HW 3.1 Ch.15 # 9,15 Ch.19 # 6,21

15.9) do?

$Q_{min} = 700 gpm \left| \frac{.1336 ft^3}{1 gal} \right| \frac{1 min}{60 sec} = 1.559 ft^3/sec$ $Q_{max} = 1100 gpm \frac{(.1336)(1 min)}{60 sec} = 2.722 ft^3/sec$

$V_{min} = \frac{Q_{min}}{A} = \frac{1.559 ft^3/s}{.1259 ft^2} = 12.37 ft/s$

$N_{R_{min}} = \frac{V_{min} D}{\nu} = \frac{(12.37 ft/s)(.400)}{3.04 \times 10^{-5}} = 12854.16$

$\epsilon_{min} = .455$

$V_{max} = \frac{Q_{max}}{A} = \frac{2.722 ft^3/s}{.1259} = 17.60 ft/s$

$N_{R_{max}} = \frac{V_{max} D}{\nu} = \frac{(17.60)(.400)}{3.84 \times 10^{-5} ft^2/s} = 18416.6$

$C_{max} = .961$

$V_{max} = C_{max} \sqrt{\frac{2gh(\gamma_m/\gamma_f) - 1}{(A/A_1)^2 - 1}}$

$A_1 = \frac{A}{\sqrt{\frac{2gh(\gamma_m - \gamma_f)(C_{max})^2}{V_{max}^2} + 1}} = \frac{.1259 ft^2}{\sqrt{2(32.2)(.667)\left(\frac{849.1}{58}\right)(.961)^2 + 1}}$

$A_1 = .07459 ft^2$

$A_1 = \frac{\pi}{4} d^2$

$d = \sqrt{\frac{A_1 \cdot 4}{\pi}} = \sqrt{\frac{.07459 ft^2 (4)}{\pi}}$

$d = .3081 ft \left| \frac{12 in}{1 ft} \right.$

$d = 3.697 in$

15.15) $V = ?$

$$V = \sqrt{2gh(\gamma_m - \gamma_a)/\gamma_a}$$

$$= \sqrt{2(1.81\,m/s^2)(32.2\,ft/s)(.02\,ft)(124 - .0736)/.0736\,lb/ft^3)}$$

$$V = 33\ ft/s$$

14.6) $R = \frac{A}{wp} = ?$

$$A = BD + \frac{1}{2}XD$$

$$= (4)(2) + \left(\frac{1}{2}\right)(2)(2)$$

$$A = 10\ in^2$$

$$L = \sqrt{X^2 + D^2}$$

$$L = \sqrt{2^2 + 2^2}$$

$$L = 2.828\ in$$

$$w = D + B + L$$

$$w = 2 + 4 + 2.828$$

$$w = 8.828\ in$$

$$R = \frac{10}{8.828}$$

$$R = 1.13\ in$$

14.21) D=?

$$Q = (500\ gal/min)\left|\frac{1\ ft^3/s}{449\ gal/min}\right| = 1.114\ ft^3/s$$

$$AR^{2/3} = \frac{nQ}{1.49 S^{1/2}} = \frac{(.013)(1.114)}{1.49(.001)^{1/2}} = .307$$

$$A = \frac{\pi D^2}{8}$$

$$WP = \frac{\pi D}{2} \qquad R = \frac{A}{WP} = \frac{\frac{\pi D^2}{8}}{\frac{\pi D}{2}} = \frac{D}{4}$$

$$AR^{2/3} = \frac{\pi D^2}{8}\left[\frac{D}{4}\right]^{2/3} = \frac{\pi D^2 (D^{2/3})}{8(4)^{2/3}} = \frac{\pi D^{8/3}}{8(2.52)} = .156 D^{8/3} = .307$$

$$D = \left[\frac{.307}{.156}\right]^{3/8}$$

$$D = 1.29\ ft$$