



Experiment Details

Department Name	MECHANICAL
Class	B.TECH
Semester	VII
Subject Name	REFRIGERATION AND AIR CONDITIONING
Experiment No.	02
Experiment Name	TRIAL ON DOMESTIC REFRIGERATOR

Version History

Sr. No.	Version Number	Created By	Approved By	Date
1	v1.0	BA Name	Faculty Name	DD/MM/YYYY
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**AIM:**

1. To study construction and working of domestic refrigerator
2. To evaluate cooling capacity of the refrigerator at the ambient temperature
3. To evaluate the actual coefficient of performance of the refrigeration system
4. To evaluate the theoretical coefficient of performance of the refrigeration system
5. To plot the cycle on PH and TS chart

THEORY:**Product Description and Principle of Operation:**

The refrigerator works on a simple vapour compression cycle. Continuously circulating, evaporating and condensing a fixed supply of refrigerant in a closed system to accomplish mechanical refrigeration. Evaporating occurs at a low temperature and low pressure while condensation occurs at a high temperature and pressure. Thus, it is possible to transfer heat from an area of low temperature (refrigerator cabinet) to an area of high temperature (kitchen). Beginning the cycle at the evaporator inlet the low-pressure liquid expands, absorbs heat and evaporates changing to a low-pressure gas from the evaporator outlet.

The compressor pumps this gas from the evaporator through the accumulator increases its pressure and discharges the high-pressure gas condenser. Accumulator is designed to protect the compressor by preventing slug of liquid refrigerant from passing directly into the compressor. An accumulator should be included on all systems subjected to varying load condition for frequent compressor cycling. In the condenser heat is removed from the gas which then condenses and becomes a high-pressure liquid. In some system high pressure liquid drains from the condenser into the liquid storage/ receiver tank on other system both the receiver and the liquid line are omitted.

A heat exchanger between the liquid line and the suction line is also an option item which may or may not be included in a given system design. Between the condenser and evaporator expansion device is located. Immediately preceding this device there is a liquid line strainer/ drier which prevents plugging of valve or tube by retaining scale, dirt and moisture. The flow of refrigerant into the evaporator is controlled by the pressure differential across the expansion device or in the case of thermal expansion valves by the degree of superheat of suction gas. Does the thermal expansion valve shown require a sensor bulb located at the evaporator outlet? In any case the flow of refrigerant into the evaporator increases as the evaporator load increases.

As the high pressure liquid refrigerant enters the evaporator it is subjected to a much lower pressure due to the suction of the compressor and pressure drop across the expansion device. Then the refrigerant tends to expand and evaporate. In order to evaporate the liquid must absorb heat from the air passing over the evaporator.

Eventually the desired air temperature is reached and the thermostat or cold control will break the electrical circuit to the compressor motor and stop the compressor.

As the temperature of air through the evaporator rises, the thermostat or cold control remakes the electrical circuit. The compressor motor starts and the cycle continues.

Technical specification:

Capacity	170 litres
Refrigerator	Haier make
Power source	220-240V; 50Hz; single phase; AC
Freezer	Ice trays provided component shelf provided freezer door rack
Heater for load	provided

Energy meter for compressor	provided
Energy meter heater	provided
HP/LP cut-outs	provided
Refrigerator	Storage shelves Egg shelf provided Bottle shelf provided Crisper provider Glass shelf provided
Pressure gauges	Two numbers provided suction gas pressure and discharge gas pressure

Temperature	Digital temperature indicator with selector to display refrigerant temperature at salient point
Refrigerant	R-600 a non CFC and environment friendly

PRE TEST:

1) Rating of a domestic refrigerator is of the order of.....

A.0.1 ton

B.100 ton

C.10 ton

D.40 ton

2) Domestic refrigerators works on

Air refrigeration cycle

Vapour compression ref. Cycle

Vapour absorption ref. Cycle

None of the above

3) The C.O.P. of domestic refrigerator.....

A.Is less than 1

B.Is more than 1

C.Is equal to 1

D.None of the above

4) Which type of compressor is used in domestic refrigerator.....

A.Centrifugal

B.Axial

C.Miniature sealed unit

D.Piston type reciprocating

5) The bank of tubes at the back of domestic refrigerator are.....

A.Condenser tube

B.Evaporator tube

C.Refrigerant cooling tubes

D.Capillary tubes

PROCEDURE:

Trial on domestic refrigerator test rig

Operating procedure:

1. Keep the unit on level surface
2. Give stabilized power supply of 230 vac, 50hz to the unit
3. Place a unit in properly ventilated
4. Start the unit wait for minimum 30 minutes to reach steady state
5. Record all the readings as per following observation table

To study the construction and working of a domestic refrigerator

Introduction

A domestic refrigerator is one of the simplest of refrigeration devices widely used all over the world. Uses of fractional hp hermetically sealed compressor, natural convection condenser, capillary tube as an expansion device and direct expansion type roll bond evaporator. As per as the controls are concerned, ON OFF type thermostat controls the average temperature of the refrigerator. The inside heat transfer takes place by natural convection and converts to currents set due to density difference of cold and warm air.

Construction:

The domestic refrigerator has a vertical cabinet. The inside of which was made up of pvc material. The outside construction is of CRCA sheet metal duly power coated/ epoxy coated paint. These two portions are separated by polyurethane foam insulation.

The compressor (hermetically sealed one) is located at the rear in the bottom portion. The condenser is made up of a 5 mm diameter MS tube made in zig-zag pattern. It is a natural convection type condenser. Small wire bike rods (called fins) are fixed to the tubes in order to enhance the heat transfer rate to the surrounding. At the end of the condenser there is a filter/ drier.

Inside the cabinet at the upper portion there is a location of an evaporator. Evaporator tubes are made up of aluminium through which cold refrigerant circulates. A suction line accumulator is fixed at the end of the evaporator. Lighting bulb operated by your switch inside the cabinet. An adjustable thermostat with a defrosting mechanism is placed to control the temperature inside the refrigerator.

Suitable shelf rack and compartments are provided inside the cabinet for the required items to be stored and preserved.

Working:

Refrigerators work on vapour compression cycle. Refrigerant vapour is compressed by means of compressor to a pressure at which temperature obtained at the end of compression will be more than the atmospheric. So that at this high temperature it will reject heat to the atmosphere and we'll then get condensed. The condensate is allowed to pass through a capillary so that the pressure and temperature are lowered. Capillary tubes act as a throttling device. The low temperature refrigerant enters the evaporator where it absorbs the heat from surrounding space. Separate saturated along with these major components there are strainer/drier and accumulator. The strainer driver will absorb moisture if at all present in the refrigerant to avoid freezing in the capillary. Accumulator will not allow the liquid refrigerant to enter into the compressor.

Defrosting:

Frost is collected in the evaporator coil and the temperature of the coil is lower than the freezing temperature of water. Frost thickness increases due to frequent opening. As frost is a poor conductor of heat the accumulation of frost on the coil adversely affects the heat transfer between the cabinet air and the refrigerant. It increases the running time of the refrigerator and power consumption. Regular defrosting must be done when frost thickness increases above 6 mm.

In the present case the manual defrosting is done by pushing their red button which stops the compressor on pushing it. When the ice is melted the compressor will restart.

Standard values and formula:

1. Standard barometric pressure= 1.073 bar
2. Density of water = 1000Kg/m²
3. Specific heat of water = 4.18 KJ/Kg K
4. Gas constant for air = 287 KJ/Kg K
5. Specific gravity of R22 at 40°C = 1.2
6. 1 ton of refrigeration effect = 350 Watt = 3.5KJ/s
7. Density of air at 25°C = 1.2 Kg/m³
8. 1 KW/hr. = 3600 KJ
9. Specific gravity of fluid used in inclined manometer = 0.8

POST TEST:

1) The vapour pressure of the refrigerant should be.....

A.Lower than atmospheric pressure

B.Higher than atmospheric pressure

C.Equal than atmospheric pressure

D.None of the above

2) Horse power per ton of refrigeration is expressed as.....

A.4.75/COP

B.COP/4.75

C.4.75 x COP

D.47.5/COP

3) The value of COP in vapour compressure cycle is usually.....

A.Always less than unity

B.Always greater than unity

C.Equal to unity

D.None of the above

4) In refrigeration cycle,the flow of refrigerant is controlled by

A.Condenser

B.Compressor

C.Evaporator

D.Expansion valve

5) Where does the lowest temperature occurs in vapour compression cycle?

A.Condenser

B.Compressor

C.Evaporator

D.Expansion valve

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