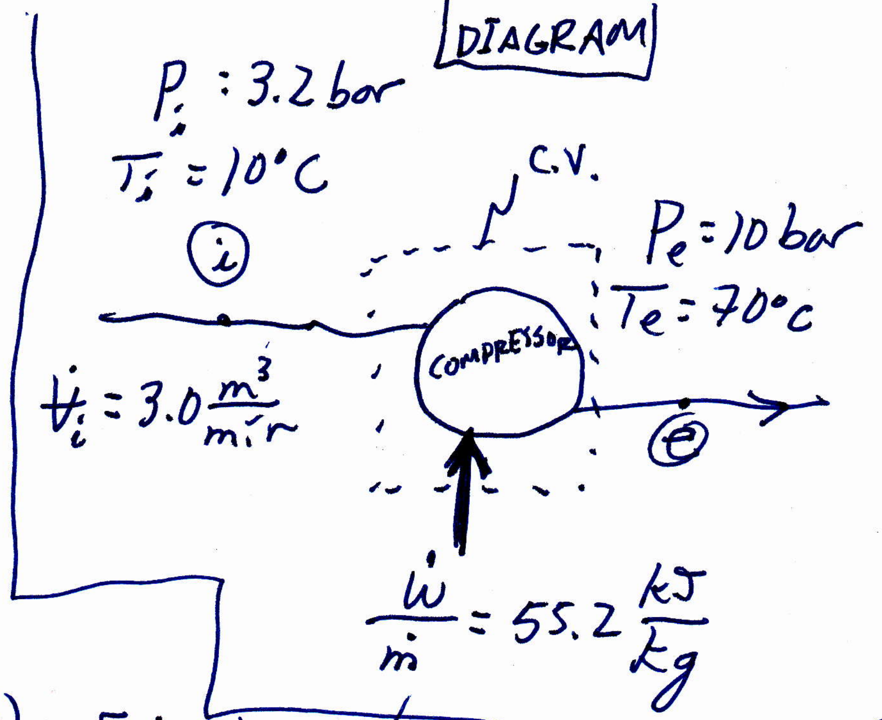
M.S. 4.59




**GIVEN:** R-134a, $\frac{\dot{W}}{\dot{m}}$, $\dot{V}_i$, inlet and exit conditions, S.S., KE & PE effects can be neglected.

**FIND:** $\dot{Q}$ in kW

**ANALYSIS:**

C.O.E. for C.V.

$$\frac{dE}{dt} = \dot{Q} - \dot{W} + \sum_i \dot{m}_i \left(h_i + \cancel{\frac{V_i^2}{2}} + \cancel{gz_i}\right) - \sum_e \dot{m}_e \left(h_e + \cancel{\frac{V_e^2}{2}} + \cancel{gz_e}\right)$$

$$\dot{Q} = \dot{W} + \dot{m}(h_e - h_i)$$

$$\frac{\dot{Q}}{\dot{m}} = \frac{\dot{W}}{\dot{m}} + (h_e - h_i)$$

Inlet and exit states are both superheated.

inlet $\quad h_i = 255.65 \frac{kJ}{kg} \quad v_i = 0.06576\ m^3/kg$

exit $\quad h_e = 302.3\ kJ/kg$

$$\frac{\dot{Q}}{\dot{m}} = -55.2 \frac{kJ}{kg} + \left(302.3 \frac{kJ}{kg} - 255.65 \frac{kJ}{kg}\right)$$

$$\frac{\dot{Q}}{\dot{m}} = -8.55\ kJ/kg$$

Now get $\dot{m}$ $\quad \dot{m} = \frac{\dot{V}}{v} = \frac{\dot{V}_i}{v_i} = \frac{3.0\ m^3/min \,/\, 60\ s/min}{0.06576\ m^3/kg}$

$$\dot{m} = 0.76\ kg/s$$

So, $\dot{Q} = -8.55 \frac{kJ}{kg} \cdot 0.76\ kg/s = \underline{-6.5\ kW}$ ← ANS.