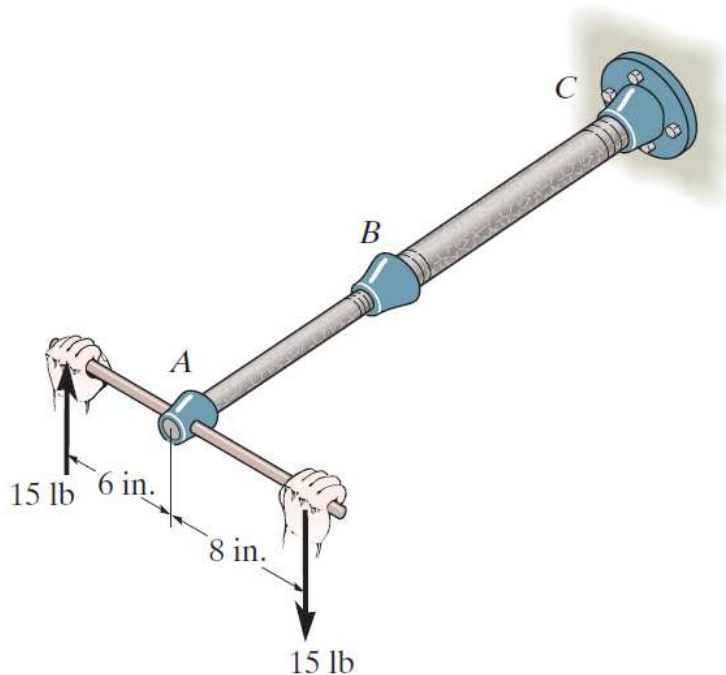


5–11. The assembly consists of two sections of galvanized steel pipe connected together using a reducing coupling at *B*. The smaller pipe has an outer diameter of 0.75 in. and an inner diameter of 0.68 in., whereas the larger pipe has an outer diameter of 1 in. and an inner diameter of 0.86 in. If the pipe is tightly secured to the wall at *C*, determine the maximum shear stress developed in each section of the pipe when the couple shown is applied to the handles of the wrench.



$$T = (15 \text{ lb} \times 6 \text{ in}) + (15 \text{ lb} \times 8 \text{ in})$$

$$\Rightarrow T = 15 (14) = 210 \text{ lb} \cdot \text{inch}$$

Torque Equation:

$$\frac{\tau}{R} = \frac{T}{J}$$

$$\Rightarrow \frac{\tau_{AB}}{R_{AB}} = \frac{T_{AB}}{J_{AB}} = \frac{210}{\frac{\pi}{2} \left(\left(\frac{0.75}{2} \right)^4 - \left(\frac{0.68}{2} \right)^4 \right)}$$

\swarrow $\frac{0.75}{2}$

$$\Rightarrow \tau_{AB} = 7.82 \text{ ksi}$$

$$\frac{\tau_{BC}}{R_{BC}} = \frac{T_{BC}}{J_{BC}} = \frac{210 \times 0.5}{\frac{\pi}{2} (0.5^4 - 0.43^4)} = 2.36 \text{ ksi}$$

$$\Rightarrow \tau_{BC} = 2.36 \text{ ksi}$$

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

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