

PROBLEM 1.47

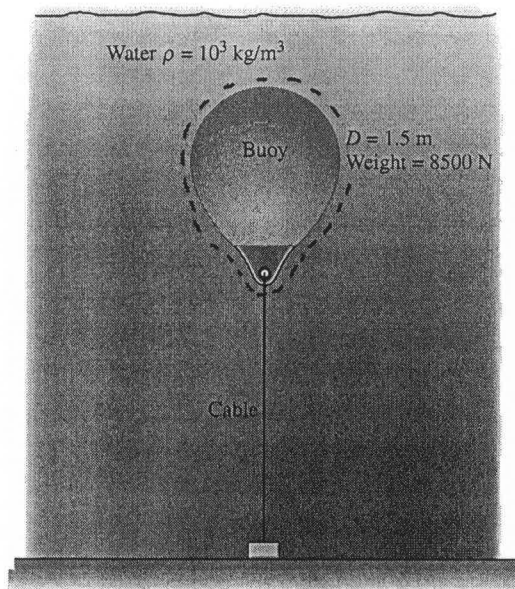


Fig. P1.47

Calculating,

$$F_{\text{CABLE}} = \left(10^3 \frac{\text{kg}}{\text{m}^3} \right) \left(\pi \frac{(1.5 \text{ m})^3}{6} \right) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) \left| \frac{1 \text{ N}}{1 \text{ kg} \cdot \text{m/s}^2} \right| - 8500 \text{ N}$$

$$= (17336 - 8500) \text{ N} = 8836 \text{ N}$$

The resultant pressure force acting on the system denoted by the dashed line is the buoyant force, F_B , acting vertically upward with a magnitude equal to the weight of the displaced water. See Sec. 1.6.2 for discussion.

Also acting on the system, vertically downward, is the weight of system and the force exerted by the cable.

In sum,

$$F_B = \text{Weight} + F_{\text{CABLE}}$$

$$\Rightarrow F_{\text{CABLE}} = F_B - \text{Weight}$$

$$= (\rho V) g - \text{Weight}$$

$\left(\pi D^3 / 6 \right)$

PROBLEM 1.48

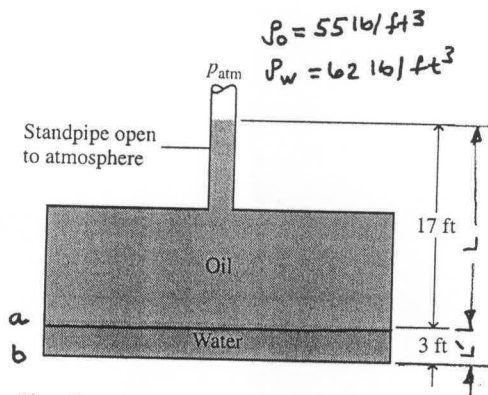


Fig. P1.48

With Eq. 1.11, the pressure at the oil-water interface is

$$P_a = P_{\text{atm}} + \rho_o g L$$

Expressed as a gage pressure, this is

$$[P_a - P_{\text{atm}}] = \rho_o g L$$

Calculating,

$$P_a(\text{gage}) = \left(55 \frac{\text{lb}}{\text{ft}^2} \right) \left(32.2 \frac{\text{ft}}{\text{s}^2} \right) (17 \text{ ft}) \left| \frac{1 \text{ lbf}}{32.2 \text{ lb} \cdot \text{ft/s}^2} \right| \left| \frac{1 \text{ ft}^2}{144 \text{ in}^2} \right|$$

$\left(\text{rounded} \right)$

$$= 6.49 \frac{\text{lbf}}{\text{in}^2} (\text{gage})$$

The pressure at the bottom of the tank is

$$P_b = P_a + \rho_w g L' = [P_{\text{atm}} + \rho_o g L] + \rho_w g L'$$

$$\Rightarrow P_b(\text{gage}) = \rho_o g L + \rho_w g L'$$

$$= 6.49 \frac{\text{lbf}}{\text{in}^2} + \left(62 \frac{\text{lb}}{\text{ft}^2} \right) \left(32.2 \frac{\text{ft}}{\text{s}^2} \right) (3 \text{ ft}) \left| \frac{1 \text{ lbf}}{32.2 \text{ lb} \cdot \text{ft/s}^2} \right| \left| \frac{1 \text{ ft}^2}{144 \text{ in}^2} \right|$$

$$= (6.49 + 1.29) \frac{\text{lbf}}{\text{in}^2} (\text{gage})$$

$$= 7.78 \frac{\text{lbf}}{\text{in}^2} (\text{gage})$$