Important Design Thickness of Skirt Formulas PDF

Formulas
Examples
with Units

List of 16
Important Design Thickness of Skirt Formulas

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

Evaluate Formula

Formula

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

Example with Units

$$0.001\,\text{N/mm}^2 = \frac{4 \cdot 370440000\,\text{N*mm}}{3.1416 \cdot \left(19893.55\,\text{mm} \right)^2 \cdot 1.18\,\text{mm}}$$

2) Compressive Stress due to Vertical Downward Force Formula

Evaluate Formula

Formula

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

Example with Units

$$0.678\,\text{N/mm}^2 = \frac{50000\,\text{N}}{3.1416 \cdot 19893.55\,\text{mm} \cdot 1.18\,\text{mm}}$$

3) Maximum Bending Moment in Bearing Plate Inside Chair Formula

Evaluate Formula

Formula

$$\text{Maximum}_{BM} = \frac{P_{bolt} \cdot b_{spacing}}{8}$$

Example with Units

$$2.3\text{E+}6\,\text{N*mm} = \frac{70000\,\text{N} \cdot 260\,\text{mm}}{8}$$

4) Maximum Bending Stress in Base Ring Plate Formula

Evaluate Formula

Formula

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

Example with Units

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

5) Maximum Tensile Stress Formula

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

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

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

Evaluate Formula

Formula

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

Example with Units

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

8) Minimum Width of Base Ring Formula

Evaluate Formula

Formula

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

Example with Units

$$12.6525\,\text{mm} = \frac{28\,\text{N}}{2.213\,\text{N/mm}^2}$$

9) Minimum Wind Pressure at Vessel Formula

Evaluate Formula

Formula

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

Example with Units

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

10) Moment Arm for Minimum Weight of Vessel Formula

Evaluate Formula

Formula

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

Example with Units

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

11) Thickness of Base Bearing Plate Formula

Evaluate Formula

Formula

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

Example with Units

$$87.6615\,\text{mm} = 50.09\,\text{mm} \cdot \left(\sqrt{\frac{3 \cdot 161\,\text{N/mm}^2}{157.7\,\text{N/mm}^2}} \right)$$

12) Thickness of Bearing Plate inside Chair Formula

Evaluate Formula

Formula

$$t_{bp} = \sqrt{\frac{6 \cdot \text{Maximum}_{BM}}{\left(W_{bp} - d_{bh}\right) \cdot f_{all}}}$$

Example with Units

$$1.1621\,\text{mm} = \sqrt{\frac{6 \cdot 2000546\,\text{N*mm}}{\left(501\,\text{mm} - 400\,\text{mm}\right) \cdot 88\,\text{N/mm}^2}}$$

13) Thickness of Skirt in Vessel Formula

Evaluate Formula

Formula

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

Example with Units

$$1.18\,\text{mm} = \frac{4 \cdot 370440000\,\text{N*mm}}{3.1416 \cdot \left(19893.55\,\text{mm}\right)^2 \cdot 1.01\,\text{N/mm}^2}$$

14) Total Compressive Load on Base Ring Formula

Evaluate Formula

Formula

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

Example with Units

$$0.8001\,\text{N} = \left(\left(\frac{4 \cdot 13000000\,\text{N*mm}}{\left(3.1416\right) \cdot \left(19893.55\,\text{mm}\right)^2}\right) + \left(\frac{50000\,\text{N}}{3.1416 \cdot 19893.55\,\text{mm}}\right)\right)$$

15) Wind Load acting on Lower Part of Vessel Formula

Evaluate Formula

Formula

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

Example with Units

$$69.552\,\text{N} = 0.69 \cdot 4 \cdot 20\,\text{N/m}^2 \cdot 2.1\,\text{m} \cdot 0.6\,\text{m}$$

16) Wind Load acting on Upper Part of Vessel Formula

Evaluate Formula

Formula

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

Example with Units

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

Variables used in list of Design Thickness of Skirt Formulas above

- **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)*

Constants, Functions, Measurements used in list of Design Thickness of Skirt Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- 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), 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*

- 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)*

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