PROBLEM 1.42

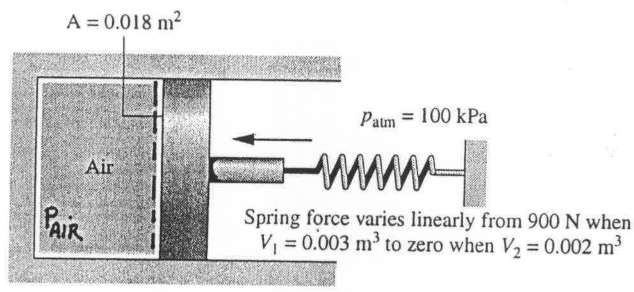


Fig. P1.42

At the initial and final states static equilibrium with no effect of friction (between the piston and cylinder) can be assumed. Thus, looking at the interface between the air and the piston (shown dotted) we have

$P_{AIR} A \rightarrow$ | $\leftarrow P_{atm} A$, $\leftarrow F_{spring}$ $\Rightarrow P_{AIR} = P_{atm} + \dfrac{F_{spring}}{A}$

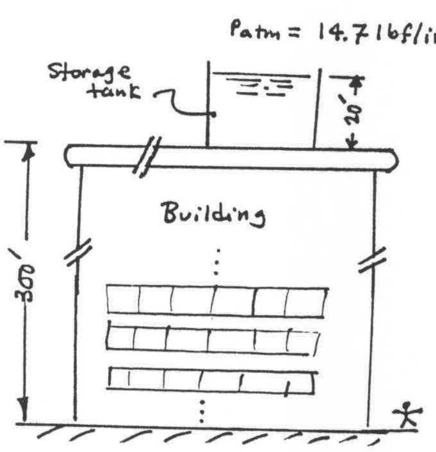
Initially, $F_{spring} = 900$ N. So, $P_1 = 100\text{ kPa} + \dfrac{900\text{ N}}{0.018\text{ m}^2}\left|\dfrac{1\text{ kPa}}{10^3\text{ N/m}^2}\right| = 150\text{ kPa}$. ←

$P_1 = 150\text{ kPa}\left|\dfrac{1\text{ atm}}{101.325\text{ kPa}}\right| = 1.48\text{ atm}.$ ←

Finally, $F_{spring} = 0$ N. So, $P_2 = 100\text{ kPa}$. ←

$P_2 = 100\text{ kPa}\left|\dfrac{1\text{ atm}}{101.325\text{ kPa}}\right| = 0.99\text{ atm}.$ ←

PROBLEM 1.43



$\rho = 62.2\text{ lb/ft}^3$

$g = 32.0\text{ ft/s}^2$

The pressure at the bottom of the storage tank is

$$p = P_{atm} + \rho g L$$

$$= 14.7\frac{\text{lbf}}{\text{in}^2} + \left(62.2\frac{\text{lb}}{\text{ft}^3}\right)\left(32.0\frac{\text{ft}}{\text{s}^2}\right)(20\text{ ft})\left|\frac{1\text{ ft}^2}{144\text{ in}^2}\right|\left|\frac{1\text{ lbf}}{32.2\text{ lb ft/s}^2}\right|$$

rounded

$$= 14.7\frac{\text{lbf}}{\text{in}^2} + 8.6\frac{\text{lbf}}{\text{in}^2} = 23.3\frac{\text{lbf}}{\text{in}^2}$$ ←