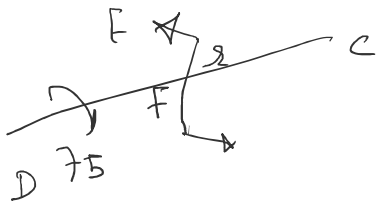
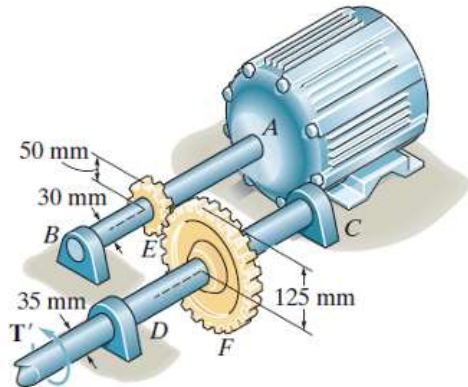
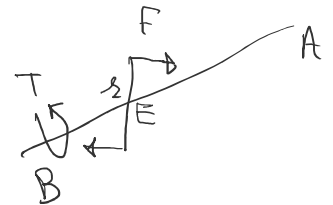


•5-13. If the applied torque on shaft CD is $T' = 75 \text{ N} \cdot \text{m}$, determine the absolute maximum shear stress in each shaft. The bearings B , C , and D allow free rotation of the shafts, and the motor holds the shafts fixed from rotating.



$$\begin{aligned} \sum T = 0; \quad 75 - (F \times 0.05) &= 0 \\ F &= \frac{75}{0.05} = 1500 \text{ N} \end{aligned}$$

$$\Rightarrow F = 1500 \text{ N}$$



$$\begin{aligned} \sum T = 0 \\ \Rightarrow F \times 0.05 - T &= 0 \end{aligned}$$

$$0.05 = 0.05 \text{ m}$$

$$F = 1500 \text{ N}$$

$$\Rightarrow 1500 \times 0.05 = T$$

$$\Rightarrow T = 75 \text{ N} \cdot \text{m}$$

Max shear stresses on AE & CD;

we know:

$$\frac{\tau_{\max}}{R} = \frac{T_{\max}}{J} \quad [\text{Torsion formula}]$$

$$\Rightarrow \tau_{AE, max} = \frac{T_{max, AE} \times R_{AE}}{J_{AE}} = \frac{30 \times 0.015}{\frac{\pi}{2} \times 0.015^4} = 5.66 \text{ MPa}$$

similarly :

$$\tau_{CD, max} = \frac{75 \times 0.0175}{\frac{\pi}{2} \times 0.0175^4} = 8.91 \text{ MPa}$$

This problem was solved by Civil Thinking (<https://civilthinking.com>)

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