Formula for Milling

1. Cutting Time T_c [sec]

$$T_c = \frac{60 \times L \times \pi \times DC}{fz \times z \times vc \times 1{,}000} = \frac{60 \times L}{vf}$$

2. Power Requirements P_c [kW]

$$P_c = \frac{Q \times k_C}{60 \times 1{,}000 \times (\eta \div 100)}$$

$$= \frac{ap \times ae \times vf \times k_C}{60 \times 10^6 \times (\eta \div 100)}$$

3. Cutting Speed vc [m/min]

$$vc = \frac{\pi \times DC \times n}{1{,}000}$$

4. Spindle Speed n [min^{-1}]

$$n = \frac{vc \times 1{,}000}{\pi \times DC}$$

5. Feed Rate per Tooth fz [mm/t]

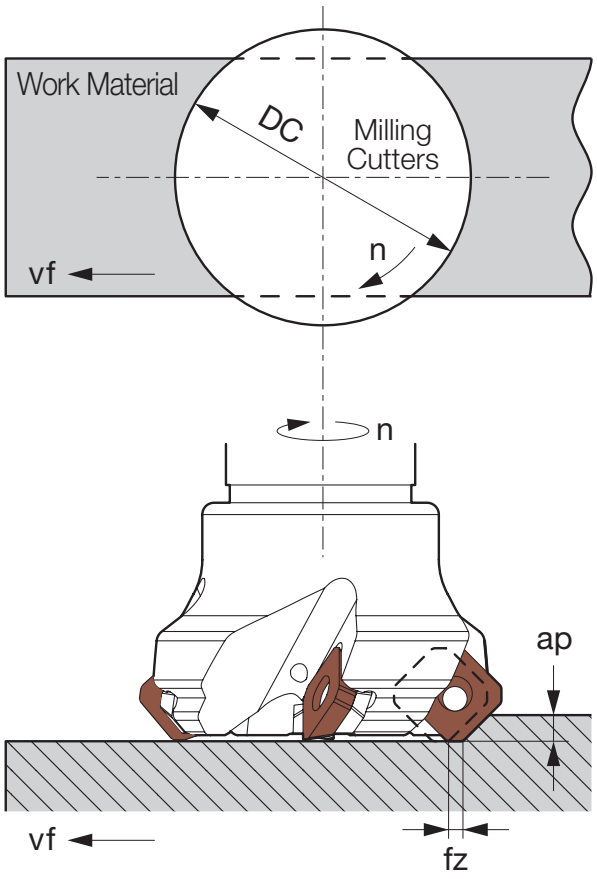
$$fz = \frac{vf \times \pi \times DC}{z \times vc \times 1{,}000}$$

$$= \frac{vf}{z \times n}$$

6. Table Feed vf [mm/min]

$$vf = \frac{fz \times z \times vc \times 1{,}000}{\pi \times DC}$$

$$= fz \times z \times n$$



Specific Cutting Force k_C

P	Un alloyed	1,500 MPa
	Low alloyed	2,000 MPa
	High alloyed	3,000 MPa
M	Austenitic	2,000 MPa
	Ferritic	2,500 MPa
K	Malleable	900 MPa
	Grey	1,200 MPa
	Ductile	1,500 MPa
N	Al based alloys	500 MPa
	Cu based alloys	900 MPa
S	Ti based alloys	1,400 MPa
	Fe based alloys	2,500 MPa
	Ni based alloys	2,800 MPa
	Co based alloys	3,000 MPa
H	Hardened steel 50-55	3,300 MPa
	Hardened steel 60-63	4,500 MPa
	Hardened cast iron	3,500 MPa

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Formula for Milling

7. Horsepower H [HP]

$$H = \frac{P_C}{0.75}$$

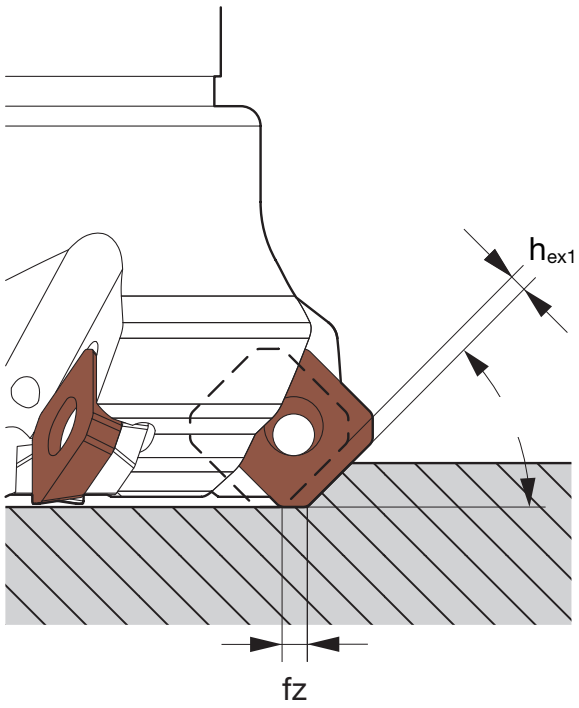
8. Max. Chip thickness h_{ex1} [mm]

【 ae ≦ DCx0.5 】

$$h_{ex1} = \sqrt{\frac{ae}{DC} - \left(\frac{ae}{DC}\right)^2} \times fz \times 2 \times \sin(KAPR)$$

【 DCx0.5 < ae ≦ DC 】

$$h_{ex1} = fz \times \sin(KAPR)$$



9. Max. Chip thickness(R-insert) h_{ex2} [mm]

$$h_{ex1} = \sqrt{\frac{ap}{IC} - \left(\frac{ap}{IC}\right)^2} \times fz \times 2$$

10. Material Removal Rate Q [cm³/min]

$$Q = \frac{ap \times ae \times fz \times z \times vc}{\pi \times DC}$$

$$= \frac{ap \times ae \times vf}{1{,}000}$$

T_C	:	Cutting Time	[sec]
P_C	:	Power Requirements	[kW]
vc	:	Cutting Speed	[m/min]
n	:	Spindle Speed	[min^{-1}]
fz	:	Feed Rate per Tooth	[mm/rev]
vf	:	Table Feed	[mm/min]
H	:	Horsepower	[HP]
h_{ex1}	:	Max. Chip thickness	[mm]
h_{ex2}	:	Max. Chip thickness(R-insert)	[mm/min]
Q	:	Material Removal Rate	[cm^3/min]
L	:	Length of Cut	[mm]
DC	:	Diameter	[mm]
IC	:	Insert Diameter	[mm]
KAPR	:	Cutting Edge Angle	[°]
ap	:	Depth of Cut	[mm]
ae	:	Width of Cut	[mm]
z	:	No. of Flutes	[pcs]
k_C	:	Specific Cutting Force	[MPa]
η	:	Machine Efficiency	[%] (70 ~ 85)

※ π ≒ 3.14