Torque Transmitted by a Hollow Circular Shaft Formulas

List of 16 Torque Transmitted by a Hollow Circular Shaft Formulas

Torque Transmitted by a Hollow Circular Shaft

1) Maximum Shear Stress at Outer Surface given Diameter of Shaft on Hollow Circular Shaft

Open Calculator

fx $$\tau_m = \frac{16 \cdot d_o \cdot T}{\pi \cdot \left(d_o^4 - d_i^4\right)}$$

ex $$-0.195051\text{MPa} = \frac{16 \cdot 14\text{mm} \cdot 4\text{N*m}}{\pi \cdot \left((14\text{mm})^4 - (35\text{mm})^4\right)}$$

2) Maximum Shear Stress at Outer Surface given Total Turning Moment on Hollow Circular Shaft

Open Calculator

fx $$\tau_m = \frac{T \cdot 2 \cdot r_h}{\pi \cdot \left(r_h^4 - r_i^4\right)}$$

ex $$4.8\text{E\^{}-8MPa} = \frac{4\text{N*m} \cdot 2 \cdot 5500\text{mm}}{\pi \cdot \left((5500\text{mm})^4 - (5000\text{mm})^4\right)}$$

3) Maximum Shear Stress at Outer Surface given Turning Force on Elementary Ring

Open Calculator

fx $$\tau_s = \frac{T_f \cdot d_o}{4 \cdot \pi \cdot (r^2) \cdot b_r}$$

ex $$111.4085\text{MPa} = \frac{2000.001\text{N} \cdot 14\text{mm}}{4 \cdot \pi \cdot \left((2\text{mm})^2 \right) \cdot 5\text{mm}}$$

4) Maximum shear stress induced at outer surface given shear stress of elementary ring

Open Calculator

fx $$\tau_s = \frac{d_o \cdot q}{2 \cdot r}$$

ex $$0.389928\text{MPa} = \frac{14\text{mm} \cdot 0.111408\text{MPa}}{2 \cdot 2\text{mm}}$$

5) Maximum Shear Stress Induced at Outer Surface given Turning Moment on Elementary Ring

Open Calculator

fx $$\tau_s = \frac{T \cdot d_o}{4 \cdot \pi \cdot (r^3) \cdot b_r}$$

ex $$111.4085\text{MPa} = \frac{4\text{N*m} \cdot 14\text{mm}}{4 \cdot \pi \cdot \left((2\text{mm})^3 \right) \cdot 5\text{mm}}$$

6) Outer Radius of Shaft given Shear Stress of Elementary Ring

Open Calculator

fx $$r_o = \frac{\tau_s \cdot r}{q}$$

ex $$2000.009\text{mm} = \frac{111.4085\text{MPa} \cdot 2\text{mm}}{0.111408\text{MPa}}$$

7) Outer Radius of Shaft using Turning Force on Elementary Ring

Open Calculator

fx $$r_o = \frac{2 \cdot \pi \cdot \tau_s \cdot \left(r^2\right) \cdot b_r}{T_f}$$

ex $$6.999999\text{mm} = \frac{2 \cdot \pi \cdot 111.4085\text{MPa} \cdot \left((2\text{mm})^2\right) \cdot 5\text{mm}}{2000.001\text{N}}$$

8) Outer Radius of Shaft using Turning Force on Elementary Ring given Turning Moment

Open Calculator

fx $$r_o = \frac{2 \cdot \pi \cdot \tau_s \cdot \left(r^2\right) \cdot b_r}{T}$$

ex $$3500.001\text{mm} = \frac{2 \cdot \pi \cdot 111.4085\text{MPa} \cdot \left((2\text{mm})^2\right) \cdot 5\text{mm}}{4\text{N*m}}$$

9) Radius of Elementary Ring given Shear Stress of Elementary Ring

Open Calculator

fx $$r = \frac{d_o \cdot q}{2 \cdot \tau_s}$$

ex $$0.007\text{mm} = \frac{14\text{mm} \cdot 0.111408\text{MPa}}{2 \cdot 111.4085\text{MPa}}$$

10) Radius of Elementary Ring given Turning Force of Elementary Ring

Open Calculator

fx $$r = \sqrt{\frac{T_f \cdot d_o}{4 \cdot \pi \cdot \tau_s \cdot b_r}}$$

ex $$2\text{mm} = \sqrt{\frac{2000.001\text{N} \cdot 14\text{mm}}{4 \cdot \pi \cdot 111.4085\text{MPa} \cdot 5\text{mm}}}$$

11) Radius of Elementary Ring given Turning Moment of Elementary Ring

Open Calculator

fx $$r = \left(\frac{T \cdot d_o}{4 \cdot \pi \cdot \tau_s \cdot b_r}\right)^{\frac{1}{3}}$$

ex $$2\text{mm} = \left(\frac{4\text{N*m} \cdot 14\text{mm}}{4 \cdot \pi \cdot 111.4085\text{MPa} \cdot 5\text{mm}}\right)^{\frac{1}{3}}$$

12) Shear Stress at Elementary Ring of Hollow Circular Shaft

Open Calculator

fx $$q = \frac{2 \cdot \tau_s \cdot r}{d_o}$$

ex $$31.831\text{MPa} = \frac{2 \cdot 111.4085\text{MPa} \cdot 2\text{mm}}{14\text{mm}}$$

13) Total Turning Moment on Hollow Circular Shaft given Diameter of Shaft

Open Calculator

fx $$T = \frac{\pi \cdot \tau_m \cdot \left(\left(d_o^4 \right) - \left(d_i^4 \right) \right)}{16 \cdot d_o}$$

ex $$\text{-6.6E\^{}-6N*m} = \frac{\pi \cdot 3.2\text{E\^{}-7MPa} \cdot \left(\left((14\text{mm})^4 \right) - \left((35\text{mm})^4 \right) \right)}{16 \cdot 14\text{mm}}$$

14) Total Turning Moment on Hollow Circular Shaft given Radius of Shaft

Open Calculator

fx $$T = \frac{\pi \cdot \tau_m \cdot \left(\left(r_h^4 \right) - \left(r_i^4 \right) \right)}{2 \cdot r_h}$$

ex $$26.50933\text{N*m} = \frac{\pi \cdot 3.2\text{E\^{}-7MPa} \cdot \left(\left((5500\text{mm})^4 \right) - \left((5000\text{mm})^4 \right) \right)}{2 \cdot 5500\text{mm}}$$

15) Turning Force on Elementary Ring

Open Calculator

fx $$T_f = \frac{4 \cdot \pi \cdot \tau_s \cdot r^2 \cdot b_r}{d_o}$$

ex $$2000.001\text{N} = \frac{4 \cdot \pi \cdot 111.4085\text{MPa} \cdot (2\text{mm})^2 \cdot 5\text{mm}}{14\text{mm}}$$

16) Turning Moment on Elementary Ring

Open Calculator

fx $$T = \frac{4 \cdot \pi \cdot \tau_s \cdot \left(r^3\right) \cdot b_r}{d_o}$$

ex $$4.000001\text{N*m} = \frac{4 \cdot \pi \cdot 111.4085\text{MPa} \cdot \left((2\text{mm})^3\right) \cdot 5\text{mm}}{14\text{mm}}$$

Variables Used

- **b_r** Thickness of Ring *(Millimeter)*
- **d_i** Inner Diameter of Shaft *(Millimeter)*
- **d_o** Outer Diameter of Shaft *(Millimeter)*
- **q** Shear Stress at Elementary Ring *(Megapascal)*
- **r** Radius of Elementary Circular Ring *(Millimeter)*
- **r_h** Outer Radius Of Hollow circular Cylinder *(Millimeter)*
- **r_i** Inner Radius Of Hollow Circular Cylinder *(Millimeter)*
- **r_o** Outer Radius of Shaft *(Millimeter)*
- **T** Turning Moment *(Newton Meter)*
- **T_f** Turning Force *(Newton)*
- **τ_m** Maximum Shear Stress on Shaft *(Megapascal)*
- **τ_s** Maximum Shear Stress *(Megapascal)*

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: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion
- Measurement: **Stress** in Megapascal (MPa)
  Stress Unit Conversion

Check other formula lists

- **Deviation of Shear Stress produced in a Circular Shaft subjected to Torsion Formulas**
- **Expression for Strain Energy stored in a Body Due to Torsion Formulas**
- **Expression for Torque in terms of Polar Moment of Inertia Formulas**
- **Flanged Coupling Formulas**
- **Polar Modulus Formulas**
- **Torque Transmitted by a Hollow Circular Shaft Formulas**

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