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Design Thickness of Skirt Formulas

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List of 16 Design Thickness of Skirt Formulas

Design Thickness of Skirt

1) Axial Bending Stress due to Wind Load at Base of Vessel

Open Calculator

fx $$f_{wb} = \frac{4 \cdot M_w}{\pi \cdot (D_{sk})^2 \cdot t_{sk}}$$

ex $$0.00101 N/mm^2 = \frac{4 \cdot 370440000 N*mm}{\pi \cdot (19893.55 mm)^2 \cdot 1.18 mm}$$

2) Compressive Stress due to Vertical Downward Force

Open Calculator

fx $$f_d = \frac{\Sigma W}{\pi \cdot D_{sk} \cdot t_{sk}}$$

ex $$0.677994 N/mm^2 = \frac{50000 N}{\pi \cdot 19893.55 mm \cdot 1.18 mm}$$

3) Maximum Bending Moment in Bearing Plate Inside Chair

Open Calculator

fx $$Maximum_{BM} = \frac{P_{bolt} \cdot b_{spacing}}{8}$$

ex $$2.3E\hat{}6 N*mm = \frac{70000 N \cdot 260 mm}{8}$$

4) Maximum Bending Stress in Base Ring Plate

Open Calculator

fx $$f_{max} = \frac{6 \cdot M_{max}}{b \cdot t_b^2}$$

ex $$60.9375\text{N/mm}^2 = \frac{6 \cdot 13000000\text{N*mm}}{200\text{mm} \cdot (80\text{mm})^2}$$

5) Maximum Tensile Stress

Open Calculator

fx $$f_{tensile} = f_{sb} - f_d$$

ex $$119.17\text{N/mm}^2 = 141.67\text{N/mm}^2 - 22.5\text{N/mm}^2$$

6) Maximum Wind Moment for Vessel with Total Height Greater than 20m

Open Calculator

fx $$M_w = P_{lw} \cdot \left(\frac{h_1}{2}\right) + P_{uw} \cdot \left(h_1 + \left(\frac{h_2}{2}\right)\right)$$

ex $$4.3\text{E}\hat{}8\text{N*mm} = 67\text{N} \cdot \left(\frac{2.1\text{m}}{2}\right) + 119\text{N} \cdot \left(2.1\text{m} + \left(\frac{1.81\text{m}}{2}\right)\right)$$

7) Maximum Wind Moment for Vessel with Total Height Less than 20m

Open Calculator

fx $$M_w = P_{lw} \cdot \left(\frac{H}{2}\right)$$

ex $$5\text{E}\hat{}8\text{N*mm} = 67\text{N} \cdot \left(\frac{15\text{m}}{2}\right)$$

8) Minimum Width of Base Ring

Open Calculator

$$L_b = \frac{F_b}{f_c}$$

$$12.65251\text{mm} = \frac{28\text{N}}{2.213\text{N/mm}^2}$$

9) Minimum Wind Pressure at Vessel

Open Calculator

$$p_w = 0.05 \cdot (V_w)^2$$

$$744.2\text{N/m}^2 = 0.05 \cdot (122\text{km/h})^2$$

10) Moment Arm for Minimum Weight of Vessel

Open Calculator

$$R = 0.42 \cdot D_{ob}$$

$$519.54\text{mm} = 0.42 \cdot 1237\text{mm}$$

11) Thickness of Base Bearing Plate

Open Calculator

$$t_b = l_{outer} \cdot \left(\sqrt{\frac{3 \cdot f_{Compressive}}{f_b}}\right)$$

$$87.66147\text{mm} = 50.09\text{mm} \cdot \left(\sqrt{\frac{3 \cdot 161\text{N/mm}^2}{157.7\text{N/mm}^2}}\right)$$

12) Thickness of Bearing Plate inside Chair

Open Calculator

fx $$t_{bp} = \sqrt{\frac{6 \cdot Maximum_{BM}}{(W_{bp} - d_{bh}) \cdot f_{all}}}$$

ex $$1.162112mm = \sqrt{\frac{6 \cdot 2000546N*mm}{(501mm - 400mm) \cdot 88N/mm^2}}$$

13) Thickness of Skirt in Vessel

Open Calculator

fx $$t_{skirt} = \frac{4 \cdot M_w}{\pi \cdot (D_{sk})^2 \cdot f_{wb}}$$

ex $$1.18mm = \frac{4 \cdot 370440000N*mm}{\pi \cdot (19893.55mm)^2 \cdot 1.01N/mm^2}$$

14) Total Compressive Load on Base Ring

Open Calculator

fx $$F_b = \left(\left(\frac{4 \cdot M_{max}}{(\pi) \cdot (D_{sk})^2}\right) + \left(\frac{\Sigma W}{\pi \cdot D_{sk}}\right)\right)$$

ex $$0.800075N = \left(\left(\frac{4 \cdot 13000000N*mm}{(\pi) \cdot (19893.55mm)^2}\right) + \left(\frac{50000N}{\pi \cdot 19893.55mm}\right)\right)$$

15) Wind Load acting on Lower Part of Vessel

Open Calculator

fx $$P_{lw} = k_1 \cdot k_{coefficient} \cdot p_1 \cdot h_1 \cdot D_o$$

ex $$69.552N = 0.69 \cdot 4 \cdot 20N/m^2 \cdot 2.1m \cdot 0.6m$$

16) Wind Load acting on Upper Part of Vessel

Open Calculator

fx $$P_{uw} = k_1 \cdot k_{coefficient} \cdot p_2 \cdot h_2 \cdot D_o$$

ex $$119.8944\text{N} = 0.69 \cdot 4 \cdot 40\text{N/m}^2 \cdot 1.81\text{m} \cdot 0.6\text{m}$$

Variables Used

- **b** Circumferential Length of Bearing Plate *(Millimeter)*
- **$b_{spacing}$** Spacing Inside Chairs *(Millimeter)*
- **d_{bh}** Diameter of Bolt Hole in Bearing Plate *(Millimeter)*
- **D_o** Outside Diameter of Vessel *(Meter)*
- **D_{ob}** Outer Diameter of Bearing Plate *(Millimeter)*
- **D_{sk}** Mean Diameter of Skirt *(Millimeter)*
- **f_{all}** Allowable Stress in Bolt Material *(Newton per Square Millimeter)*
- **f_b** Allowable Bending Stress *(Newton per Square Millimeter)*
- **F_b** Total Compressive Load at Base Ring *(Newton)*
- **f_c** Stress in Bearing Plate and Concrete Foundation *(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_{max}** Maximum Bending Stress in Base Ring Plate *(Newton per Square Millimeter)*
- **f_{sb}** Stress due to Bending Moment *(Newton per Square Millimeter)*
- **$f_{tensile}$** Maximum Tensile Stress *(Newton per Square Millimeter)*
- **f_{wb}** Axial Bending Stress at Base of Vessel *(Newton per Square Millimeter)*
- **H** Total Height of Vessel *(Meter)*
- **h_1** Height of Lower Part of Vessel *(Meter)*
- **h_2** Height of Upper Part of Vessel *(Meter)*

- k_1 Coefficient depending on Shape Factor
- $k_{coefficient}$ Coefficient Period of One Cycle of Vibration
- L_b Minimum Width of Base Ring *(Millimeter)*
- l_{outer} Difference Outer Radius of Bearing Plate and Skirt *(Millimeter)*
- M_{max} Maximum Bending Moment *(Newton Millimeter)*
- M_w Maximum Wind Moment *(Newton Millimeter)*
- $Maximum_{BM}$ Maximum Bending Moment in Bearing Plate *(Newton Millimeter)*
- p_1 Wind Pressure acting on Lower Part of Vessel *(Newton per Square Meter)*
- p_2 Wind Pressure acting on Upper Part of Vessel *(Newton per Square Meter)*
- P_{bolt} Load on Each Bolt *(Newton)*
- P_{lw} Wind Load acting on Lower Part of Vessel *(Newton)*
- P_{uw} Wind Load acting on Upper Part of Vessel *(Newton)*
- p_w Minimum Wind Pressure *(Newton per Square Meter)*
- R Moment Arm for Minimum Weight of Vessel *(Millimeter)*
- t_b Thickness of Base Bearing Plate *(Millimeter)*
- t_{bp} Thickness of Bearing Plate inside Chair *(Millimeter)*
- t_{sk} Thickness of Skirt *(Millimeter)*
- t_{skirt} Thickness of Skirt in Vessel *(Millimeter)*
- V_w Maximum Wind Velocity *(Kilometer per Hour)*
- W_{bp} Width of Bearing Plate *(Millimeter)*
- ΣW Total Weight of Vessel *(Newton)*

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: **Pressure** in Newton per Square Meter (N/m²)
  Pressure Unit Conversion
- Measurement: **Speed** in Kilometer per Hour (km/h)
  Speed Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Moment of Force** in Newton Millimeter (N*mm)
  Moment of Force 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

Check other formula lists

- **Design of Anchor Bolt & Bolting Chair Formulas**
- **Design Thickness of Skirt Formulas**
- **Lug or Bracket Support Formulas**
- **Saddle Support Formulas**
- **Skirt Supports Formulas**

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