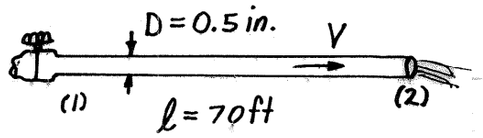
8.35

8.35 A 70-ft-long, 0.5-in.-diameter hose with a roughness of $\varepsilon = 0.0009$ ft is fastened to a water faucet where the pressure is p_1. Determine p_1 if there is no nozzle attached and the average velocity in the hose is 6 ft/s. Neglect minor losses and elevation changes.



$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2 + f\frac{\ell}{D}\frac{V^2}{2g}$, where $z_1 = z_2$, $V_1 = V_2 = V = 6\ \frac{ft}{s}$, and $p_2 = 0$

Thus,

$$p_1 = f\frac{\ell}{D}\frac{1}{2}\rho V^2 \qquad (1)$$

From Fig. 8.20 with $\frac{\varepsilon}{D} = \frac{0.0009\ ft}{\left(\frac{0.5}{12}\ ft\right)} = 2.16 \times 10^{-2}$

and

$Re = \frac{VD}{\nu} = \frac{(6\ \frac{ft}{s})(\frac{0.5}{12}\ ft)}{1.21 \times 10^{-5}\ \frac{ft^2}{s}} = 2.07 \times 10^4$ we obtain $f = 0.052$

Hence, from Eq. (1)

$p_1 = (0.052)\frac{70\ ft}{\left(\frac{0.5}{12}\ ft\right)}\frac{1}{2}\left(1.94\ \frac{slugs}{ft^3}\right)\left(6\ \frac{ft}{s}\right)^2 = 3050\ \frac{lb}{ft^2} = \underline{\underline{21.2\ psi}}$