

**Product Name :**  
Vapour Absorption Test Rig

**Product Code :**  
NLAB-ENGINEERINGLB34008



**Description :**

Vapour Absorption Test Rig

**Technical Specification :**

**PRODUCT DESCRIPTION**

“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 NH<sub>3</sub>-H<sub>2</sub>O system with H<sub>2</sub> as the third fluid is shown in figure. Liquid NH<sub>3</sub> evaporates in the evaporator in the presence of H<sub>2</sub>. 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 NH<sub>3</sub>-H<sub>2</sub>O solution into the separator.

Two U-bends are provided as vapour-locks to prevent H<sub>2</sub> from getting into the high side or solution circuit.

Partial pressure of H<sub>2</sub> provides the pressure difference of NH<sub>3</sub> between the condenser and evaporator. Accordingly, we have:

In condenser pure NH<sub>3</sub> vapour pressure = Total pressure

In evaporator NH<sub>3</sub> vapour pressure = Total pressure - partial pressure H<sub>2</sub>

For example, consider the condenser temperature at 50 °C, and evaporator temperature as -15 °C. The corresponding vapour pressures of NH<sub>3</sub> are:

Condenser, P<sub>k</sub> = 20.33bar; Evaporator outlet, P<sub>o2</sub> = 2.6bar

The approximate pressures in various parts of the system then will be as given in the table.

Section				

Total	20.330.33			
Condenser	20.330.33			
Evaporator inlet	20.330.33			
Evaporator outlet	20.330.33			
Generator top	20.330.33			

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 NH<sub>3</sub> is 15.45bar. It has also been assumed that the temperature at evaporator inlet is -25 C at which temperature saturation pressure of NH<sub>3</sub> is 1.516bar.

**TECHNICAL SPECIFICATIONS OF VAPOUR ABSORPTION SYSTEM**

REFRIGERANT	
GENERATOR HEATING TYPE	
CONDENSER CONVECTION TYPE	
EVAPORATOR CONVECTION TYPE	
MATERIAL OF CONDENSER	
MATERIAL OF EVAPORATOR	
CONDENSER COOLING WATER SUPPLY	
EVAPORATOR COOLING WATER SUPPLY	
REFRIGERANT DRYER	
TEMPERATURE INDICATOR	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.

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