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Shear Stress in I Section Formulas

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List of 33 Shear Stress in I Section Formulas

Shear Stress in I Section

Shear Stress Distribution in Flange

1) Area of Flange or Area above Considered Section

Open Calculator

fx $$A_{abv} = B \cdot \left(\frac{D}{2} - y \right)$$

ex $$449500\text{mm}^2 = 100\text{mm} \cdot \left(\frac{9000\text{mm}}{2} - 5\text{mm} \right)$$

2) Distance of CG of Considered Area of Flange from Neutral Axis in I Section

Open Calculator

fx $$\bar{y} = \frac{1}{2} \cdot \left(\frac{D}{2} + y \right)$$

ex $$2252.5\text{mm} = \frac{1}{2} \cdot \left(\frac{9000\text{mm}}{2} + 5\text{mm} \right)$$

3) Distance of Considered Section from Neutral Axis given Shear Stress in Flange

Open Calculator

fx $$y = \sqrt{\frac{D^2}{2} - \frac{2 \cdot I}{F_s} \cdot \tau_{beam}}$$

ex $$6024.948\text{mm} = \sqrt{\frac{(9000\text{mm})^2}{2} - \frac{2 \cdot 0.00168\text{m}^4}{4.8\text{kN}} \cdot 6\text{MPa}}$$

4) Distance of Lower Edge of Flange from Neutral Axis

Open Calculator

fx $$y = \frac{d}{2}$$

ex $$225\text{mm} = \frac{450\text{mm}}{2}$$

5) Distance of Upper Edge of Flange from Neutral Axis

Open Calculator

fx $$y = \frac{D}{2}$$

ex $$4500\text{mm} = \frac{9000\text{mm}}{2}$$

6) Inner Depth of I-section given Shear Stress in Lower Edge of Flange

Open Calculator

fx $$d = \sqrt{D^2 - \frac{8 \cdot I}{F_s} \cdot \tau_{beam}}$$

ex $$8012.49\text{mm} = \sqrt{(9000\text{mm})^2 - \frac{8 \cdot 0.00168\text{m}^4}{4.8\text{kN}} \cdot 6\text{MPa}}$$

7) Moment of Inertia of I section given Shear Stress in Lower Edge of Flange

Open Calculator

fx $$I = \frac{F_s}{8 \cdot \tau_{beam}} \cdot \left(D^2 - d^2\right)$$

ex $$0.00808\text{m}^4 = \frac{4.8\text{kN}}{8 \cdot 6\text{MPa}} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)$$

8) Moment of Inertia of Section for I-section

Open Calculator

fx $$I = \frac{F_s}{2 \cdot \tau_{beam}} \cdot \left(\frac{D^2}{2} - y^2\right)$$

ex $$0.0162\text{m}^4 = \frac{4.8\text{kN}}{2 \cdot 6\text{MPa}} \cdot \left(\frac{(9000\text{mm})^2}{2} - (5\text{mm})^2\right)$$

9) Outer Depth of I section given Shear Stress in Lower Edge of Flange

Open Calculator

fx $$D = \sqrt{\frac{8 \cdot I}{F_s} \cdot \tau_{beam} + d^2}$$

ex $$4123.409\text{mm} = \sqrt{\frac{8 \cdot 0.00168\text{m}^4}{4.8\text{kN}} \cdot 6\text{MPa} + (450\text{mm})^2}$$

10) Outer Depth of I-section given Shear Stress in Flange

Open Calculator

fx $$D = 4 \cdot \sqrt{\frac{2 \cdot I}{F_s} \cdot \tau_{beam} + y^2}$$

ex $$8197.585\text{mm} = 4 \cdot \sqrt{\frac{2 \cdot 0.00168\text{m}^4}{4.8\text{kN}} \cdot 6\text{MPa} + (5\text{mm})^2}$$

11) Shear Force in Flange of I-section

Open Calculator

fx $$F_s = \frac{2 \cdot I \cdot \tau_{beam}}{\frac{D^2}{2} - y^2}$$

ex $$0.497778\text{kN} = \frac{2 \cdot 0.00168\text{m}^4 \cdot 6\text{MPa}}{\frac{(9000\text{mm})^2}{2} - (5\text{mm})^2}$$

12) Shear Force in Lower Edge of Flange in I-section

Open Calculator

fx $$F_s = \frac{8 \cdot I \cdot \tau_{beam}}{D^2 - d^2}$$

ex $$0.998051\text{kN} = \frac{8 \cdot 0.00168\text{m}^4 \cdot 6\text{MPa}}{(9000\text{mm})^2 - (450\text{mm})^2}$$

13) Shear Stress in Flange of I-section

Open Calculator

fx $$\tau_{beam} = \frac{F_s}{2 \cdot I} \cdot \left(\frac{D^2}{2} - y^2\right)$$

ex $$57.85711\text{MPa} = \frac{4.8\text{kN}}{2 \cdot 0.00168\text{m}^4} \cdot \left(\frac{(9000\text{mm})^2}{2} - (5\text{mm})^2\right)$$

14) Shear Stress in Lower Edge of Flange of I-section

Open Calculator

fx $$\tau_{beam} = \frac{F_s}{8 \cdot I} \cdot \left(D^2 - d^2\right)$$

ex $$28.85625\text{MPa} = \frac{4.8\text{kN}}{8 \cdot 0.00168\text{m}^4} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)$$

15) Width of Section given Area above Considered Section of Flange

Open Calculator

fx $$B = \frac{A_{abv}}{\frac{D}{2} - y}$$

ex $$1.423804\text{mm} = \frac{6400\text{mm}^2}{\frac{9000\text{mm}}{2} - 5\text{mm}}$$

Shear Stress Distribution in Web

16) Distance of Considered Level from Neutral Axis at Junction of Top of Web

Open Calculator

fx $$y = \frac{d}{2}$$

ex $$225\text{mm} = \frac{450\text{mm}}{2}$$

17) Maximum Shear Force in I Section

Open Calculator

fx $$F_s = \frac{\tau_{max} \cdot I \cdot b}{\frac{B \cdot (D^2 - d^2)}{8} + \frac{b \cdot d^2}{8}}$$

ex $$0.128061\text{kN} = \frac{11\text{MPa} \cdot 0.00168\text{m}^4 \cdot 7\text{mm}}{\frac{100\text{mm} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8} + \frac{7\text{mm} \cdot (450\text{mm})^2}{8}}$$

18) Maximum Shear Stress in I Section

Open Calculator

fx $$\tau_{max} = \frac{F_s}{I \cdot b} \cdot \left(\frac{B \cdot (D^2 - d^2)}{8} + \frac{b \cdot d^2}{8}\right)$$

ex $$412.3045\text{MPa} = \frac{4.8\text{kN}}{0.00168\text{m}^4 \cdot 7\text{mm}} \cdot \left(\frac{100\text{mm} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8} + \frac{7\text{mm} \cdot (450\text{mm})^2}{8}\right)$$

19) Moment of Flange Area about Neutral Axis

Open Calculator

fx $$I = \frac{B \cdot (D^2 - d^2)}{8}$$

ex $$1.009969\text{m}^4 = \frac{100\text{mm} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8}$$

20) Moment of Inertia of I-Section given Maximum Shear Stress and Force

Open Calculator

fx $$I = \frac{F_s}{\tau_{beam} \cdot b} \cdot \left(\frac{B \cdot (D^2 - d^2)}{8} + \frac{b \cdot d^2}{8}\right)$$

ex $$0.115445\text{m}^4 = \frac{4.8\text{kN}}{6\text{MPa} \cdot 7\text{mm}} \cdot \left(\frac{100\text{mm} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8} + \frac{7\text{mm} \cdot (450\text{mm})^2}{8}\right)$$

21) Moment of Inertia of I-Section given Shear Stress of Web

Open Calculator

fx $$I = \frac{F_s}{\tau_{beam} \cdot b} \cdot \left(\frac{B}{8} \cdot \left(D^2 - d^2\right) + \frac{b}{2} \cdot \left(\frac{d^2}{4} - y^2 \right) \right)$$

ex $$0.115445m^4 = \frac{4.8kN}{6MPa \cdot 7mm} \cdot \left(\frac{100mm}{8} \cdot \left((9000mm)^2 - (450mm)^2 \right) + \frac{7mm}{2} \cdot \left(\frac{(450mm)^2}{4} - (5mm)^2 \right) \right)$$

22) Moment of Inertia of Section given Shear Stress at Junction of Top of Web

Open Calculator

fx $$I = \frac{F_s \cdot B \cdot \left(D^2 - d^2\right)}{8 \cdot \tau_{beam} \cdot b}$$

ex $$0.115425m^4 = \frac{4.8kN \cdot 100mm \cdot \left((9000mm)^2 - (450mm)^2 \right)}{8 \cdot 6MPa \cdot 7mm}$$

23) Moment of Shaded Area of Web about Neutral Axis

Open Calculator

fx $$I = \frac{b}{2} \cdot \left(\frac{d^2}{4} - y^2 \right)$$

ex $$0.000177m^4 = \frac{7mm}{2} \cdot \left(\frac{(450mm)^2}{4} - (5mm)^2 \right)$$

24) Shear Force at Junction of Top of Web

Open Calculator

fx $$F_s = \frac{8 \cdot I \cdot b \cdot \tau_{beam}}{B \cdot \left(D^2 - d^2\right)}$$

ex $$0.069864kN = \frac{8 \cdot 0.00168m^4 \cdot 7mm \cdot 6MPa}{100mm \cdot \left((9000mm)^2 - (450mm)^2 \right)}$$

25) Shear Force in Web

Open Calculator

fx $$F_s = \frac{I \cdot b \cdot \tau_{beam}}{\frac{B \cdot \left(D^2 - d^2\right)}{8} + \frac{b}{2} \cdot \left(\frac{d^2}{4} - y^2 \right)}$$

ex $$0.069851kN = \frac{0.00168m^4 \cdot 7mm \cdot 6MPa}{\frac{100mm \cdot \left((9000mm)^2 - (450mm)^2 \right)}{8} + \frac{7mm}{2} \cdot \left(\frac{(450mm)^2}{4} - (5mm)^2 \right)}$$

26) Shear Stress at Junction of Top of Web

Open Calculator

fx $$\tau_{beam} = \frac{F_s \cdot B \cdot \left(D^2 - d^2\right)}{8 \cdot I \cdot b}$$

ex $$412.2321\text{MPa} = \frac{4.8\text{kN} \cdot 100\text{mm} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8 \cdot 0.00168\text{m}^4 \cdot 7\text{mm}}$$

27) Shear Stress in Web

Open Calculator

fx $$\tau_{beam} = \frac{F_s}{I \cdot b} \cdot \left(\frac{B}{8} \cdot \left(D^2 - d^2\right) + \frac{b}{2} \cdot \left(\frac{d^2}{4} - y^2\right)\right)$$

ex $$412.3044\text{MPa} = \frac{4.8\text{kN}}{0.00168\text{m}^4 \cdot 7\text{mm}} \cdot \left(\frac{100\text{mm}}{8} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right) + \frac{7\text{mm}}{2} \cdot \left(\frac{(450\text{mm})^2}{4} - (5\text{mm}\right.\right.$$

28) Thickness of Web

Open Calculator

fx $$b = \frac{2 \cdot I}{\frac{d^2}{4} - y^2}$$

ex $$66.40316\text{mm} = \frac{2 \cdot 0.00168\text{m}^4}{\frac{(450\text{mm})^2}{4} - (5\text{mm})^2}$$

29) Thickness of Web given Maximum Shear Stress and Force

Open Calculator

fx $$b = \frac{B \cdot F_s \cdot \left(D^2 - d^2\right)}{8 \cdot I \cdot \tau_{beam} - F_s \cdot d^2}$$

ex $$486.8052\text{mm} = \frac{100\text{mm} \cdot 4.8\text{kN} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8 \cdot 0.00168\text{m}^4 \cdot 6\text{MPa} - 4.8\text{kN} \cdot (450\text{mm})^2}$$

30) Thickness of Web given Shear Stress at Junction of Top of Web

Open Calculator

fx $$b = \frac{F_s \cdot B \cdot \left(D^2 - d^2\right)}{8 \cdot I \cdot \tau_{beam}}$$

ex $$480.9375\text{mm} = \frac{4.8\text{kN} \cdot 100\text{mm} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8 \cdot 0.00168\text{m}^4 \cdot 6\text{MPa}}$$

31) Thickness of Web given Shear Stress of Web

Open Calculator

fx $$b = \frac{F_s \cdot B \cdot \left(D^2 - d^2\right)}{8 \cdot I \cdot \tau_{beam} - F_s \cdot \left(d^2 - 4 \cdot y^2\right)}$$

ex $$486.8023\text{mm} = \frac{4.8\text{kN} \cdot 100\text{mm} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}{8 \cdot 0.00168\text{m}^4 \cdot 6\text{MPa} - 4.8\text{kN} \cdot \left((450\text{mm})^2 - 4 \cdot (5\text{mm})^2\right)}$$

32) Width of Section given Moment of Flange Area about Neutral Axis

Open Calculator

fx $$B = \frac{8 \cdot I}{D^2 - d^2}$$

ex $$0.166342\text{mm} = \frac{8 \cdot 0.00168\text{m}^4}{(9000\text{mm})^2 - (450\text{mm})^2}$$

33) Width of Section given Shear Stress at Junction of Top of Web

Open Calculator

fx $$B = \frac{\tau_{beam} \cdot 8 \cdot I \cdot b}{F_s \cdot \left(D^2 - d^2\right)}$$

ex $$1.455491\text{mm} = \frac{6\text{MPa} \cdot 8 \cdot 0.00168\text{m}^4 \cdot 7\text{mm}}{4.8\text{kN} \cdot \left((9000\text{mm})^2 - (450\text{mm})^2\right)}$$

Variables Used

- A_{abv} Area of Section above Considered Level *(Square Millimeter)*
- **b** Thickness of Beam Web *(Millimeter)*
- **B** Width of Beam Section *(Millimeter)*
- **d** Inner Depth of I Section *(Millimeter)*
- **D** Outer Depth of I section *(Millimeter)*
- F_s Shear Force on Beam *(Kilonewton)*
- **I** Moment of Inertia of Area of Section *(Meter^4)*
- **y** Distance from Neutral Axis *(Millimeter)*
- $\bar{y}$ Distance of CG of Area from NA *(Millimeter)*
- τ_{beam} Shear Stress in Beam *(Megapascal)*
- τ_{max} Maximum Shear Stress on Beam *(Megapascal)*

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Area** in Square Millimeter (mm^2)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Second Moment of Area** in $Meter^4$ (m^4)
  Second Moment of Area Unit Conversion

Check other formula lists

- **Shear Stress in Circular Section Formulas**
- **Shear Stress in Rectangular Section Formulas**
- **Shear Stress in I Section Formulas**

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