0047 - .0063	.0047 - .0071		.0055 - .0079		.0063 - .0087		.0087 - .011			
N	29	Non Metallic Materials	Duroplastic, Fiber Reinforced Plastic				○	66	RPM	6370	99	RPM	4770	3180		2390	1590		1190		950.000		730			
									FEED	.0004 - .0012		FEED	.0016 - .0031	.0024 - .0039		.0031 - .0047	.0047 - .0063		.0047 - .0071		.0063 - .0087		.0071 - .0094			
S	36	Titanium Alloys	Pure Titanium		400 Rm		○	49+	RPM	4770	66	RPM	3180	2120		1590	1060		800		640.000		490			
									FEED	.0004 - .0008		FEED	.0008 - .002	.0008 - .0024		.0016 - .0031	.002 - .0035		.0024 - .0039		.0028 - .0051		.0031 - .0055			

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)*