

EVAPCO ENGINEERING FLASH



WINTER OPERATION CONSIDERATIONS FOR: OPEN COOLING TOWERS

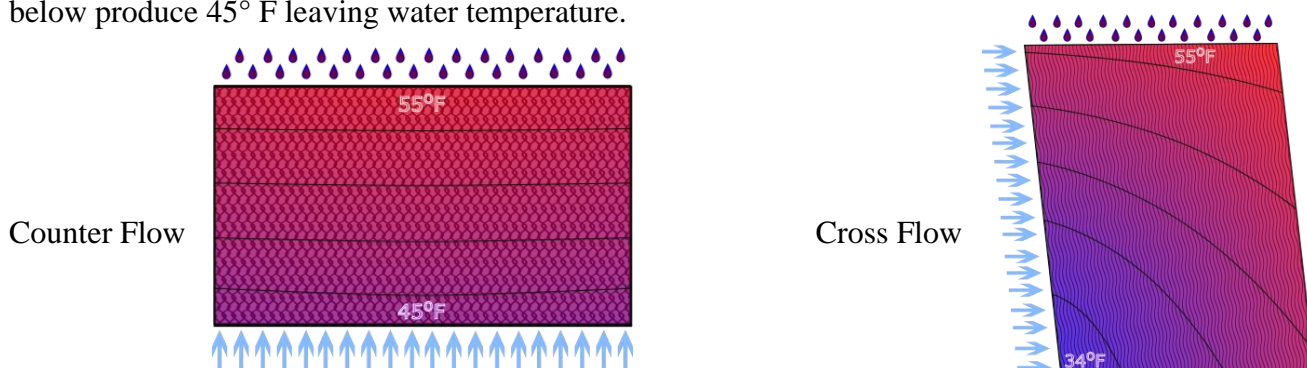
When ambient conditions approach freezing, water inevitably forms into ice. Open cooling towers are susceptible to freezing due to their inherent nature of operation, heat rejection by evaporation. As a result, ice formation becomes a subject of management, not elimination.

Several design considerations should be made to minimize the time and effort spent on ice management. The chart below takes into consideration multiple designs for open cooling towers and shows the best option for winter operation to minimize ice formation in the tower.

Winter Operation Design Considerations	Best Option
Forced Draft vs. Induced Draft	Induced Draft
Counter Flow vs. Cross Flow	Counter Flow
Multiple Cell vs. Single Cell	Multiple Cell
Two Speed Fan Motor vs. VFD Control	VFD

Induced draft cooling towers have a distinct advantage over forced draft cooling towers. Should ice begin to form, induced draft units can utilize a de-icing sequence by running the axial fan in reverse at a maximum of 50% speed for short periods of time, while monitoring the tower closely, making winter operation much more sustainable.

When comparing counter flow technology and cross flow technology, counter flow has the edge for winter time operation. The heat transfer media in counter flow towers is totally encased within the unit, providing a layer of protection from the elements. Counter flow towers also have a more even cooling temperature gradient throughout the heat transfer media compared to crossflow. This ensures that the process water is cooled at an even rate through the heat transfer media, which is critical during freezing conditions. Temperature gradients below produce 45° F leaving water temperature.



In some cooling systems, the cooling tower is designed to operate at reduced water flow to satisfy the lower heat load during winter months. A multi-cell design allows for greater flexibility for capacity control during the colder months, while minimizing the likelihood of ice formation on or in the tower. Diverting the reduced flow to one cell of a multi-cell tower provides more favorable water loading over the fill, resulting in more efficient operation. Low water flow may result in non-uniform water distribution over the tower fill causing wet/dry areas which are more prone to freezing.

It is very important to maintain a minimum leaving water temperature of 42°F (6°C) during winter operation of a cooling tower. Using variable frequency drives provides the most flexible and efficient method of capacity control for both induced draft and forced draft cooling towers, followed by two speed motors. During colder ambient conditions, long periods of operation with an idle fan should be avoided to minimize the risk of damage to the unit's drive system.

Other factors must be considered when determining the appropriate open cooling tower for a particular project. Some of these factors include piping, unit layout, the use of a remote sump, and several accessories that can aide in winter operation and/or ice management. All system piping and associated accessories that are not drained should be heat traced and insulated and have the ability to gravity feed from the tower. A full flow bypass is recommended in the system piping for any cooling tower that will operate during the winter. During winter operation, an improper unit installation can cause recirculation of moist air back into the air intake of the unit, which could cause ice to form on the tower air inlets.

Winter operation of an open cooling tower presents certain design considerations for a project. It is in the design stage of a project that these decisions must be made to minimize ice formation on the future cooling tower. Keeping these factors and many others in mind when designing a system will minimize the costs that can be associated with ice management.

If you have further questions about your open cooling tower project and ice management, please contact your local EVAPCO Sales Representative!

Regards,



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