



ROHINI

COLLEGE OF ENGINEERING & TECHNOLOGY

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(AUTONOMOUS)

AI3001 REFRIGERATION AND COLD STORAGE

UNIT IV

The air conditioning system may be broadly classified as follows:

According to the purpose

Comfort air conditioning system.

Industrial air conditioning system.

According to a season of the year

Winter air conditioning system.

Summer air conditioning system.

Year-round air conditioning system.

According to the arrangement of equipment

The unitary air conditioning system

Central air conditioning system.

According to the purpose

Comfort air conditioning system

In comfort air conditioning, the air is brought to the required dry bulb temperature and relative humidity for human health, comfort and efficiency. If sufficient data of the required is not available, then it is assumed to be 21°C dry bulb temperature and 50% relative humidity. Ex. In homes, offices, shops, restaurants, theatres, hospitals, schools etc. are using air-conditioning systems to give comfort to people.

At its core, comfort air conditioning involves:

- **Temperature Control:** Regulating the air temperature to desired levels ensures a comfortable living and working environment.
- **Relative Humidity Management:** Proper humidity levels are crucial for comfort. Too much moisture can make a space feel sticky, while too little can dry out the air and irritate respiratory systems.
- **Air Cleanliness:** Treating air to remove contaminants and pollutants is vital for health and comfort. Utilizing effective filtration systems can significantly improve indoor air quality.
- **Distribution:** Efficient distribution of conditioned air throughout the space ensures that all areas receive the necessary heating or cooling, promoting uniform comfort.

Industrial air conditioning system

In the industrial air conditioning system, the inside dry bulb temperature and relative humidity of the air is kept constant for working of the machine and for the manufacturing process. Textile mills, Paper mills, Machine part manufacturing plants, Toolroom, Photographic etc. are using this type of air-conditioning systems.

Industrial air conditioning units work the same way as ordinary air conditioning. But the systems installed in warehouses and factories are much larger in scale.

Essentially, there's a compressor inside of the unit that compresses a refrigerant. Normally,

compounds like propane or butane are used as refrigerants for large systems. R134A or R410A HFC refrigerant gas is often used for this.

This compressor compresses these compounds and increases their pressure and temperature. Externally, hot air is blown over the refrigerant vapor using a fan to liquefy it.

The expansion valve inside the machine changes the refrigerant into a low-pressure liquid and simultaneously cools it.

High-speed fans then extract the cool air out, suck in warm air, and the process continues.

This entire process is done through one control panel.

This control panel works by communicating with a series of temperature detectors that will be installed in various positions across the building to determine the average temperature of each room and activate the industrial air conditioning and cool each room to the desired temperature,

According to a season of the year

Winter air conditioning system

Air conditioner working principle In winter air conditioning system, the air is burnt and heated, which is generally followed by humidification. The outside air flows through a damper and mixes with the recirculated air. The mixed air passes through a filter to remove the dirt, dust and impurities. The air now passes through a preheat coil to prevent the possible freezing of water and to control the evaporation of water in the humidity.

After that, the air is made to pass through a reheat coil to bring the air to the designed dry bulb temperature. Now, the conditioned air is supplied to the conditioned space by a fan. From the conditioned space, a part of the air is exhausted to the atmosphere by the exhaust fans. The remaining part of the used air is again conditioned and this will repeat again and again.

Summer air conditioning system

Air conditioner working principle in summer air conditioning system. In this system, the air is cooled and generally dehumidified. Schematic for a typical summer air conditioning system is arranged. The outside air flows through the damper and mixed with recirculated air (which is obtained from the conditioned space). The mixed air passes through a filter to remove the dirt, dust and impurities. The air now passes through a cooling coil. The coil has a temperature much below the required dry bulb temperature of the air in the conditioned space. The cooled air passes through a perforated membrane and loses its moisture in the condensed form which is collected in the sump. After that, the air is made to pass through a heating coil which heats the air slowly. This is done to bring the air to the designed dry bulb temperature and relative humidity. Now the conditioned air is supplied to the conditioned space by a fan. From conditioned space, a part of the used air is rejected to the atmosphere by the exhaust fan. The remaining air is again conditioned and this repeated for again and again. The outside air is sucked and made to mix with recirculated air to make for the loss of conditioned air through exhaust fan from the conditioned space.

This system is primarily employed in summer air conditioning applications, where the focus is on cooling and dehumidification. The working principle of the summer air conditioning system can be understood as follows:

To initiate the process, outdoor air enters via a damper and blends with recirculated air sourced from the air-conditioned space.

Before entering the next stage, this combined air stream undergoes filtration to effectively remove dirt, dust, and impurities.

Subsequently, the air passes through a cooling coil, which operates at a significantly lower temperature than the desired dry bulb temperature within the conditioned space. As a result, the cooled air proceeds through a perforated membrane, shedding moisture in the form of condensation, which is then collected in a sump.

To ensure the air meets the requisite dry bulb temperature and relative humidity, it passes through a heating coil, elevating its temperature slightly.

Finally, the conditioned air is delivered into the conditioned space with the assistance of a fan. Within this space, a portion of the air is exhausted into the atmosphere by exhaust fans or ventilators, while the remainder, referred to as recirculated air, re-enters the conditioning cycle. This cyclic process effectively compensates for the loss of conditioned or used air through exhaust fans or ventilators in the conditioned space.

Advantages of Summer Air Conditioning System

The advantages of the Summer Air Conditioning system are:

Provides cooling comfort during hot weather.

Improves indoor air quality by filtering and dehumidifying.

Increases productivity and sleep quality.

Enhances safety by reducing heat-related illnesses.

Preserves food and prevents heat damage to electronics.

Year-round air conditioning system

In year-round air conditioning system, it should have equipment for both the summer and winter air conditioning. Schematic for a modern summer year-round air conditioning is arranged. Air conditioner working principle. In year-round air conditioning system. In this, the outside air flows through the damper and mixed with the recirculated air. The mixed air passes through a filter to remove dirt, dust and impurities. In summer air conditioning system, the cooling by operates to cool the air to the desired value. The dehumidification is obtained by operating the cooling coil at a lower temperature than the dew point temperature. In winter air conditioning system, the cooling coil is made inoperative and the heating coil operates to heat the air. The spray type humidifier is also used in the dry season to humidify the air.

According to the arrangement of equipment

Unitary air conditioning System

In unitary air conditioning system, the assembled air conditioner is installed in or adjacent to the space to be conditioned.

Unitary systems, the common type of one room conditioners, sit in a window or wall opening, with interior controls.

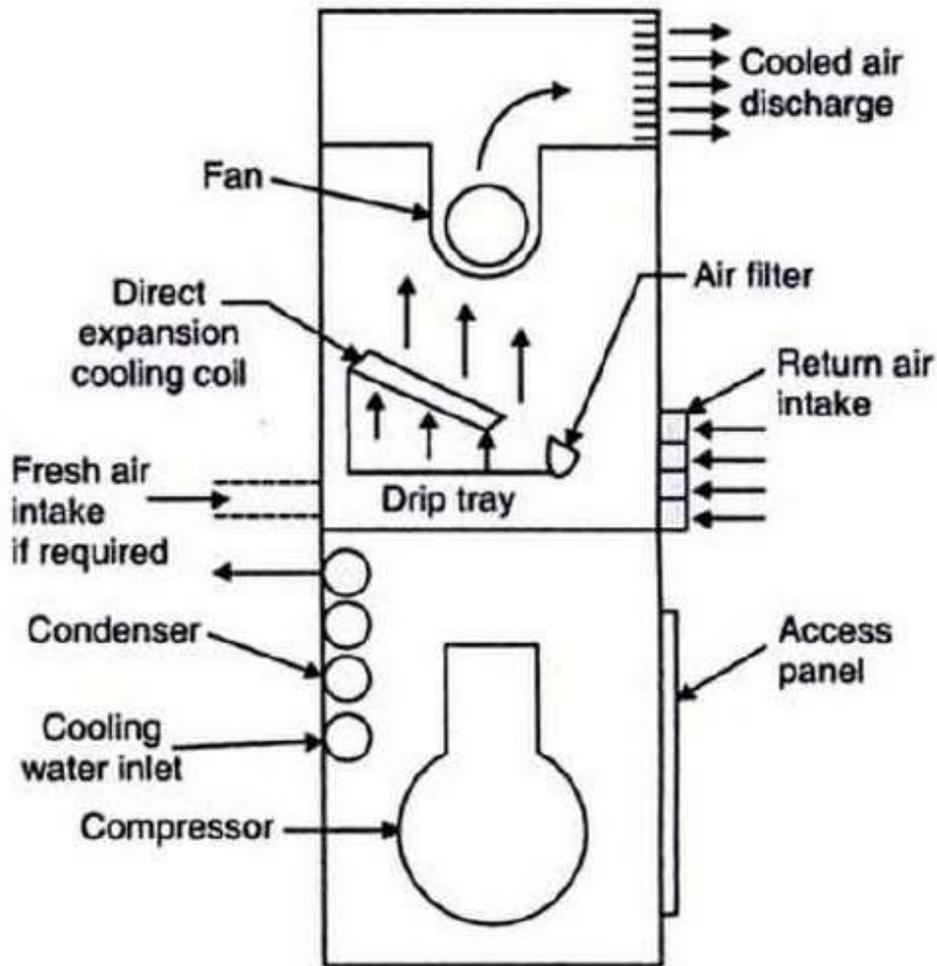
Interior air is cooled as a fan blows it over the evaporator.

The exterior air is heated as a second fan blows it over the conditioner.

In this process, heat is supplied from the room and discharge to the environment.

A large house or building may have several such units, permitting each room to be cooled separately.

Figure Unit air-conditioner



The unitary air conditioning systems are of the following two types,

Window unit

Vertical packed units or PTAC systems

Window Unit

These types of conditioners have a small capacity of 1TR to 3TR and are mentioned through a window or wall. They are employed to condition the air of one room only. If the room is bigger in size, then two or more units are used.

Vertical packed units or PTAC systems

These type of air conditioners are bigger in the capacity of 5 to 20TR and are adjacent to the space to be conditioned. This unit is very useful for conditioning the air of a restaurant, bank or small office. PTAC systems are also known as wall split air conditioning systems or ductless systems. These PTAC systems which are widely used in hotels have two separate units, the evaporative unit on the interior and the condensing unit on the exterior, with tubing passes through the wall and connect them together. This minimizes the interior system footprint and allows each room to be adjacent independently. PTAC system may be adapted to provide heating in cold weather, either directly by using an electric strip, gas or other heaters, or by reversing the refrigerant flow to heat the interior and draw heat from the exterior air,

converting the air into a heat pump.

While room air conditioning provides maximum flexibility when cooling rooms it is generally more expensive than a central air conditioning system.

Central Air Conditioning System

It is a most important type of air conditioning system. It uses when the required cooling capacity 25TR or more. It uses when the air flow is more than 300 m³/min or different zones in a building are to be air-conditioned.

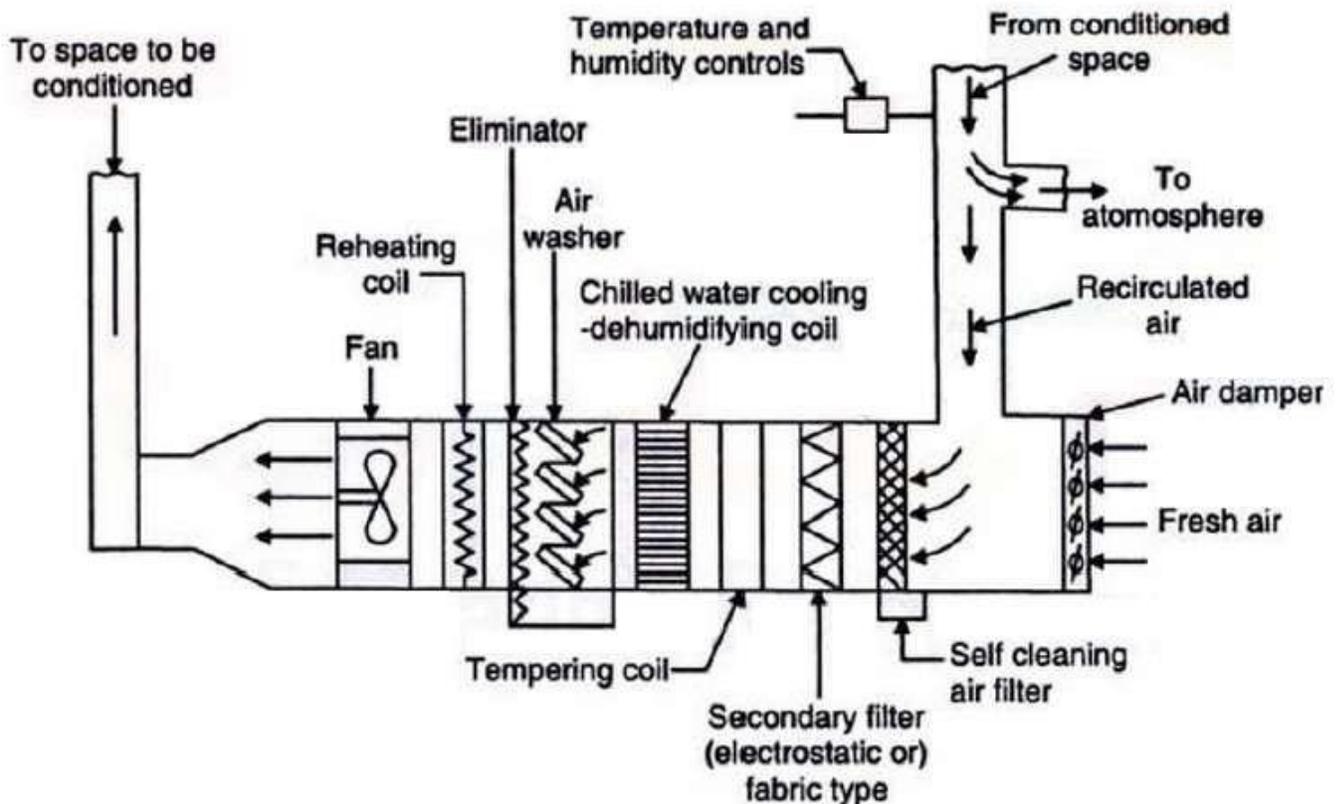


Figure 2.4.2 Central system

[Source: "Utilisation of Electrical Power" by R. K. Rajput, Page: 176]

APPLICATIONS

Using air-conditioner is common in food cooking and processing areas. Used in hospital operating theatres to provide comfortable conditions to patients. And many more industries like Textile, Printing, Photographic and much more.

Air-conditioning system used as the commercial purpose for a human being. Example, in Theatres, Departmental store-room etc.

Many of transport vehicles use air-conditioning systems such as cars, trains, aircraft, ships etc. This provides a comfortable condition for the passengers.

The air-conditioning system used in Television-centres, Computer centres and museum for a special purpose.