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Strength and Stress Formulas

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List of 13 Strength and Stress Formulas

Strength and Stress

1) Bending Stress in Cotter of Cotter Joint

Open Calculator

fx $$\sigma_b = \left(3 \cdot \frac{L}{t_c \cdot b^2}\right) \cdot \left(\frac{d_2 + 2 \cdot d_4}{12}\right)$$

ex $$49.48376\text{N/mm}^2 = \left(3 \cdot \frac{50000\text{N}}{21.478\text{mm} \cdot (48.5\text{mm})^2}\right) \cdot \left(\frac{40\text{mm} + 2 \cdot 80\text{mm}}{12}\right)$$

2) Compressive Stress in Socket of Cotter Joint given Diameter of Spigot and of Socket Collar

Open Calculator

fx $$\sigma_{cso} = \frac{L}{(d_4 - d_2) \cdot t_c}$$

ex $$58.19909\text{N/mm}^2 = \frac{50000\text{N}}{(80\text{mm} - 40\text{mm}) \cdot 21.478\text{mm}}$$

3) Compressive Stress in Spigot of Cotter Joint Considering Crushing Failure

Open Calculator

fx $$\sigma_{c1} = \frac{L}{t_c \cdot d_2}$$

ex $$58.19909\text{N/mm}^2 = \frac{50000\text{N}}{21.478\text{mm} \cdot 40\text{mm}}$$

4) Compressive Stress of Spigot

Open Calculator

$$\sigma_{cp} = \frac{L}{t_c \cdot D_s}$$

$$46.55927\text{N/mm}^2 = \frac{50000\text{N}}{21.478\text{mm} \cdot 50.0\text{mm}}$$

5) Permissible Shear Stress for Cotter

Open Calculator

$$\tau_p = \frac{P}{2 \cdot b \cdot t_c}$$

$$719988.7\text{N/m}^2 = \frac{1500\text{N}}{2 \cdot 48.5\text{mm} \cdot 21.478\text{mm}}$$

6) Permissible Shear Stress for Spigot

Open Calculator

$$\tau_p = \frac{P}{2 \cdot a \cdot d_{ex}}$$

$$957854.4\text{N/m}^2 = \frac{1500\text{N}}{2 \cdot 17.4\text{mm} \cdot 45\text{mm}}$$

7) Shear Stress in Cotter given Cotter Thickness and Width

Open Calculator

$$\tau_{co} = \frac{L}{2 \cdot t_c \cdot b}$$

$$23.99962\text{N/mm}^2 = \frac{50000\text{N}}{2 \cdot 21.478\text{mm} \cdot 48.5\text{mm}}$$

8) Shear Stress in Socket of Cotter Joint given Inner and Outer Diameter of Socket

Open Calculator

$$\tau_{so} = \frac{L}{2 \cdot (d_4 - d_2) \cdot c}$$

$$25\text{N/mm}^2 = \frac{50000\text{N}}{2 \cdot (80\text{mm} - 40\text{mm}) \cdot 25.0\text{mm}}$$

9) Shear Stress in Spigot of Cotter Joint given Diameter of Spigot and Load

Open Calculator

$$\tau_{sp} = \frac{L}{2 \cdot L_a \cdot d_2}$$

$$26.59574\text{N/mm}^2 = \frac{50000\text{N}}{2 \cdot 23.5\text{mm} \cdot 40\text{mm}}$$

10) Tensile Stress in Rod of Cotter Joint

Open Calculator

$$\sigma t_{rod} = \frac{4 \cdot L}{\pi \cdot d^2}$$

$$49.99939\text{N/mm}^2 = \frac{4 \cdot 50000\text{N}}{\pi \cdot (35.6827\text{mm})^2}$$

11) Tensile Stress in Socket of Cotter Joint given Outer and Inner Diameter of Socket

Open Calculator

$$(\sigma_t so) = \frac{L}{\frac{\pi}{4} \cdot (d_1^2 - d_2^2) - t_c \cdot (d_1 - d_2)}$$

ex

$$68.22288\text{N/mm}^2 = \frac{50000\text{N}}{\frac{\pi}{4} \cdot \left((54\text{mm})^2 - (40\text{mm})^2\right) - 21.478\text{mm} \cdot (54\text{mm} - 40\text{mm})}$$

12) Tensile Stress in Spigot

Open Calculator

$$\sigma_t = \frac{P}{\left(\frac{\pi}{4} \cdot d_{ex}^2\right) - (d_{ex} \cdot t_c)}$$

$$2.404149\text{N/mm}^2 = \frac{1500\text{N}}{\left(\frac{\pi}{4} \cdot (45\text{mm})^2\right) - (45\text{mm} \cdot 21.478\text{mm})}$$

13) Tensile Stress in Spigot of Cotter Joint given Diameter of Spigot, Thickenss of Cotter and Load

Open Calculator

$$(\sigma_t sp) = \frac{L}{\frac{\pi \cdot d_2^2}{4} - d_2 \cdot t_c}$$

$$125.7808\text{N/mm}^2 = \frac{50000\text{N}}{\frac{\pi \cdot (40\text{mm})^2}{4} - 40\text{mm} \cdot 21.478\text{mm}}$$

Variables Used

- **a** Spigot Distance *(Millimeter)*
- **b** Mean Width of Cotter *(Millimeter)*
- **c** Axial Distance From Slot to End of Socket Collar *(Millimeter)*
- **d** Diameter of Rod of Cotter Joint *(Millimeter)*
- d_1 Outside Diameter of Socket *(Millimeter)*
- d_2 Diameter of Spigot *(Millimeter)*
- d_4 Diameter of Socket Collar *(Millimeter)*
- d_{ex} External Diameter of Spigot *(Millimeter)*
- D_s Spigot Diameter *(Millimeter)*
- **L** Load on Cotter Joint *(Newton)*
- L_a Gap between End of Slot to End of Spigot *(Millimeter)*
- **P** Tensile Force on Rods *(Newton)*
- t_c Thickness of Cotter *(Millimeter)*
- σ_b Bending Stress in Cotter *(Newton per Square Millimeter)*
- σ_{c1} Compressive Stress in Spigot *(Newton per Square Millimeter)*
- σ_{cp} Stress in Spigot *(Newton per Square Millimeter)*
- σ_{cso} Compressive Stress In Socket *(Newton per Square Millimeter)*
- σ_t Tensile Stress *(Newton per Square Millimeter)*
- σ_{tso} Tensile Stress In Socket *(Newton per Square Millimeter)*
- σ_{tsp} Tensile Stress In Spigot *(Newton per Square Millimeter)*
- σt_{rod} Tensile Stress in Cotter Joint Rod *(Newton per Square Millimeter)*
- τ_{co} Shear Stress in Cotter *(Newton per Square Millimeter)*
- τ_{so} Shear Stress in Socket *(Newton per Square Millimeter)*
- τ_{sp} Shear Stress in Spigot *(Newton per Square Millimeter)*

- τ_p Permissible Shear Stress *(Newton per Square Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Pressure** in Newton per Square Meter (N/m²)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Stress** in Newton per Square Millimeter (N/mm²)
  Stress Unit Conversion

Check other formula lists

- **Forces and Loads on Joint Formulas**
- **Joint Geometry and Dimensions Formulas**
- **Strength and Stress Formulas**

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