

# DESIGN OF 360° AIR COOLER AND HEATER

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**ABSTRACT:** 360° air cooler and heater is a device used to cool or heat the air according to the requirement of the user. As the years are passing by the energy consumption by humans is also increasing as a result there will be no energy left for the future generations to use. To reduce the consumption of energy a 360° air cooler and heater need to be used. One more reason for the use of 360° air cooler and heater is reduction in global warming as the conventional air conditioning system gives out Chloro-Flouro Carbon resulting in depletion of Ozone layer due to global warming. Conventional air conditioning system uses three to five times electricity as compared to the 360° air cooler and heater which results in emission of a considerable amount of heat resulting in global warming. Working of 360° air cooler and heater is such that it takes latent heat of vaporization from the air that is passed through it and gives us a decrease in temperature and increases the specific humidity. 360° air cooler and heater is also beneficial as compared to conventional air conditioning system as it cools the air of all the four direction with the help of chilled water. At the time of winters the relative humidity of the air is high which also leads to low dry bulb temperature so the cooler is in ideal condition, the efficiency will be low as high relative humidity is present. Hence, adding a heater coil will make the cooler more efficient even though the relative humidity of air is high and it will provide us with hot air in colder conditions.

**Index Terms** - 360° air cooler and heater, specific humidity, latent heat of vaporization, Chloro-Flouro Carbon, depletion of Ozone layer.

## I. INTRODUCTION

Human always tries for better comfort and sophistication at each level of his life. Considering 360° air cooler is used in dry climates. Air conditioning in today's world has a vital importance. Considering human comfort it is necessary to study and do researches on the topic of 360° air cooler cum heater, in order to make it more economical and efficient. The air may be sufficiently cooled by 360° evaporative process to results a considerable degree of summer comfort in climates of high dry bulb temperatures associated with low relative humidity. The minimum outdoor temperature required for successful 360° evaporative cooling is above 32°C. The comfort given by the 360° evaporative cooling always depends upon the outdoor temperature & relative humidity. Always gives more comfort with 360° evaporative cooling. Although the 360° evaporative cooling does not perform all the function of true air-conditioning but it provides comfort by filtering & circulating the cooled air. This system does not dehumidify the air but on the contrary, further humidify air. Before the advent of residential air-conditioning it was the only mechanical means available to make home interiors livable in the hot, dry, desert summers. 360° evaporative coolers function well except for the felon with its accompanying elevated humidity and thus decreased cooler efficiency. These cooling systems are economical in terms of energy usage. During the energy crunches of the last two decades, 360° evaporative cooler use was promoted as one means to control household utility bills. However, little thought was given to cooler water consumption. With rapidly increasing population, warm temperatures, and limited water supply, 360° evaporative cooler water usage can no longer be ignored. Heater is process of heating forced air with the help of heating coil. 360° heater, is forced convective heater that has an electric fan to speed up the airflow. They operate with considerable noise caused by the fan. In a convection heater, the heater made of stainless steel the heating element heats the air in contact with it by thermal conduction. Hot air is less dense than cool air, so it rises due to buoyancy allowing more cool air to flow in to take its place. This sets up convection current of hot air that rises from the heater, 360° heater is more use full temperature less than 30°Celsius, during the summer season the efficiency of the heater may decrees, the degree heater allowing the hot air to move in 360° manner and heats up the surrounding space. And as including heating coil make it useful even in when wet bulb temperature is high and even if relative humidity is high. As heating due to heating coil is sensible heating i.e. latent heat of air does not go into any changes, only temperature of the air is raised and no phase conversation takes place. Hence the efficiency of heating coil remains almost constant. Heater used may be of any kind but mostly electric heater is used.

## II. PROBLEM STATEMENT

Now a day's power crisis is much more. So importance should be given to power saving and energy conservation. Efforts being concentrated on finding resources or method of saving energy. In this project 360° air cooler cum heater will be design, developed and fabricate to low operational and overall cost. And as cooler can only be used in summer seasons and during winter and monsoon it is kept ideal as we now that during winter ambient air is already cold and during monsoon even if its ambient air temperature is high but it also has high relative humidity hence using 360° cooler in such conditions are non-effective, hence there is need to find a convenient method for even heating the air so that the utilization of it must be maximum and even it will be favorable for human in cold conditions. 360° Directions will allow to sit people anywhere.

### III. LITERATURE REVIEW

Michael T. Talbot and James H. Fletcher Explains in this paper title Design and development of portable forced air cooler, published by Automotive Research & Testing Center (ARTC) in 2012 that Designing and construct a domestic (portable) air-cooler depends upon external parameters as inlet temperature, humidity, etc. And step involved in designing cooler.

Sunil J. Kavle, Vivek M. shahane and Vitthal N. Garje explains in this paper title Manufacturing of 360° rotation air cooler, published by International Journal of Mechanical And Production Engineering Oct-2014. That the present investigation is evident that for drip type 360° Evaporative cooling the performance characteristic can be related to the variables like thickness and atmospheric conditions. And from the given result it also is seen that higher level of effectiveness can be achieved with decreasing the power consumption.

Miss Namrata Govkar And Mr. Amol Yadav explains in this paper title Modern Evaporative Cooler Published by International Journal of Innovative Research in Science, Engineering and Technology, July 2016 that Evaporative air conditioner is also very affordable and efficient in keeping work and living spaces cool. This paper helps in detail study of evaporative cooling its characteristic, performance parameter, material selection

### IV. DESING OF COMPONENTS

The major components that are employed in the fabrication of the 360° air cooler cum heater are as follows

- 1) Motor
- 2) Fan
- 3) Cellulose Pad
- 4) Pump
- 5) Frame
- 6) Heating Coil
- 7) Sump
- 8) Baffles

### V. DESCRIPTION OF COMPONENTS

#### 1. Motor

The specifications of motor needed for the model is single phase induction motor as it less noisy. And its frame size is B42. Genral purpose FHP (fractional horse power) and air handling application motors are offered in B42. This motor is design for high efficiency and reliability considering the global customer requirement. This motor offered different mounting arrangements like open or closed enclosures. Power ranges from 75W to 370W.

Features:

- Compact design
- Thermal protection available.
- Corrosion resistance due to powder coated rolled sheet metal body.

#### 2. Fan :

Fans are mainly classified into two types, namely centrifugal and axial. In a Centrifugal fan, air is pulled along the fan shaft and then blown radially outward from the shaft, where as in axial fan ,air is pulled along the fan shaft and then blown along the axis of shaft. The fan used for the model is low pressure and high discharge. As the requirement for this model light weight (polycarbonate) material. And as centrifugal fan has greater weight axial fan is suitable for this model. For selecting fan knowledge of fan performance is of most useful like volume flow rate of air (cmm), pressure, brake power (BP), etc

#### 3. Cellular pad

It is used because it has high efficiency and cooling rate. The thickness of cellular pad 50 mm .Its type are :

- Khus grass
- Cellulose pads
- Coconut coir

#### 4. Pump

Electric pump is used. It has power 14W, having 1m head.

#### 5. Heating Coil

The heating of air can be carried out in no of ways .The heating device can be a steam coil, hot water coil, an electric heater, fuel gas furnace. But as the requirement for this model is low cost with simplicity and efficient use of electric coil is convent. As air is directly exposed to heating element response is quick and its life is more. The Ni-chrome coil is used, it has high resistance and high stability to withstand high temp.

#### 6. Frame

The material used for frame is MS or cast iron. As it has to support the other parts

It should be strong to withstand the force, stresses and vibration. And even as it is constantly in contact with wet environment it should also have high corrosive resistance.

#### 7. Water sump

The material used for the water sump is MS .As plastic materials has leakage problems.

#### 8. Baffles

Baffles is the component used for distributing the air in required direction in this case that is all direction .It is made of MS material as it has to absorb vibration, impact forces due to air and it should be corrosive resistance as it has to frequently operate in wet or moistures environment.

### VI. WORKINGOF 360° AIR COOLER AND HEATER

The working procedure of 360° air cooler and heater is very simple. Principal behind this cooler that cooling effect is obtained due to evaporation of water i.e. when hot air with low relative humidity comes in contact with air latent heat is absorbed by water and phase change of water takes place and hence ware gets converted to vapors which is carried away by air and due to this effect temperature of air reduces and its relative humidity is increased. In this cooler air will enter into cooler through all four directions which will be sucked in by fan provided, while entering cooler the outside hot air will flow through cellular pad on which water will be sprinkled this is where evaporation of water takes pace and cooling effect is achieved then this air is pass through canal to baffles which is then supplied in 360° direction by baffles. Water is sprinkled on cellular pad with the help of pump provided in sump. Cooler is used in summer. While in winter and monsoon where high temperature is required for human comfort as ambient temp is low at such time heating coil is used to increase the temperature of air. This cooler is provided with a switch when the switch is on heating coil get no power supply as power supply is given to pump for carrying out cooling process, but when ambient temperature is low and the demand is to increase the temperature then turn switch off so the power will be supplied to heating coil instead of pump and as water will not be sprinkled air will follow the same route but instead it be heated by heatingcoil. This process is sensible heating as humidity of air remains unaffected.

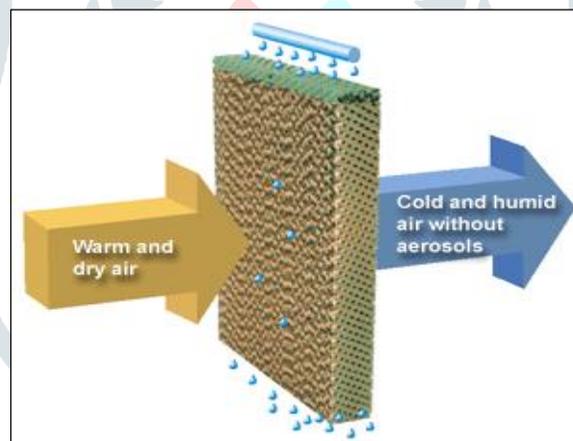


Fig 1 : Concept diagram

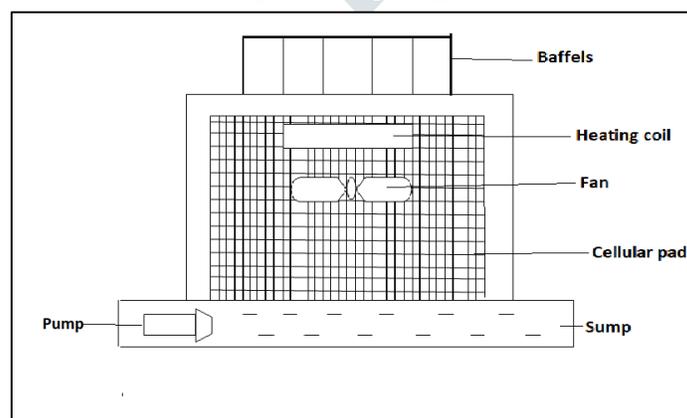


Fig 2 : Block diagram

## VII. CONCLUSION

Through above research paper and model it is good to conclude that 360° cooler and heater can cool air up to 10° to 12° due to evaporation of water while at the same time if heating coil is used it can increase the temperature of the air by 5° to 8°. And this system cost much low as compared to regular air conditioner. It also has a advantage of saving the natural resources as it works on natural phenomenon and it is pollution free.

## VIII. FUTURE SCOPE

- Fabrication and testing of 360° air cooler and heater.
- If dehumidifier is added at the inlet of cooler will increase its efficiency. And it will also enable to use this cooler in condition when relative humidity of air is high.
- The cooling range of cooler can be varied by changing the fluid but it can also result in increasing the cost of cooler.
- And even increasing the no of pads through which air will pass further cooled air can be obtained.

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