MesurFlo & Glycol

Subject and Scope
Use of Mesurflo™ flow controller with high concentrations of anti-freeze water solutions. Is a correction factor necessary for proper application?

Applicability
All mixtures wherein the density of the final solution will deviate significantly from that of pure water are covered providing the following criteria hold true.

- This bulletin will cover fluids with only small changes in viscosity from water. For fluids whose viscosity differs markedly from that of pure water contact Anemostat Customer Service.
- Fluids that are compatible with the materials used in a Mesurflo™ valve. The fluid used must be compatible with copper, brass and EPDM materials.
- The fluid is Newtonian (shear stress is proportional to the rate of strain).

Background
The Mesurflo™ is an accurate and economical solution to automatic flow control. Constant flow rates may be held over a wide variety of differential pressures. Unless otherwise requested the specifications for Mesurflo™ valves are referenced to flow rate in water. The design of the Mesurflo™ valve provides a constant rate of mass flow over a wide range of pressures and temperatures.

Most HVAC systems do not utilize 100% concentration of water in their systems due to freezing issues. Changes in fluid transport properties will result in small changes in volumetric flow rate when using Mesurflo™ devices. The cold temperature design point for most systems is a result of the environment in which they are installed. Concentrations of anti-freeze additives such as Ethylene-Glycol are usually below 50%. As a result the majority of HVAC systems require no flow rate correction when using a Mesurflo™.

For systems designed to operate in extreme cold climates greater percentages of anti-freeze additives are required. For example in a climate such as Alaska percentages of Ethylene-Glycol may be required to be significantly higher. A correction to account for the variation in fluid properties may be used to ensure the design flow rates in these situations.

Details
The Mesurflo™ valve is a constant mass flow device. To determine the volumetric flow rate of a fluid whose density is different from that of water it is only necessary to divide the flow rate in water by the ratio in densities of that fluid and water. The equation below expresses this relationship in mathematical form:

$$\dot{V} = \dot{V}_w * \left(\frac{\rho_w}{\rho_f}\right)$$

Where $\dot{V}_w$ is the volumetric flow rating of the Mesurflo ™

ρ_w is the density of water at the reference temperature

ρ_f is the density of the alternate fluid at the reference temperature

$\dot{V}$ is the resulting volumetric flow of the alternate fluid

For example, to obtain the correct volumetric flow rate of a mixture of an Ethylene Glycol-Water of 70%/30% it would be necessary to determine the density of the Ethylene Glycol - Water mixture and water alone at that temperature. For our example we will use a density of 69.1 lb/cu ft for the Ethylene Glycol-Water mixture. The reference density of water at this temperature is 62.42 lb/cu ft. The resulting calculation to determine the flow rate through a Mesurflo™ rated at 3 gpm in water is:

$$\dot{V} = \dot{V}_w * \left(\frac{\rho_w}{\rho_f}\right) = 3 * \left(\frac{62.42}{69.1}\right) = 2.7 \text{ gpm (of 70\% Ethylene glycol / 30\% Water)}$$

Glycol Adjustment Factors

Volumetric Flow Rate Ratio for Constant Mass Flow of Glycol Mixtures Compared to a Water Mass Flow Reference*

Temperature °F	Reference Water Flow	Propylene Glycol Content (% by Volume) 10%	20%	30%	40%	50%	60%	70%	80%	90%
30		0.98	0.97	0.96	0.96	0.95	0.94	0.94	0.93	0.94
40	1.00	0.99	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.94
50	1.00	0.99	0.98	0.97	0.96	0.95	0.95	0.94	0.94	0.94
60	1.00	0.99	0.98	0.97	0.96	0.95	0.95	0.95	0.94	0.95
70	1.00	0.99	0.98	0.97	0.96	0.96	0.95	0.95	0.95	0.95
80	1.00	0.99	0.98	0.97	0.96	0.96	0.95	0.95	0.95	0.95
90	1.00	0.99	0.98	0.97	0.97	0.96	0.95	0.95	0.95	0.95
100	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.95	0.95	0.96
110	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
120	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
130	1.00	0.99	0.98	0.98	0.97	0.96	0.96	0.96	0.96	0.96
140	1.00	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.96	0.96
150	1.00	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.96	0.96
160	1.00	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.96	0.97
170	1.00	0.99	0.98	0.98	0.97	0.97	0.97	0.96	0.97	0.97
180	1.00	0.99	0.98	0.98	0.97	0.97	0.97	0.97	0.97	0.97
190	1.00	0.99	0.98	0.98	0.97	0.97	0.97	0.97	0.97	0.97
200	1.00	0.99	0.98	0.98	0.98	0.97	0.97	0.97	0.97	0.97
210	1.00	0.99	0.99	0.98	0.98	0.97	0.97	0.97	0.97	0.97
220	1.00	0.99	0.99	0.98	0.98	0.98	0.97	0.97	0.97	0.97
230	1.00	0.99	0.99	0.98	0.98	0.98	0.97	0.97	0.97	0.97

* The data in this table is based on Propylene-Glycol with corrosion inhibitors incorporated. Due to differences in corrosion inhibiting additives it is recommended that data specific to the particular Propylene-Glycol mixture to be used is obtained and used to calculate corrected flow rates.

Volumetric Flow Rate Ratio for Constant Mass Flow of Glycol Mixtures Compared to a Water Mass Flow Reference*

Temperature °F	Reference Water Flow	Ethylene Glycol Content (% by Volume) 10%	20%	30%	40%	50%	60%	70%	80%	90%
30		0.98	0.96	0.95	0.94	0.92	0.91	0.90	0.89	0.88
40	1.00	0.98	0.97	0.95	0.94	0.93	0.91	0.90	0.89	0.88
50	1.00	0.98	0.97	0.95	0.94	0.93	0.92	0.90	0.89	0.89
60	1.00	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.90	0.89
70	1.00	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.90	0.89
80	1.00	0.98	0.97	0.95	0.94	0.93	0.92	0.91	0.90	0.89
90	1.00	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89
100	1.00	0.99	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89
110	1.00	0.98	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.89
120	1.00	0.99	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.90
130	1.00	0.99	0.97	0.96	0.94	0.93	0.92	0.91	0.90	0.90
140	1.00	0.99	0.97	0.96	0.94	0.93	0.92	0.91	0.91	0.90
150	1.00	0.99	0.97	0.96	0.95	0.93	0.92	0.91	0.91	0.90
160	1.00	0.99	0.97	0.96	0.95	0.93	0.92	0.92	0.91	0.90
170	1.00	0.98	0.97	0.96	0.95	0.93	0.92	0.92	0.91	0.90
180	1.00	0.98	0.97	0.96	0.95	0.93	0.92	0.92	0.91	0.90
190	1.00	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90
200	1.00	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90
210	1.00	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90
220	1.00	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90
230	1.00	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.90

* The data in this table is based on Ethylene-Glycol with corrosion inhibitors incorporated. Due to differences in corrosion inhibiting additives it is recommended that data specific to the particular Ethylene-Glycol mixture to be used is obtained and used to calculate corrected flow rates.