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									
							METRIC	1.0	2.0		METRIC	3.0	-	4.0	-	5.0	6.0	-	-	8.0
ISO	VDI 3323						FRACTIONAL	-	-		FRACTIONAL	-	1/8	-	3/16	-	-	1/4	5/16	-
							DECIMAL	.0394	.0787		DECIMAL	.1181	.1250	.1575	.1875	.1969	.2362	.2500	.3125	.3150
P	2	Non-alloy steel	190	13	◎	80	RPM	25,460	12,730	110	RPM	11,670		8,750	7,000		5,840		4,380	
							FEED	0.03-0.05	0.05-0.07		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
	3		250	25	◎	80	RPM	25,460	12,730	110	RPM	11,670		8,750	7,000		5,840		4,380	
							FEED	0.03-0.05	0.05-0.07		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
	4		270	28	◎	80	RPM	25,460	12,730	110	RPM	11,670		8,750	7,000		5,840		4,380	
							FEED	0.03-0.05	0.05-0.07		FEED	0.04-0.10		0.07-0.13	0.10-0.16		0.12-0.18		0.14-0.20	
	5		300	32	○	70	RPM	22,280	11,140	90	RPM	9,550		7,160	5,730		4,770		3,580	
							FEED	0.03-0.05	0.05-0.07		FEED	0.04-0.10		0.07-0.13	0.10-0.16		0.12-0.18		0.14-0.20	
	6	Low alloy steel	180	10	◎	80	RPM	25,460	12,730	110	RPM	11,670		8,750	7,000		5,840		4,380	
							FEED	0.03-0.05	0.05-0.07		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
	7		275	29	◎	70	RPM	22,280	11,140	90	RPM	9,550		7,160	5,730		4,770		3,580	
							FEED	0.03-0.05	0.05-0.07		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
	8		300	32	○	70	RPM	22,280	11,140	90	RPM	9,550		7,160	5,730		4,770		3,580	
							FEED	0.02-0.04	0.03-0.05		FEED	0.04-0.10		0.07-0.13	0.10-0.16		0.12-0.18		0.14-0.20	
	9		350	38	○	40	RPM	12,730	6,370	50	RPM	5,310		3,980	3,180		2,650		1,990	
							FEED	0.02-0.04	0.03-0.05		FEED	0.03-0.08		0.05-0.11	0.08-0.14		0.10-0.16		0.12-0.18	
	10	High alloyed steel, and tool steel	200	15	◎	60	RPM	19,100	9,550	80	RPM	8,490		6,370	5,090		4,240		3,180	
							FEED	0.03-0.05	0.05-0.07		FEED	0.04-0.10		0.07-0.13	0.10-0.16		0.12-0.18		0.14-0.20	
	11		325	35	○	40	RPM	12,730	6,370	45	RPM	4,770		3,580	2,860		2,390		1,790	
							FEED	0.02-0.04	0.03-0.05		FEED	0.03-0.08		0.05-0.11	0.08-0.14		0.10-0.16		0.12-0.18	
M	12	Stainless steel	200	15	○	60	RPM	19,100	9,550	80	RPM	8,490		6,370	5,090		4,240		3,180	
							FEED	0.03-0.05	0.05-0.07		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
	13		240	23	○	45	RPM	14,320	7,160	55	RPM	5,840		4,380	3,500		2,920		2,190	
							FEED	0.02-0.04	0.03-0.05		FEED	0.04-0.10		0.07-0.13	0.10-0.16		0.12-0.18		0.14-0.20	
K	15	Grey cast iron	180	10	◎	80	RPM	25,460	12,730	110	RPM	11,670		8,750	7,000		5,840		4,380	
							FEED	0.04-0.06	0.04-0.06		FEED	0.08-0.14		0.12-0.18	0.15-0.22		0.20-0.26		0.22-0.28	
	16		260	26	○	75	RPM	23,870	11,940	95	RPM	10,080		7,560	6,050		5,040		3,780	
							FEED	0.04-0.06	0.04-0.06		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
	17	Nodular cast iron	160	3	◎	90	RPM	28,650	14,320	120	RPM	12,730		9,550	7,640		6,370		4,770	
							FEED	0.04-0.06	0.04-0.06		FEED	0.08-0.14		0.12-0.18	0.15-0.22		0.20-0.26		0.22-0.28	
	18		250	25	○	60	RPM	19,100	9,550	80	RPM	8,490		6,370	5,090		4,240		3,180	
							FEED	0.04-0.06	0.04-0.06		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
	19	Malleable cast iron	130		◎	70	RPM	22,280	11,140	90	RPM	9,550		7,160	5,730		4,770		3,580	
							FEED	0.04-0.06	0.04-0.06		FEED	0.08-0.14		0.12-0.18	0.15-0.22		0.20-0.26		0.22-0.28	
	20		230	21	○	60	RPM	19,100	9,550	80	RPM	8,490		6,370	5,090		4,240		3,180	
							FEED	0.03-0.05	0.05-0.07		FEED	0.06-0.12		0.08-0.14	0.14-0.20		0.16-0.22		0.18-0.24	
H	38	Hardened steel	550	55	○	25	RPM	7,960	3,980	30	RPM	3,180		2,390	1,910		1,590		1,190	
							FEED	0.01-0.02	0.01-0.03		FEED	0.01-0.03		0.01-0.04	0.02-0.05		0.03-0.06		0.03-0.06	

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									
							METRIC	-	10.0	12.0	-	14.0	-	-	16.0	18.0	-	20.0
							FRACTIONAL	3/8	-	-	1/2	-	9/16	5/8	-	-	3/4	-
ISO	VDI 3323						DECIMAL	.3750	.3937	.4724	.5000	.5512	.5625	.6250	.6299	.7087	.7500	.7874
P	2	Non-alloy steel	190	13	◎	110	RPM	3,500		2,920	2,770	2,500		2,190		1,950	1,840	1,750
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
	3		250	25	◎	110	RPM	3,500		2,920	2,770	2,500		2,190		1,950	1,840	1,750
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
	4		270	28	◎	110	RPM	3,500		2,920	2,770	2,500		2,190		1,950	1,840	1,750
							FEED	0.15-0.23		0.17-0.25	0.17-0.25	0.18-0.26		0.19-0.27		0.20-0.30	0.20-0.30	0.22-0.32
	5		300	32	○	90	RPM	2,860		2,390	2,260	2,050		1,790		1,590	1,510	1,430
							FEED	0.15-0.23		0.17-0.25	0.17-0.25	0.18-0.26		0.19-0.27		0.20-0.30	0.20-0.30	0.22-0.32
	6	Low alloy steel	180	10	◎	110	RPM	3,500		2,920	2,770	2,500		2,190		1,950	1,840	1,750
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
	7		275	29	◎	90	RPM	2,860		2,390	2,260	2,050		1,790		1,590	1,510	1,430
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
	8		300	32	○	90	RPM	2,860		2,390	2,260	2,050		1,790		1,590	1,510	1,430
							FEED	0.15-0.23		0.17-0.25	0.17-0.25	0.18-0.26		0.19-0.27		0.20-0.30	0.20-0.30	0.22-0.32
	9		350	38	○	50	RPM	1,590		1,330	1,260	1,140		990		880	840	800
							FEED	0.13-0.19		0.14-0.20	0.14-0.20	0.15-0.21		0.16-0.22		0.17-0.25	0.16-0.26	0.18-0.28
	10	High alloyed steel, and tool steel	200	15	◎	80	RPM	2,550		2,120	2,010	1,820		1,590		1,410	1,340	1,270
							FEED	0.15-0.23		0.17-0.25	0.17-0.25	0.18-0.26		0.19-0.27		0.20-0.30	0.20-0.30	0.22-0.32
	11		325	35	○	45	RPM	1,430		1,190	1,130	1,020		900		800	750	720
							FEED	0.13-0.19		0.14-0.20	0.14-0.20	0.15-0.21		0.16-0.22		0.17-0.25	0.16-0.26	0.18-0.28
M	12	Stainless steel	200	15	○	80	RPM	2,550		2,120	2,010	1,820		1,590		1,410	1,340	1,270
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
	13		240	23	○	55	RPM	1,750		1,460	1,380	1,250		1,090		970	920	880
							FEED	0.15-0.23		0.17-0.25	0.17-0.25	0.18-0.26		0.19-0.27		0.20-0.30	0.20-0.30	0.22-0.32
K	15	Grey cast iron	180	10	◎	110	RPM	3,500		2,920	2,770	2,500		2,190		1,950	1,840	1,750
							FEED	0.25-0.33		0.27-0.35	0.27-0.35	0.29-0.37		0.31-0.39		0.32-0.42	0.32-0.42	0.34-0.44
	16		260	26	○	95	RPM	3,020		2,520	2,390	2,160		1,890		1,680	1,590	1,510
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
	17	Nodular cast iron	160	3	◎	120	RPM	3,820		3,180	3,020	2,730		2,390		2,120	2,010	1,910
							FEED	0.25-0.33		0.27-0.35	0.27-0.35	0.29-0.37		0.31-0.39		0.32-0.42	0.32-0.42	0.34-0.44
	18		250	25	○	80	RPM	2,550		2,120	2,010	1,820		1,590		1,410	1,340	1,270
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
	19	Malleable cast iron	130		◎	90	RPM	2,860		2,390	2,260	2,050		1,790		1,590	1,510	1,430
							FEED	0.25-0.33		0.27-0.35	0.27-0.35	0.29-0.37		0.31-0.39		0.32-0.42	0.32-0.42	0.34-0.44
	20		230	21	○	80	RPM	2,550		2,120	2,010	1,820		1,590		1,410	1,340	1,270
							FEED	0.19-0.27		0.21-0.29	0.21-0.29	0.23-0.31		0.25-0.33		0.28-0.38	0.28-0.38	0.30-0.40
H	38	Hardened steel	550	55	○	30	RPM	950		800	750	680		600		530	500	480
							FEED	0.04-0.07		0.04-0.08	0.04-0.08	0.05-0.09		0.05-0.09		0.05-0.10	0.05-0.10	0.05-0.10

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)*