



Kurdistan regional government

Kurdistan Engineers Union

Cooling Tower

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The purpose of writing the report is to change the title of the engineering rank from licensed to consultant.

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Cooling Tower :

Cooling towers are devices used to transfer heat from industrial processes to the atmosphere. Cooling towers may use water evaporation to remove heat and cool liquid used in an industrial process to a temperature close to air temperature. Popular uses include water cycle cooling used in oil refineries, chemical plants, and power plants .

Common applications include cooling the circulating water used in oil refineries, petrochemical and other chemical plants, thermal power stations, nuclear power stations and HVAC systems for cooling buildings. The classification is based on the type of air induction into the tower: the main types of cooling towers are natural draft and induced draft cooling towers .

Cooling towers vary in size from small roof-top units to very large hyperboloid structures (as in the adjacent image) that can be up to (100) metres (330 ft) tall and (100) metres (330 ft) in diameter, or rectangular structures that can be over (100) metres (330 ft) tall and (100) metres (330 ft) long , Hyperboloid cooling towers are often associated with nuclear power plants, although they are also used in some coal-fired plants and to some extent in some large chemical and other industrial plants. Although these large towers are very prominent, the vast majority of cooling towers are much smaller, including many units installed on or near buildings to discharge heat from air conditioning. Cooling towers are also often thought to emit smoke or harmful fumes by the general public, when in reality the emissions from those towers do not contribute to carbon footprint, and consist solely of water vapor .



How does a cooling tower work ?

Air conditioning equipment and industrial processes can generate heat in the form of tons of hot water that needs to be cooled down. That's where an industrial cooling tower comes in. Overheated water flows through the cooling tower where it's recirculated and exposed to cool, dry air. Heat leaves the recirculating cooling tower water through evaporation. This is called evaporative cooling. The colder water then reenters the air conditioning equipment or process to

cool that equipment down, and the cooling cycle repeats over and over again. When the warm condenser goes into the cooling tower, the water is passed through some nozzles which spray the water into small droplets across the fill, which increases the surface area of water and allows for better heat loss thru greater evaporation. The purpose of the fan on top of the water cooling tower is to bring in air from the bottom of the tower and move it up and out in the opposite direction of the warm condenser water at the top of the unit. The air will carry the heat by evaporating water from the cooling tower into the atmosphere .



What is the purpose of a Cooling Tower ?

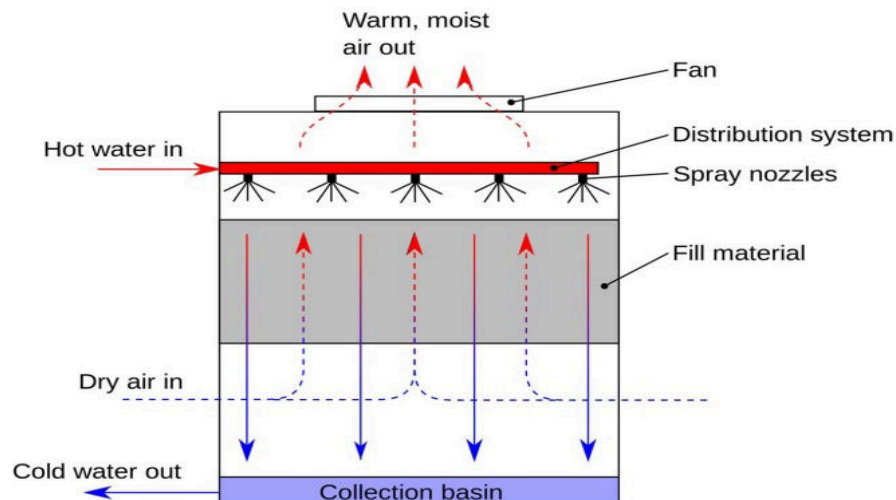
A water cooling tower is used to cool water and is a huge heat exchanger, expelling building heat into the atmosphere and returning colder water to the chiller. A water cooling tower receives warm water from a chiller. This warm water is known as condenser water because it gets heat in the condenser of the chiller. The chiller is typically at a lower level, like in a basement. The cooling tower's role is to cool down the water, so it can return to the chiller to pick up more heat .

Why is an Industrial Cooling Tower Needed ?

An industrial cooling tower is a critical component of many refrigeration systems and can be found in industries such as power plants, chemical processing, steel mills, and many manufacturing companies where process cooling is necessary. Also, a commercial cooling tower can be used to provide comfort-cooling for large commercial buildings like airports, schools, hospitals, or hotels.

An industrial cooling tower can be larger than an HVAC system and is used to remove the heat absorbed in the circulating cooling water systems used in power plants, petroleum refineries, petrochemical plants, natural gas processing plants, food processing plants, and other industrial facilities.

With the increased rate of the population all over the world, there has been a huge rise in the rate of needs and requirements by the world for manufactured products. This has forced the industrial sector to manufacture more and more products every day, which generates more manufacturing process heat. The machines and processes of industries that generate tremendous amounts of heat must be continuously cooled so that those machines can continue to operate efficiently. The most efficient, effective, and least expensive solution to removing this heat is the installation of an industrial cooling tower.

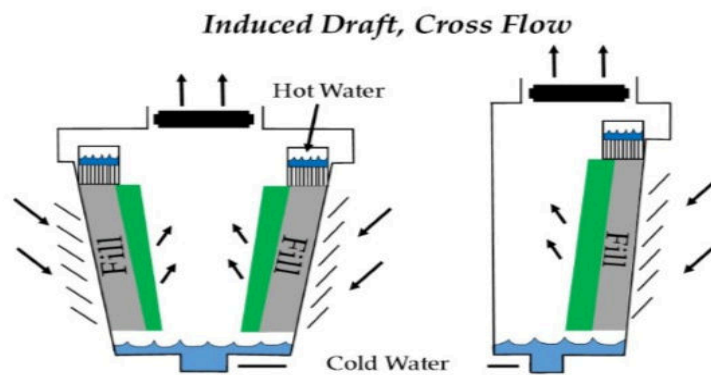


Cooling tower components :

- ١- External structure: The outer structure of the cooling tower is made of galvanized steel or aluminum.
- ٢- Cooling tower fan: The fan draws air out of the cooling tower in some types, or pushes air into the cooling tower in other types.
- ٣- Cooling tower splash guard: The function of the mist preventer is to prevent some water droplets from escaping with the air outside the cooling tower and returning them to the bottom of the tower. The splash guard also helps prevent corrosion and rust of the fan.
- ٤- Cooling tower water sprinklers: The sprinklers work to extract water in the form of mist and direct it to the bottom of the cooling tower to fall directly on the filler.
- ٥- Cooling tower stuffing: In it, the heat exchange process takes place between the hot water and the cold air, and works to break the water and increase its path to the bottom of the cooling tower.
- ٦- Cooling tower air deflectors: Air deflector's direct air from outside the cooling tower into it and prevent anything other than air from entering the cooling tower.
- ٧- Basin: The basin is located at the bottom of the cooling tower to collect cold water, and the basin is equipped with a float to measure the percentage of water inside it to maintain the required water level.

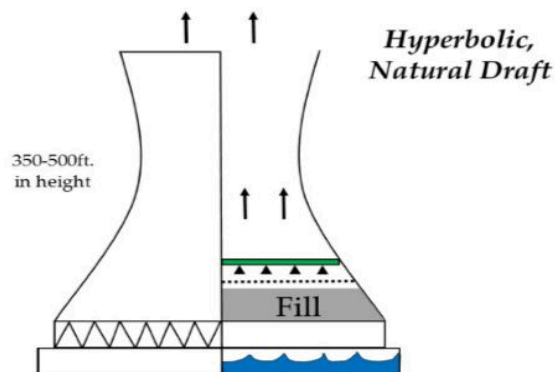
Cooling Tower Types :

Cooling tower systems are often vital to industrial processes. These tall open-topped cylindrical structures are responsible for cooling water generated from industrial or HVAC comfort cooling airflow. The different types of cooling towers are identified by the classification of the draft (natural or mechanical) and by the direction of airflow (counter or cross).



1. Natural Draft Cooling Tower Systems :

These towers usually used for large power plants and industries with infinite cooling water flow, The tower operates by removing waste heat by way of rising hot air that is then released into the atmosphere , These towers are tall and have a hyperbolic shape to induce proper airflow .



२. Mechanical Draft Cooling Tower Systems :

These towers have air forced through the structure by a fan that circulates air through the tower, Common fans used in these towers include propeller fans and centrifugal fans, While Mechanical draft towers are more effective than natural draft towers, they consume more power and cost more to operate as a result .

३. Crossflow Cooling Tower Systems :

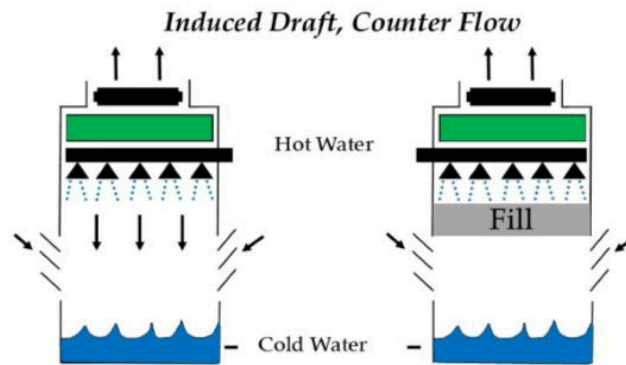
These towers have a design that allows the air to flow horizontally through the fill and the tower's structure into an open plenum area , Hot water flows downward from distribution basins , However fans and motor drive require weather-proofing against moisture which can lead to freezing making it less efficient .

४. Counterflow Cooling Tower Systems :

have a design where the air moves upwards and the counter-current, with hot water , falls downward to cool the air , This allows for maximum performance out of each plan area and helps minimize pump head requirements , Also a counter flow cooling tower system is less likely to ice up in cold weather conditions and can save energy in the long run , All Delta Cooling Towers are counter flow and all include these advantages.

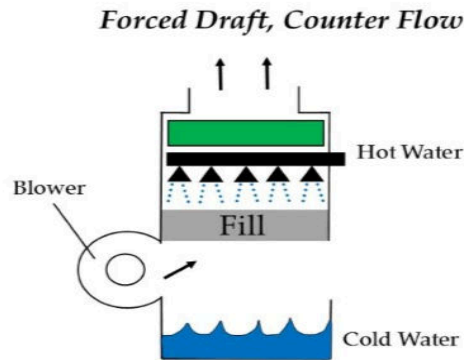
०. Induced Draft Cooling Tower Systems :

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 . To avoid the entrapment of water droplets in the leaving stream air, drift eliminators are used. Induced draft towers are more efficient as they use (३०%) to up to (४०%) less energy compared to forced draft designs.



7. Forced Draft Cooling Tower Systems :

This cooling tower system is similar to induced draft, but the basic difference is that the air-moving fan is placed at the base of the cooling tower, which allows the air to blow through from the bottom. Their use is limited due to water distribution challenges, high horsepower fans, and the possibility of re-circulation.



What is the best material for a Cooling Tower ?

Water-cooled systems are primarily made from three materials : Metal, fiberglass, and plastic. As you know, metal can rust and corrode, and whatever's inside of it can begin to leak over time. To no surprise, a metal cooling tower only has an average shelf life of up to only (10) years and requires maintenance with epoxy paint, sealants, and more. That maintenance

can lead to downtime for your business. This is why metal is now being replaced with better technology. Fiberglass cooling tower manufacturers, although providing a better alternative to metal, are still prone to cracks and wear which can lead to long-term higher maintenance costs .



What are the advantages of using engineered plastic?

An engineered plastic cooling tower is designed to stand up to wear and tear. It doesn't rust or chip—and it can weather harsh environmental conditions. It also requires almost zero maintenance. High-density polyethylene (HDPE), a best-in-class engineered plastic used by Delta Cooling Systems, is seamless and resistant to environment-induced corrosion, unlike metal or fiberglass cooling towers. With a life expectancy of more than 20 years, you can install it once knowing you will not have to worry about it afterward .

Advancements in the manufacturing and design of today's engineered plastic towers changed the use of cooling towers from a valuable support tool, to one of productivity and savings in the cost of a cooling tower. Factory-assembled commercial cooling towers became popular at the same time when engineered molded plastics became more desired over the galvanized metal models that once dominated the industry. There are many reasons why you might want to consider an engineered plastic cooling tower to reduce costs and better meet your process needs :

1. **Life expectancy** : A standard metal cooling tower has casings with thin sheets of galvanized steel. These sheets usually have welded seams that can deteriorate within a year and will require re-welding, patching, or coating to prevent leakage. Additionally, the treated water tends to attack the galvanized metal, essentially wearing it out in an extraordinarily short time. Environmental conditions such as sunlight, pollution, salt air, and harsh process chemicals also contribute to galvanized steel's early demise. Even ambient air pollution can affect galvanized steel, leading to premature failure. Since metal expands and contracts, depending on the temperature, repeated cycling causes stress that can also accelerate corrosion, rust, and leakage. Even low-grade stainless steel options, series 304 stainless steel, are attacked and worn out against water treatment chemicals and environmental factors .
2. **Flexible modular design** : In the past , a plastic cooling tower was too small for many industrial processes. For that reason, galvanized metal cooling towers were traditionally used for most applications above 200 tons but that situation has changed dramatically. Delta, for instance, has introduced its TM Series of factory-assembled plastic towers that can be combined to provide up to 2,000 cooling tons in a single, modularized unit. Modular cooling towers also facilitate the use of an extra margin of cooling capacity that can be advantageous in adjusting to operational heat load or outflow changes, or in upgrading to meet future cooling requirements .
3. **Continuous, more economical operation** : Engineered plastic can also reduce the expected and inconvenient consequences of operating a cooling tower, which include: electric power usage, water-treatment chemicals, labor and materials for maintenance, and unscheduled process downtime for cooling tower repairs. Maintenance and repairs usually mean process interruptions, the costliest of all problems related to cooling towers.
4. **Easier installation** : The basic design advantages of the latest plastic cooling towers also include easier installation, especially on rooftops, because a lightweight plastic shell weighs as much as 40% less than a steel tower while being 0.10 times thicker. When modular cooling towers are combined in a cluster, installation is often faster and easier .

Is a cooling tower environmentally friendly ?

With the increasing concerns about meeting green standards and improving ROI on capital equipment expenditures, there are some standards to consider. A systematic approach to cooling tower greenness will improve sustainability, increase energy efficiency, add water conservation, and create a smaller carbon footprint; all while improving some cost ramifications involved in achieving such green goals. Businesses can save up to (20) percent on energy costs. While conventional cooling towers, often constructed with sheet metal cladding, are environmentally challenging and maintenance intensive, the alternative of using cooling towers with molded seamless plastic is immediately beneficial to both the environment and your bottom line .

Traditional metal towers, which last only a few years in many applications, encounter environmental and economic issues including increased chemical use, higher maintenance costs, replacement costs, and disposal requirements. Engineered HDPE plastic design cooling towers allow the most aggressive water treatment options available. This can allow users to run at higher cycles of concentration, thereby saving make-up water. This can save tens of thousands of gallons of water per year. These water and chemical savings can be significant and help solve water issues as well as save on operating costs. Cooling towers of this counter flow design also keep water totally enclosed and free from sunlight, thereby lessening the occasion for biological growth, which requires less harsh water treatment chemicals .

How can Cooling Tower systems help businesses save money ?

Think of it this way: Cooling tower systems are essential to many businesses, which means looking for efficiencies in operations and products can help impact the bottom line. Water consumption can be a major operating expense, and cooling towers can recycle about 98% of the

water used in process cooling or air conditioning. If the unit is made from plastic and uses water instead of air as a cooling method, business owners can anticipate reduced energy costs, little-to-no maintenance, and extended product longevity, compared to older, metal systems. That's a highly desirable scenario for any business to cut down on costs. Furthermore, many customers appreciate knowing that the businesses and industries that support communities are environmentally conscious and working toward sustainable practices. That may not be a money-saving factor, but it could boost consumer confidence and that's good for business too.

What is the connection between Cooling Tower systems and Legionnaires' Disease?

According to the Centers for Disease Control and Prevention (CDC), water cooling towers can be a breeding ground for Legionella bacteria, the microbes that cause Legionnaires' disease. Here's why: Bacteria thrive in warm, wet conditions, making water-cooling towers an ideal environment. As a result, people can get Legionnaire's disease, which can cause pneumonia, when they breathe in water droplets dispensed from HVAC systems that contain Legionella bacteria. In fact, a 2017 study by the CDC found six Legionnaires' outbreaks in New York City that resulted in 223 cases and 18 deaths. Three of those outbreaks were linked to cooling towers.

To address this public health concern and liability, companies are treating the water inside of their industrial cooling tower with antimicrobial substances that kill the bacteria. For other water treatment applications, an air stripper is often used. As another precaution, plastic cooling tower systems can be manufactured with antimicrobial resins built into the unit materials and components to provide an additional layer of defense against Legionella. Find out more about the anti-microbial product technology at Delta Cooling Towers .

References:

١. https://en.wikipedia.org/wiki/Cooling_tower
٢. <https://www.mb-egy.com/ar/post/%D9%80%D9%83%D9%88%D9%86%D8%A7%D8%AA-%D8%A8%D8%B1%D8%AC-%D8%A7%D9%8E%D8%AA%D8%A8%D8%B1%D9%8A%D8%AF>