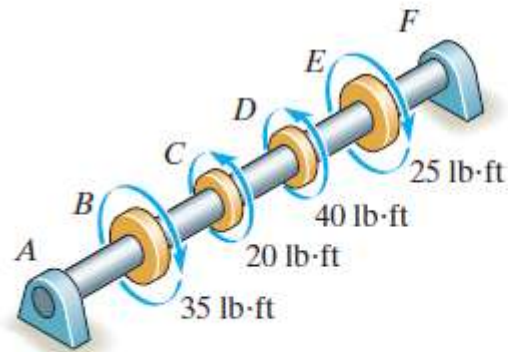**5–6.** The solid shaft has a diameter of 0.75 in. If it is subjected to the torques shown, determine the maximum shear stress developed in regions *BC* and *DE* of the shaft. The bearings at *A* and *F* allow free rotation of the shaft.

Since the bearings at A and F are free, ∴ the internal torques are equal to Applied torques.

Torque Equation:

$$\frac{\tau_{max}}{R} = \frac{T_{max}}{J}$$

$$\Rightarrow \tau_{max} = \frac{T_{max,\,BC}}{J} \times R$$

$$\Rightarrow \tau_{BC,max} = \frac{T_{max,BC}}{J} \times R$$

$$= \frac{35 \times 12 \times 0.0375}{\frac{\pi}{2}(0.375)^4} = 5.07 \, ksi$$

Similarly:

$$\tau_{DE,max} = \frac{25 \times 12 \times 0.375}{\frac{\pi}{2}(0.375)^4} = 3.62 \, ksi$$

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