Horsepower and torque calculation for tapping

for M, MF, UNC, UNF, UNEF, UN, GRp, NPSM, BSW, MJ

Torque

$$M_D = \frac{k_c \cdot h^2 \cdot d_1}{8000}$$

Nm

k_c . . . Spec. cutting force (N/mm^2) (table)
h . . . Pitch (mm)
d_1 . . . Nominal thread dia. (mm)

Tapping power

$$P = \frac{M_D \cdot n}{9500}$$

kW

n . . . Spindle speed (r.p.m.)

Machine required power

$$P_M = \frac{P}{N_M}$$

kW

P_M . . . Required driving power of the machine

N_M . . . Machine efficiency $N_M < 1$

Material	k_c-value (n/mm^2)
Steel 1000-1300 N/mm^2	3600
Steel 800-1000 N/mm^2	2600
Steel 600-850 N/mm^2	2500
Steel < 600 N/mm^2	2300
Stainless Steel	3200
Cast bronze	1900
Grey cast iron (HB 170)	1600
White malleable iron	1250
Copper	1100
White malleable iron	900
Brass	720
Al-Si alloy	680
Zinc alloy	440

Calculation example

Thread M36, pitch 4mm,
Material being machined: steel 900 N/mm^2
Spindle speed: 50 r.p.m.
Efficiency of machine $N_m = 0.6$

Torque

$$M_D = \frac{k_c \cdot h^2 \cdot d_1}{8000} = \frac{2600 \cdot 4^2 \cdot 36}{8000} = 187\ N_m$$

Tapping power

$$P = \frac{M_D \cdot n}{9500} = \frac{187 \cdot 10}{9500} = 0.98\ kW$$

Machine required power

$$P_M = \frac{P}{N_M} = \frac{0.98}{0.6} = 1.6\ kW$$

These calculations are valid for new taps. When using blunt tools the torque can increase up to three times; i.e., horsepower increases by the same factor.

Horsepower and torque calculation for tapping

for M, MF, MJ, UNC, UNF, UNEF, UN, UNS

1.1 Torque calculation

$$Md = k_{c1.1} \cdot h_m^{(1-mc)} \cdot \frac{D \cdot P \cdot Z \cdot Za}{40} \cdot Td^{kt} \cdot Ta \cdot Af$$

Md	=	Torque in N_{cm}
$k_{c1.1}$	=	Specific cutting force (material constant N/mm2)
hm	=	P / (2•Z•Za) in mm
mc	=	Exponent of chip thickness (material constant)
D	=	Nominal thread diameter (mm)
P	=	Pitch (mm)
Z	=	Number of flutes
Za	=	Number of start threads
T	=	Depth of thread (mm)
Td	=	Factor Depth of thread - Diameter
Ta	=	Factor Depth of thread - Length of thread
kt	=	Factor

1. Definition of the factors Td and Ta
If the length of lead (= number of start threads • pitch) > depth of thread

Td	=	Length of thread / nominal diameter
Ta	=	Depth of thread / length of thread

In order cases:

Td	=	Depth of thread / nominal diameters
Ta	=	1

2. Definition of the factor k_t

k_t	=	0.55 for taps for blind holes
k_t	=	0.25 for taps for through holes
k_t	=	0.15 for internal thread formers