Edmonton hotel finds solution to looming DHW shortage

One of Edmonton's busiest tourist hotels recently averted a DHW shortage with a mechanical upgrade. The luxury Fantasyland Hotel in West Edmonton Mall has 355 guest rooms, of which 118 are themed retreats with large Jacuzzi tubs. Domestic water downtime isn't an option.

"Our guests expect access to all the water they want, whenever they want it," said Marino Martinez, the hotel's chief engineer. "The mechanics of making that happen is serious business. Serious enough that, when we began to have some problems meeting the demand for hot water, we took a long, careful look at how to fix it."

Greg Blais, president and managing director of T&P Mechanical Services, Ltd. in Edmonton, recalls the gradual recognition of a looming water problem. "Occupancy exceeded expectation and it was clear that the original boilers lost their ability to meet the demand."

And, as a University of Alberta-trained mechanical engineer, he had an appreciation for the complexity of the task, from meeting the up-to-five million Btu/h domestic water demand, to lifting replacement boilers into the penthouse-level mechanical room, and everything in between.

The 26-year-old T&P Mechanical is a local, Edmonton-based union shop with service and construction divisions. Their preference is for design/build work.

Heartbeat of the hotel

"What was especially appealing about this job is that it tapped just about every facet of our business," said Blais. "The complexity of the boiler replacement, with essentially no downtime, required careful planning on the front end and close cooperation between our shop and Mariano Martinez at the hotel, and Vic Carriere and Barry Graham at DC Sales, the manufacturer's rep firm who were consulted in the planning stages of the system's primary/secondary piping. There really was no room for error. The hotel is a living, breathing entity with demands that had to be maintained.

Martinez stipulated that the new boilers be fully modulating. The designers specified three high-efficiency, Laars Rheos boiler/water heaters. Their controls monitor the demand for hot water and automatically adjust each boiler's capacity to meet the required heating load from 1.2 million to 2.4 million Btu/h with variability of modulation between 100 percent and 25 percent of the input rate.

"They're an environmental win too," added Blais. NOx levels are less than 10ppm and, with low CO greenhouse gas emissions, the boilers offer up to 96 percent efficiency.

Space was limited in the existing mechanical room. The new boilers have a smaller footprint than the versions they replaced, allowing three new boilers to replace two existing ones.

Primary/secondary piping

T&P redesigned the mechanical room piping to optimize recovery from the boilers and two 3,000-gallon storage tanks. The primary/secondary piping system incorporated bypass piping so that any piece of equipment within the system can be isolated for maintenance without disrupting the supply of hot water.

When the hot water temperature drops below the systems' set point, the boiler pump(s) switch on, drawing water from the secondary piping header. The water is heated by the boilers and injected back into the secondary piping loop and, when the water reaches the desired temperature within the system, the boiler pumps switch off and wait in standby mode.

"The hot water continues to circulate through the secondary piping and the storage tanks without passing through the boilers," added Blais. "By preventing hot water from circulating through the boiler when in 'standby,' there's no heat loss to the atmosphere through the vent stack/heat exchanger. The water instead flows through the two tees that were installed in the secondary piping, flowing by the primary piping as if the boilers weren't even there."

The first two new boilers, at right, were installed as one of the existing boilers continued to operate. Minimizing downtime was critical.

And because each boiler has its own circulation pump, the water flow rate through the heat exchangers, and the design temperature between the inlet and outlet water, are maintained optimally.

Reducing downtime

T&P project manager James Hill is a Northern Alberta Institute of Technology-trained mechanical engineering technologist. At the design stage, Hill drafted a dimensional layout of the existing mechanical room, comparing piping scenarios, and searching for boilers that would meet the required heating demand and fit within the limited room size. This was especially important because Martinez directed T&P to install the new boilers "around" the existing system. Reducing downtime was a critical factor.

Plumber Jarek Padjesek, left, and project manager James Hill take measurements to determine pump location.

T & P technicians Reynold Johnson, Jarek Padjasek and Kyle Kellar started by removing the first three-million Btu/h boiler and heat exchanger arrangement, freeing access to the penthouse mechanical room from the rooftop. "This gave us the required floor space for the first two of the three new boilers to be installed," reported Blais.

With no access for a crane from below, T&P moved the new boilers to the 12th floor by two sets of elevators and then hoisted them individually up two flights of stairs, out across the roof, and finally through an access door cut in the side of the mechanical room wall.

"To minimize disruption of domestic hot water supply to the hotel we had to schedule four-hour, minimum-demand-time shutdown periods to remove the existing piping and transition to the new boiler header piping for the first two boilers," said Hill. "We also fabricated our tie-in header piping and primary/secondary piping in sections, complete with boiler isolation valves, electrical, and controls in advance."

During the early start-up phase, T&P ran the two newly installed boilers for a week to prove their ability to meet initial domestic hot water needs. The second existing boiler remained off but ready for duty. The test proved successful and, a week later, the last of the old boilers was removed.

"From the beginning, we decided to set up the new systems with lead-lag redundancy, exercising each of them uniformly and to permit non-disruptive off cycles for preventive maintenance tasks as required," explained Blais.

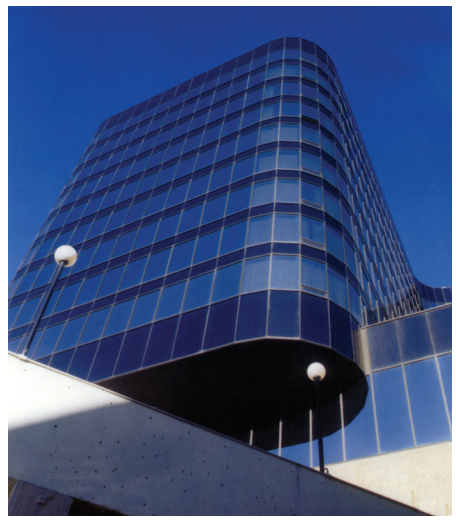
Open loop

Typically, primary/secondary piping is used in a closed-loop hydronic system. "But at the Fantasyland Hotel, we developed an open loop system," explained Blais. "We used the two hot water storage tanks to temper the water before entering the boilers." Each of the three boilers has its own pump and primary piping. The secondary piping consists of a secondary circulating pump, piping, and the storage tanks. The boilers are connected as three separate injection sources to the main loop.

In the new system, cold water makeup is introduced at the first tank where it's mixed with hot water circulating through the system. The tempered water then flows through the secondary piping, passing two of the three boilers. Each boiler pump draws water by and through the boilers to be heated as required. The water continues on through the secondary piping to the second storage tank where water is drawn off and used by the hotel.

Surplus water from the second storage tank is circulated through the piping where it is bypassed, or heated again by the third boiler if required, and carried on back to the first storage tank to mix and temper the cold makeup water.

"The system is a huge improvement for the hotel," said Martinez. "T&P Mechanical designed and installed a fully capable and efficient system that will serve us well for years."



The 355-room Fantasyland Hotel operated without a hitch during boiler installation.