

Classifying Cooling Towers

Cooling towers are used in a range of applications. The cooling tower industry has devised several ways to classify cooling towers to make comparing them for various applications easier. This paper outlines these different classifications.

Manufacture Type

The broadest way to classify a cooling tower is by the way it is manufactured. The two primary types are field-erected products (FEP) and factory-assembled products (FAP). Field-erected cooling towers typically serve the power and heavy industrial market where the heat rejection required and water volume are very large. Primary construction of an FEP tower typically happens at the site of use. Factory-assembled cooling towers are primarily assembled at the manufacturing plant, then shipped and installed at the site of use. FAP towers serve HVAC, light industrial and commercial markets.



Factory-assembled (FAP) cooling tower – induced-draft crossflow cooling tower



Field-erected (FEP) cooling tower – induced-draft counterflow cooling tower

Draft Type

Once a manufacture type is determined, a subclassification exists by the method in which air is introduced into the cooling tower. There are three ways to bring air into the tower – natural draft (FEP only), induced draft, and forced draft. Airflow through a natural draft cooling tower is produced by the density differential that exists between the heated (less dense) air inside the stack and the relatively cool (more dense) ambient air outside the tower. Natural-draft cooling towers are primarily used in very large power and heavy industrial applications. Induced-draft towers have axial fans at the air discharge of the tower and pull the air in. Induced-draft cooling towers are the most common and are used in power, industrial and HVAC markets. Forced-draft cooling towers typically use centrifugal fans (blowers) at the air inlet of the cooling tower which push the air through. Forced-draft cooling towers have the advantage of being able to operate against the high static pressures associated with ducting and can be installed indoors, space permitting. Centrifugal fans are less common than axial fans because they can consume twice as much power.





Forced-draft cooling tower – factory-assembled (FAP) counterflow cooling tower

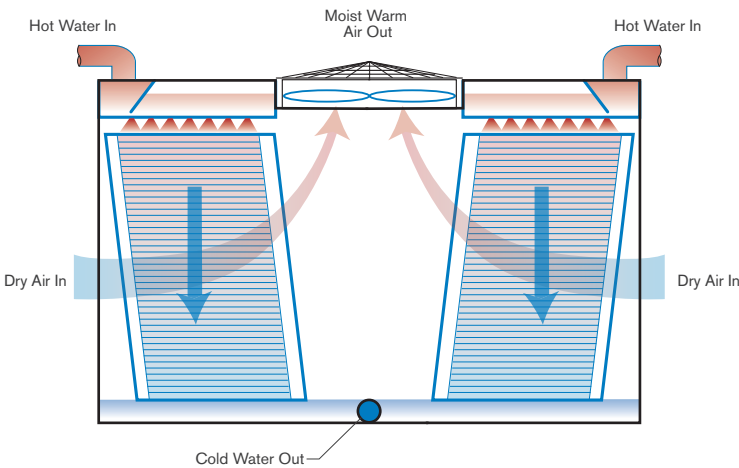


Natural-draft cooling tower – field-erected (FEP) counterflow cooling tower

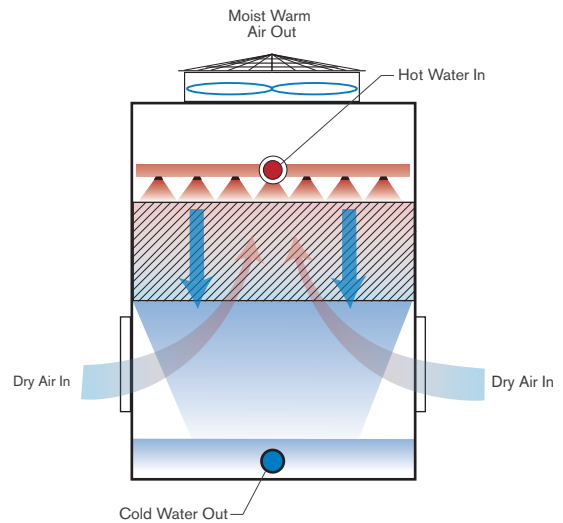
Air Movement

An additional way to sub-classify a cooling tower is the method by which the air and the process water make contact. The two classifications are crossflow and counterflow, both of which are used in FEP and FAP cooling towers. In a crossflow cooling tower, air travels horizontally across the direction of the falling water. In a counterflow tower, air travels in the opposite direction (counter) to the direction of the falling water. The type of application usually dictates whether a crossflow or counterflow cooling tower would

be better suited for the process. In HVAC, an FAP counterflow tower may be preferred for its small footprint, whereas a crossflow tower may be preferred for its maintenance access and better tolerance for cold weather operation. In the power and heavy industrial market, an FEP crossflow tower may be preferred for dirty water applications whereas a counterflow cooling tower may be preferred for its higher efficiency in applications with better water quality.



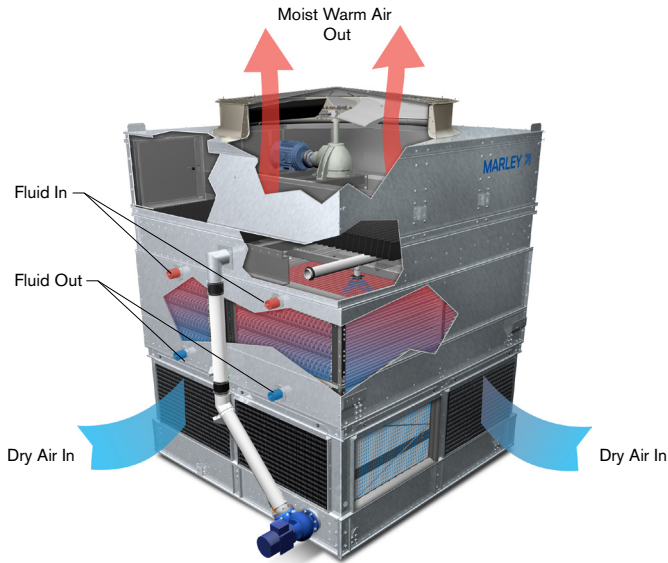
Crossflow cooling tower schematic



Counterflow cooling tower schematic

Air/Water Contact Type

Within the FAP category, cooling towers are also classified by air/water contact based on open-loop or closed-loop design. Closed-loop cooling towers (fluid coolers) typically have a smaller single-cell capacity relative to an open tower, but have several advantages. Closed-loop cooling towers keep the process fluids separated and clean. Because the process fluid is in a closed loop, fluids other than water and fluids at much higher temperatures can be cooled.



Induced-draft closed-loop cooling tower (fluid cooler) cutaway

Summary

There are three primary ways to classify a cooling tower – manufacture type, draft type, and air/water contact. Although there are several different potential combinations from an FAP forced-draft, counterflow, closed-loop cooling tower to an FEP induced-draft, crossflow, open cooling tower, typically the application easily narrows down the best choices to one or two preferred types of cooling towers.

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