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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 🗗

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

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

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

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

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

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

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

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

4) Distance of Lower Edge of Flange from Neutral Axis 🗗

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

ex $225mm = \dfrac{450mm}{2}$

5) Distance of Upper Edge of Flange from Neutral Axis 🗗

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

ex $4500mm = \dfrac{9000mm}{2}$

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

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

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 ⎘

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

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 ⎘

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

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 ⎘

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

ex $$4123.409\text{mm} = \sqrt{\frac{8 \cdot 0.00168\text{m}^4}{4.8\text{kN}} \cdot 6\text{MPa} + (450\text{mm})^2}$$
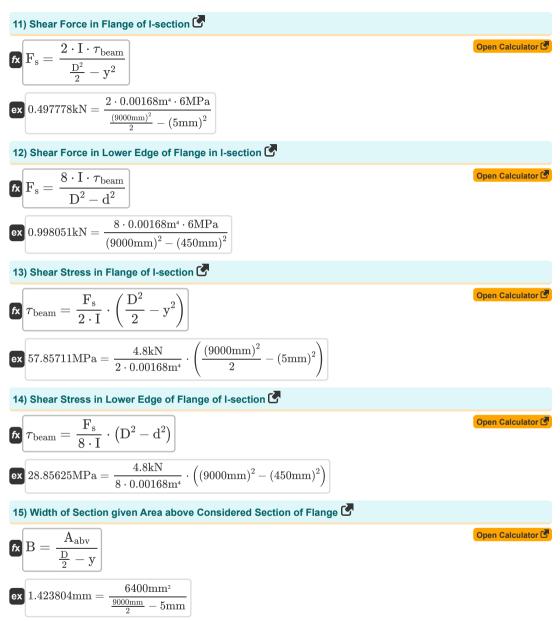
10) Outer Depth of I-section given Shear Stress in Flange ⎘

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

ex $$8197.585\text{mm} = 4 \cdot \sqrt{\frac{2 \cdot 0.00168\text{m}^4}{4.8\text{kN}} \cdot 6\text{MPa} + (5\text{mm})^2}$$
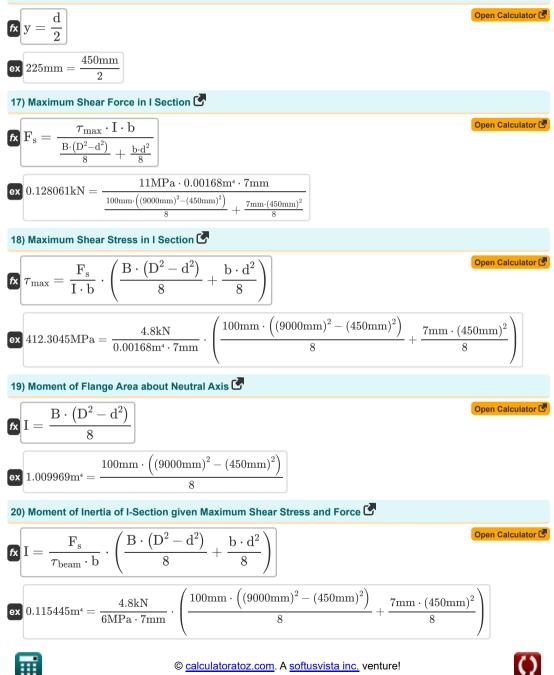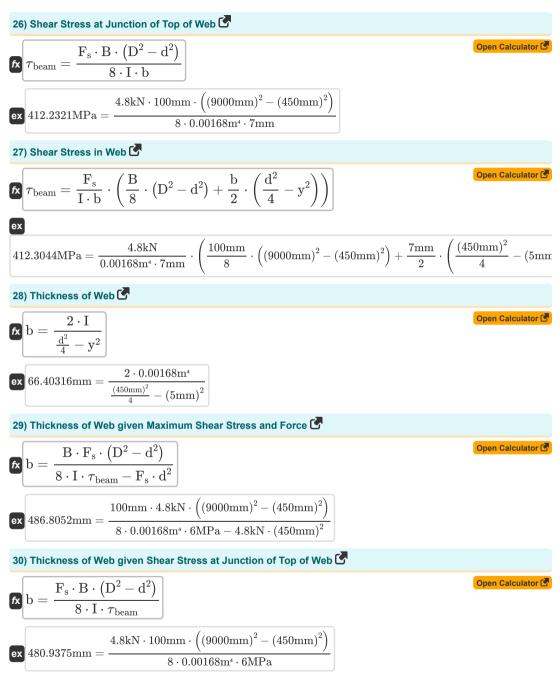
11) Shear Force in Flange of I-section ⎘

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

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

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

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

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

13) Shear Stress in Flange of I-section ⎘

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

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

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

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

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

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

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

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

Shear Stress Distribution in Web 🔗

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

Open Calculator 🔗

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

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

17) Maximum Shear Force in I Section 🔗

Open Calculator 🔗

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

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

18) Maximum Shear Stress in I Section 🔗

Open Calculator 🔗

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

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

19) Moment of Flange Area about Neutral Axis 🔗

Open Calculator 🔗

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

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

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

Open Calculator 🔗

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

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

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

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

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

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

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

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

23) Moment of Shaded Area of Web about Neutral Axis ⎘

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

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

24) Shear Force at Junction of Top of Web ⎘

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

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

25) Shear Force in Web ⎘

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

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

26) Shear Stress at Junction of Top of Web 🔗

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

Open Calculator 🔗

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

27) Shear Stress in Web 🔗

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

Open Calculator 🔗

ex

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

28) Thickness of Web 🔗

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

Open Calculator 🔗

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

29) Thickness of Web given Maximum Shear Stress and Force 🔗

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

Open Calculator 🔗

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

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

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

Open Calculator 🔗

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

31) Thickness of Web given Shear Stress of Web ⤢

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

Open Calculator ⤢

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 ⤢

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

Open Calculator ⤢

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 ⤢

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

Open Calculator ⤢

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 *(Meter⁴)*
- 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)
  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: **Area** in Square Millimeter (mm²)
  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 Meter⁴ (m⁴)
  Second Moment of Area Unit Conversion ⎘

Check other formula lists

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

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