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Shear Stress Formulas

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List of 42 Shear Stress Formulas

Shear Stress

Horizontal Shear Flow

1) Area given Horizontal Shear Flow

$$fx \quad A = \frac{I \cdot \tau}{V \cdot y}$$

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$ex \quad 3.193548m^2 = \frac{36000000mm^4 \cdot 55MPa}{24.8kN \cdot 25mm}$$

2) Distance from Centroid given Horizontal Shear Flow

$$fx \quad y = \frac{I \cdot \tau}{V \cdot A}$$

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$ex \quad 24.9496mm = \frac{36000000mm^4 \cdot 55MPa}{24.8kN \cdot 3.2m^2}$$

3) Horizontal Shear Flow

$$fx \quad \tau = \frac{V \cdot A \cdot y}{I}$$

[Open Calculator !\[\]\(f1c5da15572e3e09d343161be98f508d_img.jpg\)](#)

$$ex \quad 55.11111MPa = \frac{24.8kN \cdot 3.2m^2 \cdot 25mm}{36000000mm^4}$$

4) Moment of Inertia given Horizontal Shear Flow

$$fx \quad I = \frac{V \cdot A \cdot y}{\tau}$$

[Open Calculator !\[\]\(166772600a13ad0a433053f90fe45649_img.jpg\)](#)

$$ex \quad 3.6E^7mm^4 = \frac{24.8kN \cdot 3.2m^2 \cdot 25mm}{55MPa}$$





5) Shear given Horizontal Shear Flow 

$$fx \quad V = \frac{I \cdot \tau}{y \cdot A}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 24.75kN = \frac{36000000mm^4 \cdot 55MPa}{25mm \cdot 3.2m^2}$$

Longitudinal Shear Stress 6) Area given Longitudinal Shear Stress 

$$fx \quad A = \frac{\tau \cdot I \cdot b}{V \cdot y}$$

[Open Calculator !\[\]\(5361750c22c4e047a52f4eac1ec2d4cc_img.jpg\)](#)

$$ex \quad 0.958065m^2 = \frac{55MPa \cdot 36000000mm^4 \cdot 300mm}{24.8kN \cdot 25mm}$$

7) Breadth for given Longitudinal Shear Stress 

$$fx \quad b = \frac{V \cdot A \cdot y}{I \cdot \tau}$$

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

$$ex \quad 1002.02mm = \frac{24.8kN \cdot 3.2m^2 \cdot 25mm}{36000000mm^4 \cdot 55MPa}$$

8) Maximum Distance from Neutral Axis to Extreme Fiber given Longitudinal Shear Stress 

$$fx \quad y = \frac{\tau \cdot I \cdot b}{V \cdot A}$$

[Open Calculator !\[\]\(84f47badaad7772cd95667a7c387a639_img.jpg\)](#)

$$ex \quad 7.484879mm = \frac{55MPa \cdot 36000000mm^4 \cdot 300mm}{24.8kN \cdot 3.2m^2}$$



9) Moment of Inertia given Longitudinal Shear Stress 

$$fx \quad I = \frac{V \cdot A \cdot y}{\tau \cdot b}$$

[Open Calculator !\[\]\(c15650232aa6660c9deb34f3b82dcb72_img.jpg\)](#)


$$ex \quad 0.00012mm^4 = \frac{24.8kN \cdot 3.2m^2 \cdot 25mm}{55MPa \cdot 300mm}$$



I-Beam 10) Breadth of Flange Given Longitudinal Shear Stress in Web for I beam [Open Calculator](#) 

$$fx \quad b_f = \frac{8 \cdot I \cdot \tau \cdot b_w}{V \cdot (D^2 - d_w^2)}$$

$$ex \quad 39.93339mm = \frac{8 \cdot 36000000mm^4 \cdot 55MPa \cdot .040m}{24.8kN \cdot ((800mm)^2 - (15mm)^2)}$$

11) Breadth of Web given Longitudinal Shear Stress in Web for I beam [Open Calculator](#) 

$$fx \quad b_w = \left(\frac{b_f \cdot V}{8 \cdot \tau \cdot I} \right) \cdot (D^2 - d_w^2)$$

$$ex \quad 0.250417m = \left(\frac{250mm \cdot 24.8kN}{8 \cdot 55MPa \cdot 36000000mm^4} \right) \cdot ((800mm)^2 - (15mm)^2)$$

12) Longitudinal Shear Stress in Flange at Lower Depth of I beam [Open Calculator](#) 


$$fx \quad \tau = \left(\frac{V}{8 \cdot I} \right) \cdot (D^2 - d_w^2)$$

$$ex \quad 55.09174MPa = \left(\frac{24.8kN}{8 \cdot 36000000mm^4} \right) \cdot ((800mm)^2 - (15mm)^2)$$

13) Longitudinal Shear Stress in Web for I beam [Open Calculator](#) 

$$fx \quad \tau = \left(\frac{b_f \cdot V}{8 \cdot b_w \cdot I} \right) \cdot (D^2 - d_w^2)$$


$$ex \quad 344.3234MPa = \left(\frac{250mm \cdot 24.8kN}{8 \cdot .040m \cdot 36000000mm^4} \right) \cdot ((800mm)^2 - (15mm)^2)$$

14) Maximum Longitudinal Shear Stress in Web for I beam [Open Calculator](#) 

$$fx \quad \tau_{maxlongitudinal} = \left(\left(\frac{b_f \cdot V}{8 \cdot b_w \cdot I} \cdot (D^2 - d_w^2) \right) \right) + \left(\frac{V \cdot d_w^2}{8 \cdot I} \right)$$

$$ex \quad 344.3427MPa = \left(\left(\frac{250mm \cdot 24.8kN}{8 \cdot .040m \cdot 36000000mm^4} \cdot ((800mm)^2 - (15mm)^2) \right) \right) + \left(\frac{24.8kN \cdot (15mm)^2}{8 \cdot 36000000mm^4} \right)$$




15) Moment of Inertia given Longitudinal Shear Stress at lower edge in Flange of I beam 

$$fx \quad I = \left(\frac{V}{8 \cdot \tau} \right) \cdot (D^2 - d_w^2)$$

Open Calculator 


$$ex \quad 3.6E^7 mm^4 = \left(\frac{24.8kN}{8 \cdot 55MPa} \right) \cdot ((800mm)^2 - (15mm)^2)$$

16) Moment of Inertia given Longitudinal Shear Stress in Web for I beam 

$$fx \quad I = \left(\frac{b_f \cdot V}{8 \cdot \tau \cdot b_w} \right) \cdot (D^2 - d_w^2)$$

Open Calculator 

$$ex \quad 2.3E^8 mm^4 = \left(\frac{250mm \cdot 24.8kN}{8 \cdot 55MPa \cdot .040m} \right) \cdot ((800mm)^2 - (15mm)^2)$$

17) Moment of Inertia given Maximum Longitudinal Shear Stress in Web for I beam 

$$fx \quad I = \frac{\left(\frac{b_f \cdot V}{8 \cdot b_w} \right) \cdot (D^2 - d_w^2)}{\tau_{max}} + \frac{V \cdot d_w^2}{8 \tau_{max}}$$

Open Calculator 


$$ex \quad 3E^8 mm^4 = \frac{\left(\frac{250mm \cdot 24.8kN}{8 \cdot .040m} \right) \cdot ((800mm)^2 - (15mm)^2)}{42MPa} + \frac{24.8kN \cdot (15mm)^2}{8 \cdot 42MPa}$$

18) Polar Moment of Inertia given Torsional Shear Stress 

$$fx \quad J = \frac{T \cdot R}{\tau_{max}}$$

Open Calculator 

$$ex \quad 2.22619mm^4 = \frac{0.85kN \cdot m \cdot 110mm}{42MPa}$$


19) Transverse Shear for Longitudinal Shear Stress in Web for I Beam 

$$fx \quad V = \frac{8 \cdot I \cdot \tau \cdot b_w}{b_f \cdot (D^2 - d_w^2)}$$

Open Calculator 

$$ex \quad 3.961393kN = \frac{8 \cdot 36000000mm^4 \cdot 55MPa \cdot .040m}{250mm \cdot ((800mm)^2 - (15mm)^2)}$$




20) Transverse Shear force given Maximum Longitudinal Shear Stress in Web for I beam 


$$fx \quad V = \frac{\tau_{\max\text{longitudinal}} \cdot b_w \cdot 8 \cdot I}{(b_f \cdot (D^2 - d_w^2)) + (b_w \cdot (d_w^2))}$$

Open Calculator 



$$ex \quad 18.00604\text{kN} = \frac{250.01\text{MPa} \cdot .040\text{m} \cdot 8 \cdot 36000000\text{mm}^4}{(250\text{mm} \cdot ((800\text{mm})^2 - (15\text{mm})^2)) + (.040\text{m} \cdot ((15\text{mm})^2))}$$

21) Transverse Shear given Longitudinal Shear Stress in Flange for I beam 

$$fx \quad V = \frac{8 \cdot I \cdot \tau}{D^2 - d_w^2}$$

Open Calculator 


$$ex \quad 24.7587\text{kN} = \frac{8 \cdot 36000000\text{mm}^4 \cdot 55\text{MPa}}{(800\text{mm})^2 - (15\text{mm})^2}$$

Longitudinal Shear Stress for Rectangular Section 22) Average Longitudinal Shear Stress for Rectangular Section 

$$fx \quad q_{\text{avg}} = \frac{V}{b \cdot d}$$

Open Calculator 


$$ex \quad 0.183704\text{MPa} = \frac{24.8\text{kN}}{300\text{mm} \cdot 450\text{mm}}$$

23) Breadth for given Maximum Longitudinal Shear Stress for Rectangular Section 

$$fx \quad b = \frac{3 \cdot V}{2 \cdot \tau_{\max\text{longitudinal}} \cdot d}$$

Open Calculator 

$$ex \quad 0.330653\text{mm} = \frac{3 \cdot 24.8\text{kN}}{2 \cdot 250.01\text{MPa} \cdot 450\text{mm}}$$


24) Breadth given Average Longitudinal Shear Stress for Rectangular Section 

$$fx \quad b = \frac{V}{q_{\text{avg}} \cdot d}$$

Open Calculator 

$$ex \quad 300.006\text{mm} = \frac{24.8\text{kN}}{0.1837\text{MPa} \cdot 450\text{mm}}$$




25) Depth given Average Longitudinal Shear Stress for Rectangular Section 

$$fx \quad d = \frac{V}{q_{avg} \cdot b}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)


$$ex \quad 450.0091\text{mm} = \frac{24.8\text{kN}}{0.1837\text{MPa} \cdot 300\text{mm}}$$

26) Maximum Longitudinal Shear Stress for Rectangular Section 

$$fx \quad \tau_{maxlongitudinal} = \frac{3 \cdot V}{2 \cdot b \cdot d}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)


$$ex \quad 275.5556\text{MPa} = \frac{3 \cdot 24.8\text{kN}}{2 \cdot 300\text{mm} \cdot 450\text{mm}}$$

27) Transverse Shear given Average Longitudinal Shear Stress for Rectangular Section 

$$fx \quad V = q_{avg} \cdot b \cdot d$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)


$$ex \quad 24.7995\text{kN} = 0.1837\text{MPa} \cdot 300\text{mm} \cdot 450\text{mm}$$

28) Transverse Shear given Maximum Longitudinal Shear Stress for Rectangular Section 

$$fx \quad V = \left(\tau_{maxlongitudinal} \cdot b \cdot d \cdot \left(\frac{2}{3} \right) \right)$$

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)

$$ex \quad 0.022501\text{kN} = \left(250.01\text{MPa} \cdot 300\text{mm} \cdot 450\text{mm} \cdot \left(\frac{2}{3} \right) \right)$$


Longitudinal Shear Stress for Solid Circular Section 29) Average Longitudinal Shear Stress for Solid Circular Section 

$$fx \quad q_{avg} = \frac{V}{\pi \cdot r^2}$$

[Open Calculator !\[\]\(dc0c40d45c42e86bc0669168926f812c_img.jpg\)](#)

$$ex \quad 0.18423\text{MPa} = \frac{24.8\text{kN}}{\pi \cdot (207\text{mm})^2}$$




30) Maximum Longitudinal Shear Stress for Solid Circular Section 

$$fx \quad \tau_{\max\text{longitudinal}} = \frac{4 \cdot V}{3 \cdot \pi \cdot r^2}$$

Open Calculator 


$$ex \quad 245.6404\text{MPa} = \frac{4 \cdot 24.8\text{kN}}{3 \cdot \pi \cdot (207\text{mm})^2}$$

31) Radius given Average Longitudinal Shear Stress for Solid Circular Section 

$$fx \quad r = \sqrt{\frac{V}{\pi \cdot q_{\text{avg}}}}$$

Open Calculator 


$$ex \quad 207.2986\text{mm} = \sqrt{\frac{24.8\text{kN}}{\pi \cdot 0.1837\text{MPa}}}$$

32) Radius given Maximum Longitudinal Shear Stress for Solid Circular Section 

$$fx \quad r = \sqrt{\frac{4 \cdot V}{3 \cdot \pi \cdot \tau_{\max\text{longitudinal}}}}$$

Open Calculator 


$$ex \quad 0.006488\text{mm} = \sqrt{\frac{4 \cdot 24.8\text{kN}}{3 \cdot \pi \cdot 250.01\text{MPa}}}$$

33) Transverse Shear given Average Longitudinal Shear Stress for Solid Circular Section 

$$fx \quad V = q_{\text{avg}} \cdot \pi \cdot r^2$$

Open Calculator 

$$ex \quad 24.72861\text{kN} = 0.1837\text{MPa} \cdot \pi \cdot (207\text{mm})^2$$

34) Transverse Shear given Maximum Longitudinal Shear Stress for Solid Circular Section 

$$fx \quad V = \frac{\tau_{\max} \cdot \pi \cdot r^2 \cdot 3}{4}$$

Open Calculator 

$$ex \quad 4240.344\text{kN} = \frac{42\text{MPa} \cdot \pi \cdot (207\text{mm})^2 \cdot 3}{4}$$



Maximum Stress of a Triangular Section

35) Base of Triangular Section given Maximum Shear Stress

$$fx \quad b_{tri} = \frac{3 \cdot V}{\tau_{max} \cdot h_{tri}}$$

[Open Calculator !\[\]\(d66ff64371a51729ac8c1cdaa685ba6f_img.jpg\)](#)

$$ex \quad 31.63265mm = \frac{3 \cdot 24.8kN}{42MPa \cdot 56mm}$$

36) Base of Triangular Section given Shear Stress at Neutral Axis

$$fx \quad b_{tri} = \frac{8 \cdot V}{3 \cdot \tau_{NA} \cdot h_{tri}}$$

[Open Calculator !\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0_img.jpg\)](#)

$$ex \quad 31.42862mm = \frac{8 \cdot 24.8kN}{3 \cdot 37.5757MPa \cdot 56mm}$$

37) Height of Triangular Section given Maximum Shear Stress

$$fx \quad h_{tri} = \frac{3 \cdot V}{b_{tri} \cdot \tau_{max}}$$

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822_img.jpg\)](#)

$$ex \quad 55.35714mm = \frac{3 \cdot 24.8kN}{32mm \cdot 42MPa}$$

38) Height of Triangular Section given Shear Stress at Neutral Axis

$$fx \quad h_{tri} = \frac{8 \cdot V}{3 \cdot b_{tri} \cdot \tau_{NA}}$$

[Open Calculator !\[\]\(56549452e01ca28bdf2500ced9653143_img.jpg\)](#)

$$ex \quad 55.00008mm = \frac{8 \cdot 24.8kN}{3 \cdot 32mm \cdot 37.5757MPa}$$

39) Maximum Shear Stress of Triangular Section

$$fx \quad \tau_{max} = \frac{3 \cdot V}{b_{tri} \cdot h_{tri}}$$

[Open Calculator !\[\]\(bff896c19919791b89ab521f039b410a_img.jpg\)](#)

$$ex \quad 41.51786MPa = \frac{3 \cdot 24.8kN}{32mm \cdot 56mm}$$




40) Shear Stress at Neutral Axis in Triangular Section 

$$fx \quad \tau_{NA} = \frac{8 \cdot V}{3 \cdot b_{tri} \cdot h_{tri}}$$

[Open Calculator !\[\]\(0f848bbd71cef6b345273b16f905912a_img.jpg\)](#)

$$ex \quad 36.90476MPa = \frac{8 \cdot 24.8kN}{3 \cdot 32mm \cdot 56mm}$$

41) Transverse Shear Force of Triangular Section given Maximum Shear Stress 

$$fx \quad V = \frac{h_{tri} \cdot b_{tri} \cdot \tau_{max}}{3}$$

[Open Calculator !\[\]\(3211b5d1d968fc1665909b34f9f16010_img.jpg\)](#)

$$ex \quad 25.088kN = \frac{56mm \cdot 32mm \cdot 42MPa}{3}$$

42) Transverse Shear Force of Triangular Section given Shear Stress at Neutral Axis 

$$fx \quad V = \frac{3 \cdot b_{tri} \cdot h_{tri} \cdot \tau_{NA}}{8}$$

[Open Calculator !\[\]\(9c2e8d1b5bd77cb5c9f83b7a9cff79fd_img.jpg\)](#)

$$ex \quad 25.25087kN = \frac{3 \cdot 32mm \cdot 56mm \cdot 37.5757MPa}{8}$$









Variables Used

- **A** Cross Sectional Area (Square Meter)
- **b** Breadth of Rectangular Section (Millimeter)
- **b_f** Width of Flange (Millimeter)
- **b_{tri}** Base of Triangular Section (Millimeter)
- **b_w** Width of Web (Meter)
- **d** Depth of Rectangular Section (Millimeter)
- **D** Overall Depth of I Beam (Millimeter)
- **d_w** Depth of Web (Millimeter)
- **h_{tri}** Height of Triangular Section (Millimeter)
- **I** Area Moment of Inertia (Millimeter⁴)
- **J** Polar Moment of Inertia (Millimeter⁴)
- **q_{avg}** Average Shear Stress (Megapascal)
- **r** Radius of Circular Section (Millimeter)
- **R** Radius of Shaft (Millimeter)
- **T** Torsional Moment (Kilonewton Meter)
- **V** Shear Force (Kilonewton)
- **y** Distance from Neutral Axis (Millimeter)
- **τ** Shear Stress (Megapascal)
- **τ_{max}** Maximum Shear Stress (Megapascal)
- **τ_{maxlongitudinal}** Maximum Longitudinal Shear Stress (Megapascal)
- **τ_{NA}** Shear Stress at Neutral Axis (Megapascal)













Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Millimeter (mm), Meter (m)
Length Unit Conversion 
- **Measurement:** **Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement:** **Force** in Kilonewton (kN)
Force Unit Conversion 
- **Measurement:** **Torque** in Kilonewton Meter (kN*m)
Torque Unit Conversion 
- **Measurement:** **Second Moment of Area** in Millimeter⁴ (mm⁴)
Second Moment of Area Unit Conversion 
- **Measurement:** **Stress** in Megapascal (MPa)
Stress Unit Conversion 



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