HW 2.2 Ch.8 #33, 62

8.33) $\frac{P_1}{\gamma} + z_1 + \frac{V_1^2}{2g} - h_L = \frac{P_2}{\gamma} + z_2 + \frac{V_2^2}{2g}$ Given: $D = .5054$ ft, $A = .2006\ ft^2$ Find: $h = ?$

$h_L = f \cdot \frac{L}{D} \frac{V^2}{2g}$

$V = \frac{Q}{A} = \frac{2.50}{.2006}$

$V = 12.46$ ft/s

$V = 9.15 \times 10^{-6}\ ft^2/s$

$N_r = \frac{VD}{\nu} = \frac{(12.46\ ft/s)(.5054\ ft)}{(12.46\ ft/s)}$

$N_r = 688227.7$

$R_r = \frac{D}{\varepsilon} = \frac{.5054\ ft}{1.5 \cdot 10^{-4}\ ft}$

$R_r = 3369.3$

$f = .0165$ from moody's diagram

$h_L = .0165 \cdot \frac{550\ ft}{.5054\ ft} \cdot \frac{12.46\ ft/s^2}{2 \cdot 32.2\ ft/s^2}$

$h_L = 45.69$ ft

8.62) $f = ?$

$$f = \frac{.25}{\log\left[\left(\frac{1}{3.7\frac{D}{\varepsilon}} + \frac{5.74}{N_r^{.9}}\right)\right]^2}$$

$N_r = \frac{VD}{\nu} = \frac{(12.46\ ft/s)(.5054\ ft)}{1.27 \times 10^{-5}\ ft^2/s} = N_r = 4775.43$

$$f = \frac{.25}{\left[\log\left(\frac{1}{3.7\left(\frac{.5054}{1.5 \times 10^{-4}}\right)} + \frac{5.74}{(4775)^{.9}}\right)\right]^2}$$

$f = .0388$

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10.39) $h_L = ?$

$$h_L = f \frac{L}{D} \cdot \frac{V^2}{2g}$$

$$V = \frac{Q}{A} = \frac{.40}{.0515}$$

$f_T = .017$

$V = 7.794 \text{ ft/s}$

$$h_L = (.017)\cdot(20)\cdot\frac{(7.794)^2}{2(32.2)}$$

$h_L = .3207 \text{ ft}$

10.48) $h_L = ?$

$$h_L = K(V^2/2g)$$

$$\frac{r}{D} = \frac{3.25" \cdot \frac{1}{12}}{.0903 \text{ ft}}$$

$\frac{r}{D} = 2.998$

$$\frac{D}{\varepsilon} = \frac{.0903}{1.5 \times 10^{-4}}$$

$\frac{D}{\varepsilon} = 602.2$

$\frac{L_e}{D} = 12.5$

$f_T = .0222$

$K = f_T\left(\frac{L_e}{D}\right)$

$K = (.0222)(12.5)$

$K = .2775$

$$V = \frac{Q}{A} = \frac{(27.5 \text{ gal/min})(.1337 \text{ ft}^3)\left(\frac{1}{60 \text{ sec}}\right)}{6.409 \times 10^{-3}}$$

$V = 9.559 \text{ ft/s}$

$$h_L = .2775 \frac{(9.559)^2}{2(32.2)}$$

$h_L = .3937 \text{ ft}$