

$$\text{Stress_area} = 84 \text{ mm}^2$$

$$\text{Dia} = 12 \text{ mm}$$

$$\text{Yield} = 640 \text{ MPa}$$

$$\text{Utilisation} = 0.67$$

$$\text{Load} = 40 \text{ kg} \cdot 2$$

$$\text{Allowable} = \text{Yield} \cdot \text{Utilisation}$$

$$\text{Load} = 784.5 \text{ N}$$

$$\text{Allowable} = 428.8 \text{ MPa}$$

$$\delta(P, l, E, I) := \frac{P \cdot l^3}{3 \cdot E \cdot I}$$

$$I_{12} := \frac{\pi \cdot \text{Dia}^4}{64}$$

$$E = 210 \text{ GPa}$$

$$Y_{12} := \frac{\text{Dia}}{2}$$

$$l = 50 \text{ mm}$$

Deflection, δ

$$\delta_{\max} := \delta(\text{Load}, 80 \text{ mm}, E, I_{12})$$

$$\delta_{\max} = 0.6 \text{ mm}$$

Bending Stress, σ

$$\text{BM} := \text{Load} \cdot l$$

$$\text{BM} = 39.2 \text{ N m}$$

$$\sigma := \frac{\text{BM} \cdot Y_{12}}{I_{12}}$$

$$\sigma = 231.2 \text{ MPa}$$

Tension

$$\text{Load} = 784.5 \text{ N}$$

$$\mu = 0.09$$

$$\text{Tension} := \frac{\text{Load}}{\mu}$$

$$\text{Tension} = 8.7 \text{ kN}$$