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Milling Operation Formulas

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List of 18 Milling Operation Formulas

Milling Operation

Face and Vertical Milling

1) Diameter of Tool given Proportion of Edge Engagement for Face Milling

Open Calculator

fx $$D_{cut} = \frac{a_e}{\sin(Q \cdot \pi)}$$

ex $$54.67604\text{mm} = \frac{52\text{mm}}{\sin(0.4 \cdot \pi)}$$

2) Feed Speed in Vertical Milling given Maximum Chip Thickness

Open Calculator

fx $$V_{fm} = C_v \cdot N_t \cdot v_{rot}$$

ex $$0.704\text{mm/s} = 0.004\text{mm} \cdot 16 \cdot 11\text{Hz}$$

3) Machining Time for Milling Operation

Open Calculator

fx $$t_m = \frac{L + L_v}{V_{fm}}$$

ex $$480.1517\text{s} = \frac{400\text{mm} + 27.335\text{mm}}{0.89\text{mm/s}}$$

4) Machining Time for Shaping Operation

Open Calculator

fx $$t_m = \frac{b_w}{f_r \cdot n_{rs}}$$

ex $$487.9121\text{s} = \frac{444\text{mm}}{0.70\text{mm/rev} \cdot 1.3\text{Hz}}$$

5) Maximum Chip Thickness in Vertical Milling

Open Calculator

fx $$C_v = \frac{V_{fm}}{N_t \cdot v_{rot}}$$

ex $$0.005057\text{mm} = \frac{0.89\text{mm/s}}{16 \cdot 11\text{Hz}}$$

6) Minimum Length of Approach required in Face Milling

Open Calculator

fx $$L_v = \frac{D_{cut}}{2}$$

ex $$27.335\text{mm} = \frac{54.67\text{mm}}{2}$$

7) Proportion of Cutting Edge Engagement for Face Milling

Open Calculator

fx $$Q = a\frac{\sin\left(\frac{a_e}{D_{cut}}\right)}{\pi}$$

ex $$0.400108 = a\frac{\sin\left(\frac{52\text{mm}}{54.67\text{mm}}\right)}{\pi}$$

8) Work Engagement given Proportion of Edge Engagement for Face Milling

Open Calculator

fx $a_e = \sin(Q \cdot \pi) \cdot D_{cut}$

ex $51.99426\text{mm} = \sin(0.4 \cdot \pi) \cdot 54.67\text{mm}$

Slab and Slide Milling

9) Depth of Cut in Slab Milling using Tool Engagement Angle

Open Calculator

fx $d_{cut} = (1 - \cos(\theta)) \cdot \frac{D_{cut}}{2}$

ex $4.943479\text{mm} = (1 - \cos(35^\circ)) \cdot \frac{54.67\text{mm}}{2}$

10) Diameter of Tool given Proportion of Edge Engagement for Slab and Side Milling

Open Calculator

fx $D_{cut} = 2 \cdot \frac{a_e}{\sin((Q - 0.25) \cdot 2 \cdot \pi) + 1}$

ex $57.48979\text{mm} = 2 \cdot \frac{52\text{mm}}{\sin((0.4 - 0.25) \cdot 2 \cdot \pi) + 1}$

11) Feed in Slab Milling given Feed Speed

Open Calculator

fx $$f_r = \frac{V_{fm}}{n_{rs}}$$

ex $$0.684615\text{mm/rev} = \frac{0.89\text{mm/s}}{1.3\text{Hz}}$$

12) Feed Speed of Workpiece in Slab Milling

Open Calculator

fx $$V_{fm} = f_r \cdot n_{rs}$$

ex $$0.91\text{mm/s} = 0.70\text{mm/rev} \cdot 1.3\text{Hz}$$

13) Maximum Chip Thickness obtained in Slab Milling using Depth of Cut

Open Calculator

fx $$C_{max} = 2 \cdot V_{fm} \cdot \frac{\sqrt{\frac{d_{cut}}{D_{cut}}}}{N_t \cdot v_{rot}}$$

ex $$0.002981\text{mm} = 2 \cdot 0.89\text{mm/s} \cdot \frac{\sqrt{\frac{4.75\text{mm}}{54.67\text{mm}}}}{16 \cdot 11\text{Hz}}$$

14) Maximum Chip Thickness obtained in Slab Milling using Tool Engagement Angle

Open Calculator

fx $$C_{max} = V_{fm} \cdot \frac{\sin(\theta)}{N_t \cdot v_{rot}}$$

ex $$0.0029\text{mm} = 0.89\text{mm/s} \cdot \frac{\sin(35^\circ)}{16 \cdot 11\text{Hz}}$$

15) Minimum Length of Approach required in Slab Milling

Open Calculator

fx $$A = \sqrt{d_{cut} \cdot (D_{cut} - d_{cut})}$$

ex $$15.3987\text{mm} = \sqrt{4.75\text{mm} \cdot (54.67\text{mm} - 4.75\text{mm})}$$

16) Proportion of Cutting Edge Engagement for Slab and Side Milling

Open Calculator

fx $$Q = 0.25 + \left(a \frac{\sin\left(\left(2 \cdot \frac{a_e}{D_{cut}}\right) - 1\right)}{2 \cdot \pi} \right)$$

ex $$0.42907 = 0.25 + \left(a \frac{\sin\left(\left(2 \cdot \frac{52\text{mm}}{54.67\text{mm}}\right) - 1\right)}{2 \cdot \pi} \right)$$

17) Tool Engagement Angle in Slab Milling using Depth of Cut

Open Calculator

fx $$\theta = a\cos\left(1 - \left(2 \cdot \frac{d_{cut}}{D_{cut}}\right)\right)$$

ex $$34.2866^\circ = a\cos\left(1 - \left(2 \cdot \frac{4.75\text{mm}}{54.67\text{mm}}\right)\right)$$

18) Work Engagement given Proportion of Edge Engagement for Slab and Side Milling

Open Calculator

fx $$a_e = (\sin((Q - 0.25) \cdot 2 \cdot \pi) + 1) \cdot \frac{D_{cut}}{2}$$

ex $$49.44948\text{mm} = (\sin((0.4 - 0.25) \cdot 2 \cdot \pi) + 1) \cdot \frac{54.67\text{mm}}{2}$$

Variables Used

- **A** Length of Approach in Slab Milling *(Millimeter)*
- a_e Work Engagement *(Millimeter)*
- b_w Width of Workpiece *(Millimeter)*
- C_{max} Max Chip Thickness in Slab Milling *(Millimeter)*
- C_v Max Chip Thickness in Vertical Milling *(Millimeter)*
- d_{cut} Depth of Cut in Milling *(Millimeter)*
- D_{cut} Diameter of a Cutting Tool *(Millimeter)*
- f_r Feed Rate in Milling *(Millimeter Per Revolution)*
- **L** Length of Workpiece *(Millimeter)*
- L_v Length of Approach in Vertical Milling *(Millimeter)*
- n_{rs} Reciprocating Strokes Frequency *(Hertz)*
- N_t Number of Teeth on Cutting Tool
- **Q** Time Proportion of Cutting Edge Engagement
- t_m Machining Time *(Second)*
- V_{fm} Feed Speed in Milling *(Millimeter per Second)*
- v_{rot} Rotational Frequency in Milling *(Hertz)*
- **θ** Tool Engagement Angle in Milling *(Degree)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **acos**, acos(Number)
  The inverse cosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.
- Function: **asin**, asin(Number)
  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Speed** in Millimeter per Second (mm/s)
  Speed Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Feed** in Millimeter Per Revolution (mm/rev)
  Feed Unit Conversion

Check other formula lists

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