Fluid Cooler Cold Weather Operation

Closed circuit fluid coolers are a great solution for a variety of applications ranging from water source heat pumps to process cooling. They combine the functionality of a cooling tower and plate and frame heat exchanger into one piece of equipment which keeps process fluids in a clean closed loop, and minimizes risk of fouling other system components. Preparing a fluid cooler for cold weather operation or shutdown season is similar to an open cooling tower, but with additional requirements. This paper discusses special considerations needed for cold weather operation and freeze protection for fluid coolers. For more detailed information on cooling tower cold weather operation, refer to **"Cold Weather Operation of Cooling Towers"** Technical Report TR-015 .

Coil Freeze Protection

The coil is the most expensive component of a fluid cooler and must be protected from freezing and bursting. Draining the coil is one method to prevent freezing, but has its limitations. Draining galvanized coils should only be done in an emergency and should not be part of standard operating procedure as the coil interior is bare steel and will corrode quickly. Stainless steel and copper coils can be drained if necessary, but the process is not easy and proper system modifications should be made. To avoid complications from draining the coil, it is most common to maintain circulation through the fluid cooler and provide coil freeze protection via the process fluid inside the coil. This is typically done by decreasing the freezing point of the process fluid with a glycol additive. Decreasing the process fluid freezing point with glycol is needed if a minimum coil exit temperature, usually around 45°F – 50°F, and a minimum flow rate can't be met. The fluid cooler manufacturer can provide estimated coil exit temperatures at reduced ambient temperatures to help plan for coil freeze protection.

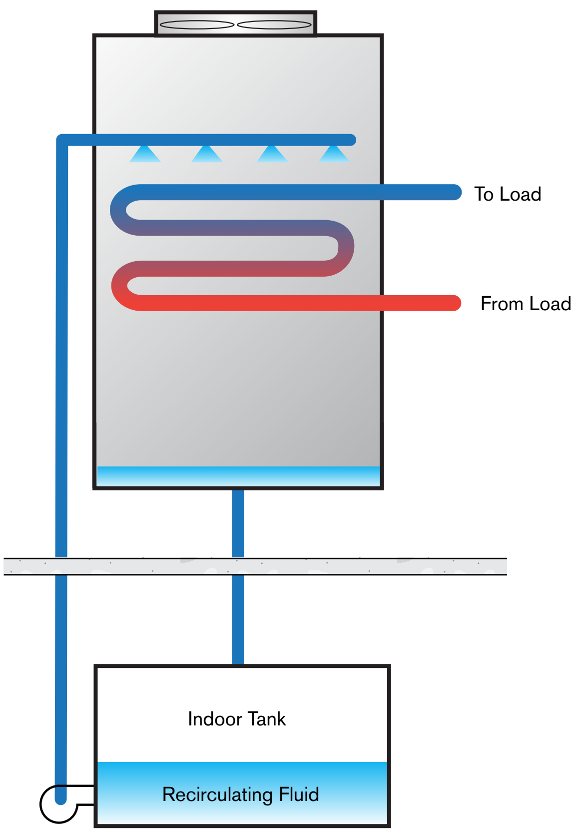
The two glycols commonly used are propylene glycol, which is food grade but less efficient, and ethylene glycol which is toxic, but less viscous at lower temperatures leading to higher efficiencies. Due to the toxicity of ethylene glycol, it is typically limited to industrial applications. Most HVAC applications will require propylene glycol. The first place to start when identifying required glycol volume is with the glycol manufacturer's data sheet. From there you can determine percentage by volume of glycol required for protection to the lowest ambient temperature expected. On the glycol data sheet there will be to volumes listed—one for freeze protection and another for burst protection. Be sure to use volume for freeze

protection plus a safety factor you are comfortable with, rather than volume for burst protection. Once the required volume is determined, you can use that to fine tune your fluid cooler and process-fluid pump selections. Below are some tips for dealing with glycol solutions:

- Glycol protection is needed in freezing climates from the time the system is filled, to the time it is drained and/or retired. Even 24-hour operations are recommended to have glycol protection to prevent freezing during unforeseen down times or maintenance cycles.
- Do not simply displace partial system volume with the required amount of glycol. This may prevent protection from reaching all parts of the systems. Proper mixing and circulation is needed to distribute glycol evenly throughout the process fluid.
- Only use inhibited industrial glycols, do not use automotive or other grade anti-freeze. Furthermore, do not mix glycol manufacturers if possible to avoid chemical incompatibilities.
- Use quality water for mixing glycol. Reach out to the glycol manufacturer for specific mix water recommendations.

Basin Freeze Protection

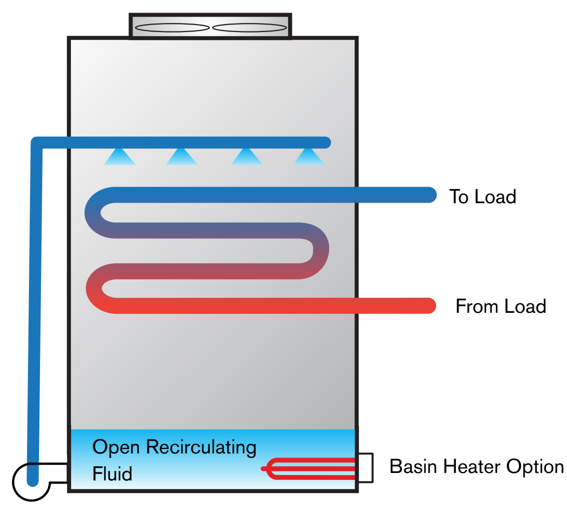
It is critical to recognize that even though glycol inhibited process fluid can protect the closed loop coil, the open recirculating water basin is not receiving freeze protection from the process fluid. If the open recirculating water basin won't be drained in the winter, it may be necessary to implement resistive-electric or steam basin heaters to stop the open recirculating water system from freezing when the fluid cooler is not in operation. Input heat energy required for the basin is determined by the ambient condition and can be found on the data sheet of the selected fluid cooler. Alternatively, gravity draining the open recirculating fluid to a remote sump below the frost line or into a heated building can be used to prevent freezing of the open recirculating water.



Fluid Cooler with Indoor Storage Tank

Further Considerations

Due to the difficulty and associated risks of draining the fluid cooler coil, for certain applications such as HVAC water source heat pumps, it is common practice to circulate the boiler process fluid through the fluid cooler. When doing this, the open recirculating water can be drained, or properly heated as it is no longer needed for cooling the coil. Furthermore, since boiler heat will be lost through the coils, it is best practice to install dampers to prevent air circulation over the coil. Although dampers will prevent a larger percentage of the heat loss, insulation panels can also be implemented for further heat loss protetion. These two techniques will minimize heat loss from the coil and may prevent an upsized boiler and increased energy costs.



Fluid Cooler with Basin Heater

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