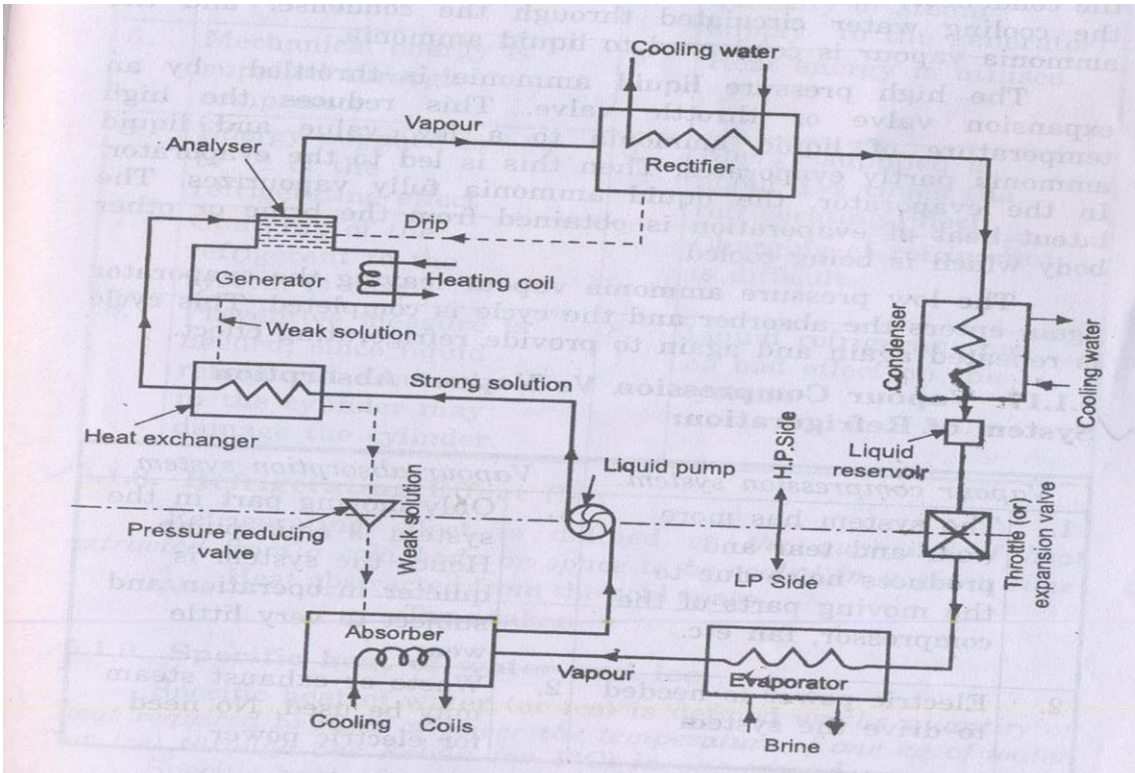
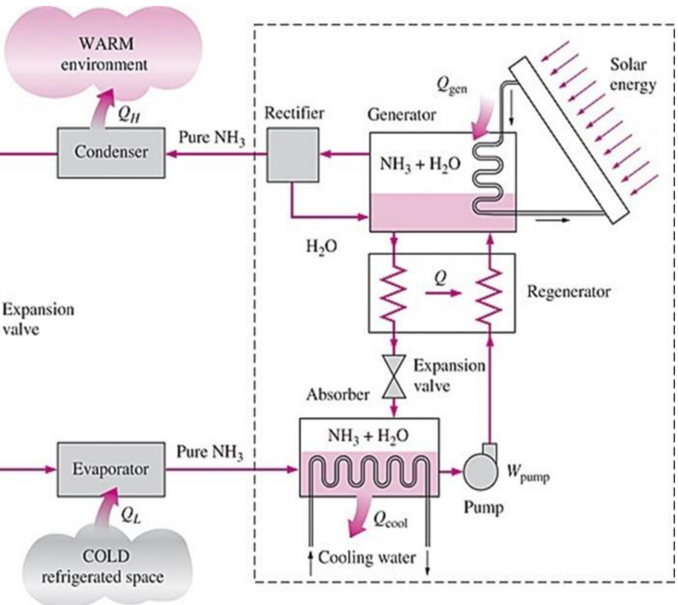
Vapour Absorption Refrigeration system

- The vapour absorption refrigeration system is one of the oldest methods of producing refrigerating effect. The principle of vapour absorption was first discovered by Michael Faraday in 1824. The first vapour absorption refrigeration machine was developed by French Scientist, Ferdinard Carre, in 1860. In this system ammonia is used as the refrigerant and water is used as the absorbent.





Construction:

- The vapour absorption system consists of a condenser, an expansion valve and an evaporator.
- They perform the same as they do in vapour compression method.
- In addition to these, this system has an absorber, a heat exchanger, an analyser and a rectifier.

ANALYZER

The ammonia vapours leaving the generator may contain certain moisture. The function of the analyzer is to remove the moisture as far as possible.

RECTIFIER

It is a closed type of cooler and is actually a miniature condenser where any traces of water vapour left in the ammonia vapour, are removed by condensation

The cooling is achieved by circulating water as is done in an ordinary condenser

Heat Exchangers

Two heat exchangers are provided to internally exchange heat from the higher temperature fluid to the lower temperature fluid so that one is cooled and the other is heated.

Working:

1. Dry ammonia vapor at low pressure passes in to the absorber from the evaporator.
2. In the absorber the dry ammonia vapor is dissolved in cold water and strong solution of ammonia is formed.
3. Heat evolved during the absorption of ammonia is removed by circulating cold water through the coils kept in the absorber.
4. The highly concentrated ammonia (known as Aqua Ammonia) is then pumped by a pump to generator through a heat exchanger.
5. In the heat exchanger the strong ammonia solution is heated by the hot weak solution returning from the generator to the absorber.
6. In the generator the warm solution is further heated by steam coils, gas or electricity and the ammonia vapour is driven out of solution.
7. The boiling point of ammonia is less than that of water.
8. Hence the vapours leaving the generator are mainly of ammonia.
9. The weak ammonia solution is left in the generator is called weak aqua.
10. This weak solution is returned to the absorber through the heat exchanger.
11. Ammonia vapours leaving the generator may contain some water vapour.
12. If this water vapour is allowed to the condenser and expansion valve, it may freeze resulting in chocked flow.
13. Analyser and rectifiers are incorporated in the system before condenser.
14. The ammonia vapour from the generator passes through a series of trays in the analyser and ammonia is separated from water vapour.
15. The separated water vapour returned to generator. Then the ammonia vapour passes through a rectifier.

16. The rectifier resembles a condenser and water vapour still present in ammonia vapour condenses and the condensate is returned to analyser.
17. The virtually pure ammonia vapour then passes through the condenser.
18. The latent heat of ammonia vapour is rejected to the cooling water circulated through the condenser and the ammonia vapour is condensed to liquid ammonia.
19. The high pressure liquid ammonia is throttled by an expansion valve or throttle valve.
20. This reduces the high temperature of the liquid ammonia to a low value and liquid ammonia partly evaporates. Then this is led to the evaporator. In the evaporator the liquid fully vaporizes.
21. The latent heat of evaporation is obtained from the brine or other body which is being cooled.
22. The low pressure ammonia vapour leaving the evaporator again enters the absorber and the cycle is completed.
23. This cycle is repeated again to provide the refrigerating effect.

Advantages:

- The whole system will operated at huge temperature range
- Circulation volume of refrigerant is low which reduces the running cost
- Evaporator size is also small when compared with others
- Coefficient of performance will be very high here
- Load variation does not affect performance
- More will be the capacity i.e.,> 1000 T, 30TR 91% electricity saves.

Disadvantages:

- Efficiency of absorption system will be very low when compared with others
- Time to quotient will be high so as to produce cooling effect
- As it uses kerosene/oil/gas flame it emits bad smell.
- Initial cost will be very high in the case of vapor absorption refrigeration system
- Leakage will also affects the vapor absorption refrigeration system
- Lithium bromide which will be used in VARS will is corrosive in nature which may affect the overall life of the system

Single Effect Cycle: A simple and practical absorption system using ammonia as refrigerant and water as absorbent described in the previous articles is an example of single-effect cycle system for vapour absorption refrigeration system.

Double Effect Cycle : If the heat is supplied in two stages then the system is called two stage or double effect cycle of operation**.**

Comparison between Vapour compression & Vapour Absorption refrigeration systems

S.No.	Vapour Compression System	Vapour Absorption System
1	This system has more wear and tear and produces more noise due to the moving parts of the compressor.	Only moving part in this system is an aqua pump. Hence the quieter in operation and less wear and tear.
2.	Electric power is needed to drive the system	Waste of exhaust steam may be used. No need of electric power
3.	COP is more	COP is less
4.	At partial loads performance is poor.	At partial loads performance is not affected.
5.	Mechanical energy is supplied through compressor	Heat energy is utilised
6.	Energy supplied is ¼ to ½ of the refrigerating effect (less)	Energy supplied is about one and half times the refrigerating effect (more)
7.	Charging of the refrigerating to the system is easy	Charging of refrigerant is difficult
8.	Preventive measure is needed, since liquid refrigerant accumulated in the cylinder may damage to the cylinder	Liquid refrigerant has no bad effect on the system.