LAB ENGINEERING

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Product Name :	**Product Code :**
VAPOUR ABSORPTION TEST RIG	Conditioning0008

Description :

VAPOUR ABSORPTION TEST RIG

Technical Specification :

“Vapour Absorption Refrigerator” earlier known as “Electrolux” refrigerator is a self contained refrigerator working on absorption technology. In the absence of a compressor or pump, the circulation takes place by density difference. The system is pre-charged with three fluids namely water, ammonia and hydrogen. Hydrogen is used as an “inert gas” and does not undergo any phase change and heat transfer processes. Its purpose is to keep the pressure of the system constant. It uses an electrically operated generator, where, the ammonia vapours dissolved in water are separated and pure ammonia vapours enter the condenser. In the condenser, the high pressure vapours reject its latent heat to the surroundings and get liquefied. The liquid ammonia expands through expansion device where its pressure and temperature is reduced and cold low pressure vapour enters the evaporator where it absorbs heat from the space to be cooled and then vaporized ammonia absorbs in water. This strong solution then enters the generator and the cycle repeats.

PRINCIPLE OF OPERATION

Electrolux principle works on 3-fluid system. There is solution circulation pump. Total pressure is the same throughout the system. The third fluid remains mainly in the evaporator thus reducing partial pressure of refrigerant to enable it to evaporate at low pressure and hence low temperature.

The schematic diagram of the Electrolux refrigerator working on NH3-H2O system with H2 as the third fluid is shown in figure. Liquid NH3 evaporates in the evaporator in the pressure of H2.Hydrogen is chosen as it is non –corrosive and insoluble in water.

A thermosyphon bubble pump is used to lift the weak aqua from the generator to the separator. The discharge tube from the evaporator the generator is extended down below the liquid level in the generator. The bubbles

rise and carry slugs of weak NH3-H2O solution into the separator.

Two U-bends are provided as vapour- locks to prevent H2 from getting into the high side or solution circuit.

Partial pressure of H2 provides the pressure difference of NH3 between the condenser and evaporator. Accordingly, we have:

In condenser pure NH3 vapour pressure = Total pressure
In evaporator NH3 vapour pressure = Total pressure - partial pressure H2

For example, consider the condenser temperature at 50 0C, and evaporator temperature as -15 0C. The corresponding vapour pressures of NH3 are:
Condenser, Pk = 20.33bar; Evaporator outlet, Po2 = 2.6bar
The approximate pressures in various parts of the system then will be as given in the table.

Section	NH3	H2O	H2	Total
Condenser	20.33	0	0	20.33
Evaporator inlet	1.516	0	18.814	20.33
Evaporator outlet	2.36	0	17.97	20.33
Generator top	15.54	4.79	0	20.33

It has been assumed that vapours leaving generator top are in equilibrium with entering rich solution at 40 C, at which temperature saturation pressure of NH3is 15.45bar. It has also been assumed that the temperature at evaporator inlet is -25 C at which temperature saturation pressure of NH3 is 1.516bar.

TECHNICAL SPECIFICATIONS OF VAPOUR ABSORPTION SYSTEM

GROSS VOLUME	:	41 LITERS
REFRIGERANT	:	WATER, AMMONIA, HYDROGEN
GENERATOR	:	ELECTRICALLY HEATED
CONDENSER	:	NATURAL CONVECTION TYPE
EVAPORATOR	:	NATURAL CONVECTION TYPE
MATERIAL OF CONSTRUCTION SUPPLY	: :	M.S. 230 VOLTS, 50 HZ, 1 PH
ENERGY CONSUMPTION	:	1.07 KWH PER 24 HRS
ENERGYMETER	:	PROVIDED
TEMPERATURE INDICATOR	:	DIGITAL INDICATOR AT THE SALIENT POINTS

LIST OF EXPERIMENTS

- To study construction and working of a vapour absorption refrigerator
- To evaluate performance of the refrigerator by calculating the C.O.P of the system