2.43

2.43 For the inclined-tube manometer of Fig. P2.43 the pressure in pipe A is 0.6 psi. The fluid in both pipes A and B is water, and the gage fluid in the manometer has a specific gravity of 2.6. What is the pressure in pipe B corresponding to the differential reading shown?

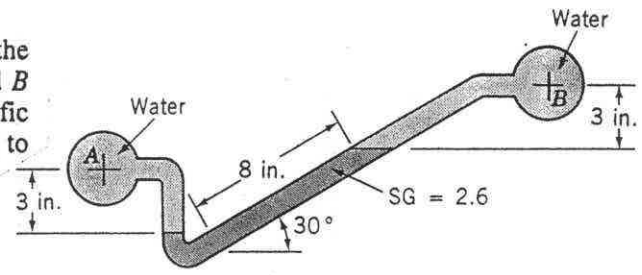


FIGURE P2.43

$$p_A + \gamma_{H_2O}\left(\tfrac{3}{12}\text{ ft}\right) - \gamma_{gf}\left(\tfrac{8}{12}\text{ ft}\right)\sin 30^\circ - \gamma_{H_2O}\left(\tfrac{3}{12}\text{ ft}\right) = p_B$$

(where γ_{gf} is the specific weight of the gage fluid)

Thus,

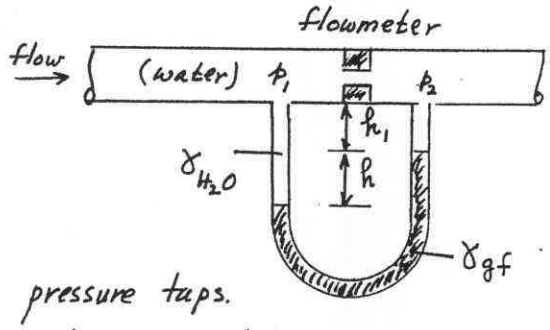
$$p_B = p_A - \gamma_{gf}\left(\tfrac{8}{12}\text{ ft}\right)\sin 30^\circ$$

$$= \left(0.6\ \frac{\text{lb}}{\text{in.}^2}\right)\left(144\ \frac{\text{in.}^2}{\text{ft}^2}\right) - (2.6)\left(62.4\ \frac{\text{lb}}{\text{ft}^3}\right)\left(\tfrac{8}{12}\text{ ft}\right)(0.5) = 32.3\ \frac{\text{lb}}{\text{ft}^2}$$

$$= 32.3\ \text{lb/ft}^2 / 144\ \text{in.}^2/\text{ft}^2 = \underline{\underline{0.224\ \text{psi}}}$$

2.44

2.44 A flowrate measuring device is installed in a horizontal pipe through which water is flowing. A U-tube manometer is connected to the pipe through pressure taps located 3 in. on either side of the device. The gage fluid in the manometer has a specific weight of 112 lb/ft³. Determine the differential reading of the manometer corresponding to a pressure drop between the taps of 0.5 lb/in.².



Let p_1 and p_2 be pressures at pressure taps.

Write manometer equation between p_1 and p_2. Thus,

$$p_1 + \gamma_{H_2O}(h_1 + h) - \gamma_{gf} h - \gamma_{H_2O} h_1 = p_2$$

so that

$$h = \frac{p_1 - p_2}{\gamma_{gf} - \gamma_{H_2O}} = \frac{\left(0.5\ \frac{\text{lb}}{\text{in.}^2}\right)\left(144\ \frac{\text{in.}^2}{\text{ft}^2}\right)}{112\ \frac{\text{lb}}{\text{ft}^3} - 62.4\ \frac{\text{lb}}{\text{ft}^3}}$$

$$= \underline{\underline{1.45\ \text{ft}}}$$

21 bi