

DRILLING

Speed

$$n = \frac{v_c \times 1000}{D_c \times \pi} \quad (\text{rpm})$$

Cutting speed

$$v_c = \frac{D_c \times \pi \times n}{1000} \quad (\text{m/min})$$

Feed per revolution

$$f = f_z \times z \quad (\text{mm/U})$$

Feed rate

$$vf = f \times n \quad (\text{mm/min})$$

Metal removal rate

$$Q = \frac{vf \times \pi \times D_c^2}{4 \times 1000} \quad (\text{cm}^3/\text{min})$$

Power requirement

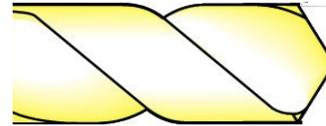
$$P_{\text{mot}} = \frac{Q \times k_c}{60000 \times \eta} \quad (\text{kW})$$

Torque

$$M_C = \frac{D_c^2 \times k_c \times f}{8000} \quad (\text{Nm})$$

Feed force

$$F_f = \frac{1 \times f \times D_c \times k_c}{2} \quad (\text{N})$$



n	Speed
D _c	Drill diameter
z	Number of cutting edges
V _c	Cutting speed
V _f	Feed rate
f _z	Feed per cutting edge
f	Feed per revolution
A	Chip cross section
Q	Metal removal rate
P _{mot}	Drive power
M _c	Torque
F _f	Axial force
h	Chip thickness
k _c	Specific cutting force
η	Efficiency of machine (<1)
κ	Approach angle
kc1.1*	Specific cutting force for 1 mm ² chip cross section with h = 1 mm
mc*	Increase in k _c value graph

mc und kc1.1 see table below

Specific cutting force

$$k_c = \frac{kc1.1}{h^{mc}} \quad (\text{N/mm}^2)$$

Chip thickness

$$h = f_z \times \text{sink} \quad (\text{mm})$$

TAPPING

Speed

$$n = \frac{v_c \times 1000}{D_c \times \pi} \quad (\text{rpm})$$

Cutting speed

$$v_c = \frac{D_c \times \pi \times n}{1000} \quad (\text{m/min})$$

Torque

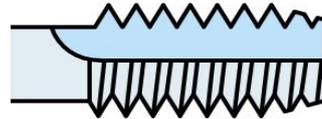
$$M_D = \frac{k_c \times h^2 \times d_1}{8000} \quad \text{Nm}$$

Power requirement tool

$$P = \frac{M_D \times n}{9500} \quad (\text{kW})$$

Power requirement motor

$$P_{\text{mot}} = \frac{P}{\eta M} \quad (\text{kW})$$



V_c	Cutting speed
$k_{c1.1}$	Specific cutting force
n	Speed
h	Pitch (mm)
d_1	Tapping diameter (mm)
P_{mot}	Power requirement motor
ηM	Machine efficiency (<1)

Specific cutting force

$$k_c = \frac{kc1.1}{h^{mc}} \quad (\text{N/mm}^2)$$

MATERIAL LIST

Material list Suhner	Tensile strength	kc _{1.1}	m _c
Common structural steels <500	<500	1780	0.21
Common structural steels >500-850	>500-850	2260	0.30
Free-cutting steels <850	<850	1500	0.22
Free-cutting steels >850-1000	>850-1000	1900	0.22
Unalloyed heat-treatable steels <700	<700	1860	0.20
Unalloyed heat-treatable steels 700-850	700-850	2220	0.14
Unalloyed heat-treatable steels 850-1000	850-1000	2130	0.18
Alloyed heat-treatable steels 850-1000	850-1000	2260	0.20
Alloyed heat-treatable steels >1000-1200	>1000-1200	2500	0.26
Unalloyed case-hard steels <750	<750	1820	0.22
Alloyed case-hard steels 850-1000	850-1000	2260	0.30
Alloyed case-hard steels >1000	>1000	2140	0.25
Nitriding steels >850-1000	>850-1000	1740	0.26
Nitriding steels >1000-1200	>1000-1200	1740	0.26
Tool steels <850	<850	1410	0.39
Tool steels >850-1000	>850-1000	1820	0.26
High-speed steels >650-1000	>650-1000	1820	0.26
Stainless steels <850 sulphured	<850	1820	0.26
Stainless steels <850 austenitic	<850	2000	0.21
Stainless steels <850 martensitic	<850	2400	0.21
Cast iron <200	<200	1020	0.25
Cast iron <450	<450	1160	0.25
Spheroidat and malleable cast iron <500	<500	1135	0.21
Spheroidat and malleable cast iron <700	<700	1008	0.50
Ti and Ti alloys <850	<850	1500	0.25
Ti and Ti alloys <850-1200	>850-1200	1500	0.25
Aluminum and Al alloys <400	<400	650	0.25
Aluminum wrought alloys <450	<450	600	0.25
Aluminum cast alloys <600	<600	600	0.25
Aluminum cast alloys >600	>600	700	0.25
Magnesium alloys <450	<450	390	0.19
Copper low alloys <400	<400	550	0.25
Brass <600	<600	550	0.25
Brass >600	>600	1000	0.25
Bronze, short-chipping <600	<600	550	0.25
Bronze, short-chipping >600	>600	1000	0.25
Bronze, long-chipping <850	<850	550	0.25
Bronzen, long-chipping >850-1000	>850-1000	1000	0.25
Plastic, duroplastics		150	0.20
Plastic, thermoplastics		300	0.30