33.57 $150gpm$ **of water flows through a standard weight steel** $4in$ **diameter pipe which serves (4) air handling units. The coil in each air handling unit has a pressure drop of** $5psi$**. The system contains** 200 **linear feet of pipe and (12) 90-degree elbows. What is the total pressure loss through the system?**

A. $11.8psi$

B. $23.8psi$

C. $28.2psi$

D. $54.4psi$

The total pressure loss in the system is the pressure loss in the air handling units plus the pressure loss from the piping and fittings.

$$\Delta p_{total} = \Delta p_{AHUs} + \Delta p_{system}$$

For the air handling units, multiply the pressure drop per unit times the number of units.

$$\Delta p_{AHUs} = (4)\,(5psi) = 20psi$$

For the system losses, start by obtaining the velocity and the losses per hundred feet from the Steel Pipe Friction Tables based on the pipe size and gpm.

$$v = 3.78fps$$

$$h_d = 2.52\frac{ft}{100ft}$$

Use the velocity along with the Equivalent Lengths for Elbows table to determine the equivalent length of each 90-degree elbow. Formal interpolation is not needed, a quick estimation based on the velocity will suffice.

$$L_{elbow} \approx 10.5ft$$

Find the total head loss in the system, then convert from ft to psi using the rule of thumb conversion factor for water.

$$h_f = h_d L_{eq} = \left(2.52\frac{ft}{100ft}\right)[200ft + (12)\,(10.5ft)] = 8.2ft$$

$$\Delta p_{system} = 8.2ft\left(\frac{1psi}{2.31ft}\right) = 3.6psi$$

Calculate the total pressure loss including the AHUs.

$$\Delta p_{total} = 20psi + 3.6psi = 23.6psi$$

Answer B