

Known:

Material 12L14 Steel

$$S_y = 60,000 \text{ psi}$$

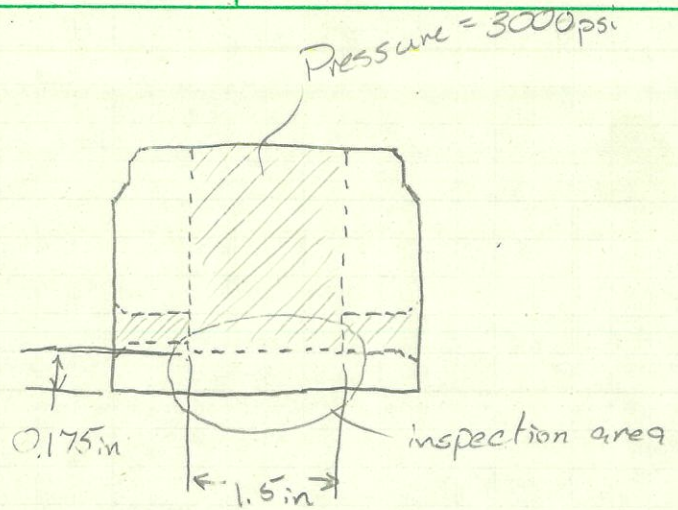
$$E = 28,000 \text{ ksi}$$

$$\nu = 0.28$$

$$t = 0.175$$

$$d = 1.5 \text{ in}, r = 0.75 \text{ in}$$

$$P_{\max} = 3000 \text{ psi}$$

Find:

$$\sigma_{\max} = ?$$

Analysis:

$$D = \frac{Et^3}{12(1-\nu^2)} = \text{plate constant}$$

$$= \frac{28(10^6)(0.175^3)}{12(1-0.28^2)} = \frac{150,062.5}{11.06} = 13,569$$

$$y_c = \frac{-Pr}{64D} \cdot \frac{5+\nu}{1+\nu} = \frac{-3000(0.75)}{64(13,569)} \cdot \frac{5+0.28}{1+0.28} = -0.011 \text{ in}$$

$$M_{\max} = M_c = \frac{P \cdot r^2}{16} (3+\nu) = \frac{3000(0.75)^2}{16} = 105.5 \text{ psi}$$

$$\sigma_{\max} = \frac{6M_c}{t^2} = \frac{6(105.5)}{0.175^2} = 20,663 \text{ psi}$$

Conclusion:

with $\sigma_{\max}$ at approximately $\frac{1}{3} S_y$, there should never be a failure of the end cap due to internal pressure.