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Turning Operation Formulas

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List of 17 Turning Operation Formulas

Turning Operation 🗗

1) Basic Setup time given Non-productive Time in Turning 🗗

fx $t_s = (NPT - t_{ln} - (t_{pt} \cdot n_0)) \cdot N_b - (N_t \cdot t_{st})$

ex $20.507\text{min} = (28.169\text{min} - 30\text{s} - (1.50\text{min} \cdot 5)) \cdot 3 - (4 \cdot 10\text{min})$

2) Batch Size given Non-productive Time in Turning 🗗

fx $N_b = \dfrac{t_s + N_t \cdot t_{st}}{(NPT - t_{ln} - (t_{pt} \cdot n_0))}$

ex $2.999653 = \dfrac{20.50\text{min} + 4 \cdot 10\text{min}}{(28.169\text{min} - 30\text{s} - (1.50\text{min} \cdot 5))}$

3) Constant for given Cylindrical Turning 🗗

fx $K = \pi \cdot d \cdot \dfrac{L_{cut}}{f}$

ex $2393.894\text{mm} = \pi \cdot 76.20\text{mm} \cdot \dfrac{9\text{mm}}{0.9\text{mm}}$

4) Diameter of Turned Parts given Length-to-Diameter Ratio ⤢

fx $d = \left(\dfrac{1.67}{l_r} \right)^{\frac{1}{0.68}}$

ex $76.36711\text{mm} = \left(\dfrac{1.67}{0.79} \right)^{\frac{1}{0.68}}$

5) Diameter of Workpiece given Constant for Cylindrical Turning ⤢

fx $d = K \cdot \dfrac{f}{\pi \cdot L_{cut}}$

ex $76.20001\text{mm} = 2393.894\text{mm} \cdot \dfrac{0.9\text{mm}}{\pi \cdot 9\text{mm}}$

6) Feed given Constant for Cylindrical Turning ⤢

fx $f = \pi \cdot d \cdot \dfrac{L_{cut}}{K}$

ex $0.9\text{mm} = \pi \cdot 76.20\text{mm} \cdot \dfrac{9\text{mm}}{2393.894\text{mm}}$

7) Feed Rate for Turning Operation given Machining Time ⤢

fx $f_r = \dfrac{L_{cut}}{t_m \cdot \omega}$

ex $0.716197\text{mm/rev} = \dfrac{9\text{mm}}{0.6\text{s} \cdot 200\text{rev/min}}$

8) Length of Cut using Machining Time ⎘

fx $L_w = f_r \cdot t_{m^\circ} \cdot \omega_w$

ex $26165.63\text{mm} = 0.7\text{mm/rev} \cdot 62.6224\text{min} \cdot 95\text{rev/min}$

9) Length-to-diameter Ratio given diameter of turned parts ⎘

fx $l_r = \dfrac{1.67}{d^{0.68}}$

ex $0.791178 = \dfrac{1.67}{(76.20\text{mm})^{0.68}}$

10) Loading and Unloading Time given Non-productive Time in Turning ⎘

fx $t_{ln} = \text{NPT} - \left(\dfrac{t_s + N_t \cdot t_{st}}{N_b} \right) - (t_{pt} \cdot n_0)$

ex $30.14\text{s} = 28.169\text{min} - \left(\dfrac{20.50\text{min} + 4 \cdot 10\text{min}}{3} \right) - (1.50\text{min} \cdot 5)$

11) Machining Time for Turning Operation ⎘

fx $t_m = \dfrac{L_{cut}}{f_r \cdot \omega}$

ex $0.613883\text{s} = \dfrac{9\text{mm}}{0.7\text{mm/rev} \cdot 200\text{rev/min}}$

12) Non-Productive Time in Turning ⌖

fx $NPT = \left(\dfrac{t_s + N_t \cdot t_{st}}{N_b} \right) + t_{ln} + (t_{pt} \cdot n_0)$

Open Calculator ⌖

ex $28.16667\text{min} = \left(\dfrac{20.50\text{min} + 4 \cdot 10\text{min}}{3} \right) + 30\text{s} + (1.50\text{min} \cdot 5)$

13) Number of Operations given Non-productive Time in Turning ⌖

fx $n_0 = \dfrac{NPT - \left(\frac{t_s + N_t \cdot t_{st}}{N_b} \right) - t_{ln}}{t_{pt}}$

Open Calculator ⌖

ex $5.001556 = \dfrac{28.169\text{min} - \left(\frac{20.50\text{min} + 4 \cdot 10\text{min}}{3} \right) - 30\text{s}}{1.50\text{min}}$

14) Number of Tools given Non-Productive Time in Turning ⌖

fx $N_t = \dfrac{(NPT - t_{ln} - (t_{pt} \cdot n_0)) \cdot N_b - t_s}{t_{st}}$

Open Calculator ⌖

ex $4.0007 = \dfrac{(28.169\text{min} - 30\text{s} - (1.50\text{min} \cdot 5)) \cdot 3 - 20.50\text{min}}{10\text{min}}$

15) Set-up Time per Tool Terms of Non-Productive Time in Turning ⬚

Open Calculator ⬚

$$fx \quad t_{st} = \frac{(NPT - t_{ln} - (t_{pt} \cdot n_0)) \cdot N_b - t_s}{N_t}$$

$$ex \quad 10.00175 min = \frac{(28.169 min - 30s - (1.50 min \cdot 5)) \cdot 3 - 20.50 min}{4}$$

16) Tool Positioning Time per Operation given Non-Productive Time in Turning ⬚

Open Calculator ⬚

$$fx \quad t_{pt} = \frac{NPT - \left(\frac{t_s + N_t \cdot t_{st}}{N_b}\right) - t_{ln}}{n_0}$$

$$ex \quad 1.500467 min = \frac{28.169 min - \left(\frac{20.50 min + 4 \cdot 10 min}{3}\right) - 30s}{5}$$

17) Turning Length given Constant for Cylindrical Turning ⬚

Open Calculator ⬚

$$fx \quad L_{cut} = K \cdot \frac{f}{\pi \cdot d}$$

$$ex \quad 9.000001 mm = 2393.894 mm \cdot \frac{0.9 mm}{\pi \cdot 76.20 mm}$$

Variables Used

- **d** Diameter of Workpiece *(Millimeter)*
- **f** Feed *(Millimeter)*
- **f_r** Feed Rate *(Millimeter Per Revolution)*
- **K** Constant For Machining Condition *(Millimeter)*
- **L_{cut}** Length of Cut *(Millimeter)*
- **l_r** Length to Diameter Ratio
- **L_w** Length of Cut in Machining *(Millimeter)*
- **n_0** Number of Operations
- **N_b** Batch Size
- **N_t** Number of Tools Used
- **NPT** Non-Productive Time *(Minute)*
- **t_{ln}** Loading And Unloading Time *(Second)*
- **t_m** Turning Time *(Second)*
- **$t_{m°}$** Machining Time in Machining *(Minute)*
- **t_{pt}** Tool Positioning Time Per Operation *(Minute)*
- **t_s** Basic Setup Time *(Minute)*
- **t_{st}** Setup Time Per Tool *(Minute)*
- **ω** Angular Velocity of Job or Workpiece *(Revolution per Minute)*
- **$ω_w$** Rotational Frequency of Workpiece *(Revolution per Minute)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion ⬈
- Measurement: **Time** in Minute (min), Second (s)
  Time Unit Conversion ⬈
- Measurement: **Angular Velocity** in Revolution per Minute (rev/min)
  Angular Velocity Unit Conversion ⬈
- Measurement: **Feed** in Millimeter Per Revolution (mm/rev)
  Feed Unit Conversion ⬈

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- **Milling Operation Formulas** ⤤
- **Turning Operation Formulas** ⤤

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