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 C_V 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

Low Pressure Intermediate Pressure High Pressure

Figure A: Mesurflo Deflection with Pressure

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 C_V). 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.

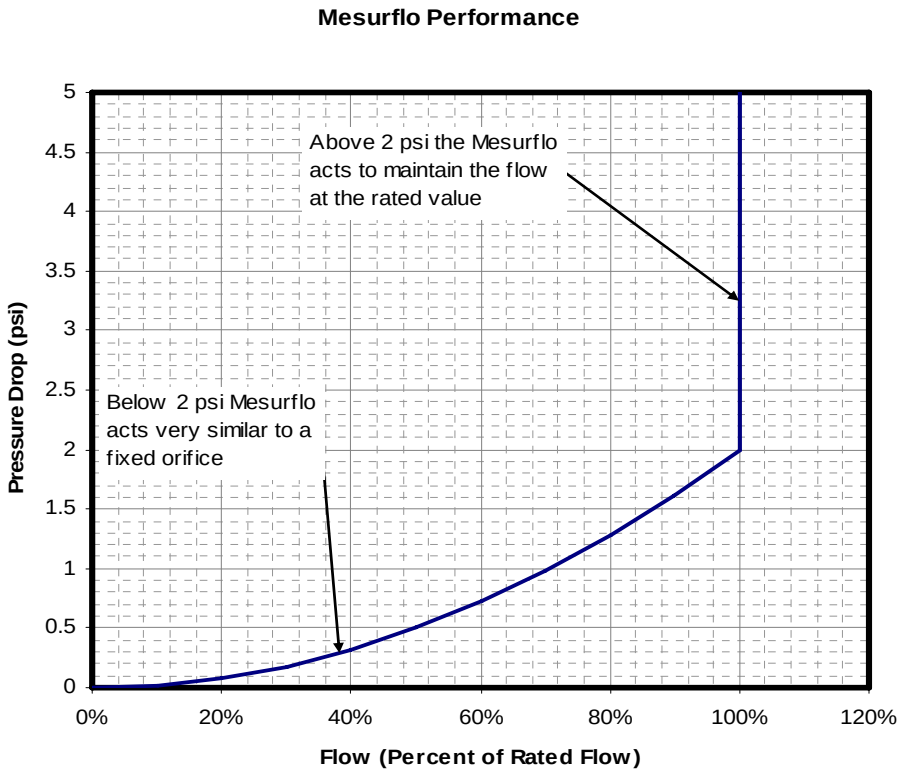

Figure B: Mesurflo Performance

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 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.

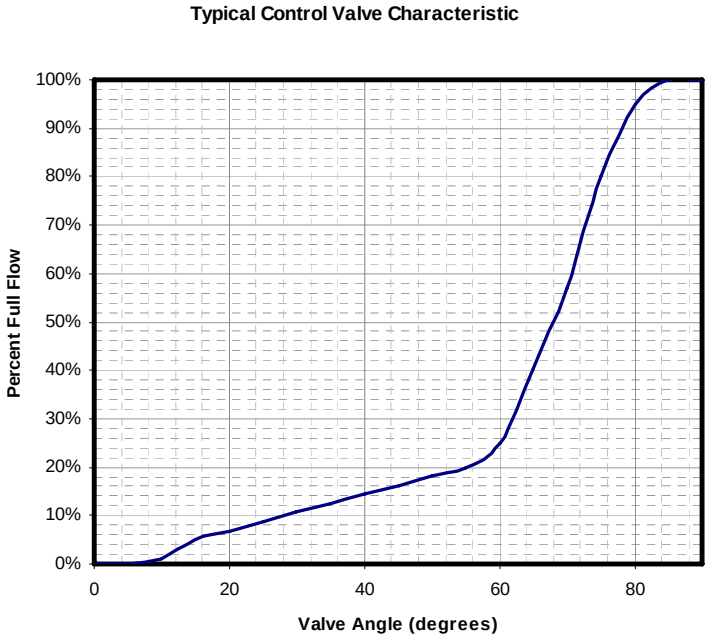

Figure C: Typical Control Valve Flow versus Travel at a Single Pressure

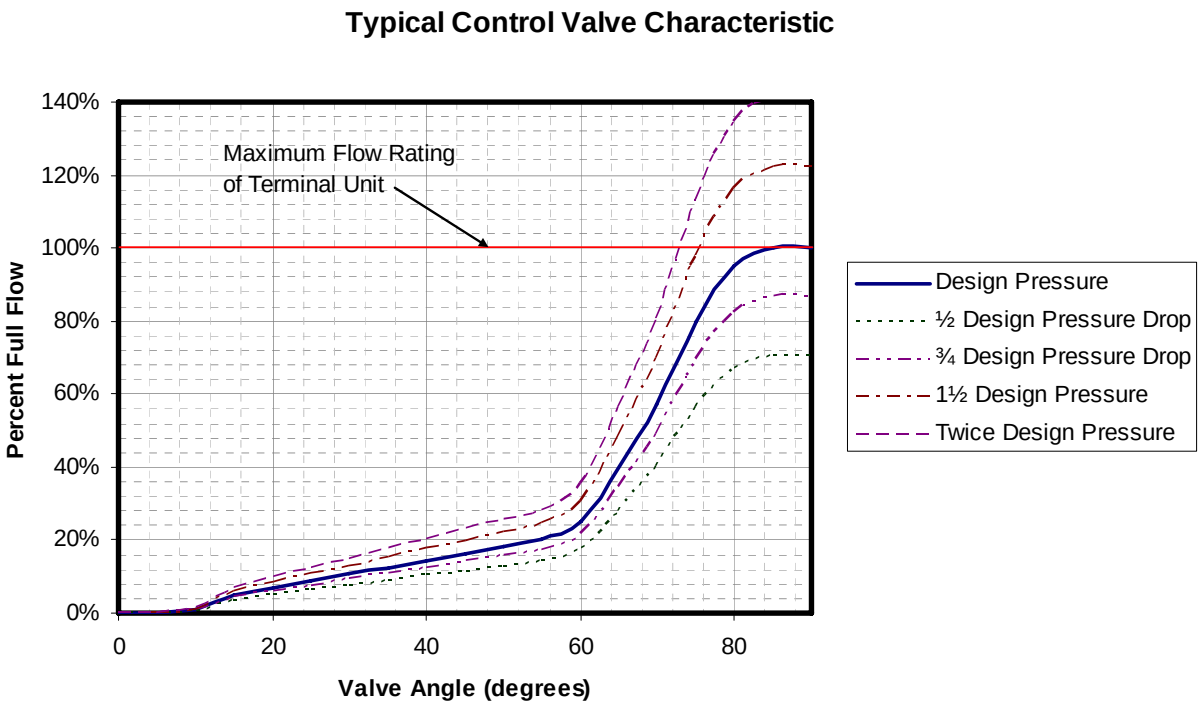

Figure D: Typical Control Valve Performance at Varying Pressures

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.

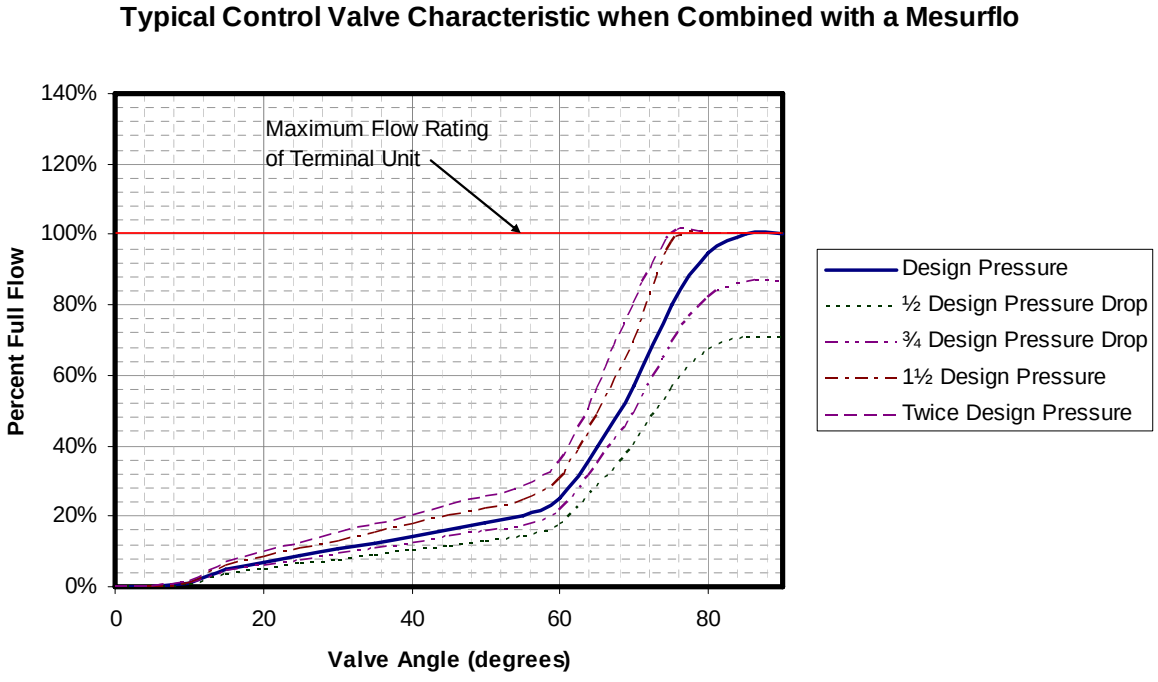

Figure E: Performance of a Modulating Control valve with Mesurflo

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.

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.

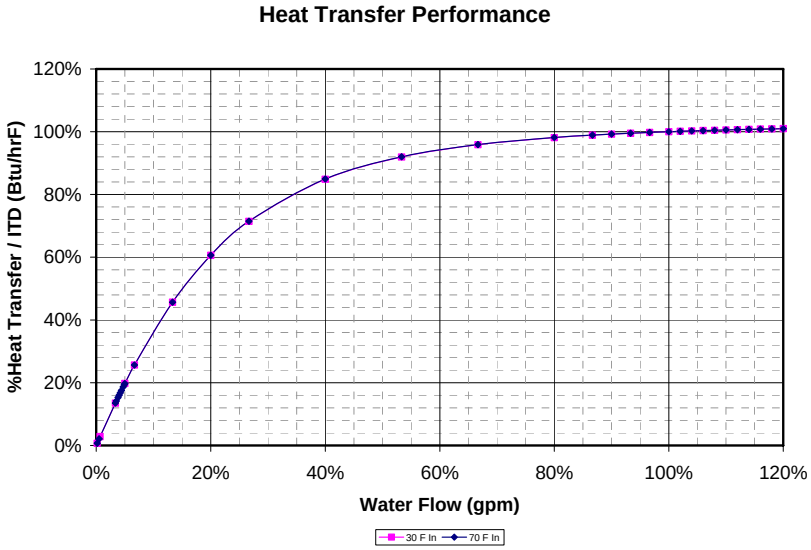

Figure F: Diminishing Returns of Heat Exchangers

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.

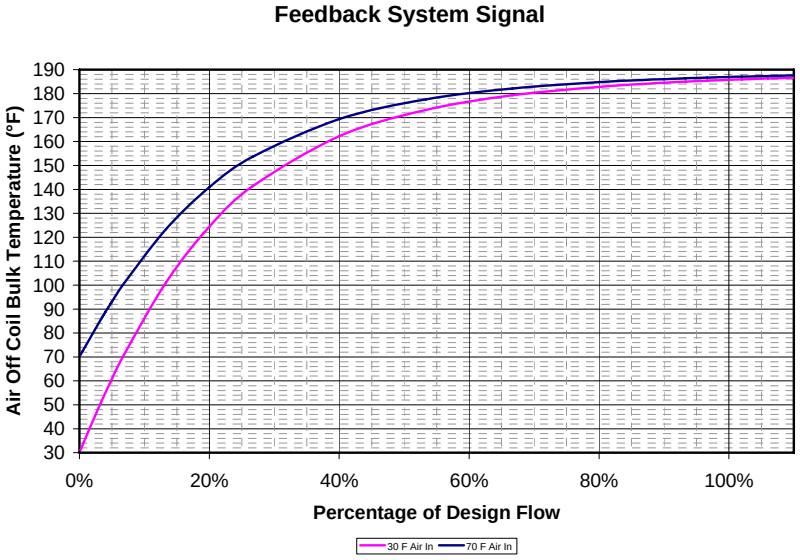

Figure G: Air Off Coil Temperature / Feedback Signal

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.

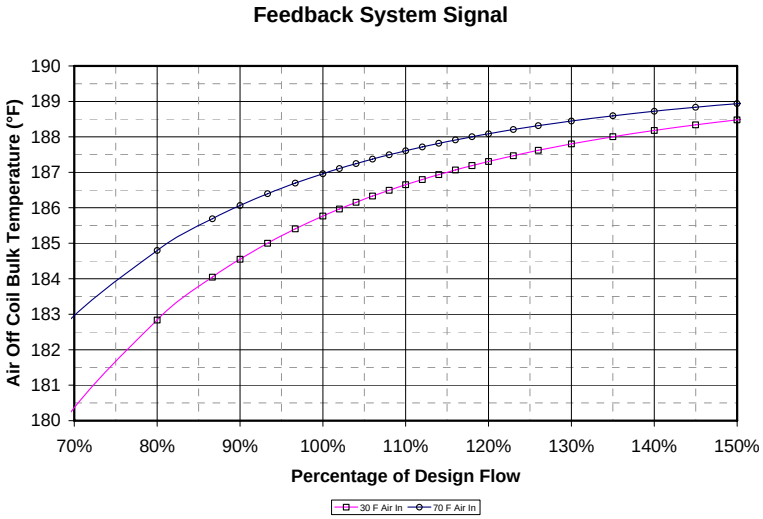

Figure H: Detail of Temperature Off Coil / Feedback Signal at Design Point

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.

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