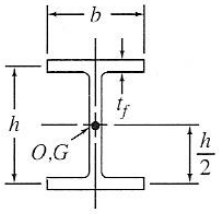
TABLE A2 TORSIONAL PROPERTIES

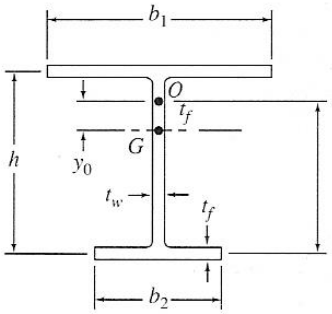
O = shear center $\quad J$ = torsion constant, $\quad C_w$ = warping constant
G = centroid $\quad I_p$ = polar moment of inertia about shear center



$$J = \tfrac{1}{3}(2bt_f^3 + ht_w^3)$$

$$C_w = \frac{I_f h^2}{2} = \frac{t_f b^3 h^2}{24} = \frac{h^2 I_y}{4}$$

$$I_p = I_x + I_y$$

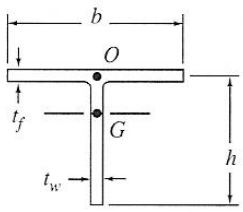


$$e = h\frac{b_1^3}{b_1^3 + b_2^3}$$

$$J = \tfrac{1}{3}(b_1 t_f^3 + b_2 t_f^3 + ht_w^3)$$

$$C_w = \frac{t_f h^2}{12}\left(\frac{b_1^3 b_2^3}{b_1^3 + b_2^3}\right)$$

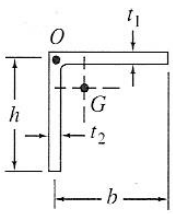
$$I_p = I_y + I_x + Ay_0^2$$



$$J = \tfrac{1}{3}(bt_f^3 + ht_w^3)$$

$$C_w = \frac{1}{36}\left(\frac{b^3 t_f^3}{4} + h^3 t_w^3\right)$$

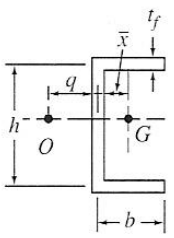
$\approx$ zero for small t



$$J = \tfrac{1}{3}(bt_1^3 + ht_2^3)$$

$$C_w = \frac{1}{36}(b^3 t_1^3 + h^3 t_2^3)$$

$\approx$ zero for small t



$$J = \tfrac{1}{3}(2bt_f^3 + ht_w^3)$$

$$C_w = \frac{t_f b^3 h^2}{12}\left(\frac{3bt_f + 2ht_w}{6bt_f + ht_w}\right) = \frac{h^2}{4}(I_y + A\bar{x}^2 - q\bar{x}A)$$

$$q = \frac{th^2 b^2}{4I_x}$$