



Mechanics of Orthogonal Cutting Formulas

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Examples!

Conversions!

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List of 10 Mechanics of Orthogonal Cutting Formulas

Mechanics of Orthogonal Cutting

1) Area of Cut from Tool Temperature

$$\mathbf{K} \mathbf{A} = \left(rac{\mathbf{ heta} \cdot \mathbf{k}^{0.44} \cdot \mathbf{c}^{0.56}}{\mathrm{C}_0 \cdot \mathrm{U}_\mathrm{s} \cdot \mathrm{V}^{0.44}}
ight)^{rac{100}{22}}$$

Open Calculator 🗗

$$26.4493 \text{m}^2 = \left(\frac{273 \text{°C} \cdot (10.18 \text{W}/(\text{m*K}))^{0.44} \cdot (4.184 \text{kJ/kg*K})^{0.56}}{0.29 \cdot 200 \text{kJ/kg} \cdot (120 \text{m/min})^{0.44}}\right)^{\frac{100}{22}}$$

2) Cutting Speed from Tool Temperature

$$V = \left(rac{ heta \cdot k^{0.44} \cdot c^{0.56}}{ ext{C}_0 \cdot ext{U}_{ ext{s}} \cdot ext{A}^{0.22}}
ight)^{rac{100}{44}}$$

Open Calculator 🗗

$$= \left(\frac{273 \text{°C} \cdot (10.18 \text{W}/(\text{m*K}))^{0.44} \cdot (4.184 \text{kJ/kg*K})^{0.56}}{0.29 \cdot 200 \text{kJ/kg} \cdot (26.4493 \text{m}^2)^{0.22}}\right)^{\frac{100}{44}}$$

3) Cutting Speed given Spindle Speed

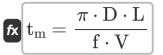
fx
$$V = \pi \cdot D \cdot N$$

Open Calculator 🗗

$$\texttt{ex} \ 120.0933 \text{m/min} = \pi \cdot 0.01014 \text{m} \cdot 600 \text{rev/min}$$

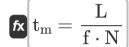


4) Machining Time given Cutting Speed



Open Calculator 🗗

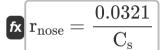
5) Machining Time given Spindle Speed



Open Calculator

$$oxed{ex} 68.20926 ext{s} = rac{3 ext{m}}{0.70 ext{mm/rev} \cdot 600 ext{rev/min}}$$

6) Nose Radius of Tool from Surface Finish Constraint



Open Calculator

$$0.107 \mathrm{m} = rac{0.0321}{0.3 \mathrm{m}^{-1}}$$

7) Specific Cutting Energy Per Unit Cutting Force from Tool Temperature

$$ext{U}_{
m s} = rac{ heta \cdot {
m c}^{0.56} \cdot {
m k}^{0.44}}{{
m C}_0 \cdot {
m V}^{0.44} \cdot {
m A}^{0.22}}$$

$$\boxed{ 200 \text{kJ/kg} = \frac{273 \, ^{\circ}\text{C} \cdot \left(4.184 \text{kJ/kg*K}\right)^{0.56} \cdot \left(10.18 \text{W/(m*K)}\right)^{0.44} }{0.29 \cdot \left(120 \text{m/min}\right)^{0.44} \cdot \left(26.4493 \text{m}^{2}\right)^{0.22} } }$$





8) Specific Heat of Work from Tool Temperature 🗗

 $\mathbf{c} = \left(rac{\mathrm{C_0 \cdot U_s \cdot V^{0.44} \cdot A^{0.22}}}{\mathrm{\theta \cdot k^{0.44}}}
ight)^{rac{100}{56}}$

Open Calculator 🗗

ex

$$oxed{4.184 ext{kJ/kg*K} = \left(rac{0.29 \cdot 200 ext{kJ/kg} \cdot (120 ext{m/min})^{0.44} \cdot (26.4493 ext{m}^2)^{0.22}}{273 \, ext{C} \cdot (10.18 ext{W/(m*K)})^{0.44}}
ight)^{rac{100}{56}}}$$

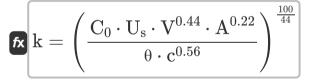
9) Surface Finish Constraint

 $oldsymbol{\mathcal{C}}_{\mathrm{s}} = rac{0.0321}{\mathrm{r}_{\mathrm{nose}}}$

Open Calculator

$$\mathbf{ex} = 0.3 \mathrm{m}^{-1} = rac{0.0321}{0.107 \mathrm{m}}$$

10) Thermal Conductivity of Work from Tool Temperature



Open Calculator 🗗

ex

$$\boxed{10.18 \text{W}/(\text{m*K}) = \left(\frac{0.29 \cdot 200 \text{kJ/kg} \cdot (120 \text{m/min})^{0.44} \cdot (26.4493 \text{m}^2)^{0.22}}{273 \, ^{\circ}\text{C} \cdot (4.184 \text{kJ/kg*K})^{0.56}}\right)^{\frac{100}{44}}}$$





Variables Used

- A Cutting Area (Square Meter)
- C Specific Heat Capacity (Kilojoule per Kilogram per K)
- C₀ Tool Temperature Constant
- C_s Constraint on Feed (1 per Meter)
- **D** Workpiece Diameter (Meter)
- **f** Feed Rate (Millimeter Per Revolution)
- **k** Thermal Conductivity (Watt per Meter per K)
- L Length Of Bar (Meter)
- **N** Spindle Speed (Revolution per Minute)
- rnose Nose Radius (Meter)
- t_m Machining Time (Second)
- U_s Specific Cutting Energy (Kilojoule per Kilogram)
- **V** Cutting Velocity (Meter per Minute)
- θ Tool Temperature (Celsius)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Time in Second (s)
 Time Unit Conversion
- Measurement: Temperature in Celsius (°C)
 Temperature Unit Conversion
- Measurement: Area in Square Meter (m²)
 Area Unit Conversion
- Measurement: Speed in Meter per Minute (m/min)
 Speed Unit Conversion
- Measurement: Thermal Conductivity in Watt per Meter per K (W/(m*K))
 Thermal Conductivity Unit Conversion
- Measurement: Specific Heat Capacity in Kilojoule per Kilogram per K (kJ/kg*K)
 Specific Heat Capacity Unit Conversion
- Measurement: Angular Velocity in Revolution per Minute (rev/min)

 Angular Velocity Unit Conversion
- Measurement: Specific Energy in Kilojoule per Kilogram (kJ/kg)
 Specific Energy Unit Conversion
- Measurement: Feed in Millimeter Per Revolution (mm/rev)
 Feed Unit Conversion
- Measurement: Reciprocal Length in 1 per Meter (m⁻¹)
 Reciprocal Length Unit Conversion





Check other formula lists

 Mechanics of Orthogonal Cutting Formulas

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