Important Shear Stress in I Section Formulas PDF

Formulas
Examples
with Units

List of 33
Important Shear Stress in I Section Formulas

1) Shear Stress Distribution in Flange Formulas

1.1) Area of Flange or Area above Considered Section Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

$$6024.9481\,\text{mm} = \sqrt{\frac{9000\,\text{mm}^2}{2} - \frac{2 \cdot 0.00168\,\text{m}^4}{4.8\,\text{kN}} \cdot 6\,\text{MPa}}$$

1.4) Distance of Lower Edge of Flange from Neutral Axis Formula

Evaluate Formula

Formula

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

Example with Units

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

1.5) Distance of Upper Edge of Flange from Neutral Axis Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

$$8012.4902\,\text{mm} = \sqrt{9000\,\text{mm}^2 - \frac{8 \cdot 0.00168\,\text{m}^4}{4.8\,\text{kN}} \cdot 6\,\text{MPa}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$0.0081\,\text{m}^4 = \frac{4.8\,\text{kN}}{8 \cdot 6\,\text{MPa}} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)$$

1.8) Moment of Inertia of Section for I-section Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

$$4123.4088\,\text{mm} = \sqrt{\frac{8 \cdot 0.00168\,\text{m}^4}{4.8\,\text{kN}} \cdot 6\,\text{MPa} + 450\,\text{mm}^2}$$

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

Evaluate Formula

Formula

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

Example with Units

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

1.11) Shear Force in Flange of I-section Formula

Evaluate Formula

Formula

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

Example with Units

$$0.4978\,\text{kN} = \frac{2 \cdot 0.00168\,\text{m}^4 \cdot 6\,\text{MPa}}{\frac{9000\,\text{mm}^2}{2} - 5\,\text{mm}^2}$$

1.12) Shear Force in Lower Edge of Flange in I-section Formula

Evaluate Formula

Formula

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

Example with Units

$$0.9981\,\text{kN} = \frac{8 \cdot 0.00168\,\text{m}^4 \cdot 6\,\text{MPa}}{9000\,\text{mm}^2 - 450\,\text{mm}^2}$$

1.13) Shear Stress in Flange of I-section Formula

Evaluate Formula

Formula

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

Example with Units

$$57.8571\,\text{MPa} = \frac{4.8\,\text{kN}}{2 \cdot 0.00168\,\text{m}^4} \cdot \left(\frac{9000\,\text{mm}^2}{2} - 5\,\text{mm}^2 \right)$$

1.14) Shear Stress in Lower Edge of Flange of I-section Formula

Evaluate Formula

Formula

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

Example with Units

$$28.8562\,\text{MPa} = \frac{4.8\,\text{kN}}{8 \cdot 0.00168\,\text{m}^4} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)$$

1.15) Width of Section given Area above Considered Section of Flange Formula

Evaluate Formula

Formula

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

Example with Units

$$1.4238\,\text{mm} = \frac{6400\,\text{mm}^2}{\frac{9000\,\text{mm}}{2} - 5\,\text{mm}}$$

2) Shear Stress Distribution in Web Formulas

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

Evaluate Formula

Formula

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

Example with Units

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

2.2) Maximum Shear Force in I Section Formula

Evaluate Formula

Formula

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

Example with Units

$$0.1281\,\text{kN} = \frac{11\,\text{MPa} \cdot 0.00168\,\text{m}^4 \cdot 7\,\text{mm}}{\frac{100\,\text{mm} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)}{8} + \frac{7\,\text{mm} \cdot 450\,\text{mm}^2}{8}}$$

2.3) Maximum Shear Stress in I Section Formula

Evaluate Formula

Formula

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

Example with Units

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

2.4) Moment of Flange Area about Neutral Axis Formula

Evaluate Formula

Formula

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

Example with Units

$$1.01\,\text{m}^4 = \frac{100\,\text{mm} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)}{8}$$

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

Evaluate Formula

Formula

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

Example with Units

$$0.1154\,\text{m}^4 = \frac{4.8\,\text{kN}}{6\,\text{MPa} \cdot 7\,\text{mm}} \cdot \left(\frac{100\,\text{mm} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)}{8} + \frac{7\,\text{mm} \cdot 450\,\text{mm}^2}{8} \right)$$

2.6) Moment of Inertia of I-Section given Shear Stress of Web Formula

Evaluate Formula

Formula

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

Example with Units

$$0.1154\,\text{m}^4 = \frac{4.8\,\text{kN}}{6\,\text{MPa} \cdot 7\,\text{mm}} \cdot \left(\frac{100\,\text{mm}}{8} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right) + \frac{7\,\text{mm}}{2} \cdot \left(\frac{450\,\text{mm}^2}{4} - 5\,\text{mm}^2 \right) \right)$$

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

Evaluate Formula

Formula

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

Example with Units

$$0.1154\,\text{m}^4 = \frac{4.8\,\text{kN} \cdot 100\,\text{mm} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)}{8 \cdot 6\,\text{MPa} \cdot 7\,\text{mm}}$$

2.8) Moment of Shaded Area of Web about Neutral Axis Formula

Evaluate Formula

Formula

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

Example with Units

$$0.0002\,\text{m}^4 = \frac{7\,\text{mm}}{2} \cdot \left(\frac{450\,\text{mm}^2}{4} - 5\,\text{mm}^2 \right)$$

2.9) Shear Force at Junction of Top of Web Formula

Evaluate Formula

Formula

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

Example with Units

$$0.0699\,\text{kN} = \frac{8 \cdot 0.00168\,\text{m}^4 \cdot 7\,\text{mm} \cdot 6\,\text{MPa}}{100\,\text{mm} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)}$$

2.10) Shear Force in Web Formula

Evaluate Formula

Formula

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

Example with Units

$$0.0699\,\text{kN} = \frac{0.00168\,\text{m}^4 \cdot 7\,\text{mm} \cdot 6\,\text{MPa}}{\frac{100\,\text{mm} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)}{8} + \frac{7\,\text{mm}}{2} \cdot \left(\frac{450\,\text{mm}^2}{4} - 5\,\text{mm}^2 \right)}$$

2.11) Shear Stress at Junction of Top of Web Formula

Evaluate Formula

Formula

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

Example with Units

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

2.12) Shear Stress in Web Formula

Evaluate Formula

Formula

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

Example with Units

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

2.13) Thickness of Web Formula

Evaluate Formula

Formula

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

Example with Units

$$66.4032\,\text{mm} = \frac{2 \cdot 0.00168\,\text{m}^4}{\frac{450\,\text{mm}^2}{4} - 5\,\text{mm}^2}$$

2.14) Thickness of Web given Maximum Shear Stress and Force Formula

Evaluate Formula

Formula

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

Example with Units

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

2.15) Thickness of Web given Shear Stress at Junction of Top of Web Formula

Evaluate Formula

Formula

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

Example with Units

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

2.16) Thickness of Web given Shear Stress of Web Formula

Evaluate Formula

Formula

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

Example with Units

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

2.17) Width of Section given Moment of Flange Area about Neutral Axis Formula

Evaluate Formula

Formula

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

Example with Units

$$0.1663\,\text{mm} = \frac{8 \cdot 0.00168\,\text{m}^4}{9000\,\text{mm}^2 - 450\,\text{mm}^2}$$

2.18) Width of Section given Shear Stress at Junction of Top of Web Formula

Evaluate Formula

Formula

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

Example with Units

$$1.4555\,\text{mm} = \frac{6\,\text{MPa} \cdot 8 \cdot 0.00168\,\text{m}^4 \cdot 7\,\text{mm}}{4.8\,\text{kN} \cdot \left(9000\,\text{mm}^2 - 450\,\text{mm}^2 \right)}$$

Variables used in list of Shear Stress in I Section Formulas above

- 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 in list of Shear Stress in I Section 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: **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

Download other Important Shear Stress Distribution for Different Sections PDFs

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

Try our Unique Visual Calculators

- Winning percentage
- LCM of two numbers
- Mixed fraction

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

English Spanish French German Russian Italian Portuguese Polish Dutch

7/8/2024 | 7:49:22 AM UTC