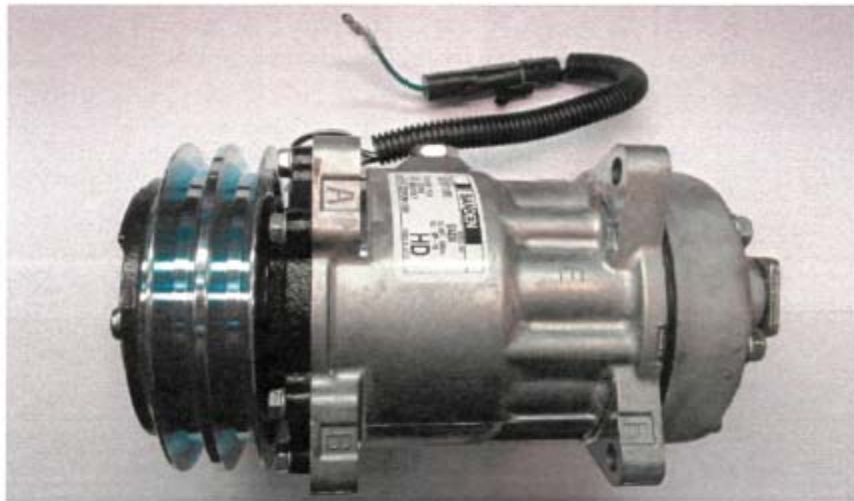


# Basic function of the AC system.

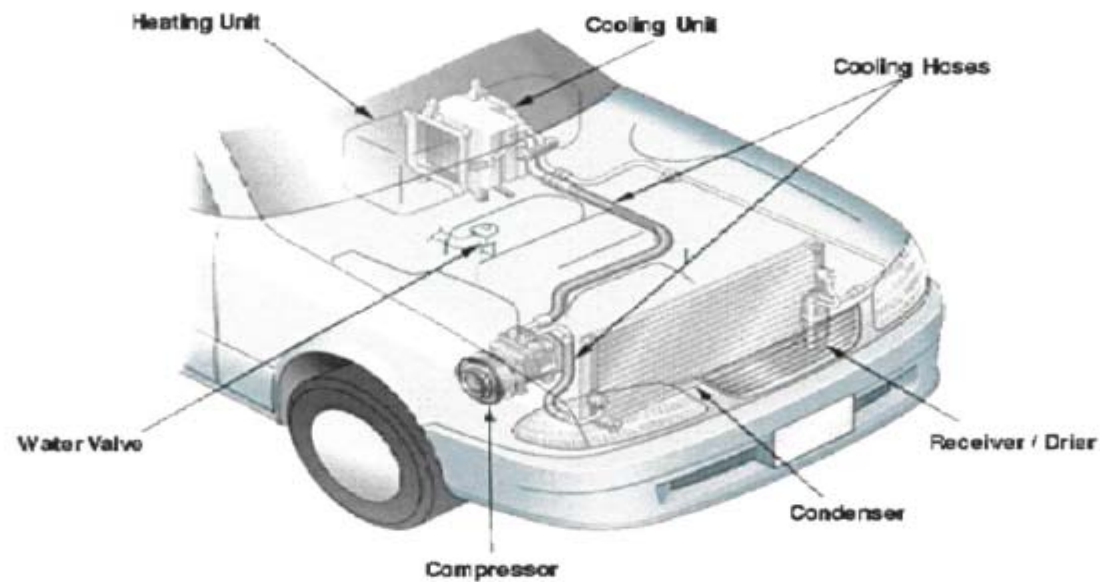


# Understanding the system.

- Your A/C system is nothing more than a heat exchanger. There are only 6 major parts to the system.
- The Compressor
- The Condenser
- The Receiver/Dryer or Accumulator
- The Thermal Expansion Valve or Orifice Tube
- The Evaporator
- The electronic components, switches, sensors etc..

# Understanding the system.

## CONVENTIONAL SYSTEM

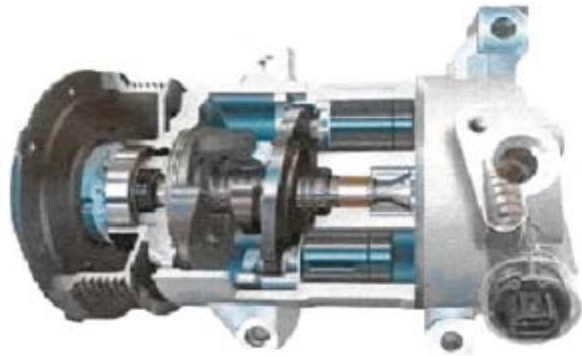




# The Compressor

- Commonly referred to as the heart of the system, the Compressor is typically a belt driven pump that is fastened to the engine or motor. It is responsible for compressing and transferring refrigerant gas.
- The A/C system is split into two sides, a **High** pressure side and a **Low** pressure side; defined as **Discharge** and **Suction**. Since the Compressor is basically a pump, it must have an intake side and a discharge side.

## Variable Swash Plate



## Variable Wobble Plate



## Vane



## Scroll

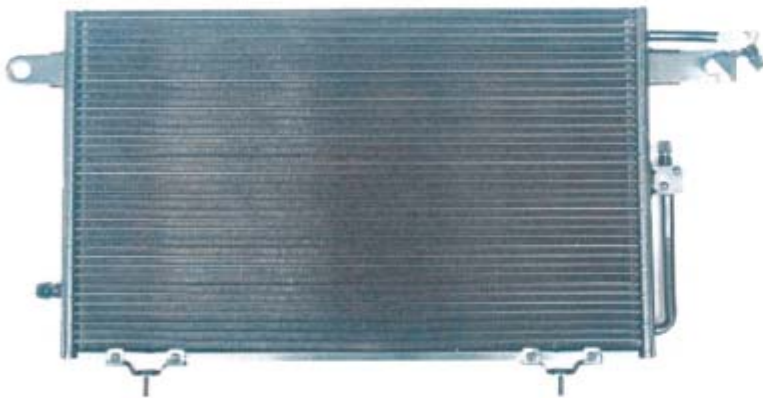




# The Condenser

- This is the area in which heat dissipation occurs. The Condenser, in many cases, will have much the same appearance as the radiator in your car as the two have very similar functions. The Condenser is designed to radiate heat. Its location is usually in front of the radiator.
- As hot compressed gases are introduced into the top of the Condenser, they're cooled off. As the gas cools, it condenses and exits the bottom of the Condenser as a high pressure liquid.

# The Condenser



The Condenser function is to act as a heat exchanger and allow heat to flow from the hot refrigerant to the cooler outside air.

R134a entering the condenser will be a high-pressure high temperature vapor. As the R134a vapor travels through the tubes of the condenser heat is given off to the cooler ambient air, the refrigerant vapor condenses and changes to a liquid state.

At this point a large amount of heat is given off by the R134a. The refrigerant will now be a hot, high pressure liquid.

## Design types

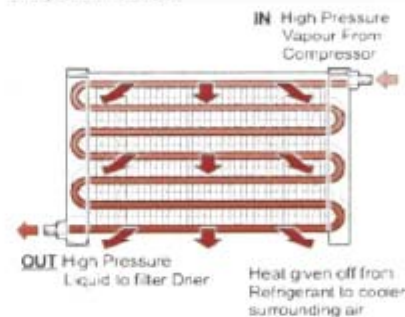
### *Serpentine*

This type of condenser consists of one long tube which is coiled over and back on itself with cooling fins in between the tubes.

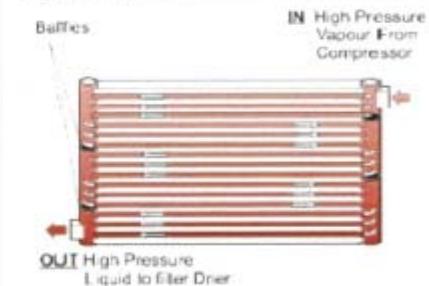
### *Parallel flow design* (Recommended for R134a)

This design is very similar to a cross flow radiator. Instead of refrigerant travelling through one passage (like serpentine type), it can now travel across numerous passages. This will give larger surface area for the cooler ambient air to contact.

### *Serpentine Flow*



### *Parallel Flow*



## R134a - R12 Comparison

As R134a operates on higher pressures, less internal flow, restrictive and improved heat rejection condensers are required.

- Most manufacturers select the parallel flow design for this version. They are approximately 25% more efficient than the serpentine condensers.

# The Receiver/Dryer

- The Receiver/Dryer is used on the high side of systems that use a thermal expansion valve. This type of metering expansion valve requires liquid refrigerant. To ensure that the expansion valve gets liquid refrigerant, a receiver is used.
- Two Functions of the Receiver/Dryer :
  1. The primary function of the Receiver/Dryer is to separate gas and liquid.
  2. The secondary purpose is to remove moisture and filter out debris.
- Newer Receiver/Dryers use desiccant type XH-7 and are compatible with both R-12 and R-134a refrigerants. Older Receiver/Dryers are not compatible with R-134a refrigerants.



# The Receiver/Dryer

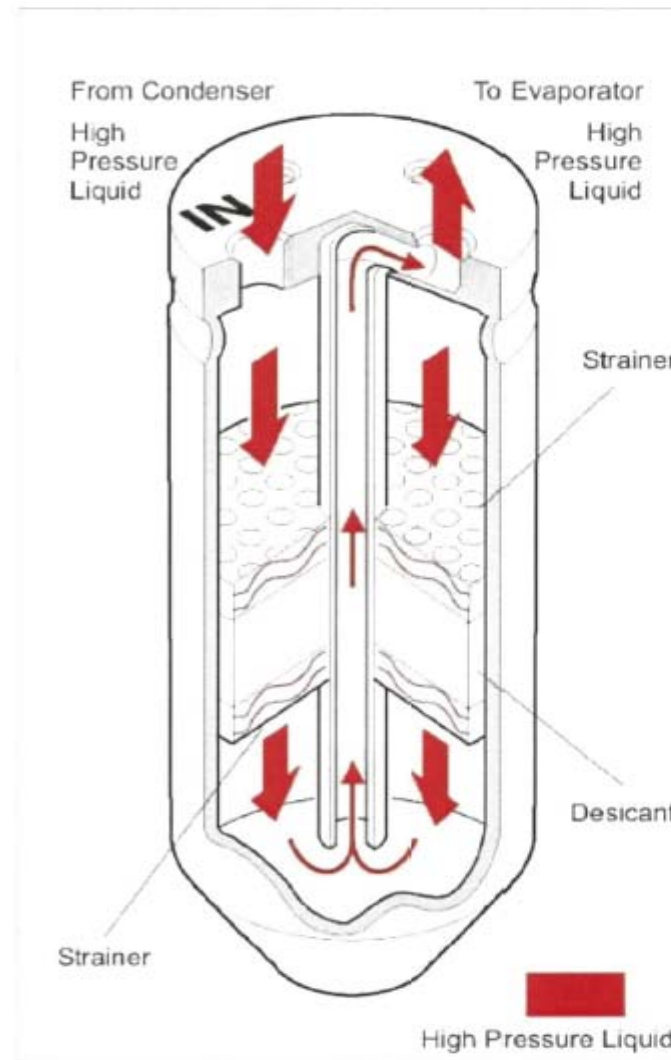
The filter drier acts as a particle filter, refrigerant storage container and most importantly moisture absorber.

Moisture, temperature and R134a causes hydrofluoric and hydrochloric acid. The silica gel beads (desiccant) located in the FDR absorb small quantities of moisture thus preventing acid establishment.

Most R134a filter dryers have NO sight glass. This is because at approximately 70°C refrigerant temperature the PAG oil will foam giving a false impression of low gas charge. If the FDR does utilize a sight glass ensure correct diagnosis when viewing.

**Note: Ensure the connection indicated with the word "IN" is connected to the condenser outlet.**

**Important:** Never use an R12 FDR on a R134a system.



## Two functions of The Thermal Expansion Valve

- **First Function:**

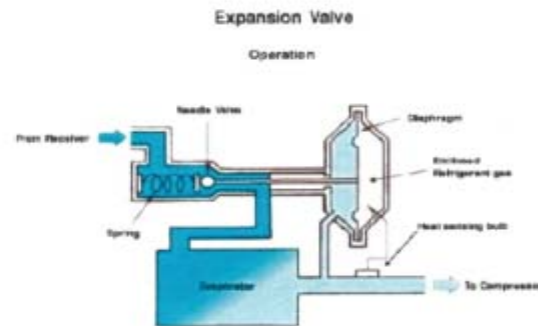
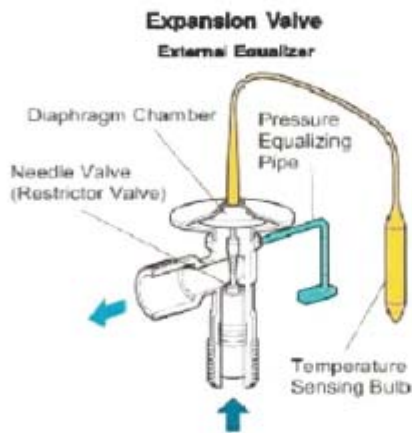
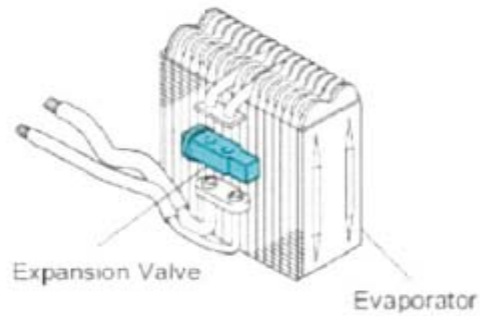
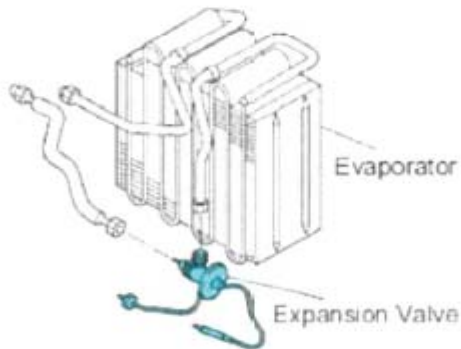
It creates a pressure drop in the liquid refrigerant to produce a temperature drop (this occurs almost all the time)

- **Second Function:**

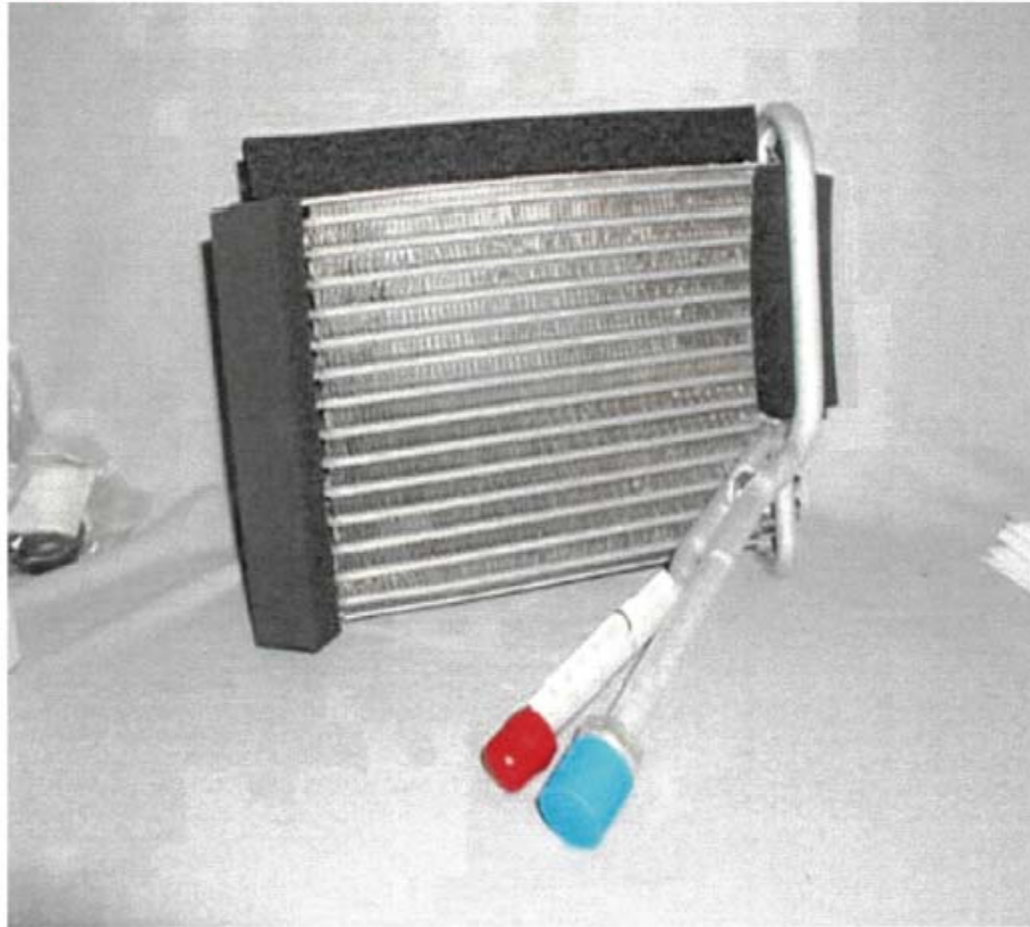
It regulates the flow of the cold liquid refrigerant allowed into the evaporator so it will evaporate to the vapor prior to exiting the evaporator.

# The Thermal Expansion Valve

## Expansion Valve



# The Evaporator





# The Evaporator

- Located inside the vehicle, the Evaporator serves as the heat absorption component. The Evaporator provides several functions. Its primary duty is to remove heat from the inside of your vehicle. A secondary benefit is dehumidification. On humid days you may have seen this as water dripping from the bottom of your vehicle.
- The ideal temperature of the evaporator is 32° Fahrenheit or 0° Celsius. Refrigerant enters the bottom of the Evaporator as a low pressure liquid. The warm air passing through the Evaporator fins causes the refrigerant to boil (refrigerants have very low boiling points). As the refrigerant begins to boil, it can absorb large amounts of heat.

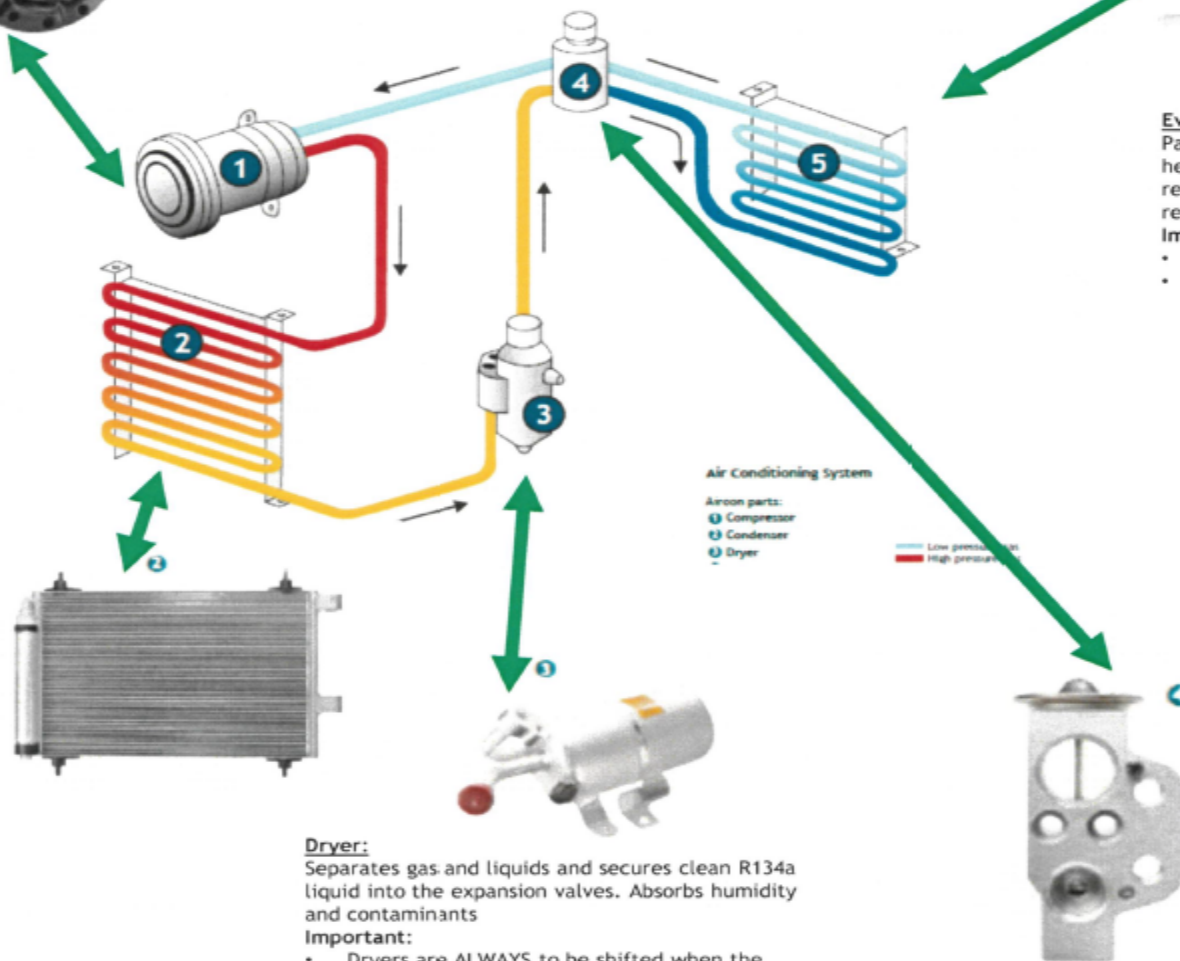
# Things to be aware of when servicing / repairing A/C systems

## Compressor:

Is the heart of the A/C. Secures the pressure needed and circulation of gas and liquids in the system.

### Important:

- After compressor breakdown you need to flush the system to rinse for shavings and fragments which have settled in the system
- Most errors in A/C are NOT compressor failures
- Other causes can be in the pulley, clutch hub or clutch coil
- Always check the oil stand. Too little oil will damage the compressor

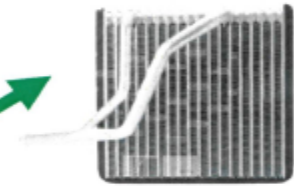


## Evaporator:

Part of to the cabin heater and eliminates heat and humidity from the cabin. The reheated R134a becomes a gas again and is returned to the compressor

### Important:

- Failures are seldom.
- Typical errors are leaks or can be blocked by fragments and contaminants which in both cases demands exchange.

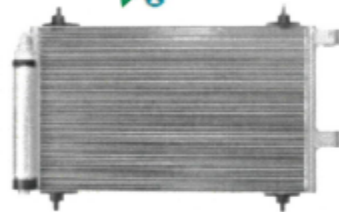


## Condenser:

Cools down the R134a gas coming from the compressor

### Important:

- To be tested after repairs to see if cooling function is OK
- Corrosion by water and salt is the most frequent reason for leaks
- Can also be blocked by leaves preventing sufficient circulation of air
- Leaks are the most common failure in the condenser.
- After compressor break down: always replace condenser as most are so narrow that fragments etc. get stuck when flushing the system = continued failure.



## Dryer:

Separates gas and liquids and secures clean R134a liquid into the expansion valves. Absorbs humidity and contaminants

### Important:

- Dryers are ALWAYS to be shifted when the system has been opened - also important according to complaints/warranty



## Expansion valve:

Creates the drop of pressure in R134a liquid = temperature falls. Controls the flow of cold R134a to the evaporator

### Important:

- Most common failures are fragments and contaminants preventing the valve from functioning properly.
- Demands exchange - especially after compressor break down.

