

# 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,  $V_c$  (m/min) and feed,  $f_n$  (mm/rev). Adjust the cutting speed and/or feed based on your cutting conditions.

Material					Recommended Cutting Values														
Group		Material Description	HB	HRC	SMM	Drill Diameter			SMM	Drill Diameter									
ISO	VDI 332 <sup>2</sup>					METRIC	1.0	2.0		METRIC	3.0	-	4.0	-	5.0	6.0	-	-	8.0
						FRACTIONAL	-	-	FRACTIONAL	-	1/8	-	3/16	-	-	1/4	5/16	-	
						DECIMAL	.0394	.0787	DECIMAL	.111	.121	.1575	.181	.191	.231	.251	.311	.311	
P	2	Non-alloy steel	190	13	⊙	70	RPM	22,280	11,140	100	RPM	10,610	7,960	6,370	5,310	3,980			
	3		250	25	○	70	FEED	0.02-0.04	0.04-0.06	100	FEED	0.04-0.10	0.06-0.12	0.12-0.18	0.14-0.20	0.16-0.22			
	6	Low alloy steel	180	10	⊙	70	RPM	22,280	11,140	100	RPM	10,610	7,960	6,370	5,310	3,980			
	7		275	29	○	50	FEED	0.02-0.04	0.04-0.06	70	FEED	0.04-0.10	0.06-0.12	0.12-0.18	0.14-0.20	0.16-0.22			
M	12	Stainless steel	200	15	⊙	40	RPM	12,730	6,370	50	RPM	5,310	3,980	3,180	2,650	1,990			
	13		240	23	⊙	25	FEED	0.02-0.04	0.02-0.04	40	FEED	0.03-0.05	0.05-0.09	0.07-0.11	0.08-0.12	0.09-0.13			
	14		180	10	⊙	45	RPM	14,320	7,160	60	RPM	6,370	4,770	3,820	3,180	2,390			
N	21	Aluminum-wrought alloy	60		⊙	130	FEED	0.02-0.04	0.02-0.04	200	FEED	0.04-0.10	0.06-0.12	0.08-0.12	0.09-0.13	0.10-0.14			
	22		100		⊙	130	RPM	41,380	20,690	200	RPM	21,220	15,920	12,730	10,610	7,960			
	23	Aluminum-cast, alloyed	75		○	110	FEED	0.04~0.10	0.08~0.14	180	FEED	0.14~0.20	0.19~0.25	0.20~0.26	0.22~0.28	0.24~0.30			
	24		90		○	110	RPM	35,010	17,510	180	RPM	19,100	14,320	11,460	9,550	7,160			
	25		130		○	90	FEED	0.04~0.10	0.08~0.14	150	FEED	0.14~0.20	0.19~0.25	0.20~0.26	0.22~0.28	0.24~0.30			
S	37	Titanium alloys	1050 Rm		○	25	RPM	28,650	14,320	40	RPM	15,920	11,940	9,550	7,960	5,970			
							FEED	0.01-0.03	0.01-0.03		FEED	0.12~0.18	0.16~0.22	0.17~0.23	0.19~0.25	0.21~0.27			
											RPM	4,240	3,180	2,550	2,120	1,590			
											FEED	0.02-0.04	0.04-0.08	0.06-0.10	0.07-0.11	0.08-0.12			



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Material					Recommended Cutting Values														
Group		Material Description	HB	HRC	SFM	Drill Diameter													
ISO	VDI 3323					METRIC	-	10.0	12.0	-	14.0	-	-	16.0	18.0	-	20.0		
						FRACTIONAL	3/8	-	-	1/2	-	9/16	5/8	-	-	3/4	-		
		DECIMAL	.375	.393	.724	.700	.551	.5625	.625	.6299	.787	.7500	.7874						
P	2	Non-alloy steel	190	13	⊙	100	RPM	3,180	2,650	2,510	2,270	1,990	1,770	1,680	1,590				
							FEED	0.18-0.24	0.19-0.27	0.19-0.27	0.21-0.39	0.23-0.31	0.26-0.36	0.26-0.36	0.28-0.38				
	3		250	25	○	100	RPM	3,180	2,650	2,510	2,270	1,990	1,770	1,680	1,590				
							FEED	0.18-0.24	0.19-0.27	0.19-0.27	0.21-0.39	0.23-0.31	0.26-0.36	0.26-0.36	0.28-0.38				
	6	180	10	⊙	100	RPM	3,180	2,650	2,510	2,270	1,990	1,770	1,680	1,590					
						FEED	0.18-0.24	0.19-0.27	0.19-0.27	0.21-0.39	0.23-0.31	0.26-0.36	0.26-0.36	0.28-0.38					
						7	275	29	○	70	RPM	2,230	1,860	1,760	1,590	1,390	1,240	1,170	1,110
											FEED	0.18-0.24	0.19-0.27	0.19-0.27	0.21-0.39	0.23-0.31	0.26-0.36	0.26-0.36	0.28-0.38
M	12	Stainless steel	200	15	⊙	50	RPM	1,590	1,330	1,260	1,140	990	880	840	800				
							FEED	0.10-0.15	0.11-0.16	0.11-0.16	0.12-0.17	0.13-0.18	0.14-0.19	0.14-0.19	0.15-0.20				
	13		240	23	⊙	40	RPM	1,270	1,060	1,010	910	800	710	670	640				
							FEED	0.10-0.15	0.11-0.16	0.11-0.16	0.12-0.17	0.13-0.18	0.14-0.19	0.14-0.19	0.15-0.20				
	14		180	10	⊙	60	RPM	1,910	1,590	1,510	1,360	1,190	1,060	1,010	950				
							FEED	0.11-0.16	0.12-0.17	0.12-0.17	0.13-0.18	0.14-0.19	0.15-0.20	0.15-0.20	0.16-0.21				
N	21	Aluminum-wrought alloy	60		⊙	200	RPM	6,370	5,310	5,030	4,550	3,980	3,540	3,360	3,180				
							FEED	0.26~0.32	0.28~0.34	0.28~0.34	0.30~0.36	0.32~0.38	0.33~0.43	0.33~0.43	0.35~0.45				
	22		100		⊙	200	RPM	6,370	5,310	5,030	4,550	3,980	3,540	3,360	3,180				
							FEED	0.26~0.32	0.28~0.34	0.28~0.34	0.30~0.36	0.32~0.38	0.33~0.43	0.33~0.43	0.35~0.45				
	23	75		○	180	RPM	5,730	4,770	4,530	4,090	3,580	3,180	3,020	2,860					
						FEED	0.26~0.32	0.28~0.34	0.28~0.34	0.30~0.36	0.32~0.38	0.33~0.43	0.33~0.43	0.35~0.45					
						24	90		○	180	RPM	5,730	4,770	4,530	4,090	3,580	3,180	3,020	2,860
											FEED	0.26~0.32	0.28~0.34	0.28~0.34	0.30~0.36	0.32~0.38	0.33~0.43	0.33~0.43	0.35~0.45
	25	130		○	150	RPM	4,770	3,980	3,770	3,410	2,980	2,650	2,520	2,390					
						FEED	0.23~0.29	0.25~0.31	0.25~0.31	0.27~0.33	0.28~0.34	0.28~0.38	0.28~0.38	0.30~0.40					
S	37	Titanium alloys	1050 Rm		○	40	RPM	1,270	1,060	1,010	910	800	710	670	640				
							FEED	0.09-0.14	0.10-0.15	0.10-0.15	0.11-0.16	0.12-0.17	0.13-0.18	0.13-0.18	0.14-0.19				



# 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)