Important Proof Load on Spring Formulas PDF

Formulas
Examples
with Units

List of 18
Important Proof Load on Spring Formulas

1) Leaf Springs Formulas

1.1) Deflection given Proof Load on Leaf Spring Formula

Evaluate Formula

Formula

$$\delta = \frac{3 \cdot W_{O\ (Leaf\ Spring)} \cdot L^3}{8 \cdot E \cdot n \cdot t^3 \cdot b}$$

Example with Units

$$3.4047\,\text{mm} = \frac{3 \cdot 585\,\text{kN} \cdot 4170\,\text{mm}^3}{8 \cdot 20000\,\text{MPa} \cdot 8 \cdot 460\,\text{mm}^3 \cdot 300\,\text{mm}}$$

1.2) Length given Proof Load on Leaf Spring Formula

Evaluate Formula

Formula

$$L = \left(\frac{8 \cdot E \cdot n \cdot b \cdot t^3 \cdot \delta}{3 \cdot W_{O\ (Leaf\ Spring)}}\right)^{\frac{1}{3}}$$

Example with Units

$$4168.0748\,\text{mm} = \left(\frac{8 \cdot 20000\,\text{MPa} \cdot 8 \cdot 300\,\text{mm} \cdot 460\,\text{mm}^3 \cdot 3.4\,\text{mm}}{3 \cdot 585\,\text{kN}}\right)^{\frac{1}{3}}$$

1.3) Modulus of Elasticity given Proof Load on Leaf Spring Formula

Evaluate Formula

Formula

$$E = \frac{3 \cdot W_{O\ (Leaf\ Spring)} \cdot L^3}{8 \cdot n \cdot b \cdot t^3 \cdot \delta}$$

Example with Units

$$20027.7262\,\text{MPa} = \frac{3 \cdot 585\,\text{kN} \cdot 4170\,\text{mm}^3}{8 \cdot 8 \cdot 300\,\text{mm} \cdot 460\,\text{mm}^3 \cdot 3.4\,\text{mm}}$$

1.4) Number of Plates given Proof Load on Leaf Spring Formula

Evaluate Formula

Formula

$$n = \frac{3 \cdot W_{O\ (Leaf\ Spring)} \cdot L^3}{8 \cdot E \cdot b \cdot t^3 \cdot \delta}$$

Example with Units

$$8.0111 = \frac{3 \cdot 585\,\text{kN} \cdot 4170\,\text{mm}^3}{8 \cdot 20000\,\text{MPa} \cdot 300\,\text{mm} \cdot 460\,\text{mm}^3 \cdot 3.4\,\text{mm}}$$

1.5) Proof Load on Leaf Spring Formula

Evaluate Formula

Formula

$$W_{O\ (Leaf\ Spring)} = \frac{8 \cdot E \cdot n \cdot b \cdot t^{3} \cdot \delta}{3 \cdot L^{3}}$$

Example with Units

$$584.1901\,\text{kN} = \frac{8 \cdot 20000\,\text{MPa} \cdot 8 \cdot 300\,\text{mm} \cdot 460\,\text{mm}^{3} \cdot 3.4\,\text{mm}}{3 \cdot 4170\,\text{mm}^{3}}$$

1.6) Thickness given Proof Load on Leaf Spring Formula

Evaluate Formula

Formula

$$t = \left(\frac{3 \cdot W_{O\ (Leaf\ Spring)} \cdot L^{3}}{8 \cdot E \cdot n \cdot \delta \cdot b}\right)^{\frac{1}{3}}$$

Example with Units

$$460.2125\,\text{mm} = \left(\frac{3 \cdot 585\,\text{kN} \cdot 4170\,\text{mm}^{3}}{8 \cdot 20000\,\text{MPa} \cdot 8 \cdot 3.4\,\text{mm} \cdot 300\,\text{mm}}\right)^{\frac{1}{3}}$$

1.7) Width given Proof Load on Leaf Spring Formula

Evaluate Formula

Formula

$$b = \frac{3 \cdot W_{O\ (Leaf\ Spring)} \cdot L^{3}}{8 \cdot E \cdot n \cdot t^{3} \cdot \delta}$$

Example with Units

$$300.4159\,\text{mm} = \frac{3 \cdot 585\,\text{kN} \cdot 4170\,\text{mm}^{3}}{8 \cdot 20000\,\text{MPa} \cdot 8 \cdot 460\,\text{mm}^{3} \cdot 3.4\,\text{mm}}$$

2) Quarter Elliptical Springs Formulas

2.1) Deflection given Proof Load in Quarter Elliptical Spring Formula

Evaluate Formula

Formula

$$\delta = \frac{6 \cdot W_{O\ (Elliptical\ Spring)} \cdot L^{3}}{E \cdot n \cdot t^{3} \cdot b}$$

Example with Units

$$3.4455\,\text{mm} = \frac{6 \cdot 37\,\text{kN} \cdot 4170\,\text{mm}^{3}}{20000\,\text{MPa} \cdot 8 \cdot 460\,\text{mm}^{3} \cdot 300\,\text{mm}}$$

2.2) Length given Proof Load in Quarter Elliptical Spring Formula

Evaluate Formula

Formula

$$L = \left(\frac{E \cdot n \cdot b \cdot t^{3} \cdot \delta}{6 \cdot W_{O\ (Elliptical\ Spring)}} \right)^{\frac{1}{3}}$$

Example with Units

$$4151.5814\,\text{mm} = \left(\frac{20000\,\text{MPa} \cdot 8 \cdot 300\,\text{mm} \cdot 460\,\text{mm}^{3} \cdot 3.4\,\text{mm}}{6 \cdot 37\,\text{kN}} \right)^{\frac{1}{3}}$$

2.3) Modulus of Elasticity given Proof Load in Quarter Elliptical Spring Formula

Evaluate Formula

Formula

$$E = \frac{6 \cdot W_{O\ (Elliptical\ Spring)} \cdot L^{3}}{n \cdot b \cdot t^{3} \cdot \delta}$$

Example with Units

$$20267.3742\,\text{MPa} = \frac{6 \cdot 37\,\text{kN} \cdot 4170\,\text{mm}^{3}}{8 \cdot 300\,\text{mm} \cdot 460\,\text{mm}^{3} \cdot 3.4\,\text{mm}}$$

2.4) Number of Plates given Proof Load in Quarter Elliptical Spring Formula

Evaluate Formula

Formula

$$n = \frac{6 \cdot W_{O\ (Elliptical\ Spring)} \cdot L^{3}}{E \cdot b \cdot t^{3} \cdot \delta}$$

Example with Units

$$8.1069 = \frac{6 \cdot 37\,\text{kN} \cdot 4170\,\text{mm}^{3}}{20000\,\text{MPa} \cdot 300\,\text{mm} \cdot 460\,\text{mm}^{3} \cdot 3.4\,\text{mm}}$$

2.5) Proof Load in Quarter Elliptical Spring Formula

Evaluate Formula

Formula

$$W_{O\ (Elliptical\ Spring)} = \frac{E \cdot n \cdot b \cdot t^{3} \cdot \delta}{6 \cdot L^{3}}$$

Example with Units

$$36.5119\,\text{kN} = \frac{20000\,\text{MPa} \cdot 8 \cdot 300\,\text{mm} \cdot 460\,\text{mm}^{3} \cdot 3.4\,\text{mm}}{6 \cdot 4170\,\text{mm}^{3}}$$

2.6) Thickness given Proof Load in Quarter Elliptical Spring Formula

Evaluate Formula

Formula

$$t = \left(\frac{6 \cdot W_{O\ (Elliptical\ Spring)} \cdot L^3}{E \cdot n \cdot \delta \cdot b} \right)^{\frac{1}{3}}$$

Example with Units

$$462.0408\,\text{mm} = \left(\frac{6 \cdot 37\,\text{kN} \cdot 4170\,\text{mm}^3}{20000\,\text{MPa} \cdot 8 \cdot 3.4\,\text{mm} \cdot 300\,\text{mm}} \right)^{\frac{1}{3}}$$

2.7) Width given Proof Load in Quarter Elliptical Spring Formula

Evaluate Formula

Formula

$$b = \frac{6 \cdot W_{O\ (Elliptical\ Spring)} \cdot L^3}{E \cdot n \cdot t^3 \cdot \delta}$$

Example with Units

$$304.0106\,\text{mm} = \frac{6 \cdot 37\,\text{kN} \cdot 4170\,\text{mm}^3}{20000\,\text{MPa} \cdot 8 \cdot 460\,\text{mm}^3 \cdot 3.4\,\text{mm}}$$

3) Springs in Parallel and Series Load Formulas

3.1) Springs in Parallel - Load Formula

Evaluate Formula

Formula

$$W_{load} = W_1 + W_2$$

Example with Units

$$85\,\text{N} = 35\,\text{N} + 50\,\text{N}$$

3.2) Springs in Parallel - Spring Constant Formula

Evaluate Formula

Formula

$$K = K_1 + K_2$$

Example with Units

$$100\,\text{N/mm} = 49\,\text{N/mm} + 51\,\text{N/mm}$$

3.3) Springs in Series- Deflection Formula

Evaluate Formula

Formula

$$\delta = \delta_1 + \delta_2$$

Example with Units

$$179\,\text{mm} = 36\,\text{mm} + 143\,\text{mm}$$

3.4) Springs in Series- Spring Constant Formula

Evaluate Formula

Formula

$$K = \frac{K_1 \cdot K_2}{K_1 + K_2}$$

Example with Units

$$24.99\,\text{N/mm} = \frac{49\,\text{N/mm} \cdot 51\,\text{N/mm}}{49\,\text{N/mm} + 51\,\text{N/mm}}$$

Variables used in list of Proof Load on Spring Formulas above

- **b** Width of Cross Section *(Millimeter)*
- **E** Young's Modulus *(Megapascal)*
- **K** Stiffness of Spring *(Newton per Millimeter)*
- K_1 Stiffness of Spring 1 *(Newton per Millimeter)*
- K_2 Stiffness of Spring 2 *(Newton per Millimeter)*
- **L** Length in Spring *(Millimeter)*
- **n** Number of Plates
- **t** Thickness of Section *(Millimeter)*
- W_1 Load 1 *(Newton)*
- W_2 Load 2 *(Newton)*
- W_{load} Spring Load *(Newton)*
- $W_{O\ (Elliptical\ Spring)}$ Proof Load on Elliptical Spring *(Kilonewton)*
- $W_{O\ (Leaf\ Spring)}$ Proof Load on Leaf Spring *(Kilonewton)*
- δ Deflection of Spring *(Millimeter)*
- δ_1 Deflection 1 *(Millimeter)*
- δ_2 Deflection 2 *(Millimeter)*

Constants, Functions, Measurements used in list of Proof Load on Spring Formulas above

- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Force** in Kilonewton (kN), Newton (N)
  Force Unit Conversion
- Measurement: **Stiffness Constant** in Newton per Millimeter (N/mm)
  Stiffness Constant Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

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