SPECIFIC GRAVITY

We often need to calculate the pressure head that corresponds to the pressure. Pressure can be converted to pressure head or fluid column height for any fluid. However, not all fluids have the same density. Water for example has a density of 62.34 pounds per cubic foot whereas gasoline has a density of 46.75 pounds per cubic foot. Specific gravity is the ratio of the fluid density to water density at standard conditions. By definition water has a specific gravity (SG) of 1. To convert pressure to pressure head, the specific gravity *SG* of the fluid must be known. The specific gravity of a fluid is:

$$SG = \frac{r_F}{r_W}$$

where ρ_F is the fluid density and ρ_W is water density at standard conditions. Since

$$p = g_F z = \frac{r_F g z}{g_c} \qquad \text{and} \quad r_F = SG\ r_W \quad \text{therefore} \quad p = SG\ \frac{r_W g z}{g_c}$$

where g_F is the fluid density in terms of weight per unit volume and r_F is the density in terms of mass per unit volume. The constant g_c is required to provide a relationship between mass in lbm and force in lbf (see Appendix D).

The quantity $r_W g/g_c$ (r_W = 62.34 lbm/ft^3 for water at 60 °F) is:

$$\frac{r_W g}{g_c} = \frac{62.34(lbm/ft^3) \times 32.17(ft/s^2)}{32.17(lbm - ft/lbf - s^2)} \times \frac{1(ft)}{144(in^2)} = \frac{1}{2.31}\left(\frac{lbf}{in^2 - ft}\right)$$

After simplification, the relationship between the fluid column height and the pressure at the bottom of the column is:

$$p(psi) = \frac{1}{2.31} SG\ z(ft\ of\ fluid) \qquad [1\text{-}5]$$

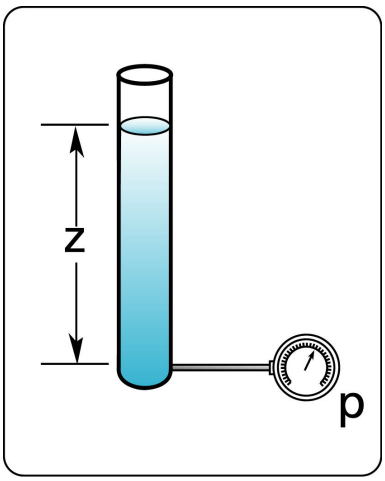

Figure 1-30 Pressure vs. elevation in a fluid column.