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Joint Analysis Formulas

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List of 8 Joint Analysis Formulas

Joint Analysis

1) Amount of Compression in Parts Joined by Bolt

$$fx \quad \delta_c = \frac{P_i}{k}$$

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

$$ex \quad 11\text{mm} = \frac{16500\text{N}}{1500\text{N/mm}}$$

2) Elongation of Bolt under Action of Pre Load

$$fx \quad \delta_b = \frac{P_i}{k_b}$$

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

$$ex \quad 0.05205\text{mm} = \frac{16500\text{N}}{3.17\text{E}^5\text{N/mm}}$$

3) Factor of Safety given Tensile Force on Bolt in Tension

$$fx \quad f_s = \frac{\pi}{4} \cdot d_c^2 \cdot \frac{S_{yt}}{P_{tb}}$$

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

$$ex \quad 3.00574 = \frac{\pi}{4} \cdot (12\text{mm})^2 \cdot \frac{265.5\text{N/mm}^2}{9990\text{N}}$$



4) Maximum Tensile Stress in Bolt

$$\text{fx } \sigma_{t_{\max}} = \frac{P_{tb}}{\frac{\pi}{4} \cdot d_c^2}$$

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

$$\text{ex } 88.33099\text{N/mm}^2 = \frac{9990\text{N}}{\frac{\pi}{4} \cdot (12\text{mm})^2}$$

5) Primary Shear Force of Eccentrically Loaded Bolted Connection

$$\text{fx } (P_1') = \frac{P}{n}$$

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

$$\text{ex } 3000\text{N} = \frac{12000\text{N}}{4}$$

6) Yield Strength of Bolt in Shear given Tensile Force on Bolt in Shear

$$\text{fx } S_{sy} = P_{tb} \cdot \frac{f_s}{\pi \cdot d_c \cdot h}$$

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

$$\text{ex } 132.4965\text{N/mm}^2 = 9990\text{N} \cdot \frac{3}{\pi \cdot 12\text{mm} \cdot 6\text{mm}}$$

7) Yield Strength of Bolt in Tension given Tensile Force on Bolt in Shear

$$\text{fx } S_{yt} = \frac{2 \cdot P_{tb} \cdot f_s}{\pi \cdot d_c \cdot h}$$

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

$$\text{ex } 264.993\text{N/mm}^2 = \frac{2 \cdot 9990\text{N} \cdot 3}{\pi \cdot 12\text{mm} \cdot 6\text{mm}}$$



8) Yield Strength of Bolt in Tension given Tensile Force on Bolt in Tension



$$f_x \quad S_{yt} = 4 \cdot P_{tb} \cdot \frac{f_s}{\pi \cdot d_c^2}$$

[Open Calculator](#)

$$ex \quad 264.993\text{N/mm}^2 = 4 \cdot 9990\text{N} \cdot \frac{3}{\pi \cdot (12\text{mm})^2}$$







Variables Used

- d_c Core Diameter of Bolt (Millimeter)
- δ_b Elongation of Bolt (Millimeter)
- f_s Factor of Safety of Bolted Joint
- h Height of Nut (Millimeter)
- k Combined Stiffness of Bolt (Newton per Millimeter)
- k_b' Stiffness of Bolt (Newton per Millimeter)
- n Number of Bolts in Bolted Joint
- P Imaginary Force on Bolt (Newton)
- P_1' Primary Shear Force on Bolt (Newton)
- P_i Pre Load in Bolt (Newton)
- P_{tb} Tensile Force in Bolt (Newton)
- S_{sy} Shear Yield Strength of Bolt (Newton per Square Millimeter)
- S_{yt} Tensile Yield Strength of Bolt (Newton per Square Millimeter)
- δ_c Amount of Compression of Bolted Joint (Millimeter)
- $\sigma_{t_{max}}$ Maximum Tensile Stress in Bolt (Newton per Square Millimeter)



Constants, Functions, Measurements used

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



Check other formula lists

- [Joint Analysis Formulas](#) 
- [Load and Strength Characteristics Formulas](#) 

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