

Summary (Torsion)

Shape	Name	τ	$d\phi/dz$	ϕ	J	Remarks
	solid circular	$\frac{T r}{J}$	$\frac{T}{J G}$	$\frac{T L}{J G}$	$\frac{\pi r^4}{2}$	<ul style="list-style-type: none"> $\tau_{max} @ Y_{max} = Y_{out}$
	hollow circular	$\frac{T r}{J}$	$\frac{T}{J G}$	$\frac{T L}{J G}$	$\frac{\pi}{2} (r_o^4 - r_i^4)$	<ul style="list-style-type: none"> $\tau_{max} @ Y_{max} = Y_{out}$
	thin-walled closed	$\frac{T}{2tA_m}$	$\frac{T}{4GA_m^2} \sum_{i=1}^n \frac{S_i}{t_i}$	$\frac{T L}{4GA_m^2} \sum_{i=1}^n \frac{S_i}{t_i}$	N.A.	<ul style="list-style-type: none"> A_m = area contained within mean perime (NOT material area) e.g. $\tau_{max} @ t_{min}$ for rectangular section, formula given for τ_{max} @ midpoint of long side \rightarrow $b > a$ $b >> h$ $\frac{b}{h} > 10$ formulas similar to circular section except J
	solid noncircular	depends on shape $\frac{T}{\alpha b a^2}$ for rectangle	depends on shape $\frac{T}{\beta b a^3 G}$ for rectangle	depends on shape $\frac{T L}{\beta b a^3 G}$ for rectangle	N.A.	<ul style="list-style-type: none"> for rectangular section, formula given for τ_{max} @ midpoint of long side \rightarrow $b > a$ $b >> h$ $\frac{b}{h} > 10$ formulas similar to circular section except J
	narrow rectangle	$\frac{T h}{J}$	$\frac{T}{J G}$	$\frac{T L}{J G}$	$\frac{1}{3} b h^3$	<ul style="list-style-type: none"> $\tau_{max} @ h_{max}$ h is the smaller dimension in each segment formulas similar to circular and narrow rectangular sections except J = $\sum_{i=1}^n \frac{1}{3} b_i h_i^3$ n = number of segments
	series of narrow rectangles (section composed of several long narrow rectangles)	$\frac{T h_i}{J}$	$\frac{T}{J G}$	$\frac{T L}{J G}$	$\sum_{i=1}^n J_i$ $J_i = \frac{1}{3} b_i h_i^3$ (as above)	<ul style="list-style-type: none"> $\tau_{max} @ h_{max}$ h is the smaller dimension in each segment formulas similar to circular and narrow rectangular sections except J = $\sum_{i=1}^n \frac{1}{3} b_i h_i^3$ n = number of segments