Air conditioning

Air conditioning, often abbreviated as A/C (US) or air con (UK), is the process of removing heat from an enclosed space to achieve a more comfortable interior environment (sometimes referred to as 'comfort cooling') and in some cases also strictly controlling the humidity of internal air. Air conditioning can be achieved using a mechanical 'air conditioner' or alternatively a variety of other methods, including passive cooling and ventilative cooling. Air conditioning is a member of a family of systems and techniques that provide heating, ventilation, and air conditioning (HVAC). Heat pumps are similar in many ways to air conditioners, but use a reversing valve to allow them both to heat and to cool an enclosed space.

Air conditioners, which typically use vapor-compression refrigeration, range in size from small units used within vehicles or single rooms to massive units that can cool large buildings. Air source heat pumps, which can be used for heating as well as cooling, are becoming increasingly common in cooler climates.

According to the International Energy Agency (IEA), as of 2018, 1.6 billion air conditioning units were installed, which accounted for an estimated 20% of electricity usage in buildings globally with the number expected to grow to 5.6 billion by 2050. The United Nations called for the technology to be made more sustainable to mitigate climate change and for the use of alternatives, like passive cooling, evaporative cooling, selective shading, windcatchers, and better thermal insulation. CFC and HCFC refrigerants such as R-12 and R-22, respectively, used within air conditioners have caused damage to the ozone layer, and HFC refrigerants such as R-410a and R-404a, which were designed to replace CFCs and HCFCs, are instead exacerbating climate change. Both issues happen due to the venting of refrigerant to the atmosphere, such as during repairs. HFO refrigerants, used in some if not most new equipment, solve both issues with an ozone damage potential (ODP) of zero and a much

lower global warming potential (GWP) in the single or double digits vs. the three or four digits of HFCs .

What Are the Main Parts of an Air Conditioner?

There are four major components of an air conditioning system. They are the evaporator, condenser, compressor, and expansion valve. Each of these air conditioner components functions in sync with each other and has a specific job to do – to keep your air conditioner running like a well-oiled machine.

1. Evaporator Coil

In a mini-split air conditioner, the evaporator coil is found in the indoor unit, while in a central system, it is located in the air handler. Refrigerant, which is flowing through the system, is cooled to a low temperature just before entering the evaporator coils. As warm air from your home is drawn in your HVAC unit, it is blown over the cool evaporator coils which extract the heat and cool the air down. Fans located behind the evaporator coil then blow this cool air back inside, reducing your home temperature.

These coils are usually made out of copper but can also be made of steel or aluminum. Copper is the preferred choice because it has better thermal conductivity, is easier to work with, and is effortless to maintain.

Be sure to keep your coils clean, though, as over time, dirt and dust can build upon them and reduce their efficiency. A build-up of this dust can also block the condensation drain and result in refrigerant leaks. While it is protected by the air filter, yearly cleaning will help keep your evaporator coils in the best condition.

2. Compressor

Perhaps the most important of all air conditioner components, the compressor is the workhorse of air conditioning. For central and split systems, the compressor is located in the outdoor unit. The majority of an air conditioner's energy consumption is because of the compressor, and it is generally the most expensive part of the system.

The purpose of the compressor is, as the name suggests, to compress the refrigerant, which is a warm vapor as it reached the compressor, to a hot compressed liquid. As the air conditioning process continues, this is then cooled down and expanded again to remove heat from the indoor air. More on this later in the article.

Based on the size of your air conditioner, the size of the compressor will vary. You can keep the most important AC component healthy by often checking for refrigerant leaks, preventing dirt & contamination, keeping the condenser coils cleaned, and keeping your AC well oiled.

3. Condenser Coil

The opposite of the evaporator, the condenser coil, pulls away heat from the refrigerant and ejects it to the outside environment. It is located in the outdoor unit of your air conditioner.

The evaporator coil works effectively in reverse to the condenser, with a fan blowing heat away from it. If you stand outside the outdoor unit of your air conditioner, you will feel hot air blowing out from it. This is the heat that the condenser is expelling during the process when changing the refrigerant from hot vapor to a hot liquid.

4. Expansion Valve

In between the condenser and evaporator, there is another little gadget called an expansion valve. As the refrigerant is now a liquid, it will be unable to absorb the heat. In the expansion valve, the refrigerant expands into gas after facing a drop in pressure and is also rapidly cooled. This gaseous, cooled refrigerant then goes into the evaporator coils to repeat the air conditioning process.

How Do Air Conditioners Work?

On July 17th, 1902, Willis Carrier invented the first modern air conditioning system. Carrier's invention helped give rise to numerous industries that continue to power our economy today. In the early years, air conditioning helped boost manufacturing of everything from baked goods to wartime supplies. It led directly to summer movie blockbusters as people flocked to cooled theaters to escape the heat. Precise control of temperature and humidity has even enabled the development of indoor shopping malls, transatlantic flight and the computers and servers that power the internet. Today's "modern" cooling systems still operate on the same basic principles, providing comfortably chilled air to people inside. So, how do air conditioners work?

Air conditioners come in a variety of shapes and sizes, but they all operate on the same basic premise. An air conditioner provides cold air inside your home or enclosed space by actually removing heat and humidity from the indoor air. It returns the cooled air to the indoor space, and transfers the unwanted heat and humidity outside. A standard air conditioner or cooling system uses a specialized chemical called refrigerant, and has three main mechanical components: a compressor, a condenser coil and an evaporator coil. These components work together to quickly convert the refrigerant from gas to liquid and back again. The compressor raises the pressure and temperature of the refrigerant gas and sends it to the condenser coil where it is converted to a liquid. Then the

refrigerant travels back indoors and enters the evaporator coil. Here the liquid refrigerant evaporates, and cools the indoor coil. A fan blows indoor air across the cold evaporator coil where the heat inside the home is absorbed into the refrigerant. The cooled air is then circulated throughout the home while the heated evaporated gas is sent back outside to the compressor. The heat is then released into the outdoor air as the refrigerant returns to a liquid state. This cycle continues until your home has reached the desired temperature.

Air Conditioning Types - Typical Capacity Ranges

Like many types of equipment, air conditioning is often split into groups which described by suitability to different users for instance residential, domestic, commercial, office and industrial. These groupings generally indicate the units size, capability and robustness, rather than how the air conditioner functions. As a rough guide the following table indicates the typical capacity ranges to these generic groups.

Air conditioner - User type	**Cooling Capacity in BTU**	**Cooling Capacity in kw**
Residential / domestic,	6000 - 20000	1.76 - 5.8
commercial / office	12000 – 50000	3.5 - 14.65
Industrial	30000 -	8.79 -

Air Conditioning Types - The Main Groups

Air conditioners fall into one of three major groups; they are either...

- monoblock, i.e units consisting of one block (window air conditioner, portable, etc.)

- split-systems which have an element for inside and a separate but linked element for outside the building

- multi-split where for a single outdoor element there are 2 or more linked internal elements

Monoblock Air Conditioners

The operation of an air conditioner basically revolves round the flow of refrigerant from one set of coils where it collects heat to a second set of coils where it disperses heat. In monoblock air conditioners the two sets of coils are combined in the same body shell. The units are designed to be located inside the building, however they always have an air pipe to link to outside so that the heated air can be dispersed to outside.

Mobile monoblock air conditioning

Portable or mobile air conditioners

Perhaps the most familiar air conditioner to most consumers, these units do not require special mounting but do come with a flexible air pipe which is routed through a window or hole in the wall. Generally the diameter of the air pipe is about 5" and the pipes are about 2 - 3 m long. The air conditioner discharges hot through this pipe when in use. Because the compressor is located inside the unit rather than in the case of split units, in an external element, the mobile

	monoblock air conditioners have the disadvantage of being quite noisy and limited in capacity. On the other hand they do not require installation and are these days relatively cheap to buy. Although there are numerous mobile air conditioners on the market, the vast majority are small units either 9000 or 12000 btu, we only sell mobile units larger than 10000 btu, simply because for the vast majority of applications 9000 btu models are just too small.
 Floor mounted monoblock air conditioner	Floor mounted air conditioners Floor mounted monoblock air conditioners are installed against the wall in the same way a storage heater is and they are typically of a similar appearance and size to storage heaters. These type of air conditioners usually have a heat pump facility, thus providing very cost-effective heating in colder months. These air conditioners typically have 2 air pipes which lead directly from the rear of the unit, through the wall, where the ends are usually capped with small louvres.
 Wall mounted monoblock air conditioning	Wall air conditioners Some times called high wall air conditioners, wall mounted monoblock air conditioning is a neat solution to older buildings where planning does not permit the installation of an external condenser unit. The wall mounted monoblock air conditioner pattachesp high on the wall and two air pipes are routed from the back directly

	through the wall. The disadvantage of these air conditioners is that they are slightly larger in-depth compared to split wall mounted unit as the condenser is contained inside the wall mount unit. They usually feature a heat pump so that air can be heated in winter as well as cooled in summer.
 Industrial mobile aka 'spot cooler'	Spot coolers (industrial mobile) Spot cooling can be provided by these large mobile monoblock air conditioners. They are heavily build, powerful and designed to be wheeled to ships, boats and aircraft to provide temporary cooling to the internal air. Spot coolers can also be used to provide cool air to industrial processes. Unlike small portable air conditioners, spot coolers are designed to be located in the warm outside air and to provide cool air into areas that they themselves do not occupy. Most have capacity to deliver cold air via a number of ducts to exactly where the air is required. The snout pipes that are typically fitted to the front of these units are rigid but adjustable, enabling the flow of cold air to be directed to a preset spot.
 Window air conditioner	Window air conditioners Window air conditioners or window rattlers as they are referred to by the trade, used to be the most widespread configuration of air conditioner. They are almost standard in

	apartments, houses, offices and cabins in Mediterranean countries and the Middle East. The basic ones can only chill the air, the more expensive have a heat pump mode and a remote-control. Main disadvantages of window air-conditioners are increased noise and necessity of mounting into the window opening or more usually through a narrow wall. On the plus side they are reasonably priced and easy to fit. Window air conditioners are sometimes known as 'thro the wall air conditioners', although they generally can not be mounted in a wall any thicker than 9" because then the additional depth of wall impinges and blocks the air flow from the side vents of the units on the outside. Several of our customers find it much cheaper long-term to run and replace window air conditioners, that to install and maintain split systems. New European efficiency regulations that took effect in 2013, mean that many manufacturers have stopped manufacturing this type of air conditioner, and stocks of units made before the regulations took effect are now gone. The market was almost free of window air conditioners for about 2 years and now there are some machines on the market which are compliant with the new ErP regulations.

Advantages & Disadvantages of Air Conditioners

Advantages

Most people use air conditioners to stay more comfortable in their homes or offices during hot and humid summer weather. Under extreme conditions, air conditioners may keep elderly and other vulnerable people safer from heat-induced health problems. Air conditioners are used in many commercial settings not only for increased comfort but for decreasing heat stress on delicate machinery such as computers, and reducing food spoilage in grocery stores and restaurants.

Prevents Dehydration and Heat strokes

Being exposed to excessive heat for long periods can cause dehydration. This is because high temperature leads to profuse sweating and makes your body lose water. If you fail to replenish this lost water, the result will be dehydration. Since air conditioners reduce sweating, they can minimize the risk of water loss and dehydration.

Heat strokes are another problem that excessive heat can cause. This is because too much heat can make it difficult for the body to regulate its temperature. Failing to treat this problem early enough can cause damage to the brain and other organs of the body. Since air conditioners reduce the temperature of the air, they can be helpful in preventing heat strokes.

Improves the Quality of Air

Air conditioners can significantly improve indoor air quality and create a much healthier atmosphere. This is because they are capable of flittering out pollen, dust, and other allergens present in the environment. By reducing humidity, air conditioners can check the growth of mildew and mold.

Helps to Reduce Asthma and Allergies

Air conditions can help to filter as well as disinfect the air that we breathe. This can help to reduce the risk of asthma attacks and allergies by removing pollen and dust, and also preventing the growth of mildew and mold. Being exposed to mold is one of the main factors that increase the risk of asthma attacks, allergic reactions, and other respiratory issues. The fact that we close our windows while using air conditioners helps to prevent the entry of environmental allergens, bacteria, and dust.

Disadvantages

Air conditioners use a lot of electricity. This creates both financial disadvantages for the people who have to pay for the power, and more generalized environmental disadvantages caused by power production. Because a large percentage of electricity is created by coal-burning power plants, air conditioning contributes indirectly to the release of greenhouse gases and other pollutants. In addition, according to The Independent, spending too much time in an air-conditioned environment can contribute to health problems such as asthma, tightness in the chest and other respiratory ailments.

Skin Dryness

Spending increased amount of time in an air-conditioned room can make your skin lose its moisture, thereby becoming sensitive and dry. It can also cause irritation and dryness of the mucous membrane.

Aggravation of Respiratory Problems

A sudden change in temperature has shown to exacerbate the symptoms of various respiratory diseases. Fortunately, you can significantly reduce the risk of this problem by setting a higher temperature and decreasing it gradually.

Respiratory Tract Infections and Allergies

Not cleaning the air conditioner can cause the buildup of dust, bacteria, and pollen in the air filters. This will significantly increase the risk of asthma attacks and respiratory tract infections.

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