EXPERIMENT

AIM: To determine the COP and Tonnage capacity of an Ice Plant.

APPARATUS: Compressor, Condenser, Evaporator, Capillary Tube, Ammeter, and Voltmeter.

INTRODUCTION:-

Ice plant machine is used to manufacture ice. Solid state of water is called the ice. Working principle of ice plant is based on compression system. An ice plant consists of following components.

1. Compressor: Compressor increases the pressure and temperature of refrigerant and pumps it out towards condenser in vapour form. After condensation that refrigerant goes to evaporator and again converted into vapour form. From the evaporator refrigerant is sucked by the compressor during the suction stroke and again being pump to condenser.

2. Condenser: This is a heat exchanger and made of copper tubes of U-shape refrigerant flows through these tubes & getting condensed by the surrounding air to forced or natural air according to the capacity of the plant. In condenser vapour refrigerant is converted into liquid form.

3. Receiver Tank: This is one sort of storage tank, which is filled by the liquid refrigerant. This tank is made of steel to withstand the high pressure and get stored. The main advantage of receiver in only during the shut off period of plant, at which time refrigerant can keep safe after condensation.

4. Filter driver: To absorb moisture from the refrigerant filter drier is used. This is made of brass and filled by silica jell or activated alumina.

5. Expansion service: For expansion of refrigerant in evaporated expansion device are used. There are two types of expansion devices commonly in use, (I) expansion valve, (II) capillary tube. Capillary tube is a copper tube of very small size. Due to its small size gas is form in is end portion which causing low temperature in evaporator.

6. Evaporator: This is made of U-shaped tubes. In these tubes refrigerant circulated. Evaporator is an ice plant is fitted next to expansion device. The refrigerant in evaporator converted into vapour form and in result low temperature creating in surrounding, due to heat transfer. Evaporator also called as cooling coil or freezing unit.

THEORY:

The ratio of useful heat to work input is called the co-efficient of performance of a refrigerating machine i.e.

COP = Heat output / Power input

= m. CpΔT / Kwh

Where

m = Mass of water is ice cane in kg.

Cp =Specific heat of water = 4.18

ΔT = Temperature drop of ice cane water in unit time, k

kwh = Power consumed by the compressor in unit time.

PROCEDURE:

Fill the water in ice box and add the solid salt in it, which that the gravity of brine becomes 1.2. Fill the water in ice canes. The measured quantity of water should be filled. And keep the ice canes in brine tank and close the door. Switch on the power supply to compressor, at the time of starting note down the initial temperature of ice cane water and energy meter reading. Also switch on the stop on the stop watch take the readings of ice cane temperature and energy meter at the interval of 5 minutes. Take enough set of readings for considerable difference in temperature. Switch off the compressor and drain the ice can water.

OBSERVATION TABLE:

S.No.	Mass of water (kg)	Temprature			Energy meter		Time (sec)
		Initial (a)	Final (b)	ΔT (b-a)	Initial	Final	

APPLICATIONS:

Experimental ice plant unit consist of a hermetically sealed compressor which is fitted on a press wood foundation and M.S stand. Discharge pipe of compressor goes to condenser. From here refrigerant flows towards evaporator or ice tank, through the receiver tank, drier filter and capillary tube. Condenser is of fin type and made of U-shaped copper tubes in rows. A fan motor is fitted at stand

to supply forced air to condenser to increase heat transfer rate. Ice tank consist is a brine tank and ice cans, those are packed in an insulation box. Refrigerant flow towards compressor from the evaporator coil. Thermocouples are embedded on different positions. Thermocouple number T1 at selector switch indicated the temperature of discharge side, T2 after condensation, T3 ice can water temperature, T4 at the end of evaporator coil and T5 at control panel is also provided which consist, energy meter, digital temperature indicator, ammeter, voltmeter, pressure gauge and suction gauge. Hand shut off valves are connected with pressure and suction gauge. By opening these valves pressure of discharge or suction side can be checked as and when required. Density of brine is measured with the help of hydrometer.

CALCULATIONS:

q = Heat removed by refrigerant in unit time = m. Cp. ΔT = …….

W = Power consumed by compressor in unit time = ……..……...

COP = q / w

PRECAUTIONS: Insure correct gravity of the brine solution

- Measure time precisely
- Store the refrigerant in receiver tank
- Drain water from ice canes
- Do not open the door of ice box
- Keep thermocouple well in deep in ice cane

RESULTS:--

VIVA QUESTION:

1. What is the working principle of ice plant?

2. What is the role of brine in ice plant?

3. Why ammonia is used as a refrigerant in ice plant?

4. Which refrigerant is mostly used in ice plant & why?

5. What is TR of ice plant?