calculatoratoz.com

unitsconverters.com

Allowable-Stress Design Formulas

Calculators! Examples! Conversions!

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

Please leave your feedback here...

List of 17 Allowable-Stress Design Formulas

Allowable-Stress Design

Allowable-Stress Design for Building Beams

1) Allowable Stress for Solid Compression Flange having Area not Less than Tension Flange

Open Calculator

fx $$F_b = \frac{12000 \cdot C_b}{\frac{l_{max} \cdot d}{A_f}}$$

ex $$367.3087\text{MPa} = \frac{12000 \cdot 1.960}{\frac{1921\text{mm} \cdot 350\text{mm}}{10500\text{mm}^2}}$$

2) Allowable Stress given Simplifying Term between 0.2 and 1

Open Calculator

fx $$F_b = \frac{(2 - Q) \cdot F_y}{3}$$

ex $$156.5054\text{MPa} = \frac{(2 - 0.121935) \cdot 250\text{MPa}}{3}$$

3) Allowable Stress when Simplifying Term Greater than 1

Open Calculator

$$F_b = \frac{F_y}{3 \cdot Q}$$

$$683.4242\text{MPa} = \frac{250\text{MPa}}{3 \cdot 0.121935}$$

4) Maximum Fiber Stress in Bending for Laterally Supported Compact Beams and Girders

Open Calculator

$$F_b = 0.66 \cdot F_y$$

$$165\text{MPa} = 0.66 \cdot 250\text{MPa}$$

5) Maximum Fiber Stress in Bending for Laterally Supported Noncompact Beams and Girders

Open Calculator

$$F_b = 0.60 \cdot F_y$$

$$150\text{MPa} = 0.60 \cdot 250\text{MPa}$$

6) Maximum Unsupported Length of Compression Flange-1

Open Calculator

$$l_{max} = \frac{76.0 \cdot b_f}{\sqrt{F_y}}$$

$$21629.98\text{mm} = \frac{76.0 \cdot 4500\text{mm}}{\sqrt{250\text{MPa}}}$$

7) Maximum Unsupported Length of Compression Flange-2

Open Calculator

fx $$l_{max} = \frac{20000}{\frac{F_y \cdot d}{A_f}}$$

ex $$2400\text{mm} = \frac{20000}{\frac{250\text{MPa} \cdot 350\text{mm}}{10500\text{mm}^2}}$$

8) Modifier for Moment Gradient

Open Calculator

fx $$C_b = 1.75 + \left(1.05 \cdot \left(\frac{M_1}{M_2}\right)\right) + \left(0.3 \cdot \left(\frac{M_1}{M_2}\right)^2\right)$$

ex $$1.960884 = 1.75 + \left(1.05 \cdot \left(\frac{10\text{kN*m}}{52.5\text{kN*m}}\right)\right) + \left(0.3 \cdot \left(\frac{10\text{kN*m}}{52.5\text{kN*m}}\right)^2\right)$$

9) Simplifying Term for Allowable Stress Equations

Open Calculator

fx $$Q = \frac{\left(\frac{l_{max}}{r}\right)^2 \cdot F_y}{510000 \cdot C_b}$$

ex $$0.121935 = \frac{\left(\frac{1921\text{mm}}{87\text{mm}}\right)^2 \cdot 250\text{MPa}}{510000 \cdot 1.960}$$

Allowable-Stress Design for Building Columns

10) Allowable Compressive Stress when Slenderness Ratio is Greater than Cc

Open Calculator

$$F_a = \frac{12 \cdot \pi^2 \cdot E_s}{23 \cdot \left(\frac{k \cdot l}{r}\right)^2}$$

$$1539.773\text{MPa} = \frac{12 \cdot \pi^2 \cdot 200000\text{MPa}}{23 \cdot \left(\frac{0.75 \cdot 3000\text{mm}}{87\text{mm}}\right)^2}$$

11) Allowable Compressive Stress when Slenderness Ratio is Less than Cc

Open Calculator

$$F_a = \frac{\left(1 - \left(\frac{\left(\frac{k \cdot l}{r}\right)^2}{2 \cdot C_c^2}\right)\right) \cdot F_y}{F_s}$$

$$140.6352\text{MPa} = \frac{\left(1 - \left(\frac{\left(\frac{0.75 \cdot 3000\text{mm}}{87\text{mm}}\right)^2}{2 \cdot (125.66)^2}\right)\right) \cdot 250\text{MPa}}{1.74}$$

12) Effective Length Factor

Open Calculator

$$k = \frac{l}{l'}$$

$$0.75 = \frac{3000\text{mm}}{4000\text{mm}}$$

13) Factor for Unbraced Segment of any Cross-Section

Open Calculator

fx $$C_c = \frac{1986.66}{\sqrt{F_y}}$$

ex $$125.6474 = \frac{1986.66}{\sqrt{250\text{MPa}}}$$

14) Safety Factor for Allowable Compressive Stress

Open Calculator

fx $$F_s = \frac{5}{3} + \left(\frac{3 \cdot \left(\frac{k \cdot l}{r}\right)}{8 \cdot C_c}\right) - \left(\frac{\left(\frac{k \cdot l}{r}\right)^3}{8 \cdot C_c^3}\right)$$

ex $$1.742756 = \frac{5}{3} + \left(\frac{3 \cdot \left(\frac{0.75 \cdot 3000\text{mm}}{87\text{mm}}\right)}{8 \cdot 125.66}\right) - \left(\frac{\left(\frac{0.75 \cdot 3000\text{mm}}{87\text{mm}}\right)^3}{8 \cdot (125.66)^3}\right)$$

15) Slenderness Ratio Used for Separation

Open Calculator

fx $$C_c = \sqrt{\frac{2 \cdot (\pi^2) \cdot E_s}{F_y}}$$

ex $$125.6637 = \sqrt{\frac{2 \cdot (\pi^2) \cdot 200000\text{MPa}}{250\text{MPa}}}$$

Allowable-Stress Design for Shear in Buildings

16) Allowable Shear Stress with Tension Field Action

Open Calculator

$$F_v = \frac{F_y}{289} \cdot \left(C_v + \left(\frac{1 - C_v}{1.15 \cdot \sqrt{1 + \left(\frac{a}{h}\right)^2}} \right) \right)$$

ex $$0.853653\text{MPa} = \frac{250\text{MPa}}{289} \cdot \left(0.9 + \left(\frac{1 - 0.9}{1.15 \cdot \sqrt{1 + \left(\frac{50\text{mm}}{900\text{mm}}\right)^2}} \right) \right)$$

17) Allowable Shear Stress without Tension Field Action

Open Calculator

$$F_v = \frac{C_v \cdot F_y}{289}$$

ex $$0.778547\text{MPa} = \frac{0.9 \cdot 250\text{MPa}}{289}$$

Variables Used

- **a** Spacing of Stiffeners *(Millimeter)*
- **A_f** Area of Compression Flange *(Square Millimeter)*
- **b_f** Width of Compression Flange *(Millimeter)*
- **C_b** Moment Gradient Factor
- **C_c** Factor for Allowable Stress Design
- **C_v** Stress Buckling Coefficient
- **d** Beam Depth *(Millimeter)*
- **E_s** Modulus of Elasticity of Steel *(Megapascal)*
- **F_a** Allowable Compression Stress *(Megapascal)*
- **F_b** Maximum Fiber Stress *(Megapascal)*
- **F_s** Safety Factor
- **F_v** Allowable Shear Stress *(Megapascal)*
- **F_y** Yield Stress of Steel *(Megapascal)*
- **h** Height of Web *(Millimeter)*
- **k** Effective Length Factor
- **l** Effective Column Length *(Millimeter)*
- **l'** Actual Unbraced Length *(Millimeter)*
- **l_{max}** Maximum Unbraced Length *(Millimeter)*
- **M_1** Smaller Beam End Moment *(Kilonewton Meter)*
- **M_2** Larger Beam End Moment *(Kilonewton Meter)*
- **Q** Simplifying Term for Fb
- **r** Radius of Gyration *(Millimeter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **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 Millimeter (mm²)
  Area Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Moment of Force** in Kilonewton Meter (kN*m)
  Moment of Force Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- **Allowable-Stress Design Formulas**
- **Base and Bearing Plates Formulas**
- **Cold Formed or Light Weighted Steel Structures Formulas**

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

3/5/2024 | 4:56:29 AM UTC

Please leave your feedback here...