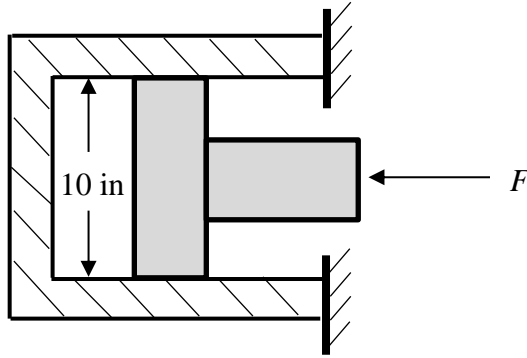


5-6. Force F is exerting on the piston of a thin-walled cylinder as shown below. The diameter of the piston is 10 in, and the wall has a thickness of 3 in. If the internal pressure caused by F follows $p \sim N(70, 7^2)$ psi . Determine the distribution of the Hoop stress and longitudinal stress developed in the cylinder.



Solution:

Hoop Stress:

$$s_1 = \frac{pr}{t} = \left(\frac{10/2}{3} \right) p = 1.67p$$

Since $p \sim N(70, 7^2)$ psi , s_1 also follows a normal distribution, and

$$\mu_{s_1} = 1.67\mu_p = 1.67(70) = 116.9 \text{ psi}$$

$$\sigma_{s_1} = 1.67\sigma_p = 1.67(7) = 11.7 \text{ psi}$$

Thus, s_1 follows a normal distribution $s_1 \sim N(116.9, 11.7^2)$ MPa .

Ans.

Longitudinal stress:

$$s_2 = \frac{pr}{2t} = 0.835p$$

Thus, s_2 also follows a normal distribution, and

$$\mu_{s_2} = 0.835\mu_p = 0.835(70) = 58.45 \text{ psi}$$

$$\sigma_{s_2} = 0.835\sigma_p = 0.835(7) = 5.85 \text{ psi}$$

Thus, s_1 follows a normal distribution $s_1 \sim N(58.45, 5.85^2)$ psi .

Ans.