Fabrication And Analysis of Water Cooling Tower

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Abstract—**Due to the increase in industrialization and increasing power demand, the load on power plant increase to fulfill the outstanding requirements. Water cooling tower plays an important role in improving the overall efficiency of the power plant. It is an essential setup widely used in industrial sector, hospital, schools, boilers etc. the steam coming out of the turbine is converted to liquid water in condenser but the water is still hot and cannot be stored in the storage tank or released in the nature. This is where water cooling tower comes into play and reduces temperature of the water to ambient temperature. Mechanical Draft Air Convection water cooling tower is widely used in plants because of low maintenance and for good performance. In analysis, we found that increasing the heat exchanging area which results in more working ability of cooling tower. So we increase the heat exchange area by providing triangular and pin profile mild steel fins. This resulted in reduction in time required to cool the water as fins facilitated in transmission the heat from the water. We observed that pin fins improved the performance of water cooling tower in by 17% in comparison of mechanical Draft cooling tower with triangular fins. This type of study inspire use to increase performance and workability of cooling tower which enhances the efficiency of power plants.**

Keywords— Mechanical Draft Air Cooling tower, Fins, Analysis, Hot Water Cooling.

I. Introduction

Water Cooling Tower is a basic setup used to lower the temperature of hot water (working fluid) in a power plant. Not just the power plants but water cooling tower serves in a wide range of areas such as hospitals, schools in typically warm climate as air conditioning units and in power plants as water cooling system. It plays an important role in improving the efficiency of the power plant. There are wide variety of water cooling towers used, which are widely classified as Mechanical Draft Water Cooling Tower and Natural Draft Water Cooling Tower. In this paper we will be concerned with Mechanical Draft Water Cooling Tower. Previous research done on the related topic and the references we used are mentioned hence forth.[1] Sam Duniam, Ingo Jhan, Kamel Hooman used direct and indirect NDDCT cooling tower to cool sCO2 recompression brayton cycle. The minimum size of tower is based on the minimum tower which can meet the design point heat rejection duty at 20 degree ambient temperature and found out direct cooling configuration requires smaller cooling tower therefore indirect cooling configuration and 40% less heat transfer area. [2]Ali Ayoub, Blaze Gjorgiev, Giovanni Sansavini simulated performance of cooling tower on ANSYS and worked on tower height optimization and found out that the humidity inside cooling tower reduces the cooling rate. [3] M.Deziani, M.Kordloo carried out experiment in which air to air heat exchange was done. Also warm wet air from tower was cooled by an auxiliary fan and further concluded water saving could be done by 35% of evaporation depending on ambient air condition. [4] Mehdi Rehmati, Sayad Rashid Alavi captured and investigated thermal images and pertinent temperature histogram an visualized and calculated temperature distributions in cooling towers. It was then concluded that coefficient of efficiency is in direct relation with air mass flow rate. [5] M. Goodarzi, R. Ramezanpour Used numerical modeling and an array of various calculations to compare elliptical with conventional type and found out that the elliptical cooling towers are more efficient in cross wind conditions as compared to its circular shape counterpart.

II. Fabrication

The water cooling tower consist of a metallic frame, a submersible water pump, PVC pipes, fins, blower and a water delivery system. The frame is made up of mild steel, having dimensions 2x2x5 feet. The individual limbs of the frames are joined by arc welding. It acts as a supporting setup for the water delivery system, pipes and sump. Water is delivered from the top of the frame with help of an array of pipes with small holes punched in order to slowly deliver water droplets. The pipes and the delivery system is made up polyvinyl chloride (PVC) having diameter of ½ inch. The fins are used as main heat exchanging interface and facilitates in increasing the area of contact between air and hot water. Fins are made of mild steel and have triangular and pin profile. The water accumulated in the sump is redirected to the delivery system with the help of a submersible water pump of 200W. And the mechanical draft of air is maintained by the blower and a motor. The water is collected in the lower part of the tower in a sump made up of mild steel having 2x2x1 feet dimensions. The above materials for respective parts are selected by taking following points into consideration:

1. Suitability of material for required component.
2. Suitability of material for desired working condition.
3. Availability of material.
4. Cost of material.

III. Experimentation

We used above setup for experimentation so as to find out the temperature drop by using two types of fins namely triangular and pin fins. Hot water of 65℃ was introduced in the sump located at the bottom of the tower. This water was pumped to the water delivery system with the help of submersible water pump .The water coming out of delivery system would come in contact with the air and fins resulting in reduction in temperature of falling water and return to the return to the sump and slightly decrease the temperature of water in the sump. This process is continuously repeated and the temperature of water in sump is recorded every 15 minutes. Same experiment was carried out for both triangular fin and pin fin.

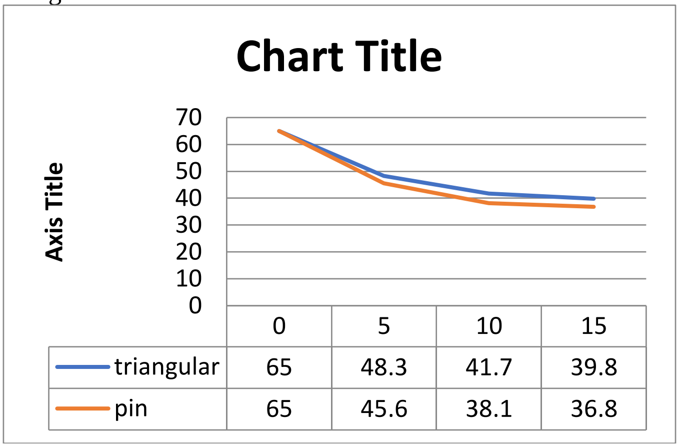
IV. Results and Conclusion

Following results were observed after the experimentation:

Time (mins.)	Temperature recorded with Triangular profile Fins (℃)	Temperature recorded with Pin profile Fins (℃)
0	65	65
5	48.3	45.6
10	41.7	38.1
15	39.8	36.8

It was thus observed that the fins with pin profile showed a greater drop in temperature than that of triangular profile. Triangular profile fins required additional 2 minutes and 40 seconds to reach 37℃.

Thus about 17% more time was required for the setup with triangular fin.



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