

Important Lug or Bracket Support Formulas PDF



Formulas Examples with Units

List of 14 Important Lug or Bracket Support Formulas

1) Axial Bending Stress in Vessel Wall for Unit Width Formula

Formula

$$f_a = \frac{6 \cdot M \cdot a}{t^2}$$

Example with Units

$$1.2414 \text{ N/mm}^2 = \frac{6 \cdot 600112.8 \text{ N*mm} \cdot 102 \text{ mm}}{17.2 \text{ mm}^2}$$

Evaluate Formula 

2) Bending Stress in Column due to Wind Load Formula

Formula

$$f_w = \frac{\left(\frac{P_w}{N_{\text{Column}}} \right) \cdot \left(\frac{L}{2} \right)}{Z}$$

Example with Units

$$39.4909 \text{ N/mm}^2 = \frac{\left(\frac{3840 \text{ N}}{4} \right) \cdot \left(\frac{1810 \text{ mm}}{2} \right)}{22000 \text{ mm}^3}$$

Evaluate Formula 

3) Maximum Combined Stress on Long Column Formula

Formula

$$f = \left(\left(\frac{P_{\text{Column}}}{N_{\text{Column}} \cdot A_{\text{Column}}} \right) \cdot \left(1 + \left(\frac{1}{7500} \right) \cdot \left(\frac{l_e}{r_g} \right)^2 \right) + \left(\frac{P_{\text{Column}} \cdot e}{N_{\text{Column}} \cdot Z} \right) \right)$$

Example with Units

$$6.8866 \text{ N/mm}^2 = \left(\left(\frac{5580 \text{ N}}{4 \cdot 389 \text{ mm}^2} \right) \cdot \left(1 + \left(\frac{1}{7500} \right) \cdot \left(\frac{57 \text{ mm}}{21.89 \text{ mm}} \right)^2 \right) + \left(\frac{5580 \text{ N} \cdot 52 \text{ mm}}{4 \cdot 22000 \text{ mm}^3} \right) \right)$$

Evaluate Formula 

4) Maximum Combined Stress on Short Column Formula

Formula

$$f = \left(\left(\frac{P_{\text{Column}}}{N_{\text{Column}} \cdot A_{\text{Column}}} \right) + \left(\frac{P_{\text{Column}} \cdot e}{N_{\text{Column}} \cdot Z} \right) \right)$$

Example with Units

$$6.8834 \text{ N/mm}^2 = \left(\left(\frac{5580 \text{ N}}{4 \cdot 389 \text{ mm}^2} \right) + \left(\frac{5580 \text{ N} \cdot 52 \text{ mm}}{4 \cdot 22000 \text{ mm}^3} \right) \right)$$

Evaluate Formula 



5) Maximum Compressive Load acting on Bracket Formula

Formula

$$P_{\text{Load}} = \frac{\left(4 \cdot \left(\text{Wind}_{\text{Force}} \right) \right) \cdot \left(\text{Height} - c \right)}{N \cdot D_{\text{bc}}} + \left(\frac{\Sigma W}{N} \right)$$

Evaluate Formula 

Example with Units

$$59866.0066 \text{ N} = \frac{\left(4 \cdot \left(3841.6 \text{ N} \right) \right) \cdot \left(4000 \text{ mm} - 1250 \text{ mm} \right)}{2 \cdot 606 \text{ mm}} + \left(\frac{50000 \text{ N}}{2} \right)$$

6) Maximum Compressive Load on Remote Bracket due to Dead Load Formula

Formula

$$P_{\text{Load}} = \frac{\Sigma W}{N}$$

Example with Units

$$25000 \text{ N} = \frac{50000 \text{ N}}{2}$$

Evaluate Formula 

7) Maximum Compressive Stress Formula

Formula

$$f_{\text{Compressive}} = f_{\text{sb}} + f_{\text{d}}$$

Example with Units

$$164.17 \text{ N/mm}^2 = 141.67 \text{ N/mm}^2 + 22.5 \text{ N/mm}^2$$

Evaluate Formula 

8) Maximum Compressive Stress Parallel to Edge of Gusset Plate Formula

Formula

$$f_{\text{Compressive}} = \left(\frac{M_{\text{GussetPlate}}}{Z} \right) \cdot \left(\frac{1}{\cos(\theta)} \right)$$

Example with Units

$$155.5248 \text{ N/mm}^2 = \left(\frac{201134 \text{ N*mm}}{22000 \text{ mm}^3} \right) \cdot \left(\frac{1}{\cos(54^\circ)} \right)$$

Evaluate Formula 

9) Maximum Pressure on Horizontal Plate Formula

Formula

$$f_{\text{horizontal}} = \frac{P_{\text{Load}}}{a \cdot L_{\text{Horizontal}}}$$

Example with Units

$$2.688 \text{ N/mm}^2 = \frac{34820 \text{ N}}{102 \text{ mm} \cdot 127 \text{ mm}}$$

Evaluate Formula 

10) Minimum Area by Base Plate Formula

Formula

$$A_p = \frac{P_{\text{Column}}}{f_c}$$

Example with Units

$$1468.4211 \text{ mm}^2 = \frac{5580 \text{ N}}{3.8 \text{ N/mm}^2}$$

Evaluate Formula 



11) Minimum Thickness of Base Plate Formula

Formula

Evaluate Formula 

$$t_B = \left(\left(3 \cdot \frac{w}{f_b} \right) \cdot \left((A)^2 - \left(\frac{(B)^2}{4} \right) \right) \right)^{0.5}$$

Example with Units

$$1.9551 \text{ mm} = \left(\left(3 \cdot \frac{0.4 \text{ N/mm}^2}{155 \text{ N/mm}^2} \right) \cdot \left((26 \text{ mm})^2 - \left(\frac{(27 \text{ mm})^2}{4} \right) \right) \right)^{0.5}$$

12) Pressure Intensity on under side of Base Plate Formula

Formula

Example with Units

Evaluate Formula 

$$w = \frac{P_{\text{Column}}}{a \cdot L_{\text{Horizontal}}}$$

$$0.4308 \text{ N/mm}^2 = \frac{5580 \text{ N}}{102 \text{ mm} \cdot 127 \text{ mm}}$$

13) Thickness of Gusset Plate Formula

Formula

Evaluate Formula 

$$T_g = \left(\frac{\frac{M_{\text{GussetPlate}}}{f_{\text{Compressive}} \cdot (h^2)}}{6} \right) \cdot \left(\frac{1}{\cos(\theta)} \right)$$

Example with Units

$$3.5322 \text{ mm} = \left(\frac{\frac{2011134 \text{ N*mm}}{161 \text{ N/mm}^2 \cdot (190 \text{ mm})^2}}{6} \right) \cdot \left(\frac{1}{\cos(54^\circ)} \right)$$

14) Thickness of Horizontal Plate Fixed at Edges Formula

Formula

Evaluate Formula 

$$T_h = \left((0.7) \cdot (f_{\text{horizontal}}) \cdot \left(\frac{(L_{\text{Horizontal}})^2}{f_{\text{Edges}}} \right) \cdot \left(\frac{(a)^4}{(L_{\text{Horizontal}})^4 + (a)^4} \right) \right)^{0.5}$$

Example with Units

$$3.7109 \text{ mm} = \left((0.7) \cdot (2.2 \text{ N/mm}^2) \cdot \left(\frac{(127 \text{ mm})^2}{530 \text{ N/mm}^2} \right) \cdot \left(\frac{(102 \text{ mm})^4}{(127 \text{ mm})^4 + (102 \text{ mm})^4} \right) \right)^{0.5}$$



Variables used in list of Lug or Bracket Support Formulas above

- **a** Effective Width of Horizontal Plate (Millimeter)
- **A** Greater Projection of Plate beyond Column (Millimeter)
- **A_{Column}** Cross Sectional Area of Column (Square Millimeter)
- **A_p** Minimum Area provided by Base Plate (Square Millimeter)
- **B** Lesser Projection of Plate beyond Column (Millimeter)
- **c** Clearance between Vessel Bottom and Foundation (Millimeter)
- **D_{bc}** Diameter of Anchor Bolt Circle (Millimeter)
- **e** Eccentricity for Vessel Support (Millimeter)
- **f** Maximum Combined Stress (Newton per Square Millimeter)
- **f_a** Axial Bending Stress induced in Vessel Wall (Newton per Square Millimeter)
- **f_b** Permissible Bending Stress in Base Plate Material (Newton per Square Millimeter)
- **f_c** Permissible Bearing Strength of Concrete (Newton per Square Millimeter)
- **f_{Compressive}** Maximum Compressive Stress (Newton per Square Millimeter)
- **f_d** Compressive Stress due to Force (Newton per Square Millimeter)
- **f_{Edges}** Maximum Stress in Horizontal Plate fixed at Edges (Newton per Square Millimeter)
- **f_{horizontal}** Maximum Pressure on Horizontal Plate (Newton per Square Millimeter)
- **f_{sb}** Stress due to Bending Moment (Newton per Square Millimeter)
- **f_w** Bending Stress in Column due to Wind Load (Newton per Square Millimeter)
- **h** Height of Gusset Plate (Millimeter)
- **Height** Height of Vessel above Foundation (Millimeter)
- **L** Length of Columns (Millimeter)

Constants, Functions, Measurements used in list of Lug or Bracket Support Formulas above

- **Functions:** **cos**, **cos(Angle)**
Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- **Measurement:** **Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement:** **Volume** in Cubic Millimeter (mm³)
Volume Unit Conversion 
- **Measurement:** **Area** in Square Millimeter (mm²)
Area Unit Conversion 
- **Measurement:** **Pressure** in Newton per Square Millimeter (N/mm²)
Pressure Unit Conversion 
- **Measurement:** **Force** in Newton (N)
Force Unit Conversion 
- **Measurement:** **Angle** in Degree (°)
Angle Unit Conversion 
- **Measurement:** **Bending Moment** in Newton Millimeter (N*mm)
Bending Moment Unit Conversion 
- **Measurement:** **Stress** in Newton per Square Millimeter (N/mm²)
Stress Unit Conversion 



- **I_e** Column Effective Length (Millimeter)
- **$L_{Horizontal}$** Length of Horizontal Plate (Millimeter)
- **M** Axial Bending Moment (Newton Millimeter)
- **$M_{GussetPlate}$** Bending Moment of Gusset Plate (Newton Millimeter)
- **N** Number of Brackets
- **N_{Column}** Number of Columns
- **P_{Column}** Axial Compressive Load on Column (Newton)
- **P_{Load}** Maximum Compressive Load on Remote Bracket (Newton)
- **P_w** Wind Load acting on Vessel (Newton)
- **r_g** Radius of Gyration of Column (Millimeter)
- **t** Vessel Shell Thickness (Millimeter)
- **t_B** Minimum Thickness of Base Plate (Millimeter)
- **T_g** Thickness of Gusset Plate (Millimeter)
- **T_h** Thickness of Horizontal Plate (Millimeter)
- **w** Pressure Intensity on Under Side of Base Plate (Newton per Square Millimeter)
- **$Wind_{Force}$** Total Wind Force acting on Vessel (Newton)
- **Z** Section Modulus of Vessel Support (Cubic Millimeter)
- **Θ** Gusset Plate Edge Angle (Degree)
- **ΣW** Total Weight of Vessel (Newton)



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