Digital Learning Paths

Field	***Central Heating***
Chapter	***Heating theory and heating techniques***
Subtitle	***Air Conditioning, Ventilation and Cooling Systems.***

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Air conditioning

Air conditioning is the regulation of the temperature, humidity, movement, air purity of a space which is called air-conditioned.

The main functions performed in an air conditioning system are:

1. Heating: it is the process of adding thermal energy (heat) to the air of the conditioned space.

2. Cooling: is the process of removing thermal energy (heat) from the air of the conditioned space.

3. Humidification: is the process of adding water (moisture) to the air in the air-conditioned space.

4. Dehumidification: it is the process of removing water (moisture) from the air of the conditioned space.

5. Air renewal: it is the process of receiving outside air and rejecting air from the premises of the building, in order to ensure the necessary quality of indoor air.

6. Air purification: is the process of removing particulate and biological impurities from the air in order to improve and maintain indoor air quality.

Inverter Technology - How it works:

The compressor located in the outdoor unit "collaborates" with the temperature sensor located in the indoor unit to achieve the desired result.

The inverter technology allows the compressor to operate at a variable number of revolutions, depending on the frequency received by its motor, thus changing the flow of the Freon refrigerant.

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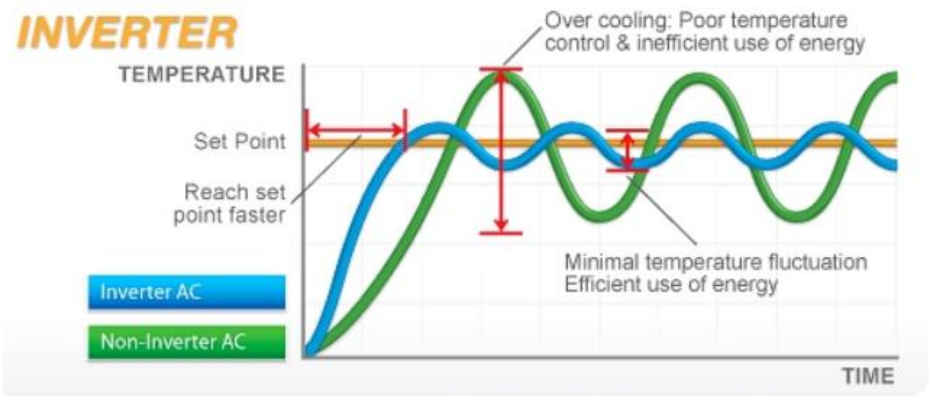
When the difference between the temperature of the room and the desired temperature in it is large, the compressor operates with many revolutions (high frequency) until it reaches the desired result.

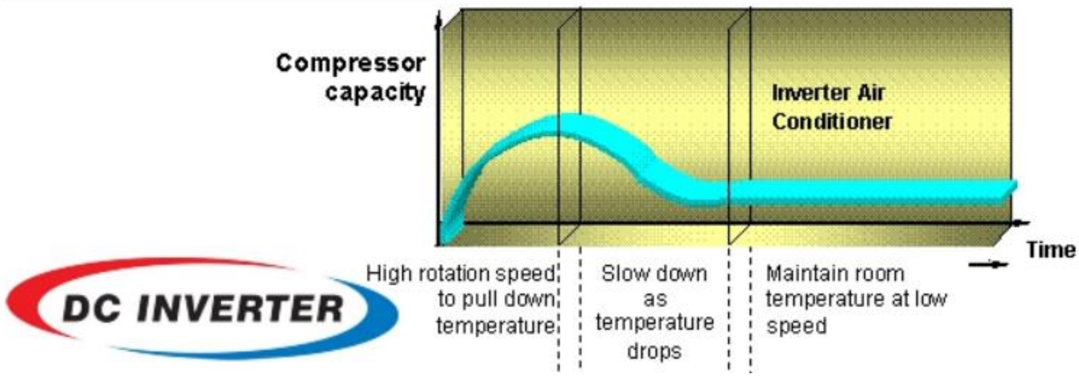
When the desired temperature is reached, the inverter technology instructs the compressor to gradually reduce its power and operate at the speeds required to maintain the desired temperature.

In simple words, the inverter technology makes our air conditioner work at full capacity until it reaches the desired temperature and then work less and continuously keeping the temperature levels very close to the desired ones.

In this way, inverter technology ensures us:

- Rapid achievement of the desired temperature.
- Keeping the temperature consistently close to the desired levels.
- Minimal noise levels.
- Saving energy and money.
- Reduction of startup time by 1/3.





VRV-VRF systems:

VRV-VRF systems allow the outdoor unit to be connected via a central piping network to multiple indoor units. In sophisticated systems, the possibility of connecting to 16 indoor units to one outdoor unit is ensured and linear control of efficiency from 10 to 100% is achieved. The possibility of developing the central piping network reaches up to 100 meters per indoor unit, with a maximum height difference between outdoor and indoor units of 50 meters and between indoor units of 15 meters. They can also operate in extreme external environmental conditions, from -25 °C in heating up to +45 °C in cooling. The internal machines are available in many types, and we can choose between a wide range depending on our needs and the layout. VRV-VRF systems therefore offer flexibility, autonomy, economy, energy saving and can be connected to BEMS (Building Energy Management System) Building Control and Energy Management System offering the possibility for absolute control and a high degree of efficiency. Our company will study your case and propose you the best solution that will meet your needs by offering quality construction, good operation, efficiency with consistency and professionalism.

Heat recovery from refrigeration and air conditioning machines for DHW production:

All refrigerators and air conditioners release significant amounts of heat into the environment. By recovering heat through heat exchangers, we exploit this heat to heat domestic water at no cost at temperatures up to 60C. Heat losses from ventilation represent a significant percentage of the heat losses of a building's air conditioning system. 70% of these losses can be recovered, using appropriate heat recovery methods. Plate-shaped air-air exchangers, thermal wheels, as well as tubular exchangers with two air ducts and a heat transfer fluid in the pipes (heat pipe exchangers) are usually used, but without excluding the use of other related devices. In buildings that only have passive ventilation, it is also possible to recover heat using suitable exchangers. The critical point, in this case, is the reduction of the pressure difference between the interior and exterior air of the building, which causes a corresponding reduction in the efficiency of the system of this natural cooling. Methods have been developed to calculate this pressure drop caused by the exchanger, which varies according to its type. Tubular heat exchangers (heat pipes) have a high heat transfer efficiency, given that they also exploit the latent heat of the transfer medium. They consist of tubes with fins, which penetrate the air ducts of the air conditioning system. Hot air from the air conditioning system return heats the exchanger tubes. The tubes contain some relatively volatile fluid, such as methanol, freon, but also water or other liquids, depending on the temperature level of the air in the return duct. The return air heats the tubes by one half and causes the fluid they contain to evaporate, causing one side of the tubes to act as an evaporator. At the same time, the outside air cools the other side of the pipes (which acts as a condenser) thus condensing the fluid and yielding for recovery, in addition to the sensible, the latent heat of the fluid. Energy is transferred, in this way, faster from one air stream to another, even if the temperature difference of the two streams is small. The efficiency of these alternators can exceed 80%.

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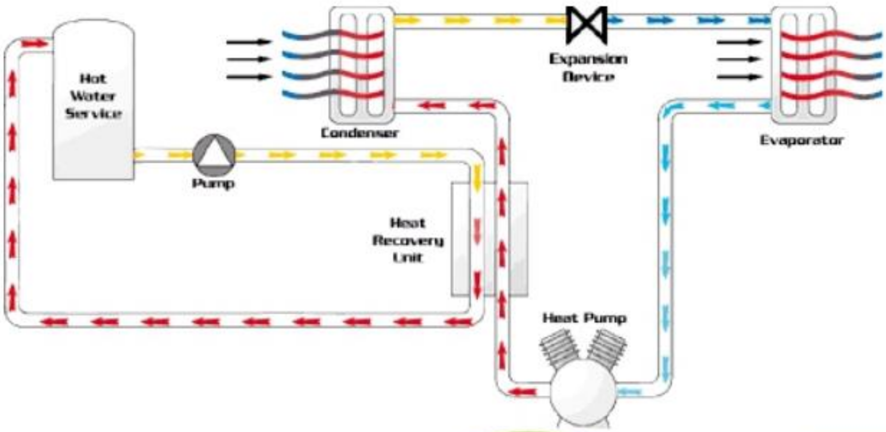

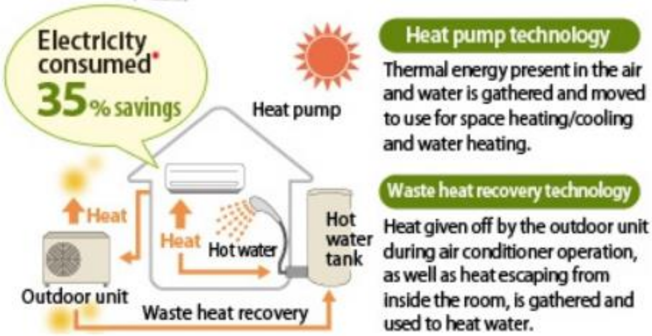

<u>Fan-coil Systems</u>

The system of Forced Circulation Bodies (Fan coils) may remind many of those rickety, giant water conditioners of the public services of the past fifteen years. Perhaps few people know that today's fan coils are no different from any other air conditioner in terms of appearance and are produced in all the types that our well-known air conditioners are produced (wall, floor, ceiling, cassette and hidden false ceiling type, air ducts). Their only difference is that in one, freon passes through its alternator and water into the fan coil. In this way, having a supply of hot or cold water from the heat pump gives us cooling and heating in a similar way and feeling to a room air conditioner. All types of fan coils, apart from the wall and ceiling, have the ability to receive fresh air giving the designer the perspective to create the necessary ventilation where there are needs. With the appropriate automation panel, each fan coil is fully autonomous both in operation and in settings and can work in parallel or independently from underfloor heating or floor cooling, which floor systems also have the possibility of autonomy per room. In order for autonomy to work successfully, efficiently and without the use of a bulky inertia tank, it is necessary for the pump to be an inverter, i.e. of varying efficiency. With Fan coils, in addition to cooling needs, we also cover the cases where we want a quick heating to draw the humidity at a time when we still don't need main heating. In temporary accommodation buildings, as well as in public gathering areas, Fan Coils are a good and reliable solution, as well as the only solution for existing buildings that would like a better way of cooling than local air conditioning units, without extensive reconstruction of the building.

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Advantages :

• Lower cost.

• Pleasant and clean interior environment. It offers comfort and enables the application of an auxiliary ventilation system.

• Cooling - Heating from a source.

• Low noise levels.

• Effectiveness, i.e. it satisfies the user's requirements in immediate demand.

Ventilation systems simple or with heat recovery

Autonomous ventilation unit with heat recovery. The construction of many new buildings with airtight materials makes it necessary all year round to use ventilation systems which, however, lead to the release of large amounts of heat into the environment through the air that has been heated or cooled inside the building. This is what happens in conventional ventilation systems where conditioned air is simply expelled from the building and then new unheated air is introduced into the building. Therefore, a large amount of air is heated or cooled unnecessarily, resulting in a significant waste of energy. Autonomous ventilation solutions prevent energy waste by recovering the heat of the outgoing air, so that they offer a much higher efficiency and an even greater improvement of the atmosphere inside the space. This means they draw heat from the unclean air and use it to automatically balance the outside and inside temperature and humidity. This increases energy efficiency, while at the same time maintaining a constant pleasant temperature inside the room without cold currents (or hot in summer) from the fresh air inlets.

Advantages :

Standalone ventilation solution is ideal if you only need ventilation or want to add ventilation to an existing heating and cooling system. This solution offers:

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• Pleasant and clean indoor environment.

• Free cooling.

• Low noise levels.

• Large range of air supply.

Ventilation systems can be used as a stand-alone solution or in combination with air conditioning systems, to automatically switch from air conditioning to ventilation according to requirements.

Room Ventilation Calculations:

When studying a ventilation system, the following should mainly be calculated:

1) The air flow required for the specific space.

The calculation of the air flow required for space ventilation can be done either by estimating the volume of the specific space, or by estimating the number of people inside this space. Of course, in some cases it is necessary to do both of these calculation methods, finally taking into account the one that prevails.

2) The pressure drop caused by the air flow e.g. within an air duct network etc.

Another element that should be calculated, in addition to the required air flow, is the pressure of the requested fan. The pressure of the fan should be such that it overcomes the pressure drop that may be caused by existing air ducts, louvres (mouths), filters, air conditioning exchangers and in general anything that presents resistance to the fan's air flow.

3) Calculation of the flow depending on the material we want to transport.

Here we should calculate the required capture and transfer speed of the material we want to transfer.

Other factors that affect the required fan pressure are the altitude of the fan installation point from sea level and even the temperature of the air flowing through the fan.

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How does the Refrigerant Cycle work?

An air conditioner works like a refrigerator. The refrigerant circulates through the system and changes its form or state. The "refrigerant cycle" has four stages.

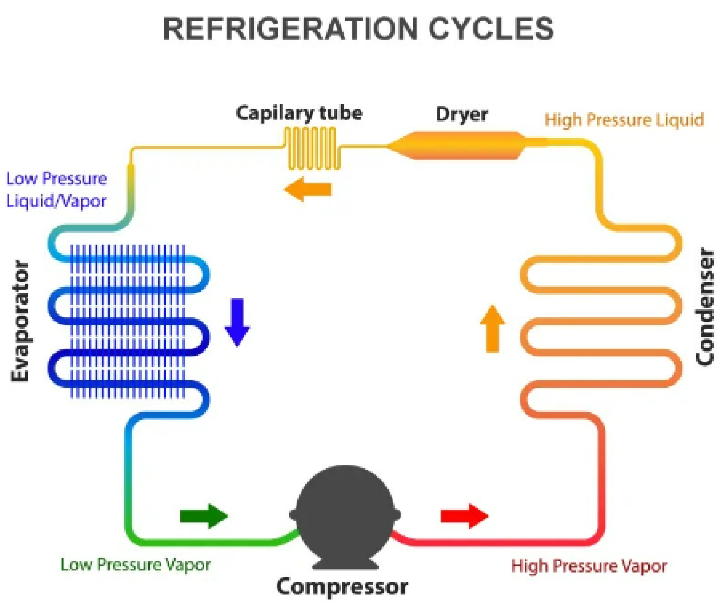
Stages:

1) The compressor that circulates the refrigerant in the system is the heart of the air conditioner. The refrigerant, before passing through the compressor, is in gaseous form at low pressure. Due to the compressor, the pressure of the gas increases, it heats up and is directed to the condenser.

2) In the condenser, the high-pressure and high-temperature gas gives off its heat to the environment and turns into a high-pressure subcooled liquid.

3) The high-pressure liquid passes through the expansion valve, which reduces the pressure and therefore the temperature drops below the temperature of the space being cooled. This results in cold, low pressure coolant.

4) The low-pressure refrigerant is directed to the evaporator where it absorbs heat from the indoor air during the evaporation phase and turns into a low-pressure gas. The gas returns to the compressor and the cycle repeats itself from the beginning.



In the case of a heat pump, the cycle can be reversed.

The energy is absorbed by the refrigerant in the heat exchanger known as the evaporator. This energy comes from the material to be cooled which is water, air, or anything else. The compressor, which is usually driven by an electric motor, increases the pressure and thus the temperature of the refrigerant. The compressed steam is then cooled and liquefied in the heat exchanger, called the condenser, giving up its latent heat, usually to the surrounding air or water. The liquefied refrigerant then passes from high pressure through the expansion valve (throttling mechanism) to low pressure and back to the evaporator.

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