**Introduction:**

An air-conditioning system is a process where the surrounding air properties are altered to more comfortable conditions. It involves cooling, heating, dehumidification

Air-Conditioning's main principles are **Evaporation and condensation,** and then **expansion and compression.** These four processes continuous cycle is called an air-conditioning cycle. The cycle goes on like Evaporation – compression – condensation – Expansion – Evaporation.

**Components of an Air-Conditioning system:**

An air-conditioning system is a construction of continuous copper coil which consists of:

* Compressor
* Condenser
* Receiver-dryer
* Expansion Valve
* Evaporator
* Refrigerant

**Compressor:**

Compressor, often called as the heart of a air-conditioning system. As the name suggests it compresses the gaseous refrigerant thus generating a lot of heat and pressure. Most commonly used compressors in automobile air-conditioning systems are rotary type considering their quiet and smooth operation.

**Condenser:**

Coil constructed with a seamless copper tubes helps in losing the heat to the surrounding atmosphere. Hot and pressurized refrigerant from the chamber of compressor enters to the condensing coil at the same time a fan blows cool outside air over the condensing coil. This will help in extracting the heat of the refrigerant and releasing it to the outside atmosphere.

As this process is rapid, after enough heat is extracted the gaseous refrigerant turns to liquid which further proceeds towards expansion valve.

**Receiver-Dryer:**

A receiver which can also be termed as filter dryer is located in between the continuous coil from condenser to expansion valve. A receiver-dryer is a small liquid reservoir vessel for the refrigerant, and it’s main function is to remove any excess moisture that may have leaked into the refrigerant. Presence of moisture in the refrigerant creates ice crystals which leads to the blockage and mechanical damages of the system.

**Expansion valve:**

Expansion valve which is also called as a throttling device helps in turning high pressure liquid into low pressure liquid. Thus, it helps in regulating the flow of refrigerant as needed. some of the expansion valve types available are direction expansion type, thermal expansion valve, electrical expansion valves.

Most commonly used expansion valves in air condition are thermal expansion valves (TEV).

**Evaporator:**

Cool and low pressurized refrigerant from the expansion valve enters the evaporator coil which then chemically compelled into vapour and it requires hot air for which another blower is needed which blows hot air over the evaporator. As indoor hot air is being blown over the evaporator, eventually room’s air grows cooler as the room’s heat is being transferred to the evaporating refrigerant.

**Refrigerant:**

Refrigerant/ Freon is the fluid made of hydro flouro carbons (HFCs) which helps in rapid transfer of heat. Refrigerant can turn into liquid from vapour state at high pressure and liquid refrigerant turns into gaseous state at lower temperature/ pressure. Most commonly used refrigerants in air-conditioning industry as per their applications are as listed in the below table:

|  |  |
| --- | --- |
| Application | Refrigerant Name |
| Automobiles ACs | R134a |
| Commercial ACs | R410a |
| Residential ACs | R32 |

**Automobile air-conditioning system:**

An automobile air-conditioning system uses the same working principle as explained earlier. However, the compressor in an automobile will be driven by a belt connected to the crank shaft of engine and is regulated by an electromagnetic clutch which engages or disengages the compressor as required.

In the beginning R-12 was the widely used refrigerant in almost all the cars. However, later it was found that it was a contributor towards the Earth’s ozone layer depletion as it was chloro-flouro-carbon (CFC). From 1996, It was made mandatory that all cars should use non-CFCs as a refrigerant and then R134a was brought into picture.

To conclude, all the air-conditioning systems works on same principle, even if the exact components used may vary as per the car manufacturer’s design and interest.

Quiz:

1) How many blower fans a typical air-conditioning system do need?

A) Three B) Four C) One D) Two

Answer: D) Two

2) Condenser is made up of?

A) Bronze B) Copper C) Aluminium D) Stainless Steel

Answer: B) Copper

3) Evaporator is made up of?

A) Stainless Steel B) Cast iron C) Copper D) Aluminum

Answer: C) Copper

4) Widely used refrigerant in cars?

A) R407C B) R410a C) R134a D) R32

Answer: C) R134a

5) What is the function of a Receiver-Dryer?

A) To remove excess heat from the system.

B) To purify the gaseous refrigerant

C) To remove excess moisture from liquid state refrigerant

D) To depressurize the system

Answer: C) To remove excess moisture from liquid state refrigerant.