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Design and Fabrication of Mini Cooling Tower

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Abstract: ***A cooling tower is a specialized heat exchanger in which air andwater are brought into direct contact with each other in order to reduce the water's temperature. As this occurs, a small volume of water is evaporated, reducing the temperature of the water being circulated through the tower. This method of cooling provides with efficient and environment-friendly method of cooling particularly in locations where sufficient cooling water cannot be easily obtained from natural sources or where concern for the environment imposes some limits on the temperature at which cooling water can be returned to the surrounding The performance of the cooling tower is dominated by wind speed, ambient air temperatures and humidity in the atmospheric conditions.***

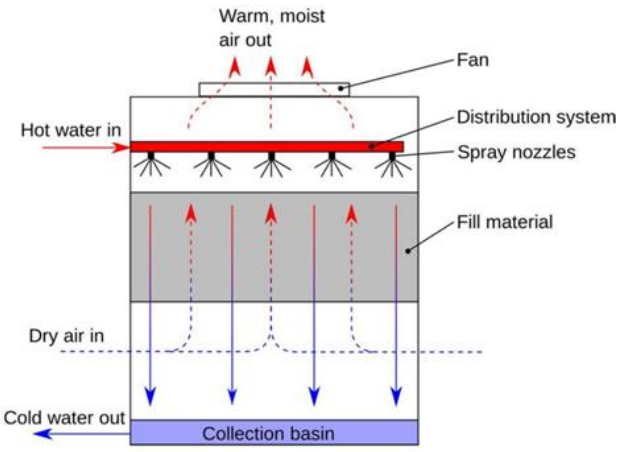
Keywords: Cooling Tower, Efficiency, Effectiveness, Makeup water, Design, Fabrication, Mini

1. Objective

1) To provide an overview of different types of cooling tower.
2) To design a mini cooling tower for small scale industries.
3) To analyze the efficiency and effectiveness of cooling tower.

Working principle of cooling tower

In a typical cooling tower water circuit, warm water from the condenser of the nuclear plant is pumped to the cooling tower, where it is discharged through a series of sprays against a stream of cooling air. In some case one or more propeller fan is used moving air vertically up or horizontally through the tower. Baffles and fill materials are placed in the path of the falling water to break it up into tiny drops, thus increasing the effective surface area of the water. These baffles are made wood, ceramics and in recent times plastics are used. The tower cools the water by bringing it in contact with air and evaporating some of the water. The heat lost to the air which becomes hot and moist by water evaporation. Water in collected in a reservoir and pumped back to the condenser. Make-up water is added to the tank to replace the water that is lost die to evaporation, drift and bleed.



2. Types of Cooling Tower

1) **Natural draft cooling tower**
The air circulation through the tower is by natural convection. These types of towers are made of wood or steel deck. Warm water is discharged at the top that trickles down across the wooden or metallic decks and into a basin at the bottom. In spray type towers water is pumped at the top and sprayed through the nozzles to fall into the basin of the tower.

2) **Mechanical draft cooling tower**
The air circulation of this type of tower is done through by means of blower or fan.

There are three types of mechanical draft cooling towers namely;

1) **Forced draft cooling tower**
Here the fan generates a centrifugal pull using the propeller of the fan that blows air though the tower, counter to the flow of the water in the tower. A forced draft cooling tower is compact in size but it requires additional horsepower and in fact more than the induced one
2) **Induced draft cooling tower**
In this type of tower the propeller fan is located at the top of the tower and the air is pulled out of it from the ends through the tower across the water flow path.
3) **Forced Induced cooling tower**
In these both of above mechanism is used simultaneously

2.1 Mini cooling tower

The purpose of designing mini cooling tower is to used in small scale industries like Food processing plant, Petro-chemical plant etc.

2.2 System design

List of component

1) 1.Frame and Base
2) Louvers
3) 3.Storage tank
4) Head (Exhaust)
5) Fan
6) Pipe network
7) Pump
8) Honey comb structure (Inter face between water and air)

3. Methodology

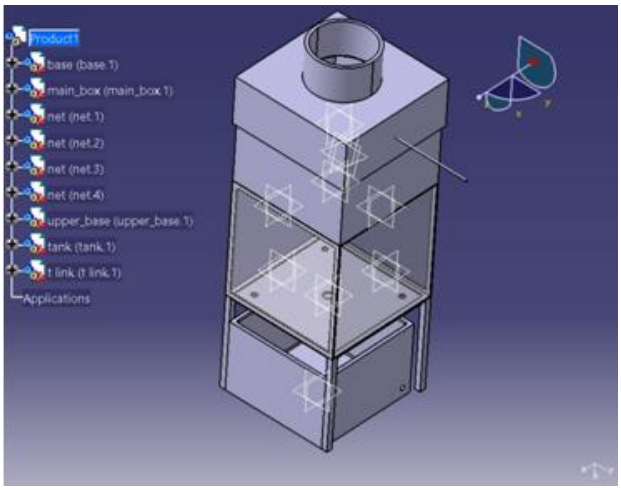


Figure 1: CATIA design

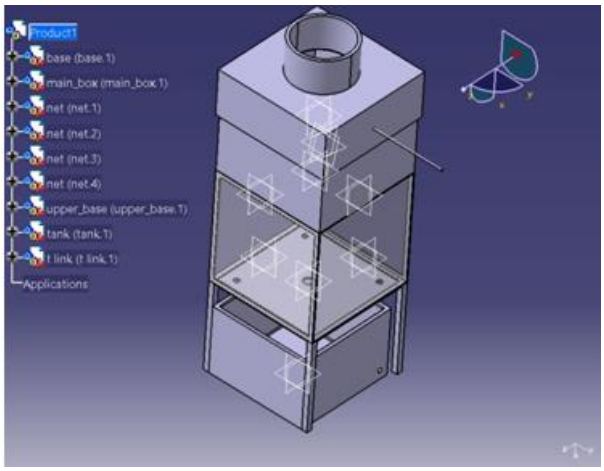


Figure 2: Frame and base

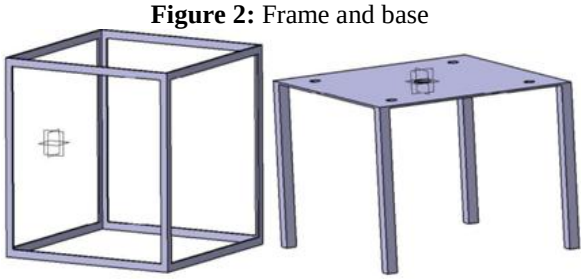


Figure 3: Exhaust

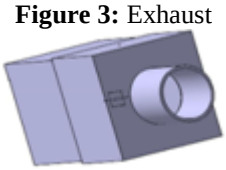


Figure 4: Storage tank and louvers

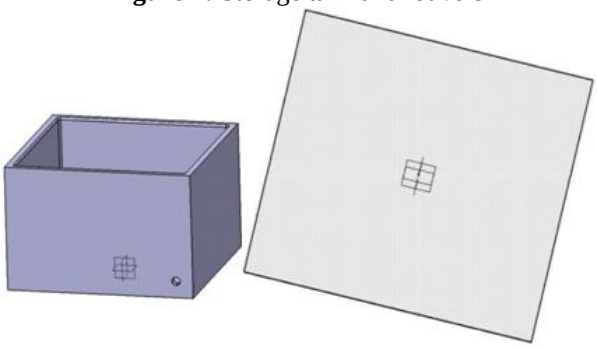
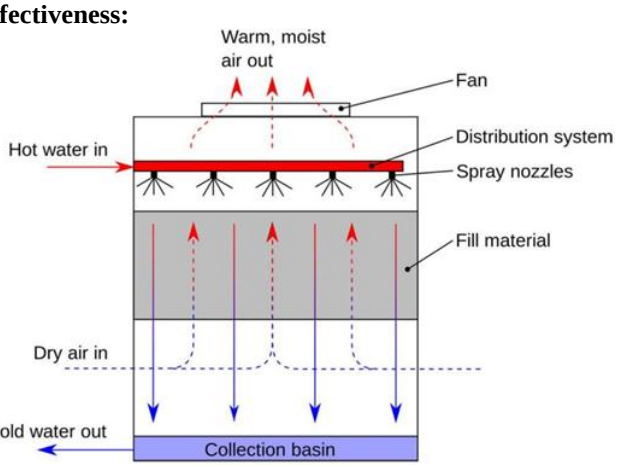


Figure 5: Pipe Network

Mathematical analysis

Effectiveness:



Let
t1= inlet temp of water
t2 =exit temp of water
t3= inlet temp of air
t4 = exit temp of air
Effectiveness= (t1-t2)/(t1-t3)

Cooling tower mass balance
Cooling tower mass balance gives an indication about make-up water requirement in system. Cooling Tower Makeup is required due to water losses resulting from Drift, Evaporation & Blowdown.
Water make-up (M) = Total water losses = Drift Losses (D) + Evaporation Losses (E) + Blow down Losses (B)
M = D + E + B
M= Make up water Requirement in m^3/hr.
D= Drift Loss in m^3/hr.
E= Evaporation Loss in m^3/hr.
B= Blow Down in m^3/hr.

Efficiency= (total water -make up water)/total water

4. Summery

In this paper we analyze and established relationship between various parameter of cooling tower.

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