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Hydrostatic Step Bearing with Pad Formulas

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List of 10 Hydrostatic Step Bearing with Pad Formulas

Hydrostatic Step Bearing with Pad

1) Dimension b of Slot given Flow of Lubricant

Open Calculator

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

ex $$46.58824\text{mm} = 48\text{mm} \cdot 12 \cdot 220\text{cP} \cdot \frac{15\text{mm}^3/\text{s}}{\left((0.02\text{mm})^3\right) \cdot 5.1\text{MPa}}$$

2) Dimension X in Terms of Total Projected Area of Bearing Pad

Open Calculator

fx $$X = \frac{A_p}{Y}$$

ex $$32.14286\text{mm} = \frac{450\text{mm}^2}{14\text{mm}}$$

3) Dimension Y in Terms of Total Projected Area of Bearing Pad

Open Calculator

fx $$Y = \frac{A_p}{X}$$

ex $$14.0625\text{mm} = \frac{450\text{mm}^2}{32\text{mm}}$$

4) Flow Coefficient in Terms of Flow of Lubricant through Pad

Open Calculator

fx $$q_f = Q \cdot A_p \cdot \frac{\mu_l}{W \cdot h^3}$$

ex $$11 = 1600\text{mm}^3/\text{s} \cdot 450\text{mm}^2 \cdot \frac{220\text{cP}}{1800\text{N} \cdot (0.02\text{mm})^3}$$

5) Flow of Lubricant through slot in Terms of Pressure Difference

Open Calculator

fx $$Q_{slot} = \Delta P \cdot b \cdot \frac{h^3}{12 \cdot \mu_l \cdot l}$$

ex $$15\text{mm}^3/\text{s} = 5.1\text{MPa} \cdot 46.58824\text{mm} \cdot \frac{(0.02\text{mm})^3}{12 \cdot 220\text{cP} \cdot 48\text{mm}}$$

6) Flow of Lubricating Oil Passing through Pad in Terms of Flow Coefficient

Open Calculator

fx $$Q = q_f \cdot W \cdot \frac{h^3}{A_p \cdot \mu_l}$$

ex $$1600\text{mm}^3/\text{s} = 11 \cdot 1800\text{N} \cdot \frac{(0.02\text{mm})^3}{450\text{mm}^2 \cdot 220\text{cP}}$$

7) Length of Slot in Direction of Flow in Terms of Flow of Lubricant

Open Calculator

$$l = \Delta P \cdot b \cdot \frac{h^3}{12 \cdot \mu_l \cdot Q_{slot}}$$

$$48\text{mm} = 5.1\text{MPa} \cdot 46.58824\text{mm} \cdot \frac{(0.02\text{mm})^3}{12 \cdot 220\text{cP} \cdot 15\text{mm}^3/\text{s}}$$

8) Total Projected Area of Bearing Pad

Open Calculator

$$A_p = X \cdot Y$$

$$448\text{mm}^2 = 32\text{mm} \cdot 14\text{mm}$$

9) Total Projected Area of Bearing Pad in Terms of Flow of Lubricant

Open Calculator

$$A_p = q_f \cdot W \cdot \frac{h^3}{\mu_l \cdot Q}$$

$$450\text{mm}^2 = 11 \cdot 1800\text{N} \cdot \frac{(0.02\text{mm})^3}{220\text{cP} \cdot 1600\text{mm}^3/\text{s}}$$

10) Total Projected Area of Bearing Pad in Terms of Load acting on Bearing

Open Calculator

$$A_p = \frac{W}{p_r \cdot a_f}$$

$$450.1125\text{mm}^2 = \frac{1800\text{N}}{4.3\text{MPa} \cdot 0.93}$$

Variables Used

- a_f Load Coefficient for Bearing
- A_p Total Projected Area of Bearing Pad *(Square Millimeter)*
- **b** Breadth of Slot for Oil Flow *(Millimeter)*
- **h** Oil Film thickness *(Millimeter)*
- **l** Length of Slot in Direction of Flow *(Millimeter)*
- p_r Pressure of Lubricating Oil *(Megapascal)*
- **Q** Flow of Lubricant *(Cubic Millimeter per Second)*
- q_f Flow Coefficient
- Q_{slot} Flow of Lubricant from Slot *(Cubic Millimeter per Second)*
- **W** Load Acting on Sliding Bearing *(Newton)*
- **X** Dimension X of Bearing Pad *(Millimeter)*
- **Y** Dimension Y of Bearing Pad *(Millimeter)*
- **ΔP** Pressure Difference between Slot Sides *(Megapascal)*
- μ_l Dynamic Viscosity of Lubricant *(Centipoise)*

Constants, Functions, Measurements used

- 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: **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

Check other formula lists

- **Film Thickness Formulas**
- **Hydrostatic Step Bearing with Pad Formulas**

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