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CFD Analysis Of FRP Counter Flow Cooling Tower In Blow Molding Machine

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Abstract- Cooling towers are one of the biggest heat and mass transfer devices used to transfer process waste heat to the atmosphere. Cooling towers make use of evaporation whereby some of the water is evaporated into a moving air stream and subsequently discharged into the atmosphere. As a result, the remainder of the water is cooled down significantly.

The process parameters such as inlet Air Wet bulb Temperature, Flow rate of Water and fills porosity have more influence on Thermal performance of cooling tower. The Temperature of outlet water is maintained nearest to inlet air wet bulb temperature to obtain the best Thermal Performance of cooling tower.. In this paper the CFD analysis of cooling tower is present and result is compared with practical reading for validation purpose.

I. INTRODUCTION

cooling tower is a heat rejection device that transfers waste heat from a process to the atmosphere though the cooling of the recalculated water flow. The type of heat rejection is commonly termed "evaporative cooling". Cooling Towers are used in facilities where process cooling is required in order to dissipate the heat that is created as a result of the process application, including power generation, oil refining, steel mills, pulp and paper plants, chemical processing and more. Cooling Towers are also a necessary component of the HVAC systems used to heat and cool large commercial buildings or server rooms.

There are number of factor affecting the performance of cooling tower like inlet temperature of water and air, outlet temperature of water and air, porosity in fills, speed of fan, mass flow rate of air and water. For increase the efficiency of cooling tower need to be optimizing this parameter. Here CFD Analysis of cooling tower is done.

II. PROCEDURE

In this work first of all the practical reading of cooling tower is taken from DOLPHIN PLAST PVT LTD at Ahmedabad. In practical reading we measure the inlet temperature of water and air, outlet temperature of water and air. For taking practical reading thermocouple sensor is used. For measure the temperature at different place the probe of the thermocouple is placed at the place where the temperature is measure.

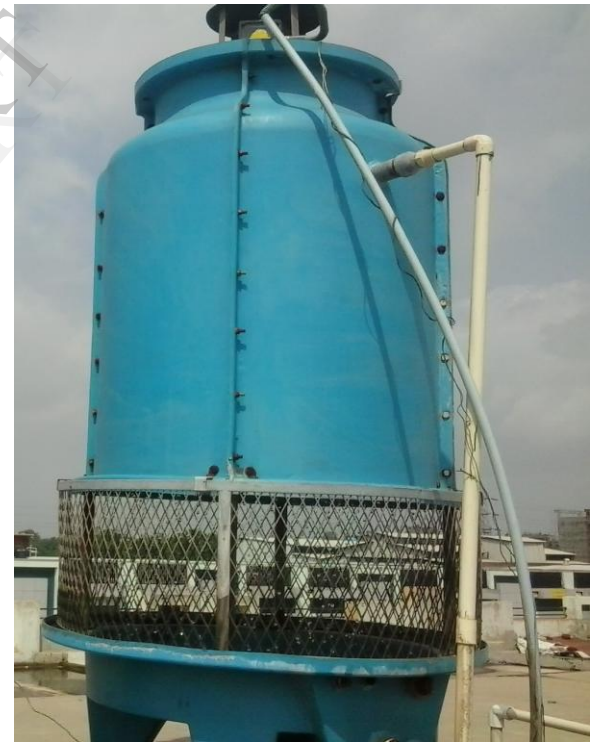


Fig cooling tower for practical reading

The practical reading is plotted below.

Table 1
Practical reading of cooling tower

MAXIMUM TEMPERATURE	327 K
MINIMUM TEMPERATURE	320K

Here ANSYS workbench is used for CFD analysis of cooling tower. For CFD analysis following step are perform. In step 1 cooling tower modal make in Creo are converted in to STEP file and this step file are imported in ANSYS. In step 2 the meshing of this cooling tower model is done. In meshing CFD mesh type is selected and fine meshing is done by using ten node tetrahedral elements. The reason for selecting this element is that is gives the good meshing on curvature parts here the ANSYS is automatically select the element. In step 3 various domains is define. Here there are three domain are define. Domain 1 is for water. The domain 2 is porous domain and domain 3 is air domain. After define the domain interface between domain is define between each domain to transfer the effect of each other. In boundary condition the inlet water temperature 327 K inlet air wet bulb temperature 308 K , mass flow rate 3Kg/s.

Table 2
ANSYS result

MAXIMUM TEMPERATURE	327 K
MINIMUM TEMPERATURE	319K

Fig 1 shows the cooling tower model made in Creo. It consists various parts such as Air mesh, fills, sprinkler head, fan motor, strainer.etc. In ANSYS analysis the outer cover is neglected.

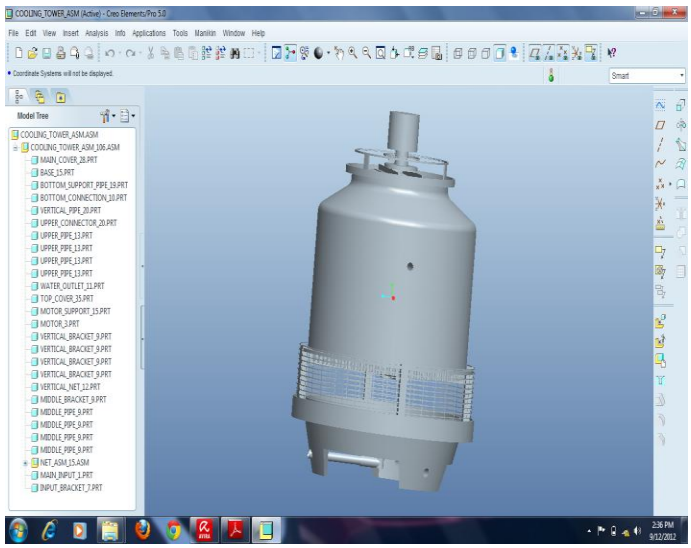


Fig 1: Cooling tower drawing in Creo

Fig 2 indicates the meshing model of the cooling tower. Meshing detail of the cooling tower is shown table below.

Table 3
Meshing detail of cooling tower

DOMAIN	NODES	ELEMENT
ALL DOMAIN	243832	727631

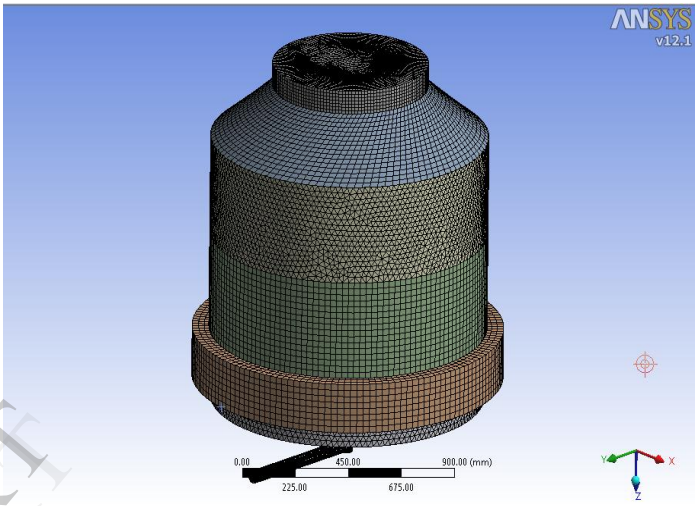


Fig 2: Meshing modal of cooling tower

In fig 3 shows the cooling tower imported in pre processor where various boundary condition is define as discuss above.

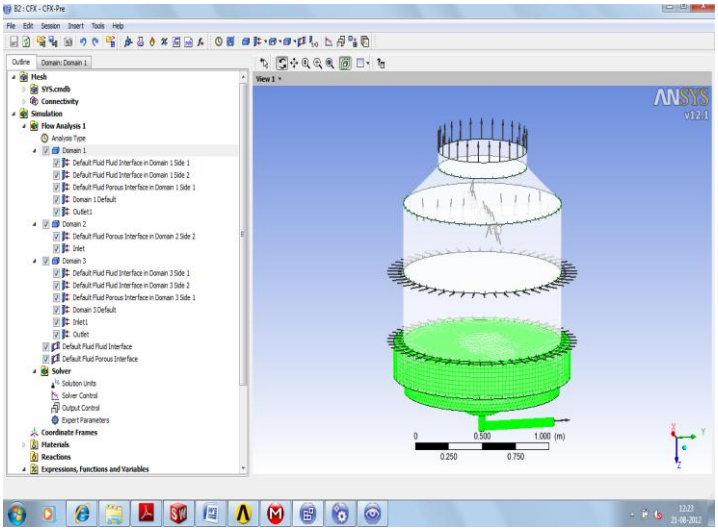


Fig 3: cooling tower in preprocessor

In fig 4 ANSYS CFX analyses is shown. From we can say that the maximum temperature is 327K and minimum temperature is 319 K.

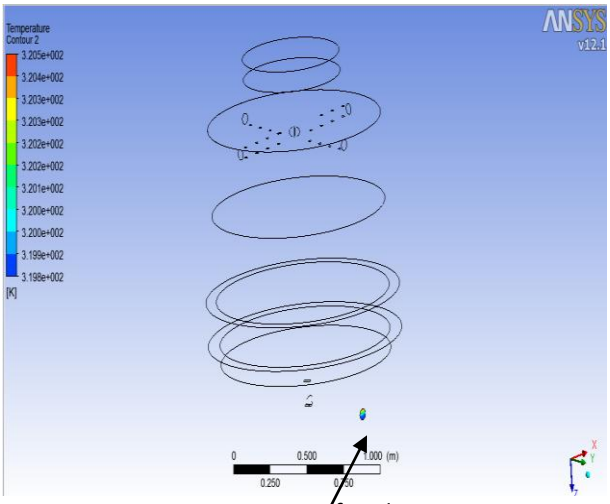
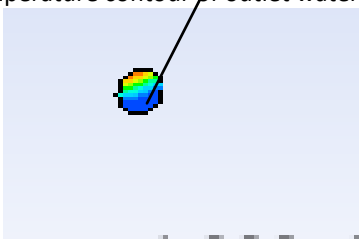


Fig 4: Temperature contour of outlet water in ANSYS.



III. CONCLUSION

ANSYS is very important software for analysis purpose. The application of ANSYS is wide in engineering field. From table 1 and table 2 which are indicate practical reading and ANSYS result we can say that the result of ANSYS is close to practical reading. So ANSYS is use for solve engineering problem as a FEA software and reduce the time and cost.

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