elective course:

Boiler Replacement 202

Comprehensive Energy Savings Earns A+ at Boise State University

By JOHN VASTYAN
Special to HN

BOISE, Ida.—More than just a central gathering place for Boise State University's student population, the Student Union is the heart of campus life and a major asset to the surrounding metropolitan community. Comprising two stories and 185,000 square feet, the facility offers 15 meeting rooms, two divisible ballrooms, a proscenium theater, five retail dining establishments with seating for 350, and a game center with six bowling lanes, billiards tables and video games.

"Approximately 6,500 people travel through the Student Union every day," says Leah Barrett, the facility's director. "More than 10,000 meetings and events are held here each year, and 350,000 people attend those events."

"The Student Union operates much like a private hotel," adds Einar Norton, P.E., the campus mechanical engineer. "When people pay for a convention center, they wouldn't be happy to learn that hot water isn't available."

The ability to meet peak demand for domestic hot water was a growing concern for Norton and the facility's staff. At 35 years old, the four existing boilers had reached the end of their useful life. Flue gas condensate acids were corroding exhaust stacks, and operating efficiency hovered in the range of 65 to 70 percent. Patching up the system no longer was an option; the facility was ready for a complete replacement of the boiler systems.

Installation of the new boilers would not be a simple drop-in replacement. Because of the constant activity at the Student Union, downtime would have to be kept to a minimum, and the new boilers would need to be installed prior to removal of the existing systems. The major challenge here was finding boilers with a footprint small enough to fit into the existing space.

"Back in the '60s and '70s, big buildings were built around boilers and chillers," says Preston Nance of Musgrove Engineering, the engineer of record and principal designer on the project. "It's nearly impossible to get new equipment into these rooms. So, a big selling factor in my mind was equipment with a small size that could fit through a normal door."

Nance found his solution in the form of two Pennant fan-assisted, sealed combustion boilers from Laars Heating Systems. At 40 inches tall, 30 inches deep, and 58 inches wide, the units were small enough to fit through the existing doorway, and they were rack-mounted and stacked to further save floor space, making a full rack height of 95 inches.

The pump installed on the side of the boiler added about 12 inches to the unit's width. Another key attribute of the seismic rack is that the water heaters can be serviced without being pulled down.

According to Joe Paige, project superintendent for Ridgeway, Inc., which was awarded the installation contract, the units are designed to maintain a specific water velocity for a specific water type, i.e., for normal, hard and soft water. The company designates the pump based on specific application and conditions. Once installed, they need to be tuned or set for the proper flow rates to maintain the velocity within the pipes.

"Pump mounted water heaters can be ordered with standard pump for soft or normal or with pumps for hard water," said Paige. "The pumps used are sized for the head loss through the heater, plus 30 feet of full-sized piping (same size as the heater outlet) with, typically, five to six fittings."

Laars defines the flow rates and head loss that should be maintained for each water type and model. Once these are set, the boiler delivers a consistent temperature rise through the heat exchanger. With normal water conditions, each of the Pennant 1000 boilers in the Student Union requires 68 gallons of water per minute at 3.6 feet of head pressure. The unit delivers a 25 degrees Fahrenheit temperature rise through the boiler.

"Other features that made the Pennant boilers an excellent choice for us included a combined 2 million BTU output [1 million BTUs per unit]," added Paige, "Because of this, the boilers provided additional capacity for a building expansion that is planned for within the next five years." The new units operate at 85-percent efficiency. They offer four-stage control to meet demand as needed, providing considerable energy savings. They also offer reliability and continuous operation.

Jim Beatty, service technician, inspects the Laars equipment during installation.

Completing mechanical room installations are, left to right, Doran Hatrick, apprentice plumber; Jim Beatty, service technician; and Brian Duvall, project foreman from Ridgeway Mechanical.

In larger Pennant models, where two ignition modules are used (models 1000, 1500 and 2000, such as the Pennant 1000s used in the Student Union), each burner stage fires independently of one another. This patented design offers balanced airflow to each stage, enabling operation as individual water heaters. This permits each unit to continue operation without having to shut down the entire heater.

"It's like having a built-in standby water heater," Norton says. "If there would be failure of one of the ignition systems, the other takes over. That's unlike any other water heater, and an important factor for us."

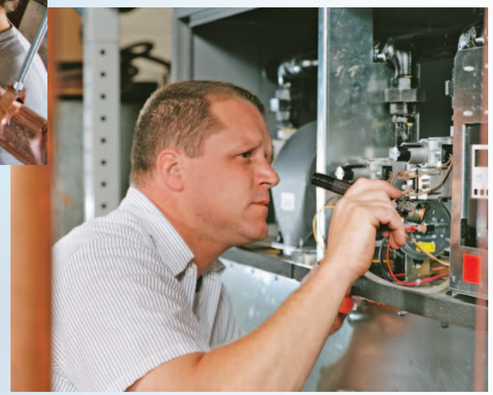
Local manufacturer representation was another crucial factor, according to Norton. "I wouldn't care if it was the most technologically advanced product we could have," he says. "I wouldn't want it if no one was here to take care of it."

The Boise State team found that support through Columbia Hydronics Company, which ultimately was awarded the bid contract. In addition to supplying the equipment, Columbia Hydronics' team, led by Joe Stagg, assisted Musgrove Engineering with the water heating loads and boiler control design.

"When our Boise office was opened in February 2003, we knew nothing of this project," Stagg says. "But in the end, both the engineering firm and the University were satisfied with our service and performance, as well as our dedication to our superior equipment."

Space limitations were not the only challenging factor in this project. Seamless installation also played a large role.

"Because we're such a busy facility, that's integral to the operation of the campus. Having the facility shut down with its water off puts a significant strain on everything," said Leah Barrett, facility director.



Joe Stagg, Columbia Hydronics, runs some pre-fire diagnostics on the Pennant systems.

Full switch-over to the new system was scheduled for the Memorial Day weekend. Hot water supply was to be turned off Sunday afternoon, and everything had to be up and running Monday morning.

"Everything worked out so well that even our guys got some time off for the holiday," said Paige. "We got the equipment there and prefabricated as much as we could. BSU helped us bleed out the systems. We had to replace the waterline valve, but we planned that it might happen and had the equipment there.

"We had our best foreman on the job, our best journeyman and a very good apprentice," added Paige. "If you have good staff and good clients to work with, then nothing is that hard."

"We're absolutely thrilled with the support we've had," Norton adds. "The local rep provided fantastic service, and we'll definitely spec them again." HN

Boise State and Siemens Team Up for Energy Performance Contracting

BOISE, Ida.—By replacing the Student Union's boilers with newer, more efficient equipment, Boise State University has taken an important step in improving overall campus operations. The university announced the formation of an energy 'Performance Contracting' partnership with Siemens Building Technologies, Inc. Energy Services. This follows already successful efforts by the university to reduce energy costs by $250,000 annually through avoided utility consumption.

According to David Naccarato, Siemens account executive, Boise State's sweeping initiative is fueled by a desire to steward funds responsibly. Virtually all facets of school facility energy management and operations today are driven by a desire to reduce energy use and improve indoor comfort for a campus that serves more than 18,000 students and 2,000 faculty and staff.

"Because they've approached it so comprehensively, the performance contracting program provides a way to leverage future avoided utility costs to improve the comfort, safety, and efficiency of their facilities today," said Naccarto.

According to Siemens, performance contracting permits the university to make capital improvements to facilities, finance all of the associated costs, and have a guarantee that the resulting energy savings will cover the debt service.

"It's a performance-based, design-build energy plan that's self-funded by virtue of its own savings," said Mike Johnson, Siemens project energy engineer. "Put another way, the debt service created as a result of the program is retired by the savings generated by the newly applied and/or installed technologies and operating procedures."

"We're making a concerted effort to manage the taxpayers' funds responsibly," says Einar Norton, P.E., the university's engineer. "We have taken some major steps and have achieved some really fantastic results. Full involvement in the performance contract will be the next logical step in continuing to conserve energy and replace our older equipment."

Siemens recently completed a comprehensive energy audit. Improvements now focus on the following:

- **New lighting technology and controls;**
- **New HVAC equipment, mechanical systems and automated controls;**
- **Campus-wide trash compacting;**
- **New window technology;**
- **Utility information-management software;**
- **Water conservation and**
- **Individual sub-metering and monitoring.**

"[The Boise State plan is] innovative, open and comprehensive in its approach to reducing utilities consumption, as well as improving the overall learning, teaching, research and work environment," said Naccarato. "This project can serve as a benchmark for universities nationwide." HN