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Forces and Loads on Joint Formulas

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List of 11 Forces and Loads on Joint Formulas

Forces and Loads on Joint

1) Force on Cotter given Shear Stress in Cotter

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

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad 50000.78N = 2 \cdot 21.478mm \cdot 48.5mm \cdot 24N/mm^2$$

2) Load Taken by Cotter Joint Rod given Tensile Stress in Rod

$$fx \quad L = \frac{\pi \cdot d^2 \cdot \sigma_{t_{rod}}}{4}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$ex \quad 50000.61N = \frac{\pi \cdot (35.6827mm)^2 \cdot 50N/mm^2}{4}$$

3) Load Taken by Socket of Cotter Joint given Compressive Stress

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

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$ex \quad 50000.78N = 58.20N/mm^2 \cdot (80mm - 40mm) \cdot 21.478mm$$

4) Load Taken by Socket of Cotter Joint given Shear Stress in Socket

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

[Open Calculator !\[\]\(83bbbd261710c59db0214aa27b2edc0d_img.jpg\)](#)

$$ex \quad 50000N = 2 \cdot (80mm - 40mm) \cdot 25.0mm \cdot 25N/mm^2$$

5) Load Taken by Socket of Cotter Joint given Tensile Stress in Socket

$$fx \quad L = (\sigma_{tso}) \cdot \left(\frac{\pi}{4} \cdot (d_1^2 - d_2^2) - t_c \cdot (d_1 - d_2) \right)$$

[Open Calculator !\[\]\(f507db636256ac11a5525ef93ec6b8d7_img.jpg\)](#)

$$ex \quad 50000.82N = 68.224N/mm^2 \cdot \left(\frac{\pi}{4} \cdot ((54mm)^2 - (40mm)^2) - 21.478mm \cdot (54mm - 40mm) \right)$$



6) Load Taken by Spigot of Cotter Joint given Compressive Stress in Spigot Considering Crushing Failure

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 50000.78N = 21.478mm \cdot 40mm \cdot 58.2N/mm^2$$

7) Load Taken by Spigot of Cotter Joint given Shear Stress in Spigot

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 50000.48N = 2 \cdot 23.5mm \cdot 40mm \cdot 26.596N/mm^2$$

8) Maximum Load taken by Cotter Joint given Spigot Diameter, Thickness and Stress

$$fx \quad L = \left(\frac{\pi}{4} \cdot d_2^2 - d_2 \cdot t_c \right) \cdot (\sigma_{tsp})$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 50000.89N = \left(\frac{\pi}{4} \cdot (40mm)^2 - 40mm \cdot 21.478mm \right) \cdot 125.783N/mm^2$$

9) Permissible Shear Stress for Cotter

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

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

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


10) Permissible Shear Stress for Spigot

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

[Open Calculator !\[\]\(aff7c69c44a5e015f18c35867ef3f5c3_img.jpg\)](#)

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



11) Tensile Stress in Spigot [Open Calculator](#) 

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

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







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)
- **d₁** Outside Diameter of Socket (Millimeter)
- **d₂** Diameter of Spigot (Millimeter)
- **d₄** Diameter of Socket Collar (Millimeter)
- **d_{ex}** External Diameter of Spigot (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_{c1}** Compressive 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)
- **σ_{trod}** Tensile Stress in Cotter Joint Rod (Newton per Square Millimeter)
- **T_{co}** Shear Stress in Cotter (Newton per Square Millimeter)
- **T_{so}** Shear Stress in Socket (Newton per Square Millimeter)
- **T_{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](#) 
- [Strength and Stress Formulas](#) 
- [Joint Geometry and Dimensions Formulas](#) 

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