

TEMA 2**DATOS****IPE 400**

$$Jx_IPE := 23130 \text{ cm}^4$$

$$Jy_IPE := 1320 \text{ cm}^4$$

$$d_IPE := 400 \text{ mm}$$

$$bf_IPE := 180 \text{ mm}$$

$$tf_IPE := 13,5 \text{ mm}$$

$$tw_IPE := 8,6 \text{ mm}$$

$$Ag_IPE := 84,5 \text{ cm}^2$$

UPN 300

$$Jx_UPN := 8030 \text{ cm}^4$$

$$Jy_UPN := 495 \text{ cm}^4$$

$$d_UPN := 300 \text{ mm}$$

$$bf_UPN := 100 \text{ mm}$$

$$tf_UPN := 15 \text{ mm}$$

$$tw_UPN := 10 \text{ mm}$$

$$Ag_UPN := 58,8 \text{ cm}^2$$

$$ey_UPN := 2,70 \text{ cm}$$

$$P := 200 \text{ kN}$$

$$\tau B_adm := 15 \frac{\text{kN}}{\text{cm}^2}$$

$$dB := 1 \text{ in} = 25,4 \text{ mm}$$

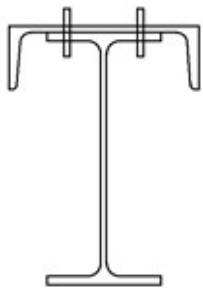
$$\eta := 2$$

$$\lambda := 422 \text{ mm}$$

$$d_IPE + tw_UPN = 410 \text{ mm}$$

$$zg_IPE := \frac{d_IPE}{2} = 200 \text{ mm}$$

$$zg_UPN := d_IPE + tw_UPN - ey_UPN = 383 \text{ mm}$$



$$zG := \frac{\frac{d_IPE}{2} \cdot Ag_IPE + (d_IPE + tw_UPN - ey_UPN) \cdot Ag_UPN}{Ag_IPE + Ag_UPN}$$

Medido desde la base:

$$zG = 275,09 \text{ mm}$$

$$zG := 275 \text{ mm}$$

$$zG - \frac{d_IPE}{2} = 75,09 \text{ mm}$$

$$d_IPE + tw_UPN - ey_UPN - zG = 107,91 \text{ mm}$$

$$Jy := Jx_IPE + \left(\left(zG - \frac{d_IPE}{2} \right)^2 \cdot Ag_IPE \right) + Jy_UPN + \left((d_IPE + tw_UPN - ey_UPN - zG)^2 \cdot Ag_UPN \right)$$

$$Jy = 35236,5454 \text{ cm}^4$$

b) Tensión máxima (en G --> S máx).

$$S1 := bf_IPE \cdot tf_IPE \cdot \left(zG - \frac{tf_IPE}{2} \right) = 652,0663 \text{ cm}^3$$

$$S2 := tw_IPE \cdot (zG - tf_IPE) \cdot \left(zG - \frac{d_IPE}{2} \right) = 168,9281 \text{ cm}^3$$

$$Smax := S1 + S2 = 820,9943 \text{ cm}^3$$

$$\tau_max := \frac{P \cdot Smax}{Jy \cdot tw_IPE} = 5,4185 \frac{\text{kN}}{\text{cm}^2}$$

c) Resistencia de los bulones.

$$S_UPN := Ag_UPN \cdot (d_IPE + tw_UPN - ey_UPN - zG) = 634,5107 \text{ cm}^3$$

$$F_S := \frac{P \cdot S_UPN}{Jy} \cdot \lambda = 151,9806 \text{ kN}$$

$$F_R := \tau B_adm \cdot \left(\frac{\pi \cdot dB^2}{4} \right) \cdot \eta = 152,0122 \text{ kN}$$

$$\lambda := \frac{Jy}{P \cdot S_UPN} \cdot \tau B_adm \cdot \left(\frac{\pi \cdot dB^2}{4} \right) \cdot \eta = 422,088 \text{ mm}$$

$$F_S < F_R = 1$$

Se verifica la condición de resistencia de los bulones.