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Cold Formed or Light Weighted Steel Structures Formulas

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List of 15 Cold Formed or Light Weighted Steel Structures Formulas

Cold Formed or Light Weighted Steel Structures

1) Allowable Design Strength

Open Calculator

fx $$R_a = \frac{R_n}{f_s}$$

ex $$833.3333\text{MPa} = \frac{1500\text{MPa}}{1.8}$$

2) Compressive Stress when Basic Design Stress restricted to 20000 psi

Open Calculator

fx $$f_c = 24700 - 470 \cdot w_t$$

ex $$18.59\text{kN/m}^2 = 24700 - 470 \cdot 13$$

3) Compressive Stress when Flat Width Ratio is between 10 and 25

Open Calculator

fx $$f_c = \left(\frac{5 \cdot f_b}{3}\right) - 8640 - \left(\left(\frac{1}{15}\right) \cdot (f_b - 12950) \cdot w_t\right)$$

ex $$18.58333\text{kN/m}^2 = \left(\frac{5 \cdot 20\text{kN/m}^2}{3}\right) - 8640 - \left(\left(\frac{1}{15}\right) \cdot (20\text{kN/m}^2 - 12950) \cdot 13\right)$$

4) Depth of Stiffener Lip

Open Calculator

$$d = 2.8 \cdot t \cdot \left((w_t)^2 - 144 \right)^{\frac{1}{6}}$$

$$143.638\text{mm} = 2.8 \cdot 30\text{mm} \cdot \left((13)^2 - 144 \right)^{\frac{1}{6}}$$

5) Elastic Local Buckling Stress

Open Calculator

$$f_{cr} = \frac{k \cdot \pi^2 \cdot E_s}{12 \cdot w_t^2 \cdot \left(1 - \mu^2\right)}$$

$$2139.195\text{MPa} = \frac{2 \cdot \pi^2 \cdot 200000\text{MPa}}{12 \cdot (13)^2 \cdot \left(1 - (0.3)^2\right)}$$

6) Flat Width Ratio for Deflection Determination

Open Calculator

$$w_t = \frac{5160}{\sqrt{f_{uc}}}$$

$$13.32306 = \frac{5160}{\sqrt{0.15\text{MPa}}}$$

7) Flat Width Ratio for Safe Load Determination

Open Calculator

$$w_t = \frac{4020}{\sqrt{f_{uc}}}$$

$$10.3796 = \frac{4020}{\sqrt{0.15\text{MPa}}}$$

8) Flat Width Ratio given Depth of Stiffener Lip

Open Calculator

fx $$w_t = \sqrt{\left(\frac{d}{2.8 \cdot t}\right)^6 + 144}$$

ex $$13 = \sqrt{\left(\frac{143.638\text{mm}}{2.8 \cdot 30\text{mm}}\right)^6 + 144}$$

9) Flat Width Ratio given Plate Slenderness Factor

Open Calculator

fx $$w_t = \lambda \cdot \sqrt{\frac{k \cdot E_s}{f_{emax}}} \cdot \left(\frac{1}{1.052}\right)$$

ex $$12.97969 = 0.326 \cdot \sqrt{\frac{2 \cdot 200000\text{MPa}}{228\text{MPa}}} \cdot \left(\frac{1}{1.052}\right)$$

10) Flat Width Ratio of Stiffened Element using Elastic Local Buckling Stress

Open Calculator

fx $$w_t = \sqrt{\frac{k \cdot \pi^2 \cdot E_s}{12 \cdot f_{cr} \cdot \left(1 - \mu^2\right)}}$$

ex $$13 = \sqrt{\frac{2 \cdot \pi^2 \cdot 200000\text{MPa}}{12 \cdot 2139.195\text{MPa} \cdot \left(1 - (0.3)^2\right)}}$$

11) Flat Width Ratio of Stiffened Element using Moment of Inertia

Open Calculator

fx $$w_t = \sqrt{\left(\frac{I_{min}}{1.83 \cdot t^4}\right)^2 + 144}$$

ex $$12.99702 = \sqrt{\left(\frac{7.4E\hat{}6mm^4}{1.83 \cdot (30mm)^4}\right)^2 + 144}$$

12) Minimum Allowable Moment of Inertia

Open Calculator

fx $$I_{min} = 1.83 \cdot \left(t^4\right) \cdot \sqrt{\left(w_t^2\right) - 144}$$

ex $$7.4E\hat{}6mm^4 = 1.83 \cdot \left((30mm)^4\right) \cdot \sqrt{\left((13)^2\right) - 144}$$

13) Nominal Strength using Allowable Design Strength

Open Calculator

fx $$R_n = f_s \cdot R_a$$

ex $$1499.994MPa = 1.8 \cdot 833.33MPa$$

14) Plate Slenderness Factor

Open Calculator

fx $$\lambda = \left(\frac{1.052}{\sqrt{k}}\right) \cdot w_t \cdot \sqrt{\frac{f_{emax}}{E_s}}$$

ex $$0.32651 = \left(\frac{1.052}{\sqrt{2}}\right) \cdot 13 \cdot \sqrt{\frac{228MPa}{200000MPa}}$$

15) Reduction Factor for Cold Form Strength Determination

Open Calculator

fx $$\rho = \frac{1 - \left(\frac{0.22}{\lambda}\right)}{\lambda}$$

ex $$0.997403 = \frac{1 - \left(\frac{0.22}{0.326}\right)}{0.326}$$

Variables Used

- **d** Depth of Stiffener Lip *(Millimeter)*
- E_s Modulus of Elasticity for Steel Elements *(Megapascal)*
- f_b Design Stress *(Kilonewton per Square Meter)*
- f_c Maximum Compressive Stress of Concrete *(Kilonewton per Square Meter)*
- f_{cr} Elastic Local Buckling Stress *(Megapascal)*
- f_{emax} Maximum Compressive Edge Stress *(Megapascal)*
- f_s Safety Factor for Design Strength
- f_{uc} Computed Unit Stress of Cold formed Element *(Megapascal)*
- I_{min} Minimum Area Moment of Inertia *(Millimeter⁴)*
- **k** Local Buckling Coefficient
- R_a Allowable Design Strength *(Megapascal)*
- R_n Nominal Strength *(Megapascal)*
- **t** Thickness of Steel Compression Element *(Millimeter)*
- w_t Flat Width Ratio
- **λ** Plate Slenderness Factor
- **μ** Poission Ratio for Plates
- **ρ** Reduction Factor

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa), Kilonewton per Square Meter (kN/m²)
  Pressure Unit Conversion
- Measurement: **Second Moment of Area** in Millimeter⁴ (mm⁴)
  Second Moment of Area Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- **Cold Formed or Light Weighted Steel Structures Formulas**

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