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September 20th 2010 ~ Monday Morning Minutes: ## Pressure Drop Corrections for Glycol in HVAC Systems (Part 1)

Question: I have selected my piping friction loss based on water, but I am pumping a glycol solution. What correction do I use? Answer: There are three glycol corrections when designing a hydronic or process cooling system; heat transfer correction, pressure drop correction, and pump curve correction. This R L Deppmann Monday Morning Minute defines the second of three glycol corrections.

When determining the pressure drop in a closed hydronic system, using water, the engineer normally takes the sum of equipment, control valve, piping and fitting pressure drops and adds a safety factor. When the fluid is a glycol based heat transfer solution, this process changes slightly. Some of the pressure drops may be based on the glycol fluid and some may be based on water. Typically, the equipment is selected for the glycol solution, therefore the pressure drop has already been corrected. Often the piping friction pressure drop is calculated using the ITT Bell &Gossett System Syzer® or other tables based on 60°F water. What correction factor do we use for the glycol solution? Table 3 below is a typical published table.

Sample summary of system pressure drop	Water PD	Glycol PD
Equipment P. Drop based on glycol solution		YYY feet
Control Valve P. Drop based on water	XXX feet	
Piping Friction loss	XXX feet	
Fittings (Piping X .25)	XXX feet	
Total Friction loss uncorrected	Sum above	
Times Glycol Correction factor	1.XX	
Friction corrected	XXX feet	YYY feet
Total Friction loss (Water plus Glycol)	ZZZ feet	

HYDRONIC ANTIFREEZE DESIGN FOR 50% ETHYLENE GLYCOL / WATER SOLUTION

Fluid Temperature °F	Pressure Drop Correction Flow Rates Equal
40	1.45
100	1.1
140	1.0
180	.94
220	.9

The problem with correction factors is they not only change with the fluid and the temperature, but they also change based on velocity. In general, the greater the velocity, the smaller the correction factor.

Let's look at an example. Use the B&G electronic System Syzer® and compare pressure drop for 50% EG at 40°F compared with the normal default of water at 60°F for various flow rates in 2-1/2" copper pipe. The results are as follows:

Flow Rate (GPM)	35 GPM	50 GPM	75 GPM	100 GPM
Glycol Pressure drop per 100'	1.42	2.64	5.36	8.89
Water Pressure drop per 100'	.94	1.77	3.65	6.12
Correction (Glycol PD/Water PD)	1.51	1.49	1.46	1.45

It would be rare to have enough time and money allocated for us to calculate the pressure drop in every section of pipe using a different multiplier. It also may not make enough of a difference to be of value. We must settle on a single correction. I suggest you use the correction at about 2 feet per 100 feet of pipe. This is about the center of the "pie" in scale 2 of the System Syzer. Some flows will be higher and some lower, but the suggestion above is a good middle ground in commercial and industrial systems.

Next week the R. L. Deppmann Monday Morning Minutes will feature a table showing various correction factors for various percentages of propylene base fluids, such at Dowfrost* or ethylene glycol based Dowtherm SR-1* at different temperatures.

* Trademark of The Dow Chemical Company