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so many fake sites. this is the first one which worked! Many thanks

8-25.  
The drill handle in the wall and is subjected to the torque and force shown. Determine the state of stress at point B on the inner surface of the drill for section a-a.

**SOLUTION**  
Internal Forceings: Consider the equilibrium of the free-body diagram of the drill segment between Fig. a.

$$\sum F_x = 0; N - 10\left(\frac{4}{5}\right) = 0 \quad N = 120\text{ N}$$

$$\sum F_y = 0; 10\left(\frac{3}{5}\right) - V = 0 \quad V = 60\text{ N}$$

$$\sum M = 0; 20 - F = 0 \quad F = 20\text{ N}\cdot\text{m}$$

$$\sum M = 0; -10\left(\frac{4}{5}\right)(10) + 10\left(\frac{3}{5}\right)(125) + M = 0$$

$$M = 23\text{ N}\cdot\text{m}$$

**Section Properties:** The cross-sectional area, the moment of inertia about the  $x$  axis, and the polar moment of inertia of the drill cross-section are

$$A = \pi(60\text{ mm})^2 = 25131\text{ mm}^2$$

$$I_x = \frac{\pi}{4}(60\text{ mm})^4 = 634956\text{ mm}^4$$

$$J = \frac{\pi}{2}(60\text{ mm})^4 = 634956\text{ mm}^4$$

Referring to Fig. a,  $Q_B$  is

$$Q_B = \bar{y}'A' = \frac{60(60)}{2}\left[\frac{\pi}{4}(60\text{ mm})^2\right] = 63330\text{ mm}^3$$

**Normal Stress:** The normal stress is a combination of axial and bending stress. Thus,

$$\sigma = \frac{N}{A} \pm \frac{My}{I_x}$$

For point B,  $y = 0$ . Thus,

$$\sigma_B = \frac{120}{25131} = 0 = -1.52\text{ MPa} = 1.52\text{ MPa (C)} \quad \text{Ans.}$$

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