E) $\dot{m} = \frac{\dot{Q}_{in}}{h_1 - h_4} = \frac{941{,}055 \text{ Btu/s}}{(99.5 - 92) \text{ Btu/lbm}} = 125.47 \text{ lbm/s}$

F) $\dot{m}_R = 125.47 \text{ lb/s} = 7528.2 \text{ lb/min}$

$\eta = 80\% = 0.8$

$\text{Pressure ratio} = \frac{P_1}{P_4} = 2.32$

$$P_{comp} = \frac{\dot{m}_R \cdot \frac{P_1}{P_4}}{\eta}$$

$$= \frac{125.47 \text{ lb/s} \cdot \frac{35.14 \text{ psia}}{14.69 \text{ psia}}}{0.8}$$

$$= 363.863 \text{ HP}$$

G) $\dot{Q}_L = \dot{m}(h_1 - h_4)$

$$= 125.47(99.5 - 92)$$

$$= 941{,}025 \text{ Btu/s}$$

8) Summary

Problem 2 involved analyzing a heat pump system equipped with an indoor air handler capable of both cooling and heating functions. The compressor played a key role by compressing the refrigerant and managing moisture removal. The total power required by the isentropic compression process was calculated to be 363.863 HP, which we considered to be more efficient compared to the power requirement found in Problem 1.