

AIR CONDITIONING

AIR CONDITIONING:

Air Conditioning is the process of conditioning the air according to the human comfort, irrespective of external conditions.

Applications of Air Conditioning

Used in offices, hotels, buses, cars, etc.

Used in industries having tool room machines.

Used in textile industries to control moisture. Used in printing press.

Used in Food industries, Chemical plants.

5.1 CLASSIFICATION OF AIR CONDITIONING:

1) Air conditioning systems are classified as

According to the purpose

Comfort Air conditioning.

Industrial Air conditioning.

2) **According to Season of the year**

Summer Air conditioning. Winter

Air conditioning. Year round Air conditioning.

Types of Air conditioners

Room Air Conditioners

Winter Air Conditioners

Central Air conditioners

Functions of Air Conditioners

Cleaning air.

Controlling the temp of air. Controlling the moisture content. Circulating the air.

BASIC CONCEPTS:

- 1) Dry air: The atmospheric air which no water vapour is called dry air.
 - 2) Psychrometric: Psychrometric is the study of the properties of atmospheric air.
 - 3) Temperature: The degree of hotness(or) Coldness is called the temperature.
- Moisture: Moisture is the water vapour present in the air.
- 4) Relative humidity: Relative humidity is the ratio of actual mass of water vapour in a given volume to the mass of water vapour.
 - 5) Dry bulb temperature: The temperature of air measured by the ordinary thermometer is called dry bulb temperature:
 - 6) Wet bulb Temperature: The temperature of air measured by the thermometer when it is covered by the wet cloth is known as wet bulb Temperature.
 - 7) Dew point Temperature: The temperature at which the water vapour starts condensing is called dew point Temperature

1. What are the various applications of air conditioning?

- (i) Air-conditioning of houses, hotels, theatres etc.,
- (ii) For comfort of passengers in cars, buses, trains, ships and aircrafts.
- (iii) Air-conditioning is used textile industries, printing and machine tools etc.

2. Define the following. (i) Dry air (ii) Moist air (iii) Dry bulb temperature (iv) Wet bulb temperature.

- (i) **Dry air:** Air without water vapour or moisture
- (ii) **Moist air:** It is a mixture of dry air and moisture
- (iii) **Dry bulb temperature:** Actual temperature of a gas, measured by a standard mercury thermometer
- (iv) **Wet bulb temperature:** The temperature measured by a mercury thermometer, when the bulb is covered by a moistened cloth.

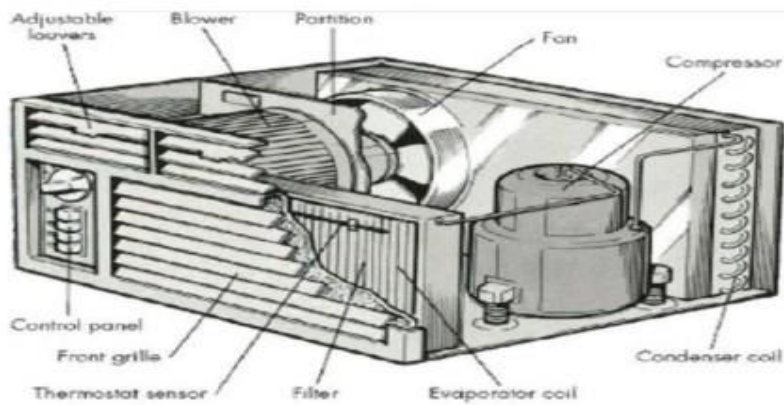
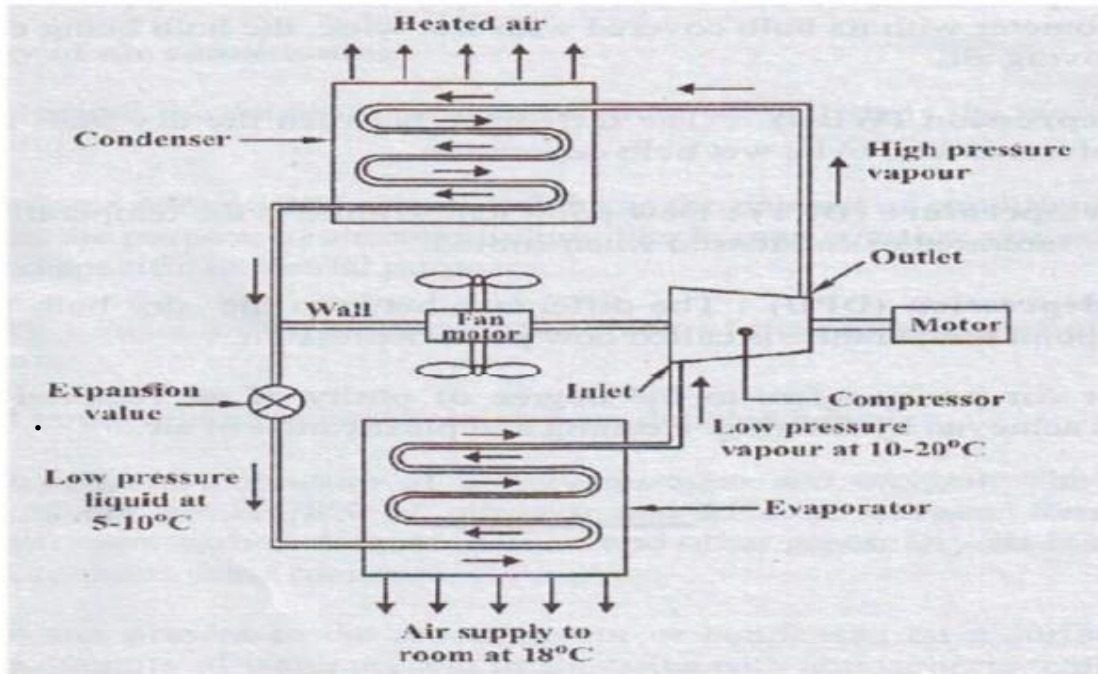
3. What are the various applications of centralized air conditioning?

The central air conditioning system is adopted for large buildings, hotels, hospitals, cinema theatres etc. This system is used only for heavy loads of about 20 tons or more.

4. What is meant by dry ice refrigeration?

Dry ice is *solid carbon dioxide*. It may be pressed into various sizes and shapes, blocks, or slabs. As it absorbs heat, it changes directly from a solid to a vapor. It does not go through the liquid state. This change from solid to vapor is called sublimation. At atmospheric pressure, solid carbon dioxide vaporizes at -109°F (-78°C).

Window Air Conditioner



Working:

- The low pressure vapour refrigerant from the evaporator is sucked by compressor through the open inlet valve.
- The compressor compresses the vapour refrigerant.
- The high pressure and high temperature vapour refrigerant then flows to the condenser through the open outlet valve.
- In the condenser, the outside atmospheric temperature in summer being around 42° C, air is circulated by fan.
- After condensation, the high pressure liquid refrigerant formed passes through an expansion valve which reduces its pressure
- The low pressure refrigerant then enters the evaporator and evaporates, thus absorbing latent heat of vaporization from the room air.
- The equipment which is used for evaporating the refrigerant is called evaporator.
- After evaporation, the refrigerant becomes vapour.
- The low pressure vapour is again passed to the compressor. Thus the cycle is repeated.
- A partition separates high temperature side of condenser, compressor and low temperature side of evaporator
- The quantity of air circulated can be controlled by the dampers.
- The moisture in the air passing over the evaporator coil is dehumidified and drips into the trays.
- The unit automatically stops when the required temperature is reached in the room. This is accomplished by the thermostat and control panel.

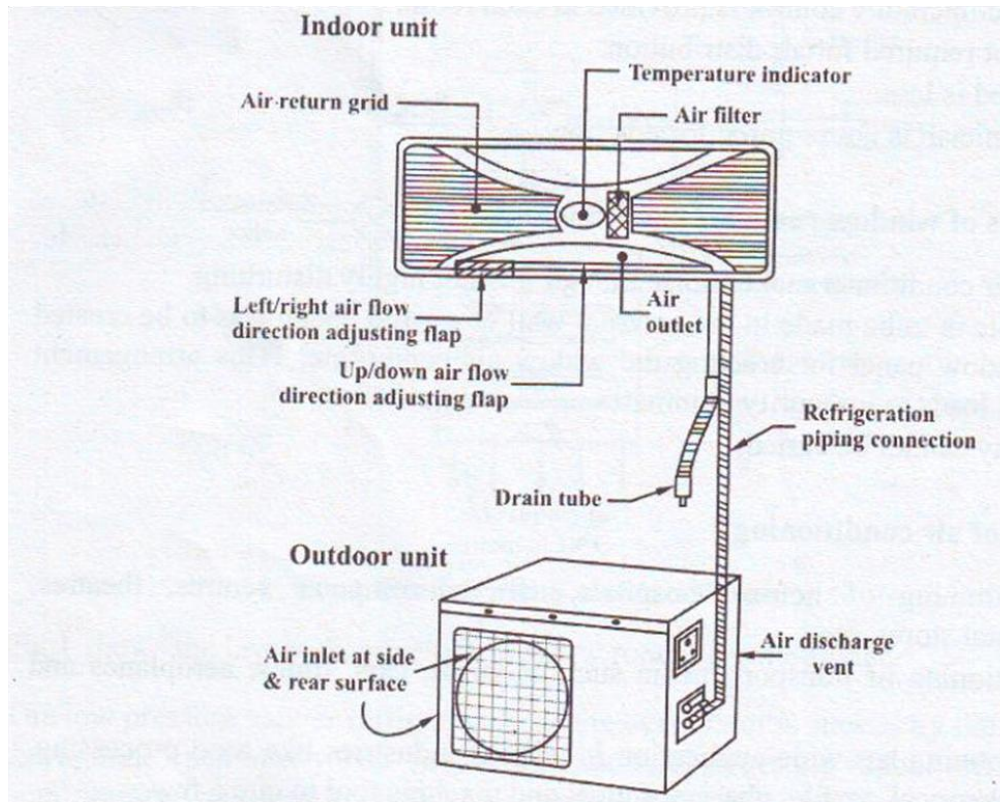
Merits :

- A separate temperature control is provided in each room.
- Ducts are not required for distribution.
- Cost is less.
- Skilled technician is required for installation.

Demerits:

- It makes noise.
- Large hole is made in the external wall or a large opening to be created in the window panel. This leads to insecurity to inmates.
- Air quantity cannot be varied.

Split Type Air Conditioner.



In split air type air conditioner noise making components like compressor and condenser are mounted outside or away from room. Split type air conditioning system has two main components.

(i) Outdoor Unit (ii) Indoor unit.

- The outdoor unit consists of compressor and condenser.
- The indoor unit consists of power cables, refrigerant tube and an evaporator mounted inside the room.
- Compressor is used to compress the refrigerant.
- The refrigerant moves between the evaporator and condenser through the circuit of tubing and fins in the coils.
- The evaporator and condenser are usually made of coil of copper tubes and surrounded by aluminum fins.
- The liquid refrigerant coming from the condenser evaporates in the indoor evaporator coil.
- During this process the heat is removed from the indoor unit air and thus, the room is cooled.
- Air return grid takes in the indoor air.

- Water is dehumidified out of air is drained through the drain pipe.
- The hot refrigerant vapour is passed to the compressor and then to the condenser where it becomes liquid.
- Thus the cycle is repeated.
- A thermostat is used to keep the room at a constant, comfortable temperature avoiding the frequent turning on off.

Merits and Demerits of a split type air conditioner.

Merits:

- It is compact
- Upto four indoor AHU's may be connected to one outdoor unit.
- It is energy and money saving.
- Duct is not used.
- Easier to install.
- It is noiseless, because rotary air compressor used is, kept outside.
- It is more efficient and powerful.
- It has the flexibility for zoning.

Demerits:

- Initial cost is higher than window air conditioner
- Skilled technician is required for installation.
- Each zone or room requires thermostat to control the air cooling

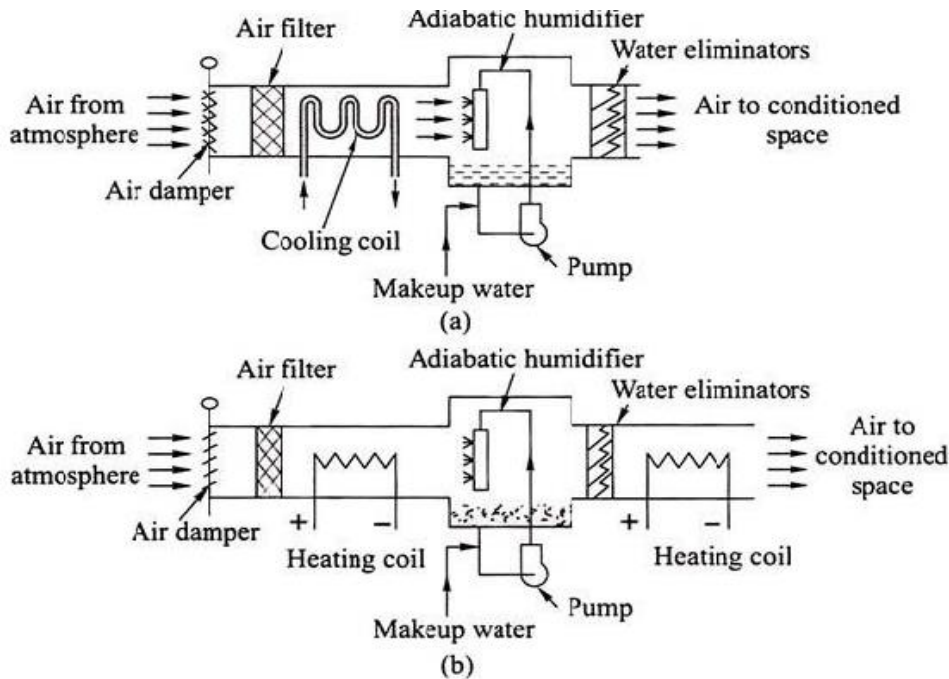
Comfort air conditioning.

Due to the natural phenomenon of body heat disposal by evaporation of moisture from the human body and inflow of moisture from other sources, the humidity inside the room increases. The increased humidity causes difficulty in disposing of body heat. Also, the room temperature rises due to the heat dissipated from the human body and heat gains from light source and any other equipment's. When the room temperature is high, it causes human discomfort.

It has been found that for human comfort we need a dry bulb temperature of 20° C and 25° C and relative humidity of 60 percent in the room. Any air conditioning system should primarily be able to achieve the above conditions inside the room.

Central Air Conditioning:

Centralized air conditioning system is a large-capacity plant which has a cooling capacity of 30 TR or more. This is also adopted when the air flow requirement is more than 5 m³/s. The systems employed for air conditioning of theater, restaurant, auditorium, and public buildings in below Figs.



There is a separate machine room and the conditioned air is distributed to different places to be cooled by means of a ducting system. The unit will have the provision of cooling and dehumidification, heating and humidification, and proper ventilation to the room. The system will have the provision of return air ducting system also. The system includes a complete refrigeration system, blower, air ducts, and a plenum where the outdoor air is mixed with indoor air.

Technology

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