



Load and Strength Characteristics Formulas

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Examples!

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List of 13 Load and Strength Characteristics Formulas

Load and Strength Characteristics &

1) Imaginary Force at Center of Gravity of Bolted Joint given Primary Shear Force

fx
$$P = (P_1') \cdot n$$

Open Calculator

$$\texttt{ex} \ 12000 \texttt{N} = 3000 \texttt{N} \cdot 4$$

2) Number of Bolts given Primary Shear Force

$$\mathbf{fx} \left[n = \frac{P}{P_1}, \right]$$

Open Calculator

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

3) Pre Load in Bolt given Amount of Compression in Parts Joined by Bolt

$$ho_{
m i} = \delta_{
m c} \cdot {
m k}$$

Open Calculator 🖸

$$\texttt{ex} \ 16500 \texttt{N} = 11 \texttt{mm} \cdot 1500 \texttt{N} / \texttt{mm}$$



4) Pre Load in Bolt given Elongation of Bolt 🗗

fx $P_{i} = \delta_{b} \cdot (k_{b}$ ')

Open Calculator

ex $15850 \text{N} = 0.05 \text{mm} \cdot 3.17 \text{E}^5 \text{N/mm}$

5) Pre Load in Bolt given Wrench Torque

 $extbf{P}_i = rac{M_t}{0.2 \cdot d}$

Open Calculator

 $= 16500 N = \frac{49500 N^* mm}{0.2 \cdot 15 mm}$

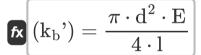
6) Resultant Load on Bolt given Pre Load and External Load

fx $P_{b}=P_{i}+\Delta P$

Open Calculator

= 19000 N = 16500 N + 2500 N

7) Stiffness of Bolt given Thickness of Parts Joined by Bolt 🗗



Open Calculator 🗗

 $ag{318086.3 ext{N/mm}} = rac{\pi \cdot (15 ext{mm})^2 \cdot 207000 ext{N/mm}^2}{4 \cdot 115 ext{mm}}$



8) Tensile Force on Bolt given Maximum Tensile Stress in Bolt

 $\left| \mathbf{P}_{\mathrm{tb}} = \sigma t_{\mathrm{max}} \cdot rac{\pi}{4} \cdot d_{\mathrm{c}}^{2}
ight|$

Open Calculator 🗗

 $ext{ex} 9952.566 ext{N} = 88 ext{N/mm}^2 \cdot rac{\pi}{4} \cdot (12 ext{mm})^2$

9) Tensile Force on Bolt in Shear

 $\left| \mathbf{F}_{\mathrm{tb}}
ight| \mathbf{P}_{\mathrm{tb}} = \pi \cdot \mathbf{d}_{\mathrm{c}} \cdot \mathbf{h} \cdot rac{\mathbf{S}_{\mathrm{sy}}}{\mathbf{f}_{\mathrm{s}}}
ight|$

Open Calculator

40) Tomella Forma au Bulli T

10) Tensile Force on Bolt in Tension 🖒

 $\left[\mathbf{F}_{\mathrm{tb}} = rac{\pi}{4} \cdot \mathrm{d_{c}^{2}} \cdot rac{\mathrm{S_{yt}}}{\mathrm{f_{s}}}
ight]$

Open Calculator 🖒

 $ext{ex} \left[10009.11 ext{N} = rac{\pi}{4} \cdot (12 ext{mm})^2 \cdot rac{265.5 ext{N/mm}^2}{3}
ight]$

11) Thickness of Parts Held Together by Bolt given Stiffness of Bolt

 $132.6\mathrm{N/mm^2}$

$$l = rac{\pi \cdot d^2 \cdot E}{4 \cdot (k_b')}$$

Open Calculator 🗗

ex $115.3941 \mathrm{mm} = rac{\pi \cdot \left(15 \mathrm{mm}
ight)^2 \cdot 207000 \mathrm{N/mm^2}}{4 \cdot 3.17 \mathrm{E} \hat{}^{5} \mathrm{N/mm}}$







12) Wrench Torque Required to Create Required Pre Load 🗗

fx $M_{
m t} = 0.2 \cdot P_{
m i} \cdot d$

Open Calculator 🗗

 $49500N*mm = 0.2 \cdot 16500N \cdot 15mm$

13) Young's Modulus of Bolt given Stiffness of Bolt

 $E=rac{(k_{
m b}{}')\cdot l\cdot 4}{{
m d}^2\cdot \pi}$

Open Calculator



Variables Used

- ΔP Load due to External Force on Bolt (Newton)
- **d** Nominal Bolt Diameter (Millimeter)
- d_c Core Diameter of Bolt (Millimeter)
- δ_h Elongation of Bolt (Millimeter)
- E Modulus of Elasticity of Bolt (Newton per Square Millimeter)
- fs Factor of Safety of Bolted Joint
- **h** Height of Nut (Millimeter)
- **k** Combined Stiffness of Bolt (Newton per Millimeter)
- **k**_h' Stiffness of Bolt (Newton per Millimeter)
- I Total Thickness of Parts held together by Bolt (Millimeter)
- M_t Wrench Torque for Bolt Tightening (Newton Millimeter)
- n Number of Bolts in Bolted Joint
- P Imaginary Force on Bolt (Newton)
- P₁' Primary Shear Force on Bolt (Newton)
- P_b Resultant Load on Bolt (Newton)
- Pi Pre Load in Bolt (Newton)
- P_{tb} Tensile Force in Bolt (Newton)
- S_{SV} Shear Yield Strength of Bolt (Newton per Square Millimeter)
- Svt Tensile Yield Strength of Bolt (Newton per Square Millimeter)
- δ_c Amount of Compression of Bolted Joint (Millimeter)
- σt_{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: Torque in Newton Millimeter (N*mm)
 Torque 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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