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Proof Load on Spring Formulas

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List of 18 Proof Load on Spring Formulas

Proof Load on Spring

Leaf Springs

1) Deflection given Proof Load on Leaf Spring

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

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$\text{ex } 3.404713\text{mm} = \frac{3 \cdot 585\text{kN} \cdot (4170\text{mm})^3}{8 \cdot 20000\text{MPa} \cdot 8 \cdot (460\text{mm})^3 \cdot 300\text{mm}}$$

2) Length given Proof Load on Leaf Spring

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

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$\text{ex } 4168.075\text{mm} = \left(\frac{8 \cdot 20000\text{MPa} \cdot 8 \cdot 300\text{mm} \cdot (460\text{mm})^3 \cdot 3.4\text{mm}}{3 \cdot 585\text{kN}} \right)^{\frac{1}{3}}$$



3) Modulus of Elasticity given Proof Load on Leaf Spring

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

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

$$\text{ex } 20027.73 \text{MPa} = \frac{3 \cdot 585 \text{kN} \cdot (4170 \text{mm})^3}{8 \cdot 8 \cdot 300 \text{mm} \cdot (460 \text{mm})^3 \cdot 3.4 \text{mm}}$$

4) Number of Plates given Proof Load on Leaf Spring

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

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

$$\text{ex } 8.01109 = \frac{3 \cdot 585 \text{kN} \cdot (4170 \text{mm})^3}{8 \cdot 20000 \text{MPa} \cdot 300 \text{mm} \cdot (460 \text{mm})^3 \cdot 3.4 \text{mm}}$$

5) Proof Load on Leaf Spring

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

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

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



6) Thickness given Proof Load on Leaf Spring

[Open Calculator !\[\]\(dfbd6b3763a6d1d9afaa974f64e2e4b5_img.jpg\)](#)

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

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

7) Width given Proof Load on Leaf Spring

[Open Calculator !\[\]\(ec9132f1d27c8919987d92907322654d_img.jpg\)](#)

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

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

Quarter Elliptical Springs

8) Deflection given Proof Load in Quarter Elliptical Spring

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

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

$$\text{ex } 3.445454\text{mm} = \frac{6 \cdot 37\text{kN} \cdot (4170\text{mm})^3}{20000\text{MPa} \cdot 8 \cdot 460\text{mm}^3 \cdot 300\text{mm}}$$



9) Length given Proof Load in Quarter Elliptical Spring

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

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 4151.581\text{mm} = \left(\frac{20000\text{MPa} \cdot 8 \cdot 300\text{mm} \cdot 460\text{mm}^3 \cdot 3.4\text{mm}}{6 \cdot 37\text{kN}} \right)^{\frac{1}{3}}$$

10) Modulus of Elasticity given Proof Load in Quarter Elliptical Spring

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

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 20267.37\text{MPa} = \frac{6 \cdot 37\text{kN} \cdot (4170\text{mm})^3}{8 \cdot 300\text{mm} \cdot (460\text{mm})^3 \cdot 3.4\text{mm}}$$

11) Number of Plates given Proof Load in Quarter Elliptical Spring

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

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 8.10695 = \frac{6 \cdot 37\text{kN} \cdot (4170\text{mm})^3}{20000\text{MPa} \cdot 300\text{mm} \cdot (460\text{mm})^3 \cdot 3.4\text{mm}}$$



12) Proof Load in Quarter Elliptical Spring

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

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$\text{ex } 36.51188\text{kN} = \frac{20000\text{MPa} \cdot 8 \cdot 300\text{mm} \cdot (460\text{mm})^3 \cdot 3.4\text{mm}}{6 \cdot (4170\text{mm})^3}$$

13) Thickness given Proof Load in Quarter Elliptical Spring

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

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

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

14) Width given Proof Load in Quarter Elliptical Spring

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

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

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



Springs in Parallel and Series Load

15) Springs in Parallel - Load

$$fx \quad W_{load} = W_1 + W_2$$

[Open Calculator !\[\]\(83f22ed94ec5517769dd76d702c6bfd8_img.jpg\)](#)

$$ex \quad 85N = 35N + 50N$$

16) Springs in Parallel - Spring Constant

$$fx \quad K = K_1 + K_2$$

[Open Calculator !\[\]\(3cb60d42b10e53f9522bb0b392c1c4cd_img.jpg\)](#)

$$ex \quad 100N/mm = 49N/mm + 51N/mm$$

17) Springs in Series- Deflection

$$fx \quad \delta = \delta_1 + \delta_2$$

[Open Calculator !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

$$ex \quad 179mm = 36mm + 143mm$$

18) Springs in Series- Spring Constant

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

[Open Calculator !\[\]\(683dba75afe26e28cd4de5730b776760_img.jpg\)](#)

$$ex \quad 24.99N/mm = \frac{49N/mm \cdot 51N/mm}{49N/mm + 51N/mm}$$







Variables Used

- **b** Width of Cross Section (Millimeter)
- **E** Young's Modulus (Megapascal)
- **K** Stiffness of Spring (Newton per Millimeter)
- **K₁** Stiffness of Spring 1 (Newton per Millimeter)
- **K₂** Stiffness of Spring 2 (Newton per Millimeter)
- **L** Length in Spring (Millimeter)
- **n** Number of Plates
- **t** Thickness of Section (Millimeter)
- **W₁** Load 1 (Newton)
- **W₂** 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)
- **δ₁** Deflection 1 (Millimeter)
- **δ₂** Deflection 2 (Millimeter)



Constants, Functions, Measurements used

- **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 



Check other formula lists

- [Deflection in Spring Formulas](#) 
- [Maximum Bending Stress in Spring Formulas](#) 
- [Proof Load on Spring Formulas](#) 

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