BASIC AC REFRIGERATION CYCLE:

The refrigeration cycle of an HVAC system is determined by the Laws of Thermodynamics. Simply, we'll look at four attributes:

The heat of vaporization or evaporation is the amount of heat required to convert a liquid into a gas. This is measured at a liquid's boiling point at a specific pressure. More on this later. In the refrigeration cycle, boiling or evaporation means changing a liquid to a gas. Conversely, condensation refers to changing a gas into a liquid. Whenever evaporation or condensation takes place, a considerably greater amount of energy is required during either of these processes or changes of state.

The pressure surrounding the liquid changes the boiling point of a liquid. Lower pressures make it easier for a liquid to boil, and higher pressures make it more difficult. An example would be water, If you lived at sea level, your water would boil at 212° F. However, if you lived in Denver, the Mile High City, where the pressure is lower than at sea level, your water would boil at approximately 194° F. The difference in pressure lowers the boiling point of water. Being able to control a refrigerant's pressure to change its boiling point (and condensation point) is crucial to making the refrigeration cycle possible.

We also know energy (or heat) cannot be created or destroyed but it can be converted from one form to another. We use electrical energy to drive a compressor to produce different pressures and change the states of a refrigerant. Turn the electricity off and pressures equalize.

There is no such thing as cold, only the absence of heat. When an air conditioner being used to cool a space, it is removing heat. The refrigeration cycle is to remove the heat from one area and eject into another. You take this same principle and apply it to a heat pump.

The four major components of the refrigeration cycle are the compressor, condenser, an expansion device, and an evaporator. Connecting these components will be refrigerant lines plus the usual control and safety devices.

The Compressor
The compressor is the heart of the refrigeration cycle. It consumes the most power of any of the HVAC system's components and forces refrigerant through the system. As the refrigerant gas enters the compressor it is transformed into a hot, high pressure gas which flows into the next component in the refrigeration cycle—the condenser.

The Condenser
The condenser's function to cool the refrigerant so it condenses from a gas into a liquid. This happens when the outdoor air blows across a condenser coil filled with hot, gaseous refrigerant. This allows heat to transfer from the refrigerant to the outdoor air, where it dissipates into the atmosphere. The refrigerant turns from a vapor into a warm liquid due to the high pressure and reduction in temperature.

The Expansion Device
The refrigerant glows next to the expansion device (TXV or orifice) as a warm, high-pressure liquid. The expansion device is responsible for reducing the refrigerant pressure. The refrigerant becomes a combination of a cold liquid and gas.

The Evaporator
This mixture of cold liquid and gas (vapor) moves through the evaporator. The evaporator allows for cooling the air going to a space by boiling (evaporating) the refrigerant flowing through it. This happens when warm air blows across the evaporator as cold refrigerant moves through the evaporator coil. Heat transfers from the air to the refrigerant, which cools the air directly before being going into the conditioned space. The low-pressure liquid refrigerant is easily boiled by the warm air blown across the evaporator and heads back to the compressor as a cool gas/vapor.