

HW 2.3 Ch. 11: 13, 20

11.13) $V = ?$
 $V = \frac{Q}{A}$

$$\frac{P_A}{\gamma} + \frac{V_A^2}{2g} + z_A = \frac{P_B}{\gamma} + \frac{V_B^2}{2g} + z_B + h_{L_{A-B}}$$

a) $\frac{D}{\Sigma} = \frac{5 \text{ in}}{1.5 \cdot 10^{-4} \cdot 12}$

$$h_{L_{A-B}} = \frac{r_A - r_B}{\gamma} + z_A - z_B$$

$$\frac{D}{\Sigma} = 277.77$$

$$h_{L_{A-B}} = \left(\frac{2880}{62.4} \right) + (0 - 18)$$

$$h_{L_{A-B}} = 28.15 \text{ ft}$$

Class II: $Q = -2.22 D^2 \sqrt{\frac{g \cdot D \cdot h_c}{L}} \log \left(\frac{1}{3.7 D / \Sigma} + \frac{1.784 \cdot V}{D \sqrt{\frac{g \cdot D \cdot h_c}{L}}} \right)$

$$Q = -2.22 (277.77)^2 \sqrt{\frac{(32.2)(.041667)(28.15)}{20}} \log \left(\frac{1}{3.7(277.77)} + \frac{1.784 \cdot 7.37 \times 10^{-6}}{.041667 \sqrt{(32.2)(.041667)(28.15)}} \right)$$

$$V = \frac{.0425 \text{ ft}^3/\text{s}}{.0013635 \text{ ft}^2}$$

$$\left(\frac{1}{3.7(277.77)} + \frac{1.784 \cdot 7.37 \times 10^{-6}}{.041667 \sqrt{(32.2)(.041667)(28.15)}} \right)$$

$$V = 33.24 \text{ ft/s}$$

$$Q = .0425 \text{ ft}^3/\text{s}$$

b) $h_{L_{A-B}} = \frac{r_A - r_B}{\gamma} + z_A - z_B$ $V = \frac{Q}{A}$

$$h_{L_{A-B}} = \frac{11520}{62.4} + (0 - 18)$$

$$h_{L_{A-B}} = 166.615 \text{ ft}$$

Class II: $Q = -2.22 \cdot D^2 \sqrt{\frac{g \cdot D \cdot h_c}{L}} \log \left(\frac{1}{3.7 D / \Sigma} + \frac{1.784 \cdot V}{D \sqrt{\frac{g \cdot D \cdot h_c}{L}}} \right)$

$$Q = -2.22 \cdot .041667^2 \sqrt{\frac{(32.2)(.041667)(166.61)}{20}} \log \left(\frac{1}{3.7(277.77)} + \frac{1.784(7.37 \times 10^{-6})}{.041667 \sqrt{(32.2)(.041667)(166.61)}} \right)$$

$$Q = .110294 \text{ ft}^3/\text{s}$$

$$V = \frac{.110294 \text{ ft}^3/\text{s}}{.0013635 \text{ ft}^2}$$

$$V = 81.48 \text{ ft/s}$$

11.20) $D = ?$

(105) III $D = .66 \left[\Sigma^{1.25} \left(\frac{LQ}{\rho h_c} \right)^{4.75} + vQ^{1.4} \left(\frac{L}{\rho h_c} \right)^{5.2} \right]^{.04}$

$$\frac{P_1}{\gamma} + \frac{v_1^2}{2g} + z_1 = \frac{P_2}{\gamma} + \frac{v_2^2}{2g} + z_2 + h_c$$

$h_c = 12 \text{ ft}$, $\Sigma = 1.5 \times 10^{-4} \text{ ft}$, $v = 9.15 \times 10^{-6} \text{ ft/s}$

$$D = .66 \left[(1.5 \times 10^{-4})^{1.25} \left(\frac{(75 \text{ ft})(.891)}{(32.2)(12)} \right)^{4.75} + (9.15 \times 10^{-6})^{1.4} \left(\frac{75}{(32.2)(12)} \right)^{5.2} \right]^{.04}$$

$D = .306 \text{ ft}$