

# Technical Summary – Pressure Independent Technology Prevails in Cost Comparison with Standard 2-way Control

Two virtually identical buildings at Shell Point Retirement Community in Fort Myers, Florida provided the perfect opportunity to compare the operational and construction costs of two separate control valve strategies. The resulting analysis demonstrated that significant cost benefits can be achieved by opting for pressure independent valve control over standard 2-way control with a separate balancing valve.

Integrated Energy Concepts Engineering, PC (Rochester, NY and Fort Myers, FL) performed a detailed energy and cost analysis of two 6-story residential buildings, Lakewood and Parkwood, at Shell Point. The study compared Belimo’s 2-position Characterized Control Valve (CCV) used throughout the Lakewood facility with its 2-position Pressure Independent Characterized Control Valves (PICCV) installed at the Parkwood facility.

Except for the control valve technology, the buildings are identical in mechanical design, occupancy, and use. Both HVAC systems are served by the same central plant and have the same 24/7 occupancy/load pattern. Each of the condominium rooms are conditioned with dedicated air handling units with heating and cooling coils. Flow through these coils is controlled by control valves from Belimo, with Parkwood using the PICCV and Lakewood using the CCV and a separate balancing valve.

Both the PICCV and CCV have the same patented characterizing disc design which yields an equal percentage flow characteristic. This design provides a very slow and controlled increase in flow as the valve opens. However, the PICCV also incorporates a differential pressure regulator that absorbs all pressure changes, maintaining a constant differential pressure across the control valve, making it immune to pressure variations in the chilled and hot water systems. This technology eliminates the need for a separate balancing valve. Theoretically, this method enhances the efficiency of a hydronic system in a few different ways:

- More accurate flow control leads to better overall efficiency and less wear and tear on equipment.
- Pump power requirement is kept to a minimum because the valve accurately adjusts for low load conditions without incurring balancing problems.

- The benefits of variable pumped systems are more effectively realized both in terms of flow reduction and decreased friction losses through the piping.

## PICCV: Operational and Installation Savings

Bruce Keeley, PE, of Energy Concepts developed the spreadsheet analysis program that was used to compare the control valve technologies used at the Parkwood and Lakewood facilities. Energy Concepts is a mechanical, electrical, plumbing, energy and controls design and consulting firm who specializes in energy and financially conscious design services and efficiency analysis. In addition, Energy Concept’s services include a variety of general building systems energy conservation studies.

“The goal was to evaluate the PICCV technology. The identical buildings at Shell Point provided an exquisite opportunity for a comparative case study on the pressure independent technology against the straight characterized control technology,” said Keeley, who developed a highly customized program that would compare the two technologies.

In addition to a series of theoretical calculations, the firm conducted a series of random onsite tests to confirm the results of the analysis. These tests demonstrated that the spreadsheet had, in fact, accurately predicted the flow of chilled water to each of the buildings (within 7% of range) under all normal operating conditions. This validates the substantial savings that the study shows the PICCV technology has over the CCV technology, or conventional control valve in this 2-position application.

Taking into account Bin hours, brake horse power and kWh cost, the analysis showed that Shell Point is enjoying an annual savings of \$1,882.00 in the Parkwood building as a result of using the PICCV. Table 1 shows the resulting calculations that are based on the operating parameters of the two buildings. Due to the use of an Ice Storage system on this project, additional chiller savings are not reflected in the annual figures as noted. A system that does not use Ice Storage would yield higher annual savings. The PICCV promotes substantial savings in chiller-energy consumption by maintaining the system’s design differential temperature (delta t), and completely increasing the efficiency of chiller plants.

Pressure Independent Technology continuation

Energy Savings		
<b>2 Position Valves</b>		
		<b>Payback</b>
PICCV over 3-Way	\$4,342	N/A
PICCV over 2-Way	\$1,882	N/A
<b>Modulating Valves</b>		
PICCV over 3-Way	\$4,342	N/A
PICCV over 2-Way	\$998	N/A

Table 1

In terms of installation costs, a separate comparison also demonstrated substantial savings by using the PICCV. The total cost for installing all the heating and cooling coils with PICCV's at Parkwood was \$83,031.00 versus the \$101,889.00 installed costs of the CCV/coil balancing assemblies at Lakewood. This is a savings of over 18% in installed costs at the Parkwood facility, which is referenced in Table 2.

Cost Estimates			
<b>2 Position Valves</b>			
	Cooling	Heating	Totals
3-Way CCV	\$78,567	\$77,272	\$155,838
2-Way CCV	\$51,321	\$50,568	\$101,889
2-Way PICCV	\$41,871	\$41,160	\$83,031
<b>Modulating Valves</b>			
3-Way CCV	\$78,567	\$77,272	\$155,838
2-Way CCV	\$56,669	\$55,877	\$112,545
2-Way PICCV	\$46,737	\$45,864	\$92,601

Table 2

In addition to these savings, the analysis provided other valuable information to Shell Point. First it was determined that the pumps serving the Lakewood and Parkwood facilities are not needed under low load conditions; the central chilled water system differential pressure is sufficient. This makes it possible to achieve further operational savings by installing a bypass with check valve and isolation butterfly valve and potentially turning the building pumps off during low loads. Second, it was determined that with PICCV technology, the piping design for the risers in the chilled water distribution for future buildings could be reduced in size. Smaller piping systems are not only less expensive, they

have less heat gain—another potential area for operational savings.

**Future of Pressure Independent Technology**

Mr. Keeley surmises that this is just one of many success stories to be told about pressure independent technology. "The PICCV solution provides the best performance with the lowest operating cost at the least first cost," said Keeley. "This is profound and, I predict, will eventually be realized by the educated design and contracting community."

According to Mr. Keeley, the operational cost savings of this technology is augmented by the PICCV's ability to actively and continuously balance a hydronic system, making it ideally suited for use in phased projects and large facilities. Keeley compares its effectiveness to pressure independent variable air volume boxes.

"Pressure independent technology has become an industry standard for VAV applications in large facilities. I think that pressure independent control valve technology will achieve this same stature as an industry standard."

Dan Parker, Manager of Engineering Services for the Shell Point Retirement Community, agrees.

"We had been using Belimo valves for some time when we switched to the PICCV on Parkwood. The results, compared to the previous buildings, were astonishing," says Parker. "From almost the first day the difference in flow to the building was less and the temperature difference always stays at 10 degrees. I know if I had them on more buildings at this time I could eliminate the operation of one pump at the central plant during non-peak months."

Since the testing at the Parkwood and Lakewood facilities, Shell Point has started up a new building using the PICCV with results equally positive.

"It is the kind of product approval that every manufacturer strives for when it introduces a new technology," says Valerie Raia, Product Manager of Chilled and Hot Water Systems at Belimo Aircontrols, Inc.

"If we know we've got a product that reduces start-up cost, labor, and enhances efficiency, then we know we have a win-win scenario," says Raia.