SONA COLLEGE OF TECHNOLOGY

SALEM-05

DEPARTMENT OF MECHANICAL ENGINEERING

GREEN AIR CONDITIONER

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GREEN AIR CONDITIONER

INTRODUCTION:

The need at the moment is eco-friendly Air Conditioners. The present Air Conditioning System produces cooling effect by using Chloro Fluro Carbons like Freon, Ammonia, etc., Which damages the environment. We can overcome the existing Air Conditioning System by modifying it to protect the environment. By using Thermoelectric modules (Peltier Modules) Air Conditioners can be made. These Air conditioners can be used summer as well as in winter. These Thermoelectric modules are completely eco-friendly system. These type of air conditioners have wide range of applications.

THERMOELECTRIC EFFECT:

The thermoelectric effect is the direct conversion of temperature differences to electric voltage and vice versa.

THERMOELECTRIC DEVICE:

A thermoelectric device creates a difference in temperature on each side when a voltage is applied (known as the Peltier effect) and vice versa.

MAIN INTENTION BEHIND CHOOSING THERMOELECTRIC MODULES:

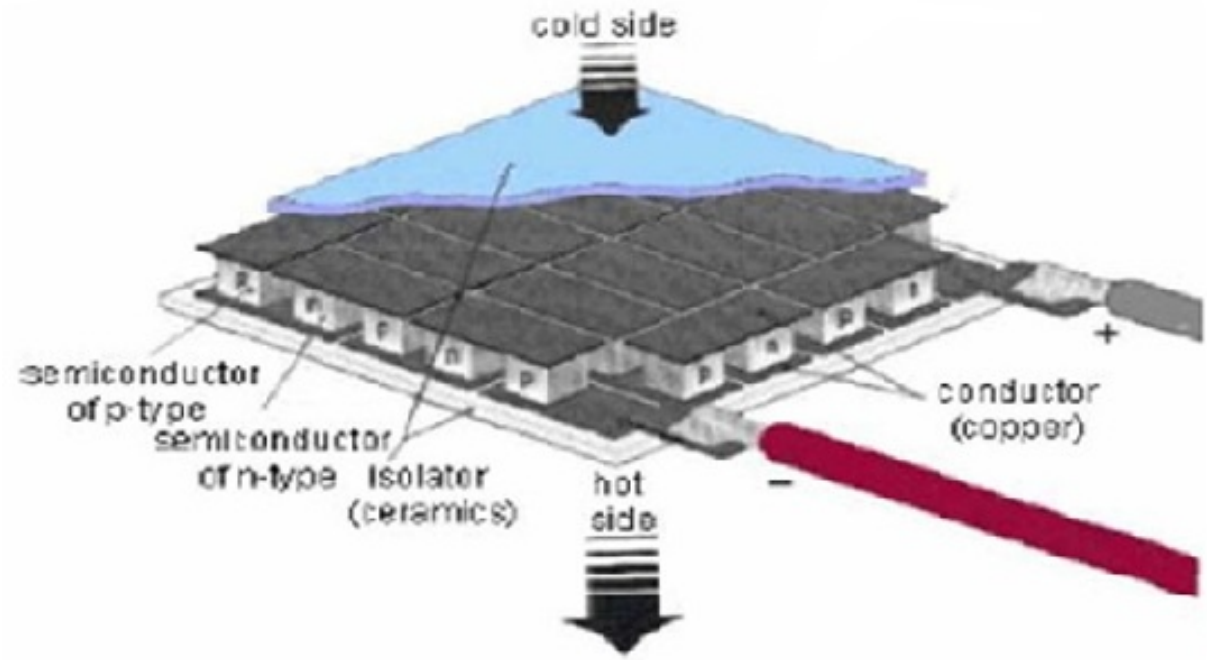
Now the thermoelectric modules are used in places like medical application, temperature preference testing machine, theme park exhibit, laboratory and research purpose. But we here applied in air conditioning system. Because in these type of crystals heating and cooling is produced simultaneously and also it consumes only less amount of electrical energy.

PELTIER EFFECT:

When a current is made to flow through the circuit, heat is evolved at one junction and absorbed at the another junction. This is known as Peltier effect.

THERMOELECTRIC MODULES:

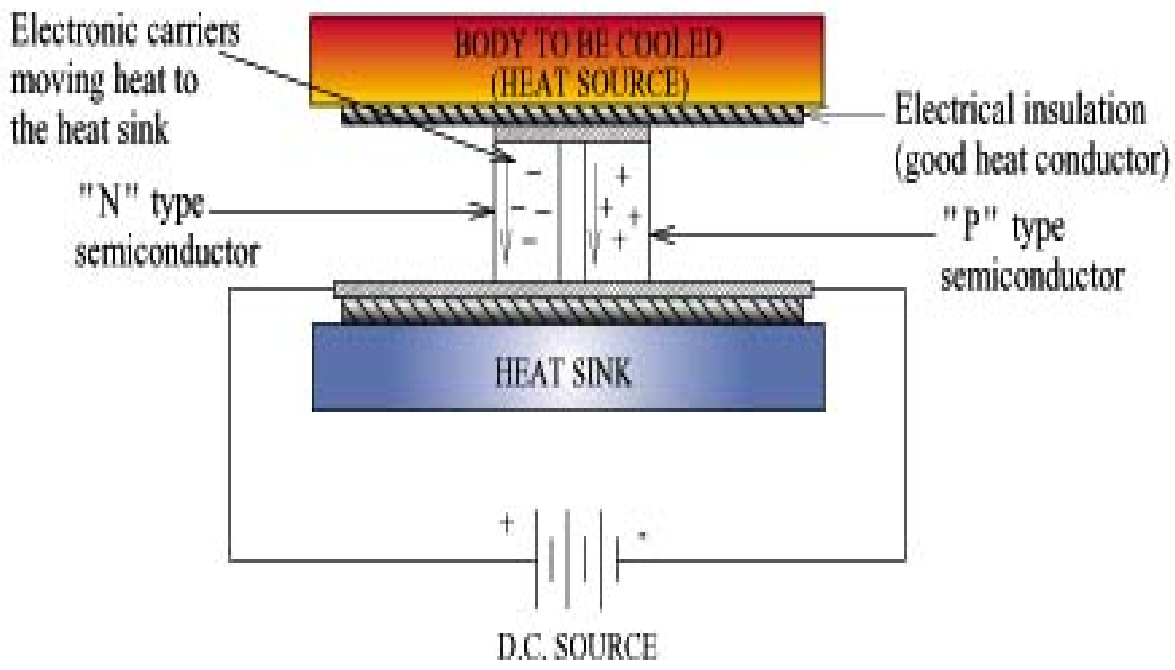
A Thermoelectric module is a device composed of thermoelectric couples (*n* and *p*-type semiconductor legs) that are connected electrically in series, in parallel thermally and, fixed by soldering, sandwiched between two ceramic plates. The latter form the hot and cold thermoelectric cooler (TEC) sides. Thermoelectric modules are also known as Peltier modules.



COMMERCIAL PELTIER MODULE:

WORKING OF THERMOELECTRIC MODULE:

By applying a low-voltage, high-current, DC power source, heat will be moved in the direction of the current (+ to –). The heat is pumped from one side of the module to the other, so that one face will be cold while the opposite face will be heated, and the effect is reversible.



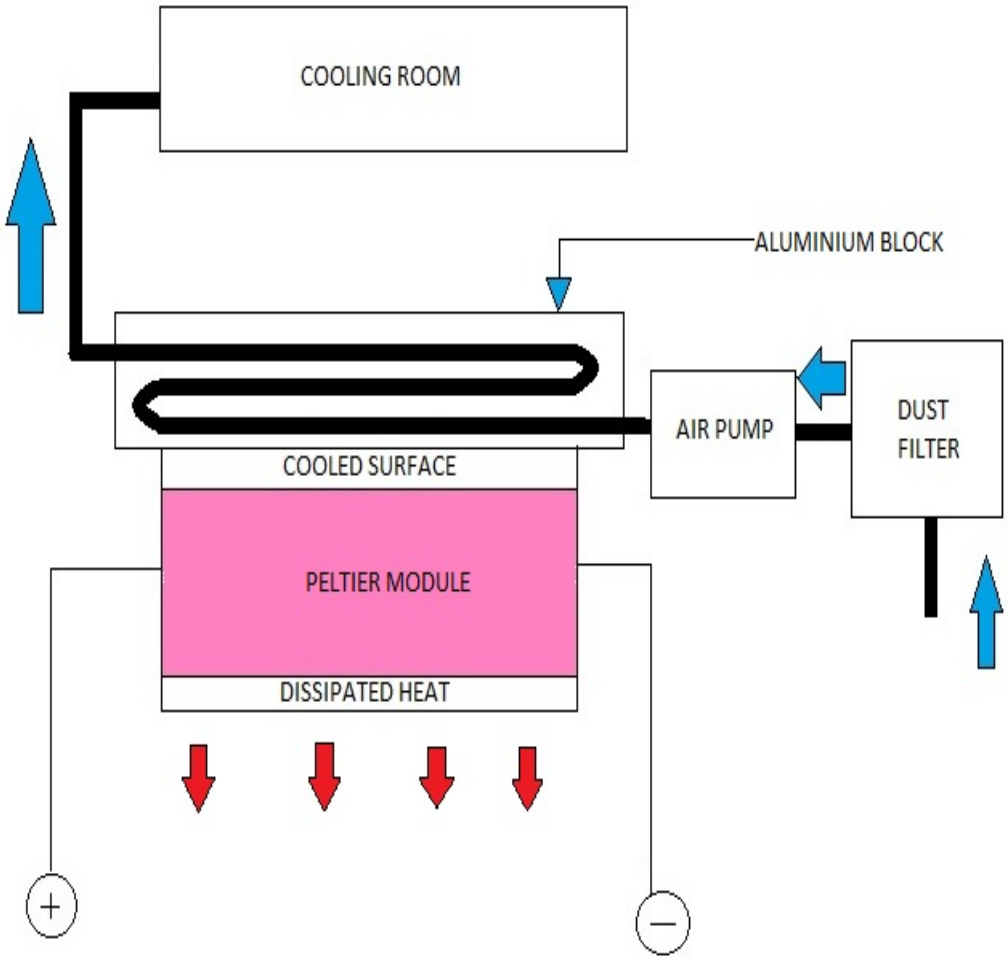
CLASSIFICATION OF GREEN AIR CONDITIONER:

1. Summer Air conditioner.
2. Winter Air conditioner.

SUMMER AIR CONDITIONER:

In summer the outside temperature is normally high so we need reduced temperature for convenient living.

MODEL OF SUMMER AIR CONDITIONER:



CONSTRUCTION:

- A Peltier module or Thermoelectric module consist of one hotter surface and one colder surface.
- By applying the low voltage, high current D.C supply one of the surface of peltier module gets cooled and another gets heated up.
- A rectangular block of aluminium is placed over the cooler surface.
- The inner part of the aluminium block consist of hollow coil like surface which only one inlet and one outlet.
- The Dust filter and Air Pump is connected in series with the inlet valve of the aluminium block.

- The outlet valve is connected to the room which is to be air conditioned.

WORKING:

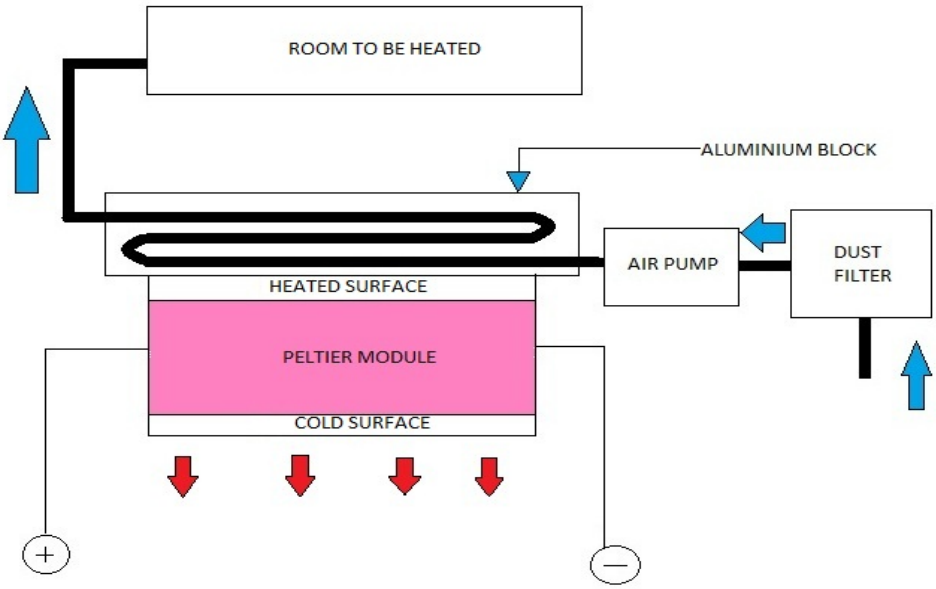
- When the D.C voltage is supplied to the peltier module the surface which is in contact with the aluminium block gets cooled and in the other side heat is dissipated.
- Due to this the aluminium block is also cooled naturally.
- Now the normal air enters in to the Dust Filter and it is pumped in to the aluminium block by air pump.
- When the air passes through the coil in aluminium block the heat from the air gets transferred to the aluminium as aluminium is cooled by peltier.
- When the air comes out through the outlet, the air is completely cooled.
- This air can be sent to the room to cool it.
- The heat dissipated in another side of the peltier module can be used effectively to heat water or cook the food.

WINTER AIR CONDITIONER:

In winter the outside temperature is normally low so we need increased temperature for convenient living.

This is achieved just by reversing the D.C supply to the Peltier module in the summer type air conditioner.

MODEL OF WINTER AIR CONDITIONER:



CONSTRUCTION:

- Just by reversing the direction of D.C supply in summer air conditioner it becomes winter air conditioner.
- By applying the low voltage, high current D.C supply one of the surface of peltier module gets cooled and another gets heated up.
- The Dust filter and Air Pump is connected in series with the inlet valve of the aluminium block.
- The outlet valve is connected to the room which is to be air conditioned.

WORKING:

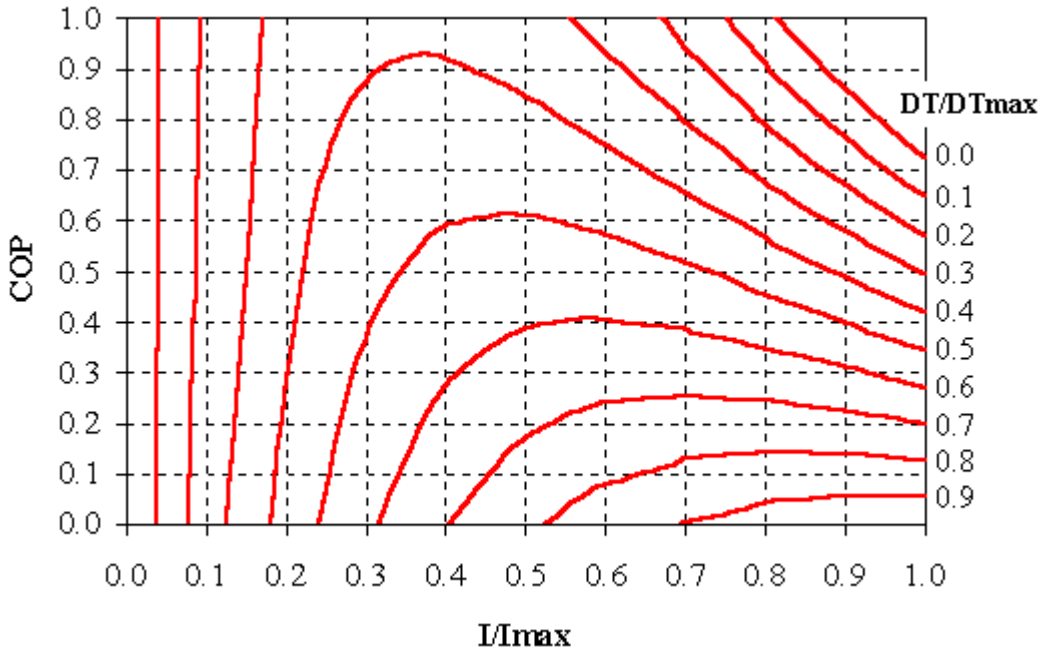
- When the D.C voltage is supplied to the peltier module the surface which is in contact with the aluminium block gets heated and in the other side cooled.
- Due to this the aluminium block is also heated naturally.
- Now the normal air enters in to the Dust Filter and it is pumped in to the aluminium block by air pump.
- When the air passes through the coil in aluminium block which is heated by peltier module the heat from the aluminium block gets transferred to air.

- When the air comes out through the outlet, the air is gets warmed up.
- This air can be sent to the room which is to be warmed.
- The chillness from the colder surface of peltier can be used for refrigeration purpose.

EFFICIENCY OF A THERMOELECTRIC MODULE:

Technically, the word efficiency relates to the ratio of the amount of work one gets out of a machine to the amount of power input. In heat pumping applications, this term is rarely used because it is possible to remove more heat than the amount of power input it takes to move that heat. For thermoelectric modules, it is standard to use the term "coefficient of performance" rather than "efficiency." The coefficient of performance (COP) is the amount of heat pumped divided by the amount of supplied electrical power.

The COP depends on the heat load, input power, and the required temperature differential. Typically, the COP is between 0.3 and 0.7 for single-stage applications. However, COPs greater than 1.0 can be achieved especially when the module is pumping against a positive temperature difference (that is, when the module is removing heat from an object that is warmer than the ambient). The figure below shows a normalized graph of COP versus I/Imax (the ratio of input current to the module's Imax specification). Each line corresponds with a constant DT/DTmax (the ratio of the required temperature difference to the module's DTmax specification).



TEMPERATURE RANGE OF THERMO ELECTRIC MODULE:

The operating temperature of thermo electric module is about -40 °C to +200 °C.

AN EXAMPLE OF OPERATING RANGE OF PELTIER MODULE:

MODEL.NO	Vmax(V)	Imax(A)	Qmax(W)	DTmax(°C)	SIZE(mm)	PRICE($)
VT-199-1.4-1.5	27.6	6.1	103.1	79	**L=40 B=40 H=4.1**	**39.5**
VT-31-1.0-1.3	4.2	3.6	9.2	78	**L=14.8 B=14.8 H=3.6**	14

Like this there are variety of peltier modules which will vary in size, operating range, etc.,

ADVANTAGES OF A THERMOELECTRIC UNIT OVER A COMPRESSOR:

Thermoelectric modules have no moving parts and do not require the use of chlorofluorocarbons. Therefore they are safe for the environment, inherently reliable, and virtually maintenance free. They can be operated in any orientation and are ideal for cooling devices that might be sensitive to mechanical vibration. Their compact size also makes them ideal for applications that are size or weight limited where even the smallest compressor would have excess capacity. Their ability to heat and cool by a simple reversal of current flow is useful for applications where both heating and cooling is necessary or where precise temperature control is critical.

ADVANTAGES:

1. This type air conditioner is completely eco friendly.
2. This air conditioner can be used as both summer air conditioner (cooler) and winter air conditioner (heater)

3. It consumes lesser voltage then conventional air conditioner.
4. Thermoelectric module have a life expectancy of 2,00,000 hours.
5. It can be used even to cool the internal air in the room.

DISADVANTAGES:

1. As the number of stages in the thermoelectric module increases, the achievable temperature difference also increases. Unfortunately, the heat pumping capacity decreases.
2. The initial investment is quietly high when compared with the conventional air conditioners.
3. The efficiency is slightly lower than the normal air conditioners.

APPLICATIONS:

1. Applied for cooling rooms.
2. Used as room heaters
3. It is used to make cooled car seat.
4. Used as coolers in CPU and other electronic appliances.
5. Can be used for refrigeration purpose.

CONCLUSION:

It consumes only a little amount of electrical energy and also completely eco-friendly. A single machine can be used as both cooler and heater and has many other applications like car seat coolers, CPU coolers, etc.,

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