

جامعة تكريت

قسم الميكانيك

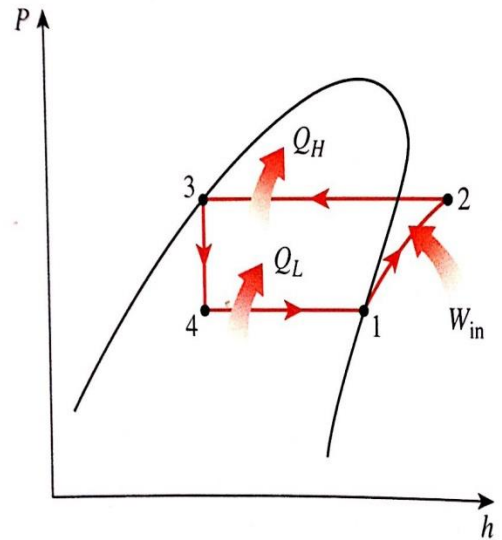
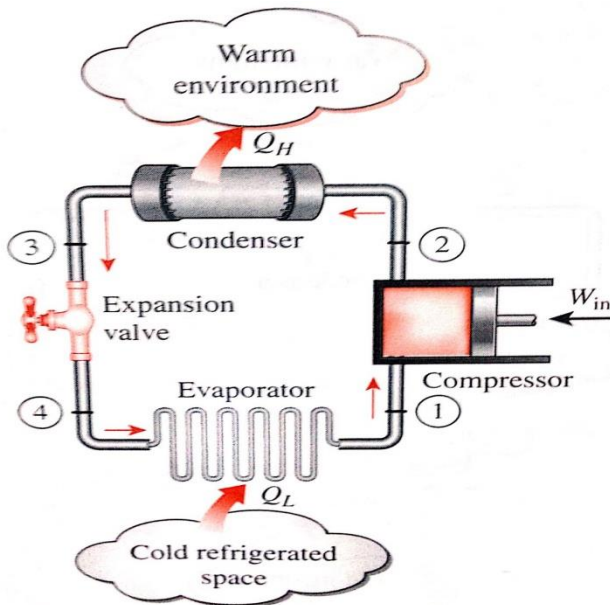
كلية الهندسة

محاضرة اساسيات دورة التبريد الانضغاطية

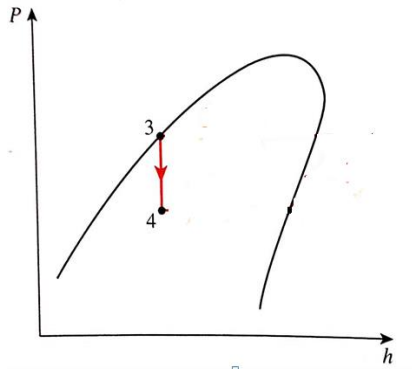
المادة: تكييف التاريف ٧ حزيران 2021

Compression Refrigeration Cycle

دورة التثليج الانضغاطية



Expansion valve (3-4)

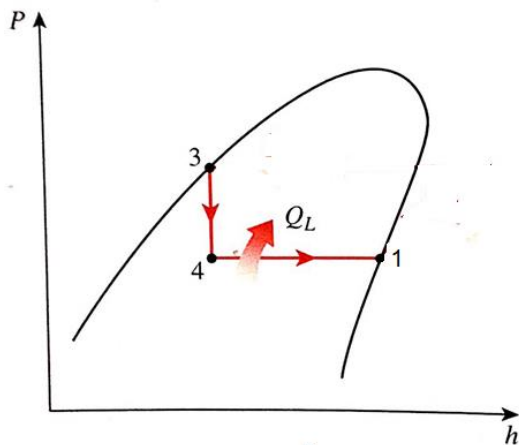


$$gZ_3 + \frac{1}{2}C_3^2 + h_3 + Q = gZ_4 + \frac{1}{2}C_4^2 + h_4 + W$$

$$h_3 - h_4 = 0$$

$$h_3 = h_4$$

Evaporator (4-1)

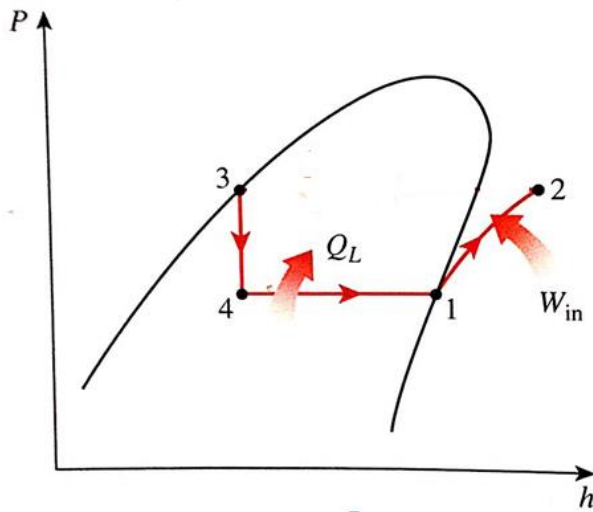


$$gZ_4 + \frac{1}{2}C_4^2 + h_4 + Q = gZ_1 + \frac{1}{2}C_1^2 + h_1 + W$$

$$h_4 + Q = h_1$$

$$Q_{4-1} = h_1 - h_4$$

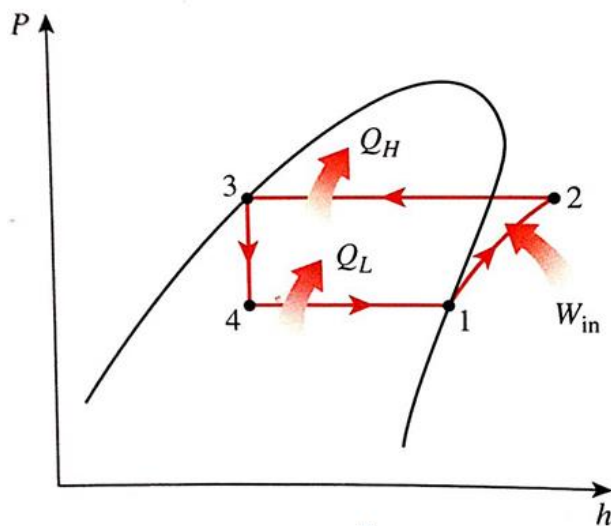
Compressor (1-2)



$$gZ_1 \nearrow^0 + \frac{1}{2} C_1^2 \nearrow^0 + h_1 + Q \nearrow^0 = gZ_2 \nearrow^0 + \frac{1}{2} C_2^2 \nearrow^0 + h_2 + W$$

$$W_{1-2} = h_1 - h_2$$

Condenser(2-3)



$$gZ_2 \nearrow^0 + \frac{1}{2} C_2^2 \nearrow^0 + h_2 + Q = gZ_3 \nearrow^0 + \frac{1}{2} C_3^2 \nearrow^0 + h_3 + W \nearrow^0$$

$$h_2 + Q = h_3$$

$$Q_{2-3} = h_3 - h_2$$

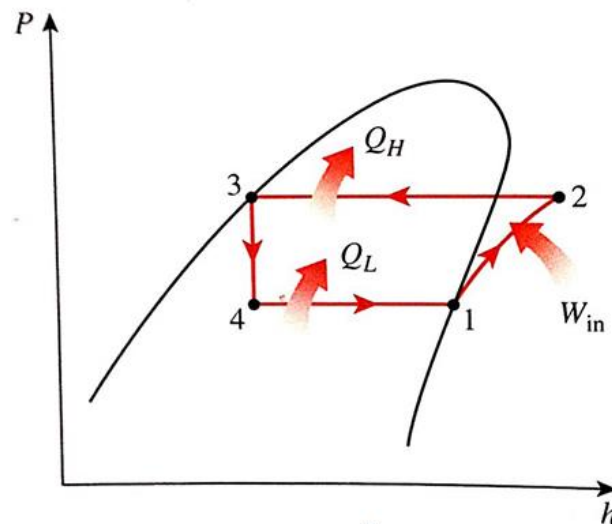
Coefficient of Performance (COP)

$$COP = \frac{\dot{m}_f(h_1 - h_4)}{\dot{m}_f(h_2 - h_1)} = \frac{(h_1 - h_4)}{(h_2 - h_1)}$$

Example

Find the *COP* and refrigerator capacity of a refrigerator system uses R134a as a working fluid, saturated vapour at (-8 °C) enters the compressor and leaves at 48 °C when the condenser temperature is 40 °C, the mass flow rate of refrigerant is 0.25 kg/s.

Solution



For a refrigerator system

R 134a $T_{\text{evaporator}} = -8^\circ\text{C}$ $T_{\text{condenser}} = 48^\circ\text{C}$ $\dot{m}_f = 0.25 \text{ kg/s}$

To find *COP* & refrigerator capacity

$$COP = \frac{h_1 - h_4}{h_2 - h_1}$$

From table or chart of R 134a at $T = -8^\circ\text{C}$

$$h_1 = h_g = 393.95 \text{ kJ/kg}$$

$$h_3 = h_f = 268.219 \text{ kJ/kg}$$

h_2 (from chart)

$$h_2 = 425.0 \text{ kJ/kg}$$

$$h_4 = h_3 = 268.49 \text{ kJ/kg}$$

$$COP = \frac{q_e}{W} = \frac{\dot{m}_f(h_1 - h_4)}{\dot{m}_f(h_2 - h_1)} = \frac{(h_1 - h_4)}{(h_2 - h_1)}$$

$$COP = \frac{(393.95 - 268.49)}{(425.0 - 393.95)} = 4.0405$$

$$COP = 4.0405$$

$$\text{Refrigerator capacity} = \dot{m}_f(h_1 - h_4) = 0.25(393.95 - 268.49) = 31.365 \text{ kW}$$

$$\text{Refrigerator capacity} = 31.365 / 3.514 = 8.928 \text{ Ton}$$