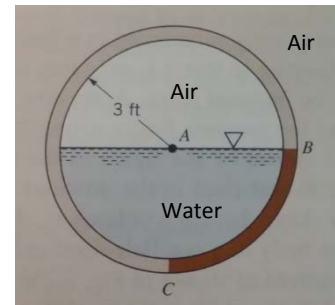


September 22, 2014

NAME _____

Fluids-ID _____

Quiz 3. A 6-ft-diameter cylindrical drainage conduit of the type shown in figure is half full of water at rest. The length of the drainage (into to the paper) is 1-ft. Air pressure inside the drainage is same pressure as the atmospheric pressure. ($\gamma_{\text{water}}=62.4 \text{ lb/ft}^3$)



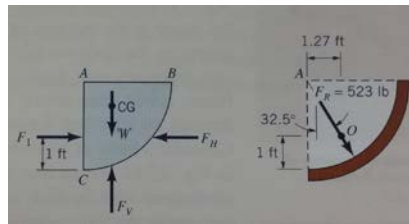
(a) Determine the magnitude and location of the horizontal component of the force on curved section BC of the conduit wall.

(Hint: Moment of inertia for a rectangle $I = \frac{bh^3}{12}$)

(b) Determine the magnitude and location of the vertical component of the force on curved section BC of the conduit wall. (Hint: Centroid of quarter circle area $\frac{4R}{3\pi}$)

Note: Attendance (+2 points), Format (+1 point)

Solution:



(a)

$$F_H = \gamma h_c A \quad (+2 \text{ point})$$

$$F_H = \gamma \left(\frac{h}{2}\right) (h \times b) = \left(\frac{62.4 \text{ lb}}{\text{ft}^3}\right) \left(\frac{3}{2} \text{ ft}\right) (3 \times 1 \text{ ft}^2) = 281 \text{ lb} \quad (+0.5 \text{ point})$$

$$y_H = \frac{I}{y_c A} + y_c \quad (+1 \text{ point})$$

$$y_H = \frac{bh^3/12}{(h/2)(bh)} + \frac{h}{2} = \frac{1 \times \frac{3^3}{12} \text{ ft}^4}{\left(\frac{3}{2} \text{ ft}\right) \times (1 \times 3 \text{ ft}^2)} + \frac{3}{2} \text{ ft} = 2 \text{ ft} \quad (+0.5 \text{ point})$$

(b)

$$F_V = \gamma V \quad (+2 \text{ point})$$

$$F_V = (62.4 \text{ lb/ft}^3) (9\pi/4 \text{ ft}^2 \times 1 \text{ ft}) = 441 \text{ lb} \quad (+0.5 \text{ point})$$

$$y_V = \frac{4R}{3\pi}$$

$$y_V = \frac{4 \times 3 \text{ ft}}{3\pi} = 1.27 \text{ ft} \quad (+0.5 \text{ point})$$