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Torsion of Leaf Spring Formulas

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List of 39 Torsion of Leaf Spring Formulas

Torsion of Leaf Spring

1) Central Deflection of Leaf Spring

Open Calculator

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

ex $$0.642857\text{mm} = \frac{(6\text{mm})^2}{8 \cdot 7\text{mm}}$$

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

Open Calculator

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

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

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

Open Calculator

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

ex $$1.733333\text{kN} = \frac{2 \cdot 5200\text{N*mm}}{6\text{mm}}$$

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

Open Calculator

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

$$5.333333\text{MPa} = \frac{4 \cdot 10\text{MPa} \cdot 1.2\text{mm} \cdot 4\text{mm}}{(6\text{mm})^2}$$

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

Open Calculator

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

$$0.857143\text{MPa} = \frac{10\text{MPa} \cdot 1.2\text{mm}}{2 \cdot 7\text{mm}}$$

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

Open Calculator

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

$$1750.837\text{MPa} = \frac{3 \cdot 251\text{kN} \cdot 6\text{mm}}{2 \cdot 8 \cdot 112\text{mm} \cdot (1.2\text{mm})^2}$$

7) Modulus of Elasticity given Central Deflection of Leaf Spring

Open Calculator

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

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

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

Open Calculator

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

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

9) Moment of Inertia of each Leaf Spring Plate

Open Calculator

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

ex $$0.016128\text{g*mm}^2 = \frac{112\text{mm} \cdot (1.2\text{mm})^3}{12}$$

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

Open Calculator

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

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

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

Open Calculator

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

ex $$12.89683 = \frac{6 \cdot 5200\text{N*mm}}{15\text{MPa} \cdot 112\text{mm} \cdot (1.2\text{mm})^2}$$

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

Open Calculator

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

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

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

Open Calculator

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

ex $$3.466667\text{kN} = \frac{4 \cdot 5200\text{N*mm}}{6\text{mm}}$$

14) Radius of Plate to which they are Bent

Open Calculator

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

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

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

Open Calculator

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

ex $$1.125\text{mm} = \frac{(6\text{mm})^2}{8 \cdot 4\text{mm}}$$

16) Total Resisting Moment by n Plates

Open Calculator

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

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

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

Open Calculator

fx $$M_t = n \cdot M_b$$

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

Bending Moment

18) Bending Moment at Center given Point Load Acting at Center of Spring Load

Open Calculator

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

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

19) Bending Moment at Center of Leaf Spring

Open Calculator

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

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

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

Open Calculator

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

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

21) Bending Moment on Single Plate

Open Calculator

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

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

22) Maximum Bending Moment Developed in Plate given Bending Moment on Single Plate

Open Calculator

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

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

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

Open Calculator

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

ex $$24.18155\text{MPa} = \frac{6 \cdot 5200\text{N*mm}}{112\text{mm} \cdot 8 \cdot (1.2\text{mm})^2}$$

Span of Spring

24) Span of Leaf Spring given Central Deflection of Leaf Spring

Open Calculator

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

ex $$3.577709\text{mm} = \sqrt{\frac{4\text{mm} \cdot 4 \cdot 10\text{MPa} \cdot 1.2\text{mm}}{15\text{MPa}}}$$

25) Span of Spring given Bending Moment at Center of Leaf Spring

Open Calculator

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

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

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

Open Calculator

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

ex $$0.082869\text{mm} = \frac{4 \cdot 5200\text{N*mm}}{251\text{kN}}$$

27) Span of Spring given Central Deflection of Leaf Spring

Open Calculator

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

ex $$14.96663\text{mm} = \sqrt{8 \cdot 7\text{mm} \cdot 4\text{mm}}$$

28) Span of Spring given Maximum Bending Stress

Open Calculator

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

ex $$3.577709\text{mm} = \sqrt{\frac{4 \cdot 10\text{MPa} \cdot 1.2\text{mm} \cdot 4\text{mm}}{15\text{MPa}}}$$

29) Span of Spring given Maximum Bending Stress Developed in Plates

Open Calculator

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

ex $$0.051404\text{mm} = \frac{2 \cdot 8 \cdot 112\text{mm} \cdot (1.2\text{mm})^2 \cdot 15\text{MPa}}{3 \cdot 251\text{kN}}$$

Thickness of Plate

30) Thickness of each Plate given Bending Moment on Single Plate

Open Calculator

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

ex $$4.309458\text{mm} = \sqrt{\frac{6 \cdot 5200\text{N*mm}}{15\text{MPa} \cdot 112\text{mm}}}$$

31) Thickness of each Plate given Moment of Inertia of each Plate

Open Calculator

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

ex $$8.121653\text{mm} = \left(\frac{12 \cdot 5\text{g*mm}^2}{112\text{mm}}\right)^{\frac{1}{3}}$$

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

Open Calculator

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

ex $$1.523624\text{mm} = \sqrt{\frac{6 \cdot 5200\text{N*mm}}{15\text{MPa} \cdot 8 \cdot 112\text{mm}}}$$

33) Thickness of Plate given Central Deflection of Leaf Spring

Open Calculator

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

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

34) Thickness of Plate given Maximum Bending Stress Developed in Plate

Open Calculator

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

ex $$12.96458\text{mm} = \sqrt{\frac{3 \cdot 251\text{kN} \cdot 6\text{mm}}{2 \cdot 8 \cdot 112\text{mm} \cdot 15\text{MPa}}}$$

35) Thickness of Plate given Radius of Plate to which they are Bent

Open Calculator

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

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

Width of Plate

36) Width of each Plate given Bending Moment on Single Plate

Open Calculator

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

ex $$1444.444\text{mm} = \frac{6 \cdot 5200\text{N*mm}}{15\text{MPa} \cdot (1.2\text{mm})^2}$$

37) Width of each Plate given Moment of Inertia of each Plate

Open Calculator

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

ex $$34722.22\text{mm} = \frac{12 \cdot 5\text{g*mm}^2}{(1.2\text{mm})^3}$$

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

Open Calculator

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

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

39) Width of Plates given Maximum Bending Stress Developed in Plates

Open Calculator

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

ex $$13072.92\text{mm} = \frac{3 \cdot 251\text{kN} \cdot 6\text{mm}}{2 \cdot 8 \cdot 15\text{MPa} \cdot (1.2\text{mm})^2}$$

Variables Used

- **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

- Function: **sqrt**, sqrt(Number)
  Square root function
- 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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- **Coil Spring Formulas**
- **Helical Springs Formulas**
- **Torsion of Leaf Spring Formulas**

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