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Solid shaft

$$P = 20 \text{ kW}$$

$$f = 20 / \text{s}$$

$$d = ?$$

$$\tau_{\text{max}} = 40 \text{ MN/m}^2$$

$$\theta = 6^\circ$$

$$L = 3 \text{ m}$$

$$G = 83 \text{ GN/m}^2$$

Soln:

$$P = T \cdot \omega$$

$$= T \cdot 2\pi f$$

$$T = \frac{P}{2\pi f} = \frac{20 \times 10^3}{2\pi \times 20} = 1590 \text{ N}\cdot\text{m}$$

$$T = \frac{16T}{\pi d^3} \quad / \quad 40 \times 10^6 = \frac{16 \times 1590}{\pi d^3}$$

$$d = 58.7 \text{ mm}$$

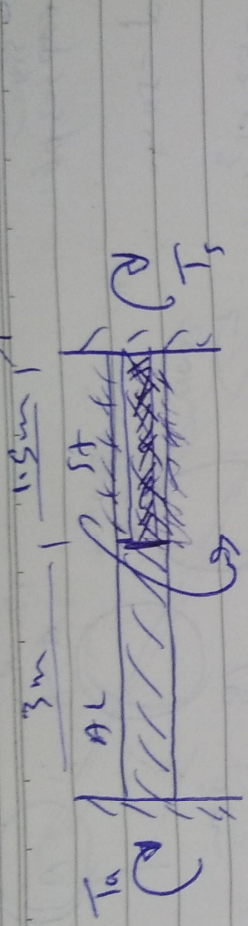
$$\theta = \frac{T \cdot L}{GJ}$$

$$6 \times \frac{1}{57.3} = \frac{1590 \times 3}{83 \times 10^9 \times J} \left(\frac{\pi}{32} d^4 \right)$$

$$d = 48.6 \text{ mm}$$

$$\therefore d = 58.7 \text{ mm}$$

سجل
exp 302 p 80



solid study
 $T_a, T_s = ?$

AL $T = 1 \text{ kW} \cdot \text{m}$
St

$d = 75 \text{ mm}$

$d = 50 \text{ mm}$

$G = 28 \times 10^9 \text{ N/m}^2$

$G = 83 \times 10^9 \text{ N/m}^2$

$T = 1000 \text{ N} \cdot \text{m}$ applied at joint two segments

$T_{\text{max}} = 1$

$T_s + T_a = T = 1000$ — D

$\theta = \theta_a$

$$\left(\frac{T L}{G J}\right)_s = \left(\frac{T L}{G J}\right)_a$$

$$\frac{T_s \times 1.5}{\frac{\pi}{32} (0.075)^4 \times 83 \times 10^9} = \frac{T_a \times 3}{\frac{\pi}{32} (0.075)^4 \times 28 \times 10^9}$$

$T_s = 1.17 T_a$ — D

$$T_a = \frac{16 \times 461}{\pi (0.075)^3} = 5.57 \times 10^6 \text{ N/m}^2$$

$T_s = 539 \text{ N} \cdot \text{m}$

$$T_s = \frac{16 \times 539}{\pi (0.075)^3} = 2.2 \times 10^6 \text{ N/m}^2$$

$T_a = 461 \text{ N} \cdot \text{m}$

$$\tau = \frac{16 T}{\pi d^3} = 2.2 \text{ MN/m}^2$$