Milling (Inch)

Surface Speed per Minute

$$SFM = .262 \times DIA \times RPM$$

Revolutions per Minute

$$RPM = \frac{3.82 \times SFM}{DIA}$$

Feedrate (inches/minute)

$$IPM = IPT \times N \times RPM$$

Feedrate (inches/tooth)

$$\text{Programmed } IPT = \frac{t_{chip\ Max}}{\cos\alpha}$$

Radial Chip Thinning for 90° Cutters

$$f_1 = \frac{1/2\left(\frac{Dia}{Ae}\right)}{\sqrt{\left(\frac{Dia}{Ae}\right)} - 1}$$

Table Feed with f_1 Compensation (inches/minute)
$= IPT \times N \times RPM \times f_1$

Metal Removal Rate

$$Q = WOC \times DOC \times IPM \text{ (in/min)}$$

Horsepower Required at the Spindle

$$HPS = Q \times UHP$$

Horsepower Required at the Motor

$$HPM = \frac{HPS}{EFF}$$

Time in Cut (seconds)

$$T = \frac{15.7 \times DIA \times LOC}{SFM \times IPR \times N}$$

or

$$T = \frac{60 \times LOC}{IPM}$$

Definition of Terms

DIA = Cutter Diameter (Inches)
ap= Axial depth of Cut (Inches)
EFF = Machine Efficiency
f = Feedrate (See IPM, IPR and IPT)
HPM = Horsepower Required at the Motor (HP)
HPS = Horsepower Required at the Spindle (HP)
IPM = Feedrate (Inches per Minute)
IPR = Feedrate (Inches per Revolution)
IPT = Feedrate (Inches per Tooth)
f_1 = Cutter Compensation Factor
WOC = Width of Cut (Inches)
LOC = Length of Cut (Inches)
N = Number of Effective Teeth in Cutter
Q = Metal Removal Rate (Cubic Inches per Minute)
RPM = Revolutions per Minute
SFM = Surface Speed (Feet per Minute)
T = Time (in Seconds)
$t_{chip\ Max}$ = Maximum Recommended Chip Thickness (Inches)
UHP = Unit Horsepower Factor
α = Lead Angle

Milling (Metric)

Cutting Speed

$$Vc = \frac{\pi \times Ds \times n}{1000}$$

Vc : Cutting Speed [m/min]
Ds : End Mill Diameter [mm]
n : Spindle Revolution [min^{-1}]

End Mill Diameter
(Diameter at Edge Point)

Power Requirement

$$fz = \frac{Vf}{Z \times n}$$

fz : Feed Per Tooth [mm/t]
Vf : Table Feed [mm/min]
Z : Number of Inserts
n : Spindle Revolution [min^{-1}]