36.22 **A $1.5hp$ motor drives a re-circulation fan serving a room with a $7500ft^3$volume of room temperature air. The fan and fan motor are located in an adjacent mechanical room which is a return plenum for the conditioned space. What is the maximum possible increase in the room air temperature if the fan is left to run for 30 minutes?**

A. $1°F$

B. $3°F$

C. $8°F$

D. $14°F$

In a worst-case scenario, assume all of the motor's energy heats the air. This drives the maximum possible increase in the room air temperature. Determine the amount of energy producted by the motor during a half hour.

$$(1.5hp)\left(\frac{0.7457KW}{hp}\right)(0.5hr)\left(3412\frac{\frac{Btu}{hr}}{KW}\right) = 1908Btu$$

Assume a typical density for air of $0.075\frac{lb_m}{ft^3}$ and find the mass of air based on the volume given.

$$m = \rho V = \left(0.075\frac{lb_m}{ft^3}\right)\left(7500ft^3\right) = 562.5lb_m$$

Find ΔT based on the heat transfer, mass, and specific heat capacity of air.

$$Q = mc_p\Delta T$$

$$\Delta T = \frac{Q}{mc_p} = \frac{(1908Btu)}{(562.5lb_m)\left(0.24\frac{Btu}{lb_m\,°F}\right)} = 14.1°F$$

Answer D