

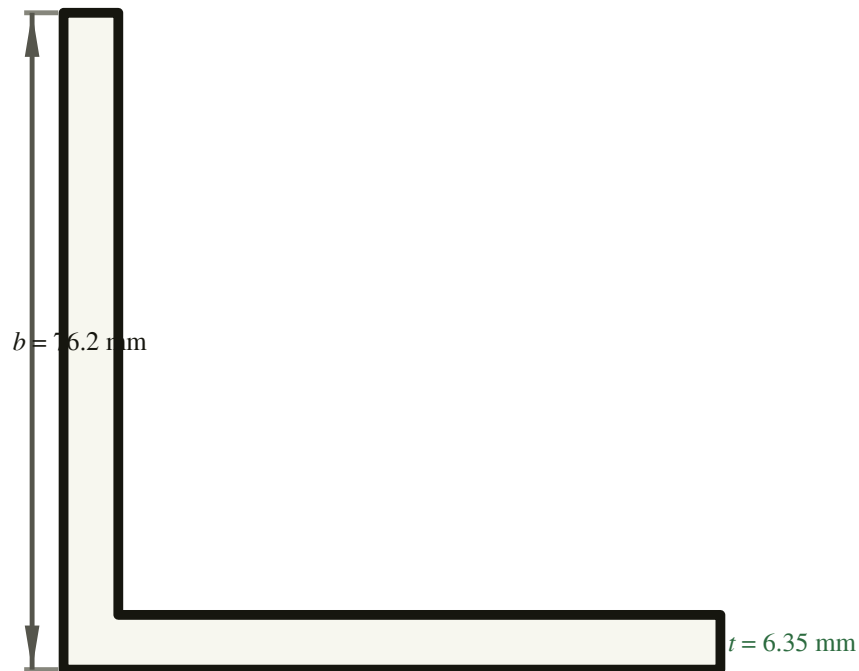
Single angle in compression

An equal-leg angle brace, concentric or bolted through one leg, to CSA S16 and AISC F10.

Inputs

Symbol	Value	Unit	Description
C_f	20	kN	Factored axial compression
L	1500	mm	Length
k	1		Effective length factor, bolted through one leg
F_y	300	MPa	Yield strength
t_p	10	mm	Gusset thickness, bolted through one leg
e	45	mm	Bolt gauge from the heel, bolted through one leg
case	Concentric, Cl. 13.3.2		Load
section	L76x76x6.4		Angle

Figures



The angle's cross-section to scale, with the gusset and bolt line when bolted through one leg.

Checks

Name	Check	Result
Axial ok	$C_f \leq C_r \Rightarrow 20 \text{ kN} \leq 91.79 \text{ kN}$	PASS

Results

Quantity	Description	Value	Unit
C_r	Factored compressive resistance	91.79	kN

Derivation

$$\phi = 0.9$$

Resistance factor | S16 Cl. 13.1

$$E = 200 \text{ GPa}$$

$$G = 77 \text{ GPa}$$

$$b = 76.2 \text{ mm}$$

Depth of section or height of vertical leg

$$t = 6.35 \text{ mm}$$

Thickness of flange

$$A_0 = 927 \text{ mm}^2$$

Cross-sectional area

$$\begin{aligned}\lambda_l &= \frac{b}{t} \\ &= \frac{76.2 \text{ mm}}{6.35 \text{ mm}} \\ &= 12\end{aligned}$$

$$\begin{aligned}\lambda_3 &= \frac{250}{\sqrt{\frac{F_y}{1 \text{ MPa}}}} \\ &= \frac{250}{\sqrt{\frac{300 \text{ MPa}}{1 \text{ MPa}}}} \\ &= 14.43\end{aligned}$$

S16 Cl. 11, Table 1, legs of angles

Branch: $\lambda_l > \lambda_3$ did not hold

$$\begin{aligned} A_e &= 1 \cdot A_0 \\ &= 1 \cdot 927 \text{ mm}^2 \\ &= 927 \text{ mm}^2 \end{aligned}$$

$$r_x = 23.6 \text{ mm}$$

Radius of gyration about axis XX

Branch: $\frac{L}{r_x} \leq 80$ held

$$\begin{aligned} \text{KL}_r &= 72 + \frac{0.75 \cdot L}{r_x} && \text{S16 Cl. 13.3.2.2 a)} \\ &= 72 + \frac{0.75 \cdot 1500 \text{ mm}}{23.6 \text{ mm}} \\ &= 119.7 \end{aligned}$$

$$\begin{aligned} \lambda_c &= \text{KL}_r \cdot \sqrt{\frac{F_y}{1.974 \text{ TPa}}} \\ &= 119.7 \cdot \sqrt{\frac{300 \text{ MPa}}{1.974 \text{ TPa}}} \\ &= 1.475 \end{aligned}$$

$$\begin{aligned} f_s &= F_y \cdot \left(1 + \lambda_c^{2 \cdot 1.34}\right)^{\frac{-1}{1.34}} && \text{S16 Cl. 13.3.1, n} = 1.34 \\ &= 300 \text{ MPa} \cdot \left(1 + 1.475^{2 \cdot 1.34}\right)^{\frac{-1}{1.34}} \\ &= 110 \text{ MPa} \end{aligned}$$

$$\begin{aligned} C_r &= \phi \cdot A_e \cdot f_s \\ &= 0.9 \cdot 927 \text{ mm}^2 \cdot 110 \text{ MPa} \\ &= 91.79 \text{ kN} \end{aligned}$$