جامعة تكريت

كلية الهندسة **قسم الميكانيك**

محاضرة دورة التبريد الامتصاصية مع مبادل حراري (**Absorption Refrigerator Cycle)**

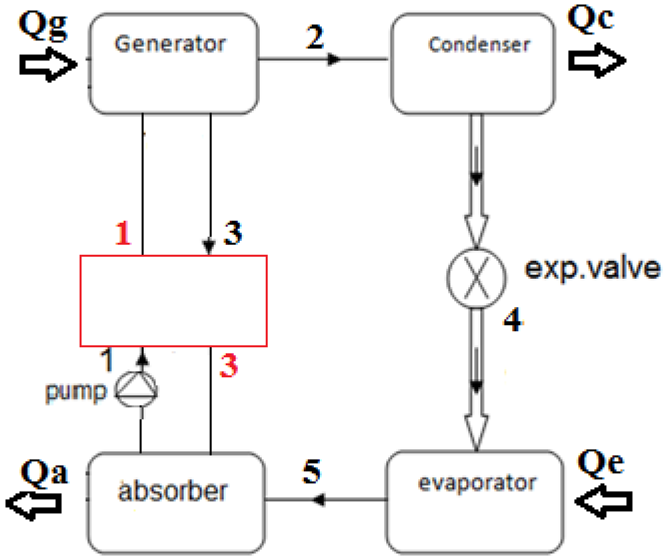
المادة: **تكييف** **التاريخ** **٥ تموز 2021**

$$(COP)_{act} = \frac{usefual\ \text{effective heat}}{heat\ added} = \frac{\mathrm{q_e}}{\mathrm{q_g}}$$

$$(COP)_{tho} = \frac{T_e(T_g - T_c)}{T_g(T_c - T_e)}$$

$$(COP)_{act} = \frac{usefual\ \text{effective heat}}{heat\ added} = \frac{\mathrm{Q_e}}{\mathrm{Q_g}}$$

$$(COP)_{relative} = \frac{(COP)_{act}}{(COP)_{tho}}$$



Generator

$$Q_g + \dot{m}_1 h_1 = \dot{m}_2 h_2 + \dot{m}_3 h_3$$

Condenser

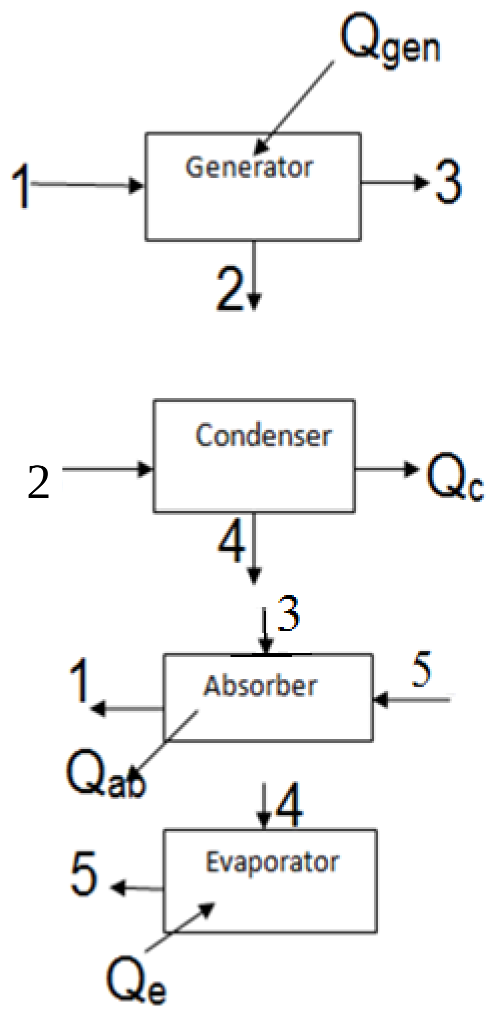
$$Q_c + \dot{m}_4 h_4 = \dot{m}_2 h_2$$

Absorber

$$Q_a + \dot{m}_1 h_1 = \dot{m}_5 h_5 + \dot{m}_3 h_3$$

Evaporator

$$Q_e + \dot{m}_4 h_4 = \dot{m}_5 h_5$$



معامل أداء المنظومة الامتصاصية الفعلية $(COP)_{act}$

$$(COP)_{act} = \frac{Q_e}{Q_g}$$

معامل أداء المنظومة الامتصاصية النظرية $(COP)_{tho}$

$$(COP)_{tho} = \frac{T_e(T_g - T_c)}{T_g(T_c - T_e)}$$

Example: -The following data are known for Libr-H_2O absorption system. The cooling capacity is 1 kW, generation temp. is 76℃ , condenser temp. 38℃ , evaporator temp. 4℃ . Temp. of absorber is 32℃. Assumed saturation condition for strong solution entering generation, weak solution leaving generation and water vapor Leaving evaporator.

Find: -

a-Properties of solution or water at each point (p, t, h, x).

b-Mass flow rate each point.

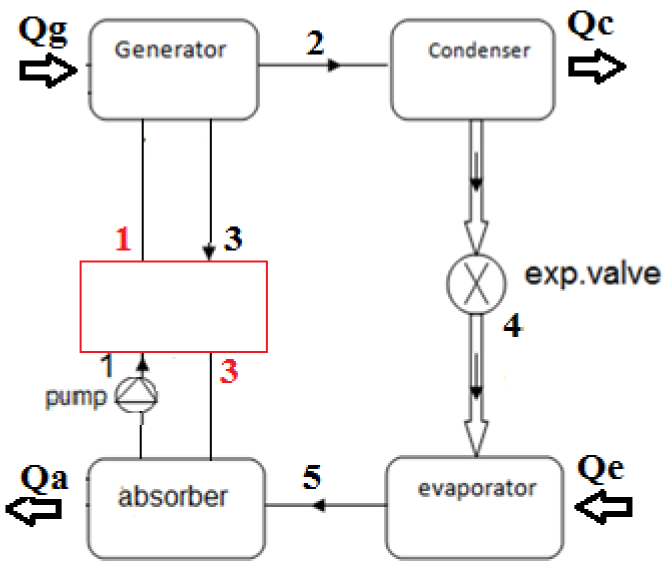
c-$(COP)_{act}$ & $(COP)_{tho}$

d- Relative COP

e- Heat rejected or added for the cycle components.

f- The COP when heat exchanger added between high and low solution leave the absorber then enter the generator at 40℃.

Solution



$P_g = P_c = high\ pressure\ at\ \ T_{sat} = 38°\text{C}$

$P_{ab} = P_e = low\ pressure\ at\ \ T_{sat} = 4°\text{C}$

Absorber

$P_1 = P_5 = 0.813\ kPa$

$X_1 = 53.1\% \qquad \text{h}_1 = 72\,\frac{\text{kJ}}{\text{kg}}$

Generator -3-

$P_2 = P_3 = 6.624\ kPa$

$X_3 = 57.2\% \qquad\qquad \text{h}_3 \cong 172\,\frac{\text{kJ}}{\text{kg}}$

$$h_4 = 159.1\ \frac{kJ}{kg} = h_f\ at\ P_c$$

$$h_5 = 2508\ \frac{kJ}{kg} = h_g\ at\ P_e$$

$$h_2 = h_{\text{Super heated at Pc \& 76°C}} = 2640.8\ \frac{kJ}{kg}$$

Or

$$h_2 = h_{\text{Super heated at Pc \& 76°C}} = 2501 + 1.84\ x\ T_2$$

$$= 2501 + 1.84\ x\ 76 = 2642.8\ \frac{kJ}{kg}$$

$$\dot{m}_2 = \dot{m}_4 = \dot{m}_5 = \frac{1}{h_5 - h_4} = \frac{1}{2508.9 - 159.1}$$

$$= 0.000426\ kg/s = 0.426\ l/s$$

$$\dot{m}_3 X_3 = \dot{m}_1 X_1$$

$$\dot{m}_1 = \dot{m}_2 + \dot{m}_3$$

$$\dot{m}_1 = 0.426 + \dot{m}_3$$

$$\dot{m}_1 = 0.0005941 \frac{kg}{s}\ \&\ \dot{m}_3 = 0.0005515 \frac{kg}{s}$$

Heat Exchanger

$$\dot{m}_1 h_1 + \dot{m}_3 h_3 = \dot{m}_1 \dot{h}_1 + \dot{m}_3 \dot{h}_3$$

$$\dot{h}_3 = 161.2\ \frac{kJ}{kg}\ When\ T1 = 40\ C\ \&\ \dot{h}_1 = 82 \frac{kJ}{kg}$$

$$Q_c + \dot{m}_4 h_4 = \dot{m}_2 h_2$$

$Q_c = 1.057\ kW$

$Q_g + \dot{m}_1 h_1 = \dot{m}_2 h_2 + \dot{m}_3 h_3$

$Q_g = 1.5896\ kW$

Heat Exchanger

$Q_g + \dot{m}_1 \dot{h}_1 = \dot{m}_2 h_2 + \dot{m}_3 \dot{h}_3$

$Q_g = 1.166\ kW$

Total energy balance

Supplied energies = Rejected energies

Supplied energies $= q_g + q_e$

=1+1.6458=2.6458 kW

Rejected energies $= q_a + q_c$

=1.5896+1.057=2.6466 kW

$$(COP)_{act} = \frac{Q_e}{Q_g} = \frac{1}{1.5896} = 0.629$$

Heat Exchanger

$$(COP)_{act} = \frac{Q_e}{Q_g} = \frac{1}{1.166} = 0.857$$

$$(COP)_{tho} = \frac{T_e(T_g - T_c)}{T_g(T_c - T_e)} = \frac{277(349 - 311)}{349(311 - 277)} = 1.103$$

$$(COP)_{relative} = \frac{(COP)_{act}}{(COP)_{tho}} = \frac{0.629}{1.103} = 0.74$$