Minimization of Wet Bulb Temperature of Ambient Air for Improve Efficiency of Cooling Tower

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***Abstract* -Now a days a efficiency is most important in cooling tower. In previous time cooling tower operated by heat transfer through a surface That separates the working fluid from ambient air, such as in a tube to air Heat exchanger, they do not use principal of evaporation. And then do Modification in cooling tower and it's operateon the principal of evaporative Cooling. But using this water temperature is will be not much reduced as a Required. So we will using a dew point cooling tower system utilizes cooled water Produced by the system to reduced the wet bulb temperature of ambient air Directed through fill in the cooling tower. So by this process the smart Combination of the basic thermodynamics process of heat exchange and Evaporation that results in production of a temperature approaching the Dew point of ambient air.**

***IndexTerms*—Dew point, heat exchanger, sensible heating, evaporation.**

I. INTRODUCTION

A conventional cooling tower is a device that is used to reject heat by using an ambient air stream to support evaporation thereby cooling a water stream to a lower temperature and then expelling the moist air with extracted heat from the water into the ambient air atmosphere. Heat is transferred in a cooling tower by conduction, radiation, and convection. Sensible heat from the water at the water inlet and air exit raises the temperature of the air flowing through the cooling tower.

However, the dominant heat extraction process in a wet tower is evaporation because of the behavior of water where a small portion of the water that is being circulated is evaporated into the ambient air stream. The evaporation of this small amount of water significantly cools the remainder of the water since it pulls the latent heat of vaporization from the surrounding water and the specific heat of water is two orders of magnitude lower than the latent heat of vaporization. Air passing through the cooling tower can only support evaporative cooling to the point where it reaches 100% relative humidity with this cooling slowing down as it approaches this end point. This limitation drives the design ratio of air to water flow in a cooling tower and particularly a dew point tower where conditions are pushed closer to 100% relative humidity or the dew point with the typical design values for this ratio being very close to two to one. As the ratio of airflow to liquid flow increases (L/G ratio decreases), the surface area of the water film must increase to support effective air to water interaction.

II. LITERATURE REVIEW

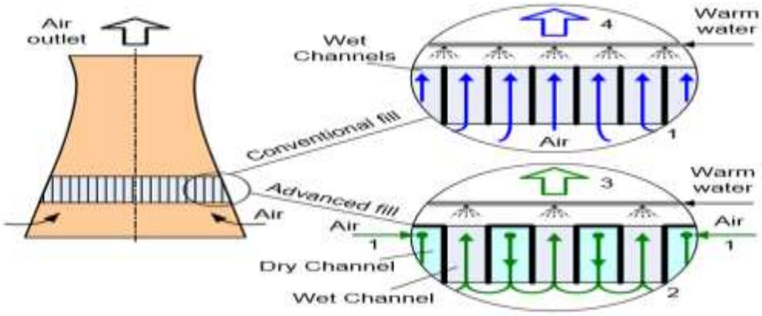
[1] The object of the invention is to provide a heat exchanger which enables a high flow rate per unit of volume, causes a small pressure fall, has a high efficiency and allows of simple mass production at low cost. With a view hereto the invention generally provides a heat exchanger of the type which has the feature that the wires are arranged in flat strips or mats which are placed such that at least one of the media flows first between the strips or mats and then through the strips or mats and between the wires with heat exchange between that medium and the wires.

[2]The invention relates to a cost effective and thermally efficient gas-to-liquid heat transfer plate assembly that is particularly effective as an air cooler to transform a wet cooling tower to a heretofore unachievable dew point temperature limited cooling tower. In another respect, the invention relates to a cooling tower that utilizes inlet air that has been sensibly cooled to achieve a web bulb temperature cooler than the ambient wet bulb temperature while retaining the same ambient dew point temperature such that it is able to produce water at a temperature approaching this ambient dew point temperature.

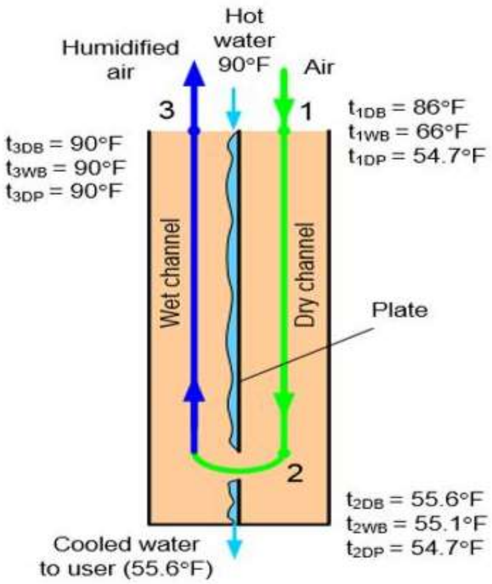
[3]The invention relates to the field of evaporative fluid conditioning. More specifically, the invention relates to the field of sensible cooling of fluids (gas, liquid or mixtures with and without phase changes) to substantially the dew point for gas by indirect evaporative cooling within a heat exchanger having canalized gas and fluid flows and a lateral temperature gradient across the heat exchange plates.

III. DEW POINT COOLING OPERATION

Utilization of psychometric energy available from latent heat of water evaporating into air. The smart combination of the basic thermodynamic processes of heat exchange and evaporation that results in production of a temperature approaching the dew point of ambient air.[1]



in conventional cooling tower water will pass in all the channel with ambient air. So in this cooling tower operated by sensible heating such as in a tube to air Heat exchanger, they do not use principal of evaporation . but in the advanced cooling tower water and ambient air will pass in separate channel.



First of all when the air will enter in the dry channel at that time evaporative heating is doing. So that the moisture content in the air will evaporate so that humidity of the air is decreased.then air is going in the wet channel at that time the humidity is lower. When the humidity of air is lower at that time the heat absorption capacity is higher. So that in wet channel higher rate of heat gain. So then finally we will gain lower temperature of water and increase the efficiency of cooling tower.[1]

IV. DESIGN CONCEPT

- Step 1. Establish a process flow diagram by connecting and establishing the air side and liquid side process relationships for the components in a dew point cooling tower including the process to be cooled by the dew point cooling tower. These components include the wet cooling tower, cooling tower inlet air to water heat exchanger, and the associated pumps, valves, instrumentation, and controls;
- Step 2. Establishing the design ambient conditions (dry bulb, wet bulb, and dew point temperatures);
- Step 3. Identify the process heat load (BTU/hr) to be rejected by the dew point tower and the upper limit for the coolant return temperature;
- Step 4. Conduct a preliminary sizing for the cooling tower using the subject process heat load with a 2 degree approach temperature and a 0.5 l/g ratio;
- Step 5. Using the ambient air temperature and the upper limit for the coolant return temperature determine whether the air to water heat exchanger coolant is to be cooled in the main tower or in a separate tower or cell; (The cooling tower size and air flow, and inlet air heat exchanger surface area are all minimized with higher inlet air heat exchanger coolant return temperatures. Restrictive process return temperature requirements where the maximum return temperature is limited to less than 30 degrees of the design ambient dry bulb temperature suggest but do not force the use of a separate cell to cool the inlet air heat exchanger);
- Step 6. Establish a rough cut for the air to water heat exchanger air flow and heat load using the ambient conditions and preliminary cooling tower sizing information;
- Step 7. Develop a preliminary heat transfer surface area sizing for the Dew Point Tower air inlet heat exchanger;

- Step 8. Determine the post sensible cooling air outlet dry bulb and wet bulb conditions for the cooling tower inlet air heat exchanger
- Step 9. Determine the approach temperature for the cooling tower and the approach temperature for the inlet air heat exchanger such that the sum of these approach temperatures is equal to the difference between the dry bulb and wet bulb temperatures of the air entering the cooling tower;
- Step 10. Size the heat exchanger to produce sensibly cooled air having a the desired dry bulb temperature; and,
- Step 11. Using the sizing data and associated performance information produced above, optimize the cooling tower size and parameters along with the cooling tower inlet air heat exchanger in an iterative manner to arrive at performance parameters that will produce sufficient coolant to cool.the cooling tower inlet air heat exchanger and produce the designed cooling tower performance.[2]

V. Conclusion

- Water cools to lower temperature.
- water can be cooled at higher ambient %RH.
- while conventional tower has approached its design limit.
- lower pressure drop at the same load.
- laminar flow in the fill due to smaller channels.
- lower flow rates compared to conventional fill.
- Potential to decrease evaporation loss.

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