Pressure Independent Valve Technology Earns Wings at Eglin AFB

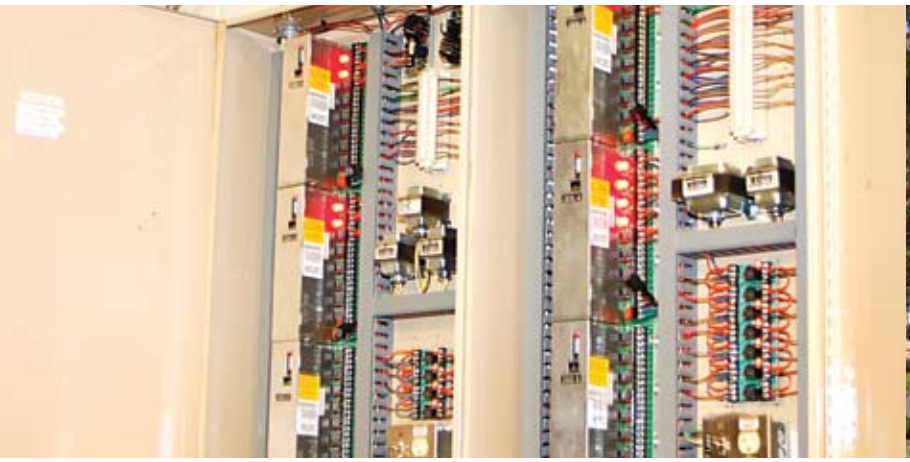

Photo credit: Eglin Air Force Base, Florida

Pressure independent valve technology played a key role in a major Utility Energy Service Contract (UESC) Project at Eglin Air Force Base, Florida. The project, completed in late 2006, included the conversion of a chilled water plant, known as Building 42, to variable flow. The conversion helped the plant and the buildings that it serves meet the requirements outlined in the Energy Policy Act of 2005 and has also resulted in significant energy savings. The installation of 62 Belimo pressure independent characterized control valves (PICCV) helped pave the way for a smooth transition to variable flow, ensuring that the base will continue to enjoy worry-free energy savings for years to come.

Building 42 was originally laid out in a primary/secondary configuration, with intent to utilize variable flow through the secondary loop to save energy. However, because of budget constraints, variable speed drives had never been installed on the plant's secondary pumps. Rather, the entire system ran on constant speed regardless of cooling load, generating 2800 gpm through the system 24/7, and consuming an average of 4,155,000 kWh/year.

Well aware that this was operationally expensive, the engineering staff at Eglin was eager to upgrade the system. Opportunity came in the way of a Utility Energy Savings Contract (UESC) with Gulf Power, the local utility in northwest Florida. Under the guidelines of the UESC, Gulf Power arranged financing for several energy conservation projects at Eglin, one of which was a chilled water optimization project at Building 42.

Alan Mardis, Electrical Engineer and Energy Manager for the 796 Civil Engineering Squadron, was involved in the UESC project from its inception. As Energy Manager he facilitated the initial contract with Gulf Power and has helped coordinate the UESC project from beginning to end. Mardis was in the midst of this major coordination effort when he first learned about Belimo pressure independent technology and how it might fit into the overall scheme of a variable flow system thru the Eglin's control contractor, Systems Specialist, Inc.

Systems Specialists, Inc., the sole source temperature control provider for Eglin, initiated the introduction of pressure independent technology to Eglin personnel by bringing Belimo to the base for a presentation in Fall 2005. Matt Woods, Sales Engineer for Systems Specialists, Inc. cites 3 main reasons that his company felt that Belimo PICCV technology was right for Eglin:

1. Pressure independent technology would allow them to reduce chilled water flow and save energy, which fit nicely into the overall goals of the UESC.

2. Belimo PICCV actuators accept multiple inputs which makes it easily applicable in a retrofit like the one at Eglin, where types of input signals vary from one building to another.

3. The high level of engineering expertise at Chevron Energy Solutions (selected by Gulf Power to design the retrofit) predisposed the company with an interest in new, energy savings technologies. At the same time, Systems Specialists was confident that the engineers at Chevron would not be intimidated by a new approach to control.

"Basically, the folks at Chevron realized the potential for Belimo PICCV technology, and right away they knew they wanted to use it," said Matt Woods.

After some additional research, all parties (including those from Gulf Power) agreed that pressure independent control technology fit well into Eglin's overall energy conservation plan.

Variable Flow "Less Tricky" with PICCV

Gulf Power enlisted the help of Chevron Energy Solutions to develop a feasibility study and proposal for 6.8 million dollars in energy related projects that included the chilled water optimization project. The feasibility study indicated that significant energy savings could be obtained by converting the existing system to variable volume flow by installing variable speed

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drives on the secondary and tertiary pumps and 2-way pressure independent valves at the cooling coils.

Spencer O'Quinn, Project Manager for the Federal Business Unit of Chevron believes that the pressure independent valves were key to the overall success of the chiller plant optimization project.

"You can do [variable flow] with standard 2-way valves, but it is tricky. With Belimo PICCV valves, you just need to maintain a minimum 5 psi drop across the valve and it automatically maintains proper flow to your circuits," said O'Quinn. "Standard 2-way valves, which have many different pressure requirements, will hunt all over the place in a variable flow system."

The PICCV provides consistent flow over its entire operating range, from 5 to 50 PSI by automatically absorbing excess pressures so its internal control valve always sees a constant pressure drop. The valve maintains consistent flow even during extremely low system load conditions, so that facilities are better able to capitalize on the benefits of variable volume pumping systems. This is the true advantage of pressure independent valves over standard control and balancing valves—their ability to maintain stable flow at part load conditions. Better stability means enhanced fine tuning, so comfort is improved while less energy is consumed.

30% Reduction in KWHs

62 Belimo PICCVs were installed in the secondary and distribution loops at Eglin. The valves were installed in air handling units and fan coil units throughout the six buildings served by Building 42. With the new variable flow system in operation, and pressure independent valves distributing flow only when and where it is needed, the air force base was able to eliminate operation of 6 building chilled water booster pumps. Furthermore, the secondary pumps that once ran at 100% are now getting the job done at 50-60% of their capacity.

Chevron estimated a total annual savings of approximately $669,500.00, and $400,000.00 in capital cost avoidance as a result of the overall UESC project plan, which included energy conservation measures unrelated to the chilled water system. While it's difficult to extrapolate how much of this savings is attributable to the reduction in pumping horsepower (a direct result of the pressure independent valves), Alan Mardis believes it is significant. Otherwise the variable speed drives would likely be running the pumps at approximately 83-87% capacity all the time.

"I know for a fact we saved over 100,000 kWh in the month of January 2007," said Mardis. He bases this on an analysis that his team conducted comparing January 2007 consumption with the average January usage from years prior to the variable speed conversion. Overall, Mardis has seen a 30% reduction in average kWh, which he attributes directly to the chilled water optimization project.

"With constant volume we ran both chillers all the time. Now we can run just one chiller, often at part load," he said. "And when there isn't a high load the building booster pumps don't have to run at all."

Matt Ossi, Chevron's Lead Engineer, made this observation: "Variable flow greatly reduces pumping energy over constant flow, especially during the cooler months. During the winter, many of the secondary distribution pumps are offline. What used to be 300 hp of constant flow pumping can now operate on about 1/8th of that same power and satisfy cooling requirements in the winter. Savings during the summer are significant, but less drastic."

These successes have both Chevron and Alan Mardis looking forward to another UESC project with Gulf Power that will use the same pressure independent technology to capitalize on the savings from variable flow.

"To me, this project shows how significant pressure independent technology can be in the greater scheme of Performance Contracting projects," observed Dan Dix, Senior Sales Manager for Belimo. "We tend to think of larger equipment like chillers and pumping systems as being central to these projects, but the savings could not occur without accurate, consistent flow control. It's exciting to know that Belimo is playing such an important role in 'greening' federal agencies."

Belimo Meets Tough Delivery Challenge

Timing is everything in a large scale military renovation such as the one at Eglin. In this particular case, the desired delivery for the Belimo PICCVs left very little room for error. The plan was to keep operations in all buildings served by Building 42 going as usual, therefore installations would take place on weekends, one building floor at a time. While control valves are typically considered a longer lead item, there were delays in ordering the valves, and Belimo literally had just days to turn the PICCV order around.

"I'm convinced that Belimo jumped through hoops to get the valves in on time," said Spencer O'Quinn. "This was a major part of this overall project. We got the valves installed and literally finished everything a week later."

Matt Woods, of System Specialists, Inc. was equally impressed. "It was a very, very tight shipping schedule. I'm talking about days not weeks and everything came in perfectly. Belimo really went above and beyond the call of duty to meet the base's needs."

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