FABRICATION AND THERMAL INVESTIGATION OF INDUCED DRAFT COOLING TOWER

Department of mechanical engineering

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Abstract - The Present Project work proposes to a new innovative design of waste heat removal system. The cost of Hyperbolic shaped cooling towers is considered to be very high in respect of high construction cost a large volume of concrete and cement cost. So now a day's packaged type cooling towers are gaining thought of design engineers, since they are compact and highly efficient and can perform effectively with lower power inputs. The work proceeds with the fabrication of induced cooling tower with couple of fance provided to create a draft. This type of cooling provided by the system is called indirect cooling system. An induced draft cooling towers are the heat removal campaign that are used for transfering the procedure of excess heat into the air atmosphere we using induced fan at the top most of the tower. The applicability of fiber rain forced plastic material, based on reuse of resin designed for erection purposes and the purpose of the excess synthetic material in manufacture practices will make multiple remuneration of turning ravage(inoperative) in to wealth, sustence of environment, job conception as well as opening up opportunities' for designing smart materials with predetermined mechanical characteristic. We modified the fin angle about 17.5 of the surface plate in this cooling tower so that the efficiency of tower is maximized by using pet materials when compared to other materials.

Key Words- Cooling Tower, Fins(PET), Efficiency**,** Material FRP**(**fiber reinforce material), Heater, Motor, Thermometer.

1. Introduction:

Now a days In many Industries Facilities various pieces of equipment as well as many fluids used in process system need to be cooled in many cases the cooling equipment and process is fluid is done with water. The warm water which is being sent from the chiller and contains the heat from the building which needs to be rejected that's going to enter this header and pass through the spray nozzle will be distributed over this packaging that will then warm water will then lose some of its heat as makes its way to the bottom here. We drip down and then collect into this basin and the water. The cooler condenser water is then collected from the basin and sent back down to the

chiller we'll pick up that heat again and sent up in a continuous loop there mean while cooler air is ambient air is being sucked into this cooling tower that passes in the opposite direction of the condenser water and that picks up the heat from the water. But as it does that it will also pick up some of the water making this a very humid and very moist so we've got this drift eliminator at the top here and that will condense some of that water we can reclaim it. We have got a fan this cooling tower. Fan is obviously spins and as it does so it pulls air out of the unit air flows in fresh air. The purpose of the fill is that the water condenser water will run as its sprayed really fine particles and it collect and runs down the size of thin film of water. Now the air which is rushing past the other way(cool ambient air drawn in by fan) and pick up heat from this(combine these three and heat will transfer from the warm condenser water into the stream of cool air). Film across all these packaging sheets which is made of plastic. Increases the surface area and so you're maximizing the area that the air can reach you can touch and pulls heat out of that water. The water condenser water will then roll down the side here in the basin and that warm air will enter through these sides. These panels here make its way up through these grills of the feeler packaging pass this pipe work up through out the drift eliminators and then out through the top. As that water pours out of this pipe work here and its sprays and becomes a thin film along this fill packaging here what we're going to find is that some of the water will evaporate which gives off take some of the heat away.

2. Material:

FRP materials used cooling tower body. FRP cooling tower used to hot water or warm water to change the cool or normal water temperature. Because of in between working fin material. general applications consist of cooling to the circulate water used in nuclear power plants, chemical plants, small scale industries and building cooling etc.

PET is a polymer which produced from two monomers. Which at the building blocks. These two react they form along a chain called the polymer and in this chain these two chemicals complete. Now PET is a material which can be converted in to many products including textiles, fibers, doors, and also marbles it transparent material they extremely used packing materials. The pet chemicals react at a time 280' to 300'cg in the presence of small amount of antimony as a catalyst. All polymerization process which involve linking of monomers require a catalyst. Without a catalyst we cannot polymerize. Every polymer that we know requires catalyst.



Fig 2.1- Constructional FRP Cooling tower

3. Results:

- The material used for pipe line is " **Aluminium**"

Cooling water flow = 700 meter^3/hour

T_1°C = 43.9 °C

T_2°C = 39.2°C

W_b °C = 29.2 °C

W_d °C = 42°C

Number of cooling tower Cells on line with water flow = 4

cooling tower range = (43.9 – 39.2) = 4.7°c

cooling tower approach = (39.22 – 29.2) = 10°c

$$\% \text{ cooling tower effective ness} = \frac{\text{Range}}{(\text{Range} + \text{Approach})} \times 100 = \frac{4.7}{(4.7 + 10)} \times 100$$

$$= 31.9°C$$

Rated % CT Effectiveness = 100 * (43.9 – 39.2) / (39.22 – 29.2) = 49.3%

- The material used for pipe line is " **Poly ethylene terephthalate**"

Cooling water flow = 700 mete^3/hour

T_1°C = 43.9 °C

T_2°C = 37.4°C

W_b °C = 29.2 °C

W_d °C = 41°C

number of cooling tower cells on line with water flow= 4

cooling tower range = (43.9 – 37.4) = 6.5°c

cooling tower approach = (37.4 – 29.2) = 8.2°c

$$\% \text{ cooling tower effective ness} = \frac{\text{Range}}{(\text{Range} + \text{Approach})} \text{x100} = \frac{6.5}{(6.5+8.2)} \text{x100}$$

$$= 45.49°C$$

Rated % CT Effectiveness = 100 * (42.9 – 33.2) / (42.9 – 27.3) = 64.2%.

4. Discussion:

The FRP cooling towers working is the pump start to rotates this cold water is supply to the condenser and from condenser the hot water is supplied to the spray headers with the help of spray nozzles water is supplied in the form of the fine droplets and with the help of blowers air is supplied to the cooling tower and it takes heat from the hot water and finally it goes out and fan sucks the air at the top. And finally the air goes out to the atmosphere so this is the whole arrangement of the induced draft cooling tower. Additionally we adding to the make up water is added in the system. The induced draft cooling tower is constructed with fiber rain forced plastic material. In this cooling tower, the warm water from unruffled tank posses into the tower through pipes at the topmost. Here the inlet hot water temperature is calculated with the help of thermocouple. This hot water sprays through the spray headers in to the tower ; here the fins is used for maximization of heat convey rate because we modified the fin angle some-17.5^{o}. The atmospheric air enters from bottom place of the tower combined with warm water air for cooling process whereas the induced fan which is placed at the peak of the tower, that sucks the overload hot air and sent into the atmosphere. In this induced cooling tower the heat reassign takes place in two ways for minimizing the temperature of hot water.

Case-1: heat relocate takes place from hot water to low temperature sheets.

Case-2: atmospheric air from bottom directly comes contact with hot water.

at last the cooled water is bottom place collect in to the tank. And this cooled water is added with makeup water(ex. River water connects) for salvage and reusing the process.

4.1 Components of the machine

1. FRP Material (Fibre reinforced plastic)
2. Induced fan
3. Fiber fins
4. Spray heads
5. Motor
6. Heater
7. Collected basin
8. Thermometer
9. Pipes.

4.2 Energy Efficiency Opportunities

This section includes main areas for improving energy efficiency of cooling towers. The main areas for energy conservation include:

- Selecting the right cooling tower (because the structural aspects of the cooling tower cannot be changed after it is installed)
- Fills
- Pumps and water distribution system
- Fans and motors

4.3 Advantages of FRP Materials

- Simple in construction cooling towerion
- This system is noiseless in operation
- It is portable, so it can be transferred easily from one place to other place
- Maintenance cost is low
- Low cost and high performance
- Power generation is attached for this cooling tower

5. Conclusion

The fiber reinforced cooling tower fin modification for cooling tower was successfully made. It gives good efficiency of heat load. The analysis of cost base of cooling tower requires less cost compare to other cooling tower. And minor change of cooling tower inside fin material result gives more efficiency compare to cost basis of cooling towers. It was very useful in small scale and industries life time is more. Environmentally good working under conditions. Easy construction cooling tower.From the literature it was found the angle of fin was found to be 17.5, which has been used for the present tower work. The comparison of other cooling towers fins are aluminum < PET = PVC. The cost basis of pvc is more and PET is less.

The effectiveness of conventional cooling tower was 31.9% , where as with fin modification using polyethylene Terephthalate (PET) with fin angle of 17.5 degrees it was increased to 64.2.

Table 1.- Cooling Tower Efficiency Values.

	Design	Material used	Cooling tower range	Cooling tower approach	Cooling tower effectiveness
Modified cooling tower	Tube carrying hot water	Aluminium	4.7	10	31.9
Conventional cooling tower	Cooling fins over which water is flowing	polyethylene Terephthalate	6.5	8.2	64.2

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