Torsion in Shafts. Question 5-46 Solution

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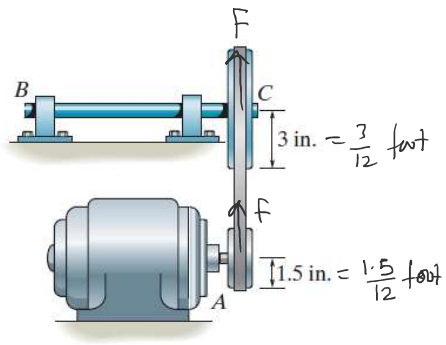

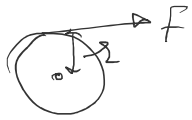

$T = f \times r \Rightarrow f = T/r$

$T = \frac{\text{Power}}{\text{Ang. velocity}} = \frac{15\,hP \times 550}{2\pi \times \frac{180}{60}} = 275/2\pi$ lb.ft

$\Rightarrow f = T/r_A = \frac{275/2\pi}{1.5/12} = 1100/\pi$ lb

$T_c = f \times r_c = 1100/\pi \times \frac{3}{12} = 275/\pi$ lb.ft $\times 12 =$ **1050.42 lb.inch**

$\frac{T_{BC}}{r_{BC}} = \frac{T_c}{J_{BC}}$

$\Rightarrow \frac{12 \times 10^3}{d/2} = \frac{1050.42}{\frac{\pi}{2}\left(\frac{d}{2}\right)^4}$

$\Rightarrow d = 0.764$ inch = Minimum dia.

have to see d_{min} in $\frac{1}{8}$ th factor.

$\frac{6}{8} = 0.75 < 0.764 \Rightarrow$ Not good

$\frac{7}{8} = 0.875 > 0.764 \Rightarrow$ good

$\therefore \frac{7}{8}$ inch is the correct answer.

i know this solution is hard to understand if you are a beginner. contact Civil Thinking if you need more help!