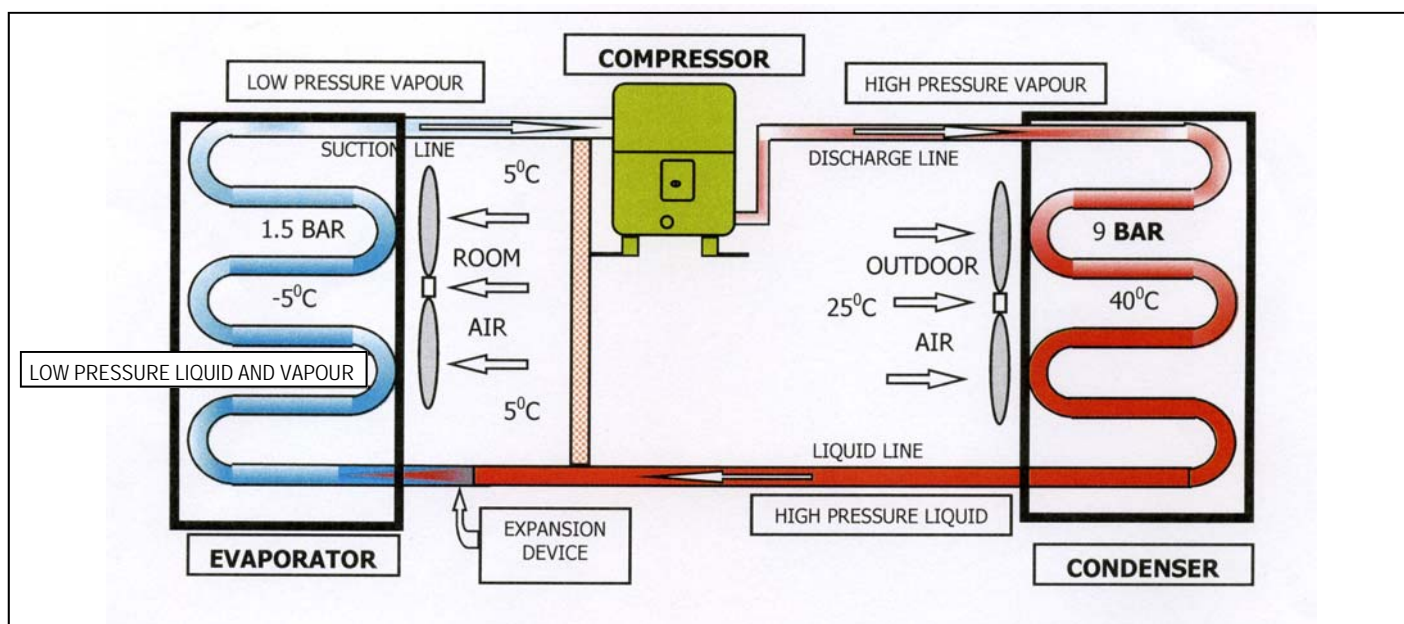




# THE VAPOUR COMPRESSION CYCLE



Many experienced and fully trained engineers will know much of this basic theory already—but the guides can be used for training of colleagues, apprentices or helping customers understand their equipment.

The basic vapour compression or mechanical refrigeration cycle involves the circulation of refrigerant, which in the process of boiling (evaporating) absorbs large amounts of heat and gives up heat when condensing. This heat which must be gained or lost during the change of state is called **latent heat of vaporisation**. It is in general more than the specific heat, that is the heat lost or gained during a one degree change in temperature.

There are in principal, only two pressures within the refrigeration system, which are relative to the required evaporating and condensing temperatures but vary depending on the refrigerant used, the temperature of the space to be cooled and the type of application.

An example of a basic vapour compression circuit for an air conditioning application is shown above.

1. The refrigeration cycle start with high pressure liquid (eg 9 BAR) in the liquid line passing through a restrictor device, which typically could be a capillary line or an **expansion valve**. Here it is allowed to expand and its flow is regulated.

2. Next it passes into the **evaporator** where with its pressure greatly reduced eg 1.5 BAR, it will be boiling at -5°. But in order for it to boil it must absorb heat, which it gets from the metal of the coils which in turn absorbs the heat from the room space which, in this example might be around 5°C.

3. Once the refrigerant has been vaporised it moves from the evaporator into the **suction line** and on to the **compressor**. The compressor compresses the the vapour into a smaller volume and in doing so raises its pressure (eg 9 BAR) and its condensing temperature (40°C).

4. The high pressure refrigerant vapour now passes into the **condenser** (also a matrix of finned pipes), where it is condensed back into a liquid state, by use of a fan drawing ambient air over it.

5. The high pressure refrigerant now moves to the bottom of the condenser coil and sometimes into a vessel called a **liquid receiver**, where the cycle begins again!

The zone temperature can be controlled by simply cycling the compressor on and off according to the desired set point of a thermostat or controller, where it is monitored by a bulb or sensor usually found in the return air to the evaporator or a suitable place in the area.

Note: the refrigeration cycle does not create “cold” it merely transfers heat from one place to another. A **heat pump** system employs a valve which basically reverses the cycle in order to absorb heat from ambient air and transfer it to where it is required.