Important Grain Formulas PDF

Formulas
Examples
with Units

List of 13
Important Grain Formulas

1) Grain-aspect Ratio Formula

Evaluate Formula

Formula

$$r_g = \frac{w_{gMax}}{t_{gMax}}$$

Example with Units

$$0.26 = \frac{78\,\text{mm}}{300\,\text{mm}}$$

2) Grain-aspect Ratio given Constant for Grinding Wheel Formula

Evaluate Formula

Formula

$$r_g = \frac{6}{C_g \cdot K \cdot \sqrt{D_t}}$$

Example with Units

$$0.26 = \frac{6}{5 \cdot 13.32346 \cdot \sqrt{120\,\text{mm}}}$$

3) Infeed given Constant for Grinding Wheel Formula

Evaluate Formula

Formula

$$f_{in} = \left(t_{gMax}^{\,2} \cdot \frac{V_t}{K \cdot V_w} \right)^2$$

Example with Units

$$3.2771\,\text{mm} = \left(300\,\text{mm}^{\,2} \cdot \frac{50\,\text{m/s}}{13.32346 \cdot 5.9\,\text{m/s}} \right)^2$$

4) Infeed given Metal Removal Rate during Grinding Formula

Evaluate Formula

Formula

$$F_{in} = \frac{Z_w}{A_p \cdot V_w}$$

Example with Units

$$1.3297\,\text{mm} = \frac{0.00375\,\text{m}^3\text{/s}}{478\,\text{mm} \cdot 5.9\,\text{m/s}}$$

5) Material Removal Rate in Cylindrical and Internal Grinder Formula

Evaluate Formula

Formula

$$Z_{gMax} = \pi \cdot f_t \cdot d_w \cdot T$$

Example with Units

$$14.8252\,\text{m}^3\text{/s} = 3.1416 \cdot 3\,\text{m/rev} \cdot 121\,\text{mm} \cdot 13\,\text{m/s}$$

6) Material Removal Rate in Horizontal and Vertical Spindle Surface-Grinder Formula

Evaluate Formula

Formula

$$Z_g = f_c \cdot a_p \cdot T$$

Example with Units

$$3.705\,\text{m}^3\text{/s} = 0.5\,\text{m/rev} \cdot 570\,\text{mm} \cdot 13\,\text{m/s}$$

7) Material Removal Rate in Plunge-Grinder Formula

Evaluate Formula

Formula

$$Z_{gMax} = \pi \cdot a_p \cdot d_m \cdot v_f$$

Example with Units

$$14.8252\,\text{m}^3/\text{s} = 3.1416 \cdot 570\,\text{mm} \cdot 350\,\text{mm} \cdot 23.65414\,\text{m/s}$$

8) Metal removal rate during Grinding Formula

Evaluate Formula

Formula

$$Z_w = f_i \cdot a_p \cdot V_w$$

Example with Units

$$0.0037\,\text{m}^3/\text{s} = 1.115\,\text{mm} \cdot 570\,\text{mm} \cdot 5.9\,\text{m/s}$$

9) Number of Active Grains per Unit Area given Constant for Grinding Wheel Formula

Evaluate Formula

Formula

$$C_g = \frac{6}{K \cdot r_g \cdot \sqrt{D_t}}$$

Example with Units

$$5 = \frac{6}{13.32346 \cdot 0.26 \cdot \sqrt{120\,\text{mm}}}$$

10) Number of Active Grains per Unit Area on Wheel Surface Formula

Evaluate Formula

Formula

$$C_g = \frac{N_c}{V_t \cdot a_p}$$

Example with Units

$$5 = \frac{142.5}{50\,\text{m/s} \cdot 570\,\text{mm}}$$

11) Traverse Speed for Cylindrical and Internal Grinder given MRR Formula

Evaluate Formula

Formula

$$U_{trav} = \frac{Z_w}{\pi \cdot f \cdot D_m}$$

Example with Units

$$0.0048\,\text{m/s} = \frac{0.00375\,\text{m}^3/\text{s}}{3.1416 \cdot 0.70\,\text{m/rev} \cdot 352.74\,\text{mm}}$$

12) Traverse Speed in Horizontal and Vertical Spindle Surface-Grinder given MRR Formula

Evaluate Formula

Formula

$$V_{trav} = \frac{Z_w}{f \cdot d_{cut}}$$

Example with Units

$$0.3695\,\text{m/s} = \frac{0.00375\,\text{m}^3/\text{s}}{0.70\,\text{m/rev} \cdot 14.49643\,\text{mm}}$$

13) Width of Grinding Path given Metal Removal Rate Formula

Evaluate Formula

Formula

$$a_p = \frac{Z_w}{f_i \cdot V_w}$$

Example with Units

$$570.0388\,\text{mm} = \frac{0.00375\,\text{m}^3/\text{s}}{1.115\,\text{mm} \cdot 5.9\,\text{m/s}}$$

Variables used in list of Grain Formulas above

- a_p Back Engagement *(Millimeter)*
- A_p Width of Cut *(Millimeter)*
- C_g Number of Active Grains Per Area on Wheel Surface
- d_{cut} Depth of Cut *(Millimeter)*
- d_m Machined Surface Diameter *(Millimeter)*
- D_m Diameter of Machined Surface *(Millimeter)*
- D_t Diameter of Grinding Wheel *(Millimeter)*
- d_w Diameter of Work Surface *(Millimeter)*
- f Feed Rate *(Meter Per Revolution)*
- f_c Cross Feed Per Cutting Stroke *(Meter Per Revolution)*
- f_i Infeed in Grinding Operation *(Millimeter)*
- f_{in} Feed *(Millimeter)*
- F_{in} Infeed Given on Workpiece *(Millimeter)*
- f_t Feed Per Stroke of Machine Table *(Meter Per Revolution)*
- K Constant for Particular Grinding Wheel
- N_c Number of Chip Produced Per Unit Time
- r_g Grain Aspect Ratio
- T Traverse *(Meter per Second)*
- t_{gMax} Maximum Undeformed Chip Thickness *(Millimeter)*
- U_{trav} Traverse Speed in Cylindrical Grinding *(Meter per Second)*
- v_f Feed Speed in Plunge Grinding *(Meter per Second)*
- V_t Surface Speed of Wheel *(Meter per Second)*
- V_{trav} Traverse Speed of Work Table *(Meter per Second)*
- V_w Surface Speed of Workpiece *(Meter per Second)*
- w_{gMax} Maximum Width of Chip *(Millimeter)*

Constants, Functions, Measurements used in list of Grain Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **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: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s) *Volumetric Flow Rate Unit Conversion*
- Measurement: **Feed** in Meter Per Revolution (m/rev) *Feed Unit Conversion*

- Z_g Material Removal Rate *(Cubic Meter per Second)*
- Z_{gMax} Maximum Material Removal Rate *(Cubic Meter per Second)*
- Z_w Metal Removal Rate *(Cubic Meter per Second)*

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