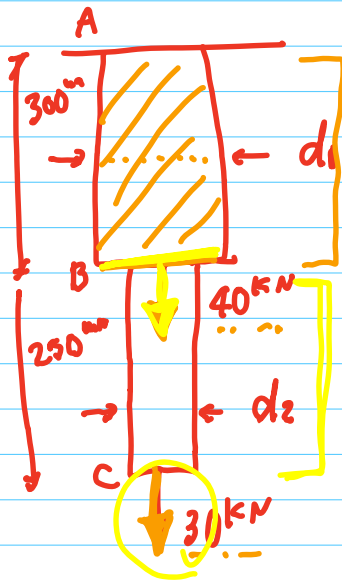


Solution of Mini quiz 5



Two solid cylindrical rods AB and BC are welded together at B and loaded as shown.

Knowing that the average normal stress must not exceed 175 MPa in rod AB and 150 MPa in rod BC,

determine the smallest allowable values of d_1 and d_2 .

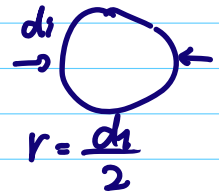
[A.B] $\sigma = \frac{P}{A} \rightarrow P = 40 \text{ kN} + 30 \text{ kN} = 70 \text{ kN} = 70000 \text{ N}$

* MPa = N/mm²

$$\sigma_{all} = 175 \text{ MPa}$$

$$A = \left(\frac{d_1}{2}\right)^2 \cdot \pi$$

$$\sigma_{all} = \frac{P}{A} \quad 175 \text{ MPa} = \frac{70000 \text{ N}}{A}$$



$$A = \frac{70000 \text{ N}}{175 \text{ N/mm}^2}$$

$$\frac{d_1^2}{4} \cdot \pi = \frac{70000 \text{ N}}{175 \text{ N/mm}^2}$$

$$d_1^2 = \frac{70000 \text{ N} \cdot 4}{175 \text{ N/mm}^2 \cdot \pi}$$


$$d_1 = 22.56 \text{ mm} = 22.6 \text{ mm}$$

$$d_1 = \sqrt{\frac{70000 \cdot 4}{175 \cdot \pi}}$$

$$[BC] \quad \sigma = \frac{P}{A}$$

$$P = 30 \text{ kN} = 30000 \text{ N}$$

$$\sigma_{\text{all}} = 150 \text{ MPa}$$

$$A = \left(\frac{d_2}{2}\right)^2 \cdot \pi$$


A hand-drawn diagram of a circle representing a cross-section. The diameter is labeled as d_2 . Two arrows point from the left and right sides towards the center of the circle, indicating the diameter measurement.

$$150 \text{ N/mm}^2 = \frac{30000 \text{ N}}{\left(\frac{d_2^2}{4}\right) \pi}$$

$$\boxed{15.9} \text{ Ok}$$

$$d_2 = \sqrt{\frac{30000 \text{ N} \cdot 4}{150 \text{ N/mm}^2 \cdot \pi}} = 15.96 = 16.0 \text{ mm}$$

↑