8.42

8.42 Water flows through a 6-in.-diameter horizontal pipe at a rate of 2.0 cfs and a pressure drop of 4.2 psi per 100 ft of pipe. Determine the friction factor.

For a horizontal pipe $\Delta p = f \frac{l}{D} \frac{1}{2} \rho V^2$

where $V = \frac{Q}{A} = \frac{2.0 \text{ ft}^3/\text{s}}{\frac{\pi}{4}\left(\frac{6}{12} \text{ ft}\right)^2} = 10.2 \text{ ft/s}$

Thus,

$$f = \frac{2D\Delta p}{\rho l V^2} = \frac{2\left(\frac{6}{12} \text{ ft}\right)\left(4.2 \times 144 \frac{\text{lb}}{\text{ft}^2}\right)}{\left(1.94 \frac{\text{slugs}}{\text{ft}^3}\right)(100 \text{ ft})\left(10.2 \frac{\text{ft}}{\text{s}}\right)^2} = \underline{\underline{0.0300}}$$