

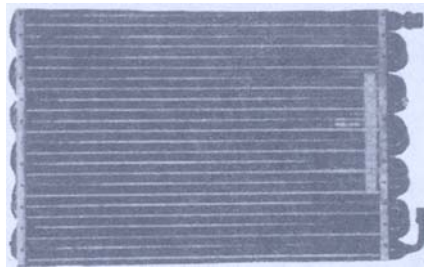
AUTOMOTIVE AIR CONDITIONING REPAIR

Question:

How does an air conditioning system work?

Answer:

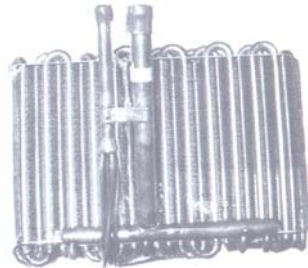
The purpose of air conditioning is to move heat. Heat is absorbed inside an area and deposited outside. In physics, all chemicals are affected by heat uniformly. As temperature increases, so does pressure. Conversely, as pressure increases, so does temperature. All substances have three states of matter: a solid, a liquid, and a vapor. These conditions accrue at definite temperatures. An air conditioning system uses two of these conditions: a liquid and a vapor. A liquid contains less heat than a vapor. By boiling a liquid, heat is absorbed and creates a vapor. By cooling a vapor, heat is reduced and the vapor returns to liquid. This requires two heat exchangers.



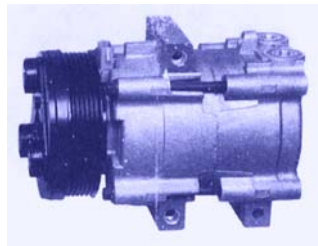
The first heat exchanger is the condenser. It is located in front of the engine radiator. This is where heat is removed and vapor is condensed to liquid. The methods of conduction and convection are used to reduce heat in the refrigerant. Conduction is where two or more substances are in direct contact with each other and transfer heat from one to the other. Hence, the refrigerant is in contact to the tubes of the condenser and the tubes are in contact to the fins of the

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condenser. Convection is the means in which heat is removed. Air, passing over the condenser, absorbs heat from the fins of the condenser and the cooled refrigerant transforms from a vapor to a liquid. The temperature of the refrigerant entering the condenser will vary according to the outside temperature.



The second heat exchanger is the evaporator. Refrigerant entering the evaporator will be in a liquid form, collect heat and boil until it is a vapor. The same methods of heat transfer in the evaporator as in the condenser.

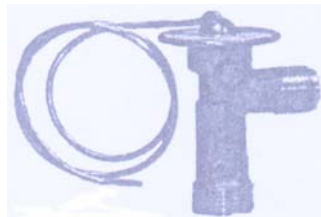


The system requires some method to move the refrigerant. A pump is used and is referred to as the compressor. The compressor plays a larger roll than just being a pump. Refrigerant will boil at twenty-one degrees below zero

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and change to a vapor. The condenser is for condensing vapor back to a liquid with air temperatures that may be as high as one hundred degrees. The compressor, through compression and friction, raises the temperature high enough so that the air crossing the condenser feels cool to it. This action is referred to as superheated vapor. The vapor can only have additional heat added to it after all liquid is gone. The temperature of the refrigerant will be slightly higher than the outside air temperature. (45 Degrees)

There has to be a method to control flow. There are two methods used in automotive AC. One is a thermostatic expansion valve. The other is an orifice tube.



The expansion valve (TXV) is used with a receiver dryer and is located at the inlet to the evaporator.



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The orifice tube is used with an accumulator and can be located in the system anywhere from the outlet of the condenser to the inlet of the evaporator.

The TXV is a mechanical device that uses a sensing tube that one end is connected to a bellows and the other end is connected to the suction line as it leaves the evaporator. The tube senses temperature of the suction side of the evaporator and controls the size of the opening in the TXV. The TXV controls flow into the evaporator so that it is correctly filled. The TXV is the dividing line between the high and the low sides of the system. The TXV is always used in conjunction with a receiver dryer.

An orifice tube is used with an accumulator, which is located on the outlet of the evaporator. The orifice tube is a fixed size orifice and relies on the accumulator to control flow. Also the size of the inside diameter of the tube, inside the assembly, will determine the amount of flow. The orifice is also the dividing line of the high and low side of the system. The accumulator is a functioning part of the system whereas the receiver dryer is not. The accumulator causes the system to work. The receiver-dryer helps to ensure the system will continue to operate, by supplying a

storage space for the refrigerant as the ambient temperature increases. So it can be said that a TXV system has four functioning parts and an accumulator system has five functioning parts.

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The one word that can explain why an AC system works is “restriction”—the metering device of the system. The TXV or orifice tube is the restriction that the compressor pumps against. This action raises the temperature of the refrigerant about 45 degrees above outside air temperature, referred to as ambient temperature. This allows heat to be removed from the refrigerant in the condenser by air crossing the fins of the condenser.

When the system is at rest, the TXV is closed. The closed expansion valve also allows the compressor to remove the liquid refrigerant in the evaporator, which protects the compressor when the unit is first turned on.