

Important Allowable Design for Column Formulas PDF



**Formulas
Examples
with Units**

List of 15 Important Allowable Design for Column Formulas

1) Allowable-Stress Design Approach (AISC) Formulas

1.1) Allowable Bearing Pressure given Area of Lowest Column of Structure Formula

Formula

$$F_p = \frac{P}{A}$$

Example with Units

$$17 \text{ MPa} = \frac{59.5 \text{ N}}{3.5 \text{ m}^2}$$

Evaluate Formula

1.2) Allowable Bearing Pressure when Full Area of Support is Occupied by Base Plate Formula

Formula

$$F_p = 0.35 \cdot f'_c$$

Example with Units

$$19.25 \text{ MPa} = 0.35 \cdot 55.0 \text{ MPa}$$

Evaluate Formula

1.3) Area of Foundation of Lowest Column of Structure Formula

Formula

$$A = \frac{P}{F_p}$$

Example with Units

$$3.5 \text{ m}^2 = \frac{59.5 \text{ N}}{17 \text{ MPa}}$$

Evaluate Formula

1.4) Base Plate Thickness Formula

Formula

$$t_p = 2 \cdot l \cdot \left(\sqrt{\frac{f_p}{F_y}} \right)$$

Example with Units

$$70.014 \text{ mm} = 2 \cdot 25 \text{ mm} \cdot \left(\sqrt{\frac{100 \text{ MPa}}{51 \text{ MPa}}} \right)$$

Evaluate Formula

1.5) Bearing Pressure on Base Plate Formula

Formula

$$f_p = \frac{(t_p)^2 \cdot F_y}{(2 \cdot l)^2}$$

Example with Units

$$99.96 \text{ MPa} = \frac{(70 \text{ mm})^2 \cdot 51 \text{ MPa}}{(2 \cdot 25 \text{ mm})^2}$$

Evaluate Formula



1.6) Depth of Section of Column for Equivalent Cantilever Dimension Formula

Formula

$$d = \left(n'^2 \right) \cdot \frac{16}{b_f}$$

Example with Units

$$40 \text{ mm} = \left(5^2 \right) \cdot \frac{16}{10 \text{ mm}}$$

Evaluate Formula 

1.7) Equivalent Cantilever Dimension Formula

Formula

$$n' = \left(\frac{1}{4} \right) \cdot \sqrt{d \cdot b_f}$$

Example with Units

$$4.0311 = \left(\frac{1}{4} \right) \cdot \sqrt{26 \text{ mm} \cdot 10 \text{ mm}}$$

Evaluate Formula 

1.8) Load using Area of Lowest Column of Structure Formula

Formula

$$P = F_p \cdot A$$

Example with Units

$$59.5 \text{ N} = 17 \text{ MPa} \cdot 3.5 \text{ m}^2$$

Evaluate Formula 

1.9) Width of Flange Column for Equivalent Cantilever Dimension Formula

Formula

$$b_f = \left(n'^2 \right) \cdot \frac{16}{d}$$

Example with Units

$$15.3846 \text{ mm} = \left(5^2 \right) \cdot \frac{16}{26 \text{ mm}}$$

Evaluate Formula 

1.10) Yield Strength of Base Plate Formula

Formula

$$F_y = \left(2 \cdot l \right)^2 \cdot \frac{f_p}{\left(t_p \right)^2}$$

Example with Units

$$51.0204 \text{ MPa} = \left(2 \cdot 25 \text{ mm} \right)^2 \cdot \frac{100 \text{ MPa}}{\left(70 \text{ mm} \right)^2}$$

Evaluate Formula 

2) Allowable Design Loads for Aluminium Columns Formulas

2.1) Allowable Compressive Stress for Aluminium Columns Formula

Formula

$$F_e = \frac{c \cdot \pi^2 \cdot E}{\left(\frac{L}{\rho} \right)^2}$$


Example with Units

$$54.8311 \text{ MPa} = \frac{4 \cdot 3.1416^2 \cdot 50 \text{ MPa}}{\left(\frac{3000 \text{ mm}}{500 \text{ mm}} \right)^2}$$

Evaluate Formula 



2.2) Allowable Compressive Stress for Aluminium Columns given Column Yield Stress

Formula 

Evaluate Formula 

Formula

$$F_e = F_{ce} \cdot \left(1 - \left(K \cdot \left(\frac{\frac{L}{\rho}}{\pi \cdot \sqrt{c \cdot \frac{E}{F_{ce}}}} \right)^k \right) \right)$$

Example with Units

$$14.1737 \text{ MPa} = 15 \text{ MPa} \cdot \left(1 - \left(0.385 \cdot \left(\frac{\frac{3000 \text{ mm}}{500 \text{ mm}}}{3.1416 \cdot \sqrt{4 \cdot \frac{50 \text{ MPa}}{15 \text{ MPa}}}} \right)^3 \right) \right)$$

2.3) Length of Column given Allowable Compressive Stress for Aluminium Columns Formula



Formula

$$L = \sqrt{\frac{c \cdot \pi^2 \cdot E}{\frac{F_e}{(\rho)^2}}}$$

Example with Units

$$2995.3911 \text{ mm} = \sqrt{\frac{4 \cdot 3.1416^2 \cdot 50 \text{ MPa}}{\frac{55 \text{ MPa}}{(500 \text{ mm})^2}}}$$

Evaluate Formula 

2.4) Radius of Gyration of Column given Allowable Compressive Stress for Aluminium Columns Formula



Formula

$$\rho = \sqrt{\frac{F_e \cdot L^2}{c \cdot (\pi^2) \cdot E}}$$

Example with Units

$$500.7693 \text{ mm} = \sqrt{\frac{55 \text{ MPa} \cdot 3000 \text{ mm}^2}{4 \cdot (3.1416^2) \cdot 50 \text{ MPa}}}$$

Evaluate Formula 

2.5) Transition from Long to Short Column Range Formula



Formula

$$\lambda = \pi \cdot \left(\sqrt{c \cdot k \cdot \frac{E}{F_{ce}}} \right)$$

Example with Units

$$19.8692 = 3.1416 \cdot \left(\sqrt{4 \cdot 3 \cdot \frac{50 \text{ MPa}}{15 \text{ MPa}}} \right)$$






Evaluate Formula 



Variables used in list of Allowable Design for Column Formulas above

- **A** Area of Foundation (Square Meter)
- **b_f** Width of Flange (Millimeter)
- **c** End Fixity Coefficient
- **d** Depth of Section of Column (Millimeter)
- **E** Modulus of Elasticity (Megapascal)
- **f_c** 28-Day Compressive Strength of Concrete (Megapascal)
- **F_{ce}** Column Yield Stress (Megapascal)
- **F_e** Allowable Column Compressive Stress (Megapascal)
- **f_p** Bearing Pressure on Base Plate (Megapascal)
- **F_p** Allowable Bearing Pressure (Megapascal)
- **F_y** Yield Strength of Base Plate (Megapascal)
- **k** Aluminum Constant
- **K** Aluminum Alloy Constant K
- **l** Maximum Cantilever Dimension (Millimeter)
- **L** Effective Length of Column (Millimeter)
- **n'** Equivalent Cantilever Dimension
- **P** Columns Axial Load (Newton)
- **t_p** Base Plate Thickness (Millimeter)
- **λ** Slenderness Ratio of Column
- **p** Radius of Gyration of Column (Millimeter)

Constants, Functions, Measurements used in list of Allowable Design for Column 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)
Length Unit Conversion 
- **Measurement: Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement: Pressure** in Megapascal (MPa)
Pressure Unit Conversion 
- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Stress** in Megapascal (MPa)
Stress Unit Conversion 



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