37.43 **A building has 8 office floors and a basement chiller plant, with $15ft$ of vertical spacing per floor. The chiller plant houses a set of pumps distributing chilled water via a central core riser to air handling units located in the building core on each floor of the building. Each floor has one air handling unit designed for $100gpm$ and $8ft$ of head pressure drop for the coil and $4psi$ of pressure drop for the control valve. The chillers are piped in parallel and have a maximum pressure drop of $15ft$ of head in all modes of operation. The head loss for the piping at the maximum flow rate is $4ft$ per $100ft$ of pipe. What is the head pressure that must be added by the pump set?**

A. $39ft$

B. $44ft$

C. $59ft$

D. $152ft$

The total head pressure added by the pumps must be sufficient to overcome the pressure drop through the chillers, air handling units, and the piping losses through the longest run. It is not necessary to consider all floors individually as the pressure required is determined by the the *longest run* which is to the top floor.

Determine the vertical distance between the basement and the top floor. The total length of piping is double the height to account for losses in both the supply and return piping. Horizontal distance may be neglected since the piping distribution is through a central core riser and the AHUs are located in the core.

$$L = 8\,(15ft) \times 2 = 240ft$$

Calculate the losses associated with the length of the longest run.

$$h_f = \left(\frac{4ft}{100ft}\right)(240ft) = 9.6ft$$

Next, find the head pressure required to overcome the pressure drop for one air handler. Convert the pressure drop for the valves to ft by multiplying by the conversion factor $2.31\frac{ft}{psi}$. Refer to Commonly Used Equivalents.

$$h_{AHU} = 8ft + (4psi)\left(2.31\frac{ft}{psi}\right) = 17.24ft$$

Lastly, consider the pressure drop for the chillers. Since the chillers are piped in parallel, the pressure drop is the same regardless of the number of chillers.

$$h_{chillers} = 15ft$$

Calculate the total pressure drop for the longest run in feet of head. This is the minimum head pressure that must be added by the pump set.

$$h_A = h_f + h_{AHU} + h_{chillers}$$

$$h_A = 9.6ft + 17.24ft + 15ft \approx 44ft$$

Answer B