6.7 Vapor Absorption Refrigeration System:

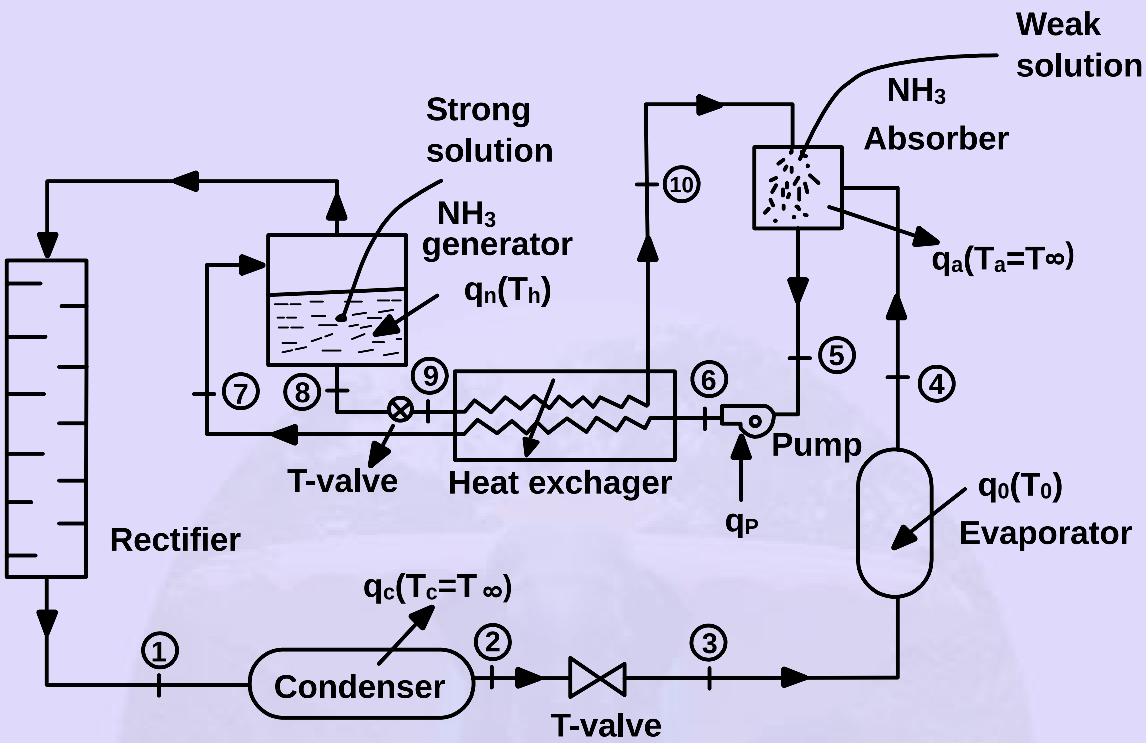

Fig.6.7. Vapor absorption refrigeration system

Some liquids like water have great affinity for absorbing large quantities of certain vapors (NH_3) and reduce the total volume greatly. The absorption refrigeration system differs fundamentally from vapor compression system only in the method of compressing the refrigerant. An absorber, generator and pump in the absorption refrigerating system replace the compressor of a vapor compression system.

Figure 6.7 shows the schematic diagram of a vapor absorption system. Ammonia vapor is produced in the generator at high pressure from the strong solution of NH_3 by an external heating source. The water vapor carried with ammonia is removed in the rectifier and only the dehydrated ammonia gas enters into the condenser. High pressure NH_3 vapor is condensed in the condenser. The cooled NH_3 solution is passed through a throttle valve and the pressure and temperature of the refrigerant are reduced below the temperature to be maintained in the evaporator. The low temperature refrigerant enters the evaporator and absorbs the required heat from the evaporator and leaves the evaporator as saturated vapor. Slightly superheated, low pressure NH_3 vapor is absorbed by the weak solution of NH_3 which is sprayed in the absorber as shown in Fig.6.7.

Weak NH_3 solution (aqua–ammonia) entering the absorber becomes strong solution after absorbing NH_3 vapor and then it is pumped to the generator through the heat exchanger. The pump increases the pressure of the strong solution to generator pressure. The strong NH_3 solution coming from the absorber absorbs heat form high temperature weak NH_3 solution in the heat exchanger. The solution in the generator becomes weak as NH_3 vapor comes out of it. The weak high temperature ammonia solution from the generator is passed to the heat exchanger through the throttle valve. The pressure of the liquid is reduced to the absorber pressure by the throttle valve.

Comparison between Vapor Compression and Absorption system:

Absorption system	Compression System
a) Uses low grade energy like heat. Therefore, may be worked on exhaust systems from I.C engines, etc.	a) Using high-grade energy like mechanical work.
b) Moving parts are only in the pump, which is a small element of the system. Hence operation is smooth.	b) Moving parts are in the compressor. Therefore, more wear, tear and noise.
c) The system can work on lower evaporator pressures also without affecting the COP.	c) The COP decreases considerably with decrease in evaporator pressure.
d) No effect of reducing the load on performance.	d) Performance is adversely affected at partial loads.
e) Liquid traces of refrigerant present in piping at the exit of evaporator	e) Liquid traces in suction line may damage the compressor.

constitute no danger.	
f) Automatic operation for controlling the capacity is easy.	f) It is difficult.