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Deflection in Spring Formulas

Calculators! Examples! Conversions!

List of 23 Deflection in Spring Formulas

Deflection in Spring

Close-Coiled Helical Spring

1) Deflection for Close-Coiled Helical Spring

Open Calculator

fx $$\delta = \frac{64 \cdot W_{load} \cdot R^3 \cdot N}{G_{Torsion} \cdot d^4}$$

ex $$3.4\text{mm} = \frac{64 \cdot 85\text{N} \cdot (225\text{mm})^3 \cdot 9}{40\text{GPa} \cdot (45\text{mm})^4}$$

2) Diameter of Spring Wire or Coil given Deflection for Close-Coiled Helical Spring

Open Calculator

fx $$d = \left(\frac{64 \cdot W_{load} \cdot R^3 \cdot N}{G_{Torsion} \cdot \delta} \right)^{\frac{1}{4}}$$

ex $$45\text{mm} = \left(\frac{64 \cdot 85\text{N} \cdot 225\text{mm}^3 \cdot 9}{40\text{GPa} \cdot 3.4\text{mm}} \right)^{\frac{1}{4}}$$

3) Load Applied on Spring Axially given Deflection for Close-Coiled Helical Spring

Open Calculator

fx $$W_{load} = \frac{\delta \cdot G_{Torsion} \cdot d^4}{64 \cdot N \cdot R^3}$$

ex $$85N = \frac{3.4mm \cdot 40GPa \cdot 45mm^4}{64 \cdot 9 \cdot (225mm)^3}$$

4) Mean Radius of Spring given Deflection for Close-Coiled Helical Spring

Open Calculator

fx $$R = \left(\frac{\delta \cdot G_{Torsion} \cdot d^4}{64 \cdot W_{load} \cdot N}\right)^{\frac{1}{3}}$$

ex $$225mm = \left(\frac{3.4mm \cdot 40GPa \cdot 45mm^4}{64 \cdot 85N \cdot 9}\right)^{\frac{1}{3}}$$

5) Modulus of Rigidity given Deflection for Close-Coiled Helical Spring

Open Calculator

fx $$G_{Torsion} = \frac{64 \cdot W_{load} \cdot R^3 \cdot N}{\delta \cdot d^4}$$

ex $$40GPa = \frac{64 \cdot 85N \cdot 225mm^3 \cdot 9}{3.4mm \cdot 45mm^4}$$

6) Number of Spring Coils given Deflection for Close-Coiled Helical Spring

Open Calculator

fx $$N = \frac{\delta \cdot G_{Torsion} \cdot d^4}{64 \cdot W_{load} \cdot R^3}$$

ex $$9 = \frac{3.4\text{mm} \cdot 40\text{GPa} \cdot (45\text{mm})^4}{64 \cdot 85\text{N} \cdot (225\text{mm})^3}$$

Spring of Square Section Wire

7) Deflection of Square Section Wire Spring

Open Calculator

fx $$\delta = \frac{44.7 \cdot W_{load} \cdot R^3 \cdot N}{G_{Torsion} \cdot d^4}$$

ex $$2.374688\text{mm} = \frac{44.7 \cdot 85\text{N} \cdot (225\text{mm})^3 \cdot 9}{40\text{GPa} \cdot (45\text{mm})^4}$$

8) Load given Deflection of Square Section Wire Spring

Open Calculator

fx $$W_{load} = \frac{\delta \cdot G_{Torsion} \cdot d^4}{44.7 \cdot R^3 \cdot N}$$

ex $$121.7002\text{N} = \frac{3.4\text{mm} \cdot 40\text{GPa} \cdot (45\text{mm})^4}{44.7 \cdot (225\text{mm})^3 \cdot 9}$$

9) Mean radius given Deflection of Square Section Wire Spring

Open Calculator

$$R = \left(\frac{\delta \cdot G_{Torsion} \cdot d^4}{44.7 \cdot W_{load} \cdot N}\right)^{\frac{1}{3}}$$

$$253.5946\text{mm} = \left(\frac{3.4\text{mm} \cdot 40\text{GPa} \cdot (45\text{mm})^4}{44.7 \cdot 85\text{N} \cdot 9}\right)^{\frac{1}{3}}$$

10) Modulus of Rigidity using Deflection of Square Section Wire Spring

Open Calculator

$$G_{Torsion} = \frac{44.7 \cdot W_{load} \cdot R^3 \cdot N}{\delta \cdot d^4}$$

$$27.9375\text{GPa} = \frac{44.7 \cdot 85\text{N} \cdot (225\text{mm})^3 \cdot 9}{3.4\text{mm} \cdot (45\text{mm})^4}$$

11) Number of Coils given Deflection of Square Section Wire Spring

Open Calculator

$$N = \frac{\delta \cdot G_{Torsion} \cdot d^4}{44.7 \cdot R^3 \cdot W_{load}}$$

$$12.88591 = \frac{3.4\text{mm} \cdot 40\text{GPa} \cdot (45\text{mm})^4}{44.7 \cdot (225\text{mm})^3 \cdot 85\text{N}}$$

12) Width given Deflection of Square Section Wire Spring

Open Calculator

$$d = \left(\frac{44.7 \cdot W_{load} \cdot R^3 \cdot N}{\delta \cdot G_{Torsion}}\right)^{\frac{1}{4}}$$

$$41.13812\text{mm} = \left(\frac{44.7 \cdot 85\text{N} \cdot (225\text{mm})^3 \cdot 9}{3.4\text{mm} \cdot 40\text{GPa}}\right)^{\frac{1}{4}}$$

Leaf Springs

13) Deflection in Leaf Spring given Moment

Open Calculator

$$\delta = \left(\frac{M \cdot L^2}{8 \cdot E \cdot I}\right)$$

$$4.584964\text{mm} = \left(\frac{67.5\text{kN*m} \cdot (4170\text{mm})^2}{8 \cdot 20000\text{MPa} \cdot 0.0016\text{m}^4}\right)$$

14) Length given Deflection in Leaf Spring

Open Calculator

$$L = \sqrt{\frac{8 \cdot \delta \cdot E \cdot I}{M}}$$

$$3590.935\text{mm} = \sqrt{\frac{8 \cdot 3.4\text{mm} \cdot 20000\text{MPa} \cdot 0.0016\text{m}^4}{67.5\text{kN*m}}}$$

15) Modulus of Elasticity given Deflection in Leaf Spring and Moment

Open Calculator

fx $$E = \frac{M \cdot L^2}{8 \cdot \delta \cdot I}$$

ex $$26970.38\text{MPa} = \frac{67.5\text{kN*m} \cdot (4170\text{mm})^2}{8 \cdot 3.4\text{mm} \cdot 0.0016\text{m}^4}$$

16) Moment given Deflection in Leaf Spring

Open Calculator

fx $$M = \frac{8 \cdot \delta \cdot E \cdot I}{L^2}$$

ex $$50.05492\text{kN*m} = \frac{8 \cdot 3.4\text{mm} \cdot 20000\text{MPa} \cdot 0.0016\text{m}^4}{(4170\text{mm})^2}$$

17) Moment of Inertia given Deflection in Leaf Spring

Open Calculator

fx $$I = \frac{M \cdot L^2}{8 \cdot E \cdot \delta}$$

ex $$0.002158\text{m}^4 = \frac{67.5\text{kN*m} \cdot (4170\text{mm})^2}{8 \cdot 20000\text{MPa} \cdot 3.4\text{mm}}$$

For Centrally Loaded Beam

18) Deflection in Leaf Spring given Load

Open Calculator

fx $$\delta_{\mathrm{Leaf}} = \frac{3 \cdot W_{\mathrm{load}} \cdot L^3}{8 \cdot E \cdot n \cdot b \cdot t^3}$$

ex $$494.702\mathrm{mm} = \frac{3 \cdot 85\mathrm{N} \cdot (4170\mathrm{mm})^3}{8 \cdot 20000\mathrm{MPa} \cdot 8 \cdot 300\mathrm{mm} \cdot (460\mathrm{mm})^3}$$

19) Load given Deflection in Leaf Spring

Open Calculator

fx $$W_{\mathrm{load}} = \frac{8 \cdot \delta_{\mathrm{Leaf}} \cdot E \cdot n \cdot b \cdot t^3}{3 \cdot L^3}$$

ex $$84.87939\mathrm{N} = \frac{8 \cdot 494\mathrm{mm} \cdot 20000\mathrm{MPa} \cdot 8 \cdot 300\mathrm{mm} \cdot (460\mathrm{mm})^3}{3 \cdot (4170\mathrm{mm})^3}$$

20) Modulus of Elasticity in Leaf Spring given Deflection

Open Calculator

fx $$E = \frac{3 \cdot W_{\mathrm{load}} \cdot L^3}{8 \cdot \delta_{\mathrm{Leaf}} \cdot n \cdot b \cdot t^3}$$

ex $$20028.42\mathrm{MPa} = \frac{3 \cdot 85\mathrm{N} \cdot (4170\mathrm{mm})^3}{8 \cdot 494\mathrm{mm} \cdot 8 \cdot 300\mathrm{mm} \cdot (460\mathrm{mm})^3}$$

21) Number of plates given Deflection in Leaf Spring

Open Calculator

fx $$n = \frac{3 \cdot W_{load} \cdot L^3}{8 \cdot \delta_{Leaf} \cdot E \cdot b \cdot t^3}$$

ex $$8.011368 = \frac{3 \cdot 85\text{N} \cdot (4170\text{mm})^3}{8 \cdot 494\text{mm} \cdot 20000\text{MPa} \cdot 300\text{mm} \cdot (460\text{mm})^3}$$

22) Thickness given Deflection in Leaf Spring

Open Calculator

fx $$t = \left(\frac{3 \cdot W_{load} \cdot L^3}{8 \cdot \delta_{Leaf} \cdot E \cdot n \cdot b}\right)^{\frac{1}{3}}$$

ex $$460.2178\text{mm} = \left(\frac{3 \cdot 85\text{N} \cdot (4170\text{mm})^3}{8 \cdot 494\text{mm} \cdot 20000\text{MPa} \cdot 8 \cdot 300\text{mm}}\right)^{\frac{1}{3}}$$

23) Width given Deflection in Leaf Spring

Open Calculator

fx $$b = \frac{3 \cdot W_{load} \cdot L^3}{8 \cdot \delta_{Leaf} \cdot E \cdot n \cdot t^3}$$

ex $$300.4263\text{mm} = \frac{3 \cdot 85\text{N} \cdot (4170\text{mm})^3}{8 \cdot 494\text{mm} \cdot 20000\text{MPa} \cdot 8 \cdot (460\text{mm})^3}$$

Variables Used

- **b** Width of Cross Section *(Millimeter)*
- **d** Diameter of Spring *(Millimeter)*
- **E** Young's Modulus *(Megapascal)*
- $G_{Torsion}$ Modulus of Rigidity *(Gigapascal)*
- **I** Area Moment of Inertia *(Meter⁴)*
- **L** Length in Spring *(Millimeter)*
- **M** Bending Moment *(Kilonewton Meter)*
- **n** Number of Plates
- **N** Number of Coils
- **R** Mean Radius *(Millimeter)*
- **t** Thickness of Section *(Millimeter)*
- W_{load} Spring Load *(Newton)*
- **δ** Deflection of Spring *(Millimeter)*
- δ_{Leaf} Deflection of Leaf Spring *(Millimeter)*

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Pressure** in Gigapascal (GPa)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Moment of Force** in Kilonewton Meter (kN*m)
  Moment of Force Unit Conversion
- Measurement: **Second Moment of Area** in Meter⁴ (m^4)
  Second Moment of Area Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- **Deflection in Spring Formulas**

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