

Important Joint Analysis Formulas PDF



Formulas Examples with Units

List of 8 Important Joint Analysis Formulas

1) Amount of Compression in Parts Joined by Bolt Formula ↻

Formula

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

Example with Units

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

Evaluate Formula ↻

2) Elongation of Bolt under Action of Pre Load Formula ↻

Formula

$$\delta_b = \frac{P_i}{k_b'}$$

Example with Units

$$0.0521_{\text{mm}} = \frac{16500_{\text{N}}}{3.17\text{E}+5_{\text{N/mm}'}}$$

Evaluate Formula ↻

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

Formula

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

Example with Units

$$3.0057 = \frac{3.1416}{4} \cdot 12_{\text{mm}}^2 \cdot \frac{265.5_{\text{N/mm}^2}}{9990_{\text{N}}}$$

Evaluate Formula ↻

4) Maximum Tensile Stress in Bolt Formula ↻

Formula

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

Example with Units

$$88.331_{\text{N/mm}^2} = \frac{9990_{\text{N}}}{\frac{3.1416}{4} \cdot 12_{\text{mm}}^2}$$

Evaluate Formula ↻

5) Primary Shear Force of Eccentrically Loaded Bolted Connection Formula ↻

Formula

$$P_1' = \frac{P}{n}$$

Example with Units

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

Evaluate Formula ↻

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

Formula

$$S_{Sy} = P_{tb} \cdot \frac{f_s}{\pi \cdot d_c \cdot h}$$

Example with Units

$$132.4965_{\text{N/mm}^2} = 9990_{\text{N}} \cdot \frac{3}{3.1416 \cdot 12_{\text{mm}} \cdot 6_{\text{mm}}}$$

Evaluate Formula ↻



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

Formula

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

Example with Units

$$264.993 \text{ N/mm}^2 = \frac{2 \cdot 9990 \text{ N} \cdot 3}{3.1416 \cdot 12 \text{ mm} \cdot 6 \text{ mm}}$$

Evaluate Formula 

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

Formula

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

Example with Units

$$264.993 \text{ N/mm}^2 = 4 \cdot 9990 \text{ N} \cdot \frac{3}{3.1416 \cdot 12 \text{ mm}^2}$$





Evaluate Formula 



Variables used in list of Joint Analysis Formulas above

- 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 in list of Joint Analysis Formulas above


- **constant(s):** π ,
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 



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