Glycol & your system

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GreenDataCenterMan

Using glycol for your chilled water system will have dramatic effects and understanding how painful it can be to your efficiency is a must.

Why are we using glycol? In most applications the use of glycol is to lower the fluid (most often water) freezing point. The more glycol that is used, the lower the freeze point is depressed. This is great if you are aiming to produce ice or for a similar application. However, for data centers this is not the likely goal. Glycol may be added to prevent freezing of piping that is exposed to low outdoor conditions, but this should be reviewed to see if it is necessary. Often it can be added as a precautionary measure for piping exposed to low temperatures, but when the fluid is expected to keep moving there is usually little chance for it to freeze. It is when the pumps stop and the fluid rests where the most danger of freezing occurs. And even then insulation and heat tape are preventative measures that can keep the fluid temperature from freezing.

So perhaps you will reconsider a new chilled water system without glycol, but what about an existing system? Most chillers are designed at ARI standards of 45 degree F supply, which is 100% water. When the glycol amount reaches about 20% of the concentration, there are adjustments that need to be made for the chiller and the system. The chiller evaporator can be designed to help counteract the losses from glycol by having a lower pressure drop and more surface area. These adjustments also maintain a lower kW so that the compressor horsepower does not change. For commissioning the lower pressure with glycol, the default settings will need to be adjusted to prevent nuisance shut downs of the compressor. With glycol in the system will require at least annual testing to look for the pH and alkalinity to look for degradation of the fluids in the system. Once the levels begin to change, the breakdown of the materials, such as piping, pump impellers, and heat exchanger surfaces, begins to accelerate.

Now you may want to know what the capacity loss might be of your chilled water system. While there are small differences in glycol brands, as the concentration increases so do the losses. This is because the heat transfer will decrease since glycol is less conductive than water. But how much am I losing? Here is a quick guide to help from a glycol manufacturer based on the two most commonly used glycols:

	20%	30%	40%	50%	60%
Propylene	0.93	0.90	0.87	0.83	0.76
Ethylene	0.90	0.86	0.81	0.76	0.71

From this it is easy to see that using more glycol than necessary can be more costly to efficiency than most people realize. If an existing plant decides to lower its propylene glycol concentration from 40% to 20%, the savings are about 6%; for a simple example this translates to:

6% savings on the chiller operation for a 1,000 ton chiller at 0.45 kW/ton

6% x 1,000 tons x 0.45 kW/ton x (24x7x365 hours/year) x $0.08/kWh = $18,900 per year.

That is a savings of 236 kW per year and $18.9 per ton per year based only on lowering the amount of glycol from 40% to 20%. Keep in mind that if you eliminated the glycol completely, the amount of savings increases to 510 kW per year and almost $41 per ton per year.

Can we just take out the glycol on an existing system? In every case the system will need to be examined to determine whether there are risks for freezing of the fluid. If the glycol can be removed or decreased, there will be an increase in the amount of heat transfer capacity that the chilled water system will have. The evaporator will operate more efficiently, increasing the overall heat transfer of the chiller, and the coils and other equipment adding heat to the system will be able to do so more efficiently as well.

Using glycol can be a safeguard against catastrophic freezing failures but those who pay those energy costs may want to explore ways to decrease or eliminate the glycol in their chilled water system.

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