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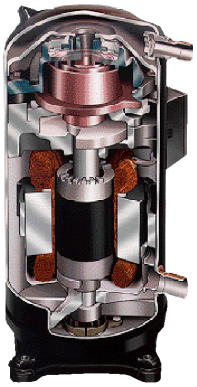
How Does an Air Conditioner Work?

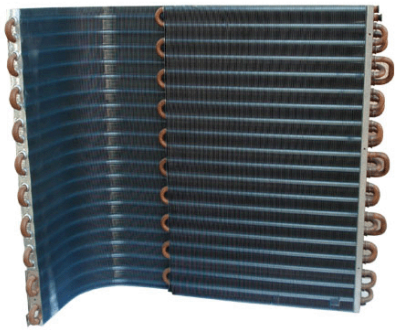
The goal with air conditioning is to capture heat in the house and throw it outside. Air conditioners and refrigerators work the same way. instead of cooling just the small insulated space inside a refrigerator, an air conditioner cools a room, the whole house or an entire business.

Air conditioning is actually the transfer (removal) of heat from a place where it is undesirable (indoors) to a place where it is unobjectionable (outdoors).

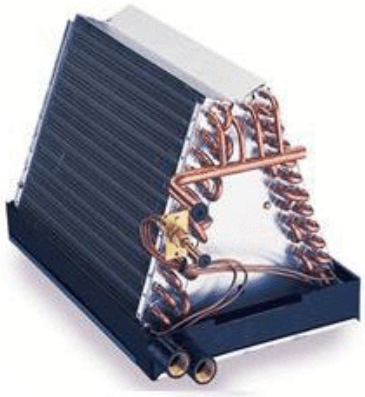
The air conditioning system has three main parts:



COMPRESSOR



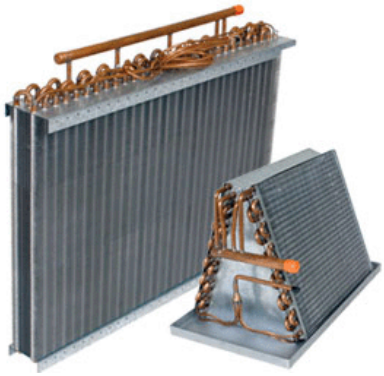
CONDENSER



EVAPORATOR

The compressor, a condenser and an evaporator. The compressor and condenser are usually located on the outside air portion of the air conditioner. The evaporator is located on the inside of the house, sometimes as part of the furnace (often referred to as the "A coil").

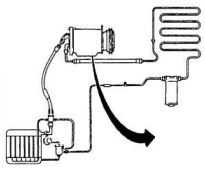
An air conditioner has an evaporator (cold indoor coil) and a condenser (hot outdoor coil). The evaporator is the one that cools a room while the condenser is in charge of collecting heat and releasing it outside the home. These two coils are made of copper tubing formed like a serpent inside the unit and surrounded by aluminum fins.



CONDENSER EVAPORATOR

Air conditioners use chemicals that easily convert from a liquid to a gas and back again. This chemical (refrigerant) is used to transfer heat from the air inside a home to the outside air.

A compressor also plays a major role by moving the refrigerant (heat transfer fluid) from the evaporator to the condenser vice versa. As the liquid refrigerant gets into the indoor evaporator coil, it evaporates and extracts heat out of the indoor air to provide a cooler air in the room.



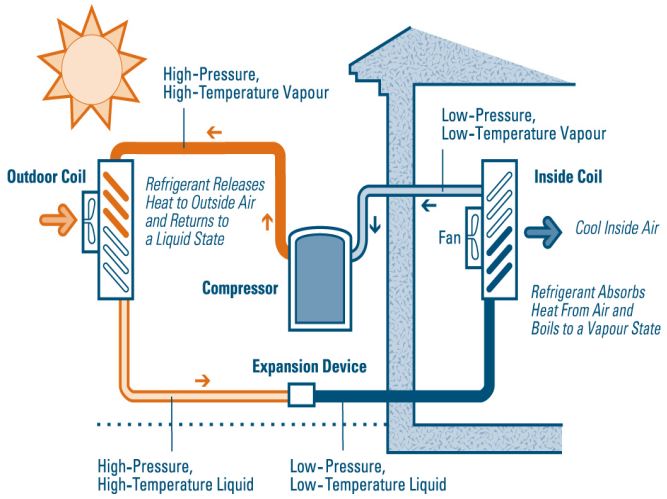
The working fluid arrives at the compressor as a cool, low-pressure gas. The compressor squeezes the fluid. This packs the molecule of the fluid closer together. The closer the molecules are together, the higher its energy and its temperature.

The working fluid leaves the compressor as a hot, high pressure gas and flows into the condenser. The fins on the condenser act just like a radiator and helps the heat go away, or dissipate, more quickly.

When the working fluid leaves the condenser, its temperature is much cooler and it has changed from a gas to a liquid under high pressure. The liquid goes into the evaporator through a very tiny narrow hole, on the other side, the liquid's pressure drops. When it does it begins to evaporate into a gas.

As the liquid changes to gas and evaporates, it extracts heat from the air around it. The heat in the air is needed to separate the molecules of the fluid from a liquid to a gas.

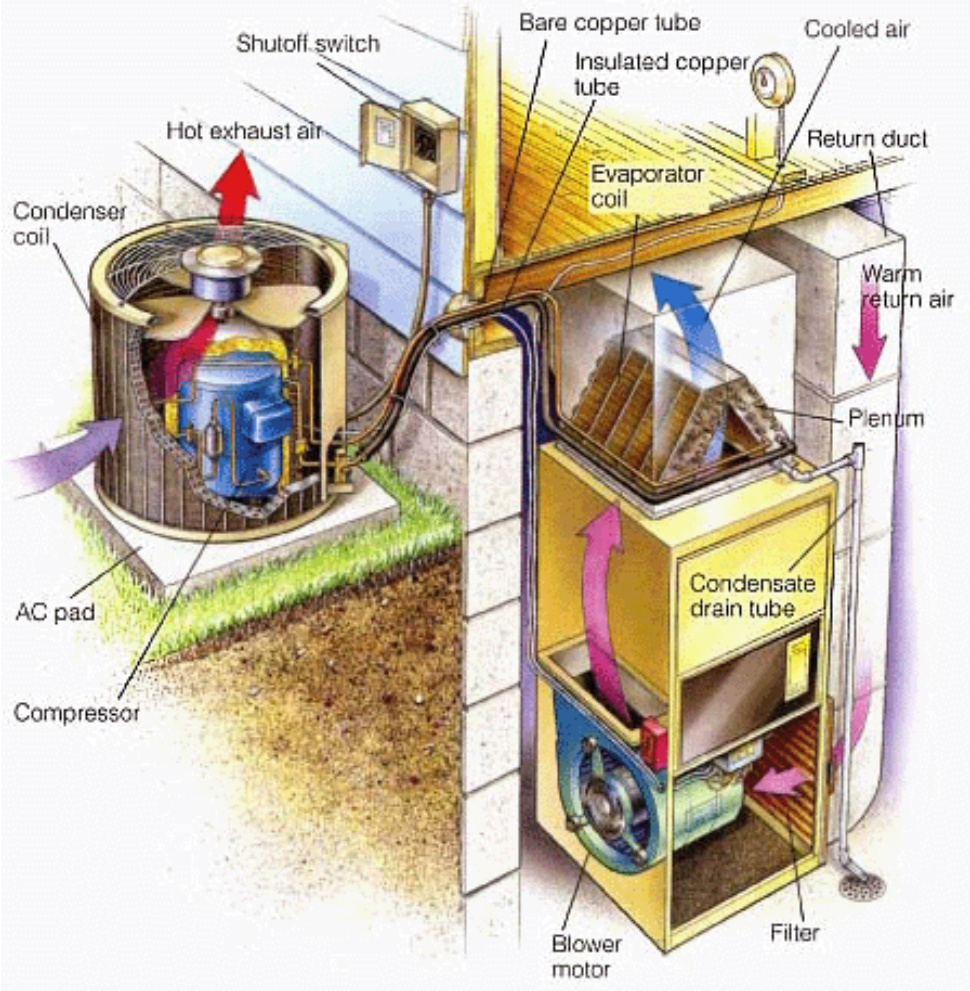
The evaporator also has metal fins to help exchange the thermal energy with the surrounding air.



By the time the working fluid leaves the evaporator, it is cool, low pressure gas. It then returns to the compressor to begin its trip all over again.

Connected to the evaporator is a fan that circulates the air inside the house to blow across the evaporator fins. Hot air is lighter than cold air, so the hot air in the room rises to the top of a room.

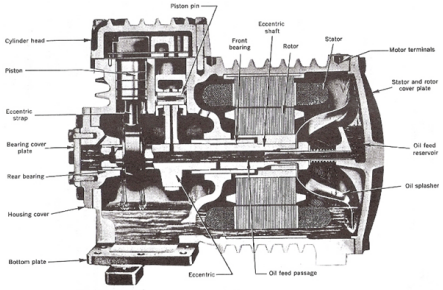
There is a vent there where air is sucked into the air conditioner and goes down ducts. The hot air is used to cool the gas in the evaporator. As the heat is removed from the air, the air is cooled. it is then blown into the house through ducts.



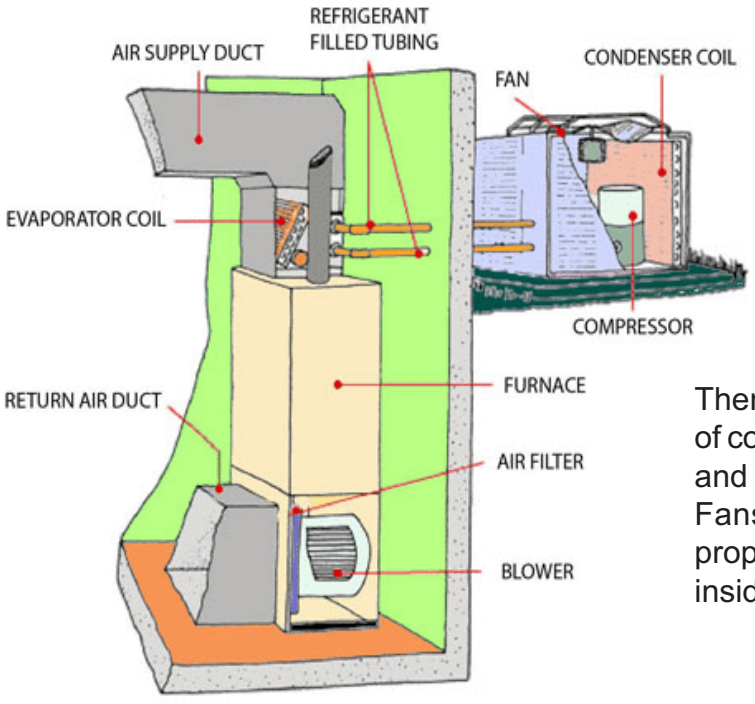
This continues over and over until the room reaches the temperature you want the room cooled to. The thermostat senses that the temperature has reached the right setting and turns off the air conditioner. As the room warms up, the thermostat turns the air conditioner back on until the room reaches the set temperature.

Air conditioners use the evaporation of coolants, such as Freon, a nonflammable fluorocarbon, to create cool air.

The evaporation cycle in an air conditioner begins when the compression unit unit compresses cool Freon gas. The Freon is mixed with a small amount of oil, which helps to lubricate the compressor. The compression of the Freon causes it to become a hot, high-pressured gas.

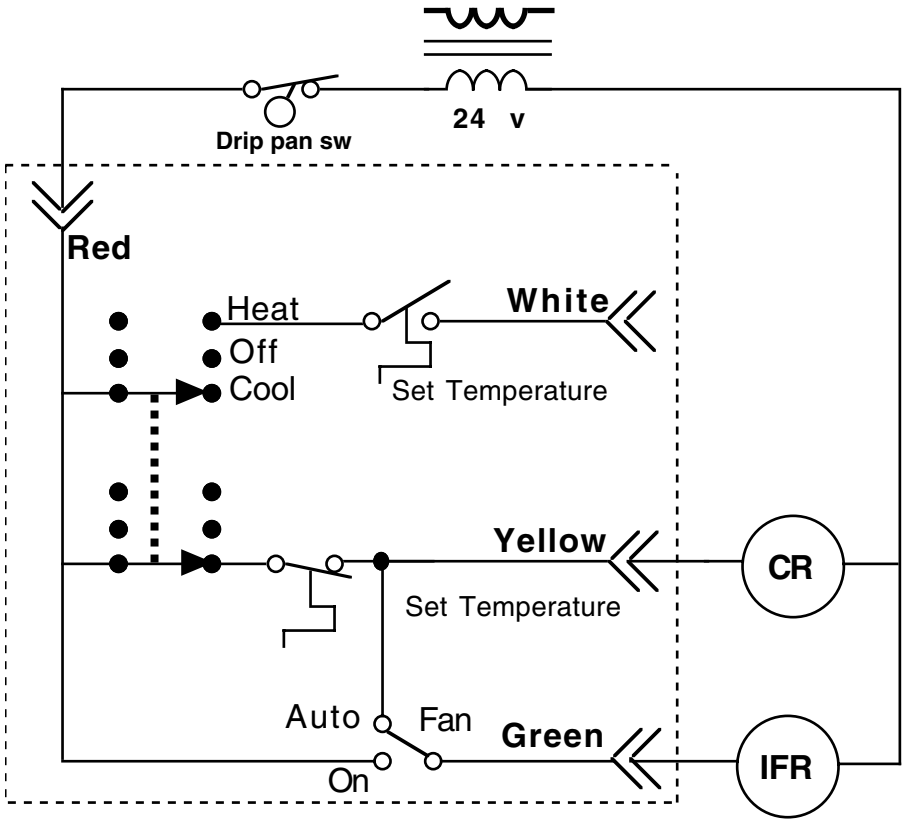


The gas is then propelled through a series of coils where it dissipates its heat and condenses into a liquid. next, the Freon moves through an expansion valve where it becomes a cold, low-pressured gas.

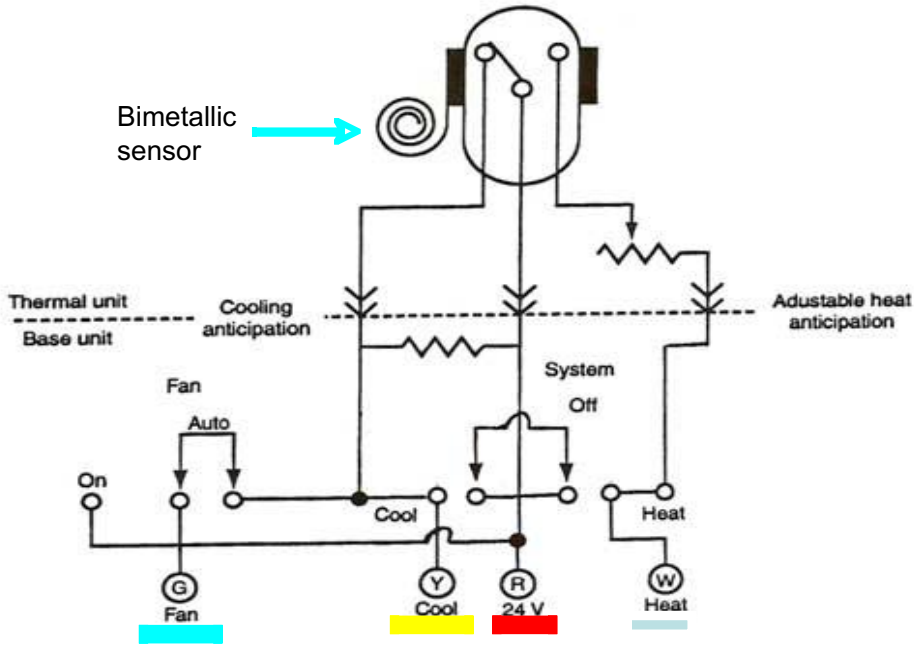


Then, the gas runs through another set of coils that allows the gas to absorb heat and cool down the air inside your home. Fans placed near these coils help to propel hot air outside and move cool air inside.

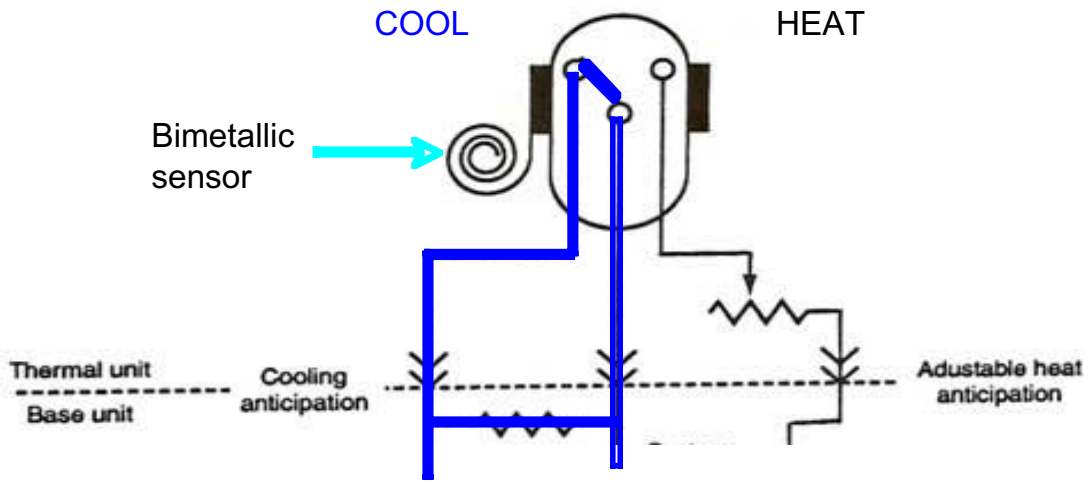
THE THERMOSTAT CIRCUIT



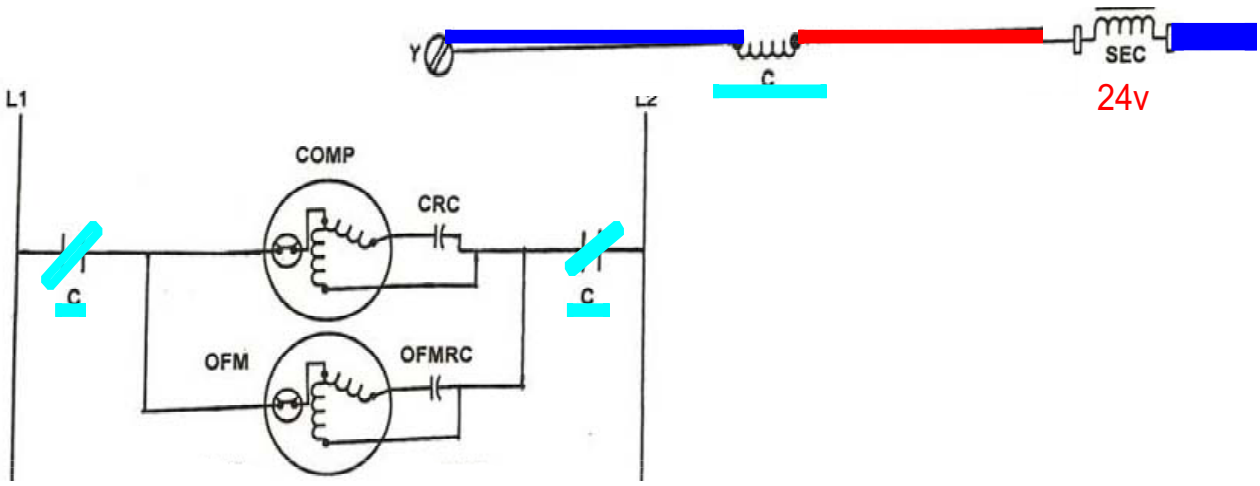
The Bimetallic sensor monitors the temperature of the room. The GREEN terminal is to the indoor fan. The YELLOW terminal is for the cooling mode. The RED terminal is the 24 volt supply from the transformer. The WHITE terminal is for the heating mode.



When the switch is set in the COOL mode you can follow the circuit through the cool anticipator.



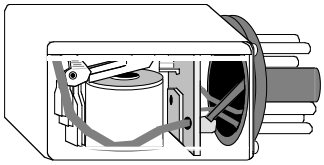
This diagram shows the COOL mode sending a 24 volt supply from the "Y" terminal to the "C" (contactor) coil which energizes and closes the two normally open "C" contacts thus starting the compressor motor "COMP" and outdoor fan motor "OFM."



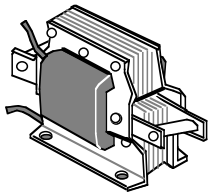
RELAYS

Before introducing relays and contactors, students must clearly understand circuits, loads, and switches. A relay is essentially an electrically operated switch. A contactor is really just a bigger relay. The key to understanding relay operation is realizing that a relay is actually two electrical devices: a set of contacts and a coil. The contacts are a switch. They are wired in circuits exactly like switches and they behave like switches because they are switches. Relay coils are loads; specifically, solenoids. They wire in circuits like a solenoid and they behave like solenoids because they are solenoids. The purpose of the relay coil is to operate the relay contacts. Energizing or de-energizing the relay coil makes the contacts open or close, but the coil and contacts are almost always in separate circuits.

Relays, solenoids, etc. contain a magnetic coil when energized by an electrical current passing through it causes the iron armature to move in the frame.



relay

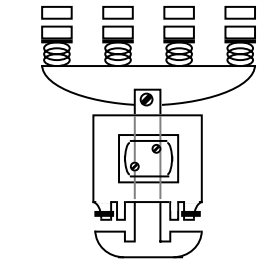


solenoid

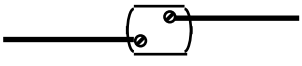
Relays are **switching devices**. A relay is used in a control circuit as a switch. Relays are NOT designed to carry large currents.

The 4-pole relay shown has four normally open contacts. The contacts are referred to as poles.

When the coil is **energized** creating a magnetic field it will draw the iron plunger "up" closing the normally open contacts. This is the switching action of a relay. The 4-pole relay contains four switches which can be normally open or normally closed.



4-pole relay



coil