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Performance Analysis Of Cooling Tower – A Review

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***Abstract**: In the present world with the increasing use of plant efficiency many technology are to be taken in industry but all have not recovery problem and not more useful to improve the growth rate of plant where in this paper we study about a cooling tower howto benefits in plant to development.Every industry use cooling method to reduced the heat transfer rate with high amount of machinery but now the modern world all the machine parts are reduced and easily working operation performed, So Many selected parameters is to be used in this paper which help to development growth rate and efficiency of industry by the application of cooling tower to benefits in plant to development. The hot water become cooled and distributed in the tower spray nozzles, splash bars, film-type fill, which is available to very large water surface area. A portion of the water will absorbs heat and converted in to vapor at the constant pressure. This latent heat has been long used to transfer heat from water to the atmosphere. Lots of work have been carried out with wire mesh, zig-zag type fins and etc and measure the significant improvement in the efficiency and heat transfer rate of the cooling tower.*
***Keywords**: cooling Tower, Heat transfer, Fill Materials, splash type , twisted type*

I. Introduction:

Now-a-days Cooling tower is essential part of many industrial processes like chemical process, dairy plant, thermal plants, manufacturing process in which water is used as cooling medium. Cooling towers are able to lower the water temperatures more than devices that use only air to reject heat, like the radiator in a car, and are therefore more cost efficient. Cooling towers use the principle of evaporative or 'wet bulb' cooling in order to cool water. Cooled water is needed for, for example, air conditioners, manufacturing processes or power generation. A cooling tower equipment used to reduce the temperature of water stream by extracting heat from water and emitting it into the atmosphere. It acts as a heat and mass transfer device using direct contact between ambient air and hot water through some different types of packing. Indeed, the type of packing applied in cooling tower, plays an important role in the tower performance, as it increases contact area and contact time between water and air in order to heat and mass transfer. One of the common types of cooling tower packing is splash type. Many researchers have studied packing's effect via experimental and numerical analysis in cooling tower.

In a counter flow design,flow of air is directly contrary to the water flow. Air flow first enters an open area beneath fill the media, and then drawn up the vertically. The water sprayed through pressurized nozzles near top of the tower, and flows downward through fill, opposite to air flow. This type cooling tower is good indissipation of heat due to therotary sprinkler and honey comb PVC fills. The induced draft counter flow cooling towers have square shapes. This enables fair distribution of the airflow. The induced draft square is absolutely silent and is toused for their efficiency and high performance**.**

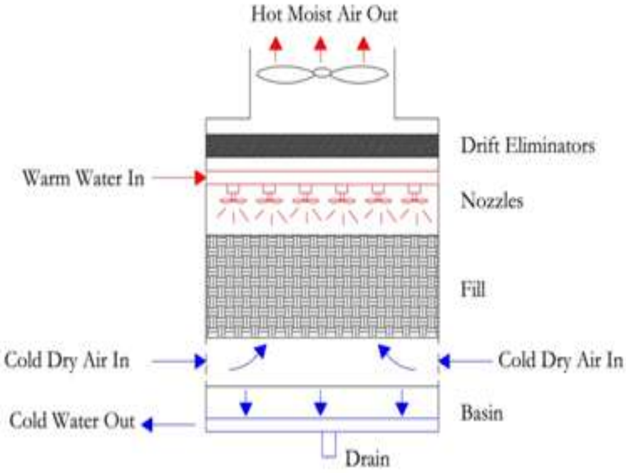

Figure. 1.0:- **Counter Flow Cooling Tower**

Performance Characteristics:-

Dry-bulb temperature – The temperature of the entering or ambient air adjacent to cooling tower measured with a dry-bulb thermometer.

Entering wet-bulb temperature – The wet-bulb temperature of the air actually entering the tower, including any effects of recirculation.In testing, the average of multiple readings taken at the air inlets to establish a true entering wert-bulb temperature.

Forced draft – Refers the movement of air under pressure through a cooling tower.Fans of the forced draft towers are located at the air inlets to force air through tower.

Range – Difference between the hot water temperature to the cold water temperature.

Psychrometer – An instrument incorporating both a dry-bulb and a wet-bulb thermometer, by which simultaneous dry-bulb and wet-bulb temperature readings can be taken.

Approach – Difference between the cold water temperature and either the ambient or entering wet-bulb temperature.

Ambient wet-bulb temperature – The wet bulb temperature of the air encompassing a cooling tower, not including the temperature contribution by the tower itself.Generally measured upwind of a tower, in a number of locations sufficient to account for all extraneous sources of heat.

Air inlet – Opening in a cooling tower through which air enters. Sometimes referred to as the louvered face on induced draft towers.

Air rate – Mass flow of dry air per square foot of cross-sectional area in the tower's heat transfer region per hour.

Blower – A squirrel-cage (centrifugal) type fan; usually applied for operation at higherthan- normal static pressures.

Casing – Exterior enclosing wall of a tower, exclusive of the louvers.

Fill – That portion of a cooling tower which constitutes its primary heat transfer surface.

Counterflow – Air flow direction through the fill is counter-current to that of the falling water.

Crossflow – Air flow direction through the fill is essentially perpendicular to that of the falling water.

Splash fill – Descriptive of a cooling tower in which splash type fill is used for the primary heat transfer surface.

II. Structural Components of Cooling tower:

Water distribution system :

Lines might be buried to reduced problem of thrust loading, thermal expansion and freezing; or elevated to reduced cost of installation and repair. In either case, the risers to the tower inlet must be externally supported, independent of the tower structure and piping.

Fill (heat transfer surface) :

Fill (heat transfer surface) is able to raise maximum contact surface and maximum contact time between air and water determines the efficiency of the tower. The two basic fill classifications are splash type and film type. Splash type fill breaks the water, and interrupts its vertical progress, by transferring it to the cascade through successive the offset levels of that parallel splash bars. It is characterized by reduced air pressure losses, and is not conducive to logging. However, it is very sensitive to inadequate support. Film type fill causes the water spread into the thin film, flowing over the large vertical areas, to promote maximum exposure of the air flow. It has capability to provide more effective cooling capacity within the same amount of space, but is extremely sensitive to poor water distribution.

Drift eliminator :

Drift eliminators remove entrained water from the discharge air by causing to make sudden changes in direction. The resulting centrifugal force separates the drops of water from air, depositing them on the eliminator surface, from which they flow back into the tower. Eliminator are normally classified by the number of the directional changes or "passes", through an increase in the number of passes usually an accompanied by an increase in pressure drop.

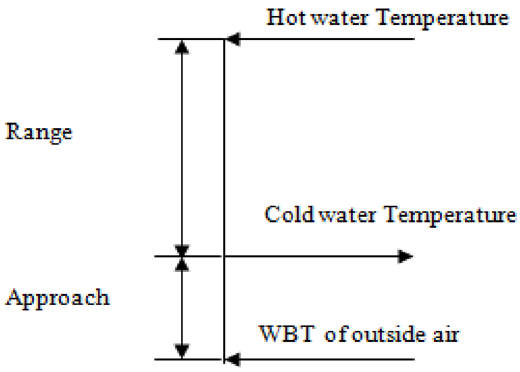

Figure 3.0: Range and Approach for cooling tower

III. Review of Literature:

Fill Performance Characteristics:

Cross flow and cross-counter flow fill configuration:

The modeling of cross-counterflow in wet-cooling is complicated by the fact that most types of fill are anisotropic, i.e. their performance characteristics in crossflow are not the same as in counterflow. In cross-counterflow their characteristics are somewhere between their crossflow and counterflow characteristics. In the last decade, numerous researchershave published work on using CFD to model cooling towers, but this work is limited to orthotropic fills, i.e. fills that are only porous in a single direction, and can still not take anisotropic fill behavior into account.

P.J. Grobbelaar , H.C.R. Reuter, T.P. Bertrand [4],concluded that The trickle fill that was used in the comparative experimental tests has cross-fluted channels to facilitate air flow in a specific direction. The observations made during this experimental study prove that this fill is anisotropic. It also highlights the necessity to develop models that can accurately model anisotropic fill. For cross flow different variation in performance obtained.

Bilal A. Qureshi, Syed M. Zubair[6] also concluded for counter flow configuration , 15% temperature is reduced in spray region and 25% for fill region.

Fill package type configuration:

ArashMirabdolahLavasani , Zahra NamdarBaboli , Mohsen Zamanizadeh , MasoudZareh[9]conducts experiment on counter flow rotational splash type fill packaging.they concluded that Cooling water range increases with increasing packing rotational velocity in all inlet air temperature. Indeed more cooling water range is provided at lower air temperature.

Rohit K. Singla, Kuljeet Singh, RanjanDas[7],also conduct experiment on wire meshed packing as fill material. The experiments are conducted with the variation of two controlling parameters such as mass flow rates of water and air. Variation of controlling parameters on the performance parameters has been investigated in detail.

Krunalpatel, Mr. N.V.Mohite[1],conducts experiment on twisted tape packing material.it has been conclude that the twisted tape insert is more effective in vertical mounting twisted tape as compared to the horizontal mounting. Efficiency in the vertical mounting twisted tape is greater as compared to others

Fouling in the packing material:

Bilal A. Qureshi, Syed M. Zubair[6],also cocluded that fouling can result in a reduction in the overall effectiveness of the tower a symptom of fill fouling interfering with air and water flow through the tower. It is important to note that plastic fills are more prone to fouling than traditional splash bars.

Airdistribution system for fill materials:

MugishullaShekh, AmitTiwari, Deepak Solanki&MahendraLabana[2],concluded that that In counter flow towers the air movement is vertically upward through the fill, counter to the downward fall of the water. Cross flow towers have a fill configuration through which air flows horizontally across the downward flow of the water.

Water distribution system for different fills:

R. Terblanche , H.C.R. Reuter , D.G. Kröger[8], conducts experiment on drop size distribution on different fill materials such as cross fluted film fill, trickle fill, fibre fitted fill, slad grid ,expanded metal grid they concluded that The initial drop distribution, at the top of the rain zone, depends on the type of fill used in the cooling tower. Drop distributions are therefore measured at a distance of 260 mm below three types of cooling tower fills (cross-fluted film, trickle and fibre cement film).

IV. Methodology:-

The current research focuses on conducting numerical experiments by using techniques of CFD in an effort to understand the effect of crosswinds on the thermal performance of NDWCTs more clearly.

They used fundamental laws of mass and energy balance to approximate the effectiveness of heat exchange by a second order polynomial equation.

V. Conclusion:

A way to calculate the tower characteristic ratio of a cooling tower has been found and used**.** Additionally, a lot of tower concepts and other information about cooling has been obtained, but not been used during the writing of thisfinal text.

It is concluded that factors which governs the efficiency of cooling tower was changed by different fill packing materials and types .it also concluded that for better performance characteristic rotational splash type fill packaging will be used.

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