Modulating Flow Control with Mesurflo®

Excellent synergies occur when using a Mesurflo valve with a modulating temperature control valve. Both valves serve their design function and do not interfere with the function of each other. Since the Mesurflo valve will limit the flow rate of fluid independent of pressure the usual way of approaching the combination of two valves using CV values does not work. Instead the result must be evaluated in terms of flow directly. A look at how the Mesurflo and a modulating control valve each work from the viewpoint of flow will lead into a clear understanding of how the two will behave together.

The Mesurflo flow control device is designed to limit flow through the valve to the rated amount on the valve. The Mesurflo operates by the deflection of a diaphragm on to an orifice plate. As flow increases through the flow control the pressure across the diaphragm increases. This pressure deflects the diaphragm such that the open area between the diaphragm and the orifice plate decreases as shown in Figure A.

The orifice plate is carefully designed such that the flow rate through the device is maintained constant from 2 to 80 psi differential across the Mesurflo. Below 2 psi (minimum operating pressure for most Mesurflo devices) the Mesurflo will behave very similar to a fixed orifice (constant CV). In terms of flow the Mesurflo will produce a restriction proportional to flow rate squared until almost the rated flow. As the flow approaches the rated flow the restriction then becomes independent of flow such that the flow through the Mesurflo is held constant, this is shown in Figure B.

The modulating flow control basically operates by changing the open area of the valve in such a way that for each position of the valve there is a different C_V. The performance of a typical Equal Percentage valve for a single pressure across the valve is shown in Figure C.

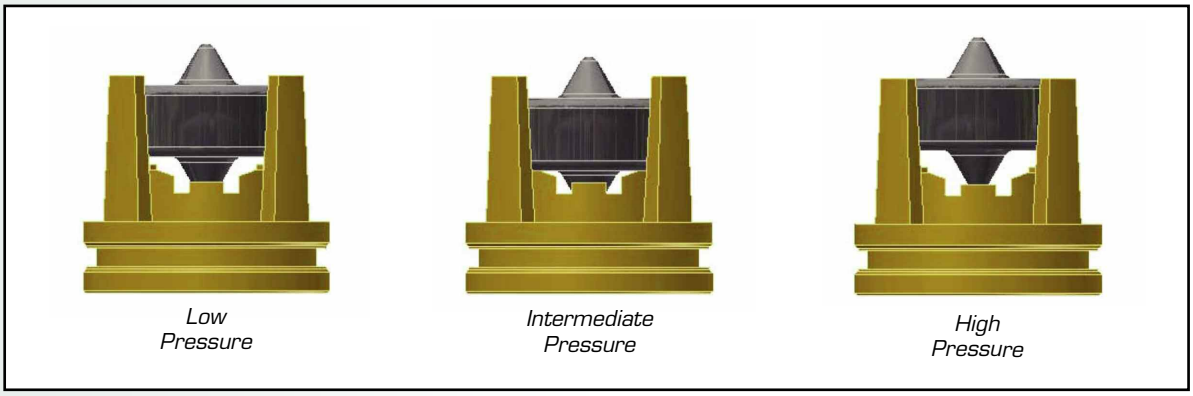


Figure A: Mesurflo Deflection with Pressure

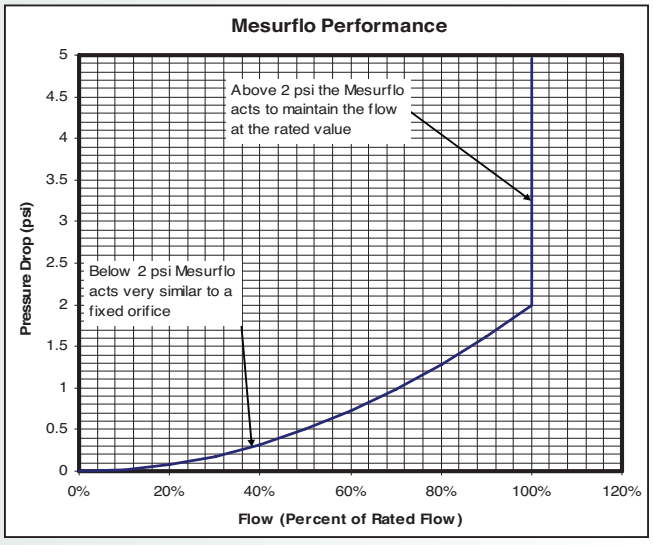


Figure B: Mesurflo Performance

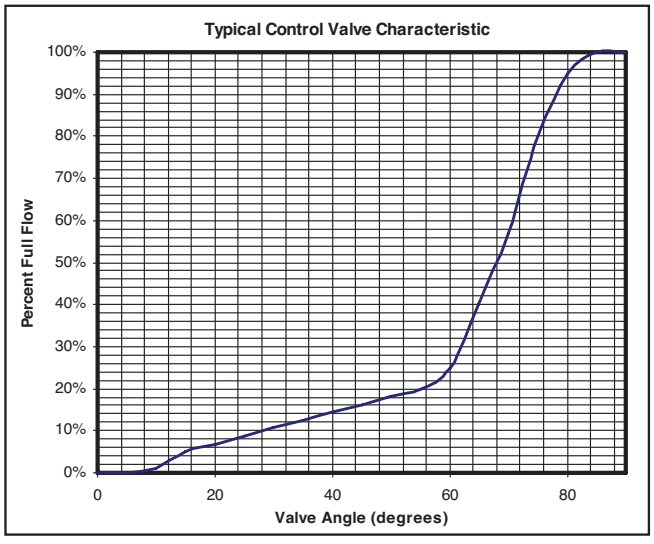


Figure C: Typical Control Valve Flow versus Travel at a Single Pressure

Anemostat

Figure D shows the effect of varying pressures on the flow rate through the valve. Note that at all points above the design pressure the flow can exceed the design flow rate.

When a Mesurflo device is added in line with the Control Valve there is no impact on the operation of the valve at flows below the rated flow. When the pressure exceeds the design pressure the Mesurflo will act to limit the flow. This is shown graphically in Figure E.

The Mesurflo prevents the system from experiencing excessive flow. This saves energy by lowering total system flow in conditions where higher than normal pressures occur. This also protects equipment from the detrimental effects of flow induced erosion.

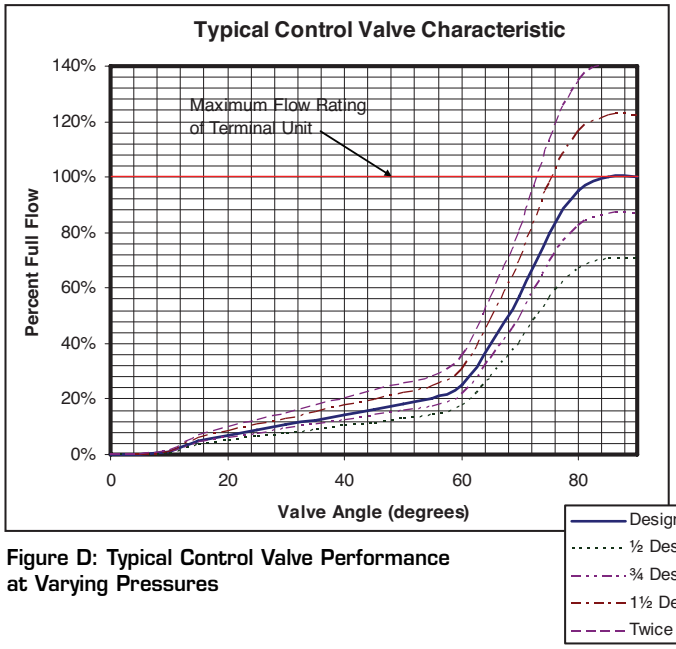


Figure D: Typical Control Valve Performance at Varying Pressures

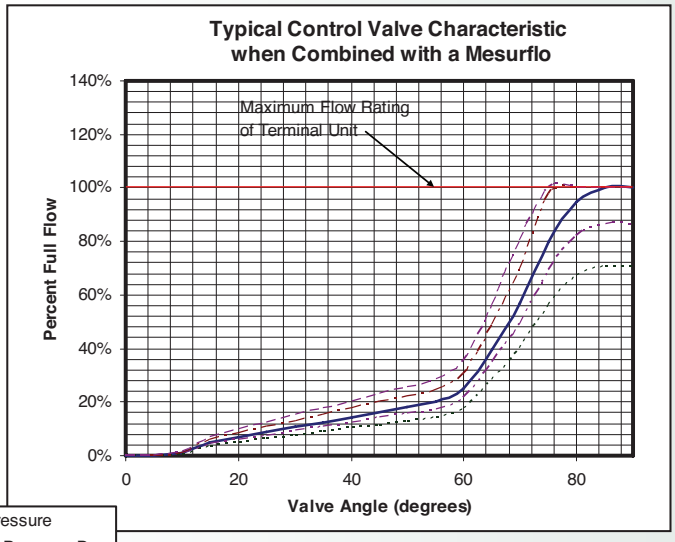


Figure E: Performance of a Modulating Control Valve with Mesurflo

Modulating Flow Control with Mesurflo®

Since Mesurflo acts very much like a fixed orifice at flow rates below the design point there is no interaction of the Mesurflo with the Control valve for authority. Due to the diminishing returns of heat exchangers, see Figure F, the impact on the control system of limiting flow to the rated maximum is minimal.

For modulating valves that are controlled by a temperature feedback system the combination of a Mesurflo and Characterized Disk Control valve provides the same benefit as the more expensive Pressure Independent Control Valve.

The temperature feedback system will correct for changes in flow due to pressure changes in the system. Below the design point any change in flow will result in a change in temperature off the coil. The controller will modify the position of the valve to provide the correct temperature. This makes the Pressure Independent aspect of a PICCV superfluous below the design point. The temperature off a typical coil is provided in Figure G.

As can be seen the change in temperature off the coil diminishes as the flow approaches the design point. A detail of the change in temperature is provided in Figure H.

As can be seen it is only at the design point where the air off temperature control breaks down. At the design point the change in temperature is not sufficient to provide control.

For example a dead band of ±2ºF (fairly normal) will result in no position correction until 150% of design flow. Without flow control, this provides a potential waste of 50% of flow, increasing both the pressure drop of the distribution system (further exacerbating imbalance) and the flow required. Mesurflo in line with each control valve will prevent the flow from increasing above the design point, correcting the only limitation found in the use of modulating valves with air off control.

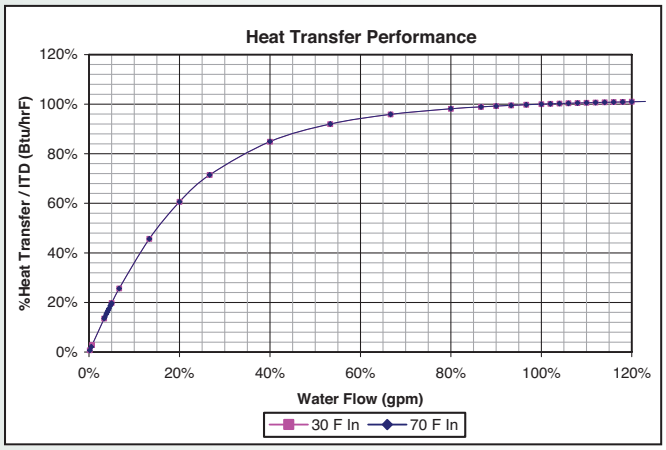


Figure F: Diminishing Returns of Heat Exchangers

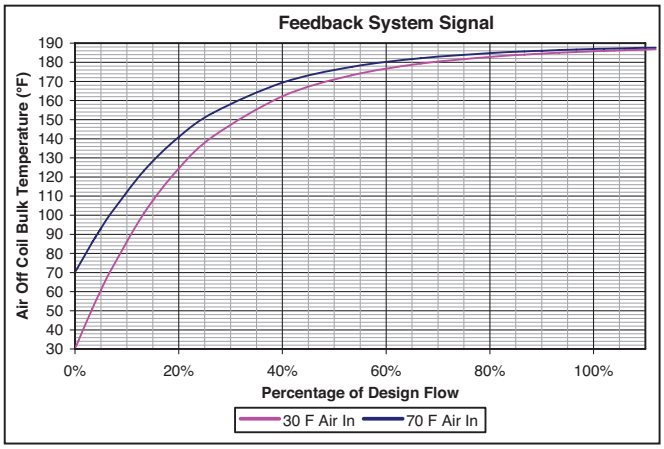


Figure G: Air Off Coil Temperature / Feedback Signal

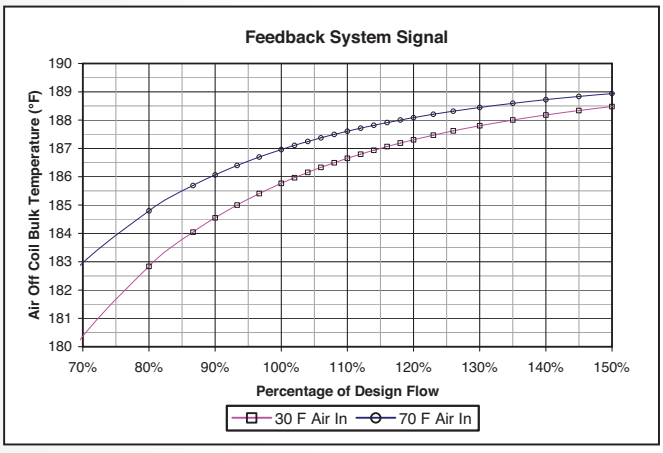


Figure H: Detail of Temperature Off Coil/Feedback Signal at Design Point

Mesurflo® Modulating Control Valve vs. Competitive Valves

The Mesurflo® Modulating Control Valve is latest addition to our lineup of Mesurflo Automatic balancing valves. Designed with performance and simplicity in mind, the Mesurflo® Modulating Control Valve provides accurate modulating flow control and reliable operation in a smaller package and lower initial cost.

The Mesurflo® Modulating Control Valve combines our patented Mesurflo technology and a characterized control valve to deliver 0 -100% flow. In a wide open control valve condition, the Mesurflo® has the authority and works as a regular Mesurflo® Automatic balancing valve which is selected at the rated terminal unit flow. The flow is constant across the entire pressure differential range 2-80 psi.

As the control signal from the thermostat changes, the characterized control valve portion gains authority and controls the flow. The characterized control valve in combination with the specially designed actuator controls the flow even as the pressure in the system changes. The equal percentage characteristic of the control valve guarantees a linear output from the terminal device.

SPECIFICATIONS

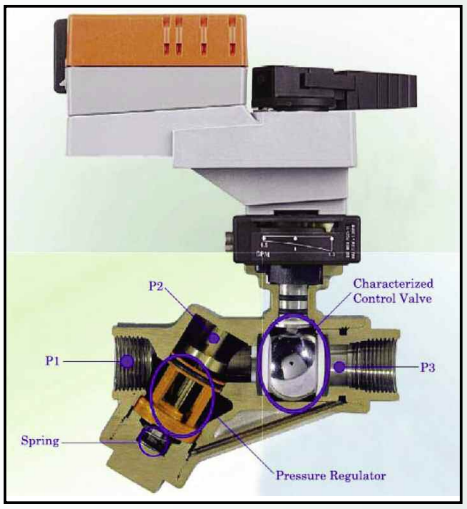
Actuator

Voltage	24 Vac +20%, -15% @ 50/60 Hz
Power Requirements	2.3 W / 1.6W (AC/DC)
Control Signal	2-Position, Floating or Proportional; half wave rectified power supply
Manual Operating Lever/Position Indicator	Standard on all models
Auxiliary End Switch (optional)	SPST 24 Vac/Vdc, 101 mA to 5 A max
Materials	Thermoplastic base and cover. Approved for use in air plenums.
Shipping & Storage Temperature Limit	-40 to 169 °F (-40 to 76°C)
Operating Temperature Limit at max fluid temp	
Proportional	32 to 140 °F (0 to 60 °C)
Humidity	5 to 95% relative humidity, non-condensing
Locations	NEMA 2, IEC IP31 Indoor Use Only

Valve

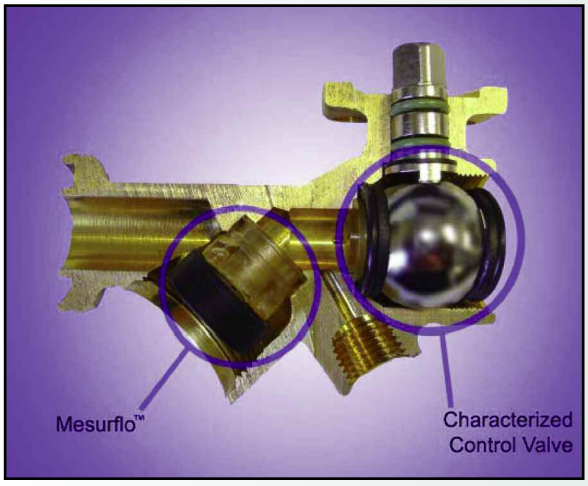
Service	Hot and chilled water, up to 60% glycol .
System Static Pressure Limit	600 psi (4137 kPa)
Fluid Temperature Limit	32 to 255°F
Close-off Pressure	130 psi
Differential Pressure	80 psi
Rangeability	Greater than 300:1
Body Material	Forged brass
Stem Material	Stainless steel anti-blow out stem with dual Viton™ o-rings
Ball Material	Chrome plated brass
Seat Material	PTFE
Characterized Insert	Glass-filled PEEK

A commonly adopted technology by our competitors is to use a pressure regulator in series with a characterized control valve. In the market these valves are known as the PICC valves. This is one way to control and modulate the flow but we believe that the Mesurflo® Modulating Control Valve through its exquisitely simple design provides the same performance with reduced complexity. To understand the operation of PI valve and the Mesurflo® Modulating Control Valve, consider the side by side comparison of both valves.



As inlet pressure changes, the pressure regulator reacts to the forces exerted by the intermediate pressure, discharge pressure and the spring to maintain a constant flow.

In a modulating condition, as the ball valve closes in response to reduced flow requirements the intermediate pressure and discharge pressure change moving the regulator and adjusting the flow rate. The flow is maintained by moving three elements internal to the valve – spring, a thin diaphragm and a stem running through the center of the regulator.



The Mesurflo® technology relies on a patented diaphragm and orifice assembly to control flow through the valve.

In modulating condition, the valve relies on the specially designed ball valve and characterized disc combination to provide the required flow rate. All the movement is external to valve.

The flow is maintained by moving only one element – ball valve. The actuator utilizes sophisticated algorithms to precisely position the valve without over-reacting or being sluggish.