Speeds and Feeds

HAAS TOOLING.COM

ISO	VDI 3323	Material Description	Composition / Structure / Heat Treatment		HB	HRC	SMM (m/min)	Countersink Diameter MMPR(mm/rev)								
								METRIC	5	10	15	20	25	30	40	50
								DECIMAL	.1969	.3937	.5906	.7874	.9843	1.1811	1.5748	1.9685
P	1	Non-alloy steel	About 0.15% C	Annealed	125		20	FEED	.119-.16	.16-.201	.201-.231	.231-.259	.259-.29	.29-.33	.33-.371	.371-.409
P	2		About 0.45% C	Annealed	190	13	20	FEED	.119-.16	.16-.201	.201-.231	.231-.259	.259-.29	.29-.33	.33-.371	.371-.409
P	3		About 0.45% C	Quenched & tempered	250	25	13	FEED	.099-.14	.14-.18	.18-.211	.211-.239	.239-.269	.269-.31	.31-.351	.351-.391
P	4		About 0.75% C	Annealed	270	28	10	FEED	.061-.099	.099-.14	.14-.17	.17-.211	.211-.239	.239-.269	.269-.31	.31-.351
P	5		About 0.75% C	Quenched & tempered	300	32	10	FEED	.061-.099	.099-.14	.14-.17	.17-.211	.211-.239	.239-.269	.269-.31	.31-.351
P	6	Low alloy steel		Annealed	180	10										
P	7			Quenched & tempered	275	29										
P	8			Quenched & tempered	300	32										
P	9			Quenched & tempered	350	38										
P	10	High alloyed steel, and tool steel		Annealed	200	15										
P	11			Quenched & Tempered	325	35										
M	12	Stainless steel	Ferritic / Martensitic	Annealed	200	15	6	FEED	.061-.079	.061-.079	.079-.099	.079-.099	.099-.119	.099-.119	.119-.15	.119-.15
M	13		Martensitic	Quenched & Tempered	240	23	5	FEED	.061-.079	.061-.079	.079-.099	.079-.099	.099-.119	.099-.119	.119-.15	.119-.15
M	14			Austenitic	180	10	4	FEED	.061-.079	.061-.079	.079-.099	.079-.099	.099-.119	.099-.119	.119-.15	.119-.15
		Duplex			180	10										
K	15	Grey cast iron	Pearlitic / ferritic		180	10	22	FEED	.089-.109	.109-.13	.13-.16	.16-.191	.191-.221	.221-.249	.249-.279	.279-.32
K	16		Pearlitic (Martensitic)		260	26	17	FEED	.079-.099	.099-.119	.119-.15	.15-.18	.18-.211	.211-.239	.239-.269	.269-.31
K	17	Nodular cast iron	Ferritic		160	3	17	FEED	.089-.109	.109-.13	.13-.16	.16-.191	.191-.221	.221-.249	.249-.279	.279-.32
K	18		Pearlitic		250	25	15	FEED	.079-.099	.099-.119	.119-.15	.15-.18	.18-.211	.211-.239	.239-.269	.269-.31
K	19	Malleable cast iron	Ferritic		130		17	FEED	.089-.109	.109-.13	.13-.16	.16-.191	.191-.221	.221-.249	.249-.279	.279-.32
K	20		Pearlitic		230	21	15	FEED	.079-.099	.099-.119	.119-.15	.15-.18	.18-.211	.211-.239	.239-.269	.269-.31
N	21	Aluminum-wrought alloy	Not Curable		60		42	FEED	.15-.18	.18-.211	.211-.239	.239-.269	.269-.31	.31-.351	.351-.399	.399-.45
N	22		Curable	Hardened	100		42	FEED	.15-.18	.18-.211	.211-.239	.239-.269	.269-.31	.31-.351	.351-.399	.399-.45
N	23	Aluminum-cast, alloyed	≤ 12% Si, Not Curable		75		39	FEED	.15-.18	.18-.211	.211-.239	.239-.269	.269-.31	.31-.351	.351-.399	.399-.45
N	24		≤ 12% Si, Curable	Hardened	90		37	FEED	.119-.15	.15-.18	.18-.211	.211-.239	.239-.279	.279-.31	.31-.371	.371-.419
N	25		> 12% Si, Not Curable		130		35	FEED	.15-.18	.18-.211	.211-.239	.239-.269	.269-.31	.31-.351	.351-.399	.399-.45
N	26	Copper and Copper Alloys (Bronze / Brass)	Cutting Alloys, PB>1%		110		28	FEED	.119-.15	.15-.18	.18-.211	.211-.239	.239-.279	.279-.31	.31-.371	.371-.419
N	27		CuZn, CuSnZn (Brass)		90		25	FEED	.119-.15	.15-.18	.18-.211	.211-.239	.239-.279	.279-.31	.31-.371	.371-.419
N	28		CuSn, lead-free copper and electrolytic copper		100		15	FEED	.119-.15	.15-.18	.18-.211	.211-.239	.239-.279	.279-.31	.31-.371	.371-.419
N	-	High strngth Bronze														
N	29	Non Metallic Materials	Duroplastic, Fiber Reinforced Plastic													
N	30		Rubber, Wood, etc.													
N	-	CFRP, Graphite Composite														
S	31	Heat Resistant Super Alloys	Fe Based	Annealed	200	15										
S	32			Cured	280	30										
S	33		Ni or Co Based	Annealed	250	25										
S	34			Cured	350	38										
S	35			Cast	320	34										
S	36	Titanium Alloys	Pure Titanium		400 Rm											
S	37		Alpha + Beta Alloys	Hardened	1050 Rm											
H	38	Hardened steel		Hardened	550	55										
H	39			Hardened	630	60										
H	40	Chilled Cast Iron		Cast	400	42										
H	41	Hardened Cast Iron		Hardened	550	55										

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)*