Tech Talk:

Differential Pressure Valves

There has been a big fascination over the use of Differential pressure valves also known as Delta "P"™ valves over the past few years. They are always used to control flow for an entire building, on areas of a building, on air handlers, VAV and fan powered box reheat coils and recently we have even seen them specified for use on baseboard radiation.

The valve is basically a linear modulating control valve that is pressure independent. What is meant by linear is that the valve flows 25% of its total flow rate when it is 25% open, 50% when it is 50% open and so fourth. Pressure independent means that it will flow x gallons per minute (GPM) when it is 50% open regardless of system pressure fluctuations. If the pressure goes up the valve adjusts by closing down, if the pressure drops the valve will automatically open up to maintain flow.

The valve specifications dictate that the valve shall not vary more +/- 5% due to system pressure fluctuations a cross the valve. The valve is very similar to a shower anti scald valve that adjusts hot water flow should someone flush a toilet.

The application makes sense in a non-DDC controlled system. You don't want one building shorted of hot or chilled water flow when another building has an unusually high demand for heating or cooling. It has the advantage over a fixed circuit setter in that you can vary the flow.

The biggest disadvantage is that they are outrageously expensive, costing well over $1000 per inch. A typical 6" globe valve will cost about $950 without actuator to the end user. A 6" Delta "P"™ will cost about $6,000 to the end user or about 6 times the cost. If you have a DDC system, which many of you do, an easy method to accomplish pressure independence with a standard inexpensive globe valve is to install a differential pressure transducer across the valve. This method turns your standard globe valve into a pressure independent control valve. Strangely enough this very method is printed in the Delta "P"™ valve specifications.

Another method is not to use a differential pressure transducer at all. The cost of flow meters have dropped dramatically. A typical flow meter costs about $650. If you include the input point, software and installation will cost about $1500 regardless of the size of the pipe. An extremely low cost option is to utilize a butterfly valve and a flow meter. A 10" butterfly valve without an actuator is about $500 plus a $1500 flow meter is about $2000. A 10" inch Delta "P"™ valve without an actuator is about $10,000. Even the new Ultrasonic flow sensors that attach to the outside of the pipe for an operational system can be extremely cost effective. As mentioned earlier, the stated accuracy of a Delta "P"™ valve is +/- 5%. If you take into consideration the accuracy of the actuator being +/- 5% at best along with linkage Hysterisis you could easily be off by 20% of your output's percentage open. With a good flow meter you will be within several percent of actual flow.

One of the strangest applications of a differential pressure valve is on a DDC controlled air handler or VAV reheat with a discharge air sensor. What's even stranger is using one on a chilled water coil in a VAV air handler. It does not matter what the flow rate is thru the valve. You control off of discharged air temperature not off of flow rate in a VAV so the valve is continually moving and having secondary control within the valve would make tuning the P.I.D. loop difficult.

In conclusion one thing to consider a differential pressure valve is designed similiar to the now obsolete pneumatic control receiver controllers, because they utilize springs which require peridic calibration (from their own O & M manual) your never sure if it is in callibration. On the other hand a computer controlled method as stated above is continually re-calibrated, so those additional maintance cost are unnecessary.