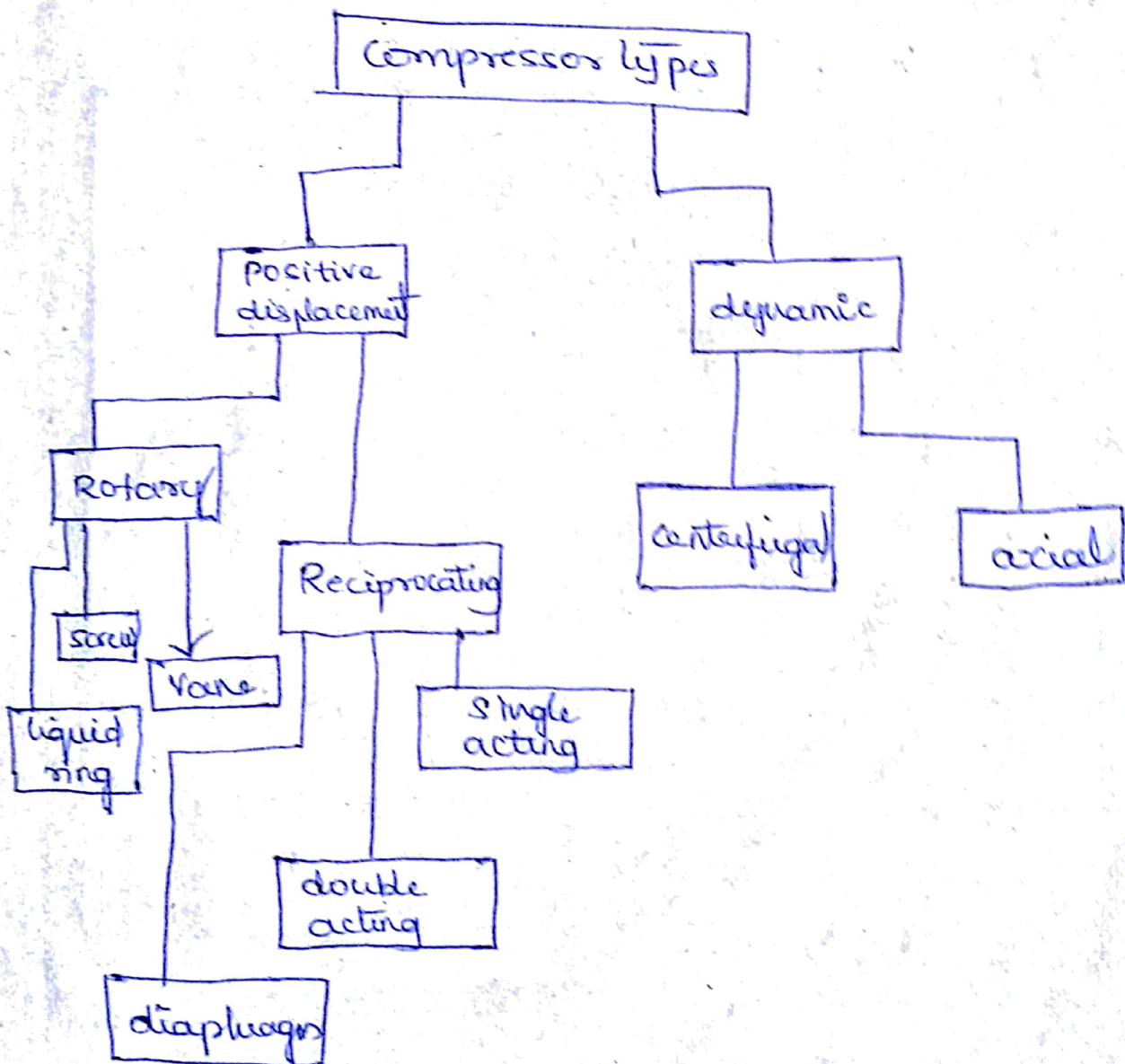


UNIT - II .

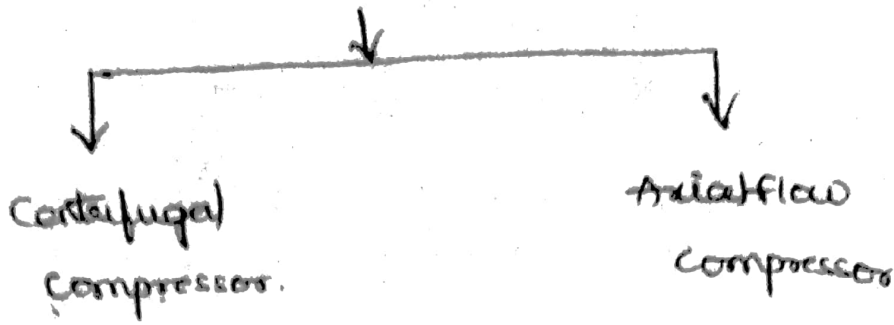
COMPRESSOR .

Compressors are mechanical devices that compress gases . It is widely used in industries and has various applications .

Classification of compressor .

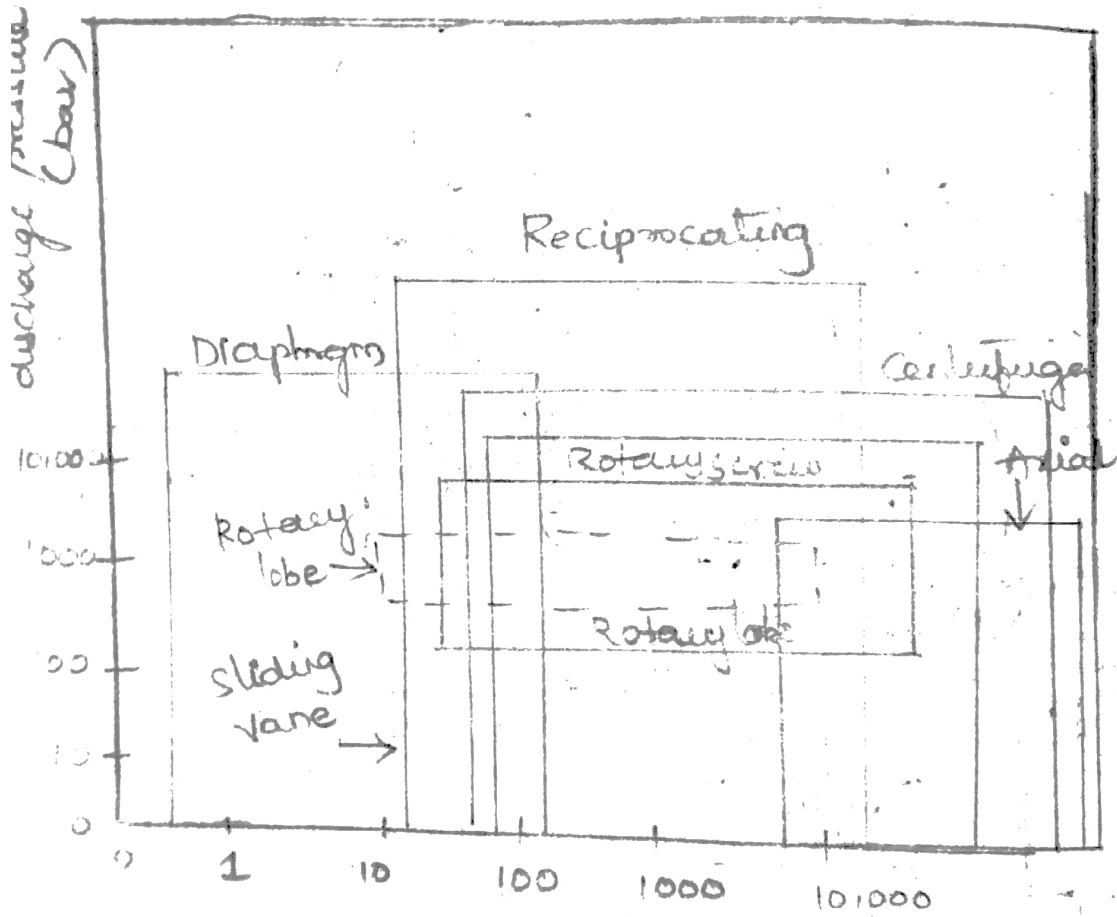


DYNAMIC COMPRESSORS



Axial Flow Compressor.

→ working fluid principally flows parallel to the axis of rotation



Inlet capacity (m³/h)
Graph showing operating regions of various compressor

Performance of compressor
Work per cycle

$$\frac{n}{n-1} P_1 V_1 \left[\gamma_P^{\frac{n-1}{n}} - 1 \right]$$

Compressors	Advantages	Disadvantages
Centrifugal compressor	<ul style="list-style-type: none">• wide operating range• High reliability• low maintenance	<ul style="list-style-type: none">• Instability at reduced flow• sensitive to gas composition change
Axial	High capacity for given size High efficiency Heavy duty low maintenance	<ul style="list-style-type: none">• low compression ratio• limited turn down

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CONDENSERS

- Heat exchange surface that rejects system heat
- Rejects sensible heat

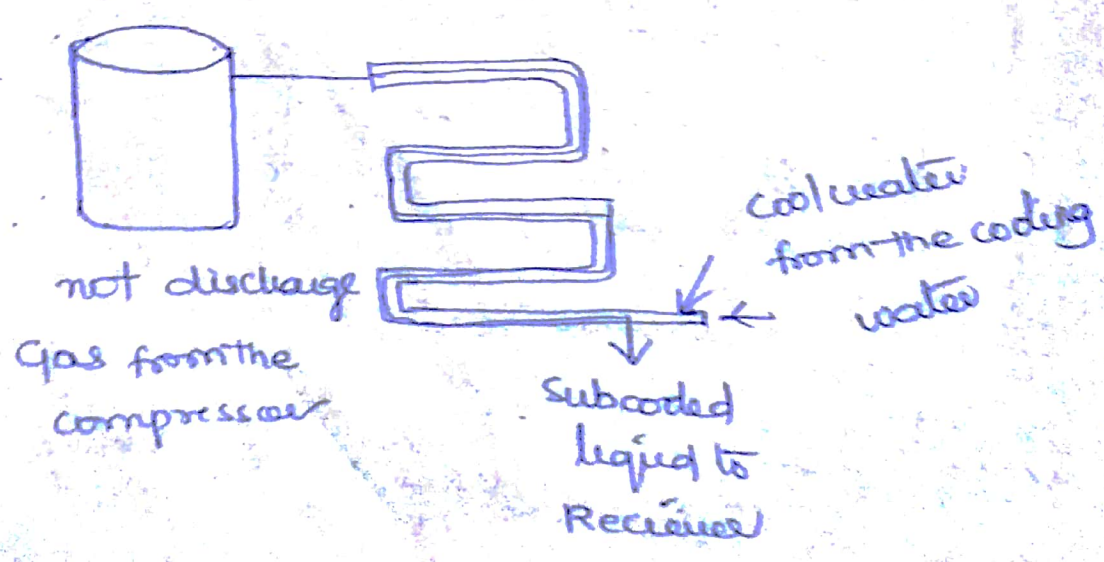
Condensation :-

It is the process of removal of heat from hot fluid or hot substances. The device which is used for condensation process is called condenser.

→ Condenser is also called as a heat exchanger device.

→ Rejection of heat (or) adding of heat will be occurred in two process: sensible heat and latent heat

Classification of condensers :-



All to secondary fluid condensers are classified into 2 ways

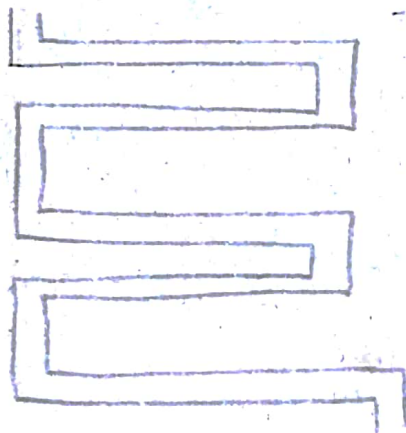
1. water cooled.
2. air cooled.

Water cooled.

Tube within tube condensers, they are 3 types

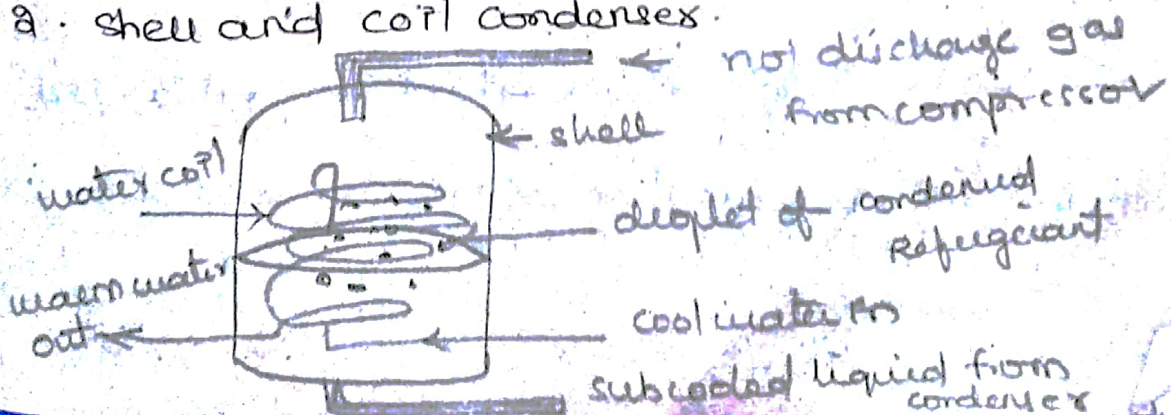
- i) Tube within a tube condenser
- ii) shell and coil condenser
- iii) shell & tube condenser

1. Tube within tube condensers

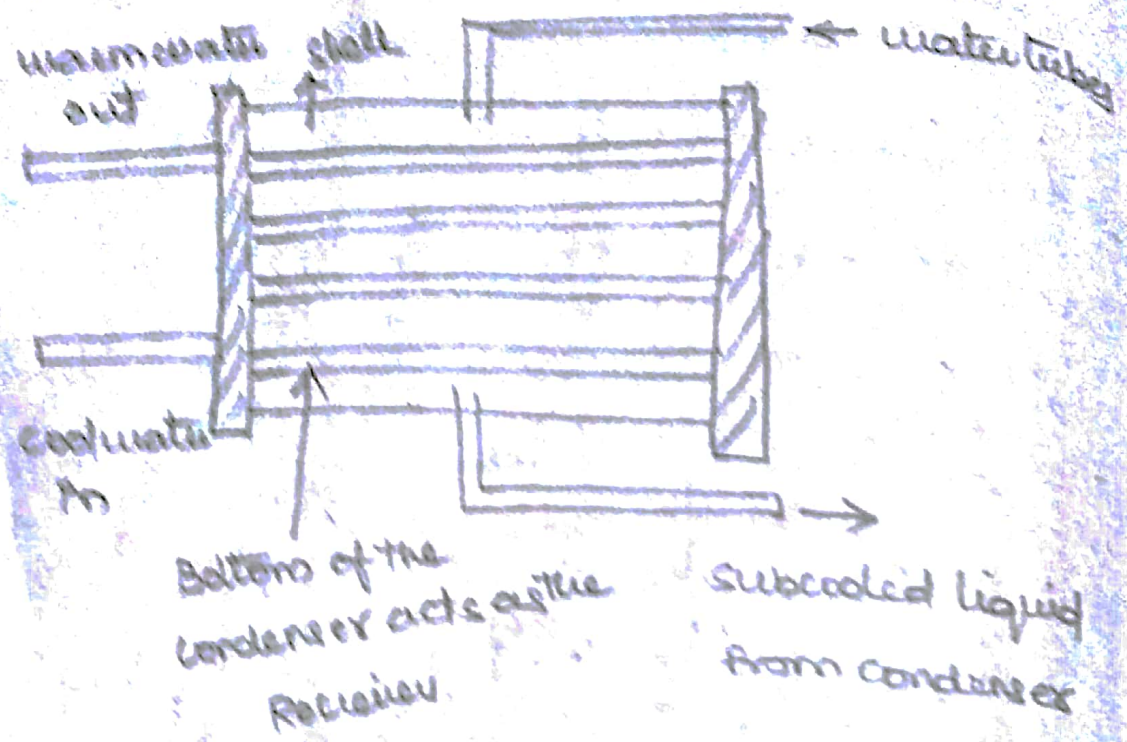


In these heat exchanging takes place between fluids through the walls of tube.

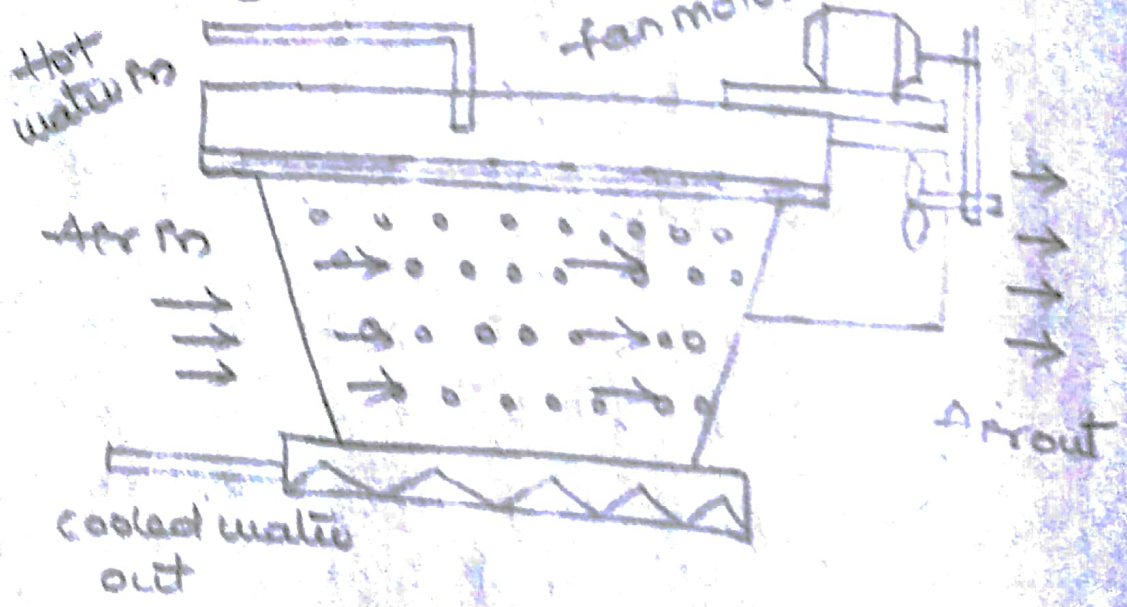
2. shell and coil condensers.



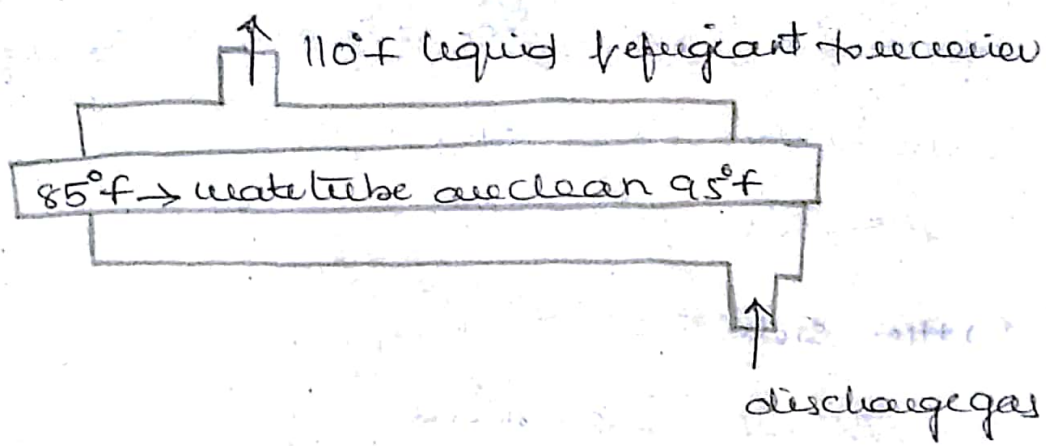
- 3. shell & tube condenser
 - i) can be cleaned mechanically
 - ii) most expensive



Cooling Tower :-



In this condenser, the heat will be extracted from the refrigerant by using air as a refrigerant.



Functions of expansion device

1. It reduces the pressure & temperature of the refrigerant coming from the condenser as per the requirement of the system.
2. It must regulate the flow of refrigerant as per the load on the evaporator.

Expansion devices are classified into.

Expansion devices are essentially a restriction offering resistance to flow so that the pressure drops resulting in a throttling process.

Basically 2 types of Expansion devices

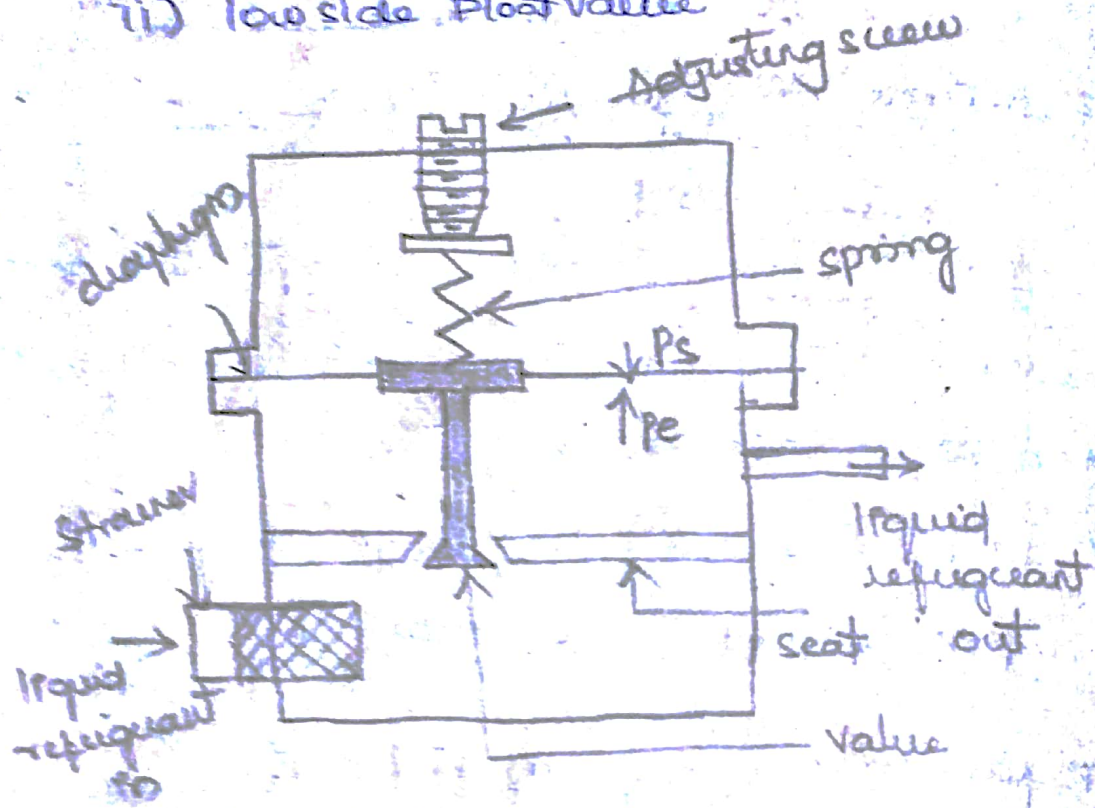
1. Variable Restriction type
2. Constant restriction type

In variable restriction expansion devices are classified into 3 types

- a. automatic expansion valve (pressure control)
- b. Thermostatic expansion valve
- c. Float valve

i) High side float valve

ii) low side float valve



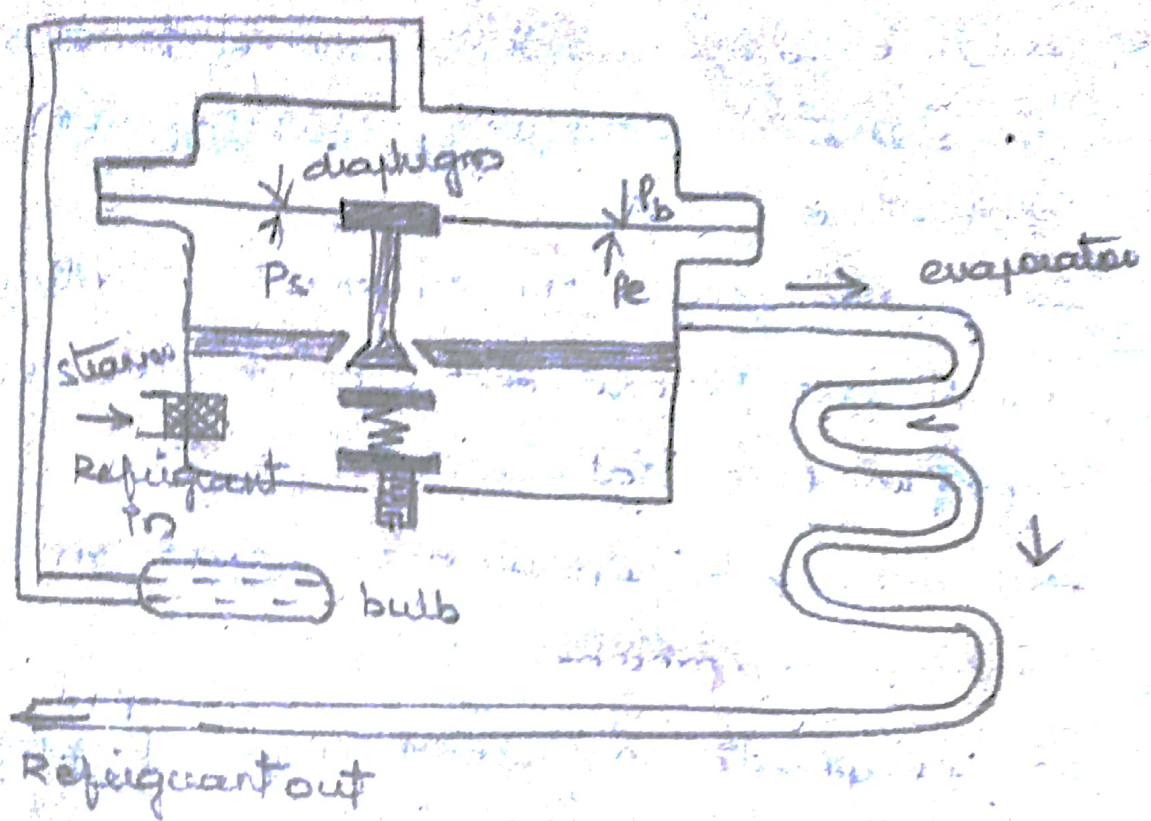
Automatic Expansion valve

- This works in response to the pressure change in the evaporator due to increase in load or due to the decrease in load

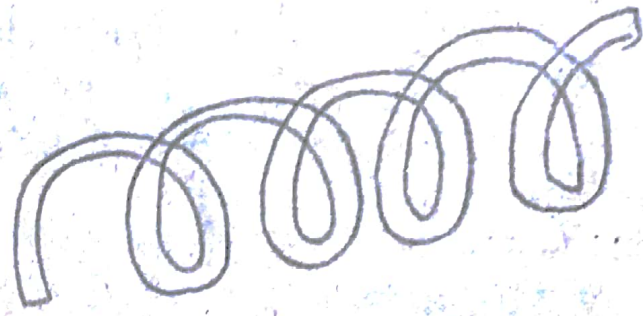
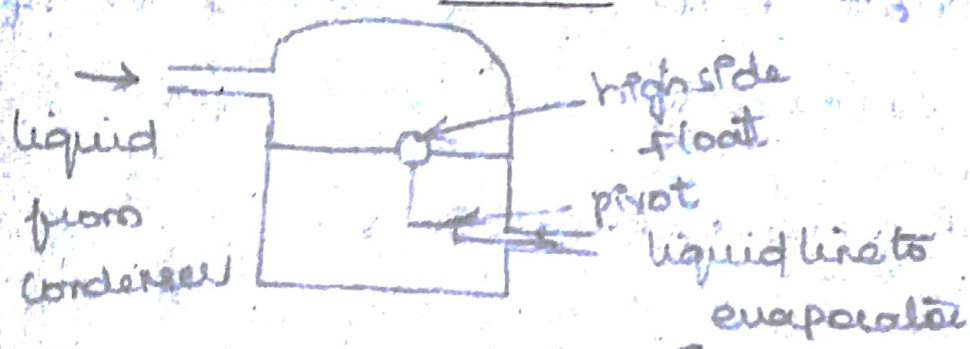
- This valve maintains a constant pressure throughout the varying load on the evaporator controlling the quantity of refrigerant flowing into evaporator

- This consist of a needle valve, a seat, a diaphragm and a spring

Thermostatic expansion valve.



Float Type condensers



The capillary tube is a fixed restriction type device. It is a long and narrow tube connecting the condenser directly to the evaporator.

Evaporator :-

→ It is a device used to removal of heat from the substances by using cold (Refrigerant) substance.

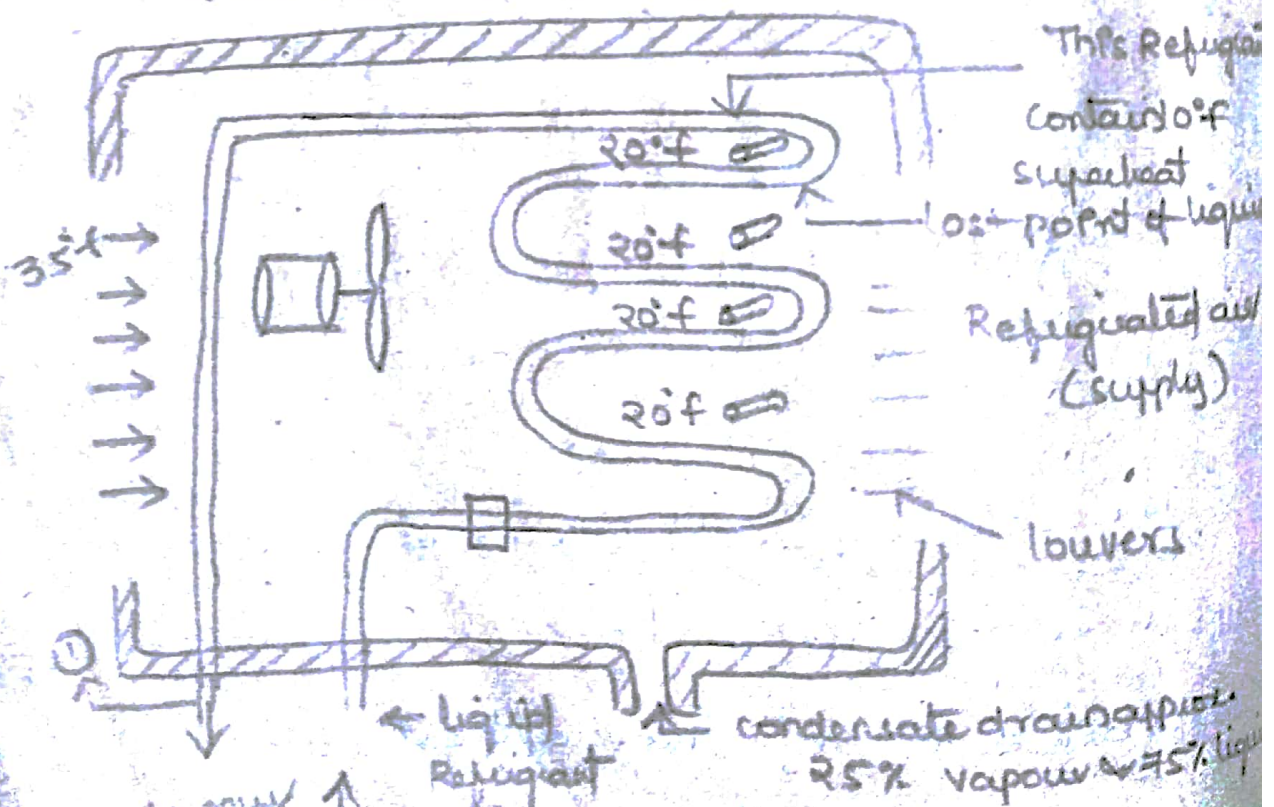
→ In evaporator the Refrigerant is in liquid condition, at the exit of the evaporator the Refrigerant is in saturated dry condition

→ evaporator is kept below the expansion valve and the compressor.

→ evaporator is the most required ^{part} of the Refrigeration system

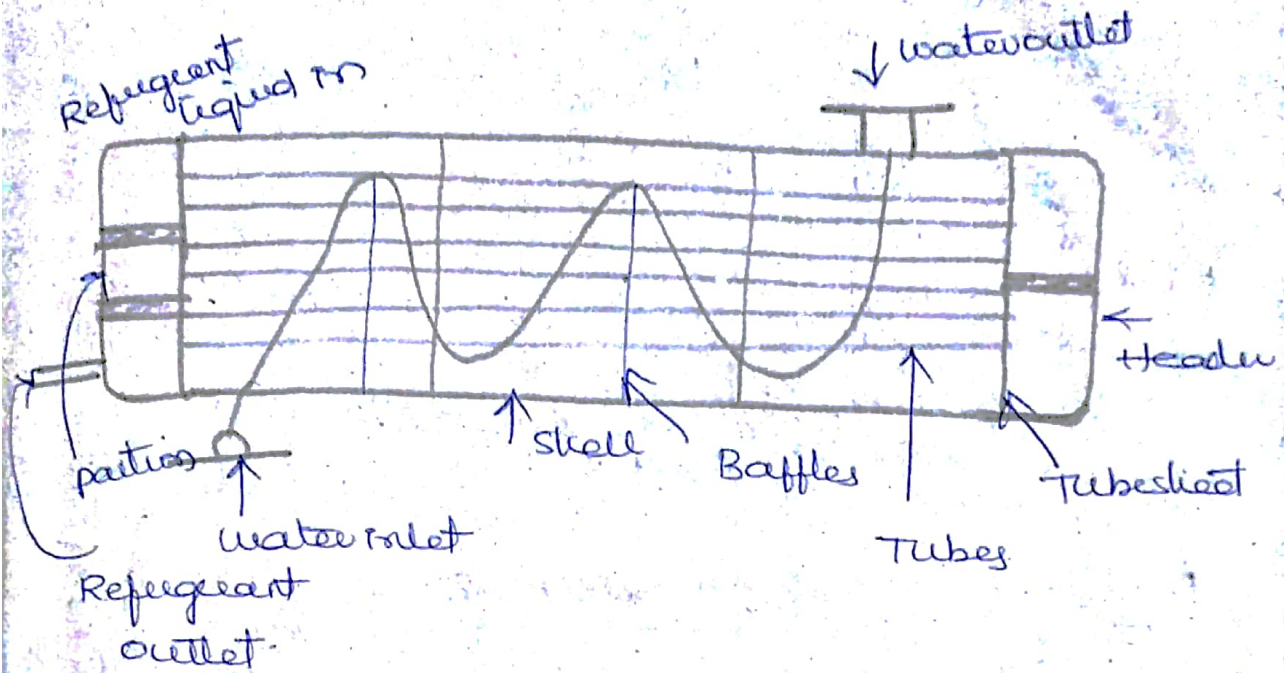
→ evaporator is also called as heat exchanging device is known as a cooler or a freezer.

Classification of evaporator :-



Evaporators are classified into two ways

1. dry-expansion evaporator
2. Flooded evaporator



Dry Evaporator :-

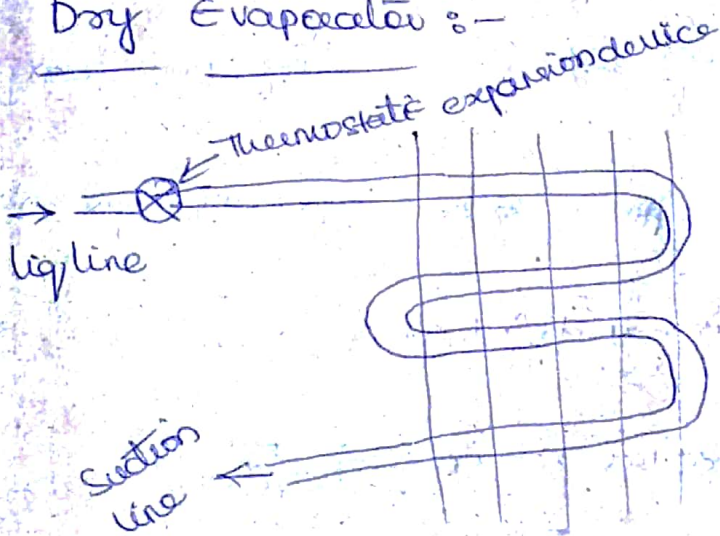
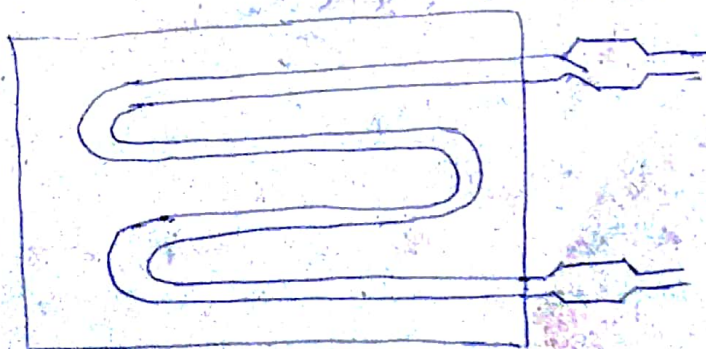
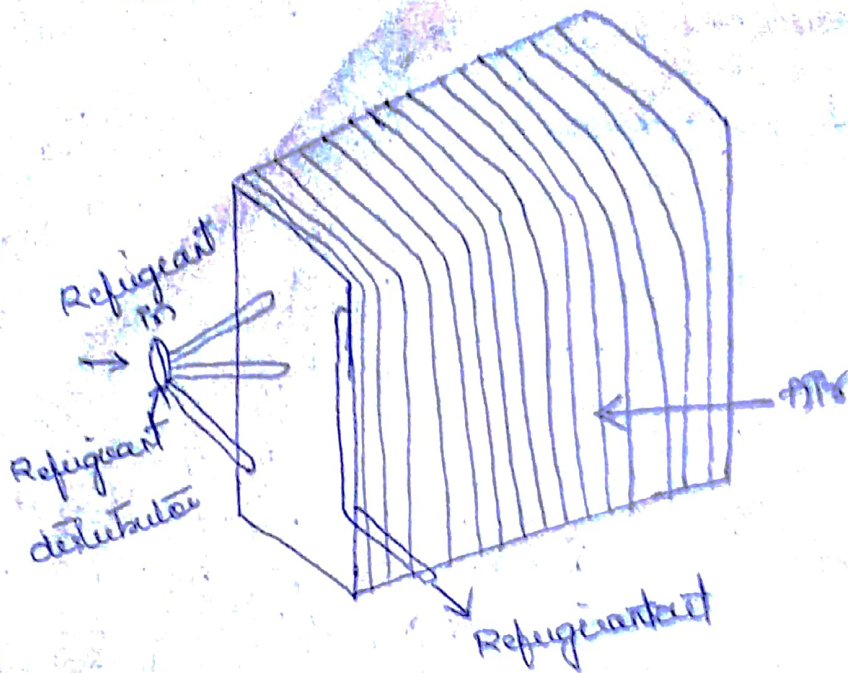


Plate type evaporator :-



FIn type evaporator coil :-



Design calculation for evaporator :-

The heat carried away by the refrigerant from air or any other substance mainly by convection.

The heat transfer capacity of the evaporator is given by

$$Q = u A (T_f - T_s) \text{ kW}$$

u = overall heat transfer coefficient.

A = area of evaporator.

T_f = temperature of the fluid substance passing through the evaporator.

T_s = saturation temp.

materials for evaporator

In evaporator heat transfer rate depends upon thermal conductivity of evaporator tube and the convection heat transfer coefficient of circulating fluid