2.31

2.31 A U-tube manometer is connected to a closed tank as shown in Fig. P2.31. The air pressure in the tank is 0.50 psi and the liquid in the tank is oil (γ = 54.0 lb/ft^3). The pressure at point A is 2.00 psi. Determine: **(a)** the depth of oil, z, and **(b)** the differential reading, h, on the manometer.

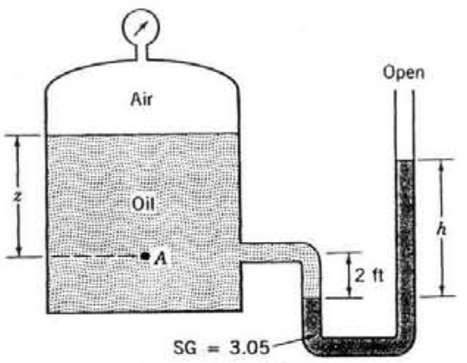

FIGURE P2.31

(a) $p_A = \gamma_{oil} z + p_{air}$

Thus, $z = \dfrac{p_A - p_{air}}{\gamma_{oil}} = \dfrac{\left(2 \frac{lb}{in.^2} - 0.5 \frac{lb}{in.^2}\right)\left(144 \frac{in.^2}{ft^2}\right)}{54.0 \frac{lb}{ft^3}} = 4.00 \text{ ft}$

(b) $p_A + \gamma_{oil}(2 \text{ ft}) - (SG)(\gamma_{H_2O})\, h = 0$

Thus, $h = \dfrac{p_A + \gamma_{oil}(2 \text{ ft})}{(SG)(\gamma_{H_2O})}$

$$= \frac{\left(2 \frac{lb}{in.^2}\right)\left(144 \frac{in.^2}{ft^2}\right) + \left(54.0 \frac{lb}{ft^3}\right)(2 \text{ ft})}{(3.05)\left(62.4 \frac{lb}{ft^3}\right)}$$

$$= 2.08 \text{ ft}$$