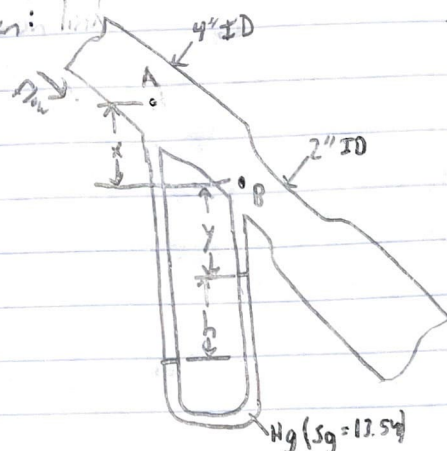


9/14/23

Cameron Sutton

79. Given:



$$S_{g\text{oil}} = 0.90 \quad S_{g\text{Hg}} = 13.54$$

$$h = 28 \text{ in}$$

Bernoulli Eq:

$$\frac{P_1}{\gamma} + z_1 + \frac{V_1^2}{2g} = \frac{P_2}{\gamma} + z_2 + \frac{V_2^2}{2g}$$

Determine: Volume flow rate of oil. ($Q = AV$)

Solution: $S_{g\text{oil}} = \frac{\gamma_{\text{oil}}}{\gamma_w @ 4^\circ\text{C}}$

$S_{g\text{Hg}} = \frac{\gamma_{\text{Hg}}}{\gamma_w @ 4^\circ\text{C}}$

$$A_A = \pi r^2 = \pi (2)^2 = 12.6 \text{ in}^2$$

$$A_B = \pi r^2 = \pi (1)^2 = 3.14 \text{ in}^2$$

$$0.90 = \frac{\gamma_{\text{oil}}}{62.4}$$

$$13.54 = \frac{\gamma_{\text{Hg}}}{62.4 \text{ lb/ft}^3}$$

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

$$\gamma_{\text{Hg}} = 847.9 \text{ lb/ft}^3$$

* ($z_A - z_B$) denoted by xContinuity Eq: $\rho_A A_A V_A = \rho_B A_B V_B$

$$12.6 V_A = 3.14 V_B$$

$$V_B = 4 V_A$$

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

$$\frac{1840.39 - 56.16x}{56.16} + (x) = \frac{(4V_A)^2 - V_A^2}{2(32.2)}$$

$$\frac{1840.39 - 56.16x + 56.16x}{56.16} = \frac{15V_A^2}{64.4}$$

$$V_A = 11.86 \text{ ft/s}$$

$$P_A - P_B : P_B + \gamma_{\text{oil}}(y) + \gamma_{\text{Hg}}(h) - \gamma_{\text{oil}}(h) - \gamma_{\text{oil}}(y) - \gamma_{\text{oil}}(x) = P_A$$

$$\gamma_{\text{Hg}}(h) - \gamma_{\text{oil}}(h) - \gamma_{\text{oil}}(x) = P_A - P_B$$

$$847.9(28/12) - 56.16(28/12) - 56.16(x) = P_A - P_B$$

$$1971.93 - 131.04 - 56.16x = P_A - P_B$$

$$1840.39 - 56.16x = P_A - P_B$$

Volume flow rate: $Q = A_A V_A$

$$Q = (12.6 \text{ in}^2 / 144) (11.86 \text{ ft/s})$$

$$Q = 1.04 \text{ ft}^3/\text{s}$$

I learned from the problems covered in class and in the lecture slides how to apply Bernoulli's equation and that it may also be used for static fluids by reworking the equation and canceling irrelevant unknowns, and that the Darcy-Weisbach equation is used to compute energy losses. It is also critical to choose point locations where you have the most information while building up the problem to solve.