Important Tribology Formulas PDF

Formulas
Examples
with Units

List of 13
Important Tribology Formulas

1) Absolute Viscosity from Petroff's Equation Formula

Evaluate Formula

Formula

$$\mu_{viscosity} = \frac{\mu_{friction} \cdot \psi}{2 \cdot \pi^2 \cdot \left(\frac{N}{P}\right)}$$

Example with Units

$$15.1982\,\text{P} = \frac{0.4 \cdot 0.005}{2 \cdot 3.1416^2 \cdot \left(\frac{10\,\text{rev/s}}{0.15\,\text{MPa}}\right)}$$

2) Diametrical Clearance Ratio or Relative Clearance from Petroff's Equaiton Formula

Evaluate Formula

Formula

$$\psi = 2 \cdot \pi^2 \cdot \left(\frac{\mu_{viscosity}}{\mu_{friction}}\right) \cdot \left(\frac{N}{P}\right)$$

Example with Units

$$0.0034 = 2 \cdot 3.1416^2 \cdot \left(\frac{10.2\,\text{P}}{0.4}\right) \cdot \left(\frac{10\,\text{rev/s}}{0.15\,\text{MPa}}\right)$$

3) Load per Projected Area of Bearing from Petroff's Equation Formula

Evaluate Formula

Formula

$$P = 2 \cdot \pi^2 \cdot \left(\frac{\mu_{viscosity}}{\mu_{friction}}\right) \cdot \left(\frac{N}{\psi}\right)$$

Example with Units

$$0.1007\,\text{MPa} = 2 \cdot 3.1416^2 \cdot \left(\frac{10.2\,\text{P}}{0.4}\right) \cdot \left(\frac{10\,\text{rev/s}}{0.005}\right)$$

4) Petroffs Equation for Coefficient of Friction Formula

Evaluate Formula

Formula

$$\mu_{friction} = 2 \cdot \pi^2 \cdot \mu_{viscosity} \cdot \left(\frac{N}{P}\right) \cdot \left(\frac{1}{\psi}\right)$$

Example with Units

$$0.2685 = 2 \cdot 3.1416^2 \cdot 10.2\,\text{P} \cdot \left(\frac{10\,\text{rev/s}}{0.15\,\text{MPa}}\right) \cdot \left(\frac{1}{0.005}\right)$$

5) Vertical Shaft Rotating in Guide Bearing Formulas

5.1) Angular Length of Bearing given Length of Bearing in Direction of Motion Formula

Evaluate Formula

Formula

$$\beta = \frac{2 \cdot B}{D}$$

Example with Units

$$16.6667\,\text{rad} = \frac{2 \cdot 30\,\text{m}}{3.600\,\text{m}}$$

5.2) Diameter of Shaft given Shaft Speed and Surface Velocity of Shaft Formula

Evaluate Formula

Formula

$$D = \frac{U}{\pi \cdot N}$$

Example with Units

$$0.2101\,\text{m} = \frac{6.6\,\text{m/s}}{3.1416 \cdot 10\,\text{rev/s}}$$

5.3) Eccentricity Ratio given Radial Clearance and Film Thickness at any Position Formula

Evaluate Formula

Formula

$$\varepsilon = \frac{\frac{h}{c} - 1}{\cos(\theta)}$$

Example with Units

$$5.874 = \frac{\frac{0.5\,\text{m}}{0.082\,\text{m}} - 1}{\cos(0.52\,\text{rad})}$$

5.4) Journal Diameter given Angular Length of Bearing and Length of Bearing in Direction of Motion Formula

Evaluate Formula

Formula

$$D = \frac{2 \cdot B}{\beta}$$

Example with Units

$$10\,\text{m} = \frac{2 \cdot 30\,\text{m}}{6\,\text{rad}}$$

5.5) Length of Bearing in Direction of Motion Formula

Evaluate Formula

Formula

$$B = \frac{D \cdot \beta}{2}$$

Example with Units

$$10.8\,\text{m} = \frac{3.600\,\text{m} \cdot 6\,\text{rad}}{2}$$

5.6) Oil Film Thickness at any Position in Journal Bearing Formula

Evaluate Formula

Formula

$$h = c \cdot (1 + \varepsilon \cdot \cos(\theta))$$

Example with Units

$$0.1389\,\text{m} = 0.082\,\text{m} \cdot (1 + 0.8 \cdot \cos(0.52\,\text{rad}))$$

5.7) Radial Clearance given Eccentricity Ratio and Thickness of Film at any Position Formula

Evaluate Formula

Formula

$$c = \frac{h}{1 + \varepsilon \cdot \cos(\theta)}$$

Example with Units

$$0.2951\,\text{m} = \frac{0.5\,\text{m}}{1 + 0.8 \cdot \cos(0.52\,\text{rad})}$$

5.8) Speed of Shaft given Diameter of Shaft and Surface Velocity of Shaft Formula

Evaluate Formula

Formula

$$N = \frac{U}{\pi \cdot D}$$

Example with Units

$$0.5836\,\text{rev/s} = \frac{6.6\,\text{m/s}}{3.1416 \cdot 3.600\,\text{m}}$$

5.9) Surface Velocity of Shaft given Shaft Speed and Diameter Formula

Evaluate Formula

Formula

$$U = \pi \cdot D \cdot N$$

Example with Units

$$113.0973\,\text{m/s} = 3.1416 \cdot 3.600\,\text{m} \cdot 10\,\text{rev/s}$$

Variables used in list of Tribology Formulas above

- **B** Length of Bearing in Direction of Motion *(Meter)*
- **c** Radial Clearance *(Meter)*
- **D** Shaft Diameter *(Meter)*
- **h** Oil Film Thickness at any Position θ *(Meter)*
- **N** Shaft Speed *(Revolution per Second)*
- **P** Load per Projected Area of Bearing *(Megapascal)*
- **U** Surface Velocity of Shaft *(Meter per Second)*
- **β** Angular or Circumferential Length of Bearing *(Radian)*
- **ε** Eccentricity Ratio
- **θ** Angle Measured from Point of Minimum of Oil Film *(Radian)*
- $\mu_{friction}$ Coefficient of Friction
- $\mu_{viscosity}$ Dynamic Viscosity *(Poise)*
- **ψ** Diametrical Clearance Ratio or Relative Clearance

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

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Pressure** in Megapascal (MPa) *Pressure Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Angle** in Radian (rad) *Angle Unit Conversion*
- Measurement: **Frequency** in Revolution per Second (rev/s) *Frequency Unit Conversion*
- Measurement: **Dynamic Viscosity** in Poise (P) *Dynamic Viscosity Unit Conversion*

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