Important Section Modulus for Various Beams or Shape Sections Formulas PDF

Formulas
Examples
with Units

List of 21
Important Section Modulus for Various Beams or Shape Sections Formulas

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1) Circular Section Formulas ⏏

1.1) Diameter of Circular Section given Distance of Outermost Layer from Neutral Layer Formula ⏏

Evaluate Formula ⏏

Formula
$$d_c = 2 \cdot Y_{max}$$

Example with Units
$$15000\,\text{mm} = 2 \cdot 7500\,\text{mm}$$

1.2) Diameter of Circular Section given Moment of Inertia about Neutral Axis Formula ⏏

Evaluate Formula ⏏

Formula
$$d_c = \left(\frac{64 \cdot I_{circular}}{\pi} \right)^{\frac{1}{4}}$$

Example with Units
$$12.3825\,\text{mm} = \left(\frac{64 \cdot 1154\,\text{mm}^4}{3.1416} \right)^{\frac{1}{4}}$$

1.3) Diameter of Circular Section given Section Modulus Formula ⏏

Evaluate Formula ⏏

Formula
$$d_c = \left(\frac{32 \cdot Z}{\pi} \right)^{\frac{1}{3}}$$

Example with Units
$$63.3841\,\text{mm} = \left(\frac{32 \cdot 25000\,\text{mm}^3}{3.1416} \right)^{\frac{1}{3}}$$

1.4) Distance of Outermost Layer from Neutral Layer in Circular Sections Formula ⏏

Evaluate Formula ⏏

Formula
$$Y_{max} = \frac{d_c}{2}$$

Example with Units
$$180\,\text{mm} = \frac{360\,\text{mm}}{2}$$

1.5) Moment of Inertia about Neutral Axis for Circular Section Formula ⏏

Evaluate Formula ⏏

Formula
$$I_{circular} = \frac{\pi}{64} \cdot d_c^{\,4}$$

Example with Units
$$8.2E{+}8\,\text{mm}^4 = \frac{3.1416}{64} \cdot 360\,\text{mm}^{\,4}$$

1.6) Section Modulus for Circular Section Formula 📲

Formula

$$Z = \frac{\pi}{32} \cdot d_c^{\ 3}$$

Example with Units

$$4.6E{+}6\,\text{mm}^3 = \frac{3.1416}{32} \cdot 360\,\text{mm}^{\ 3}$$

Evaluate Formula 📲

2) Hollow Circular Section Formulas 📲

2.1) Distance of Outermost Layer from Neutral Axis in Hollow Circular Section Formula 📲

Evaluate Formula 📲

Formula

$$Y_{max} = \frac{d_o}{2}$$

Example with Units

$$120\,\text{mm} = \frac{240\,\text{mm}}{2}$$

2.2) Inner Diameter of Hollow Circular Section given Section Modulus Formula 📲

Evaluate Formula 📲

Formula

$$d_i = \left(d_o^{\ 4} - \frac{32 \cdot d_o \cdot Z}{\pi} \right)^{\frac{1}{4}}$$

Example with Units

$$238.887\,\text{mm} = \left(240\,\text{mm}^{\ 4} - \frac{32 \cdot 240\,\text{mm} \cdot 25000\,\text{mm}^3}{3.1416} \right)^{\frac{1}{4}}$$

2.3) Moment of Inertia of Hollow Circular Section Formula 📲

Evaluate Formula 📲

Formula

$$I_{circular} = \frac{\pi}{64} \cdot \left(d_o^{\ 4} - d_i^{\ 4} \right)$$

Example with Units

$$1.6E{+}8\,\text{mm}^4 = \frac{3.1416}{64} \cdot \left(240\,\text{mm}^{\ 4} - 15\,\text{mm}^{\ 4} \right)$$

2.4) Outer Diameter of Hollow Circular Section Formula 📲

Evaluate Formula 📲

Formula

$$d_o = 2 \cdot Y_{max}$$

Example with Units

$$15000\,\text{mm} = 2 \cdot 7500\,\text{mm}$$

2.5) Section Modulus of Hollow Circular Section Formula 📲

Evaluate Formula 📲

Formula

$$Z = \frac{\pi}{32 \cdot d_o} \cdot \left(d_o^{\ 4} - d_i^{\ 4} \right)$$

Example with Units

$$1.4E{+}6\,\text{mm}^3 = \frac{3.1416}{32 \cdot 240\,\text{mm}} \cdot \left(240\,\text{mm}^{\ 4} - 15\,\text{mm}^{\ 4} \right)$$

3) Hollow Rectangular Section Formulas 📲

3.1) Distance of Outermost Layer from Neutral Axis for Hollow Rectangular Sections Formula 📲

Evaluate Formula 📲

Formula

$$Y_{max} = \frac{L_{outer}}{2}$$

Example with Units

$$550\,\text{mm} = \frac{1100\,\text{mm}}{2}$$

3.2) Moment of Inertia for Hollow Rectangular Section Formula ⤴

Formula

$$I_{circular} = \frac{B_{outer} \cdot L_{outer}^{3} - B_{inner} \cdot L_{inner}^{3}}{12}$$

Example with Units

$$4.9E{+}10\,mm^4 = \frac{480\,mm \cdot 1100\,mm^{3} - 250\,mm \cdot 600\,mm^{3}}{12}$$

3.3) Outer Breadth of Hollow Rectangular Section given Section Modulus Formula ⤴

Formula

$$B_{outer} = \frac{6 \cdot Z \cdot L_{outer} + B_{inner} \cdot L_{inner}^{3}}{L_{outer}^{3}}$$

Example with Units

$$40.695\,mm = \frac{6 \cdot 25000\,mm^3 \cdot 1100\,mm + 250\,mm \cdot 600\,mm^{3}}{1100\,mm^{3}}$$

3.4) Outer Length of Hollow Rectangular Section Formula ⤴

Formula

$$L_{outer} = 2 \cdot Y_{max}$$

Example with Units

$$15000\,mm = 2 \cdot 7500\,mm$$

3.5) Section Modulus for Hollow Rectangular Section Formula ⤴

Formula

$$Z = \frac{B_{outer} \cdot L_{outer}^{3} - B_{inner} \cdot L_{inner}^{3}}{6 \cdot L_{outer}}$$

Example with Units

$$8.9E{+}7\,mm^3 = \frac{480\,mm \cdot 1100\,mm^{3} - 250\,mm \cdot 600\,mm^{3}}{6 \cdot 1100\,mm}$$

4) Rectangular Section Formulas ⤴

4.1) Breadth of Rectangular Section given Section Modulus Formula ⤴

Formula

$$B = \frac{6 \cdot Z}{L^{2}}$$

Example with Units

$$0.0667\,mm = \frac{6 \cdot 25000\,mm^3}{1500\,mm^{2}}$$

4.2) Distance of Outermost Layer from Neutral Layer for Rectangular Section Formula ↪

Formula

$$Y_{max} = \frac{L}{2}$$

Example with Units

$$750\,_{mm} = \frac{1500\,_{mm}}{2}$$

4.3) Length of Rectangular Section given Section Modulus Formula ↪

Formula

$$L = \sqrt{\frac{6 \cdot Z}{B}}$$

Example with Units

$$15.1911\,_{mm} = \sqrt{\frac{6 \cdot 25000\,_{mm^3}}{650\,_{mm}}}$$

4.4) Length of Rectangular Section using Distance of Outermost Layer from Neutral Layer Formula ↪

Formula

$$L = 2 \cdot Y_{max}$$

Example with Units

$$15000\,_{mm} = 2 \cdot 7500\,_{mm}$$

4.5) Section Modulus for Rectangular Section Formula ↪

Formula

$$Z = \frac{1}{6} \cdot B \cdot L^2$$

Example with Units

$$2.4E{+}8\,_{mm^3} = \frac{1}{6} \cdot 650\,_{mm} \cdot 1500\,_{mm}{}^2$$

Variables used in list of Section Modulus for Various Beams or Shape Sections Formulas above

- **B** Breadth of Rectangular Section *(Millimeter)*
- **B$_{inner}$** Inner Breadth of Hollow Rectangular Section *(Millimeter)*
- **B$_{outer}$** Outer Breadth of Hollow Rectangular Section *(Millimeter)*
- **d$_c$** Diameter of Circular section *(Millimeter)*
- **d$_i$** Inner Diameter of Hollow Circular Section *(Millimeter)*
- **d$_o$** Outer Diameter of Hollow Circular Section *(Millimeter)*
- **I$_{circular}$** MOI of Area of Circular Section *(Millimeter⁴)*
- **L** Length of Rectangular Section *(Millimeter)*
- **L$_{inner}$** Inner Length of Hollow Rectangle *(Millimeter)*
- **L$_{outer}$** Outer Length of Hollow Rectangle *(Millimeter)*
- **Y$_{max}$** Distance b/w Outermost and Neutral Layer *(Millimeter)*
- **Z** Section Modulus *(Cubic Millimeter)*

Constants, Functions, Measurements used in list of Section Modulus for Various Beams or Shape Sections 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: **Volume** in Cubic Millimeter (mm³) *Volume Unit Conversion* 📤
- Measurement: **Second Moment of Area** in Millimeter⁴ (mm⁴) *Second Moment of Area Unit Conversion* 📤

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