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**September 13th 2010 ~ Monday Morning Minutes:**

# Centrifugal Pump Curve Corrections for Glycol in for HVAC Systems

Pump curves are based on water, but I am pumping a glycol solution. How will this affect the selection? This week we define the first of three glycol corrections. There are three glycol corrections when designing a hydronic or process cooling system; heat transfer correction, pressure drop correction, & pump curve correction. The first correction we'll look at is heat transfer correction.

When choosing chillers, boilers, heat exchangers, and terminal units, it is important to select them using the correct system fluid. If a heat exchanger system requires a 30% water-propylene glycol mix, use that in the calculation. Likewise, if your cooling system design requires a 50% Ethylene glycol-water fluid, then the chiller and coil designs should be based on that fluid. This way the heat transfer correction is built into the selection.

Heat Transfer Selection from the Bell and Gossett ESP-PLUS Software

INCREASED FLOW REQUIREMENT FOR SAME HEAT CONVEYANCE 50% GLYCOL AS COMPARED WITH WATER

| Fluid Temperature °F | Flow Increase Need for 50% Glycol as Compared with Water |
|---|---|
| 40 | 1.22 |
| 100 | 1.16 |
| 140 | 1.15 |
| 180 | 1.14 |
| 220 | 1.14 |

Table 2 from the B&G TEH_ 176 Hydronic Antifreeze Design
http://www.bellgossett.com/literature/files/1157.pdf

What do we use if the system is existing and we are changing from water to glycol? How do we "de-rate" the system if the fluid is changing to glycol from water? This is when we use a "heat transfer" correction. When we change fluids, there are two choices: either we de-rate the BTUH of the system or we have to increase the flow rate intending to increase the U value. This assumes the velocity may be increased without reaching the maximum velocity limitation of the device. Tables, such as the Bell and Gossett one listed above, provide rules of thumb to avoid de-rating the BTUH capacity of a system by increasing the velocity.

If you need to de-rate a system, use the BTUH formula: BTUH = GPM x $\Delta T$ x 500 x SPg x SPht. The specific gravity multiplied by specific heat becomes the correction. Here is a table created from Dow's catalog of Dowfrost* and Dowtherm* heat transfer fluids.

| Temperature | 30% Dowfrost* | 50% Dowfrost* | 30% Dowtherm SR-1* | 50% Dowtherm SR-1* |
|---|---|---|---|---|
| 40°F | .926 | .835 | .905 | .832 |
| 80°F | .936 | .854 | .917 | .850 |
| 100°F | .941 | .863 | .923 | .858 |
| 140°F | .955 | .884 | .938 | .879 |
| 180°F | .967 | .904 | .954 | .900 |

Heat Transfer BTUH formula corrections for glycol solutions by volume

Example: Given an existing system with 1,000,000 BTUH output using water as the medium, what is the BTUH output expected if we fill the system with 30% SR-1 at 140°F? Solution: 1,000,000 X .938 = 938,000 BTUH output. ***Next week we look at glycol pressure drop corrections.***

* Trademark of The Dow Chemical Company