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Lug or Bracket Support Formulas

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List of 14 Lug or Bracket Support Formulas

Lug or Bracket Support 🔗

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

Open Calculator 🔗

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

ex $$1.241445\,N/mm^2 = \frac{6 \cdot 600112.8N*mm \cdot 102mm}{(17.2mm)^2}$$

2) Bending Stress in Column due to Wind Load 🔗

Open Calculator 🔗

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

ex $$39.49091\,N/mm^2 = \frac{\left(\frac{3840N}{4}\right) \cdot \left(\frac{1810mm}{2}\right)}{22000mm^3}$$

3) Maximum Combined Stress on Long Column 🔗

Open Calculator 🔗

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

ex
$$6.886633\,N/mm^2 = \left(\left(\frac{5580N}{4 \cdot 389mm^2}\right) \cdot \left(1 + \left(\frac{1}{7500}\right) \cdot \left(\frac{57mm}{21.89mm}\right)^2\right) + \left(\frac{5580N \cdot 52mm}{4 \cdot 22000mm^3}\right)\right)$$

4) Maximum Combined Stress on Short Column 🔗

Open Calculator 🔗

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

ex $$6.883391\,N/mm^2 = \left(\left(\frac{5580N}{4 \cdot 389mm^2}\right) + \left(\frac{5580N \cdot 52mm}{4 \cdot 22000mm^3}\right)\right)$$

5) Maximum Compressive Load acting on Bracket ⎘

fx $P_{Load} = \dfrac{(4 \cdot (Wind_{Force})) \cdot (Height - c)}{N \cdot D_{bc}} + \left(\dfrac{\Sigma W}{N} \right)$

Open Calculator ⎘

ex $59866.01N = \dfrac{(4 \cdot (3841.6N)) \cdot (4000mm - 1250mm)}{2 \cdot 606mm} + \left(\dfrac{50000N}{2} \right)$

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

fx $P_{Load} = \dfrac{\Sigma W}{N}$

Open Calculator ⎘

ex $25000N = \dfrac{50000N}{2}$

7) Maximum Compressive Stress ⎘

fx $f_{Compressive} = f_{sb} + f_d$

Open Calculator ⎘

ex $164.17N/mm^2 = 141.67N/mm^2 + 22.5N/mm^2$

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

fx $f_{Compressive} = \left(\dfrac{M_{GussetPlate}}{Z} \right) \cdot \left(\dfrac{1}{\cos(\Theta)} \right)$

Open Calculator ⎘

ex $155.5248N/mm^2 = \left(\dfrac{2011134N*mm}{22000mm^3} \right) \cdot \left(\dfrac{1}{\cos(54°)} \right)$

9) Maximum Pressure on Horizontal Plate ⎘

fx $f_{horizontal} = \dfrac{P_{Load}}{a \cdot L_{Horizontal}}$

Open Calculator ⎘

ex $2.687973N/mm^2 = \dfrac{34820N}{102mm \cdot 127mm}$

10) Minimum Area by Base Plate ⌘

$$fx \quad A_p = \frac{P_{Column}}{f_c}$$

Open Calculator ⌘

$$ex \quad 1468.421 \text{mm}^2 = \frac{5580\text{N}}{3.8\text{N/mm}^2}$$

11) Minimum Thickness of Base Plate ⌘

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

Open Calculator ⌘

$$ex \quad 1.955142\text{mm} = \left(\left(3 \cdot \frac{0.4\text{N/mm}^2}{155\text{N/mm}^2} \right) \cdot \left((26\text{mm})^2 - \left(\frac{(27\text{mm})^2}{4} \right) \right) \right)^{0.5}$$

12) Pressure Intensity on under side of Base Plate ⌘

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

Open Calculator ⌘

$$ex \quad 0.430755\text{N/mm}^2 = \frac{5580\text{N}}{102\text{mm} \cdot 127\text{mm}}$$

13) Thickness of Gusset Plate ⌘

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

Open Calculator ⌘

$$ex \quad 3.532161\text{mm} = \left(\frac{2011134\text{N*mm}}{\frac{161\text{N/mm}^2 \cdot \left((190\text{mm})^2 \right)}{6}} \right) \cdot \left(\frac{1}{\cos(54°)} \right)$$

14) Thickness of Horizontal Plate Fixed at Edges ⎘

fx

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

ex $3.710854\text{mm} = \left((0.7) \cdot (2.2\text{N/mm}^2) \cdot \left(\frac{(127\text{mm})^2}{530\text{N/mm}^2} \right) \cdot \left(\frac{(102\text{mm})^4}{(127\text{mm})^4 + (102\text{mm})^4} \right) \right)^{0.5}$

Variables Used

- **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)*
- **l_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)*

Constants, Functions, Measurements used

- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- 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 ⬈

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