

# Speeds and Feeds



Feed: mm/rev  
RPM: rev/min

ISO	VDI 3323	Material Description	Composition / Structure / Heat Treatment		HB	HRC		Vc(m/min)		Drill Diameter (mm)	Vc(m/min)		Drill Diameter (mm)						
								1			2	3	4	6	8	10	13		
P	1	Non-alloy steel	About 0.15% C	Annealed	125		•	28	RPM	8910	40	RPM	6370	4240	3180	2120	1590	1270	980
									FEED			0.01-0.03	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
	2		About 0.45% C	Annealed	190	13	•	25	RPM	7960	35	RPM	5570	3710	2790	1860	1390	1110	860
									FEED			0.01-0.03	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
	3	About 0.45% C	Quenched & tempered	250	25	•	20	RPM	6370	30	RPM	4770	3180	2390	1590	1190	950	730	
								FEED			0.01-0.03	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	○	15	RPM	4770	20	RPM	3180	2120	1590	1060	800	640	490	
								FEED			0.01-0.02	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	•	25	RPM	7960	35	RPM	5570	3710	2790	1860	1390	1110	860	
								FEED			0.01-0.03	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	○	20	RPM	6370	30	RPM	4770	3180	2390	1590	1190	950	730	
								FEED			0.01-0.03	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	○	20	RPM	6370	30	RPM	4770	3180	2390	1590	1190	950	730	
								FEED			0.01-0.02	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	○	15	RPM	4770	20	RPM	3180	2120	1590	1060	800	640	490		
							FEED			0.01-0.03	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	•	18	RPM	5730	25	RPM	3980	2650	1990	1330	990	800	610
									FEED			0.01-0.03	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
	13		Martensitic	Quenched & Tempered	240	23	○	15	RPM	4770	20	RPM	3180	2120	1590	1060	800	640	490
									FEED			0.01-0.03	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
	14	Austenitic	180	10	○	10	RPM	3180	15	RPM	2390	1590	1190	800	600	480	370		
							FEED			0.01-0.02	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	○	28	RPM	8910	40	RPM	6370	4240	3180	2120	1590	1270	980
									FEED			0.01-0.03	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
	16		Pearlitic (Martensitic)	260	26	○	25	RPM	7960	35	RPM	5570	3710	2790	1860	1390	1110	860	
								FEED			0.01-0.02	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	○	28	RPM	8910	40	RPM	6370	4240	3180	2120	1590	1270	980	
								FEED			0.01-0.03	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		20	RPM	6370	30	RPM	4770	3180	2390	1590	1190	950	730	
								FEED			0.01-0.02	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		○	25	RPM	7960	35	RPM	5570	3710	2790	1860	1390	1110	860	
								FEED			0.01-0.03	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		20	RPM	6370	30	RPM	4770	3180	2390	1590	1190	950	730		
							FEED			0.01-0.02	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		○	45	RPM	14320	65	RPM	10350	6900	5170	3450	2590	2070	1590
									FEED			0.02-0.05	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
	22		Curable	Hardened	100		○	45	RPM	14320	65	RPM	10350	6900	5170	3450	2590	2070	1590
									FEED			0.02-0.05	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
23	Aluminum-cast, alloyed	≤ 12% Si, Not Curable	75		○	35	RPM	11140	50	RPM	7960	5310	3980	2650	1990	1590	1220		
							FEED			0.02-0.05	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			○	20	RPM	6370	30	RPM	4770	3180	2390	1590	1190	950	730		
							FEED			0.01-0.03	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		○	15	RPM	4770	20	RPM	3180	2120	1590	1060	800	640	490	
								FEED			0.01-0.02	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<sup>3</sup>/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 <sup>3</sup> /min)