RSES
RSES Journal
HEATING, VENTILATION, AIR CONDITIONING AND REFRIGERATION
JANUARY 2010 • rsesjournal.com • $5.95

Gaining & Sustaining at the

ASHRAE Winter Conference/AHR Expo

PURE WATER VERSUS GLYCOL:
CHOOSING A FILL FOR A WATER-BASED HVACR SYSTEM

When it comes to making a decision on "winterizing" equipment or shutting units down for the season, numerous factors such as physical location as it relates to the surrounding environment (air temperature); accessibility; and cost must be accounted for.

Understanding the unique circumstances of a system and its application are critical factors when determining the cost of winterizing a system—and the benefits of using pure water compared to a winterization fluid that contains glycol.

BY KEVIN CONNOR

The transition from fall to winter can be a busy time for industry professionals responsible for maintaining water-based HVACR systems that are idled during winter months. In areas where winter temperatures can fall below 32°F, proper winterization procedures are a necessary requirement for systems filled with pure water. Likewise, the arrival of spring requires a comparable investment of labor and materials to de-winterize these systems.

The use of an inhibited glycol heat-transfer fluid provides an alternative to annual winterization procedures, all but eliminating the need for additional freeze-protection measures and the corresponding costs of system idling and start-up. But pure water does provide excellent heat-transfer properties compared to glycol/water mixtures, generally resulting in better efficiency and lower pumping costs.

Determining the proper methodology to protect a system from freezing becomes a matter of whether the benefits of pure water outweigh the cost of winterization and de-winterization. Employed correctly, each methodology offers its own set of advantages.

The workings of water

Pure water provides excellent heat-transfer properties for many reasons. It is relatively inexpensive and less viscous than other mediums, which contributes to lower pumping costs. But pure water freezes at 32°F, making it inappropriate for use in any

›› While pure water offers benefits such as lower pumping costs due to its less-viscous nature compared to other mediums, a 32°F temperature will result in freezing, eliminating it from applications where it will be exposed to those conditions and requiring some type of freeze protection—such as glycol—to maintain system integrity.

system exposed to freezing temperatures or designed to operate at below-freezing temperatures, such as refrigeration-system applications. A glycol/water solution is the preferred medium for any application requiring freeze-protection as part of its normal operations; the appropriate concentration of glycol in water can provide freeze-protection at temperatures as low as -60°F. However, if the system operates at temperatures well above the freezing point of water and there is no risk of freezing, then pure water is the preferred medium.

The necessity for freeze-protection should not require explanation within the HVACR industry. If such protection is neglected, nature will not allow the mistake to stand. The burst pipes and other damage that can result from winter freeze-up can be catastrophic to the system, the facility and the reputation of the HVACR technician responsible.

In certain seasonal HVACR applications in cold-weather climates—including chilling operations not required during the winter months and HVACR systems in facilities not in use during the winter—pure water can be used despite the need for freeze-protection. In these instances, the system is drained during the fall and certain components are filled with winterization fluid—more than likely a glycol solution. In the spring, the winterization fluid is flushed out and the system is refilled with water, plus whatever corrosion inhibitors and other additives are used.

Considering costs

When applying the aforementioned methodology, the benefits of pure water must be weighed against the overall cost of winterization, which can include some hidden fees. There are several considerations, listed below, that must be taken into account.

Draining the system—This step requires a significant investment in man-hours from a qualified HVACR technician. Many facilities will not have this capability within their maintenance staff and will need to contract a service company.

Disposal of used water—If using pure water, a technician should add some type of corrosion inhibitor and/or anti-scaling compounds and biocides to protect the system. HVACR technicians need to be aware of any municipal regulations regarding the disposal of water-treatment chemicals. Some communities will object to disposing of water-treatment chemicals used in HVACR operations through the municipal sewer, and may even have specific handling requirements to prevent it from entering the water table.

Winterization fluid—Certain components need to be filled with a winterization fluid. In some cases, particularly residential applications, the entire system will be filled with winterization fluid. In addition to the cost of the fluid, springtime disposal issues should be a consideration. As such, a propylene-glycol product may be preferable to an ethylene-glycol product, as the former is recommended for use in applications where incidental contact with potable water is possible and may be required by municipal regulations. An inhibited glycol will provide corrosion protection for the idled system.

Scheduling—Due to the amount of effort required to winterize and de-winterize a system, the process will only be done once a year. There is no flexibility for unseasonably warm weather. Once it is winterized, a system cannot be restarted until a date when there is no possibility of freezing temperatures.

Refilling the system—All winterization procedures performed during the fall must be reversed during the spring. This requires a comparable investment in labor from a qualified HVACR technician or service company.

Corrosion inhibitors—An HVACR technician will need to add any necessary corrosion inhibitors, anti-scaling compounds and biocides to the water each spring in order to protect the system. Not only is this an underestimated cost; it also creates the potential for mistakes that could severely damage a system over time. Excess corrosion can quickly lead to system leaks caused by metal failure. Corrosion products

Determining the proper methodology to protect a system from freezing becomes a matter of whether the benefits of pure water outweigh the cost of winterization and de-winterization. Employed correctly, each methodology offers its own set of advantages.

also can build up and reduce heat-transfer efficiency in the same way.

Going with glycol

Operating a system with the proper solution of inhibited glycol and water eliminates the need for special winterization concerns. If properly maintained, the initial fill of a quality industrially inhibited glycol-based fluid will not require any significant attention for several years. In fact, fills of inhibited-glycol heat-transfer fluids in some systems have lasted 20 years or more with proper maintenance. A quality industrially inhibited-glycol solution provides the freeze-protection required for an idled system, and the pumpability and protection from corrosion and scale buildup required when in operation. Plus a system filled with a glycol-and-water solution can be shut off and restarted with little or no preparation, for greater operating flexibility.

The one drawback of an inhibited glycol heat-transfer fluid in a water-based HVACR system is the higher viscosity of the fluid compared to pure water. This will increase the energy requirements needed to pump the fluid through the system. For systems that must operate below the freezing point of water, the reduced pumping efficiency of a glycol solution is an unavoidable concession to achieve the necessary freeze-protection. However, where system shut down is an option, the loss of pumping efficiency should be weighed against the costs associated with winterization on a case-by-case basis.

When determining whether to incorporate a winterization fluid into a system, HVACR professionals should review municipal regulations and confer with building owners on proper disposal of the product—which may be a determining factor in deciding whether to use a propylene- or ethylene-glycol fluid.

Kevin Connor, Senior Development Specialist at The Dow Chemical Company, provides technical support for the company's inhibited glycol heat-transfer fluid products. For more information, e-mail kcconnor@dow.com or call 989-638-5209.

IF YOU **WINTERIZE**

The situation and environment of each system is unique. Once all factors have been evaluated and the decision to winterize a system has been made, HVACR professionals should keep these key points in mind:

- Add sufficient winterization fluid—If there is a question as to whether all the water has been drained from a specific component, err on the side of safety and fill with fluid.
- Consider disposal and handling of winterization fluid—While ethylene glycol offers pumping-efficiency advantages in operation due to its lower viscosity, there are no such advantages in an idled system. Use propylene glycol whenever possible because it is less toxic.
- Do not forget to vent an idle system—Remember to vent an idle system, even if filled with glycol or another winterization fluid. The fluid does expand and contract naturally as temperatures rise and fall. And in the event the fluid does freeze, an open loop could prevent burst damage.