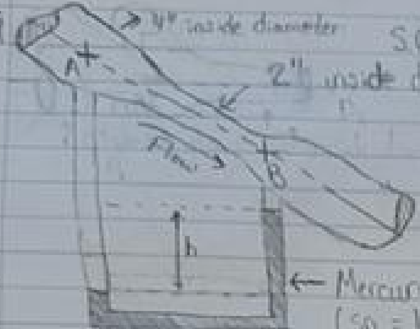
Group 2
MET 330
HW# 1.3

HW1.3

6.79



$SG_{oil} = 0.90$ Manometer deflection $h = 28\text{in}\left(\frac{1ft}{12in}\right)$, $h = 2.333$

$Q_A = Q_B = Q$

$A_A V_A = A_B V_B$

$\frac{\pi D_A^2}{4} V_A = \frac{\pi D_B^2}{4} V_B$ $V_B = \left(\frac{4in}{2in}\right)^2 V_A$

$V_B = \left(\frac{D_A}{D_B}\right)^2 V_A$ $V_B = 4V_A$

$P_A = P_B$

$P_A + \gamma_o z_A = P_B + \gamma_{oil}(z_B - h) + \gamma_{Hg} h$

$P_A - P_B = \gamma_{oil}(z_B - z_A - h) + \gamma_{Hg} h$

$P_A - P_B = 56.16(z_B - z_A - 2.333) + (844.896)(2.333)$

$P_A - P_B = 56.16(z_B - z_A) + 1971.142 - 131.021$

$P_A - P_B = 56.16(z_B - z_A) + 1,840.121$

× (Pressure difference)

$\gamma_{oil} = SG_{oil} \times \gamma_w$

$= 0.90 \times (62.4 lb/ft^3)$

$\gamma_{oil} = 56.16 lb/ft^3$

$\gamma_{Hg} = SG_{Hg} \times \gamma_w$

$13.54 \times (62.4 lb/ft^3)$

$\gamma_{Hg} = 844.896 lb/ft^3$

$E_A = E_B$

$\frac{P_A}{\gamma_o} + \frac{V_A^2}{2g} + z_A = \frac{P_B}{\gamma_o} + \frac{V_B^2}{2g} + z_B$ (Gather Like Terms)

$\frac{(P_A - P_B) + \gamma_{oil}(z_A - z_B)}{\gamma_{oil}} = \frac{V_B^2 - V_A^2}{2g}$

$\frac{56.16(z_B - z_A) + 1840.121 + 56.16(z_A - z_B)}{56.16} = \frac{(4V_A)^2 - (V_A)^2}{2(32.2 ft/s^2)}$

$(32.765)(64.4) = 15V_A^2$

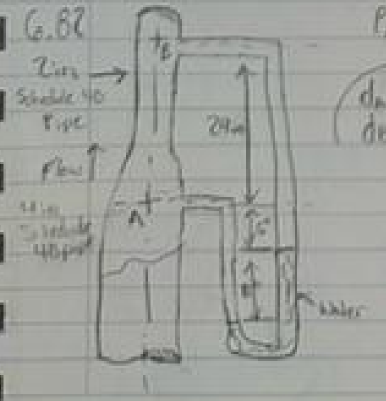
$V_A = \sqrt{140.674 ft^2/s^2} = 11.86 ft/s$

$Q = A_A V_A$

$Q = \frac{\pi D_A^2}{4} V_A$

$Q = \frac{\pi\left(4in\left(\frac{1ft}{12in}\right)\right)^2}{4}(11.86 ft/s) = 1.0349 ft^3/s$

6.82



$P_A - P_B = -55 lb/ft^3\left(\frac{6ft}{12in}\right) + 62.4 lb/ft^3\left(\frac{8ft}{12in}\right) + 55 lb/ft^3\left(\frac{32ft}{12in}\right)$

$P_A - P_B = 114.93 lb/ft^2$

$d_A = (4.5 - 2) \times 0.237 = 4.026 in$

$d_B = (2.375 - 2) \times 0.154 = 2.067 in$

$A_A V_A = A_B V_B$

$\frac{\pi(4.026 in)^2}{4} \cdot V_A = \frac{\pi(2.067 in)^2}{4} \cdot V_B$

$V_B = 3.794 V_A$

$\frac{P_A - P_B}{\gamma_o} = \frac{V_B^2 - V_A^2}{2g} + (z_B - z_A)$

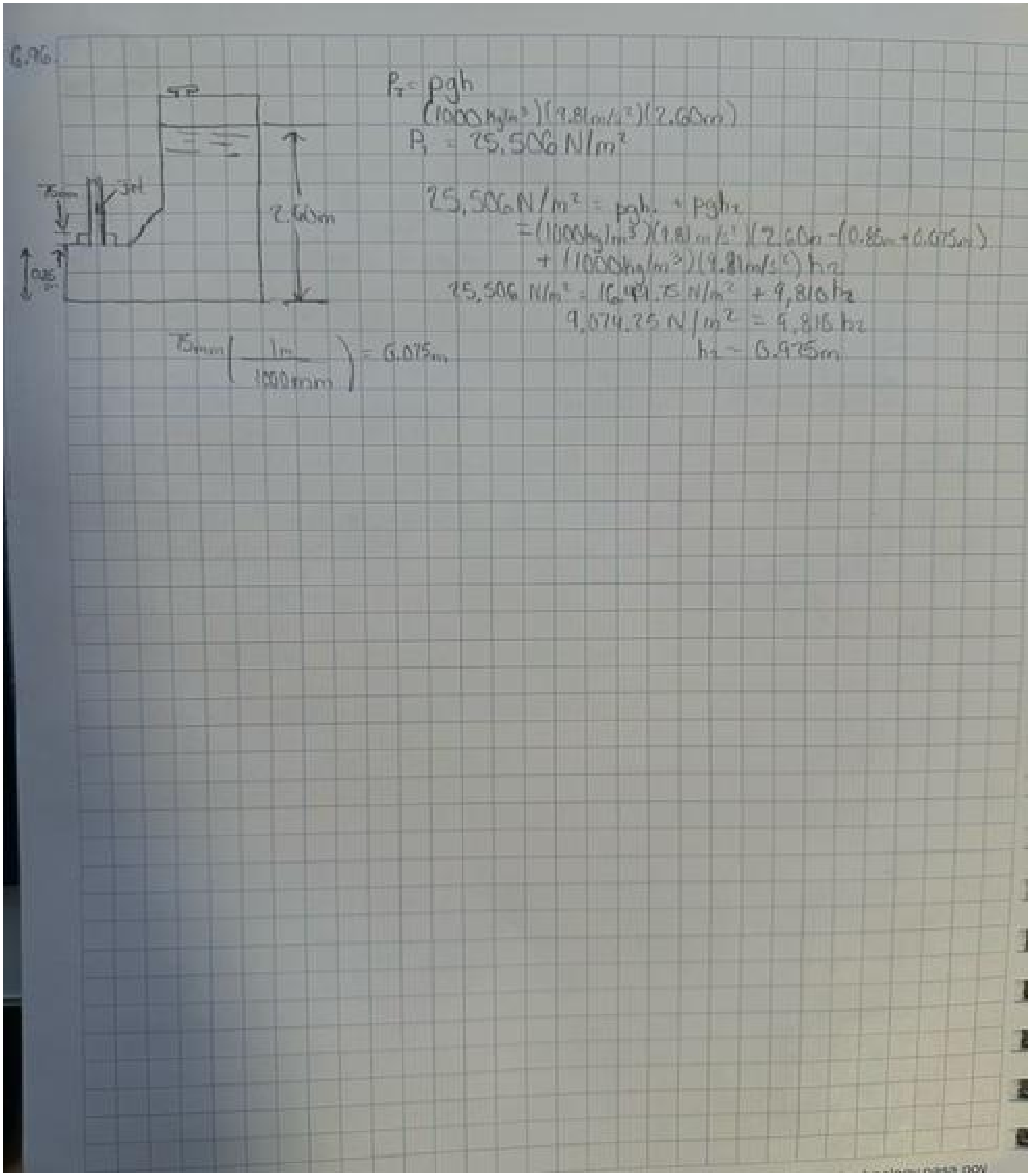
$\frac{114.93 lb/ft^2}{55 lb/ft^3} - 2ft = \frac{(3.794 V_A)^2 - V_A^2}{2 \times 32.2 ft/s^2}$

$V_A = 0.6565 ft/s$

$Q = A_A V_A$

$Q = \frac{\pi(4.026/12 ft)^2}{4} \times 0.6565 ft/s$

$Q = 0.058 ft^3/s$



During class and through the lectures posted on canvas we learned several different things. One of the things we learned is that in a closed loop with a pump we must make sure the Bernoulli's points are placed in the correct position to include the pump. At times, this could even be at the same spot as we saw in 8.49. When working with pipes that bend, we have to make sure to take into account both the horizontal and vertical distances, number of bends and shape of the inlet pipe when figuring out equations. This all helps determine the friction loss in the system.