Important Design of Anchor Bolt & Bolting Chair Formulas PDF

Formulas
Examples
with Units

List of 14
Important Design of Anchor Bolt & Bolting Chair Formulas

1) Cross Sectional Area of Bolt Formula

Evaluate Formula

Formula

$$A_{bolt} = \frac{P_{bolt}}{f_{bolt}}$$

Example with Units

$$20.4342\,\text{mm}^2 = \frac{2151.921\,\text{N}}{105.31\,\text{N/mm}^2}$$

2) Diameter of Anchor Bolt Circle Formula

Evaluate Formula

Formula

$$D_{bc} = \frac{\left(4 \cdot \left(Wind_{Force}\right)\right) \cdot \left(Height - c\right)}{N \cdot P_{Load}}$$

Example with Units

$$741.3926\,\text{mm} = \frac{\left(4 \cdot \left(3841.6\,\text{N}\right)\right) \cdot \left(4000\,\text{mm} - 1250\,\text{mm}\right)}{2 \cdot 28498.8\,\text{N}}$$

3) Diameter of Bolt given Cross Sectional Area Formula

Evaluate Formula

Formula

$$d_b = \left(A_{bolt} \cdot \left(\frac{4}{\pi}\right)\right)^{0.5}$$

Example with Units

$$5.1007\,\text{mm} = \left(20.43416\,\text{mm}^2 \cdot \left(\frac{4}{3.1416}\right)\right)^{0.5}$$

4) Height of Lower Part of Vessel Formula

Evaluate Formula

Formula

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

Example with Units

$$2.0229\,\text{m} = \frac{67\,\text{N}}{0.69 \cdot 4 \cdot 20\,\text{N/m}^2 \cdot 0.6\,\text{m}}$$

5) Height of Upper Part of Vessel Formula

Evaluate Formula

Formula

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

Example with Units

$$1.7965\,\text{m} = \frac{119\,\text{N}}{0.69 \cdot 4 \cdot 40\,\text{N/m}^2 \cdot 0.6\,\text{m}}$$

6) Load on Each Bolt Formula

Evaluate Formula

Formula

$$P_{bolt} = f_c \cdot \left(\frac{A}{n} \right)$$

Example with Units

$$2151.9208\,\text{N} = 2.213\,\text{N/mm}^2 \cdot \left(\frac{102101.98\,\text{mm}^2}{105} \right)$$

7) Maximum Compressive Load Formula

Evaluate Formula

Formula

$$P_{Load} = f_{horizontal} \cdot \left(L_{Horizontal} \cdot a \right)$$

Example with Units

$$28498.8\,\text{N} = 2.2\,\text{N/mm}^2 \cdot \left(127\,\text{mm} \cdot 102\,\text{mm} \right)$$

8) Maximum Seismic Moment Formula

Evaluate Formula

Formula

$$M_s = \left(\left(\frac{2}{3} \right) \cdot C \cdot \Sigma W \cdot H \right)$$

Example with Units

$$4.7E{+}7\,\text{N*mm} = \left(\left(\frac{2}{3} \right) \cdot 0.093 \cdot 50000\,\text{N} \cdot 15\,\text{m} \right)$$

9) Maximum Stress in Horizontal Plate fixed at Edges Formula

Evaluate Formula

Formula

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

Example with Units

$$531.723\,\text{N/mm}^2 = 0.7 \cdot 2.2\,\text{N/mm}^2 \cdot \left(\frac{\left(127\,\text{mm} \right)^2}{\left(6.8\,\text{mm} \right)^2} \right) \cdot \left(\frac{\left(102\,\text{mm} \right)^4}{\left(\left(127\,\text{mm} \right)^4 + \left(102\,\text{mm} \right) \right)^4} \right)$$

10) Mean Diameter of Skirt in Vessel Formula

Evaluate Formula

Formula

$$D_{sk} = \left(\frac{4 \cdot M_w}{\left(\pi \cdot \left(f_{wb} \right) \cdot t_{sk} \right)} \right)^{0.5}$$

Example with Units

$$19893.5508\,\text{mm} = \left(\frac{4 \cdot 370440000\,\text{N*mm}}{\left(3.1416 \cdot \left(1.01\,\text{N/mm}^2 \right) \cdot 1.18\,\text{mm} \right)} \right)^{0.5}$$

11) Number of Bolts Formula

Evaluate Formula

Formula

$$n = \frac{\pi \cdot D_{sk}}{600}$$

Example with Units

$$104.1624 = \frac{3.1416 \cdot 19893.55\,\text{mm}}{600}$$

12) Stress due to Internal Pressure Formula

Evaluate Formula

Formula

$$f_{cs1} = \frac{p \cdot D}{2 \cdot t}$$

Example with Units

$$140000\,\text{N/mm}^2 = \frac{0.7\,\text{N/mm}^2 \cdot 80000000\,\text{mm}}{2 \cdot 200\,\text{mm}}$$

13) Wind Pressure acting on Lower Part of Vessel Formula

Evaluate Formula

Formula

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

Example with Units

$$19.2662\,\text{N/m}^2 = \frac{67\,\text{N}}{0.69 \cdot 4 \cdot 2.1\,\text{m} \cdot 0.6\,\text{m}}$$

14) Wind Pressure acting on Upper Part of Vessel Formula

Evaluate Formula

Formula

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

Example with Units

$$39.7016\,\text{N/m}^2 = \frac{119\,\text{N}}{0.69 \cdot 4 \cdot 1.81\,\text{m} \cdot 0.6\,\text{m}}$$

Variables used in list of Design of Anchor Bolt & Bolting Chair Formulas above

- **a** Effective Width of Horizontal Plate *(Millimeter)*
- **A** Area of Contact in Bearing Plate and Foundation *(Square Millimeter)*
- A_{bolt} Cross Sectional Area of Bolt *(Square Millimeter)*
- **c** Clearance between Vessel Bottom and Foundation *(Millimeter)*
- **C** Seismic Coefficient
- **D** Vessel Diameter *(Millimeter)*
- d_b Diameter of Bolt *(Millimeter)*
- D_{bc} Diameter of Anchor Bolt Circle *(Millimeter)*
- D_o Outside Diameter of Vessel *(Meter)*
- D_{sk} Mean Diameter of Skirt *(Millimeter)*
- f_{bolt} Permissible Stress for Bolt Materials *(Newton per Square Millimeter)*
- f_c Stress in Bearing Plate and Concrete Foundation *(Newton per Square Millimeter)*
- f_{cs1} Stress due to Internal Pressure *(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_{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)*
- **Height** Height of Vessel above Foundation *(Millimeter)*
- k_1 Coefficient depending on Shape Factor
- $k_{coefficient}$ Coefficient Period of One Cycle of Vibration
- $L_{Horizontal}$ Length of Horizontal Plate *(Millimeter)*

Constants, Functions, Measurements used in list of Design of Anchor Bolt & Bolting Chair Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Measurement: **Length** in Millimeter (mm), Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Newton per Square Meter (N/m²), Newton per Square Millimeter (N/mm²)
  Pressure 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

- M_s Maximum Seismic Moment *(Newton Millimeter)*
- M_w Maximum Wind Moment *(Newton Millimeter)*
- **n** Number of Bolts
- **N** Number of Brackets
- **p** Internal Design Pressure *(Newton per Square 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_{Load} Maximum Compressive Load on Remote Bracket *(Newton)*
- P_{lw} Wind Load acting on Lower Part of Vessel *(Newton)*
- P_{uw} Wind Load acting on Upper Part of Vessel *(Newton)*
- **t** Shell Thickness *(Millimeter)*
- T_h Thickness of Horizontal Plate *(Millimeter)*
- t_{sk} Thickness of Skirt *(Millimeter)*
- $Wind_{Force}$ Total Wind Force acting on Vessel *(Newton)*
- **ΣW** Total Weight of Vessel *(Newton)*

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