36.80 An outside air handling unit delivers $5000CFM$ of outside air. On a winter day, the outside air is $18°F$ and is heated to $68°F$ using a hot water coil. Hot water is supplied at $165°F$ and returned at $140°F$. What is the required flow rate of hot water?

A. $0.4GPM$

B. $3GPM$

C. $22GPM$

D. $173GPM$

The air undergoes sensible heating. Use the sensible heating rule of thumb.

$$Q_s = 1.08CFM\Delta T_{air}$$

The heat given up by the water can be determined with the sensible heating/cooling rule of thumb for water.

$$Q_w = 500GPM\Delta T_{water}$$

The quantity of heat added to the air is supplied entirely by the hot water, therefore we can equate the two formulas.

$$1.08CFM\Delta T_{air} = 500GPM\Delta T_{water}$$

The volume flow rate of the hot water is the only unknown. Isolate, substitute, and solve for the GPM.

$$GPM = \frac{1.08CFM\Delta T_{air}}{500\Delta T_{water}} = \frac{1.08\,(5000)\,(68-18)}{500\,(165-140)} = 21.6GPM$$

Note that no units need to be included when using these "rules of thumb" provided *all input values are in the correct units in the first place* i.e. CFM, GPM, and Farenheit.

Answer C