Class: 2nd Stage
Subject: air conditioning and refrigeration lab
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EXP. NO. 8

Calculate the performance factor for the impedance cycle

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Objective: - To Determine COP and Tonnage capacity of a Air Conditioning system.

Apparatus: - Compressor, Condenser, Evaporator, Capillary Tube, Ammeter and Voltmeter.

Theory: -

Air conditioning equipment is used to maintain controlled atmospheric conditions as per required. The controlled atmospheric conditions may be required for human comfort or manufacturing processes of engineering goods. Air conditioning systems are classified in two groups.

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1. Packed Units
2. Central Unit

A packed unit is self-contained unit, because complete unit including compressor, evaporator, condenser, fan motor etc. are kept in a common enclosure. Capacity of packed or window AC is 1 to 1.5 T.R. This AC is mounted with the room which is required for controlled atmosphere.

A window AC mainly consists of following sub-assemblies:

1-System assembly includes compressor, condenser, evaporator, expansion device, and filter.

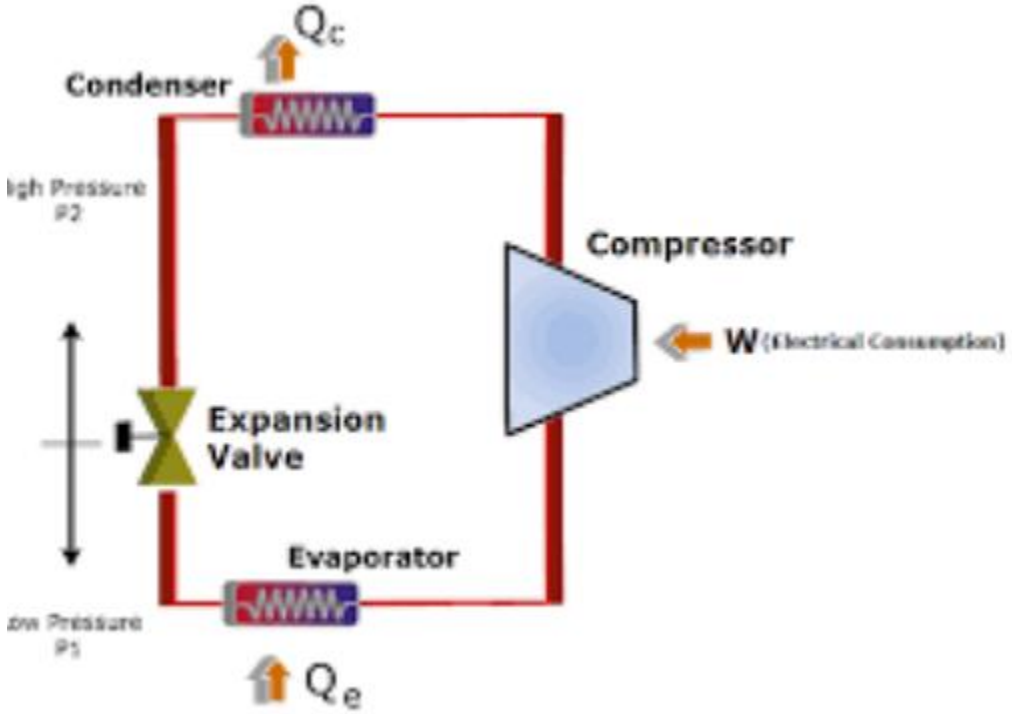
2-Motor with blower & fan assembly includes, a double ended shaft motor, a fan and a motor and suitable bracket for it.

3-Cabinet and air distributing assembly – it includes a cabinet as enclosure for whole system, an air distributing system.

4-Control panel assembly – it includes the switched those required to control the entire AC system as per the requirement, IC temperature, humidity etc.

The AC Test Rig is designed and fabricated, to determine the performance and to study its working principle. The AC test Rig consist a 1.5 T sealed compressor unit, a finned condenser (heating coil) and evaporator (cooling coil), a double ended (shaft) motor to run fan and blower simultaneously and fitted on a wooden stand and properly covered by grill. A duct is assembled along with blower unit as a carrier of comfort air, the velocity of the air passing through the coil is measured by using a pilot tube fitted in duct itself and connected to V-tube manometer which is fitted on control panel. The control panel is fitted over compressor and fan blower assembly. Control panel consist of 1 phase energy meter to measure power consumed by compressor, a Rota meter to measure flow rate of refrigerant pressure gauge to measure pressure of discharge side compound vacuum gauge to measure suction side pressure, a digital temperature indicator to measure

temperature at various places. The desired temperature find out by changing position of selector switch with it. A voltmeter and ammeter is also fitted on control panel.



Working principle

The operation of the air conditioner is as shown below

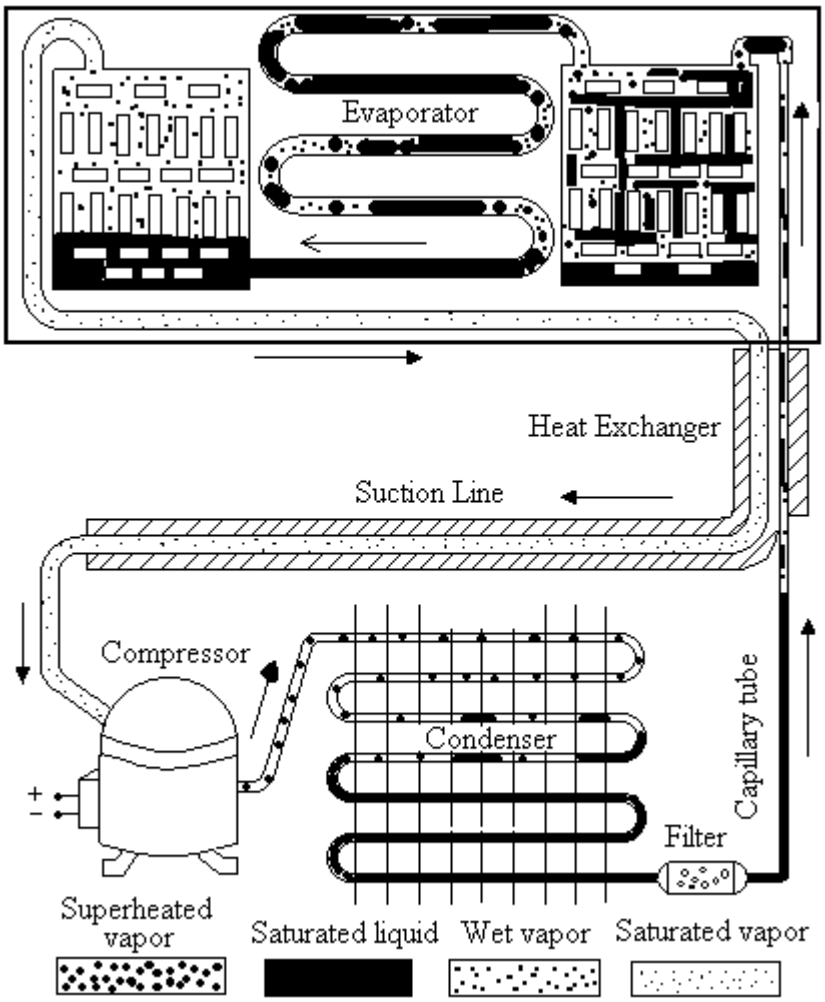
1- The refrigerant enters the compressor as a saturated vapour and leaves it as a superheated vapour

2- Then this superheated vapor flows through the condenser pipes.
The fan is formed by the passage of air through the condenser tubes, where its temperature is less than the refrigerant and limits the heat exchange process between the air and the coolant, as the coolant turns into a liquid state and this process is constant pressure

3- Now the liquid refrigerant flows through the capillary tube and a pressure drop will take place and the refrigerant leaves the capillary tube as a two – phase mixture

4- The two – phase mixture of refrigerant enters the evaporator which is relatively cold will .

Where the heat exchange takes place between the coolant and the air that passes through the evaporator tubes by the fan, and the coolant that is illuminated by a liquid in two liquid and vapor phases turns into a total vapor and more heat and enters the compressor and the process is repeated



$$COP = \frac{Unit \quad refrigeration \quad capacity}{Net \quad power \quad input}$$

$$COP = \frac{Q_e}{W.D}$$

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

7.Experimental Work:

The experimental part can be summarized as indicated below

1. After running the experimental rig of the air conditioner, wait 20 minutes to reach the system the steady state conditions.
2. After reaching the steady state, you can take the experimental data using the thermocouples and the pressure gauge.
3. The thermocouples type K should be installed at the inlet and the exit of each of the main component of the heat pump as indicated below
4. Pressure gauge installed at the high and low temperature levels.
5. The temperature and pressure sensors are important as the whole of the experiment are based on their data.
6. air conditioner system uses Freon R-22 with 2.5 *kg/min.*
7. Experimentally, using thermocouples, the evaporating temperature is -10 *C*, condensing pressure is 9.5 *bar*
8. Select more that evaporator pressure and condensation pressure for example; 1.5, 2, 2.5, 3, 3.25, 3.5, 4.5 bar and 8.5, 9, 9.5, 10, 12, 14, 16 bar.
9. Based upon the above measured data, calculate the following;

9.1. Desired Output
9.2. Desired output
9.3. compression work

9.4. coefficient of performance

10. The measured data should be tabulated in the following table as we need it in the obtaining the thermal performance of the heat pump experimentally.

No	Condensation Pressure	Evaporator Pressure	Condensation Heat Transfer	Work Done in the Compressor	Thermal Performance