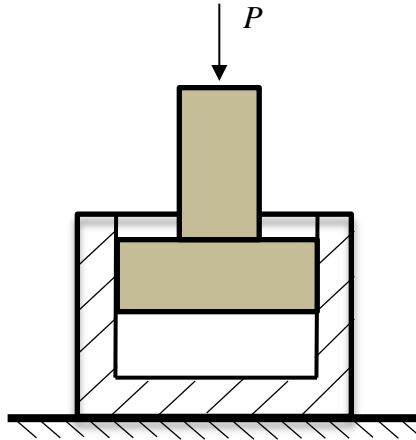


5-5. Force  $P \sim N(3, 0.3^2)$  kN is exerting on the piston of a cylinder as shown in the figure. The diameter of the piston is 100 mm, and the cylinder has a wall thickness of 3 mm. Determine the distribution of the Hoop stress developed in the cylinder.



**Solution:**

**Hoop Stress:** Since  $\frac{r}{t} = \frac{(100/2)}{3} = 16.67 > 10$ , then thin wall analysis can be used. Thus, the hoop stress is

$$s_1 = \frac{pr}{t} = \frac{P}{A} \frac{r}{t} = \frac{P}{3.14(0.1/2)^2} (16.67) = 2123P$$

Since  $P \sim N(3, 0.3^2)$  kN,  $s_1$  also follows a normal distribution, and

$$\mu_{s_1} = 2123\mu_p = 2123(3 \times 10^3) = 6.37 \text{ MPa}$$

$$\sigma_{s_1} = 2123\sigma_p = 2123(0.3 \times 10^3) = 0.64 \text{ MPa}$$

Thus,  $s_1$  follows a normal distribution  $s_1 \sim N(6.37, 0.64^2)$  MPa.

**Ans.**