37.70 $20\frac{lb_m}{min}$ **of** $50°F$ **air at atmostpheric pressure enters an air compressor and exits at** $350°F$**. What is the power required to drive the compressor?**

A. $34hp$

B. $40hp$

C. $114hp$

D. $142hp$

Consider the air entering the Compressor as State 1 and the air exiting the compressor as State 2. Since there is not enough information about State 2 to fully define it, assume the air behaves as an Ideal Gas with Constant Specific Heats. Solve for the compressor power and convert units to hp.

$$\dot{W}_{comp} = \dot{m} c_p \left(T_e - T_i\right)$$

$$\dot{W}_{comp} = \left(20\frac{lb}{min}\right)\left(0.24\frac{Btu}{lb \cdot °F}\right)(350°F - 50°F) = 1440\frac{Btu}{min}$$

$$\dot{W}_{comp} = 1440\frac{Btu}{min}\left(\frac{60min}{1hr}\right)\left(\frac{1KW}{3412\frac{Btu}{hr}}\right)\left(\frac{1hp}{0.7457KW}\right) = 34hp$$

Answer A