

# Fabrication of Refrigerant Cooler Based on VCRS

<sup>1</sup>Pratik Kumar, <sup>2</sup>Ashish Verma, <sup>3</sup>Sumit Bhandari, <sup>4</sup>Dhruv Kumar, <sup>5</sup>Ashutosh Singh

<sup>1,2,3</sup> U.G. Students,

<sup>4,5</sup> Assistant Professors

Department of Mechanical Engineering,

JIMS Engineering Management Technical Campus, Greater Noida, India

**Abstract:** To beat the issue of high electric power utilization in a traditional forced air system, it must be changed to a degree that it downsizes the power utilization. To expand the cooling limit of a conventional desert cooler, it must be upgraded to a dimension that it very well may be conversely with the cooling impact of a forced air system. The point of this paper is to structure a cooling arrangement which is unique in relation to the regular framework and subsequently, it very well may be named as a Hybrid or Modified Air Cooler as it contains the conventional desert cooler as well as the cutting edge Vapor Compression Refrigeration Cycle too. The half and half air cooler not just covers the issue of high power misfortunes yet additionally gives a superior cooling productivity. The anticipated arrangement visualizes a desert air cooling framework that lies in the middle of cooling and customary desert cooling frameworks. It may downsize the power utilization contrasted with cooling in moderate hot atmosphere and it gives higher cooling than the customary desert cooler. Its esteem will likewise be beneath the present air-con frameworks.

**Keywords-** Air conditioner, Desert Cooler, Cold Storage, Vapor Compression Refrigeration Cycle, Hybrid Air Cooler.

## I. INTRODUCTION

India is home to a remarkable combination of climatic regions. Regardless of the way that more affordable procedures for warming are available amid the winter season, methodologies for chilling off the hot temperatures amid the pre-summer don't have wide arrangement of decisions. Climate control systems and Desert Coolers are the premier alternatives to beat the warmth. Despite the fact that them two have different points of interest however the partner is hazardously basic. Climate control systems have high beginning and running costs, which can't be overseen by all of the all-inclusive community in a making country like India. Climate control systems give unacceptable results, utilizing a ton of power, a vast level of which is made by coal-consuming force plants, cooling contributes in a roundabout way to the arrival of ozone harming substances and different poisons. What's more, investing excessively energy in a cooled situation can add to medical issues, for example, asthma, snugness in the chest and other respiratory infirmities. Then again, Coolers in spite of being relatively less expensive with low power utilization, neglect to achieve high cooling effect. Coolers can wind up unhygienic rapidly except if kept up appropriately. Water must be changed and the water cushions must be cleaned consistently. Coolers are frequently boisterous contrasted with AC or other cooling gadgets and don't have controlled temperature drop.

Subsequently there is a prerequisite for working up a proper room cooling structure. A structure that can handle the deficiencies of both the cooler and climate control system. A framework which is more affordable and gives a fair cooling impact. An answer which is control proficient and nature neighborly. A setup which lies in the middle of cooling and customary desert cooling frameworks. A course of action which is versatile and easy to understand in the meantime.

In the ongoing decades, the interest for air cooling has expanded because of high dry globule temperature and low dampness particularly in sodden locales like Rajasthan, Andhra Pradesh, Jharkhand, and Odisha. This undertaking centers on profoundly muggy districts. It includes the different parts of a Vapor Compression Refrigeration Cycle (VCRS) inside the setup of a desert cooler. It includes the establishment of the essential segments like Compressor, condenser, extension valve and the evaporator alongside the components of a desert cooler like cooler Pump, cooler cushions, fan cutting edges and cooler engine. It additionally incorporates a chilly stockpiling vessel which can be utilized to store water.

## II. RESEARCH GAP

Despite the fact that few endeavors have been made to refine the ordinary desert cooler yet there has dependably been a disparity in its effective cooling and power utilization. Thinking about all the past endeavors, either the setup was cumbersome and settled or the power utilization and time has taken were high. So there is an extent of making a framework with a decent extent of

compactness and power utilization.

- There has never been the thought of utilizing VCRS cycle in the cooler.
- Coolers have dependably been utilized for cooling air and no other thought for utilizing its cooling impact for different purposes.
- To build the viable cooling, the power utilization was also raised in the greater part of the undertakings.

### III. COMPONENTS

The goal of this paper is to give an answer for enhancing the cooling impact of the customary desert cooler alongside disposing of the considerable number of deficiencies of the recently made endeavors to change the regular desert cooler. The undertaking of the proposed plan is to introduce the VCRS cycle in the desert cooler which will scale up the cooling impact as it were. Every one of the parts in the cooler will be custom fitted so that it won't influence its convenience. Our structure comprises of different parts which are

- Motor- It is utilized to give pivot to the fan which in result sucks the air from the chamber and afterward exchanges it to the room.
- Pump- It gives the flow of the water in the cooler framework.
- Compressor- It is introduced to give the flow of the refrigerant in the framework.
- Evaporator- It helps in warmth exchange between the refrigerant and air.
- Condenser- It helps in warmth exchange between the air and refrigerant.
- Expansion Valves and Copper Tubes- It is utilized to diminish the weight of the refrigerant and furthermore controls the dampness content in the conveyed air.
- Storage box- It is taken into utilization for putting away the water and afterward cooling it with the assistance of air.
- Tap- It is utilized as an outlet for the put-away water.
- Switch- A switch will be utilized to control the utilization of the VCRS cycle.

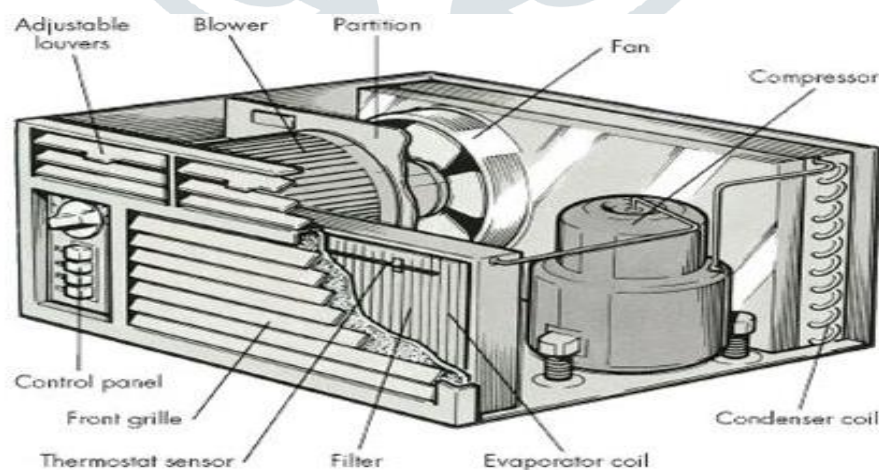


Figure1- Cut section view of cooler(www.google.com)

### IV. PROPOSED DESIGN AND METHODOLOGY

Our endeavor is to structure a framework that works either on the straightforward regular component of the desert cooler or uses

the VCRS framework. This will help in downsizing the power utilization when there is no need of accomplishing high cooling rate in less length. Every one of the segments will be welded together and since every one of the segments is mounted on the cooler in such a course of action, to the point that conveyability of the framework isn't influenced; it won't test to fit it in the Indian local condition. The proposed structure additionally comprises of a capacity box which can be utilized to store water and is cooled with the assistance of cooled air which can be additionally utilized for drinking purposes as it is totally secluded from the framework.

**Motor**-air cooler comprises of two Motor, one is air Compressor engine it is a capacitor begin run acceptance engine and the other engine is for flowing water around the barbecues which is a shaded post submersible enlistment engine.

**Pump**- The Pump runs the water through the cooling pads, enabling them to splash the water previously. The fan ought to be pursued the tank is full. This aides the cooler to cool the air, when you turn it on.

**Compressor**- The Compressor's utilization is to pull the low-temperature and low-weight vapor from the evaporator, through a suction line. When the vapor is drawn, it will be compacted. This will make the vapor's temperature rise. Its principle work is to change a low-temperature vapor in to a high-temperature vapor, to build weight. Vapor is discharged from the Compressor into a release line. We used a double door refrigerator's compressor in our setup to cut down the cost and power consumption.

**Evaporator**-An evaporator is utilized to transform any fluid material into gas. In this procedure, warm is consumed. The evaporator exchanges warm from the refrigerated space into a warmth siphon through a fluid refrigerant, which bubbles in the evaporator at a low-weight. In accomplishing heat exchange, the fluid refrigerant ought to be lower than the products being cooled. After the exchange, fluid refrigerant is drawn by the blower from the evaporator through a suction line. Fluid refrigerant will be in vapor shape after leaving the evaporator coil.

**Condenser**-Condensation changes gas to a fluid frame. Its primary design is to melt the refrigerant gas sucked by the blower from the evaporator. As buildup starts, the warmth will spill out of the condenser into the air, just if the buildup temperature is higher than that of the climate. The high-weight vapor in the condenser will be cooled to wind up a fluid refrigerant once more, this time with a little warmth. The fluid refrigerant will at that point spill out of the condenser to a fluid line.

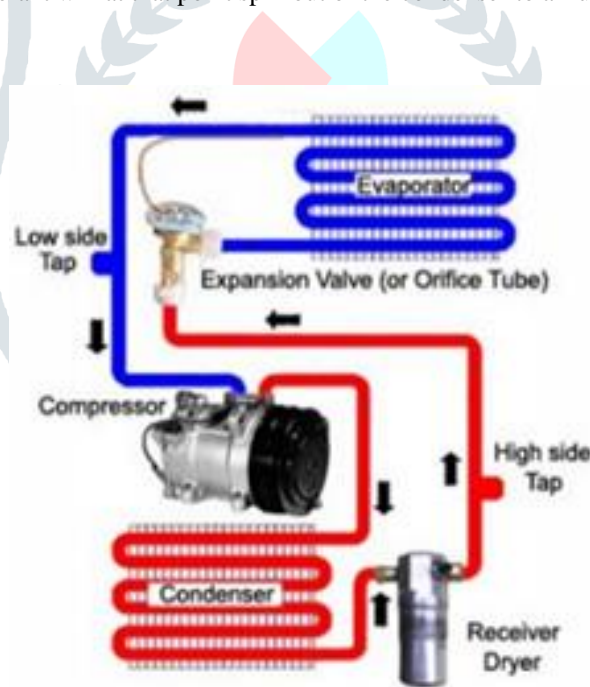


Figure2- Basic Components of VCRS ( <http://www.fixya.com>)

**Expansion Valves**-Commonly set before the evaporator and toward the finish of the fluid line, the extension valve is come to by the fluid refrigerant after it has been consolidated. Lessening the weight of the refrigerant, its temperature will diminish to a dimension underneath its climate. This fluid will at that point be siphoned into the evaporator.

**Blower**- The blower fan acts as medium of exchanging heat through the setup. When placed near a window, the hot air is thrown out of the room through the back end and cold air is circulated from the condenser. A separation between the front end and the back end was achieved through a cardboard which was placed inside the setup to help in exchanging of heat.

**Switch**-The SPDT (Single Pole Double Throw) switch is a three terminal switch, one terminal is utilized as information and staying two terminals are utilized as yields. It joins a common terminal to either of two terminals. It will be utilized to control the utilization

of the VCRS cycle.

**Wooden Board**-The entire setup was placed and fixed on a wooden board.



Figure3- Actual Model (Front View)

### V. DESIGN

The schematic design of our proposed cooler is shown in the figure below-

**Dimension of Cooler-** 52\*58\*46 cm

**Dimension of Wooden Board-** 80\*46 cm

**Dimension of Compressor-** 18\*14\*12 cm

**Dimension of Coil-** 23\*20\*6 cm

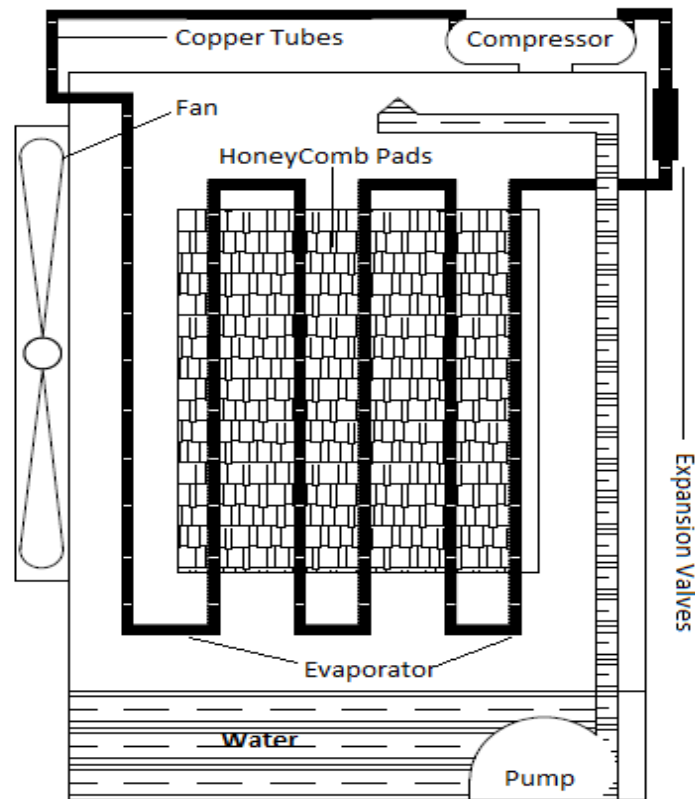


Figure4 -Basic Layout of Design

Figure5- Actual Model (Side View)



## VI. OBSERVATION

- It was observed that the setup was capable of achieving a temperature of around 22°C even in tough conditions where the temperatures reached near about 40°C. It is capable of maintaining a comfortable atmosphere during hot and humid conditions. (Keeping in mind that we tested our hybrid air cooler in a small sized room we achieved the below observations. It is highly capable of many modifications which could increase the overall comfort it provides.)
- The cost of the Hybrid Air Cooler is estimated to be around Rs 10,000 which includes the cost of the cooler setup, compressor, a wooden base, evaporative tubes, switch, relay push, pump, blower, coils. This cost is much cheaper than a standard air conditioner and matches the cooler range as well.

- A standard air conditioner draws a current of round about 7amp and a power of about 1500W whereas the hybrid air cooler draws a current of around 3.8amp which roughly estimates to a power consumption of around 800W(these values were calculated when the compressor was on.) The value of the current gradually decreases when the setup is utilized only for the evaporative cooler and the compressor is turned off.

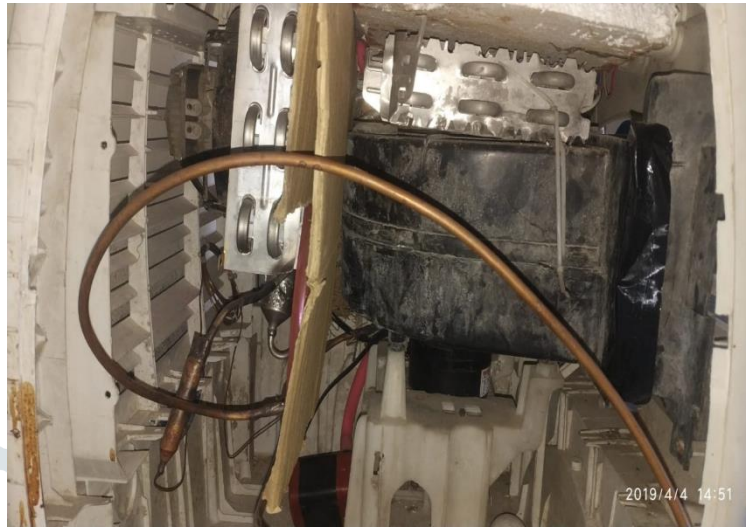


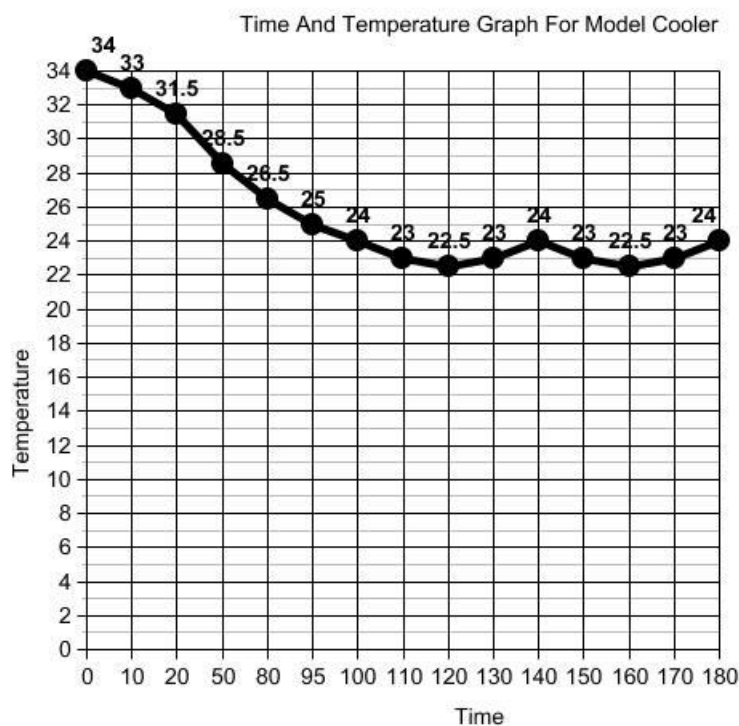
Figure6- Actual Model (Inside View)

**Dimension of Room-** 360\*540 cm = 216 sq feet area

**Temperature Achieved-**

S. No.	Time Duration (in min)	Temperature Achieved (in °C )	Compressor(ON/OFF)
1	0	34	OFF
2	10	33	OFF
3	20	31.5	OFF
4	50	28.5	ON
5	80	26.5	ON
6	95	25	ON
7	100	24	ON
8	110	23	ON
<b>9</b>	<b>120</b>	<b>22.5</b>	<b>ON</b>
10	130	23	OFF
11	140	24	OFF
12	150	23	ON
13	160	22.5	ON
14	170	23	OFF
15	180	24	OFF

Table-1-(time And temperature)



Graph1-Time And Temperature graph for the cooler

## VII. CONCLUSION

After carrying out various experiments under different circumstances, it was observed that the hybrid air cooler achieved the set target and was able to attain a temperature of 22.5°C. It serves as a conventional desert cooler and enhances the features of an air conditioner. This cooler would fill the gap between the cooling of a desert cooler and cooling of the air conditioner. It is not only economic but also portable. The Model is also able to function as desert cooler and air conditioner that means if an individual wants to use a specific function of the cooler then he would be able to do so. That means the basic functions of the machine are also preserved as well as extra and new features have been added.

## VIII. FUTURE SCOPE

In the cutting edge period of human advancement, we have achieved a circumstance where natural debasement is expanding continuously. These days, Environmental Protection is an absolute necessity. Our Project chiefly centers around removing condition influencing factors. Sooner rather than later, we trust, condition stronghold will constantly increase which is the point at which our undertaking becomes an integral factor. We trust it can possibly grasp very moist locale which incorporate most parts of our nation, India. It tends to be additionally refashioned to build up a minimized framework including a R.O. Channel System alongside a storage room for wares to develop a smaller refrigeration framework overall.

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