Abstract-A cooling tower is a heat rejection device that rejects waste heat to the atmosphere through the cooling of a water stream to a lower temperature. Cooling towers are used in all heat producing industries. There are two shapes of cooling tower: rectangular and circular cooling tower. In our project, we are going to design a circular cooling tower named as induced draft cooling tower. Induced draft towers are typically mounted with a fan at the top of the cooling tower, which allows hot air out and pulls air throughout. The high exiting air velocities reduce the chance of re-circulation. Design and analysis of induced draft cooling tower is made, with consideration of different loads. Various loads such as wind load, temperature load, self-weight, seismic loads. Analysis of cooling tower is done by using staad pro.

INTRODUCTIONS

A Natural draft cooling tower is means to remove waste heat from a system and release it into the atmosphere. Cooling towers area unit used at mill, power plants and Oil refineries to get rid of heat absorbed from current cool water system. A standard form is that the quadric. Cooling is around for over a hundred years. However, in their early for were solely regarding twenty meters high. Today, some will reach two hundred meters. As recently cooling towers were additional the exception then the rule out the trade due to their severely high overhead and therefore the great amount of capital needed for construction. However, with todays would like for conservation and mineral environmental impact.

As heat water enters the natural draft cooling towers, through a series of pumps, to the warm water inlet. The worm water is distributed into through a packing or fill materials inside the tower keeps the water evenly distributed. This is plays a major role and contracts heavily to the efficiency of the tower. As water is being distributed, the exposed lower portion of the tower allows for air to pass over the cold water basin which actually creates the differential, thus cause the natural draft. As this differential is being made the form of the tower itself, the hyperbolic form, induces current upwards.

When there is a large pressure differential between the outside air and air within a structure. Warm, moist air is less dense then dry air of the same pressure thu causing the warm, moist air to rise.
The generic term "cooling tower" is employed to explain each direct (open circuit) and indirect (closed circuit) heat rejection instrumentality. Whereas most think about a "cooling tower" open direct contact heat rejection device, the indirect cooling system, typically named as a "closed circuit cooling system" is still additionally a cooling tower.

**Direct or Open Circuit Cooling**

A direct or electrical circuit cooling is an indoor structure with internal suggests that to distribute the hot water fed thereto over a labyrinth-like packing or "fill." The fill provides an immensely enlarged airwater interface for heating of the air and evaporation to require place. The water is cooled because it descends through the fill by gravity whereas in direct contact with air that passes over it. The cooled water is then collected during a cold water basin below the fill from that it's pumped-up back through the method to soak up additional heat. Open circuit cooling tower has a high efficiency due to direct contact between water and air. Large amount of heat transfer surface area. Heat transfer is also based on evaporate heat transfer. Evaporative heat transfer, 1000 BTU per pound of evaporated water, so it takes away a lot of heat with just a small amount of water so u lose about 2% of water to evaporation but that evaporation then cools the remainder of the water very efficiently close to the wet bulb of the air. Indirect or Closed Circuit Cooling An indirect or loop cooling system involves no direct contact of the air and therefore the fluid, typically water or a glycol mixture, being cooled. in contrast to the open cooling system, the indirect cooling system has 2 separate fluid circuits. One is associate degree external circuit during which water is recirculate on the skin of the second circuit, that is tube bundles (closed coils) that are connected to the method for the recent fluid being cooled and came in a very loop. Air is drawn through the recirculating water cascading over the skin of the recent tubes, providing phase change cooling just like associate degree open cooling system.

Many traditional open cooling systems can benefit by “closed the loop”. This helps you to maintain high performance over time, reducing energy consumption it also reduces the need for periodic cleaning. With a closed loop have a location flexibility the heat rejection equipment can be located at grade or even below the load, can reduce installation costs and enhance accessibility for maintenance.
Necessity of Cooling the Condenser Water

The high cost of water makes it necessary to use cooling towers for water cooled condensers. The cooling water requirement in an open system is about 50 times the flow of steam to the condenser. Even with closed cooling system using cooling towers, the requirement for cooling water is also considerably large as 5 to 8 kg/kW-hr. This means a 1000 MW station will require about 100 thousand tons of circulating water per day even with the use of cooling towers. This huge requirement of cooling water is equivalent to a requirement of big city like Mumbai.

As the cooling water takes the latent heat of steam in the condenser, the temperature of the water increases. The hot water coming out of the condenser cannot be used again in a closed system without pre-cooling. This is because, the hot water coming out if used again will not be able to absorb the heat as temp. reaches near to saturation temperature of steam at condenser pressure and the condenser vacuum cannot be maintained. Therefore, it is absolutely necessary to pre cool the water coming out of condenser before using again.

INDUCED DRAFT COOLING TOWERS

Working principle

Cooling towers are devices used to transfer heat or cooling water for reuse. The basic operation is fairly simple hot water is pumped in from an outside source and sprayed in to the tower the hot water flows over what is called the fill. This spreads the water over a large surface to allow for more cooling. Cool air flows over the fill which transfers more heat through evaporation. The heat exits the tower and the now cooling water gather in the basin this cooling tower is pump back in to the system to be used again.

Within a cooling tower see the usage of plastic or wooden salts these are called fill and used to direct the flow. The purpose of this is to increase the area of contact between the hot water and the cooler air. There are two types of heat loss; they are sensible heat loss and evaporation heat loss. Sensible heat is what can be felt or measured. Evaporation accounts for the majority of the heat transfer and is the most critical aspect of the entire process.

Fig 4 Induced draft cooling towers

TYPES OF COOLING TOWER

Package Type

This type of cooling towers is preassembled and might be merely transported on trucks as they're compact machines. The capability of package kind towers are restricted and for that reason, they're typically most popular by facilities with low heat rejection necessities like food process plants, textile plants, buildings like hospitals, hotels, malls, chemical process plants, automotive factories etc. owing to the intensive use in domestic areas, sound level management could be a comparatively additional vital issue for package kind cooling towers.
Field Erected Type

Field erected kind cooling towers square measure sometimes most popular for power plants, steel process plants, crude oil refineries, and organic compound plants. These towers square measure larger in size compared to the package kind cooling towers.

Atmospheric Tower

An region tower consists of an enormous rectangular chamber with 2 opposite ventilated walls. The tower is jam-choked with an appropriate tower fill. region air enters the tower through the louvers driven by its own rate. A region tower is affordable however inefficient. Its performance for the most part depends upon the direction and rate of wind.

Natural Draft Tower

Towers are typically used for giant power plants and industries with infinite cooling water flow. The tower operates by hot air within the tower rising removing waste heat so cathartic it into the atmosphere. These towers are tall and have a hyperbolic form to induce correct air flow.

Mechanical Draft

The mechanical draught cooling system, conjointly spoken as fan-type wet cooling system, is that the most generally used sort of cooling system. The specified cooling air being sent through the tower by one or additional fans. Towers have air forced through the structure by a follower that circulates air through the tower. Common fans utilized in these towers embrace propeller fans and centrifugal fans. Whereas Mechanical draft towers are simpler than natural draft towers, they consume additional power and value additional to work as a result. Differing kinds of mechanical draught cooling towers are developed victimization an equivalent purposeful principle.

Induced Draft towers

Induced draft towers square measure generally mounted with a lover at the highest of the cooling system that permits hot air out and pulls air throughout. The high exiting air velocities reduces the prospect of re-circulation. To avoid the defense of water droplets within the heat stream air, drift eliminators square measure used. Evoked draft towers square measure additional economical as they use half-hour to up to seventy fifth less energy compared to forced draft styles.

Forced Draft towers

Forced draft towers are like induced draft however the fundamental distinction is that the fan is placed at the bottom of the cooling system, that permits the air to blow from all-time low. Their use is restricted thanks to water distribution challenges, high H.P. fans and also the risk of re-circulation.

Counter flow

Towers incorporate a style wherever the air is vertically upwards and therefore the counter current with plight is falling downward to cool down the air. This permits for optimum performance out of every set up space and helps minimize pump head necessities. Also, they're less seemingly to frost over in weather conditions and may save energy within the long-term. All Delta Cooling towers are counter flow. Cross flow

Towers feature a style that permits the air to flow horizontally through the fill and also the tower’s structure into associate open plenum space. Quandary flows downward from distribution basins. There’s less recirculation as a result of the speed of exit air is over getting into air. However, fans and motor drive need weather-proofing against wetness which might result in phase change creating it less economical.

COMPONENTS

The basic components of a cooling tower include,

- Frame and casing
- Fill
- Cold-water basin
- Drift eliminators
- Air inlet
- Louvers ➔ Nozzles
- Fans
We can conclude that there is difference between the theoretical and practical work done. The scope of understanding will be much more when practical work is done and we get more knowledge in such a situation where we have great experience doing the practical work. Were we designed induced draft cooling tower by considering different types of loads such as temperature load, seismic load, plate load etc., with using staad pro and IS 875-1987, IS 875 (PART 2) – 1987, IS 1893 (part 1), IS 875 (PART-3) – 1987, IS 456-2000 and IS 8188 code books. This code books are used for finding loads condition for cooling tower in staad pro. The calculations have been done for slab and circular footing.

**CONCLUSIONS**
Fig 13 SEISMIC LOAD

REFERENCES

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