An extraction on Air conditioning system basics:

An air conditioner (AC) in a room or a car works by collecting hot air from a given space, processing it to release cool air into the same space where the hot air had originally been collected. This processing is primarily done using five components:

- Evaporator
- Compressor
- Condenser
- Expansion valve
- Refrigerant

An air conditioner (AC) in a room or a car works by collecting hot air from a given space, processing it within itself with the help of a refrigerant and a bunch of coils and then releasing cool air into the same space where the hot air had originally been collected. This is essentially how air conditioners work.

Imagine that you're outside in the sweltering heat of a particularly hot summer day, running some godforsaken errands that couldn't be put off any longer. The heat is so unbearable that it feels like the hottest day on Earth since the dawn of civilization. However, there is one thing that keeps you going: the knowledge that you'll be inside your air-conditioned home in one hour.

In this article, we're going to talk about air conditioners and what they do – as well as how do they do it – which makes them almost a necessity in urban regions.
Parts of an air conditioner

Air conditioner installations mainly come in two types: window systems and split systems (these are further classified into mini-split and central systems). In everyday language, these are commonly referred to as window ACs and split ACs, respectively.

Regardless of the type of installation, all air conditioners consist of four major components that are listed below:

Evaporator

An evaporator is basically a heat exchanger coil that's responsible for collecting heat from inside a room through a refrigerant gas. This component is known as the evaporator, and is where the liquid refrigerant absorbs heat and *evaporates* to become gas.

Some of the most common refrigerant gases used in air conditioning systems include hydrofluorocarbons or HFCs (like, R-410A) hydrochlorofluorocarbons or HCFCs (like, R-22) and

hydrocarbons (like R-290 and R-600A). It is *this* gas that actually absorbs the heat from the room and travels to the the next component for further processing, which is…

Compressor

As the name clearly signifies, this is where compression of the gaseous refrigerant occurs. It's located in the outside unit, i.e., the part that's installed outside the house.

Condenser

The condenser receives the vaporized refrigerant from the compressor, converts it back to liquid and expels the heat outside. Needless to say, it's also located on the outside unit of the split AC.

Expansion valve

Also referred to as the throttling device, the expansion valve is located between the two sets of coils (the chilled coils of the evaporator and the hot coils of the condenser). It keeps tabs on the amount of refrigerant moving towards the evaporator.

Note that in the case of window ACs, the three components are all located inside a small metal box that is installed in a window opening.

These are the main components of an air conditioner. Now let's look at how they work together to make an AC do what it does.

Air conditioner (AC) working principle

An air conditioner collects hot air from a given space, processes it within itself with the help of a refrigerant and a bunch of coils and then releases cool air into the same space where the hot air had originally been collected. This is essentially how all air conditioners work.

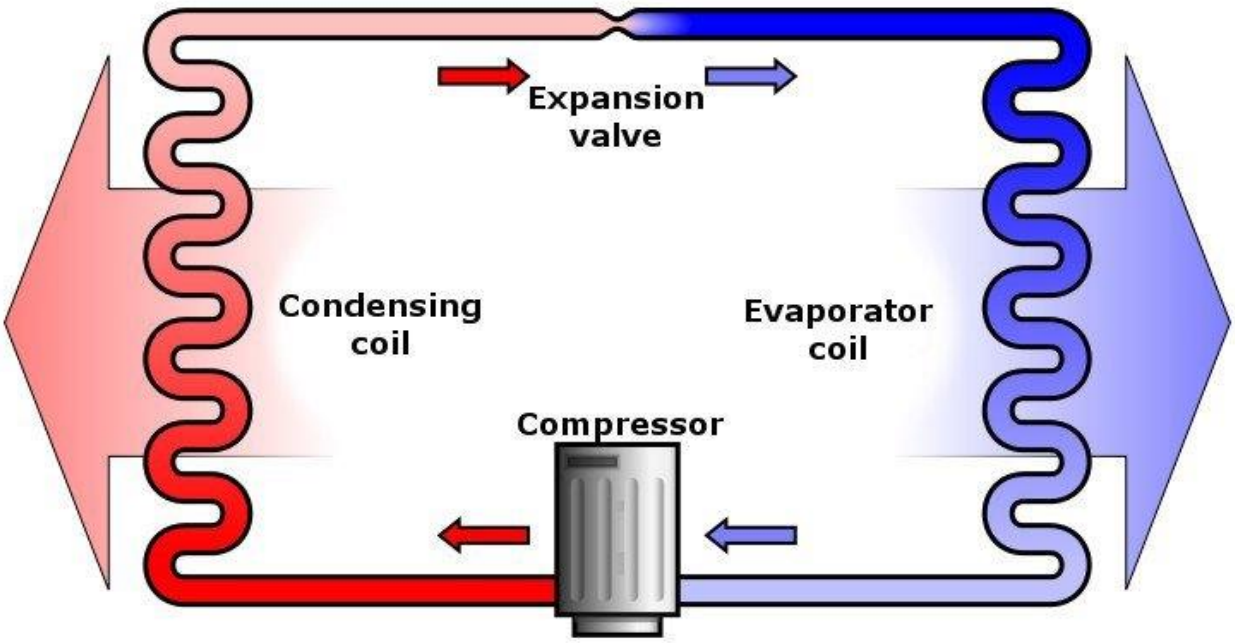
Many folks believe that an air conditioner *produces* chilled air with the help of machines installed inside it, allowing it to cool a room so quickly. That might also explain why it consumes so much electricity. However, that's a misconception. An air conditioner is not a magical device; it just uses some physical and chemical phenomena very effectively to cool a given space.
When you switch an AC on and set your desired temperature (say, 20 degrees Celsius), the thermostat installed in it senses that there is a difference in the temperature of the room's air and the temperature that you've chosen.

This warm air is drawn in through a grille at the base of the indoor unit, which then flows over some pipes through which the refrigerant (i.e., a coolant fluid) is flowing. The refrigerant liquid absorbs the heat and becomes a hot gas itself. This is how heat is removed from the air that falls on the evaporator coils. Note that the evaporator coil not only absorbs heat, but also wrings out moisture from the incoming air, which helps to dehumidify the room.

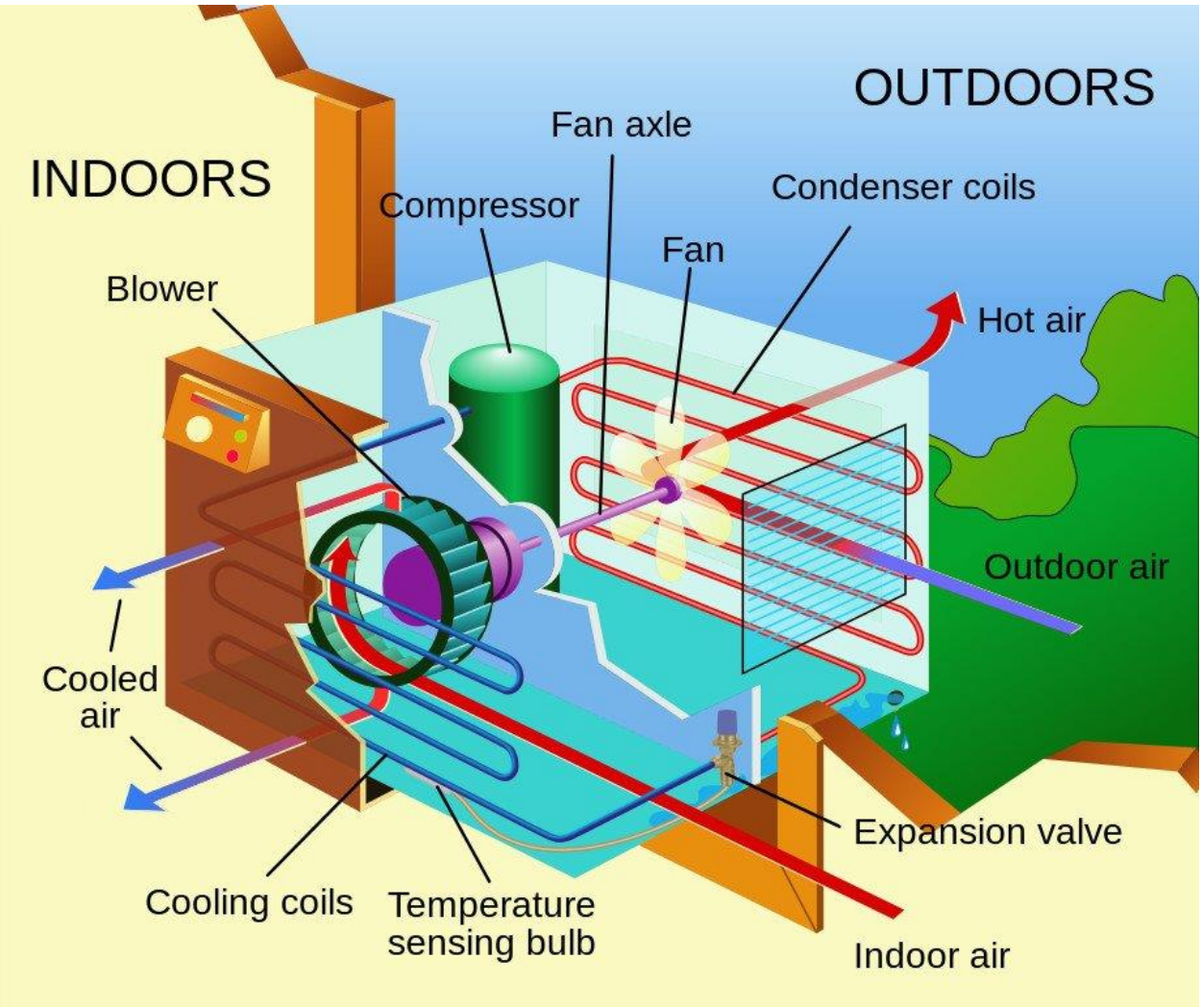
This hot refrigerant gas is then passed on to the compressor (located on the outside unit). Being true to its name, the compressor compresses the gas so that it becomes hot, since compressing a gas increases its temperature.

This hot, high-pressure gas then travels to the third component – the condenser. Again, the condenser remains true to its name, and condenses the hot gas so that it becomes a liquid.

The refrigerant reaches the condenser as a hot gas, but quickly becomes a cooler liquid because the heat of the 'hot gas' is dissipated to the surroundings through metal fins. So, as the refrigerant leaves the condenser, it loses its heat and becomes a cooler liquid. This flows through an expansion valve – a tiny hole in the system's copper tubing – which controls the flow of cool liquid refrigerant into the evaporator, so the refrigerant arrives at the point where its journey started.



Above is a simplified diagram of the air-conditioning process. Although all the components involved in the air-conditioning process in window ACs are located inside the same metal box, the underlying process of cooling remains the same.



Schematic of Window type Air conditioning system

The entire process is repeated over and over again until the desired temperature is attained. In a nutshell, an AC unit keeps drawing in warm air and expelling it back into the room until there's no more warm air left to cool.

Dependent as we may be on air conditioners, it's surprising to note that they were not intended for human comfort when they were initially developed. The motivation for the first modern air-conditioning system was to eliminate certain problems in the manufacturing processes of a publishing company! To think that a machine intended to support publishing papers on a large scale could one day become an integral part of every modern household is quite something, isn't it?

References

1. University of Kentucky
2. Best air conditioner in India – Bijli Bachao