Speeds and Feeds

ISO	VDI 3323	Material Description	Composition / Structure / Heat Treatment		HB	HRC		Vc(m/min)		Drill Diameter(mm)
										1
P	1	Non-alloy steel	About 0.15% C	Annealed	125		●	28	RPM	8910
									FEED	0.01-0.03
	2		About 0.45% C	Annealed	190	13	●	25	RPM	7960
									FEED	0.01-0.03
	3		About 0.45% C	Quenched & tempered	250	25	●	20	RPM	6370
									FEED	0.01-0.03
	4		About 0.75% C	Annealed	270	28	○	15	RPM	4770
									FEED	0.01-0.02
	6	Low alloy steel		Annealed	180	10	●	25	RPM	7960
									FEED	0.01-0.03
	7			Quenched & tempered	275	29	○	20	RPM	6370
									FEED	0.01-0.03
	8			Quenched & tempered	300	32	○	20	RPM	6370
									FEED	0.01-0.02
	10	High alloyed steel, and tool steel		Annealed	200	15	○	15	RPM	4770
									FEED	0.01-0.03
M	12	Stainless steel	Ferritic / Martensitic	Annealed	200	15	●	18	RPM	5730
									FEED	0.01-0.03
	13		Martensitic	Quenched & Tempered	240	23	○	15	RPM	4770
									FEED	0.01-0.03
	14			Austenitic	180	10	○	10	RPM	3180
									FEED	0.01-0.02
K	15	Grey cast iron	Pearlitic / ferritic		180	10	○	28	RPM	8910
									FEED	0.01-0.03
	16		Pearlitic (Martensitic)		260	26	○	25	RPM	7960
									FEED	0.01-0.02
	17	Nodular cast iron	Ferritic		160	3	○	28	RPM	8910
									FEED	0.01-0.03
	18		Pearlitic		250	25		20	RPM	6370
									FEED	0.01-0.02
	19	Malleable cast iron	Ferritic		130		○	25	RPM	7960
									FEED	0.01-0.03
	20		Pearlitic		230	21		20	RPM	6370
									FEED	0.01-0.02
N	21	Aluminum-wrought alloy	Not Curable		60		○	45	RPM	14320
									FEED	0.02-0.05
	22		Curable	Hardened	100		○	45	RPM	14320
									FEED	0.02-0.05
	23	Aluminum-cast, alloyed	≤ 12% Si, Not Curable		75		○	35	RPM	11140
									FEED	0.02-0.05
	29	Non Metallic Materials	Duroplastic, Fiber Reinforced Plastic				○	20	RPM	6370
									FEED	0.01-0.03
S	36	Titanium Alloys	Pure Titanium		400 Rm		○	15	RPM	4770
									FEED	0.01-0.02

Speeds and Feeds

ISO	VDI 3323	Material Description	Composition / Structure / Heat Treatment		HB	HRC		Vc (m/min)		Drill Diameter (mm)						
										2	3	4	6	8	10	13
P	1	Non-alloy steel	About 0.15% C	Annealed	125		●	40	RPM	6,370	4,240	3,180	2,120	1,590	1,270	980
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	2		About 0.45% C	Annealed	190	13	●	35	RPM	5,570	3,710	2,790	1,860	1,390	1,110	860
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	3		About 0.45% C	Quenched & tempered	250	25	●	30	RPM	4,770	3,180	2,390	1,590	1,190	950	730
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	4		About 0.75% C	Annealed	270	28	○	20	RPM	3,180	2,120	1,590	1,060	800	640	490
									FEED	0.02-0.05	0.02-0.06	0.04-0.08	0.04-0.10	0.06-0.12	0.08-0.14	0.12-0.18
	6	Low alloy steel		Annealed	180	10	●	35	RPM	5,570	3,710	2,790	1,860	1,390	1,110	860
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	7			Quenched & tempered	275	29	○	30	RPM	4,770	3,180	2,390	1,590	1,190	950	730
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	8			Quenched & tempered	300	32	○	30	RPM	4,770	3,180	2,390	1,590	1,190	950	730
									FEED	0.02-0.05	0.02-0.06	0.04-0.08	0.04-0.10	0.06-0.12	0.08-0.14	0.12-0.18
	10	High alloyed steel, and tool steel		Annealed	200	15	○	20	RPM	3,180	2,120	1,590	1,060	800	640	490
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
M	12	Stainless steel	Ferritic / Martensitic	Annealed	200	15	●	25	RPM	3,980	2,650	1,990	1,330	990	800	610
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	13		Martensitic	Quenched & Tempered	240	23	○	20	RPM	3,180	2,120	1,590	1,060	800	640	490
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	14			Austenitic	180	10	○	15	RPM	2,390	1,590	1,190	800	600	480	370
									FEED	0.02-0.05	0.02-0.06	0.04-0.08	0.04-0.10	0.06-0.12	0.08-0.14	0.12-0.18
K	15	Grey cast iron	Pearlitic / ferritic		180	10	○	40	RPM	6,370	4,240	3,180	2,120	1,590	1,270	980
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	16		Pearlitic (Martensitic)		260	26	○	35	RPM	5,570	3,710	2,790	1,860	1,390	1,110	860
									FEED	0.02-0.05	0.02-0.06	0.04-0.08	0.04-0.10	0.06-0.12	0.08-0.14	0.12-0.18
	17	Nodular cast iron	Ferritic		160	3	○	40	RPM	6,370	4,240	3,180	2,120	1,590	1,270	980
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	18		Pearlitic		250	25		30	RPM	4,770	3,180	2,390	1,590	1,190	950	730
									FEED	0.02-0.05	0.02-0.06	0.04-0.08	0.04-0.10	0.06-0.12	0.08-0.14	0.12-0.18
	19	Malleable cast iron	Ferritic		130		○	35	RPM	5,570	3,710	2,790	1,860	1,390	1,110	860
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
	20		Pearlitic		230	21		30	RPM	4,770	3,180	2,390	1,590	1,190	950	730
									FEED	0.02-0.05	0.02-0.06	0.04-0.08	0.04-0.10	0.06-0.12	0.08-0.14	0.12-0.18
N	21	Aluminum-wrought alloy	Not Curable		60		○	65	RPM	10,350	6,900	5,170	3,450	2,590	2,070	1,590
									FEED	0.05-0.09	0.07-0.11	0.12-0.16	0.12-0.18	0.14-0.20	0.16-0.22	0.22-0.28
	22		Curable	Hardened	100		○	65	RPM	10,350	6,900	5,170	3,450	2,590	2,070	1,590
									FEED	0.05-0.09	0.07-0.11	0.12-0.16	0.12-0.18	0.14-0.20	0.16-0.22	0.22-0.28
	23	Aluminum-cast, alloyed	≤ 12% Si, Not Curable		75		○	50	RPM	7,960	5,310	3,980	2,650	1,990	1,590	1,220
									FEED	0.05-0.09	0.07-0.11	0.12-0.16	0.12-0.18	0.14-0.20	0.16-0.22	0.22-0.28
	29	Non Metallic Materials	Duroplastic, Fiber Reinforced Plastic				○	30	RPM	4,770	3,180	2,390	1,590	1,190	950	730
									FEED	0.04-0.08	0.06-0.10	0.08-0.12	0.12-0.16	0.12-0.18	0.16-0.22	0.18-0.24
S	36	Titanium Alloys	Pure Titanium		400 Rm		○	20	RPM	3,180	2,120	1,590	1,060	800	640	490
									FEED	0.02-0.05	0.02-0.06	0.04-0.08	0.05-0.09	0.06-0.10	0.07-0.13	0.08-0.14

Speeds and Feeds

Penetration Rate (mm/min)
$v_f = f_n \cdot n$

Feed Per Revolution (mm/rev)
$f_n = \frac{v_f}{n}$

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 (cm^3/min)
$MRR = \frac{D_{tool} \cdot f_n \cdot v_c}{4}$

Metric

Symbol	Definition	Unit
v_f	Penetration rate	*mm/min*
f_n	Feed per revolution	*mm/rev*
v_c	Cutting speed	*m/min (SMM)*
n	Spindle speed	*rev/min (RPM)*
D_{tool}	Tool cutting diameter	*mm*
MRR	Material removal rate	*(cm^3/min)*