Important Torsion of Leaf Spring Formulas PDF

Formulas
Examples
with Units

List of 39
Important Torsion of Leaf Spring Formulas

1) Central Deflection of Leaf Spring Formula

Evaluate Formula

Formula

$$\delta = \frac{l^2}{8 \cdot R}$$

Example with Units

$$0.6429\,\text{mm} = \frac{6\,\text{mm}^2}{8 \cdot 7\,\text{mm}}$$

2) Central Deflection of Leaf Spring for given Modulus of Elasticity Formula

Evaluate Formula

Formula

$$\delta = \frac{\sigma \cdot l^2}{4 \cdot E \cdot t_p}$$

Example with Units

$$11.25\,\text{mm} = \frac{15\,\text{MPa} \cdot 6\,\text{mm}^2}{4 \cdot 10\,\text{MPa} \cdot 1.2\,\text{mm}}$$

3) Load at One End given Bending Moment at Center of Leaf Spring Formula

Evaluate Formula

Formula

$$L = \frac{2 \cdot M_b}{l}$$

Example with Units

$$1.7333\,\text{kN} = \frac{2 \cdot 5200\,\text{N*mm}}{6\,\text{mm}}$$

4) Maximum Bending Stress Developed given Central Deflection of Leaf Spring Formula

Evaluate Formula

Formula

$$\sigma = \frac{4 \cdot E \cdot t_p \cdot \delta}{l^2}$$

Example with Units

$$5.3333\,\text{MPa} = \frac{4 \cdot 10\,\text{MPa} \cdot 1.2\,\text{mm} \cdot 4\,\text{mm}}{6\,\text{mm}^2}$$

5) Maximum Bending Stress Developed given Radius of Plate to which they are Bent Formula

Evaluate Formula

Formula

$$\sigma = \frac{E \cdot t_p}{2 \cdot R}$$

Example with Units

$$0.8571\,\text{MPa} = \frac{10\,\text{MPa} \cdot 1.2\,\text{mm}}{2 \cdot 7\,\text{mm}}$$

6) Maximum Bending Stress Developed in Plates given Point Load at Center Formula

Evaluate Formula

Formula

$$\sigma = \frac{3 \cdot w \cdot l}{2 \cdot n \cdot B \cdot t_p^2}$$

Example with Units

$$1750.8371\,\text{MPa} = \frac{3 \cdot 251\,\text{kN} \cdot 6\,\text{mm}}{2 \cdot 8 \cdot 112\,\text{mm} \cdot 1.2\,\text{mm}^2}$$

7) Modulus of Elasticity given Central Deflection of Leaf Spring Formula

Evaluate Formula

Formula

$$E = \frac{\sigma \cdot l^2}{4 \cdot \delta \cdot t_p}$$

Example with Units

$$28.125\,\text{MPa} = \frac{15\,\text{MPa} \cdot 6\,\text{mm}^2}{4 \cdot 4\,\text{mm} \cdot 1.2\,\text{mm}}$$

8) Modulus of Elasticity given Radius of Plate to which they are Bent Formula

Evaluate Formula

Formula

$$E = \frac{2 \cdot \sigma \cdot R}{t_p}$$

Example with Units

$$175\,\text{MPa} = \frac{2 \cdot 15\,\text{MPa} \cdot 7\,\text{mm}}{1.2\,\text{mm}}$$

9) Moment of Inertia of each Leaf Spring Plate Formula

Evaluate Formula

Formula

$$I = \frac{B \cdot t_p^3}{12}$$

Example with Units

$$0.0161\,\text{g*mm}^2 = \frac{112\,\text{mm} \cdot 1.2\,\text{mm}^3}{12}$$

10) Number of Plates given Maximum Bending Stress Developed in Plates Formula

Evaluate Formula

Formula

$$n = \frac{3 \cdot w \cdot l}{2 \cdot \sigma \cdot B \cdot t_p^2}$$

Example with Units

$$933.7798 = \frac{3 \cdot 251\,\text{kN} \cdot 6\,\text{mm}}{2 \cdot 15\,\text{MPa} \cdot 112\,\text{mm} \cdot 1.2\,\text{mm}^2}$$

11) Number of Plates in Leaf Spring given Total Resisting Moment by n Plates Formula

Evaluate Formula

Formula

$$n = \frac{6 \cdot M_b}{\sigma \cdot B \cdot t_p^2}$$

Example with Units

$$12.8968 = \frac{6 \cdot 5200\,\text{N*mm}}{15\,\text{MPa} \cdot 112\,\text{mm} \cdot 1.2\,\text{mm}^2}$$

12) Point Load Acting at Center of Spring given Maximum Bending Stress Developed in Plates Formula

Evaluate Formula

Formula

$$w = \frac{2 \cdot n \cdot B \cdot t_p^2 \cdot \sigma}{3 \cdot l}$$

Example with Units

$$2.1504\,\text{kN} = \frac{2 \cdot 8 \cdot 112\,\text{mm} \cdot 1.2\,\text{mm}^2 \cdot 15\,\text{MPa}}{3 \cdot 6\,\text{mm}}$$

13) Point Load at Center of Spring Load given Bending Moment at Center of Leaf Spring Formula

Evaluate Formula

Formula

$$w = \frac{4 \cdot M_b}{l}$$

Example with Units

$$3.4667\,\text{kN} = \frac{4 \cdot 5200\,\text{N*mm}}{6\,\text{mm}}$$

14) Radius of Plate to which they are Bent Formula

Evaluate Formula

Formula

$$R = \frac{E \cdot t_p}{2 \cdot \sigma}$$

Example with Units

$$0.4\,\text{mm} = \frac{10\,\text{MPa} \cdot 1.2\,\text{mm}}{2 \cdot 15\,\text{MPa}}$$

15) Radius of Plate to which they are Bent given Central Deflection of Leaf Spring Formula

Evaluate Formula

Formula

$$R = \frac{l^2}{8 \cdot \delta}$$

Example with Units

$$1.125\,\text{mm} = \frac{6\,\text{mm}^2}{8 \cdot 4\,\text{mm}}$$

16) Total Resisting Moment by n Plates Formula

Evaluate Formula

Formula

$$M_t = \frac{n \cdot \sigma \cdot B \cdot t_p^2}{6}$$

Example with Units

$$3.2256\,\text{N*m} = \frac{8 \cdot 15\,\text{MPa} \cdot 112\,\text{mm} \cdot 1.2\,\text{mm}^2}{6}$$

17) Total Resisting Moment by n Plates given Bending Moment on each Plate Formula

Evaluate Formula

Formula

$$M_t = n \cdot M_b$$

Example with Units

$$41.6\,\text{N*m} = 8 \cdot 5200\,\text{N*mm}$$

18) Bending Moment Formulas

18.1) Bending Moment at Center given Point Load Acting at Center of Spring Load Formula

Evaluate Formula

Formula

$$M_b = \frac{w \cdot l}{4}$$

Example with Units

$$376500\,\text{N*mm} = \frac{251\,\text{kN} \cdot 6\,\text{mm}}{4}$$

18.2) Bending Moment at Center of Leaf Spring Formula

Evaluate Formula

Formula

$$M_b = \frac{L \cdot l}{2}$$

Example with Units

$$19200\,\text{N*mm} = \frac{6.4\,\text{kN} \cdot 6\,\text{mm}}{2}$$

18.3) Bending Moment on each Plate given Total Resisting Moment by n Plates Formula

Evaluate Formula

Formula

$$M_b = \frac{M_t}{n}$$

Example with Units

$$9750\,\text{N*mm} = \frac{78\,\text{N*m}}{8}$$

18.4) Bending Moment on Single Plate Formula

Evaluate Formula

Formula

$$M_b = \frac{\sigma \cdot B \cdot t_p^2}{6}$$

Example with Units

$$403.2\,\text{N*mm} = \frac{15\,\text{MPa} \cdot 112\,\text{mm} \cdot 1.2\,\text{mm}^2}{6}$$

18.5) Maximum Bending Moment Developed in Plate given Bending Moment on Single Plate Formula

Evaluate Formula

Formula

$$\sigma = \frac{6 \cdot M_b}{B \cdot t_p^2}$$

Example with Units

$$193.4524\,\text{MPa} = \frac{6 \cdot 5200\,\text{N*mm}}{112\,\text{mm} \cdot 1.2\,\text{mm}^2}$$

18.6) Maximum Bending Moment Developed in Plate given Total Resisting Moment by n Plates Formula

Evaluate Formula

Formula

$$\sigma = \frac{6 \cdot M_b}{B \cdot n \cdot t_p^2}$$

Example with Units

$$24.1815\,\text{MPa} = \frac{6 \cdot 5200\,\text{N*mm}}{112\,\text{mm} \cdot 8 \cdot 1.2\,\text{mm}^2}$$

19) Span of Spring Formulas

19.1) Span of Leaf Spring given Central Deflection of Leaf Spring Formula

Evaluate Formula

Formula

$$l = \sqrt{\frac{\delta \cdot 4 \cdot E \cdot t_p}{\sigma}}$$

Example with Units

$$3.5777\,\text{mm} = \sqrt{\frac{4\,\text{mm} \cdot 4 \cdot 10\,\text{MPa} \cdot 1.2\,\text{mm}}{15\,\text{MPa}}}$$

19.2) Span of Spring given Bending Moment at Center of Leaf Spring Formula

Evaluate Formula

Formula

$$l = \frac{2 \cdot M_b}{L}$$

Example with Units

$$1.625\,\text{mm} = \frac{2 \cdot 5200\,\text{N*mm}}{6.4\,\text{kN}}$$

19.3) Span of Spring given Bending Moment at Center of Leaf Spring and Point Load at Center Formula

Evaluate Formula

Formula

$$l = \frac{4 \cdot M_b}{w}$$

Example with Units

$$0.0829\,\text{mm} = \frac{4 \cdot 5200\,\text{N*mm}}{251\,\text{kN}}$$

19.4) Span of Spring given Central Deflection of Leaf Spring Formula

Evaluate Formula

Formula

$$l = \sqrt{8 \cdot R \cdot \delta}$$

Example with Units

$$14.9666\,\text{mm} = \sqrt{8 \cdot 7\,\text{mm} \cdot 4\,\text{mm}}$$

19.5) Span of Spring given Maximum Bending Stress Formula

Evaluate Formula

Formula

$$l = \sqrt{\frac{4 \cdot E \cdot t_p \cdot \delta}{\sigma}}$$

Example with Units

$$3.5777\,\text{mm} = \sqrt{\frac{4 \cdot 10\,\text{MPa} \cdot 1.2\,\text{mm} \cdot 4\,\text{mm}}{15\,\text{MPa}}}$$

19.6) Span of Spring given Maximum Bending Stress Developed in Plates Formula

Evaluate Formula

Formula

$$l = \frac{2 \cdot n \cdot B \cdot t_p^{\,2} \cdot \sigma}{3 \cdot w}$$

Example with Units

$$0.0514\,\text{mm} = \frac{2 \cdot 8 \cdot 112\,\text{mm} \cdot 1.2\,\text{mm}^{\,2} \cdot 15\,\text{MPa}}{3 \cdot 251\,\text{kN}}$$

20) Thickness of Plate Formulas

20.1) Thickness of each Plate given Bending Moment on Single Plate Formula

Evaluate Formula

Formula

$$t_p = \sqrt{\frac{6 \cdot M_b}{\sigma \cdot B}}$$

Example with Units

$$4.3095\,\text{mm} = \sqrt{\frac{6 \cdot 5200\,\text{N*mm}}{15\,\text{MPa} \cdot 112\,\text{mm}}}$$

20.2) Thickness of each Plate given Moment of Inertia of each Plate Formula

Evaluate Formula

Formula

$$t_p = \left(\frac{12 \cdot I}{B}\right)^{\frac{1}{3}}$$

Example with Units

$$8.1217\,\text{mm} = \left(\frac{12 \cdot 5\,\text{g*mm}^2}{112\,\text{mm}}\right)^{\frac{1}{3}}$$

20.3) Thickness of each Plate given Total Resisting Moment by n Plates Formula

Evaluate Formula

Formula

$$t_p = \sqrt{\frac{6 \cdot M_b}{\sigma \cdot n \cdot B}}$$

Example with Units

$$1.5236\,\text{mm} = \sqrt{\frac{6 \cdot 5200\,\text{N*mm}}{15\,\text{MPa} \cdot 8 \cdot 112\,\text{mm}}}$$

20.4) Thickness of Plate given Central Deflection of Leaf Spring Formula

Evaluate Formula

Formula

$$t_p = \frac{\sigma \cdot l^2}{4 \cdot E \cdot \delta}$$

Example with Units

$$3.375\,\text{mm} = \frac{15\,\text{MPa} \cdot 6\,\text{mm}^{\,2}}{4 \cdot 10\,\text{MPa} \cdot 4\,\text{mm}}$$

20.5) Thickness of Plate given Maximum Bending Stress Developed in Plate Formula

Evaluate Formula

Formula

$$t_p = \sqrt{\frac{3 \cdot w \cdot l}{2 \cdot n \cdot B \cdot \sigma}}$$

Example with Units

$$12.9646\,\text{mm} = \sqrt{\frac{3 \cdot 251\,\text{kN} \cdot 6\,\text{mm}}{2 \cdot 8 \cdot 112\,\text{mm} \cdot 15\,\text{MPa}}}$$

20.6) Thickness of Plate given Radius of Plate to which they are Bent Formula

Evaluate Formula

Formula

$$t_p = \frac{2 \cdot \sigma \cdot R}{E}$$

Example with Units

$$21\,\text{mm} = \frac{2 \cdot 15\,\text{MPa} \cdot 7\,\text{mm}}{10\,\text{MPa}}$$

21) Width of Plate Formulas

21.1) Width of each Plate given Bending Moment on Single Plate Formula

Evaluate Formula

Formula

$$B = \frac{6 \cdot M_b}{\sigma \cdot t_p^{\,2}}$$

Example with Units

$$1444.4444\,\text{mm} = \frac{6 \cdot 5200\,\text{N*mm}}{15\,\text{MPa} \cdot 1.2\,\text{mm}^{\,2}}$$

21.2) Width of each Plate given Moment of Inertia of each Plate Formula

Evaluate Formula

Formula

$$B = \frac{12 \cdot I}{t_p^{\,3}}$$

Example with Units

$$34722.2222\,\text{mm} = \frac{12 \cdot 5\,\text{g*mm}^2}{1.2\,\text{mm}^{\,3}}$$

21.3) Width of each Plate given Total Resisting Moment by n Plates Formula

Evaluate Formula

Formula

$$B = \frac{6 \cdot M_b}{\sigma \cdot n \cdot t_p^{\,2}}$$

Example with Units

$$180.5556\,\text{mm} = \frac{6 \cdot 5200\,\text{N*mm}}{15\,\text{MPa} \cdot 8 \cdot 1.2\,\text{mm}^{\,2}}$$

21.4) Width of Plates given Maximum Bending Stress Developed in Plates Formula

Evaluate Formula

Formula

$$B = \frac{3 \cdot w \cdot l}{2 \cdot n \cdot \sigma \cdot t_p^{\,2}}$$

Example with Units

$$13072.9167\,\text{mm} = \frac{3 \cdot 251\,\text{kN} \cdot 6\,\text{mm}}{2 \cdot 8 \cdot 15\,\text{MPa} \cdot 1.2\,\text{mm}^{\,2}}$$

Variables used in list of Torsion of Leaf Spring Formulas above

- **B** Width of Full Size Bearing Plate *(Millimeter)*
- **E** Modulus of Elasticity Leaf Spring *(Megapascal)*
- **I** Moment of Inertia *(Gram Square Millimeter)*
- **l** Span of Spring *(Millimeter)*
- **L** Load at One End *(Kilonewton)*
- M_b Bending Moment in Spring *(Newton Millimeter)*
- M_t Total Resisting Moments *(Newton Meter)*
- **n** Number of Plates
- **R** Radius of Plate *(Millimeter)*
- t_p Thickness of Plate *(Millimeter)*
- **w** Point Load at Center of Spring *(Kilonewton)*
- **δ** Deflection of Centre of Leaf Spring *(Millimeter)*
- **σ** Maximum Bending Stress in Plates *(Megapascal)*

Constants, Functions, Measurements used in list of Torsion of Leaf Spring Formulas above

- Functions: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Moment of Inertia** in Gram Square Millimeter (g*mm²)
  Moment of Inertia Unit Conversion
- Measurement: **Moment of Force** in Newton Millimeter (N*mm)
  Moment of Force Unit Conversion
- Measurement: **Bending Moment** in Newton Meter (N*m)
  Bending Moment Unit Conversion

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