The New DeltaP SmartValve:
Using Real-Time Data to Guarantee Performance

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Despite many technological advances in building equipment and controls, overall hydronic system control and instrumentation has not kept up. Many hydronic systems are lacking the real-time information that technicians require for efficient operation. The DeltaP SmartValve has been designed as a direct remedy for this problem. The precision control and information provided by the SmartValve allows operators to make educated decision regarding plant operation as well as diagnose performance issues utilizing the existing BAS. The SmartValve is designed to integrate into the existing controls and report entering and leaving water temperatures, water pressures and flow rate of the precision control valve. The combination of these data points allow the SmartValve to excel at system troubleshooting.

The sole purpose of a hydronic system is to transfer energy from the space to the plant (cooling) or vice versa (heating). The quantity of energy transferred is the load on the system and it is the absolute performance metric that a hydronic system can be measured by. A healthy system will maximize the amount of energy being transferred per unit of water, meeting demand load as efficiently as possible. The SmartValve utilizes the water flow and differential temperature information to calculate and report the operating load at the coil. The DeltaP SmartValve allows for the total system or plant load to be broken down to the individual coil load level. When the current load is contrasted against the known occupancy, weather conditions and system flow, system operating efficiency is easily quantified. Given the ability to recognize operational anomalies, the operators are better able to determine a solution quickly.

Receiving data at this level allows a facility to take care of major problems in much less time. A high cooling load during what should be a moderate or low load day is an immediate indication that something in the system is not functioning correctly. Some common issues are poor damper control, leaking heating valves and excessive reheat. But, if the only information available are central plant or even building level return water temperatures, these issues fade in to noise of the larger volume.

For example, a large air handler at a hospital in Southern California was operating at night with a high cooling load despite the fact that the occupancy of the building was minimal and the weather was mild. The information provided by the SmartValve indicated that the cooling load of the air handler was substantially higher than expected. Further investigation revealed that the heating valve was configured incorrectly, fully open when the system was calling for cooling, costing the hospital several thousand dollars per year.

While load is an immediate indication of how efficiently the system is transferring energy, pressure is a quick indicator of valve and coil status, as well as pumping capability and performance. While flow and temperature give some insight into system performance, pressure is a strong diagnostic tool to determine the cause of performance issues. The three pressures on the SmartValve (P1, P2, & P3) can be used to determine if the valve is open or closed and if it is operating pressure independently. Further, pressure information from multiple SmartValves can be used to determine the hydraulically remote point in a system for pump control, as well as locating sources of unexpected system head loss.

Open bypasses, partially closed isolation valves and clogged coils are some examples of head loss that currently take a considerable amount of time to locate and diagnose. Utilizing the differential pressure across the SmartValves in a system will quickly identify these problems. During a 2017 SmartValve installation in an office building, a pressure loss was noted between two air handlers that could not be accounted for through piping loss. Despite the building pump running at 100%, the pressure sensor that it was controlling to was not satisfied. Further investigation revealed a partially open bypass in the mechanical room. After the bypass was closed, the differential pressure across the valve and at the pressure sensor increased. The pump subsequently backed off to a point that satisfied the system load while reducing pump energy and increasing the return water temperature.

The most prevalent blight in a hydronic system is known as Low Delta T Syndrome (LDTS). System design Delta T, the difference between water temp leaving and returning to the central plant, is the basis for equipment selection and pipe sizing. An engineer designing a hydronic system must first determine load demand in the space, then design mechanical equipment from this requirement. LDTS occurs when an inadequate amount of energy is transferred to the water. Traditionally, 10-12 degrees was the engineering standard. A system designed for 10 degrees and suffering from LDTS might have operate at 6-8 degrees at part load. This mode of operation requires a greater volume of water to satisfy the load as not enough energy is being transferred from the air to the water.

LDTS is a symptom of poor control and combatting it requires meeting the design dT at each distribution point. The DeltaP SmartValve combats LDTS by utilizing precision control to supply the coil with the exact amount of chilled water to serve the load and maximize DT. By monitoring and responding to temperature problems utilizing the data transmitted from the SmartValve at the coil level, control is maintained and delta T is maximized. Operating at the optimum DT minimizes the water flow required and properly loads the chillers to allow for efficient system operation.

By continuously analyzing coil performance, facility managers can proactively maintain equipment. A drop in coil performance will be quickly identified by high flow and low DT. Clogged filters, broken dampers and dirty coils can all be identified using the DPSV and the existing BAS information. DPSV guarantees design Delta T shall be maintained across the coil, ensuring that engineers can design systems for higher Delta T. Meeting these advanced efficiency demands allows for smaller piping and less pump and chiller equipment, greatly decreasing overall project capital and operating costs.

In the quest for more efficient systems and reduced maintenance, the missing piece has always been the lack of accurate real-time operating data of the hydronic system. The DPSV fills that void by not only guaranteeing performance but providing the necessary tools to diagnose system issues quickly and easily. With a fuller view of the entire hydronic system, Facility Managers can now put their skills and time to use more effectively. The result will be a system that not only provides consistent comfort to occupants, but reduces energy and maintenance costs.