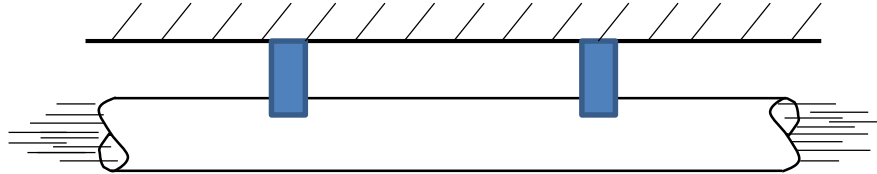6-2. The inner diameter and thickness of an open water pipe are 6 in and 0.3 in, respectively. If the pipe carries flowing water at a pressure of $p \sim N(80, 8^2)$ psi, determine the distribution of the Hoop stress and Longitudinal stress in the walls of the pipe.

Solution:

Hoop Stress:

$$s_1 = \frac{pr}{t} = \frac{p(6/2)}{0.3} = 10p$$

Since $p \sim N(80, 8^2)$ psi, s_1 also follows a normal distribution, and

$$\mu_{s_1} = 10\mu_p = 10(80) = 800 \text{ psi}$$

$$\sigma_{s_1} = 10\sigma_p = 10(8) = 80 \text{ psi}$$

Thus, s_1 follows a normal distribution $s_1 \sim N(800, 80^2)$ psi .   **Ans.**

Longitudinal stress: Since the pipe has open ends, there is no longitudinal stress.   **Ans.**