



# **SNS COLLEGE OF ENGINEERING**

Kurumbapalayam (Po), Coimbatore – 641 107

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## **DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**COURSE NAME : 190E219 BUILDING AUTOMATION**

IV YEAR /VII SEMESTER

Unit 1- HVAC SYSTEM

Topic : Introduction of HVAC System



# Introduction



- The full form of HVAC is Heating, Ventilation, and Air Conditioning.
- Appropriate HVAC provides comfort for people & maintains an effective Environment for surroundings.
- Proper HVAC Allows humans to exist under adverse conditions.
- The requirement of HVAC Systems is a must for critical areas like Control rooms, Electronic Equipment Rooms, switchgear halls, Battery rooms, workshop areas, etc. in a petrochemical plant.



# Introduction



- HVAC systems are designed following basic principles of thermodynamics, heat transfer, and fluid mechanics.
- The main purpose of the HVAC system is to adjust and change the outdoor air conditions to the desired conditions of occupied buildings for achieving the thermal comfort of occupants.
- Outside air is drawn inside the buildings and either heated or cooled depending on the outdoor condition.
- The air is then distributed into the occupied spaces.



# Objectives of HVAC Systems



- Maintaining environmental conditions (temperature and humidity) appropriate to the operating requirements.
- Increase in Productivity.
- Building & Equipment Durability.
- Maintaining pressurization between hazardous and non-hazardous areas.
- Increase Life & Health.
- Dilution and removal of potentially hazardous concentrations of flammable/toxic gaseous mixtures in hazardous areas.
- Filtration of dust, chemical contaminants, and odors through chemical and carbon-activated filters.
- Inside condition of 21–24°C & 50–60% Relative Humidity is most comfortable & purity of air.
- The isolation of individual areas and control of ventilation in emergency conditions, through interface with the shutdown logic of the fire and gas detection and alarm safety systems.



## What it is exactly do?



- However, note that an HVAC system is not intended to prevent catastrophic events such as the release of toxic and/or hazardous gases.
- Also, HVAC can not compensate on its own, for the intrinsic safety design features such as structural stability, coatings, area segregation, fire protection systems, etc.
- **It only aids the safety process.**

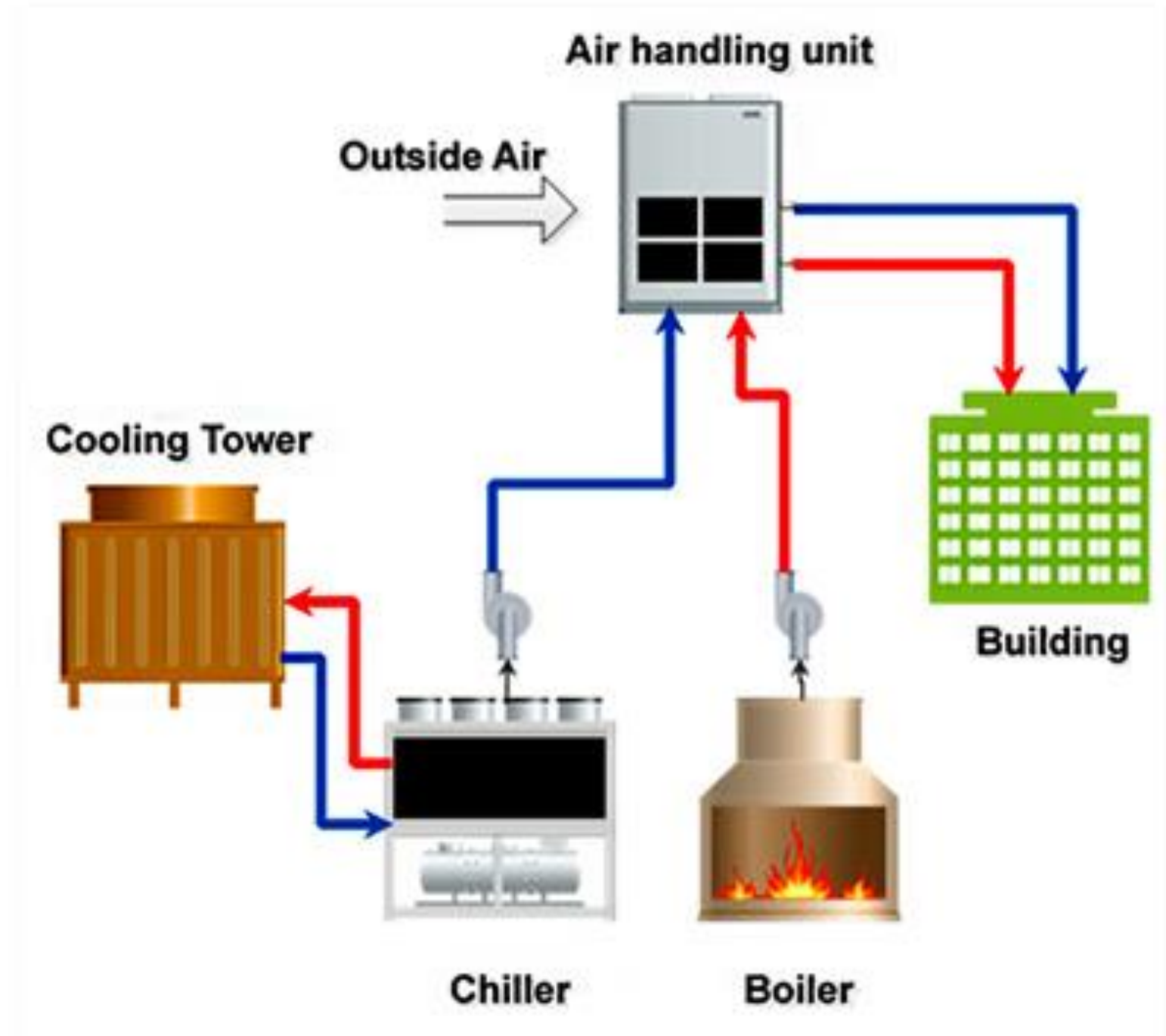




# HVAC System Components



- Air filter
- Supply fan
- Mixed-air plenum and outdoor air control
- Exhaust or relief fans and an air outlet
- Outdoor air intake
- Ducts
- Terminal devices
- Heating and cooling coils
- Self-contained heating or cooling unit
- Return air system
- Cooling tower
- Boiler
- Control
- Humidification and dehumidification equipment
- Water chiller





# Types of HVAC System



There are four major types of HVAC systems available in different sizes. They are:

- Split HVAC systems
- Hybrid Heat Split HVAC systems,
- Duct-free or Ductless HVAC systems, and
- Packaged heating and air HVAC systems.



## Split HVAC Systems:



- A split HVAC system is the most common and classic type of HVAC system providing energy efficiency at lower costs.
- In this model, components are kept both outside and inside the building and the system is split between two main units, one for heating, and one for cooling.
- The installation of split HVAC systems is quite complex; So must be performed under expert supervision.







Typically, a split HVAC system consists of

- An outdoor component, or a condenser, such as an air conditioner or a heat pump.
- An indoor component that consists of an evaporator coil or fan, along with furnaces that convert refrigerant and help circulate air.
- A system of ducts that circulate air from the HVAC unit throughout the building.
- A programmable or non-programmable thermostat to manage the system.
- Accessories like purifiers, air cleaners, UV lamps, or humidifiers improve indoor air quality and comfort.

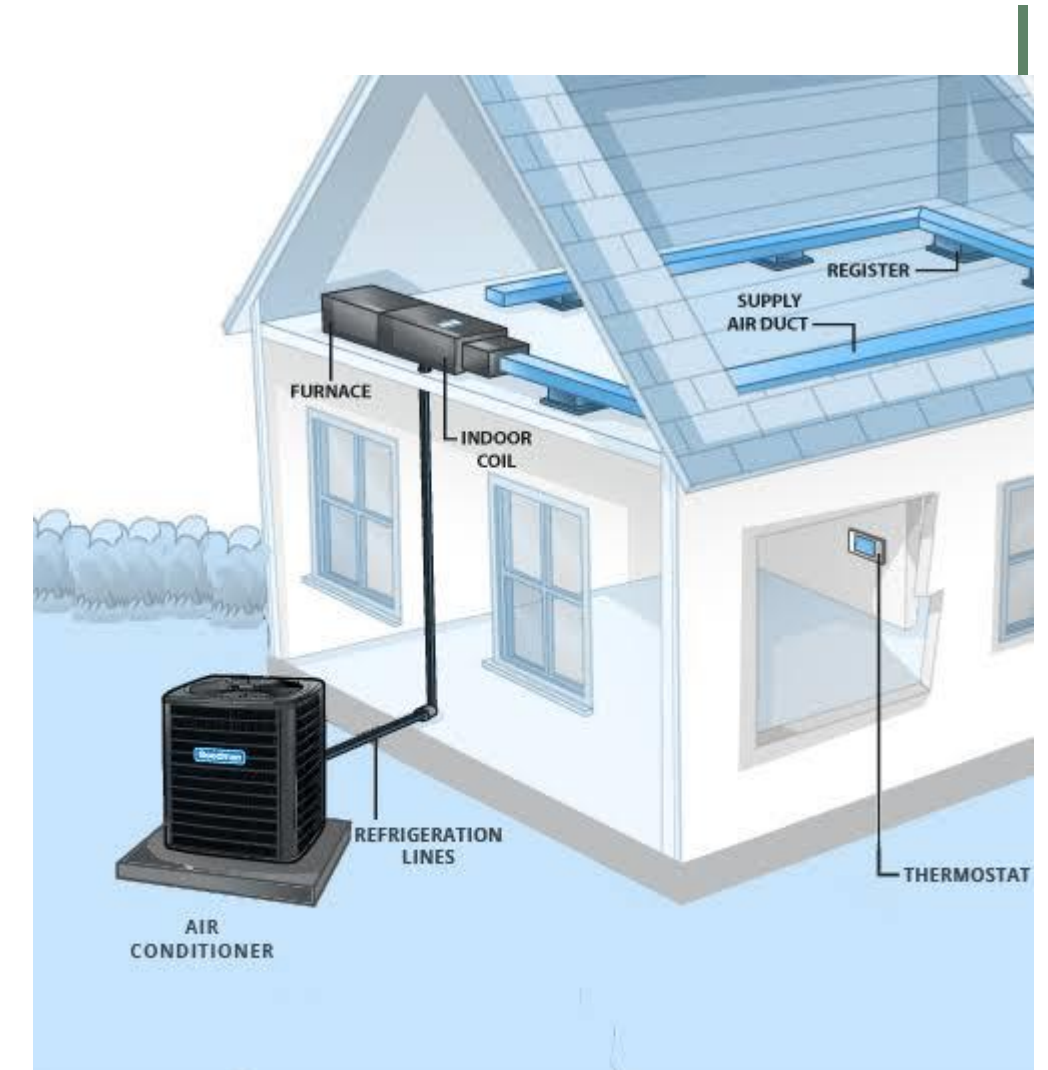


## Hybrid Heat Split HVAC systems:



Hybrid Heat Split HVAC systems are basically an advanced form of split system with improved energy efficiency and lower utility bills. This type of HVAC system typically consists of

- An evaporator coil and furnaces that work to convert refrigerant and circulate air.
- A heat pump to cool or heat refrigerant.
- An oil or gas furnace.
- Ducts to take the warm or cool air throughout the building.
- Accessories to improve indoor air quality.





## Duct-free or Ductless HVAC systems:



A duct-free or mini-split HVAC system is a unique ultra-efficient HVAC system with large upfront costs. It provides big benefits for certain needs and applications where conventional systems of ducts cannot be used.

Duct-free or ductless HVAC systems consist of the following components:

- An air conditioner or heat pump to cool or heat refrigerant.
- Wires and tubes to connect refrigerant from the outdoor unit to the fan coil.
- A compact fan coil.
- A thermostat to manage the system.
- Indoor air quality accessories.



## Packaged heating and air HVAC systems:

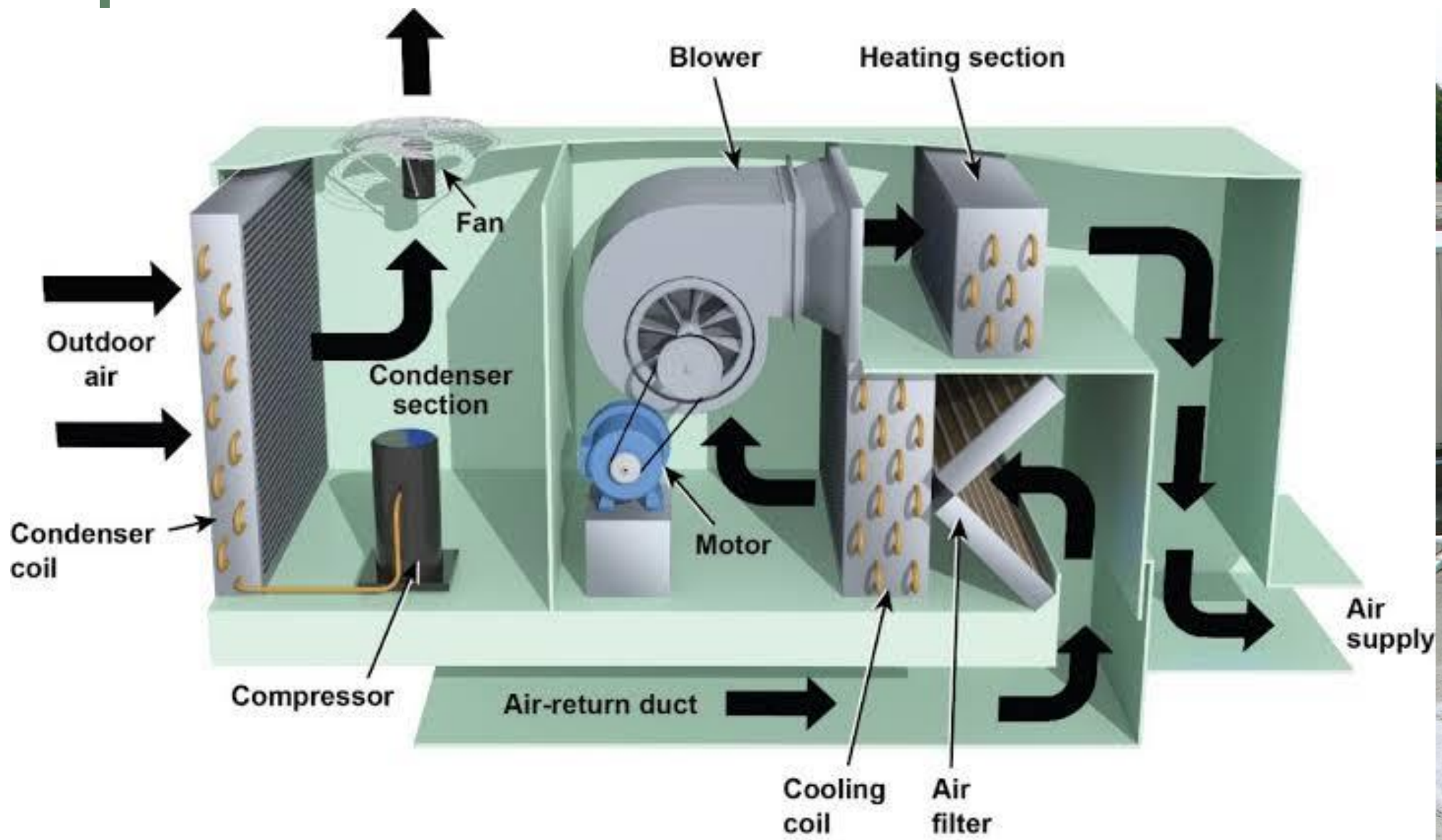


- Packaged heating and air HVAC systems are best suited for buildings without enough indoor spaces for split system components.
- In such HVAC systems, all components come together in one single package. So, easier to install. But the packed system is outside and exposed to extreme weather conditions, so can be damaged easily.

A packaged heating and air HVAC system generally consist of:

- A heat pump, gas furnace, air conditioner, and the fan coil and evaporator reside in one unit
- An interface/thermostat on the front of the unit controls the system.
- Optional indoor air quality accessories.

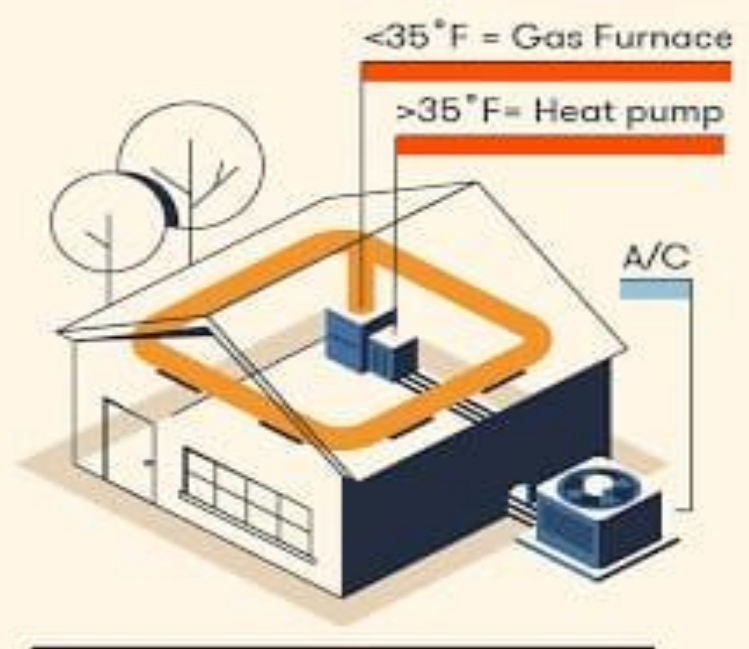








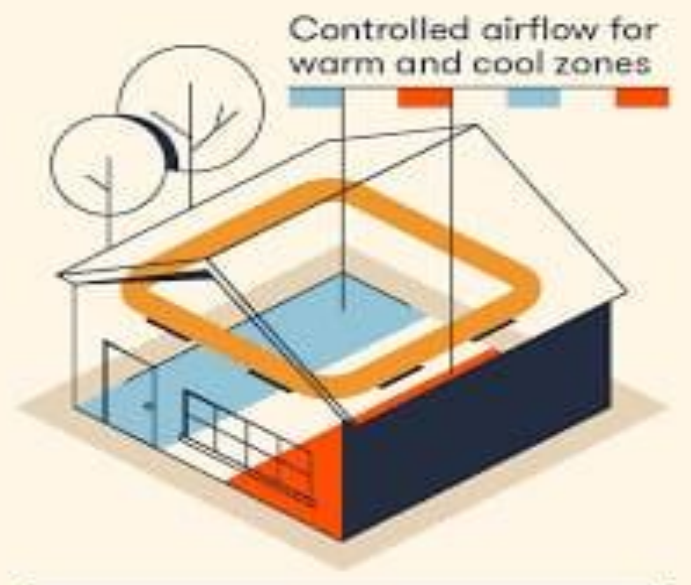
**Split System**



**Hybrid Split System**



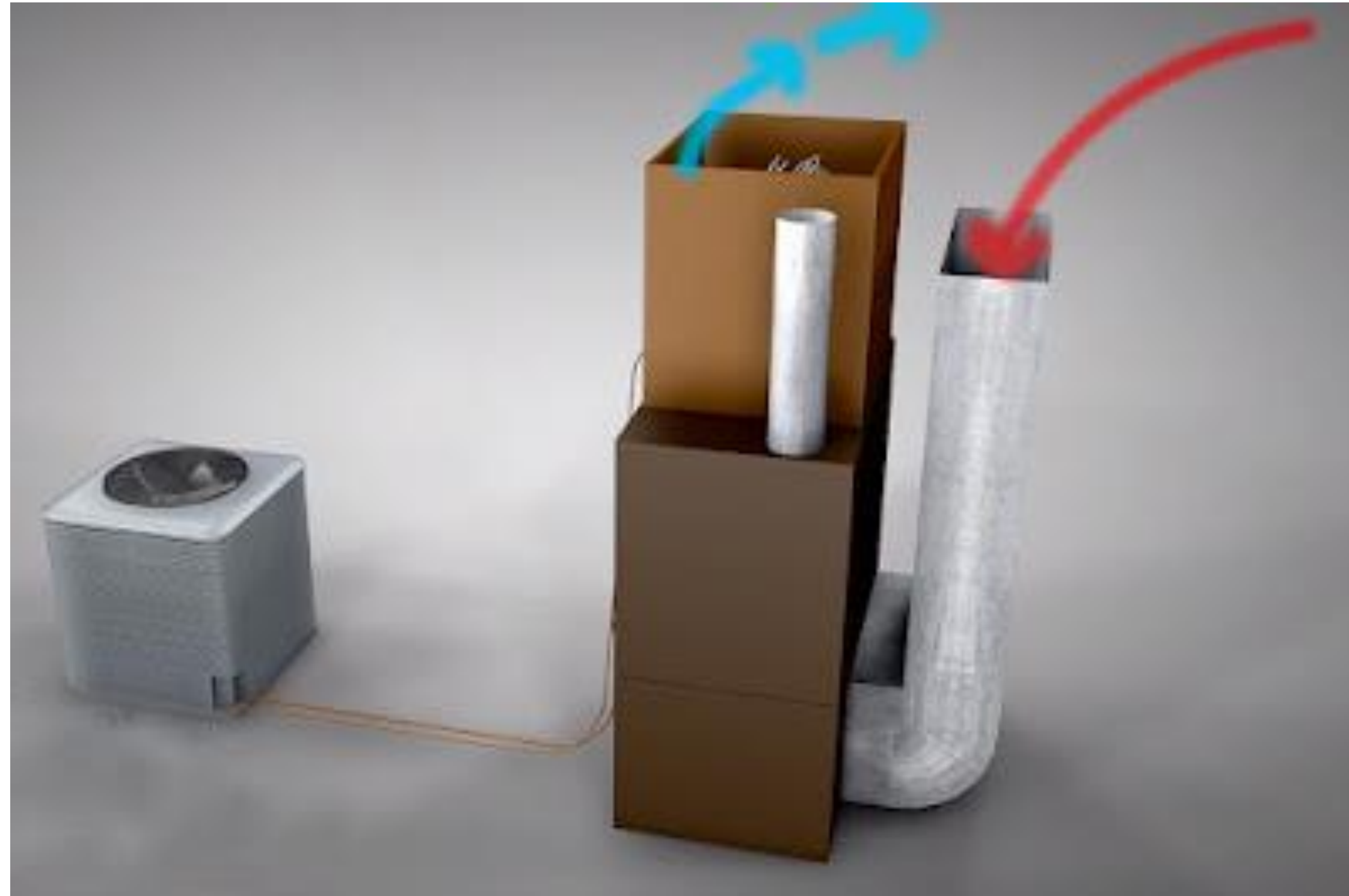
**Packaged Heating and Cooling**



**Zoned System**

## Centralized air conditioning system

- In a centralized air conditioning system, the air is conditioned at one central point in the building and then sent through ducts to the other parts of the building.
- They provide easy to maintain consistent temperature environment in different rooms and it has less maintenance difficulty problems.
- It is cheaper to maintain a centralized HVAC system.



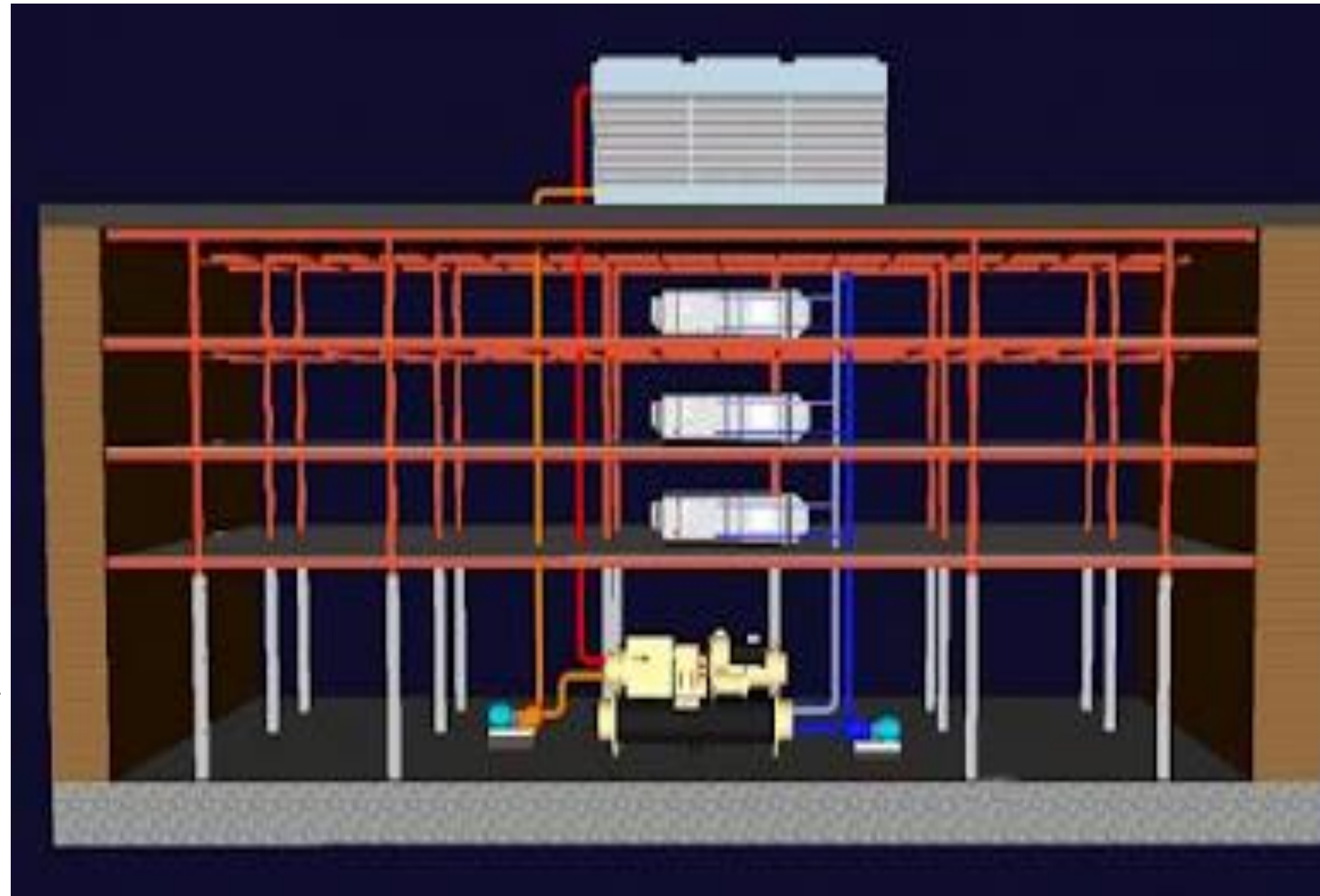




# Decentralized or local air conditioning system



- Decentralized or local air conditioning system is the opposite of the central HVAC system.
- In it, multiple units are used to meet HVAC requirements instead of a single centralized system.
- Its lowers the cost and increase the control of the heating, ventilation and cooling as it is easy to maintain different temperatures at different places.
- But it increases the maintenance points. It has a benefit that the whole system will not collapse if just one-unit stop working which is the case in the centralized HVAC system.



# HVAC system consists of various components

## Thermostat

- Thermostat is used to control the temperature within the required area.
- It senses the temperature of the surrounding and regulates the HVAC system to obtain the desired level of conditioning.



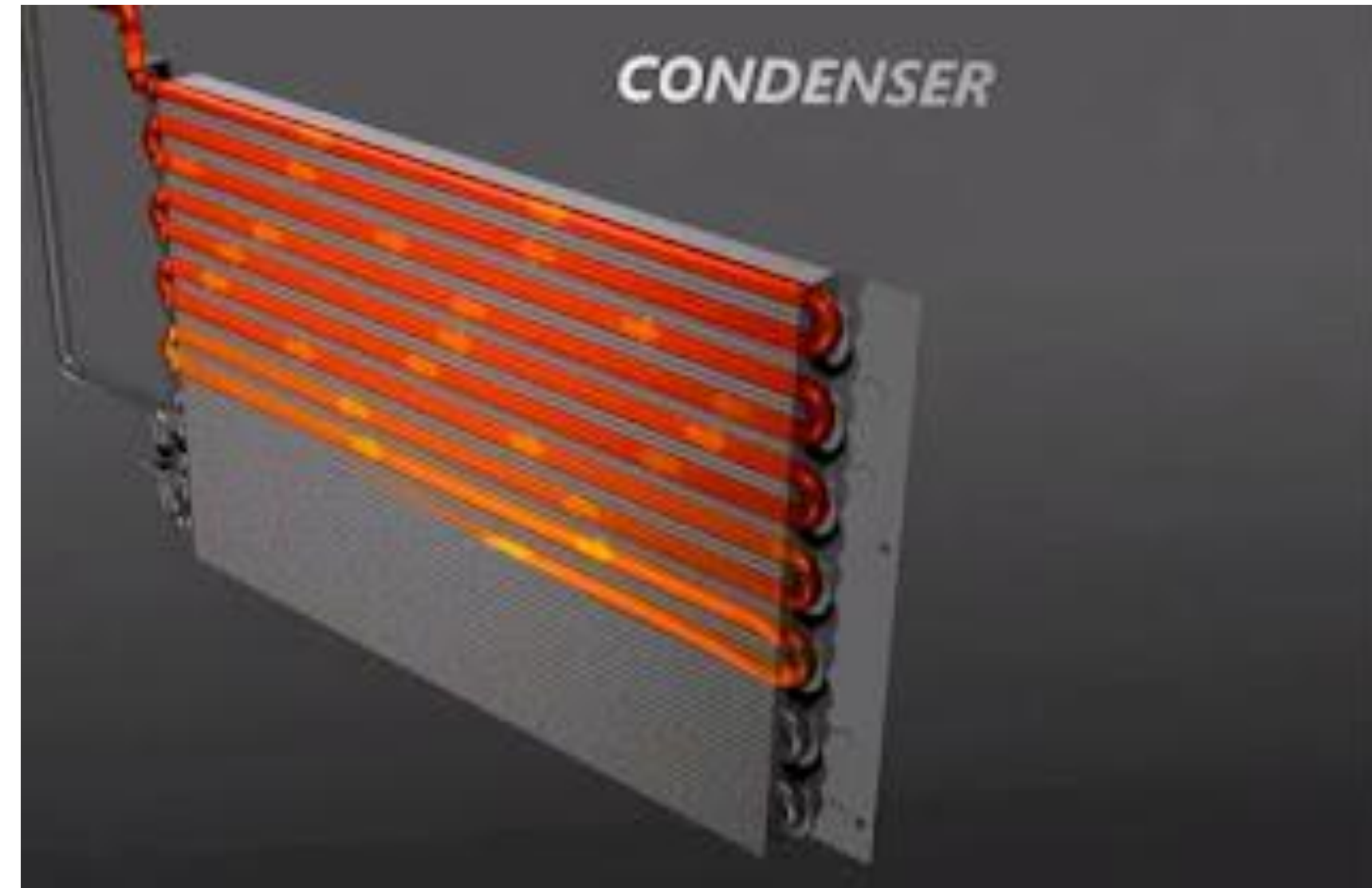




## Condenser unit



- The purpose of a condenser unit in HVAC system is to condense the high-temperature refrigerant gas into liquid stage to be sent to the evaporator coil for cooling purpose.





## Evaporator coil

- The purpose of evaporator coil in HVAC system is to cool the external air using the condensed refrigerant from the condenser.
- It is used to evaporate the liquid refrigerant present within the coils which in turn cools the incoming air.





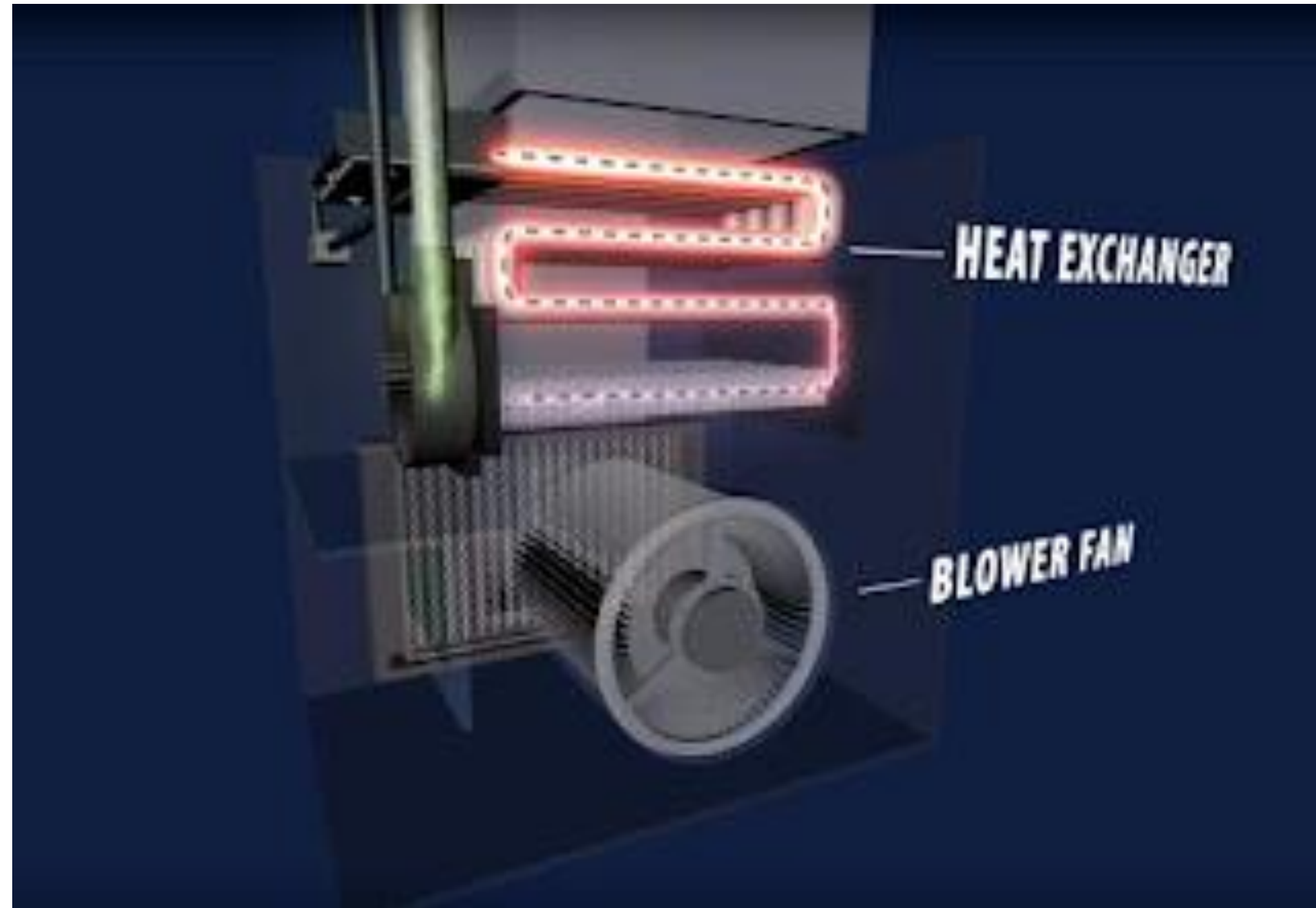
# Furnace (Combustion Chamber)



- Furnace is the most important part of HVAC system. The purpose of furnace in HVAC system is to produce heat.
- Furnace create heat in many ways depending on application of uses and design.
- As an example, Gas furnace, Oil furnace and Electric furnace. The heating is usually produced by the combustion of fuels or gas.

# Heat Exchanger

- The purpose of heat exchanger in HVAC system is to heat the incoming air in winters.
- It is located with the furnace part where it exchanges heat with the cool atmospheric air to deliver air at required temperature by the thermostat.





- The purpose of blower is to suck air from the atmosphere to and give it kinetic energy so that it can move with the ducts easily.

## Duct System

- Duct system distribute air to the required location from one part to the other.
- They have usually rectangular, cylindrical and oval shape





## Vents



- Vents are present at the ends of the ducts to deliver conditioned air to the required rooms and places.







# Diffusers



- Diffusers are used to reduce the flow of the air by hindering their path.
- They may be installed within the duct work or at the end of the ducts.



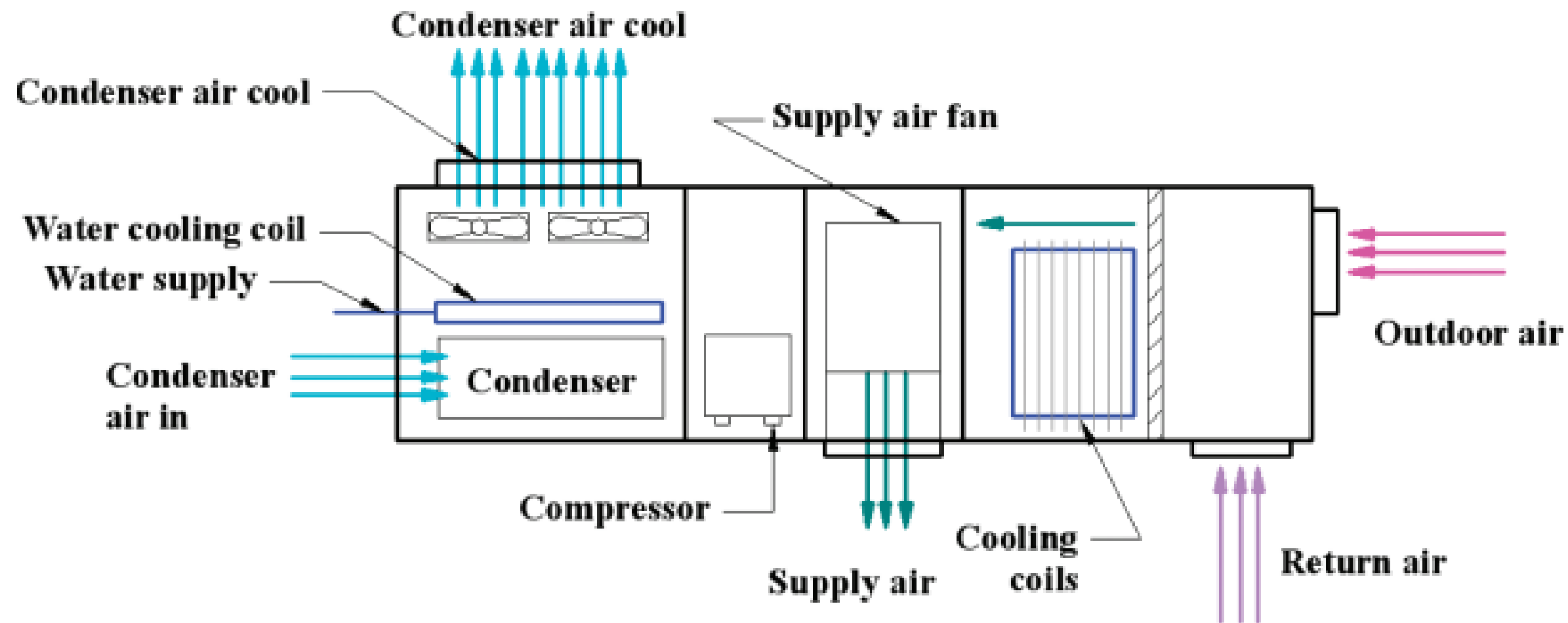


# Application Of HVAC



- Commercial
- Residential
- Industrial
- Hospital
- Pharmaceutical's
- Educational institutes.

1. Can you say this shown in fig. is the example of which method of HVAC?







# References



1. Shengwei Wang, “ Intelligent Buildings and Building Automation”, Routledge 2010.
2. Reinhold A, Carlson Robert A, Di Giandomenico, “Understanding Building Automation Systems: Direct Digital Control, Energy Management, Life Safety, Security Access Control, Lightning, Building”, R. S Means company limited, 1<sup>st</sup> edition, 1991.

**Thank You**