Important Film Thickness Formulas PDF

Formulas
Examples
with Units

List of 11
Important Film Thickness Formulas

1) Eccentricity of Bearing in Terms of Minimum Film Thickness Formula

Evaluate Formula

Formula

$$e = R - \left(h_o + r \right)$$

Example with Units

$$0.4878\,\text{mm} = 26\,\text{mm} - \left(0.01224\,\text{mm} + 25.5\,\text{mm} \right)$$

2) Eccentricity Ratio in Terms of Minimum Film Thickness of Bearing Formula

Evaluate Formula

Formula

$$\varepsilon = 1 - \left(\frac{h_o}{c} \right)$$

Example with Units

$$0.49 = 1 - \left(\frac{0.01224\,\text{mm}}{0.024\,\text{mm}} \right)$$

3) Eccentricity Ratio of Bearing in Terms of Minimum Film Thickness Variable Formula

Evaluate Formula

Formula

$$\varepsilon = 1 - h_{min}$$

Example

$$0.5 = 1 - 0.5$$

4) Film Thickness in Terms of Absolute Viscosity and Tangential Force Formula

Evaluate Formula

Formula

$$h = \mu_o \cdot A_{po} \cdot \frac{V_m}{P}$$

Example with Units

$$0.02\,\text{mm} = 490\,\text{cP} \cdot 1750\,\text{mm}^2 \cdot \frac{5\,\text{m/s}}{214\,\text{N}}$$

5) Film Thickness in Terms of Flow Coefficient and Flow of Lubricant Formula

Evaluate Formula

Formula

$$h = \left(Q \cdot A_p \cdot \frac{\mu_l}{W \cdot q_f} \right)^{\frac{1}{3}}$$

Example with Units

$$0.0195\,\text{mm} = \left(1600\,\text{mm}^3/\text{s} \cdot 450\,\text{mm}^2 \cdot \frac{220\,\text{cP}}{1800\,\text{N} \cdot 11.80} \right)^{\frac{1}{3}}$$

6) Fluid Film Thickness in Terms of Flow of Lubricant Formula

Evaluate Formula

Formula

$$h = \left(l \cdot 12 \cdot \mu_l \cdot \frac{Q_{slot}}{b \cdot \Delta P} \right)^{\frac{1}{3}}$$

Example with Units

$$0.0197\,\text{mm} = \left(48\,\text{mm} \cdot 12 \cdot 220\,\text{cP} \cdot \frac{15\,\text{mm}^3/\text{s}}{49\,\text{mm} \cdot 5.1\,\text{MPa}} \right)^{\frac{1}{3}}$$

7) Minimum Film Thickness given Radius of Bearing Formula

Evaluate Formula

Formula

$$h_o = R - \left(e + r \right)$$

Example with Units

$$0.013\,\text{mm} = 26\,\text{mm} - \left(0.487\,\text{mm} + 25.5\,\text{mm} \right)$$

8) Minimum Film Thickness in Terms of Minimum Film Thickness Variable of Bearing Formula

Evaluate Formula

Formula

$$h_o = h_{min} \cdot c$$

Example with Units

$$0.012\,\text{mm} = 0.5 \cdot 0.024\,\text{mm}$$

9) Minimum Film Thickness of bearing in Terms of Eccentricity Ratio Formula

Evaluate Formula

Formula

$$h_o = c \cdot \left(1 - \varepsilon \right)$$

Example with Units

$$0.0122\,\text{mm} = 0.024\,\text{mm} \cdot \left(1 - 0.49 \right)$$

10) Minimum Film Thickness Variable of Bearing Formula

Evaluate Formula

Formula

$$h_{min} = \frac{h_o}{c}$$

Example with Units

$$0.51 = \frac{0.01224\,\text{mm}}{0.024\,\text{mm}}$$

11) Minimum Film Thickness Variable of Bearing in Terms of Eccentricity Ratio Formula

Evaluate Formula

Formula

$$h_{min} = 1 - \varepsilon$$

Example

$$0.51 = 1 - 0.49$$

Variables used in list of Film Thickness Formulas above

- A_p Total Projected Area of Bearing Pad *(Square Millimeter)*
- A_{po} Area of Moving Plate on Oil *(Square Millimeter)*
- **b** Breadth of Slot for Oil Flow *(Millimeter)*
- **c** Radial clearance for bearing *(Millimeter)*
- **e** Eccentricity in Bearing *(Millimeter)*
- **h** Oil Film thickness *(Millimeter)*
- $h_\circ$ Minimum Film Thickness *(Millimeter)*
- h_{min} Minimum Film Thickness Variable
- **l** Length of Slot in Direction of Flow *(Millimeter)*
- **P** Tangential Force on Moving Plate *(Newton)*
- **Q** Flow of Lubricant *(Cubic Millimeter per Second)*
- q_f Flow Coefficient
- Q_{slot} Flow of Lubricant from Slot *(Cubic Millimeter per Second)*
- **r** Radius of Journal *(Millimeter)*
- **R** Radius of Bearing *(Millimeter)*
- V_m Velocity of Moving Plate on Oil *(Meter per Second)*
- **W** Load Acting on Sliding Bearing *(Newton)*
- **ΔP** Pressure Difference between Slot Sides *(Megapascal)*
- **ε** Eccentricity Ratio of Journal Bearing
- μ_l Dynamic Viscosity of Lubricant *(Centipoise)*
- μ_o Dynamic Viscosity of Oil *(Centipoise)*

Constants, Functions, Measurements used in list of Film Thickness Formulas above

- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Millimeter per Second (mm³/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Dynamic Viscosity** in Centipoise (cP)
  Dynamic Viscosity Unit Conversion

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