Class :2nd stage
Subject: thermodynamics
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Experiment No: 9 Vapor pressure compression cycle.

Introduction:

Vapor compression refrigeration cycle VCC are the most commonly used among all refrigeration systems and is the most widely used method for air-conditioning of buildings. In a vapor compression refrigeration cycle VCC, refrigeration is obtained as the refrigerant evaporates at low temperatures. The input to the system is in the form of mechanical energy required to run the compressor.

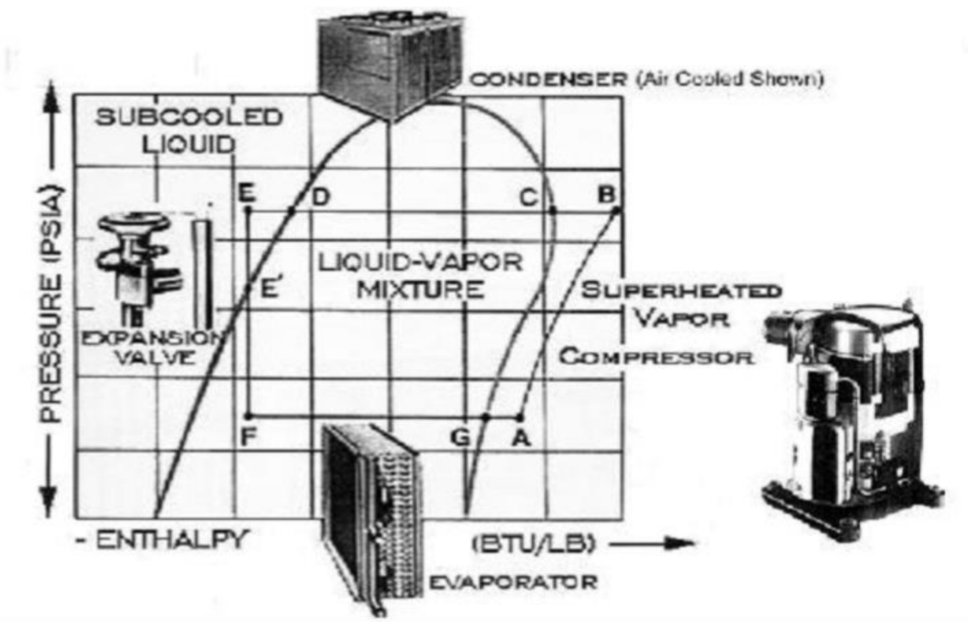
OBJECTIVE:

1- Record high, low pressure, temperature at input and output of each component and compressor work.

2- Analyses the pressure-enthalpy diagram for a vapor compression remigration cycle

3- Analyses its performance vapor compression remigration cycle .

Theory and Principle



Figure(9-1): Liquid vapor cycle.

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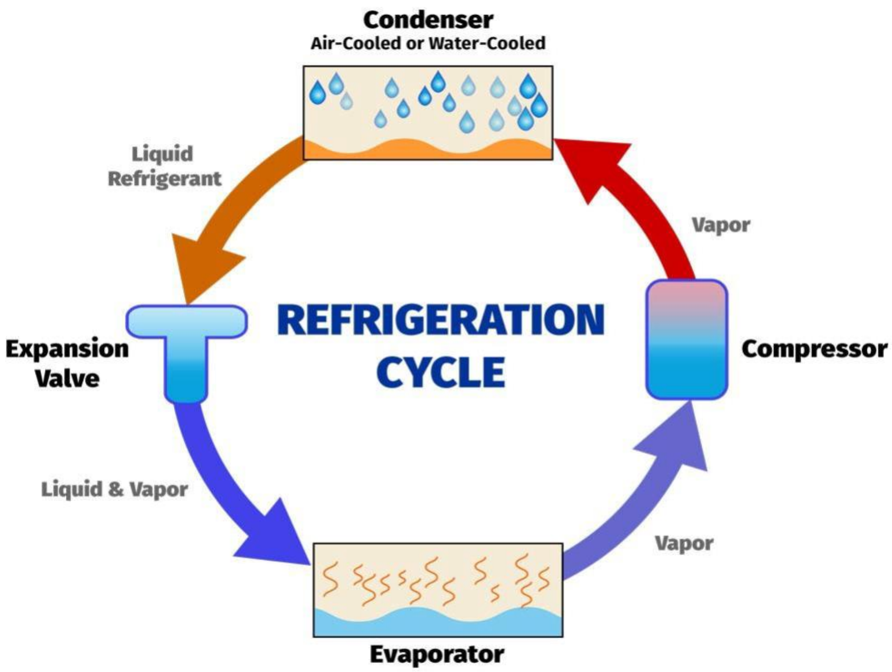

Figure(9-2): Refrigeration cycle.

1- Compressor [compression]

$$W_{compressor} = m_{ref}(h_2 - h_1)$$

where h_2 , h_1 are the enthalpy of the refrigerant after and before the compressor (kJ kg^{-1})

2- Condenser (Heat exchanger) $$Q_{condenser} = m_{ref}(h_2 - h_3)$$

where $\dot{m}_{ref}$ is the mass flow rate of the refrigerant (kg s^{-1})
h_3 , h_2 are the enthalpy of the refrigerant after and before the condenser (kJ kg^{-1})

ENERGY Eq. → ($\boldsymbol{qin}$-$\boldsymbol{qout}$) + $\boldsymbol{Win}$ + $\boldsymbol{Wout}$ = $\boldsymbol{hout}$ – $\boldsymbol{hin}$

1- Compressor

$$W_{compressor} = m_{ref}(h_2 - h_1)$$

where h_2 , h_1 are the enthalpy of the refrigerant after and before the compressor (kJ kg^{-1})

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2- Condenser (Heat exchanger), [liquefaction]

$$Q_{condenser} = m_{ref}(h_2 - h_3)$$

where $\dot{m}_{ref}$ is the mass flow rate of the refrigerant (kg s^{-1})
h_3 , h_2 are the enthalpy of the refrigerant after and before the condenser (kJ kg^{-1})

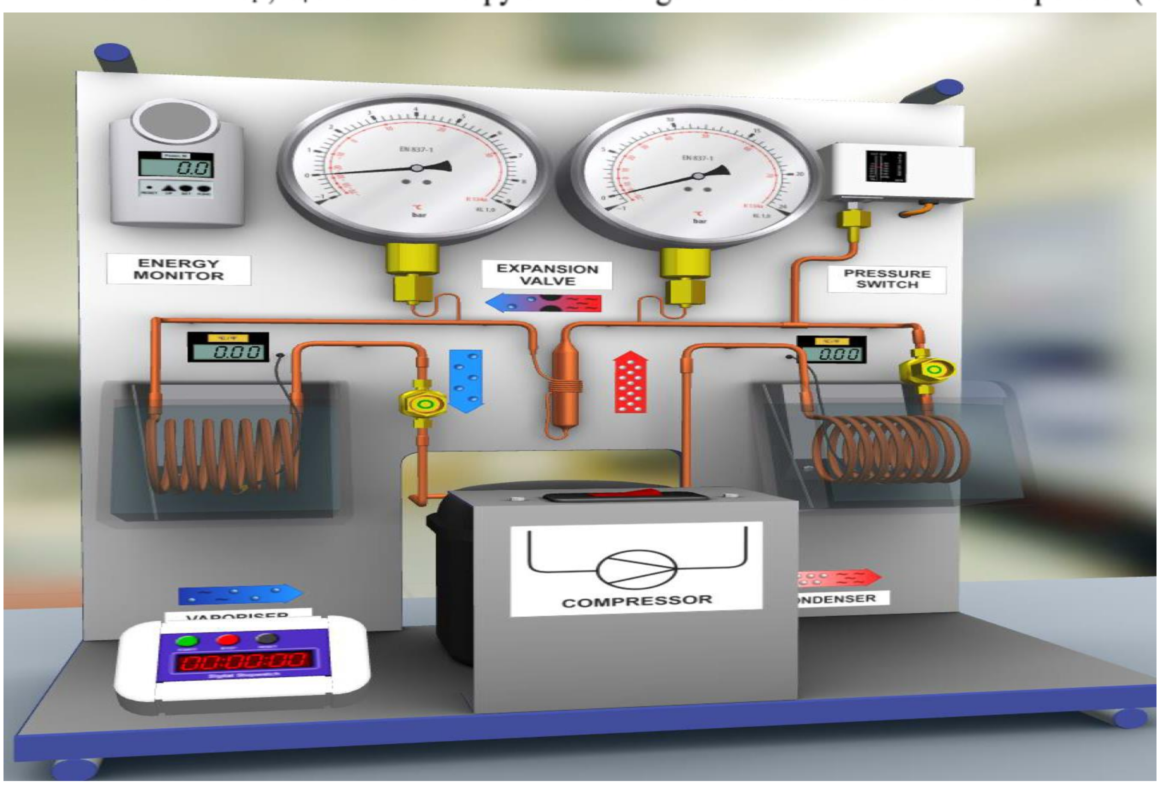
3- Expansion Valve or Capillary Tube

h3=h4
Q=0 , W=0

4. Evaporator (Heat exchanger), [depressurization]

$$Q_{evaporator} = m_{ref}(h_1 - h_4)$$

where h_1 , h_4 are the enthalpy of the refrigerant after and before the evaporator (kJ kg^{-1})



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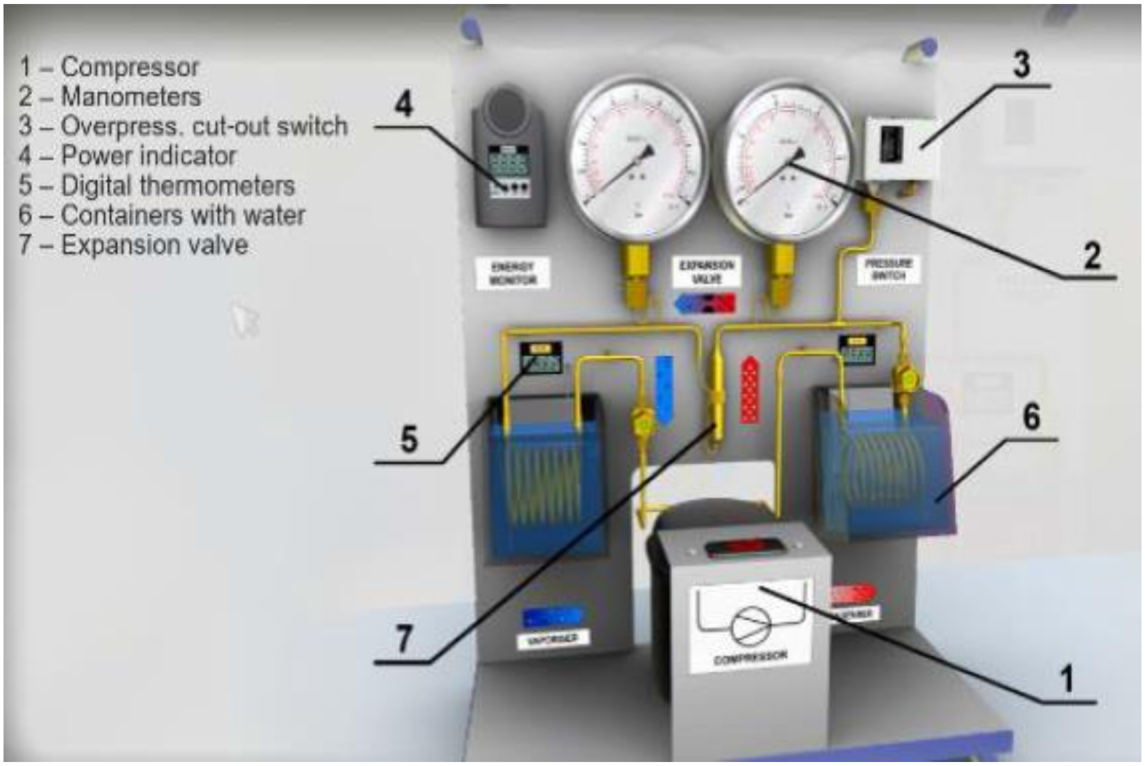

Figure(9-3): sketch of heat pump.

Figure(9-4): Heat pump.

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Procedure

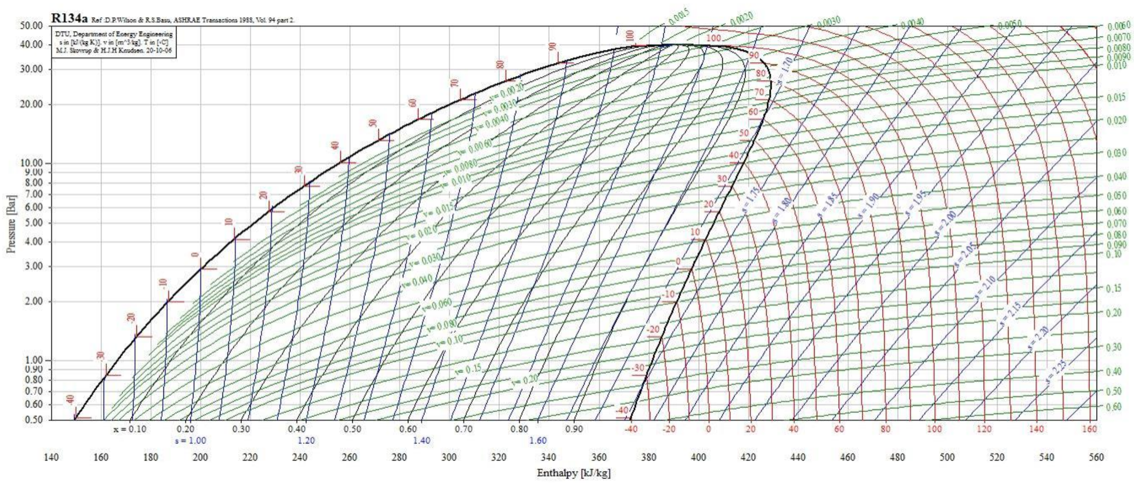
1- Press on power switch point 1 (compressor started).

2- Wait for steady state to provide by watching the variation of pressure reader at point 2. Usually 5-10 minutes are enough to achieve steady state condition.

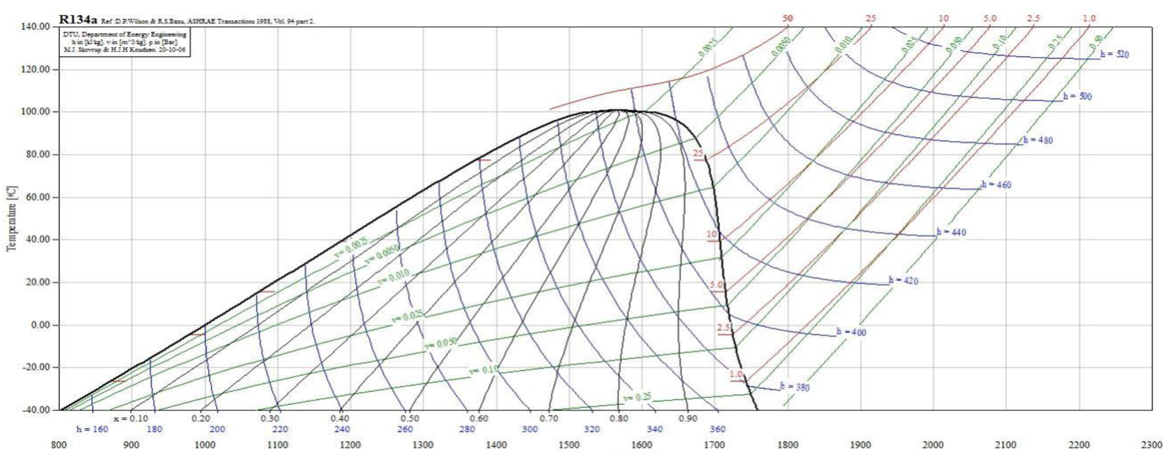
3- Record the data on worksheet.

4.Calculate the enthalpies of cycle by using chart1

5.Find output by using given laws.



Figure(9-5): P-H diagram.



Figure(9-6): T-h diagram.

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WORKSHEET

Record Data						
TEST NO	HP (Bar)	LP (Bar)	T1 ℃	T2 ℃	T3 ℃	T4 ℃
1						
2						
3						
Out put Data						
TEST NO	h1 kJ/kg	h2 kJ/kg	h3 kJ/kg	h4 kJ/kg	W_{comp} kJ/kg	
1						
2						
3						

Discussion

1- Plot the VCRC on The p-h diagram

2- According first law of thermodynamics if work of compressor increase what happened to the efficiency of cycle ? Explain ?

3- Plot curve between T1 and Q condenser ?